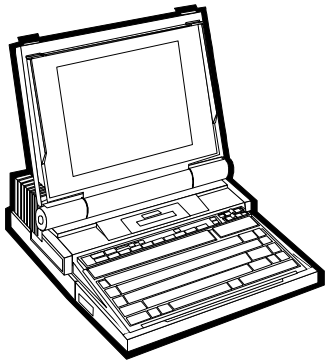
Rhombus Industries Inc.
Transformers & Magnetic Products

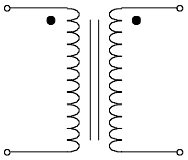
1999

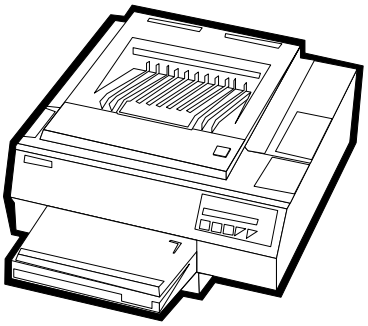
Audio Transformers & Inductors for Telecommunications

Products Include ...

Modem Transformers	**Low Profile**
Voice & Data Coupling	**V.17**
PCMCIA	**V.22**
56kbps	**V.29**
Line Matching	**V.32**
Hybrids	**V.32bis**
TAX Filters	**V.34**
Surface Mount Packages	**Wet / Dry**







www.rhombus-ind.com

15801 Chemical Lane, Huntington Beach, CA 92649-1595 • Phone: (714) 898-0960 • FAX: (714) 896-0971

Rhombus Industries Inc.

Transformers & Magnetic Products

Founded in 1970, Rhombus Industries Incorporated is a privately owned corporation and a leading designer and manufacturer of transformers and magnetic products. Our headquarters is located in Huntington Beach, California and includes engineering, research and development, complete manufacturing capabilities, marketing and extensive in-house environmental testing capabilities. Supporting the Huntington Beach facility is our privately owned and operated sub-assembly operation located in Thailand. Insuring the accuracy, consistency, and overall quality of Rhombus products is of primary concern. All of our products are designed and built to meet the most demanding reliability requirements. We have an extensive quality control program which incorporates statistical process control and is also in strict compliance with MIL-I-45208.

For over 25 years, Rhombus has gained unique experience in providing quality components and innovative designs for users of magnetic products. Rhombus welcomes custom designs tailored to unique customer requirements. Our dedicated employees look forward to proving to you that Rhombus offers the price, delivery and application support advantages that can address your most critical needs.

Transformers and Magnetics for Data Communications Catalog

Table of Contents

For additional product offerings ask for specific Data Sheets or refer to our other Catalogs:

Transformers & Magnetics for Data Communications • *Magnetic Components* •• *Delay Lines*

15801 Chemical Lane, Huntington Beach, CA 92649-1595

Phone: (714) 898-0960 • FAX: (714) 896-0971 • www.rhombus-ind.com

PCMCIA Modem Transformers

T-33003/T-33004 Compatible with 56 kb/s Technologies

Impedance matching transformers for telecommunications.

Ideal for PCMCIA Type II data/fax modem cards

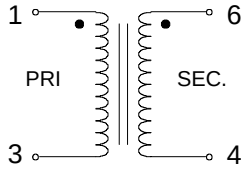
V.32 bis / V.17 14400 bps applications

Longitudinal Balance is 60dB minimum

Designed to meet FCC Part 68

Custom Designs Available

Schematic Style "B"



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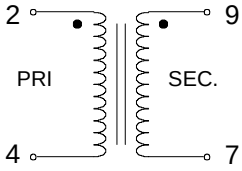
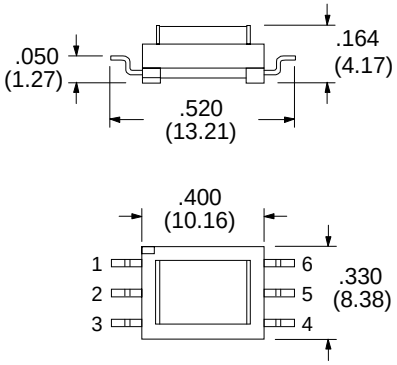


Electrical Specifications at 25°C

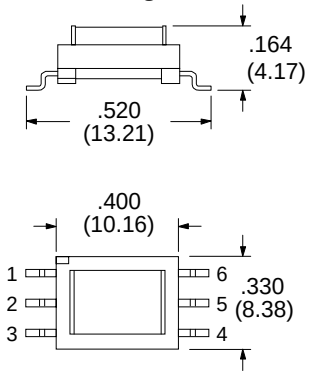
Parameter		T-33001	T-33002	T-33003	T-33004	Units
Impedance R Load	PRI. SEC.	600 346	600 346	600 392	600 294	Ω Ω
Turns Ratio	± 2%	1:1	1:1	1:1	1:1	
Direct Current in Pri. (DCI)	maximum	0	0	0	0	mA
DC Resistance	PRI. ± 10% SEC. ± 10%	127 150	127 150	105 112	180 156	Ω Ω
Insertion Loss	max., ref. 1 kHz	3.3	3.3	2.35	2.7	dB
Return Loss	min., 300 Hz to 3.5 kHz	25	25	20	30	dB
Longitudinal Balance	minimum	60 200Hz - 4kHz	60 200Hz - 4kHz	60 300Hz - 3.5kHz	60 300Hz - 3.5kHz	dB
Frequency Response	300 Hz to 3.5 kHz	± 0.25	±0.25	± 0.25	±0.25	dB
Total Harmonic Distortion	typ. 600 Hz, -10 dBm	-76	-76	-76	-83	dB
Isolation	minimum	1000	1000	1650	1000	V_{RMS}
Schematic Style		B	B	C	C	

Dimensions in Inches (mm)

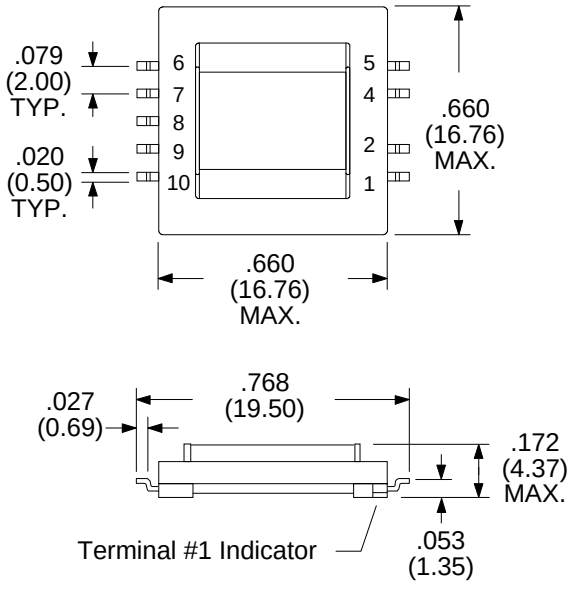
T-33001 Package



T-33002 Package



T-33003 & T-33004 Package



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

PCMCIA2 - 10/98

Rhombus Industries Inc.

15801 Chemical Lane, Huntington Beach, CA 92649-1595

Tel: (714) 898-0960 • Fax: (714) 896-0971

Pocket / Laptop Modem Couplers

Small Size -- High Isolation

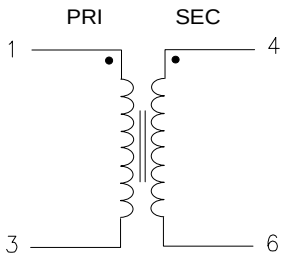
Designed for laptop and pocket modem applications.
Suitable for modem speeds from V.22 to V.34, V.Fast
Ideal for a variety of voice and data interconnect networks
Designed to meet FCC part 68.

Electrical Specifications at 25°C

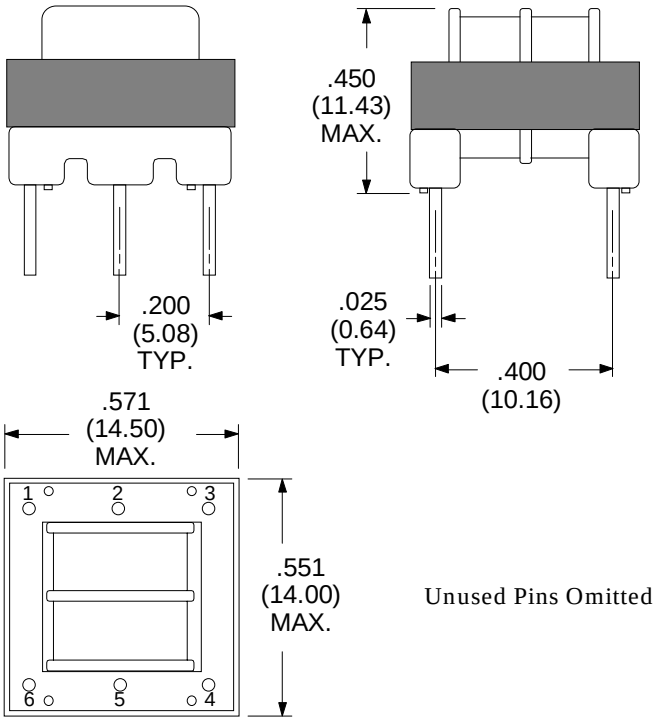
Part Number	Impedance Pri. Ω	Impedance Sec. Ω	Insertion Loss (1) (dB)	DCR Pri. (Ω)	DCR Sec. (Ω)	Frequency Response (2) (± dB)	Hi-Pot (VAC)	Modem Speed
T-35100	600	600	1.25	46.5	67.6	0.25	1250	V.29
T-35101 (4)	600	600	1.50	52.0	59.0	0.50	3750	V.29
T-35102 (4)	600	600	1.25	46.5	67.6	0.25	1250	V.32
T-35103 (4)	600	475	1.50	59.0	80.0	0.50	3750	V.32
T-35104 (4)	600	442	2.00	80.0	87.0	0.25	3750	V.32bis
T-35105 (4)	600	442	2.00	86.0	91.0	0.50	3750	V.32bis
T-35106 (4)	600	348	3.25	152	151	0.50	3750	V.34

1. Typical Insertion Loss (IL) in dB at 0 mADC, 0 dBm & 1kHz.
2. Typical Frequency Response (FR) from 0.3 to 3.5kHz.
3. Suitable for Modem speeds from V.29 to V.fast.
4. Except P / N T-35100, these are built to meet BABT creepage and clearance requirements.

Schematic Diagram



Dimensions in inches (mm)



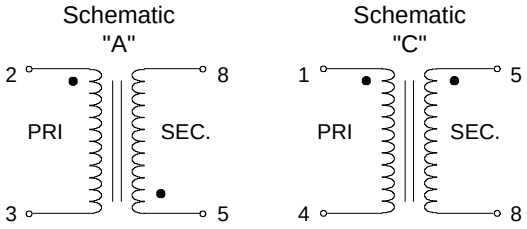
Unused Pins Omitted

Modem Coupling & Voiceband Transformers

Low Distortion

Low Profile / SMD Versions

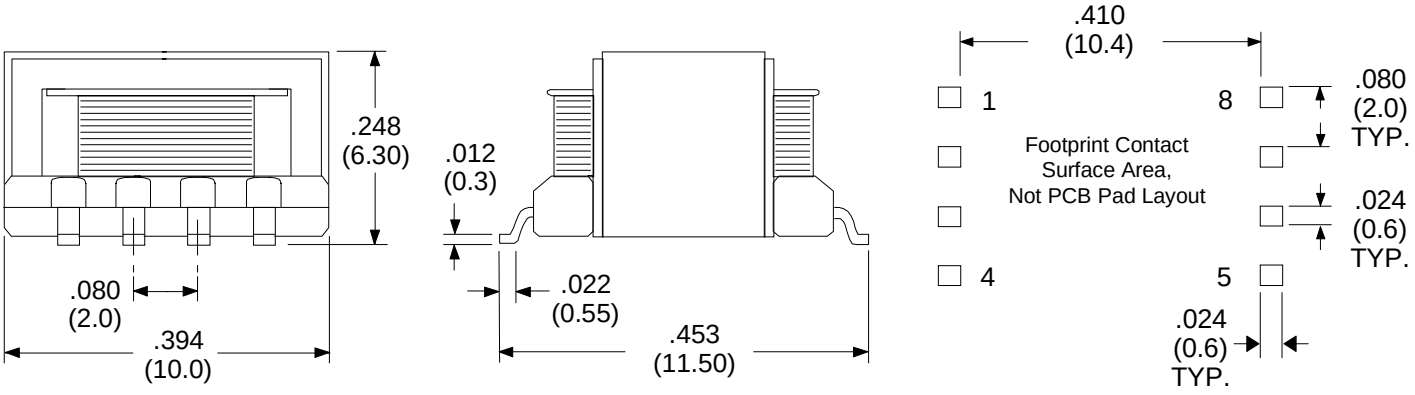
Most Parts Listed are Suitable for V.32 Applications



Electrical Specifications at 25°C

Parameter		T-33000	T-843	Units
Impedance R Load	PRI. SEC.	600 487	600 600	Ω Ω
Turns Ratio	± 2%	1:1	1:1	
Direct Current in Pri. (DCI)	maximum	0	0	mA
DC Resistance	PRI. SEC.	67 ± 10% 85 ± 10%	55 ± 10% 43 ± 10%	Ω Ω
Insertion Loss	max., ref. 1 kHz	1.5	1.0	dB
Return Loss	min., 300 Hz to 3.5 kHz	25	20	dB
Longitudinal Balance	minimum	60 60Hz - 1kHz	--	dB
Frequency Response	300 Hz to 3.5 kHz	± 0.5	± 0.7	dB
Total Harmonic Distortion	typ. 600 Hz, -10 dBm	-60	--	dB
Isolation	minimum	1250	150	V_{RMS}
Schematic Style		A	C	

Package for T-33000 & T-843



Dimensions in Inches (mm)

Modem Coupling & Voiceband Transformers

Low Distortion

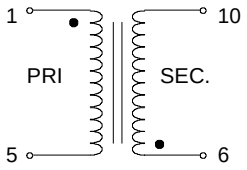
Low Profile / SMD Versions

Most Parts Listed are Suitable for V.32 Applications

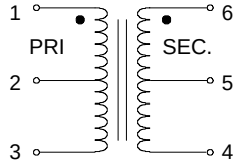
Electrical Specifications at 25°C

Parameter		T-31103	T-531	Units
Impedance R Load	PRI. SEC.	600 365	600 470	Ω Ω
Turns Ratio	± 2%	1:1	1:1	
Direct Current in Pri. (DCI)	maximum	0	0	mA
DC Resistance	PRI. SEC.	118 ± 10% 118 ± 10%	68 max. 102 max.	Ω Ω
Insertion Loss	max., ref. 1 kHz	2.15	1.2	dB
Return Loss	min., 300 Hz to 3.5 kHz	25	30	dB
Longitudinal Balance	minimum	60 200Hz - 1kHz	60 200Hz - 4kHz	dB
Frequency Response	300 Hz to 3.5 kHz	±0.25	±0.25	dB
Isolation	minimum	1100	1100	V_{RMS}
Schematic Style		B	D	

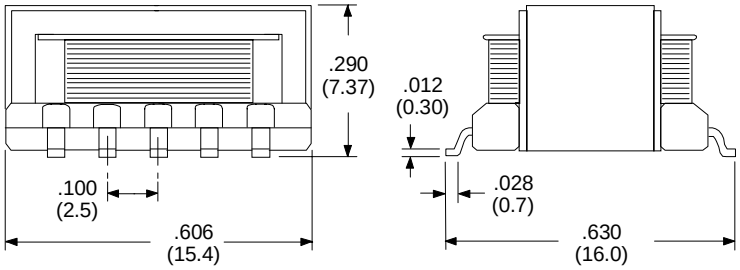
Schematic "B"

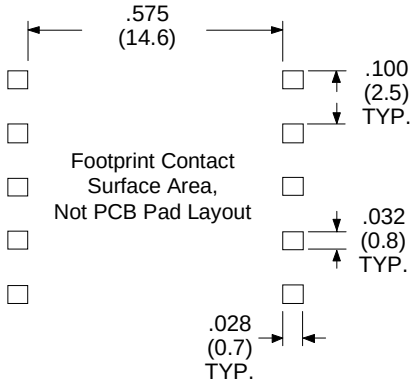


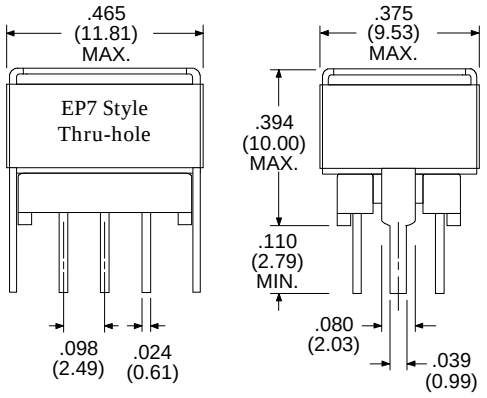
Schematic "D"



Package for T-31103



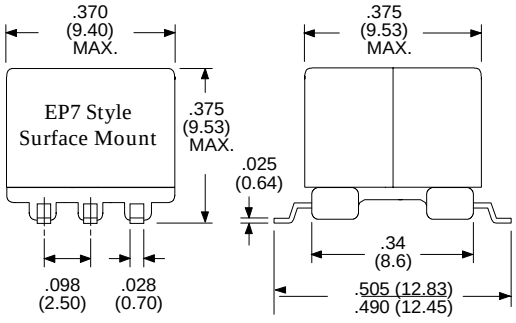




Package for T-531

Dimensions in Inches (mm)

Package for T-531SM



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

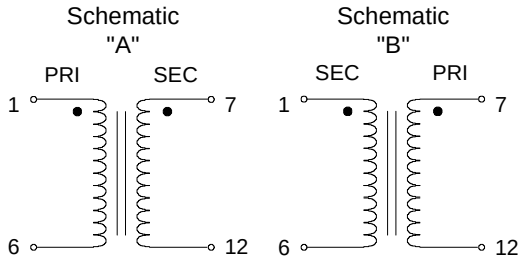
Rhombus Industries Inc.

15801 Chemical Lane, Huntington Beach, CA 92649-1595

Tel: (714) 898-0960 • Fax: (714) 896-0971

Low Profile Modem Coupling and Voiceband Transformers

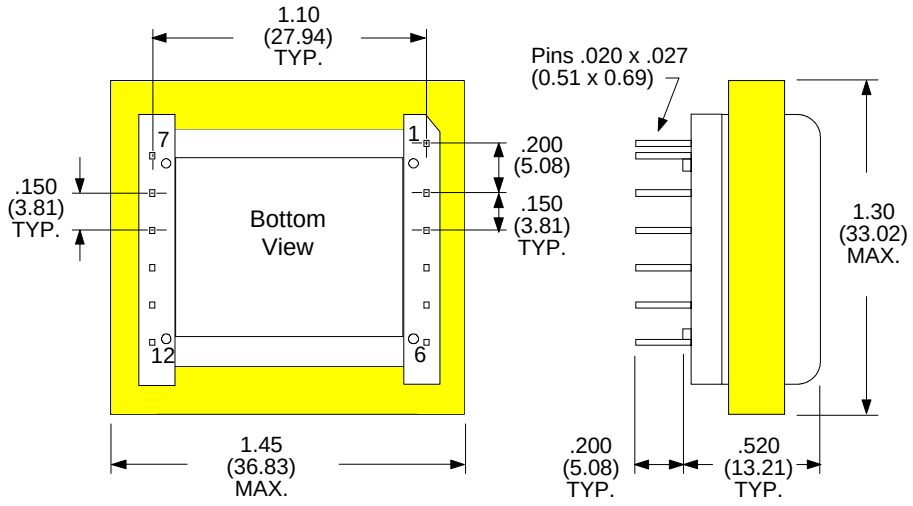
- Low Distortion
- Isolation is 1500V_{RMS} Min.
- Designed to meet FCC part 68
- Frequency Range: 300Hz to 3500Hz
- Low Profile Package
- Custom Designs Available



Electrical Specifications at 25°C

Parameter		T-31104	T-31105	T-31106	Units
Impedance R Load	PRI. SEC.	600 530	600 600	600 470	Ω Ω
Turns Ratio		1:1	1:1	1:1	
Direct Current in Pri. (DCI)	maximum	70	60	80	mA
DC Resistance	PRI. ± 10% SEC. ± 10%	70 81	75 80	62.4 60.1	Ω Ω
Insertion Loss	max., ref. 1 kHz	1.3	2.0	1.3	dB
Return Loss	min., @ 300 Hz	25	20	20	dB
Longitudinal Balance	min., 200Hz to 4kHz	60	60	60	dB
Frequency Response	300 Hz to 3.5 kHz	± 0.2	±0.5	± 1.0	dB
Isolation	minimum	1500	1500	1500	V_{RMS}
Schematic Style		A	B	A	

Dimensions in Inches (mm)



Specifications subject to change without notice.

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COUPLNG2 11/98

Rhombus Industries Inc.

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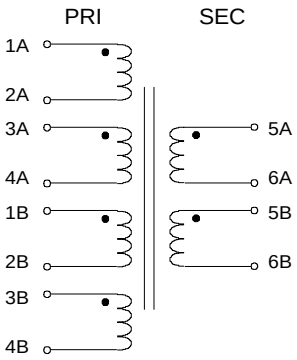
Tel: (714) 898-0960 • Fax: (714) 896-0971

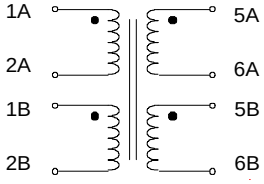
Modem Coupling and Voiceband Transformers

- Low Distortion
- Isolation is 1500V_{RMS} Min.
- Designed to meet FCC part 68
- Frequency Range: 300Hz to 3500Hz
- Low Profile Package
- Custom Designs Available

Schematic "C"

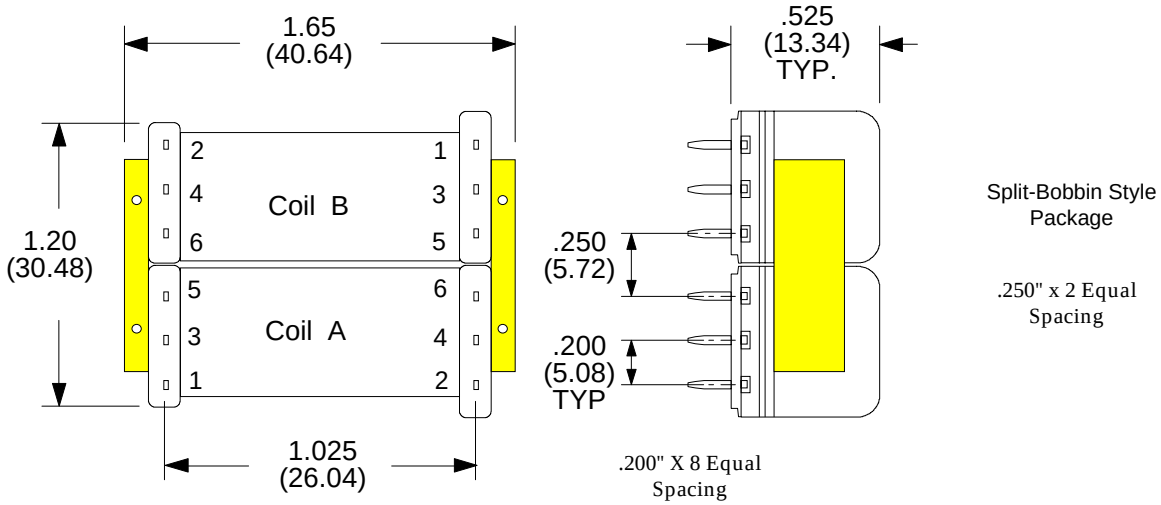


Schematic "D"



Electrical Specifications at 25°C

Parameter		T-31107	T-31108	Units
Impedance R Load	PRI. SEC.	600 365	600 470	Ω Ω
Turns Ratio		1:1	1:1	
Direct Current in Pri. (DCI)	maximum	80	80	mA
DC Resistance	PRI. ± 10% SEC. ± 10%	95 180	95 180	Ω Ω
Insertion Loss	max., ref. 1 kHz	2.0	2.1	dB
Return Loss	min., @ 300 Hz	15	26	dB
Longitudinal Balance	min., 200Hz to 4kHz	60	60	dB
Frequency Response	300 Hz to 3.5 kHz	± 0.25	± 0.25	dB
Isolation	minimum	1500	1500	V_{RMS}
Schematic Style		C	D	



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

COUPLNG3 - 11/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Multi-Purpose Voice & Data Coupling Transformers

Impedance matching transformers for telecommunications.

Ideal for a variety of voice and data inter-connect networks

Isolation is 1500 V_{RMS} minimum
Longitudinal Balance is 60dB minimum
Frequency range: 300Hz to 3400Hz
Designed to meet FCC part 68
Custom Designs Available

Dry / Economy

Electrical Specifications at 25°C

Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (1) (dB)	Frequency Response (dB)	Return Loss (2) (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30600	600 / 600	0.0	2.0	0.5	26	65	85	A
T-30601	600 / 600CT	0.0	2.0	0.5	26	65	85	B
T-30602	600CT / 600CT	0.0	2.0	0.5	26	65	85	C
T-30603	600 / 900	0.0	2.0	0.5	26	65	105	A
T-30604	600 / 900CT	0.0	2.0	0.5	26	65	105	B
T-30605	900 / 900	0.0	2.0	0.5	26	85	105	A
T-30606	900 / 900CT	0.0	2.0	0.5	26	85	105	B
T-31300	600 / 600	0.0	1.0	0.5	20	25	35	A
T-31301	600 / 600CT	0.0	1.0	0.5	20	25	35	B
T-31302	600CT / 600CT	0.0	1.0	0.5	20	25	35	C
T-31303	600 / 900	0.0	1.0	1.0	20	25	40	A
T-31304	900 / 900	0.0	1.0	1.0	20	35	40	A

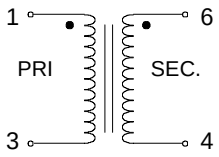
Dry / High Performance

Electrical Specifications at 25°C

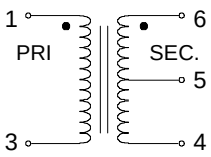
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (1) (dB)	Frequency Response (dB)	Return Loss (2) (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-31350	600 / 600	0.0	0.85	0.25	20	25	35	A
T-31351	600 / 600CT	0.0	0.85	0.25	20	25	35	B
T-31352	600CT / 600CT	0.0	0.85	0.25	20	25	35	C
T-31353	600 / 900	0.0	0.85	0.25	20	25	40	A
T-31354	900 / 900	0.0	0.85	0.25	20	30	40	A

1. Insertion Loss measured at 1 KHz
2. Return Loss measured at 300 Hz

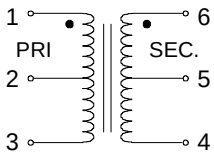
Schematic "A"



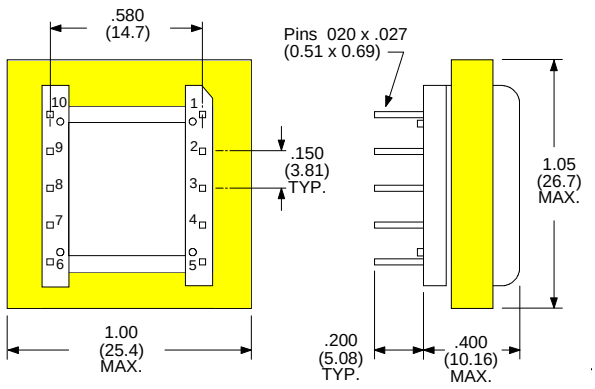
Schematic "B"



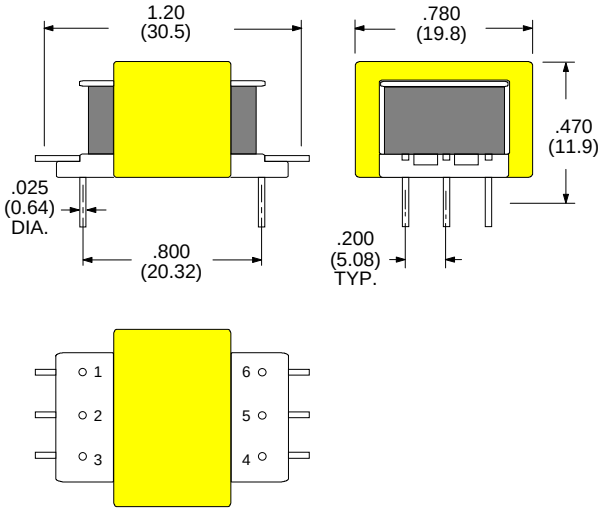
Schematic "C"



T-3060X Package per Table Above



T-313XX Package per Table Above



Dimensions in Inches (mm)
Unused Pins Omitted as Per Schematic

Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

COUPLN56 - 11/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Voice & Data Coupling Transformers

Impedance Matching Transformers for Telecommunications

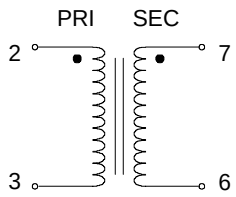
- Low Distortion
- May be used in V.32 applications
- Isolation is 1500 V_{RMS} min.
- Frequency 300Hz to 3500Hz
- Designed to meet FCC part 68
- Custom Designs Available

Secondary load 600 Ω with DC in Pri.

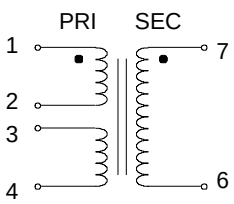
Part Number	Impedance PRI. (Ω)	Impedance SEC. (Ω)	Turns Ratio ± 2%	DCI max. (mA)	Insertion Loss (1) (dB)	Return (2) Loss (dB)	THD (3) (dB)	DCR PRI. (Ω)	DCR SEC. (Ω)	Frequency (4) Response (± dB)	Schematic Style / Pkg
T-31000	600	600	1:1	80	1.50	11.5	-65	55.0	65.0	0.5	A / 8-pin
T-31001	600	600	1:1.127	80	1.00	14.5	-65	55.0	70.0	0.3	B / 8-pin
T-31002	600	600	1:1.127	80	1.30	12.5	-53	67.0	76.0	0.5	B / 8-pin
T-31003	900	600	1:0.817	80	1.55	11.0	-65	76.0	92.0	0.5	A / 8-pin
T-31004	900	600	1:0.817	80	1.60	10.5	-53	76.0	92.0	0.5	A / 8-pin
T-31005	900	600	1:0.942	80	1.20	12.5	-65	83.0	126	0.5	B / 8-pin
T-31006	900	600	1:0.942	80	1.30	11.0	-53	83.0	126	0.5	B / 8-pin
T-31010	600	600	1:1	80	1.20	13.0	-53	66.2	82.2	0.5	C / 12-pin
T-31011	600	600	1:1.125	80	1.25	16.0	-59	76.0	86.0	0.5	D / 12-pin
T-31012	900	600	1:.0816	80	1.50	9.5	-53	82.8	85.4	0.5	C / 12-pin
T-31013	900	600	1:0.946	80	1.55	12.0	-53	90.0	110	0.5	D / 12-pin
T-31014	600	600	1:1	80	1.20	13.0	-53	66.0	82.0	0.5	D / 12-pin

1. Insertion Loss measured at 1 KHz
2. Return Loss measured at 300 Hz
3. Total Harmonic Distortion measured at 0 dBm & 300 Hz
4. Frequency Response measured from 300 Hz to 3500 Hz

Schematic "A"



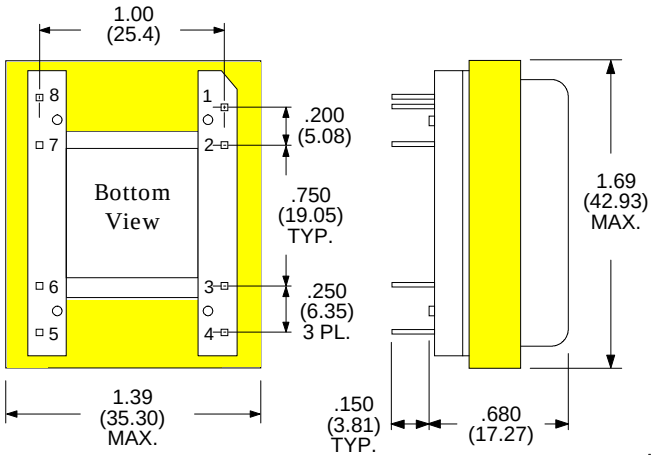
Schematic "B"



Dimensions in Inches (mm)

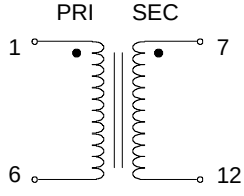
Unused Pins Omitted as per Schematic

8-Pin Package (T-31000 to T-31006)

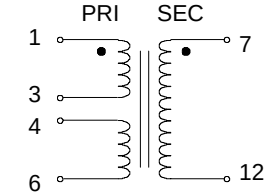


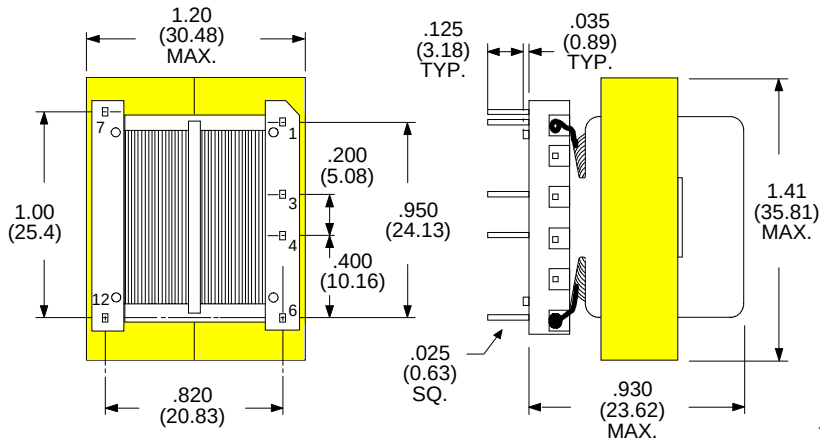
12-Pin Package (T-31010 to T-31014)

Schematic "C"



Schematic "D"





For other values & Custom Designs, contact factory.

15801 Chemical Lane, Huntington Beach, CA 92649-1595

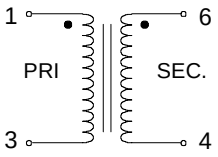
Tel: (714) 898-0960 • Fax: (714) 896-0971

High Isolation Multi-Purpose Audio Transformers

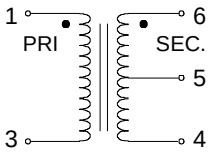
Ideal for a variety of Voice and Data interconnect network applications

- 3000 V_{RMS} minimum Isolation
- Longitudinal Balance is 60dB minimum
- Frequency range: 300Hz to 3400Hz
- Designed to meet FCC part 68
- Materials used in construction of this component meet or exceed UL Class B and can operate up to 130°C

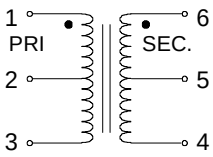
Schematic "A"



Schematic "B"



Schematic "C"



Dry / High Performance

Electrical Specifications at 25°C

Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (1) (dB)	Frequency Response (dB)	Return Loss (2) (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30700	600 / 600	0.0	1.5	0.3	20	45	45	A
T-30701	600 / 600CT	0.0	1.5	0.3	20	45	45	B
T-30702	600CT / 600CT	0.0	1.5	0.3	20	45	45	C
T-30703	600 / 900	0.0	1.5	0.5	20	45	55	A
T-30704	900 / 900	0.0	1.5	0.5	20	55	55	A

Dry / Economy

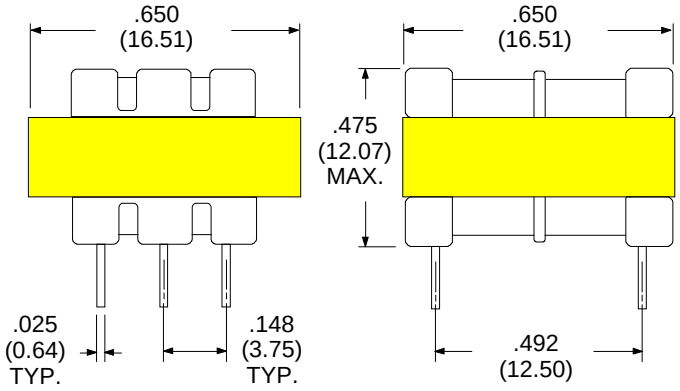
Electrical Specifications at 25°C

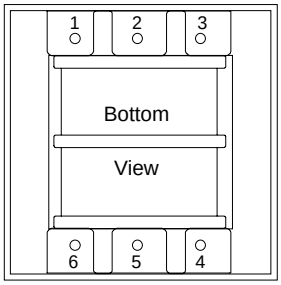
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (1) (dB)	Frequency Response (dB)	Return Loss (2) (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30750	600 / 600	0.0	1.7	0.5	20	45	45	A
T-30751	600 / 600CT	0.0	1.7	0.5	20	45	45	B
T-30752	600CT / 600CT	0.0	1.7	0.5	20	45	45	C
T-30753	600 / 900	0.0	1.7	0.7	20	45	55	A
T-30754	900 / 900	0.0	1.7	0.7	20	55	55	A

1. Insertion Loss measured at 1 KHz
2. Return Loss measured at 300 Hz

Dimensions in Inches (mm)

Unused Pins Omitted as Per Schematic





Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

EE16 - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Low Cost Multi-Purpose Audio Transformers

Impedance matching transformers for telecommunications.

Ideal for a variety of voice and data interconnect networks

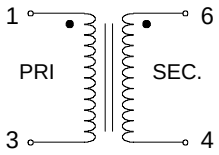
Isolation is 1500 V_{RMS} minimum
Longitudinal Balance is 60dB minimum
Frequency range: 300Hz to 3400Hz
Designed to meet FCC part 68
Custom Designs Available

Electrical Specifications at 25°C

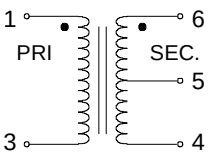
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion [1] Loss (dB)	Frequency Response (dB)	Return [2] Loss (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30000	600 / 600	0.0	1.25	0.5	26	30	40	A
T-30001	600 / 600CT	0.0	1.25	0.5	26	30	40	B
T-30007	600CT / 600CT	0.0	1.25	0.5	26	30	40	C
T-30002	600 / 900	0.0	1.25	0.5	26	30	73	A
T-30003	900 / 900	0.0	1.25	0.5	26	40	53	A
T-30004	600 / 600	80	2.0	3.0	9.0	65	85	A
T-30005	600 / 600CT	80	2.0	3.0	9.0	65	85	B
T-30050	600 / 600	0.0	0.4	0.25	26	13	16	A
T-30051	600 / 600CT	0.0	0.4	0.25	26	13	16	B
T-30057	600CT / 600CT	0.0	0.4	0.25	26	13	16	C
T-30052	600 / 900	0.0	0.5	0.25	26	13	23	A
T-30053	900 / 900	0.0	0.5	0.25	26	19	23	A
T-30054	600 / 600	80	2.0	3.0	9.0	57	75	A
T-30055	600 / 600CT	80	2.0	3.0	9.0	57	75	B

1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.

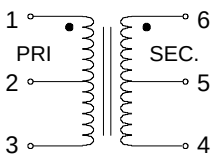
Schematic "A"

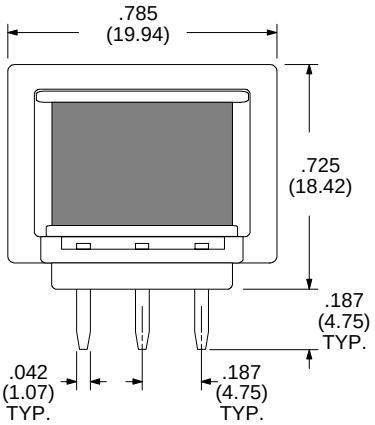


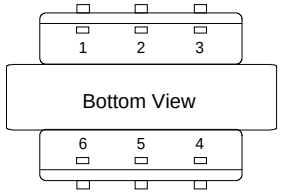
Schematic "B"

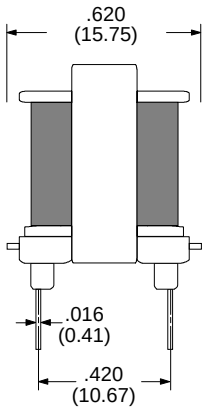


Schematic "C"









Dimensions in Inches (mm)

Unused Pins Omitted as Per Schematic

Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

LC-AUDIO - 11/98

Rhombus Industries Inc.

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Miniature Multi-Purpose Audio Transformers

Impedance matching transformers for telecommunications.

Ideal for a variety of voice and data inter-connect networks

Isolation is 1500 V_{RMS} minimum
Longitudinal Balance is 60dB minimum
Frequency range: 300Hz to 3400Hz
Designed to meet FCC part 68
Custom Designs Available

Dry / High Performance

Electrical Specifications at 25°C

Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB)	Frequency Response (dB)	Return Loss (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-35200	600 / 600	0.0	1.5	0.7	26	48	65	A
T-35201	600 / 600CT	0.0	1.5	0.7	26	48	65	B
T-35202	600CT / 600CT	0.0	1.5	0.7	26	48	65	C
T-35203	600 / 900	0.0	1.7	0.3	20	48	94	A
T-35204	900 / 900	0.0	1.9	0.4	20	114	146	A

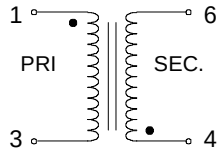
Dry / Economy

Electrical Specifications at 25°C

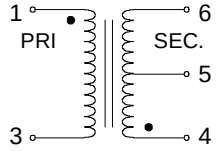
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB)	Frequency Response (dB)	Return Loss (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-35250	600 / 600	0.0	1.5	1.2	26	50	55	A
T-35251	600 / 600CT	0.0	1.5	1.2	26	50	55	B
T-35252	600 / 900	0.0	1.6	1.2	20	50	95	A
T-35253	900 / 900	0.0	1.6	1.2	20	75	95	A
T-35254	600 / 600	80	2.5	1.25	9.0	68	85	A
T-35255	600 / 600CT	80	2.5	1.25	9.0	68	85	B

1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.

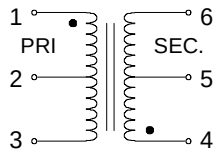
Schematic "A"



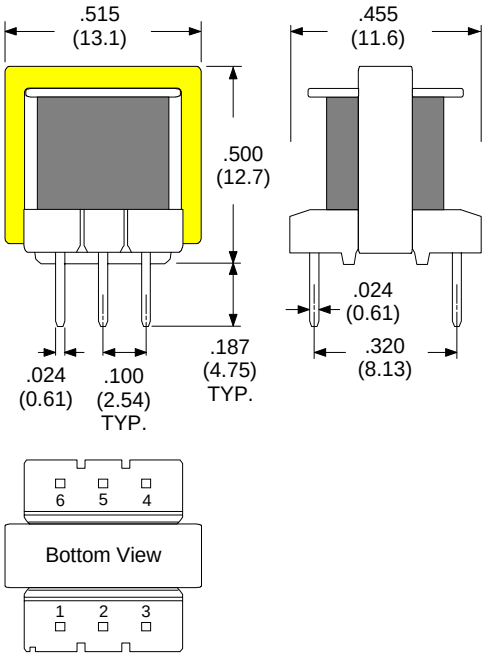
Schematic "B"



Schematic "C"



Dimensions in Inches (mm)
Unused Pins Omitted as Per Schematic



Specifications subject to change without notice.

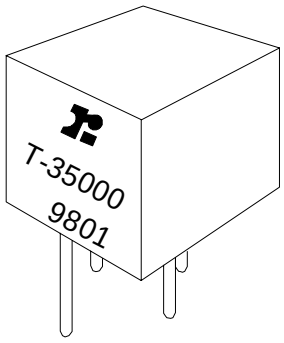
For other values & Custom Designs, contact factory.

MINIAUD2 - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Mini Audio Transformers

Ideal for use in Input, Interface, Isolation & Output Impedance Matching Applications



Electrical Specifications at 25°C

Part Number	Pri. Impedance (Ω)	Sec. Impedance (Ω)	Pri. DCR (Ω)	Sec. DCR (Ω)	L (1) (H)
T-35000	1600	3.2	186	0.8	1.27
T-35001	1500	600	160	95	1.19
T-35002	1200	3.2	125	0.7	0.95
T-35003	1000	1000	80	100	0.80
T-35004	1000	600	85	95	0.80
T-35005	1000	50	87	8	0.80
T-35006	900	600	75	95	0.72
T-35007	600	600	70	95	0.48
T-35008	600	250	54	26	0.48
T-35009	600	8	60	1.5	0.48
T-35010	600	3.2	60	0.7	0.48
T-35011	500	600	65	95	0.40
T-35012	500	50	55	8	0.40
T-35013	320	3.2	35	0.7	0.25
T-35014	300	600	38	98	0.24
T-35015	150	12	16	2.1	0.12
T-35016	120	3.2	12	0.4	0.10
T-35017	300	12	38	2.5	0.24
T-35018	600	600	32	87	0.48
T-35019	10000	125	453	26	7.96
T-35020	600	600	35	58	0.48

1. Inductance measured at 10 kHz and 100 mV.

Impedance matching transformers for telecommunications.

Ideal for a variety of voice and data interconnect networks.

Operating temperature range: 0°C to 105°C.

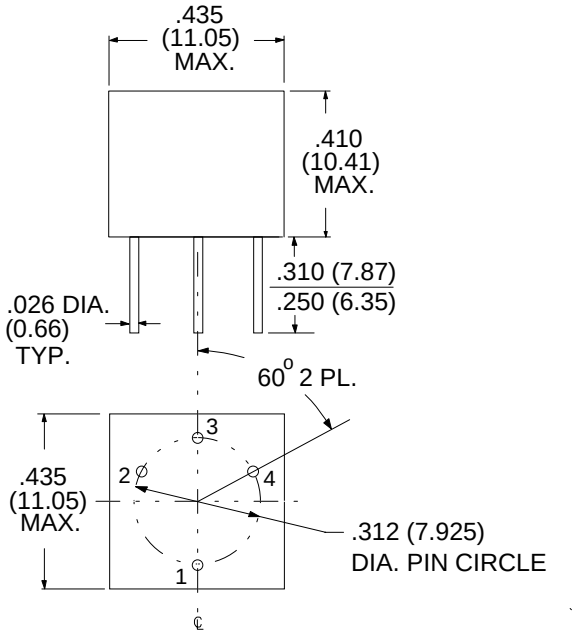
Encapsulated Package

Isolation is 500 V_{RMS} minimum.

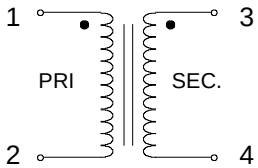
Frequency Response: 300 to 3500Hz ±3dB.

Insulation Resistance is 100 $V_{DC.}$

Dimensions in inches (mm)



Schematic



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

MINI-AUD - 9/98

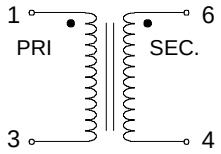
15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Encapsulated Multi-Purpose Audio Transformers

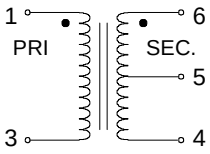
Ideal for a variety of Voice and Data interconnect network applications

- 3000 V_{RMS} minimum Isolation
- Longitudinal Balance is 60dB minimum
- Frequency range: 300Hz to 3400Hz
- Designed to meet FCC part 68
- Materials used in construction of this component meet or exceed UL Class B and can operate up to 130°C

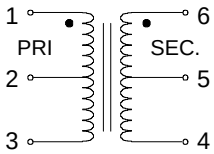
Schematic "A"



Schematic "B"



Schematic "C"



Dry / High Performance

Electrical Specifications at 25°C

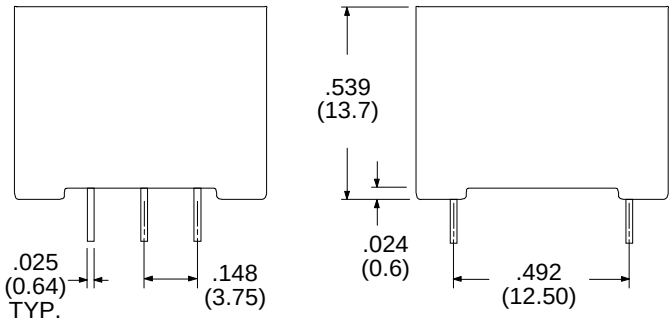
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB)	Frequency Response (dB)	Return Loss (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30800	600 / 600	0.0	1.5	0.3	20	45	45	A
T-30801	600 / 600CT	0.0	1.5	0.3	20	45	45	B
T-30802	600CT / 600CT	0.0	1.5	0.3	20	45	45	C
T-30803	600 / 900	0.0	1.5	0.5	20	45	55	A
T-30804	900 / 900	0.0	1.5	0.5	20	55	55	A

Dry / Economy

Electrical Specifications at 25°C

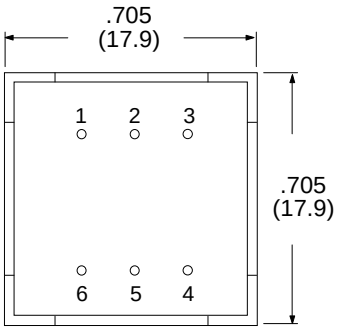
Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB)	Frequency Response (dB)	Return Loss (dB)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)	Schem. Style
T-30850	600 / 600	0.0	1.7	0.5	20	45	45	A
T-30851	600 / 600CT	0.0	1.7	0.5	20	45	45	B
T-30852	600CT / 600CT	0.0	1.7	0.5	20	45	45	C
T-30853	600 / 900	0.0	1.7	0.7	20	45	55	A
T-30854	900 / 900	0.0	1.7	0.7	20	55	55	A

1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.



Dimensions in Inches (mm)

Unused Pins Omitted as Per Schematic



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

EE16POTT - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595

Tel: (714) 898-0960 • Fax: (714) 896-0971

Self-Shielded Audio Transformers

Using EP Geometry cores, these transformers provide excellent shielding.

Isolation is 1500 Vrms minimum

Longitudinal Balance is 60dB min.

Frequency range: 300Hz to 3400Hz

Electrical Specifications at 25°C

Thru-hole EP7 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30400	600 / 600	0.0	0.7	0.50	18	31	39

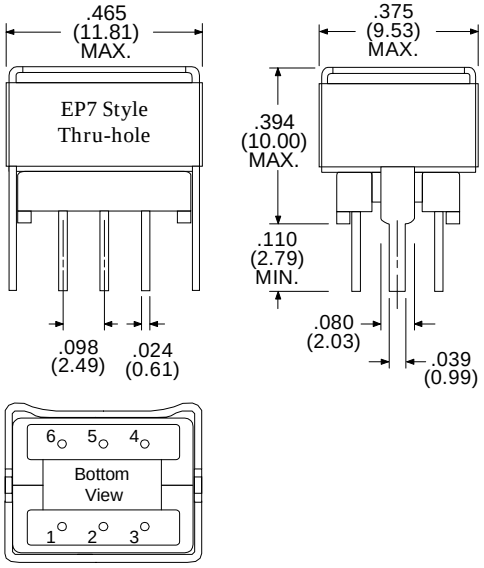
Electrical Specifications at 25°C

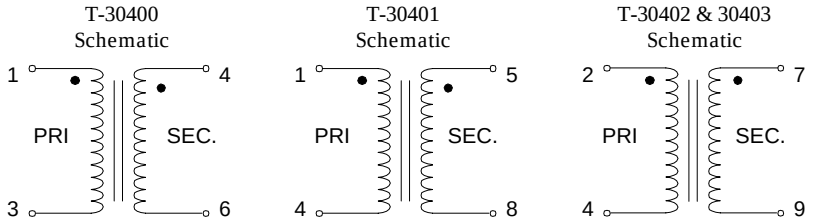
Thru-hole EP10 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30401	600 / 600	0.0	0.9	0.50	21	34	43

Electrical Specifications at 25°C

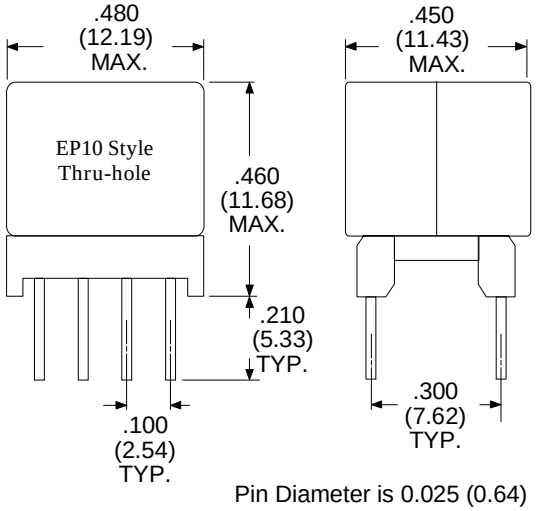
Thru-hole EP13 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30402	600 / 600	0.0	1.0	0.25	26	36	47
T-30403	900 / 900	0.0	1.0	0.25	26	44	58

1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.

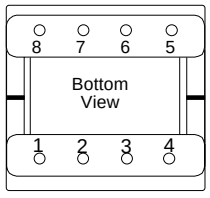


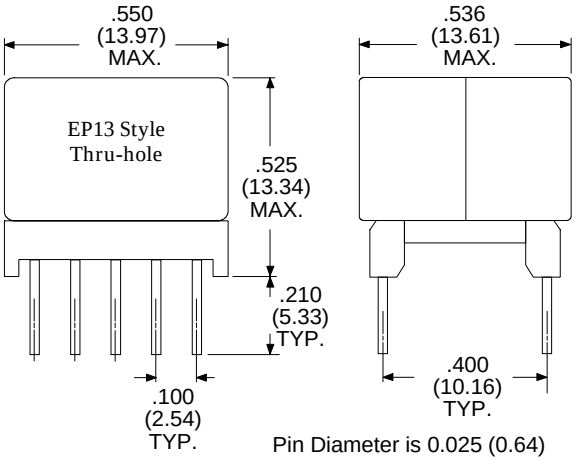


Dimensions in Inches (mm)

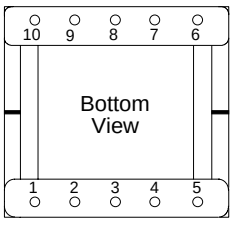


Pin Diameter is 0.025 (0.64)





Pin Diameter is 0.025 (0.64)



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

EP - 10/98

Self-Shielded Audio Transformers

Using EP Geometry cores, these transformers provide excellent shielding.

Isolation is 1500 Vrms minimum

Longitudinal Balance is 60dB min.

Frequency range: 300Hz to 3400Hz

Electrical Specifications at 25°C

Surface Mount EP7 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30400G	600 / 600	0.0	0.7	0.50	18	31	39

Electrical Specifications at 25°C

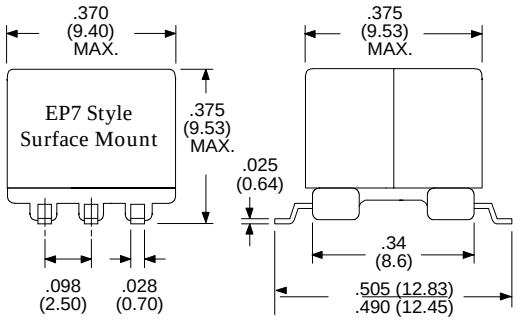
Surface Mount EP10 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30401G	600 / 600	0.0	0.9	0.50	21	34	43

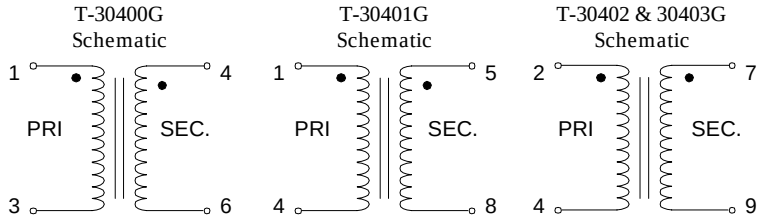
Electrical Specifications at 25°C

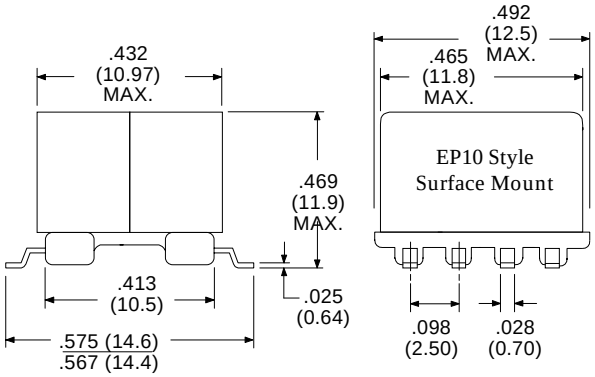
Surface Mount EP13 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30402G	600 / 600	0.0	1.0	0.25	26	36	47
T-30403G	900 / 900	0.0	1.0	0.25	26	44	58

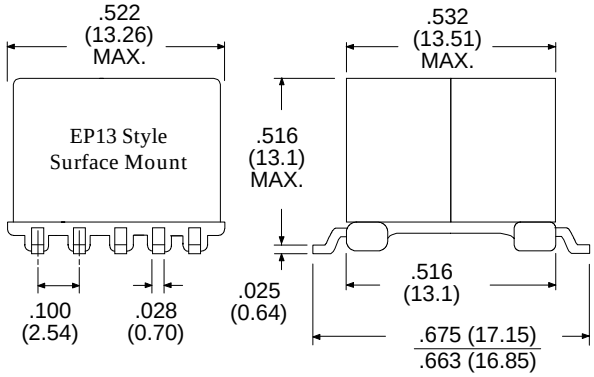
1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.

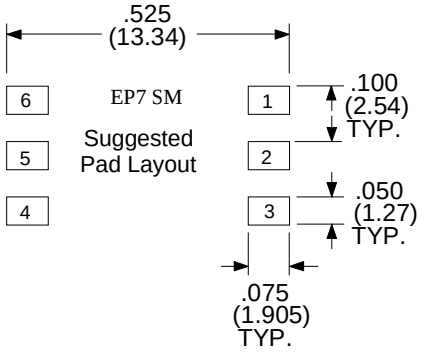
Dimensions in Inches (mm)

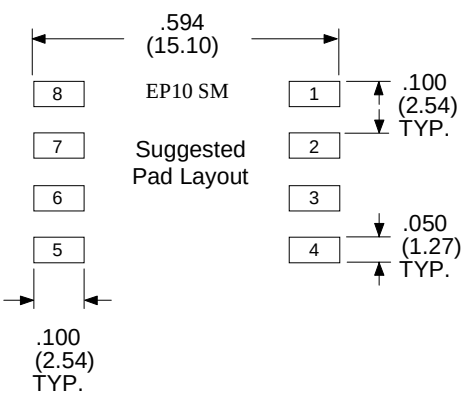


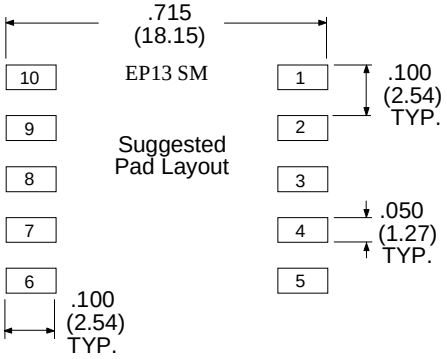












Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

EP - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Self-Shielded Audio Transformers

Built with Ferrite EP Geometry cores, these transformers provide excellent shielding.

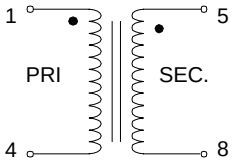
Isolation is 1500 Vrms minimum

Longitudinal Balance is 60dB minimum

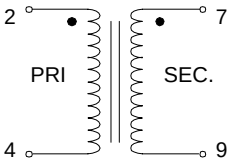
Frequency range: 300Hz to 3400Hz

Custom Designs Available

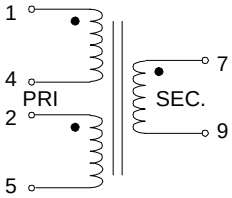
T-30404 & 30405
Schematic



T-30406 & 30408
Schematic



T-30407 & 30409
Schematic



Electrical Specifications at 25°C

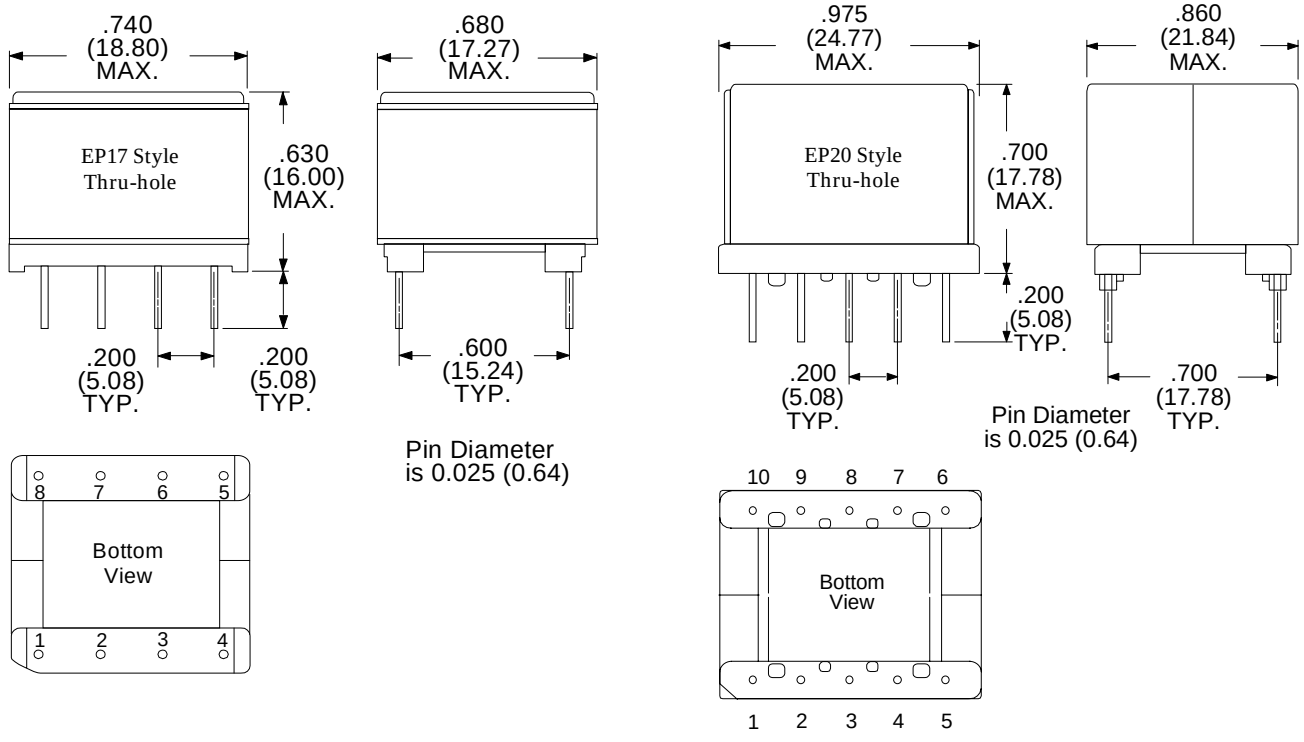
Thru-hole EP17 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30404	600 / 600	2.5	1.0	0.25	26	45	58
T-30405	900 / 900	2.5	1.0	0.25	26	55	71

Electrical Specifications at 25°C

Thru-hole EP20 Style Part Number	Impedance (Ohms)	UNBAL. DC (mA)	Insertion Loss (dB) (1)	Frequency Response (dB)	Return Loss (dB) (2)	Pri. DCR max. (Ω)	Sec. DCR max. (Ω)
T-30406	600 / 600	5.0	0.8	0.25	26	27	36
T-30407	600CT / 600	5.0	0.8	0.25	26	27	36
T-30408	600 / 900	5.0	0.8	0.25	26	27	44
T-30409	900CT / 600	5.0	0.8	0.25	26	33	36

1. Insertion Loss measured at 1 kHz.
2. Return Loss measured at 300 Hz.

Dimensions in Inches (mm)



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

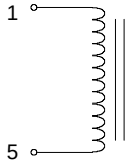
EP - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Very Low Profile Tax Filters

- Attenuates 12 or 16 kHz signals to telco equipment by more than 25 dB.
- Uses standard-value capacitor for either 12 or 16 kHz resonance
- Designed to provide 25 dB minimum attenuation at 12 or 16 kHz.

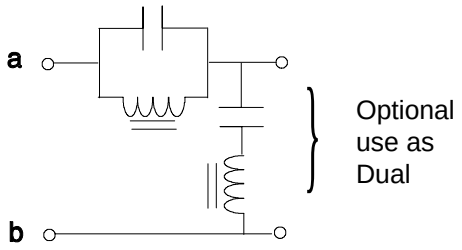
Schematic Diagram



Electrical Specifications at 25° C

Part Number	Inductance (1) ±5% (mH)	D.C. Resistance Max. (Ω)	D.C. Current Max. (mA)	Hi-Pot Min. (VAC)	Attenuates 12 or 16 kHz
F-3551	2.58	14.0	70	1250	12 kHz, *Parallel* L with C=68 nF
F-3552	1.44	10.0	90	1250	16 kHz, *Parallel* L with C=68 nF
F-3553	7.96	28.0	70	1250	12 kHz, *Series* L with C=22 nF
F-3554	4.52	20.0	90	1250	16 kHz, *Series* L with C=22 nF

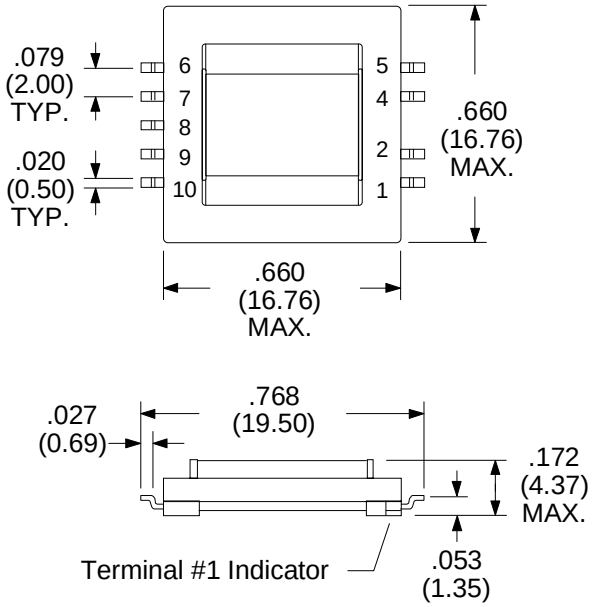
1. Tested at 10KHz and 100 mV_{RMS}



Use of F-3551 inductor in a parallel LC configuration followed by a F-3553 in a series configuration to provide more than 40 dB attenuation of tax pulse signals

Use of F-3552 inductor in a parallel LC configuration followed by a F-3554 in a series configuration to provide more than 40 dB attenuation of tax pulse signals

Physical Dimensions inches (mm)



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

TAXFILTR - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Tax Pulse Filter Inductor

Single Inductance

Vary capacitor value for 12 KHz or 16 KHz

Rhombus Part Number: **F-3503**

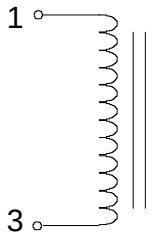
Materials used in the construction of this component meet or exceed UL Class B and can be operated up to 130°C

Electrical Specifications at 25° C

Parameter	Min.	Typ.	Max.	Units
Inductance (Pins 1-3)	6.19	6.52	6.84	mH
D.C. Resistance	10.5	12.05	13.6	Ω
Current			70	mADC
"12 KHz" Capacitor	25.0	27.0	28.0	nF
"16 KHz" Capacitor	14.0	15.0	15.7	nF
Single LC attenuation		25		dB
Dual LC attenuation		40		dB

1. Tested at 10KHz and 100 mV_{RMS}

Schematic



Physical Dimensions in inches (mm)

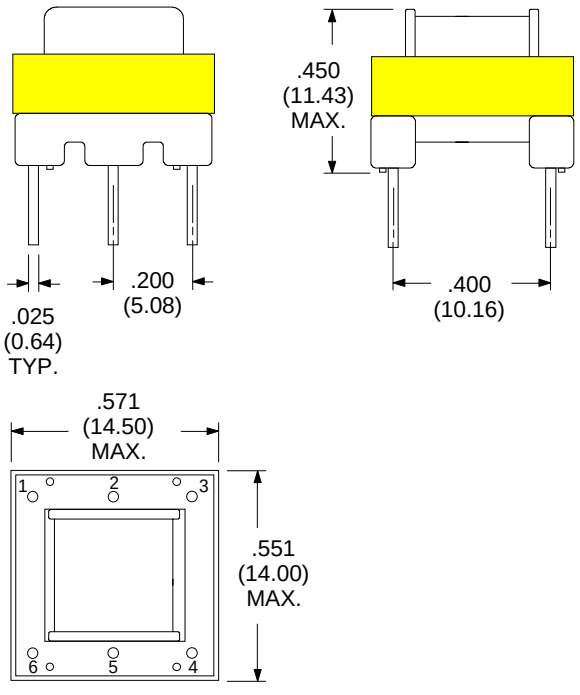


Table #1

"Tax Pulse" Frequencies for various countries:

Country	Frequency
Austria	12 kHz
Belgium	16 kHz
Switzerland	12 kHz
Germany	16 kHz
Denmark	12 kHz
Spain	12 kHz
France	12 kHz
Great Britain	50 Hz*
Greece	16 kHz
Italy	12 kHz
Ireland	12 kHz
Israel	16 kHz
Norway	16 kHz
Netherlands	50 Hz*
Portugal	12 kHz
Sweden	12 kHz
Finland	16 kHz
Turkey	12 kHz
Yugoslavia	16 kHz
Australia	12 kHz
Czechoslovakia	16 kHz

*Common-mode (longitudinal) signal

Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

TAXFILTR - 10/98

Rhombus Industries Inc.

15801 Chemical Lane, Huntington Beach, CA 92649-1595

Tel: (714) 898-0960 • Fax: (714) 896-0971

12 or 16 kHz Tax Pulse Filter

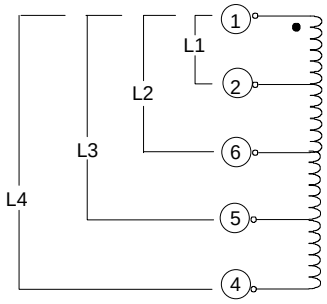
- Attenuates 12 or 16 kHz signals to telco equipment by more than 25 dB.
- Use two F-3501 inductors, one in a parallel LC configuration followed by one in a series configuration, to provide more than 40 dB attenuation of tax pulse signals.

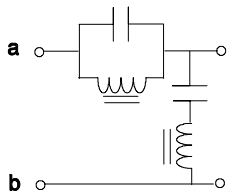
Electrical Specifications at 25° C

P / N F-3501 Section (Pins)	Inductance ±5% (mH)	D.C. Resistance Max. (Ω)	D.C. Current Max. (mA)	Dielectric Min. (VAC)	Attenuates 12kHz or 16 kHz
L1 (1-2)	1.44	2.30	90	1250	16 kHz, *Parallel* L1 with C=68 nF
L2 (1-6)	2.58	3.25	70	1250	12 kHz, *Parallel* L2 with C=68 nF
L3 (1-5)	4.52	6.35	90	1250	16 kHz, *Series* L3 with C=22 nF
L4 (1-4)	7.96	10.7	70	1250	12 kHz, *Series* L4 with C=22 nF

1. Tested at 10KHz and 100 mV_{RMS}

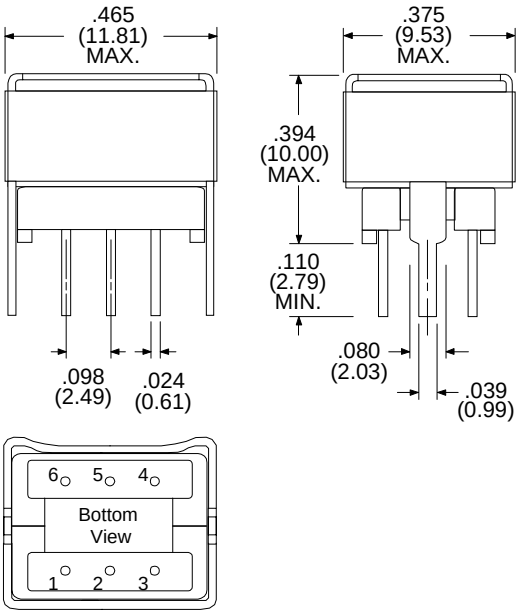
Schematic Diagram for P/N F-3501



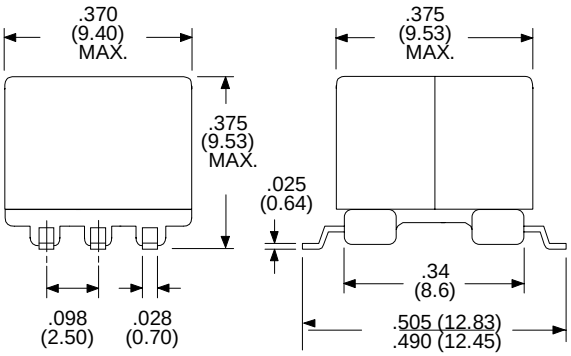


Optional use as Dual

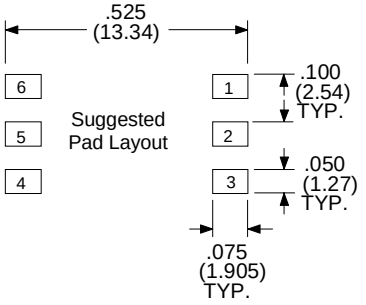
P / N F-3501
Thru-hole Package



P / N F-3501G
Surface Mount Package



Surface Mount version Available on Tape & Reel



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

TAXFILT2 - 10/98

15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

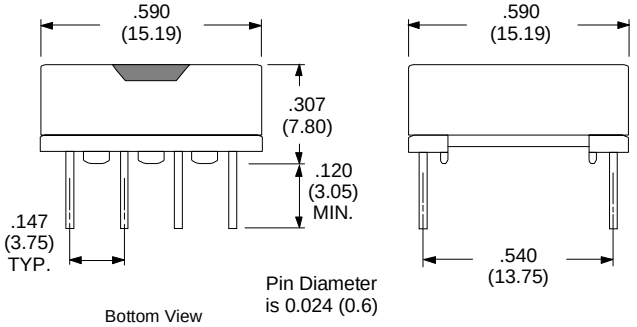
12 or 16 kHz Tax Pulse Filter

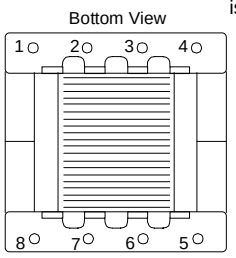
- Attenuates 12 or 16 kHz signals to telco equipment by more than 25 dB.
- Use two F-3504 inductors, one in a parallel LC configuration followed by one in a series configuration, to provide more than 40 dB attenuation of tax pulse signals.

Electrical Specifications at 25° C

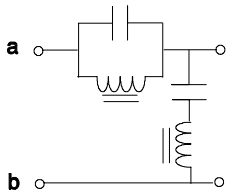
P / N F-3504 Section (Pins)	Inductance ±5% (mH)	D.C. Resistance Max. (Ω)	D.C. Current Max. (mA)	Dielectric Min. (VAC)	Attenuates 12kHz or 16 kHz
L1 (1-3)	1.44	2.30	90	1250	16 kHz, *Parallel* L1 with C=68 nF
L2 (1-10)	2.58	3.25	70	1250	12 kHz, *Parallel* L2 with C=68 nF
L3 (1-8)	4.52	6.35	90	1250	16 kHz, *Series* L3 with C=22 nF
L4 (1-6)	7.96	10.7	70	1250	12 kHz, *Series* L4 with C=22 nF

1. Tested at 10KHz and 100 mV_{RMS}

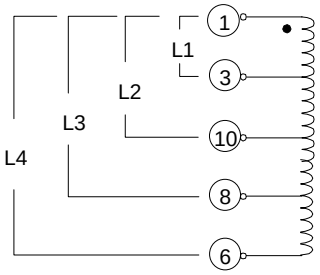


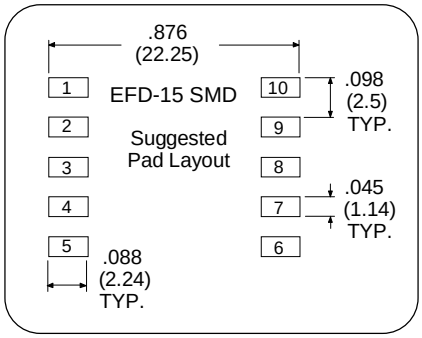


P / N F-3504
EFD-15 Thru-hole Package

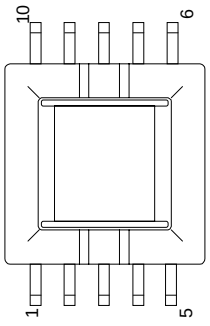


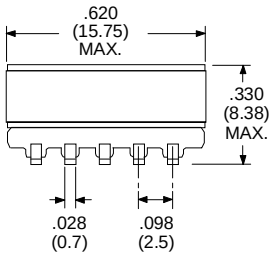
Schematic
Diagram
P/N F-3504



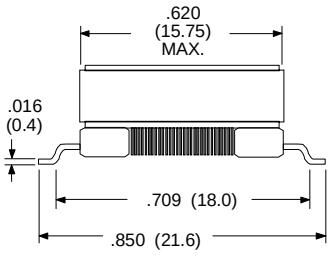


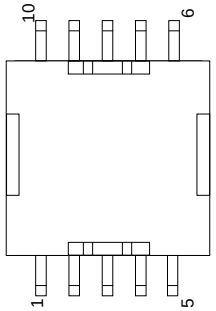
Physical Dimensions in Inches (mm)

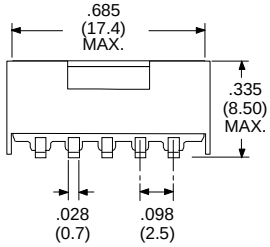




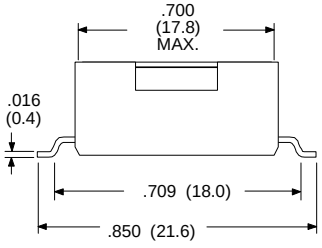
P / N F-3504G
EFD-15 Surface Mount
Package







P / N F-3504GCP
EFD-15 Surface Mount
with Pick-&-Place Cap



Specifications subject to change without notice.

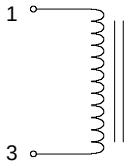
For other values & Custom Designs, contact factory.

TAXFILT2 - 10/98

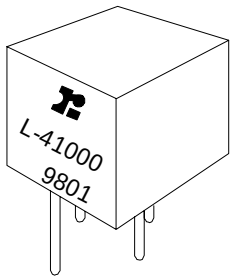
15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

Miniature Encapsulated Inductors

Schematic



Encapsulated
Multi-Purpose
High Inductance / Low Bias
Low Inductance / High Bias
Other Values Available



High Inductance / Low Bias

Part Number	L (1) (H)	Q	DCR (Ω)	DCI (mA)
L-41000	6.0	2.0	522	.912
L-41001	3.5	1.9	267	1.18
L-41002	1.25	1.8	180	2.00
L-41003	0.3	1.7	40	4.23
L-41004	0.1	1.7	15	7.00

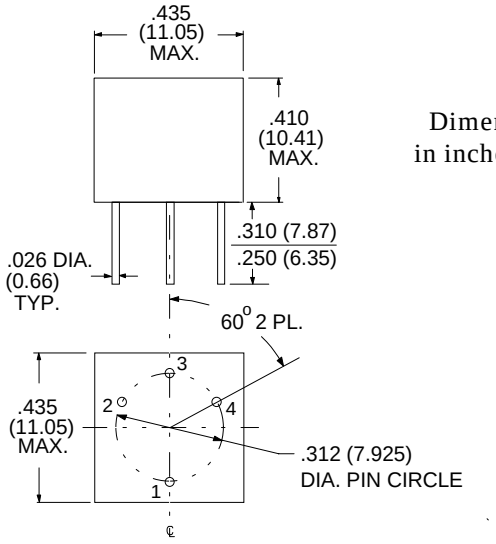
1. Tested at 10KHz and 100 mV_{RMS}

Low Inductance / High Bias

Part Number	L (1) (mH)	Q	DCR (Ω)	DCI (mA)
L-41050	600	5.2	447	29
L-41051	400	5.1	300	41
L-41052	150	5.1	117	60
L-41053	35	5.0	26.0	125
L-41054	0.8	5.0	0.65	840

1. Tested at 10KHz and 100 mV_{RMS}

Dimensions in inches (mm)



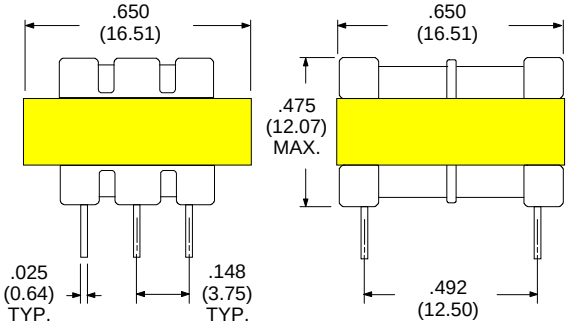
DUAL AUDIO INDUCTORS

3000 V_{RMS} Isolation between inductors

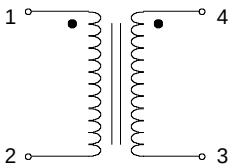
Part Number	L (1) (mH)	DCR (Ω)	DCI (A)
L-41101	1	0.74	1.0
L-41102	5	1.95	.580
L-41103	10	4.45	.420
L-41104	20	11.3	.250
L-41105	50	27.0	.165

1. Tested at 10KHz and 100 mV_{RMS}

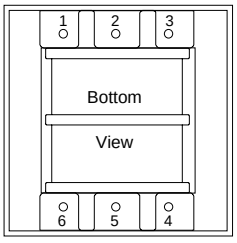
Dimensions in inches (mm)



Schematic



See data sheets for additional information



Specifications subject to change without notice.

For other values & Custom Designs, contact factory.

Rhombus Industries Inc.
15801 Chemical Lane, Huntington Beach, CA 92649-1595
Tel: (714) 898-0960 • Fax: (714) 896-0971

High Bias / High L Audio Frequency Inductors

Electrical Specifications at 25 °C

Part Number	L (1) ±20% (H)	Q typ.	DCR typ. (Ω)	DCI max. (mA)	Schematic
L-593	0.1	7.10	6.0	160	Single
L-594	0.1	7.10	6.0	160	Dual
L-595	0.3	7.35	16.5	95	Single
L-596	0.3	7.35	16.5	95	Dual
L-597	0.7	8.10	35.0	58	Single
L-598	0.7	8.10	35.0	58	Dual
L-599	1.4	8.79	59.7	45	Single
L-600	1.4	8.79	59.7	45	Dual
L-601	2.0	10.00	190.0	26	Single
L-602	2.0	10.00	190.0	26	Dual

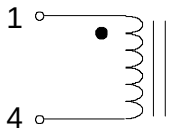
1. Tested at 10KHz and 100 mV_{RMS}

Dual Inductors are tested in a series. With pins 2 & 3 shorted, they are the equivalent to a single inductor.
See data sheets for further details

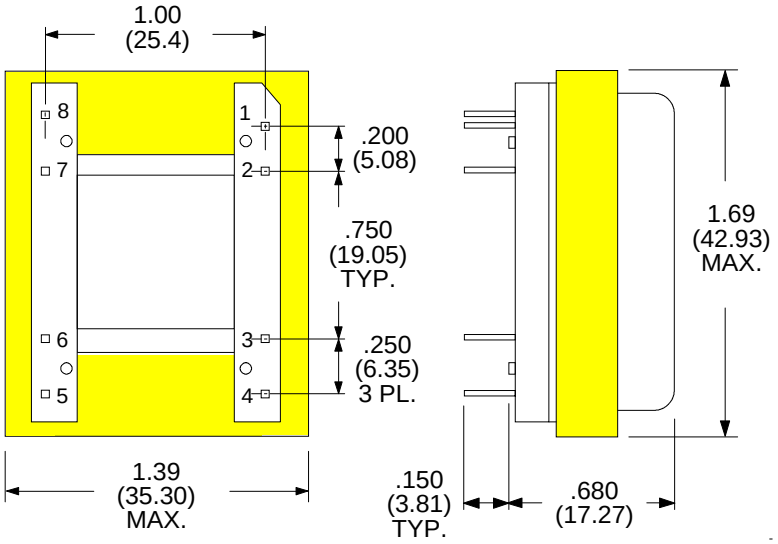
Multi-Purpose Applications:

- Battery Feed
- Holding Coil
- Surge Retard Coil

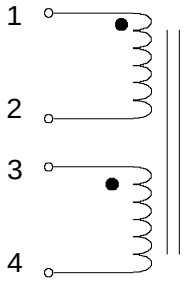
Single Inductor Schematic Diagram



Dimensions in Inches (mm)



Dual Inductor Schematic Diagram



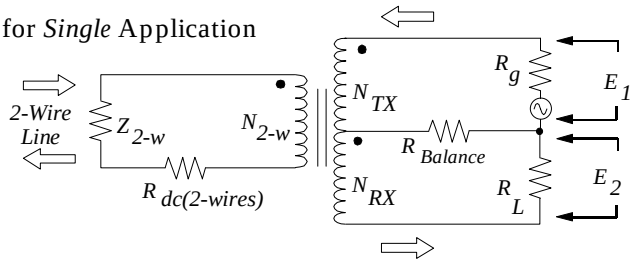
HYBRIDS

Single Configuration

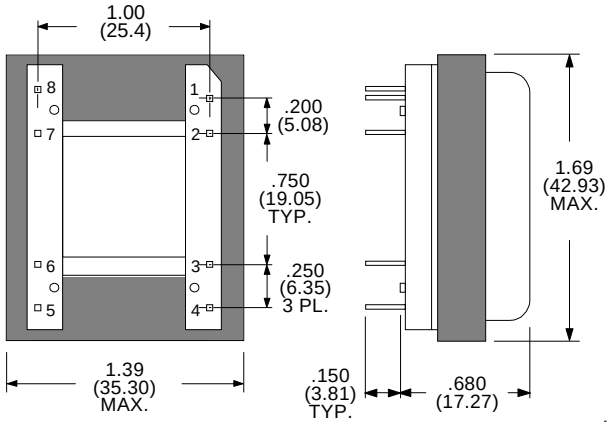
Electrical Specifications at 25°C

Parameter -- *Single Hybrid*		T-31201	Units
Impedance R Load	PRI. SEC.	600 1200	Ω Ω
Turns Ratio		0.613 : 1	
Direct Current in Pri. (DCI)	maximum	90	mA
DC Resistance	PRI. ± 10% SEC. ± 10%	80 197	Ω Ω
Insertion Loss	max., ref. 1 kHz	4.5	dB
Return Loss	Typ., @ 1 kHz	25	dB
Longitudinal Balance	min., @ 1 kHz	60	dB
Frequency Response	300 Hz to 3.5 kHz	± 0.50	dB
Isolation	minimum	1250	V_{RMS}

Schematic for *Single* Application



Package for *Single* Hybrid P / N T-31201
Dimensions in Inches (mm)



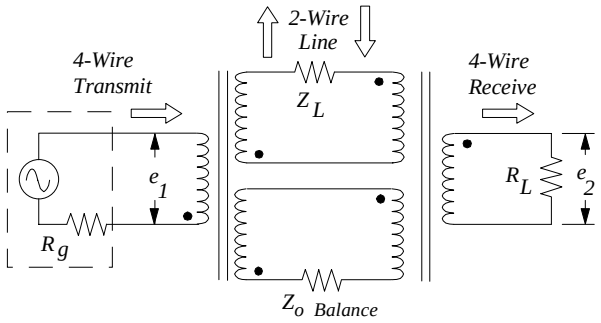
Dual Configuration

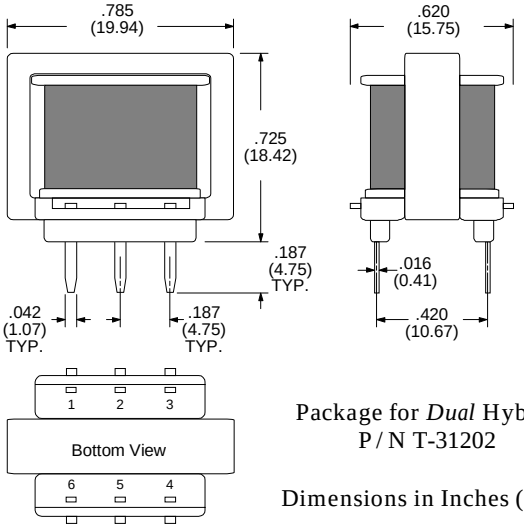
Electrical Specifications at 25°C

Parameter -- *Dual Hybrid **		T-31202	Units
Impedance R Load	PRI. SEC.	600 1200	Ω Ω
Turns Ratio		0.660 : 1	
Direct Current in Pri. (DCI)	maximum	0	mA
DC Resistance	PRI. ± 10% SEC. ± 10%	58 82	Ω Ω
Insertion Loss	max., ref. 1 kHz	3.85	dB
Return Loss	min., @ 1 kHz	25	dB
Longitudinal Balance Longitudinal Balance	min., @ 200Hz to 1kHz min., @ 1 kHz to 4 kHz	60 40	dB dB
Frequency Response	300 Hz to 3.5 kHz	± 0.50	dB
Isolation	minimum	1500	V_{RMS}

* *Dual* Applications require 2 each of P / N T-31202

Schematic for *Dual* Application: 2 each of P / N T-31202





Package for *Dual* Hybrid
P / N T-31202

Dimensions in Inches (mm)

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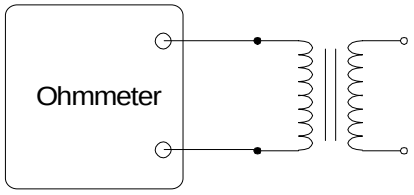
DC Resistance

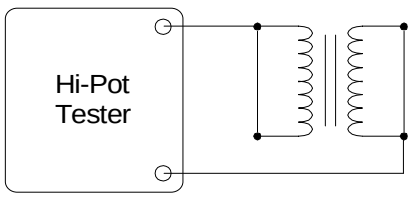
Any commercial Ohmmeter or VOM can be used, but when measuring DCR one must be aware of the meter's accuracy, as well as potential sources for error.

Be aware of length of test leads. These often contribute to higher resistance measurements. It is imperative to short the leads before testing to determine the "zero" reference number. If possible "zero out" the meter. If this is not possible, any value above zero must be subtracted from measurement.



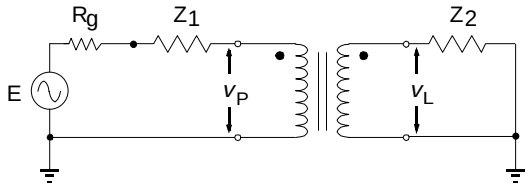
Dielectric Strength (Hi-Pot)

The dielectric strength test is a measurement of isolation. For a transformer, it is measured between each winding or all other windings and the core or case. The terminals of the winding under test are connected together, while all other winding terminals and the case or core are tied to ground. For an RMS voltage, a leakage current can be specified even though this test is generally a go / no-go test since failure will be determined by a flash-over or breakdown. A DC voltage can also be used, and should be specified in Volts DC. If a sinusoidal voltage is applied, it will always be an appropriate 60Hz root-mean-squared (rms) voltage.



Frequency Response (FR)

Rhombus Industries measures Frequency Response as a variation in Insertion loss over a specified range of frequencies. A meter calibrated in dB can be used, however, care must be taken that the frequency range tested is within the capabilities of the meter. The source voltage must be held constant regardless of voltage measurement technique. Unless otherwise stated in a data sheet, the reference frequency for all audio transformers is 1 KHz and the test signal level is 0 dBm. The test circuit below is used by Rhombus Industries to measure Frequency Response.



v_L = Voltage across secondary

$v_{L\,ref}$ = Voltage v_L, at reference frequency

$v_{L\,test}$ = Voltage v_L, at frequency under test

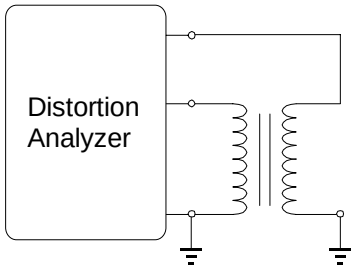
v_P = Source Voltage (Must be held constant)

Frequency Response Formula: (if v_p is constant)

$$20\log \frac{v_{L\,test}}{v_{L\,ref}}$$

Harmonic Distortion (HD)

The Harmonic Distortion test requires the use of a good distortion analyzer (it is critical that the source signal be of low distortion). The test itself is performed to determine how much distortion the transformer is introducing into the signal by comparing the input and output. The measurement is given in decibels (dB).

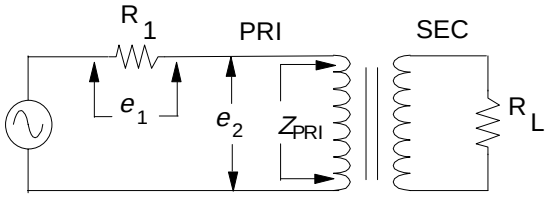


Notes on Test Methods and Testing

Impedance (Z)

Although normally measured on an Impedance Analyzer at Rhombus, this valuable lab instrument is not always available to engineers. Otherwise, the impedance of a transformer can be found by using Ohms Law after measuring the voltage and current on the primary winding. Due to the fact that measuring current is not as easy as measuring voltage, the "Voltmeter Method" is used.

The voltage of the primary is measured, and the voltage across a resistor is measured, using the circuit below:



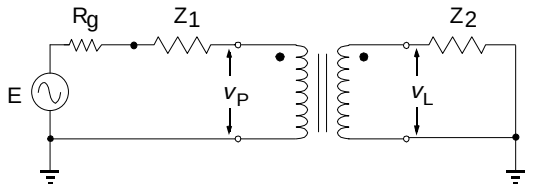
The resistor should be a non-inductive type and of low resistance (less than 10 Ω). The values for resistance and voltage are then substituted into the algebraic equivalent of Ohms Law:

$$Z_{pri} = e_2 R_1 / e_1$$

Z_{PRI} = the impedance seen at transformer's primary
e_1 = the voltage across the shunt resistor R_1
e_2 = the voltage at transformer's primary winding
R_1 = the shunt resistor whose value is typically much lower than Z_{PRI}

Insertion Loss (IL)

The insertion loss of the transformer is a measurement of the signal loss due to the insertion of the transformer in the circuit. Primarily due to the copper loss of the wire, it can also include losses due to the magnetic material. Unless otherwise stated in a data sheet, the test signal level is 0 Dbm. The test circuit below is used by Rhombus Industries to measure insertion loss.



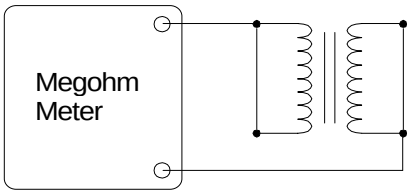
V_P = Primary Voltage
V_L = Load Voltage
Z_1 = Primary Impedance
Z_2 = Load Impedance

Insertion Loss Formula:

$$20\log \frac{V_L\sqrt{Z_1}}{V_P\sqrt{Z_2}}$$

Insulation Resistance (IR)

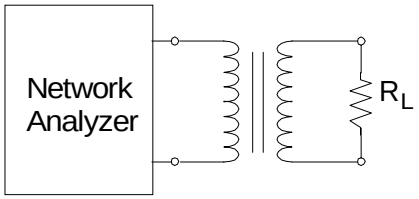
The IR test, sometimes referred to as DC Insulation Resistance, is a test to determine the insulation properties of the transformer. The direct-current insulation resistance is measured between each winding or all other windings and the core or case. The measured value will be greater than a specified minimum value and is measured in Megohms at a specified DC voltage level. The voltage level is typically 50 to 1000 Vdc and is applied for a minimum of 10 seconds.



Return Loss (RL)

The Return Loss is a measurement of any mismatch in impedance between an ideal telecommunication line and the transformer. The frequency range and signal level will be specified on the data sheet, and is measured in dB.

Return Loss is measured using a Network Analyzer. Care must be taken to use the proper load impedance with the source impedance of concern.



Glossary of Terms and Acronyms

ANSI: American National Standards Institute.

Attenuation: Signal power loss through equipment, lines or other transmission devices. Measured in decibels.

AWG: The American Wire Gauge System, which specifies wire diameter.

Balanced: A transmission line in which voltages on the two conductors are equal in magnitude, but opposite in polarity, with respect to ground.

Baud: Unit of signaling speed equivalent to the number of discrete conditions or events per second. If each signal event represents only one bit condition, baud rate equals bps (bits per second).

Bps (Bits Per Second): A measure of data transmission rate in serial transmission.

C_D: *see* Distributed Capacitance.

$C_{W/W}$: *see* Interwinding Capacitance.

CCITT: Consultative Committee for International Telephone and Telegraph.

CMRR: *see* COMMON MODE REJECTION RATIO

Common-Mode Noise: Electrical interference that is common to both lines in relation to earth ground

Common Mode Rejection Ratio: A measure of the isolation between a transformers windings. For a specific input voltage and frequency with the primary terminals shorted, CMRR is the ratio of input voltage to output voltage measured at the loaded secondary output terminals.

Crosstalk: The unwanted transfer (or pick up) of a signal from one transformer to another.

dB (Decibel) - Unit for measuring relative strength (ratio) of two signals.

dBm - A measure of power in communications: the decibel in reference to one milliwatt
(0 dBm = 1 milliwatt and -30 dBm = .001 milliwatt)

DCR: Direct Current Resistance.

Distributed Capacitance: The shunt capacitance of the winding being measured.

Dielectric Strength: The dielectric strength is a measurment of isolation between each winding and/or windings and the core. The voltage applied is typically a 60Hz root-mean-squared (rms) voltage.

Differential-Mode Noise: Electrical interference that is not common to both lines but is present between both lines. (Normal Mode noise)

Distortion: The unwanted change in a signal's waveform occurring between two points in a transmission system.

DTE: Data Terminal Equipment

Dry: Refers to a transformer which is designed to carry no Direct Current in it's windings.

Echo Cancellation: A technique used in high speed modems and voice ciruits to isolate and filter out unwanted signal energy caused by echoes from the main transmitted signal.

Echo-Signal: Distortion occurring when a transmitted signal is echoed back (reflected) to the originating station.

ECMA: European Computer Manufacturers Association

EIA (Electronic Industries Association) - A standards organization in the U.S. specializing in the electrical and functional characteristics of interface equipment.

EMI (Electromagnetic Interference) - Radiation leakage outside a transmission medium resulting mainly from the use of high frequency wave energy and signal modulation. EMI can be reduced by appropriate shielding.

FCC (Federal Communications Commission) -
The regulatory agency established in the United States for all interstate radio and electronic communications.

Full Duplex: A circuit or device permitting transmission in two directions at the same time.

Half Duplex: A circuit or device capable of transmitting in two directions, but not at the same time.

High Potential (HI-POT) Test: Typically this refers to Insulation Resistance (IR) test. Consult appropriate data sheet for information.

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Glossary of Terms and Acronyms

IEEE (Institute of Electrical and Electronic Engineers) - An international professional society issuing its own standards. The IEEE is a member of ANSI and ISO.

Insertion Loss: The difference between the power received at the load before, and after, the insertion of the transformer.

Insulation Resistance (IR): The IR test, sometimes referred to as DC Insulation Resistance, is a test to determine the insulating properties of the transformer. The direct-current insulation resistance is measured between each winding and all other windings and the core or case. Specified as a minimum value, it is measured in Megohms.

Interwinding Capacitance: The capacitance between primary and secondary windings.

ISO (International Standards Organization) - An international organization involved in writing communications standards.

ITU (International Telecommunication Union) - European-based, international advisory committee recommending worldwide standards for transmission.

Jitter: The deviation of a transmission signal in time or phase. It can introduce errors and loss of synchronization in high speed synchronous communications.

Leakage Inductance: The part of the inductance of one winding which does not link to another.

Modem (Modulator-Demodulator) - A device used to convert serial digital data from a transmitting DTE to a signal suitable for transmission over extended distances. It also reconverts the transmitted signal to serial digital data for acceptance by a receiving DTE.

Modulation: The alteration of a carrier wave in relation to the value or samples of the data being transferred.

OCL: *see* Open Circuit Inductance

Open Circuit Inductance: The inductance of one winding (usually the primary) with other windings open. OCL effects the lower portion of frequency response.

PBX (Private Branch Exchange) - A private telephone exchange.

Shielding : The protective enclosure surrounding a transmission medium, designed to minimize electromagnetic interference (EMI/RFI).

Return Loss: At a discontinuity in a transmission system, the difference between the power incident upon, and the power reflected from, the discontinuity. Typically measured in dB.

Turns Ratio: The ratio of the number of turns in the primary winding to the number of turns in the secondary winding of a transformer. The turns ratio is often derived from the measurement of input-to-output voltage ratio.

V.17: 14.4 Kbps Fax transmission over dial lines

V.21: 300 bps Dial line modulation

V.22: 1.2 Kbps Dial line modulation

V22bis: 2.4 Kbps Dial line modulation

V27bis: 4.8 Kbps 4-wire leased line modulation

V29: 9.6 Kbps 4-wire leased line modulation (Data & Fax)

V32: 9.6 Kbps Dial and 2 wire leased line modulation

V32bis: 14.4 Kbps Dial and 2 wire leased line modulation

V33: 14.4 Kbps 4-wire leased line modulation

V34: 28.8 Kbps Dial and 2 wire leased line modulation

V34+: 33.6 Kbps Dial and 2 wire leased line modulation

Wet: Refers to a transformer which is designed to carry a certain amount of Direct Current in its windings.

Z_{oc}: The open circuit impedance of a transformer.

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Magnetic Product Families

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ISDN
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SCR Trigger

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Voice / Data • Dry / Wet
Hybrids

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& Differential Mode
Output Inductors
Drive Transformers
Current Sense Transformer

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Transformers & Magnetic Products

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