

# LOW COST LINE MATCHING TRANSFORMER

# P3324

## Features

- \* Low Cost
- \* 12.6mm (0.5") Seated Height
- \* Industry Standard Pinout
- \* IEC 950, UL 1950 and EN 60950 Certified
- \* UL Recognized Component
- \* BABT Certificate of Recognition
- \* Extended Frequency Response
- \* Flat TX and RX Responses
- \* Simple Matching
- \* Low Insertion Loss
- \* High Thermal Stability

## Applications

- \* Voice
- \* V.22bis Modems
- \* Set Top Boxes
- \* Least Cost Routers
- \* Instrumentation

## DESCRIPTION

P3324 is intended for low speed data and voice applications where good distortion at moderate power levels is required at a most competitive price.

P3324 uses patented design and construction methods to achieve excellent signal performance and safety isolation to international standards at truly low cost, making it the component of choice for voice and low speed data applications throughout the world. P3324 is certified to EN 60950, IEC 950, UL1950 and EN 41003. P3324 is a UL Recognized Component, and is supported by a BABT Certificate of Recognition and an IEC CB Test Certificate.

P3324 has exceptionally flat frequency response from 100Hz to 10kHz, a 3dB bandwidth of over 50kHz and requires only the very simplest of matching to achieve good return loss and transhybrid loss across the voiceband, with low levels of signal distortion at signal frequencies as low as 200Hz.

P3324 also exhibits stable electrical characteristics over its full operating temperature range.

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## SPECIFICATIONS

### Electrical

At T = 25°C and as circuit Fig. 2 unless otherwise stated.

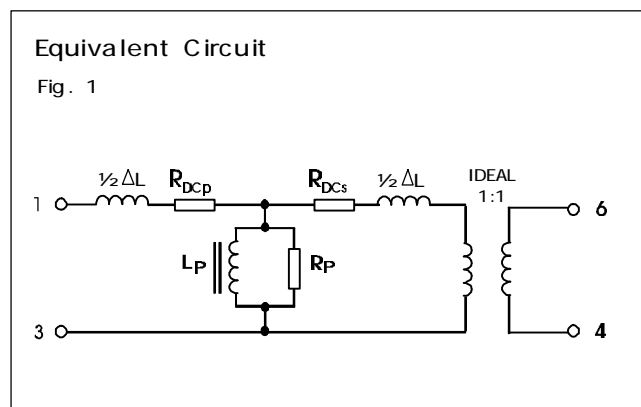
Parameter	Conditions	Min	Typ	Max	Units
Insertion Loss	f = 2kHz, R <sub>L</sub> = 600Ω	-	1.8	-	dB
Frequency Response	LF -3dB cutoff	-	30	-	Hz
	HF -3dB cutoff	-	55	-	kHz
	200Hz – 4kHz	-	-	±0.1	dB
Return Loss <sup>(5)</sup>	200Hz – 4kHz	16	-	-	dB
Transhybrid Loss <sup>(5)</sup>	200Hz – 4kHz	20	-	-	dB
Third Harmonic Distortion <sup>(1)</sup>	450Hz -10dBm in line	-	-86	-	dBm
	200Hz -10dBm in line	-	-79	-	dBm
Voltage Isolation <sup>(2)</sup>	50Hz	2.12	-	-	kVrms
	DC	3.0	-	-	kV
Operating Range:	Functional	0	-	+70	°C
	Storage	-40	-	+85	°C

Lumped equivalent circuit parameters as Fig. 1

DC resistance <sup>(3)</sup>	Primary resistance R <sub>DCp</sub>	70	-	87	Ω
	Secondary resistance R <sub>DCs</sub>	95	-	120	Ω
Leakage inductance, ΔL		3	3.8	5	mH
Shunt inductance, L <sub>p</sub> <sup>(4)</sup>	200Hz -43dBm	3	4	-	H
Shunt loss, R <sub>p</sub>	200Hz -43dBm	6	8	-	kΩ

#### Notes:

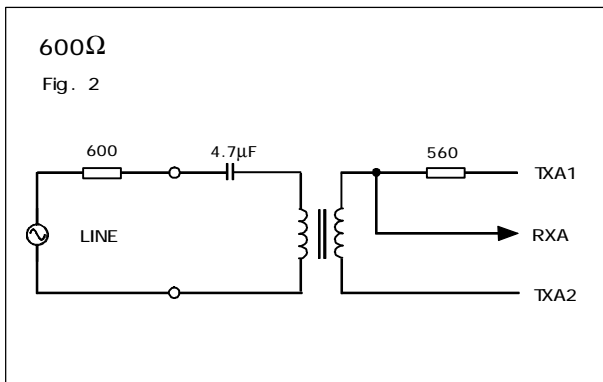
1. Third harmonic typically exceeds other harmonics by 10dB.
2. Components are 100% tested at 3.25kVDC.
3. Caution: do not pass DC through windings. Telephone line current must be diverted using semiconductor line hold circuit or choke.
4. At signal levels greater than -20dBm, L<sub>p</sub> will increase and R<sub>p</sub> will decrease slightly but the effect is usually favourable to the return loss characteristic.
5. Return loss and transhybrid loss can be improved to 30dB in improved matching circuit. The values shown relate to the simplest configuration, Fig. 2.



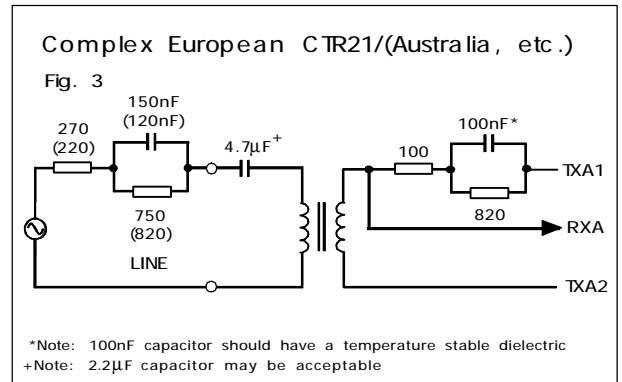
**MATCHING RECOMMENDATIONS**

The following recommendations start with the simplest implementations and progress to enhanced performance utilizing additional components. Good performance is achieved even with the simplest configurations. The implementations assume a low impedance balanced TX drive and a relatively high impedance RX input, as is commonly available, though use with other TX/RX arrangements is straightforward. Note that there are no changes to components on the line side, or in the hybrid, whether 600Ω or complex reference impedance selected, thus assisting country configuration. For complex impedance, the matching circuits derived are suitable for reference impedances of the type 270 + 750//150nF e.g. European CTR21 and 220 + 820//120nF (or 115nF) e.g. Australia, South Africa, etc., and yield similar performance characteristics. For other impedances, please contact ETAL.

**Minimum Cost Implementations**

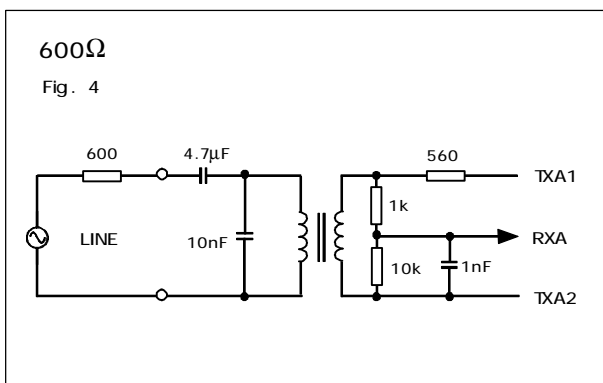


Insertion Loss: 2.2dB @ 2kHz  
Frequency Response : ±0.1dB 200Hz – 10kHz  
Return Loss: 18dB 200Hz – 4kHz  
Transhybrid Loss: 22dB 200Hz – 4kHz

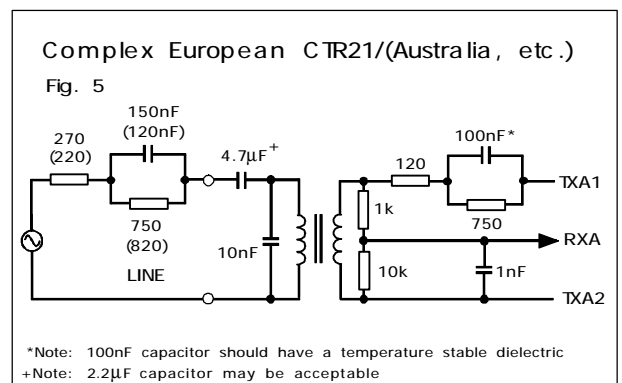


Insertion Loss: 1.3dB @ 2kHz  
Frequency Response : ±0.5dB 200Hz – 4kHz  
Return Loss: 18dB 200Hz – 4kHz  
Transhybrid Loss: 14dB 200Hz – 4kHz

**Improved matching and hybrid**



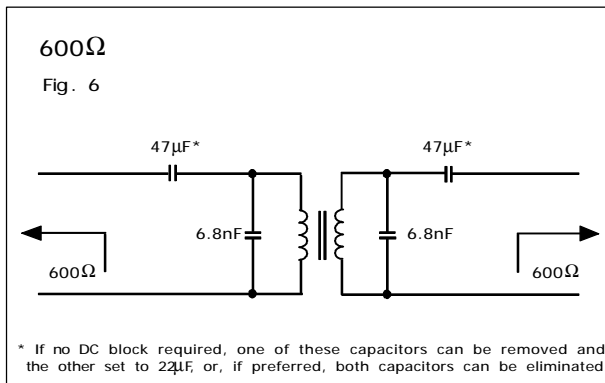
Insertion Loss (Line to RXA): 3.2dB @ 2kHz  
Frequency Response : ±0.1dB 200Hz – 10kHz  
Return Loss: 20dB 200Hz – 4kHz  
Transhybrid Loss: 30dB 200Hz – 10kHz



Insertion Loss (Line to RXA): 2.5dB @ 2kHz  
Frequency Response : ±0.5dB 200Hz – 4kHz  
Return Loss: 20dB 200Hz – 4kHz  
Transhybrid Loss: 18dB 200Hz – 4kHz

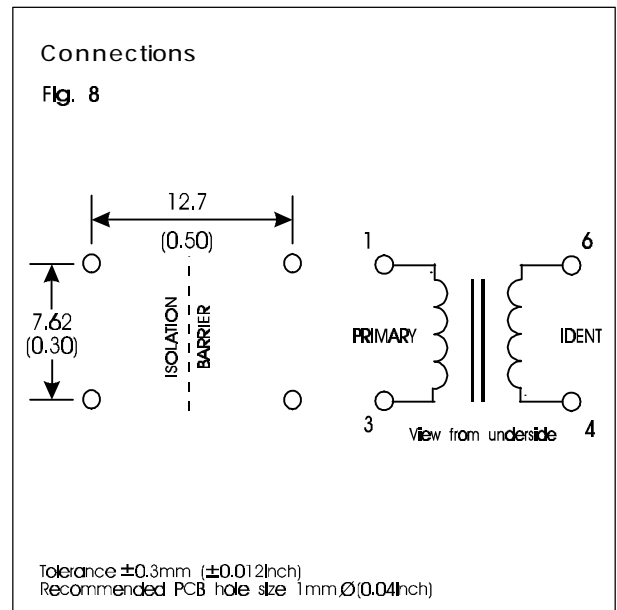
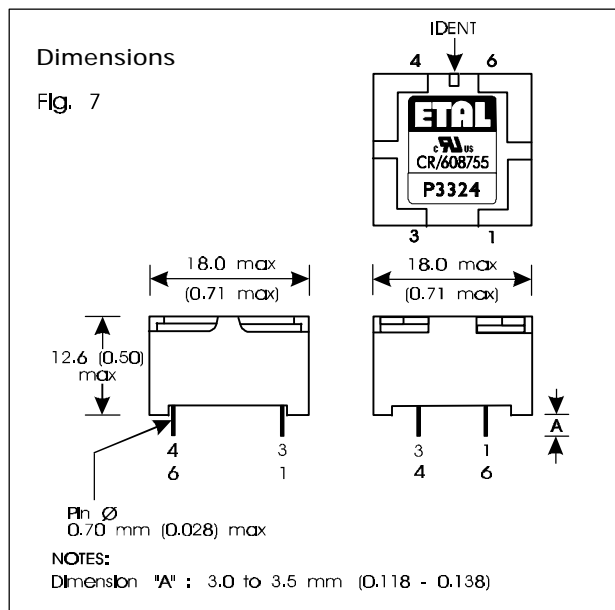
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**600Ω Instrumentation**



Insertion Loss: 1.8dB @ 2kHz  
 Frequency Response : ±0.2dB 50Hz – 20kHz  
 Return Loss: 16dB 20Hz – 20kHz

**CONSTRUCTION**



Dimensions shown are in millimetres (inches).  
 Geometric centres of outline and pin grid coincide within a tolerance circle of 0.6mmØ.  
 Windings may be used interchangeably as primary or secondary.  
 Total weight typically 5.2g.

**SAFETY**

Constructed in accordance with IEC 950:1991, EN 60950:1992 (BS7002:1992), supplementary insulation, 250Vrms maximum working voltage, flammability class V-0.

There are no special installation requirements (beyond attending to usual PCB track separations) since the integral cover provides supplementary insulation from its external faces to internal core and windings.

**CERTIFICATION**

Certified under the IEC CB scheme (Certificate GB445W) to IEC 950:1991, up to amendment 4, sub-clauses 1.5, 1.5.1, 1.5.3, 2.2, 2.2.3, 2.2.4, 2.9.2, 2.9.3, 2.9.4, 4.4, 4.4.3.2 (class V-0) and 5.3 for a maximum working voltage of 250Vrms, nominal mains supply voltage not exceeding 300Vrms and a maximum operating temperature of 70°C in Pollution Degree 2 environments.

Recognized under the Component Recognition Program of Underwriters Laboratories Inc. to US and Canadian requirements CAN/CSA C22.2 No. 950-95/UL1950, Third Edition, including revisions through to revision date March 1, 1998, based on Fourth Amendment of IEC 950, Second Edition, maximum working voltage 180Vrms (creepage), 420V peak (clearance), Pollution Degree 2, supplementary insulation.

UL File number E203175.  
Approved and certified by BABT to EN 60950 and EN 41003.  
BABT Certificate of Recognition 608755

Additionally, ETAL certifies all transformers as providing voltage isolation of 2.12kVrms, 3kV DC minimum. All shipments are supported by a certificate of conformity to current applicable safety standards.

**ABSOLUTE MAXIMUM RATINGS**

(Ratings of components independent of circuit).

Short term isolation voltage (1s)	2.12kVrms, 3.0 kVDC
DC current	100µA
Storage temperature	-40°C to +85°C
Lead temperature, 10s	260°C

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P3324 design and construction are protected by patents and registered design.  
British Patent No. 2333646.  
British Patent No. 2340667.  
UK Registered Design No. 2077360.  
French Registered Design No. 991512.  
Germany Registered Design 49902311.0.  
United States Registered Design 426, 815.  
Other patents and registered designs pending.

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ISO 9001  
FM 25326

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