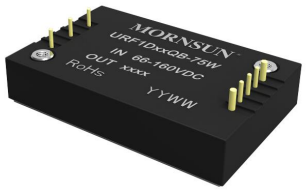
DC/DC Converter

URF1D_QB-75W Series

MORNSUN®

75W isolated DC-DC converter in ¼-Brick package
wide input voltage, regulated single output



Patent Protection RoHS

3 years Warranty

FEATURES

- Wide 66-160V input voltage range
- High efficiency up to 91%
- Low no-load power consumption
- I/O isolation voltage 3k VDC
- Operating ambient temperature range: -40℃ ~ +100℃
- Input under-voltage protection, output short-circuit, over-current, over–voltage, over-temperature protection
- Industry standard ¼-Brick package and pin-out
- Meets requirements of railway standard EN50155

URF1D_QB -75W Series is a high-performance product specifically designed for a variety of railway applications. The DC-DC converters feature 75W output power with no requirement for minimum load, wide input voltage from 66-160VDC, and allowing operating out-case temperatures as high as 100℃. The products also provide input under-voltage protection, output over-voltage, short-circuit and over-temperature protection. Meets requirements of railway standard EN50155 . Additional functions include remote On/Off control, remote sense compensation and output voltage trim adjustment.

Selection Guide

Part No.	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Max. Capacitive Load(μF)
	Nominal (Range)	Max.*	Voltage (VDC)	Current(mA) Max./Min.		
URF1D05QB-75W	110 (66-160)	170	5	15000/0	86/88	7500
URF1D05QB-75WH						
URF1D12QB-75W			12	6250/0	87/89	6000
URF1D12QB-75WH						
URF1D15QB-75W			15	5000/0	87/89	4700
URF1D15QB-75WH						
URF1D24QB-75W			24	3125/0	89/91	3000
URF1D24QB-75WH						

Note: *Exceeding the maximum input voltage may cause permanent damage.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (no-load / full load)	Nominal input voltage	URF1D05QB-75W(H)	--	5/774	15/793	mA
		URF1D12QB-75W(H)	--	5/766	15/783	
		URF1D15QB-75W(H)	--	5/766	15/783	
		URF1D24QB-75W(H)	--	5/749	15/766	
Reflected Ripple Current	Nominal input voltage		--	50	--	
Surge Voltage (1sec. max.)			-0.7	--	180	VDC
Start-up Voltage			--	--	66	
Under-voltage Protection			--	58	--	
Start-up Time			--	25	--	mS
Input Filter			Pi filter			
Hot Plug			Unavailable			
Ctrl*	Module on		Ctrl pin open or pulled high (TTL 3.5-12VDC)			
	Module off		Ctrl pin pulled low to GND (0-1.2VDC)			
	Input current when off		--	2	--	mA

Note: *The Ctrl pin voltage is referenced to input -Vin.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	Nominal input voltage,10%-100% load	--	--	±2	%
	Nominal input voltage, 0%-10% load	--	--	±3	
Linear Regulation	Input voltage variation from low to high at full load	--	--	±0.3	
Load Regulation	Nominal input voltage,10%-100% load	--	--	±0.5	
Transient Recovery Time	25% load step change	--	300	500	μs
Transient Response Deviation		--	±3	±5	%
Temperature Coefficient	Full load	--	--	±0.03	%/℃
Ripple & Noise *	20MHz bandwidth	--	100	300	mVp-p
Trim		-5	--	10	%
Remote Sense Compensation		--	--	5	
Over-voltage Protection	Input voltage range	110	--	140	%Vo
Over-current Protection		110	130	180	%Io
Short-circuit Protection		Continuous			

Note: * For ripple and noise measuring method, please refer to Fig. 1

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output	Test for 1 minute with a leakage current of 1mA max.	3000	--	--	VDC
	Input-case		1500	--	--	
	Output-case		1500	--	--	
Insulation Resistance		Input-output resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance		Input-output capacitance at 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
Out-case Temperature Range		Within the operating temperature curve	-40	+100	℃
Over-temperature Protection		Out-case Temperature	--	+115	
Thermal Resistance(Rth (B-A))	URF1D_QB-75W	Natural convection	8	--	℃/W
		200LFM convection	6.0	--	
		400LFM convection	5.0	--	
		1000LFM convection	4.0	--	
	URF1D_QB-75WH	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	℃
Pin Soldering Resistance Temperature		Soldering spot is 1.5mm away from case for 10 seconds	--	+300	
Cooling Test			EN60068-2-1		
Dry Heat			EN60068-2-2		

Damp heat		EN60068-2-30
Shock and Vibration Test		IEC61373-Category 1, Grade B

Mechanical Specifications

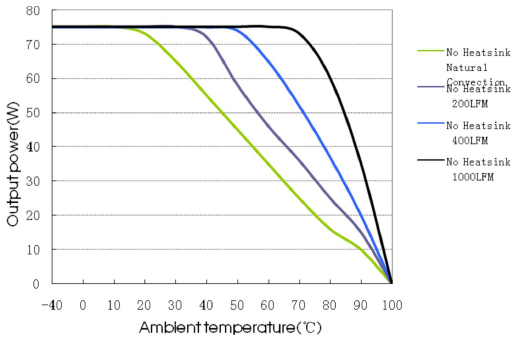
Case Material		Black plastic, flame-retardant and heat-resistant (UL94 V-0)
Dimensions	Without Heatsink	60.80 x 39.20 x 12.70mm
	With Heatsink	62.00 x 39.20 x 30.80mm
Weight	Without Heatsink	46.0g (Typ.)
	With Heatsink	76.0g (Typ.)
Cooling Method		Free air convection or Forced convection

Electromagnetic Compatibility (EMC)

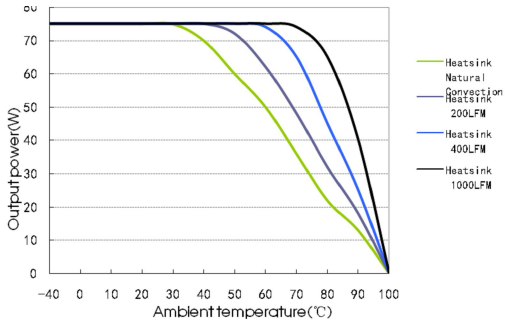
Emissions	CE	CISPR32/EN55032	150KHz-30MHz Class B (see Fig. 2 -1for recommended circuit)	
	RE	CISPR32/EN55032	30MHz-1GHz Class B (see Fig. 2 -1 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	GB/T17626.2 Contact ±6KV, Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3	GB/T17626.3 10V/m	perf.Criteria A
	CS	IEC/EN61000-4-6	GB/T17626.6 10Vr.m.s	perf.Criteria A
	EFT	IEC/EN61000-4-4	GB/T17626.4 ±2KV(5KHz, 100KHz) (see Fig. 2-1 for recommended circuit)	perf.Criteria B
	Surge	IEC/EN61000-4-5	GB/T17626.5 line to line ±2KV(1.2μs/50μs 2Ω), (see Fig.2-1 for recommended circuit) line to ground±4KV(1.2μs / 50μs 12Ω), (see Fig.2-1 for recommended circuit)	perf.Criteria B
		EN50155	See Fig.2-1for recommended circuit	perf.Criteria B
	Immunity of short interruption	EN50155	100%, 0%, 10ms (see Fig.2-1 for recommended circuit)	perf.Criteria B

Typical Characteristic Curves

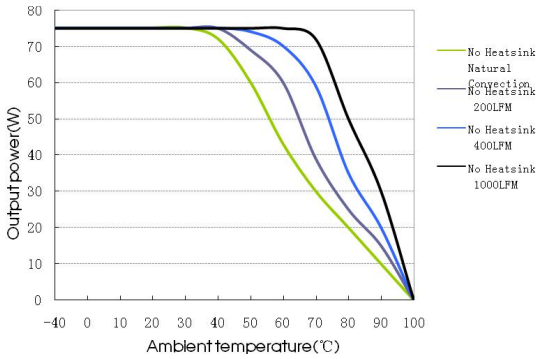
URF1D05QB-75W Temperature Derating Curves (Vin=110V)



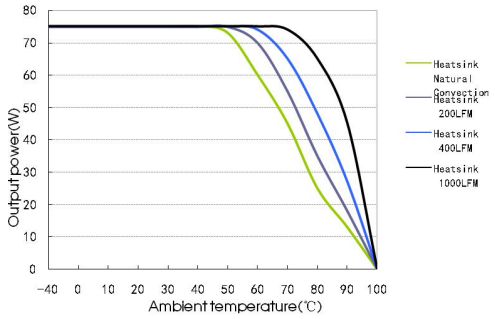
URF1D05QB-75WH Temperature Derating Curves (Vin=110V)



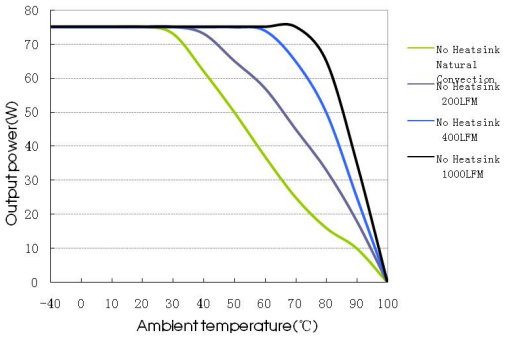
URF1D12QB-75W Temperature Derating Curves (Vin=110V)



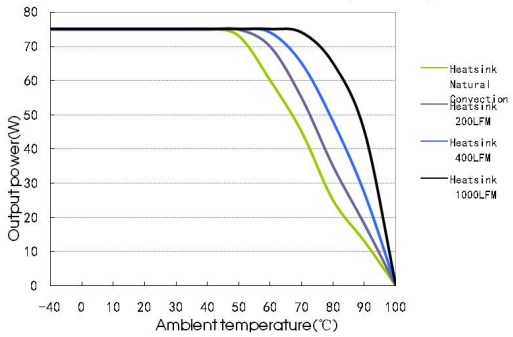
URF1D12QB-75WH Temperature Derating Curves (Vin=110V)



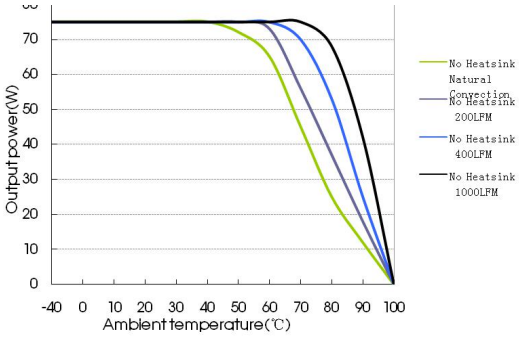
URF1D15QB-75W Temperature Derating Curves (Vin=110V)



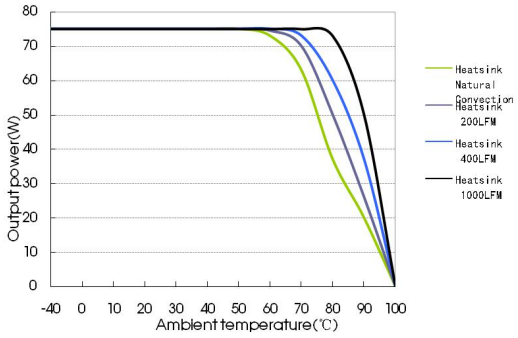
URF1D15QB-75WH Temperature Derating Curves (Vin=110V)



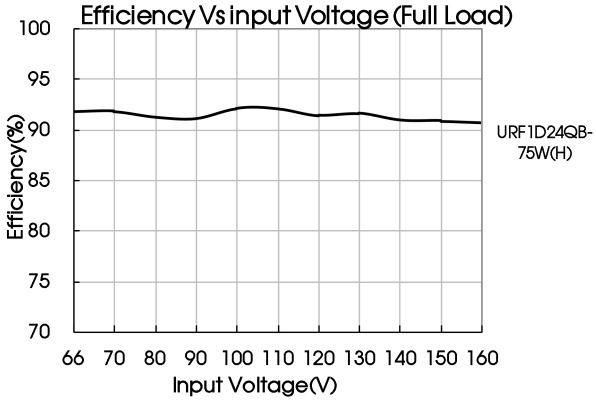
URF1D24QB-75W Temperature Derating Curves (Vin=110V)



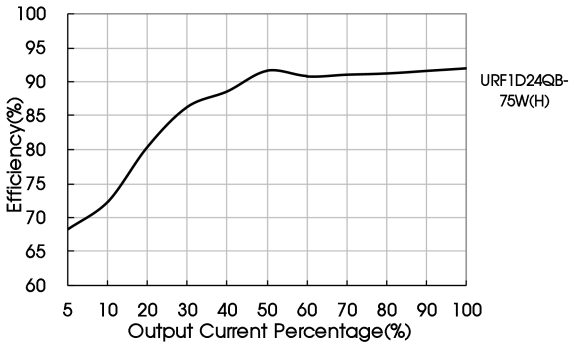
URF1D24QB-75WH Temperature Derating Curves (Vin=110V)



Efficiency Vs input Voltage (Full Load)



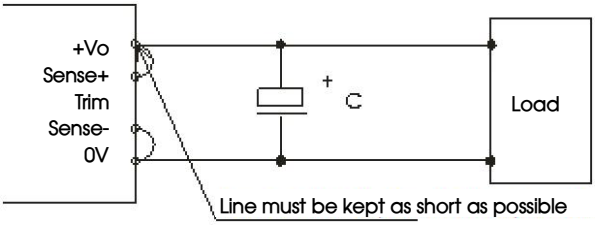
Efficiency Vs Output Load(Vin=Vin-nominal)



Note:
1.Temperature derating curves and efficiency curves are typical test values;
2.Temperature derating curve in accordance with our laboratory test conditions for testing, the actual use of environmental conditions if the customer is not consistent, to ensure that the product aluminum shell temperature does not exceed 100 ℃, can be used within any rated load range.

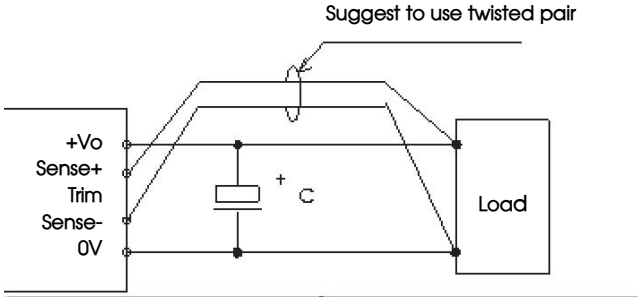
Remote Sense Application

1. Remote Sense Connection if not used



Notes:
(1) If the sense function is not used for remote regulation the user must connect the +Sense to + Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only.
(2) The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation



Notes:
1. PCB-tracks or cables/wires for Remote Sense must be kept as short as possible.
2. In cables and discrete wiring applications, twisted pair or other techniques should be implemented.
3. Using remote sense with long wires long wires may cause unstable operation. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.
4. We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.

Design Reference

1. Ripple & noise

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 1.

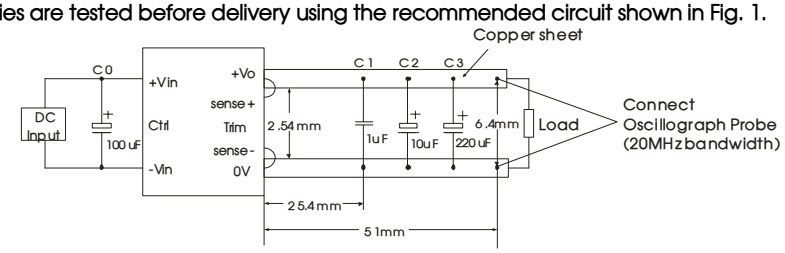


Fig. 1

2. Typical application

(1) We recommened using the recommended circuit shown in Fig.1 during product testing and application,otherwise please ensure that at least a 220 μ F electrolytic capacitors is connected at the input in order to ensure adequate voltage surge suppression and protection.
(2) Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

Capacitive Parameter / Vout (VDC)	Cout(μF)	Cin(μF)
5VDC	220	100
12VDC		
15VDC		
24VDC		

3. EMC compliance circuit

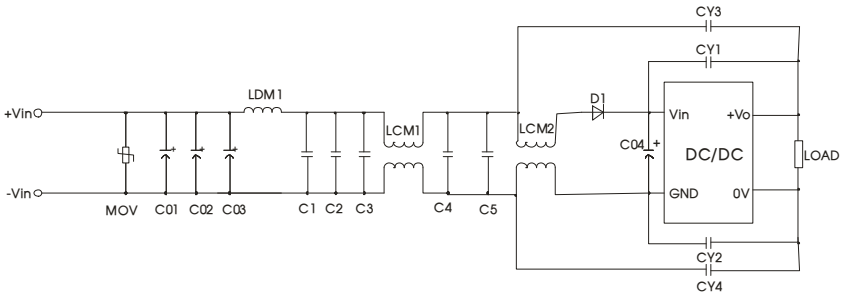


Fig. 2-1

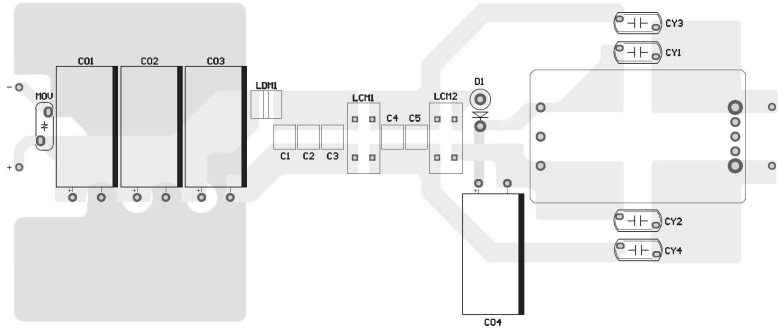


Fig. 2-2

MOV	S20K130 (Varistor)
C01、C02、C03、C04	100uF/400V (electrolytic caoacitor)
LDM1	10uH (Shielded inductor)
C1、C2、C3、C4、C5	2.2uF/250V
D1	SF306
CY1、CY2、CY3、CY4	2200 pF /400VAC (Y safety capacitor)
LCM1	FL2D-30-222
LCM2	FL2D-30-472

4. Thermal design

The maximum operating out-case temperature TB is 100 ℃. As long as the users thermal application keeps TB <100 ℃, the converter can be used with its full rated power. When using a heatsink attached to the out-case of the converter the power derating curve can be calculated accordingly. It is only necessary to determine the selected heatsinks thermal resistance Rth(B-A) between out-case and ambient for a given airflow rate. This information is usually available from the heatsink vendor.

The following formula can be used to determine the maximum power the converter can dissipate for a given thermal condition with the out-case is to be maintained at a temperature no higher than 100 ℃.

$$P_{diss}^{\max} = \frac{100℃ - T_A}{Rth_{(B-A)}}$$

(T_A = ambient temperature, $Rth(B-A)$ = thermal out-case resistance, $P_{diss}^{\max}$ = max power dissipation)

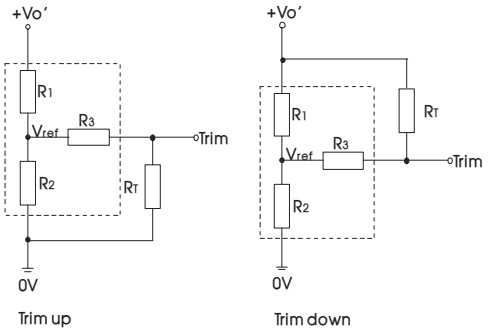
The maximum available power of the module at a certain ambient temperature can be calculated by the power dissipation according to following Formula which allows customers to choose the appropriate heatsink according to the actual application:

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

(η is converter efficiency)

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

5. Trim function for output voltage adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Calculating Trim resistor values:

$$\text{up:}\quad R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$$

$$\text{down:}\quad R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

table 1

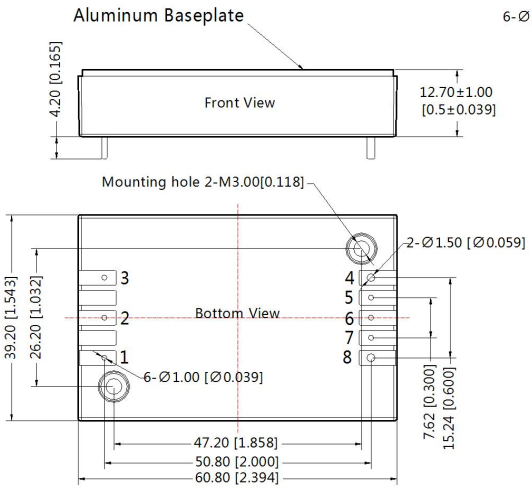
Vo / Parameter	5(VDC)	12(VDC)	15(VDC)	24(VDC)
R1(KΩ)	2.94	11	14.49	24.87
R2(KΩ)	2.87	2.87	2.87	2.87
R3(KΩ)	10	15	15	20
Vref(V)	2.5	2.5	2.5	2.5

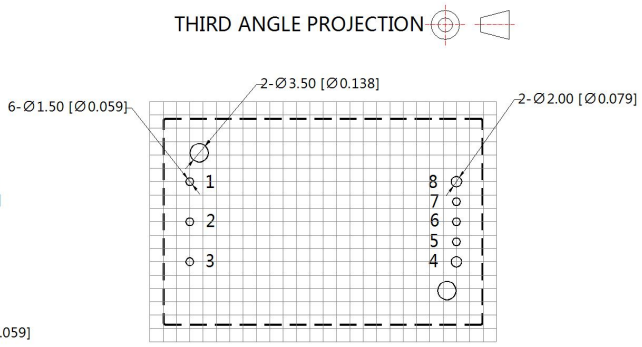
For R1, R2, R3 and V_{ref} values refer to table 1.

R_T = Trim Resistor value; a = self-defined parameter Vo' = desired output voltage (+10%, -5% max.).

6. The products do not support parallel connection of their output
7. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

Dimensions and Recommended Layout (without heatsink)



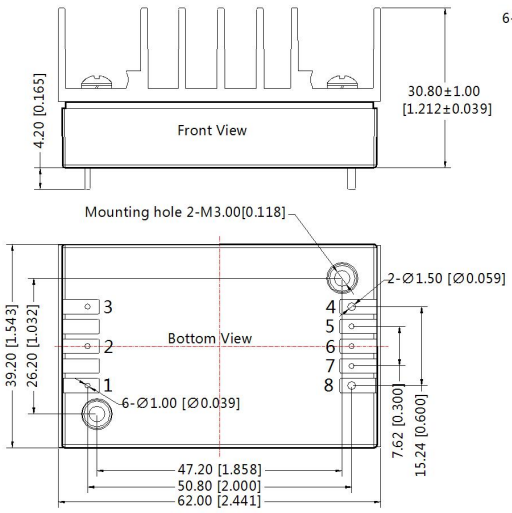


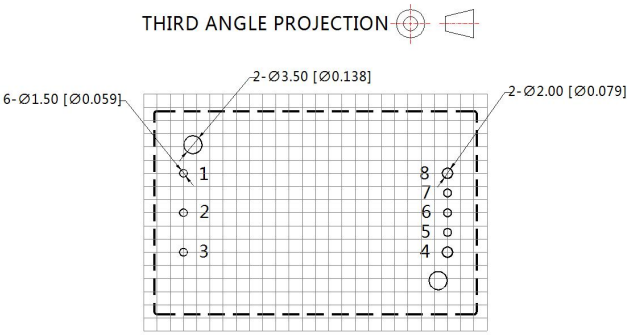
Note:Grid 2.54*2.54mm

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

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

Dimensions and Recommended Layout(with heatsink)





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

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113(without heatsink), 58220017(with heatsink);
2. Recommend to use module with more than 5% load, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. It is suggested to take our recommended circuit for EMC testing. If the customer needs to meet the performance of the surge and without taking recommended solution of ours, please make sure the residual voltage of surge less than 180V;
5. It is recommended that customers use enamel film or thermal grease between the heat sink and the module when using the heat sink to ensure good heat dissipation;
6. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
7. All index testing methods in this datasheet are based on company corporate standards;
8. Products are related to laws and regulations: see "Features" and "EMC";
9. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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