

# LOW DISTORTION LINE MATCHING TRANSFORMER

# P3302

## Features

- \* Lead-free (Pb-free)
- \* RoHS compliant
- \* Low Distortion
- \* 12.6mm (0.5") Seated Height
- \* IEC 60950 and UL 60950 Certified
- \* UL Recognized Component
- \* Environmentally tested to IEC 68
- \* CERT reliability tested
- \* Excellent Frequency Response
- \* High Thermal Stability
- \* Electrical substitute for XM-1025, 2802-B, and 671-8079

## Applications

- \* V.90 and V.92 Modems
- \* V.34 Modems

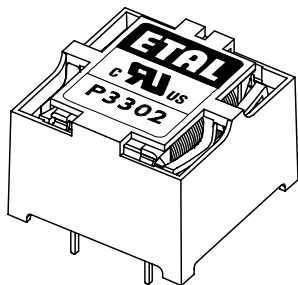
## DESCRIPTION

P3302 is intended for V.90 and V.92 (56kbps) modems and other high-speed applications where ultra-low distortion at moderate power levels and very low voiceband frequencies is required at a most competitive price.

P3302 is offered as a more compact internationally safety approved substitute for XM-1025, 2802-B and 671-8079 in existing circuits without changes to matching components.

P3302 uses patented design and construction methods to achieve excellent signal performance and safety isolation to international standards. P3302 is certified to IEC 60950 and UL 60950. P3355 is a UL Recognized Component and is supported by an IEC CB Test Certificate. The part is completely lead-free, compliant with RoHS Directive 2002/95/EC, and suitable for lead-free and conventional processing.

P3302 has been subjected to relevant environmental testing according to IEC 68 and Combined Environmental Reliability Testing (CERT) beyond normal operational levels and passed all tests, remaining fully functional.



FOR NEW DESIGNS  
P3356 IS RECOMMENDED

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## SPECIFICATIONS

### Electrical

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

| Parameter                                | Conditions                      | Min  | Typ | Max  | Units |
|--|---------------------------------|------|-----|------|-------|
| Insertion Loss                           | f = 2kHz, R <sub>L</sub> = 600Ω | -    | 2.0 | -    | dB    |
| Frequency Response                       | LF -3dB cutoff                  | -    | 10  | -    | Hz    |
|  | HF -3dB cutoff                  | -    | 30  | -    | kHz   |
|  | 100Hz – 4kHz                    | -    | -   | ±0.1 | dB    |
| Return Loss                              | 200Hz – 4kHz                    | 26   | 30  | -    | dB    |
| Third Harmonic Distortion <sup>(1)</sup> | 150Hz -3dBm in line             | -    | -   | -74  | 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

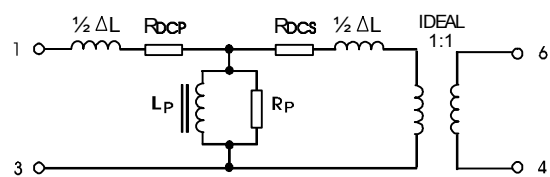
|   |           |     |    |     |    |
|---|-----------|-----|----|-----|----|
| DC resistance <sup>(3)</sup> , R <sub>DCP</sub><br>R <sub>DCS</sub> | Primary   | 126 | -  | 154 | Ω  |
|   | Secondary | 130 | -  | 160 | Ω  |
| Leakage inductance, ΔL  |           | 3.6 | -  | 5.4 | mH |
| Shunt inductance, L <sub>p</sub>                                    | 200Hz 1V  | 8   | 18 | -   | H  |
| Shunt loss, R <sub>p</sub>  | 200Hz 1V  | 16  | 19 | -   | kΩ |

### Notes:

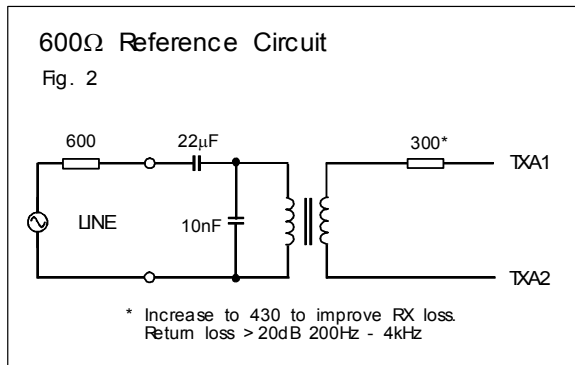
1. Third harmonic typically exceeds other harmonics by 10dB.
2. Components are 100% tested at 3.25kVDC.
3. Caution: do not pass DC through windings. Telephone line current must be diverted using semiconductor line hold circuit or choke.
4. At signal levels greater than 100mV, L<sub>p</sub> will increase and R<sub>p</sub> will decrease slightly but the effect is usually favourable to the return loss characteristic.

### Equivalent Circuit

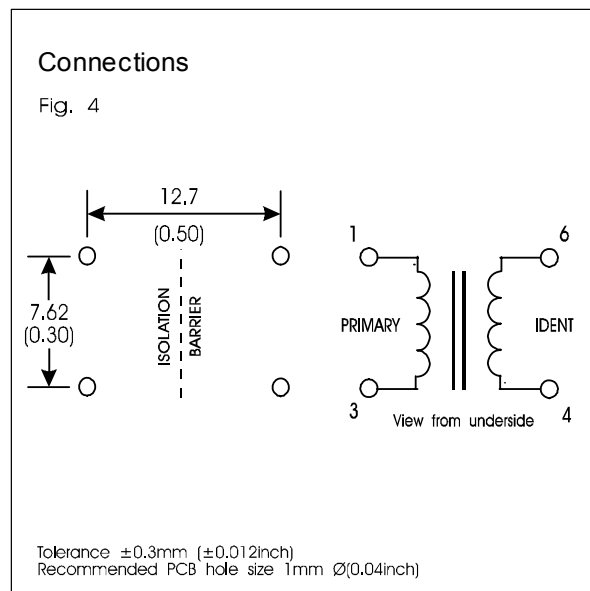
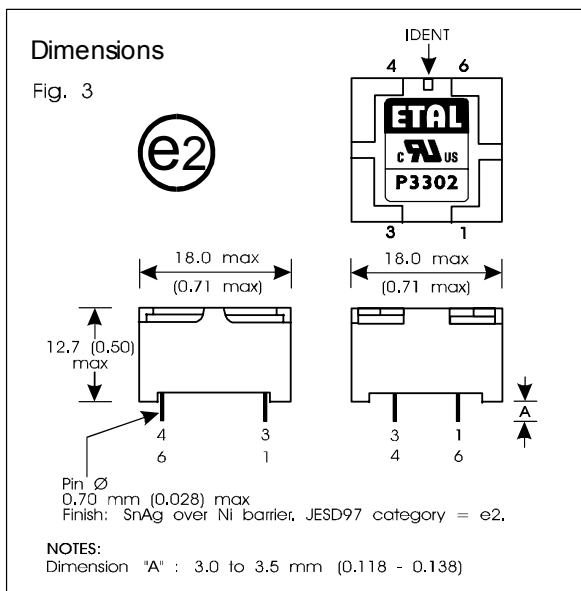
Fig. 1



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**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 6.7g.

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## ENVIRONMENTAL TESTING

### Reliability testing to IEC 68

Tested to clauses of IEC 68 and compliant with all functional and safety requirements following exposure as follows:

| Test description             | IEC 68 reference   | Test details  | Result   |
|------------------------------|--|---|--|
| Robustness of terminations   | 68-2-21 Test Ua <sub>1</sub><br>68-2-21 Test Ua <sub>2</sub> | Tensile 5N pull<br>Thrust 1N push   | No impairment<br>No pin detachment or distortion |
| Solderability                | 68-2-20 Test Ta Method 1                                     | Solder bath 235°C 2s  | No impairment<br>Finish smooth, bright and even  |
| Resistance to soldering heat | 68-2-20 Test Tb Method 1A<br>68-2-20 Test Tb Method 2        | Solder bath 260°C 10s<br>Soldering iron 350°C 5s  |  |
| Vibration                    | 68-2-6 Test Fc   | Sweep 10-55-10Hz in 1 minute<br>Amplitude 1.5mm pk-pk<br>Duration 2h per axis, 3 axes   | No impairment                                    |
| Shock                        | 68-2-27 Test Ea  | Peak acceleration 1000m/s <sup>2</sup><br>Duration of pulse 6ms<br>3 shocks each direction on 3 axes  | No impairment                                    |
| Cold                         | 68-2-1 Test Ab   | -25°C 16h<br>Recovery to ambient 1-2h   | No impairment                                    |
| Dry heat                     | 68-2-2 Test Bb   | 125°C 16h<br>Recovery to ambient 1-2h   | No impairment                                    |
| Damp heat                    | 68-2-3 Test Ca   | 40°C 4 days, RH 93%<br>Recovery to ambient 1-2h   | No impairment                                    |
| Change of temperature        | 68-2-14 Test Na  | T <sub>A</sub> -25°C<br>T <sub>B</sub> +85°C<br>t <sub>1</sub> 30 min<br>2 min ≤ t <sub>2</sub> ≤ 3 min<br>Recovery to ambient 1-2h<br>5 cycles | No impairment                                    |

### Combined Environmental Reliability Testing (CERT)

Components step stressed at increasing levels of severity using combined stresses to detect potential weaknesses.

Results are shown for highest levels of stress tested. Compliant with all functional and safety tests following exposure as follows:

| Test description    | Test details  | Duration          | Result        |
|---------------------|---|-------------------|---------------|
| Storage Test        | Thermal cycling -30°C to +100°C at 11°C/min<br>6mm pk 2-9Hz at 1 octave/min<br>20m/s <sup>2</sup> 9-200Hz | 20 mins per plane | No impairment |
| Transportation Test | Thermal cycling -65°C to +80°C<br>Random vibration 10-200Hz and 200-2000Hz at 57m/s <sup>2</sup> RMS      | 2 hours per plane | No impairment |

## SAFETY

Constructed in accordance with IEC 60950-1, EN 60950-1 and UL 60950-1, 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 DK-8570) to IEC 60950-1-2001, sub-clauses 1.5, 1.5.1, 1.5.2, 1.7.1, 2.9, 2.9.1, 2.9.2, 2.9.3, 2.10, 2.10.1, 2.10.2, 2.10.3, 2.10.3.1, 2.10.3.3, 2.10.4, 2.10.5, 2.10.5.1, 2.10.5.2, 2.10.5.4, 4.7, 4.7.1 (classV-1), 4.7.3, 4.7.3.1, 4.7.3.4, 5.2, 5.2.1, 5.2.2, 6.1.2.1 (Finland, Norway, Sweden national deviations) 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. 60950-1-03/UL60950-1, First Edition, based on IEC 60950-1, First Edition, maximum working voltage 180Vrms (creepage), 420V peak (clearance), Pollution Degree 2, supplementary insulation.

UL File number E203175.

Additionally, Profec Technologies 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,<br>3.0 kVDC |
| DC current                        | 100µA                  |
| Storage temperature               | -40°C to<br>+85°C      |
| Lead temperature, 10s             | 260°C                  |

## INTELLECTUAL PROPERTY RIGHTS

ETAL and P3302 are Trade Marks of Profec Technologies Ltd.

The Trade Mark ETAL is registered at the UK Trade Marks Registry.

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P3302 design and construction are protected by patents and registered design.

British Patent No. 2333646.

USA Patent Nos. 6, 344, 787; 6,690,254

European Patent No. 1082734

China Patent No. ZL 99806739.3

UK Registered Design No. 2077360.

French Registered Design No. 991512.

United States Registered Design 426, 815.

Mexico Registered Design 12143

Other patents and registered designs pending.

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