THERMAL COMPOUNDS, ADHESIVES AND INTERFACE MATERIALS

120 SERIES

The **120 Series** Silicone Oil-Based Thermal Joint Compound fills the minute air gap between mating surfaces with a grease-like material containing zinc oxide in a silicone oil carrier. It possesses an excellent thermal resistance of only 0.05°C/W for a 0.001 in. film with an area of one square inch. There is no measurable increase in case temperature of a mounted semiconductor on a heat sink after the 6-month stabilization period (Time versus Thermal Resistivity graph below).

TYPICAL VALUES FOR THERMAL RESISTANCE, CASE TO SINK ($Ø_{CS}$) WHEN THERMAL JOINT COMPOUNDS ARE USED

Case Style Characteristics	Mounting Torque in inch • pounds (N•M)	Typical Thermal Resistance (°C/W)
T0-3	8 (0.9)	0.09
TO-66	9 (0.9)	0.14
TO-220	8 (0.9)	0.50
0.19 (4.8) stud x 0.44 (11.2) hex	15 (1.7)	0.16
0.25 (6.4) stud x 0.69 (17.5) hex	30 (3.39)	0.10
0.38 (9.7) stud x 1.06 (26.9) hex	75 (8.47)	0.07
0.50 (12.7) stud x 1.06 (26.9) hex	125 (14.12)	0.07
0.75 (19.1) stud x 1.25 (31.8) hex	600 (67.79)	0.052

120 SERIES - THERMAL JOINT COMPOUND

Characteristic	Description
Volume Resistivity	5 X 10e 14 ohm/cm
Dielectric Strength	225 volts/mil
Specific Gravity	2.1 min.
Thermal Conductivity @ WC	0.735 W/(m)(K) 5.1(Btu) (in.)/(hr)(ft²)(°F)
Thermal Resistivity (P)	56 (°C)(in.)/watt
Bleed, % after 24 hrs @ 200°C	0.5
Evaporation, % after 24 hrs @ 200°C	0.5
Color	opaque white
Shelf life	5 years
Operating Temperature Range (°C)	-40/+200

120 SERIES - ORDER GUIDE

Series - P/N	Container Size
120-SA ▲	4 gram plastic pak
120-2 ▲	2 oz (0.06 kg) jar
120-5 ▲	5 oz (0.14 kg) tube
120-8 ▲	8 oz (0.23 kg) jar
120-80 ▲	5 lb (2.27 kg) can
120-320	20 lb (9.08 kg) can

126 SERIES

The **126 Series** is a nontoxic, synthetic, ester-based (nonsilicone) Thermal Joint Compound with metal oxide fillers designed to enhance thermal performance characteristics of plastic and metal package devices exceeding that of silicone-based compounds. Solved are problems associated with contamination of wave solder baths and migration of silicone-based products.

Shelf life: 5 years.

126 SERIES THERMAL JOINT COMPOUND

Characteristics	Description
Appearance	Smooth, white homogeneous paste
Solids Content, wt %	65% min
Thermal Conductivity at 36°C = 4.8 (Btu)(in.)/(hr) (ft²) (°F)	19.0 X 10e 4 cal/sec cm °C, min
Interface Thermal Resistance	0.043°C/W TO-3 at 0.0008 thick film
Bleed, 24 hrs at 200°C, wt%	0.09% max
Evaporation, 24 hrs at 200°C, wt%	0.6 max
Volume Resistivity	2.3 x 10e 12 ohms/cm
Dielectric Strength	200 volts/mil
Specific Gravity @ 60°F	2.93 (gm/cc)
Penetration	280 to 320
Operating Range	-40°C to 200°C

126 SERIES - ORDER GUIDE

Series - P/N	Container Size
126-2 ▲	2 oz (0.6 kg) jar
126-4	4 oz (0.11 kg) tube
126-4S	4 oz (0.11 kg) syringe
126-5LB	5 lb (2.27 kg) can

THERMAL COMPOUNDS, ADHESIVES AND INTERFACE MATERIALS

DeltaBond™ 152

DeltaBond™ 152 adhesive is ideal for general cementing; thermally bonding semiconductors and components to chassis or heat sinks, while electrically isolating one from the other; fabricating heat sinks or thermal links; and for all permanent bonding of assemblies which require high thermally conductive interfaces. It produces a rigid, high strength bond to most materials when cured. **DeltaBond™ 152** is available in bi-packs, kits, and quarts. Order one bottle of hardener A-4 or B-4 per one quart of **DeltaBond™ 152** separately. Shelf life: 152KA 1 year, all others 2 years.

DELTABOND™152			
Characteristics		Hardener Type	
Typical Properties Fully Cured		A4	B-4
Thermal conductivity - W/(m) (°K)		0.836	0.908
(Btu) (in.)/(hr) (ft²) (°F)		5.8	6.3
Thermal resistivity - (°C) (in.)watt		47	42
Bond shear strength 1 in. overlap - psi etched aluminum to etched aluminum	77°F	2,900	2,300
	125°F	2,200	2,000
	212°F	400	800
Heat distortion point - °F		130	225
Minimum dielectric strength, v/mil, 0.125 in. sample		400	400
Max operation temp - °C	Continuous	65	150
	Intermittent	100	190

DELTABOND™152		
Mixing Proportions and Working Properties		
Characteristics	A-4	B4
Parts of hardener per 100 parts of resin by weight	7.5	3.5
*Working Time - at 77°F	45 min	30 min
†Initial cure time 77°F	8 hrs	6 hrs
150°F	45 min	30 min
250°F	20 min	15 minn
‡Post-cure time at a temp in °F	4 hrs @200°F	4 hrs @ 200°F
‡Alternate room temp. aging time at 77°F	4 days	4 days
Working consistency (77°F)	viscous liquid	paste
Working viscosity (77°F) cps	25,000	—

Model Number	DELTABOND™152 Ordering Guide - Resin and Hardener			
	Resin		Hardener	
	Part No.	Container	Part Number	
DeltaBond™ 152	152-1A	Bi-Pack (1 oz)	Included in PIN 152-1 A ("A-4") Type	All hardener part numbers A-4, B-4
	152-1B	Bi-Pack (1 oz)	Included in P/N 152-1 B ("B-4") Type	
	152-KA	Kit (7 oz Resin, 0.5 oz Hardener)	Included in P/N 152-KA	
	152-Q	1 quart (4 lbs)	A-4 (0.316 lb), B-4 (0.14 lb), (order 1 only)	

NOTES:

* Since the hardener/resin reaction is exothermic, it is important that batch size be matched to hardener speed. Working times given are for approximate batch sizes: A—200 gms, B—200 gms. Larger batch sizes will greatly reduce working time.

** For optimum electrical properties, dry parts for 15 minutes at 150°F (65°C) or 30 minutes at 75°F (24°C) to slowly evaporate the thinner and then final cure for 4 hours at 275°F (135°C).

† After initial cure, material may be handled, removed from fixture, etc., but has not yet achieved full properties and should be room temperature aged or post-cured as shown to achieve full physical and electrical properties.

‡ After initial cure, material may be brought to full physical and electrical properties during post-cure or may be room temperature aged for charted length of time to achieve same full properties.

The information contained herein is based on data believed to be reliable but we do not assume responsibility for accuracy. All such information is used at the customer's own risk, conditions of use being beyond our control.

THERMAL INTERFACE MATERIAL DATA FOR T-SERIES AND S-SERIES

T-Series Thermal Tapes come double-sided, and can be attached at the factory. Clips or mechanical fasteners are not required when thermal tapes are used. Not to be used for electrical isolation.

Material	Thermal Resistivity Degc in. Watt	Thickness	Description	Manufacturer Reference
T-1	79	0.006	Thermal Tape	Chomerics T-405
T-2	55	0.0045	Thermal Tape	Adhesives Research Arclad 8223
T-3	28	0.009	Thermal Tape	Chomerics T-412
T-4	157	0.007	Thermal Tape	Chomerics T-410

S-Series Thermal Interface Material come double-sided, and are applied at the factory only. They fill gaps due to surface roughness and flatness either under pressure or at temperature. These products also require mechanical fasteners. Not to be used for electrical isolation.

Material	Thermal Resistivity Degc in. Watt	Thickness	Description	Manufacturer Reference
S-3	25	0.005	Thermal Interface	Bergquist Q-pad 3
S-4	11	0.005	Thermal Interface	Bergquist softface
S-5	15	0.0055	Thermal Interface	Chomerics T-710
S-6	19	0.0052	Phase-Change Pad	Chomerics T-443
S-7	6	0.003	Tape a/Alum. Sub.	Power Devices AI-S (Thermstrate)
S-8	25	0.0065	Phase-Change Pad	Bergquist 2004

THERMAL COMPOUNDS, ADHESIVES AND INTERFACE MATERIALS

DeltaCast™ 153

DeltaCast™ 153 is a pourable casting resin having thermal expansion characteristics similar to aluminum and copper allowing assemblies to operate over a very wide temperature range. Ideal for encapsulating components and assemblies, this series' major advantages and uses include potted systems (virtually indestructible), protecting components and systems from moisture and contaminants, securing proprietary circuitry, mechanical support of devices, removal of heat from hot components and the assembly equalizing temperatures, and high voltage isolation. **DeltaCast™ 153** is available in quarts and gallons. Order one bottle of hardener A4 or B-4 per one quart of **DeltaCast™ 153** separately. Shelf life: 2 years.

DELTACAST™153			
Characteristics		Hardener Type	
Typical Properties Fully Cured		A4	B-4
Thermal conductivity -			
W/(m) (°K)		0.836	0.908
(Btu) (in.)/(hr) (ft²) (°F)		5.8	6.3
Thermal resistivity - (°C) (in.)watt		47	42
Bond shear strength 1 in. overlap - psi etched aluminum to etched aluminum	77°F	2,500	1,900
	125°F	—	—
	212°F	—	—
Heat distortion point - °F		130	225
Minimum dielectric strength, v/mil, 0.125 in. sample		400	400
Max operation temp - °C	Continuous	65	150
	Intermittent	100	190

DELTACAST™153		
Mixing Proportions and Working Properties		
Characteristics	A-4	B4
Parts of hardener per 100 parts of resin by weight	7.5	3.5
*Working Time - at 77°F	45 min	30 min
† Initial cure time 77°F	8 hrs	6 hrs
150°F	45 min	30 min
250°F	20 min	15 minn
‡Post-cure time at a temp in °F	4 hrs @200°F	4 hrs @ 200°F
‡Alternate room temp. aging time at 77°F	4 days	4 days
Working consistency (77°F)	heavy liquid	viscous liquid
Working viscosity (77°F) cps	10,000	30,000

Model Number	DELTACAST™153 Ordering Guide - Resin and Hardener			
	Resin		Hardener	
	Part No.	Container	Part Number	
DeltaCast™ 153	153-Q	1 quart (4 lbs)	A-4 (0.316 lb), B-4 (0.14 lb), (order 1 only)	All hardener part numbers A-4, B-4

DeltaBond™ 154

DeltaBond™ 154 is a medium viscosity, aluminum-filled resin with the best thermal conductivity of this series. It is, however, neither a good electrical insulator nor conductor. Its principal application is that of a good thermal mechanical adhesive for applications such as bonding fins to base plates or structural mounting blocks or brackets to heat sinks. Shelf life: 2 years.

DELTABOND™154			
Characteristics		Hardener Type	
Typical Properties Fully Cured		A4	B-4
Thermal conductivity -			
W/(m) (°K)		1.053	1.154
(Btu) (in.)/(hr) (ft²) (°F)		7.3	8.0
Thermal resistivity - (°C) (in.)watt		37	34
Bond shear strength 1 in. overlap - psi etched aluminum to etched aluminum	77°F	3,000	2,400
	125°F	2,300	2,100
	212°F	500	800
Heat distortion point - °F		130	225
Minimum dielectric strength, v/mil, 0.125 in. sample		NA*	NA*
Max operation temp - °C	Continuous	65	150
	Intermittent	100	190

DELTABOND™154		
Mixing Proportions and Working Properties		
Characteristics	A-4	B4
Parts of hardener per 100 parts of resin by weight	11.0	4.5
*Working Time - at 77°F	45 min	30 min
† Initial cure time 77°F	8 hrs	6 hrs
150°F	45 min	30 min
250°F	20 min	15 min
‡Post-cure time at a temp in °F	4 hrs @200°F	4 hrs @ 200°F
‡Alternate room temp. aging time at 77°F	4 days	4 days
Working consistency (77°F)	viscous liquid	paste
Working viscosity (77°F) cps	25,000	—

Model Number	DELTABOND™154 Ordering Guide - Resin and Hardener			
	Resin		Hardener	
	Part No.	Container	Part Number	
DeltaBond™ 154	154-Q	1 quart (2.5 lbs)	A-4 (0.316 lb), B-4 (0.14 lb), (order 1 only)	All hardener part numbers A-4, B-4

THERMAL COMPOUNDS, ADHESIVES AND INTERFACE MATERIALS

DeltaBond™ 155

DeltaBond™ 155 is an epoxy adhesive formulated for use within the semiconductor industry. An easy to mix spread thixotropic paste, it offers high heat transfer, low shrinkage, and a coefficient of thermal expansion comparable to that of copper and aluminum. This adhesive is principally used to form thermally conductive joints in fabricated heat sinks and between heat sinks and power devices. When used to bond semiconductors to heat sinks, it also serves as an electrical insulator. Its strong bond to a wide variety of substrates resists severe temperature cycling. **DeltaBond™ 155** is only available in kit size. Simply squeeze out equal lengths and mix to uniform color. Shelf life: 1 year.

DELTABOND™155		
Characteristics		**Hardener Type DeltaBond™155**
Typical Properties Fully Cured		
Thermal conductivity -		
W/(m) (°K)		0.836
(Btu) (in.)/(hr) (ft²) (°F)		5.8
Thermal resistivity - (°C) (in.)watt		47
Bond shear strength 1 in. overlap - psi etched aluminum to etched aluminum	77°F	2,600
	125°F	—
	212°F	—
Heat distortion point - °F		130
Minimum dielectric strength, v/mil, 0.125 in. sample		400
Max operation temp - °C	Continuous	65
	Intermittent	100

DELTABOND™155	
Mixing Proportions and Working Properties	
Parts of hardener per 100 parts of resin	by volume 100
*Working Time - at 77°F	90 min
†Initial cure time 77°F	8 hrs
150°F	45 min
250°F	20 min
‡Post-cure time at a temp in °F	4 hrs @ 200°F
‡Alternate room temp. aging time at 77°F	4 days
Working consistency (77°F)	paste
Working viscosity (77°F) cps	paste

DELTABOND™154			
Model Number	**Ordering Guide - Resin and Hardener**		
	Resin		**Hardener**
	Part No.	**Container**	**Part Number**
DeltaBond™ 155	155	Kit (3 oz resin, 3 oz hardener)	Included in P/N 155

DeltaBond™ 156

DeltaBond™ 156 Thermally Conductive Adhesive is a modified acrylic adhesive designed for permanent mounting on components where heat must be effectively transmitted. Recommended for electromechanical assemblies to bond components and dissipate heat, it replaces mechanical fasteners and compressible pads, silicone grease, and epoxies; eliminates air entrapment, and other variables related to epoxy mixing. This soft paste requires no mixing and flows easily to allow thin bond lines. Primer activated, cure begins upon assembly. DeltaBond™ Activator fixtures at room temperature in less than 5 minutes. Full strength is developed in 4 to 12 hours and fillets become dry to the touch in 24 hours. It is not recommended to use this durable adhesive without the use of DeltaBond™ Activator. **DeltaBond™ 156** is available in kit size; order 156-K (25 ml Syringe and Activator Kit). Shelf life: 1 year.

DELTABOND™156		
Characteristics	**Description**	
Typical Properties Fully Cured		
Test	**Results**	**ASTM**
Temperature Range	-65 to 300°F (-54 to 149°C) 300°F to (177°C) Intermittent	
Tensile Strength, at break	2360 psi	D638
Modulus	233,000 psi	D638
Elongation, at break	7.75%	D638
Outgassing	2.5% TLM 0.05% CVCM	E595
Coefficient of Thermal Expansion	7.1 x 10e -4 (cm/cm°C)	
Tensile Shear	2500psi	D1002
Thermal Conductivity, K	3.47 Btu x in./hr ft²°F	
(absolute at 86°F (30°C)	(0.50 W/m °C)	

Note: The absolute thermal conductivity test was developed specifically for measuring thermal properties of thin film adhesive bonds.

DELTABOND™156		
Typical Electrical Properties		
Test	**Results**	**ASTM**
Dielectric Strength	220 volts/mil	D149
Dielectric Constant, 77°F (25°C)		D150
100 Hz	14.92	
1000 Hz	14.26	
1MM Hz	12.34	
Dissipaton Factor, 77°F (25°C)		D150
100 Hz	0.05	
1000 Hz	0.03	
1MM Hz	0.06	
Volume Resistivity	5.2x10e 11 (ohms-cm)	D257
Surface Resistivity	8.6 x 10e 13 (ohms)	D257

Note: DeltaBond™ Thermally Conductive Adhesive-High Strength contains a metallic filler which, in certain applications, may have an effect on electrical properties. Therefore, test each particular application to ensure that electrical properties are as required.

Model Number	**DELTABOND™156**		
	Ordering Guide - Resin and Hardener		
	Resin		**Hardener**
	Part No.	**Container**	**Part Number**
DeltaBond™ 156	156-K	Resin Kit Hardener Syringe - 0.85 fl oz - 25 ml - 2 oz net/0.44 oz fl contents bottle -12ml	Included in kit hardener with brush applicator - 4.2 oz total wt/kt

* Since the hardener/resin reaction is exothermic, it is important that batch size be matched to hardener speed. Working times given are for approximate batch sizes: A—200 gms, B—200 gms. Larger batch sizes will greatly reduce working time.

† After initial cure, material may be handled, removed from fixture, etc., but has not yet achieved full properties and should be room temperature aged or post-cured as shown to achieve full physical and electrical properties.

‡ After initial cure, material may be brought to full physical and electrical properties during post-cure or may be room temperature aged for charted length of time to achieve same full properties.

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THERMAL COMPOUNDS, ADHESIVES AND INTERFACE MATERIALS

173/174 SERIES ***DeltaPads™ Thermally Conductive Insulators***

175 SERIES ***Greaseless Thermally Conductive Kapton® Reinforced Insulators***

TO-3, TO-66, TO-220,DO-4, DO-5 SHEET

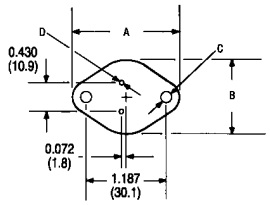
The 173, 174, and 175 Series are highly efficient thermally conductive insulators designed for semi - conductor interface to heat sinks. Their properties eliminate messy concerns asso- ciated with thermal greases.

Characteristics	DeltaPads™ 173-7 Series	DeltaPads™ 173-9 Series	DeltaPads™ 174-9 Series	Kapton® 175-6 Series	Test Method
Material Thickness	0.007 in.	0.009 in.	0.009 in.	0.006 in.	Micrometer
Color	Gray	Gray	Tan	Gray	Visual
Tear Strength, lb/in. Typical	100	100	100	100	ASTM 0624
Volume Resistivity, megohm-cm, Minimum Normal	1.0 x 10e 9	1.0 x 10e 9	1.0 x 10e 13	1 x 10e 13	ASTM D257
Breakdown Voltage, Minimum	4,000	5,000	5,000	6,000	ASTM 0149
Dielectric Constant at 60 Hz and 100 V Maximum	2.70	2.40	2.50	5.5 @ 1,000 Hz	ASTM D 150
Continuous Use Temperature, °C	-60/+200	-60/+200	-60/+200	-60/+200	–
Thermal Conductivity, cal/cm sec. °C, Minimum	3 x 10e -3	3 x 10e -3	1 x 10e -2	1.2 x 10e -3	–
Thermal Resistance (TO-3), 1 in.^{2} °C/W	0.33	0.50	0.25	0.40	–
Recommended Mounting Pressure, lb/in.^{2}	350/550	350/550	350/550	350/550	Formula*

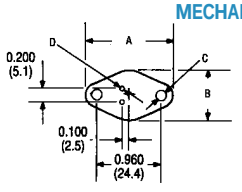
$$*P \text{ (pressure in psi)} = \frac{T \text{ (torque [in.-lb] x N (number of fasteners)}}{0.2 \text{ x D (Thread Dia) x A (contact surface area square inches)}}$$

173-7 Series		173-9 Series	174-9 Series	175-6 Series	Mechanical Dimensions in. (mm)				
No Adhesive	Adhesive Backing	No Adhesive	No Adhesive	Greaseless	A	B	C	D	Case Style
173-7-210P	–	173-9-210P	174-9-210P	175-6-210P	0.687 (17.4)	0.562 (14.3)	0.218 (5.5)	0.125 (3.2)	TO-220
173-7-220P▲	–	173-9-220P▲	174-9-220P	175-6-220P	0.710 (18-0)	0.500 (12.7)	0.160 (4.1)	0.141 (3.6)	TO-220
173-7-230P	–	173-9-230P	174-9-230P	175-6-230P	0.750 (19.1)	0.500 (12.7)	0.187 (4.8)	0.125 (3.2)	TO-220
173-7-240P	173-7-240A	173-9-240P	174-9-240P	175-6-240P▲	0.750 (19.1)	0.500 (12.7)	0.187 (4.8)	0.147 (3.7)	TO-220
173-7-250P	–	173-9-250P	174-9-250P	175-6-250P	0.865 (22.0)	0.650 (16.5)	0.205 (5.2)	0.140 (3.6)	TO-220
–	–	–	–	175-6-260P	1.000 (25.4)	0.750 (19.1)	0.320 (8.1)	0.141 (3.6)	TO-220
–	–	173-9-280P	–	175-6-280P	0.860 (21.8)	0.740 (18.8)	0.200 (5.1)	0.160 (4.1)	TO-220
173-7-290P	–	173-9-290P	–	–	0.855 (21.7)	0.630 (16.0)	0.230 (5.8)	0.093 (2.4)	TO-220
173-7-310P	–	173-9-310P	174-9-310P	175-6-310P▲	1.593 (40.5)	1.100 (27.9)	0.156 (4.0)	0.062 (1.6)	TO-3
173-7-320P	173-7-320A	173-9-320P	174-9-320P	175-6-320P	1.650 (41.9)	1.140 (29.0)	0.122 (3.1)	0.062 (1.6)	TO-3
173-7-330P		173-9-330P	174-9-330P	175-6-330P	1.650 (41.9)	1.140 (29.0)	0.140 (3.6)	0.093 (3.4)	TO-3
173-7-340P	–	173-9-340P	–	175-6-340P	1.780 (45.2)	1.250 (31.8)	0.140 (3.6)	0.093 (3.4)	TO-3
173-7-350P	–	173-9-350P	–	–	1.563 (39.7)	1.050 (26.7)	0.140 (3.6)	0.080 (2.0)	TO-3
173-7-410P	–	173-9-410P	174-9-410P	175-6-410P	0.625 (15.9)OD	0.200 (5.1)ID	N/A	N/A	DO-4, DO-5
173-7-510P	–	173-9-510P	174-9-51OP	175-6-51OP	0.800 (20.3)OD	0.260 (6.6)ID	N/A	N/A	D0-4, DO-5
173-7-520P	–	173-9-520P	174-9-520P	175-6-520P	1.000 (25.4)OD	0.260 (6.6)ID	N/A	N/A	DO-4, DO-5
173-7-610P	–	173-9-610P	174-9-610P	175-6-610P	1.312 (33.3)	0.762 (19.4)	0.140 (3.6)	0.062(1.6)	TO-66
173-7-710P	–	173-9-710P	–	175-6-710P	0.360 (9.14)OD	0.200 (5.1)ID	0.040 (1.0)	–	TO-5
–	–	173-9-810P	–	175-6-810P	2.000 (50.8)	0.750 (19.1)	0.187 (4.3)	0. 125 (3.8)DIA	TO-220
–	–	173-9-820P	–	175-6-820P	4.000 (101.6)	0.750 (19.1)	0.187 (4.3)	0. 125 (3.8)DIA	TO-220
–	–	173-9-910P	–	–	1.000 (25.4)	0.500 (12.7)	0.200 (5.1)	0.141 (3.6)	TO-66
173-7-66P	173-7-66A	173-9-66P	174-9-66P	175-6-66P	6.000 (152.4)	6.000 (152.4)	N/A	N/A	SHEET
173-7-1212P	173-7-1212A	173-9-1212P	174-9-1212P	–	12.000 (304.8)	12.000 (304.8)	N/A	N/A	SHEET
–	–	–	–	175-6-1311P	13.000 (330.2)	11.000 (279.4)	N/A	N/A	SHEET

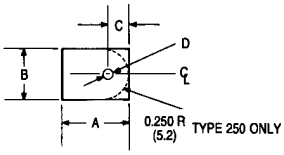
MECHANICAL DIMENSIONS



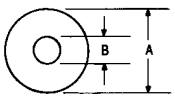
TO-3



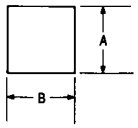
TO-66



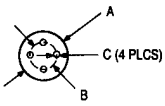
TO-220



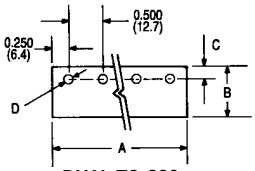
D04/05



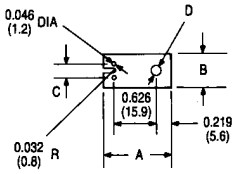
Dimensions: in. (mm) SHEET



TO-5



DUAL TO-220



TO-66 (RECTANGLE)

▲ Normally stocked

All other products, please contact factory for price, delivery, and minimums.