

# DC/DC Converter

## VRA(B)\_LD-15WR2 & VRA(B)\_LD-20WR2 Series

# MORNSUN®

15W&20W, wide input isolated & regulated dual / single output DC/DC converter



## FEATURES

- Wide range of input voltage (2:1)
- Efficiency up to 90%
- Isolation voltage : 1.5K VDC
- Output over-voltage, over-current and short circuit protection
- Operating temperature range: -40°C to +85°C
- Six-sided metal shielding package
- Meet CISPR22/EN55022 CLASS A
- A2S (wring mounting) and A4S (35mm rail mounting) products featuring anti-reverse connection for input
- Meet EN60950
- International standard pin-out

Patent Protection RoHS



VRA(B)\_LD-15WR2 & VRA(B)\_LD-20WR2 series are applied to wide voltage range input situation such as data transmission device, battery power supply device, telecommunication device, distributed power supply system, remote control system, industrial robot system etc.

## Selection Guide

Certification	Part No. ①	Input Voltage (VDC)		Output		Efficiency ② (%.Min./Typ.) @ Full Load	Max. Capacitive Load ③ (μF)
		Nominal (Range)	Max. ②	Output Voltage (VDC)	Output Current (mA)(Max./Min.)		
CE	VRA1205LD-15WR2	12 (9-18)	20	±5	±1500/±75	84/86	1020
	VRA1212LD-15WR2			±12	±625/±32	86/88	495
	VRA1215LD-15WR2			±15	±500/±25	86/88	165
	VRA1224LD-15WR2			±24	±313/±16	86/88	200
	VRB1203LD-15WR2			3.3	4000/200	85/87	10500
	VRB1205LD-15WR2			5	3000/150	87/89	4020
	VRB1212LD-15WR2			12	1250/63	87/89	1035
	VRB1215LD-15WR2			15	1000/50	87/89	705
	VRB1224LD-15WR2			24	625/32	88/90	250
	VRA2405LD-15WR2	24 (18-36)	40	±5	±1500/±75	84/86	1020
	VRA2412LD-15WR2			±12	±625/±32	86/88	495
	VRA2415LD-15WR2			±15	±500/±25	86/88	165
	VRA2424LD-15WR2			±24	±313/±16	86/88	200
	VRB2403LD-15WR2			3.3	4000/200	86/88	10500
	VRB2405LD-15WR2			5	3000/150	88/90	4020
	VRB2412LD-15WR2			12	1250/63	87/89	1035
	VRB2415LD-15WR2			15	1000/50	88/90	705
	VRB2424LD-15WR2			24	625/32	88/90	250
	VRA4805LD-15WR2	48 (36-75)	80	±5	±1500/±75	84/86	1020
	VRA4812LD-15WR2			±12	±625/±32	86/88	495
	VRA4815LD-15WR2			±15	±500/±25	86/88	165
	VRA4824LD-15WR2			±24	±313/±16	86/88	200
	VRB4803LD-15WR2			3.3	4000/200	84/86	10500
	VRB4805LD-15WR2			5	3000/150	85/87	4020
VRB4812LD-15WR2	12			1250/63	87/89	1035	

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2015.08.11-B/1

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CE	VRB4815LD-15WR2	48 (36-75)	80	15	1000/50	88/90	705		
	VRB4824LD-15WR2			24	625/32	87/89	250		
	VRA1205LD-20WR2	12 (9-18)	20	±5	±2000/±100	84/86	4800		
	VRA1212LD-20WR2			±12	±834/±42	86/88	800		
	VRA1215LD-20WR2			±15	±667/±34	86/88	500		
	VRA1224LD-20WR2			±24	±417/±21	86/88	300		
	VRB1203LD-20WR2			3.3	5000/250	84/86	18700		
	VRB1205LD-20WR2			5	4000/200	87/89	9600		
	VRB1212LD-20WR2			12	1667/84	87/89	1600		
	VRB1215LD-20WR2			15	1333/67	87/89	1000		
	VRB1224LD-20WR2			24	834/42	88/90	470		
	VRA2405LD-20WR2			24 (18-36)	40	±5	±2000/±100	84/86	4800
	VRA2412LD-20WR2					±12	±834/±42	86/88	800
	VRA2415LD-20WR2					±15	±667/±34	86/88	500
	VRA2424LD-20WR2	±24	±417/±21			86/88	300		
	VRB2403LD-20WR2	3.3	5000/250			84/86	18700		
	VRB2405LD-20WR2	5	4000/200			88/90	9600		
	VRB2412LD-20WR2	12	1667/84			87/89	1600		
	VRB2415LD-20WR2	15	1333/67			88/90	1000		
	VRB2424LD-20WR2	24	834/42			88/90	470		
	VRA4805LD-20WR2	48 (36-75)	80			±5	±2000/±100	84/86	4800
	VRA4812LD-20WR2					±12	±834/±42	86/88	800
	VRA4815LD-20WR2					±15	±667/±34	87/89	500
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	VRB4803LD-20WR2			3.3	5000/250	84/86	18700		
	VRB4805LD-20WR2			5	4000/200	86/88	9600		
	VRB4812LD-20WR2			12	1667/84	87/89	1600		
	VRB4815LD-20WR2			15	1333/67	88/90	1000		
VRB4824LD-20WR2	24			834/42	87/89	470			

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-20WHR2A2S is chassis mounting of with heat sink, VRB2405LD-20WR2A4S 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;  
 ② Absolute maximum rating without damage on the converter, but it isn't recommended;  
 ③ The efficiency of A2S (wiring type) and A4S (rail type) products is 2% lower than the above-mentioned value due to the reverse connection protection for input;  
 ④ The capacitive loads of positive and negative outputs are identical.

### Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit	
Input Current (full load / no-load)	15W	12VDC input	3.3VDC/5VDC output	--	1454/60	1489/75	mA
			others	--	1421/25	1454/40	
		24VDC input	3.3VDC/5VDC output	--	727/35	745/50	
			others	--	717/20	727/35	
		48VDC input	3.3VDC/5VDC output	--	364/35	373/50	
			others	--	356/15	364/25	
Input Current (full load / no-load)	20W	12VDC input	3.3VDC/5VDC output	--	1938/60	1985/75	
			others	--	1896/25	1940/40	
		24VDC input	3.3VDC/5VDC output	--	969/40	992/50	
			others	--	948/20	970/35	
		48VDC input	3.3VDC/5VDC output	--	485/25	497/40	
			others	--	474/10	485/25	

Reflected Ripple Current	12VDC input	--	30	--	
	24VDC input	--	30	--	
	48VDC input	--	30	--	
Input impulse Voltage (1sec. max.)	12VDC input	-0.7	--	25	VDC
	24VDC input	-0.7	--	50	
	48VDC input	-0.7	--	100	
Input Filter		Pi filter			
Starting Time	Nominal input & constant resistance load	--	10	--	ms
Ctrl*	Module switch on	Ctrl suspended or connected to TTL high level (2.5-12VDC)			
	Module switch off	Ctrl pin connected to GND or low level (0-1.2VDC)			
	Input current when switched off	--	1	--	mA
Hot Plug		Unavailable			

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

### Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Positive output	--	±1	±3	
	Negative output				
Balance of Output Voltage	Dual output, balanced load	--	±0.5	±1	%
Line Regulation	Full load, the input voltage is from low voltage to high voltage	--	±0.2	±0.5	
Load Regulation	5%-100% load	--	±0.5	±1	
Cross Regulation	Dual output, main circuit with 50% load, auxiliary circuit with 10%-100% load	--	--	±5	
Transient Recovery Time	25% load step change	--	300	500	
Transient Response Deviation		--	±3	±5	%
Temperature Drift Coefficient	Full load	--	±0.02	--	%/°C
Ripple & Noise *	20MHz bandwidth	--	70	100	mV p-p
Trim		--	±10%Vo	--	VDC
Over-voltage Protection	3.3VDC output	--	3.9	--	
	5VDC output	--	6.2	--	
	12VDC output	--	15	--	
	15VDC output	--	18	--	
	24VDC output	--	30	--	
Over-current Protection	Input voltage range	--	150	--	%
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	
Isolation Voltage	Input-output, with the test time of 1 minute and the leak current lower than 1mA	1500	--	--	VDC	
Isolation Resistance	Input-output, isolation voltage 500VDC	1000	--	--	MΩ	
Isolation Capacitance	Input-output, 100KHz/0.1V	15W	24VDC output	--	2000	pF
			others	--	1000	
		20W	--	1000	--	
Operating Temperature	see Fig. 1	-40	--	+85	°C	
Storage Temperature		-55	--	+125		
Storage Humidity	Non-condensing	5	--	95	%RH	
Max. Casing Temperature	Within the operating temperature curve	--	--	+105	°C	
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	+300		

Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z			
Switching Frequency	PWM mode	--	300	--	KHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	K hours

Physical Specifications

Casing Material		Aluminum alloy			
Dimension	Without heat sink	Horizontal package	50.80*25.40*11.80mm		
		A2S wiring package	76.00*31.50*21.20 mm		
		A4S rail package	76.00*31.50*25.80 mm		
	With heat sink	Horizontal package	50.80*25.40*16.30mm		
		A2S wiring package	76.00*31.50*25.10 mm		
		A4S rail package	76.00*31.50*29.70 mm		
Weight	Without heat sink	Horizontal package/A2S wiring package/A4S rail package		28.00g/50.00g/70.00g(Typ.)	
	With heat sink	Horizontal package/A2S wiring package/A4S rail package		36.00g/58.00g/78.00g(Typ.)	
Cooling Method		Free air convection			

EMC Specifications

EMI	CE	CISPR22/EN55022 CLASS A (Bare component)/ CLASS B (see Fig.3-② for recommended circuit)			
	RE	CISPR22/EN55022 CLASS A (Bare component)/ CLASS B (see Fig.3-② 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.3-① for recommended circuit)	perf. Criteria B	
	Surge	IEC/EN61000-4-5	±2KV (see Fig.3-① for recommended circuit)	perf. Criteria B	
	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A	
	Voltage dips, short interruptions and voltage variations immunity		IEC/EN61000-4-29	0-70%	perf. Criteria B

Product Characteristic Curve

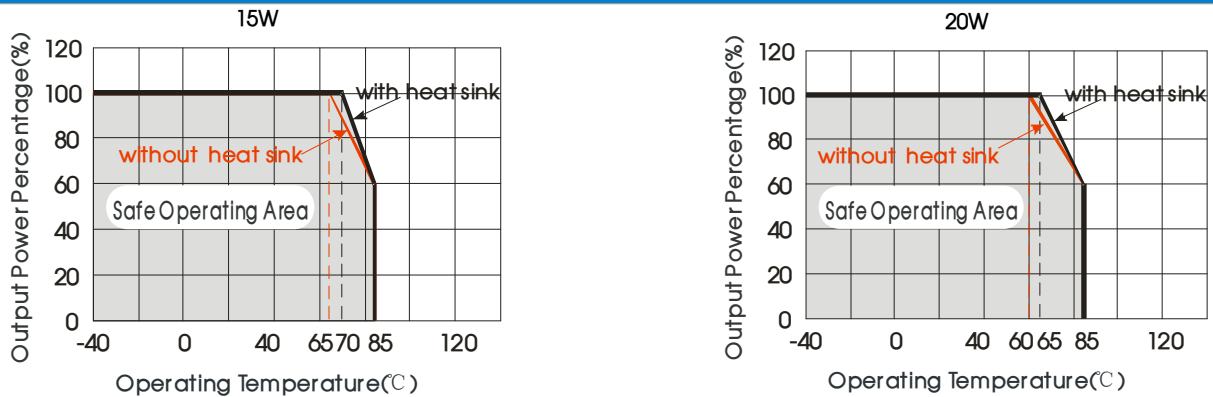
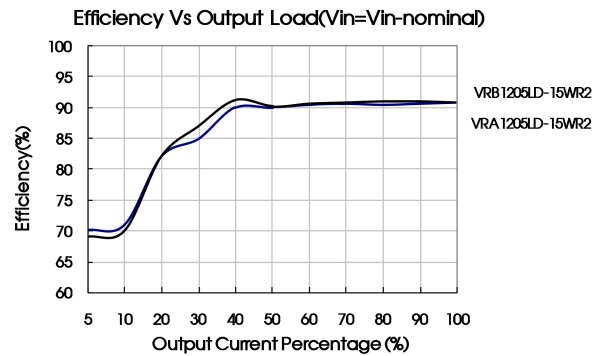
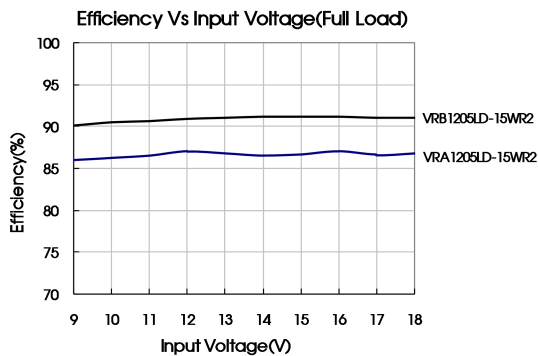
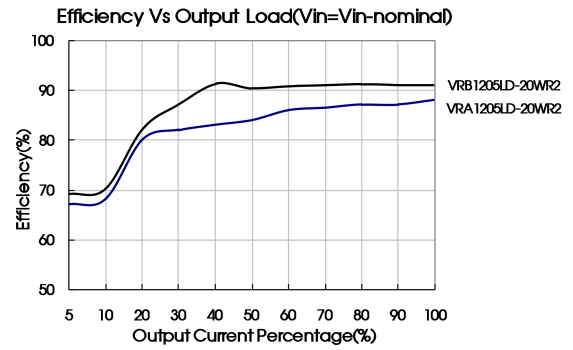
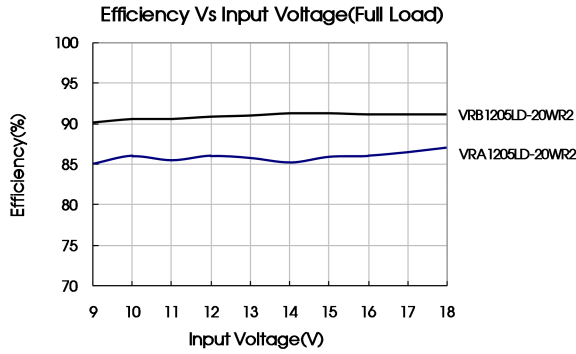


Fig. 1





## Design Reference

### 1. Typical application

All the DC/DC converters of this series are tested according to the recommended circuit (see Fig. 2) 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.

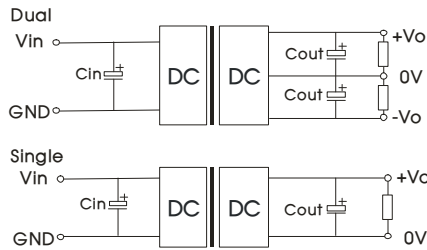


Fig. 2

	Vout(VDC)	$C_{in}(\mu F)$	$C_{out}(\mu F)$
Dual	$\pm 5$	100	220
	$\pm 12/\pm 15$		100
	$\pm 24$		47
Single	3.3/5	100	470
	12/15		220
	24		100

### 2. EMC solution-recommended circuit

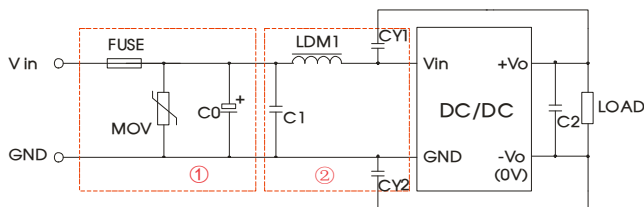


Fig. 3

Notes: Part ① in the Fig. 3 is used for EMS test and part ② for EMI filtering; selected based on needs.

#### Parameter description

型号	Vin:12V	Vin:24V	Vin:48V
FUSE	Choose according to actual input current		
MOV	--	S14K35	S14K60
$C_0$	680 $\mu F$ /25V	330 $\mu F$ /50V	330 $\mu F$ /100V
$C_1$	1 $\mu F$ /50V	1 $\mu F$ /50V	1 $\mu F$ /100V
$C_2$	Refer to the $C_{out}$ in Fig.2		
LDM1	4.7 $\mu H$		
CY1、CY2	1nF/2KV		

### EMC solution-recommended circuit PCB layout

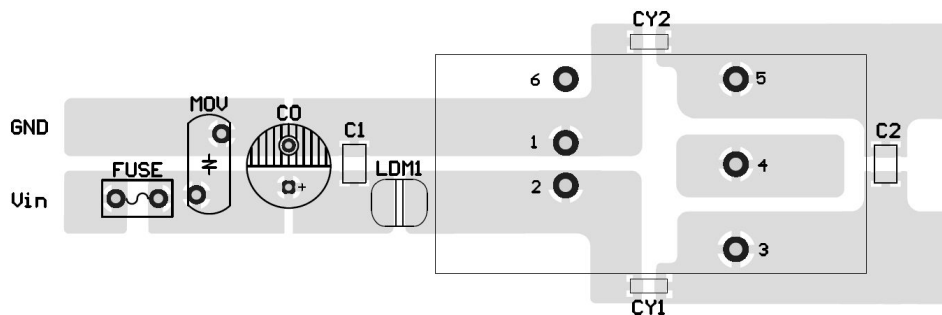
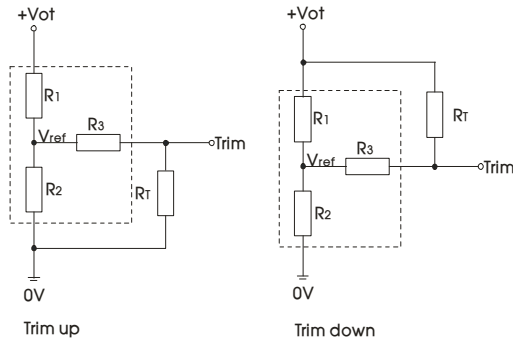


Fig. 4

Note: the min. distance of the bonding pads between input & output isolation capacitors (CY1/CY2) shall be  $\geq 2mm$ .

1. Application of Trim and calculation of Trim resistance



Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{\alpha R_2}{R_2 - \alpha} - R_3 \quad \alpha = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{\alpha R_1}{R_1 - \alpha} - R_3 \quad \alpha = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

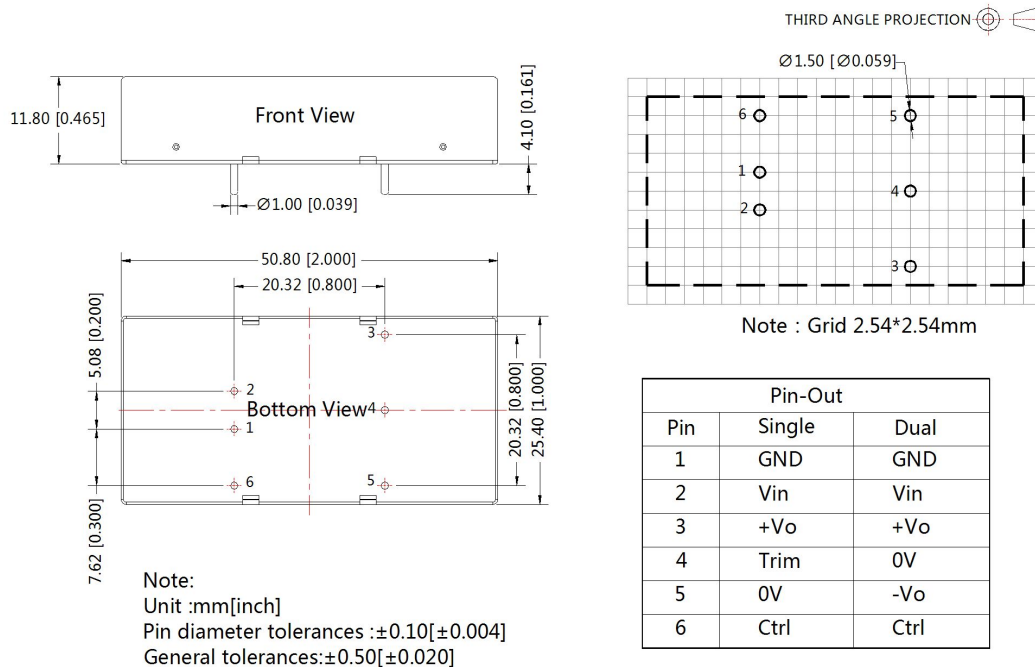
Note: Leave open if not used. R<sub>T</sub>: Resistance of Trim. α: User-defined parameter, no actual meanings.

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

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	4.801	2.863	15	1.24
5	2.883	2.864	10	2.5
12	10.971	2.864	17.8	2.5
15	14.497	2.864	17.8	2.5
24	24.872	2.863	20	2.5

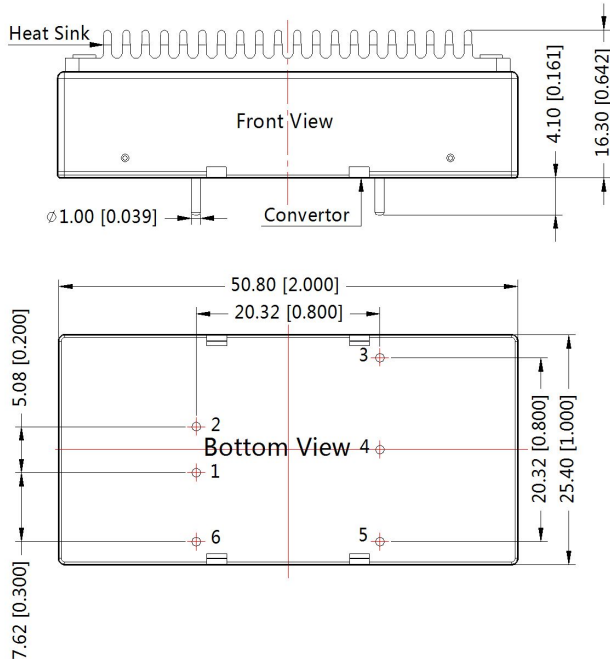
- It is not allowed to connect modules output in parallel to enlarge the power
- For more information about Mornsun EMC Filter products, please visit [www.mornsun-power.com](http://www.mornsun-power.com) to download the Selection Guide of EMC Filter

Dimensions and Recommended Layout(without heatsink)



Dimensions (with heatsink)

THIRD ANGLE PROJECTION 

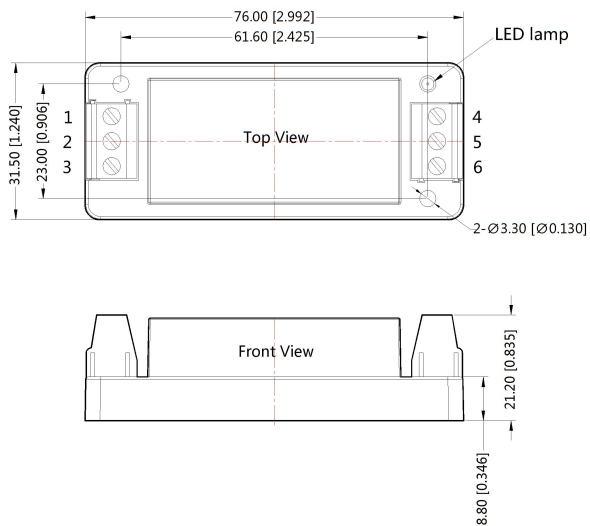


Pin-Out		
Pin	Single	Dual
1	GND	GND
2	Vin	Vin
3	+Vo	+Vo
4	Trim	0V
5	0V	-Vo
6	Ctrl	Ctrl

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

A2S Wiring Package Dimensions(without heatsink)

THIRD ANGLE PROJECTION 

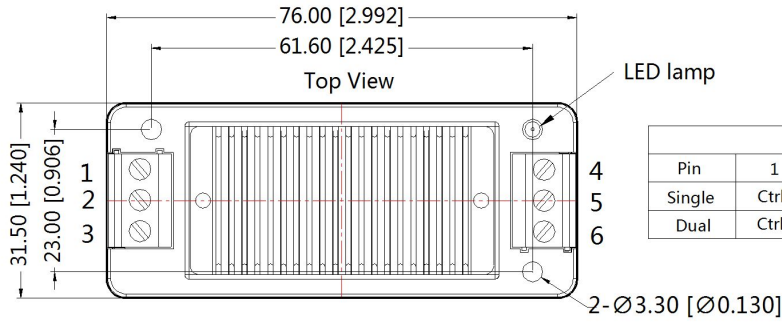


Pin-Out						
Pin	1	2	3	4	5	6
Dual	Ctrl	GND	Vin	-Vo	0V	+Vo
Single	Ctrl	GND	Vin	0V	Trim	+Vo

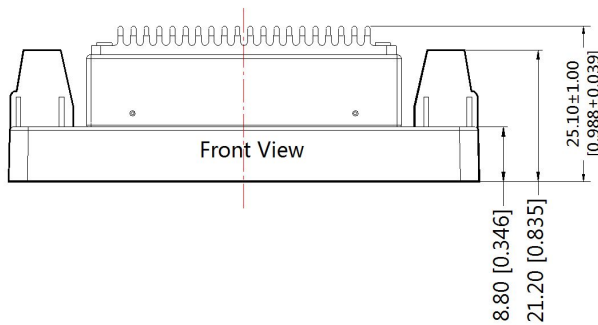
Note:  
Unit:mm[inch]  
Wire range : 24~12 AWG  
General tolerances:±0.50[±0.020]

A2S Wiring Package Dimensions(with heatsink)

THIRD ANGLE PROJECTION 



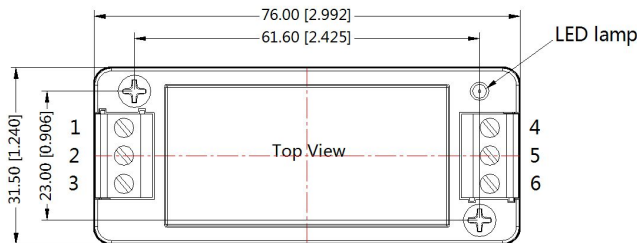
Pin-Out						
Pin	1	2	3	4	5	6
Single	Ctrl	GND	Vin	0V	Trim	+Vo
Dual	Ctrl	GND	Vin	-Vo	0V	+Vo



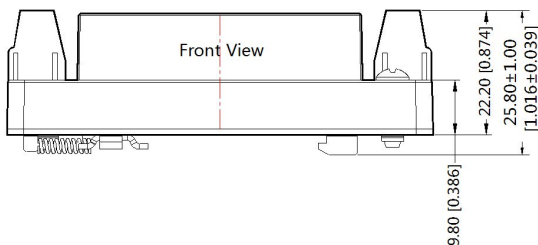
Note:  
Unit:mm[inch]  
Wire range:24~12 AWG  
General tolerances:±0.50[±0.020]

A4S Rail Package Dimensions(without heatsink)

THIRD ANGLE PROJECTION 



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

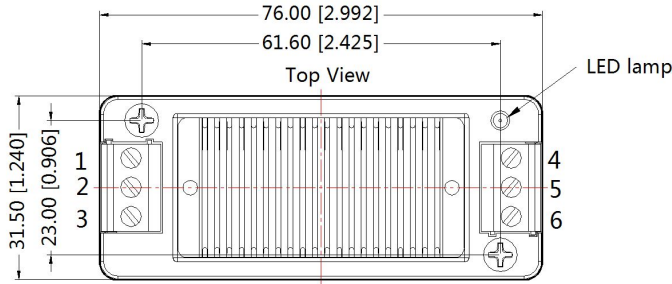


Note:  
Unit:mm[inch]  
Wire range : 24~12 AWG  
General tolerances:±0.50[±0.020]

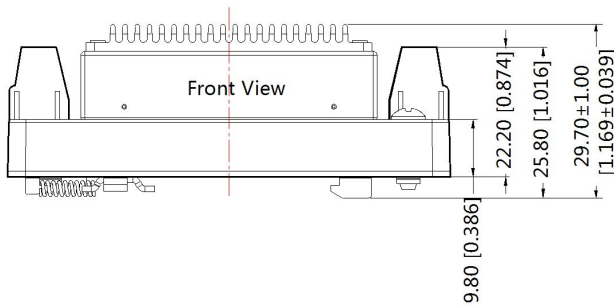


A4S Rail Package Dimensions(with heatsink)

THIRD ANGLE PROJECTION 



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



Note:  
Unit:mm[inch]  
Wire range:24~12 AWG  
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](http://www.mornsun-power.com). Horizontal Packing Bag Number : 58200035(without heatsink),58200051(with heatsink), A2S/A4S Packing Bag Number: 58220022;
2. Recommend to use module with more than 5% load, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
3. The recommended unbalance degree of the dual output module load is  $\leq \pm 5\%$ ; if the degree exceeds  $\pm 5\%$ , than the product performance cannot be guaranteed to comply with all parameters in the datasheet. Please contact our technicians directly for specific information;
4. The maximum capacitive load offered were tested at nominal input voltage and full load;
5. Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^\circ\text{C}$ , humidity<75% with nominal input voltage and rated output load;
6. All index testing methods in this datasheet are based on our Company's corporate standards;
7. The performance parameters of the product models listed in this manual are as above, but some parameters of non-standard model products may exceed the requirements mentioned above. Please contact our technicians directly for specific information;
8. We can provide product customization service;
9. Specifications are subject to change without prior notice.

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