Series **LF/LM**

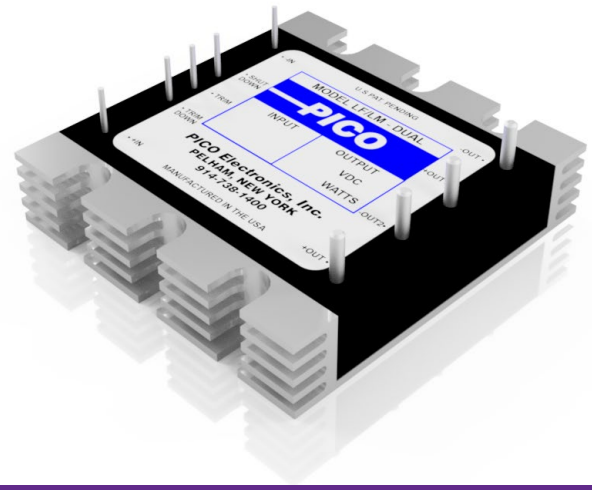
75W Isolated Regulated High Power DC-DC Converter

PICO Electronics, Inc.

PRODUCT OVERVIEW

The LF/LM series are isolated DC-DC converters with a wide selection of input voltage ranges from 18V to 380V in a compact half brick size foot print - 2.4" x 2.3". These modules have trim capability and shutdown features. Protections include input overvoltage, output short-circuit, output overvoltage and over temperature.

The unique case has integrated side heat sink for better thermal dissipation but is capable of conduction cooling through the baseplate or additional top mounted heat sink.



FEATURES

- 18V to 380V input range models
- 3.3V to 200V output models
- Up to 75W output
- Input/output isolation
- Integrated side heat sink
- Parallel operation option
- Single and dual isolated outputs
- Industrial temperature option -40°C (LF)
- Military temperature option -55°C (LM)
- Trim capability
- Remote shutdown feature
- Fixed operating frequency
- No external components required

Contact Pico for part number of available options:

- Select screening per MIL-STD-883:
  - Stabilization Bake
  - Temperature Cycle
  - Burn-In
- Special Input Voltage, Output Voltage, Isolation Voltage or Output Power
- Parallel Operation

LM	A	28	S
TEMPERATURE RANGE	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE	NUMBER OF OUTPUTS
LF = -40°C to +85°C **LM** = -55°C to +85°C	**A** = 18 - 36V **B** = 36 - 72V **C** = 100 - 180V **D** = 200 - 380V	**3.3** = 3.3V **5** = 5V **5.2** = 5.2V **9** = 9V **12** = 12V **15** = 15V **24** = 24V **28** = 28V **48** = 48V **100** = 100V **125** = 125V **150** = 150V **175** = 175V **200** = 200V **225** = 225V **250** = 250V	**S** = SINGLE **D** = DUAL

MODEL LIST - LFA/LMA (18-36V INPUT RANGE)

SINGLE OUTPUT

Pico Part Number		Output Voltage	Output Current		Output Power	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFA3.3S	LMA3.3S	3.3	0.91	9.09	30	73	1	1.5	2
LFA5S	LMA5S	5	1.00	10.00	50	80	1	1.25	1.5
LFA5.2S	LMA5.2S	5.2	0.96	9.62	50	80	1	1.25	1.5
LFA9S	LMA9S	9	0.67	6.67	60	84	1	1.25	1
LFA12S	LMA12S	12	0.50	5.00	60	85	1	1.25	0.75
LFA15S	LMA15S	15	0.43	4.33	65	85	0.75	1	0.75
LFA24S	LMA24S	24	0.31	3.13	75	87	0.5	0.75	0.75
LFA28S	LMA28S	28	0.27	2.68	75	87	0.5	0.5	0.5
LFA48S	LMA48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LFA100S	LMA100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LFA125S	LMA125S	125	0.04	0.40	50	82	0.3	0.5	0.5
LFA150S	LMA150S	150	0.03	0.33	50	82	0.3	0.5	0.5
LFA175S	LMA175S	175	0.03	0.29	50	82	0.3	0.5	0.5
LFA200S	LMA200S	200	0.03	0.25	50	82	0.3	0.5	0.5

DUAL OUTPUT

Pico Part Number		Output Voltage Per Output	Output Current Per Output		Output Power Per Output [4]	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFA5D	LMA5D	5	1.00	10.00	25	80	1	1.25	1.5
LFA9D	LMA9D	9	0.67	6.67	30	84	1	1.25	1
LFA12D	LMA12D	12	0.50	5.00	30	85	1	1.25	0.75
LFA15D	LMA15D	15	0.43	4.33	32.5	85	0.75	1	0.75
LFA24D	LMA24D	24	0.31	3.13	37.5	87	0.5	0.75	0.5
LFA28D	LMA28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LFA48D	LMA48D	48	0.16	1.56	37.5	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: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.
Note 4: Dual output loads must be balanced.

MODEL LIST - LFB/LMB (36-72V INPUT RANGE)

SINGLE OUTPUT

Pico Part Number		Output Voltage	Output Current		Output Power	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFB3.3S	LMB3.3S	3.3	0.91	9.09	30	74	0.75	1.5	2
LFB5S	LMB5S	5	1.00	10.00	50	80	0.75	1	1.5
LFB5.2S	LMB5.2S	5.2	0.96	9.62	50	80	0.75	1	1.5
LFB9S	LMB9S	9	0.72	7.22	65	84	0.75	1	1
LFB12S	LMB12S	12	0.63	6.25	75	84	0.5	0.75	1
LFB15S	LMB15S	15	0.50	5.00	75	84	0.5	0.75	1
LFB24S	LMB24S	24	0.31	3.13	75	87	0.5	0.5	0.5
LFB28S	LMB28S	28	0.27	2.68	75	87	0.5	0.5	0.5
LFB48S	LMB48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LFB100S	LMB100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LFB125S	LMB125S	125	0.04	0.40	50	84	0.3	0.5	0.5
LFB150S	LMB150S	150	0.03	0.33	50	84	0.3	0.5	0.5
LFB175S	LMB175S	175	0.03	0.29	50	84	0.3	0.5	0.5
LFB200S	LMB200S	200	0.03	0.25	50	84	0.3	0.5	0.5
LFB225S	LMB225S	225	0.02	0.22	50	84	0.3	0.5	0.5
LFB250S	LMB250S	250	0.02	0.20	50	84	0.3	0.5	0.5

DUAL OUTPUT

Pico Part Number		Output Voltage Per Output	Output Current Per Output		Output Power Per Output [4]	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFB5D	LMB5D	5	1.00	10.00	25	80	0.75	1	1.5
LFB9D	LMB9D	9	0.72	7.22	30	84	0.75	1	1
LFB12D	LMB12D	12	0.63	6.25	30	84	0.5	0.75	1
LFB15D	LMB15D	15	0.50	5.00	32.5	85	0.5	0.75	1
LFB24D	LMB24D	24	0.31	3.13	37.5	87	0.5	0.5	0.5
LFB28D	LMB28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LFB48D	LMB48D	48	0.16	1.56	37.5	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: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.
Note 4: Dual output loads must be balanced.

MODEL LIST - LFC/LMC (100-180V INPUT RANGE)

SINGLE OUTPUT

Pico Part Number		Output Voltage	Output Current		Output Power	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFC3.3S	LMC3.3S	3.3	0.91	9.09	30	74	0.75	1.25	2
LFC5S	LMC5S	5	1.00	10.00	50	81	0.75	1	1.5
LFC5.2S	LMC5.2S	5.2	0.96	9.62	50	81	0.75	1	1.5
LFC9S	LMC9S	9	0.72	7.22	65	84	0.5	0.75	1
LFC12S	LMC12S	12	0.63	6.25	75	85	0.5	0.75	1
LFC15S	LMC15S	15	0.50	5.00	75	86	0.5	0.75	1
LFC24S	LMC24S	24	0.31	3.13	75	87	0.5	0.5	0.5
LFC28S	LMC28S	28	0.27	2.68	75	87	0.3	0.5	0.5
LFC48S	LMC48S	48	0.16	1.56	75	85	0.3	0.5	0.5
LFC100S	LMC100S	100	0.08	0.75	75	85	0.3	0.5	0.5
LFC125S	LMC125S	125	0.04	0.40	50	85	0.3	0.5	0.5
LFC150S	LMC150S	150	0.03	0.33	50	85	0.3	0.5	0.5
LFC175S	LMC175S	175	0.03	0.29	50	85	0.3	0.5	0.5
LFC200S	LMC200S	200	0.03	0.25	50	85	0.3	0.5	0.5
LFC225S	LMC225S	225	0.02	0.22	50	85	0.3	0.5	0.5
LFC250S	LMC250S	250	0.02	0.20	50	85	0.3	0.5	0.5

DUAL OUTPUT

Pico Part Number		Output Voltage Per Output	Output Current Per Output		Output Power Per Output [4]	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFC5D	LMC5D	5	1.00	10.00	25	81	0.75	1	1.5
LFC9D	LMC9D	9	0.72	7.22	30	84	0.75	1	1
LFC12D	LMC12D	12	0.63	6.25	30	85	0.5	0.75	1
LFC15D	LMC15D	15	0.50	5.00	32.5	86	0.5	0.75	1
LFC24D	LMC24D	24	0.31	3.13	37.5	87	0.5	0.5	0.5
LFC28D	LMC28D	28	0.27	2.68	37.5	87	0.5	0.5	0.5
LFC48D	LMC48D	48	0.16	1.56	37.5	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: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.
Note 4: Dual output loads must be balanced.

MODEL LIST - LFD/LMD (200-380V INPUT RANGE)

SINGLE OUTPUT

Pico Part Number		Output Voltage	Output Current		Output Power	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFD3.3S	LMD3.3S	3.3	0.91	9.09	30	73	1	1.5	2
LFD5S	LMD5S	5	1.00	10.00	50	80	1	1.25	1.5
LFD5.2S	LMD5.2S	5.2	0.96	9.62	50	80	1	1.25	1.5
LFD9S	LMD9S	9	0.72	7.22	65	84	0.75	1.25	1
LFD12S	LMD12S	12	0.63	6.25	75	84	0.75	1	1
LFD15S	LMD15S	15	0.50	5.00	75	84	0.75	1	1
LFD24S	LMD24S	24	0.31	3.13	75	85	0.5	0.75	0.5
LFD28S	LMD28S	28	0.27	2.68	75	86	0.5	0.5	0.5
LFD48S	LMD48S	48	0.16	1.56	75	85	0.5	0.5	0.5
LFD100S	LMD100S	100	0.08	0.75	75	85	0.5	0.5	0.5
LFD125S	LMD125S	125	0.04	0.40	50	85	0.3	0.5	0.5
LFD150S	LMD150S	150	0.03	0.33	50	85	0.3	0.5	0.5
LFD175S	LMD175S	175	0.03	0.29	50	85	0.3	0.5	0.5
LFD200S	LMD200S	200	0.03	0.25	50	85	0.3	0.5	0.5
LFD225S	LMD225S	225	0.02	0.22	50	85	0.3	0.5	0.5
LFD250S	LMD250S	250	0.02	0.20	50	85	0.3	0.5	0.5

DUAL OUTPUT

Pico Part Number		Output Voltage Per Output	Output Current Per Output		Output Power Per Output [4]	Efficiency [2]	Line Regulation	Load Regulation [3]	Output Voltage Tolerance [2]
-40°C to +85°C	-55°C to +85°C	[VDC]	Min. [1] [A]	Max. [A]	[W]	[%] typ.	[±%] max	[±%] max	[±%]
LFD5D	LMD5D	5	1.00	10.00	25	80	1	1.25	1.5
LFD9D	LMD9D	9	0.72	7.22	30	84	0.75	1.25	1
LFD12D	LMD12D	12	0.63	6.25	30	84	0.75	1	1
LFD15D	LMD15D	15	0.50	5.00	32.5	84	0.5	1	1
LFD24D	LMD24D	24	0.31	3.13	37.5	85	0.5	0.75	0.5
LFD28D	LMD28D	28	0.27	2.68	37.5	86	0.5	0.5	0.5
LFD48D	LMD48D	48	0.16	1.56	37.5	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: For ≤100V output models, load regulation is specified for 10-100% load. For ≥125V output models, load regulation is specified for 20-100% load.
Note 4: Dual output loads must be balanced.

SPECIFICATIONS (Nominal V_{IN}, Full Load, T_A = +25°C, 1 hour warm up unless otherwise specified)

INPUT

Parameter	Condition	Min.	Typ.	Max.	Units
Input Voltage Range	LFA/LMA models	18	28	36	VDC
	LFB/LMB models	36	48	72	
	LFC/LMC models	100	150	180	
	LFD/LMD models	200	300	380	

OUTPUT

Parameter	Condition		Min.	Typ.	Max.	Units
Output Ripple	1MHz bandwidth	≤48V output models	-	-	50	mVp-p
		100V output models	-	-	100	
		≥125V output models	-	-	1	%

ENVIRONMENTAL

Parameter	Condition		Min.	Typ.	Max.	Units
Operating Temperature Range	Baseplate	LF models	-40	-	+85	°C
		LM models	-55	-	+85	
Storage Temperature Range			-55	-	+105	°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	-	-	MΩ
Size	L x W x H	2.4 x 2.3 x 0.5 (60.96 x 58.42 x 12.7)			inches (mm)
Weight	Single output models	-	110	-	grams
	Dual output models	-	135	-	
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	LFA/LMA, LFB/LMB & LFC/LMC models		Yes			
Short circuit or Overload	Hiccup mode, self-recovery		120	-	-	%
Overtemperature	Baseplate, self-recovery	Shutdown	-	95	-	°C
		Restart	-	50	-	
Output Overvoltage	Zener diode clamp		-	120	-	%
Shutdown (SHUTDOWN)	Non-latched shutdown, Self-recovery		-	-	0.15	VDC
Output Voltage Trim (TRIM & TRIM DOWN)	Trim up or trim down		-5	0	5	%
Parallel [3]	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°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
Surge	MIL-STD-704	LFA/LMA & LFD/LMD models

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

THERMAL RESISTANCE

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

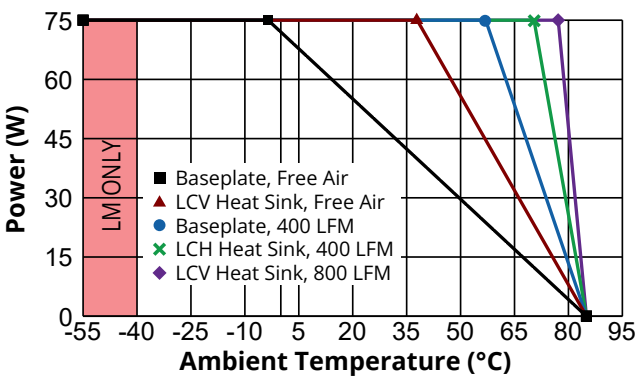
P_{OUT} = *Output Power in Watts*
η = *Efficiency*
T_C = *Case temperature in °C*
T_A = *Ambient temperature in °C*
T_{RCA} = *Thermal resistance of case to air in °C / W*

Thermal resistance of case (T_{RCA})

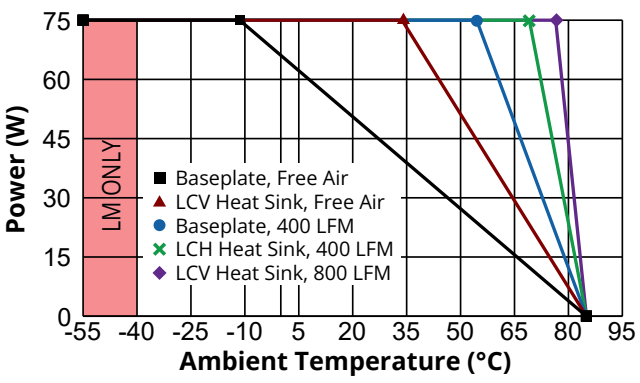
Airflow	Baseplate only	LCV Heat Sink	LCH Heat Sink	Units
Free Air	7.9	4.2	4.0	°C / W
200 LFM	4.9	1.6	1.6	
400 LFM	2.5	1.6	1.3	
600 LFM	2.2	0.9	0.9	
800 LFM	1.5	0.7	0.7	
1000 LFM	1.2	0.6	0.6	

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

Models with Max. Output Power = 75W & Efficiency at full load = 87%

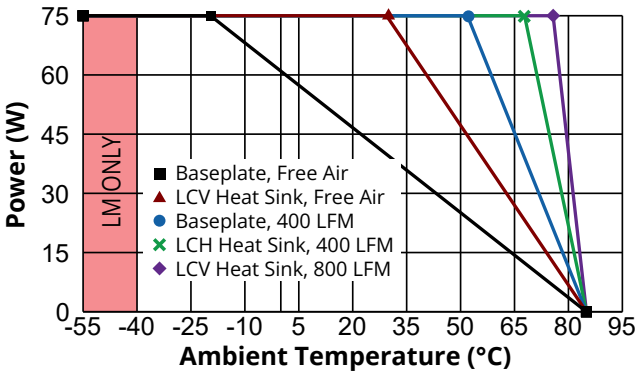


Models with Max. Output Power = 75W & Efficiency at full load = 86%

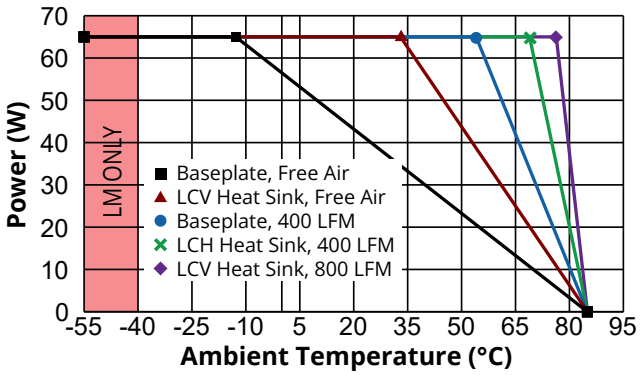


DERATING GRAPHS (Nominal V_{IN}, Full Load, Efficiency @ Full Load)

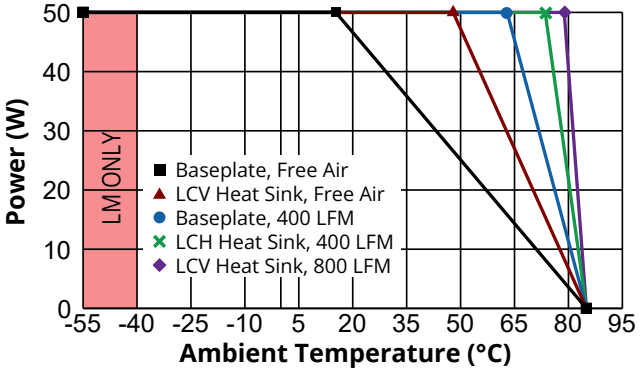
Models with Max. Output Power = 75W & Efficiency at full load = 85%



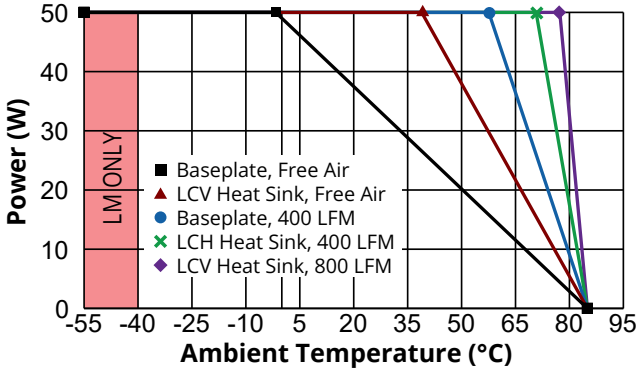
Models with Max. Output Power = 65W & Efficiency at full load = 84%



Models with Max. Output Power = 50W & Efficiency at full load = 85%



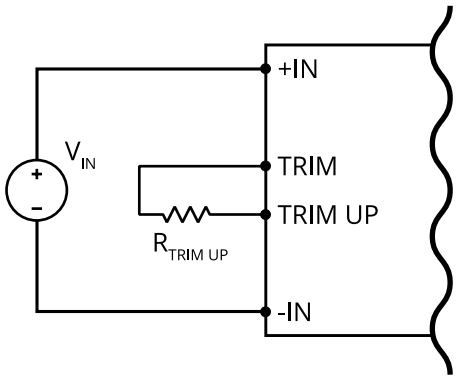
Models with Max. Output Power = 50W & Efficiency at full load = 82%



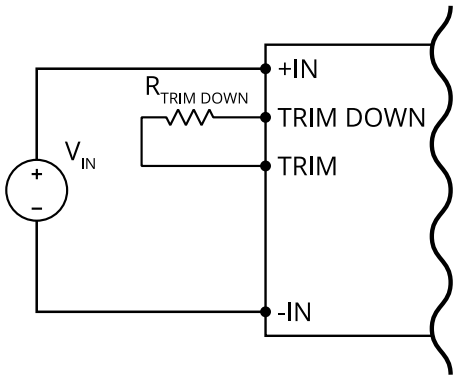
TYPICAL CONNECTION CIRCUIT

TRIM

TRIM UP



TRIM DOWN

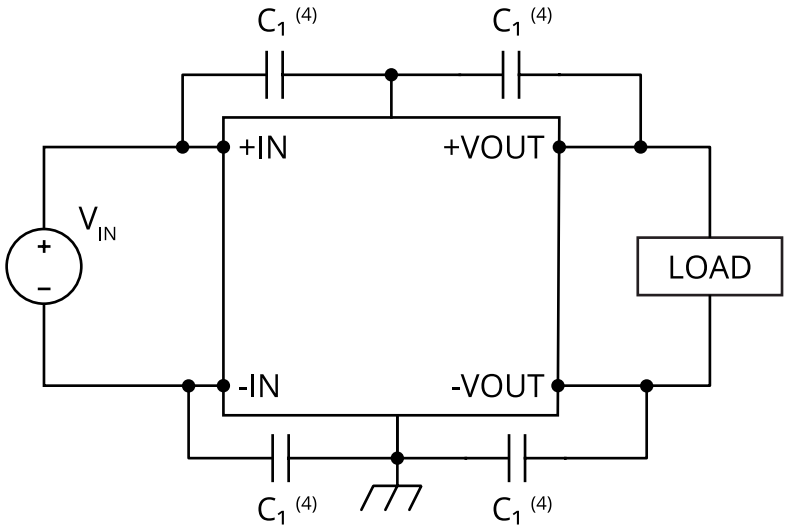


ΔV_{OUT}	0	1	2	3	5	% typ.
Trim Up Resistance	Open	300	150	50	20	kΩ typ.
Trim Down Resistance	Open	1000	500	250	100	

Note: Each individual unit will vary slightly. It is recommended to use a 1MΩ 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.

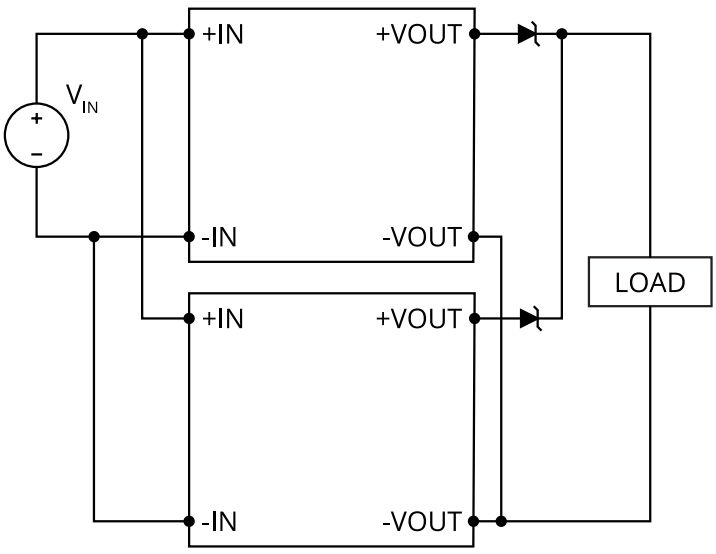
TYPICAL CONNECTION CIRCUIT

NOISE REDUCTION



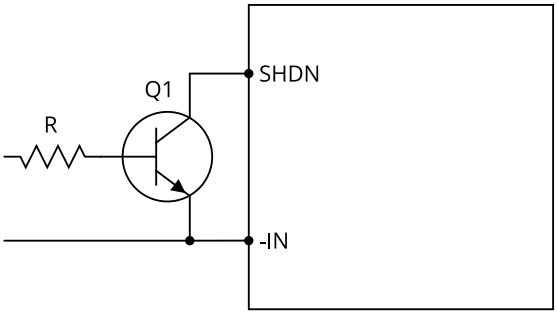
Note 4: C1 filter capacitors may reduce noise further. Please contact Pico for more details.

PARALLEL

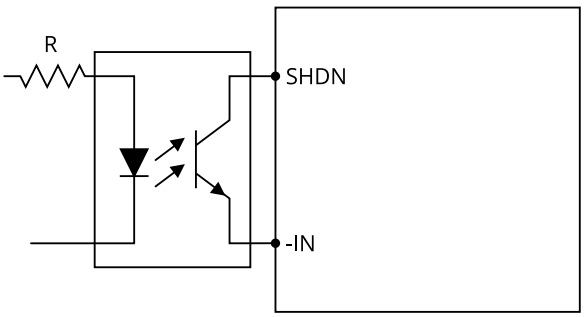


SHUTDOWN

NON-ISOLATED

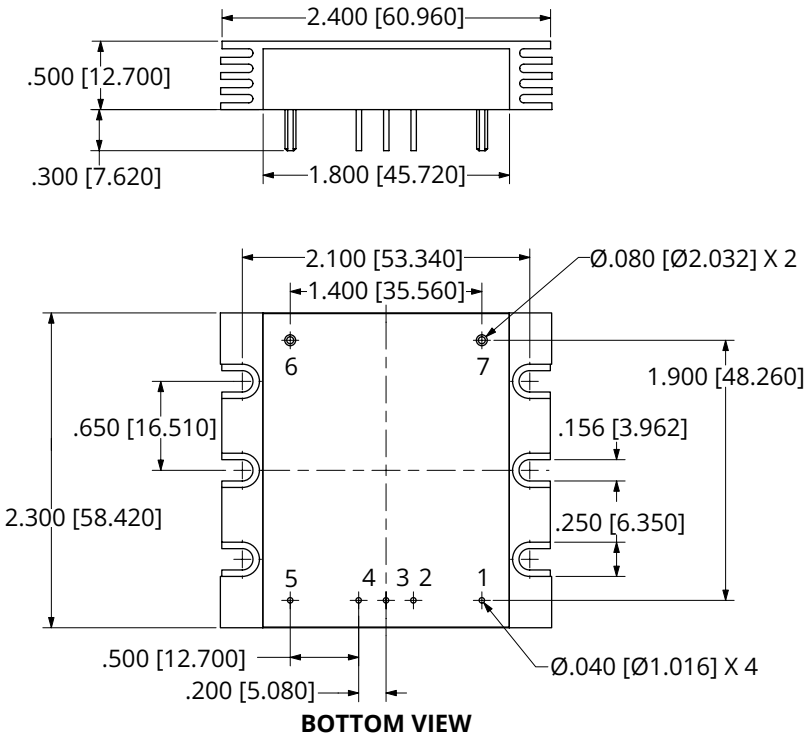


ISOLATED



MECHANICAL DRAWINGS

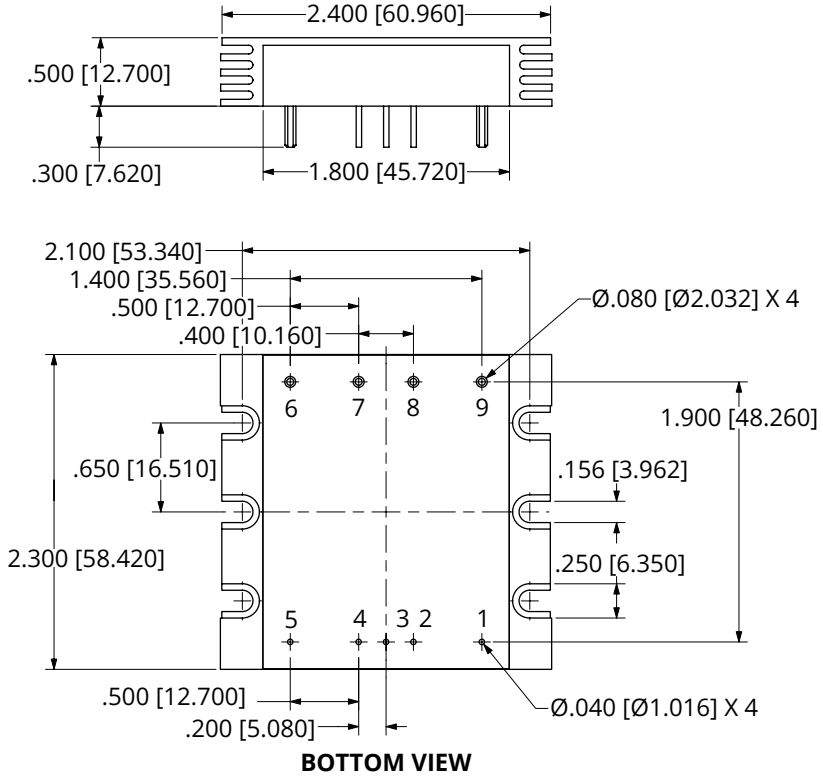
SINGLE OUTPUT



BOTTOM VIEW

PIN	FUNCTION	PIN DIAMETER
1	+IN	.040 [1.016]
2	TRIM DOWN	.040 [1.016]
3	TRIM	.040 [1.016]
4	SHUT DOWN	.040 [1.016]
5	-IN	.040 [1.016]
6	-OUT	.080 [2.032]
7	+OUT	.080 [2.032]

DUAL OUTPUTS



BOTTOM VIEW

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

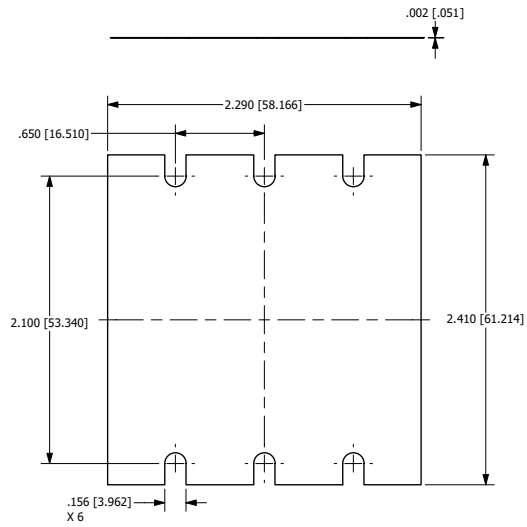
NOTES

a. ALL DIMENSIONS ARE IN INCHES, [ ] = MM

b. RECOMMENDED TORQUE FOR MOUNTING SCREWS: 6-9 INCH-LBS

MECHANICAL DRAWINGS

LTI - THERMAL INTERFACE

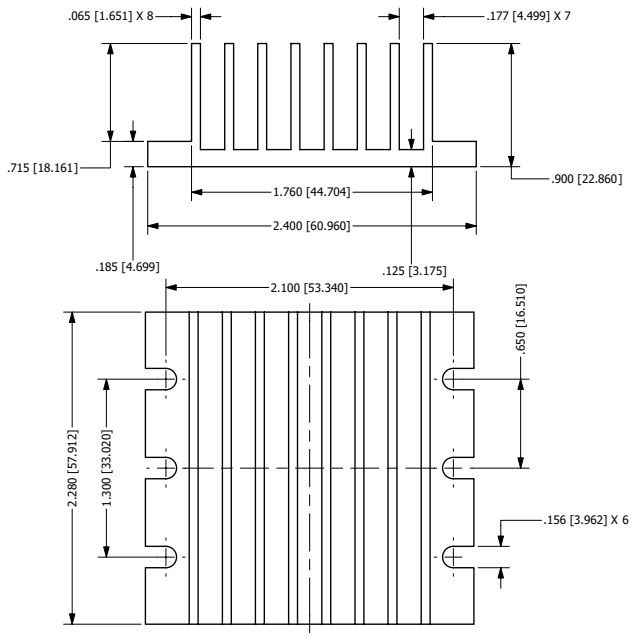


BOTTOM VIEW

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

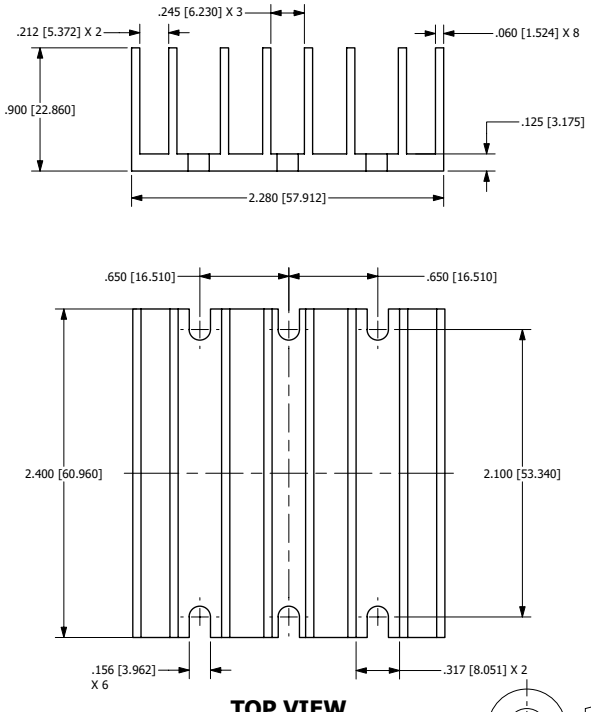
HEAT SINKS

LCV

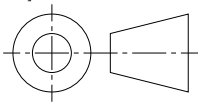


TOP VIEW

LCH



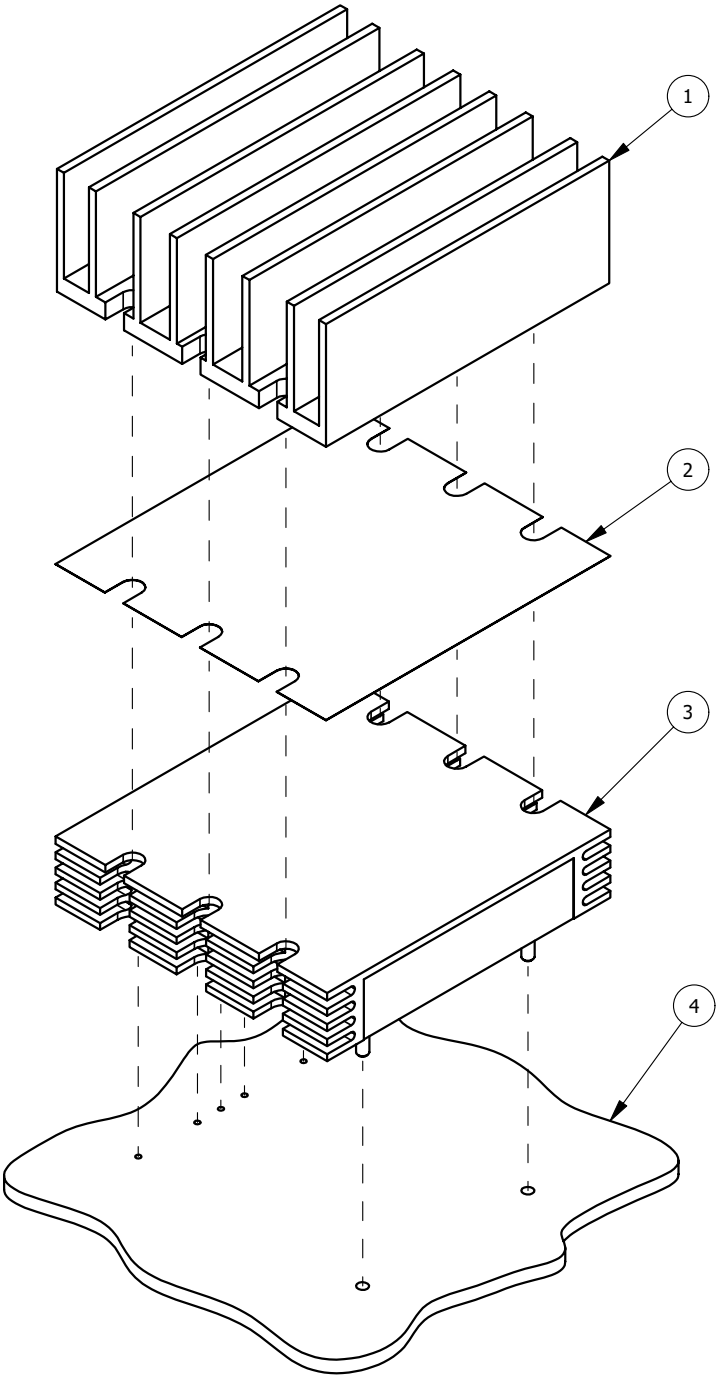
TOP VIEW

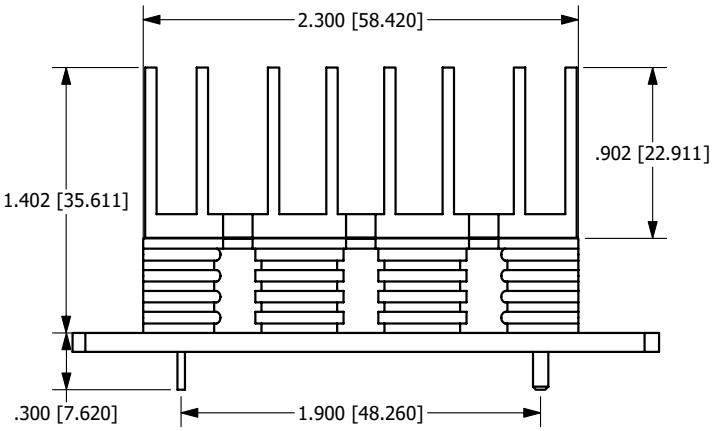


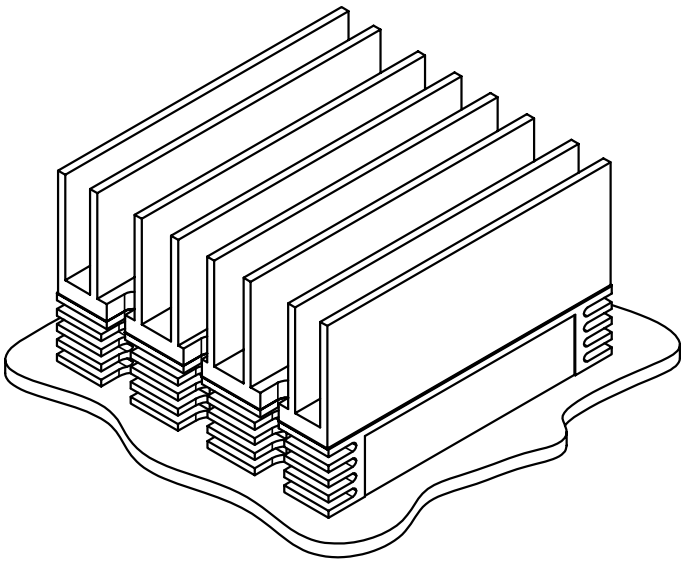
Weight: 70 grams typical

MECHANICAL DRAWINGS

HEAT SINK ASSEMBLY







ITEM	QTY	DESCRIPTION
1	1	LCH OR LCV HEAT SINK
2	1	LTI THERMAL INTERFACE
3	1	LF/LM MODULE
4	1	PCB

TUBE PACKAGING