ESR25-48S3V3 series

RoHS Compliant

DataSheet

Industry Standard 1/8 brick: 48 Vin, 3.3Vout, 25A

Options:

- Positive/Negative Remote on/off
- Sprayed Conformal coating
- Aluminum Heat Sink

Features:

- Industry standard 1/8 brick package & footprint 0.90″×2.28″×0.41″
- Operating temperature: -40～85°C
- Wide input voltage range: 2:1 (36～75Vdc)
- Output voltage trim range: -20% ～+10%
- Isolation voltage: 1500Vdc
- High efficiency: up to 91%
- High power density
- Low output voltage ripple & noise
- Remote on/off
- Input Under-voltage protection
- Output short-circuit protection
- Output over-voltage protection
- Output over-current protection
- Over-temperature protection
- RoHS (2002/95/EC) complaint
- EN60950-1 Certified

Numbering Convention:

ESR 25 – 48 S 3V3 – L B–C G5
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

No	Features	Descriptions
1	Product Series	ESR-1/8 brick package
2	Output current	25 - Max output current 25A
3	Input voltage	48 - Typical input voltage 48V
4	Number of Outputs	S – Single output
		D – Double output
5	Output voltage	3V3 - Output voltage 3.3V
6	Remote logic	L – Negative logic
		H or Default – Positive logic
7	Aluminum HeatSink	B – Heatsink
		Default – No heatsink
8	Sprayed conformal coating	C - Sprayed conformal coating
		Default - No sprayed conformal coating
9	RoHS	G5 - ROHS5
		G - ROHS6
		Default – Lead

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1 Description

The ESR25-48S3V3 Series power modules are open-frame DC-DC converters in an industry 1/8 brick packaging & footprint, and provide up to 3.3V output voltage and 25A output current. All components of the converter are surface mounted. The converters feature high power density, remote on/off, over-temperature protection and current limit, etc.

2 Specifications (Unless otherwise indicated, all specifications are typical at nominal input voltage, full load at 25℃, air speed is 1m/S, with a 330uF/100V capacitor at input, and a 470uF/10V capacitor at output.)

Parameter		Test Condition	Min	Typ	Max	Unit
2.1 Absolute Maximum Ratings						
Input Voltage (Vi)		no operating, continuous	0	—	80	Vdc
		transient (100ms)	—	—	100	Vdc
Max Output Power (Pomax)		allowable operating conditions	—	—	82.5	W
2.2 Input Specifications						
Typical Input Voltage (Vinom)		—	—	48	—	Vdc
Input Voltage Range		—	36	—	75	Vdc
Input Under-voltage Protection		Ionom	30	—	34	Vdc
Input Under-voltage Recovery Point		Ionom	31	—	36	Vdc
Max Input Current (Iimax)		Vimin, Vonom,Ionom	—	—	2.6	A
No-load Input Current (Iio)		Vinom, Io＝0A	—	—	80	mA
Quiescent Input Current (Iiof)		Vinom, remote output shutdown	—	—	10	mA
No-load Loss		Vinom, Io=0A	—	2	3.84	W
Inrush Transient Current		Io=Ionom	—	—	1	A^2S
Input Reflected Ripple Current		Vinom,Ionom	—	20	30	mAp-p
Input Filtering Capacitance		Vimin-Vimax	—	330	—	μF
Remote (positive logic)	On	High Level: 2.4V to 48V, or open circuit (reference to –Vin)				
	Off	Low Level: -0.7V to 0.8V(reference to –Vin), or connected to -Vin				
Remote (negative logic)	Off	High Level: 2.4V to 48V, or open circuit (reference to –Vin)				
	On	Low Level: -0.7V to 0.8V(reference to –Vin), or connected to -Vin				
2.3 Output Specifications						
Output Voltage (Vonom)		Vinom,Ionom	3.27	3.3	3.33	Vdc
Typical Load (Ionom)		—	0	—	25	A
Output Current Range (Io)		Po≤ 82.5W	0	—	25	A
Line Regulation (Vov)		Vimin-Vimax,Ionom	—	±0.1	±0.2	%Vo
Load Regulation (Vol)		0-100%Ionom,Vinom	—	±0.2	±0.5	%Vo
Output Voltage Trim Range (Voadj)		Io≤Ionom,Po≤82.5W	-20	—	+10	%Vo

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Parameter		Test Condition	Min	Typ	Max	Unit
Output Over-voltage Protection ①	Protection Mode	——	Auto Recovery			—
	Threshold	Po<Pomax	3.8		4.62	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, Auto Recovery			—
	Threshold	Vinmin~Vinmax, Tc (baseplate temp.) = -40~100°C	105	—	150	%Ionom
Output Short-circuit protection	Protection Mode	——	Hiccup, Auto Recovery			—
Dynamic Load Response	Peak Deviation	25%-50%-25%Ionom 50%-75%-50%Ionom ΔIo/Δt =0.1A/μS,Vinom	—	100	165	mV
	Settling Time		—	100	200	μs
	Peak Deviation	0%-100%-0%Ionom ΔIo/Δt =0.1A/μS,Vinom	—	—	50	%Vo
	Settling Time		—	—	800	μs
Output Ripple and Noise ②	RMS (20MHz)	Vinom,20MHz, externally add a 10μF tantalum capacitor and a 1μF ceramic capacitor to output	—	—	30	mV
	Peak-to-Peak (20MHz)		—	—	75	mV
	Peak-to-Peak (100MHz)		—	—	150	mV
External Output Capacitance (Co)		V_{INMIN}~V_{INMAX},0~100%I_O	0	—	10000	μF
Turn-on/off Peak Deviation		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		10%Vinnom-- 90%Vonom	5	—	30	mS
Output Rise Time ③		10%Vonom--90%Vonom	5	—	15	mS
Remote Sense Voltage Sampling		——	Available			
2.4 Safety Specifications						
Isolation Voltage	Input to output	Leak Current≤1mA, 1min	1500	—	—	Vdc
Isolation Resistance (R_{ISO})		500V_{DC}	10	—	—	MΩ
Safety Certificate		EN 60950-1 Recognized				
2.5 Reliability						
Vibration Test (sine)		Frequency: 10~55Hz Amplitude: 0.35mm Acceleration: 10m/s^2 Cycle: X,Y,Z 30min each axis	After being tested, no damage to the converter and its components, the appearance, output voltage and output ripple and noise (p-p) meet the data sheet requirements.			
Impact Test (half-sine)		Peak Acceleration:: 300m/s^2 Duration: 6ms 6 times for three perpendicular directions	After being tested, no damage to the converter and its components, the appearance, output voltage and output ripple and noise (p-p) meet the data sheet requirements.			
MTBF		≥2×10^6h Bellcore TR-332 (Ta=25°C) ≥1×10^6h Bellcore TR-332 (Ta=55°C)				

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Parameter		Test Condition		Min	Typ	Max	Unit
2.6 Environmental Specifications							
Relative Humidity		(40±2) ℃, No dew		—	—	90	%RH
Cooling		——		Forced-air cooling or heatsink			
Over-temperature Protection	Protection Mode	——		105℃~125℃ (Auto-recovery)			
	Temperature Range	——		5	8	12	℃
Operating Temperature				-40	—	+85	℃
Storage Temperature (Tst)				-55	—	+125	℃
2.7 General Specifications							
Switching Frequency		——		—	300	—	KHz
Temperature Coefficient (Tcoeff)		——		—	—	±0.02	%Vo/℃
Efficiency (η)		Vinom	100%Ionom	90	91	—	%
			20%Ionom	—	87	—	%
			50%Ionom	—	91	—	%
			80%Ionom	—	91.2	—	%
Weight		——		—	30	—	g
RoHS		2002/95/EC Directive					
Anti-sulfuration feature		Sprayed conformal coating					

Notes: At high/low temperature,

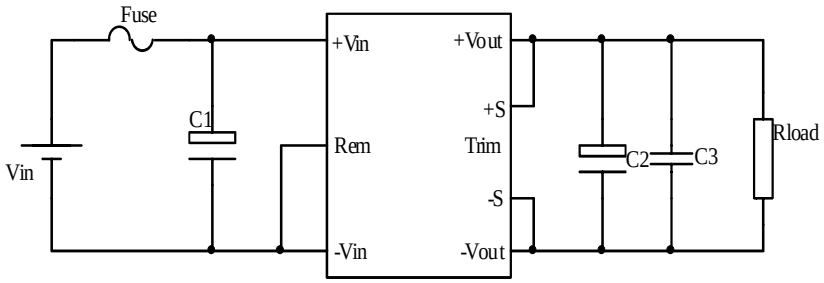
① Output over-voltage protection: 3.8V<V<4.95V (Test condition: Po<Pomax)

② Output ripple & noise: Vrp<100mV (Test condition: Vinom, 20MHz, besides the 470μF capacitor, externally add a 1μF ceramic capacitor and a 220μF tantalum capacitor to the output)

③ Output rise time: 5mS<T<20mS (Test condition: 10%Vonom--90%Vonom)

3 Basic Application Circuit and Considerations

3.1 Basic Connection



Fuse: 7.5A C1: ≥330μF/100V C2: 470μF/10V (high frequency, low ESR capacitor)
C3: 1μF/10V (monolithic capacitor)

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3.2 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged.

3.3 Output will be off when the Rem is at high level or when the Rem keeps open circuit referenced to –Vin.

3.4 Output short current protection Mode is hiccup, automatic recovery

3.5 Output Trim: Exceed the maximum output power (trim up) or the maximum output current (trim down) may cause the converter operates abnormally. The output voltage shall not exceed 3.63V (trim up) or be lower than 2.64V (trim down), or the converter can't work well. See "4. Output Voltage Adjustment (Trim)" for details.

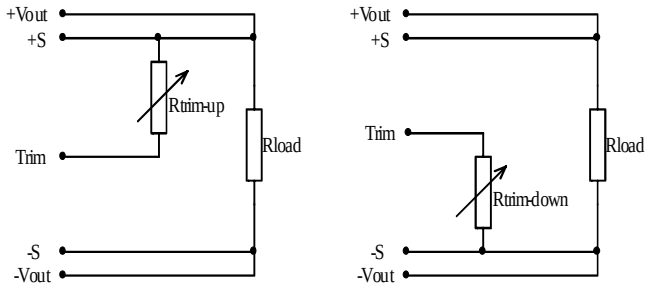
3.6 Connect a 330μF/100V capacitor to the input when a capacitor is connected to the output.

4. Instruction for Use/Test (Forced-air cooling required)

4.1 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged. Sudden changes of input voltage will cause output inrush. The module is not internally fused, and an external 7.5A/250V fuse is required.

4.2 Output Voltage Trim

4.2.1 Output Voltage Trim Circuit



4.2.2 Output Trim Equations

(1) To increase the output voltage, the value of the external resistor should be

$$R_{Trim-up} = \left(\frac{5.11 \times Vo(100(\%) + \Delta(\%))}{1.225 \times \Delta(\%)} - \frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right) (k\Omega)$$

(2) To decrease the output voltage, the value of the external resistor should be

$$R_{Trim-down} = \left(\frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right) (k\Omega)$$

Where Vo: rated output voltage;

$R_{Trim-up}$、$R_{Trim-down}$: adjusted voltage;

$\Delta(\%)$: ratio of output voltage changes to nominal output voltage.

4.2.3 Output Voltage Trim Curve

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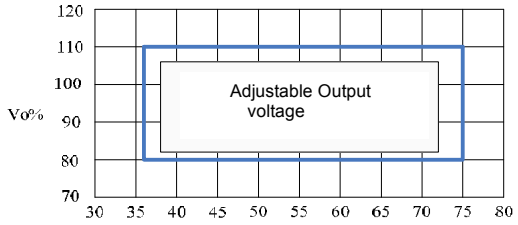


Input voltage: V
Maximum input voltage and output voltage adjustable value curve

4.3 Over-current Protection

When the over-current/short-circuit protection functions, the module is in hiccup mode, and the input current varies from a few mA to hundreds of mA.

4.4 Over-voltage Protection

When the module is at over-voltage conditions, the module is in hiccup mode; after eliminating the over-voltage conditions, the output will be automatically recovered.

4.5 Over-temperature Protection:

When the baseplate temperature exceeds the over-temperature protection threshold (105℃ to 125℃), the over-temperature protection functions, and the output is off; when the baseplate temperature is lower than the over-temperature protection threshold by 5℃ to 12℃, the module is auto recovered.

4.6 Remote Sense (+S, -S terminals):

To use remote sense, use twisted wire to connect +S and –S to + LOAD and –LOAD respectively, and the twisted-pair shall be as short as possible. The remote sense terminals can not be used to provide output current, or the module may be damaged.

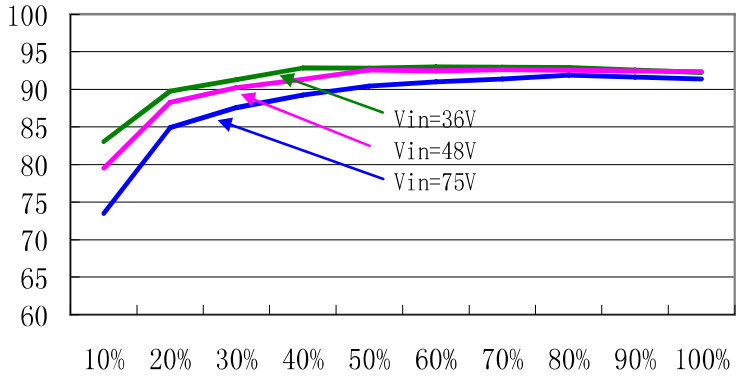
4.7 For the negative logic, output will be on when the Rem is at low level, short connected to–Vin; and output will be off when the Rem is at high level or keep open circuit referenced to -Vin.

For the positive logic, output will be off when the Rem is at low level, short connected to–Vin; and output will be on when the Rem is at high level or keep open circuit referenced to -Vin.

4.8 For hi-pot test, short +Vin to –Vin and + Rem, short +Vout to-Vout, and short signal terminals, Trim, +S and –S.

5 Operating Curve: Ta = +25℃, airflow = 1m/S

5.1 Efficiency Curve



Output Current vs Efficiency Curve (Tc = +25℃)

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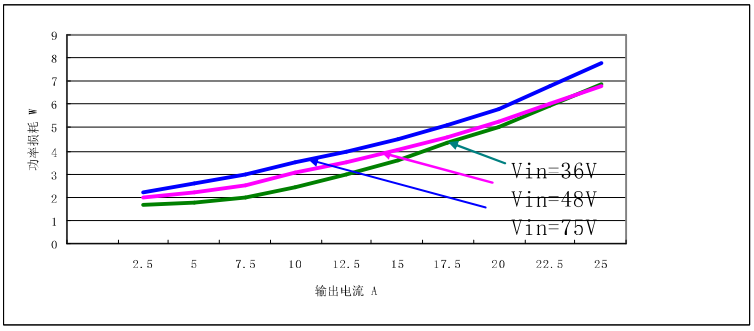
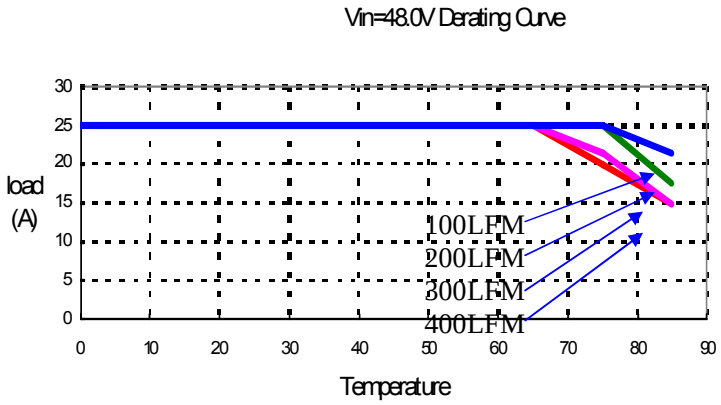
5.2 Power Loss Curve



Power Loss vs Output Current

5.3 Derating Curve



Thermal Derating Curve with no heatsink at different airflow speeds

Test conditions：

① The module shall be soldered on a 2.0mm standard 4-layer test board, of which the middle two layers are two-ounce copper foils.

② A certain gap is required between the module and test board. Keep the test board perpendicular to the horizontal direction and the long edge parallel with the horizontal plane.

③ Put the module into a thermal test box, and test the module using infrared thermal imaging equipment and thermocouple test equipment. See the diagram below for airflow directions.

④ When the module reaches thermal equilibrium state, the devices on the module can meet thermal derating requirements.

5.4 Dynamic Response:

Test Condition: Tc=25℃,Vin=48V,Bandwidth 20 MHz, externally add a 470μF electrolytic capacitor and a 1μF ceramic capacitor to output, add a 330μF/100V electrolytic capacitor to input.

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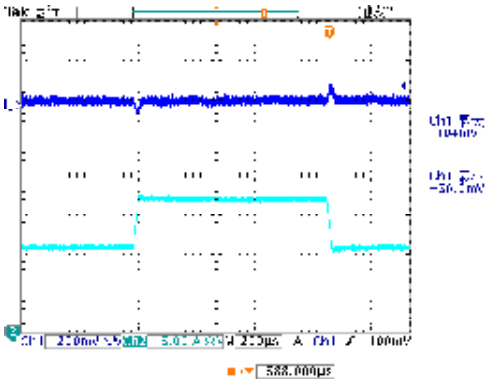
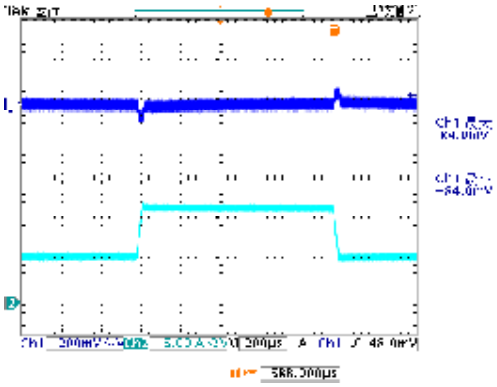


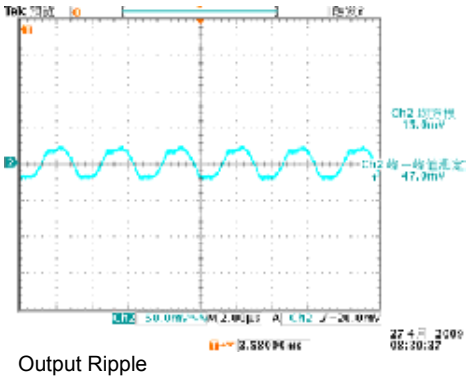
25%-50%-25%Io Dynamic Load



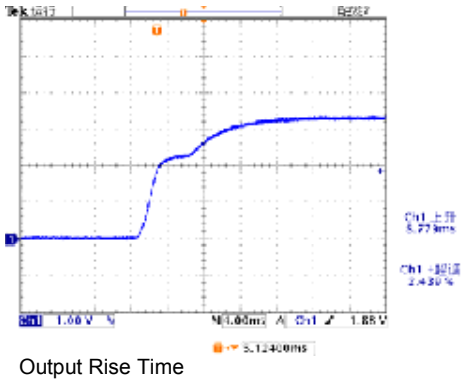
50%-75%-50%Io Dynamic Load

5.5 Output Ripple and Power-on Wave:

Test Condition: Tc=25℃,Vin=48V, Bandwidth 20 MHz, externally add a 470μF electrolytic capacitor and a 1μF ceramic capacitor to output, add a 330μF/100V electrolytic capacitor to input.

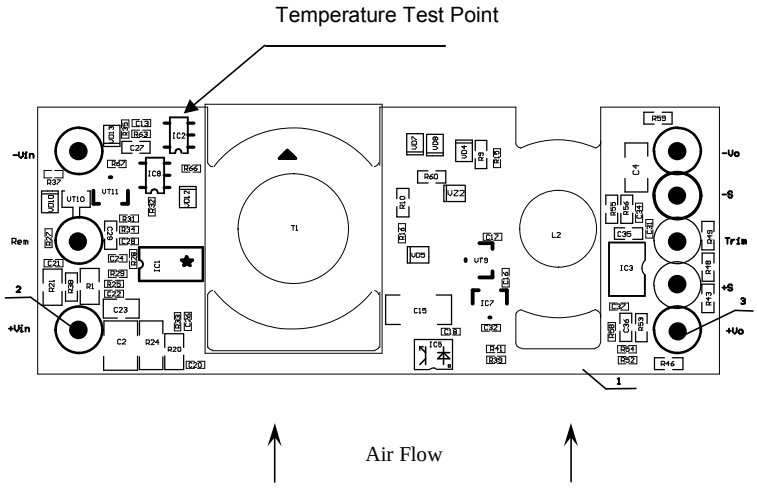


Output Ripple



Output Rise Time

5.6 Temperature Test Point and Airflow Direction



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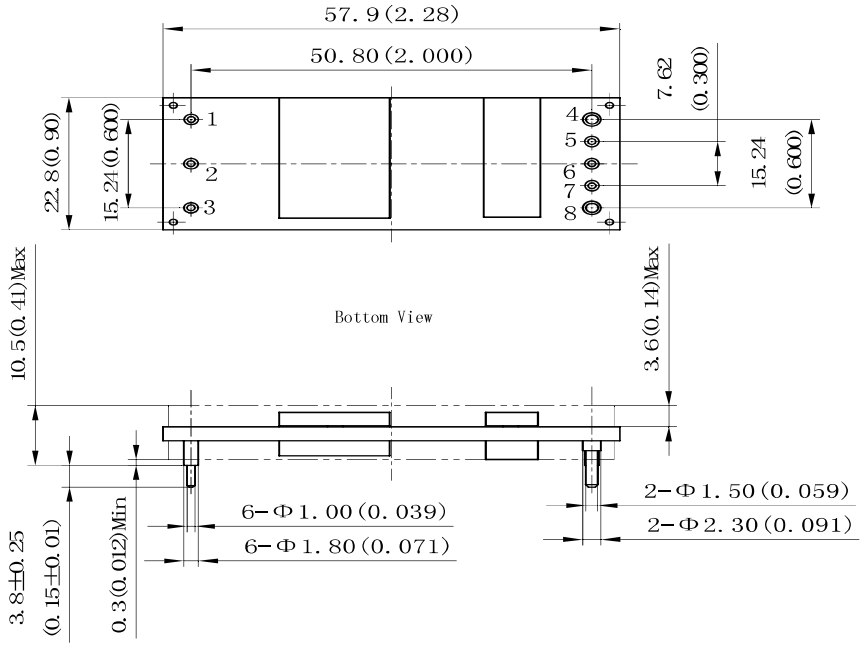
6. Dimensions and Pin definition

6.1 Dimensions

The product is equipped with an option of Aluminum baseplate, which includes through-threaded mounting holes, allowing for attachment of heat sinks. There are two outline designs: open-frame and aluminum baseplate.

1) Outline Diagram - Open-frame (no suffix “B” in model number):



Note (1) Unit: mm (inch)

(2) Tolerance: .X±0.5 (.XX±0.02) ; .XX±0.13 (.XXX±0.005)

(3) The maximum height of the highest device at non-pin side is 3.6 (0.14); and the minimum space between the highest device at pin side and the mounting surface of pin side is 0.3 (0.012).

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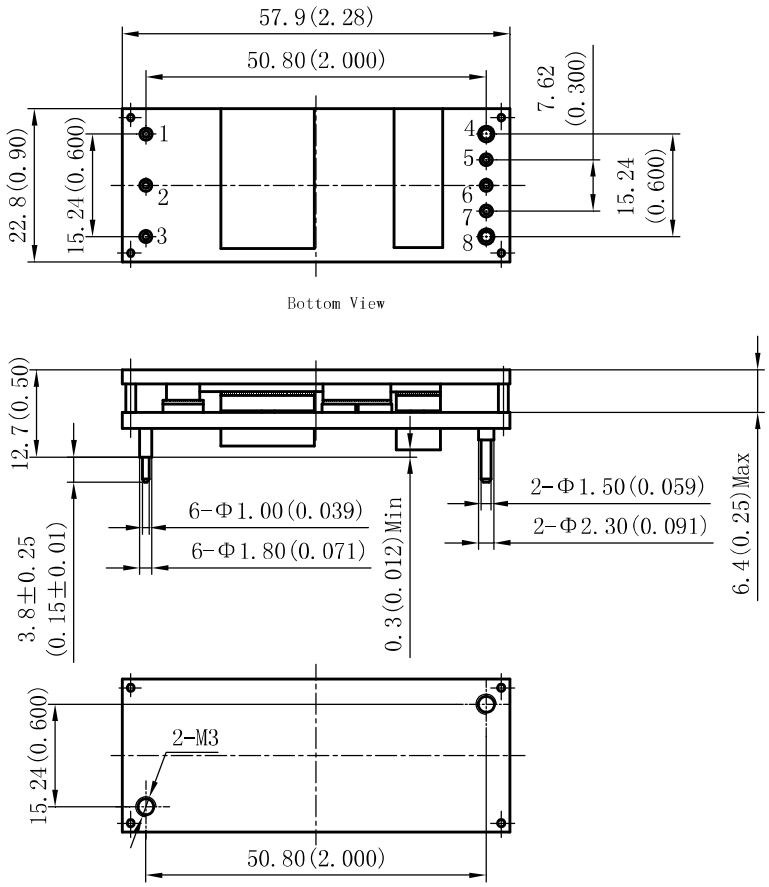
2) Outline Diagram - Aluminum Baseplate (with a suffix “B” in model number):



Note:

(1) Unit: mm (inch)

(2) Tolerance: .X±0.5 (.XX±0.02) ; .XX±0.13 (.XXX±0.005)

(3) The maximum height of the highest device at non-pin side is 6.4 (0.25); and the minimum space between the highest device at pin side and the mounting surface of pin side is 0.3 (0.012).

(4) 2-M3 is the through-threaded mounting hole allowing for attachment of heat sinks. The length of M3 screw screwed into the aluminum baseplate shall be less than 3.5mm.

6.2 Pin definition

No	1	2	3	4	5	6	7	8
Symbol	-Vin	Rem	+Vin	-Vout	-S	Trim	+S	+Vout
Definition	Negative input	Remote	Positive input	Negative output	Negative Remote Sense	Trim	Positive Remote Sense	Positive output

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