DC/DC Converter

SURF48_QB-200W(F/H)R3 Series

200W isolated DC-DC converter with Ultra-wide Input and Regulated Single Output

FEATURES

- Ultra-wide 4:1 input voltage range
- High efficiency up to 91%
- 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℃ ~ +85℃
- Five-sided metal shielding package
- Industry standard ¼-Brick package and pin-out

SURF48_QB-200W(F/H)R3 series are isolated 200W DC-DC products with 4:1 input voltage. They feature efficiency up to 91%, 2250VDC input to output isolation, operating temperature of -40℃ to +85℃, input under-voltage, output short circui, over-current, over–voltage, 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 and intelligent robotic.

Selection Guide

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.)		
SURF4805QB-200W(F/H)R3	48 (18-75)	80	5	40	86/88	6000
SURF4812QB-200W(F/H)R3			12	16.7	89/91	2000
SURF4815QB-200W(F/H)R3			15	13.3	87/89	2000
SURF4824QB-200W(F/H)R3			24	8.4	89/91	1000
SURF4848QB-200W(F/H)R3			48	4.2	89/91	450

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)	Nominal input voltage	--	4682/100	4845/200	mA
Reflected Ripple Current	Nominal input voltage	--	100	--	
Surge Voltage (1sec. max.)		-0.7	--	90	VDC
Start-up Threshold Voltage		--	--	18	
Input Under-voltage Protection		14	16	--	
Input Filter		Pi filter			
Ctrl*	Module on	Ctrl pin open or pulled high (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
Voltage Accuracy			--	±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		--	300	500	μs
Transient Response Deviation	25% load step change	5V output	--	±3	±7.5	%
		Others	--	±3	±5	
Temperature Coefficient	Full load		--	--	±0.03	%/℃
Ripple & Noise*	20MHz bandwidth		--	150	250	mVp-p
Over-voltage Protection	Input voltage range		110	130	160	%Vo
Over-current Protection			110	130	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 operation.

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation	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 resistance at 500VDC		100	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100KHz/0.1V		--	2200	--	pF
Trim			90	--	110	%Vo
Sense			--	--	105	
Operating Temperature			-40	--	+85	℃
Storage Temperature			-55	--	+125	
Over-temperature Protection	Max. Casing Temperature		--	115	120	
Pin Soldering Resistance Temperature	Wave-soldering, 10 seconds		--	--	260	
	Soldering spot is 1.5mm away from case for 10 seconds		--	--	300	
Thermocouple	Natural convection (20LFM)	SURF48xxQB-200WR3	--	--	7.5	℃/W
		SURF48xxQB-200WFR3	--	--	6.3	
		SURF48xxQB-200WHR3	--	--	5.2	
Storage Humidity	Non-condensing		5	--	95	%RH
Vibration			IEC/EN61373 train 1B category			
Switching Frequency	PWM mode		--	250	--	KHz
MTBF	MIL-HDBK-217F@25℃		500	--	--	K hours

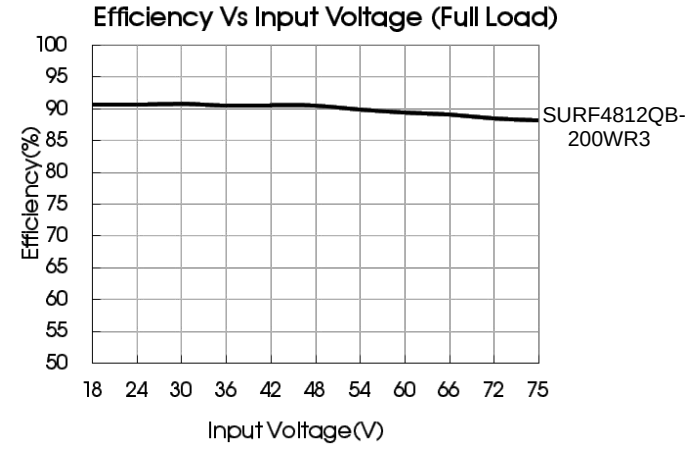
Mechanical Specifications

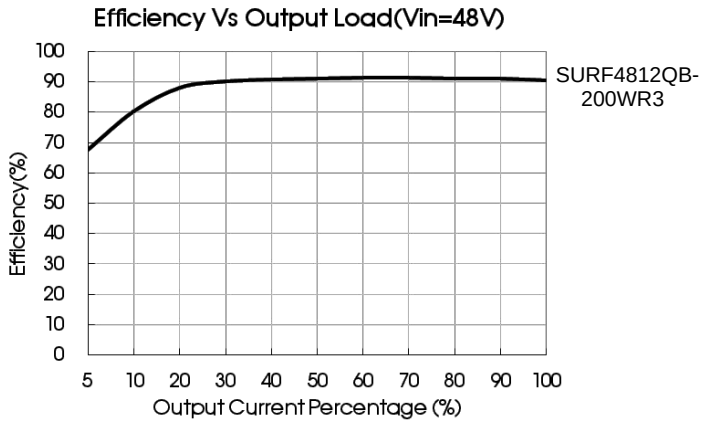
Case Material	Aluminum alloy case, Black flame-retardant and heat-resistant plastic bottom case (UL94 V-0)	
Dimensions	SURF48xxQB-200WR3	61.8 x 40.2 x 12.7 mm
	SURF48xxQB-200WFR3	62.0 x 56.0 x 14.6 mm
	SURF48xxQB-200WHR3	61.8 x 40.2 x 27.7 mm
Weight	SURF48xxQB-200WR3	89.0g(Typ.)
	SURF48xxQB-200WFR3	109.0g(Typ.)
	SURF48xxQB-200WHR3	120.0g(Typ.)
Cooling Method	Free air convection (20LFM)	

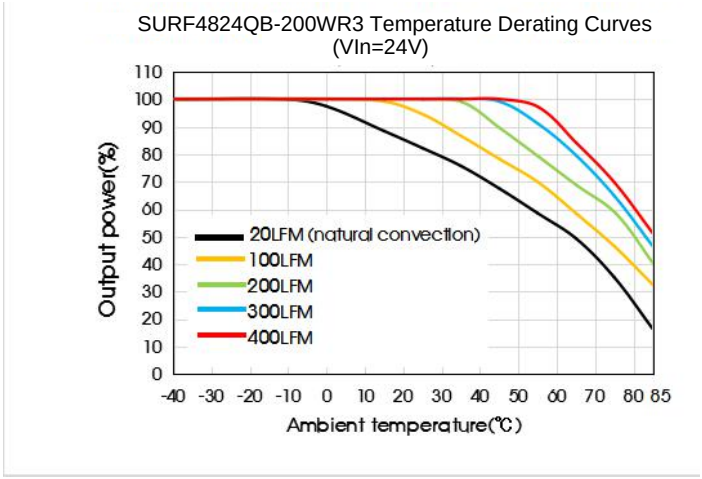
Electromagnetic Compatibility (EMC)

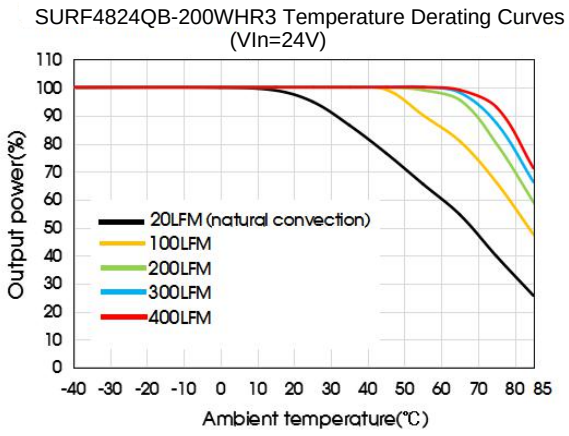
Emissions	CE	CISPR32/EN55032	CLASS A (see Fig. 2 for recommended circuit)	
	RE	CISPR32/EN55032	CLASS A (see Fig. 2 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2, EN50121-3-2	Contact ±6KV Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3, EN50121-3-2	10V/m	perf.Criteria A
	EFT	IEC/EN61000-4-4, EN50121-3-2	±2KV(see Fig. 2-1for recommended circuit)	perf.Criteria A
	Surge	EN50121-3-2	differential mode ±1KV, 1.2/50us, source impedance 42Ω (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 Characteristic Curves







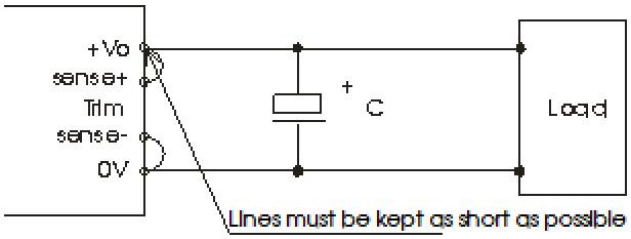


Notes:

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.

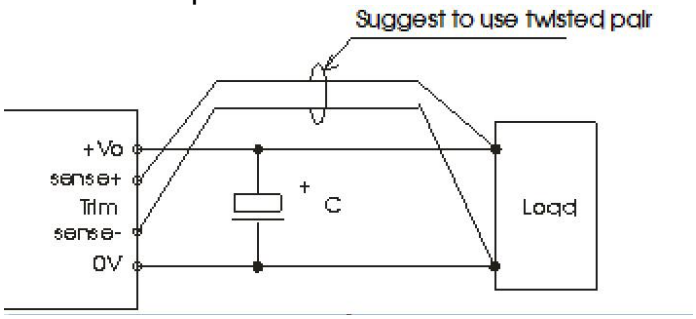
Remote Sense Application

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 recommened 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 recommened 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 stablity of input terminal and avoid repeatedly start-up problems due to input voltage lower than undervoltage protection point.
(3) We recomended increasing the output capacitance with limited to the capactive 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.

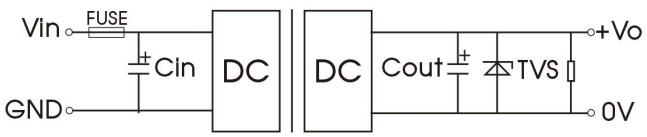


Fig.1

Vout(VDC)	Fuse	Cin*	Cout	TVS
5	20A, slow blow	220μF	470μF	SMDJ6.0A
12			220μF	SMDJ14A
15				SMDJ17A
24			100μF	SMDJ28A
48				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℃).

2. EMC compliance circuit

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

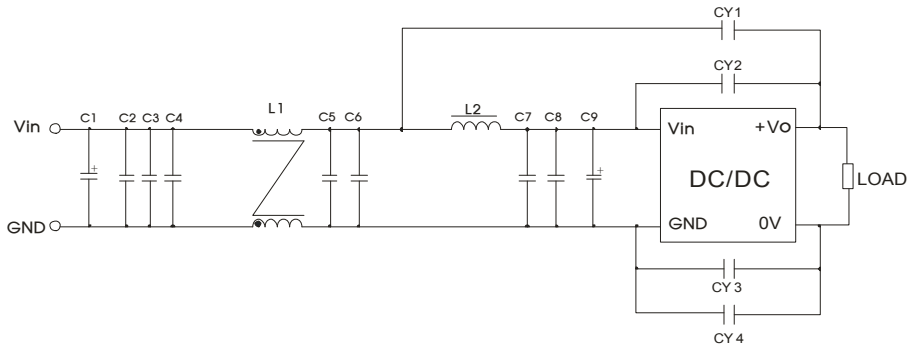
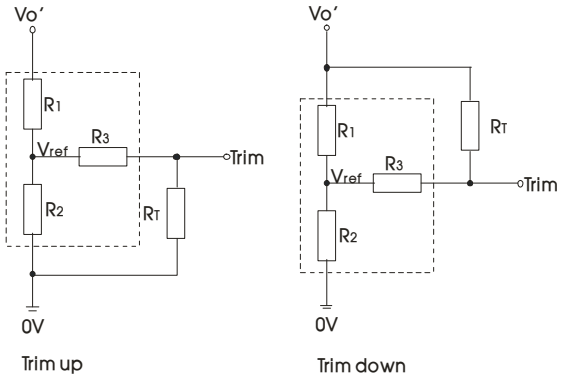


Fig. 2

Components	Recommended Component value
C1	150μF/100V electrolytic capacitor
C9	47μF/100V electrolytic capacitor
C2, C3, C4, C5, C6, C7, C8	2.2μF/100V ceramic capacitor
L1	1.0mH/15A common mode inductor
L2	1.5μH/15A inductance
CY1, CY2, 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:

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

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

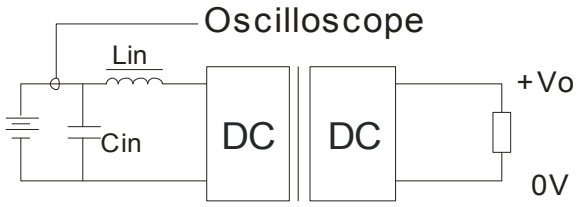
R_T = Trim Resistor value; a = self-defined parameter

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
48	53.017	2.913	15	2.5

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

4. Reflected ripple current--test circuit

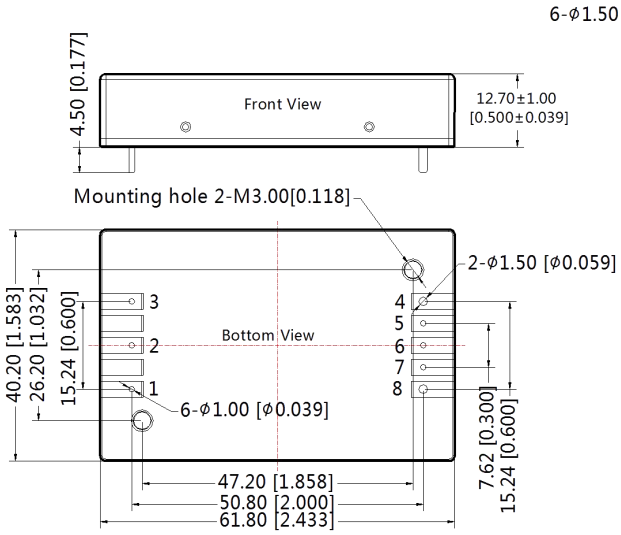


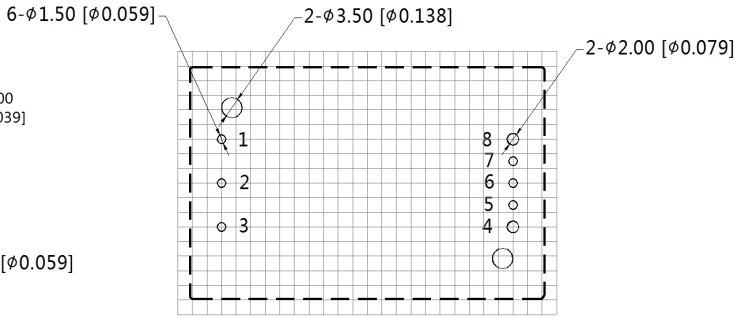
Note:Lin(4.7μH) ， Cin(220μF, ESR < 1.0Ω at 100 KHz)

The products do not support parallel connection of their output and we recommended the use of a converter with higher output power capability to cover applications with higher power requirements.

SURF48xxQB-200WR3 Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



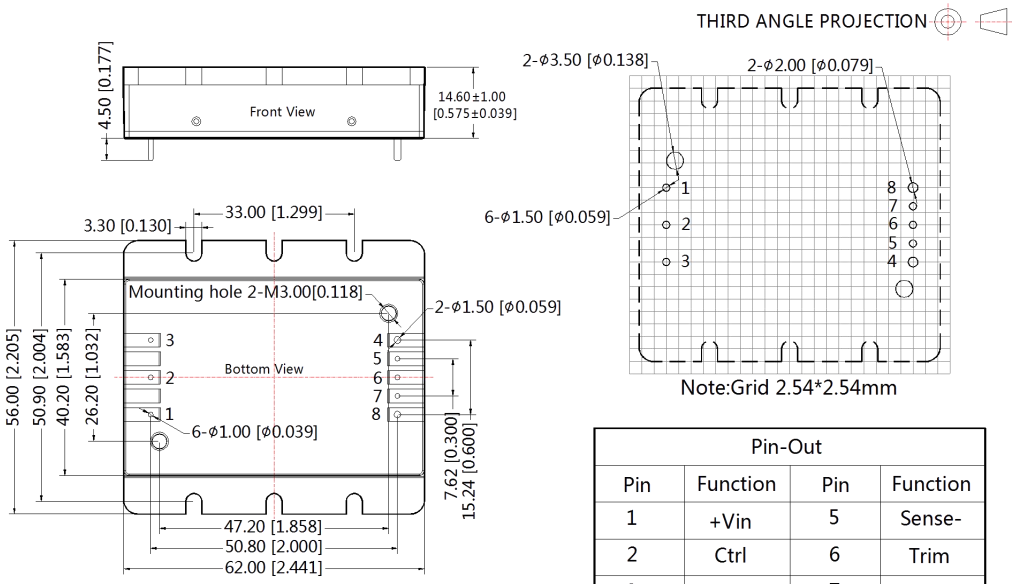


Note:Grid 2.54*2.54mm

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

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

SURF48xxQB-200WFR3 Dimensions and Recommended Layout



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

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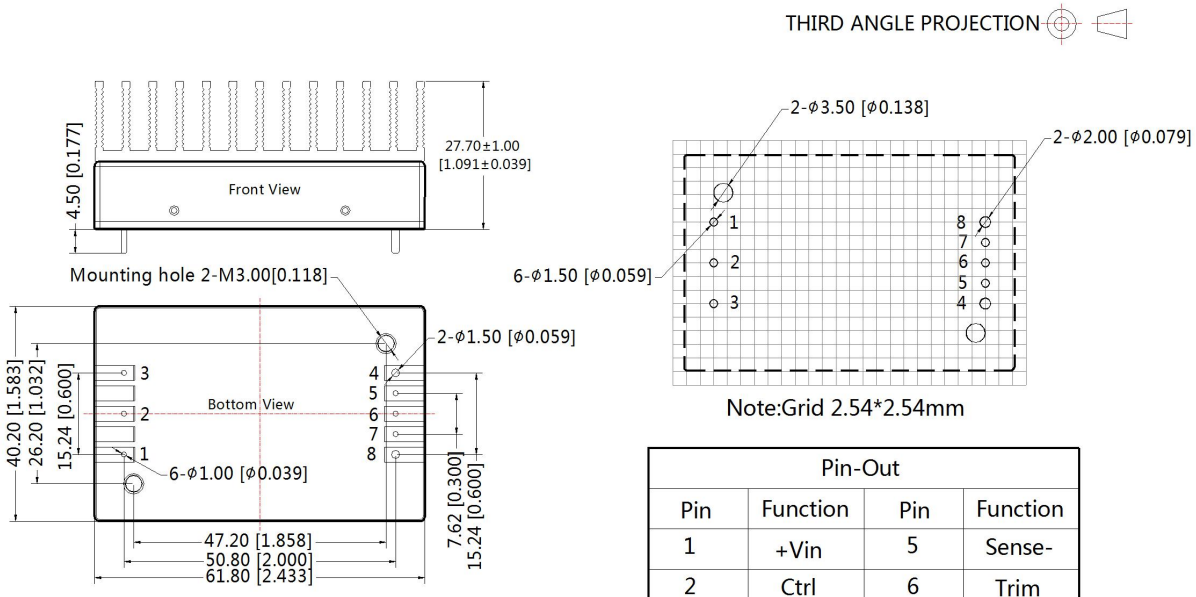
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
Mounting hole screwing torque: Max 0.4 N·m

SURF48xxQB-200WHR3 Dimensions and Recommended Layout



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

Note:
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Note:

1. The maximum capacitive load offered were tested at input voltage range and full load;
2. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25℃, humidity<75%RH when inputting nominal voltage and outputting rated load;
3. All index testing methods in this datasheet are based on our company corporate standards;
4. We can provide product customization service and match filter module;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.