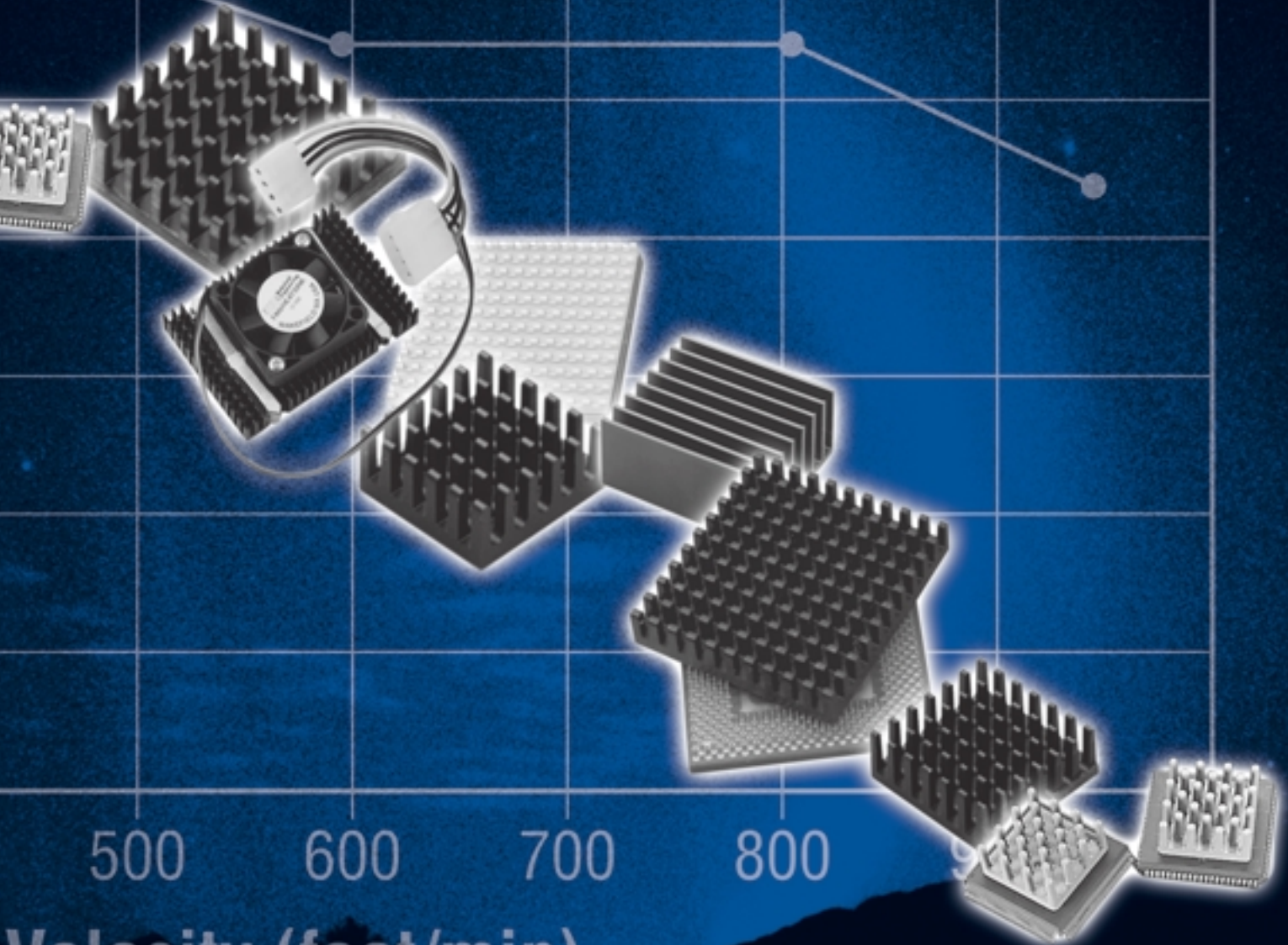




*"Thermal Management Solutions and Aluminum Extrusions since 1957"*

# THERMAL MANAGEMENT SOLUTIONS FOR BGAs

DESIGN • ANALYSIS • FABRICATION



500

600

700

800

Velocity (feet/min)



## INTRODUCTION

This short form catalog features Wakefield Thermal Solutions' product offering for BGAs, Super BGAs, PBGAs and FPBGAs. Applications include Network routers and switches, high resolution printers, digital cameras, video games, digital video disk (DVD) and global positioning systems (GPS).

A full line catalog is also available. To receive your copy, please contact your local sales representative, our corporate headquarters, email us at [info@wakefield.com](mailto:info@wakefield.com), or visit us on the web at [www.wakefield.com](http://www.wakefield.com).

## ABOUT WAKEFIELD THERMAL SOLUTIONS

Thermal Management Solutions for Electronics

- Leadership in design
- Applications Engineering and sales support worldwide
- Aggressive implementation of world-class manufacturing concepts

Wakefield is recognized as the worldwide leader in innovative thermal management solutions for a diverse range of commercial, industrial, and military markets.

Nearly half a century of heat transfer design, analysis, manufacture, and fabrication expertise of components, systems, and assemblies is now joined with an aggressive commitment to customer support, product designs, and engineering services.

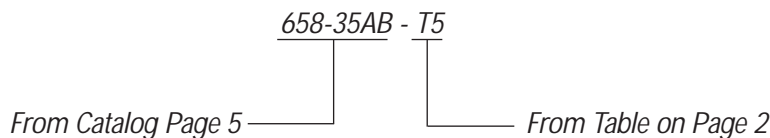
Wakefield Engineering offers components and system level thermal management solutions for utilization in business equipment, computers, consumer electronics, automotive, industrial controls, instrumentation, integrated circuits, medical, laser, power conversion, telecommunications, transportation, and welding applications.

## ORDERING INFORMATION

Once you have chosen heat sink and thermal interface material that meets your thermal & mechanical requirements it is easy to designate the part number. Simply add the interface material suffix (from the table on page 3) to the base part number for the heat sink. The base part number already includes information regarding its size and finish.

Example:

To Order the 658 Series heat sink at .350" tall with the T5 thermal interface material, specify part number:



Wakefield Thermal Solutions believes that information provided in this product catalog is accurate as of publication date. Product testing for proper performance in customer applications is recommended for all component designs and adhesives. Obtain mechanical samples of all assembly components and test to determine suitability. The physical properties reported herein are representative of performance values obtained by standard predictive and testing methods and typically exclude the interface resistance of any adhesive or other interface material in heat sink data. Wakefield Thermal Solutions is a manufacturer of heat dissipation products and reserves the right to make changes to its products without notice to improve the design or performance characteristics. All trademarks and tradenames used in this publication are for identification purposes only and may be trademarks of their respective companies. All specifications subject to change without notice.



## THERMAL INTERFACE MATERIAL PART NUMBER GUIDE

All of the heat sinks shown in this brochure are available with any of the following thermal tape and interface materials, pre-applied at the factory. Use the "T" series, thermally enhanced, pressure sensitive adhesives to attach the heat sink to the electronic package and provide a good thermal link to the heat sink. The "S" series interface materials have adhesives on only one side, for pre-attachment to the heat sink, and provide superior thermal performance. Specify these materials in applications where the heat sink will be fixed to the electronic package by some mechanical means other than a tape. Please note that none of these materials are for use in applications requiring electrical isolation from the electronic device.

Note: To obtain the estimated thermal resistance of the interface material in your application, divide the thermal impedance value by the area of the pad in square inches. For example, a 2" x 2" piece of T4 has a resistance of  $1.10 \text{ C-in}^2/\text{W} \div 4 \text{ in}^2 = 0.275 \text{ C/W}$

### "T" SERIES THERMALLY ENHANCED PRESSURE SENSITIVE ADHESIVES

Suffix	Manufacturer Product	Thermal Impedance C-in <sup>2</sup> /W	Thickness, Inches	Package Surface, Comments
-T1	Chomerics, T405	0.47	0.006	Metal/ceramic; aluminum carrier
-T2	Adhesives Research, 8223	0.25	0.005	Metal/ceramic; very good thermal performance
-T3	Chomerics, T412	0.25	0.009	Metal/ceramic; very good performance and conformity
-T4	Chomerics, T410	1.10	0.007	Plastic
-T5	Chomerics, T411	1.00	0.011	Plastic; conforms to out-of-flat packages
-T6	3M, 8810	0.88	0.010	Metal/ceramic; very good adhesion and conformity
-T7	Bergquist, BP 108	1.28	0.008	Metal/ceramic; electrically insulating

## THERMAL INTERFACE MATERIAL PART NUMBER GUIDE

P/N	T1	T2	T3	T4	T5	T6	T7
602-100AB					▲		
604-40AB					▲		
604-60AB					▲		
605-75AB					▲		
606-77AB							
607-65AB					▲		
609-100AB	See Page 11						
609-50B							
610-35AB					▲		
610-40AB					▲		
611-80AB							▲
612-65AB							▲
613-50AB							▲
614-100AB					▲		
614-30AB					▲		
614-50AB					▲		
615-41AB							
616-80AB					▲		
617-80AB							▲
618-100AB					▲		
618-20AB					▲		
619-95AB							

P/N	T1	T2	T3	T4	T5	T6	T7
620-24AB					▲		
622-80AB							▲
624-25AB	▲	▲	▲	▲			
624-35AB	▲	▲	▲	▲			
624-45AB	▲	▲	▲	▲			
624-60AB	▲	▲	▲	▲			
625-25AB	▲	▲	▲	▲			
625-35AB	▲	▲	▲	▲			
625-45AB	▲	▲	▲	▲			
625-60AB	▲	▲	▲	▲			
628-20AB							
628-25AB							
628-35AB							
628-40AB		▲	▲				
628-65AB	▲						
630-25AB							
630-35AB							
630-45AB							
630-60AB							
642-25AB	▲	▲	▲	▲			
642-35AB	▲	▲	▲	▲			
642-45AB	▲	▲	▲	▲			

P/N	T1	T2	T3	T4	T5	T6	T7
642-60AB	▲	▲	▲	▲			
643-35AB	▲	▲	▲	▲			
655-26AB	▲						
655-53AB							
658-25AB	▲	▲	▲	▲			
658-35AB		▲	▲	▲			
658-45AB	▲	▲		▲			
658-60AB	▲	▲	▲	▲			
659-65AB	▲	▲					
660-29AB							
663-35AB							
698-100AB							
698-40AB							
698-65AB							
698-80AB							
798-100AB	▲						
798-40AB							
798-65AB							
798-80AB							
D10650-40							
D10850-40		▲					
D20850-40			▲				



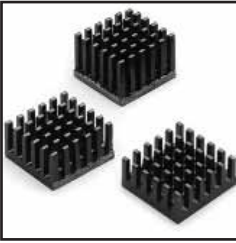
## BGA THERMAL SOLUTIONS MATRIX

The following table represents Wakefield's recommendations for a variety of standard BGA sizes. However, this is by no means a complete list of components that can be used with these heat sinks. To determine suitability for your particular component, request a BGA heat sink evaluation kit.

BGA Sizes (mm)	Heat Sink Footprint (mm)	Heat Sink Height (inches)	Recommended Series #	Attachment Method
17	17 x 17	.40	D10650	Adhesive
19	19 x 19	1.00	602	Adhesive
21	21 x 21	.40	D10850/D20850	Adhesive
21	21 x 21	.25 .35 .45 .60	624	Adhesive
23	22 x 22	.40 .60	604	Adhesive
23	22 x 22	.75	605	Adhesive
25	25 x 25	.25 .35 .45 .60	625	Adhesive
27	28 x 28	.25 .35 .45 .60	658	Adhesive
29	30 x 30	.77	606	Adhesive
31	31 x 28	.65	607	Adhesive
31	31 x 31	.80	611	Adhesive
33	32 x 32	.35 .40	610	Adhesive
35	35 x 35	.65	612	Adhesive
35	35 x 35	.25 .35 .45 .60	642	Adhesive
35	35 x 35	.25 .35 .45 .60	630	Adhesive
37.5	37 x 37	.50	613	Adhesive
37.5	37 x 37	.65	659	Adhesive
45.7 x 35.5	37 x 47	.80	617	Adhesive
40	38 x 38	.30 .50 1.00	614	Adhesive
37.5	38 x 38	.29	660	Adhesive
40	40 x 28	.35	643	Clip
40	40 x 40	.26 .53	655	Adhesive
42.5	41 x 41	.41	615	Adhesive
45	43 x 43	.20 .25 .35 .45 .60	628	Adhesive
45	43 x 43	.15	662	Adhesive
47.5	47 x 47	.80	616	Adhesive
50	50 x 50	.40 .65 .80 1.00	698	Adhesive
50	51 x 51	.20 1.00	618	Adhesive
50	52 x 51	.80	622	Adhesive
50	53 x 47	.40 .65 .80 1.00	798	Adhesive
50	64 x 51	.24	620	Adhesive
up to 45	73 x 50	.50 1.00	609	Clip
up to 45	73 x 50	.95	619	Clip



## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs



### 624 SERIES Omnidirectional Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. Sq.	Fin Height "A" in. (mm)	Typical Applications	Weight lbs. (grams)
624-25AB	.827 (21)	.250 (6.4)	21mm BGA	.009 (4.09)
624-35AB	.827 (21)	.350 (8.9)	21mm BGA	.011 (4.99)
624-45AB	.827 (21)	.450 (11.4)	21mm BGA	.015 (6.81)
624-60AB	.827 (21)	.600 (15.2)	21mm BGA	.026 (11.80)

Material: Aluminum, Black Anodized

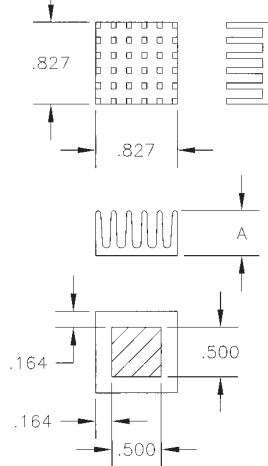
The 624 Series is an omnidirectional pin fin heat sink for both natural and forced-convection applications.

Applications include network routers and switches, high-resolution printers, digital cameras, consumer video games, digital video disks (DVD) and global positioning systems (GPS).

#### PRODUCT FEATURES

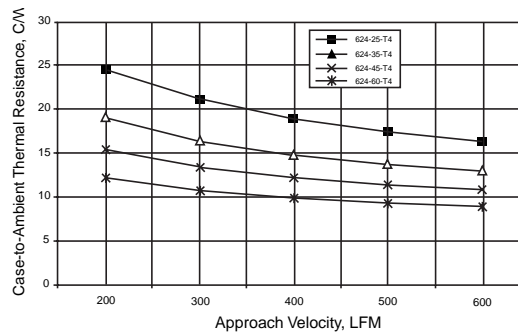
- Available in four standard heights, .25 inch, .35 inch, .45 inch, and .60 inch.
- Available with pressure sensitive adhesives for quick and easy mounting. See Page 2

#### MECHANICAL DIMENSIONS

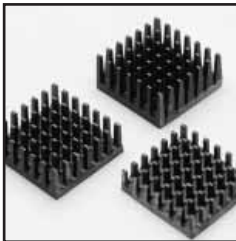


#### 624 SERIES

#### 624 THERMAL PERFORMANCE



Dimensions: in.



### 625 SERIES Omnidirectional Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. Sq.	Fin Height "A" in. (mm)	Typical Applications	Weight lbs. (grams)
625-25AB ▲	.984 (25)	0.250 (6.4)	25 mm BGA	.012 (5.45)
625-35AB ▲	.984 (25)	0.350 (8.9)	25 mm BGA	.014 (6.36)
625-45AB ▲	.984 (25)	0.450 (11.4)	25 mm BGA	.018 (8.17)
625-60AB ▲	.984 (25)	0.600 (15.2)	25 mm BGA	.030 (13.62)

Material: Aluminum, Black Anodized

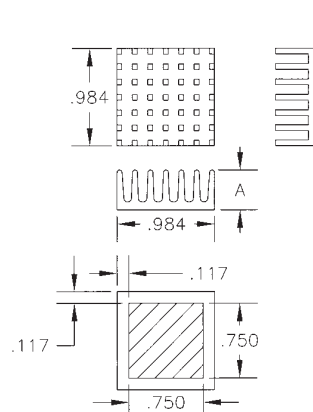
The 625 Series is an omnidirectional pin fin heat sink for both natural and forced-convection applications.

Applications include network routers and switches, high-resolution printers, digital cameras, consumer video games, digital video disks (DVD) and global positioning systems (GPS).

#### PRODUCT FEATURES

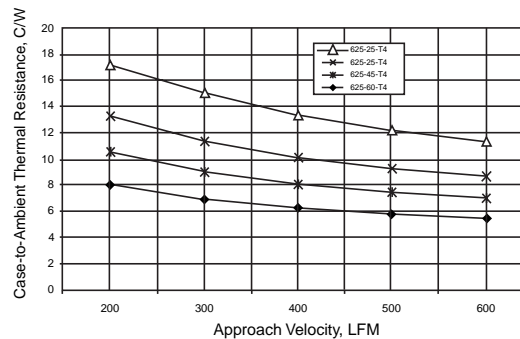
- Available in four standard heights, .25 inch, .35 inch, .45 inch, and .60 inch.
- Available with pressure sensitive adhesives for quick and easy mounting. See Page 2

#### MECHANICAL DIMENSIONS



#### 625 SERIES

#### 625 THERMAL PERFORMANCE



Dimensions: in.



**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

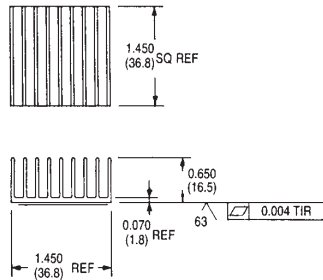


**659 SERIES Unidirectional Fin Heat Sink for BGAs**

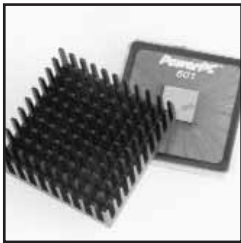
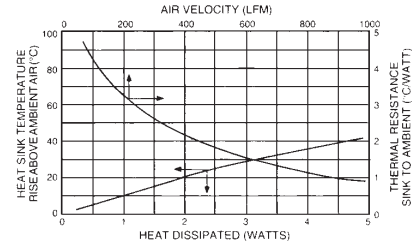
Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Application	Heat Sink Finish	Weight lbs. (grams)
659-65AB ▲	1.45 (36.8) sq	0.650 (16.5)	37mm BGA	Black Anodized	0.050 (22.68)

Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**



**NATURAL AND FORCED CONVECTION CHARACTERISTICS**

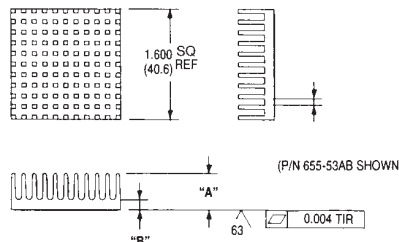


**655 SERIES Omnidirectional Pin Fin Heat Sink for BGAs and PowerPC™**

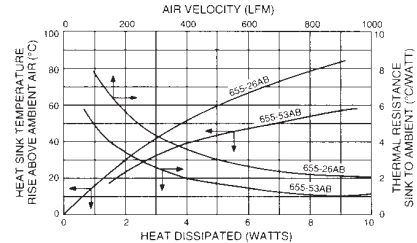
Standard P/N	Base Dimensions in. (mm)	Dimension "A" in. (mm)	Dimension "B" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
655-26AB ▲	1.600 (40.6) sq	0.260 (6.6)	0.125 (3.2)	40mm BGA	Black Anodized	0.038 (17.01)
655-53AB ▲	1.600 (40.6) sq	0.525 (13.3)	0.145 (3.7)	40mm BGA	Black Anodized	0.050 (22.68)

Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**



**NATURAL AND FORCED CONVECTION CHARACTERISTICS**

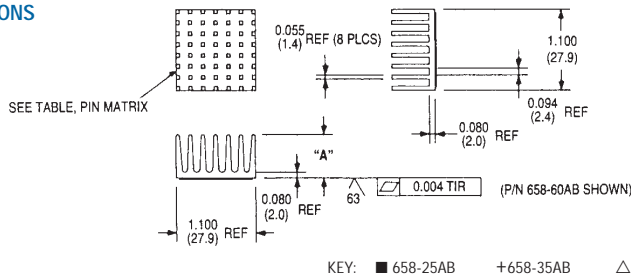


**658 SERIES Omnidirectional Pin Fin Heat Sink for BGAs and PowerPC™**

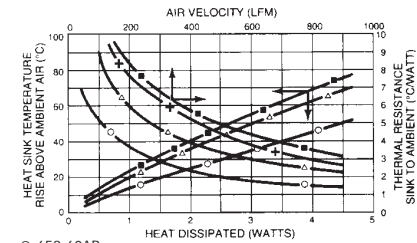
Standard P/N	Base Dimensions in. (mm)	Dimension "A" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
658-25AB ▲	1.100 (27.9) sq	0.250 (6.4)	27mm BGA	Black Anodized	0.013 (5.67)
658-35AB ▲	1.100 (27.9) sq	0.350 (8.9)	27mm BGA	Black Anodized	0.015 (6.70)
658-45AB ▲	1.100 (27.9) sq	0.450 (11.4)	27mm BGA	Black Anodized	0.019 (8.50)
658-60AB ▲	1.100 (27.9) sq	0.600 (15.2)	27mm BGA	Black Anodized	0.031 (14.17)

Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**



**NATURAL AND FORCED CONVECTION CHARACTERISTICS**





**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

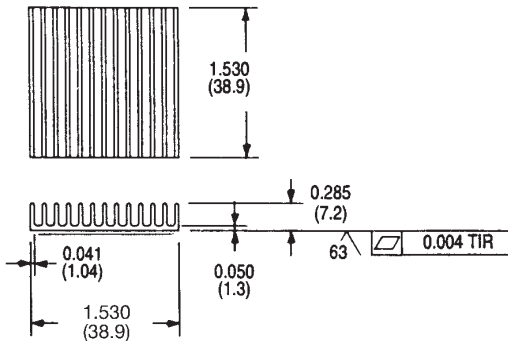


**660 SERIES Unidirectional Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Application	Heat Sink Finish	Weight lbs. (grams)
660-29AB ▲	1.530SQ. (38.9)SQ.	0.285 (7.2)	37mm BGA	Black Anodized	0.031 (14.17)

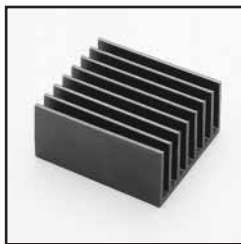
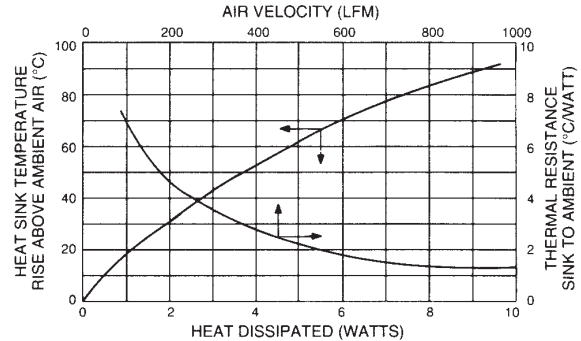
Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**



Dimensions: in. (mm)

**NATURAL AND FORCED CONVECTION CHARACTERISTICS**



**642 SERIES Unidirectional Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in. Sq.	Fin Height "A" in. (mm)	Typical Applications	Weight lbs. (grams)
642-25AB ▲	1.378 (35)	.250 (6.4)	35 mm BGA	.022 (9.99)
642-35AB ▲	1.378 (35)	.350 (8.9)	35 mm BGA	.027 (12.26)
642-45AB ▲	1.378 (35)	.450 (11.4)	35 mm BGA	.031 (14.07)
642-60AB ▲	1.378 (35)	.600 (15.2)	35 mm BGA	.039 (17.71)

Material: Aluminum, Black Anodized

The 642 Series is an unidirectional pin fin heat sink for both natural and forced-convection applications.

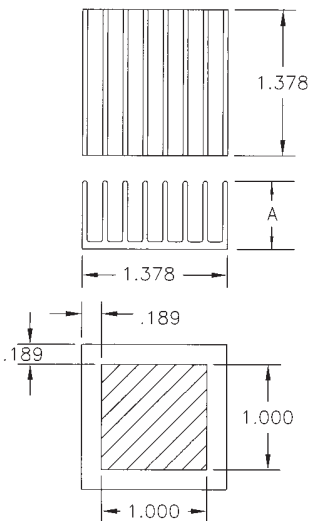
Applications include network routers and switches, high-resolution printers, digital cameras, consumer video games, digital video disks (DVD) and global positioning systems (GPS).

**PRODUCT FEATURES**

- Available in four standard heights, .25 inch, .35 inch, .45 inch, and .60 inch.
- Available with pressure sensitive adhesives for quick and easy mounting. See Page 2

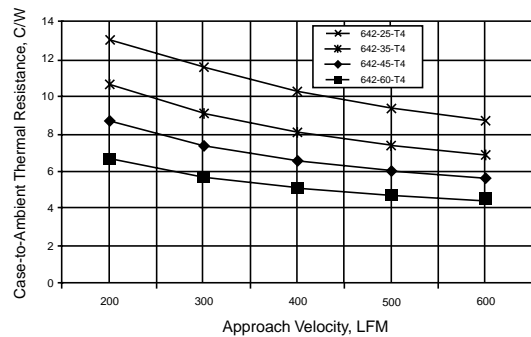
**MECHANICAL DIMENSIONS**

**642 SERIES**



Dimensions: in. (mm)

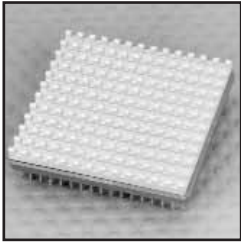
**642 THERMAL PERFORMANCE**



Performance shown is with T4 thermal adhesive applied.



**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**



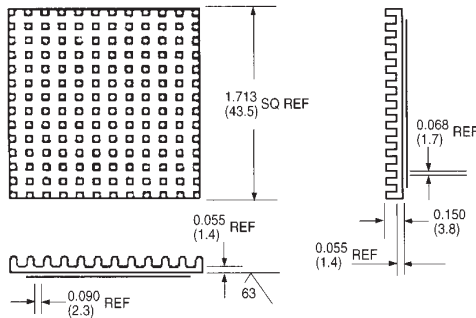
**662 SERIES** Omnidirectional Pin Fin Heat Sink for Limited Height BGAs

Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
662-15AG	1.713 (43.5) sq	0.150 (3.8)	45mm BGA	Gold Iridite	0.019 (8.50)
662-15AB	1.713 (43.5) sq	0.150 (3.8)	45mm BGA	Black Anodized	0.019 (8.50)

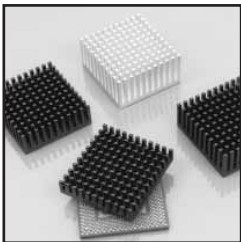
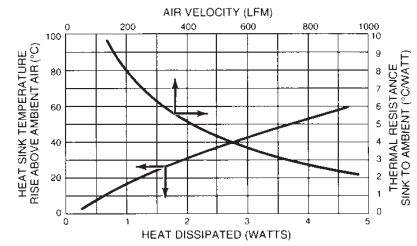
Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**

12 x 14 PINS



**NATURAL AND FORCED CONVECTION CHARACTERISTICS**



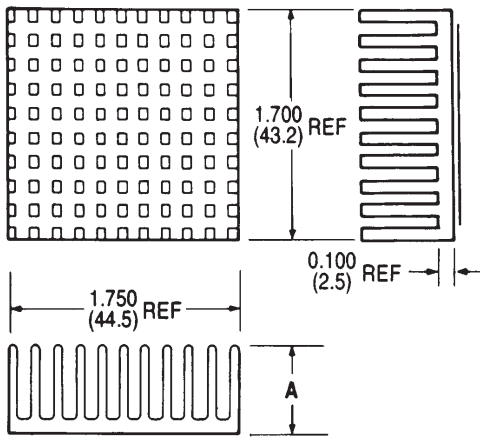
**628 SERIES** Omnidirectional Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. (mm)	Dimensions "A" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
628-20AB	1.750 (44.5) x 1.700 (43.2)	0.200 (5.1)	45mm BGA	Black Anodized	0.031 (14.17)
628-25AB	1.750 (44.5) x 1.700 (43.2)	0.250 (6.4)	45mm BGA	Black Anodized	0.038 (17.01)
628-35AB	1.750 (44.5) x 1.700 (43.2)	0.350 (8.9)	45mm BGA	Black Anodized	0.044 (19.84)
628-40AB ▲	1.750 (44.5) x 1.700 (43.2)	0.400 (10.2)	45mm BGA	Black Anodized	0.050 (22.68)
628-65AB ▲	1.750 (44.5) x 1.700 (43.2)	0.650 (16.5)	45mm BGA	Black Anodized	0.056 (25.51)

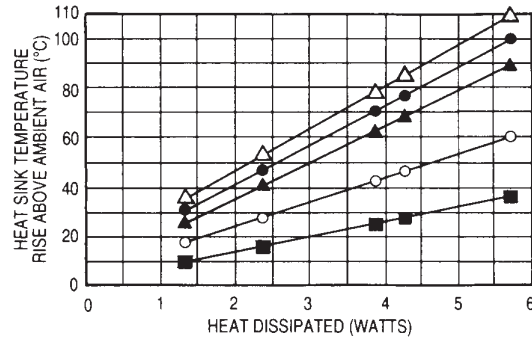
Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

**MECHANICAL DIMENSIONS**

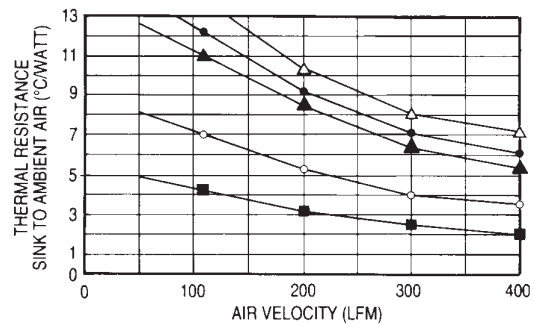
11 x 10 PINS



**NATURAL CONVECTION CHARACTERISTICS**



**FORCED CONVECTION CHARACTERISTICS**

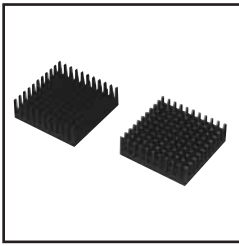


KEY: △ 628-20AB ● 628-25AB ▲ 628-35AB ○ 628-40AB ■ 628-65AB





## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs



### 630 SERIES Omnidirectional Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. Sq.	Fin Height "A" in. (mm)	Typical Applications	Weight lbs. (grams)
630-25AB	1.378 (35)	.250 (6.4)	35mm BGA	.009 (4.09)
630-35AB	1.378 (35)	.350 (8.9)	35mm BGA	.011 (4.99)
630-45AB	1.378 (35)	.450 (11.4)	35mm BGA	.015 (6.81)
630-60AB	1.378 (35)	.600 (15.2)	35mm BGA	.026 (11.80)

Material: Aluminum, Black Anodized

The 630 Series is an omnidirectional pin fin heat sink for both natural and forced-convection applications.

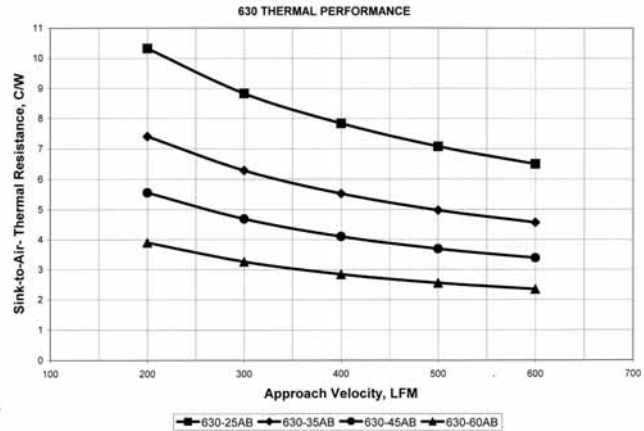
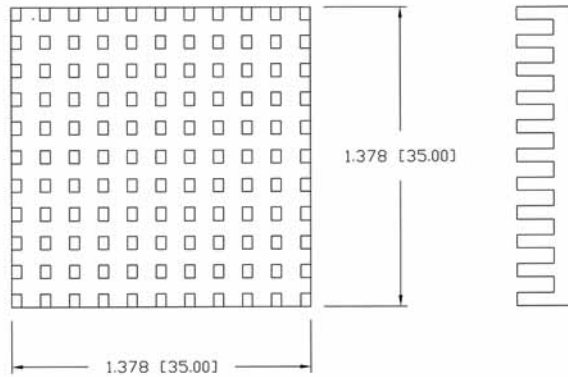
Applications include network routers and switches, high-resolution printers, digital cameras, consumer video games, digital video disks (DVD) and global positioning systems (GPS).

#### PRODUCT FEATURES

- Available in four standard heights, .25 inch, .35 inch, .45 inch, and .60 inch.
- Available with pressure sensitive adhesives for quick and easy mounting. See Page 2

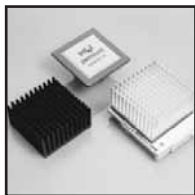
#### MECHANICAL DIMENSIONS

#### 630 SERIES



Dimensions: in.

## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs

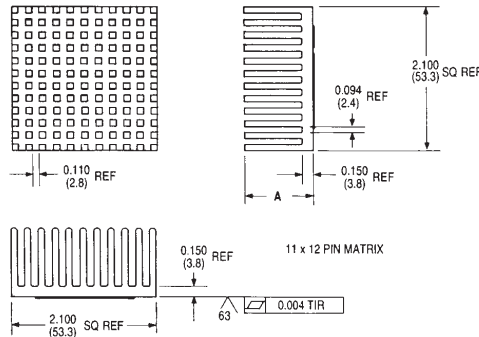


### 698 SERIES Omnidirectional Pin Fin Heat Sink For BGAs

Standard P/N	Base Dimensions in. (mm)	Dimensions "A" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
698-40AB	2.100 (53.3) sq.	0.400 (10.2) sq.	45mm BGA	Black Anodized	0.075 (34.02)
698-65AB	2.100 (53.3) sq.	0.650 (16.5) sq.	45mm BGA	Black Anodized	0.119 (53.86)
698-80AB	2.100 (53.3) sq.	0.800 (20.3) sq.	45mm BGA	Black Anodized	0.125 (56.70)
698-100AB ▲	2.100 (53.3) sq.	1.000 (25.4) sq.	45mm BGA	Black Anodized	0.144 (65.20)

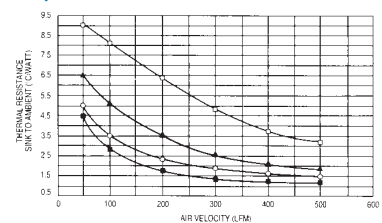
Notes: 1. Optional factory preapplied pressure-sensitive adhesive. See Page 2

#### MECHANICAL DIMENSIONS



Dimensions: in. (mm)

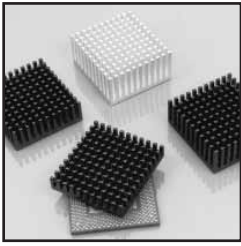
#### FORCED CONVECTION THERMAL PERFORMANCE DATA (FLOW PARALLEL TO EXTRUSION DIRECTION)



KEY: □ 698-40AB ▲ 698-65AB ○ 698-80AB ◆ 698-100AB



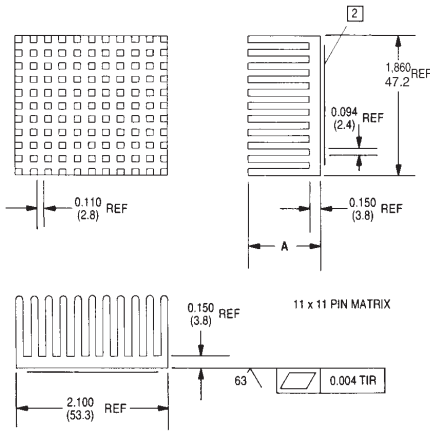
# PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs



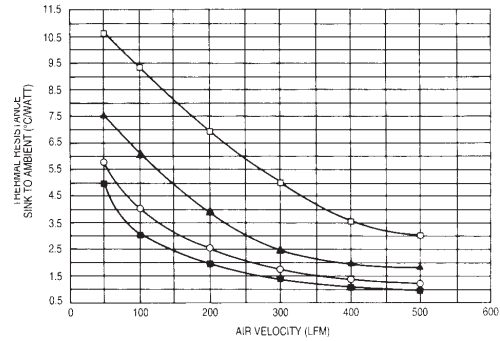
**798 SERIES** Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. (mm)	Dimensions "A" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
798-40AB	2.100 (53.3) x 1.860 (47.2)	0.400 (10.2)	45mm BGA	Black Anodized	0.063 (28.35)
798-65AB	2.100 (53.3) x 1.860 (47.2)	0.650 (16.5)	45mm BGA	Black Anodized	0.106 (48.19)
798-80AB	2.100 (53.3) x 1.860 (47.2)	0.800 (20.3)	45mm BGA	Black Anodized	0.113 (51.03)
798-100AB ▲	2.100 (53.3) x 1.860 (47.2)	1.000 (25.4)	45mm BGA	Black Anodized	0.131 (59.53)

## MECHANICAL DIMENSIONS



## FORCED CONVECTION THERMAL PERFORMANCE DATA (FLOW PARALLEL TO EXTRUSION DIRECTION)

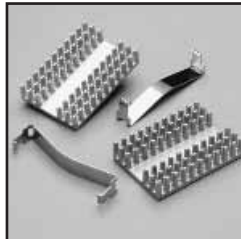


KEY: □ 798-40AB ▲ 798-65AB ○ 798-80AB ■ 798-100AB

### Notes:

1. Heat sink mounting surface flatness: 0.004" TIR
2. Optional factory preapplied pressure-sensitive adhesive. See Page 2

Dimensions: in. (mm)



**643 SERIES** Omnidirectional Pin Fin Heat Sink for BGAs

Standard P/N	Base Dimensions in. (mm)	Fin Height in. (mm)	Typical Applications	Weight lbs. (grams)
643-35AP ▲	1.60 (40.64) x 1.10 (27.94)	0.350 (8.89)	40 mm BGA	.070 (31.78)

Material: Aluminum, Plain Finish

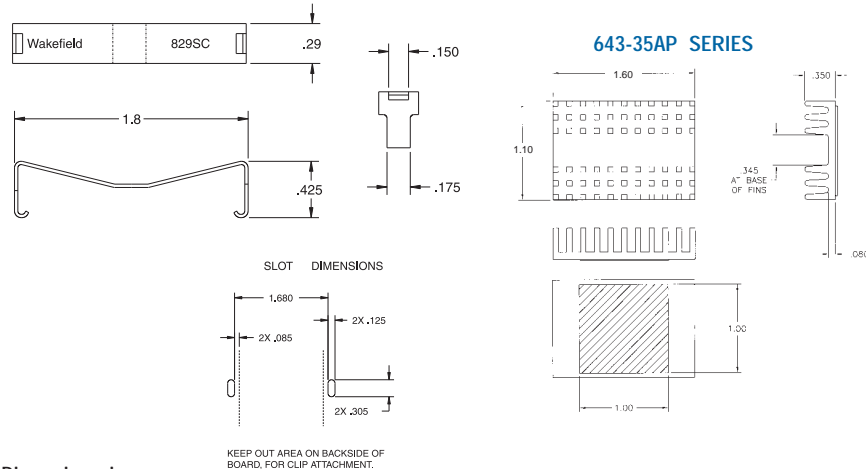
The Series 643-35AP is an omnidirectional pin fin heat sink for both natural and forced-convection applications designed to fit a 40 mm BGA.

Applications include network routers and switches, high-resolution printers, digital cameras, consumer video games, digital video disks (DVD) and global positioning systems (GPS).

## PRODUCT FEATURES

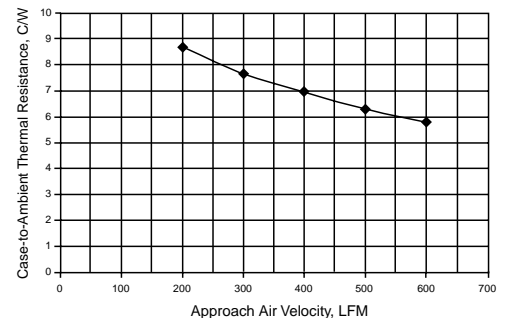
- Available with pressure sensitive adhesives to ensure good thermal performance. See Pages 2 and 3
- Can be ordered with the 829SC clip. Order clip separately. (Clip cannot be purchased without heat sink)

## MECHANICAL DIMENSIONS



Dimensions: in.

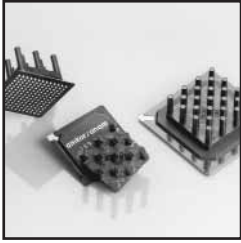
## 643 THERMAL PERFORMANCE



Performance shown is with S5 interface material applied.



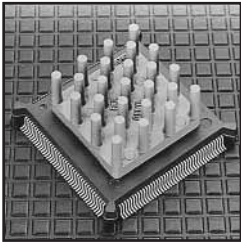
## DELTEM™ COMPOSITE HEAT SINKS FOR BGAs



**Deltem™ D10650-40 Pin Fin Heat Sink**

Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Weight lbs. (grams)
D10650-40 ▲	0.650 (16.5) sq	0.400 (10.2)	0.013 (5.67)

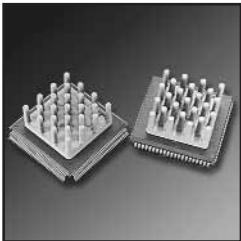
Notes: Available with pressure sensitive adhesives for quick and easy mounting. See Page 2



**Deltem™ D10850-40 Pin Fin Heat Sink**

Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Applications	Weight lbs. (grams)
D10850-40 ▲	0.850 (21.6) sq	0.400 (10.2)	21mm BGA	0.019 (8.50)

Notes: Available with pressure sensitive adhesives for quick and easy mounting. See Page 2



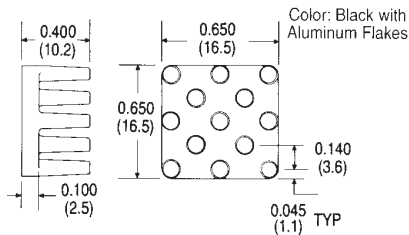
**Deltem™ II D20850-40 Pin Fin Heat Sink**

Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Applications	Weight lbs. (grams)
D20850-40 ▲	0.850 (21.6) sq	0.400 (10.2)	21mm BGA	0.019 (8.5)

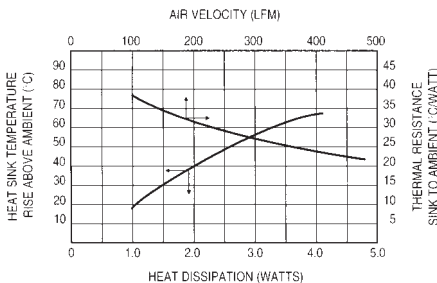
Notes: Available with pressure sensitive adhesives for quick and easy mounting. See Page 2

### MECHANICAL DIMENSIONS

#### DELTEM™ D10650-40 PIN FIN HEAT SINK

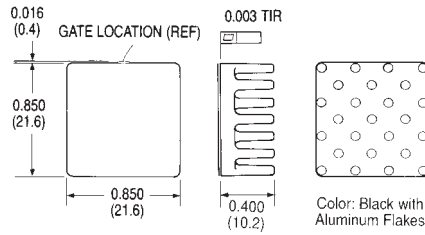


#### NATURAL AND FORCED CONVECTION CHARACTERISTICS

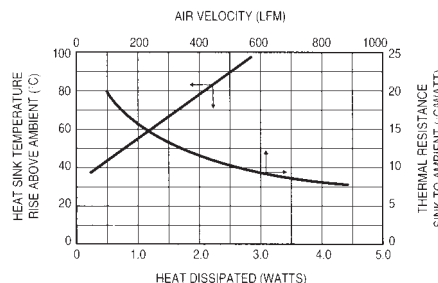


Dimensions: in. (mm)

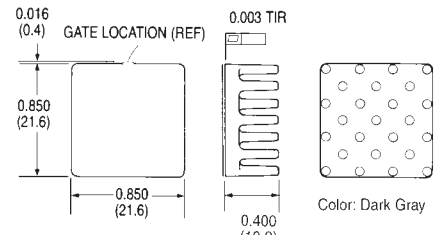
#### DELTEM™ D10850-40 PIN FIN HEAT SINK



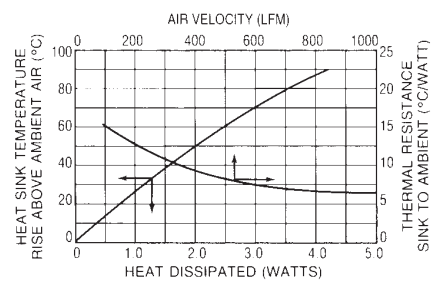
#### NATURAL AND FORCED CONVECTION CHARACTERISTICS



#### DELTEM™ II D20850-40 PIN FIN HEAT SINK

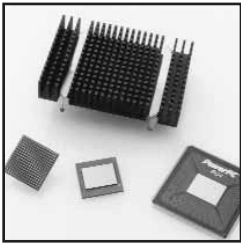


#### NATURAL AND FORCED CONVECTION CHARACTERISTICS





## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs

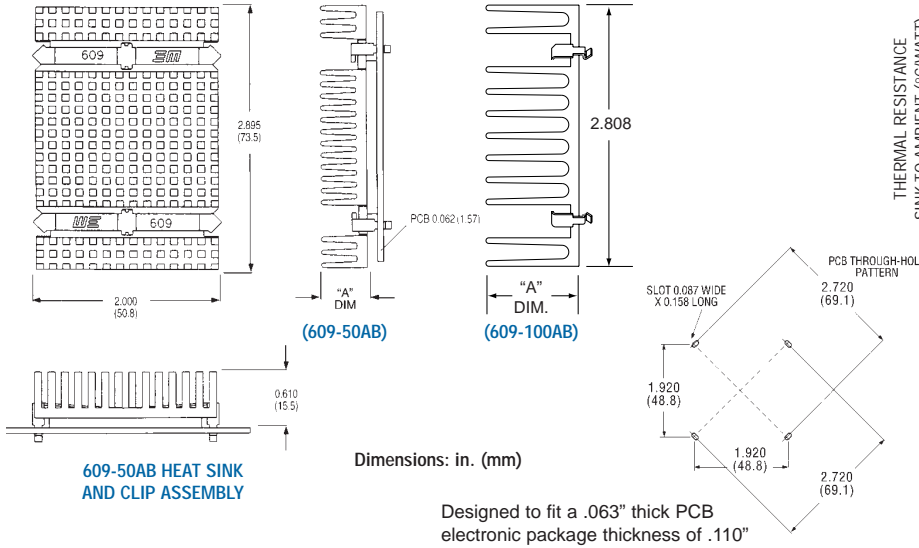


### 609 SERIES Pin Fin Heat Sink/Clip Assembly for BGAs and PowerPC™ Packages

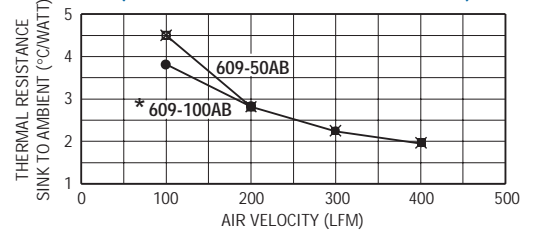
Standard P/N	Base Dimensions in. (mm)	Dimensions "A" in. (mm)	Typical Applications	Heat Sink Finish	Weight lbs. (grams)
609-50AB	2.895 (73.5) x 2.000 (50.8)	0.500 (12.7)	40&45mm BGA	Black Anodized	0.094 (42.5)
609-100AB	2.808 (71.32) x 1.700 (43.2)	1.00 (25.4)	40&45mm BGA	Black Anodized	0.130 (59.0)

Note: Optional factory preapplied thermal interface material.  
S3 (Bergquist Q-Pad 3, 0.14 °C in<sup>2</sup>/w)  
S4 (Bergquist Softface, 0.07 °C in<sup>2</sup>/w)

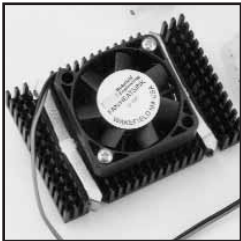
#### MECHANICAL DIMENSIONS



#### FORCED CONVECTION THERMAL PERFORMANCE DATA (FLOW PARALLEL TO EXTRUSION DIRECTION)



\*Performance is for shrouded conditions. 609-100 will perform better than 609-50 in cases with bypass.



### 619 SERIES Fan Heat Sink for BGA and PowerPC™ Packages

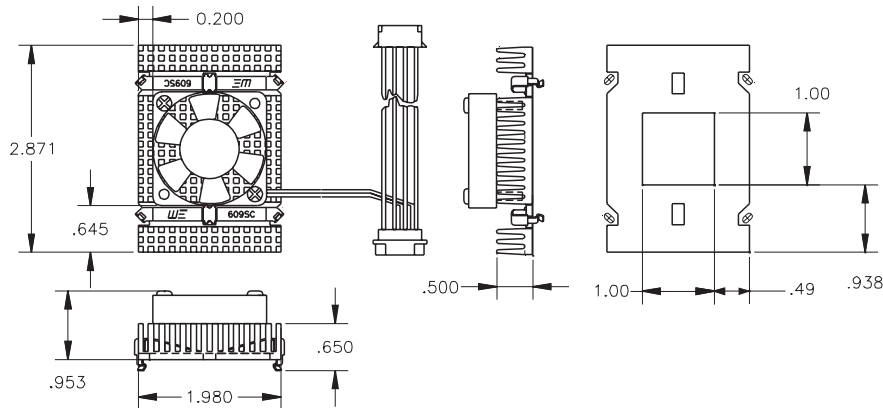
Standard P/N	Base Dimensions in. (mm)	Height in. (mm)	Typical Applications	Heat Sink Finish	Thermal Performance	Weight lbs. (grams)
61995AB124D1	2.871 (72.92) x 1.98 (50.29)	0.953 (24.21)	40&45mm BGA	Black Anodized	1.2° C/W	.150 (68.10)
61995AB054D1	2.871 (72.92) x 1.98 (50.29)	0.953 (24.21)	40&45mm BGA	Black Anodized	1.2° C/W	.150 (68.10)

Note: Optional factory preapplied thermal interface material. See 609 series.

#### FEATURES AND BENEFITS:

- Captivated clips for ease of assembly
- Impingement air flow
- Low acoustic noise
- Accommodates BGA packages up to 45 mm in size

#### MECHANICAL DIMENSIONS





**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**



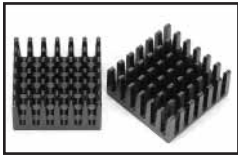
**602 SERIES Unidirectional Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
602-100AP	.750" (19.1) sq	1.000" (25.4)	Plain	.021 (9.59)

Material: Aluminum, Plain Finish

**MECHANICAL DIMENSIONS**

**602 THERMAL PERFORMANCE**



**604 SERIES Omnidirectional Pin Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
604-40AB	.850" (21.6) sq	.400" (10.2)	Black Anodized	.012 (5.60)
604-60AB	.850" (21.6) sq	.600" (15.2)	Black Anodized	.016 (7.47)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**

**604 THERMAL PERFORMANCE**



## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs



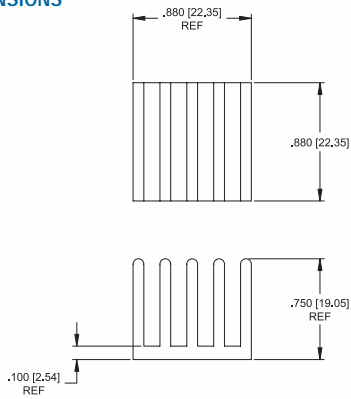
605 SERIES

Unidirectional Fin Heat Sink for BGAs

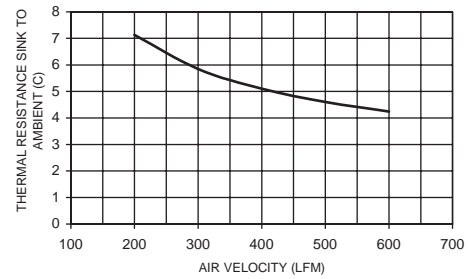
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
605-75AB	.880" (22.4) sq	.750" (19.1)	Black Anodized	.030 (13.5)

Material: Aluminum, Black Anodized

MECHANICAL DIMENSIONS



605 THERMAL PERFORMANCE



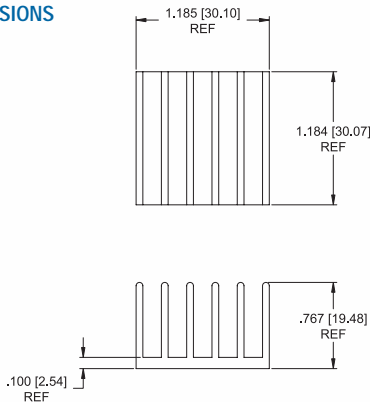
606 SERIES

Unidirectional Fin Heat Sink for BGAs

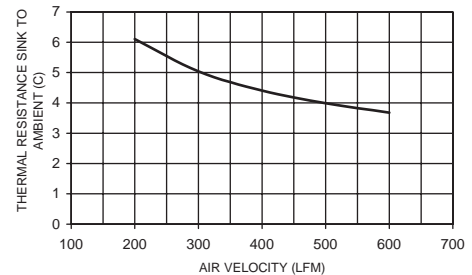
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
606-77AB	1.185" (30.1) sq	.767" (19.5)	Black Anodized	.041 (18.7)

Material: Aluminum, Black Anodized

MECHANICAL DIMENSIONS



606 THERMAL PERFORMANCE





**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

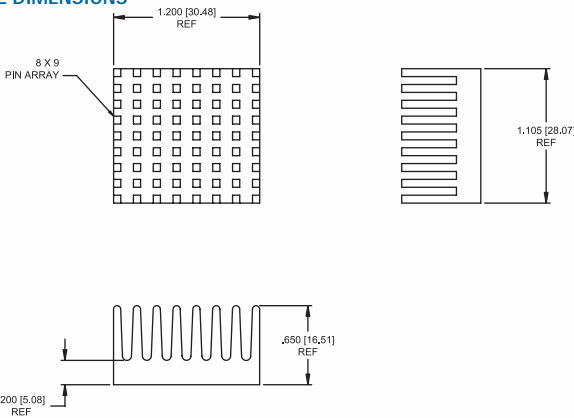


**607 SERIES Omnidirectional Pin Fin Heat Sink for BGAs**

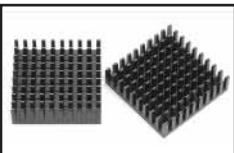
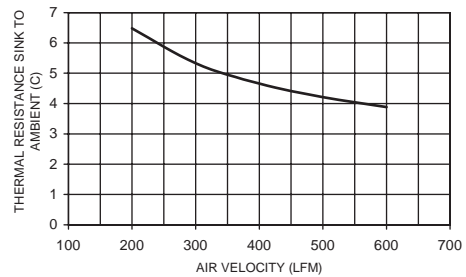
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
607-65AB	1.200" (30.5) x 1.105" (28.1)	.650" (16.5)	Black Anodized	.041 (18.7)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**607 THERMAL PERFORMANCE**

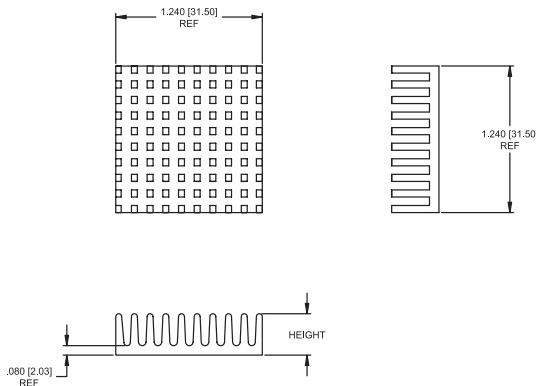


**610 SERIES Omnidirectional Pin Fin Heat Sink for BGAs**

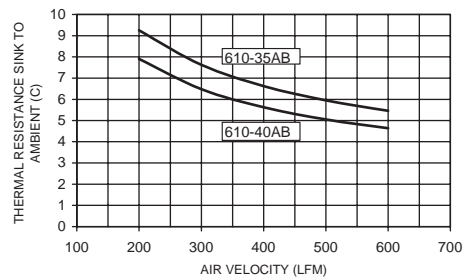
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
610-35AB	1.240" (31.5) sq	.350" (8.9)	Black Anodized	.022 (10.0)
610-40AB	1.240" (31.5) sq	.400" (10.2)	Black Anodized	.024 (10.8)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**

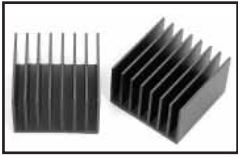


**610 THERMAL PERFORMANCE**





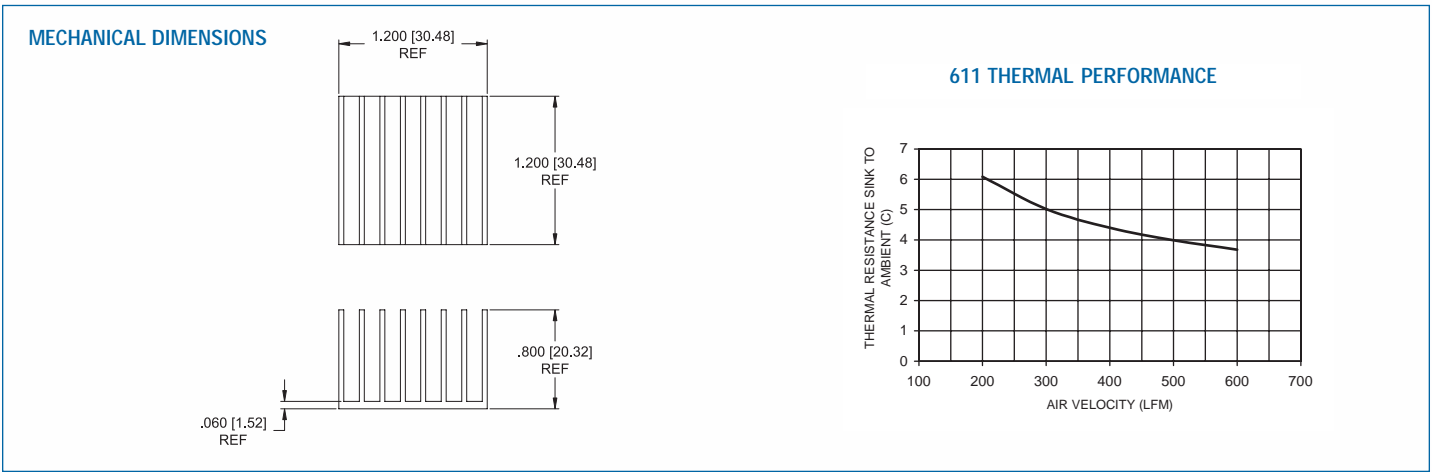
**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**



**611 SERIES Unidirectional Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
611-80AB	1.200" (30.5) sq	.800" (20.3)	Black Anodized	.036 (16.3)

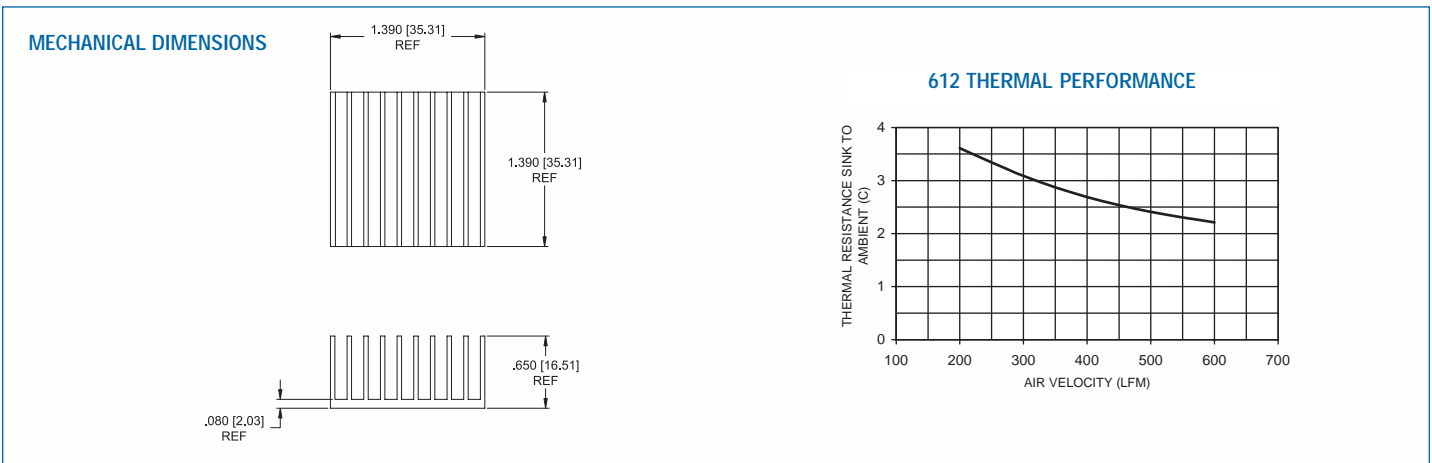
Material: Aluminum, Black Anodized



**612 SERIES Unidirectional Fin Heat Sink for BGAs**

Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
612-65AB	1.390" (35.3) sq	.650" (16.5)	Black Anodized	.054 (24.5)

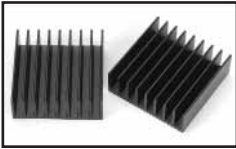
Material: Aluminum, Black Anodized







**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

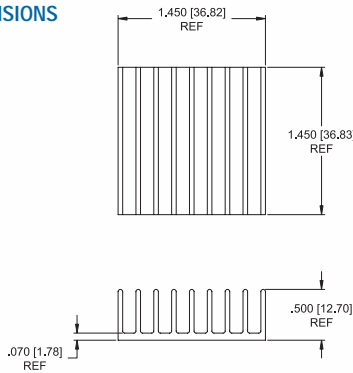


**613 SERIES Unidirectional Fin Heat Sink for BGAs**

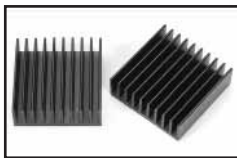
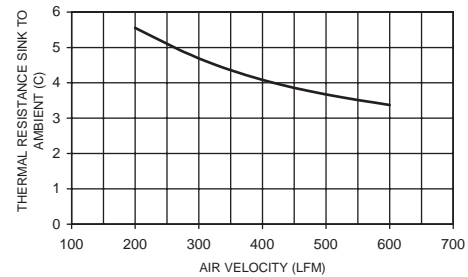
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
613-50AB	1.450" (36.8) sq	.500" (12.7)	Black Anodized	.046 (20.8)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**613 THERMAL PERFORMANCE**

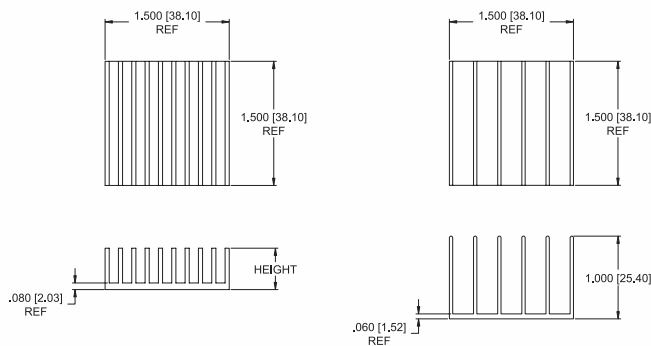


**614 SERIES Unidirectional Fin Heat Sink for BGAs**

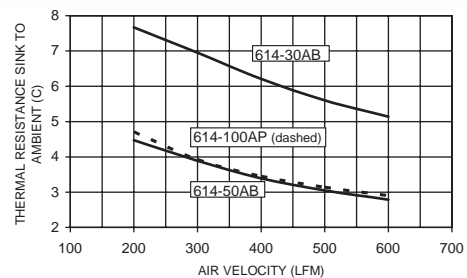
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
614-30AB	1.500" (38.1) sq	.300" (7.6)	Black Anodized	.030 (13.8)
614-50AB	1.500" (38.1) sq	.500" (12.7)	Black Anodized	.048 (21.8)
614-100AP	1.500" (38.1) sq	1.000" (25.4)	Plain	.046 (20.9)

Material: Aluminum, Black Anodize or Plain

**MECHANICAL DIMENSIONS**



**614 THERMAL PERFORMANCE**





**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

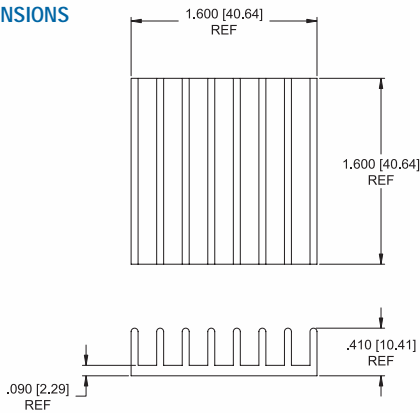


**615 SERIES**      *Unidirectional Fin Heat Sink for BGAs*

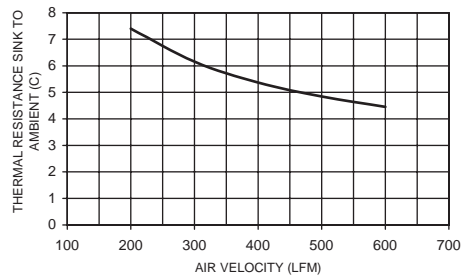
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
615-41AB	1.600" (40.6) sq	.410" (10.4)	Black Anodized	.046 (21.0)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**615 THERMAL PERFORMANCE**

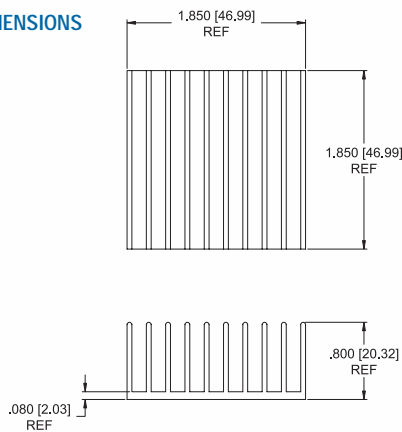


**616 SERIES**      *Unidirectional Fin Heat Sink for BGAs*

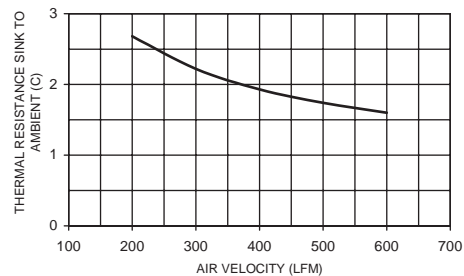
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
616-80AB	1.85" (47.0) sq	.800" (20.3)	Black Anodized	.054 (24.5)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**

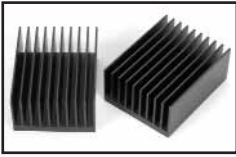


**616 THERMAL PERFORMANCE**





**PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs**

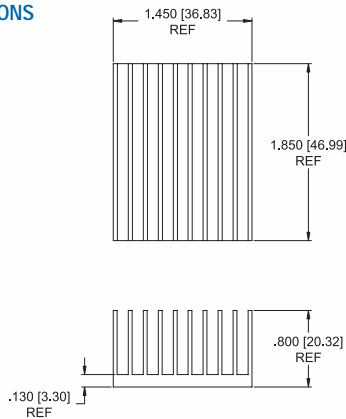


**617 SERIES Unidirectional Fin Heat Sink for BGAs**

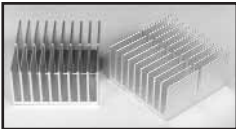
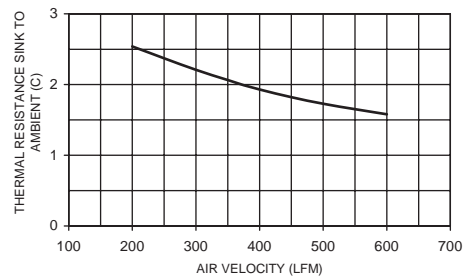
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
617-80AB	1.450" (36.8) x 1.850 (47.0)	.800" (20.3)	Black Anodized	.082 (37.2)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**617 THERMAL PERFORMANCE**

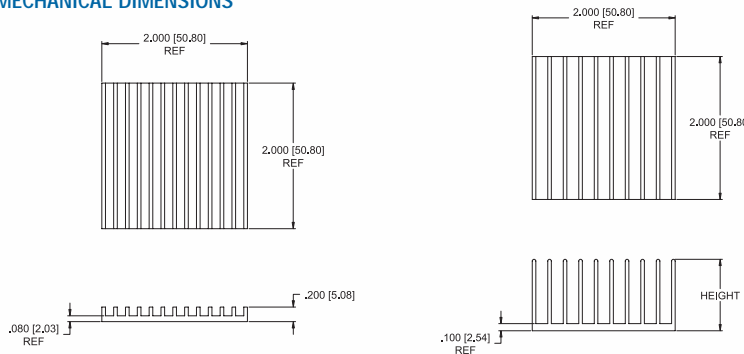


**618 SERIES Unidirectional Fin Heat Sink for BGAs**

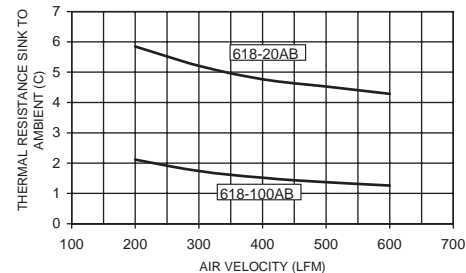
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
618-20AB	2.00" (50.8) sq	.200" (5.1)	Black Anodized	.046 (21.0)
618-100AB	2.00" (50.8) sq	1.000" (25.4)	Plain	.122 (55.5)

Material: Aluminum, Black Anodize or plain

**MECHANICAL DIMENSIONS**

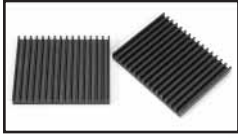


**618 THERMAL PERFORMANCE**





## PENGUIN™ COOLERS: HEAT SINKS FOR BGAs, SUPER BGAs, PBGAs, and FPBGAs

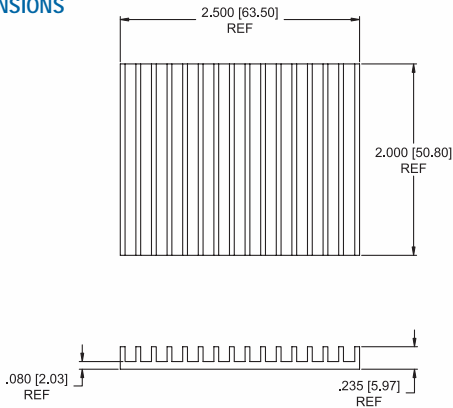


**620 SERIES** *Unidirectional Fin Heat Sink for BGAs*

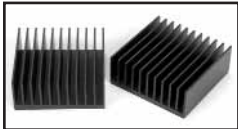
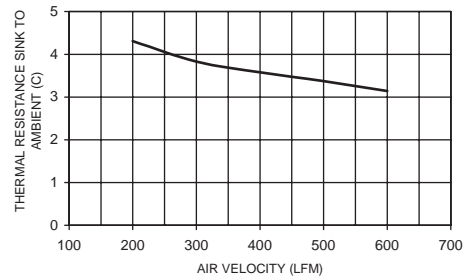
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
620-24AB	2.500" (63.5) x 2.000" (50.8)	.235" (6.0)	Black Anodized	.063 (28.6)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**620 THERMAL PERFORMANCE**

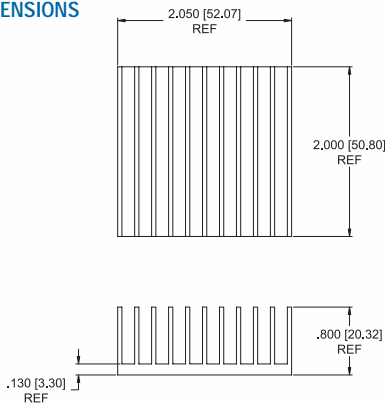


**622 SERIES** *Unidirectional Fin Heat Sink for BGAs*

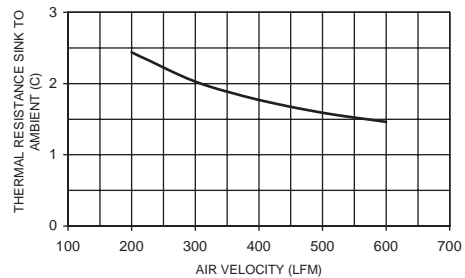
Standard P/N	Base Dimensions in.(mm)	Height in. (mm)	Heat Sink Finish	Weight lbs. (grams)
622-80AB	2.050" (52.1) x 2.000" (50.8)	.800" (20.3)	Black Anodized	.123 (56.0)

Material: Aluminum, Black Anodized

**MECHANICAL DIMENSIONS**



**622 THERMAL PERFORMANCE**





**WAKEFIELD**  
Thermal Solutions

*"Thermal Management Solutions and Aluminum Extrusions since 1957"*

Thermal Management  
Solutions for BGAs



**NOTES:**

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Please copy and complete this form, then fax or mail to:



33 Bridge Street
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Fax: (603) 635-1900

FROM: Total # pgs. being fax ed
Name
Title
Company
Division/Department Mail Stop
Address
City
State Zip Country
Telephone ( ) Fax ( )
Email
Product or project

APPLICATION INFORMATION REQUIRED:

- 1. What type of electronic device will be cooled?
2. How many of these devices will be cooled?
3. How many watts of power must be dissipated from each device and in aggregate?
Please specify: Each device Total Power
A sketch of the heat distribution on the base is attached. Yes No
A sketch of the component is also being fax ed. Yes No
4. What is the maximum allowable junction temperature of the device? °C
( See the manufacturer' s data sheet ) .
If no junction temperature has been specified, what is the maximum case temperature? °C
5. What is the thermal resistance of the semiconductor from junction to case Θj - c?
( See the manufacturer' s data sheet ) Θj - c
6. Is electrical isolation required between the device case and the heat sink?
At what voltage level?
7. What finish is required on the heat sink? Anodize Paint Chromate
Special None What color?
8. What is the maximum ambient air temperature? °C
9. What type of convection is required? Forced Natural
10. If forced convection have you chosen a fan? Yes No
Fan Manufacturer/Part Number Fan Size
Free Flow ( CFM) Static Pressure (Inches H
11. Will you shroud the air flow ( i.e. , direct the air through the heat sink) ? Yes No
If no, what is the cross-sectional size of the air space where the heat sink will be located?
Width X Height
12. How much space is available for this heat sink?
Length Width Height in. or cm
Samples needed by: Prototype completion date:
Pre-production target date: Production target date:
Rate of usage: Estimated Annual Usage ( EAU) :
Estimated program life expectancy: