DC/DC Converter

SURF24_QB-100W(F/H)R3 Series

100W, wide input voltage, isolated & regulated single output DC-DC converter

FEATURES

- Ultra wide input voltage range (4:1)
- High efficiency up to 90%
- Isolation voltage: 2.25K VDC
- Input under-voltage protection, output short circuit, over-current, over–voltage, over-temperature protection
- Operating temperature range: -40℃ to +85℃
- Five-sided metal shielding package
- International standard pin-out: 1/4 brick
- Meets requirements of railway standard EN50155

SURF24_QB -100W(F/H)R3 series are isolated 100W DC-DC products with 4:1 input voltage. They feature efficiency up to 90%, 2250VDC isolation, operating temperature of -40℃ to +85℃, Input under-voltage protection, output short circuit protection, over-current protection, over-voltage protection, over-temperature protection and EMI meets CISPR32/EN55032 CLASS B, which make them widely applied in battery power supplies, industrial control, electricity, instruments, railway, communication fields.

Selection Guide

Part No.①	Input Voltage (VDC)		Output		Efficiency (%,Min./Typ.) @ Full Load	Max. Capacitive Load(μF)
	Nominal (Range)	Max.②	Output Voltage(VDC)	Output Current (A)(Max.)		
SURF2405QB-100W(F/H)R3	24 (9-36)	40	5	20	87/89	6000
SURF2412QB-100W(F/H)R3			12	8.3	88/90	2000
SURF2415QB-100W(F/H)R3			15	6.7	88/90	2000
SURF2424QB-100W(F/H)R3			24	4.2	88/90	1000
SURF2428QB-100W(F/H)R3			28	3.6	88/90	1000
SURF2448QB-100W(F/H)R3			48	2.1	88/90	470

Note:
①"F" means product with aluminium bottom case;Series with suffix "H" are heat sink mounting; If the application has a higher requirement for heat dissipation, you can choose modules with heat sink;
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	--	4682/120	4789/160	mA
Reflected Ripple Current	Nominal input voltage	--	30	--	
Surge Voltage (1sec. max.)		-0.7	--	50	VDC
Start-up Threshold Voltage		--	--	9	
Input Under-voltage Protection		7.0	7.5	--	
Input Filter		Pi filter			
Ctrl *	Module switch on	Ctrl open circuit or connected to TTL high level (3.5-12VDC)			
	Module switch off	Ctrl pin connected to GND or low level (0-1.2VDC)			
	Input current when switched off	--	2	65	mA
Hot Plug		Unavailable			

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

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Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	0%-100% load		--	±1	±3	%
Line Regulation	Full load, the input voltage is from low to high		--	±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	%/℃
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: *Ripple and noise are measured by "parallel cable" method, please see DC-DC Converter Application Notes for specific operation.

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	2250	--	--	VDC
		Input-case		1600	--	--	
		Output-case		500	--	--	
Insulation Resistance		Input-output, insulation voltage 500VDC		1000	--	--	MΩ
Isolation Capacitance		Input-output, 100KHz/0.1V		--	2200	--	pF
Trim*		5V/15V output		91	--	110	%Vo
		Others		90	--	110	
Sense				--	--	110	
Thermocouple	SURF24_QB-100WR3	free convection		--	--	8	℃/W
	SURF24_QB-100WFR3	free convection		--	--	6.8	
	SURF24_QB-100WHR3	free convection		--	--	5.7	
Operating Temperature				-40	--	+85	℃
Storage Temperature				-55	--	+125	
Over-temperature Protection				95	105	115	
Pin Welding Resistance Temperature		Wave-soldering, 10 seconds		--	--	260	
		Welding spot is 1.5mm away from the casing, 10 seconds		--	--	300	
Storage Humidity		Non-condensing		5	--	95	%RH
Vibration				IEC/EN61373 car body 1 B mold			
Switching Frequency		PWM mode		--	250	--	KHz
MTBF		MIL-HDBK-217F@25℃		500	--	--	K hours

Physical Specifications

Casing Material		Aluminum alloy case, Black flame-retardant and heat-resistant plastic bottom case (UL94 V-0)
Dimension	SURF24xxQB-100WR3	61.8*40.2*12.7 mm
	SURF24xxQB-100WFR3	62.0*56.0*14.6 mm
	SURF24xxQB-100WHR3	61.8*40.2*27.7 mm
Weight	SURF24xxQB-100WR3	80g(Typ.)
	SURF24xxQB-100WFR3	100g(Typ.)
	SURF24xxQB-100WHR3	116(Typ.)
Cooling method		Natural convection or Forced convection

EMC Specifications

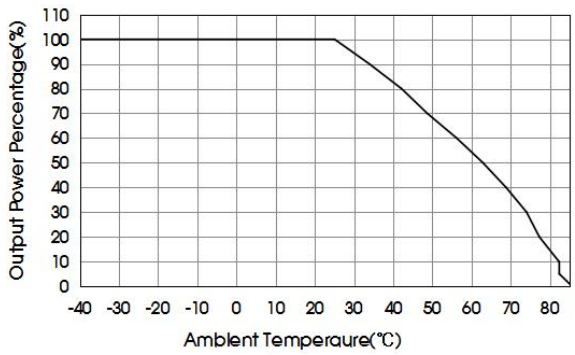
EMI	CE	CISPR32/EN55032, CLASS A and CLASS B (see Fig. 3 for recommended circuit)	
	RE	CISPR32/EN55032, CLASS A and CLASS B (see Fig. 3 for recommended circuit)	
EMS	ESD	IEC/EN61000-4-2, Contact ±6KV Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3, 20V/m	perf.Criteria A
	EFT	IEC/EN61000-4-4, ±2KV(see Fig. 2-1for recommended circuit)	perf.Criteria A
	CS	IEC/EN61000-4-6, 10 Vr.m.s	perf.Criteria A

EMC Specifications（EN50155）

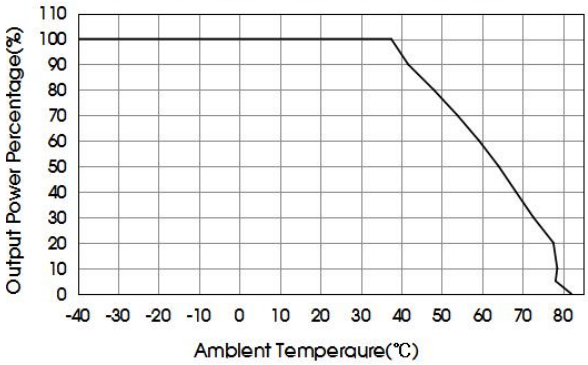
EMI	CE	EN50121-3-2 150kHz-500kHz 99dBuV (see Fig.3 for recommended circuit) EN55016-2-1 500kHz-30MHz 93dBuV
	RE	EN50121-3-2 30MHz-230MHz 40dBuV/m at 10m (see Fig.3 for recommended circuit) EN55016-2-1 230MHz-1GHz 47dBuV/m at 10m
EMS	ESD	EN50121-3-2 Contact ±6KV/Air ±8KV
	RS	EN50121-3-2 20V/m(rms)
	EFT	EN50121-3-2 ±2kV 5/50ns 5kHz (see Fig.2 or 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)

Product Characteristic Curve

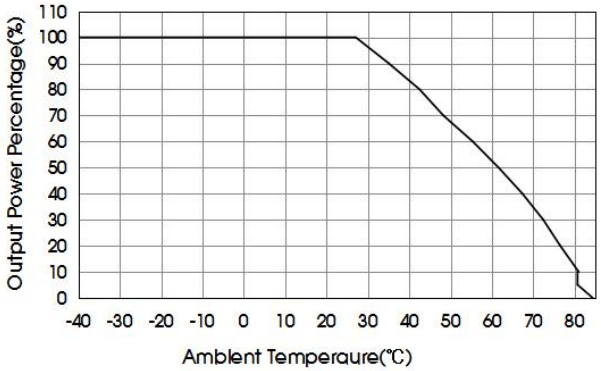
SURF2405QB-100WHR3 Temperature Derating Curves (Vin=24V)



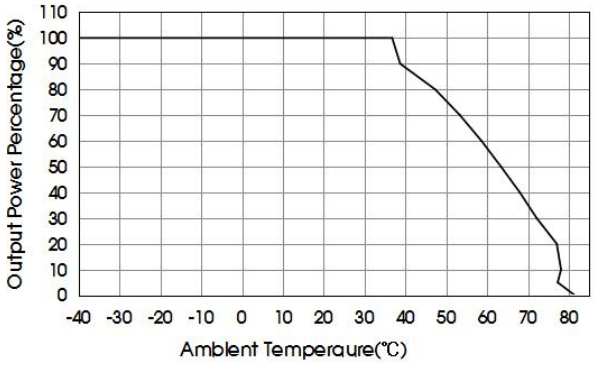
SURF2412QB-100WHR3 Temperature Derating Curves (Vin=24V)



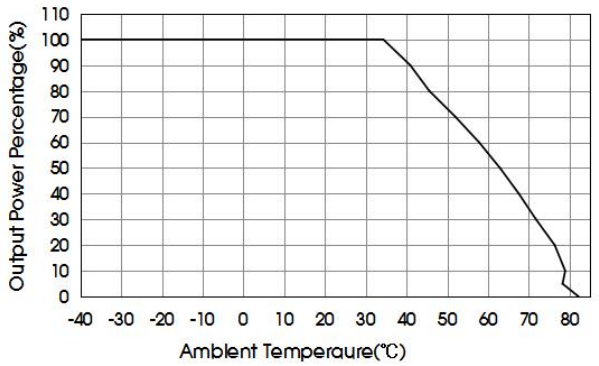
SURF2415QB-100WHR3 Temperature Derating Curves (Vin=24V)



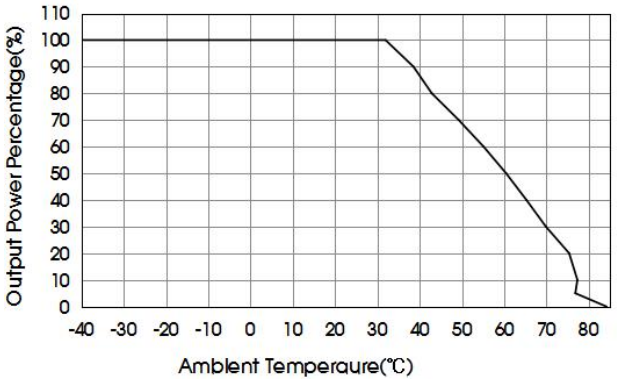
SURF2424QB-100WHR3 Temperature Derating Curves (Vin=24V)



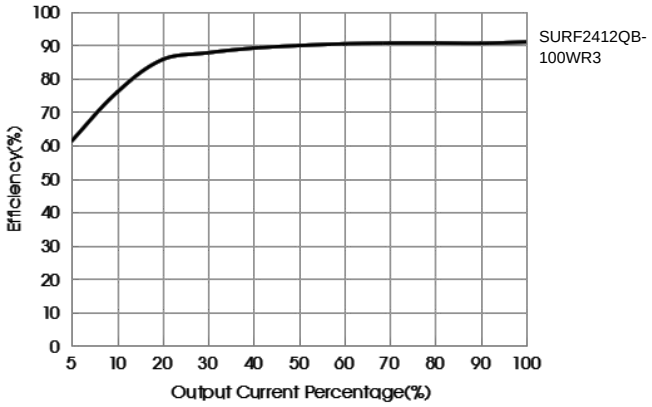
SURF2428QB-100WHR3 Temperature Derating Curves (Vin=24V)



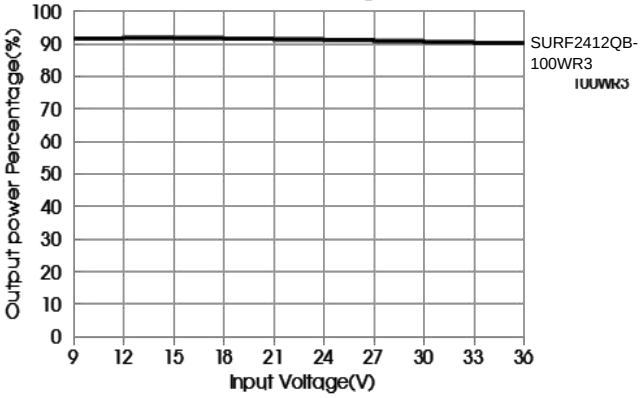
SURF2448QB-100WHR3 Temperature Derating Curves (Vin=24V)



Efficiency Vs Output Load(Vin=24V)

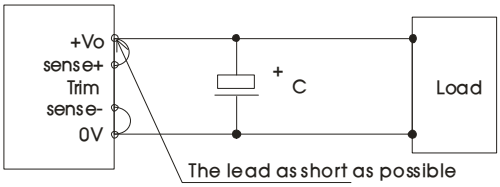


Efficiency Vs input Voltage (Full Load)



Sense of application and precautions

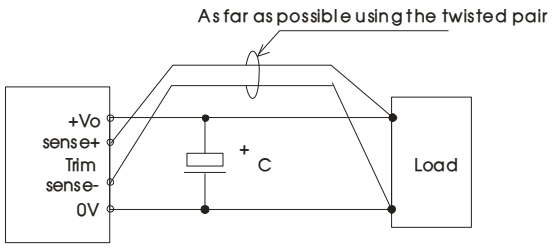
1. When not using remote sense



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 +, 0V and Sense- as short as possible. and close to the terminal. Avoid a looping track. If noise interferes the loop, the operation of the power module will become unstable.

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 take adequate assessments before using.

Design Reference

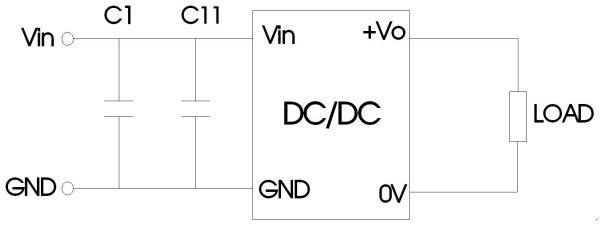
1. Typical application

If not using Schmid-M's recommended cicuit, please ensure an 220 μ F electrolytic capacitors in parallel with the input, which used to suppress the surge voltage come from the iuput terminal.
All the DC/DC converters of this series are tested according to the recommended circuit (see Fig. 1) before delivery.
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.

Fig.1

Vout(VDC)	Fuse	Cin	Cout
5	20A, slow blow	220μF	470μF
12/15			220μF
24/28			100μF
48			100μF

2. EMC solution-module recommended circuit



device number	Device parameter	Device function
C1	150 μ F electrolytic capacitor	Meet puise group and surge
C11	47 μ F electrolytic capacitor	

Fig. 2

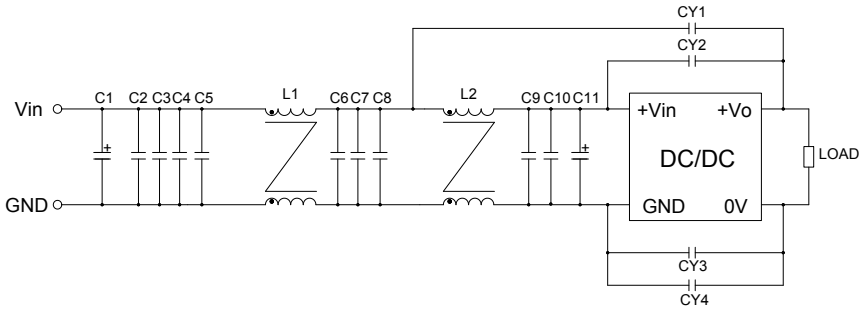
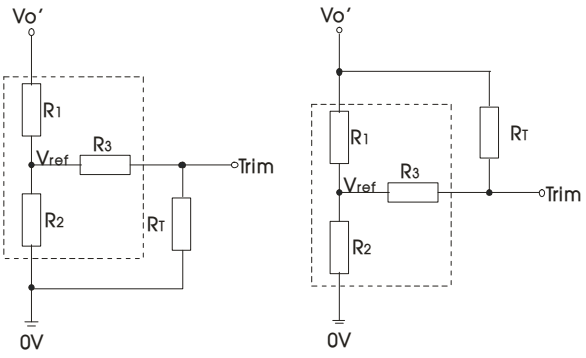


Fig. 3

CLASSA device number	CLASS B device number	Device parameter	Device function
C1		150 μ F electrolytic capacitor	Meet conducted emission and radiated emission
C11		47 μ F electrolytic capacitor	
C2、C3、C4、C5、C6、C7、C8、C9、C10		10 μ F ceramic capacitor	
L1、L2		1.6mH common mode inductor	
CY3	CY1、CY2	2.2nF Y1safety capacitor	
	CY3、CY4	1nF Y1safety capacitor	

3. Application of Trim and calculation of Trim resistance



Trim up　　Trim down

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

Calculation formula of Trim resistance:

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

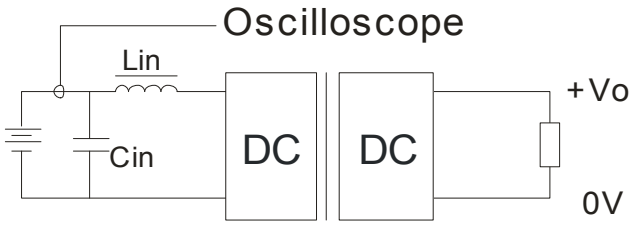
$$down:\ R_T=\frac{aR_1}{R_1-a}-R_3 \qquad a=\frac{Vo'-Vref}{Vref}\cdot R_2$$

R_T is Trim resistance ,a is a self-defined parameter, with no real meaning. Vo' for the actual needs of the up or down regulated voltage

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

When the Trim function with down regulated is used, If the RT resistor is too low or "Trim" is short with "+Vo", the output voltage Vo' would be lower than 0.9Vo, which may cause the product to be irreversibly damaged.

4. Reflected ripple current--test circuit

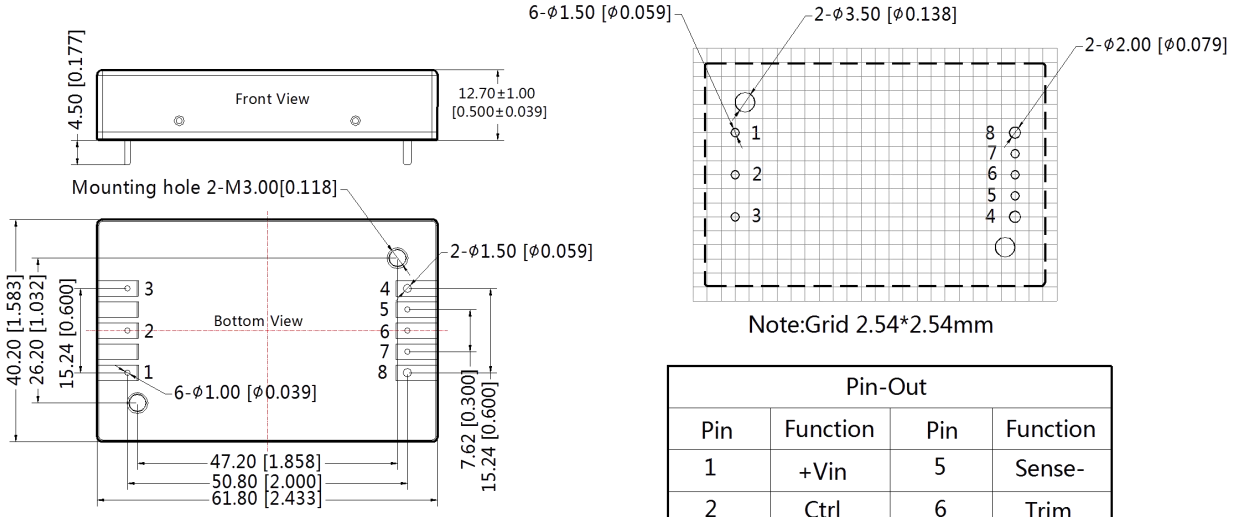


Note:Lin(4.7μH) ， Cin(220μF, ESR < 1.0Ω at 100 KHz)

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

Dimensions and Recommended Layout (SURF24xxQB-100WR3)

THIRD ANGLE PROJECTION

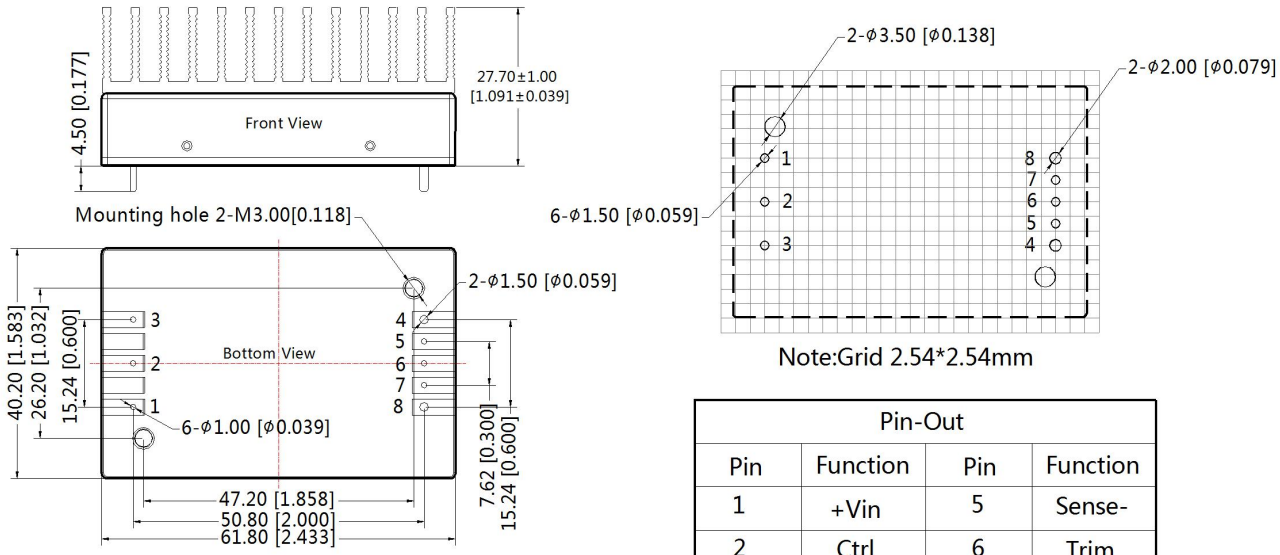


Pin-Out			
Pin	Function	Pin	Function
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

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 (SURF24xxQB-100WHR3)

THIRD ANGLE PROJECTION



Pin-Out			
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2	Ctrl	6	Trim
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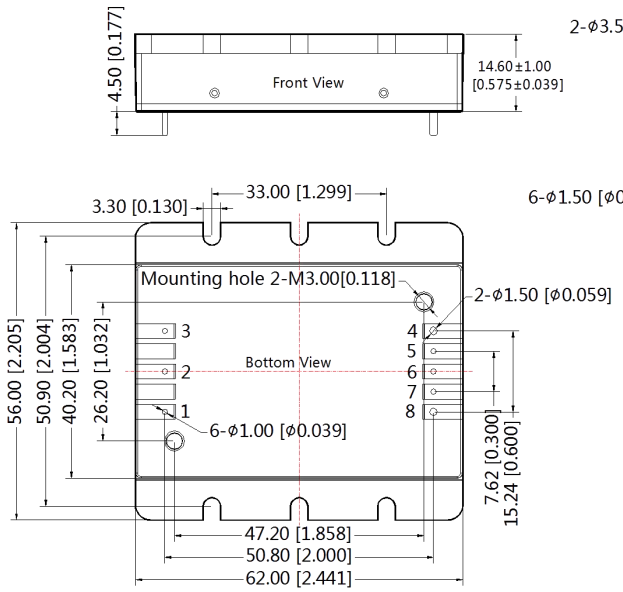
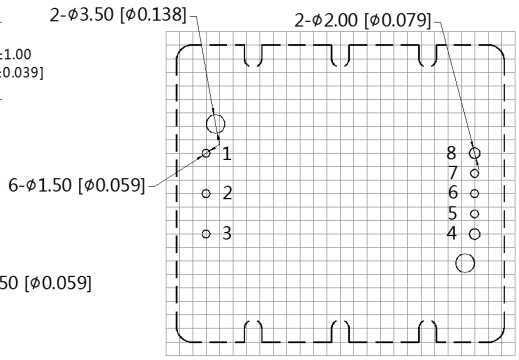
4	0V	8	+Vo

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(SURF24xxQB-100WFR3)

THIRD ANGLE PROJECTION





Pin-Out			
Pin	Function	Pin	Function
1	+Vin	5	Sense-
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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

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's corporate standards;
4. We can provide product customization service, please contact our technicians directly for specific information;
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.