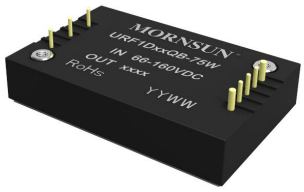
DC/DC Converter
URF1D_QB-75W Series

MORNSUN®

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



Patent Protection RoHS

3 years Warranty

FEATURES

- Wide input voltage range: 66-160V
- Efficiency up to 91%
- 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 railway standard EN50155

URF1D_QB -75W Series is a high performance product designed for the field of railway applications. The DC/DC converters feature 75W output power, no min. load requirement, wide input voltage of 66-160VDC, And allow the high base plate temperature(up to 100℃). The products also provide input under-voltage protection, output over-voltage protection, short-circuit protection, over-temperature protection, remote control and compensation, output voltage regulation functions. The series meet railway standard EN50155 , And target railway system.

Selection Guide

Part No.	Input Voltage (VDC)		Output		Efficiency (%, Typ) @ Full Load	Max. Capacitive Load(μF)
	Nominal (Range)	Max.*	Output Voltage(VDC)	Output 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	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		--	50	--	
Input Surge Voltage (1sec. max.)			-0.7	--	180	VDC
Start-up Threshold Voltage			--	--	66	
Under-voltage Shutdown Voltage			--	58	--	
Start-up Time			--	25	--	mS
Input Filter			Pi filter			
Hot Plug			Unavailable			
Ctrl*	Module switch on		Ctrl open circuit 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.

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Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Nominal input,10%-100% load	--	--	±2	%
	Nominal input,0%-10% load	--	--	±3	
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)		-5	--	10	%
Output voltage remote compensation(Sense)		--	--	5	
Over-voltage Protection	Input voltage range	110	--	140	%Vo
Over-current Protection		110	130	180	%Io
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	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(Rth(B-A))	URF1D_QB-75W	Natural convection	10.7	--	℃/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	℃
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		

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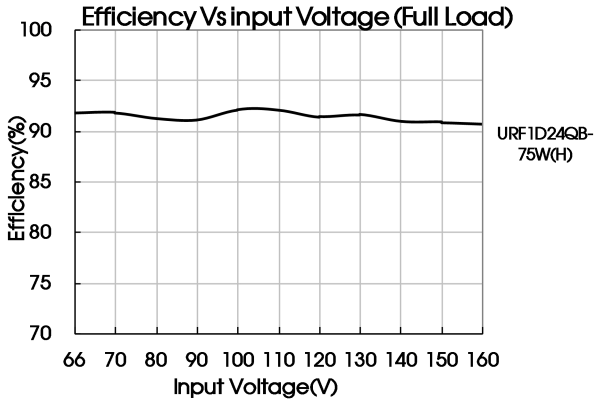
Physical Specifications

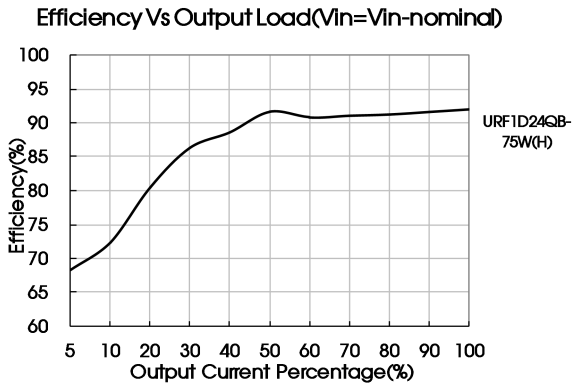
Casing Material		Black flame-retardant and heat-resistant plastic (UL94-V0)
Dimension	Without Heatsink	60.80*39.20*12.70mm
	With Heatsink	62.00*39.20*30.80mm
Weight	Without Heatsink	46g (Typ.)
	With Heatsink	76g (Typ.)
Cooling method		Natural convection or Forced convection

EMC Specifications

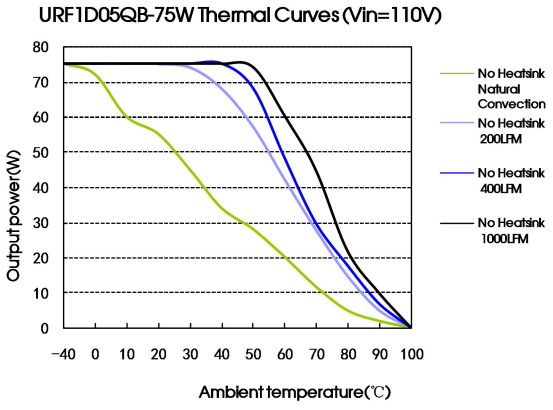
EMI	CE	CISPR22/EN55022 150KHz-30MHz Class B (see Fig. 2 -1for recommended circuit)	
	RE	CISPR22/EN55022 30MHz-1GHz Class B (see Fig. 2 -1 for recommended circuit)	
EMS	ESD	IEC/EN61000-4-2 GB/T17626.2 Contact ±6KV, Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3 GB/T17626.3 10V/m	perf.Criteria A
	CS	IEC/EN61000-4-6 GB/T17626.6 10Vr.m.s	perf.Criteria A
	EFT	IEC/EN61000-4-4 GB/T17626.4 ±2KV(5KHz, 100KHz)(see Fig. 2-1for recommended circuit)	perf.Criteria B
	Surge	IEC/EN61000-4-5 GB/T17626.5 ±2KV(1.2μs/50μs 2Ω),(see Fig.2-1 for recommended circuit) ±4KV(1.2μs/50μs 12Ω), (see Fig.2-1 for recommended circuit)	perf.Criteria B
		EN50155 ±1.8KV (5/50μs 5Ω), (see Fig.2-1for recommended circuit)	perf.Criteria B
	Immunities of short interruption	EN50155 100%-0%, 10ms (see Fig.2-1 for recommended circuit)	perf.Criteria B

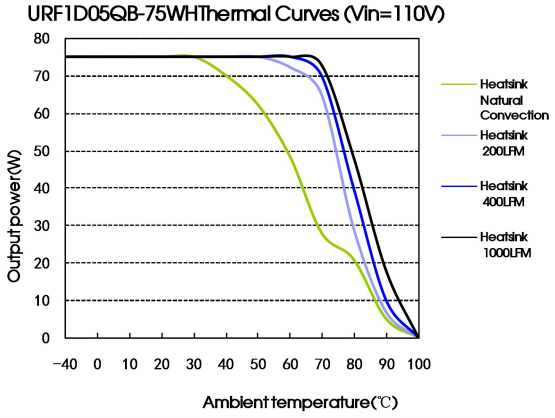
Efficiency Curves





Thermal Curves





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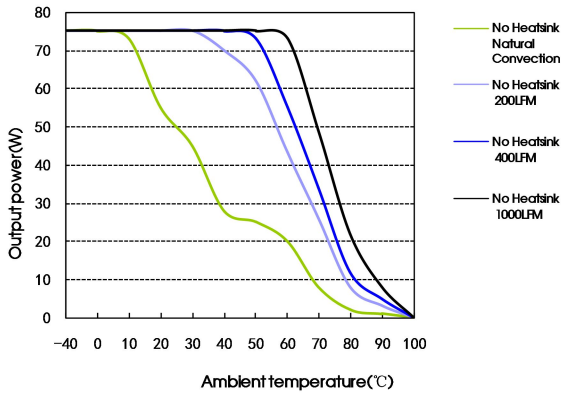
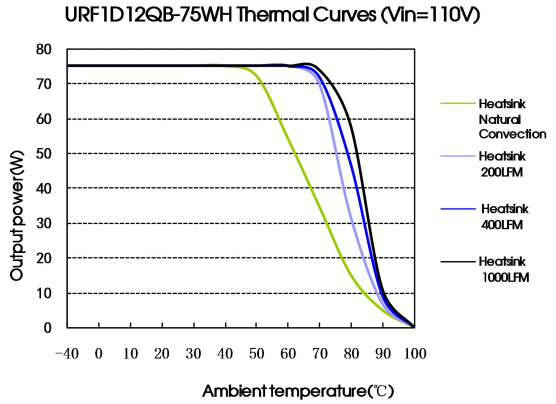
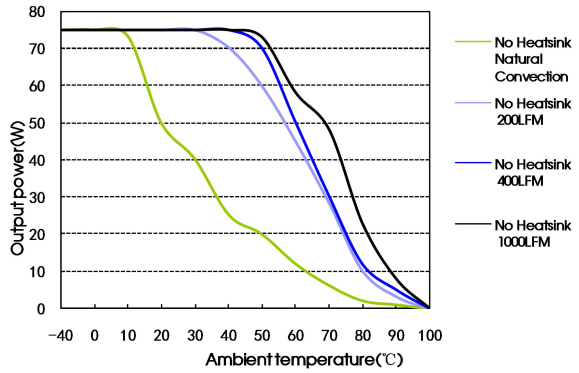
URF1D12QB-75W Thermal Curves (Vin=110V)



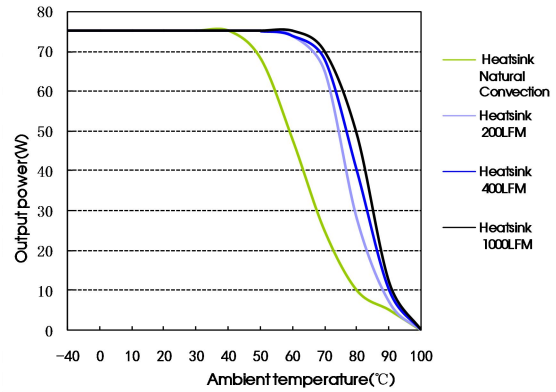
URF1D12QB-75WH Thermal Curves (Vin=110V)



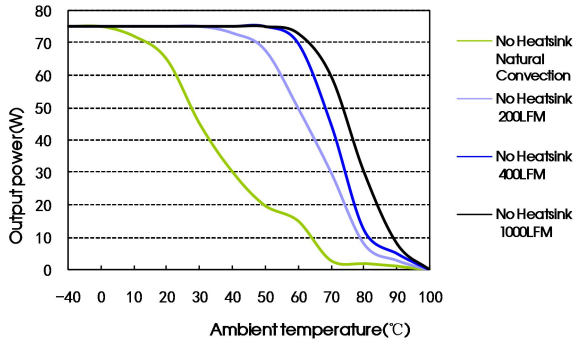
URF1D15QB-75W Thermal Curves (Vin=110V)



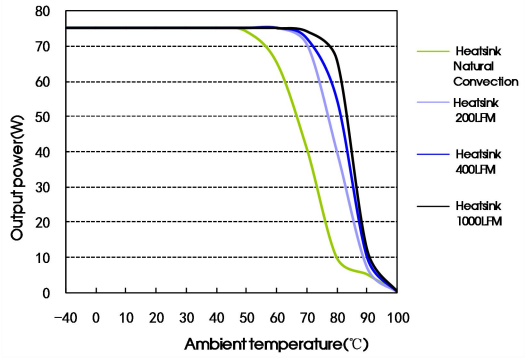
URF1D15QB-75WH Thermal Curves (Vin=110V)



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

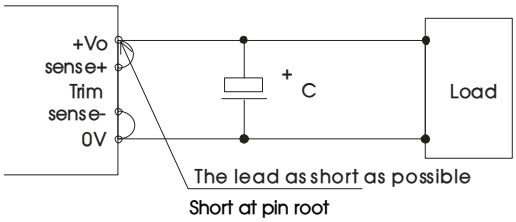


URF1D24QB-75WH Thermal Curves （Vin=110V）



Sense of application and precautions

1. When not using remote sense



Notes：

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

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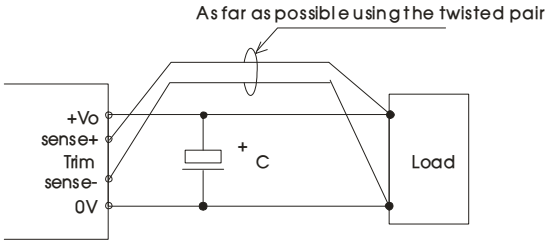
2. When Remote Sense is used



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 tracks or wires should be as short as possible. If using wires, it should not use twisted-pair or shielded wires.
3. Please use wide PCB tracks 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 voltage oscillation or a greater ripple, please do adequate assessments before using.

Design Reference

1. Ripple & noise

All the URF1D_QB-75W series have been tested according to the following recommended test circuit before leaving the factory (see Fig. 1).

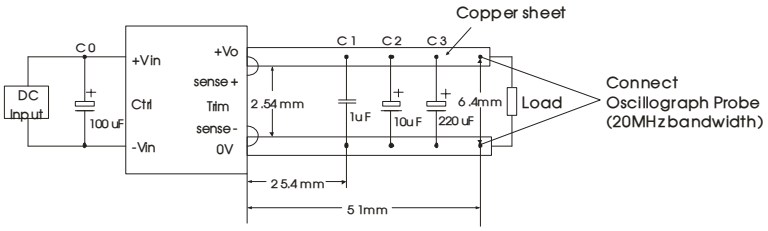


Fig. 1

2. Typical application

If not using our Mornsun's recommended circuit, please ensure an 100 μF electrolytic capacitors in parallel with the input, which used to suppress the surge voltage come from the input terminal.
If it is required to further reduce input&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)
5VDC	220	100
12VDC		
15VDC		
24VDC		

3. EMC solution-module recommended circuit

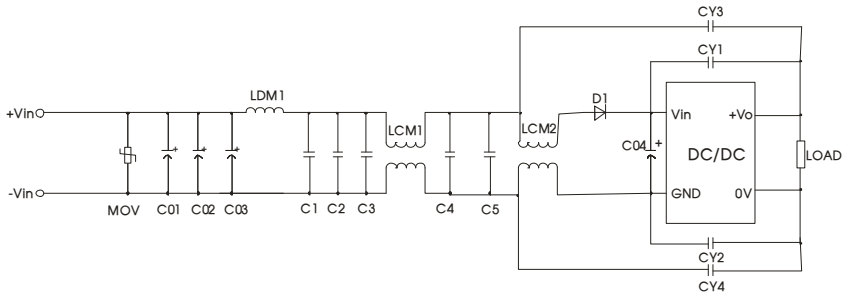


Fig. 2-1

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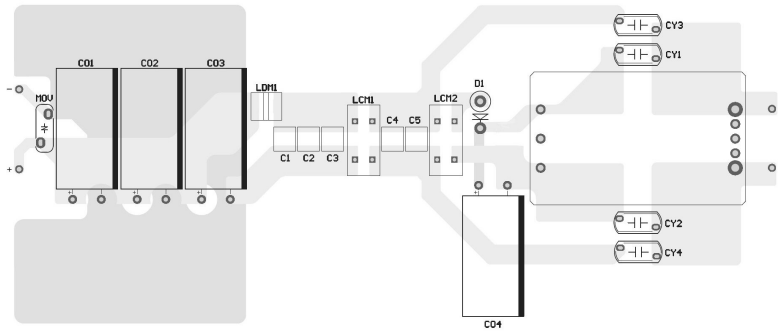


Fig. 2-2

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 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 onen airflow rate. This information is usually available from the heatsink vendor. The following formula can the be used to determine the maximly necessary to determine the thermal resistance, Rth(B-A), of the chosen heatsink between the base-plate and the ambient air for a givum power the converter can dissipate for a given thermal condition if its base-plate is to be no higher than 100 ºC.

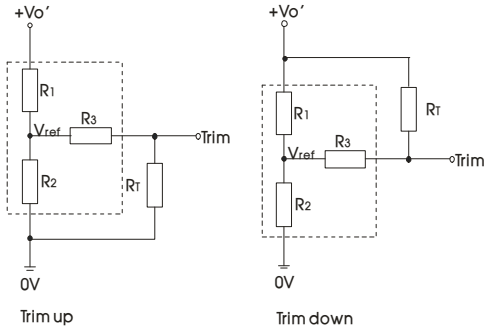
$$P_{diss}^{\max} = \frac{100℃ - T_A}{Rth_{(B-A)}}$$ (T_A is ambient temperature, $Rth_{(B-A)}$ is thermal resistance of base-plate, $P_{diss}^{\max}$ is max dissipation power)

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.

5. Application of Trim and calculation of Trim resistance



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

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Calculation formula of Trim resistance:

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

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

table 1

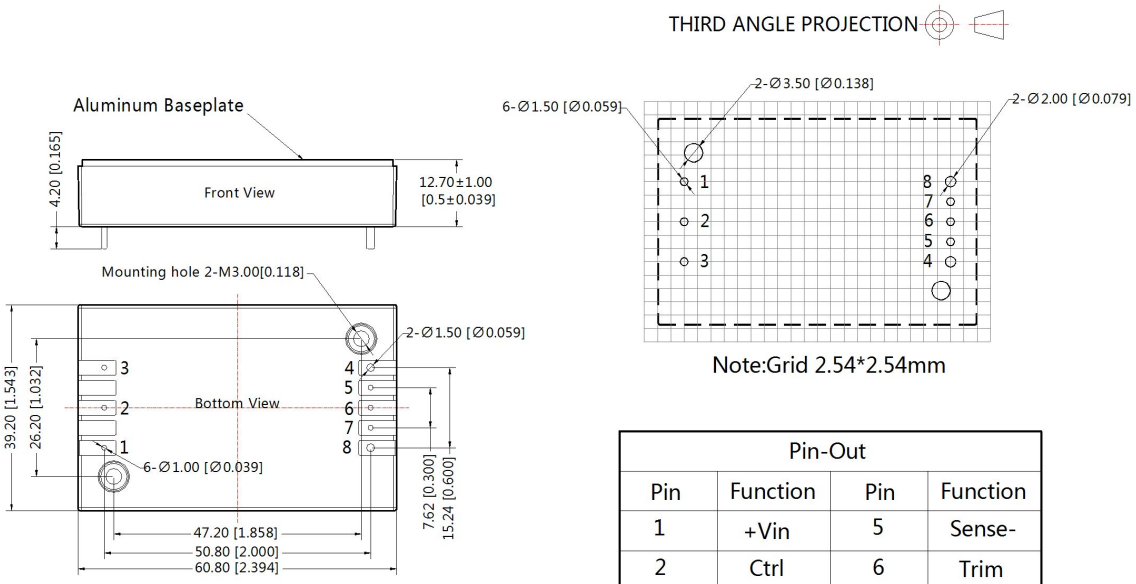
Parameter \ Vo	5(VDC)	12(VDC)	15(VDC)	24(VDC)
R1(KΩ)	2.94	11	14.49	24.87
R2(KΩ)	2.87	2.87	2.87	2.87
R3(KΩ)	10	15	15	20
Vref(V)	2.5	2.5	2.5	2.5

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.

6. It is not allowed to connect modules output in parallel to enlarge the power

7. For more information please find the 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

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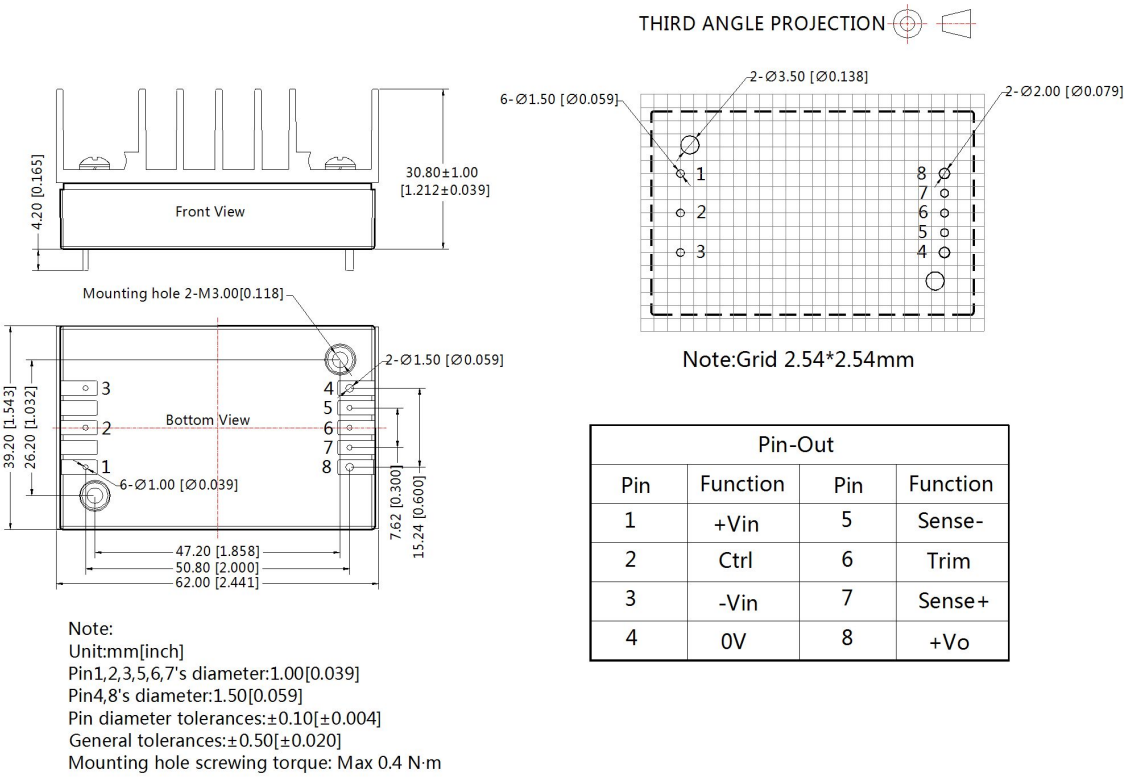
Dimensions and Recommended Layout(with heatsink)



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

1. Note
2. Packing Information please refer to 'Product Packing Information'. Packing bag number: 58010113(without heatsink), 58220017(with heatsink);
3. 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;
4. The max capacitive load should be tested within the input voltage range and under full load conditions;
5. If the customer tests EMC, suggest to take our recommended circuit. If the customer needs to meet the performance aspects of the surge, and don't take our recommended circuit, please make sure the surge residual voltage is less than 180V, to ensure the reliability of the product;
6. Recommends that customers plus silicone film or thermal grease between the module and the heatsink, in order to ensure good heat dissipation;
7. 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;
8. All index testing methods in this datasheet are based on our Company's corporate standards;
9. 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;
10. We can provide product customization service and match filter module;
11. Specifications of this product are subject to changes without prior notice.

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