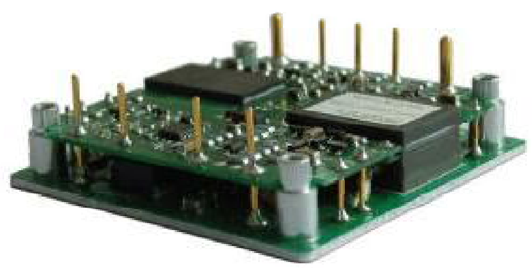
BCT® **HDR-1505SC-T-CG5** *RoHS Compliant*

DC-DC Converter **Data Sheet**



Industry Standard 1/2 brick：48Vin 48Vout 3.2A

Options

- Negtive/Posive Remote on/off Logic
- Sprayed Conformal Coating

Features:

- Industry Standard 1/2 brick package & footprint 2.40″×2.28″×0.50″
- Operating Temperature Range:-40～100°C
- 2:1 Wide Input Voltage Range: 36～75Vdc
- Output Voltage Trim Range: －10% ～＋10％
- Basic Insulation, Isolation Voltage: 1500Vdc
- Efficiency: up to 89%
- High Power density
- Low Output Ripple & Noise
- Remote on/off and Remote Sense
- Input Under-voltage Protection
- Output Short-circuit Protection
- Output Over-voltage Protection
- Output Over-current Protection
- Thermal Protection
- RoHS (2002/95/EC) Complaint
- EN60950-1:2006 Recognized

Numbering Convention

HDR –L 150 5 S C – T – C G5
1 2 3 4 5 6 7 8 9

No	Features	Descriptions
1	Product Series	HDR—Al-baseplate half brick series
2	Remote on/off Logic	L-Negative Logic
		H or default –Positive Logic
3	Typical Output Power	150- Max output power:150W
4	Typical Output Voltage	5- Typical output voltage: 48V
5	Number of Outputs	S- Single Output
		D- Dual Output
6	Typical Input Voltage	C-Typical Input Voltage: 48V
7	Model Number suffix	T-Positive Logic (Trim up:+S to Trim; Trim down:—S to Trim)
		N or default—Negative Logic (Trim down:+S to Trim; Trim up: —S to Trim)
8	Sprayed Conformal Coating	C-Sprayed Conformal Coating
		Default-No Sprayed Conformal Coating
9	RoHS feature	G5-ROHS5
		G-ROHS6
		Default: lead products

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1. Description

The HDR-1505SC-T-CG5 series power modules are DC-DC converters in an industry 1/2 brick package and footprint, and can provide up to $48V_{DC}$ output voltage and 3.2A output current. The modules are packed in a molded package with Aluminum baseplate (heat sink), and all the components on the module are surface mounted. The power modules feature high power density, remote on/off, thermal 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	—	—	153.6	W
2.2 Input Specifications						
Norminal Input Voltage(Vinom)		—	—	48	—	Vdc
Input Voltage Range		—	36	—	75	Vdc
Input Under-voltage Protection Threshold		Ionom	30	—	35	Vdc
Input Under-voltage Recovery Threshold		Ionom	31	—	36	Vdc
Max Input Current (Iimax)		Vimin, Vonom,Ionom	—	—	5	A
Unload Input Current (Iio)		Vinom, Io＝0A	—	—	100	mA
Quiescent Input Current (Iiof)		Vinom, remote output shutdown	—	—	10	mA
Unload Power Loss		Vinom, Io=0A	—	2.7	3.5	W
Transient Current		Io=Ionom	—	—	0.1	A^2S
Input Reflected Rippled Current		Vinom,Ionom	—	200	400	mAp-p
Input Filtering Current		V_{INMIN}~V_{INMAX}	—	330	—	μF
Remot	Off	Low Level (≤1.2V) or shorted to -Vin				
	On	High Level (3~15V) or Open Circuits				
2.3 Output Specifications						
Nominal Output Voltage (Vonom)		Vinom,Ionom	47.23	48	48.77	Vdc
Nominal Output Current (Ionom)		—	0	—	3.2	A
Output Current Range (Io)		Po≤153.6W	0	—	3.2	A
Line Regulation (Vov)		Vimin-Vimax,Ionom	—	—	±1	%Vo
Load Regulation (Vol)		0-100%Ionom,Vinom	—	—	±1	%Vo
Voltage Stabilization Precision		V_{INMIN}~V_{INMAX},0~100%I_O	-1.6%	—	1.6%	%Vo
Output Voltage Trim Range (Voadj)		Io≤Ionom,Po≤153.6W	-10	—	+10	%Vo

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Parameter		Test Condition	Min	Typ	Max	Unit
Output Over-voltage Protection	Protection Mode	——	Auto-recovery			—
	Threshold	Po<Pomax	55		59	Vdc
Output Over-current Protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Threshold	Vinmin~Vinmax, Tc (base-plate) = -40~100°C	3.6	—	5.5	A
Output Short-circuit Protection	Protection Mode	——	Hiccup, Auto-recovery			—
Load Dynamic Response	Peak Deviation	25%-50%-25%Ionom 50%-75%-50%Ionom Slope: 0.1A/µS,Vinom	—	—	2400	mV
	Settling Time		—	—	500	µs
	Peak Deviation	0-100%-0Ionom Slope: 0.1A/µS,Vinom	—	—	24	V
	Settling Time		—	—	40	ms
Output Ripple & Noise	RMS (20MHz)	Vinom, add a 1µF ceramic capacitor and a 470µF electrolytic capacitor to output	—	—	150	mV
	Pk-to-Pk (20MHz)		—	—	300	mV
	Pk-to-Pk (100MHz)		—	—	400	mV
External Output Capacitance (Co)		V_{INMIN}~V_{INMAX},0~100%I_O	47	—	1200	µF
Turn-on/off Overshoot Amplitude		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		10%Vinnom-- 90%Vonom	20	—	200	mS
Output Rise Time		10%Vonom---90%Vonom	—	50	100	mS
Remote Voltage Sampling		——	Available			
2.4 Safety Specifications						
Insulation Strength	Input to Output	Leak Current≤1mA, 1min	1500	—	—	Vdc
	Input to Al-baseplate Output to Case	Leak Current≤1mA, 1min	1050	—	—	Vdc
	Output to Al-baseplate	Leak Current≤1mA, 1min	500	—	—	Vdc
Isolation Resistance (RISO)		$500V_{DC}$	50	—	—	MΩ
Safety Certification		EN60950-1:2006 Recognized				
2.5 Reliability						
Vibration Test(sine)		Frequency: 10~55Hz Amplitude: 0.35mm Acceleration: 10m/s2 Cycle: 30min for each X,Y,Z 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/s2 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		$\geq 2\times10^6$h Bellcore TR-332 (Ta=25°C) $\geq 1\times10^6$h Bellcore TR-332 (Ta=55°C)				
2.6 Environmental Specifications						
Relative Humidity		(40±2) ℃, No dew	—	—	90	%RH

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Parameter	Test Condition	Min	Typ	Max	Unit
Cooling	——	Conduction Cooling (Force-air or heat sink)			
Over-temperature Protection: Protection Mode	——	100℃~125℃ (Base-plate temp., Auto-recovery)			
Over-temperature Protection: hystersis	——	5	10	15	℃
Operating Baseplate Temperature		-40	—	+100	℃
Storage Temperature (Tst)		-40	—	+125	℃
2.7 General Specifications					
Switching Frequency	——	—	250	—	KHz
Temperature Coefficient (Tcoeff)	——	—	—	±0.02	%Vo/℃
Efficiency (η)	Vinom, 100%Ionom	88	89	—	%
	Vinom, 20%Ionom	—	84	—	%
	Vinom, 50%Ionom	—	88	—	%
	Vinom, 80%Ionom	—	89	—	%
Weight	——	—	90	—	g
RoHS	RoHS(2002/95/EC)				
Anti-sulfuration feature	Sprayed conformal coating				

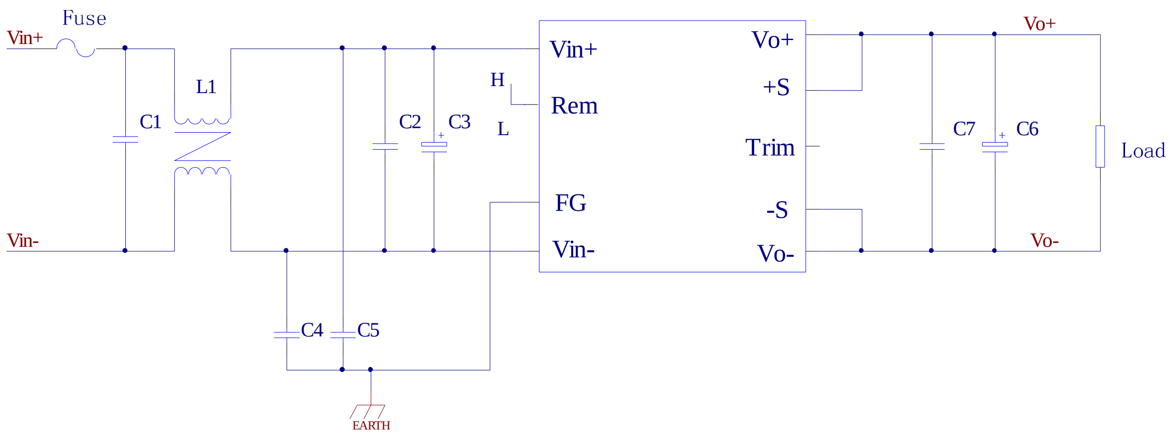
Note:

1. Ripple at ambient temperature of -40℃～-5℃, test condition: Vinom,Ionom, add a 1000μF electrolytic capacitor and a 1μF ceramic capacitor to output, and add a 330μF/100V electrolytic capacitor to input.

2. Ripple at high temperature: test conditions and indicators are the same as the ones at 25℃

3. Basic Application Circuit and Considerations

3.1 Typical Application



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Note:

Fuse: 10A; C2:100nF/100V; C: 330μF/100V; C7: 1μF /100V; C6: 470μF /100V (-5℃～100℃) , 1000μF /100V (-40℃～-5℃) Keep C6 no less than 47μF under any conditions.

With EMC requirements: C1: 1μF /100V; L1: Common-mode Inductor (Single phase) 1.32mH±25%-4A-R5K-21×21×12.5mm; C4,C5: X7R-22nF/1000V

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 low level or connected to **–**Vin; Output will be on when the Rem is at high level or when the Rem keeps open circuit referenced to **–**Vin.

3.4 Output short-current protection mode is hiccup, automatic recovery.

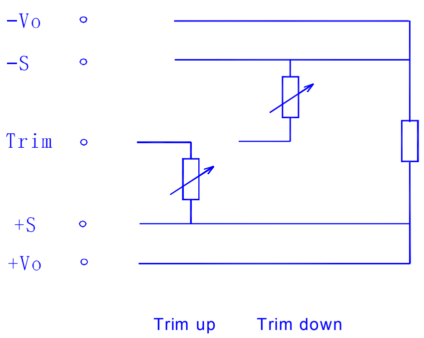
3.5 Output Trim: Exceed the maximum output power (trim up) or the maximum output current (trim down) may cause the converter operates abnormally. The output voltage shall not exceed 52.8V (trim up) or be lower than 43.2V (trim down), or the converter can't work well.

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

4.1 Input Voltage up to 80Vdc for long time or reverse input polarity would cause the module damaged. Sudden changes of input voltage will incur transient output voltage. The module is not internally fused, so m external 10A/250V fuse is required.

4.2 Output Voltage Trim

4.2.1 Output Trim Circuit



4.2.2 Output Trim Equations

Trim up: $R_{Trim-up} = \left(\frac{1-(2.5-1.2\times Vn)\times \frac{Vo}{Vn}}{\frac{Vo}{Vn}-1} \right) (k\Omega)$

Trim down: $R_{Trim-down} = \left(\frac{2.5\times \frac{Vo}{Vn}-1}{1-\frac{Vo}{Vn}} \right) (k\Omega)$

Where Vo is the adjusted output voltage,

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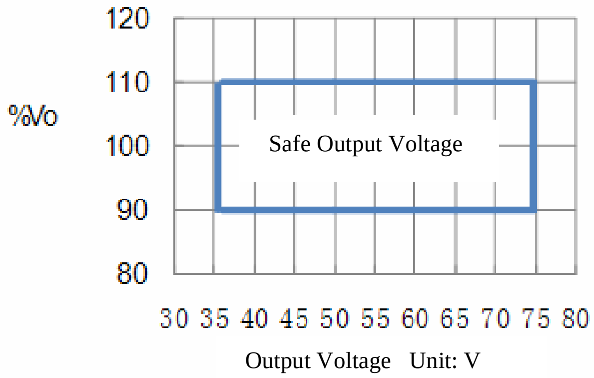
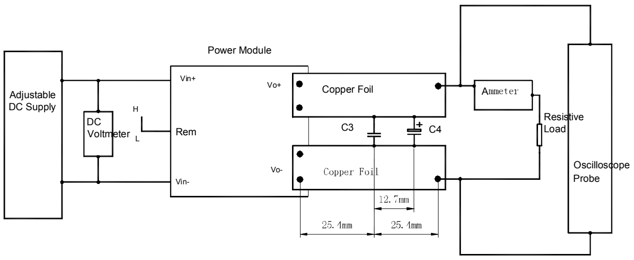
$R_{Trim-up}$、$R_{Trim-down}$ are external adjusting resistors, and
Vn is nominal output voltage.

4.2.3 Output Voltage Trim Curve



Max adjusted Output Voltage vs. Input Voltage

4.3 Max Ripple & Noise: test as shown in the figure below; Oscilloscope: 20M



Measuring of Output Ripple

Note:

1) C3: 1μF /100V high-frequency capacitor; C4: electrolytic capacitor, 470μF /100V (-5℃～100℃); 1000μF /100V (-40℃～-5℃)
2) Distance between the two parallel copper foils is 2.5mm; the sum of voltage drop shall be less than 2% of output voltage.
3) The copper foils can be replaced by twisted-pairs, which are less than 50mm, and the voltage drop of the twisted-pairs shall be less than 2% of output voltage.

4.4 Over-current Protection

If the output is in over-current conditions or in short-circuits, the module is in hiccup mode, and the output current varies from a few mA to hundreds of mA.

4.5 Over- Voltage protection

When the output voltage exceeds the over-voltage protection threshold, the module is hiccup mode; after eliminating the over-voltage conditions, the module recovers automatically.

4.6 Over-temperature protection:

When the baseplate temperature exceeds the threshold (100℃~125℃), the over-temperature protection functions, and the output is off; when the baseplate temperature is 5℃~15℃ less than the threshold, the module recovers automatically.

4.7 Remote Sense (+S,-S)

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When using remote sense, use twisted-pair to connect +S and –S respectively to + LOAD and –LOAD. The remote sense pins shall not be used to bear load current, or the module may be damaged.

4.8 Remote On/Off:

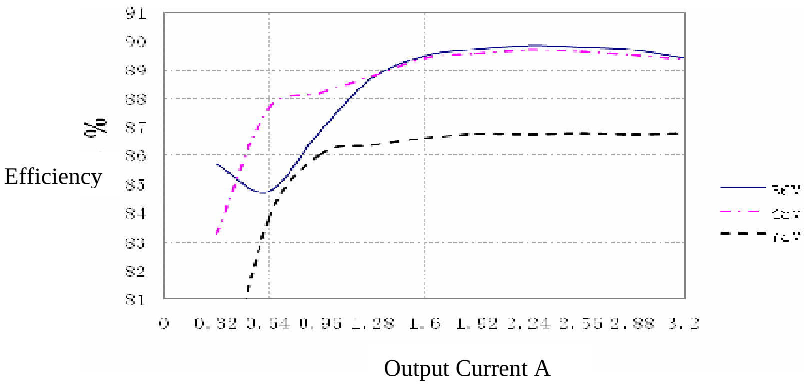
OFF: Rem is at low level or shorted to -Vin;

ON: Rem is at high level or keeps open circuit referenced to-Vin;

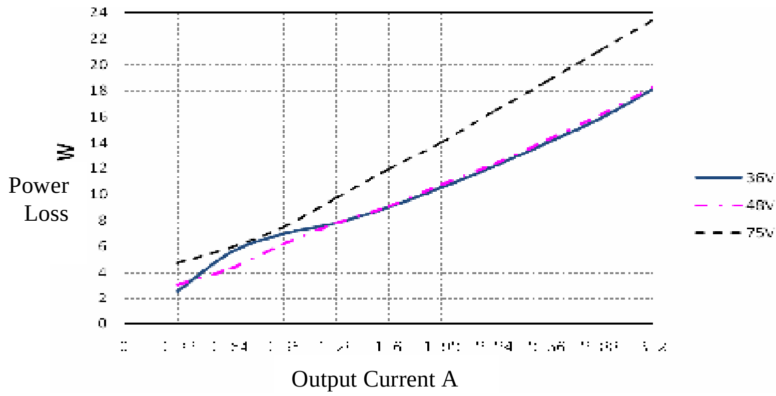
4.9 Hipot Test:

Short the input terminals (+ Vin,-Vin, Rem), and short the output terminals (+ Vout,-Vout, Trim, + S,-S).

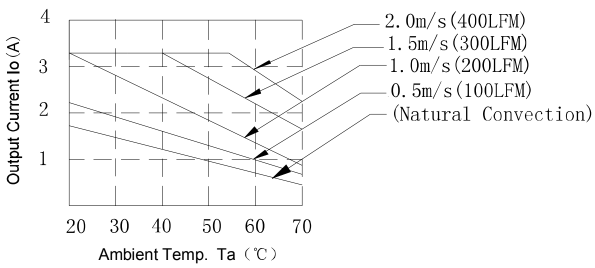
5 Characteristic Curves (Ta=＋25℃)



Efficiency Vs. Output Current (Tc=＋25℃)



Power Loss Vs. Output Current



Thermal Derating Curve with no heat-sink at different air-flows (Vinom)

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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.)

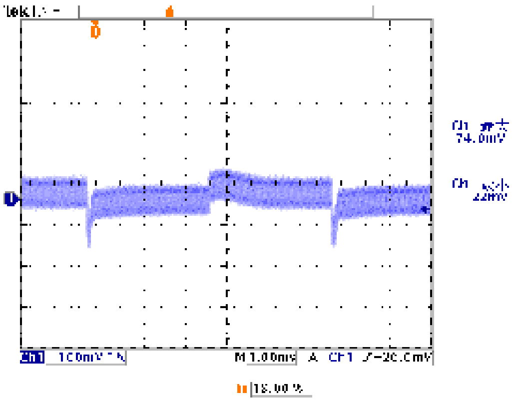
（2） A certain gap is required between the module and test board. Keep the test board perpendicular to the horizontal direction and the long edge parallel with the horizontal plane.

（3） Put the module into a thermal test box, and test the module using infrared thermal imaging equipment and thermocouple test equipment. See the Figure 5.4 for the test points.

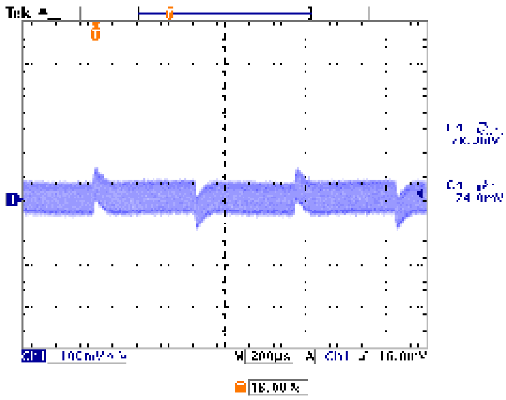
（4） When the module reaches thermal equilibrium state, the devices on the module can meet thermal derating requirements.

5.1 Dynamic Response

Test Conditions: Vin=48V, add a1μF ceramic capacitor and a 470μF electrolytic capacitor to output.



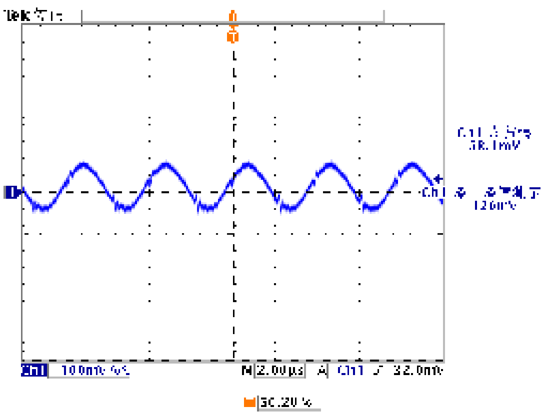
25%-50%-25%Io Dynamic Load



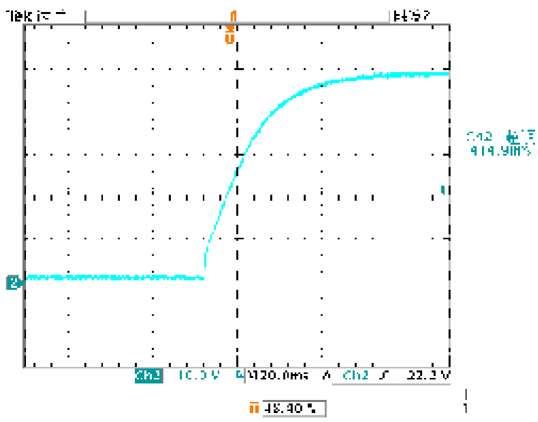
50%-75%-50%Io Dynamic Load

5.2 Output Response and Power-on Wave

Test Conditions: Tc=25℃,Vin=48V, Io=3.2A, 20 MHz, add a1μF ceramic capacitor and a 470μF electrolytic capacitor to output, and add a 330μF/100V electrolytic capacitor to input.



Output Ripple



Output Rise Time

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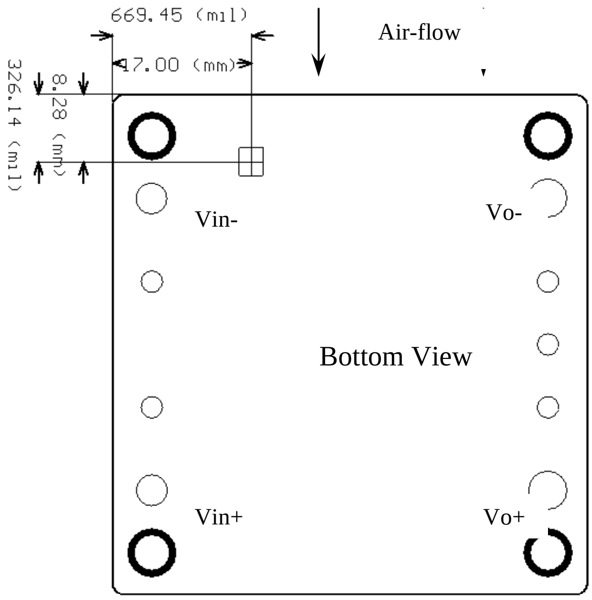
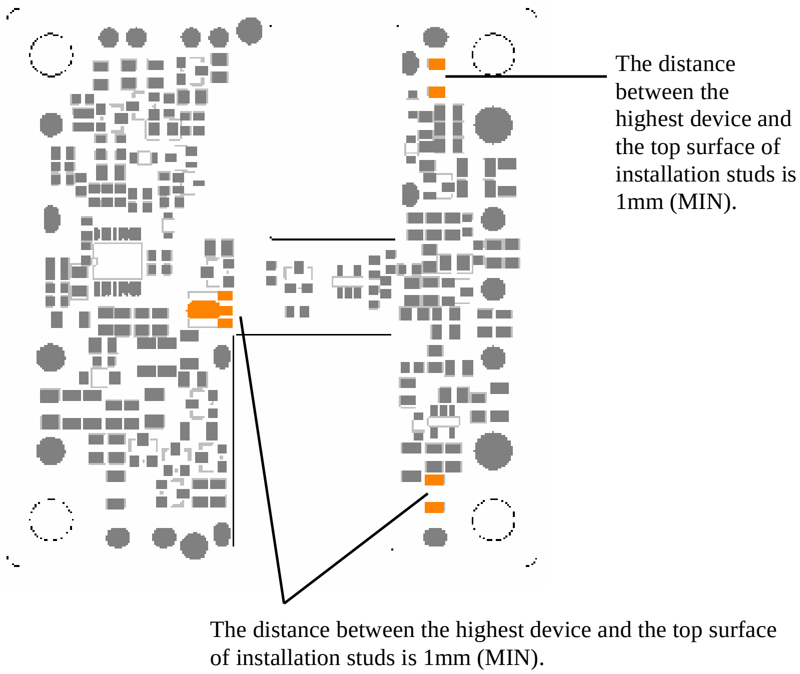
5.3 Thermal Derating Curve

The module can work at severe temperature conditions, but good cooling is required. Test the module as shown in the figure below to determine whether the operating temperature exceeds the temperature limits. The airflow is in the same direction with the air channel of heat-sink.



Temperature Test Points (Al-baseplate)



PCB Layout and Highest Devices (Bottom View)

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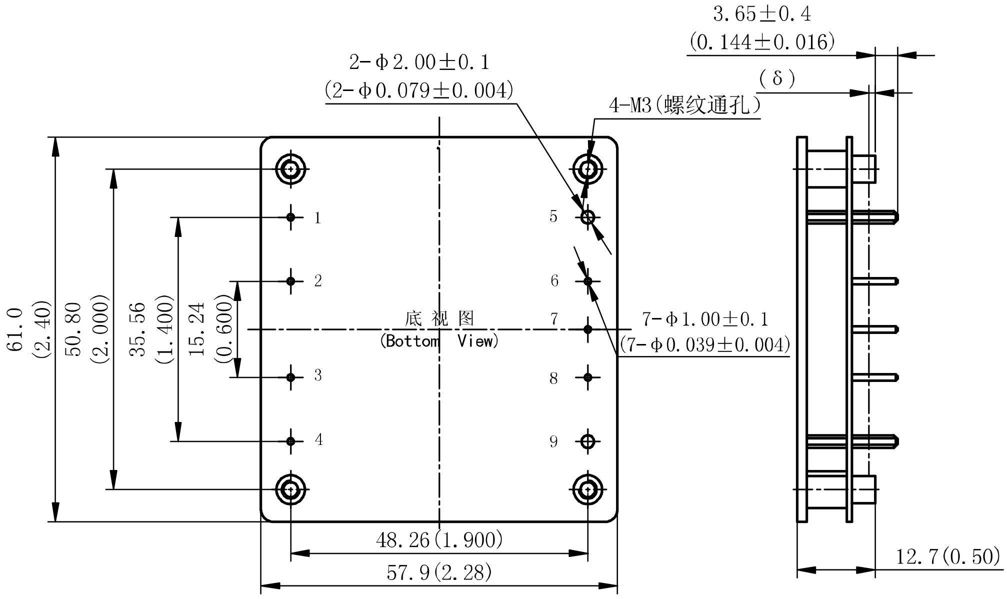
6 Dimensions and Pin definition

6.1 Dimensions



Note (1) Unit: mm(inch)

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

(3) The minimum space between the highest device at pin side and the top surface of screw studs is δ=1mm(Min)

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	Grounding	Remote	Positive Input	Negative Output	Negative Remote Sense	Trim	Positive Remote Sense	Positive Output

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