



ACCESSORIES INFORMATION

RECOMMENDATIONS FOR THERMALLY CONDUCTIVE WASHERS

Apex thermal washers are also available from Power Devices. "Thermstrate" is the material trade name for these washers unless the model specification states otherwise. These washers are pre-coated aluminum stampings which provide better thermal conductivity than thermal grease, easier use and freedom from application variables. Electrical conductivity of these washers makes sleeving of at least two opposing pins a requirement to achieve correct alignment. A small number of Apex washers are noted to be electrically insulating or made of Polyimide. These are made of "Isostrate" material, type MT Polyimide with over twice the thermal conductivity of type HN Polyimide. Thermal performance is similar to a mica washer with thermal grease. Both types are 3 mils thick and NON-COMPRESSIBLE.

HEATSINK THRU-HOLES

Custom heatsink manufacture or mounting of the Apex power amplifier to a bulkhead for heatsinking, requires the use of individual heatsink thru-holes for the external connection pins. For the 8-pin TO-3 package the main path for heat flow occurs inside the circumference of 8 pins. (Refer to Figure 1)

Therefore, a single large hole, (to allow the 8 pins to pass through), will remove the critical heatsink material from where it is most needed. Instead, 8 separate holes must be drilled. Refer to Table 1 for recommended drill sizes for heatsink thru-holes for Apex power amplifier packages.

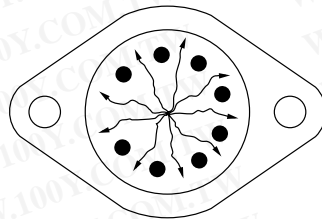


Fig. 1: Main heat flow path, 8-pin to TO-3 package.

PIN DIAMETER	RECOMMENDED DRILL SIZE	HOLE DIAMETER	
		INCHES	mm
.025"	#50	.070±.002	1.781±.051
.040"	#46	.081±.002	2.057±.051
.060"	#37	.104±.002	2.642±.051

Table 1: Heatsink thru-hole sizes.

TEFLON TUBING

Anodized heatsinks can be easily nicked or scratched, exposing bare aluminum, which is an excellent electrical conductor. When mounting the Apex power amplifier using a socket, it is recommended to sleeve, with Teflon tubing, a minimum of two opposite pins. This centers the external connection pins in the heatsink thru-holes and prevents electrical shorts when tightening the power amplifier down on a heatsink. When soldering directly to external connection pins it is recommended to sleeve, with Teflon tubing, all pins. Table 2 lists the recommended Teflon tubing and some suggested manufacturers (for manufacturers' phone numbers, see "Vendors for Power Op Amp Accessories").

TUBING DIMENSIONS

PIN DIAMETER	Nominal I.D.		Nominal O.D.		MFG.	MFG. PART NO.
	Inches	mm	Inches	mm		
.025"	.028	.711	.052	1.321	★	TSI-S22
					★★	TFT-250-22
.040"	.042	1.067	.074	1.88	★	TSI-S18
					★★	TFT-250-18
.060"	.066	1.676	.098	2.489	★	TSI-S14
					★★	TFT-250-14

Table 2: Teflon tubing. ★ SPC Technology
★★ Alpha Wire Corp.

Teflon meets all known requirements but many other materials will work fine in some applications if three requirements are met. The tubing must fit the pin and the heatsink hole, it must be rated for the maximum voltage of the application and it must be rated for the temperature extremes of the application. Simply stripping the insulation from #14, #18 or #22 wire may be a viable tubing source.

HEATSINKS

A wide spectrum of applications can be satisfied with the heatsinks stocked as accessories for APEX power amplifiers. All are made of aluminum to provide high levels of conduction. HS01 clamps over the TO-3 case using virtually no additional space on a printed circuit board. Some are suitable for chassis or printed circuit mounting. Some are designed for chassis mounting only. The HS09 is a second source for 0803HS from Burr-Brown. The HS11 provides the most protection for prototyping or for production of high power products. All heatsinks are pre-drilled with hole patterns as shown. Conservative calculations are recommended for prototype work while performance graphs are included to enable optimization for production runs. Due to calculation complexity of thermal circuits and of power dissipation levels where reactive loads are driven, it is often helpful to utilize temperature measurements after the electrical design has been completed.

Ratings are all thermal resistances from amplifier mounting surface to ambient expressed as °C/W. Rating 1 is for an unobstructed mounting of optimum orientation, running at high temperature. Refer to performance graphs to obtain temperature rise at lower power levels. Rating 2 pertains to forced air at a velocity of 100 FPM and Rating 3 is for 200 FPM. For further details consult individual heatsink graphs.

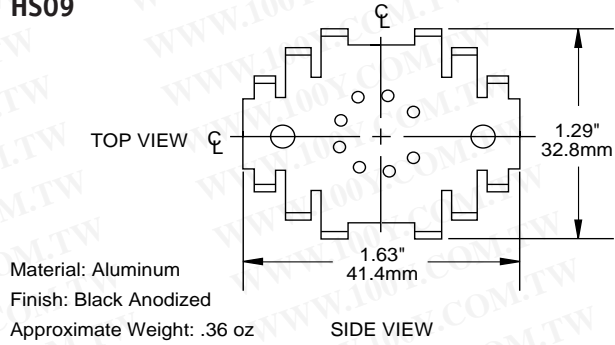
Individual heatsink ratings shown on following page.

HEATSINKS

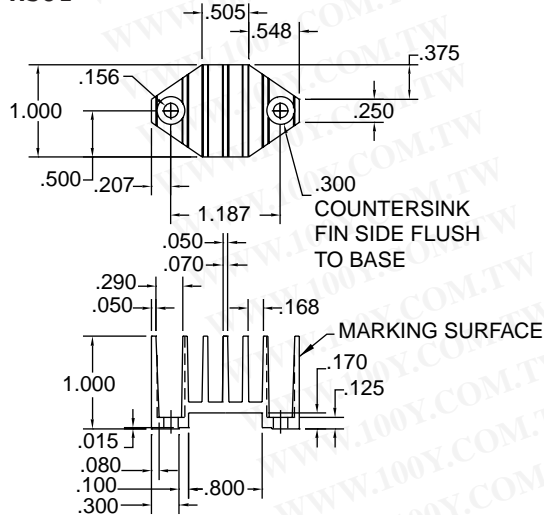
APEX PN	RATING 1	RATING 2	RATING 3
HS01	11.6	6.0	4.2
HS02	4.5	3.2	2.5
HS03	1.7	1.4	1.0
HS04	.95	.57	.44
HS05	.85	.7	.53
HS06	.96	.72	.51
HS09	11.7	-	6.6
HS11*	.68	-	-
HS13	1.48	1.1	.77
HS14/16	2.0	1.47	1.04
HS18	1.0	-	-

* HS11 efficiency improves for water cooling.

HS09



HS01

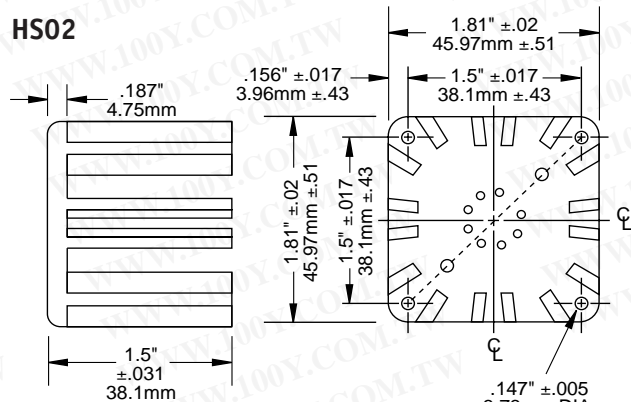


NOTES:

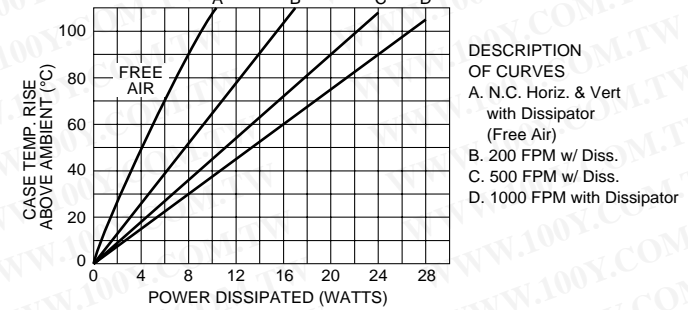
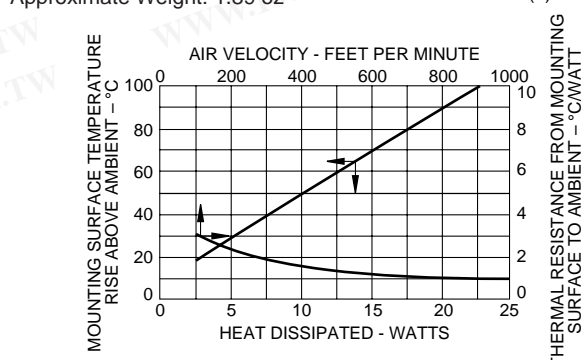
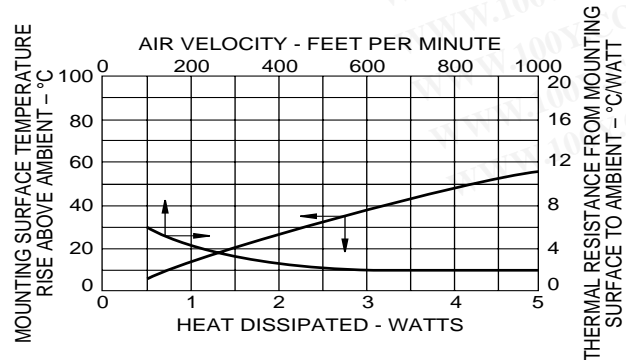
FINISH TO BE BLACK ANODIZE PER MIL-A-8625, TYPE II, CLASS 2.
 FOR REFERENCE, TYPICAL BREAKDOWN VOLTAGE >300V

TOLERANCES- UNLESS OTHERWISE SPECIFIED	.XX= ±.01 .XXX= ±.02 ANG.= ±.5°
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HS02



Approximate Weight: 1.89 oz

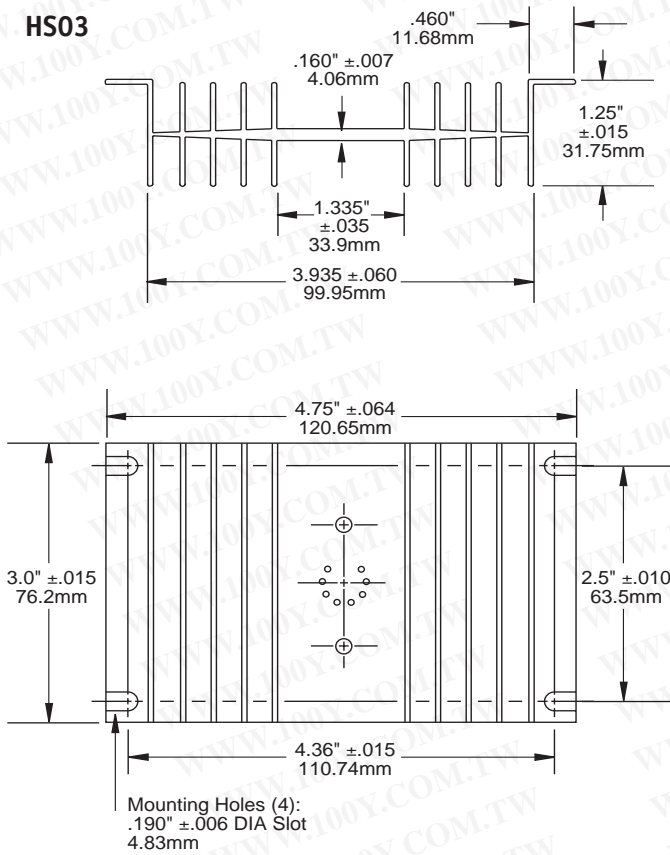


ACCESSORIES
INFORMATION

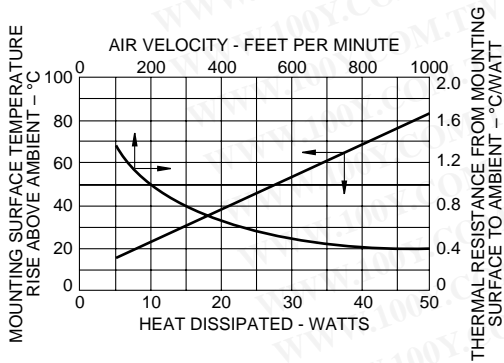
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

HEATSINKS

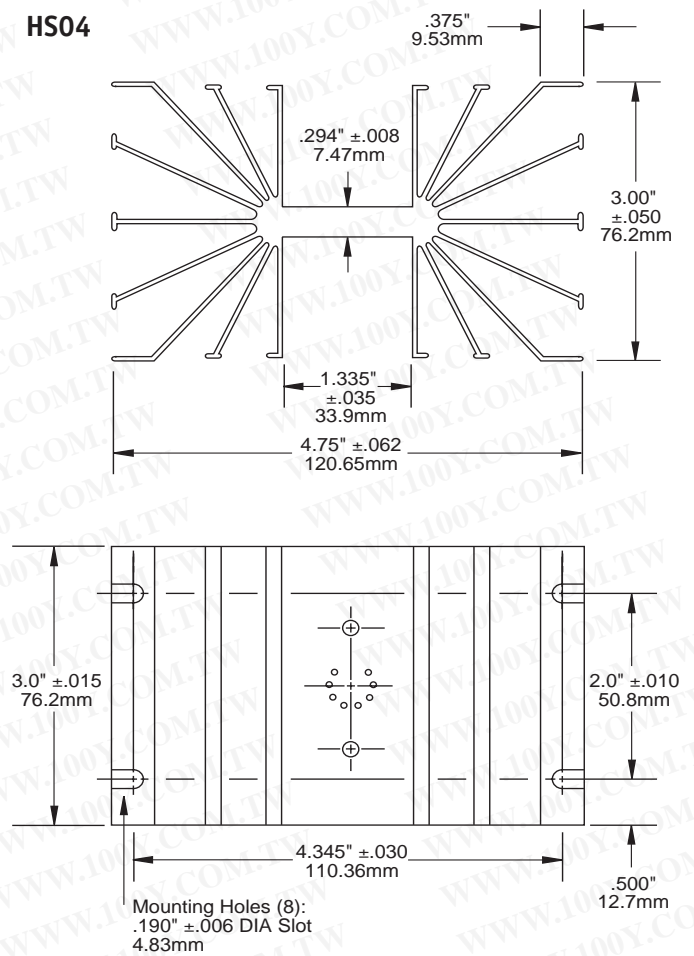
HS03



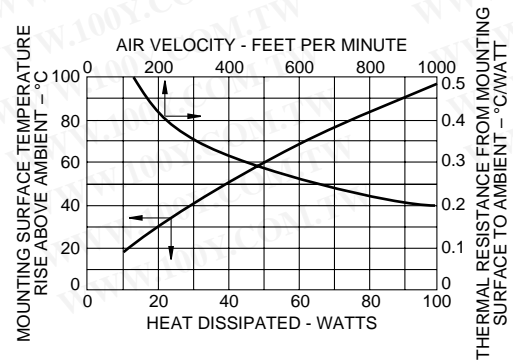
Approximate Weight: 5.6 oz



HS04



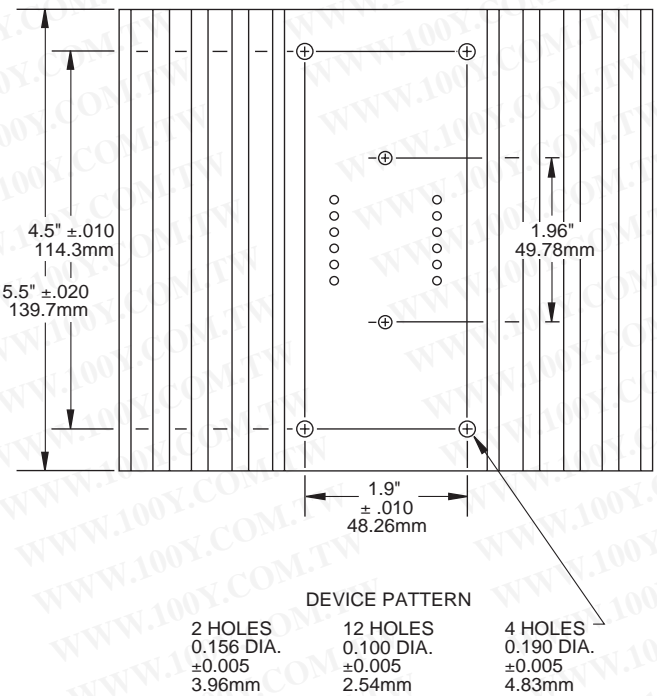
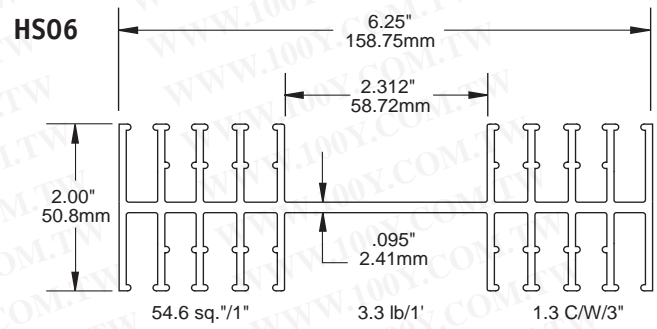
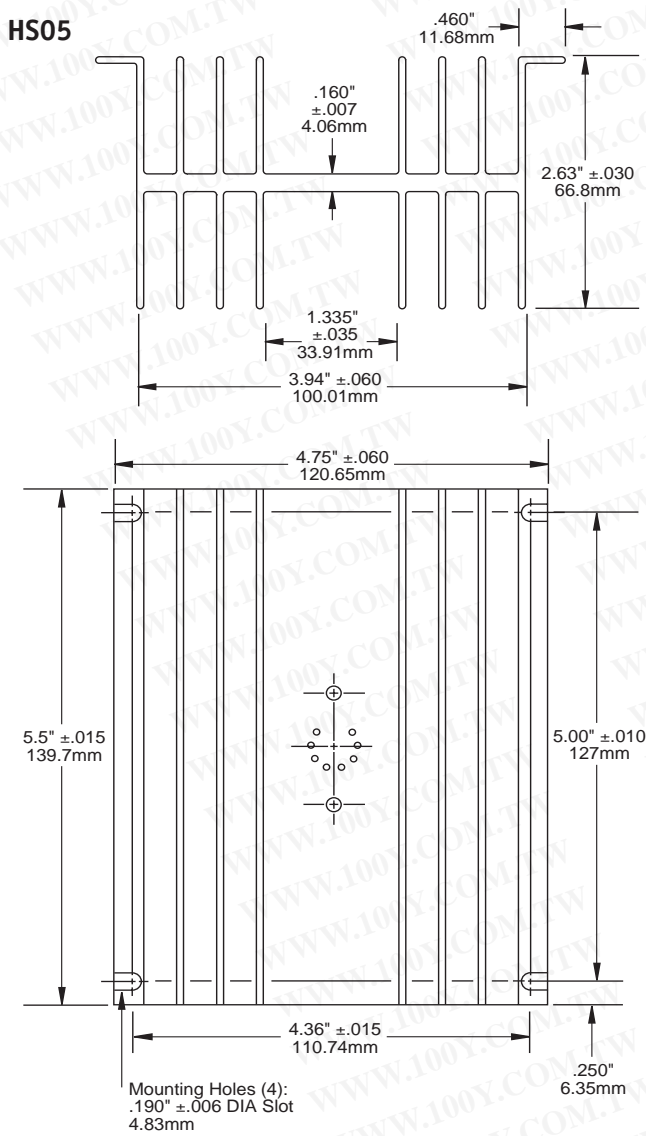
Approximate Weight: 12 oz



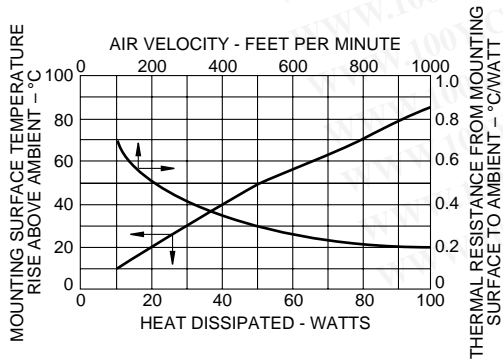
HEATSINKS

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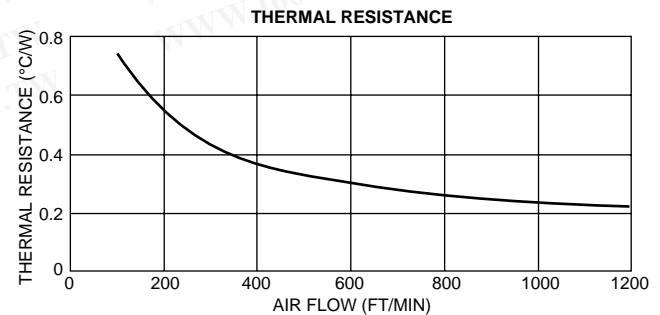
ACCESSORIES INFORMATION



Approximate Weight: 18.3 oz

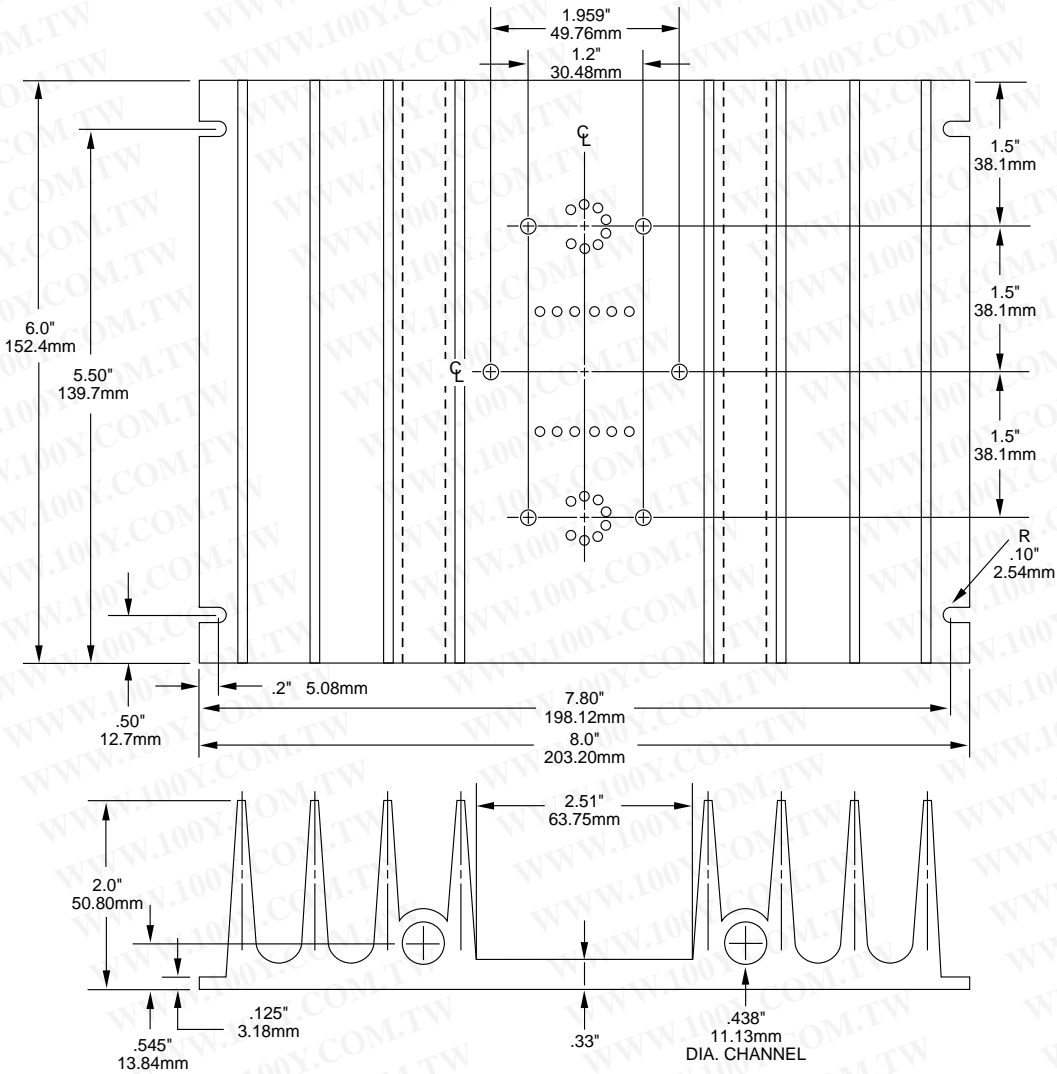


Standard Commercial
 Extrusion Tolerances Apply
 Material: Aluminum Alloy
 Finish: Black Anodize
 Thermal Resistance: ≈ .96°C/W
 Approximate Weight: 19.8 oz

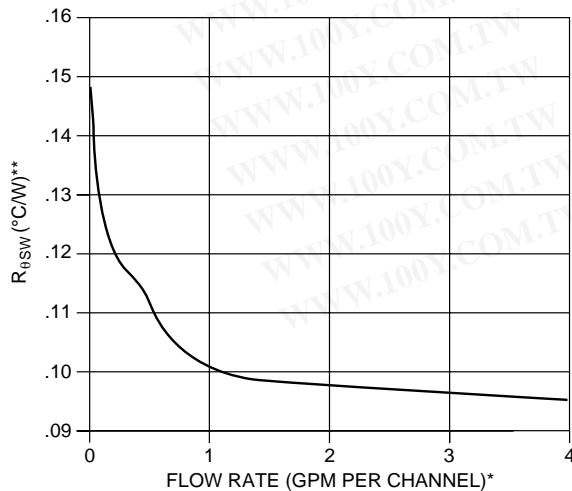


AMBIENT AIR TEMPERATURE 25°C

HS11



Approximate Weight: 44.8 oz



$R_{\theta SA} = .675$ $^{\circ}C/W$ (Free air vertical)

$R_{\theta SW} = .102$ $^{\circ}C/W$ (Water cooled @ 1 GPM per channel)

Additional mounting loss (with thermal grease):

PD12: .008 - .017 $^{\circ}C/W$

TO-3: .05 - .1 $^{\circ}C/W$

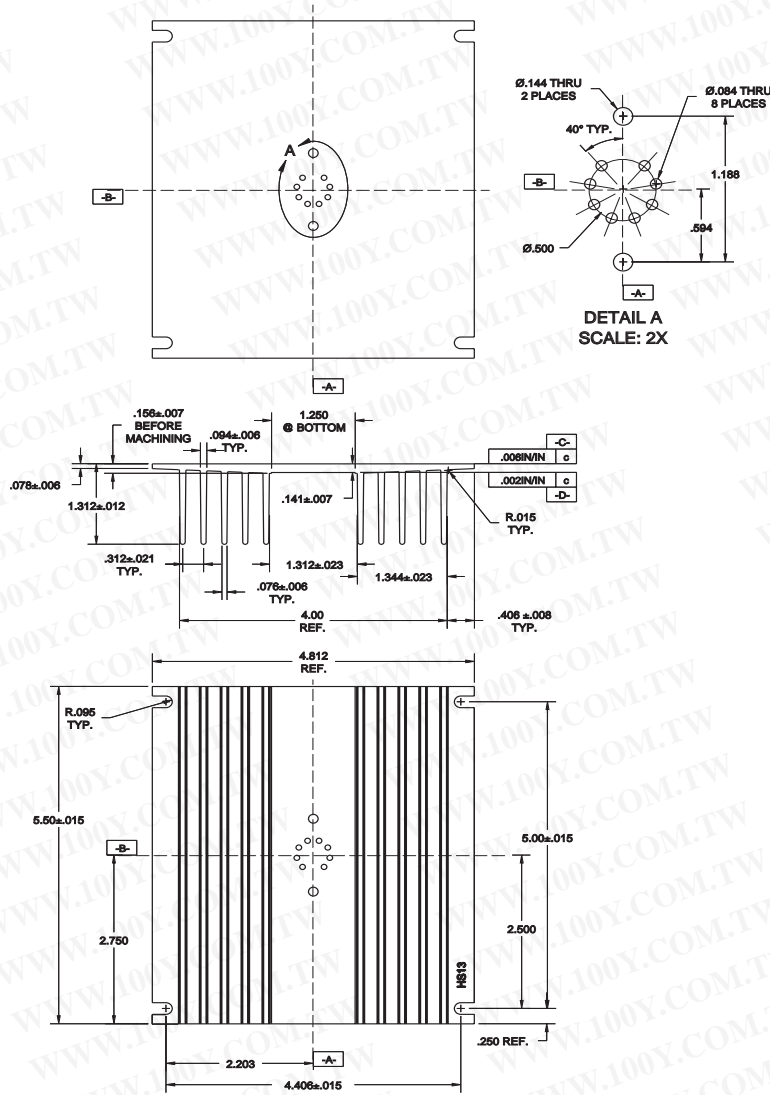
* BOTH CHANNELS FED IN PARALLEL USING CLEAN WATER
 ** $R_{\theta SW}$ = THERMAL RESISTANCE FROM HEATSINK TO WATER

HEATSINKS

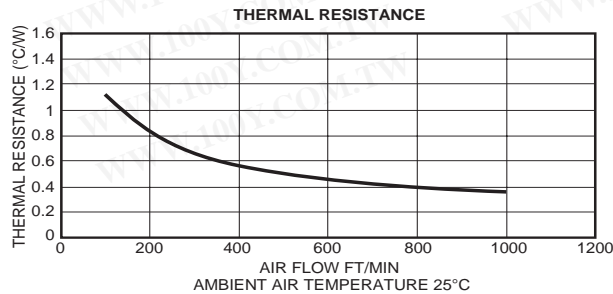
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
 勝特力电子(深圳) 86-755-83298787
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ACCESSORIES
INFORMATION

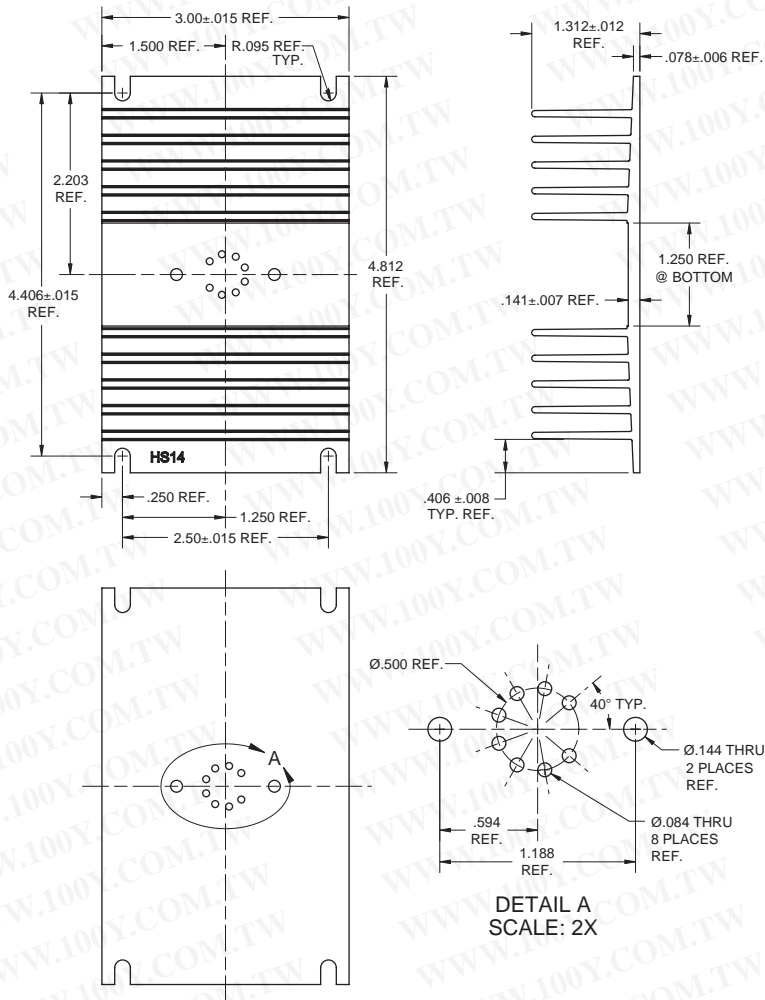
HS13



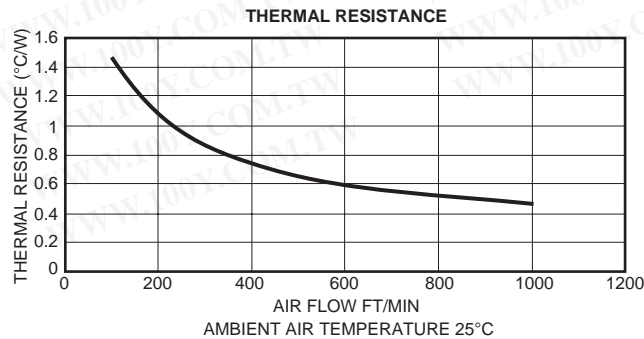
FITS PACKAGE STYLE CE
 STANDARD COMMERCIAL EXTRUSION TOLERANCES APPLY
 REFER TO HS13 FOR EXACT DIMENSIONS
 MATERIAL: ALUMINUM ALLOY
 FINISH: BLACK ANODIZE
 THERMAL RESISTANCE: 1.48°C/W
 WEIGHT: 13.9 oz



HS14



FITS PACKAGE STYLE: CE
 STANDARD COMMERCIAL EXTRUSION TOLERANCES APPLY
 REFER TO HS14 FOR EXACT DIMENSIONS
 MATERIAL: ALUMINUM ALLOY
 FINISH: BLACK ANODIZE
 THERMAL RESISTANCE: 2°C/W
 WEIGHT: 7.6 oz

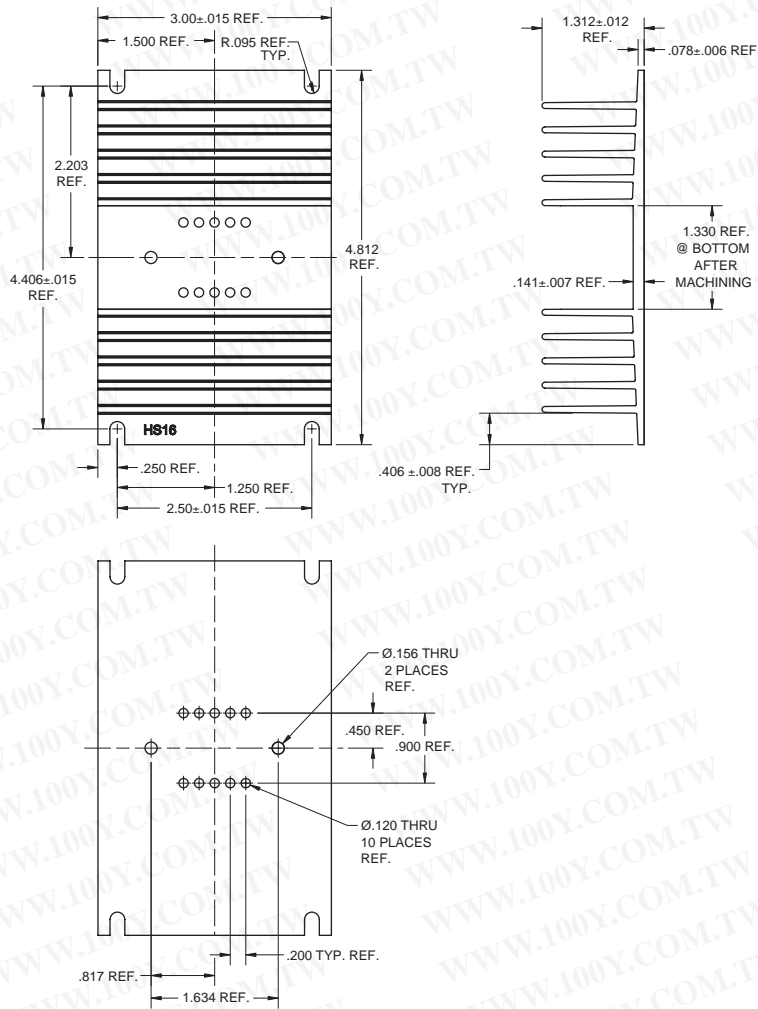


HEATSINKS

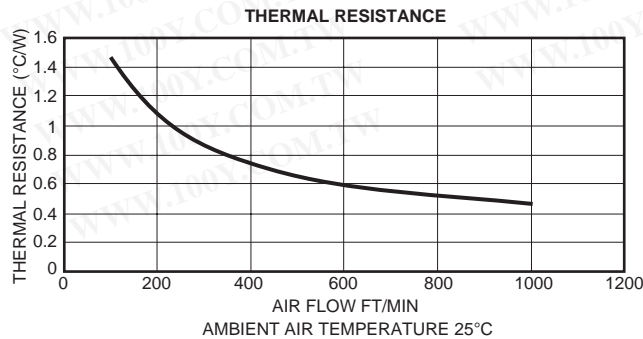
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
 勝特力电子(深圳) 86-755-83298787
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ACCESSORIES
INFORMATION

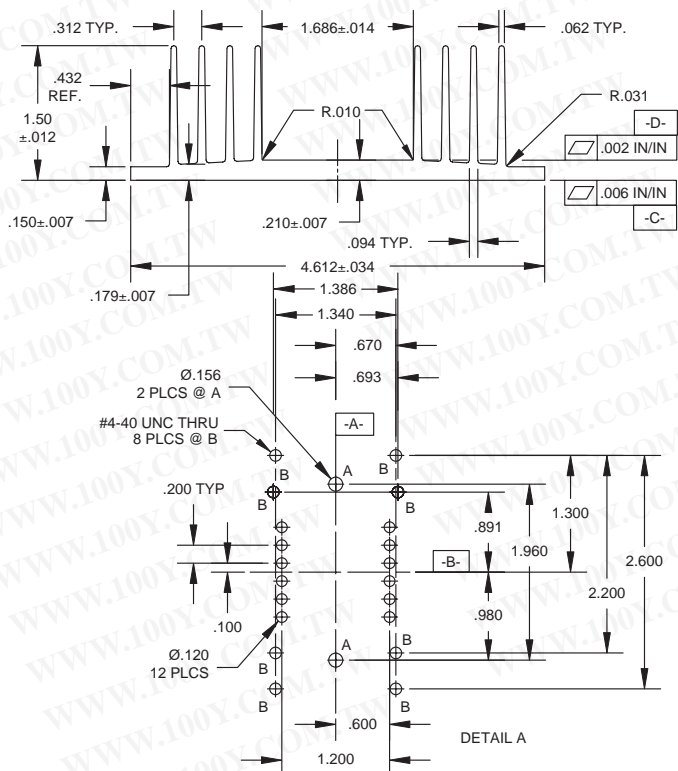
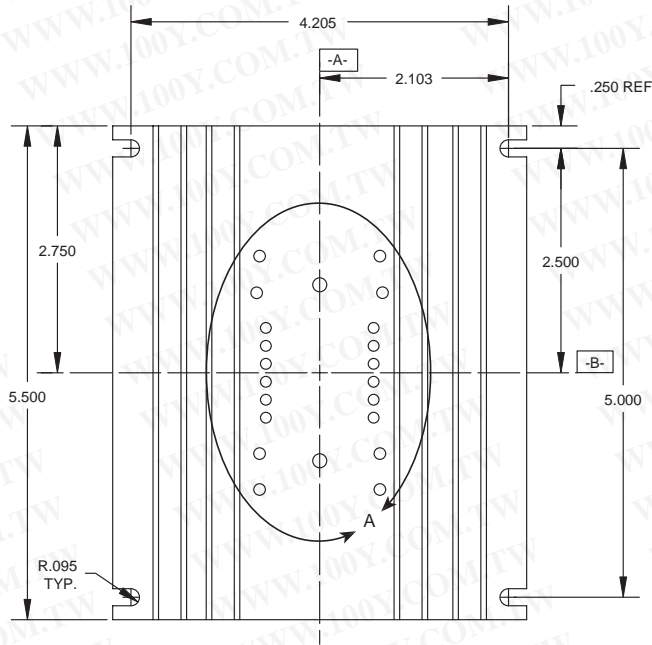
HS16



FITS PACKAGE STYLE: DE
 STANDARD COMMERCIAL EXTRUSION TOLERANCES APPLY
 REFER TO HS16 FOR EXACT DIMENSIONS
 MATERIAL: ALUMINUM ALLOY
 FINISH: BLACK ANODIZE
 THERMAL RESISTANCE: 2°C/W
 WEIGHT: 7.6 oz



HS18



NOTES:
 MADE FROM AAVID EXTRUSION 72555.
 FINISH: BLACK ANODIZE
 HOLE PATTERN IS HORIZONTALLY AND
 VERTICALLY CENTERED IN HEATSINK.
 $R_{\theta SA} = 1^{\circ}C/W$

TOLERANCES - UNLESS OTHERWISE SPECIFIED	.XX = ±.01 .XXX = ±.005 ANG = ±.5°
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HEATSINKS

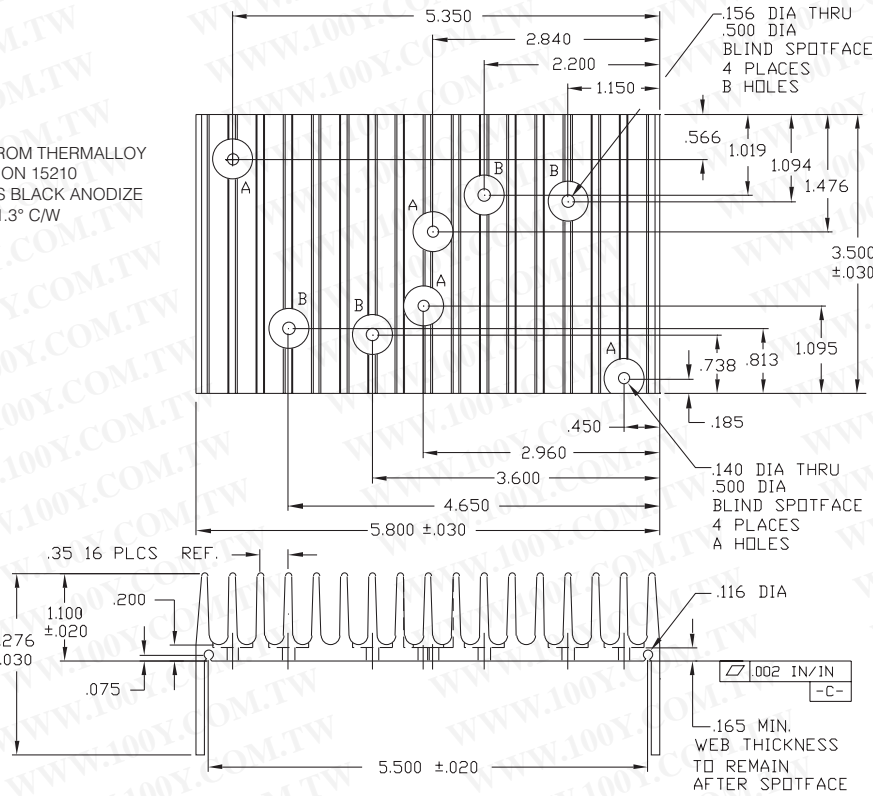
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
 勝特力电子(深圳) 86-755-83298787
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ACCESSORIES
INFORMATION

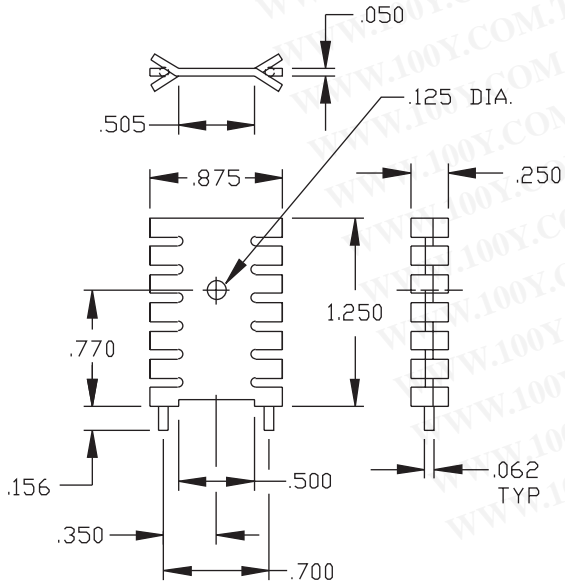
HS20

NOTES:

1. MADE FROM THERMALLOY EXTRUSION 15210
2. FINISH IS BLACK ANODIZE
3. $R_{\theta SA} = 1.3^{\circ}C/W$

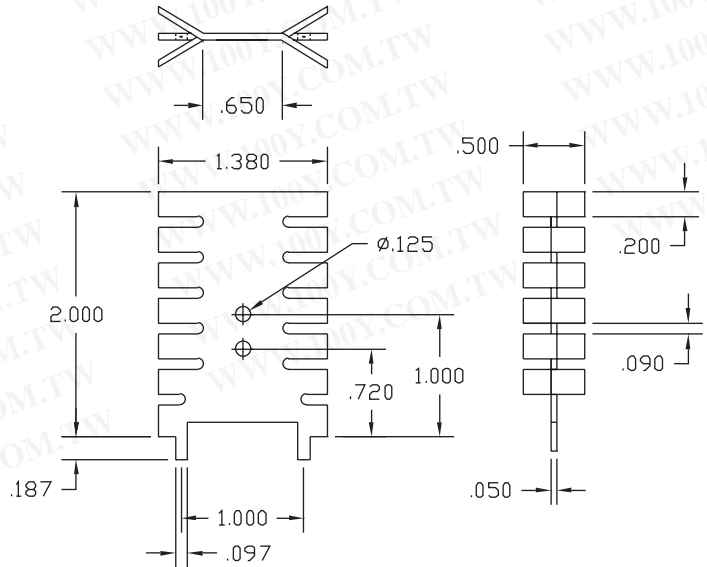


HS22



$$R_{\theta SA} = 20^{\circ}C/W$$

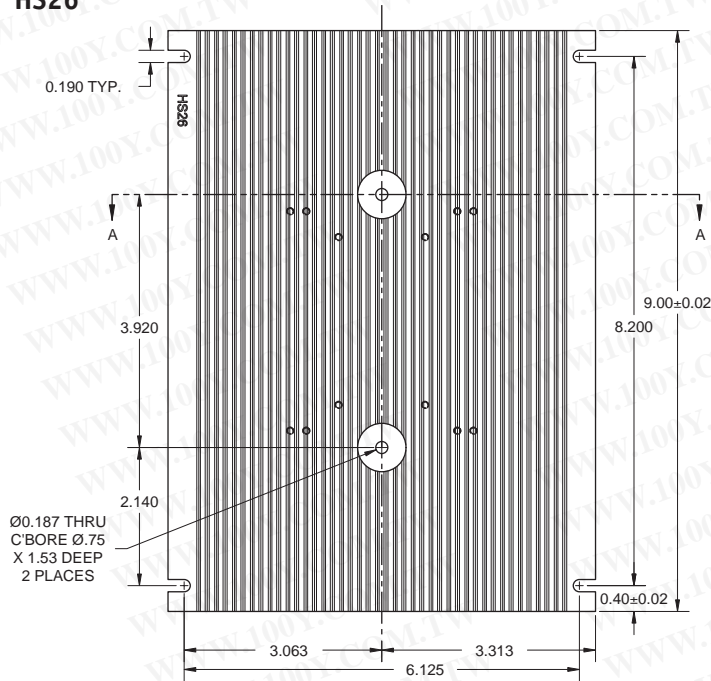
HS23



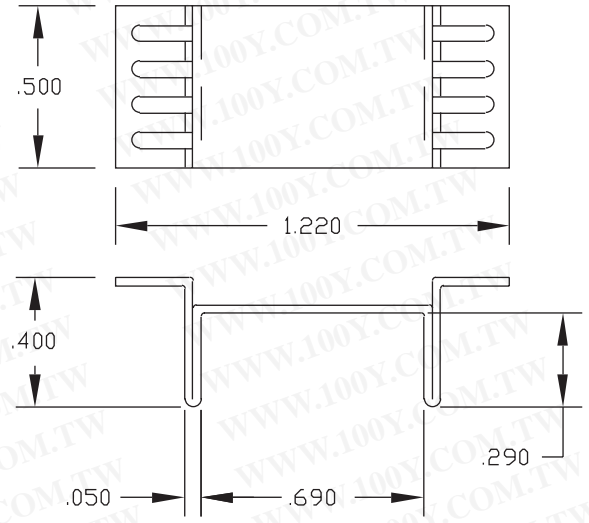
$$R_{\theta SA} = .10^{\circ}C/W$$

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 勝特力电子(深圳) 86-755-83298787
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HS26

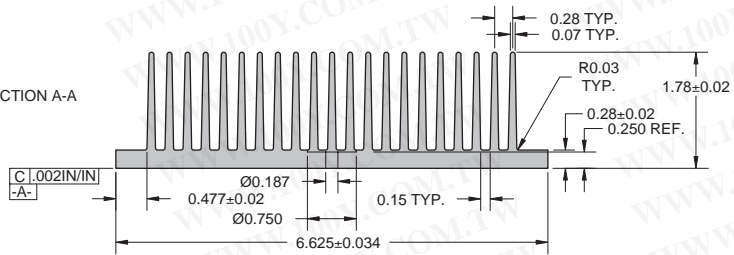


HS24

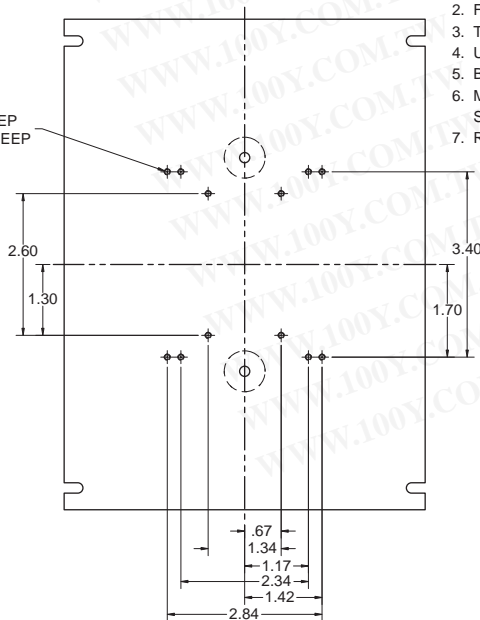


$R_{\theta SA} = 20^{\circ}\text{C/W}$

SECTION A-A



Ø.089 X.24 DEEP
TAP 4-40 X .20 DEEP



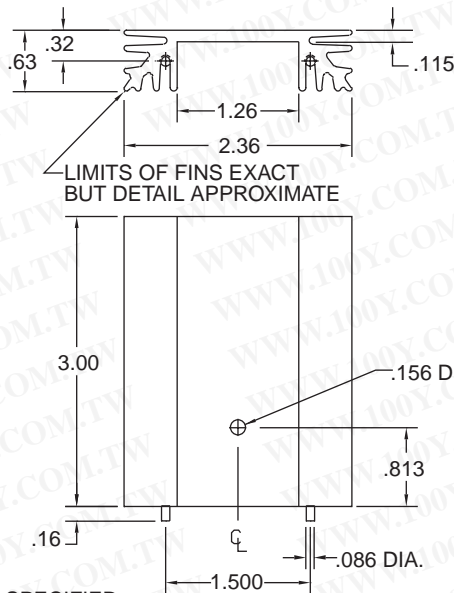
1. MATERIAL: 6063-T5 ALUMINUM (AAVID EXTRUSION #69800).
2. FINISH: ANODIZE PER MIL-A-8625, TYPE II, CL 2, BLACK.
3. TYPICAL BREAKDOWN VOLTAGE > 300V.
4. UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES.
5. BREAK ALL SHARP EDGES, DE-BURR & REMOVE LOOSE CHIPS.
6. MARK "HS26" WITH CONTRASTING INK AS SHOWN, IF SPECIFIED BY PURCHASE ORDER.
7. $R_{\theta SA} = 0.5^{\circ}\text{C/W}$.

HEATSINKS

勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
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ACCESSORIES
INFORMATION

HS27



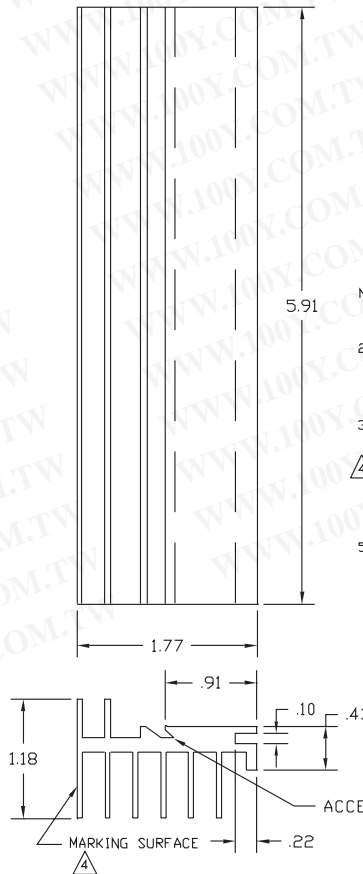
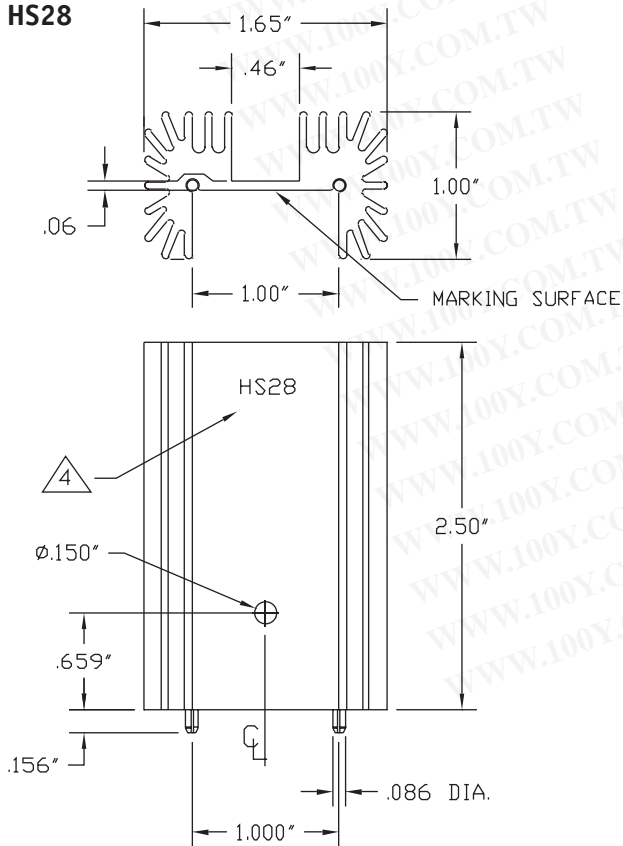
NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
2. ROLL PIN FITS .114 ± .005" PLATED THROUGH HOLE.

$R_{\theta SA} = 5.3^{\circ}\text{C/W}$

HS29

HS28

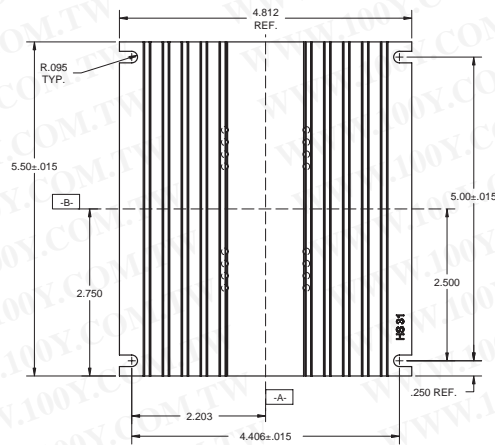
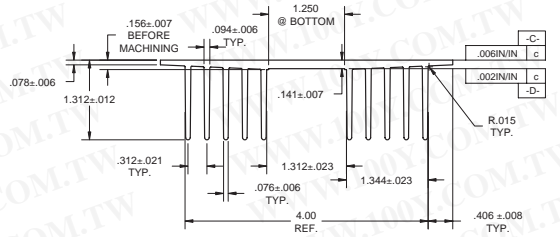
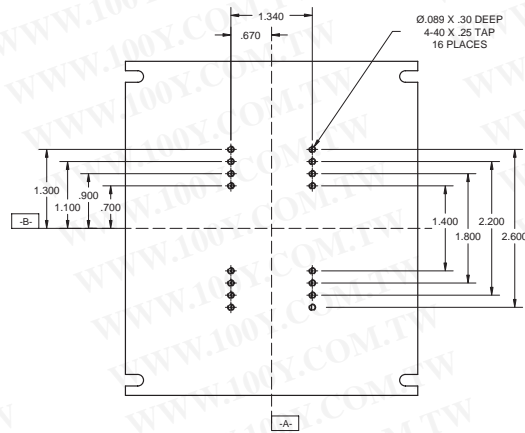


NOTES:

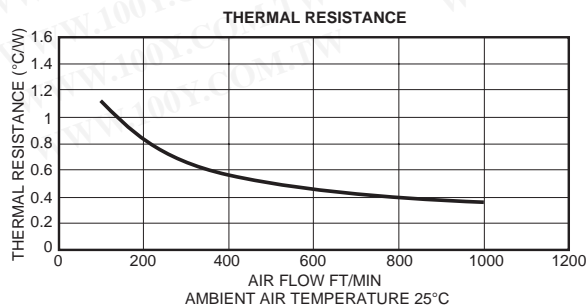
1. MADE FROM THERMALLOY EXTRUSION KM150-1
2. FINISH TO BE BLACK ANODIZE PER MIL-A-8625, TYPE II, CLASS 2. FOR REFERENCE, TYPICAL BREAKDOWN VOLTAGE >300V.
3. BREAK ALL SHARP EDGES, DE-BURR AND REMOVE ALL LOOSE CHIPS.
4. MARKING: HS29 MARK WITH CONTRASTING WHITE INK OR CAN BE STAMPED. DO NOT MARK PART WITH REV. LEVEL.
5. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.

TOLERANCES - UNLESS OTHERWISE SPECIFIED	.XX = ±.015
	XXX = ±.005
	ANG. = ±.5°

HS31



FITS PACKAGE STYLES: FC, FD, FE AND FF
 STANDARD COMMERCIAL EXTRUSION TOLERANCES APPLY
 REFER TO HS13 FOR EXACT DIMENSIONS
 MATERIAL: ALUMINUM ALLOY
 FINISH: BLACK ANODIZE
 THERMAL RESISTANCE: 1.48°C/W
 WEIGHT: 13.9 oz



CAGE JACKS & MATING SOCKETS

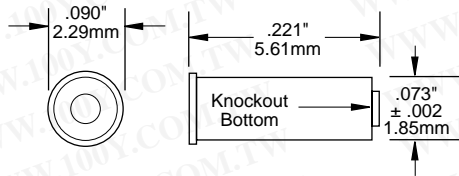
ACCESSORIES
 INFORMATION

REFER TO APPLICATION NOTE 11 FOR MOUNTING TECHNIQUES USING CAGE JACKS AND MATING SOCKETS

MS02/CAGE JACK

(Package of 8 for PC board insertion)

.040" DIA. PINS

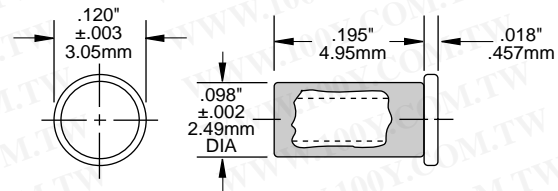


Recommended Mounting Hole: $.076 \pm .002$ DIA (#48 Drill)
 Minimum Insertion Depth: .10

MS04/CAGE JACK

(Package of 12 for PC board insertion)

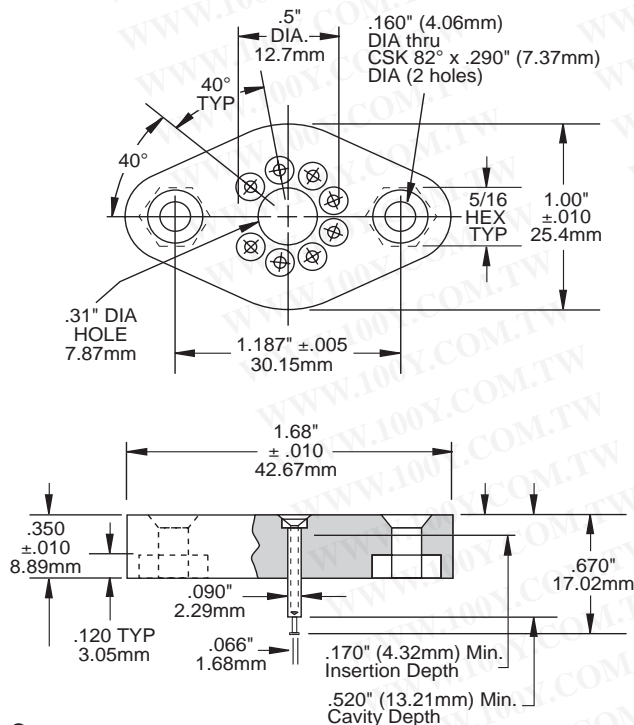
.060" DIA. PINS



Recommended Mounting Hole: $.102 \pm .002$ DIA (#38 Drill)
 Hole Depth: .200 Minimum

MS03/MATING SOCKET

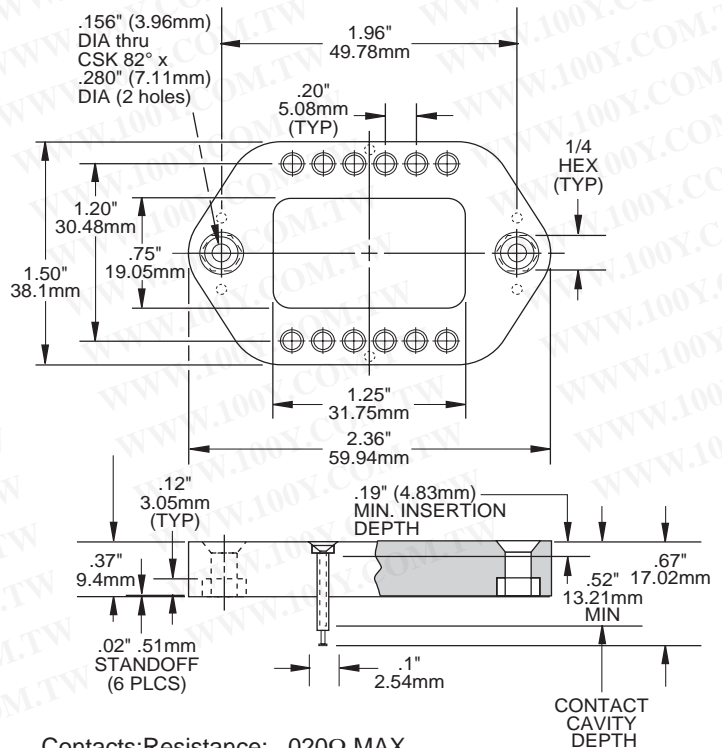
.040" DIA. PINS — CE PACKAGE



Contacts:
 Resistance: $.020 \Omega$ MAX
 Contact Body: Brass
 200/300 μ in. Tin over 100/150 μ in. Nickel
 Inner Contact Clip: BeCu
 30 μ in. Gold over 50 μ in. Nickel
 Socket Body: Polyester, Glass Filled, 94 V₀-Rating
 Color: Green
 Operating Temperature Range: -55°C to $+125^{\circ}\text{C}$

MS05/MATING SOCKET

.060" DIA. PINS — CR, DC, DD PACKAGES — MO-127



Contacts: Resistance: $.020 \Omega$ MAX
 Contact Body: Brass
 200/300 μ in. Tin over 100/150 μ in. Nickel
 Inner Contact Clip: BeCu
 30 μ in. Gold over 50 μ in. Nickel
 Socket Body: Polyester, Glass Filled, 94 V₀-Rating
 Color: Green
 Operating Temperature Range: -55°C to $+125^{\circ}\text{C}$

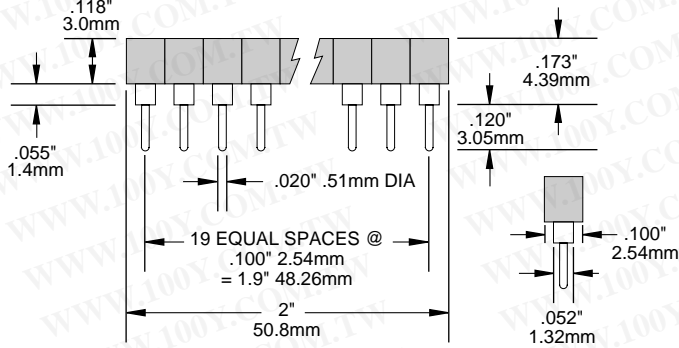
CAUTION

Combined heat and force during hand soldering plastic mating sockets can unseat pins and cause shorts to the header.

REFER TO APPLICATION NOTE 11 FOR MOUNTING TECHNIQUES USING CAGE JACKS AND MATING SOCKETS

MS06/MATING SOCKET

**.025" DIA. PINS — FOR CR package
MO-127 HIGH VOLTAGE**



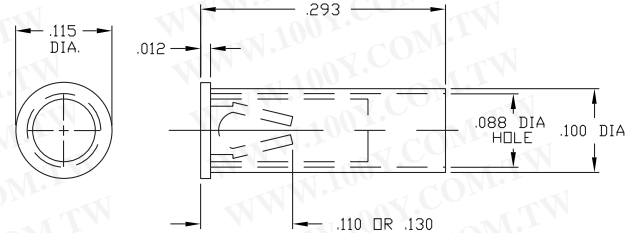
Body: Black polyester, glass filled
 Contacts: Beryllium Copper
 Shell: Half Hard Brass
 PCB Hole: .035" ±.002", .889mm ±.051mm
 Insulation Resistance: 5000 megohms minimum
 Dielectric Withstanding Voltage: 500 volts AC
 Flammability: UL 94V-0
 Temperature Range: -65°C to +125°C

S = Solder Tail
 TG = 10 μinch (.254μm) minimum
 Gold on contact area
 200 μinch (5.08 μm) minimum Tin on terminal area
 50 μinch (1.27μm) minimum Nickel underplate

**Also suitable for DW packages.
 Not suitable for DX packages.**

MS07/CAGE JACK

**PACKAGE OF 24 FOR PC CARD INSERTION
FOR CK PACKAGE**

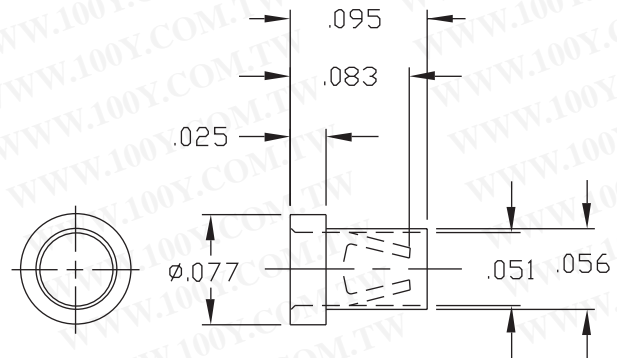


SOLDER MOUNT IN .102 MIN. MOUNTING HOLE
 TOL = ±.003

Body: Brass
 Spring: Beryllium Copper
 Finish: Body: 10μ in. Gold over Nickel
 Contact: 30μ in. Gold over Nickel

MS08/CAGE JACK

**PACKAGE OF 15 FOR PC CARD INSERTION
FOR DX (SIP12), CL (DIP10), CX (STAGGERED TO220)
PACKAGES**



Solder mount in .059/.061 mounting hole

Body: Brass
 Finish: 200μ in. Tin/Lead over Nickel
 Contact: 30μ in. Gold over Nickel

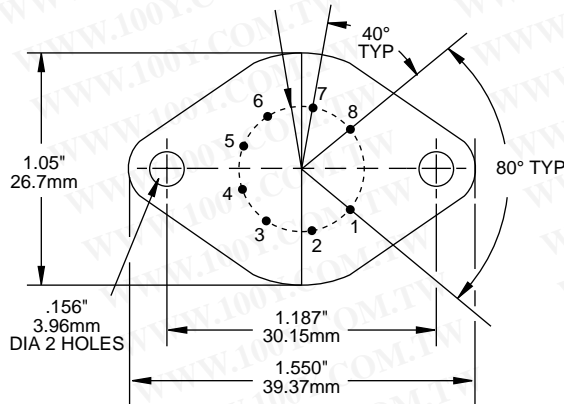
THERMAL WASHERS

Part Number	TW03, 06, 07, 09	TW05	TW10	TW12	TW13	TW14
Thermal Resistance	.1°C/W	.05°C/W	.08°C/W	.2°C/W	.2°C/W	.17°C/W
Package Quantity	10	10	10	15	10	10

CAUTION

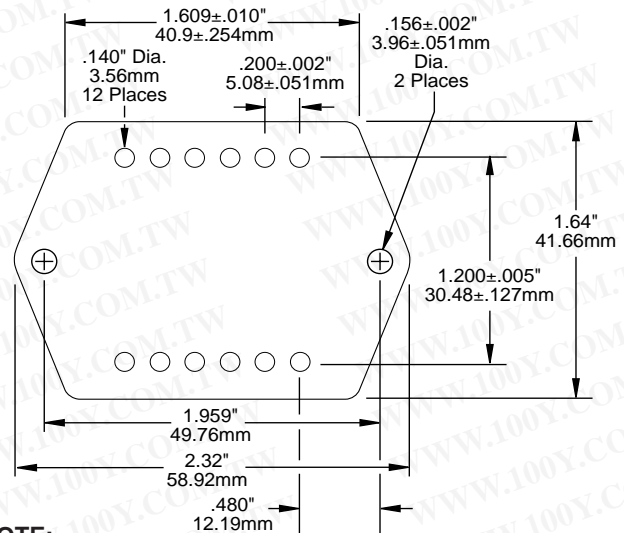
Do not store unused thermal washers above 45°C. A new washer must be used for each mounting.

TW03/THERMAL WASHER FOR CE (8-PIN T0-3) PACKAGE



PIN CIRCLE DIAMETER .500" OR 12.7mm
 PIN DIAMETER .090" or 2.29mm

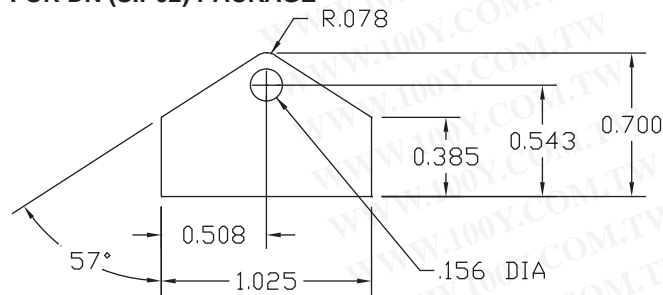
TW05/THERMAL WASHER FOR CR, DC (MO-127) PACKAGE



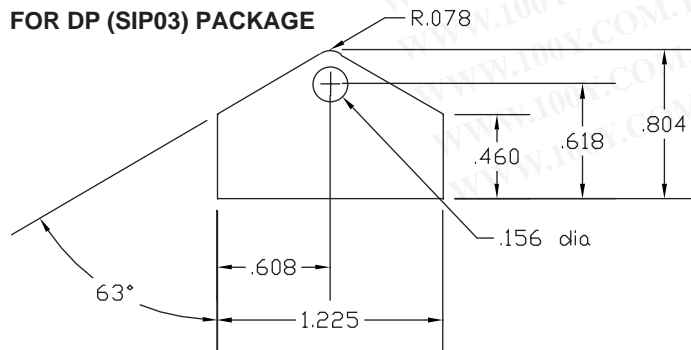
NOTE:

1. Base material of TW12, TW13 and TW14 are Polyimide Type MT (over twice the thermal conductivity of standard type HN Polyimide). Base material of other washers is aluminum. Total thickness of all washers is .003".
2. For optimum thermal transfer, avoid abrasive handling of washers which can damage their .5 mil thick layer of dry thermal compound with which each side is coated.
3. The dry thermal compound will flow filling header to heatsink voids as soon as the material reaches 51°C.

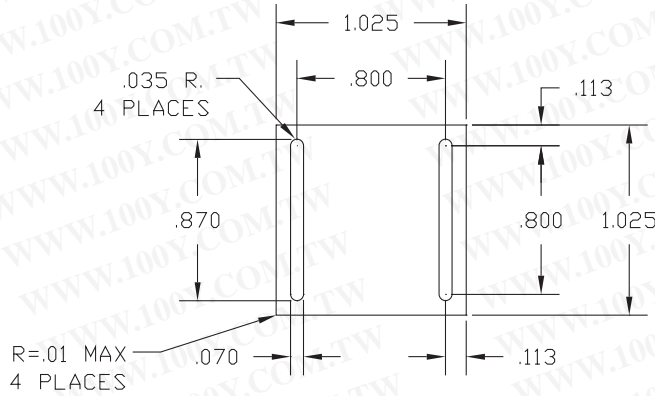
TW06/THERMAL WASHER FOR DN (SIP02) PACKAGE



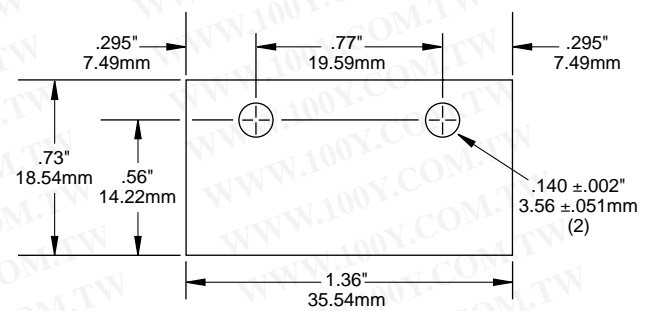
TW07/THERMAL WASHER FOR DP (SIP03) PACKAGE



TW09/THERMAL WASHER FOR EL (DIP6) PACKAGE

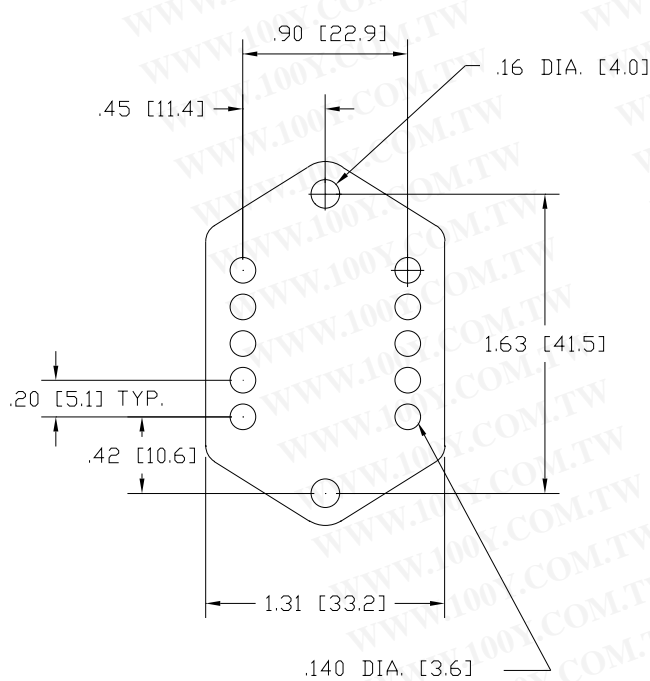


TW12/THERMAL WASHER FOR DX (SIP12) PACKAGE

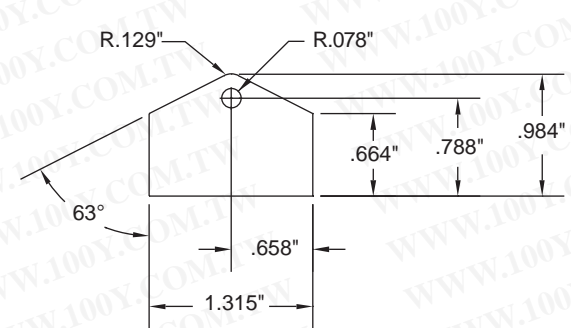


TW12 is an electrical insulator.

TW10/THERMAL WASHER FOR DE (PD10/60S) PACKAGE

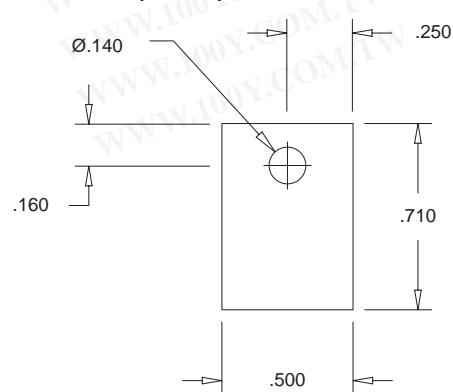


TW13/THERMAL WASHER FOR DQ, DR (SIP04, SIP05) PACKAGE



Material: Polyimide .002" Thick W/ .0005" thermal compound on each side.
 Recommended only for amplifiers rated above 450V supply.

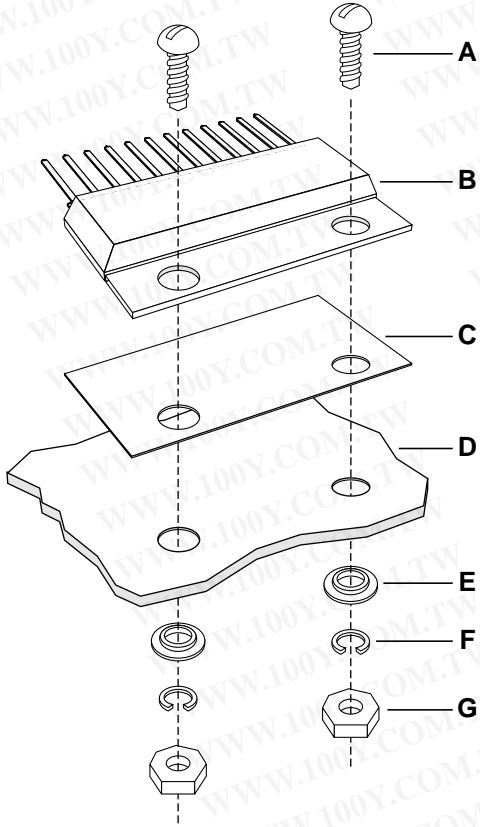
TW14/THERMAL WASHER FOR CD, CX (TO220) PACKAGE



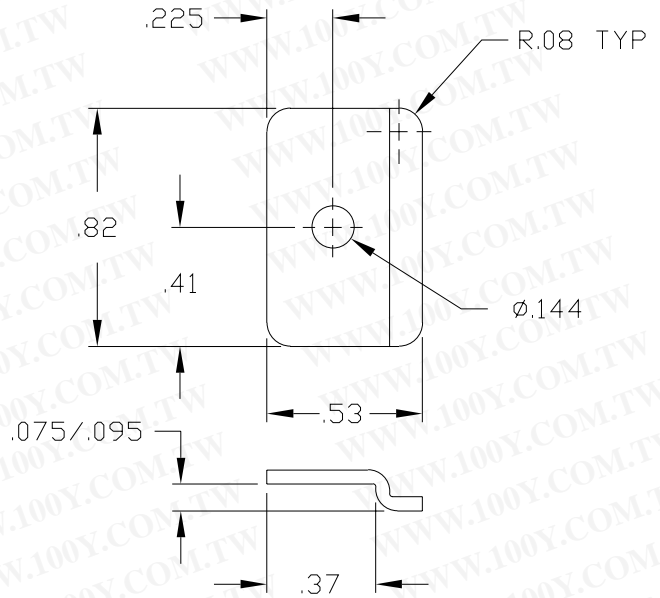
TW14 is an Electrical Insulator

HARDWARE KITS

HK26/HARDWARE KIT FOR DX (SIP12) PACKAGE



HK03/HARDWARE KIT CLAMP FOR FLANGELESS PACKAGES

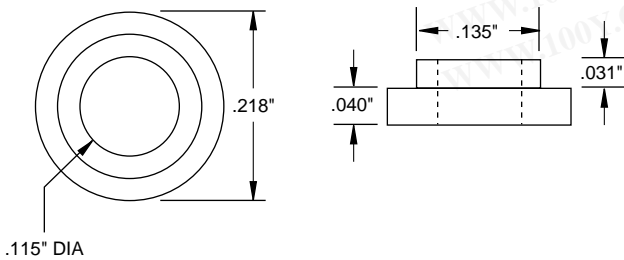


NOTES:

One HK03 includes two clamps.
Material: .048 thick 304 stainless

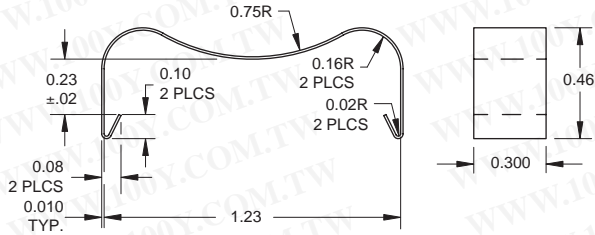
ITEM	DESCRIPTION	QUANTITY
A	4-40 x 7/16" Screws	2
B	PA26 (not supplied)	
C	TW12 Washer	1
D	Heatsink (not supplied)	
E	Shoulder Washer*	2
F	Lockwasher	2
G	4-40 Nuts	2

* Keystone Part Number 3049
Nylon 6/6 per ASTM D4066



勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-54151736
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

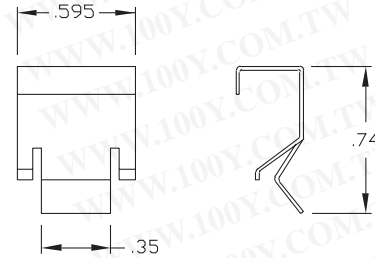
CLAMP02



1. MATERIAL: .010 THICK 302 STAINLESS STEEL, FULL HARD.
2. FINISH: NONE
3. BREAK ALL SHARP EDGES
4. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
5. MARKING: NONE

TOLERANCES - UNLESS OTHERWISE SPECIFIED	.XX = ±.010 .XXX = ±.005 ANG. = ±.5°
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CLAMP04



NOTES:

1. THERMALLOY CLIP 4426
2. MATERIAL: .017 THICK
3. FINISH TO BE BLACK ANODIZE
4. BREAK ALL SHARP EDGES
5. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
6. MARKING: NONE

TOLERANCES - UNLESS OTHERWISE SPECIFIED	.XX = ±.010 .XXX = ±.005 ANG. = ±.5°
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