DC/DC Converter

URF1D_QB Series

MORNSUN®

50W/75W/100W, wide input voltage, isolated &regulated single output DC-DC converter

Patent Protection RoHS

FEATURES

- Wide range of input voltage : 66-160V
- Efficiency up to 92%
- Low no-load power
- Isolation voltage 3000VDC
- Operating temperature range:-40℃~+100℃
- Input under-voltage protection, output over-voltage, over-current, short circuit, over-temperature protection
- International standard: 1/4 brick
- Meets requirements of UL60950 and railway standard EN50155

URF1D_QB Series is a high performance product designed for the field of railway applications. Output power contains 50W/75W/100W, no min. load requirement, wide input voltage 66-160VDC, which allows the base plate temperature up to 100 ℃. Further product feathers include input under-voltage protection, output over-voltage protection, short circuit protection, over temperature protection, remote control and compensated, output voltage regulation functions. Meets the EN50155 railway standard and UL/EN60950 safety standards. Widely used in the railway system and associated equipment.

Selection Guide

Part No.	Input Voltage (VDC)		Input Voltage (VDC)		Efficiency (%, Typ) @ Full Load	Max. Capacitive Load(μF)
	Nominal (Range)	Max.*	Output Voltage(VDC)	Output Current (mA)(Max./Min.)		
URF1D24QB-50W	110 (66-160)	170	24	2083/0	92	3000
URF1D24QB-50WH						
URF1D24QB-75W			24	3125/0	92	3000
URF1D24QB-75WH						
URF1D24QB-100W			24	4167/0	92	3000
URF1D24QB-100WH						

Note: *Absolute maximum rating without damage on the converter, but it isn't recommended.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (no-load / full load)	Nominal input	URF1D24QB-100W(H)	--	5/988	--	mA
		URF1D24QB-75W(H)	--	5/741	--	
		URF1D24QB-50W(H)	--	5/494	--	
Reflected Ripple Current	Nominal input		--	50	--	
Input Surge Voltage (1sec. max.)			-0.7	--	180	VDC
Start-up Threshold Voltage			--	--	66	
Under-voltage Shutdown Voltage			--	55	--	
Start-up Time			--	25	--	mS
Input Filter			Pi filter			
Ctrl*	Module switch on		Ctrl psuspended or connected to TTL high level (3.5-12VDC)			
	Module switch off		Ctrl connected to -Vin or low level (0-1.2VDC)			
	Input current when switched off		--	2	--	mA

Note: * the voltage of Ctrl pin is relative to input pin -Vin.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Nominal input,10%-100% load	--	--	±2	%
Line Regulation	Full load, the input voltage is from low to high	--	--	±0.3	
Load Regulation	Nominal input,10%-100% load	--	--	±0.5	

Transient Recovery Time	25% load step change	--	300	500	μs
Transient Response Deviation		--	±3	±5	%
Temperature Drift Coefficient	Full load	--	--	±0.03	%/℃
Ripple & Noise *	20MHz bandwidth	--	100	300	mVp-p
Output voltage Regulated range(Trim)		-10	--	10	%
Output voltage remote compensation(Sense)		--	--	5	
Output Over-voltage Protection	Input voltage range	110	--	140	%Vo
Output Over-current Protection		110	130	180	%Io
Output Short circuit Protection		Continuous			
Note: * The measuring method of ripple and noise, please refer to Fig. 1 .					

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Insulation Voltage	Input-output	Input-output, with the test time of 1 minute and the leak current less than 1mA	3000	--	--	VDC
	Input-case		1500	--	--	
	Output-case		1500	--	--	
Insulation Resistance		Input-output, insulation voltage 500VDC	1000	--	--	MΩ
Isolation Capacitance		Input-output, 100KHz/0.1V	--	2200	--	pF
Switching Frequency		PFM mode	--	220	--	KHz
MTBF		MIL-HDBK-217F@25℃	500	--	--	K hours

Environmental Specifications

Item		Operating Conditions	Min.	Max.	Unit
Base- Plate Temperature Range		Within the operating temperature curve	-40	100	℃
Over-temperature Protection		Base- Plate Temperature	--	115	
Thermal Resistance	URF1DxxQB-100W	Natural convection	10.7	--	℃/W
		200LFM convection	6.0	--	
		400LFM convection	5.0	--	
		1000LFM convection	4.0	--	
	URF1DxxQB-100WH	Natural convection	5.1	--	
		200LFM convection	2.8	--	
		400LFM convection	2.2	--	
		1000LFM convection	1.8	--	
Storage Humidity		Non-condensing	5	95	%RH
Storage Temperature			-55	125	℃
Lead Temperature		Welding spot is 1.5mm away from the casing, 10 seconds	--	300	
Cooling Test			EN60068-2-1		
Dry Heat			EN60068-2-2		
Damp heat			EN60068-2-30		
Shock and Vibration Test			IEC/EN61373		

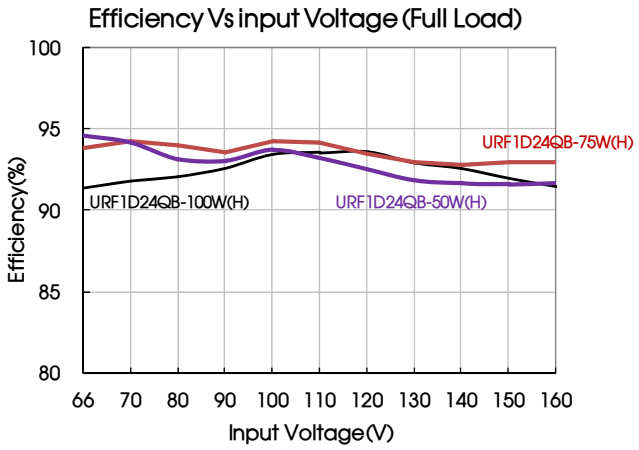
Physical Specifications

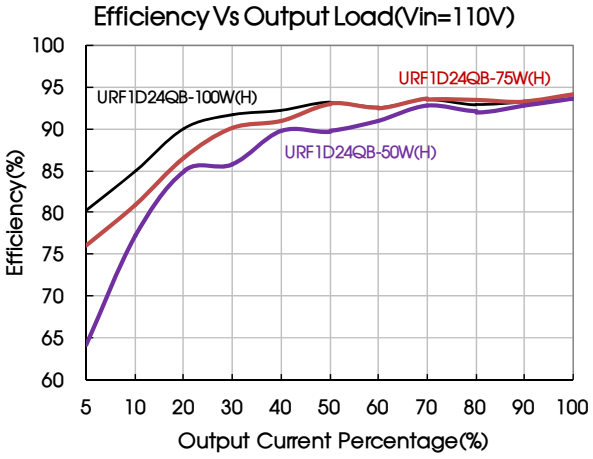
Casing Material		Black flame-retardant and heat-resistant plastic (UL94-V0)
Weight	URF1D24QB-50W、URF1D24QB-75W、URF1D24QB-100W	46g (Typ.)
	URF1D24QB-50WH、URF1D24QB-75WH、URF1D24QB-100WH	76g (Typ.)
Cooling method		Natural convection or Forced convection

EMC Specifications

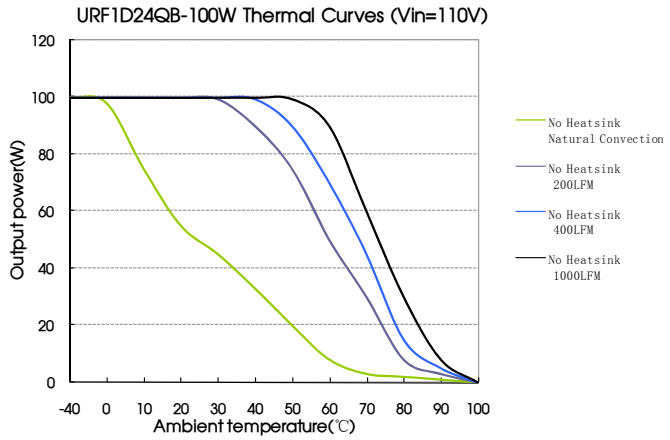
Item		Test Conditions		Test Procedure
EMI	Conducted Disturbance	150KHz-30MHz Class B (see Fig. 2 for recommended circuit)		CISPR22/EN55022
	Radiated Emission	30MHz-1GHz Class B (see Fig. 2 for recommended circuit)		CISPR22/EN55022
EMS	Electrostatic Discharge	Contact ±6KV, Air ±8KV	perf.Criteria B	IEC/EN61000-4-2 GB/T17626.2
	Radiation Immunity	10V/m	perf.Criteria A	IEC/EN61000-4-3 GB/T17626.3
	Conducted disturbance Immunity	10Vr.m.s	perf.Criteria A	IEC/EN61000-4-6 GB/T17626.6
	EFT	±2KV(5KHz, 100KHz)(see Fig. 2 for recommended circuit)	perf.Criteria B	IEC/EN61000-4-4 GB/T17626.4
	Surge Immunity	±2KV(1.2μs/50μs 2Ω), (see Fig. 2 for recommended circuit) ±4KV(1.2μs/50μs 12Ω), (see Fig. 2 for recommended circuit)	perf.Criteria B	IEC/EN61000-4-5 GB/T17626.5
		±1.8KV (5/50μs 5Ω), (see Fig. 2 for recommended circuit)	perf.Criteria B	EN50155
	Immunities of short interruption	100%-0%, 10ms (see Fig. 2 for recommended circuit)	perf.Criteria B	EN50155

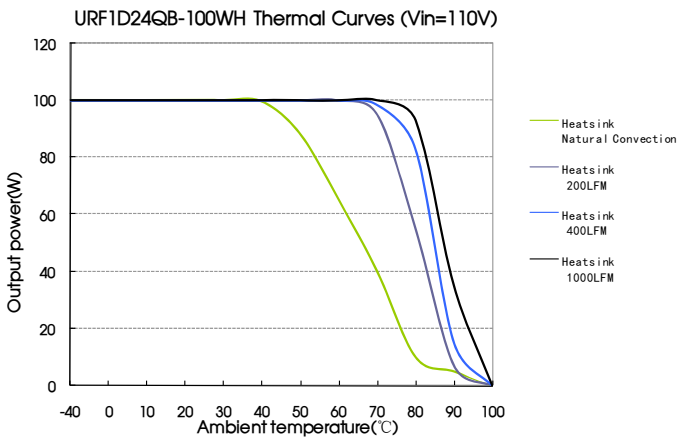
Efficiency Curves



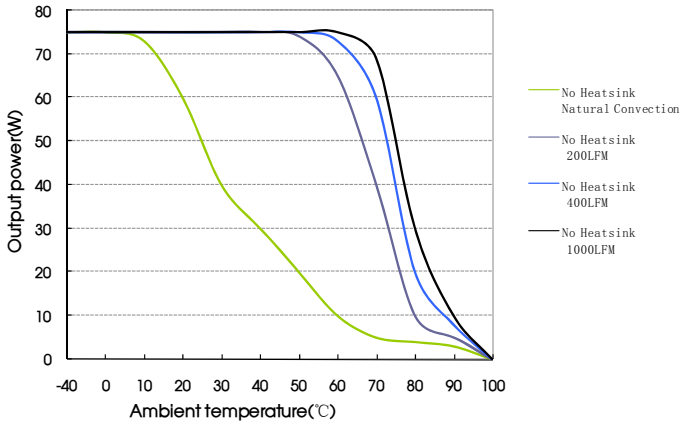


Thermal Curves

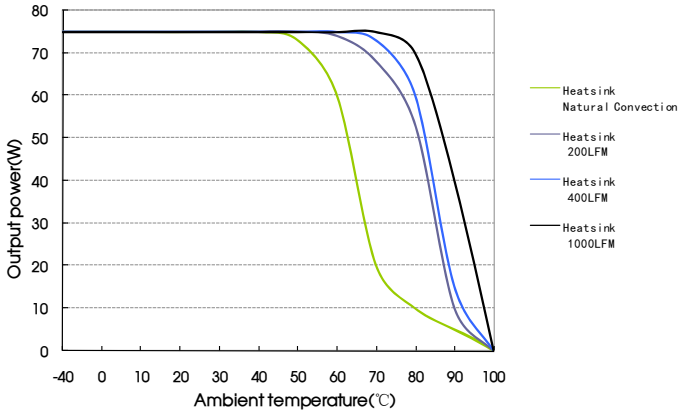




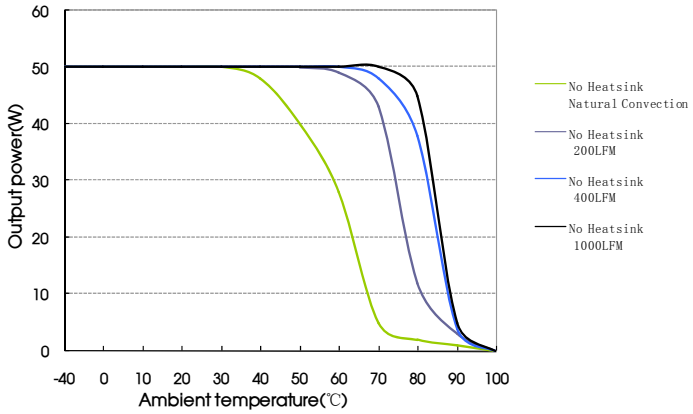
URF1D24QB-75W Thermal Curves (Vin=110V)



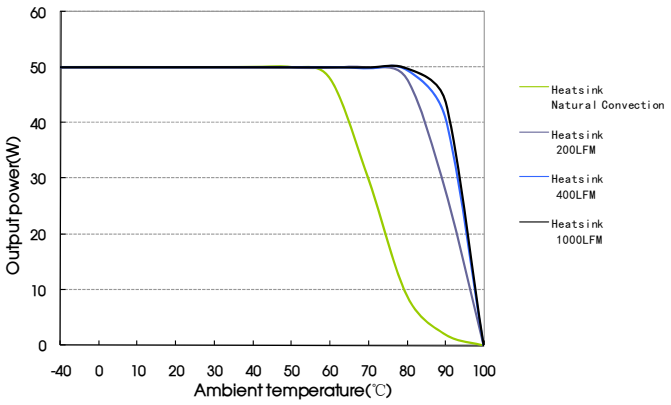
URF1D24QB-75WH Thermal Curves (Vin=110V)



URF1D24QB-50W Thermal Curves (Vin=110V)

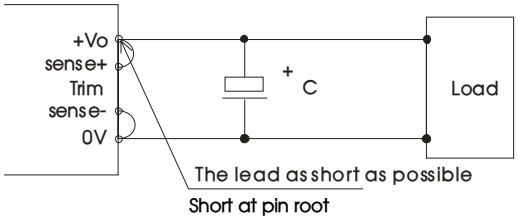


URF1D24QB-50WH Thermal Curves (Vin=110V)



Sense of application and precautions

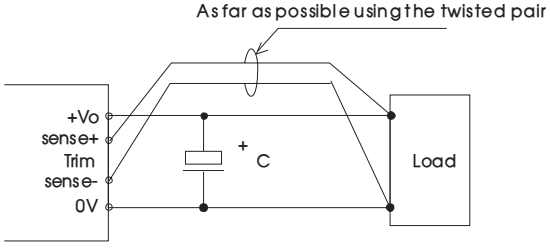
1. When Remote Sense is not used



Notes:

1) When remote sense is not used, make sure + Vo and Sense + are shorted, and that 0V and Sense- are shorted as well;
2) Keep the patterns between + Vo and Sense + and 0V and Sense- as short as possible. Avoid a looping pattern. If noise enters the loop, the operation of the power module will become unstable.

2. When Remote Sense is used



Notes:

1. Using remote sense with long wires may cause output voltage to become unstable. Consult us if long sensing wiring is necessary.
2. Sense patterns or wires should be as short as possible. If wires are used, use either twisted-pair or shielded wires.
3. Please Use wide PCB trace or a thick wires between the power supply module and the load, the line voltage drop should be kept less than 0.3V. Make sure the power supply module's output voltage remains within the specified range.
4. The impedance of wires may cause the output the voltage oscillation or have a greater ripple, please do adequate assessments before using.

Design Reference

1. Ripple & noise

All the URF1D_QB-100W series have been tested according to the following recommended test circuit before leaving the factory (see Figur 1).

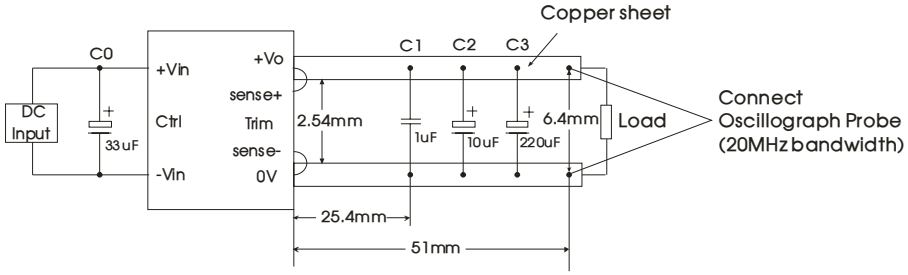


Fig. 1

2. Typical application

If don't use our company's EMC models, please make sure the input of at least 33uF electrolytic capacitor in parallel to suppress the input terminal may produce surge voltage.

If it is required to further reduce input and output ripple, properly increase the input & output of additional capacitors Cin and Cout or select capacitors of low equivalent impedance provided that the capacitance is no larger than the max. capacitive load of the product.

Capacitive Parameter / Output Voltage	Cout(μF)	Cin(μF)
24V	220	100

3. EMC solution-module recommended circuit

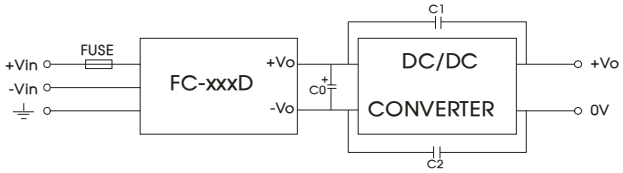
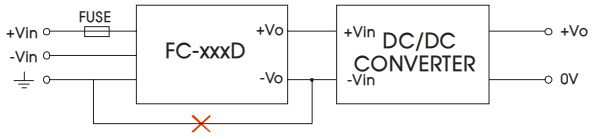
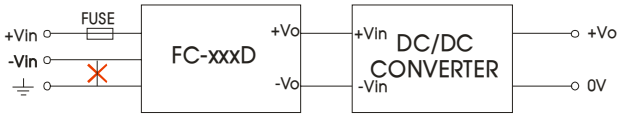


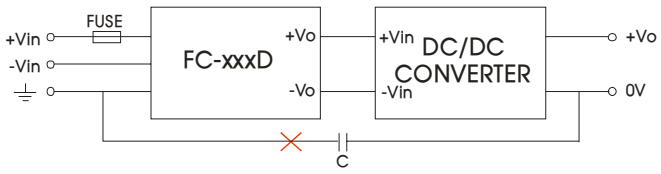
Fig. 2

C0	82uF/200V electrolytic capacitor
C1, C2	2200pF/400VAC capacitor
FC-xxxD	recommended to use MORNSUN's FC-CX3D
FUSE	Due to the difference of the power module input current, the fuse of the recommended values, please refer to the Technical Manual for the power module.

4. These applications are not supported for the follow models







5. Thermal design

The maximum operating temperature of base- plate TB is 100 ℃, as long as the user's thermal system keeps TB <100 ℃, the converter can deliver its full rated power. A power derating curve can be calculated for any heatsink that is attached to the base-plate of the converter. It is only necessary to determine the thermal resistance, Rth(B-A), of the chosen heatsink between the base-plate and the ambient air for a given airflow rate. This information is usually available from the heatsink vendor. The following formula can the be used to determine the maximum power the converter can dissipate for a given thermal condition if its base-plate is to be no higher than 100 ºC.

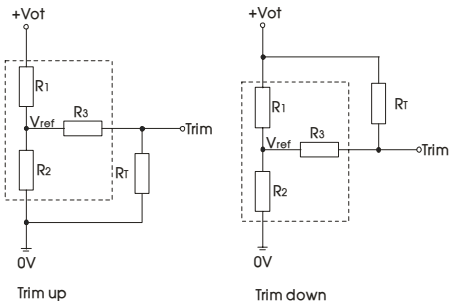
$$P_{diss}^{\max} = \frac{100℃ - T_A}{Rth\ (B-A)}$$ (T_A is ambient temperature)

The maximum load operating power of power supply module at a certain ambient temperature can be calculated by the power dissipation, Formula is as follows:

$$Po_{\max} = \frac{P_{diss}^{\max}}{(\frac{1}{\eta} - 1)}$$ (η is converter efficiency)

Therefore, customers can according to the actual application to choose the right heatsink.

6. Application of Trim and calculation of Trim resistance



Applied circuits of Trim (Part in broken line is the interior of models)

Calculation formula of Trim resistance:

up: $R_T = \frac{aR_2}{R_2 - a} - R_3$ $\quad a = \frac{Vref}{Vo' - Vref} \cdot R_1$

down: $R_T = \frac{aR_1}{R_1 - a} - R_3$ $\quad a = \frac{Vo' - Vref}{Vref} \cdot R_2$

Note: Value for R1, R2, R3, and V_{ref} refer to the above table 1. R_T: Resistance of Trim. a: User-defined parameter, no actual meanings. Vo': The trim up/down voltage.

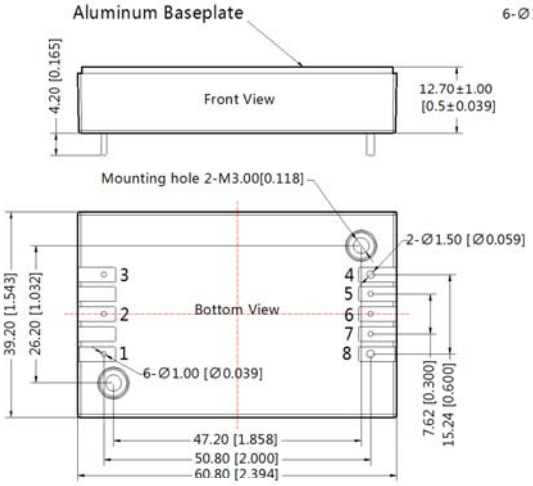
table 1

Parameter \ Vo	24(VDC)
R1(KΩ)	24.87
R2(KΩ)	2.87
R3(KΩ)	20
Vref(V)	2.5

7. The product does not support in parallel and hot-plug use

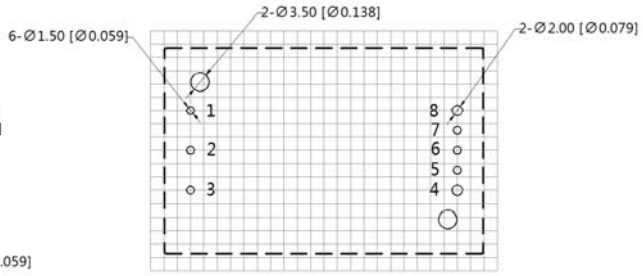
8. For more information please find the application notes on www.mornsun-power.com

Dimensions and Recommended Layout (without heatsink)



Note:
Unit:mm[inch]
Pin1,2,3,5,6,7's diameter:1.00[0.039]
Pin4,8's diameter:1.50[0.059]
Pin diameter tolerances:±0.10[±0.004]
General tolerances:±0.50[±0.020]
Mounting hole screwing torque: Max 0.4 N·m

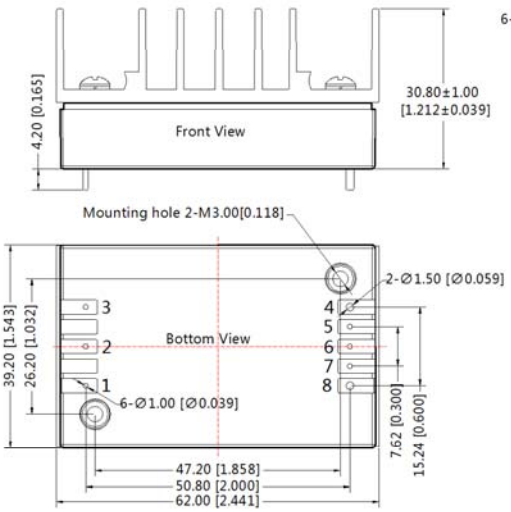
THIRD ANGLE PROJECTION



Note:Grid 2.54*2.54mm

Pin-Out			
Pin	Function	Pin	Function
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

Dimensions and Recommended Layout(with heatsink)



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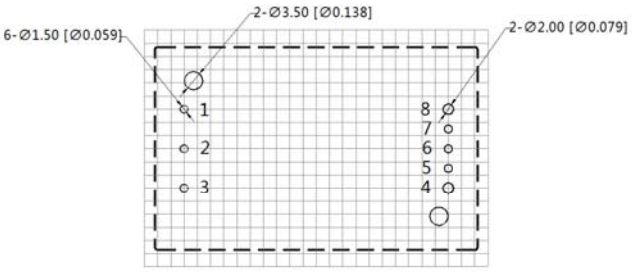

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Pin-Out			
Pin	Function	Pin	Function
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

Note

1. Packing Information please refer to 'Product Packing Information'. Packing bag number:58010113(without heatsink), 58010112(with heatsink);
2. Recommended used in more than 5% load, if the load is lower than 5%, then the ripple index of the product may exceed the specification, but does not affect the reliability of the product;
3. The max capacitive load should be tested within the input voltage range and under full load conditions;
4. If the customer tests EMC, suggest to take our EMC module FC-CX3D. If the customer needs to meet the performance aspects of the surge, and don't take our EMC module FC-CX3D, please make sure the surge residual voltage less than 180V, to ensure the reliability of the product;
5. Recommends that customers plus silicone film or thermal grease between the module and the heatsink, in order to ensure good heat dissipation;
6. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25℃, humidity<75% when inputting nominal voltage and outputting rated load;
7. All index testing methods in this datasheet are based on our Company's corporate standards;
8. The performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technicians for specific information;
9. We can provide product customization service;
10. Specifications of this product are subject to changes without prior notice.

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