
LUNDAHL
– TRANSFORMERS –

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Catalouge 2017.01

About this catalogue

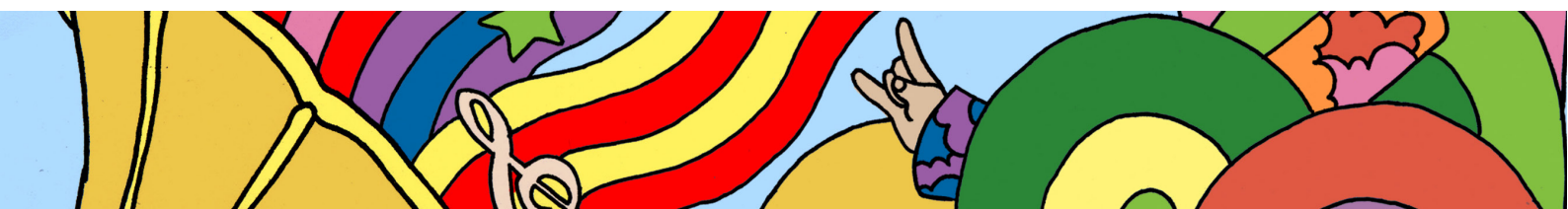
In this down-loadable pdf document we have collected the data sheets
for most of our standard transformers for pro audio and audiophile applications.
It also includes some of our technical papers of more general interest.

In the “Quick selection guide” we have grouped the transformers based on their most common application. If you prefer to search the catalogue in strict type number order, please use the bookmarks icon in the menue to the left.

For additional information about Lundahl Transformers please visit our website, www.lundahl.se and our facebookpage, www.facebook.com/lundahltransformers

Over the past several years we have had the pleasure of meeting many of you at our booth at the ProSound & Light exhibitions in Europe and at the AES exhibition in the United States.
Thank you very much for the visits and for all the nice comments about our products. We welcome your appreciation with great pride, but also feel a big responsibility to justify your confidence by continuing to deliver excellent products in the coming years.

Per Lundahl
Managing Director



Quick selection guide

TRANSFORMERS MOSTLY USED IN PRO AUDIO APPLICATIONS

Line input transformers

Type	Turns ratio	Level (@50 Hz)	Usage / Comment
LL1531	1+1 : 1+1	+20 dBU	Line input. Small size
LL1540	1+1 : 1+1	+30 dBU	High level line input
LL1544A	1+1+1+1 : 2+2	+20 dBU	Line input. Amorphous core
LL1545A	1+1+1+1 : 2+2	+24 dBU	Line input
LL1592	1+1 : 1+1	+30 dBU	High quality line input.
LL1922	1+1 : 4+4	+26 dBU	Line step-up input. Similar to UTC LS-10
LL6404	1 : 1	N/A (High!)	Zero Field line input
LL7101	1+1 : 1.37	N/A (High!)	Zero Field line input
LL7901	1+1+1+1 : 1+1+1+1	+34 dBU	Very high level line input

Line output transformers

Type	Turns ratio	Level (@50 Hz)	Usage / Comment
LL1517	1+1,ct : 1+1	+28 dBU	With Faraday shields. General purpose.
LL1524	1+1 : 1+1	+28 dBU	Balanced drive. Very low leakage inductance.
LL1539	2 : 1+1	+31 dBU	Balanced drive
LL1555	1+1+1+1 : 2+2	+27 dBU	Balanced drive
LL1560	2+2 : 1+1+1+1	+26 dBU each secondary	Balanced drive. 4 output active split.
LL1582	1+1 : 1+1	+30 dBU	With Faraday shields. General purpose. Size optimized for Euroboard
LL1585	1+1 : 1+1	+31 dBU	With Faraday shields. General purpose.
LL2734	1+1 : 1.4 + 1.4	+30 dBU	Solid State Single End
LL2811	1+1 : 1+1	+30 dBU	Balanced drive. Low leakage inductance. Size optimized for Euroboard
LL5402	2 : 1+1	+22 dBU	Unbalanced drive
LL7401	1+1 : 1+1	+24 dBU	Balanced drive. Low profile. Very low leakage inductance.

General purpose transformers

Type	Turns ratio	Level (@50 Hz)	Usage
LL1527	1+1 : 1+1	+16 dBU	Split 1 : 1 direct + 1 isolated. Ground isolation
LL1527xl	1+1 : 1+1	+19 dBU	Split 1 : 1 direct + 1 isolated. Ground isolation
LL1532	1+1 : 2	+10 dBU	Mic input. Ground isolation
LL1570	1+1 : 1+1	+16 dBU	Split 1 : 1direct + 1 isolated. Ground isolation
LL1570xl	1+1 : 1+1	+19 dBU	Split 1 : 1direct + 1 isolated. Ground isolation
LL1581xl	1 : 1+1	+13 dBU	Splitting 1 : 1 direct + 2 isolated
LL1583	1 : 1+1	+8 dBU	Splitting 1 : 1 direct + 2 isolated. Small size
LL1588	1+1 : 1+1	+22 dBU	High level line isolation transformer
LL1590	1 : 1+1+1	+15 dBU	Splitting 1 : 1 direct + 3 isolated
LL1591	1+1 : 1+1	+16 dBU	Low price ground isolation transformer
LL1593	1+1 : 2	+12 dBU	Small, low price ground isolation transformer
LL1944	1+1 : 1+1+1+1	+28 dBU	Mic split for speaker box etc.
LL7902	1+1+1+1 : 1+1+1+1	+28 dBU	For high level applications, input and output.
LL7904	1 : 1+1	+23 dBU	High level splitting 1 : 1 direct + 2 isolated

DIN units. Transformer units with screw connectors for audio installations

Type	Max level (@50 Hz)	Usage / Comment
DIN1527	+16 dBU	Galvanic isolation and balanced-unbalanced conversion
DIN1588	+22 dBU	High signal level galanic isolation etc.
DIN1581XL	+13 dBU	Splitting 1 direct + 2 isolated

Microphone transformers

Type	Turns ratio	Level (@50 Hz)	Usage / Comment
LL1528	1+1 : 2.5+2.5	+10 dBU	200Ω : 5k microphone input
LL1530	1+1 : 3.5+3.5	+10 dBU	DI (Direct Input) 10k : 200Ω
LL1538*	1+1 : 5	+10 dBU	200Ω : 5k microphone input
LL1538xl*	1+1 : 5	+13 dBU	High level 200Ω : 5k microphone input.
LL1550	1+1+1+1 : 4+4	+6 dBU	Special application input. Amorphous core
LL1571	1+1 : 1.75+1.75	+10 dBU	200Ω : 2k5 microphone input
LL1576*	1+1 : 7	+10 dBU	200Ω : 10k microphone input
LL1577*	1+1 : 14	+4 dBU	50Ω : 10k microphone input
LL1578*	1+1 : 10	+4 dBU	50Ω : 5k microphone input
LL1578xl*	1+1 : 10	+7 dBU	High level 50Ω : 5k microphone input.
LL1587	1+1 : 4	+0 dBU	Small size 200Ω : 3k2 microphone input
LL1636	1+1+1+1 : 10+10	-2 dBU	Special application input. Amorphous core
LL1927A	1+1 : 55 + 55		Very high turns ratio. For ribbon mics.
LL1935	1+1 : 5 + 5	+7 dBU	DI (Direct Input) 20k : 200Ω
LL1936	(2+1) + (2+1) : 4+4	+14 dBU	75Ω, 150Ω, 300Ω and 600Ω : 1200Ω
LL1940	9:1+1	45V RMS	Tube mic output with “character”
LL1951*	1+1 : 14	+4 dBU	Improved LL1577
LL2912	1 : 37	-30 dBU (1:37)	For ribbon microphones. Amorphous core.
LL2913	1+1+1+1 : 37	-30 dBU (1:37)	For ribbon microphones. Amorphous core.
LL2914	1+1+1+1 : 37	-30 dBU (1:37)	For ribbon microphones. Mu metal core.
LL2915	1:37	-30 dBU (1:37)	For ribbon microphones. Mu metal core.
LL2916	1+1 : 55 + 55		Mu metal core version of LL1927A
LL7903	1+1+1+1 : 2+2+2+2	+28 dBU	Very high level mic/line input.
LL7906	1+1+1+1 : 5.6 + 5.6	+16 dBU	High level mic/line input.

Transformers marked with * have compatible pinout.

XLR-XLR problem solvers units (All with turns ratio 1 : 1)

Type	Mex level @ 50 Hz	Usage / Comment	
LL6810-phmphm	+15 dBU	Isolation transformer unit Phono - Phono w. 6 ft cable	
LL156X-3FX3MX	+24 dBU	XLR female to XLR male	line input
LL156X-3FXPHM	+24 dBU	XLR female to Phono male	line input
LL156X-3FXNP2C	+24 dBU	XLR female to 2 pole 1/4” plug	line input
LL156X-PHF3MX	+24 dBU	Phono female to XLR male	line input
LL1584-3FX3MX	+16 dBU	XLR female to XLR male	general purpose
LL1584-3FXPHM	+16 dBU	XLR female to Phono male	general purpose
LL1584-3FXNP2C	+16 dBU	XLR female to 2 pole 1/4” plug	general purpose
LL1584-PHF3MX	+16 dBU	Phono female to XLR male	general purpose
SIB15	+12 dBU	Stereo Isolation and Balancing unit (PC to Pro)	

Miscellaneous transformers

Type	Turns ratio	Usage / Comment
LL1572	110 : 110 ohms	Digital audio isolation. Replaces LL1566
LL1573	110 : 110 + 110 ohms	Digital audio split, 2 isolated out.
LL1574	110 : 75 ohms	Digital Audio AES/EBU : SPDIF interface
LL1575	1 : 1	Composite video isolation
LL1589	110 : 110 + 110 + 110 ohms	Digital audio split, 3 isolated out.
LL2410	2+2+2+2 : 1+1+1+1+1+1+1+1	General purpose 100V loudspeaker transformer
LL6702	N/A	Telephone hybrid transformer

TRANSFORMERS FOR TUBE AMPLIFIERS AND OTHER AUDIOPHILE APPLICATIONS

Tube amplifier output transformers

Type	Primary	Secondary	Comments
LL1620	3.3k, 6.0k or 11.5k	4, 8, 16 ohms	
LL1620CFB	3.3k, 6.0k or 11.5k	4, 8, 16 ohms	For cathode feedback
LL1623	1.6k, 3.0k or 5.6k	4, 8, 16 ohms	
LL1627	650 ohms, 1.2k or 2.3k	4, 8, 16 ohms	
LL1663	5k	8 ohms	Small size
LL1664	3k	8 ohms	Small size
LL1679	2.6k, 4.5k, 9.7k	4, 8, 16 ohms	UL taps
LL1682	5.5k	5 ohms	Small size
LL1688	5.5k, 9.2k, 20.5k	4, 8, 16 ohms	Big size
LL1691	9k	8 ohms	Big size
LL1693	600 ohms, 1k or 2.3k	4, 8, 16 ohms	High power
LL2735B	16k	8 ohms	For SE
LL2750	5.5k	5 ohms	Small size LL1682
LL2752	1.2k, 2.0k, 4.6k	4, 8, 16 ohms	Silver version available
LL2755	11k	8 ohms	Big size. For 813 etc.

LL1620, LL1623, LL1627, LL1663, LL1664, LL1679, LL1682, LL2735B, LL2752 are also available with **amorphous C-core.**

Interstage transformers, anode chokes, grid chokes and tube line output transformers

Type	Usage	Usage / Comment
LL1621	Non-inverting interstage transformer	
LL1630	Line output	7.2 : 1 line output
LL1635	Interstage transformer	1+1 : 1+1
LL1660	Interstage / line output transformer	2.25 + 2.25 : 1+1+1+1
LL1660Ag	Interstage / line output transformer	2.25 + 2.25 : 1+1+1+1. **Silver**
LL1660S	Interstage with phase splitting	2.25 + 2.25 : 1+1+1+1
LL1667	Tube anode choke	DC current 15 – 40 mA
LL1668	Tube anode choke	DC current 25 – 80 mA
LL1670	Grid choke	0.8mA
LL1671	Interstage / line output transformer	2+2 : 1+1+1+1
LL1677	High current interstage transformer	For 300B driver tube.
LL1680	Line output transformer	Replacement for UTC LS-27 transformer
LL1689	Line Output Transformer	9+9 : 1+1+1+1 Line output version of LL1660
LL1689Ag	Line Output Transformer. **Silver**	9+9 : 1+1+1+1 Line output version of LL1660
LL1692A	Interstage / Line output transformer	1.75+1.75 : 1+1+1+1
LL2743	Tube anode choke	DC current 40 – 110mA
LL2745	Line output	2.8+2.8 : 1+1+1+1
LL2746	Interstage stepup	1 : 2 for two stage tube amp.
LL2747	Line output	1+1+1+1 : 2 for low impedance tubes
LL2753	Interstage SE –SE 1:1	20 – 60mA. Improved bandwidth
LL2754	Solid state headphone out. 1+1:1.1	For 32/50 and for 600 ohm headphones
LL2756	Interstage SE –SE 1:1	10 -40mA . Improved bandwidth

LL1660, LL1660S, LL1667, LL1668, LL1671, LL1677, LL1689, LL1692A, LL2743 also available with **amorphous C-core**.

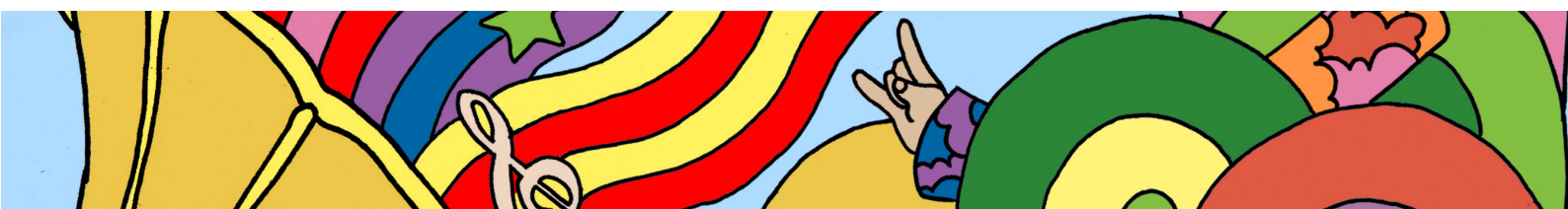
Other audiophile type transformers

Type	Usage	Usage / Comment
LL1674	Mic/line input transformer	1+1 : 4+4 Amorphous core
LL1676	Mic/line input transformer	1+1 : 2+2 Amorphous core
LL1678	MC input. Amorphous core	1+1+1+1 : 16 + 16
LL1681	MC input. Mu-metal core	1+1 : 13 + 13
LL1684	Audio isolation transformer.	General purpose. With amorphous core
LL1690	Line input . Amorphous core	1+1 : 1+1. Excellent for phase splitting.
LL1930	Tube preamp line output	Mu metal core. For DC decoupled output
LL1931	MC input. Amorphous core	1:8, 1:16. Medium impedance cartridge
LL1931Ag	MC input. Amorphous core. **Silver**	1:8, 1:16. Medium impedance cartridge
LL1933	MC input. Mu metal core	1:8, 1:16 Medium impedance cartridge
LL1933Ag	MC input. Mu metal core. **Silver**	1:8, 1:16 Medium impedance cartridge
LL1941	MC input.Amorphous core	1:16, 1:32 Low impedance cartridge
LL1941Ag	MC input.Amorphous core. **Silver**	1:16, 1:32. Low impedance cartridge
LL1943	MC input.Mu metal core	1:16, 1:32. Low impedance cartridge
LL1943Ag	MC input.Mu metal core. **Silver**	1:16, 1:32. Low impedance cartridge
LL1948	Line input, Amorphous core	1+1 : 1+1 Amorphous core
LL1948Ag	Line input, Amorphous core. **Silver**	1+1 : 1+1 Amorphous core
LL1949	Stepdown line input	2+2 : 1+1 Cardas copper wire.
LL7903Ag	Line input or output. Silver	1+1+1+1 : 2+2+2+2
LL7905	Amplifier input transformer	High level input, 1+1+1+1 : 5.6 + 5.6
LL7906	Amplifier input transformer	Improved LL7905
LL9206	MC input. Amorphous core	1+1+1+1 : 10 + 10
LL9226	MC input. Amorphous core	1+1+1+1 : 10 + 10 (Improved LL9226)

Mains transformers, mains isolation transformers and power supply chokes

Type	Usage	Usage / Comment
LL1638	Mains choke	1 – 8 Hy, 800 – 200 mA
LL1648	Mains transformer	350V, 2 x 5.9V + 2 x 6.6V
LL1649	Mains transformer	230V, 4 x 6.6V
LL1650	Mains transformer	350V, 4 x 6.6V
LL1651	Mains transformer	500V, 4 x 6.6V
LL1655	Mains isolation transformer	2 x 115V, 300VA total
LL1658	Mains isolation transformer	2 x 115V, 100VA total
LL1662	Mains isolation transformer with stepup/stepdown	2 x 115V +2 x 10V , 300VA total
LL1669A	Mains transformer	340V, 110V and 4 x 6.3V
LL1673	Mains choke	8 – 20 Hy, 100 – 250mA
LL1683	Preamp mains transformers	250V, 48V , 2 x 6.6V and 2 x 5.2V
LL1685	Preamp mains choke	10H – 17H, 160mA – 100mA
LL1694	Filament current choke	3A, 40mH for filament current filtering
LL2733	Filament current choke	3.4A, 100mH for filament current filtering
LL2738	Filament current mains transformer	8 x 6.6V (3A) and 1 x 110V (0.1A)
LL2751	Small size filament current choke	0.6A, 180mH or 1.2A, 45mA

Datasheets



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"100V Line" Loudspeaker transformers

140V systems

Auto transformer LL2415, LF: 50 Hz/140 V

Taps Voltage (V) (at 140V primary voltage)	Power @ 8 ohms (W)	Power @ 16 ohms (W)
16	32	16
24	72	36
32	128	64
35	153	76

Auto transformer LL2416, LF: 50 Hz/140 V

Taps Voltage (V) (at 140V primary voltage)	Power @ 8 ohms (W)	Power @ 16 ohms (W)
8	8	4
16	32	16
24	72	36
32	128	64
48	288	144

LL2415 and LL2416 can also be used in 100V systems. LF : 36Hz@100V
Each tap voltage is reduced with approx. 29%
Each tap power level is reduced with 50%

70V systems

Auto transformer LL2417, LF : 50 Hz / 70V

Taps Voltage (V) (at 65V primary voltage)	Power @ 8 ohms (W)	Power @ 16 ohms (W)
21	50	25

100V systems

Full transformer LL3610, LF: 100Hz@100V

Taps Voltage (V) (at 100V primary voltage)	Power @ 8 ohms (W)	Power @ 16 ohms (W)
2.8V	1	0.5

(Each LL3610 is designed to feed up to 20 x 8ohms loudspeaker elements connected in parallel)

General Purpose High Power Transformer LL2410

Our transformer LL2410 and its' descendants are general purpose high power loudspeaker transformers. The transformer is extremely flexible and well suited for applications with power levels from 250W and up, line voltage from 70V to 140V. The transformer can be configured as auto transformer or full transformer.
This transformer is e.g. used in the loudspeaker systems of Nya Ullevi in Gothenburg and Råsunda Stadium in Stockholm.

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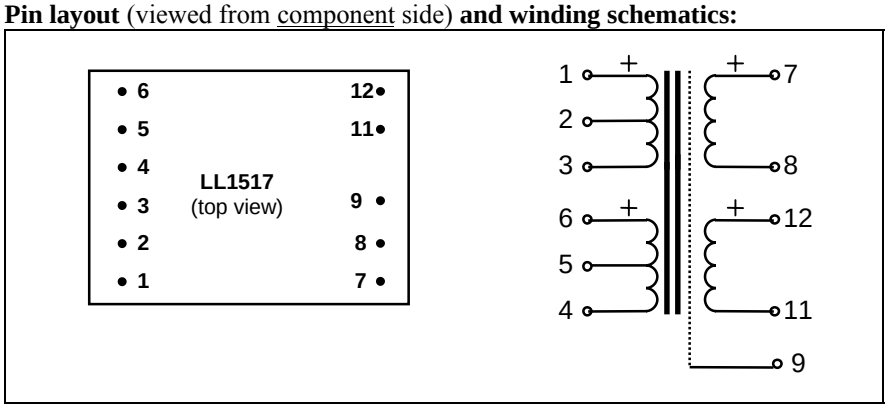
Audio Output Transformer
LL1517

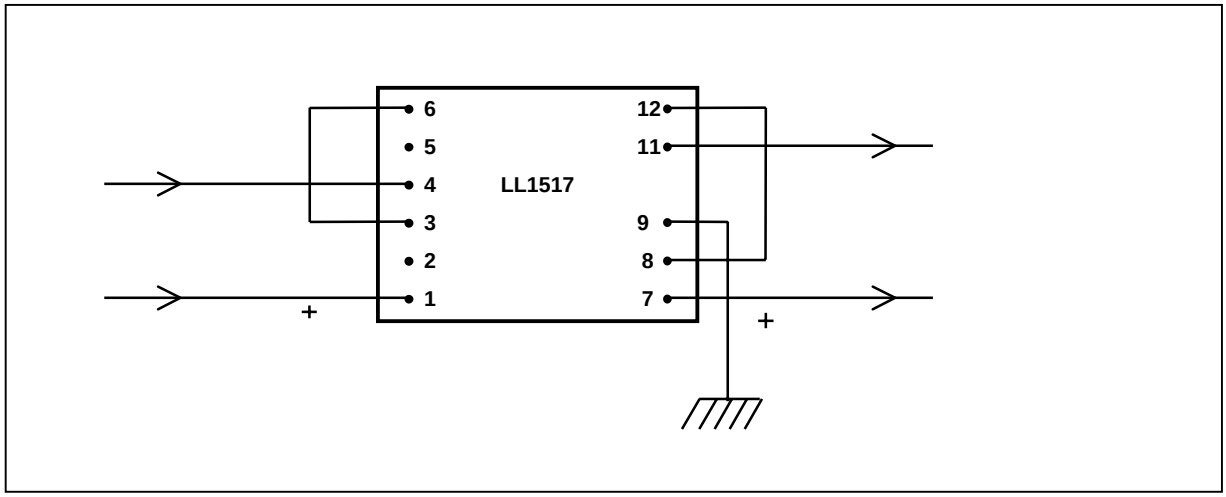
LL1517 is an audio output transformer for balanced or unbalanced drive. The transformer is built from two three-section coils, with primaries and secondaries separated by electrostatic shields, and a audio C-core of our own production. The transformer is housed in a mu-metal housing.
The LL1517 has sufficient low copper resistance to meet broadcast specifications in a conventional drive configuration, but is (as all output transformers) ideally used with mixed feedback drive circuits. (See separate paper for mixed feedback design principles).

Turns ratio: 1 + 1 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 47 x 34 x 18
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	105 g
Core:	Audio C-core
Housing:	Mu-metal
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	9.2 Ω
Static resistance of each secondary:	9.5 Ω
Leakage inductance of secondaries (sec. in series):	0.3 mH
No-load impedance:	>1kΩ @ 50 Hz, +20 dBU
Optimum source impedance:	Minus 18 Ω (See above)
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 60 dB
Maximum output level before saturation (sec. in series, load 600 Ω)	+ 24 dBU @ 30 Hz
Distortion (achieved with mixed feedback drive circuit, load 600 Ω)	< 0.03 % @ 20 dBU, 30Hz
Frequency response (source 10 Ω, load 600 Ω):	10 Hz -- 80 kHz +/- 0.3 dB
Loss across transformer (at midband with 600 Ω load):	0.3 dB
Isolation between primary and secondary windings / between windings and core:	4 kV / 2 kV

Suggested use



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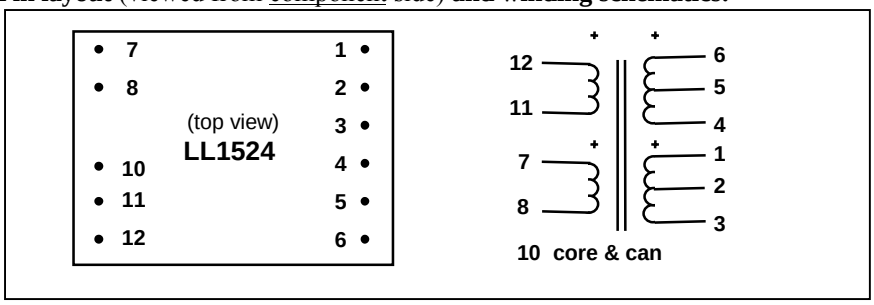
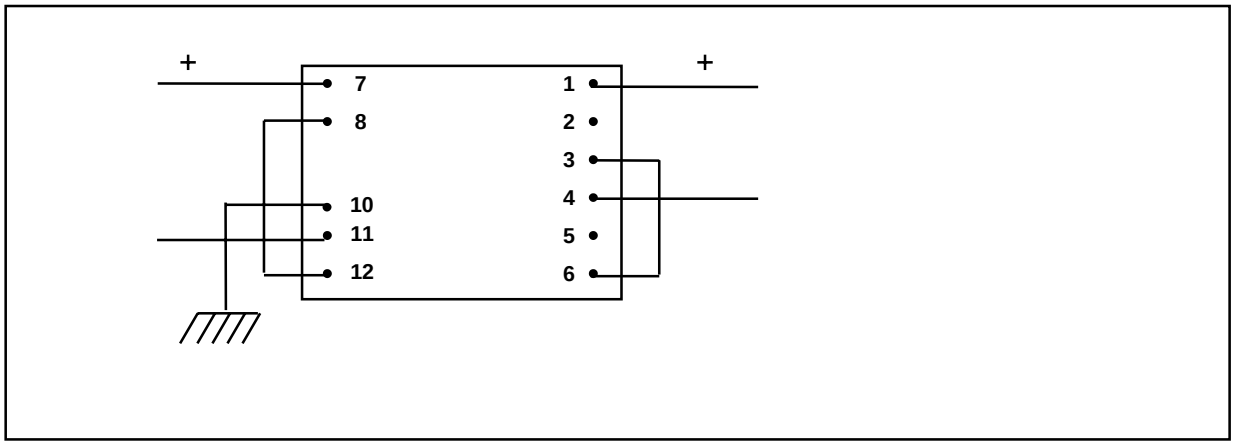
Audio Output Transformer
LL1524

LL1524 is an audio output transformer for balanced drive. The LL1524 is a 5-section output transformer. This results in a very low leakage inductance and thus excellent HF characteristics.
The LL1524 is (like all C-core audio output transformers) ideally used with negative source impedance achieved using mixed feedback drive circuits. See separate paper for mixed feedback design principles.

Turns ratio: 1 + 1 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 48 x 34 x 22
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	125 g
Core:	Audio C-core
Housing:	Mu-metal
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	7.3 Ω
Static resistance of each secondary:	7.5 Ω
Leakage inductance of secondaries (sec. in series):	0.1 mH
No-load impedance:	>1kΩ @ 50 Hz, +20 dBU
Optimum source impedance:	Minus 14 Ω (mixed feedback)
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 45 dB
Maximum output level before saturation (sec. in series, load 600 Ω)	+ 24 dBU @ 30 Hz
Distortion (achieved with mixed feedback drive circuit, load 600 Ω)	< 0.04 % @ 20 dBU, 30Hz
Frequency response (source 0 Ω, load 600 Ω):	5 Hz -- 100 kHz +/- 0.5 dB
Loss across transformer (at midband with 600 Ω load):	0.5 dB
Isolation between primary and secondary windings / between windings and core:	4 kV / 2 kV



Please refer to separate paper for balanced, mixed feedback drive circuitry.

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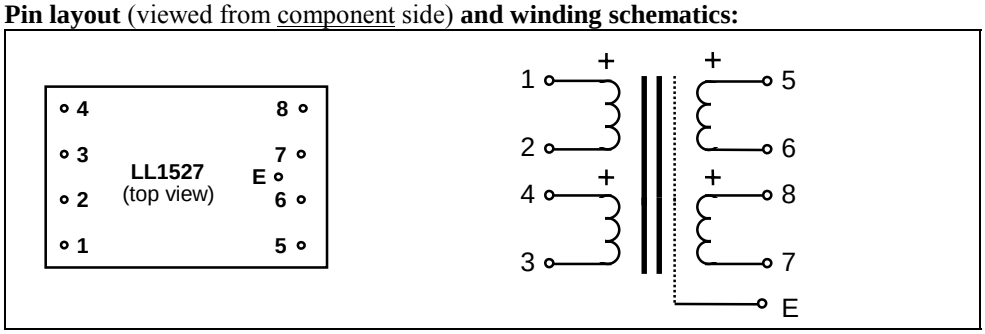
General Purpose Transformers
LL1527 and LL1527XL

LL1527 is a truly general purpose transformer for microphone or line input, for output and for galvanic isolation of units. LL1527 has been generally accepted by the audio industry as **the** general purpose audio transformer.
The LL1527 is built-up from two coils, each with one primary and one secondary winding separated by an electrostatic shield. The core is a high permeability mu metal core. The transformer is housed in a mu-metal can.
In the LL1527XL, the core is about 45% larger than in the LL1527, resulting in a larger level capability.

Turns ratio: 1 + 1 : 1 + 1

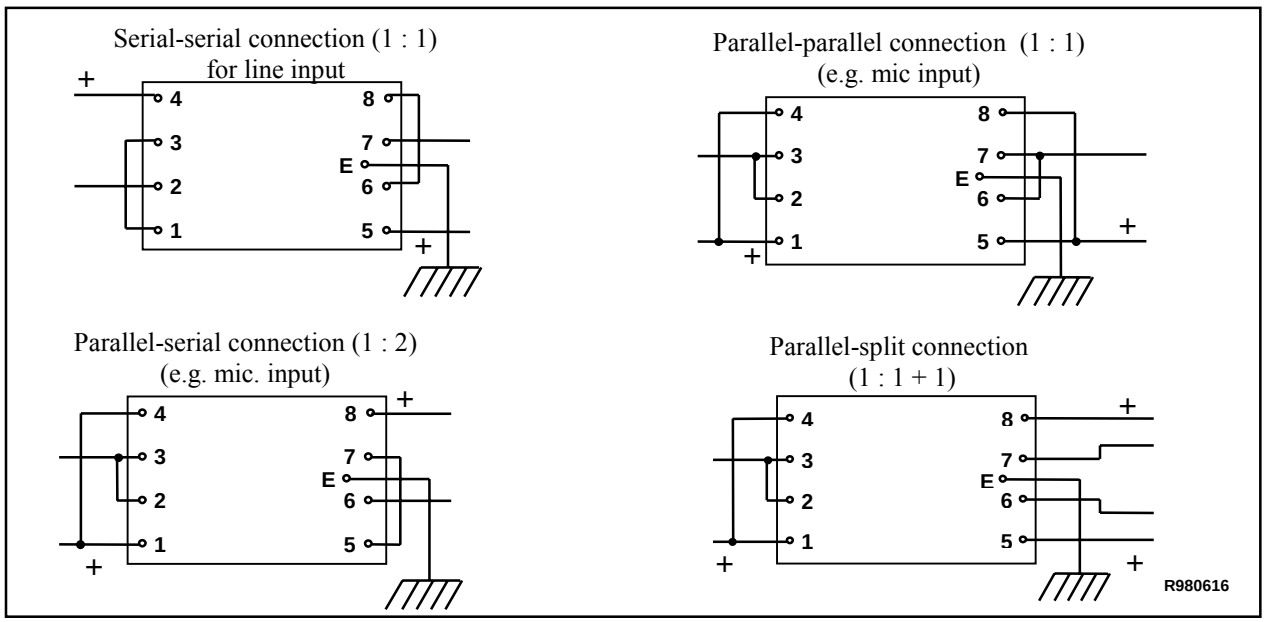
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins	Spacing between rows of pins	Offset of earth pin from adjacent row:
5.08 mm (0.2")	27.94 mm (1.1")	2.54 mm (0.1")

	LL1527	LL1527XL
Dimensions (L x W x H above PCB, in mm)	38 x 24 x 17	38 x 24 x 20.5
Weight:	48 g	65 g
Rec. PCB hole diameter:	1.5 mm	1.5 mm
Static resistance of each primary:	43Ω	54Ω
Static resistance of each secondary:	56Ω	67Ω
Distortion (primaries connected in series, source impedance 800Ω):	+ 6 dBU 0.1% @ 50 Hz	+ 9 dBU 0.1% @ 50 Hz
	+16 dBU < 1 % @ 50 Hz	+19 dBU < 1 % @ 50 Hz
Self resonance point :	> 200 kHz	> 200 kHz
Optimum load for best square-wave response (sec. in series):	3 - 4 kΩ	3 - 4 kΩ
Frequency response (source 800Ω , load 4 kΩ serial connection):	10 Hz -- 150 kHz +/- 0.2 dB	10 Hz -- 150 kHz +/- 0.2 dB
Loss across transformer (at midband, with above termination):	0.4 dB	0.5 dB
Isolation between windings/ between windings and shield:	4 kV / 2 kV	4 kV / 2 kV

Connection alternatives and suggested applications:



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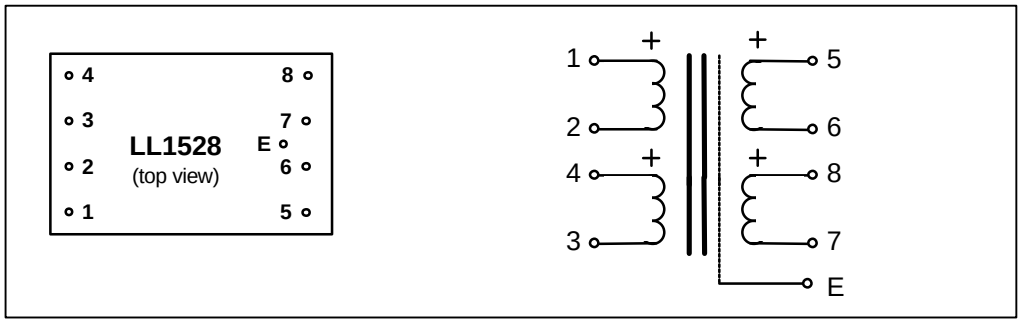
Microphone Input Transformer
LL1528

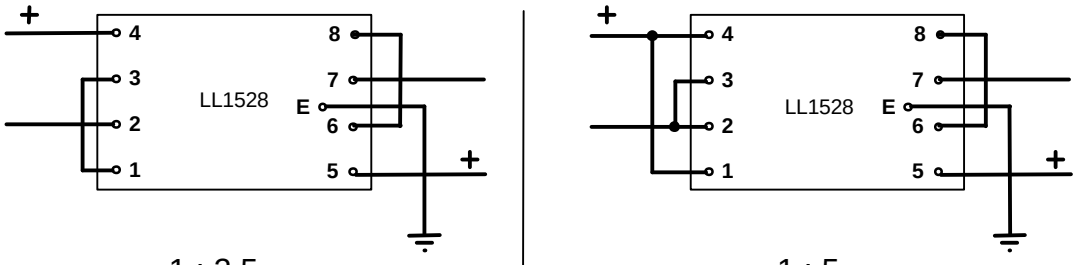
LL1528 is a microphone input transformers built up from two coils, each with one primary and one secondary section separated by a electrostatic shield. The core is a high permeability mu-metal core, and the transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 2.5 + 2.5
Dimensions (Length x Width x Height above PCB (mm)): 38 x 24 x 17
Pin layout (viewed from component side) **and winding schematics:**



Spacing between rows of pins:	27.94 mm (1.1")
Offset of earth pin from adjacent row:	2.54 mm (0.1")
Weight:	46 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	42 Ω
Static resistance of each secondary:	450 Ω
Distortion (primaries connected in parallel, source impedance 200 Ω):	+ 0 dBU primary level, 50 Hz: 0.2 % + 10 dBU primary level, 50 Hz: 1 %
Self resonance point :	> 80 kHz
Optimum termination for best square-wave response (Connection 1:5, source imp. 200Ω) **:**	9 kΩ in series with 3 nF
Frequency response (source and load as above):	10 Hz - 40 kHz +/- 0.3 dB
Isolation between windings/ between windings and shield:	4 kV / 2 kV

Connection alternatives



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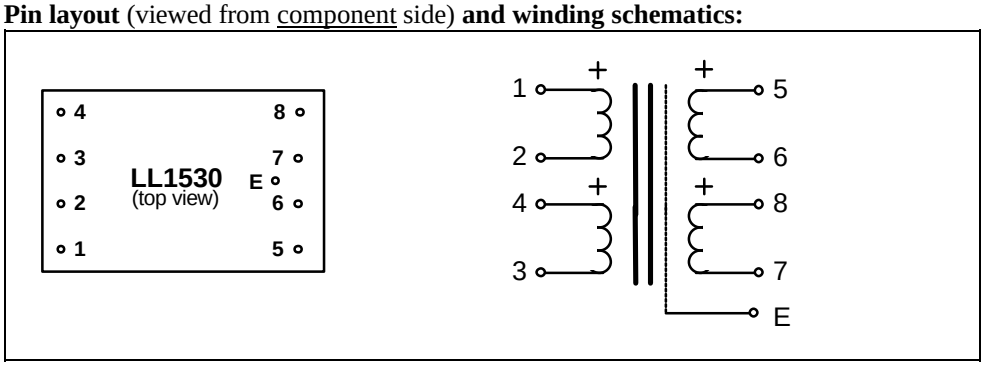
Microphone Transformer / D-I Box Transformer
LL1530

LL1530 is a microphone input transformer used for matching a 200 or 800 Ω microphone to 10 kΩ or for matching a high impedance source to a microphone input.
The transformer consists of two coils, each with one primary and one secondary winding separated by an electrostatic shield, and a high permeability mu-metal core. The transformer is encapsulated in a mu-metal case for magnetic shielding.
For best performance, the high impedance side of the transformer (3.5 + 3.5) should be connected in series.

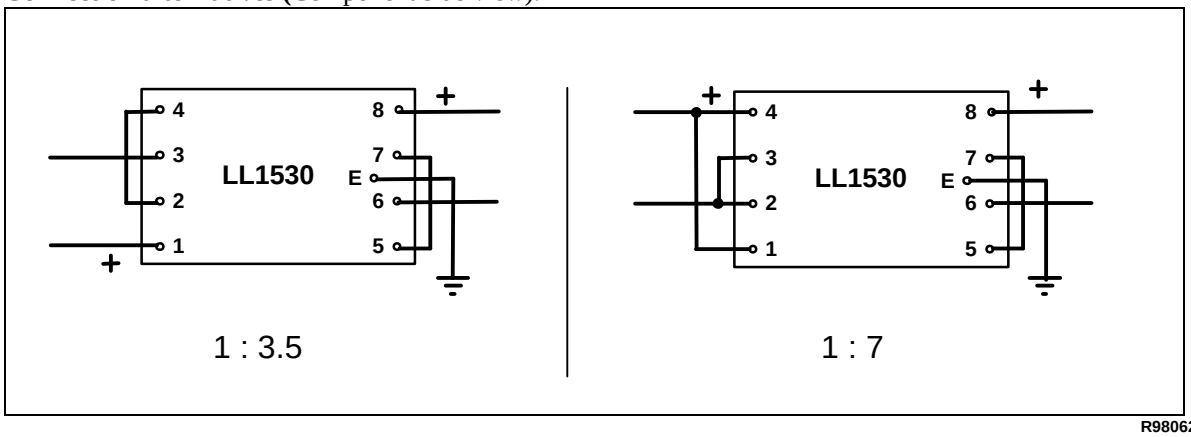
Turns ratio: 1 + 1 : 3.5 + 3.5
Dims (Length x Width x Height above PCB (mm)): 38 x 23 x 16
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 27.94 mm (1.1")
Offset of earth pin from adjacent row: 2.54 mm (0.1")
Weight: 46 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of each primary: 42Ω
Static resistance of each secondary: 790Ω
Distortion (primaries connected in series, source impedance 800Ω): + 6 dBU (primary level) 0.1% @ 50 Hz
+16 dBU (primary level) < 1% @ 50 Hz
Self resonance point : > 100 kHz
Recommended termination for best square-wave response:

connection 1:3.5	10 kΩ in series with 220 pF
connection 3.5:1	2 kΩ in series with 2.2 nF
connection 7:1	1 kΩ

Frequency response
(1:3.5, source 800Ω , load 10kΩ in series with 220 pF): 20 Hz -- 30 kHz +/- 0.3 dB
Isolation between windings/ between windings and shield: 4 kV / 2 kV
Connection alternatives (Component side view):



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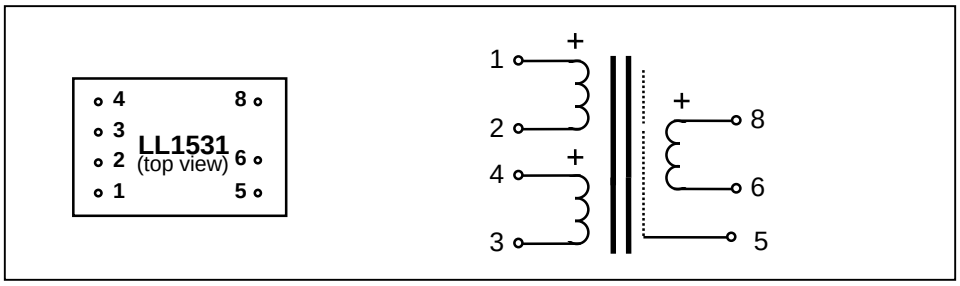
High Impedance Line Input Transformer
LL1531

LL1531 is a small size, high impedance line input transformer for bridging input applications
The transformer consists of two coils, each with one primary and one secondary winding separated by an electrostatic shield. The two secondary windings are internally connected in series.
The core is a high permeability mu-metal lamination core.
The transformer is magnetically shielded by a mu-metal housing.

Being a high impedance transformer, the LL1531 should normally be used with primaries connected in series.

Turns ratio: 1 + 1 : 2
Dims (Length x Width x Height above PCB (mm)): 28 x 17 x 15
Pin layout (viewed from component side) **and winding schematics:**

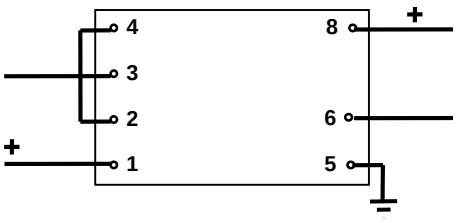


Spacing between pins: 3.81 mm (0.15")
Spacing between rows of pins: 20.32 mm (0.8")
Weight: 25 g
Rec. PCB hole diameter: 1.5 mm

	LL1531
Static resistance of each primary:	500Ω
Static resistance of secondary:	1.3kΩ
Distortion (primaries connected in series, source impedance 600Ω):	+ 10 dBU primary level, 50 Hz: 0.2 %
	+ 20 dBU primary level, 50 Hz: 1 %
Self resonance point :	> 80 kHz
Optimum termination for best square-wave response (source imp. 600Ω) **:**	8 kΩ in series with 1.2 nF
Frequency response (source and load as above)	10 Hz - 25 kHz +/- 0.3 dB

Isolation between windings/ between windings and shield: 3 kV / 1.5 kV

Connection alternatives



Line input, 1 : 1

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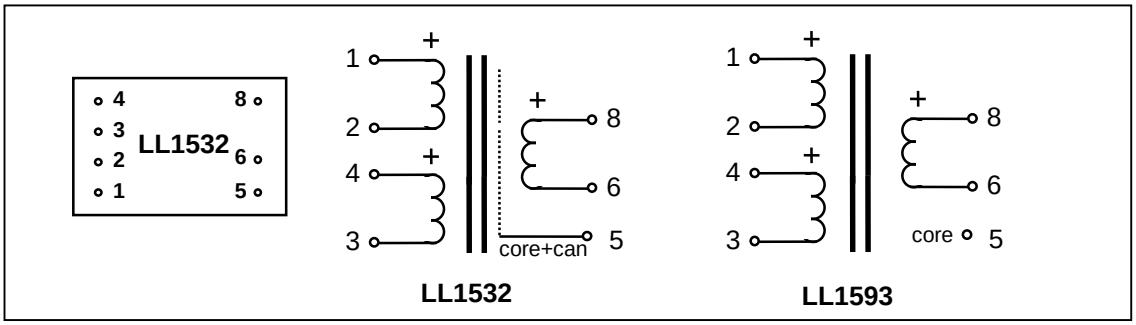
General Purpose Audio Transformers
LL1532 and LL1593

LL1532 and LL1593 are small size medium impedance transformers suitable for splitting and other general purpose applications.
LL1532 consists of two coils each with one primary and one secondary winding separated by an electrostatic (Faraday) shield. The two secondary windings are internally connected in series. The core is a high permeability mu-metal core. The LL1532 is magnetically shielded by a mu-metal housing.
LL1593 is a **low-cost version** of the LL1532, with the same winding structure but without Faraday shields and mu-metal housing.
The LL1532 and LL1592 can be used with primaries in series for 1:1 or in parallel for 1:2 turns ratio.

Turns ratio: 1 + 1 : 2
Dims (Length x Width x Height above PCB (mm)): 28 x 17 x 15 / 28 x 17 x 14
Pin layout (viewed from component side) **and winding schematics:**

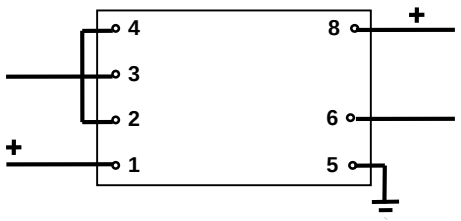


Spacing between pins: 3.81 mm (0.15")
Spacing between rows of pins: 20.32 mm (0.8")
Weight: 25 g / 19 g
Rec. PCB hole diameter: 1.5 mm

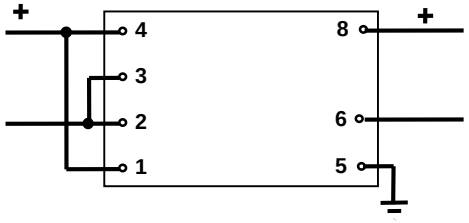
	LL1532	**LL1593**
Static resistance of each primary:	70Ω	70Ω
Static resistance of secondary:	180Ω	175Ω
Distortion (primaries connected in series, source impedance 600Ω):	+ 6 dBU primary level, 50 Hz: 0.2 %	+ 6 dBU primary level, 50 Hz: 0.2 %
	+ 12 dBU primary level, 50 Hz: 1 %	+ 12 dBU primary level, 50 Hz: 1 %
Self resonance point :	~ 200 kHz	~ 200 kHz
Frequency response (source 600Ω , load 10kΩ)	10 Hz - 60 kHz +/- 0.3 dB	10 Hz - 60 kHz +/- 0.3 dB
Optimum termination for best square-wave response (source imp. 600Ω) **:**	2 kΩ in series with 1.6 nF	2 kΩ in series with 1.6 nF

Isolation between windings/ between windings and shield: 3 kV / 1.5 kV

Connection alternatives



1 : 1



1 : 2

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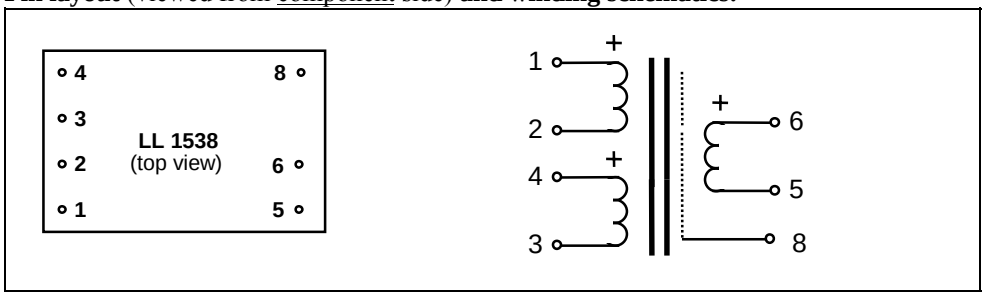
Microphone Input Transformers
LL1538 and LL1538XL

The LL1538 and the LL1538XL are high performance microphone input transformers, each with a high permeability mu-metal core and two three-section coils.
In the LL1538XL the core is about 45% larger than in the LL1538, resulting in a larger level capability. In both types, primary and secondary windings are separated by electrostatic shields. The three-section winding structure of the transformers results in a very low leakage inductance and thus an excellent frequency response.
The transformers are encapsulated in mu-metal cases for magnetic shielding.

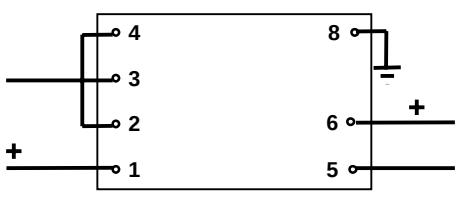
Turns ratio: 1 + 1 : 5

Pin layout (viewed from component side) **and winding schematics:**

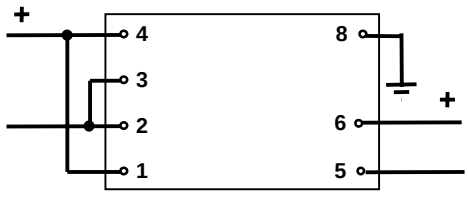


	LL1538	LL1538XL
Dimensions (Max. Length x Width x Height above PCB (mm))	38 x 24 x 17	38 x 24 x 20.5
Spacing between pins	5.08 mm (0.2")	5.08 mm (0.2")
Spacing between rows of pins	27.94 mm (1.1")	27.94 mm (1.1")
Weight	46 g	65 g
Rec. PCB hole diameter	1.5 mm	1.5 mm
Static resistance of each primary	44Ω	61Ω
Static resistance of each secondary	880 Ω	975 Ω
Distortion (primaries connected in parallel, source impedance 200Ω)	0.2 % @ 0 dBU (0.775V rms) primary level, 50 Hz	0.2 % @ + 3 dBU (1.1V rms) primary level, 50 Hz
	1 % @ + 10 dBU (2.5 V rms) primary level, 50 Hz	1 % @ + 13 dBU (3.5V rms) primary level, 50 Hz
Self resonance point	> 120 kHz	> 120 kHz
Optimum termination for best square-wave response (Connection 1:5, source imp. 200Ω)	No termination necessary	No termination necessary
Frequency response (source 200 Ω, no termination)	10 Hz - 100 kHz +/- 0.3 dB	10 Hz - 80 kHz +/- 0.3 dB
Isolation between windings/ between windings and shield	4 kV / 2 kV	4 kV / 2 kV

Connection alternatives



1 : 2.5



1 : 5

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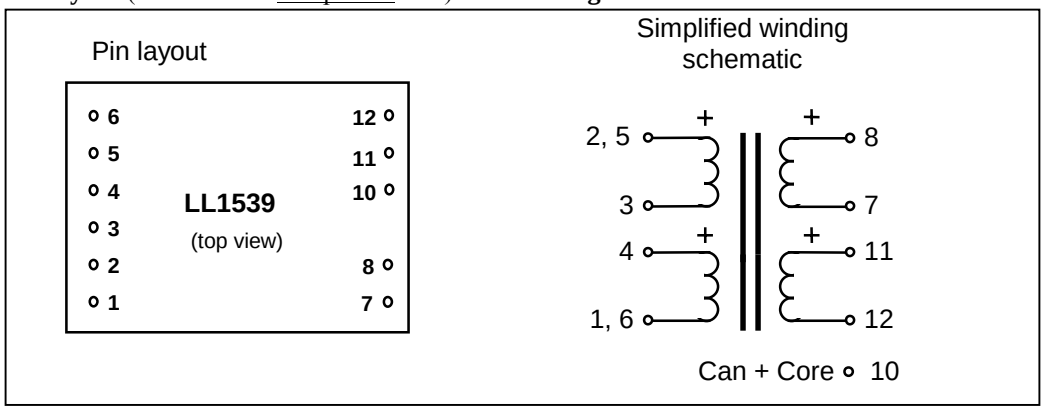
Audio Output Transformer
LL1539

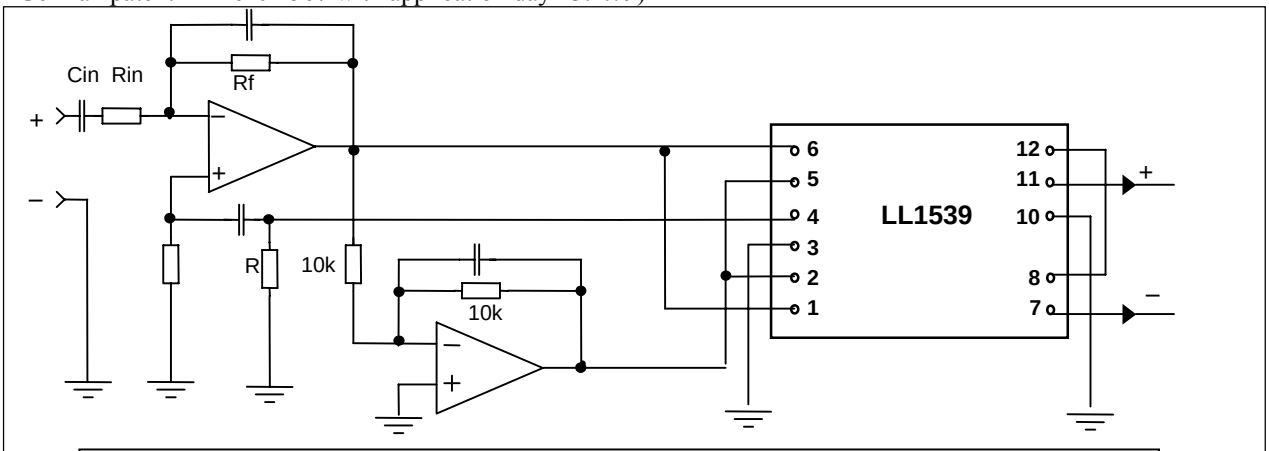
LL1539 is an audio output transformer for balanced drive.
In LL1539, the winding arrangement is such that (properly connected) the secondary windings are surrounded by cold (neutral) parts of the primary windings. This reduces the effect of the capacitance between the primary and the secondary windings. Thus, primaries should always be connected as in the application example below, with or without current feedback drive (negative source impedance).

Turns ratio: 2 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 47 x 34 x 21
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 35.56 mm (1.4")
Weight: 130 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of each primary half (4 -- 1&6 or 3 -- 2&5 respectively**):** 20 Ω
Static resistance of each secondary: 20 Ω
Secondary leakage inductance (secondaries in series): 0.6 mH
No-load impedance: >2 kΩ @ 50 Hz, +20 dBU
Optimum source impedance: Minus 40 Ω
Balance of output (according to IRT, source < 10 Ω , load 600 Ω): > 65 dB
Maximum output level before saturation (load 600 Ω): + 24 dBU @20Hz
Frequency response (@ 10 dBU, source < 10 Ω, load 600 Ω): 20 Hz -- 60 kHz +/- 0.3 dB
Voltage loss across transformer (at midband with 600 Ω load): 1 dB
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Application example: This schema shows the principles of mixed feedback circuitry for eliminating transformer-induced distortion and for reducing output impedance. **(NOTE**! This application was covered by a now outdated German patent DE 29 01 567 with application day 13.1.79)



Gain = 2 * Rf / Rin. Optimum R <= (Rin/Rf) * Rp / 2, where Rp is Cu resistance of prim.
Select R for good THD at LF and for good square wave response

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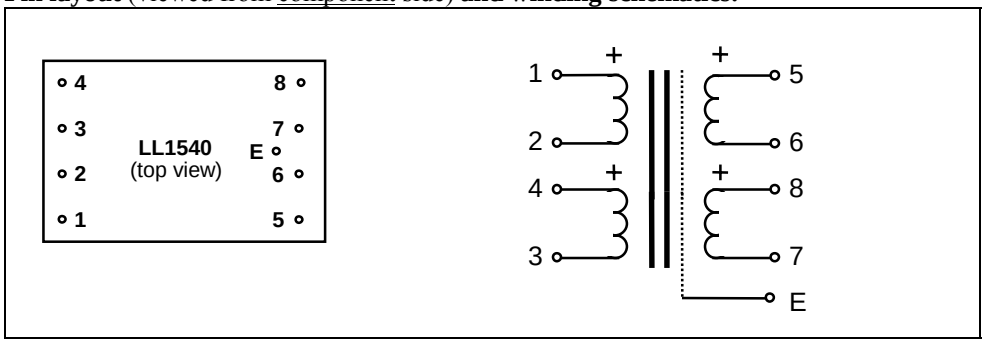
Line Input Transformer
LL1540

LL1540 is a high impedance, high level line input transformer.
The transformer consists of two coils, each with one primary and one secondary part separated by a electrostatic shield. The core is a high permeability mu-metal core, and the transformer is housed in a mu-metal can.
Being a high impedance transformer, the LL1540 should normally be used in a series-series connection.

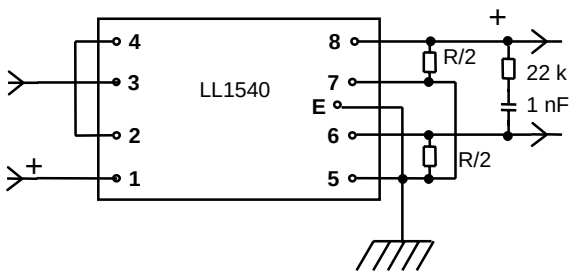
Turns ratio: 1 + 1 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 38 x 24 x 17
Pin layout (viewed from component side) **and winding schematics:**



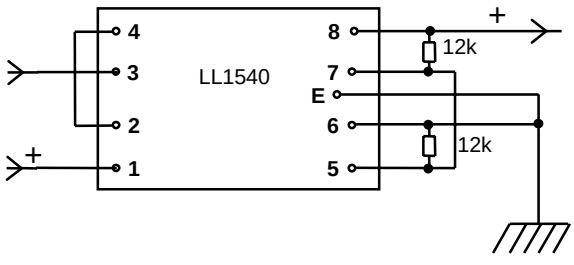
Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 27.94 mm (1.1")
Offset of earth pin from adjacent row: 2.54 mm (0.1")
Weight: 47 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of <u>each</u> primary: 610Ω
Static resistance of <u>each</u> secondary: 800Ω
Distortion (source impedance 600Ω): + 20 dBU < 0.1% @ 50 Hz
+30 dBU < 1 % @ 50 Hz
Self resonance point : > 60 kHz
Recommended load for best square-wave response: 22 kΩ in series with 1nF
Frequency response (source 600Ω, load 15 k Ω) 5 Hz -- 50 kHz +/- 0.2 dB
Loss across transformer (at 1 kHz with above termination): 0.5 dB

Isolation between windings / between windings and shield: 4 kV / 2 kV

Suggested connections:



Suggested connection for symmetric input amplifier (recommended for very high CMRR).
Select R for desired input impedance.
With R < 25 k, RC network can be omitted.



Suggested connection for asymmetric input amplifier.
2 x 12 k resistors required for > 60 dB CMRR.

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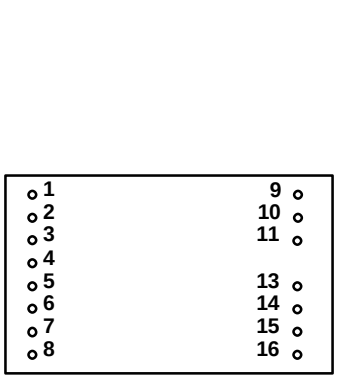
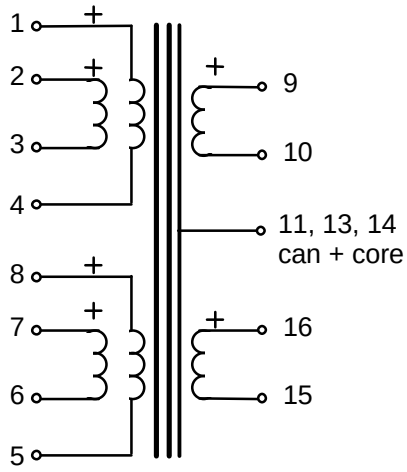
Audio Transformer LL1544A

LL1544A is a line input / general purpose audio transformer which can be used in many different applications ranging from bridging input to microphone input applications. The transformer is built up from two three-section coils with interleaved Faraday shields. The core is a two-component amorphous strip core. This core type combines a high sensitivity for very low signal levels with excellent high-level capabilities. In addition, as this type of core does not store energy (unlike conventional mu-metal cores), at low frequencies phase response is excellent and resonance with a series capacitor is practically eliminated.
The LL1544A replaces previous types LL1544 and LL1554.

Turns ratio: 1 + 1 + 1 + 1 : 2 + 2
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and Windings Schematics:





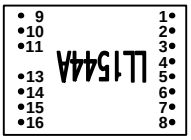
Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 27 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of <u>each</u> primary (average): 130 Ω
Static resistance of <u>each</u> secondary (average): 260 Ω
Self resonance point: > 220 kHz
Recommended load for best square-wave response (Termination alternative A below): 6.7 kΩ + 470 pF
Frequency response (source 600Ω , load (6.7 kΩ + 470 pF) in parallel with 56 kΩ): 10 Hz - 70 kHz +/- 0.5 dB @ 0 dBU
Loss across transformer (at 1kHz with termination as above): 0.2 dB
Isolation between windings / between windings and shields: 3 kV / 1.5 kV

Data at different termination alternatives, showed on the following page:

Termination Alternative	Turns ratio	Copper Resistance Prim/sec	Idle impedance @40 Hz, 0dBU	Suggested Use	THD < 0.5%@50 Hz primary level / real source impedance
R4B / R4U : L4B / L4U	1:1	520Ω / 520Ω	80kΩ / 80kΩ	10 kΩ / 10 kΩ	20 dBU / 600Ω
R2B / R2U : L2B / L2U	1:1	130Ω / 130Ω	20kΩ / 20kΩ	600Ω / 600Ω	14 dBU / 150Ω
R2B / R2U : L4B / L4U	1:2	130Ω / 520Ω	20kΩ / 80kΩ	600Ω / 2.5 kΩ	14 dbU / 150Ω
R4B / R4U : L2B / L2U	2:1	520Ω / 130Ω	5kΩ / 20kΩ	10 kΩ / 2.5 kΩ	22 dBU / 37.5Ω
R4B / R4U : L1	4:1	520Ω / 65Ω	80kΩ / 5kΩ	10 kΩ / 600Ω	22 dBU / 37.5Ω

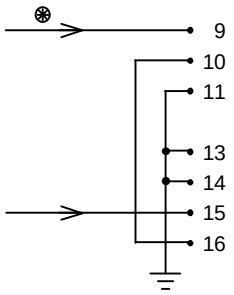
.

Connection alternatives for LL1544A
Component side view

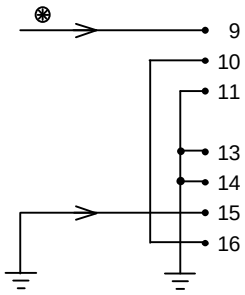


Component side view

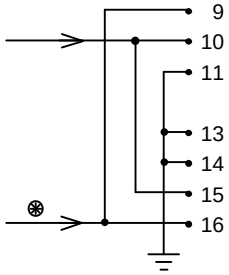
Connection: R4B
Balanced source



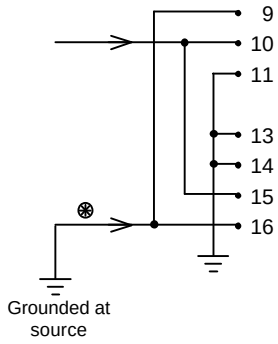
Connection: R4U
Unbalanced source



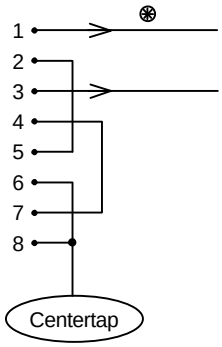
Connection: R2B
Balanced source



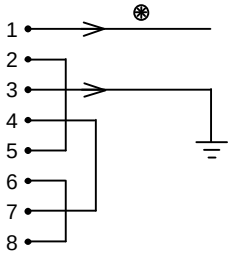
Connection R2U
Unbalanced source



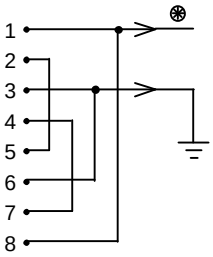
Connection L4B
Balanced load



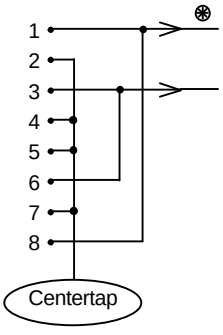
Connection L4U
Unbalanced load



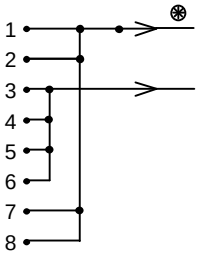
Connection L2U
Unbalanced load



Connection L2B
Balanced load



Connection L1



Turns ratio	Application	Transformer Input (primary)	Transformer Output (secondary)
1:1	Line input to unbalanced circuits	R4B / R4U	L4U
1:2	Line input to unbalanced circuits	R2B / R2U	L4U
2:1	Line input to unbalanced circuits	R4B / R4U	L2U
1:1	Low impedance line input to unbalanced circuits	R2B / R2U	L2U
1:1	Line input to balanced circuits	R4B / R4U	L4B
1:2	Line input to balanced circuits	R2B / R2U	L4B
2:1	Line input to balanced circuits	R4B / R4U	L2B
1:1	Low impedance line input to balanced circuits	R2B / R2U	L2B

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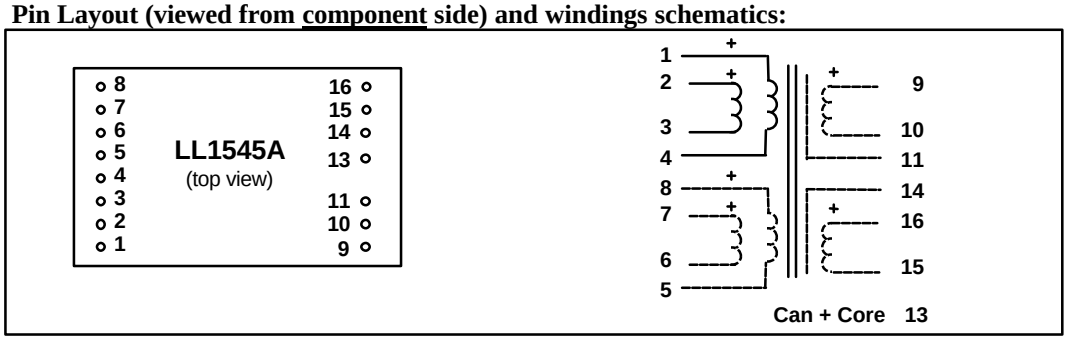
Audio Transformer
LL1545A

LL1545A is a general-purpose audio transformer with a variety of connection alternatives. The transformer is built up from two coils, each with a secondary winding surrounded by shields and two primary windings. This structure results in an excellent frequency response. The transformer can be used in many different applications such as a high impedance line input transformer (accepting signal levels of 22 dBU @ 40 Hz with primaries in series), for splitting or as a microphone input transformer.
The LL1545A is made with a mu-metal core and is housed in a mu-metal can.
Refer to page 2 of this sheet for termination alternatives.

Turns ratio: 1 + 1 + 1 + 1 : 2 + 2
Dims: (Length x Width x Height above PCB (mm)) 37 x 22.5 x 14.5
Pin Layout (viewed from component side) and windings schematics:



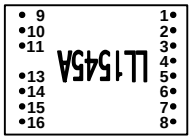
Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 46 g
Rec. PCB hole diameter 1.5 mm
Static resistance of windings: 2-3 or 6-7 — 122 Ω
1-4 or 5-8 — 182 Ω
9-10 or 15-16 — 305 Ω
Self resonance point: > 220 kHz
Recommended load for best square-wave response
(Termination alternative R4B:L4B over): 6.7 kΩ + 470 pF
Frequency response (source 600Ω , load (6.7 kΩ + 470 pF) in parallel with 56 kΩ): 10 Hz - 70 kHz +/- 0.5 dB @ 0 dBU
Loss across transformer (at 1 kHz with termination as above): 0.3 dB
Core: Mu-metal
Isolation between windings / between windings and shields: 3 kV / 1.5 kV

Data at different termination alternatives, showed on page 2 of this data sheet.

Termination Alternatives	Turns ratio	Copper Resistance Prim/sec	Idle impedance @40 Hz, 0dBU	Suggested Use	THD < 0.2%@40 Hz primary level / real source impedance
R4B / R4U : L4B / L4U	1:1	610 Ω / 610 Ω	80 kΩ / 80 kΩ	10 kΩ / 10 kΩ	22 dBU / 600 Ω
R2B / R2U : L2B / L2U	1:1	150 Ω / 150 Ω	20 kΩ / 20 kΩ	600 Ω / 600 Ω	16 dBU / 150 Ω
R2B / R2U : L4B / L4U	1:2	150 Ω / 610 Ω	20 kΩ / 80 kΩ	600 Ω / 2.5 kΩ	16 dbU / 150 Ω
R4B / R4U : L2B / L2U	2:1	610 Ω / 150 Ω	80 kΩ / 20 kΩ	10 kΩ / 2.5 kΩ	22 dBU / 37.5 Ω
R4B / R4U : L1	4:1	610 Ω / 75 Ω	80 kΩ / 5 kΩ	10 kΩ / 600 Ω	22 dBU / 37.5 Ω

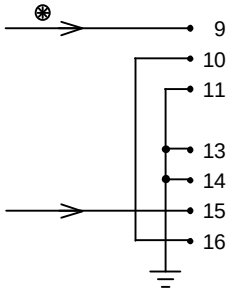
R030220

Connection alternatives for LL1545A
Component side view

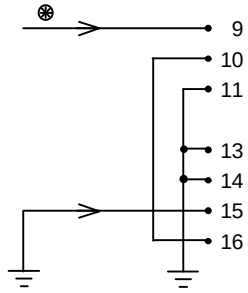


Component side view

Connection: R4B
Balanced source

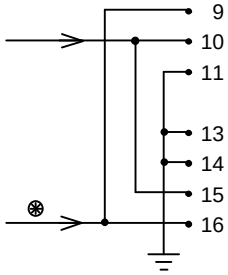


Connection: R4U
Unbalanced source

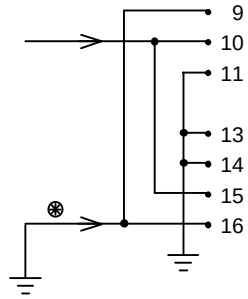


Grounded at source

Connection: R2B
Balanced source

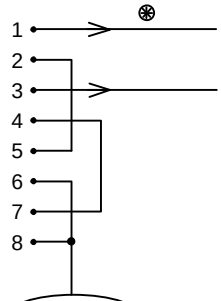


Connection R2U
Unbalanced source



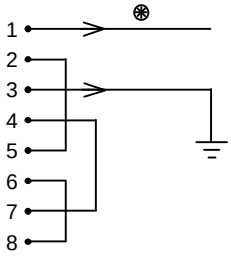
Grounded at source

Connection L4B
Balanced load

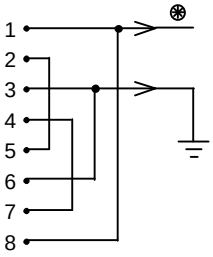


Centertap

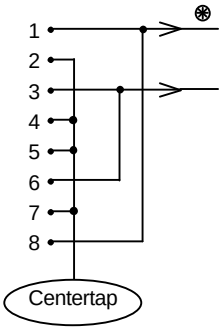
Connection L4U
Unbalanced load



Connection L2U
Unbalanced load

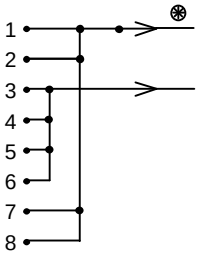


Connection L2B
Balanced load



Centertap

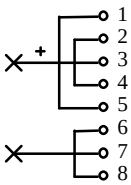
Connection L1



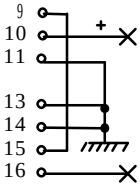
Turns ratio	Application	Transformer Input (primary)	Transformer Output (secondary)
1:1	Line input to unbalanced circuits	R4B / R4U	L4U
1:2	Line input to unbalanced circuits	R2B / R2U	L4U
2:1	Line input to unbalanced circuits	R4B / R4U	L2U
1:1	Low impedance line input to unbalanced circuits	R2B / R2U	L2U
1:1	Line input to balanced circuits	R4B / R4U	L4B
1:2	Line input to balanced circuits	R2B / R2U	L4B
2:1	Line input to balanced circuits	R4B / R4U	L2B
1:1	Low impedance line input to balanced circuits	R2B / R2U	L2B

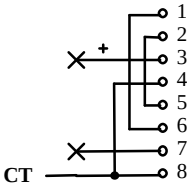
R030206

LL1545A Connection alternatives
(Left side is input if not stated otherwise)
!!!! Pin side view !!!!

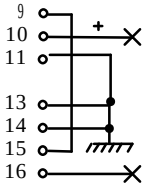


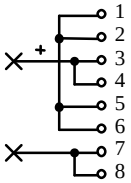
A





A
CENTER TAP





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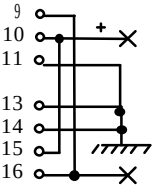

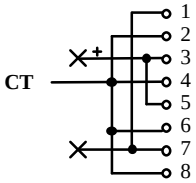

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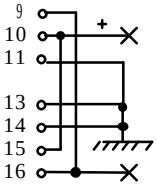
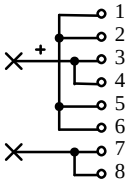
CENTER TAP





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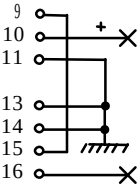
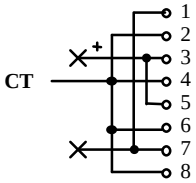
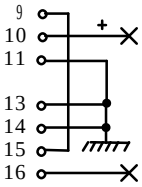
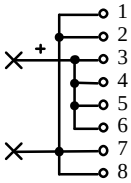


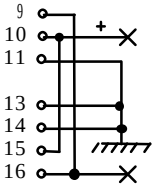


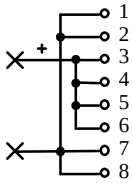
C
CENTER TAP





D





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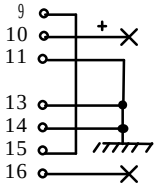
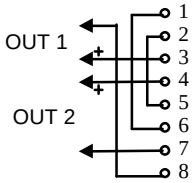
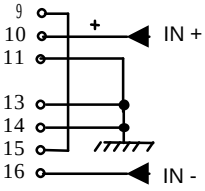
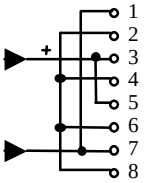


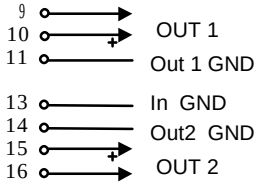


F
SPLIT





G
SPLIT



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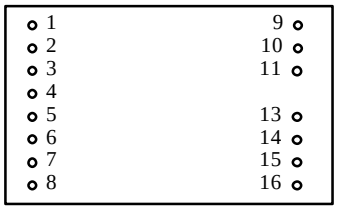
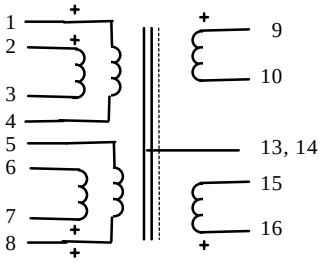
Audio Transformer
LL1550

LL1550 is an audio transformer with rather high turns ratio and with a variety of connection alternatives. The transformer is built up from two coils, each with a secondary winding surrounded by shields and two primary windings. This structure results in an excellent frequency response. All winding ends are available on the pins. The transformer is ideally used in applications where the high turns ratio is utilized, e.g. in a D.I. box.
The LL1550 is made with amorphous core material. As this type of core does not store energy (unlike conventional mu-metal cores) the low frequency resonance with external capacitors is practically eliminated.
Refer to the back side of this sheet for termination alternatives.

Turns ratio: 1 + 1 + 1 + 1 : 4 + 4
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and Windings Schematics:





Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 30 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of <u>each</u> primary (average): 33 Ω
Static resistance of <u>each</u> secondary (average): 265 Ω
Self-resonance point: > 280 kHz
Recommended load for best square-wave response
(Termination alternative A below): 6.7 kΩ + 470 pF
Frequency response
(source 150Ω , load (6.7 kΩ + 470 pF) in parallel with 56 kΩ): 10 Hz - 70 kHz +/- 0.5 dB @ 0 dBU
Loss across transformer (at midband with termination as above): 0.3 dB
Core: Amorphous Strip
Isolation between windings / between windings and shields: 3 kV / 1.5 kV

Data at different termination alternatives, showed on the back side of this sheet:

Termination Alternative	Turns ratio	Copper Resistance prim/sec	No load impedance @40 Hz, 0dBU	Suggested Use	THD < 0.5%@40 Hz primary level / real source impedance
A	1:2	130Ω / 530Ω	40kΩ / 160kΩ	600 Ω / 10 kΩ	12 dBU / 150Ω
B	1:2	33Ω / 133Ω	10kΩ / 40kΩ	200Ω / 10 kΩ	6 dBU / 40Ω
C	1:4	33Ω / 530Ω	10kΩ / 160kΩ	200Ω / 5kΩ	6 dbU / 40Ω
D	1:4	8Ω / 133Ω	2.5kΩ / 40kΩ	200Ω / 1kΩ	-1 dBU / 10Ω
E	1:8	8Ω / 530Ω	2.5kΩ / 160kΩ	200Ω / 10kΩ	-1 dBU / 10Ω

F (Split) 4:1+1 530Ω / 66Ω + 66Ω
G (Split) 1:2+2 33Ω / 265Ω + 265Ω Left side can also be connected as $B_{CenterTap}$ (1:1+1) or D (1:2+2)
.

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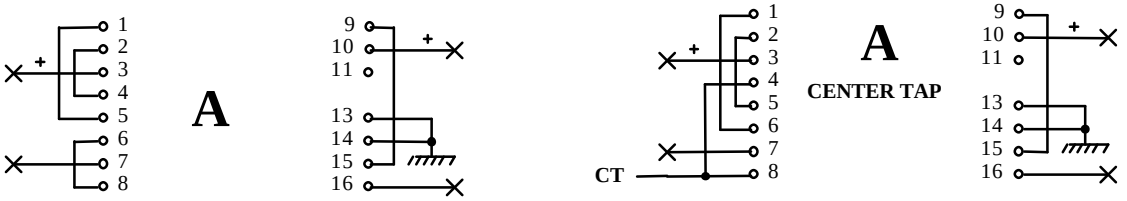
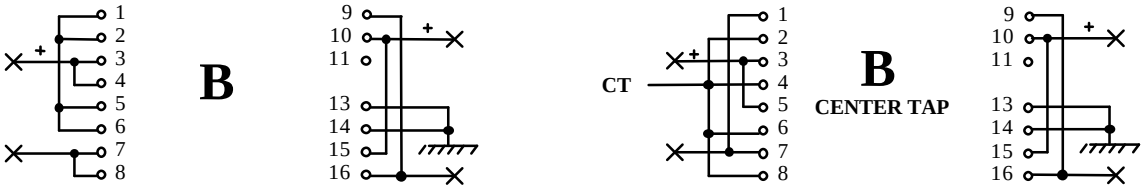
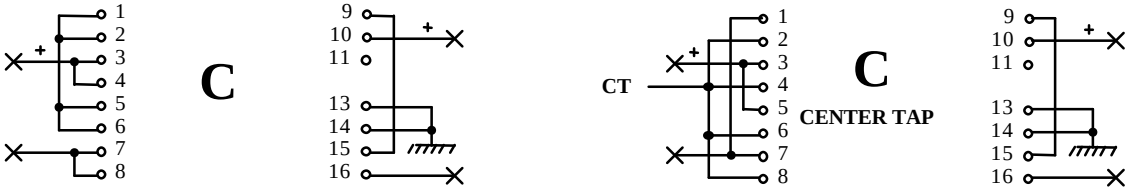
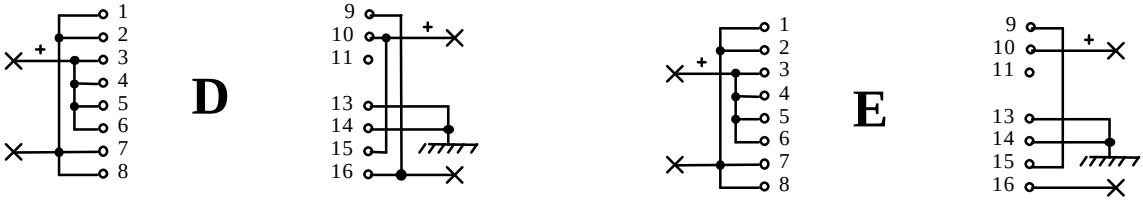
LL1550 Termination Alternatives
(Left side is input if not stated otherwise)
!!!!! Pin's side views !!!!!









R940324

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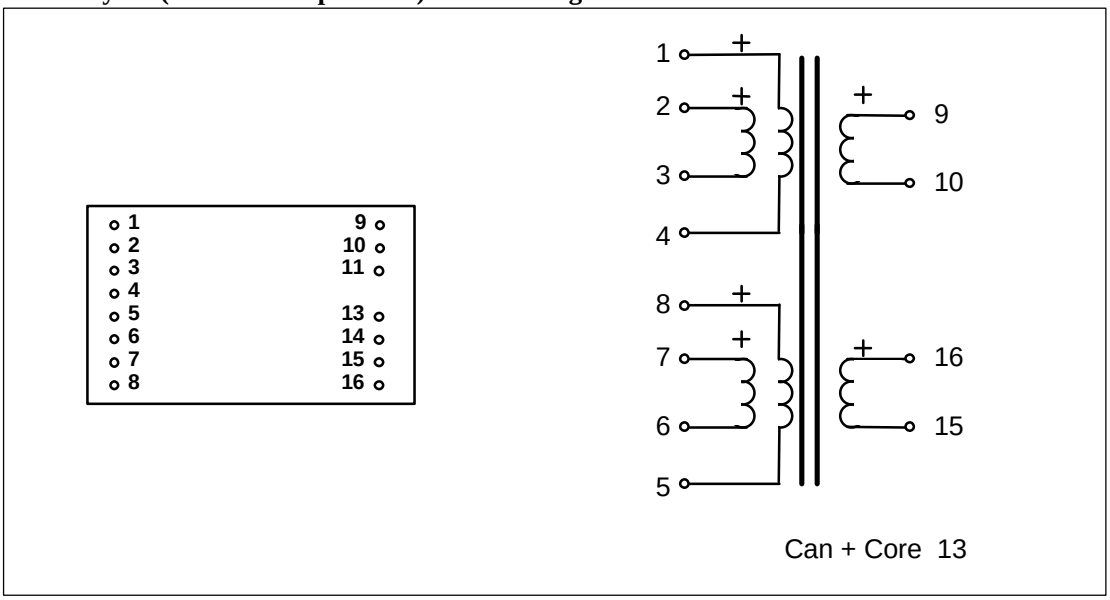
Audio Output Transformer
LL1555

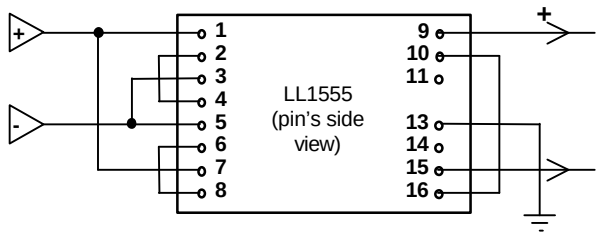
LL1555 is an audio output transformer for balanced drive. The winding arrangement is such that, connected as shown below, each secondary winding is surrounded by cold primary winding ends. The transformer is ideally used with a mixed feedback drive circuit (refer to our separate sheet). The secondaries can be connected in parallel (for low output impedance) or in series.
The LL1555 is made with an audio C-core of our own production and is housed in a mu-metal housing.

Turns ratio: 1 + 1 + 1 + 1 : 1 + 1
Dims: (Length x Width x Height above PCB (mm)) 33 x 26x 20
Pin Layout (viewed from pins side) and Windings Schematics:

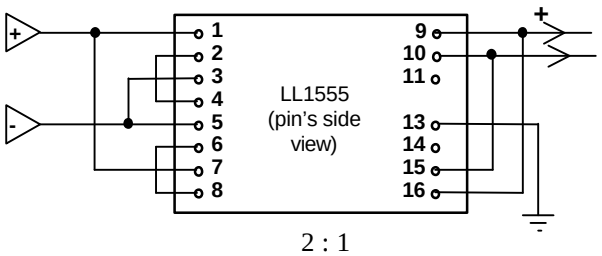


Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 59 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of <u>each</u> primary (average): 120 Ω
Static resistance of <u>each</u> secondary (average): 75 Ω
Max. primary level (primaries connected as below): +27 dBU @ 50 Hz
Leakage inductance of secondaries (sec. in series): 1.0 mH
No-load impedance(primaries connected as below)**:** >2kΩ @ 50 Hz, @+14 dBU primary level
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω) > 60 dB
Frequency response (source 10 Ω, load 600 Ω): 10 Hz -- 40 kHz +/- 0.3 dB
Isolation between primary and secondary windings/ between windings and core: 4 kV / 2 kV

Suggested usage



1 : 1
Max. output level +27 dBU @ 50 Hz
Primary resistance 120 Ω
Secondary resistance 150 Ω



2 : 1
Max. output level +21 dBU @ 50 Hz
Primary resistance 120 Ω
Secondary resistance 37 Ω

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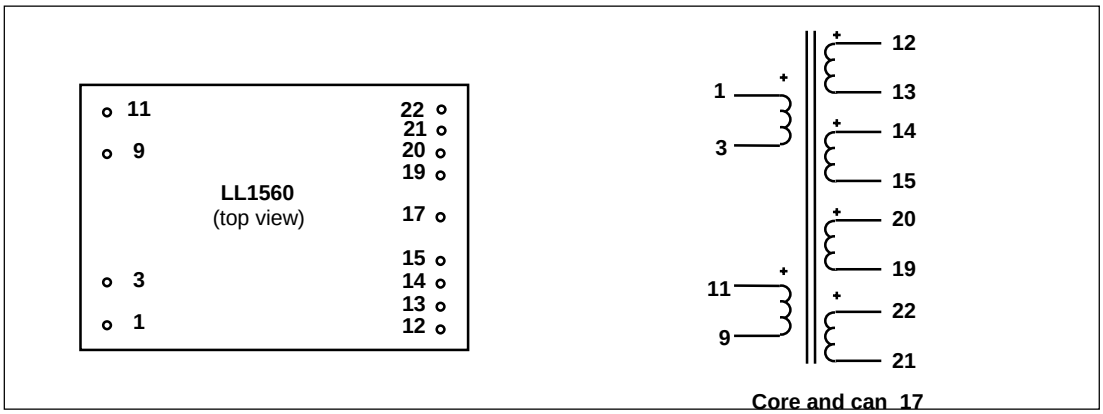
Audio Split Transformer
LL1560

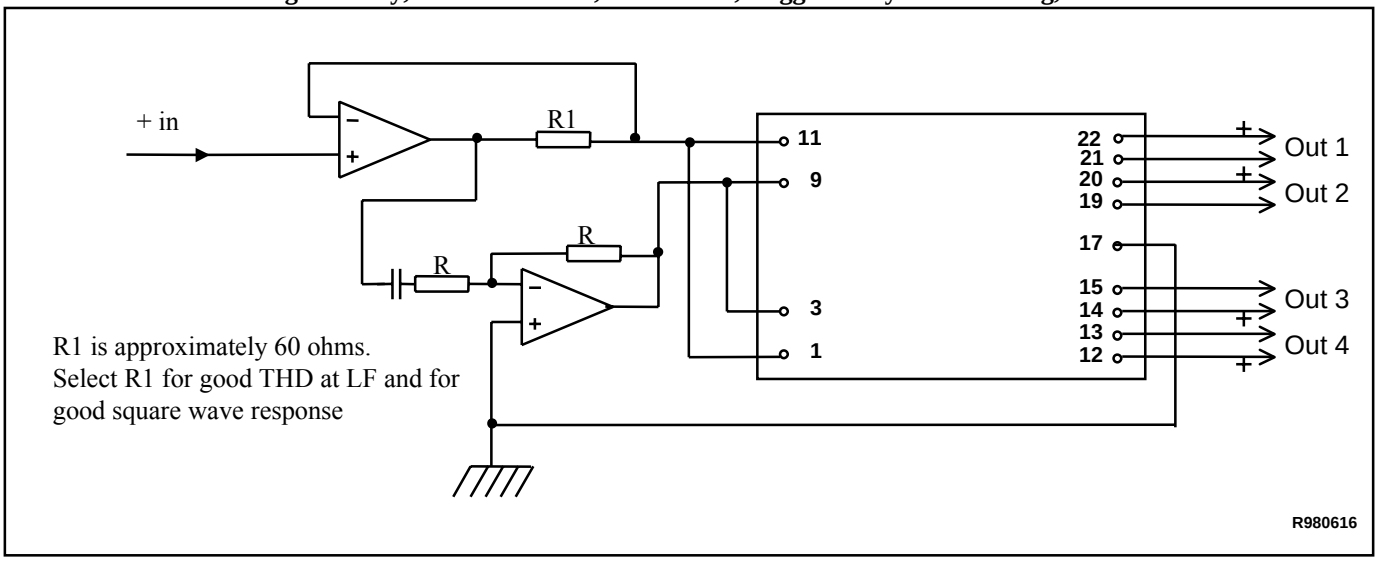
LL1560 is an audio transformer specially built for active splitting.
Each of the four secondary windings is surrounded by primary winding parts. This results in a low leakage inductance and ensures that output signal is maintained on three of the secondary windings even if one is short-circuited, provided of course that driving power is available.
The primary windings should be used in parallel.

Turns ratio: 2 + 2 : 1 + 1 + 1 + 1
Dims: (Length x Width x Height above PCB (mm)) 47 x 34 x 23
Pin Layout (viewed from component side) and Windings Schematics (simplified):



Housing:	Mu-metal
Core:	Audio C-core
Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	130 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of <u>each</u> primary (average):	120 Ω
Static resistance of <u>each</u> secondary (average):	55 Ω
Secondary leakage inductance (secondaries in series, primary short circuited):	< 1 mH
Max. secondary level (each secondary)	+ 26 dBU @ 50 Hz
No-load primary impedance(primaries in parallel, primary level)**:**	> 1 kΩ @ 50 Hz, +20 dBU
Balance of output (according to IRT, source 10 Ω , Load 600 Ω):	> 60 dB
Frequency response (source 10 Ω, each sec. loaded with 600 Ω, 0 dBU sec. level):	20 Hz - 50 kHz +/- 0.5 dB
Isolation between windings / between windings and shields:	4 kV / 2 kV

Driving circuitry, mixed feedback, 2:1+1+1+1, suggested by A. Offenberg, NRK



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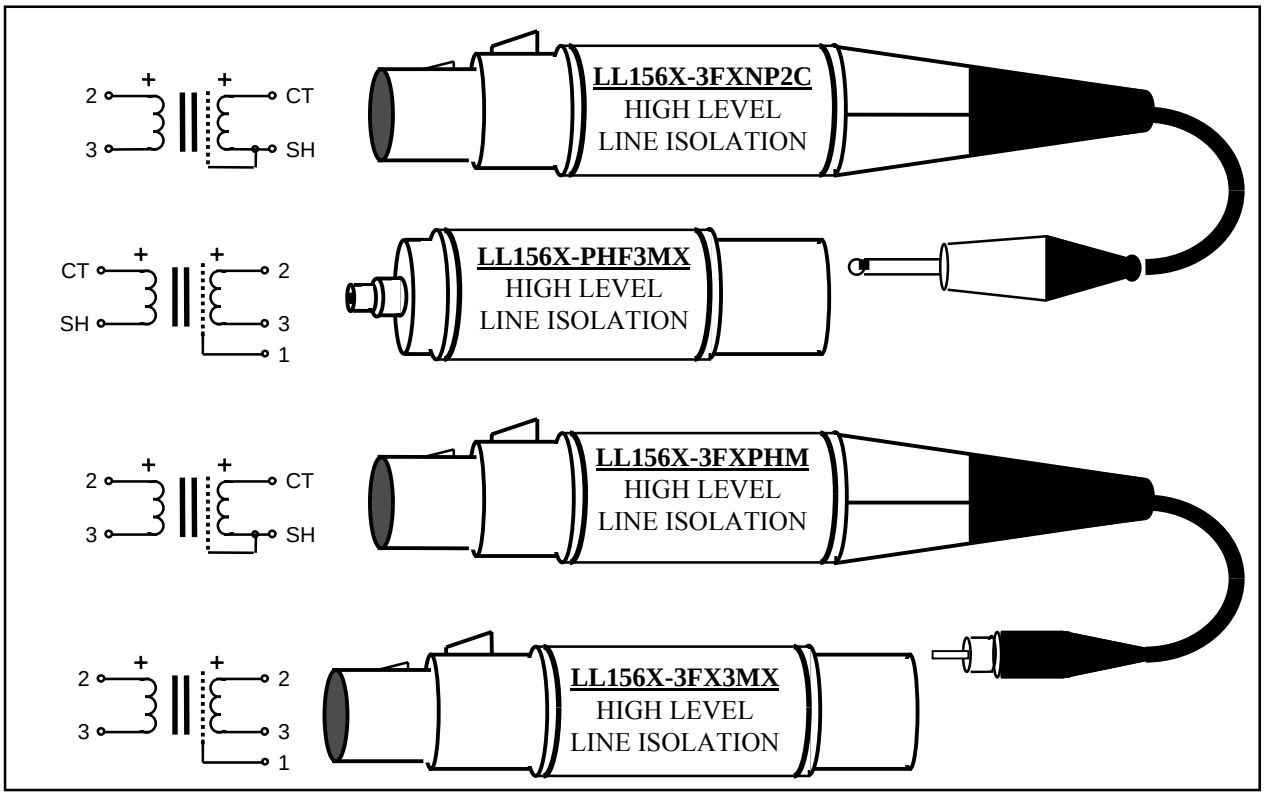
High Level, High Impedance Ground Isolation Unit
Balanced to Unbalanced Converter
LL156X

The XLR inline transformer unit LL156X is designed for breaking up ground loops and for balanced-to-unbalanced conversion in mobile or stationary audio systems. The unit is magnetically shielded and contains a high impedance input transformer LL1565, with LF saturation above +22 dBU, 40 Hz.
The two ends of the unit are galvanically isolated from each other.



The LL156X is available in four versions:

LL156X-3FXNP2C Female XLR connector to 2-pole 'A'-gauge 1/4" jack plug
LL156X-PHF3MX Female Phono (RCA) connector to male XLR connector
LL156X-3FXPHM Female XLR connector to Phono (RCA) male
LL156X-3FX3MX Female XLR connector to male XLR connector

Characteristics of built in transformer LL1565

Static resistance of primary:	1.6 kΩ
Static resistance of secondary:	1.3 kΩ
Core:	Amorphous strip core
Max level:	+22 dBU @ 40 Hz
No-load impedance (@20 dBU, 50Hz)	220 kΩ typically
Frequency response @ 0 dBU (source 600Ω, load 10kΩ)	4 Hz - 100 kHz +/- 0.5 dB
Distortion (THD, source 600Ω)	< 0.2 % @ 50 Hz, 0 - 22 dBU
Loss across transformer, load 10kΩ / 100kΩ	2.2 dB / 0.3 dB
Isolation between windings:	1 kV

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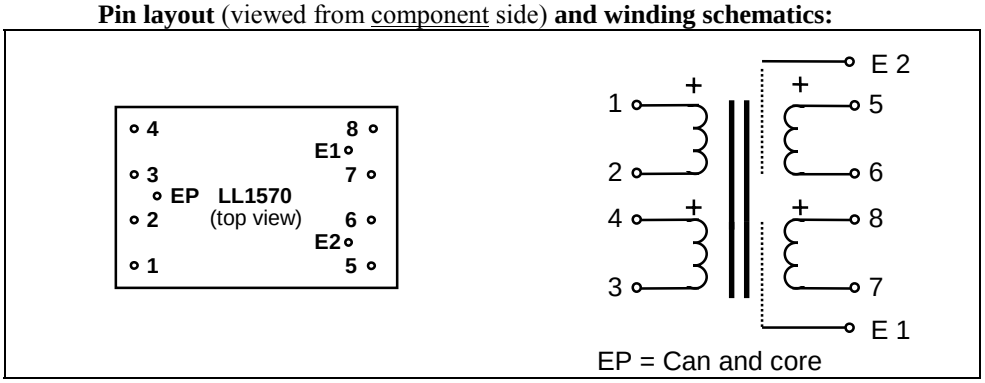
Transformers for splitting
LL1570 and LL1570XL

The LL1570 is designed for splitting signals in application where large ground differences may appear, but is also very useful as a general purpose audio transformer. By careful design, the capacative coupling between the different part of the transformer is kept to a minimum. The three-section winding structure which is necessary for decoupling also results in a very high bandwidth. The transformer is built up from two coils, each with primary and secondary windings separated by electrostatic shields, and a high permeability mu-metal core. The two coil structure in combination with the mu-metal can results in high immunity to external magnetic fields.
In the LL1570XL, the core is about 45% larger than in the LL1570, resulting in a larger level capability.

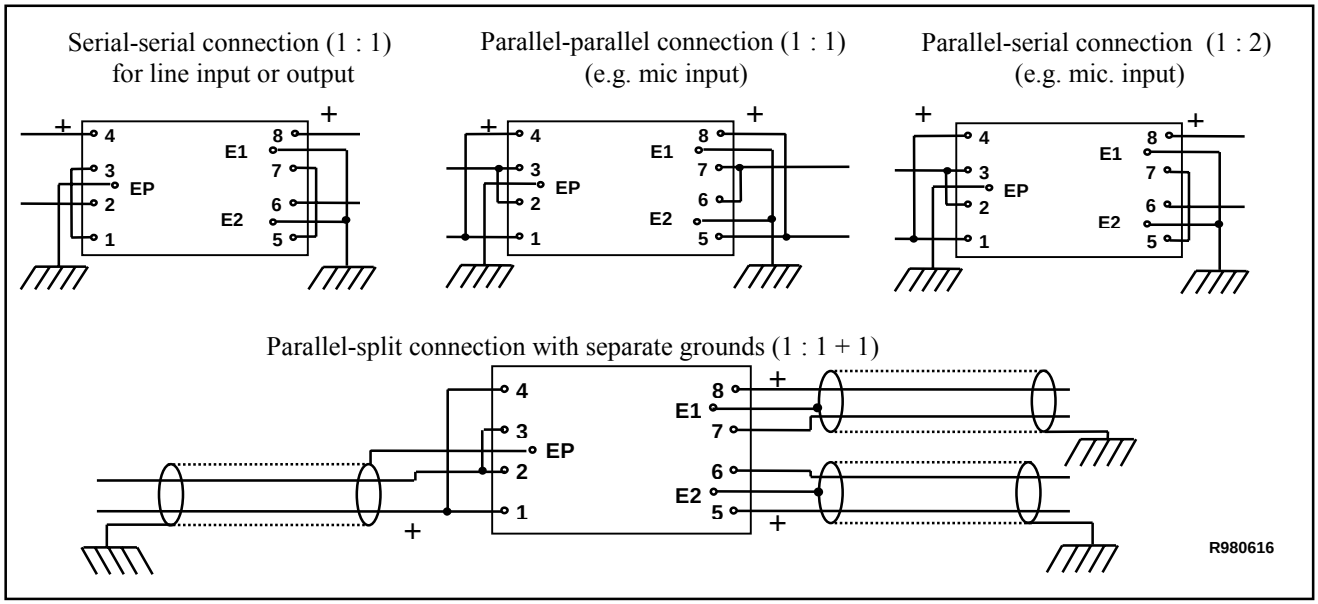
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins	Spacing between rows of pins	Offset of earth pin from adjacent row:	Recommended PCB hole diameter:
5.08 mm (0.2")	27.94 mm (1.1")	2.54 mm (0.1")	1.5 mm

	LL1570	LL1570XL
Dimensions (Max. L x W x H above PCB(mm))	38 x 24 x 17	38 x 24 x 20.5
Weight:	48 g	65 g
Static resistance of each primary:	50 Ω	62 Ω
Static resistance of each secondary:	50 Ω	62 Ω
Distortion (primary level, primaries connected in series, source impedance 800Ω)	0.1% @ + 6 dBU, 50 Hz 1 % < @ +16 dBU, 50 Hz	0.1% @ + 9 dBU, 50 Hz 1 % < @ +19 dBU, 50 Hz
Self resonance point :	> 250 kHz	> 250 kHz
Optimum load for best square-wave response (secondaries. in series)**:**	2.8 kΩ in series with 0.7 nF	2.8 kΩ in series with 0.7 nF
Frequency response (source 600Ω, load as above, serial-serial connections)**:**	10 Hz -- 200 kHz +/- 0.5 dB	10 Hz -- 200 kHz +/- 0.5 dB
Isolation winding-winding / winding-shield / shield-shield	4 kV / 2 kV / 2 kV	4 kV / 2 kV / 2 kV



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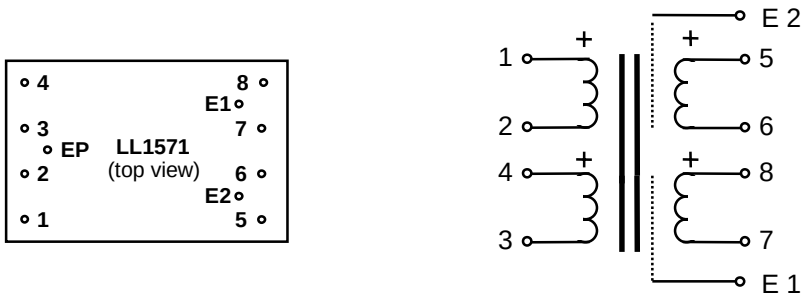
Microphone Input Transformer
LL1571

LL1571 is a microphone input transformer built up from two coils and a high permeability mu metal core. Each coil is wound in three sections with electrostatic shields connected to separate pins. This result in a transformer with a very broad band, also ideal for splitting purpose. The two-coil structure in combination with the mu-metal can results in a high immunity to external magnetic fields.

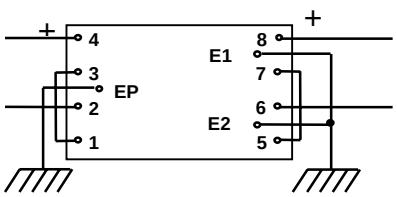
Turns ratio: 1 + 1 : 1.75 + 1.75
Dims (Length x Width x Height above PCB (mm)): 38 x 24 x 17
Pin layout (viewed from component side) **and winding schematics:**



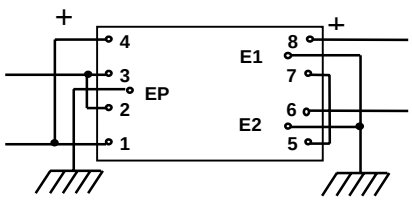
Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 27.94 mm (1.1")
Offset of earth pin rows from adjacent rows: 2.54 mm (0.1")
Weight: 48 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of each primary: 50 Ω
Static resistance of each secondary: 175 Ω
Distortion (primaries in series, source impedance 800Ω)**:** + 6 dBU 0.1% @ 50 Hz
+16 dBU < 1 % @ 50 Hz
Self resonance point : > 200 kHz
Optimum load for best square-wave response
(Source imp. 800 Ω, primaries and secondaries in series)**:** 4 kΩ in series with 0.3 nF
Frequency response (source and load as above)**:** 10 Hz -- 100 kHz +/- 0.5 dB
Isolation between windings/ between windings and shield: 4 kV / 2 kV

Connections:

1 : 1.75
Serial - serial connection



1:3.5
Parallel-serial connection



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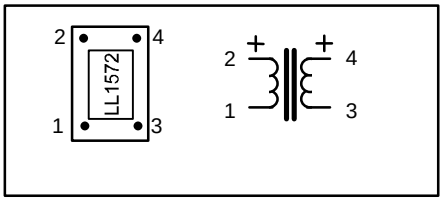
Digital audio transformers
LL1572 (1:1), LL1573 (1:1:1) and LL1589 (1:1:1:1)

The LL1572, LL1573, LL1589 are pulse transformer designed for digital audio. They are designed with a rather large amorphous metal core and have thus low copper resistance, high signal tolerance and low internal capacitance. The amorphous core has a very high mu. Thus, when used, the transformer should be protected from DC current.

LL1572 isolation transformer

Turns ratio:	1:1
Dims: (Length x Width x Height above PCB (mm))	15 x 9 x 11
Spacing between pins 1 and 2:	10.16 mm (0.4")
Spacing between pins 1 and 3:	5.08 mm (0.2")
Rec. PCB hole diameter:	1.5 mm
Weight	2 grams

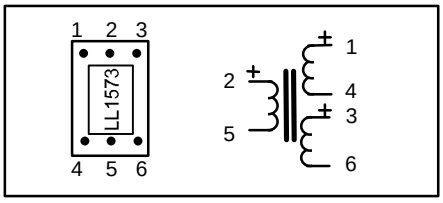
Pin Layout (Top View) **and Winding Schematic**



LL1573 two output splitting transformer

Turns ratio:	1:1:1
Dims: (Length x Width x Height above PCB (mm))	15 x 9 x 12
Spacing between rows of pins:	10.16 mm (0.4")
Spacing between pins in a row	2.54 mm (0.1")
Rec. PCB hole diameter:	1.4 mm
Weight	2.3 grams

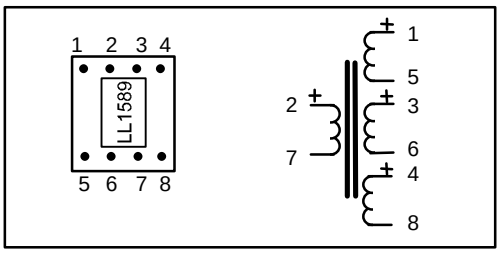
Pin Layout (Top View) **and Winding Schematic**



LL1589 three output splitting transformer

Turns ratio:	1:1:1:1
Dims: (Length x Width x Height above PCB (mm))	15 x 12 x 12
Spacing between rows of pins:	10.16 mm (0.4")
Spacing between pins in a row	2.54 mm (0.1")
Rec. PCB hole diameter:	1.4 mm
Weight	2.5 grams

Pin Layout (Top View) **and Winding Schematic**



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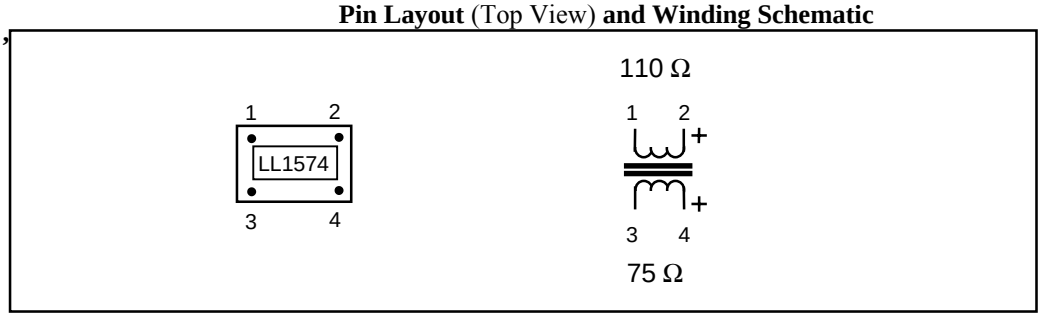
AES - DATS conversion transformer
LL1574

LL1574 is a pulse transformer designed for impedance matching between 110 Ω and 75 Ω systems. The transformer has a large amorphous metal core which results in low copper resistance, high signal tolerance and low internal capacitance.

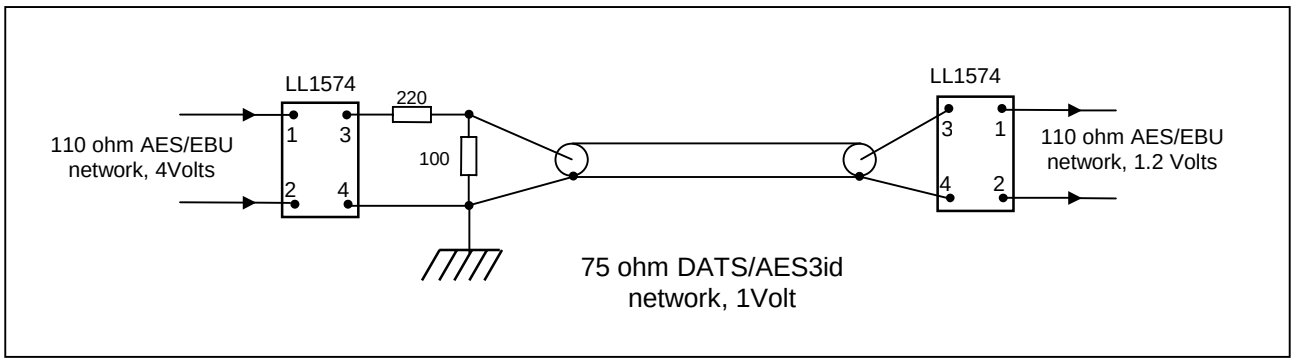
Turns ratio:	1 : 1.2
Impedance ratio	75 : 110
Dims: (Length x Width x Height above PCB (mm))	15 x 9 x 11

Pin Layout (Top View) **and Winding Schematic**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	10.16 mm (0.4")
Rec. PCB hole diameter:	1.5 mm
Weight	2 grams
Core	Amorphous core material
Static resistance of primary (Pins 1 - 2)**:**	1.0 Ω
Static resistance of secondary(Pins 3 - 4)**:**	1.1 Ω
Maximum primary signal • time before saturation:	160 µVs at 8 volts p-p.
Maximum no load current at above conditions:	Î = 3 mA
Primary main inductance (tuned at 10 kHz, 2 V):	40mH
Primary leakage inductance:	1.3 µH
Total coupling capacitance:	< 15 pF
Winding capacitance:	< 1 pF
Isolation between windings:	2 kV
Source impedance:	0 -- 500 Ω
Optimum load impedance:	200 Ω

Application example:
Interface between 110 ohms AES/EBU and 75 ohms DATS/AES3id networks



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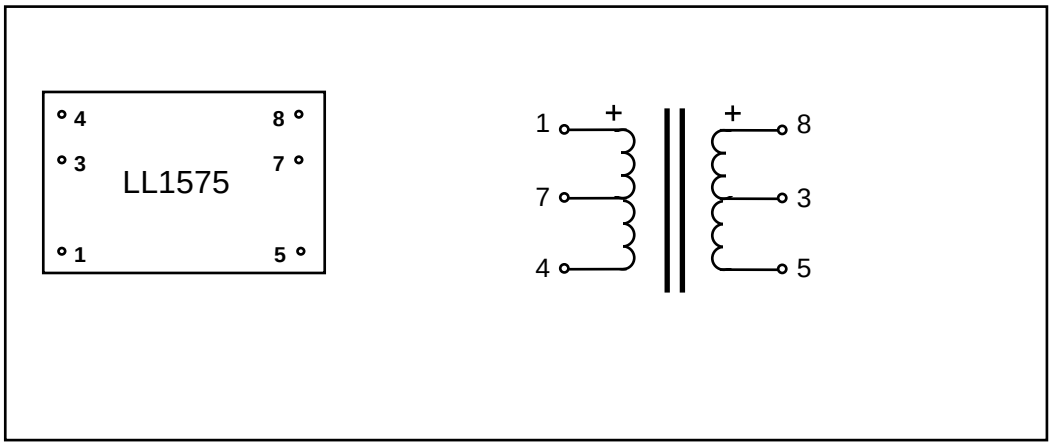
Video Isolation Transformer LL1575

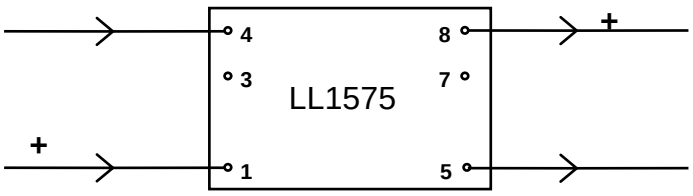
LL1575 is a high bandwidth video isolation transformer for CCTV (closed circuit television). Due to the very wide bandwidth required in CCTV applications, the LL1575 is wound with a special, bifilar winding technique and uses our unique amorphous strip core.

Turns ratio: 1 : 1
Dims (Length x Width x Height above PCB (mm)): 29 x 22 x 14 mm
Pin layout (top view) **and winding schematics:**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	22 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of primary:	4.5 Ω
Static resistance of secondary :	4.5 Ω
Signal loss (source 75Ω , load 75Ω)	0.5 dB
Primary no-load impedance (300 Hz, 7V rms)	> 3.5 kΩ
Frequency response	
(1V p-p sinus. Source 75Ω , load 75Ω):	20 Hz - 11 MHz +0 /- 3 dB
Isolation between primary and secondary windings:	2 kV rms

Suggested connection for galvanic isolation of video signal



NOTE! If DC current is present in signal, the transformer should be decoupled with capacitor 220 uF

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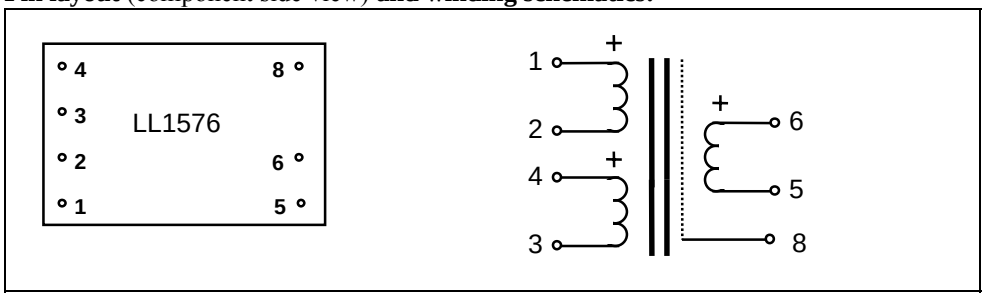
Microphone Input Transformers, Line-box Transformers LL1576 and LL1577

The LL1576 and the LL1577 are high performance microphone input transformers/line-box transformers with high permeability mu-metal cores and high bandwidth coils. The LL1576 and the LL1577 use the same pin-out as our well known microphone transformer LL1538.
In both types, primary and secondary windings are separated by electrostatic shields. The very low leakage inductance and thus excellent frequency response is achieved by a two-coil, three-section per coil winding structure.
The transformers are encapsulated in mu-metal cases for magnetic shielding.

Pin layout (component side view) **and winding schematics:**



Dimensions Max. Length x Width x Height above PCB (mm)	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Weight
38 x 24 x 17	5.08 mm (0.2")	27.94 mm (1.1")	1.5 mm	46 g

	LL1576	**LL1577**
Turns ratio	1 + 1 : 7	1 + 1 : 14
Static resistance of each primary	50 Ω	12 Ω
Static resistance of secondary	1.5 kΩ	1.5 kΩ
Primary level at 0.2 % THD, 50 Hz signal Primaries connected in parallel (fig b), source impedance 50Ω	+2 dBU (sec. level +19 dBU)	-4 dBU (sec. level +19 dBU)
Primary level at 1 % THD, 50 Hz signal Primaries connected in parallel (fig b), source impedance 50Ω	+ 12 dBU (sec. level +29 dBU	+6 dBU (sec level +29 dBU)
Frequency response +/- 0.5 dB to balanced input Signal level 0 dBU, source 200 Ω, fig b, no termination	15Hz – 50kHz	30Hz – 12kHz
Frequency response +/- 0.5 dB to balanced input Signal level -10 dBU, source 50 Ω, fig b, load:	5Hz – 40kHz 30 kΩ + 200pF	10Hz – 50kHz 80 kΩ + 100pF
Isolation between windings / between windings and shield	4 kV / 2 kV	4 kV / 2 kV

Connection alternatives

Component side

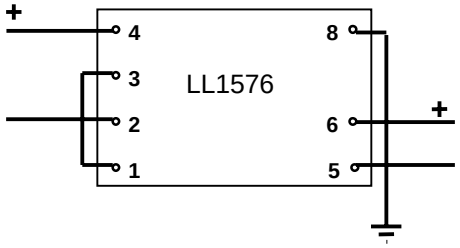


Fig. a. Primaries in series.
Turns ratio 1 : 3.5 with LL1576
Turns ratio 1 : 7 with LL1577

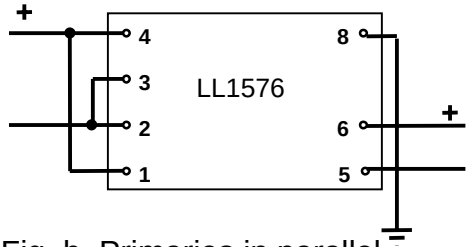


Fig. b. Primaries in parallel.
Turns ratio 1 : 7 with LL1576
Turns ratio 1 : 14 with LL1577

The transformers are often used reversed (7:1 or 14:1) for example in line boxes.

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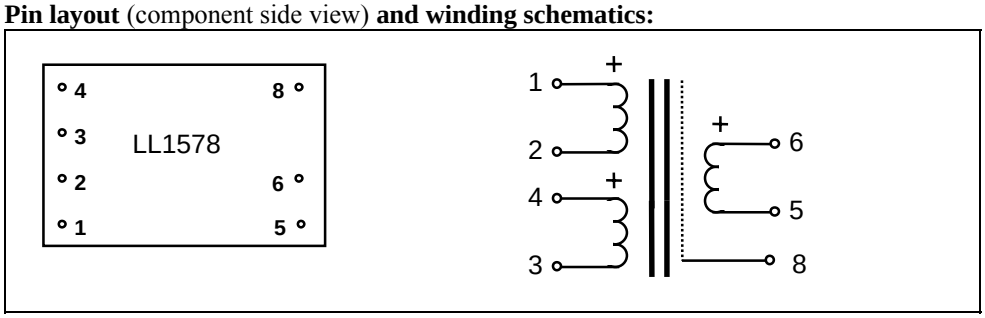
Microphone Input Transformers, Line-box Transformers LL1578 and LL1578XL

The LL1578 and the LL1578XL are high performance microphone input transformers/line-box transformers with high permeability mu-metal cores and high bandwidth coils. The LL1578 and the LL1578XL use the same pin-out as our well known microphone transformer LL1538.
In the LL1578XL the core is about 45% larger than in the LL1578, resulting in a higher signal level capability. In both types, primary and secondary windings are separated by electrostatic shields. The very low leakage inductance and thus excellent frequency response is achieved by a two-coil, three-section per coil winding structure.
The transformers are encapsulated in mu-metal cases for magnetic shielding.

Pin layout (component side view) **and winding schematics:**



Turns ratio	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Isolation between windings / between windings and shield
1 + 1 : 10	5.08 mm (0.2")	27.94 mm (1.1")	1.5 mm	4 kV / 2 kV

	LL1578	**LL1578XL**
Dimensions Max. Length x Width x Height above PCB (mm)	38 x 24 x 17	38 x 24 x 20.5
Weight	46 g	65 g
Static resistance of each primary	12 Ω	15 Ω
Static resistance of secondary	880 Ω	960 Ω
Primary level at 0.2 % THD, 50 Hz signal Primaries connected in parallel (fig b), source impedance 50Ω	-5 dBU (sec. level +15 dBU)	0 dBU (sec. level +20 dBU)
Primary level at 1 % THD, 50 Hz signal Primaries connected in parallel (fig b), source impedance 50Ω	+ 4 dBU (sec. level +24 dBU	+12 dBU (sec level +32 dBU)
Frequency response +/- 0.5 dB to balanced input Signal level 0 dBU, source 200 Ω, fig b, no termination	30Hz – 20kHz	20Hz – 20kHz
Frequency response +/- 0.5 dB to balanced input Signal level -10 dBU, source 50 Ω, fig b, load:	10Hz – 70kHz 40 k Ω + 200pF	6Hz – 50kHz 50 k Ω + 200pF

Connection alternatives

Component side

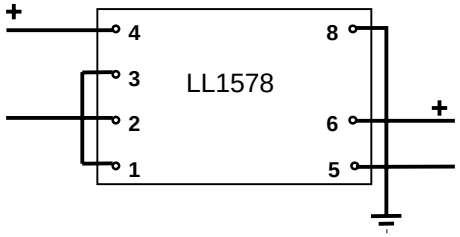


Fig. a. Primaries in series.
Turns ratio 1 : 5

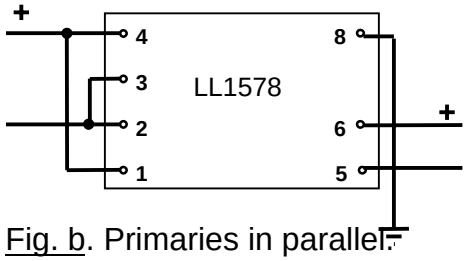


Fig. b. Primaries in parallel.
Turns ratio 1 : 10

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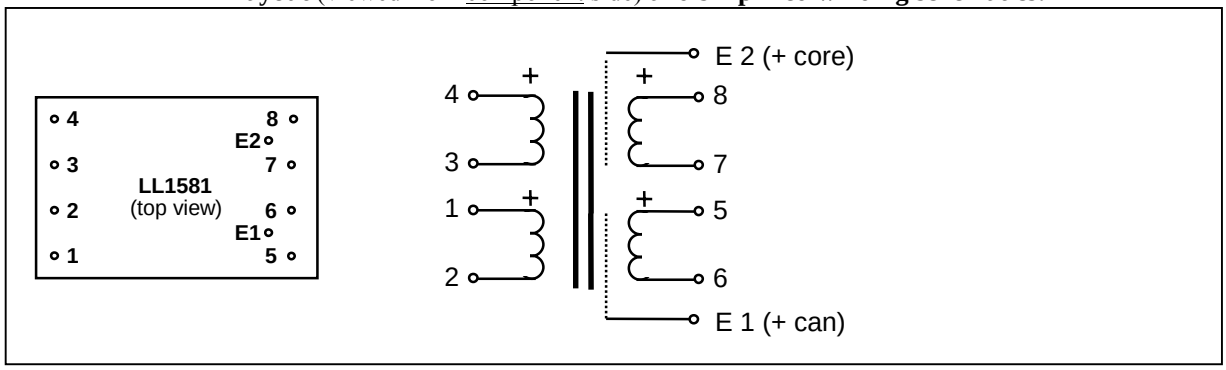
LL1581XL
Splitting Transformer

In many splitting applications, the splitting transformer must have a high immunity to input common mode signals, to stray magnetic fields from e.g. power transformers and to large ground potential differences in receiving systems. The LL1581XL is developed to handle those types of problems. When designing the LL1581, we have used our well established two coil structure to create a transformer with a high degree of symmetry. The transformer is built up from two primary windings (which should be used in parallel) and two secondary windings. Each secondary winding is built up from two sections, one from each coil. Its own electrostatic shields surround each secondary section. The symmetric structure results in an internal cancellation of noise signals caused by external magnetic field. It also increase immunity to ground noise between secondary systems and reduces the effects of input common mode signals.
The transformer is housed in a mu-metal can and is impregnated in solventless epoxy resin.

Turns ratio: 1 + 1 : 1 + 1

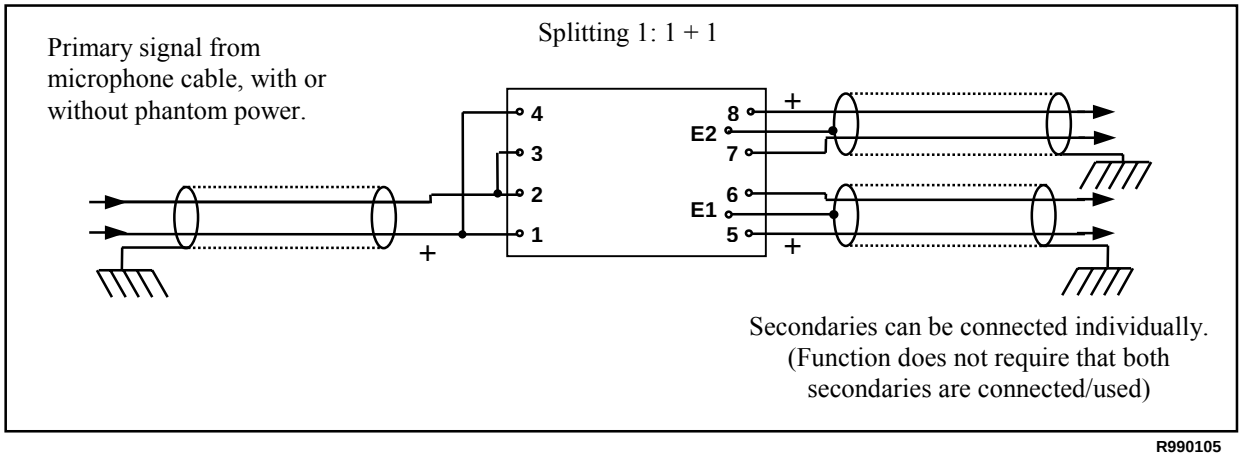
Pin layout (viewed from component side) **and simplified winding schematics:**



Spacing between pins	Spacing between rows of pins	Offset of earth pins from adjacent row:	Recommended PCB hole diameter:
5.08 mm (0.2")	27.94 mm (1.1")	2.54 mm (0.1")	1.5 mm

Dimensions (Max. L x W x H above PCB(mm))	38 x 24 x 20.5
Weight:	61 g
Static resistance of each primary:	61 Ω
Static resistance of each secondary (Pins 5 - 6 and pins 7 to 8):	51 and 71 Ω
Self resonance point :	> 200 kHz
Distortion	0.1% @ +3 dBU, 50 Hz
	1 % < @ +13 dBU, 50 Hz
Frequency response (Ref : -6 dBu, 1kHz)	10 Hz -- 100 kHz +/- 0.5 dB
Test arrangement: Parallel input - parallel output . Source 150Ω , load 10 kΩ	
CMRR at 20 kHz (Source 600 ohms, load 2 x 10k)	> 60 dB
CMRR at 20 kHz from sec. to sec. (Source 600 ohms, load 2 x 10k)	> 40 dB
Isolation test primary - secondary / secondary - secondary / E1 - E2	4 kV / 2 kV / 1 kV RMS

Application example. Component side view.



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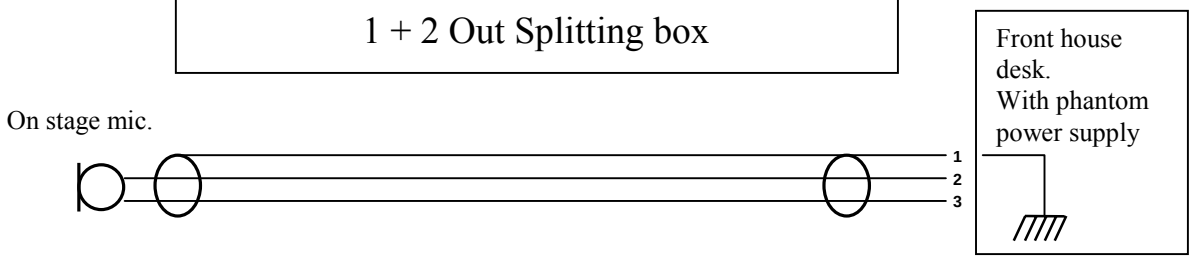
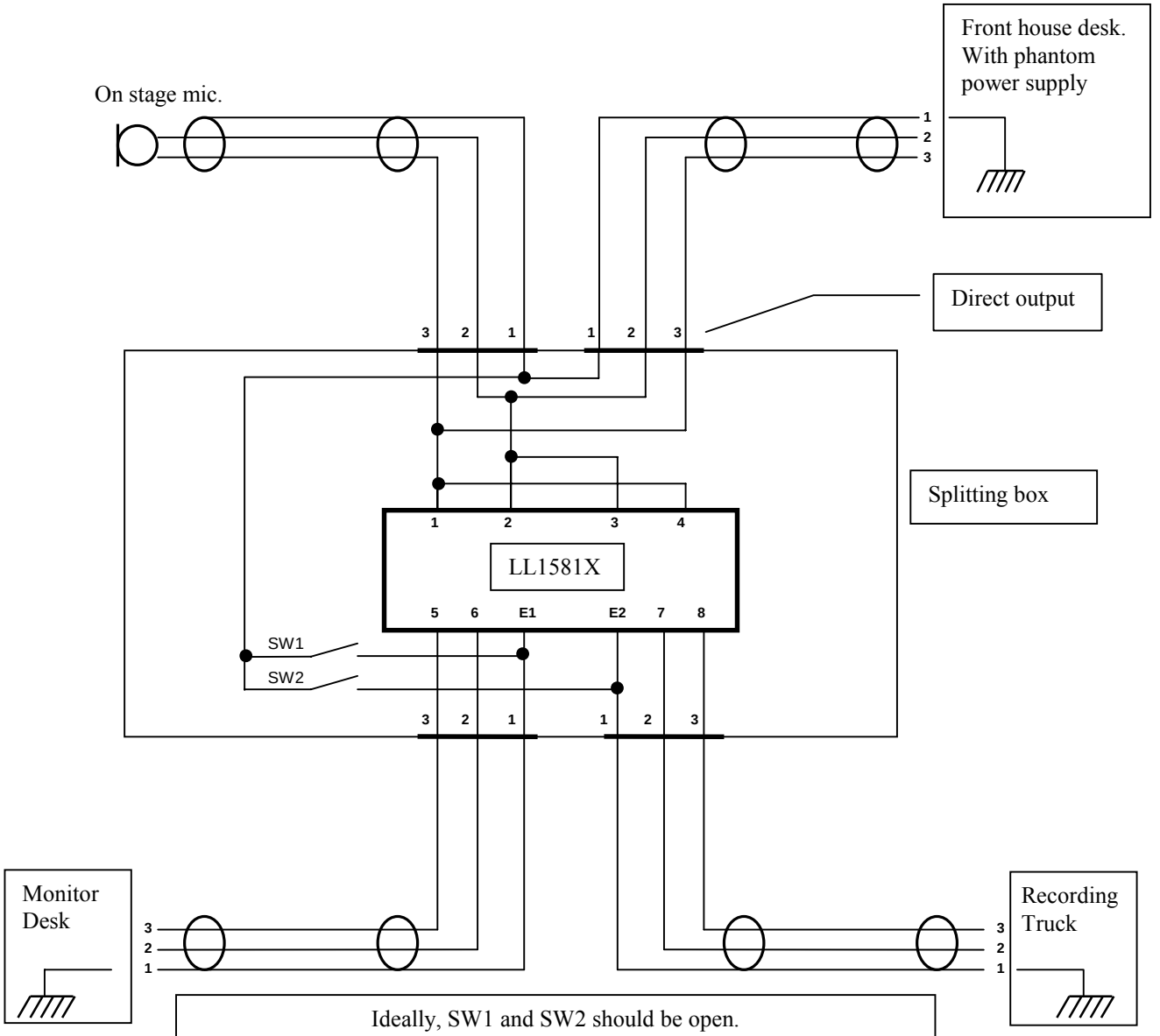
LL1581XL application example.

1 + 2 Out Splitting box



Before connecting splitting box

With splitting box



Ideally, SW1 and SW2 should be open.

Close SW1 and / or SW2 when E1 and / or E2 do not receive ground reference from Monitor desk or from Recording truck respectively.

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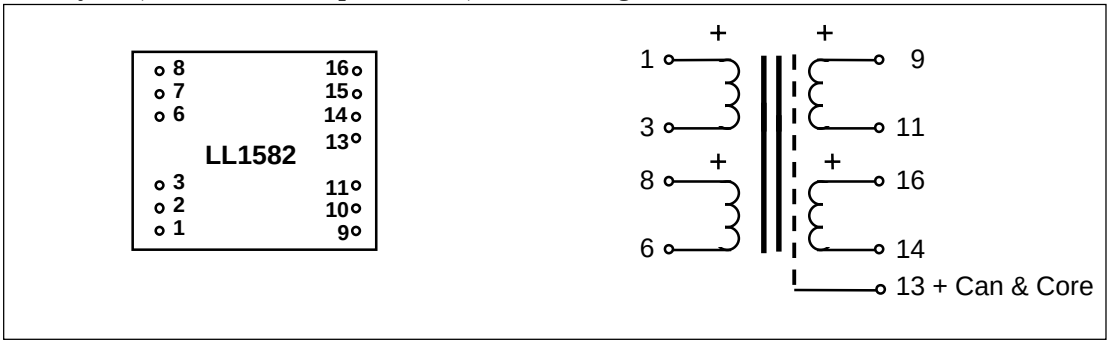
Audio Output Transformer
LL1582

LL1582 is an audio output transformer for balanced or unbalanced drive, with the following features:

1. Pin compatible with the popular LL2811
2. With internal shields to improve common mode passthrough rejection. This is important in analog output from digital systems.
3. Suggested use: 2 : 1 (secondaries in parallel) with e.g. NE5532 op amps for low noise.
4. Precision made audio C core for small size.
5. Two-coil structure and mu-metal housing for high magnetic noise immunity.
6. Designed to fit three in a row across a Euroboard.

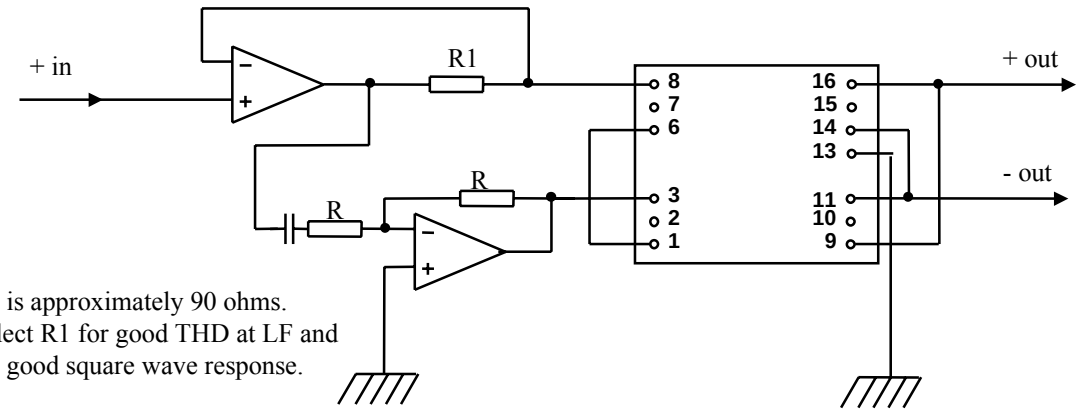
The secondaries can be connected in parallel for low output impedance or in series for high output level.

Turns ratio: 1 + 1: 1 + 1
Dims: (Length x Width x Height above PCB (mm)) 31 x 26x 23
Pin Layout (viewed from component side) and Windings Schematics:



Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	65 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary (average):	45 Ω
Static resistance of each secondary (average):	45 Ω
Max. primary level (primaries in series)	+30 dBU @ 50 Hz
Leakage inductance (windings in series):	< 1 mH
No-load impedance(primaries in series, primary level)**:**	> 750 Ω @ 50 Hz, +20 dBU
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω)	
Output windings in parallel	60 dB
Output windings in series	>50 dB
Frequency response (source 10 Ω, load 600 Ω, 0 dBU):	10 Hz -- 100 KHz +/- 0.3 dB
Isolation between primary and secondary windings/between windings and shield:	4 kV / 2 kV

Suggested design of driving circuitry, mixed feedback, 2:1, suggested by A. Offenberg, NRK



R1 is approximately 90 ohms.
Select R1 for good THD at LF and for good square wave response.

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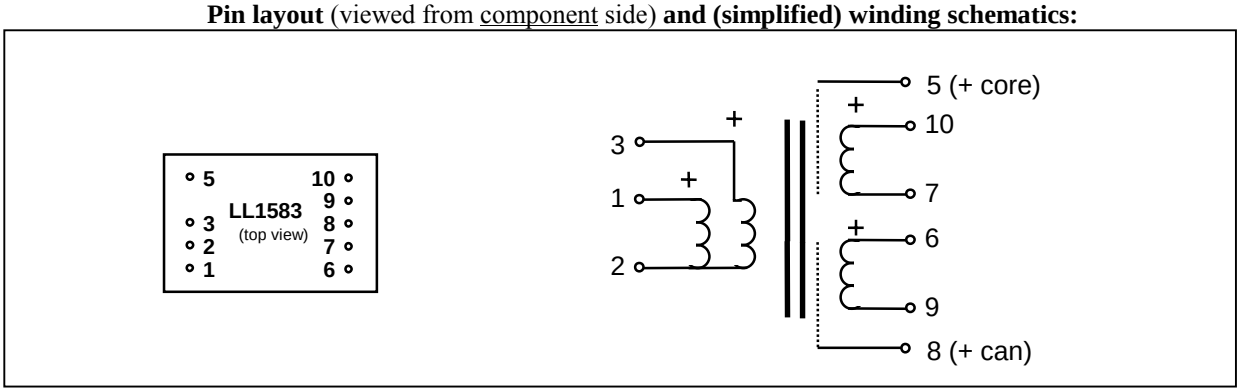
LL1583
Small Size Splitting Transformer

In many splitting applications, the splitting transformer must have a high immunity to input common mode signals, to stray magnetic fields from e.g. power transformers and to large ground potential differences in receiving systems.
In the design of the LL1583, we have used our well established two coil structure to create a transformer with a high degree of symmetry. The transformer is built up from two primary windings (which should be used in parallel) and two secondary windings. Each secondary winding is built up from two sections, one from each coil. Its own electrostatic shields surround each secondary section. The symmetric structure results in an internal cancellation of noise signals caused by external magnetic field. It also increases immunity to ground noise between secondary systems and reduces the effects of input common mode signals.
The transformer is housed in a mu-metal can and is impregnated in solventless epoxy resin.

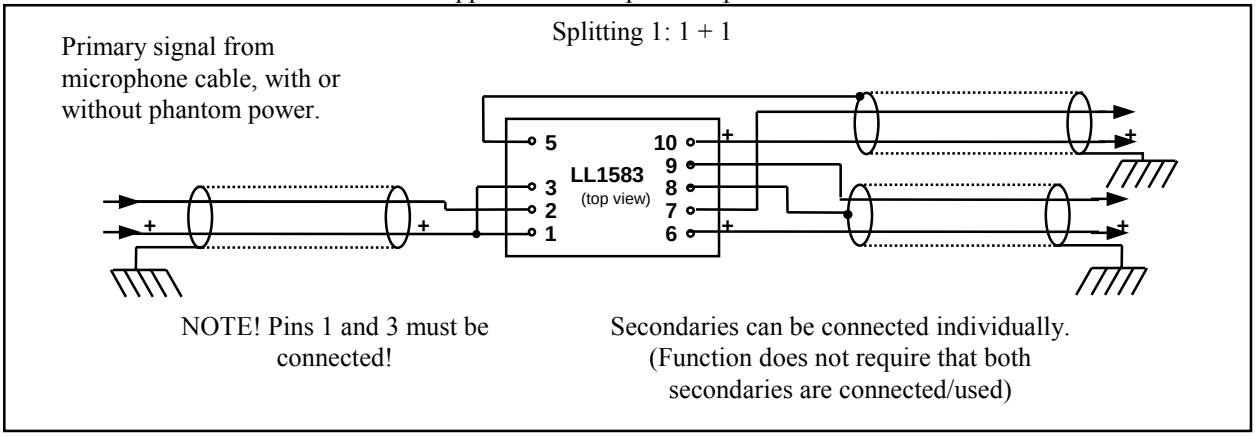
Pin layout (viewed from component side) **and (simplified) winding schematics:**



Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter:
2.54 mm (0.1")	20.32 mm (0.8")	1.3 mm

Turns ratio:	1 : 1 + 1
Dimensions (Max. L x W x H above PCB(mm))	28 x 17 x 15
Weight:	25 g
Static resistance of primary (in parallel)	56 Ω
Static resistance of each secondary (Pins 10 to 7 and pins 6 to 9):	95 and 130 Ω
Self resonance point :	> 200 kHz
Distortion	0.1% @ -2 dBU, 50 Hz 1 % < @ 8 dBU, 50 Hz
Frequency response (Ref : -6 dBu, 1kHz)	10 Hz -- 120 kHz +/- 0.5 dB
Test arrangement: Parallel input - parallel output . Source 150Ω , load 10 kΩ	
CMRR at 20 kHz (Source 600 ohms, load 2 x 10k)	> 60 dB
CMRR at 20 kHz from sec. to sec. (Source 600 ohms, load 2 x 10k)	> 40 dB
Isolation test primary - secondary / secondary - secondary / E1 - E2	4 kV / 2 kV / 1 kV RMS

Application example. Component side view.



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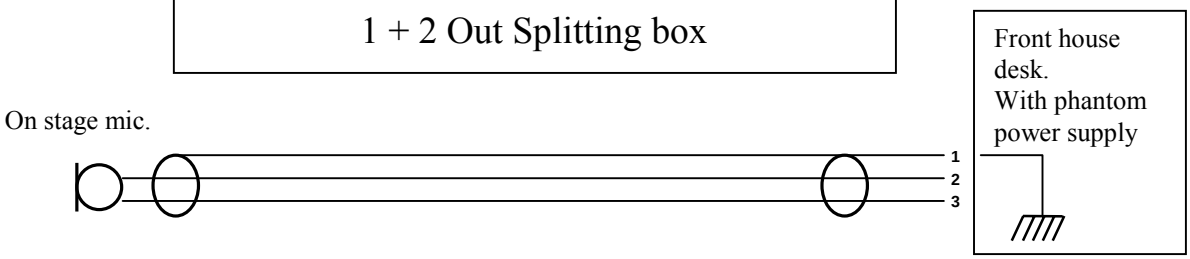
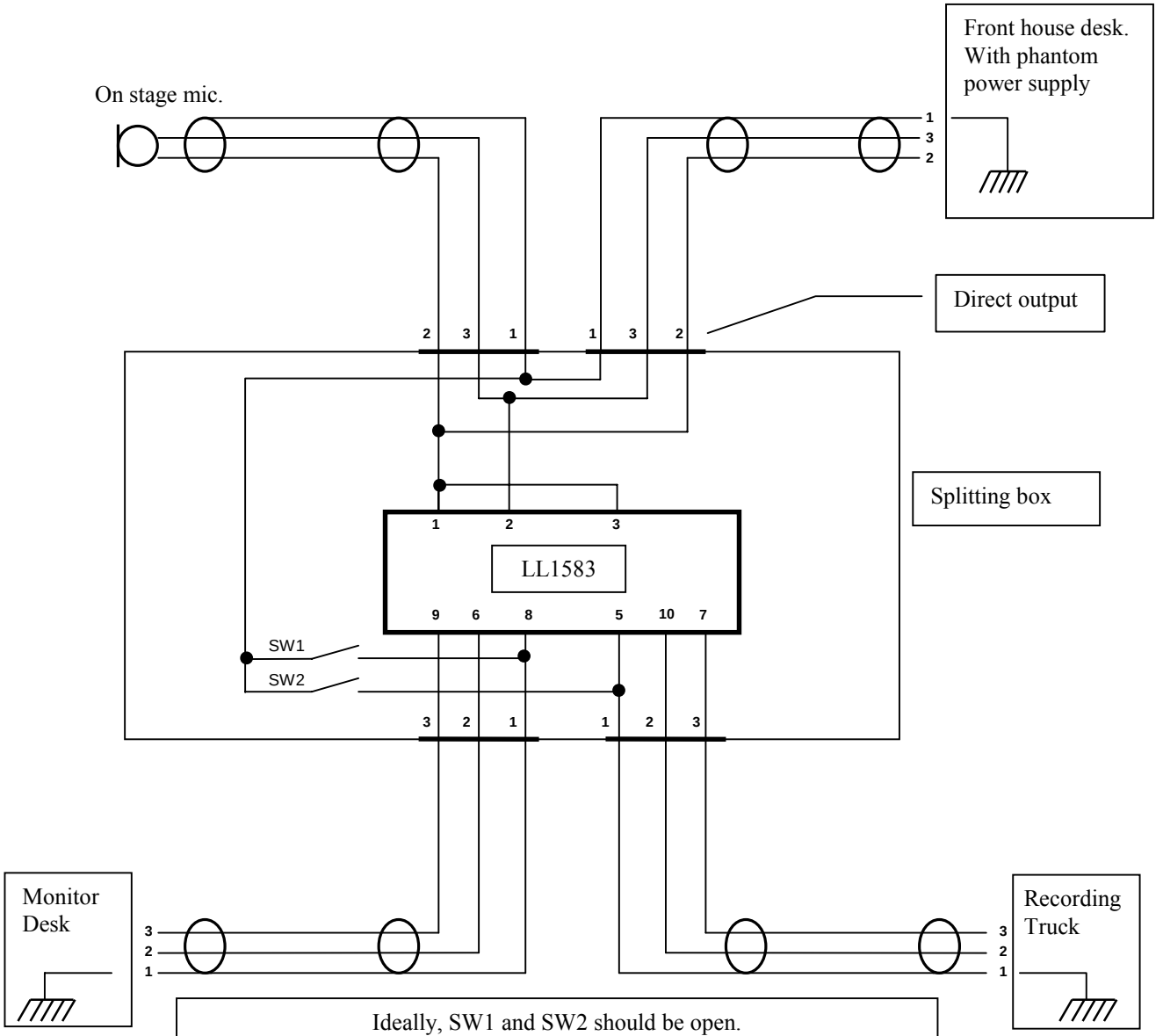
LL1583 application example.

1 + 2 Out Splitting box



Before connecting splitting box

With splitting box



Ideally, SW1 and SW2 should be open.

If, however, pin 8 and/or pin 5 do not receive ground reference from Monitor desk or from Recording truck, close SW1 and/or SW2

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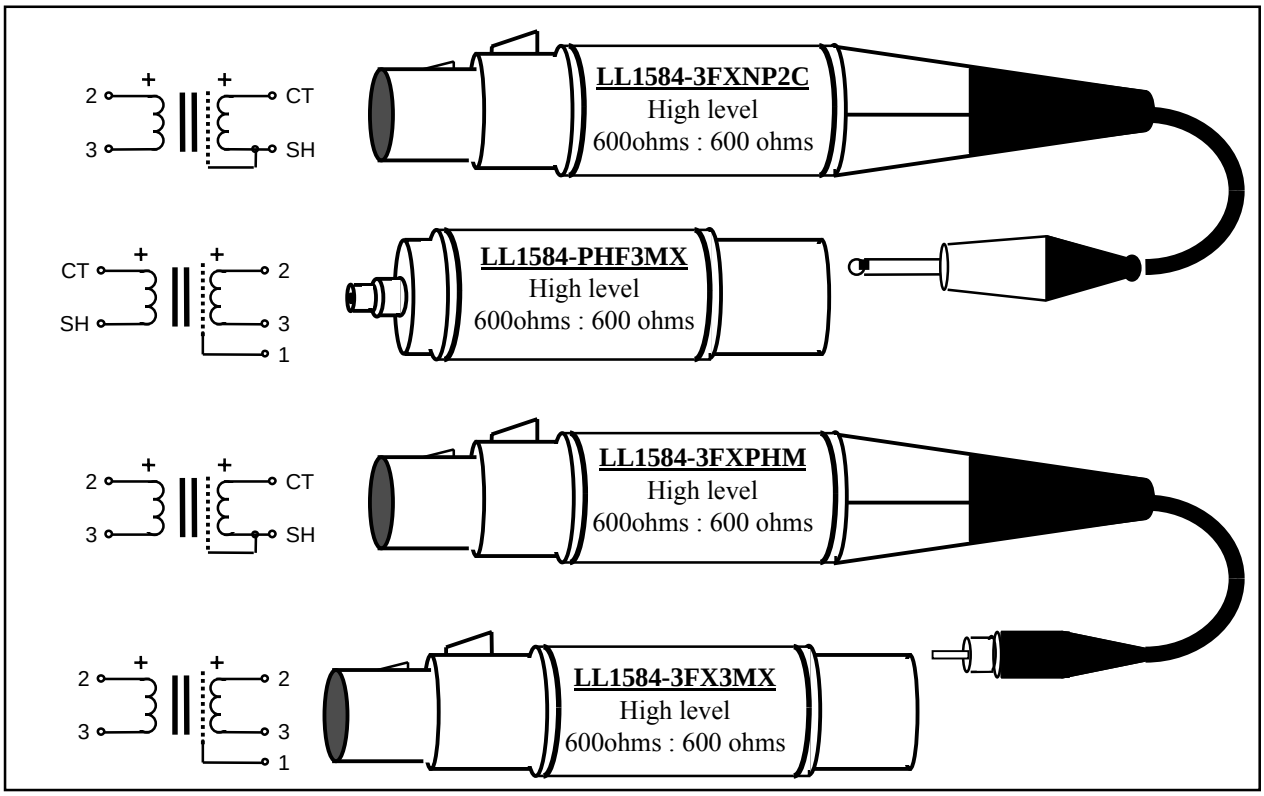
High level, 600 ohms to 600 ohms transformer unit
LL1584

The XLR inline transformer unit LL1584 is designed for breaking up ground loops and for balanced-to-unbalanced conversion in mobile or stationary audio systems. The unit is magnetically shielded and contains a medium impedance isolation transformer LL1584, with LF saturation above +17 dBU @ 50 Hz.
The two ends of the units are galvanically isolated from each other.



The LL1584 is available in four versions:

LL1584-3FXNP2C Female XLR connector to 2-pole 'A'-gauge 1/4" jack plug
LL1584-PHF3MX Female Phono (RCA) connector to male XLR connector
LL1584-3FXPHM Female XLR connector to Phono (RCA) male
LL1584-3FX3MX Female XLR connector to male XLR connector

Electrical characteristics

Transformer static resistance primary + secondary:	640 Ω
Core:	Amorphous strip core
Max signal level (THD less than 1%):	+17 dBU @ 50 Hz
No-load impedance @0 dBU, 50Hz	11 kΩ typically
Frequency response @ 0 dBU (source 150Ω, load 10kΩ)	10 Hz - 70 kHz +/- 0.5 dB
Distortion (THD) at 50 Hz (source 150Ω)	< 0.2 % @ 50 Hz, for all signal levels -2 through +16 dBU
Loss across transformer with load 10kΩ	0.5 dB
Isolation between input and output sides:	1 kV

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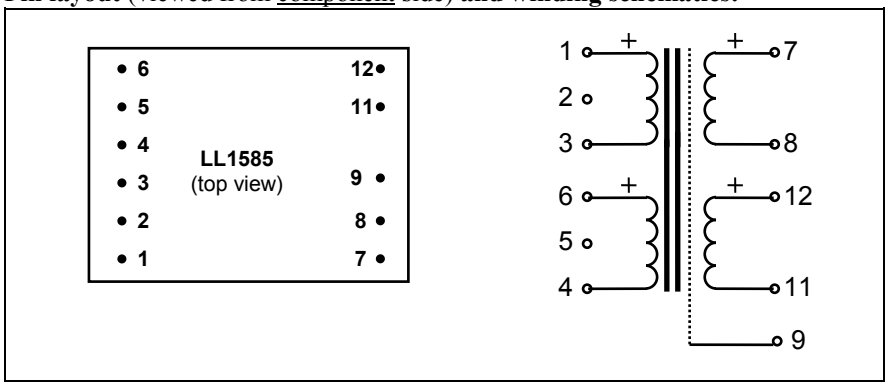
High Level Audio Output Transformer
LL1585

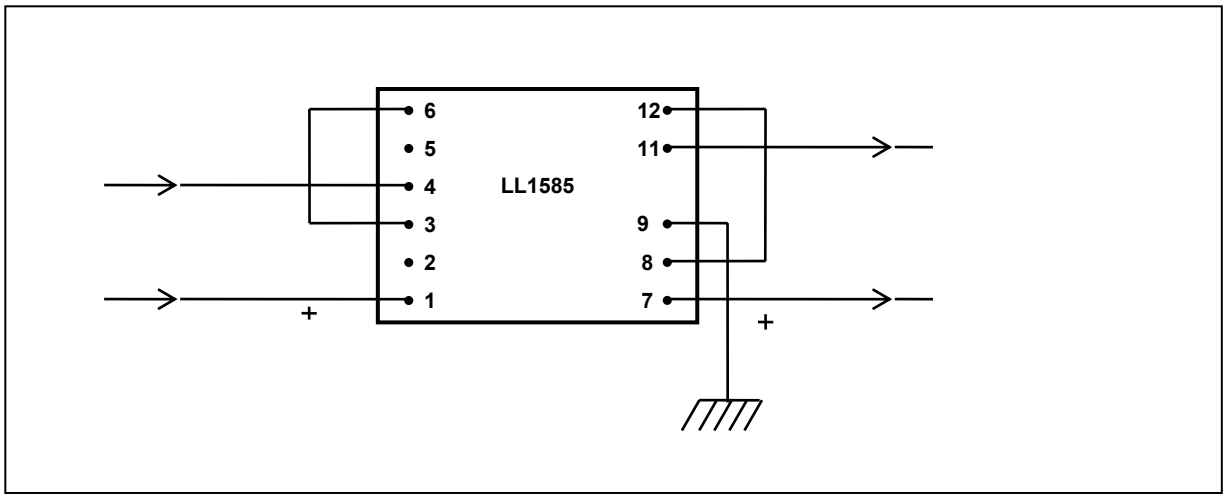
LL1585 is a high level audio line output transformer for balanced or unbalanced drive. The transformer is built from two three-section coils, with primaries and secondaries separated by electrostatic shields, and a audio C-core of our own production. The transformer is housed in a mu-metal housing.
The LL1585 is (as all output transformers) ideally used with mixed feedback drive circuits. (See separate paper for mixed feedback design principles).

Turns ratio: 1 + 1 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 47 x 34 x 21
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	130 g
Core:	Audio C-core
Housing:	Mu-metal
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	64 Ω
Static resistance of each secondary:	64 Ω
Leakage inductance of secondaries (sec. in series):	0.4 mH
No-load impedance, typically (primaries in series)**:**	6 kΩ @ 50 Hz, 15V RMS.
Optimum source impedance:	Minus 128 Ω (Mixed feedback drv)
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 60 dB
Maximum output level before saturation (sec. in series, load 600 Ω)	+ 28 dBU @ 20 Hz
Frequency response (source 10 Ω, load 600 Ω):	10 Hz -- 100 kHz +/- 0.3 dB
Loss across transformer (at midband with 600 Ω load):	3 dB
Isolation between primary and secondary windings / between windings and core:	4 kV / 2 kV

Suggested use



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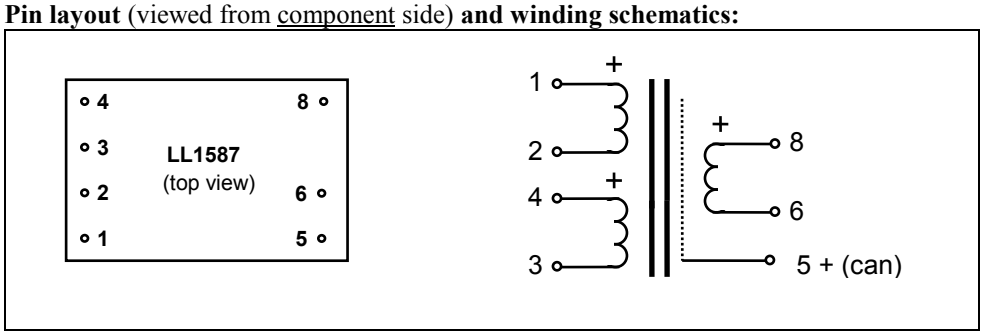
Microphone Transformer
LL1587

The LL1587 is small size microphone input transformer, with a high permeability mu-metal core and two two-section coils with internal Faraday shields.
The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 4

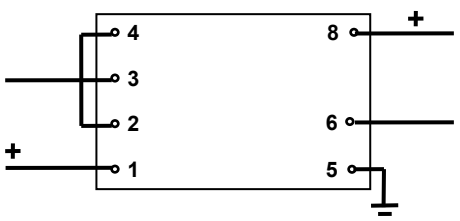
Pin layout (viewed from component side) **and winding schematics:**



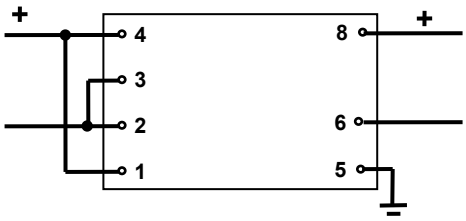
Dimensions Max. Length x Width x Height above PCB (mm)	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Weight
28 x 17.5 x 12	3.81 mm(0.15")	20.32 mm (0.8")	1.5 mm	18 g

	LL1587
Turns ratio	1 + 1 : 4
Static resistance of each primary	56 Ω
Static resistance of secondary	600 Ω
Primary level at 0.2 % THD, 50 Hz signal Primaries connected in parallel, source impedance 150Ω	**-9 dBU** (typically) **(sec. level +2 dBU)**
Primary level at 1 % THD, 50 Hz signal Primaries connected in parallel, source impedance 150Ω	**0 dBU** **(sec. level +11 dBU)**
Frequency response +/- 1.0 dB Primary signal level -5 dBU, source 200 Ω Primaries in parallel, secondary termination 10k	**15Hz – 150kHz** **+/- 1 dB**
Optimum termination for best square-wave response (Connection 1:4, source imp. 200Ω , following stage input impedance < 10 kΩ)	**no additional termination required**
Optimum termination for best square-wave response (Connection 1:4, source imp. 200Ω , following stage input impedance >> 10 kΩ)	**10 kΩ in series with 200 pF**
Isolation between windings / between windings and shield	3 kV / 1.5 kV

Connection alternatives



1 : 2



1 : 4

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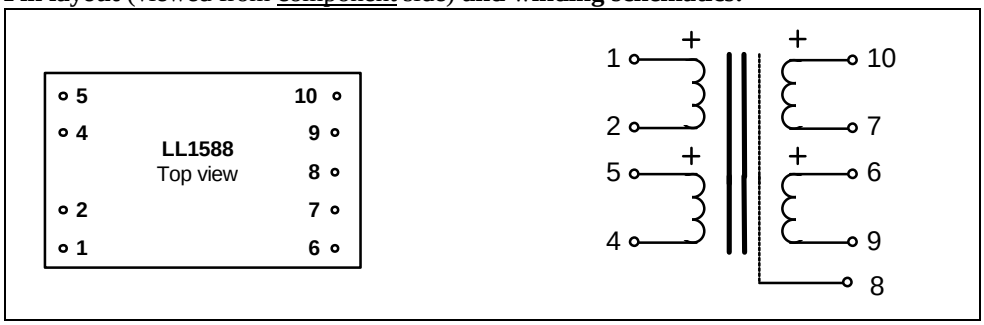
High Level General Purpose Transformer
LL1588

LL1588 is a high-level general-purpose transformer which can be used for microphone or line input, for line output and for galvanic isolation. The windings are arranged to give perfect symmetry if the transformer is used in phase splitting input applications. The two coils structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields. The core is a high permeability mu metal core. The transformer is housed in a mu-metal can.

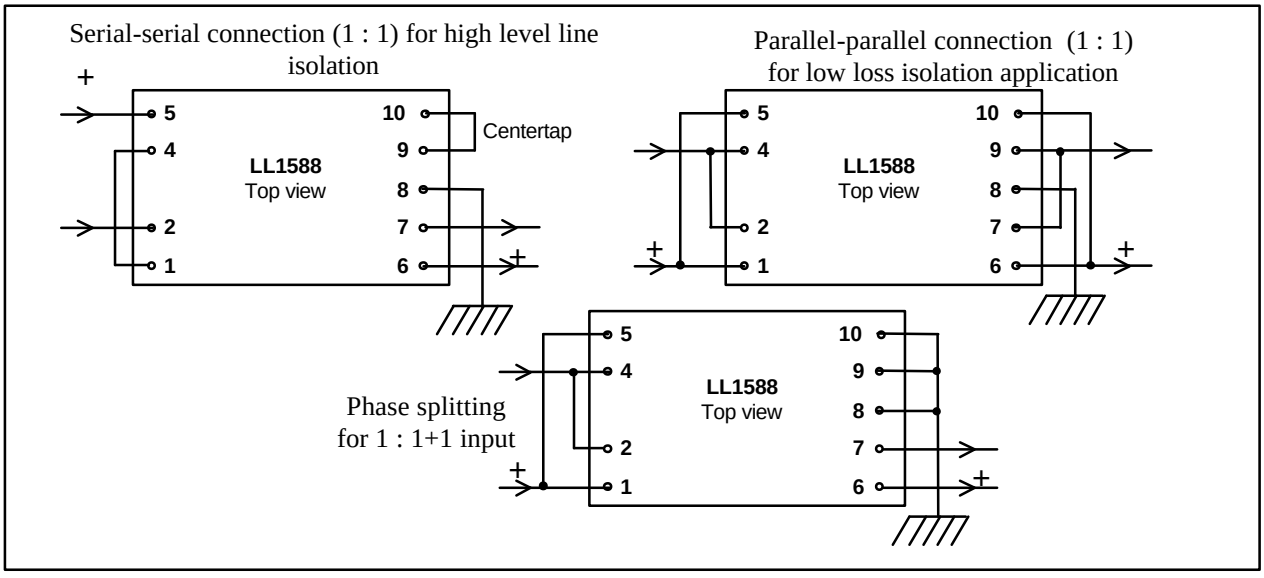
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.56 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		115 g
Static resistance of each primary:		61Ω
Static resistance of each secondary:		61Ω
Distortion	(primaries connected in series, source impedance 150Ω):	+ 25 dBU 0.1% @ 50 Hz + 28 dBU < 1 % @ 50 Hz
Distortion	(primaries connected in parallel, source impedance 150Ω):	+ 16 dBU 0.1% @ 50 Hz + 22 dBU < 1 % @ 50 Hz
Self resonance point:		> 250 kHz
Frequency response	(source 150Ω, load 10 kΩ, serial connection):	10 Hz -- 100 kHz +/- 1.0 dB
Phase response	(deviation from linear phase)	20 Hz – 20kHz, +/- 0.5°
Isolation between windings/ between windings and shield:		4 kV / 2 kV

Connection alternatives and suggested applications:



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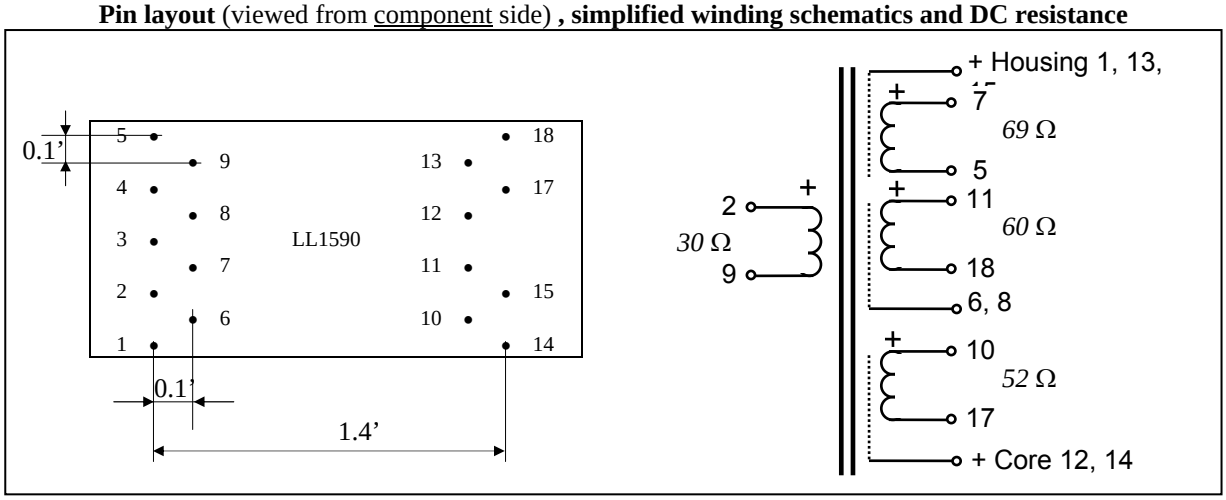
LL1590
Splitting Transformer, 1 direct + 3 isolated

In many splitting applications, the splitting transformer must have a high immunity to input common mode signals, to stray magnetic fields from e.g. power transformers and to large ground potential differences in receiving systems. The LL1590 is developed to handle those types of problems. When designing the LL1590, we have used our well established two coil structure to create a transformer with a high degree of symmetry. The primary winding consists of four sections, two on each coil, connected in parallel. The three secondary windings consists each of two sections, one from each coil, separated from the primary sections by electrostatic shields. The symmetric structure results in an internal cancellation of noise signals caused by external magnetic field. It also increase immunity to ground noise between secondary systems and reduces the effects of input common mode signals.
The transformer is housed in a mu-metal can and is impregnated in epoxy resin.

Turns ratio: 1 : 1 + 1 + 1

Pin layout (viewed from component side) **, simplified winding schematics and DC resistance**



Dimensions (Max. L x W x H above PCB(mm))	47 X 28 X 23
Recommended PCB hole diameter:	1.5 mm
Weight:	115 g
Static resistance of windings:	See above figure
Self resonance point :	> 200 kHz
Distortion	0.2% @ +6 dBU, 50 Hz
CMRR at 15kHz (according to IRT, source 600 ohm, load 1k)	Typically 50 dB
Frequency response (Ref : +1 dBu, 1kHz)	10 Hz -- 100 kHz +/- 0.5 dB
Test arrangement:	
Signal on input - outputs measured individually . Source 150Ω , load 10 kΩ	
Isolation test: Any winding to shield or housing / shield – shield	1.5 kV / 700 V RMS

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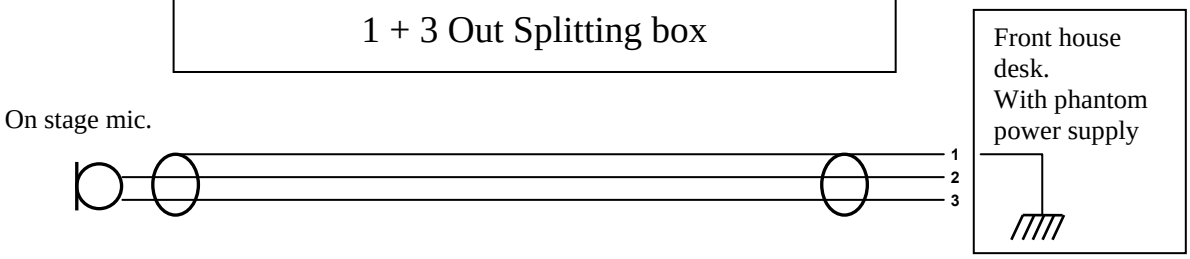
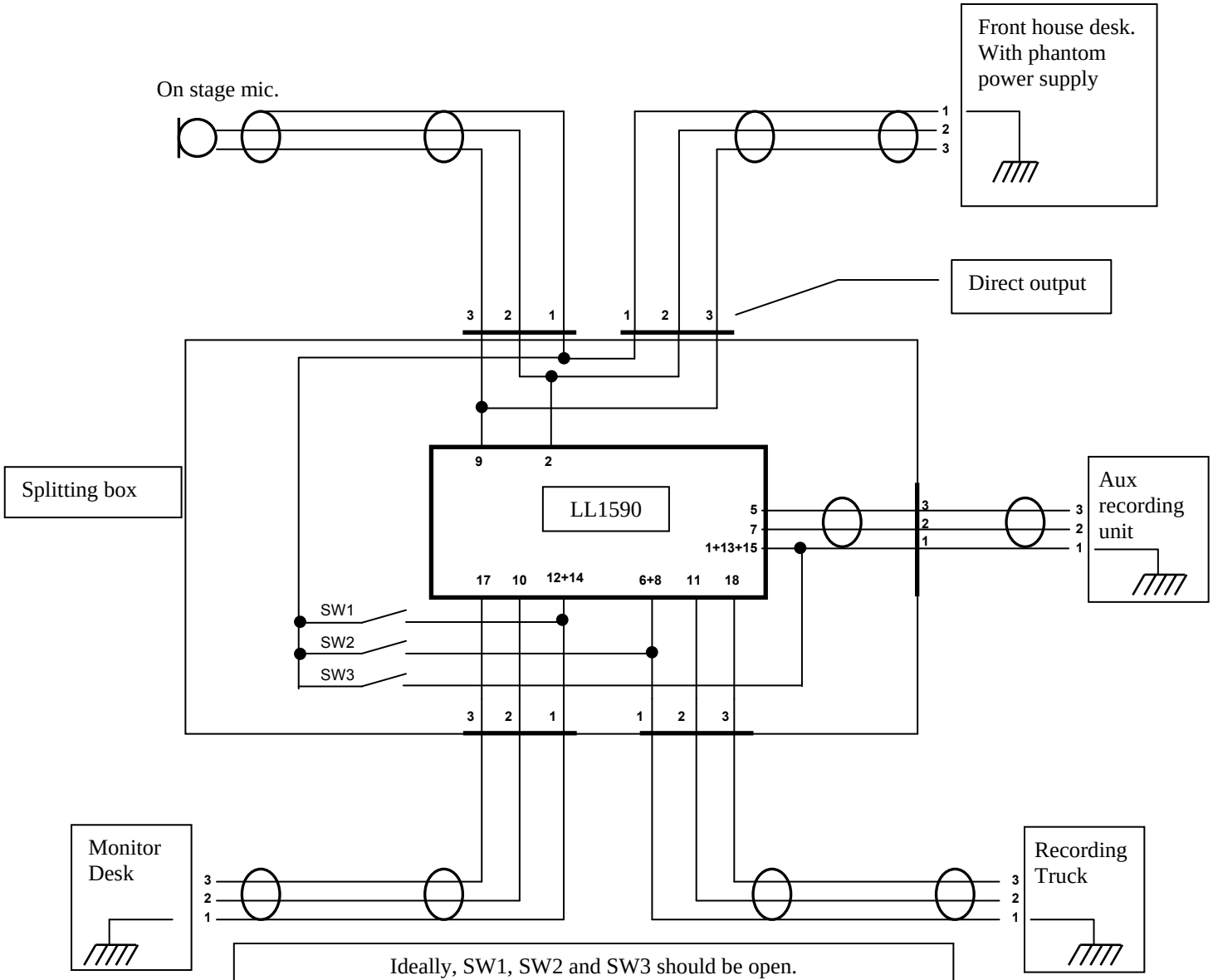
LL1590 application example.

1 + 3 Out Splitting box



Before connecting splitting box

With splitting box



Ideally, SW1, SW2 and SW3 should be open.

Close SW1, SW2 and / or SW3 when there is no ground reference available from Monitor desk, Recording truck or Aux unit respectively.

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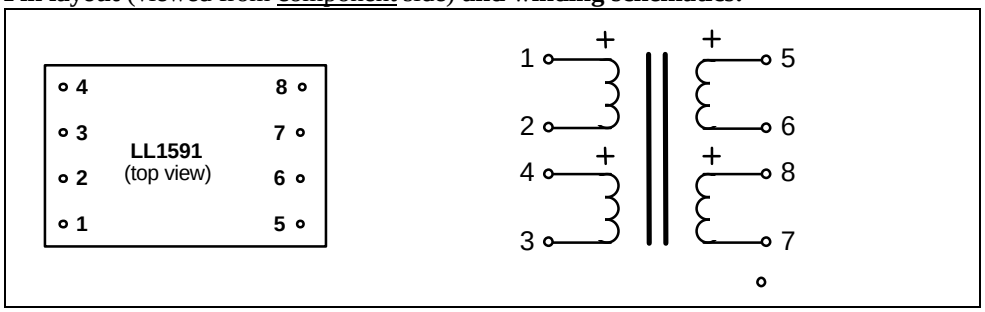
Low cost audio isolation transformer
LL1591

LL1591 is a low cost audio isolation transformer, pin compatible with e.g. LL1527 and LL1581XL.
The purpose with LL1591 is to provide a low cost solution, when noise rejection requirements are small.
The LL1591 does not have internal faraday shields, nor mu metal housing.

Turns ratio: 1 + 1 : 1 + 1

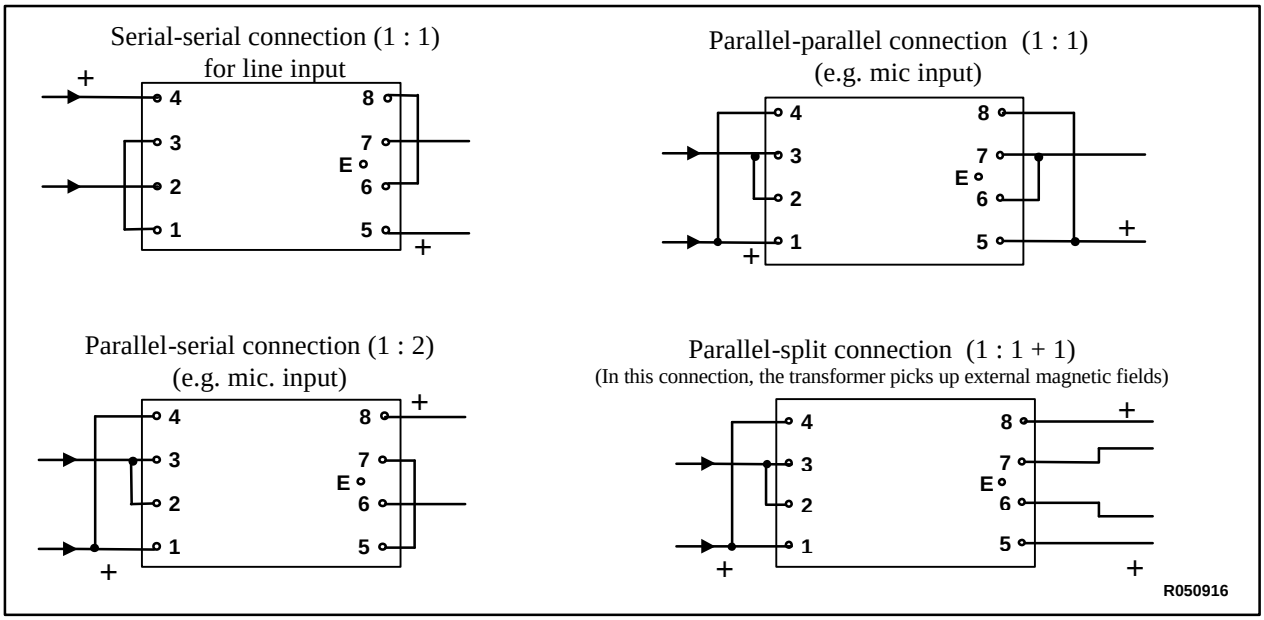
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins	**Spacing between rows of pins**
5.08 mm (0.2")	27.94 mm (1.1")

Dimensions: (L x W x H above PCB, in mm)	37 x 22 x 17
Weight:	39 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	43Ω
Static resistance of each secondary:	55Ω
Distortion (primaries connected in series, source impedance 800Ω):	+ 6 dBU 0.1% @ 50 Hz +16 dBU < 1 % @ 50 Hz
Self resonance point :	> 120 kHz
Optimum load for best square-wave response (sec. in series):	3 – 4 kΩ
Frequency response (source 600Ω , load 10 kΩ serial connection):	10 Hz -- 80 kHz +/- 1 dB
Loss across transformer (at midband, with above termination):	0.4 dB
Isolation between windings/ between windings and core:	3 kV / 1.5 kV

Connection alternatives and suggested applications:



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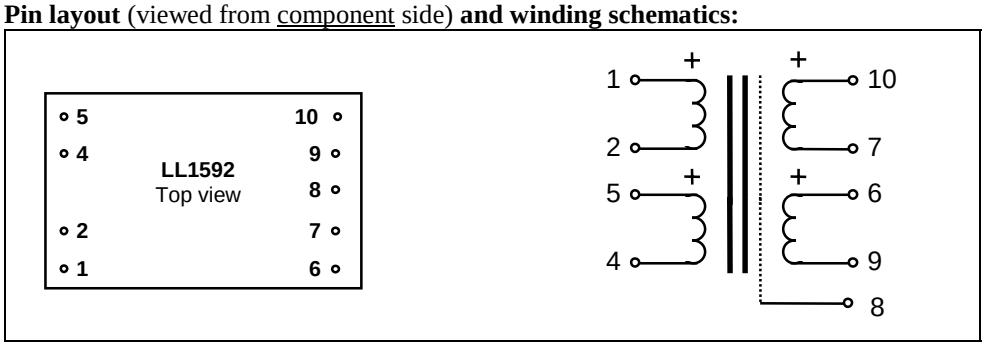
High Level Line Input Transformer
LL1592

LL1592 is a high-level line input transformer with a mu metal lamination core. The transformer is designed for high end pro audio line input applications with or without phase splitting. The windings are arranged to give a high degree of symmetry if the transformer is used for phase splitting. The dual-coil structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields.. The transformer is housed in a mu-metal can.

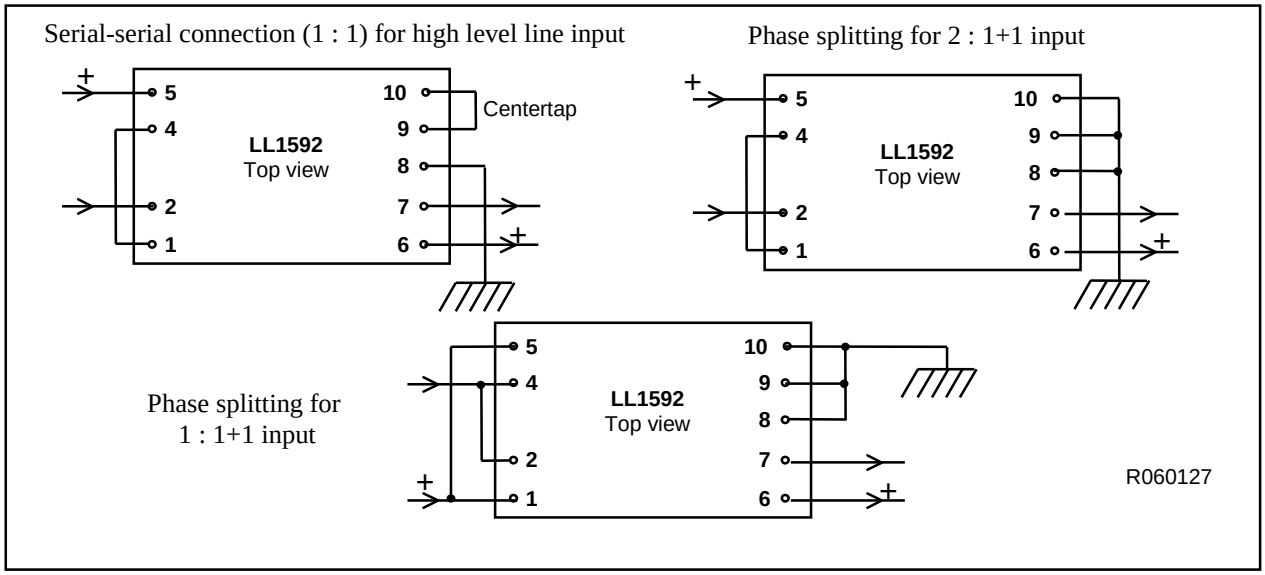
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 20
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.56 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		83 g
Static resistance of each primary:		270 Ω
Static resistance of each secondary:		270 Ω
Distortion	(primaries connected in series,	+ 23 dBU 0.1% @ 40 Hz
	source impedance 600Ω):	+ 29 dBU < 1 % @ 40 Hz
Self resonance point:		> 120 kHz
Suggested termination for best square wave response, serial-serial connection.		7k + 400pF
Frequency response (serial connection , source 600 Ω, load 20 kΩ , no terminating network		10 Hz -- 50 kHz +/- 1.0 dB
Frequency response (serial connection , source 600 Ω, load 100 kΩ in parallel with 7k + 400pF):		10 Hz -- 100 kHz +/- 1.0 dB
Phase splitting balance (connection 2:1+1. Source 1kΩ, load (20kΩ +20kΩ) in parallel with 7k + 400pF):**,**		>46 dB, 10Hz – 50kHz
Phase response (deviation from linear phase) (source 600 ohm, load 10k (Audio Precision))		10 Hz – 20kHz, < 2°
Isolation between windings/ between windings and shield:		3 kV / 1.5 kV

Connection alternatives and suggested applications:



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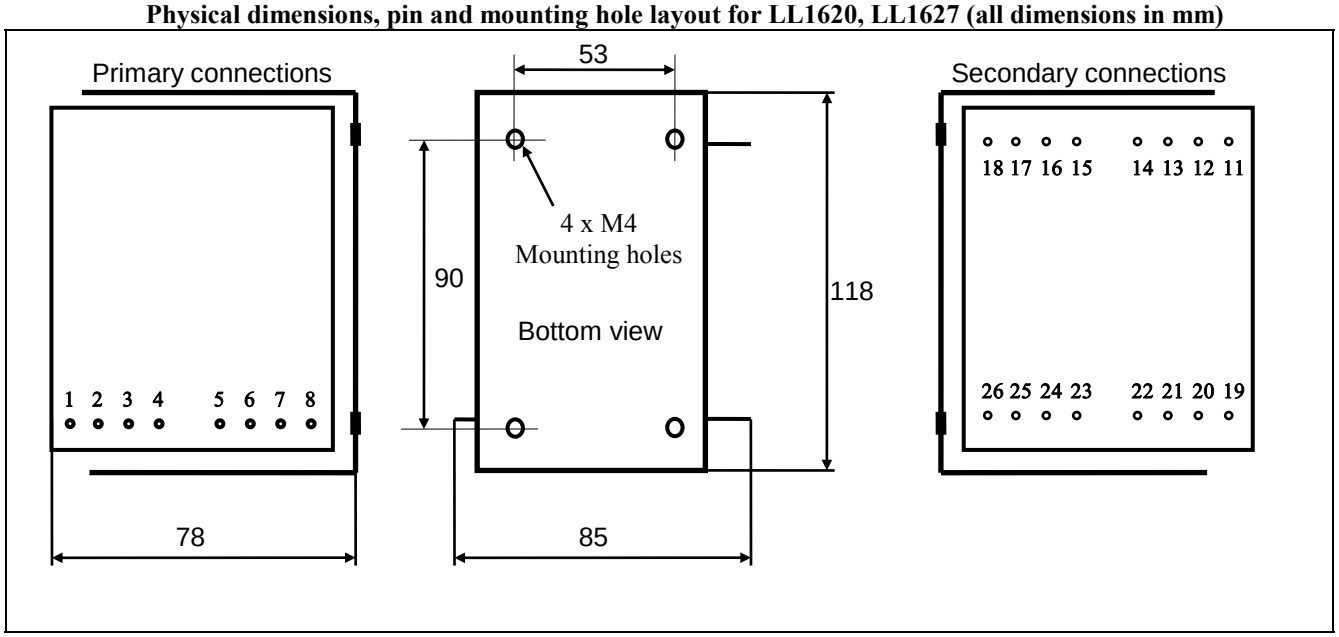
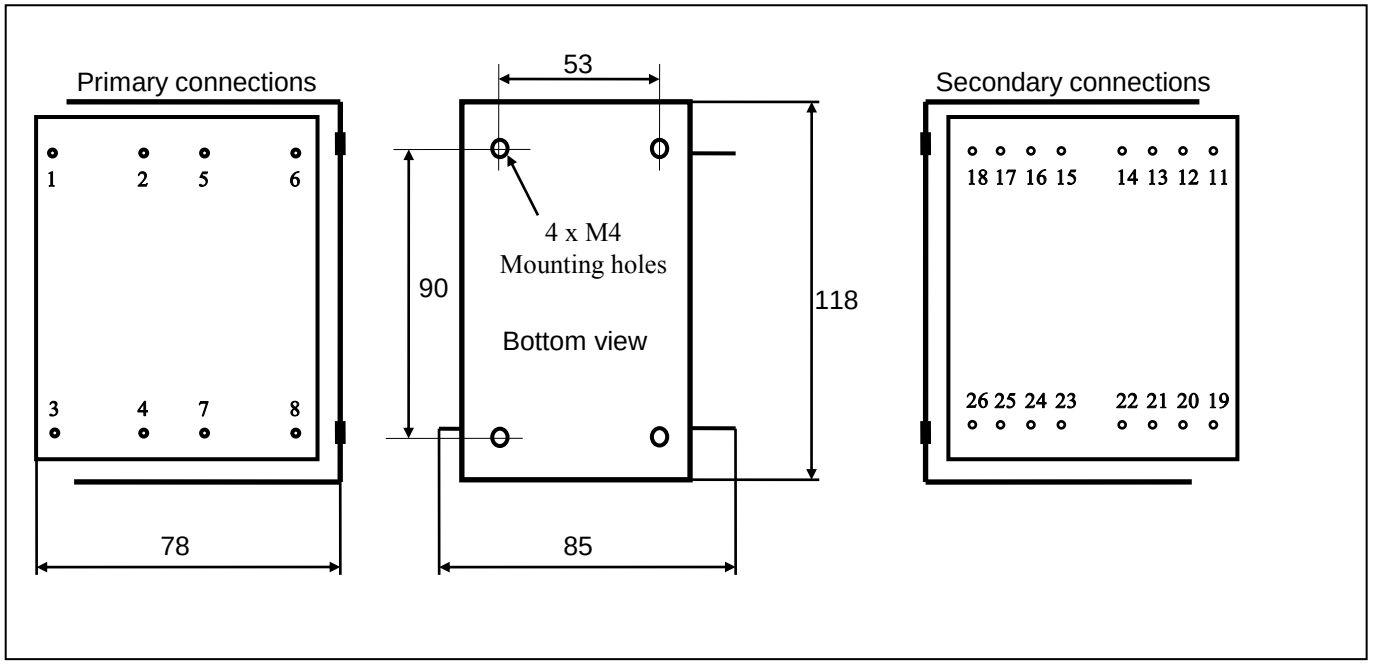
Tube Amplifier Output Transformers
LL1620 , LL1623, LL1627, LL9202

The LL1620, LL1623, LL1627 and LL9202 are output transformers for tube amplifiers. All transformers are based on the same core size, winding structure and secondaries, but differ in number of turns (and thus impedance level) of primaries.
The transformers are highly sectioned with harmonically sized sections, which results in a minimum leakage inductance. This, combined with a low capacitance coil winding technique results in a wide frequency range.
The transformers have a special audio C-core of our own production, which is gapped for desired DC current.
The transformers are of open frame type suitable for mounting inside an amplifier housing.

Physical dimensions, pin and mounting hole layout for LL1620, LL1627 (all dimensions in mm)



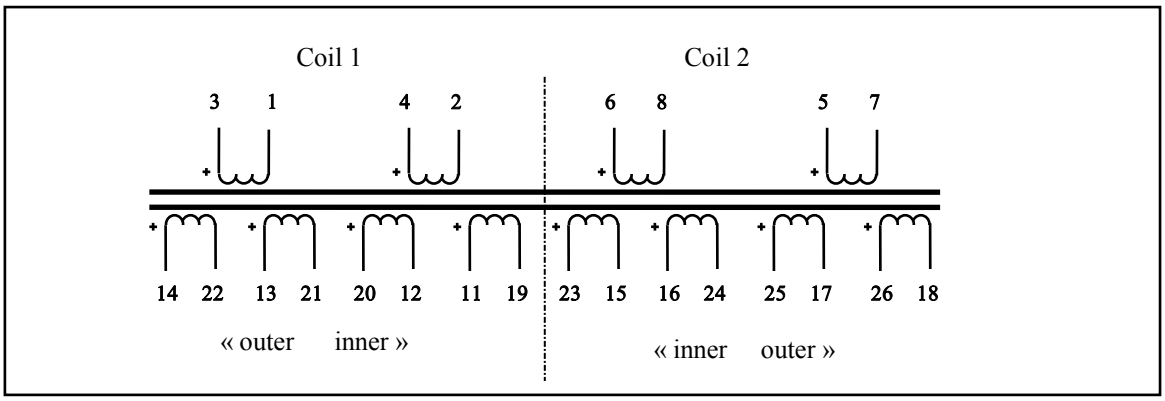
Physical dimensions, pin and mounting hole layout for LL1623, LL9202 (all dimensions in mm)



R150220 PL

Pin spacing module: 5.08 mm (0.2")
Weight: 2.5 kg

Winding schematics:



The inner windings have a lower copper resistance due to smaller circumference

	LL9202		LL1620		LL1623		LL1627	
Turns ratio:	4 x 26.5 : 8 x 1		4 x 19.2 : 8 x 1		4 x 13.4 : 8 x 1		4 x 8.5 : 8 x 1	
Static resistance of primary (all in series)	600 Ω (4 • 150 Ω)		308 Ω (4 • 77 Ω)		164 Ω (4 • 41 Ω)		56Ω (4 •14 Ω)	
Static resistance of each secondary (average)	0.4 Ω		0.4 Ω		0.4 Ω		0.4 Ω	
Primary leakage inductance (all in series)	20 mH		11 mH		4.6 mH		1.9 mH	
Max. recommended primary DC current (heat dissip. 7W)	125 mA		150 mA		210 mA		350 mA	
Max. primary signal voltage r.m.s. at 30 Hz (all in series)	Push-Pull 1180V	Single End 525V	Push-Pull 860V	Single End 380V	Push-Pull 610V	Single End 270V	Push-Pull 380V	Single End 170V

Isolation between primary and secondary windings / between windings and core: 3 kV / 1.5 kV

Standard types:

	LL9202 / PP	LL9202 / 50mA	LL9202 / 85mA	
	LL1620 / PP	LL1620 / 40 mA	LL1620 / 60 mA	LL1620 / 80 mA
	LL1623 / PP	LL1623 / 60 mA	LL1623 / 90 mA	LL1623 / 120 mA
	LL1627 / PP	LL1627 / 90 mA	LL1627 / 140 mA	LL1627 / 185 mA

Other sub-types available on request.

Frequency response example:

The frequency response is dependent on transformer type and connection alternative.
For the LL1623 / 90 mA, connection alt. C, with R_{SOURCE} = 650 Ω
R_{LOAD} = 8 Ω

you get:

Frequency response	7 Hz - 25 kHz	+/- 0.5 dB
Phase Shift	@ 20 Hz	2°
	@ 20 kHz	13.5°
Group delay (δφ/δω)	@ 20 kHz	2.2 µs

Electrical characteristics

Primary Load Impedance, Primary DC Current Core Air-gap and Maximum Output Power

	Secondary connection for 4/8/16 Ω (See next page)			**Core Airgap (Delta/2)**			
	-/B/C	B/C/D	C/D/E	25 µ (Push-Pull)	125 µ (Single Ended)	190 µ (Single Ended)	250 µ (Single Ended)
	Primary Load Impedance (transformer copper resistance included)			**DC current for 0.9 Tesla (rec. operating point) Primary Inductance**			
LL1627	2.3 kΩ	1.2 kΩ	0.65 kΩ	Push-Pull 60 H	90 mA 18 H	140 mA 12 H	185 mA 9 H
LL1623	5.6 kΩ	3.0 kΩ	1.6 kΩ	Push-Pull 150 H	60 mA 46 H	90 mA 30 H	120 mA 23 H
LL1620	11.5 kΩ	6.0 kΩ	3.3 kΩ	Push-Pull 300 H	40 mA 90 H	60 mA 60 H	80 mA 45 H
LL9202	23 kΩ	11 kΩ	6.5 kΩ	Push-Pull 570 H	50 mA / 225µ 100 H	85 mA / 400µ 57 H	

	Output Power and Loss			
All types	62W	125W	250W	**Max. Power, Push-Pull at 30 Hz**
	13W	25W	50W	**Max. Power, Single Ended at 30 Hz**
	0.2 dB	0.5 dB	0.8 dB	**Loss across transformer**

Our recommendations on how to choose your tube output transformer:

Push-pull output stages:

All our push-pull output transformers have a 25 microns core air gap to allow for a small DC unbalance of your output circuits.

Step 1 From your secondary load impedance (4, 8 or 16 ohms), we suggest a secondary connection alternative with 0.5 dB loss. This will give you a maximum power limit of 125W at 30 Hz, and a LF -1 dB point at 6.4 Hz for pentodes and lower still for triodes.
If you require more headroom at low frequencies, the 0.8 dB loss alternative expands the LF limit one octave.

Step 2 Your tube choice gives you a desired primary load impedance. Select the transformer type having a primary load impedance which best matches the desired impedance.
The LL1623 (5.6 kΩ plate-to-plate impedance) or the LL1620 (6.0 kΩ plate-to-plate impedance) suits many tubes like the 300B triode or the EL34 pentode. The 6C33 (low voltage, high current) requires a transformer LL1627 while high anode voltage tubes require the high impedance of the LL1620.

Footnote: In class A push-pull, each **tube** will see a load impedance = 1/2 transformer primary load impedance.
In class B push-pull, each **tube** will see 1/4.

Single-end output stages:

The core of Single End output transformers have an airgap. The purpose of the airgap is to accept the DC current of the output tube without saturating the core, leaving enough headroom for the sound signal. As a result of the airgap, the primary inductance is lower for SE output transformers compared to P-P dittos. In addition, the inductance tends to vary with DC current. For our high quality C- cores with carefully ground surfaces, the variation is within +7% of rated value.

Step 1 We recommend that, given your secondary load impedance (4, 8 or 16 ohms), you select a secondary connection alternative with 0.5 dB loss. This will give you a power limit of 25 W at 30 Hz. If you find that you require more bass headroom, select a secondary connection alternative with 0.8 dB loss.

Step 2 From the tube load line you determine a primary load impedance. This results in a choice of transformer main type.

Step 3 From the tube data sheet you also select your desired DC current. From the table above you select the transformer subtype (DC current) which best fits your needs. For many tubes such as the 300B and the EL34, the transformer LL1623 / 90 mA is the ideal choice.

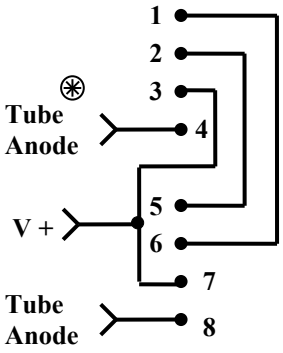
Step 4 We define **Power Low Frequency Limit, F_{PL}**, as the frequency where $\omega L_P = R_{LOAD}$. (The reactive impedance of the transformer equals the primary load impedance). At F_{PL}, the output power is reduced to 50%. For the LL1623 / 90 mA in a 0.5 dB loss connection, F_{PL} = 16 Hz ($R_{PRIMARY}$ = 3.0 kohms and L_P = 30H).

Step 5 We define **Response Low Frequency Limit, F_{RL}** as the frequency where a (small) output signal is reduced with -1 dB due to finite primary inductance. $F_{RL} = \omega / \pi$, if you solve ω in
$\omega L_P = (R_{LOAD}$ *in parallell with* $R_{ANODE})$.
For the LL1623 / 90 mA and a 300B triode, F_{RL} = 7 Hz. (R_{ANODE} = 650 ohms, $R_{PRIMARY}$ = 3.0 kohms and L_P = 30H),

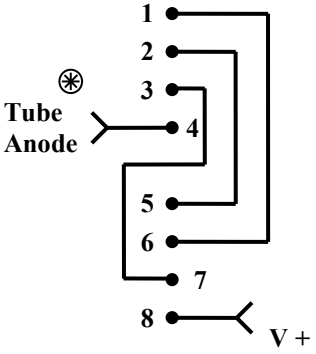
Primary Connections

⊛ Indicates phase

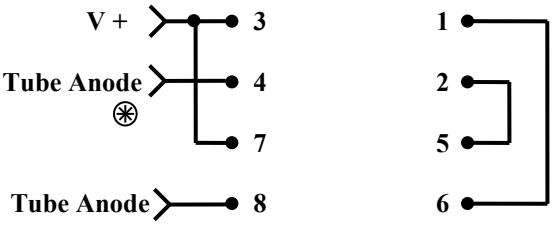
LL1620, LL1627 Primary connection for push-pull output stage



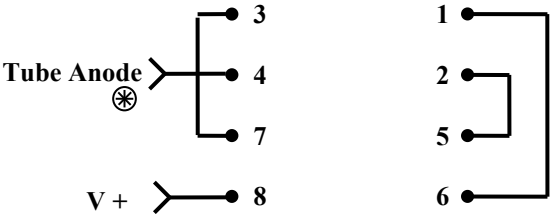
LL1620, LL1627 Primary connection for single-end output stage



LL1623 and LL9202 primary connection for push-pull output stage



LL1623 and LL9202 primary connection for single-ended output

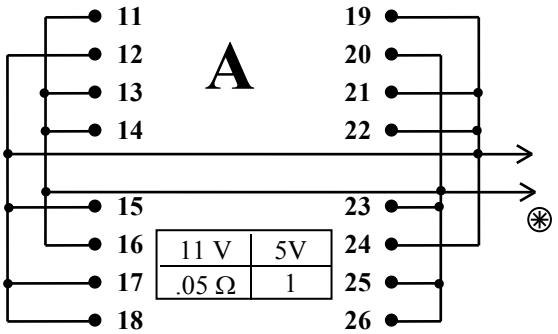


Secondary connections

⊛ Indicates phase

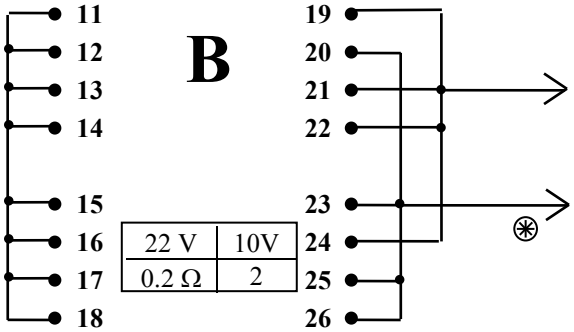
Max secondary Voltage RMS @ 30 Hz	
Push-Pull	Single Ended
Copper resistance	Windings in series

A



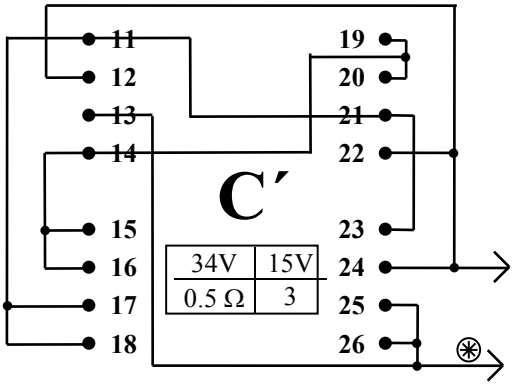
11 V	5V
.05 Ω	1

B



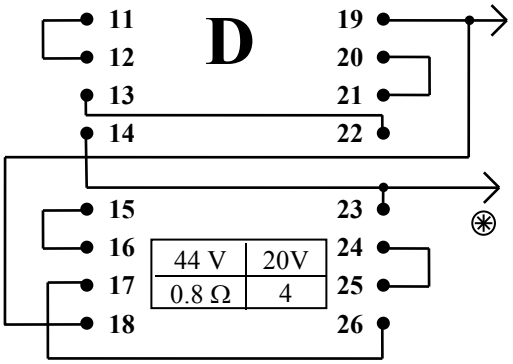
22 V	10V
0.2 Ω	2

C′



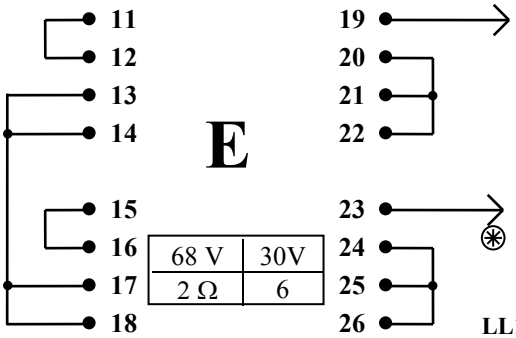
34V	15V
0.5 Ω	3

D



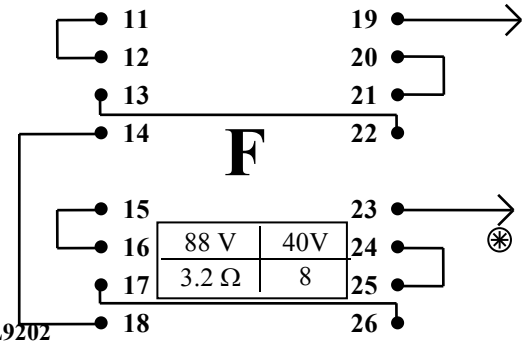
44 V	20V
0.8 Ω	4

E



68 V	30V
2 Ω	6

F



88 V	40V
3.2 Ω	8

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Amorphous core output transformers

LL1620AM, LL1623AM, LL1627AM, LL1679AM, LL9202AM

Some of our tube output transformers are now available with amorphous core. Listening tests, in particular for the PP versions where the core airgap is not as dominating as in SE applications, have reported a more transparent, wider bandwidth character than our silicon iron counterparts.

For connection alternatives and general application information, please refer to data sheets for our regular (silicon-iron) output transformers.

The obvious measurable difference between our silicon-iron cores and amorphous cores is that the saturation flux for the amorphous core is approximately 33% less than for the silicon-iron counterpart. This is caused partly by a lower saturating flux level, partly by a smaller fill-factor due to the thickness of the amorphous sheets.

As a result, power bandwidth is reduced by about 50%. (This means that if the max output power for a standard LL1620/40mA is 25W at 30 Hz, corresponding max. power for LL1620AM/40mA is 13W.)
This is probably not a problem in most Push-Pull applications, but should possibly be considered in Single End amplifiers.

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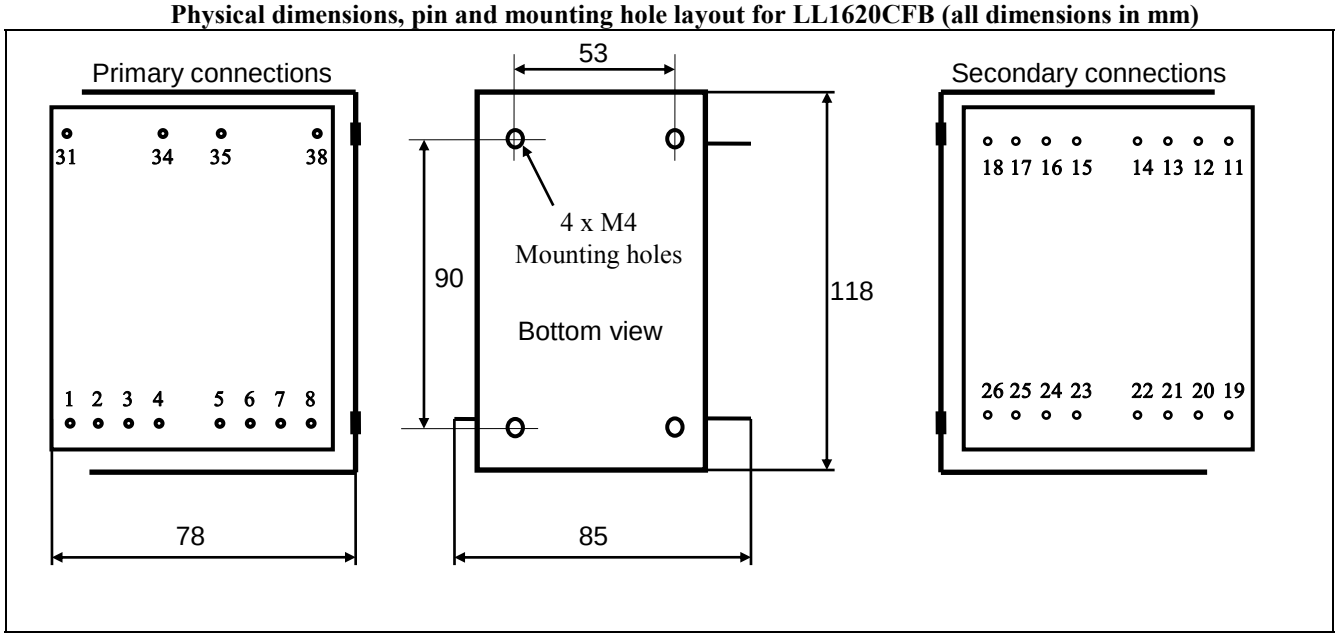
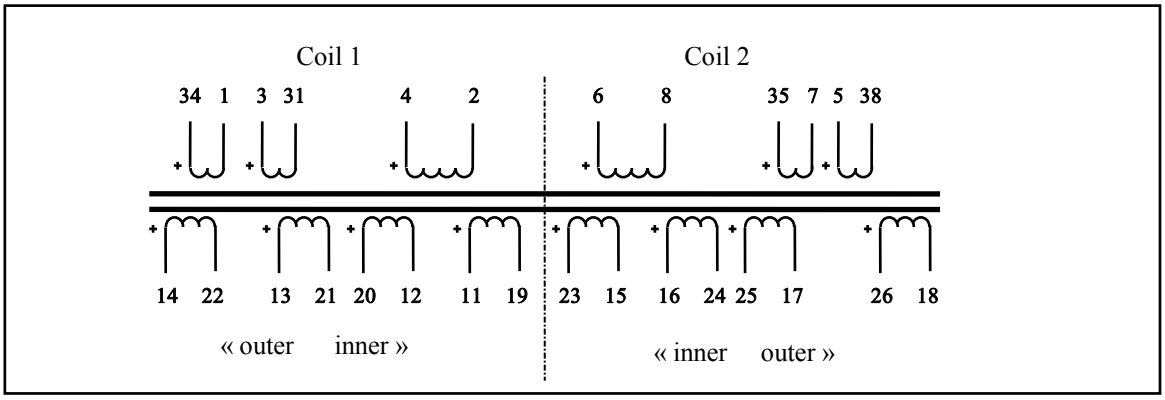
Tube Amplifier Output Transformer
LL1620CFB (Cathode FeedBack)

The LL1620CFB is a version of the LL1620 where one primary winding on each coil has been split in half to support Push-Pull Cathode Feedback applications with 25% feedback. For all data not presented in this sheet, please refer to the regular LL1620 data sheet.

Physical dimensions, pin and mounting hole layout for LL1620CFB (all dimensions in mm)

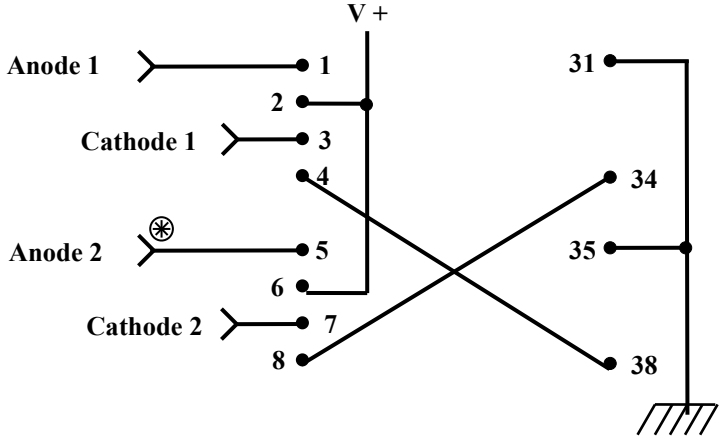


Winding schematics:



LL1620CFB
Primary connection for push-pull output stage with 25% cathode feedback

R150220 PL



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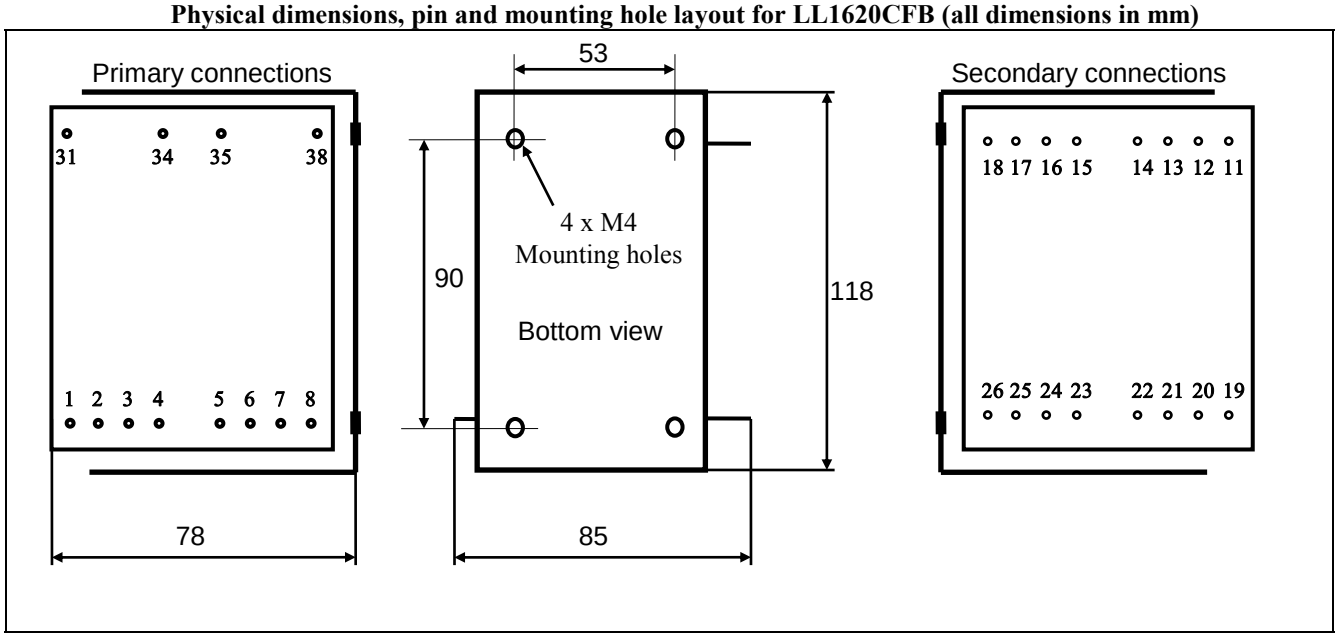
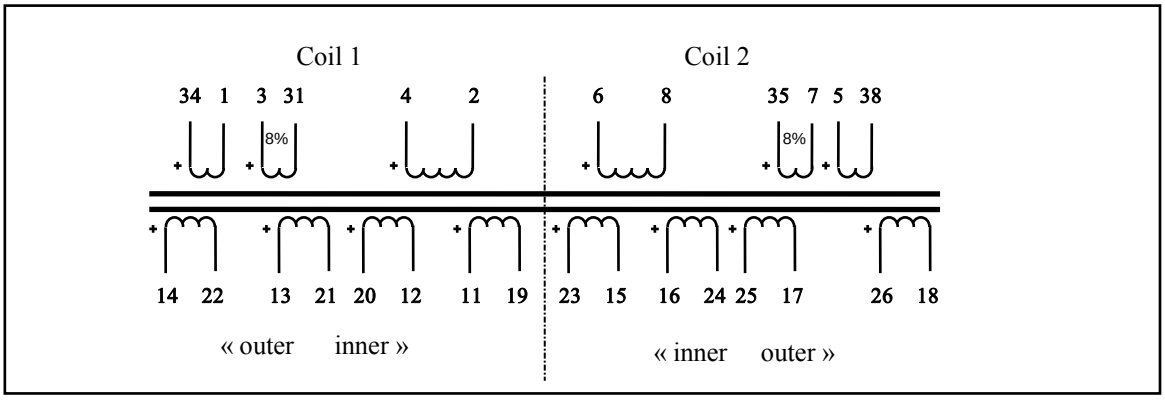
Tube Amplifier Output Transformer
LL1620CFB8% (for Cathode FeedBack)

The LL1620CFB is a version of the LL1620 where one primary winding on each coil has been split to support Push-Pull Cathode Feedback applications with 8% feedback. For all data not presented in this sheet, please refer to the regular LL1620 data sheet.

Physical dimensions, pin and mounting hole layout for LL1620CFB (all dimensions in mm)

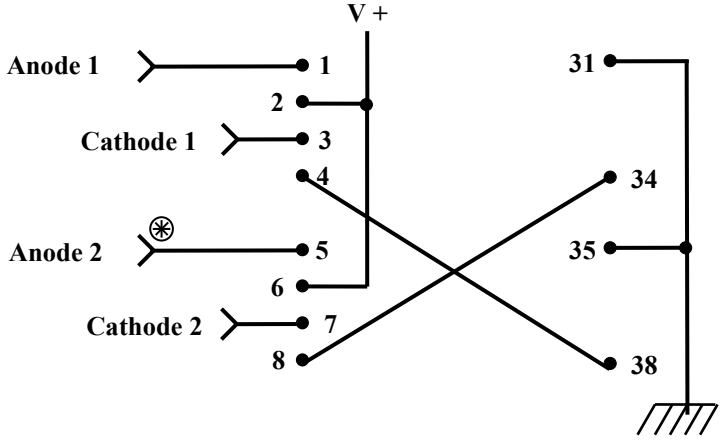


Winding schematics:



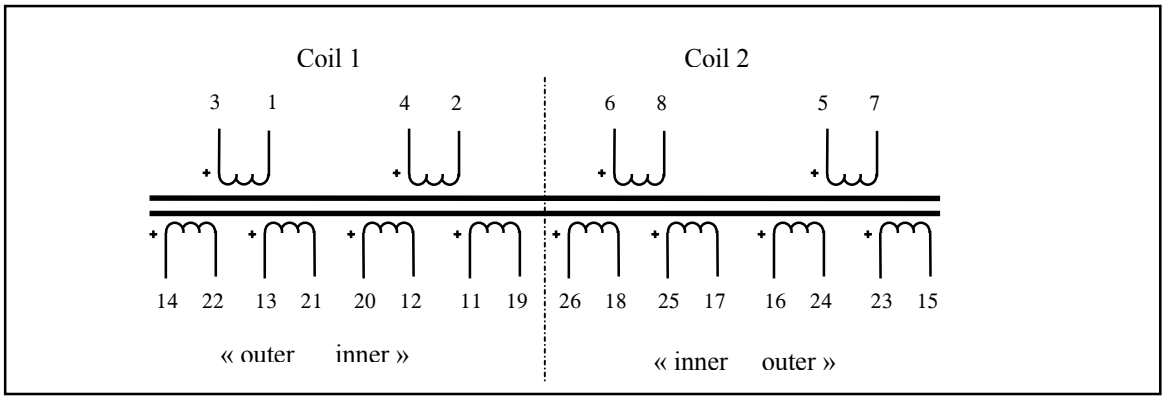
LL1620CFB
Primary connection for push-pull output stage with 8% cathode feedback

R150220 PL



Pin spacing module: 5.08 mm (0.2")
Weight: 2.5 kg

Winding schematics:



The inner windings have lower copper resistance due to smaller circumference

	LL1620		LL1623		LL1627	
Turns ratio:	4 x 19.2 : 8 x 1		4 x 13.4 : 8 x 1		4 x 8.5 : 8 x 1	
Static resistance of primary (all in series)	308 Ω (4 • 77 Ω)		164 Ω (4 • 41 Ω)		56Ω (4 •14 Ω)	
Static resistance of each secondary (average)	0.4 Ω		0.4 Ω		0.4 Ω	
Primary leakage inductance (all in series)	13 mH		4.6 mH		1.9 mH	
Max. primary signal voltage r.m.s. at 30 Hz (all in series)	Push-Pull 860V	Single End 380V	Push-Pull 610V	Single End 270V	Push-Pull 380V	Single End 170V

Isolation between primary and secondary windings / between windings and core: 3 kV / 1.5 kV

Standard types:

LL1620 P-P	LL1620 / 40 mA	LL1620 / 60 mA	LL1620 / 80 mA
LL1623 P-P	LL1623 / 60 mA	LL1623 / 90 mA	LL1623 / 120 mA
LL1627 P-P	LL1627 / 90 mA	LL1627 / 140 mA	LL1627 / 185 mA

Frequency response: The frequency response is dependent on transformer type and connection alternative.
E.g. for the LL1623 / 90 mA, connection alt. C, with R_{SOURCE} = 650 Ω
R_{LOAD} = 8 Ω

you get:

Frequency response	7 Hz - 25 kHz	+/- 0.5 dB
Phase Shift	@ 20 Hz	2°
	@ 20 kHz	13.5°
Group delay (δφ/δω)	@ 20 kHz	2.2 µs

Electrical characteristics

Primary Load Impedance, Primary DC Current Core Air-gap and Maximum Output Power

	Sec. connection for 4/8/16 Ω (See next page)			**Core Airgap (Delta/2)**			
	-/B/C	B/C/D	C/D/E	25 µ (Push-Pull)	125 µ (Single End)	190 µ (Single End)	250 µ (Single End)
	Primary Load Impedance			**DC current for 0.9 Tesla (rec. operating point) Primary Inductance**			
LL1627	2.3 kΩ	1.2 kΩ	0.65 kΩ	Push-Pull 60 H	90 mA 18 H	140 mA 12 H	185 mA 9 H
LL1623	5.6 kΩ	3.0 kΩ	1.6 kΩ	Push-Pull 150 H	60 mA 46 H	90 mA 30 H	120 mA 23 H
LL1620	11.5 kΩ	6.0 kΩ	3.3 kΩ	Push-Pull 300 H	40 mA 90 H	60 mA 60 H	80 mA 45 H
	Power and Loss						
All types	62W	125W	250W	**Max. Power, P-P at 30 Hz**			
	13W	25W	50W	**Max. Power, S.E. at 30 Hz**			
	0.2 dB	0.5 dB	0.8 dB	**Loss across transformer**			

Our recommendations on how to choose your tube output transformer

Push-pull output stages:
All our push-pull output transformers have a 25 microns core air gap to allow for a small DC unbalance of your output circuits.

Step 1 From your secondary load impedance (4, 8 or 16 ohms), we suggest a secondary connection alternative with 0.5 dB loss. This will give you a maximum power limit of 125W at 30 Hz, and a LF -1 dB point at 6.4 Hz for pentodes and lower still for triodes.
If you require more headroom at low frequencies, the 0.8 dB loss alternative expands the LF limit one octave.

Step 2 Your tube choice gives you a desired primary load impedance. Select the transformer type having a primary load impedance which best matches the desired impedance.
The LL1623 (5.6 kΩ plate-to-plate impedance) or the LL1620 (6.0 kΩ plate-to-plate impedance) suites many tubes like the 300B triode or the EL34 pentode. The 6C33 (low voltage, high current) requires a transformer LL1627 while high anode voltage tubes require the high impedance of the LL1620.

Footnote: In class A push-pull, each **tube** will see a load impedance = 1/2 transformer primary load impedance.
In class B push-pull, each **tube** will see 1/4.

Single-end output stages:
The core of Single End output transformers have an airgap. The purpose of the airgap is to accept the DC current of the output tube without saturating the core, leaving enough headroom for the sound signal. As a result of the airgap, the primary inductance is lower for SE output transformers compared to P-P dittos. In addition, the inductance tends to vary with DC current. For our high quality C- cores with carefully ground surfaces, the variation is within +7% of rated value.

Step 1 We recommend that, given your secondary load impedance (4, 8 or 16 ohms), you select a secondary connection alternative with 0.5 dB loss. This will give you a power limit of 25 W at 30 Hz. If you find that you require more bass headroom, select a secondary connection alternative with 0.8 dB loss.

Step 2 From the tube load line you determine a primary load impedance. This results in a choice of transformer main type.

Step 3 From the tube data sheet you also select your desired DC current. From the table above you select the transformer subtype (DC current) which best fits your needs. For many tubes such as the 300B and the EL34, the transformer LL1623 / 90 mA is the ideal choice.

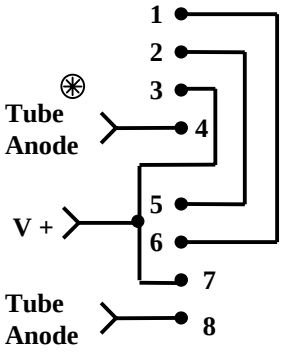
Step 4 We define **Power Low Frequency Limit, F_{PL}**, as the frequency where $\omega L_P = R_{LOAD}$. (The reactive impedance of the transformer equals the primary load impedance). At F_{PL}, the output power is reduced to 50%. For the LL1623 / 90 mA in a 0.5 dB loss connection, F_{PL} = 16 Hz ($R_{PRIMARY}$ = 3.0 kohms and L_P = 30H).

Step 5 We define **Response Low Frequency Limit, F_{RL}** as the frequency where a (small) output signal is reduced with -1 dB due to finite primary inductance. $F_{RL} = \omega / \pi$, if you solve ω in
$\omega L_P = (R_{LOAD}$ *in parallell with* $R_{ANODE})$.
For the LL1623 / 90 mA and a 300B triode, F_{RL} = 7 Hz. (R_{ANODE} = 650 ohms, $R_{PRIMARY}$ = 3.0 kohms and L_P = 30H),

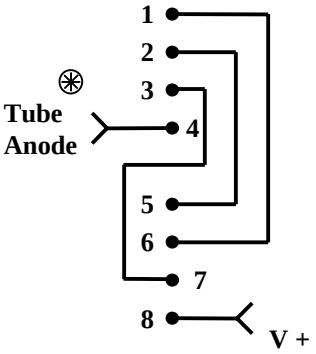
Primary Connections

⊛ Indicates phase

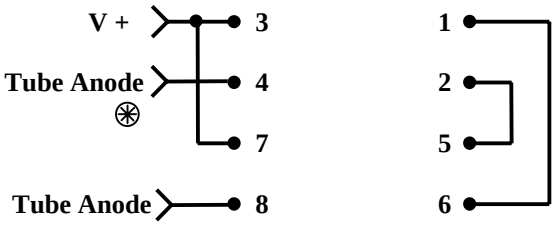
LL1620, LL1627 Primmary connection for push-pull output stage



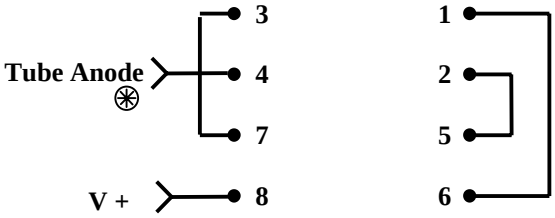
LL1620, LL1627 Primmary connection for single-end output stage



LL1623 Primmary connection for push-pull output stage



LL1623 Primmary connection for single-end output stage

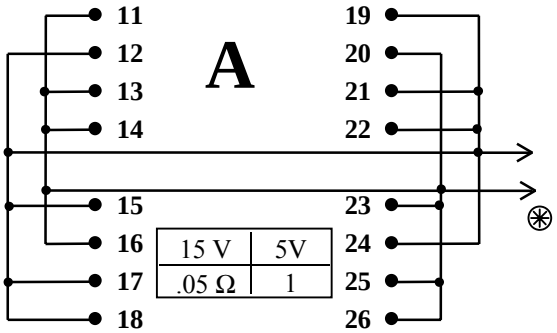


Secondary connections

⊛ Indicates phase

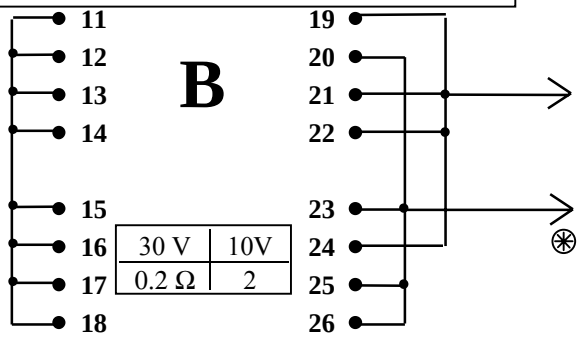
Max secondary Voltage RMS @ 30 Hz	
Push-Pull	Single End
Copper resistance	Windings in series

A



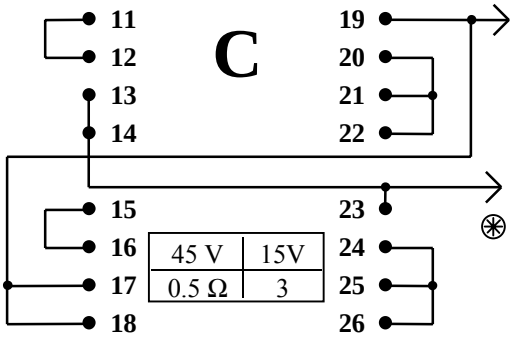
15 V	5V
.05 Ω	1

B



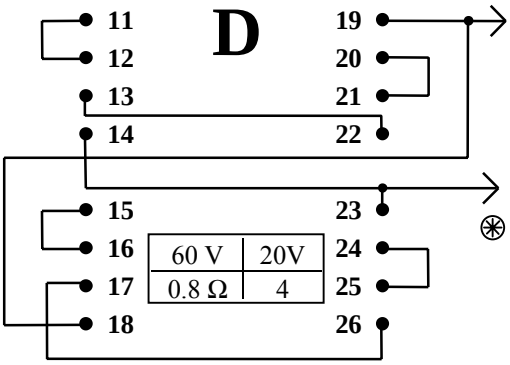
30 V	10V
0.2 Ω	2

C



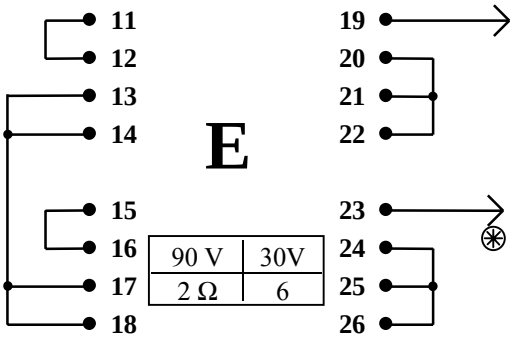
45 V	15V
0.5 Ω	3

D



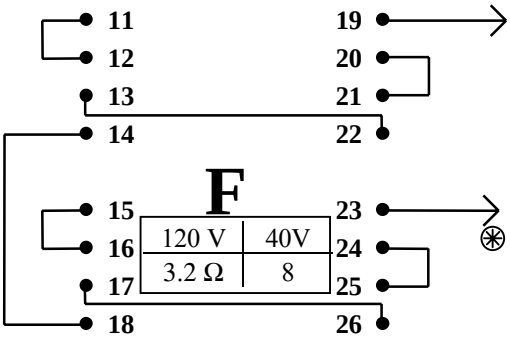
60 V	20V
0.8 Ω	4

E



90 V	30V
2 Ω	6

F



120 V	40V
3.2 Ω	8

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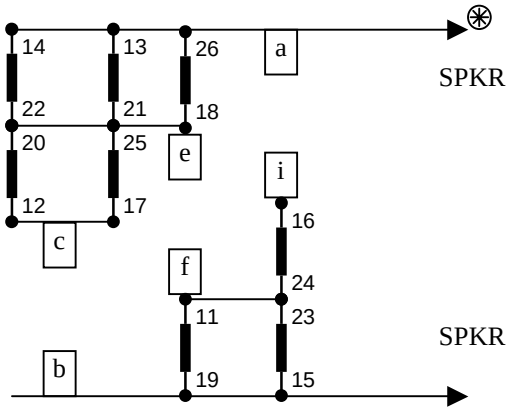
LL1620, LL1623, LL1627
Suggested connection diagram for simplified switching between different output impedance.

Switch between secondary connections B and C

(numbers refer to LL1620, LL1623, LL1627 secondary taps)



	B	C
Bridge	c – b	c – f
Bridge	e – f	e – i
Bridge	a – i	

Possible PCB layout for 3 jumpers

B

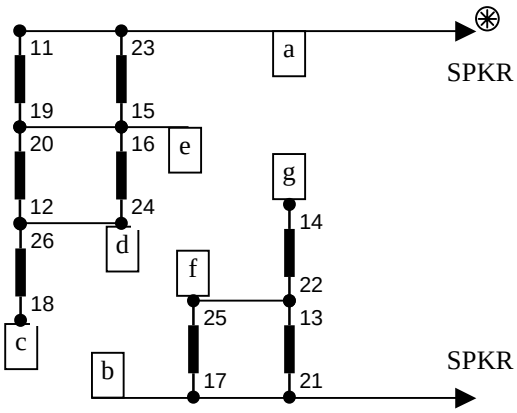
		a	i
b	c	f	e

C

		a	i
b	c	f	e

Switch between secondary connections C and D

(numbers refer to LL1620, LL1623, LL1627 secondary taps)



	C	D
Bridge	c – b	c – f
Bridge	d – f	d – g
Bridge	e - g	

Possible PCB layout for 3 jumpers

C

	e	g	d
b	c		f

D

	e	g	d
b	c		f

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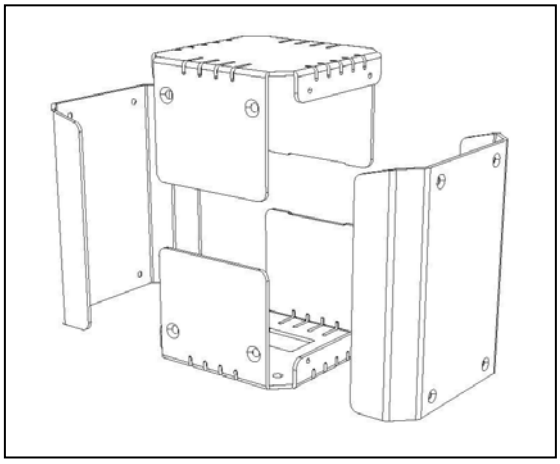
LL1620_HOUSING

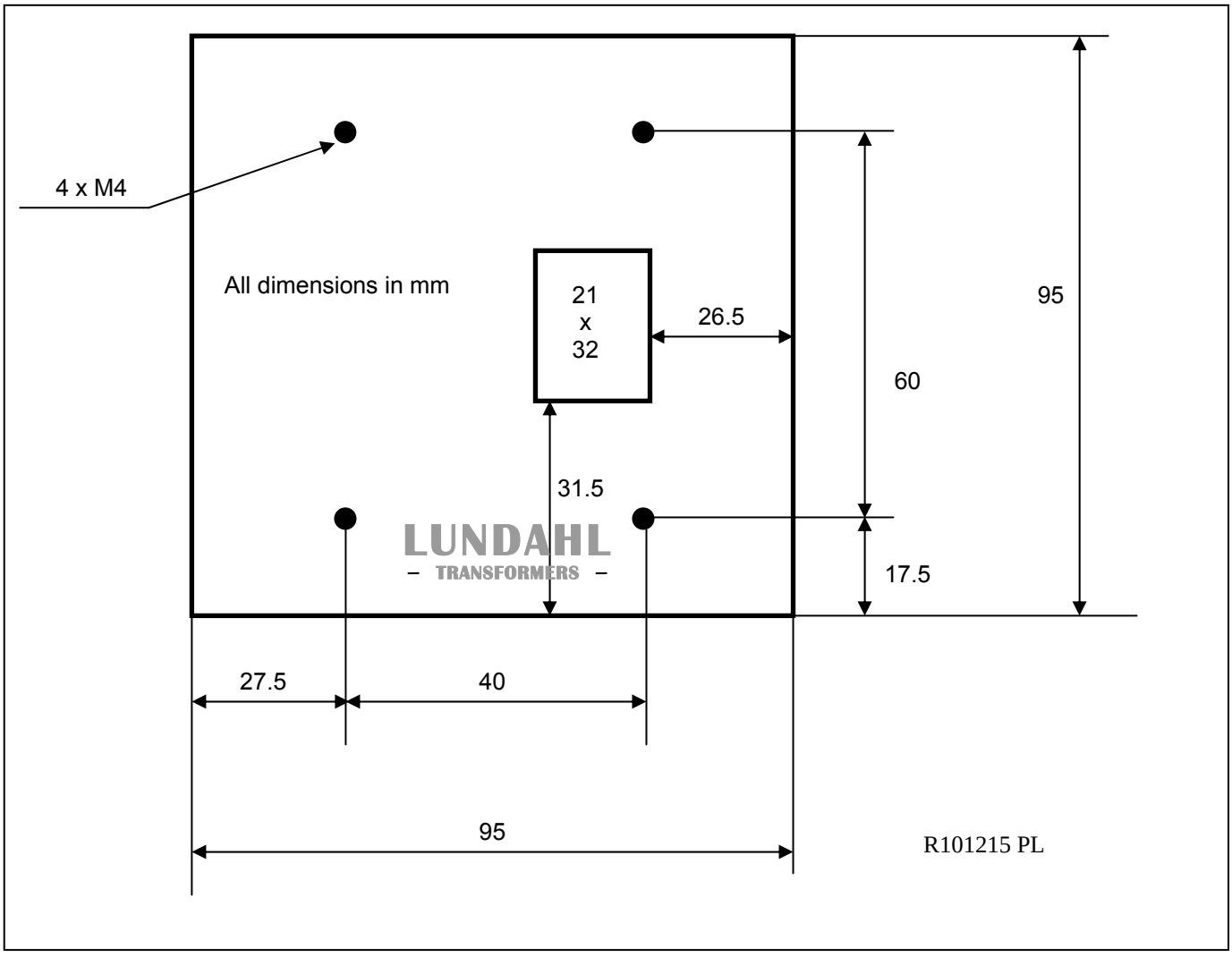
Housing for LL1620-size tube amp transformers. (LL1620, LL1623, LL1627, LL1648, LL1649, LL1650, LL1651, LL1679, LL2410, LL2414, LL2418, LL2419, LL9202)



Dimensions	126 mm (4.95”) tall, 95 x 95 mm (3.76” x 3.76”) footprint	**Material**	2 mm construction steel
Finish	Medium charcoal semi-gloss powder coat	**Logo**	Black silk screen print

LL1620_housing footprint.

NOT TO SCALE. For mounting, drill 4 x 4.5 mm holes for M4 screws, and one 20mm hole for cabels.



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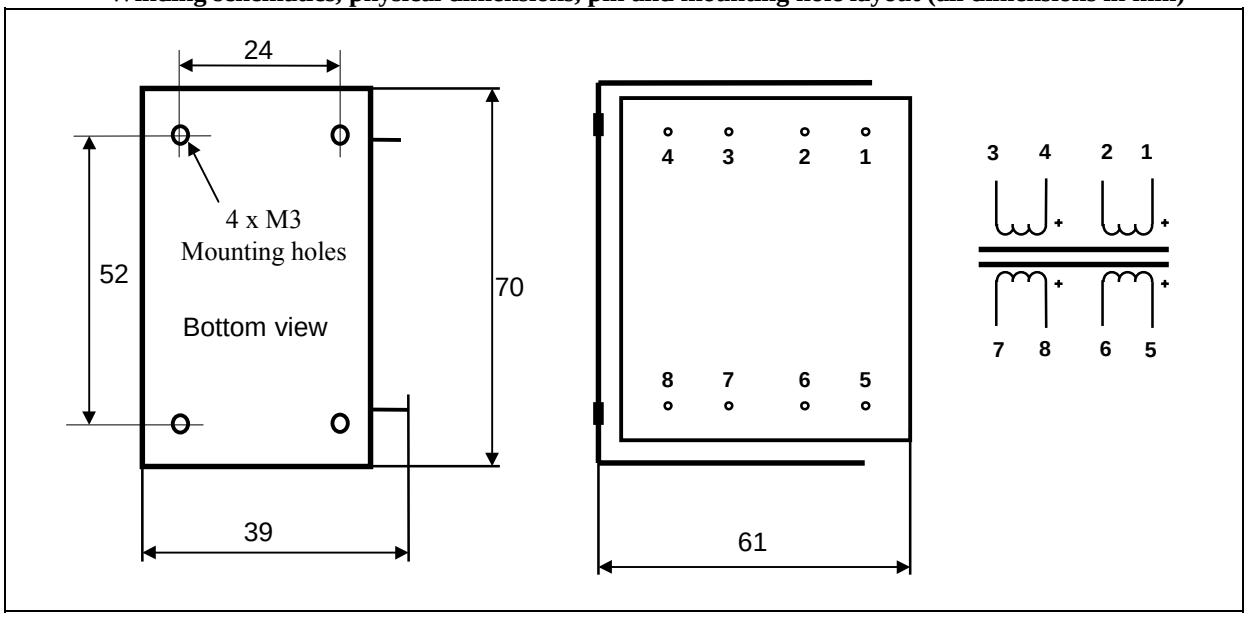
Noninverting Drive Transformer for Tube Amplifier Output Stage
LL1621

LL1621 is a noninverting high inductance drive transformer for tube amplifier output stages.
The transformer has a special audio C-core of our own production, and the coil is made using a low capacitance coil winding technique. LL1621 is available in Push-pull and Single-end versions.

Turns ratio: 1 + 1 : 1+1

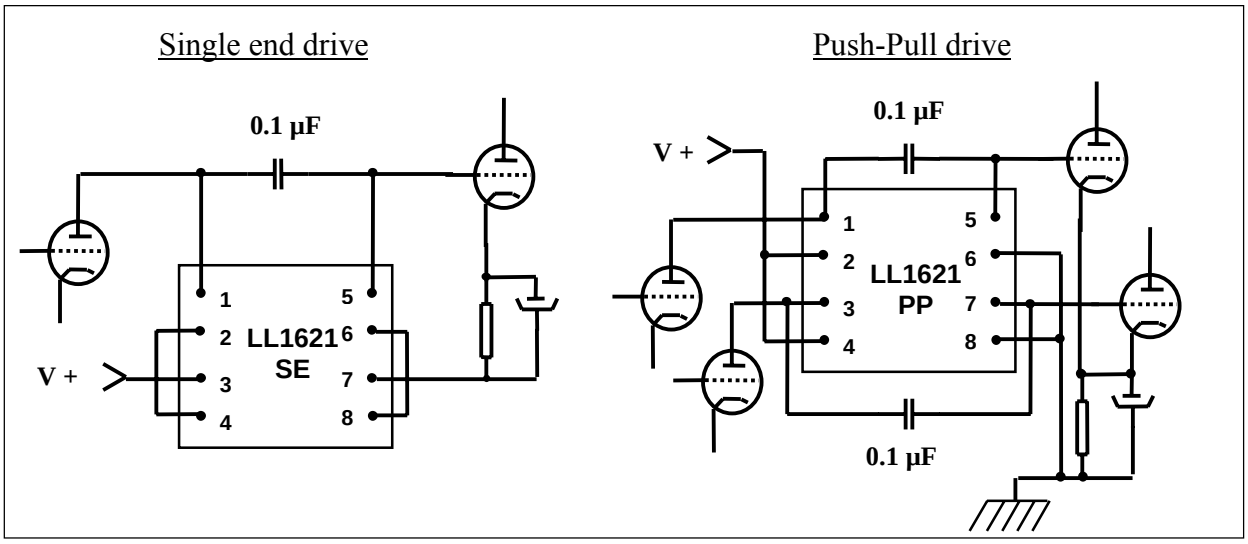
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



	LL1621 / P-P	LL1621 / 6mA	LL1621 / 20mA
Weight:	0.5 kg	0.5 kg	0.5 kg
Static resistance of each primary (avarage)	445 Ω	445 Ω	445 Ω
Static resistance of each secondary (avarage)	455 Ω	455 Ω	455 Ω
Recommended primary DC current, primaries in series		6 mA	20 mA
Maximum DC current before saturation, primaries in series		10 mA	35 mA
Primary inductance (primaries in series)	> 300 H	130 H	30 H
Freq. response (EXAMPLE!) LL1621 / 6mA	source 3.9 k, no load	+/- 0.5 dB 10 Hz -- 100 kHz	

Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Output stage drive examples :



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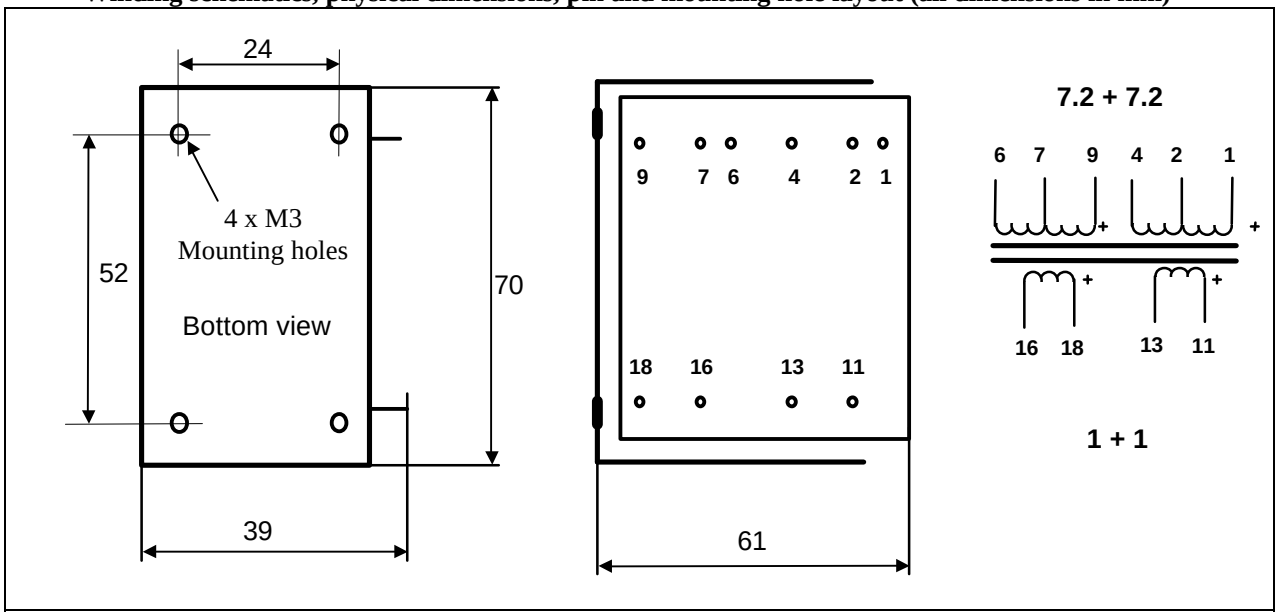
Line Output Transformer for Tube Amplifiers
LL1630

LL1630 is a line output transformer for tube amplifiers.
The transformer is highly sectioned, and wound with a special low capacitance winding technique. This results in very good high frequency performance. The transformer has a special audio C-core of our own production.

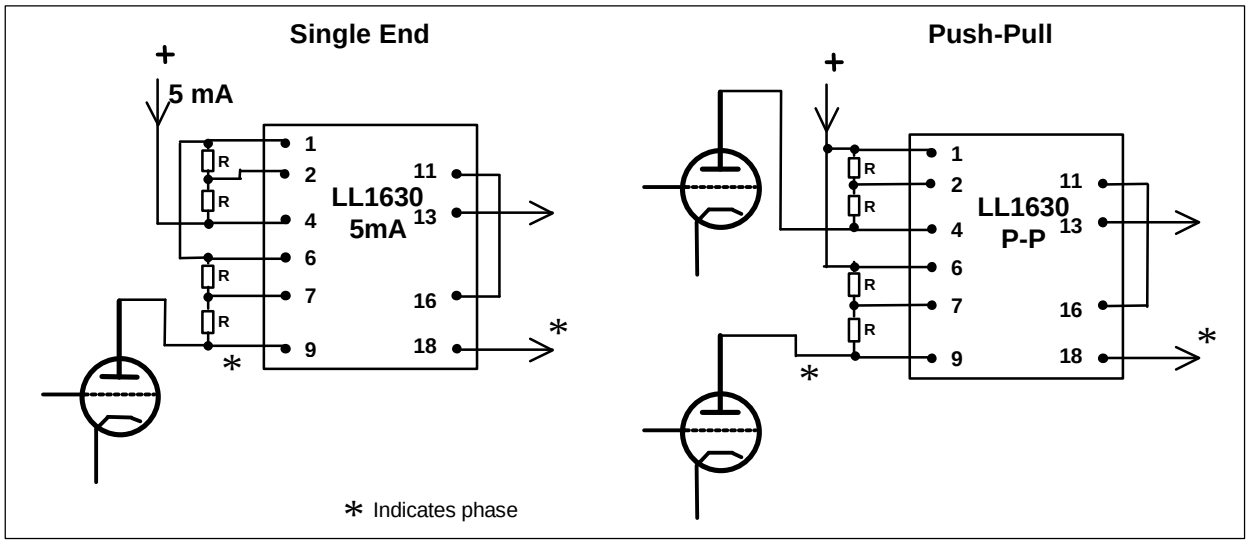
Turns ratio: 7.2 + 7.2 : 1+1

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



	LL1630 / 5mA	LL1630 P-P
Static resistance of each primary (average)	480 Ω	480 Ω
Static resistance of each secondary (average)	14 Ω	14 Ω
Primary DC current, primaries in series (For B_0 = 0.9 T)	5 mA	
Maximum DC current before core saturation, primaries in series	9 mA	
Max standing DC current through any primary section	40mA	40mA
Primary inductance (primaries in series)	130 H	> 300H
Frequency response @ 0 dBU output level	10 Hz - 40 KHz	5 Hz - 40 KHz
(Source 2 kΩ , load 600Ω. Primaries terminated as suggested below**)**	+/- 0.5 dB	+/- 0.5 dB
Max. output level at 30 Hz (Secondaries in series)	18 V rms	45 V rms
Weight	0.5 kg	0.5 kg
Isolation between primary and secondary windings / between windings and core	4 kV / 2 kV	4 kV / 2 kV

Application examples. Suggested primary terminating resistors 10 k each.



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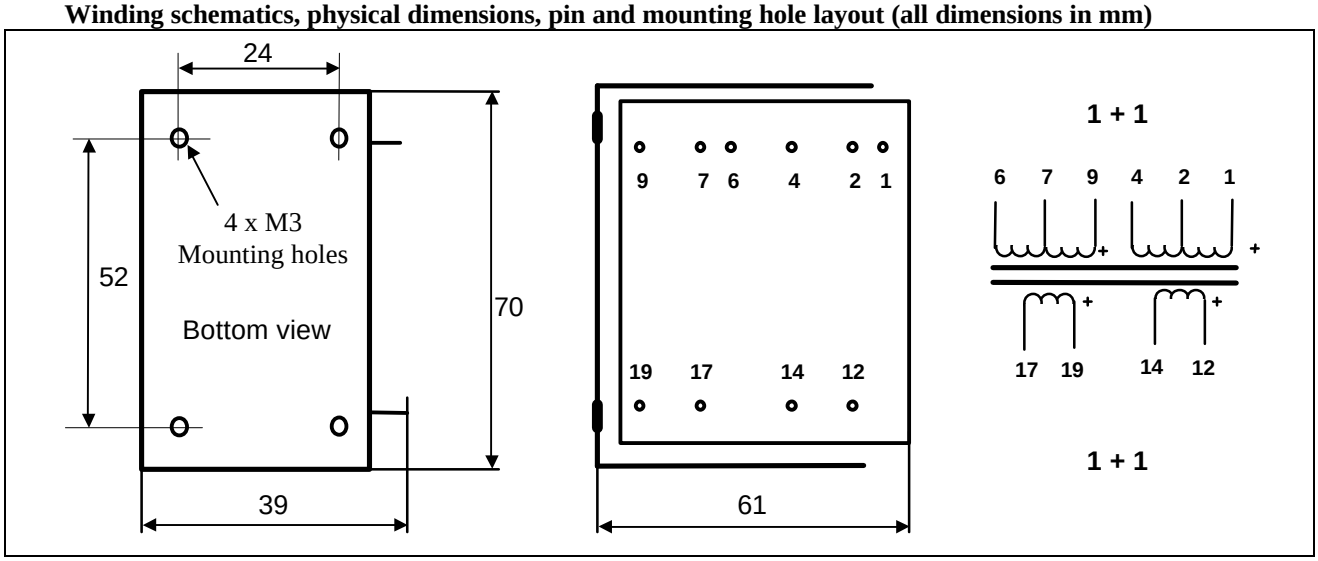
Tube Amplifier Interstage Transformer
LL1635

LL1635 is an interstage transformer for tube (valve) amplifiers available in Push-pull or Single-end versions. The transformer is highly sectioned, and wound with a special low capacitance winding technique which results in very good frequency response. The transformer has a special high flux, low distortion audio C-core of our own production. **NOTE:** LL1635 is not suitable for SE to PP interstage. For this application we suggest transformer LL1660 or LL1660S

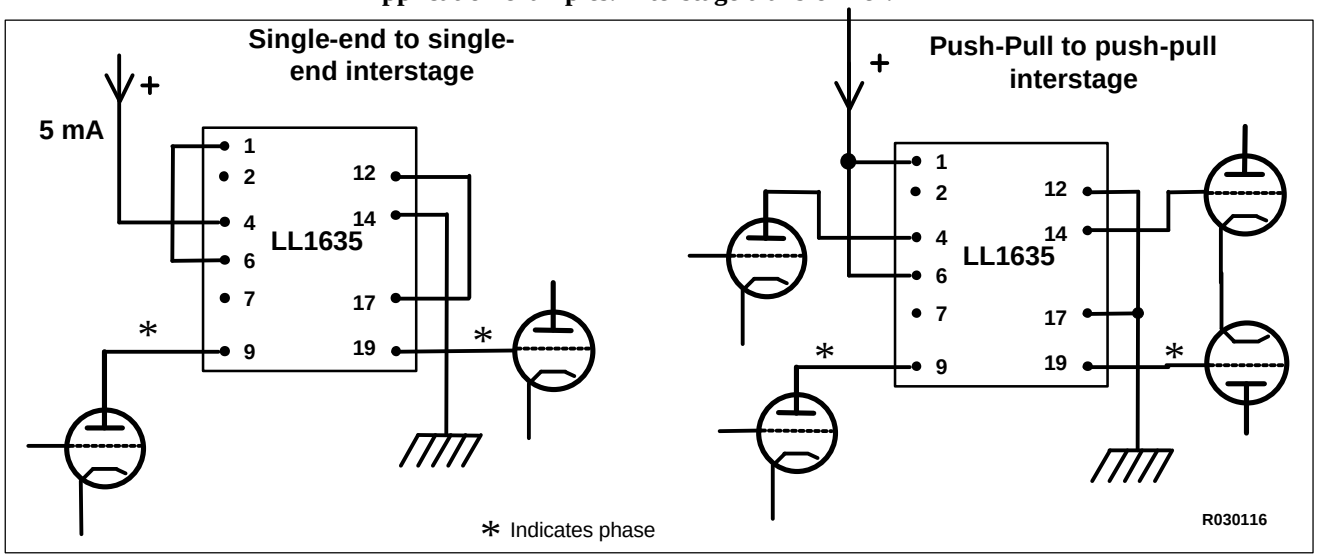
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, each primary	Static resistance, each secondary
0.5 Kg	1+1 : 1+1	500 Ω	500 Ω

	LL1635 P-P	LL1635 /5mA	LL1635/20mA
Primary DC current, primaries in series (for B_0 = 0.9T)		5 mA	20 mA
Maximum DC current before saturation, primaries in series		9 mA	35 mA
Primary inductance (primaries in series)	> 300 H	130 H	30 H
Frequency response, primaries in series	5 Hz - 60 kHz	10 Hz -60 kHz	20 Hz -75 kHz
(Source 4 kΩ for PP and 5mA, 2 kΩ for 20 mA. Load 68 pF)	+/- 1 dB	+/- 1 dB	+/- 1 dB
Group delay @ 20 kHz (Source and load as above)	0.5µs	0.5µs	0.5µs
Max. output voltage @ 30 Hz	2x220 V peak (tot. 310Vrms)	2x90 V peak (tot. 125Vrms)	2x90 V peak (tot. 125Vrms)
Recommended max DC current through any primary section	40mA	40mA	40mA
Isolation between primary and secondary windings / between windings and core	4 kV / 2 kV	4 kV / 2 kV	4 kV / 2 kV

Application examples. Interstage transformer.



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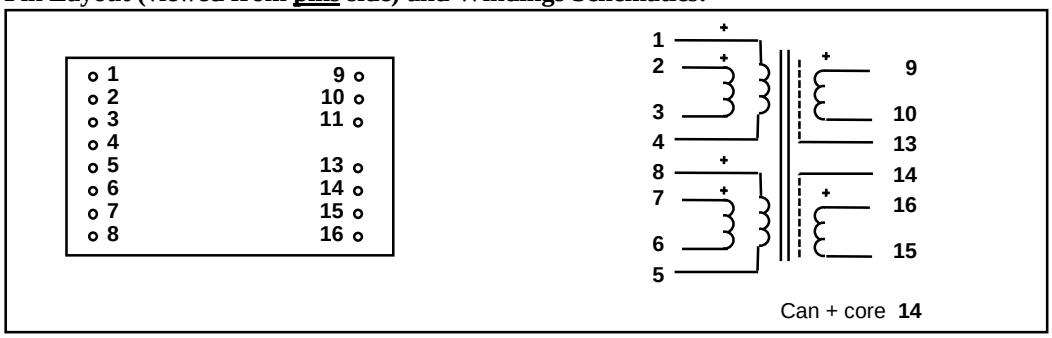
Microphone Input Transformer
LL1636

LL1636 is an audio input transformer for applications where a high turn's ratio is desired. The transformer is built up from two coils, each with a secondary winding surrounded by shields and two primary windings. This structure results in an excellent frequency response. All winding ends are available on the pins. Thus, the transformer can be configured for a number of different turn's ratios.
The LL1636 is made with amorphous core material. As this type of core does not store energy (unlike conventional mu-metal cores) the low frequency resonance with external series capacitors is practically eliminated.

Turns ratio: 1 + 1 + 1 + 1 : 10 + 10
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and Windings Schematics:



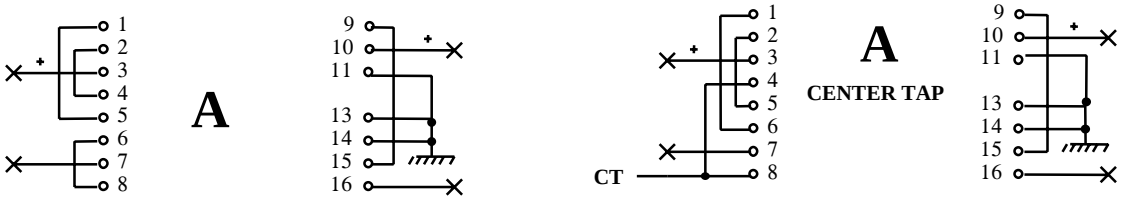
Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 27 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of each primary (average): 10 Ω
Static resistance of each secondary (average): 415 Ω
Self resonance point : > 250 kHz
Frequency response
(@ -10 dBU, all in series. Source 50Ω , load 100 kΩ) **:** 10 Hz -- 25 kHz +/- 1 dB
10 Hz -- 90 kHz +/- 1.5 dB
Distortion (primaries connected in series, source impedance 50Ω **):** < 0.5% @ -2 dBU, 50 Hz
Primary no load impedance @ 0 dBU, 50 Hz, all in series: 8 kΩ typically
Core / Can: Amorphous Strip Core / Mu-metal can
Isolation between windings / between windings and core: 3 kV / 1.5 kV

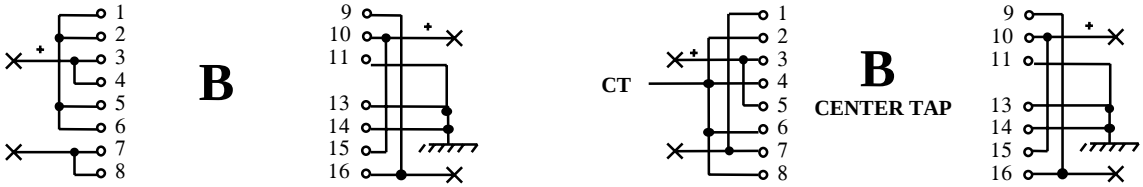
Turns ratio and possible use at different termination alternatives. Termination alternatives are shown on the following page.

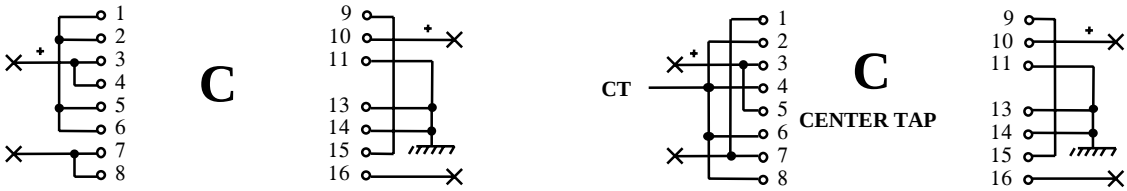
Termination Alternative	Turns ratio	Copper Resistance prim/sec	Possible Use
A	1:5	40Ω / 790 Ω	400Ω / 10 kΩ
B	1:5	10Ω / 200 Ω	Not recommended
C	1:10	10Ω / 790 Ω	100Ω / 10kΩ
D	1:10	2.5Ω / 200 Ω	Not recommended
E	1:20	2.5Ω / 790 Ω	25Ω / 10kΩ

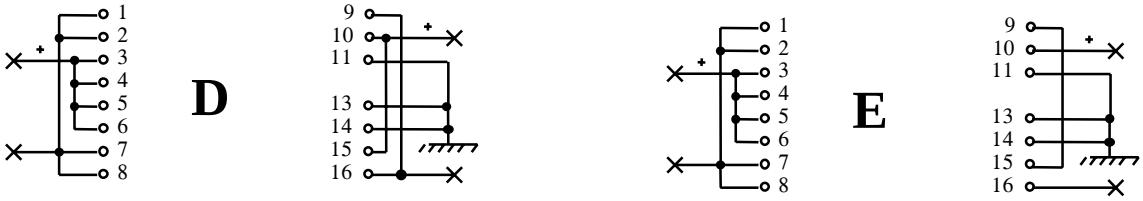
.

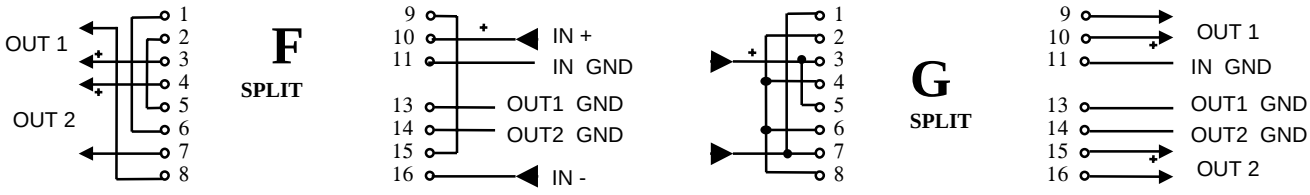
LL1636 Termination Alternatives
(Left side is input if not stated otherwise)
!!!! Pin side view !!!!











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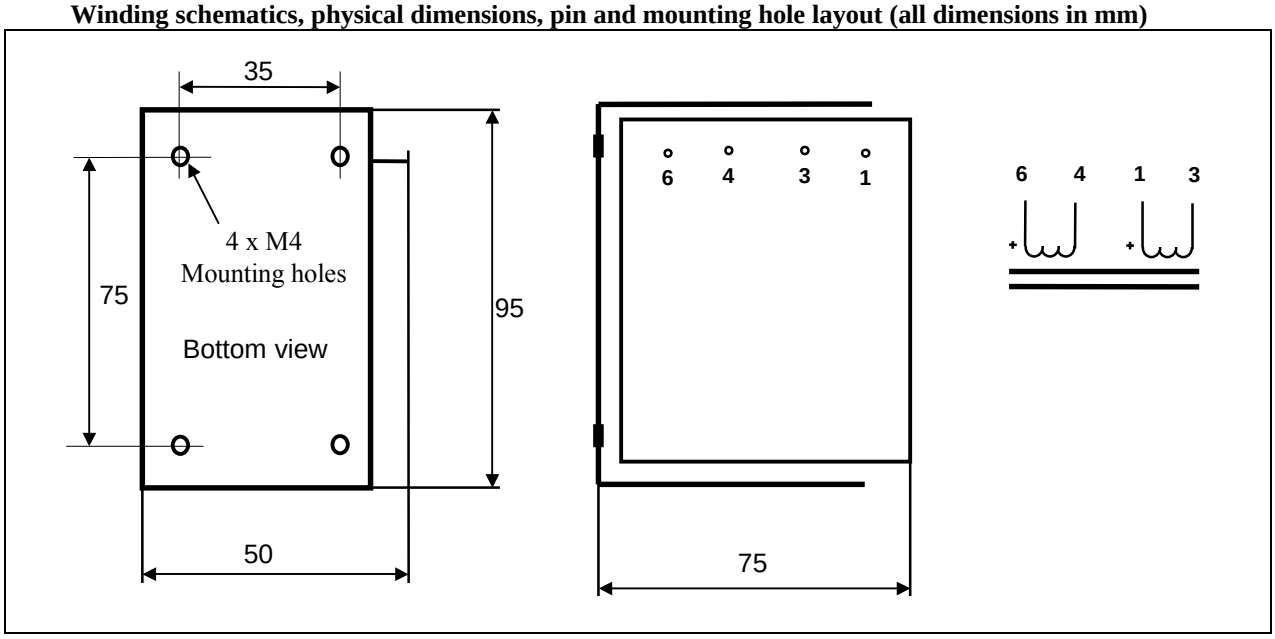
Choke LL1638

The LL1638 is a 2 coils choke for tube amplifier anode supply.
The choke is available with different core air-gap, which results in different inductance and DC current capability.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

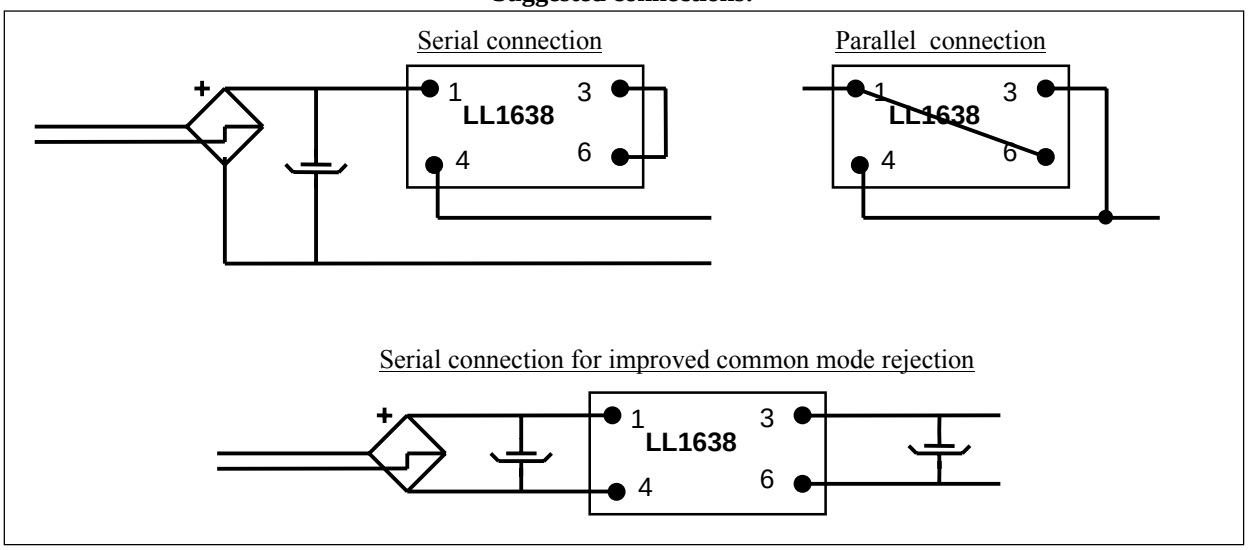
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 1.35 kg
Static resistance of each winding: 18 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**In-ductance**	**Recommended DC current**	**Saturating current**	**In-ductance**	**Recommended DC current**	**Saturating current**
LL1638 / 4 H	4 H	400 mA	575 mA	1 H	800 mA	1150 mA
LL1638 / 8 H	8 H	200 mA	290 mA	2 H	400 mA	580 mA
LL1638 / 10 H	10 H	150 mA	215 mA	2.5 H	300 mA	430 mA
Max. ripple voltage at rec. DC current	300V rms / 100 Hz			150V rms / 100 Hz		

Suggested connections:



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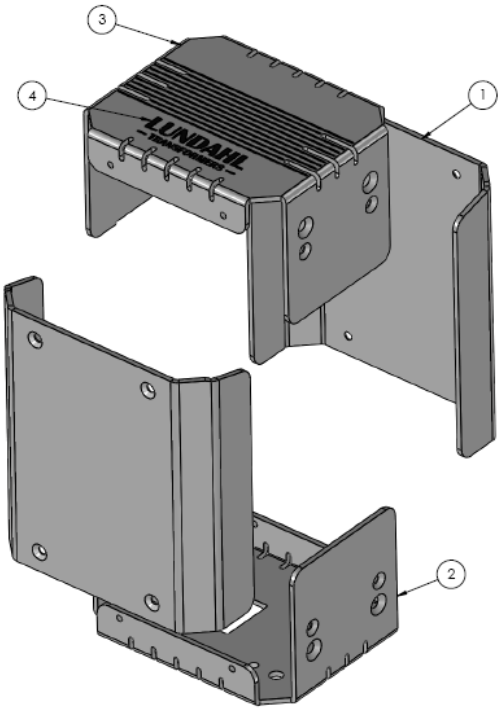
LL1638_HOUSING

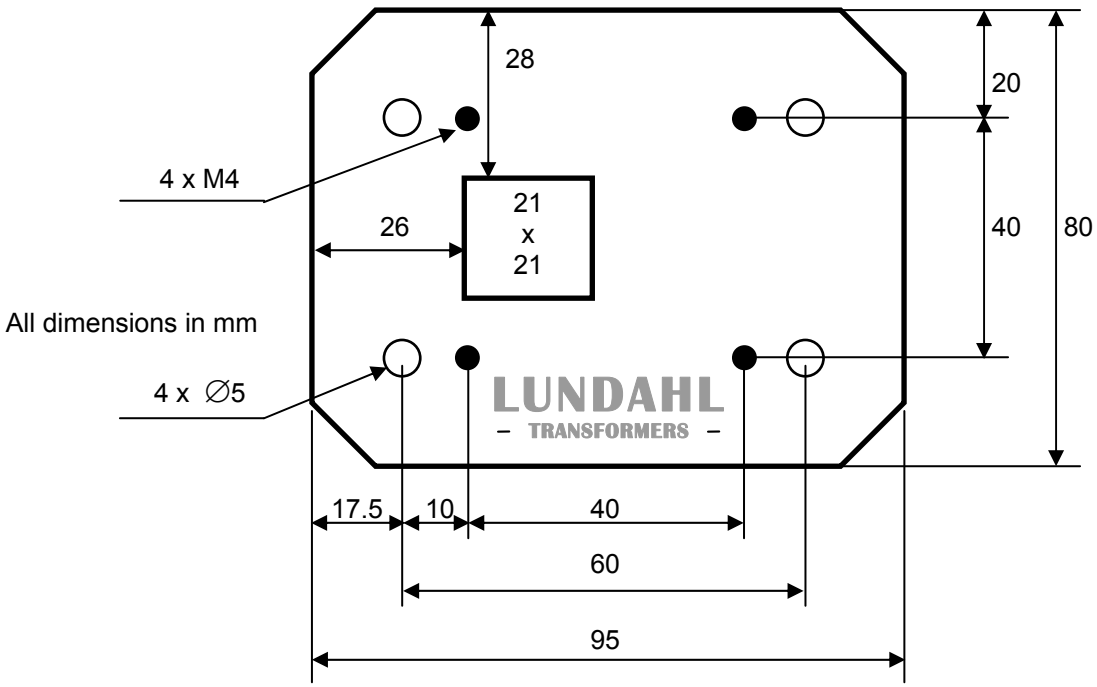
Housing for **LL1638** and **LL1660** size chokes and transformers.



Dimensions	110 mm (4.33”) tall, 95 x 80 mm (3.76” x 3.15”) footprint	**Material**	2 mm construction steel
Finish	Medium charcoal semi-gloss powder coat	**Logo**	Black silk screen print

LL1638_housing footprint.

NOT TO SCALE. For mounting, drill 4 x 4.5 mm holes for M4 screws, and one 20mm hole for cables.



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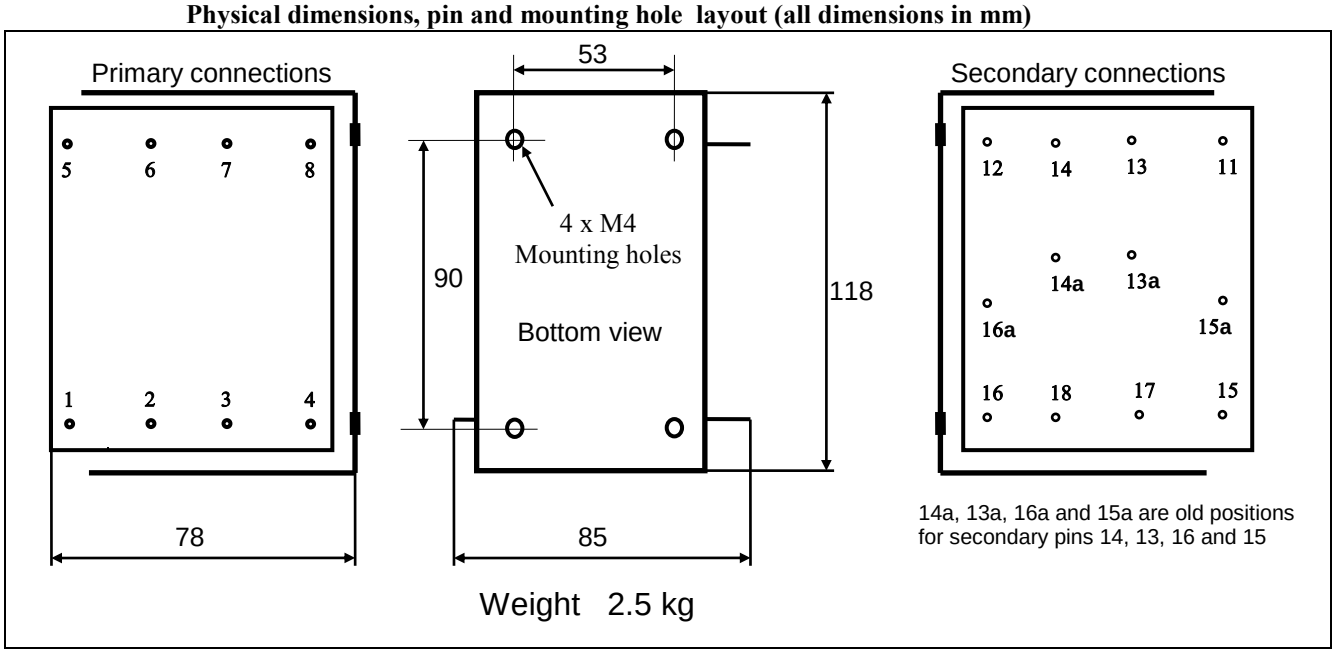
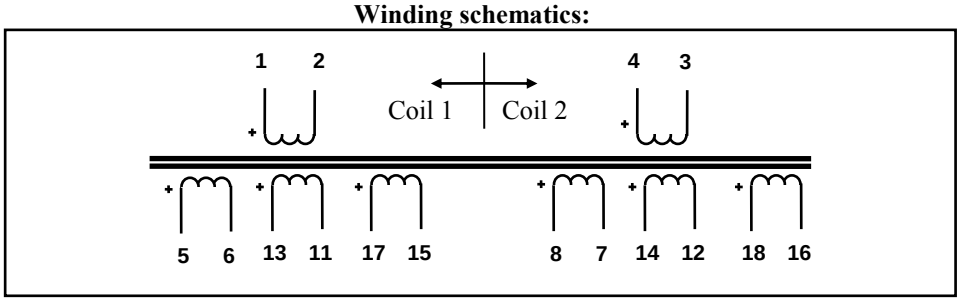
Mains Transformers for Tube Amplifiers
LL1648, LL1649, LL1650, LL1651

C-core mains transformers. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

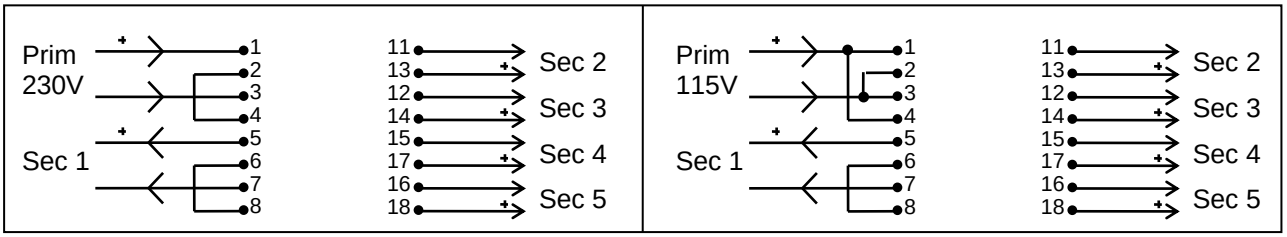
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Type	Primary res. Serial/parallel	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5
LL1648	7.5 Ω / 1.9 Ω	20 Ω / 350 V 0.63A	0.1 Ω / 5.9 V 3.1A	0.1 Ω / 5.9 V 3.1A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6 V 3.1A
LL1649	7.5 Ω / 1.9 Ω	8.4 Ω / 230 V 1.0A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6 V 3.1A
LL1650	7.5 Ω / 1.9 Ω	20 Ω / 350 V 0.63A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6 V 3.1A
LL1651	7.5 Ω / 1.9 Ω	42 Ω / 500V 0.43A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6 V 3.1A

Please note! Output current from rectifier: 63% of above with condensor input rectifier, 95% of above with choke input rectifier.

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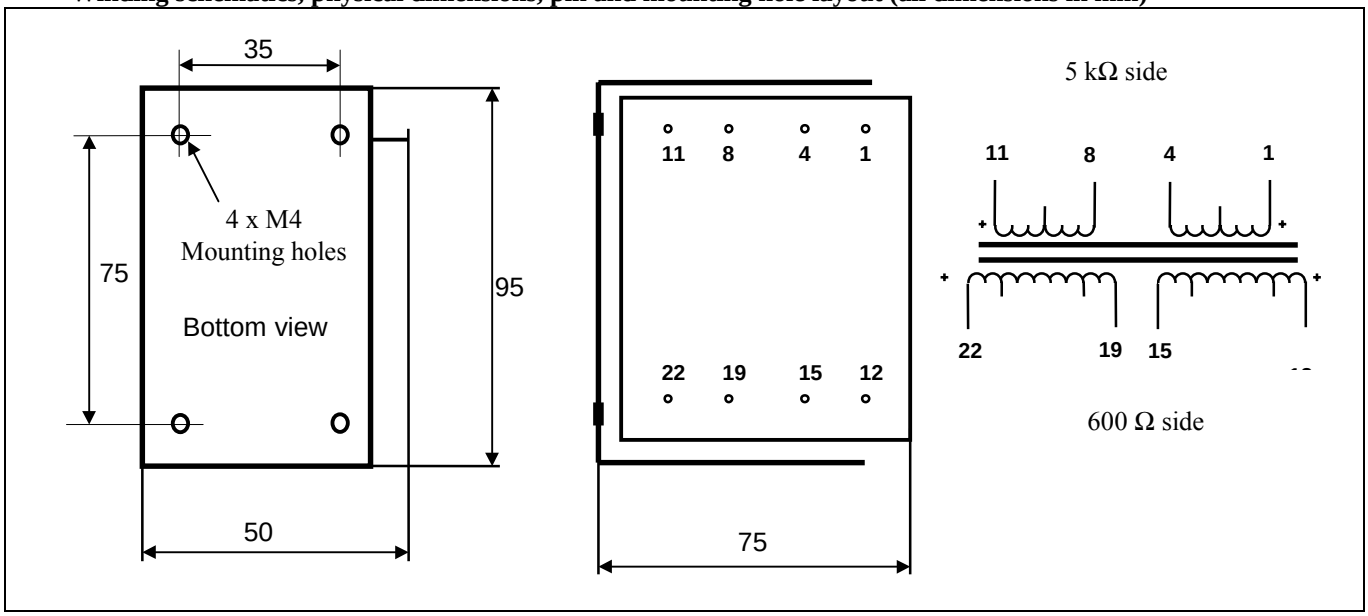
Line Output Transformer LL1654

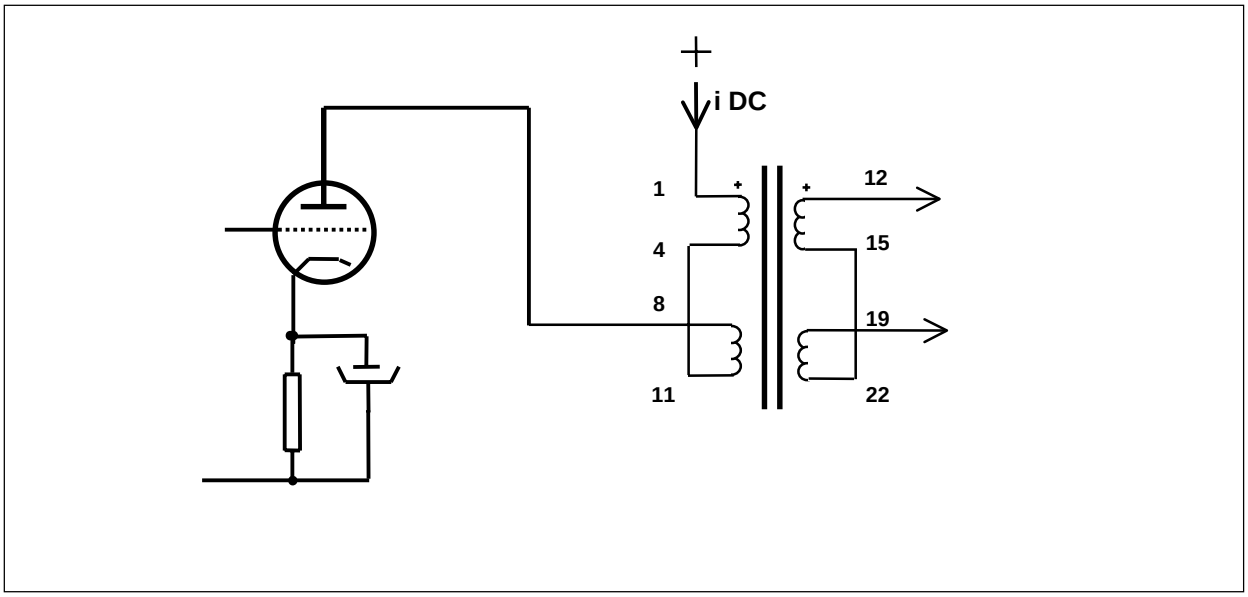
The LL1654 is a 5 section line output transformer, 5 kΩ : 600 Ω , for tube amplifiers.
The C-core is an audio core of our own production.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each primary winding:	134 Ω
Static resistance of each secondary winding:	15 Ω
Primary inductance (Primaries in series, DC 40 mA, Primary voltage 150V, 50 Hz)	58H
Isolation between windings / between windings and core:	4 kV / 2 kV

Suggested use:



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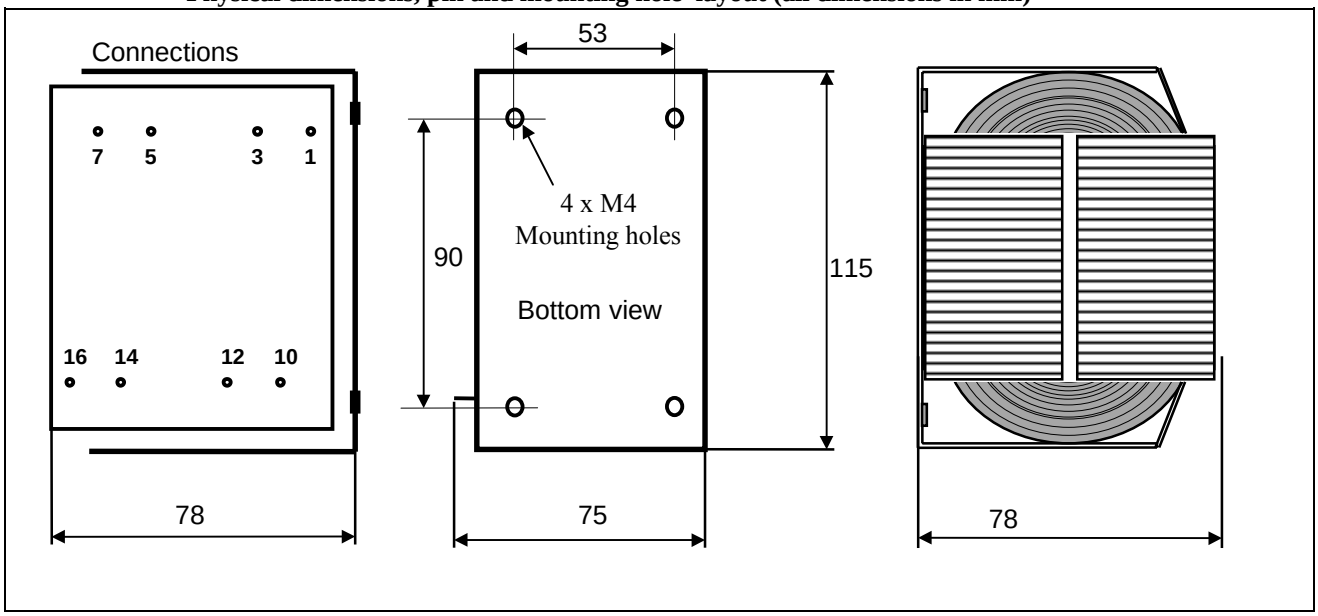
Mains Isolation Transformer
LL1655

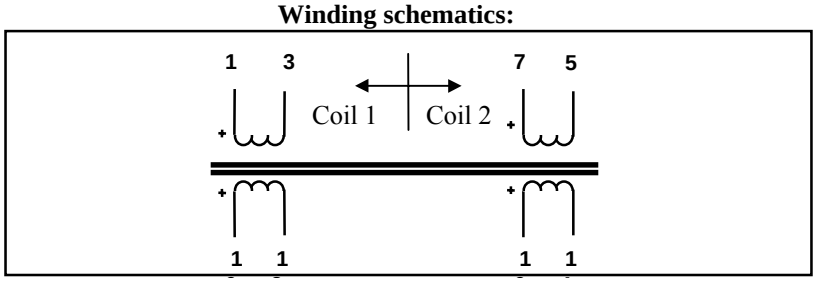
LL1650 is a C-core mains transformers for isolation and DC current elimination. The core is assembled with a carefully selected, very small air-gap to compensate for any mains DC-unbalance. Estimated power rating 300 VA which can be increased with good cooling.

Physical dimensions, pin and mounting hole layout (all dimensions in mm)

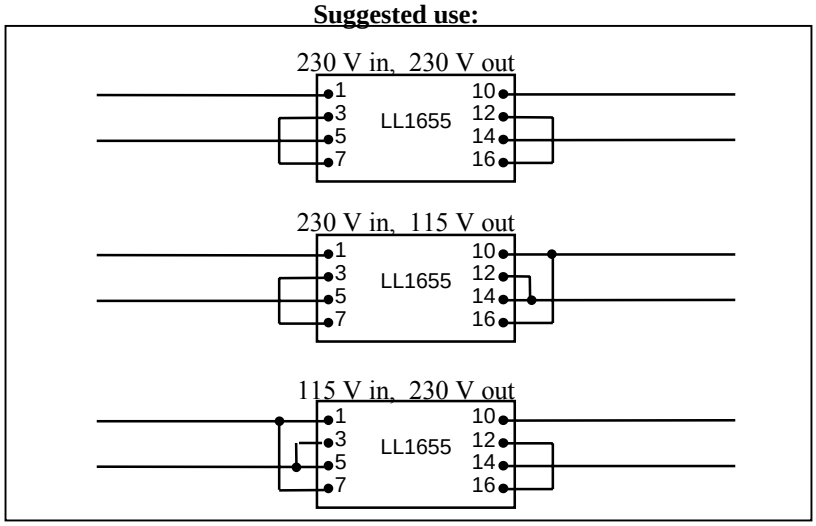


Weight:	2.5 kg
Copper resistance, windings 1 - 3 and 7 - 5 respectively	3.3 Ω
Copper resistance, windings 10 - 12 and 14 - 16 respectively	2.9 Ω
Isolation between windings / between windings and core	4 kV / 4 kV

Winding schematics:



Suggested use:



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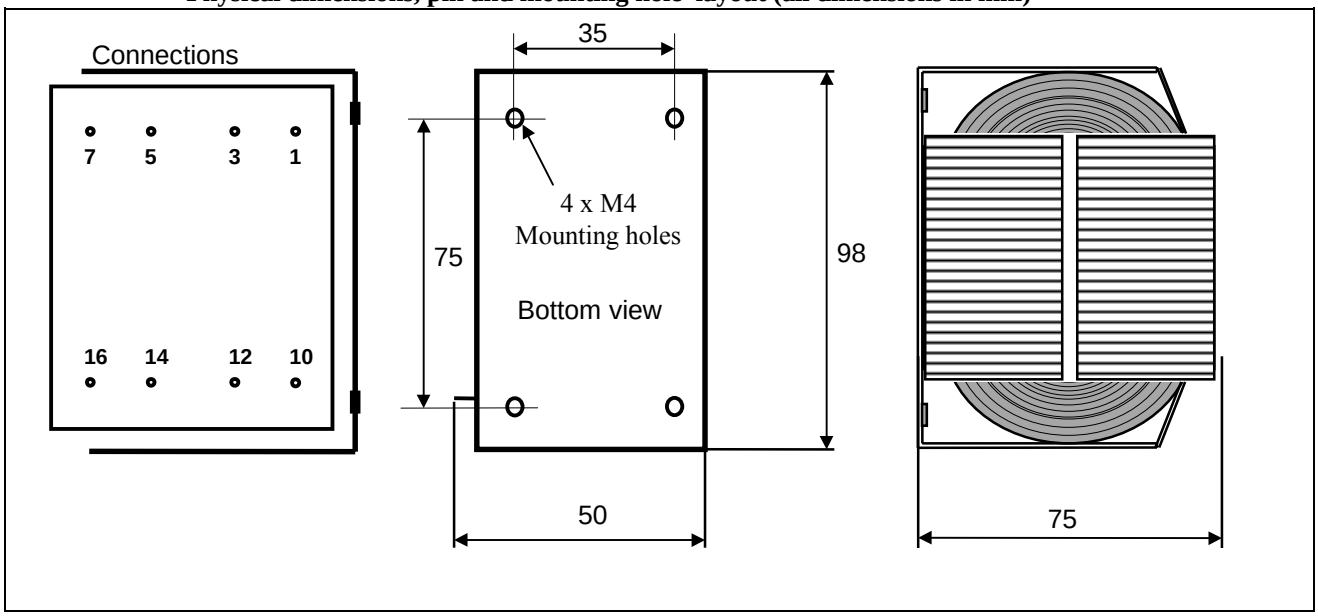
Mains Isolation Transformer
LL1658

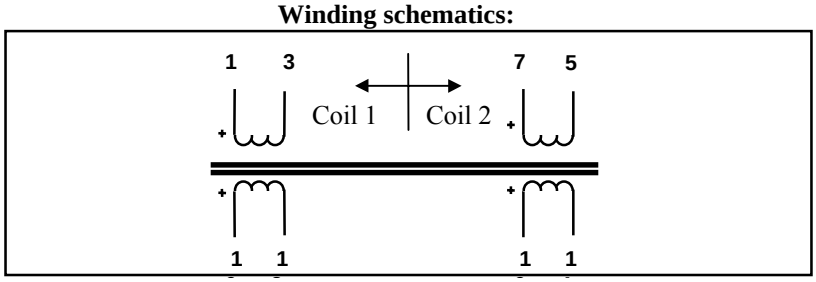
LL1658 is a C-core mains transformers for isolation and DC current elimination. The core is assembled with a carefully selected, very small air-gap to compensate for any mains DC-unbalance. Estimated power rating 100 VA which can be increased with good cooling.

Physical dimensions, pin and mounting hole layout (all dimensions in mm)

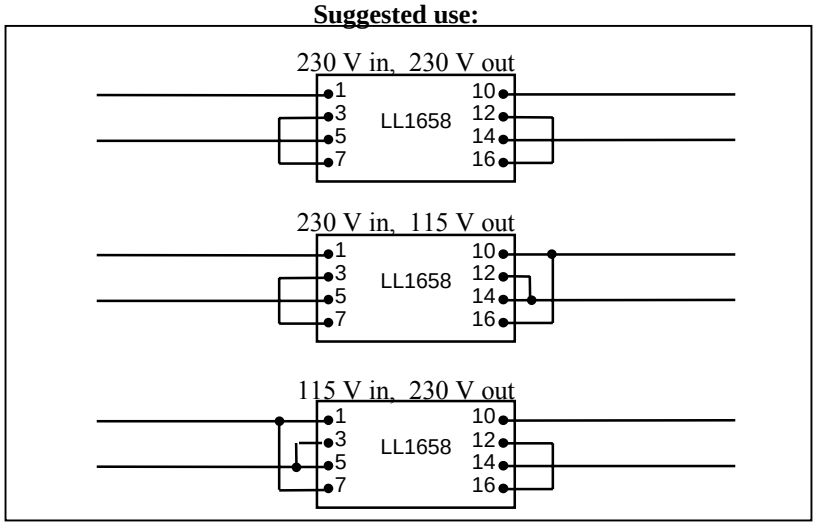


Weight:	1.35 kg
Copper resistance, windings 1 - 3 and 7 - 5 respectively	11.3 Ω
Copper resistance, windings 10 - 12 and 14 - 16 respectively	9.9 Ω
Isolation between windings / between windings and core	4 kV / 4 kV

Winding schematics:



Suggested use:



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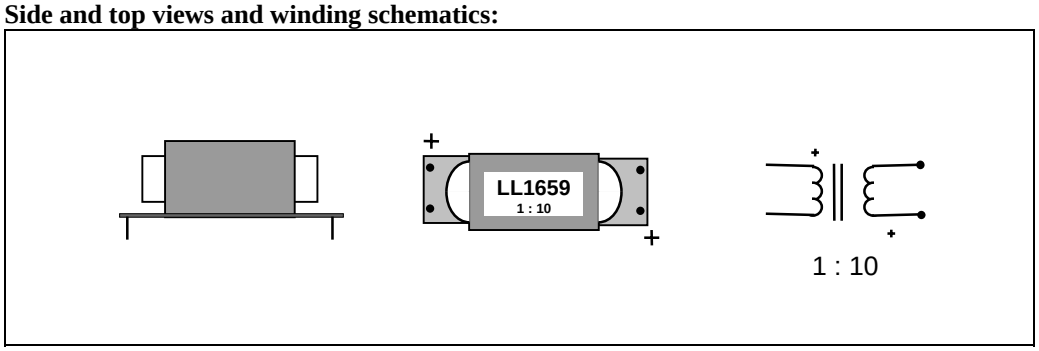
Inline Microphone Transformer
LL1659

Turns ratio:	10 : 1
Dims:	
Length	35mm
Width	15 mm (max)
Height above PCB	12 mm (max)
Distance between pins	5.08 x 30.48 mm (0.2” x 1.2”)

Side and top views and winding schematics:



Static resistance of primary:	810 Ω
Static resistance of secondary:	14 Ω
Core:	Amorphous strip core
Max signal level:	approx. 1.2 V / 12 V r.m.s. @ 50 Hz
Isolation between windings / between windings and core:	2 kV/1 kV

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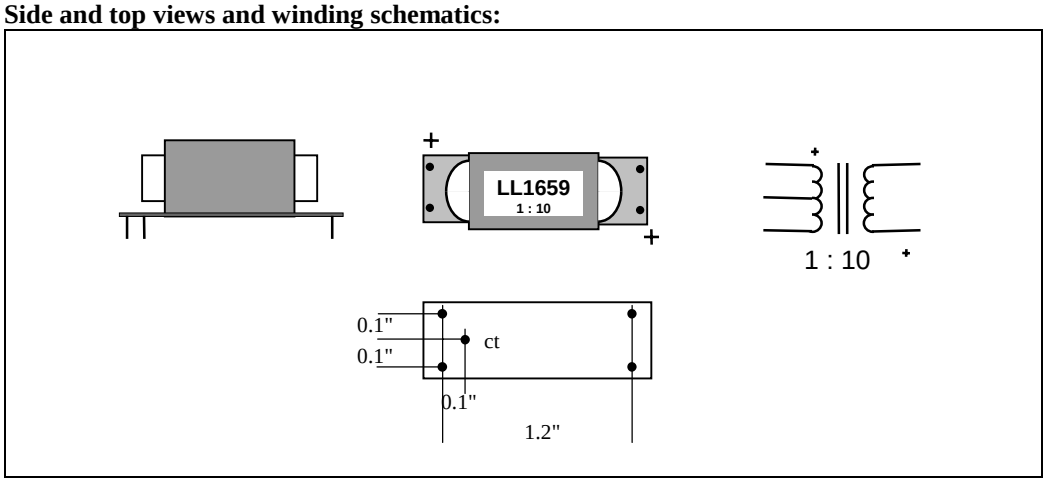
Inline Microphone Transformer
LL1659CT

Inline transformer LL1659 with center tap

Turns ratio:	10 : 1
Dims:	
Length	35mm
Width	15 mm (max)
Height above PCB	12 mm (max)

Side and top views and winding schematics:



Static resistance of primary:	810 Ω
Static resistance of secondary:	14 Ω
Core:	Amorphous strip core
Max signal level:	approx. 1.2 V / 12 V r.m.s. @ 50 Hz
Isolation between windings / between windings and core:	2 kV/1 kV

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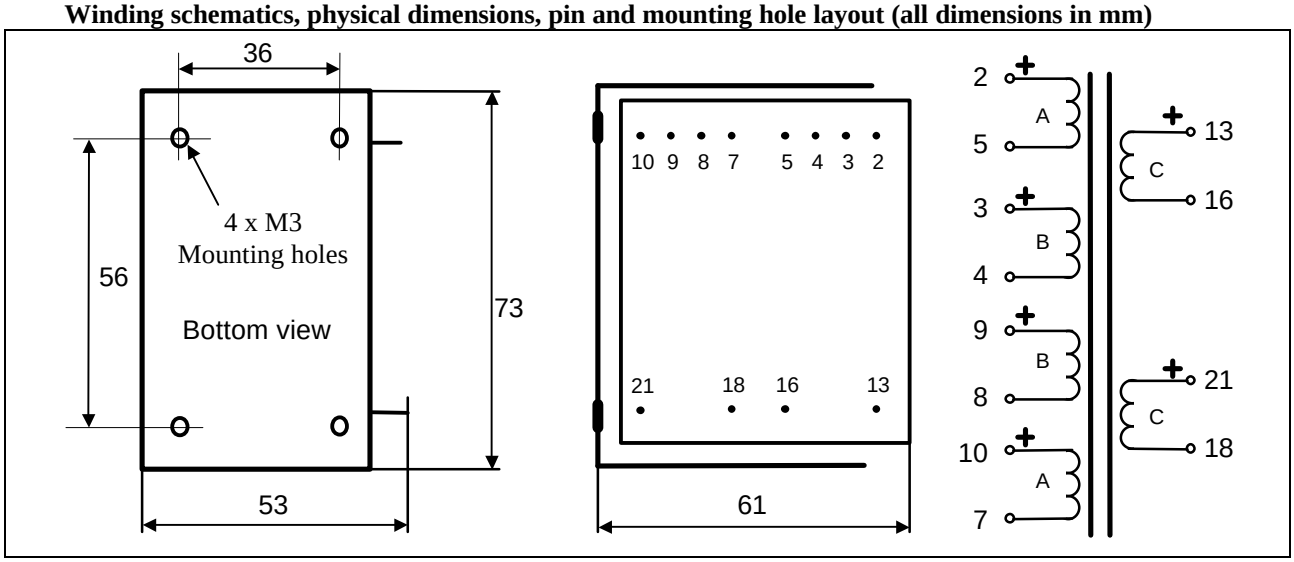
Tube Amplifier Interstage Transformer / Line Output Transformer
LL1660

LL1660 is an interstage / line output transformer for tube amplifiers. The transformer is available with different core air gap for PP or SE drives.
The transformer is wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
The LL1660PP is assembled with a small core air gap to allow for some DC current unbalance.
For the S.E. versions of the LL1660, the core air gap is chosen such that the denoted DC current (18mA for a LL1660/18mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 2.25+2.25	315 Ω	240 Ω	625 Ω

Max. current through any single section: 50 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	**LL1660 PP**	**LL1660 PP**	**LL1660/18mA**	**LL1660/10mA**
Connection	Alt M´´ PP to PP Interst. 2.25+2.25 : 2+2	Alt N PP Line output 2.25+2.25 : 1	Alt Q SE Line Output 4.5 : 1	Alt S SE to SE Interst. 4 : 4.5
Primary DC current for 0.9 Tesla	-	-	16 mA	10 mA
Primary Inductance	290H	290H	100H	130H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	20 Hz – 25 kHz 15kΩ	16 Hz – 30 kHz 15kΩ	11 Hz – 35 kHz 3 kΩ	25Hz - 40 kHz 14 kΩ
Max output voltage @ 30 Hz	2 x 260V r.m.s.	130V r.m.s.	57 V r.m.s.	250 V r.m.s.

Applications

Type	**LL1660/10mA**	**LL1660/10mA**
Connection	Alt T SE to SE Interst. 2 : 4.5	Alt V SE to PP Interst. 2.25 : 2 + 2
Primary DC current for 0.9 Tesla	20 mA	18 mA
Primary Inductance	33H	42H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	25 Hz - 30 kHz 3.5kΩ	25 Hz - 30 kHz 3.5kΩ
Max output voltage @ 30 Hz	250 V r.m.s.	220 V r.m.s.

(*) The source impedances used in the tables indicates a recommended upper limit, unless freq. response can be compromised.
At lower source impedance resonance peaking will occure. It can be reduced using secondary load resistors.

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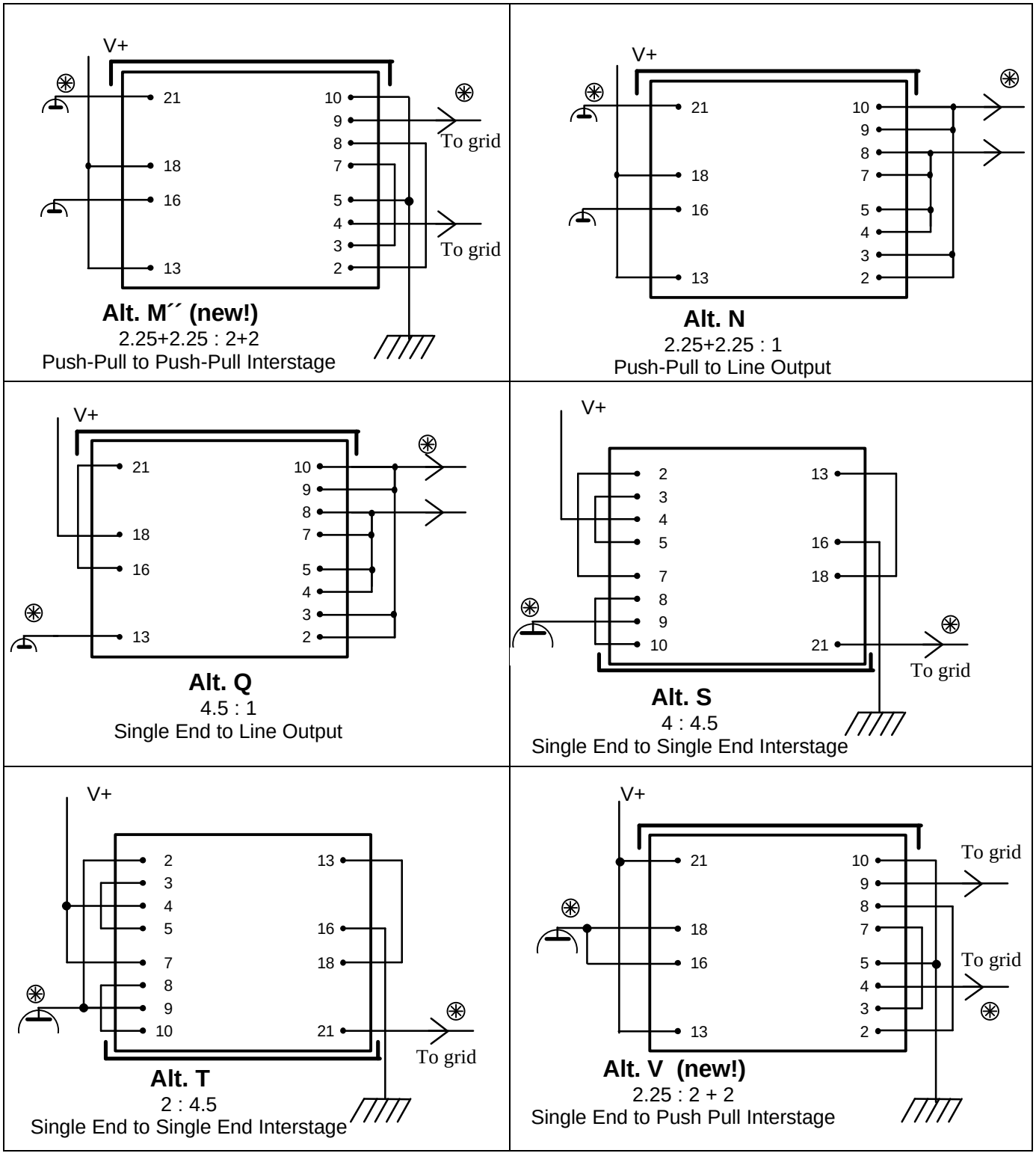
Tube Amplifier Interstage Transformer / Line Output Transformer
LL1660
Connection Alternatives



⊛ Phase Indicator

Alt. M´´ and Alt. V have been introduced to improve balance in PP applications

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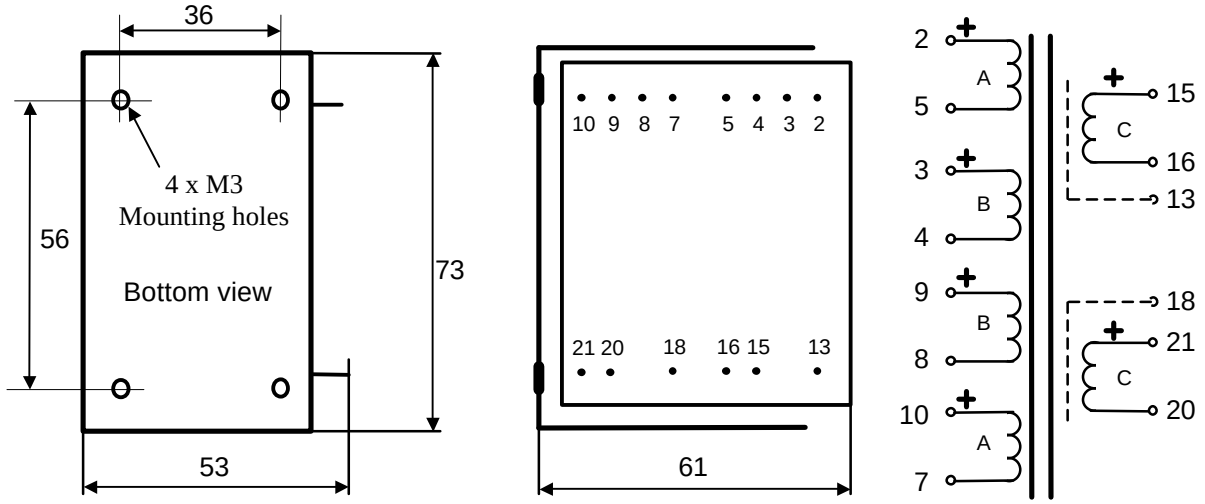
Tube Amplifier Phase Splitting Interstage Transformer
LL1660S

LL1660S is a version of LL1660 with internal Faraday shields to improve balance in phase splitting interstage applications. The transformer is available with different core air gap for different driving tubes.
The transformer is wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
The LL1660S is assembled with a small core air gap to allow for some DC current unbalance.
For the L1660S, the core air gap is chosen such that the denoted DC current (18mA for a LL1660S/18mA) generates a no signal core flux density of 0.9 Tesla when used with windings 2 through 10 in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Distance between pins	0.2” (5.08mm)
Distance between rows of pins	1.8” (45.7 mm)
Pin diameter	1.2 - 1.4 mm

Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 2.25+2.25	315 Ω	240 Ω	625 Ω

Max. current through any single section: 50 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	LL1660S/PP	LL1660S/10mA
Connection	Alt A PP to PP Interst. 2.25+2.25 : 2+2	Alt B SE to PP Interst. 2.25 : 2 + 2
Primary DC current for 0.9 Tesla	-	18 mA
Primary Inductance	290H	42H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	20 Hz – 25 kHz 15kΩ	25 Hz - 30 kHz 3.5kΩ
Max output voltage @ 30 Hz	2 x 260V r.m.s.	220 V r.m.s.

APPLICATIONS

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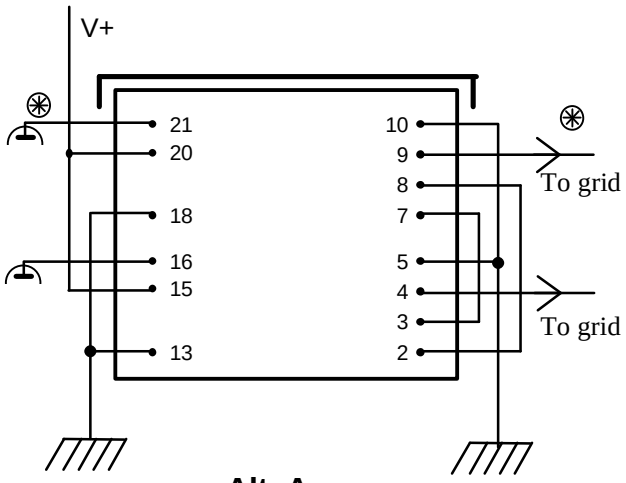
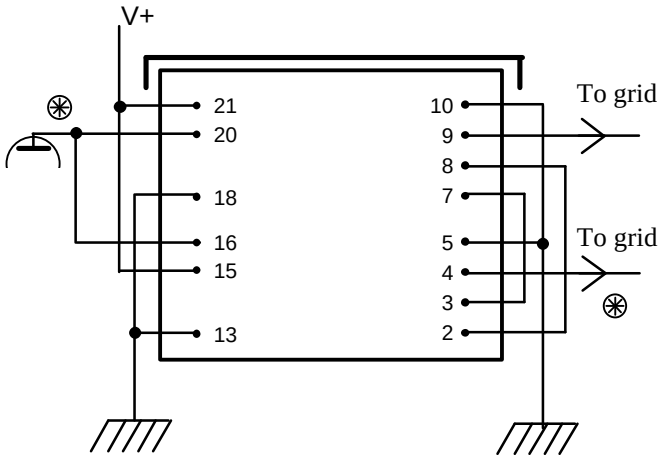
Tube Amplifier Interstage Transformer LL1660S
Connection Alternatives



Alt. A
2.25+2.25 : 2+2
Push-Pull to Push-Pull Interstage



Alt. B
2.25 : 2 + 2
Single End to Push Pull Interstage

⊛ Phase Indicator

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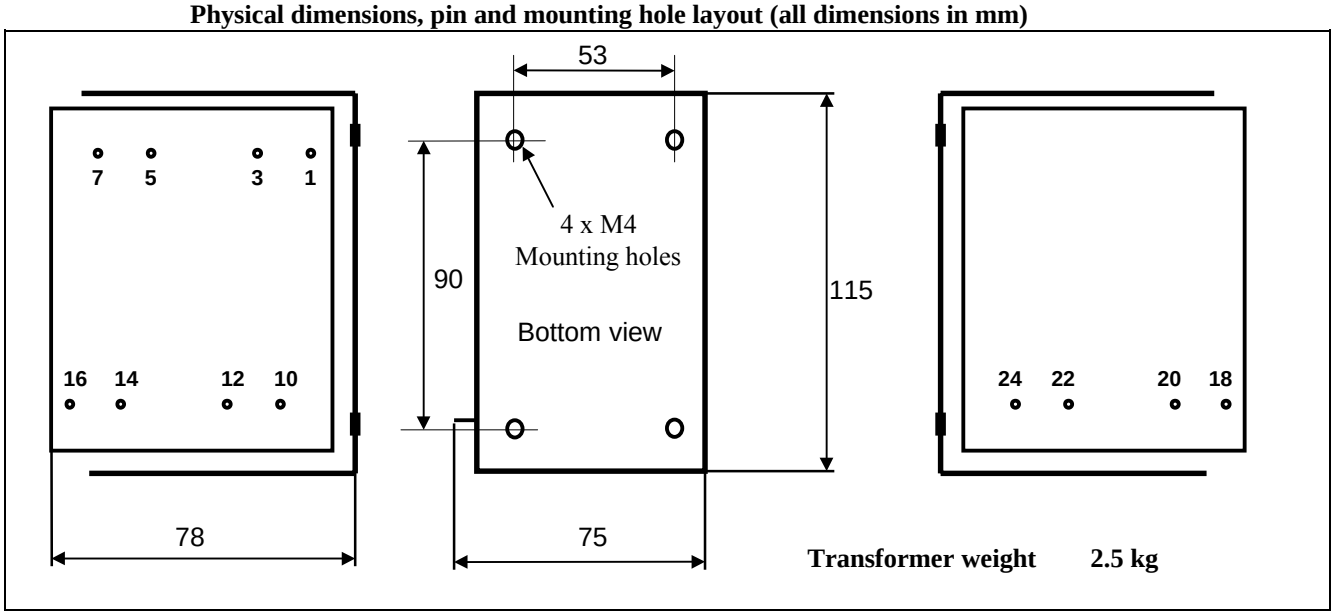
Mains Isolation Transformer with Stepup Windings
LL1662

LL1662 is a C-core mains transformer for isolation and DC current elimination. The core is assembled with a carefully selected, very small air-gap to compensate for any mains DC-unbalance. Additional two windings of 10V each are provided to compensate for voltage drop and low mains voltage.
Estimated power rating 300 VA, which can be increased with good cooling.

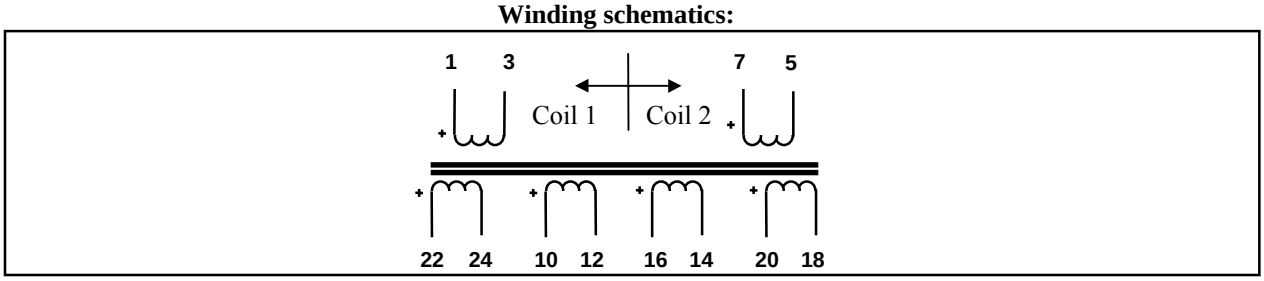
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



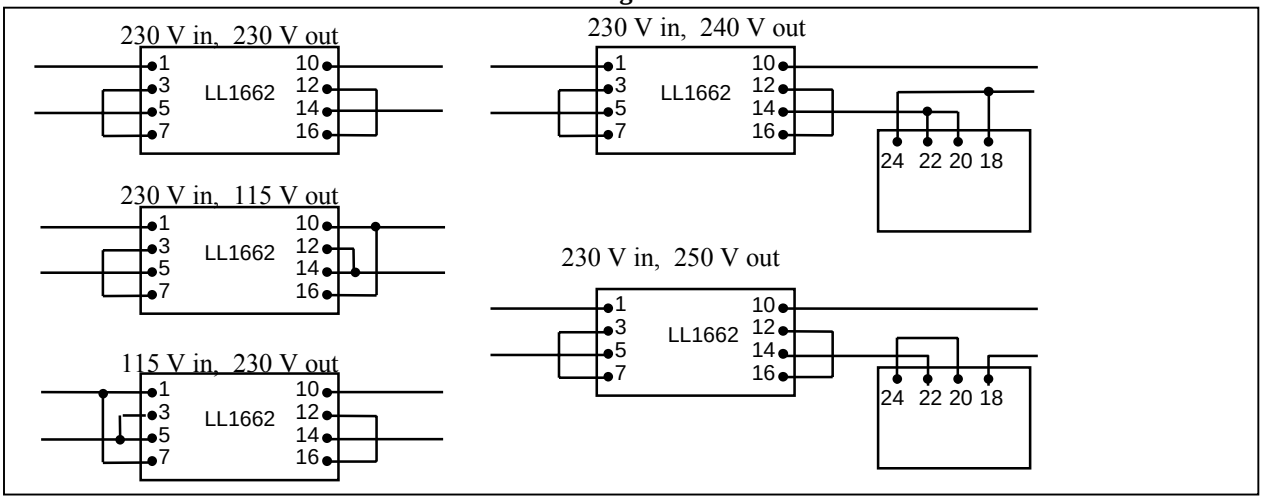
	Copper resistance	Voltage at 50 Hz
Windings 1 - 3 and 7 - 5 respectively	3.3 Ω	115V
Windings 10 - 12 and 14 - 16 respectively	2.9 Ω	115V
Windings 18 - 20 and 22 - 24 respectively	0.3 Ω	10V

Isolation between windings / between windings and core 4 kV / 4 kV

Winding schematics:



Usage:



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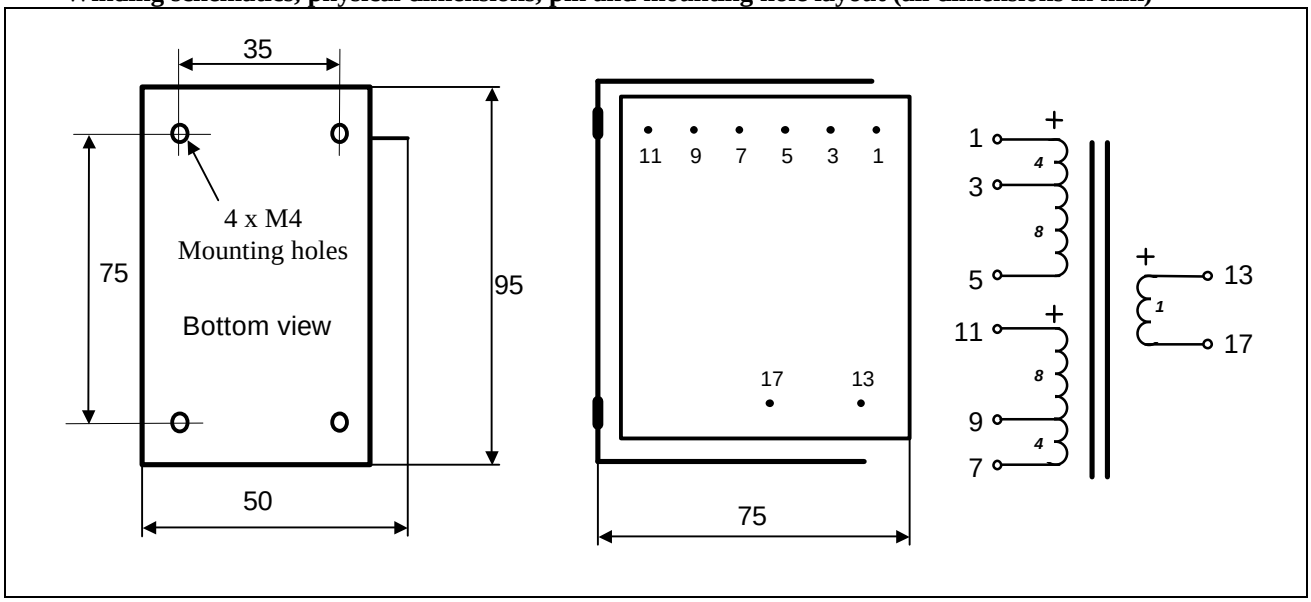
Tube amplifier output transformer LL1663
5k : 8 ohms

The LL1663 is a four-sectioned dual coil C-core tube amplifier output transformer for 5 k: 8 ohms impedance ratio available in PP and SE versions.
The coil is wound using our high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **12+12 : 1 or (4+8)+(4+8) : 1**

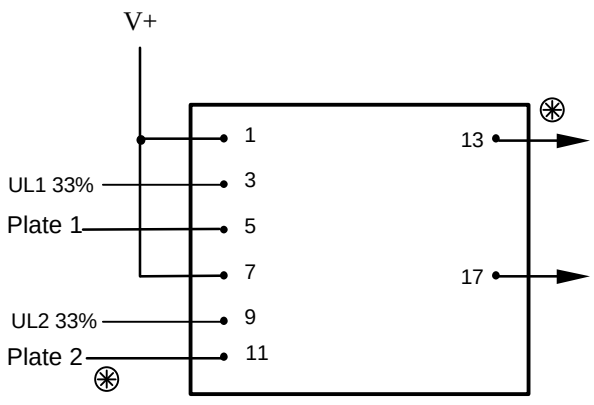
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



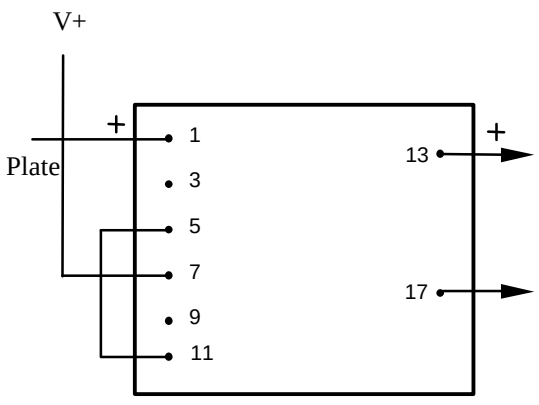
Weight:	1.35 kg
Static resistance of each primary:	102 Ω
Static resistance of secondary:	0.4 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding:	160mA

	LL1663/PP	**LL1663/50mA**	**LL1663/100mA**
Primary inductance (approx.)		35H	17H
Max primary signal	450V R.M.S. @ 30 Hz	200V R.M.S. @ 30 Hz	200V R.M.S. @ 30 Hz
Max output power @ 30 Hz	40W (8Ω spkr)	8W (8Ω spkr)	8W (8Ω spkr)

Suggested use:



LL1663 used in Push Pull
Plate-to-plate impedance
5k at 8 ohms load



LL1663 used in Single End
Primary impedance 5k at 8
ohms load

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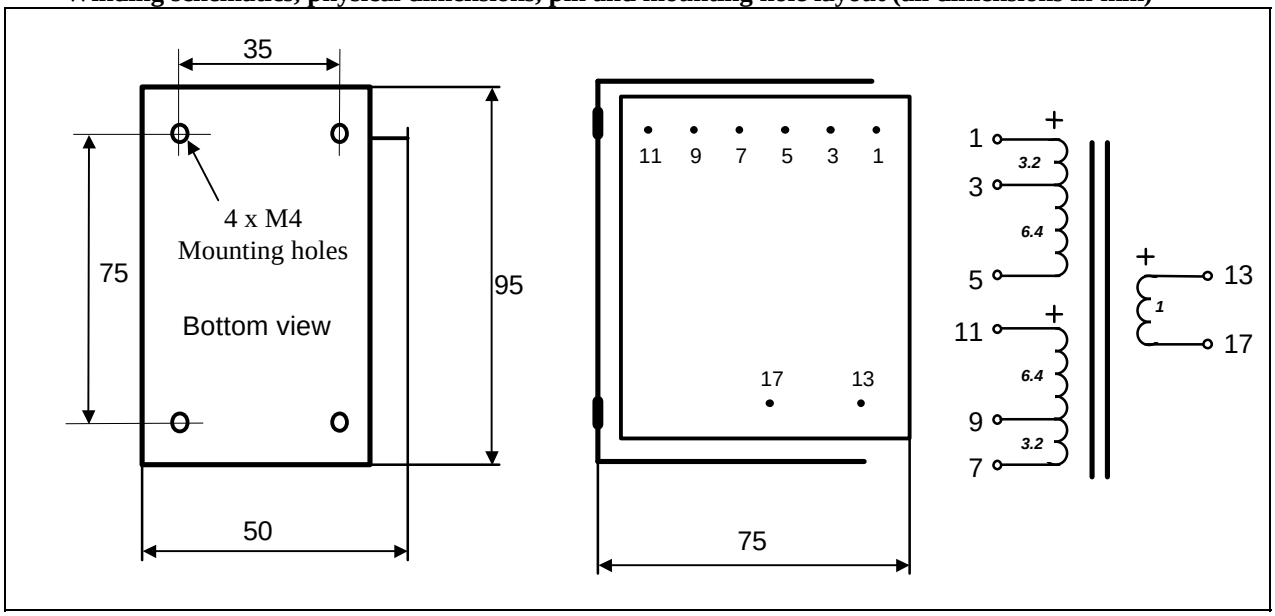
Tube amplifier output transformer LL1664
3k : 8 ohms

The LL1664 is a four-sectioned dual coil C-core tube amplifier output transformer for 3 k: 8 ohms impedance ratio available in PP and SE versions.
The coil is wound using our high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **9.6 + 9.6 : 1 or (3.2+6.4)+(3.2+6.4) : 1**

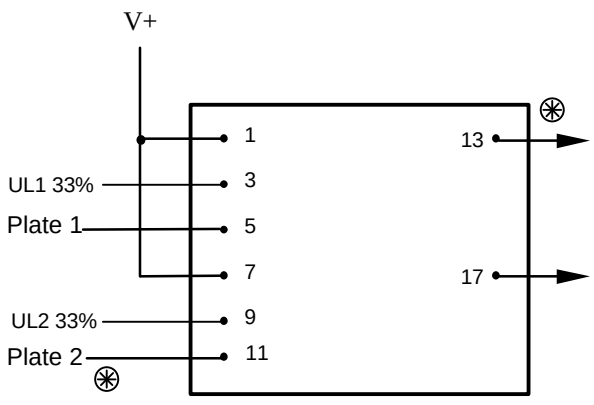
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



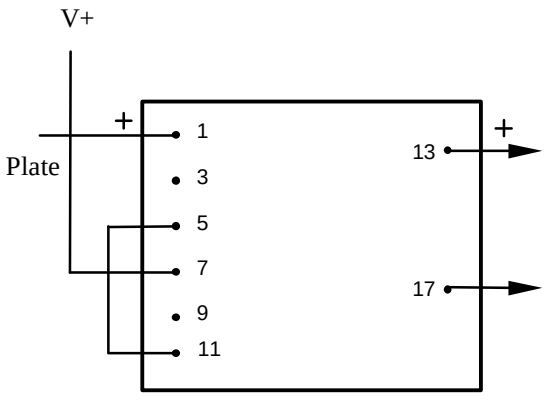
Weight:	1.35 kg
Static resistance of each primary:	74 Ω
Static resistance of secondary:	0.5 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding:	200mA
Primary leakage inductance, primaries in series:	8mH

	LL1664/PP	LL1664/50mA	LL1664/100mA
Primary inductance		35H	17H
Max primary signal	410V R.M.S. @ 30 Hz	180V R.M.S. @ 30 Hz	180V R.M.S. @ 30 Hz
Max output power @ 30 Hz	55W (8Ω spkr)	10W (8Ω spkr)	10W (8Ω spkr)

Suggested use:



LL1664 used in Push Pull
Plate-to-plate impedance
3k at 8 ohms load



LL1664 used in Single End
Primary impedance 3k at 8
ohms load

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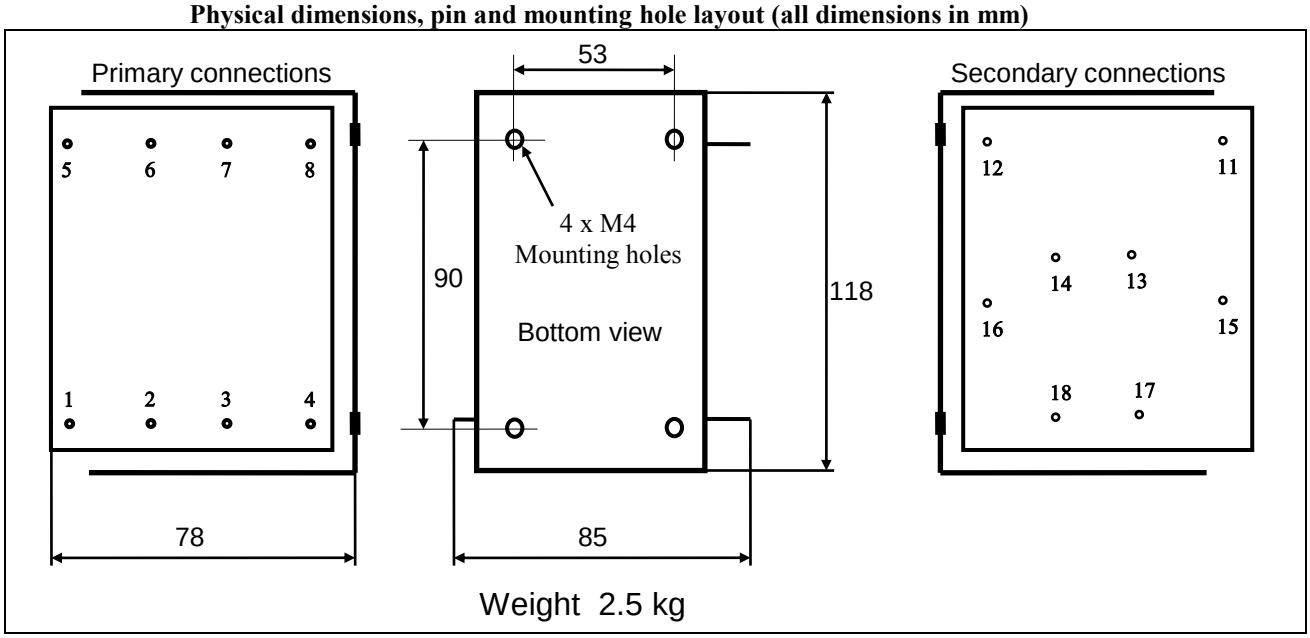
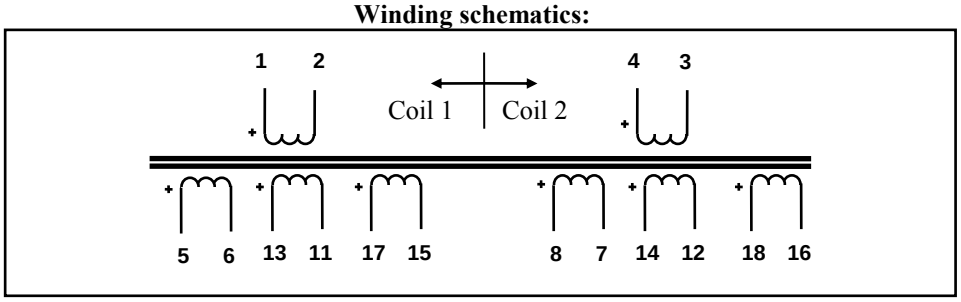
Mains Transformers for Tube Amplifiers
LL1665
230V : 530V + 530V + (4 x 6.6V)

C-core mains transformers. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling.

Physical dimensions, pin and mounting hole layout (all dimensions in mm)

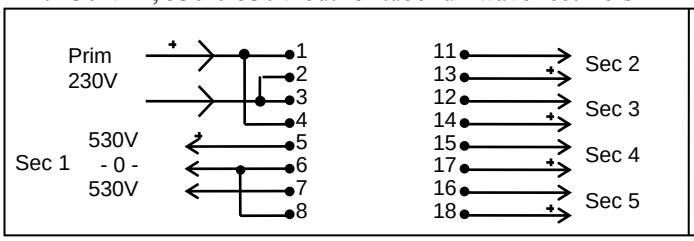


Winding schematics:

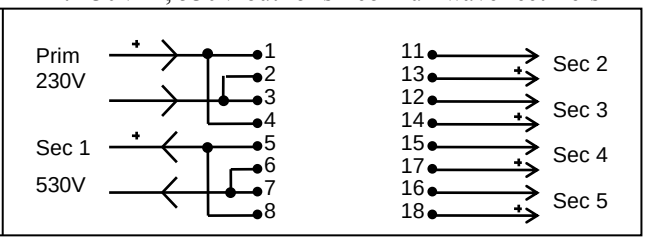


Connection alternatives.

A: 230 V in, 530-0-530V out for tube full wave rectifiers



B: 230V in, 530V out for silicon full wave rectifiers



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V and Sec 1 connected as above

Connection alternative	Primary resistance	Sec 1	Sec 2 through 5 <u>each</u>
A	7.5 Ω	98 Ω / 530V-0-530V 0.35 A	0.1 Ω / 6.6 V 3.1A
B	7.5 Ω	49 Ω / 530 V 0.5 A	0.1 Ω / 6.6 V 3.1A

Please note! Output current from rectifier: 63% of above with condenser input rectifier, 95% of above with choke input rectifier

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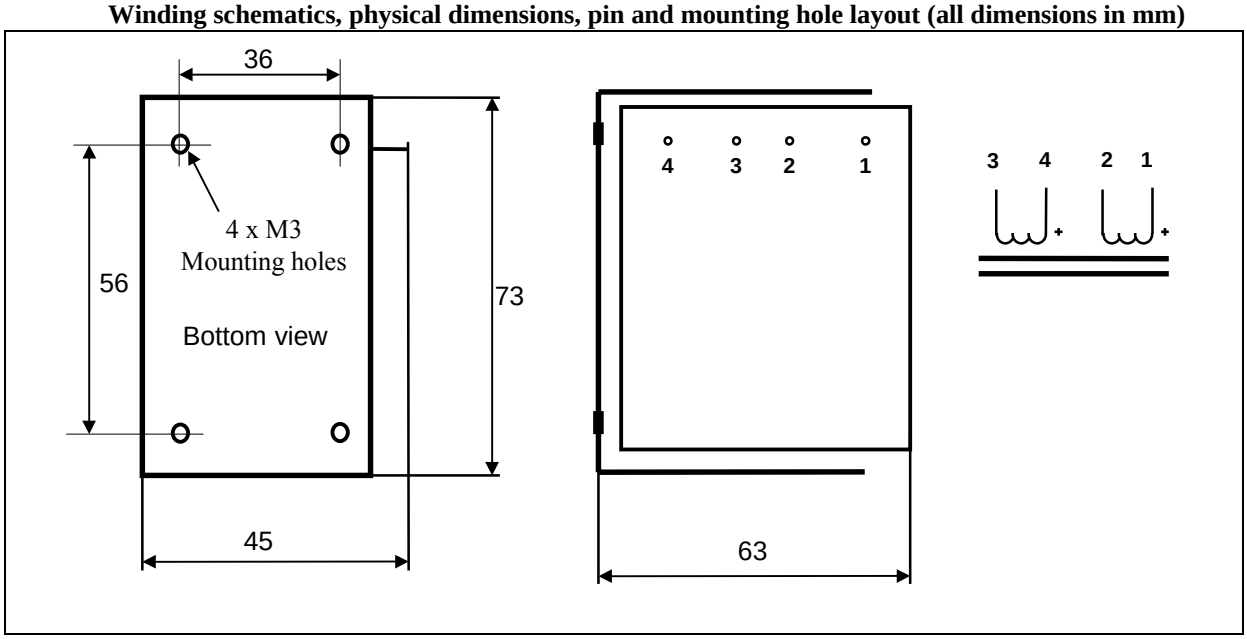
Tube anode chokes
LL1667 and LL1668

The LL1667 and LL1668 are anode chokes for tube amplifiers. The chokes are built with two coils and are using our own special audio C-core. The coils is made using a low capacitance coil winding technique. The two coil structure greatly reduces the risk of picking up hum caused by external magnetic fields from e.g. mains transformers.
The LL1667 and LL1668 are available with different core airgaps resulting in different inductance-DC current combinations on request.

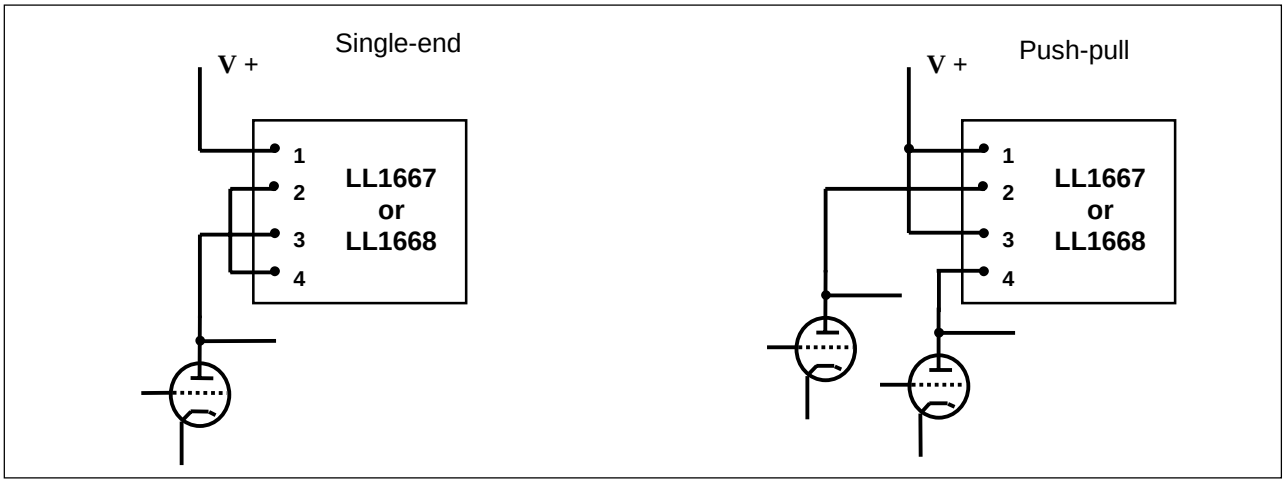
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



	LL1667	LL1668
Weight:	0.78 kg	0.78 kg
Static resistance of each winding	1.2 kΩ	340 Ω
Max DC current per winding, all applications	40 mA	80 mA
Isolation between windings and core:	4 kV	4 kV

Type	Approx. inductance (windings in series)	Standing DC current	Saturating DC current	Max signal voltage @ 30 Hz
LL1667 / 15mA	270 H	15 mA	25 mA	390V RMS
LL1668/ 25 mA	100 H	25mA	40 mA	235V RMS

Usage:



NOTE! In previous shipments (and datasheet) of LL1667 and LL1668 (labeled "Choke LL166…"), the core air gap were incorrectly set.
From Nov 1, 2000, airap is corrected and the chokes are labeled "Anode Choke…"

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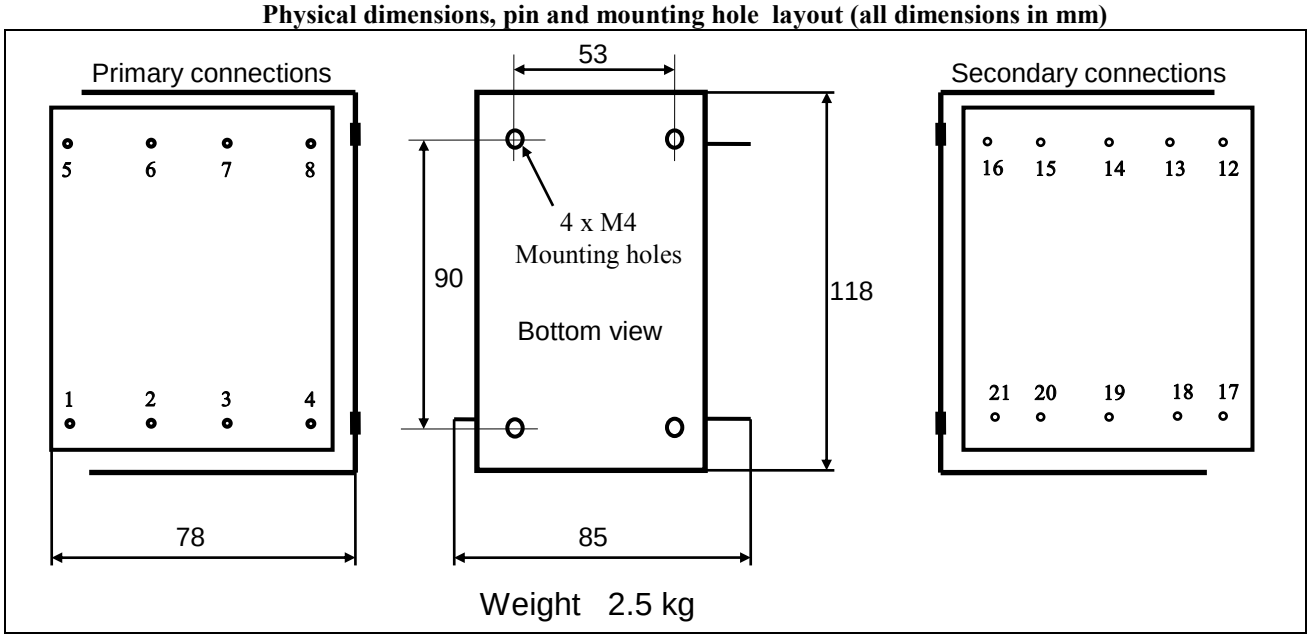
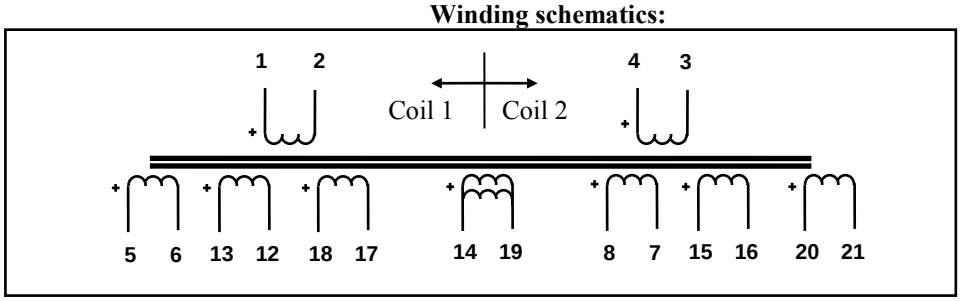
Mains Transformers for Tube Amplifiers
LL1669

C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

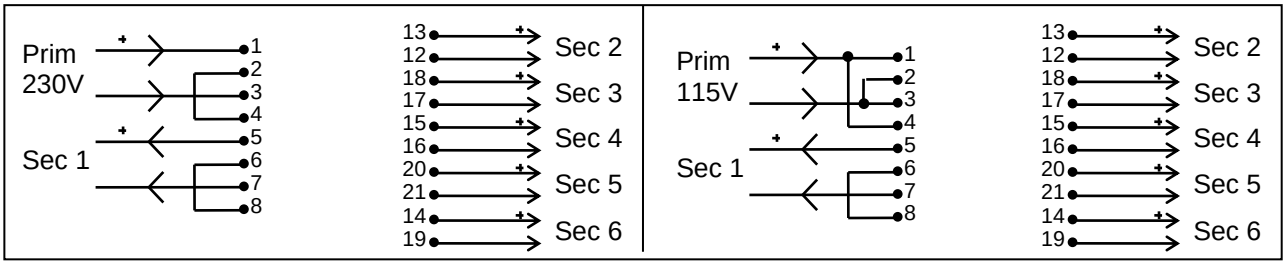
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Primary res. Serial/parallel	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5	Sec 6
7.5 Ω / 1.9 Ω	28 Ω / 390 V 0.55 A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6V 3.1A	0.1 Ω / 6.6 V 3.1A	0.1 Ω / 6.6 V 3.1A	35 Ω / 110 V 40mA

Please note! Output current from rectifier: 63% of above with condensor input rectifier, 95% of above with choke input rectifier.

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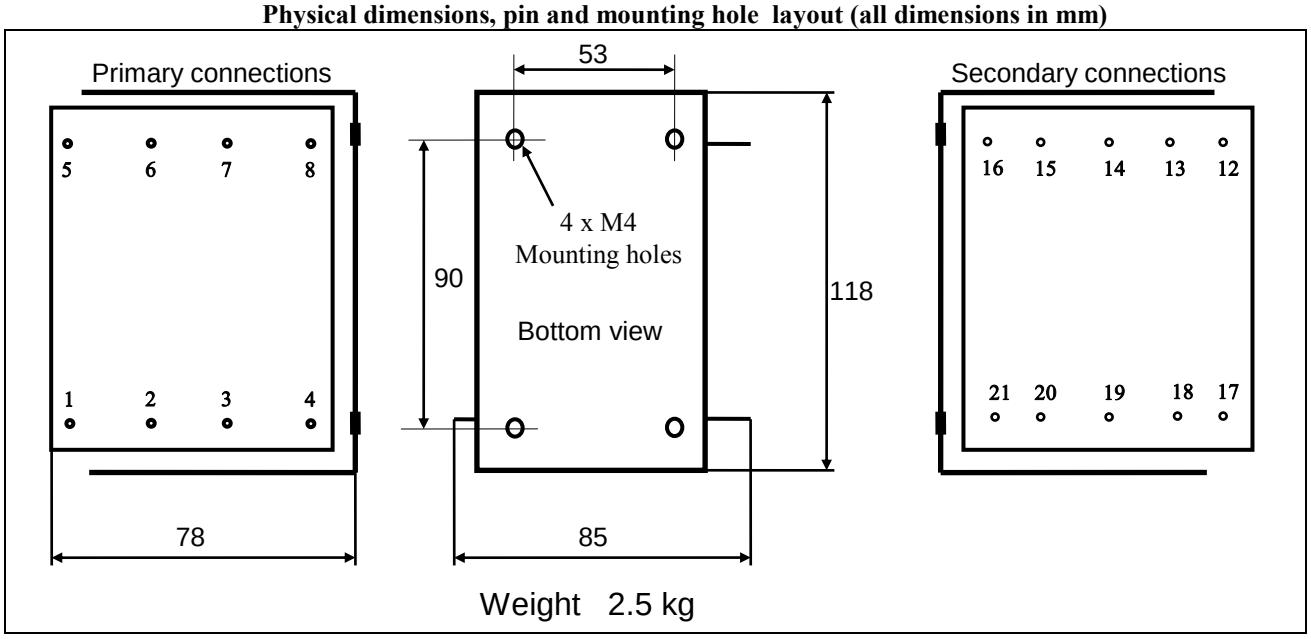
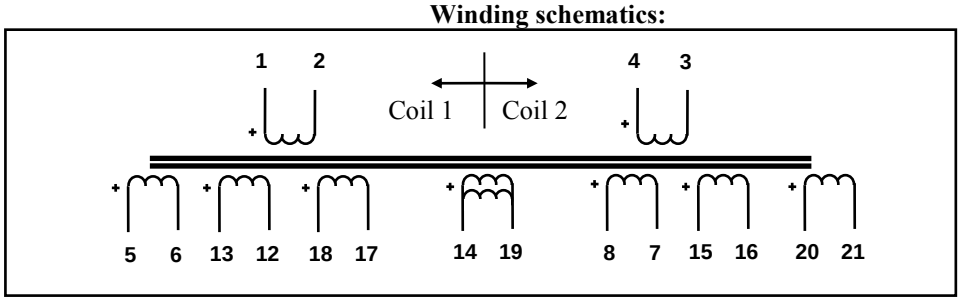
Mains Transformers for Tube Amplifiers
LL1669A

C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

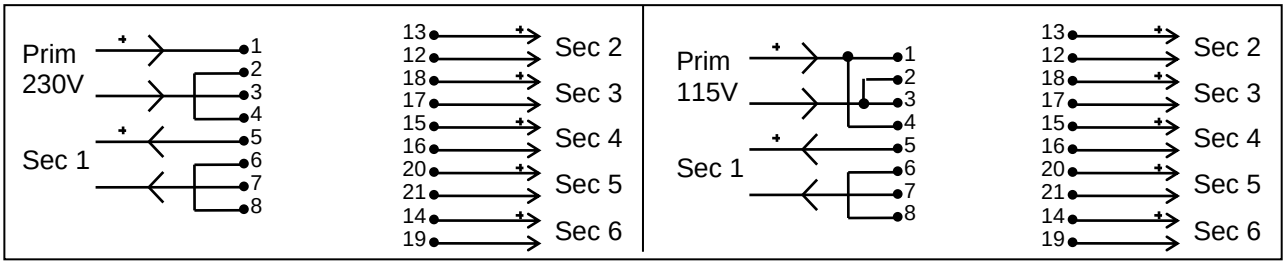
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Primary res. Serial/parallel	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5	Sec 6
7.5 Ω / 1.9 Ω	28 Ω / 340 V 0.55 A	0.1 Ω / 6.3V 3.1A	0.1 Ω / 6.3V 3.1A	0.1 Ω / 6.3 V 3.1A	0.1 Ω / 6.3 V 3.1A	35 Ω / 110 V 40mA

Please note! Output current from rectifier: 63% of above with condensor input rectifier, 95% of above with choke input rectifier.

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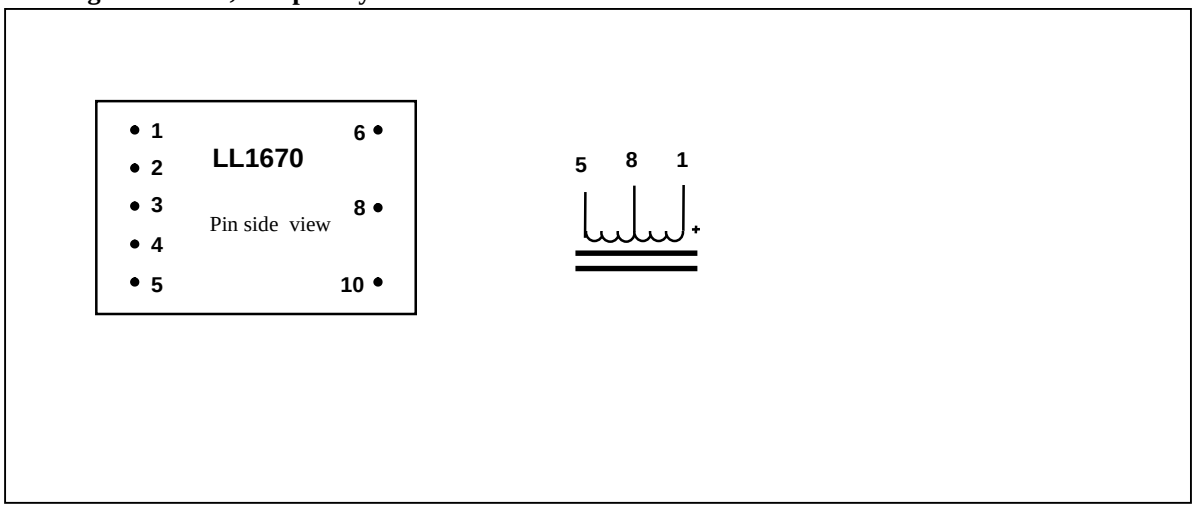
Grid choke LL1670

The LL1670 is a small size, high inductance grid choke for tube amplifiers. The choke is built with two coils and is using one of our own special audio C-cores. The coils is wound using a low capacitance coil winding technique. The two coil structure greatly reduces the risk of picking up hum caused by external magnetic fields from e.g. mains transformers.

Winding schematics, and pin layout



Dimensions (mm) (Length x Width x Height above PCB/ excluding pins)	43 x 28 x 20	
Weight	88 g	
Spacing between pins	5.08 mm (0.2")	
Spacing between rows of pins	30.48 mm (1.1")	
Recommended minimum PCB hole dimensions	1.5mm	
Static resistance of winding	5.3 kΩ	(2.65 kΩ + 2.65 kΩ)
Max DC current per winding, all applications	10 mA	
Isolation between windings and core	2 kV	
Max signal at 30Hz	100V rms	

Type	Inductance (windings in series)	Standing DC current	Saturating DC current
LL1670 / 0.8mA	540 H	0.8 mA	1.2 mA

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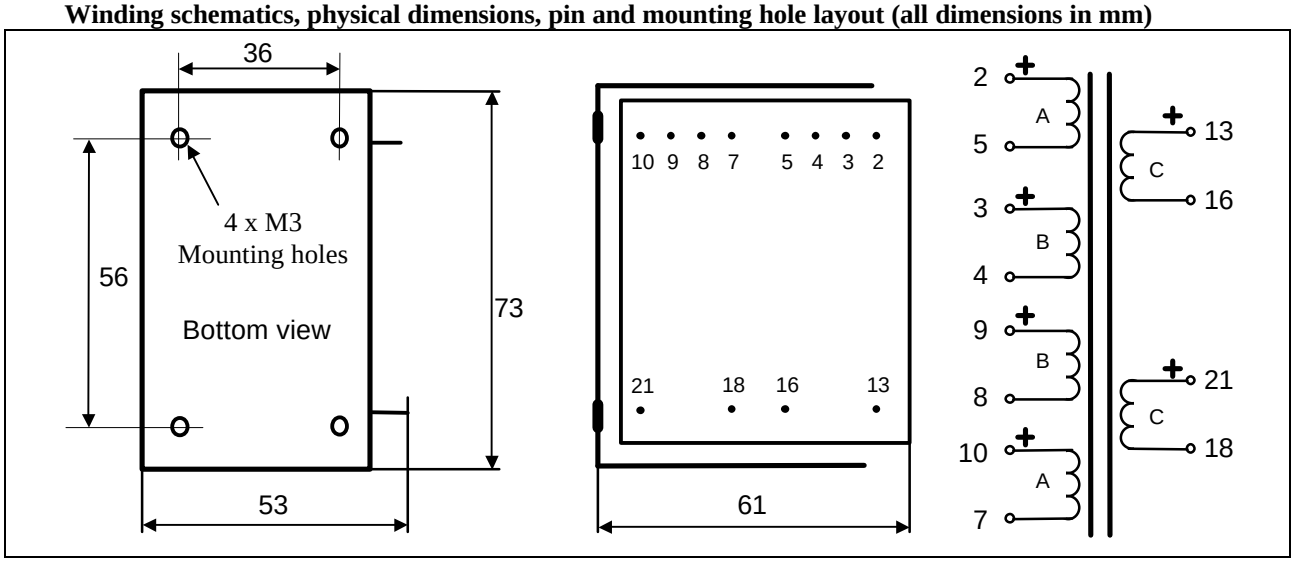
High Current Tube Amplifier Interstage / Line Output Transformer LL1671

LL1671 is a high current interstage / line output transformer for tube amplifiers. The transformer is available with various core air gaps optimised for PP or SE drives.
The transformer is wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
The LL1671PP is assembled with a small core air gap to allow for some DC current unbalance.
For the S.E. versions of the LL1671, the core air gap is chosen such that the denoted DC current (30mA for a LL1671/30mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, Winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 2+2	88 Ω	69 Ω	156 Ω

Max. current through any single section: 100 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	**LL1671 PP**	**LL1671 PP**	**LL1671/30mA**	**LL1671/30mA**
Connection	Alt M´´ PP to PP Interst. 2+2 : 2+2	Alt N PP Line output 2+2 : 1	Alt Q SE Line Output 4 : 1	Alt S SE to SE Interst. 1 : 1
Primary DC current for 0.9 Tesla	-	-	30 mA	30 mA
Primary Inductance	80 H	80 H	35 H	35 H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	20 Hz – 25 kHz 5kΩ	15 Hz – 50 kHz 5kΩ		30Hz - 30 kHz 3 kΩ
Max output voltage @ 30 Hz	2 x 150V r.m.s.	75V r.m.s.	33 V r.m.s.	130 V r.m.s.

Applications

Type	**LL1671/30mA**	**LL1671/30mA**
Connection	Alt T SE to SE Interst. 1 : 2	Alt V SE to PP Interst. 1 : 1 + 1
Primary DC current for 0.9 Tesla	60 mA	60 mA
Primary Inductance	10 H	10 H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	40 Hz - 25 kHz 1 kΩ	40 Hz - 25 kHz 1 kΩ
Max output voltage @ 30 Hz	130 V r.m.s.	130 V r.m.s.

(*) The source impedances used in the tables indicates a recommended upper limit, unless freq. response can be compromised.
At lower source impedance resonance peaking will occur. It can be reduced using secondary load resistors.

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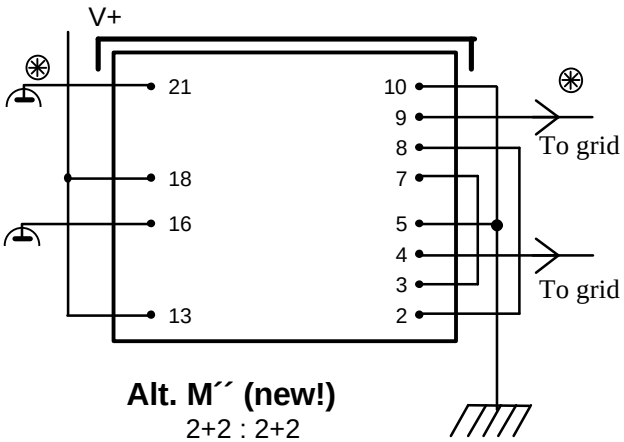
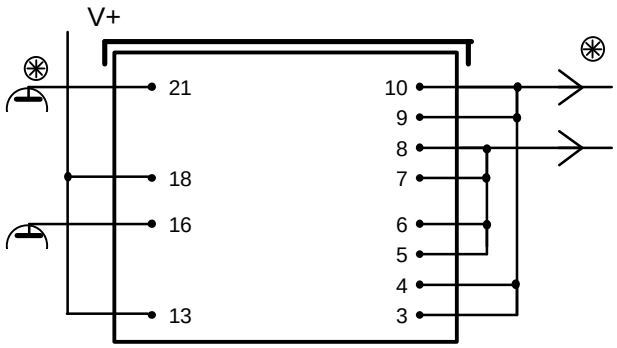
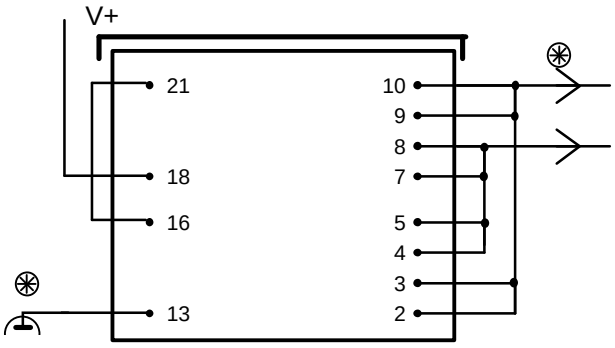
Tube Amplifier Interstage Transformer / Line Output Transformer
LL1671
Connection Alternatives



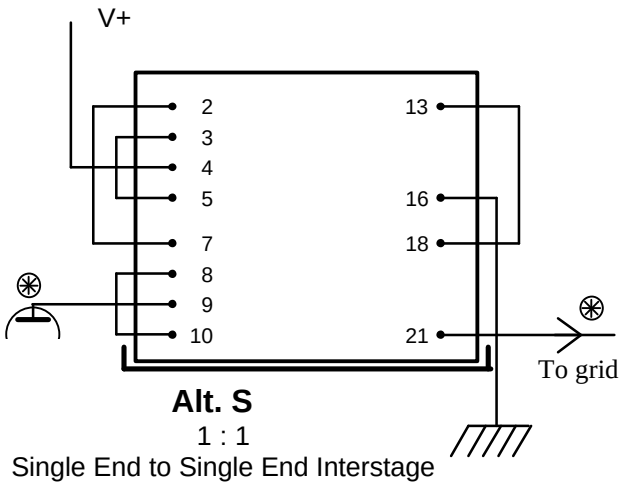
Alt. M´´ (new!)
2+2 : 2+2
Push-Pull to Push-Pull Interstage



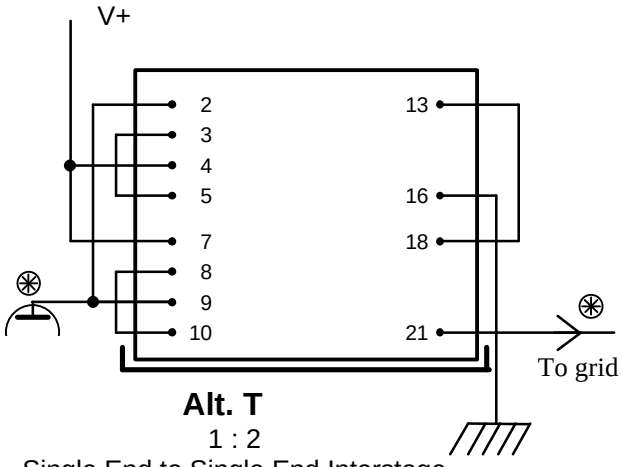
Alt. N
2+2 : 1
Push-Pull to Line Output



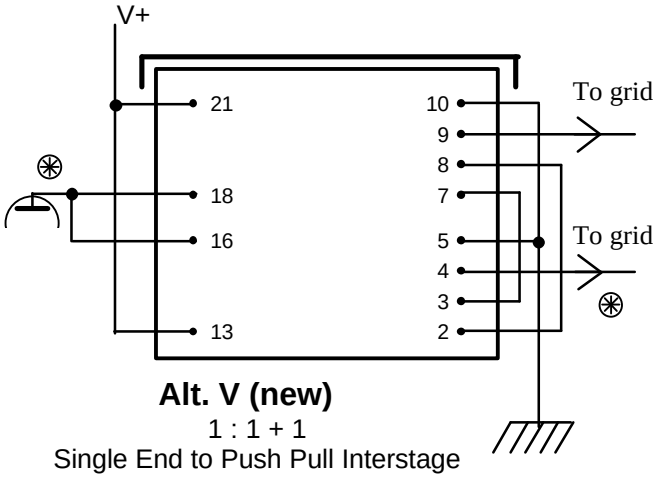
Alt. Q
4 : 1
Single End to Line Output



Alt. S
1 : 1
Single End to Single End Interstage



Alt. T
1 : 2
Single End to Single End Interstage



Alt. V (new)
1 : 1 + 1
Single End to Push Pull Interstage

⊛ Phase Indicator

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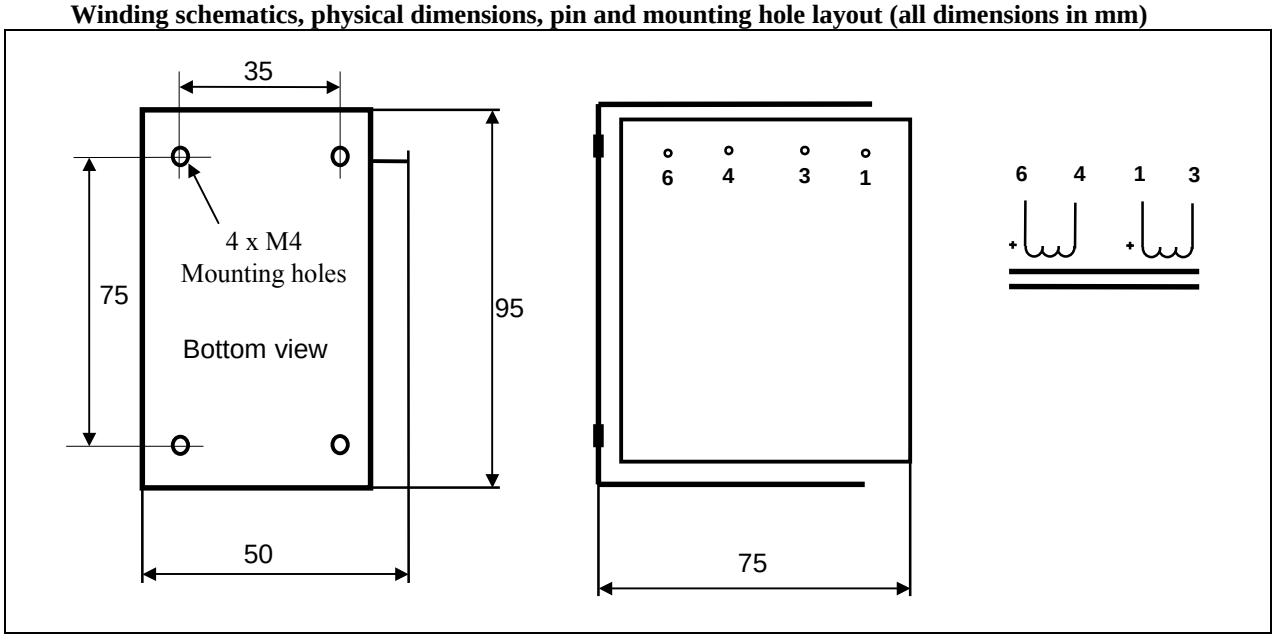
Choke LL1673

The LL1673 is a 2 coils choke for tube amplifier anode supply.
The choke is available with different core air-gap, which results in different inductance and DC current capability. LL1673 can be used in choke input and cap input applications.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

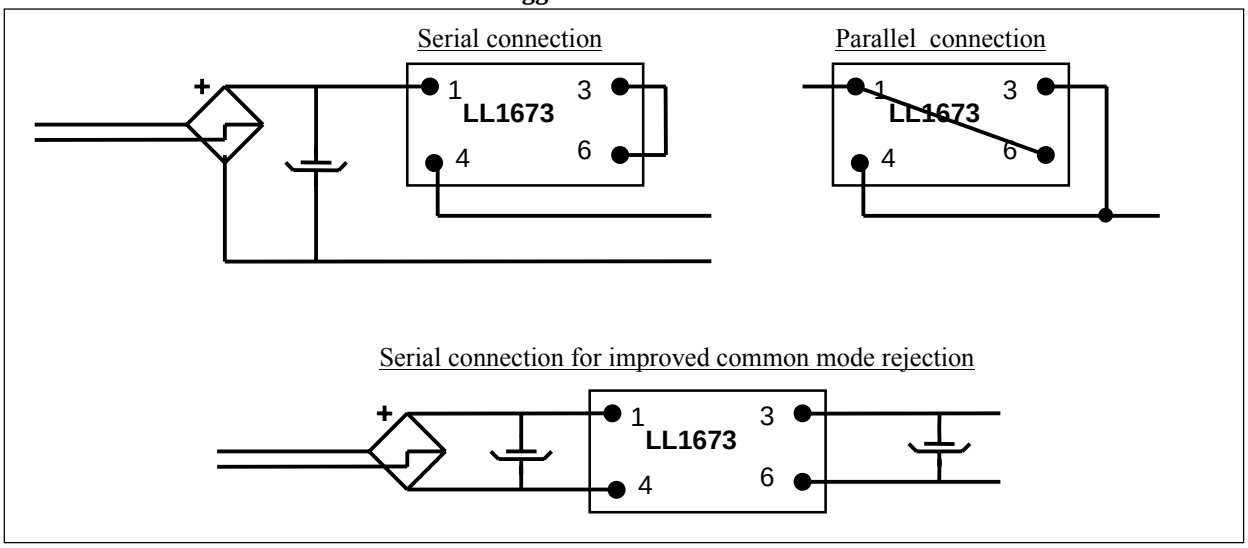
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 1.35 kg
Static resistance of each winding: 30 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**In-ductance**	**Recommended DC current**	**Saturating current**	**In-ductance**	**Recommended DC current**	**Saturating current**
LL1673 / 10 H	10 H	200 mA	290 mA	2.5 H	400 mA	580 mA
LL1673 / 15 H	15 H	140 mA	200 mA	3.75 H	280 mA	400 mA
LL1673 / 20 H	20 H	100 mA	145 mA	5 H	200 mA	290 mA
Max. ripple voltage at rec. DC current	400V rms / 100 Hz			200V rms / 100 Hz		

Suggested connections:



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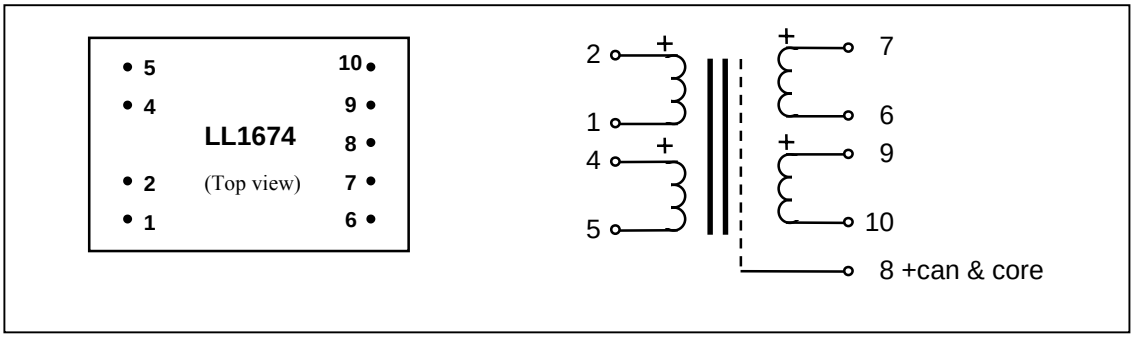
High Level Tube Amplifier Input Transformer
LL1674

The LL1674 is a large, high signal level audio transformer built with the well know Lundahl amorphous core. The LL1674 consists of two coils, each with a two-sectioned primary winding and a high level secondary winding separated by electrostatic shields. The core is a two-component amorphous strip core. The very high mu of the core results in a phase shift of less than 0.5 degree at 10Hz.
The transformer is magnetically shielded by a mu metal housing.

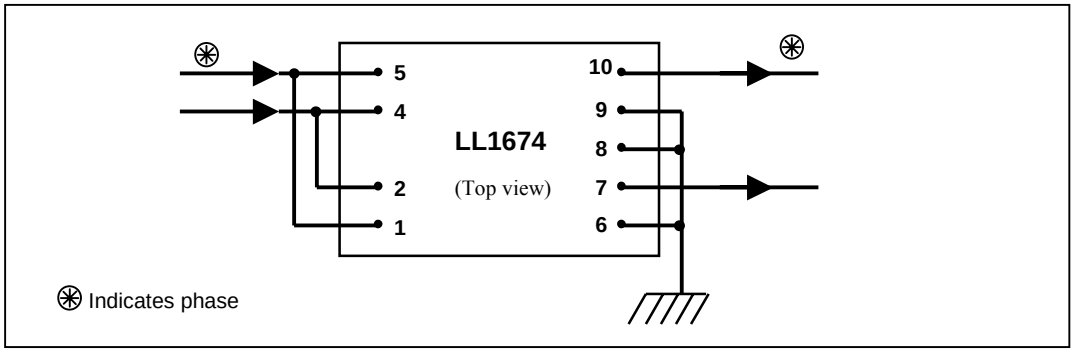
Turns ratio: 1 + 1 : 4 + 4
Dims (Length x Width x Height above PCB (mm)): 43 x 28 x 21
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 30.48mm (1.2")
Weight: 80 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary (average):	33Ω
Static resistance of each secondary (average):	605Ω
Distortion (primaries connected in parallel, source impedance 150Ω):	22V rms (+29 dBU) **secondary** level, 30 Hz: **1%**
	22V rms (+29 dBU) **secondary** level, 50 Hz: **0.2%**
Self resonance point :	70 kHz
Optimum termination for best frequency response (source imp. 150Ω) **:**	No termination required
Frequency response (source 150Ω , load 10k)	10Hz – 45kHz +/- 0.5dB -3dB @ 80kHz
Isolation between primary and secondary windings/ between windings and shield (rms):	3 kV / 1.5 kV

Suggested usage, 1: 4+4



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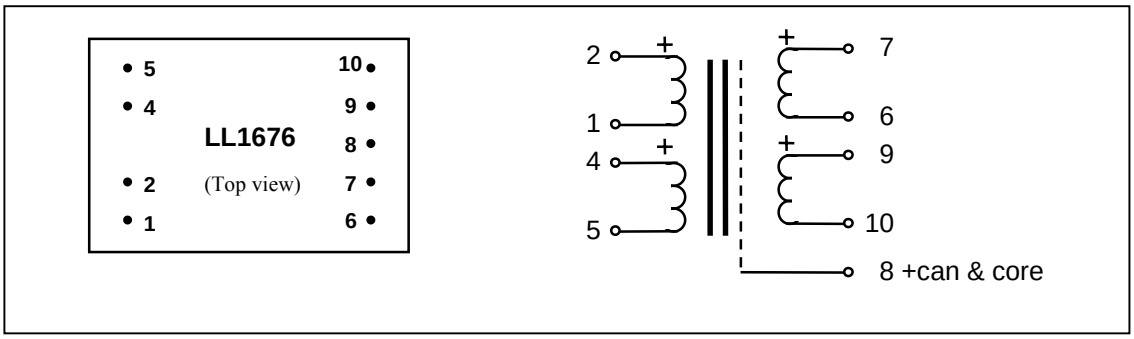
High level Tube Amplifier Input Transformer
LL1676

The LL1676 is a large, high level, high performance audio transformer built with the well know Lundahl amorphous core
The LL1676 consists of two coils, each with a two-sectioned primary winding and a high level secondary winding separated by electrostatic shields. . The core is a two-component amorphous strip core. The very high mu of the core results in a phase shift of less than 0.5 degree at 10Hz.
The transformer is magnetically shielded by a mu metal housing.

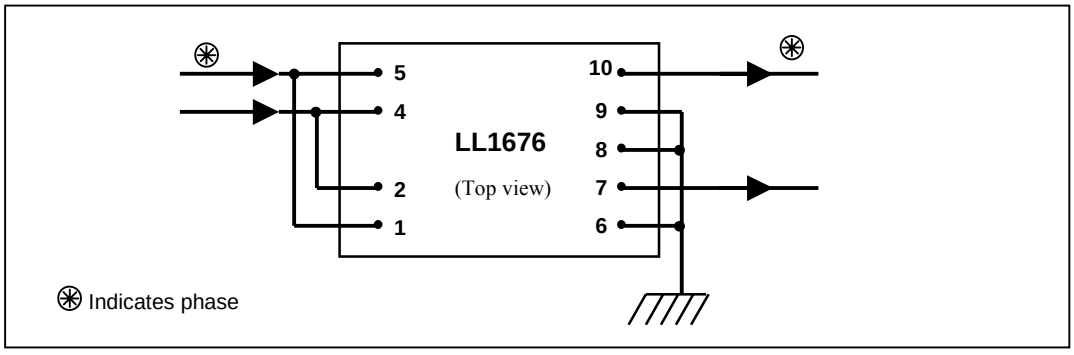
Turns ratio: 1 + 1 : 2 + 2
Dims (Length x Width x Height above PCB (mm)): 43 x 28 x 21
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 30.48mm (1.2")
Weight: 80 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary (average):	145Ω
Static resistance of each secondary (average):	605Ω
Distortion (primaries connected in parallel, source impedance 600Ω):	22V rms (+29 dBU) **secondary** level, 30 Hz: **1%**
	22V rms (+29 dBU) **secondary** level, 50 Hz: **0.2%**
Self resonance point :	70 kHz
Optimum termination for best frequency response (source imp. 600Ω) **:**	10k – 33k
Frequency response (source 600 , load 10k)	10Hz – 40kHz +/- 0.5dB -3dB @ 80kHz
Isolation between primary and secondary windings/ between windings and shield:	3 kV / 1.5 kV

Suggested usage, 1:2+2



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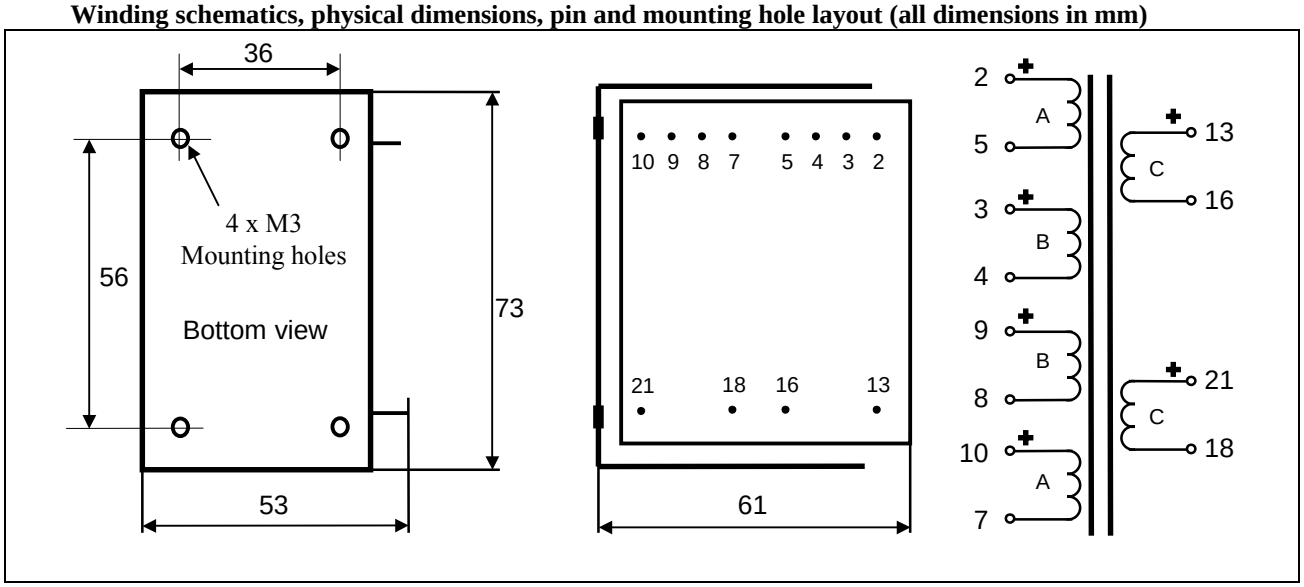
High Current Tube Amplifier Interstage Transformer
LL1677

LL1677 is a high current interstage transformer with a 1:2 step up ratio.
The transformer is wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
For the LL1677, the core air gap is chosen such that the denoted DC current (80mA for a LL1677/80mA) generates a no signal core flux density of 1.2 Tesla when used with all primaries in series. This leaves a flux density swing of 0.4 T for the signal.

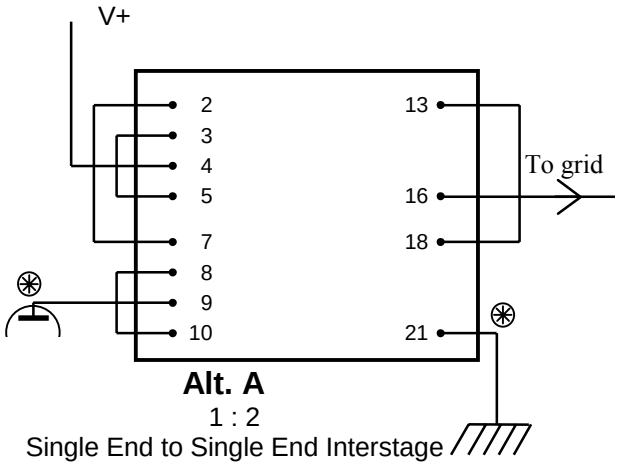
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, Winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 4 + 4	88 Ω	69 Ω	800 Ω

Max. current through any single primary section: 100 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	**LL1677/80mA**
Connection	Alt A SE to SE Interst. 1 : 2
Primary DC current for 1.2 Tesla	80 mA
Primary Inductance	24 H
Suggested termination for best freq. response	22k in series with 330 pF
Freq. Response (+/-1dB) @ source impedance (*) Secondary terminated as above	23Hz - 34 kHz 1 kΩ
Max output voltage @ 30 Hz	145 V r.m.s. (410V peak-peak)



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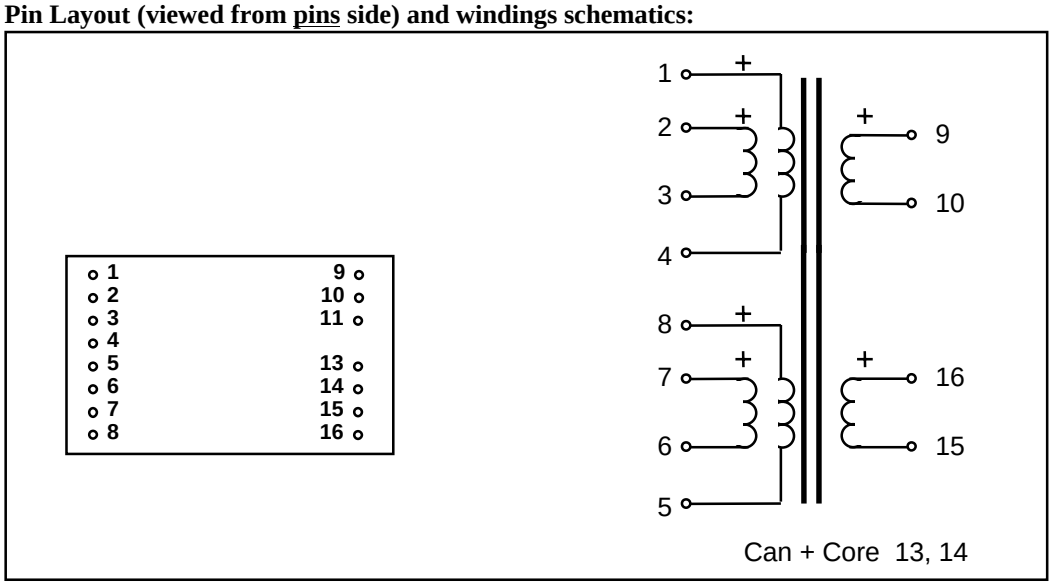
Moving Coil Input Transformer
LL1678

LL1678 is an input audio transformer for moving coil pickups. The transformer is built up from two coils, each coil with one secondary winding surrounded by two primary windings. This structure results in an excellent frequency response. All winding ends are available on the pins. Thus, the transformer can be used with a set of different turn's ratios.
The LL1678 is made with amorphous core material. As this type of core does not store energy (unlike e.g. conventional mu-metal cores) the low frequency resonance with external series capacitors is practically eliminated.

Turns ratio: 1 + 1 + 1 + 1 : 16 + 16
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and windings schematics:



Spacing between pins:	Spacing between rows of pins:	Rec. PCB hole diameter:	Weight:
2.54 mm (0.1")	22.86 mm (0.9")	1.5 mm	27 g

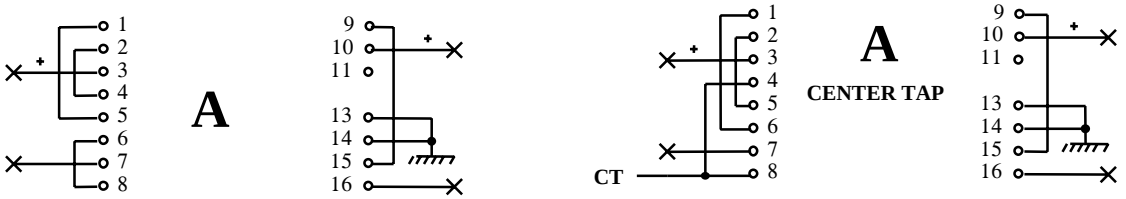
Static resistance of each primary (average):	4.5 Ω
Static resistance of each secondary:	375 Ω
Frequency response (primary signal level -17 dBU [0.1Vrms]. Termination alternative A. Source 50Ω , load 100 kΩ) **:**	
Balanced/unbalanced input. Balanced output	10 Hz -- 90 kHz +/- 1 dB
Balanced/unbalanced input. Unbalanced output	10 Hz -- 35 kHz +/- 1 dB
Distortion (primaries connected in series, source impedance 50Ω)**:**	< 0.5% @ -8 dBU, 50 Hz
Primary no load impedance @ 0 dBU, 50 Hz, all in series:	8 kΩ typically
Core / Can:	Amorphous Strip Core / Mu metal can
Isolation between windings / between windings and core:	3 kV / 1.5 kV

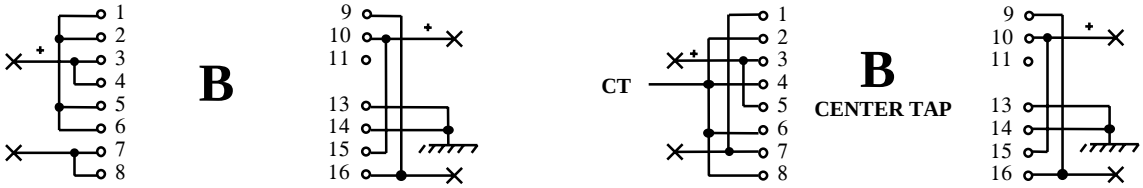
Turns ratio and possible use at different termination alternatives.
Termination alternatives are shown on the next page

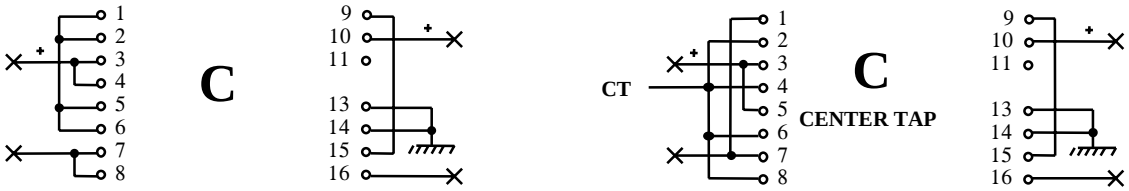
Termination Alternative	Turns ratio	Copper Resistance prim/sec	Possible Use
A	1:8	18Ω / 750 Ω	150Ω / 10 kΩ
B	1:8	4.5Ω / 190 Ω	Not recommended
C	1:16	4.5Ω / 790 Ω	25Ω / 10kΩ
D	1:16	1.1Ω / 190 Ω	Not recommended
E	1:32	1.1Ω / 790 Ω	10Ω / 10kΩ

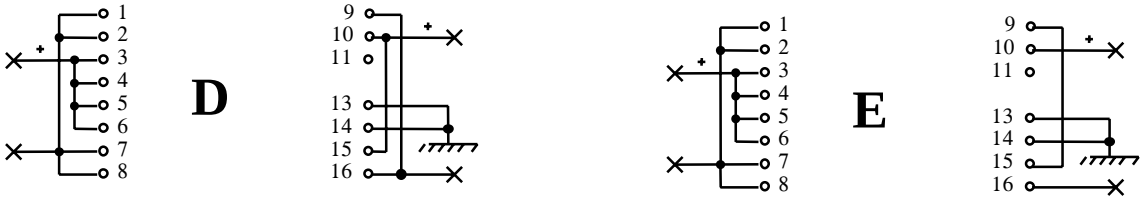
When the LL1678 is used in MC pickup applications, please note that the primary side of the transformer must have a ground reference.

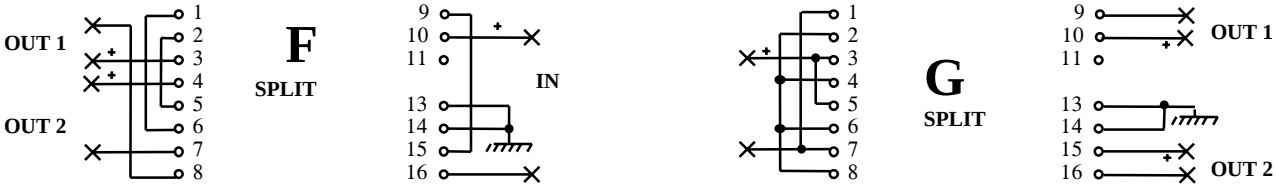
LL1678 Termination Alternatives
(Left side is input if not stated otherwise)
(Pins side view)











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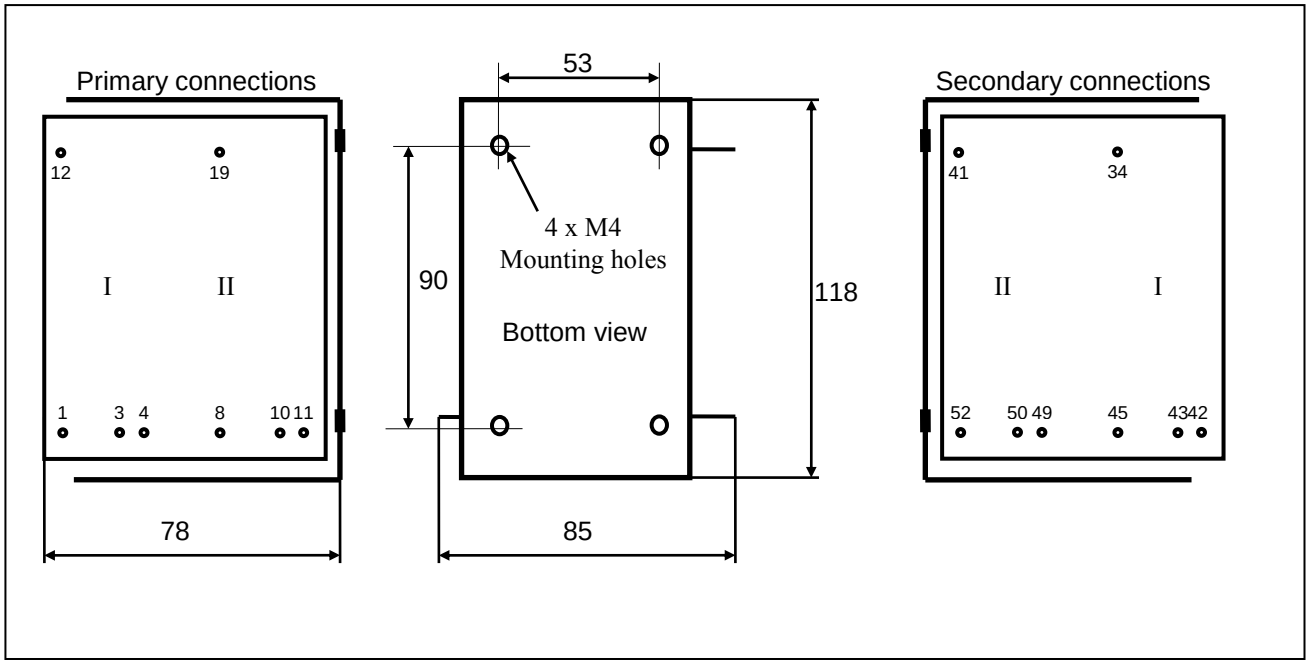
Tube Amplifier Output Transformers
LL1679

LL1679 is an output transformer for tube amplifiers, available with different core air-gaps for different types of output stages. The transformers are highly sectioned with harmonically sized sections, which results in a minimum leakage inductance. This combined with a low capacitance coil winding technique results in a wide frequency range.
The primary winding can be tapped for 36% UL connection.
The transformers have a special audio C-core of our own production.
The transformers are unpotted, open frame type suitable for mounting inside an amplifier housing.

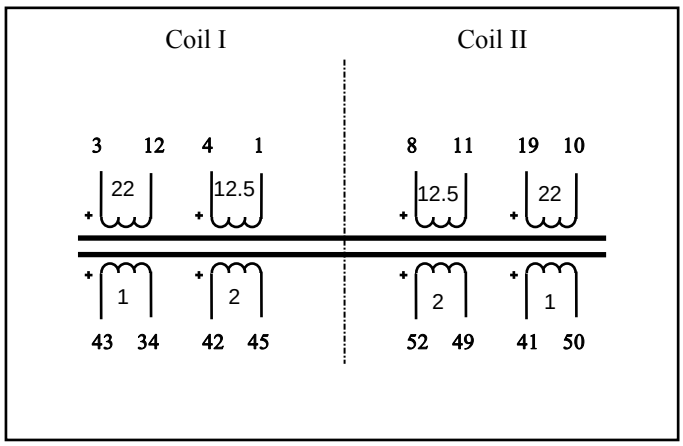
Physical dimensions, pin and mounting hole layout LL1679 (all dimensions in mm)



R150220 PL

Pin spacing module:	5.08 mm (0.2")
Row spacing:	76mm approx.
Weight:	2.5 kg
Turns ratio:	22 + 12.5 + 22 + 12.5 : 2 + 1 + 2 + 1

Winding schematics:



	LL1679	
Turns ratio:	**22 + 12.5 + 22 + 12.5 : 2 + 1 + 2 + 1**	
Static resistance of primary (all in series)	160 Ω (2 x 54Ω + 2 x 26Ω)	
Static resistance of inner/outer secondary winding	0.5Ω / 0.3Ω	
Primary leakage inductance (all in series)	8 mH	
Max. primary signal voltage r.m.s. at 30 Hz (all in series)	Push-Pull 670V	Single End 295V

Isolation between primary and secondary windings / between windings and core: 3 kV / 1.5 kV

Electrical characteristics

Primary Load Impedance, Max power and power loss.

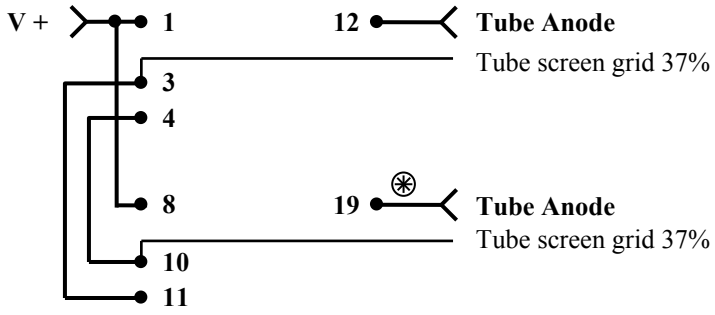
	Sec. connection for 4/8/16 Ω (See next page)		
	-/B/C	B/C/D	C/D/E
	Primary Load Impedance (transformer copper resistance included)		
LL1679	9.7 kΩ	4.5 kΩ	2.6 kΩ
	Power and Loss		
Max. Power, P-P at 30 Hz	45W	105W	188W
Max. Power, S.E. at 30 Hz	9W	20W	36W
Power loss across transformer	0.2 dB	0.4 dB	0.6 dB

Primary DC Current Core Air-gap and Primary inductance

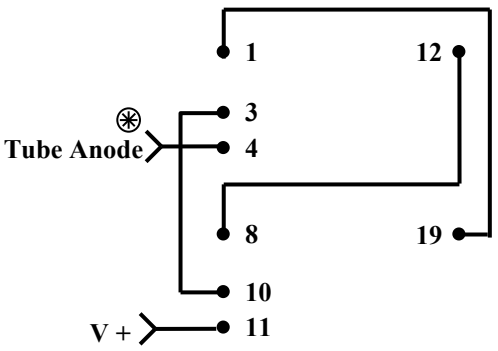
	LL1679/PP	LL1679/70mA
Core Airgap (delta/2)	25 µ	190 µ
Single end standing current for 0.9 Tesla (recommended operating point)		70mA
Primary inductance	150 H	40H

Frequency response, LL1679/PP 10 Hz – 70 kHz +0/-3 dB
(source impedance 2k, load impedance 10 ohms
primary winding is series, secondary winding alt. C)

Primary connections, Push-Pull

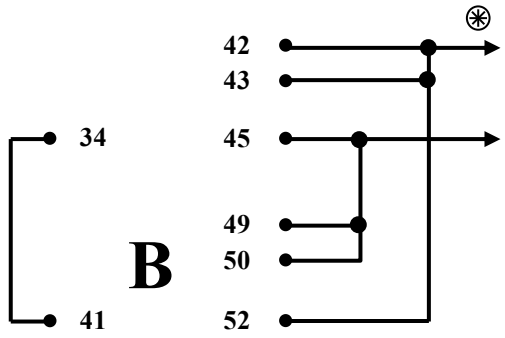


Primary connections, Single End

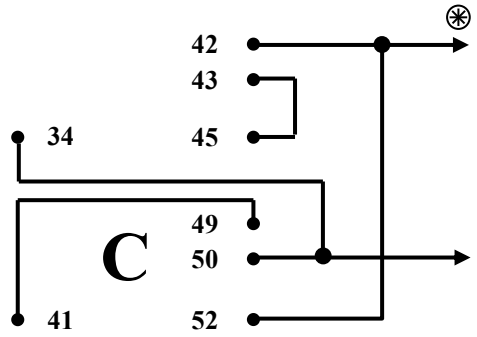


Secondary connections

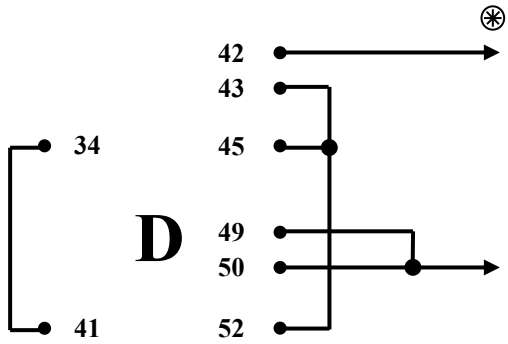
⊛ Indicates phase



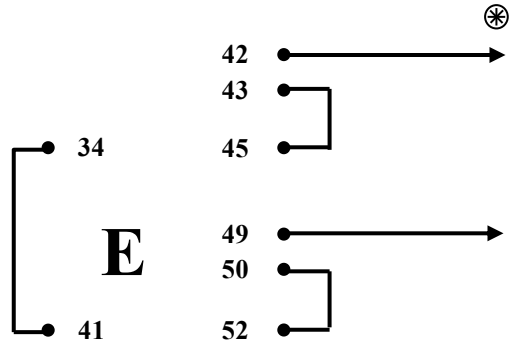
Max secondary Voltage RMS @ 30 Hz	
P-P: 19V	SE : 8.5V
Sec. copper resistance 0.2 Ω	Windings in series 2



Max secondary Voltage RMS @ 30 Hz	
P-P: 29V	SE : 13V
Sec. copper resistance 0.4 Ω	Windings in series 3



Max secondary Voltage RMS @ 30 Hz	
P-P: 39V	SE : 17V
Sec. copper resistance 0.7 Ω	Windings in series 4



Max secondary Voltage RMS @ 30 Hz	
P-P: 58V	SE : 25V
Sec. copper resistance 1.6 Ω	Windings in series 6

	LL1679	
Turns ratio:	**22 + 12.5 + 22 + 12.5 : 2 + 1 + 2 + 1**	
Static resistance of primary (all in series)	160 Ω (2 x 54Ω + 2 x 26Ω)	
Static resistance of inner/outer secondary winding	0.5Ω / 0.3Ω	
Primary leakage inductance (all in series)	8 mH	
Max. primary signal voltage r.m.s. at 30 Hz (all in series)	Push-Pull 670V	Single End 295V

Isolation between primary and secondary windings / between windings and core: 3 kV / 1.5 kV

Electrical characteristics

Primary Load Impedance, Max power and power loss.

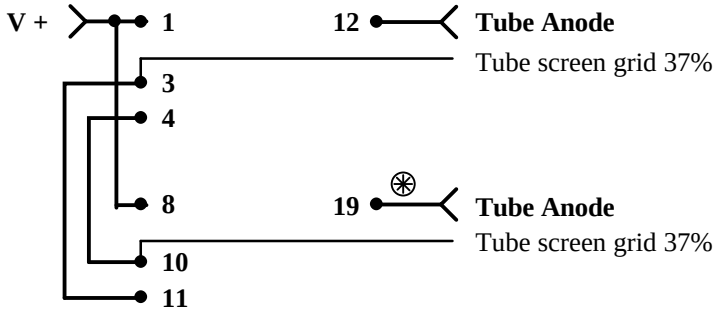
	Sec. connection for 4/8/16 W (See next page)		
	-/B/C	B/C/D	C/D/E
	Primary Load Impedance (transformer copper resistance included)		
LL1679	9.7 kΩ	4.5 kΩ	2.6 kΩ
	Power and Loss		
Max. Power, P-P at 30 Hz	45W	105W	188W
Max. Power, S.E. at 30 Hz	9W	20W	36W
Power loss across transformer	0.2 dB	0.4 dB	0.6 dB

Primary DC Current Core Air-gap and Primary inductance

	LL1679/PP
Core Airgap (delta/2)	25 µ
Single end standing current for 0.9 Tesla (recommended operating point)	
Primary inductance	150 H

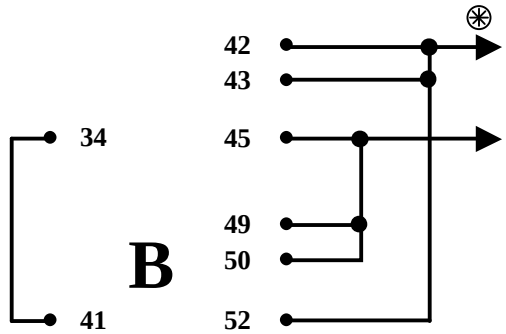
Frequency response, LL1679/PP 10 Hz – 70 kHz +0/-3 dB
(source impedance 2k, load impedance 10 ohms
primary winding is series, secondary winding alt. C)

Primary connections, Push-Pull

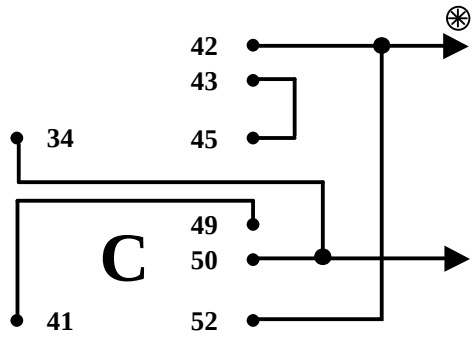


Secondary connections

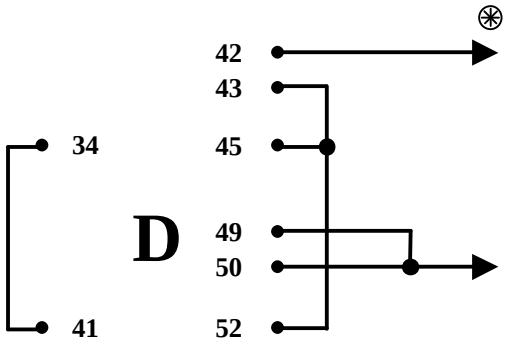
⊛ Indicates phase



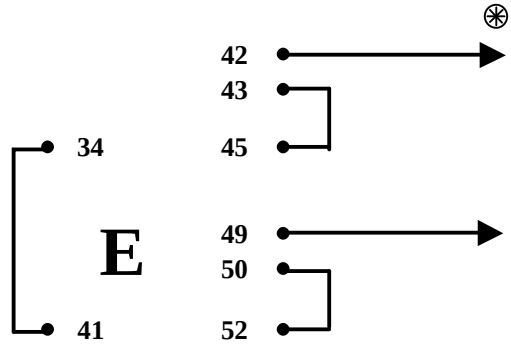
Max secondary Voltage RMS @ 30 Hz	
P-P: 19V	SE : 8.5V
Sec. copper resistance 0.2 Ω	Windings in series 2



Max secondary Voltage RMS @ 30 Hz	
P-P: 29V	SE : 13V
Sec. copper resistance 0.4 Ω	Windings in series 3



Max secondary Voltage RMS @ 30 Hz	
P-P: 39V	SE : 17V
Sec. copper resistance 0.7 Ω	Windings in series 4



Max secondary Voltage RMS @ 30 Hz	
P-P: 58V	SE : 25V
Sec. copper resistance 1.6 Ω	Windings in series 6

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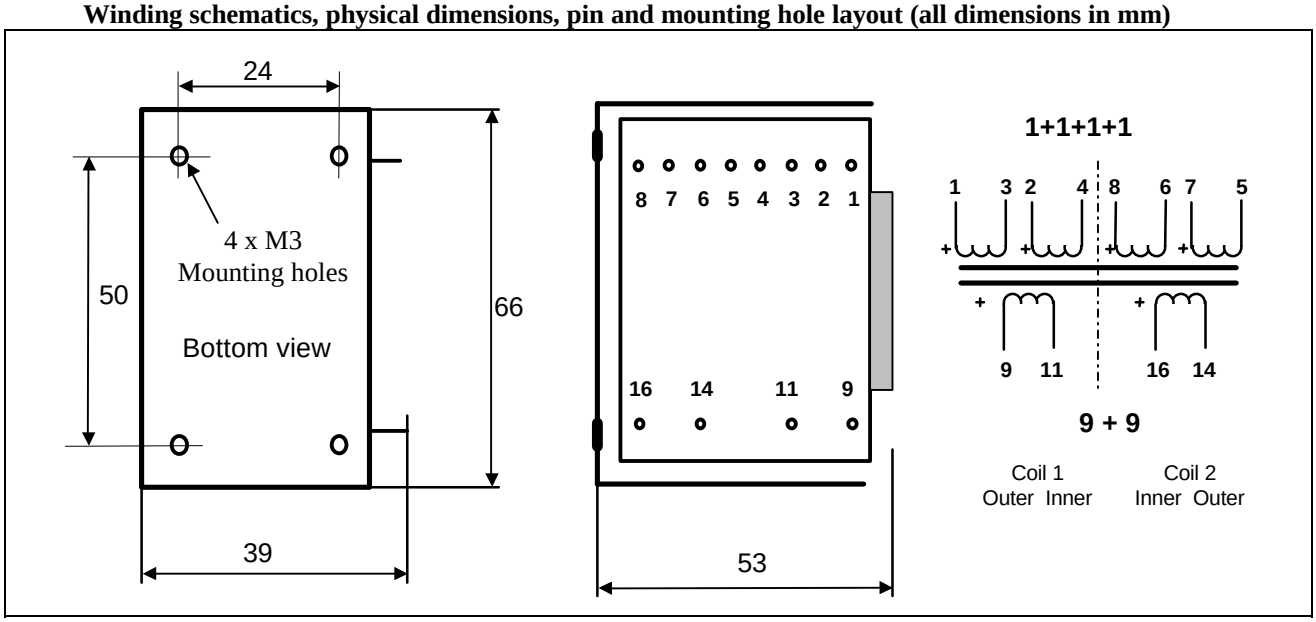
Line Output Transformer for Tube Amplifiers
LL1680

The LL1680 line output transformer is made to match or exceed the specs of the UTC transformer LS-27. The LS-27 was used in the RCA Tube Mike Pre (which was used in BC-2B Consoles).
For the internal insulation of the LL1680 high impedance sections we have used paper (and not polypropylene foil) to minimize internal capacitance. Each coil consists of three sections to optimize leakage inductance versus inter-winding capacitance. The transformer has a special audio C-core of our own production.

Turns ratio: 9 + 9 : 1+1+1+1

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding 9-11 and 16-14	Static resistance, winding 2-4 and 8-6	Static resistance, winding 1-3 and 7-5
0.35 Kg	9 + 9 : 1 + 1+ 1+ 1	580 Ω	11 Ω	15 Ω

Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV
Max standing DC current through any primary section 50 mA

Type	**LL1680/5mA**	**LL1680/5mA**	**LL1680/5mA**	**LL1680/5mA**
Application	15k : 600 ohm Balanced output	15k : 600 ohm Unbalanced output	15k : 150 ohm Balanced output	15k : 150 ohm Unbalanced output
Connection	Alt A	Alt B	Alt C	Alt D
Turns ratio	18 : 4	18 : 4	18 : 2	18 : 2
Primary DC current for 0.9 Tesla	5mA	5mA	5mA	5mA
Primary Inductance	210H	210H	210H	210H
Frequence response, +0, -1.5dB (ref. 1kHz) Source impedance Load	15 Hz – 50 kHz 15kΩ 600 Ω	15 Hz – 40 kHz 15kΩ 600 Ω	15 Hz – 55 kHz 15kΩ 150 Ω	15 Hz – 40 kHz 15kΩ 150 Ω
Max primary signal voltage (RMS) at 30 Hz	150V	150V	150V	150V
Max output voltage @ 30 Hz	33V RMS	33VRMS.	16V RMS	16V RMS

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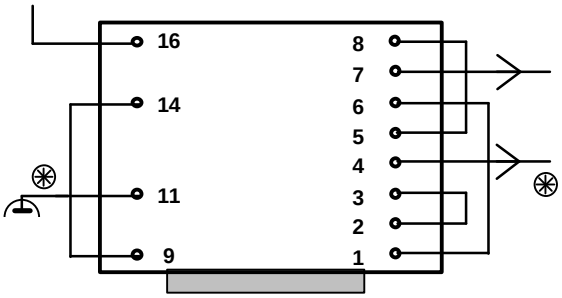
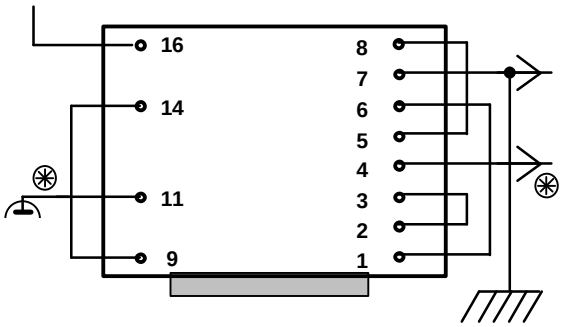
Tube Amplifier Line Output Transformer LL1680
Connection Alternatives

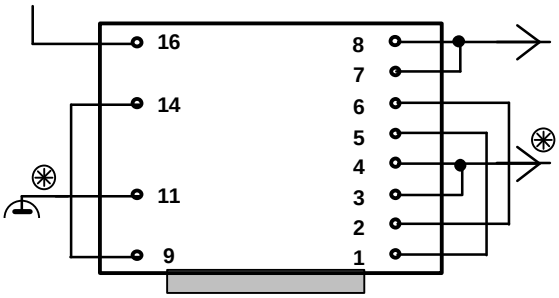
Alt A
Balanced output 600Ω



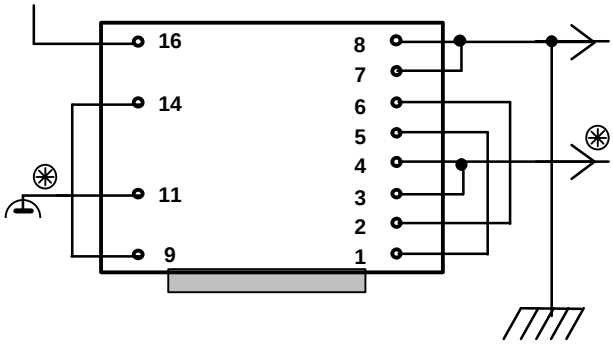
Alt B
Unbalanced output 600Ω

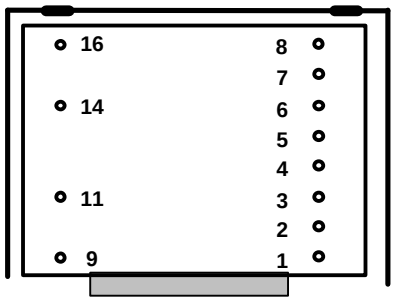


Alt C
Balanced output 150Ω



Alt D
Unbalanced output 150Ω





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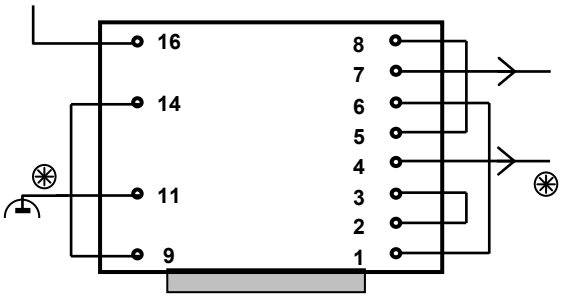
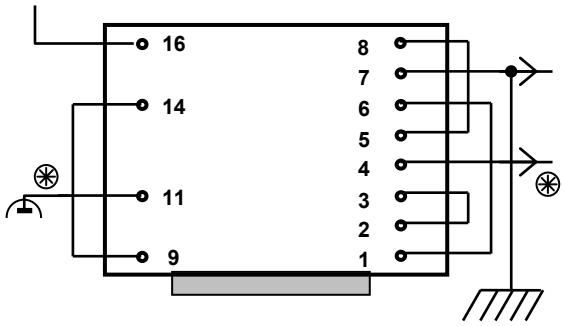
Tube Amplifier Line Output Transformer LL1680
Connection Alternatives

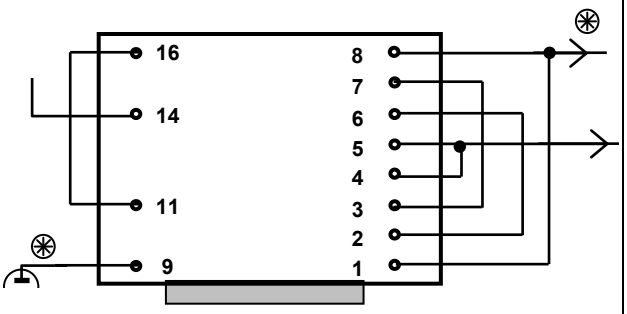
Alt A
Balanced output 600Ω



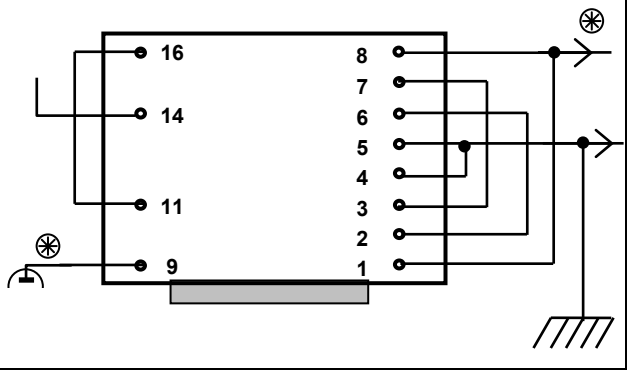
Alt B
Unbalanced output 600Ω

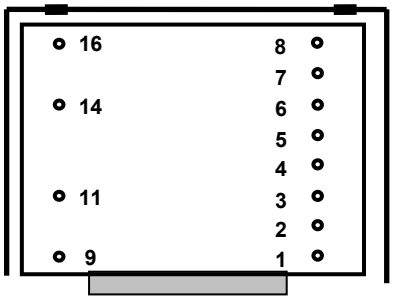


Alt C'
Balanced output 150Ω



Alt D'
Unbalanced output 150Ω





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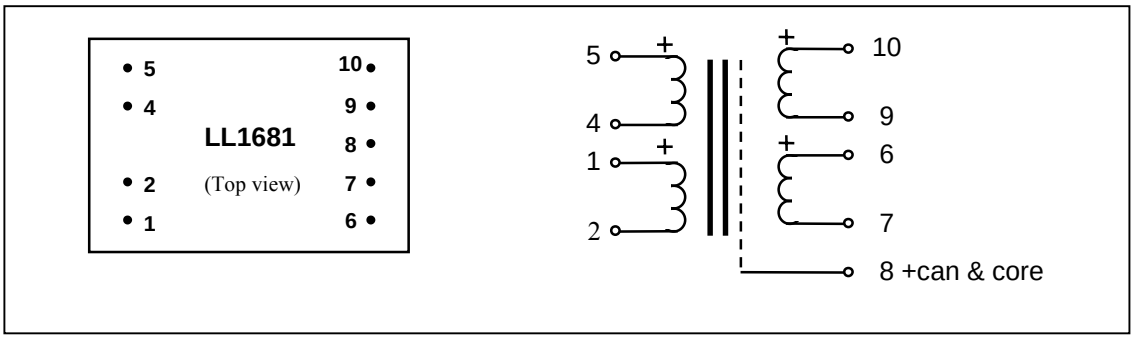
Moving Coil Input Transformer
LL1681

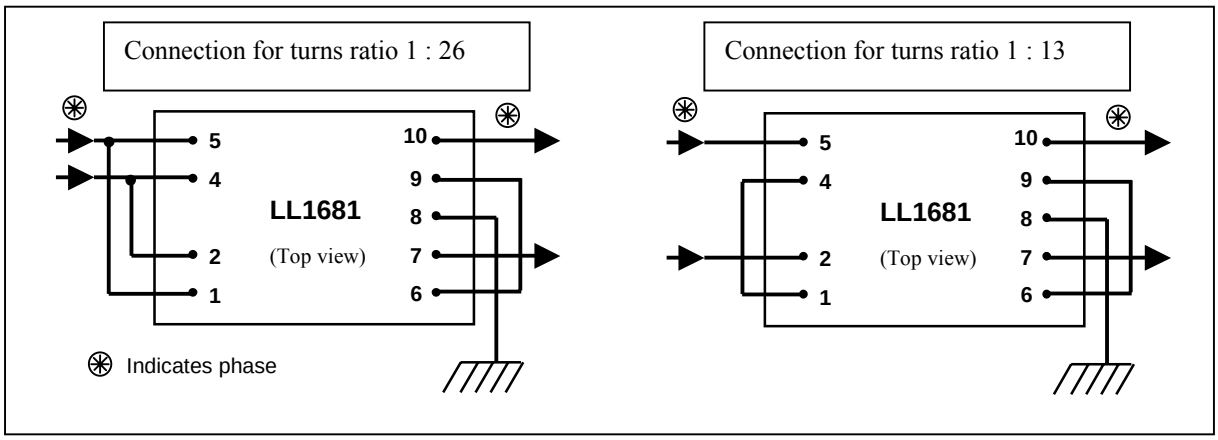
The LL1681 is a large core moving coil input transformer with a mu-metal core.
The LL1681 consists of two coils, each with a two-sectioned primary winding and one high level secondary winding (with paper insulation) separated by electrostatic shields.
The transformer is magnetically shielded by a mu metal housing.

Turns ratio: 1 + 1 : 13 + 13
Dims (Length x Width x Height above PCB (mm)): 48 x 29 x 20
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 35.56mm (1.4")
Weight: 90 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary:	4.8Ω
Static resistance of each secondary:	820Ω
Distortion (Transformer connected 1:26, source impedance 40 ohms)	< 0.15% at –10 dBU, 50Hz (typically 0.1%)
	< 1% at +5 dBU, 50Hz
Frequency response, balanced input (Transformer connected 1:13, source 50Hz, sec. level +10dBU)	7Hz – 70 kHz +/- 1dB
Frequency response, Unbalanced input (Transformer connected 1:13, source 50Hz, sec. level +10dBU)	7Hz – 40 kHz +/- 1dB
Isolation between primary and secondary windings/ between windings and shield:	4 kV / 2 kV



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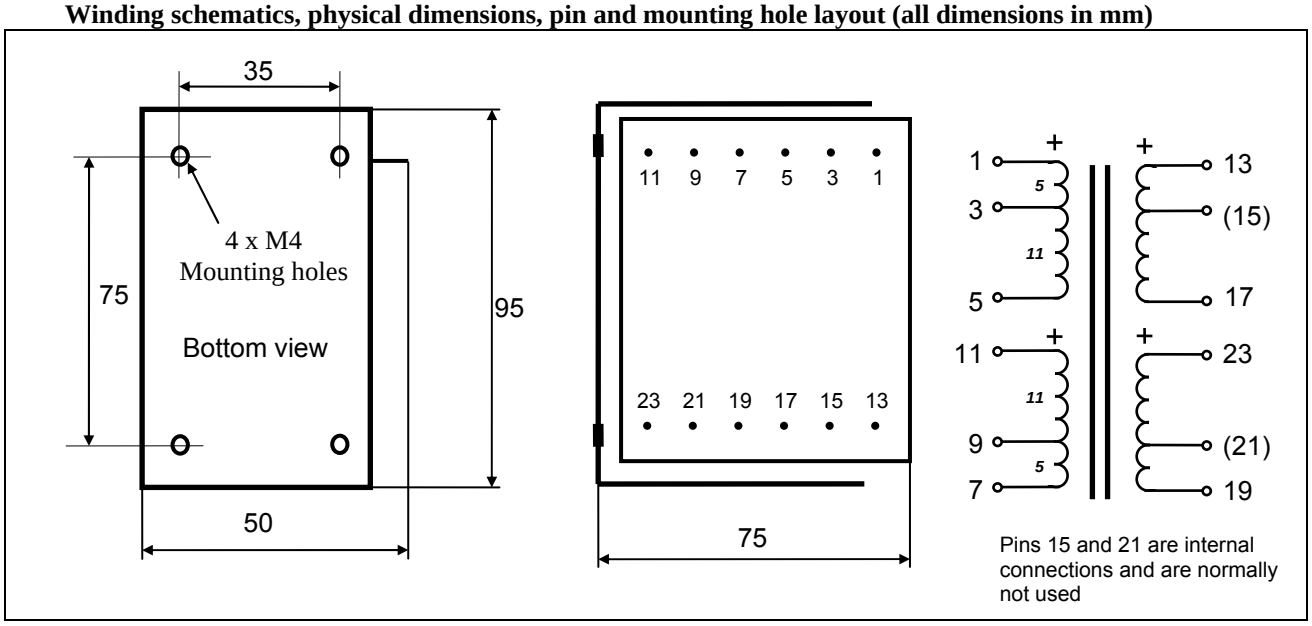
Tube amplifier output transformer LL1682
5.5k : 5 ohms

The LL1682 is a four-sectioned, dual coil C-core tube amplifier output transformer for 5.5k: 5 ohms impedance ratio available in PP and SE versions.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **16+16 : 1+1 or (5+11)+(5+11) : 1 + 1**

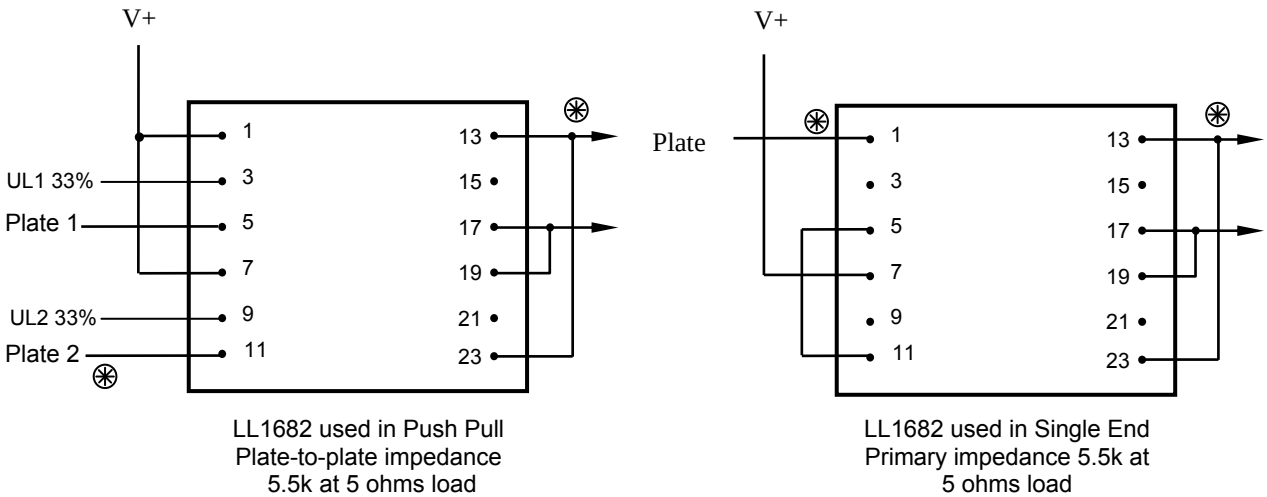
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each primary:	105 Ω
Static resistance of secondary (connected in parallel as below)**:**	0.4 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through any primary winding:	160mA

	LL1682/PP	**LL1682/50mA**	**LL1682/100mA**
Primary inductance (approx)	100H	35H	17H
Max primary signal	450V R.M.S. @ 30 Hz	200V R.M.S. @ 30 Hz	200V R.M.S. @ 30 Hz
Max output power @ 30 Hz	40W (5Ω spkr)	8W (5Ω spkr)	8W (5Ω spkr)

Suggested use:



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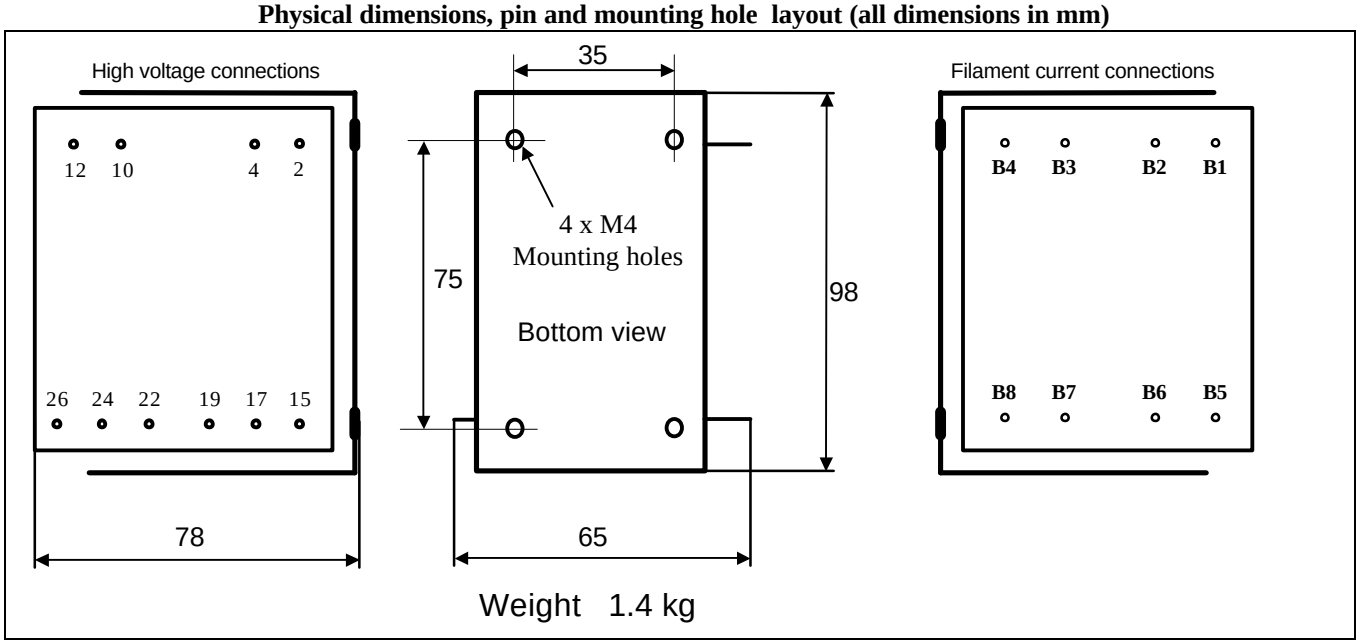
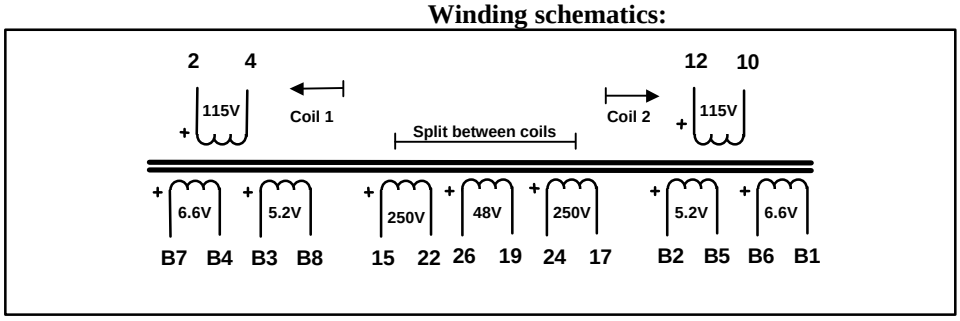
Mains Transformers for Tube Amplifiers
LL1683

C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 120 VA, which can be increased with good cooling. The 2 x 250V secondaries are internally divided between the two coils. As a result, the transformer can be used with bridge or full wave rectifiers without a problem of asymmetric load. Magnetic stray is extremely small if filament secondaries of the two coils are loaded identically.

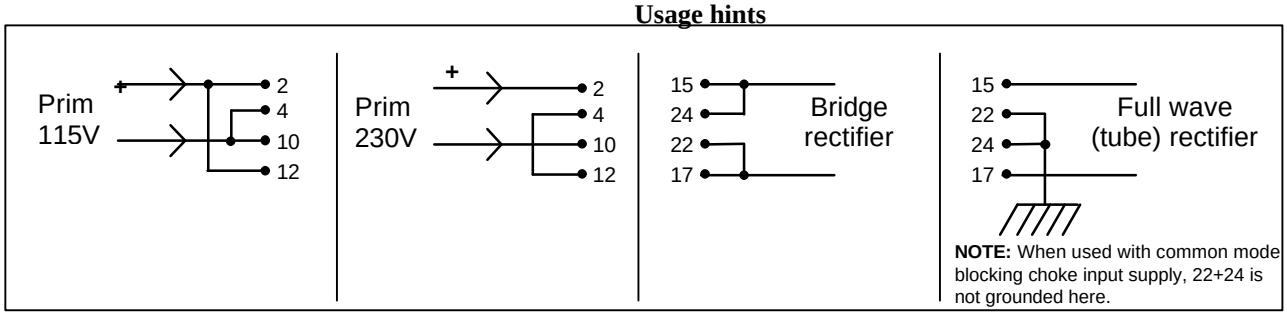
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Usage hints



No load output voltage, max recommended transformer current (rms) and coil resistance with primary connected to 230 V series / 115V parallel

Primary res. Series/parallel	**Sec 1** Pins 15 - 22	**Sec 2** Pins 24 - 17	**Sec 3** Pins 26 - 19	**Sec 4** Pins B7 – B4	**Sec 5** Pins B6 – B1	**Sec 6** Pins B3 – B8	**Sec 6** Pins B2 – B5
7.5 Ω / 1.9 Ω	250V / 80mA 100Ω	250V / 80mA 100Ω	48V / 0.1A 40Ω	6.6 V / 3A 0.2 Ω	6.6 V / 3A 0.2 Ω	5.2 V / 3A 0.2Ω	5.2 V/ 3A 0.2Ω

Please note! Output current from rectifier: 63% of above with cap. input rectifier, 95% of above with choke input rectifier.

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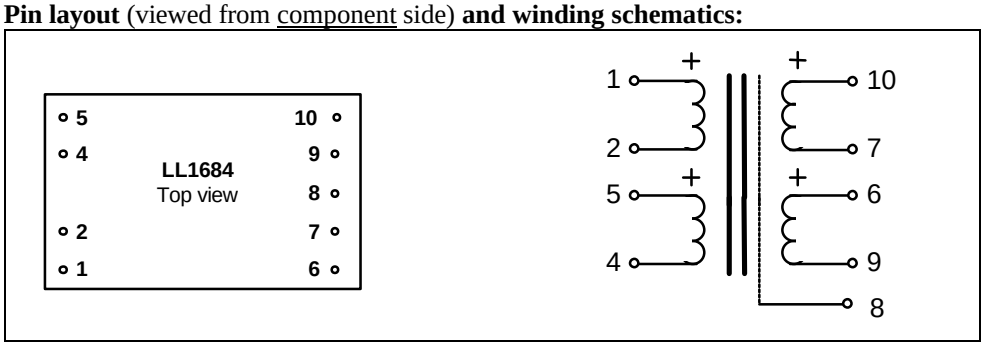
High Level General Purpose Transformer
LL1684

LL1684 is a high-level, general-purpose, amorphous core transformer which can be used for microphone or line input, for line output and for galvanic isolation. The windings are arranged to give perfect symmetry if the transformer is used in phase splitting input applications. The two coils structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields.. The transformer is housed in a mu-metal can.

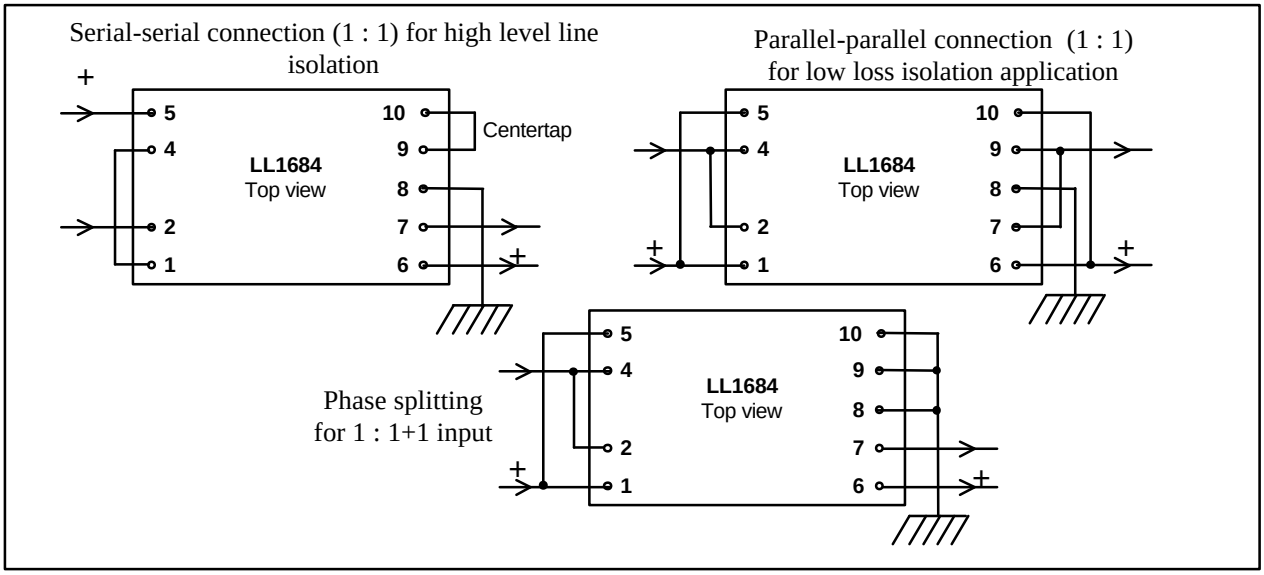
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	42 x 28 x 22
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		30.5 mm (1.2")
Rec. PCB hole diameter:		1.5 mm
Weight:		81 g
Static resistance of each primary:		41Ω
Static resistance of each secondary:		41Ω
Distortion	(primaries connected in series, source impedance 150Ω):	+ 23 dBU 0.1% @ 50 Hz + 25 dBU < 1 % @ 50 Hz
Distortion	(primaries connected in parallel, source impedance 150Ω):	+ 16 dBU 0.1% @ 50 Hz + 19 dBU < 1 % @ 50 Hz
Self resonance point:		> 250 kHz
Frequency response	(source 150Ω, load 10 kΩ, serial connection):	10 Hz -- 100 kHz +/- 1.0 dB
Phase response	(deviation from linear phase)	20 Hz – 20kHz, +/- 0.5°
Suggested load for best square wave response		10k // 1k + 3nF
Isolation between windings/ between windings and shield:		3 kV / 1.5 kV

Connection alternatives and suggested applications:



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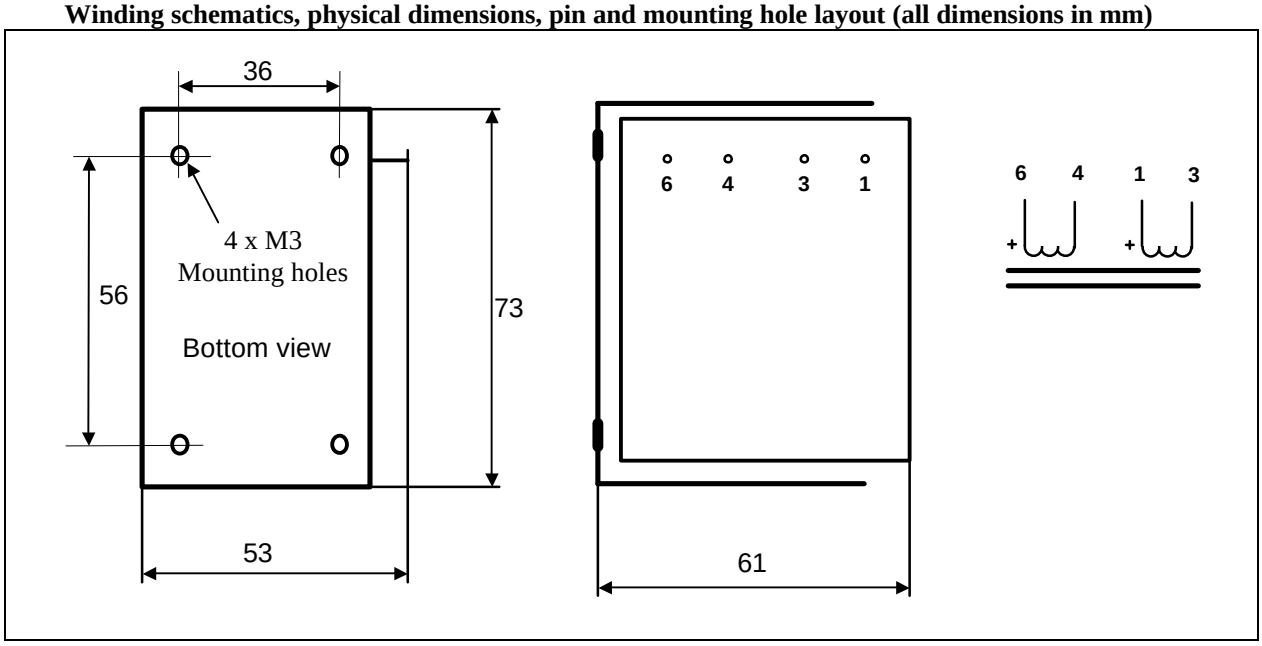
Choke LL1685

The LL1685 is a 2 coils choke for tube amplifier anode supply.
The choke is available with different core air-gap, which results in different inductance and DC current capability. LL1685 can be used in choke input and cap input applications.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

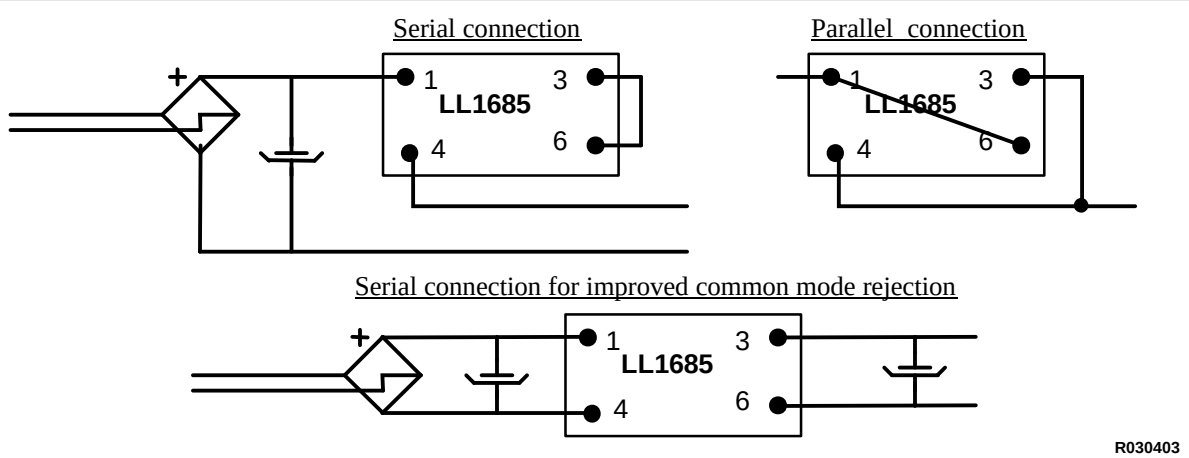
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 0.75 kg
Static resistance of each winding: 65 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**Approx. Inductance**	**Recommended DC current**	**Saturating current**	**Approx. Inductance**	**Recommended DC current**	**Saturating current**
LL1685 / 100mA	17 H	100 mA	145 mA	4 H	200 mA	290 mA
LL1685 / 130mA	13 H	130 mA	190 mA	3 H	260 mA	380 mA
LL1685 / 160 mA	10 H	160 mA	230 mA	2.5 H	360 mA	460 mA
Max. ripple voltage at rec. DC current (Ripple voltage is approx. 0.42 x input voltage)	330V rms / 100 Hz			165V rms / 100 Hz		

Suggested connections:



Note! The LL1685 can also be used in choke input power supplies

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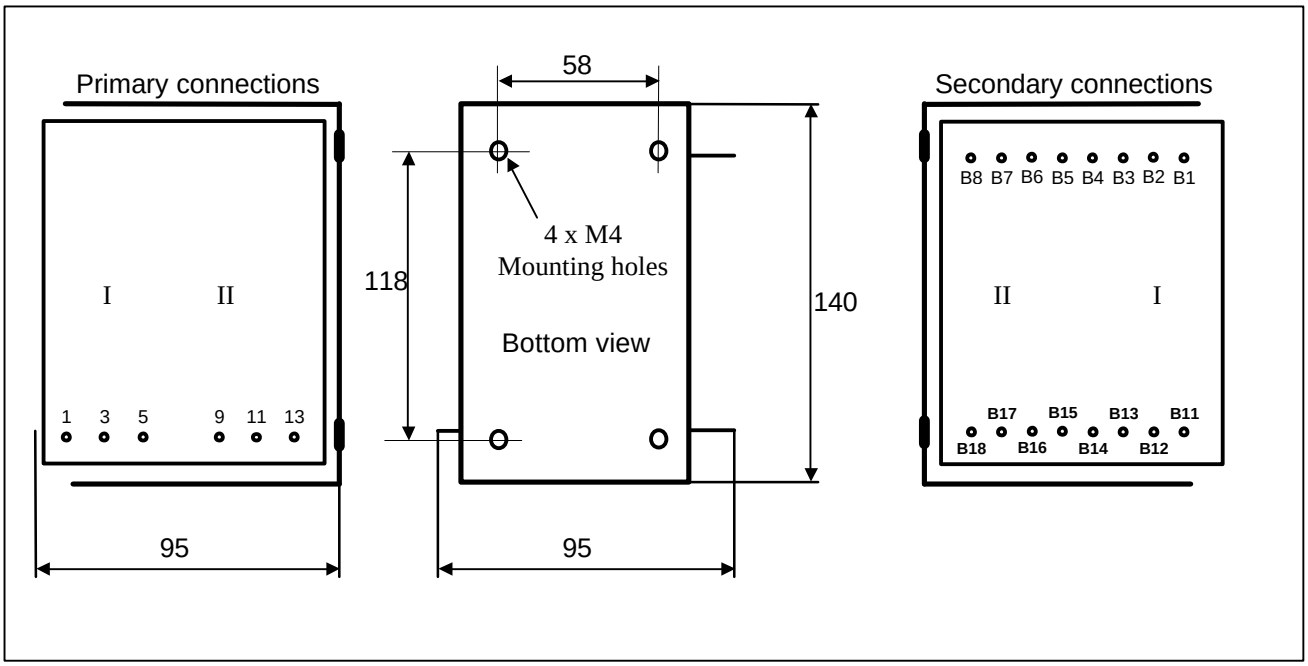
Tube Amplifier Output Transformers
LL1688

LL1688 is an output transformer, designed primarily for 845 tube amplifiers, but the LL1688 is available with different core air-gaps for different types of output stages. The transformers are highly sectioned with harmonically sized sections, which results in a minimum leakage inductance. This, combined with a low capacitance coil winding technique results in a wide frequency range.
The primary winding can be tapped for 33% UL connection.
The transformers have a special audio C-core of our own production.
The transformers are unpotted, open frame type suitable for mounting inside an amplifier housing.

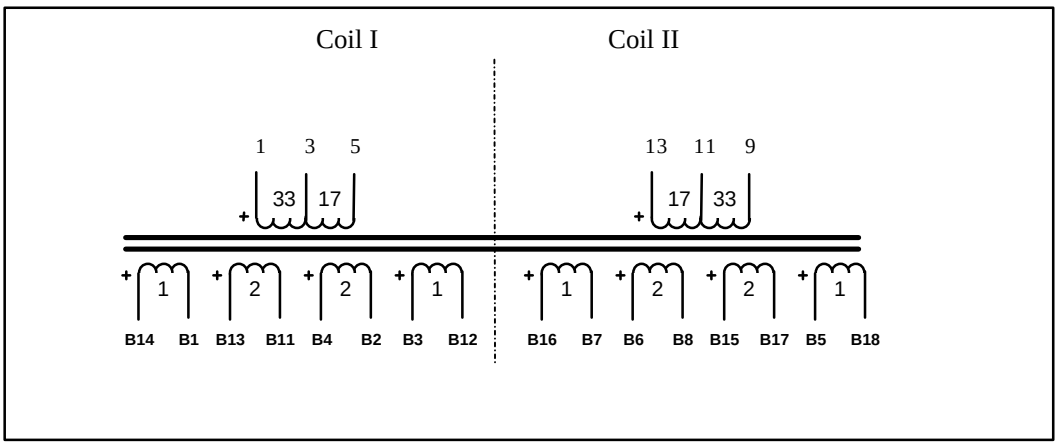
Physical dimensions, pin and mounting hole layout LL1688 (all dimensions in mm)



R040312

Pin spacing module: 5.08 mm (0.2")
Row spacing: 91 mm approx.
Weight: 4 kg
Turns ratio: 50 + 50 : 1 + 2 + 2 + 1 + 1 + 2 + 2 + 1

Winding schematics:



	LL1688	
Turns ratio:	50 + 50 : 1 + 2 + 2 + 1 + 1 + 2 + 2 + 1	
Static resistance of primary (all in series)	260 Ω (130Ω + 130Ω)	
Static resistance of secondary windings (in -> out)	0.3Ω, 0.7Ω, 0.7Ω, 0.4Ω	
Primary leakage inductance (all in series)	7 mH	
Max recommended primary DC current (heat dissip. 10W)	200mA	
Max. primary signal voltage r.m.s. at 30 Hz (all in series)	Push-Pull (1.6T) 1220V	Single End (0.7T) 530V

Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Electrical characteristics

Primary Load Impedance, Max power and power loss.

	Sec. connection for 4/8/16 W (See next page)		
	-/B/C	B/C/D	C/D/E
	Primary Load Impedance (transformer copper resistance included)		
LL1688	20.5 kΩ	9.2 kΩ	5.5 kΩ
	Power and Loss		
Max. Power, P-P at 30 Hz	72W	160W	320W
Max. Power, S.E. at 30 Hz	15W	30W	60W
Power loss across transformer	0.15 dB	0.25 dB	0.5 dB

Primary DC Current Core Air-gap and Primary inductance

	LL1688/70mA
Core Airgap (delta/2)	240 µ
Single end standing current for 0.9 Tesla (recommended operating point)	70mA
Primary inductance	70 H

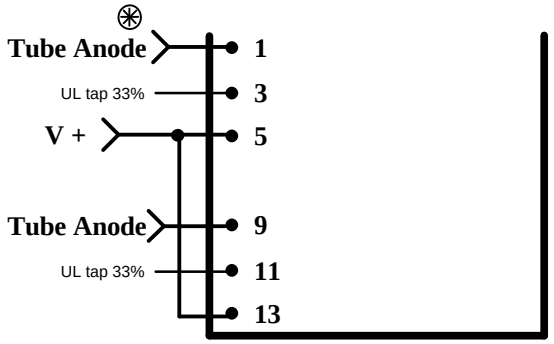
Frequency response, LL1688/70mA

(source impedance 2.2k, load impedance 10 ohms. Primary winding is series, secondary winding "alt. C". Secondary winding not grounded. Primary signal level approx 10V)

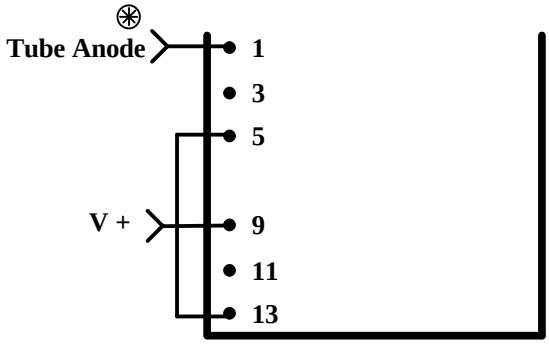
10 Hz – 25kHz +0 / -1 dB

5Hz – 33 kHz +0 / -3 dB

Primary connections, Push-Pull

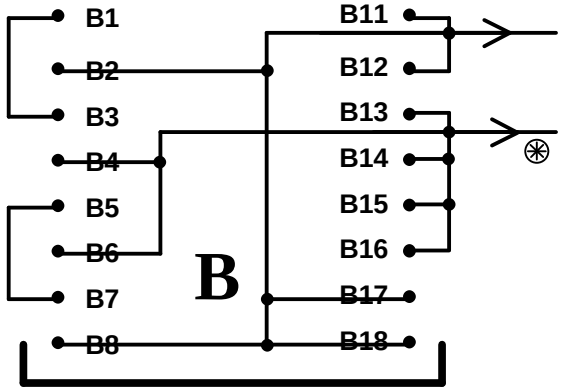


Primary connections, Singe End

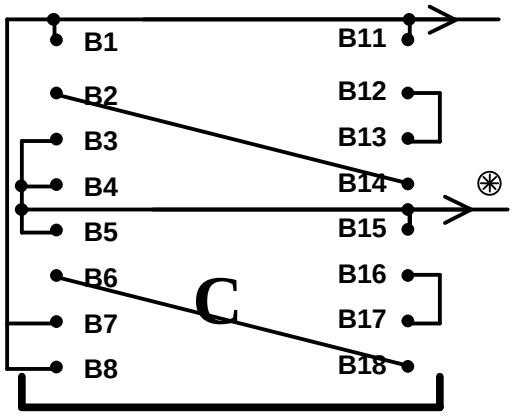


Secondary connections

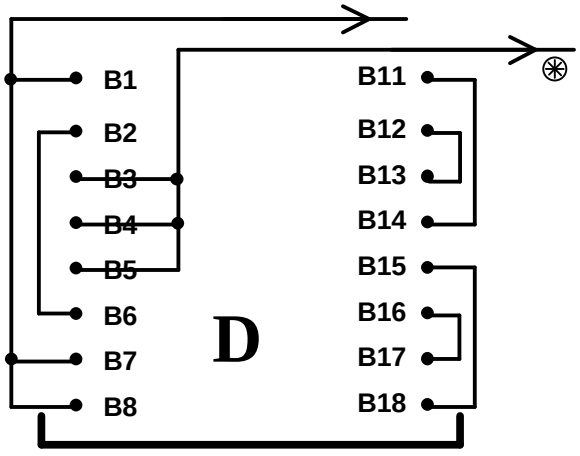
⊛ Indicates phase



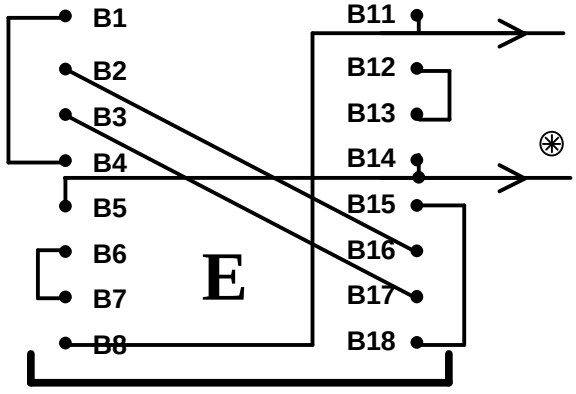
Max secondary Voltage RMS @ 30 Hz	
P-P: 25V	SE : 11V
Sec. copper resistance 0.15 Ω	Windings in series 2



Max secondary Voltage RMS @ 30 Hz	
P-P: 37V	SE : 16V
Sec. copper resistance 0.2 Ω	Windings in series 3



Max secondary Voltage RMS @ 30 Hz	
P-P: 50V	SE : 22V
Sec. copper resistance 0.5 Ω	Windings in series 4



Max secondary Voltage RMS @ 30 Hz	
P-P: 74V	SE : 32V
Sec. copper resistance 1 Ω	Windings in series 6

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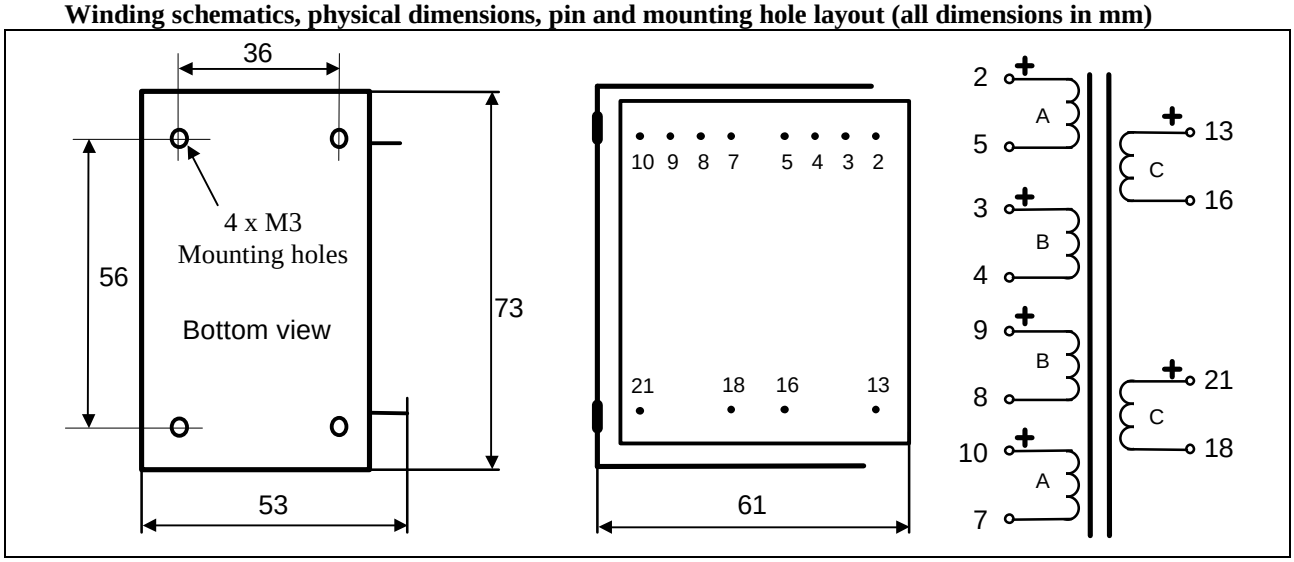
Line Output Transformer LL1689

LL1689 is a line output transformer for tube amplifiers. The transformer is available with different core air gap for PP or SE drives.
The transformer primaries are wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
The LL1689PP is assembled with a small core air gap to allow for some DC current unbalance.
For the S.E. versions of the LL1689, the core air gap is chosen such that the denoted DC current (18mA for a LL1689/18mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	9+9 : 1+1+1+1	19 Ω	15 Ω	655 Ω

Max. current through any primary ("C") section: 50 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	LL1689/PP	LL1689/PP	LL1689/PP	LL1689/18mA
Connection	Alt M PP to Line Out. 9+9 : 4	Alt N PP to Line Out. 9+9 : 2	Alt O PP to Line Out. 9+9 : 1	Alt P SE to Line Out. 18 : 4
Primary DC current for 0.9 Tesla	-	-	-	18 mA
Primary Inductance	290 H	290 H	290 H	90H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	Hz – kHz 15kΩ	15kΩ	15 kΩ	3 kΩ
Max sec. voltage @ 30 Hz	128V r.m.s.	64V r.m.s.	32V r.m.s.	56 V r.m.s.

Type	LL1689/18mA	LL1689/18mA
Connection	Alt Q SE to Line Out. 18 : 2	Alt R SE to Line Out. 18 : 1
Primary DC current for 0.9 Tesla	18 mA	18 mA
Primary Inductance	90H	90H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	3.5kΩ	3.5kΩ
Max output voltage @ 30 Hz	28 V r.m.s.	14 V r.m.s.

Applications

(*) The source impedances used in the tables indicates a recommended upper limit, unless freq. response can be compromised.
At lower source impedance resonance peaking will occure. It can be reduced using secondary load resistors.

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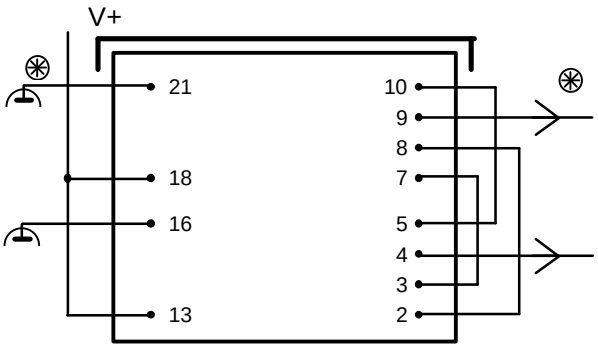
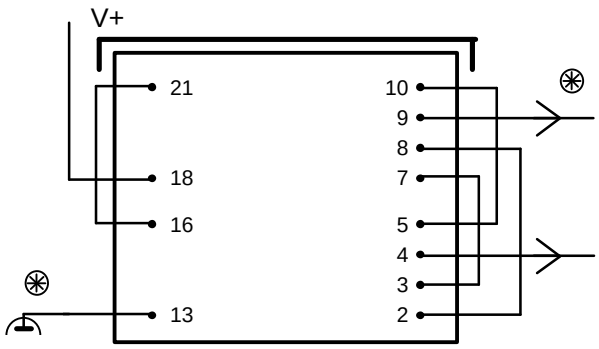
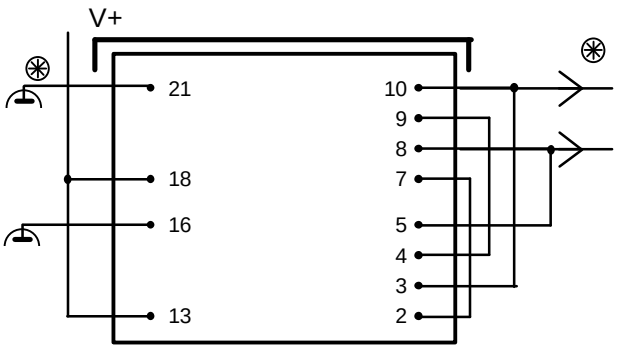
Tube Amplifier Interstage Transformer / Line Output Transformer
LL1689
Connection Alternatives



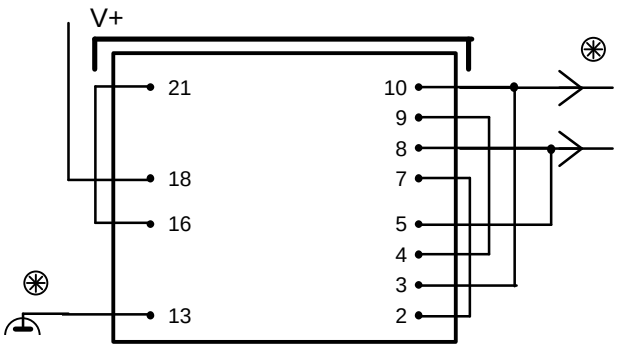
Alt. M
9+9 : 4 (CT at 5)
Push-Pull to Line Output



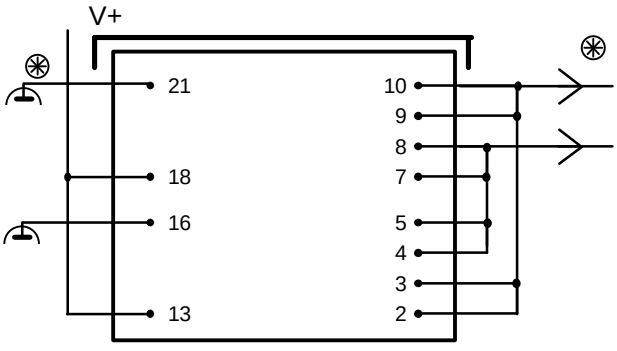
Alt. P
18 : 4 (CT at 5)
Single End to Line Output



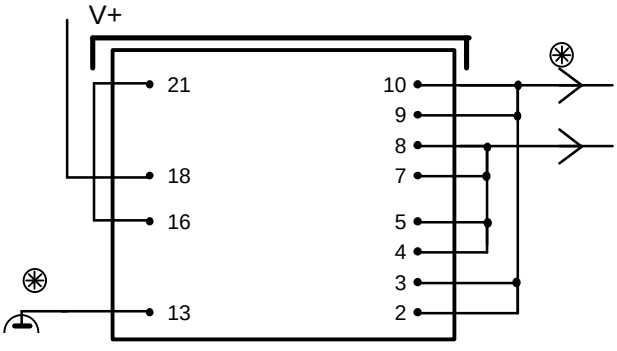
Alt. N
9+9 : 2 (CT at 7+4)
Push-Pull to Line Output



Alt. Q
18 : 2 (CT at 7 + 4)
Single End to Line Output



Alt. O
9+9 : 1
Push-Pull to Line Output



Alt. R
18 : 1
Single End to Line Output

⊛ Phase Indicator

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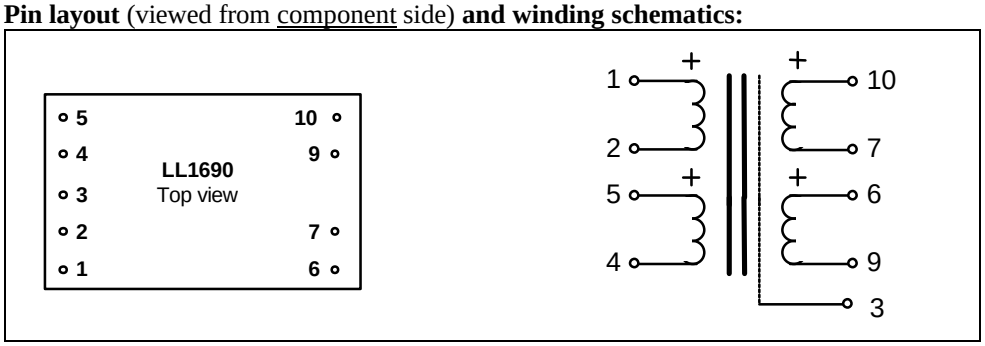
Amorphous Core High Level Line Input Transformer
LL1690

LL1690 is a high-level line input transformer with an uncut cobalt-based amorphous strip core. The transformer is designed for high end audio applications such as tube amplifier line input with or without phase splitting. The windings are arranged to give a high degree of symmetry if the transformer is used for phase splitting. The dual-coil structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields.. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 1 + 1

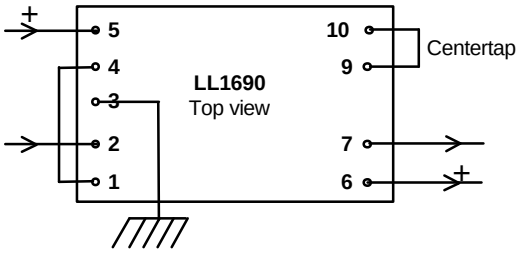
Pin layout (viewed from component side) **and winding schematics:**



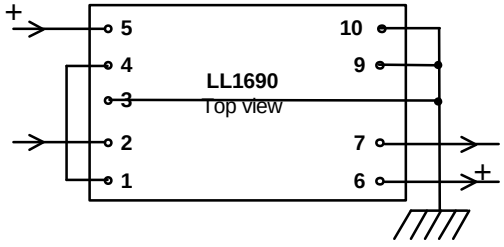
Dimensions (L x W x H above PCB, in mm)	42 x 28 x 22
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	30.5 mm (1.2")
Rec. PCB hole diameter:	1.5 mm
Weight:	81 g
Static resistance of each primary:	150 Ω
Static resistance of each secondary:	150 Ω
Distortion (primaries connected in series, source impedance 600Ω):	+ 23 dBU 0.1% @ 30 Hz + 26 dBU < 1 % @ 30 Hz
Self resonance point:	> 150 kHz
Suggested load for best square wave response, serial-serial connection.	40k // 7k + 400pF
Frequency response (serial connection , source 1kΩ, load 40 kΩ in parallel with 7k + 400pF):	10 Hz -- 100 kHz +/- 1.0 dB
Phase splitting balance (connection 2:1+1. Source 1kΩ, load (20kΩ +20kΩ) in parallel with 7k + 400pF):**,**	>55dB, 10Hz – 50kHz
Phase response (deviation from linear phase) (source 600 ohm, load 10k (Audio Precision))	20 Hz – 20kHz, < 2°
Isolation between windings/ between windings and shield:	3 kV / 1.5 kV

Connection alternatives and suggested applications:

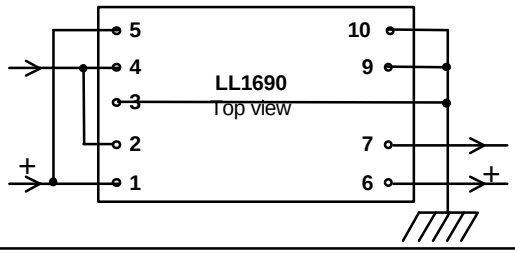
Serial-serial connection (1 : 1) for high level line input



Phase splitting for 2 : 1+1 input



Phase splitting for
1 : 1+1 input



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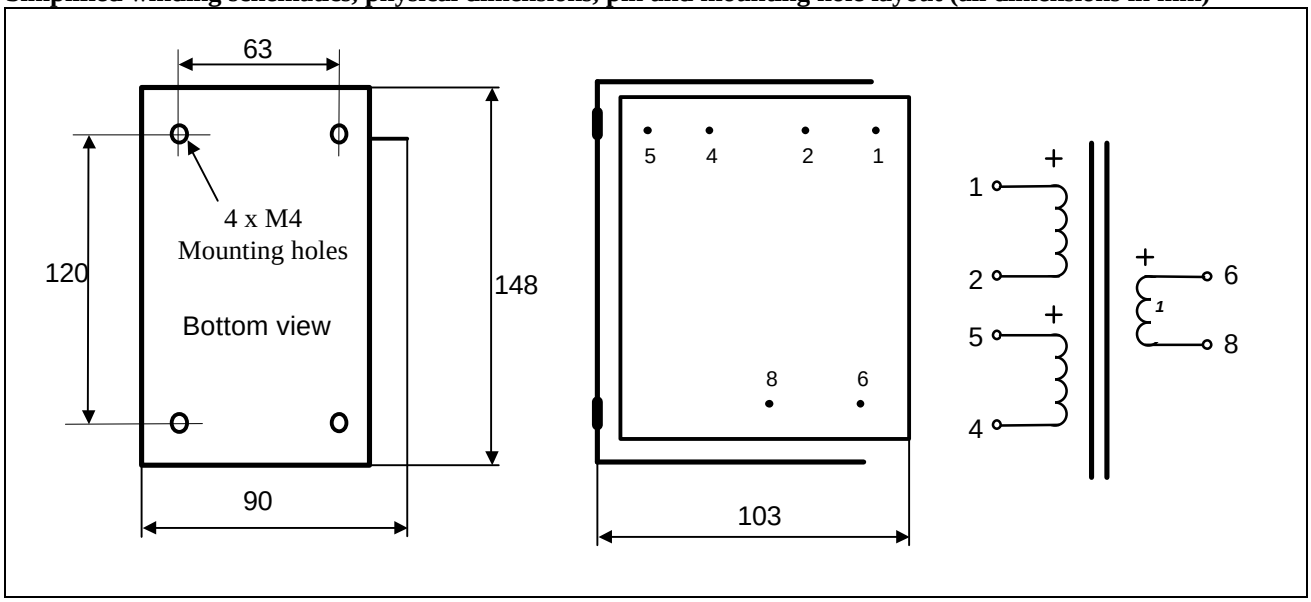
Tube amplifier output transformer LL1691
9k : 8 ohms (for 845 tubes)

The LL1691 is a dual coil C-core tube amplifier output transformer for 9k: 8 ohms impedance ratio available in PP and SE versions.
The coil is wound using our high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **17+17 : 1**

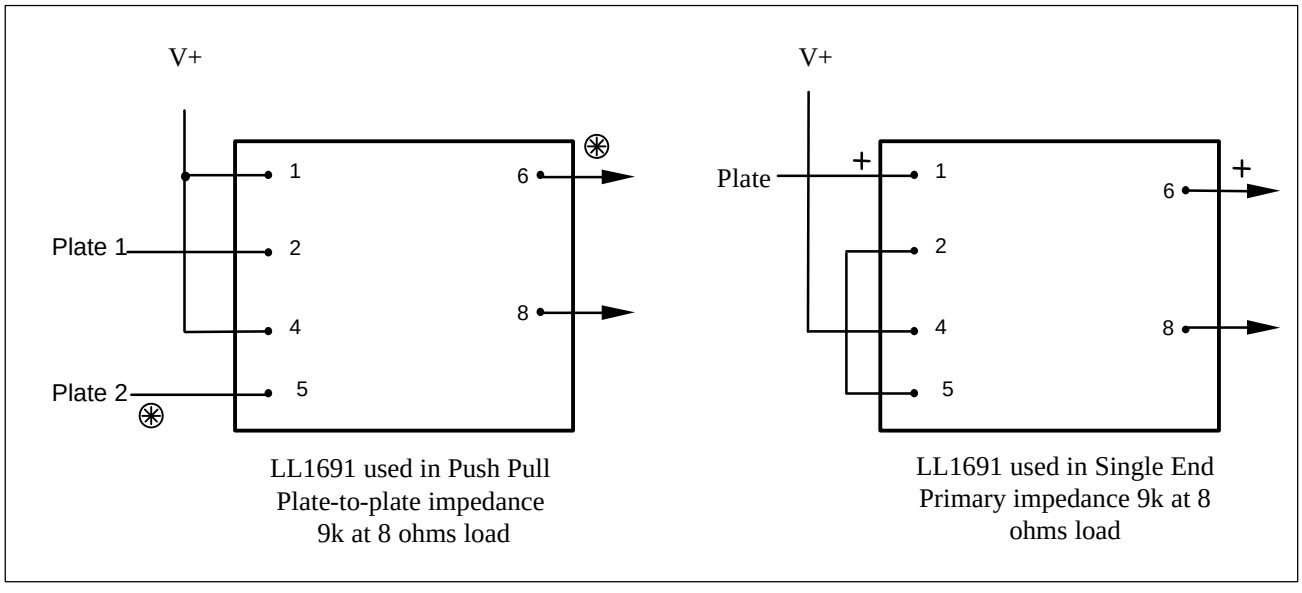
Simplified winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	4.6 kg
Static resistance of each primary:	112 Ω
Static resistance of secondary:	0.3 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding (10W heat dissip):	210mA

	LL1691/PP	**LL1691/70mA**
Primary inductance (approx.)		75H
Max primary signal	1220V R.M.S. @ 30 Hz	530V R.M.S. @ 30 Hz
Max output power @ 30 Hz	160W (8Ω spkr)	30W (8Ω spkr)

Suggested use:



LL1691 used in Push Pull
Plate-to-plate impedance
9k at 8 ohms load

LL1691 used in Single End
Primary impedance 9k at 8
ohms load

R050330

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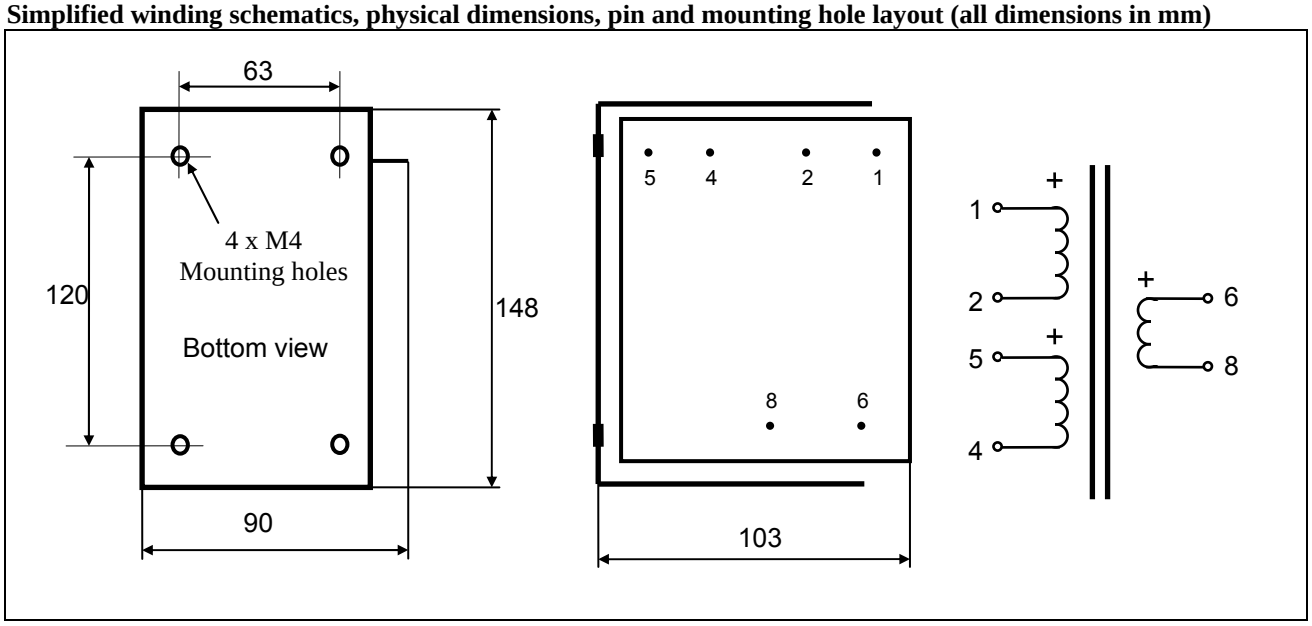
Tube amplifier output transformer LL1691B
20k : 8 ohms

The LL1691B is a dual coil C-core tube amplifier output transformer for 20k: 8 ohms impedance ratio, Based on the LL1691 design. The LL1691B is available in PP and SE versions.
The coil is wound using our high internal isolation technique with isolation foil between each individual layer of copper wire. The core is an audio C-core of our own production.

Turns ratio **25 + 25 : 1**

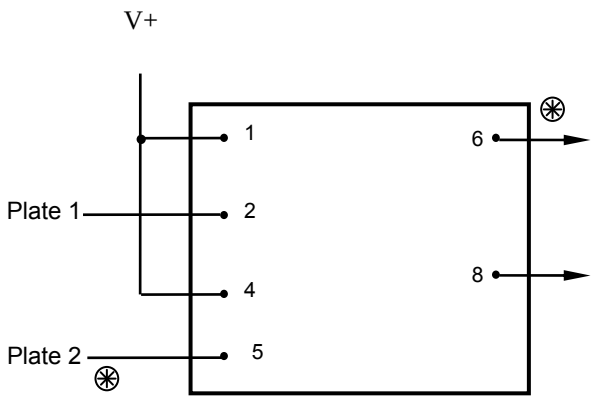
Simplified winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



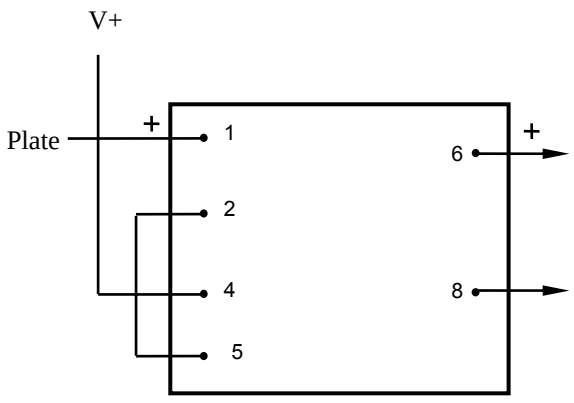
Weight:	4.6 kg
Static resistance of each primary:	260 Ω
Static resistance of secondary:	0.3 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding (10W heat dissip):	140mA

	LL1691B/PP	**LL1691B/70mA**
Primary inductance (approx.)		110 H
Max primary signal	1830V R.M.S. @ 30 Hz	790V R.M.S. @ 30 Hz
Max output power @ 30 Hz	160W (8Ω spkr)	30W (8Ω spkr)

Suggested use:



LL1691B used in Push Pull
Plate-to-plate impedance
20k at 8 ohms load



LL1691B used in Single End
Primary impedance
20k at 8 ohms load

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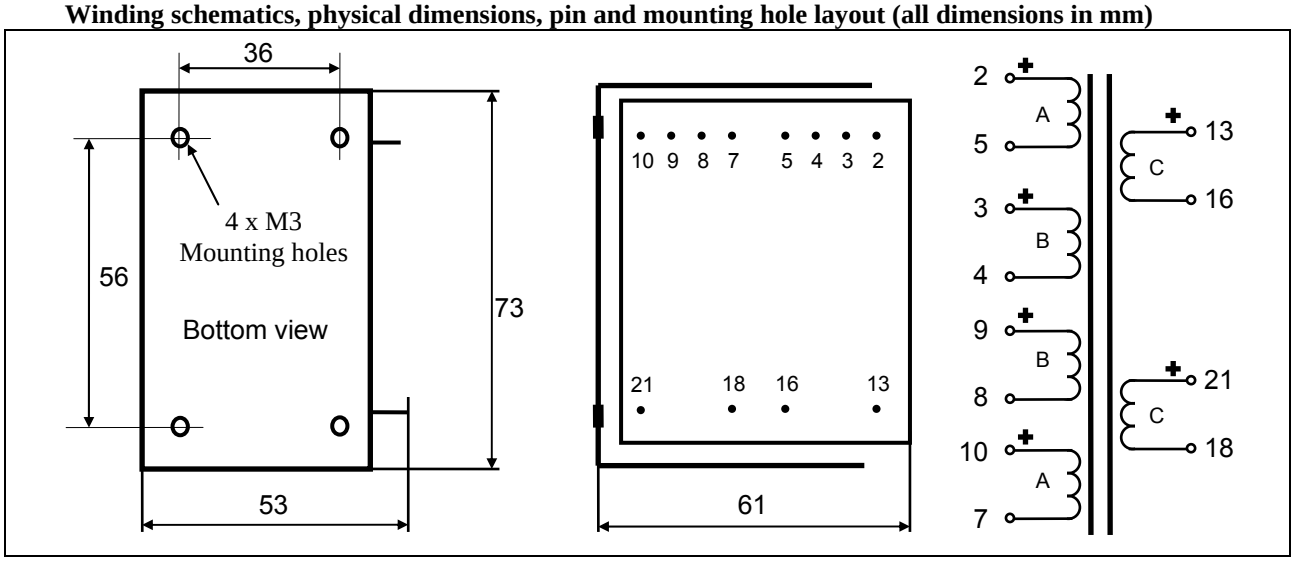
Tube Amplifier Interstage Transformer / Line Output Transformer LL1692A

LL1692A is an interstage transformer for tube amplifiers, impedance-wise placed between LL1660 and LL1671. LL1692A is available with various core air gaps optimised for PP or SE drives.
The transformer is wound with a special low capacitance winding technique to achieve best high frequency performance. It has a special high flux, low distortion audio C-core of our own production.
The Push-Pull version is assembled with a small core air gap to allow for some DC current unbalance. For the S.E. versions of the LL1692A, the core air gap is chosen such that the denoted DC current (18mA for a LL1692A/18mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of approx. 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 1.75+1.75	220 Ω	175 Ω	345 Ω

Max. DC current through any single section: 70 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	**LL1692A PP**	**LL1692A PP**	**LL1692A/18mA**	**LL1692A/18mA**
Connection	Alt M PP to PP Interst. 1.75+1.75 : 2+2	Alt N PP Line output 1.75+1.75 : 1	Alt Q SE Line Output 3.5 : 1	Alt S SE to SE Interst. 4 : 3.5
Primary DC current for 0.9 Tesla	-	-	21 mA	18 mA
Primary Inductance	210H	210H	95H	125H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	20 Hz – 45 kHz 10kΩ	20 Hz – 50 kHz 10kΩ	10 Hz – 55 kHz 2 kΩ	30Hz - 30 kHz 10 kΩ
Max output voltage @ 30 Hz	2 x 240V r.m.s.	120V r.m.s.	50 V r.m.s.	175 V r.m.s.

Type	**LL1692A/18mA**	**LL1692A/18mA**
Connection	Alt T SE to SE Interst. 2 : 3.5	Alt V SE to PP Interst. 1.75 : 2 + 2
Primary DC current for 0.9 Tesla	36 mA	41 mA
Primary Inductance	35H	24H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	40 Hz - 30 kHz 3 kΩ	50 Hz - 30 kHz 3 kΩ
Max output voltage @ 30 Hz	175 V r.m.s.	190 V r.m.s.

Applications

(*) The source impedances used in the tables indicate a recommended upper limit, unless the specified LF frequency response can be compromised.
At lower source impedance, bass will improve but resonance peaking might occur. Peaking can be reduced using secondary load resistors or RC networks.

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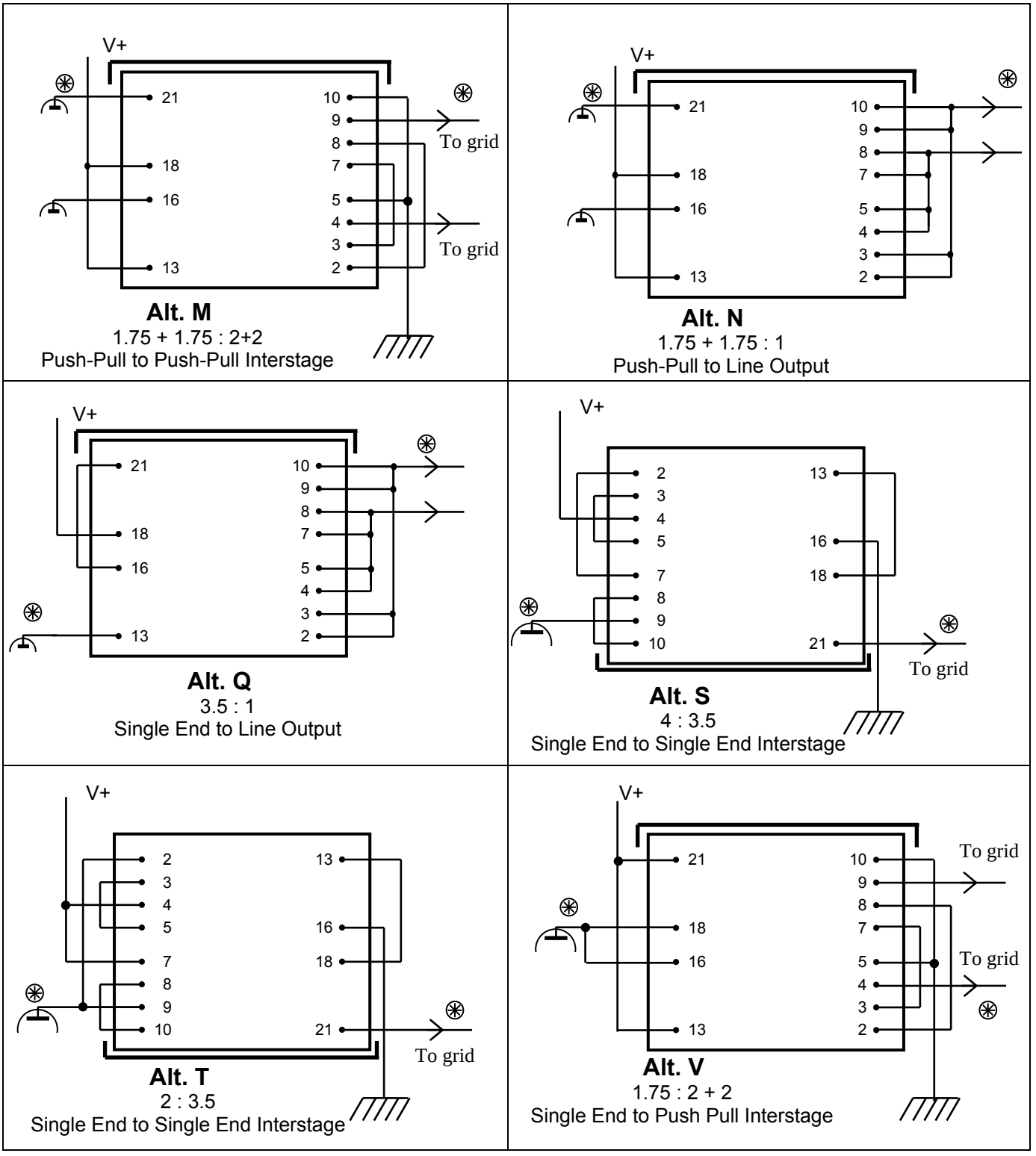
Tube Amplifier Interstage Transformer / Line Output Transformer
LL1692A
Connection Alternatives



⊛ Phase Indicator

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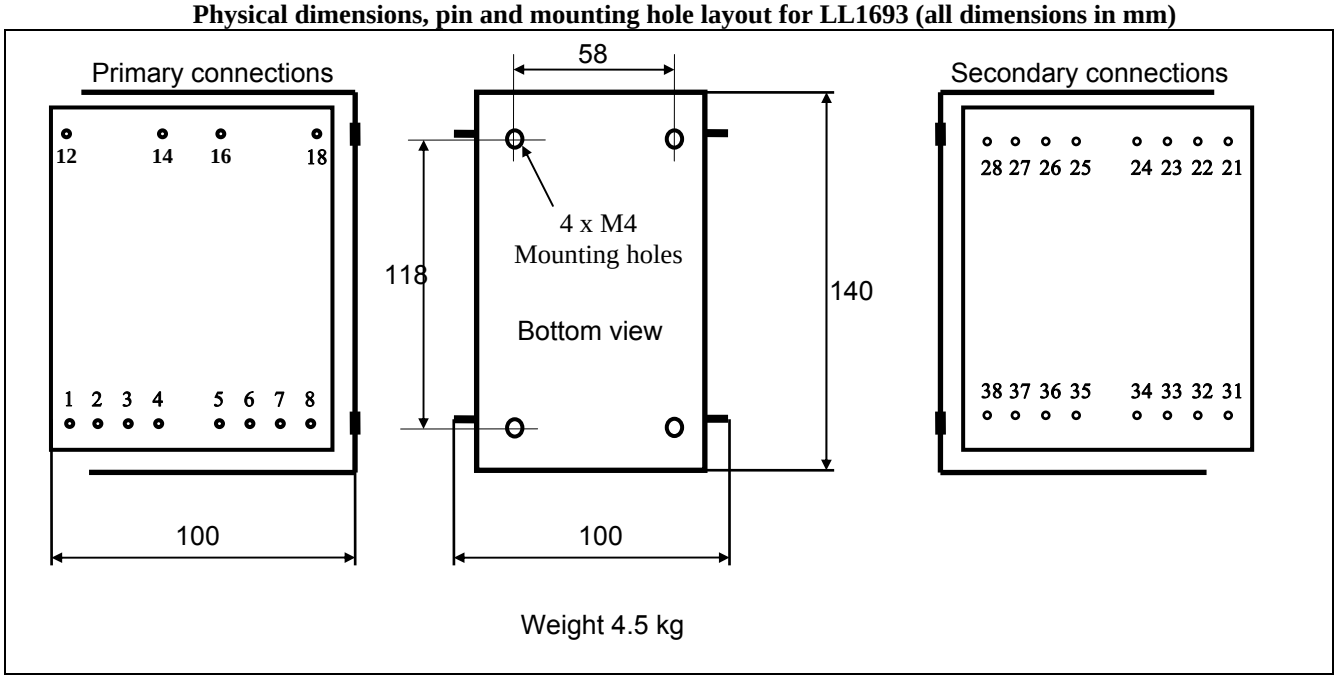
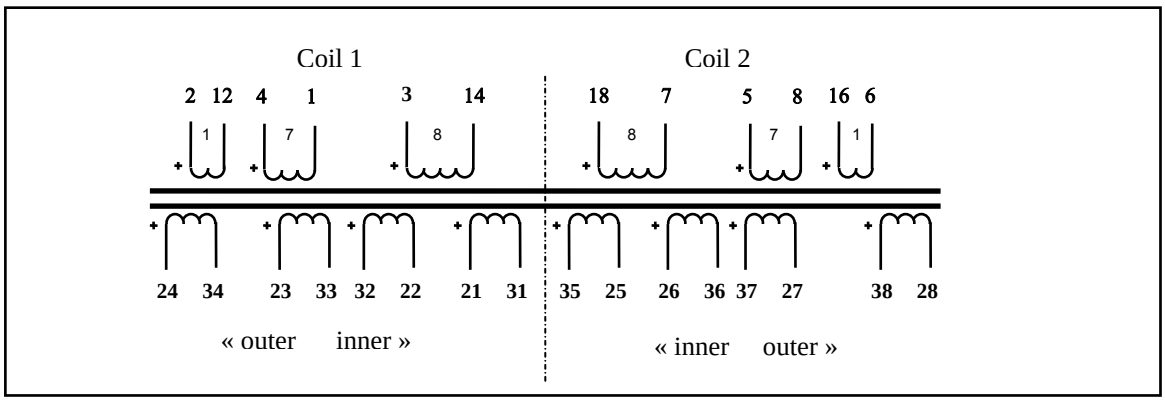
Tube Amplifier Output Transformer
LL1693

The LL1693 is a high power tube output transformer primarily for low impedance high power tubes. The transformer is built up from two coils, each consisting of 5 sections. The core is a high quality grain oriented silicon steel C-core from our own production.

Physical dimensions, pin and mounting hole layout for LL1693 (all dimensions in mm)



Winding schematics:



	LL1693	
Turns ratio (approx)	**8 + 7 + 1 + 8 + 7 + 1 : 1+1+1+1+1+1+1+1**	
Static resistance of primary (all in series)	60 Ω (2 x 15Ω + 2 x 12Ω + 2 x 3Ω)	
Static resistance of inner/outer secondary winding	0.4Ω / 0.5Ω	
Primary leakage inductance (all in series)	To be measured	
Max recommended primary DC current (heat dissipation 12W)	450 mA	
Max. primary <u>signal</u> voltage r.m.s. at 30 Hz (all in series)	Push-Pull 530V	Single End 235V

R080603

Electrical characteristics

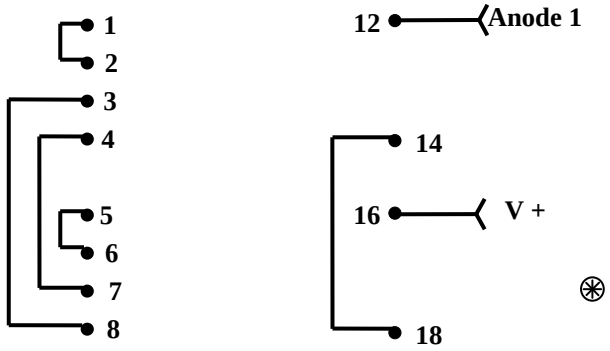
Primary Load Impedance, Max power and power loss.

	Sec. connection for 4/8/16 Ω (See next page)		
	-/B/C	B/C/D	C/D/E
	Primary Load Impedance (transformer copper resistance included)		
LL1693	2.3 kΩ	1 kΩ	600 Ω
	Power and Loss		
Max. Power, P-P at 30 Hz	180W	360W	700W
Max. Power, S.E. at 30 Hz	35W	70W	140W

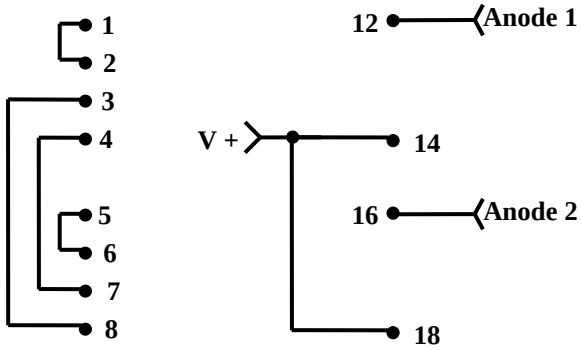
Primary DC Current Core Air-gap and Primary inductance

	LL1693/PP	LL1693/230mA
Core Airgap (delta/2)	25 µ	450 µ
Single end standing current for 0.9 Tesla (recommended operating point)		230mA
Primary inductance	150 H	16H

LL1693
Primary connection for Single-End output stage



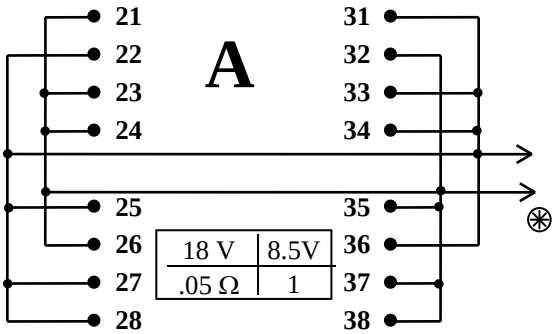
LL1693
Primary connection for Push-Pull output stage

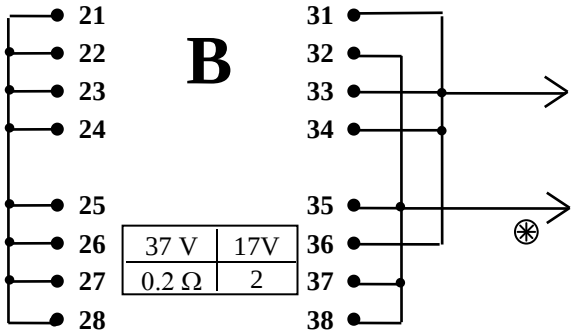


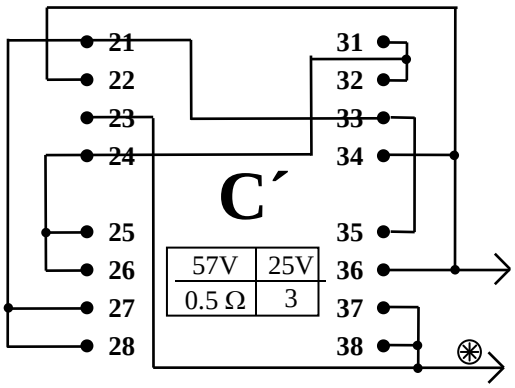
Secondary connections

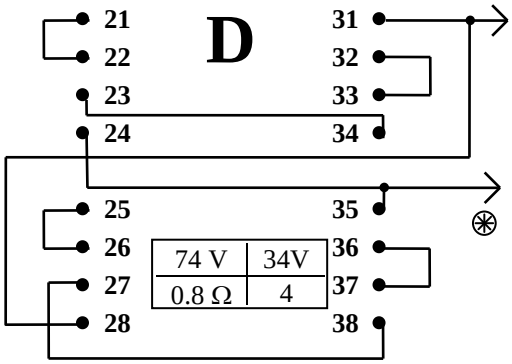
⊛ Indicates phase

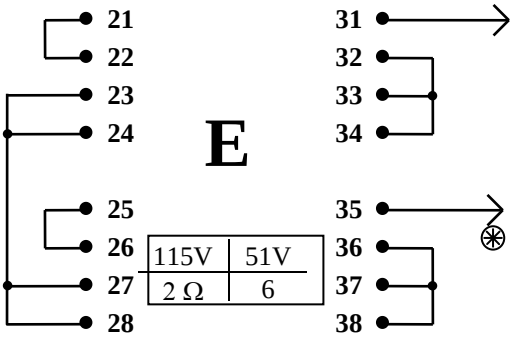
Max secondary Voltage RMS @ 30 Hz	
Push-Pull	Single Ended
Copper resistance	Windings in series

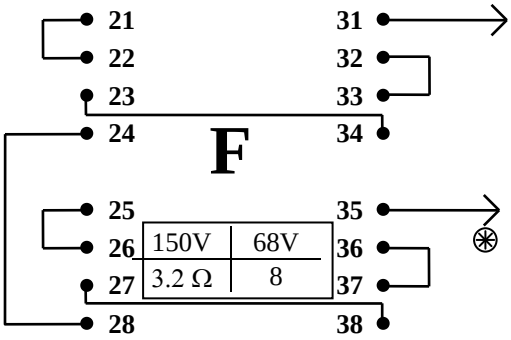












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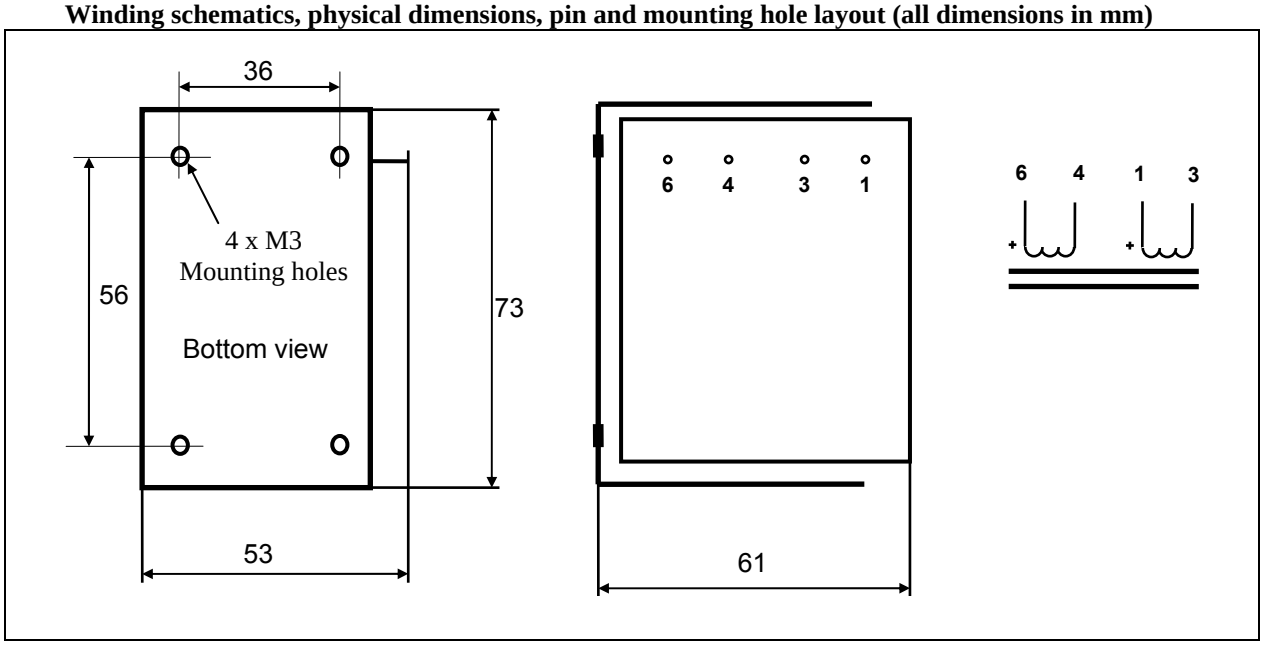
Filament Current Choke LL1694

The LL1694 is a 2 coils choke for tube/valve filament current filtering.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

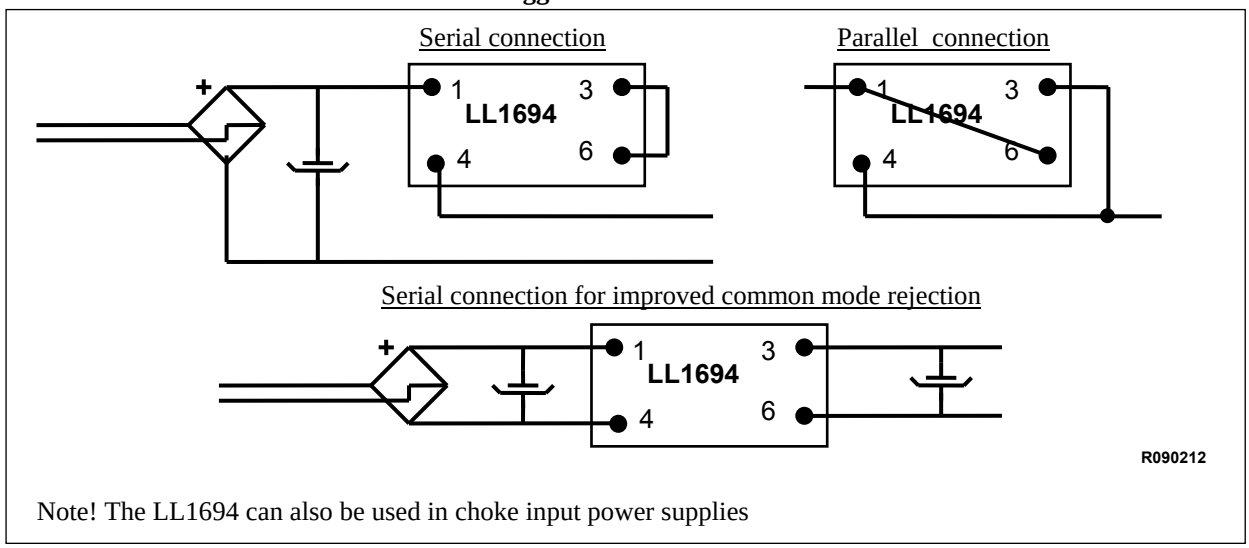
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 0.83 kg
Static resistance of each winding: 0.9 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)
LL1694 / 1.5A	0.16 H	1.5 A	2.4 A	0.04 H	3 A	4.8 A
Max. ripple voltage at rec. DC current (Ripple voltage is approx. 0.42 x input voltage)	50 V rms / 100 Hz			25 V rms / 100 Hz		

Suggested connections:



Note! The LL1694 can also be used in choke input power supplies

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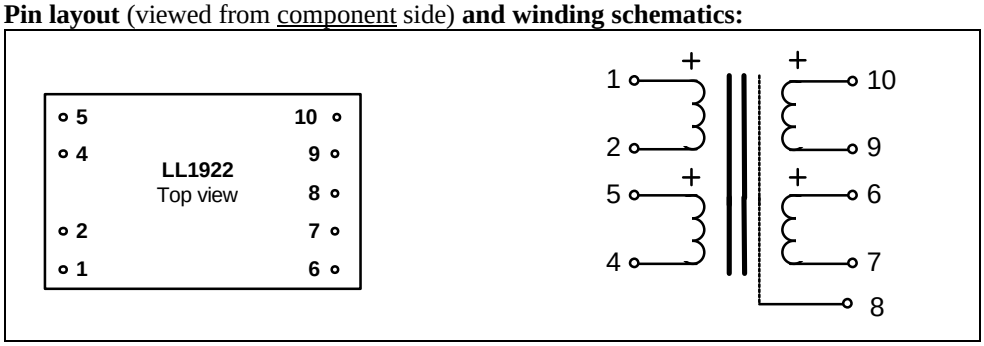
High Level Stepup Line Input Transformer
LL1922

LL1922 is a high-level input transformer similar to the UTC LS-10. Thus it is designed for step-up input from 600 ohm sources. To reach the LS-10 freq. response in 1:8 applications with nondifferential amplifier input, the internal Faraday shield must be tied to one of the source lines (the UTC LS-10 does not have any Faraday shield).
The two coils structure results in a high immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields. The core is a high permeability mu metal core. The transformer is housed in a mu-metal can.

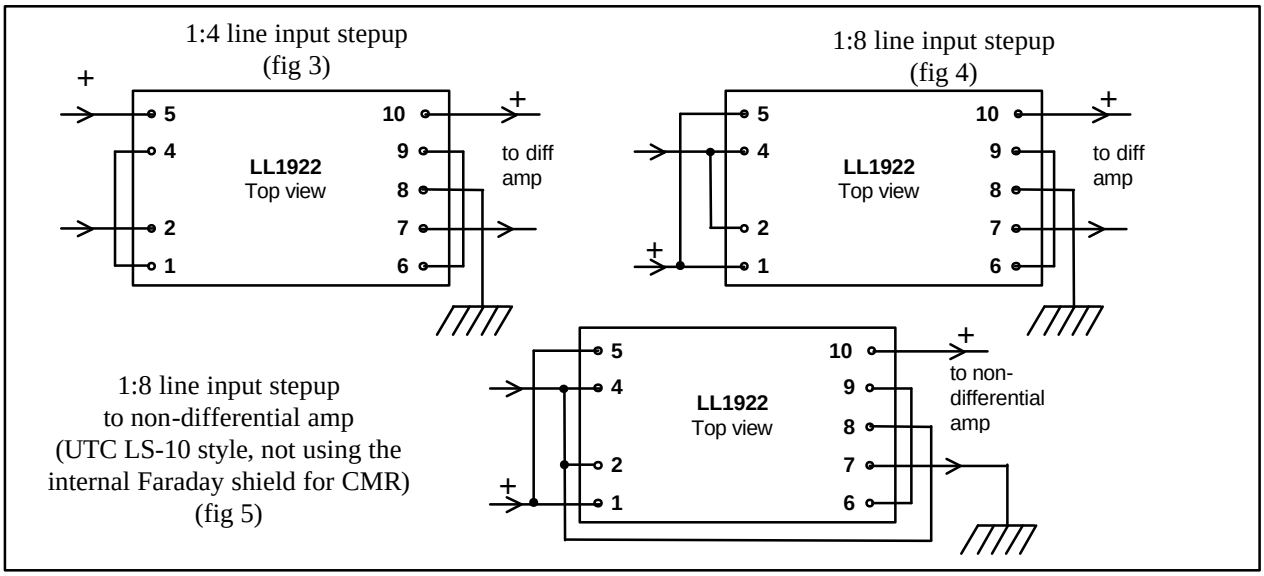
Turns ratio: 1 + 1 : 4 + 4

Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	35.56 mm (1.4")
Rec. PCB hole diameter:	1.5 mm
Weight:	115 g
Static resistance of each primary:	60Ω
Static resistance of each secondary:	730Ω
Distortion (primaries connected in series, source impedance 600Ω, load 47k. Primary signal level)):	+ 21 dBU 0.1% @ 50 Hz + 26 dBU < 1 % @ 50 Hz
Distortion (primaries connected in parallel source impedance 600Ω, load 47k. Primary signal level))::	+ 11 dBU 0.1% @ 50 Hz + 19 dBU < 1 % @ 50 Hz
Frequency response (source 600Ω, load 47 kΩ,	
Connected 1:4 (fig 3), primary level +10dBU	10 Hz -50 kHz +/- 1.0 dB
Connected 1:8 (fig 4), primary level +10dBU	10 Hz -30 kHz +/- 1.0 dB
Connected 1:8 (fig 5), primary level +10dBU	10 Hz -30 kHz +/- 1.0 dB
Isolation between windings/ between windings and shield:	4 kV / 2 kV

Connection alternatives and suggested applications:



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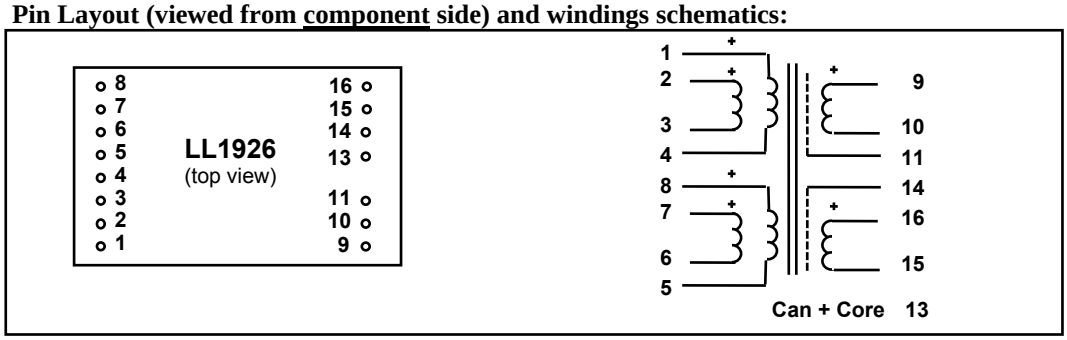
Audio Transformer
LL1926

LL1926 is an audio transformer with a variety of connection alternatives. It is designed for microphone input (step-up) applications, but can also be used as a line input step-down transformer.
The transformer consists of two coils, each with one high impedance winding surrounded by two low impedance windings, with Faraday shields between all sections. The LL1926 has a mu-metal lamination core and is housed in a mu-metal can.
The LL1926 is pin compatible with the amorphous core transformer LL1550, but LL1926 takes up more board space due to the shape of the mu metal laminations.

Turns ratio: 1 + 1 + 1 + 1 : 4 + 4
Dims: (Length x Width x Height above PCB (mm)) 37 x 23 x 12
Pin Layout (viewed from component side) and windings schematics:



Spacing between pins:		2.54 mm (0.1")
Spacing between rows of pins:		22.86 mm (0.9")
Weight:		46 g
Rec. PCB hole diameter		1.3 mm
Static resistance of windings:	2-3 or 6-7	30 Ω
	1-4 or 5-8	45 Ω
	9-10 or 15-16	290 Ω
Self resonance point:		> 100 kHz
Recommended load for best square-wave response (Connection alternative "C"):		6.7 kΩ + 470 pF
Frequency response ("C", source 600Ω , load 20 kΩ):		10 Hz - 60 kHz +/- 1.0 dB @ 0 dBU
Core:		Mu-metal lamination
Isolation between windings / between windings and shields:		3 kV / 1.5 kV

Data at different connection alternatives:

Connection Alternatives	Turns ratio	Copper Resistance Prim/sec	Suggested Use	Max input signal level (1 % THD @ 50Hz) / source impedance	THD < 0.2%@50 Hz primary level / source impedance
A	1:8	10 Ω / 580 Ω	Microphone input, 50 – 200 ohm	+7 dBU / 40 Ω	+2 dBU / 40 Ω
B	1:4	40 Ω / 580 Ω	Microphone input 200 ohms	+13 dBU / 150 Ω	+8 dBU / 150 Ω
C	1:2	150 Ω / 580 Ω	Mic. or line input	+19 dBU / 600 Ω	+13 dBU / 600 Ω

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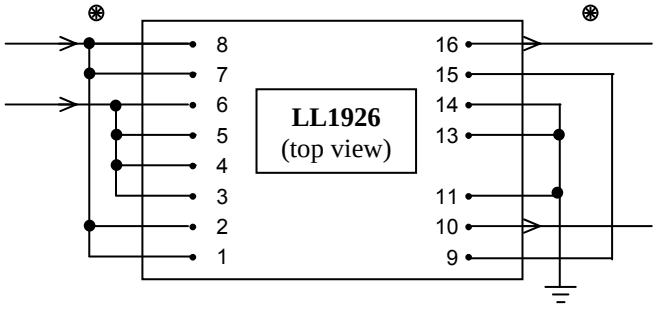
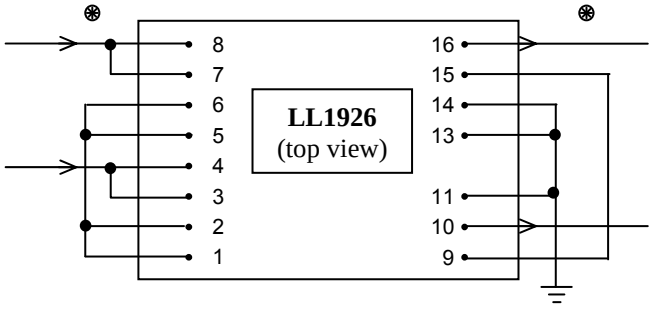
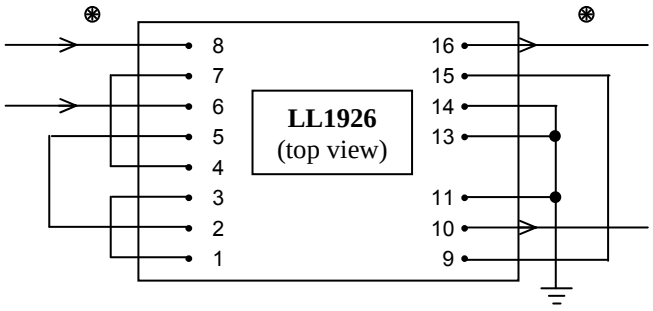
LL1926 connection alternatives



A. Turns ratio 1:8 (or 8:1 if used “backwards”)



B. Turns ratio 1:4 (or 4:1)



C. Turns ratio 1:2 (or 2:1)

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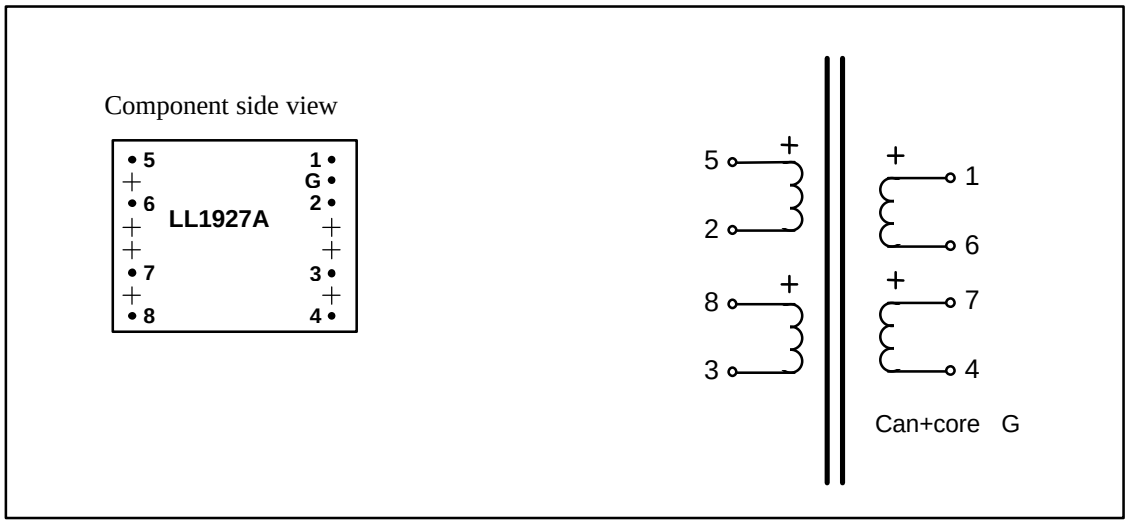
Ribbon Microphone Transformer
LL1927A

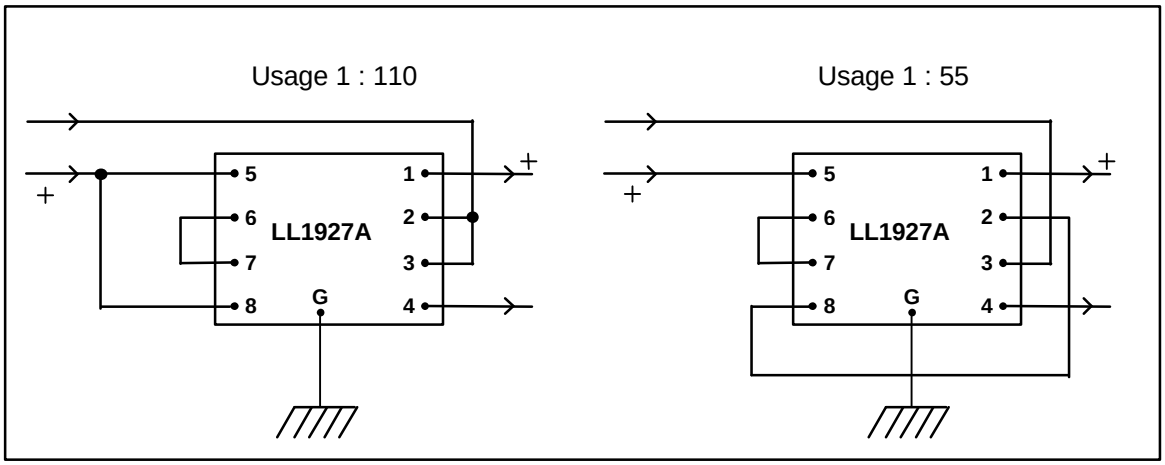
(Difference between LL1927 and LL1927A is pinout)
The LL1927A is a very high turns ratio transformers for active ribbon microphones. The transformer has an uncut amorphous strip core and is built up from two coils of each four sections for low leakage inductance.

Turns ratio: 1 + 1 **:** 55 + 55
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout and Windings Schematics:



Spacing between pin positions: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 27 g
Rec. PCB hole diameter: 1.5 mm
Housing: Mu metal
Core: High mu amorphous strip core
Static resistance of <u>each</u> primary (average): 0.05 Ω
Static resistance of <u>each</u> secondary: 182 Ω
Frequency response (Source 0.3Ω, load 10kΩ.
Connection 1 : 110. Secondary signal level 0dBU) 10Hz – 70kHz +/- 1dB

Suggested connections for ribbon microphone



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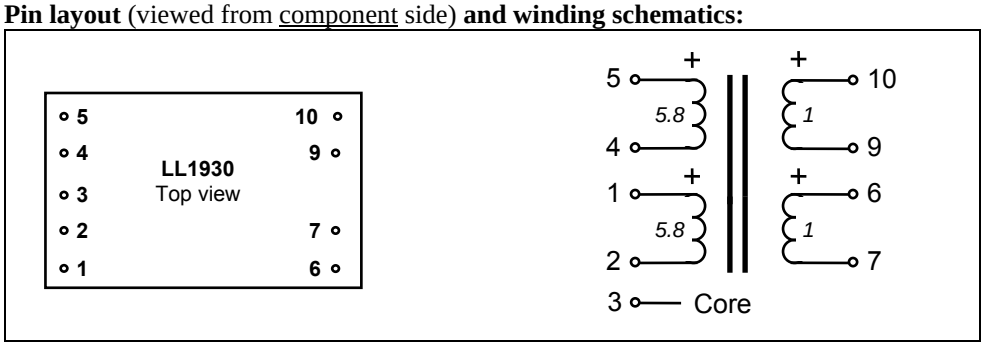
Audio transformer for tube preamp line output
LL1930

LL1930 is designed to be a line output transformer for tube preamp parafeed output applications. The core is a high permeability mu metal core. The transformer has no internal Faraday shield or magnetic shield housing.

Turns ratio: 5.8 + 5.8 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	47 x 28 x 23
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	35.56 mm (1.4")
Rec. PCB hole diameter:	1.5 mm
Weight:	105 g
Static resistance of each primary (pins 1-2, 4-5)**:**	610Ω
Static resistance of each secondary (pins 6-7, 9-10)**:**	16Ω
Distortion at 30 dBU primary signal. Source impedance 4.5k. Primaries connected in series.	< 0.1% at 50Hz < 1% at 25Hz
Frequency response. Connection and signal level as above. Secondary load 10k.	20 Hz – 30kHz < +/- 0.1 dB
Isolation between windings/ between windings and core:	4 kV / 2 kV

R090828

LUNDAHL
– TRANSFORMERS –

Tibeliusgatan 7
S-761 50 NORRTÄLJE
SWEDEN

	International	Domestic
Phone	+46 - 176 13930	0176-13930
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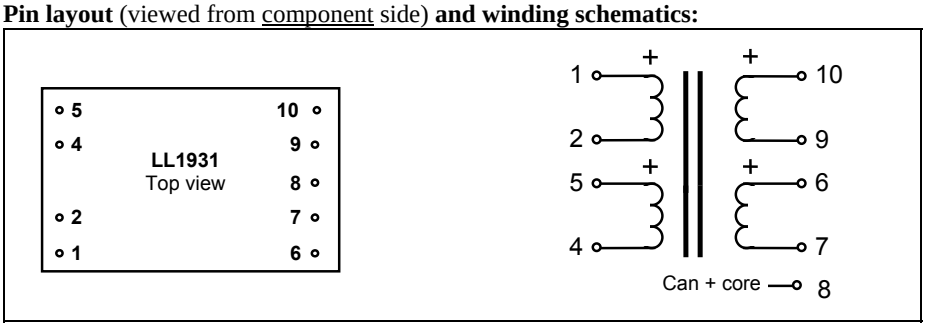
Amorphous Core Moving Coil Input Transformer
LL1931

LL1931 is a high performance moving coil step-up transformer. The transformer combines our unique uncut amorphous cobalt core and our dual coil structure with Cardas high purity copper wire in an oversized design. The objective is to provide the best possible MC transformer, cost-no-object. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc.. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 8 + 8

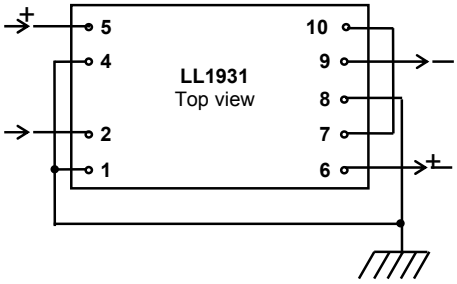
Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	43 x 28 x 22
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	30.5 mm (1.2")
Rec. PCB hole diameter:	1.5 mm
Weight:	80 g
Static resistance of each primary:	1.8 Ω
Static resistance of each secondary:	105 Ω
Frequency response (serial connection, source 50 Ω, no load / secondaries open):	10 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:	3 kV / 1.5 kV

Connection alternatives:

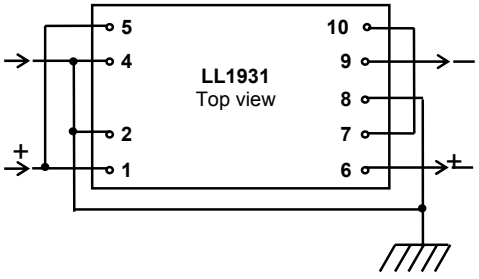
Serial-serial connection 1 : 8



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:16



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R090627

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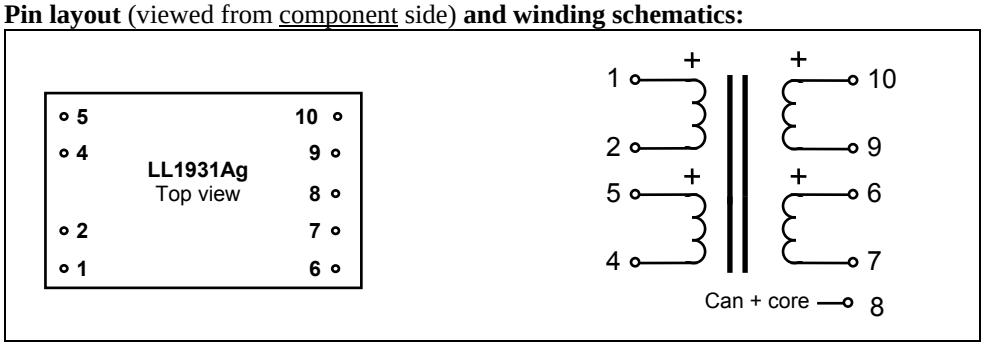
Silver Wire Amorphous Core Moving Coil Input Transformer LL1931Ag

LL1931Ag is a silver wire version of our high performance moving coil step-up transformer LL1931. The LL1931Ag combines our unique uncut amorphous cobalt core and our dual coil structure with high purity (99.99%) silver wire in an oversized design. The objective is to provide the best possible MC transformer, cost-no-object. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc.. The transformer is housed in a mu-metal housing.

Turns ratio: 1 + 1 : 8 + 8

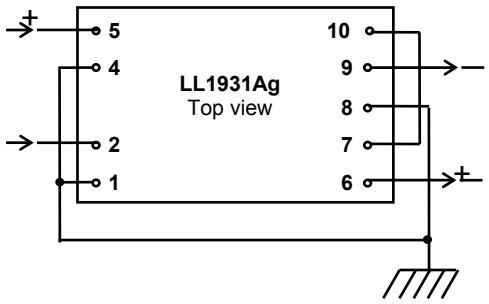
Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	43 x 28 x 22
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		30.5 mm (1.2")
Rec. PCB hole diameter:		1.5 mm
Weight:		80 g
Static resistance of each primary:		1.5 Ω
Static resistance of each secondary:		95 Ω
Frequency response	(serial connection, source 50 Ω, no load / secondaries open):	10 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:		3 kV / 1.5 kV

Connection alternatives:

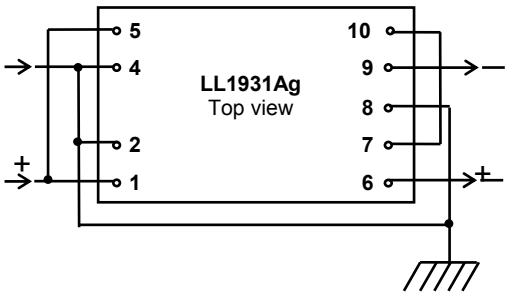
Serial-serial connection 1 : 8



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:16



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R120329

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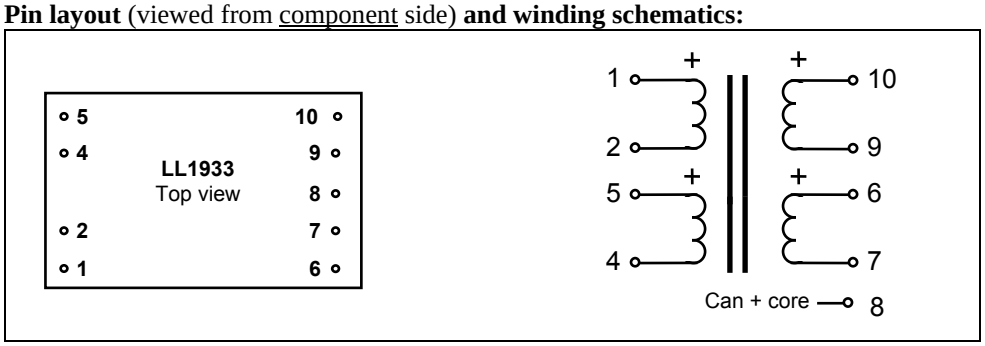
Moving Coil Input Transformer
LL1933

LL1933 is a high performance moving coil step-up transformer. The transformer combines our dual coil structure with Cardas high purity copper wire in an oversized design. The objective with LL1933 is to provide an alternative for the successful amorphous core LL1931 for those who prefer a low distortion, linear magnetization curve nickel lamination core transformer. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 8 + 8

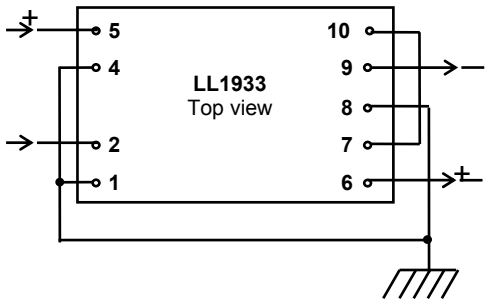
Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	35.6 mm (1.4")
Rec. PCB hole diameter:	1.5 mm
Weight:	115 g
Static resistance of each primary:	1.5 Ω
Static resistance of each secondary:	85 Ω
Frequency response (serial connection, source 50 Ω, no load / secondaries open):	8 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:	3 kV / 1.5 kV

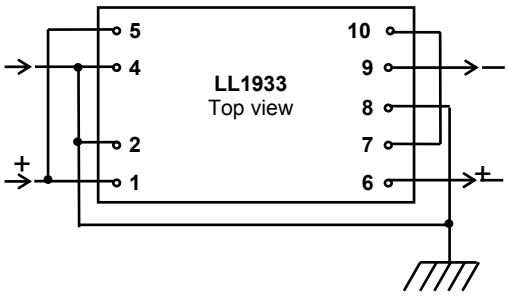
Connection alternatives:

Serial-serial connection 1 : 8



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

Parallel-serial connection 1:16



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

R090209

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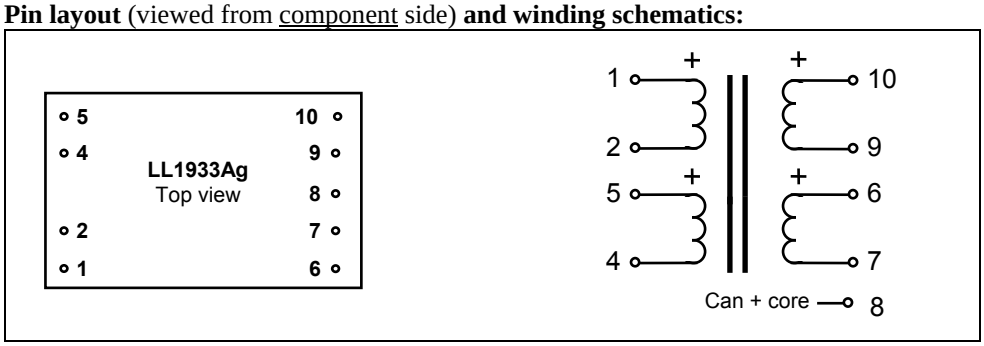
Silver Wire Moving Coil Input Transformer
LL1933Ag

LL1933Ag is a silver wire version of our high performance moving coil step-up transformer LL1933. The LL1931Ag combines our dual coil structure with high purity (99.99%) silver wire in an oversized design. The core is a mu metal lamination core for low distortion and for a linear magnetization curve. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc. The transformer is housed in a mu-metal housing.

Turns ratio: 1 + 1 : 8 + 8

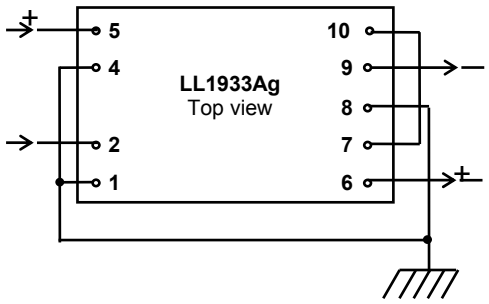
Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.6 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		115 g
Static resistance of each primary:		1.3 Ω
Static resistance of each secondary:		80 Ω
Frequency response	(serial connection, source 50 Ω, no load / secondaries open):	8 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:		3 kV / 1.5 kV

Connection alternatives:

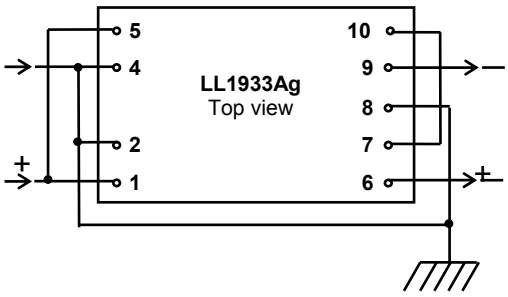
Serial-serial connection 1 : 8



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:16



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R120329

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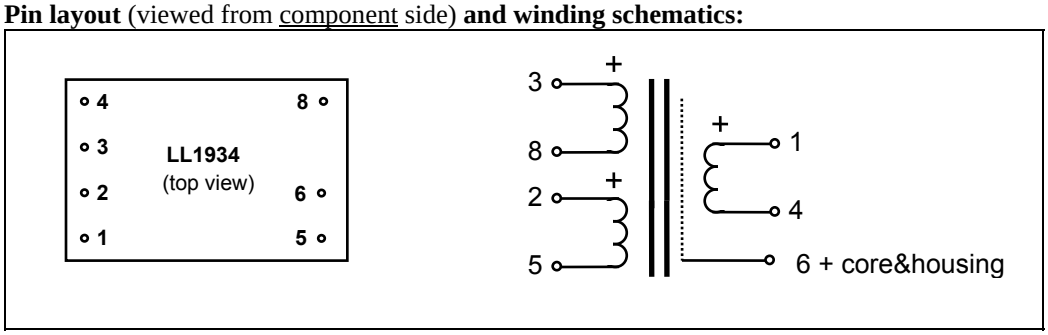
Microphone Transformer
LL1934

The LL1934 is small size microphone input transformer, with a high permeability mu-metal core and two two-section coils with internal Faraday shields.
The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 7

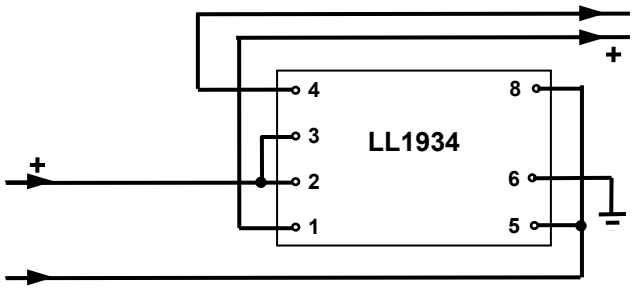
Pin layout (viewed from component side) **and winding schematics:**



Dimensions Max. Length x Width x Height above PCB (mm)	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Weight
28 x 17.5 x 12	3.81 mm(0.15”)	20.32 mm (0.8”)	1.5 mm	18 g

	LL1934
Turns ratio	1 + 1 : 7
Static resistance of each primary	35 Ω
Static resistance of secondary	1 kΩ
Primary level at 0.2 % THD, 50 Hz signal Primaries connected in parallel, source impedance 150Ω	-10 dBU
Primary level at 1 % THD, 50 Hz signal Primaries connected in parallel, source impedance 150Ω	-2 dBU
Frequency response +/- 1.0 dB Primary signal level -10 dBU, source 200 Ω Primaries in parallel, secondary termination 10k	15Hz – 60kHz
Isolation between windings / between windings and shield	3 kV / 1.5 kV

Connection for 1 : 7



R081201

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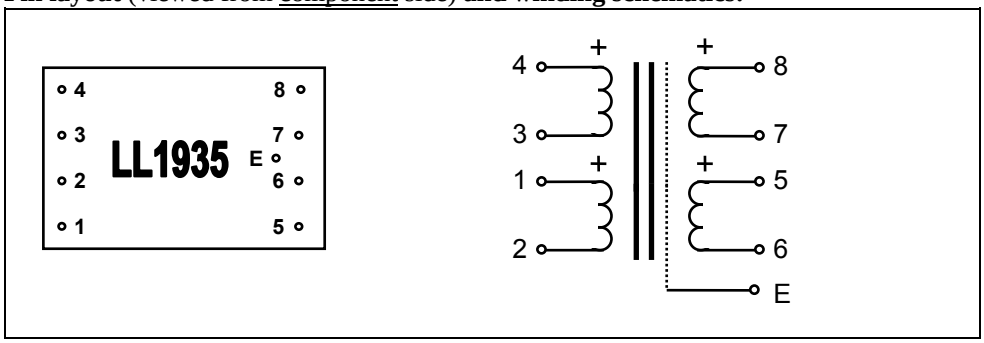
DI Transformer
LL1935

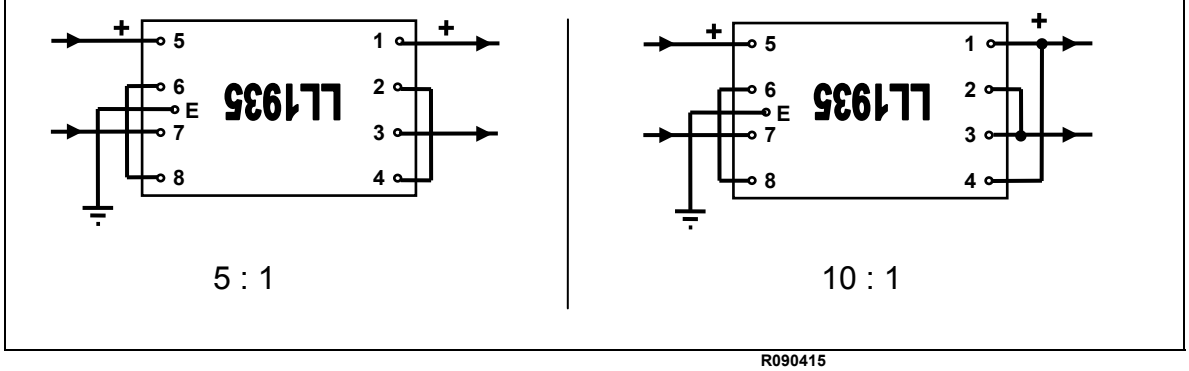
LL1935 is a transformer designed for DI (Direct Input) applications, matching high impedance guitar pickups to low impedance microphone preamp inputs, but is also ideal for 1:10 microphone input applications. The transformer consists of two coils, each with one primary and one secondary winding separated by an electrostatic shield, and a high permeability mu-metal core. The high impedance windings are wound using a special low capacitance winding technique. The transformer is encapsulated in a mu-metal case for magnetic shielding.
For best performance, the high impedance side of the transformer (5 + 5) should be connected in series.

Turns ratio: 1 + 1 : 5 + 5
Dims (Length x Width x Height above PCB (mm)): 38 x 23 x 16
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	27.94 mm (1.1")
Offset of earth pin from adjacent row:	2.54 mm (0.1")
Weight:	46 g
Recommended PCB hole diameter:	1.5 mm
Static resistance of each primary (pins 5-6 and 7-8):	650 Ω
Static resistance of each secondary (pins 1-2 and 3-4):	17 Ω
Frequency response (reference 1.0 kHz) 10:1, source 100 kΩ , secondary open: 10:1, source 100 kΩ, load 1 kΩ 1:10, source 200 Ω, secondary open	 20 Hz – 20 kHz +0 / -3 dB 10 Hz – 45 kHz +0 / -2 dB 10 Hz – 80 kHz +/- 1dB
Distortion For practical reasons measured in 1:10 configuration. Source 150Ω, load 10k (Audio Precision portable)	-5 dBU input level, +14 dBU output level < 0.1% THD @ 50 Hz +7 dBU input level, +26 dBU output level < 1% THD @ 50 Hz
Self resonance point :	None detected in above configurations
Isolation between windings/ between windings and shield	4 kV / 2 kV

Connection alternatives (Component side view):



R090415

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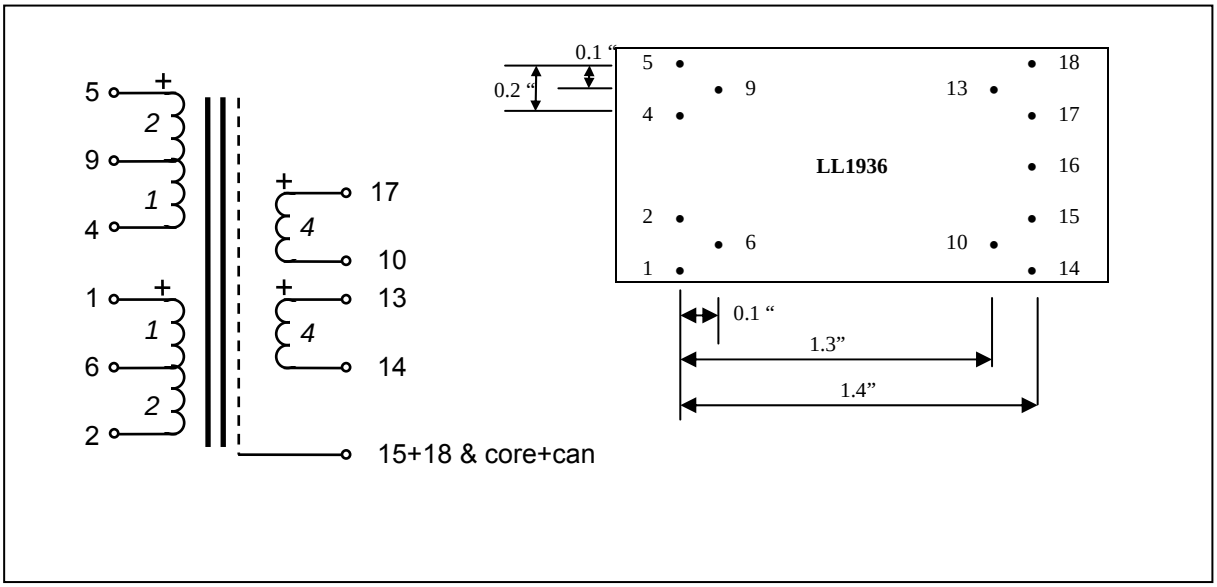
Microphone Input Transformer
LL1936

The LL1936 is a microphone input transformer which can be connected for microphones with different impedance. It is built using our dual coil structure, with a mu metal lamination core. The transformer is magnetically shielded by a mu metal housing.

Turns ratio: **(**2+1) + (2+1) : 4 + 4
Dims (Length x Width x Height above PCB (mm)): 48 x 29 x 20
Pin layout (viewed from component side) **and winding schematics:**



Weight: 90 g
Rec. PCB hole diameter: 1.5 mm

Secondary connection	Out+	Out-	Connect (= Output centertap)
for 1200 Ω real or virtual impedance	17	14	10 + 13

Input impedance (1200 ohm load)	Turns ratio	In+	In-	Connect	Faraday shield and housing
75 Ω	2 : 8	5 + 6	9 + 2		15 + 18
150 Ω	3 : 8	5 + 1	4 + 2		15 + 18
300 Ω	4 : 8	5	2	9 + 6	15 + 18
600 Ω	6 : 8	5	2	4 + 1	15 + 18

Static resistance of each primary 1 (9-4 or 1-6):	13 Ω
Static resistance of each primary 2 (5-9 or 6-2):	24 Ω
Static resistance of each secondary:	50 Ω
Distortion Source 600 Ω, primary connection for 600 Ω	0.1% THD @10dBU, 50Hz 1% THD @ 20dBU, 50Hz
Frequency response: Balanced input, 0 dBU signal level, source 600Ω , load 10kΩ	10Hz – 100kHz +/- 1dB rel. 1kHz
Isolation between primary and secondary windings/ between windings and shield:	4kV / 2kV

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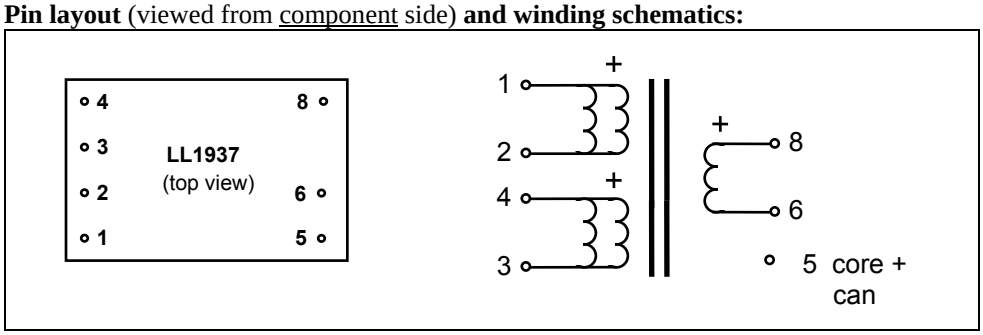
Moving Coil Transformer
LL1937

The LL1937 is small size transformer for impedance matching between MC cartridges and phono preamps. The LL1937 consists of two three-section coils and a high permeability mu-metal core.
The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 30

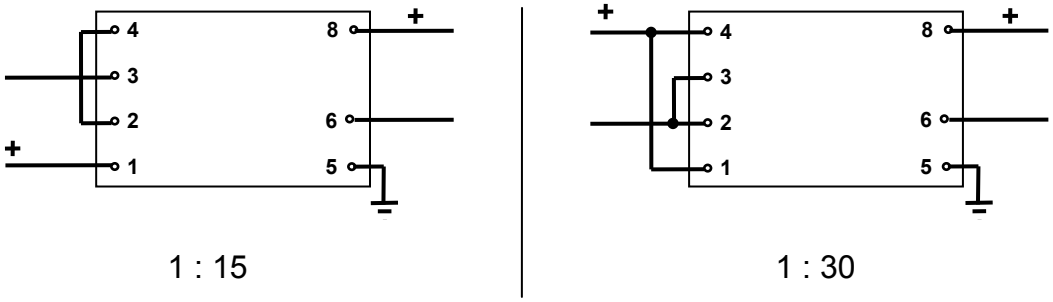
Pin layout (viewed from component side) **and winding schematics:**



Dimensions Max. Length x Width x Height above PCB (mm)	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Weight
28 x 17.5 x 12	3.81 mm(0.15”)	20.32 mm (0.8”)	1.5 mm	18 g

	LL1937
Turns ratio	1 + 1 : 30
Static resistance of each primary	1.7 Ω
Static resistance of secondary	660 Ω
Isolation between windings / between windings and shield	3 kV / 1.5 kV

Connection alternatives



R100222

Application hint:
As the LL1937 does not have Faraday shields, both sides of the transformer should have a common ground reference.

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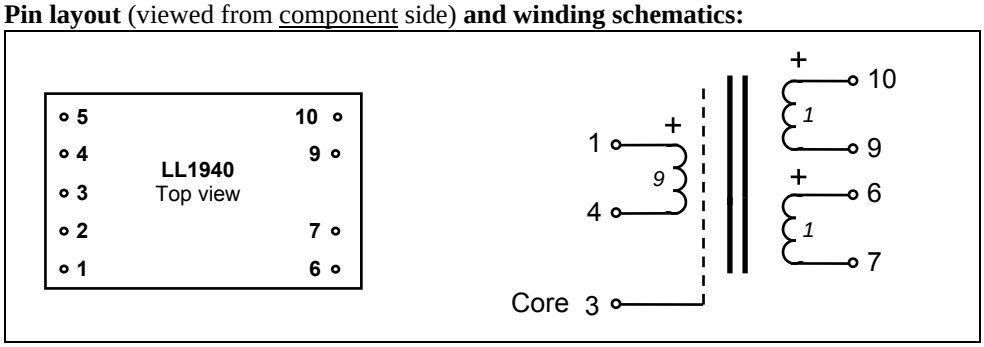
Tube microphone output transformer
LL1940

LL1940 is a high turns ratio transformer designed for tube microphones. Conventionally, this type of transformer has a mu metal lamination core for minimum distortion and maximum transparency. For the LL1940 we have chosen a silicon iron C-core (with approx 10 times as high distortion compared to mu metal) to add more "transformer character" to the signal. The transformer has an internal Faraday shield for optimal output balance, but no housing.

Turns ratio: 9 : 1 + 1

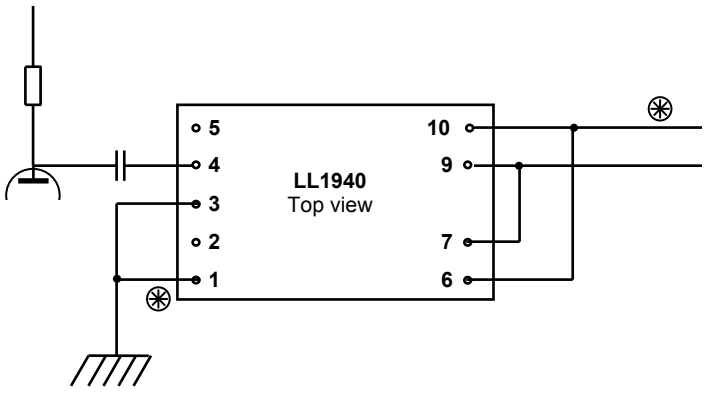
Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	31 x 25 x 16
Spacing between pins	3.81 mm (0.15")
Spacing between rows of pins	22.86 mm (0.9")
Rec. PCB hole diameter:	1.5 mm
Weight:	35 g
Static resistance of primary (pins 1-4)**:**	1.5 kΩ
Static resistance of each secondary (pins 6-7, 9-10)**:**	34Ω
Max primary signal level.	18V RMS at 20Hz 45V RMS at 50 Hz
Primary no load impedance	30 kΩ at 50 Hz
Frequency response. Source impedance 10k. Load 600 ohms Secondaries connected in parallel	20 Hz – 50kHz + 0 / - 3 dB 40Hz – 30 kHz + 0 / -1 dB
Frequency response. Source impedance 50k. Load 600 ohms Secondaries connected in parallel	50 Hz – 40kHz + 0 / - 3 dB
Distortion. Source impedance 10k.	Approx 1% THD at 50Hz, 20dBU primary level.
Isolation between windings/ between windings and core:	4 kV / 2 kV

R110923

Typical application, tube microphone output, 9:1



⊛ Indicates phase

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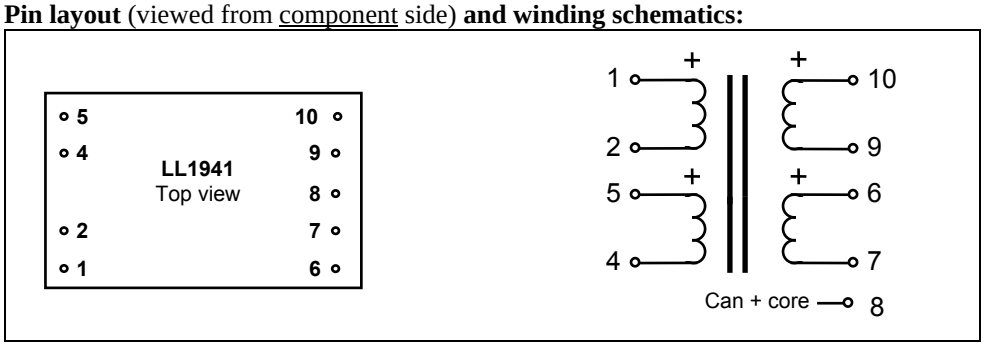
Amorphous Core Moving Coil Input Transformer
LL1941

LL1941 is a high turns ratio version of our LL1931 moving coil step-up transformer. The LL1941 transformer combines our unique uncut amorphous cobalt core and our dual coil structure with Cardas high purity copper wire in an oversized design. The objective is to provide the best possible MC transformer, cost-no-object, for low output MC cartridges. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc.. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 16 + 16

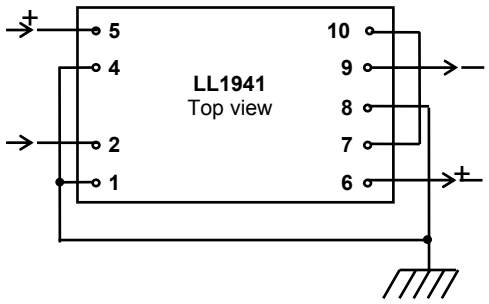
Pin layout (viewed from component side) **and winding schematics:**



Dimensions (L x W x H above PCB, in mm)	43 x 28 x 22
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	30.5 mm (1.2")
Rec. PCB hole diameter:	1.5 mm
Weight:	90 g
Static resistance of each primary:	0.8 Ω
Static resistance of each secondary:	105 Ω
Frequency response (serial connection, source 10 Ω, no load / secondaries open):	10 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:	3 kV / 1.5 kV

Connection alternatives:

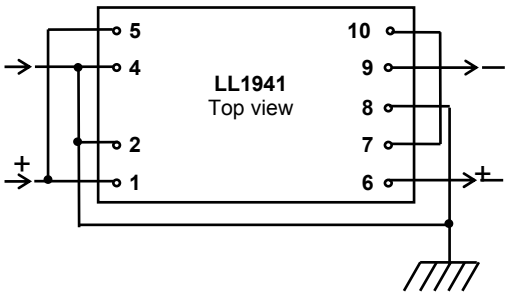
Serial-serial connection 1 : 16



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:32



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R101123

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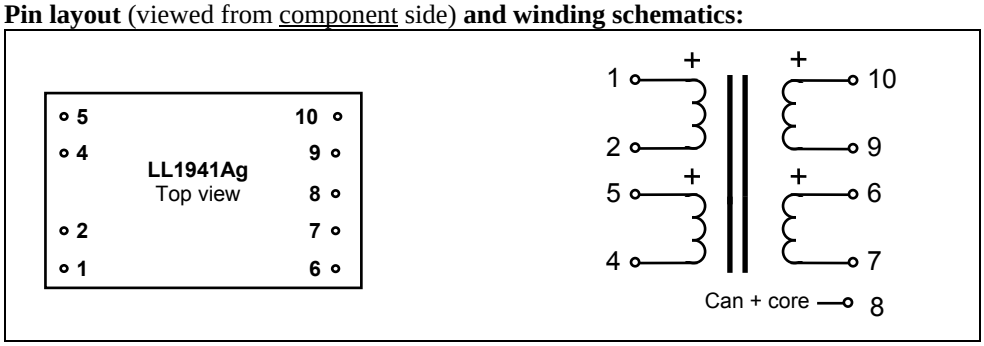
Silver Wire Amorphous Core Moving Coil Input Transformer LL1941Ag

LL1941Ag is a silver wire version of our high turn's ratio, high performance moving coil step-up transformer LL1941. The LL1941Ag combines our unique uncut amorphous cobalt core and our dual coil structure with high purity (99.99%) silver wire in an oversized design. The objective is to provide the best possible MC transformer, cost-no-object, for low output MC cartridges. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc.. The transformer is housed in a mu-metal housing.

Turns ratio: 1 + 1 : 16 + 16

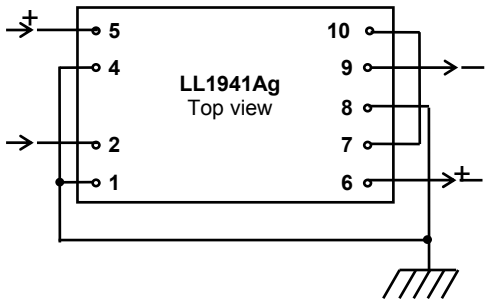
Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	43 x 28 x 22
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		30.5 mm (1.2")
Rec. PCB hole diameter:		1.5 mm
Weight:		90 g
Static resistance of each primary:		0.5 Ω
Static resistance of each secondary:		95 Ω
Frequency response	(serial connection, source 10 Ω, no load / secondaries open):	10 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:		3 kV / 1.5 kV

Connection alternatives:

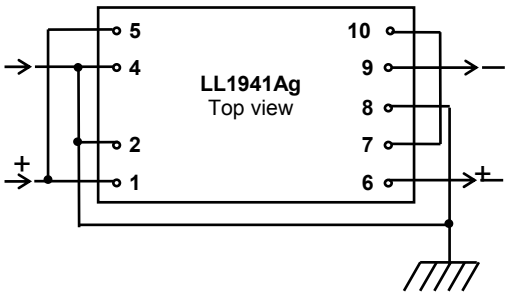
Serial-serial connection 1 : 16



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:32



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R120329

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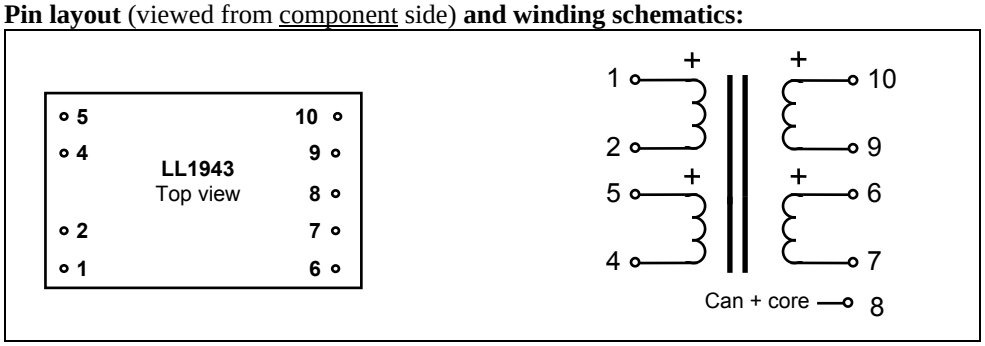
Moving Coil Input Transformer
LL1943

LL1943 is a high turns ratio of our LL1933 high performance moving coil step-up transformer. The LL1943 transformer combines our dual coil structure with Cardas high purity copper wire in an oversized design. The objective with LL1943 is to provide an alternative for the amorphous core LL1941 for those who prefer a low distortion, linear magnetization curve nickel lamination core transformer. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 16 + 16

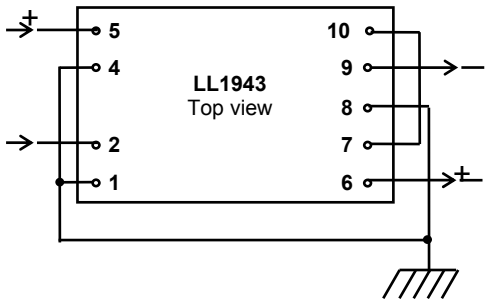
Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.6 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		115 g
Static resistance of each primary:		0.8 Ω
Static resistance of each secondary:		85 Ω
Frequency response	(serial connection, source 10 Ω, no load / secondaries open):	8 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:		3 kV / 1.5 kV

Connection alternatives:

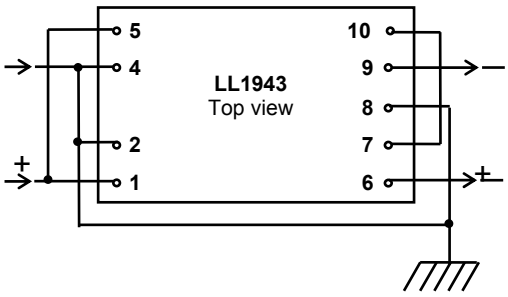
Serial-serial connection 1 : 16



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:32



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

R101122

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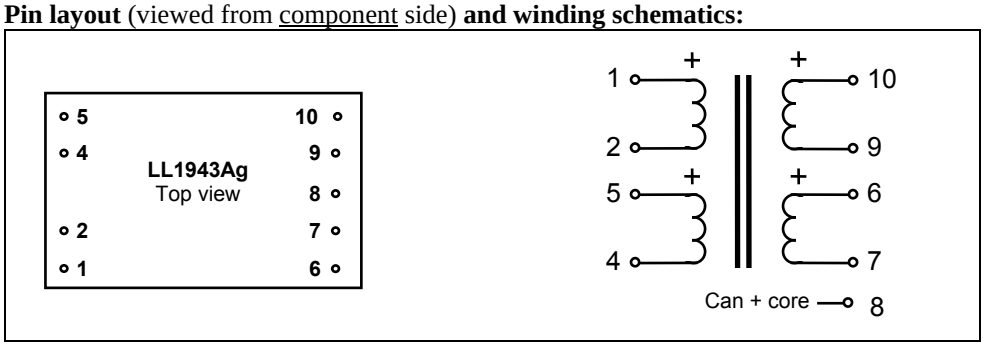
Silver Wire Moving Coil Input Transformer
LL1943Ag

LL1943Ag is a silver wire version of our LL1943 high turns ratio, high performance moving coil step-up transformer. The LL1943Ag combines our dual coil structure with high purity (99.99%) silver wire in an oversized design. The core is a mu metal lamination core for low distortion and for a linear magnetization curve. The dual-coil structure greatly improves immunity to external magnetic fields from power supplies, motors etc. The transformer is housed in a mu-metal can.

Turns ratio: 1 + 1 : 16 + 16

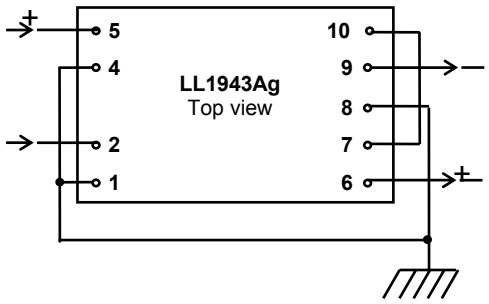
Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.6 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		115 g
Static resistance of each primary:		0.4 Ω
Static resistance of each secondary:		80 Ω
Frequency response	(serial connection, source 10 Ω, no load / secondaries open):	8 Hz -- 100 kHz +/- 1.0 dB
Isolation between windings/ between windings and core:		3 kV / 1.5 kV

Connection alternatives:

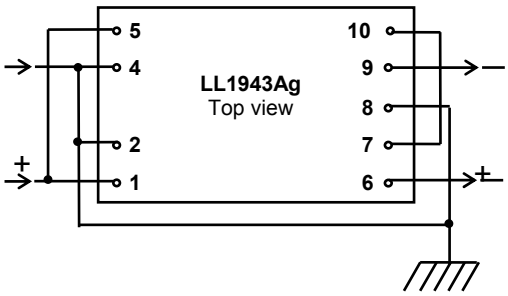
Serial-serial connection 1 : 16



Cartridge is grounded through primary center tap. If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

If cartridge cable is unbalanced (such as a coaxial cable), ground cartridge through pin 2 and not through pins 1+4.

Parallel-serial connection 1:32



Cartridge is grounded through primary "cold". If phono preamp input is unbalanced, connect pins 9 and 8 to input ground.

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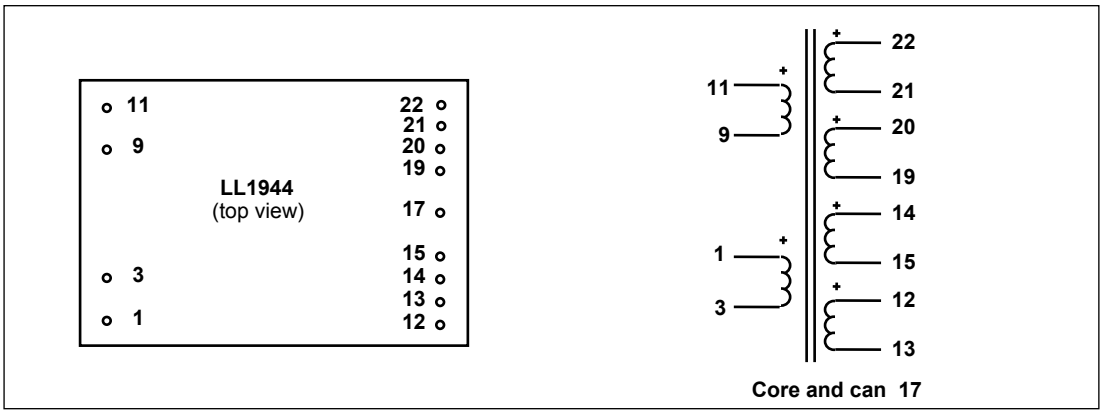
Audio Split Transformer
LL1944

LL1944 is a four-output splitting transformer to be used with low impedance signal sources.
Each of the four secondary windings is surrounded by primary winding sections. In addition to low leakage inductance, this ensures that output signal is maintained (but slightly dropped) on three of the secondary windings even if one of the secondaries is short-circuited, provided that the source is enough low impedance.
The primary windings should normally be used in parallel.

Turns ratio: 1 + 1 : 1 + 1 + 1 + 1

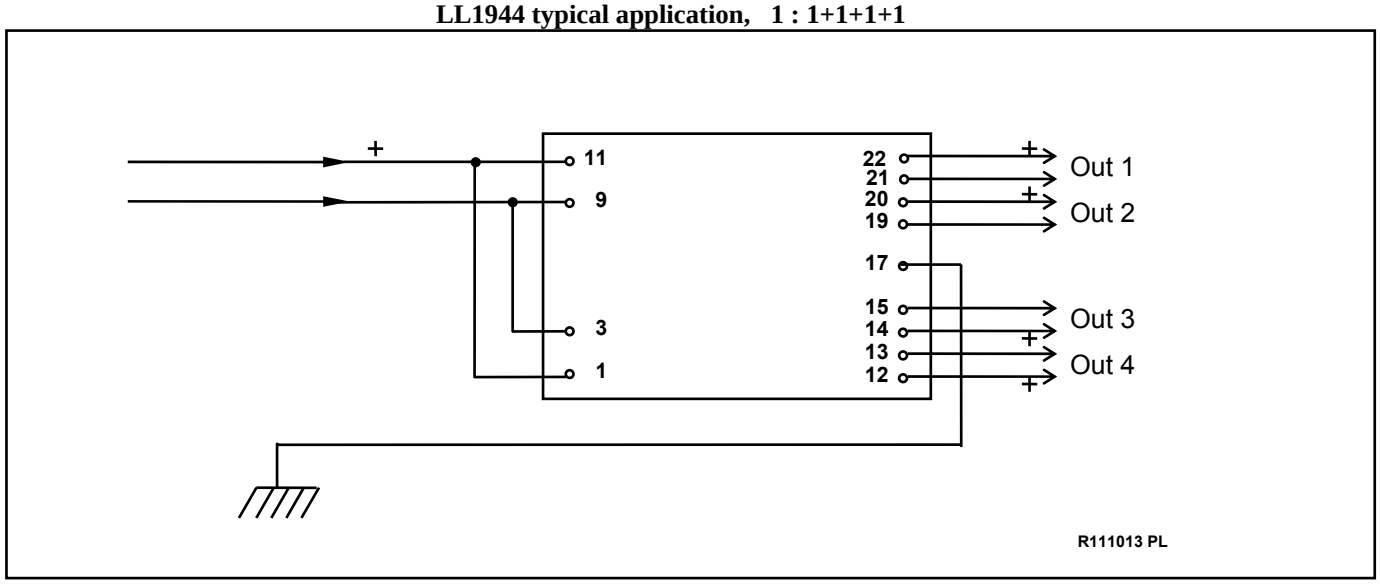
Dims: (Length x Width x Height above PCB (mm)) 47 x 34 x 23

Pin Layout (viewed from component side) and Windings Schematics (simplified):



Housing:	Mu-metal
Core:	Silicon Iron C-core
Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	130 g
Rec. PCB hole diameter:	1.3 mm
Static resistance of <u>each</u> primary (average):	54 Ω
Static resistance of <u>each</u> secondary (average):	110 Ω
Max. secondary level (each secondary)	+ 28 dBU @ 50 Hz
No-load primary impedance(primaries in parallel, primary level)**:**	> 0.9 kΩ @ 50 Hz, +20 dBU
Balance of output (according to IRT, source 10 Ω , Load 600 Ω):	> 60 dB
Frequency response (source 10 Ω, each sec. loaded with 600 Ω, 0 dBU sec. level):	20 Hz - 50 kHz +/- 0.5 dB
Isolation between primary and secondary windings:	4 kV
Isolation between between windings and shields:	2 kV

LL1944 typical application, 1 : 1+1+1+1



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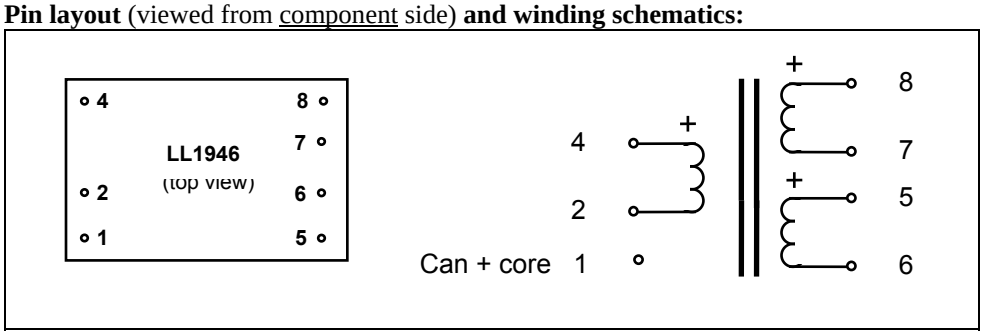
Line Transformer
LL1946

The LL1946 is a small size line transformer, with a high permeability mu-metal core and two two-section coils. The transformer is housed in a mu-metal can.

Turns ratio: 2 : 1 + 1

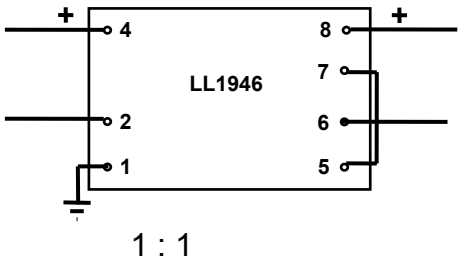
Pin layout (viewed from component side) **and winding schematics:**



Dimensions Max. Length x Width x Height above PCB (mm)	Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter	Weight
28 x 17.5 x 11	3.81 mm(0.15”)	20.32 mm (0.8”)	1.5 mm	16 g

	LL1946
Turns ratio	2 : 1 + 1
Static resistance of primary	8 Ω
Static resistance of each secondary	5 Ω
Primary level at 0.1 % THD, 150 Hz signal Source impedance 40Ω	**+3 dBU**
Frequency response +/- 1.5 dB Primary signal level -5 dBU, source 40 Ω	**100Hz – 40kHz**
Isolation between windings / between windings and core+housing	3 kV / 1.5 kV

Connection alternatives



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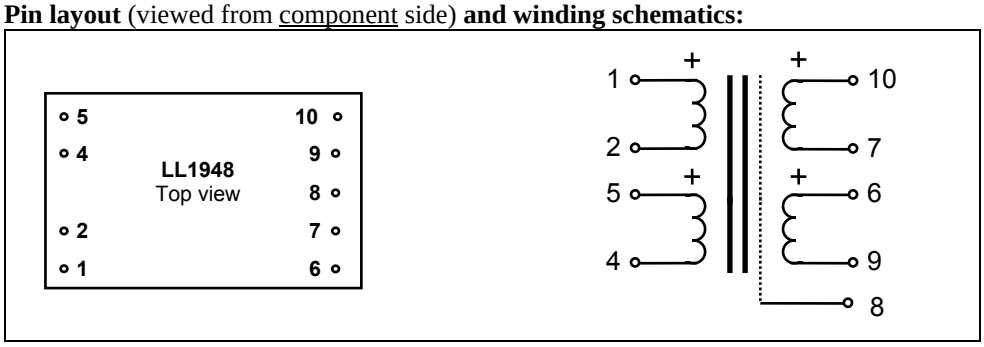
Amorphous Core Line Input Transformer
LL1948

LL1948 is a high-level line input transformer designed with audiophile applications in mind. The LL1948 combines Cardas high purity copper wire windings with our own cobalt-based amorphous core. The transformer is suitable for preamplifier or power amplifier line input with or without phase splitting. The windings are arranged to give perfect symmetry and high noise immunity. The two coil structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields. The transformer is housed in a mu-metal can.

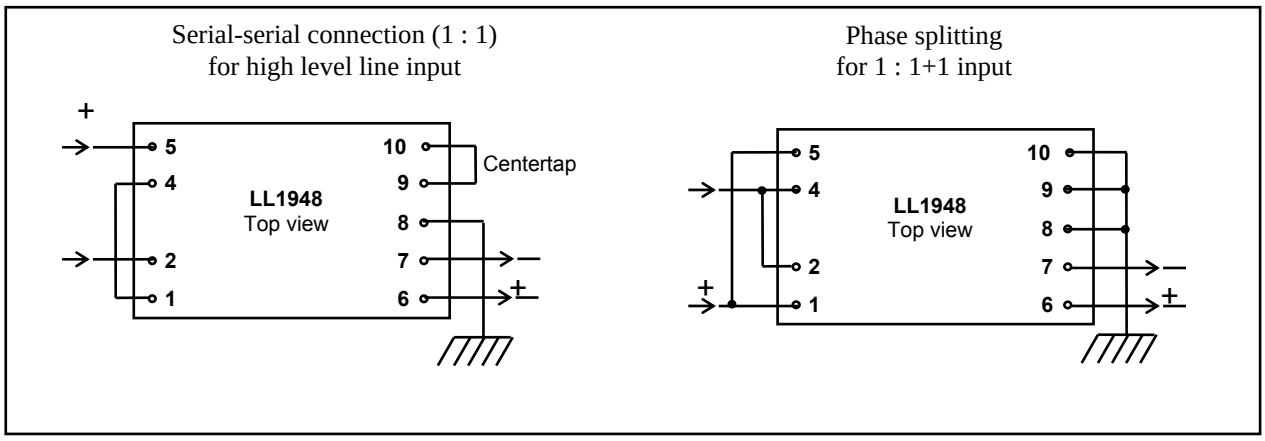
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	43 x 29 x 23
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		30.5 mm (1.2")
Rec. PCB hole diameter:		1.5 mm
Weight:		81 g
Static resistance of each primary:		75Ω
Static resistance of each secondary:		75Ω
Distortion	(primaries connected in series, source impedance 600Ω):	+ 25 dBU 0.2% @ 50 Hz + 28 dBU < 1 % @ 50 Hz
Self resonance point:		> 120 kHz
Frequency response	(source 600Ω, load 10 kΩ, serial connection):	10 Hz -- 100 kHz +/- 1.0 dB
Phase response	(deviation from linear phase)	20 Hz – 30kHz, +/- 0.5°
Isolation between windings/ between windings and shield:		3 kV / 1.5 kV

Connection alternatives and suggested applications:



R121218 PL

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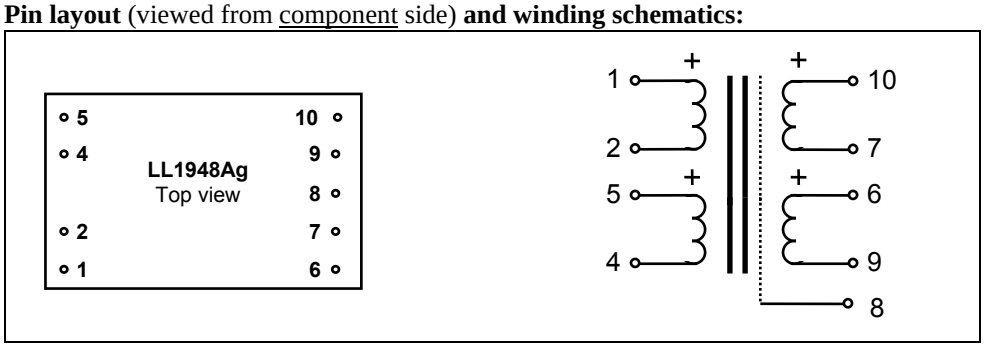
Silver Wire, Amorphous Core
Line input Transformer
LL1948Ag

LL1948Ag is a high-level line input transformer for audiophile applications, suitable for amplifier line input with or without phase splitting. The windings are arranged to give perfect symmetry and high noise immunity. The two coil structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Primary and secondary windings are separated by electrostatic shields. The transformer is housed in a mu-metal can.

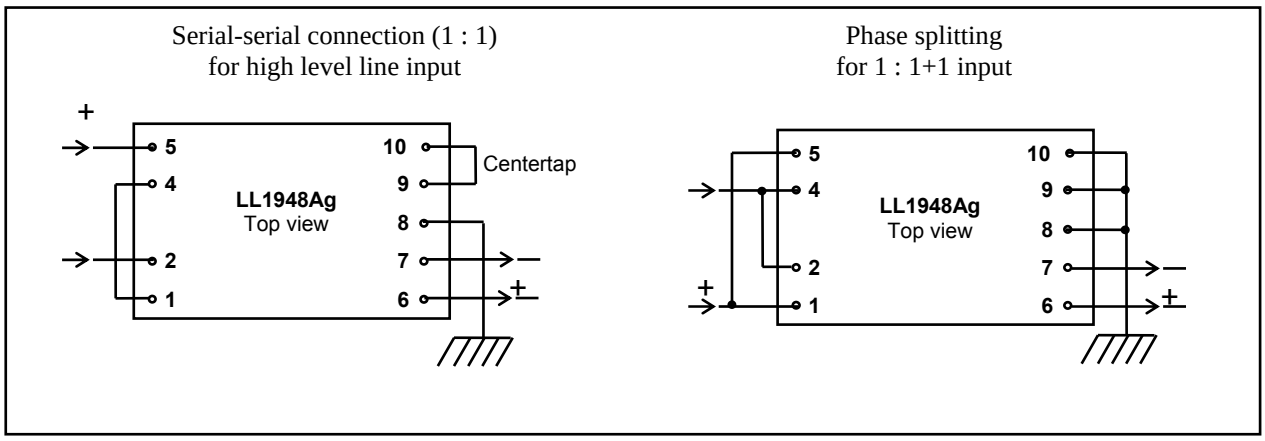
Turns ratio: 1 + 1 : 1 + 1

Pin layout (viewed from component side) **and winding schematics:**



Dimensions	(L x W x H above PCB, in mm)	43 x 29 x 23
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		30.5 mm (1.2")
Rec. PCB hole diameter:		1.5 mm
Weight:		81 g
Static resistance of each primary:		72Ω
Static resistance of each secondary:		72Ω
Distortion	(primaries connected in series, source impedance 600Ω):	+ 25 dBU 0.2% @ 50 Hz + 28 dBU < 1 % @ 50 Hz
Self resonance point:		> 120 kHz
Frequency response	(source 600Ω, load 10 kΩ, serial connection):	10 Hz -- 100 kHz +/- 1.0 dB
Phase response	(deviation from linear phase)	20 Hz – 30kHz, +/- 0.5°
Isolation between windings/ between windings and shield:		3 kV / 1.5 kV

Connection alternatives and suggested applications:



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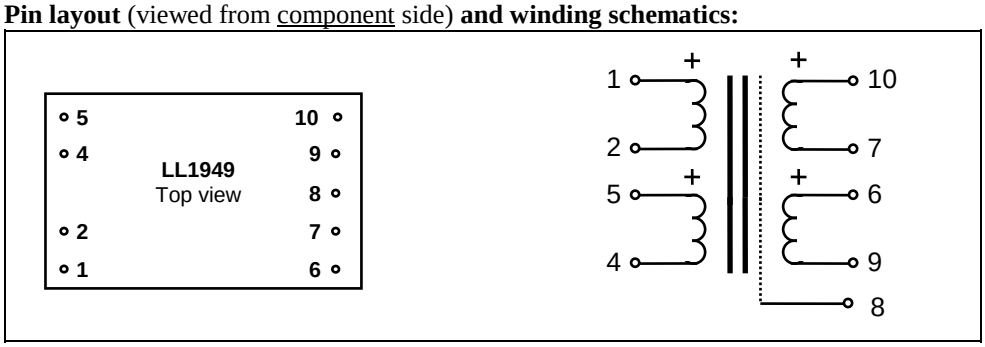
Line Input Transformer 2+2 : 1+1
LL1949

LL1949 is a high-level line input transformer normally used 2:1 . The windings are arranged to give perfect symmetry if the transformer is used in phase splitting input applications. The two-coil structure also greatly improves immunity to external magnetic fields from e.g. power supplies and motors. Coils are wound using Cardas high purity post annealed audiophile grade copper wire Primary and secondary windings are separated by electrostatic shields. The core is a high permeability mu metal core. The transformer is housed in a mu-metal can.

Turns ratio: 2 + 2 : 1 + 1

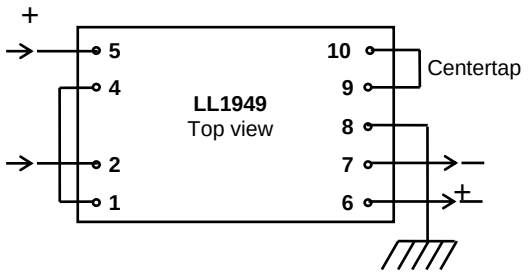
Pin layout (viewed from component side) **and winding schematics:**



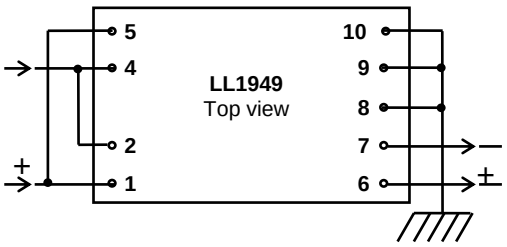
Dimensions	(L x W x H above PCB, in mm)	47 x 28 x 24
Spacing between pins		5.08 mm (0.2")
Spacing between rows of pins		35.56 mm (1.4")
Rec. PCB hole diameter:		1.5 mm
Weight:		115 g
Static resistance of each primary:		81Ω
Static resistance of each secondary:		20 Ω
Distortion	(primaries connected in series, source impedance 600Ω):	+ 24 dBU 0.1% @ 50 Hz + 29 dBU < 1 % @ 50 Hz
Self resonance point:		> 150 kHz
Frequency response	(source 600Ω, load 10 kΩ, serial connection, ref 1 kHz, 6dBU input signal):	10 Hz -- 120 kHz +/- 0.5 dB
Phase response	(deviation from linear phase)	20 Hz – 20kHz, +/- 0.5°
Isolation between windings/ between windings and shield:		4 kV / 2 kV

Connection alternatives and suggested applications:

Serial-serial connection (2 : 1) for high level line input



Phase splitting for 2 : 1+1 input



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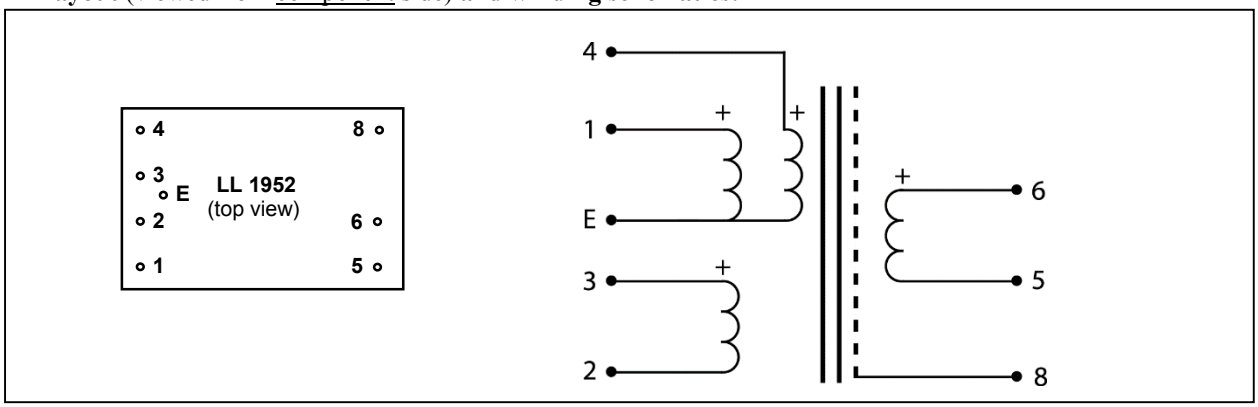
Microphone and Line Input Transformer
LL1952

The LL1952 is an input transformer with dual primaries. The purpose is to be able to handle both line level signals in a 1:1 configuration, or microphone level signals in a 1:4 configuration. This is useful where space is limited, for instance in combination with a hybrid connector (XLR and jack) input.
As usual for our input transformers, primary and secondary windings are separated by Faraday shields.
The transformer is encapsulated in a mu-metal housing for magnetic shielding.

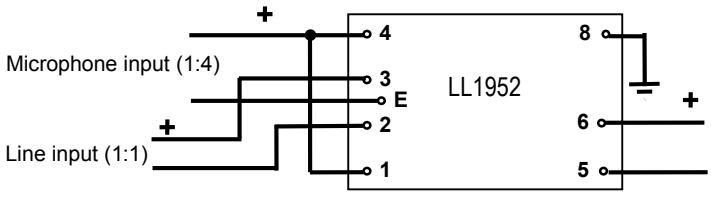
Turns ratio: 1 : 4 (mic stepup) or 1 : 1 (line input)

Pin layout (viewed from component side) **and winding schematics:**



Dimensions (Max. Length x Width x Height above PCB (mm))	38 x 24 x 17
Spacing between pins	5.08 mm (0.2")
Spacing between rows of pins	27.94 mm (1.1")
Spacing between row 1-4 and E pin	2.54 mm (0.1")
Weight	46 g
Rec. PCB hole diameter	1.5 mm
Static resistance of primary 1+4 – E when connected as below	16Ω
Static resistance of primary 2 – 3	575 Ω
Static resistance of secondary 5-6	490 Ω
Distortion, microphone connection configuration, source impedance 150Ω	0.2 % @ 2 dBU primary level, 50 Hz
Distortion, mic input as above	1 % @ + 9 dBU primary level, 50 Hz
Distortion, line input configuration, source impedance 600 ohms	0.2 % @ +14 dBU primary level, 50 Hz
Distortion, line input as above	1 % @ +22 dBU primary level, 50 Hz
Frequency response: mic input 200 ohms **or** line input 600 ohms. Load 16k (with 16k load reflected impedance is 1k (mic) or 16k (line))	10 Hz - 80 kHz +/- 1 dB ref 1kHz
Isolation between primary and secondary windings/ between windings and shield	4 kV / 2 kV

Suggested connection



NOTE! The unused input (microphone or line) must not be shortcircuited

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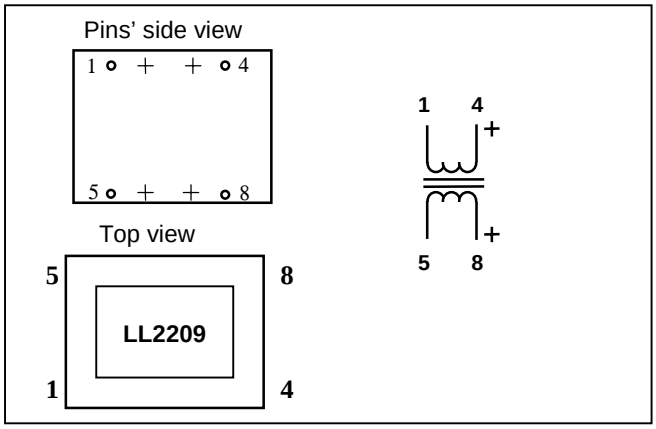
Line Transformer
LL2209

LL2209 is a small size line transformer with a mu-metal core.

Turns ratio: 1 : 1
Dims (Length x Width x Hight above PCB (mm)): 26.5 x 21 x 13
Pin layout and winding schematics:



Spacing between pins:	15.24 mm (0.6")
Spacing between rows of pins:	15.24 mm (0.6")
Weight:	20 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of primary (1 -- 4)**:**	61 Ω
Static resistance of secondary (5 -- 8)**:**	43 Ω
Frequency response (@ 0 dBU, source 2kΩ**,** load 5 kΩ)	20 Hz - 200 kHz +/- 0,5 dB
Isolation between primary and secondary windings:	4 kV

R960528

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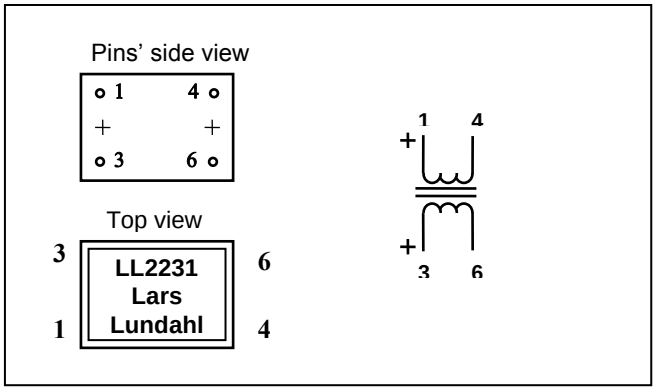
Line Transformer
LL2231

LL2231 is a small size line transformer with an amorphous strip core.

Turns ratio: 1 : 1
Dims (Length x Width x Height above PCB (mm)): 14.5 x 13.5 x 11.5
Pin layout and winding schematics:



Spacing between pins:	7.62 mm (0.3")
Spacing between rows of pins:	10.16 mm (0.4")
Weight:	5 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of primary:	48 Ω
Static resistance of secondary:	64 Ω
Frequency response (@ -10 dBU, source 600Ω**,** load 10 kΩ)	50 Hz - 100 kHz +/- 1 dB
Isolation between primary and secondary windings:	4 kV

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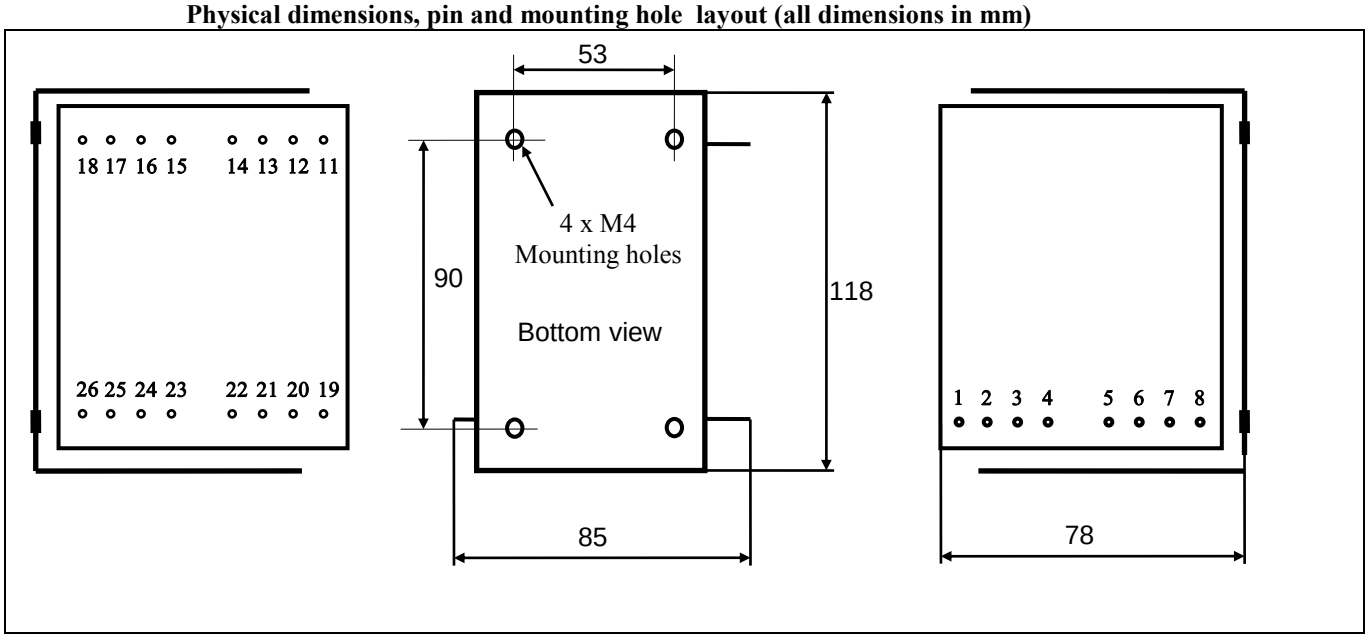
Universal Power Line Transformer
LL2410

LL2410 is a high inductance line transformer for connecting PA system loudspeakers to power lines. The transformer is highly sectioned, with harmonically sized sections, which results in a minimum leakage inductance. The twelve windings can be combined in a number of ways, but symmetry between coil 1 and coil 2 is essential for good performance.
The transformer has a special audio C-core of our own production.

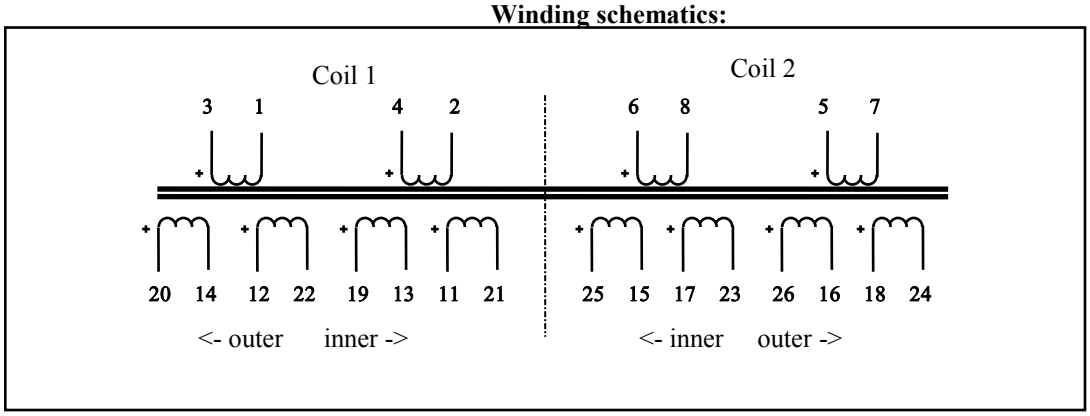
Turns ratio: 2+2+2+2 : 1+1+1+1+1+1+1+1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins: 5.08 mm (0.2")
Weight: 2.5 kg

Winding schematics:



Static resistance of each primary (avarage): 0.80 Ω
Static resistance of each secondary (avarage): 0.40 Ω
Max voltage per primary winding, at 50 Hz: 40 volts
Max voltage per secondary winding, at 50 Hz: 20 volts

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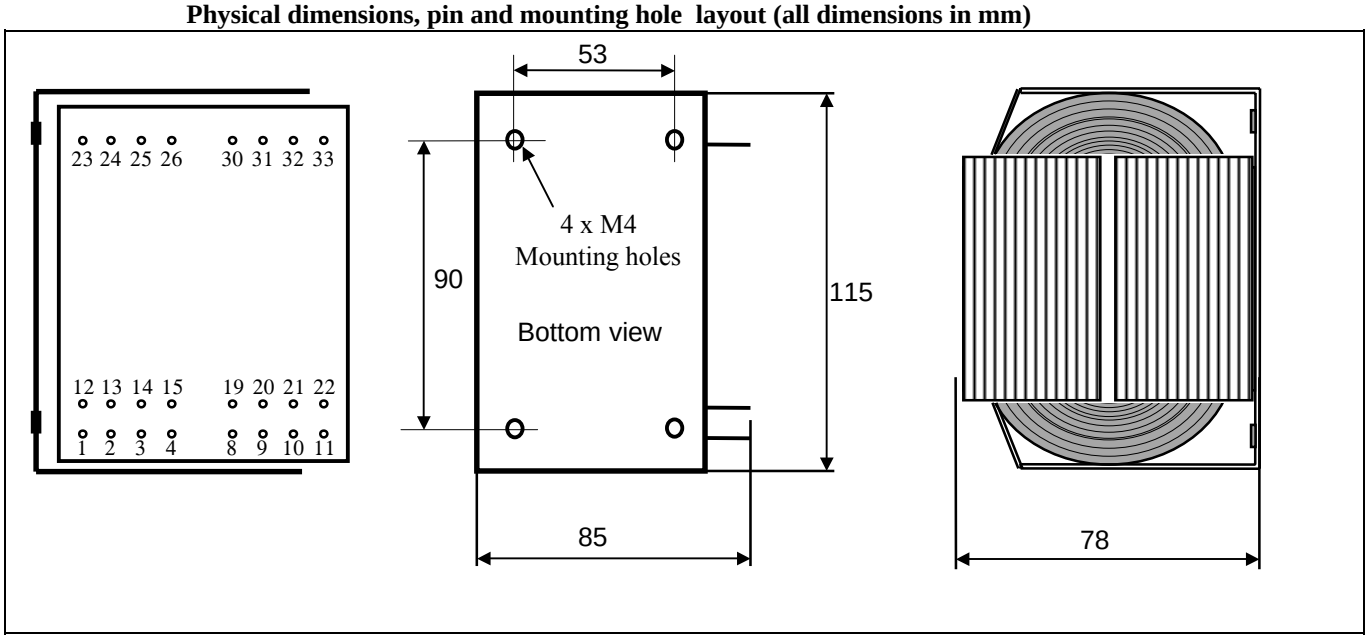
Universal Power Line Transformer
LL2411

LL2411 is a high inductance line transformer for connecting PA system loudspeakers to power lines. The transformer is highly sectioned with harmonically sized sections. This results in minimum leakage inductance and thus an excellent frequency response. The twelve windings can be combined in a number of ways, but symmetry between coil 1 and coil 2 is essential for good performance.
The transformer has a special audio C-core of our own production.

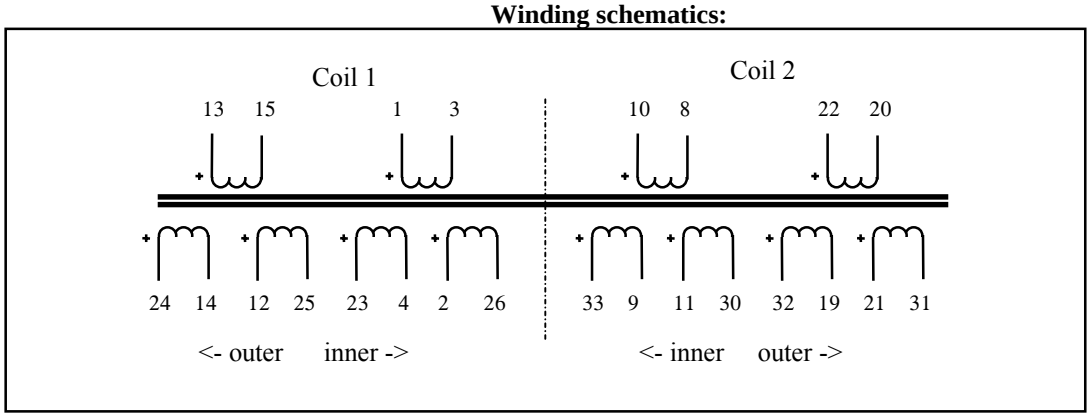
Turns ratio: 2+2+2+2 : 1+1+1+1+1+1+1+1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 73.66 mm / 10.16mm (2.9" / 0.4"
Weight: 2.5 kg

Winding schematics:



Static resistance of each primary (avarage): 0.80 Ω
Static resistance of each secondary (avarage): 0.40 Ω
Max voltage per primary winding, at 50 Hz: 40 volts
Max voltage per secondary winding, at 50 Hz: 20 volts

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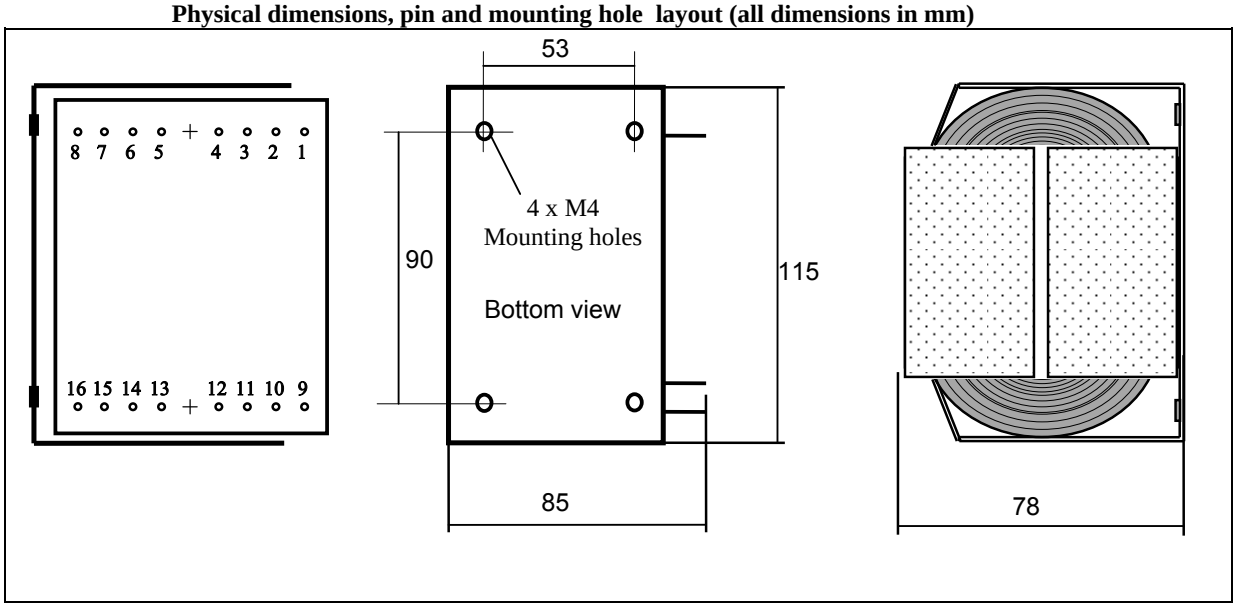
Universal Power Line Transformer
LL2414

LL2414 is a high inductance line transformer for connecting PA system loudspeakers to power lines. The transformer is based on the very flexible (too flexible?) LL2410, but sectioning is reduced to facilitate usage in most applications. The eight windings can be combined in a number of ways, but symmetry between coil 1 and coil 2 is essential for good performance.
The transformer has a special audio C-core of our own production.

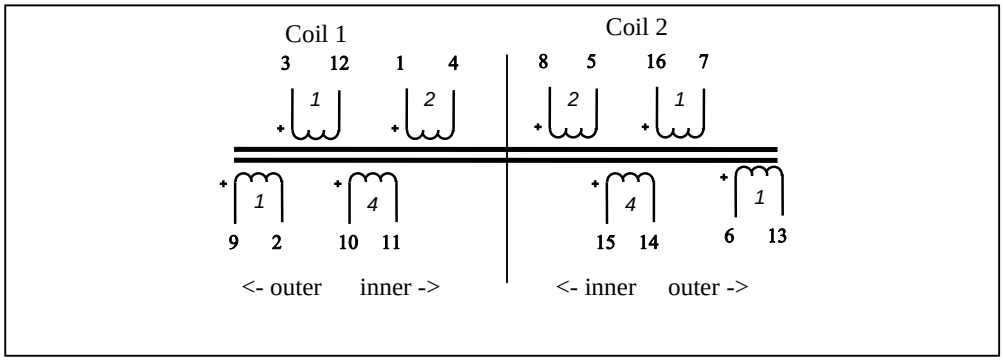
Turns ratio: 1 + 1 + 2 + 4 : 1 + 1 + 2 + 4

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Core type	Lundahl audio C-core
Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	76.20 mm (3.0")
Distance between groups of pins in one row:	20.32 mm (0.8")
Rec. PCB hole diameter:	2 mm
Weight:	2.5 kg

Winding schematics:



Windnings	Static resistance	Max voltage rms across winding at 50 Hz
1 - 4 and 8 – 5	0.8 Ω	40 V
10 – 11 and 15 – 14	1.7 Ω	80 V
3 – 12 and 16 – 7	0.5 Ω	20 V
9 – 2 and 6 – 13	0.5 Ω	20 V

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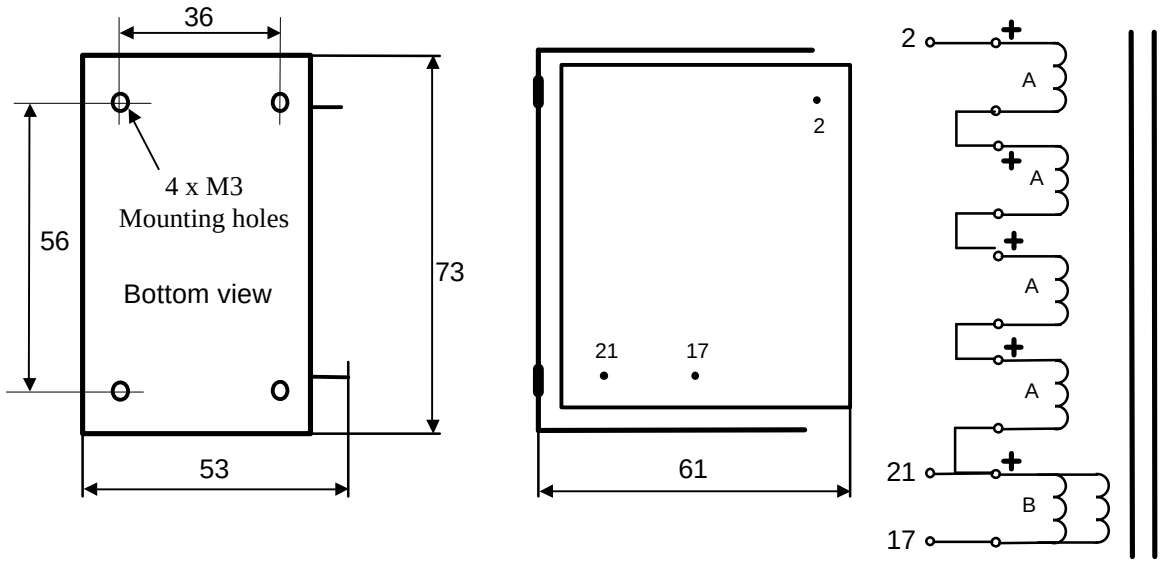
Loudspeaker transformer
LL2417

Turns ratio 3 : 1
For 65V input to 50W across 8 ohms load
Dual coil structure with Lundahl audio C-core

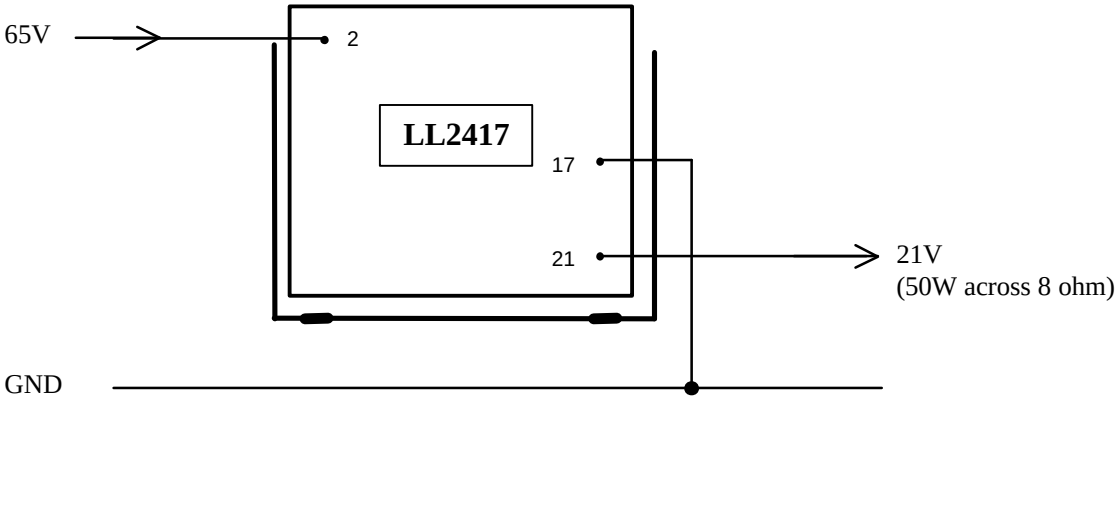
Physical dimensions, pin and mounting hole layout (all dimensions in mm) and internal winding structure



Max signal before saturation:
Winding type A : 20V at 60Hz
Winding type B : 10V at 60 Hz

Weight	0.89 kg
No load impedance at 50Hz, 65V, typically	1.3 kohms
Max input voltage at 50 Hz	70V

Usage: 65V line to 50W / 8ohms output



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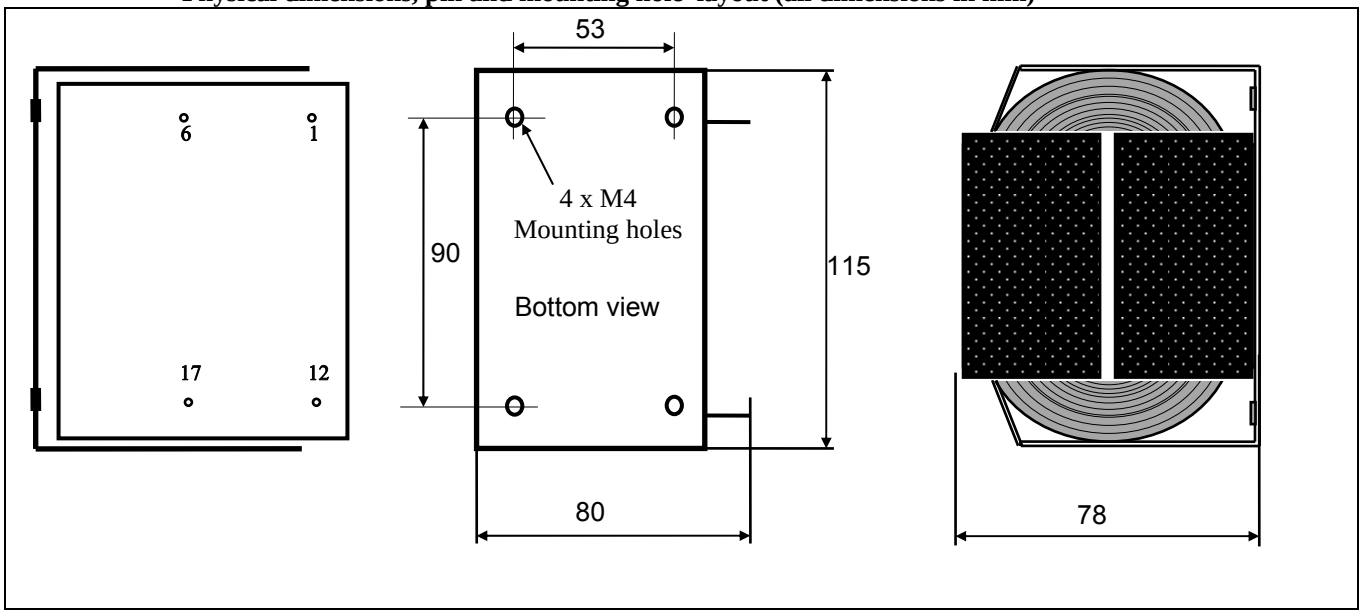
HIGH POWER ISOLATION TRANSFORMER
LL2418

LL2418 is a high power (400W across 4 Ω at 50Hz) line isolation transformer for power amplifier output. The transformer is highly sectioned with harmonically sized sections. This results in minimum leakage inductance and thus an excellent frequency response. The transformer is based on our general purpose high power isolation transformer LL2410.
The transformer has a special audio C-core of our own production.

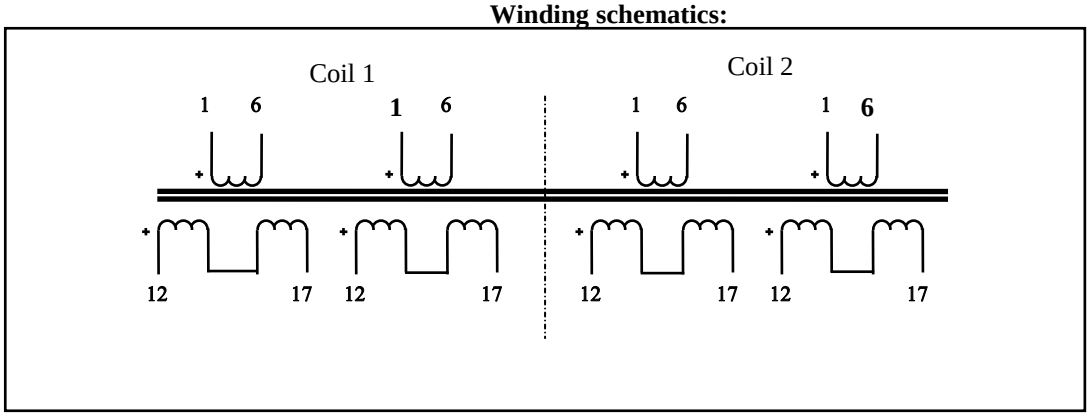
Turns ratio: 1 : 1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins: 25.4 mm (1.0")
Spacing between rows of pins: 76.2 mm (3.0")
Weight: 2.5 kg

Winding schematics:



Static resistance of each primary: 0.2 Ω
Static resistance of each secondary: 0.2 Ω
Max voltage per primary winding, at 50 Hz: 40 volts
Max voltage per secondary winding, at 50 Hz: 40 volts

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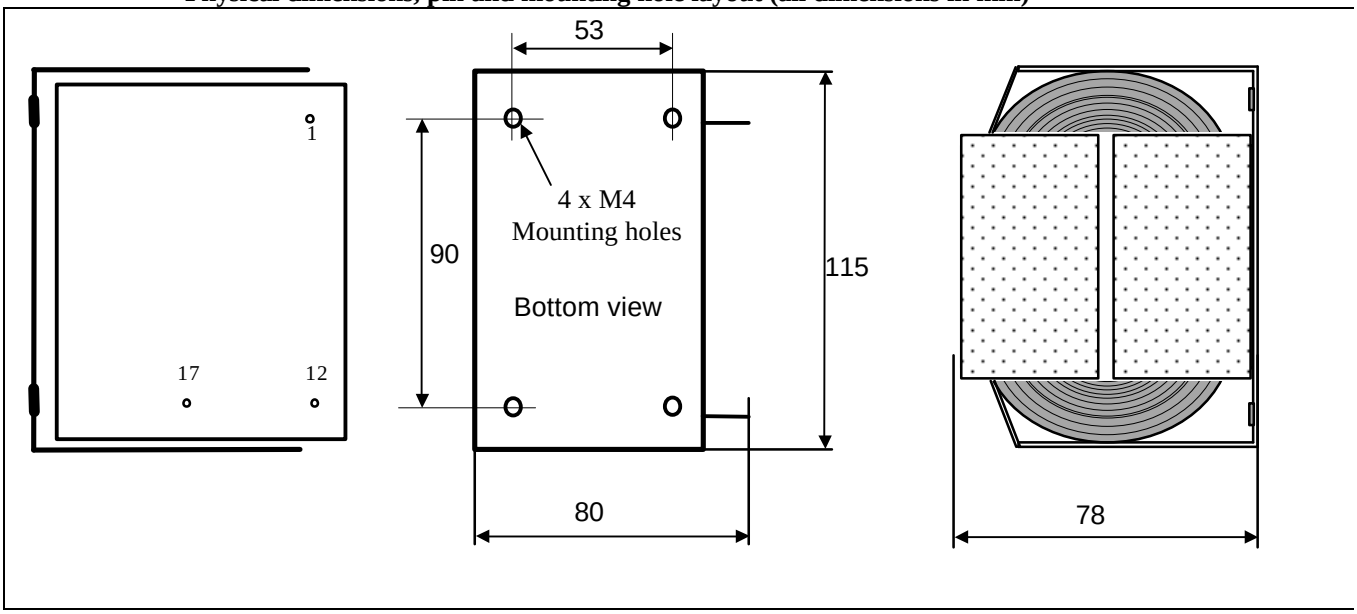
Auto Transformer LL2419
100V : 42V or 100V : 58V

LL2419 is a 100V line transformer for high quality audio applications. The transformer is well sectioned with harmonically sized sections.
Output power at 100V line signal, configuration 1 (42V) is 220W with 8 ohms load, 440W with 4 ohms load.
Output power at 100V line signal, configuration 2 (58V) is 420W with 8 ohms load, 840W with 4 ohms load.
The transformer has a special audio C-core of our own production.

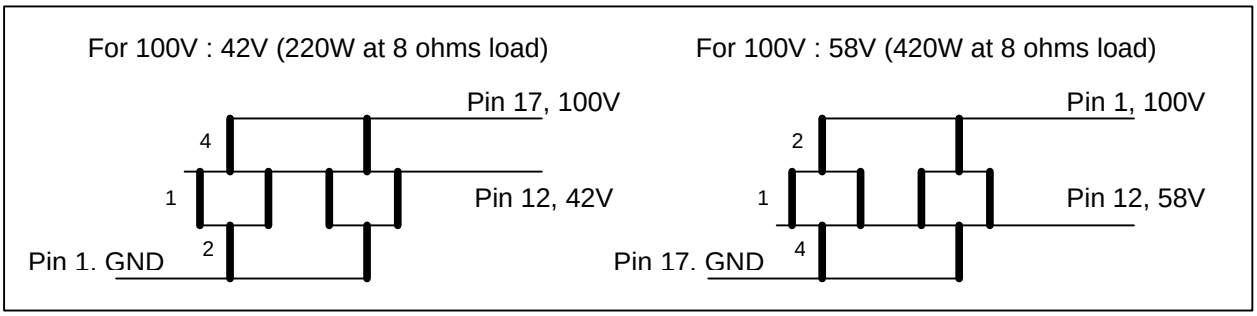
Turns ratio: **Autotransformer** 7 : 3 : 0

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins:	25.4 mm (1.0")
Spacing between rows of pins:	76.2 mm (3.0")
Weight:	2.5 kg

Internal winding schematics and external connections:



Static resistance, pin 1 to pin 17:	1.2 Ω
Static resistance, pin 1 to pin 12:	0.4 Ω
Max signal voltage, pin 1 to pin 17 at 50 Hz:	140 volts
Transformer no load impedance, pin 1 to pin 17 at 100V, 50Hz	1 k Ω typically

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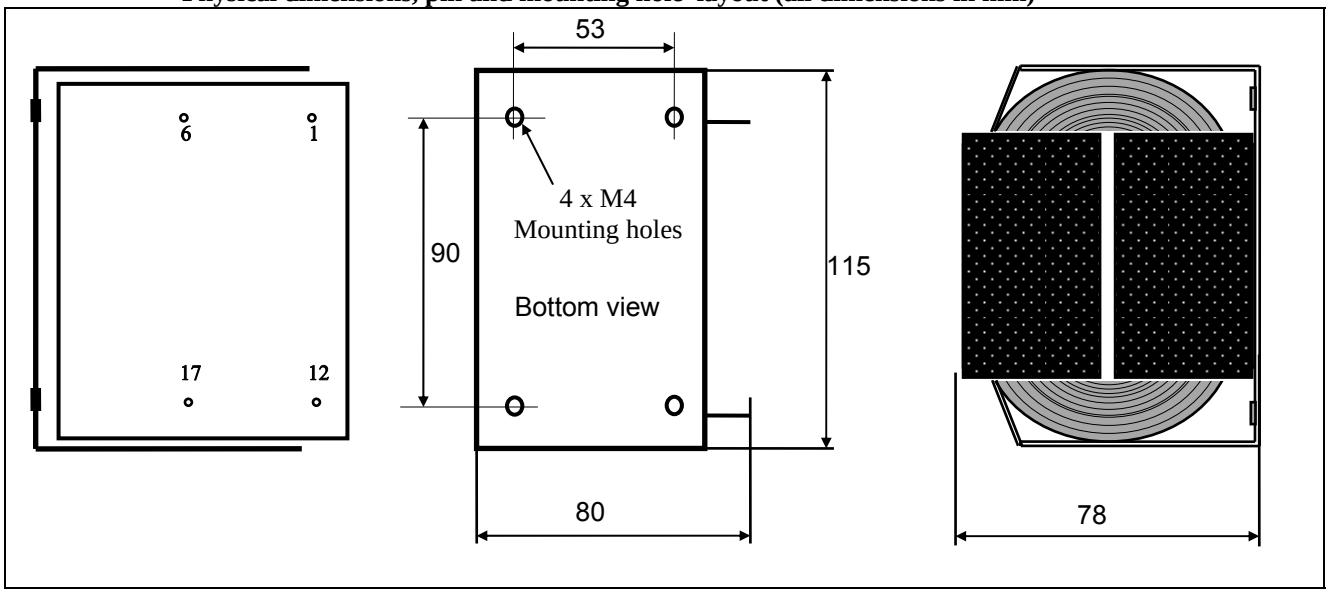
HIGH POWER STEP DOWN ISOLATION TRANSFORMER
LL2420

LL2420 is a high power (400W across 1 Ω at 50Hz) step down line isolation transformer for power amplifier output. The transformer is highly sectioned with harmonically sized sections. This results in minimum leakage inductance and thus an excellent frequency response. The transformer is based on our general purpose high power isolation transformer LL2410.
The transformer has a special audio C-core of our own production.

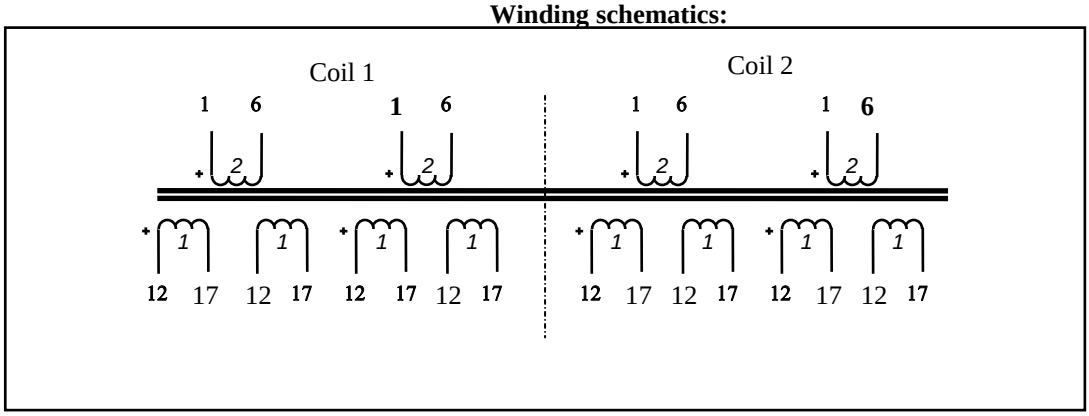
Turns ratio: 2 : 1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins: 25.4 mm (1.0")
Spacing between rows of pins: 76.2 mm (3.0")
Weight: 2.5 kg

Winding schematics:



Static resistance of each primary: 0.2 Ω
Static resistance of each secondary: 0.05 Ω
Max voltage per primary winding, at 50 Hz: 40 volts
Max voltage per secondary winding, at 50 Hz: 20 volts

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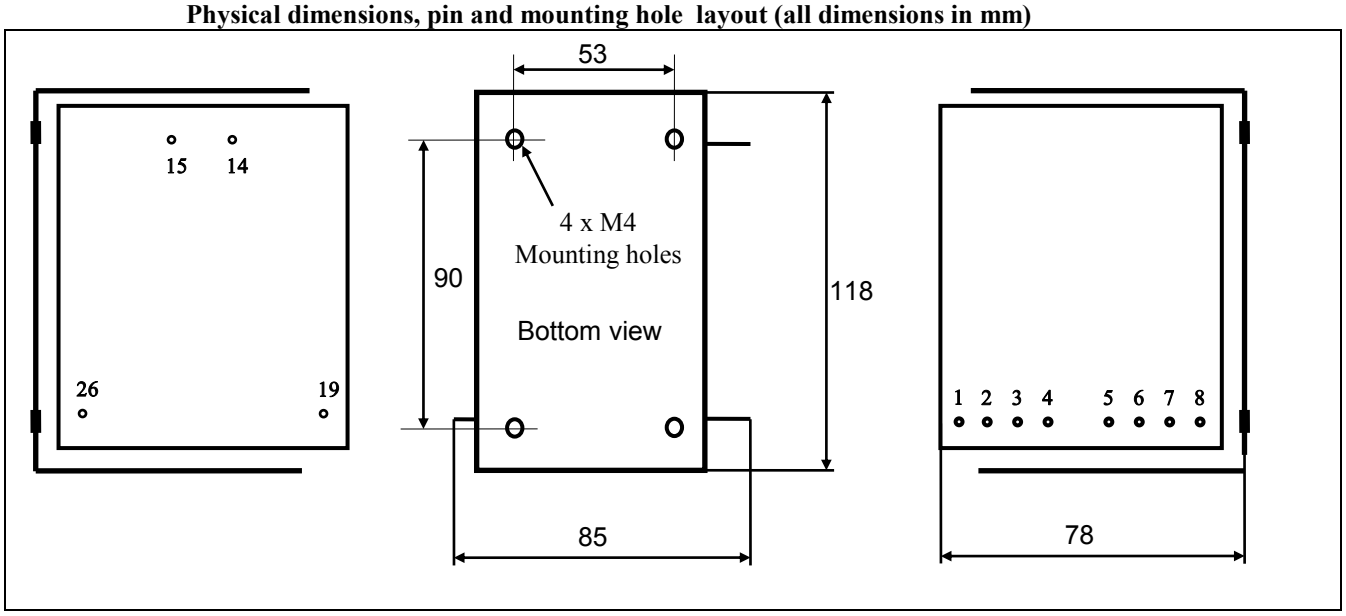
Audio Power Line Transformer
LL2421

LL2421 is a highly section audio signal power output transformer for very low impedance loads
The transformer has a special audio C-core of our own production.

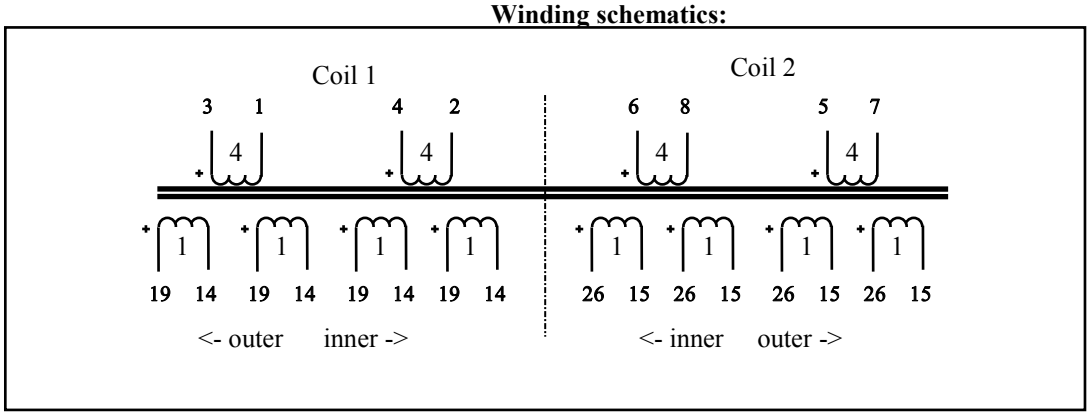
Turns ratio: 4+4+4+4 : 1+1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Spacing between pins: 5.08 mm (0.2")
Weight: 2.5 kg

Winding schematics:



Static resistance of each primary (avarage): 0.80 Ω
Static resistance of each secondary (avarage): 0.025 Ω
Primay inductance, primaries in parallel: 1.5H approx.
Max voltage per primary winding, at 50 Hz: 40 volts
Max voltage per secondary winding, at 50 Hz: 10 volts

For 4:1 high current stepdown, connect as follows:
In+ pins 3 + 4 + 5 + 6
In - pins 1 + 2 + 7 + 8

Out+ pins 19 + 26
Out- pins 14 + 15

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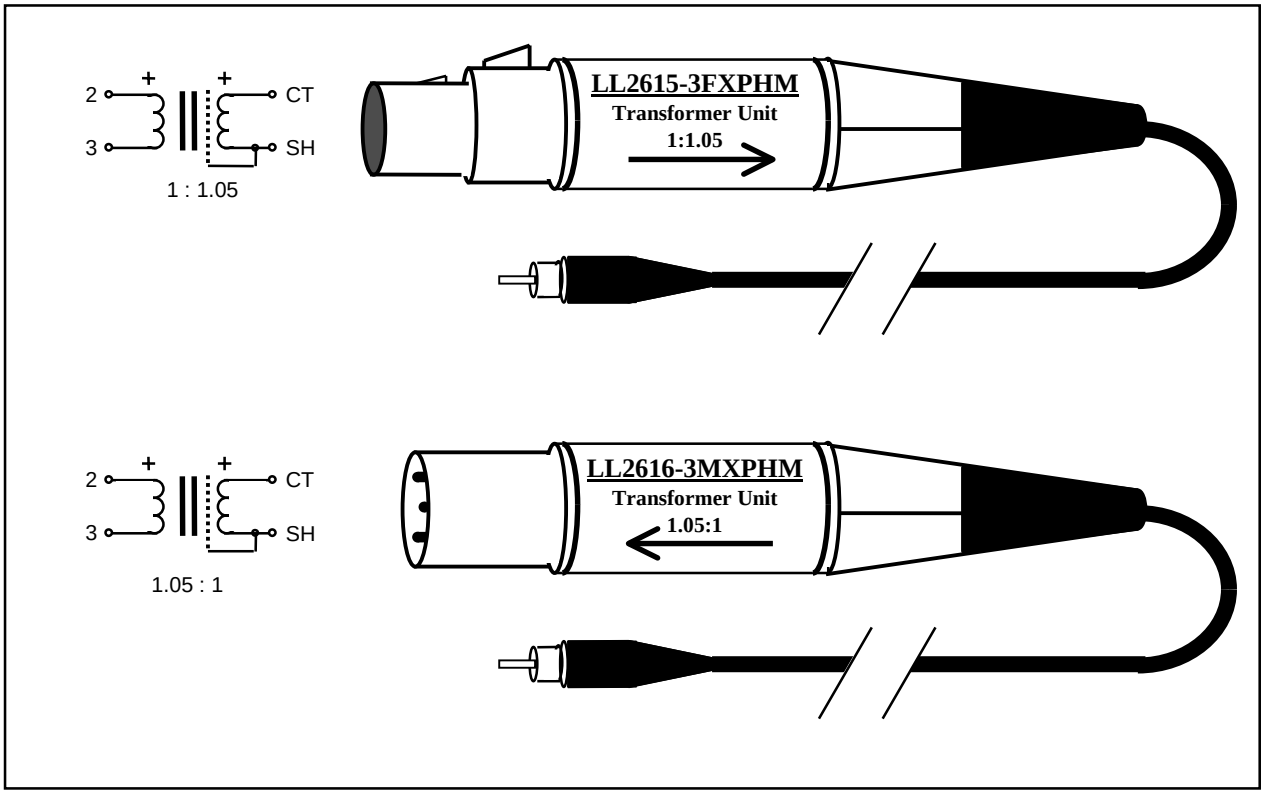
Ground Isolation, Balanced to Unbalanced Converter
LL2615 and LL2616
for 0 dB loss with 10 kΩ load

The XLR inline transformer units LL2615 and LL2616 are used for breaking up ground loops and for balanced-to-unbalanced conversion. In particular, when used with 10 kohms loads transformer signal loss is eliminated through a small step up turns ratio.
The unit is magnetically shielded and contains a high impedance transformer with LF saturation above +15 dBU, 50 Hz.



The LL2615 and LL2616 are available in the following versions:

LL2615-3FXPHM Female XLR connector to Phono (RCA) male for 10k unbalanced load
LL2616-3MXPHM Phono (RCA) male to male XLR connector for 10k balanced load

Cable length 3 ft approximately.
The arrows printed on the labels indicate intended signal direction.

Characteristics of built in transformer

Static resistance of primary:	250 Ω
Static resistance of secondary:	280 Ω
Core:	Amorphous strip core
Max level:	+15 dBU @ 50 Hz
Loss across transformer at 10kΩ load	< 0.1 dB
Isolation between windings:	1 kV

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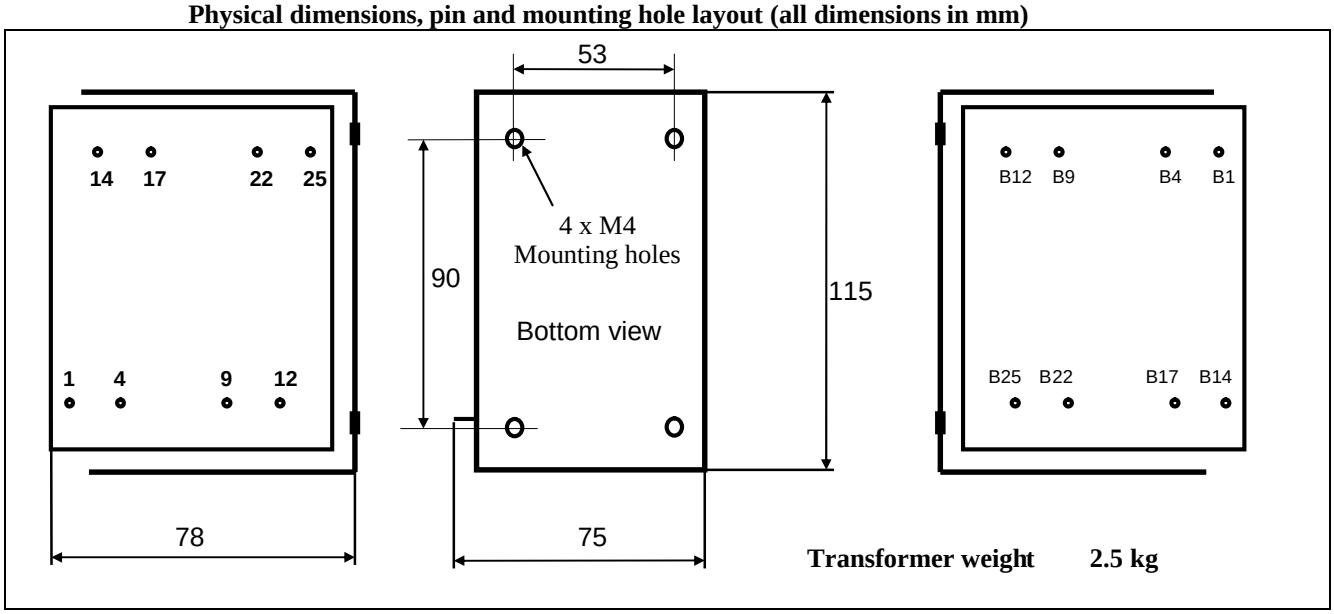
Mains Transformer LL2728
115V+115V : 15V + 15V + 15V +15V + 10V + 10V

LL2728 is a C-core mains transformer for solid state applications. The core is assembled with a carefully selected, small air-gap to compensate for any mains DC-unbalance. Estimated power rating 300 VA, which can be increased with good cooling.

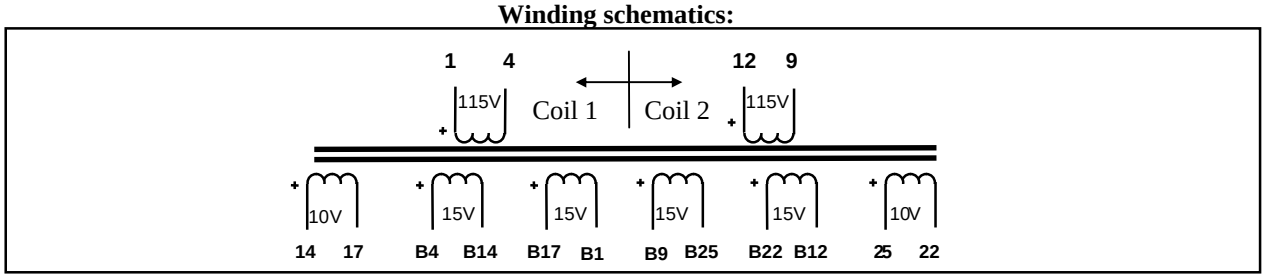
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



	Copper resistance	Voltage at 50 Hz, no load
Windings 1 - 4 and 12 - 9 respectively	3.6 Ω	115V
Windings B4-B14, B17-B1, B9-B25, B22-B12	0.2 Ω	16 V
Windings 14 - 17 and 25 - 22 respectively	0.3 Ω	10 V

Isolation between windings / between windings and core 4 kV / 4 kV

Winding schematics:



Notes:

For 115V mains, connect primaries in parallel. For 230V mains, connect primaries in series.

Suggested connection for 30V – CT – 30V

+30V B4,
B14 connect B9
CT B25 + B17
B1 connect B22
-30V B12

R060406

The 10V windings should be used symmetrically.

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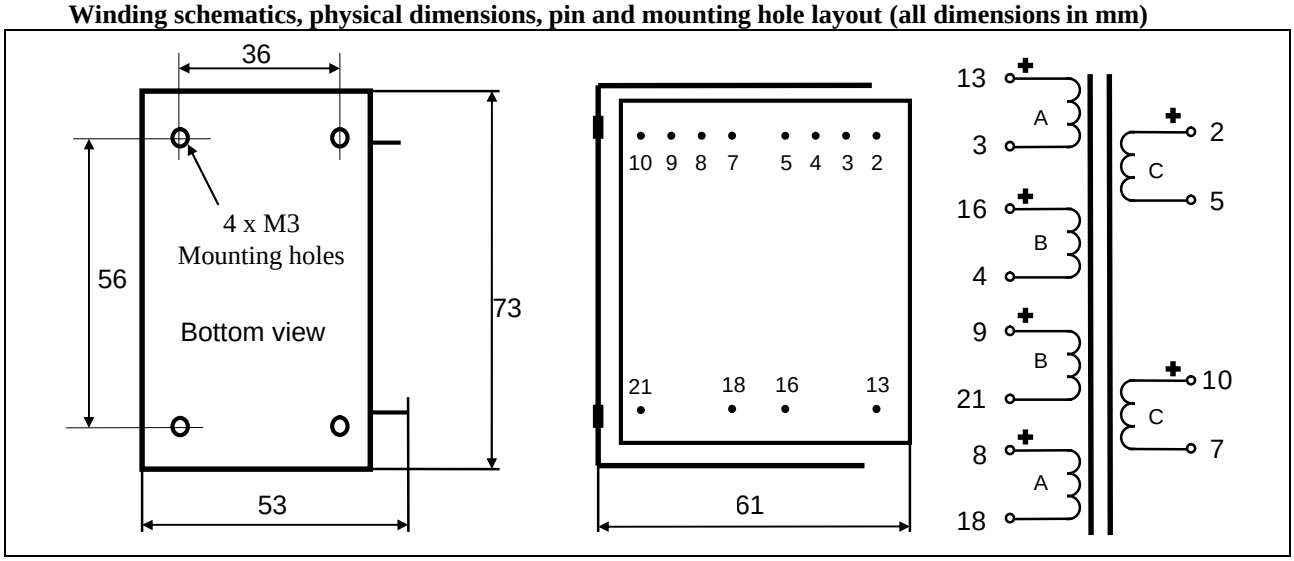
Tube Amplifier Line Output Transformer LL2730
Laurens Organ Company GmbH

LL2730 is a tube amplifier line output transformer designed for 6:1 applications.
For the LL2730/18mA, , the core air gap is chosen such that 18mA DC current generates a no signal core flux density of 0.9 Tesla when used with primaries in series. This leaves a flux density swing of 0.7 T for the signal.

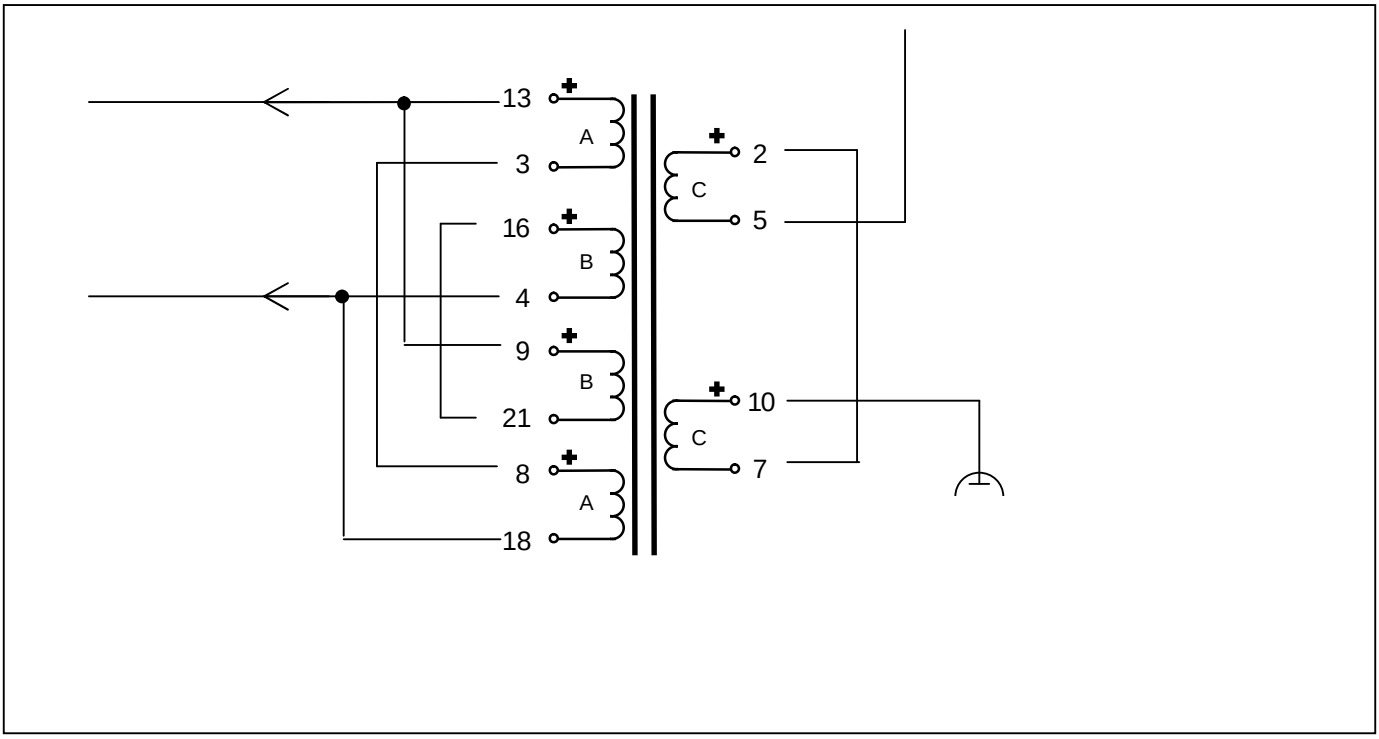
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, Winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	1+1+1+1 : 6+6	26 Ω	21 Ω	442 Ω

Max. primary current (5W heat power): 75 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Usage, SE to line output, 6 : 1



R060920, prototype

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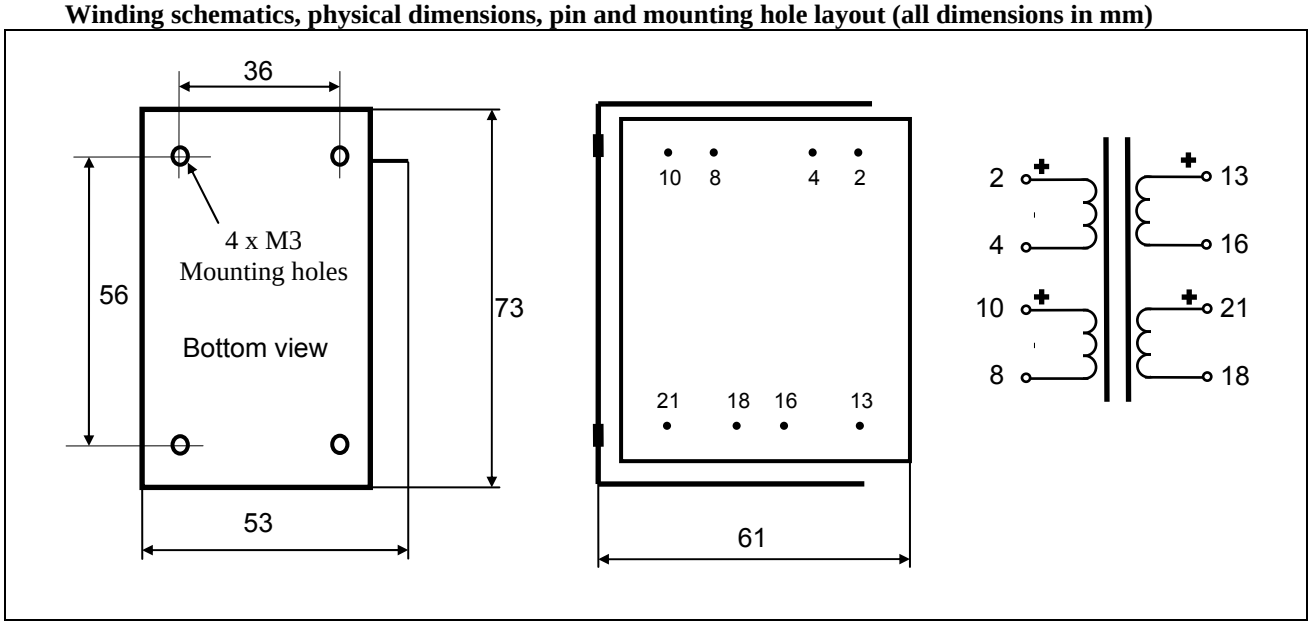
Low impedance tube amplifier line output transformer
LL2731

The LL2731 is a four-sectioned dual coil C-core tube amplifier interstage / line output transformer for low impedance applications. LL2731 is available in PP and SE versions.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **1+1 : 1+1**

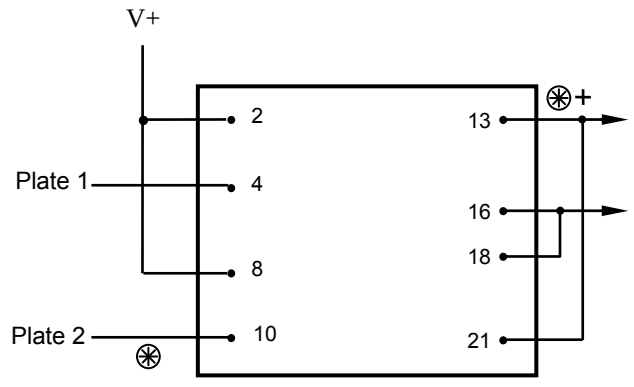
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	0.6 kg
Static resistance of each primary:	48 Ω
Static resistance of secondary:	50 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through any primary winding:	220mA (5W heat dissipation)

	LL2731/PP	**LL2731/10mA**	
Primary inductance (approx)			
Max signal across each section, at 30 Hz	75V r.m.s.	33V r.m.s.	

Suggested use, low impedance PP line output, 1:1:



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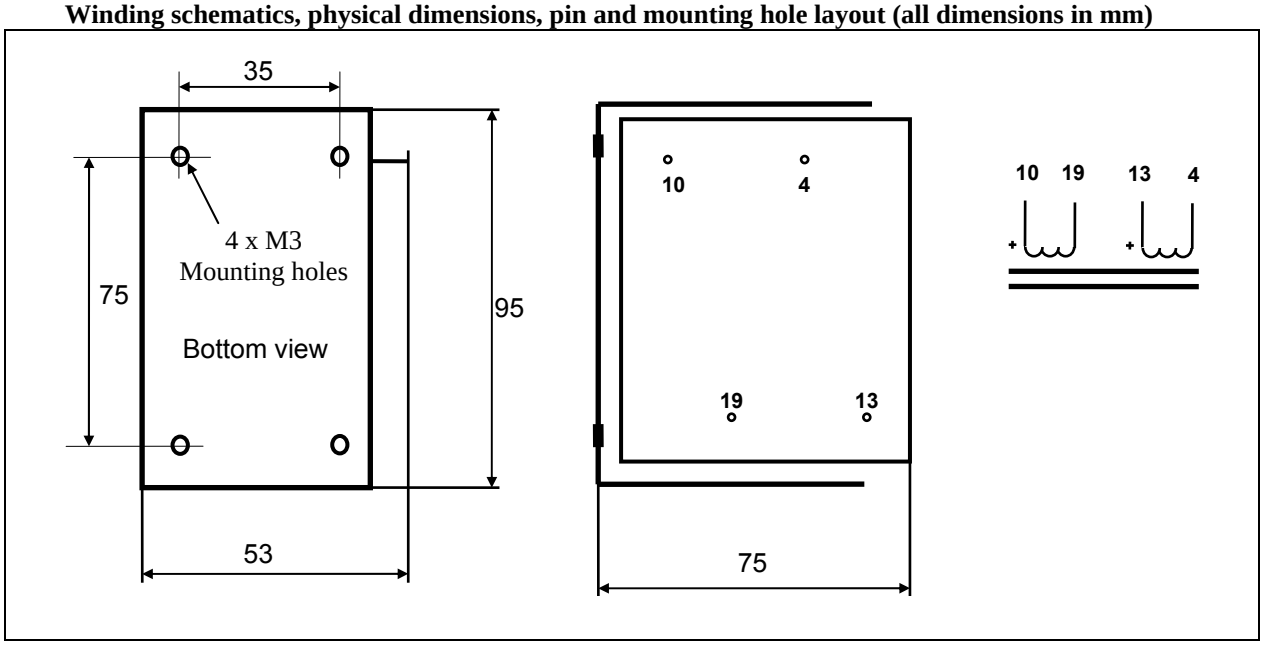
Filament Current Choke LL2733

The LL2733 is a 2 coil choke for tube/valve filament current filtering.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

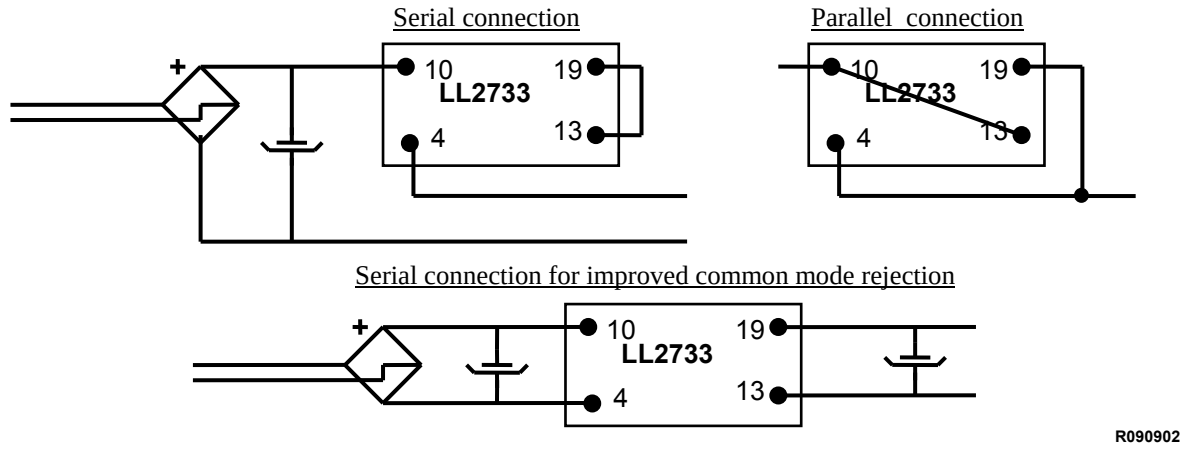
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each winding:	1.7 Ω
Max current through each winding (10W heat dissipation):	1.7 A
Isolation between windings / between windings and core:	4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)
LL2733 / 1.7A	0.4 H	1.7 A	2.7 A	0.1 H	3.4 A	5.4 A
Max. ripple voltage at rec. DC current (Ripple voltage is approx. 0.42 x input voltage)	120 V rms / 100 Hz			60 V rms / 100 Hz		

Suggested connections:



Note! The LL2733 can also be used in choke input power supplies

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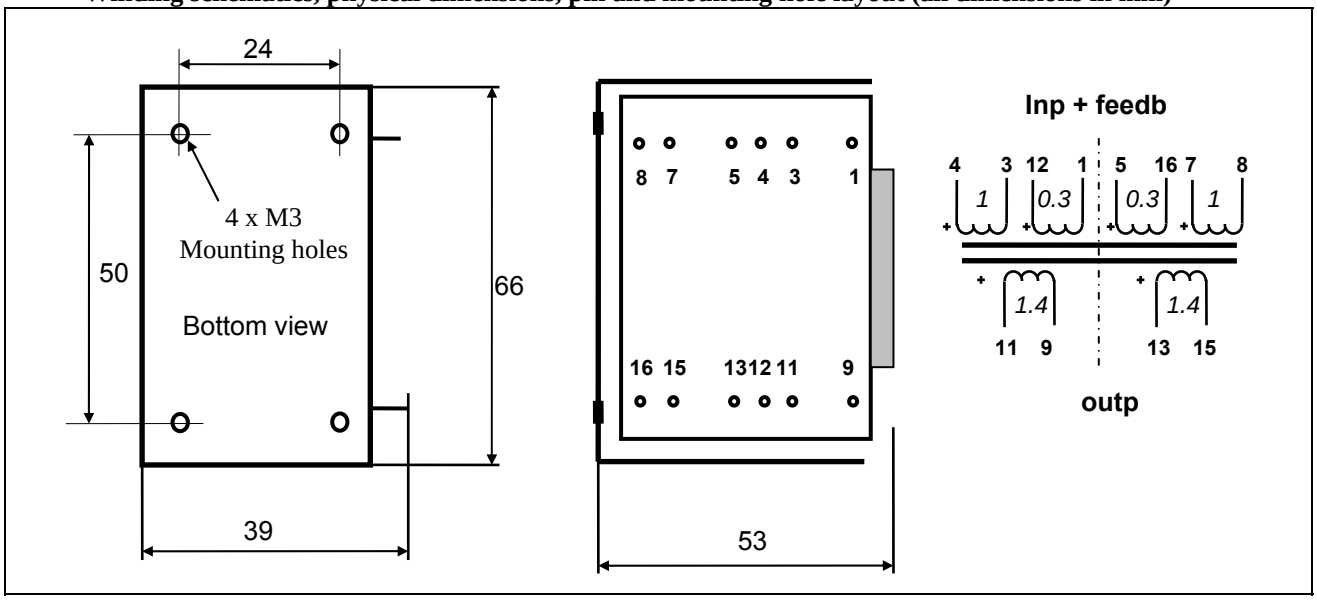
Line Output Transformer for SE Solid State
LL2734

The LL2734 is a line output transformer for SE solid state output circuits, based on the Neve LO1166A.
The transformer consists of two coils, each coil consists of one primary winding (divided in two sections to reduce leakage inductance), one secondary winding and one feedback winding. The core is a special audio C-core of our own production.

Turns ratio: 1 + 1 : 1.4 + 1.4 + 0.3 + 0.3

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding 11-9 and 13-15	Static resistance, winding 12-1 and 15-16	Static resistance, winding 4-3 and 7-8
0.35 Kg	1 + 1 : 1.4 + 1.4 + 0.3 + 0.3	16 Ω	4 Ω	5 Ω

Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV
Max standing DC current through any primary section (3W heat dissipation) 550 mA

Type	**LL2734/100mA**			
Application	Line output			
Connection	Alt A			
Turns ratio	1:1.4			
Primary DC current for 0.9 Tesla	100mA			
Primary Inductance	1.0 H			
Frequence response, +0, -1.5dB (ref. 1kHz) Source impedance 10 Ω Load 100 kΩ	15Hz – 80kHz			
Max primary signal voltage (RMS) at 30 Hz (0.6T)	11.5V rms			
Max output voltage @ **50** Hz	26V rms 30 dBU			

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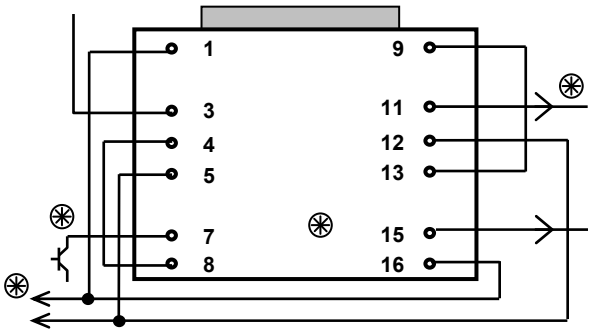
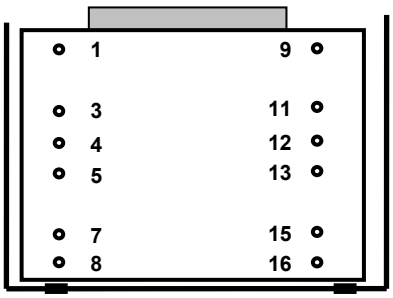
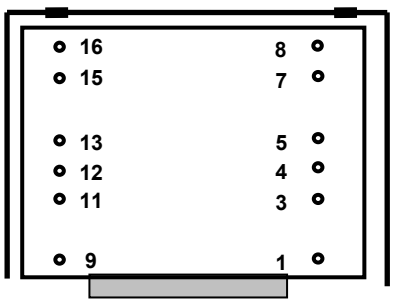
Solid State Line Output Transformer LL2734
Connection Alternatives

Alt A Balanced output 600Ω with feedback	**Alt B** Unbalanced output 600Ω
Alt C Balanced output 150Ω	**Alt D** Unbalanced output 150Ω







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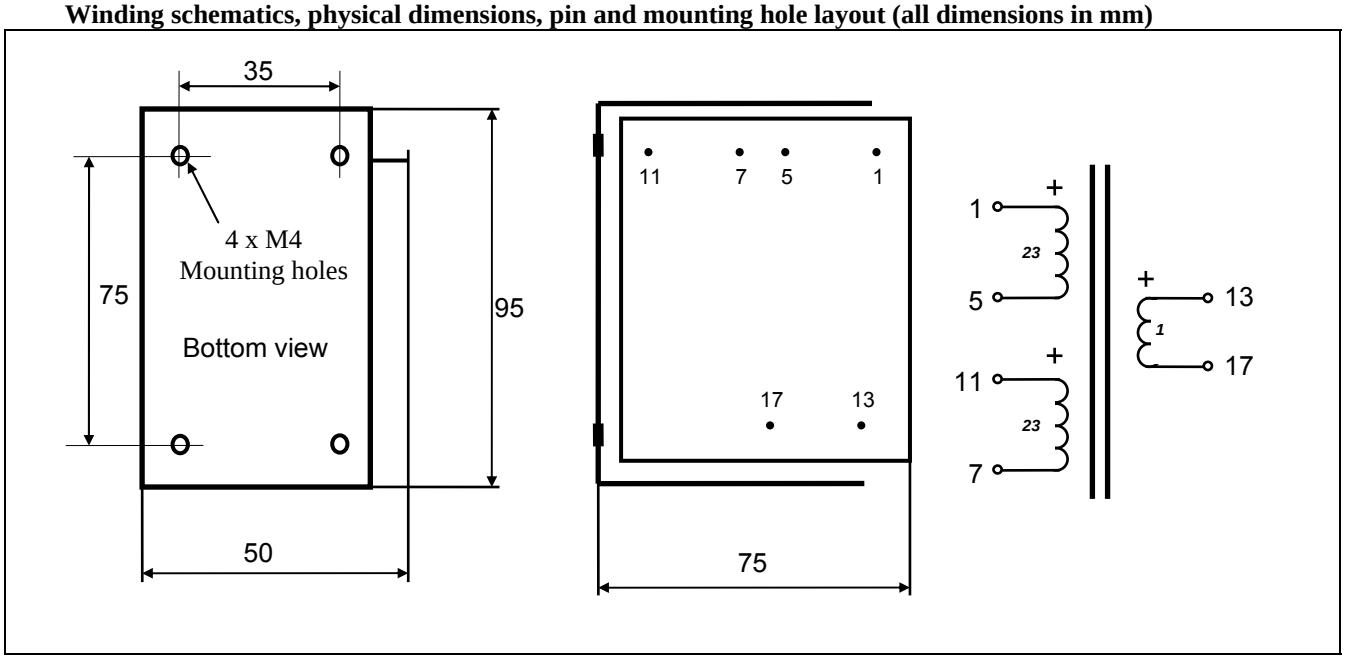
Tube amplifier output transformer LL2735B
16k : 8 ohms

The LL2735B is a tube amplifier output transformer for 16k : 8 ohms impedance ratio, primarily designed for for high rp tubes such as 10Y, 801A and EML20B in single-end applications. The transformer is a dual coil transformer where coils are wound using our high internal isolation technique with isolation foil between each layer of copper wire. Each coil consist of one primary and two secondary sections. The isolation between primary and secondary sections are gradually increased closer to the tube anode connection in order to minimize capacitive energy storage.
The core is a silicon-iron audio C-core of our own production.

Turns ratio **23 + 23 : 1**

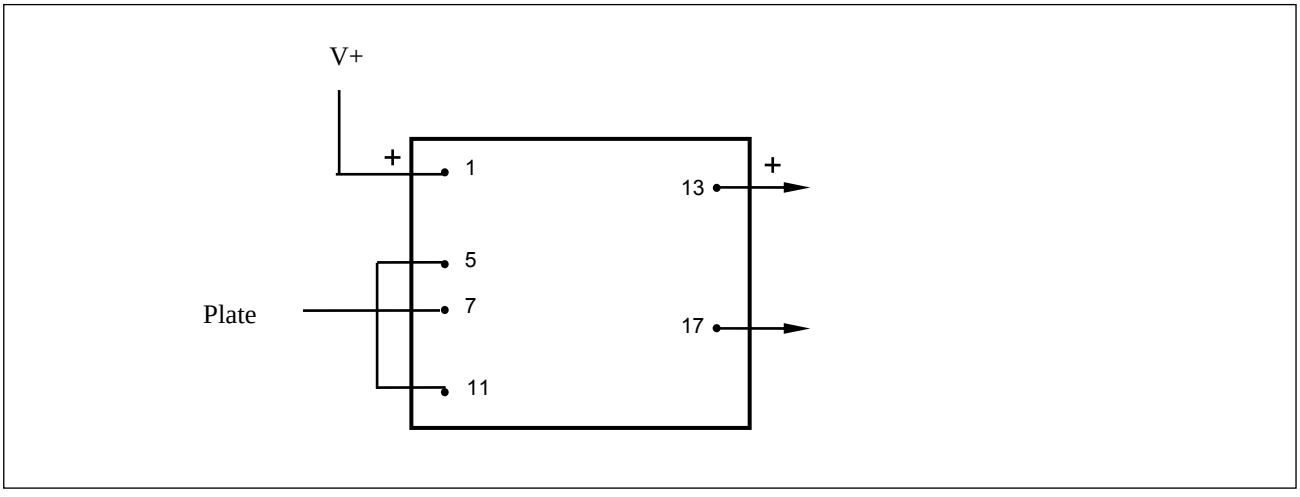
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each primary:	270 Ω
Static resistance of secondary:	0.2 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding:	100 mA (6W heat power)

	LL2735B / 30mA		
Primary inductance	90H		
Max primary signal	300V rms @ 30Hz		
Max output power @ 30 Hz, Loudspeaker impedance 8 ohm	5 W		

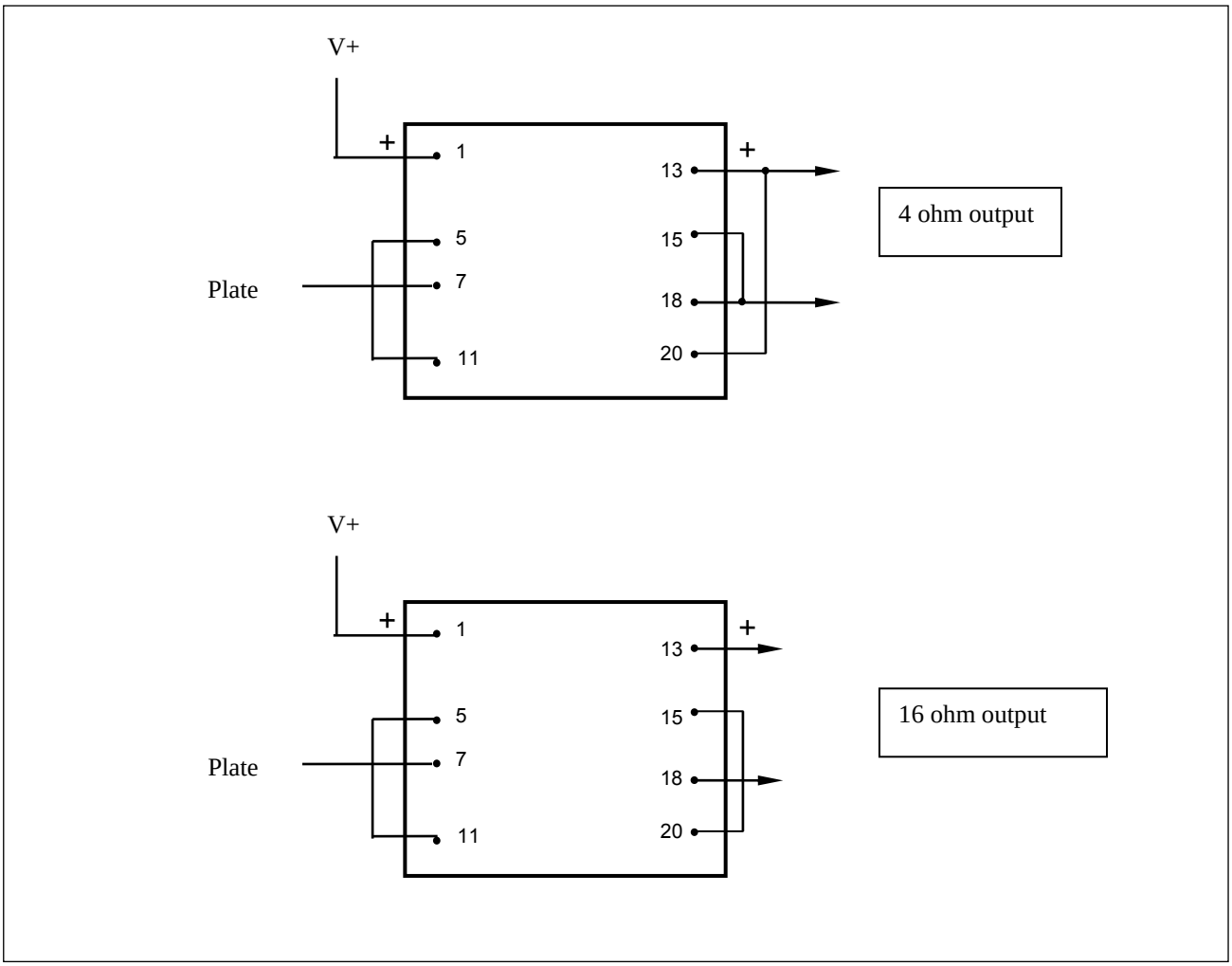
Suggested use:



LL2735F (16k to 4 and 16 ohms)

LL2735F is a 4 and 16 ohm version of the LL2735B

Suggested use:



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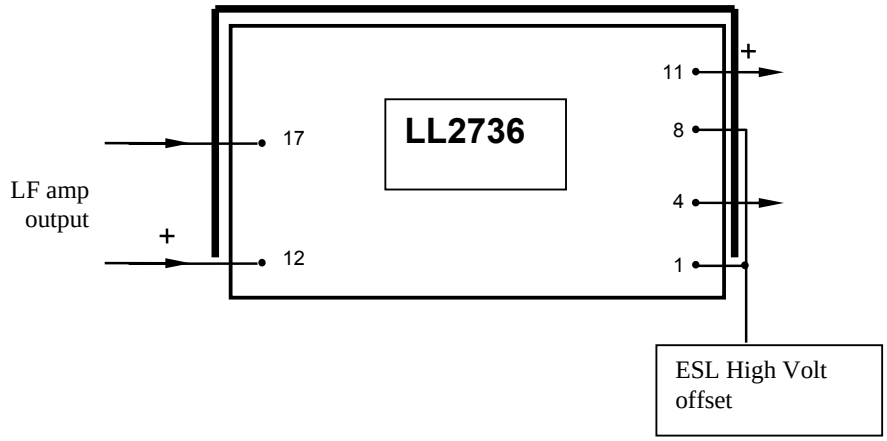
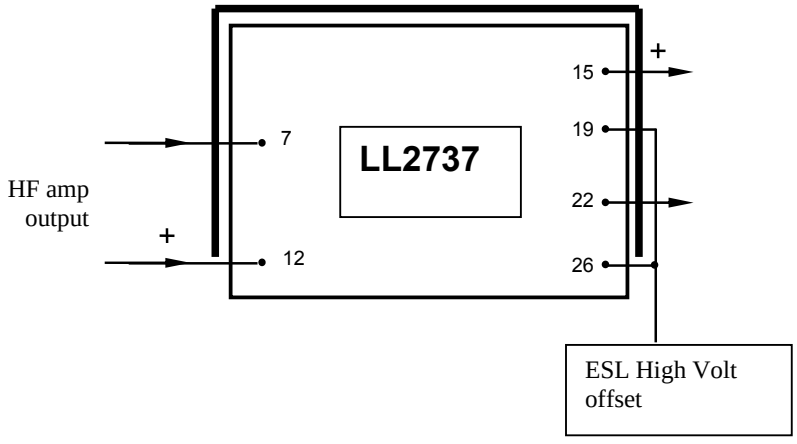
Electrostat Loudspeaker Transformers
LL2736 and LL2737

LL2736 is a 1:72+72 low frequency drive transformer for electrostatic loudspeakers



LL2737 is a 1:45+45 mid-high frequency drive transformer for electrostatic loudspeakers



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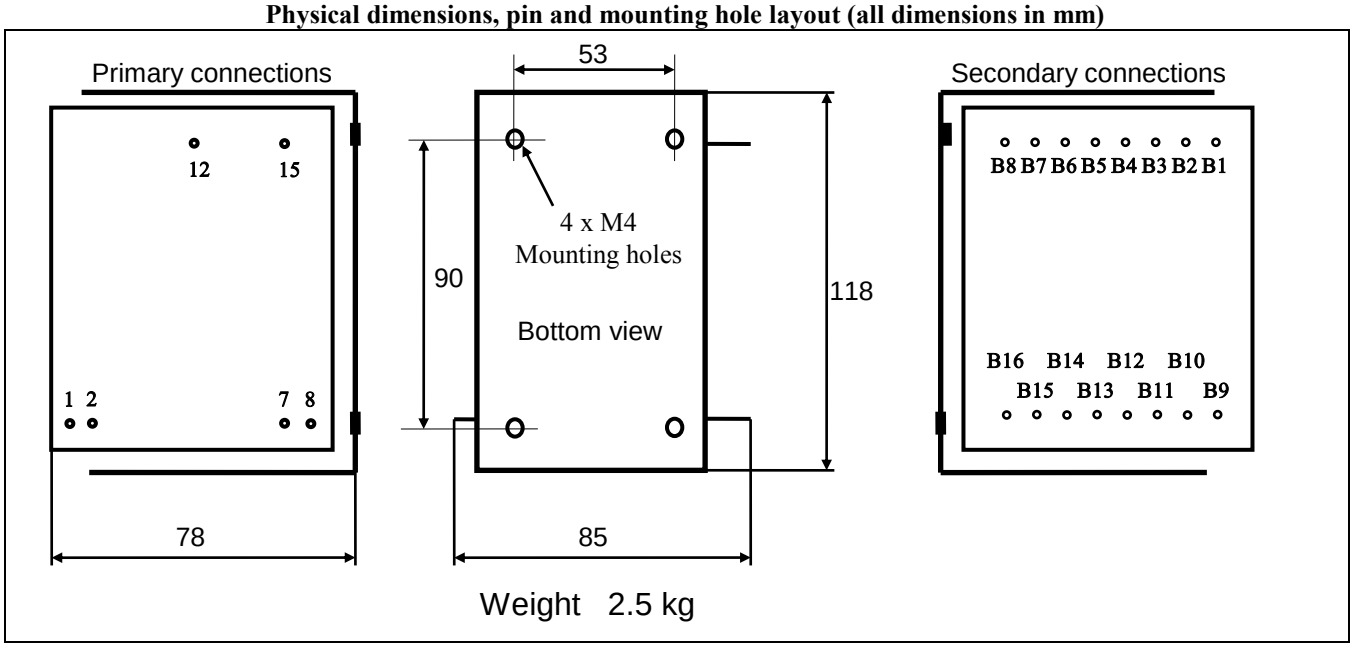
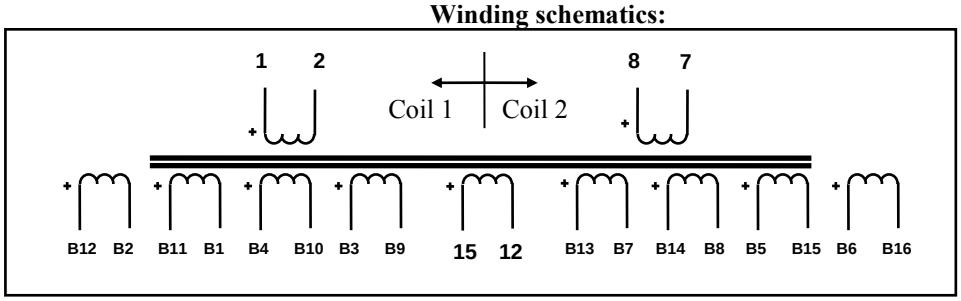
Tube Filament Current Mains Transformers
LL2738

LL2738 is a C-core (with small air gap) mains transformer for applications where a large number of tube filaments needs supply. Estimated power rating 160 VA which can be increased with good cooling. Magnetic stray is small if the two coils are loaded symmetrically.

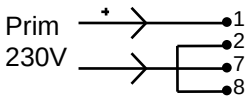
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



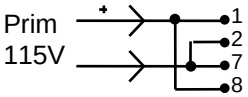
Winding schematics:



Primary connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Idle current approx. 100mA



Idle current approx. 200mA

Copper resistance, <u>no load</u> output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel

Primary res. Serial/parallel	Sec 15-12	All other secondaris
7.5 Ω / 1.9 Ω	29 Ω / 110 V 0.1 A	0.1 Ω / 6.6V * 3 A

**Will drop to approx 6.3V at 3A*

Please note! Output current from rectifier: 63% of above with capacitor input rectifier, 95% of above with choke input rectifier.

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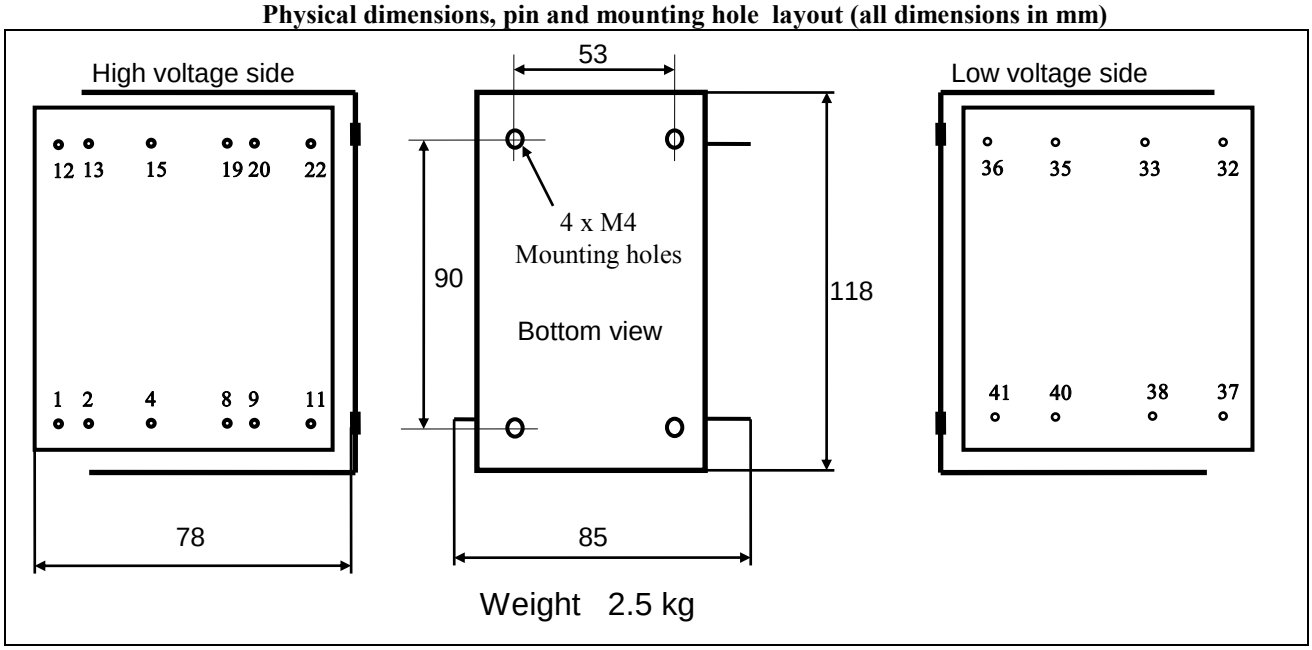
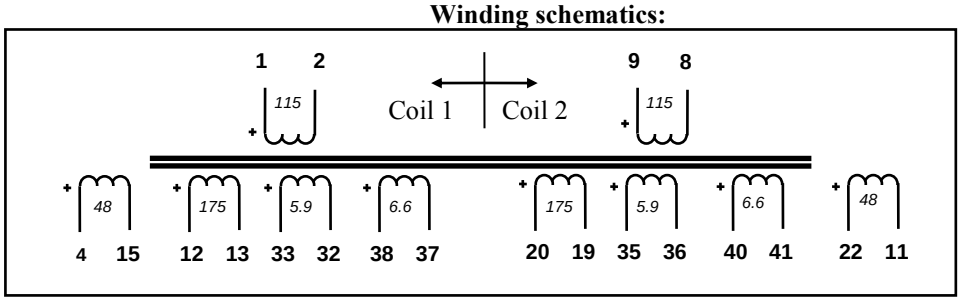
Mains Transformers for Tube Amplifiers
LL2740

C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



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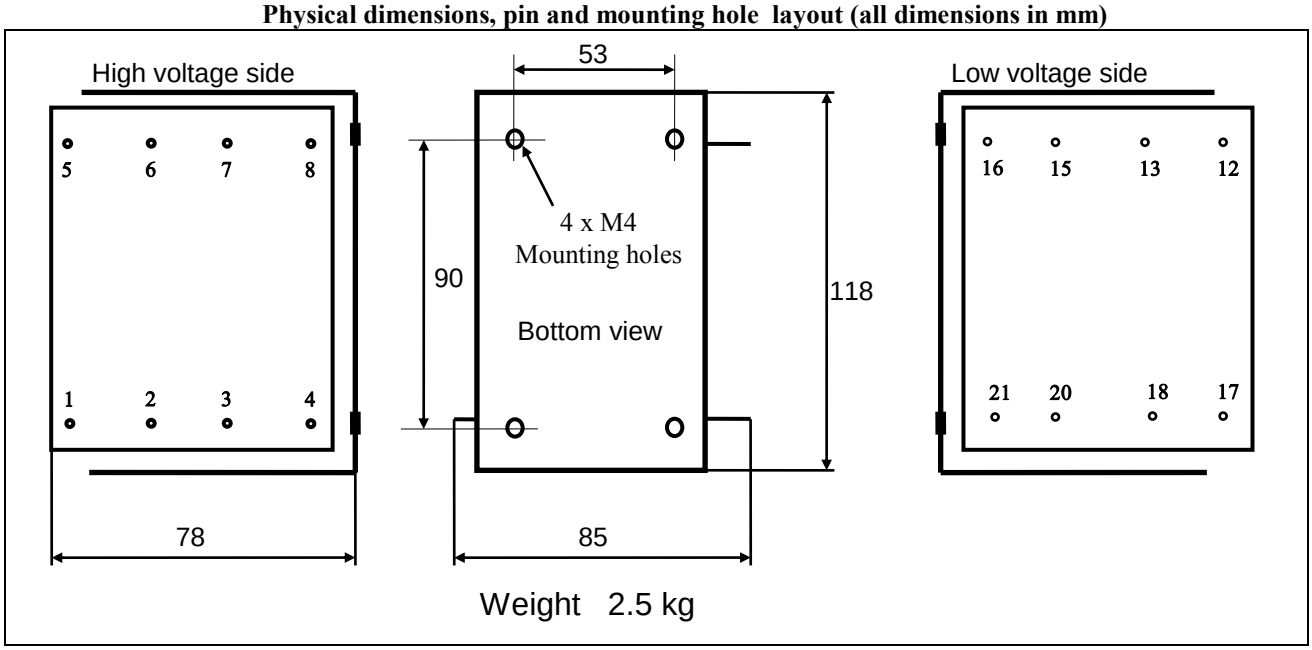
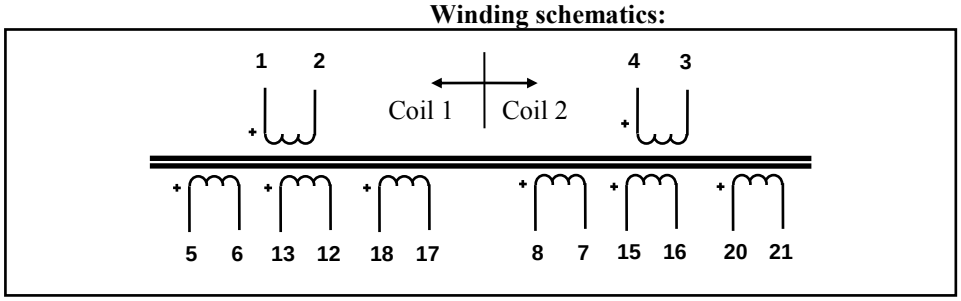
Mains Transformers for Tube Amplifiers
LL2741

C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

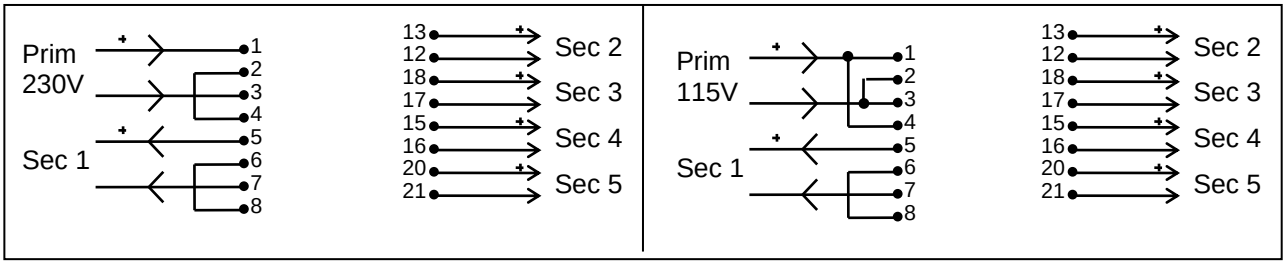
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Primary res. Serial/parallel	No-load impedance	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5
7.5 Ω / 1.9 Ω	2k / 230V 0.5k / 115V	16 Ω / 290 V 0.55 A	0.1 Ω / 6.3V 3.1A	0.1 Ω / 6.3V 3.1A	0.1 Ω / 6.3 V 3.1A	0.1 Ω / 6.3 V 3.1A

Please note! Output current from rectifier: 63% of above with capacitor input rectifier, 95% of above with choke input rectifier.

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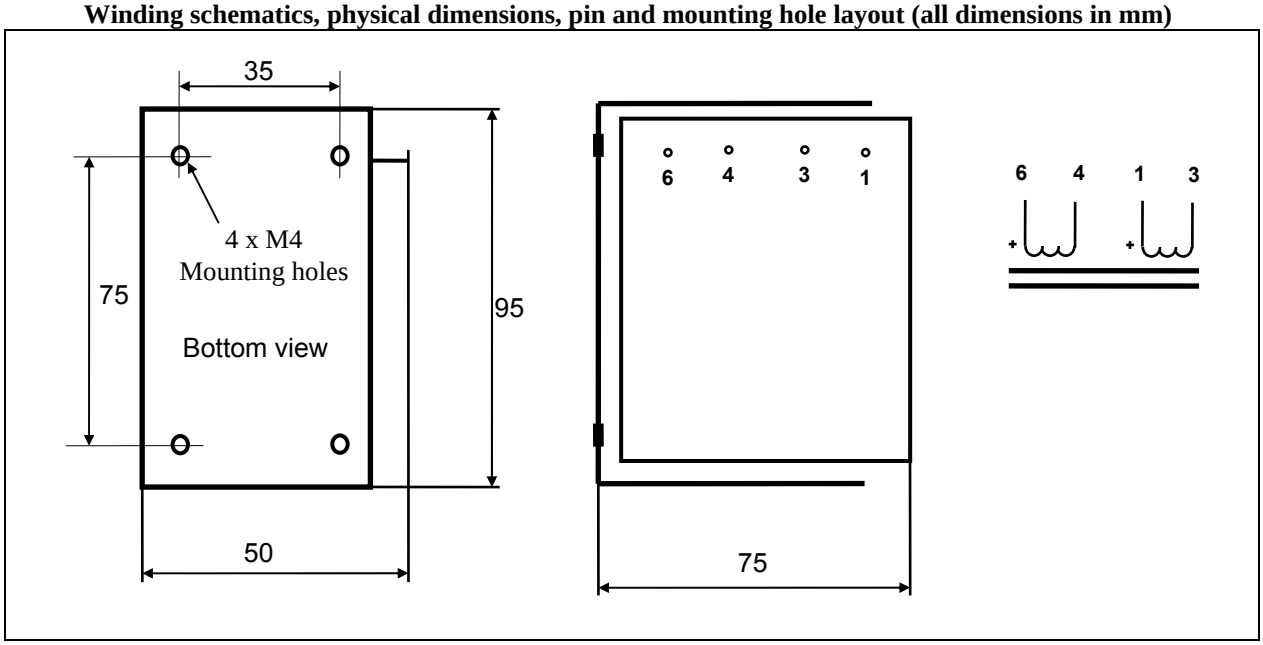
Choke LL2742

The LL2742 is a 2 coils choke for tube amplifier anode supply.
The choke is available with different core air-gap, which results in different inductance and DC current capability.
LL2742 can be used in choke input and cap input applications.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer.
The core is an audio C-core of our own production.

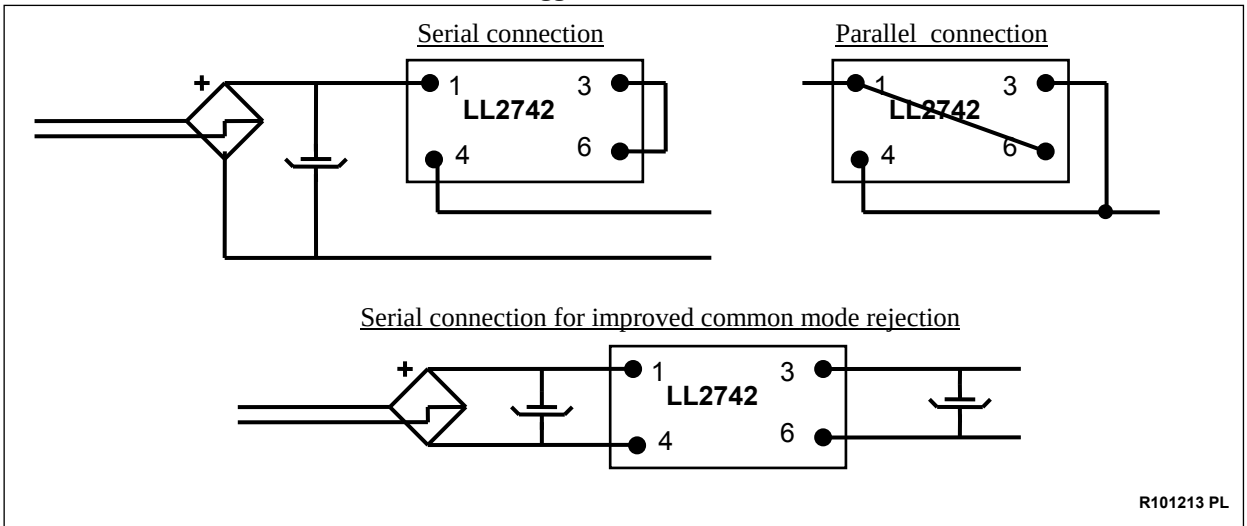
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 1.35 kg
Static resistance of each winding: 80 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel			
Type	**In-ductance**	**Recommended DC current**	**Saturating current**	**In-ductance**	**Recommended DC current**	**Saturating current**	**Heat dissipation**
LL2742 / 100 mA	42 H	100 mA	140 mA	10 H	200 mA	280 mA	2 W
LL2742 / 175mA	24 H	175 mA	250 mA	6 H	350 mA	490 mA	5 W
LL2742 / 250 mA	17 H	250 mA	350 mA	4 H	500 mA	700 mA	10 W
Max. ripple voltage at rec. DC current		640V rms / 100 Hz			320V rms / 100 Hz		

Suggested connections:



LL2742 is also well suited for choke input power supplies

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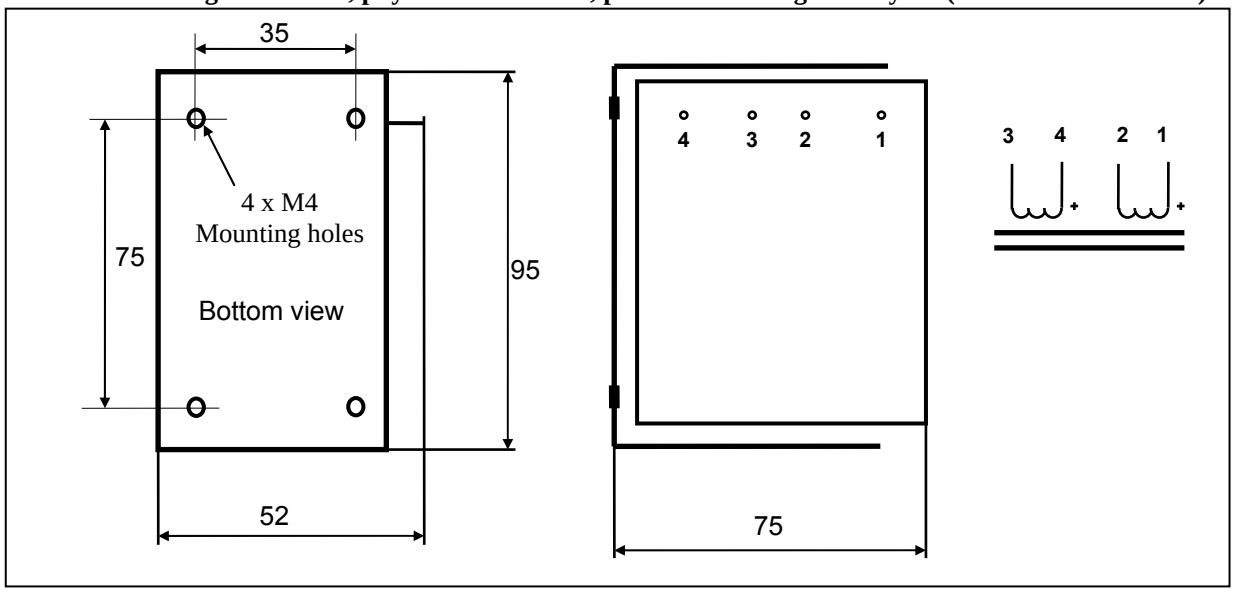
Tube anode choke
LL2743

The LL2743 is an anode choke for tube amplifiers. The choke is built with two coils and are using our own grain-oriented silicon-iron audio C-core. The coils are made using a low capacitance coil winding technique. The two coil structure greatly reduces the risk of picking up hum caused by external magnetic fields from e.g. mains transformers. The LL2743 is available with different core airgaps for different DC currents on request.

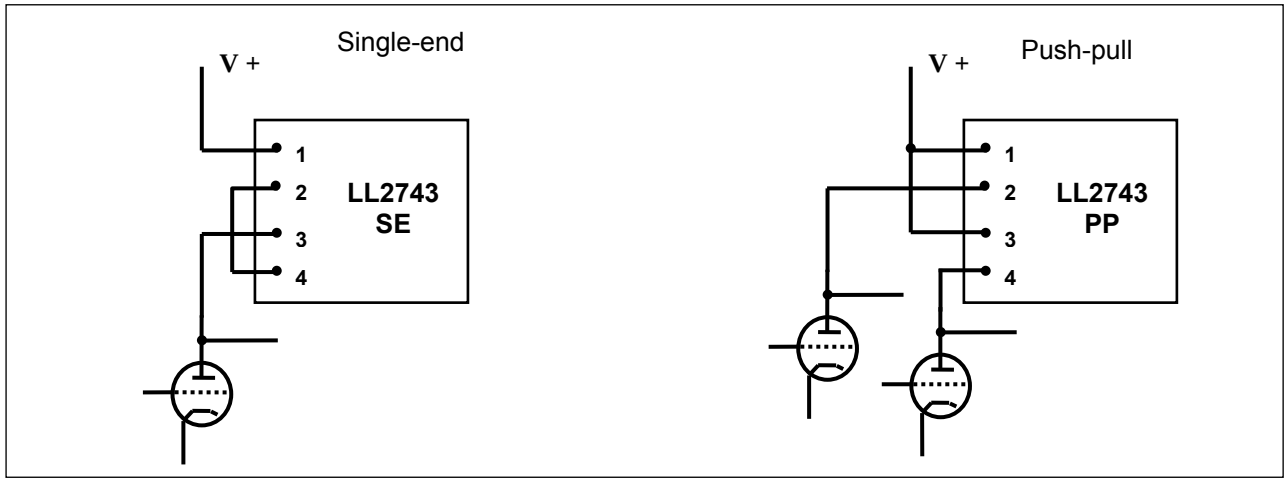
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each winding	200 Ω
Max DC current per winding, all applications (5W heat dissipation required)	110 mA
Isolation between windings and core:	4 kV

Type	Approx. inductance (windings in series)	Standing DC current	Saturating DC current	Max signal voltage @ 30 Hz
LL2743 / 70mA	64 H	70 mA	110 mA	450V RMS (70mA)
LL2743/ 90 mA	50 H	90 mA	140 mA	450V RMS (90mA)

Usage:



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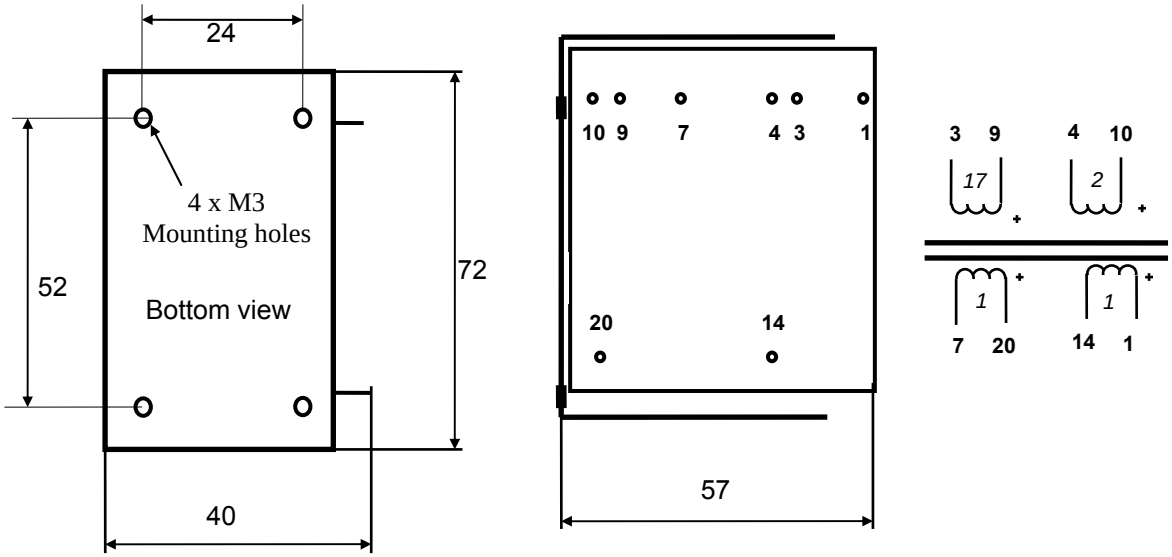
Autotransformer for Tube Amplifier
LL2744

LL2744 is a transformer for matching 420 ohm DC-free signal to 4, 8 and 16 ohms loudspeakers.
Power handling capacity approx 5 W at 30Hz
The transformer has a special audio C-core of our own production.

Turns ratio: 17 + 2 + 1 + 1

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight 0.5 kg

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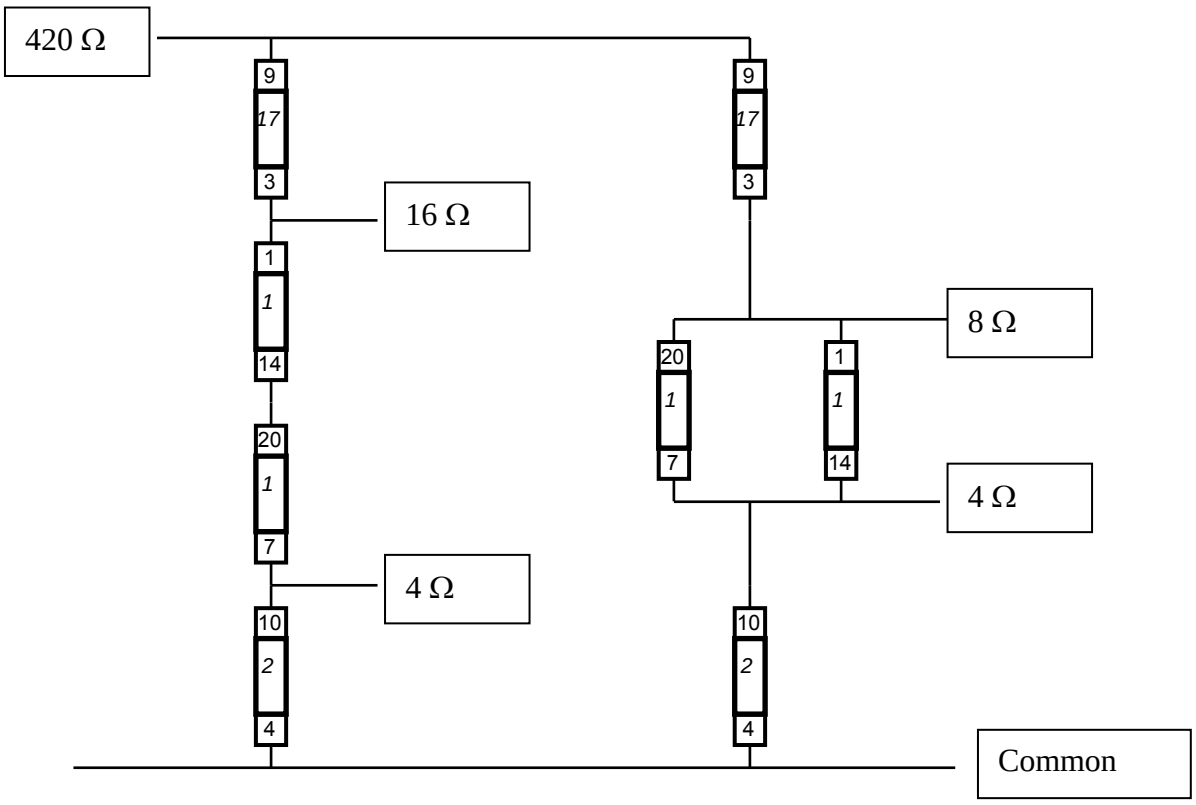

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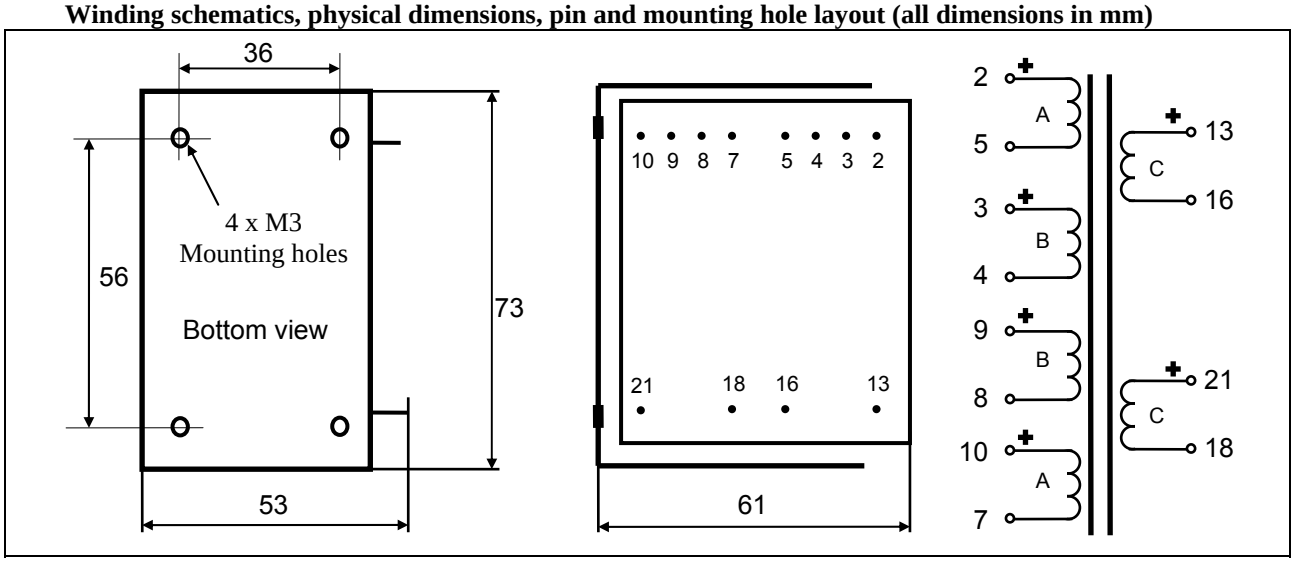
Line Output Transformer LL2745

LL2745 is a line output transformer for tube amplifiers. The transformer is available with different core air gap for PP or SE drives.
The transformer primaries are wound with a special low capacitance winding technique to achieve best high frequency performance. The transformer has a special high flux, low distortion audio C-core of our own production.
The LL2745PP is assembled with a small core air gap to allow for some DC current unbalance.
For the S.E. versions of the LL2745, the core air gap is chosen such that the denoted DC current (18mA for a LL2745/18mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	2.8+2.8 : 1+1+1+1	142 Ω	185 Ω	630 Ω

Max. current through any primary ("C") section: 50 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	LL2745/PP	LL2745/PP	LL2745/PP	LL2745/18mA
Connection	Alt M PP to Line Out. 2.8+2.8 : 4	Alt N PP to Line Out. 2.8+2.8 : 2	Alt O PP to Line Out. 2.8 : 1	Alt P SE to Line Out. 5.6 : 4
Primary DC current for 0.9 Tesla	-	-	-	18 mA
Primary Inductance	290 H	290 H	290 H	90H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	Hz – kHz 15kΩ	15kΩ	15 kΩ	3 kΩ
Max sec. voltage @ 30 Hz	380V r.m.s.	190V r.m.s.	100V r.m.s.	160 V r.m.s.

Type	LL2745/18mA	LL2745/18mA
Connection	Alt Q SE to Line Out. 5.6 : 2	Alt R SE to Line Out. 5.6 : 1
Primary DC current for 0.9 Tesla	18 mA	18 mA
Primary Inductance	90H	90H
Freq. Response (+/-1dB) @ source impedance (*) Secondaries open	3.5kΩ	3.5kΩ
Max output voltage @ 30 Hz	80 V r.m.s.	40 V r.m.s.

Applications

(*) The source impedances used in the tables indicates a recommended upper limit, unless freq. response can be compromised.
At lower source impedance resonance peaking will occure. It can be reduced using secondary load resistors.

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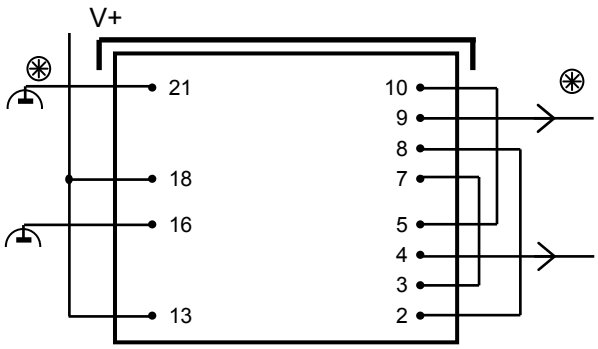
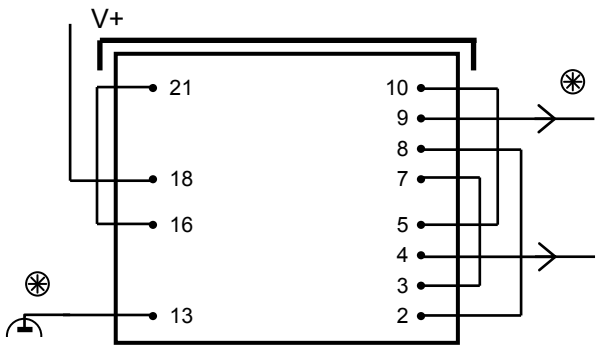
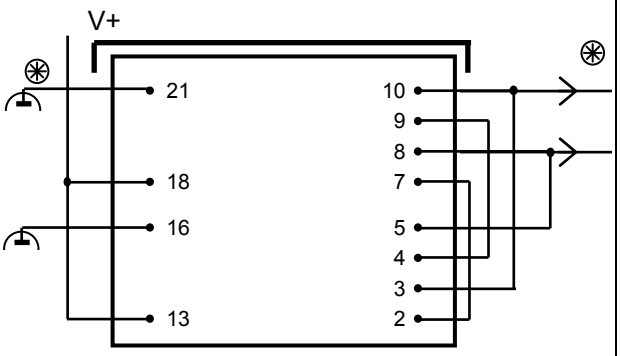
Tube Amplifier Interstage Transformer / Line Output Transformer
LL2745
Connection Alternatives



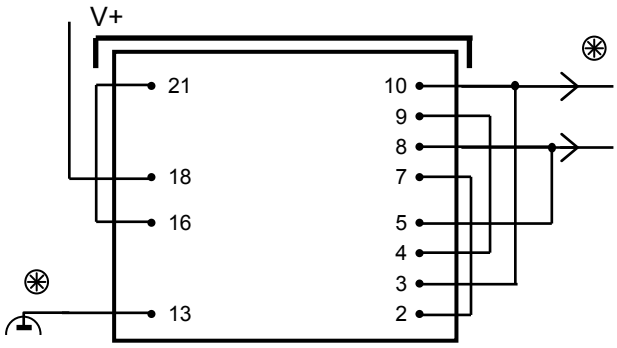
Alt. M
2.8 + 2.8 : 4 (CT at 5)
Push-Pull to Line Output



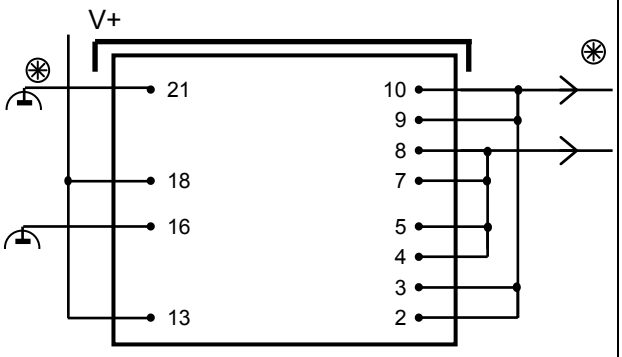
Alt. P
5.6 : 4 (CT at 5)
Single End to Line Output



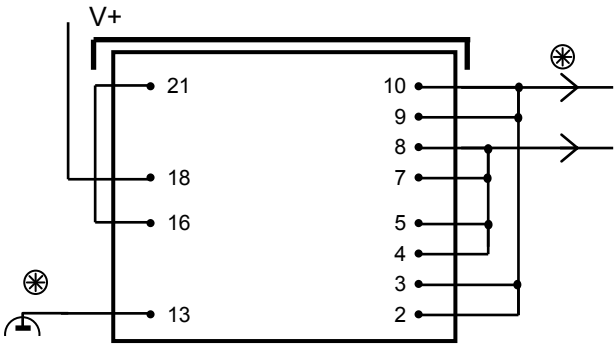
Alt. N
2.8 + 2.8 : 2 (CT at 7+4)
Push-Pull to Line Output



Alt. Q
5.6 : 2 (CT at 7 + 4)
Single End to Line Output



Alt. O
2.8 + 2.8 : 1
Push-Pull to Line Output



Alt. R
5.6 : 1
Single End to Line Output

⊛ Phase Indicator

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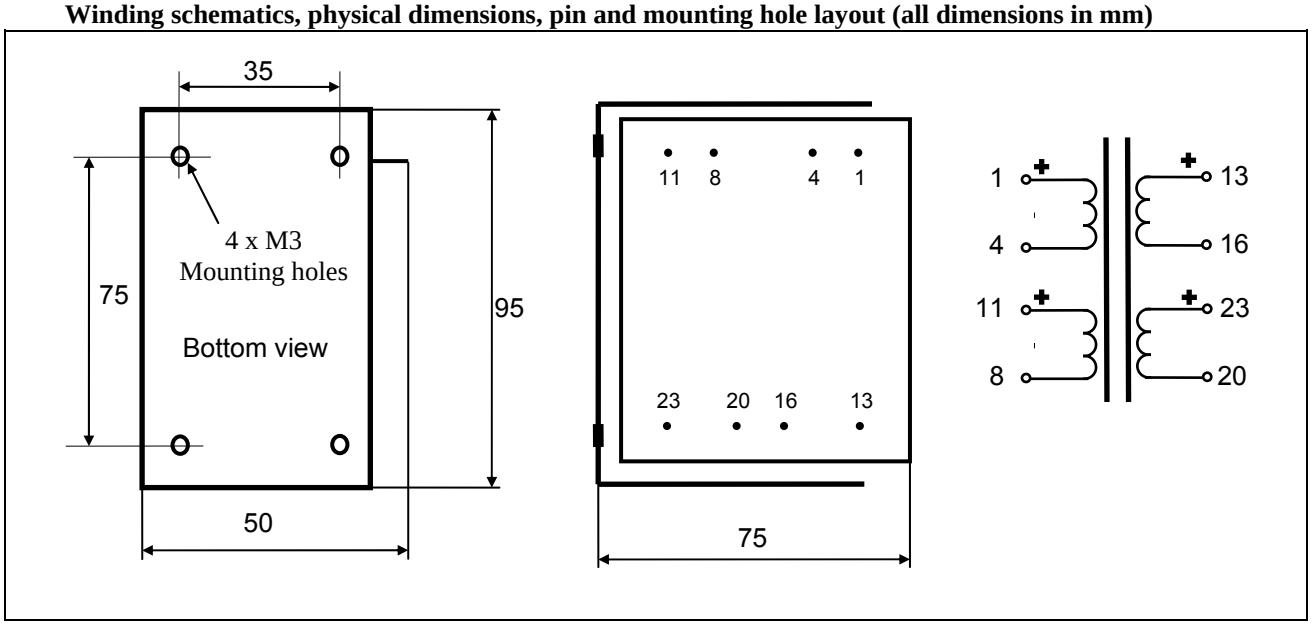
Stepup 1:2 tube amplifier interstage transformer
LL2746 (D)

The LL2746 is a three-section dual coil C-core tube amplifier stepup interstage transformer.
The coil is wound using our low capacitance, high internal isolation technique with internal multilayer isolation foil where layer-to-layer signal voltage is big. Winding order is chosen to minimize destructive capacitive energy buildup between primary and secondary sections.
The core is an audio C-core of our own production.

Turns ratio **1+1 : 2+2**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)

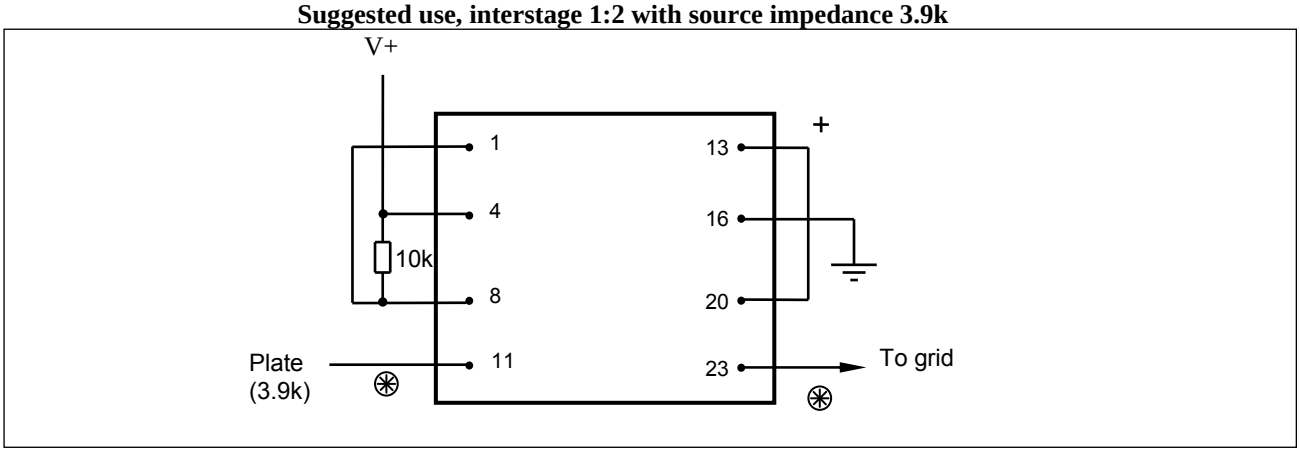


Weight:	1.35 kg
Static resistance of each primary:	75 Ω
Static resistance of secondary:	290 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through any primary winding:	220mA (5W heat dissipation)

	LL2746/30mA	
Primary inductance (approx)	45H	
Max primary signal , at 30 Hz (Operating point 1.2T)	80V r.m.s. (220V peak-peak)	

Frequency response, connected as below (source 3.9k, load 50pF) but with V+ connected to ground:
-3dB at 15Hz; -3dB at 25kHz, +/- 1dB 22Hz – 18kHz

Suggested use, interstage 1:2 with source impedance 3.9k



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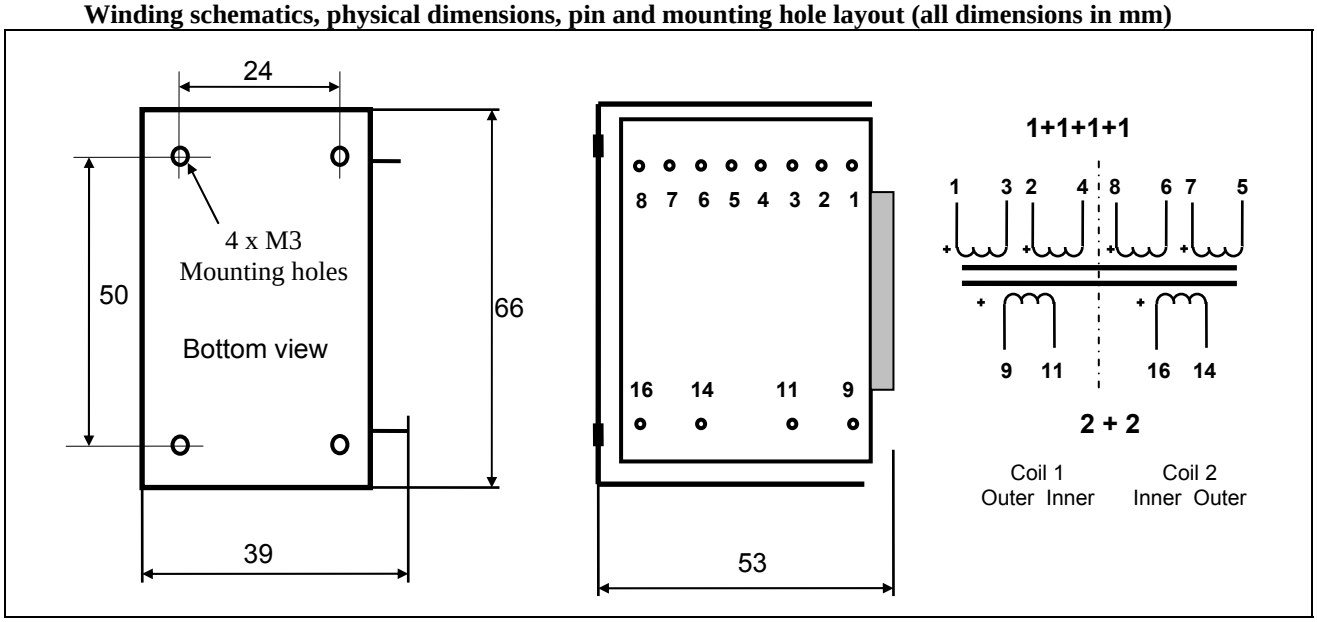
Line Output Transformer for Tube Amplifiers
LL2747

LL2747 is a small line 1:1 turns ratio tube preamp line output transformer.
In LL2747/PP the C-core is gapped with a small airgap to tolerate a certain DC offset current.

Turns ratio: 2 + 2 : 1+1+1+1

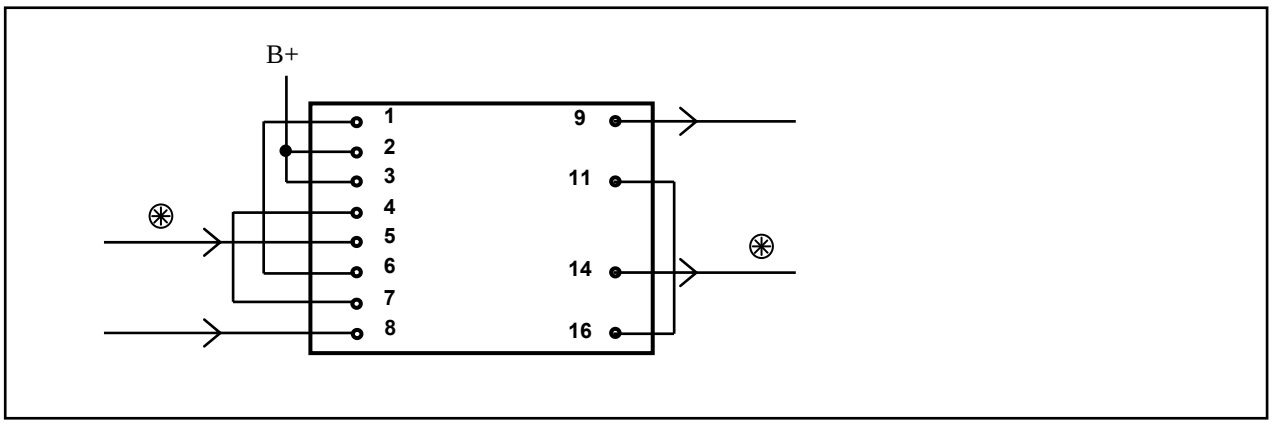
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding 9-11 and 16-14	Static resistance, winding 2-4 and 8-6	Static resistance, winding 1-3 and 7-5
0.35 Kg	2 + 2 : 1 + 1+ 1+ 1	115 Ω	50 Ω	65 Ω

LL 2747 primary inductance Approx. 80H
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Suggested connection, PP line output, 1:1



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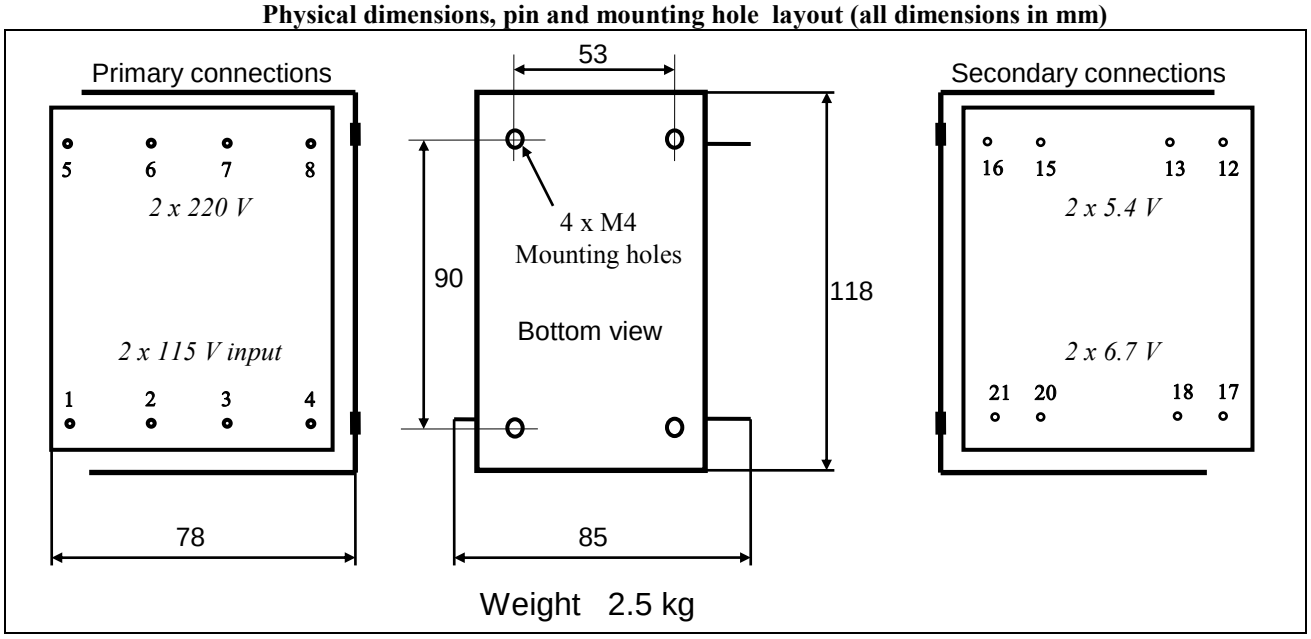
Mains Transformers for Tube Amplifiers
LL2748

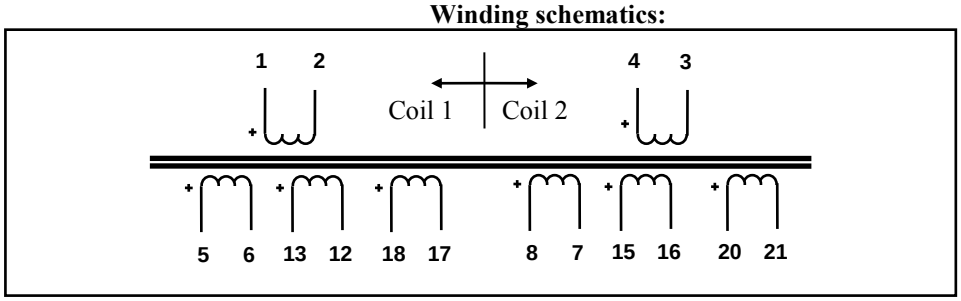
C-core mains transformer. The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically.

Physical dimensions, pin and mounting hole layout (all dimensions in mm)

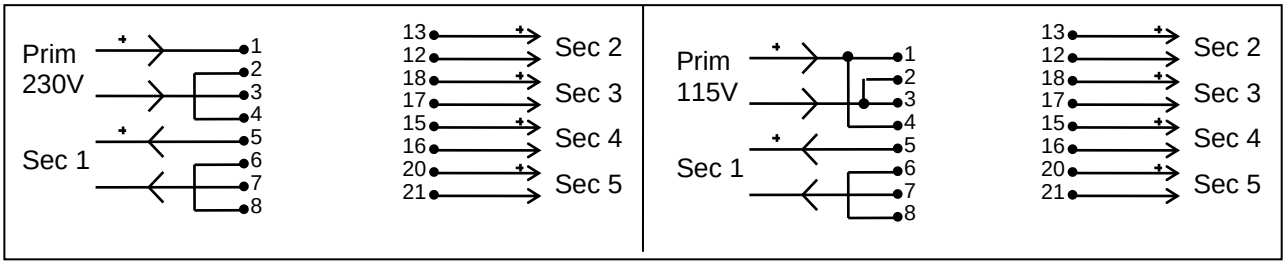


Weight 2.5 kg

Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Primary res. Serial/parallel	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5
7.5 Ω / 1.9 Ω	36 Ω / 443 V 0.3 A	0.1 Ω / 5.4V 4 A	0.1 Ω / 6.7V 2 A	0.1 Ω / 5.4 V 4 A	0.1 Ω / 6.7 V 2 A

Please note! Output current from rectifier: 63% of above with capacitor input rectifier, 95% of above with choke input rectifier.

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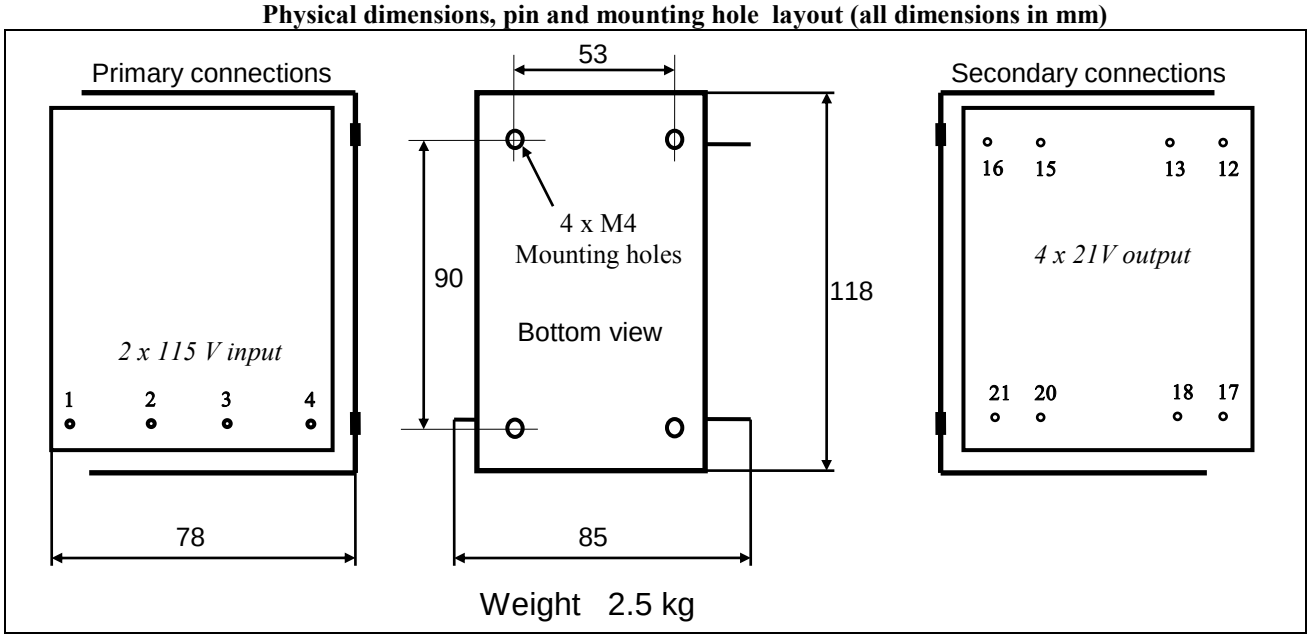
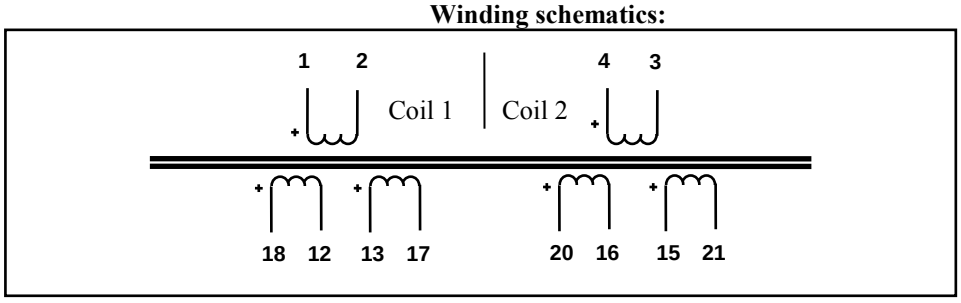
Mains Transformers LL2749

C-core mains transformer for 2 x 40V / 2A (or 2 x 20V / 4A). The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 250 VA which can be increased with good cooling. Magnetic stray is extremely small if secondaries of the two coils are loaded identically, as suggested below.

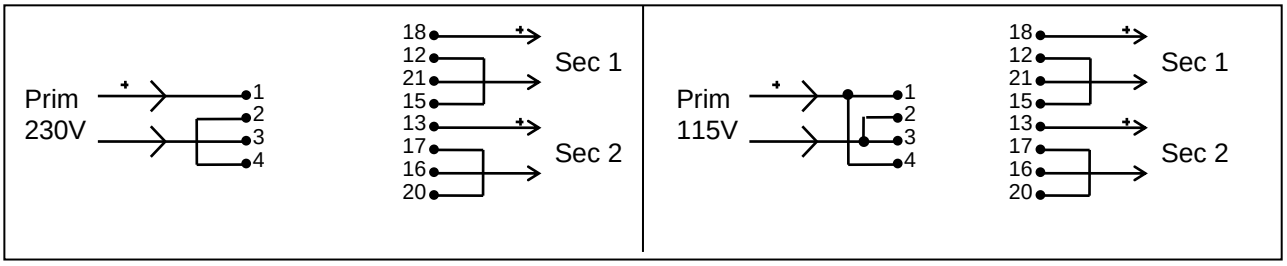
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel and Sec 1 connected as above

Primary res. Serial/parallel	Sec 1	Sec 2
10 Ω / 2.5 Ω	0.5 Ω / 42 V 2.5 A	0.5 Ω / 42 V 2.5 A

Voltage will drop approx 5% at nominal current

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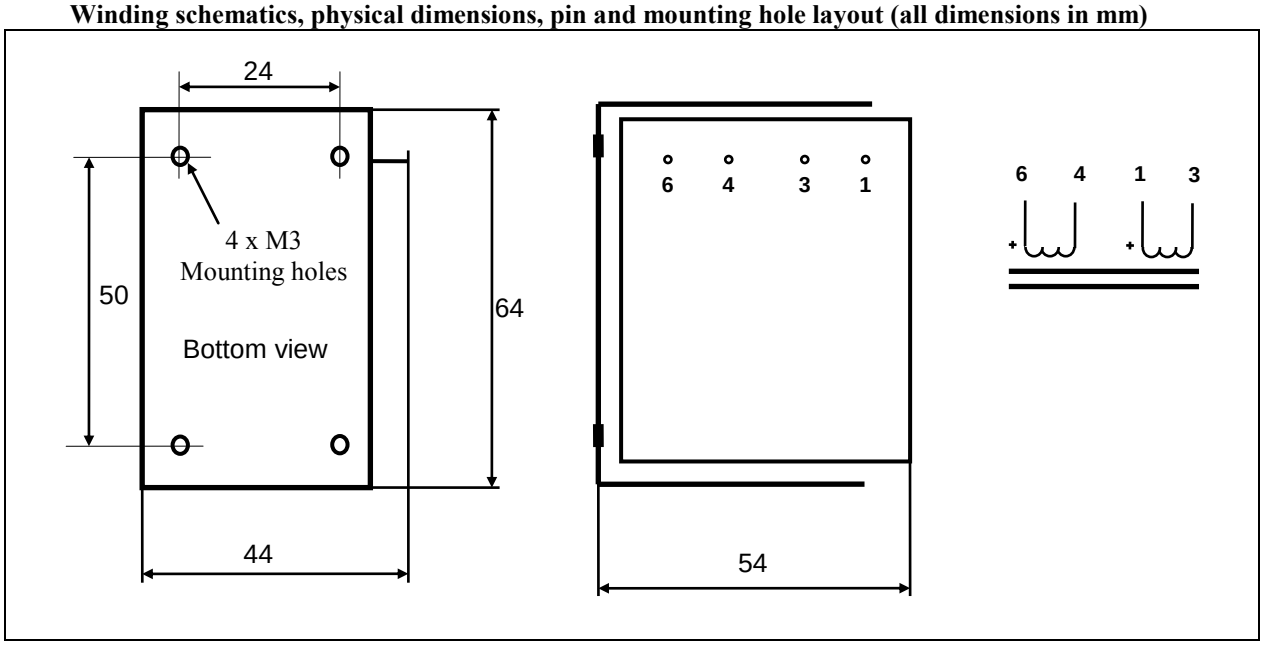
Filament Current Choke LL2751

The LL2751 is a small size two-coil choke for tube/valve filament current filtering.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

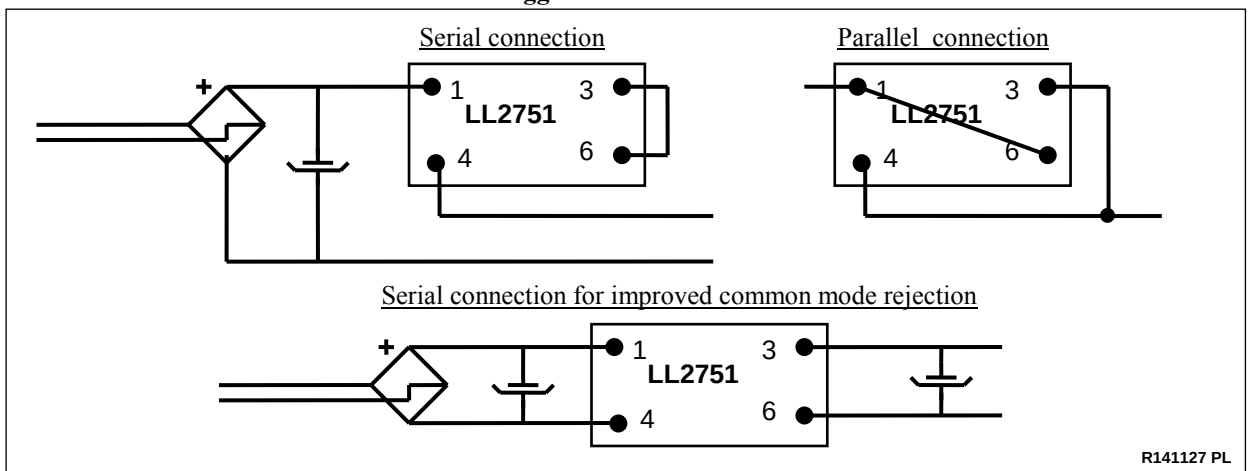
Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight: 0.44 kg
Static resistance of each winding: 0.5 Ω
Isolation between windings / between windings and core: 4 kV / 2 kV

	Coils in series			Coils in parallel		
Type	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)	**Approx. Inductance**	**Recommended DC current** (1.25 T)	**Saturating current** (2.0 T)
LL2751 / 0.6A	0.18 H	0.6 A	1 A	45 mH	1.2 A	2 A
Max. ripple voltage at rec. DC current (Ripple voltage is approx. 0.42 x input voltage)	30 V rms / 100 Hz			15 V rms / 100 Hz		

Suggested connections:



Note! The LL2751 can also be used in choke input power supplies

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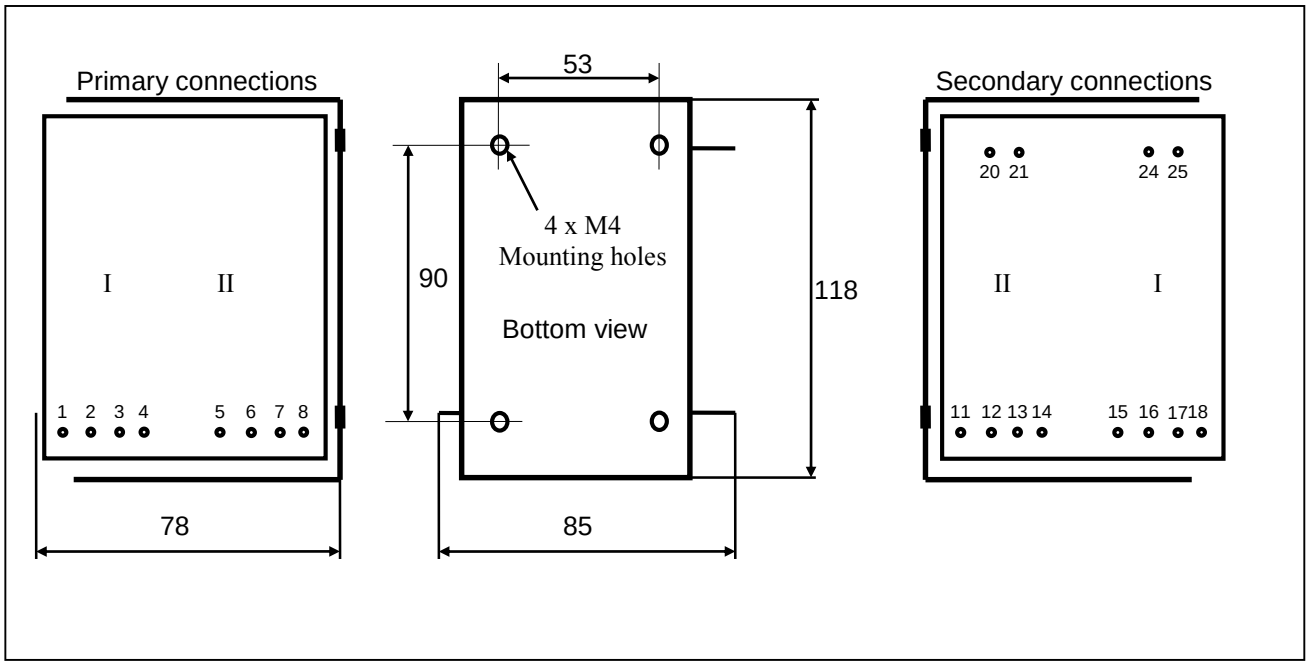
Tube Amplifier Output Transformer
LL2752

LL2752 is an output transformer for tube amplifiers, primarily designed for 2k : 8 ohm applications. The LL2752 is available with different core air-gaps for different type of output stages. The transformers are highly sectioned with harmonically sized sections, which results in a minimum leakage inductance. This combined with a low capacitance coil winding technique results in a wide frequency range. The transformers are un-potted, open frame type suitable for mounting inside amplifier housings.

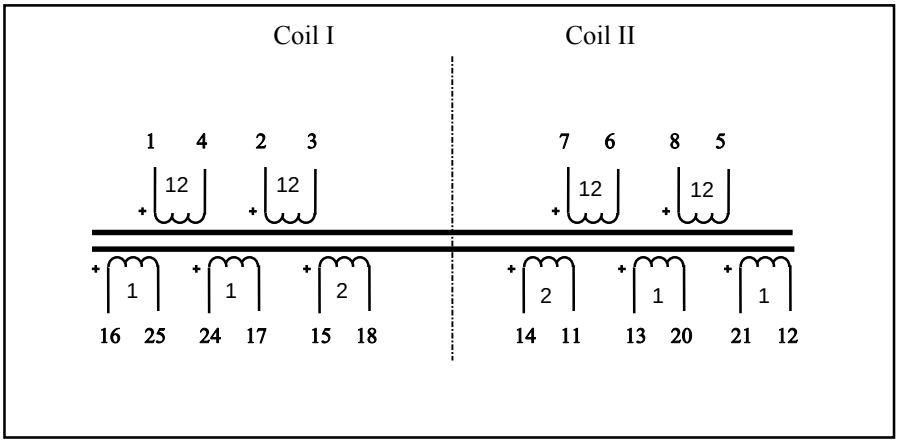
Physical dimensions, pin and mounting hole layout LL2752 (all dimensions in mm)



R150220 PL

Pin spacing module, primary side:	5.08 mm (0.2")
Pin spacing module, secondary side:	7 mm approx..
Row spacing:	75mm approx.
Weight:	2.5 kg
Turns ratio:	12+12+12+12 : 2+ 1+1 +2+1+**1**
Core type:	Lundahl silicon iron C-core. Also available with amorphous C-core

Winding schematics:



	LL2752	
Turns ratio:	12+12+12+12 : 2+ 1+1 +2+1+**1**	
Static resistance of primary (all in series)	92 Ω (4 x 23Ω)	
Static resistance of each secondary winding (approx..)	0.7Ω	
Primary leakage inductance (all in series)	1 mH	
Max recommended primary DC current (heat dissip. 7W)	280 mA	
Max. primary <u>signal</u> voltage r.m.s. at 30 Hz (all in series)	Push-Pull 480V	Single End 215V

Isolation between primary and secondary windings / between windings and core: 3 kV / 1.5 kV

Electrical characteristics

Primary Load Impedance, Max power and power loss.

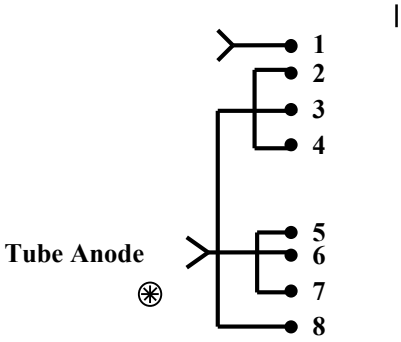
	Sec. connection for 4/8/16 Ω (See next page)		
	-/B/C	B/C/D	C/D/-
	Primary Load Impedance		
LL2752	4.6 kΩ	2 kΩ	1.2 kΩ
	Power and Loss		
Max. Power, P-P at 30 Hz	45W	105W	180W
Max. Power, S.E. at 30 Hz	10 W	21 W	36W
Power loss across transformer	0.2 dB	0.4 dB	0.7 dB

Primary DC Current Core Air-gap and Primary inductance

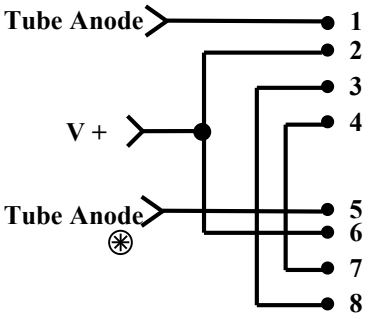
	LL2752/60mA
Core Airgap (delta/2)	100 µ
Single end standing current for 0.9 Tesla (recommended operating point)	60mA
Primary inductance	30H

Frequency response, LL2752/60mA 10 Hz – 50 kHz +0/-1 dB
(source impedance 500Ω , load impedance 10 ohms
Secondary connection "C"

Primary connections, Single-End



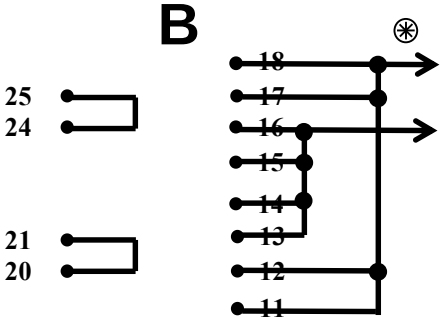
Primary connections push-pull



Secondary connections

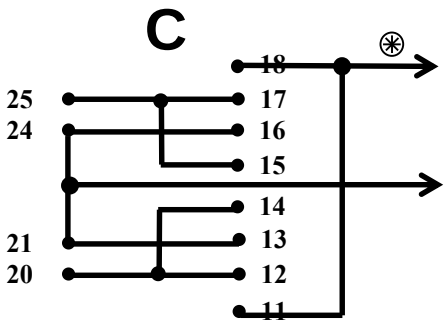
⊛ Indicates phase

B



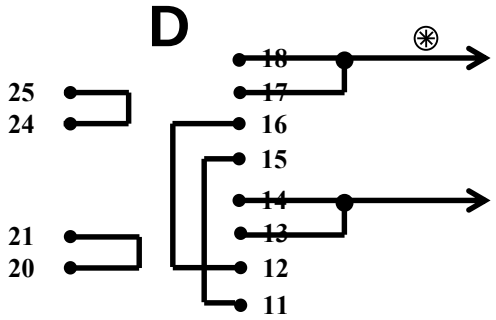
Max secondary Voltage RMS @ 30 Hz	
P-P: 19V	SE : 9V
Sec. copper resistance 0.2 Ω	Windings in series 2

C



Max secondary Voltage RMS @ 30 Hz	
P-P: 29V	SE : 13V
Sec. copper resistance 0.4 Ω	Windings in series 3

D



Max secondary Voltage RMS @ 30 Hz	
P-P: 38V	SE : 17V
Sec. copper resistance 0.9 Ω	Windings in series 4

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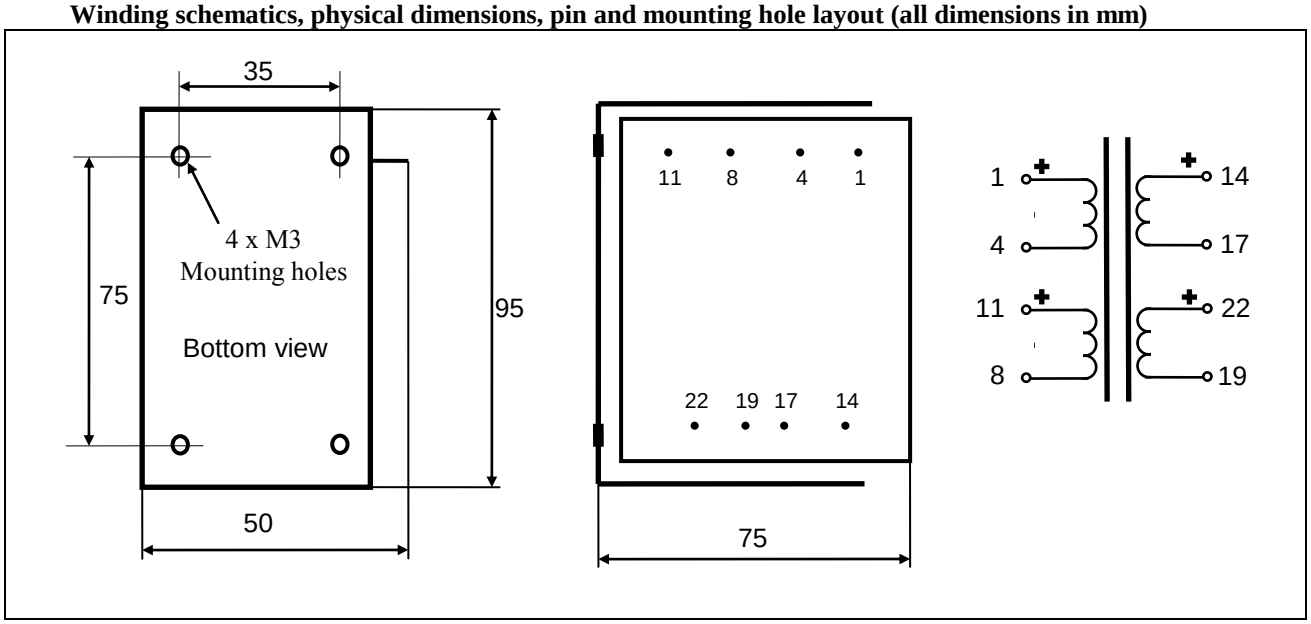
Tube amplifier interstage transformer
LL2753

The LL2753 is a three-section dual coil C-core tube amplifier interstage transformer.
The coil is wound using our low capacitance, high internal isolation technique with internal multilayer isolation foil where layer-to-layer signal voltage is big. Winding order is chosen to minimize destructive capacitive energy buildup between primary and secondary sections.
The core is an audio C-core of our own production.

Turns ratio **1+1 : 1+1**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)

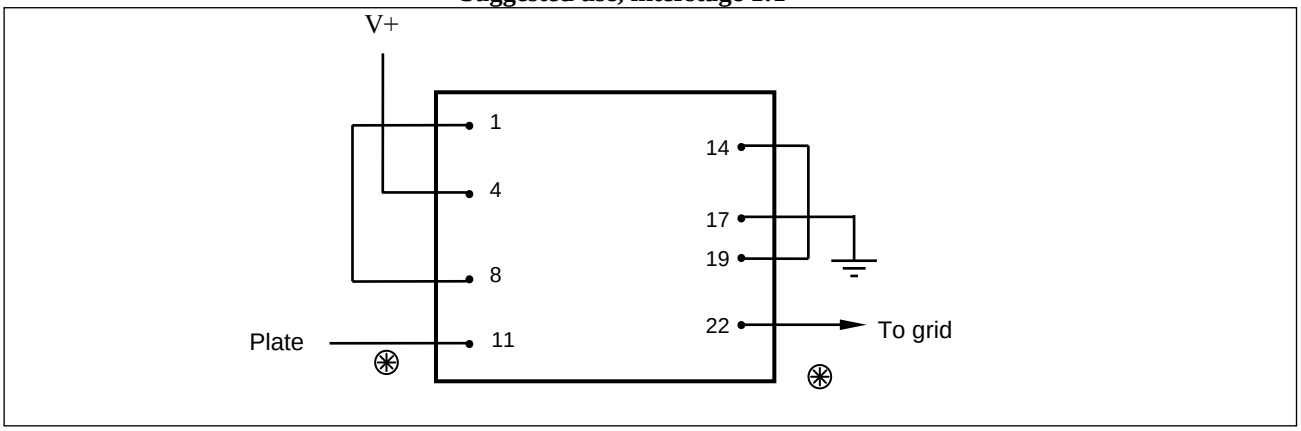


Weight:	1.35 kg
Static resistance of each primary:	75 Ω
Static resistance of secondary:	75 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through primary windings:	180mA (5W heat dissipation)

	LL2753/25mA	
Primary inductance (approx)	50 H	
Max primary signal , at 30 Hz (Operating point 0.9 T)	120V r.m.s. (330V peak-peak)	

Frequency response connected as below, source 3k, load 50 pF // 50k (with V+ connected to ground):
-3dB at 12Hz; -3dB at 65kHz, +/- 1dB 25Hz – 45kHz

Suggested use, interstage 1:1



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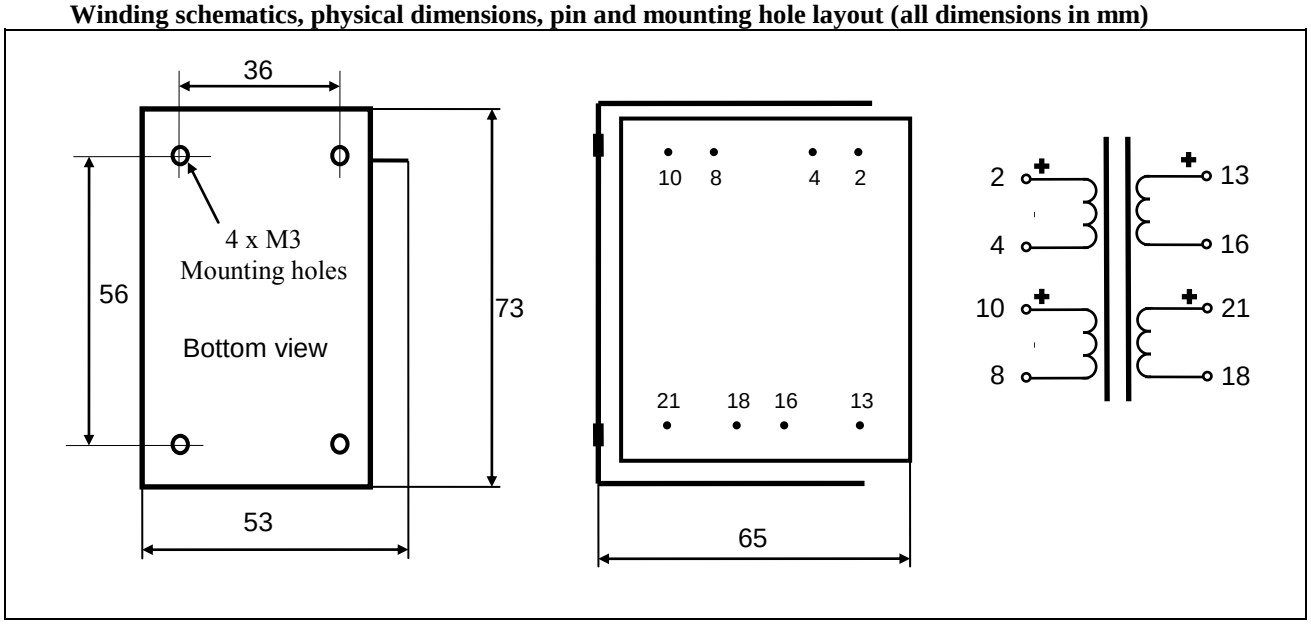
Output transformer for headphone amplifiers
LL2754

The LL2754 is a four-sectioned, dual coil, low impedance C-core output transformer for headphone amplifier applications. LL2754 is available in PP and SE versions.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **1+1 : 1+1**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)

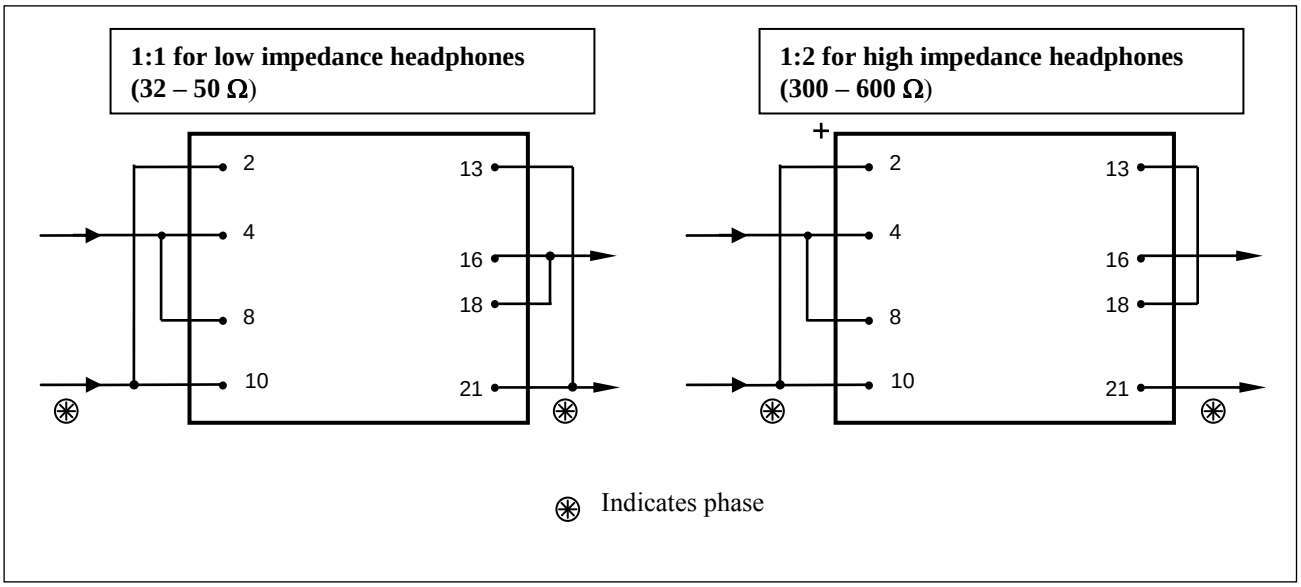


Weight:	0.6 kg
Static resistance of each primary:	7 Ω
Static resistance of secondary:	7 Ω
Max recommended DC current through primary windings:	850mA (5W heat dissipation)
Isolation between windings / between windings and core:	4 kV / 2 kV
Frequency response	5Hz – 100kHz +/- 1 dB

1:2 as below, source 10 ohms, load 500 ohms, ref 1kHz

	LL2754/PP	**LL2754/XmA**
Primary inductance (primaries in series)	7H	
Max signal across each section, at 20 Hz	20V r.m.s. (PP usage)	8 V r.m.s. (SE usage)

Suggested use



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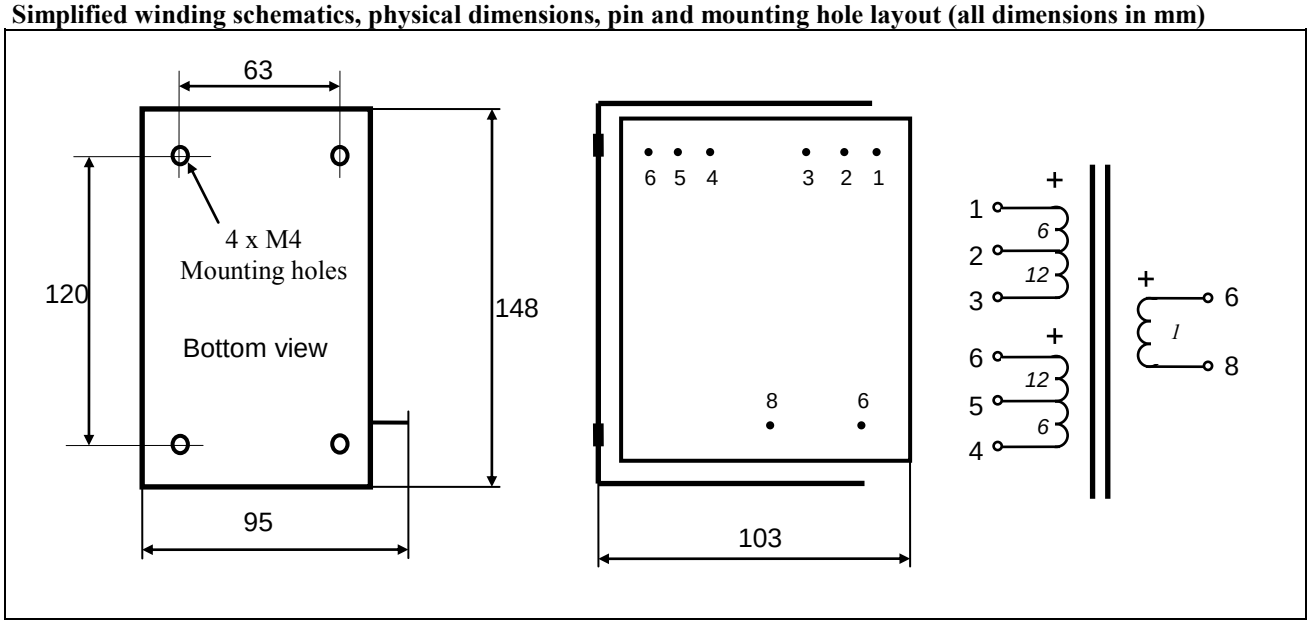
Tube amplifier output transformer LL2755
11k : 8 ohms (for 813 and similar tubes)

The LL2755 is a dual coil C-core tube amplifier output transformer for 11k : 8 ohms impedance ratio available in PP and SE versions.
The coil is wound using our high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **18+18 : 1**

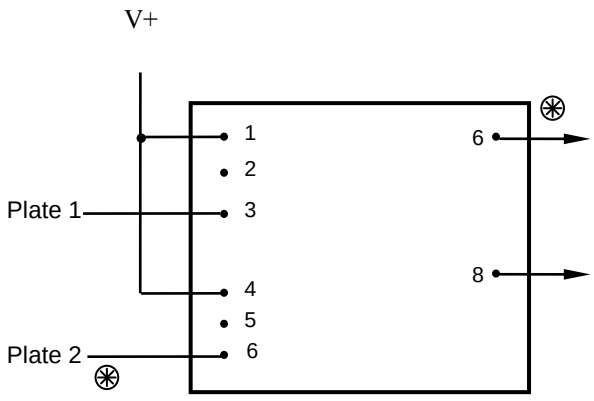
Simplified winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



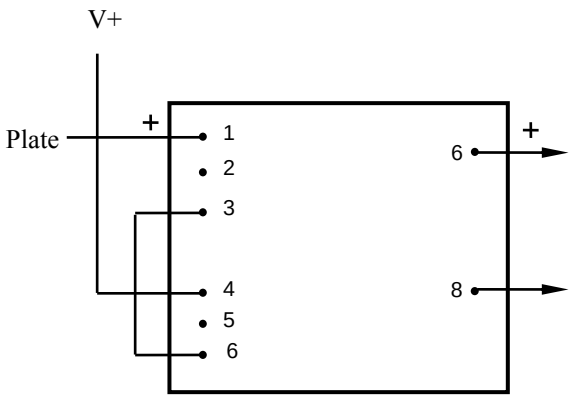
Weight:	4.6 kg
Static resistance of each primary:	82 Ω
Static resistance of secondary:	0.1 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max DC current through any primary winding (10W heat dissip):	350 mA

	LL2755/PP	LL2755/60mA
Primary inductance (approx.)		65H
Max primary signal	1000V R.M.S. @ 30 Hz	435V R.M.S. @ 30 Hz
Max output power @ 30 Hz	95W (8Ω spkr)	18W (8Ω spkr)

Suggested use:



LL2755 used in Push Pull
Plate-to-plate impedance
11k at 8 ohms load



LL2755 used in Single End
Primary impedance 11k at 8
ohms load

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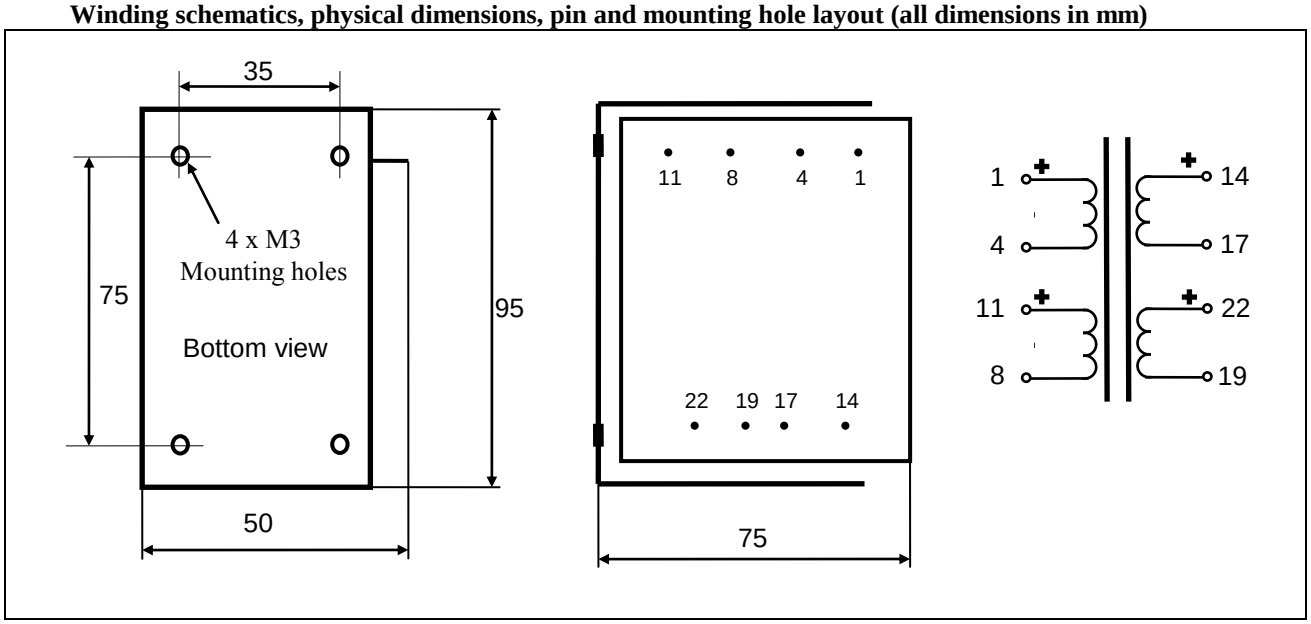
Tube amplifier interstage transformer
LL2756

The LL2756 is a three-section dual coil C-core tube amplifier interstage transformer.
The coil is wound using our low capacitance, high internal isolation technique with internal multilayer isolation foil where layer-to-layer signal voltage is big. Winding order is chosen to minimize destructive capacitive energy build-up between primary and secondary sections.
The core is an audio C-core of our own production.

Turns ratio **1+1 : 1+1**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)

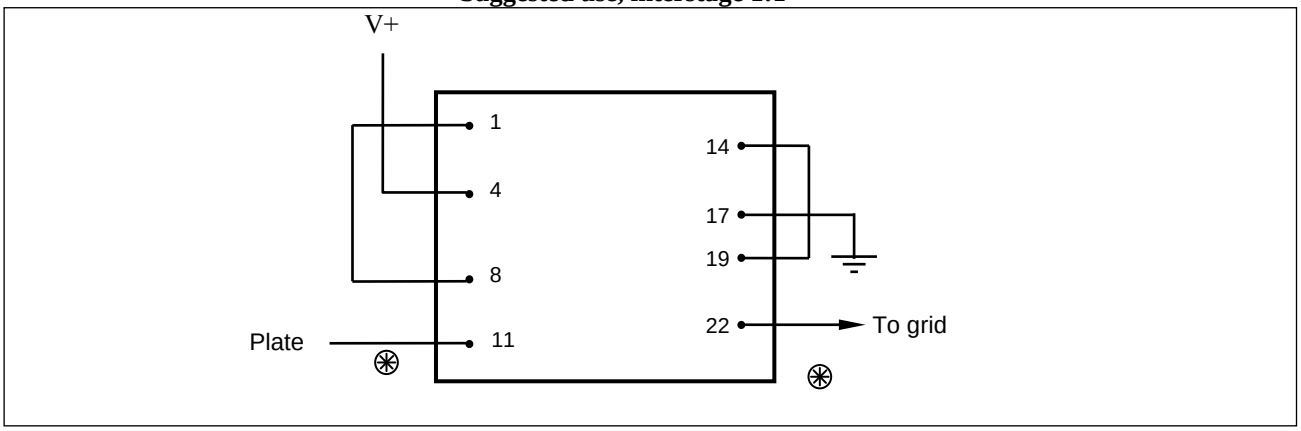


Weight:	1.35 kg
Static resistance of each primary:	180 Ω
Static resistance of secondary:	180 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through primary windings:	120mA (5W heat dissipation)

	LL2756/25mA	
Primary inductance (approx)	70 H	
Max primary signal , at 30 Hz (Operating point 0.9 T)	180V r.m.s. (500V peak-peak)	

Frequency response connected as below, source 4.5k, load 50 pF // 50k (with V+ connected to ground):
-3dB at 12Hz; -3dB at 40kHz, +/- 1dB 25Hz – 30kHz

Suggested use, interstage 1:1



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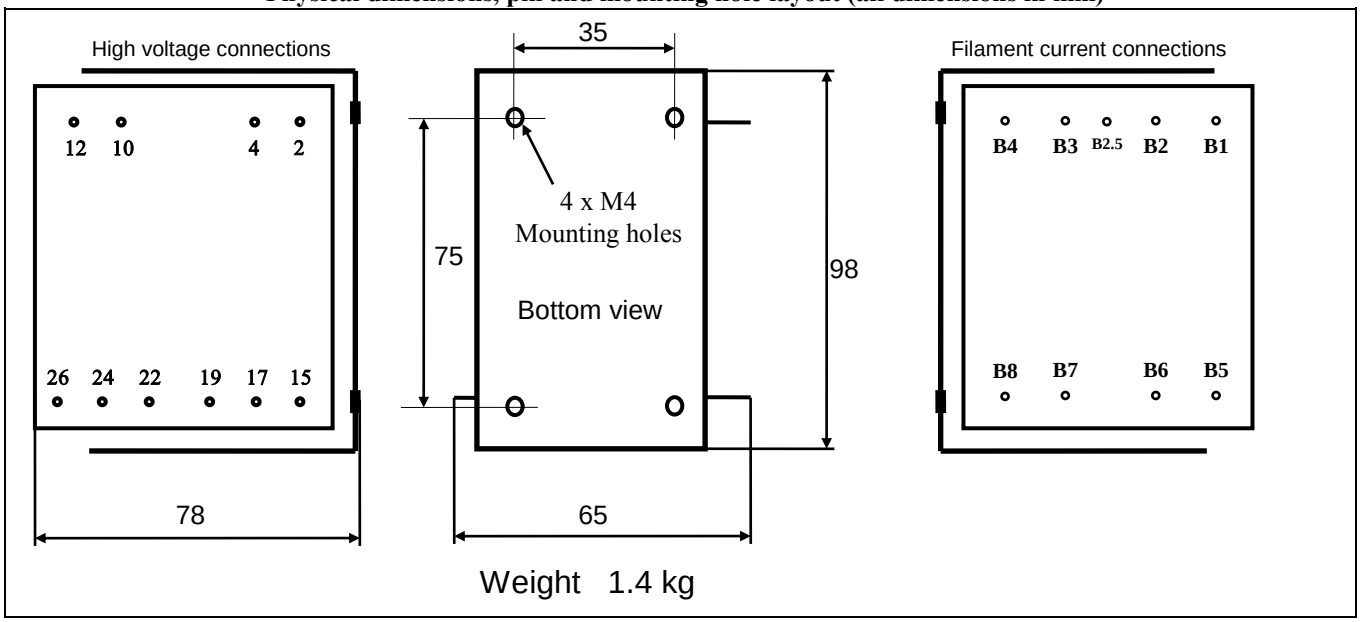
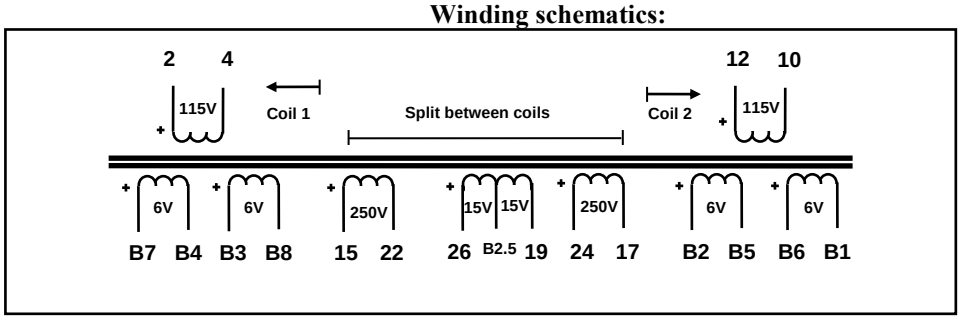
Mains Transformers for Tube Preamplifiers
LL2758

C-core mains transformer, assembled with a small core air-gap to compensate for any mains DC-unbalance. Estimated power rating 100 VA, which can be increased with good cooling. The 2 x 250V secondaries are internally divided between the two coils. As a result, the transformer can be used with bridge or full wave rectifiers without a problem of asymmetric load. Magnetic stray is extremely small if filament secondaries of the two coils and the 15V-0-15V winding are loaded symetrically.

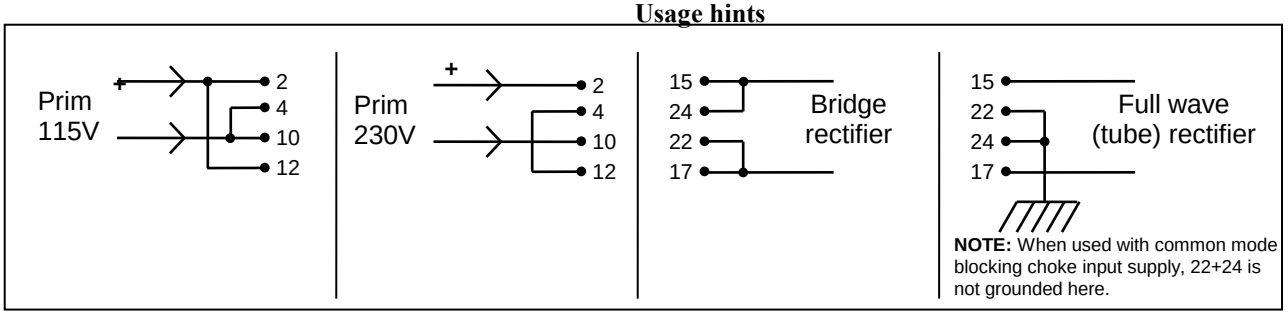
Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Winding schematics:



Usage hints



Output voltage (rms) at indicated load current, and coil resistance.
Primary connected to 230 V series / 115V parallel

Primary res. Series/parallel	**Sec 1** Pins 15 - 22	**Sec 2** Pins 24 - 17	**Sec 3** Pins 26 - 19	**Sec 4** Pins B7 – B4	**Sec 5** Pins B6 – B1	**Sec 6** Pins B3 – B8	**Sec 6** Pins B2 – B5
17Ω / 4Ω	250V / 130mA 115Ω	250V / 130mA 115Ω	30V / 0.1A 8Ω	6 V / 2A 0.2Ω	6 V / 2A 0.2Ω	6 V / 2A 0.2Ω	6 V/ 2A 0.2Ω

Please note! Output current from rectifier: 63% of above with cap. input rectifier, 95% of above with choke input rectifier.

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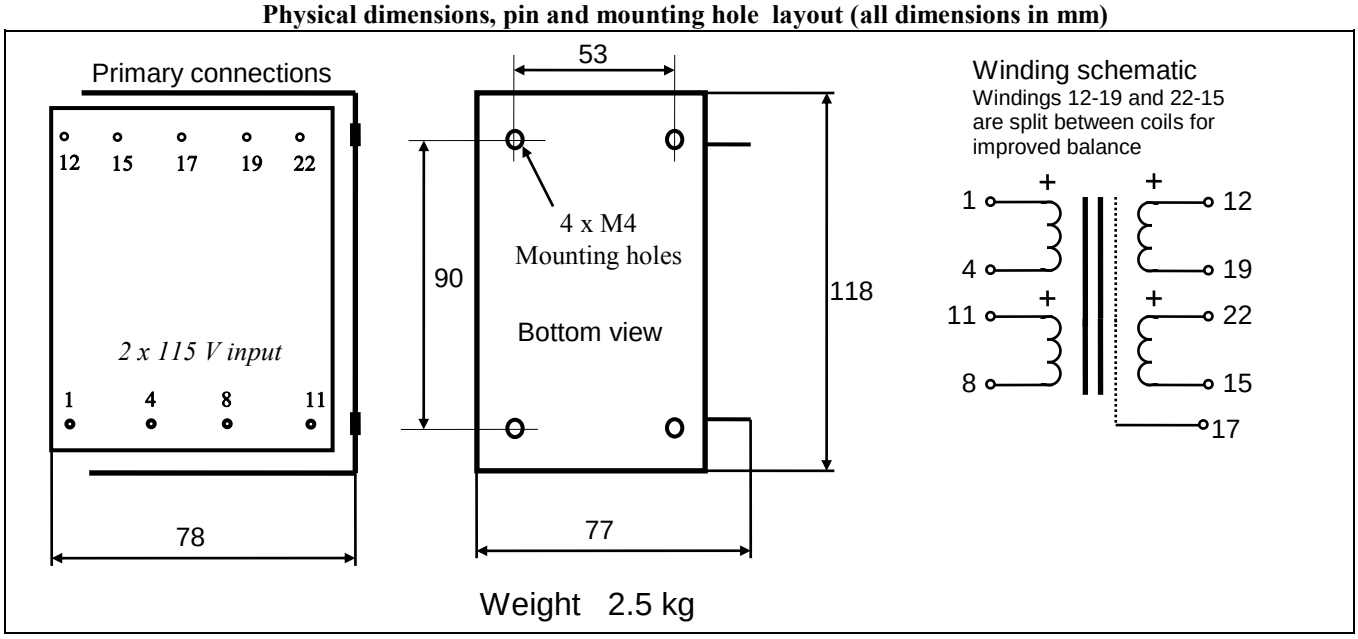
Mains Transformers LL2760

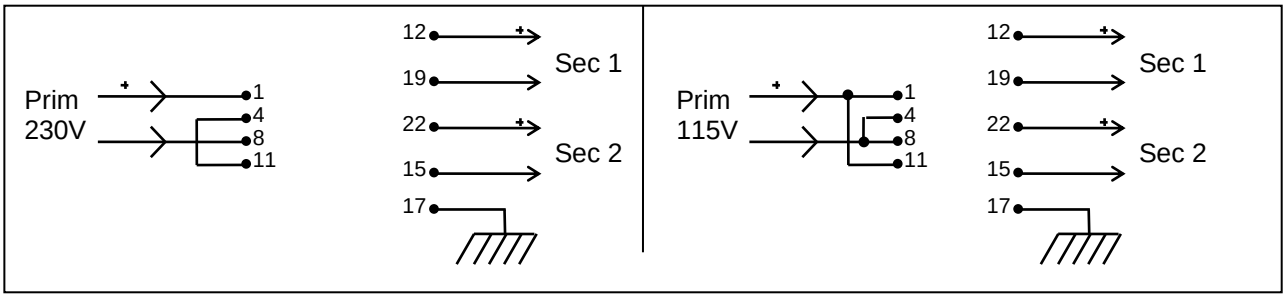
C-core mains transformer for 2 x 115V / 0.9A . The core is assembled with a small air-gap to compensate for any mains DC-unbalance. Estimated power rating 200 VA (heat dissipation 11W) which can be increased with good cooling. Magnetic stray is extremely small due to the dual coil structure. A Faraday shield is provided between primary and secondary windings to improve immunity from mains HF noise.

Turns ratio: 1 + 1 : 1 + 1

Physical dimensions, pin and mounting hole layout (all dimensions in mm)



Connection alternatives. Primary in series for 230V (left) and in parallel for 115V (right).



Copper resistance, no load output voltages and max recommended transformer current (rms) with primary connected to 230 V serial / 115V parallel

Primary res. Serial/parallel	Sec 1	Sec 2
7 Ω / 1.7 Ω	4.1 Ω / 115 V 0.9 A	3.9 Ω / 115 V 0.9 A

Voltage will drop approx 6% at nominal current

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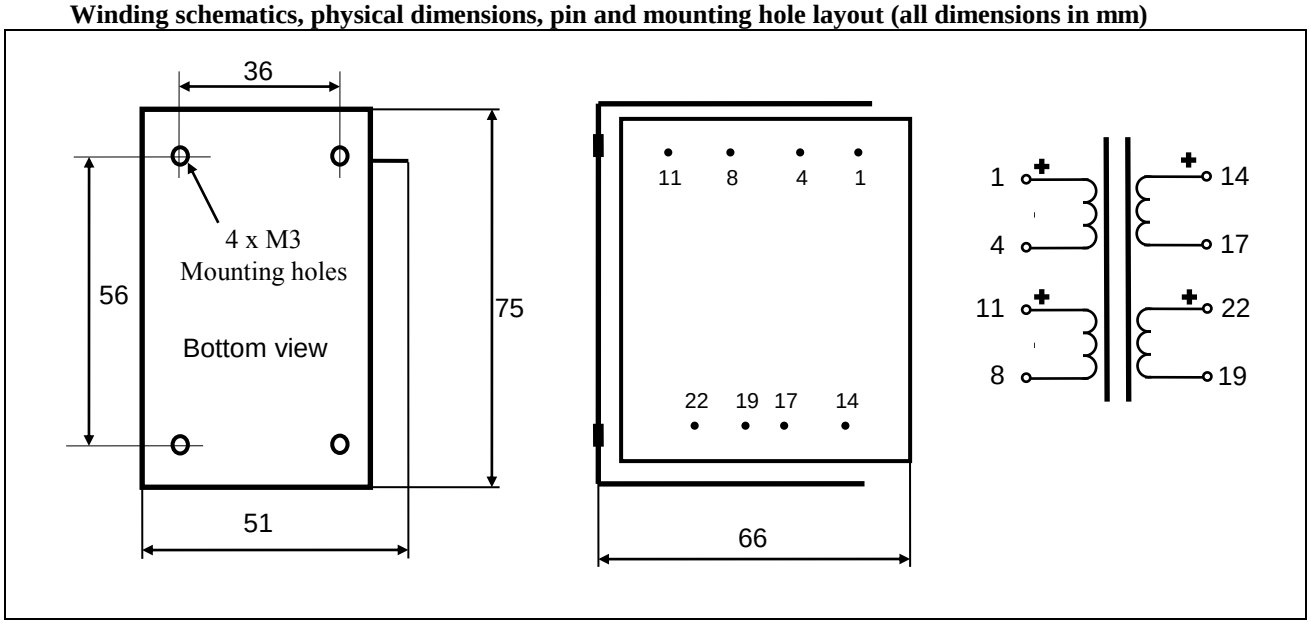
Tube amplifier interstage transformer
LL2762

The LL2762 is a three-section dual coil C-core tube amplifier interstage transformer.
The coil is wound using our low capacitance, high internal isolation technique with internal multilayer isolation foil where layer-to-layer signal voltage is big. Winding order is chosen to minimize destructive capacitive energy build-up between primary and secondary sections.
The core is an audio C-core of our own production.

Turns ratio **1+1 : 1+1**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)

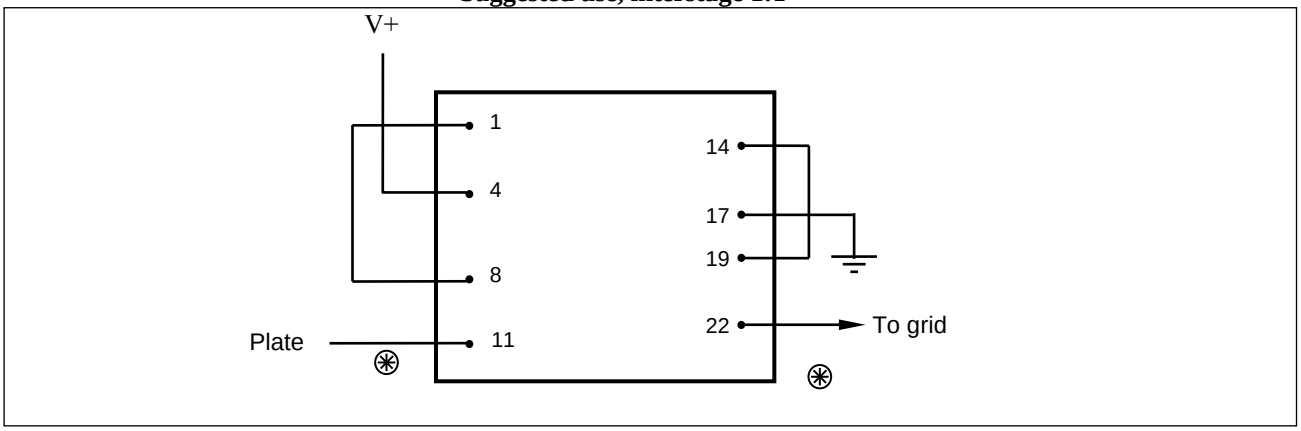


Weight:	0.75 kg
Static resistance of each primary:	560 Ω
Static resistance of secondary:	560 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV
Max recommended DC current through primary windings:	50mA (3W heat dissipation)

	LL2762/16mA	
Primary inductance (approx)	115 H	
Max primary signal , at 30 Hz (Operating point 0.9 T)	220V r.m.s. (600V peak-peak)	

Frequency response connected as below, source 4.5k, load 50 pF // 50k (with V+ connected to ground):
-3dB at 12Hz; -3dB at 33kHz, +/- 1dB 20Hz – 30kHz

Suggested use, interstage 1:1



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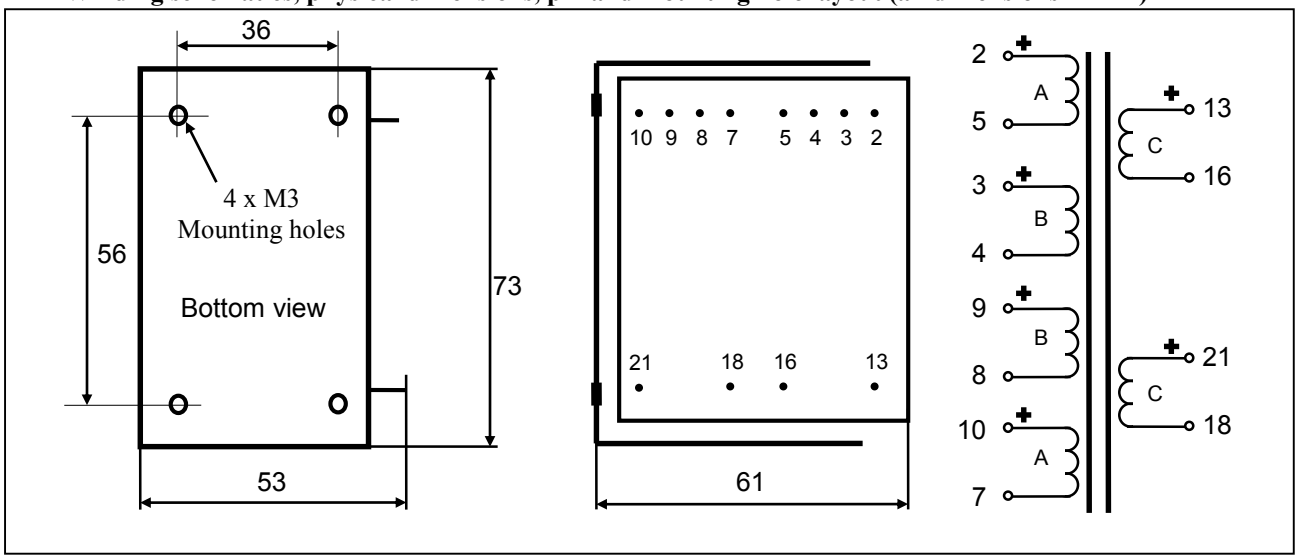
Small Size Tube Amplifier Output Transformer LL2764

LL2764 is a small size power output transformer for tube amplifiers. The transformer is available with different core air gap for PP or SE drives.
The transformer has a special high flux, low distortion audio C-core of our own production.
The LL2764PP is assembled with a small core air gap to allow for some DC current unbalance.
For the S.E. versions of the LL2764, the core air gap is chosen such that the denoted DC current (50mA for a LL2764/50mA) generates a no signal core flux density of 0.9 Tesla when used with all primaries in series. This leaves a flux density swing of 0.7 T for the signal.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight	Turns ratio	Static resistance, winding A	Static resistance, winding B	Static resistance, winding C
0.75 Kg	20+20 : 1+1+1+1	0.7 Ω	0.6 Ω	140 Ω

Max. current through any primary ("C") section (4 W heat dissipation) : 120 mA
Isolation between primary and secondary windings / between windings and core: 4 kV / 2 kV

Type	LL2764/PP	LL2764/PP	LL2764/50mA	LL2764/18mA
Connection Application Turns ratio	Alt O PP 4.8 k : 3Ω 40 : 1	Alt N PP 3.2k : 8 ohms. 20 : 1	Alt R SE 4.8k : 3Ω. 40 : 1	Alt Q SE 3.2k : 8 20 : 1
Primary DC current for 0.9 Tesla	-	-	50 mA	50 mA
Primary Inductance	? H	? H	25 H	25 H
Freq. Response (+/-3dB) @ source impedance (*) Load	 2 kΩ 4 Ω	 1kΩ 8 Ω	15Hz – 50kHz 2 kΩ 4 Ω	 1kΩ 8 Ω
Max sec. voltage @ 30 Hz Output power	7 V r.m.s. 12 W	14V r.m.s. 24W	3 V r.m.s. 2W	6 V r.m.s. 4W

R160520 PL

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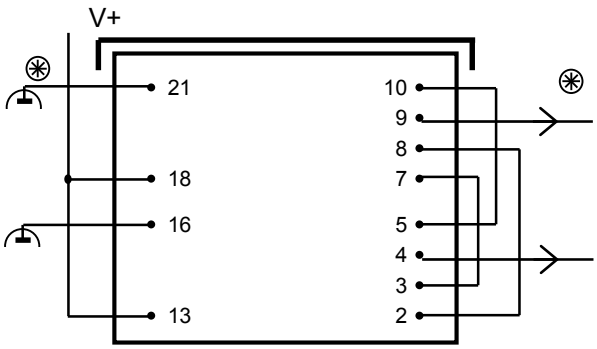
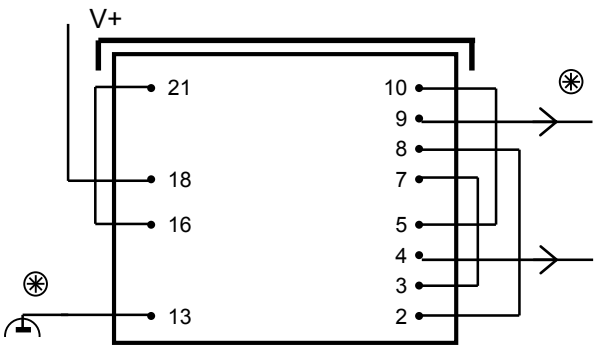
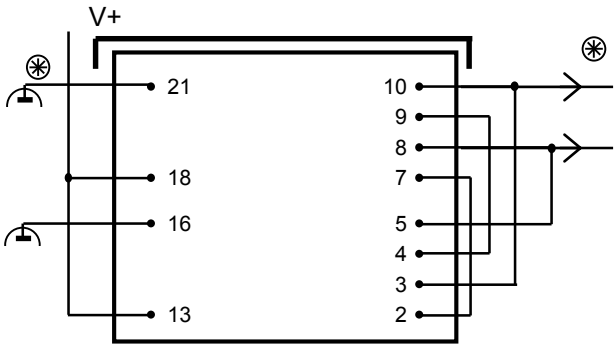
Tube Amplifier Output Transformer LL2764
Connection Alternatives



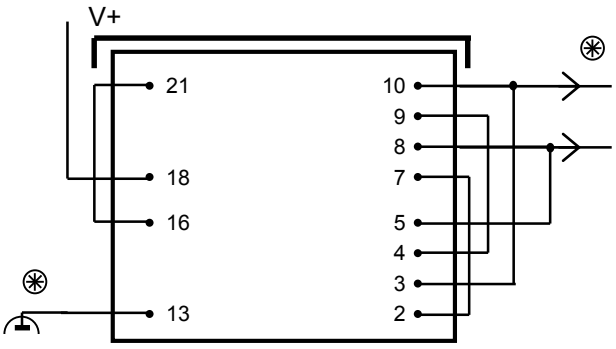
Alt. M
20+20 : 4 (CT at 5)
Push-Pull to Power Output



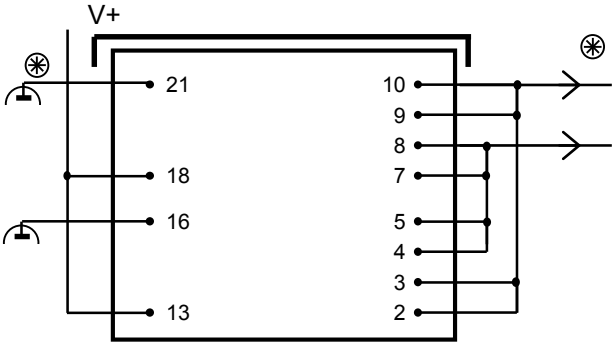
Alt. P
40 : 4 (CT at 5)
Single End to Power Output



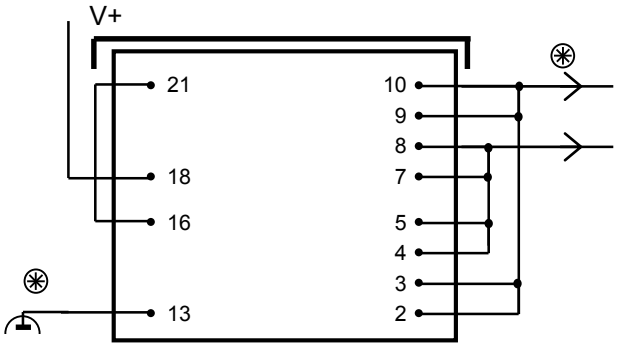
Alt. N
20+20 : 2 (CT at 7+4)
Push-Pull to Power Output



Alt. Q
40 : 2 (CT at 7 + 4)
Single End to Power Output



Alt. O
20+20 : 1
Push-Pull to Power Output



Alt. R
40 : 1
Single End to Power Output

⊛ Phase Indicator

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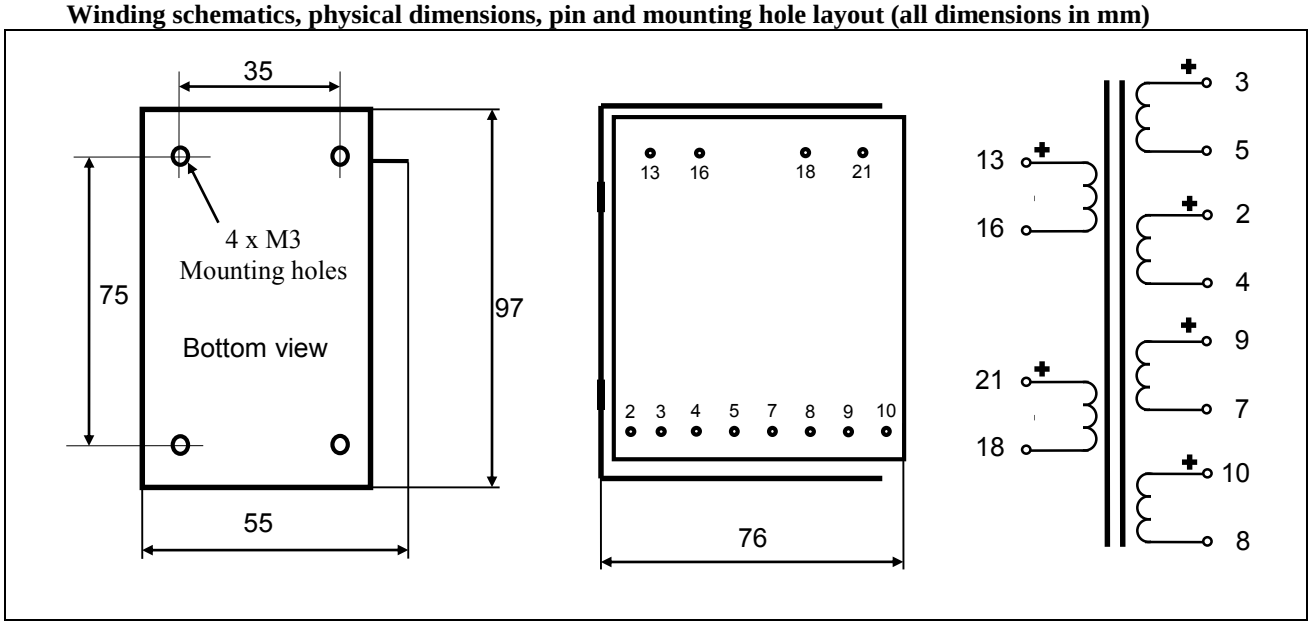
Output transformer for tube headphone amplifiers
LL2765

The LL2765 is a three sectioned, dual coil, C-core output transformer for headphone amplifier applications. LL2765 is available in PP and SE versions.
The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

Turns ratio **6+6 : 1+1+1+1**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.3 kg
Static resistance of each primary:	75 Ω
Static resistance of secondaries 2-4 and 7-9	3.5 Ω
Static resistance of secondaries 3-5 and 8-10	4.5 Ω
Max recommended DC current through primary windings:	180mA (5W heat dissipation)
Isolation between windings / between windings and core:	4 kV / 2 kV
Frequency response	

	LL2765/PP	**LL2765/30mA**
Primary inductance (primaries in series)	170H	64H
Max primary signal at 30 Hz (primaries in series)	370V r.m.s. (PP usage)	160 V r.m.s. (SE usage)

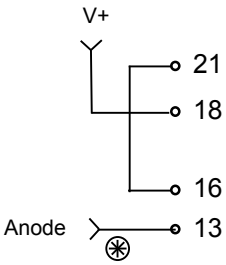
Suggested use

Headphone impedance	**Suggested connection alternative**	**Turns ratio**	**Primary impedance (ohms)**
32 ohms	A	12:1	4.6k
150 ohms	B	6:1	5.4k
600 ohms	C	3:1	5.4 k

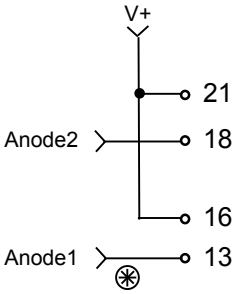
R160603 PL

Connection alternatives

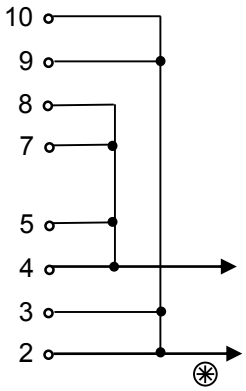
Primary connection for Single-End



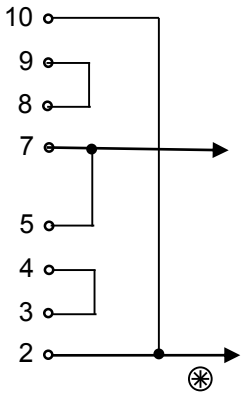
Primary connection for Push-Pull



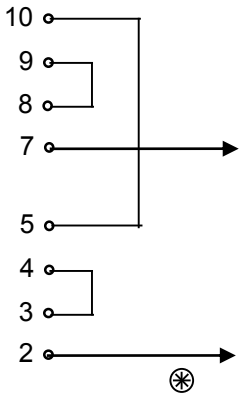
Secondary connection A (12:1)



Secondary connection B (6:1)



Secondary connection C (3:1)



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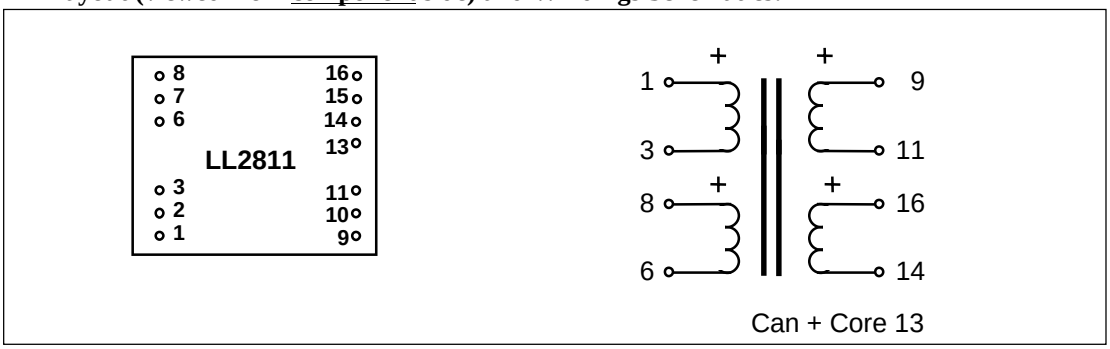
Audio Output Transformer
LL2811

LL2811 is an audio output transformer for balanced drive, with the following features:

1. Four section winding structure for small leakage inductance.
2. Ideally used 2 : 1 (secondaries in parallel) with e.g. NE5532 op amps for low noise.
3. Precision made audio C core for small size.
4. Two-coil structure and mu-metal housing for high magnetic noise immunity.
5. Designed to fit three in a row across a Euroboard.

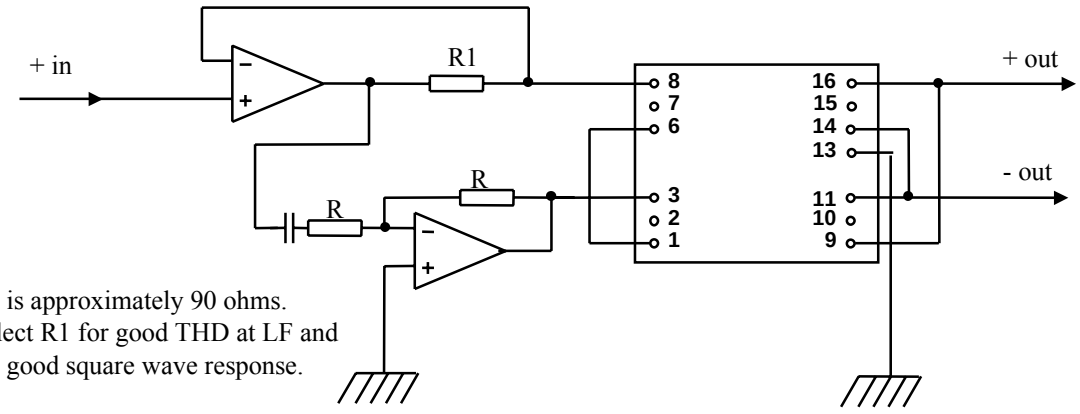
The secondaries can be connected in parallel for low output impedance or in series for high output level.

Turns ratio: 1 + 1: 1 + 1
Dims: (Length x Width x Height above PCB (mm)) 31 x 26x 23
Pin Layout (viewed from component side) and Windings Schematics:



Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	65 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary (average):	45 Ω
Static resistance of each secondary (average):	45 Ω
Max. primary level (primaries in series)	+30 dBU @ 50 Hz
Leakage inductance (windings in series):	< 1 mH
No-load impedance(primaries in series, primary level)**:**	> 750 Ω @ 50 Hz, +20 dBU
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 55 dB
Frequency response (source 10 Ω, load 600 Ω, 0 dBU):	10 Hz -- 100 KHz +/- 0.3 dB
Isolation between primary and secondary windings/ between windings and core:	4 kV / 2 kV

Fundamental design of driving circuitry, mixed feedback, 2:1, suggested by A. Offenberg, NRK



R1 is approximately 90 ohms.
Select R1 for good THD at LF and for good square wave response.

R980626

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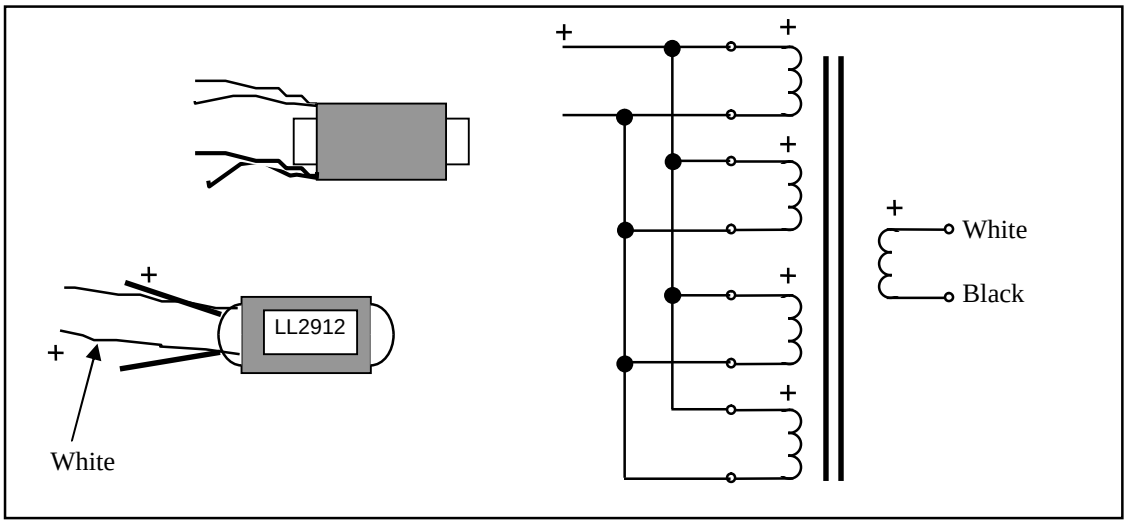
Ribbon Microphone Transformer
LL2912

LL2912 is a flying lead version of microphone ribbon transformer LL2911. Core is our proprietary high mu amorphous strip core.

Turns ratio:		1 : 37
Dimensions:	Length [leads not included]	27mm
	Max diameter	19.5 mm

Layout and Windings Schematics:



Weight:	17 g
Core:	Amorphous strip core
Static resistance of primary:	0.05 Ω
Static resistance of secondary:	59 Ω

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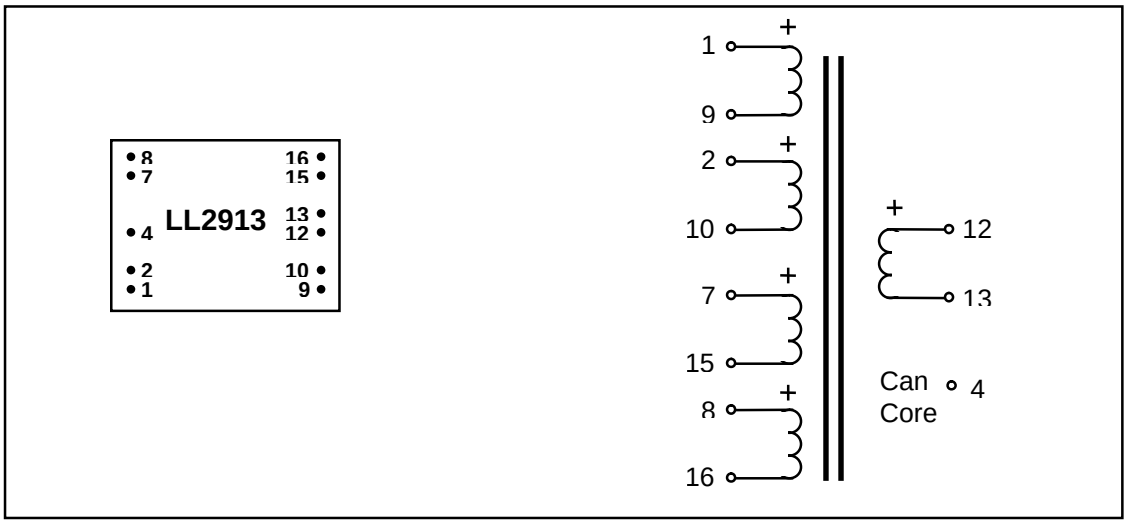
Ribbon Microphone Transformer
LL2913

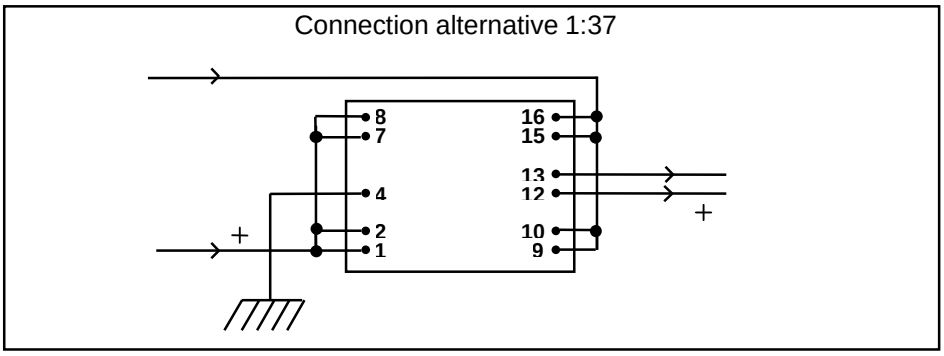
LL2913 is identical to our ribbon microphone transformer LL2911, but (for manufacturing reasons) with a different pinout / winding phase.

Turns ratio: 1 + 1 + 1 + 1 : 37
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from component side) **and winding schematic:**



Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	27 g
Rec. PCB hole diameter:	1.5 mm
Housing:	Mu metal
Core:	Amorphous strip core
Static resistance of <u>each</u> primary (average):	0.2 Ω
Static resistance of secondary:	59 Ω

Connection alternative 1:37



R070214

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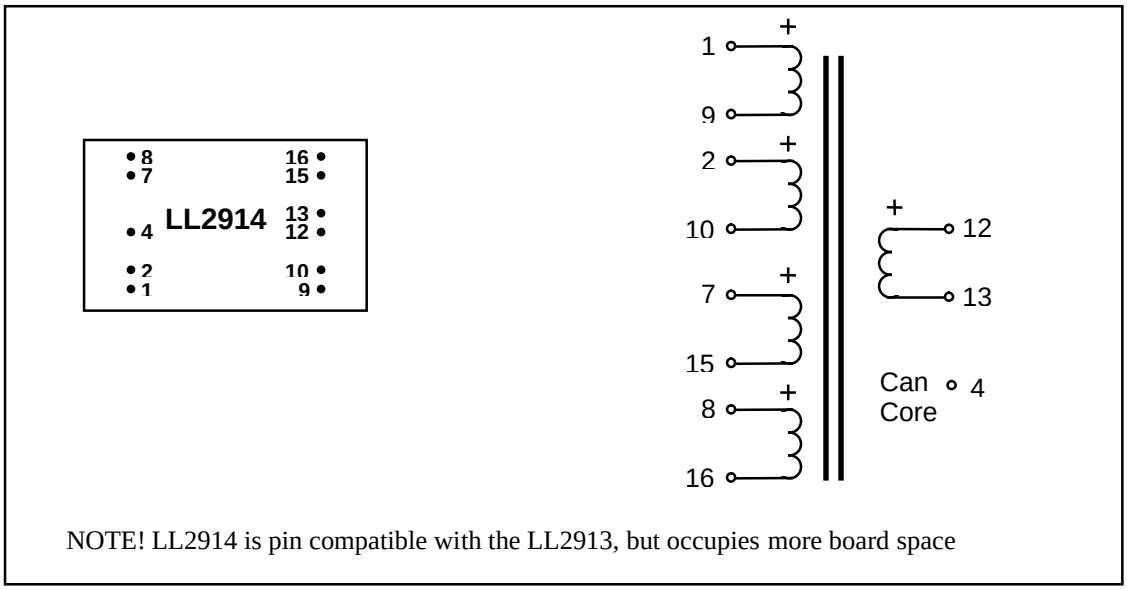
Ribbon Microphone Transformer
LL2914

LL2914 is a mu metal core version of our amorphous core ribbon microphone transformers LL2913.

(LL2913 is identical to our well known ribbon microphone transformer LL2911, but [for manufacturing reasons] with a different pinout / winding phase.)

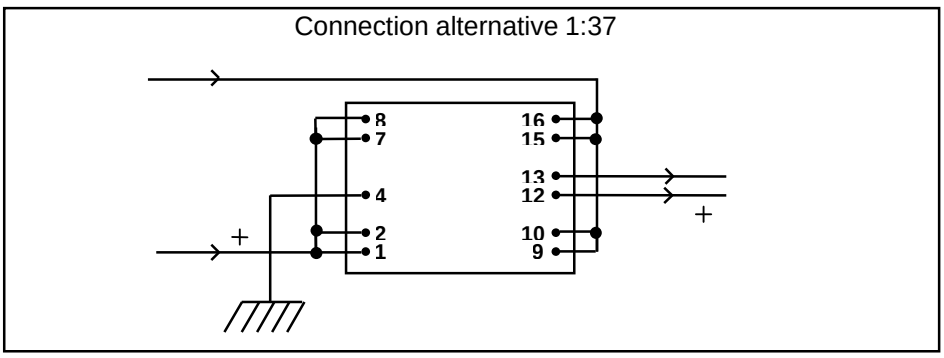
Turns ratio: 1 + 1 + 1 + 1 : 37
Dims: (Length x Width x Height above PCB (mm)) 38 x 24 x 17
Pin Layout (viewed from component side) **and winding schematic:**



NOTE! LL2914 is pin compatible with the LL2913, but occupies more board space

Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	45 g
Rec. PCB hole diameter:	1.5 mm
Housing:	Mu metal
Core:	Mu metal laminations
Static resistance of <u>each</u> primary (average):	0.2 Ω
Static resistance of secondary:	68 Ω

Connection alternative 1:37



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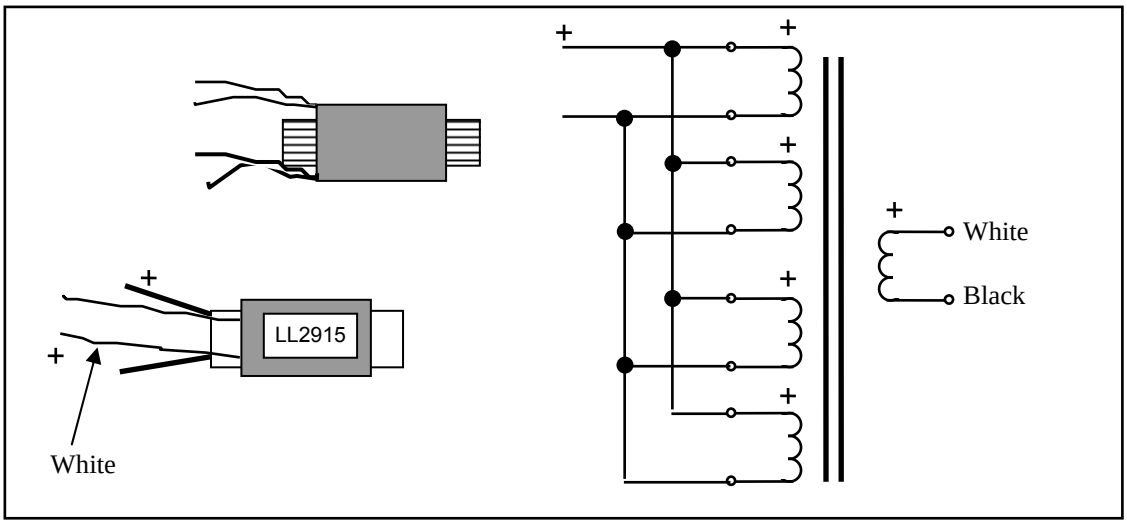
Ribbon Microphone Transformer
LL2915

LL2915 is a flying lead version of microphone ribbon transformer LL2914. Core is a classic mu metal lamination core. The two coils each have three winding sections and is combined for best magnetic noise immunity.

Turns ratio:		1 : 37
Dimensions:	Length [leads not included]	36mm
	Max diameter	22 mm

Layout and Windings Schematics:



Weight:	34 g
Core:	Mu metal lamination core
Static resistance of primary:	0.05 Ω
Static resistance of secondary:	69 Ω

R090321

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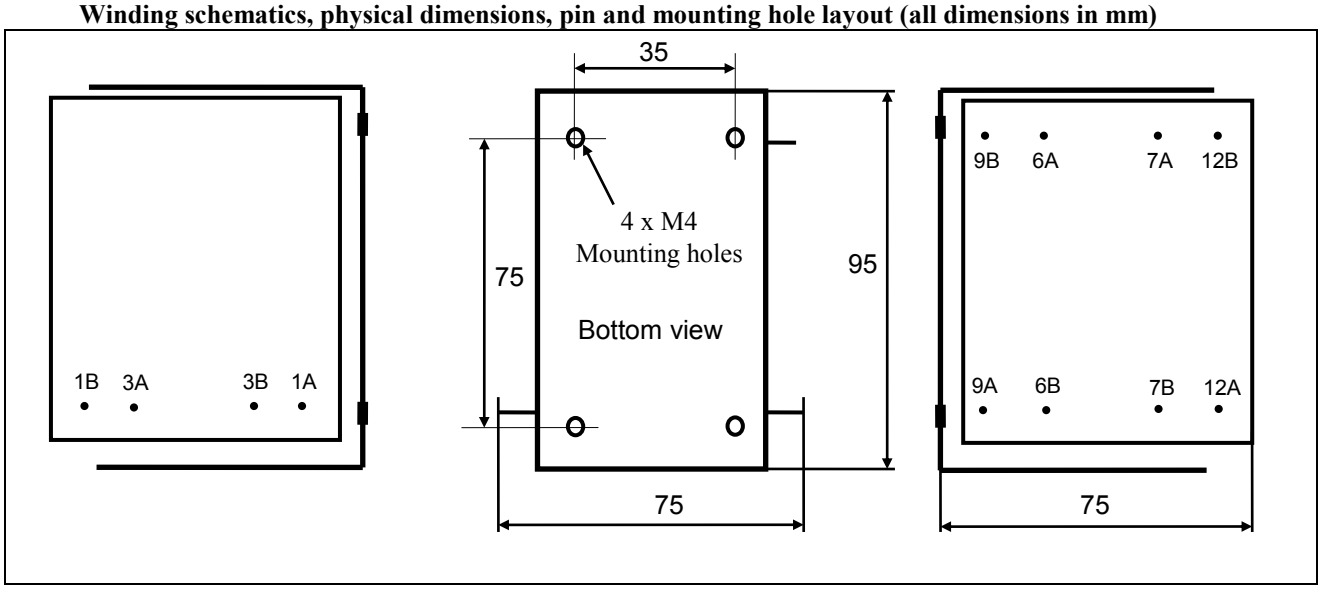
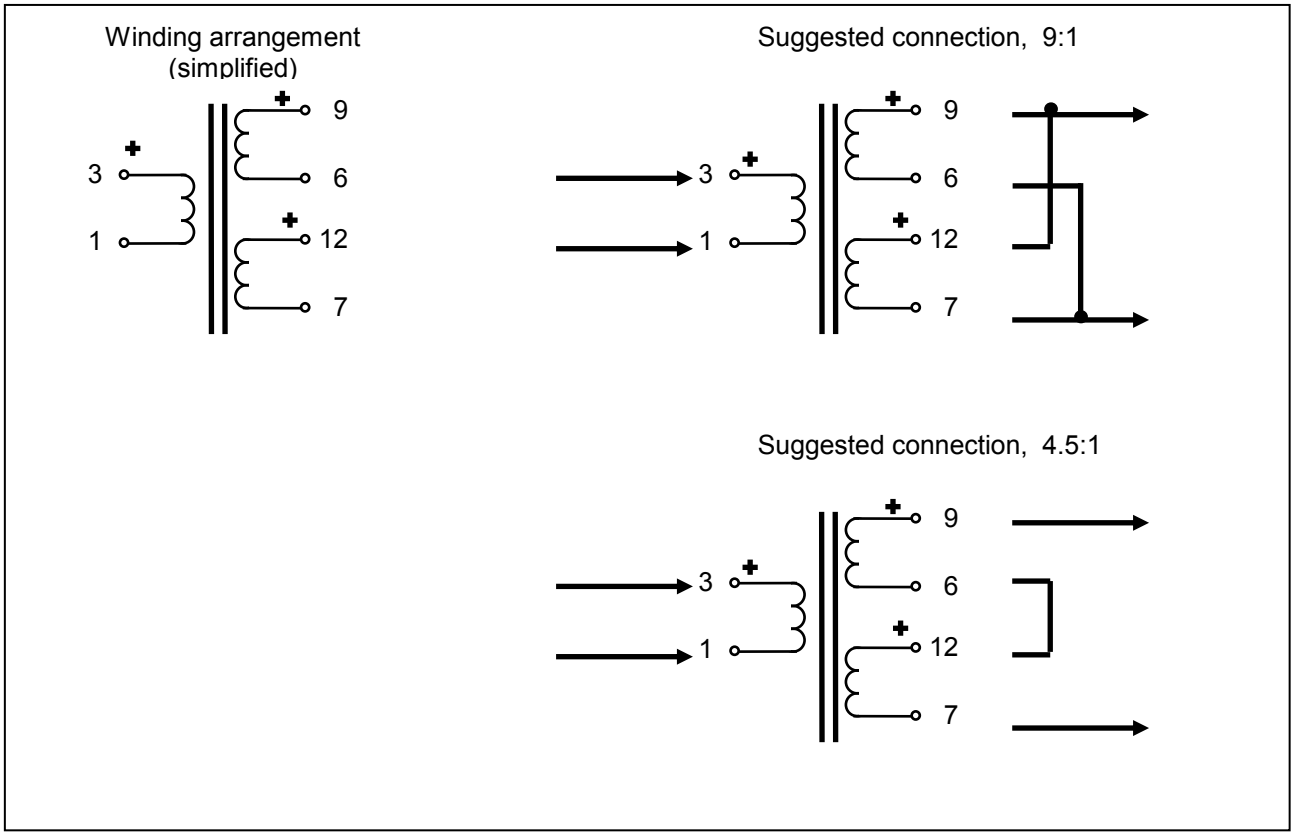
Output Transformer LL3322

The LL3322 is a output transformer, designed to drive a low impedance ribbon element from a 4 - 8 ohms output.
The transformer is highly sectioned (5 sections per coil) for high bandwidth.
For production reasons, the LL3322 comes in two shapes, LL3322A and LL3322B. Function is identical, but the pinout is different.

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)





Weight	1.3 Kg
Turns ratio	9 : 1+1
Static resistance, primary	0.2 Ω
Static resistance, each secondary	< 0.01 Ω
Primary inductance	170mH approx.
Max primary signal at 400Hz	approx. 130V rms.

R160615 PL

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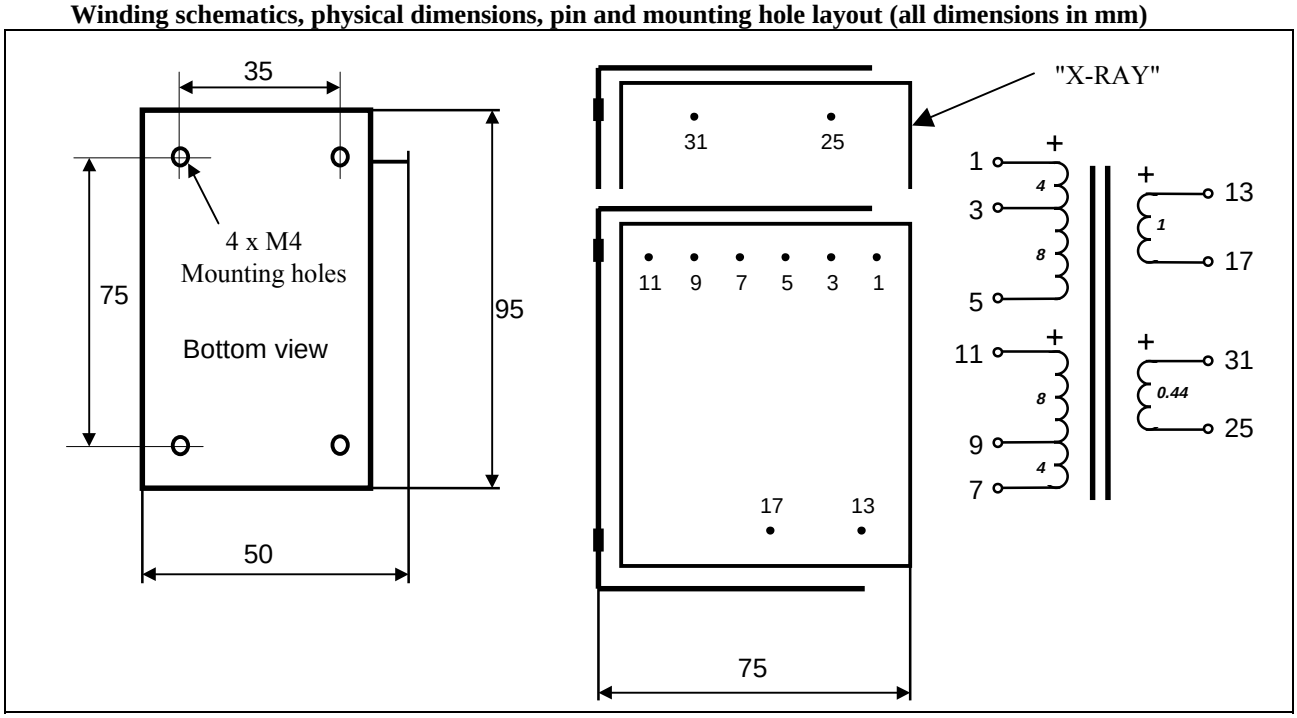
LL3910 = LL1663 with feedback
5k : 8 ohms

The LL3910 P-P is a four-sectioned dual coil C-core tube amplifier output transformer for 5 k: 8 ohms impedance ratio. The design is based on LL1663, but with a 3.5 ohms low power feedback windning added. The coil is wound using our standard high internal isolation technique with isolation foil between each copper layer. The core is an audio C-core of our own production.

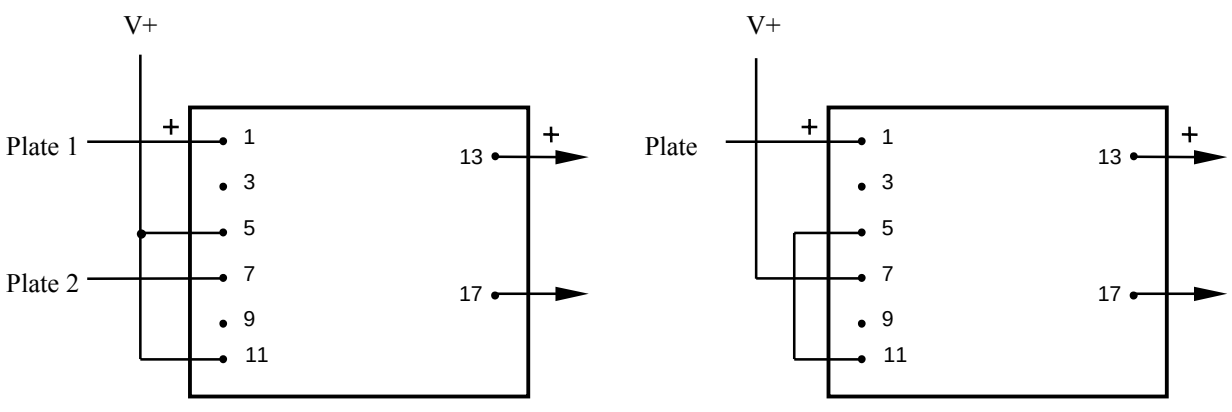
Turns ratio **12+12 : 1+ 0.44 or (4+8)+(4+8) : 1+0.44**

Winding schematics, physical dimensions, pin and mounting hole layout (all dimensions in mm)



Weight:	1.35 kg
Static resistance of each primary:	102 Ω
Static resistance of secondary:	0.4 Ω
Isolation between windings / between windings and core:	4 kV / 2 kV

LL1663 Suggested use (LL3910 feedback not shown):



LL1663 used in Push Pull
Plate-to-plate impedance
5k at 8 ohms load

LL1663 used in Single End
Primary impedance 5k at 8
ohms load

R991215

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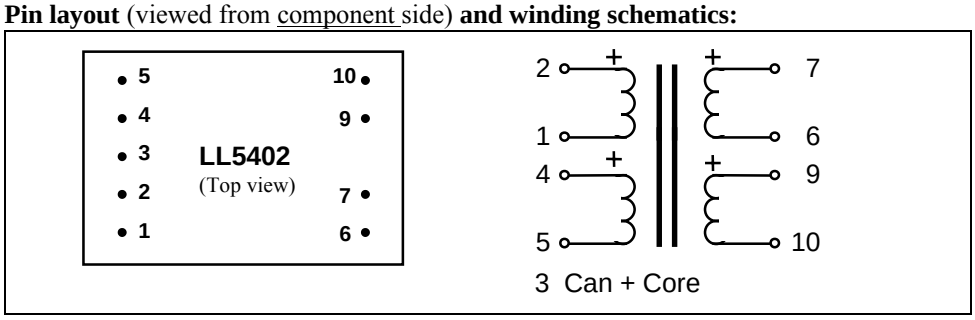
Audio Output Transformer
LL5402

LL5402 is an audio output transformer for unbalanced drive, ideally used with mixed feedback drive circuits (see application example below). If primary pins 1 and 5 are connected to ground, the windings are arranged such that cold ends of the primary windings surround each secondary winding. This reduces the effect of capacitance between the primary and the secondary windings.

Turns ratio: 2 + 2 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 43 x 28 x 21
Pin layout (viewed from component side) **and winding schematics:**

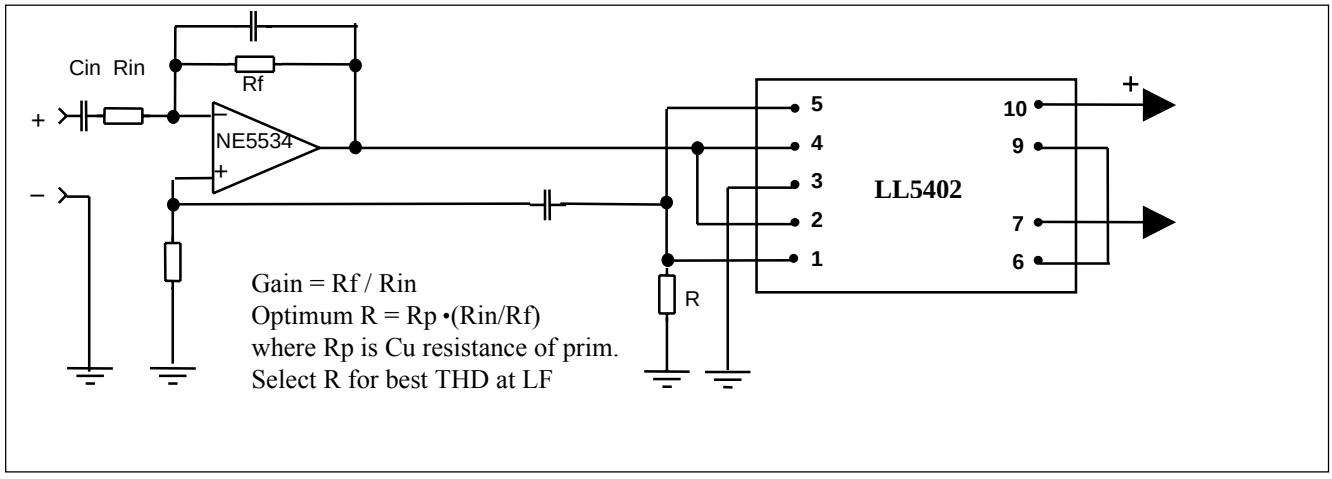


Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	30.48 mm (1.2")
Weight:	92 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	30 Ω
Static resistance of each secondary:	7 Ω
Leakage inductance of secondaries (sec. in series):	0.2 mH
No-load impedance:	>800 Ω @ 50 Hz, +20 dBU
Optimum source impedance:	Minus 15 Ω (See application below)
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 60 dB

Note! *Performance figures below are obtained using mixed feedback drive circuits. (See application example).Otherwise use lowest possible source impedance*.

Distortion (connection as application example below, load 600 Ω)	+ 22 dBU 0.1% @ 50 Hz
Frequency response (as below , load 600 Ω):	20 Hz -- 40 kHz +/- 0.3 dB
Voltage loss across transformer (at midband with 600 Ω load):	0 dB
Isolation between primary and secondary windings / between windings and core:	4 kV / 2 kV

Application example with mixed feedback: (NOTE! This application was covered by a German patent DE 29 01 567 with application day 13.1.79. Qs far as we know the patent is expired)



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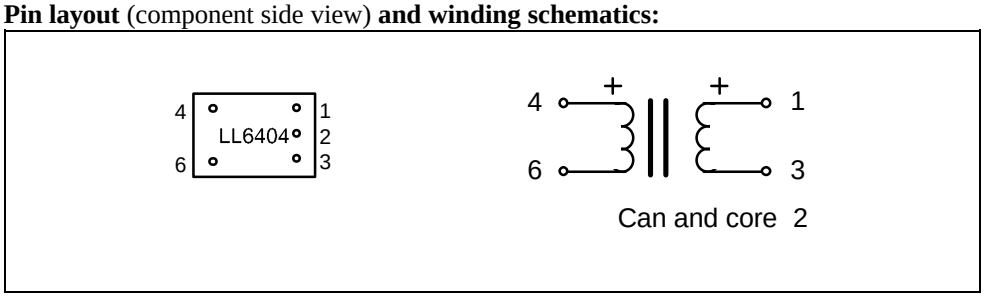
Very Small Size Zero Field Input Transformer
LL6404

In a Zero Field (ZF) transformer, the magnetic field caused by the input signal should be balanced by a feedback loop which includes the transformer's secondary winding (see schematic below). The feedback arrangement extends the low frequency range (to almost DC!) while maintaining the small size of the transformer. The very small size of the LL6404 requires that the feedback resistor value be very close to the secondary winding resistance.

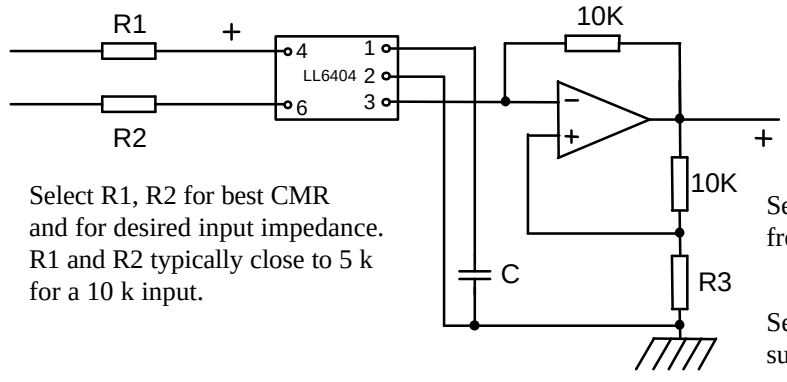
Turns ratio:	1 : 1
Dims (Length x Width x Height above PCB (mm)):	15.5 x 11 x 10

Pin layout (component side view) **and winding schematics:**



Housing:	Mu-metal
Core:	Amorphous strip core
Impregnation:	Solvent less epoxy resin
Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	10.16 mm (0.4")
Weight:	4 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of primary (pins 4 - 6)**:**	210Ω
Static resistance of secondary (pins 1 - 3)**:**	160Ω
Isolation between windings/ between windings and core:	3kV / 1.5 kV

Principle design of Zero Field input circuitry:



Select R1, R2 for best CMR and for desired input impedance. R1 and R2 typically close to 5 k for a 10 k input.

Select R3 for best THD at low freq. R3 ~ 160 ohms

Select C such that $C*R_3$ gives sufficient LF response.

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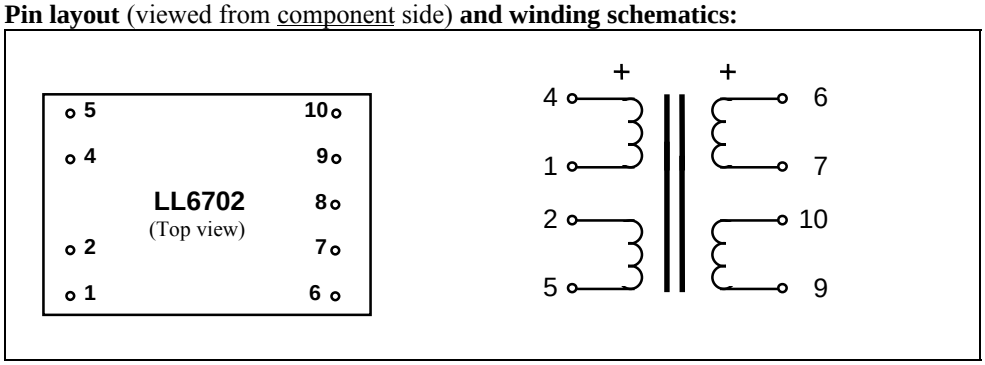
Hybrid Transformer
LL6702

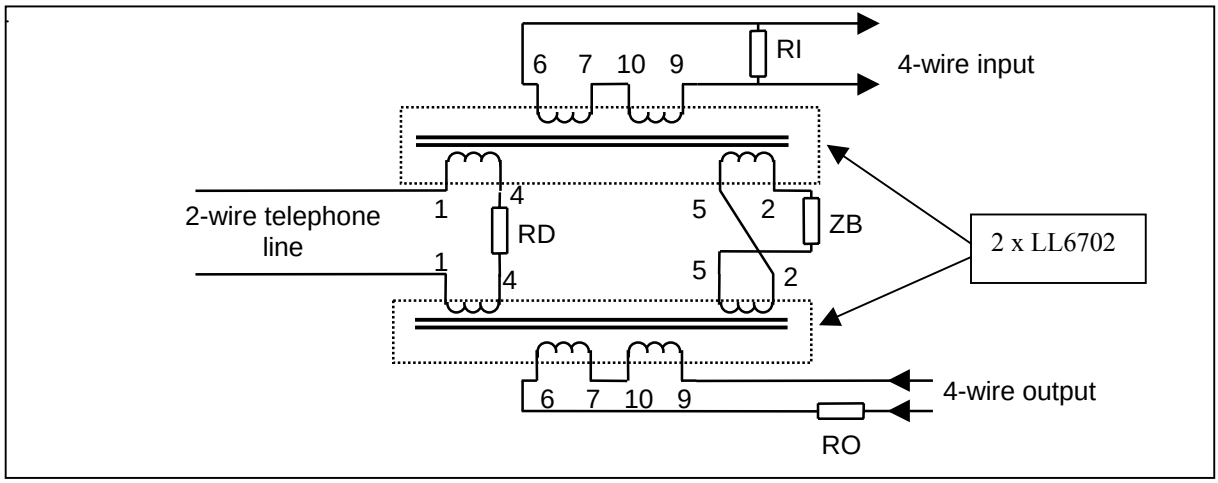
LL6702 is a hybrid transformer for telephone applications. It is built using a C-core, and meets requirements for high isolation between windings.
The LL6702 has an extremely low leakage inductance and thus a flat frequency response curve. This makes it easy to design the balancing network for good transhybrid loss in the entire frequency range.

Turns ratio: 1.5 , 1.5 : 1 + 1
Dims (Length x Width x Height above PCB (mm)): 47 x 31 x 15
Pin layout (viewed from component side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 30.48 mm (1.2")
Weight: 70 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of primary (pins 1 - 4)**:** 50Ω
Static resistance of balance (pins 2 - 5)**:** 45Ω
Static resistance of each secondary (pins 6 - 7, 9 - 10)**:** 36Ω
Max. DC current: 60 mA
Transhybrid loss (laboratory conditions): 50 dB, 10 Hz - 10 kHz
Isolation between primary and balance windings/ between primary and secondary windings: 2 kV / 4 kV

Typical application: Telephone hybrid using two LL6702:
Balancing network ZB: Select ZB for minimum crosstalk which occurs when ZB equals actual line impedance. In applications, this is often accomplished with a combination of a potentiometer and a series of capacitors
Line termination: If RI = RO, the termination impedance, **ZT** , as seen from the two-wire side is:
ZT (AC) = 170 Ω + RI + RD. Thus, ZT is independent of ZB.
ZT (DC) = 100 Ω + RD. RD is an optional resistor used to reduce the line DC current



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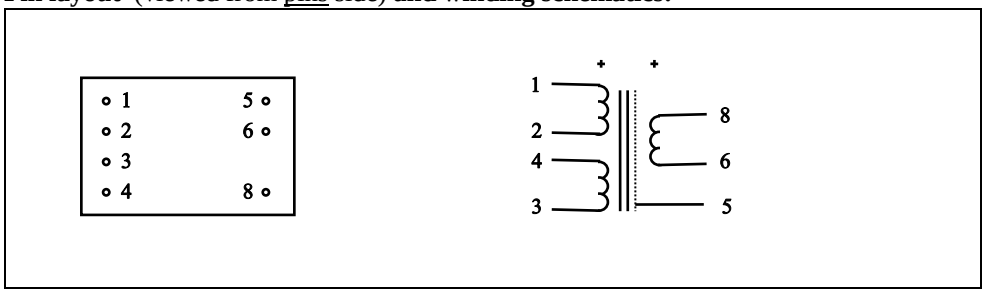
Line Input Transformer
LL6807

LL6807 is a small size, high impedance line input transformer.
The transformer consists of two coils each with one primary and one secondary part separated by a electrostatic shield. The secondaries are serially connected internally. The core is a high permeability mu-metal core.
Being a high impedance transformer, the LL6807 should normally be used with primaries connected in series.
The transformer is housed in a mu-metal box.

Turns ratio: 1 + 1 : 2
Dims (Length x Width x Height above PCB (mm)): 28 x 18 x 12
Pin layout (viewed from pins side) **and winding schematics:**

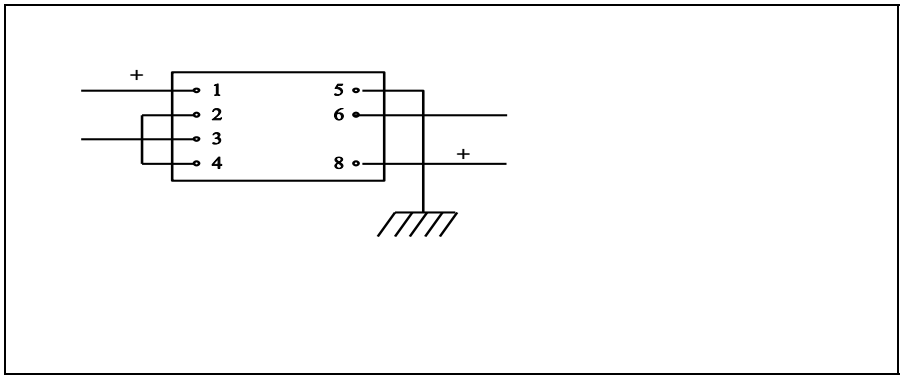


Spacing between pins: 3.81 mm (0.15")
Spacing between rows of pins: 20.32 mm (0.8")
Weight: 18 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of <u>each</u> primary: 400Ω
Static resistance of secondary: 1.1 kΩ
Distortion (source impedance 600Ω): + 10 dBU < 0.2% @ 50 Hz
+ 17 dBU < 1 % @ 50 Hz
Self resonance point : > 100 kHz
Frequency response (source 600Ω, load 33 kΩ): 15 Hz -- 25 kHz +/- 0.5 dB
Loss across transformer (at 1 kHz with above termination): 0.5 dB

Isolation between windings/ between windings and shield: 3 kV / 1.5 kV

Recommended connection:



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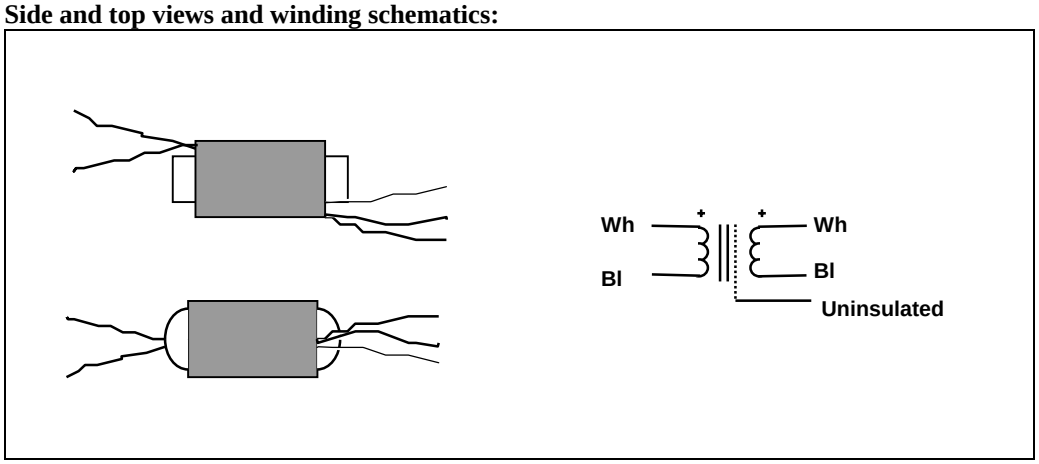
XLR Inline Transformer
LL6808

The transformer LL6808 is designed to be housed in Neutrik XLR connector bodies. It can be used for e.g. ground isolation or for balanced-to-unbalanced conversion.

Turns ratio:	1 : 1
Dims:	
Length (Not including connection wires)	26mm
Minimum inner diameter of housing tube	16 mm (Designed to fit inside M17x1 thread)
Weight:	13 grams

Side and top views and winding schematics:



Static resistance of primary	260 Ω
Static resistance of secondary	205 Ω
Core	Amorphous strip core
No-load impedance	typically > 40 k Ω @ +15 dBU, 50 Hz
Frequency response @ 0 dBU (source 50Ω, load 10kΩ)	10 Hz - 100 kHz +/- 0.3 dB
Distortion (THD, source 600Ω)	0.5% @ +15 dBU, 50Hz
Isolation between windings:	1 kV

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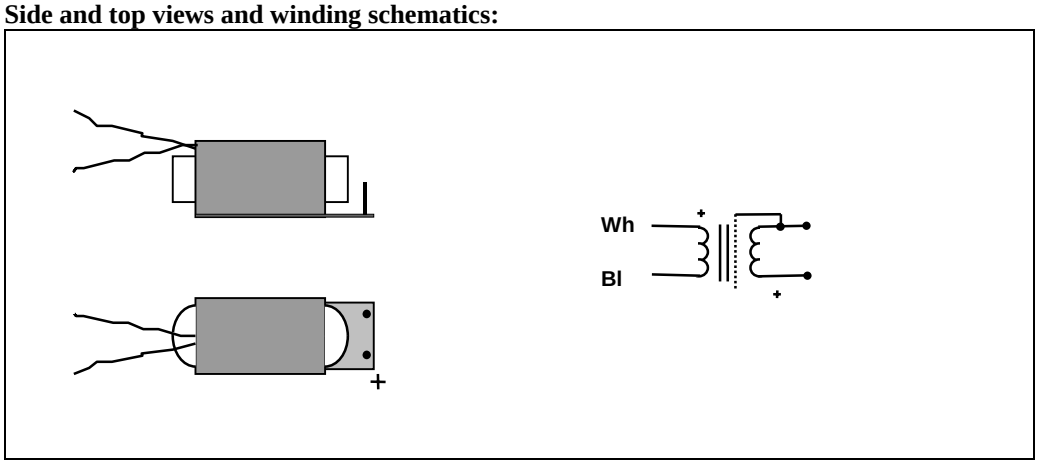
XLR Inline Transformer
LL6809

The transformer LL6809 is designed to be housed in Neutrik XLR connector bodies. It can be used for e.g. ground isolation or for balanced-to-unbalanced conversion.

Turns ratio:	1 : 1
Dims:	
Length (Not including connection wires)	31mm
Minimum inner diameter of housing tube	16 mm (Designed to fit inside M17x1 thread)
Weight:	14 grams

Side and top views and winding schematics:



Static resistance of primary	260 Ω
Static resistance of secondary	205 Ω
Core	Amorphous strip core
No-load impedance	typically > 40 k Ω @ +15 dBU, 50 Hz
Frequency response @ 0 dBU (source 50Ω, load 10kΩ)	10 Hz - 100 kHz +/- 0.3 dB
Distortion (THD, source 600Ω)	0.5% @ +15 dBU, 50Hz
Isolation between windings:	1 kV

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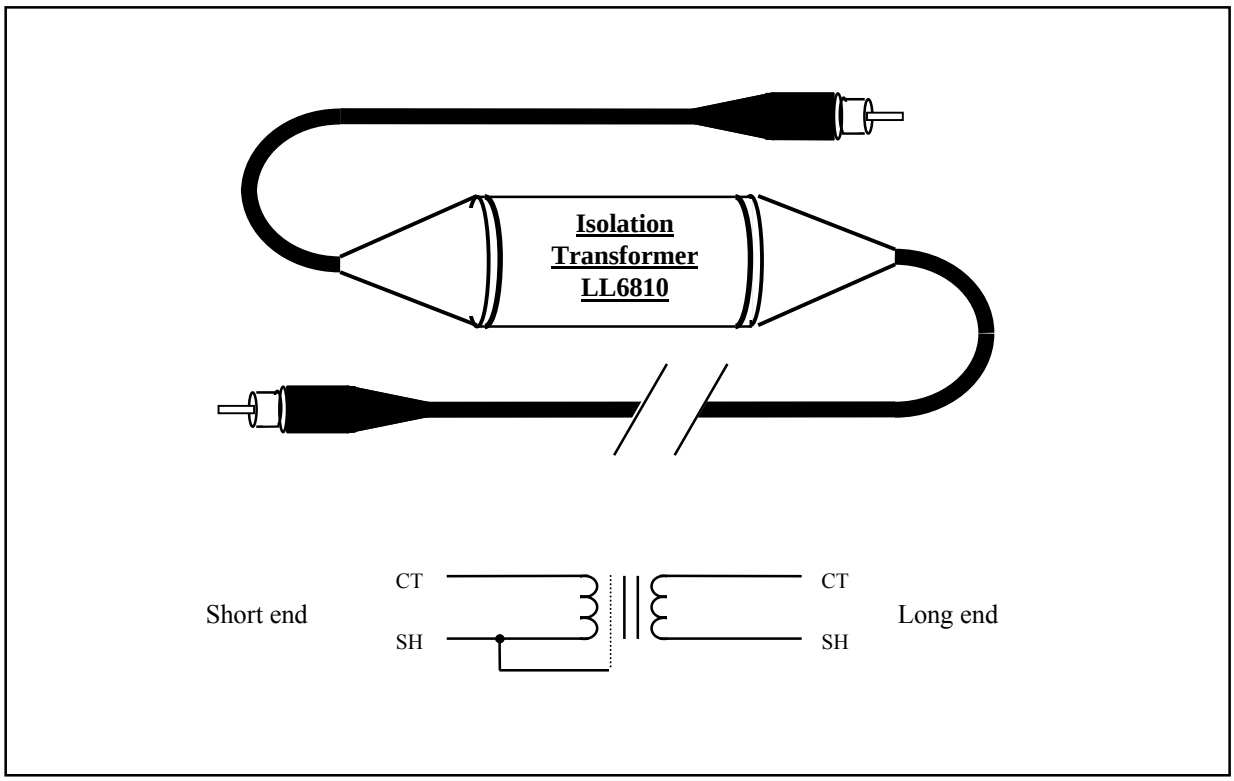
Phono Cable Isolation Transformer Unit
LL6810-phmphm

The cable transformer unit LL6810 is designed for breaking up ground connections between unbalanced units in mobile or stationary audio systems. The unit is magnetically shielded and contains a medium impedance transformer, with LF saturation above +15 dBU, 50 Hz.
Due to the low copper resistance of the transformer, the unit can be used both for output and input.



Cable length	6 ft
Connector type	Phono Male
External magnetic shielding	Amorphous sheet
Housing	Brass, Diam. 19 mm

Transformer Characteristics

Static resistance of primary	260 Ω
Static resistance of secondary	210 Ω
Core	Amorphous strip core
No-load impedance (@+15 dBU, 50Hz)	Typically > 40 k Ω
Frequency response @ 0 dBU (source 600Ω, load 10kΩ)	10 Hz - 100 kHz +/- 0.3 dB
Distortion (THD, source 600Ω)	< 0.5 % @ +15 dBU, 50 Hz
Isolation:	1 kV

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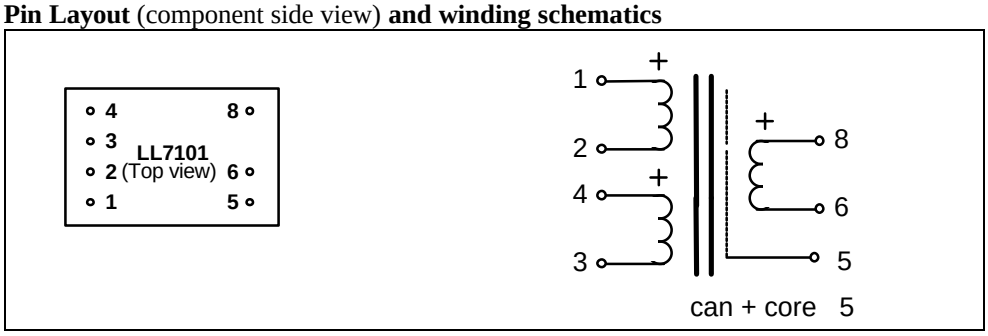
Zero Field Input Transformer
LL7101

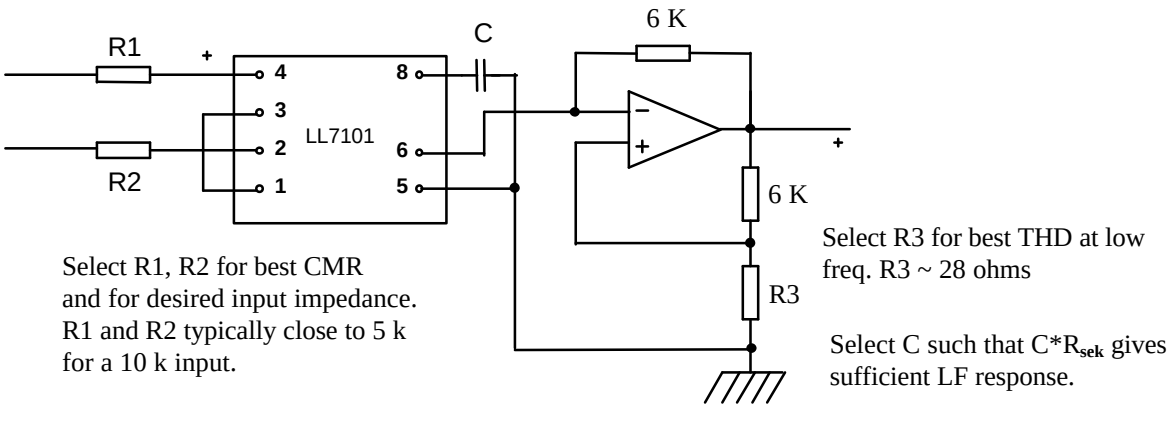
In a Zero Field (ZF) transformer application, the magnetic field caused by the input signal is balanced by a feedback loop which includes the transformer's secondary winding. (See application example below). The feedback arrangement extends the low frequency range to almost DC in spite of the small size of the transformer.

Turns ratio: 1 + 1 : 1.38
Dims: (Length x Width x Height above PCB (mm)) 28 x 18 x 11
Pin Layout (component side view) **and winding schematics**



Housing:	Mu-metal
Core:	Mu-metal
Impregnation:	Solventless epoxi resin
Spacing between pins:	3.81 mm (0.15")
Spacing between rows of pins:	20.32 mm (0.8")
Rec. PCB hole diameter:	1.5 mm
Weight:	16 g
Static resistance of each primary:	138 Ω
Static resistance of secondary:	28 Ω
Isolation between windings:	2 kV
Recommended primary resistance:	10 kΩ –– 20 kΩ

Principle design of Zero Field input circuitry:



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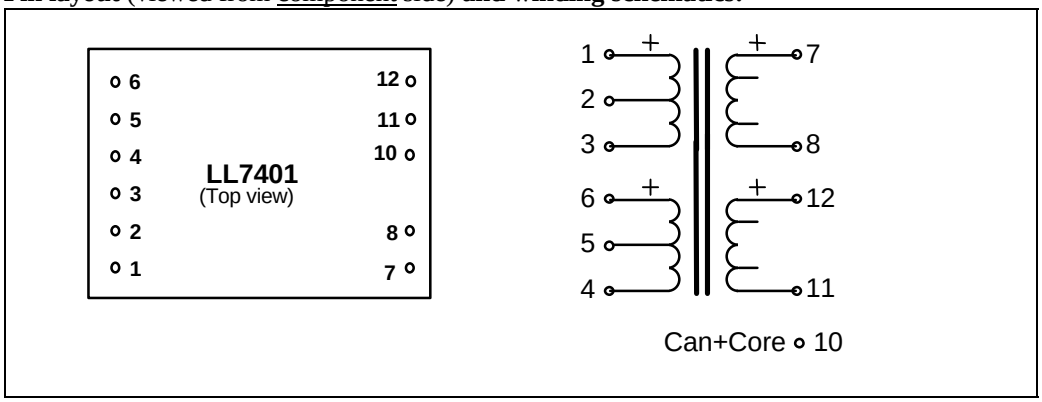
Audio Output Transformer
LL7401

LL7401 is an audio output transformer for balanced drive.
In LL7401 a five section winding structure is used. This results in a very low leakage inductance without high capacitive coupling and low isolation voltage, which are drawbacks of the bifilar winding technique.

Turns ratio: 1 + 1: 1 + 1
Dims (Length x Width x Height above PCB (mm)): 47 x 34 x 17
Pin layout (viewed from component side) **and winding schematics:**

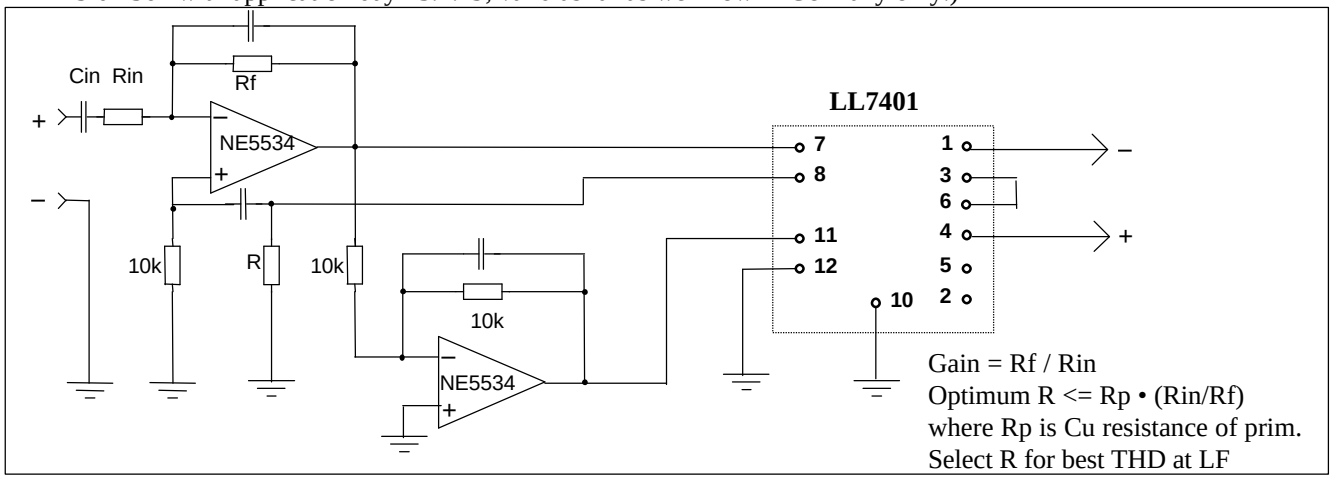


Spacing between pins:	5.08 mm (0.2")
Spacing between rows of pins:	35.56 mm (1.4")
Weight:	92 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary:	9 Ω
Static resistance of each secondary:	9 Ω
Leakage inductance of secondaries (sec. in series):	50 µH
No-load impedance:	>700 Ω @ 50 Hz, +20 dBU
Optimum source impedance:	Minus 9 Ω (See application below)
Balance of output (according to IRT, source < 10 Ω , Load 600 Ω):	> 60 dB

Note! *Performance figures below are obtained using mixed feedback drive circuits. (See application example).Otherwise use lowest possible source impedance*.

Distortion (connection as application example below, load 600 Ω)	0.05 % @ +22 dBU, 50 Hz
Frequency response (@ 10 dBU, connections as below , load 600 Ω):	20 Hz -- 80 kHz +/- 0.3 dB
Voltage loss across transformer (at midband with 600 Ω load):	0 dB
Isolation between primary and secondary windings / between windings and core:	4 kV / 2 kV

Application example with mixed feedback: (NOTE! This application is covered by a German patent DE 29 01 567 with application day 13.1.79, valid as far as we know in Germany only.)



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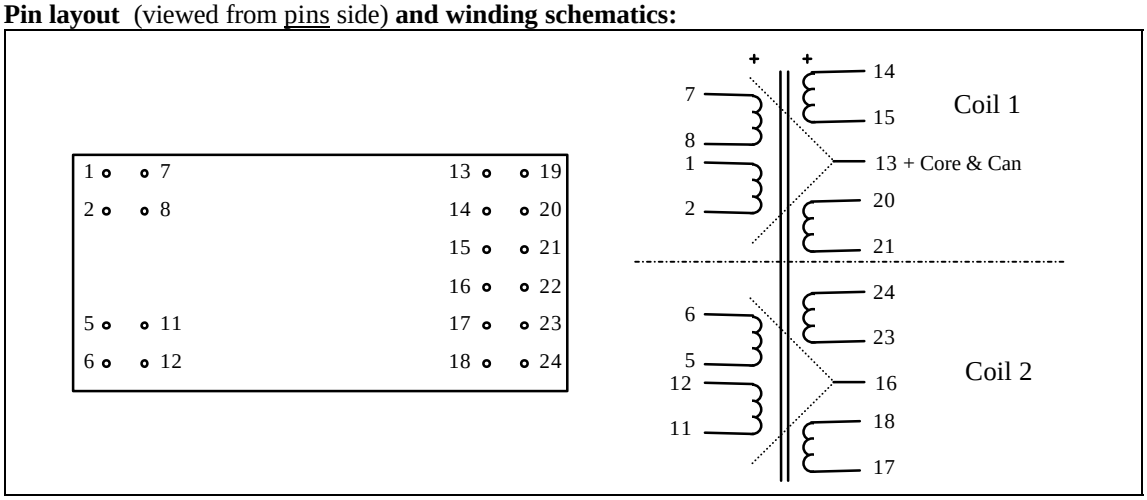
Line Input / General Purpose Transformers
LL7901 and LL7902

LL7901 and LL7902 are large size, high level, high performance audio transformers, made for extraordinary requirements. The LL7901 has an extreme level capability (+ 34 dBU @ 50 Hz) while the LL7902 combines high level capability (+28 dBU @ 50 Hz) with low copper resistance.
The transformer consists of two coils each with two primary and two secondary windings separated by electrostatic shields. The core is a high permeability mu metal lamination core.

The transformers are magnetically shielded by a mu metal case.

Turns ratio: 1 + 1 + 1 + 1 : 1 + 1 + 1 + 1
Dims (Length x Width x Height above PCB (mm)): 66 x 32 x 21
Pin layout (viewed from pins side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 5.08 / 45.72 mm (0.2 / 1.8")
Weight: 155 g
Rec. PCB hole diameter: 1.5 mm

	LL7901	**LL7902**
Static resistance of each primary (average):	120Ω	28Ω
Static resistance of each secondary (average):	125Ω	28Ω
Distortion (primaries connected in series, source impedance 600Ω):	+ 20 dBU primary level, 50 Hz: 0.1 %	+ 10 dBU primary level, 50 Hz: 0.1 %
	+ 34 dBU primary level, 50 Hz: 1 %	+ 28 dBU primary level, 50 Hz: 1 %
Self resonance point :	> 80 kHz	> 150 kHz
Optimum termination for best square-wave response (source imp. 600Ω) **:**	12 kΩ in series with 1.7 nF	5 kΩ in series with 1.3 nF
Frequency response (source and load as above)	10 Hz - 55 kHz +/- 0.5 dB	10 Hz - 100 kHz +/- 0.5 dB

Isolation between primary and secondary windings/ between windings and shield: 4 kV / 2 kV

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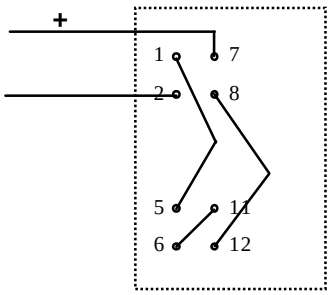
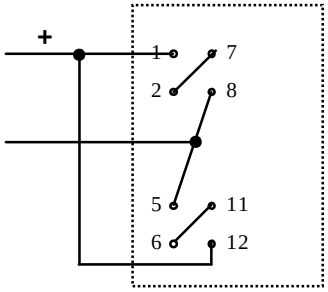
Connection alternatives, LL7901 and LL7902

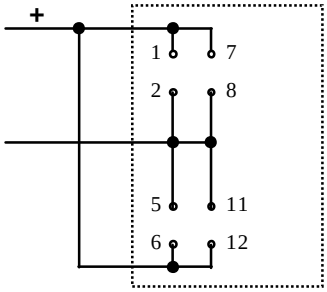
Left side connections NOTE! Pin side view



L4

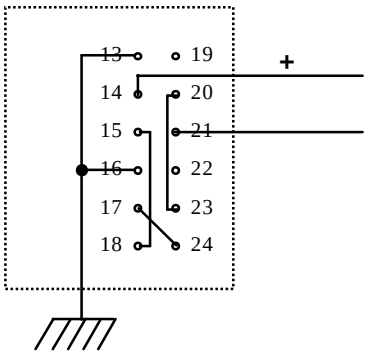


L2

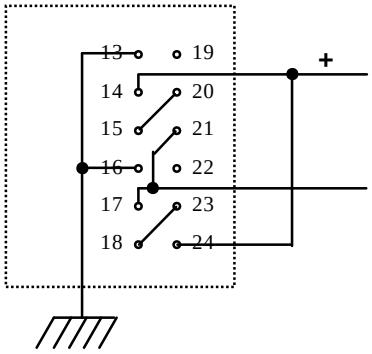


L1

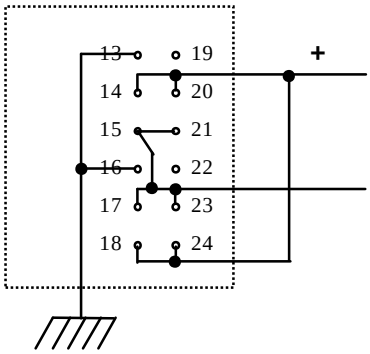
Right side connections NOTE! Pin side view



R4. Center tap at 17



R2. Center tap at 20+23



R1

Suggested applications using LL7901 and LL7902

Application	**Max primary level, < 1% THD@50 Hz**	**Transformer**	**Connections**
Very high level input stage 1:1	+34 dBU	LL7901	L4 - R4
Very high level input stage 1:2	+28 dBU	LL7901	L2 - R4
Very high level input stage 2:1	+34 dBU	LL7901	L4 - R2
High level isolation unit 1:1	+28 dBU	LL7902	L4 - R4
High level isolation unit 1:1 Reduced copper resistance	+22 dBU	LL7902	L2 - R2
Low resistance isolation unit 1:1 (Transformer copper resistance 14 ohms)	+16 dBU	LL7902	L1- R1
Microphone / line input 1:2	+22 dBU	LL7902	L2 - R4
Microphone / line input 1:4	+16 dBU	LL7902	L1 - R4

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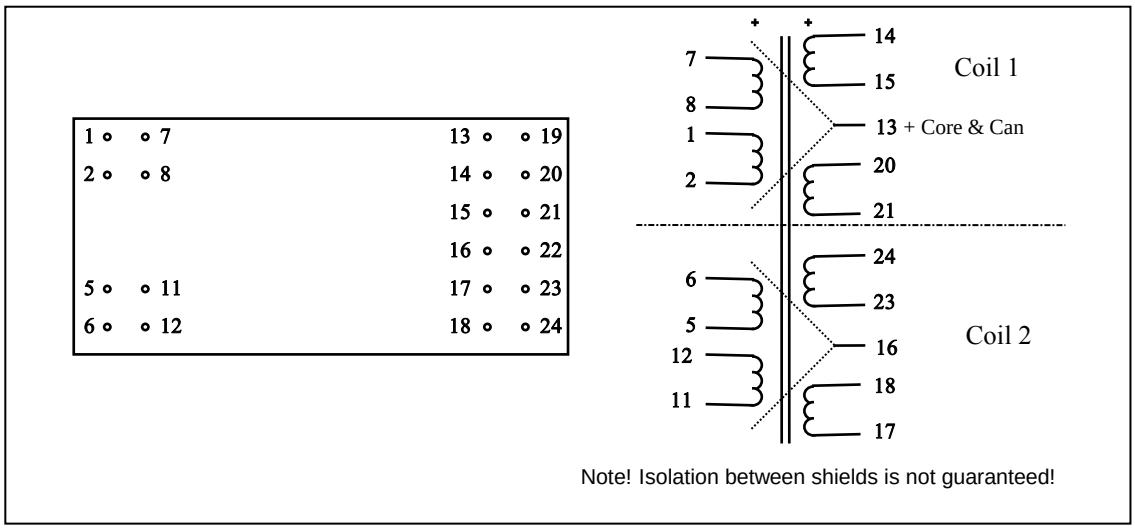
Microphone Input Transformer
LL7903

The LL7903 is a large, high level, high performance audio transformer, made for extraordinary requirements. The transformer combines high level capability (+28 dBU @ 50 Hz primary level) with low copper resistance and is designed for the most demanding applications. The LL7903 consists of two coils, each with two primary and two secondary windings separated by electrostatic shields. The core is a high permeability mu metal lamination core.
The transformer is magnetically shielded by a mu metal case.

Turns ratio: 1 + 1 + 1 + 1 : 2 + 2 + 2 + 2
Dims (Length x Width x Height above PCB (mm)): 66 x 32 x 21
Pin layout (viewed from pins side) **and winding schematics:**



Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 5.08 / 45.72 mm (0.2 / 1.8")
Weight: 155 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary (average):	28Ω
Static resistance of each secondary (average):	125Ω
Distortion (primaries connected in series, source impedance 600Ω):	+ 10 dBU primary level, 50 Hz: 0.1 %
	+ 28 dBU primary level, 50 Hz: 1 %
Self resonance point :	80 kHz
Optimum termination for best square-wave response Source imp. 600Ω. Connection L4 : R4	30kΩ in series with 400pF
Frequency response Source and load as above. Connection L4 : R4	10 Hz - 70 kHz +/- 0.5 dB

Isolation between primary and secondary windings/ between windings and shield: 4 kV / 2 kV

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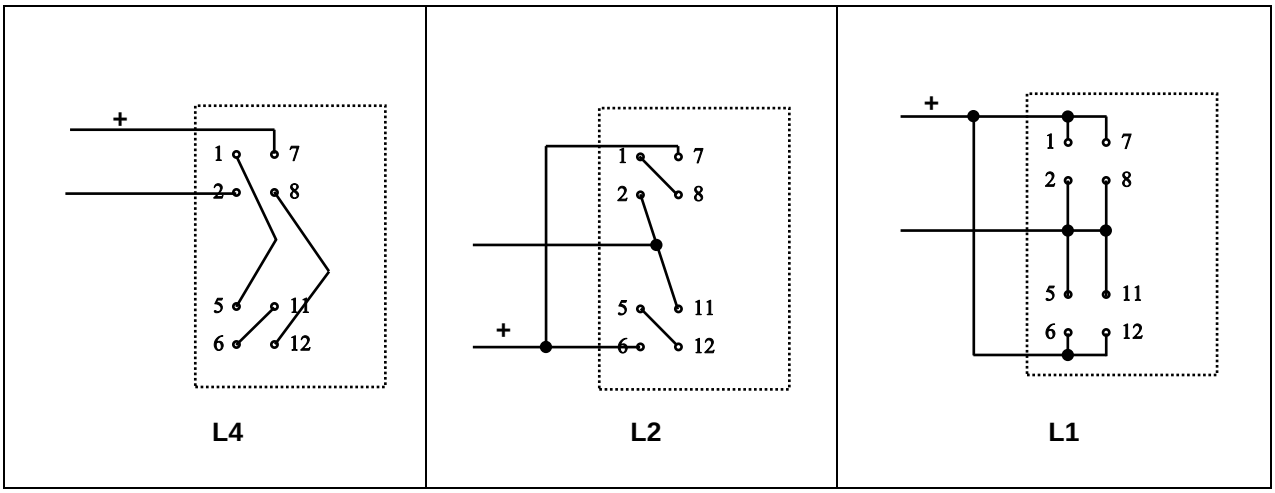
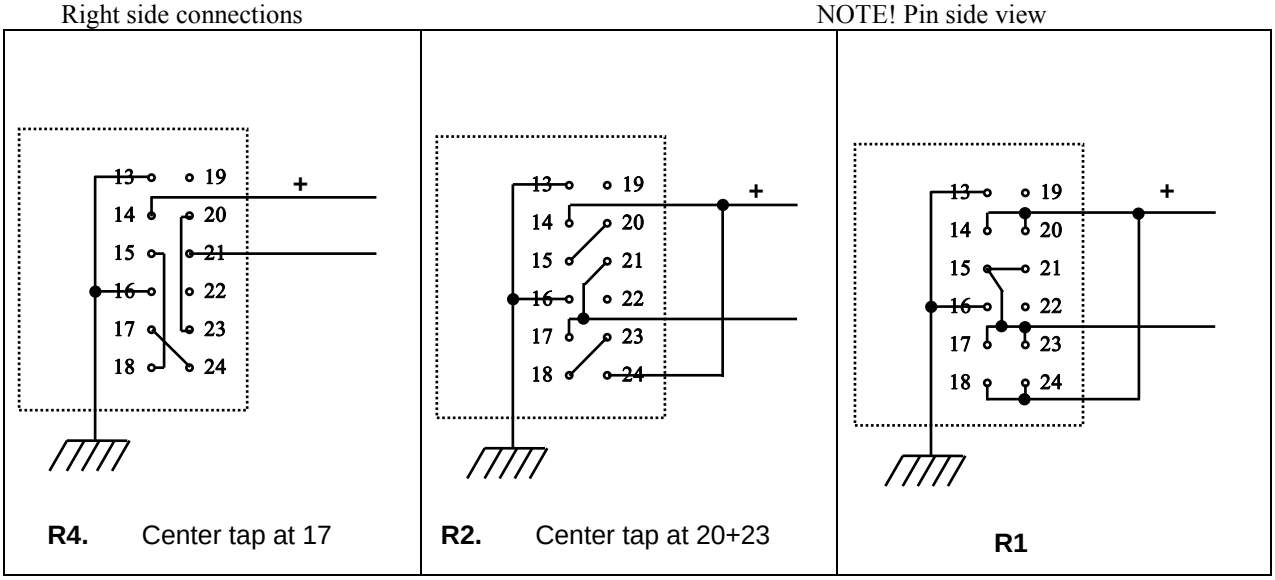
Connection alternatives, LL7903

Left side connections NOTE! Pin side view



Right side connections NOTE! Pin side view



Suggested applications using LL7903

Application	Max primary level, < 1% THD@50 Hz	Connections
Microphone / line input 1:2	+28 dBU	L4 - R4
Microphone / line input 1:4	+22 dBU	L2 - R4
Microphone / line input 1:8	+16 dBU	L1 - R4

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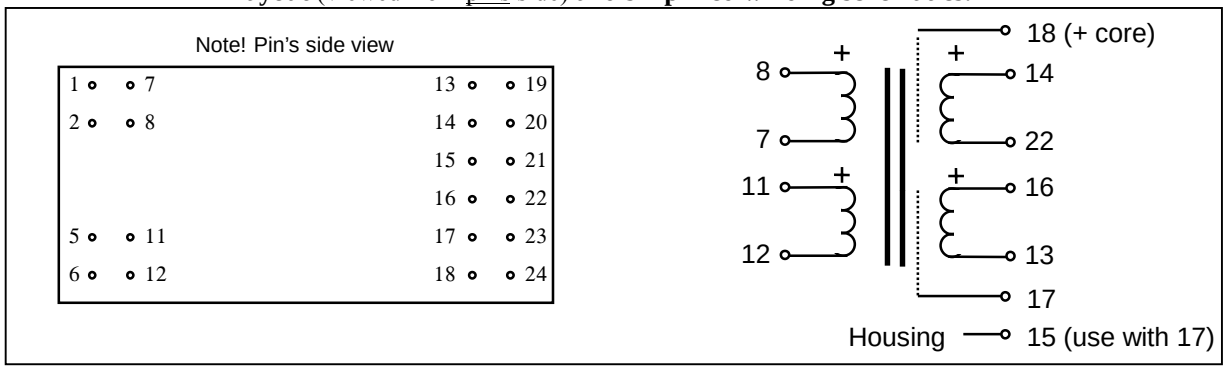
LL7904
High Level Splitting Transformer

In many splitting applications, the splitting transformer must have a high immunity to input common mode signals, to stray magnetic fields from e.g. power transformers and to large ground potential differences in receiving systems. The LL7904 is developed to handle those types of problems. When designing the LL7904, we have used our well-established two-coil structure to create a transformer with a high degree of symmetry. The transformer is built up from two primary windings (which should be used in parallel) and two secondary windings. Each secondary winding is built up from two sections, one from each coil and is surrounded by it own electrostatic shields. The symmetric structure results in an internal cancellation of noise signals caused by external magnetic field (humbucking). It also increases immunity to ground noise between secondary systems and reduces the effects of input common mode signals.
The transformer is housed in a mu-metal can and is impregnated in solventless epoxy resin.

Turns ratio: 1 + 1 : 1 + 1

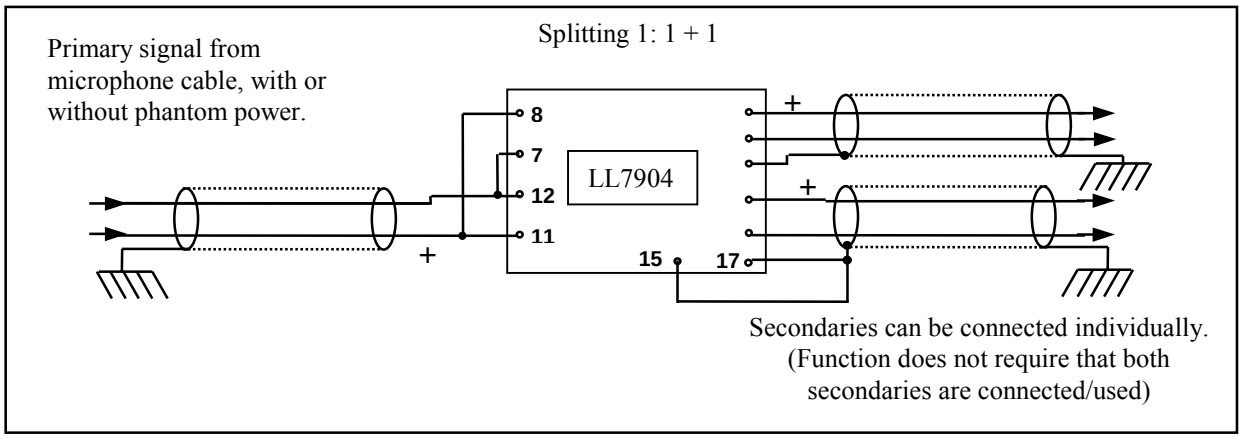
Pin layout (viewed from pins side) **and simplified winding schematics:**



Spacing between pins	Spacing between rows of pins	Recommended PCB hole diameter:
5.08 mm (0.2")	5.08 / 45.72 mm (0.2 / 1.8")	1.7 mm

Dimensions (Max. L x W x H above PCB(mm))	66 x 32 x 21
Weight:	155 g
Static resistance of each primary:	55 Ω
Static resistance of each secondary (Pins 14 - 22 and pins 16 - 13 resp.):	43 Ω and 66 Ω
Distortion	0.1% @ +16 dBU, 50 Hz < 1 % @ +23 dBU, 50 Hz
Frequency response (Ref : 0 dBu, 1kHz)	10 Hz -- 80 kHz +/- 0.5 dB
Test arrangement: Parallel input - parallel output . Source 150Ω , load 10 kΩ	
CMRR at 20 kHz (Source 600 ohms, load 2 x 10k)	> 60 dB
CMRR at 20 kHz from sec. to sec. (Source 600 ohms, load 2 x 10k)	> 40 dB
Isolation test primary - secondary / secondary - secondary / 18 - (15+17)	4 kV / 2 kV / 1 kV RMS

Application example.



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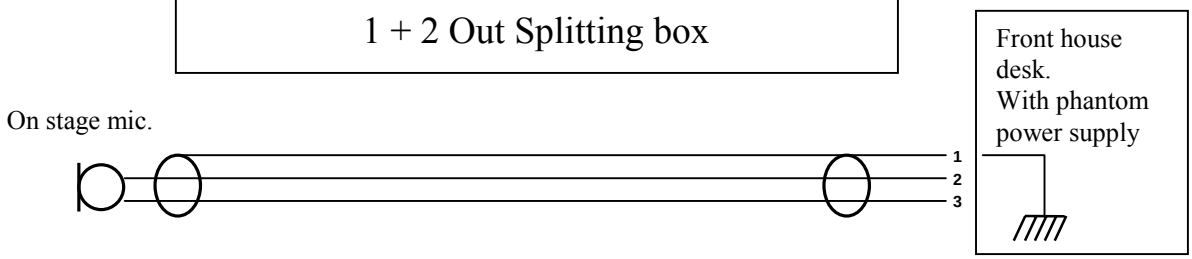
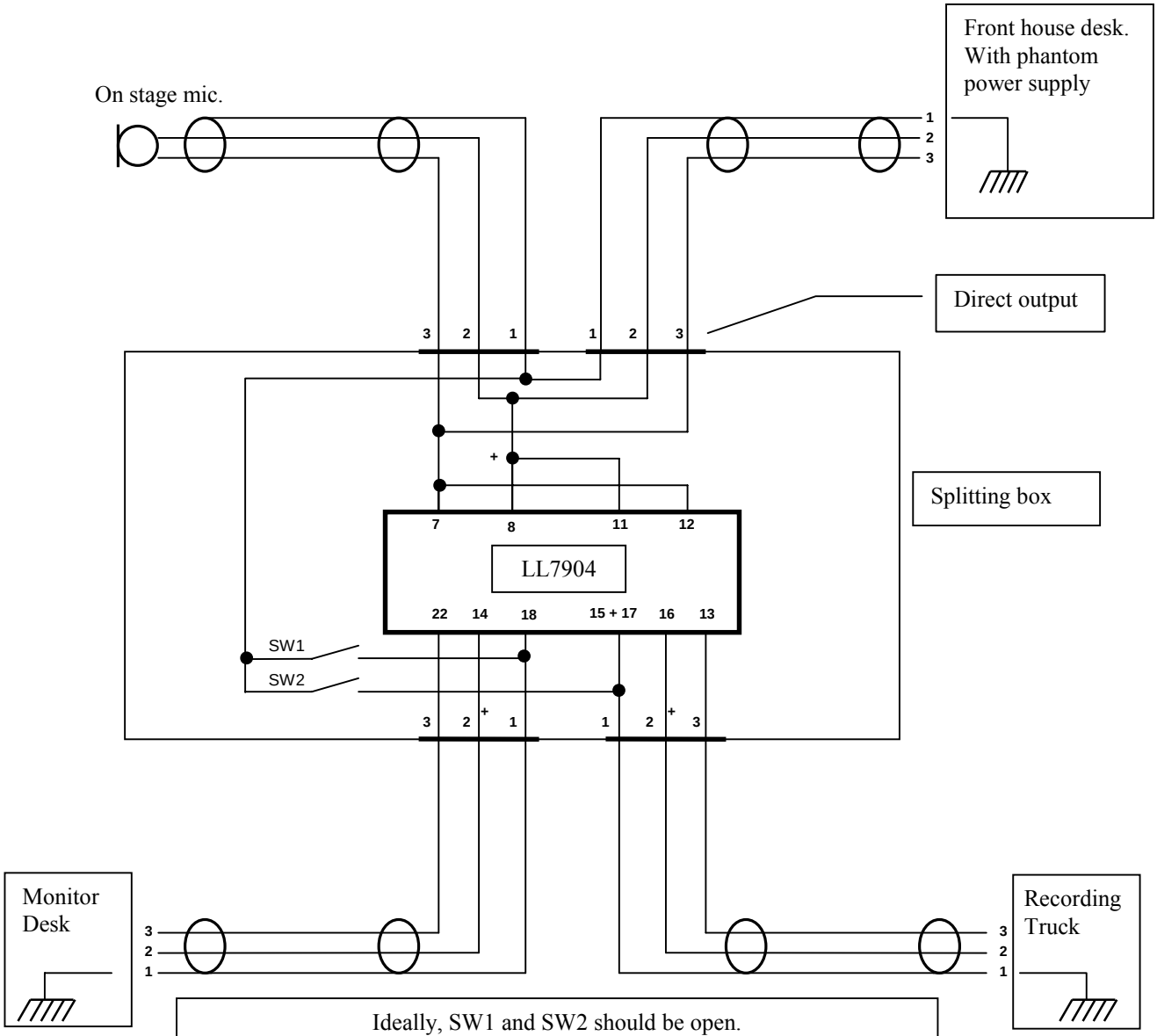
LL7904 application example.

1 + 2 Out Splitting box



Before connecting splitting box

With splitting box



Ideally, SW1 and SW2 should be open.

Close SW1 and / or SW2 when E1 and / or E2 do not receive ground reference from Monitor desk or from Recording truck respectively.

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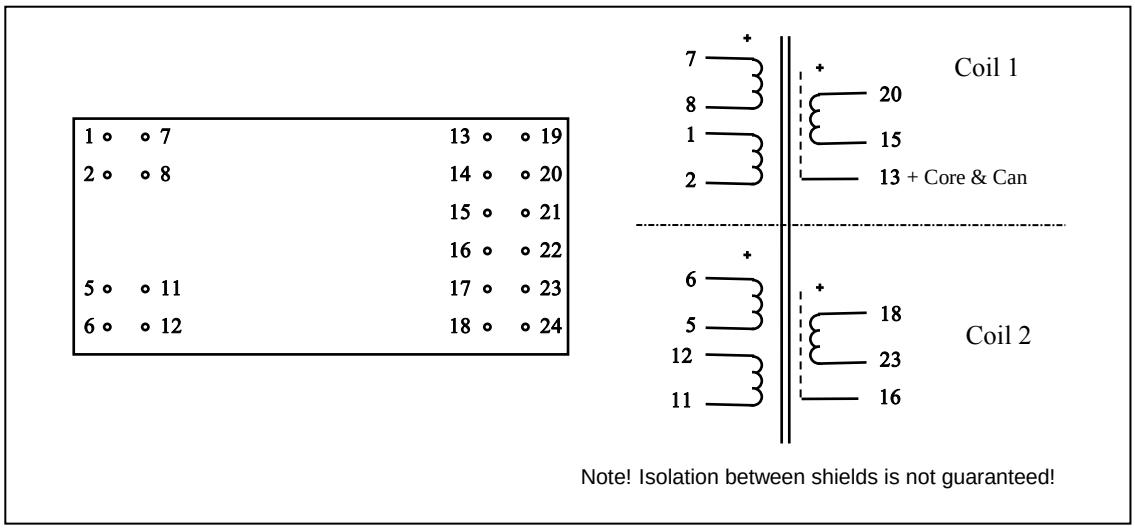
Mic/Line Input Transformer
LL7905

The LL7905 is a large, high level, high performance audio transformer, made for extraordinary requirements. The transformer combines very high secondary level capability (+37 dBU [54.5V rms] @ 50 Hz) with low copper resistance and is designed for the most demanding applications. The LL7905 consists of two coils, each with two primary and one secondary windings separated by electrostatic shields. The core is a high permeability mu metal lamination core.
The transformer is magnetically shielded by a mu metal case.

Turns ratio: 1 + 1 + 1 + 1 : 5.6 + 5.6
Dims (Length x Width x Height above PCB (mm)): 66 x 32 x 21
Pin layout (viewed from pins side) **and winding schematics:**



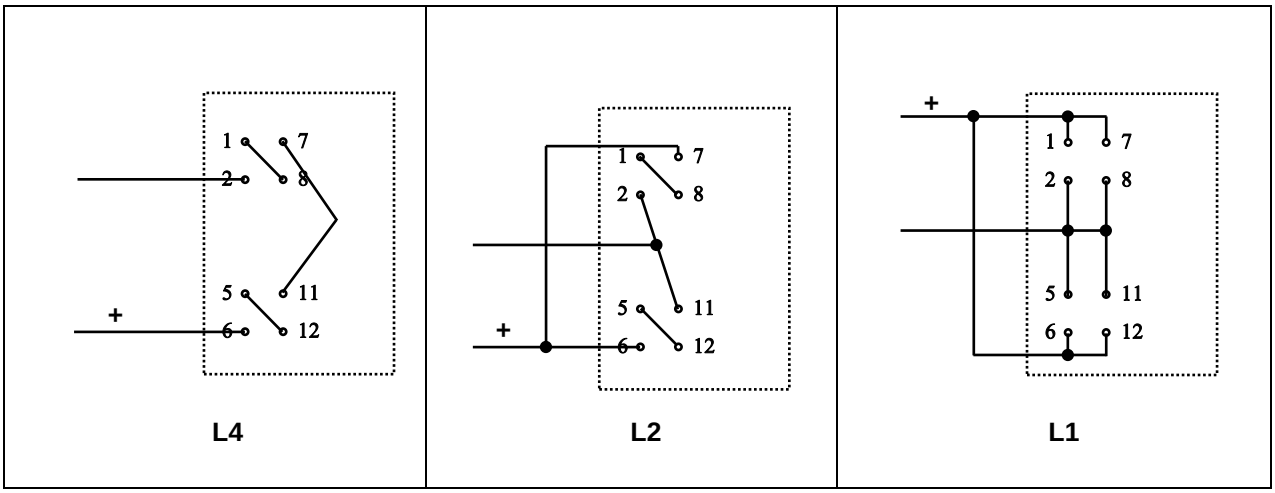
Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 5.08 / 45.72 mm (0.2 / 1.8")
Weight: 155 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary (average):	28Ω
Static resistance of each secondary (average):	395Ω
Distortion (primaries connected in series, source impedance 600Ω):	+ 10 dBU primary level, 50 Hz: 0.1 %
	+ 28 dBU primary level, 50 Hz: 1 %
Self resonance point :	80 kHz
Optimum termination for best square-wave response (Connections L4-R2 , source imp. 600Ω) **:**	30kΩ in series with 100pF
Frequency response (source and load as above, connection L4-R2, secondary side balanced with or without grounded centertap.	10 Hz - 55 kHz +/- 1 dB
Frequency response (source and load as above, connection L4-R2, secondary side unbalanced with pin 23 grounded)	10 Hz - 30 kHz +/- 1 dB

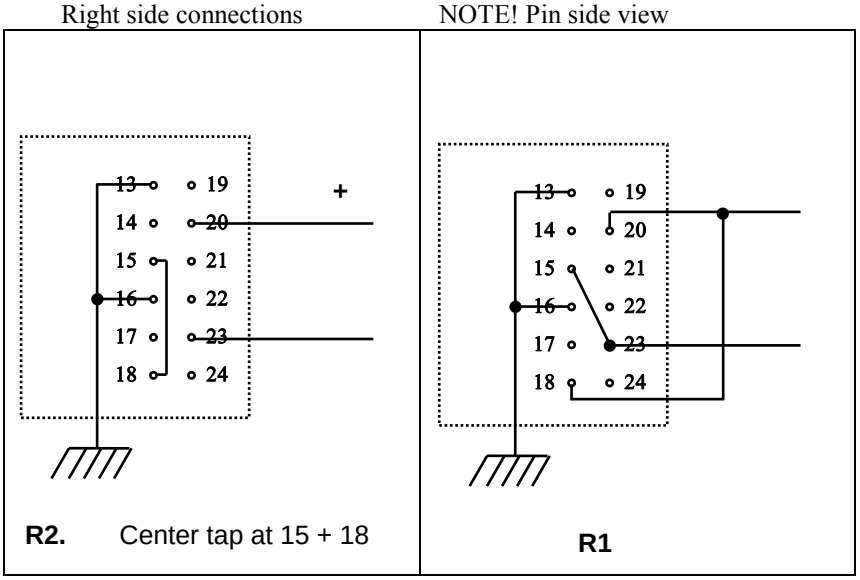
Isolation between primary and secondary windings/ between windings and shield: 4 kV / 2 kV

Connection alternatives, LL7905

Left side connections NOTE! Pin side view



Right side connections NOTE! Pin side view



Suggested applications using LL7905

Application	Connections	Max primary level, < 1% THD@50 Hz	Corresponding secondary level
Microphone / line input 1:2.8	L4 – R2	+28 dBU (19.5 V rms)	+37 dBU (54.5V rms)
Microphone / line input 1:5.6	L2 – R2	+22 dBU (9.7 V rms)	+37 dBU (54.5V rms)
Microphone / line input 1:11.2	L1 – R2	+16 dBU (4.9 V rms)	+37 dBU (54.5V rms)

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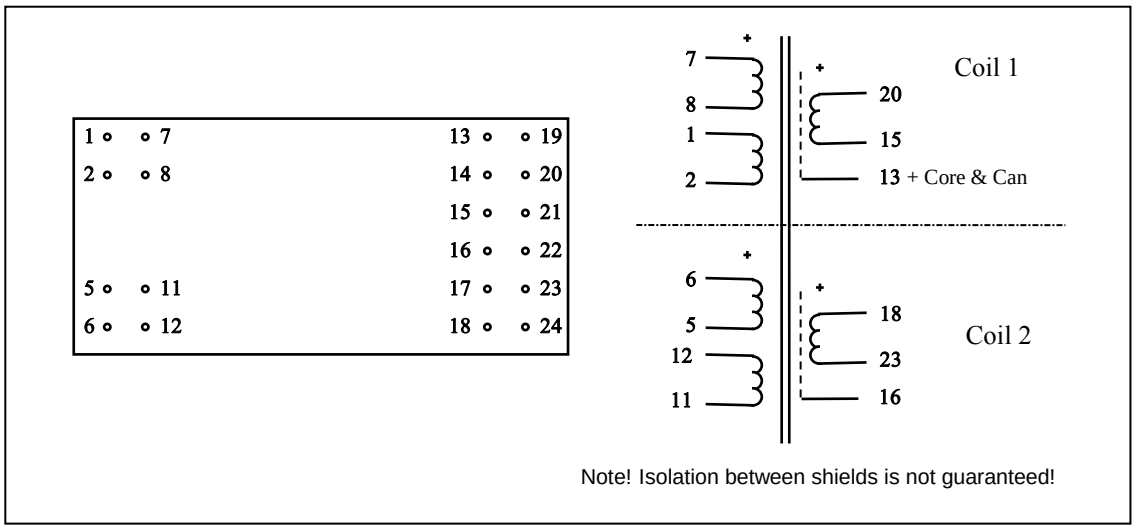
Mic/Line Input Transformer
LL7906

The LL7906 is a large, high level, high performance audio transformer, pin compatible with our LL17905, but with an internal structure better optimized for high turns-ratio step-up applications. The transformer combines very high secondary level capability (+37 dBU [54.5V rms] @ 50 Hz) with low copper resistance. The LL7906 consists of two coils, each with two primary and one secondary windings separated by electrostatic shields. The core is a high permeability mu metal lamination core. The transformer is magnetically shielded by a mu metal case.

Turns ratio: 1 + 1 + 1 + 1 : 5.6 + 5.6
Dims (Length x Width x Height above PCB (mm)): 66 x 32 x 21
Pin layout (viewed from pins side) **and winding schematics:**



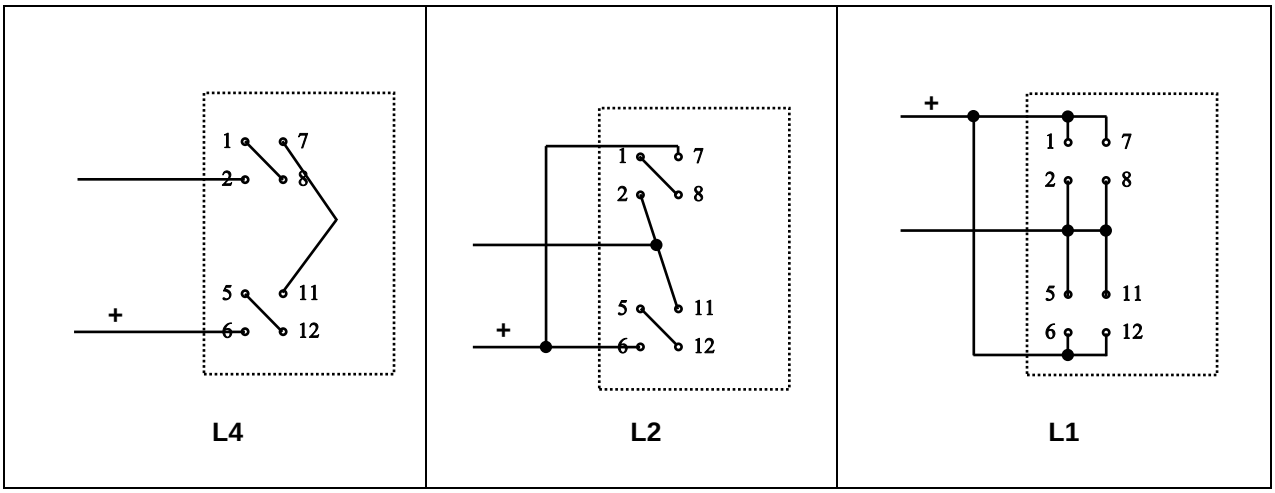
Spacing between pins: 5.08 mm (0.2")
Spacing between rows of pins: 5.08 / 45.72 mm (0.2 / 1.8")
Weight: 155 g
Rec. PCB hole diameter: 1.5 mm

Static resistance of each primary (average):	24Ω
Static resistance of each secondary (average):	450Ω
Distortion (primary connection L1, source impedance 150Ω):	+ 8 dBU primary level, 50 Hz: 0.1 %
	+ 16 dBU primary level, 50 Hz: 1 %
Self resonance point :	30 kHz
Optimum termination for best square-wave response (Connections L1-R2 [1:11.2], source imp. 200Ω) **:**	80kΩ
Frequency response: (source and load as above, connection L1-R2, secondary side balanced with or without grounded centertap.	10 Hz - 45 kHz +/- 1 dB
Frequency response (source and load as above, connection L1-R2, secondary side unbalanced with pin 23 grounded)	10 Hz - 25 kHz +/- 1 dB

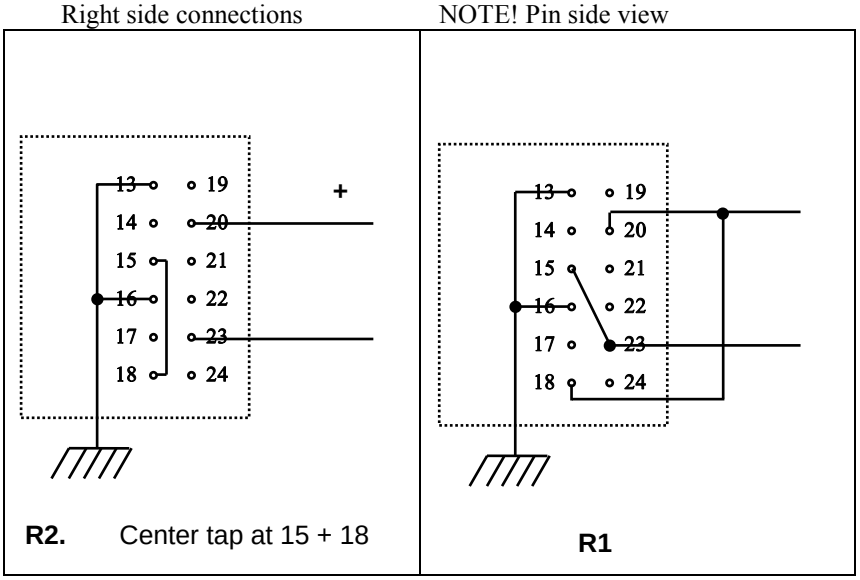
Isolation between primary and secondary windings/ between windings and shield: 4 kV / 2 kV

Connection alternatives, LL7906

Left side connections NOTE! Pin side view



Right side connections NOTE! Pin side view



Suggested applications using LL7906

Application	Connections	Max primary level, < 1% THD@50 Hz	Corresponding secondary level
Microphone / line input 1:2.8	L4 – R2	+28 dBU (19.5 V rms)	+37 dBU (54.5V rms)
Microphone / line input 1:5.6	L2 – R2	+22 dBU (9.7 V rms)	+37 dBU (54.5V rms)
Microphone / line input 1:11.2	L1 – R2	+16 dBU (4.9 V rms)	+37 dBU (54.5V rms)

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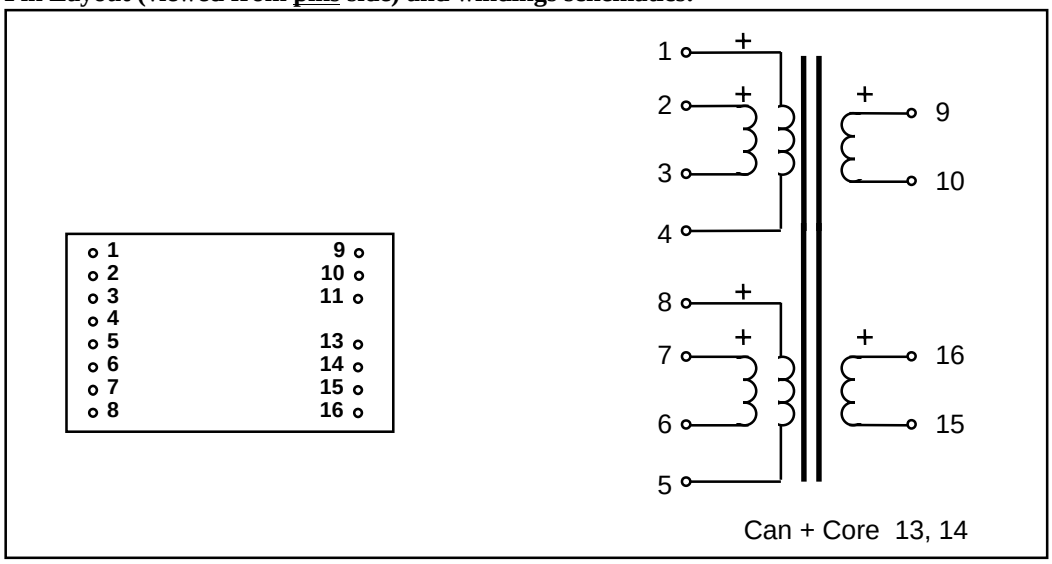
Audio Transformer/Moving Coil Input Transformer
LL9206

LL9206 is an input audio transformer for moving coil pickups. The transformer is built up from two coils, each coil with one secondary winding surrounded by two primary windings. This structure results in an excellent frequency response. All winding ends are available on the pins. Thus, the transformer can be used with a set of different turn's ratios.
The LL9206 is made with amorphous core material. As this type of core does not store energy (unlike e.g. conventional mu-metal cores) the low frequency resonance with external series capacitors is practically eliminated.

Turns ratio: 1 + 1 + 1 + 1 : 10 + 10
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and windings schematics:



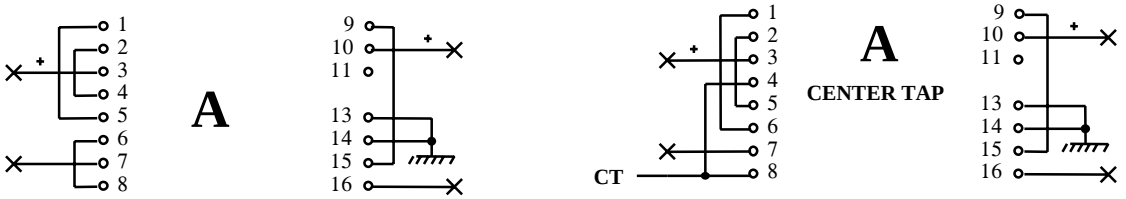
Spacing between pins: 2.54 mm (0.1")
Spacing between rows of pins: 22.86 mm (0.9")
Weight: 27 g
Rec. PCB hole diameter: 1.5 mm
Static resistance of each primary (average): 10 Ω
Static resistance of each secondary (average): 395 Ω
Self resonance point : > 250 kHz
Frequency response (@ -10 dBU, all in series. Source 50Ω , load 100 kΩ) **:**
10 Hz -- 25 kHz +/- 1 dB
10 Hz -- 90 kHz +/- 1.5 dB
Distortion (primaries connected in series, source impedance 50Ω **):** < 0.5% @ -2 dBU, 50 Hz
Primary no load impedance @ 0 dBU, 50 Hz, all in series: 8 kΩ typically
Core / Can: Amorphous Strip Core / Mu metal can
Isolation between windings / between windings and core: 3 kV / 1.5 kV

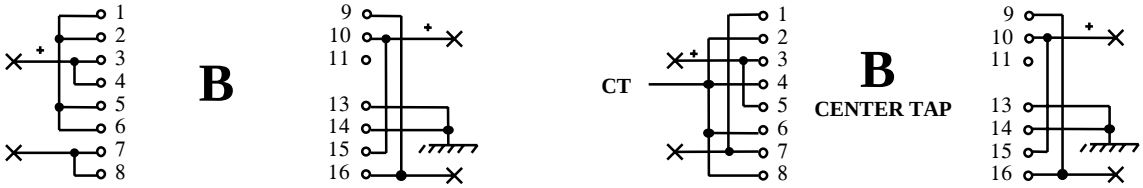
Turns ratio and possible use at different termination alternatives.
Termination alternatives are shown on the next page

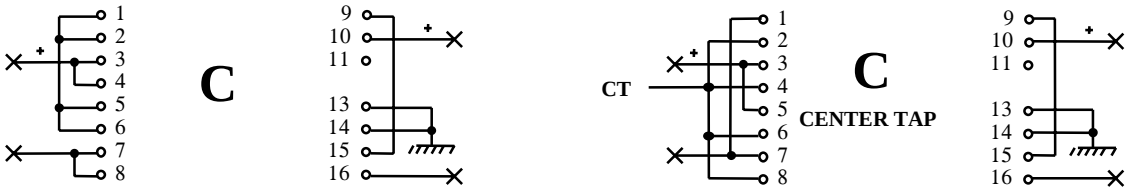
Termination Alternative	Turns ratio	Copper Resistance prim/sec	Possible Use
A	1:5	40Ω / 790 Ω	400Ω / 10 kΩ
B	1:5	10Ω / 200 Ω	Not recommended
C	1:10	10Ω / 790 Ω	100Ω / 10kΩ
D	1:10	2.5Ω / 200 Ω	Not recommended
E	1:20	2.5Ω / 790 Ω	25Ω / 10kΩ

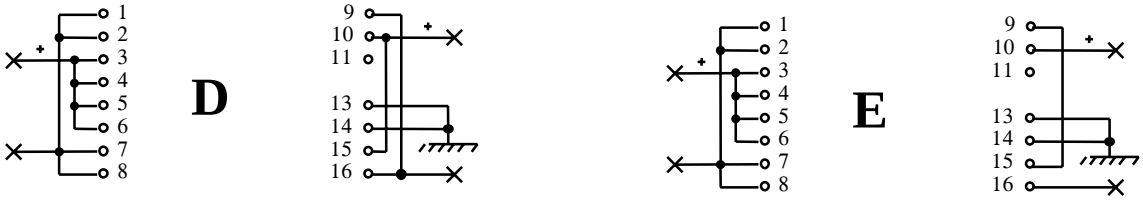
When the LL9206 is used in MC pickup applications, please note that the primary side of the transformer must have a ground reference.

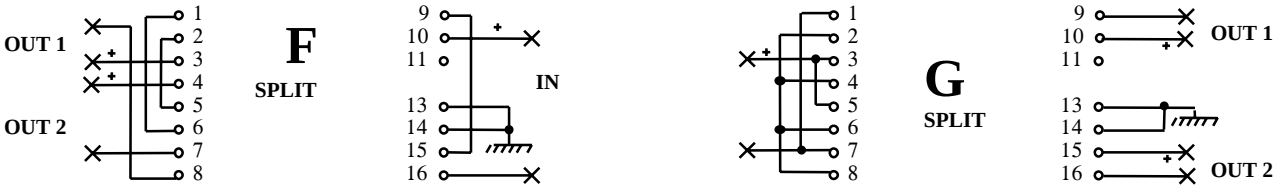
LL9206 Termination Alternatives
(Left side is input if not stated otherwise)
(Pins side view)











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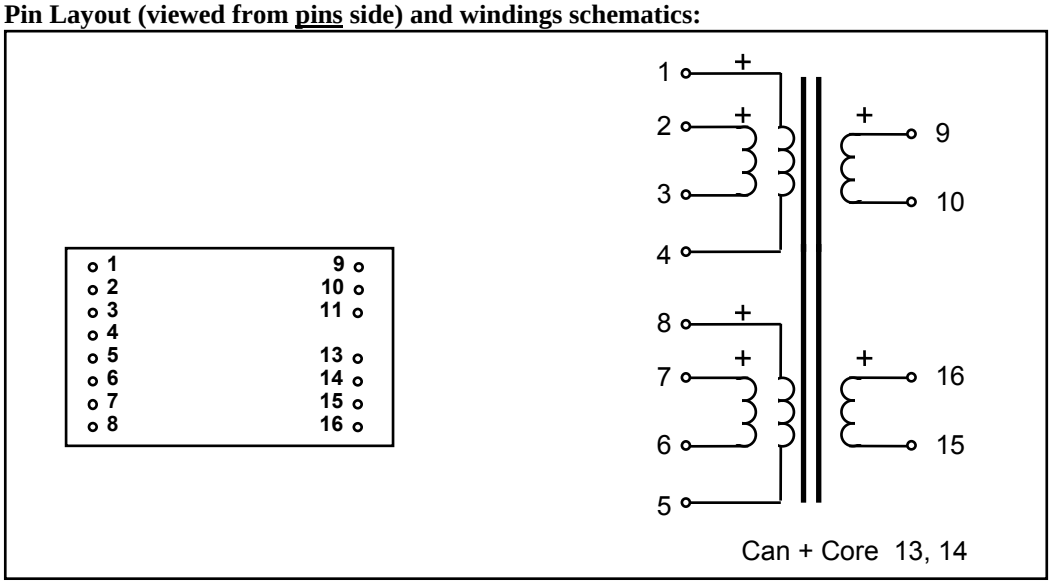
Moving Coil Input Transformer
LL9226

LL9226 is an MC transformer based on (and pin compatible with) our classic LL9206, but with reduced copper resistance and level capability. The new design has resulted in an even better frequency response but still with enough no load impedance to maintain the LF bandwidth. The transformer is built up from two coils, each coil with one secondary winding surrounded by two primary windings. Advantages with this structure are excellent frequency response and high immunity to surrounding magnetic fields. All winding ends are available on the pins. Thus, the transformer can be used with a set of different turns ratios.
The LL9226 core is our cobalt based uncut amorphous strip core. The transformer is housed in a mu metal can.

Turns ratio: 1 + 1 + 1 + 1 : 10 + 10
Dims: (Length x Width x Height above PCB (mm)) 30 x 22.5 x 14.5
Pin Layout (viewed from pins side) and windings schematics:



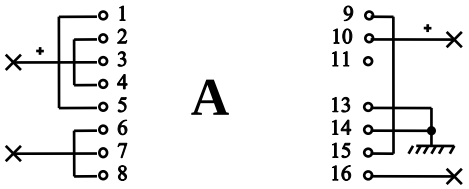
Spacing between pins:	2.54 mm (0.1")
Spacing between rows of pins:	22.86 mm (0.9")
Weight:	29 g
Rec. PCB hole diameter:	1.5 mm
Static resistance of each primary (average):	5 Ω
Static resistance of each secondary (average):	130 Ω
Frequency response (@ -10 dBU, Connection "A", source 50Ω , load 100 kΩ) **:**	10 Hz -- 50 kHz +/- 1 dB 5 Hz -- 100 kHz +/- 1.5 dB
Distortion (primaries connected in series, source impedance 40Ω)**:**	< 0.5% @ -2 dBU, 50 Hz
Primary no load impedance @ 0 dBU, 50 Hz, all in series:	3 kΩ typically
Core / Can:	Amorphous Strip Core / Mu metal can
Isolation between windings / between windings and core:	3 kV / 1.5 kV

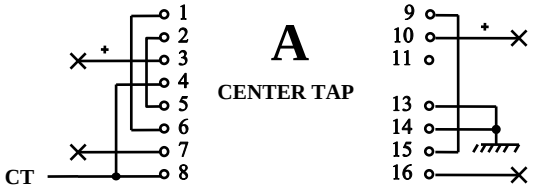
Turns ratio and possible use at different termination alternatives.
Termination alternatives are shown on the next page

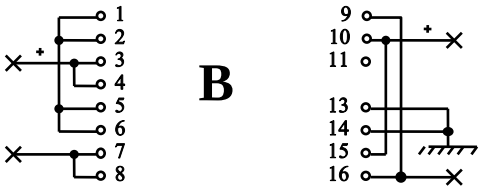
Termination Alternative	Turns ratio	Copper Resistance prim/sec	Suggested use for best frequency response
A	1:5	20 Ω / 260 Ω	MC cartridge < 100 Ω
B	1:5	5 Ω / 65 Ω	Not recommended
C	1:10	5 Ω / 260 Ω	MC cartridge < 50 Ω
D	1:10	1 Ω / 65 Ω	Not recommended
E	1:20	1 Ω / 260 Ω	MC cartridge < 25 Ω

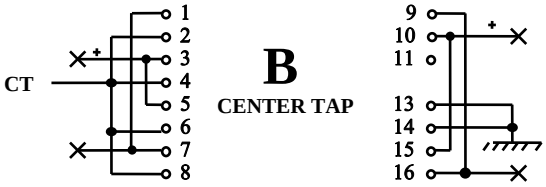
Application hint:
As the LL9226 does not have Faraday shields, both sides of the transformer should have a common ground reference.

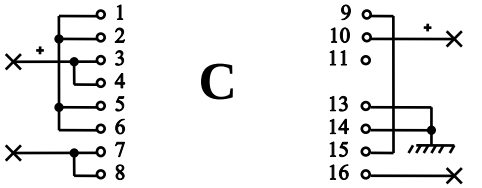
LL9226 Termination Alternatives
(Left side is input if not stated otherwise)
(Pins side view)

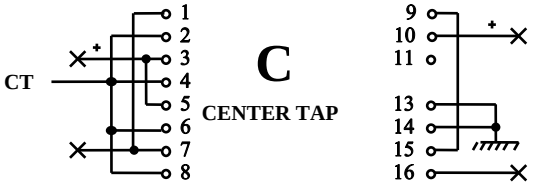


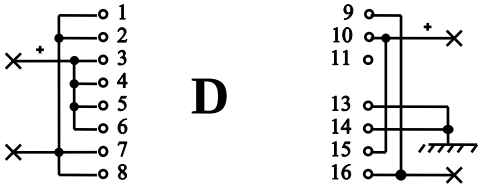


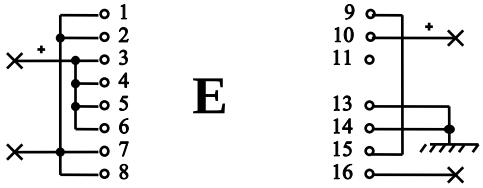












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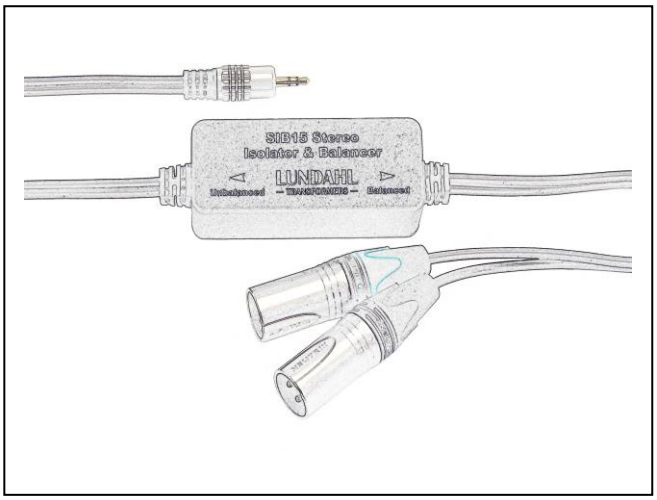
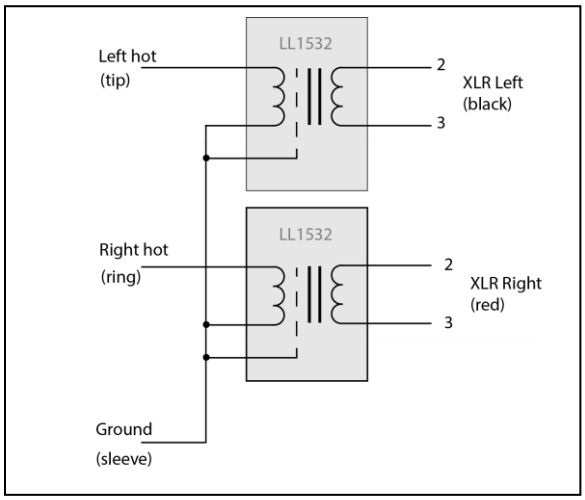
SIB15
Stereo Isolation and Balancing unit

SIB15 is a unit for interfacing between unbalanced audio sources (such as laptops and tablets) and professional, balanced audio systems. In particular in situations where a laptop is the source for both audio and video signals, the SIB15 eliminates the ground loops which are common sources of hum and noise.
SIB15 has a length of 1.8 meters (where length of unbalanced cable is 1.4m), which is enough for most situations.
SIB15 provides:

- Full galvanic isolation between all connectors
- True unbalanced-to-balanced conversion
- Robust die-cast aluminum housing





Technical specification:

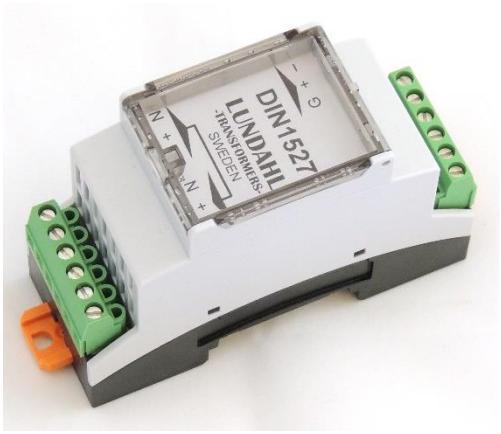
Total weight	275 g
Total length	1.9 m
Internal transformers	2 x LL1532
Signal level capability at 50Hz	+12 dbu / 3V RMS / 8V P-P
Signal loss across transformer (load 10k)	0.3 dB
Frequency response (source 10 ohms, load 10k)	6Hz – 80kHz +/- 1 dB
Isolation between any two connectors	> 1 kV RMS

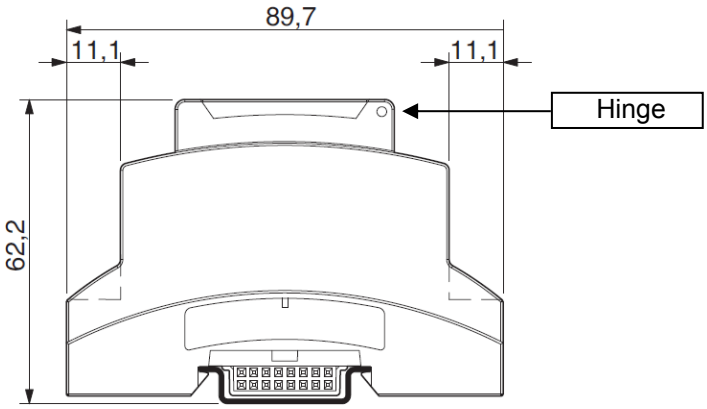
LUNDAHL
— TRANSFORMERS —

Transformer unit DIN1527

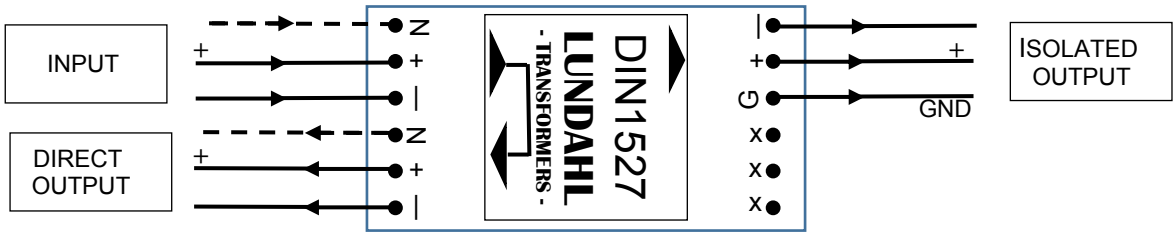
DIN1527 is a ready-to-use transformer unit with screw terminals. DIN1527 can be used for galvanic isolation, balanced/unbalanced conversion and splitting 1 direct -> 1 direct + 1 isolated output.

As indicated in the name, the unit is designed to fit on DIN rail (EU EN50022, US TS35) profiles, but it also has facilities for screw mounting. The internal transformer is our general purpose LL1527

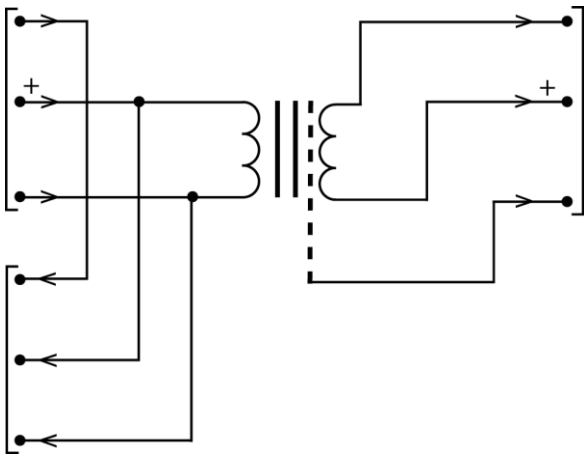




---------- Suggested connection ----------



---------- Technical details ----------



Transformer static resistance primary + secondary	200Ω
Core	Mu metal lamination core
Max signal level (THD less than 1%)	+16 dBU @ 50 Hz
Frequency response @ 0 dBU (source 150Ω, load 10kΩ)	10 Hz - 60 kHz +/-1 dB
Distortion (THD) at 50 Hz (source 150Ω)	**<** 0.2 % @ 50 Hz, for all signal levels -40 through +10 dBU
Loss across transformer with load 10kΩ	0.2 dB
Isolation between input and output sides	1 kV

R160628 PL

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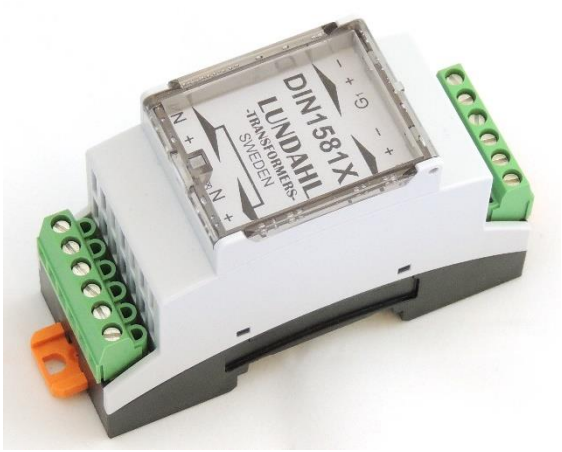
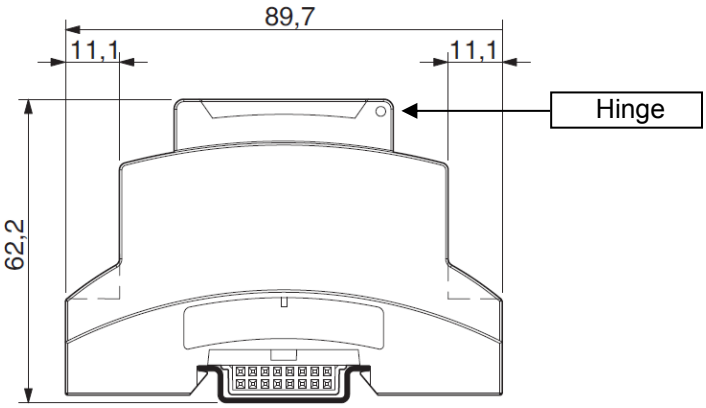
Transformer splitting unit DIN1581XL

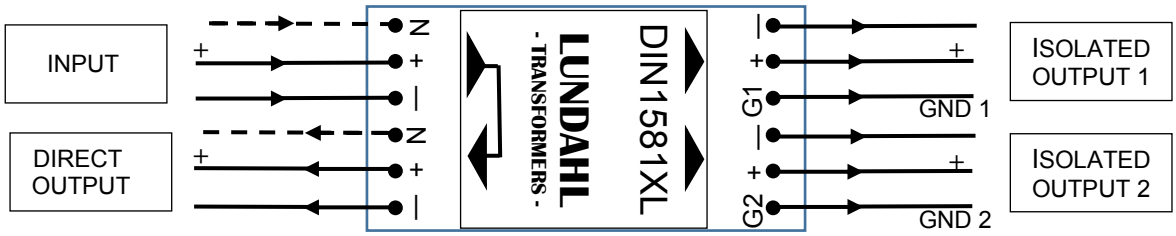
DIN1581XL is a ready-to-use transformer unit with screw terminals. DIN1581XL can be used for galvanic isolation, balanced/unbalanced conversion and splitting 1 direct -> 1 direct + 2 isolated output.

As indicated in the name, the unit is designed to fit on DIN rail (EU EN50022, US TS35) profiles, but it also has facilities for screw mounting. The internal transformer is our general purpose LL1581XL





---------- Suggested connection ----------



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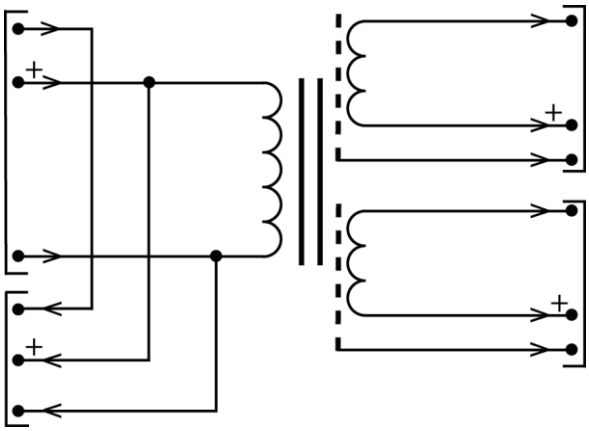

Transformer static resistance primary + secondary	60Ω , each channel
Core	Mu metal lamination core
Max signal level (THD less than 1%)	+13 dBU @ 50 Hz
Frequency response @ 0 dBU (source 150Ω, load 10kΩ)	10 Hz - 100 kHz +/-1 dB
Distortion (THD) at 50 Hz (source 150Ω)	< 0.2 % @ 50 Hz, for all signal levels -40 through +8 dBU
Loss across transformer with load 10kΩ	0.2 dB
Isolation between input and output sides	1 kV

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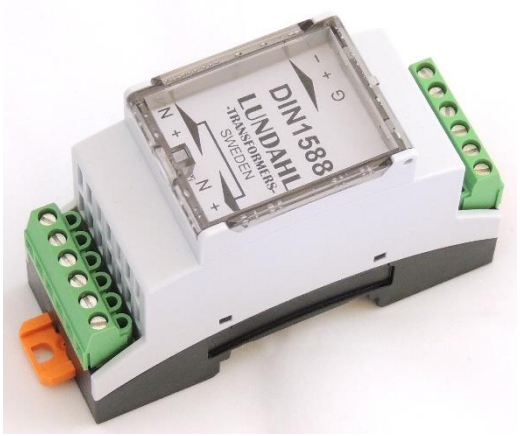
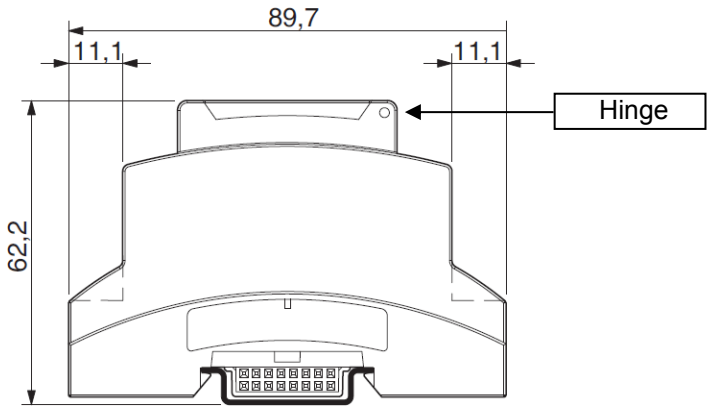
High level transformer unit DIN1588

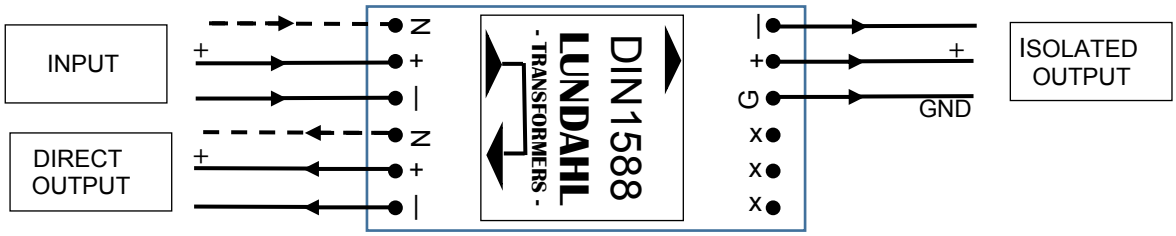
DIN1588 is a high level ready-to-use transformer unit with screw terminals. DIN1588 can be used for galvanic isolation, balanced/unbalanced conversion and splitting 1 direct -> 1 direct + 1 isolated output.

As indicated in the name, the unit is designed to fit on DIN rail (EU EN50022, US TS35) profiles, but it also has facilities for screw mounting. The internal transformer is our general purpose LL1588

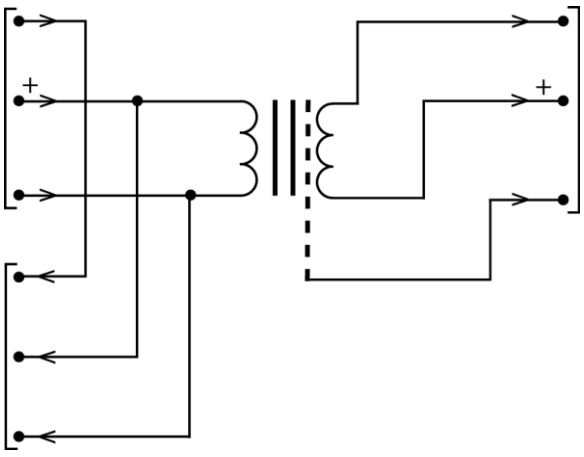




---------- Suggested connection ----------



---------- Technical details ----------



Transformer static resistance primary + secondary	240Ω
Core	Mu metal lamination core
Max signal level (THD less than 1%)	+28 dBU @ 50 Hz
Frequency response @ 0 dBU (source 150Ω, load 10kΩ)	10 Hz - 60 kHz +/-1 dB
Distortion (THD) at 50 Hz (source 150Ω)	**<** 0.2 % @ 50 Hz, for all signal levels -40 through +24 dBU
Loss across transformer with load 10kΩ	0.2 dB
Isolation between input and output sides	1 kV

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LUNDAHL
— TRANSFORMERS —

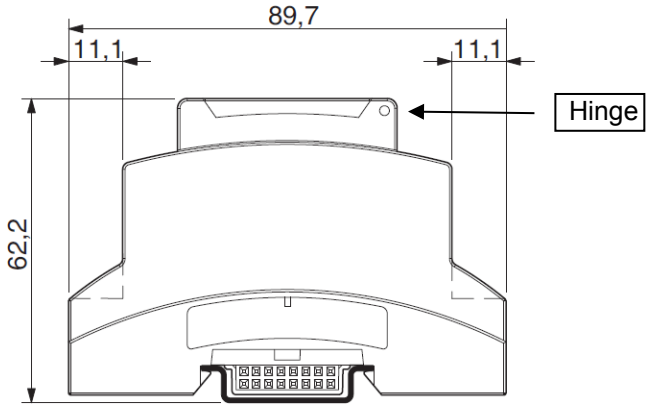
Transformer DIN unit

Depending on which transformer you chose, you will need to configure jumper wires on the PCB to match the transformer and meet your needs. On the next page you find the most common configurations. We will be glad to help you with other configurations if the one you need cannot be found here.

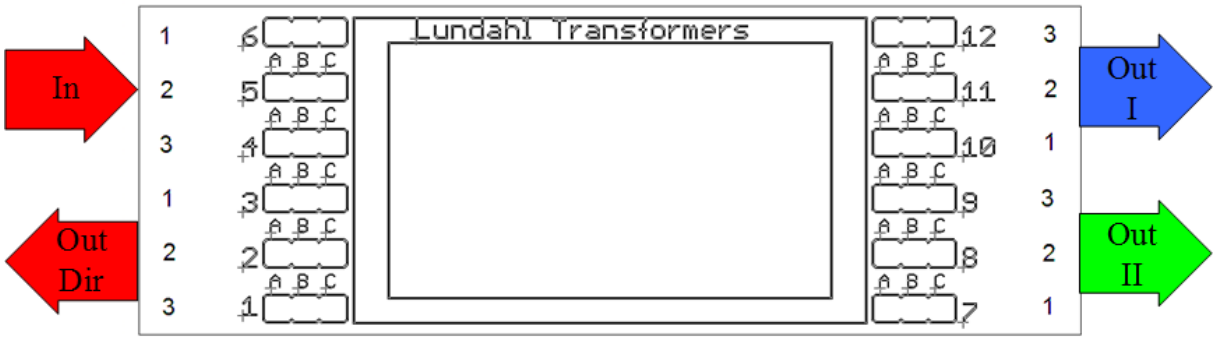
Recommended work flow:

1. On the PCB, wire and solder the jumper wires (use insulated wires)
2. On the PCB, place and solder the screw terminals
3. On the PCB, place and solder the transformer
4. Test the assembled board with AC signal (don't use Ohmmeter/DC voltage as this might magnetize the transformer's core)
5. Put down the PCB in the DIN base (lower black housing part) until it snaps in
6. Take the DIN cover (upper grey housing part) and turn cover hinge side to output side of the PCB
7. Place the DIN cover (upper grey housing part) on the base and press it until it snap in place
8. Connect wires to screw terminals in the same manner as in XLR connectors (1-GND, 2-Hot, 3-Cold)

Housing – Phoenix Contact BC 35,6 - 2TE (2 pitch), Material: polycarbonate
The housing is suitable for use in common installation distributor boxes and complies with the standard DIN 43880. When needed to be installed with screws, pull out the orange mounting flanges. Mounting holes distance is 98mm.
Screw Terminals – Phoenix Contact MKDSP 1,5/6 Ratings: Max 300V/10A, Cu wire 0,05 – 2,1 mm^2 / 30 - 14 AWG



DIN PCB v1.0 – Top view



NOTES:
1-2-3 numbers are indicators for the external wiring which is XLR-like (1-Ground, 2-Hot, 3-Cold).
Arrows shows the intended signal flow to/from this unit.
Arrow colours mean different GND's (ground references).

R161117 MZ

Recommended PCB configurations (with reservation for typographical mistakes, inaccuracies or omissions)

LL1527, LL1527XL
(Important: Ground pin "E" of the transformer should be oriented towards OUT I & II side of the PCB)

Ratio 1:1 (serial : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 7B with 10C
Connect 3A with 3B	Connect 8B with 11C
Connect 5A with 5B	Connect 9A with 11A
Connect 6A with 6B	Connect 12B with 12C
Connect 2A with 5C	
Connect 1C with 4A	
Connect 2C with 4C	

Ratio 1:1 (parallel : parallel) In – Dir Out – Out I

Connect 1A with 1B	Connect 7B with 10C
Connect 2A with 2B	Connect 8A with 11A
Connect 3A with 3B	Connect 9A with 12A
Connect 4A with 4B	Connect 11B with 11C
Connect 5A with 5B	Connect 12C with 12C
Connect 6A with 6B	
Connect 1C with 4C	
Connect 2C with 5C	

Ratio 1:2 (parallel : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 7B with 10C
Connect 2A with 2B	Connect 8B with 11C
Connect 3A with 3B	Connect 9A with 11A
Connect 4A with 4B	Connect 12B with 12C
Connect 5A with 5B	
Connect 6A with 6B	
Connect 1C with 4C	
Connect 2C with 5C	

Important note: Ground reference should be provided for position 10 for proper transformer operation (see transformer's data sheet).

LL1540
(Important: Ground pin "E" of the transformer should be oriented towards OUT I & II side of the PCB)

Ratio 1:1 (serial : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 7B with 10C
Connect 3A with 3B	Connect 8B with 11C
Connect 5A with 5B	Connect 9A with 11A
Connect 6A with 6B	Connect 12B with 12C
Connect 2A with 5C	
Connect 1C with 4A	
Connect 2C with 4C	

Important note: Ground reference should be provided for position 10 for proper transformer operation (see transformer's data sheet).

LL1570 – LL1570XL
Ratio 1:1 (serial : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 7A with 10A
Connect 3A with 3B	Connect 8B with 11C
Connect 5A with 5B	Connect 9A with 11A
Connect 6A with 6B	Connect 10B with 10C
Connect 2A with 5C	Connect 12B with 12C
Connect 1C with 4A	
Connect 2C with 4C	

Ratio 1:1 (parallel : parallel) In – Dir Out – Out I

Connect 1A with 1B	Connect 7A with 10A
Connect 2A with 2B	Connect 8A with 11A
Connect 3A with 3B	Connect 9A with 12A
Connect 4A with 4B	Connect 10B with 10C
Connect 5A with 5B	Connect 11B with 11C
Connect 6A with 6B	Connect 12C with 12C
Connect 1C with 4C	
Connect 2C with 5C	

Ratio 1:2 (parallel : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 7A with 10A
Connect 2A with 2B	Connect 8B with 11C
Connect 3A with 3B	Connect 9A with 11A
Connect 4A with 4B	Connect 10B with 10C
Connect 5A with 5B	Connect 12B with 12C
Connect 6A with 6B	
Connect 1C with 4C	
Connect 2C with 5C	

Important note: Ground reference should be provided for positions 6 (IN-1) and 10 (OUT I-1) for proper transformer operation (see LL1570, LL1570XL data sheet).

Splitting In – Dir Out – Out I – Out II

Connect 1A with 1B	Connect 7B with 7C
Connect 2A with 2B	Connect 8B with 8C
Connect 3A with 3B	Connect 9B with 9C
Connect 4A with 4B	Connect 10B with 10C
Connect 5A with 5B	Connect 11B with 11C
Connect 6A with 6B	Connect 12B with 12C
Connect 1C with 4C	
Connect 2C with 5C	

Important note: Ground reference should be provided for positions 3 (and/or 6) (IN-1 and/or DIR OUT-1), 7 (OUT II-1) and 10 (OUT I-1) for proper transformer operation (see LL1570, LL1570XL data sheet).

LL1581XL
Splitting In – Dir Out – Out I – Out II

Connect 1A with 1B	Connect 7B with 7C
Connect 2A with 2B	Connect 8B with 8C
Connect 3A with 3B	Connect 9B with 9C
Connect 4A with 4B	Connect 10B with 10C
Connect 5A with 5B	Connect 11B with 11C
Connect 6A with 6B	Connect 12B with 12C
Connect 1C with 4C	
Connect 2C with 5C	

Important note: Ground reference should be provided for positions 7 (OUT II-1) and 10 (OUT I-1) for proper transformer operation (see transformer's data sheet).

LL1588
Ratio 1:1 (serial : serial) In – Dir Out – Out I

Connect 1A with 1B	Connect 12B with 12C
Connect 3A with 3B	Connect 8B with 11C
Connect 5A with 5B	Connect 9A with 11A
Connect 6A with 6B	Connect 7B with 10C
Connect 2A with 5C	
Connect 1C with 4A	
Connect 2C with 4C	

Ratio 1:1 (parallel : parallel) In – Dir Out – Out I

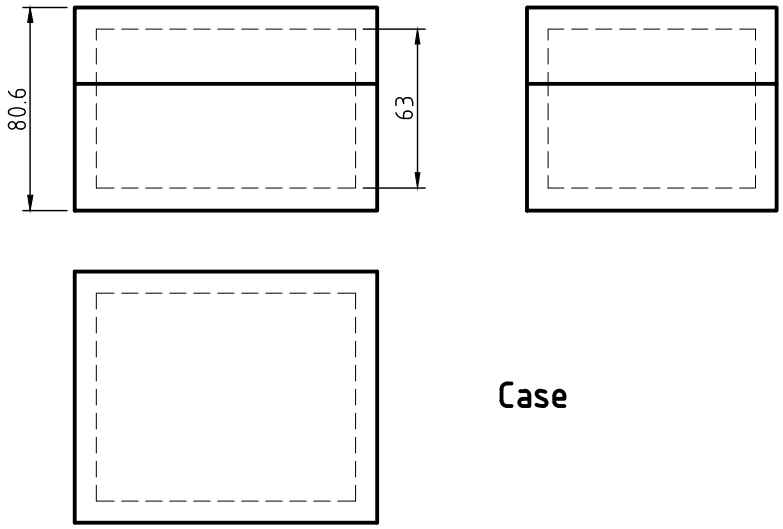
Connect 1A with 1B	Connect 11B with 11C
Connect 2A with 2B	Connect 12C with 12C
Connect 3A with 3B	Connect 8A with 11A
Connect 4A with 4B	Connect 9B with 12A
Connect 5A with 5B	Connect 7B with 10C
Connect 6A with 6B	
Connect 1C with 4C	
Connect 2C with 5C	

Important note: Ground reference should be provided for position 10 (OUT I-1) for proper transformer operation (see transformer's data sheet).

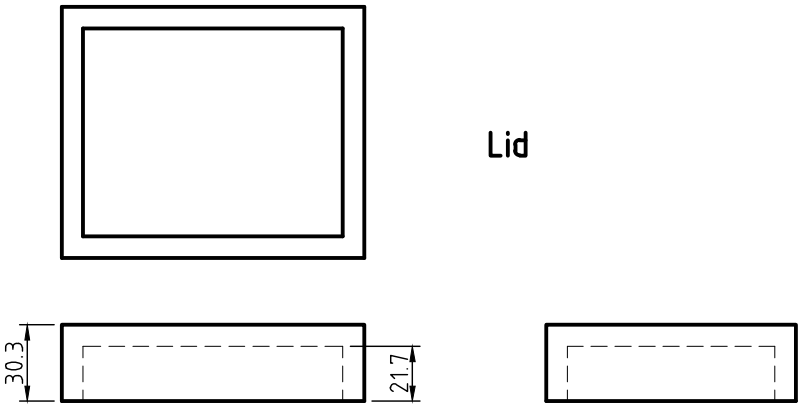
Splitting In – Dir Out – Out I – Out II

Connect 1A with 1B	Connect 7B with 7C
Connect 2A with 2B	Connect 8B with 8C
Connect 3A with 3B	Connect 9B with 9C
Connect 4A with 4B	Connect 11B with 11C
Connect 5A with 5B	Connect 12B with 12C
Connect 6A with 6B	
Connect 1C with 4C	
Connect 2C with 5C	

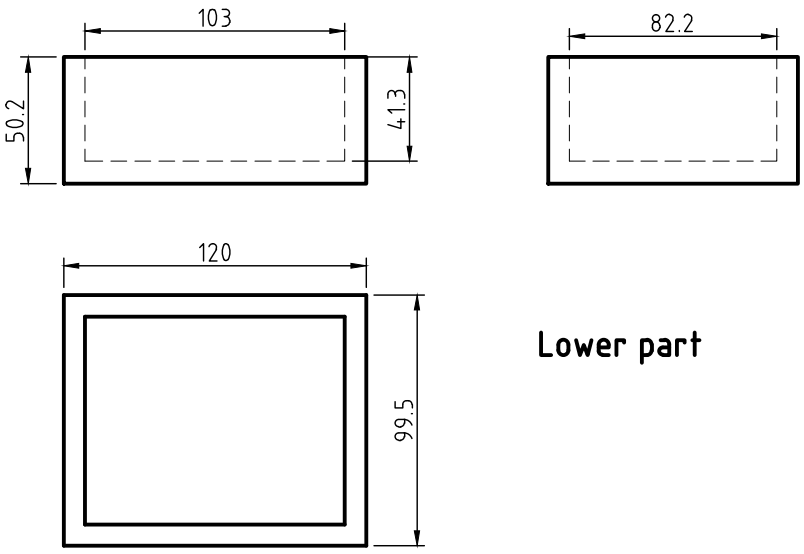
Important note: Ground reference should be provided for position 7 (OUT II-1) for proper transformer operation (see transformer's data sheet).



Case



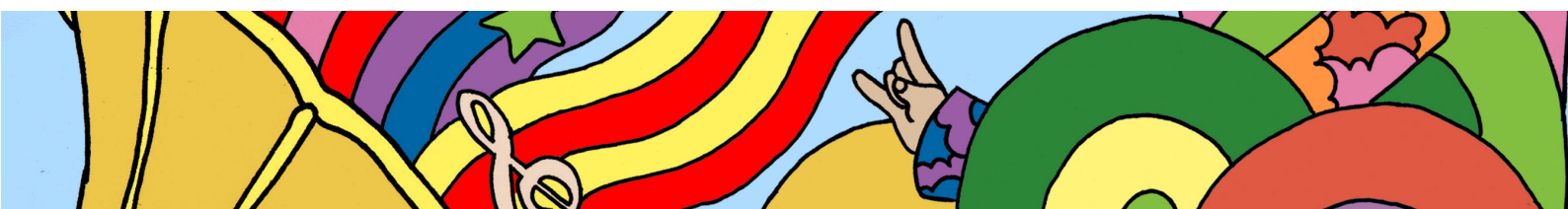
Lid



Lower part

LUNDAHL — TRANSFORMERS — Tibeliusgatan 7, 761 50 NORRTÄLJE Tel. 0176-139 30	Skala 1:3 All walls are 8.6 mm thick	Maskin: Wooden case	Detalj: Wooden case
		Konstruerad av: BOF	Ritad av: BOF / Sida: 1:3
		Datum: 2014-02-18	Rev. / Forts.

Technical Papers



LUNDAHL
– TRANSFORMERS –

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Transformer Design Philosophies

Our transformer design philosophy is based on forty years of experience from manufacturing transformers for a diversity of applications. Our transformers are used in professional audio and hi-fi as well as in power supplies, telecommunications, welding, military applications etc.

We have evolved some unique problem solving strategies when designing transformers, discussed further below, and we design and build our own production machines in order to fulfill otherwise unobtainable transformer design goals.

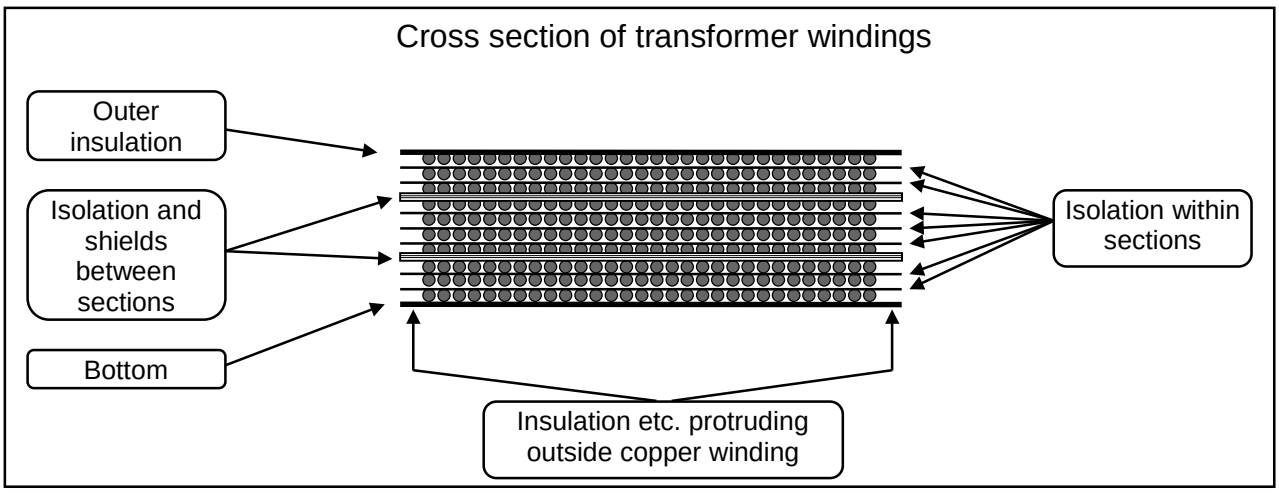
1. Winding technique

Most manufacturers of audio transformers use a conventional bobbin winding system: Within a transformer section, the copper wire is wound in a more or less "random" fashion, and thus the voltage difference between two adjacent wires may be substantial. Transformer sections (such as primary and secondary sections) are separated by isolation film and tape, but the isolation materials is confined by the same bobbin sides as the copper wire. Static shields are also confined to the same limits.

The Lundahl Transformers winding technique does not use bobbins. Our open end winding technique (with insulation between each layer of copper wire within a transformer section) is consistently applied, even for the smallest transformer types and for the thinnest wire dimensions. This gives the following advantages:

- The wire is wound in well-ordered layers. As a result, no wires are crossed and the fill factor is increased (in spite of more insulating material!).
- As additional isolation is applied in the vertical direction, the isolation is reinforced where strong mechanical forces and high voltage differences occur.
- The copper wire is in close contact with low-voltage neighbors of the same layer only.
- Inter-winding capacitance is reduced and reproducible.

Insulation and, if applicable, electrostatic shields are placed between each section, protruding outside the copper wire edges to improve the insulating capability as well as the electrostatic shielding.



R990428

2. Dual coil structure.
Our transformers are built up from two coils, each coil with both primary and secondary windings. (It is a common misconception that the primary winding is placed in one coil and the secondary winding is placed in the other. This was the case in high school physics laboratory classes, but such a transformer does not perform very well in the real world.)
The dual coil structure has many advantages:
Magnetic immunity is improved with about 40 dB, as a signal caused by an external magnetic field is cancelled between the two coils.
Magnetic stray field is likewise reduced.
CMRR is improved, in particular if windings are used in parallel across the two coils, as plus and minus contributions cancel.

3. Choice of core shape and core materials
In order to meet customer requirements on both electrical and mechanical parameters, we manufacture not only transformer coils, but also cans and C-cores (and machines for can and C-core production) in house. For some applications, we also use amorphous metal cores made in a "inverted toroid technique" developed in house. These manufacturing capabilities give us a large freedom to optimize design also for limited volume applications. We focus on PCB mount transformers as we think this is a rational way of using small size transformers and regularly turn down requests for flying leads.

4. Long lifetime and high insulation requirements
Our winding technique gives us an excellent base for high insulation requirements. A molding process fills empty space in the transformer. When impregnated with epoxy resin, the result is high electrical insulation (normally 4 kV between windings) and excellent mechanical strength.

5. Price / performance considerations:
Manufacture of high quality audio transformers is, in spite of a semi automated production process, a very labor-intensive task. Cheap transformers can be found in many electronics supply catalogs. However, it is not the transformers you would like to listen to in your application. Truly sound transparent transformers are manufactured by a handful of companies only.

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– TRANSFORMERS –

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Mixed feedback drive circuits for audio output transformers

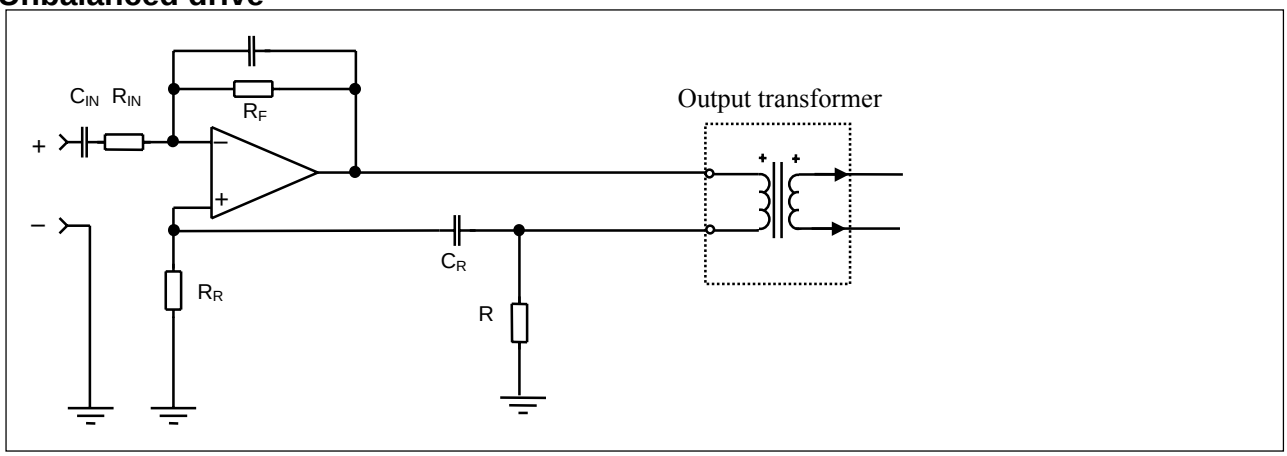
Using mixed feedback drive circuits with audio output transformers have two major advantages:

1. Transformer-caused distortion is reduced (or almost eliminated)
2. The primary copper resistance of the transformer is eliminated, thus reducing the output impedance correspondingly.

The circuits below illustrate the principles for mixed feedback. In real applications, additional components may have to be added to reach desired performance.

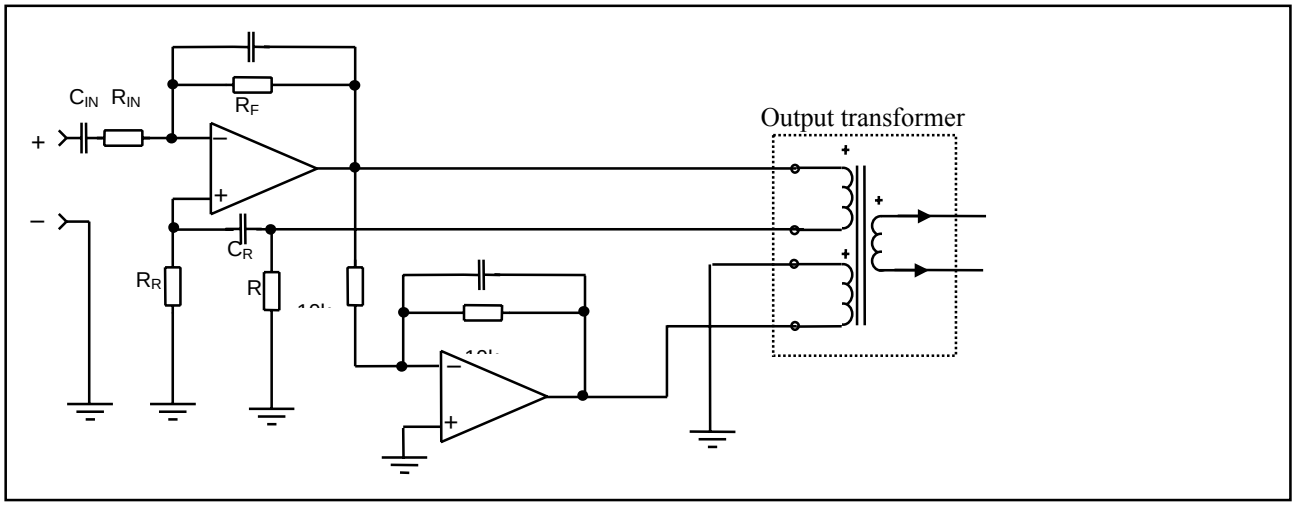
NOTE! Application of mixed feedback principles for audio output was covered by a German patent DE 29 01 567 with application day 13.1.79. As far as we understand, the patent has now expired.

Unbalanced drive



Gain = R_F/ R_{IN} • Transformer turns ratio.
Select R_R ~ R_{IN}
Select C_R such that 1 / (2π • R_R • C_R) << F_{MIN}, the lowest desired output frequency.
Optimum R = $R_{primary}$ • (R_{IN}/R_F), where $R_{primary}$ is copper resistance of primary winding(s).
Select R for good THD at LF, and for good square wave response

Balanced drive



Gain = 2 • R_F/ R_{IN} • Transformer turns ratio.
Select R_R ~ R_{IN}
Select C_R such that 1 / (2π • R_R • C_R) << F_{MIN}, the lowest desired output frequency.
Optimum R <= $R_{primary}$ • (R_{IN}/R_F) / 2, where $R_{primary}$ is copper resistance of primary winding(s).
Select R for good THD at LF, and for good square wave response.

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Grounding and shielding.

Line Output.

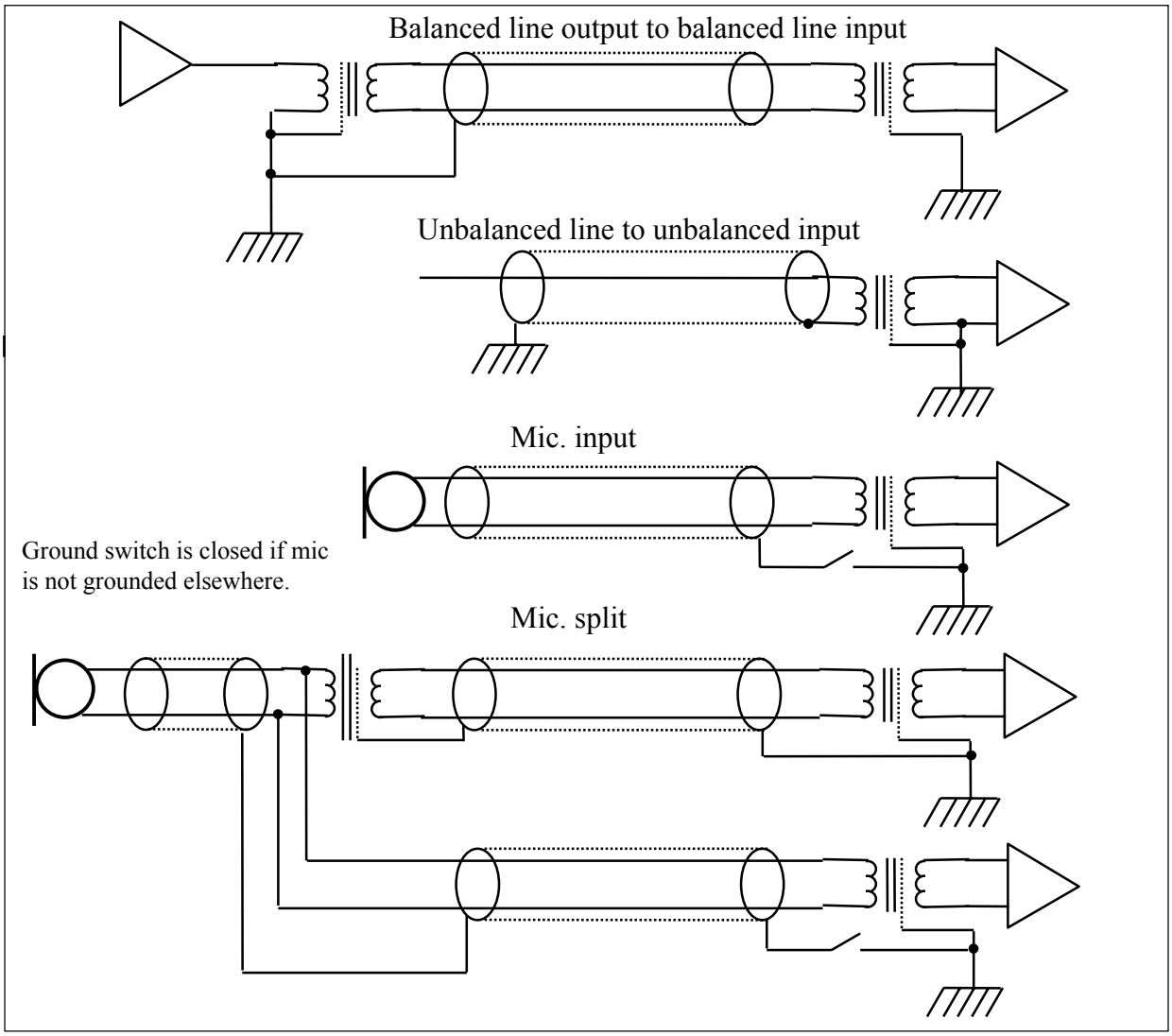
One of the objectives of an output transformer is to give the output line a high and symmetrical impedance versus ground. This is obtained with transformer faradays shield(s) or symmetrical winding arrangements. The symmetry is necessary to prevent mode transfer, i.e. common mode signals picked up by the output line creating differential mode signals (IRT test).
The shield(s) also contributes to output signal balance (IEC test) and to the protection of the output stage from high line voltages caused by lightning.
The line shield and the transformer shield / the transformer primary cold connection should be connected to the ground of the line output device.

Line Input.

A line input transformer must not allow common mode signals from the line to form differential mode signals (good CMR). For best result, the shield of an input transformer should be connected to the ground of the receiving device. To avoid ground loops, the shield of the line cable should not be connected to this ground.

Mirophone Input.

If the mic. is not grounded, the shield of the microphone cable must be connected to the mic amplifier ground, togheter with the shields of the mic input transformer. In case of mic splitting, the grounding scheme must be carefully designed to make shure all cable shields are grounded without creating ground loops.



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Where quality and transformers meet

In conventionally manufactured transformers one have to rely on the enamel isolation of the copper winding wire for electrical isolation within a section. Extra isolation, such as tape and film, is placed only between sections. Within a section, the copper wire is wound in a more or less random fashion, and the voltage difference between two adjacent wires may be substantial. In addition to the risk for short-circuits, the inter-winding capacitance may vary substantially between individual transformers.

As the vast majority of transformers used are produced in this way, transformers have a reputation for unreliability. And the problems are inherent in the construction of the transformers. Thus quality programs which aim at conformity of production (like ISO-9000) can reduce the problems only slightly.

Transformers from LUNDAHL TRANSFORMERS, on the other hand, have a strong reputation for reliability and repeatability. This is a result of a careful design and manufacturing process:

1 An open end winding technique with insulation between each layer of copper wire is consequently applied even for the thinnest of wire dimensions. This gives the following properties:
   - 1.1 The wire is wound in well-ordered layers. As a result, no wires are crossed and the fill factor is increased (in spite of more insulating material!).
   - 1.2 As the additional isolation is applied across the vertical direction, the isolation is reinforced where strong mechanical forces and high voltage differences occur.
   - 1.3 The copper wire is in close contact with low-voltage neighbors of the same layer only.
   - 1.4 Winding capacitances are reduced and reproducible.

2 Each transformer is submitted to isolation tests prior to molding to correct and sort out potential low isolation voltage candidates.

3 A molding process is developed where naked wires are fixated in a ceramic casting.

4 Each transformer is impregnated in a pressure and vacuum cycling process where the windings and the mold is soaked with a solventless epoxy resin.

5 In the final tests each individual transformer is tested for malfunction and isolation breakdown.

6 The production is carried out by our very long-experienced staff (average employment time for our employees is more then 10 years).

Due to our unwillingness to compromise on our ideas on how the ideal transformer should be designed and manufactured, we refrain from manufacturing products where our design principles cannot be applied, such as toroidal transformers. Due to our rather unique concept, we have also been forced to build most of our production machines in house, including e.g. winding machines.

As all companies, we are dependent on the satisfaction of our customers to survive, and we will continue to do our best to retain our customers' confidence. In terms of quality development, our future plans are to document certain key steps in the production process which have not yet been properly documented, and to continue to develop the products and the production process in order to give our customers maximum value for their money.

Per Lundahl, Managing Director

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Winding arrangements of output transformers

The winding arrangement of an output transformer can be optimized to achieve good common mode rejection and/or good bandwidth. Good CMRR is desirable to avoid mode transfer (common mode signals are transformed to differential mode signals) in the output transformer. This sheet explains the different winding structures for our output transformers

With Faraday shield

Faraday shields, placed between the primary and the secondary windings, are used to reduces the capacitive coupling. A transformer with Faraday shield is more complicated to manufacture but can be used with any type of output drive. In our Faraday shielded output transformers, such as the LL1517 and the LL1518 each coil is wound in three sections.

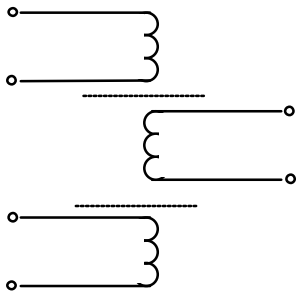
Primary cold ends facing secondary winding

The primary and secondary windings can be arranged such that the cold (grounded) side of the primary windning faces the secondary windning. As the voltage swing in this end of the primary windning is only a fraction of the total swing, the capacitive coupling is greatly reduced. This technique requires different winding arrangement for unbalanced drive (e.g. LL5402) or balanced drive (e.g. LL1524).

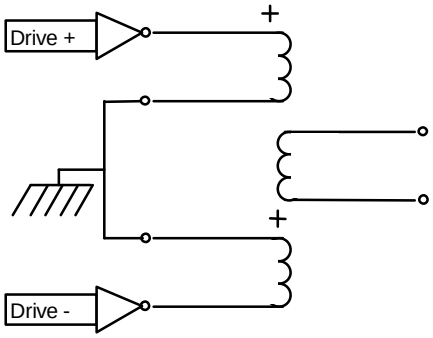
Five-section structure for increased bandwidth

In a five-section structure, leakage inductance is minimized almost to the extent of a bifilar wounded transformer. By letting the electrical potential of each layer of the secondary winding follow the potential of the adjecent primary winding, capacitive coupling is reduced, and thus high bandwidth is acheived.

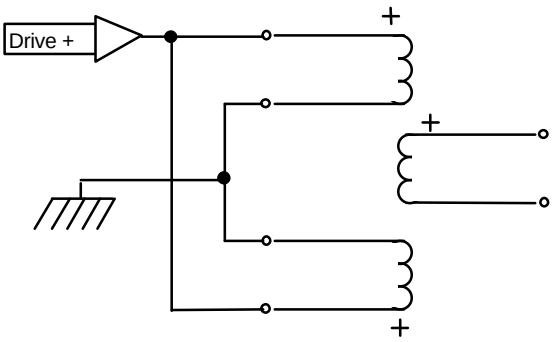
Three section structure with Faraday shields



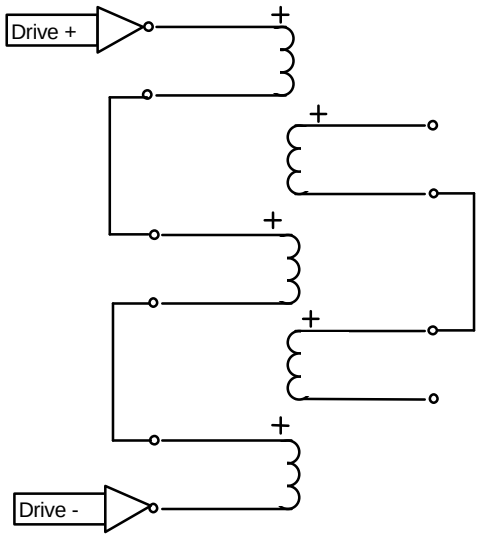
Three section structure, balanced drive. The secondary is faced by primary neutral parts.



Three section structure, unbalanced drive. The seconday is faced by primary cold ends.



Five section structure, balanced drive



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Norrtälje, September 22, 2014

Company statement regarding:
the EU directive 2011/65/EU (RoHS2)
the EU REACH regulation (SVHC 155 of June 16th, 2014)

From mid June 2005, all soldering at Lundahl Transformers are carried out with lead-free solder. We have also ensured from our suppliers that all materials used in production of our transformers are RoHS-compliant. Thus all transformers manufactured after July 1, 2005 are RoHS compliant.

All Lundahl RoHS-compliant transformers are market with an encircled "F" on the label, except in some very rare cases (e.g. LL6404, LL1572, LL1574….) where the label is too small to accommodate anything but the type number.

In our products or production process, no substances listed in the above REACH regulation are used.

Per Lundahl
Managing Director
Lundahl Transformers AB