

DC/DC Converter

URF24_QB-100W(F/H)R3(A5/A6) Series

MORNSUN®

100W isolated DC-DC converter,
Ultra-wide input and regulated single output



Patent Protection RoHS



EN62368-1 BS EN62368-1

URF24_QB - 100W(F/H)R3(A5/A6) series of isolated 100W DC-DC products with a 4:1 input voltage range. They feature efficiency up to 90%, 2250VDC input to output isolation, operating ambient temperature of -40°C to +85°C, input under-voltage, output over-voltage, short-circuit, over-current protection, over-temperature protection. The products meet CLASS B of CISPR32/EN55032 EMI standards by adding the recommended external components, and they are widely used in applications such as battery powered systems, industrial controls, electricity, instrumentation, railway, communication.

FEATURES

- Ultra-wide 4:1 input voltage range
- High efficiency up to 90%
- I/O isolation test voltage: 2.25k VDC
- Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection
- Operating ambient temperature range: -40°C to +85°C
- Five-sided metal shielded package
- Industry standard ¼-Brick package and pin-out

Selection Guide

Certification	Part No. ^①	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Capacitive Load (µF) Max.
		Nominal (Range)	Max. ^②	Voltage (VDC)	Current (A) Max.		
EN/BS EN	URF2405QB-100WFR3	24 (9-36)	40	5	20	87/89	6000
	URF2412QB-100WFR3			12	8.3	88/90	2000
	URF2415QB-100WFR3			15	6.7	88/90	2000
	URF2424QB-100WFR3			24	4.2	88/90	1000
	URF2428QB-100WFR3			28	3.6	88/90	1000
	URF2448QB-100WFR3			48	2.1	88/90	470
	URF2405QB-100W(H)R3(A5/A6)			5	20	87/89	6000
	URF2412QB-100W(H)R3(A5/A6)			12	8.3	88/90	2000
	URF2415QB-100W(H)R3(A5/A6)			15	6.7	88/90	2000
	URF2424QB-100W(H)R3(A5/A6)			24	4.2	88/90	1000
	URF2428QB-100W(H)R3(A5/A6)			28	3.6	88/90	1000
	URF2448QB-100W(H)R3(A5/A6)			48	2.1	88/90	470

Note:
 ①Use "F" suffix is for added aluminum baseplate and "H" suffix for heat sink mounting, Use "A5" suffix for chassis mounting and "A6" suffix for DIN-Rail mounting, we recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
 ②Exceeding the maximum input voltage may cause permanent damage;
 ③The minimum input voltage range and start-up voltage of the A5/A6 product model are 1VDC higher than the horizontal package model;
 ④A5/A6 package products are 2% less efficient than standard products.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load/no-load)	Nominal input voltage	--	4682/120	4789/160	mA
Reflected Ripple Current	Nominal input voltage	--	30	--	

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Surge Voltage (1sec. max.)		-0.7	--	50	VDC
Start-up Voltage		--	--	9	
Input Under-voltage Protection		7.0	7.5	--	
Input Filter		Pi filter			
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	10	mA
Hot Plug		Unavailable			

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

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy	0%-100% load	--	±1	±3	%	
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5		
Load Regulation	5%-100% load	--	±0.5	±0.75		
Transient Recovery Time	25% load step change	--	200	500	µs	
Transient Response Deviation	25% load step change	5V output	--	±3	±7.5	%
		Others	--	±3	±5	
Temperature Coefficient	Full load	--	--	±0.03	%/°C	
Ripple & Noise*	20MHz bandwidth	12V/15V output	--	100	200	mVp-p
		Others	--	130	250	
Output Over-voltage Protection	Input voltage range	110	125	160	%Vo	
Output Over-current Protection		110	125	150	%Io	
Short-circuit Protection		Hiccup, continuous, self-recovery				

Note:* The "parallel cable" method is used for ripple and noise test, please see DC-DC Converter Application Notes for specific information.

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Insulation voltage	Input-output	2250	--	--	VDC	
	Input-case	1600	--	--		
	Output-case	500	--	--		
Insulation Resistance	Input-output insulation voltage 500VDC	100	--	--	MΩ	
Isolation Capacitance	Input-output capacitance at 100KHz/0.1V	--	2200	--	pF	
Trim	5V, 15V output	91	--	110	%Vo	
	Others	90	--	110		
Sense	See remote sense application	--	--	110		
Thermal Resistance	Natural convection	URF24_QB-100WR3	--	--	8	°C/W
		URF24_QB-100WFR3	--	--	6.8	
		URF24_QB-100WHR3	--	--	5.7	
Operating Temperature		-40	--	+85	°C	
Storage Temperature		-55	--	+125		
Over-temperature Protection	Max. case temperature	--	115	120		
Pin Soldering Resistance Temperature	Wave-soldering, 10 seconds	--	--	260	°C	
	Soldering spot is 1.5mm away from case for 10 seconds	--	--	300		
Storage Humidity	Non-condensing	5	--	95	%RH	
Vibration		IEC/EN61373 - Category 1, Grade B				
Switching Frequency	PWM mode	--	250	--	KHz	

MTBF	MIL-HDBK-217F@25°C	500	--	--	K hours
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Mechanical Specifications

Case Material	Aluminum alloy case; Black plastic bottom, flame-retardant and heat-resistant (UL94 V-0)				
Dimensions	URF24xxQB-100WR3	61.8 x 40.2 x 12.7 mm			
	URF24xxQB-100WFR3	62.0 x 56.0 x 14.6 mm			
	URF24xxQB-100WHR3	61.8 x 40.2 x 27.7 mm			
	URF24xxQB-100WR3A5	135.00 x 70.00 x 22.6mm			
	URF24xxQB-100WR3A6	137.00 x 70.00 x 28.10mm			
	URF24xxQB-100WHR3A5	135.00 x 70.00 x 36.20mm			
	URF24xxQB-100WHR3A6	137.00 x 70.00 x 37.20mm			
Weight	URF24xxQB-100WR3	86.0g(Typ.)			
	URF24xxQB-100WFR3	106.0g(Typ.)			
	URF24xxQB-100WHR3	117.0(Typ.)			
	URF24xxQB-100WR3A5	162.0g (Typ.)			
	URF24xxQB-100WR3A6	232.0g (Typ.)			
	URF24xxQB-100WHR3A5	193.0g (Typ.)			
	URF24xxQB-100WHR3A6	263.0g (Typ.)			
Cooling Method	Free air convection or forced convection				

Electromagnetic Compatibility (EMC)

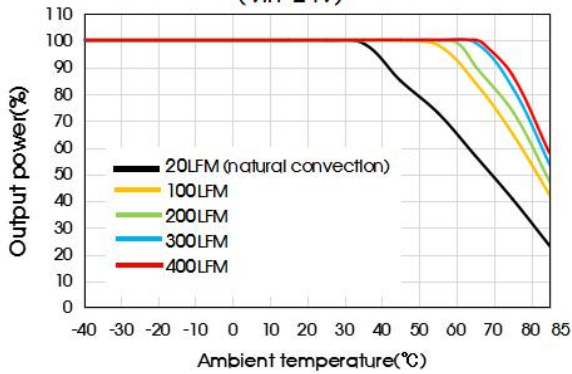
Emissions	CE	CISPR32/EN55032	CLASS A and CLASS B (see Fig. 3 for recommended circuit)		
	RE	CISPR32/EN55032	CLASS A and CLASS B (see Fig. 3 for recommended circuit)		
Immunity	ESD	IEC/EN61000-4-2	Contact ±6KV Air ±8KV	perf.Criteria B	
	RS	IEC/EN61000-4-3	20V/m	perf.Criteria A	
	EFT	IEC/EN61000-4-4	±2KV(see Fig. 2 for recommended circuit)	perf.Criteria A	
	CS	IEC/EN61000-4-6	10 Vr.m.s	perf.Criteria A	

Electromagnetic Compatibility (EMC) (EN50155)

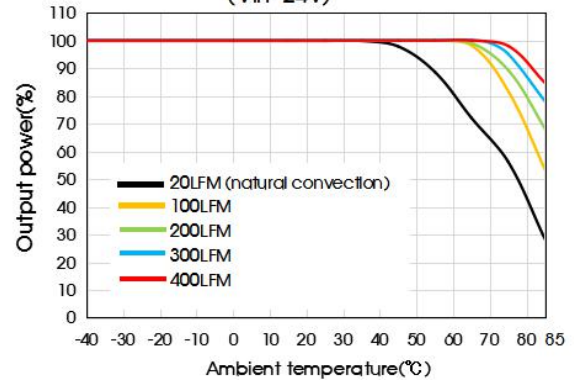
Emissions	CE	EN50121-3-2	150kHz-500kHz 99dBuV	(see Fig.3 for recommended circuit)	
		EN55016-2-1	500kHz-30MHz 93dBuV		
Immunity	RE	EN50121-3-2	30MHz-230MHz 40dBuV/m at 10m	(see Fig.3 for recommended circuit)	
		EN55016-2-1	230MHz-1GHz 47dBuV/m at 10m		
	ESD	EN50121-3-2	Contact ±6KV/Air ±8KV		
	RS	EN50121-3-2	80MHz-800MHz 20V/m(rms)		
	EFT	EN50121-3-2	±2kV 5/50ns 5kHz	(see Fig.2 for recommended circuit)	
	Surge	EN50121-3-2	line to line ±1KV	(42Ω 0.5uF see Fig.2 for recommended circuit)	
CS	EN50121-3-2	0.15MHz-80MHz	10V(rms)		

Typical Characteristic Curves

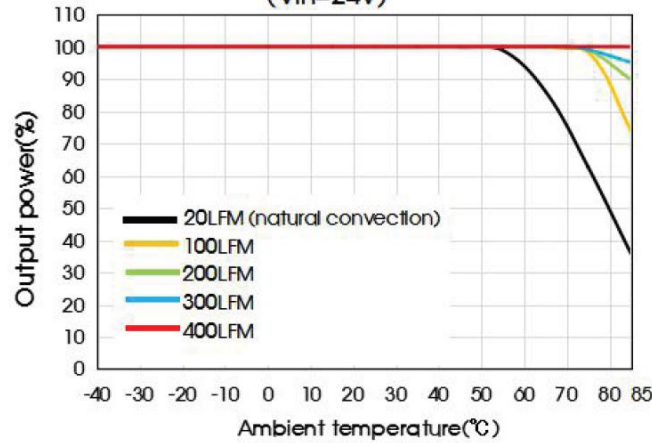
URF2424QB-100WR3 Temperature Derating Curves (Vin=24V)



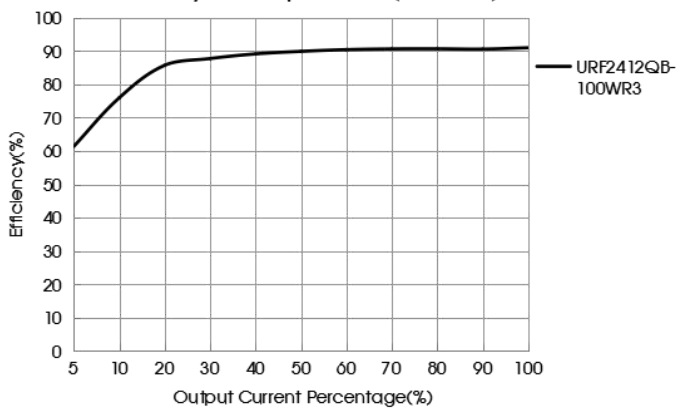
URF2424QB-100WFR3 Temperature Derating Curves (Vin=24V)



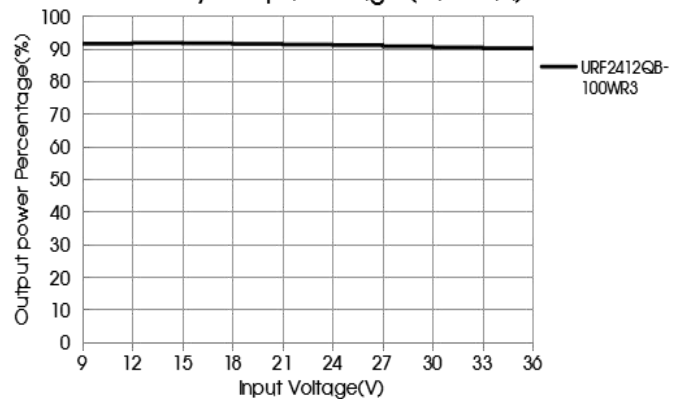
URF2424QB-100WHR3 Temperature Derating Curves (Vin=24V)



Efficiency Vs Output Load (Vin=24V)



Efficiency Vs input Voltage (Full Load)

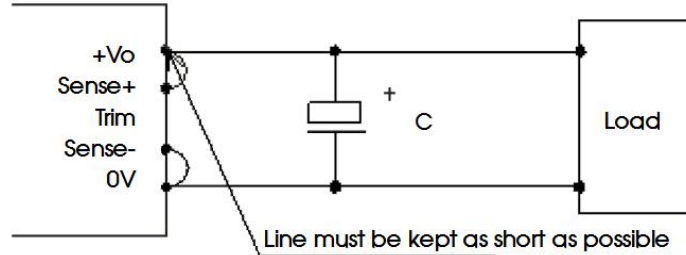


Notes:

1) Product application thermal design should be referred to the recommended PCB layout and recommended heat dissipation structure, please see DC-DC Converter Application Notes for specific information.

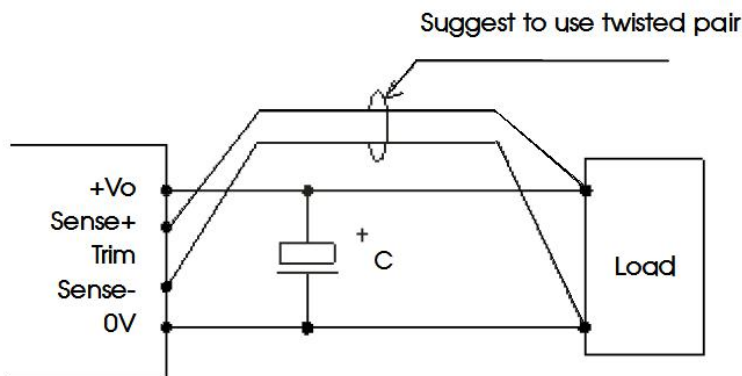
Remote Sense Application

1. Remote Sense Connection if not used



- (1) If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V.
- (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

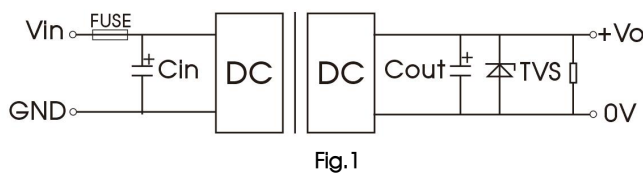


- (1) Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used.
- (2) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wires are suggested for remote compensation and must be kept as short as possible.
- (3) 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.
- (4) 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.

Design Reference

1. Typical application

- (1) We recommended using the recommended circuit shown in Fig.1 during product testing and application, otherwise please ensure that at least a 220µF electrolytic capacitors is connected at the input in order to ensure adequate voltage surge suppression and protection.
- (2) We recommended increasing the value of Cin and pay attention to the unstable input voltage if the product input side is paralleled with motor drive circuit and/or larger energy transient circuits, to ensure the stability of input terminal and avoid repeatedly start-up problems due to input voltage lower than undervoltage protection point.
- (3) We recommended increasing the output capacitance with limited to the capacitive load specification and/or increasing the voltage clamping circuit(such as TVS) if the output terminal is inductive device such as relay or a motor, to ensure adequate voltage surge suppression and protection.
- (4) 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.



Vout(VDC)	Fuse	Cin	Cout	TVS
5	20A, slow blow	220µF	470µF	SMDJ7.0A
12			220µF	SMDJ15A
15			100µF	SMDJ18A
24				SMDJ30A
28				SMDJ36A

48				SMDJ64A
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Note:

*Please pay attention to the ambient temperature of the product when using an external capacitor, increase the electrolytic capacitor values to at least 1.5 times the original parameter if the ambient temperature is low (such as -25°C).

2. EMC compliance circuit

We recommended using the recommended circuit shown in Fig.2 during product EMC testing and application.

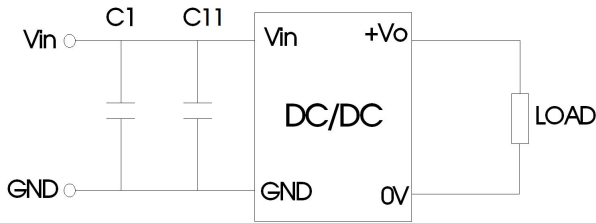


Fig. 2

components	Recommended value	Function
C1	150μF electrolytic capacitor	Meets EFT and surge
C11	47μF electrolytic capacitor	

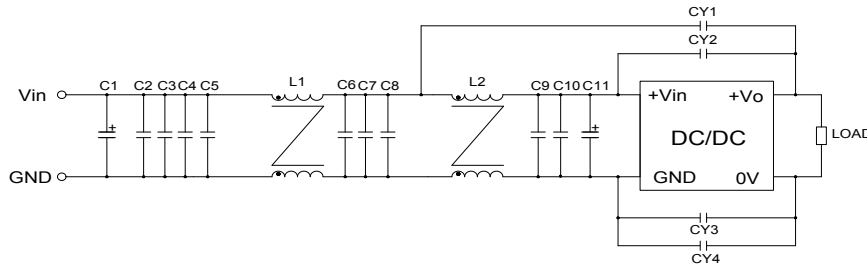
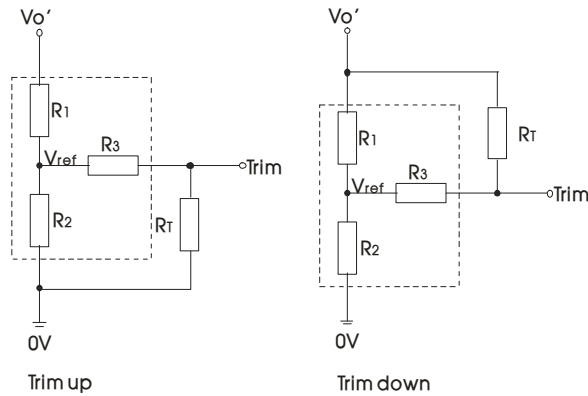


Fig. 3

CLASS A components	CLASS B components	Recommended component value	Function
	C1	150μF electrolytic capacitor	Meets conducted emission and radiated emission
	C11	47μF electrolytic capacitor	
	C2, C3, C4, C5, C6, C7, C8, C9, C10	10μF ceramic capacitor	
	L1, L2	2mH, recommended to use MORNSUN P/N: FL2D-A2-202(C)	
CY3	CY1, CY2	2.2nF Y1 safety capacitor	
	CY3, CY4	1nF Y1 safety capacitor	

3. Trim Function for Output Voltage Adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Calculation formula of Trim resistance:

$$\begin{aligned} \text{up: } R_T &= \frac{\alpha R_2}{R_2 - \alpha} - R_3 & \alpha &= \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{\alpha R_1}{R_1 - \alpha} - R_3 & \alpha &= \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

Note:

Value for R1, R2, R3, and Vref refer to the above table

RT: Resistance of Trim

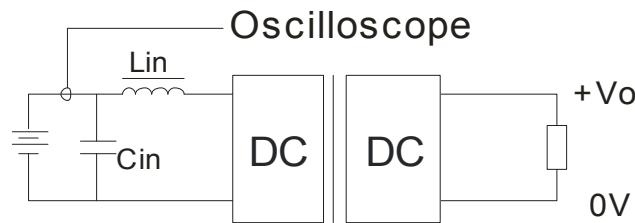
α: User-defined parameter, no actual meanings

Vo' = desired output voltage (±10% max.)

Vout(VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
5	3.036	3	10	2.5
12	11.00	2.87	15	2.5
15	14.03	2.8	15	2.5
24	24.872	2.87	15	2.5
28	29.201	2.851	15	2.5
48	53.017	2.894	15	2.5

Note: When using the Trim down function, if RT resistor value is too low, or the Trim pin is shorted with +Vo, then the output voltage Vo' would be lower than 0.9Vo, which may cause permanent damage to the product.

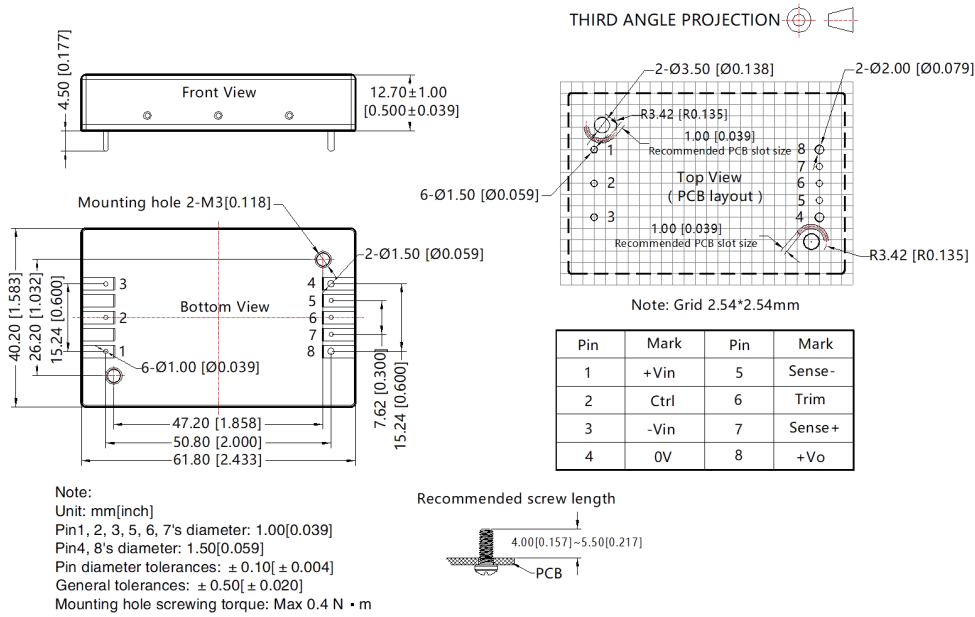
4. Reflected ripple current--test circuit



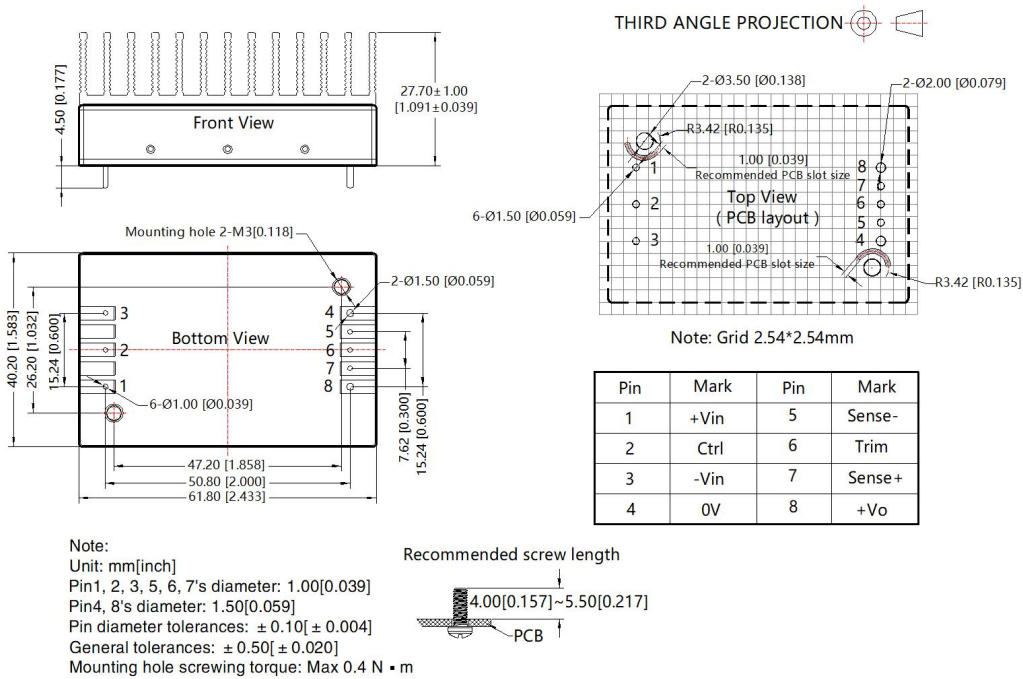
Note: Lin(4.7μH) , Cin(220μF, ESR < 1.0Ω at 100 KHz)

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

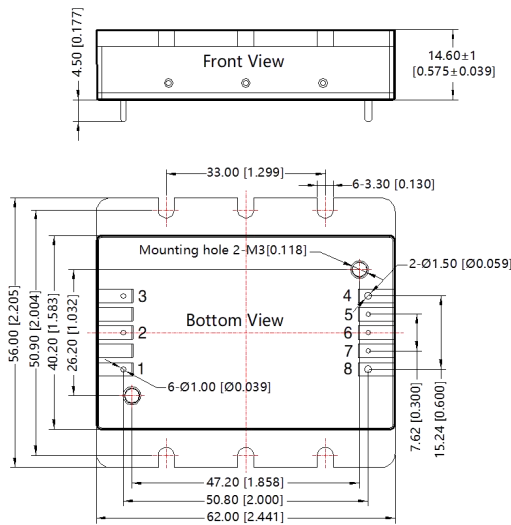
Dimensions and Recommended Layout (URF24xxQB-100WR3)



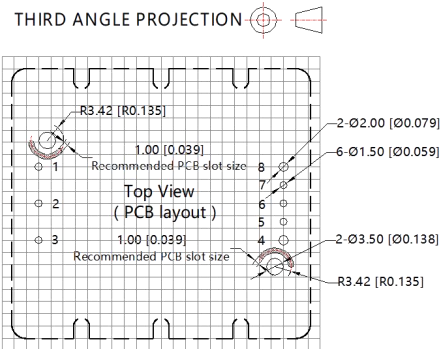
Dimensions and Recommended Layout (URF24xxQB-100WHR3)



Dimensions and Recommended Layout(URF24xxQB-100WFR3)



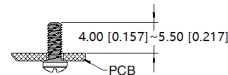
Note:
Unit: mm[inch]
Pin1, 2, 3, 5, 6, 7's diameter: 1.00[0.039]
Pin4, 8's diameter: 1.50[0.059]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
Mounting hole screwing torque: Max 0.4 N · m



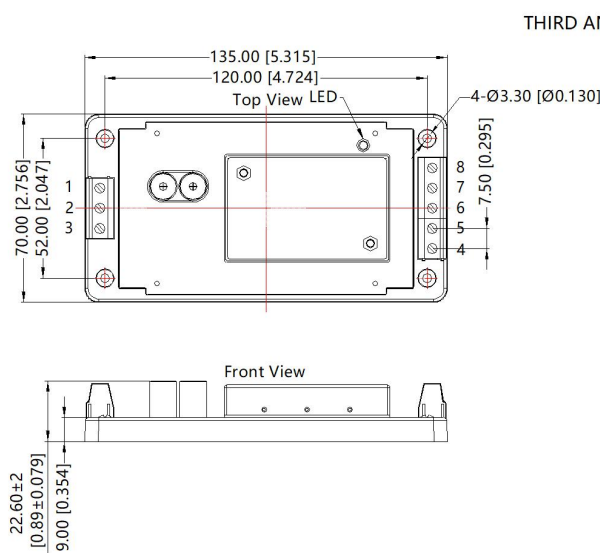
Note: Grid 2.54*2.54mm

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

Recommended screw length



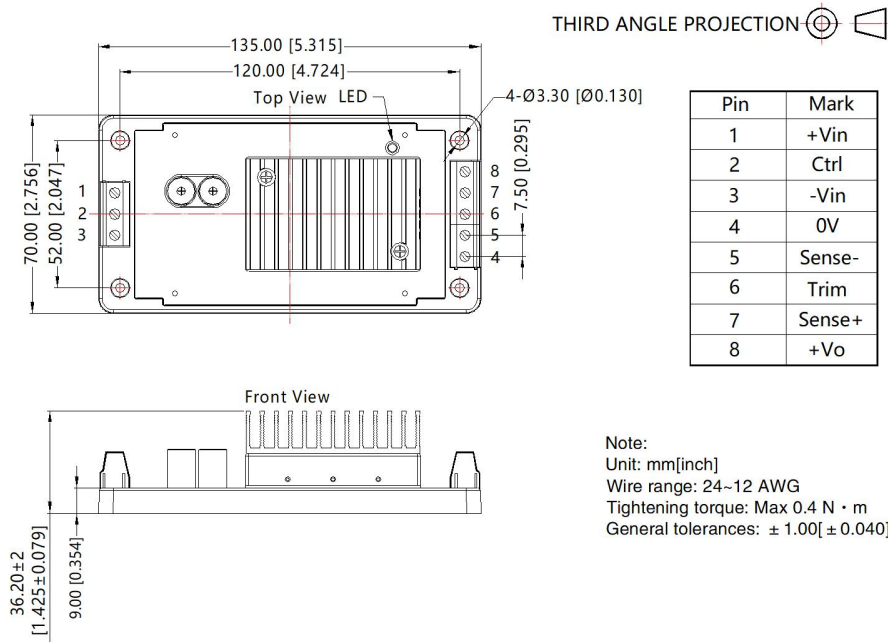
Dimensions and Recommended Layout(URF24xxQB-100WR3A5)



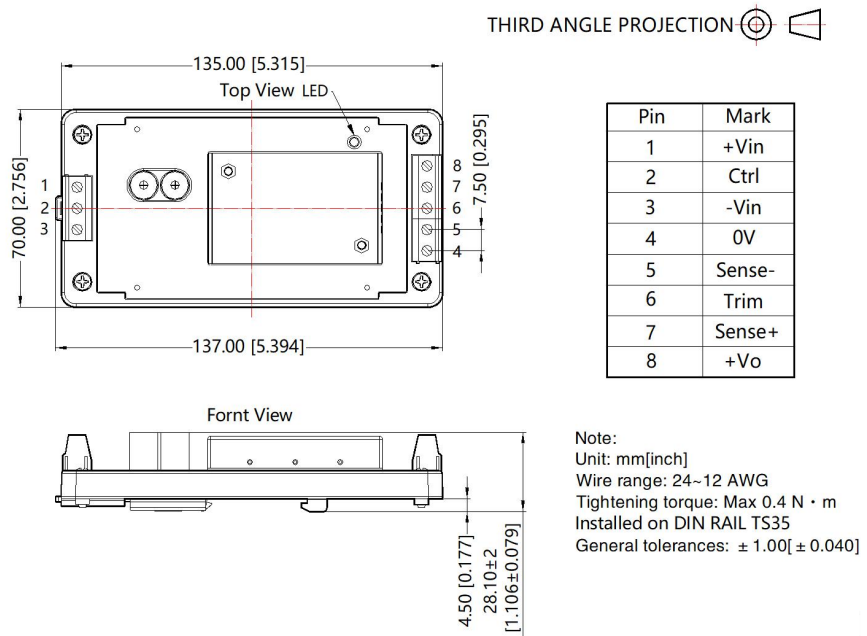
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	Sense-
6	Trim
7	Sense+
8	+Vo

Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N · m
General tolerances: ± 1.00[± 0.040]

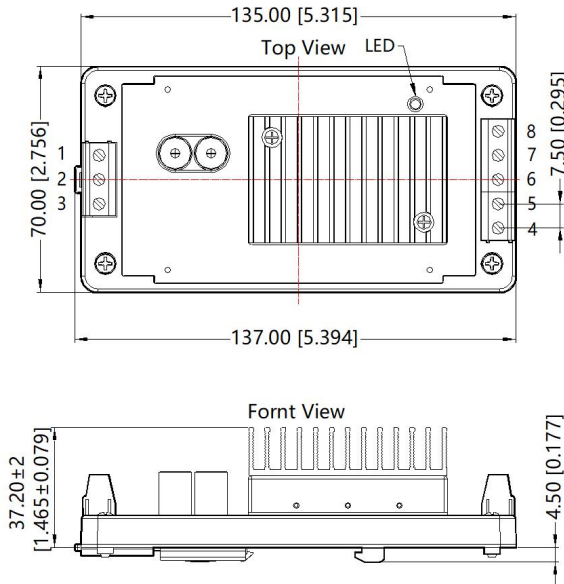
Dimensions and Recommended Layout(URF24xxQB-100WHR3A5)



Dimensions and Recommended Layout(URF24xxQB-100WR3A6)



THIRD ANGLE PROJECTION 



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

Note:
Unit: mm[inch]
Wire range: 24~12 AWG
Tightening torque: Max 0.4 N · m
Installed on DIN RAIL TS35
General tolerances: ± 1.00[± 0.040]

Note:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113(URF24xxQB-100WR3), 58200069(URF24xxQB-100WFR3), 58220017(URF24xxQB-100WHR3), 58220031(URF24xxQB-100W(H)R3(A5/A6));
- The maximum capacitive load offered were tested at input voltage range and full load;
- Unless otherwise specified, data in this datasheet should be tested under the conditions of $T_a=25^{\circ}\text{C}$, humidity<75%RH with nominal input voltage and rated load;
- All index testing methods in this datasheet are based on our company corporate standards;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

Mornsun Guangzhou Science & Technology Co., Ltd.

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