

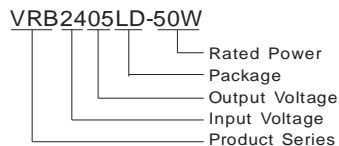
MORNSUN®

VRB_LD-50W Series 50W, WIDE INPUT, ISOLATED & REGULATED SINGLE OUTPUT DIP PACKAGING, DC-DC CONVERTER



Patent Protected RoHS

PART NUMBER SYSTEM



PRODUCT FEATURES

- Efficiency up to 93%
- Ultra wide input range(2:1)
- High and low temperature characteristics
- Output short circuit protection
- Input over- under voltage protection
- Output over current protection
- Output over voltage protection
- 1.5KVDC isolation
- Operating temperature range:
-40°C ~+85°C
- Six-sided metal shield
- Industry standard pinout
- Industrial level specifications
- Good EMC performance
- Inverse polarity protection for A2S (chassis mounting) and A4S (DIN-Rail mounting)

APPLICATION

VRB_LD-50W series offer 50W of output, 18-36VDC, 36-75VDC, single output, and features 1500VDC isolation, Six-sided metal shield, under over current and short circuit protection. All models are particularly suited to tele-communications, industrial, test equipments power etc.

SELECTION GUIDE

Model ①	Input Voltage(VDC)	Output Voltage (VDC)	Output Current (mA)		Input Current (mA)(Typ.)		Reflected Ripple Current (mA,Typ.)	Max. Capacitor Load (μF)	Efficiency ② (% , Typ.) @Max. Load
	Nominal(Range)		Max.	Min.	@Max. Load	@No Load			
VRB2403LD-50W	24 (18-36)	3.3	10000	500	1511	50	40	27000	91
VRB2405LD-50W		5	10000	500	2240	70		18900	93
VRB2412LD-50W		12	4167	208	2240	85		3700	93
VRB2415LD-50W		15	3333	167	2240	85		2000	93
VRB2424LD-50W		24	2083	104	2240	85		1000	93
VRB4803LD-50W	48 (36-75)	3.3	10000	500	756	35	30	27000	91
VRB4805LD-50W		5	10000	500	1120	45		18900	93
VRB4812LD-50W		12	4167	208	1120	50		3700	93
VRB4815LD-50W		15	3333	167	1120	50		2000	93
VRB4824LD-50W		24	2083	104	1120	50		1000	93

Note: ① Series with suffix "H" are heat sink mounting, series with suffix "A2S" are chassis mounting, with suffix "A4S" are DIN-Rail mounting, for example VRB2405LD-50WHA2S is chassis mounting with heat sink, VRB2405LD-50WA4S is DIN-Rail mounting without heat sink. If the application has a higher requirement for heat dissipation, you can choose modules with heat sink.

②The efficiency of "A2S" and "A4S" is approx. 2% lower for the protection of inverse polarity.

INPUT SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit	
Input Surge Voltage(1sec. max.)	24VDC Input	-0.7	--	50	VDC	
	48VDC Input	-0.7	--	100		
Input Under Voltage Protection	Start-up Voltage	24VDC Input	--	18		
		48VDC Input	--	36		
	Under Voltage Shutdown	24VDC Input	16	--		--
		48VDC Input	32	--		--

Input Over Voltage Protection	Start-up Voltage	24VDC Input	--	--	36	VDC
		48VDC Input	--	--	75	
	Over Voltage Shutdown	24VDC Input	40	--	--	
		48VDC Input	81	--	--	
Start-up Time		Nominal input& constant resistance load	--	10	--	ms
Ctrl*	Models ON		Ctrl open or connect TTL high level(3-12VDC)			
	Models OFF		Ctrl connect GND or low level(0-1.2VDC)			
	Input current (Models OFF)		--	6	--	mA
Input Filter		Pi Filter				

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

OUTPUT SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Output voltage Accuracy		--	±1	±3	%
Line Regulation	Full load, Input voltage from low to high	--	±0.2	±0.5	
Load Regulation	5% to 100% load	--	±0.5	±1	
Transient Recovery Time	25% load step change, 0.1A/Us, 0.5mS	--	300	500	
Transient Response Deviation		--	±3	±5	%
Temperature Drift Coefficient	100% load	--	±0.02	--	%/°C
Ripple & Noise*	20MHz bandwidth	--	50	120	mV p-p
Trim		--	±10%	--	VDC
Output Over Voltage Protection	3.3V output	--	3.9	--	
	5V output	--	6.2	--	
	12V output	--	15	--	
	15V output	--	18	--	
Output Over Current Protection		--	150	--	%
Over Temperature Protection	Input voltage range	--	110	--	°C
Output Short Circuit Protection	Continuous, automatic recovery				

Note:* Ripple and noise tested with "parallel cable" method. See detailed operation instructions at *DC-DC Application Notes* .

COMMON SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-Output, tested for 1 minute , leakage current less than 1 mA	1500	--	--	VDC
Isolation Resistance	Input-Output, test at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-Output, 100KHz/0.1V	--	1000	--	pF
Switching Frequency	PWM mode	--	320	--	KHz
MTBF	MIL-HDBK-217F @25°C	1000	--	--	K hours
Case Material	Aluminum Alloy				
Size	PCB mounting (without heat sink)	50.8×25.4×11.8			mm
	PCB mounting (with heat sink)	50.8×25.4×16.3			
	A2S chassis mounting (without heat sink)	76.0×31.5×21.2			
	A2S chassis mounting (with heat sink)	76.0×31.5×25.7			
	A4S DIN-Rail mounting (without heat sink)	76.0×31.5×25.8			
	A4S DIN-Rail mounting (with heat sink)	76.0×31.5×30.3			
Weight	PCB mounting (without heat sink)	--	35	--	g
	PCB mounting (with heat sink)	--	43	--	
	A2S chassis mounting (without heat sink)	--	57	--	
	A2S chassis mounting (with heat sink)	--	65	--	
	A4S DIN-Rail mounting (without heat sink)	--	77	--	
	A4S DIN-Rail mounting (with heat sink)	--	85	--	

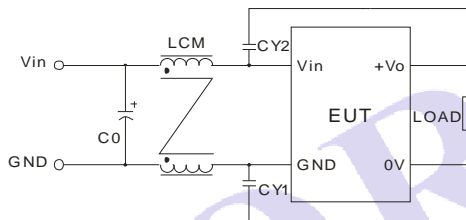
ENVIRONMENTAL SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Storage Humidity	Non condensing	5	--	95	%
Operating Temperature		-40	--	85	°C
Storage Temperature		-55	--	125	
The Max. Case Temperature	Operating Temperature curve range	--	--	105	
Lead Temperature	1.5mm from case for 10 seconds	--	--	300	
Cooling		Free air convection			
Vibrating		10-55Hz, 10G, 30 Min. along X, Y and Z			

EMC SPECIFICATIONS

EMI	CE	CISPR22/EN55022	CLASS B (External Circuit Refer to Figure1 or Figure 3)	
	RE	CISPR22/EN55022	CLASS B (External Circuit Refer to Figure1 or Figure 3)	
EMS	ESD	IEC/EN61000-4-2	Contact ±4KV perf. Criteria B	
	RS	IEC/EN61000-4-3	10V/m perf. Criteria A	
	EFT	IEC/EN61000-4-4	±2KV (Recommended Circuit Refer to Figure 1)	perf. Criteria B
		IEC/EN61000-4-4	±4KV (Recommended Circuit Refer to Figure 3)	perf. Criteria B
	Surge	IEC/EN61000-4-5	±2KV (Recommended Circuit Refer to Figure 1)	perf. Criteria B
		IEC/EN61000-4-5	±2KV/±4KV (Recommended Circuit Refer to Figure 3)	perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A
Voltage dips, short and interruptions immunity	IEC/EN61000-4-29	0%-70%	perf. Criteria B	

EMC RECOMMENDED CIRCUIT



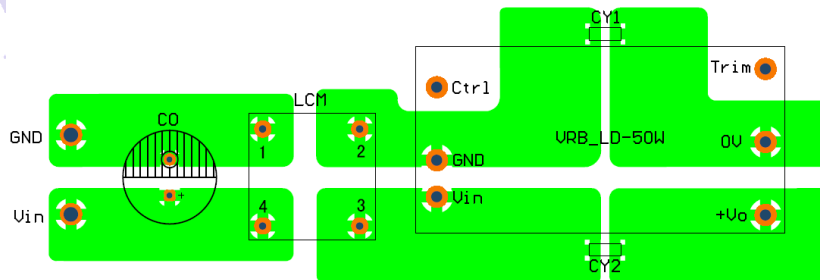
Recommended external circuit parameters:

Model	VRB24XXLD-50W	VRB48XXLD-50W
C0	330μF/50V	330μF/100V
LCM	2.2mH(FL2D-30-222)	2.2mH(FL2D-30-222)
CY1,CY2	1nF/2KV	1nF/2KV

(Figure 1)

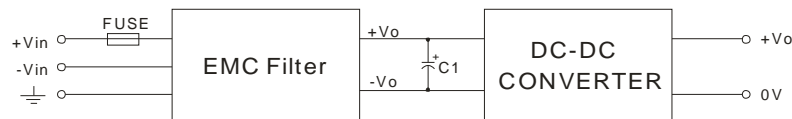
Note: The external recommended circuit of EMS test section of figure 1 can be used for transient pulse protection and EMI filtering. Choose according to requirements.

EMC RECOMMENDED CIRCUIT PCB LAYOUT



(Figure 2)

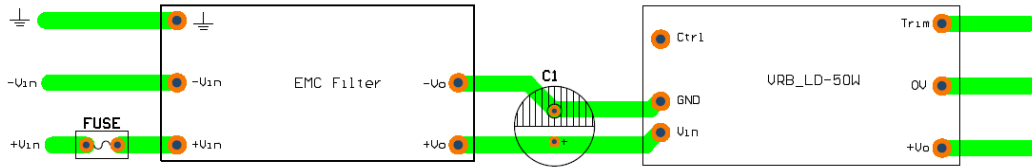
EMC MODULE APPLICATION CIRCUIT



(Figure 3)

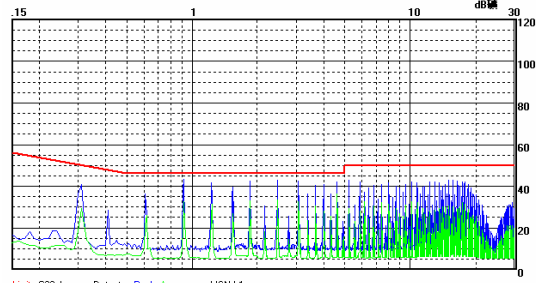
Note: EMC Filter (FC-D03D is applied to input voltage for ranging 18-36VDC.FC-E03D is applied to input voltage for ranging 36-75VDC). C1: The capacitor C1 can enhance the voltage dips, short and interruptions immunity.

EMC MODULE RECOMMENDED CIRCUIT PCB LAYOUT

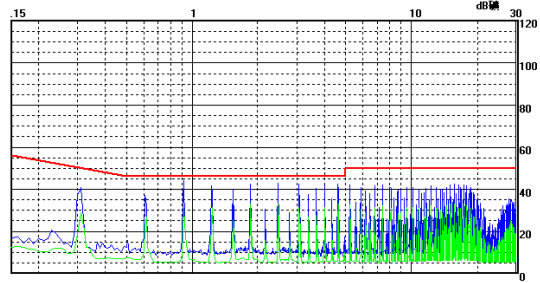


(Figure 4)

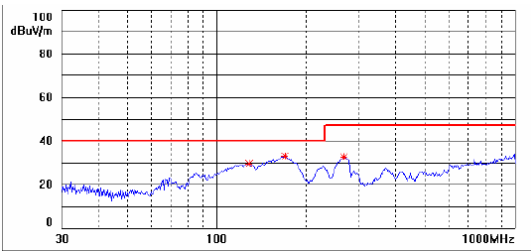
EMI TEST WAVEFORM (RECOMMENDED CIRCUIT FIGURE 1)



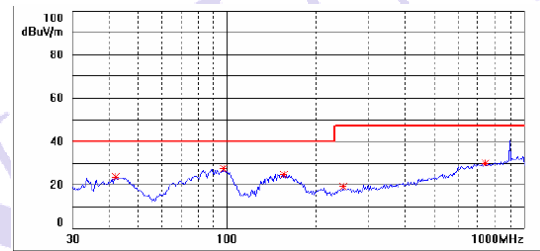
VRB-LD-50W CE (Class B, Positive line)



VRB-LD-50W CE (Class B, Negative line)



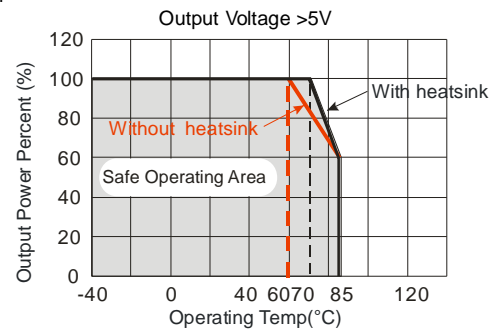
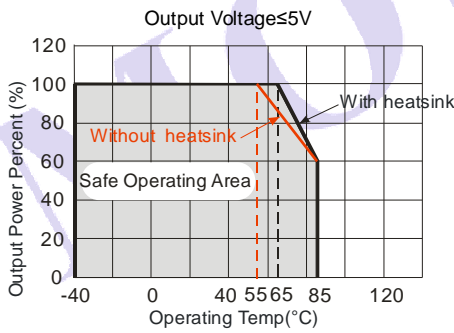
VRB-LD-50W RE (Class B, Horizontal)



VRB-LD-50W RE (Class B, Vertical)

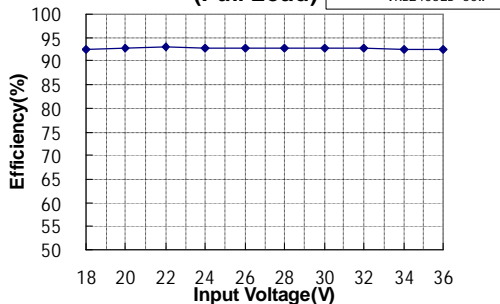
PRODUCT TYPICAL CURVE

Temperature Derating Graph

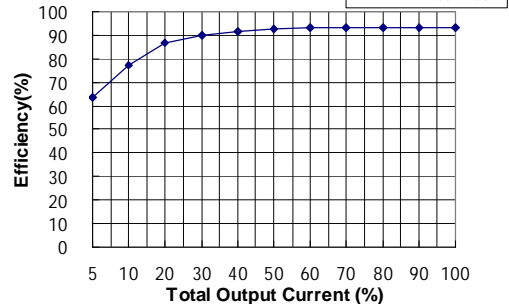


(Figure 5)

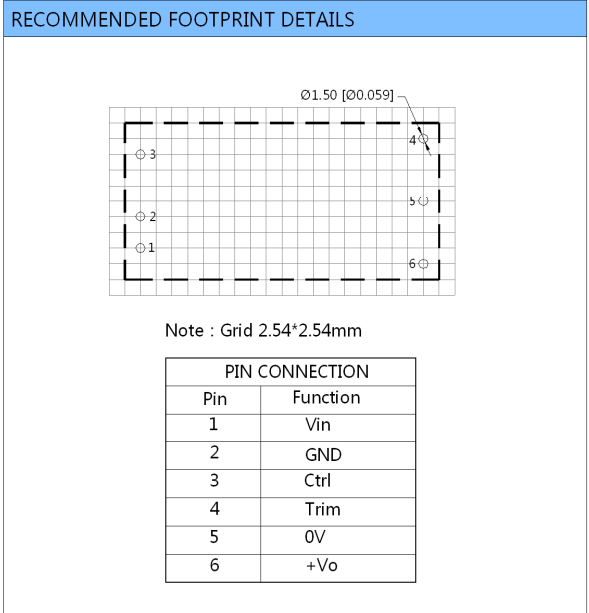
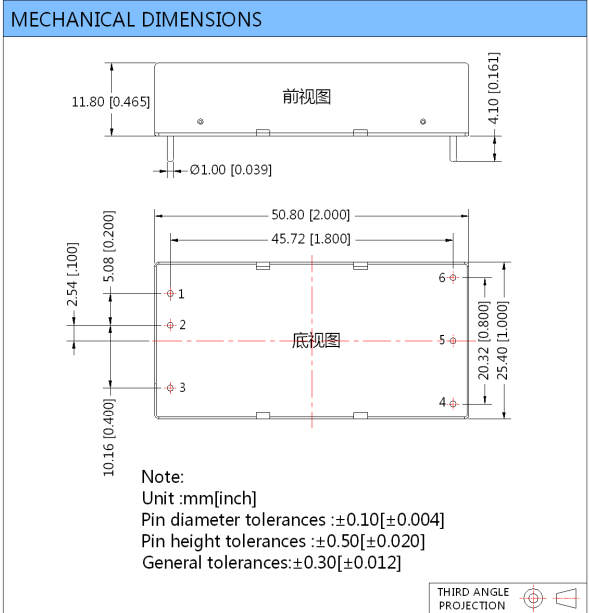
Efficiency VS Input Voltage curve (Full Load)



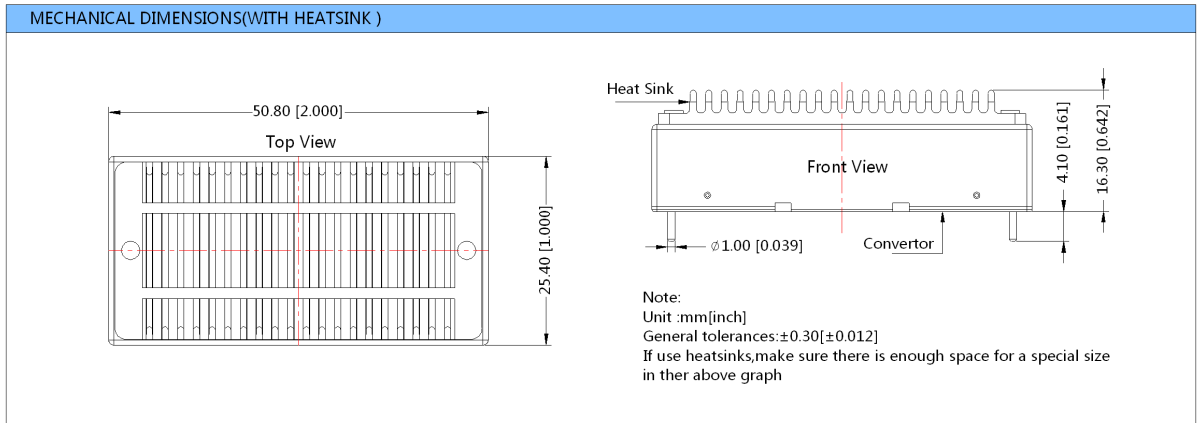
Efficiency VS Output Load curve (Vin=Vin-nominal)



URB_YMD-20W PCB MOUNTING OUTLINE DIMENSIONS,RECOMMENDED FOOTPRINT (WITHOUT HEAT SINK)



VRB-LD-50WHR2 PCB MOUNTING OUTLINE DIMENSIONS(WITH HEAT SINK)

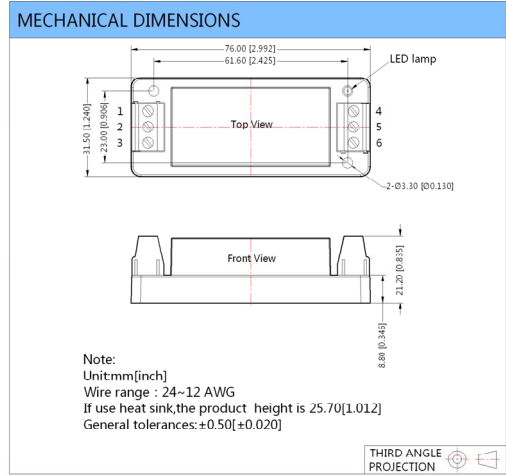


VRB_LD-50WA2S CHASSIS MOUNTING OUTLINE DIMENSIONS



Footprint Details

Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo



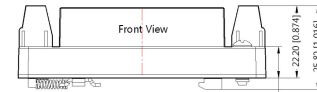
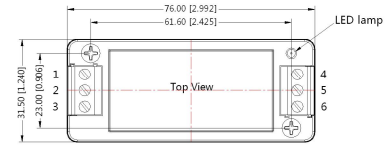
VRB_LD-50WA4S DIN-RAIL MOUNTING OUTLINE DIMENSIONS



DIN-rail modules are fitting to TS35 rails

Footprint Details						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo

MECHANICAL DIMENSIONS



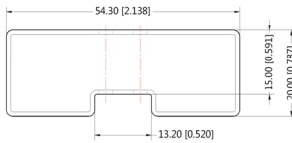
Note:
Unit:mm[inch]
Wire range : 24~12 AWG
If use heat sink,the product height is 30.30[1.193]
General tolerances:±0.50[±0.020]

THIRD ANGLE PROJECTION

PACKAGE DIAGRAM

PCB mounting Series (Without heat sink)

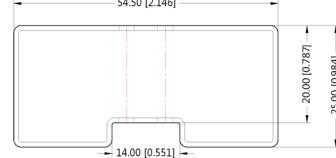
TUBE PACKAGING DIMENSIONS (WITHOUT HEATSINK)



Note:
Unit :mm[inch]
General tolerances :±0.50[±0.020]
L=230[9.055] Tube Quantity:7 pcs
Inner carton(S): L*W*H=255*170*80
Outer carton(S): L*W*H=375*280*270, 6 inner cartons(S)

PCB mounting Series (With heat sink)

TUBE PACKAGING DIMENSIONS (WITH HEATSINK)



Note:
Unit :mm[inch]
General tolerances :±0.50[±0.020]
L=220[8.661] Tube Quantity:7 pcs
Inner carton(S): L*W*H=255*170*80
Outer carton(S): L*W*H=375*280*270, 6 inner cartons(S)

Special Package Series (A2S/A4S)

PACKAGE DIAGRAM

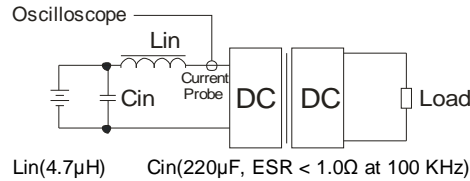


Note:
Unit:mm[inch]
Inner carton dimensions L*W*H=365*350*105
Packaging quantity : 48 PCS
Outer carton dimensions: L*W*H=390*360*245
Packaging quantity : 96 PCS

TEST CONFIGURATIONS

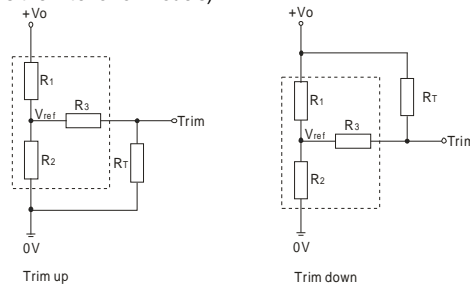
Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.



TRIM APPLICATION & TRIM RESISTANCE

Application circuit for TRIM (Part in broken line is the interior of models)



Formula for resistance of Trim

$$\begin{aligned} \text{up: } R_T &= \frac{aR_2}{R_2-a} - R_3 & a &= \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{aR_1}{R_1-a} - R_3 & a &= \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

Note: Value for R1, R2, R3, and Vref refer to the above table 1.

R_T: Resistance of Trim

a: User-defined parameter, no actual meanings.

V_o: The trim up/down voltage.

(TABLE 1)

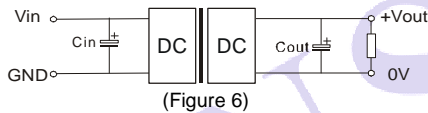
Vo Parameter	3.3(VDC)	5(VDC)	12(VDC)	15(VDC)	24(VDC)
R1(KΩ)	4.788	2.87	11	15	20
R2(KΩ)	2.87	2.87	2.87	3	2.308
R3(KΩ)	15	12.1	22	22	15
Vref(V)	1.24	2.5	2.5	2.5	2.5

DESIGN CONSIDERATIONS

① Recommended circuit

All the VRB_LD-50W Series have been tested according to the following recommended testing circuit before leaving factory. This series should be tested under load. Never be tested under no load (see Figure 6).

If you want to further decrease the input surge voltage and the output ripple, you can increase a capacitance properly or choose capacitors with low ESR. It should also be noted that the capacitance of filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the recommended capacitance of its filter capacitor sees (Table 2).



EXTERNAL CAPACITOR TABLE (TABLE 2)

Output Voltage	Capacitance Cout(μF)	Cin(μF)
3.3V,5V	220	100
12V,15V	100	
24V	47	

② It is not recommended to increase the output power capability by connecting two or more converters in parallel. The product is not hot-swappable.

Note:

1. Min. load shouldn't be less than 5%, otherwise ripple maybe increased dramatically, If the product operates under min. load, it may not be guaranteed to meet all specifications listed. Operation under minimum load will not damage the converter.
2. Recommended Dual output models unbalanced load is $\leq \pm 5\%$, If the product operates $> \pm 5\%$, it may not be guaranteed to meet all specifications listed. Please contact our technical support for more details.
3. Max. Capacitive Load is tested at input voltage range and full load.
4. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
5. In this datasheet, all test methods are based on our corporate standards.
6. All characteristics are for listed models, and non-standard models may perform differently. Please contact our technical support for more details.
7. Please contact our technical support for any specific requirement.
8. Specifications of this product are subject to changes without prior notice.

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