Industry Standard 1/4 brick: 48Vin, 3.3Vout, 25A

Options:

- Positive/Negative Remote on/off Logic
- Sprayed Conformal Coating

Features:

- Industry standard 1/4brick package & footprint 2.28″×1.45″×0.5″
- Operating temperature range:-40～85°C
- 2:1 input voltage range: 36～75Vdc
- Output voltage trim: -20% ～+10％
- Basic insulation, isolation voltage: 1500Vdc
- High efficiency: up to 91%
- High power density
- Low output noise and ripple
- Remote sense
- Input under-voltage protection
- Output short-circuit protection
- Output over-voltage protection
- Output over-current protection
- Thermal shutdown protection
- UL60950-1/ EN60950-1 Certified
- RoHS (2002/95/EC) complaint

Numbering Convention:

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

NO	Features	Descriptions
1	Product Series	QSR 1/4 brick
2	Typical Output Current	25 - Typical Output current: 25A
3	Typical Input Voltage	48 - Typical Input Voltage: 48V
4	Number of Outputs	S - Single Output
5	Typical Output Voltage	3V3 -Typical Output Voltage: 3.3V
6	Remote on/off Logic	L - Negative Logic
		H or Default - Positive Logic
7	Aluminum Radiator	B - Aluminum radiator
		Default - No Aluminum radiator
8	Sprayed conformal coating	C - Sprayed conformal coating
		Default: no sprayed conformal coating
9	RoHS	G5 - ROHS5
		G - lead-free, ROHS6
		Default - lead

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1. Description

The QSR25-48S3V3 series power modules are open-frame DC-DC converters in an industry standard 1/4 brick package and footprint, and can provide up to 3.3V output voltage and 25A output current. All devices of the modules are surface mounted. The converter features high power density, remote on/off, thermal shutdown protection, and current limit.

2. Technical Specifications (Unless otherwise stated, all specifications are typical at nominal input voltage, full load, 25℃ and airflow of 1m/s. Add a100uF/100V capacitor to input, and add a 470uF/10V capacitor to output.)

Parameter	Test Condition	Min	Typ	Max	Unit
2.1 Absolute Maximum Ratings					
Input Voltage (Vin)	Non-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	33	35	Vdc
Input Under-voltage Recovery Point	Ionom	31	34	36	Vdc
Maximum Input Current (Iimax)	Vimin, Vonom,Ionom	—	—	3.0	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	—	2.4	3.84	W
Inrush Transient Current	Io=Ionom	—	—	1	A^2S
Input Reflected Ripple Current	Vinom,Ionom, 5Hz ～ 20MHz, 12μH Absorption inductance, 0.1μF ceramic capacitor, 220μF electrolytic capacitor	—	50	100	mAp-p
Input Filtering Capacitance	Vimin ~ Vimax	—	100	—	μF
Remote (Positive Logic) On	High Level (2.4V~ 48V) or Open Circuit (reference to –Vin)				
Remote (Positive Logic) Off	Low Level (-0.7~ 0.8V reference to–Vin) or connected to-Vin				
Remote (Negative Logic) On	High Level (2.4V~ 48V) or Open Circuit (reference to –Vin)				
Remote (Negative Logic) Off	Low Level (-0.7~ 0.8V reference to–Vin) or connected to-Vin				
2.3 Output Specifications					
Output Voltage Set-point (Vonom)	Vinom,Ionom	3.267	3.3	3.333	Vdc
Typical Output Current (Ionom)	—	—	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

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Parameter		Test Condition	Min	Typ	Max	Unit
Voltage Regulation Precision		Vimin ~ Vimax, 0-100%Ionom	—	—	±1	
Output Voltage Trim (Voadj)		Io≤Ionom,Po≤82.5W	-20	—	+10	%Vo
Over-voltage Protection	Protection Mode	——	Auto-recovery			—
	Threshold	Po<Pomax	3.8		4.95	Vdc
Over-current protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Threshold	Vinmin~Vinmax, Tc (baseplate temp) = -40 ~ 100°C	105	—	150	%Io nom
Short-circuit protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Input current	Vinom	—	200	400	mA
Dynamic Load Response	Peak Deviation	25%-50%-25%Ionom 50%-75%-50%Ionom ΔIo/Δt=0.1A/μS,Vinom	—	60	120	mV
	Settling Time		—	70	140	μs
	Peak Deviation	0%-100%-0%Ionom ΔIo/Δt=0.1A/μS,Vinom	—	—	50	%Vo
	Settling Time		—	—	800	μs
Output Ripple and Noise	RMS(20MHz)	Vinom,20MHz, externally add a 10μF tantalum capacitor and 1μF ceramic capacitor to output ①	—	15	30	mV
	P-to-P(20MHz)		—	50	100	mV
	P-to-P(100MHz)		—	100	200	mV
External Output Capacitance(Co)		Vinmin ~ Vinmax,0~100%I_O	470	—	10000	μF
Turn-on/off Peak Deviation		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		10%Vinnom ~ 90%Vonom	4	8	12	mS
Turn-on Rise Time		10%Vonom ~ 90%Vonom	2	4	8	mS
Remote Voltage Sampling		——	can			
2.4 Safety Specifications						
Isolation voltage	Input to output	Leak Current≤1mA, 1min	—	—	1500	Vdc
Isolation Resistance (RISO)		$500V_{DC}$	10	—	—	MΩ
Safety Certificate		EN 60950-1 Recognize				
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.			

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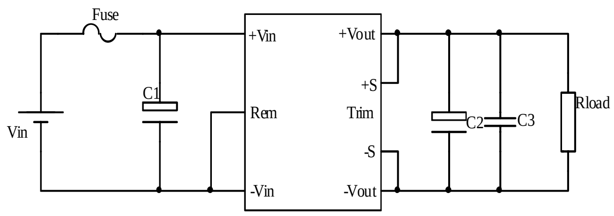
Parameter	Test Condition	Min	Typ	Max	Unit
MTBF	≥2×10[6]h Bellcore TR-332 (Ta=25°C) ≥1×10[6]h Bellcore TR-332 (Ta=55°C)				
2.6 Environmental Specifications					
Relative Humidity	(40±2) ℃, No dew	—	—	90	%RH
Cooling	——	Forced-air Cooling			
Over-temperature protection: Protection Mode		Hiccup, Auto-recovery			
Over-temperature protection: Thermistor Temperature	——	95	105	115	℃
Over-temperature protection: Hysteresis	——	5	—	—	℃
Operating Ambient Temperature		-40	—	+85	℃
Storage Temperature (Tst)		-40	—	+125	℃
2.7 General Specifications					
Switching Frequency	——	—	300	—	KHz
Temperature Coefficient (Tcoeff)	——	—	—	±0.02	%Vo/℃
Efficiency (η)	Vinom, 100%Ionom	89	91	—	%
	Vinom, 80%Ionom		91	—	%
	Vinom, 50%Ionom		91	—	%
	Vinom, 20%Ionom		86	—	%
Weight	——	—	32	—	g
RoHS	RoHS(2002/95/EC)				
Anti-sulfuration feature	Sprayed conformal coating (plus a suffix "C" in model no.)				

Note: At high/low temperature,

① Output ripple and noise at an ambient temperature below -5℃ (Test Conditions: Vinom,20MHz, besides a 470uF capacitor, externally add a 20μF tantalum capacitor and a 1μF ceramic capacitor to output)

3. Basic Application Circuits and Considerations

3.1 Typical Application



Note: Fuse: 5A fuse (fast blow type) ; C1: 100V, ≥100μF (High-frequency & low –ESR capacitor);
C2: 470μF/10V(High-frequency & low-ESR capacitor); C3: 1μF/10V, monolithic capacitor.
The test conditions for Output ripple & noise at an ambient temperature below -5℃ shall be: Vinom, 20MHz, and besides a 470uF capacitor, externally add a 220μF tantalum capacitor and a 1μF ceramic capacitor to the output.

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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 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 "4.2 Output Voltage Adjustment (Trim)" for details.

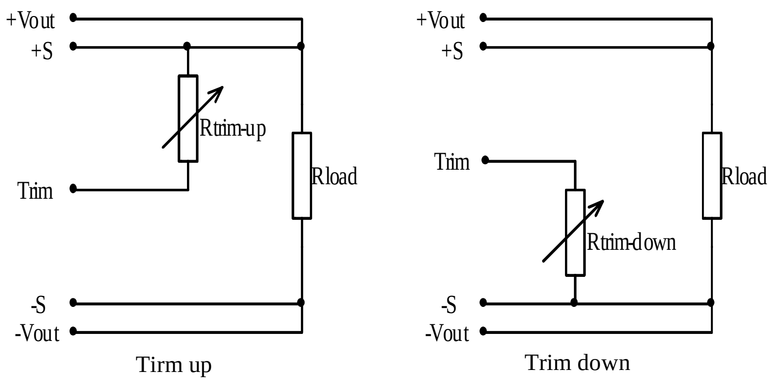
3.4 Connect a 100uF/100V capacitor to the input when a capacitor is connected to the output.

4. Instruction for Use

4.1 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged. The module is not internally fuse; an external 5A fast blow fuse shall be used.

4.2 Output Voltage Adjustment (Trim)

4.2.1 Output 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

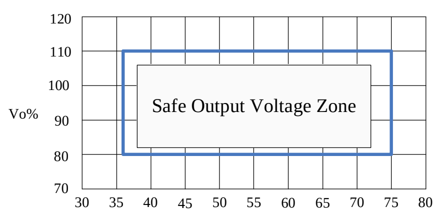
$$R_{Trim-down} = \left(\frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right) (k\Omega)$$

Where V_O: Output Voltage;

$R_{Trim-up}$、$R_{Trim-down}$: external adjusting resistor;

$\Delta(\%)$: The output voltage relative to the rate of change of nominal output voltage.

4.2.3 Output voltage Regulation Curve



Output Voltage Unit: V

Changes of Output Voltage vs Input Voltage

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4.3 Over-current Protection

When the module is in short-circuits or in over-current conditions, the module is in hiccup mode, and the output current varies from a few mA to hundreds of mA; the module recovers after the over-current or short-circuit conditions are eliminated.

4.4 Over-voltage Protection

When the output voltage exceeds the threshold of over-voltage protection, the module is in hiccup mode. After eliminating the over-voltage conditions, the module recovers automatically.

4.5 Over-temperature Protection

When the thermostat temperature exceeds the threshold of over-temperature protection, the over-temperature protection functions and the output is off; when the thermostat temperature is 5℃ less than the protection threshold, the module recovers automatically.

4.6 Remote Sense (+S,-S)

When using remote sense, use twisted-pair to connect +S/-S respectively to +load/-load. The remote sense terminals can not be used for transmission of load current, or the module may be damaged.

4.7 Remote on/off

Negative logic:

The output will be on when REM is at low level or shorted to **–**Vin;

The output will be off when REM is at high level or keeps open circuit (reference to -Vin).

Positive logic:

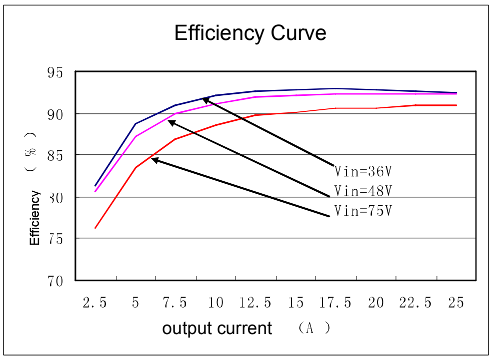
The output will be off when REM is at low level or shorted to **–**Vin;

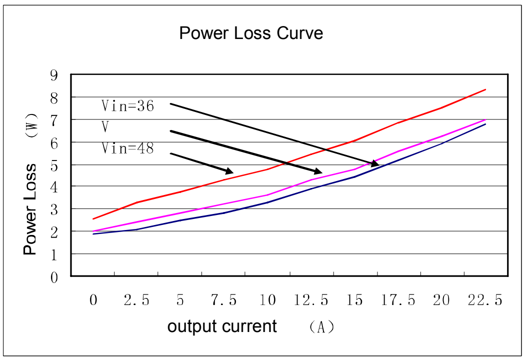
The output will be on when REM is at high level or keeps open circuit (reference to -Vin).

4.8 For isolation voltage test, short +Vin, -Vin and Rem, and short +Vout, -Vout, Trim, +S and -S.

5. Operating Curves (Ta＝+25℃, airflow = 1m/S)

5.1 Efficiency and Power Loss Curve





Efficiency vs Output Current (Tc＝+25℃) Power Loss vs Output Current

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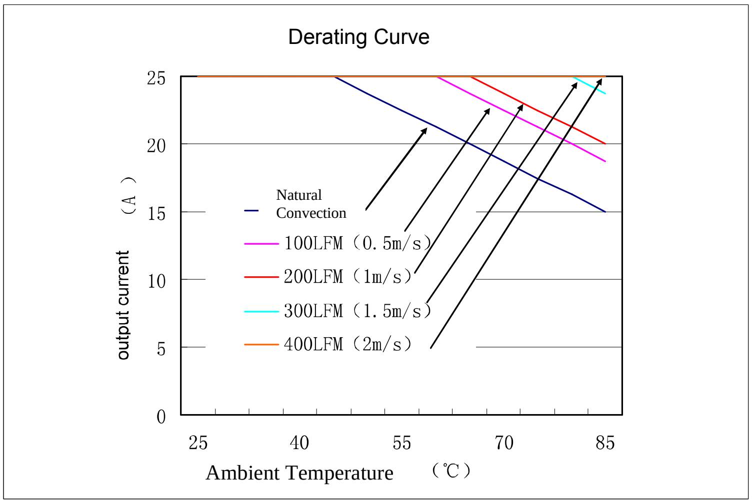


Thermal Derating Curve with no heat sink (Different wind speeds, Vinom)

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.

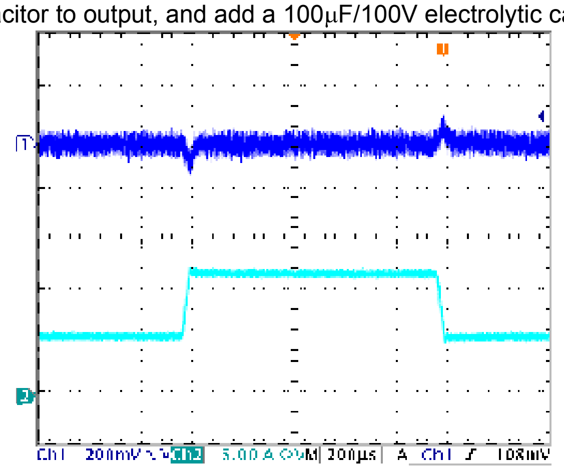
(2) A certain gap is required between the module and test board. Keep the test board perpendicular to the horizontal direction and the long edge parallel with the horizontal plane.

(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.

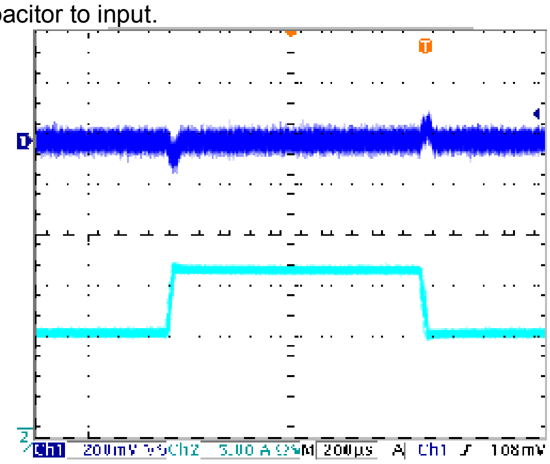
(4) When the module reaches thermal equilibrium state, the devices on the module can meet thermal derating requirements.

5.2 Dynamic Response

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



25%-50%-25%Io Dynamic Load



50%-75%-50%Io Dynamic Load

5.3 Output Ripple and Power-on Wave

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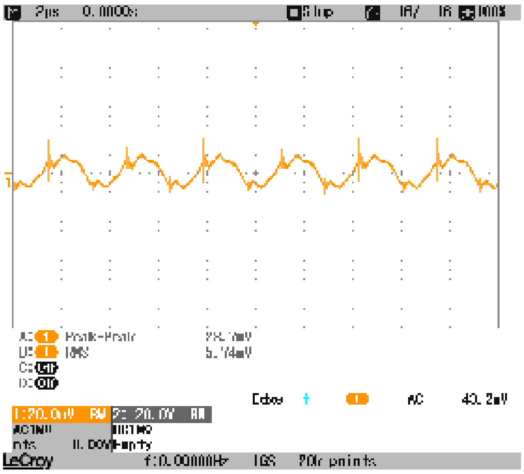
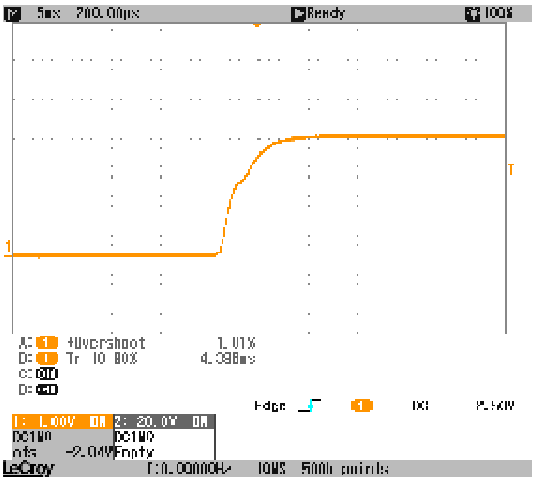
Test Conditions: Ta=25℃,Vin=48V, Io=25A, 20MHz, externally add a 470μF electrolytic capacitor and a 1μF ceramic capacitor to output, and add a 100μF/100V electrolytic capacitor to input.

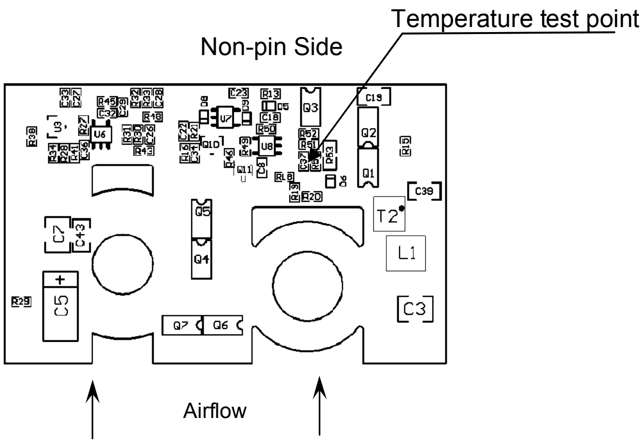


Output Ripple



Output Rise Time

5.4 Temperature test point and the direction of air-cooled



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 (with no suffix "B" in model no.)

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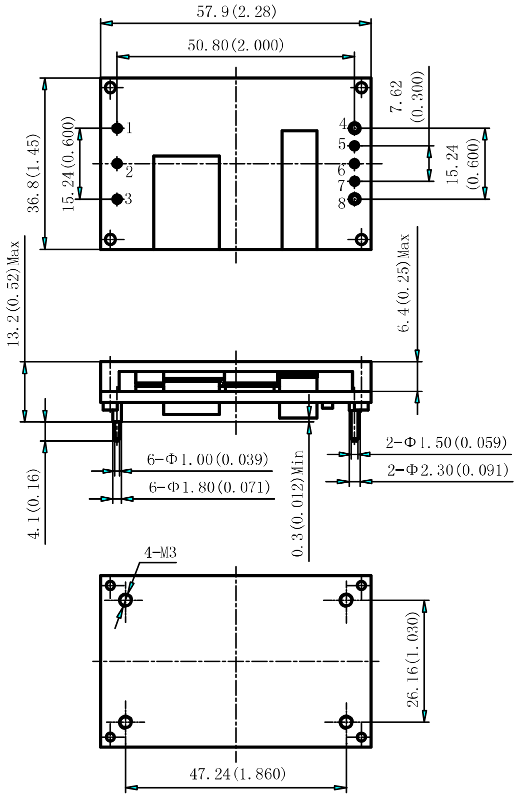

(1) Unit: mm (inch)

(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 4.1 (0.16); and the minimum space between the highest device at pin side and the mounting surface of pin side is 0.3(0.012).

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

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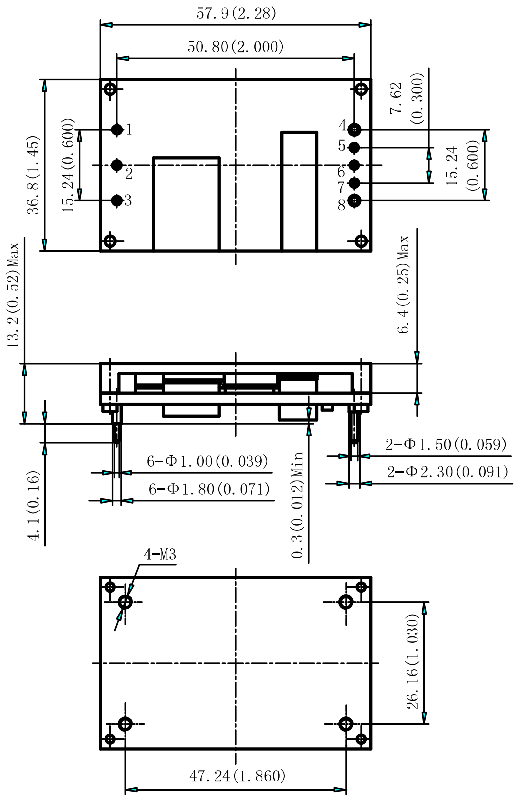

(1) Unit: mm (inch)

(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(0.24); and the minimum space between the highest device at pin side and the mounting surface of pin side is 0.3 (0.012).

(4) 4-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 3mm.

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	Rem	Positive Input	Negative Output	Negative Remote Sense	Trim	Positive Remote Sense	Positive Output

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