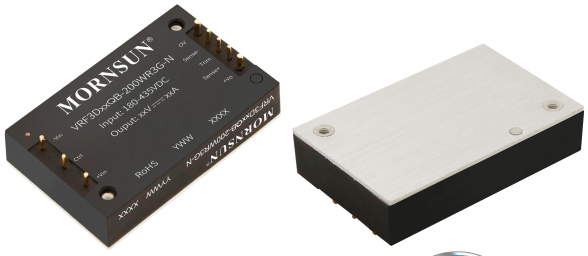
200W, Wide input voltage, isolated voltage regulator single output, DC/DC module power supply



Patent Protection RoHS

FEATURES

- Wide input voltage range: 180-435VDC
- High efficiency up to 90%
- Enhanced isolation, isolation voltage: 3kVAC
- Input under-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection
- Shell operating temperature range Tc: -40℃ to +105℃
- Industry standard 1/4-Brick package and pin-out
- Meet the EN62368 standard

VRF3D_QB-200WR3G-N series output power is 200W, 180-435VDC wide input voltage range, efficiencies up to 90%, isolation voltage 3000VAC, housing allowed operating temperature -40℃ to +105℃, with input under-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection, widely used in industrial control, communication and other fields.

Selection Guide

Certification	Part No.	Ctrl Logic①	Input Voltage (VDC)		Output		Full Load Efficiency③ (%)Min./Typ.	Capacitive Load (μF) Max.	Capacitive Load (μF)Min.
			Nominal (Range)	Max.②	Voltage (VDC)	Current (mA) Max./Min.			
--	VRF3D05QB-200WR3G-N	N	270 (180-435)	435	05	40000/0	87/89	10000	2000
	VRF3D06QB-200WR3G-N	N			06	33330/0	87/89	10000	2000
	VRF3D12QB-200WR3G-N	N			12	16600/0	88/90	5000	1000
	VRF3D24QB-200WR3G-N	N			24	8330/0	88/90	2000	470
	VRF3D28QB-200WR3G-N	N			28	7140/0	88/90	1500	470
	VRF3D48QB-200WR3G-N	N			48	4160/0	88/90	800	470

Note:
①"P" indicates positive logic, "N" indicates negative logic;
②Exceeding the maximum input voltage may cause permanent damage;
③Efficiency is measured with nominal input voltage and rated output load.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (full load/no-load)	Nominal input voltage	5V Output	--	832/30	852/50	mA
		6V Output	--	832/40	852/60	
		12V Output	--	823/30	842/50	
		24V/28V/48V Output	--	823/7	842/15	
Reflected Ripple Current①	Nominal input voltage, 100% load		--	100	--	
Starting Voltage			--	--	180	VDC
Input Under-voltage Protection			155	165	--	
Start-up Time	Nominal input voltage & constant resistance load		--	100	300	ms
Input Filter			C filter			
Hot Plug			Unavailable			
Ctrl②	Module open		Ctrl pin pulled -Vin or pulled low (0-1.2VDC)			
	Module shutdown		Ctrl pin open or TTL pulled high (3.5-12VDC)			
	Input current when turned off		--	5	10	mA

Note:
①See reflected ripple current test circuit "Design Reference" Fig 7;
②The voltage of Ctrl pin is relative to input pin -Vin.

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		--	±0.1	±0.5	
Load Regulation	0% - 100% load		--	±0.5	±1	
Transient Response Deviation	25% load step change, input voltage range	5V/6V/12V Output	--	±6	±10	
		24V/28V Output	--	±5	±8	
		48V Output	--	±3	±5	
Transient Recovery Time	Nominal input, 25% load step change		--	300	500	μs
Temperature Coefficient	Full load		--	--	±0.03	%/℃
Ripple & Noise①	20MHz bandwidth, 5%-100% load②	5V Output	--	150	200	mVp-p
		6V/12V/24V Output	--	180	250	
		28V Output	--	200	300	
		48V Output	--	250	350	
Over-Temperature Protection	Case Temperature③		--	110	--	℃
Trim	Input voltage range		80	--	110	%Vo
Sense			--	--	105	
Output Over-voltage Protection			110	120	130	
Output Over-current Protection			110	135	160	%Io
Short-circuit Protection			Hiccup, continuous, self-recovery			

Note:
①The "Tip and barrel" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information;
②Ripple & noise value less than 5% Vo when with 0%~5% load;
③The case temperature test points are shown in "Design Reference" Fig. 8.

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation	Electric strength test for 1 minute with a leakage current of 10mA max.	Input - Output	3000	--	--	VAC
		Input - Case	1500	--	--	
		Output - Case	1500	--	--	
Insulation Resistance	Input-output resistance at 500VDC		100	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V		--	600	1000	pF
Shell Operating Temperature Range	See Fig. 1		-40	--	+105	℃
Storage Temperature			-55	--	+125	
Storage Humidity	Non-condensing		5	--	95	%RH
Pin Soldering Resistance Temperature*	Soldering spot is 1.5mm away from case for 10 seconds		--	--	300	℃
	Wave soldering,10 seconds		255	260	265	
Vibration			10-150Hz, 5G, 0.75mm. along X, Y and Z			
Switching Frequency①	PWM mode		--	250	--	kHz
MTBF	MIL-HDBK-217F@25℃		500	--	--	k hours

Note: *The pin resistance temperature is not the actual set temperature of the soldering iron, but the temperature required for a good solder joint. The actual set temperature by the customer needs to be comprehensively set based on the thickness of the PCB, the size of the copper cladding, the power of the soldering iron, and the selection of the soldering iron tip.
①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

Mechanical Specifications

Case Material	Black flame retardant and heat resistant plastic (UL94 V-0), aluminum alloy
Dimensions	57.90 x 36.80 x 12.70 mm
Weight	83.0g (Typ.)

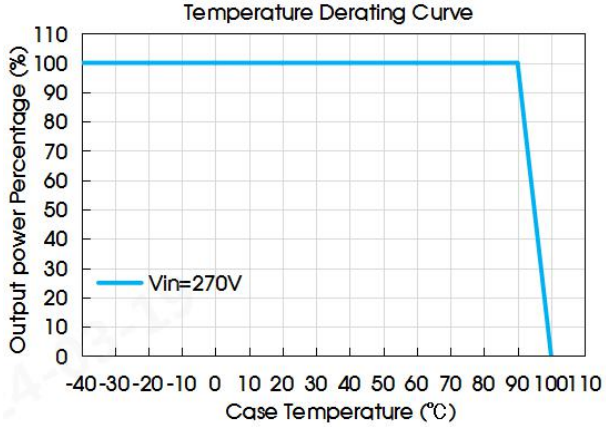
Cooling Method	Natural convection or forced air convection

Electromagnetic Compatibility (EMC)

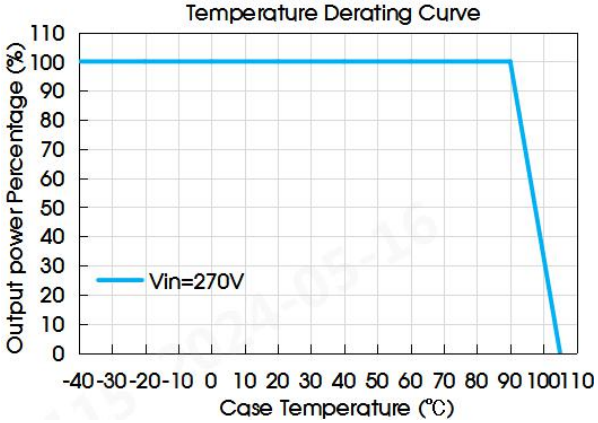
EMI	CE	CISPR32/EN55032	CLASS A (see Fig.6 for recommended circuit)	
	RE	CISPR32/EN55032	CLASS A (see Fig.6 for recommended circuit)	
EMS	ESD	IEC/EN61000-4-2	Air ±8kV/Contact ±6kV (see Fig.4 for recommended circuit)	perf. Criteria B
	RS	IEC/EN61000-4-3	20V/m (see Fig.6 for recommended circuit)	perf. Criteria A
	EFT	IEC/EN61000-4-4	100khz ±2kV (see Fig.6 for recommended circuit)	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2kV (see Fig.6 for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	10 Vr.m.s (see Fig.6 for recommended circuit)	perf. Criteria A

Product Characteristic Curve

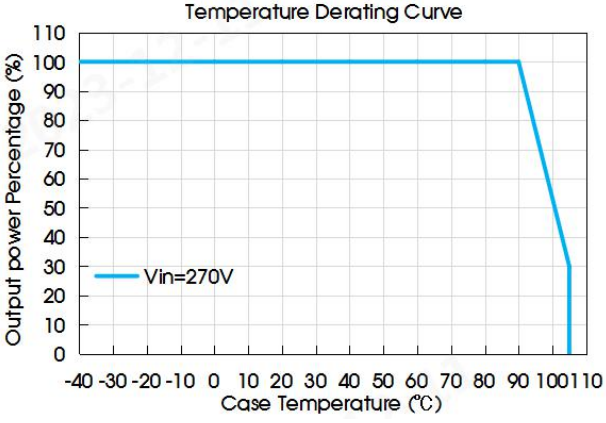
VRF3D05/06QB-200WR3G-N
Temperature Derating Curve



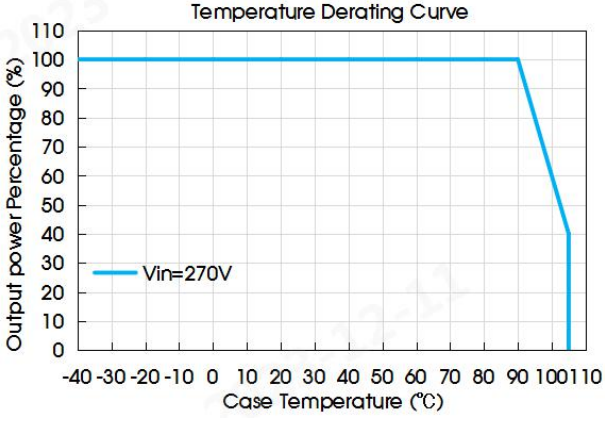
VRF3D12QB-200WR3G-N
Temperature Derating Curve



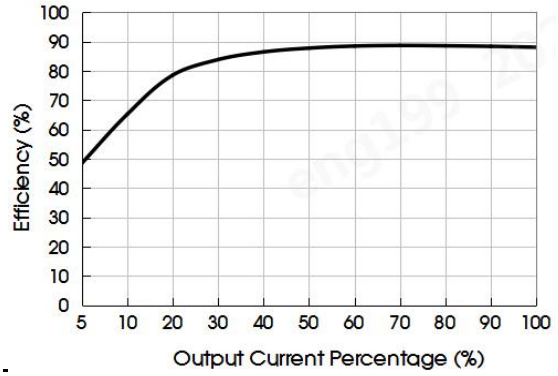
VRF3D24/28QB-200WR3G-N
Temperature Derating Curve



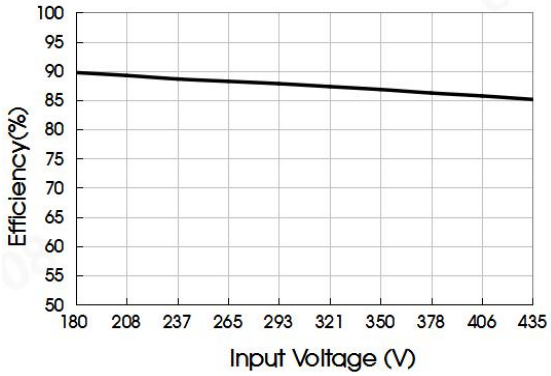
VRF3D48QB-200WR3G-N
Temperature Derating Curve



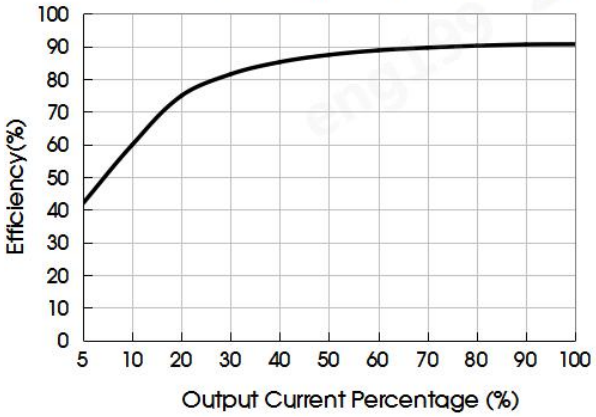
VRF3D05QB-200WR3G-N
Efficiency Vs Output Load (Vin=270V)



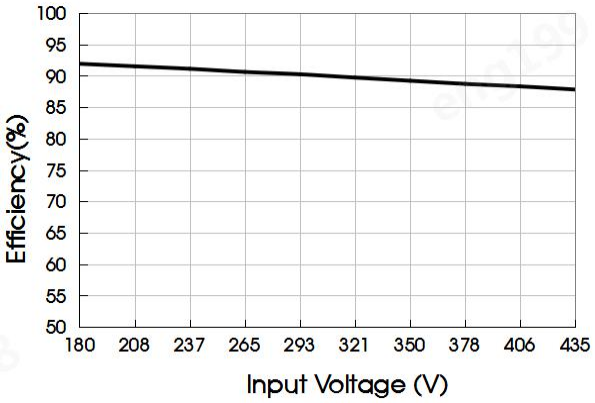
VRF3D05QB-200WR3G-N
Efficiency Vs Input Voltage (Full Load)



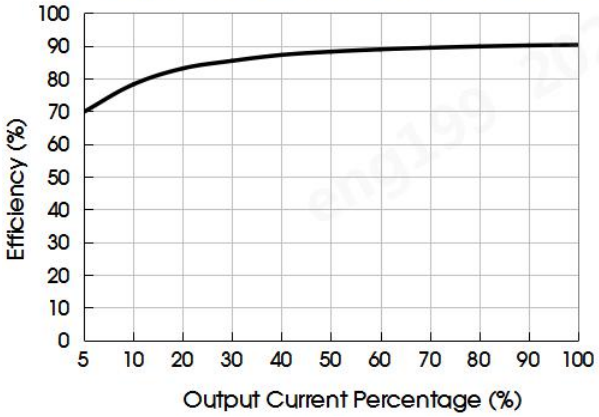
VRF3D12QB-200WR3G-N
Efficiency Vs Output Load (Vin=270V)



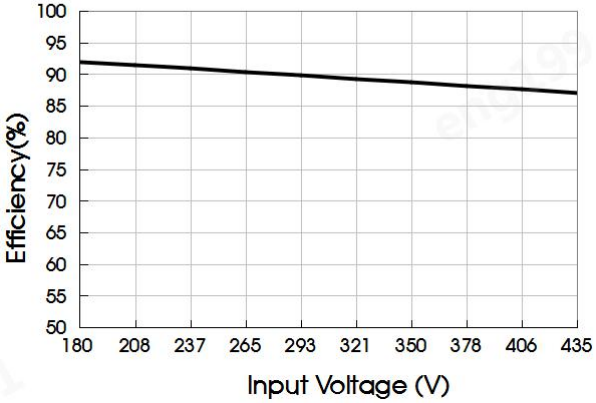
VRF3D12QB-200WR3G-N
Efficiency Vs Input Voltage (Full Load)

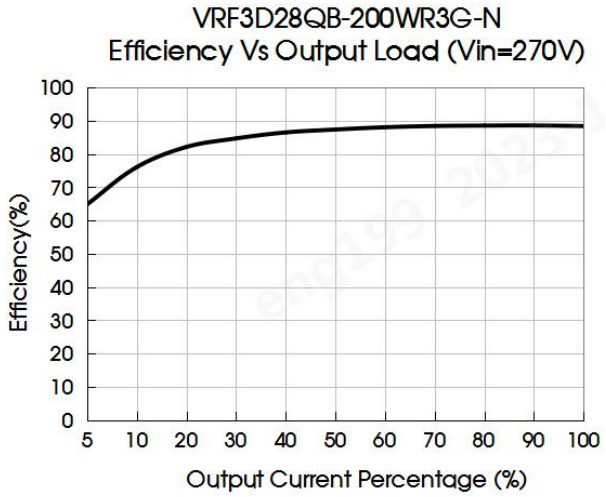


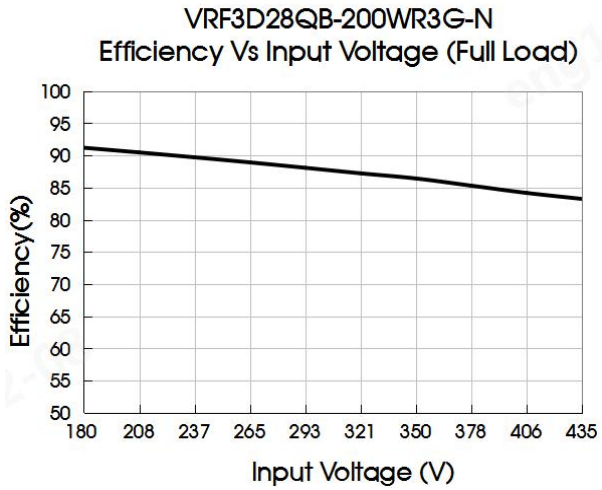
VRF3D24QB-200WR3G-N
Efficiency Vs Output Load (Vin=270V)

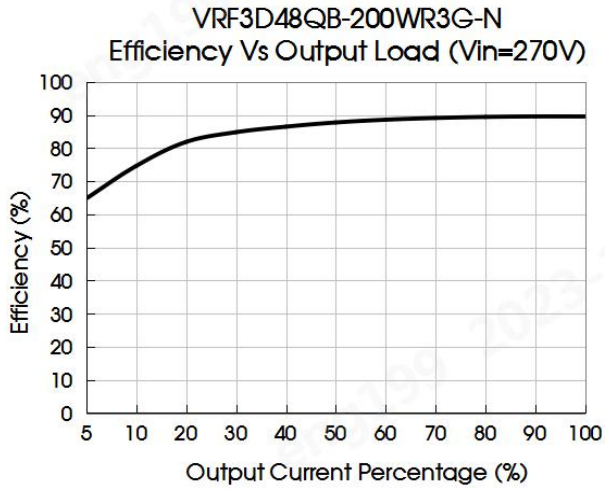


VRF3D24QB-200WR3G-N
Efficiency Vs Input Voltage (Full Load)









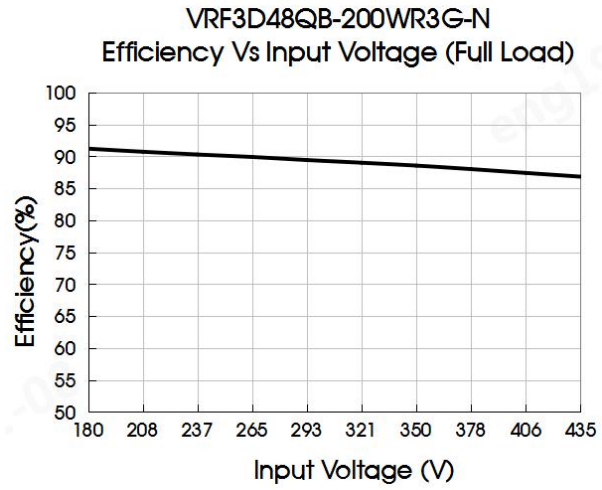


Fig.1

Remote Sense Application

1. Remote Sense Connection if not used

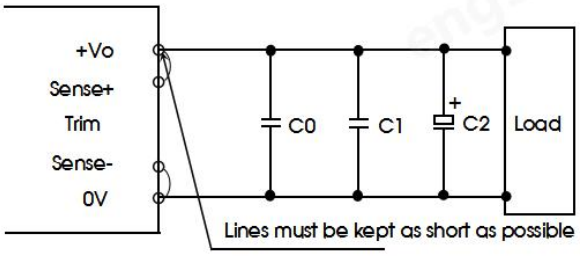


Fig.2

Note：
(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

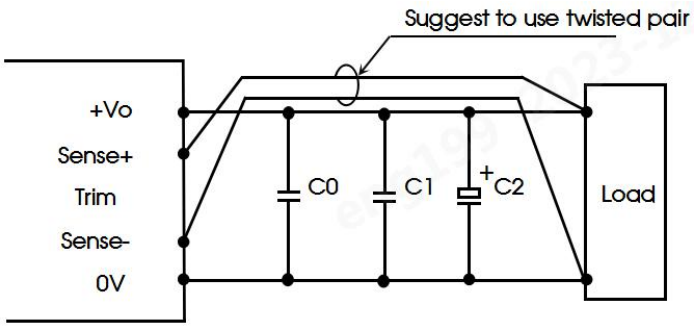


Fig.3

Note:

(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

If the EMC recommended circuit not being used, please be sure to connect an electrolytic capacitor of at least 100uF in parallel with the input terminal to suppress the surge voltage that may be generated at the input terminal, and a capacitor larger than the minimum capacitive load in parallel with the output terminal to stabilise the product output working condition.

All the DC/DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 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.

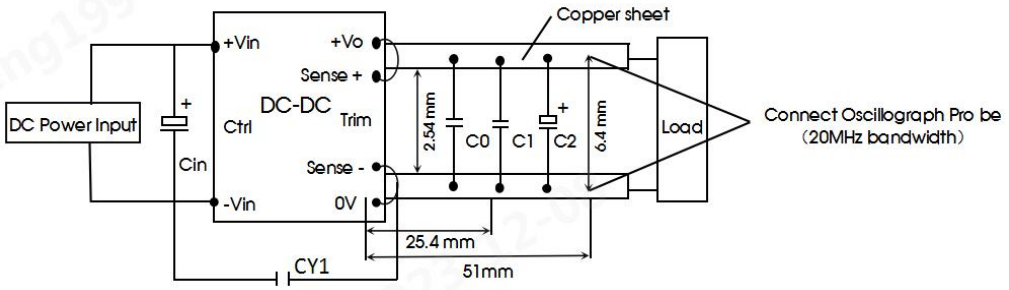


Fig.4

Part No.	Cin Selection Guide	C0 Selection Guide	C1 Selection Guide	C2 Selection Guide	CY1
05V	100uF/500V	22uF/25V	22uF/25V	2000uF/10V Solid-state capacitors	1nF/400VAC Y1 Safety capacitor
06V				2000uF/10V Solid-state capacitors	
12V		4.7uF/100V	4.7uF/100V	1000uF/35V Solid-state capacitors	
24V				470uF/50V Electrolytic capacitor	
28V				470uF/50V Electrolytic capacitor	
48V				470uF/100V Electrolytic capacitor	

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

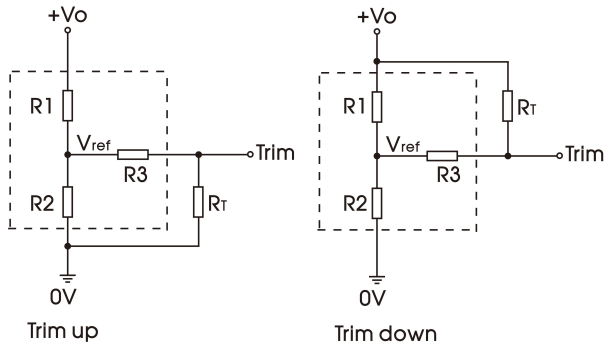


Fig.5
TRIM resistor connection (dashed line shows internal resistor network)

Calculation formula of Trim resistance:

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

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

Note:
a = Self-defined parameter, accurate to two decimal places;
R_T(kΩ): Resistance of Trim.
Vo' is the actual output voltage;
Vref (VDC) indicates the reference voltage.

Vout (VDC)	R1(kΩ)	R2 (kΩ)	R3 (kΩ)	Vref (V)
05	8.7	2.87	11.5	1.25
06	10.91			1.25
12	10.91			2.5
24	24.77			2.5
28	29.41			2.5
48	52.28			2.5

3. EMC compliance circuit

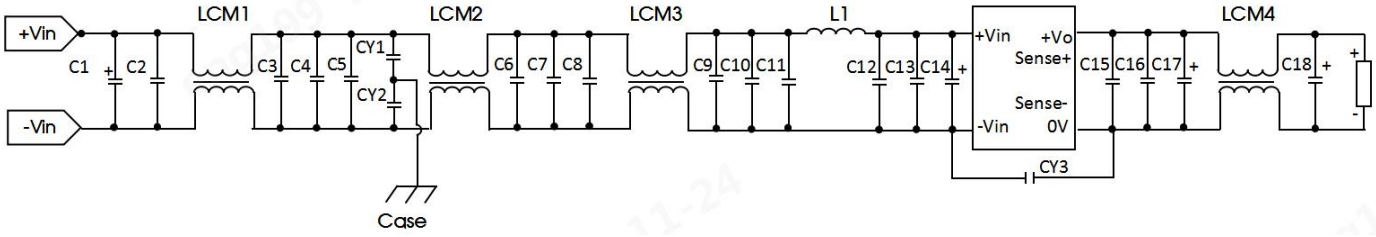


Fig.6

Components	Parameter description:	
	5V/06V/12V Output	24V/28V/48V Output
C1	100uF/500V (Electrolytic capacitor)	
C14	47uF/500V (Electrolytic capacitor)	
C2, C3, C6, C9	2.2μF/450V (Film capacitor)	
C4, C5, C7, C8, C10, C11, C12, C13	0.1μF/630V (Ceramic capacitor)	
C15, C16	1μF/100V (Ceramic capacitor)	
C17, C18	330μF/63V (Electrolytic capacitor)	
LCM1	10mH, Recommended to use MORNSUN P/N:FL2D-30-103B	
LCM2	1mH, Recommended to use MORNSUN P/N:FL2D-50-102	
LCM3	7mH, Recommended to use MORNSUN P/N:FL2D-30-702B	
LCM4	4uH (Nickel zinc), Recommended to use MORNSUN P/N:FL2D-D0-040	
L1	2.2uH/3A	
CY1, CY2	4.7nF/400VAC Y1 Safety capacitor	
CY3	1nF/400VAC Y1 Safety capacitor	NC

4. Reflected ripple current--test circuit

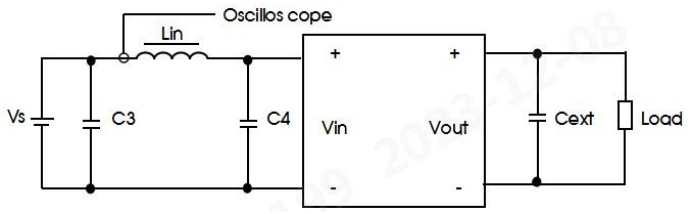


Fig.7

Components	Parameter description:
C3	100uF/500V
Lin	22uH/4.7A
C4	100uF/500V
Cext	See application circuit C0/C1/C2

5. Recommended scheme for thermal testing

In the application process, the thermal design of the product can be evaluated with the product temperature derating curve; or by testing the temperature of point A in Fig.8 to determine the stable working range of the product, when the temperature of point A is lower than 105℃, it is the stable working range of the product.

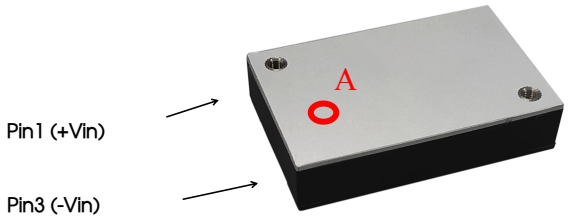
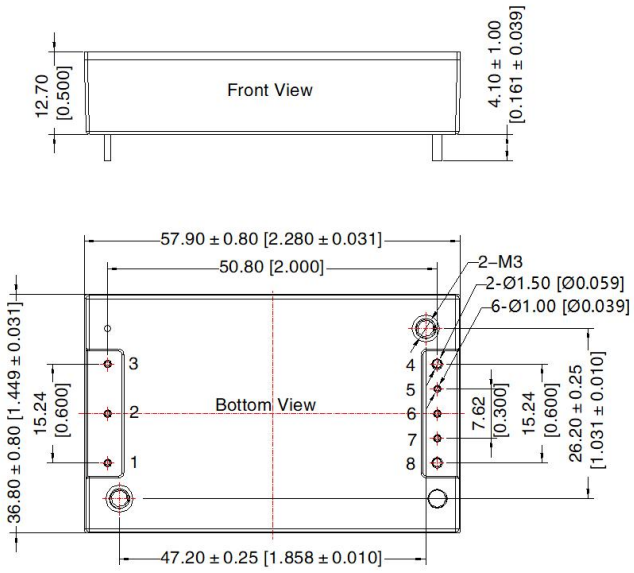


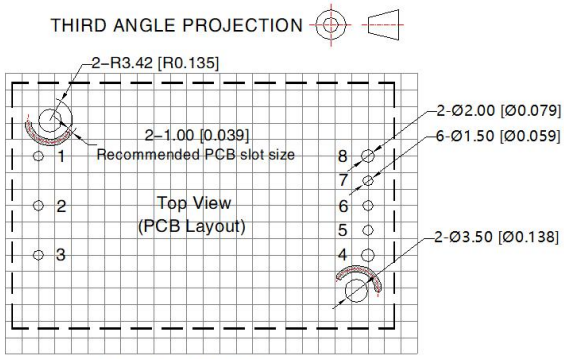
Fig.8

6. The products do not support parallel connection of their output

7. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

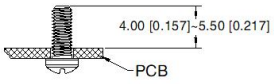
Dimensions and Recommended Layout





Note: Grid 2.54*2.54mm

Recommended screw length



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

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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