

# DC/DC Converter

## URF48\_QB-75W(F/H)R3 Series

# MORNSUN®

75W Isolated DC-DC converter in 1/4-Brick package  
Wide Input Voltage, Regulated Single Output



Patent Protection RoHS



## FEATURES

- Ultra-wide 4:1 input voltage range
- High efficiency up to 93%
- I/O isolation test voltage: 2250VDC
- 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 shielding package
- Industry standard 1/4-Brick package and pin-out

URF48\_QB-75W(F/H)R3 series are isolated 75W DC-DC converter products with a 4:1 input voltage range. They feature efficiencies of up to 93%, 2250VDC input to output isolation, operating ambient temperature of -40°C to +85°C, input undervoltage, output short circuit, overcurrent, overvoltage and overtemperature 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 and intelligent robotics.

## Selection Guide

| Part No. <sup>①</sup> | Input Voltage (VDC) |                   | Output              |                          | Full Load Efficiency (%) Min./Typ. | Capacitive Load (μF) Max. |
|-----------------------|---------------------|-------------------|---------------------|--------------------------|------------------------------------|---------------------------|
|                       | Nominal (Range)     | Max. <sup>②</sup> | Output Voltage(VDC) | Output Current (A)(Max.) |                                    |                           |
| URF4805QB-75W(F/H) R3 | 48<br>(18-75)       | 80                | 5                   | 15                       | 89/91                              | 6000                      |
| URF4812QB-75W(F/H) R3 |                     |                   | 12                  | 6.25                     | 90/92                              | 2000                      |
| URF4815QB-75W(F/H) R3 |                     |                   | 15                  | 5                        | 91/93                              | 2000                      |
| URF4824QB-75W(F/H) R3 |                     |                   | 24                  | 3.13                     | 90/92                              | 1000                      |
| URF4848QB-75W(F/H) R3 |                     |                   | 48                  | 1.56                     | 90/92                              | 470                       |

Note:①Use "F" suffix is for added aluminum baseplate and "H" suffix for heat sink 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.

## Input Specifications

| Item                                           | Operating Conditions   | Min.                                         | Typ.    | Max.    | Unit |
|------------------------------------------------|------------------------|----------------------------------------------|---------|---------|------|
| Input Current (full load/no-load) <sup>①</sup> | Nominal input voltage  | --                                           | 1698/50 | 1756/80 | mA   |
| Reflected Ripple Current                       | Nominal input voltage  | --                                           | 30      | --      |      |
| Surge Voltage (1sec. max.)                     |                        | -0.7                                         | --      | 90      | VDC  |
| Start-up Threshold Voltage                     |                        | --                                           | --      | 18      |      |
| Input Under-voltage Protection                 | 5VDC/15VDC output      | 16                                           | 16.5    | --      |      |
|                                                | Others                 | 15                                           | 15.5    | --      |      |
| Input Filter                                   |                        | Pi filter                                    |         |         |      |
| On/Off control (Ctrl) <sup>②</sup>             | 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:

①During testing and/or application, please ensure the input current  $I_{in} \geq 1A$  and meets  $I_{in} \geq 150\% \times \eta \times P_{out} / V_{in}$  ( $\eta$ , efficiency;  $P_{out}$ , output power;  $V_{in}$ , input voltage) to avoid the under-power repeated start-up problem.

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② Please ensure that input voltage would not vary between 1.2-3.5VDC when testing and using the remote control pin (Ctrl) and the rise/fall slope of the voltage of the remote control pin (Ctrl) needs to be higher than 10V/ms.

## Output Specifications

| Item                           | Operating Conditions                                  |                    | Min.                              | Typ. | Max.  | Unit  |
|--------------------------------|-------------------------------------------------------|--------------------|-----------------------------------|------|-------|-------|
| Output Voltage Accuracy        | 0%-100% load                                          |                    | --                                | ±1   | ±3    | %     |
| Line Regulation                | Input voltage variation from low to high at full load |                    | --                                | ±0.2 | ±0.5  |       |
| Load Regulation                | 0%-100% load                                          |                    | --                                | ±0.5 | ±0.75 |       |
| Transient Recovery Time        | 25% load step change                                  |                    | --                                | 200  | 500   | μs    |
| Transient Response Deviation   | 25% load step change                                  | 5VDC output        | --                                | ±3   | ±7.5  | %     |
|                                |                                                       | Others             | --                                | ±3   | ±5    |       |
| Temperature Coefficient        | Full load                                             |                    | --                                | --   | ±0.03 | %/°C  |
| Ripple & Noise*                | 20MHz bandwidth                                       | 12VDC/15VDC output | --                                | 100  | 200   | mVp-p |
|                                |                                                       | Others             | --                                | 150  | 250   |       |
| Output Over-voltage Protection | Input voltage range                                   |                    | 110                               | 130  | 160   | %Vo   |
| Output Over-current Protection |                                                       |                    | 110                               | 140  | 190   | %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 operation.

## General Specifications

| Item                                 | Operating Conditions                                     |                                                                        | Min.                          | Typ. | Max. | Unit    |
|--------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------|-------------------------------|------|------|---------|
| Insulation Voltage                   | Input-output                                             | Electric Strength Test for 1 minute with a leakage current of 5mA max. | 2250                          | --   | --   | VDC     |
|                                      | Input-case                                               |                                                                        | 1500                          | --   | --   |         |
|                                      | Output-case                                              |                                                                        | 500                           | --   | --   |         |
| Insulation Resistance                | Input-output, insulation voltage 500VDC                  |                                                                        | 100                           | --   | --   | M Ω     |
| Isolation Capacitance                | Input-output, 100KHz/0.1V                                |                                                                        | --                            | 2200 | --   | pF      |
| Trim Range*                          |                                                          |                                                                        | 95                            | --   | 110  | %Vo     |
| Remote Sense Compensation            |                                                          |                                                                        | --                            | --   | 105  |         |
| Operating Temperature                |                                                          |                                                                        | -40                           | --   | +85  | °C      |
| Storage Temperature                  |                                                          |                                                                        | -55                           | --   | +125 |         |
| Over-temperature Protection          |                                                          |                                                                        | --                            | 115  | 120  |         |
| Pin Soldering Resistance Temperature | Wave-soldering, 10 seconds                               |                                                                        | --                            | --   | 260  |         |
|                                      | Soldering spot is 1.5mm away from the casing, 10 seconds |                                                                        | --                            | --   | 300  |         |
| Storage Humidity                     | Non-condensing                                           |                                                                        | 5                             | --   | 95   | %RH     |
| Vibration                            |                                                          |                                                                        | IEC/EN61373 train 1B category |      |      |         |
| Switching Frequency                  | PWM mode                                                 |                                                                        | --                            | 250  | --   | KHz     |
| MTBF                                 | MIL-HDBK-217F@25°C                                       |                                                                        | 500                           | --   | --   | K hours |

Note: \*Models URF4805QB-75W (F/H)R3 and URF4815QB-75W (F/H)R3 meet Trim range of ±10% and Sense compensation of 5% with Vin >20VDC.

## Mechanical Specifications

|                 |                                                                                              |  |                   |  |  |
|-----------------|----------------------------------------------------------------------------------------------|--|-------------------|--|--|
| Casing Material | Aluminum alloy case, Black flame-retardant and heat-resistant plastic bottom case (UL94 V-0) |  |                   |  |  |
| Dimension       | URF48xxQB-75WR3                                                                              |  | 61.8*40.2*12.7 mm |  |  |
|                 | URF48xxQB-75WFR3                                                                             |  | 62.0*56.0*14.6 mm |  |  |
|                 | URF48xxQB-75WHR3                                                                             |  | 61.8*40.2*27.7 mm |  |  |
| Weight          | URF48xxQB-75WR3                                                                              |  | 90g(Typ.)         |  |  |
|                 | URF48xxQB-75WFR3                                                                             |  | 110g(Typ.)        |  |  |
|                 | URF48xxQB-75WHR3                                                                             |  | 121g(Typ.)        |  |  |

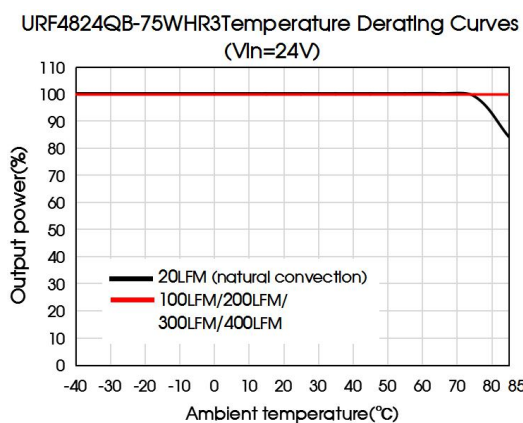
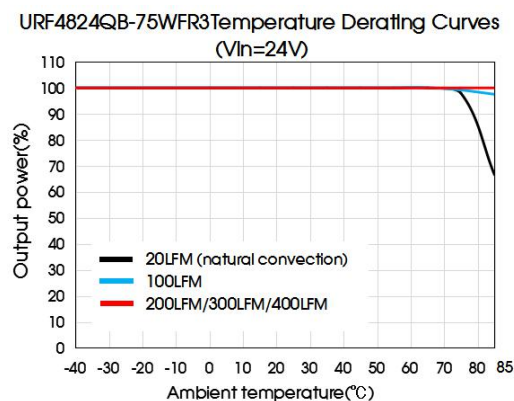
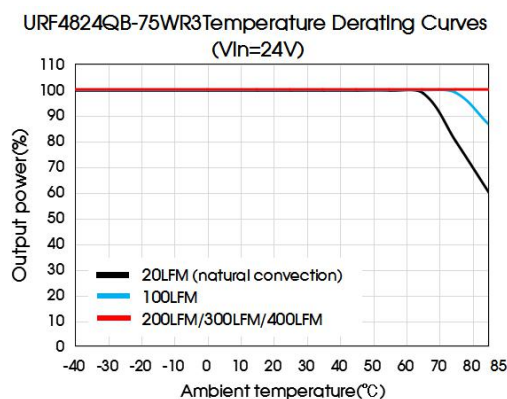
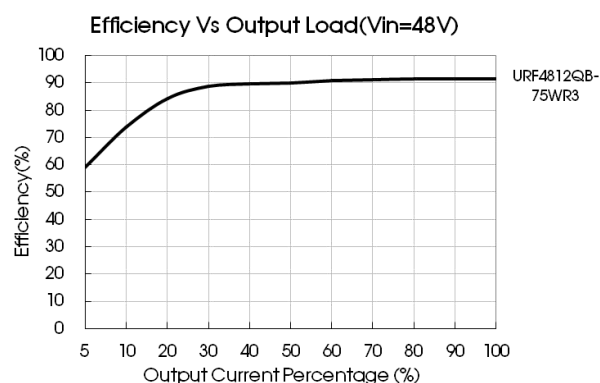
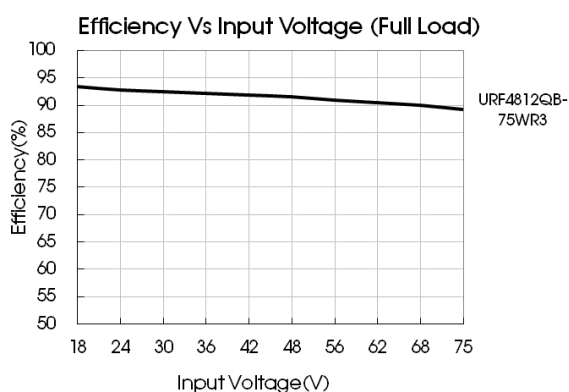
Cooling method

Natural convection (20FLM)

### 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, EN50121-3-2 | Contact ±6KV Air ±8KV                                                                           | perf.Criteria B |
|           | RS    | IEC/EN61000-4-3, EN50121-3-2 | 10V/m                                                                                           | perf.Criteria A |
|           | EFT   | IEC/EN61000-4-4, EN50121-3-2 | ±2KV(see Fig. 2-1for recommended circuit)                                                       | perf.Criteria A |
|           | Surge | EN50121-3-2                  | differential mode ±1KV, 1.2/50us, source impedance 42 Ω<br>(see Fig.2-1for recommended circuit) | perf.Criteria B |
|           | CS    | IEC/EN61000-4-6, EN50121-3-2 | 10 Vr.m.s                                                                                       | perf.Criteria A |

### Typical Performance Curves

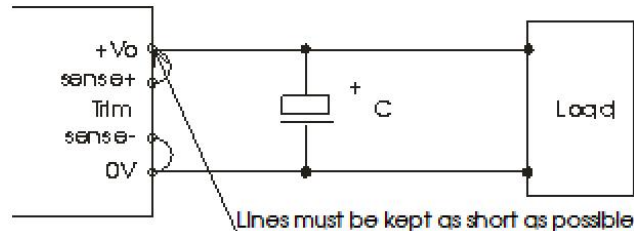


Notes:

(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 operation.

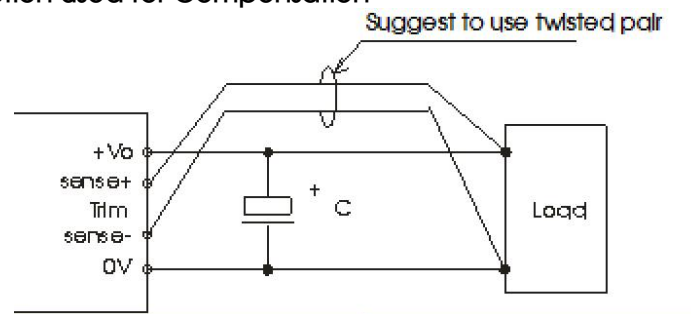
## Remote Sense Application

### 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 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



- (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. 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 220 $\mu$ F 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.



Fig. 1

| Vout(VDC) | Fuse              | Cin*  | Cout  | TVS      |
|-----------|-------------------|-------|-------|----------|
| 5         | 10A,<br>slow blow | 220μF | 470μF | SMDJ6.0A |
| 12        |                   |       | 220μF | SMDJ14A  |
| 15        |                   |       |       | SMDJ17A  |
| 24        |                   |       |       | SMDJ28A  |
| 48        |                   |       | 100μF | SMDJ54A  |

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 recommended circuit

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

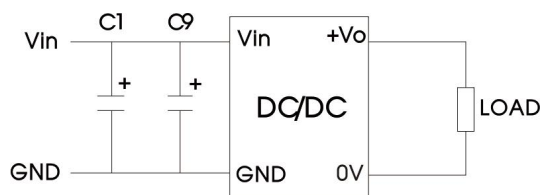


Fig. 2

| Capacitor | Recommended value  | Function           |
|-----------|--------------------|--------------------|
| C1        | 150μF electrolytic | Meet EFT and surge |
| C9        | 47μF electrolytic  |                    |

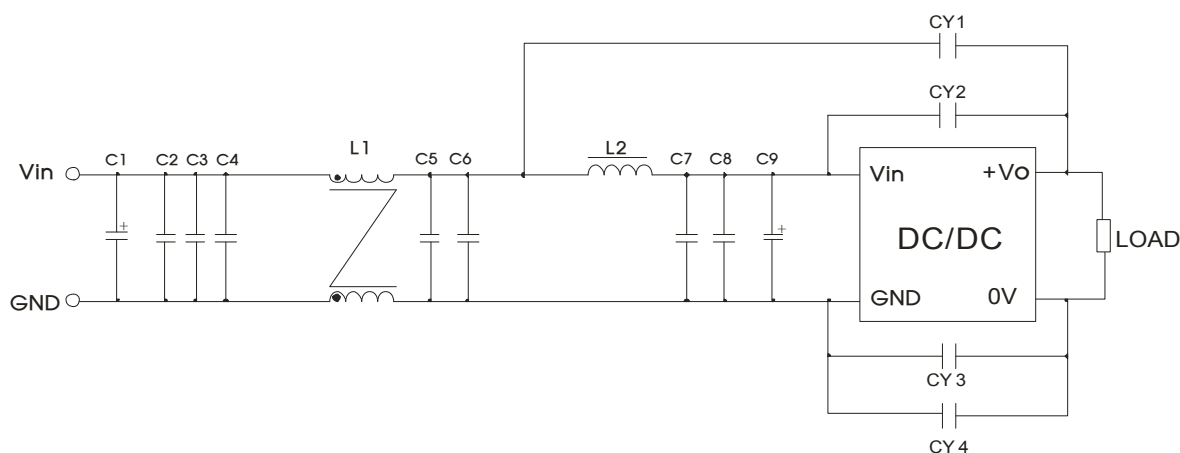
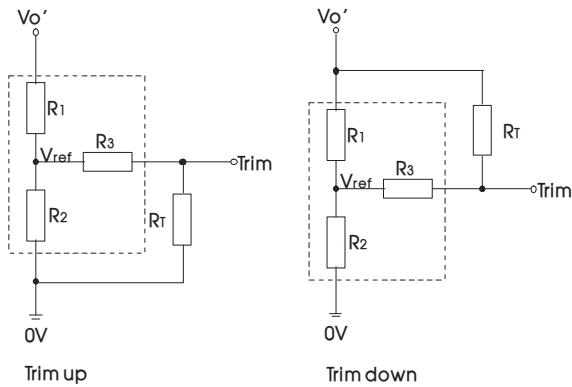


Fig. 3

| Component            | Recommended Component value    | function                                      |
|----------------------|--------------------------------|-----------------------------------------------|
| C1                   | 150 μ F electrolytic capacitor | Meet conducted emission and radiated emission |
| C9                   | 47 μ F electrolytic capacitor  |                                               |
| C1                   | 150 μ F electrolytic capacitor |                                               |
| C9                   | 47 μ F electrolytic capacitor  |                                               |
| C2、C3、C4、C5、C6、C7、C8 | 2.2 μ F ceramic capacitor      |                                               |
| L1                   | 1.0mH common mode inductor     |                                               |
| L2                   | 1.5 μ H inductance             |                                               |
| CY1、CY2、CY3、CY4      | 1nF Y1 safety capacitor        |                                               |

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



Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{\alpha R_2}{R_2 - \alpha} - R_3 \quad \alpha = \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{\alpha R_1}{R_1 - \alpha} - R_3 \quad \alpha = \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2$$

$R_T$  = Trim Resistor value;  $\alpha$  = self-defined parameter

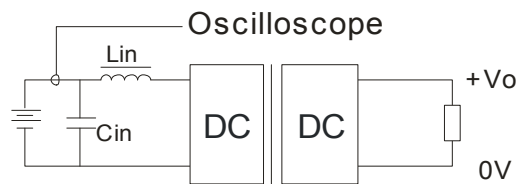
$V_{o'}$  = desired output voltage ( $\pm 10\%$  max).

TRIM resistor connection (dashed line shows internal resistor network)

| Vout(VDC) | R1(K $\Omega$ ) | R2(K $\Omega$ ) | R3(K $\Omega$ ) | 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     |
| 48        | 53.017          | 2.913           | 15              | 2.5     |

Note: When using the Trim down function make sure that the  $R_T$  resistor value is calculated correctly. If the Trim pin is shorted with "+Vo", or its value is too low, the or "the output voltage  $V_{o'}$  would be lower than  $0.9V_o$ , which may cause the product to fail.

#### 4. Reflected ripple current--test circuit



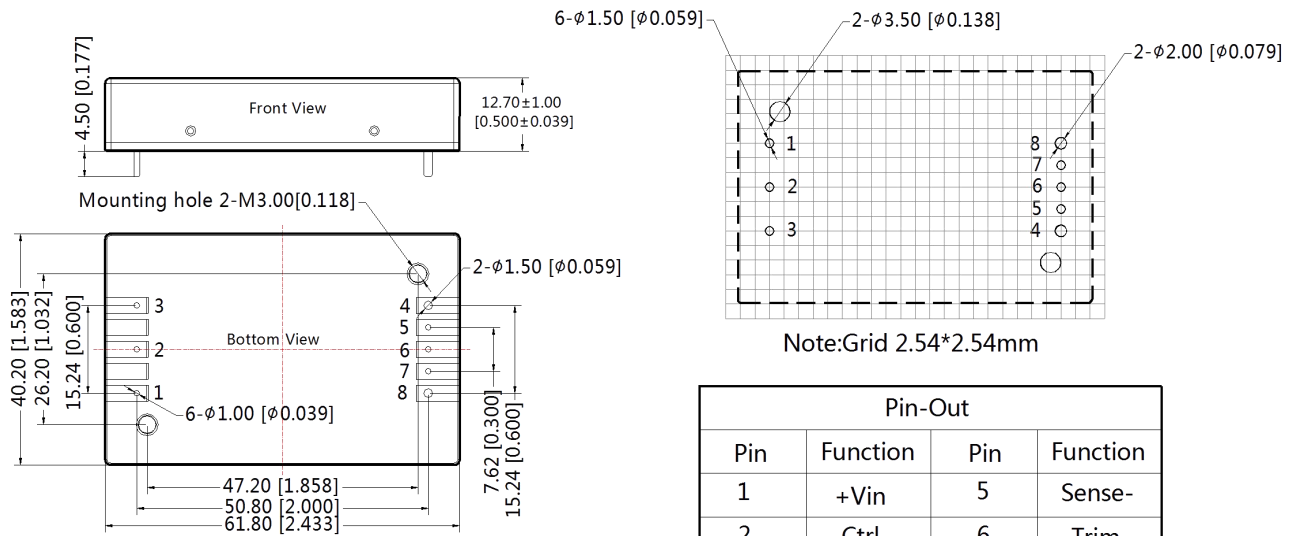
Note:  $L_{in}(4.7\mu H)$  ,  $C_{in}(220\mu F, ESR < 1.0\Omega \text{ at } 100 \text{ KHz})$

- The products do not support parallel connection of their output and we recommended the use of a converter with higher output power capability to cover applications with higher power requirements.
- For additional information please refer to application notes on [www.mornsun-power.com](http://www.mornsun-power.com)



URF48xxQB-75WR3 Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

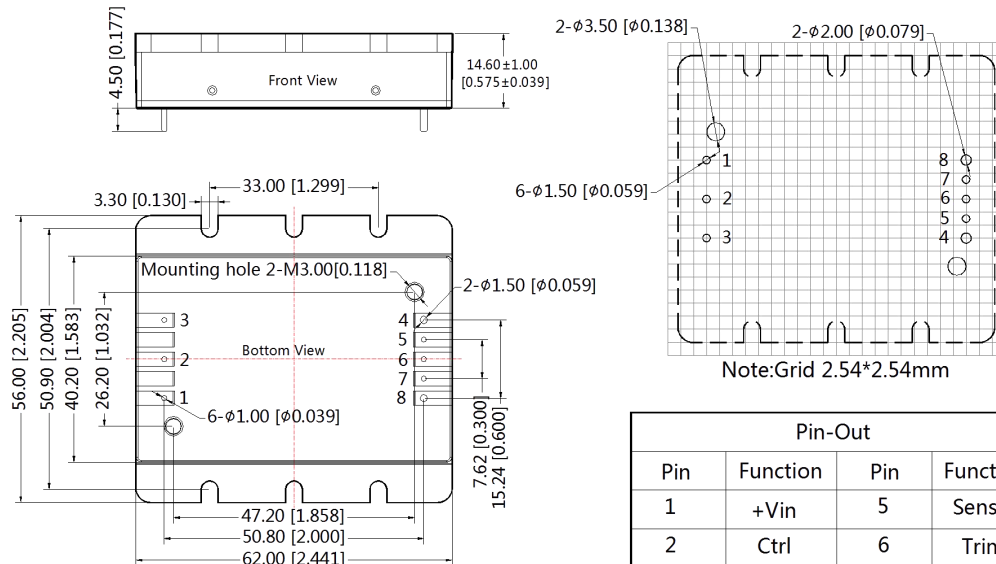


Note:  
Unit: mm[inch]  
Pin1, 2, 3, 5, 6, 7's diameter: 1.00[0.039]  
Pin4, 8's diameter: 1.50[0.059]  
Pin diameter tolerances:  $\pm 0.10[\pm 0.004]$   
General tolerances:  $\pm 0.50[\pm 0.020]$   
Mounting hole screwing torque: Max 0.4 N·m

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

URF48xxQB-75WFR3 Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

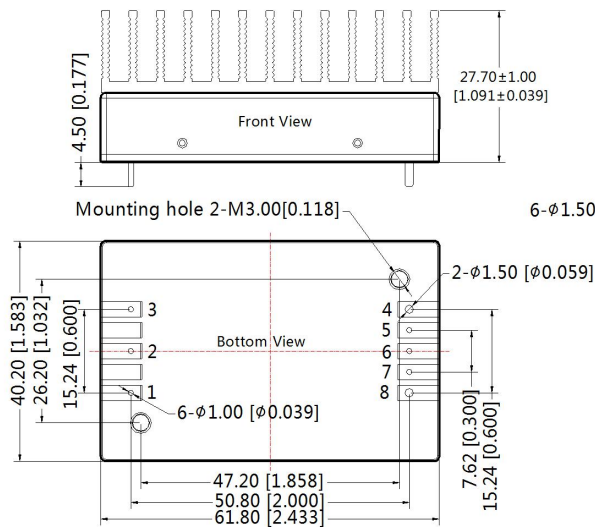


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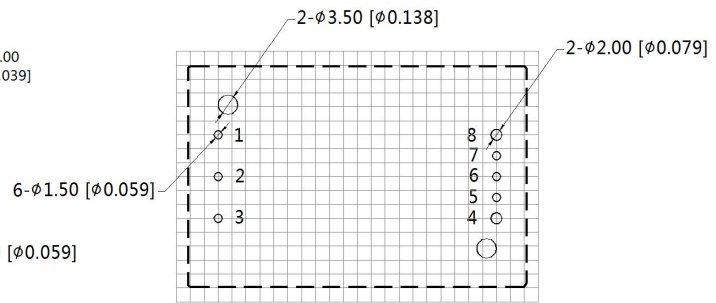
| Pin-Out |          |     |          |
|---------|----------|-----|----------|
| Pin     | Function | Pin | Function |
| 1       | +Vin     | 5   | Sense-   |
| 2       | Ctrl     | 6   | Trim     |
| 3       | -Vin     | 7   | Sense+   |
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URF48xxQB-75WHR3 Dimensions and Recommended Layout

THIRD ANGLE PROJECTION 



Note:  
Unit: mm[inch]  
Pin1, 2, 3, 5, 6, 7's diameter: 1.00[0.039]  
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General tolerances:  $\pm 0.50[\pm 0.020]$   
Mounting hole screwing torque: Max 0.4 N·m



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:

- For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). Packaging bag number: 58010113(URF48xxQB-75WR3), 58200069(URF48xxQB-75WFR3), 58220017(URF48xxQB-75WHR3);
- 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 when inputting nominal voltage and outputting rated load;
- All index testing methods in this datasheet are based on our Company's 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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