

30W, Wide input, isolated & regulated single output DC/DC converter



CE Patent Protection **RoHS**

FEATURES

- wide input voltage range (2:1)
- High efficiency up to 90% with full load
- No-load power consumption as low as 0.14W
- Isolation voltage: 1.5K VDC
- Output short circuit, over-voltage, over-current protection
- Operating temperature range: -40°C to +80°C
- Meet CISPR22/EN55022 CLASS A, without external components
- Six-sided metal shielding package
- Reverse voltage protection available with A2S(Chassis mounting) or A4S(35mm DIN-Rail mounting)
- EN60950 approval

VRB_LD-30WR3 series are isolated 30W DC-DC products with 2:1 input voltage. They feature efficiency up to 90%, 1500VDC isolation, operating temperature of -40°C to +80°C, output short circuit protection, over-voltage protection, over-current protection and EMI meets CISPR22/EN55022 CLASS A, which make them widely applied in data transmission device, battery power supply device, tele-communication device, distributed power supply system, remote control system, industrial robot fields. And extension package A2S and A4S also enable them with reverse voltage protection.

Selection Guide

Certification	Part No. ①	Input Voltage (VDC)		Output		Efficiency® (%Min./Typ.) @ Full Load	Max. Capacitive Load(μF)
		Nominal® (Range)	Max. ③	Output Voltage (VDC)	Output Current (mA)(Max./Min.)		
CE	VRB2403LD-30WR3	24 (18-36)	40	3.3	6000/0	83/85	10000
	VRB2405LD-30WR3			5	6000/0	86/88	10000
	VRB2409LD-30WR3			9	3333/0	86/88	4700
	VRB2412LD-30WR3			12	2500/0	88/90	2700
	VRB2415LD-30WR3			15	2000/0	88/90	1680
	VRB2424LD-30WR3			24	1250/0	88/90	680
	VRB4803LD-30WR3	48 (36-75)	80	3.3	6000/0	84/86	10000
	VRB4805LD-30WR3			5	6000/0	86/88	10000
	VRB4812LD-30WR3			12	2500/0	86/88	2700
	VRB4815LD-30WR3			15	2000/0	87/89	1680
VRB4824LD-30WR3	24			1250/0	87/89	680	

Notes: ①Series with suffix "H" are heat sink mounting; series with suffix "A2S" are chassis mounting, with suffix "A4S" are DIN-Rail mounting, for example VRB2405LD-30WHR3A2S is chassis mounting of with heat sink.VRB2405LD-30WR3A4S is DIN-Rail mounting of without heat sink; If the application has a higher requirement for heat dissipation, you can choose modules with heat sink;
 ②A2S (wiring) and A4S (rail) Model due to input reverse polarity protection function, input voltage range the minimum value and starting voltage is higher than 1VDC DIP package;
 ③Absolute maximum rating without damage on the converter, but it isn't recommended;
 ④Efficiency is measured In nominal input voltage and rated output load;A2S (wiring) and A4S (rail) Model due to input reverse polarity protection, minimum efficiency greater than Min.-2 is qualified.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Input Current (full load / no-load)	24VDC nominal input series, nominal input voltage	3.3V output	--	970/60	993/100	mA
		5V output	--	1420/60	1453/100	
		Others	--	1388/6	1453/12	

Input Current (full load / no-load)	48VDC nominal input series, nominal input voltage	3.3V output	--	474/20	485/30	mA
		5V output	--	710/20	726/35	
		Others	--	702/5	726/10	
Reflected Ripple Current	Nominal input voltage	--	40	--		
Surge Voltage (1sec. max.)	24VDC nominal input series	-0.7	--	50	VDC	
	48VDC nominal input series	-0.7	--	100		
Starting Voltage	24VDC nominal input series	--	--	18		
	48VDC nominal input series	--	--	36		
Starting Time	Nominal input voltage & constant resistance load	--	10	--		ms
Input Filter		PI filter				
Hot Plug		Unavailable				
Ctrl *	Module switch on	Ctrl suspended 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	--	5	8		mA

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

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy	5%-100% load	--	±1	±3	%	
	0%-5% load	--	±1	±5		
Line Regulation	Full load, the input voltage is from low voltage to high voltage	--	±0.2	±0.5		
Load Regulation ^①	5%-100% load	--	±0.5	±1		
Transient Recovery Time		--	300	500	μs	
Transient Response Deviation	25% load step change, nominal input voltage	3.3V/5V output	--	±5	±8	%
		Others	--	±3	±5	
Temperature Coefficient	Full load	--	--	±0.03	%/°C	
Ripple & Noise ^②	20MHz bandwidth, nominal input voltage, 100% load	--	50	100	mV p-p	
Trim		--	±10	--	%Vo	
Output Over-voltage Protection		110	--	160		
Output Over-current Protection	Input voltage range	110	--	190	%Io	
Short circuit Protection		Hiccup, Continuous, self-recovery				

Note: ①When testing from 0% to 100% load working conditions, load regulation index of ±5%;
②Ripple 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 lower than 1mA	1500	--	--	VDC
Insulation Resistance	Input-output, insulation voltage 500VDC/60sec., Ta=25°C, humidity=75%RH	1000	--	--	MΩ
Isolation Capacitance	Input-output, 100KHz/0.1V	--	2000	--	pF
Operating Temperature	see Fig. 1 and Fig. 2	-40	--	+80	°C
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	+300	°C
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z			
Switching Frequency *	PWM mode	--	300	--	KHz

MTBF	MIL-HDBK-217F@25°C, Full load(Ground, Benign, controlled environment)	1000	--	--	K hours
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Note: *This series of products using reduced frequency technology, the switching frequency is test value of full load,When the load is reduced to below 50%, the switching frequency decreases with decreasing load.

Physical Specifications

Casing Material	Aluminum alloy	
Package Dimensions	Horizontal package(without heat sink)	50.80*25.40*11.80 mm
	Horizontal package(with heat sink)	50.80*25.40*16.30 mm
	A2S wiring package (without heat sink)	76.00*31.50*21.20 mm
	A2S wiring package(with heat sink)	76.00*31.50*25.10 mm
	A4S rail package(without heat sink)	76.00*31.50*25.80 mm
	A4S rail package(with heat sink)	76.00*31.50*29.70 mm
Weight	without heat sink	Horizontal package/A2S wiring package/A4S rail package 26g/48g/68g(Typ.)
	with heat sink	Horizontal package/A2S wiring package/A4S rail package 34g/56g/76g(Typ.)
Cooling Method	Free air convection	

EMC Specifications

EMI	CE	CISPR22/EN55022	CLASS A (Bare component)/ CLASS B (see Fig.6-② for recommended circuit)
	RE	CISPR22/EN55022	CLASS A (Bare component)/ CLASS B (see Fig.6-② for recommended circuit)
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 (see Fig.6-① for recommended circuit) perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2KV (see Fig.6-①for recommended circuit) perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s perf. Criteria A

Product Characteristic Curve

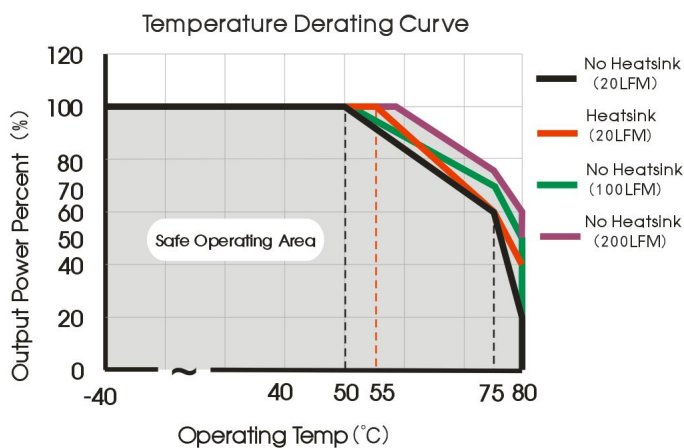


Fig. 3

Apply model: VRB2403LD-30W(H)R3, VRB2405LD-30W(H)R3, VRB4803LD-30W(H)R3, VRB4805LD-30W(H)R3

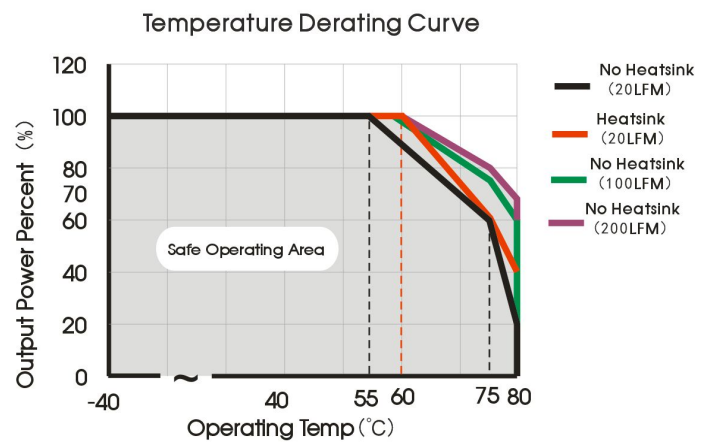
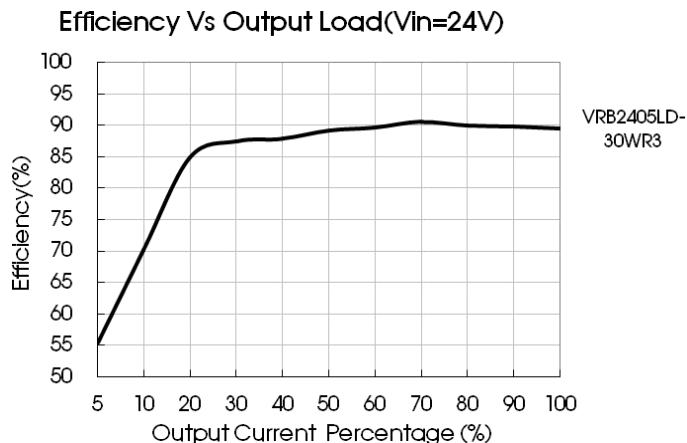
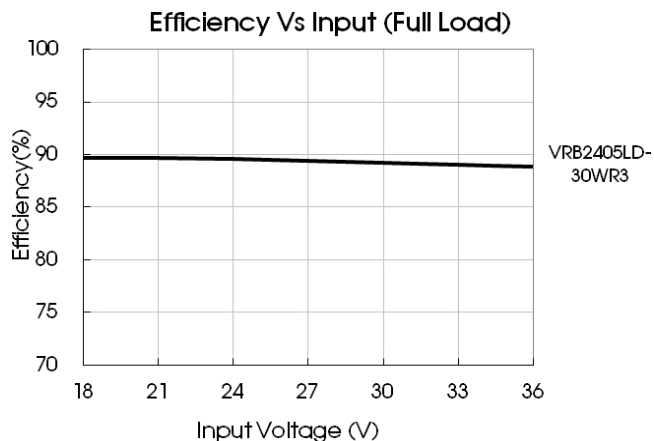


Fig. 4

Apply model: VRB2409LD-30W(H)R3, VRB2412LD-30W(H)R3, VRB2415LD-30W(H)R3, VRB2424LD-30W(H)R3, VRB4812LD-30W(H)R3, VRB4815LD-30W(H)R3, VRB4824LD-30W(H)R3



Design Reference

1. Typical application

All the DC/DC converters of this series are tested according to the recommended circuit (see Fig. 5) before delivery. If it is required to further reduce input and output ripple, properly increase the input & output of additional capacitors C_{in} and C_{out} or select capacitors of low equivalent impedance provided that the capacitance is no larger than the max. capacitive load of the product.



Fig. 5

output voltage (VDC)	C_{out} (μF)	C_{in} (μF)
3.3/5/9	220	100
12/15/24	100	

2. EMC solution-recommended circuit

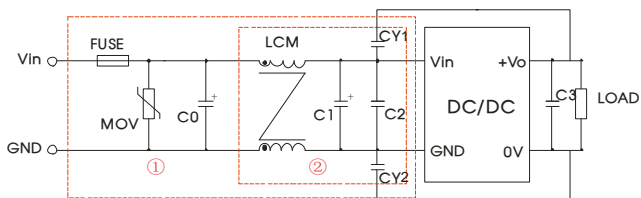


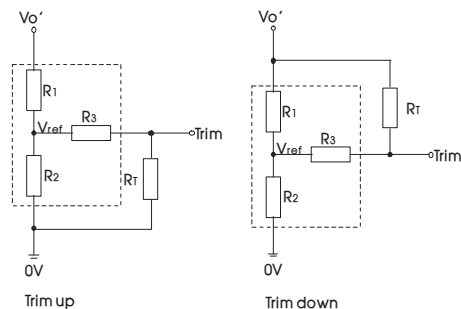
Fig. 6

Notes: Part ① in the Fig. 6 is used for EMS test and part ② for EMI filtering; selected based on needs.

Parameter description

Model	$V_{in}:24V$	$V_{in}:48V$
FUSE	Choose according to actual input current	
MOV	S20K30	S14K60
C0	680 μF /50V	330 μF /100V
C1	330 μF /50V	330 μF /100V
C2	4.7 μF /50V	2.2 μF /100V
C3	Refer to the C_{out} in Fig.5	
LCM	1mH, recommended to use MORNSUN's FL2D-30-102s	
CY1、CY2	1nF/2KV	

3. Application of Trim and calculation of Trim resistance



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

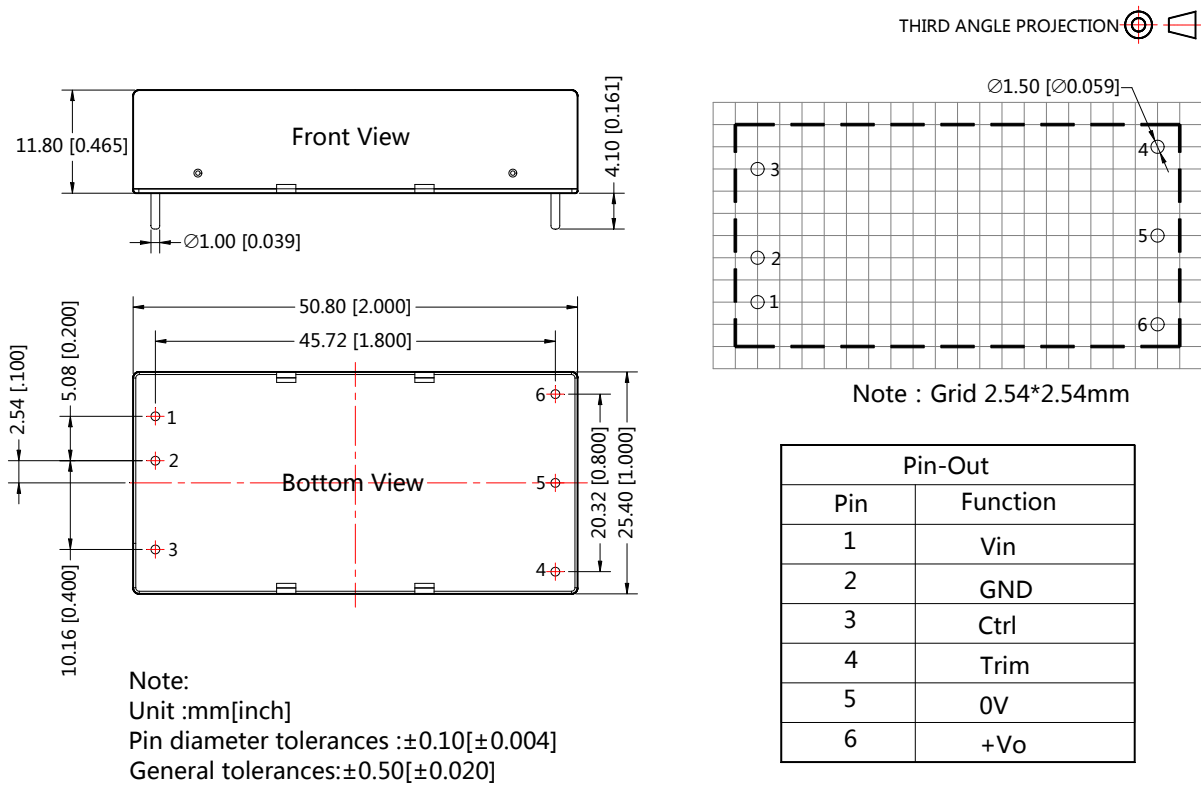
Calculation formula of Trim resistance:

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

Vout(VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	4.801	2.87	12.4	1.24
5	2.883	2.87	10	2.5
9	7.500	2.87	15	2.5
12	11.000	2.87	15	2.5
15	14.494	2.87	15	2.5
24	24.872	2.87	17.8	2.5

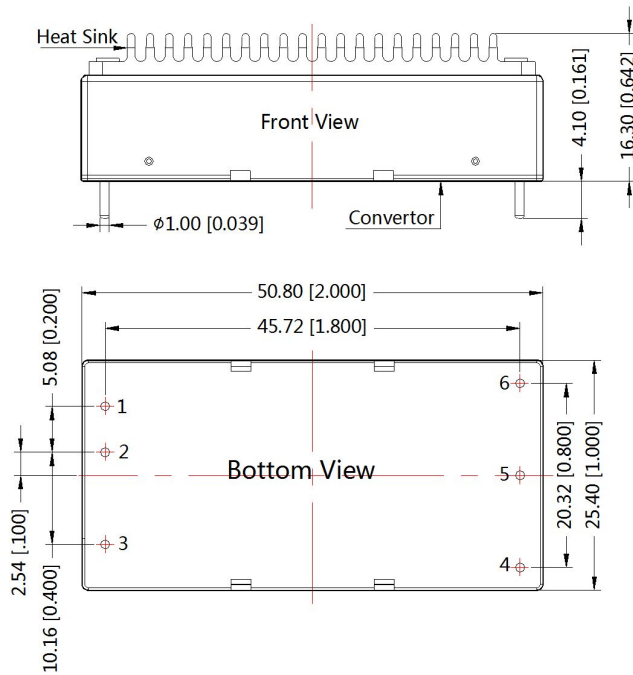
- It is not allowed to connect modules output in parallel to enlarge the power
- For more information please find DC-DC converter application notes on www.mornsun-power.com

Horizontal Package (without heat sink) Dimensions and Recommended Layout



Horizontal Package (with heat sink) Dimensions

THIRD ANGLE PROJECTION

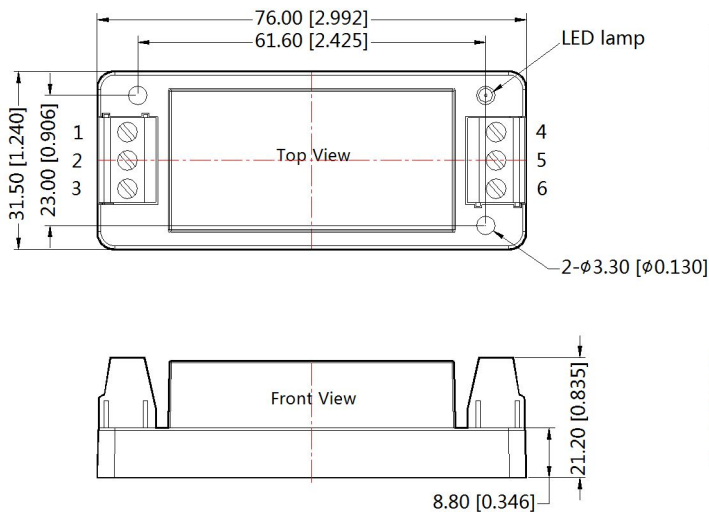


Pin-Out	
Pin	Function
1	Vin
2	GND
3	Ctrl
4	Trim
5	0V
6	+Vo

Note:
Unit: mm[inch]
General tolerances: $\pm 0.50[\pm 0.020]$
If use heatsinks, make sure there is enough space for a special size in their above graph

VRB_LD-30WR3A2S(without heat sink) Dimensions

THIRD ANGLE PROJECTION

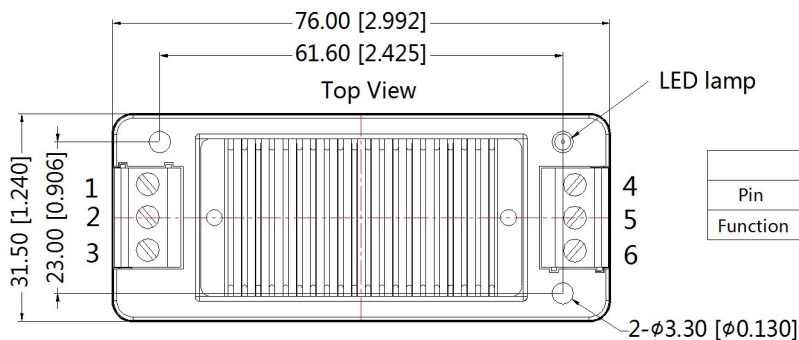


Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo

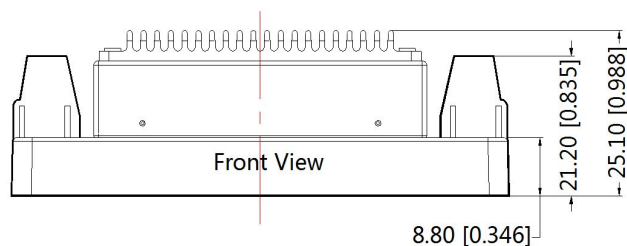
Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: $\pm 0.50[\pm 0.020]$

VRB_LD-30WR3A2S(with heat sink) Dimensions

THIRD ANGLE PROJECTION 



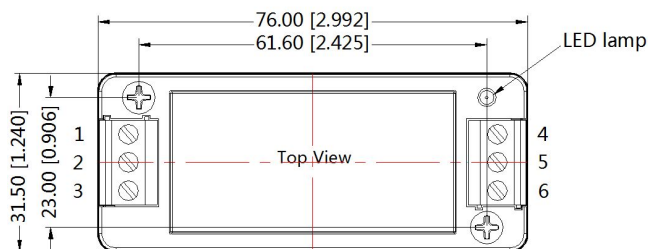
Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo



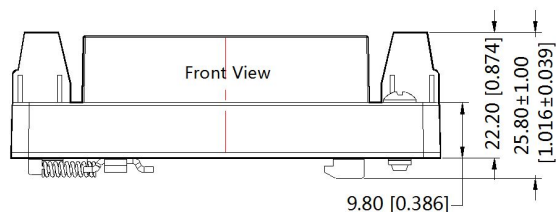
Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±0.50[±0.020]

VRB_LD-30WR3A4S(without heat sink) Dimensions

THIRD ANGLE PROJECTION 



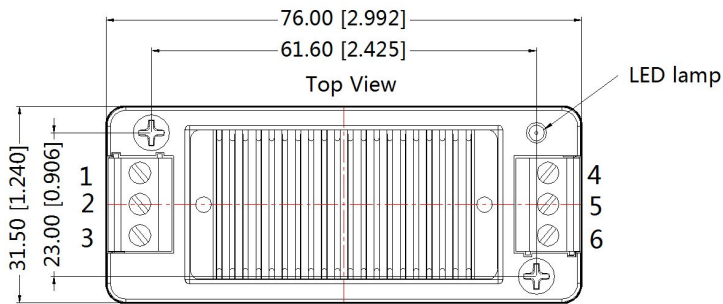
Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo



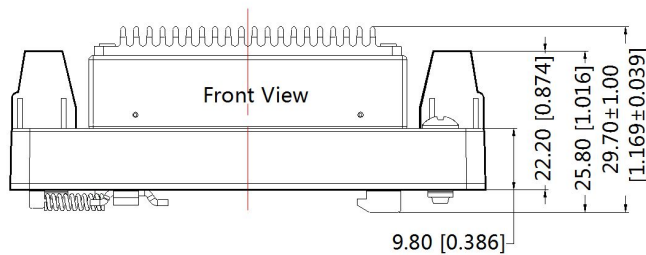
Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±0.50[±0.020]

VRB_LD-30WR3A4S(with heat sink) Dimensions

THIRD ANGLE PROJECTION 



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



Note:
Unit: mm[inch]
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±0.50[±0.020]

Notes:

1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Horizontal Packing Bag Number: 58200035(without heat sink), 58200051(with heat sink), A2S/A4S Packing Bag Number: 58220022;
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 $T_a=25^{\circ}\text{C}$, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on Company's corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Specifications are subject to change without prior notice.

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