Features:

- Industry standard 1/4 brick package & footprint
  57.9mm×36.8mm×10.5mm
  (2.28"×1.449"×0.413")
- High power density: 31.8W/in^3
- High efficiency
- 2: 1 input voltage range
- Low output noise & ripple
- Remote sense
- Constant frequency
- Over-temperature protection: Auto-recovery
- Output over-voltage protection: locked
- Dual adjustable output voltage: +10%/-20%
- Output over-current/voltage protection
- EN60950-1 recognized
- RoHS (2002/95/EC) complaint

Options:

- Positive/Negative Remote on/off
- Sprayed conformal coating

Numbering Convention

QSR 20–48 D 3V3 1V5–L B - C G5
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

NO	Features	Descriptions
①	Product Series	Industry standard 1/4 brick
②	Output Current	Total output current of 2 outputs: 20A
③	Typical Input Voltage	Input Voltage: 48V
④	Number of Outputs	S - Single Output
		D - Dual Output
⑤	Typical Output Voltage	Voltage Output 1: 3.3V
⑥	Typical Output Voltage	Voltage Output 2: 1.5V
⑦	Remote on/off Logic	L - Negative Logic
		H or Default - Positive Logic
⑧	Aluminum HeatSink	Default-No HeatSink
		B - HeatSink
⑨	Sprayed conformal coating	C - Sprayed Conformal coating
		Default: No sprayed Conformal coating
⑩	ROHS	G5 - ROHS5
		G - lead-free, ROHS6
		Default - lead

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1. Description

The QSR20-48D3V31V5-L-CG5 series power modules are open-frame DC-DC converters in an industry 1/4 brick packaging & footprint equipped with an option of aluminum board. The converters can provide two outputs: 3.3V/8A and 1.2V/13A. The converters feature wide input voltage range, high efficiency, high power density, high isolation voltage, and are well suited for telecommunication, industrial automation and test equipments, etc.

2. Technical Specifications (Unless otherwise stated, all specifications are typical at nominal input voltage, full load and 25 ℃. ambient temperature measured. An external 100μF/100V electrolytic capacitor shall be added to the input of the test tooling, and a 220μF/10V tantalum capacitor shall be added to each 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	—	—	45	W
2.2 Input Specifications						
Typical Input Voltage (Vinom)		—	—	48	—	Vdc
Input Voltage Range		—	36	—	75	Vdc
Input Under-voltage Protection		Ionom	30	—	32	Vdc
Input Under-voltage Recovery Point		Ionom	31	—	36	Vdc
Maximum Input current (Iimax)		Vimin, Vonom,Ionom	—	—	1.6	A
No-load Input Current (Iio)		Vinom, Io＝0A	—	90	110	mA
Quiescent Input Current (Iiof)		Vinom, remote output shutdown	—	—	40	mA
No-load Loss		Vinom, Io=0A	—	—	5.28	W
Inrush Transient current		Io=Ionom	—	—	1	A^2S
Input Filtering Capacitance		Vimin-Vimax	—	—	100	μF
Input Reflected Ripple Current		5Hz~20MHz, 12μH absorption inductor, 0.1μF ceramic capacitor, 100μF electrolytic capacitor	—	10	20	mA (p-p)
Remote	On	-0.7V-1.8V, or connected to -Vin; Current: 0.5~2mA				
	Off	3.5V~12V(reference to -Vin) or open circuit				
2.3 Output Specifications						
Output voltage Set-point (Vonom)		Vinom,Ionom, Vo1	3.30	3.33	3.36	Vdc
		Vinom,Ionom, Vo2	1.50	1.54	1.56	Vdc
Typical Output Current (Ionom)		Io1	—	8.0	—	A
		Io2	—	12.0	—	A
Output Current Range (Io)		Io1	0	—	8.0	A
		Io2	0	—	12.0	A

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Parameter		Test Condition	Min	Typ	Max	Unit
Line Regulation (Vov)		Vimin-Vimax,Ionom,Vo1	—	±0.2	±0.5	%Vo1
		Vimin-Vimax,Ionom,Vo2	—	±0.2	±0.5	%Vo2
Load Regulation (Vol)		0-100%Ionom,Vinom,Vo1, Vo2	—	±0.5	±1.5	%Vo1, 2
Interactive regulation		One output: full load, Another output: 0-100%Ionom, Vinom,Vo1, Vo2	—	±0.5	±1.5	%Vo1, 2
Output Voltage Trim (Voadj)		Io2≤Io2nom	-20	—	+10	%Vo2
Voltage Regulation Precision		Vinom, 0-100%Ionom	—	—	2	%Vo1, 2
Output Over-voltage Protection	Protection Mode	——	locked, power on to recovery			—
	Threshold	Po<Pomax, Vo1	3.9	—	5.0	Vdc
		Po<Pomax , Vo2	1.77	—	2.26	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Threshold	Vo1: Over-current (Vo1I: full load), Vinom	9.0	—	13.0	A
		Vo1I: Over-current (Vo1: full load), Vinom	15.0	—	22.0	A
Output Short-circuit Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Input Current	Vimin-Vimax,Ionom	—	—	0.2	A
Dynamic Load Response (25%Ionom)	Peak Deviation	25%-50%-25%Ionom, 50%-75%-50%Ionom ΔIo/Δt=1.0A/μS Vinnom	—	—	5%	Vo1/2
	Settling Time		—	—	100	μs
Dynamic Load Response (50%Ionom)	Peak Deviation	25%-75%-25%Ionom, 25%-100%-25%Ionom, ΔIo/Δt=1.0A/μS Vinnom	—	—	5	Vo1/2
	Settling Time		—	—	6	Vo2
			—	—	400	μs
Dynamic Load Response (100%Ionom)	Peak Deviation	0%-100%-0%Ionom, ΔIo/Δt=1.0A/μS, Vinnom	—	—	50%	Vo1/2
	Settling Time		—	—	1000	μs
Output Ripple & Noise (Peak-to-Peak) ①	RMS	20MHz, add a 10μF/10V Tantalum capacitor and a 1μF Ceramic capacitor to the test tooling for V_{o1} and V_{o2}	—	—	30	mV
	Peak-to-Peak (20Mz)		—	—	50	mV
	Peak-to-Peak(100Mz)		—	—	200	mV
External Output Capacitance (Co)		V_{inmin}~V_{inmax}, 0~100%I_{O}, Vo1	220	—	5000	μF
		V_{inmin}~V_{inmax}, 0~100%I_{O}, Vo2	220	—	10000	μF
Turn-on/off Peak Deviation		Vinom,Ionom, Vo1	—	—	±5	%Vo1
		Vinom,Ionom, Vo2	—	—	±6	%Vo2
Turn-on Delay Time		△V=｜Vo2-Vo1｜ 0%Vo2---90%Vo2	—	—	0.5	Vdc
Turn-on Rise Time		10%Vonom---90%Vonom	—	5	20	mS

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Parameter		Test Condition	Min	Typ	Max	Unit
2.4 Safety Specifications						
Isolation voltage	Input to output	Leak Current≤1mA, 1min	1500	—	—	Vdc
Isolation Resistance (RISO)		test voltage: 500Vdc, normal temperature		—	—	MΩ
Safety Certificate		EN60950-1				
2.5 Reliability						
Vibration Test(sine)		ΔIo/Δt=: 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^{6}h Bellcore TR-332 (Vinom,Ionom, Ta=25°C)				
		≥1×10^{6}h Bellcore TR-332 (Vinom,Ionom, Ta=55°C)				
2.6 Environmental Specifications						
Relative Humidity		(40±2) ℃, No dew	5	—	95	%RH
Cooling		See the thermal derating curves	Forced-air cooling or heat sink			
Over-temperature Protection		——	100℃~115℃, Auto-recovery			
Operating Ambient Temperature		＜55℃, Natural Convection	-40	—	+70	℃
Storage Temperature (Tst)		——	-40	—	+100	℃
2.7 General Specifications						
Switching Frequency		——	—	300	—	k Hz
Temperature Coefficient (Tcoeff)		——	—	—	±0.02	%/℃
Efficiency (η)		Vinom,100%Ionom	85	87.5	—	%
		Vinom,80%Ionom	—	87	—	%
		Vinom,50%Ionom	—	84.5	—	%
		Vinom,20%Ionom	—	71.5	—	%
Weight		——	—	35	—	g
Anti-sulfuration feature		Sprayed conformal coating				
RoHS		2002/95/EC Directive				

Note: ① 20MHz, besides the 220μF capacitors on the test tooling (one for each output), add a 10μF/10V tantalum capacitor to the ripple test tooling for Vo1, and a 1μF ceramic capacitor for Vo2, Ta=-25℃~+55℃.

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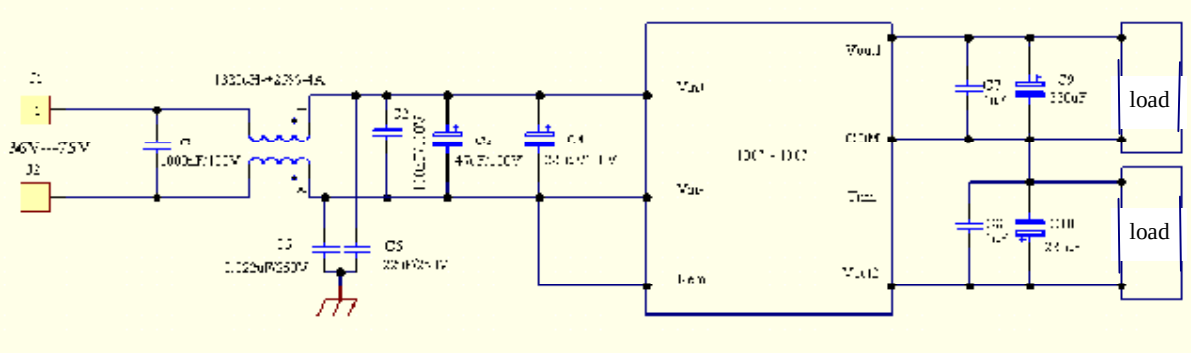
3. Basic Application Circuit and Considerations

3.1 Typical Application



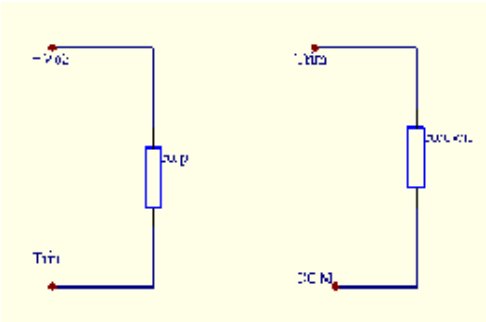
3.2 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged.

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-circuit protection model is hiccup, automatic recovery.

3.5 Output Trim: Vo1 is not adjustable, but Vo2 is adjustable. Exceed the maximum output power (trim up) or the maximum output current (trim down) of Vo2 may cause the converter operate abnormally.

3.6 Output Voltage Trim



Trim up Trim down

Trim-down: $R_{down} = \frac{2.82V_{o2}}{V_{o2nom} - V_{o2}} - 2.4$

Trim-up: $R_{up} = \frac{(4.75V_{o2nom} - 2.82)V_{o2}}{V_{o2} - V_{o2nom}} - 2.4$

Where V_{o2nom}: nominal output voltage of Vo2 ,

V_{o2}: adjusted output voltage of Vo2,

Rdown, Rup: external trim up/down resistors;

Unit: kΩ.

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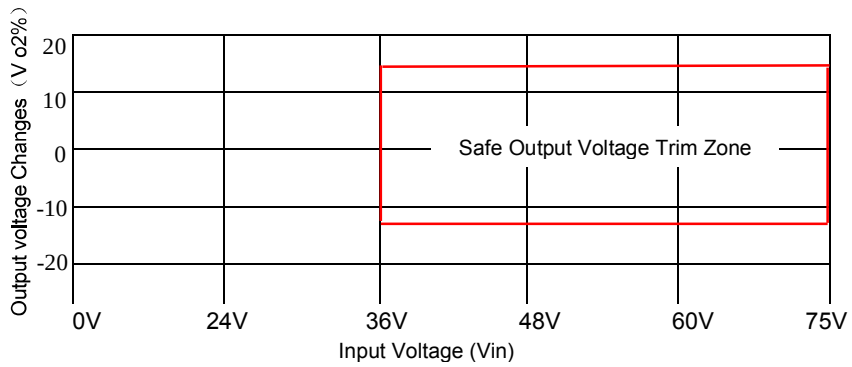
3.7 Output Voltage Trim

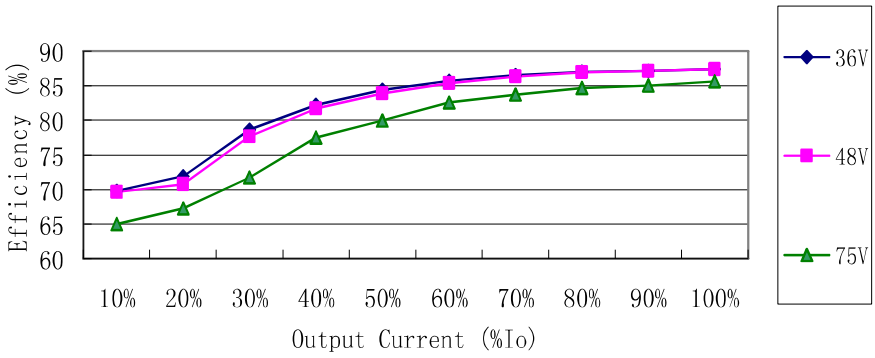


3.8 Note: Vo1 is not adjustable, but Vo2 is adjustable. If the out voltage is trimmed up higher than the over-voltage threshold, the over-voltage protection functions.

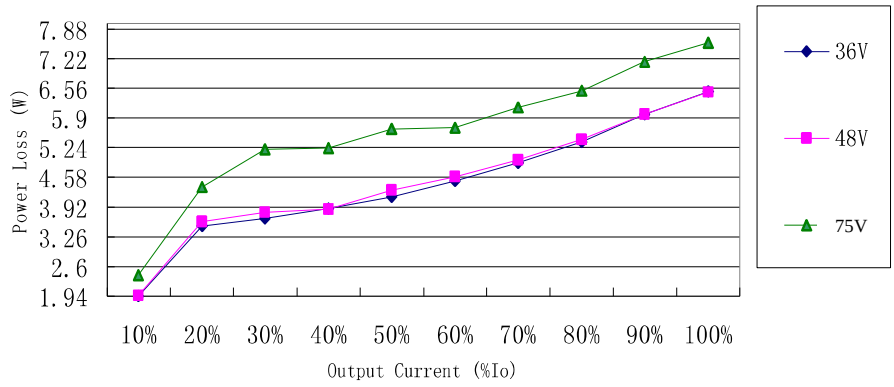
3.9 Ripple & noise: 20MHz, add a 10μF/10V Tantalum capacitor and a 1μF ceramic capacitor to the test tooling for Vo1 and Vo2.

4. Characteristic Curves (Ta=25℃)

4.1 Efficiency Curve



4.2 Dissipation Efficiency Curve



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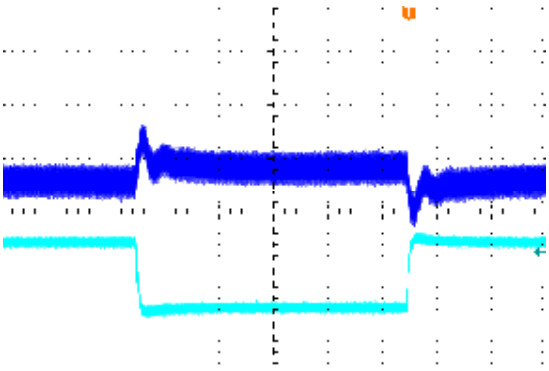
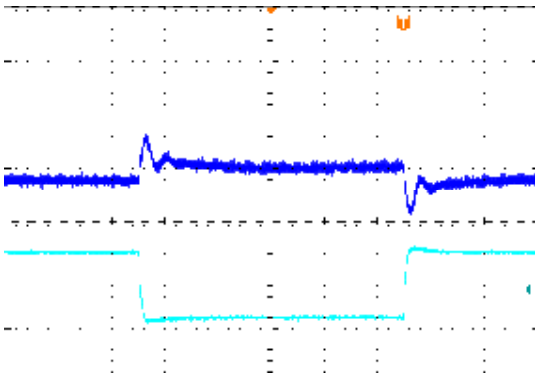
5.3 Dynamic Response

Test Condition: Ta=25℃, Vin=48V, ΔIo/Δt = 1.0A/μS, add a 220uF capacitor to each output.



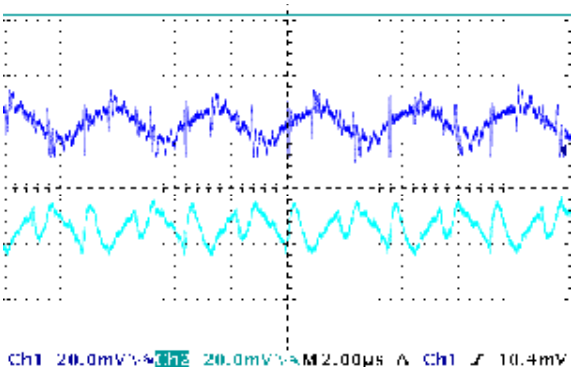
25%-50%-25%Ionom



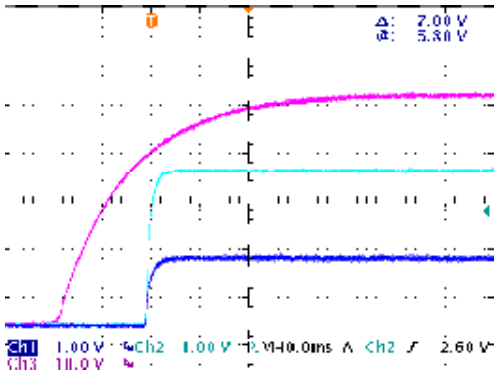
25%-75%-25%Ionom

4.4 Output Ripple and Power-on Wave

Test Condition: Ta=25℃, Vin=48V, 20MHz, add a 10μF/10V Tantalum capacitor and a 1μF ceramic capacitor to the test tooling for Vo1 and Vo2.



Output Ripple
CH1: 3.3V Output Ripple Voltage
CH2: 1.2V Output Ripple Voltage



Power-on Wave
CH1: 3.3V Output Voltage Wave
CH2: 1.2V Output Voltage Wave
CH3: Input Voltage Wave

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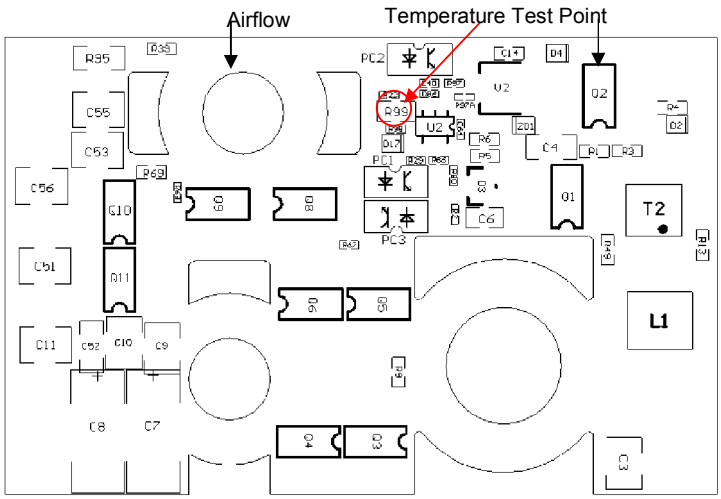
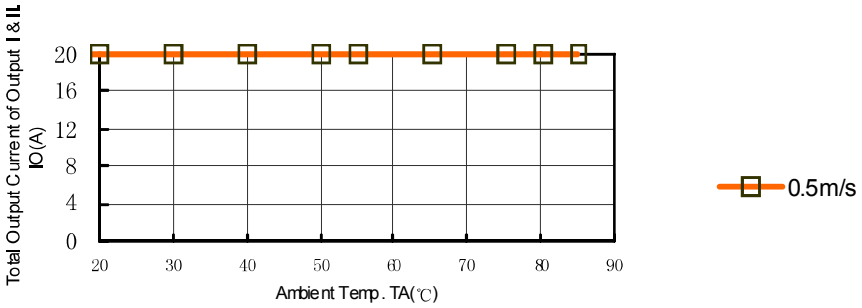
4.5 Temperature Test Point

The diagram below shows the location of thermistor.



5. Thermal Derating Curve



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.

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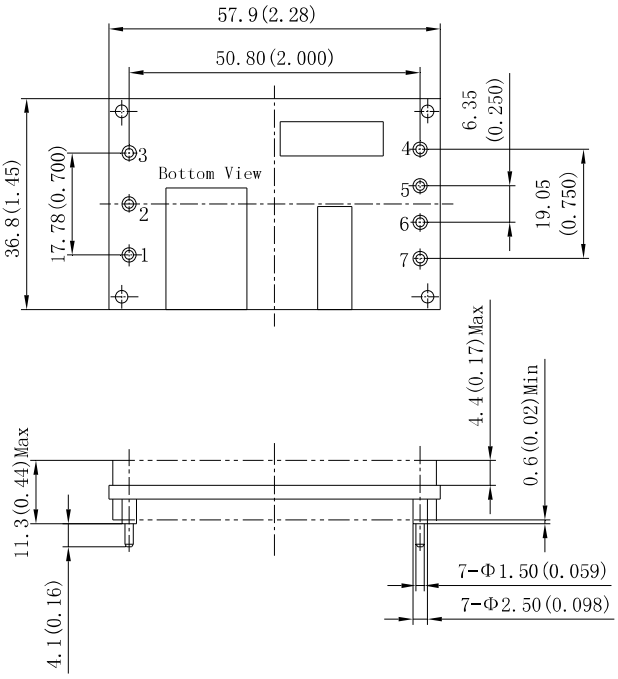
6. Dimensions and Pin definition

6.1 Dimensions

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

1) Outline Diagram - Open-frame:



(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 components at non-pin side is 4.4mm (0.17inch); and the minimum space between the highest components at pin side and the mounting surface of pin side is 0.6mm(0.02inch).

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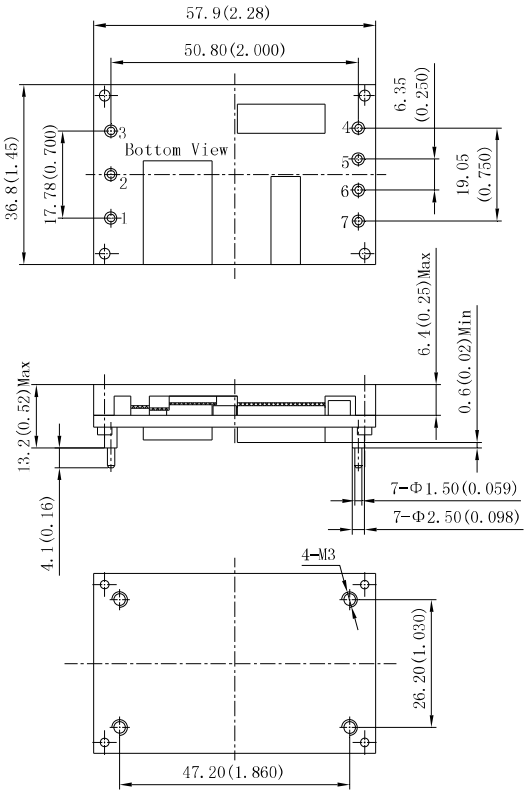
2) Outline Diagram - Aluminum Board (with a suffix “B” in model number):



(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 (0.25inch); and the minimum space between the highest component at pin side and the mounting surface of pin side is 0.6mm (0.02inch).

(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
Symbol	+Vin	Rem	-Vin	+Vo2	COM	Trim	+Vo1
Definition	Positive Input	Remote	Negative Input	Positive Vo1I	Common Terminal	Trim (Vo1I)	Positive Vo1

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