OPT INDUSTRIES, INC.

INDUCTORS • ELECTRIC WAVE FILTERS
HI-Q INDUCTORS • TRANSFORMERS

United Transformer Company a subsidiary of OPT Industries Inc.

INDUSTRIES, INC.

From the office of the president

To Our Customers:

OPT has been a recognized leader in design, development and manufacture of magnetic components for many years. Recently, our industry position was strengthened by the acquisition of the United Transformer Division of TRW, another industry leader with complementary product lines and capabilities.

The union of the OPT and UTC capabilities in magnetic component development and manufacture formed the basis for our new Magnetics Division, one of the industry's major viable sources of supply of transformers, inductors, coils, filters and vertically integrated assemblies.

Our purpose is to serve our customers with innovative and cost effective solutions to their applications problems and answer their needs for quality magnetic components. This catalog offers standard products, with proven reliability, readily available for your immediate use. If your needs are not served by the standard product offering in this catalog, we will be pleased to custom design products as solutions to your problems.

Our employees are dedicated to providing optimum customer service and to producing products with optimum quality. We hope that you consider all of us at OPT as members of your team.

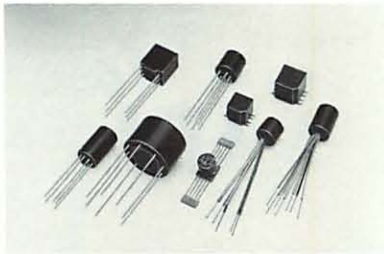
We appreciate your business and look forward to serving you in the future with OPT products . . . the optimum choice.

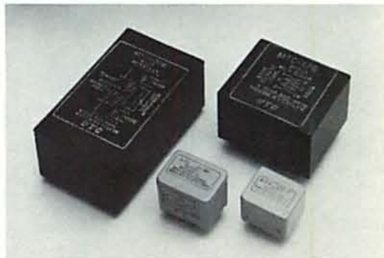
Jerome Potash
President

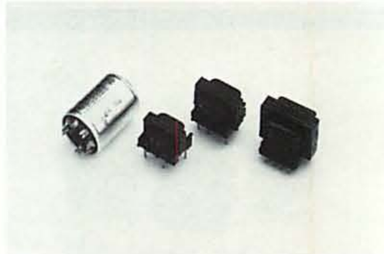
OPT Industries Inc. • 300 Red School Lane, Phillipsburg, NJ 08865 • (201) 454-2600 • FAX (201) 454-3172

PRODUCT SERIES INDEX

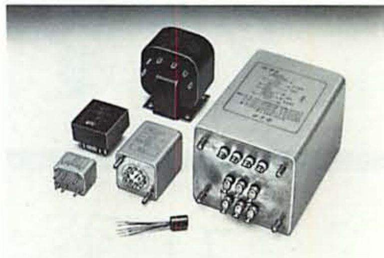
AUDIO TRANSFORMERS AND INDUCTORS



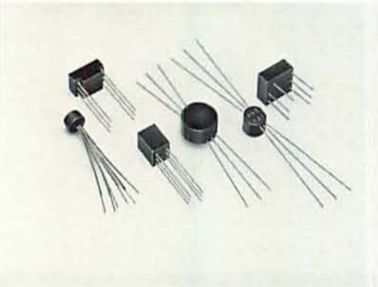


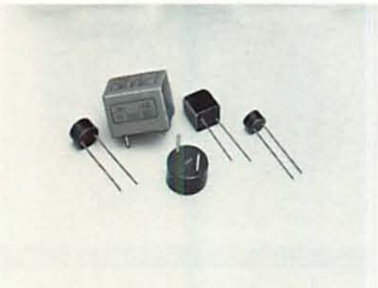


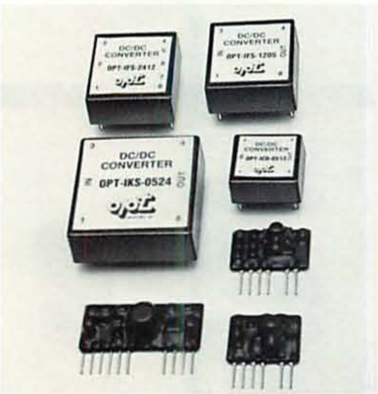
POWER TRANSFORMERS AND INDUCTORS



PRODUCT SERIES INDEX







PULSE TRANSFORMERS

HIGH Q INDUCTORS

ELECTRIC WAVE FILTERS

DC/DC Converters

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GENERAL INFORMATION
Audio Transformers and Inductors

The audio transformer is defined by operation over a frequency band. Originally the audio band referred to the audible spectrum of frequencies, 15 Hz to 20 KHz. As it was found that the audio type transformer could be used successfully beyond this frequency range and for other functions, the applications broadened but the name "audio" remained.

Some of the applications of audio transformers are impedance matching, coupling, isolation and voltage gain. In selecting audio transformers the following are key parameters: source and load, impedance voltage level (power rating), frequency response and DC current capability; if any.

UTC has broad experience in custom designing transformers for special applications. Facilities are available for full engineering discussion to work out magnetics in early stages of equipment design. Fully equipped electronics, mechanical, and chemical laboratories with modern, accurate equipment are available to aid in the design of custom transformers.

CATALOG SPECIFICATIONS

The primary and secondary impedances listed in this catalog are the rated source and load resistances between which the transformer's performance ratings are determined. For instance, a unit rated at 500 ohms primary impedance and 500 ohms secondary impedance would yield the rated response limits when the part is driven by a 500 ohm source and is loaded with a 500 ohm load. Reductions in source and/or load impedances below the rated values would "push" the response characteristics toward lower frequencies. Conversely, higher than rated sources or loads edge the part ratings toward higher frequencies at the sacrifice of the lower portion of the rated frequency band.

A listing of "CT" after the impedance means that the winding has a termination midway toward the total winding turns (center tap).

"Split" listing after the impedance rating means that the total impedance rating shown is composed of two separated windings, which when placed in series produce the larger of the two rated listings. When the windings are placed in parallel, the smaller of the winding ratings is achieved (1/4 of the larger).

The maDC rating shows the maximum unbalanced DC current which can be taken in the winding without disturbing the rated response limits. The maDC rating is not a measure of the maximum DC current which the part can tolerate. The maximum currents are a function of the wire sizes used in the part and the allowable heat rise for the part. The maximum AC power to be handled also affects the analysis. Because of the complicated interrelationships, maximum DC ratings are generally not listed as catalog values.

Milliwatt or maximum level is the power handling capability of the transformer in terms of power delivered to a matched load with a matched source impedance. This power level is typically measured at 1 KHz with 5% maximum waveform distortion. In some of the product lines, this power is measured at the lowest frequency within the band pass. The DO-T and DI-T line are all measured at 1 KHz. All other audio transformer products, because of specific applications, vary in terms of the frequency at which the maximum power level of operation is specified.

CUSTOM SPECIFICATIONS

ELECTROSTATIC AND ELECTROMAGNETIC SHIELDING

Audio transformers require more shielding, in most cases, than any other type transformer. Because of the low power levels they operate at, they may be susceptible to radiated and line coupled interference.

Electrostatic shielding is commonly used between the primary and secondary of a transformer to reduce line coupled interference by reducing the interwinding capacity. This is accomplished by use of highly conductive materials, such as copper, silver or aluminum, as a wrap around or between the coils of a transformer.

Magnetic shielding is used to reduce radiated type interference from affecting a transformer. It is accomplished by encasing the transformer in a single high permeability nickel-iron case, or several nickel-iron cases, depending upon the intensity of the radiation.

DISTORTION

This is a measure of conformance between the transformer input and output signal waveshapes. Alternately it is a measure of the degradation of signal purity as it passes through a device.

TRANSFORMER PHASE SHIFT

A transformer is a series parallel network of complex impedances and will exhibit phase shift from primary to secondary as a function of frequency. Because its inductance is non-linear with applied voltage, phase shift will also be dependent on input voltage level.

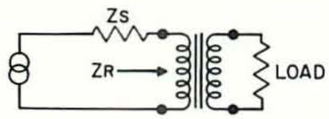
By no means have we dealt with all of the terminology of audio transformers with regard to specifications. We have merely touched upon the surface as indicative of the variety of customer requirements that UTC frequently experiences. Specific requirements for tight performance characteristics are best discussed with our engineering department to arrive at practical solutions based on the state of the art.

GENERAL INFORMATION
Audio Transformers and Inductors

REFLECTED IMPEDANCE AND RETURN LOSS.

A transformer can be designed to reflect a specific impedance (within a reasonable tolerance) under a particular set of operating conditions. A measure of the accuracy of the impedance reflection is referred to as a return loss.

RETURN LOSS MEASURES THE ENERGY REFLECTION BETWEEN TWO IMPEDANCE'S DUE TO MISMATCHING THEIR VALUES



Z_R = INPUT IMPEDANCE OF TRANSFORMER AT FREQ AND LEVEL OF INTEREST

Z_S = SOURCE IMPEDANCE TO BE MATCHED

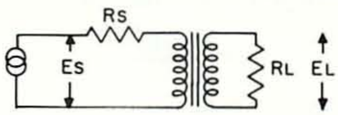
RETURN LOSS $= 20\text{LOG}\left|\dfrac{Z_S + Z_R}{Z_S - Z_R}\right|$ **DB**

INSERTION LOSS AND EFFICIENCY.

Insertion loss is the ratio of useful power delivered, to the input power supplied, the latter being a somewhat larger quantity to overcome losses inherent in the power transferring device. It is expressed in db.

Efficiency expresses the discrepancy between power supplied and power delivered. It is expressed as a percentage.

INSERTION LOSS MEASURES THE EFFICIENCY OF POWER TRANSFER THROUGH THE TRANSFORMER



INSERTION LOSS $= 20\text{LOG}\left|\dfrac{E_S}{E_L}\right| + 10\text{LOG}\left|\dfrac{R_L}{4R_S}\right|$ **DB**

FREQUENCY RESPONSE.

The reference frequency is a frequency in the flat portion of the frequency response and is typically 1 KHz. It is usually the frequency at which the insertion loss is measured. (Refer to Insertion Loss circuit above).

FREQUENCY RESPONSE $\text{db} = 20\text{LOG}\dfrac{EF}{ER}$

Where

ER = output voltage at reference frequency

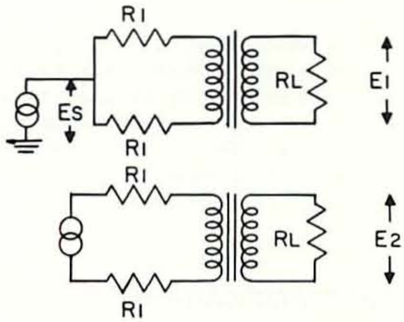
EF = output voltage at any other frequency

BALANCE WINDING, CENTER TAP, LONGITUDINAL, AND HYBRID.

Many audio transformer applications require two matched windings or winding halves. Depending upon the parameters to be compared and the operating conditions, the type of balance required takes on a variety of names, as mentioned above.

Low frequency winding balance requirements are generally turned to accurate turns ratios and extremely well matched DCR's, while high frequency balance includes balancing of winding capacitances.

LONGITUDINAL BALANCE MEASURES SUPPRESSION OF LONGITUDINAL SIGNALS BY THE TRANSFORMER



LONGITUDINAL BALANCE $= 20\text{LOG}\left|\dfrac{E2}{E1}\right|$ **DB**

ELECTROSTATIC SHIELDING CIRCUIT.

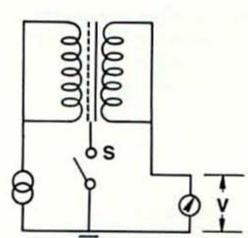
Electrostatic Shielding ratio is the ratio of the voltage with switch open to the voltage with switch closed.

Electrostatic shielding ratio $= \dfrac{VO}{VC}$

VO = voltage with switch open

VC = voltage with switch closed

All windings are short circuited and those on the same side of the shield are connected together.



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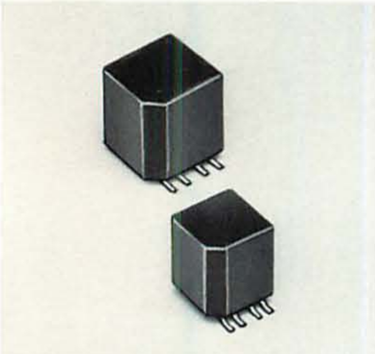
SELECTION GUIDE
Audio Transformers and Inductors

Product Series	Description	Weight	Size (inches) (Nominal)	Freq. Range	Max. Power	Page
MILITARY TYPES: GRADE 5, METAL ENCASED						
BIT-250	Ribbon style Kovar leads; compatible with transistor and IC flat pack styles. Transformers and inductors.	.04 oz	.26 d x .26 h	300 Hz to 250 kHz	80 mW @ 1 kHz	8
DO-T	Flexible 1½" Dumet leads. Ultraminiature transformers and inductors for transistor circuitry.	.1 oz	.34 d x .46 h	300 Hz to 20 kHz	500 mW @ 1 kHz	9/10
DO-T200	Plug-in — TO-5 pattern. Ultraminiature transformers and inductors for transistor style circuitry.	.125 oz	.350 d x .56 h	300 Hz to 20 kHz	100 mW @ 1 kHz	9/12
DI-T	Flexible 1½" Dumet leads. Goldplated. Ultraminiature transformers and inductors for transistor circuitry.	.067 oz	.34 d x .31 h	400 Hz to 100 kHz	500 mW @ 1 kHz	9/11
DI-T200	Plug-in — TO-5 pattern. Ultraminiature transformers and inductors for transistor circuitry.	.067 oz	.35 d x .36 h	400 Hz to 100 kHz	500 mW @ 1 kHz	9/12
TOP 1000	Plug-in, low profile, Class 5 miniature transformers	4.5 gr	.50 d x .35 h	300 Hz to 75 kHz	.6 W @ 1 kHz	14
TOP 2000	Plug-in, low profile, Class 5 miniature transformers	7 gr	.50 d x .50 h	150 Hz to 75 kHz	1 W @ 1 kHz	14
TOP 3000	Plug-in, low profile, Class 5 miniature transformers	16 gr	.75 d x .52 h	50 Hz to 30 kHz	2 W @ 1 kHz	15
TOP 4000	Plug-in, Class 5 miniature transformers	28 gr	.75 d x .82 h	20 Hz to 25 kHz	3 W @ 1 kHz	15
MILITARY TYPES: GRADE 5, MOLDED						
SSO-P	Transistor and tube type transformers. Input interstage output and inductors.	.04 lbs	.75 x .88 x .56 h	300 Hz to 20 kHz	100 mW @ 300 kHz	17/22, 23, 24
SO-P	Transistor and tube type transformers. Input interstage output and inductors.	.05 lbs	.75 x 1.0 x .72 h	200 Hz to 20 kHz	250 mW @ 200 Hz	17/20/21
TSM 1000	Surface mount ultraminiature transformers	.055 oz	.31 x .31 x .31 h	400 Hz to 250 kHz	125 mW @ 1 kHz	6
TSM 2000	Surface mount ultraminiature transformers and inductors	.11 oz	.385 x .385 x .385 h	400 Hz to 100 kHz	400 mW @ 1 kHz	7
RST & RSI	Plug-in ultraminiature transformers and inductors	.1 oz	.31 x .41 x .465 h	300 Hz to 100 kHz	50 mW @300 Hz	13
MTC	Telephone and modem interconnect transformers	0.8 to 11 oz	.875 x 1.093 x .179 h to 1.625 x 2.812 x 1.156 h	300 Hz to 4 kHz	10 mW	16
INDUSTRIAL TYPES: CASED, NON-HERMETIC						
O	Excellent quality compact audio transformers and inductors, full range of transistor and tube applications.	1 oz	.88 d x 1.19 h	300 Hz to 20 kHz	1 Watt	17/18/19
INDUSTRIAL TYPES: OPEN FRAME, NON-HERMETIC						
PC-O	Plug-in types for mtg. on P.C. boards. Same electrical characteristics as std. ouncer, sub-ouncer and sub-sub-ouncer lines.	.07 lbs PC-O:	1.0 x .90 x .75 h	100 Hz to 20 kHz	1 W	17/18/19
PC-SO		.04 lbs PC-SO:	.88 x .88 x .63 h	200 Hz to 20 kHz	250 mW	17/20/21
PC-SSO		.024 lbs PC-SSO:	.75 x .75 x .50 h	300 Hz to 20 kHz	100 mW	17/22, 23, 24
COMMON MODE INDUCTORS						
CMA	1 to 1 hi frequency matching and/or isolation transformers	.033 lbs	.81 d x .50 h	1.5 kHz to 5 mHz	35 mW to 230 mW	38
CMB		.052 lbs	.96 d x .63 h	1.5 kHz to 5 mHz	35 mW to 230 mW	38
CMC		.09 lbs	1.14 d x .73 h	1.5 kHz to 5 mHz	35 mW to 230 mW	38

Note: Description, freq. range, max. power info. is common to all types (CMA, B & C).

TSM
Transformer Surface Mount



NOTES

All are designed and constructed to meet the requirements of MIL-T-27 Grade 5, Class S.

Transformers are **MIL-T-27 Type TF5S21ZZ**
Inductors are **MIL-T-27 Type TF5S20ZZ**

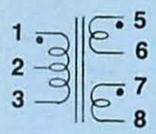
TSM 1000
SIZE
.31 x .31 x .31
WEIGHT
.055 oz.
Terminals are copper clad steel, tinned.
FREQUENCY RESPONSE
±3 db at 1mW, 400Hz - 250KHz

TSM 2000
SIZE
.385 x .385 x .385
WEIGHT
.11 oz.
Terminals are copper clad steel, tinned.
FREQUENCY RESPONSE
±3db at 1mW, 400 Hz-100KHz

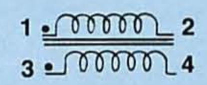
The power rating of the larger TSM-2000 Series is approximately 3 times that of the smaller TSM 1000 Series.

SCHEMATICS

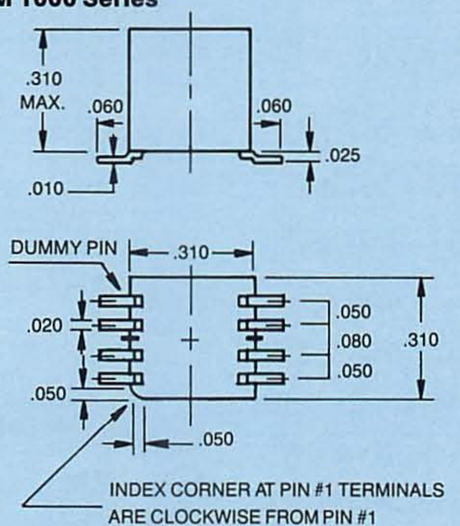
TRANSFORMERS



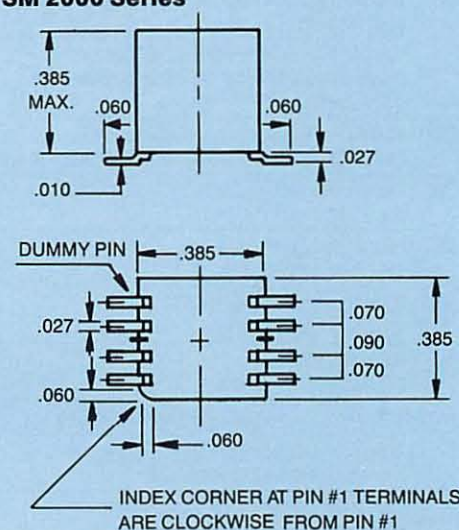
INDUCTORS



TSM 1000 Series



TSM 2000 Series



Part No.	Pri. Imp ohms	MaDC in Pri.	Sec. Imp ohms	Power Milliwatts 1 KHz and higher	400Hz	DCR Pri./Sec. ±25% ohms	Turns Ratio Pri./Sec.
TSM-1045	100 CT	3.6	100 split	125	20	12.1/12	1/1
TSM-1080	150 CT	3	150 split	125	20	15 /18.3	1/1
TSM-1090	200 CT	2.5	200 split	125	20	22 /26.8	1/1
TSM-1110	300 CT	2	300 split	125	20	33 /40.3	1/1
TSM-1115	300 CT	2	600 split	125	20	33 /72	1/1.41
TSM-1170	500 CT	1.6	50 split	125	20	54 /6.6	3.16/1
TSM-1180	500 CT	1.6	500 split	125	20	54 /65	1/1
TSM-1215	600 CT	1.5	600 split	125	20	59 /72	1/1
TSM-1270	1000 CT	1.2	1000 split	125	20	120 /120	1/1
TSM-1305	1500 CT	1	500 split	125	20	180 /65	1.73/1

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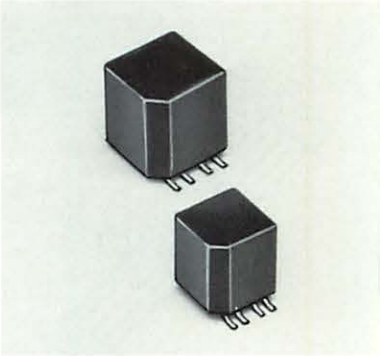
TSM
Transformer Surface Mount

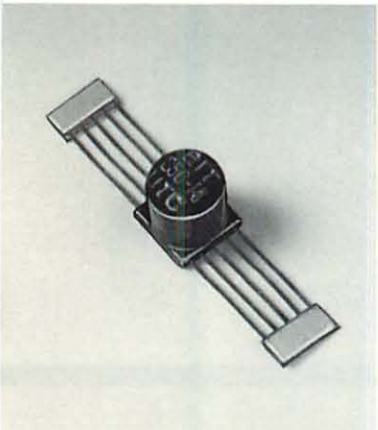
Part No.	Pri. Imp ohms	Ma DC 1A Pri.	Sec. Imp ohms	Power Milliwatts 1 KHz and higher	400Hz	DCR Pri./Sec. ±25% ohms	Turns Ratio Pri./Sec.
TSM-2035	80 CT	11.1	32 split	400	75	8/4	1.58/1
TSM-2080	150 CT	8.2	150 split	400	75	15/16.8	1/1
TSM-2115	300 CT	5.8	600 split	400	75	30/72	1/1.41
TSM-2125	400 CT	5	40 split	400	75	40/4.5	3.16/1
TSM-2140	400 CT	5	400 split	400	75	40/48	1/1
TSM-2170	500 CT	4.5	50 split	400	75	50/6	3.16/1
TSM-2190	500 CT	4.5	600 split	400	75	50/72	1/1.1
TSM-2215	600 CT	4.1	600 split	400	75	60/72	1/1
TSM-2265	1000 CT	3.2	50 split	400	75	100/6	4.47/1
TSM-2305	1500 CT	2.6	500 split	400	75	150/60	1.73/1
TSM-2340	2000 CT	2.2	8000 split	400	75	200/960	1/2
TSM-2460	1000 CT	1.0	500 split	250	75	1000/60	4.47/1
TSM-2475	10000 CT	1.0	1200 split	250	75	1000/144	2.89/1
TSM-2485	10000 CT	1.0	2000 split	250	75	1000/240	4.47/1
TSM-2500	10000 CT	1.0	10000 split	250	75	1000/1200	1/1
TSM-2555	20000 CT	0.7	800 split	125	75	2000/96	5/1



INDUCTORS

Part No.	Series Inductance henries	DC ma	DCR ± 25%	Parallel Inductance henries	DC ma	DCR ± 25%
TSM-2705	0.1 .08	4 10	25	0.025 0.020	8 20	6.3
TSM-2710	0.9 0.5	2 6	105	0.23 0.13	4 12	26
TSM-2715	2.5 0.9	2 4	630	0.6 0.23	4 8	158
TSM-2720	4.5 1.2	2 4	2300	1.1 0.3	4 8	575

BIT-250™
Surface Mount Transformer



PACKAGING

Size reduction without loss of performance is achieved by major reduction of air gaps in the magnetic circuit. Core permeability closely approaches the theoretical maximum for material and structure.

Materials, dimensions, and surface finish are identical with IC Flat Pack standards. Removable support protects terminal alignment prior to final assembly. This insulated support allows testing in conventional jigs.

RELIABILITY

Cylindrical bobbin-winding techniques eliminate corner stress normally found in fine-wire windings of conventional rectangular structures.

Lead arrangements and terminations have been designed to maximum reliability under thermal shock and temperature cycling.

FLEXIBILITY

The stock units shown on facing page are designed to afford maximum flexibility of application.

Transformers are 7-terminal types, with center-tapped primaries and split secondaries. When connected in parallel, split-winding secondaries provide ¼ the impedance and twice the DC current capability as series connections.

Inductors in the stock line include both single-winding and split-winding types.

SPECIALS

BIT-250's not found in the stock line will be designed to customer's requirements.

- Special electrical parameters
- 10 or more leads
- Operation to 130°C per MIL Class S.

NOTES

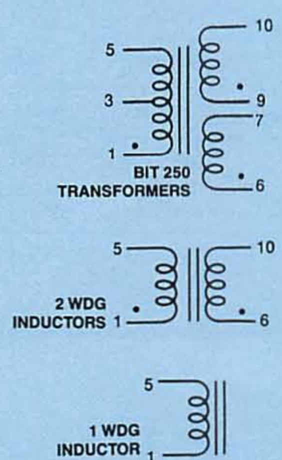
FREQUENCY RESPONSE:
±2 db, 300 Hz—250,000 Hz, @ 1 MW Ref. level.

DIELECTRIC STRENGTH:
tested @ 200 V RMS.

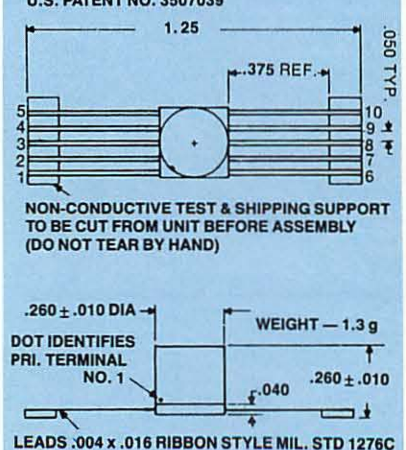
MIL SPECS:
To complete MIL-T-27 Specs. Metal encased, ruggedized, Grade 5, Class R.

SHIELDING:
All units electromagnetically self-shielded.

LEAD MATERIAL:
Tinned ribbon-style, solderable and weldable — MIL-STD-1276.



U.S. PATENT NO. 3507039



TRANSFORMERS

BIT-250 Type No.	MIL Part No.	Pri Imp Ω (CT)	Sec Imp Ω (Split Wdg) Series/Par	Power Level mW for 5% Max Dist @ 1 KHz	Pri DCR Ω	(Series Conn.) Sec DCR Ω	Turns Ratio Pri/ Sec/ Sec	Turns Ratio Pri./ Overall Sec	Typical Application
BIT-250-14	M27/173-03	150	12/3	80	16	1.85	7.1:1:1	3.54:1	Output
BIT-250-18	M27/173-04	300	600/150	80	30	65	1.4:1:1	1:1.4	Output or Matching
BIT-250-20	M27/173-05	400	400/100	80	45	45	2:1:1	1:1	Matching or Interstage
BIT-250-26	M27/173-06	500	50/12.5	80	58	5.5	6.32:1:1	3.16:1:1	Output
BIT-250-30	M27/173-07	600	600/150	80	65	65	2:1:1	1:1	Isolation or Matching
BIT-250-36	M27/173-08	1000	1000/250	80	110	100	2:1:1	1:1	Output or Matching
BIT-250-40	M27/173-02	1500	600/150	75	150	65	3.16:1:1	1.58:1	Output
BIT-250-48	M27/173-09	2000	8000/2000	75	177	745	1:1:1	1:2	Isolation or Interstage
BIT-250-56	M27/173-10	10K	500/125	75	900	45	8.92:1:1	4.46:1	Output or Driver
BIT-250-60	M27/173-11	10K	1200/300	75	900	100	5.78:1:1	2.89:1	Driver
BIT-250-64	M27/173-12	10K	2000/500	75	900	160	4.48:1:1	2.24:1	Interstage
BIT-250-70	M27/173-13	10K	10K/2500	75	900	750	2:1:1	1:1	Isolation or Interstage
BIT-250-90	M27/173-01	25K	1000/250	40	2400	78	10:1:1	5:1	Interstage

INDUCTORS

BIT-250 Type No.	MIL-Type	Connections	Inductance Hys Min @ 1 KHz 5 V	@ ma DC	DC Res Ω	Ratio of Wdgs.
BIT-250-03 (2 Wdgs)	TF5R20ZZ	Series	8.6 2.5	0 2	2260	1:1
		Parallel	2.4 .63	0 4	565	
BIT-250-05 (1 Wdg)	TF5R20ZZ		5.5 1.5	0 2	1000	
BIT-250-06 (1 Wdg)	TF5R20ZZ		.80 .25	1 6	250	
BIT-250-09 (2 Wdgs)	TF5R20ZZ	Series	.60 .15	0 5	146	1:1
		Parallel	.15 .038	0 10	37	

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DO-T and DI-T
Miniature Transformers and Inductors

PACKAGING

Hermetically sealed. The bobbin is completely rigid eliminating stress and wire movement. The turns are circular in shape rather than square, eliminating turn corner stress and effecting uniform wire lay. No tapes are employed in connecting coil wire and external leads. They are rigidly anchored in secure terminal board fashion providing strain relief.

The leads used on the stock DO-T transformers are insulated solid .016 diameter Dumet leads. For plug-in type see page 12.

MIL SPECS

To complete MIL-T-27 Specs. Units are fully ruggedized, hermetically sealed, **metal cased** to MIL Grade 5, Class R.

ALTITUDE

150,000 ft. max.

PERFORMANCE

This radically designed transistor transformer family provides unprecedented power handling capacity and reliability, coupled with small size. Electrical parameters and areas of application exceed conventional transformer capabilities.

Curves on this page and on pages 11 and 12 indicate their performance compared to that of similar size units now on the market. These curves show representative performance of all DO-T's and DI-T's except 200,000 ohm units. Higher performance is obtained when used in push-pull with balanced DC. Other manufacturers' comparative performance is shown on these curves to put unjustified claims in perspective. For example, the UTC DO-T10 delivers 100 mW @ 5% distortion @ 300 Hz. **Identical measurements** were made on contemporary manufacturers' equivalent, rated at 50 mW @ 300 Hz. Actual delivered power was under **1 mW @ 7½% distortion @ 300 Hz.**

FREQUENCY RESPONSE

±3 db, 300 Hz to 20 KHz at 1 mw.

WORKING VOLTAGE

50 volts peak.

APPLICATION

Units can be used for different impedances from those shown, keeping in mind that impedance ratio is constant. Lower source impedance will improve low frequency response and level ratings . . . higher source will reduce them. Units may be used reversed, input to secondary. The frequency response curve on this page is shown to 20 KHz. This descriptive curve is not meant to be restrictive. Units can be used at frequencies well above 20 KHz. Satisfactory applications for frequencies up to and above 250 KHz have been developed.

PULSE APPLICATION

In pulse coupling impedance matching applications, (when measured with a 30 microsecond input pulse voltage wave), typical values for these transformers are: 5% or less droop, zero overshoot and less than 10% backswing.

RELIAIBLITY

The exceptional reliability of DO-T family units, inherent in their unique structure, has been dynamically proven in the field.

SHIELDING

Hipermalloy electromagnetic shield available from stock for all DO-T family units. Order Part Number DOT-SH, or DIT-SH.

DILESIL HIGH TECHNOLOGY DO-T FAMILY TRANSFORMER

- A High Reliability version of the DO-T and DI-T line is available on special order. This alternate construction is designated DILESIL.
- DILESIL construction is intended for fine wire DO-T, DI-T transformers which are used in environments that produce prolonged thermal stress, far exceeding the thermal cycling specification requirements of MIL-T-27.
- DILESIL DO-T's have been approved and qualified by Defense Electronic Supply Command and appear on QPL-27 for MIL-T-27.
- DILESIL construction is recommended for applications requiring extreme reliability under thermal stress. Thousands of these parts have been used in Hi-Rel Military and NASA applicatons for the past thirty years.
- DILESIL DO-T and DI-T transformers are electrically identical to standard DO-T and DI-T parts. However, DILESIL parts are slightly larger than equivalent DO-T and DI-T parts.
- Contact our engineering department for more detailed information.

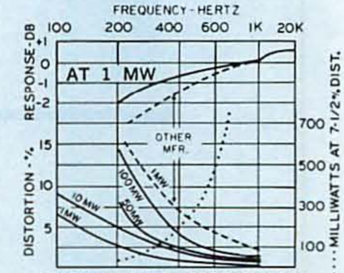
SPECIALS

For indication of possibilities of DO-T Family units custom built to your special requirements, contact our engineering department.

The stock DO-T Family are Grade 5, Class R units, for a maximum operating temperature of 105°C in accordance with MIL-T-27 Specs. On special order they can be designed to Class S requirements of MIL-T-27 (130°C maximum operating temperature). No additional life expectancy is gained by ordering Class S insulation systems for applications in the vicinity of Class R temperatures. Where the operating temperatures are above 105°C, the use of Class S insulations will afford greater life expectancy.

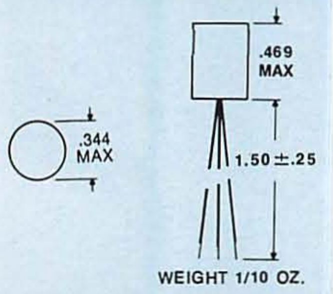
Special units with electrical modifications of changed lead lengths, modified impedance ratios, and additions of electrostatic shields, etc., are available for all DO-T Family units.

For Power DO-T Transformers (DO-T400 Series) See page 42.



TYPICAL DO-T PERFORMANCE
SOURCE : RATED PRI. IMP. AND D.C.
LOAD : RATED SEC. IMP.

DO-T®
Transistor Transformers



UNIT LOCATION KEY

Type No.	Located on Line
DO-T1	42
DO-T2	11
DO-T3	20
DO-T4	13
DO-T5	24
DO-T6	35
DO-T7	48
DO-T9	36
DO-T10	37
DO-T11	40
DO-T12	3
DO-T13	4
DO-T14	15
DO-T15	18
DO-T16	22
DO-T17	25
DO-T18	31
DO-T19	5
DO-T20	12
DO-T21	19
DO-T22	26
DO-T23	43
DO-T24	49
DO-T25	38
DO-T29	2
DO-T30	6
DO-T31	16
DO-T32	17
DO-T33	23
DO-T34	27
DO-T35	32
DO-T36	41
DO-T37	29
DO-T38	39
DO-T39	44
DO-T40	45
DO-T41	9
DO-T42	8
DO-T43	7
DO-T44	1
DO-T45	21
DO-T46	47
DO-T47	34
DO-T48	33
DO-T51	28
DO-T52	30
DO-T53	10
DO-T54	46
DO-T55	14

Locating Line	Type No.	MIL Part No.	Pri. Imp. Ω	DC ma‡ in Pri.	Sec. Imp. Ω	P. Max in mW @ 1KHz 5% Dist.	DCR ± 25% Pri.	DCR ± 25% Sec. Ser. Conn.	Turns Ratio ± 3% Pri.	Turns Ratio ± 3% Sec. Ser. Conn.
1	DO-T44	M27/172-01	80 CT 100 CT	12 10	32 split 40 split	600	9.8	6	1.58	1
2	DO-T29	M27/172-02	120 CT 150 CT	10 10	3.2 4	600	10	.46	6.12	1
3	DO-T12	M27/172-03	150 CT 200 CT	10 10	12 16	600	11	1.5	3.54	1
4	DO-T13	M27/172-04	300 CT 400 CT	7 7	12 16	600	20	1.63	5	1
5	DO-T19	M27/172-05	300 CT	7	600	600	19	89	1	1.41
6	DO-T30	M27/172-06	320 CT 400 CT	7 7	3.2 4	600	20	.46	10	1
7	DO-T43	M27/172-07	400 CT 500 CT	8 6	40 split 50 split	600	46	8	3.16	1
8	DO-T42	M27/172-08	400 CT 500 CT	8 6	120 split 150 split	600	46	26	1.82	1
9	DO-T41	M27/172-09	400 CT	8 500 CT	400 split 6	600 500 split	46	74	1	1
10	DO-T53	M27/172-10	400 CT	8 500 CT	4000 CT 6	600 5000 CT	46	550	1	3.33
11	DO-T2	M27/172-11	500 600	3 3	50 60	600	60	8	3.16	1
12	DO-T20	M27/172-12	500 CT	5.5	600	600	31	90	1	1.1
13	DO-T4	M27/172-13	600	3	3.2	600	60	.58	13.7	1
14	DO-T55	TF5R21ZZ	600 CT	4	600 CT	600	47	47	1	1
15	DO-T14	M27/172-14	600 CT 600 CT	5 5	12 16	600	43	1.5	7.07	1
16	DO-T31	M27/172-15	640 CT 800 CT	5 5	3.2 4	600	43	.46	14.1	1
17	DO-T32	M27/172-16	800 CT 1000 CT	4 4	3.2 4	600	51	.46	15.8	1
18	DO-T15	M27/172-17	800 CT 1070 CT	4 4	12 16	600	51	1.5	8.15	1
19	DO-T21	M27/172-18	900 CT	4	600	600	53	89	1.22	1
20	DO-T3	M27/172-19	1000 1200	3 3	50 60	600	115	8	4.46	1
21	DO-T45	M27/172-20	1000 CT 1250 CT	3.5 3.5	16,000 split 20,000 split	100	120	940	1	4
22	DO-T16	M27/172-21	1000 CT 1330 CT	3.5 3.5	12 16	600	71	1.5	9.15	1
23	DO-T33	M27/172-22	1060 CT 1330 CT	3.5 3.5	3.2 16	600	71	.46	18.2	1
24	DO-T5	M27/172-23	1200	2	3.2	600	105	.58	19.35	1
25	DO-T17	M27/172-24	1500 CT 2000 CT	3 3	12 16	600	108	1.5	11.2	1
26	DO-T22	M27/172-25	1500 CT	3	600	600	86	89	1.58	1
27	DO-T34	M27/172-26	1600 CT 2000 CT	3 3	3.2 4	600	109	.46	22.4	1
28	DO-T51	M27/172-27	2000 CT 2500 CT	3 3	2000 split 2500 split	125	195	125	1	1
29	DO-T37	M27/172-28	2000 CT 2500 CT	3 3	8000 split 10,000 split	125	195	455	1	2
30	DO-T52*	TF5R21ZZ	4000 CT 5000 CT	2 2	8000 CT 10,000 CT	125	320	590	1	1.41
31	DO-T18	M27/172-29	7500 CT 10,000 CT	1 1	12 16	125	505	1.6	25	1
32	DO-T35	M27/172-30	8000 CT 10,000 CT	1 1	3.2 4	125	505	.46	50	1
33	DO-T48*	TF5R21ZZ	8000 CT 10,000 CT	1 1	1200 CT 1500 CT	125	640	110	2.58	1
34	DO-T47*	TF5R21ZZ	9000 CT 10,000 CT	1 1	9000 CT 10,000 CT	125	850	1080	1	1
35	DO-T6	M27/172-31	10,000	1	3.2	125	790	.68	55.7	1
36	DO-T9	M27/172-32	10,000 12,000	1 1	500 CT 600 CT	125	780	50	4.48	1
37	DO-T10	M27/172-33	10,000 12,500	1 1	1200 CT 1500 CT	125	780	115	2.89	1
38	DO-T25	M27/172-34	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	125	780	126	2.58	1
39	DO-T38	M27/172-35	10,000 CT 12,500 CT	1 1	2000 split 2400 split	125	560	230	2.24	1
40	DO-T11	M27/172-36	10,000 12,500	1 1	2000 CT 2500 CT	125	780	190	2.24	1
41	DO-T36	M27/172-37	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	125	975	1175	1	1
42	DO-T1	M27/172-38	20,000 30,000	.5 .5	800 1200	50	830	115	5	1
43	DO-T23	M27/172-39	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	50	830	115	5	1
44	DO-T39	M27/172-40	20,000 CT 30,000 CT	.5 .5	1000 split 1500 split	50	800	113	4.47	1
45	DO-T40	M27/172-41	40,000 CT 50,000 CT	.25 .25	400 split 500 split	50	1700	60	10	1
46	DO-T54	M27/172-42	40,000 CT 50,000 CT	.25 .25	4000 CT 5000 CT	50	1700	450	3.33	1
47	DO-T46*	TF5R21ZZ	100,000 CT	0	500 CT	25	7900	85	14.14	1
48	DO-T7	M27/172-43	200,000	0	1000	25	9000	100	14.14	1
49	DO-T24	M27/172-44	200,000 CT	0	1000 CT	25	9000	100	14.14	1
50	DO-TSH		Drawn Hipermalloy shield and cover for DO-T's provides 20 to 30 db shielding. .55" h x .36" dia. 1/8" hole in cover.							
51	DO-TSH-2†		Drawn Hipermalloy shield and cover for DO-T's provides 20 to 30 db shielding. .64" h x .383" dia. 1/8" hole in cover.							

See Catalog page 42 for line of 400 cycle DO-T Transformers.

‡ maDC shown is for single ended usage.

For push-pull, maDC can be any balanced value taken by .5W transistors.

Where windings are listed as split, 1/4 of the listed impedance is available by paralleling the winding.

* Includes electrostatic shield.

† DO-TSH-2 fits over DO-TSH.

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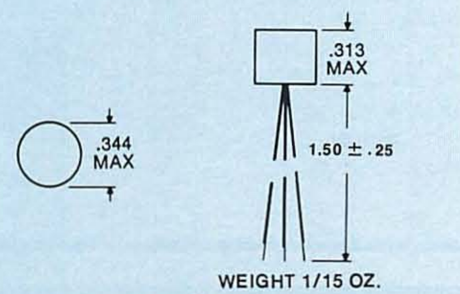
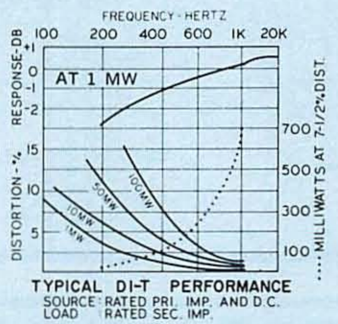
DI-T®
Transistor Transformers





Locating Line	Type No.	MIL Type	Pri. Imp. Ω	ma D.C.‡ in Pri.	Sec. Imp. Ω	Pri. DCR Ω	mw Level*	Application
1	**DI-T44**	TF5R21ZZ	80 CT 100 CT	12 10	32 split 40 split	11.5	500	Interstage
2	**DI-T56**	TF5R21ZZ	150 CT	10	150 CT	14	500	Coupling
3	**DI-T19**	TF5R21ZZ	300 CT	7	600	20	500	Output to line
4	**DI-T43**	TF5R21ZZ	400 CT 500 CT	8 6	40 split 50 split	50	500	Interstage
5	**DI-T41**	TF5R21ZZ	400 CT 500 CT	8 6	400 split 500 split	50	500	Interstage or output (Ratio 2:1:1) also wide pulse application
6	**DI-T53**	TF5R21ZZ	400 CT 500 CT	8 6	4000 CT 5000 CT	33	500	Input or driver to low noise transistor
7	**DI-T2**	TF5R21ZZ	500 600	3 3	50 60	65	100	Output
8	**DI-T20**	TF5R21ZZ	500 CT	5.5	600	32	500	Output or line to line or mixing
9	**DI-T55**	TF5R21ZZ	600 CT	4	600 CT	47	500	Isolation or Interstage (Ratio 1:1) also wide pulse application
10	**DI-T21**	TF5R21ZZ	900 CT	4	600	53	500	Output to line
11	**DI-T3**	TF5R21ZZ	1000 1200	3 3	50 60	110	100	Output
12	**DI-T5**	TF5R21ZZ	1200	2	3.2	110	100	Output
13	**DI-T22**	TF5R21ZZ	1500 CT	3	600	87	500	Output to line
14	**DI-T51**	TF5R21ZZ	2000 CT 2500 CT	3 3	2000 split 2500 split	180	100	Isolation or Interstage (Ratio 2:1:1) also wide pulse application
15	**DI-T37**	TF5R21ZZ	2000 CT 2500 CT	3 3	8000 split 10,000 split	180	100	Isolation or Interstage (Ratio 1:1:1) also wide pulse application
16	**DI-T52**	TF5R21ZZ	4000 CT 5000 CT	2 2	8000 CT 10,000 CT	300	100	Interstage Includes electrostatic shield
17	**DI-T9**	TF5R21ZZ	10,000 12,000	1 1	500 CT 600 CT	870	100	Output or driver
18	**DI-T10**	TF5R21ZZ	10,000 12,500	1 1	1200 CT 1500 CT	870	100	Driver
19	**DI-T25**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	870	100	Interstage
20	**DI-T38**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	2000 split 2400 split	620	100	Interstage
21	**DI-T11**	TF5R21ZZ	10,000 12,500	1 1	2000 CT 2500 CT	870	100	Driver
22	**DI-T36**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	970	100	Isolation or Interstage (Ratio 1:1) also wide pulse application
23	**DI-T1**	TF5R21ZZ	20,000 30,000	.5 .5	800 1200	815	50	Interstage
24	**DI-T23**	TF5R21ZZ	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	815	50	Interstage
25	**DI-TSH**	Drawn Hipermalloy shield and cover for DI-T's provides 20 to 30 db shielding .390" h x .359" dia. ⅛" hole in cover.						

* For 5% maximum distortion @ 1 KHz.

‡ ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced vlaue taken by .5W transistors.
Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding.

NOTES

FREQUENCY RESPONSE:
±3 db, 400 Hz to 100 KHz at 1 mW.

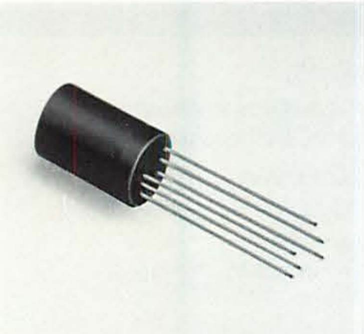
PACKAGING:
DO-T family; see Catalog Page 9

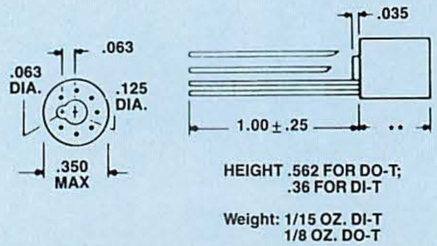
MIL SPECS:
To complete MIL-T-27 Specs. Grade 5. Class R.

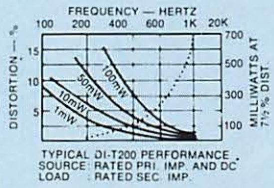
UNIT LOCATION KEY

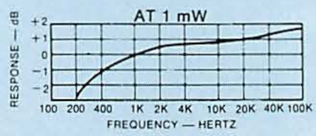
Type No.	Located on Line
DI-T1	23
DI-T2	7
DI-T3	11
DI-T5	12
DI-T9	17
DI-T10	18
DI-T11	21
DI-T19	3
DI-T20	8
DI-T21	10
DI-T22	13
DI-T23	24
DI-T25	19
DI-T36	22
DI-T37	15
DI-T38	20
DI-T41	5
DI-T43	4
DI-T44	1
DI-T51	14
DI-T52	16
DI-T53	6
DI-T55	9
DI-T56	2

DO-T200 and DI-T200
Plug-In Transformers and Inductors









Type No.	MIL Part No.	Pri. Imp. Ω	ma D.C.‡ in Pri.	Sec. Imp. Ω	Pri. DCR Ω	mw Level*	Application
DO-T255	M27/76-07	1000 CT 1200 CT	3 3	50 60	115	125	Output or matching
DO-T275	M27/76-06	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	780	125	Interstage
DO-T277	M27/76-05	10,000 CT 12,000 CT	1 1	2000 split 2400 split	560	125	Interstage
DO-T278	M27/76-04	10,000 12,500	1 1	2000 CT 2500 CT	780	125	Driver
DO-T283	M27/76-03	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	975	125	Isolation or Interstage (Ratio 1:1) also pulse application
DO-T288	M27/76-02	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	830	50	Interstage
DO-T297	M27/76-01	200,000 CT	0	1000 CT	8500	25	Input and Chopper
DO-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, .578" h x .375" dia. no cover.						
DI-T225	M27/103-15	80 CT 100 CT	12 10	32 split 40 split	11.5	500	Interstage
DI-T227	TF5R21ZZ	150 CT	10	150 CT	14	500	Coupling
DI-T230	M27/103-14	300 CT	7	600 CT	20	500	Output or line to line or matching
DI-T235	M27/103-13	400 CT 500CT	8 6	40 split 50 split	50	500	Interstage
DI-T240	M27/103-12	400 CT 500 CT	8 6	400 split 500 split	50	500	Interstage or output (Ratio 2:1:1) also wide pulse application
DI-T245	M27/103-11	500 CT 600 CT	3 3	50 CT 60 CT	65	500	Output or matching
DI-T250	M27/103-10	500 CT	5.5	600 CT	32	500	Output or line to line or mixing or matching
DI-T228	TF5R21ZZ	600 CT	3	75 CT	56	500	Output or line to line matching
DI-T255	M27/103-09	1000 CT 1200 CT	3 3	50 CT 60 CT	110	500	Output or matching
DI-T260	M27/103-08	1500 CT	3	600 CT	87	500	Output to line or matching
DI-T265	M27/103-07	2000 CT 2500 CT	3 3	8000 split 10,000 split	180	100	Isolation or Interstage (Ratio 1:1:1) also wide pulse application
DI-T270	M27/103-06	10,000 CT 12,000 CT	1 1	500 CT 600 CT	870	100	Output or driver
DI-T273	M27/103-05	10,000 CT 12,500 CT	1 1	1200 CT 1500 CT	870	100	Output or driver
DI-T276	M27/103-04	10,000 CT 12,000 CT	1 1	2000 CT 2400 CT	870	100	Interstage or driver
DI-T278	M27/103-03	10,000 CT 12,500 CT	1 1	2000 split 2500 split	620	100	Interstage or driver
DI-T283	M27/103-01	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	970	100	Isolation or Interstage (Ratio 1:1) also wide pulse application
DI-T288	M27/103-02	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	815	50	Interstage or driver
DI-T290	M27/103-16	600 CT	4	600 CT	47	500	Isolation or Interstage (Ratio 1:1) also wide pulse application
DI-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, .421" h x .375" dia. no cover.						

*For 5% maximum distortion @ 1 KHz ± ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced value taken by .5W transistors.
**DO-T .562 DI-T .360 Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding.

NOTES

PACKAGING
Metal encased. See Catalog Page 9.

MIL SPECS
To complete MIL-T-27 Specs. Ruggedized, metal encased to MIL Grade 5, Class R.

FREQUENCY RESPONSE
At 1 mW ±3 db, 300 Hz to 20 KHz. DO-T Type; ±3 db, 400 Hz to 100 KHz, DI-T Type.

TERMINALS
Leads are .016 Dumet wire, tinned, and may be either welded or soldered. They are uninsulated and are spaced on a .1" radius circle, conforming to the termination pattern of the "TO-76" cased semiconductors and micrologic elements.

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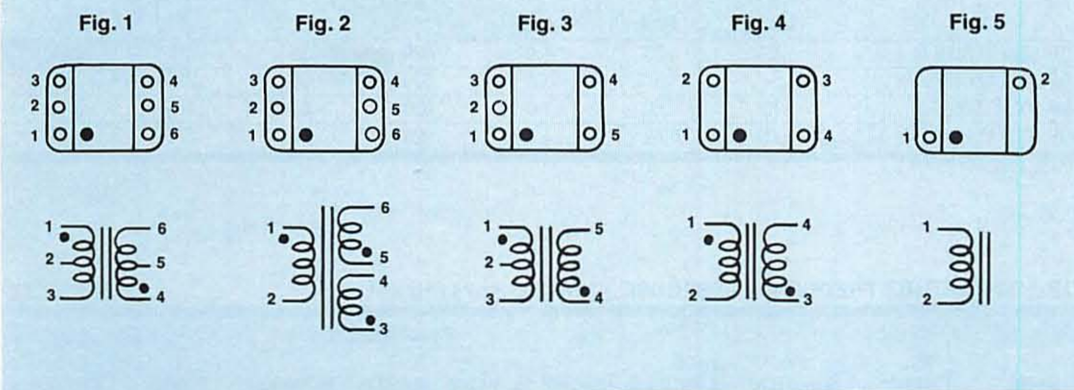
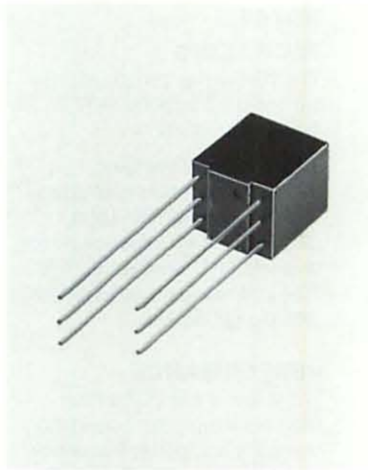
RST/RSI
Ultraminiature Plug-In Transformers and Inductors





TRANSFORMERS

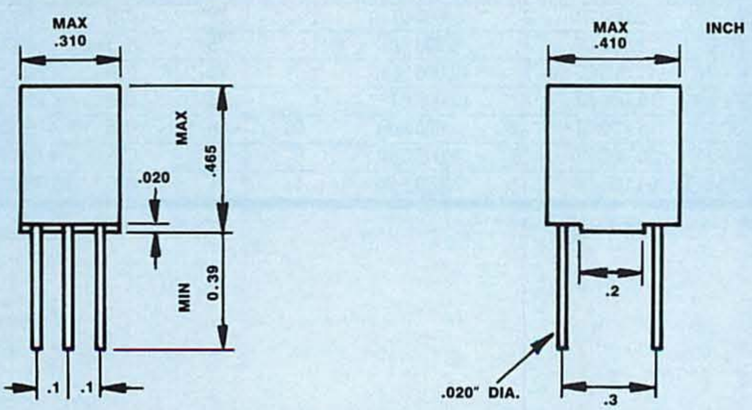
Part No.	Matching Impedance Pri	Matching Impedance Sec	Max DC Ma Unbal in Pri	DCR ±25% Pri	DCR ±25% Sec	Max Power* level MW at 300Hz	Over-all Turns Ratio	Connection Fig.
RST-09	10K CT	10K CT	1.0	1000	1300	40	1:1	1
RST-11	10K CT	2K CT	1.0	1000	300	40	2.23:1	1
RST-17	10K CT	500 CT	1.0	1000	80	40	4.47:1	1
RST-18	10K CT	4	1.0	1200	1.0	40	50:1	3
RST-24	1.5K CT	600	3.0	160	95	50	1.58:1	3
RST-31	600 CT	600 CT	3.0	70	95	50	1:1	1
RST-36	600 CT	3.2	4.5	60	0.7	50	13.7:1	3
RST-38	500	500 split	3.0	65	90	50	1:1	2
RST-42	150	12	10.0	20	2.5	50	3.54:1	4
RST-46	600	600	3.0	72	93	50	1:1	4

*Maximum distortion at rated power is 25%.

INDUCTORS

Part No.	Inductance HY	DC Ma	DCR ±25%	Connection Fig.
RSI-01	6	2.0	1800	5
RSI-02	3.5	2.0	1200	5
RSI-04	.3	4.0	40	5

MECHANICAL DIMENSIONS



NOTES

All RST Transformers and RSI Inductors are designed and constructed to meet the requirements of MIL-T-27 Grade 5, Class S.

RST is Type TF5S21ZZ
RSI is Type TF5S20ZZ
Size: .310 x .410 x .465
Weight: .1 oz.

Tinned nickel leads — .02D.

Molded case construction with base mounting pad.

Insulation Test Voltage
1000V RMS.

Frequency Response
±2db 300 Hz to 100 KHz.

TOP
Plug-In Transistor Transformers

NOTES

PACKAGING

The TOP series construction is similar to the popular DOT family of products.

They are metal encased, hermetically sealed to Grade 5 of MIL-T-27. The TOP-1000, -2000 and -3000 series provides plug-in .016 Dumet leads. The TOP-4000 series is offered with .020 Dumet leads.

PERFORMANCE

The larger-sized TOP series provides more power handling capability and better frequency response at lower frequencies. The TOP-1000 provides a lower profile (.35H) structure than the DOT size (.562H) with similar performance characteristics.

TYPICAL PERFORMANCE AT 1MW:

TOP-1000
±3db 300Hz - 75KHz
TOP-2000
±3db 150Hz - 75KHz
TOP-3000
±3db 50Hz - 30KHz
TOP-4000
±3db 20Hz - 25KHz

APPLICATIONS

Coupling, matching and isolation product capability parallels our DOT series. We invite your attention to comments on application as shown on page 9.

MIL SPECS

MIL-T-27, Class S, Grade 5, MIL Designation TF5S21ZZ. The TOP-1000, -2000, -3000 series have been assigned MIL-T-27 part numbers.

DIMENSIONS

	A MAX.	B MAX.	C ±.25	D ±.010	E ±.010	F ±.010	G ±.002
TOP-1000 SERIES	.5	.35	1.0	.020	.35	.218	.016D
TOP-2000 SERIES	.5	.50	1.0	.020	.35	.218	.016D
TOP-3000 SERIES	.75	.52	1.0	.020	.60	.475	.016D
TOP-4000 SERIES	.75	.82	1.0	.020	.60	.475	.020D

TOP-1000 SERIES FREQUENCY RESPONSE ±3 DB 300 Hz-75 KHz at 1 mW — TF5S21ZZ

Type No.	MIL Part No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 KHz & Higher	at 400 Hz	at 300 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-1265	M27/361-01	150 CT	11	150 Split	.6	.3	.16	13/18.3	1/1
TOP-1270	M27/361-02	150 CT	11	600 Split	.6	.3	.16	13/75	1/2
TOP-1290		300 CT	8	150 Split	.6	.3	.16	30/18	1.41/1
TOP-1344		500 CT	6	16 Split	.6	.3	.16	48/1.9	5.60/1
TOP-1380	M27/361-03	600 CT	5.5	600 Split	.6	.3	.16	57/79	1/1
TOP 1385*	M27/361-04	600 CT	5.5	600 CT	.6	.3	.16	53/75	1/1
TOP-1387*	M27/361-05	600 CT	5.5	1,200 Split	.6	.3	.16	53/105	1/1.41
TOP-1430		1,000 CT	4.5	1,000 Split	.6	.3	.16	103/115	1/1
TOP-1490*	M27/361-06	2,000 CT	3	2,000 CT	.6	.3	.16	198/218	1/1
TOP-1495	M27/361-07	2,000 CT	3	8,000 Split	.6	.3	.16	198/850	1/2
TOP-1640	M27/361-08	10,000 CT	1.4	10,000 Split	.6	.3	.16	855/1215	1/1
TOP-1645*	M27/361-09	10,000 CT	1.4	10,000 CT	.6	.3	.16	1060/1215	1/1
TOP-1655	M27/361-10	15,000 CT	1	600 Split	.6	.3	.16	1305/72.5	5/1

TOP-1000SH Drawn Hipermalloy Shield—.53 O.D. x .40 H

TOP-2000 SERIES FREQUENCY RESPONSE ±3 DB 150 Hz-75 KHz at 1 mW — TF5S21ZZ

Type No.	MIL Part No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 KHz & Higher	at 400 Hz	at 150 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-2265	M27/362-01	150 CT	8	150 Split	1	.75	.075	12/20	1/1
TOP-2270	M27/362-02	150 CT	8	600 Split	1	.75	.075	12/82	1/2
TOP-2300		300 CT	5	600 Split	1	.75	.075	27/66	1/1.41
TOP-2375		600 CT	4	200 Split	1	.75	.075	60/25	1.73/1
TOP-2380	M27/362-03	600 CT	4	600 Split	1	.75	.075	60/66	1/1
TOP-2385*	M27/362-04	600 CT	4	600 CT	1	.75	.075	60/68	1/1
TOP-2387	M27/362-05	600 CT	4	1,200 Split	1	.75	.075	60/116	1/1.41
TOP-2490*	M27/362-06	2,000 CT	2	2,000 CT	1	.75	.075	175/240	1/1
TOP-2495	M27/362-07	2,000 CT	2	8,000 Split	1	.75	.075	185/1015	1/2
TOP-2640	M27/362-08	10,000 CT	1	10,000 Split	1	.75	.075	780/1075	1/1
TOP-2645*	M27/362-09	10,000 CT	1	10,000 CT	1	.75	.075	715/985	1/1
TOP-2655	M27/362-10	15,000 CT	.8	600 Split	.66	.66	.075	1165/80	5/1
TOP-2695	M27/362-11	20,000 CT	.7	1,000 Split	.5	.5	.075	1750/135	4.47/1
TOP-2814	M27/362-12	100,000 CT	.3	2,000 Split	.1	.1	.075	10,000/248	7.07/1

TOP-2000SH Drawn Hipermalloy Shield—.53 O.D. x .55 H

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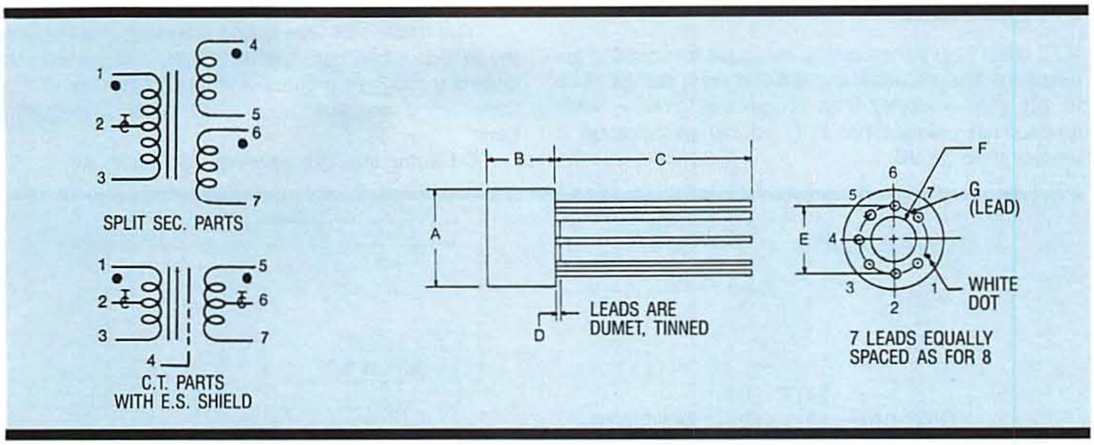
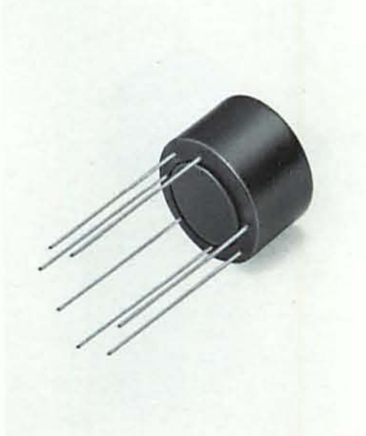
TOP
Plug-In Transistor Transformers





TOP-3000 SERIES FREQUENCY RESPONSE ± 3 DB 50 Hz-30 KHz at 1 mW — TF5S21ZZ

Type No.	MIL Part No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 KHz & Higher	Power (Watts)† at 300 Hz	Power (Watts)† at 50 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-3030		100 CT	10	100 Split	2	1.5	.03	8/11	1/1
TOP-3065	M27/363-01	150 CT	8	150 Split	2	1.5	.03	12/16.5	1/1
TOP-3070	M27/363-02	150 CT	8	600 Split	2	1.5	.03	12/66	1/2
TOP-3145		500 CT	4.5	50 Split	2	1.5	.03	40/5.5	3.16/1
TOP-3165		600 CT	4	12.8 Split	2	1.5	.03	48/1.41	6.85/1
TOP-3180	M27/363-03	600 CT	4	600 Split	2	1.5	.03	48/66	1/1
TOP-3185*	M27/363-04	600 CT	4	600 CT	2	1.5	.03	48/66	1/1
TOP-3187	M27/363-05	600 CT	4	1,200 Split	2	1.5	.03	48/132	1/1.41
TOP-3290*	M27/363-06	2,000 CT	2.2	2,000 CT	2	1.5	.03	160/220	1/1
TOP-3295	M27/363-07	2,000 CT	2.2	8,000 Split	2	1.5	.03	160/880	1/2
TOP-3440	M27/363-08	10,000 CT	1	10,000 Split	1	1	.03	800/1100	1/1
TOP-3445*	M27/363-09	10,000 CT	1	10,000 CT	1	1	.03	800/1100	1/1
TOP-3455	M27/363-10	15,000 CT	.8	600 Split	.66	.65	.03	1200/66	5/1
TOP-3495	M27/363-11	20,000 CT	.7	1,000 Split	.5	.5	.03	1600/110	4.47/1
TOP-3614	M27/363-12	100,000 CT	.3	2,000 Split	.1	.1	.03	8000/220	7.07/1

TOP-3000SH Drawn Hipermalloy Shield—.78 O.D. x .57 H

†For 5% Dist at Rated Frequency.

TOP-4000 SERIES FREQUENCY RESPONSE ± 3 DB 20 Hz-25 KHz at 1 mW, 0 DC — TF5S21ZZ

Type No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 KHz & Higher	Power (Watts)† at 300 Hz	Power (Watts)† at 20 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-4030	100 CT	10	100 Split	3	2	.006	8/10	1/1
TOP-4065	150 CT	8	150 Split	3	2	.006	12/15	1/1
TOP-4070	150 CT	8	600 Split	3	2	.006	12/60	1/2
TOP-4095	300 CT	5.5	300 Split	3	2	.006	24/30	1/1
TOP-4165	600 CT	4	12.8 Split	3	2	.006	48/1.3	6.85/1
TOP-4180	600 CT	4	600 Split	3	2	.006	48/60	1/1
TOP-4185*	600 CT	4	600 CT	3	2	.006	48/60	1/1
TOP-4187	600 CT	4	1,200 Split	3	2	.006	48/120	1/1.41
TOP-4215	900 CT	3	600 Split	3	2	.006	72/60	1.22/1
TOP-4290*	2,000 CT	2.2	2,000 CT	3	2	.006	160/200	1/1
TOP-4295	2,000 CT	2.2	8,000 Split	3	2	.006	160/800	1/2
TOP-4440	10,000 CT	1	10,000 Split	1	1	.006	800/1000	1/1
TOP-4445*	10,000 CT	1	10,000 CT	1	1	.006	800/1000	1/1
TOP-4455	15,000 CT	.8	600 Split	.66	.66	.006	1200/60	5/1
TOP-4495	20,000 CT	.7	1,000 Split	.5	.5	.006	1600/100	4.47/1

*E.S. Shield

NOTES

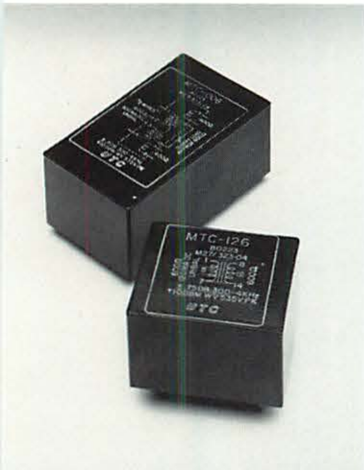
PACKAGING:
Metal encased DO-T family units. See page 9 for general data.

MIL SPECS:
To complete MIL-T-27 specs. Ruggedized, metal incased to MIL Grade 5, Class S requirements.

FREQUENCY RESPONSE: AT 1MW
TOP-1000 Series: ± 3db, 300 Hz to 75KHz
TOP-2000 Series: ± 3db, 150 Hz to 75KHz
TOP-1000 Series: ± 3db, 50 Hz to 30KHz
TOP-1000 Series: ± 3db, 20 Hz to 25KHz

TERMINALS:
Leads are .016D. Dumet wire for the TOP-1000, TOP-2000 and TOP-3000. The TOP-4000 has .020D. Dumet wire. All leads are tinned and can be soldered or welded.

MTC
Telephone Interconnect Transformers



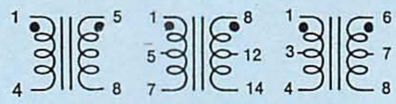
APPLICATIONS

MTC (MIL-T-27) transformers, designed for coupling applications feature unbalanced DC current ratings of up to 120 mA — higher than competitive units — while longitudinal balance per FCC 68.310 specification is greater than 60 dB.

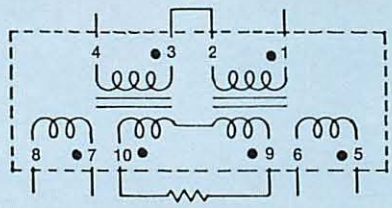
The 2-wire to 4-wire hybrid transformer is noteworthy in that it can carry up to 100 mA unbalanced DC current through its primary, and has greater than 60 dB trans-hybrid loss over the 300-Hz to 4-KHz frequency band.

Dielectric strength exceeds 1500 volts AC.

SCHEMATICS



MTC-006 MTC-109, MTC-126 MTC-076



MTC-1006

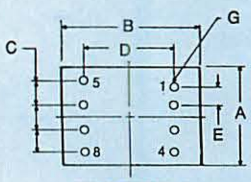


FIGURE 1

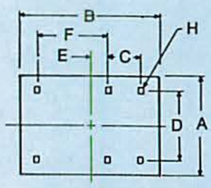


FIGURE 2

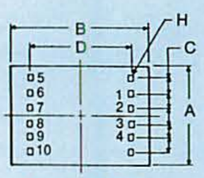


FIGURE 3

Type	MIL Part No.	A	B	Unit Height	C ±.010	D ±.010	E ±.010	F ±.010	G, Dia. ±.005	H, Sq. ±.005	Pin Ht. ±.030
MTC-006	M27/323-01	.875	1.093	.719	.20	.50	.15	—	.025	—	.125
MTC-076	M27/323-02	1.562	1.875	.750	.25	1.00	.375	.75	—	.025	.156
MTC-109	M27/323-03	1.562	1.875	1.156	.40	1.00	.20	.80	—	.025	.343
MTC-126	M27/323-04	1.562	1.875	1.156	.40	1.00	.20	.80	—	.025	.343
MTC-1006	M27/323-05	1.625	2.812	1.156	.20	2.30	—	—	—	.025	.125

Type No.	MIL Part No.	Application	Primary Impedance(Ohms)	DCR	Max Unbalanced DC Current (mA)	Secondary Impedance (Ohms)	DCR	Size
MTC-006	M27/323-01	Coupling	600	33	0	600	35	Figure 1
MTC-076	M27/323-02	Coupling	600 CT	44	70	600 CT	51	Figure 2
MTC-109	M27/323-03	Coupling	900 CT	32	100	600 CT	21	Figure 2
MTC-126	M27/323-04	Coupling	600 CT	22	120	600 CT	21	Figure 2
MTC-1006	M27/323-05	Hybrid	600 Split		100‡	600/600		Figure 3

Series	Frequency Response	Max. Power Level	Longitudinal Balance	Maximum Distortion	Impedance Matching	Return Loss	Hybrid-trans-Hybrid Loss
MTC-006	±.50 dB, 300 Hz-4 kHz	+7 dBm	60 dB min.	0.5%	—	26 dB min.*	—
MTC-076	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-109	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-126	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-1006	±.50 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	11 dB min.*	60 dB min.

* Return loss figures are lowest readings over the frequency range as measured per MIL-STD-188. For industrial use, return loss is greater than 22 dB.
‡ In 2-wire port.

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MILITARY/INDUSTRIAL
Audio Transformers and Inductors

UTC Ouncers, Subouncers and Sub-subouncers have been the industry quality standard in audio transformers for years. Now available in PC board units, with plug-in leads compatible with wave soldering, they are the industry's labor and cost saving standards as well.

TYPES:

OUNCERS:

O — Impregnated and sealed in drawn aluminum housing.
PC-O — Open frame, plug-in leads.

SUBOUNCERS:

PC-SO — Open frame, plug-in leads.
SO #P — Hermetically sealed to complete MIL-T-27 Specs, Grade 5, Class R, with plug-in leads.

SUB-SUBOUNCERS:

PC-SSO — Open frame, plug-in leads.
SSO #P — Hermetically sealed to complete MIL-T-27 Specs, Grade 5, Class R, with plug-in leads.

APPLICATIONS

These miniature transformers are used in modems, data sets, communications equipment, instrumentation, multi-channel audio consoles, for isolation, balanced to unbalanced lines, signal splitting, phase reversal and impedance matching.

NOTES

FREQUENCY RESPONSE

Ouncers: 100 Hz to 40 KHz. Subouncers: 200 Hz to 20 KHz. Sub-subouncers: 300 Hz to 20KHz.

SHIELDING

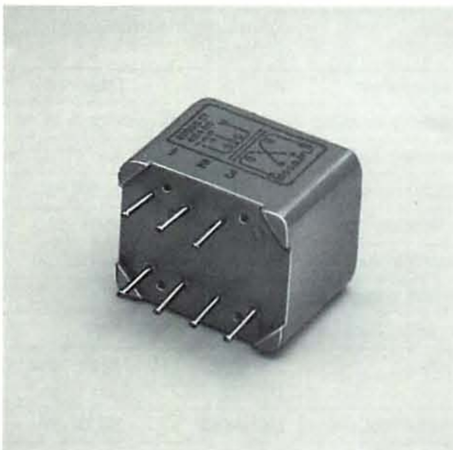
Ouncer: Hipermalloy shield, 1" O.D., is designed to slip fit over cased ouncer units, provides 25 db of shielding. PC-O Hipermalloy shield, 1.062" max. x 1.125" max. x 0.781" max., is designed to slip fit over PC-O style parts.

SPECIALS

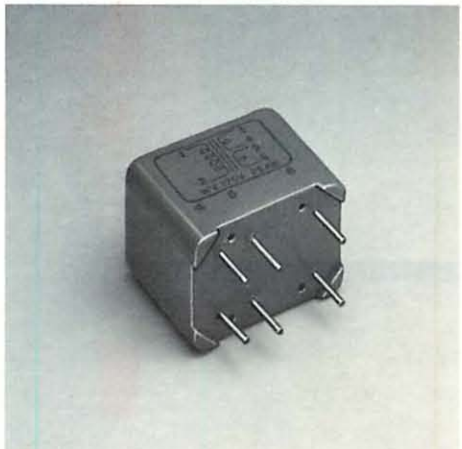
Any open frame type is available molded. Metal encased types to MIL Grade 4 can be made to your specifications.

O

SO-P

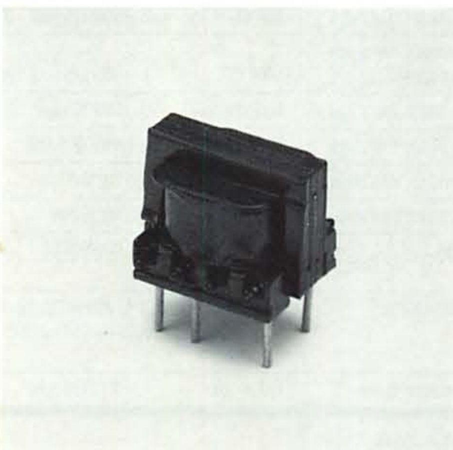


SSO-P



PC-O

PC-SO



PC-SSO

O, PC-O
Compact Audio Transformers and Inductors

Type No. O-#	Type No. PC-O-#	Application	Pri. Imp. Ω	Unbal. ma DC/Pri.	Sec. Imp. Ω	DCR ±20% Pri.	DCR ±20% Sec. Ser. Conn.	Turns Ratio ±3% Total Pri.	Turns Ratio ±3% Total Sec.	Max. Level dbm	Max. Level mw	Schem. Diag. Fig. No.	Freq. Resp. ±1 db (Hz)	Term. w/Same Polarity
1	1	Low input imp. to grid	50, 200/250, 500/600		50K	52	3900	1	10	+8	6.3	12	30-20K	1,6
2	2	Low input imp. to PP grids	50, 200/250, 500/600		50K CT	52	3900	1	10	+8	6.3	2	30-20K	1,6
3	3	Low input imp. to grid	7.5/30		50K	4.5		1	40.9	+8	6.3	13	30-20K	
4	4	Plate to grid	15K		60K	710	3200	1	2	+8	6.3	1	30-20K	1,3
5	5	Plate to grid	15K	4	60K	710	3200	1	2	+8	6.3	1	200-10K	1,3
6	6	Plate to PP grids	15K		95K CT	690	3900	1	2.5	+8	6.3	3	30-20K	1,6
7	7	Plate to PP grids	15K	4	95K CT	690	3900	1	2.5	+8	6.3	3	200-10K	1,6
8	8	Plate to line	15K		50,200/250, 500/600	950	48	5.49	1	+8	6.3	4	30-20K	1,6
9	9	Plate to line	15K	4	Same as 0-8	950	48	5.49	1	+8	6.3	4	200-10K	
10	10	PP to line	30K CT		Same as 0-8	1300	52	7.7	1	+8	6.3	5	30-20K	1,8
11	11	Crystal to line or transistor	50K		Same as 0-8	3900	53	10	1	+8	6.3	4	30-20K	1,6
12	12	Mixing matching	50, 200/250		Same as 0-8	12	45	1	1.58	+8	6.3	5	30-20K	1,6
13	13	Inductor	300 Hys @ 0DC; 50 Hys @ 3ma DC; 6000 ohms				—	—	—			10		
15	15	10:1 plate to grid	10K		1 Megohm	330	4875	1	10	+8	6.3	1	50-5K	1,3
17		Hipermalloy shield, slip fit over ouncer, 1" dia. provides 25 db shielding					—	—	—					
	17	Hipermalloy shield, slip fit over PC-O unit, 1.062" max. x 1.125" max. x .0781" max. H												
18	18	Transistor interstage	10/2.5K split	4	2K/500 split	800	204	2.24	1	+20	100	7	100-20K	1,2,5,6
19	19	Transistor interstage	10/2.5K split	4	4K/1K split	800	353	1.58	1	+20	100	7	100-20K	1,2,5,6
20	20	Transistor to line	1500 CT	8	500/125 split	100	35	1.73	1	+20	100	9	100-20K	1,4
21	21	Transistor to voice coil	2000/4000 CT	4	8/16	200	.9	15.8	1	+20	100	6	100-20K	6,1
22	22	Transistor to voice coil	400/500 CT	20	3.2/4	35	.45	11	1		1W†	6	100-20K	6,1
24	24	Inductor	1.6 Hys @ 3ma DC; .8 Hys @ 10ma DC; 25 ohms				—	—	—			10		
25	25	Transistor input	600/150 split		2K/500 split	70	280	1	1.83	+15	30	7	50-15K	1,2,5,6
26	26	Transistor interstage	10K CT	4	10K CT	700	1000	1	1	+20	100	8	100-20K	1,4
27	27	Transistor interstage	10K CT	4	500/125 split	750	52	4.5	1	+20	100	9	100-20K	1,4,5
28	28	Transistor interstage	50K CT	2	500/125 split	3200	64	10	1	+20	100	9	100-20K	1,4,5
29	29	Transistor interstage or chopper	100K CT	1	500/125 split	3200	35	14	1	+20	100	9	100-20K	1,4,5
30	30	Transistor interstage	500/125 split	20	500/125 split	37	67	1	1		1W†	7	100-20K	1,2,5,6
31	31	Transistor interstage	500/125 split	20	150/37.5 split	35	16	1.8	1		1W†	7	100-20K	1,2,5,6
32	32	Transistor interstage	500/125 split	20	50/12.5 split	37	7	3.16	1		1W†	7	100-20K	1,2,5,6
33	33	Transistor interstage	100/25 split	40	40/10 split	9	5	1.58	1		1W†	7	100-20K	1,2,5,6
35	35	Hybrid	600		600/600 CT	95 ea.	1:1:1 3 equal windings				250	11	100-20K	1,3,6
36	36	Split inductor	Series connection: 1 Hy 20 ma DC; 60 ohms Parallel connection: .25 Hys 40 ma DC; 15 ohms				—	—	—					
37	37	Transistor to line	4K/1K split		600/150 split	395	57	2.58	1		1W†	7	100-20K	1,2,5,6

† At 200 Hz, 1/4 watt at 100 Hz.

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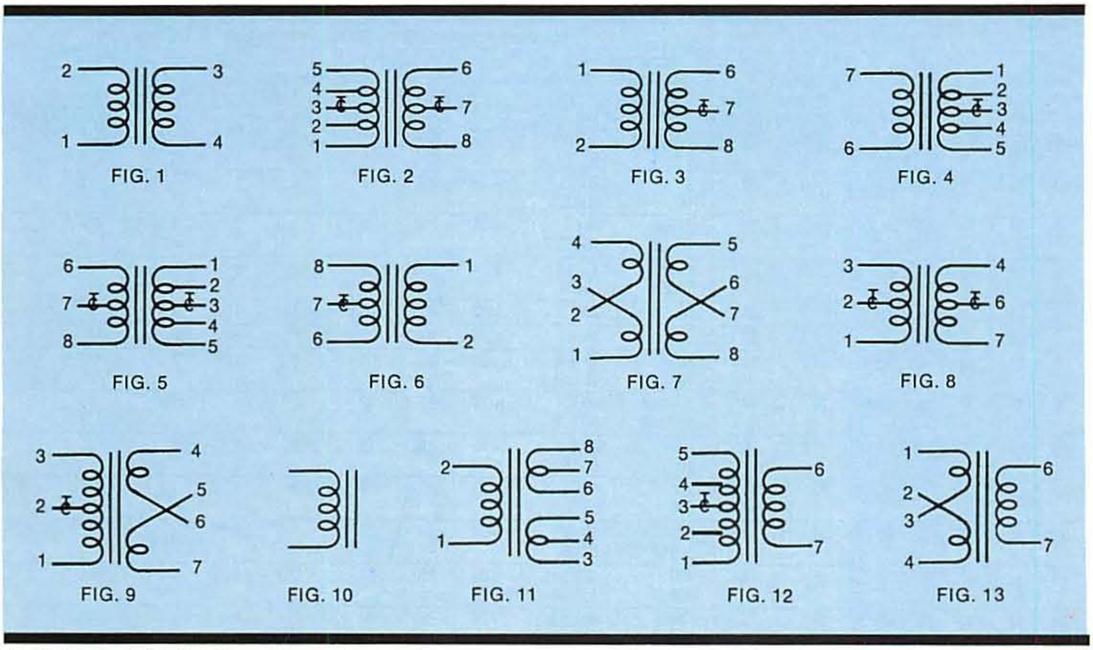
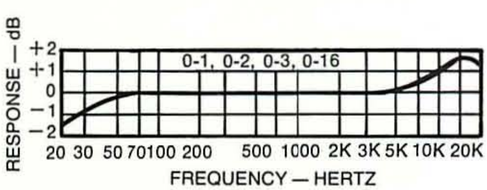
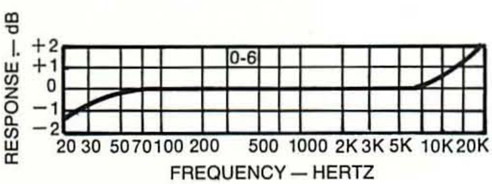
O, PC-O
Compact Audio Transformers and Inductors

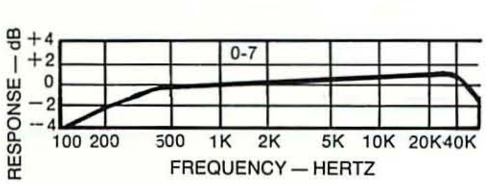


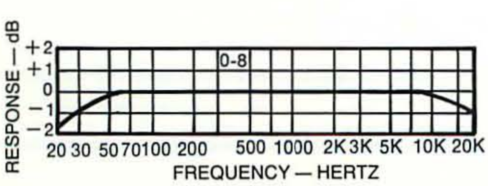
See chart on page 20 for Polarity.

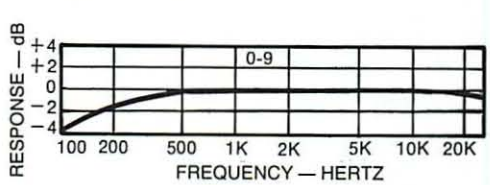
TYPICAL O-LINE RESPONSE CURVES

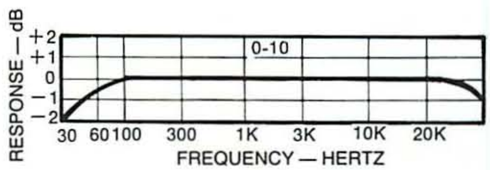


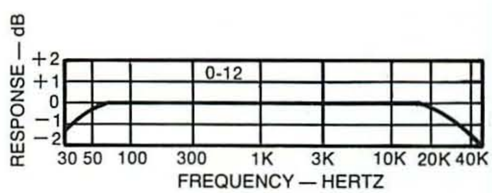


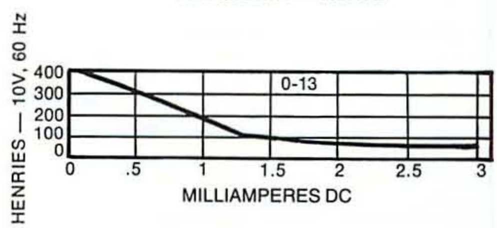


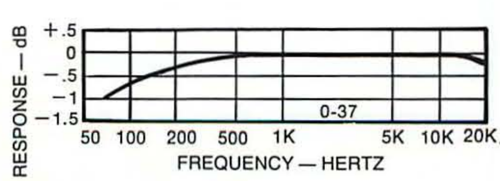






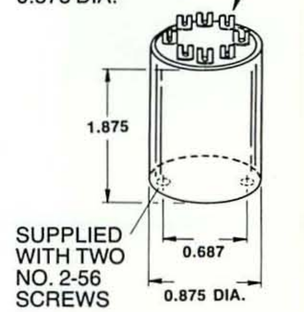






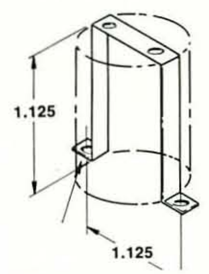
O-LINE UNIT

OUNCER TERMINALS
(0.156 HIGH)
0.109 DIA. EQUALLY SPACED AS FOR 8 ON A 0.578 DIA.



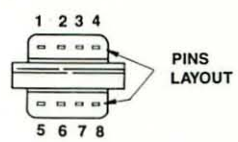
O-BR

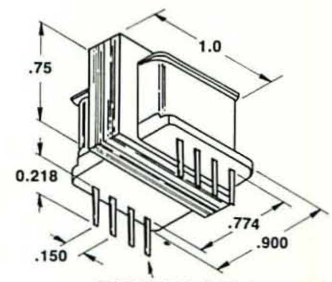
O-BR MOUNTING BRACKET
NATIONAL-22 GA. (.030) CRS.
FINISH: HOT TIN DIP



EXTRUDED & TAPPED HOLE FOR #4-40 SCREW (2)

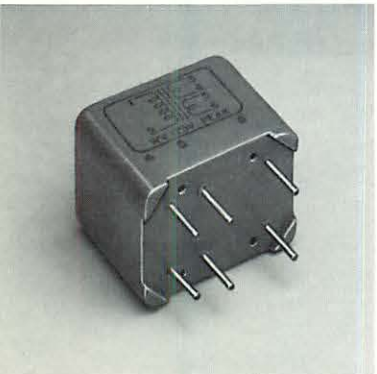
PC-O





TAPERED & FLATTENED PHOSPHOR BRONZE, SOLDER COATED PIN

SO-P, PC-SO
Miniature Audio Transformers and Inductors



Key to SO Line

SO-Type	Line Number
1	10-36
2	30-34
3	11-26
4	6-32
5	37-38
6	7-35
7	21-31
8	24-28
9	1-16
10	3-23
11	15
12	9-14
13	5-13
14	4-8
15	17
16	25
18	20-33
20	19-27
21	29
22	18-22

Input Winding							Frequency Response 200 Hz - 20KHz — Working Voltage: 175 Peak								
								Maximum Level		Series Connected DCR ± 25% Ohms		Turns Ratio ± 3%			
Line	Type No. PC-SO	Type No. SO-P	MIL Part No. for Type SO-P	E.T. Product Millivolt Sec.	Unbal. DC ma in Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	DBM	M.W.	In Pri.	Out Sec.	Pri.	Sec.	Schem. PC/P	Pins Arrange PC/P
1	9	9	M27/165-06	1.5	0	3.2	500 CT	+24	250	0.35	15	1	12.5	13/7	E/C
3	10	10	M27/165-09	4.6	60	8 16	2000 CT 4000CT	+24	250	2	290	1	15.9	13/7	E/C
4	14	14	M27/165-01	5.2	10	32 split 40 split	80 CT 100CT	+24	250	3.2	4.9	1	1.58	4/9	E/D
5	13	13	M27/165-03	5.8	2.5	40 split 50 split	400 CT 500CT	+24	250	4.5	20	1	3.16	4	E
6	4	4	M27/165-16	3.7	24	50	30K	+23	200	3.8	1850	1	24.5	8	E
7	6	6	M27/165-18	3.2	20	60	100K	+23	200	3.7	3400	1	40	8	E
8	14	14	M27/165-01	8.3	16	80 CT 100 CT	32 split 40 split	+24	250	4.9	3.2	1.58	1	4/9	E/D
9	12	12	M27/165-04	10	14	120 split 150 split	400 CT 500 CT	+24	250	12.6	20	1	1.82	4	E
10	1	1	M27/165-02	1.2	0	200 50	250K 62.5K	+10	10	16	2500	1	35	8	E
11	3	3	M27/165-11	10	21 10	200 500	10K 25K	+23	200	30	1225	1	7.1	8/1	E/A
13	13	13	M27/165-03	18	8	400 CT 500 CT	40 split 50 split	+24	250	20	4.5	3.16	1	4	E
14	12	12	M27/165-04	18	8	400 CT 500 CT	120 split 150 split	+24	250	20	12.5	1.82	1	4	E
15	11	11	M27/165-05	18	8	400 CT 500 CT	400 split 500 split	+24	250	20	45	1	1	4	E
16	9	9	M27/165-06	19	0	500 CT	3.2	+24	250	15	.35	12.5	1	13/7	E/C
17	15	15	M27/165-07	23	6	600 CT	600 split	+24	250	35	60	1	1	4/9	E/D
18	22	22	TF5R21ZZ	28	5	900 split	600 split	+24	250	72	44	1.22	1	6	E
19	20	20	M27/165-08	32	4	600 split†	10K CT	+23	200	80	1050	1	4.08	5	E
20	18	18	M27/165-17	23	9	600 split	50K CT	+24	250	63	2400	1	9.1	4/9	E/D
21	7	7	M27/165-15	9.2	2.5	800 1200	20K 30K	+23	200	32	450	1	5	8/1	E/A
22	22	22	TF5R21ZZ	23	6	600 split	900 split	+24	250	44	72	1	1.22	6	E
23	10	10	M27/165-09	7.4	4 2	2K CT 4K CT	8 16	+24	250	290	2	15.9	1	13/7	E/C
24	8	8	M27/165-12	15	2.2	2K CT	10K	+23	200	40	1000	1	2.23	2/3	E/B
25	16	16	M27/165-10	46	4	2500 CT	2500 split	+24	250	140	300	1	1	4	E
26	3	3	M27/165-11	74	3 1.5	10K 25K	200 500	+23	200	1225	30	7.1	1	8/1	E/A
27	20	20	M27/165-08	133	1	10K CT†	600 split	+23	200	1050	80	4.08	1	6	E
28	8	8	M27/165-12	34	1	10K	2000 CT	+23	200	1000	40	2.23	1	2/3	E/B
29	21	21	M27/165-13	111	1	10K CT† 12K CT†	10K split 12K split	+23	200	855	1080	1	1	5	E
30	2	2	M27/165-14	10	.25	10K	90K	+20	100	215	1850	1	3	8/1	E/A
31	7	7	M27/165-15	46	.5	20K 30K	800 1200	+23	200	450	32	5	1	8/1	E/A
32	4	4	M27/165-16	91	1	30K	50	+23	200	1850	3.8	24.5	1	8	E
33	18	18	M27/165-17	100	1	50K CT	600 split	+24	250	2400	63	9.1	1	4/9	E/D
34	2	2	M27/165-14	29	0	90K	10K	+20	100	1850	215	3	1	8/1	E/A
35	6	6	M27/165-18	130	.5	100K	60	+23	200	3400	3.7	40	1	8	E
36	1	1	M27/165-02	44	0	250K 62.5K	200 50	+10	10	2500	16	35	1	8	E

† Electrostatic Shield.

INDUCTORS

37	SO-5	Inductor, 50 Hys @ 1 maDC, 2675 ohms DC res.		
38	SO-5P PC-S05	Split Series: 40 Hys @ 1 maDC, 20 Hys @ 2 maDC, 2675 ohms Inductor Parallel: 10 Hys @ 2 maDC, 5 Hys @ 4 maDC, 670 ohms	11/10	E/A

SHIELDS Drawn Hipermalloy Shield provides 20 db Shielding

PC-SO-SH	0.968" Sq x 0.625" H
SO-P-SH	1.062" L x 0.812" W x 0.734" H

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SO-P, PC-SO
Miniature Audio Transformers and Inductors

TYPES

PC-SO — Printed circuit board mounting open frame

SO-P — Hermetically sealed type to complete MIL-T-27 Specs, Grade 5, Class R.

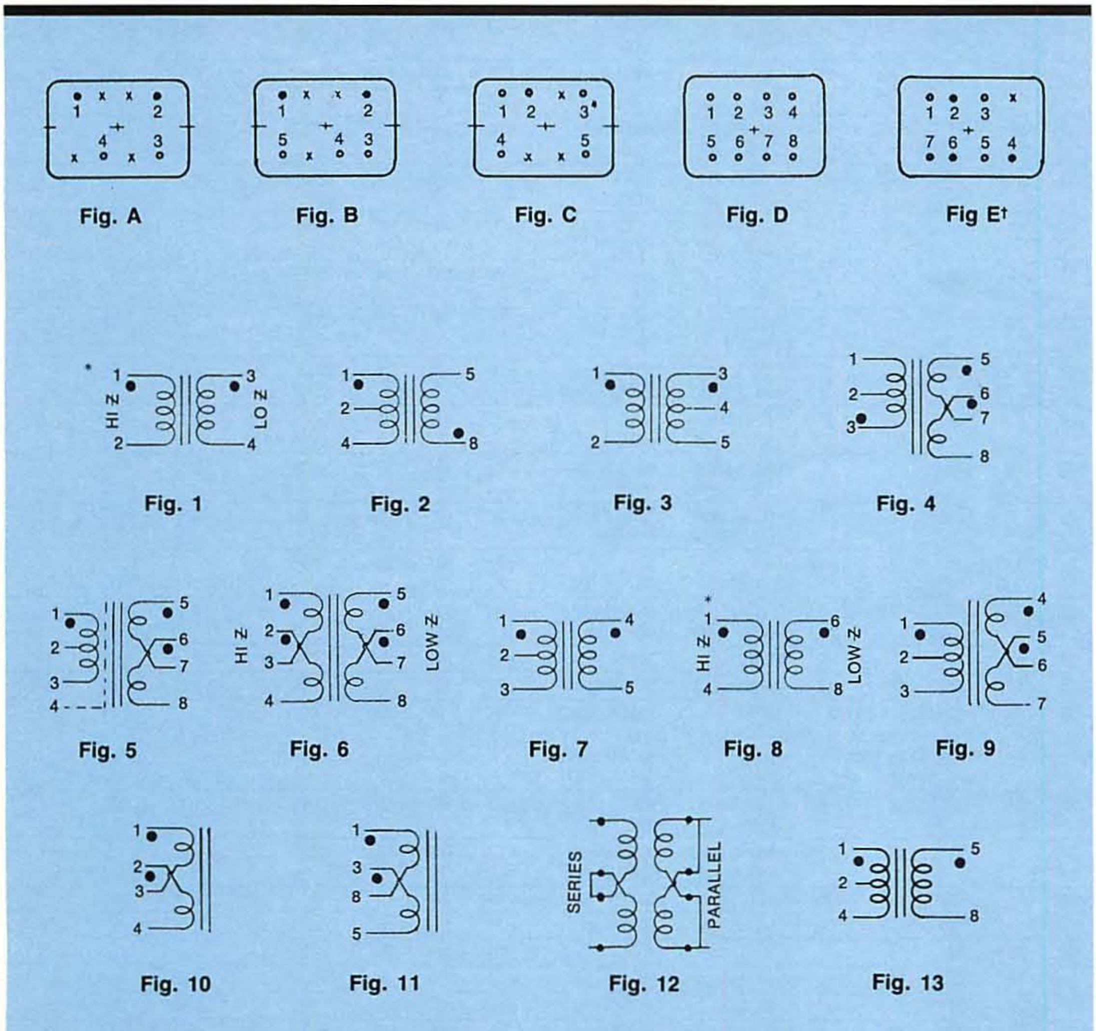
NOTES

ON PERFORMANCE CHARACTERISTICS

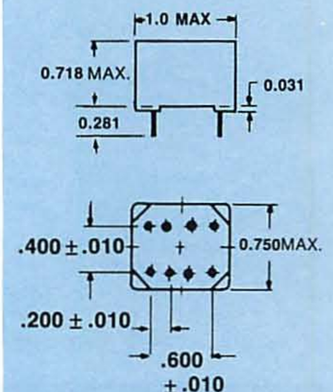
- To present the widest range of application, matching impedance values are listed in order of increasing impedance value without regard to the traditional designation of primary or secondary winding.
- The primary and secondary winding can be used arbitrarily as the input or output.
- Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
- Impedance values separated by a slash indicate the series and parallel connected impedance value of the windings.
- PC-SO Types have terminal arrangements that permit the connection of series or parallel windings by bridging adjacent terminals (see Fig. 12). This eliminates unwanted cross overs on the PC board when split is available.

(E.T. is the maximum voltage, time product for a single pulse applied to the winding.)

PIN ARRANGEMENT (Pins not used are removed. These are indicated by "x.")

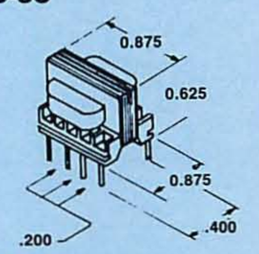


SO-P



.040 DIA. PIN UP TO 8 .200 APART

PC-SO

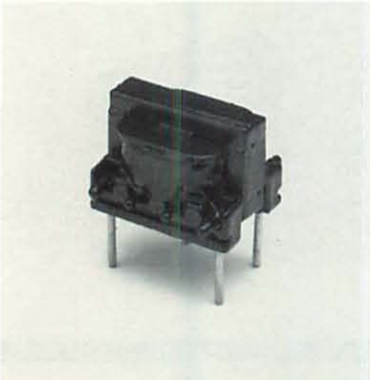


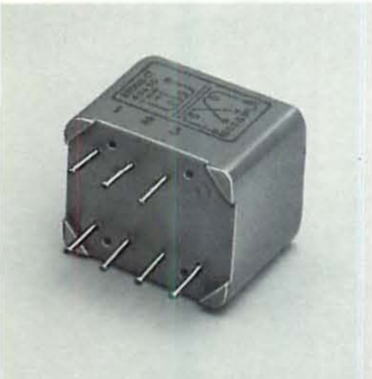
.040 DIA. PINS AS REQUIRED UP TO 8

† Pin numbers not shown in schematic will be missing.

* On PC-SO-2 and SO-2P, Hi Z and Lo Z are reversed.

SSO-P, PC-SSO
Sub-Miniature Audio Transformers and Inductors





Line	Type No. PC-SSO	Type No. SSO-P	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	Maximum Level DBM	Maximum Level M.W.	Series Connected DCR ± 25% Ohms In Pri.	Series Connected DCR ± 25% Ohms Out Sec.	Turns Ratio ± 3% Pri.	Turns Ratio ± 3% Sec.	Schematic Catalog PC/P	Pins Arrangement Catalog PC/P
	Input Winding					300 Hz - 20 KHz — Working Volts: 175 Peak								
1	16	16	1.2	54	3.2 4.0	1200 1500	+20	100	.45	70	1	18.1	9	F
2	10	10	1.5	54	3.2	10K	+20	100	.65	800	1	55.5	9	F
3	29	29	2.5	26	12.8/3.2 split* 16.0/4 split*	500/125 split* 600/150 split*	+20	100	1.5	36.2	1	6.11	6	F
4	36	36	2.5	26	12.8/3.2 split* 16.0/4 split*	4K/1K split 5K/1.25K split	+20	100	1.5	327	1	17.6	6	F
5	38	38	2.5	26	12.8/3.2 split* 16.0/4 split*	8K/2K split 10K/2.5K split	+20	100	1.5	600	1	25	6	F
6	9	9	3.3	26	16	10K	+20	100	2.7	800	1	25	9	F
7	11	11	2.5	11	50 60	500 600	+20	100	5	50	1	3.16	9	F
8	30	30	2.5	11	50/12 split* 60/15 split*	500/125 split* 600/150 split*	+20	100	6.5	36	1	3.16	6	F
9	12	12	2.5	11	50 60	1000 1200	+20	100	5.0	90	1	4.45	9	F
10	4	4	2.6	11	50	30K	+20	100	4.6	2875	1	24.5	9	F
11	6	6	2.0	15	60	100K	+20	100	3.3	3500	1	40	9	F
12	28	28	5.5	10	48/12 split* 100/25 split*	48/12 split* 100/25 split*	+20	100	5.9	6.9	1	1	6	F
13	44	44	1.2	0	100/25 split*† 200/50 split*†	100K CT 200K CT	+7	5	4.1	3290	1	31.6	5	F
14	34	34	10	0	200/50 split* 240/60 split*	1K/250 split* 1200/300 split*	+20	100	19	102	1	2.23	6	F
15	3	3	7.7	10 5	200 500	10K 25K	+20	100	34	2500	1	7.1	9/1	F/A
16	14	14	4.7	14 7	200 CT 500 CT	10K CT 25K CT	+20	100	22	560	1	7.07	13/3	F/C
17	39	39	7.7	10 5	200/50 split 500/125 split	10K/2.5K split 25K/6.25K split	+20	100	34	2500	1	7.1	6	F
18	26	26	5.7	12	400/100 split 500/125 split	40K CT 50K CT	+20	100	43	1900	1	10	4	F
19	43	43	5.7	12	400/100 split 500/125 split	40K/10K split 50K/12.5K split	+20	100	43	1900	1	10	6	F
20	29	29	5.3	8	500/125 split* 600/150 split*	12.8/3.2 split* 16/4 split*	+20	100	36.2	1.5	6.11	1	6	F
21	11	11	2.6	3.5	500 600	50 60	+20	100	50	5	3.16	1	9	F
22	30	30	2.6	3.5	500/125 split* 600/150 split*	50/12.5 split* 60/15 split*	+20	100	36	6.5	3.16	1	6	F
23	19	19	13	10	500 CT	600 CT	+20	100	26	70	1	1.1	13/3	F/C
24	31	31	13	10	500/125 split*	600/150 split*	+20	100	30	42	1	1.1	6	F
25	32	32	Hybrid, 3 equal windings Center Tapped-Trifilar		500 600	500 CT 500 CT 600 CT 600 CT	+14	25	50	50 50	1:1:1		7	F
26	17	17	18	8	500 CT 60 CT	10K 12K	+20	100	95	800	1	4.48	12	F
27	40	40	18	8	500/125 split* 600/150 split*	10K/2.5K split 12K/3.0K split	+20	100	98	1200	1	4.48	6	F
28	19	19	15	10	600 CT	500 CT	+20	100	70	26	1.1	1	13/3	F/C
29	31	31	15	10	600/150 split*	500/125 split*	+20	100	40.3	32.9	1.1	1	6	F
30	33	33	13	10	600/150 split*†	600 CT	+20	100	29	42	1	1	5	F
31	46	46	15	10	600/150 split*	900/225 split*	+20	100	43	50	1	1.22	6	F
32	20	20	15	11	600 CT	1500 CT	+20	100	65	70	1	1.58	13/3	F/C
33	35	35	13	5	600/150 split*	2K/500 split*	+20	100	40	113	1.82	1	6	F
34	27	27	6.8	11	600/150 split	4K CT	+20	100	47	155	1	2.68	4/10	F/E
35	37	37	8.5	3.2	600/150 split*†	8K CT	+10	50	55	484	1	3.65	5	F
36	7	7	8.5	2.5	800 1200	20K 30K	+20	100	110	800	1	5	9	F
37	15	15	8.5	5	800 CT 1200 CT	20K CT 30K CT	+20	100	110	800	1	5	11/3	F/D

† Electrostatic Shield   * Bifilar

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SSO-P, PC-SSO
Sub-Miniature Audio Transformers and Inductors

			Input Winding				300 Hz - 20 KHz — Working Volts: 175 Peak							
							Maximum Level		Series Connected DCR ± 25% Ohms		Turns Ratio ± 3%			
Line	Type No. PC-SSO	Type No. SSO-P	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	DBM	M.W.	In Pri.	Out Sec.	Pri.	Sec.	Schematic Catalog PC/P	Pins Arrangement Catalog PC/P
38	42	42	8.5	5	800/200 split 1200/300 split	20K/5K split 30K/7.5K split	+17	50	110	800	1	5	6	F
39	46	46	18	8	900/225 split*	600/150 split*	+20	100	50	43	1.22	1	6	F
40	12	12	11	3	1000 1200	50 60	+20	100	5	90	4.45	1	9	F
41	34	34		6	1K/25 split* 1200/300 split*	200/50 split* 240/60 split*	+20	100	102	19	2.23	1	6	F
42	13	13	3.2	0	1000	200K	+7	5	190	4000	1	14.4	9	F
43	21	21	3.2	0	1000 CT	200K CT	+7	5	200	4000	1	14.4	13/3	F/C
44	45	45	3.25	0	1000/250 split†	200K CT	+7	5	200	4000	1	14.4	5	F
45	16	16	22	3	1200 1500	3.2 40	+20	100	70	.45	18.1	1	9	F
46	20	20	23	7	1.5K CT	600 CT	+20	100	70	65	1.58	1	13/3	F/C
47	22	22	32	7	1500 CT 1800 CT	10K CT 12K CT	+20	100	300	800	1	2.58	11/3	F/D
48	35	35	25	2.5	2K/500 split*	600/150 split*	+20	100	113	40	1.82	1	6	F
49	8	8	10	2.2	2K CT	10K	+20	100	45	1200	1	2.23	12/2	F/B
50	27	27	16	2.5	4K CT	600 split	+20	100	155	47	2.58	1	4/10	F/E
51	36	36	44	2.6	4K/1K split 5K/125 split	12.8/3.2 split* 16/4 split*	+20	100	327	1.5	17.6	1	6	F
52	38	38	63	2	8K/2K split 10/2.5K split	12.8/3.2 split* 16/4 split*	+20	100	600	1.5	25	1	6	F
53	37	37	30	.6	8K CT†	600/150 split*	+7	50	484	55	3.65	1	5	F
54	9	9	82	2	10K	16	+20	100	800	2.7	25	1	9	F
55	3	3	55	3 1.5	10K 25K	200 500	+20	100	2500	34	7.1	1	9/1	F/A
56	39	39	55	3 1.5	10K/2.5K split 25K/6.25K split	200/50 split 500/125 split	+20	100	2500	34	7.1	1	6	F
57	14	14	33	2 1	10K CT 25K CT	200 CT 500 CT	+20	100	560	22	7.07	1	13/3	F/C
58	17	17	82	2	10K 12K	500 CT 600CT	+20	100	800	95	4.48	1	12	F
59	40	40	82	4	10K/2.5 split 12K/3.0K split	500/125 split 600/150 split	+20	100	1200	98	4.48	1	6	F
60	8	8	23	1	10K	2K CT	+20	100	1200	45	2.23	1	12/2	F/B
61	22	22	82	4	10K CT 12K CT	1500 CT 1800 CT	+20	100	800	300	2.58	1	11/3	F/D
62	25	25	60	1	10K CT 12K CT	10K split 12K split	+20	100	560	650	1	1	4/10	F/E
63	41	41	60	1	10K/2.5K split 12K/3.0K split	10K/2.5K split 12K/3.0K split	+20	100	560	650	1	1	6	F
64	2	2	13	.25	10K	90K	+15	30	710	3150	1	3	9	F
65	7	7	42	.5	20K 30K	800 1200	+20	100	800	110	5	1	9	F
66	15	15	42	1	20K CT 30K CT	800 CT 1200 CT	+20	100	800	110	5	1	11/3	F/D
67	42	42	42	1	20K/5K split 30K/7.5K split	800/200 split 1200/300 split	+17	50	800	110	5	1	6	F
68	4	4	64	1	30K	50	+20	100	2875	4.6	24.5	1	9	F
69	26	26	57	.5	40K CT 50K CT	400/100 split 500/125 split	+20	100	1900	43	10	1	4	F
70	43	43	57	.5	40K/10K split 50K/12.5K split	400/100 split 500/125 split	+20	100	1900	43	10	1	6	F
71	2	2	38		90K	10K	+15	30	3150	710	3	1	9	F
72	6	6	79	.5	100K	60	+20	100	3500	3.3	40	1	9	F
73	44	44	40	0	100K CT† 200K CT†	100/25 split 200/50 split	+7	5	3290	4.1	31.6	1	5	F
74	13	13	48	0	200K	1000	+7	5	4000	190	1	14.4	9	F
75	21	21	48	0	200K CT	1K CT	+7	5	4000	200	14.1	1	13/3	F/C
76	45	45	48	0	200K CT†	1K/250 split	+7	5	4000	200	14.4	1	5	F

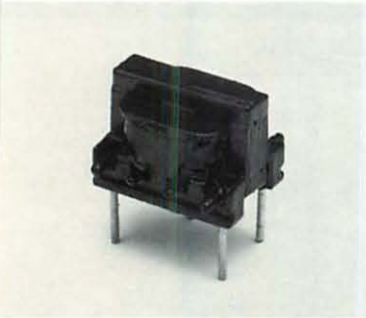
† Electrostatic Shield   * Bifilar   Magnetic Shields on Catalog page 24

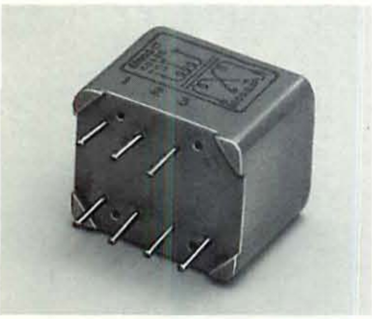
Key

SSO	Line
2	64, 71
3	15, 55
4	10, 68
6	11, 72
7	36, 65
8	49, 60
9	6, 54
10	2
11	7, 21
12	9, 40
13	42, 74
14	16, 57
15	37, 66
16	1, 45
17	26, 58
19	23, 28
20	32, 46
21	43, 75
22	47, 61
25	62
26	18, 69
27	34, 50
28	12
29	3, 20
30	8, 22
31	24, 29
32	25
33	30
34	14, 41
35	33, 48
36	4, 51
37	35, 53
38	5, 52
39	17, 56
40	27, 59
41	63
42	38, 67
43	19, 70
44	13, 73
45	44, 76
46	31, 39

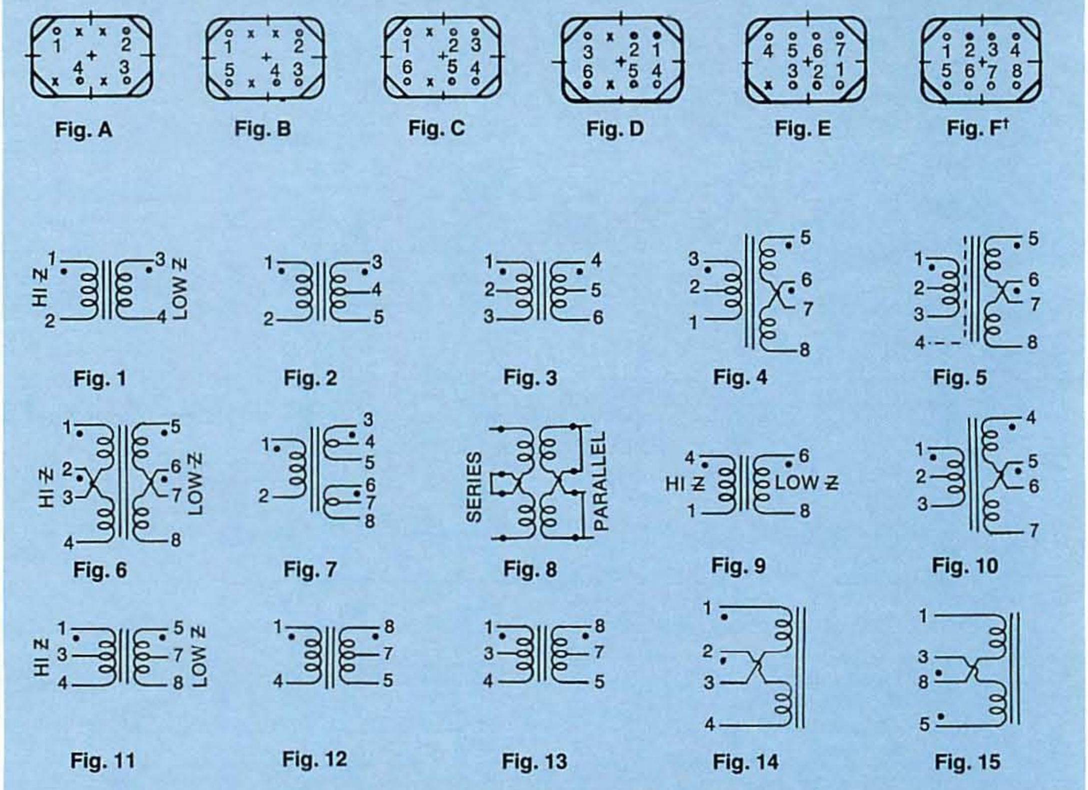
See page 24 for
- Inductors
- Schematics
- Pin Diagrams
- Outline Drawings

SSO-P, PC-SSO
Sub-Miniature Audio Transformers and Inductors

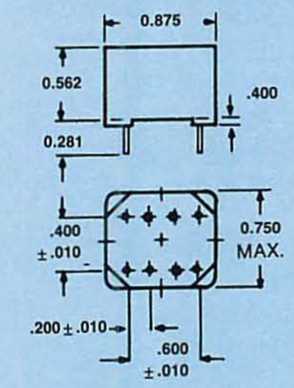




PIN DIAGRAMS (Pins not used are removed. These are indicated by "x.")

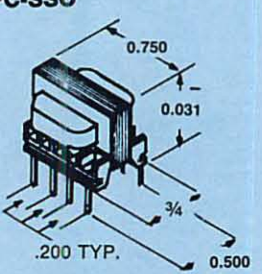


SSO-P



.040 DIA. PIN
UP TO 8
.200 APART (TYP.)

PC-SSO



.040 DIA. PINS
AS REQUIRED
UP TO 8

SHIELDS-DRAWN HIPERMALLOY SHIELD PROVIDES 20 db SHIELDING

PC-SSO-SH	0.843 Sq x 0.500 H
SSO-P-SH	1.000 L x 0.812 W x 0.593 H

INDUCTORS

		P/PC Sch.	P/PC Pin Diag.
PC-SSO-5 SSO-5P	Split Series: 100 Hys @ 0 ma DC, 50 Hys @ 1 ma DC, 4400 ohms Parallel: 25 Hys @ 0 ma DC, 12 Hys @ 2 ma DC, 1100 ohms	15/14	F/A
PC-SSO-23 SSO-23P	Split Series: 8 Hys @ 2 ma DC, 4 Hys @ 5 ma DC, 600 ohms Parallel: 25 Hys @ 4 ma DC, 1 Hy @ 10 ma DC, 150 ohms	15/14	F/A
PC-SSO-24 SSO-24P	Split Series: 3.5 Hys @ 2 ma DC, 1.5 Hys @ 5 ma DC, 160 ohms Parallel: 0.9 Hy @ 4 ma DC, 0.4 Hy @ 10 ma DC, 40 ohms	15/14	F/A

MIL-PART NUMBER DESIGNATIONS

Type No.	Part No.	Type No.	Part No.	Type No.	Part No.	Type No.	Part No.	Type No.	Part No.
SSO-1P	M27/167-02	SSO-10P	M27/167-20	SSO-19P	M27/167-07	SSO-28P	M27/167-03	SSO-37P	M27/167-12
SSO-2P	M27/167-32	SSO-11P	M27/167-05	SSO-20P	M27/167-17	SSO-29P	M27/167-04	SSO-38P	M27/167-21
SSO-3P	M27/167-01	SSO-12P	M27/167-14	SSO-21P	M27/167-41	SSO-30P	M27/167-06	SSO-39P	M27/167-24
SSO-4P	M27/167-35	SSO-13P	M27/167-40	SSO-22P	M27/167-29	SSO-31P	M27/167-08	SSO-40P	M27/167-27
SSO-5P	TF5R20ZZ	SSO-14P	M27/167-25	SSO-23P	TF5R20ZZ	SSO-32P	M27/167-11	SSO-41P	M27/167-31
SSO-6P	M27/167-38	SSO-15P	M27/167-34	SSO-24P	TF5R20ZZ	SSO-33P	M27/167-09	SSO-42P	M27/167-13
SSO-7P	M27/167-33	SSO-16P	M27/167-16	SSO-25P	M27/167-30	SSO-34P	M27/167-15	SSO-43P	M27/167-37
SSO-8P	M27/167-28	SSO-17P	M27/167-26	SSO-26P	M27/167-36	SSO-35P	M27/167-10	SSO-44P	M27/167-39
SSO-9P	M27/167-22	SSO-18P	M27/167-23	SSO-27P	M27/167-18	SSO-36P	M27/167-19	SSO-45P	M27/167-42

† Pin numbers not shown in schematic will be missing.

GENERAL INFORMATION
Power Transformers and Inductors

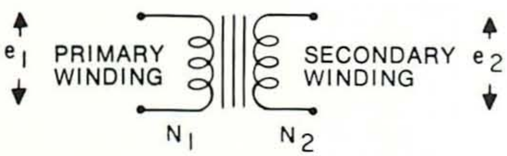
POWER TRANSFORMERS

A power transformer transforms voltage and currents to higher or lower magnitudes with the purpose of converting prime supply voltages to specific application requirements.

UTC manufactures a wide variety of power transformers for military, space, industrial and commercial application.

FUNDAMENTALS

The simplest transformer consists of two windings.



The primary winding is connected to the alternating current voltage source and the secondary winding is connected to the load.

The physical law governing induction in the windings is:

$$e = N \frac{d\phi}{dt} \times 10^{-8}$$

This law can be stated: The voltage induced in a coil is proportional to the number of turns and to the time rate of change of magnetic flux in the coil.

In a power transformer the flux links between coil windings is almost perfect, consequently

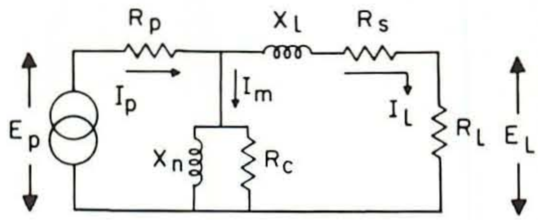
$$\frac{e_1}{e_2} = \frac{N_1}{N_2}$$

where e_1 is the source of voltage and e_2 is the output voltage,

$\frac{N_1}{N_2}$ is the turns ratio.

EQUIVALENT CIRCUIT

For simplicity of analysis a transformer with a $\frac{N_1}{N_2} = 1$ is shown. This model can be extended to other turns ratios by the use of scaling factor $\left(\frac{N_1}{N_2}\right)^2$.



R_P = Primary winding DC resistance.

R_S = Secondary winding DC resistance.

X_N = Represents an inductive reactance that causes a current to flow which produces the flux in the transformer magnetic core.

R_C = Is a resistance that represents the losses in the magnetic core of the transformer. These loses are of two types: hysteresis and eddy currents. Hysteresis refers to losses due to movement of the core molecules. Eddy currents are the currents induced in the core due to core material conductivity.

X_L = Represents an inductive reactance caused by the magnetic flux that does not couple both coils. It is shown as an inductance and is the result of imperfect coupling. This parameter is called leakage inductance.

R_L = Load resistance represents the device that is being powered by the transformer and constitutes useful power.

E_P = Input Voltage.

I_P = Input Current.

I_M = Current due to X_n and R_c called magnetization of exciting current.

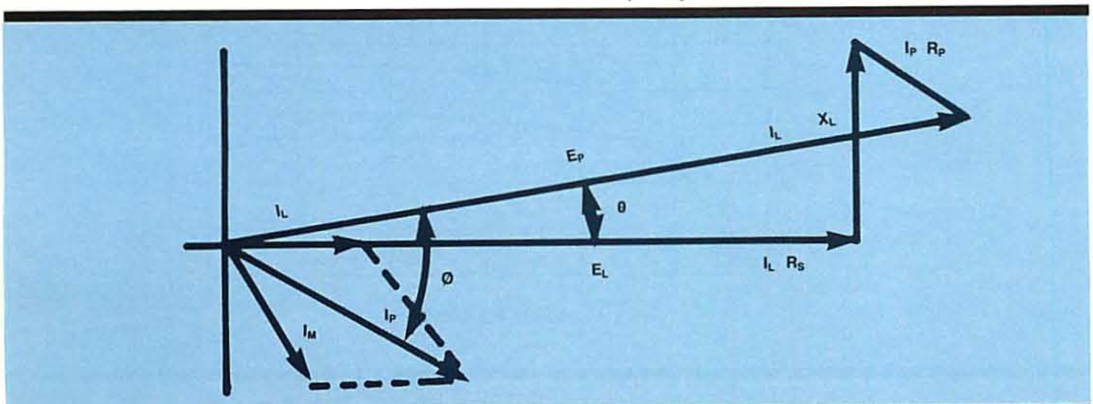
E_L = Load Voltage.

I_L = Load Current.

VECTOR DIAGRAM

The diagram below shows the result of the transformer parameters considered in the equivalent circuit and their terminology.

Although we assumed a $\frac{N_1}{N_2} = 1$ transformer E_L is smaller than E_P due to voltage drops $I_L R_S$, $I_P R_P$ and $I_L X_L$. In the unloaded transformer I_L would not exist and I_P would equal I_M, which normally is small compared to I_L. Consequently,



GENERAL INFORMATION
Power Transformers and Inductors

$$\frac{E_P}{E_L} = \frac{N_1}{N_2} \text{ very closely.}$$

1. Percent regulation $= 100 \dfrac{(E_{NL}-E_L)}{E_L \text{ Loaded}}$
2. Power Factor $= \dfrac{\text{Output power plus losses}}{\text{Imput volt-amps}}$ and is numerically equal to cosine ø.
3. Efficiency $= \dfrac{\text{Output power}}{\text{Output power plus losses}}$
4. Phase Shift between E_L and E_P sine wave shown as angle θ. Actual losses which show up as heat in the transformer and cause a temperature rise show up in the diagram at the following points:
   1. Core loss $= I_M^2 R_C$
   2. Primary winding losses $= I_P^2 R_P$
   3. Secondary winding losses $= I_L^2 R_S$

   Total losses is the sum of these losses.

POWER INDUCTORS

An inductor is used to impede the flow of AC current. They offer a high impedance to alternating currents but allow DC current to flow.

The principal purpose of these inductors is to reduce the AC ripple in rectifier power supplies in conjunction with capacitors. They are specified by inductance and DC current capability.

HERMETIC POWER COMPONENTS
HIGHEST INDUSTRIAL AND MILITARY RELIABILITY

UTC hermetic power components have found wide acceptance for industrial electronics equipment where the highest reliability is important. The insulation operating temperature (ambient temperature plus transformer's temperature rise) in a transformer considerably controls its life and reliability.

For military application ambient is based on 65°C, for Class R units. This allows a 40°C rise for the maximum final temperature of 105°C prescribed for Class R units in MIL-T-27.

Most of the power components offered are rated for Class S. These units are allowed a maximum final temperature of 130°C. MIL-T-27 allows the use of a higher temperature class unit for a lower temperature application. Therefore, a Class S unit may be used in a Class R application. Class S units are equally as reliable as Class R temperatures.

Industrial applications ambients are appreciably lower. As a result, the temperature rise can be approximately 15°C higher (40°C to 55°C rise), still providing the same overall life and reliability. This results in the ability to operate the same components at somewhat greater ratings.

The listing for AC and DC voltages and rated currents for our MET and H Series on pages 40 and 41 and the MET Series on page 42 is given for both MIL-T-27 and Industrial Service, the latter in bold type.

These units exceed MIL-T-27 requirements in many respects. The insulations employed have exceptional safety factors. The use of special core materials provides high efficiency and small size. The transformer regulation has been a fundamental design consideration in all units to provide for diverse applications in which they may be employed.

UTC has expanded its presentation of components designed for switch mode application. The components listed on pages 28 thru 38 consist of inverter transformers, gate drive transformers and an array of high frequency inductors of great variety in current and power range.

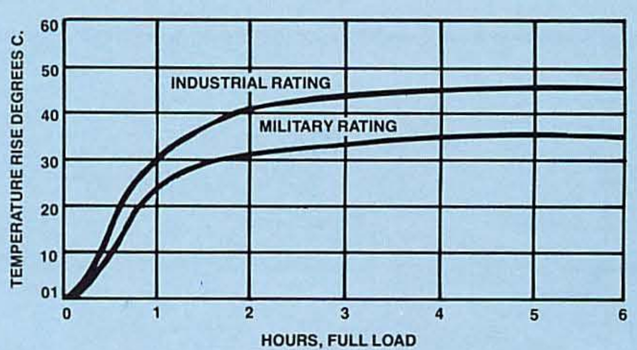
Our commitment is to continually expand this product line as the industry applications require.

We offer our full engineering assistance to develop your special requirements that cannot be served by the products offered.

SPECIAL DESIGNS

In addition to the needs met by UTC stock power components, there are many unique applications which require special units. These custom designs, produced to customer specifications, range from milliwatts to 100 KVA capacity. They comprise temperature ranges from Class R (105°C) to Class U (higher than 170°C). All types of mechanical and electrical configurations are available. Special engineering emphasis is placed on customer requirement.

Our engineering and laboratory facilities are uniquely equipped to handle customer problems in tough design areas such as shielding, corona, reliability, high voltage, miniaturization, etc.



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SELECTION GUIDE
Standard Power Transformers and Inductors

ALL PRODUCTS MILITARY TYPES

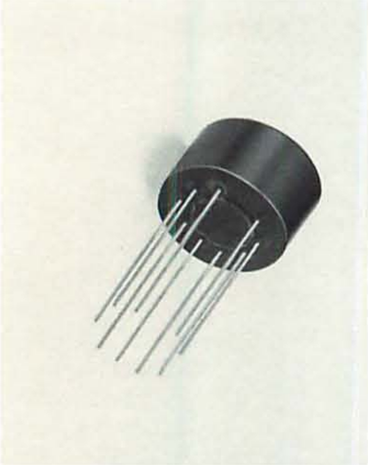
SWITCH MODE COMPONENTS

Product Series	Description	MIL Grade	Size	Weight	Current Rating	Power Range	Page
GDT	Gate drive transformer, encapsulated, plug-in	5	See Page 29	1.2 oz.	1.5A	—	29
CMA CMB CMC	Common Mode Inductors, encapsulated, plug-in	5	.811 × .500H .956 × .625H 1.142 × .728H	.033 lbs. .052 lbs. .09 lbs.	1.1 to 2.4A RMS 2.0 to 4.4A RMS 2.2 to 4.8A RMS	1 to 9 mHy 1 to 9 mHy 3 to 16 mHy	36
CSL	Current Sense Inductors, encapsulated, plug-in	5	.670 × .375 × .785	.2 oz.	8V per A–	—	30
LL	Axially Leaded Miniature Power Inductors	5	.49 × 365D	4.5 gr.	.25 to 3ADC	30µH to 5000µH	31
RML-100 RML-200 RML-300 RML-400	Power Inductors, molded wide range of inductances and current ratings	5 5 5 5	.698D × 1.04H .83 D × 1.04H 1.095D × 1.04H 1.515D × 1.32H	.05 lbs. .08 lbs. .15 lbs. .40 lbs.	2.0 to 11.4ADC 1.4 to 11.3ADC 1.4 to 8.4ADC 1.5 to 9.0ADC	18 to 560µhy 22 to 1500µhy 78 to 3600µhy 250 to 9600µhy	32, 33
			Windings Single Double				
SRA SRB SRC	Low inductance, Hi Current miniature molded plug-in Inductors	5	.875 × .438H .563 1.188 × .563H .688H 1.375 × .750H .813H	.6 oz. 1.5 oz. 3 oz.	1.2 to 15ADC 1.2 to 15ADC 1.1 to 13.6ADC	8µ to 1250µh 20µ to 3000µh 60µ to 10000µh	34 34 35
SRD	Wide Inductance Range, Hi Current molded	5	2.395 × 1.500H	14 oz.	.125 to 13ADC	500µh to 5.6 h	35
PS	Inverter Transformers, encapsulated, plug-in	5	.750 × .470H .900 × .525H 1.00 × .650H	10 gr. 12 gr. 24 gr.	50-100 KHz	16 to 60 W	28

LINEAR POWER COMPONENTS

Product Series	Description	MIL Grade	Size	Weight	Operating Frequency	Power Range	Page
DOT	Metal clad Flexible lead miniature power transformers	5	.312 × .406D	0.1 oz.	380 Hz to 2400 Hz	400mW	42
FP	Low Profile Power Transformers' 115V. Pri., Secondaries deliver 2 to 30 Volts	5	1.24 sq. × .62H 1.75 sq. × .62H 2.25 sq. × .62H	.125 lbs. .25 lbs. .38 lbs.	400 Hz	10W to 30W	39
H	Metal clad Hermetically sealed to MIL-T-27 115V Pri. Universal Transistor Supply Transformers	4	See MIL Case Size Page 40	.375 lbs. to 21 lbs.	60 Hz	.78VA to 400VA	40, 41
H	Molded transformers	5	See Page 42	.02 to 1.5 lbs.	400 Hz	1W to .57W	42
MET 445-495	Metal clad Hermetically sealed to MIL-T-27 115V Pri. Universal Transistor Supply Transformers	4	See MIL Case Size Page 40	.375 lbs. to 4.5 lbs.	400 Hz	7VA to 170VA	40, 41
MET 400, 405, 420	Metal clad Hermetically sealed to MIL-T-27 115V Pri. Universal Transistor Supply Transformers	4	See MIL Case Size Page 40	.375 lbs. to 1.75 lbs.	380-1KHz	3.8VA to 46VA	42
MET 430	Metal clad Hermetically sealed to MIL-T-27 115V Pri. Universal Transistor Supply Transformers	4	FA	1.75 lbs.	400 Hz	51VA	42

PS
Inverter Transformers



APPLICATION
Transformers for inverter circuits to provide common output feed voltages and currents. Can be used for both MOSFET and bi-polar drive circuits. 50KHz-100KHz parts providing high power and high efficiency in small sizes. DC to DC efficiency of 75 to 80% including semiconductor and rectifier losses.

PACKAGING
MIL-T-27 TF5V03YY types. Grade 5 units for up to Class V (155°C) operating temperatures.

CONSTRUCTION
PC mounting styles. Largest unit features insert mounting for sturdiness. Parts are magnetically shielded.

PS INVERTER TRANSFORMER

Part Number	Output/W	S1 DC Output	S2 DC Output	Size
PS-300	16	± 12V @ 0.25A	+5V @ 2A	.750"D x .470"H
PS-310	16	± 15V @ 0.20A	+5V @ 2A	.750"D x .470"H
PS-400	38	± 12V @ 0.75A	+5V @ 4A	.900"D x .525"H
PS-410	38	± 15V @ 0.60A	+5V @ 4A	.900"D x .525"H
PS-500	60	± 12V @ 1.25A	+5V @ 6A	1.000"D x .650"H
PS-510	60	± 15V @ 1.0A	+5V @ 6A	1.000"D x .650"H

NOTES
Freq. Range: 50-100 KHz

P.C. mounting style. Largest unit features insert for sturdiness

MIL-Type TF5V03YY, Class V environment

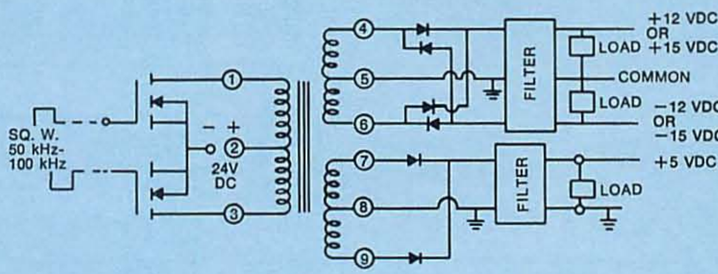
DWV = 100V RMS

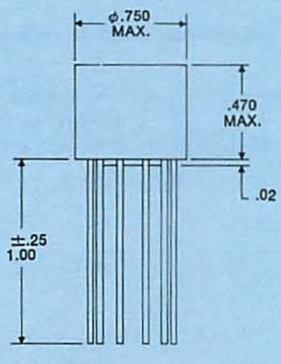
Can be used for both MOSFET and bi-polar drives

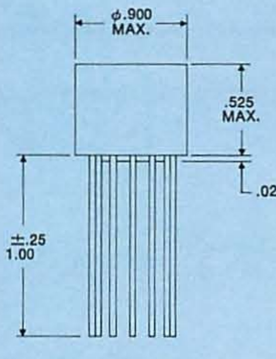
Magnetically shielded

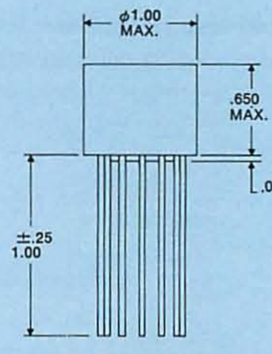
DC to DC efficiency of 75-80%, including all semiconductor and rectifier losses.

Multiple benefits: hi-frequency, hi-power, hi-efficiency.









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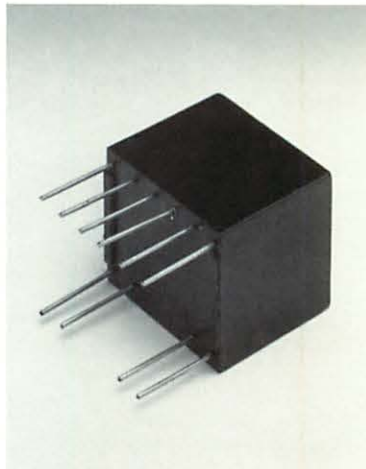
GDT
Gate Drive Transformers

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Case Fig.	Schematic Fig.	Turns Ratio ±5% N1:N2:N3	Pri. Ind., N1 mH Min. at IV, 1 kHz (½ of winding)	Leakage Ind. N3 μ H Max. Short N1	dc Resistance Ohms Max. N1	N2	N3
GDT-100	1	1	15:15:5	1.25	.85	.80	.70	.055
GDT-200	1	2	15:15:5	1.25	.85	.80	.70	.055
GDT-300	1	1	30:15:5	5.00	.85	1.60	.70	.055
GDT-400	1	2	30:15:5	5.00	.85	1.60	.70	.055
GDT-500	2	3	30:19	5.00	1.2	.29	.21	
GDT-600	3	4	14:14	.40	1.5	.07	.12	
GDT-700	4	5	14:14	.50	1.0	.08	.08	



SCHEMATICS

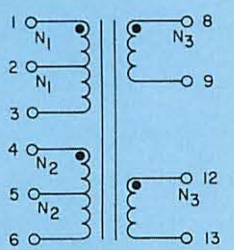


FIGURE 1

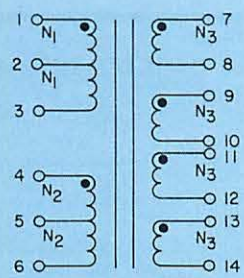


FIGURE 2

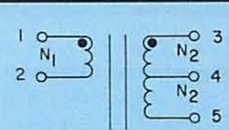


FIGURE 3

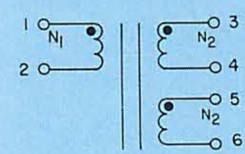


FIGURE 4

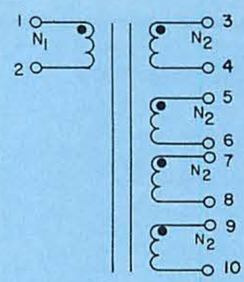


FIGURE 5

N_1 = PRIMARY END TO C.T.

N_2 = CLAMP END TO C.T. (FIGS. 1, 2)
INDIVIDUAL SECONDARIES (FIGS. 3, 4, 5)

N_3 = INDIVIDUAL SECONDARIES (FIGS. 1, 2)

DIELECTRIC STRENGTH:
2500 V RMS PRI. TO ANY SECONDARY,
1500 V RMS BETWEEN SECONDARIES,
500 V RMS PRI. TO CLAMP AND
2500 V RMS CLAMP TO ANY SECONDARY.
3750 V RMS ON SPECIAL ORDER

CASE DIMENSIONS

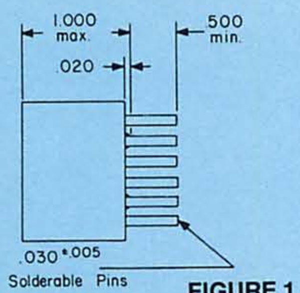


FIGURE 1

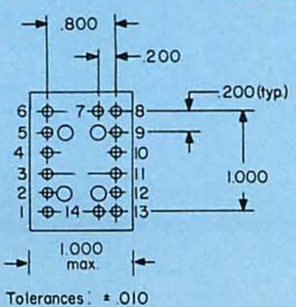
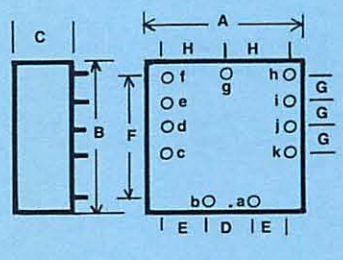


FIG.	2	3	4
A	.88	1.0	1.5
B	.94	1.0	1.5
C	.65	.65	.65
D	.70	.50	.50
E	.10	.15	.40
F	.80	.80	1.30
G	—	.30	.30
H	.25	—	—



FIGURES 2, 3, 4

PIN	a	b	c	d	e	f	g	h	i	j	k
GDT-500	1	2				3	4	5			
GDT-600	1	2			3	4		5	6		
GDT-700	1	2	3	4	5	6		7	8	9	10

NOTES

Encapsulated construction with PC BD pins.

Designed for up to 30VDC input, 50 KHz operating frequency.

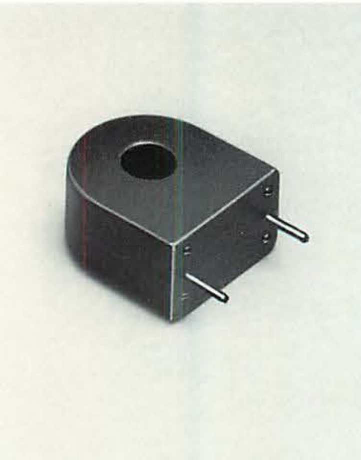
Clamp winding provided, some designs.

Provides peak base current to 1.5A.

Designed to meet MIL-T-27, TF5S03ZZ.

Designs for bi-polar and FET.

CSL
Current Sense Inductors



ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Schematic Figure	Turns ± %	Inductance (Term 1-3) mH Min.	Inductance Test Volts 15.75 kHz	DC Resistance (1-3) Ohms Max.	Rated* Terminating Resistance,(Ω)
CSL-005	1	50	5.0	0.50	0.70	50
CSL-020	1	100	20.0	1.00	1.40	100
CSL-080	1	200	80.0	2.00	4.50	200
CSL-105	2	50 C.T.	5.0	0.50	0.70	50
CSL-120	2	100 C.T.	20.0	1.00	1.40	100
CSL-180	2	200 C.T.	80.0	2.00	4.50	200
		(1-2, 3-4)	(1-2, 3-4)	(1-2, 3-4)	(1-2, 3-4)	(1-2, 3-4)
CSL-205	3	50	5.0	0.50	0.70	50
CSL-220	3	100	20.0	1.00	1.40	100

Other turns ratios available on special order.

CSL FEATURES

NOTES

- Designed for switching power supply applications. Push, pull, half bridge, full bridge.
- Molded construction. Void free.
- Meets MIL-T-27, TF5S36ZZ.
- Frequency range 50 KHz and above. To 8 volts per amp.
- 0.02 in. minimum material thickness from hole I.D. to coil.
- Dielectric strength 2500 volts RMS minimum, primary to secondary.

SCHEMATICS

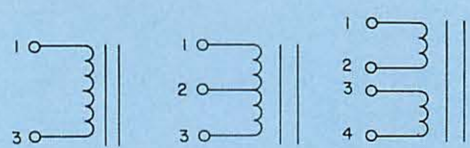
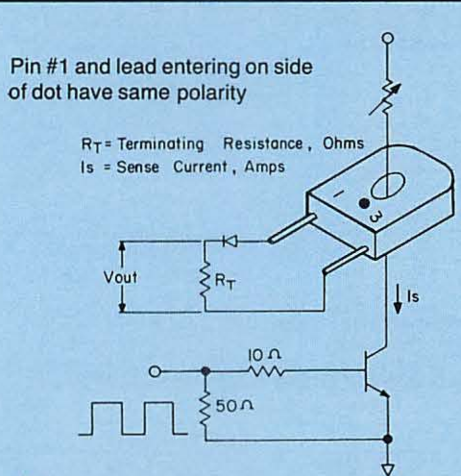


Fig. 1 Fig. 2 Fig. 3

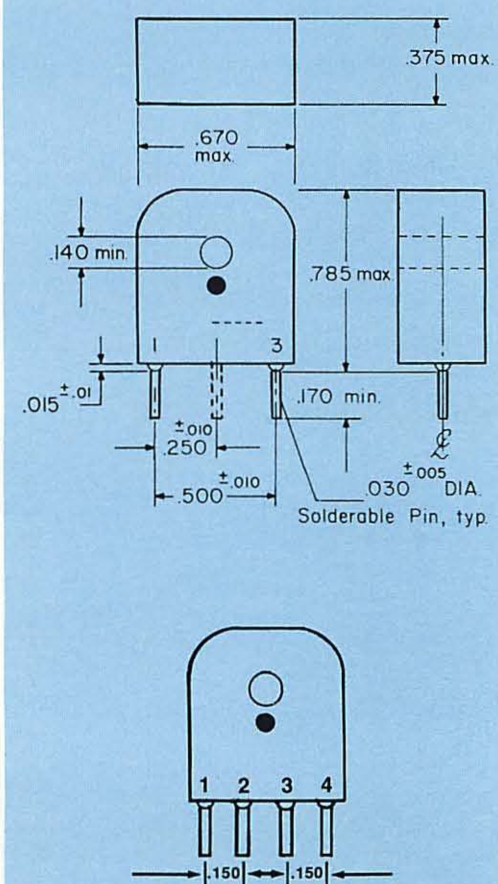
SCALE FACTOR

The scale factor is proportional to terminating resistance as shown in the following table.

TERMINATING RESISTANCE	SCALE FACTOR Vout, VOLTS per AMP
½ Rated	.5
Rated	1.0
Twice Rated	2.0



CASE DIMENSIONS



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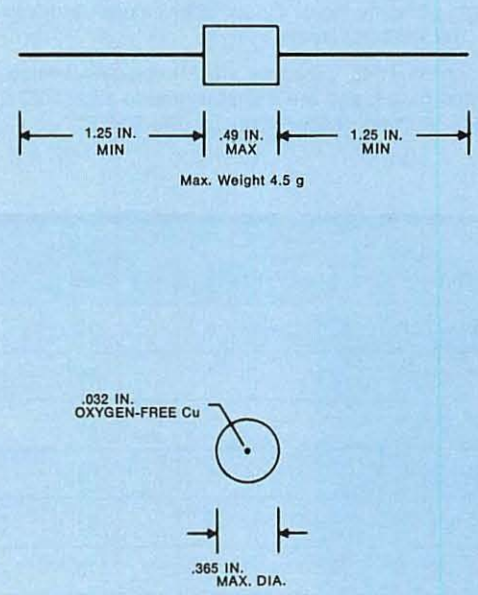
LL
Miniature Power Inductors

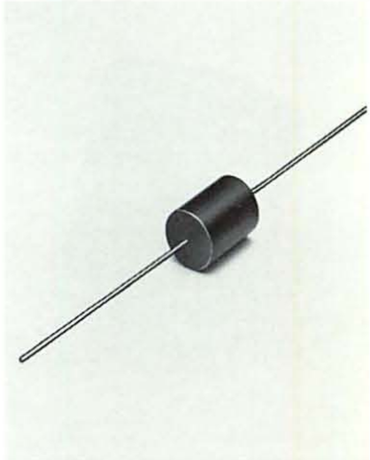
APPLICATIONS
Intended primarily for switching regulator and power filtering applications, LL inductors can be installed either through PC boards or to wiring posts. Their small size — .365 in. diameter by .49 in. length — makes them ideal for use with multi-layer boards. An axial lead configuration permits customer pre-mounting on reels, for machine insertion with other components. Other inductance values are available on special order.

PERFORMANCE
LL inductors provide unprecedented power-handling capacity and reliability coupled with small size. For example, drop in rated inductance at rated DC current will not exceed 20%, while temperature rise at rated DC current is approximately 40°C. The units feature low DC resistance for a given inductance, having ohms/milihenry values of about 1.0.

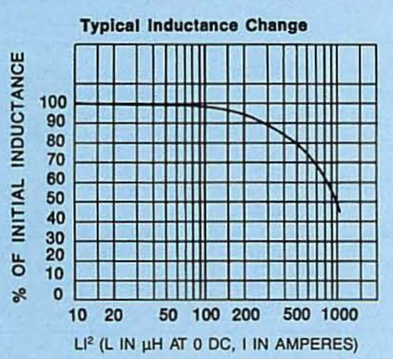
PACKAGING
Hermetically sealed case to meet MIL-T-27. The .032-in. tinned, oxygen-free copper leads are rigidly anchored in secure fashion.

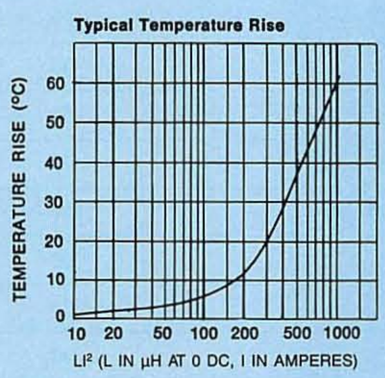
Part Number	Inductance at 1V, 20 KHz (μH)	Max. DCR (ohms)	Rated Current (amps)	MIL Part No.
LL-30	30	.035	3.0	M27/286-07
LL-50	50	.056	2.5	M27/286-08
LL-120	120	0.14	1.6	M27/286-01
LL-300	300	0.35	1.0	M27/286-02
LL-500	500	0.56	0.75	M27/286-03
LL-1200	1200	1.40	0.50	M27/286-04
LL-3000	3000	3.50	0.30	M27/286-05
LL-5000	5000	5.60	0.25	M27/286-06





NOTES
- Mountable through PC board or to posts
- Inductance from 30 to 5000 μH
- Rated current range: 3.0 to 0.25 A
- Low inductance drop at rated current
- Less than .375 inch in diameter
- Suitable for reel-mounted assembly
- Manufactured to meet MIL-T-27
- MIL Type No. TF5R04ZZ





RML
Hi Frequency Power Inductors

The new RML line of shielded inductors consists of 4 series of power chokes differing in size and power capability, covering a wide range of inductance and current.

These units are useful over a wide frequency range, the lower inductance values up to the megahertz range, while the highest inductance values easily run to the 100 kilohertz range.

These RML inductors are hermetically sealed in molded cases, and are manufactured to meet MILT 27, Grade 5, Class S specifications (TF5S04ZZ).

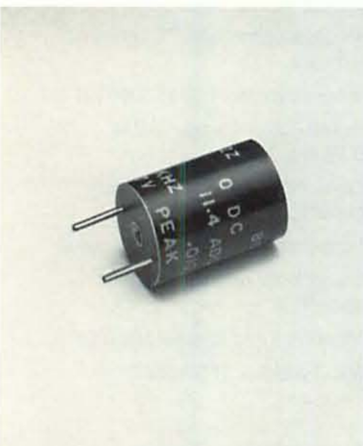
Principal applications are switching regulators, power supplies and EMI supression filters.

Current ratings are based on 45°C heat rise and 10% drop in inductance.

Inductance test conditions are .1V, 10KHz, 0DC.

Hipot is 1000 V RMS, wdg to insert.

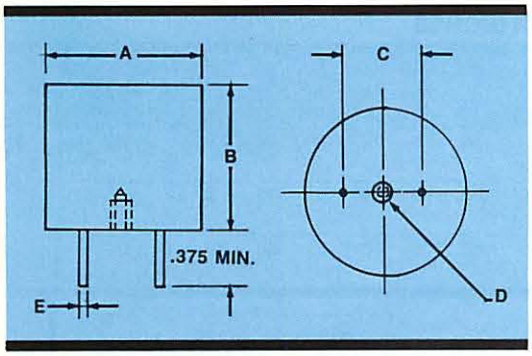
Type numbers correspond to inductance values in microhenries, with an inductance tolerance of ±15%.



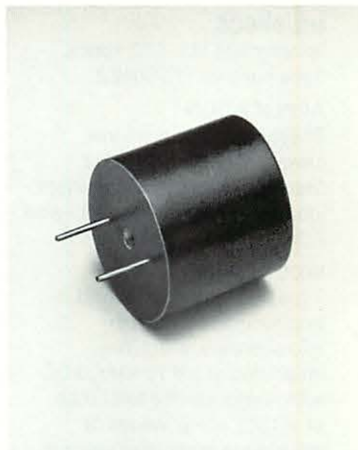
Part No.	Ind µ Hy ODC	Max DCR Ohms	DC Rated Current Amps
RML-100-18	18	.010	11.4
RML-100-25	25	.015	9.3
RML-100-39	39	.020	7.7
RML-100-56	56	.040	5.9
RML-100-82	82	.060	4.8
RML-100-120	120	.072	4.3
RML-100-180	180	.095	3.4
RML-100-250	250	.17	2.7
RML-100-390	390	.21	2.4
RML-100-560	560	.30	2.0

Part No.	Ind µ Hy ODC	Max DCR Ohms	DC Rated Current Amps
RML-200-22	22	.010	11.3
RML-200-33	33	.018	8.4
RML-200-50	50	.026	7.0
RML-200-75	75	.030	6.5
RML-200-100	100	.039	5.7
RML-200-150	150	.060	4.6
RML-200-220	220	.090	3.7
RML-200-330	330	.11	3.4
RML-200-500	500	.21	2.4
RML-200-750	750	.32	2.0
RML-200-1000	1000	.39	1.8
RML-200-1500	1500	.59	1.4

RML
Hi Frequency Power Inductors



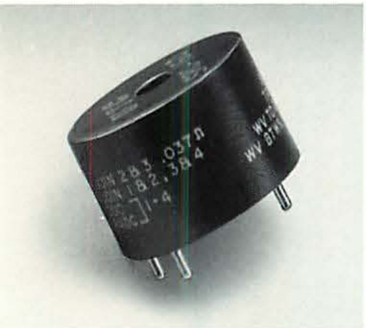
PART NUMBER	A Max Dia.	B Max	C ±.010	D 8 THD NC-2B	E Dia. ±.003
RML-100	.698	1.041	.450	4-40	.040
RML-200	.830	1.041	.500	4-40	.040
RML-300	1.095	1.041	.538	4-40	.040
RML-400	1.515	1.322	.750	6-32	.080



Part No.	Ind µ Hy ODC	Max DCR Ohms	DC Rated Current Amps
RML-300-78	78	.024	8.4
RML-300-110	110	.029	7.5
RML-300-165	165	.034	7.0
RML-300-250	250	.064	5.0
RML-300-360	360	.080	4.4
RML-300-550	550	.122	3.7
RML-300-780	780	.187	3.0
RML-300-1110	1110	.256	2.6
RML-300-1650	1650	.426	2.0
RML-300-2500	2500	.518	1.75
RML-300-3600	3600	.900	1.4

Part No.	Ind µ Hy ODC	Max DCR Ohms	DC Rated Current Amps
RML-400-250	250	.045	9.0
RML-400-390	390	.056	8.1
RML-400-560	560	.082	6.3
RML-400-800	800	.125	5.1
RML-400-1200	1200	.154	4.7
RML-400-1800	1800	.232	3.7
RML-400-2500	2500	.360	3.0
RML-400-3900	3900	.555	2.4
RML-400-5600	5600	.845	2.1
RML-400-6800	6800	1.14	1.9
RML-400-8000	8000	1.60	1.6
RML-400-9600	9600	1.76	1.5

SRA and SRB
Switching Power Inductors



NOTES

PACKAGING
Hermetically sealed, molded case.

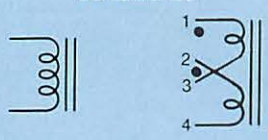
MIL SPECS
To complete MIL-T-27 specs. Type number TF5S04ZZ.

APPLICATION
These inductors have low losses in the 3 to 100 KHz frequency range, making them ideal for switching regulator and AC filter choke applications.

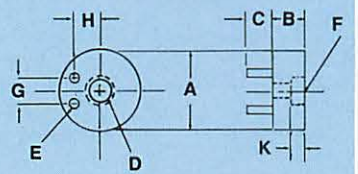
INDUCTANCE
Type numbers correspond to inductance values in microhenries, which are measured at 1 V, 10 KHz, 0 DC with an inductance tolerance of +15%, -5%. Values of inductance other than listed in an existing size are available. Part Number would be: SR (A,B, or C) — (inductance in microhy at 0 DC).

CURRENT RATINGS
Listing I_1 is for approximately 10% drop in inductance with a typical 20°C temperature rise, and Listing I_2 is for approximately 20% drop in inductance with a typical 40°C temperature rise.

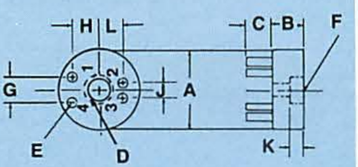
SCHEMATICS



SINGLE WINDING



DOUBLE WINDING



DIMENSIONS IN INCHES

Type Winding	A dia. ±.030	B ±.063	C ±.030	D dia. ±0.10	E dia. ±.005	F dia. ±.015	G ±.010	H ±.010	J ±.010	K C'bore ±.015	L ±.010	Wt. Oz
SRA Single	.875	.438	.250	.156	.073	.281	.400	.200	—	.082	—	.6
Double		.563							.200		.200	
SRB Single	1.188	.563	.250	.156	.073	.281	.600	.300	—	.082	—	1.5
Double		.688							.400		.300	
SRC Single	1.375	.750	.250	.156	.073	.281	.800	.300	—	.082	—	3
Double		.813							.400		.500	

SRA

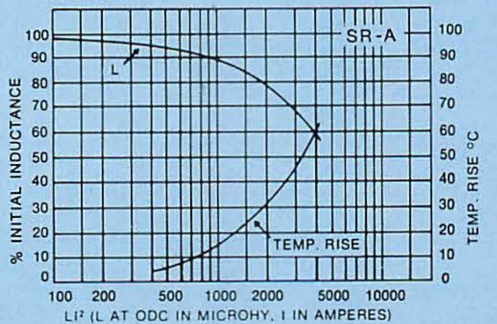
Type	No. of Windings	Inductance at 0 DC (µH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRA-1250	1	1250	.8	1.2	.7	M27/287-01
SRA-800	1	800	1	1.5	.45	M27/287-02
SRA-500	1	500	1.2	1.8	.3	M27/287-03
SRA-350	1	350	1.5	2.2	.2	M27/287-04
SRA-200*	2	200 (SER) 50 (PAR)	2 4	3 6	.12 .03	M27/287-05
SRA-88*	2	88 (SER) 22 (PAR)	3 6	4.5 9	.052 .013	M27/287-06
SRA-32*	2	32 (SER) 8 (PAR)	5 10	7.5 15	.02 .005	M27/287-07

SRB

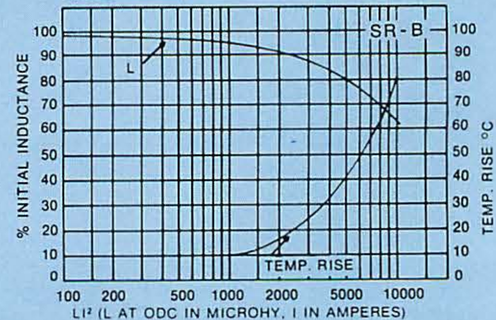
Type	No. of Windings	Inductance at 0 DC (µH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRB-3000	1	3000	.8	1.2	1.2	M27/288-01
SRB-2000	1	2000	1	1.5	.8	M27/288-02
SRB-1200	1	1200	1.25	1.88	.5	M27/288-03
SRB-780	1	780	1.6	2.4	.3	M27/288-04
SRB-520	1	520	2	3	.2	M27/288-05
SRB-320	1	320	2.5	3.75	.13	M27/288-06
SRB-220*	2	220 (SER) 55 (PAR)	3 6	4.5 9	.08 .02	M27/288-07
SRB-120*	2	120 (SER) 30 (PAR)	4 8	6 12	.05 .013	M27/288-08
SRB-80*	2	80 (SER) 20 (PAR)	5 10	7.5 15	.032 .008	M27/288-09

* Two identical windings brought out to four terminals permit series, parallel, center tapped or transformer connections.

SRA



SRB



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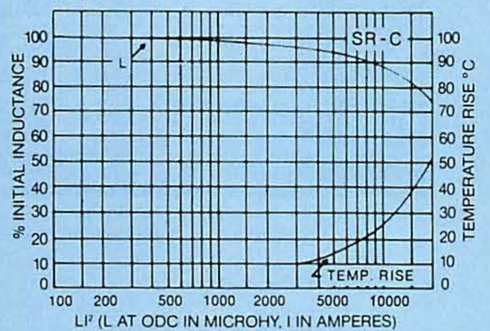
SRC and SRD
Switching Power Inductors

SRC

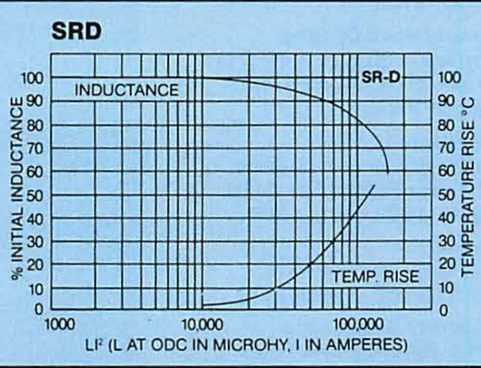
Type	No. of Windings	Inductance at 0 DC (µH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRC-10000	1	10,000	.84	1.1	2.1	M27/289-01
SRC-6400	1	6400	1	1.35	1.4	M27/289-02
SRC-2500	1	2500	1.6	2.2	.55	M27/289-03
SRC-1600	1	1600	2.1	2.8	.34	M27/289-04
SRC-1000	1	1000	2.6	3.5	.21	M27/289-05
SRC-640*	2	640 (SER) 160 (PAR)	3.3 6.6	4.5 9	.13 .033	M27/289-06
SRC-400*	2	400 (SER) 100 (PAR)	4 8	5.4 10.8	.088 .022	M27/289-07
SRC-240*	2	240 (SER) 60 (PAR)	5 10	6.8 13.6	.056 .014	M27/289-08

* Two identical windings brought out to four terminals permit series, parallel, center tapped or transformer connections.

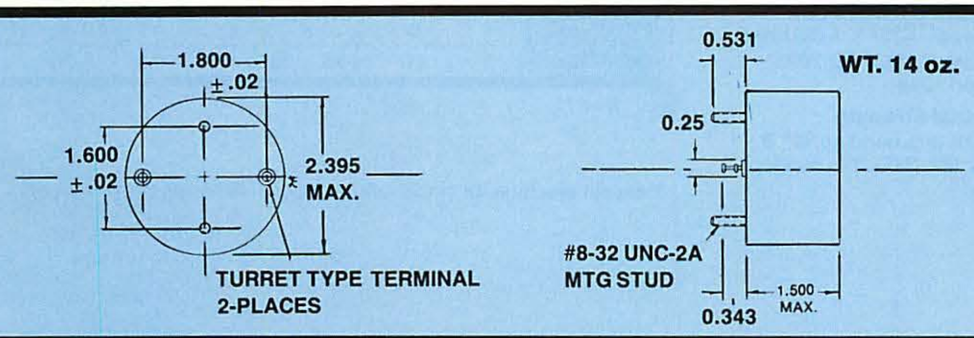


SRD - INCREASED POWER HANDLING CAPABILITY

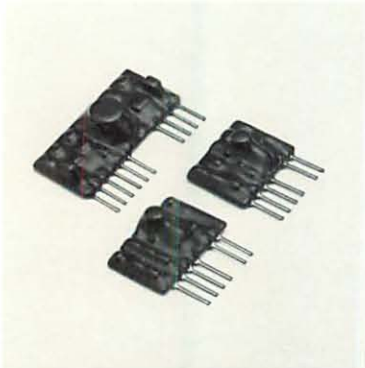
Type	No. of Windings	Inductance at 0 DC (µH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Type No.
SRD-500	1	500	9.5	13	.033	TF5S04ZZ
SRD-900	1	900	7.3	10	.057	TF5S04ZZ
SRD-2500	1	2500	4.4	6	.15	TF5S04ZZ
SRD-5000	1	5000	3.1	4.2	.33	TF5S04ZZ
SRD-10000	1	10,000	2.2	3	.60	TF5S04ZZ
SRD-22000	1	22,000	1.4	2	1.4	TF5S04ZZ
SRD-40000	1	40,000	1.1	1.5	2.4	TF5S04ZZ
SRD-90000	1	90,000	.73	1	5.4	TF5S04ZZ
SRD-360000	1	360,000	.36	.50	22	TF5S04ZZ
SRD-1.4	1	1.4 Hy	.18	.25	88	TF5S04ZZ
SRD-5.6	1	5.6 Hy	.09	.125	352	TF5S04ZZ



MIL Type TF5S04ZZ



DC-DC Converters



FEATURES —

NON-ISOLATED

- Miniaturized
- Surface mount technology
- Low cost non-isolation models
- Voltage boosting
- Polarity reversing
- Built-in noise filter inductor
- Up to 70% efficiency
- Single and dual outputs
- Board mountable
- MIL-STD-202 testing

NON-ISOLATION POLARITY REVERSING CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	Line Reg. (%) max.	I_{out} (mA)—(mA)	Load Reg. (%) max.	Efficiency (%) TYP	Temp. Coefficient (%/°C) max.
OPT-BAN-0205	1 ~ 3.5	−5	±2	3 ~ 10	1.5	57	0.1
OPT-BAN-0212	1 ~ 3.5	−12	±1	1.25 ~ 4.17	1.5	62	0.1
OPT-BAN-0215	1 ~ 3.5	−15	±1	1 ~ 3.33	1.5	62	0.1
OPT-BAP-0205	1 ~ 3.5	5	±2	3 ~ 10	1.5	57	0.1
OPT-BAP-0212	1 ~ 3.5	12	±1	1.25 ~ 4.17	1.5	62	0.1
OPT-BAP-0215	1 ~ 3.5	15	±1	1 ~ 3.33	1.5	62	0.1
OPT-NAN-0505	5	−5	±0.8	5 ~ 20	1.5	60	0.03
OPT-NAN-0512	5	−12	±0.8	2.5 ~ 8.5	1.5	60	0.03
OPT-NCN-0505	5	−5	±0.8	18 ~ 60	1.5	60	0.03
OPT-NCN-0512	5	−12	±0.8	7.5 ~ 25	1.5	60	0.03
OPT-RCN-0505	5 ± 10%	−5	±1.2	18 ~ 60	1.5	62	±0.05
OPT-RCN-0512	5 ± 10%	−12	±1.2	7.5 ~ 25	1.5	62	±0.1
OPT-RCN-1205	12 ± 20%	−5	±1.2	18 ~ 60	1.5	67	±0.05
OPT-RCN-1212	12 ± 20%	−12	±1.2	7.5 ~ 25	1.5	67	±0.1
OPT-RFP-2405	24 ± 30%	5	±1.2	60 ~ 200	1.5	72	±0.05
OPT-RHP-2405	24 ± 30%	5	±1.2	120 ~ 400	1.5	72	±0.05

0.3 to 3 Watt Isolation Converters

Polarity Reversing and Voltage Boosting Non-Isolation Converters

SPECIFICATIONS
ISOLATED AND NON-ISOLATED

Input Voltage
±20% of nominal except 5 VDC output, ±20%. 48 VDC input range 42-60 VDC. Do not exceed 1.2x nom. or rev polarity.

Output Voltage
±1% of nominal.

Output Current
See rating table. Load regulation specified over output current range.

Line Regulation
0.5% of nominal V_{in} for isolation series except -0505 models. All others 0.8%.

Load Regulation
Specified over output current range. Non-isolation series is 1.5%. Isolation series is 3% except 5 VDC outputs and Telcom series, 6%.

Efficiency
70%; 5 VDC outputs 60%.

Temperature Coefficient
0.03%/°C max.

Overload Protection
Current limiting type circuitry on isolation series only. Short circuit current is 130-200% F.L.

Operating Temperature
Full rated output from −10°C to +70°C without derating.

Operating Frequency
150 kHz.

Ripple and Noise
60 mv typical, 100 mv p-p max.

Storage Temperature
−30°C to +85°C.

Humidity
95% RH.

Weight
See table.

Insulation Resistance
50 Mohm at 500 VDC min.

Dielectric Voltage
500 VDC, primary to secondary for one minute. Isolation series only.

Solderability
230°C ± 5°C; dipping time 5 sec. ±0.5 sec. MIL-STD-202, method 208C.

Soldering Heat Resistance
260°C ±5°C; dipping time 10 sec. ±1 sec. MIL-STD-202, method 210A.

Temperature Cycling
5 cycles; −30°C to +85°C at 30 min. each. MIL-STD-202, method 102A.

Vibration
Smallest of longest distance; 1.52 mm or 15G, 10-2,000 Hz. MIL-STD-202, method 204C.

Shock
50G half-wave sine wave. MIL-STD-202, method 213B.

Humidity Resistance
40°C, 95% RH; 1344 hours. MIL-STD-202, 103B.

High Temperature Life
500 hrs at +70°C, fixed rated FL current. MIL-STD-202, method 108A.

Terminal Strength
Tensil 2.2kg, bending 90° 3 times. MIL-STD-202, method 211A.

NON-ISOLATION VOLTAGE BOOSTING CONVERTERS

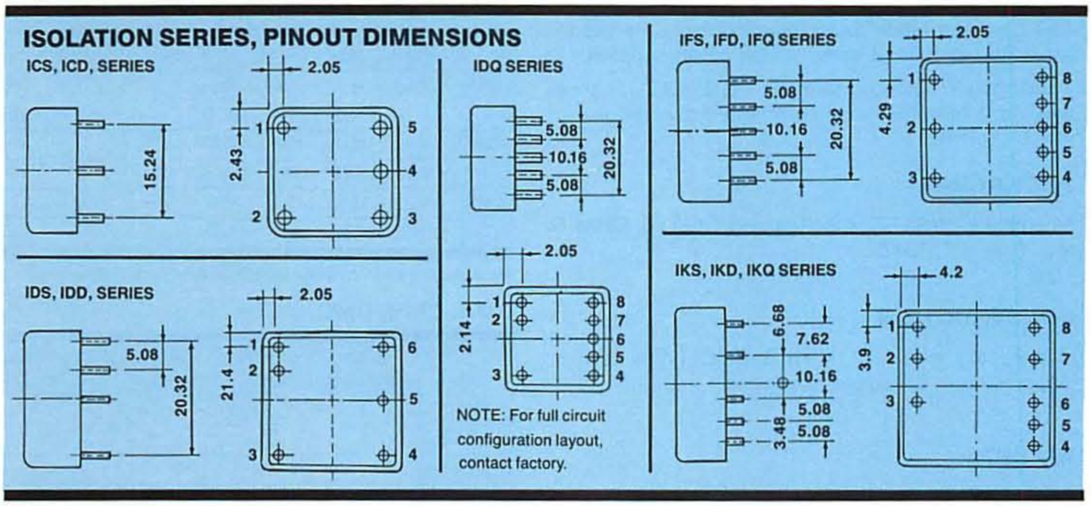
Model No.	V_{in} (VDC)	V_{out} (VDC)	Line Reg. (%) max.	I_{out} (mA)—(mA)	Load Reg. (%) max.	Efficiency (%) TYP	Temp. Coefficient (%/°C) max.
OPT-NAP-0512	5	12	±0.8	2.5 ~ 8.4	1.5	70	0.03
OPT-NAP-0515	5	15	±0.8	2.0 ~ 6.7	1.5	70	0.03
OPT-NAP-0524	5	24	±0.8	1.2 ~ 4.2	1.5	70	0.03
OPT-NCP-0512	5	12	±0.8	7.5 ~ 25	1.5	70	0.03
OPT-NCP-0515	5	15	±0.8	6.0 ~ 20	1.5	70	0.03
OPT-NCP-0524	5	24	±0.8	3.7 ~ 12.5	1.5	70	0.03
OPT-NDP-0512	5	12	±0.8	12.5 ~ 42	1.5	70	0.03
OPT-NDP-0515	5	15	±0.8	10 ~ 34	1.5	70	0.03
OPT-NDP-0524	5	24	±0.8	6.2 ~ 21	1.5	70	0.03
OPT-NFP-0512	5	12	±0.8	25 ~ 84	1.5	70	0.03
OPT-NFP-0515	5	15	±0.8	20 ~ 67	1.5	70	0.03
OPT-NFP-0524	5	24	±0.8	12.5 ~ 42	1.5	70	0.03

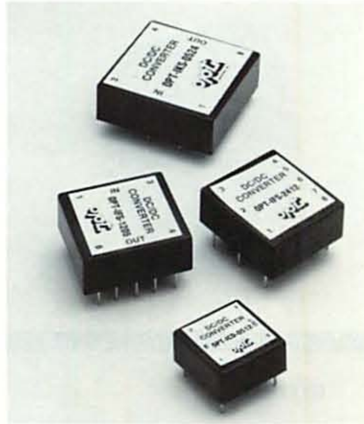
Request brochure for circuit configurations, dimensions and pin outs.

DC-DC Converters

ISOLATION CONVERTERS

ISOLATION SERIES, PINOUT DIMENSIONS





0.3 WATT ISOLATION CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	I_{out} (ma)
OPT-ICS-0505	5	5	60
OPT-ICS-0512	5	12	25
OPT-ICD-0512	5	±12	12.5
OPT-ICS-1205	12	5	60
OPT-ICS-1212	12	12	25
OPT-ICD-1212	12	±12	12.5
OPT-ICS-2405	24	5	60
OPT-ICS-2412	24	12	25
OPT-ICD-2412	24	±12	12.5

0.5 WATT ISOLATION CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	I_{out} (ma)
OPT-IDS-0505	5	5	100
OPT-IDS-0512	5	12	42
OPT-IDD-0512	5	±12	21
OPT-IDS-1205	12	5	100
OPT-IDS-1212	12	12	42
OPT-IDD-1212	12	±12	21
OPT-IDS-2405	24	5	100
OPT-IDS-2412	24	12	42
OPT-IDD-2412	24	±12	21

1.0 WATT ISOLATION CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	I_{out} (ma)
OPT-IFS-0505	5	5	200
OPT-IFS-0512	5	12	84
OPT-IFD-0512	5	±12	42
OPT-IFS-0524	5	24	42
OPT-IFS-1205	12	5	200
OPT-IFS-1212	12	12	84
OPT-IFD-1212	12	±12	42
OPT-IFS-2405	24	5	200
OPT-IFS-2412	24	12	84
OPT-IFD-2412	24	±12	42

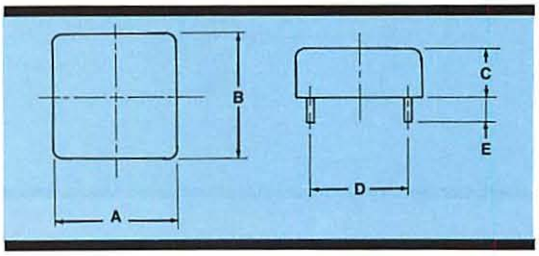
3.0 WATT ISOLATION TYPE CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	I_{out} (ma)
OPT-IKS-0505	5	5	600
OPT-IKD-0512	5	±12	125
OPT-IKS-0524	5	24	125
OPT-IKS-1205	12	5	600
OPT-IKS-1212	12	12	250
OPT-IKD-1212	12	±12	125
OPT-IKS-2405	24	5	600
OPT-IKS-2412	24	12	250
OPT-IKD-2412	24	±12	125

48V TELCOM MULTIPLE OUTPUT CONVERTERS

Model No.	V_{in} (VDC)	V_{out} (VDC)	I_{out} (ma)
OPT-IDQ-48A	48	±5 ±12	20 4.2
OPT-IFQ-48A	48	±5 ±12	33 7.1
OPT-IKQ-48A	48	±5 ±12	67 14.2

ISOLATION SERIES DIMENSIONS



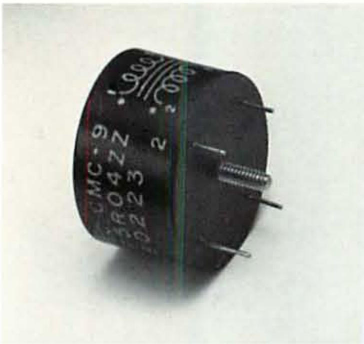
SERIES	DIMENSIONS[1]					
	A[2]	D[2]	C[3]	D	E[4]	Wt[5]
ICS, ICD	20.1	20.1	8.5	16	4	6.3
IDS, IDD, IDQ	24.6	24.6	10.5	20.5	5	11.5
IFS, IFD, IFQ	26.9	28.9	10.5	22.8	5	14.7
IKS, IKD, IKQ	36.4	36.4	12.0	28	4	29.9

NOTES:
1. Dimensions in mm
2. Tolerance ±0.3 mm
3. Maximum dimension
4. Minimum dimension
5. Weight in grams
6. Pin dia. 0.75mm

FEATURES— ISOLATED

- Miniaturized
- Surface mount technology
- Board mountable
- Low cost
- Point of load application
- Built-in noise filter
- Up to 70% efficiency
- Floating/isolated outputs
- 5, 12, and 24 volt inputs
- 0.3 to 3W outputs
- Telcom 48 Vdc input series

CMA, CMB, CMC
Common Mode Inductors



APPLICATION

EMI Common Mode Supression Inductors are used in input-filter circuits of switch mode power supplies.

Windings are balanced to within 1% effectively cancelling the differential mode current in the windings.

PACKAGING

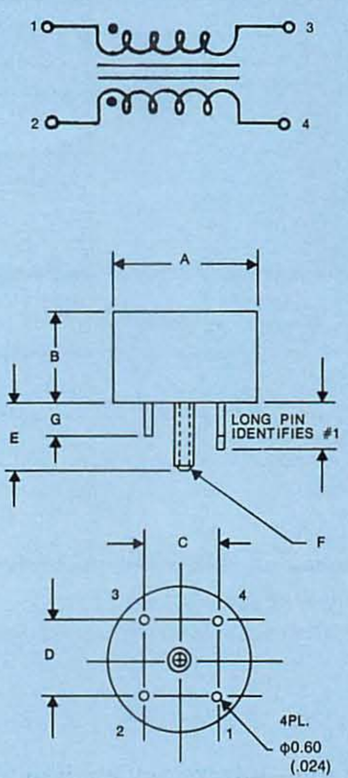
To complete MIL-T-27 specifications Grade 5, Class R, MIL Type TF5R04ZZ.

CONSTRUCTION

Magnetically shielded, CMB & CMC Types have a mounting stud for added sturdiness.

RATINGS

Current rating is for 40°C heat rise. Dielectric strength between windings is tested for 1250 volts.



NOTES

- Windings are balanced to within 1%
- Dielectric strength between windings tested at 1,250 volts
- All units are magnetically shielded
- All units meet MIL-T-27 Type TF5R04ZZ
- CMB's and CMC's have mounting stud for added sturdiness
- Current rating is for 40°C heat rise

	A Max. Dia.	B Max.	C	D	E ±1.6 (±.06)	F UNC —2A	G Min.
CMA	20.6	12.7	10.0	10.0	—	—	3.0
	(.811)	(.500)	(.394)	(.394)			(.118)
CMB	24.3	15.9	12.5	12.5	7.9	#4-40	3.0
	(.956)	(.625)	(.492)	(.492)	(.31)		(.118)
CMC	29.0	18.5	15.0	15.0	7.9	#4-40	4.0
	(1.142)	(.728)	(.590)	(.590)	(.31)		(.157)

All dimensions are in millimeters. Decimal equivalents in parenthesis.

CMA, CMB, CMC

PN	Ind.* MilliHys	I RMS Amps	Typ. Leakage uHys	DCR Ohms Max.**
CMA-1	1	2.4	10	.048
CMA-3	3	1.5	20	.12
CMA-9	9	1.1	40	.25
CMB-1	1	4.4	15	.032
CMB-3	3	2.8	20	.080
CMB-9	9	2.0	40	.16
CMC-3	3	4.8	20	.035
CMC-9	9	3.0	40	.090
CMC-16	16	2.2	60	.16

* Per winding; 1V, 10 kHz. ** Each winding.

ALTERNATE CAPABILITIES

These units can be used as high frequency matching transformers in the RF frequency range. Data pertaining to their performance in such a capability is given in the table below.

PN	Pri-Imp/Sec-Imp (ohms)	Freq. Range	Power mW
CMA-1	16/16 64/64	1.5 KHz-1.5 MHz 6 KHz-5 MHz	35 70
CMA-3	50/50 200/200	1.5 KHz-1.5 MHz 6 KHz-5 MHz	35 70
CMA-9	150/150 600/600	1.5 KHz-1.5 MHz 6 KHz-5 MHz	35 70
CMB-1	16/16 64/64	1.5 KHz-1.5 MHz 6 KHz-5 MHz	70 150
CMB-3	50/50 200/200	1.5 KHz-1.5 MHz 6 KHz-5 MHz	70 150
CMB-9	150/150 600/600	1.5 KHz-1.5 MHz 6 KHz-5 MHz	70 150
CMC-3	50/50 200/200	1.5 KHz-1.5 MHz 6 KHz-5 MHz	115 230
CMC-9	150/150 600/600	1.5 KHz-1.5 MHz 6 KHz-5 MHz	115 230
CMC-16	250/250 1000/1000	1.5 KHz-1.5 MHz 6 KHz-5 MHz	115 230

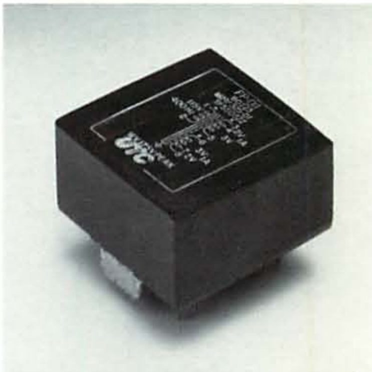
FP
400Hz Transformers

APPLICATION
Offering significant cost and size advantages over competitive low-voltage, high-current toroids, FP Series 400 Hz power transformers are wide applicability types which will fit many modern circuit needs.

RATINGS
Three power levels are available: 10, 20 and 30 watts. Within each power rating, three different winding and secondary tap arrangements are provided to cover a total voltage range from 2 to 30 volts. Since performance specifications are based on maximum-voltage, full-winding use, slight power derating is required when employing lower voltage taps, to keep current density normal.

CONSTRUCTON
FP transformers feature a semi-toroidal, hum-bucking, self-shielding construction. Integral electrostatic shields are terminated in two unique mounting tabs. The units are of a low-profile design — .62 inches high — to fit "sandwich board" shallow drawer requirements. "PC" terminal types on all units.

MIL SPECS
To complete MIL-T-27 specifications, MIL Type No. TF5S03ZZ, Grade 5, Class S.

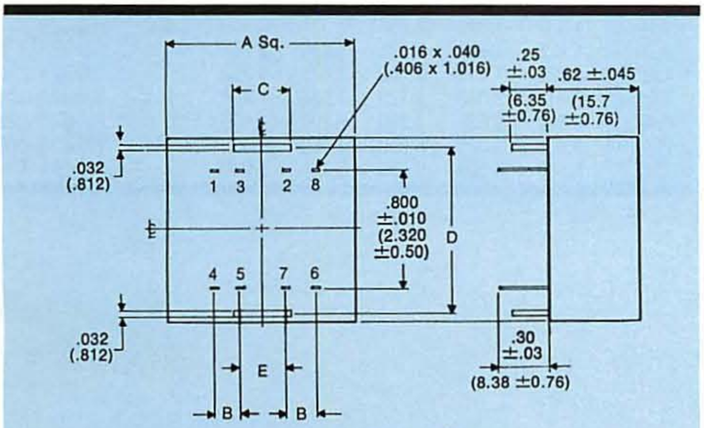


SPECIFICATIONS

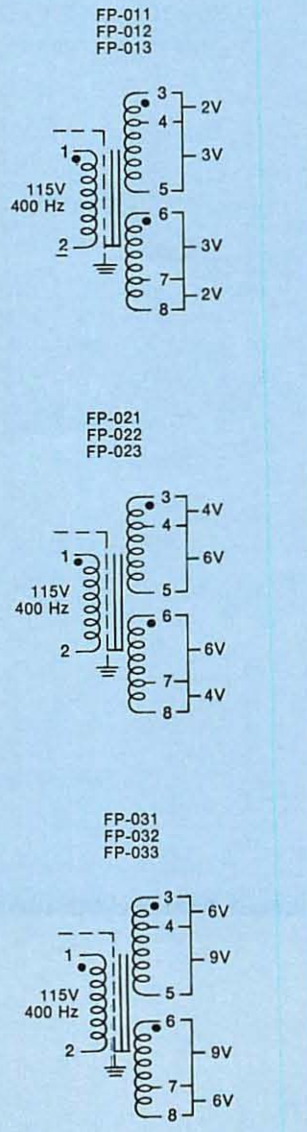
Type No.	MIL Part No.	Power Rating (Watts)	Primary Voltage (Volts)	Secondary Voltages (Volts)	Weight Lb.
FP-011	M27/325-01	10	115	2,3,4,5,6,7,8,10	.125
FP-021	M27/325-02	10	115	4,6,8,10,12,14,16,20	.125
FP-031	M27/325-03	10	115	6,9,12,15,18,21,24,30	.125
FP-012	M27/325-04	20	115	2,3,4,5,6,7,8,10	.25
FP-022	M27/325-05	20	115	4,6,8,10,12,14,16,20	.25
FP-032	M27/325-06	20	115	6,9,12,15,18,21,24,30	.25
FP-013	M27/325-07	30	115	2,3,4,5,6,7,8,10	.38
FP-023	M27/325-08	30	115	4,6,8,10,12,14,16,20	.38
FP-033	M27/325-09	30	115	6,9,12,15,18,21,24,30	.38

DIMENSIONS

Type No.	Case Width "A" ±.03in.	Case Height ±.045in.	Terminal Spacing "B" ±.005in.	Tab Width "C" ±.02in.	Tab Spacing "D" ±.01in.	A ±.03in.	B ±.005in.	C ±.02in.	D ±.010in.	E ±.005in.
FP-011	1.24sq.	.62	.200	.38	1.128	1.24	.200	.38	1.128	.300
FP-021	1.24sq.	.62	.200	.38	1.128	1.24	.200	.38	1.128	.300
FP-031	1.24sq.	.62	.200	.38	1.128	1.24	.200	.38	1.128	.300
FP-012	1.75sq.	.62	.400	.38	1.625	1.75	.400	.38	1.625	.350
FP-022	1.75sq.	.62	.400	.38	1.625	1.75	.400	.38	1.625	.350
FP-032	1.75sq.	.62	.400	.38	1.625	1.75	.400	.38	1.625	.350
FP-013	2.25sq.	.62	.600	.50	2.132	2.25	.600	.50	2.132	.400
FP-023	2.25sq.	.62	.600	.50	2.132	2.25	.600	.50	2.132	.400
FP-033	2.25sq.	.62	.600	.50	2.132	2.25	.600	.50	2.132	.400



SCHEMATICS



H, MET
IC Supply Transformers

NOTES
Chart on facing page shows the secondary AC voltages available, and the approximate DC voltages resulting, in typical capacitive filter silicon rectifier circuits (at the indicated currents). Since the capacitor following the rectifier affects the DC, voltage values used (in 1000 mfd) are shown in parenthesis ( ) after each current rating.

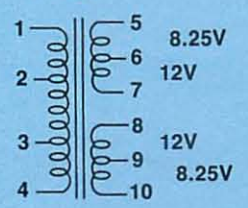
Primary taps can modify nominal AC voltages by −6%, +6%, and +12%.

PACKAGING
Hermetically sealed. Drawn metal case to Mil Grade 4.

MIL SPECS
To complete MIL-T-27 Specs. Mil Type TF4S03 plus two letter case code. H-915 is qualified as M27/184-01. H-935 is qualified as M27/157-01. H-925 is qualified as M27/156-01.

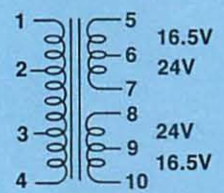
SCHEMATICS FOR TYPE NOS.

H-915 MET-465
H-925 MET-475
H-935 MET-445
H- 94 MET-455
H- 95
H- 96



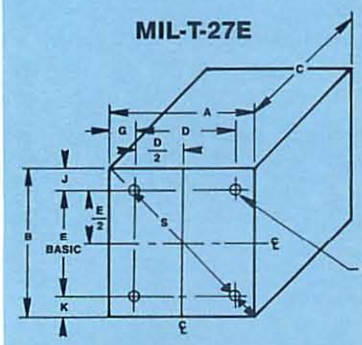
SCHEMATICS FOR TYPE NOS.

H-965 MET-495



PRI 2-4 115V NOM OUTPUT
1-4 115V −6% OUTPUT
1-3 115V +6% OUTPUT
2-3 115V +12% OUTPUT

MIL-T-27E



A, B, C DIMENSIONS ARE MAX

INCLUDING MET™ SERIES

Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 8.25 to 40.5

Type No.	MIL DC Range	Indust. DC Range	MIL Case
H-915	6V-.065A to 53 V-.02A	**6 V-.085A to 53 V-.025A**	AH
H-925	6V-.22A to 53 V-.07A	**6 V-.28A to 53 V-.085A**	AJ
H-935	6V-1.2A to 53 V-.4A	**6 V-1.52A to 53 V-.48A**	FA
H-94	6V-3A to 53 V-1A	**6 V-3.8A to 53 V-1.2A**	HA
H-95	6V-7.5A to 53 V-2.5A	**6 V-9A to 53 V-3A**	KA
H-96	6V-18A to 53 V-6A	**6 V-23A to 53 V-7.5A**	OA

Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 16.5 to 81

H-965	12V-1.5A to 106 V-.5A	**12 V-1.9A to 106 V-.6A**	HA

Primary 115 Volts, 400 Hz Nominal Sec. Volts, 8.25 to 40.5

MET-445	6V-.6A to 53 V-.2A	**6 V-.75A to 53 V-.24A**	AH
MET-455	6 V-1.2A to 53 V-.4A	**6 V-1.25A to 53 V-.48A**	AJ
MET-465	6 V-3A to 53 V-1A	**6 V-3.8A to 53 V-1.2A**	FA
MET-475	6 V-7.5A to 53 V-2.5A	**6 V-9A to 53 V-3A**	HA

Primary 115 Volts, 400 Hz Nominal Sec. Volts, 16.5 to 81

MET-495	12 V-.6A to 106 V-.2A	**12 V-.76A to 106 V-.24A**	AJ

Case symbol	Dimensions (inches)						
	Envelope			Mounting			
	A	B	C	D	E	S	F
AH	1.312	1.312	1.750			1.250	.138-32 x .375
AJ	1.625	1.625	2.375	1.188	1.188		.138-32 x .375
EA	1.938	1.812	2.750	1.375	1.250		.138-32 x .375
FA	2.312	2.062	3.125	1.688	1.438		.138-32 x .375
HA	3.062	2.625	4.250	2.297	1.859		.164-32 x .375
KA	3.938	3.375	5.250	3.000	2.438		.190-32 x .500
OA	5.500	4.500	6.750	3.750	3.000		.250-20 x .625

United Transformer Company/OPT • 300 Red School Lane, Phillipsburg, NJ 08865 • (201) 454-2600 • FAX (201) 454-3172

H, MET
IC Supply Transformers

AC AND DC VOLTAGES AT INDICATED CURRENTS

MIL-T-27 RATINGS IN REGULAR TYPE, INDUSTRIAL RATINGS IN BLUE BAR

SECONDARY AC VOLTAGES AND APPROXIMATE DC VOLTAGES

	FULL WAVE BRIDGE SILICON RECTIFIER								FULL WAVE CT		
Nom. AC Volts*	40.5	32.25	28.5	24	20.25	16.5	12	8.25	40.5 CT	24 CT	16.5 CT
Appr. DC Volts*	53	41	34	25	24	18	12	6	24	12	6.6

DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPES

Type No.																					
H-915	.02	(.1)	.023	(.1)	.025	(.1)	.027	(.1)	.042	(.2)	.035	(.2)	.055	(.2)	.065	(.2)	.035	(.2)	.040	(.2)	.055	(.2)
H-915	.025	(.1)	.035	(.1)	.040	(.1)	.042	(.1)	.055	(.2)	.042	(.2)	.070	(.2)	.085	(.2)	.042	(.2)	.055	(.2)	.068	(.2)
H-925	.07	(.1)	.08	(.1)	.085	(.1)	.09	(.1)	.14	(.2)	.11	(.2)	.18	(.2)	.22	(.2)	.11	(.2)	.13	(.2)	.17	(.2)
H-925	.085	(.1)	.12	(.1)	.13	(.1)	.14	(.1)	.18	(.2)	.14	(.2)	.23	(.2)	.28	(.2)	.14	(.2)	.17	(.2)	.21	(.2)
H-935	.4	(.5)	.44	(.5)	.48	(.5)	.52	(.5)	.8	(1)	.6	(1)	1.0	(2)	1.2	(2)	.6	(1)	.72	(1)	.92	(2)
H-935	.48	(.5)	.6	(.5)	.6	(.5)	.64	(.5)	1.0	(1)	.8	(1)	1.2	(2)	1.52	(2)	.8	(1)	.88	(1)	1.12	(2)
H-94	1	(.5)	1.1	(.5)	1.2	(.5)	1.3	(.5)	2	(1)	1.5	(1)	2.5	(2)	3	(2)	1.5	(1)	1.8	(1)	2.3	(2)
H-94	1.2	(.5)	1.5	(.5)	1.5	(.5)	1.6	(.5)	2.5	(1)	2	(1)	3	(2)	3.8	(2)	2	(1)	2.2	(1)	2.8	(2)
H-95	2.5	(1)	3	(1)	3	(1)	3.5	(1)	5	(2)	3.7	(2)	6	(4)	7.5	(4)	3.7	(2)	4.5	(2)	5.5	(4)
H-95	3	(1)	3.5	(1)	3.8	(1)	4	(1)	6	(2)	4.5	(2)	7.5	(4)	9	(4)	4.5	(2)	5.5	(2)	6.7	(4)
H-96	6	(4)	7	(4)	7.5	(4)	8	(4)	12	(6)	9	(6)	15	(12)	18	(12)	9	(6)	11	(6)	13.5	(12)
H-96	7.5	(4)	8.5	(4)	9.5	(4)	10	(4)	15	(6)	11	(6)	19	(12)	23	(12)	11	(6)	13.5	(6)	17	(12)

400 Hz TYPES

MET-445	.2	(.15)	.22	(.15)	.24	(.15)	.26	(.15)	.4	(.25)	.3	(.25)	.5	(.5)	.6	(.5)	.3	(.25)	.36	(.25)	.46	(.5)
MET-445	.24	(.15)	.3	(.15)	.3	(.15)	.32	(.15)	.5	(.25)	.4	(.25)	.6	(.5)	.75	(.5)	.4	(.25)	.44	(.25)	.56	(.5)
MET-455	.4	(.15)	.44	(.15)	.48	(.15)	.52	(.15)	.8	(.25)	.6	(.25)	1.0	(.5)	1.2	(.5)	.6	(.25)	.72	(.25)	.92	(.5)
MET-455	.48	(.15)	.6	(.15)	.6	(.15)	.64	(.15)	1.0	(.25)	.8	(.25)	1.2	(.5)	1.52	(.5)	.8	(.25)	.88	(.25)	1.12	(.5)
MET-465	1	(.15)	1.1	(.15)	1.2	(.15)	1.3	(.15)	2	(.25)	1.5	(.25)	2.5	(.5)	3	(.5)	1.5	(.25)	1.8	(.25)	2.3	(.5)
MET-465	1.2	(.15)	1.5	(.15)	1.5	(.15)	1.6	(.15)	2.5	(.25)	2	(.25)	3	(.5)	3.8	(.5)	2	(.25)	2.2	(.25)	2.8	(.5)
MET-475	2.5	(.25)	3	(.25)	3	(.25)	3.5	(.25)	5	(.5)	3.7	(.5)	6	(1)	7.5	(1)	3.7	(.5)	4.5	(.5)	5.5	(1)
MET-475	3	(.25)	3.5	(.25)	3.8	(.25)	4	(.25)	6	(.5)	4.5	(.5)	7.5	(1)	9	(1)	4.5	(.5)	5.5	(.5)	6.7	(1)

SECONDARY AC VOLTAGES AND APPROXIMATE DC VOLTAGES

Nom. AC Volts*	81	64.5	57	48	40.5	33	24	16.5	81 CT	48 CT	33 CT
Appr. DC Volts*	106	82	68	50	48	36	24	12	48	24	13

DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPES

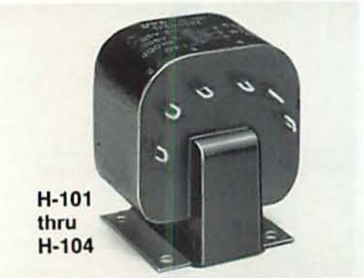
Type No.																					
H-965	0.5	(.125)	0.55	(.125)	0.6	(.125)	0.65	(.125)	1.0	(.25)	0.75	(.25)	1.25	(.5)	1.5	(.5)	0.75	(.25)	0.9	(.25)	1.15	(.5)
H-965	0.6	(.125)	0.75	(.125)	0.75	(.125)	0.8	(.125)	1.25	(.25)	1.0	(.25)	1.5	(.5)	1.9	(.5)	1.0	(.25)	1.1	(.25)	1.4	(.5)

400 Hz TYPE

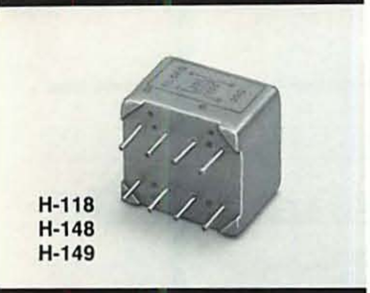
MET-495	.2	(.04)	.22	(.04)	.24	(.04)	.26	(.04)	.4	(.06)	.3	(.06)	.5	(.06)	.6	(.06)	.3	(.06)	.36	(.06)	.46	(.06)
MET-495	.24	(.04)	.3	(.04)	.3	(.04)	.32	(.04)	.5	(.06)	.4	(.06)	.6	(.06)	.76	(.06)	.4	(.06)	.44	(.06)	.56	(.06)

*Nom. AC and DC volts are at 115 volt input . . . primary taps can modify -6%, +6%, and +12%.

DOT, H, MET
400Hz Transformers



H-101
thru
H-104



H-118
H-148
H-149

MOLDED TYPES, GRADE 5

PAGE NOTES

PACKAGING
Hermetically sealed, DO-T's and MET's metal encased. H-101 group — molded.

APPLICATION
Transistor/filament and isolation.

SHIELDING
All isolation transformers electrostatically shielded.

MIL SPECS
To complete MIL-T-27D specs.
DO-T's: Grade 5, Class R.
MET's: Grade 4, Class S.
Molded units: Grade 5, Class S.

Primary: 105/115 Volts 380-1000 Hz
Secondary: 6.3 VCT 2500V RMS Test

Type No.	MIL-Type	Sec. Amp.	L In.	W In.	H In.	Mtg. Dim.	Wt. Lbs.
H-101	TF5S03ZZ	3.5	1.781	1.656	2.0	1.125 x 1.156	.3
H-102	M27/202-01	5.5	1.750	2.0	2.25	1.125 x 1.281	.44
H-103	M27/158-01	10	2.312	2.125	2.50	1.687 x 1.406	.8
H-104	M27/201-01	25	2.875	2.500	3.036	2.187 x 1.531	1.5

H-101 thru H-104 mounted by 4 holes .157D

500V RMS TEST

Type No.	H-118	H-148‡	H-149
Application	Supply	Isolation	Supply
Primary	105/115V 380-1000 Hz	105/115V 400 Hz	28V 380-1000 Hz
Secondary	6.3V CT — .3A	115V CT-.02A	1) 6.3V-.08A 2) 6.3V-.08A 12.6V-.08A* 6.3V-.16A†
MIL-Type	TF5S03ZZ	TF5S03ZZ	TF5S03ZZ
Case Type	SO-#P See Pg. 21	SO-#P See Pg. 21	SSO-#P See Pg. 24

* Series Connected. † Parallel Connected. ‡ ELECTROSTATICALLY SHIELDED.

MIL TYPE TF5R03ZZ

0.312" Dia. x 0.406"
Weight 1/10 oz.

METAL ENCASED TYPES, GRADE 5
DO-T400™ SERIES

Type No.	Application	Primary	Secondary	Rated Heat Rise
DO-T400	Isolation transformer	28V, 400 Hz	6.3V @ 60 mA	40°C
DO-T410	Isolation transformer	28V, 400 Hz	(2 secs.) 6.3 V @ 30 mA, 6.3V @ 30 mA	40°C
DO-T415	Isolation transformer	28V, 400 Hz	(2 secs.) 12.6V @ 15 mA, 12.6V @ 15 mA	40°C
DO-T420	Electrostatically shielded isolation transformer	28V, 400 Hz	28V @ 10 mA	40°C
DO-T430	3-watt autotransformer	28V, 400 Hz	12.6V - 0 - 12.6V @ 120 mA	40°C
DO-T440	3/4-watt autotransformer	28V, 400 Hz	6.3V - 0 - 6.3V @ 60 mA	40°C
DO-TSH DO-TSH2	Drawn Hipermalloy shields provide 20 to 40 dB shielding, each. See Catalog page 10 for dimensions.			

MET™ SERIES

Type No.	MIL Type	Pri. Volt	Sec. Volts	Amps. (MIL)	Amps (Industrial)	Sec. Test Volts RMS	MIL Case
MET-400‡	TF4S03AH	380-1000 Hz 105/115/125V	115 CT 115 CT 230* 115†	.06 .06 .06 .12	**.072** **.072** **.072** **.144**	1000	AH
MET-405‡	TF4S03EA	380-1000 Hz 105/115/125V	115 CT 115 CT 230* 115†	0.2 0.2 0.2 0.4	**.24** **.24** **.24** **.48**	1000	EA
MET-420	TF4S03AH	380-1000 Hz 105/115/125V	6.3 CT	2	**2.5**	1500	AH
MET-430¶	M27/180-01	400 Hz 57.5, 99.6, 115V	12.6 CT 12.6	2 2	**2.5** **2.5**	1500	FA

* Series connected. † Parallel Connected. ‡ ELECTROSTATICALLY SHIELDED.
¶ Two MET-430's Scott connected provide 26 volt two phase from 115 V. three phase 400 Hz input.

United Transformer Company/OPT • 300 Red School Lane, Phillipsburg, NJ 08865 • (201) 454-2600 • FAX (201) 454-3172

GENERAL INFORMATION
Selection Guide on Pulse Transformers

APPLICATION

Pulse transformers can be classified into coupling, impedance matching, or blocking oscillator applications.

In the pulse generating application, the characteristics of the circuit elements other than the transformer are effective in determining the pulse characteristics. Consequently, the design engineer must know the circuit in which it will be used.

The best way of specifying a coupling application is to state the source and load impedance, the voltage levels, the repetition rate, and the nature of the desired output pulse in pulse parameters.

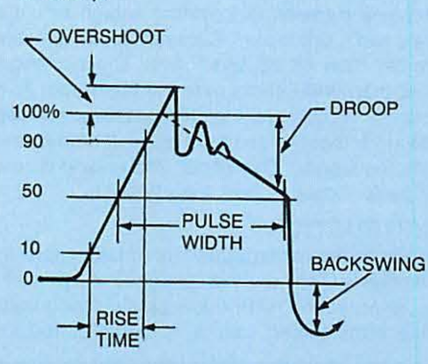
As can be seen in the diagram, a given transformer will have the same rise time regardless of the pulse width impressed on it. The droop characteristics, in percent, will be a linear function of the pulse width. A given transformer, having a 10% droop at 1 microsecond, will have a 20% droop at 2 microseconds.

The repetition rate and the pulse width determine the duty cycle which the transformer will see. This is important in the design for temperature rise consideration. Core loss energy is lost on each pulse due to eddy currents and hysteresis. The repetition rate determines the power loss in the core as well as in the windings. The voltage level as well as the pulse width determines the flux density of the transformer. This is usually stated as the ET constant and expressed in volt-microseconds.

A transformer of a given ET constant can be used for wider pulse widths and lower voltage levels or vice versa, within the insulation working voltage capability of the transformer.

PULSE CHARACTERISTICS

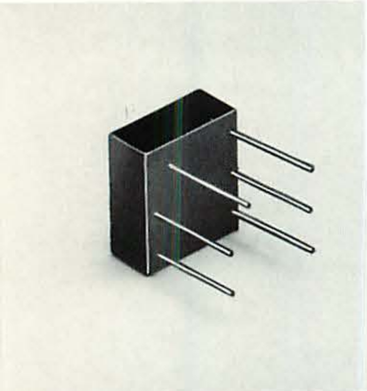
1. Pulse width
2. Rise time
3. Fall time
4. Droop
5. Overshoot
6. Backswing
7. Repetition rate

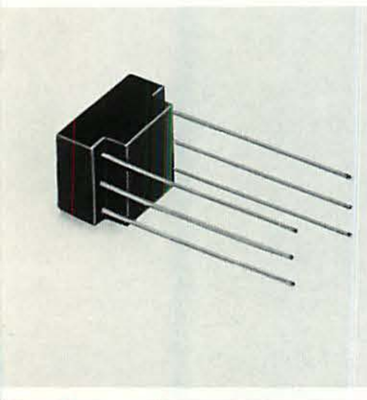


STANDARD PULSE TRANSFORMER SELECTION GUIDE

Type No.	Ratio	Pulse Width Micro-Seconds	Rise Time Micro-Seconds	Droop in %	Hi-Pot Voltage RMS	Size	Wt. Grams	MIL Type Designation	Service	Page
H-45 to H-46	1:1:1 & 5:3:1	.05-25	.01-2	0-30	1250	.406D x .406H	1	TP7SX1110AZ	Coupling and Blocking Oscillator	45
H-47 to H-52						.593D x .593H	4	TP7SX1110AC	Higher Voltage, Tube, SCR, etc.	
H-53 to H-57						.656D x .656H	6	TP7SX1110AN		
H-60 to H-68	4:4:1 & 5:3:1	.05-10	.012-.40	0-25	100	.406D x .406H	1	TP7SX4410AZ	Coupling and Blocking Oscillator	45
MPX-100	1 CT: 1 CT	Manchester II (Bi-phase 1 mHz clock)	0.1	20	100	.63SQ x .275H	4	TP7SX( )KZ	Coupling to Data Line	44
MPX-200	1.41 CT: 1CT					.63SQ x .275H				
MPX-300	1.25 CT: 1CT					.63SQ x .275H				
MPX-400	1.4 CT: 1CT 2 CT: 1 CT					.63SQ x .25H				
MPX-500	1 CT: 1CT					.5 x .35 x .25H				
MPX-600	1 CT: 1.41 CT					.5 x .35 x .25H				
PCH-45 to 46	1:1:1 & 5:3:1	.05-25	.01-2	0-30	1250	.365SQ x .52H	2	TP7SX1110KZ	Coupling and Blocking Oscillator	45
PCH-47 to 52						.64 x .52 x .52H	6		Higher Voltage, Tube, SCR, etc.	
PCH-53 to 57						.64 x .77 x .64H	8			
PIP	4:4:1 & 5:3:1	.05-10	.01-40	0-15	100	.344D x .25H	1.5	TP6RX4410CZ TP6RX5310CZ	Coupling and Blocking Oscillator	44

MPX, PIP
Pulse Transformers





MIL SPECS
MPX pulse transformers fully meet MIL STD 1553B Command/Response Multiplex Data Bus requirements. They also meet MIL-T-21038 Pulse Transformer Specs. MIL Type No. TP7SX (   ) KZ.

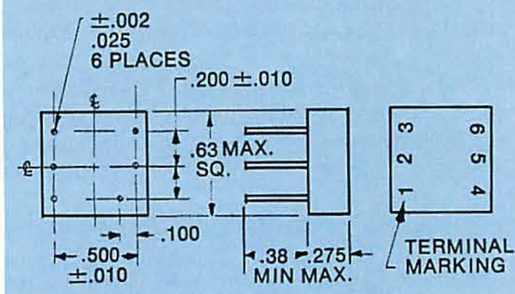
PERFORMANCE
MPX pulse transformers feature a high efficiency design for minimum losses. Common mode rejection ratio is greater than 45 db and 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 KHz to 1 MHz at 1V rms. This series possesses exceptional waveform integrity. Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

CONSTRUCTION
All windings are centertapped for greater circuit application flexibility. The series is packaged in a printed circuit style configuration, with a low profile configuration. Dielectric withstanding voltage is tested at 100 Vrms.

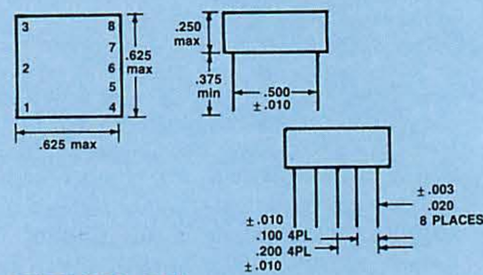
Type No.	Application	Ratio*
MPX-100	Isolation Transformer	1 CT: 1 CT
MPX-200	Coupling Transformer	1.41 CT: 1 CT
MPX-300	Coupling Transformer	1.25 CT: 1 CT
MPX-400	Coupling Transformer	1.4 CT: 1 CT 2 CT: 1 CT
MPX-500*	Isolation Transformer	1 CT: 1 CT
MPX-600*	Coupling Transformer	1 CT: 1.41 CT

*Other ratios available on special order.
MPX 500-600 meet MIL-T-21038 and are subminiature low power pulse transformers. They are not specified in MIL-STD 1553B however they can be used in multiple applications.

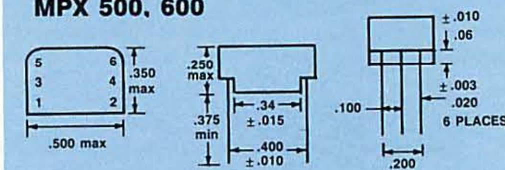
MPX 100, 200, 300

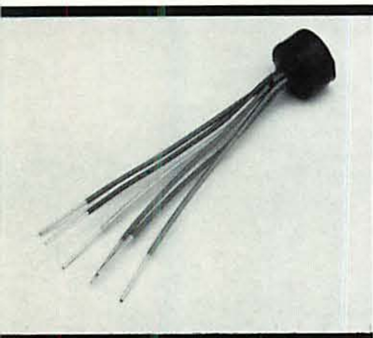


MPX 400

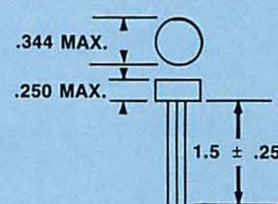


MPX 500, 600





Precision Miniature Wide Application Pulse Transformers



RATIO 4:4:1
MIL TYPE DESIGNATION TP6RX4410CZ

Type No.	Military Part No.	Approx. DCR, Ohms: 1-Brn 2-Rd	Approx. DCR, Ohms: 3-Org 4-Yel	Approx. DCR, Ohms: 5-Grn 6-Blu	Blocking Oscillator Pulse: P Width µ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	Coupling Circuit Characteristics: P Width µ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms	Frequency Response Within 2 db†
PIP-1	—	.21	.23	.13	.05	.02	0	0	37	.05	9	.018	0	0	12	50	150 KHz-29 MHz
PIP-2	—	.47	.56	.22	.1	.025	0	0	25	.1	8	.02	0	0	5	50	100 KHz-17 MHz
PIP-3	—	1.01	1.25	.37	.2	.030	2	0	15	.2	7	.035	0	0	5	100	16 KHz-9.5 MHz
PIP-4	—	1.5	1.85	.54	.5	.05	0	0	15	.5	7	.06	0	0	0	100	7 KHz-3.25 MHz
PIP-5	—	2.45	3.1	.9	1	.08	0	0	14	1	6.8	.15	0	0	5	100	7.5 KHz-2.25 MHz
PIP-6	—	3.0	3.7	1.1	2	.10	0	0	15	2	6.6	.16	0	2	10	100	2.2 KHz-1.32 MHz
PIP-7	—	4.9	6.05	1.8	3	.20	0	0	14	3	6.8	.20	0	2	10	100	1.7 KHz-1.5 MHz
PIP-8	—	8.0	9.7	2.9	5	.30	0	0	3	5	7.9	.22	0	13	25	200	1.8 KHz-1.45 MHz
PIP-9	M21038/6	13.1	15.9	4.7	10	.35	0	5	12	10	6.5	.4	0	15	20	200	1.5 KHz-1.14 MHz

RATIO 5:3:1 MIL TYPE DESIGNATION TP6RX5310CZ

Type No.	Military Part No.	1-Brn 2-Rd	3-Org 4-Yel	5-Grn 6-Blu	P Width µ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width µ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms	Frequency Response Within 2 db†
PIP-10	—	.55	.41	.15	.1	.01	0	0	20	.1	8	.01	0	0	5	140/50	170 KHz-32 MHz
PIP-11	—	2.9	2.2	8.2	1	.02	4	4	6	1	6.6	.05	0	6	12	280/100	12.5 KHz-3.25 MHz
PIP-12	M21038/7	9.4	7.1	2.6	5	.05	0	12	12	5	8	.09	2	12	25	560/200	15 KHz-4 MHz
PIP-SH	—	Drawn Hipermalloy shield and cover for PIP's provides 20 to 30 db shielding .281" h x .359" dia., 1/8" hole in cover.															

* Input winding leads Brn-Rd (1-2); output winding leads Org-Yel (3-4); leads Grn-Blu (5-6) open. † Per coupling circuit Z in/out, 1 V input.

PACKAGING
Hermetically sealed. DO-T family construction. See catalog page 9.

MIL SPECS
To complete MIL-T-21038 Specs, Grade 6, Class R, Life X.

APPLICATION
Transistor, D.W.V. Test = 100V.

NOTE
All individually adjusted to parameters shown and checked in test circuit to give required pulse width.

See page 45 for Circuits

United Transformer Company/OPT • 300 Red School Lane, Phillipsburg, NJ 08865 • (201) 454-2600 • FAX (201) 454-3172

H, PCH
Precision Miniature Pulse Transformers

PACKAGING

H - Vacuum molded; flexible leads.
PCH - Epoxy cased; designed to be used on PC boards with 0.1" pin spacings. The pins are in a non-symmetrical pattern to provide foolproof insertion.

MIL SPECS

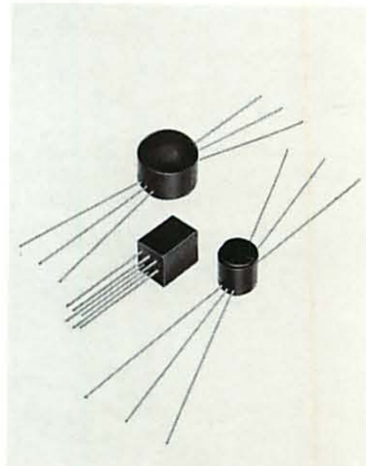
Meet MIL-T-21038 Specs. All units are Grade 7, Class S, Life X.

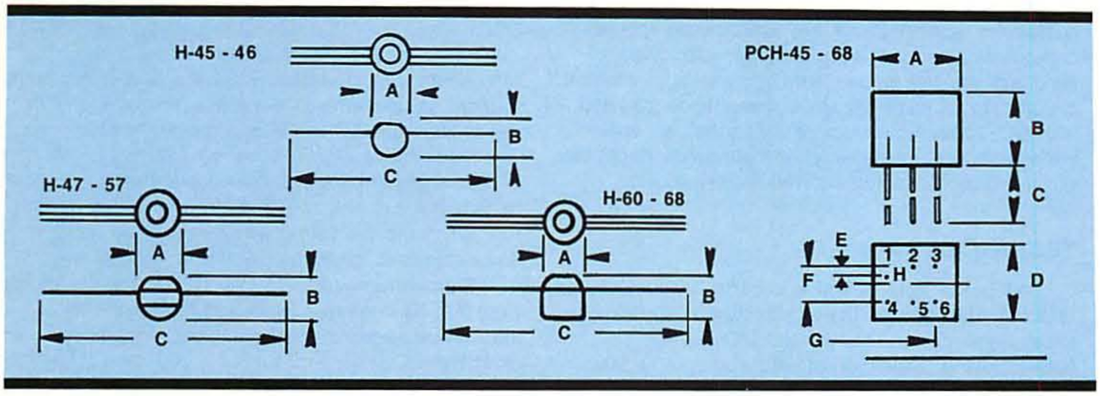
APPLICATIONS

Transistor blocking oscillators, SCR drivers, coupling and isolation. The PCH 45 through 57 also can be used in transistor circuits.

NOTE

The units are individually adjusted in the circuit shown for each group. Parameters are checked to give the required pulse widths.





MIL TYPES

PCH-45-57	TP 75 x 1110 KZ
PCH-60-68	TP 75 x 4410 KZ
H-45-46	TP 75 x 1110 AZ
H-47-52	TP 75 x 1110 AC
H-53-57	TP 75 x 1110 AN
H-60-68	TP 75 x 4410 AZ

DIMENSIONS

	A MAX	B MAX	C MIN	D MAX	E ±.005	F ±.005	G ±.005	H ±.002 Dia.
H-45-46	0.406	0.406	2.125					
H-47-52	0.593	0.593	3.250					
H-53-57	0.656	0.656	3.250					
H-60-68	0.406	0.406	2.125					
PCH-45-46	.365	.520	1	.365	.100	.200 sq.	.100	.016
PCH-47-52	.640	.520	1	.640	.100	.300	.200	.025
PCH-53-57	.765	.640	1	.765	.100	.300	.200	.025
PCH-60-68	.365	.520	1	.365	.100	.200 sq.	.100	.025

RATIO 1:1:1

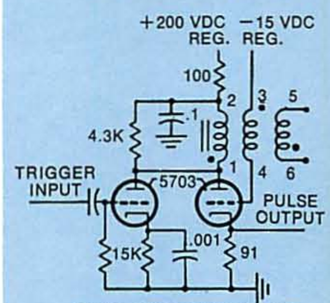
Type No. PCH	Type No. H	UTC & MIL Part No.	Approx. DCR, Ohms 1-2	3-4	5-6	Blocking Oscillator Pulse P Width μ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	Coupling Circuit Characteristics P Width μ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms	Frequency Response within 2 db†
45	45	M21038/8-001	3	3.5	4	.05	.022	0	20	10	.05	17	.01	20	0	35	250	260 kHz-34 MHz
46	46	M21038/8-002	5.5	6.5	7	.10	.024	0	25	10	.10	19	.01	30	10	50	250	220 kHz-34 MHz
47	47	M21038/9-001	3.7	4.0	4	.20	.026	0	25	8	.20	18	.01	30	15	65	500	260 kHz-93 MHz
48	48	M21038/9-002	5.5	5.8	6	.50	.03	0	20	5	.50	20	.01	30	20	65	500	85 kHz-73 MHz
49	49	M21038/9-003	8	8.5	9	1	.04	0	20	10	1	24	.02	15	15	65	500	50 kHz-62.5 MHz
50	50	M21038/9-004	20	21	22	2	.05	0	20	10	2	27	.05	10	15	35	500	24.5 kHz-49 MHz
51	51	M21038/9-005	28	31	33	3	.10	1	20	8	3	26	.07	10	10	35	500	12.6 kHz-5.65 MHz
52	52	M21038/9-006	36	41	44	5	.13	1	25	8	5	23	.15	10	10	45	1000	13 kHz-3.465 MHz
53	53	—	37	44	49	7	.28	0	25	8	7	24	.20	10	10	50	1000	9.5 kHz-6.3 MHz
54	54	M21038/10-001	50	58	67	10	.30	0	20	8	10	24	.25	10	10	50	1000	7.1 kHz-1.35 MHz
55	55	M21038/10-002	78	96	112	16	.75	0	20	10	16	23	.40	5	15	20	1000	1.65 kHz-3.05 MHz
56	56	—	93	116	138	20	1.25	0	25	10	20	23	.6	5	10	10	1000	2.15 kHz-285 kHz
57	57	M21038/10-003	104	135	165	25	2.0	0	30	10	25	24	1.5	5	10	10	1000	1.7 kHz-315 kHz

RATIO 4:4:1 — DWV TEST = 100 V RMS

Type No. PCH	Type No. H	UTC & MIL Part No.	1-2	3-4	5-6	P Width μ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width μ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms	Frequency Response within 2 db†
60	60	M21038/11-01	.124	.14	.05	.05	.016	0	0	30	.05	9.3	.012	0	0	20	50	550 kHz-43 MHz
61	61	M21038/11-02	.41	.48	.19	.1	.016	0	0	30	.1	8.2	.021	0	0	15	50	95 kHz-17 MHz
62	62	M21038/11-03	.78	.94	.33	.2	.022	0	0	18	.2	7.4	.034	0	5	12	100	60 kHz-14.5 MHz
63	63	M21038/11-04	1.86	2.26	.70	.5	.027	2	10	20	.5	7.5	.045	0	20	25	100	22 kHz-3.7 MHz
64	64	M21038/11-05	3.73	4.4	1.33	1	.033	0	12	25	1	7	.078	0	15	23	100	12 kHz-2.3 MHz
65	65	M21038/11-06	6.2	7.3	2.22	2	.066	0	15	25	2	6.6	.14	0	10	20	100	8.5 kHz-1.675 MHz
66	66	M21038/11-07	10.2	12	3.6	3	.087	0	18	30	3	6.8	.17	0	10	20	100	3.9 kHz-950 kHz
67	67	M21038/11-08	14.5	17.5	5.14	5	.097	0	23	28	5	7.9	.2	0	18	28	200	3.6 kHz-840 kHz
68	68	M21038/11-09	42.3	52.1	14.8	10	.14	0	15	28	10	6.5	.4	0	15	30	200	1.1 kHz-400 kHz

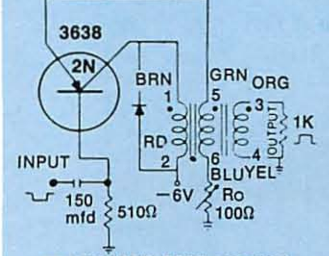
* Input winding terminals 1-2; output winding terminals 3-4: terminals 5-6 open. † Per coupling circuit Z in/out, 1 V input.

For H-45 — H-57 PCH-45 — PCH-57



STANDARD TEST CIRCUIT

For H-60 — H-68 PCH-60 — PCH-68



TRANSISTOR TEST CIRCUIT

GENERAL INFORMATION
Hi-Q Inductors
Hi-Q Coil Selection Guide

GENERAL INFORMATION ON HIGH Q INDUCTIONS

Over 50 years of specialization in High Q Inductors are reflected in the superior Q and temperature stability of the molybdenum permalloy powder toroids ferrites, and laminated structures produced by UTC today. Range of application is from DC to 30 MHz.

While this catalog lists 6 different types of stock inductors, special custom designs produced to customers' specifications are available on special order. Characteristics such as taps, additional windings, special adjustments such as in a resonant circuit, high voltage capability, inductance adjusted with DC, special mechanical configurations, even better temperature stability than our stock items, etc. are available to customers' requirements.

TECHNICAL DATA

While the toroidal coil is superior for frequencies above 1 KHz, the laminated structure is superior for lower frequencies. The ML and MO use a hum-reducing lamination structure and, in addition, the ML is in a hipermalloy shield case.

The toroidal coils MS, MM, MH and MW have extremely low hum pickup due to the symmetrical winding on the toroidal core.

All stock inductors are measured at 0 DC. The maximum DC listings are for approximately 5% drop in inductance, and negligible heat rise. The typical curves of inductance variation with AC or DC currents, illustrated on the following pages, best show the range of operation for a particular inductor. The excitation is plotted in milliamperes x $\sqrt{\text{mHy}}$. For example, the 100 mHy MS toroid (MS-100) with 10 ma of DC flowing has an excitation factor of 10 ma x $\sqrt{100\text{ mHy}}$ = 100, and the curve shows that approximately 90 mHy will be measured with 10 ma DC.

In the curves shown below, the solid line represents a stock series, while the dotted line in the toroidal group represents a few of the special capabilities of UTC in the specific stock size.

Since these high Q coils will saturate before any appreciable temperature rises occur, heating is usually not a problem. A general rule would be that four times the DC listings may be applied without any detrimental heating due to copper loss.

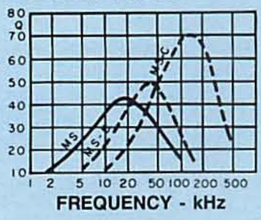
Temperature stability of all UTC inductors is excellent. Guaranteed limits and typical curves of inductance variation with temperature are shown for most types.

Engineering, laboratory, and production facilities are available for full engineering discussion, sampling, and large quantity production to meet special requirements.

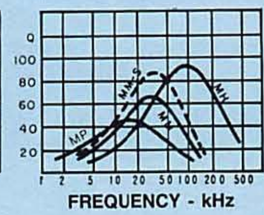
Intermediate inductance values in an existing stock toroidal series are available on special order.

Toroidal Types

MS CASE = .350 OD x .230H

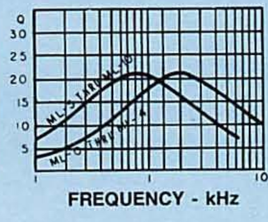


MP, MM, MH CASE = .44 OD x .23H

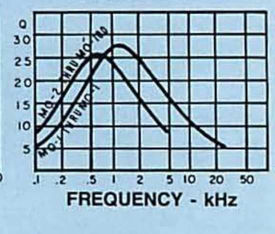


Laminated Types

ML CASE = .44 x .48 x .56H



MO CASE = .75 x 1.06 x .81H



STANDARD HIGH Q INDUCTORS SELECTON GUIDE

Type No.	MIL Gr.	Stock Line Inductance Range	Approximate DCR Ω/Hy	Approximate Peak Q	Approximate @ Freq.	Inductance Tolerance Adjustment @ 25°C	Temp. Stability	Temp. Range	Size	Wt	Page
MS	5	1 MHy-100 MHy	1300	40	20 kHz	±2% @ .1 V, 1 kHz	±2%	-55°C to +105°C	.35 dia. x .23H	1.3 gm	48
MM	5	3 MHy-120 MHy	1300	60	30 kHz	±2% @ .1 V, 1 kHz	±2%	-55°C to +105°C	.44 dia. x .23H	2 gm	48
MH	5	.6 MHy-40 MHy	2700	80	100 kHz	±2% @ .1 V, 1 kHz	±1%	-55°C to +105°C	.44 dia. x .23H	2 gm	49
ML-0 thru ML-4	5	.15 Hy-1.4Hy	150	22	1.5 kHz	±3% @ 1 V, 1 kHz	within 2%	-55°C to +105°C	.44 x .48 x .56H	.2 oz	47
ML-5 thru ML-10	5	2.5 Hy-60 Hy	85	22	800 Hz	±3% @ 1 V, 400 Hz	±2%	-55°C to +105°C	.44 x .48 x .56H	.2 oz	47
MW	5	.05 Hy-5 Hy	500	80	10 kHz	±1% @ 1 V, 1 kHz	±1%	-55°C to +105°C	.72 dia. x .41H	.25 oz	49
MO-1 thru MO-1	5	.1 Hy-1 Hy	130	27	1.5 kHz	±2% @ 1 V, 1 kHz	+1% -2%	-55°C to +105°C	.75 x 1.06 x .81H	1 oz	47
MO-2 thru MO-100	5	2 Hy-100 Hy	65	25	600 Hz	±2% @ 1 V, 400 Hz	+1% -3%	-55°C to +105°C	.75 x 1.06 x .81H	1 oz	47

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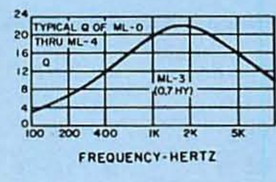
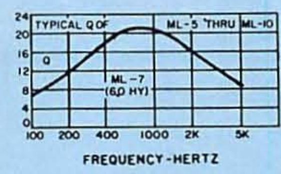
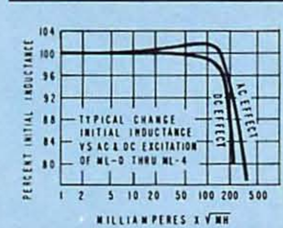
ML, MO
Miniature Laminated Hi-Q Inductors

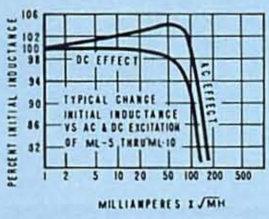
ML Series

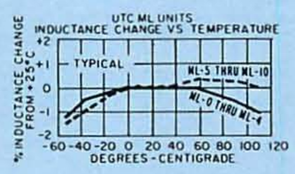
Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ± 20%
ML-0	M27/164-01	0.15	12.0	33
ML-1	M27/164-02	0.25	9.0	55
ML-2	M27/164-03	0.4	7.0	90
ML-3	M27/164-04	0.7	5.0	135
ML-4	M27/164-05	1.4	3.0	210
ML-5	M27/164-06	2.5	1.0	210
ML-6	M27/164-07	4.0	0.7	340
ML-7	M27/164-08	6.0	0.6	530
ML-8	M27/164-09	10.0	0.5	850
ML-9	M27/164-10	25.0	0.3	2300
ML-10	M27/164-11	60.0	0.2	5160

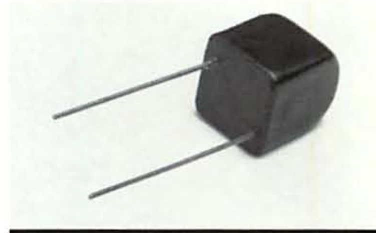


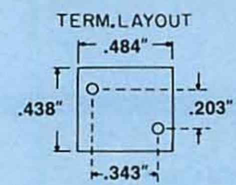












ML Case

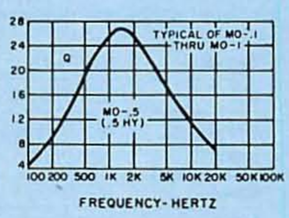
.438" x .484" x .562" H
Weight: .2 oz.

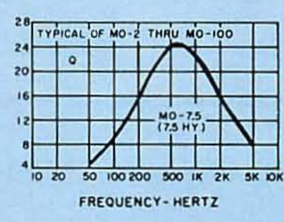
TERMINALS:
Type D — Tinned Dumet
.025" Dia. x 1.00" long;
MIL-STD 1276

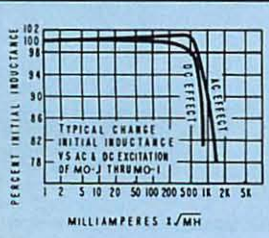
MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

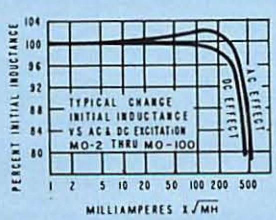
MO Series

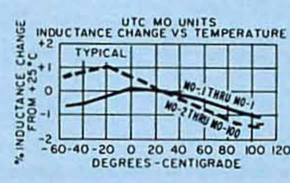
Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ± 20%
MO-.1	M27/168-01	0.1	55.0	14
MO-.15	M27/168-02	0.15	45.0	22
MO-.3	M27/168-03	0.3	28.0	34
MO-.5	M27/168-04	0.5	23.0	54
MO-1	M27/168-05	1.0	16.0	130
MO-2	M27/168-06	2.0	8.0	130
MO-5	M27/168-07	5.0	5.0	340
MO-7.5	M27/168-08	7.5	4.5	517
MO-20	M27/168-09	20.0	2.7	1310
MO-50	M27/168-10	50.0	1.4	3180
MO-100	M27/168-11	100.0	1.1	8550

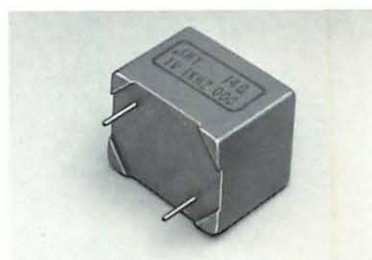


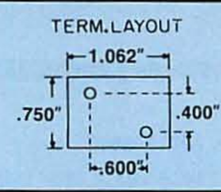












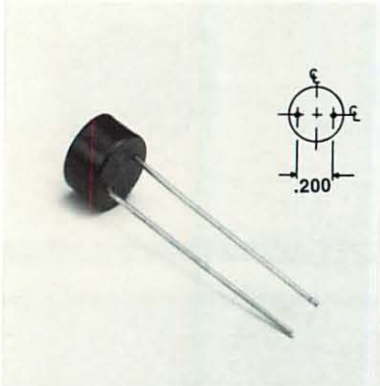
MO Case

.750" x 1.062" x .812" H
Weight: 1 oz.

TERMINALS:
Tinned Dumet
.040" Dia. x .282" long;
MIL-STD 1276

MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

MS, MM
Toroidal Hi-Q Inductors



MS Case

.35" Dia. x 23" high

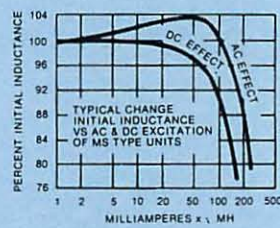
Weight:
1.3 Gm.

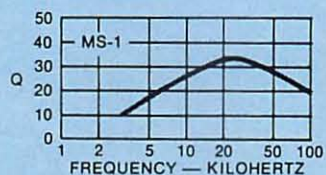
TERMINALS:
Type D — Tinned Dumet .025" Dia. x 1.250" long; MIL-STD 1276

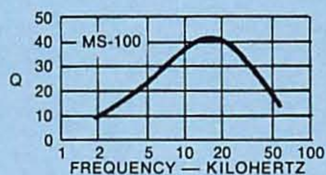
MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

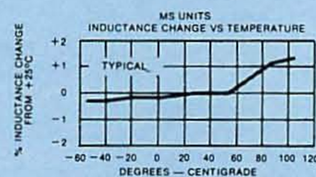
MS Series

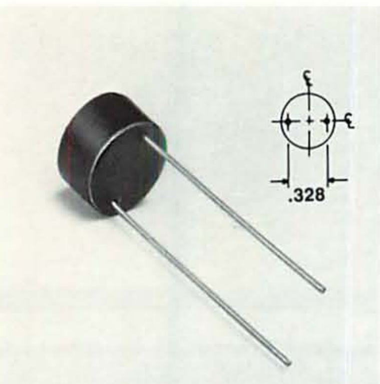
Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MS-1	M27/146-01	1	60	1.4
MS-5	M27/146-02	5	28	7
MS-10	M27/146-03	10	20	11
MS-25	M27/146-04	25	13	38
MS-50	M27/146-05	50	9	75
MS-100	M27/146-06	100	6	132











MM Case

.438" Dia. x .250" high

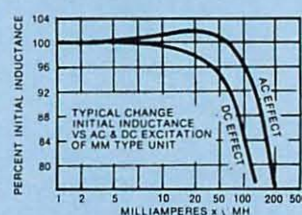
Weight:
.07 oz.

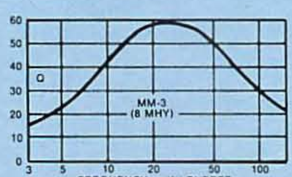
TERMINALS:
Type D — Tinned Dumet .025" Dia. x 1.250" long; MIL-STD 1276

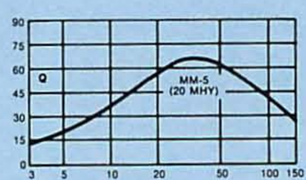
MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

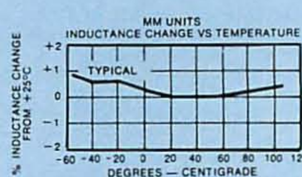
MM Series

Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MM-1	M27/240-01	3	50	4.8
MM-2	M27/240-02	5	40	8.0
MM-3	M27/240-03	8	30	13
MM-4	M27/240-04	12.5	25	19
MM-5	M27/240-05	20	20	31
MM-6	M27/240-06	30	16	47
MM-7	M27/240-07	60	11	94
MM-8	M27/240-08	120	8	186









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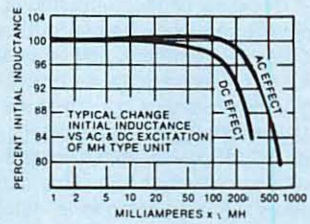
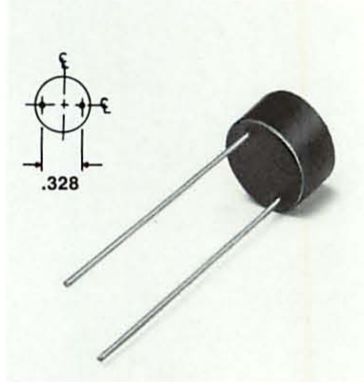
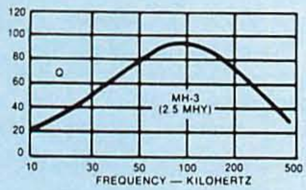
MH, MW
Toroidal Hi-Q Inductors

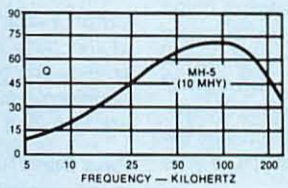
MH Series

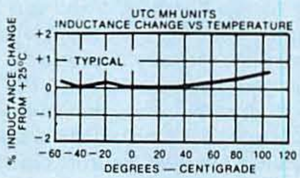
Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MH-1	M27/241-01	0.6	90	1.9
MH-2	M27/241-02	1.5	57	4.9
MH-3	M27/241-03	2.5	44	8.2
MH-4	M27/241-04	6.0	28	19.0
MH-5	M27/241-05	10.0	22	32.0
MH-6	M27/241-06	15.0	18	49.0
MH-7	M27/241-07	25.0	14	82.0
MH-8	M27/241-08	40.0	11	130.0











MH CASE

.438" Dia. x .250" high

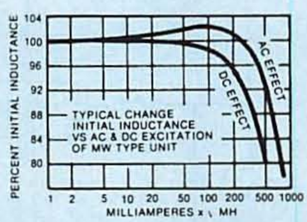
Weight:
.07 oz.

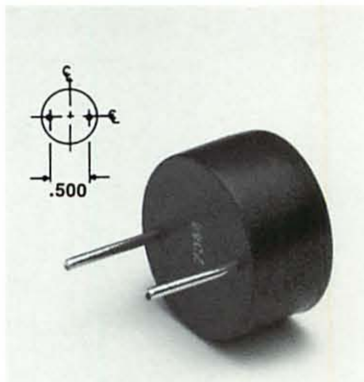
TERMINALS:
Type D — Tinned Dumet
.025" Dia. x 1.25" long;
MIL-STD 1276

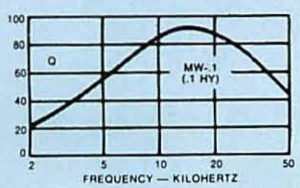
MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

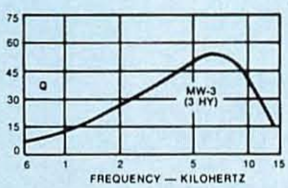
MW Series

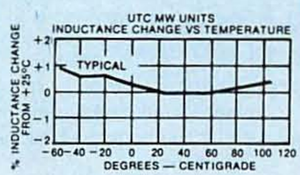
Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
MW-.05	M27/161-01	0.05	25	27
MW-.10	M27/161-02	0.10	18	51
MW-.25	M27/161-03	0.25	11	136
MW-.5	M27/161-04	0.5	8	243
MW-.75	M27/161-05	0.75	7	355
MW-1	M27/161-06	1.0	6	500
MW-1.2	M27/161-07	1.2	5	560
MW-2	M27/161-08	2.0	4	870
MW-3	M27/161-09	3.0	3.5	1340
MW-5	M27/161-10	5.0	3	2500











MW CASE

.719" Dia. x .406" high

Weight:
.25 oz.

TERMINALS:
Type N-2 — Tinned Nickel
.040" Dia. x .375" long;
MIL-STD 1276

MIL TYPE NO.
TF5RX20ZZ; MIL-T-27

GENERAL INFORMATION
LC and Crystal Filters

Over 50 years of specialization in selective networks, from image parameter design to modern network synthesis are reflected in the superior performance, miniaturization, stability, and reliability of the electric wave filters produced by UTC.

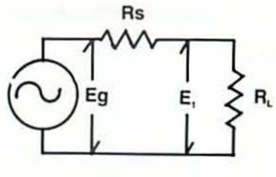
Because of the tremendous variation in requirements of frequency, band width, impedance, shape factor, size configuration, and other special characteristics such as envelope delay distortion, and return loss, catalog items are only a portion of the filters made. Special "custom" designs to customers' specifications range from DC to 30MHz, from a volume of less than 0.1 cubic inches to more than 250 cubic inches. They cover applications such as telephone, telegraph, telemetering, multiplexing, carrier elimination and restoration, etc.

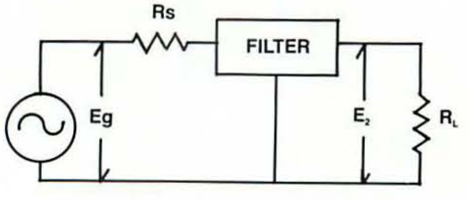
The general technical discussion that follows applies equally to all varieties of filters. UTC produces a wide range of LC & Crystal Filters. The following pages introduces a line of Monolithic Crystal Filters (Pages 55 to 57). Crystal Filters offer a practical way of achieving very narrow bandwidths and very sharp rates of cutoff coupled with high precision and stability. This new proven line formerly available on special order is now cataloged on pages 55 to 57. We invite your review of this product line. We further invite your inquiries for special design LC & Crystal Filters. Our application staff will be pleased to offer low cost practical solutions to your filter requirements.

TECHNICAL

UTC follows the standard method of measurement of insertion loss and attenuation as defined in MIL-F-18327, the military specification for filters.

Insertion Loss is defined as the ratio of power delivered to the load before insertion of the filter, to the power delivered to the load after insertion of the filter.





$$IL_{in}\ \text{db} = 20 \log_{10} \frac{E_1}{E_2}$$

where

- R_s = Source resistor.
- R_L = Load resistor.
- Eg = Generator voltage — must be maintained constant for all measurements. The generator impedance should be less than 10% of the source impedance.
- E_1 = The load voltage with the filter not in the circuit.
- E_2 = The load voltage with the filter in the circuit.

Attenuation, the relative transmission loss, is measured as the ratio output voltage (E_2) at the reference frequency to the output voltage (E_3) at the test frequency.

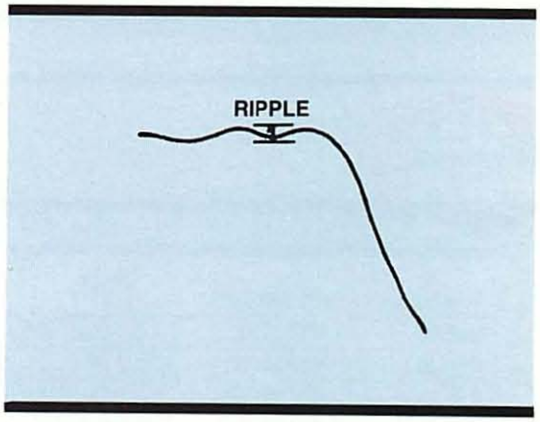
$$\text{Attenuation in db} = 20 \log_{10} \frac{E_2}{E_3}$$

Reference Frequency is that frequency by which the insertion loss is measured and to which all attenuation measurements are referred. In band pass filters, the reference frequency may be the center of the pass band or the frequency at which maximum output occurs. In low pass and high pass filters the reference is a frequency well within the flat portion of the pass band.

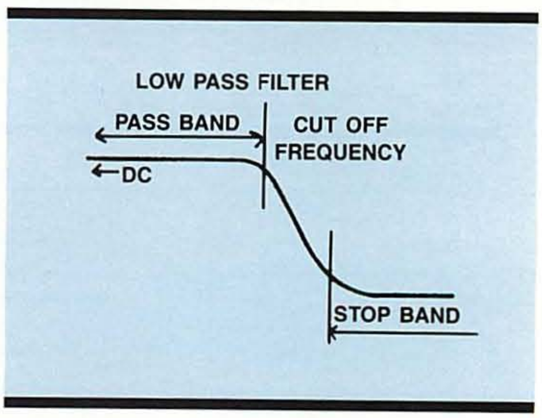
On stock, UTC uses the center frequency on band pass filters, 1/5 of the cutoff frequency on low pass filters, and 5 times the cutoff frequency on high pass filters.

Cutoff Frequency is that frequency marking the edge of the pass band. The attenuation at the cutoff frequency can be any number such as .1, 3, or 6 db depending upon the specification. The LPM's for example, are specified as 6 db maximum at cutoff frequency.

Pass Band Ripple is the difference from peak to valley of the amplitude response in the pass band measured in db.



Stop Band is that band of frequencies that the filter discriminates against.



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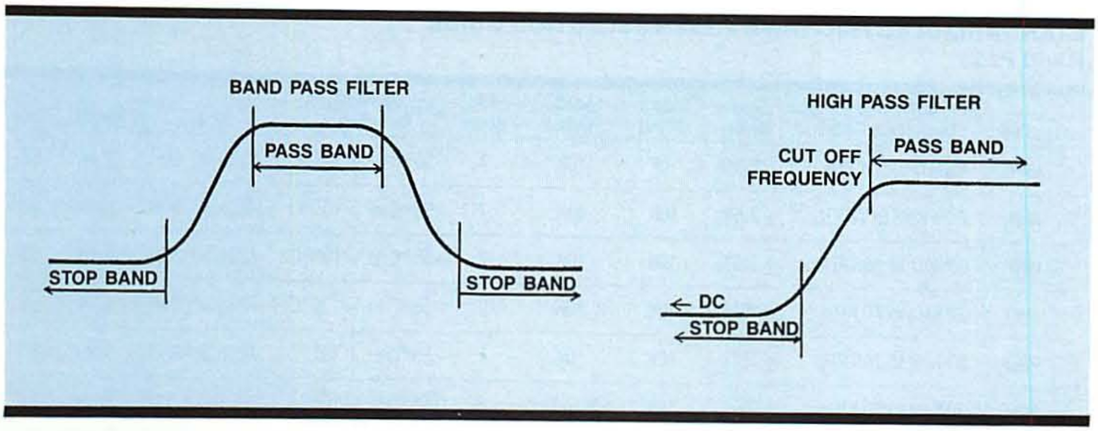
GENERAL INFORMATION
LC and Crystal Filters



Input Impedance Z_{in} is the impedance looking into the filter's input terminals with the filter properly loaded at the output terminals.

Output Impedance Z_{out} is the impedance looking into the filter's output terminals with the proper resistor across the input terminals.

Neither of these impedances, not to be confused with source and load impedances, should be specified with tolerances unless absolutely necessary. Restricting the actual impedance looking into one end or the other of a filter may complicate the design, increasing size and cost. Adjacent filters that are going to be used in parallel at their inputs or outputs, should be so specified in order to obtain units whose stop band impedances are high and thus have minimal effect on each other.

In general, to reduce size and cost of special filters, the user should be careful not to overspecify. The maximum amount of attenuation and ripple that can be tolerated in the pass band as well as the minimum stop band attenuation should be specified. The flatter the pass band and the sharper the skirt attenuation, the more complex the network and the larger and more expensive the unit becomes.

For special designs the following must be known: source and load impedances, insertion loss, pass band, stop band, operating level, operating temperature range, and size restrictions, plus any other special requirements such as phase matching, insertion loss matching, or attenuation matching between units, envelope delay distortion, return loss limits, etc.

Since filters usually contain many precisely adjusted elements and are used in critical applications where continued reliable performance is a necessity, all UTC filters, both stock and specials, are manufactured and guaranteed to MIL-F-18327.

Units with identical electrical and mechanical characteristics as stock items, except for center frequency on band pass filters, or cutoff frequency on low and high pass filters, are known as stock specials. For example, a band pass filter identical to the BPM series with a center frequency of 2700 Hz would be identified as BPM-2700, a 2700 Hz center frequency band pass filter identical to the MNF series would be identified as MNF-2.7, a low pass similar to LPM series with a 2700 Hz cutoff frequency would be identified as LPM-2700.

For Wide Band Pass applications (more than an octave wide), low pass and high pass filters may be connected in tandem. For instance, the HPM 500 in tandum with the LPM 5000 will be flat within 1 db from 625 Hz to 4000 Hz with an attenuation of 40 db below 300 Hz and above 8250 Hz.

For Band Reject applications, the BPM band pass minifilters may be used by connecting as shown on page , Figure A.

In measuring filters, precautions should be taken to be certain that the test equipment does not affect the measurement. For instance, when the lower stop band of a band pass filter or the stop band of a high pass filter is being measured, the apparent attenuation may be that of the harmonic output of the generator (which may lie in the filter pass band) rather than the actual filter attenuation at the test frequency.

To eliminate this problem the use of a wave analyzer, if available, or another filter which passes the test frequency but rejects its harmonics is recommended.

Generally, on stock filters, variations of $\pm 20\%$ in the source and load impedances will have negligible effect on the attenuation response. BPM filters may be used with a much lower source impedance and still give satisfactory results.

The nominal test level Eg is 2.0 volts RMS for MNF & MWF except 0.5 Volt on the BPM and 1.0 Volt on the LPM and HPM.

Superior and consistent performance, stability, and reliability are achieved through meticulous control of all materials and processes during the entire manufacturing cycle from the first sample to each production filter.

Engineering, laboratory and production facilities are available for full engineering discussion, sampling, and large quantity production to meet special requirements.

Filter Selection Guide

STANDARD ELECTRIC WAVE FILTER SELECTION GUIDE

Band Pass

Type No.	Center Freq Range	Band Width	Source (Ohms)	Load (Ohms)	MIL Grade	Operating Temp Range	Size	Weight	Page
MNF	400 Hz to 5.4 KHz	±7.5%	10K	10K	7	-55°C to +105°C	1.19Sq × .50H	1 oz	53
MNF	7.35 KHz to 70 KHz	±7.5%	10K	10K	7	-55°C to +105°C	.72Sq × .50H	1/3 oz	53
MNF	93 KHz to 165 KHz	±7.5%	10K	10K	7	-55°C to +105°C	.72Sq × .35H	1/5 oz	53
MWF	22 KHz to 70 KHz	±15%	10K	10K	7	-55°C to +105°C	.72Sq × .50H	1/3 oz	53
MWF	93 KHz to 165 KHz	±15%	10K	10K	7	-55°C to +105°C	.72Sq × .35H	1/5 oz	53
BPM	400 Hz to 20 KHz	±3%	10K	10K or Grid	6	-55°C to +105°C	.72Sq × 1.13H	1 oz	54

Band Reject

Type No.	Freq Range	Source (Ohms)	Load (Ohms)	MIL Grade	Operating Temp Range	Size	Weight	Page
BPM	400 Hz to 20 KHz	10K	10K	6	-55°C to +105°C	.75Sq × 1.13H	1 oz	54

Low Pass

Type No.	Cutoff Freq Range	Source& Load (Ohms)	Grade	Operating Temp Range	Size	Weight	Page
LPM	6 KHz to 15 KHz	10K	6	-55°C to +105°C	.75Sq × 1.13H	1 oz	54
LPM	200 Hz to 5 KHz	10K	6	-55°C to +105°C	1 Sq × 1.38H	2 1/4 oz	54

High Pass

Type No.	Cutoff Freq Range	Source & Load (Ohms)	MIL Grade	Operating Temp Range	Size	Weight	Page
HPM	500 Hz to 4 KHz	10K	6	-55°C to +105°C	1x1x1.38 H	2 1/4 oz	54

CRYSTAL FILTERS

Band Pass

Type No.	Center Freq Range	Band Width	Source (Ohms)	Load (Ohms)	MIL Grade	Operating Temp Range	Size	Weight	Page
MF	10.7 MHz	.07% to .28%	1.5K to 5K	1.5K to 5K	4	–25°C to +75°C	See Page 55		56
MF	21.4 MHz	.035% to .14%	1K to 3K	1K to 3K	4	–25°C to +75°C	See Page 55		57

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MNF and MWF
Telemetering Band Pass Filters

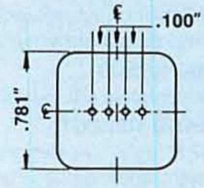
Type No.	Center Freq. (KHz)	Type No.	Center Freq. (KHz)
MNF-.4	.4	MNF-40	40
MNF-.56	.56	MNF-52.5	52.5
MNF-.73	.73	MNF-70	70
MNF-.96	.96	MNF-93	93
MNF-1.3	1.3	MNF-124	124
MNF-1.7	1.7	MNF-165	165
MNF-2.3	2.3		
MNF-3.0	3.0	MWF-22	22
MNF-3.9	3.9	MWF-30	30
MNF-5.4	5.4	MWF-40	40
MNF-7.35	7.35	MWF-52.5	52.5
MNF-10.5	10.5	MWF-70	70
MNF-14.5	14.5	MWF-93	93
MNF-22	22	MWF-124	124
MNF-30	30	MWF-165	165

ATTENUATION CHART

Type No.	Pass Band Width (less than 3 db)	Stop Band
MNF	± 7½%	15 db min @ ± 25% 40 db min @ 1.75 Fc .58 Fc
MWF	± 15%	15 db min @ ± 50% 40 db min @ 2.5 Fc .4 Fc

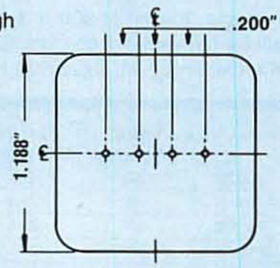
MNF-7.35 thru MNF-70,
MWF-22 thru MWF-70

.781" sq. x .500" high
WEIGHT: 1/3 oz.



MNF-.4 thru MNF-5.4

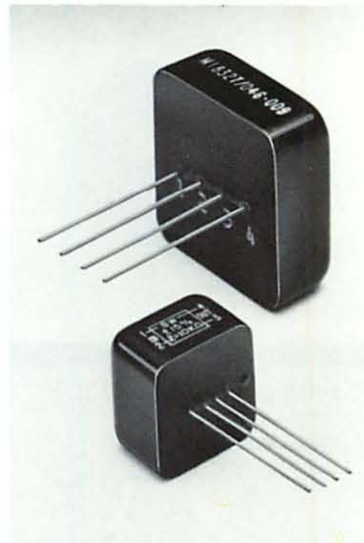
1.188" sq. x 500" high
WEIGHT: 1 oz.

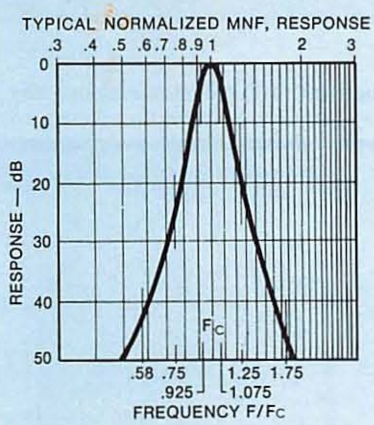


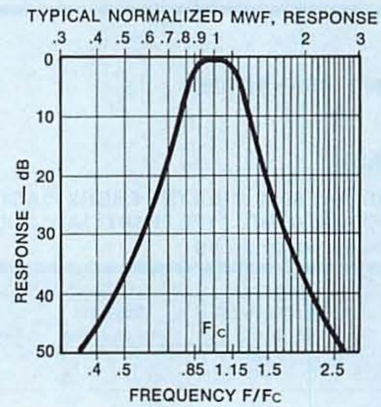
MNF-93 thru MNF-165,
MFW-93 thru MWF-165

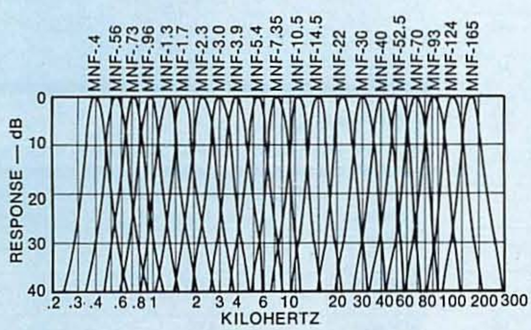
.781" sq. x .35" high
WEIGHT: 1/5 oz.

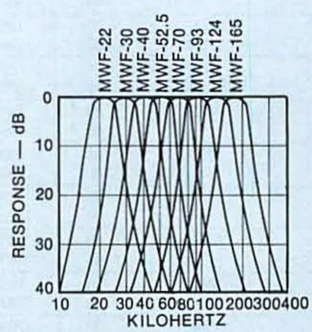
LEADS:
.025" Dia. x 1.00"; Type N-2, Tinned Nickel, MIL-STD-1276











PACKAGING

All hermetically sealed. MNF and MWF units metal cased, epoxy terminal board with pin terminals.

NOTES

The low potential connections (2 and 3 on MNF and MWF) are brought out to individual terminals so that input and output may be used at different DC potentials if desired.

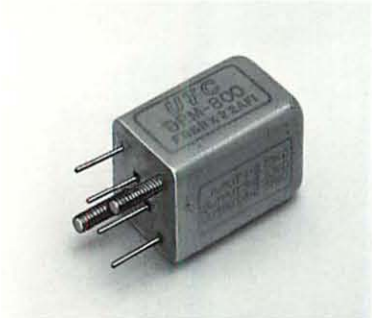
MIL SPECS
All to complete MIL-F-18327 Specs. MNF and MWF: FR7RX22ZZ1.

IMPEDANCES
MNF and MWF 10K ohms source and load.

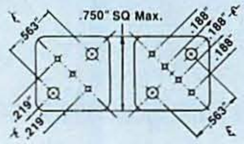
SPECIALS
MNF and MWF filters can be obtained with special center frequencies form 400 Hz to 200 KHz.

Leads: .025 Dia. x 1.00" Type N-2, Tinned Nickel, MIL-STD-1276

LPM, BPM and HPM
Miniature Band High and Low Pass Filters



BPM case
.750" x .750" x 1.125"
Weight: 1 oz.



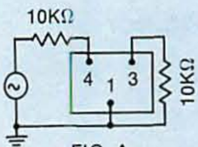


FIG. A

CONNECTIONS FOR BAND REJECT APPLICATIONS

BPM SERIES

PACKAGING
Hermetically sealed. Standard MIL metal cases. Straight pin terminals. Shielded to reduce hum pick-up.

MIL SPECS
To complete MIL-F-18327 Specs. Grade 6, Class R, Life X.

BAND REJECT
BPM units are designed for both band pass and band reject applications. For band reject connect as in fig. A.

WIDE BAND PASS APPLICATIONS
The HPM and LPM may be connected in tandem. For example, the HPM-500 in tandem with the LPM-5000 will be flat within 1 db from 625 Hz to 4000 Hz with an attenuation of 40 db at 300 Hz and 8250 Hz.

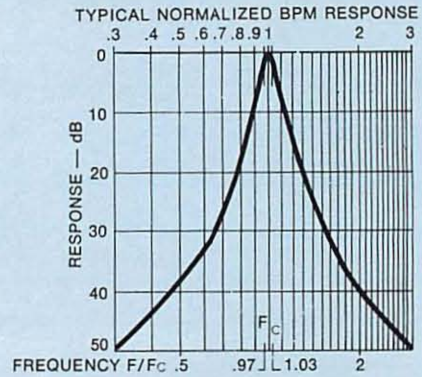
Type No.	Center Frequency (Hz)	Pass Band (Less than 2 db) (Hz)	Stop Band (more than 35 db) Below (Hz)	Above (Hz)
BPM-400	400	388-412	200	800
BPM-500	500	485-515	250	1000
BPM-600	600	582-618	300	1200
BPM-800	800	776-824	400	1600
BPM-1000	1000	970-1030	500	2000
BPM-1200	1200	1164-1236	600	2400
BPM-1500	1500	1455-1545	750	3000
BPM-2000	2000	1940-2060	1000	4000
BPM-3000	3000	2910-3090	1500	6000
BPM-4000	4000	3880-4120	2000	8000
BPM-4800	4800	4656-4944	2400	9600
BPM-5000	5000	4850-5150	2500	10000
BPM-8000	8000	7760-8240	4000	16000
BPM-10000	10000	9700-10300	5000	16000
BPM-20000	20000	19400-20600	10000	40000

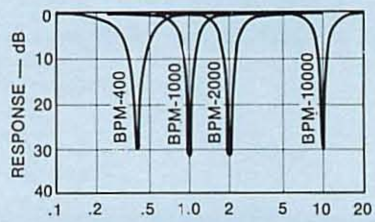
BAND PASS

MIL TYPE FR6RX22AF1

BPM's source 10K ohms; load 10K ohms or grid. Grid output gives 2:1 gain.

NOTE:
Special BPM filters with center frequency of 30 KHz to 200 KHz are available with 10,000 ohms load only, these have three terminals.

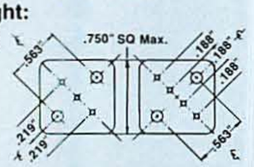




TYPICAL BAND REJECT RESPONSES

HPM and LPM case (MIL AG)
1.00" x 1.00" x 1.375"
Weight:
2¼ oz.

LPM-6000 or higher (MIL AF)
.750" x .750" x 1.125"
Weight:
1 oz.



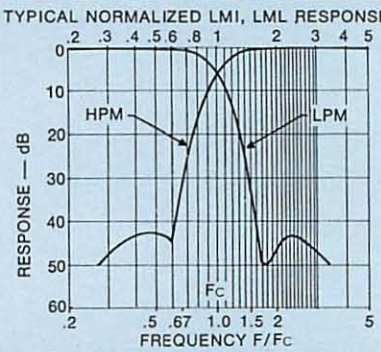
LPM AND HPM SERIES

LOW PASS

LPM's BELOW 6000 MIL TYPE FRGRX11AGI, LPM-6000 AND ABOVE MIL TYPE FR6RX11AF1. All LPM's 10K ohms source and load.

Type No.	Pass Band (less than 6 db) DC to: (Hz)	Stop Band min db @ (Hz)		MIL Case See P. 38
LPM-200	200	30 40	300 400	AG
LPM-500	500	30 40	750 1000	AG
LPM-1000	1000	30 40	1500 2000	AG
LPM-1500	1500	30 40	2250 3000	AG
LPM-2000	2000	30 40	3000 4000	AG
LPM-3000	3000	30 40	4500 6000	AG
LPM-5000	5000	30 40	7500 10000	AG
LPM-6000	6000	30 40	9000 12000	AF
LPM-10000	10000	30 40	15000 20000	AF
LPM-15000	15000	30 40	22500 30000	AF

STOCK SPECIAL LPM units available from 200 Hz to 25 KHz; HPM units available from 500 Hz to 25 KHz.



HIGH PASS

MIL TYPE FR6RX33AG1. HPM 10K ohms source and load.

Type No.	Pass Band (less than 6 db) (Hz) & above	Stop Band min db @ (Hz)	
HPM-500	500	30 40	333 250
HPM-1000	1000	20 40	667 500
HPM-4000	4000	30 40	2680 2000

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Crystal Filters
Monolithic and Discrete

1 KHz-100 MHz Crystal Filters

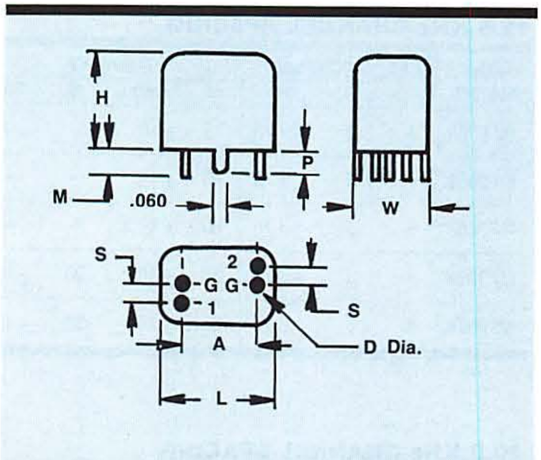
OPT/UTC manufacturing capabilities for monolithic and discrete crystal filters cover the frequency range of 1 KHz to 100 MHz.

Frequency ranges available:

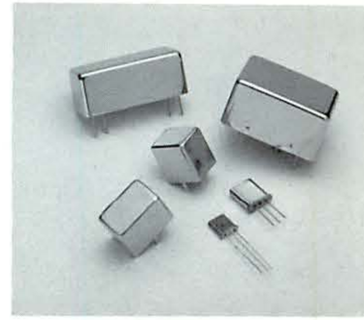
1. **Monolithic Type**
   4-45 MHz with relative bandwidth range from .04% to 0.3% of center frequency.
2. **Discrete Type**
   1 KHz–100 MHz with relative bandwidth range from .01% to 2% of center frequency.
3. **Single Side Band Type**
   .1–15 MHz.

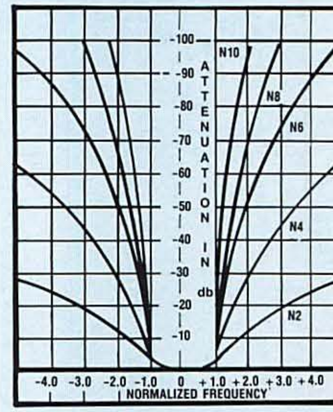
The monolithic crystal filters shown on the succeeding pages catalog some of the most popular designs in center frequencies of 10.7 and 21.4 MHz with channel spacings of 12.5, 20, 25 and 50 KHz. Other monolithic crystal filters with the foregoing channel spacings are available in center frequencies of 5.0, 5.2, 11.5, 12.5 and 16.9 MHz. These filters feature low insertion loss, excellent VSWR and steep skirt selectivity. The designs are based on .1 dB Chebychev response. Custom designs are available using linear phase, constant delay, Bessel and Gaussian response.

The normalized selectivity curves apply to conventional "all-pole" structures. By using modern synthesis techniques, it is possible to reduce the number of crystals needed to achieve a specified shape factor.



CASE	H MAX.	L MAX.	W MAX.	A	D	M MIN.	P	S
10	.590	.590	.472	.355	.018	.250	.160	.096
11	.590	.730	.472	.530	.018	.250	.160	.096
15	.455	.435	.335	.291	.014	.250	.160	.075
16	.455	.531	.335	.386	.014	.250	.160	.075

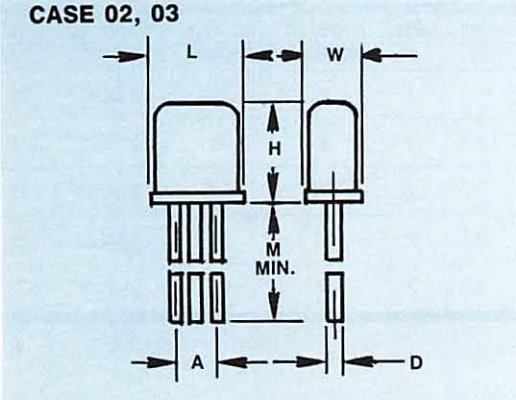




SHAPE FACTOR VS NUMBER OF POLES

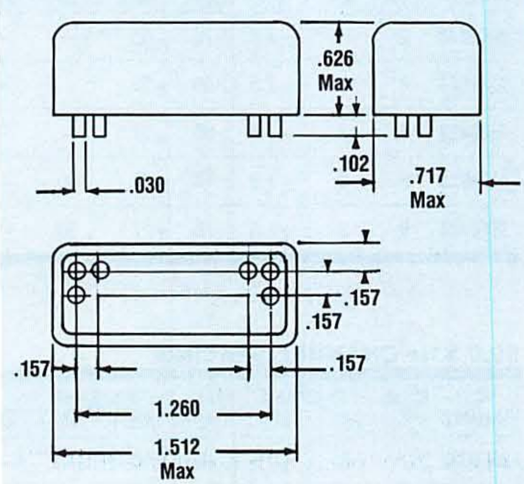
The normalized selectivity of OPT/UTC 2 to 10 pole crystal filter designs

CASE 02, 03



CASE	A	D	H MAX.	L MAX.	M MIN.	W MAX.	HOLDER
02	.147	.014	.325	.310	.200	.120	HC-45/3
03	.192	.018	.500	.432	.200	.185	HC-49/3

CASE 22



MF
10.7 MHz Monolithic Crystal Filters

12.5 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE
MF9000	2	3	±3.75	20	±18	—	—	1	1	20	50	1.5K//2	03
MF9001	4	3	±3.75	40	±14	—	—	2	1	35	70	1.5K//2	2X03
MF9002	6	3	±3.75	60	±12.5	—	—	3	2	60	80	1.5K//2	10
MF9003	8	3	±3.75	60	±10	90	±12.5	4	2	80	90	1.5K//2	11
MF9004	8	3	±3.75	60	±10	90	±12.5	4	2	80	90	910//25	22

20.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE
MF9010	2	3	±6.0	20	±25	—	—	1	1	15	50	2.7K//0	03
MF9011	4	3	±6.0	40	±20	—	—	2	1	35	70	2.7K//0	2X03
MF9012	6	3	±6.0	65	±20	—	—	3	2	60	80	2.7K//0	10
MF9013	8	3	±6.0	65	±14	90	±20	3.5	2	80	90	2.7K//0	11
MF9014	8	3	±6.0	65	±14	90	±20	3.5	2	80	90	910//25	22

25.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE
MF9020	2	3	±7.5	20	±35	—	—	1	1	15	50	3.0K//0	03
MF9021	4	3	±7.5	40	±25	—	—	2	1	35	70	3.5K//0	2X03
MF9022	6	3	±7.5	60	±22.5	—	—	3	2	60	80	3.5K//0	10
MF9023	8	3	±7.5	70	±17	90	±25	3.5	2	80	90	3.5K//0	11
MF9024	8	3	±7.5	70	±17	90	±25	3.5	2	80	90	910//25	22

50.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE
MF9030	2	3	±15	15	±30	—	—	1	1	10	35	5.0K//0	03
MF9031	4	3	±15	30	±35	—	—	2	2	30	60	5.0K//0	2X03
MF9032	6	3	±15	60	±45	—	—	3	2	60	80	5.0K//0	10
MF9033	8	3	±15	60	±30	80	±40	4	2	80	90	5.0K//0	11
MF9034	8	3	±15	60	±30	80	±40	4	2	80	90	910//25	22

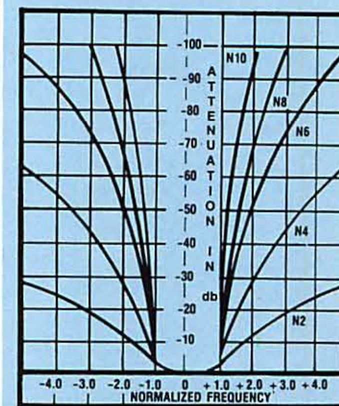
Operating temperature -25°C to +75°C   To Order: Specify the part number followed by the case code Example: MF9003-11

United Transformer Company/OPT • 300 Red School Lane, Phillipsburg, NJ 08865 • (201) 454-2600 • FAX (201) 454-3172

MF
21.4 MHz Monolithic Crystal Filters

12.5 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE **
MF9100	2	3	±3.75	20	±18	—	—	1.5	1	15	50	1.0K//2	02
MF9101	4	3	±3.75	40	±14	—	—	2.5	1	30	70	1.0K//2	2X02
MF9102	6	3	±3.75	60	±12.5	—	—	3	2	60	80	1.0K//2	15
MF9103	8	3	±3.75	60	±10	80	±12.5	4	2	80	90	1.0K//2	16
MF9104	8	3	±3.75	60	±10	80	±12.5	4	2	80	90	910//25	22



SHAPE FACTOR VS NUMBER OF POLES

The normalized selectivity of OPT/UTC 2 to 10 pole crystal filter designs

20.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE **
MF9110	2	3	±6.0	20	±25	—	—	1.5	1	15	45	1.4K//0	02
MF9111	4	3	±6.0	40	±22.5	—	—	2	1	30	70	1.4K//0	2X02
MF9112	6	3	±6.0	60	±22.5	—	—	3	2	60	80	1.4K//0	15
MF9113	8	3	±6.0	60	±14	80	±20	4	2	80	90	1.4K//0	16
MF9114	8	3	±6.0	60	±14	80	±20	4	2	80	90	910//25	22

25.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE **
MF9120	2	3	±7.5	20	±30	—	—	1.5	1	15	45	1.6K//0	02
MF9121	4	3	±7.5	40	±25	—	—	2	1	30	70	1.6K//0	2X02
MF9122	6	3	±7.5	60	±25	—	—	3	2	60	80	1.6K//0	15
MF9123	8	3	±7.5	60	±20	80	±22	4	2	80	90	1.6K//0	16
MF9124	8	3	±7.5	60	±20	80	±22	4	2	80	90	910//25	22

50.0 KHz CHANNEL SPACING

PART NUMBER	POLES	PASSBAND dB	PASSBAND KHz	STOPBAND dB	STOPBAND KHz	STOPBAND dB	STOPBAND KHz	LOSS dB	RIPPLE dB	SPURIOUS dB (MIN.)	ULT. REJ. dB (MIN.)	Z IN/Z OUT OHM/PF	CASE **
MF9130	2	3	±15	20	±45	—	—	1	1	10	40	3.0K//0	02
MF9131	4	3	±15	40	±50	—	—	2	1	25	60	3.0K//0	2X02
MF9132	6	3	±15	60	±45	—	—	3	2	45	80	3.0K//0	15
MF9133	8	3	±15	60	±35	80	±45	4	2	70	90	3.0K//0	16
MF9134	8	3	±15	60	±35	80	±45	4	2	70	90	910//25	22

Operating temperature −25°C to +75°C To Order: Specify the part number followed by the case code Example: MF9103-11

**These filters are available in the 10.7 MHz cases

OPT
Capability

OPT Industries, founded in 1972, has grown steadily from a small handful of employees to a well-trained, highly efficient work force of nearly 500 today. Our facilities occupy over 100,000 square feet in Phillipsburg, New Jersey, New York City, and Athens, Greece. In addition, OPT operates a Research and Development Center in Orlando, Florida.

Our product lines include transformers, crystal filters, LC filters, monolithic filters, linear power supplies, switching power supplies, and data communication and networking products such as baluns, adaptors, cable assemblies and multiplexers.

OPT's reputation for engineering, quality and manufacturing expertise has enabled us to become a supplier to many of the nation's major military programs, and to some of the largest, most advanced computer manufacturers, telecommunications firms and industrial producers.

Our recent acquisition of the UTC Division of TRW has greatly expanded our transformer design and manufacturing capabilities. This, plus a strong QPL position and a nationwide distributor network has greatly enhanced our ability to serve our customers.

Modern techniques such as computerized automatic testing of transformers, CAD/CAM systems, automatic circuit board testing for power supplies, as well as computer aided design, have enabled OPT to become a leader in customized magnetics as well as state of the art high power, high density power supplies.

OPT has its own in-house environmental testing laboratory which allows us to do our own qualification to MIL-T-27, MIL-F-18327, and MIL-T-21038. We have also been qualified to do in-house testing to CSA specifications. We hold many QPL approvals for both transformers and filters. In addition, we have a UL yellow card and manufacture to UL 544 as well as UL, CSA and VDE specifications.

OPT's Data Products Division manufactures a comprehensive line of data communications components which provide maximum capability and flexibility to cabling systems and networks. Available in a wide variety of configurations are an extensive line of economical baluns, adaptors, connectors, cable assemblies and multiplexers which make system installations, changes and moves easy and convenient.

The OPT Power Conversion Division serves the military, commercial, computer, and communications markets. The high current needs of super computers and large mainframes are met by our unique 100 KHz current controlled designs with either forced air cooling, conduction cooling, or nitrogen and fluorinert cooling systems. Our demonstrated 240,000 hours MTBF and N + 1 system hook-up make OPT a leader in the high power conversion systems.

In the low power range where space is a premium, our MICROSWITCH™ line, which uses our patented 1 MHz resonant converter technology, allows a low profile of 0.86 inches at the 100 watt level in both single and multiple output units.

Creative engineering and reliability are the trademarks of OPT power supplies.

The OPT Quality Assurance Program complies with MIL-I-45208 with provisions for meeting MIL-Q-9858A or NHB5300.4 when required. Our calibration system meets the requirements and has been approved by DCASR to MIL-STD-45662.

During our growth, OPT has acquired many widely known companies in the magnetics industry. Among them are Nytronics-Transformer and Filter Divisions, Omnitec, Bulova Filter Division, Burnell, Ortho Industries, Filtech, and most recently the UTC Division of TRW. As a result, we have gained access to many thousands of design and manufacturing specifications, and all products previously built by these companies are available from OPT.

We are very proud of our customer list, which includes most of the 25 largest electronic manufacturers in the country. We think this is a tribute to a competent and dedicated work force.

DATA COMMUNICATIONS PRODUCTS
Data Products Capability

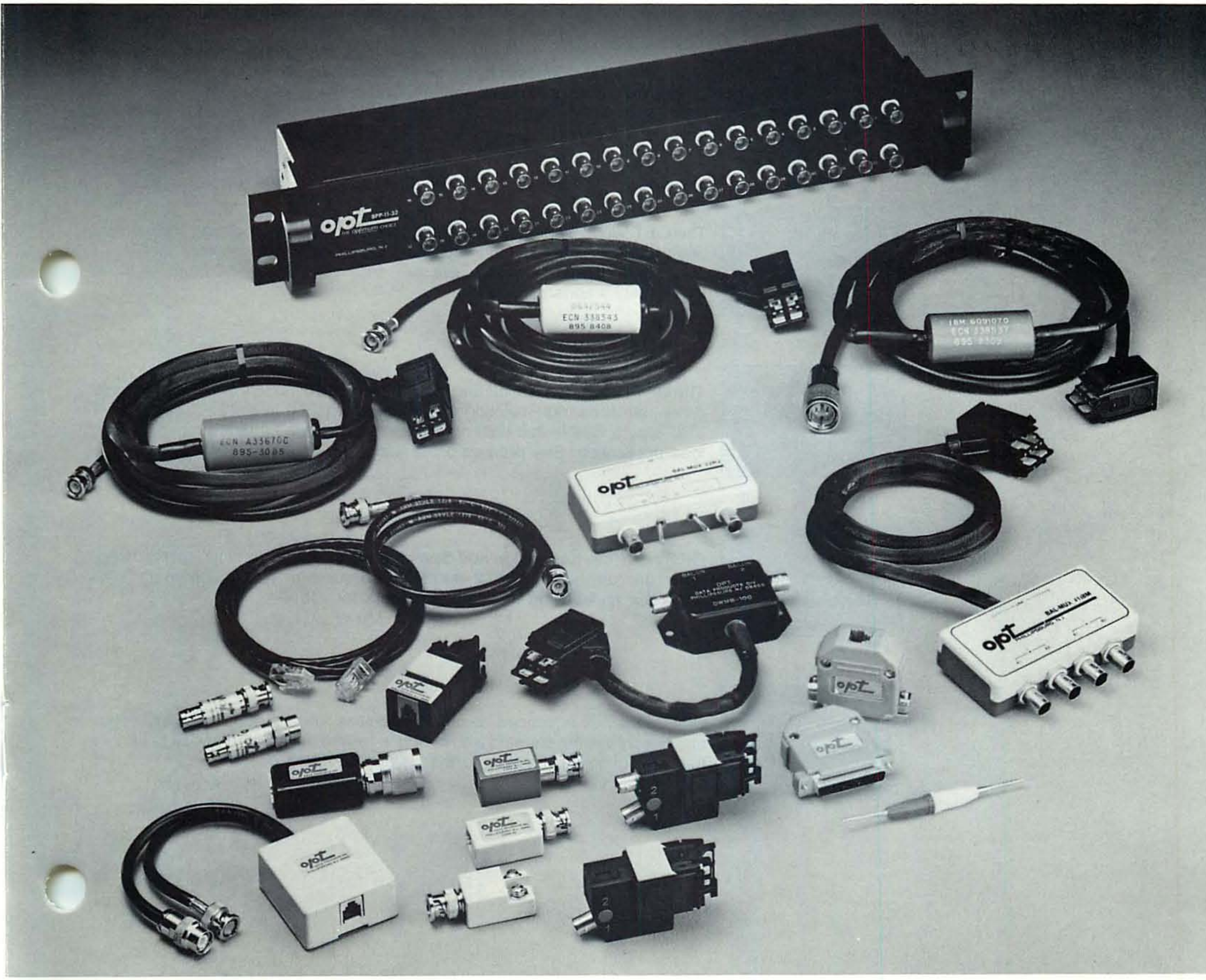
OPT's Data Products Division manufactures a full line of Data Communications Products designed to attach a broad assortment of computers and peripheral equipment to various cabling systems and Local Area Networks.

OPT baluns, cable assemblies, patch panels, multiplexers and adaptors are available in a wide variety of standard and custom configurations.

Whether you use IBM, DEC, WANG or compatible equipment, and want to transmit over the IBM Cabling System — unshielded twisted pairs — coax — twinax or other type of cable, there is an OPT product that will enable you to do it better, more conveniently and at less cost.

If one of our standard products can't do that for you, we can design one to fit your application.

Contact OPT's Data Products Division.
1-800-453-2580 (For Data Products Division only.)



POWER SUPPLY CAPABILITY

SP-R

The OPT SP-R Series, high current 1500 and 2500 watt 100 KHz switching power supplies. 1∅; 3∅ and 210 to 325 VDC inputs standard. Current mode control, N + 1 automatic current sharing. Fan cooled and conduction units. FCC level "A", UL, CSA, IEC recognized.
1500 watt — 5" x 8" x 11.5" — 2500 watt — 5" x 8" x 13.5".

Microswitch Mode™

The OPT MICROSWITCH MODE™, 750 KHz and 1 mHz AC and DC input switchers. AC input units available in 50 watt and 100 watt triple output in case sizes 0.875" x 4" x 6" and 0.875" x 4.5" x 8". DC inputs of 42 to 60 with single, dual and triple outputs of 50, 75 and 100 watts in 0.875" x 4.5" x 3.75" and 0.475" x 4.5" x 2.40" offering up to 20 watts a cubic inch.

Titan Switcher

The OPT TITAN Series, off the shelf delivery of 50 watt to 384 watt single output low current switchers. Meet FCC/VDE B level 50 and 100W, level A 150 to 384 watt. UL recognized, VDE and CSA certified. AC power fail, inhibit and cover are standard.

World Linear

The OPT World Series, off the shelf delivery of single, dual and triple output open frame high MTBF (460,000 hours calculated) linear power supplies. All units are in standard industry case size, 100/115/220/240 VAC input. UL/CSA/VDE safety standards pending.

DC-DC Converters

The OPT DC-DC Series, off the shelf delivery of 56 models in SIP and modular cases. Isolation, non-isolation and voltage boosting in 5, 12, 15, 24, and 48 VDC inputs. Single and dual outputs up to 3.0 watts for board mount point of load application. See product presentation on pages 36 and 37.

Custom Capability

OPT Industries has design and development capability for your special needs when on "off the shelf" just won't do. Call us with your requirement. We'll apply our pacesetting technology to work for you.

Military Power Supplies

OPT Industries advanced design capabilities and MIL approved inspection and quality system coupled with in-house testing capability allow us to provide hi-reliability power supplies to the military stringent needs.

A Method for Determining Approximate Sizes Obtainable for VA Power Ratings

Transformer and Choke Sizes for Military and Industrial Products

MIL SIZES

The following chart shows the obtainable VA power available in the MIL case sizes listed below. Use this handy reference guide for your size versus power planning. For chokes, see the LI² values in the last column.

CASE TYPE	CASE DIMENSIONS A	B	C	MOUNTING DIMENSIONS D	E	F	VA RATINGS 60	400	APPROX. WGHT. (Lbs.)	LI²
AF	.750"	.750"	1.012"	.562—diagonal		4-40 x .375"	1	2-4	.06	—
AG	1.0	1.0	1.375	.750—diagonal		4-40 x .375	2	4-8	.15	—
AH	1.312	1.312	1.750	1.25—diagonal		6-32 x .375	4	8-16	.35	—
AJ	1.625	1.625	2.375	1.187	1.187	6-32 x .375	6	12-24	.80	.01
EA	1.937	1.812	2.750	1.375	1.250	6-32 x .375	10	20-40	1.3	.02
EB	1.937	1.812	2.437	1.375	1.250	6-32 x .375	8	16-32	1.1	.03
FA	2.312	2.062	3.125	1.687	1.437	6-32 x .375	20	40-80	1.9	.04
FB	2.312	2.062	2.500	1.687	1.437	6-32 x .375	15	30-60	1.5	.06
GA	2.750	2.375	3.812	2.125	1.750	6-32 x .375	35	70-140	3.0	.08
GB	2.750	2.375	2.812	2.125	1.750	6-32 x .375	25	50-100	2.3	.10
HA	3.062	2.625	4.250	2.296	1.859	8-32 x .375	50	100-200	4.3	.14
HB	3.062	2.625	3.187	2.296	1.859	8-32 x .375	38	75-150	3.2	.18
JA	3.562	3.062	4.875	2.625	2.125	8-32 x .375	75	150-300	6.8	.23
JB	3.562	3.062	3.875	2.625	2.125	8-32 x .375	60	120-240	5.3	.30
KA	3.937	3.375	5.250	3.00	2.437	10-32 x .500	100	200-400	8.7	.40
KB	3.937	3.375	4.312	3.00	2.437	10-32 x .500	85	170-340	7.2	.50
LA	4.312	3.687	5.562	3.312	2.687	10-32 x .500	140	280-560	11	.62
LB	4.312	3.687	4.500	3.312	2.687	10-32 x .500	110	220-440	9	.70
MA	4.687	4.00	6.00	3.687	3.00	.250-20 x .625	180	360-720	16	.80
MB	4.687	4.00	4.937	3.687	3.00	.250-20 x .625	150	300-600	13	.90
NA	5.062	4.312	6.812	4.062	3.312	.250-20 x .625	250	500-1000	19	1.25
NB	5.062	4.312	5.500	4.062	3.312	.250-20 x .625	200	400-800	16	1.50
OA	5.500	4.500	6.750	3.750	3.00	.250-20 x .625	350	700-1400	22	2.0

COMMERCIAL/INDUSTRIAL SIZES

This chart should be used for open frame industrial/commercial open core transformers and chokes. Both lamination stack sizes and lamination sizes are shown. Use the LI² column for approximate choke sizes.

SIZE STACK	LAMIN.	VA AND LI² RATINGS 50°C RISE VA 50Hz	VA 60Hz	VA* 400Hz	LI²	REGULATION 60Hz
0.375	EI-375	2.8	3.4	7-10	.011	30%
0.750	EI-375	5.6	6.8	10-20	.022	20
0.500	EI-21	5.6	6.7	10-20	.021	21
1.000	EI-21	11.2	13.4	20-40	.042	14
0.625	EI-625	10.4	12.5	20-40	.040	14.8
1.250	EI-625	20.8	25.0	40-80	.080	10.0
0.750	EI-75	20.0	24.0	40-80	.085	10.9
1.500	EI-75	40.0	48.0	75-150	.170	7.4
0.875	EI-87	34	41	60-120	.146	9.0
1.750	EI-87	68	82	100-200	.292	6.2
1.000	EI-100	55	66	90-120	.253	7.0
2.000	EI-100	110	132	170-340	.506	4.8
1.125	EI-112	86	103	140-280	.413	5.9
2.250	EI-112	172	206	280-560	.826	4.0
1.250	EI-125	120	145	200-400	.629	5.0
2.500	EI-125	240	290	400-800	1.258	3.4
1.375	EI-138	180	200	300-600	.90	4.5
2.750	EI-138	360	400	500-1000	1.80	3.1
1.500	EI-150	250	275	275-750	1.21	4.0
3.000	EI-150	500	550	700-1400	2.42	2.7
1.750	EI-175	370	400	600-1200	2.16	3.1
3.500	EI-175	740	800	1000-2000	4.32	2.2
2.125	EI-212	650	700	900-1800	4.29	2.7
4.250	EI-212	1300	1400	2000-4000	8.58	1.8
2.250	EI-225	780	850	1000-2000	5.27	2.56
4.500	EI-225	1560	1700	2400-4800	10.54	1.75
2.500	EI-250	1080	1175	1400-2800	7.95	2.25
5.000	EI-250	2160	2350	2700-5000	15.90	1.55

*The higher VA ratings for 400Hz are based on use of .004 in. Silectron.

NOTES AND TOLERANCES

1. Tolerances on dimensions A and B are +0 to −0.062 for cases AF, AG, AH and AJ; +0 to −0.125 for all other cases.
2. Tolerances on dimension C are +0 to −0.125 for cases AF, AG, AH, AJ; +0 to −0.187 for all other cases.
3. Tolerances on dimensions D and E are ±0.015 for cases AJ to JB, inclusive; ±0.031 for cases KA to LB, inclusive; and ±0.046 for cases MA to OA, inclusive.
4. Screw-stud lengths are measured from the mounting surface and have a length tolerance of ±0.062 on studs 0.500" long or less, and ±0.125 on studs over 0.500" long.

VA ratings are based on a two winding transformer and normal operating voltages, with a 40 degree C temperature rise over a 65 degree C ambient. When there are three or more windings or high operating voltages, the VA ratings will decrease.

This table is for use merely as a guide for estimating size. By use of special materials, it is sometimes possible to greatly reduce the size of a unit. However, this generally increases price.

The higher VA ratings for 400 Hz are based on .004 in. Silectron.

UL Safety Standards Capability

Building the highest quality transformers to UL Standards for more than 5 decades.

UTC has been a leader in the design and manufacture of high quality electronic transformers for more than 55 years. During that time it has gained extensive experience in building thousands of products to applicable UL Standards and has met the safety requirements of other leading standards' bureaus throughout the world.

We have the capability and experience to design and manufacture transformers to meet the UL Standards listed below:

- **UL 455** Electrical, medical and dental equipment
- **506** Specialty transformers
- **697** Toy transformers
- **1012** Power Supplies
- **1310** Direct plug-in transformers
- **1411** Transformers and motor transformers for use in audio, radio and television-type appliances
- **1459** Telephone equipment
- **1561** Large general purpose transformers
- **1585** Class 2 and Class 3 transformers

UL 1446 System of Insulating Materials

In addition to the foregoing standards, the UTC has many years of experience in the manufacture of transformers to UL Standard 1446, which applies to insulation systems used in transformers. Many products such as data processing and office equipment, telephone, fire control, medical lighting and other medical items, where safety is a consideration, are subject to UL 1446.

In meeting these requirements, particular attention is paid to dielectric strength and leakage current. The insulation class is determined by the ambient temperature and temperature rise of the transformer. Other important considerations are the inter and intra winding insulation, creepage, spacing and clearance between windings, winding to windings, and to the core or ground.

Double insulation is required for certain applications and insulation resistance can become a major consideration under these circumstances.

UTC has Underwriters Laboratories insulation class approvals from 130°C to 220°C in various insulation and impregnants. **Our yellow card file number is E57605.**

UTC welcomes inquiries regarding applications which require UL approval. Our facility is equipped and UL-approved to perform many of the mandated UL tests. This unique capability makes it possible for us to submit our customers' test report findings directly to Underwriters Laboratories for approval.

Other Standards.

Canadian Standards Association requirements for safety are similar to those defined by Underwriters Laboratories Inc. UTC welcomes the opportunity to serve the needs of manufacturers whose products must conform to CSA requirements.

In addition, UTC will meet or exceed the safety requirements of the VDE. In general, conformance to this specification will require a slightly larger transformer because of the increased creepage, clearance distances, minimum insulation layers and thickness, and higher dielectric strength, up to 3750V.

When you're building products which must conform to UL, CSA or VDE requirements, you can depend upon UTC. Our knowledge, experience and capability are your assurance of professionalism and economy in the solution of your transformer design and performance problems.

MILITARY GENERAL SPECIFICATIONS, MILITARY TYPE DESIGNATIONS, MILITARY STANDARD DRAWINGS, MILITARY SLASH/SHEETS AND QUALIFIED PRODUCTS LISTS

Federal Supply Code for Manufacturers (FSCM No. 80223 is assigned to UTC).

UTC military products are made to the latest revisions of either MIL-T-27 (transformers and inductors), MIL-F-18327 (electric wave filters), or MIL-T-21038 (pulse transformers).

Each of these specifications make use of its own MIL Type Designation, which is essentially a shorthand description of the item. However, the MIL Type Designation will not fully describe an item without a statement of its electrical characteristics and, where necessary, a dimensional drawing. Therefore, for ordering purposes, you must specify the UTC Part Number in addition to the Type Designation. A condensed outline of MIL Designations is presented on page 64 for your reference.

The Department of Defense has phased out the use of the previous standard part documents, e.g., M.S. sheets (Military Standards) and MIL Type Designations with the three-digit suffix to describe a discrete specific part.

The general component specifications MIL-T-27, MIL-F-18327 and MIL-T-21038 now have supplementary documents known as slash/sheets, which are drawings completely describing the standard parts. The slash/sheets are prefixed with the number of the related specification, such as M27/104-001, M18327/018-001 or M21038/8-001.

However, OEMs are not restricted to the usage of slash/sheet standard parts. If a new or different application requires a new or different part it can be custom designed as previously, with all general visual, mechanical, environmental and electrical requirements governed by the applicable military general component specifications.

The slash/sheet itself does not list the qualified manufacturer. To determine this information, refer to the related QPL, look up the particular slash/sheet number and the qualified manufacturer will be listed.

The MIL Type Designation (less the three-digit suffix) does not describe a specific part — only a general family type. Refer to the charts on the following page for information obtained from the military type designations.

If the part and the drawing have TF designations that appear in conflict, refer to the cross-index chart listed in paragraph 6.16 of MIL-T-27.

Each of these three specifications contains a requirement for qualification and a procedure for obtaining qualification by reason of similarity to a qualified part. All parts qualified to each specification appear on the appropriate Qualified Products List, e.g. QPL-27, QPL-18327, QPL-21038. If a desired item does not appear on the QPL, it still may be qualified by similarity, provided the manufacturer has an acceptable similar part qualified.

The determining factors considered in an extension of qualification are many and complex. Guidance by similarity appears in paragraph 20.2 and Figure 18 of MIL-T-27, paragraph 20.3 and Figure 10 of MIL-F-18327 and paragraph 20.3 and Figure 10 of MIL-T-21038. This information can be obtained from the manufacturer. Obviously, a manufacturer with an extensive listing on the QPL is in a far better position to save the user time and high test costs than one with no listings, or with only a few parts listed.

Copies of the General Military Specifications, slash/sheets and Qualified Products Lists mentioned above may be obtained by manufacturers from:

U.S. Navy Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA, 19120.

MIL
Type Designations

Examples of Military Type Designations

MIL-T-27—Military Specifications for Transformers and Inductors (Audio and Power)

TF	4	R	03	FA
COMPONENT	**GRADE**	**CLASS**	**FAMILY**	**CASE OR ENVELOPE SIZE AND MOUNTING**
All MIL-T-27D transformers or inductors	Refers to case material and environmental capability e.g., Grade 4 = Metal cased. Max. reliability. Resistant to shock, vibration and thermal shock. Grade 5 = Same as Grade 4 except encapsulated or molded. Grade 6 = Open type for subsequent potting by OEM.	Indicative of max. operating temp. (ambient plus temperature rise) e.g., Q = 85°C, R = 105°C, S = 130°C, V = 155°C, T = 170°C, U = >170°C	Two digit number code listed in spec. representing each application or category of transformers and inductors 03 = Power Transformer, 04 = Power Inductor, 20 = Audio Inductor, 21 = Audio Transformer, 36 = Pulse Transformer, 37 = Charging Inductor, 40 = Saturable Transformer, 41 = Saturable Inductor	Two letter code listed in spec. e.g., FA = 2.313 x 2.625 x 3.125". Stud threads, heights and tolerances must conform to spec. YY = non-std. metal case. ZZ = encapsulated or molded.

MIL-F-18327—Military Specification for Filters (High Pass, Low Pass, Band Pass, Band Suppression and Dual Functioning)

FR	6	R	X	11	YY	1
COMPONENT	**GRADE**	**CLASS**	**LIFE EXPECTANCY**	**FAMILY**	**CASE OR ENVELOPE SIZE AND MOUNTING**	**COMPOSITION**
Filter	4—Metal Cased 10-55 Hz Vibration Frequency Range; 5—Encapsulated 10-55 Hz Vibration Frequency Range; 6—Metal Cased 10-2000 Hz Vibration Frequency Range; 7—Encapsulated 10-2000 Hz Frequency Range; 8—Metal Cased 10-500 Hz Vibration Frequency Range; 9—Encapsulated 10-500 Hz Vibration Frequency Range	Indicative of max. operating temperature e.g., Q = 85°C, R = 105°C, S = 125°C, V = >125°C	Designer's estimate of mean anticipated life e.g., X = 10,000 hours est. Y = 2,500 hours min.	Refers to application e.g., 11 = Low Pass, 22 = Band Pass, 33 = High Pass	Two letter code listed in space e.g., FA = 2.313 x 2.625 x 3.125".Stud threads, heights and tolerances must conform to spec. YY = non-std. metal case. ZZ = encapsulated or molded.	1—LC, 2—Crystal, 3—Other electromechanical

MIL-T-21038—Military Specification for Pulse Transformers

TP	6	R	X	1100	C	B
COMPONENT	**GRADE**	**CLASS**	**LIFE EXPECTANCY**	**TURNS RATIO**	**ENVELOPE DIMENSIONS**	**STYLE**
Transformer, Pulse	Refers to case material and environmental capability e.g., Grades 4 and 6 = Metal cased. Max. reliability. Resistant to shock, vibration and thermal shock. For use at high altitudes if required. Grades 5 and 7 = Same as Grade 6 except encapsulated or molded.	Indicative of max. operating temp. (ambient plus temperature rise) e.g. Q = 85°C, R = 105°C, S = 130°C, T = 155°C, U = 170°C, V = >170°C	Designer's estimate of mean anticipated life e.g., X = 10,000 hours est. Y = 2,500 hours min. Z = as specified	Four digit code indicating the number of wdgs. and their ratios e.g., 1110 = 1:1:1	One letter code representing fixed case styles in spec e.g., A = radial leads. C = terminations at one end.	One or two letter code representing fixed envelope dimensions. Z = other sizes. AA = Style J PC type

Quality and Reliability at UTC

UTC with over 50 years
of pioneering in the areas of research, design and engineering, assures you quality and reliability unexcelled in the industry. UTC has in continuous production the most complete line of standard items ready for immediate delivery from the factory or an authorized industrial distributor. This, coupled with broad capabilities in special (custom-built) items, covers virtually every transformer and filter requirement for both military and industrial use.

ENGINEERING
The knowledge and experience of the nation's top engineering talent create UTC products. All designs are fully laboratory proved before being released for production.

MATERIALS and LIFE TESTING
The material and process laboratories analyze and evaluate the materials employed in all products. Special processes are introduced as required by material characteristics. Finished units, as well as insulation systems, are constantly undergoing life tests to provide reliability guides for present and future designs and manufacturing processes. The purpose of these tests is to extend the life of each design to the absolute maximum—usually far beyond customer requirements.

QUALITY CONTROL
The quality control department coordinates all statistics relating to materials and processes. All incoming materials are subjected to exhaustive testing, with individual lots of materials separately isolated in order to afford tight material control throughout production. Continuous surveillance is conducted to assure conformance of products to all requirements. If discrepancies are found or anticipated, corrective action is immediately instituted. Parts made in house, such as drawn cans, stamped laminations, etc., are inspected and tested as though they were provided by an outside vendor. The QC/QA system meets MIL-I-45208 & MIL-Q-9858. The calibration control system meets MIL-C-45662. We are fully certified to perform high reliability soldering to DOD 2000, WS 6536 and MIL-S-45743.

PRODUCT TESTING
Each individual transformer or filter is tested for its performance at least three times during successive stages of manufacture. In addition to this, a substantial sampling of production is put through extensive humidity, vibration, thermal shock, and overload testing to assure exact performance and reliability. Environmental tests are in conformance with MIL-STD-202.

MILITARY COMPONENTS
The UTC laboratories include complete "in house" DESC-approved facilities for testing to MIL-T-27, MIL-F-18327, and MIL-T-21038. These facilities are employed for quality control of production as well as for proving new items. Virtually all hermetic items in this catalog have been proved to meet one or more of the MIL Specs, or are currently being tested.

A tremendous advantage exists in using the standardized UTC MIL components for military equipment. These units can be used in prototypes or full production without special tests, costs, or delays. Minor deviations from standard units do not affect the original test validity.

UTC hermetic components are of rugged design with high safety factors in all characteristics. They are either metal encased or molded and exceed MIL Specs in many respects, taking into consideration the most severe conditions which may be encountered in service. They are ideally suited for airborne, ground communications, marine, and missile service.

An increasing number of industrial equipment manufacturers, becoming concerned with the reliability of components in their equipment, are turning to hermetically sealed components. The necessity for reliability in industrial service is clear when the cost of an hour's shutdown of a broadcast schedule or industrial control system is visualized. To meet this need UTC can provide both UL-CSA approved products. For an explanation of our capability in this area, see page 62.

COMMERCIAL and INDUSTRIAL COMPONENTS
UTC non-hermetic components are designed for a wide range of applications, and have found acceptance in all types of commercial and industrial equipment. They are conservatively designed to assure highest reliability. Breakdown test voltages are used far in excess of maximum working voltages. Potted units are sealed with special insulating compounds for maximum environmental protection. Our quality control on these components is as stringent as on our military lines, requiring 100% testing on prime parameters.

SPECIAL DESIGNS
In addition to the needs met by the standard components in this catalog, there are many unique applications which require special units. Special-design facilities are available for production of samples as well as large quantities. The close coordination between our design groups, sample shop, and factory assures production quality equal to sample quality.

THE END RESULT
UTC level of quality and reliability is unmatched in the industry.

For every phase of the art of iron core inductive devices, UTC is the first source for the highest reliability, the most varied types and the most sophisticated and advanced designs in the industry.

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