

REC 17 SEP 1973

ANSD.

HEAT SINKS INDEX PAGE

FOR D.I.P. DEVICES

Inches				Typ. R _T Natural Convection	
Series	Length	Width	Height*	°C/W	Page
6007	1.24	.75	.37	32	4
6010	.75	.604	.177	38	4
6011	.75	.25	.19	44	4
6012	.73	.25	.19	47	4

FOR PLASTIC POWER DEVICES

6025	.875	.25	1.306	26	14
6106	1.18	1.0	.50	16	14
6107	.71	1.0	.50	18	14

FOR EPOXY TRANSISTORS

3118	.75	.19	.25	—	5
3120	.75	.19	.25	—	5
2224	.50	.50	.235	73	6

FOR TO-18 AND TO-92 CASES

1118	.21	.21	.28	25	6
2220	.50	.50	.283	51	6
2224	.50	.50	.235	73	6
3018	1.00	.50	.31	40	5

FOR TO-5 CASES

1101	.50	.50	.88	8	9
1103	.50	.50	.50	8	9
1115	.375	.375	.40	48	8
1116	.351	.351	.37	17	9
1121	.351	.351	.312	17	9
1123	.375	.375	.406	17	9
1129	.75	.75	.063	56	8
1130	.351	.351	.40	25	9
1131	.375	.375	.49	25	9
1132	.375	.375	.49	25	9
2205	.812	.812	.34	50	11
2207/					
PR11	.812	.812	.34	40	11
2209-4	.812	.812	.34	40	11
2210	.625	.625	.50	55	10
2211	.625	.625	.40	48	10
2212-5	1.06	1.06	.375	28	11
2215	.75	.75	.38	41	10
2225	.75	.75	.40	45	12
2226	.75	.75	.25	50	12
2227	1.25	1.25	.40	30	13
2228	.875	.875	.531	40	12
2230-5	.75	.75	.25	30	8
2250	1.14	1.14	.50	16	7
2252	1.675	1.135	.50	15	7
2254	2.32	1.14	.50	15	7
3005	1.25	.50	.375	30	13
3020	1.66	1.12	.50	14	7
3022	2.31	1.12	.50	14	7

FOR STUD MOUNTED SEMICONDUCTORS

Inches				Typ. R _T Natural Convection	
Series	Length	Width	Height*	°C/W	Page
6111	1.50	1.50	.625	10	20
6301	2.00	2.00	.75	5	24
6303	1.50	2.00	2.00	3.2	24
6306	3.00	2.00	2.00	2.3	24

FOR TO-66 CASES

2266	1.25	1.25	.315	30	18
6001	1.81	1.81	.50	7.9	16
6002	1.81	1.81	.75	7.2	16
6003	1.81	1.81	1.00	6.5	16
6004	1.81	1.81	1.25	6.0	16
6005	2.50	2.50	.90	4.4	17
6006	3.125	3.125	1.00	3.2	17
6017	1.55	1.04	.50	18	18
6018	1.55	1.04	.75	15	18
6019	1.55	1.04	1.00	11	18
6027	3.50	1.55	1.55	6.0	19
6028	3.50	1.25	4.00	3.0	19
6029	4.50	1.40	5.00	2.3	19
6111	1.50	1.50	.625	10	20
6165	1.312	.89	.609	11	15
6166	1.312	.89	.609	11	15
6167	1.312	.89	.609	11	15
6168	1.312	.89	.609	11	15
6176	3.00	1.938	.935	5.4	20

FOR TO-3 CASES

6001	1.81	1.81	.50	7.9	16
6002	1.81	1.81	.75	7.2	16
6003	1.81	1.81	1.00	6.5	16
6004	1.81	1.81	1.25	6.0	16
6005	2.50	2.50	.90	4.4	17
6006	3.125	3.125	1.00	3.2	17
6013	1.895	1.42	.50	11	18
6014	1.895	1.42	.75	8.5	18
6015	1.895	1.42	1.00	7.0	18
6016	1.895	1.42	1.25	6.3	18
6027	3.50	1.55	1.55	6.0	19
6028	3.50	1.25	4.00	3.0	19
6029	4.50	1.40	5.00	2.3	19
6103	1.53	1.25	.52	7	15
6104	1.53	1.25	.52	7	15
6105	1.53	1.25	.52	7	15

FOR TO-8 CASES

2212	1.062	1.062	.375	25	13
2240	1.062	1.062	.375	30	5
2266	.75	.75	.25	30	18

FOR TO-37 CASES

6111	1.50	1.50	.625	10	20
6176	3.00	1.938	.935	5.4	20

FOR POWER SEMICONDUCTORS

Inches				Typ. R _T Natural Convection	
Series	Length	Width	Height*	°C/W	Page
6123	3.00	4.63	1.25	1.30	23
6129	3.00	4.750	.461	3.3	21
6135	3.00	3.60	1.125	1.4	22
6141	3.00	3.75	.50	3.7	20
6169	3.00	4.12	1.00	2.2	21
6176	3.00	1.938	.935	5.4	20
6301	2.10	2.00	.75	5.0	24
6303	2.00	2.00	.75	4.0	24
6306	2.00	2.00	1.50	4.0	24
6401	1.50	4.75	1.25	2.9	23
6403	3.00	4.75	1.25	2.0	23
6421	3.00	4.75	2.63	1.1	23
6423	5.5	4.75	2.63	0.9	23
6427	3.00	4.50	1.00	2.3	22
6441	5.50	4.75	4.50	0.6	24
6442	3.00	4.75	3.00	1.0	24
6443	5.50	4.75	3.00	.78	24
6450	5.00	4.00	4.00	0.7	25
6463	3.00	4.75	1.88	1.4	23
6470	7.50	4.00	4.00	0.6	25
6500	3.00	4.50	1.032	2.5	22
6560	6.00	5.00	5.00	0.5	25
6590	9.00	5.00	5.00	0.4	25
6601	1.50	2.00	.562	8.0	21
6603	3.00	2.00	.562	5.0	21
6660	6.00	6.25	6.25	0.4	25

COMPRESSION TYPE DEVICE CLAMP	26
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*Height dimensions shown may vary slightly on 2 piece heat sinks due to variation in semiconductor weld flange thickness.


Thermalloy

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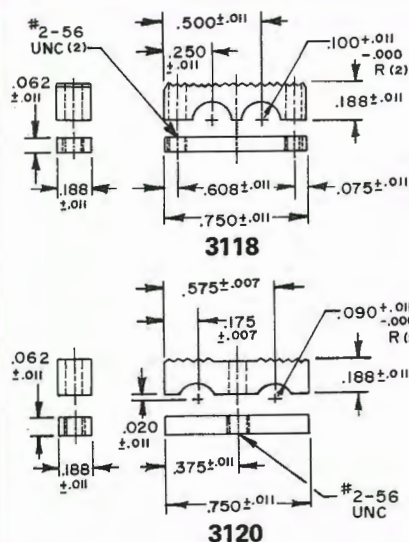
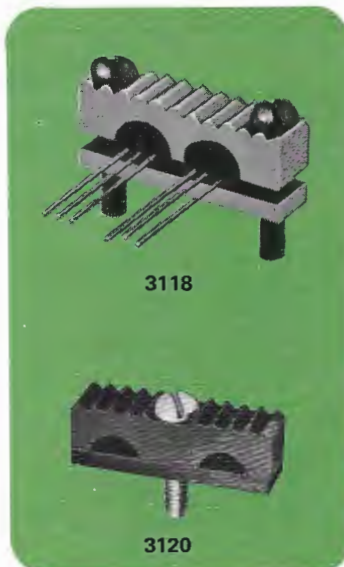
TWX: 910-860-5542

3118 AND 3120 SERIES

DUAL DEVICE COOLERS - PLASTIC "D" TRANSISTORS

The 3118 and 3120 series are 2 piece heat sinks providing low cost means of equalizing case temperatures in plastic "D" transistors. Short thermal path keeps matched pairs matched. Mounting screws provide positive retention to circuit board. Devices are the same except 3118 uses 2 mounting screws and 3120 uses 1 mounting screw.

MODEL	FINISH	WEIGHT
3118C	Gold Chromate	.0035 lbs.
3118B	Black Anodize	.0035 lbs.
3120C	Gold Chromate	.0035 lbs.
3120B	Black Anodize	.0035 lbs.

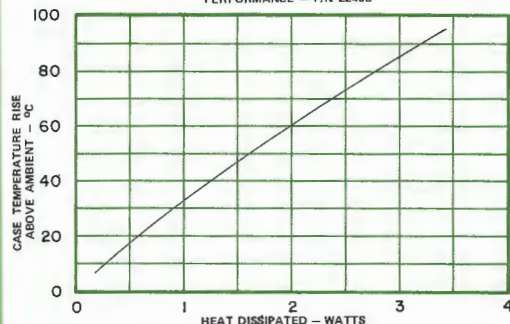


2240 SERIES

INTEGRATED CIRCUIT SINK - 12 LEAD

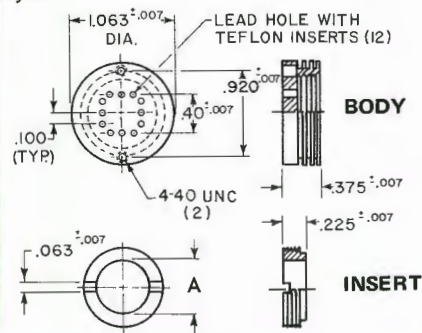
The 2240 and 2241 are 2 piece heat sinks for the 12 pin square pattern TO-8 style integrated circuit. Slotted insert clamps the weld flange for maximum thermal transfer. Solid base has teflon insulated lead holes. Tapped mounting holes provide positive retention to circuit board.

NATURAL CONVECTION THERMAL PERFORMANCE - P/N 2240B



MODEL	FINISH	DIM. A	WEIGHT
2240A	Hard Anodize	.560-.565	.0234 lbs.
2240B	Black Anodize	.560-.565	.0234 lbs.
2241A	Hard Anodize	.505-.510	.0234 lbs.
2241B	Black Anodize	.505-.510	.0234 lbs.

NOTE: The 2240 accommodates the CN48a case style. The 2241 accommodates the TO-8 case style.

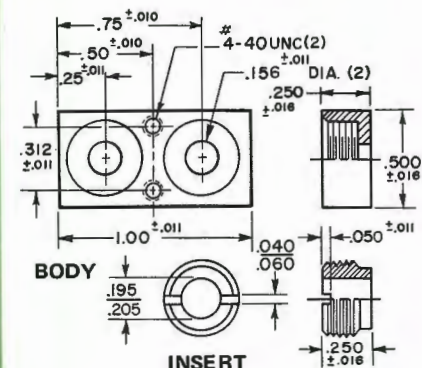
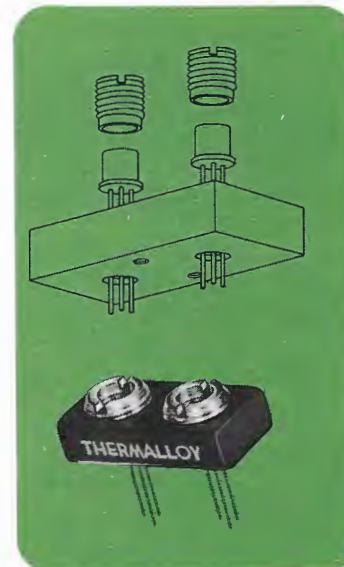


3018 SERIES

DUO SINK DEVICE COOLER - TO-18 CASE

The 3018 is a 3 piece heat sink providing low cost temperature equalizing for TO-18 transistors. Short thermal path keeps matched pairs matched. Complete electrical isolation is provided with insulated bodies and insulated insert screws. Mounting screws provide positive retention to circuit board.

MODEL	BODY FINISH	SCREW MATERIAL AND FINISH	WEIGHT
3018A	Hard Anodize	Delrin-none	.0095 lbs.
3018A-A	Hard Anodize	Aluminum, Hard Anodize	.0095 lbs.



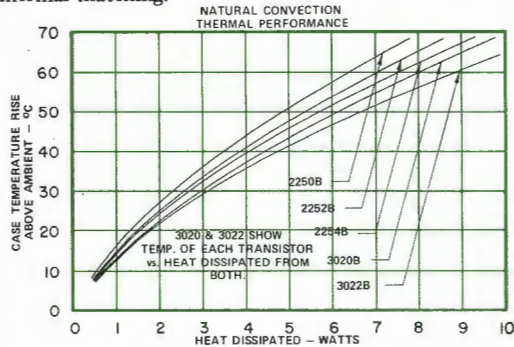
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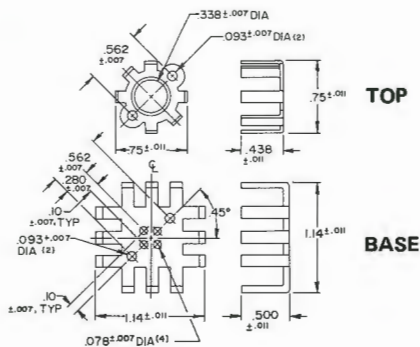
2250-3020 SERIES

CONVECTION COLLER/RETAINERS - TO-5 CASE

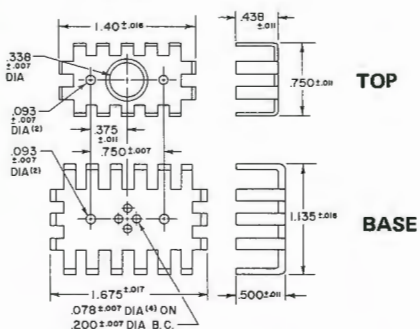
The 2250, 2252, 2254, 3020, and 3022 are a new series of 2 piece heat sinks for TO-5 transistors. The top and base clamp both sides of the weld flange for maximum heat transfer. In-line vanes on the top and base reduce wasted space and offer maximum exposed surface area. Mounting screws provide positive retention to the circuit board. The 3020 and 3022 series have the same design features as the 2250, 2252, and 2254 except they accommodate two devices providing thermal matching.



MODEL	FINISH	WEIGHT
2250A	Hard Anodize	.0099 lbs.
2250B	Black Anodize	.0099 lbs.
2251A	Hard Anodize	.0099 lbs.
2251B	Black Anodize	.0099 lbs.



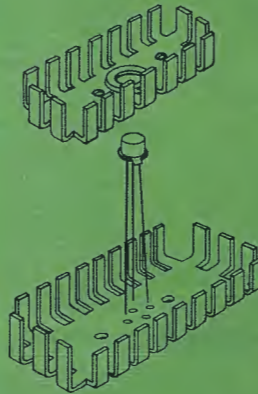
MODEL	FINISH	WEIGHT
2252A	Hard Anodize	.0176 lbs.
2252B	Black Anodize	.0176 lbs.
2253A	Hard Anodize	.0176 lbs.
2253B	Black Anodize	.0176 lbs.



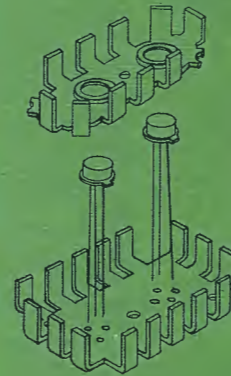
NOTE: Heat sink nos. 2251, 2253, 2255, 3021 and 3023 are identical to the above heat sinks except they have single .296 holes for multiple lead TO-5's instead of pin holes in the bases.



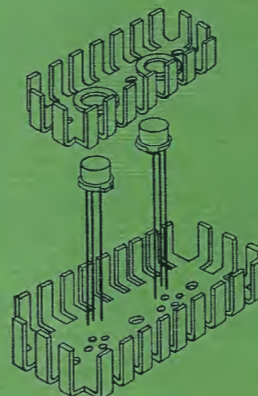
2250



2254

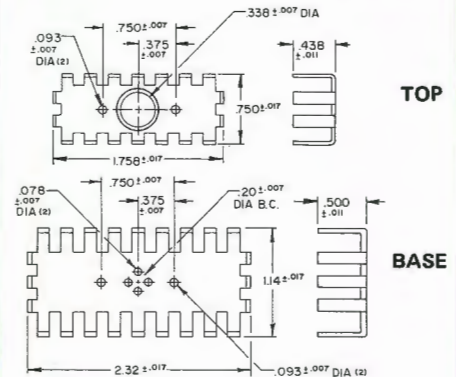


3020

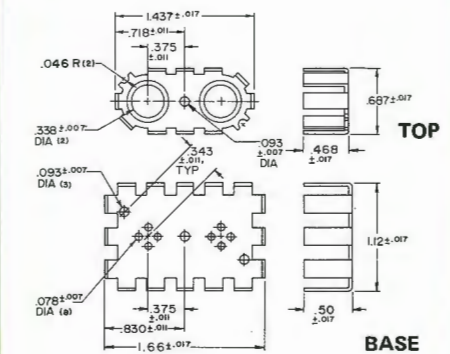


3022

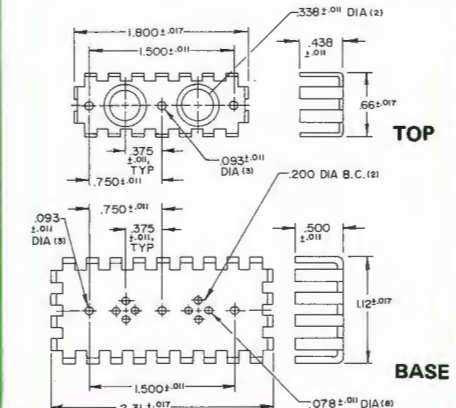
MODEL	FINISH	WEIGHT
2254A	Hard Anodize	.0246 lbs.
2254B	Black Anodize	.0246 lbs.
2255A	Hard Anodize	.0246 lbs.
2255B	Black Anodize	.0246 lbs.



MODEL	FINISH	WEIGHT
3020A	Hard Anodize	.0172 lbs.
3020B	Black Anodize	.0172 lbs.
3021A	Hard Anodize	.0172 lbs.
3021B	Black Anodize	.0172 lbs.



MODEL	FINISH	WEIGHT
3022A	Hard Anodize	.0242 lbs.
3022B	Black Anodize	.0242 lbs.
3023A	Hard Anodize	.0242 lbs.
3023B	Black Anodize	.0242 lbs.



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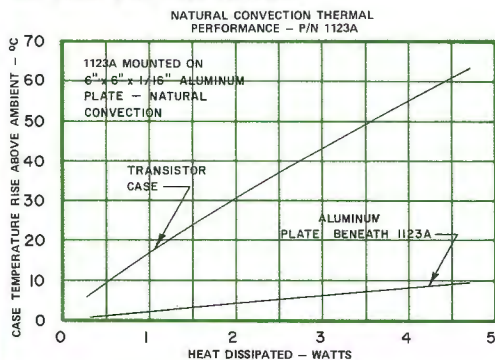
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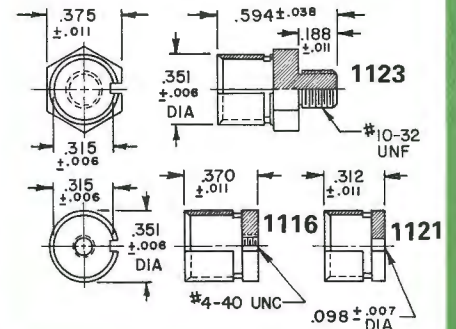
1116, 1121, 1123 SERIES

THERMACLIP – TO-5 CASE

The 1116 series is a 1 piece heat sink/retainer/thermal link for TO-5 transistors. "Wrap-around" design provides greater case surface contact than multi-finger types for improved heat transfer. Choice of tapped hole, stud, or rivet for retention under shock and vibration.



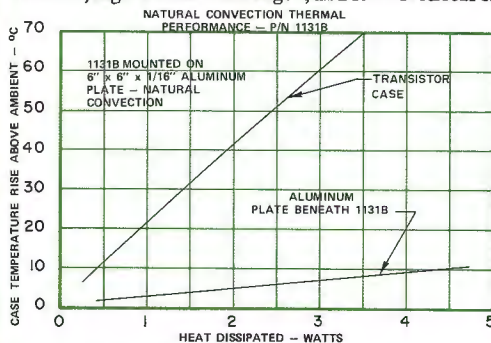
MODEL	FINISH	WEIGHT
1116A	Hard Anodize	.0012 lbs.
1116B	Black Anodize	.0012 lbs.
1121A	Hard Anodize	.0012 lbs.
1121B	Black Anodize	.0012 lbs.
1123A	Hard Anodize	.0012 lbs.
1123B	Black Anodize	.0012 lbs.



1130 SERIES

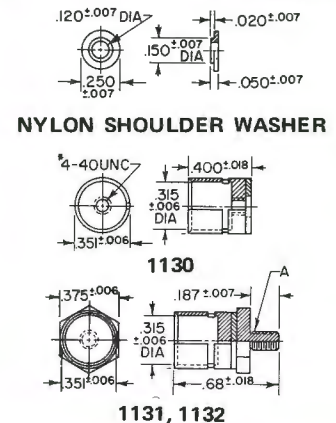
THERMACLIP WITH BeO INSULATOR – TO-5 CASE

The 1130 series are 1 piece heat sink/retainer/thermal links for TO-5 transistors. Same as the 1116 except the 1130 series come with bonded beryllium oxide insulating washers. The 1130 includes a nylon shoulder washer and 4-40 screw. The 1131 and 1132 include bonded studs. Provide excellent heat transfer, high dielectric strength, and low electrical capacitance.



MODEL	FINISH	WEIGHT	"A"
1130	Black Oxide	.0055 lbs.	
1131	Black Oxide	.0102 lbs.	#10-32
1132	Black Oxide	.0092 lbs.	#6-32

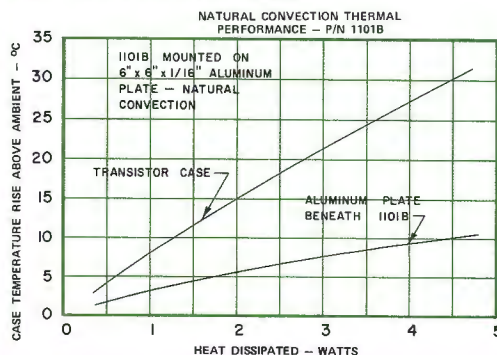
Body Material: Brass, CDA 360 or equivalent.



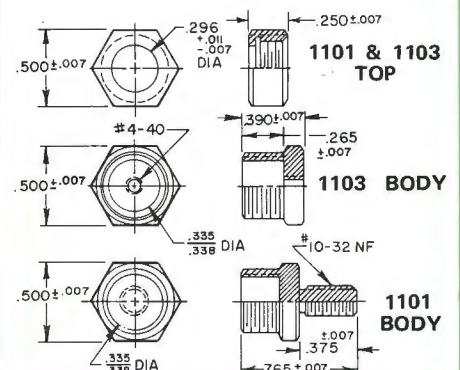
1101- 1103 SERIES

CONDUCTION COOLER/RETAINER – TO-5 CASE

The 1101, 1103 is a 2 piece heat sink/retainer/thermal link for TO-5 transistors. Top and base grip the weld flange for maximum heat transfer to circuit board or other external surface. Choice of tapped hole or stud provides positive retention under shock and vibration.



MODEL	FINISH	WEIGHT
1101A	Hard Anodize	.0069 lbs.
1101B	Black Anodize	.0069 lbs.
1101C	Gold Chromate	.0069 lbs.
1103A	Hard Anodize	.0057 lbs.
1103B	Black Anodize	.0057 lbs.



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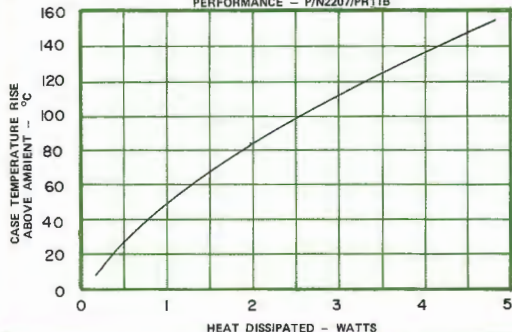
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2207/PR11 SERIES

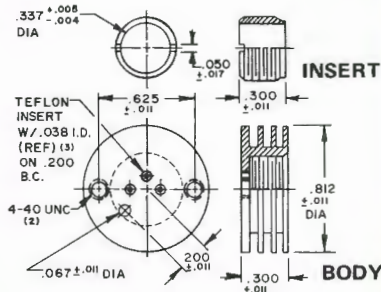
HIGH PERFORMANCE CONVECTION COOLER – TO-5 CASE

The 2207/PR11 is a 2 piece heat sink for TO-5 transistors and the most efficient heat sink available for its size. Slotted insert clamps weld flange against solid base for maximum heat transfer to integral fins. Lead holes are teflon insulated. Tapped mounting holes provide retention under shock and vibration.

NATURAL CONVECTION THERMAL PERFORMANCE – P/N2207/PR11B



MODEL	BODY FINISH	INSERT FINISH	WEIGHT
2207/PR11	Bl. Anodize	None	.0086 lbs.
2207/PR11B	Bl. Anodize	Black Anod.	.0086 lbs.
2209-4A*	Hard Anod.	None	.0086 lbs.



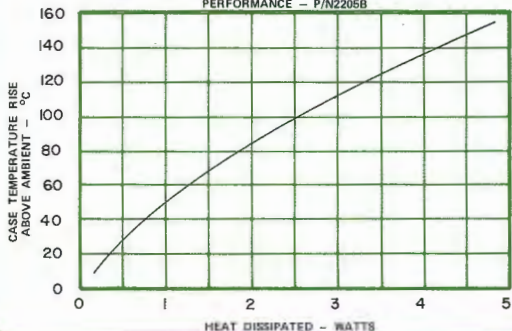
*No Teflon Inserts

2205 SERIES

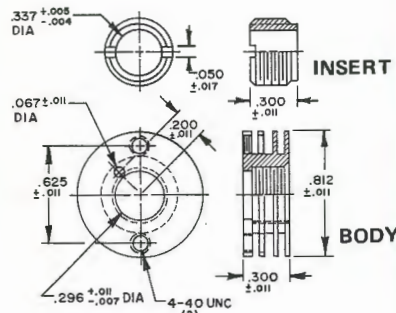
HIGH PERFORMANCE CONVECTION COOLER – TO-5 CASE

The 2205 is a 2 piece heat sink for TO-5 transistors. This is the same as the 2207/PR11 described above except a single through-hole is utilized instead of individual lead holes. Same performance with glass based transistor but with lower cost. Tapped holes provide retention.

NATURAL CONVECTION THERMAL PERFORMANCE – P/N2205B



MODEL	BODY FINISH	INSERT FINISH	WEIGHT
2205A	Hard Anodize	None	.0084 lbs.
2205B	Black Anodize	None	.0084 lbs.

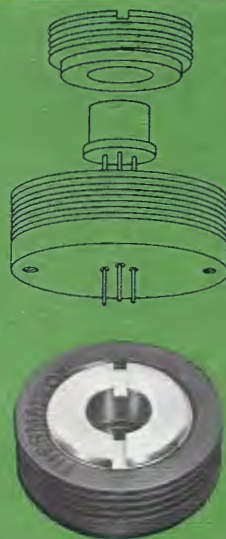
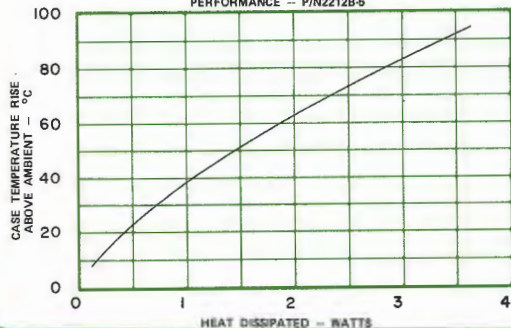


2212-5 SERIES

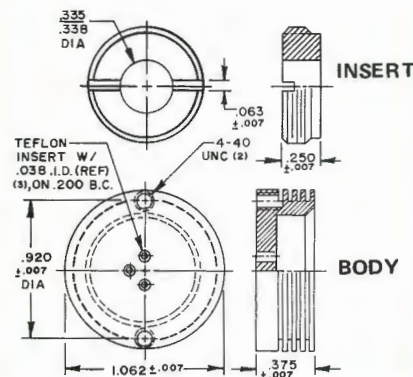
HIGH PERFORMANCE CONVECTION COOLER – TO-5 CASE

The 2212-5 is a 2 piece heat sink for TO-5 transistors and can dissipate more power than any other TO-5 heat sink on the market. Same design features as the 2207/PR11 described above but with more mass and more exposed surface area. Tapped holes provide retention.

NATURAL CONVECTION THERMAL PERFORMANCE – P/N2212B-5



MODEL	BODY FINISH	INSERT FINISH	WEIGHT
2212A-5	Hard Anodize	None	.0280 lbs.
2212B-5	Black Anodize	None	.0280 lbs.



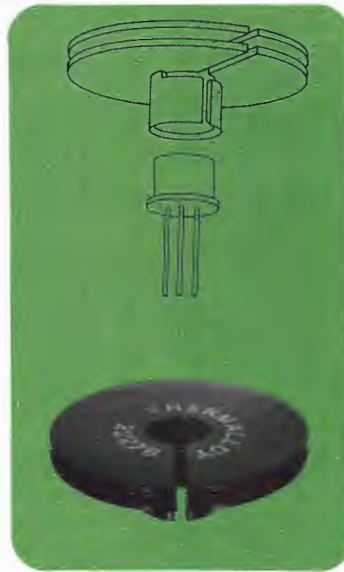
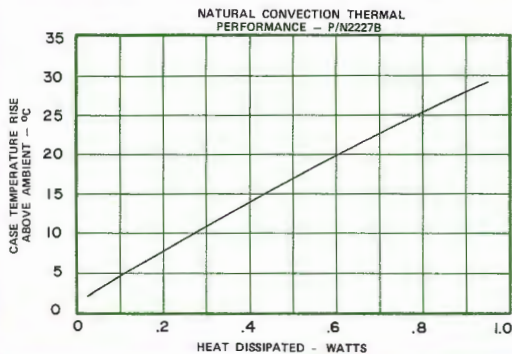
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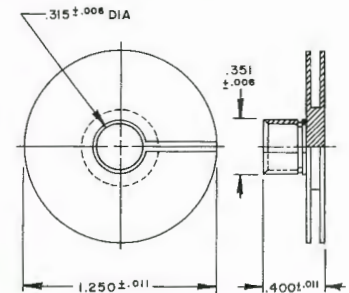
2227 SERIES

ECONOMY PRESS ON COOLER – TO-5 CASE

The 2227 is a low cost 1 piece heat sink for TO-5 transistors. Unit presses onto case, and requires no special assembly tools or additional board space. Heat is conducted to 2 integral fins for dissipation. Can be installed after assembly. Same as 2225 except larger diameter and better thermal characteristics.



MODEL	FINISH	WEIGHT
2227B	Black Anodize	.0097 lbs.
2227C	Gold Chromate	.0097 lbs.

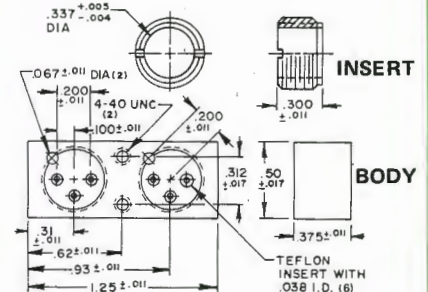
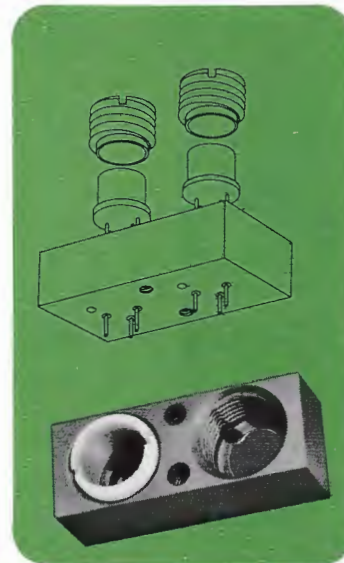


3005 SERIES

DUO SINK DEVICE COOLER – TO-5 CASE

The 3005 is a 3 piece heat sink providing low cost temperature equalizing for TO-5 transistors. Short thermal path keeps matched pairs matched. Complete electrical isolation is provided with insulated bodies and insulated retaining screws. Mounting screws provide positive retention to circuit board.

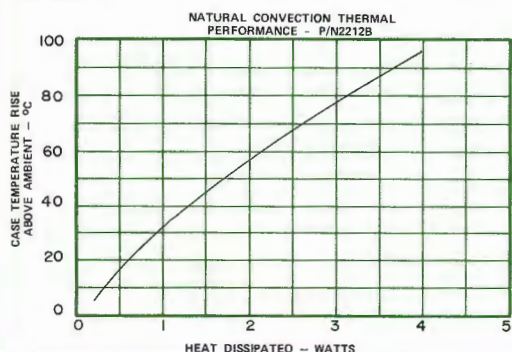
MODEL	BODY FINISH	INSERT FINISH	WEIGHT
3005A	Hard Anodize	Delrin-None	.0176 lbs.
3005A-A	Hard Anodize	Aluminum, Hard Anodize	.0176 lbs.



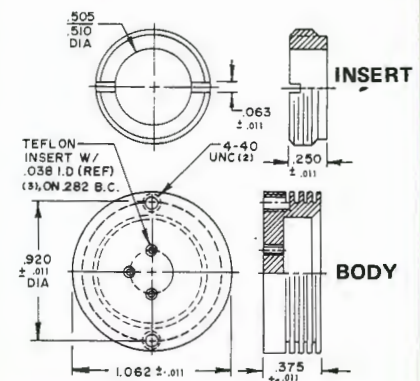
2212 SERIES

HIGH PERFORMANCE CONVECTION COOLER – TO-5 CASE

The 2212 is a 2 piece heat sink for TO-8 transistors. Slotted insert clamps weld flange against solid base for maximum heat transfer to integral fins. Lead holes are teflon insulated. Tapped mounting holes provide retention under shock and vibration.



MODEL	FINISH	WEIGHT
2212A	Hard Anodize	.0249 lbs.
2212B	Black Anodize	.0249 lbs.



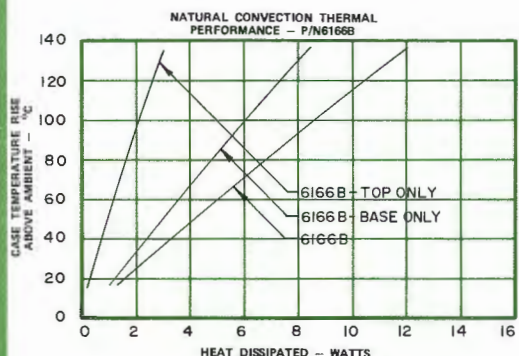
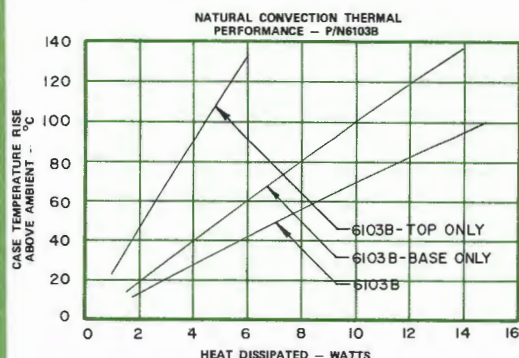
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6103, 6166, 6168 SERIES

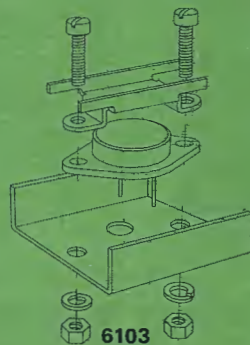
HIGH PERFORMANCE THERMAPOWER COOLER – TO-3 AND TO-66 CASES

The 6103 and 6166 series are 2 piece heat sinks for circuit board applications. Unique concept offers optimum heat transfer by utilizing the space above the device. This is accomplished by use of a top piece which contacts the upper surface of the semiconductor mounting flange. Where board space is at a premium, the top may be used alone. Both the top and the base may be ordered separately. Gold chromate uninsulated finished tops may be ordered with black anodized base where electrical contact is needed. Add prefix letter "P" to part number if two 6-32 x 7/16 screws with matching nuts are desired. (Example: P6166B)



MODEL	FINISH	DIM "A" HEIGHT	FOR CASE	WEIGHT
6103A	Hard Anodize	.167	TO-3	.025 lbs.
6103B	Black Anodize	.167	TO-3	.025 lbs.
6103C	Gold Chromate	.167	TO-3	.025 lbs.
6104B	Black Anodize	.234	TO-3	.028 lbs.
6105B	Black Anodize	.300	TO-3	.029 lbs.
6165A	Hard Anodize	.250	TO-66	.022 lbs.
6165B	Black Anodize	.250	TO-66	.022 lbs.
6165C	Gold Chromate	.250	TO-66	.022 lbs.
6166A	Hard Anodize	.188	TO-66	.020 lbs.
6166B	Black Anodize	.188	TO-66	.020 lbs.
6166C	Gold Chromate	.188	TO-66	.020 lbs.
6167A	Hard Anodize	.350	TO-66	.024 lbs.
6167B	Black Anodize	.350	TO-66	.024 lbs.
6167C	Gold Chromate	.350	TO-66	.024 lbs.
6168B	Black Anodize	.188	—	.019 lbs.
6168C	Gold Chromate	.188	—	.019 lbs.

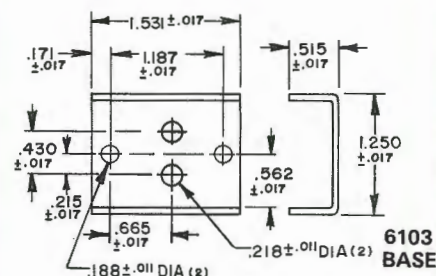
If top or base only is desired, specify by adding the word "TOP" or "BASE" as suffix to part no. (Example: 6165B-Top)



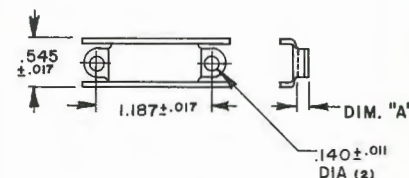
6103



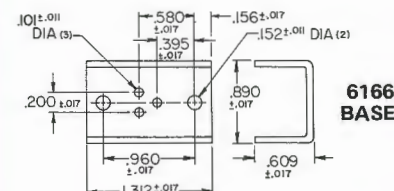
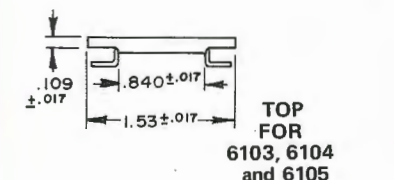
6168 BASE



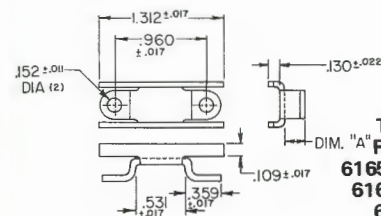
6103 BASE



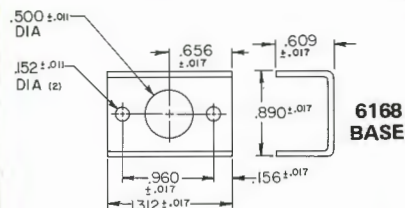
TOP FOR 6103, 6104 and 6105



6166 BASE



TOP FOR 6165, 6166 6167 and 6168



6168 BASE



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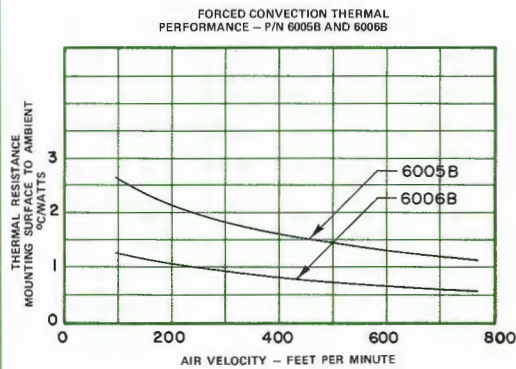
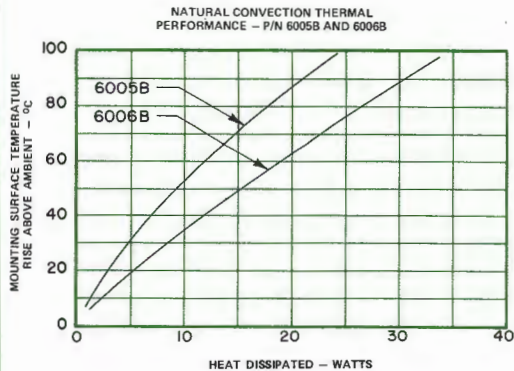
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TWY 010-860-5512

6005 SERIES

MULTIPLE DEVICE MOUNTING — UNIQUE FIN DESIGN — TO-3 AND TO-66 CASES

The 6005 series are 1 piece heat sinks for circuit board applications. The slanted vane fin design is utilized as in the 6001 series described on page 16. The 6006 is a larger version of the 6005 and will accommodate up to four devices. Thermal resistance of the 6005 series is comparable to most popular three inch extrusions. High volume tooling makes the 6005 series lower in cost than comparable extrusions and lighter in weight. Mounting accommodations include both standard and I.C. versions of the TO-3, TO-8 and TO-66.



MODEL	FINISH	WEIGHT
6005B	Black Anodize	.0753 lbs.
6005C	Gold Chromate	.0753 lbs.
6006B	Black Anodize	.1172 lbs.
6006C	Gold Chromate	.1172 lbs.

HOLE PATTERNS AVAILABLE.

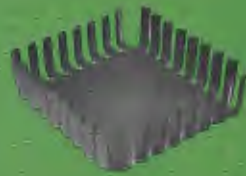
Description	Part Number Suffix
TO-3 1 Hole Pattern	-2
TO-3 2 Hole Patterns	-2-2*
TO-3 3 Hole Patterns	-2-2-2*
TO-3 4 Hole Patterns	-2-2-2-2*
TO-66 1 Hole Pattern	-11
TO-66 2 Hole Patterns	-11-11
TO-66 3 Hole Patterns	-11-11-11
TO-66 4 Hole Patterns	-11-11-11-11*
TO-3 1 8 Lead IC	-15
TO-66 1 IC	-16

See Page 35 for ordering information.

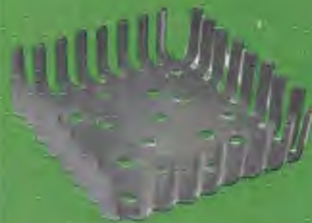
*Available on 6006 only.



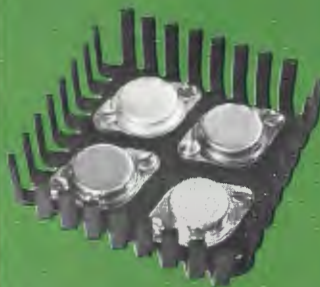
6005



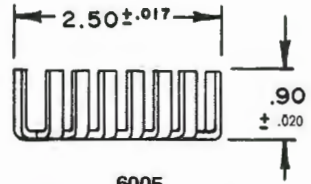
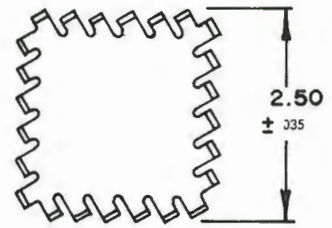
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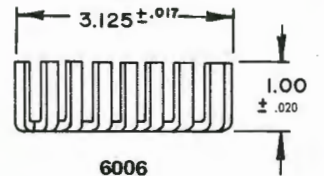
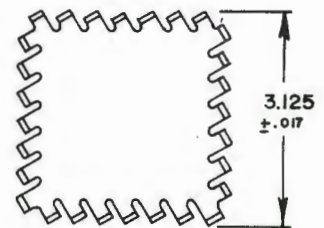
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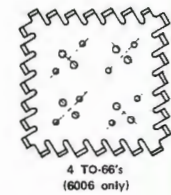
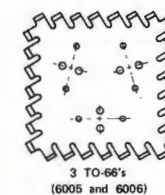
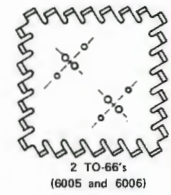
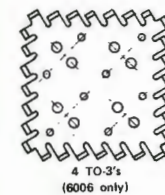
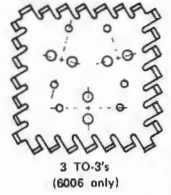
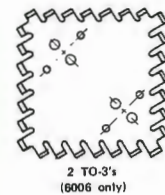
6006



6005



6006



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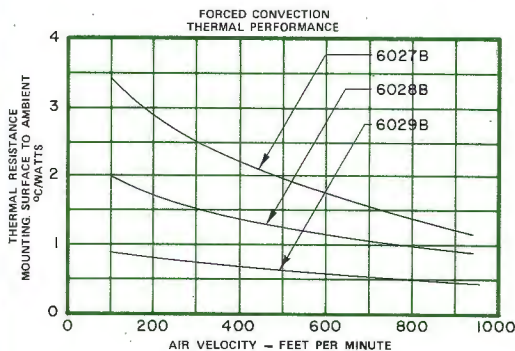
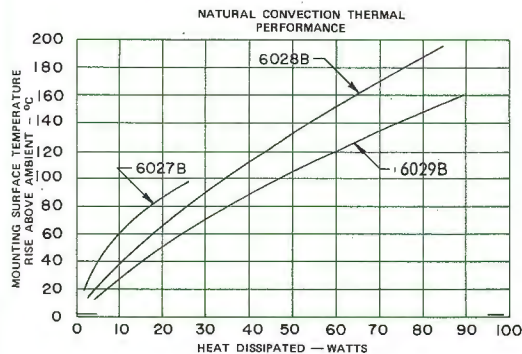
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TWX: 910-860-5542

6027 SERIES

SPACE SAVING — VERTICAL MOUNTED COOLERS — TO-3 AND TO-66 CASES

The 6027 series are 1 piece heat sinks for power semiconductors mounted in the vertical plane. Semiconductors are mounted on the center web. Heat is conducted to the alternating vanes. This exclusive design concept is especially efficient in the vertical mode. An integral angle bracket provides easy mounting to circuit boards for minimum space requirements. Thermal resistance of the 6027 series is comparable to that of popular extruded heat sinks. High volume tooling provides lower costs than comparable extrusions with added features of lighter weight and less board space required.

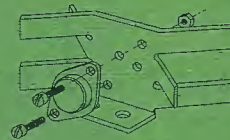


MODEL	FINISH	WEIGHT
6027B	Black Anodize	.0687 lbs.
6027C	Gold Chromate	.0687 lbs.
6028B	Black Anodize	.1176 lbs.
6028C	Gold Chromate	.1176 lbs.
6029B	Black Anodize	.2555 lbs.
6029C	Gold Chromate	.2555 lbs.

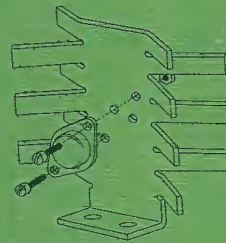
HOLE PATTERNS AVAILABLE.

Description	Part Number Suffix
Plain	no Hole Pattern
TO-3	1 Hole Pattern
TO-3	2 Hole Pattern
TO-66	1 Hole Pattern
TO-66	2 Hole Pattern

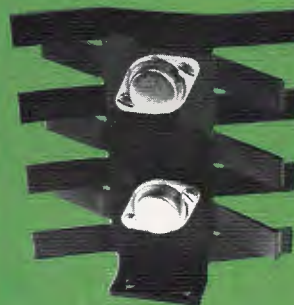
See Page 35 for ordering information



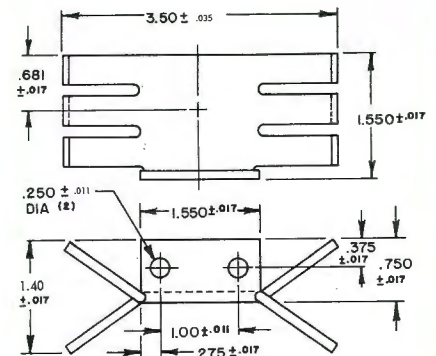
6027



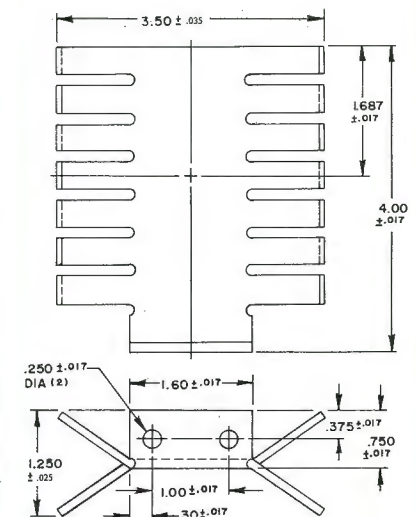
6028



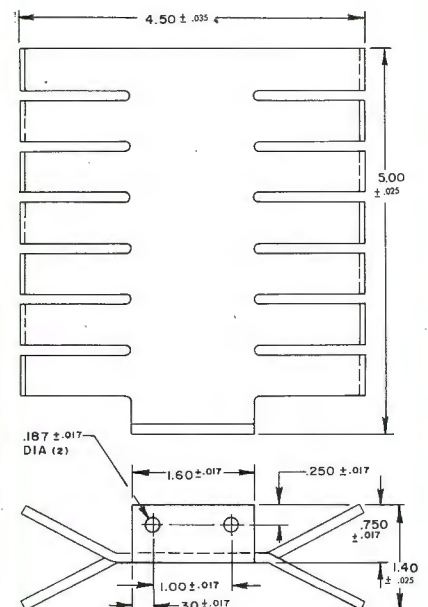
6029



6027



6028



6029



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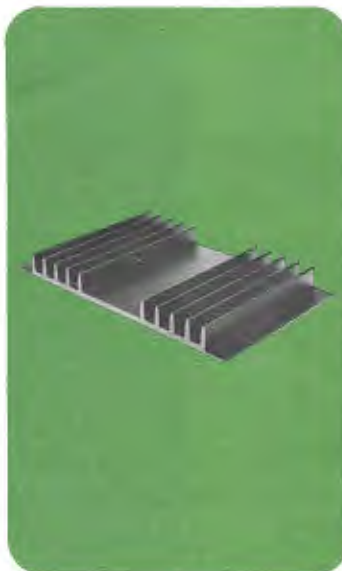
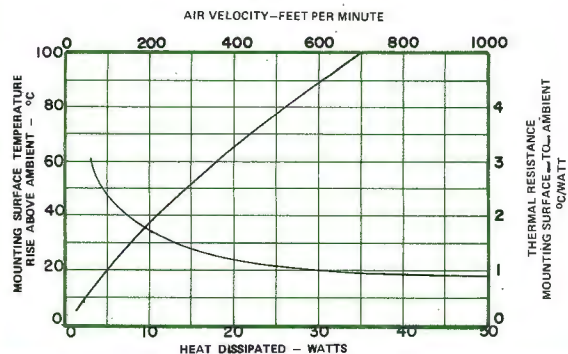
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TWX: 910-860-5542

6129 SERIES

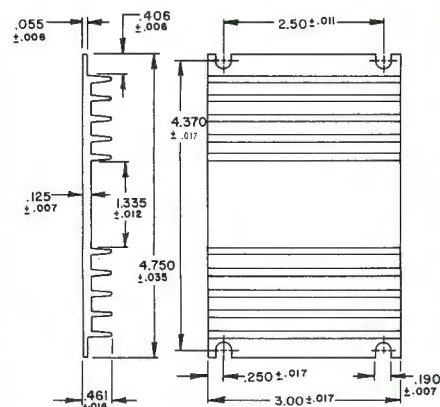
FLAT SIDED COOLER – FOR POWER SEMICONDUCTORS

The 6129 is an extruded heat sink with fins on 1 side. Accommodates all power devices. Recommended for low profile applications. See page 35 for available hole patterns.



WEIGHT
1.003 lbs.

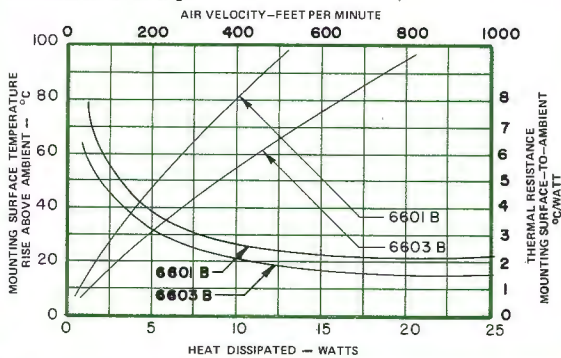
See Page 35 for ordering information



6601 AND 6603 SERIES

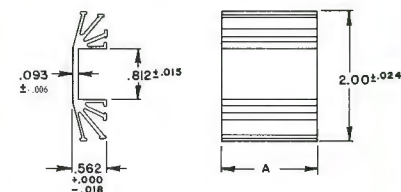
FLAT SIDED COOLER – FOR POWER SEMICONDUCTORS

The 6601 and 6603 are extruded heat sinks with radial fins on 1 side. Accommodate TO-66 and small power devices. Recommended for circuit board applications. See page 35 for available hole patterns.



MODEL	DIM. A	WEIGHT
6601	1.5	.0429 lbs.
6603	3.0	.0858 lbs.

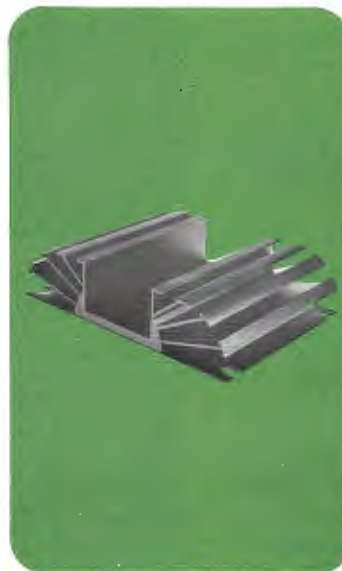
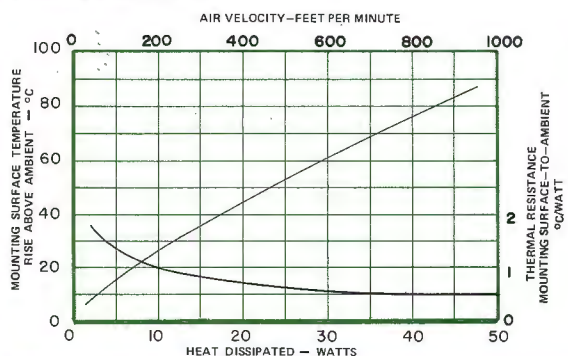
See Page 35 for ordering information.



6169 SERIES

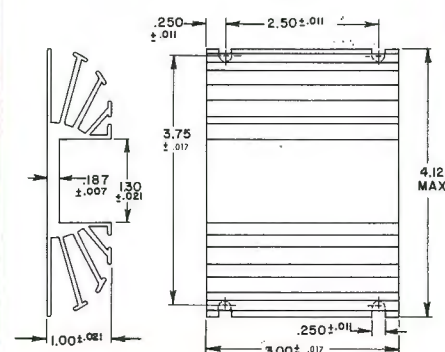
FLAT SIDED COOLER – FOR POWER SEMICONDUCTORS

The 6169 is an extruded heat sink with radial fins on 1 side. Accommodates all power devices. Recommended for circuit board or external mounting applications. See page 35 for available hole patterns.



WEIGHT
.259 lbs.

See Page 35 for ordering information.



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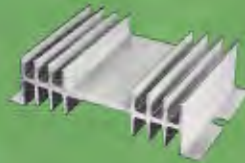
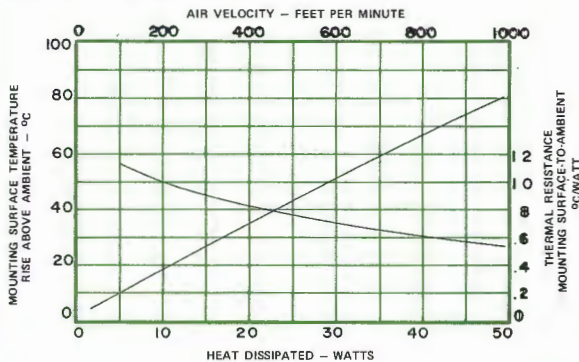
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TWX: 910-860-5542

6123 SERIES

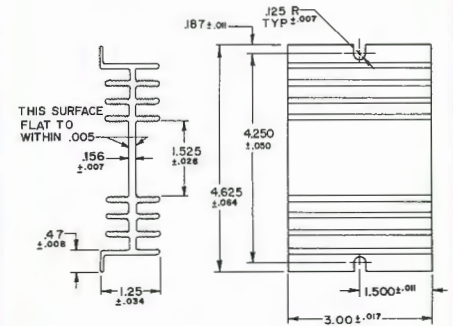
GENERAL PURPOSE COOLER — FOR POWER SEMICONDUCTORS

The 6123 is an extruded heat sink with serrated fins on both sides. Outside fins are not serrated. Accommodates all power devices. Recommended for general purpose applications. See page 35 for available hole patterns.



6123

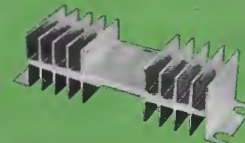
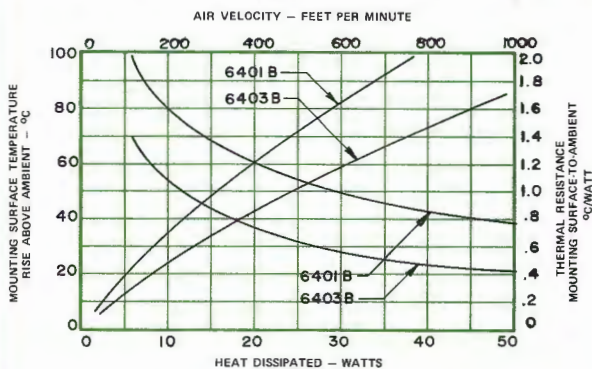
WEIGHT
.378 lbs.



6401 AND 6403 SERIES

GENERAL PURPOSE COOLER — FOR POWER SEMICONDUCTORS

The 6401 and 6403 series are extruded heat sinks with fins on both sides. Accommodate all power devices. Popular standard heat sinks. See page 35 for available hole patterns.

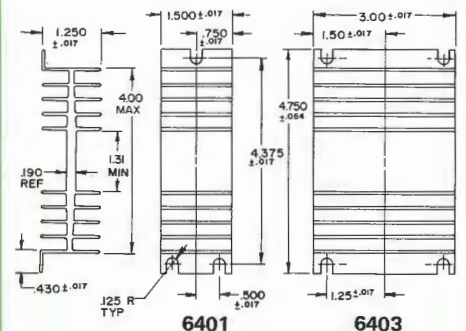


6401



6403

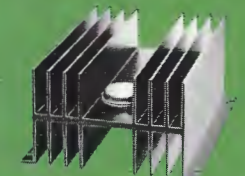
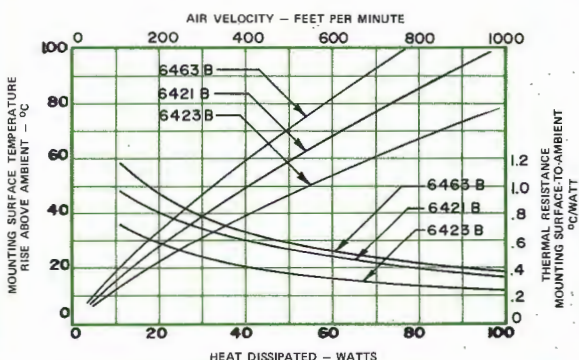
MODEL WEIGHT
6401 .184 lbs.
6403 .369 lbs.



6421 AND 6423 SERIES

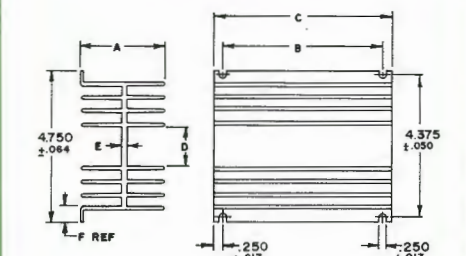
GENERAL PURPOSE COOLER — FOR POWER SEMICONDUCTORS

The 6421 and 6423 series are extruded heat sinks with fins on both sides. Accommodate all power devices. Recommended for general purpose power applications. See page 35 for available hole patterns.



6421

MODEL WEIGHT
6421 .633 lbs.
6423 1.16 lbs.
6463 .618 lbs.



DIM.	6421	6423	6463
A	2.625 ± .024	2.625 ± .024	1.875 ± .024
B	2.50 ± .010	5.00 ± .010	2.50 ± .010
C	3.00 ± .015	5.50 ± .015	3.00 ± .015
D	1.312 ± .024	1.312 ± .024	1.335 ± .025
E	.190 ± .010	.190 ± .010	.200 ± .010
F	.455	.455	.495



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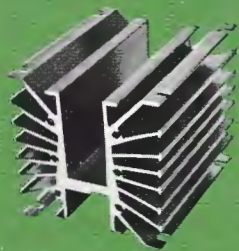
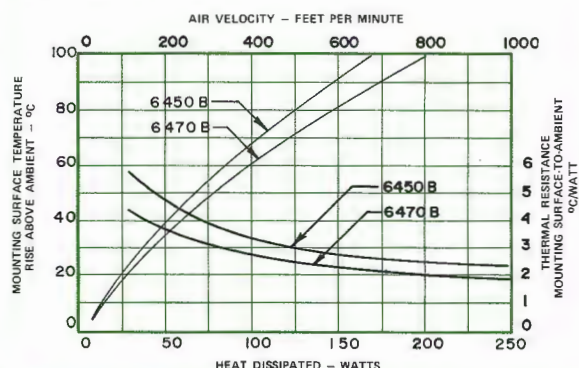
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6450 AND 6470 SERIES

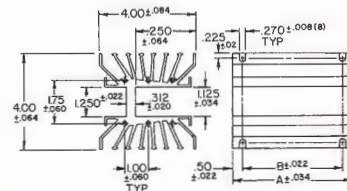
TEXAS SIZE COOLER – FOR HEAVY DUTY APPLICATIONS

The 6450 and 6470 "Texas Size" are extruded heat sinks which accommodate all high power devices. Recommended for high power SCR's and rectifiers requiring natural convection cooling.



6450

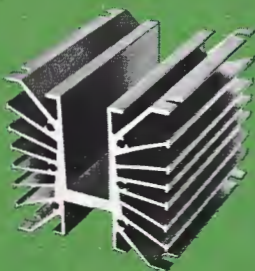
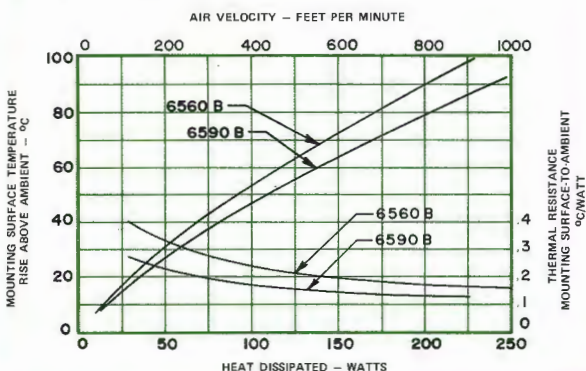
MODEL	FINISH	DIM. A	DIM. B	WEIGHT
6450 B	Bl. An.	5.00	4.00	1.80 lbs.
6450 C	G. Chr.	5.00	4.00	1.80 lbs.
6470 B	Bl. An.	7.50	6.50	2.70 lbs.
6470 C	G. Chr.	7.50	6.50	2.70 lbs.



6560 AND 6590 SERIES

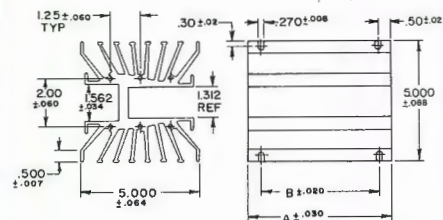
TEXAS SIZE COOLER – FOR HEAVIER DUTY APPLICATIONS

The 6560 and 6590 "Texas Size" are extruded heat sinks which accommodate all high power devices. Recommended for high power SCR's and rectifiers requiring natural convection cooling.



6560

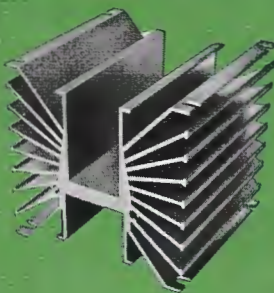
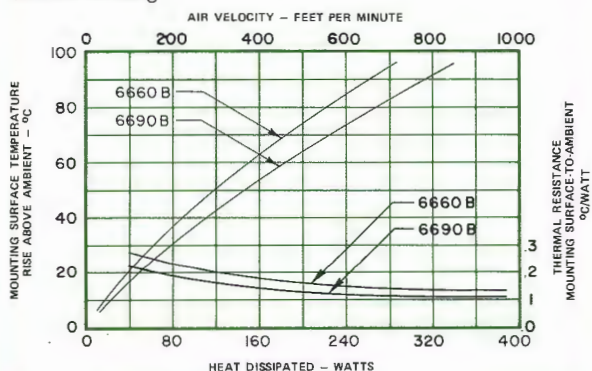
MODEL	FINISH	DIM. A	DIM. B	WEIGHT
6560 B	Bl. An.	6.00	5.00	3.00 lbs.
6560 C	G. Chr.	6.00	5.00	3.00 lbs.
6590 B	Bl. An.	9.00	8.00	4.50 lbs.
6590 C	G. Chr.	9.00	8.00	4.50 lbs.



6660 AND 6690 SERIES

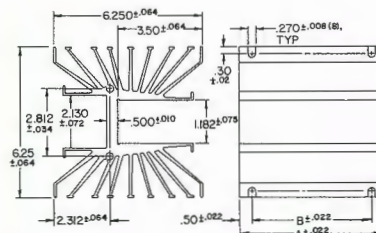
TEXAS SIZE COOLER – FOR HEAVIEST DUTY APPLICATIONS

The 6660 and 6690 "Texas Size" are extruded heat sinks which accommodate all high power devices. Recommended for high power SCR's and rectifiers requiring natural convection cooling.



6660

MODEL	FINISH	DIM. A	DIM. B	WEIGHT
6660 B	Bl. An.	6.00	5.00	4.68 lbs.
6660 C	G. Chr.	6.00	5.00	4.68 lbs.
6690 B	Bl. An.	9.00	8.00	6.87 lbs.
6690 C	G. Chr.	9.00	8.00	6.87 lbs.



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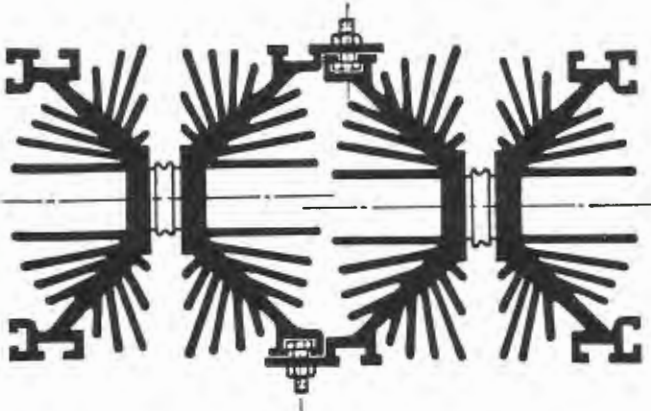
TWX: 910-860-5542

COOLERS FOR COMPRESSION DEVICES

Thermalloy Company compression device coolers are designed to satisfy the cooling requirements for the full range of compression device SCR's and diodes. In the T-slot extrusions, the 6740 series will accept 1/4 inch hex head machine bolts in the top slots and 5/16 inch hex head machine bolts in the side slots. The 6750 series will accept only 5/16 inch hex head machine bolts and the 6745 series will accept only 1/4 inch hex head machine bolts. The 6745 series have an extended self-bussing foot, having no insulating finish on top or bottom, for mating with another 6745 series unit in full wave circuit configurations as shown below. It is recommended that only one cooler in a dual configuration be bussed or rigidly attached to the chassis. This is to ensure that side loading forces will not be applied to the clamp which could upset the torquing values and deteriorate the heat transfer capabilities.

The 6850 brazed Compact Cooler[®] shown in the upper right hand corner is inherently superior to extrusions in closed flow applications. Curve data for the unit is shown on page 28 and general information concerning the design family is shown on page 40.

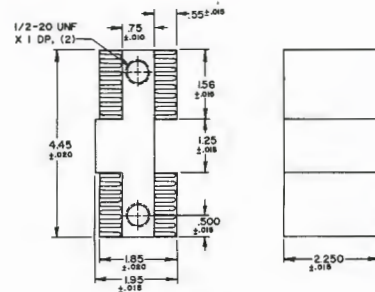
TYPICAL INSTALLATION



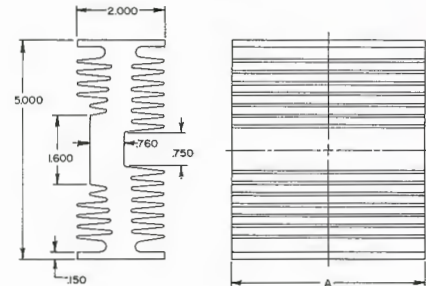
Two 6745 coolers and two 6740 coolers with the 6745's shown in self-bussing configuration.

PART	FINISH	DIM. A	WEIGHT-LBS.
6740B	Black Anodize	4.5"	1.61
6740C	Gold Chromate	4.5"	1.61
6741B	Black Anodize	7.5"	2.69
6741C	Gold Chromate	7.5"	2.69
6745B	Black Anodize	4.5"	1.65
6745C	Gold Chromate	4.5"	1.65
6746B	Black Anodize	7.5"	2.75
6746C	Gold Chromate	7.5"	2.75
6750B	Black Anodize	4.5"	3.10
6750C	Gold Chromate	4.5"	3.10
6751B	Black Anodize	7.5"	5.17
6751C	Gold Chromate	7.5"	5.17
6163B	Black Anodize	4.0"	2.09
6163C	Gold Chromate	4.0"	2.09
6164B	Black Anodize	6.0"	3.13
6164C	Gold Chromate	6.0"	3.13
6850C	Gold Chromate	—	1.00

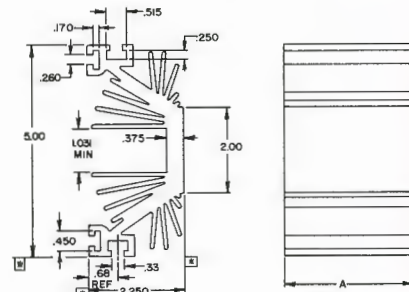
☐ Surface clean, no finish.



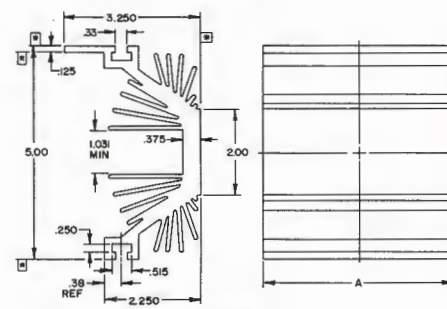
6850



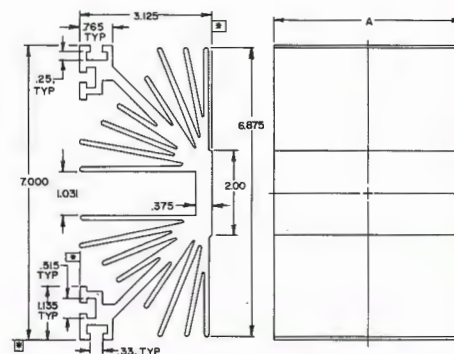
6163



6740



6745



6750



Thermalloy

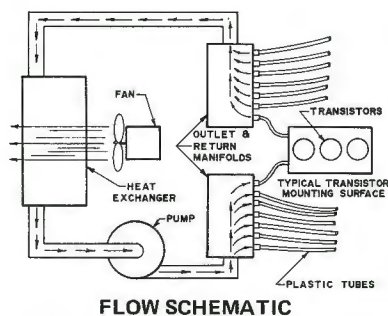
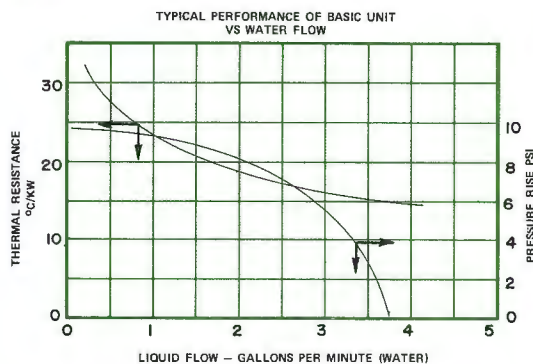
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PHONE: 214 242 1221

TELEX: 010 860 5542

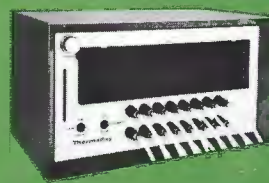
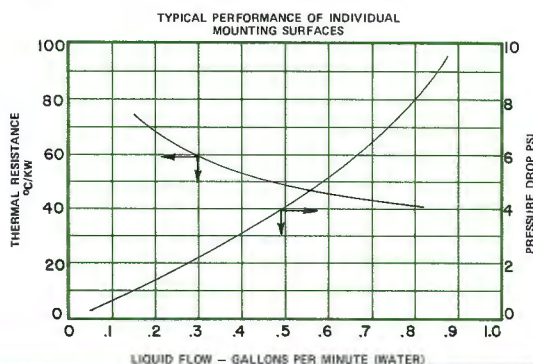
LIQUID COOLING SYSTEM

The Thermalloop recirculating liquid cooling system provides the electronics industry with the most effective cooling available today in a convenient compact package. Designed for the most extreme cooling requirements, thermal resistances from mounting surface to ambient of less than 40°C per kilowatt are obtainable.

In operation, liquid is circulated by a pump to a semiconductor mounting surface. Heat is withdrawn from the semiconductor by a coolant which then flows through a liquid-to-air heat exchanger. A fan removes the heat from the coolant which returns to the pump to start the cycle again. The Thermalloop has multiple ports for supplying coolant to mounting surfaces in parallel; or any one port can supply many mounting surfaces in series. For additional information, write for Catalog No. 69-C-5.



Thermalloy's liquid cooled mounting surfaces, made of copper, have square shaped integral flow passages, providing high Nusselt numbers and maximum conduction to the coolant. Standard mounting configurations are shown. However, Thermalloy Company has available non-standard mounting surfaces for most devices. All mounting surfaces are tin plated.



LC-201



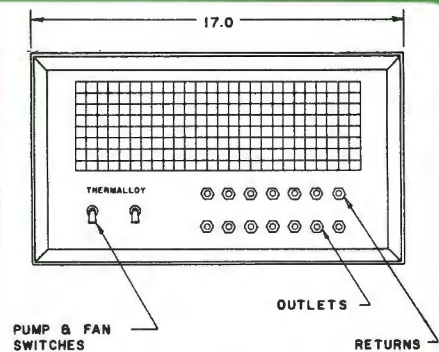
6830



6815

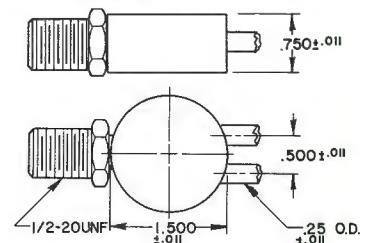


6805



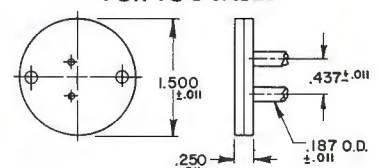
MODEL LC-201

FOR COMPRESSION DISC
SCR's AND DIODES



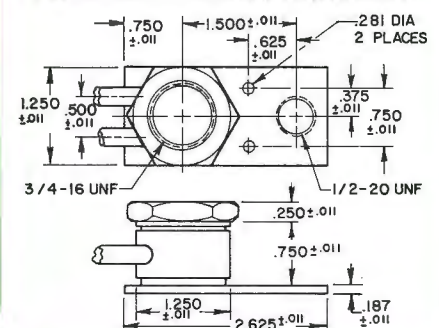
6830

FOR TO-3 CASES



6815

FOR STUD TYPE SCR's AND DIODES



6805



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STOCKED EXTRUSIONS - Standard length 3 feet, other lengths available.
 Industry standard extrusion profiles for semiconductor cooling, immediately available from your local distributor or factory stock. Thermalloy can modify any extrusion to meet your specific prototype requirements generally in 2 to 4 weeks.

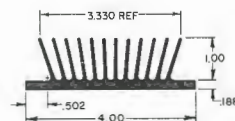
WT. - WEIGHT IN POUNDS PER FOOT

T.R. - THERMAL RESISTANCE BASED ON 3 INCH LENGTH



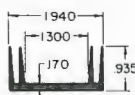
6111

WT. - .32 lb/1'
 T.R. - 10 °C/W



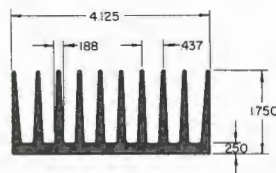
6320

WT. - 1.86 lb/1'
 T.R. - 1.8 °C/W



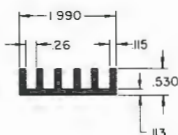
6176

WT. - .68 lb/1'
 T.R. - 5.4 °C/W



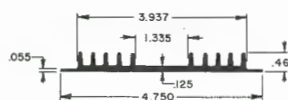
6157

WT. - 3.49 lb/1'
 T.R. - 1.4 °C/W



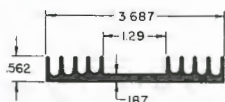
6155

WT. - .65 lb/1'
 T.R. - 6 °C/W



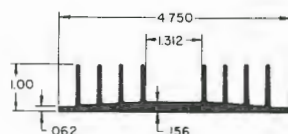
6129

WT. - .957 lb/1'
 T.R. - 3.2 °C/W



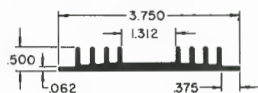
6140

WT. - 1.09 lb/1'
 T.R. - 3.5 °C/W



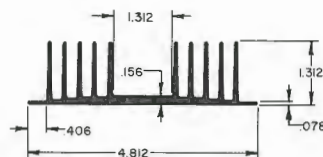
6143

WT. - 1.46 lb/1'
 T.R. - 2.7 °C/W



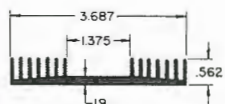
6141

WT. - .89 lb/1'
 T.R. - 3.7 °C/W



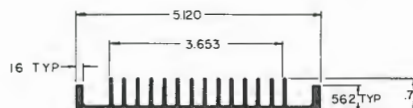
6175

WT. - 1.94 lb/1'
 T.R. - 2.5 °C/W



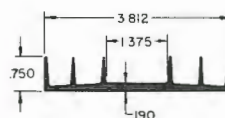
6149

WT. - 1.06 lb/1'
 T.R. - 3.5 °C/W



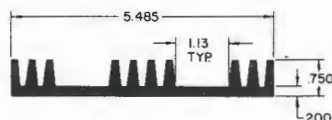
6179

WT. - 1.27 lb/1'
 T.R. - 3 °C/W



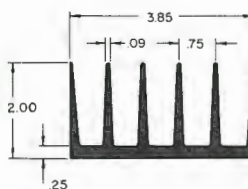
6147

WT. - 1.06 lb/1'
 T.R. - 3.5 °C/W



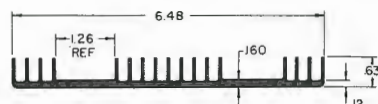
6173

WT. - 2.4 lb/1'
 T.R. - 5 °C/W



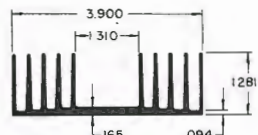
6151

WT. - 2.84 lb/1'
 T.R. - 2.0 °C/W



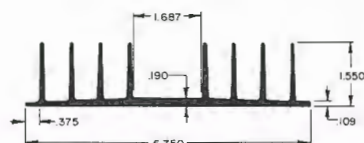
6183

WT. - 1.78 lb/1'
 T.R. - 3.5 °C/W



6181

WT. - 1.64 lb/1'
 T.R. - 2.1 °C/W



6146

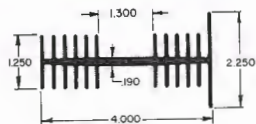
WT. - 2.35 lb/1'
 T.R. - 2 °C/W



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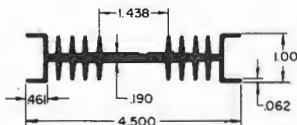
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 PHONE: 214-242-1371

TWY: 010-860-5512



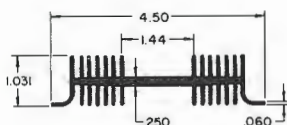
6435

WT. - 1.56 lb/1'
T. R. - 2.3 °C/W



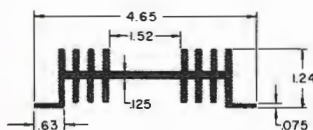
6427

WT. - 1.68 lb/1'
T. R. - 2.3 °C/W



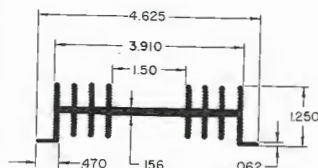
6125

WT. - 1.74 lb/1'
T. R. - 1.9 °C/W



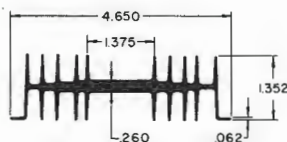
6133

WT. - 1.58 lb/1'
T. R. - 1.8 °C/W



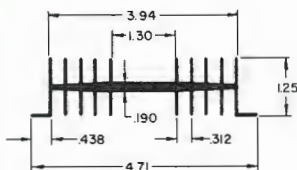
6123

WT. - 1.51 lb/1'
T. R. - 1.8 °C/W



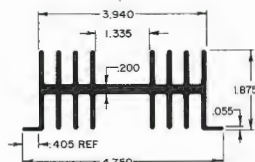
6459

WT. - 1.74 lb/1'
T. R. - 2 °C/W



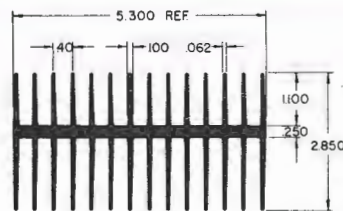
6401

WT. - 1.48 lb/1'
T. R. - 2.9 °C/W



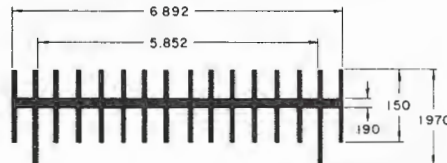
6463

WT. - 2.47 lb/1'
T. R. - 1.4 °C/W



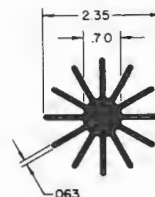
6464

WT. - 4.92 lb/1'
T. R. - 1.4 °C/W



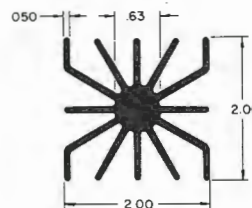
6462

WT. - 3.63 lb/1'
T. R. - 2 °C/W



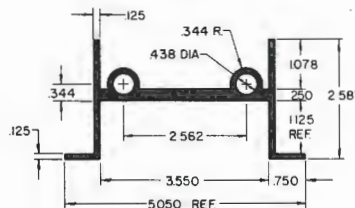
6311

WT. - 1.2 lb/1'
T. R. - 2 °C/W



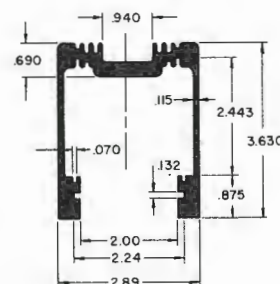
6301

WT. - 1 lb/1'
T. R. - 5.0 °C/W



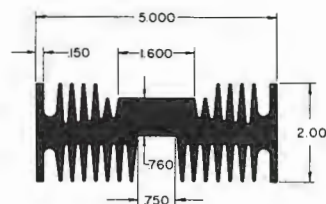
6801

WT. - 2.27 lb/1'
T. R. - 0.3 °C/W
See Note 2



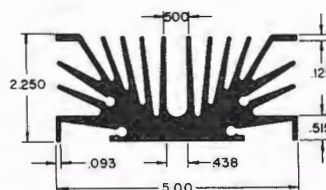
6780

WT. - 2.94 lb/1'
T. R. - 6 °C/W



6164

WT. - 6.27 lb/1'
T. R. - 1.65 °C/W



6770

WT. - 5.6 lb/1'
T. R. - .45 °C/W
See Note 3



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TELEX: 010 860 5542

HOW TO ORDER HEAT SINKS FOR SEMI-CONDUCTORS

So that we may supply the exact unit you require, please furnish the following information on your order:

BASIC TYPE — Specify model number such as #6500, 6401, 6403, 6421, 6423

EXTRUSION FINISHES:

A — Hard anodize
B — Black anodize
C — Gold chromate
D — Nickel Plated
U — Clean, no finish

HOLE PATTERNS — Indicate your choice of finish and mounting accommodations as in the following example:

EXAMPLE → **6500** **B** — **3** — **3**
Basic Type Finish First hole pattern Second hole pattern (if req'd)

Each hole pattern group will be located to within 1/32" of true position.

-1 .270±.007 -1A .330±.007 -1B .390±.007 -1C .520±.008 -1D .497±.001 -1E .765±.010 -1F 1.030±.015 -1G .765±.010 -1H .200±.005 -1J Tap 4-40 THD -1K Tap 6-32 THD -1L Tap 8-32 THD -1M Tap 10-32 THD -1N Tap 1/4-28 THD -1P Tap 5/16-24 THD -1Q Tap 1/2-20 THD -1R Tap 3/4-16 THD -1S Tap 5/16-24 THD	HOLE PATTERN NO. 2 TO-3 CASE	HOLE PATTERN NO. 3 TO-36 CASE	HOLE PATTERN NO. 11 TO-65 CASE
HOLE PATTERN NO. 13 PLASTIC POWER	HOLE PATTERN NO. 14 PLASTIC POWER	HOLE PATTERN NO. 15 TO-3, 8 LEAD	HOLE PATTERN NO. 16 TO-66 CASE
HOLE PATTERN NO. 17 TO-8 CASE	HOLE PATTERN NO. 19 TO-3 CASE	HOLE PATTERN NO. 20 TO-3 ROTATED 33°	HOLE PATTERN NO. 21 TO-66 ROTATED 45°
HOLE PATTERN NO. 22 TO-66 CASE	HOLE PATTERN NO. 23 TO-8 CASE	HOLE PATTERN NO. 24 EXTRUSIONS WITH CLAMP	HOLE PATTERN NO. 26 TO-3 SOCKET

MOUNTING TORQUE — On TO-5, TO-18, TO-8 heat sinks utilizing gland nut construction, excessive mounting torque may fracture insulating film resulting in loss of insulation. Mounting torque recommendations are as follows:

a. Body to chassis or mounting surface: 70 in. oz. b. Gland nut to body: 50 in. oz.

On finger tightened units such as the 2215 and 2220 series, no mounting torque specifications apply. The units can safely withstand all torque available by hand tightening. Also no mounting torque specifications apply to screw driver slotted insert units such as 2205, 2207/PR11, and 2209.

FINISHES — The following finishes are available on all products and should be indicated by catalog number suffix:

"A" suffix — Hard anodize insulating finish based on specifications of MIL-F-14072. "File hard" surface resists scratches and punctures. Electrical insulation of 400 VDC typical between transistor case and mounting surface. If electrical insulation is critical, mounting torque recommendations must be followed and Thermacote silicone thermal compound must be used.

"B" suffix — Black anodize finish per MIL-A-8625 Type II. This finish has the electrical insulating properties of hard anodize but can be easily scratched or punctured with resultant loss of insulating properties. It is not recommended where electrical insulation is needed.

"C" suffix — Gold chromate finish per MIL-C-5541. No electrical insulation. Some color variation may normally be expected with this finish.

"D" suffix — Nickel plate finish per MIL-STD-171. Enables soldering of heat sink to PC board. Currently available only on 6025.

"U" suffix — Clean, no finish, uninsulated.

MATERIALS — Screw machine parts — 2024T4 aluminum; Extrusions — 6063T5 aluminum; Stampings — 1100H14 and 3003H14 aluminum.



Thermalloy

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TELEX: 210 800 5542

TECHNICAL DATA — TEST PROCEDURES

Because there are no adequate standardized test procedures for electronics cooling, Thermalloy Company has devised its own procedures which are generally based on standards established by the American Society of Mechanical Engineers, American Society of Testing materials, and The Society of Automotive Engineers. Test conditions are intended to be as near to recommended operating conditions as practical. Where unusual operating conditions exist and performance is critical, tests should be made under these conditions.

Temperature Measurements: Bimetallic thermocouples are used to monitor temperature. Two types are used depending on the required accuracy. These types and their limits of error as defined by The Instrument Society of America are:

TYPE	METALS	LIMITS OF ERROR
K	Chromel/Alumel	$\pm 4^{\circ}\text{F}$, (2.22°C)
T	Copper/Constantan	$\pm 1.5^{\circ}\text{F}$, ($.83^{\circ}\text{C}$)

28 Gage thermocouple wire is used. The junctions are soldered or welded.

The thermocouples are installed in a manner to eliminate immersion depth errors. Where practical, they are soldered or welded to the point to be monitored. Otherwise, they are inserted into the smallest practical hole, insulated from the sides of the hole except for the junction and swaged to stay in place.

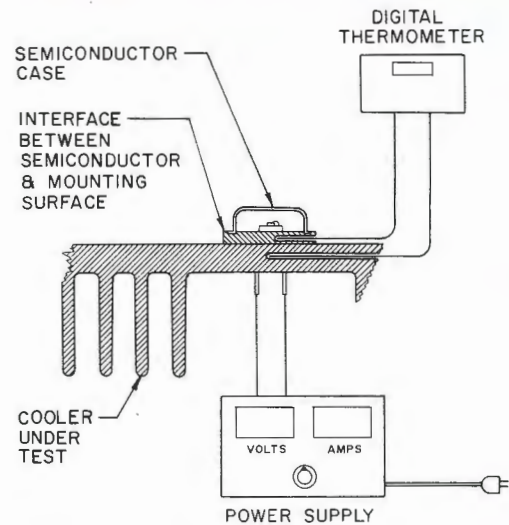
When testing cooling units that are designed only for particular semiconductor components and the method of interfacing is predictable, the thermocouple will be attached to the component case. For instance, the 2207/PR11 is designed to be used exclusively with TO-5 components which are held in place with threaded inserts. In testing this part, the thermocouple is soldered to the weld flange of the TO-5. Mounting conditions for TO-3 components (torque, surface finish, and interface insulator) may vary greatly from one application to another. Therefore, in testing cooling units for TO-3 devices, the temperature is monitored in the cooling unit mounting surface.

All thermocouples are placed in the "thermal circuit." Measuring temperature on top of a can or at a hold down screw is generally not acceptable.

Two types of readout instruments are used: A precision portable potentiometer with copper/constantan wire, where temperature differences are less than 10°C and a digital thermometer, readable to $.5^{\circ}\text{C}$, with chromel/alumel wire for larger temperature differences.

Power Measurements: All power is measured with calibrated voltmeters and ammeters. Voltage is monitored at the device terminals. Direct current is used with actual semiconductor devices. For some cooling units, particularly high power coolers, simulators are used with alternating current.

Natural Convection Tests: When testing in natural convection, the cooling unit is mounted and oriented in the same manner that it is expected to be used. It is usually attached to a circuit board with the fins in a vertical plane. The cooling unit is mounted a sufficient



TEST SET-UP

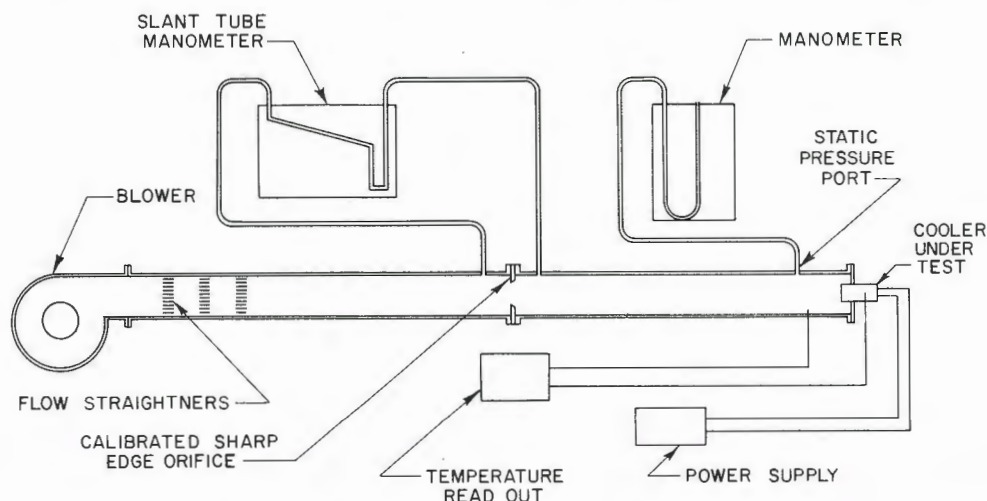
distance away from obstructions (such as a table top) to prevent airflow interference. Ambient drafts are monitored with a hot wire anemometer, sensitive to less than 5 feet per minute. Temperature readings are not accepted at ambient velocities greater than 10 feet per minute. It has been experimentally determined that drafts up to 50 feet per minute will not effect the data.

Forced Convection: Two types of forced convection tests are run; open flow and confined or ducted flow. For open flow, no duct is used. A blower is mounted such that the direction of flow is parallel to the fins. Velocity is varied either by changing the distance between the blower and cooler or by throttling. This velocity is measured in the vicinity of the fins with a hot wire anemometer for velocities up to 1000 feet per minute and with a pitot tube for velocities over 1000 feet per minute.

For confined flow, the parts to be tested are installed in a close fitting duct. A static pressure tap is placed immediately upstream of the test section. Volume airflow is measured with a sharp edge orifice in accordance with SAE Aero-Space Applied Thermodynamics Manual.

Test Data Presentation: Data is plotted on linear graphs with the following coordinates:

- Natural Convection — Temperature rise above ambient vs. Heat Dissipated.
- Open Flow — Thermal resistance vs. free stream air velocity.
- Confined Flow (ducted flow) — Thermal resistance and pressure drop vs. volume airflow.



AIR FLOW DUCT FOR FORCED CONVECTION MEASUREMENTS



Thermalloy

P. O. BOX 34829 / 2021 W. VALLEY VIEW LANE / DALLAS, TEXAS 75234
PHONE: 214-242-4221

TWY. 010 060 5542

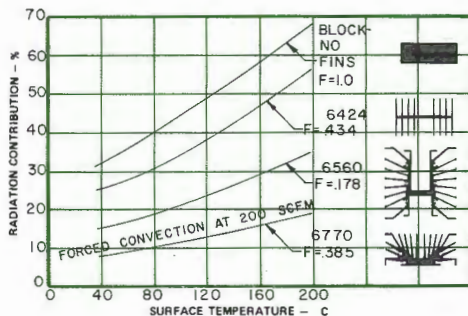
TECHNICAL DATA — APPLICATION NOTES

APPLICATION CONSIDERATIONS

Most electronics manufacturers have technical people who are skilled in heat transfer and fluid flow. This section of the Thermalloy catalog is intended to provide some quick reference technical data for such people and some guide lines for others. These guide lines are presented here in the form of a list of what you should and what you should not do to realize maximum utilization of Thermalloy products.

1. Do — mount natural convection cooling devices with the fins in a vertical plane.
2. Do not — block air flow currents directly below or above natural convection cooling devices.
3. Do — order black or hard anodized surfaces to enhance radiation from natural convection coolers.
4. Do not — expect significant radiation contributions from high performance, forced convection coolers.

The following figure shows the contribution of black body radiation for 4 Thermalloy cooling devices as a function of surface temperature and shape factor. The shape factor, F, is the ratio of total surface area to envelope surface area. The three top curves are for natural convection.



5. Do — utilize the best practical cooling method to increase reliability.

The following table shows the relative heat transfer capability for five methods.

Comparison of Different Types of Convection

TYPE OF CONVECTION	FLUID	HEAT TRANSFER COEFFICIENT BTU/HR FT ² °F
Natural	Air	.5 — 2
Forced	Air	10 — 100
Natural	Water	100 — 1000
Forced	Water	1000 — 10,000
Boiling	Water	10,000 — 100,000

6. Do not — integrate mounting and packaging problems with cooling problems — it's expensive.
7. Do — use Thermacote, (thermal joint compound) flat surfaces, and high screw torque for medium and high power devices.
8. Do — expend extra effort on lowering junction temperatures to increase system reliability.

The following table shows the life expectancy for 90% survival of a typical SCR for different junction temperatures.

JUNCTION TEMPERATURE—°C	LIFE EXPECTANCY—HOURS
86	66,000
91	40,000
101	20,000
114	10,000

9. Do — use materials in the conduction heat transfer path with high thermal conductivities.

The following table shows the thermal conductivity of some common engineering materials.

Thermal Conductivity of Materials

MATERIAL	TEMPERATURE—°F	THERMAL CONDUCTIVITY BTU/HR • FT • °F
Air	100	.0157
6 LB/FT ³ Fiberfrax	100	.025
Rubber	70	.08
Polyimide	74	.0900
Wood (Typ.)	60	.10
Teflon	200	.168
Water	100	.363
Brick	68	.40
Pyrex	100	.68
Stainless Steel (301)	100	8.7
Aluminum Oxide	100	11.0
Cast Iron	100	35
Brass	100	64
Aluminum	100	115
Beryllium Oxide	75	130
Gold	100	168
Copper	100	220
Silver	100	230

10. Do — contact Thermalloy, Inc. for your cooling needs as early in the design phase as possible.

SOME PERTINENT CONVERSION TABLES

VOLUME

from	to	cm ³	liter	m ³	in. ³	ft ³	yd ³	fl oz	fl pt	fl qt	gal
cm ³	1	0.001	1 × 10 ⁻⁶	0.06102	3.53 × 10 ⁻⁵	1.31 × 10 ⁻⁴	0.03381	0.00211	0.00106	2.64 × 10 ⁻⁴	
liter	1000	1	0.001	61.02	0.03532	0.00131	33.81	2.113	1.057	0.2642	
m ³	1 × 10 ⁶	1000	1	35.31	1.308	3.38 × 10 ⁻²	2113	1057	264.2		
in. ³	16.39	0.01639	1.64 × 10 ⁻⁵	1728	1	5.79 × 10 ⁻⁴	0.5541	0.03463	0.01732	0.00433	
ft ³	2.83 × 10 ⁴	28.32	0.02832	1	1	1	59.84	29.92	7.481		
yd ³	7.65 × 10 ⁵	764.5	0.7646	4.67 × 10 ⁴	27	1	2.59 × 10 ⁴	1616	807.9	202.0	
fl oz	29.57	0.02957	2.96 × 10 ⁻⁵	1.805	0.00104	3.87 × 10 ⁻⁴	0.06250	0.03125	0.00781		
fl pt	473.2	0.4732	4.73 × 10 ⁻⁴	28.88	0.01671	6.19 × 10 ⁻⁴	16	1	0.5000	0.1250	
fl qt	946.4	0.9463	9.46 × 10 ⁻⁴	57.75	0.03342	0.00124	32	2	1	0.2500	
gal	3785	3.785	0.00379	231.0	0.1337	0.00495	128	8	4	1	

1 cord = 128 ft³ = 3.625 m³

WEIGHT

from	to	g	kg	m. ton	grain	oz	lb	sh. ton	lg. ton
g	1	0.001	1 × 10 ⁻⁶	15.43	0.03527	0.00220	1.10 × 10 ⁻⁵	9.84 × 10 ⁻⁶	
kg	1000	1	0.001	1.54 × 10 ⁻⁴	35.27	2.205	0.00110	9.84 × 10 ⁻⁴	
m. ton	1 × 10 ⁶	1000	1	1.54 × 10 ⁻³	3.53 × 10 ⁴	2205	1.102	0.9842	
grain	0.06480	6.48 × 10 ⁻⁵	6.48 × 10 ⁻⁸	1	0.00229	1.43 × 10 ⁻⁴	7.14 × 10 ⁻⁵	6.38 × 10 ⁻⁵	
oz	28.35	0.02835	2.83 × 10 ⁻²	437.5	1	0.06250	3.12 × 10 ⁻²	2.79 × 10 ⁻²	
lb	453.6	0.4536	4.54 × 10 ⁻¹	7000	16	1	0.0005	4.46 × 10 ⁻⁴	
sh. ton	9.07 × 10 ³	907.2	0.9072	1.40 × 10 ⁴	3.20 × 10 ⁴	2000	1	0.8929	
lg. ton	1.02 × 10 ⁶	1016	1.016	1.57 × 10 ⁶	3.58 × 10 ⁶	2240	1.12	1	

Density: 1 g/cm³ = 62.43 lb/ft³; 1 lb/ft³ = 0.1337 lb/gal

ENERGY

from	to	Btu	cal	kg m	ft lb	joule	hp hr	kw hr
Btu	1	252.0	107.6	778.0	1055	3.93 × 10 ⁴	2.93 × 10 ⁻⁴	
cal	0.00397	1	0.4268	3.087	4.186	1.56 × 10 ⁻⁴	1.16 × 10 ⁻⁵	
kg m	0.00930	2.343	1	7.233	9.807	3.65 × 10 ⁻⁴	2.72 × 10 ⁻⁵	
ft lb	0.00129	0.3239	1.383	1	1.356	5.05 × 10 ⁻⁵	3.77 × 10 ⁻⁶	
joule	9.48 × 10 ⁻⁴	0.7389	0.1020	0.7376	1	3.73 × 10 ⁻⁵	2.78 × 10 ⁻⁶	
hp hr	2545	6.41 × 10 ⁵	2.74 × 10 ⁵	1.98 × 10 ⁶	2.68 × 10 ⁶	1	0.7459	
kw hr	3413	8.60 × 10 ⁵	3.67 × 10 ⁵	2.66 × 10 ⁶	3.60 × 10 ⁶	1.341	1	

1 erg = 1 dyne cm = 10⁻⁷ joules

LENGTH

from	to	cm	m	km	in.	ft	mile
cm	1	0.01	1 × 10 ⁻⁵	0.3937	0.03281	6.21 × 10 ⁻⁶	
m	100	1	0.001	39.37	3.281	6.21 × 10 ⁻⁴	
km	1 × 10 ⁵	1000	1	3.94 × 10 ⁴	3281	0.6214	
in.	2.540	0.02540	2.54 × 10 ⁻⁵	1	0.08333	1.58 × 10 ⁻⁴	
ft	30.48	0.3048	3.05 × 10 ⁻⁴	12	1	1.89 × 10 ⁻⁴	
mile	1.61 × 10 ⁵	1609	1.609	6.34 × 10 ⁴	5280	1	

1 micron = 1 × 10⁻⁶ m; 1 mil = 0.001 in.; 1 m = 1.094 yd; 1 yd = 5.682 × 10⁻⁴ mile
1 mile = 1760 yd; 1 nautical mile = 1.852 km = 6076 ft = 1.151 mile
1 acre = 4047 m² = 43560 ft² = 0.00156 mile²

AREA

from	to	cm ²	m ²	km ²	in. ²	ft ²	mile ²
cm ²	1	0.0001	1 × 10 ⁻⁶	1.550	0.00108	3.86 × 10 ⁻¹¹	
m ²	1 × 10 ⁴	1	1 × 10 ⁻⁶	1.550	10.76	3.86 × 10 ⁻⁷	
km ²	1 × 10 ¹⁰	1 × 10 ⁶	1	1.55 × 10 ⁹	1.08 × 10 ⁷	0.3861	
in. ²	6.452	6.45 × 10 ⁻⁴	6.45 × 10 ⁻¹⁰	1	0.00694	2.49 × 10 ⁻⁶	
ft ²	929.0	0.09290	9.29 × 10 ⁻⁸	144	1	3.59 × 10 ⁻⁸	
mile ²	2.59 × 10 ¹⁰	2.59 × 10 ⁶	2.590	4.01 × 10 ⁹	2.79 × 10 ⁷	1	

VELOCITY

from	to	cm/sec	km/hr	in./sec	ft/sec	ft/min	mph
cm/sec	1	0.03600	0.3937	0.03281	1.968	0.02237	
km/hr	27.78	1	10.94	0.9113	54.68	0.6214	
in./sec	2.540	0.09143	1	0.08333	5	0.05682	
ft/sec	30.48	1.097	12	1	60	0.6818	
ft/min	0.5080	0.01829	0.2000	0.01667	1	0.01136	
mph	44.70	1.609	17.60	1.467	88	1	

PRESSURE

from	to	mm Hg	in. Hg	in. H ₂ O	ft H ₂ O	atm	lb/in. ²	kg/cm ²
mm Hg	1	0.03937	0.5353	0.04460	0.00132	0.01934	0.00136	
in. Hg	25.40	1	13.60	1.133	0.03342	0.4912	0.03453	
in. H ₂ O	1.868	0.07355	1	0.08333	1	0.00246	0.03613	
ft H ₂ O	22.42	0.8826	12	1	0.02950	0.4335	0.03048	
atm	760	29.92	406.8	33.90	1	14.70	1.033	
lb-in. ²	51.71	2.034	27.67	2.307	0.06805	1	0.07031	
kg/cm ²	735.6	28.96	393.7	32.81	0.9678	14.22	1	

1 Bar = 1 × 10⁶ dynes/cm² = 0.98692 atm



TECHNICAL DATA — DETERMINING THERMAL RESISTANCE

Electronic cooling devices (heat sinks, coolers, dissipators) are generally rated by a statement of their thermal resistance. That is, temperature rise per unit of heat transfer or heat dissipated, expressed in units of degrees centigrade per watt. For a particular application it is necessary to determine the thermal resistance which the cooler must have in order to maintain a junction temperature which is not detrimental to the operation, performance and reliability of the semiconductor device.

The basic relation for heat transfer or dissipation may be stated as follows:

$$q = \frac{\Delta T}{\Sigma \Theta}$$

where q = the heat dissipated by the semiconductor device in watts.

ΔT = the temperature difference or driving potential which causes the flow of heat.

$\Sigma \Theta$ = the sum of the thermal resistances of the heat flow path across which ΔT exists.

The above relationship may be stated in the following forms:

$$(1) \quad q = \frac{T_J - T_A}{\Theta_{JC} + \Theta_{CS} + \Theta_{SA}}$$

$$(2) \quad q = \frac{T_C - T_A}{\Theta_{CS} + \Theta_{SA}}$$

$$(3) \quad q = \frac{T_S - T_A}{\Theta_{SA}}$$

where T_J = the junction temperature in $^{\circ}\text{C}$ (maximum is usually stated by manufacturer of semiconductor device)

T_C = case temperature of semiconductor device in $^{\circ}\text{C}$.

T_S = temperature of mounting surface (cooler) in thermal contact with semiconductor device in $^{\circ}\text{C}$.

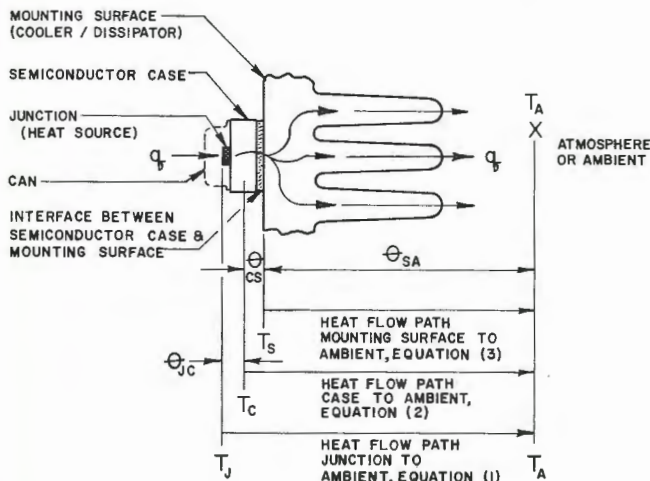
T_A = ambient temperature in $^{\circ}\text{C}$.

Θ_{JC} = thermal resistance from junction to case of semiconductor device in $^{\circ}\text{C}$ per watt (usually stated by manufacturer of semiconductor device)

Θ_{CS} = thermal resistance through the interface between the semiconductor device and the surface on which it is mounted in $^{\circ}\text{C}$ per watt.

Θ_{SA} = thermal resistance from mounting surface to ambient or thermal resistance of cooler in $^{\circ}\text{C}$ per watt.

The following schematic diagram indicates the location of the various heat flow paths, temperatures and thermal resistances.



Equations (1), (2), and (3) are equivalent since the heat flow (heat dissipation) must be the same through all sections. The equations are generally used to determine the required thermal resistance of the cooler (Θ_{SA}) since the heat dissipation, maximum junction and/or case temperature, and ambient temperature are known or set. The interface thermal resistance (Θ_{CS}), however, is usually an estimate or approximation since it is a function of many variables and is difficult to determine analytically. Typical values of interface thermal resistance for a TO-3 case style semiconductor are shown. Actual values may vary greatly with contact pressure and surface finish.

INTERFACE THERMAL RESISTANCE Θ_{CS} in $^{\circ}\text{C}/\text{watt}$

Semiconductor to mounting surface (no insulator, dry)	.05 — .20
Semiconductor to mounting surface (no insulator, with Thermacote)	.005 — .10
Beryllium oxide (BeO) wafer between semiconductor and mounting surface	.10 — .40
Hard anodized aluminum wafer between semiconductor and mounting surface	.35 — .70
2 mil. Thermafilm plastic insulator between semiconductor and mounting surface	.55 — .80

The following problems illustrate the application of the equations:

Example Problem #1

Given: TO-3 case style semiconductor dissipating 25 watts
 $\Theta_{JC} = 1.5^{\circ}\text{C}/\text{watt}$ (from semiconductor manufacturer)
 $T_J \text{ max.} = 125^{\circ}\text{C}$
 $T_A \text{ max.} = 50^{\circ}\text{C}$

Find: Thermal resistance of cooler required to keep semiconductor junction from exceeding 125°C .

Solution: Use Eq. (1) — Thermal resistance, junction to ambient

$$q = \frac{T_J - T_A}{\Theta_{JC} + \Theta_{CS} + \Theta_{SA}}$$

Solving for Θ_{SA} :

$$\Theta_{SA} = \frac{T_J - T_A}{q} - (\Theta_{JC} + \Theta_{CS})$$

Assume case to mounting surface thermal resistance (Θ_{CS}) of $0.25^{\circ}\text{C}/\text{watt}$

$$\Theta_{SA} = \frac{125^{\circ}\text{C} - 50^{\circ}\text{C}}{25 \text{ watts}} - (1.5 + .25)$$

$$\Theta_{SA} = 1.25^{\circ}\text{C}/\text{watt} \quad \leftarrow \text{ANSWER}$$

Thermalloy extruded cooler P/N 6421 with a thermal resistance (Θ_{SA}) of $1.0^{\circ}\text{C}/\text{watt}$ will meet this requirement for natural convection cooling.

Example Problem #2

Given: TO-66 case style semiconductor dissipating 15 watts.
 Ambient temperature (T_A) = 50°C max.

Find: Thermal resistance of cooler required to keep temperature of semiconductor case from exceeding 90°C .

Solution: Use Eq. (2) — Thermal resistance, case to ambient

$$q = \frac{T_C - T_A}{\Theta_{CA} + \Theta_{SA}}$$

Solving for Θ_{SA} :

$$\Theta_{SA} = \frac{T_C - T_A}{q} - \Theta_{CS}$$

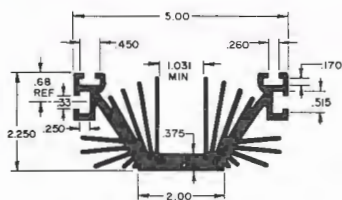
Assume case to mounting surface thermal resistance (Θ_{CS}) of $.40^{\circ}\text{C}/\text{watt}$

$$\Theta_{SA} = \frac{90^{\circ}\text{C} - 50^{\circ}\text{C}}{15 \text{ watts}} - .40^{\circ}\text{C}/\text{watt}$$

$$\Theta_{SA} = 2.27^{\circ}\text{C}/\text{watt} \quad \leftarrow \text{ANSWER}$$

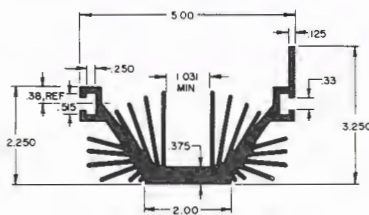
Thermalloy P/N 6427 with a thermal resistance (Θ_{SA}) of $2.25^{\circ}\text{C}/\text{watt}$ will meet this requirement for natural convection cooling.

With the relationships presented here and the thermal resistance values in the Thermalloy catalog, it should be possible to select the proper cooler for each application where the thermal characteristics of the semiconductor device are known. Additional application data and technical assistance is available from the Engineering Department of Thermalloy, Inc.



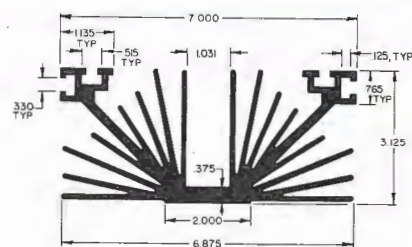
6740

WT. — 4.6 lb/1'
T.R. — .56 °C/W
See Note 5



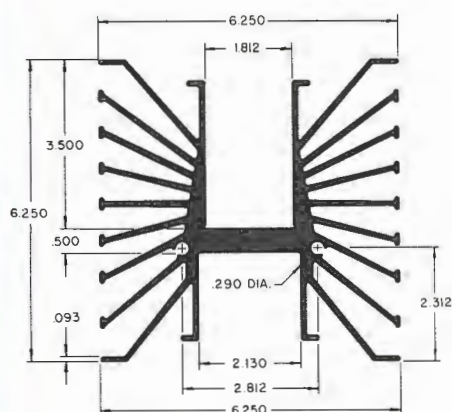
6745

WT. — 4.8 lb/1'
T.R. — .56 °C/W
See Note 5



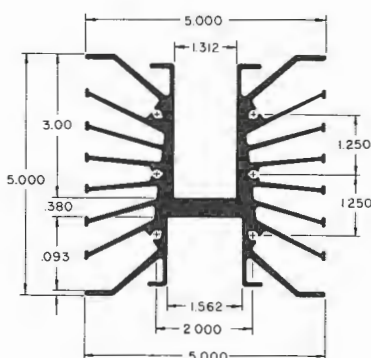
6750

WT. — 8.46 lb/1'
T.R. — .35 °C/W
See Note 5



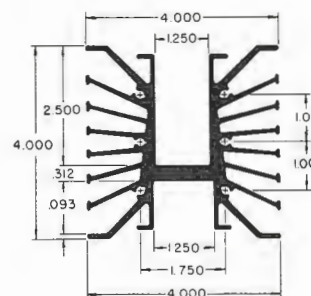
6660

WT. — 9.36 lb/1'
T.R. — .40 °C/W
See Note 3



6560

WT. — 6 lb/1'
T.R. — .50 °C/W
See Note 3



6450

WT. — 4.3 lb/1'
T.R. — .70 °C/W
See Note 4

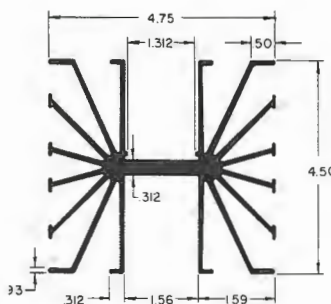
NOTES:

- (1) Thermal Resistance (T.R.) based on 3 inch extrusion length in natural convection except as noted.
- (2) Thermal Resistance of 0.3 °C/Watt is with water flowing through extrusion.
- (3) T.R. based on 6" extrusion length.
- (4) T.R. based on 5" extrusion length.
- (5) T.R. based on 4.5" extrusion length.
- (6) T.R. based on 5.5" extrusion length.

Material: Aluminum Alloy 6063-T5 per QQ-A-200/9.

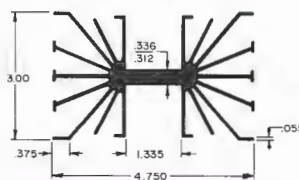
Tolerance: Commercial Extrusion Tolerances Apply. Contact Factory for Tolerance on Specific Dimensions.

6 and 12 foot lengths are also stocked at factory.



6441

WT. — 4.18 lb/1'
T.R. — .60 °C/W
See Note 6



6442

WT. — 2.27 lb/1'
T.R. — 1.0 °C/W



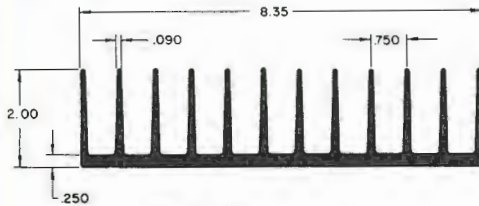
6131

WT. - 5.34 lb/1'
T. R. - 1.5 °C/W



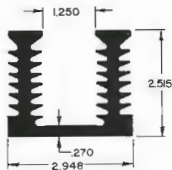
6130

WT. - 6.41 lb/1'
T. R. - 1.2 °C/W



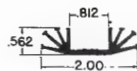
6153

WT. - 5.93 lb/1'
T. R. - 1.2 °C/W



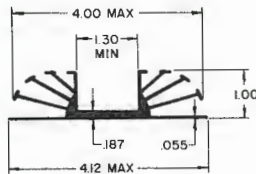
6321

WT. - 3.47 lb/1'
T. R. - 2.0 °C/W



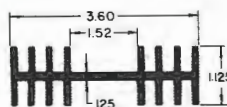
6601

WT. - .38 lb/1'
T. R. - 8 °C/W



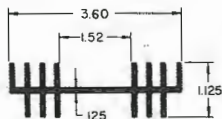
6169

WT. - 1.07 lb/1'
T. R. - 2.2 °C/W



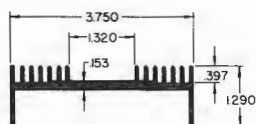
6135

WT. - 1.31 lb/1'
T. R. - 1.4 °C/W



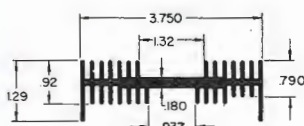
6139

WT. - 1.22 lb/1'
T. R. - 2.1 °C/W



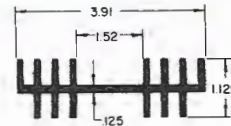
6172

WT. - 1.08 lb/1'
T. R. - 3.7 °C/W



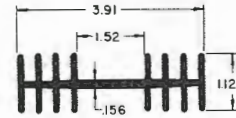
6432

WT. - 1.46 lb/1'
T. R. - 2.5 °C/W



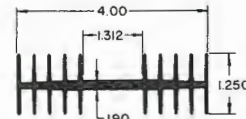
6137

WT. - 1.33 lb/1'
T. R. - 2.5 °C/W



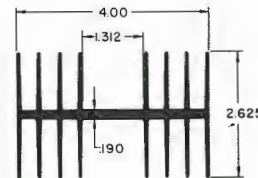
6127

WT. - 1.42 lb/1'
T. R. - 1.7 °C/W



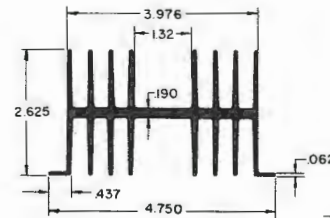
6405

WT. - 1.5 lb/1'
T. R. - 2.5 °C/W



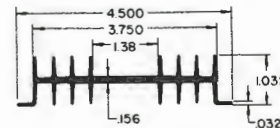
6424

WT. - 2.53 lb/1'
T. R. - 1.0 °C/W



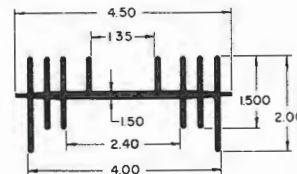
6421

WT. - 2.53 lb/1'
T. R. - 1.1 °C/W



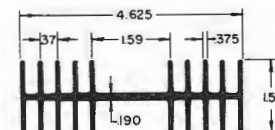
6500

WT. - 1.02 lb/1'
T. R. - 2.5 °C/W



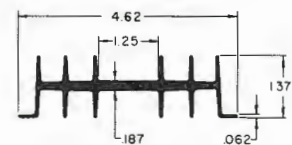
6456

WT. - 1.93 lb/1'
T. R. - 2 °C/W



6430

WT. - 2.12 lb/1'
T. R. - 1.8 °C/W



6363

WT. - 1.5 lb/1'
T. R. - 2.4 °C/W

THERMACOTE THERMAL JOINT COMPOUND



TYPICAL PROPERTIES

COLOR	OPAQUE WHITE
WORKING TEMPERATURE	-40 to +400°F
MAXIMUM TEMPERATURE	800°F
THERMAL CONDUCTIVITY	0.430 Btu/(sq ft) (hr) (°F)/ft
	0.00178 gmCal/(sq cm) (sec) (°C)/cm
	0.00745 watts/(sq cm) (°C)/cm
	0.0189 watts/(sq in) (°C)/in
DIELECTRIC STRENGTH (.050 gap)	300 volts/mil
VOLUME RESISTIVITY	4 x 10 ¹⁴ ohm-cm
SOLVENT	Trichloroethylene
SPECIFIC GRAVITY	2.7
BLEED (24 hr. at 200°C)	0.5% by weight
EVAPORATION (24 hr. at 200°C)	<1%
BULK MODULUS (25°C and 5000 psi)	150,000 psi

Thermacote is available in the following sizes:

STOCK NO.	NET WEIGHT
249	1 oz. tube
250	2 oz. jar
251	1 lb.
252	5 lb.
253	10 lb.
255	50 lb.
256	100 lb.

Thermacote is a superior thermal joint compound for use with all heat sinks. It improves the transfer of thermal energy across the metal-to-metal interfaces between the transistor or rectifier case and the heat sink.

Thermacote conducts heat approximately 30 times better than air and more than 4 times better than silicone grease. It is non-toxic, an excellent insulator, and extremely stable; neither caking nor running, from -40°F. to +400°F.

THERMABOND

THERMALLY CONDUCTIVE EPOXY ADHESIVE

Thermabond is a thermally conductive, high strength epoxy adhesive. It provides exceptional adhesion to copper, aluminum, steel, glass, ceramics, and most plastics. Thermabond also has a coefficient of thermal expansion compatible with aluminum, copper, and brass making it particularly well suited for thermally bonding semiconductors and other components to chassis or heat sinks. Thermabond bonds equally well to porous or non-porous materials, has good electrical insulating qualities and is one of the few epoxy adhesives suitable for cryogenic applications.

Typical Electrical and Physical Properties at Room Temperature with RT-7 Hardener

CHARACTERISTICS	TYPICAL VALUES
Specific gravity	2.25
Working viscosity, cps	25,000
Thermal conductivity	.0020 gm cal/sec cm °C/cm 5.8 BTU/hr ft °F/in
Thermal resistivity, °C in/watt	47
Tensile properties, psi	8,100
Compressive properties, psi	14,800
Bond shear strength, psi	2,900
Thermal coefficient of expansion, in/in/ °C	24 x 10 ⁻⁶
Heat distortion point °F	130
Water absorption, % after 7 days	.38
Hardness, Shore D	75
Volume resistivity, ohm cm	1.2 x 10 ¹⁵
Dielectric strength, volts/mil	500 - 750
Dielectric constant	6.0
Dissipation factor, 60 cps	.030
Operating temperatures, °F	-400 to 350



HOW TO ORDER

MODEL	SIZE
4951*	3½ oz. (100 Grams)
4952*	7 oz. (200 Grams)
4953*	4 lbs.
4954*	15 lbs.

*Matched Quan. of RT-7 Hardener included.

Mixing Instructions

Mix resin thoroughly before removing material. Add 7.5 parts of RT-7 hardener to 100 parts of resin by weight. Adhesive will set up in:

8 hrs at 78 °F
45 min. at 150 °F
20 min. at 250 °F

For maximum electrical and physical properties, a post cure is necessary.

Post cure at room temperature for 4 days or for 4 hrs. at 200 °F.



COMPRESSION DEVICE CLAMPS – SCR's and Diodes

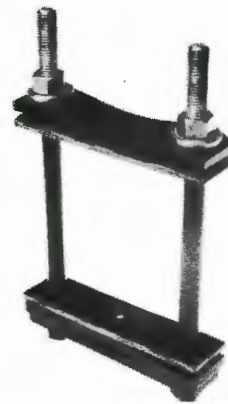
A wide variety of compression disc type SCR's and diodes are now being used by equipment manufacturers. Known as power packs, power discs, press-paks, hockey pucks, etc., they are able to operate at considerably higher current levels than stud mount types. The silicon wafer within the device is usually loosely mounted between the top and bottom surfaces. When compressed, both surfaces are brought into contact with the wafer providing a thermal and electrical connection with both sides. The greater the applied force, the better the thermal and electrical connection. The limiting factor on compression is usually a physical breakdown of the silicon wafer.

Most device manufacturers recommend clamping forces of from 800 to over 2,000 lbs. depending on the particular device. The Thermalloy clamp is designed to provide the manufacturer's recommended compression force while also clamping 2 cooling units to the device. It will accommodate compression devices up to 2.375 inches in diameter and provide clamping forces of up to 2,400 lbs. An even larger clamp is available if needed. It is practical, economical, and versatile and has the added features of rugged construction, large deflection for more accurate and consistent loading, standard rod spacing for extrusion hole patterns, and it is doubly insulated so that no part of the clamp is in the electrical circuit.

Insulation is provided by .125 inch thick phenolic impregnated load plates at both ends of the clamp and vinyl sleeves on the rods. In addition, all exposed metal on the clamp except the threads and nuts are covered with insulating epoxy coating.

The proper clamping force may be determined by using the chart which is accurate up to ± 100 lbs. The 10888 and 10898 clamp are identical except the 10898 clamp uses 4 springs instead of 2. The chart force reading should be doubled for the 10898.

Inspection is simplified by measuring the linear deflection of 1 spring and referring to the ordinate on the right of the chart. Measuring torque to determine the clamping force is not recommended. Readings are too erratic due to thread friction. Loading should be accomplished by first tightening the nuts alternately finger tight. Then turn each nut equally with a wrench until the desired loading (number of turns) determined by the clamp loading characteristics chart, is attained.

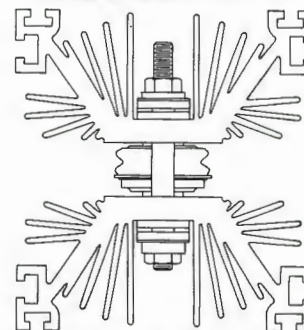


10888



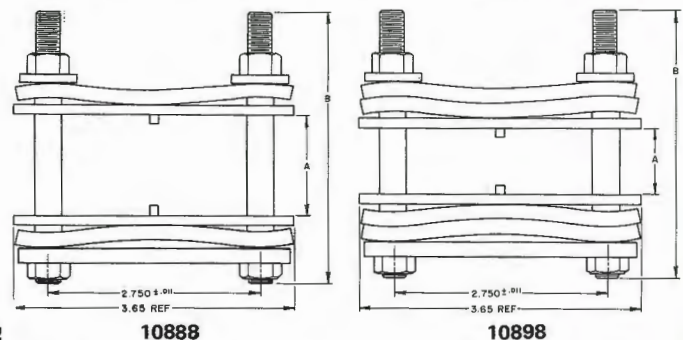
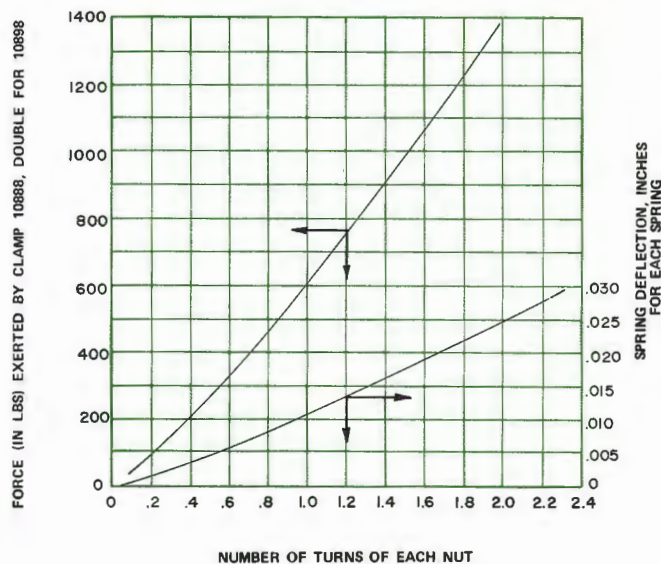
10898

TYPICAL INSTALLATION



TWO 6740 COOLERS, COMPRESSION DEVICE, AND 10888 CLAMP

CLAMP LOADING CHARACTERISTICS

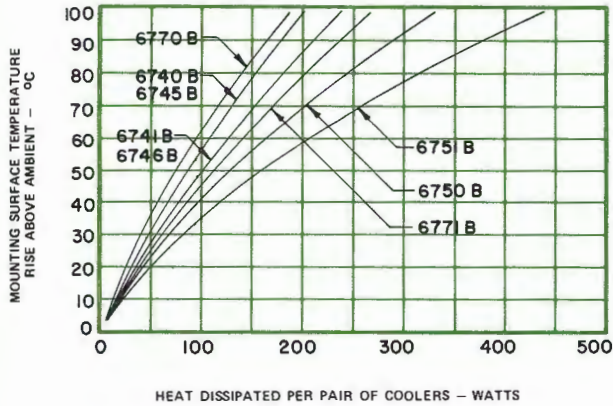


CLAMP ASSEMBLY NUMBER	A DIMENSION INCHES	B DIMENSION INCHES
10888-1	1.00 TO 2.00	3.84
10888-2	2.00 TO 3.00	4.84
10888-3	3.00 TO 4.00	5.84
10888-4	4.00 TO 5.00	6.84
10888-5	5.00 TO 6.00	7.84
10898-1	.625 TO 1.625	3.95
10898-2	1.625 TO 2.625	4.95
10898-3	2.625 TO 3.625	5.95
10898-4	3.625 TO 4.625	6.95
10898-5	4.625 TO 5.625	7.95

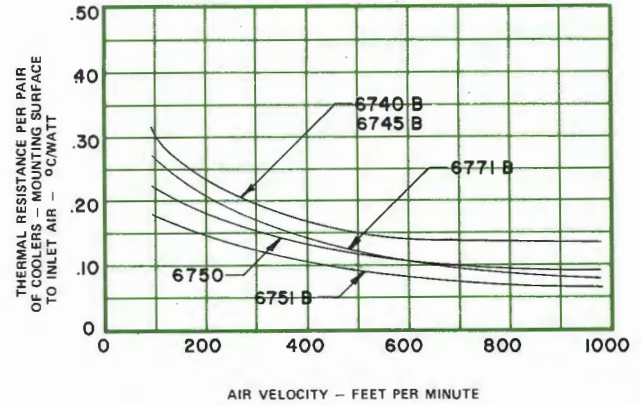
Clamps with longer rods are available on request.

COMPRESSION DEVICE COOLER PERFORMANCE CURVES

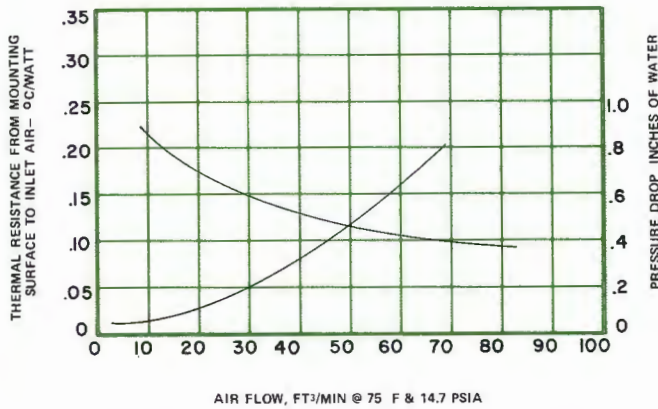
NATURAL CONVECTION
THERMAL PERFORMANCE



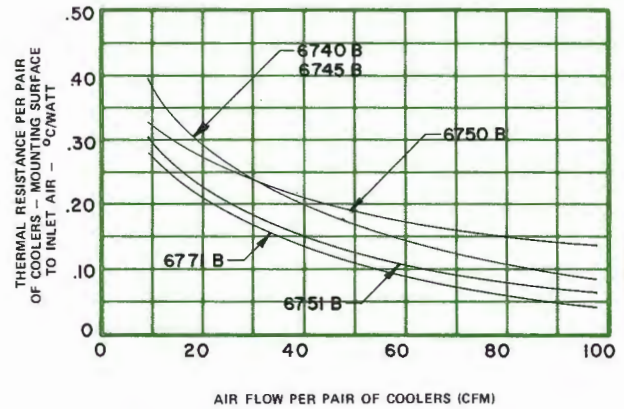
OPEN FLOW
FORCED CONVECTION
THERMAL PERFORMANCE



OPERATING CHARACTERISTICS OF
A PAIR OF P/N8850 BRAZED COMPACT
COOLERS FOR COMPRESSION SCR'S AND DIODES



DUCTED FLOW
FORCED CONVECTION
THERMAL PERFORMANCE

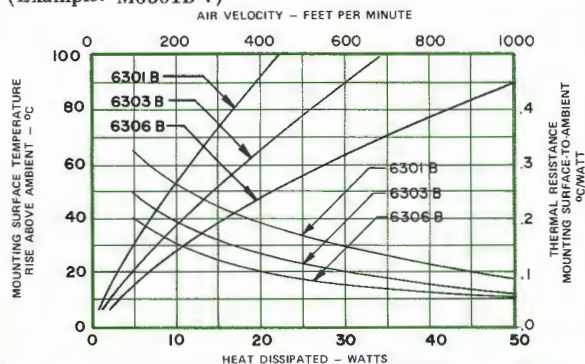


6301 SERIES

LOW COST COOLER — FOR HIGH POWER SEMICONDUCTORS

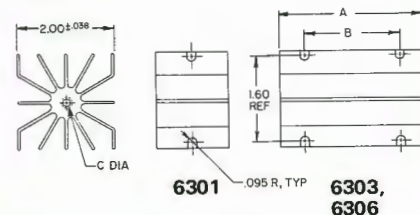
The 6301 series are extruded heat sinks with radial fins. Accommodate stud and press-fit packages on 1 or 2 ends. Recommended for bridge rectifier assemblies.

NOTE: 1 mounting foot and .63 dia. mounting surface can be free of anodizing by specifying suffix "M" to part number. (Example: M6301B-7)



MODEL	A DIM	B DIM	C, DIA.			
			-6	-7	-8	-9
6301B	3/4	—	TAP	TAP	TAP	REAM
6303B	1 1/2	1.0	8-32	10-32	1/4-28	.4975
6306B	3.0	2 1/2	5/8" Deep	5/8" Deep	5/8" Deep	3/8"

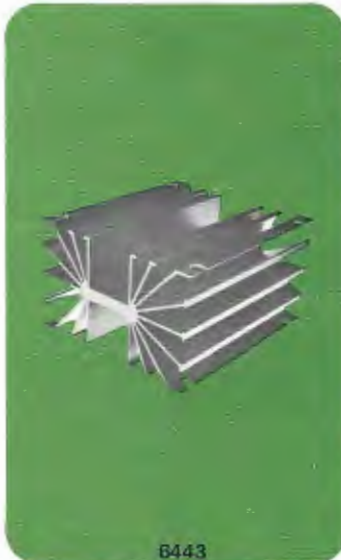
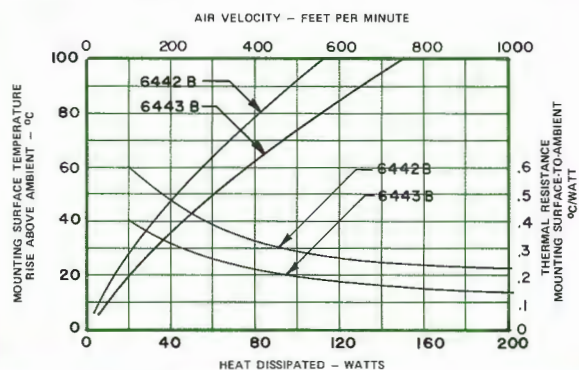
MODEL	WEIGHT
6301	.0608 lbs.
6303	.1217 lbs.
6306	.2434 lbs.



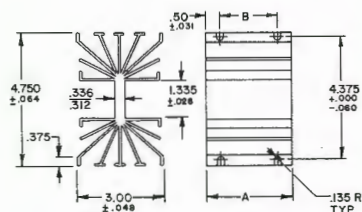
6442 AND 6443 SERIES

SUPERIOR PERFORMANCE COOLERS — FOR HIGH POWER SEMICONDUCTORS

The 6442 and 6443 series are extruded heat sinks with radial fins on both sides. Accommodate all high power devices. Recommended for high power SCR and rectifier applications.



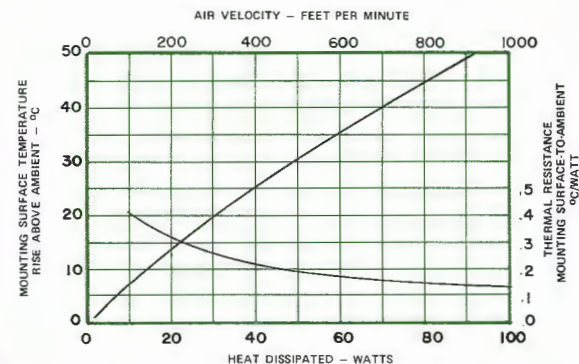
SERIES	DIM. A	DIM. B	WEIGHT
6442	3.00	2.00	.856 lbs.
6443	5.50	4.50	1.348 lbs.



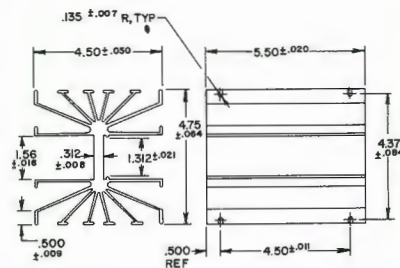
6441 SERIES

SUPERIOR PERFORMANCE COOLER — FOR HIGH POWER SEMICONDUCTORS

The 6441 is an extruded heat sink with radial fins on both sides. Accommodate all high power devices. Recommended for high power SCR and rectifier applications.



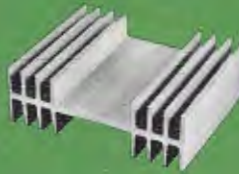
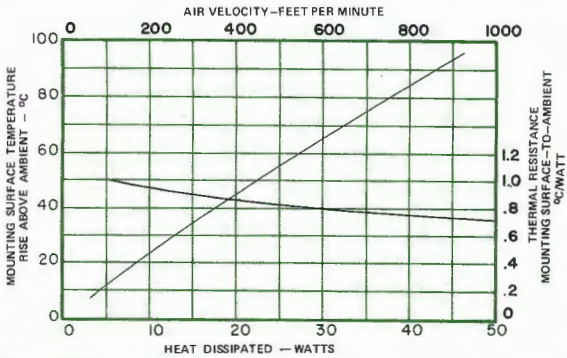
WEIGHT
1.685 lbs.



6135 SERIES

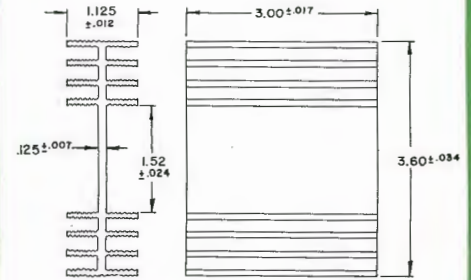
HIGH PERFORMANCE COOLER — FOR POWER SEMICONDUCTORS

The 6135 is an extruded heat sink with serrated fins on both sides. Accommodates all power devices. Recommended for forced convection and general purpose applications. See page 35 for available hole patterns.



6135

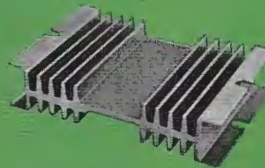
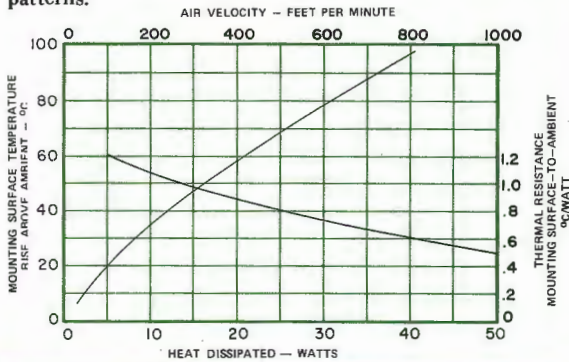
WEIGHT
.2934 lbs.



6427 SERIES

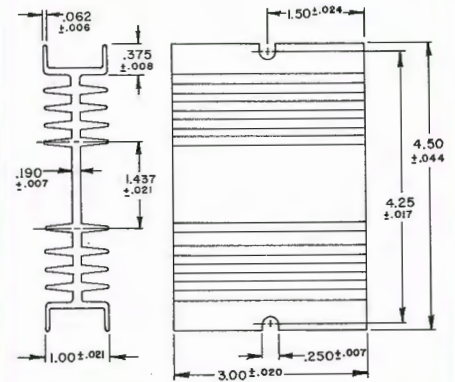
HIGH PERFORMANCE COOLER — FOR POWER SEMICONDUCTORS

The 6427 is an extruded heat sink with fins on both sides. Accommodates all power devices. Recommended where stacking of heat sinks is required. See page 35 for available hole patterns.



6427

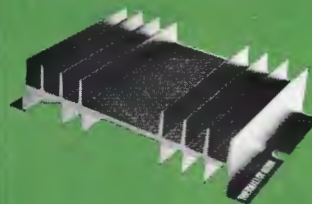
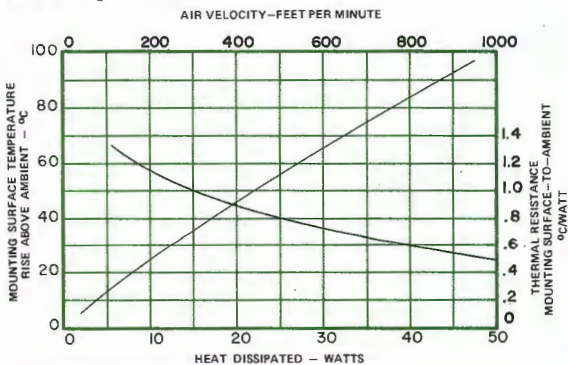
WEIGHT
.4363 lbs.



6500 SERIES

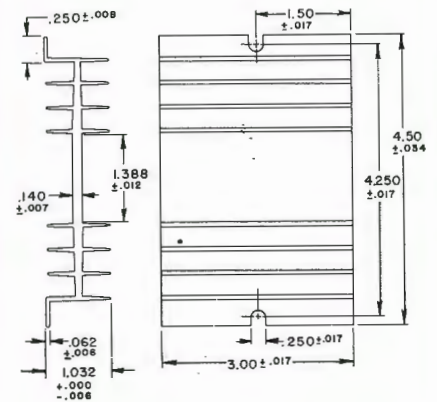
LOW COST EXTRUDED COOLER — FOR POWER SEMICONDUCTORS

The 6500 is an extruded heat sink with fins on both sides. Accommodates all power devices. Recommended where low cost and light weight are important. See page 35 for available hole patterns.



6500

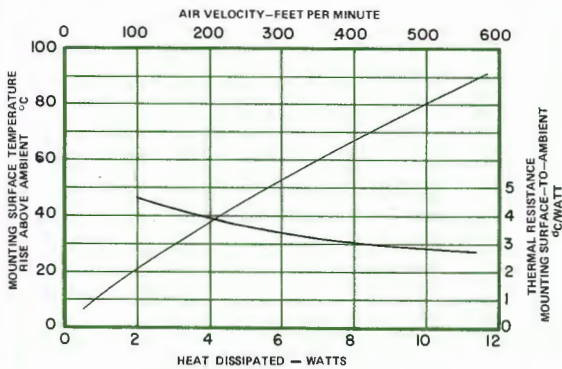
WEIGHT
.2511 lbs.



6111 SERIES

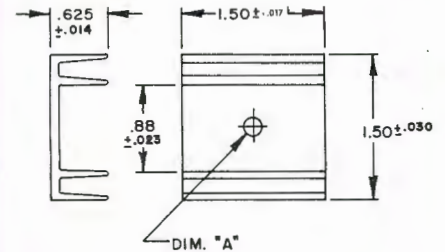
EXTRUDED CIRCUIT BOARD COOLER — TO-66 AND STUD MOUNT CASES

The 6111 is an extruded heat sink with fins on one side. Accommodates TO-66 and small power devices. Recommended for low profile, circuit board applications.



MODEL	FINISH	HOLE PATTERN	DIA	WEIGHT
6111B	Bl. An.	None		.0355 lbs.
6111B-1-6	Bl. An.	6-32 Stud	.187	.0355 lbs.
6111B-1-8	Bl. An.	8-32 Stud	.203	.0355 lbs.
6111B-1-10	Bl. An.	10-32 Stud	.250	.0355 lbs.
6111B-66	Bl. An.	TO-66		

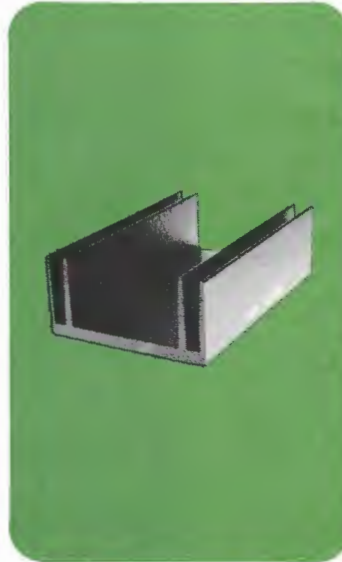
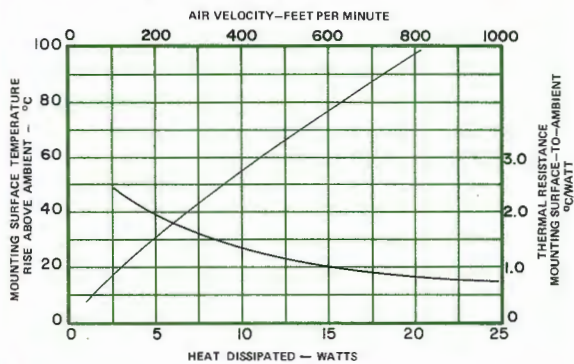
See Page 35 for ordering information.



6176 SERIES

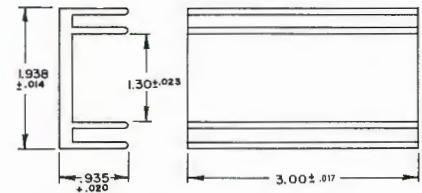
EXTRUDED CIRCUIT BOARD COOLER — TO-66, TO-3 AND STUD MOUNT CASES

The 6176 is an extruded heat sink with fins on 1 side. Accommodates all power devices. Recommended for low profile, general circuit board applications. See page 35 for available hole patterns.



MODEL	FINISH	HOLE PATTERN	WEIGHT
6176B	Black Anodize	None	.1480 lbs.
6176B-2	Black Anodize	TO-3	.1480 lbs.
6176B-11	Black Anodize	TO-66	.1480 lbs.

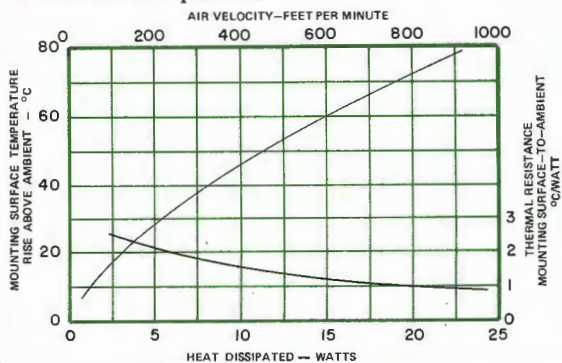
See Page 35 for ordering information.



6141 SERIES

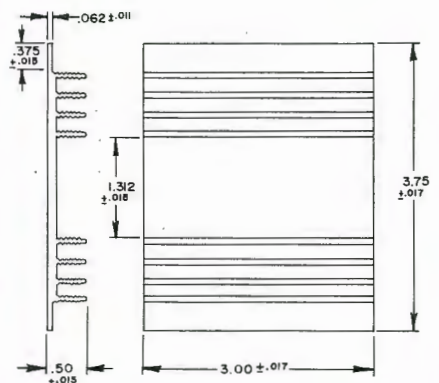
EXTRUDED CIRCUIT BOARD COOLER — FOR POWER SEMICONDUCTORS

The 6141 is an extruded heat sink with serrated fins on 1 side. Accommodates all power devices. Recommended for low profile, general circuit board applications. See page 35 for available hole patterns.



WEIGHT
.1681 lbs.

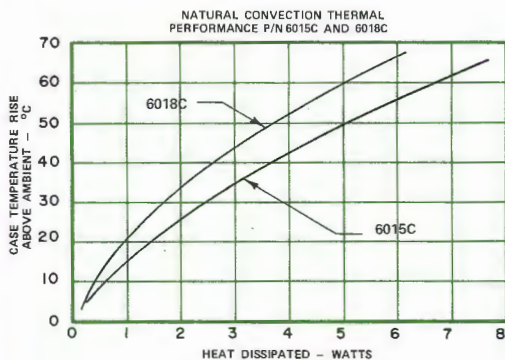
See Page 35 for ordering information.



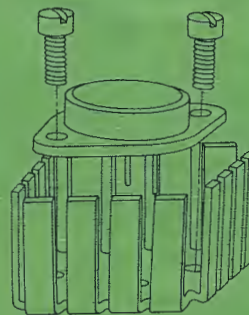
6013 SERIES

SPACE SAVER COOLER — TO-3 AND TO-66 CASES

The 6013 series are low cost light weight 1 piece heat sinks for circuit board applications. Unique design conforms to the diamond shape of the TO-3 and TO-66 package for minimum board space usage in high density applications.



MODEL	FINISH	DIM "A" FOR HEIGHT	CASE	WEIGHT
6013B	Black Anodize	.50	TO-3	.0154 lbs.
6013C	Gold Chromate	.50	TO-3	.0154 lbs.
6014B	Black Anodize	.75	TO-3	.0198 lbs.
6014C	Gold Chromate	.75	TO-3	.0198 lbs.
6015B	Black Anodize	1.00	TO-3	.0242 lbs.
6015C	Gold Chromate	1.00	TO-3	.0242 lbs.
6016B	Black Anodize	1.25	TO-3	.0286 lbs.
6016C	Gold Chromate	1.25	TO-3	.0286 lbs.
6017B	Black Anodize	.50	TO-66	.0114 lbs.
6017C	Gold Chromate	.50	TO-66	.0114 lbs.
6018B	Black Anodize	.75	TO-66	.0161 lbs.
6018C	Gold Chromate	.75	TO-66	.0161 lbs.
6019B	Black Anodize	1.00	TO-66	.0183 lbs.
6019C	Gold Chromate	1.00	TO-66	.0183 lbs.



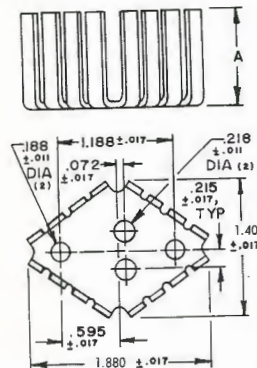
6015



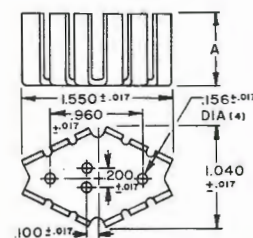
6015



6018



6013
(For TO-3's)

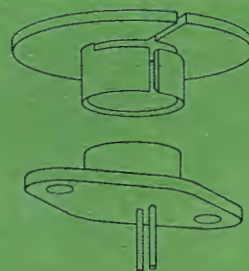
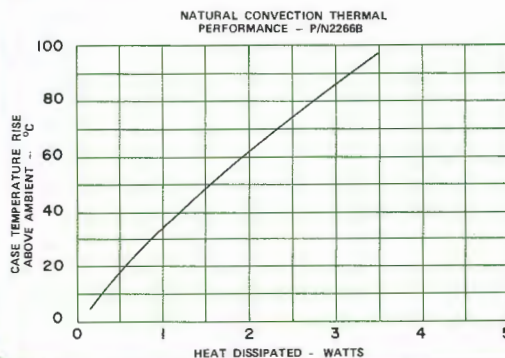


6017
(For TO-66's)

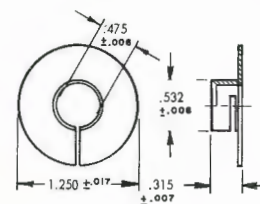
2266 SERIES

ECONOMY COMBINATION PRESS ON COOLER — TO-66 AND TO-8 CASES

The 2266 is a low cost 1 piece heat sink. Barrel flexibility enables use on TO-66 and TO-8 devices. Heat sink presses onto case and requires no board space or special assembly tools. Heat is conducted from case to the integral fin. Heat sink can be installed after board assembly.



MODEL	FINISH	WEIGHT
2266A	Hard Anodize	.0051 lbs.
2266B	Black Anodize	.0051 lbs.
2266C	Gold Chromate	.0051 lbs.

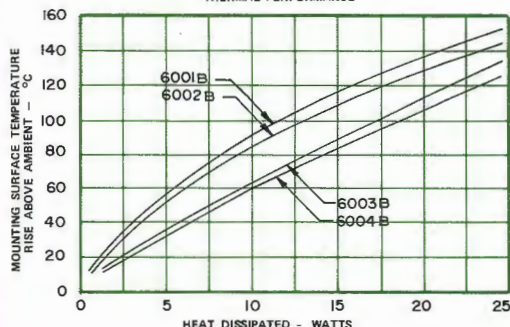


6001 SERIES

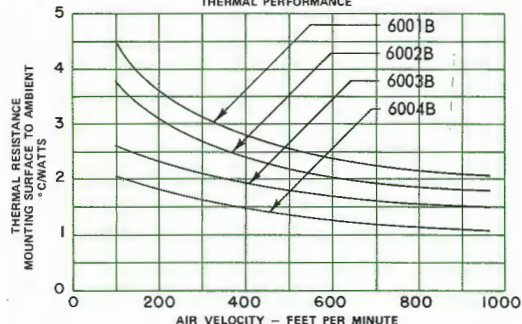
MAXIMUM PERFORMANCE — UNIQUE FIN DESIGN — TO-3 AND TO-66 CASES

The 6001 series are 1 piece heat sinks for circuit board applications. This unique design utilizes slanted vane fins for efficient heat dissipation. Air movement from any direction is diverted into the center of the heat sink to create turbulence and improve heat transfer. High thermal efficiency enables this light weight heat sink to dissipate as much heat as heavier and more costly impact extrusions and castings. The CN48a and TO-8 type I.C.'s can be accommodated by adding the 11013 clamp. The CN48a and TO-8 case styles are the same except the TO-8 can is slightly smaller in diameter.

NATURAL CONVECTION
THERMAL PERFORMANCE



FORCED CONVECTION
THERMAL PERFORMANCE

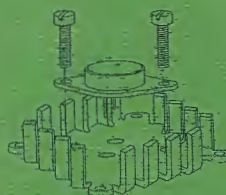


MODEL	FINISH	WEIGHT
6001B	Black Anodize	.0315 lbs.
6001C	Gold Chromate	.0315 lbs.
6002B	Black Anodize	.0377 lbs.
6002C	Gold Chromate	.0377 lbs.
6003B	Black Anodize	.0438 lbs.
6003C	Gold Chromate	.0438 lbs.
6004B	Black Anodize	.0500 lbs.
6004C	Gold Chromate	.0500 lbs.

HOLE PATTERNS AVAILABLE.

Description	Part Number Suffix
TO-3	-2
TO-66	-11
TO-3 8 Lead IC	-15
TO-66 IC	-16
TO-8 And CN48a case style IC	-17 (includes 11013 clamp)

See Page 35 for ordering information.



6001



6001



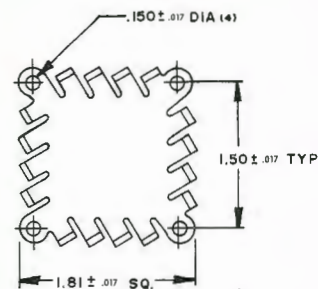
6002



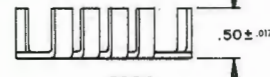
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6004



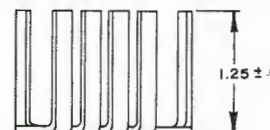
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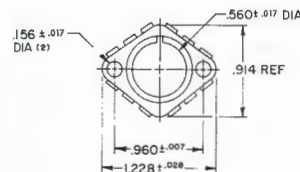
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6003



6004

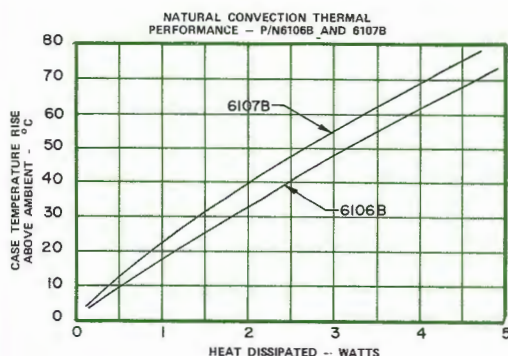


11013 CLAMP

6106 SERIES

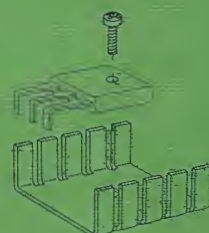
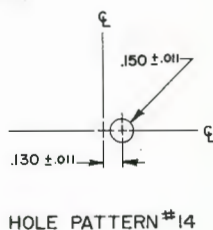
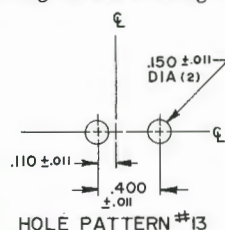
ECONOMY COOLER - PLASTIC POWER DEVICES

The 6106 and 6107 are low cost 1 piece heat sinks for plastic power transistors and SCR's. Units are designed for circuit board applications, and a .150 dia hole is provided for device and board mounting. Heat is conducted to the in-line vanes for natural convection or forced air dissipation. Heat sink is light weight and accepts most plastic case styles. The 6107 accommodates a single device and the 6106 can accommodate either one or two devices.



MODEL	FINISH	HOLE PATTERN	WEIGHT
6107B	Black Anodize	Plain, -14	.0059 lbs.
6107C	Gold Chromate	Plain, -14	.0059 lbs.
6107U	Unfinished	Plain, -14	.0059 lbs.
6106B	Black Anodize	Plain, -13, -14	.0093 lbs.
6106C	Gold Chromate	Plain, -13, -14	.0093 lbs.
6106U	Unfinished	Plain, -13, -14	.0093 lbs.

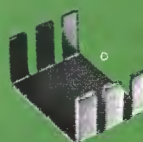
See Page 35 for ordering information.



6106



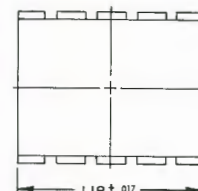
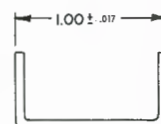
6107



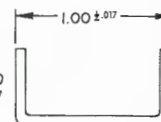
6107



6107



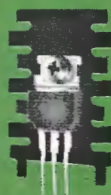
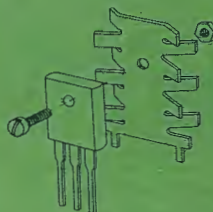
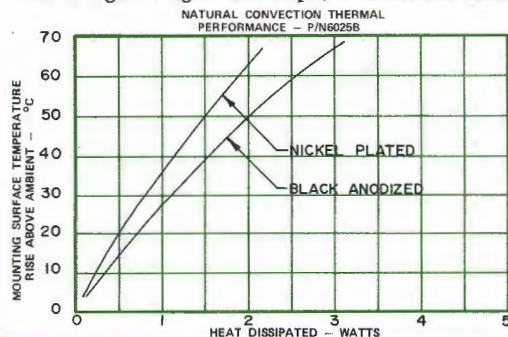
6106



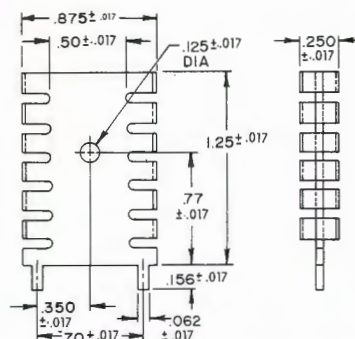
6025 SERIES

ECONOMY SPACE SAVING COOLER - PLASTIC POWER DEVICES

The 6025 is a low cost vertically mounted 1 piece heat sink for a single plastic power SCR or transistor in circuit board applications. Heat is conducted to alternating fins for dissipation. 2 tabs are provided for vertical mounting and nickel plated version may be soldered during dip soldering process. Unit is light weight and requires minimum board space.



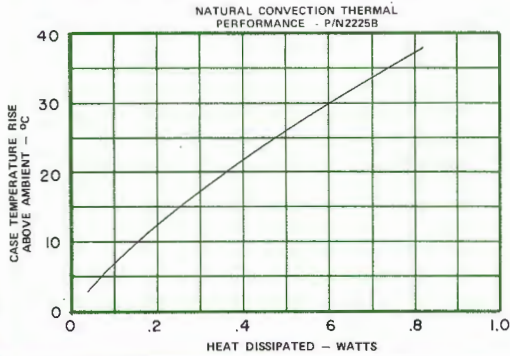
MODEL	FINISH	WEIGHT
6025C	Gold Chromate	.0046 lbs.
6025B	Black Anodize	.0046 lbs.
6025D	Nickel Plate	.0046 lbs.
6025U	Unfinished	.0046 lbs.



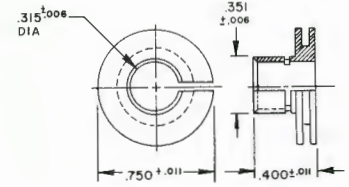
2225 SERIES

ECONOMY PRESS ON COOLER – TO-5 CASE

The 2225 is a very low cost 1 piece heat sink for TO-5 transistors. Unit presses onto case and requires no special assembly tool. Heat is conducted to integral fins for dissipation. Can be installed after assembly and requires no additional board space. Feather light unit is lead mounted.



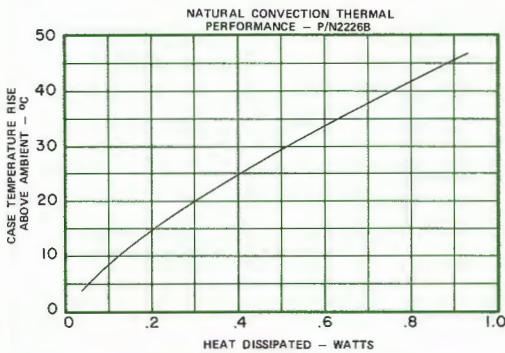
MODEL	FINISH	WEIGHT
2225B	Black Anodize	.0024 lbs.
2225C	Gold Chromate	.0024 lbs.



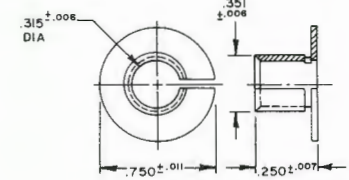
2226 SERIES

ECONOMY PRESS ON COOLER – TO-5 CASE

The 2226 is a very low cost 1 piece heat sink for TO-5 transistors. This is the same device as the 2225 described above except that it is shorter and has only a single fin. Unit is lighter weight and has slightly lower thermal characteristics.



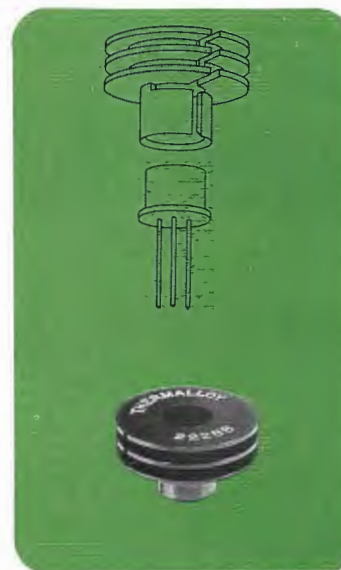
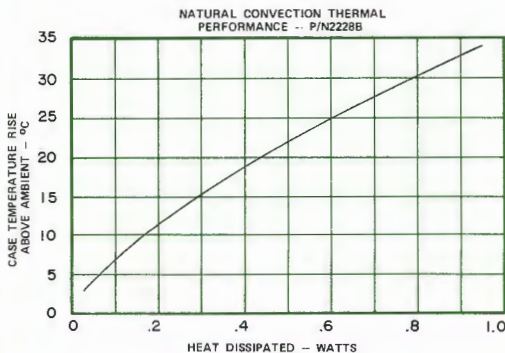
MODEL	FINISH	WEIGHT
2226B	Black Anodize	.0020 lbs.
2226C	Gold Chromate	.0020 lbs.



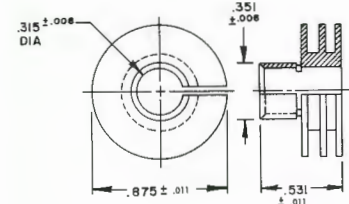
2228 SERIES

ECONOMY PRESS ON COOLER – TO-5 CASE

The 2228 is a very low cost 1 piece heat sink for TO-5 transistors. This is the same device as the 2225 described above except that it has larger diameter fins and has 3 fins instead of 2. Unit is slightly larger and has better thermal characteristics.



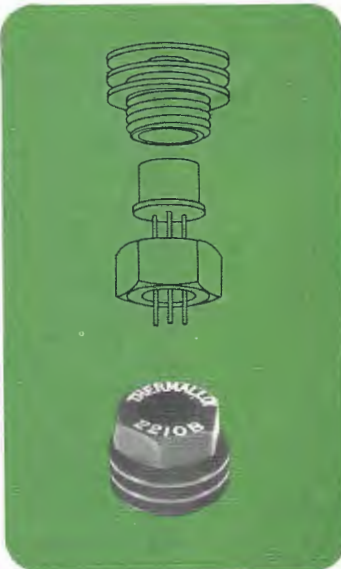
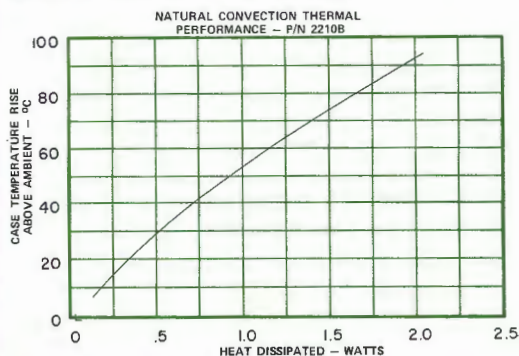
MODEL	FINISH	WEIGHT
2228B	Black Anodize	.0086 lbs.
2228C	Gold Chromate	.0086 lbs.



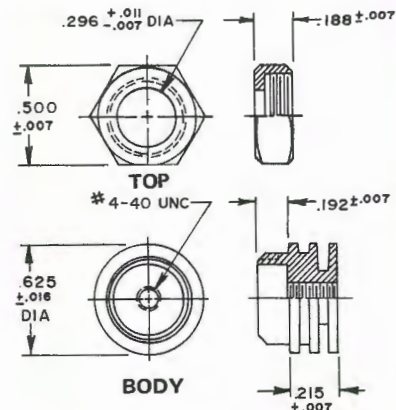
2210 SERIES

CONDUCTION/CONVECTION COOLER - TO-5 CASE

The 2210 is a 2 piece heat sink for TO-5 transistors. Top and base contact the weld flange for maximum heat transfer. Heat is dissipated through integral fins or can be conducted to an external surface. Tapped hole mounting available for retention under shock and vibration.



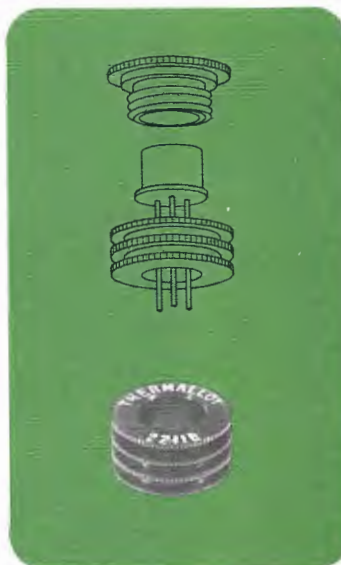
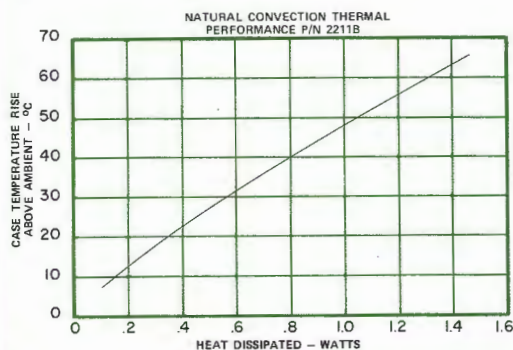
MODEL	FINISH	WEIGHT
2210A	Hard Anodize	.0055 lbs.
2210B	Black Anodize	.0055 lbs.



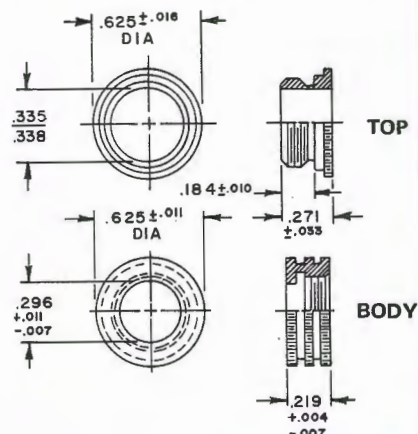
2211 SERIES

ECONOMY CONVECTION COOLER - TO-5 CASE

The 2211 is a low cost 2 piece heat sink for TO-5 transistor. Top and body grip the weld flange for maximum thermal transfer to the integral fins. Heat is dissipated by natural convection or forced air. Knurled fins facilitate tightening. Light weight unit is lead mounted.



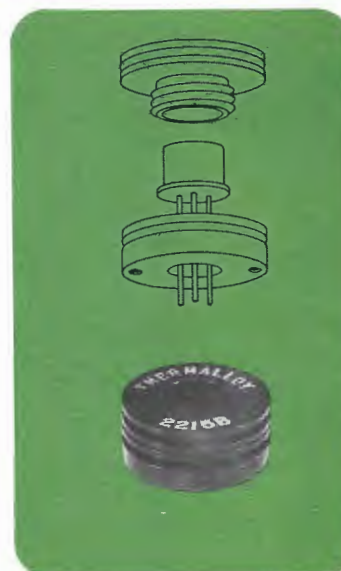
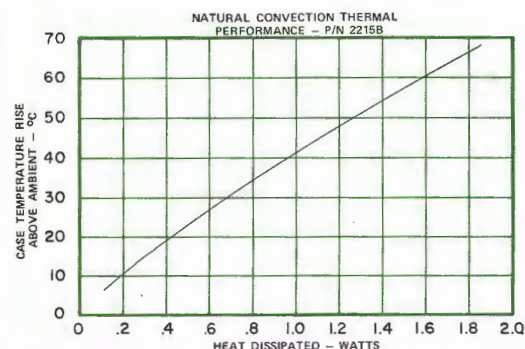
MODEL	FINISH	WEIGHT
2211A	Hard Anodize	.0038 lbs.
2211B	Black Anodize	.0038 lbs.
2211C	Gold Chromate	.0038 lbs.



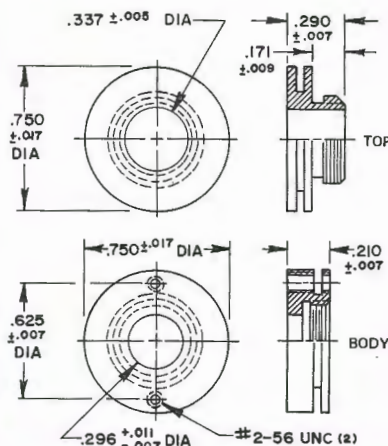
2215 SERIES

CONVECTION COOLER - TO-5 CASE

The 2215 is a 2 piece heat sink for TO-5 transistors. Top and body grip the weld flange for maximum thermal transfer. Heat is dissipated through integral fins or may be conducted to an external surface. Two tapped mounting holes provide retention under shock and vibration.



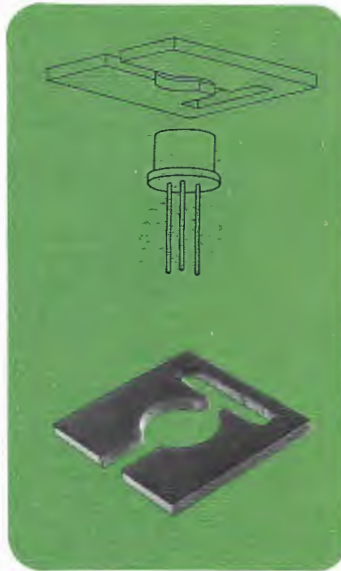
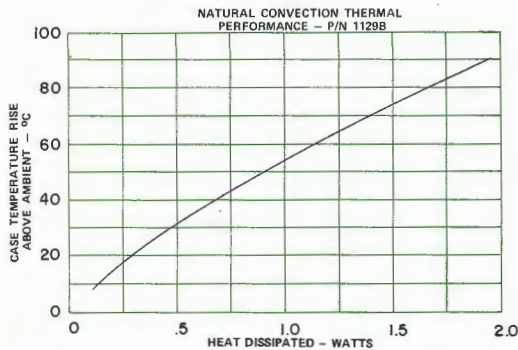
MODEL	FINISH	WEIGHT
2215A	Hard Anodize	.0090 lbs.
2215B	Black Anodize	.0090 lbs.



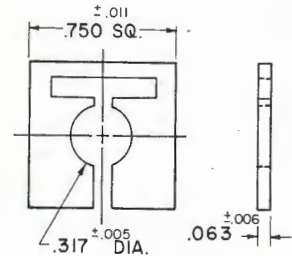
1129 PENNYSINK SERIES

PENNYSINK - PRESS ON COOLER - TO-5 CASE

The 1129 is an extremely low cost heat sink for TO-5 transistors. 1 piece design utilizes spring tension for maintaining thermal contact with transistor case at weld flange. Press on installation requiring no special tool. Cost is in pennies and units may be stacked.



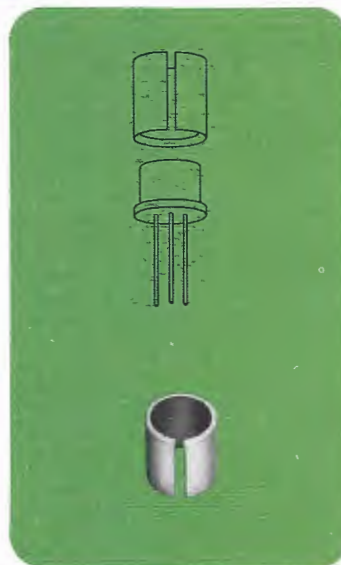
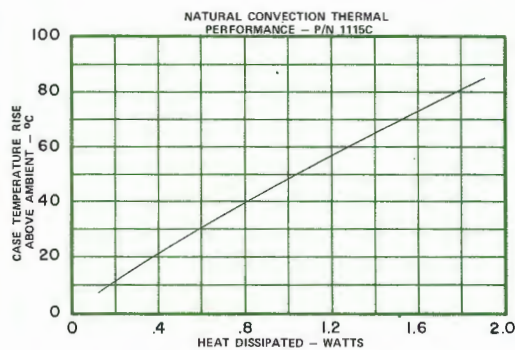
MODEL	FINISH	WEIGHT
1129B	Black Anodize	.0023 lbs.
1129C	Gold Chromate	.0023 lbs.
1129U	Unfinished	.0023 lbs.



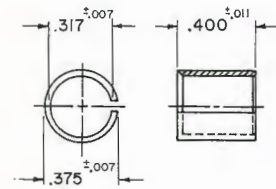
1115 SERIES

ECONOMY PRESS ON COOLER - TO-5 CASE

The 1115 is an economy heat sink for TO-5 transistors. Unit presses onto case requiring no special tool. Can be installed after board assembly and requires no additional board space.



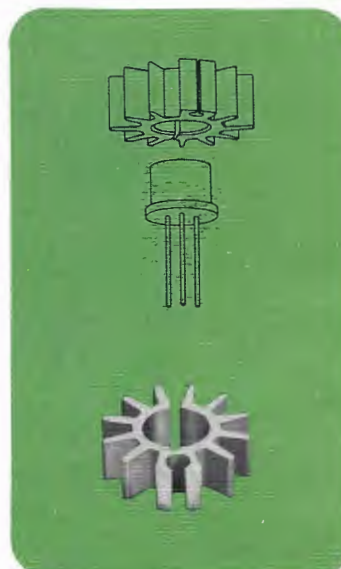
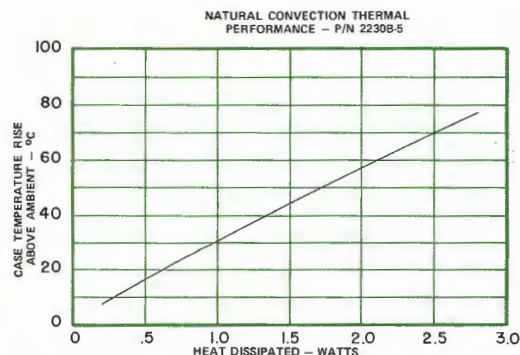
MODEL	FINISH	WEIGHT
1115B	Black Anodize	.0008 lbs.
1115C	Gold Chromate	.0008 lbs.
1115U	Unfinished	.0008 lbs.



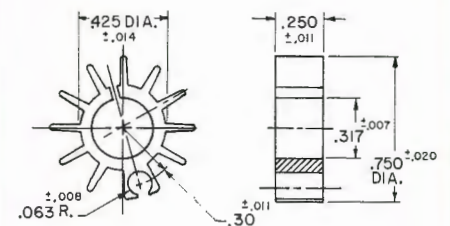
2230-5 SERIES

ECONOMY PRESS ON COOLER - TO-5 CASE

The 2230-5 is an economy heat sink for TO-5 transistors. Heat sink presses onto case and "gear" design increases exposed surface area for improved thermal dissipation. Screw boss clears a 4-40 screw-permits positive retention to circuit board.



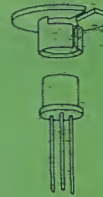
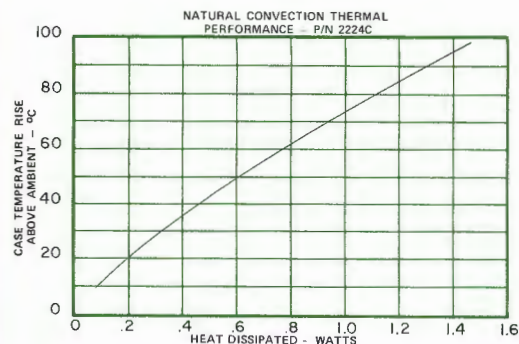
MODEL	FINISH	WEIGHT
2230B-5	Black Anodize	.0035 lbs.
2230C-5	Gold Chromate	.0035 lbs.
2230U-5	Unfinished	.0035 lbs.



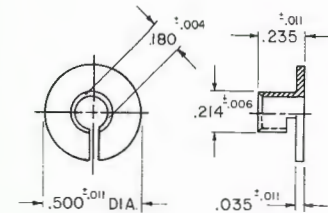
2224 SERIES

PRESS ON COOLER - TO-18, TO-92 CASES

The 2224 is a very low cost 1 piece heat sink for plastic "D", plastic TO-18, and metal can TO-18 transistors. Unit presses onto case requiring no special assembly tool. Can be installed after assembly; and takes up no additional board space. Feather light unit is lead mounted.



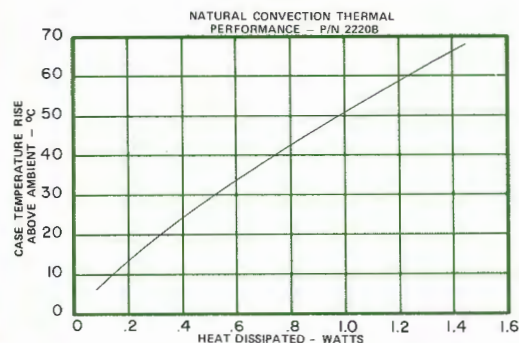
MODEL	FINISH	WEIGHT
2224B	Black Anodize	.0003 lbs.
2224C	Gold Chromate	.0003 lbs.



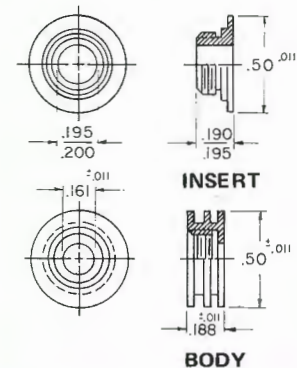
2220 SERIES

CONVECTION COOLER - TO-18 CASE

The 2220 is a low cost 2 piece heat sink for TO-18 transistors. Top and base grip the weld flange for maximum thermal transfer to the integral fins. Heat is dissipated by natural convection or forced air. Light weight unit is lead mounted.



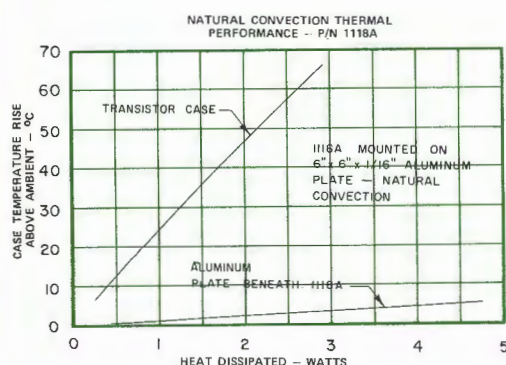
MODEL	FINISH	WEIGHT
2220A	Hard Anodize	.0024 lbs.
2220B	Black Anodize	.0024 lbs.
2220C	Gold Chromate	.0024 lbs.



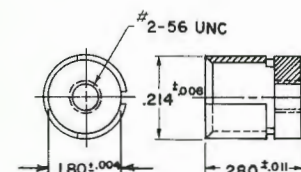
1118 SERIES

THERMAL LINK/RETAINER - TO-18 CASE

The 1118 is a 1 piece heat sink/retainer/thermal link for TO-18 transistors. "Wrap-around" design provides greater case surface contact than multi-finger types for improved heat transfer. Tapped hole mounting gives retention under shock and vibration.



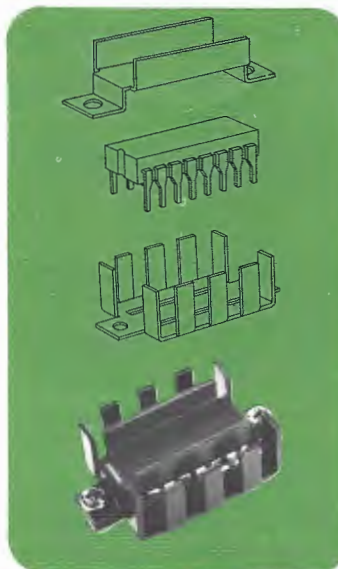
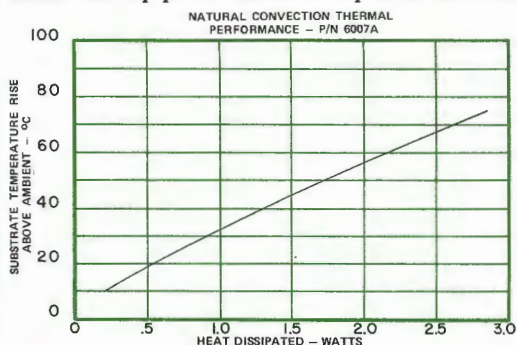
MODEL	FINISH	WEIGHT
1118A	Hard Anodize	.0004 lbs.
1118B	Black Anodize	.0004 lbs.
1118C	Gold Chromate	.0004 lbs.



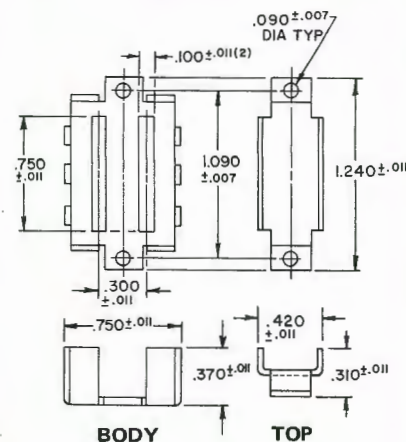
6007A SERIES

DIP HEAT SINK - 14 OR 16 PINS

The 6007A is a 2 piece heat sink for 14 and 16 pin dual in-line integrated circuit packages. The unique 2 piece design removes heat from top and bottom surface of package. Mounting screws provide positive retention to circuit board. The top piece will fit DIP's up to .82 inches in length.



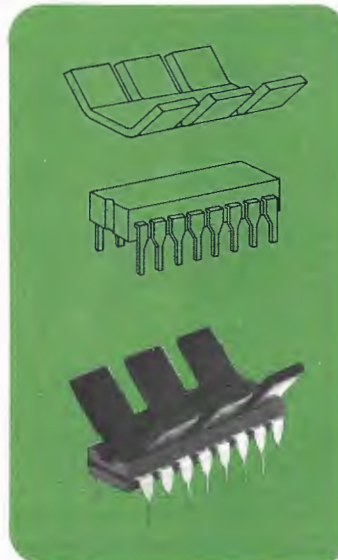
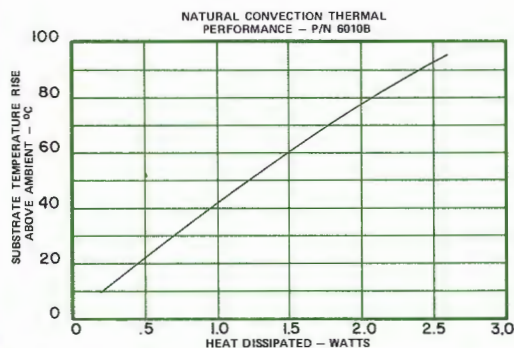
MODEL	FINISH	WEIGHT
6007A	Hard Anodize	.0066 lbs.



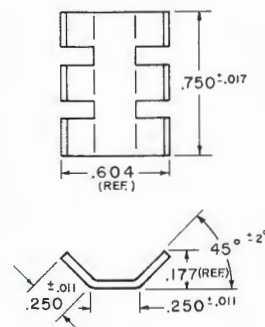
6010 SERIES

DIP HEAT SINK - 14 OR 16 PINS

The 6010 is a 1 piece heat sink for 14 or 16 pin dual in-line integrated circuit packages. The device is bonded to the top surface of the package with Thermabond epoxy or equivalent for minimum interface loss. No additional board space needed and heat sink may be added after assembly.



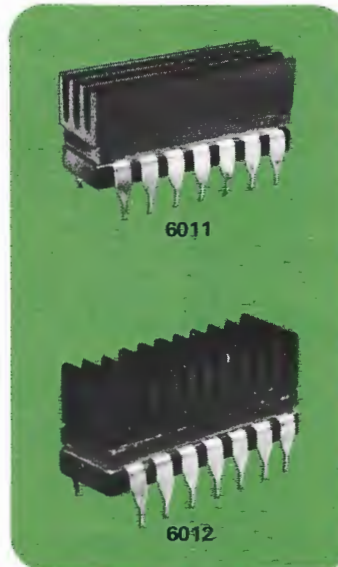
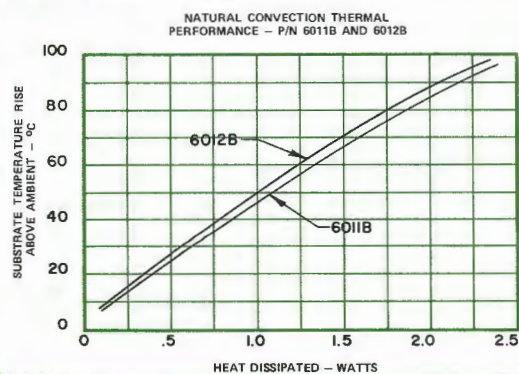
MODEL	FINISH	WEIGHT
6010B	Black Anodize	.0018 lbs.
6010C	Gold Chromate	.0018 lbs.



6011 AND 6012 SERIES

DIP HEAT SINKS - 14 OR 16 PINS

The 6011 and 6012 series are 1 piece extruded heat sinks for 14 or 16 pin dual in-line integrated circuit packages. The devices are bonded to the top surface of the package with Thermabond epoxy or equivalent for minimum interface loss. No additional board space is needed and heat sinks may be added after assembly.



MODEL	FINISH	WEIGHT
6011B	Black Anodize	.0019 lbs.
6011C	Gold Chromate	.0019 lbs.
6012B	Black Anodize	.0019 lbs.
6012C	Gold Chromate	.0019 lbs.

