



**MODEL LIST - HPB (36-72 INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPB3.3S	36-72	3.3	1.82	18.18	60	72	1.5	2	1.5
HPB5S		5	2.00	20.00	100	75	1	1.5	1.5
HPB5.2S		5.2	1.92	19.23	100	75	1	1.5	1.5
HPB9S		9	1.67	16.67	150	80	1	1.5	1
HPB12S		12	1.25	12.50	150	82	0.75	1.25	1
HPB15S		15	1.00	10.00	150	83	0.75	1.25	1
HPB24S		24	0.63	6.25	150	84	0.75	1	1
HPB28S		28	0.54	5.36	150	85	0.5	0.75	0.5
HPB48S		48	0.31	3.13	150	84	0.5	0.75	0.5
HPB100S		100	0.15	1.50	150	84	0.5	0.75	0.5

**DUAL OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPB5D	36-72	5	1.00	10.00	50	75	1	1.5	1.5
HPB9D		9	0.83	8.33	75	80	1	1.5	1
HPB12D		12	0.63	6.25	75	82	0.75	1.25	1
HPB15D		15	0.50	5.00	75	83	0.75	1.25	1
HPB24D		24	0.31	3.13	75	84	0.75	1	1
HPB28D		28	0.27	2.68	75	85	0.75	0.75	0.75
HPB48D		48	0.16	1.56	75	84	0.75	0.75	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: Dual output loads must be balanced.

**MODEL LIST - HPC (100-180V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation 10-100% [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPC3.3S	100-180	3.3	2.27	22.73	75	71	1.25	1.5	1.5
HPC5S		5	2.00	20.00	100	76	1	1.25	1.5
HPC5.2S		5.2	1.92	19.23	100	76	1	1.25	1.5
HPC9S		9	1.67	16.67	150	80	1	1.25	1
HPC12S		12	1.67	16.67	200	83	0.75	1	1
HPC15S		15	1.33	13.33	200	84	0.75	1	1
HPC24S		24	0.83	8.33	200	86	0.5	0.75	0.75
HPC28S		28	0.71	7.14	200	86	0.5	0.75	0.75
HPC48S		48	0.42	4.17	200	86	0.5	0.5	0.5
HPC100S		100	0.15	1.50	150	85	0.5	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation 10-100% [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPC5D	100-180	5	1.00	10.00	50	76	1	1.25	1.5
HPC9D		9	0.83	8.33	75	80	1	1.25	1
HPC12D		12	0.63	6.25	75	83	0.75	1	1
HPC15D		15	0.50	5.00	75	84	0.75	1	1
HPC24D		24	0.31	3.13	75	86	0.75	0.75	0.75
HPC28D		28	0.27	2.68	75	86	0.5	0.75	0.75
HPC48D		48	0.16	1.56	75	85	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: Dual output loads must be balanced.

**MODEL LIST - HPD (200-380V INPUT RANGE)****SINGLE OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage [VDC]	Output Current		Output Power [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPD3.3S	200-380	3.3	2.27	22.73	75	73	1.25	1.5	1.5
HPD5S		5	2.00	20.00	100	77	1	1.25	1.5
HPD5.2S		5.2	1.92	19.23	100	77	1	1.25	1.5
HPD9S		9	1.67	16.67	150	80	1	1.25	1
HPD12S		12	1.67	16.67	200	82	0.75	1	1
HPD15S		15	1.33	13.33	200	83	0.75	1	1
HPD24S		24	0.83	8.33	200	85	0.5	0.75	0.75
HPD28S		28	0.71	7.14	200	86	0.5	0.5	0.75
HPD48S		48	0.42	4.17	200	86	0.5	0.5	0.5
HPD100S		100	0.15	1.50	150	85	0.5	0.5	0.5

**DUAL OUTPUT**

Pico Part Number	Input Voltage Range	Output Voltage Per Output [VDC]	Output Current Per Output		Output Power Per Output <sup>(4)</sup> [W]	Efficiency <sup>(2)</sup> [%] typ.	Line Regulation [±%] max	Load Regulation [±%] max	Output Voltage Tolerance <sup>(2)</sup> [±%]
			Min. <sup>(1)</sup> [A]	Max. [A]					
HPD5D	200-380	5	1.00	10.00	50	77	1	1.25	1.5
HPD9D		9	0.83	8.33	75	80	1	1.25	1
HPD12D		12	0.63	6.25	75	82	0.75	1	1
HPD15D		15	0.50	5.00	75	83	0.75	1	1
HPD24D		24	0.31	3.13	75	85	0.75	0.75	0.75
HPD28D		28	0.27	2.68	75	86	0.5	0.75	0.75
HPD48D		48	0.16	1.56	75	86	0.5	0.5	0.5

Note 1: Maintain minimum 10% of rated load to prevent a voltage surge.

Note 2: Tested at nominal input voltage and full output load.

Note 3: Dual output loads must be balanced.

**SPECIFICATIONS (Nominal  $V_{IN}$ , Full Load,  $T_A = +25^\circ\text{C}$ , 1 hour warm up unless otherwise specified)****INPUT**

Parameter	Condition	Min.	Typ.	Max.	Units
Input Voltage Range	HPB models	36	48	72	VDC
	HPC models	100	150	180	
	HPD models	200	300	380	

**OUTPUT**

Parameter	Condition	Min.	Typ.	Max.	Units
Output Ripple	1MHz bandwidth	-	-	50	mVp-p

**ENVIRONMENTAL**

Parameter	Condition	Min.	Typ.	Max.	Units
Operating Temperature Range	Baseplate	0	-	+85	$^\circ\text{C}$
Storage Temperature Range		-55	-	+105	$^\circ\text{C}$
Cooling	Conduction through baseplate				

**GENERAL**

Parameter	Condition	Min.	Typ.	Max.	Units
Operating Frequency		-	100	-	kHz
Isolation Voltage	Input to output	4242	-	-	VDC
	Input to baseplate	2121	-	-	
	Output to baseplate	1000	-	-	
Insulation Resistance		100	-	-	$\text{M}\Omega$
Size	L x W x H	4.6 x 2.5 x 0.5 (116.84 x 63.5 x 12.7)			inches (mm)
Weight	$\leq 48\text{V}$ single output models	-	210	-	grams
	$\geq 100\text{V}$ single output models	-	220	-	
	Dual output models	-	235	-	
Case	Aluminum baseplate and Glass Reinforced Polymer				
Potting	Vacuum Impregnated Epoxy				
Tube Packaging (W x H x L)	2.595 x 1.105 x 20 (65.913 x 28.067 x 101.6)				inches (mm)

**PROTECTIONS & FEATURES**

Parameter	Condition	Min.	Typ.	Max.	Units
Input Over Voltage		Yes			
Short circuit or Overload	Hiccup mode, self-recovery	120	-	-	%
Overtemperature	Baseplate, self-recovery	Shutdown	-	95	$^\circ\text{C}$
		Restart	-	50	
Output Overvoltage	Zener diode clamp	-	120	-	%
Shutdown (SHUTDOWN)	Non-latched shutdown, Self-recovery	-	-	0.15	VDC
Output Voltage Trim (TRIM, TRIM UP & TRIM DOWN)	Trim up or trim down	-5	0	5	%
Parallel <sup>(3)</sup>	P option models	Connect as shown in connection diagram.			

Note 3: The parallel option allows units to operate the outputs in parallel to share load, increase total power or allow for N+1 redundancy.

**SPECIFICATIONS (Nominal  $V_{IN}$ , Full Load,  $T_A = +25^\circ\text{C}$ , 1 hour warm up unless otherwise specified)**

**DESIGNED TO MEET**

Test	Referenced Standard	Description
Vibration	MIL-STD-202	Method 204, Vibration, High Frequency, Condition D
Shock	MIL-STD-202	Method 213, Shock (Specified Pulse), Condition I
Humidity	MIL-STD-202	Method 106, Moisture Resistance
Altitude	MIL-STD-202	Method 105, Barometric Pressure (Reduced), Condition D

**OPTIONS AVAILABLE - CONTACT PICO FOR PART NUMBER**

Parameter	Referenced Standard	Description
Stabilization Bake	MIL-STD-883	Referenced Method 1008 Non-operating maximum storage temperature for 24 hours
Temperature Cycle	MIL-STD-883	Referenced Method 1010 Non-operating at temperature extremes, 15 mins/temp, 10 cycles
Burn-In	MIL-STD-883	Referenced Method 1015 Max operating temperature for 160 hours
Expanded Operating Temperature Range		-55°C to +85°C

**THERMAL RESISTANCE**

$$P_{OUT} = \frac{T_C - T_A}{T_{RCA} \times (1 / \eta - 1)}$$

$P_{OUT}$  = Output Power in Watts

$\eta$  = Efficiency

$T_C$  = Case temperature in °C

$T_A$  = Ambient temperature in °C

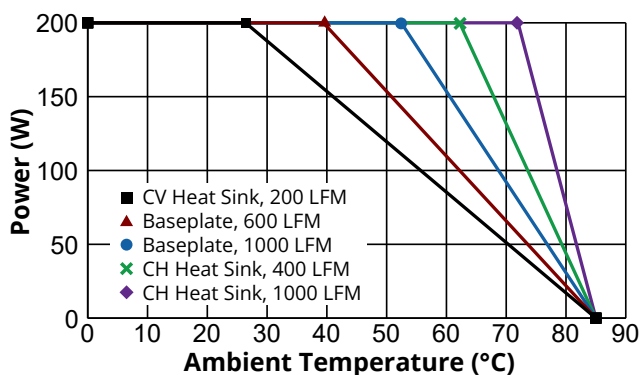
$T_{RCA}$  = Thermal resistance of case to air in °C / W

**Thermal resistance of case ( $T_{RCA}$ )**

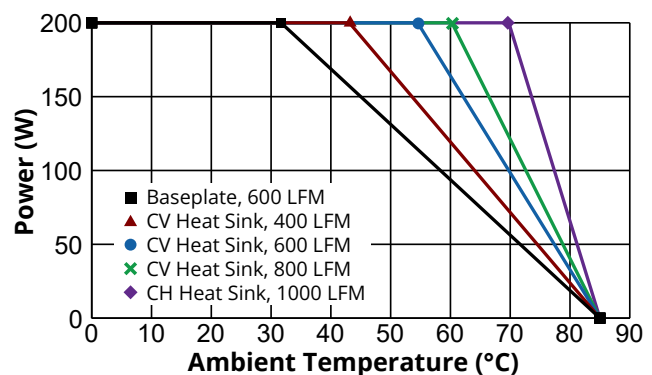
Airflow	Baseplate only	CV Heat Sink	CH Heat Sink	Units
Free Air	5.1	3.5	3.0	°C / W
200 LFM	2.8	1.8	1	
400 LFM	1.8	1.1	0.7	
600 LFM	1.4	0.8	0.55	
800 LFM	1.2	0.65	0.45	
1000 LFM	1	0.55	0.4	

**DERATING GRAPHS (Nominal  $V_{IN}$ , Full Load, Efficiency @ Full Load)**

**Models with Max. Output Power = 200W & Efficiency at full load = 86%**

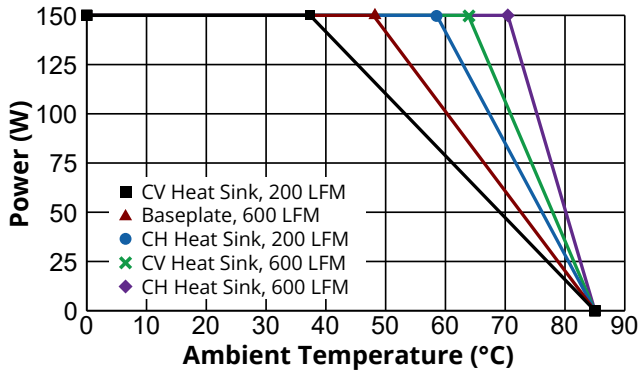


**Models with Max. Output Power = 200W & Efficiency at full load = 84%**

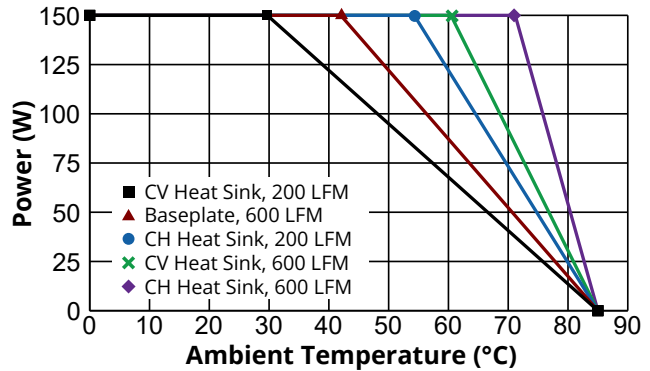


**DERATING GRAPHS (Nominal  $V_{IN}$  Full Load, Efficiency @ Full Load)**

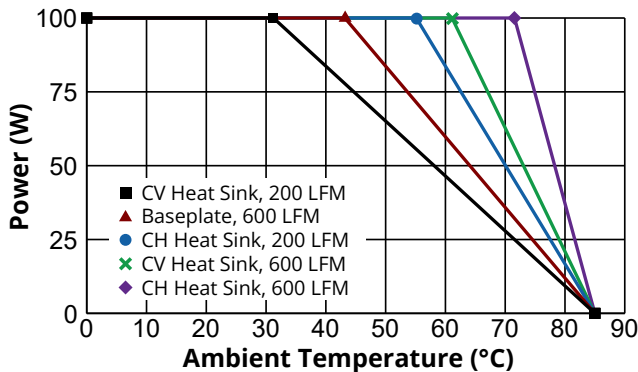
**Models with Max. Output Power = 150W  
& Efficiency at full load = 85%**



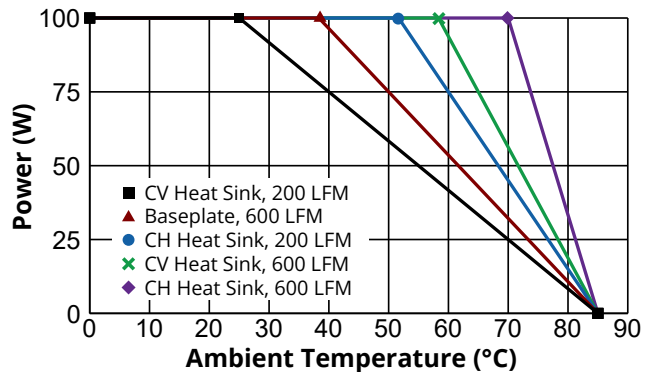
**Models with Max. Output Power = 150W  
& Efficiency at full load = 83%**



**Models with Max. Output Power = 100W  
& Efficiency at full load = 77%**

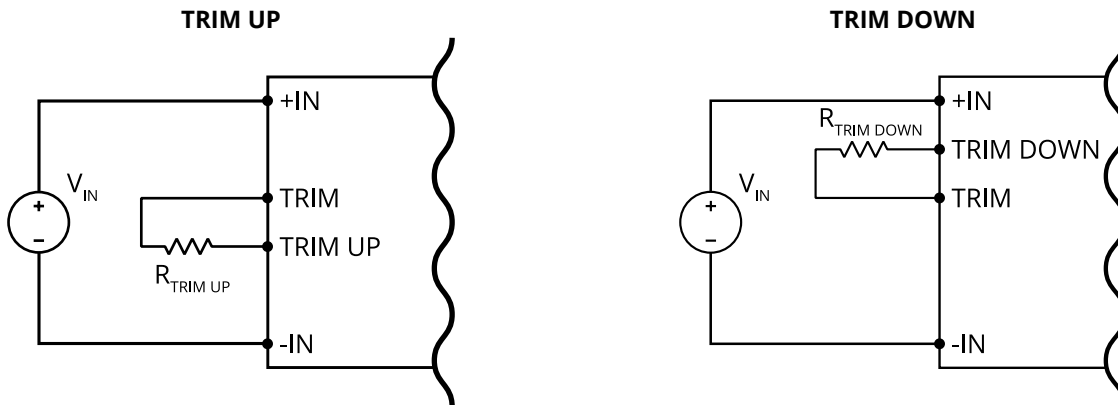


**Models with Max. Output Power = 100W  
& Efficiency at full load = 75%**



**TYPICAL CONNECTION CIRCUIT**

**TRIM**

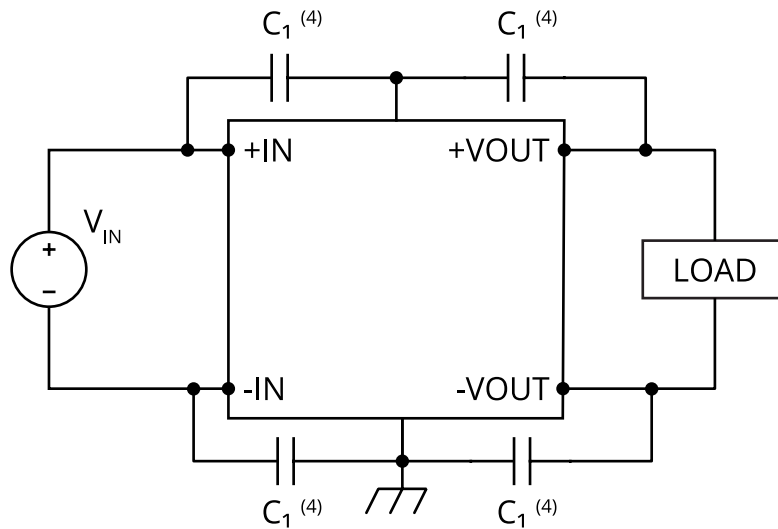


$\Delta V_{OUT}$	0	1	2	3	5	% typ.
Trim Up Resistance	Open	300	150	50	20	k $\Omega$ typ.
Trim Down Resistance	Open	1000	500	250	100	

**Note:** Each individual unit will vary slightly. It is recommended to use a 1M $\Omega$  multi-turn trimmer potentiometer to determine resistance value and achieve desired adjustment. Use minimum 1/2W power rating resistor. Keep the trim resistor leads as short as possible to eliminate the stray inductance which will effect the trimming results.

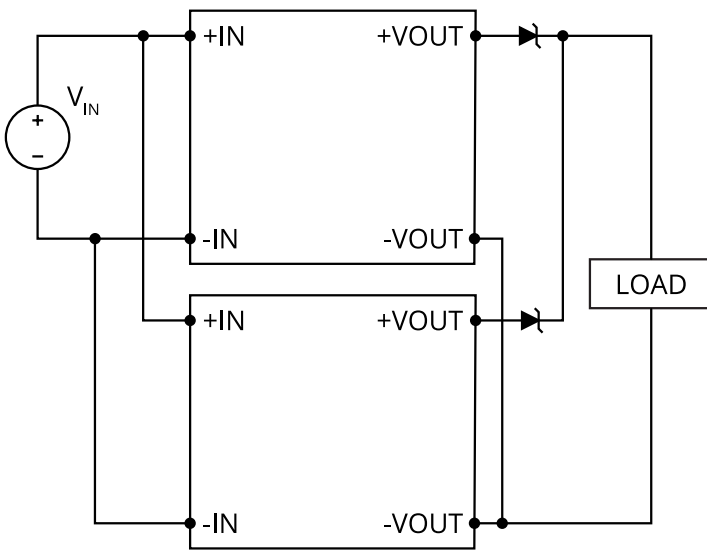
**TYPICAL CONNECTION CIRCUIT**

**NOISE REDUCTION**



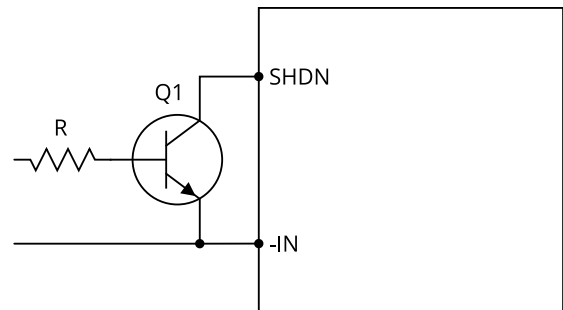
Note 4: C1 filter capacitors may reduce noise further. Please contact Pico for more details.

**PARALLEL**

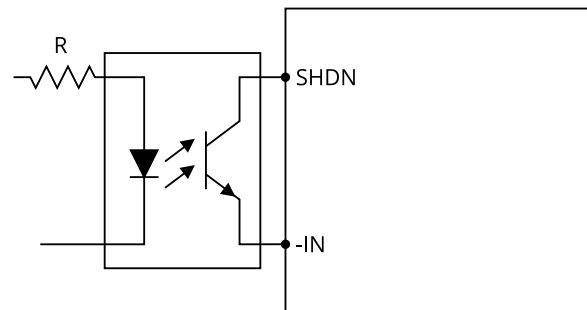


**SHUTDOWN**

**NON-ISOLATED**



**ISOLATED**

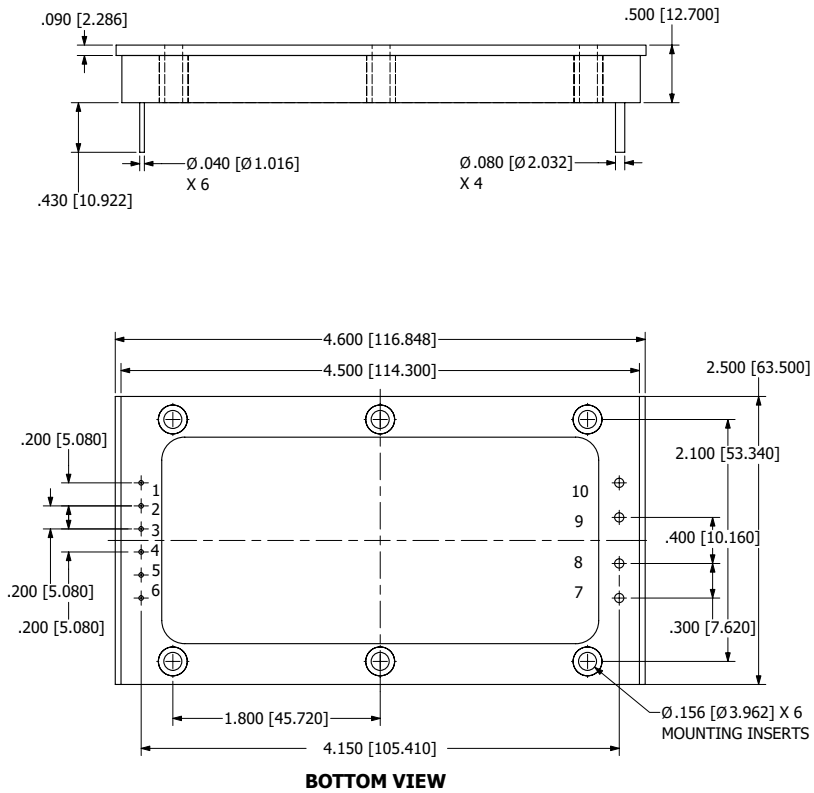






**MECHANICAL DRAWINGS**

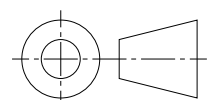
**DUAL OUTPUT MODELS**



PIN	FUNCTION	PIN DIAMETER
1	+IN	.040 [1.016]
2	TRIM DOWN	.040 [1.016]
3	TRIM	.040 [1.016]
4	TRIM UP	.040 [1.016]
5	SHUT DOWN	.040 [1.016]
6	-IN	.040 [1.016]
7	-OUT1	.080 [2.032]
8	+OUT1	.080 [2.032]
9	-OUT2	.080 [2.032]
10	+OUT2	.080 [2.032]

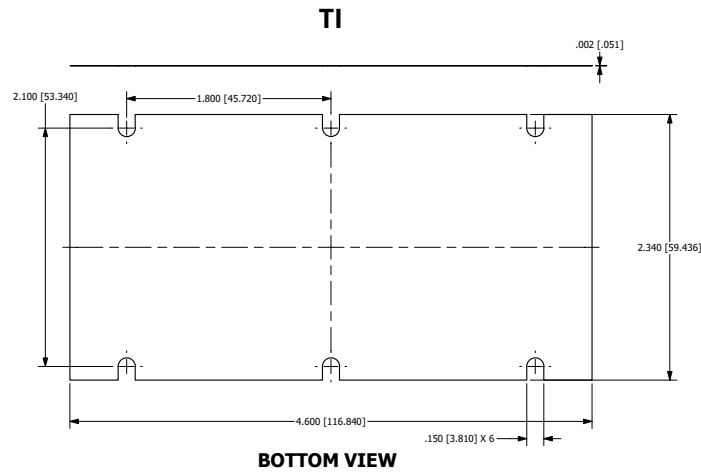
**NOTES**

- a. ALL DIMENSIONS ARE IN INCHES, [ ] = MM
- b. RECOMMENDED TORQUE FOR MOUNTING SCREWS: 6-9 INCH-LBS



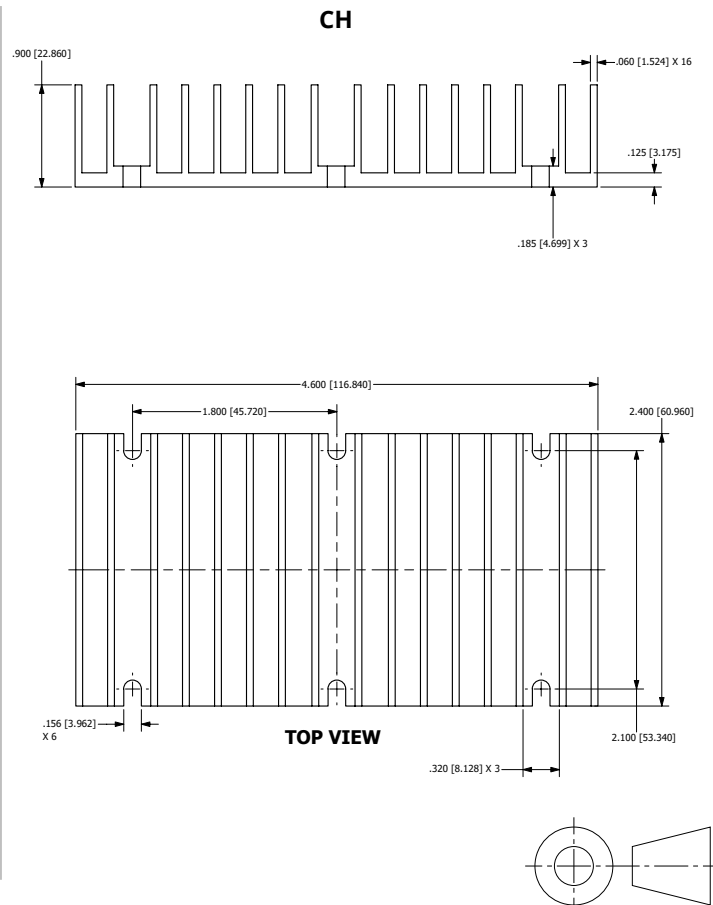
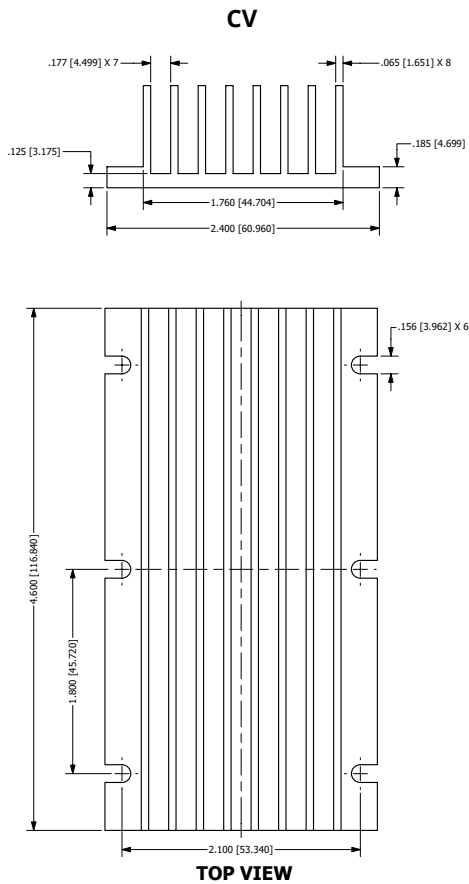
**MECHANICAL DRAWINGS**

**THERMAL INTERFACE**



Material	Alloy Aluminum Substrate
Thermal Conductivity	1530 BTU-in/hr sq.ft °F
Coefficient of Thermal Expansion, (25-100°C)	13.1 10 <sup>-6</sup> in-in/°F
Brinell Hardness	23 HB
Endurance Limit	5000 PSI
Standard Thickness	0.002 inches

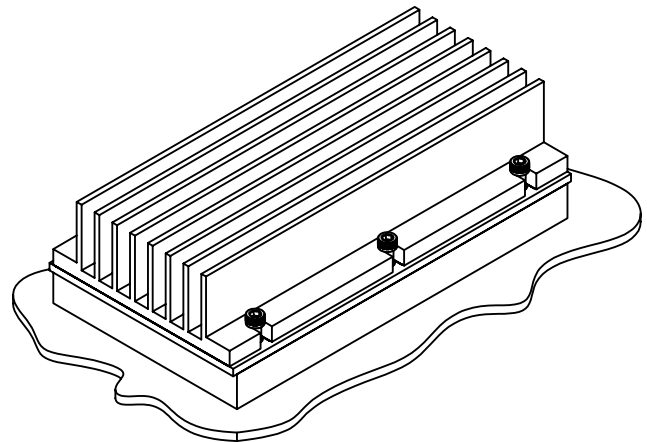
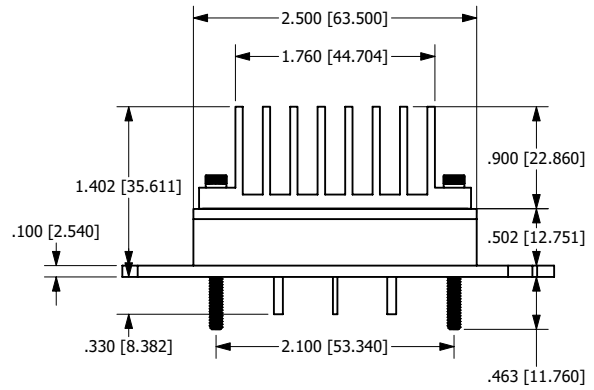
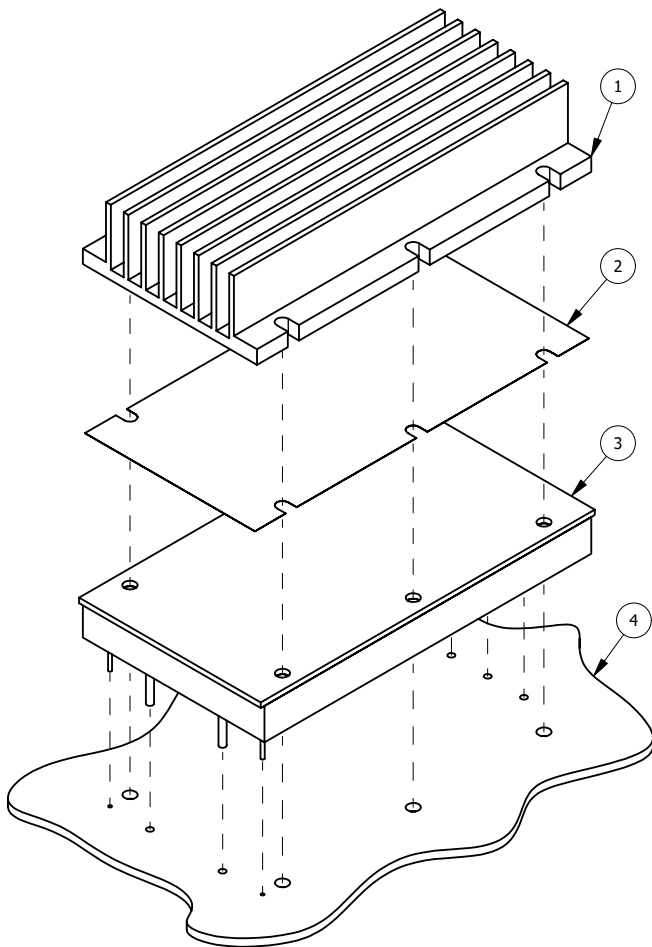
**HEAT SINKS**



Weight: 145 grams typical

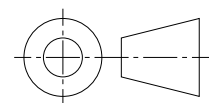
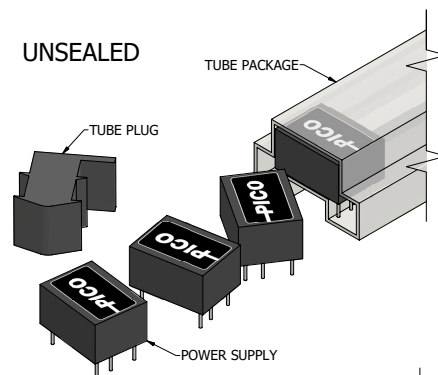
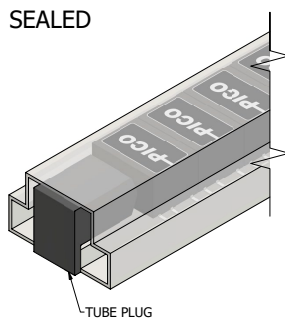
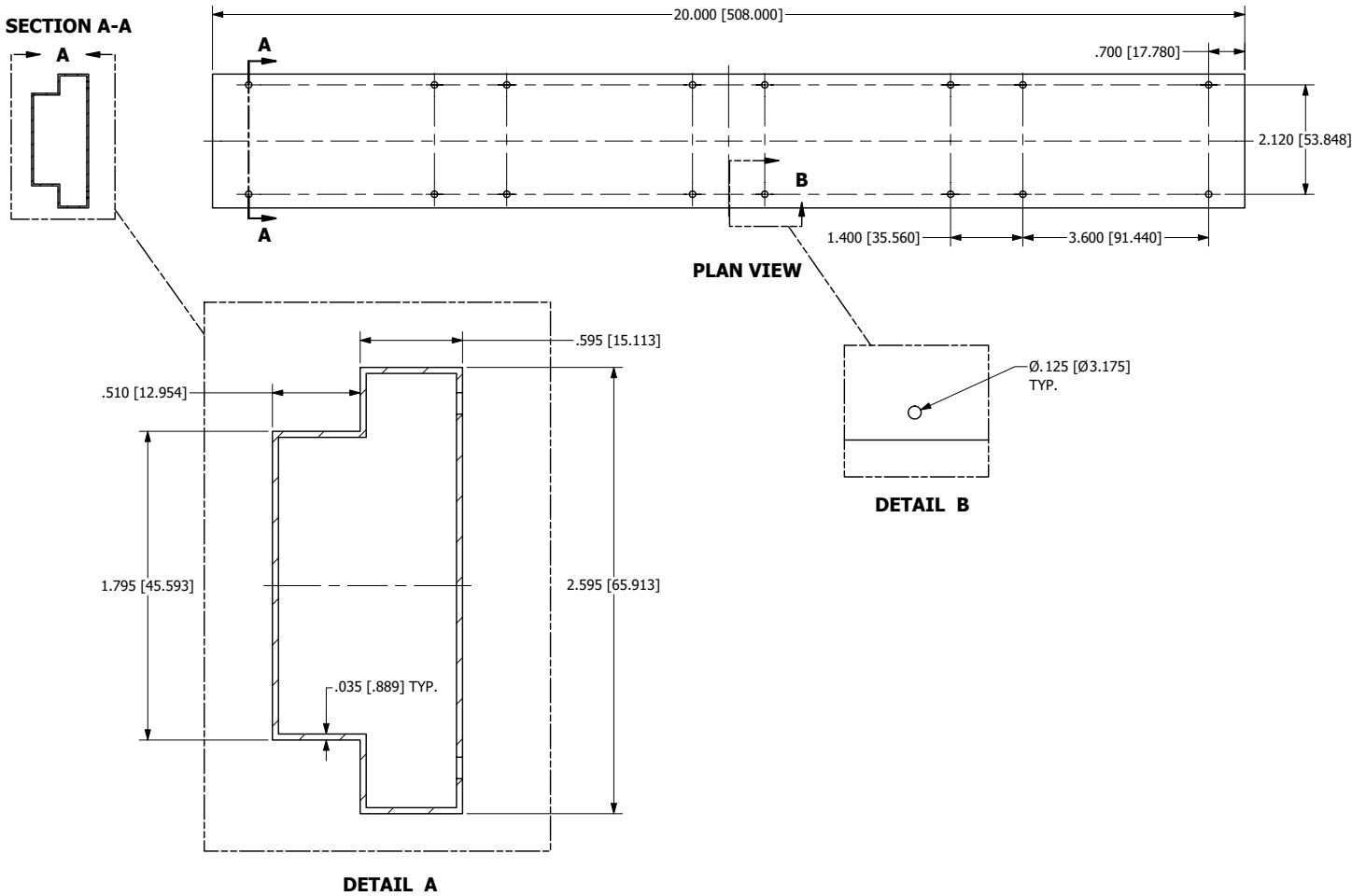
**MECHANICAL DRAWINGS**

**HEAT SINK ASSEMBLY**



ITEM	QTY	DESCRIPTION
1	1	CH OR CV HEAT SINK
2	1	TI THERMAL INTERFACE
3	1	HP MODULE
4	1	PCB

**TUBE PACKAGING**



Pico warrants each product manufactured by us and sold by us or an authorized representative, to be free from defects in material and workmanship. If properly used, it will perform within its applicable specifications for a period of one year after original shipment. Pico's obligation under this guarantee is limited to repairing or replacing our product to the original purchaser. This warranty is in lieu of all other warranties, express or implied and constitutes fulfillment of our obligations to the purchaser. We do not guarantee that the products can be used for a particular purpose other than those solely covered by the product's specifications. Pico must be notified if the product must meet particular certifications and/or standards. We assume no liability, in any event, for consequential damages, for anticipated or lost profits, incidental damages or loss of time or other losses incurred by the purchaser or any third party in connection with products covered by this warranty or otherwise. The purchaser will indemnify and hold Pico harmless for any damages, losses, costs, etc. from usage not within the product's specifications. Pico must be consulted before usage of its products in a nuclear, radioactive or space environment.

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