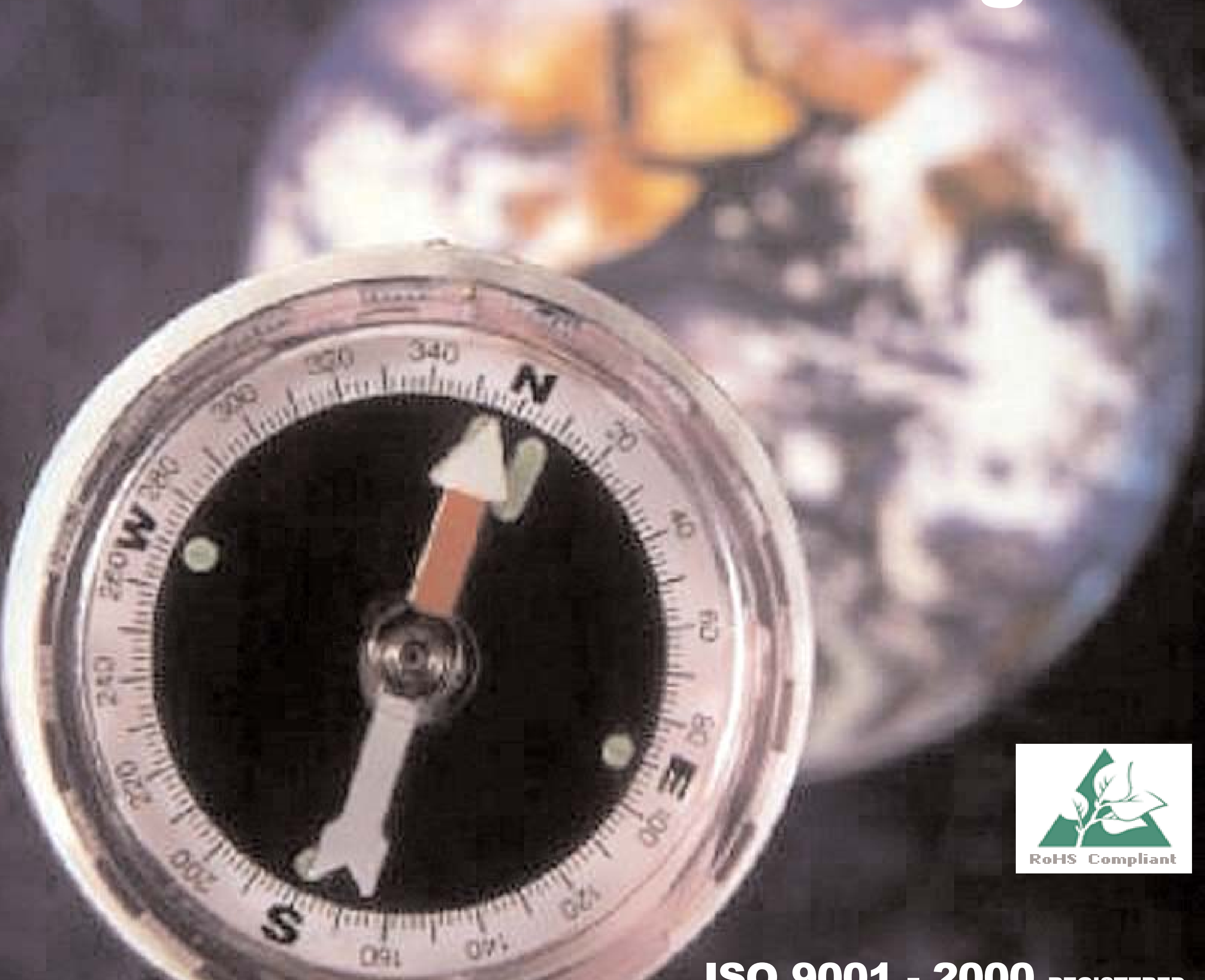
www.r-theta.com

NAVIGATOR

The Navigational Tool For On-Line Heatsink Design



RoHS Compliant

ISO 9001 - 2000 REGISTERED

R-Theta Thermal Solutions Inc.

MARKETS OF R-THETA

INNOVATIVE PRODUCTS FOR THE FUTURE

As a heatsink solutions provider, R-Theta offers innovative products to many chosen markets, including telecommunications, computers, industrial controls, power conversion, transportation, medical, alternative energy and aerospace.

Our innovative Fabfin high performance product was the first "glueless technology" for high performance, high ratio heatsink solutions. R-Theta continues to offer engineers an effective and efficient means of dissipating heat through constant product innovation. To obtain the latest and most accurate information on all products go to **www.r-theta.com** and visit a world of technology and innovation.

INDUSTRIAL CONTROL

MOTOR DRIVES

POWER CONTROLS

SOLAR POWER

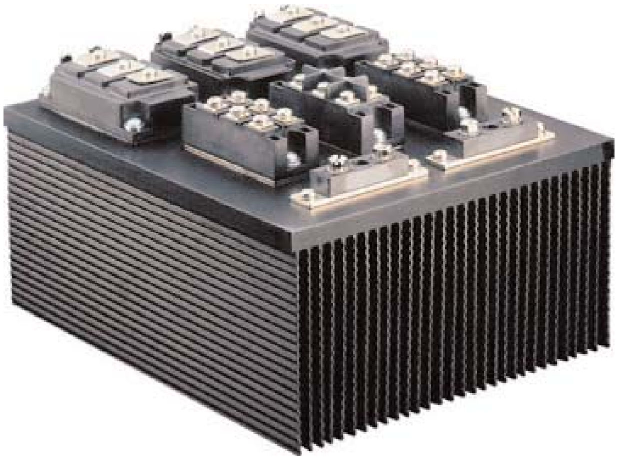
TRANSPORTATION

WIND ENERGY

MEDICAL

COMMUNICATIONS

Available Product Line



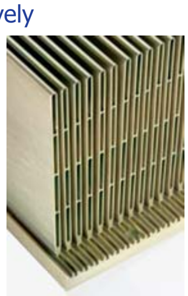
FABFIN®

Fabfin in its basic form is a fabricated heatsink essentially of any size where a multitude of aluminum fins of varying heights and thicknesses are attached by a swaging process to an aluminum baseplate of variable thickness, length and width, on four standard fin spacings. These standard spacings are designated as an FF (8.51 mm), DF (6.86 mm), AF (5.49 mm), or MF (3.43 mm) series. Typical alloy is 6063 for both fins and baseplate. Finishes are numerous. No glue is used in the process.

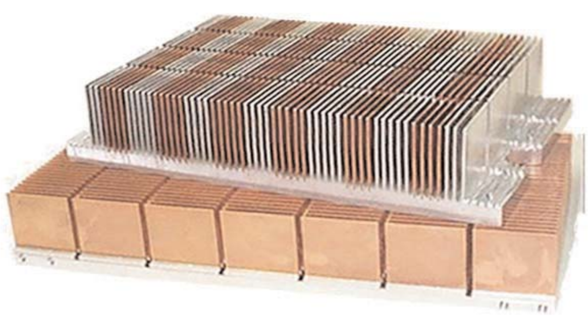
*** PERFORMANCE CAN BE MODELED WITHIN R-TOOLS**

HOLLOWFIN®

The Hollowfin heatsink is characterized by the shape of its fins which when mounted on the DF (6.86 mm) baseplate effectively duplicates the high fin density MF (3.43 mm) series, but with taller fins. A height to space ratio equivalent to 46:1 occurs when the fin height is 118 mm. The Hollowfin is an ideal candidate to attach to a copper baseplate to maximize performance. No glue is used in the process.



*** PERFORMANCE CAN BE MODELED WITHIN R-TOOLS**

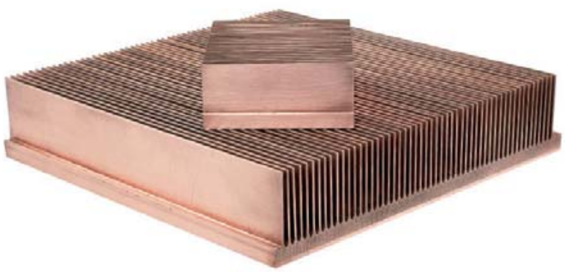


MIXED METALS

The combination Fabfin heatsinks are available with copper baseplates for concentrated heat sources and aluminum baseplates with copper fins for large area heat sources. Optimization is possible by mixing both aluminum and copper fins.

The heatsink was developed to enhance heat spreading for those semi-conductors developing high heat flux and limited allowable temperature rise. The combination heatsink is offered on MF and AF fin spacing as a standard configurable assembly. However, we do supply copper baseplates with DF (6.86 mm) spacing using a Hollowfin which effectively provides MF fin spacing with fins up to 118 mm high. No glue is used in the process.

*** CONTACT R-THETA APPLICATIONS DEPARTMENT FOR MODELING ASSISTANCE.**



COPPER

An all copper Fabfin heatsink provides maximum forced air cooling performance. The fabrication process is the same as that for an aluminum Fabfin heatsink and is offered on MF and AF fin spacing (3.43 mm and 5.49 mm respectively). While copper provides outstanding performance, the overall cost is high. No glue is used in the process.
Other fin spacing can be provided when fins are silver soldered into slots.

*** PERFORMANCE CAN BE MODELED WITHIN R-TOOLS**

DUAL BASEPLATE

NEW

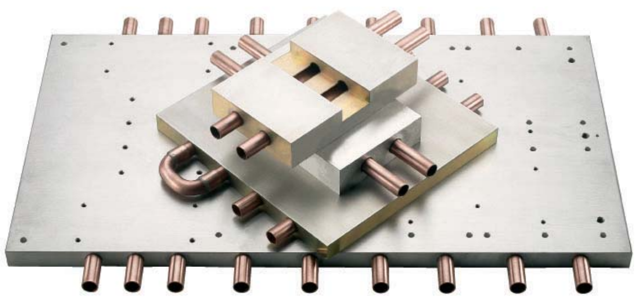
Dual Baseplate Heatsinks (Patent Pending) increase fin efficiency with all aluminum or copper/aluminum assemblies.
Mixed metal fin arrangements as well as dissimilar baseplates are available. Standard fin height, thickness and spacing are available but few mechanical constraints limit height, width, spacing, or thickness of assembly.
No glue is used in the process.

*** PERFORMANCE CAN BE MODELED WITHIN R-TOOLS**

EXTRUSION

Aluminum Extrusion heatsinks are the mainstay for cooling medium power semi-conductors. Many shapes are available to fit diverse applications.
Thousands of shapes exist in the marketplace. If you do not find your needs amid our existing offerings, we will tool a new shape to meet your needs with minimum order quantities.

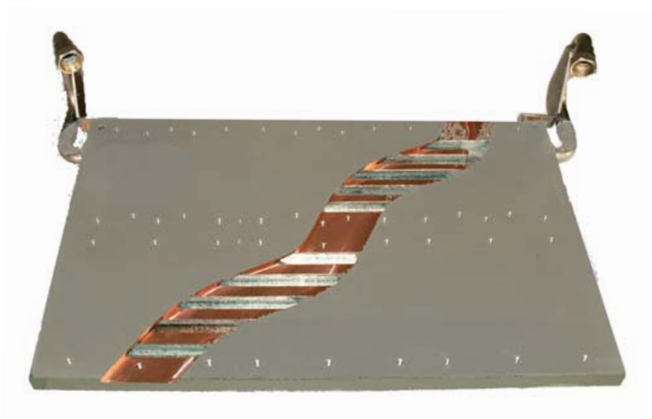
*** PERFORMANCE OF “COMB” SHAPES CAN BE MODELED WITHIN R-TOOLS**



AQUASINK®

Aquasink employs an aluminum body and copper tubes. Standard tube sizes with a nominal ID of 1/2”, 3/8” and 5/16”, 1/4” are embedded in the aluminum using a mandrel process that expands the copper tube into the aluminum body. Body thickness is typically 2x the nominal tube ID. Semi-conductors and/or resistors can be mounted on both sides with equal effectiveness. The tubes can be located at practically any spacing subject to minimum return radius of fittings. Body size can be up to 610 mm wide x 813 mm long. No glue is used in the process.

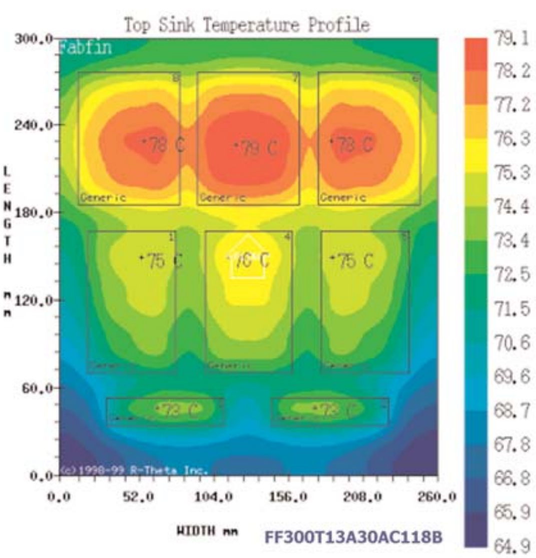
*** PERFORMANCE CAN BE MODELED WITHIN R-TOOLS**



HYPERCOOL®

Hypercool provides both cooling passage and material flexibility not available in Aquasink. Minimum body thickness is 15 mm; minimum body size is 25 mm x 25 mm, with essentially no maximum constraint. Maximum passage width is 10 mm. Materials include copper, and aluminum.
No glue is used in the process.

*** CONTACT R-THETA APPLICATION DEPARTMENT FOR MODELING ASSISTANCE**



R-TOOLS®

With the advent of the internet, and realizing the potential of providing interactive design capability on the Web, R-Theta has introduced R-Tools; a completely interactive on-line thermal design tool for heatsinks. R-Tools provides an analytical method for quickly and accurately modeling various heatsink configurations. The use of analytically based design tools allows the user to perform the thermal design of the heatsink concurrent with the optimization of the electrical and manufacturing elements prior to any prototype builds and testing. This approach results in a reduction in design time and better reliability in the finished product.

BOARD LEVEL, BGA HEAT SINKS & ACCESSORIES

Plug In Style Heat Sink for TO-220 and TO-262 features self locking clips to firmly hold the device to the heat sink. Available with or without solderable mounting tab.

Series RT1000

Channel Style Heat Sink for TO-220 features twisted fins which increase air turbulence and provide better cooling. Solderable tabs included.

Series RT1100

Hat Style Heat Sink for TO-220 are low profile and are ideal on printed circuit boards which have 0.500″ centering between boards.

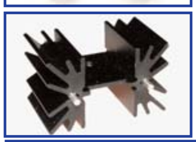
Series RT1150

Flat Back Extruded Heat Sink for TO-220 and TO-218 features solderable pins which allow verticle mounting without stress on the device leads.

Series RT3215

Extruded Heat Sink features mounting holes to accommodate both TO-202 and TO-220 devices. Includes two solderable mounting pins.

Series RT3315

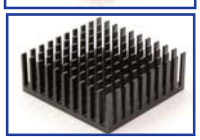


Extruded Heat Sink with radial fins for TO-218 and TO-247 has equal channel widths on both sides for single or dual mounting. Includes two solderable mounting pins.

Series RT3710

Omnidirectional Pin Fin Heat Sink for BGAs, with a 1.1″ square base. Available in four standard heights, .25″, .35″, .45″, and .60″. Thermally conductive adhesive tapes available for heatsink attachment to ceramic, metal or plastic devices.

Series RT5645



Omnidirectional Pin Fin Heat Sink for BGAs with 1.7″ x 1.75″ base. Available in three standard heights, .35″, .40″, and .65″. Thermally conductive adhesive tapes available for heatsink attachment to ceramic, metal or plastic devices.

Series RT5265

Unidirectional Fin Heat Sink for BGAs with 1.37″ square base. Available in four standard heights, .25″, .35″, .45″, and .60″. Thermally conductive adhesive tapes available for heatsink attachment to ceramic, metal or plastic devices.

Series RT5435

D^{2}Pak (TO-263) Surface Mount Solderable Heat Sink remove the heat without contacting the device. Other sizes available for D^{2}Pak (TO-268) and D-Pak (TO-252).

Series RT1755

Channel Style Heat Sink with wide mounting surface low cost and able to accept a variety of packages. Heat sink can be mounted to PC board either vertical or horizontal.

Series RT1650

High Power Extruded Heat Sink for multiwatts with large radial fins increased fin count for additional cooling capacity. Includes two solderable mounting pins.

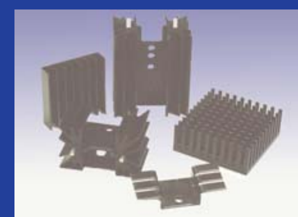
Series RT3815

Clips Available Too

Lots More @ www.r-theta.com

Check out the complete line of board level products, accessories, BGA Heat sinks, and Thermal Interface products such as grease, and mounting pads.

We offer a broad range of board level heat sinks for surface mount and thru hole discrete power semiconductor packages, including JEDEC outlines TO-202, TO-218, TO-220, TO-247, TO-262, TO-263 (D2PAK), Multiwatt and heat sinks for BGA and Dip IC packages to mention a few of the commonly used packages.



Extruded aluminum heat sinks and extrusions for cooling higher power industry standard semiconductors, solid state relays, DC to DC converters, IGBT's, rectifiers are also available. These heat dissipating products are available as standard or build to print. Black anodize and other surface finishes are available.

"Polar" Thermal interface materials include high performance pads, adhesives and grease.

R-Theta Thermal Solutions Inc.

What You Need To Know About FABFIN®

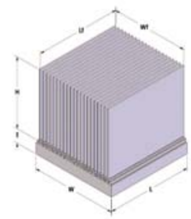
Welcome to the imagination challenging potential of Fabfin. The design engineer can now leap beyond the limitations of low ratio one piece aluminum extrusions and the thermal barriers of epoxy assemblies by using Fabfin - the high ratio, high performance, immensely rugged, thermal barrier free aluminum heatsink assembly. Within a broad mechanical envelope lies unlimited possibilities to address your most challenging thermal applications.

ALL CONFIGURATIONS

- L = Length of baseplate
- L*f* = Length of fin
- W = Width of baseplate
- W*f* = Width over fins
- T = Thickness of baseplate
- T*f* = Thickness of flange
- Baseplate thickness:
  9 mm Min
  64 mm Max
- Non-tooled fin height within each family will be provided by shearing the next taller fin. If quantities dictate we will tool a new fin.
- Max fin height 118 mm except MF which is 49 mm. Taller MF equivalent fins can be achieved by selecting the Hollowfin on 6.86 mm centers.

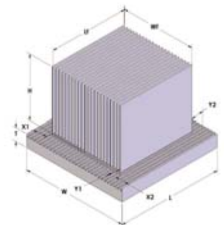
R-Theta Thermal Solutions Inc.

FABFIN



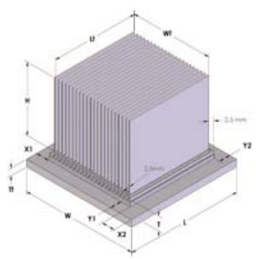
CONFIGURATION 1 (without mounting flanges: all slots filled)

- L = L*f* = 50 mm min, 1250 mm max.
- W = [W*f* + (2 x shoulder)] ≤ Wmax (see Fig. 1 Table 2)
- Number of fins = Width indicator (N) corresponding to W (see formulas in Table 3)
- Shoulder Width ≤ 2.5 mm for MF, 3.5 mm for AF, DF and FF



CONFIGURATION 2 (with mounting flanges; exposed fin slots)

- L = (L*f* + Y1 + Y2) = 100 mm min, 1250 mm max.
- If flanges Y1 and Y2 = 0, then L*f* = L
- X1 may equal X2 but both must be specified
- W = (W*f* + X1 + X2) ≤ Wmax (see Fig. 1 Table 2)
- Flanges X1 and X2 must be ≥ 2.5 mm for MF, and ≥ 3.5 mm for AF, DF and FF
- Y1 may equal Y2 but both must be specified
- Number of fins = Width indicator (N) corresponding to W*f* (see formulas in Table 3)



CONFIGURATION 3 (with mounting flanges; machined surfaces)

- L = [L*f* + Y1 + Y2 + (2 x 2.5)] = 100 mm min, 1250 mm max.
- If flanges Y1 and Y2 = 0, then L*f* = L
- X1 may equal X2 but both must be specified
- W = [W*f* + X1 + X2 + (2 x shoulder)] ≤ Wmax (see Fig. 1 Table 2)
- Flanges X1 and X2 must be specified beyond 3.5 shoulder
- Shoulder Width ≥ 2.5 mm for MF, and ≥ 3.5 mm for AF, DF and FF
- Y1 may equal Y2 but both must be specified
- Number of fins = Width indicator (N) corresponding to W*f* (see formulas in Table 3)
- T*f* must be = T – 3.3 in order to remove the fin slots

Note: Configurable aluminum air cooled assemblies. Four series organized on baseplate slot spacing. Highly flexible width, length and fin arrangement. COPPER OPTIONS AVAILABLE.

9 EASY STEPS TO CONFIGURE FABFIN HERE OR ON-LINE

The following represents a sample configuration of Figure 2 (page 7)

STEP 1: SELECT A SERIES

Select a series for a fin pitch.
(refer to Table 1 and Fig. 1)

Table 1

Series	Fin Pitch (CC) (center to center)
MF	3.43 mm
AF	5.49 mm
DF	6.86 mm
FF	**8.51 mm**

Fig.1

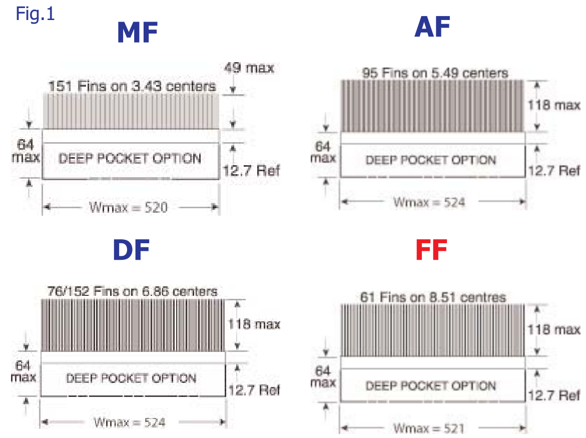


Table 1 and Fig. 1 show the four standard Fabfin series based on Fin Pitch (CC). Variables within each series include length, width and thickness of baseplate as well as height and thickness of fins.

Part Number Example

FF

FABFIN® Heatsink Configurator

STEP 2: SELECT A CONFIGURATION

All Fabfin baseplates can be configured with or without a mounting flange. To define the configuration see detailed diagrams on page 6. If configuration 2 or 3 are selected please specify the x and y coordinates for the mounting flange area. (see page 6)

CONFIGURATION 1

* fully populated, full length fins and without mounting flanges- all slots filled

CONFIGURATION 2

* exposed flange, unmachined, with mounting flanges

CONFIGURATION 3

* exposed flange, machined surfaces

PART NUMBER:

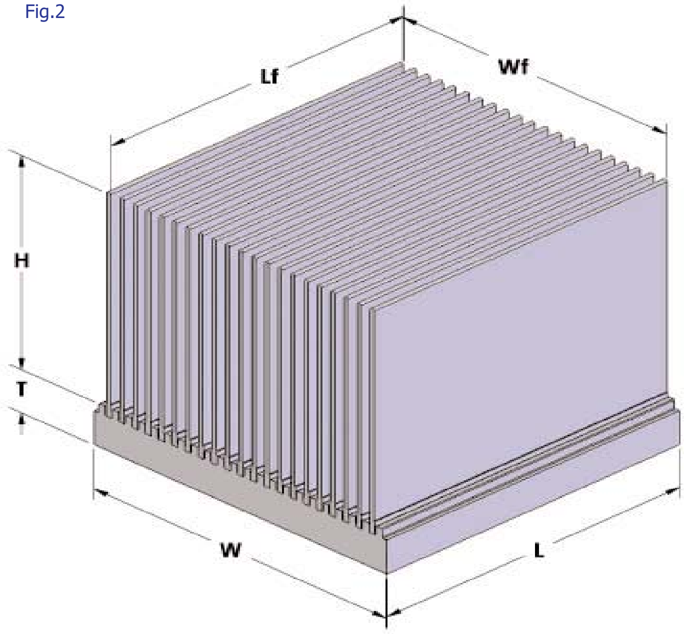
Configuration 1 = **no digit required**
Configuration 2 = 2
Configuration 3 = 3

*(if configurator 2 or 3 is selected the digit/code appears at the very end of the product number)

Part Number Example

FF

Fig.2



CONFIGURATION 1

STEP 3: SELECT TOTAL LENGTH

Select the total length in mm *(this is user defined)

eg. **L = Lƒ = 300 mm**

Part Number Example

FF300

STEP 4: SELECT BASEPLATE THICKNESS

(refer to Table 2)

All Fabfin heatsinks are available with standard 12.7 mm baseplate thickness but many other thicknesses are tooled. The baseplate thickness is typically governed by the mechanical, thermal and cost requirements of the application. Custom baseplate thicknesses can be provided within the range of 9 mm to 64 mm by cutting new extrusion dies or gang slotting of the baseplate. New tooling is coming on-line continuously and we may be able to supply your special needs at no additional cost.

Table 2a

MF BASEPLATE OPTIONS

Thickness Reference	Thickness T (mm)	Maximum Width Wmax (mm)
T13	12.7	up to 305 mm
T00	to be specified	up to 520 mm

Table 2b

AF BASEPLATE OPTIONS

Thickness Reference	Thickness T (mm)	Maximum Width Wmax (mm)
T08	7.7	up to 222 mm
T10	9.9	up to 222 mm
T13	12.7	up to 524 mm
T15	14.9	up to 524 mm
T00	to be specified	up to 524 mm

Table 2c

DF BASEPLATE OPTIONS

Thickness Reference	Thickness T (mm)	Maximum Width Wmax (mm)
T11	11.4	up to 298 mm
T13	12.7	up to 524 mm
T18	18.3	up to 400 mm
T00	to be specified	up to 524 mm

Table 2d

FF BASEPLATE OPTIONS

Thickness Reference	Thickness T (mm)	Maximum Width Wmax (mm)
T13	**12.7**	up to 520 mm
T00	to be specified	up to 520 mm

STEP 5: SELECT A BASEPLATE MATERIAL

Choose one of the following materials: **A** = Aluminum
C = Copper

Part Number Example

FF300T13A

STEP 6: DETERMINE WIDTH INDICATOR (N)

To convert baseplate width to width indicator, select desired baseplate total width (W). To determine Width Indicator (N) use the formula at the bottom of each series table. (refer to Table 3)

i.e. If $W = 260$ mm

$$N = \frac{260 - 9.4}{8.51}$$

$= 29.4$ *(round up to the nearest integer)

$\therefore N = 30$

Refer to Table 3 for standard tooled baseplate widths (W).

Alternatively go to the Fabfin configurator section on the website for a complete listing of all widths and fin counts.

R-Theta will manufacture this heatsink by machining the next wider standard baseplate. (refer to Table 3d)

FIN COUNT

Configuration 1: Number of fins = Width indicator (N)
Configuration 2,3: Substitute W_f into the formula at the bottom of each series in Table 3 to obtain fin count.

Wider widths are frequently supplied by welding Fabfin assemblies together. The swaged fin to baseplate joint is unaffected by the elevated welding temperatures.

Part Number Example

FF300T13A30

Fig. 3 Sample Heatsink

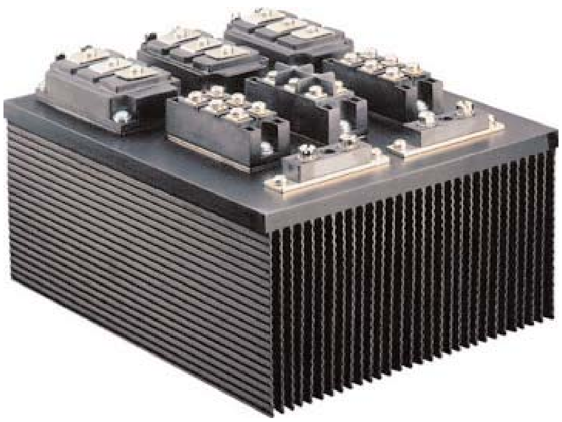


Table 3a

MF STANDARD TOOLED BASEPLATES

Width (mm) W	Width Indicator N	Width Fin to Fin W_f (mm)
127	36	121.4
202	58	196.8
237	68	231.1
302	87	296.3

Note: Base widths > 302 are achieved by gang milling the slot up to a max. width of 520 mm. Use width indicator formula to determine the value of N to insert in part to specify width.

Width Indicator $N = \left(\frac{W - 6.27}{3.43}\right)^*$

Table 3b

AF STANDARD TOOLED BASEPLATES

Width (mm) W	Width Indicator N	Width Fin to Fin W_f (mm)
223	40	215.4
234	42	226.4
300	54	292.3
349	63	341.7
525	95	517.4

Width Indicator $N = \left(\frac{W - 7.5}{5.49}\right)^*$

Table 3c

DF STANDARD TOOLED BASEPLATES

Width (mm) W	Width Indicator N	Width Fin to Fin W_f (mm)
257	37	249.4
298	43	290.5
325	47	318.0
339	49	331.7
401	58	393.4
524	76	516.9

Width Indicator $N = \left(\frac{W - 9.4}{6.86}\right)^*$

Table 3d

FF STANDARD TOOLED BASEPLATES

Width (mm) W	Width Indicator N	Width Fin to Fin W_f (mm)
121	14	113.0
139	22	181.1
274	32	266.2
308	36	300.3
393	46	385.4
521	61	513.0

Width Indicator $N = \left(\frac{W - 9.4}{8.51}\right)^*$

* Note: round up to the nearest integer

FABFIN® Heatsink Configurator

STEP 7: SELECT FIN

To select fin material, style and height, please refer to Fig. 4 and Table 4 for standard heights and fin height ratios for each series.

Non-standard fin height within each family will be provided by shearing the next taller fin. The exact fin height in millimeters should substitute the 000 in the Fin Reference in Table 4. If quantities dictate we will tool a new fin.

AC = Aluminum Corrugated
AS = Aluminum Serrated
AH = Aluminum Hollow
CF = Copper Flat
AF = Aluminum Flat

Part Number Example

FF300T13A30AC118

Fig. 4a

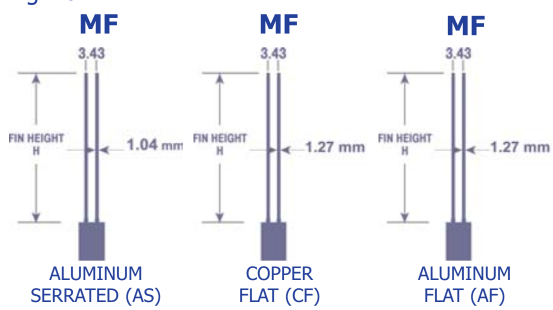


Fig. 4b

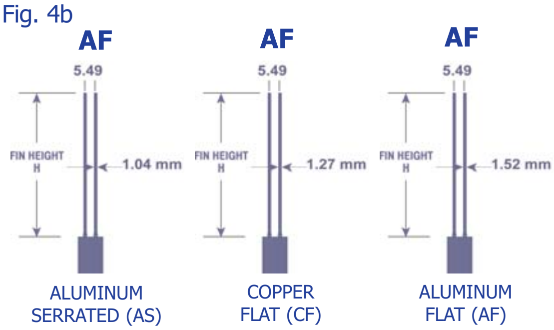
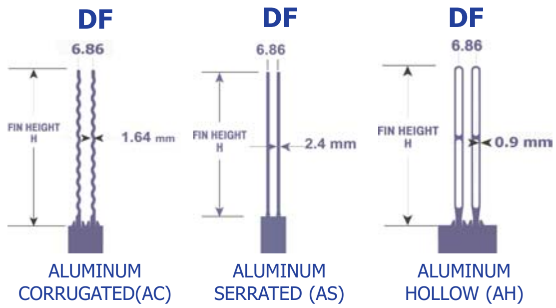


Fig. 4c



MF Fin Options

Fin Reference	Fin Style	Fin Height H (mm)	Ratio H To Space
AS035	Serrated	35	15:1
AS049	Serrated	49	20:1
AS000	Serrated	To Be Specified	-
AF000	Flat	To Be Specified	-
CF000	Flat	To Be Specified	-

AF Fin Options

Fin Reference	Fin Style	Fin Height H (mm)	Ratio H To Space
AS037	Serrated	36.5	8:1
AS051	Serrated	50.5	11:1
AS091	Serrated	90.5	20:1
AS120	Serrated	119.5	27:1
AS000	Serrated	To Be Specified	-
AF000	Flat	To Be Specified	-
CF000	Flat	To Be Specified	-

DF Fin Options

Fin Reference	Fin Style	Fin Height H (mm)	Ratio H To space
AC071	Corrugated	71.4	13:1
AS071	Serrated	71.4	16:1
AC119	Corrugated	119.4	22:1
AS119	Serrated	119.4	26:1
AH063	Hollow	63	25:1
AH102	Hollow	101.8	40:1
AH119	Hollow	119.4	46:1
AC000	Corrugated	To Be Specified	-
AS000	Serrated	To Be Specified	-
AH000	Hollow	To Be Specified	-

STEP 8: SELECT A FINISH

Choose from the following finishes:
C = RoHS compliant tri-valent ***clear*** chrome
B = Black Anodize   A = Clear Anodize
D = Degrease only

Part Number Example

FF300T13A30AC118B

STEP 9: (OPTIONAL)

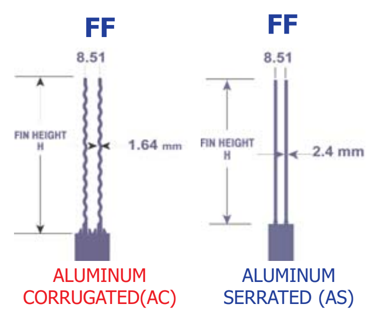
Choose legs if desired:

Yes = L
No = no digit required

Part Number Example

FF300T13A30AC118B

Fig. 4d



FF Fin Options

Fin Reference	Fin Style	Fin Height H (mm)	Ratio H To Space
AC070	Corrugated	70	10:1
AS070	Serrated	70	11:1
AC118	Corrugated	118	17:1
AS118	Serrated	118	27:1
AC000	Corrugated	To Be Specified	-
AS000	Serrated	To Be Specified	-

Note:
Take this part number and enter into R-Tools to simulate thermal performance using your selected interface materials and semi-conductors. * (refer to Fig. 3 for picture of this configured part FF300T13A30AC118B)

We offer a wide range of Extrusion sections that can be machined to meet special needs. New Extrusion sections are being tooled continuously and we invite you to submit your special needs to us for matching to these new sections. If no match is found we will be pleased to cut a new die at nominal cost.

EXTRUSION

THE MULTI-PURPOSE ALLOY - 6063-T5

6063 is a multi-purpose alloy that is most widely used for architectural hardware and heatsinks because it is extrudable into complex shapes and lends itself to anodized coating. The T5 temper provides sufficient hardness for ease of machinability. T6 is harder but requires water quenching causing warping of the more complex shapes. 6063-T5 is the aluminum extrusion most commonly used by R-Theta. 6061-T6 is sometimes selected by design engineers to take advantage of the harder alloy but is only readily available in bar stock since it is difficult to extrude heatsink shapes in this alloy. The 6061 alloy also exhibits a lower thermal conductance than 6063. For these reasons 6061 should be avoided.

The partial table below is taken from our website and characterizes only the comb-shaped Extrusions offered by R-Theta. Many other non-standard shapes are also available.

Once on the website, at the URL listed below, click on a part number to view an image of the Extrusion. Sort the table by clicking on the columns titles. Selected part number is displayed beside the send quote button.

*please refer to the web address for more information

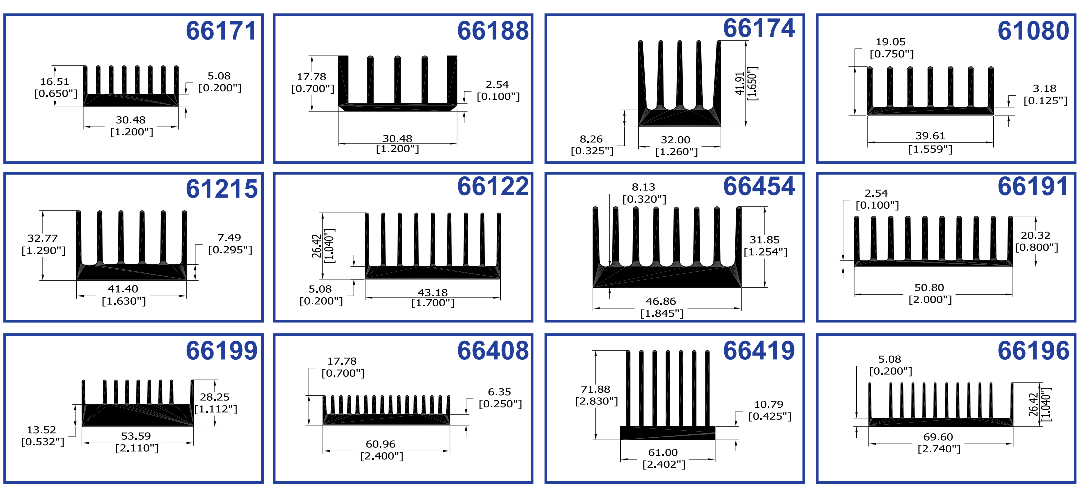
http://www.r-theta.com/products_aircooled_extrusion_create.asp

EXTRUSION CHARACTERISTICS TABLE

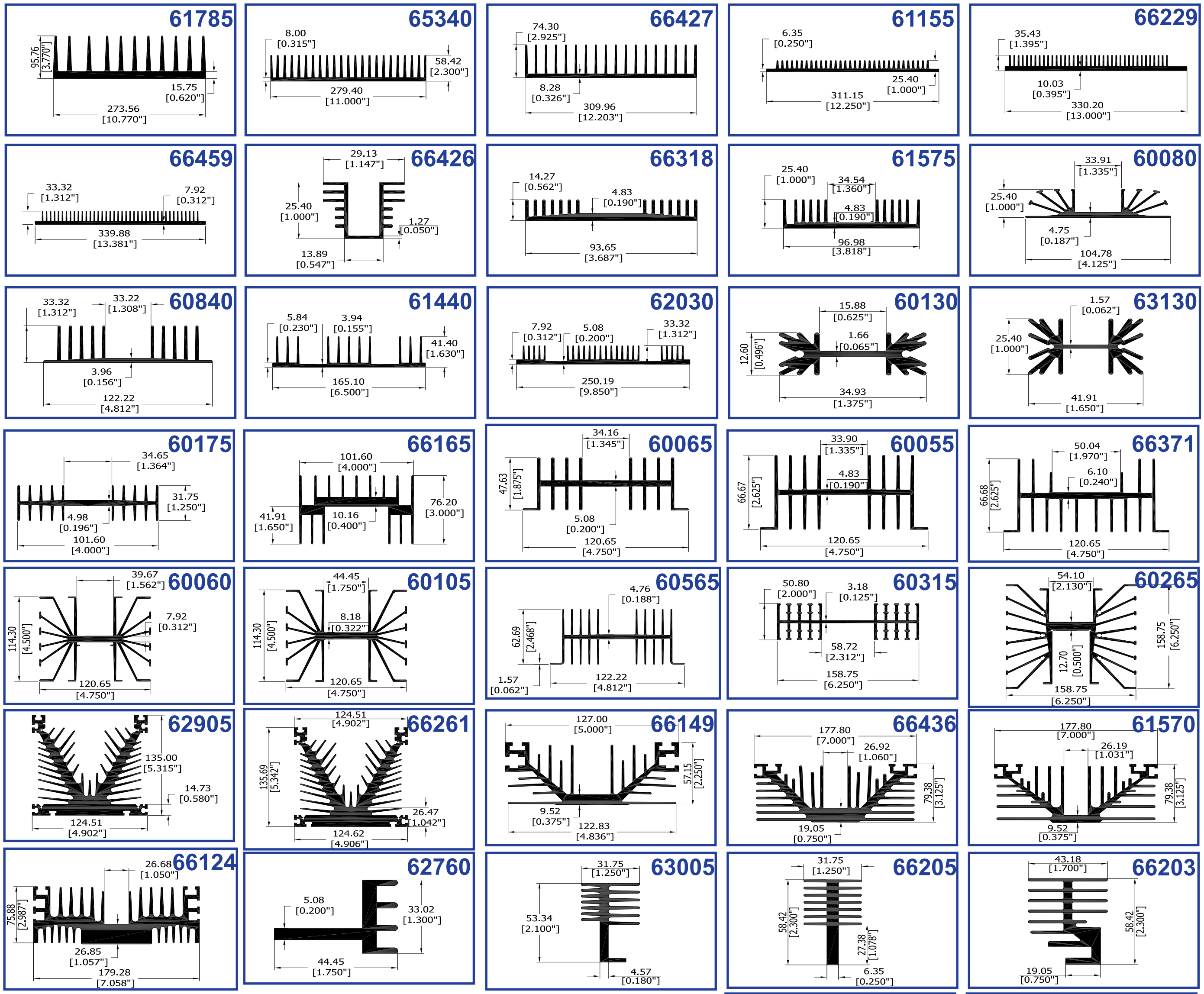
Part #	Width (mm)	Base (mm)	Fin Thickness (mm)	Fin Height (mm)	Fin Center to Center (mm)	# Fins	Fin Ratio	fpi
60075	120.65	3.175	1.143	8.53	7.95	8	1.25	3.19
60140	154.43	6.37	2.54	38.07	12.7	13	3.75	2.00
60365	44.45	6.35	4.72	38.1	12.39	4	4.97	2.05
60520	250.83	8.89	2	25.4	8	30	4.23	3.18
60815	212.09	6.35	3.81	44.45	19.05	13	[illegible]	[illegible]
60950	[illegible]	[illegible]	[illegible]	[illegible]	3.98	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	7.11	2.425	[illegible]	[illegible]	[illegible]	8.56	4.12
[illegible]	48.51	6.35	1.778	20.32	[illegible]	6	2.69	2.72
66395	272.38	7.62	1.905	19.05	11.43	23	2.00	2.22
66404	250.26	6.37	1.52	12.05	7.73	27	1.94	3.29
66406	60.96	6.35	1.83	27.94	8.51	8	4.18	2.98
66414	127	7.92	3.12	38.1	10.9	12	4.90	2.33

PROFILE TYPES OF EXTRUSION

Note: There are many more sizes and styles available. Consult the website for a complete listing.



R-Theta Thermal Solutions Inc.



REFER TO TABLE ON PAGE 10

5 EASY STEPS TO CONFIGURE EXTRUSION

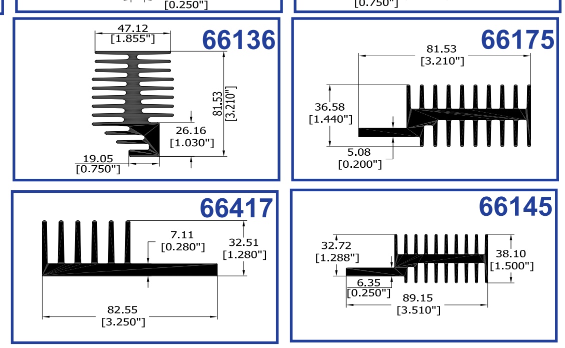
STEP 1: LOG ONTO www.r-theta.com

STEP 2: SELECT "PRODUCTS" ON MENU BAR

STEP 3: SELECT "AIRCOOLED" ON DROP DOWN MENU

STEP 4: SELECT "CREATE AN EXTRUSION"

STEP 5: SELECT "EXTRUSION CONFIGUATOR"



Select Extrusion to obtain detailed section information

Thermal Modeling of any "comb" Extrusion can be simulated in r-tools.r-theta.com

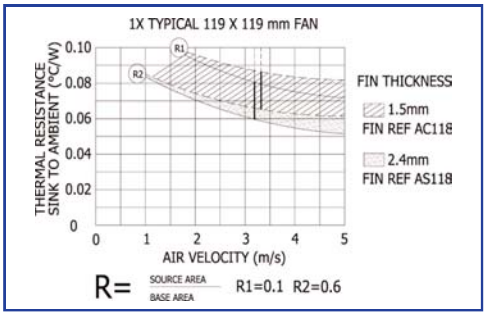
FFC SERIES WITH SIDE FASTENED LEGS AND FAN BRACKET

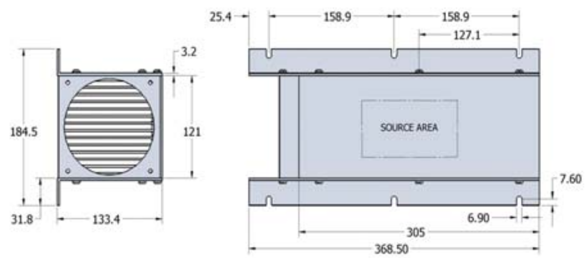
The R-Theta® range of standard Fabfin® forced convection cooled heatsinks (FFC series) was developed to incorporate standard 119mm square axial fans. The fin spacing of 8.51 mm was selected to provide a 20:1 ratio, the practical heat transfer limit for cooling Power Semiconductors in typical ambient conditions. The standard FFC series will accept 1, 2, 3 or 4 fans. Available in many finishes.

The serrated fin thickness of 2.4mm provides near optimum performance when using industry standard axial fans. If some level of performance de-rating is acceptable (approximately 20%) then we recommend that corrugated fins be used. These have a thickness of 1.5 mm and are designated by ordering the 'AC' part numbers. The use of corrugated fins provides a weight savings pf approximately 15% and will increase surface area by 7% compared with a straight fin of the same height.

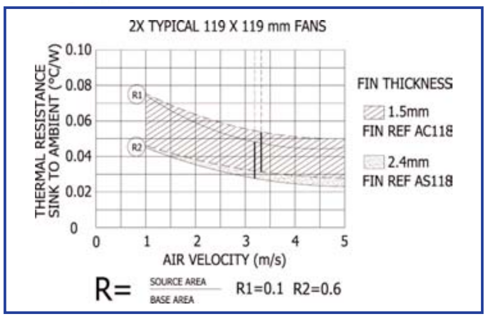
The push/pull (PP) option is common for applications where fan redundancy is important. We recommend the use of ball bearing fan(s), specifically for the "pull" end, in order to maximize the fan life due to the elevated operating temperatures. The additional weight of the fan can be offset by using the corrugated fins, if applicable.

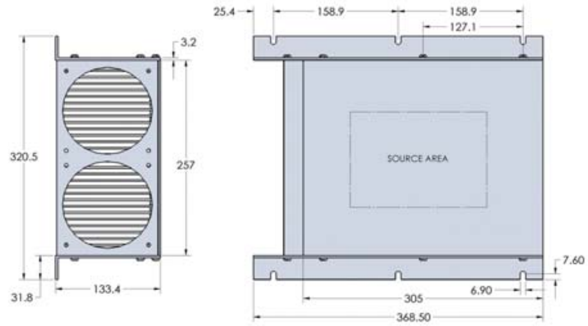
The adjacent graphs provide a performance guide for heat generating devices ranging in size from point source to 60% coverage.



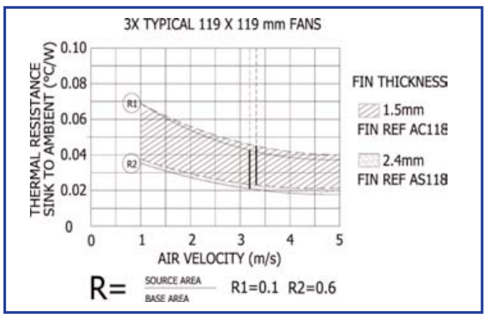


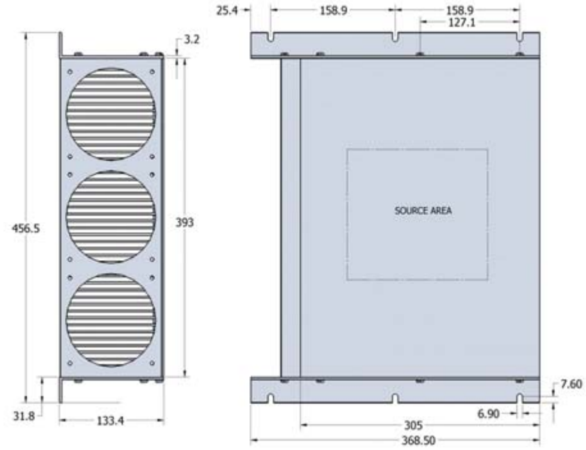
TECHNICAL DATA				
MODAL #	FFC305T13A14AS118B		FFC305T13A14AC118B	
FIN STYLE	SERRATED		CORRUGATED	
WT WITHOUT FAN	5.4	kg	4.7	kg
BASE AREA	36,774	mm^2	36,774	mm^2
TOTAL CSA	5,091	mm^2	4,242	mm^2
TOTAL PERIMETER	3,683	mm	3,749	mm





TECHNICAL DATA				
MODAL #	FFC305T13A30AS118B		FFC305T13A30AC118B	
FIN STYLE	SERRATED		CORRUGATED	
WT WITHOUT FAN	10.4	kg	8.8	kg
BASE AREA	78,387	mm^2	78,387	mm^2
TOTAL CSA	10,889	mm^2	8,981	mm^2
TOTAL PERIMETER	7,800	mm	7,929	mm





TECHNICAL DATA				
MODAL #	FFC305T13A46AS118B		FFC305T13A46AC118B	
FIN STYLE	SERRATED		CORRUGATED	
WT WITHOUT FAN	15.5	kg	13.2	kg
BASE AREA	119,865	mm^2	119,865	mm^2
TOTAL CSA	16,574	mm^2	13,766	mm^2
TOTAL PERIMETER	11,991	mm	12,578	mm

Aquasink has been developed to provide the design engineer with a rugged, low cost, high performance heatsink. This Aluminum/Copper liquid cooled cold plate is suitable for high power, isolated base semi-conductors and other heat sensitive components.

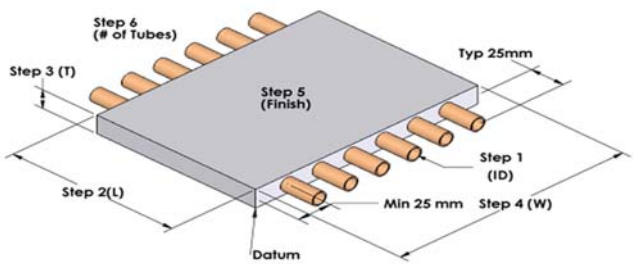
Aquasink's unique copper tube mandreling technology provides intimate long term contact of the tube with the aluminum cold plate. It is impossible to loosen Aquasink's copper tubes. The integrity of an Aquasink tube is never compromised by fly-cutting, guaranteeing that an Aquasink will survive the most rigorous of pressure tests.

EMBEDDING PROCESS

The embedding process employed to manufacture Aquasink allows you to mount electronic components on both sides of the cooling plate with equal thermal efficiency.

R-Theta Thermal Solutions Inc.

AQUASINK



* Please refer to the numbered steps illustrated in this diagram. Step numbers below correspond to the steps opposite.

BASE MATERIALS

The heat collecting semi-conductor mounting surface is fabricated from extruded 6063 aluminum alloy. Commercial grade ASTM B-75 copper tubes of a size to suit given applications are embedded within the aluminum plate by a proprietary mechanical process that provides an industry unique metal to metal bond between the aluminum and copper. This process is free of heat impeding glue or bonding epoxy interface. The copper tube location can be specified for practically any dimension from the datum point.

7 EASY STEPS TO CONFIGURE AQUASINK HERE OR ONLINE

STEP 1: SELECT TUBE DIAMETER

Select tube nominal internal diameter (ID):

AA = 1/4" (6.35 mm)
AB = 3/8" (9.53 mm)
AC = 1/2" (12.7 mm)
AD = 5/6" (7.9 mm)

Part Number Example

AC

STEP 2: SELECT BASEPLATE LENGTH

Select length (L) specified in mm (user defined):

eg. L = 250 mm

Maximum allowable length is 813 mm

Part Number Example

AC250

STEP 3: SELECT BASEPLATE THICKNESS

Select baseplate thickness (T) minimum 2x ID:

TA = 12.7 mm
TB = 19.1 mm
TC = 25.4 mm
TD = 15.9 mm

Part Number Example

AC250TC

STEP 4: SELECT BASEPLATE WIDTH

Select baseplate width (W) specified in mm (user defined): eg. W = 230 mm
Maximum allowable width is 610 mm

Part Number Example

AC250TC230

STEP 5: SELECT A FINISH

Choose from the following finishes:

D = Degrease Only

Part Number Example

AC250TC230D

STEP 6 / 7: NUMBER OF TUBES/SELECT CONFIGURATION

Select number of Tubes (user defined): eg. 6 tubes

Select tube configuration A,B,C,D,E or F (visit website configuration details): eg. A

Step 6 Part Number

AC250TC230C6

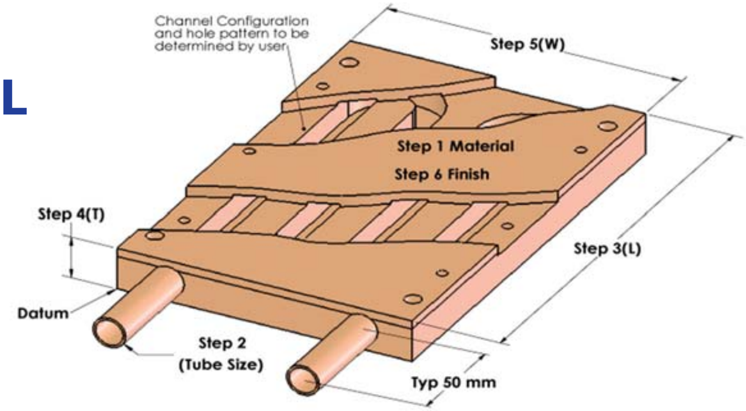
Step 7 - Final Part Number

AC250TC230C6A

* Tube location and thermal modeling can be performed on r-tools.r-theta.com.

Visit www.r-theta.com, select configure product, select "Aquasink" to obtain more Information.

HYPERCOOL



BONDING
Bonding of component sections. Silver solder is used to bond surfaces together using a tightly controlled heating process. Brazing is used as required.

MAXIMUM HEAT TRANSFER
Maximum liquid contact area possible with mounting surface achieving maximum heat transfer.

FLEXIBLE DESIGN
Ultimate in design flexibility for channels, supply and exit locations.

PREMIUM BASE MATERIALS
Copper C11000 E.T.P., Aluminum Alloys 6061,6063. Aluminum alloys are electroless nickel coated after machining channels before soldering. Mounting features are added after soldering.

6 EASY STEPS TO CONFIGURE HYPERCOOL HERE OR ONLINE

STEP 1: SELECT MATERIAL
Choose from the following material: HA = Aluminum
HC = Copper

Part Number Example
HC

STEP 2: SELECT INLET/OUTLET TUBE SIZE
Choose from the following sizes:
A = 1/4" (6.35 mm)
B = 3/8" (9.53 mm)
C = 1/2" (12.7 mm)

Part Number Example
HCC

STEP 3: SELECT BASEPLATE LENGTH
Select baseplate length (L) in mm (user defined): eg. L = 305 mm

Part Number Example
HCC305

STEP 4: SELECT BASEPLATE THICKNESS
Select baseplate thickness (T) in mm (user defined): eg. T = 20 mm
Minimum thickness is 14.3mm, (bonding plate must be 3.2mm min.)

Part Number Example
HCC305T20

STEP 5: SELECT BASEPLATE WIDTH
Select baseplate width (W) in mm (user defined): eg. W = 127 mm

Part Number Example
HCC305T20W127

STEP 6: SELECT A FINISH
Choose from the following finishes: C = Tri-valent clear chrome (Aluminum)
D = Degrease Only
E = Electroless nickel

Final Part Number
HCC305T20W127E

* User to provide channel layout to which R-Theta will designate a unique number.
* For thermal modeling contact factory.
* Minimum size is 25 mm x 25 mm subject to factory minimum order.
* Maximum standard size is 457 mm x 914 mm. Consult factory for larger sizes.
* The milled channel depth needs to be at least 2x the end mill diameter and must leave at least 1/4" between any channels or channel to edges.

The R-Theta software provides a natural or forced convection solution for air-cooled, as well as, liquid-cooled cold plate solutions, based on heatsinks currently manufactured by R-Theta. The interface is friendly, with only minimal parameters needed to be specified.

Information technology and manufacturing excellence are driving the global economy, making it imperative for manufacturers to consider strategy that includes e-business. With the launch of the R-Tools application site, R-Theta is proud to lead the heatsink industry into the realm of e-business, continually providing leading edge technology. By utilizing the world wide web as a means of "blurring the desktop" between customer and supplier, R-Theta is able to enhance and guide engineers through the designing process, free of cost. The internet allows results to base decisions, which are designed on the availability of accurate information. As a global solutions provider in thermal engineering, R-Theta is committed to an e-business strategy which provides users with a quick and accurate representation of the product that R-Theta manufactures.

R-Theta Thermal Solutions Inc.

ON-LINE THERMAL MODELING OF HEATSINKS FOR SEMI-CONDUCTORS

Heatsinks are used with semi-conductor devices to provide more surface area for heat dissipation. Power electronic designers require quick and accurate heat sink solutions. With the advent of the internet, and realizing the potential of providing interactive design capability on the Web, R-Theta has introduced R-Tools; a completely interactive on-line thermal design tool for heatsinks. The R-Tools mathematical engine is located on a web server at R-Theta Inc. and R-Tools simulation can be run on an Internet browser, which is capable of utilizing Java Applets. R-Tools thermal modeling is based on a set of analytical models for conduction heat transfer in the solid elements coupled with natural and forced convection heat transfer models in the cooling airflow. The conduction heat transfer model in the baseplate of the heatsink is based on the steady state solution of the Laplace equation for general rectangular geometry. The solution is based on a general three-dimensional Fourier series solution, which satisfies the conduction equation in the base plate. For the forced convection air-cooled fins, an analytical model is used to predict the average heat transfer rate. The model used is a composite solution based on the limiting cases of fully developed and developing flow between parallel plates. Because the R-Tools is analytically based, the solution is achieved within a few seconds, a very short time compared to the several hours required for a full CFD simulation.

R-Tools provides an analytical method for quickly and accurately testing various heat sink configurations. The use of analytically based design tools allows the user to perform the thermal design of the heatsink concurrent with the optimization of the electrical and manufacturing elements prior to any prototype or testing. This approach results in a reduction in design time and better reliability in the finished product.

FREE ON-LINE REGISTRATION

Users can register for R-Tools on the R-Theta Inc. web site www.r-theta.com. An e-mail will be sent automatically including a password. To start R-Tools, users login using a User ID (user has defined through the registration) and the password. On the first screen of R-Tools, a menu on the left-hand side of the screen lists selections and options available for users such as:

Simulation Menu button allows the user to start a new simulation.

User Option Menu gives the user two options for using R-Tools:

i) **Step by Step** option is the default option for all new users. This user-friendly approach introduces users to the R-Tools concept of designing heatsinks on-line. Colorful and clear sketches are used to describe the basic dimensions and parameters of the heatsink design. When the user points the cursor in any text box, design tips and notes are displayed in green color at the bottom of the screen.

ii) For advanced users the **Compact Pages** option reduces the design screens down to four screens, which reduces the design and browsing time.

File Menu allow users to copy, rename and delete existing simulations.

On simulation screens, the left-hand side menu list the steps of navigating R-Tools through the designing of R-Theta heatsinks. Users have two options to navigate through R-Tools screens as follows:

a) Navigate step by step through any R-Tools screen by clicking the "Next" button on the bottom of each screen.

b) Display the desired R-Tools screen by clicking on the screen name on the left-hand side menu.

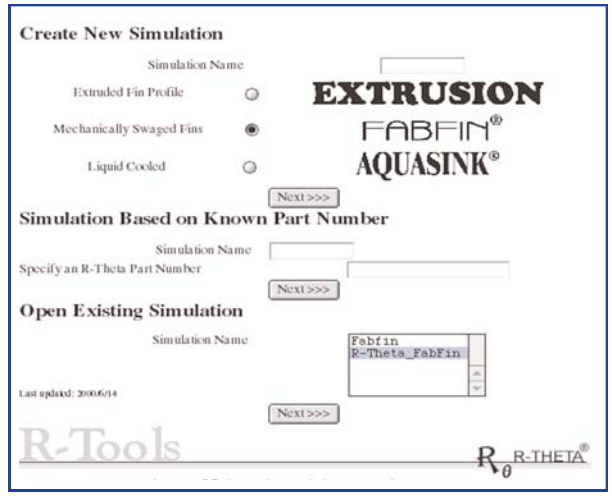
10 EASY STEPS TO FOLLOW R-TOOLS HERE OR ONLINE

STEP 1: STARTING SIMULATION

To start a simulation on R-Tools, there are three options:

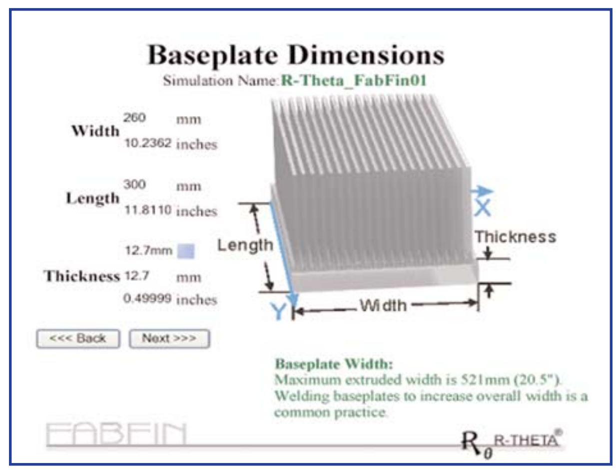
- "Create New Simulation" by typing a simulation name and selecting the product which is suitable for the applications: Examples: Extrusion, Fabfin, Aquasink.
- "Simulation Based on Known Part Number" by typing in a simulation name and the appropriate R-Theta part number to generate a new simulation: Example: FF300T13A30AC118B.
- "Open Existing Simulation" by selecting the name of the simulation from the drop down list of your previously created simulations.

Note: Click the next button to go to the next screen, baseplate dimensions.



STEP 2: BASEPLATE DIMENSIONS

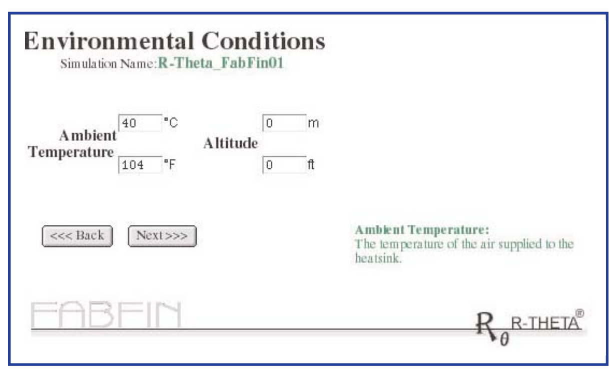
- The sketch on the right hand side of the screen demonstrates the three dimensions of the baseplate.
- Enter the dimensions by typing in the value (mm or inches) in the corresponding text box.
- The user can select a standard thickness or customized one by typing the value in the text box.
- The green design on the bottom right side of the screen will inform the user about R-Theta manufacturing capabilities.



STEP 3: ENVIRONMENTAL CONDITIONS

- "Ambient Temperature" is the temperature of the air cooling the heatsink. "Ambient Temperature" can be entered in ºC or ºF.
- "Altitude" of the application can effect the cooling capacity of the heatsink because it can change density of the cooling air.

Note: the name of the simulation will always appear on the top of the screen.

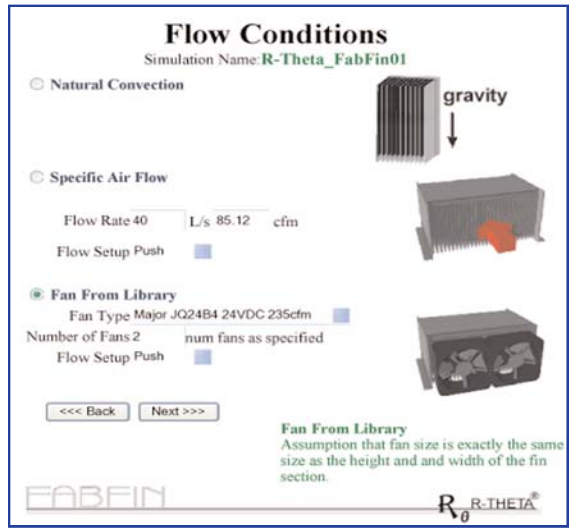


STEP 4: FLOW CONDITIONS

The heatsink can be cooled using one of the heat transfer modes:

- "Natural Convection" mode where air moves through the heatsink due to the buoyancy effects.
- Forced convection mode which has two input options in R-Tools.
  1. "Specific Air Flow": The user has to enter the appropriate volumetric flow rate of the air cooling the heatsink, or
  2. "Fan From Library": The user can select a fan from the drop down list.
- For forced convection the user can select the flow direction:
  1. Push, or
  2. Impinging, or
  3. Push/Pull.

Note: By-pass air is not modeled in R-Tools. All air flow data entered is assumed to be presented to the face of the heatsink.



STEP 5: GRAPHICAL SOURCE LAYOUT

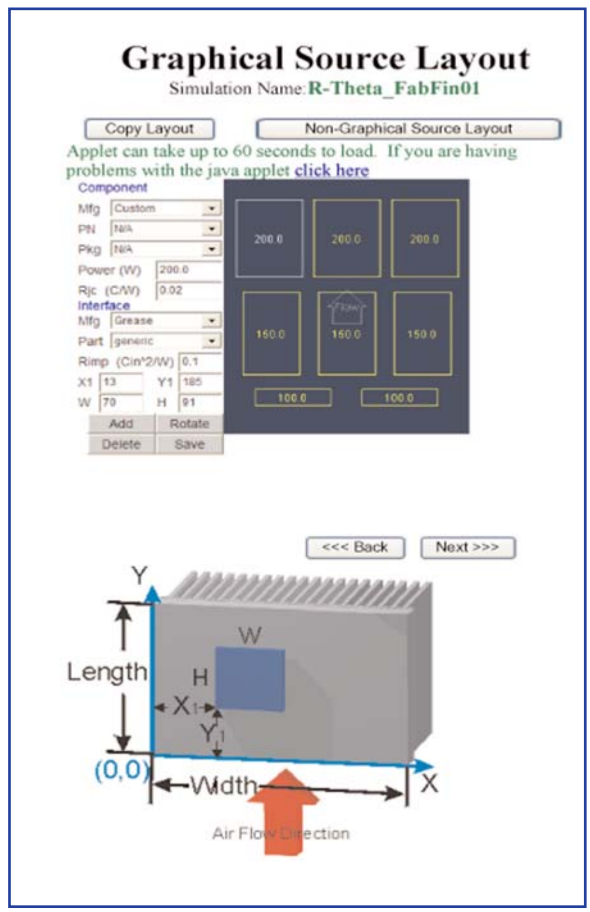
A sketch of the main dimensions of the heatsink and the locations of the heat source is shown at the bottom of the screen.

To add a heat source on the baseplate of the heatsink, **click "Add" button.**

R-Tools allows two options for specifying the heat source: i.e. Component:

1. Customize the specifications of the device by entering the dimensions, power dissipation and the thermal resistance, Rjc of the device in the corresponding text boxes on the screen.
2. Select a semi-conductor manufacturer and a part number from the R-Tools library, i.e. drop down lists.

- Users can change the dimensions (W, H) and the location (X1, Y1) of any source on the heatsink graphically or by typing the values in the corre sponding text box.
- To rotate the source on the heatsink, click "Rotate" button.
- To delete a source, click on the "Delete" button.



STEP 6: THERMAL INTERFACE MATERIAL

Users can enter the thermal impedance, Rimp, of the interface material by:

- Typing its value in the textbox, or
- Selecting the manufacturer and the part number of the interface from the drop down lists.

STEP 7: SAVE

At this point, you must click "SAVE" before advancing to the "Next" screen!!!

STEP 8: FIN SELECTION AND OPTIMIZER

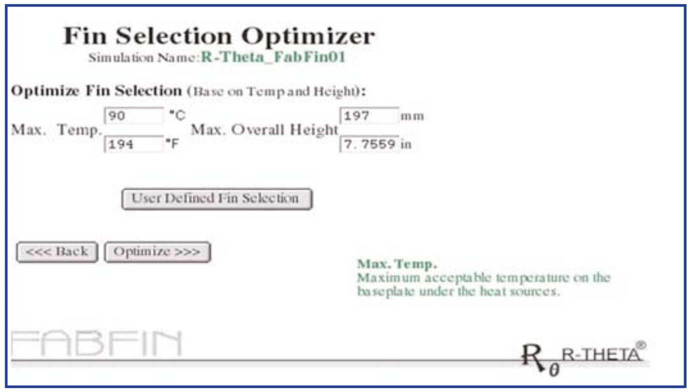
Users can select from the two following options:

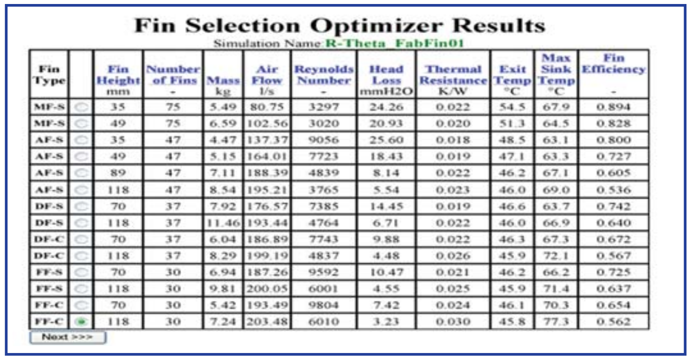
1. FIN OPTIMIZER: the user must enter

a) Thermal constraints i.e. Maximum Temperature allowed on the heatsink.

b) Physical constraints i.e. Maximum Height allowed for the heatsink.

- The fin optimizer will solve all fin configurations, which will meet the thermal performance i.e. maximum allowed temperature, and will list all the available selections in the "Fin Optimizer Results" table.
- Click on any header of the "Fin Optimizer Results" table to sort the table according to the header name ie: the user can sort the table by the mass of the heatsink by clicking on the "Mass" header.
- When selecting any configuration from the table a green design note will describe the main specification of the selected fin.





Fin Selection Optimizer Results

Simulation Name: R-Theta_FabFin01

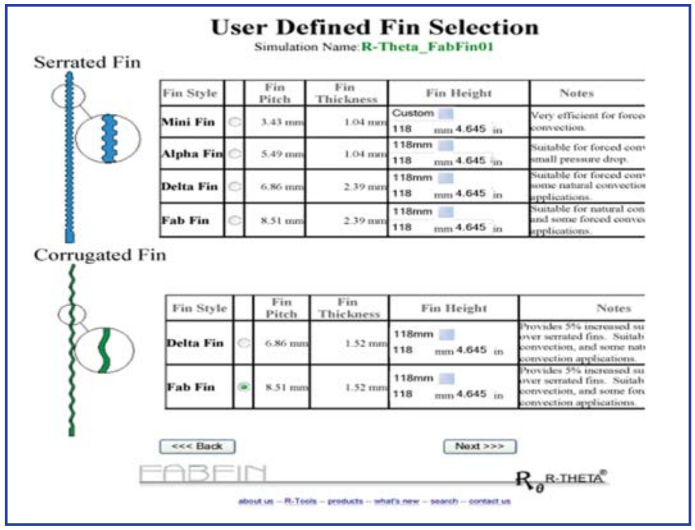
Fin Type		Fin Height mm	Number of Fins -	Mass kg	Air Flow l/s	Reynolds Number -	Head Loss mmH2O	Thermal Resistance K/W	Exit Temp °C	Max Sink Temp °C	Fin Efficiency -
MF-S	○	35	75	5.49	80.75	3297	24.26	0.022	54.5	67.9	0.894
MF-S	○	49	75	6.59	102.56	3020	20.93	0.020	51.3	64.5	0.828
AF-S	○	35	47	4.47	137.37	9056	25.60	0.018	48.5	63.1	0.800
AF-S	○	49	47	5.15	164.01	7723	18.43	0.019	47.1	63.3	0.727
AF-S	○	89	47	7.11	188.39	4839	8.14	0.022	46.2	67.1	0.605
AF-S	○	118	47	8.54	195.21	3765	5.54	0.023	46.0	69.0	0.536
DF-S	○	70	37	7.92	176.57	7385	14.45	0.019	46.6	63.7	0.742
DF-S	○	118	37	11.46	193.44	4764	6.71	0.022	46.0	66.9	0.640
DF-C	○	70	37	6.04	186.89	7743	9.88	0.022	46.3	67.3	0.672
DF-C	○	118	37	8.29	199.19	4837	4.48	0.026	45.9	72.1	0.567
FF-S	○	70	30	6.94	187.26	9592	10.47	0.021	46.2	66.2	0.725
FF-S	○	118	30	9.81	200.05	6001	4.55	0.025	45.9	71.4	0.637
FF-C	○	70	30	5.42	193.49	9804	7.42	0.024	46.1	70.3	0.654
FF-C	●	118	30	7.24	203.48	6010	3.23	0.030	45.8	77.3	0.562

Next >>>

2. USER DEFINED FIN SELECTION:

For users familiar with the R-Theta Fabfin heatsink configuration, "User Defined Fin Selection" allows users to select the exact R-Theta standard fin design as follows:

- MF is the recommended fin design for forced convection applications with maximum height of 49 mm.
- AF is recommended for forced convection applications, which require low pres sure drop i.e. low noise levels.
- DF has three fin designs satisfying different application objectives as follows:
  - i) Serrated Fin: for high power dissipation.
  - ii) Corrugated Fin: for weight sensitive applications.
  - iii) Hollowfin: for high power dissipation applications. Hollowfin with the advantage of lower pressure drop performance and lower weight.
- FF is a suitable selection for natural convection heat transfer. FF can be used for relatively low power dissipation forced convection applications. FF has two fin designs as follows:
  - i) Serrated Fin: provides mechanical integrity.
  - ii) Corrugated Fin: larger surface area to provide better cooling for natural convection.



Note: Fin height can be customized by the user with certain limitations for each group: MF: minimum of 25 mm and maximum of 49 mm; AF, DC, FF: minimum of 25 mm and maximum of 118 mm. Hollowfin is recommended as an alternative to a MF fin when a fin height higher than 49 mm is needed to dissipate more heat.

STEP 9: MISCELLANEOUS FACTORS:

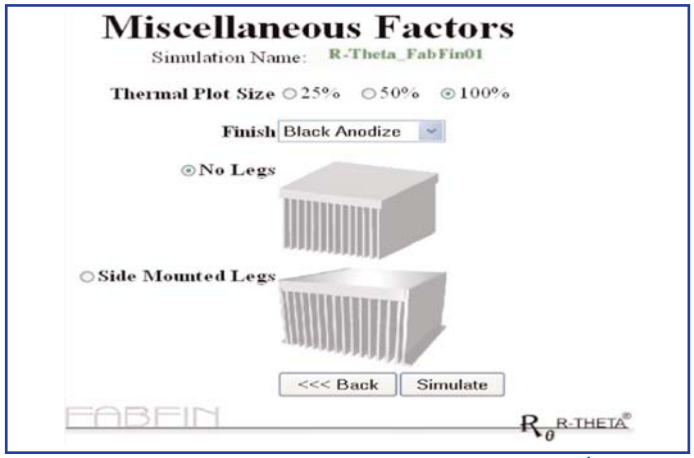
On this page users can define the following:

i) "Thermal Plot Size" in the final simulation i.e. for large heatsinks it is better to reduce the display to 50% or 25% of the original size so that the display will appear inside the web page.

ii) Specify the "Finish" of the final product which can be one of the following:
- Degreased;
- Black anodized (recommended for natural convection;)
- Clear anodized;
- RoHS compliant ***clear*** tri-valent chrome.

iii) Mounting option where the user can select to attach legs for the heatsink for mounting.

Click "Simulate" for the full thermal simulation for R-Theta heatsink.



STEP 10: R-TOOLS SIMULATION-DESIGN OUTPUT SUMMARY

THE SUMMARY CONTAINS THREE MAIN SECTIONS

A) NUMERICAL RESULTS SUMMARY (CONTAINS THREE SECTIONS)

1. Heatsink Design Details Section:
The physical dimensions of the heatsink such as weight, fin height, fin spacing, baseplate thickness, fin material, baseplate material etc. It also generates an R-Theta part number.

2. Thermal Design Detail Section:
A full list of the heat sources is displayed. For each source the the following information is displayed:

- W & L: foot print of the heat source i.e. device;
- Power: heat dissipation;
- Tsavg: average temperature of the baseplate under the device;
- Tcase: average case temperature;
- Tjunction: average junction temperature;
- Fin Efficiency;
- Thermal Resistances associated with each device.

3. Hydraulic Design Details Section:
This section displays three main sub-sections:

a) Coolant Information (if applicable):
- Coolant type air, water, Water/Glycol mix etc.;
- Supply: shows the fan name, number of fans used in the application and cooling style;
- Inlet and the outlet coolant temperatures (air or liquid);

b) Pressure drop through the entrance, the heatsink core, and exit section. The sum of the pressure drop through the three sections is displayed under total header.

c) Reynolds number, which is a measure of the turbulence level in the fluid flow.

B) HEATSINK THERMAL MAP:
This shows a temperature profile of the heatsink baseplate. Hot spots on the heatsink baseplate are identified by the red color in the thermal map. The maximum temperature under each device is printed on the thermal map in the square which identifies the location of each device.

C) HYDRAULIC PERFORMANCE CHART (FAN SHOULD BE SELECTED):
This displays heatsink performance curve vs. fan performance hydraulic curve. Displaying the performance point of the system helps designers to determine the noise level and fan efficiency. A second degree equation which represents the heatsink performance curve can help designers include the designed heatsink in CFD models.

R-THETA

ISO 9001 Registered Certificate# 001456

R-Tools Simulation – DESIGN OUTPUT SUMMARY
Date: 2005/11/23

Userid: zaghlol
Simulation: R-Theta_FabFin01
Type: FABfin

1. HEATSINK DESIGN DETAILS – metric units

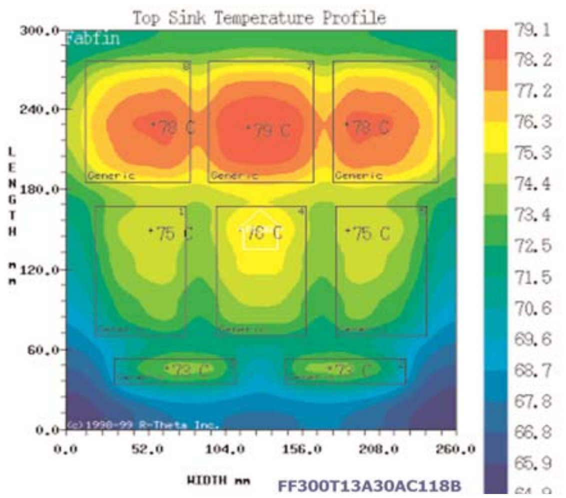
Heatsink PN	Weight	% Fin	Fin Details					Baseplate			Materi
		Wt	#fins	t	H	cc	style	L	W	t	Baseplate
	kg	-	-	mm	mm	mm	-	mm	mm	mm	
FF300T13A30AC118B	7.2	62.7	30	1.52	118.0	8.51	corrugated	300.0	260.0	12.7	Aluminum 6063-T5 Al

2. THERMAL DESIGN OUTPUT DETAILS – metric units

Device Details						Temperature			Fin	Thermal Resistances		
Source PN	W	L	%sc		Power	Tsavg	Tcase	Tjunction	Efficiency	Rsa	Rcs	Rjc
	mm	mm		Ref#	W	°C	°C	°C	%	°C/W	°C/W	°C/W
Generic	60	97	7.5	1	150.0	73.3	74.9	77.9	62.0	0.222	0.011	0.020
Generic	80	19	1.9	2	100.0	72.0	76.2	78.2	62.0	0.320	0.042	0.020
Generic	80	19	1.9	3	100.0	72.0	76.3	78.3	62.0	0.320	0.042	0.020
Generic	60	97	7.5	4	150.0	74.4	76.0	79.0	62.0	0.229	0.011	0.020
Generic	60	97	7.5	5	150.0	73.3	74.9	77.9	62.0	0.222	0.011	0.020
Generic	70	91	8.2	6	200.0	76.7	78.7	82.7	62.0	0.183	0.010	0.020
Generic	70	91	8.2	7	200.0	77.6	79.6	83.6	62.0	0.188	0.010	0.020
Generic	70	91	8.2	8	200.0	76.6	78.7	82.7	62.0	0.183	0.010	0.020

3. HYDRAULIC DESIGN OUTPUT DETAILS – metric units

Type	Coolant Information						Pressure-drop				Reynolds
	Supply	#	Style	Flow	Temp(°C)		Entrance	Core	Exit	Total	at Flow
				L/s	In	Out	mmH20	mmH20	mmH20	mmH20	
Air	Major JQ24B4 24VDC 235cfm	2.0	Push	198.2	40.0	45.7	0.572	1.200	0.000	1.772	5936



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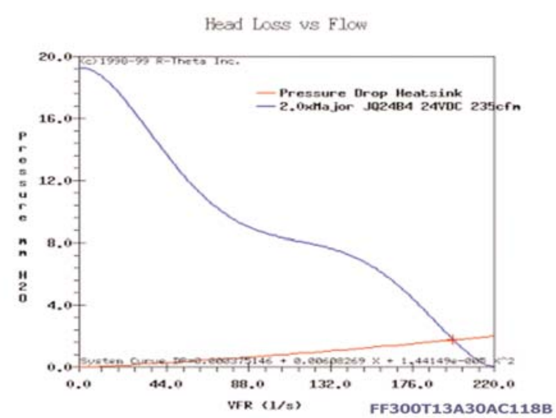

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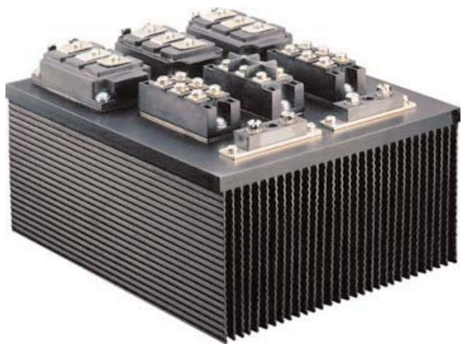
Request A Quote

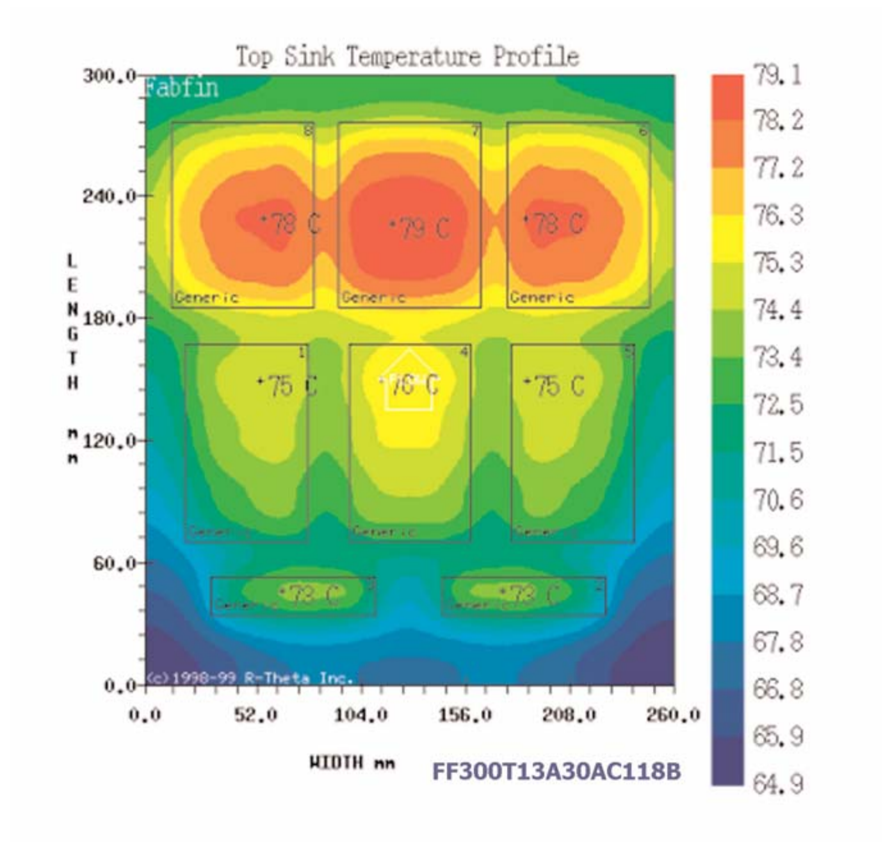
R-TOOLS®
Powerful Software

FABFIN

The Ideal Fin Cooling Solution



FABFIN

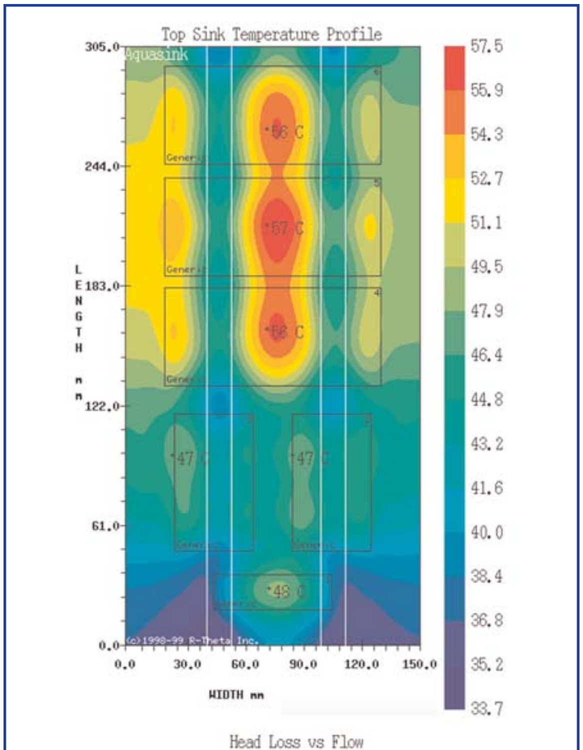


FF300T13A30AC118B

USER FRIENDLY THERMAL MODELING FOR HEATSINKS

- Completely interactive on-line thermal design tool for heatsinks.
- Quick and accurate heatsink solutions.
- Analytical models for conduction heat transfer in the solid elements.
- Natural and forced convection heat transfer models in the cooling airflow.
- Reduction in design time and better reliability in the finished product.
- User-friendly approach introduces users to R- Tools.
- Colorful and clear graphics.
- Design tips and notes.
- Step by Step approach.
- Liquid and air-cooled heatsinks.
- Graphical source layout.
- Parts library for semi-conductors, thermal interfaces, and fans.
- Fin optimizer solves for optimum heatsink configurations.
- Thermal design output details heatsink performance.
- Heatsink thermal map shows temperature profile of the heatsink baseplate.
- Hydraulic performance chart displays heatsink vs. fan performance curves.

AQUASINK



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AQUASINK

The Ideal Liquid Cooling Solution

R-Theta Thermal Solutions Inc.

GENERAL

Materials

Baseplates: Aluminum - 6063-T5, 6061-T6
Copper - C11000

Fins: Aluminum - 6063-T5, 6061-T6, 1100-H14
Copper - C11000

Legs and Fan Bracket: Aluminum 6063-T5

Tolerances:

Places	Value
X	± 0.5 mm
XX	± 0.25 mm
XXX	± 0.13 mm

Drilled Hole Diameter: ± .13mm

Note: Tighter tolerances can be supplied if required at some additional cost. Dimensions are in mm unless otherwise stated. Dual measurement convention mm (inches).

FABFIN

Cut to Length: ≤ 305 mm ± 0.5
> 305 mm ± 1.0

Cut to Width: ± 0.5 mm

Angularity: Saw Cut ± 1/4°
Extrusion ± 1°
Machined ± 1/4°

Flatness (max.): Machined 0.03/25 mm

Surface Roughness (max.): 1.6 rms or better

Overall Height: ± 0.75 mm Fin height "H" ≤ 100mm
± 1.00 mm Fin height "H" > 100mm

Baseplate Thickness: ± 0.75 mm

AQUASINK

Materials

Copper Tubes: Commercial ASTM B-75
Inlet/Outlet Adapters: Brass/Copper

Length (L) parallel to tubes. (max.) 813: ≤ 305 mm ± 0.5 mm
> 305 mm ± 1.0 mm

Width (W) transverse to tubes. (max.) 610: Up to 610 mm ± 0.5 mm

Angularity: ± 1/4°

Flatness (max.): Machined (flycut) 0.03/25 mm
Unmachined 0.1/25 mm

Surface Roughness (max.): 1.6 rms or better

Locations of tubes from datum point: ± 1.0 mm

Nominal ID	6.35 (1/4)	7.93 (5/16)	9.53 (3/8)	12.7 (1/2)
OD*	8.07 ± 0.025	9.60 ± 0.025	11.50 ± 0.024	15.92 ± 0.025

*after mandrel expansion process

Finish-Copper Tubes: Natural

Aquasink Leak Testing: To 120 psi for 5 min. using helium; other specs contact factory.

EXTRUSION

The aluminum extrusions supplied by R-Theta comply with the standard commercial tolerances established by "The Aluminum Association Inc." which roughly translate into the following "rules of thumb" when applied to heatsink sections.

Cutting to Length: ≤610mm ± 0.5mm
>610mm ≤ 1220mm ± 1.27mm
>1220mm ± 1.57mm
Flatness (max. deviation): 0.1mm/25mm of width up to 250mm
0.2mm/25mm of width over 250 mm
Roughness/Die Lines: Depth of defect <0.1mm
Angularity: ± 1°

Machined Parts

Flatness (max. deviation): 0.03/25mm of width
Roughness: 1.6 rms or better
Angularity: ± 0.25°
Edge to Datum: ±0.25mm
Feature to Feature: ±0.13mm

Product Finishes & Fabfin Information

FINISH TYPE:

MEETS THE REQUIREMENTS OF:

Black Anodize	MIL-A-8625, TYPE II, Class 2, Black
Clear Anodize	MIL-A-8625, TYPE II, Class 1, Clear
Tri-Valent Chrome	MIL-C-5541, Class 3, clear
Electroless Nickel	ASTM-B-733
Wash	Degrease Only

RoHS Compliant

SURFACE FINISH FOR AQUASINK/HYPERCOOL

AQUASINK - Degrease only
HYPERCOOL - Electroless nickel, degrease

SURFACE FINISH FOR FABFIN

ANODIZING

The entire family of Fabfin aluminum heatsinks can be anodized without worry of an inconsistent finish. Anodizing, by its nature, requires that hundreds of amperes of DC current be conducted through the entire heatsink body. Any resistance present in the interface (between the fin and the baseplate) would cause the fins to appear "off black" or grey once the processing is complete. This is yet another test of the interface between the fin and the baseplate which shows superior performance over alternative assembly techniques. Clip marks which show as white marks in a black anodize finish occur where the electrical contact(s) is/are made. Clip marks can be eliminated by inserting titanium screws into threaded holes in the heatsink to form the required electrical path. This process results in additional cost.

SURFACE “FINISH FREE”

“Finish Free” areas can be provided if required for electrical conductivity.

FABFIN

OPERATING RANGE

The swaging process which the entire family of Fabfin heatsinks incorporates, allows all assemblies to successfully pass the harshest environmental and physical tests. Storage and operating temperatures of -40°C to +350°C demonstrate that Fabfin heatsinks are unmatched by other less robust methods of construction.

VIBRATION

Fabfin's durability of design has been independently tested, without failure, to the following parameters. All three axis tested, swept sine wave vibration resonance search from 5-200 Hz with a sweep rate of 0.5 oct./min., Input acceleration amplitude of 0.5 g, A one hour dwell at each resonant frequency, and a twelve hour durability sweep from 5-200 Hz with 0.3 g input.

WELDING

Welding baseplates together (after the addition of fins) to increase overall width beyond 521 mm is common practice since the fin to baseplate join is unaffected by the welding process. If your finish selection is black anodize, please note that a shade of black variance exists along the weld joints.

TEMPERATURE CYCLING

To determine the reliability of the metal displacement swaging process both the FF & MF series Fabfin assemblies were tested by an independent third party laboratory. The results showed that extensive temperature cycling, from -40°C to +120°C, and one time heating to +350°C, had no adverse effect on the performance of the heatsink.

FIN PULL TESTS

A fin pull test was completed, following the temperature cycling period, on a 50 mm length of fin perpendicular to the baseplate, exceeded 900 kgs (18kg/mm) and occurred without failure of the fin to baseplate interface.

MF & AF FABFIN

Specify blind holes wherever possible in the mounting surface. It should be recognized that some streaking may occur at the plugged holes and as such cosmetic requirements must be specified at time of RFQ.

DF & FF FABFIN

Specify that through holes are acceptable in the mounting surface to eliminate the need to plug holes when finishing. It should be recognized that deburring between the fins may leave minor scratches near the through holes and as such cosmetic requirements must be specified at time of RFQ.

Who is R-Theta Thermal Solutions Inc. ?

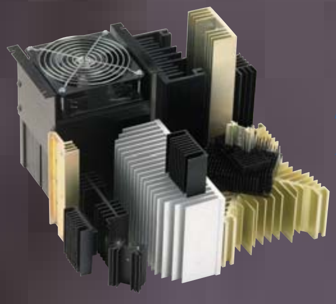
Since 1981, R-theta strives to be the best by being "easy to do business with".Starting with developing lines of communication, R-Theta Works diligently with all of its customers to understand specific needs and requirements.From our headquarters, we conduct collaborative work with customers to ensure design solutions for even the most complex of applications. In addition R-Theta has established partners in China and is able to provide high volume low cost parts.

As a heatsink solutions provider, R-Theta offers innovative products to many chosen markets, including telecommunications, computers, industrial control, power conversion, transportation, medical and aerospace.

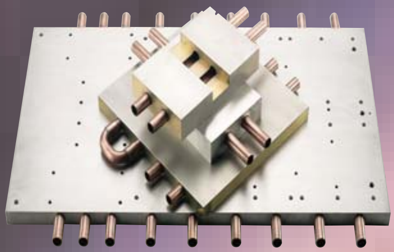
We have invested significantly in the information technology via the internet. A thermal designer can now utilize the internet as a means of bringing the R-Theta design tools to their desktop on-line. The user can define the proper cooling solution for semi-conductors by specifying and modeling an R-theta heatsink solution on-line. If futher assistance is required our Thermal Applications engineering staff are just a call away.

Once you have refined your solution we can offer support for your prototype needs. Depending on the complexity most prototypes can be shipped within days to your location.

At R-Theta Thermal Solutions Inc. we are committed to making our customers successful through our mission - to "deliver defect free services, on demand".



NAVIGATOR



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www.r-theta.com

6220 Kestrel Rd., Mississauga, ON CANADA L5T 1Y9
voice 905.795.0077 fax 905.795.2508 toll free 1.800.388.5428 website www.r-theta.com