BCT® HSR−L133ASC−T−CG5

RoHS Compliant

DC-DC Converters — Data Sheet

Options:

- Sprayed conformal coating
- RoHS

Features

- Industry standard half-brick package and footprint 2.40”×2.28”×0.413”
- High power density: up to 90W/in3
- High efficiency: 89% typical
- 2:1 input voltage range
- Low output noise and ripple
- Remote sense
- Over-temperature protection
- Output over-current/voltage protection
- Output voltage adjustment: ±10%
- Baseplate operating temperature: -25℃ to 100℃
- UL60950-1/ EN60950-1 Certified
- RoHS (2002/95/EC) complaint

Numbering Convention

HSR - L 133 A S C – T-C G5

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

No	Features	Descriptions
①	Product Series	Half-brick
②	Remote on/off Logic	L – Negative Logic
		H or Default – Positive Logic
③	Typical Output Power	133 – Output Power: 133W
④	Typical Output Voltage	A – Output Voltage: 3.3V
⑤	Number of Outputs	S – Single Output
⑥	Typical Input Voltage	C – Input Voltage: 48V
⑦	Model Numbers with suffix	'-T' output voltage adjustment
⑧	Sprayed Conformal coating	C – Sprayed Conformal coating
		Default: no Sprayed Conformal coating
⑨	RoHS feature	G5 – RoHS5
		G – lead-free, RoHS6

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1. Description

The power modules are DC-DC converters in an industry half-brick packaging and footprint & equipped with an option of aluminum board. Components are surface mount, Power component on aluminum foundation plate, the converters provide up to 3.3V_{DC} output voltage and 40A output current. The power modules feature high efficiency, teleswitch, overheated protection, current limiting 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
Input Transient Voltage (Vit)		100ms	—	—	100	Vdc
Max Output Power (Pomax)		allowable operating conditions	—	—	133	W
2.2 Input Specifications						
Typical Input Voltage(Vinom)		—	—	48	—	Vdc
Input Voltage Range		—	36	—	75	Vdc
Input Under-voltage protection (Vishl)		Ionom	30	—	35	Vdc
Input Under-voltage Recovery Range		Ionom	31	—	36	Vdc
Maximum Input current (Iimax)		Vimin, Vonom,Ionom	—	—	4.2	A
No-load Input Current (Iio)		Vinom, Io＝0A	—	60	100	mA
Static Input Current (Iiof)		Vinom, remote output shutdown	—	10	20	mA
Remote (Negative Logic)	On	High level (3.5~12V) or Open Circuit				
	Off	Low level(-0.7~1.2V) or connect to -Vin				
2.3 Output Specifications						
Output voltage set-point (Vonom)		Vinom,Ionom	3.267	3.3	3.333	Vdc
Typical load(Ionom)		—	—	40	—	A
Output Current Range (Io)		Po≤133W	0	—	40	A
Line Regulation (Vov)		Vimin-Vimax,Ionom	—	±0.1	±0.2	%Vo
Load Regulation (Vol)		0-100%Ionom,Vinom	—	±0.2	±0.5	%Vo
Output voltage Trim Range (Voadj)		Io≤Ionom,Po≤133W	-20	—	+10	%Vo
Output Over-voltage Protection		Po≤133W	3.75	—	5.0	Vdc
Output Over-current protection	Protection Mode	——	Hiccup, Auto-recovery			—
	Protection Range	——	110		140	%Ionom
Output Short-circuit protection	Protection Mode	——	Hiccup, Auto-recovery			—
Dynamic Load Response	Peak Deviation	25%-50%-25%Ionom 50%-75%-50%Ionom ΔIo/Δt=0.1A/μS,Vinom	—	—	165	mV
	Settling Time		—	—	200	μs

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Parameter		Test Condition	Min	Typ	Max	Unit
Output Ripple and Noise (Vrp)		Vinom, 20MHz, externally add a 22μF tantalum capacitor and a 1μF ceramic capacitor to output	—	50	100	mV
External Output Capacitance (Co)			0	—	10000	μF
Turn-on/off Peak Deviation		Vinom,Ionom	—	—	±5	%Vo
Turn-on Delay Time		Vinom,Ionom (10%Vinom—90%Vonom)	10	—	20	mS
Turn-on Rise Time		Vinom,Ionom (10%Vonom—90%Vonom)	5	—	10	mS
2.4 Safety Specifications						
Isolation voltage	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
Isolation Resistance (RISO)		Test voltage: 500Vdc, Normal temperature	50	—	—	MΩ
Safety Certificate		EN 60950-1Recognized				
2.5 Reliability						
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.			
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 (Baseplate Tc=40°C)				
2.6 Environmental Specifications						
Relative Humidity		(40±2) ℃, No dew	—	—	90	%RH
Cooling		——	Conduction Cooling			
Operating Baseplate Temperature (Tc)		See Figure 1	-40	—	+100	℃
Over-temperature protection		——	+115℃ (auto-recovery when 10℃ lower than protection threshold)			
Storage Temperature (Tst)		Non-operating	-55	—	+125	℃
2.7 General Specifications						
Efficiency (η)		Vinom,Ionom	87	89	—	%
Switching Frequency		——	—	280	—	k Hz
Temperature Coefficient (Tcoeff)		——	—	—	±0.02	%/℃
Weight (g)		——	—	90	—	g
RoHS		2002/95/EC Directive				
Anti-sulfuration feature		Sprayed conformal coating				

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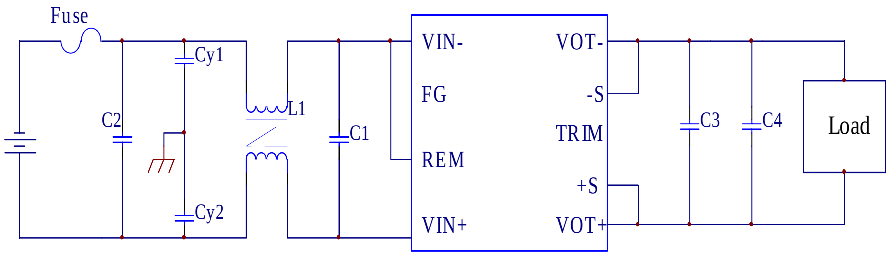
3. Basic Application Circuit and Considerations

3.1 Typical Application



Note: Fuse -12A C1- 330μF/100V C3 -1μF/10V C4 - 3300μF/10V
With EMC requirements: C2 - 1μF /100V;
L1 - Common-mode Inductor (Single phase) 1320uH-±25%-4A-R5K-21*21*12.5mm;
Cy1, Cy2: 22nF/1000V/X7R;

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

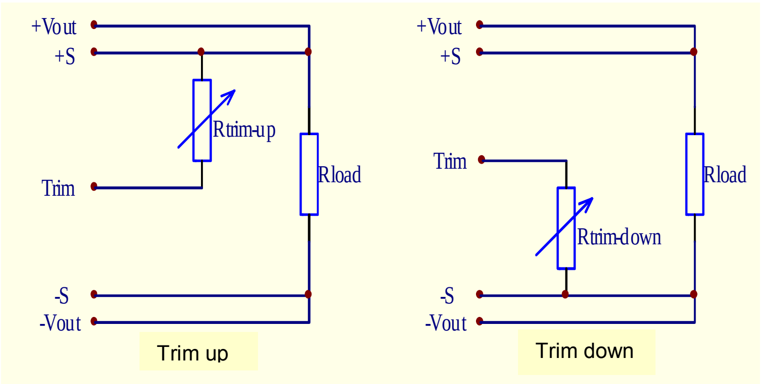
3.3 Output will be off when the Rem is at high level or keeps open circuit; Output will be on when the Rem is at low level.

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 3.63V (trim up) or be lower than 2.64V (trim down), or the converter can't work well. See "4. Output Voltage Adjustment (Trim)" for details.

4 Output Voltage Adjustment (Trim)

4.1 Output Trim Circuit



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4.2 Output Trim Equations

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

$$R_{Trim-up} = \left(\frac{Vo(100\% + \Delta)}{1.26 \times \Delta} - \frac{(100\% + 2\Delta)}{\Delta} \right) (k\,\Omega) \qquad 0<\Delta<10\%$$

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

$$R_{Trim-down} = \left(\frac{100\%}{\Delta} - 2 \right) (k\,\Omega) \qquad 0<\Delta<20\%$$

Where V_O is rated output voltage;

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

$\Delta(\%)$: Ratio of output voltage changes to nominal output voltage (0<Δ<20%).

5 Characteristic Curves

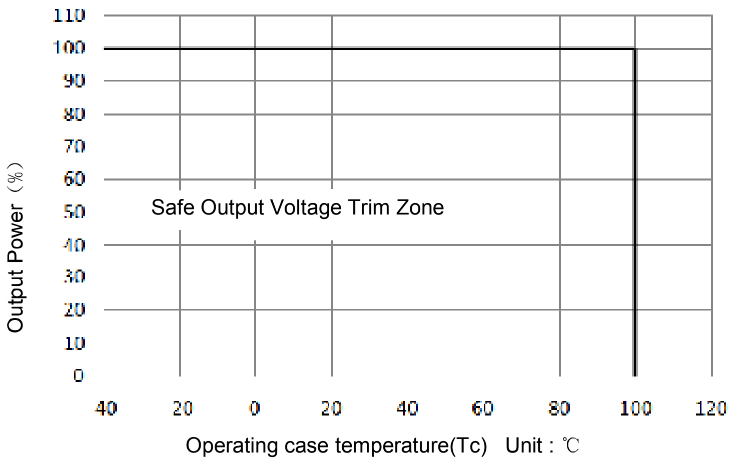

Figure 1. Output Power vs Baseplate temperature

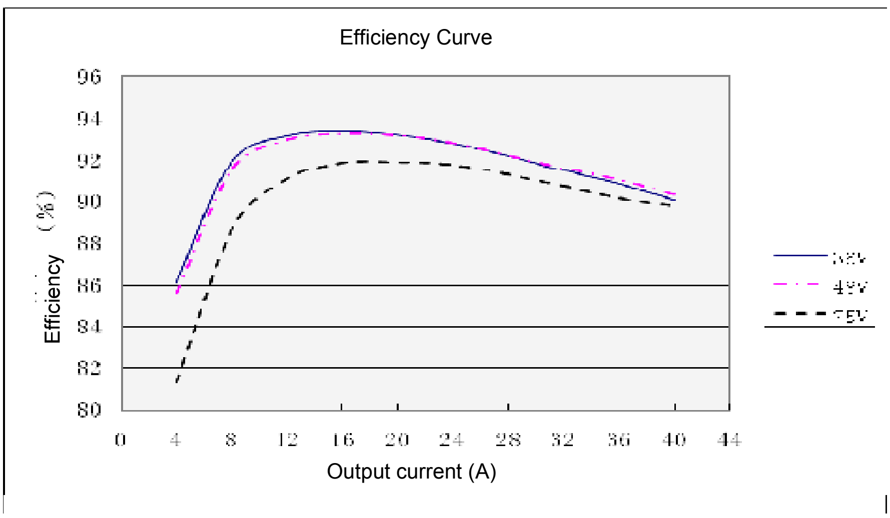

Figure 2. Output Current vs Efficiency (Ta＝＋25℃)

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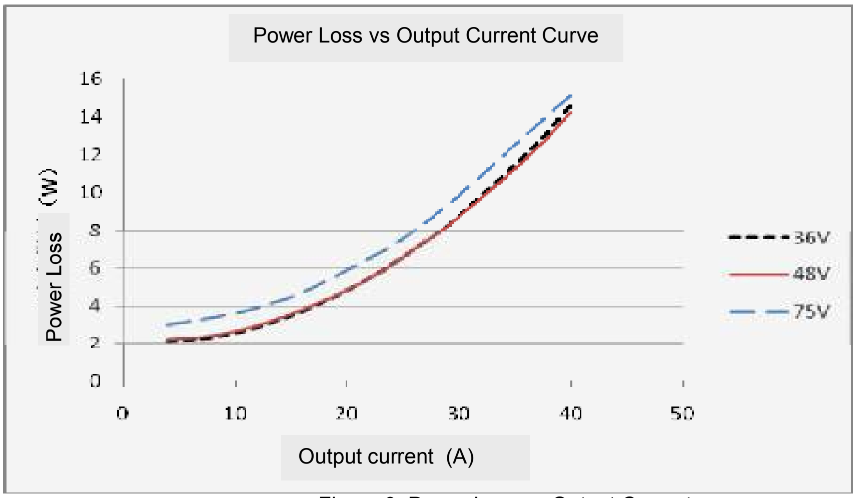

Figure 3. Power Loss vs Output Current

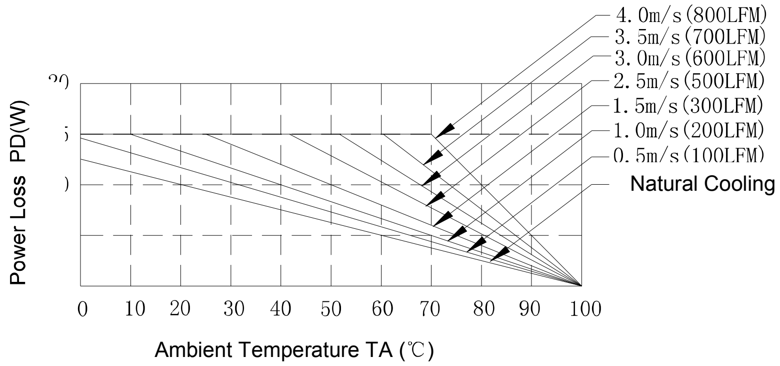

Figure 4. Derating Curves with no heat sink at different airflow

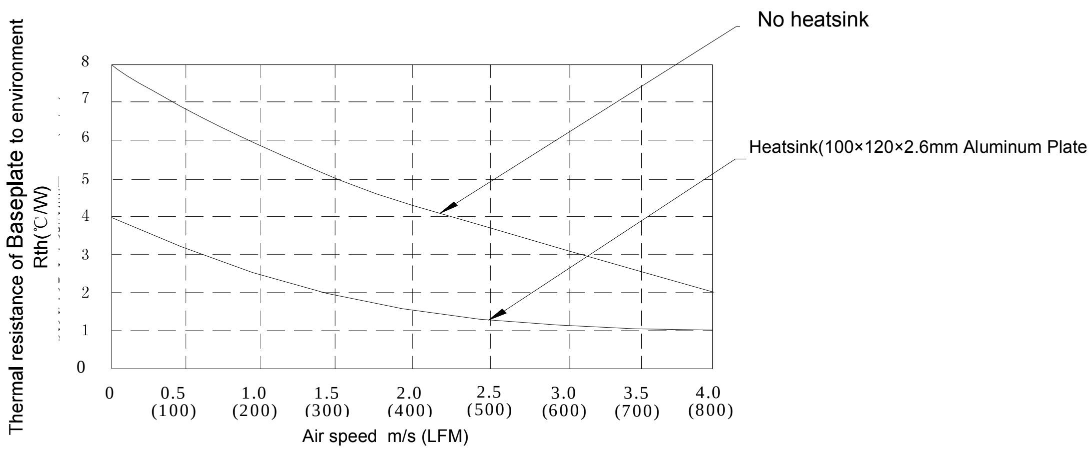

Figure 5. Thermal resistance of baseplate to environment VS Air Speed

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5 Thermal Considerations

The power modules operate in a changing temperature environment, the power module itself has a certain power conversion efficiency so that the power module will produce heat, especially when output a large power (even up to tens of watts). These losses produce a temperature difference between the power module case and the surrounding environment, namely the power module's temperature rise.

In order to ensure the power modules's reliability at long-time operation, it needs to make the case temperature (or baseplate temperature) keep within the specified specification. In particular, due to the limited heat exchanging area of the modules with high thermal dissipation, it is required to add heat sinks or forced-air cooling to reduce the thermal resistance of the module and the surrounding environment, decrease the module's case temperature using heat conduction, convection and radiation, so as to ensure the module's reliability at long-term and continuous operation.

Thermal design shall follow the following steps:

1) Determine the maximum actual output power Po, the maximum ambient temperature Ta and the expected maximum case temperature Tc;

Use the parameters above to calculate the temperature rise △T:

△T＝Tc－Ta

Note: Tc shall be kept within range specified in the technical specifications book.

2) Calculate the module's power Loss Pd:

$$P_D = \frac{1-\eta}{\eta} \times Po$$

η－Conversion Efficiency

Po－Output Power

3) Calculate the necessary thermal resistance Rth. Tow mode: heat sink and force-air cooling (no heat sink):

a) Selection of a heat sink

i. The required thermal resistance of heat sink : Rth=△T / PD

ii. According to the Rth above and the module's dimensions, select a heat sink of which the thermal resistance is less than the Rth above.

b) Selection of forced-air cooling

i. Calculate the module case's thermal resistance to surrounding air: Rth=△T / PD

ii. According to the Rth above and Figure 5 – "Thermal resistance of substrate to environment VS Air Speed", select the corresponding air speed value. It is required to consider the derating curve when determining the air speed in actual thermal design.

3) Test & Verification

Use the actual operation data to test the accuracy of the calculated values above, and revise them.

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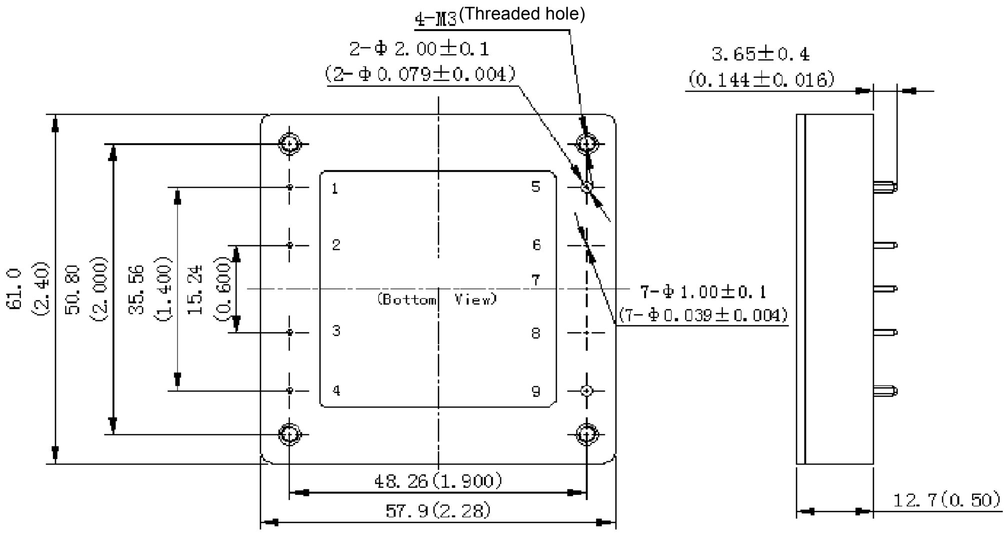
6 Dimensions and Pin definition

6.1 Dimensions



(1) .X±0.5 (.XX±0.02) .XX±0.25 (.XXX±0.010)
(2) Unit: mm (inch)

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

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