MR50CRU

50W, 1/4 Brick, Ultrawide 12:1 Input Range Railway DC/DC Converters

Key Features:

- 50W Output Power
- Ultrawide 12:1 Input
- -40°C to +105°C Temp
- 3000 VDC Isolation
- Efficiency to 90%
- Short Circuit Protection
- Over Current Protection
- 1/4 Brick Package
- Meets EN51055
- Meets AREMA
- Meets UL62368
- Optional Heat Sink

CE

UKCA

RoHS

MicroPower Direct
46 Eastman Street
Unit 1
South Easton, MA 02375
USA

T: (781) 344-8226
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

MPD
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Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage		14	110	160	VDC
Input Current			See Page 2		
Surge Voltage (1 sec)	Nominal input voltage	-0.7		200	VDC
Start Up Voltage				14	VDC
Start Up Time	Cold start, nominal input voltage			100	ms
Start Time			10		ms
No Load Input Power	CTRL pin open or pulled high, DC-DC ON		1.2	2.2	W
Idle Input Power	CTRL pin pulled low to -Vin, DC-DC OFF		1.0	1.7	
Input Filter			LC Filter		

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	Nominal input voltage, 10% - 100% load			±2	%
Line Regulation	Input voltage variation from low to high			±0.5	%
Load Regulation	Nominal input voltage, 10% - 100% load		±0.5	±1	%
Ripple & Noise	20 MHz bandwidth, 10% - 100% load		150	300	mVp-p
Trim		90		100	%Vo
Sense				105	
Temperature Coefficient	Nominal input voltage, full load			±0.03	%/°C
Over Load Protection		110	140		%Io
Over Temperature Protection	Max. case temperature		105	115	°C
Over Voltage Protection	Input voltage range (14 - 160V)	110		160	%Vo
Over Current Protection		110		260	&Io
Short Circuit Protection			Continuous, self-recovery		

General

Parameter	Conditions		Min.	Typ.	Max.	Units
Isolation Voltage	60 seconds, leakage current <5 mA	Input - Output	3000			VDC
		Input - Case	2100			
		Output - case	2100			
Isolation Resistance	500 VDC		1000			MΩ
Isolation Capacitance	100 KHz /0.1V			1100		pF
Switching Frequency	PWM			170		kHz

Environmental

Parameter	Conditions	Min.	Typ	Max.	Units
Operating Temperature Range		-40		+105	°C
Storage Temperature Range		-55		+125	°C
Cooling	Conduction or forced air cooling, free air convection with additional heat sink				
Storage Humidity	Non-Condensing	5		95	%RH

Physical

Case Size	Standard package: 2.28 x 1.45 x 0.5 in (See mechanical diagrams on page 4)
Case Material	Aluminum Alloy, Black Anodized Coating (UL94V-0)
Weight	Standard package: 2.65 oz (75g) (See mechanical diagrams on page 4)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	IEC 61709 @ 25°C	1000			kHours
Cooling Test			EN60068-2-1		
Dry Heat			EN60068-2-2		
Damp Heat			EN60068-2-30		
Shock & Vibration			IEC/EN61373 Class B		
Pollution Level			PD3		
Fire & Smoke Compliance			EN45545-2, HL3		
Salt Mist Test			EN60068-2-11, Ka		
Cyclic Damp Heat Test			EN60068-2, Db Variant 2		
Altitude				5000	m
Low Temperature Start Up and Storage Test			EN60068-1, Ad and Ab		
Lead Temperature	1.5mm from case for 10 seconds			300	°C

Model Selection Guide

Model Number	Input				Output		Full Load Efficiency (%, Typ)	Reflected Ripple Current (mA, Typ)	Capacitive Load (µF, Max) (See Note 2)	Fuse Rating Slow-Blow (mA) (See Note 1)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)				
	Nominal	Range	Full Load (Typ)	Full Load (Max)						
MR50-110S3.3CRU	110	14 - 160	348	357	3.3	10000	87	100	20000	8000
MR50-110S05CRU	110	14 - 160	516	528	5	10000	90	100	20000	8000
MR50-110S12CRU	110	14 - 160	522	534	12	4166	89	100	3500	8000
MR50-110S15CRU	110	14 - 160	522	534	15	3333	89	100	2200	8000
MR50-110S24CRU	110	14 - 160	516	528	24	2083	90	100	1000	8000
MR50-110S48CRU	110	14 - 160	522	534	48	1041	89	100	240	8000
MR50-110S54CRU	110	14 - 160	522	534	54	926	89	100	200	8000

Notes:
1. Efficiency is tested at nominal voltage and full load at 25°C.
2. Unless otherwise specified, the parameters in this datasheet were measured under the condition of Ta=25°C, humidity <75% with nominal input voltage and rated output load.
3. Exceeding the maximum input voltage may cause permamenent damage to the power supply.

For the horizontal heat sink options, add the suffix "**-F**" to the model number (i.e. **MR50-110S05CRU-F**). See page 5.

For the vertical heat sink options, add the suffix "**-H**" to the model number (i.e. **MR50-110S05CRU-H**). See page 6.

Input Current (Full Load)

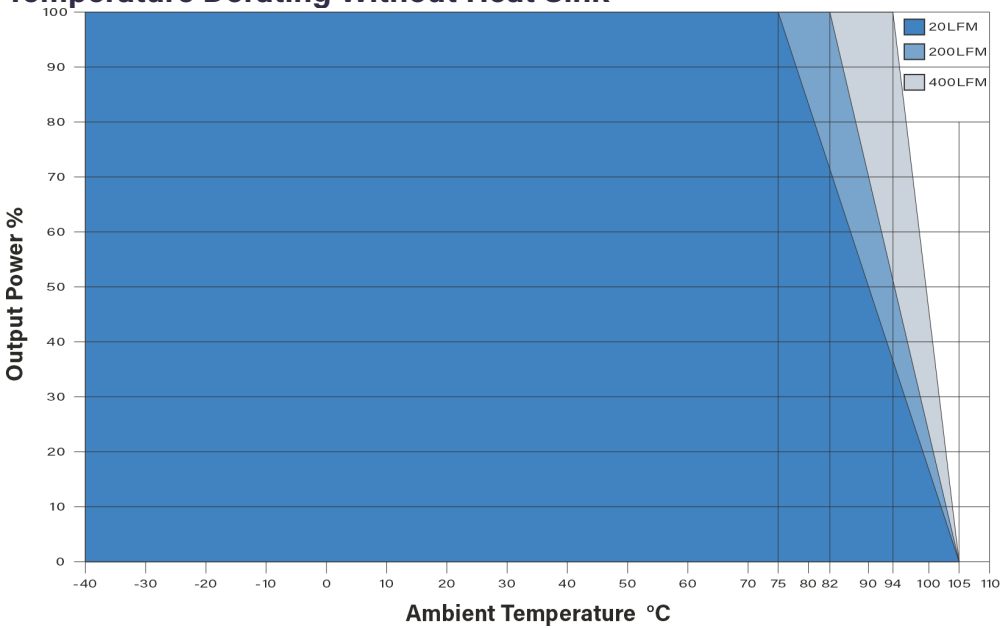
Nominal Vin (VDC)	3.3V Out	5/24V Out	12/15/48/54V Out
24V Input	1636 - 1676 mA	2422 - 2480 mA	2450 - 2510 mA
36V Input	1053 - 1078 mA	1543 - 1578 mA	1560 - 1596 mA
48V Input	791 - 809 mA	1158 - 1184 mA	1171 - 1198 mA
72V Input	526 - 539 mA	771 - 789 mA	780 - 798 mA
96V Input	395 - 404 mA	578 - 591 mA	585 - 598 mA
110V Input	348 - 357 mA	516 - 528 mA	522 - 534 mA

Note: All models operate from 14 - 160VDC input. Input current values shown are design references at full load.

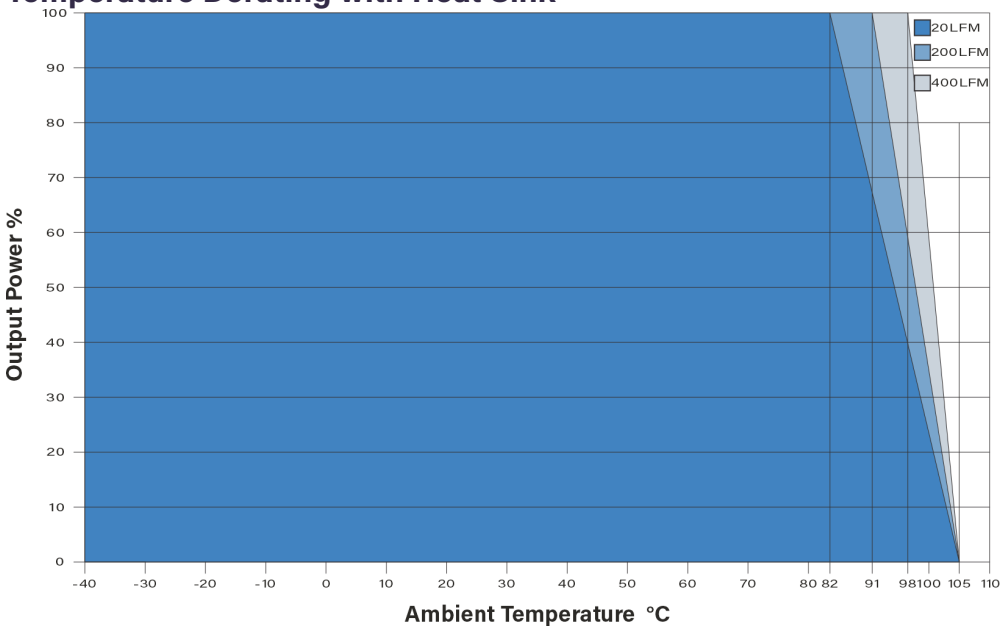
Control Function

Status	Condition
Module On	CTRL pin open or pulled high (3.5 - 12VDC)
Module Off	CTRL pin pulled low to -Vin (0 - 1.2VDC)

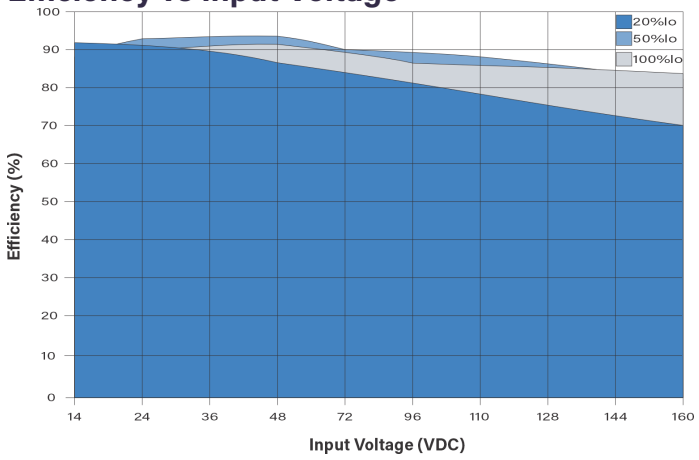
Temperature Derating Without Heat Sink



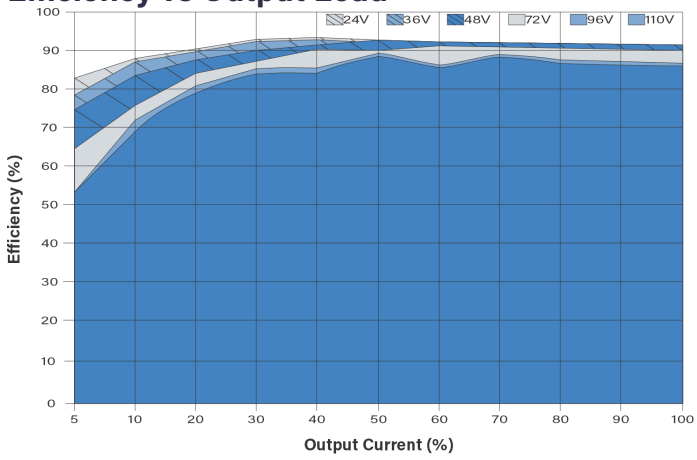
Temperature Derating with Heat Sink



Efficiency vs Input Voltage



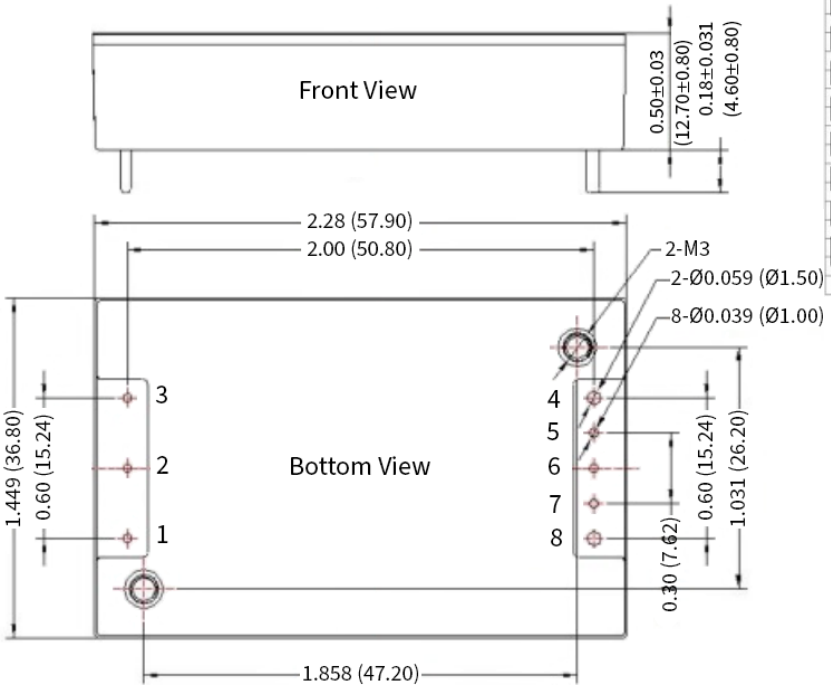
Efficiency vs Output Load



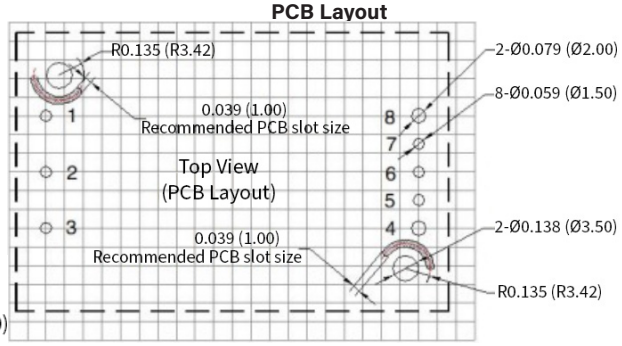
EMI Characteristics

Parameter	Standard	Criteria	Level	
Radiated Emissions	EN 55011		30MHz - 230MHz	40dBuV/m at 10m
			230MHz - 1GHz	47dBuV/m at 10m
			1GHz - 6GHz	47dBuV/m at 10m
Conducted Emissions	EN 50121-3-2		150kHz - 500kHz	99dBuV
			500kHz - 30MHz	93dBuV
ESD	IEC/EN 61000-4-2	A	±6kV Contact / ±8kV Air	
RS	IEC/EN 61000-4-3	A	80 - 800MHz	20V/m
			800 - 1000MHz	20V/m
			1400 - 2000MHz	10V/m
			2000 - 2700MHz	5V/m
			5100 - 6000MHz	3V/m
EFT	IEC/EN 61000-4-4	A	±2kV 5/50ns 5kHz	
Surge	IEC/EN 61000-4-5	A	Line to line ±2kV (2Ω, 18uF)	
			Line to ground ±2kV (2Ω, 18uF)	
CS	IEC/EN 61000-4-6	A	0.15MHz - 80MHz	10V.r.m.s
MS	IEC/EN 61000-4-8	A	60Hz	100A/m
			60Hz	300A/m

Mechanical Dimensions



PCB Layout



Grid distance is 2.54 x 2.54 mm

Pin	Function
1	+Vin
2	CTRL
3	-Vin
4	-Vo
5	Sense-
6	Trim
7	Sense+
8	+Vo

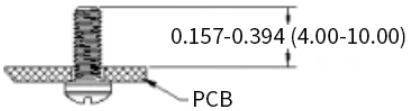
Notes:

- All dimensions are typical in inches (mm)
- Pin 1, 2, 3, 5, 6, 7 diameter: 0.039 (1.00)
- Pin 4, 8 diameter:0.059 (1.50)
- Pin diameter tolerances: ±0.004 (±0.10)
- General tolerances: ±0.020 (±0.50)
- Mounting hole screw torque: Max 0.4 N ▪ m

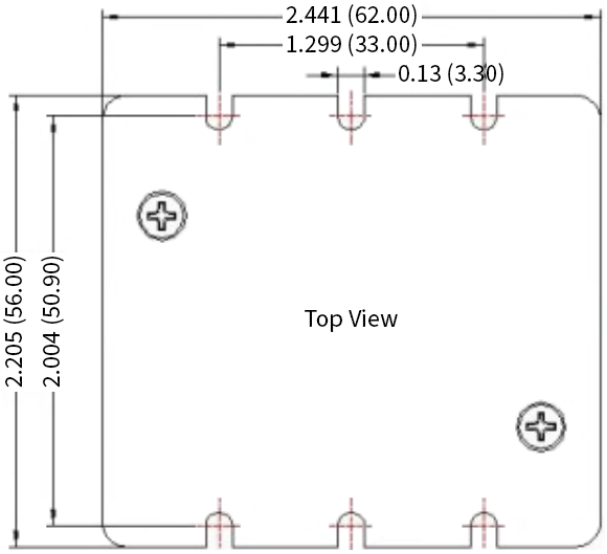
Weight:

- 2.65oz (75g)

Recommended Screw Length



F Horizontal Heat Sink



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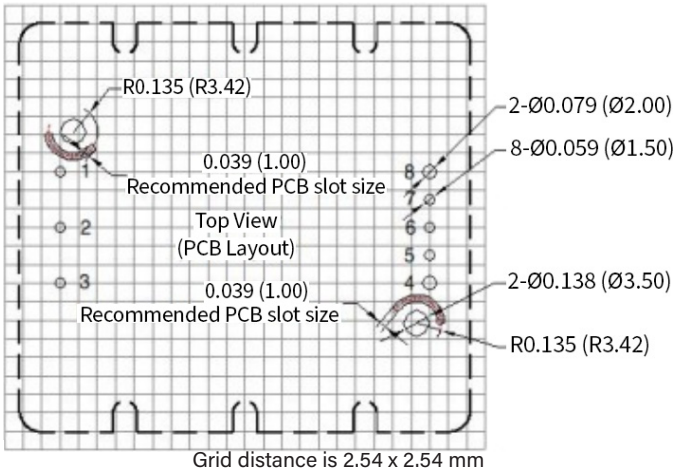

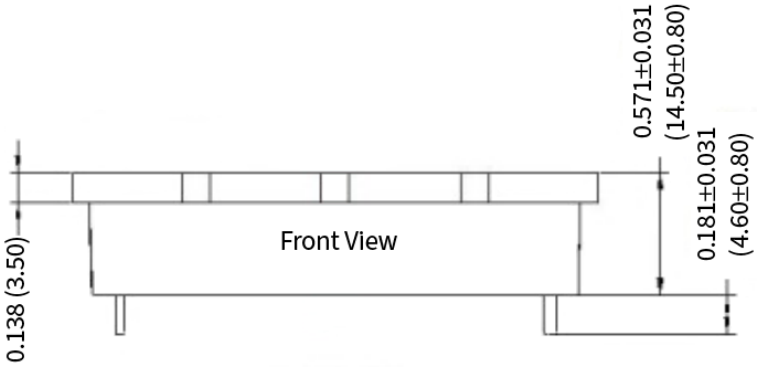

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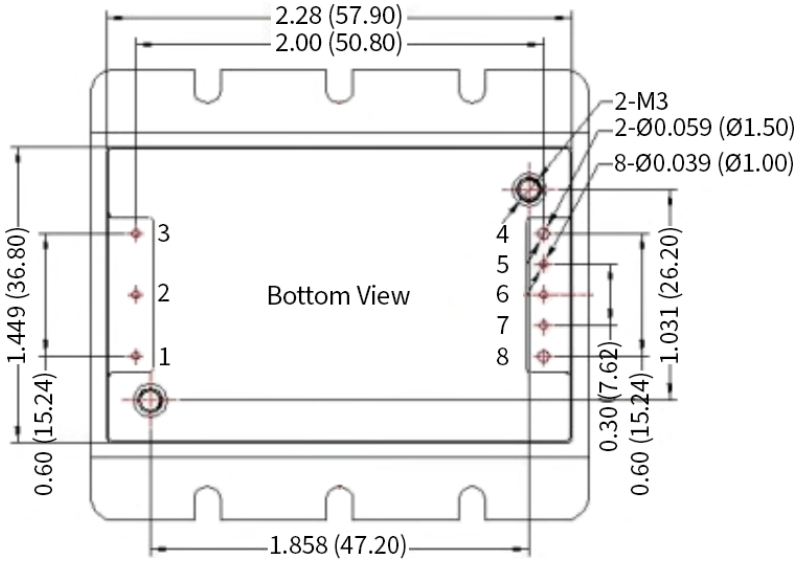

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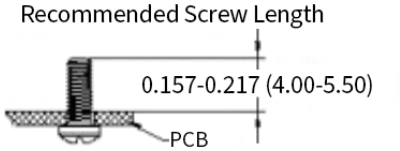

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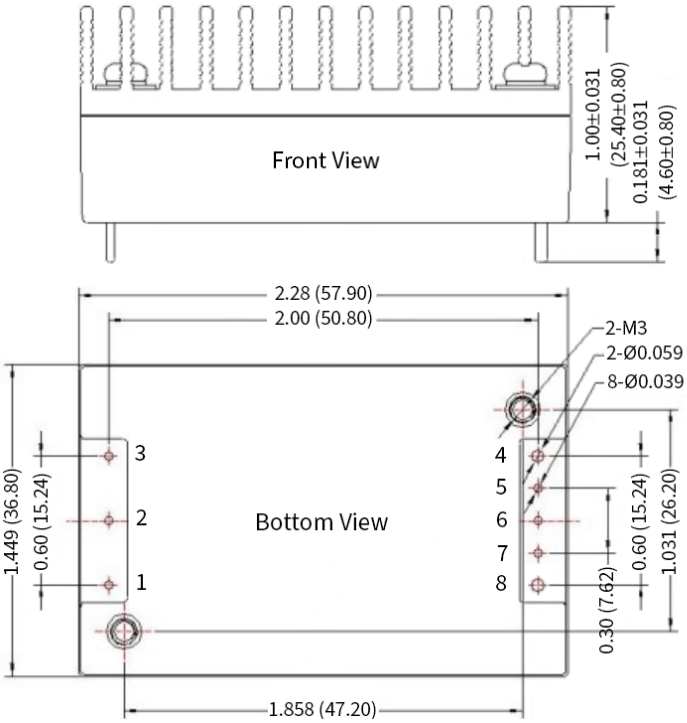
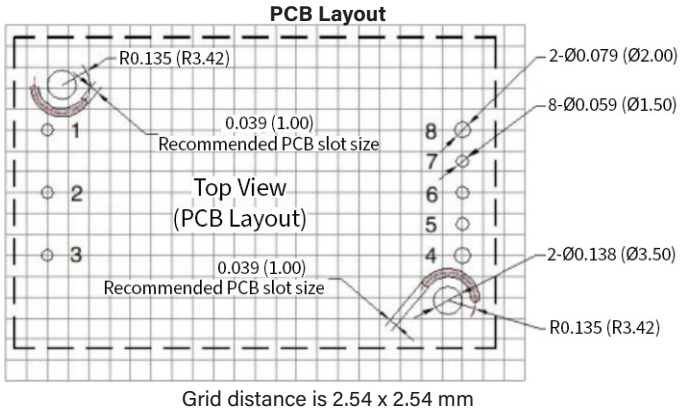
- Mounting hole screw torque: Max 0.4 N ▪ m

Weight:

- 3.74oz (106g)

H Vertical Heat Sink





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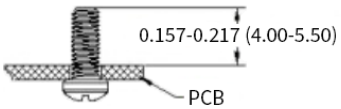
- Pin diameter tolerances: ±0.004 (±0.10)
- General tolerances: ±0.020 (±0.50)
- Mounting hole screw torque: Max 0.4 N ▪ m

Weight:

- 3.70oz (105g)

Recommended Screw Length



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