Industry Standard 1/4 brick: 48Vin, 5Vout, 20A

Options:

- Positive/Negative Remote On/off
- Sprayed conformal coating
- Aluminum heat sink

Features:

- Industry standard1/4 brick package and footprint 2.28"×1.45"×0.41"
- 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: 92%
- High power density
- Low output noise & ripple
- Remote sense
- Input under-voltage protection
- Output short-circuit protection
- Output over-voltage protection
- Output over-current protection
- Thermal Shutdown Range
- UL60950-1 Certified
- RoHS (2002/95/EC) complaint

Numbering Convention:

QSR 20 – 48 S 5 – L B–C G5

1 2 3 4 5 6 7 8 9

NO	Features	Descriptions
1	Product Series	QSR 1/4 brick Series
2	Typical Output Current	20 -Typical Output current: 20A
3	Typical Input Voltage	48 -Typical Input Voltage: 48V
4	Number of Outputs	S - Single Output
		D - Dual Output
5	Typical Output Voltage	5 -Typical Output Voltage: 5V
6	Remote on/off Logic	L - Negative Logic
		H or Default - Positive Logic
7	Aluminum Heat Sink	B - Heat Sink
		Default – No Heat Sink
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 QSR20-48S5 series power modules are open-frame DC-DC converters in an industry 1/4 brick packaging & footprint, and provide up to 5V output voltage and 20A 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. Technical Specifications

(Unless otherwise stated, all specifications are typical at nominal input, full load, 25°C and airflow = 1m/S. Externally add a 220μF/100V capacitor to input, and a 470μF/25V capacitor to output)

Parameter		Test Condition	Min	Typ	Max	Unit
2.1 Absolute Maximum Ratings						
Input Voltage (Vin)		no operating, continuous	0	—	80	Vdc
		transient (100ms)	—	—	100	Vdc
Max Output Power (Pomax)		allowable operating conditions	—	—	100	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
Maximum Input Current (Iimax)		Vimin, Vonom,Ionom	—	—	3.2	A
No-load Input Current (Iio)		Vinom, Io＝0A	—	—	110	mA
Quiescent Input Current (Iiof)		Vinom, remote output shutdown	—	—	10	mA
No-load Loss		Vinom, Io=0A	—	—	5.28	W
Inrush Transient Current		Io=Ionom	—	—	1	A^2S
Input Reflected Ripple Current		Vinom,Ionom, 12uH Filter inductor, 20MHz	—	20	30	mAp-p
Input Filtering Capacitance		V_{INMIN}~V_{INMAX}	—	220	—	μF
Positive Remote Logic	On	High Level:2.4V~ 48V or floating				
	Off	Low Level: -0.7~ 0.8V (Reference to -Vin) or shorted -Vin				
Negative Remote Logic	Off	High Level:2.4V~ 48V or floating				
	On	Low Level: -0.7~ 0.8V (Reference to -Vin) or shorted -Vin				
2.3 Output Specifications						
Output Voltage Set-point (Vonom)		Vinom,Ionom	4.95	5.0	5.05	Vdc
Typical Output Current (Ionom)		—	0	—	20	A
Output Current Range (Io)		Po≤ 100W	0	—	20	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≤100W	-20	—	+10	%Vo
Output Over-voltage Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Threshold	Po<Pomax	6.0		7.5	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Threshold	Vinmin~Vinmax, Tc (board temp) = -40~100°C	110	—	140	%Ionom
Output 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	—	—	250	mV
	Settling Time		—	—	200	μs
	Peak Deviation	0%-100%-0%Ionom ΔIo/Δt=0.1A/μS,Vinom	—	—	50	%Vo
	Settling Time		—	—	800	μs
Output Ripple and Noise ①	RMS (20MHz)	Vinom, 20MHz, externally add a 10μF tantalum capacitor and a 1μF ceramic capacitor to output	—	—	50	mV
	Peak-to-Peak(20MHz)		—	—	75	mV
	Peak-to-Peak(100MHz)		—	—	120	mV
External Output Capacitance(Co)		V_{INMIN}~V_{INMAX},0~100%I_O	470	—	5000	μF
Turn-on/off Peak Deviation		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		10%Vinnom-- 90%Vonom	5	—	30	mS
Turn-on Rise Time ②		10%Vonom---90%Vonom	5	—	15	mS
Remote 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				
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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MTBF	$\geq 2\times 10^{6}$h Bellcore TR-332 (Ta=25°C) $\geq 1\times 10^{6}$h Bellcore TR-332 (Ta=55°C)

Parameter		Test Condition		Min	Typ	Max	Unit
2.6 Environmental Specifications							
Relative Humidity		(40±2) ℃, No dew		—	—	90	%RH
Cooling		——		Forced-air cooling or heat sink			
Over-temperature Protection	Protection Mode	——		Hiccup, Auto-recovery			
	Temperature Range	——		95	105	115	℃
	Hysteresis	——		5	—	—	℃
Operating Ambient 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	92.3	—	%
			20%Ionom	—	86	—	%
			50%Ionom	—	91	—	%
			80%Ionom	—	92	—	%
Weight		Open-frame, no suffix "B" in product model no.		—	32	—	g
RoHS		RoHs (2002/95/EC) Directive					
Anti-sulfuration feature		Sprayed conformal coating (plus a suffix "C" in product model)					

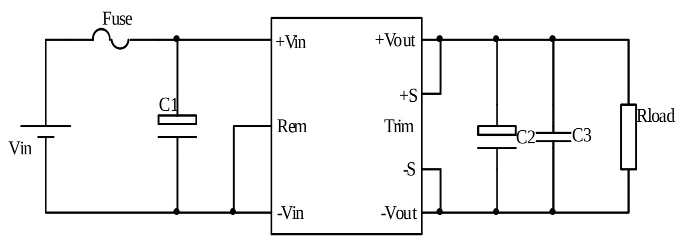
Note: At high/low temperature,

① Output Ripple & Noise (Peak-to-Peak): Vrp<100mV (Test condition: Vinom, 20MHz; at low temperature, besides the 470uF capacitor, externally add a 220µF tantalum capacitor and 1µF electrolytic capacitor to output.)

② Output Rise Time: 5mS<T<20mS (Test condition: 10%Vonom--90%Vonom)

3. Basic Application Circuit and Considerations

3.1 Typical Application (Negative logic)



Fuse: 7.5A; C1: 100V, ≥220µF; C2: 25V, 470µF (High-frequency, Low ESR);
C3: 10V, 1µF 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 floating referenced to –Vin; output will be on when the Rem is at low level or when the Rem is shorted to –Vin

3.4 Output short-circuit protection model 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 "4.2 Output Voltage Adjustment (Trim)" for details.

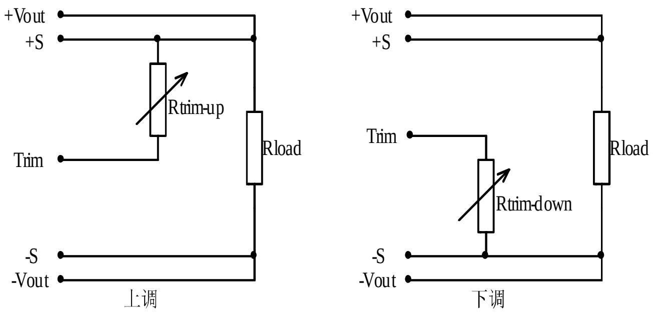
3.6 Connect a 220µF/100V capacitor to the input when a capacitor is connected to the output.

4. Instruction for Use (Forced-air cooling or heat sink required)

4.1 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged. The module is not internally fused, and an external 75A/250V fuse should be used.

4.2 Output Voltage Adjustment (Trim)

4.2.1 Output Voltage Trim Circuit:



4.2.2 Output Voltage Trim Equations

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

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

Where V_O: Output voltage;

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

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

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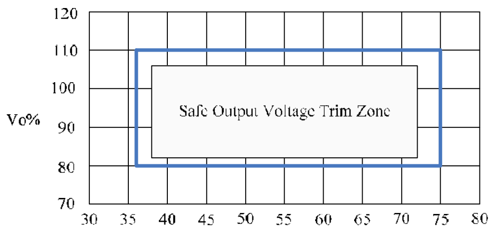
4.2.3 Output Voltage Trim Curve:



Unit: V

Max Output Voltage vs Input Voltage

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 temperature of thermistor exceeds the over-temperature protection threshold, the over-temperature protection functions, and the output is off; when the temperature is lower than the over-temperature protection threshold by 5℃, 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.

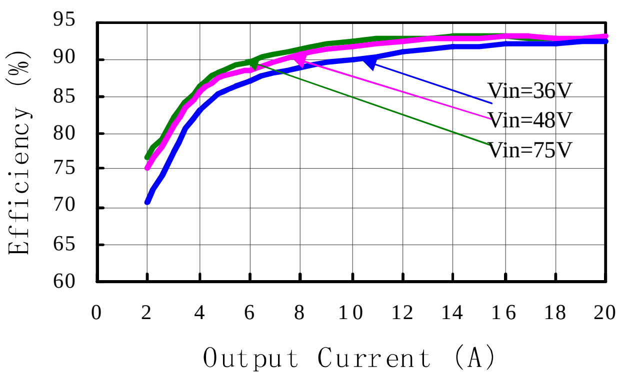
4.7 For negative logic, output will be on when the Rem is at low level, or short connected to–Vin; and output will be off when the Rem is at high level or keeps floating referenced to -Vin.

For 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 keeps floating 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 Characteristic Curves (Ta＝＋25℃, wind 1m/S):

5.1 Efficiency Curve



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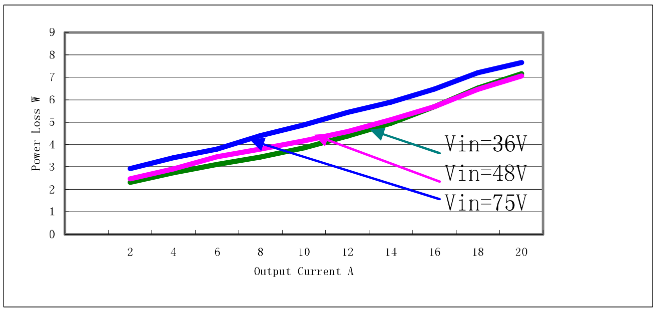
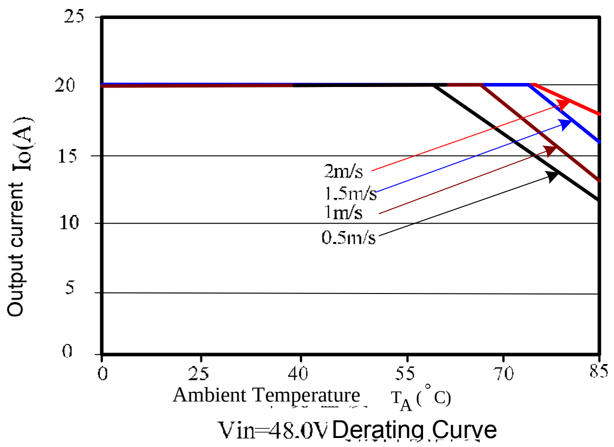
Efficiency vs Output current (Tc=＋25℃)

5.2 Power Loss Curve



Power Loss vs Output current

5.3 Thermal Derating Curve



Output Current vc Ambient Temperature at different airflow (no heat sink), 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 diagram 4.5 for the airflow direction.

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

Note: when equipped with a heat sink, keep the temperature at the center of the heat sink no more than 100℃.

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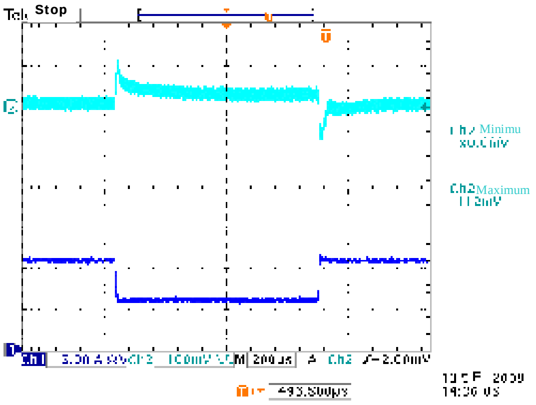
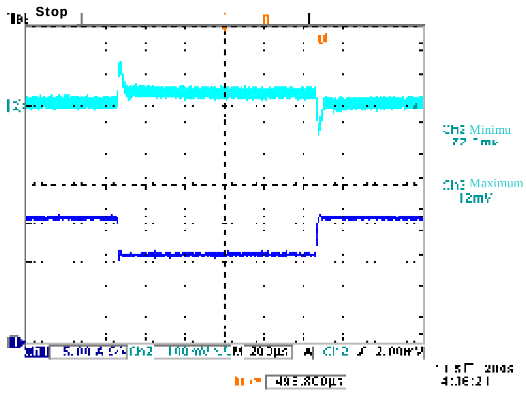
5.4 Dynamic Response:

Test Conditions: Tc=25℃,Vin=48V, 20 MHz, externally add a 470μF electrolytic capacitor and a 1μF ceramic capacitor to output, and add a 220μF/100V electrolytic capacitor to input.



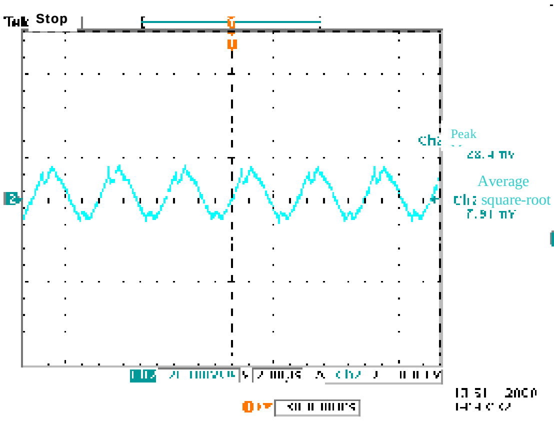
25%-50%-25%Io Dynamic Load



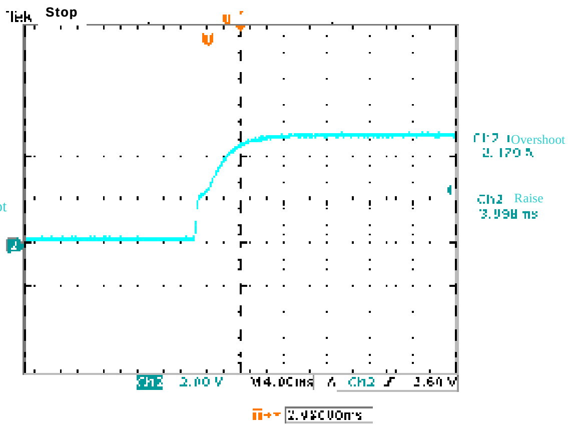
50%-75%-50%Io Dynamic Load

5.5 Output Ripple and Power-on Wave

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 220μF/100V electrolytic capacitor to input.



Output Ripple



Power-on Wave

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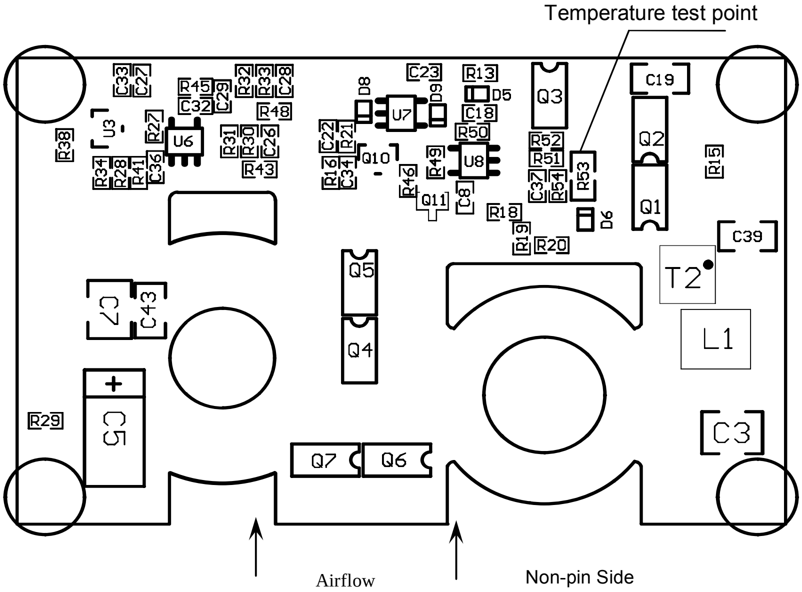
5.6 Temperature Test Point and Airflow Direction



6. Dimensions and Pin definition

6.1 Dimensions

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

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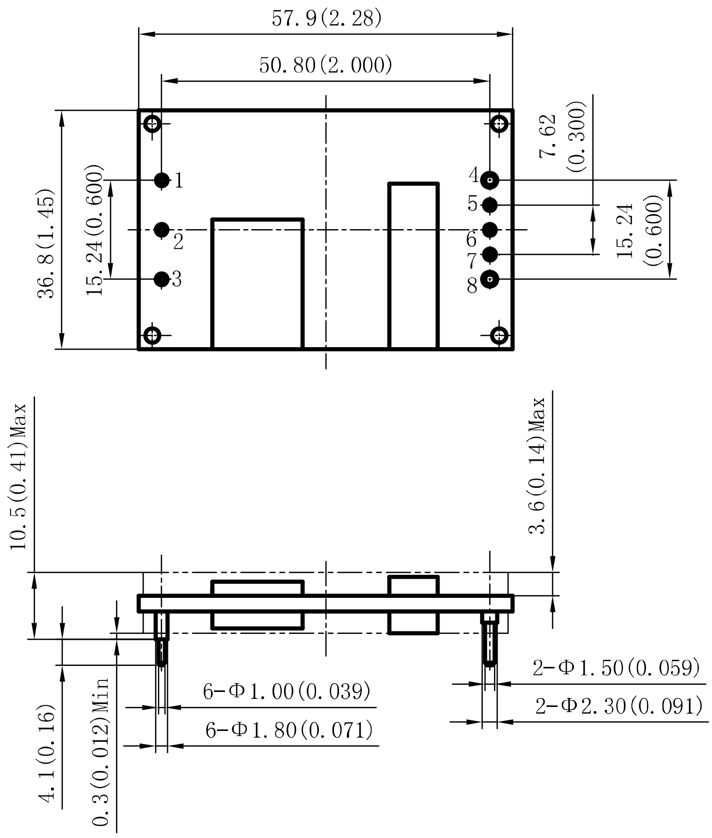
1) Outline Diagram - Open-frame (no suffix "B" in product model no.)



(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 component at non-pin side is 3.6mm (0.16inch); and the minimum space between the highest component at pin side and the mounting surface of pin side is 0.3mm(0.012inch).

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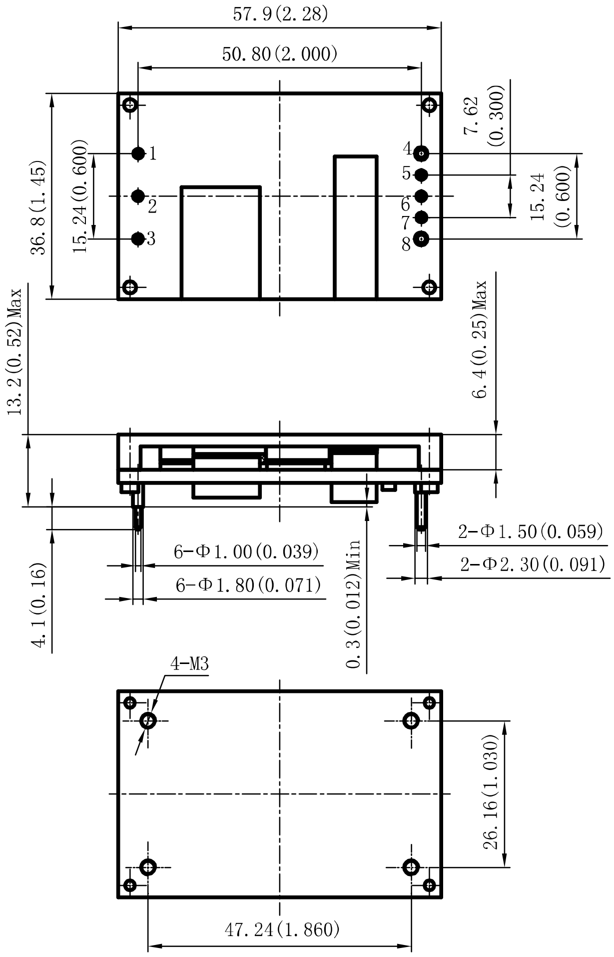
2) Outline Diagram - Aluminum Board (with a suffix "B" in model number):



(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 component at non-pin side is 6.4mm(0.24inch); and the minimum space between the highest component at pin side and the mounting surface of pin side is 0.3mm (0.012inch).

(4) 4-M3 is the through-threaded mounting hole allowing for attachment of heat sinks. The length of M3 screw screwed into the aluminum board 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	Remote	Positive Input	Negative Output	Negative Remote Sense	Trim	Positive Remote Sense	Positive Output

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