Features

- Industry standard package & footprint

  2.28 " ×1.45 " ×0.42 "
- High efficiency: 87% (typical)
- 2:1 input voltage range
- Input under-voltage projection
- Low output noise & ripple
- Remote sense
- Over-temperature protection: auto-recovery
- Output over-voltage protection: auto-recovery
- Output voltage adjustment: 80%~110%
- Output over/-current/voltage protection

Options:

- Sprayed Conformal Coating

Numbering Convention

QSR 25 - 48 S 1V8 - L - C G5

1 2 3 4 5 6 7 8

No.	Feature	Description
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	1V8 - Typical Output Voltage:1.8V
6	Remote on/off Logic	L - Negative Logic
		Default - Positive Logic
7	Sprayed conformal coating	C - Sprayed conformal coating
		Default: no sprayed conformal coating
8	RoHS	G5 - ROHS5
		G - lead-free, ROHS6
		Default - lead

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1. Description

This QSR25-48S1V8-L-CG5 series power modules are DC-DC converters in an industry standard package and footprint (2.28 " ×1.45 " ×0.42 ") , and provide up to 1.8V output voltage and 25A output current. The converters feature remote on/off, thermal shutdown protection, current limit and short-circuit protection, 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, 25℃ and 1m/s. Add an external 470μF electrolytic capacitor to the 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	—	—	45	W
2.2 Input Specifications					
Typical Input Voltage (Vinom)	—	—	48	—	Vdc
Input Voltage Range	—	36	—	75	Vdc
Input Under-voltage Protection	Ionom	30	—	35	Vdc
Input Under-voltage Recovery Point	Ionom	31	—	36	Vdc
Maximum Input current (Iimax)	Vimin, Vonom,Ionom	—	—	1.8	A
No-load Input Current (Iio)	Vinom, Io=0A	—	25	50	mA
Quiescent Input Current (Iiof)	Vinom, remote output shutdown	—	3	15	mA
No-load Power Loss	Vinom, Io=0A	—	1.2	—	W
Inrush Transient Current	Vimin, Vonom, Io=Ionom	—	0.2	1.0	A^2S
Input Reflected Ripple Current	Vinom,Ionom	—	60	100	mAp-p
Input Filtering Capacitance	V_{INMIN}~V_{INMAX}	—	100	—	μF
Remote On	Low Level (-0.7~1.2V) or connected to-Vin				
Remote Off	High Level (3.5~12V) or Open Circuit				
2.3 Output Specifications					
Output voltage Set-point (Vonom)	Vimin-Vimax,Ionom	1.77	1.80	1.83	V
Typical Output Current (Ionom)	—	—	25	—	A
Output Current Range (Io)	Po≤ Pomax	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		V_{INMIN}~V_{INMAX},0~100%I_O	—	—	±2	%Vo
Output Voltage Trim (Voadj)		Io≤Ionom,Po≤Pmax	80	—	110	%Vo
Output Over-voltage Protection	Protection Mode	——	Hiccup, auto-recovery			—
Output Over-voltage Protection	Threshold	Po<Pomax	2.2	—	3.0	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, auto-recovery			—
Output Over-current Protection	Threshold	Vinmin~Vinmax, Tc (baseplate temp.) =-40~100°C	28	—	35	A
Output Short-circuit Protection	Protection Mode	——	Hiccup, auto-recovery			—
Output Short-circuit Protection	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	—	50	150	mV
Dynamic Load Response	Settling Time	25%-50%-25%Ionom 50%-75%-50%Ionom ΔIo/Δt =0.1A/µS,Vinom	—	70	200	µs
Dynamic Load Response	Peak Deviation	0-100%-0Ionom ΔIo/Δt =0.1A/µS,Vinom	—	150	900	mV
Dynamic Load Response	Settling Time	0-100%-0Ionom ΔIo/Δt =0.1A/µS,Vinom	—	—	800	µs
Output Ripple and Noise	RMS (20MHz)	Vinom, Ionom, externally add a 470µF ceramic capacitor and a 1µF electrolytic capacitor to the output	—	30	50	mV
Output Ripple and Noise	Peak-to-Peak (20MHz)	Vinom, Ionom, externally add a 470µF ceramic capacitor and a 1µF electrolytic capacitor to the output	—	50	85	mV
Output Ripple and Noise	Peak-to-Peak (100MHz)	Vinom, Ionom, externally add a 470µF ceramic capacitor and a 1µF electrolytic capacitor to the output	—	—	120	mV
External Output Capacitance (Co)		V_{INMIN}~V_{INMAX},0~100%I_O	470	1000	10000	µF
Turn-on/off Peak Deviation		Vinom,Ionom	—	±2	±5	%Vo
Turn-on Delay Time		10%Vinnom-- 10%Vonom	—	5	15	mS
Turn-on Rise Time		10%Vonom---90%Vonom	—	7	20	mS
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		EN60950-1				
2.5 Reliability						
Vibration Test (sine)		Frequency: 10~55Hz Amplitude: 0.35mm Acceleration: 50m/s^2 Cycle: X,Y,Z 30min for 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		Vinom, Ionom, Ta=25°C, Bellcore TR-332,		≥2×10⁶			h
		Vinom, Ionom, Ta=55°C, Bellcore TR-332,		≥8×10⁵			h
2.6 Environmental Specifications							
Relative Humidity		(40±2) ℃, No dew		—	—	90	%RH
Cooling		——		Forced-air Cooling			
Over-temperature Protection	Protection Mode	—		Hiccup, Auto-recovery			
	Temperature Range	Baseplate Temp., see diagram 5.4		100℃~125℃			
	Hysteresis	Baseplate Temp., see diagram 5.4		5	—	10	℃
Operating Ambient Temperature		——		-40	—	+85	℃
Operating Baseplate Temperature		——		-40	—	+110	℃
Storage Temperature (Tst)		——		-55	—	+125	℃
2.7 General Specifications							
Switching Frequency		——		—	310	—	kHz
Temperature Coefficient (Tcoeff)		——		—	—	±0.02	%/℃
Efficiency (η)		Vinom	100%Ionom	85	87	—	%
			80%Ionom	—	88	—	%
			50%Ionom	—	89	—	%
			20%Ionom	—	85	—	%
Weight		——		—	34	—	g
RoHS		RoHS (2002/95/EC)					
Anti-sulfuration feature		Sprayed conformal coating (a suffix "C" in model no.)					

Note:
1) Low temperature (-40 ℃) Test: Vinom,Ionom, additionally add a 220μF tantalum capacitor to the output on the basis of normal temperature test, add a 220μF/100V electrolytic capacitor to the input.
2) Module test: forced-air cooling required.

3. Basic Application Circuits and Considerations

3.1 Typical Application

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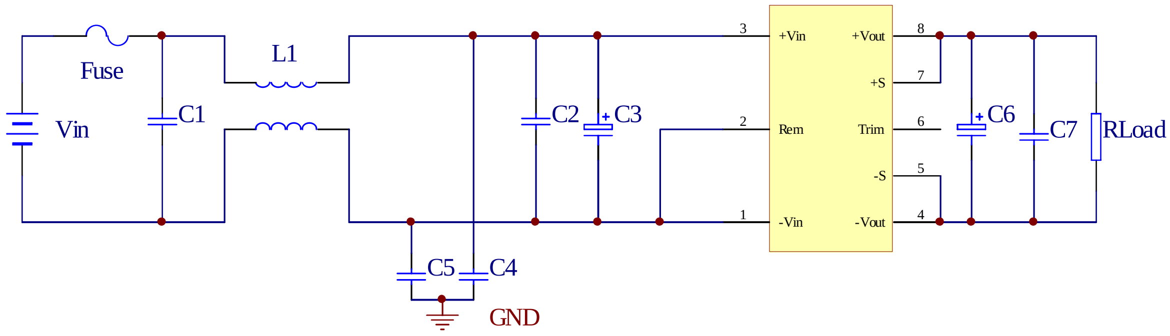

Note:

Fuse: 5A; C3: 100μF/100V high-frequency & low-ESR electrolytic capacitor (220μF/100V for surge test);
C6: 470μF/10V high-frequency & low-ESR electrolytic capacitor; C7: 1μF/25V ceramic capacitor;
For ambient temperature below -5℃, add a 220μF/10V tantalum capacitor in parallel with C6.
With EMC requirements, C1: 1μF/100V ceramic capacitor; C2: 0.1μF/100V ceramic capacitor; L1: 1.3mH;
C4,C5: 0.022uF/250V cartridge safety film capacitor (10.5*9*4-0.6-7.5mm);

3.2 The output will be on when REM is at low level or connected to –Vin, and the output will be off when REM is at high level referenced to –Vin. With no external power source for REM, connect Rem to –Vin to turn the output on.

3.3 With no EMC requirements, L1, C1, C4 and C5 are optional.

3.4 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 1.98V (trim up) or be lower than 1.44V (trim down), or the converter can't work well. See "4.2 Output Voltage Adjustment (Trim)" for details.

3.5 For ambient temperature below -5℃, add a 220μF/10V tantalum capacitor in parallel with C6.

3.6 For high-temperature application, forced-air cooling is required. See the Thermal Derating Curve for details.

4. Instruction for Use/Test

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

4.2 Output Voltage Adjustment (Trim)

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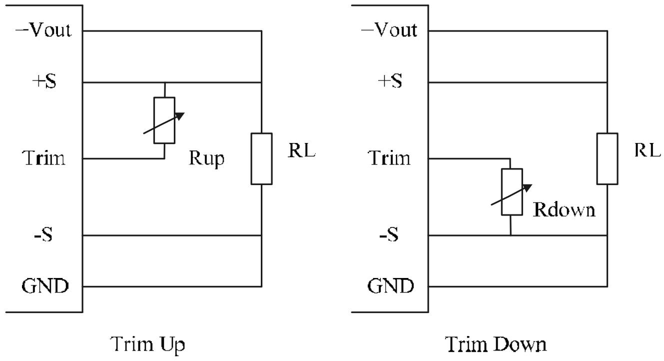


4.2.1 Output Trim Circui

4.2.2 Output Trim Equations

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

$$R_{up}=\frac{5.1\times V_e\times(100+\Delta)}{1.225\times\Delta}-\frac{510}{\Delta}-10.2\,(k\Omega)\qquad \Delta=\left(\frac{V_o-V_e}{V_e}\right)\times100$$

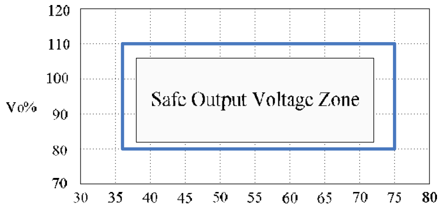
(2) To decrease the output voltage, the value of the external resistor should be

$$R_{down}=\frac{510}{\Delta}-10.2\,(k\Omega)\qquad \Delta=\left(\frac{V_e-V_o}{V_e}\right)\times100$$

Where Ve: Nominal output voltage; Vo: Output voltage;

R_{up}、R_{down} : external adjusting resistor;

4.2.3 Output Voltage Regulation Curve



Output Voltage Unit: V

Changes of Output Voltage vs Input Voltage

4.2.4 Note: Over-voltage protection functions when the output voltage is trimmed up over the protection threshold.

4.3 Max output ripple & noise: test the ripple & noise as the following figure shows. The output leads shall be twisted-pair, of which the length is no more than 50mm.

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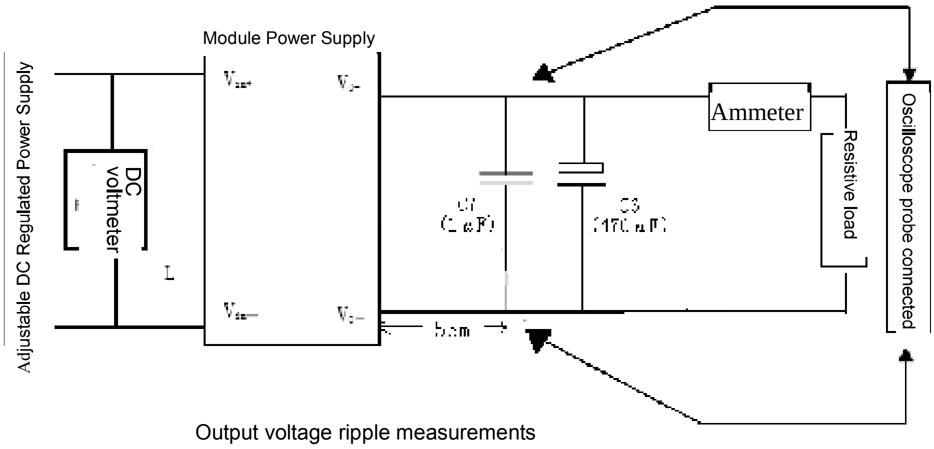

Output voltage ripple measurements

4.4 Over-current Protection

Operating at over-current conditions for long time may cause damage to the module; if the module is in short-circuits or the output current exceeds the threshold of over-current protection, 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.

4.5 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.

4.6 Over-temperature Protection

When the thermostat temperature exceeds the threshold (100℃ to 125℃) of over-temperature protection, the over-temperature protection functions and the output is off; when the thermostat temperature is lower than the protection threshold by 5℃ to 10℃, the module recovers automatically.

4.7 Remote of/off

The output will be on when REM is at low level (-0.7V to 0.8V reference to -Vin) or shorted to **–**Vin;

The output will be off when REM is at high level (3.5V to 12V reference to -Vin) or keeps open circuit.

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

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

5.1 Efficiency and Power Loss Curve

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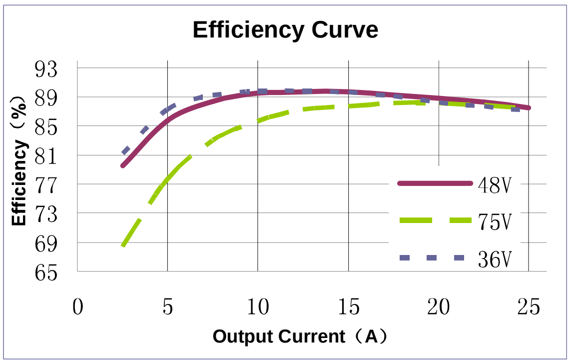
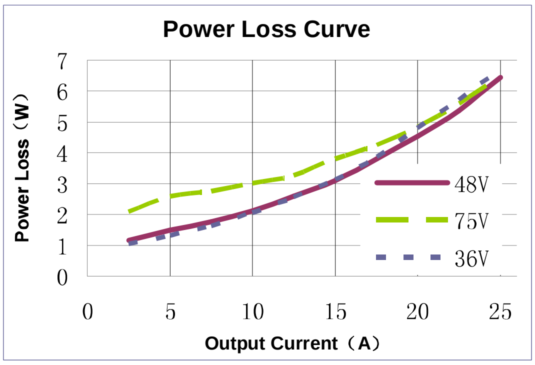




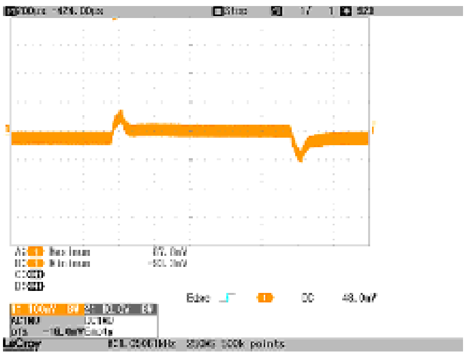
Efficiency vs Output Curren

Power Loss vs Output Current

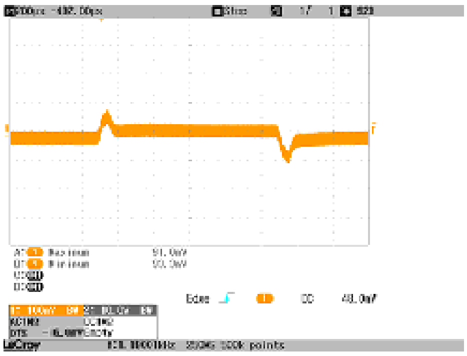
Load	20%Io	50%Io	80%Io	100%Io
Efficiency (%) Vinom	85.75	89.68	88.81	87.46

5.2 Dynamic Response

Test Conditions: Vin=48V, add a 220µF electrolytic capacitor to the input, add a 470µF tantalum capacitor and a 1µF ceramic capacitor to the output



25%-50%-25% Dynamic Load



50%-75%-50% Dynamic Load

5.3 Output Ripple and Power-on Wave

Test Conditions: Ta=25℃,Vin=48V, Io=25A,20MHz, add a 220µF electrolytic capacitor to the input, add a 470µF tantalum capacitor and a 1µF ceramic capacitor to the output.

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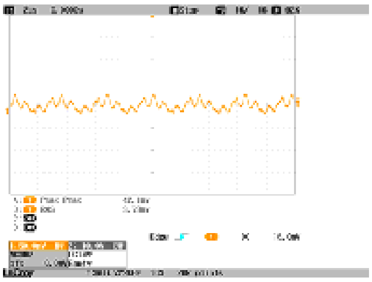
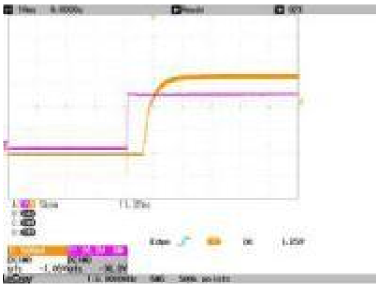


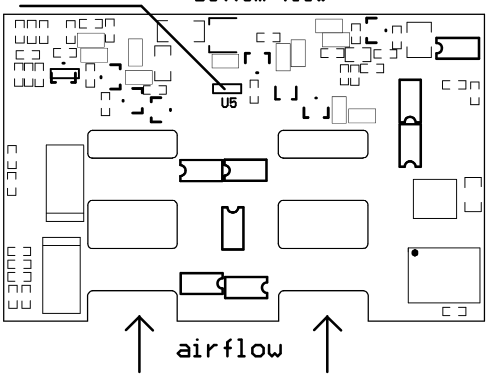
Output Ripple



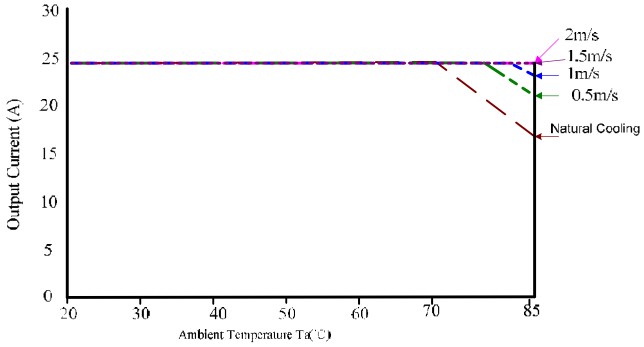
Power-on Wave (Vin=48V,Io=2.1A,CC mode,
CH1: Input wave; CH2: Output wave)

5.4 Thermal Derating Curve

The module can work at a severe temperature conditions, but good cooling is required. Test the module as the following figure shows to determine whether the operation temperature exceeds the temperature limits.



The next is the thermal derating curve:



Derating Curve at Vin=48.0V
Note: natural cooling: airflow = 0.05m/s to 0.1m/s

Test Conditions:

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(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.

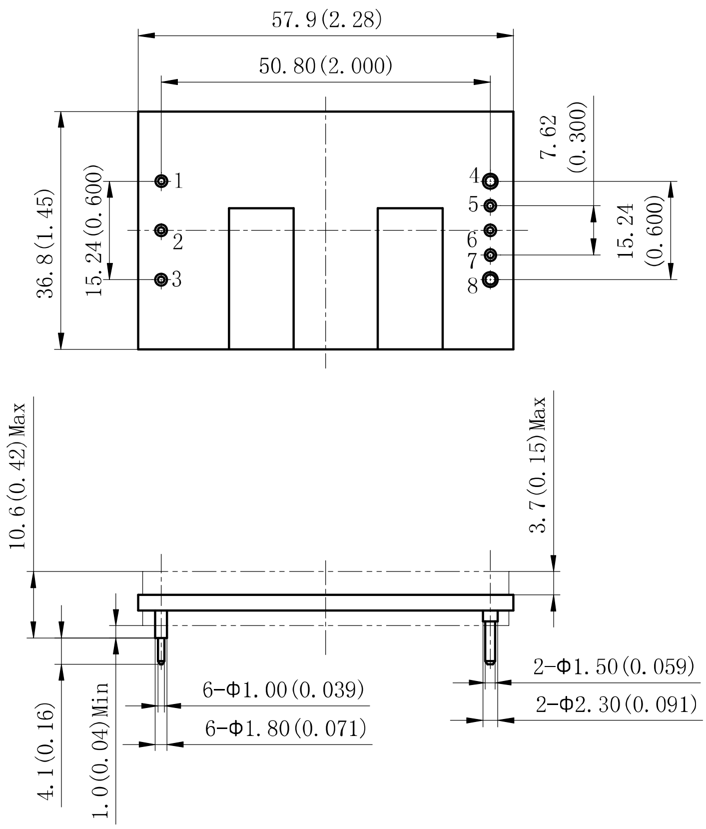
(2) A certain gap is required between the module and test board. Keep the test board perpendicular to the horizontal direction and the long edge parallel with the horizontal plane.

(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 above for airflow directions.

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

6. Dimensions and Pin definition

6.1 Dimensions



Unit: mm(inch) Tolerance: .X±0.5 (.XX±0.02) ; .XX±0.13 (.XXX±0.005) 。

6.2 Pin Definition

No	1	2	3	4	5	6	7	8
Symbol	-Vin	Rem	+Vin	GND	-S	Trim	+S	+Vout
Definition	Negative Input	Rem	Positive Input	Grounding	Negative Remote Sense	Trim	Positive Remote Sense	Positive Output

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