Features:

- Industry standard 1/2 brick package and footprint 2.40″×2.28″×0.50″
- Operating temperature range:-40～100°C
- 2:1 input voltage range 36～75Vdc
- Output voltage trim range: －10% ～＋10%
- Isolation voltage: 1500Vdc
- High efficiency：84% typical
- Low output voltage ripple and noise
- Remote on/off
- Input under-voltage protection
- Output short-circuit protection
- Output over-voltage protection
- Output over-current protection
- Over-temperature protection
- UL60950-1/ EN60950-1 Certified
- RoHS (2002/95/EC) complaint

Options:

- Sprayed Conformal Coating
- RoHS

Numbering Convention:

HDR –L 050 1 S C – T – C G5
① ② ③ ④⑤ ⑥ ⑦ ⑧ ⑨

No	Features	Descriptions
①	Product Series	1/2 brick Al-Baseplate Series
②	Remote on/off Logic	L - Negative Logic
		H or Default - Positive Logic
③	Typical Output Power	050- Output Power :50W
④	Typical Output Voltage	1- Output Voltage: 5V
⑤	Number of Outputs	S- Single Output
		D- Double Output
⑥	Typical Input Voltage	C- Input Voltage: 48V
⑦	Model Number suffix	T- Positive Logic; ＋S to Trim (trim up); －S to Trim(trim down)
		N or Default-Negative Logic; ＋S to Trim (trim down); －S to Trim (trim up)
⑧	Sprayed Conformal Coating	C - Sprayed Conformal coating
		Default: no Sprayed Conformal coating
⑨	RoHS feature	G5 – RoHS5
		G – lead-free, RoHS6

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

1. Description

The HDR-L0501SC-T-CG5 series power modules are DC-DC converters in an industry 1/2 brick packaging and footprint, and can provide up to $5V_{DC}$ output voltage and 10A output current. The modules are packed in a molded package with Aluminum baseplate, and all the devices on the module are surface mounted. The converters feature remote on/off, over-temperature protection, input under-voltage protection, over-current protection, output over-voltage protection and output short-circuit protection, etc.

2. Technical Specifications (Unless otherwise stated, all specifications are typical at nominal input voltage, full load and 25 ℃)

Parameter		Test Condition	Min	Typ	Max	Unit
2.1 Absolute Maximum Ratings						
Input Voltage (Vi)		Non-operating, continuous	0	—	80	Vdc
		Transient（100ms）	—	—	100	Vdc
Max Output Power (Pomax)		allowable operating conditions	—	—	50	W
2.2 Input Specifications						
Nominal Input Voltage(Vinom)		—	—	48	—	Vdc
Input Voltage Range		—	36	—	75	Vdc
Input Under-voltage Protection (Vishl)		Ionom	30	—	35	Vdc
Input Under-voltage Recovery Point		Ionom	31	—	36	Vdc
Max Input Current (Iimax)		Vimin, Vonom,Ionom	—	—	1.7	A
No-load Input Current（Iio）		Vinom, Io＝0A	—	—	60	mA
Quiescent Input Current (Iiof)		Vinom, remote output shutdown	—	—	10	mA
No-load Power Loss		Vinom, Io=0A	—	1.2	2.9	W
Transient current		Io=Ionom	—	—	0.1	A^2S
Input Ripple Current		Vinom,Ionom	—	30	50	mAp-p
Input Filtering Capacitance		V_{INMIN}~V_{INMAX}	—	100	—	μF
Remote	On	High level（3~15V）or Open Circuits				
	Off	Low level (0～1.2V) or shorted to -Vin				
2.3 Output Specifications						
Output voltage (Vonom)		Vinom,Ionom	4.95	5.00	5.05	Vdc
Nominal Load (Ionom)		—	—	—	10	A
Output Current Range (Io)		Po≤50W	0	—	10	A
Line Regulation (Vov)		Vimin-Vimax,Ionom	—	—	±0.2	%Vo
Load Regulation (Vol)		0-100%Ionom,Vinom	—	—	±0.5	%Vo

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

Parameter		Test Condition	Min	Typ	Max	Unit
Voltage Regulation Accuracy		V_{INMIN}~V_{INMAX},0~100%I_O	-1%	—	1%	%Vo
Output Voltage Trim (Voadj)		Io≤Ionom,Po≤50W	-10	—	+10	%Vo
Output Over-voltage Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Protection Range	Po<Pomax	5.75	—	7	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Protection Range	Vinmin~Vinmax,	11	—	14	A
Output Short-circuit Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Short current protection	Vinmin~Vinmax	—	100	150	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%-0Ionom ΔIo/Δt=0.1A/μS,Vinom externally add a 1μF ceramic capacitor and a 660μF/10V electrolytic capacitor to output	—	—	2.5	V
	Settling Time		—	3	—	ms
Output Ripple and Noise	RMS（20MHz）	Vinom, externally add a 1μF ceramic capacitor and a 10μF/25V tantalum capacitor to output	—	—	40	mV
	Peak-to-Peak（20MHz）		—	—	150	mV
	Peak-to-Peak（100MHz）		—	—	300	mV
External Output Capacitance (Co)		V_{INMIN}~V_{INMAX},0~100%I_O	0	—	10000	μF
Turn-on/off Overshoot Amplitude		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		10%Vinnom-- 90%Vonom	10	25	35	mS
Output Rise Time		10%Vonom---90%Vonom	—	15	35	mS
Remote Sense Voltage Sampling		——	Available			
2.4 Safety Specifications						
Insulation Strength	Input to output	Leak Current≤1mA, 1min	1500	—	—	Vdc
	Input to Case	Leak Current≤1mA, 1min	1050	—	—	Vdc
	Output to Case	Leak Current≤1mA, 1min	500	—	—	Vdc
Insulation Resistance (RISO)		500V_{DC}	10	—	—	MΩ
Safety Certificate		EN60950-1:2006				
2.5 Reliability						

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

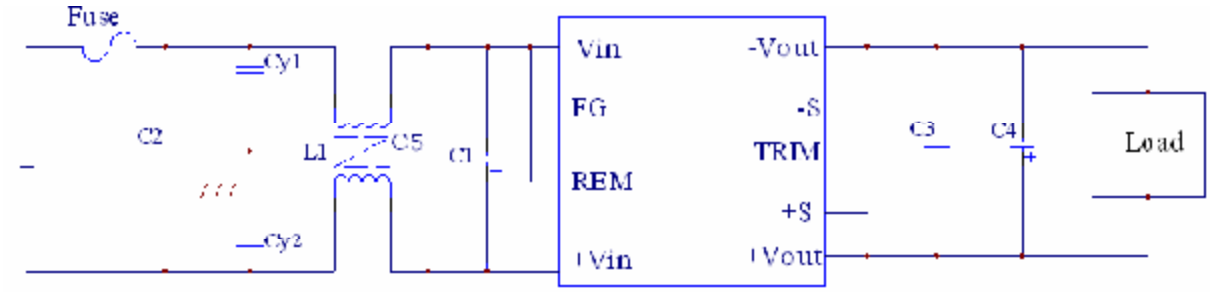
Parameter		Test Condition		Min	Typ	Max	Unit
Vibration Test(sine)		Frequency: 10~55Hz Amplitude: 0.35mm Acceleration: 50m/s^2 Cycle: X,Y,Z 30min each axis		After being tested, no damage to the converter and its components, the appearance, output voltage and output ripple and noise (p-p) meet the data sheet requirements.			
Shock 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（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 or heatsink			
Over-temperature protection	Protection Mode	——		100℃~125℃(Output Off, Auto-recovery)			
	Temperature Range	——		5	10	15	℃
Operating Baseplate Temperature		——		-40	—	+100	℃
Storage Temperature (Tst)		——		-40	—	+125	℃
2.7 General Specifications							
Switching Frequency		——		—	330	—	KHz
Temperature Coefficient (Tcoeff)		——		—	—	±0.02	%Vo/℃
Efficiency (η)		Vinom	100%Ionom	83	84	—	%
			20%Ionom	—	74	—	%
			50%Ionom	—	82	—	%
			80%Ionom	—	84	—	%
Weight		——		—	60	—	g
RoHS		According to 2002/95/EC directive					
Anti-sulfuration feature		Sprayed conformal coating					

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

3. Basic Application Circuit and Considerations

3.1 Typical Application



Fuse: 5A;

C1: ≥100μF /100V (electrolytic capacitor); C3: 1μF /10V/X7R (ceramic capacitor);

C4: ≥2200μF/10V electrolytic capacitor(-20℃~ +100℃), ≥ 2×2200μF/10V electrolytic capacitor(-40℃~ +100℃)

With EMC requirements: C2: 1μF /100V/X7R (ceramic capacitor);

C5: 100nF /100V/X7R (ceramic capacitor);

L1: Common-mode Inductor (Single phase) 1320uH-±25%-4A-R5K-21*21*12.5mm;

Cy1,Cy2: 22nF/1000V/X7R(ceramic capacitor)。

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 keeps open circuit; Output will be on when the Rem is at low level or connect 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 5.5V (trim up) or be lower than 4.5V (trim down), or the converter can't work well.

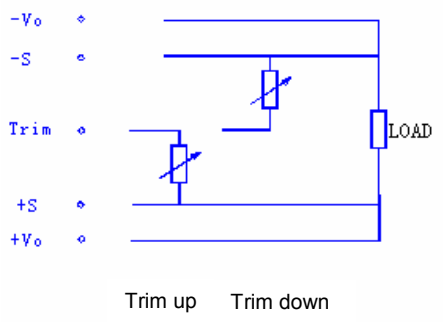
4. Instruction for Use

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

The module is not internally fused, and an external 5A/250V fuse is required.

4.2 Output Voltage Trim

4.2.1 Output Trim Circuit



PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

4.2.2 Output Trim Equations:

To increase the output voltage, the value of the external resistor should be:

$$R_{Trim-up} = \left(\frac{Vo(100\% + \Delta)}{1.225 \times \Delta} - \frac{(100\% + 2\Delta)}{\Delta} \right) (k\Omega) \qquad 0<\Delta<10\%$$

To decrease the output voltage, the value of the external resistor should be:

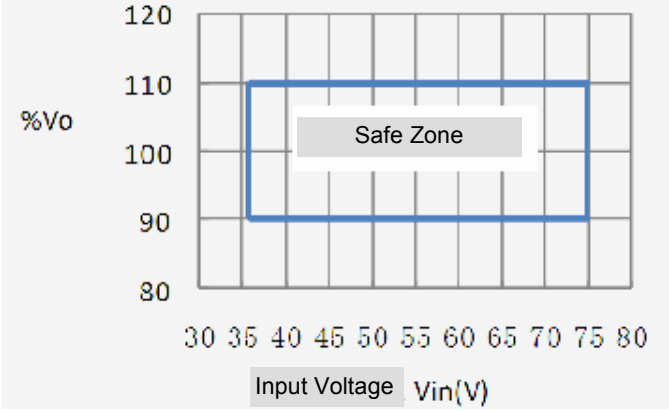
$$R_{Trim-down} = \left(\frac{100\%}{\Delta} - 2 \right) (k\Omega) \qquad 0<\Delta<10\%$$

V_O: Typical output voltage;

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

Δ: ratio of output voltage changes to nominal output voltage; (0<Δ<10%)。

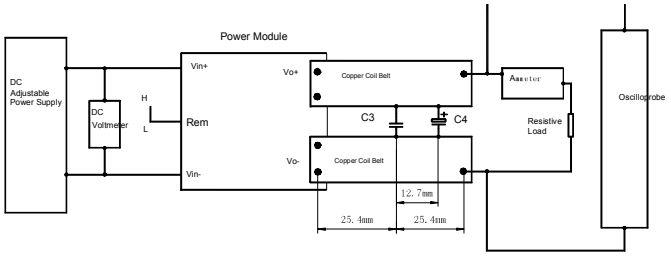
4.2.3 Output Voltage Trim Curve:



Maximum output voltage vs. Input voltage

Note: The over-voltage protection will function when trim-up voltage is higher than over-voltage threshold.

4.3 Max Ripple and Noise:: test the ripple and noise as the following figure shows。Bandwidth 20 MHz。



Measuring Method for Output Ripple & Noise

Note: 1: C3: 1μF/10V ceramic capacitor; C4: 10μF/25V Tantalum capacitor

2: The distance between two parallel copper foil belts is 2.5mm, and the sum of voltage drop of the two parallel copper foil belts shall be less than 2% of output voltage

3: Twisted-pair less than 50mm can be used to instead copper belts, and the voltage drop shall be less than 2% of output voltage

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

4.4 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.

4.5 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 recover automatically.

4.6 Over-temperature Protection:

When the baseplate temperature exceeds the over-temperature protection threshold (100℃ 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 15℃, the module will recover automatically.

4.7 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 endure output current, or the module may be damaged.

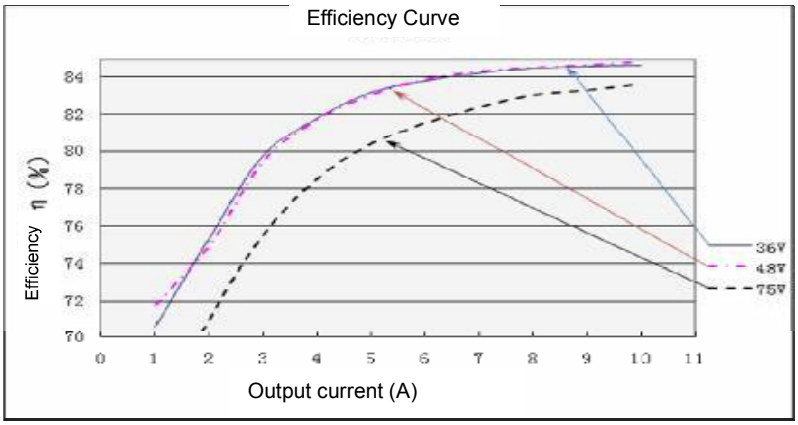
4.8 Remote（ON/OFF）:

Output will be on when the Rem is at low level or shorted to–Vin; and output will be off when the Rem is at high level or keep open circuits referenced to -Vin.

4.9 For hi-pot test, short +Vin, –Vin and + Rem, and short +Vout, -Vout.

5 Characteristic Curves

5.1 Characteristic Curves:

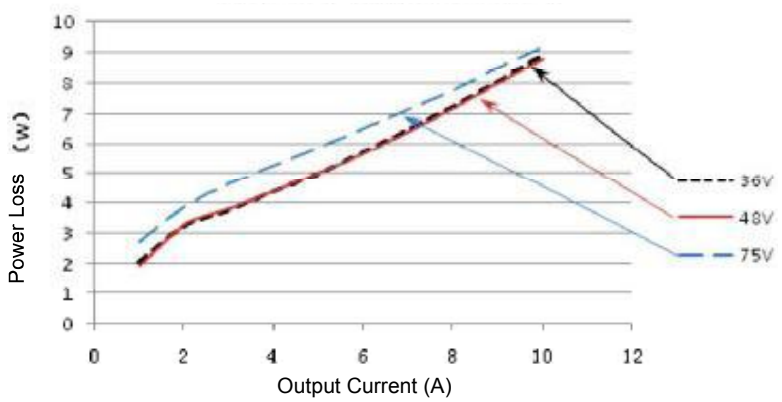


Output Current vs Efficiency (Ta＝＋25℃)

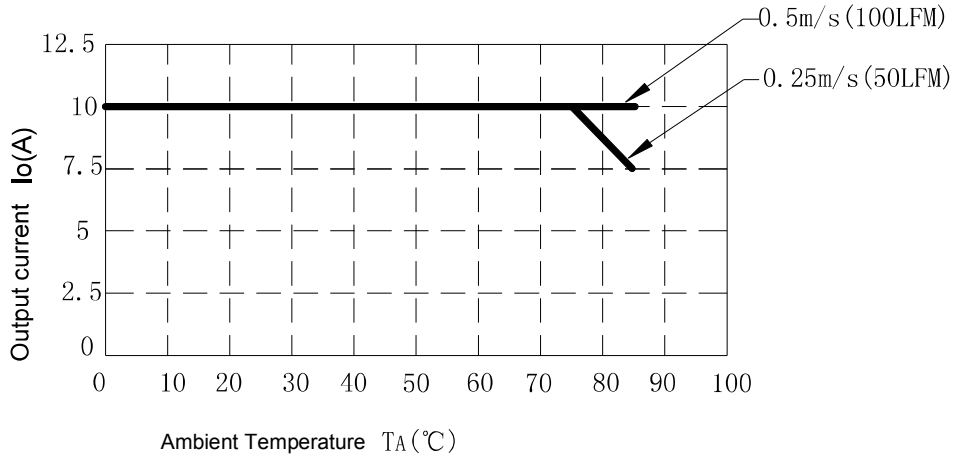
PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

Power Loss vs Output Current



Power Loss vs Output Current (Ta＝＋25℃)



Derating Curves with no heat sink at different airflow（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 clearance 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.

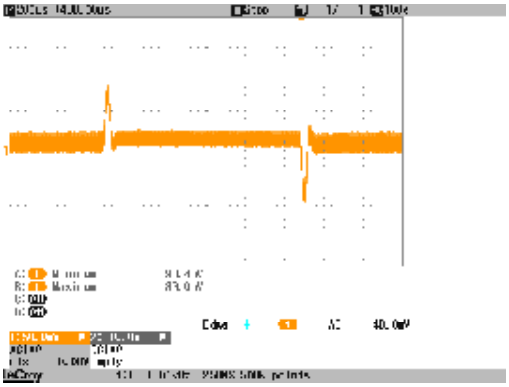
④ When the module reaches thermal equilibrium state, the devices on the module can meet thermal derating requirements.

5.2 Dynamic Response:

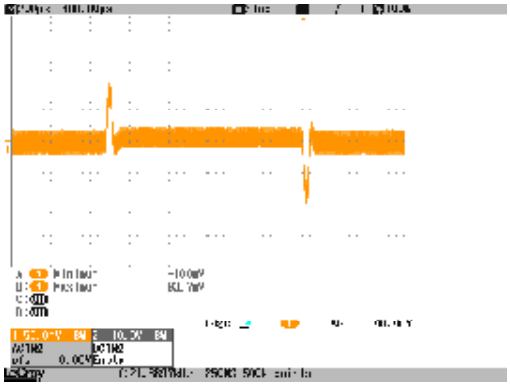
Test Condition: Tc=25℃, Vin=48V

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com



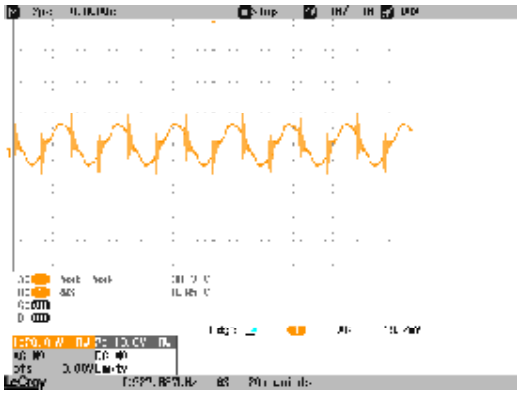
25%-50%-25%Io Dynamic Load



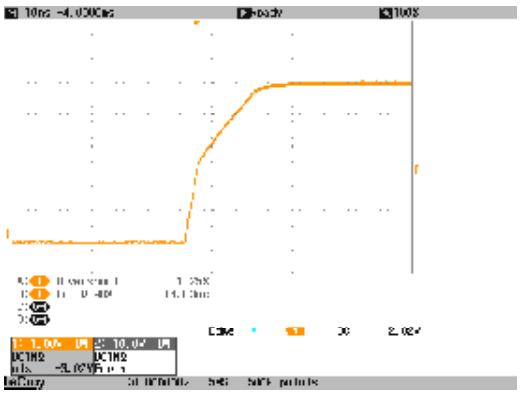
50%-75%-50%Io Dynamic Load

5.3 Output Ripple and Power-on Wave:

Test Condition: Tc=25℃,Vin=48V, Io=10A, Bandwidth 20 MHz, externally add a 10μF Tantalum capacitor and a 1μF ceramic capacitor to output.



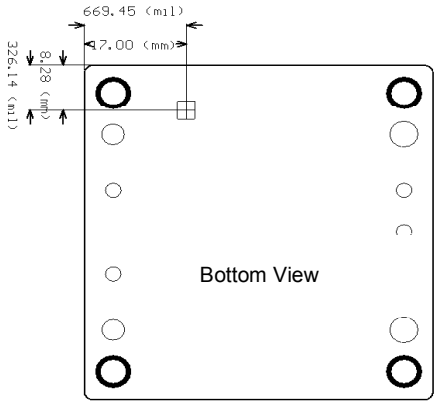
Output Ripple



Output Rise Time

5.4 Thermal Derating Curve

The module can operate at a tougher temperature. However, a good thermal dissipation is necessary for normal operation. Monitor the temperatures at points as the following figure shows to judge whether the operating temperature exceeds the specified temperature limit.



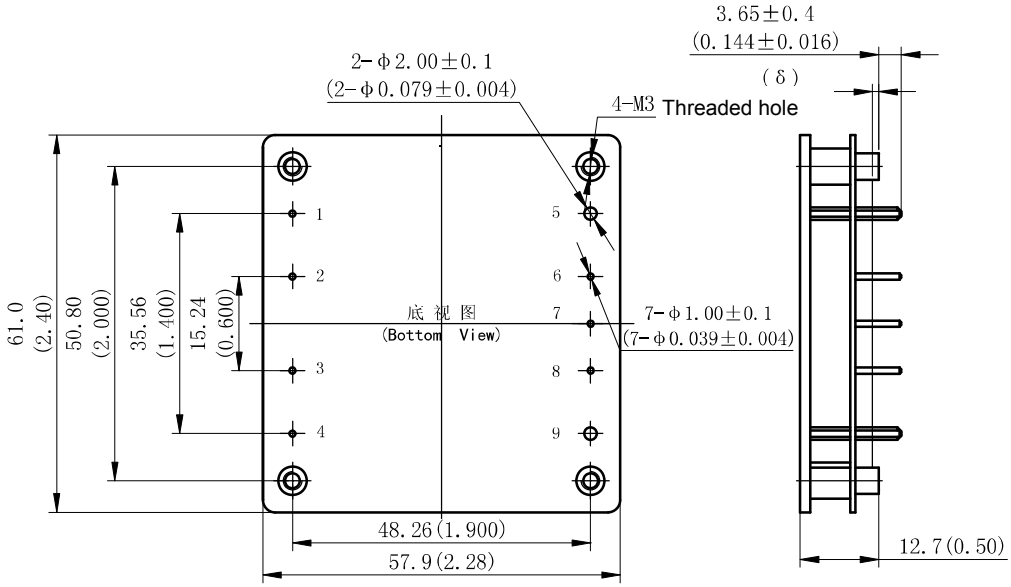
Temperature Test Points (Bottom View of MPCB)

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com

6. Dimensions and Pin definition

6.1 Dimensions



Note (1) Unit: mm (inch)

(2) Tolerance: .X±0.5 (.XX±0.02) ; .XX±0.25 (.XXX±0.010)

(3) δ=1mm(Min) is the Minimum spacing from the highest device at pin side to the install stud top。

6.2 Pin definition

No	1	2	3	4	5	6	7	8	9
Symbol	-Vin	FG	Rem	+Vin	-Vout	-S	Trim	+ S	+Vout
Definition	Negative input	FG	Remote	Positive input	Negative output	Negative Remote Sense	Trim	Positive Remote Sense	Positive output

PDF created with pdfFactory Pro trial version www.pdffactory.com

PDF created with pdfFactory Pro trial version www.pdffactory.com