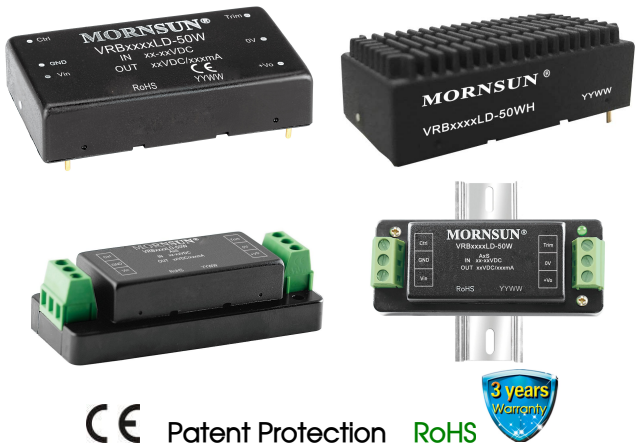
50W isolated DC-DC converter in DIP packaging
Wide input and regulated single output



CE Patent Protection RoHS

FEATURES

- Wide 2:1 input voltage range
- High efficiency up to 93%
- I/O isolation test voltage1.5k VDC
- Input over-voltage, under-voltage protection, output short-circuit, over-current and over-voltage protection
- Operating ambient temperature range: -40℃ ~ +85℃
- Six-sided metal shielding package
- Input reverse polarity protection available with chassis (A2S) or DIN-Rail mounting (A4S) version
- Industry standard pin-out
- EN60950 approved

VRB_LD-50W series products are of 50W output power, wide range of voltage input of 18-36VDC, 36-75VDC, isolation voltage of 1.5K VDC, output over-current protection, output over-voltage protection and output short circuit protection with the six-sided metal shielding package, these products are widely used in fields such as industrial control, electric power, instruments, communication and industrial robot system.

Selection Guide

Certification	Part No.①	Input Voltage (VDC) Nominal② (Range)	Output Voltage (VDC)	Output Current (mA) Max./Min.	Full Load Efficiency③ (%) Min./Typ.	Max. Capacitive Load (μF)
CE	VRB2403LD-50W	24 (18-36)	3.3	10000/500	89/91	27000
	VRB2405LD-50W		5	10000/500	89/91	18900
	VRB2412LD-50W		12	4167/208	91/93	3700
	VRB2415LD-50W		15	3333/167	91/93	2000
	VRB2424LD-50W		24	2083/104	89/91	1000
	VRB4803LD-50W	48 (36-75)	3.3	10000/500	89/91	27000
	VRB4805LD-50W		5	10000/500	89/91	18900
	VRB4812LD-50W		12	4167/208	91/93	3700
	VRB4815LD-50W		15	3333/167	91/93	2000
	VRB4824LD-50W		24	2083/104	90/92	1000

Notes:
①Use "H" suffix for heat sink mounting, "A2S" suffix for chassis mounting and "A4S" suffix for DIN-Rail mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
②The minimum input voltage and starting voltage of A2S and A4S Model are 1VDC higher than those of DIP package due to input reverse polarity protection function;
③Efficiency is measured at nominal input voltage and rated output load; efficiencies for A2S and A4S Model's is decreased by 2% due to the input reverse polarity protection circuit;

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (full load / no-load)	24VDC nominal input series, nominal input voltage	3.3VDC output	--	1511/42	1545/55	mA
		5VDC output	--	2289/59	2341/105	
		12VDC output	--	2240/85	2290/105	
		15VDC output	--	2240/90	2290/105	
		24VDC output	--	2289/45	2341/65	
	48VDC nominal input series, nominal input voltage	3.3VDC output	--	756/30	773/35	
		5VDC output	--	1144/50	1171/55	
		12VDC output	--	1120/34	1145/55	
		15VDC output	--	1120/50	1145/70	
		24VDC output	--	1132/30	1158/50	

Reflected Ripple Current	24VDC nominal input series, nominal input voltage		--	40	--	mA
	48VDC nominal input series, nominal input voltage		--	30	--	
Surge Voltage (1sec. max.)	24 VDC nominal input series		-0.7	--	50	VDC
	48 VDC nominal input series		-0.7	--	100	
Start-up Time	Nominal input voltage & constant resistance load		--	10	--	ms
Under-voltage Protection	24 VDC nominal input series	Start-up Voltage	--	--	18	VDC
		Shutdown Voltage	15	--	--	
	48 VDC nominal input series	Start-up Voltage	--	--	36	
		Shutdown Voltage	31	--	--	
Over-voltage Protection	24 VDC nominal input series	Start-up Voltage	36	--	--	
		Shutdown Voltage	--	--	41	
	48 VDC nominal input series	Start-up Voltage	75	--	--	
		Shutdown Voltage	--	--	83	
Input Filter			Pi filter			
Hot Plug			Unavailable			
Ctrl*	Module on		Ctrl pin open or pulled high(3-12VDC)			
	Module off		Ctrl pin pulled low to GND (0-1.2VDC)			
	Input current when off		--	6	--	mA

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

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Voltage Accuracy			--	±1	±3	%
Linear Regulation	Input voltage variation from low to high at full load		--	±0.2	±0.5	
Load Regulation	5%-100% load		--	±0.5	±1	
Transient Recovery Time	Nominal input voltage, 25% load step change	24VDC output	--	500	1000	μs
		Others	--	200	500	
Transient Response Deviation	Nominal input voltage, 25% load step change		--	±3	±5	%
Temperature Coefficient	Full load		--	--	±0.03	%/℃
Ripple & Noise①	20MHz bandwidth	VRB2403LD-50W VRB4803LD-50W VRB2405LD-50W VRB4805LD-50W	--	100	250	mVp-p
		VRB4824LD-50W	--	200	350	
		Others	--	200	300	
Trim			--	±10%Vo	--	VDC
Over-voltage Protection②	Input voltage range	3.3VDC output	--	3.9	--	
		5VDC output	--	6.2	--	
		12VDC output	--	15	--	
		15VDC output	--	18	--	
		24VDC output	--	30	--	
Over-current Protection	Input voltage range		120	--	160	%Io
Short-circuit Protection			Hiccup, continuous, self-recovery			

Notes:
① The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;
② The module needs to be re-start after output over-voltage protection.

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Insulation	Input-output Electric Strength test for 1 minute with a leakage current of 1mA max.	1500	--	--	VDC
Insulation Resistance	Input-output resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100KHz/0.1V	--	2000	--	pF
Operating Temperature	See Fig. 1	-40	--	+85	℃
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	℃
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z			
Switching Frequency	PWM mode	--	300	--	KHz
MTBF	MIL-HDBK-217F@25℃	1000	--	--	K hours

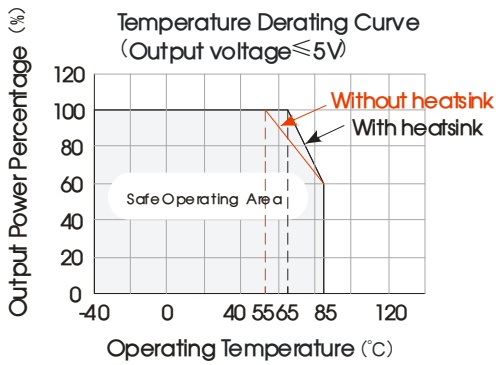
Mechanical Specifications

Case Material	Aluminum alloy		
Dimensions	Without heat sink	Horizontal package	50.80 x 25.40 x 11.80 mm
		A2S wiring package	76.00 x 31.50 x 21.20 mm
		A4S rail package	76.00 x 31.50 x 25.80 mm
	With heat sink	Horizontal package	51.40 x 26.20 x 16.50 mm
		A2S wiring package	76.00 x 31.50 x 25.30 mm
		A4S rail package	76.00 x 31.50 x 29.90 mm
Weight	Without heat sink	Horizontal package/A2S wiring package/A4S rail package	35.0g/57.0g/77.0g(Typ.)
	With heat sink	Horizontal package/A2S wiring package/A4S rail package	43.0g/65.0g/85.0g(Typ.)
Cooling Method	Free air convection		

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig.3-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig.3-② for recommended circuit)	
Immunity	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	line to line ±2KV (see Fig.3-① for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A

Typical Characteristic Curves



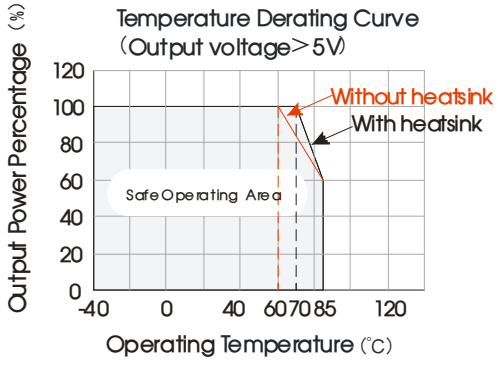
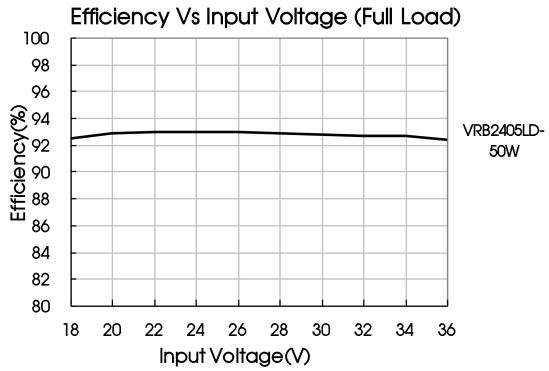
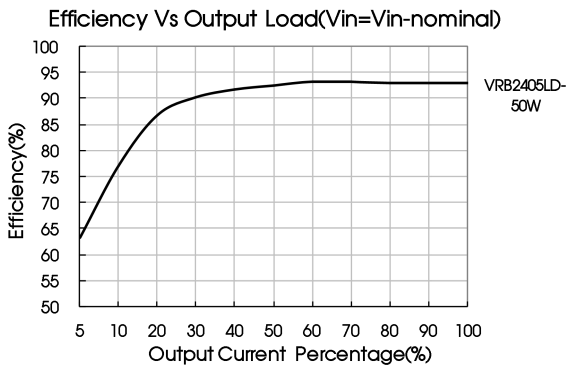


Fig. 1





Design Reference

1. Typical application

All the DC/DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.
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.

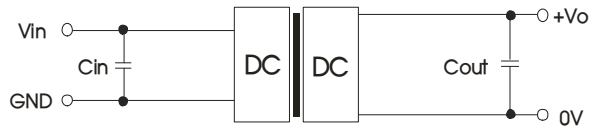


Fig. 2

Vout(VDC)	Cin(μF)	Cout(μF)
3.3/5	100	470
12/15		100
24		47

2. EMC compliance circuit

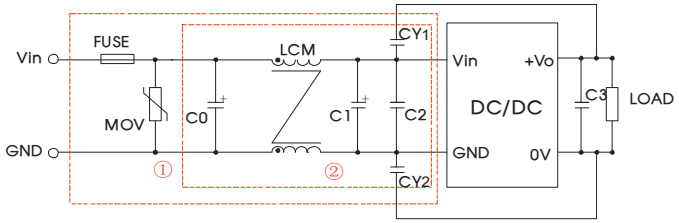


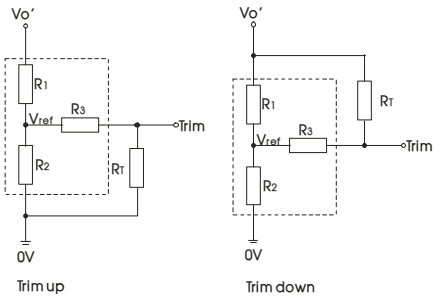
Fig. 3

Notes: For EMC tests we use Part ① in Fig. 3 for immunity and part ② for emissions test.

Parameter description

Model	Vin:24V	Vin:48V
FUSE	Choose according to actual input current	
MOV	S20K30	S14K60
C0	680μF/50V	330μF/100V
LCM	2.2mH(FL2D-30-222)	
C1	330μF/50V	330μF/100V
C2	4.7uF/50V	2.2uF/100V
CY1、CY2	Y1 Safety capacitor 3.3nF/250VAC	
C3	Refer to the Cout in Fig.2	

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



TRIM resistor connection (dashed line shows internal resistor network)

Trim resistor calculation:

$$\text{up: } R_T = \frac{aR_2}{R_2-a} - R_3 \qquad a = \frac{V_{ref}}{V_o'-V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1-a} - R_3 \qquad a = \frac{V_o'-V_{ref}}{V_{ref}} \cdot R_2$$

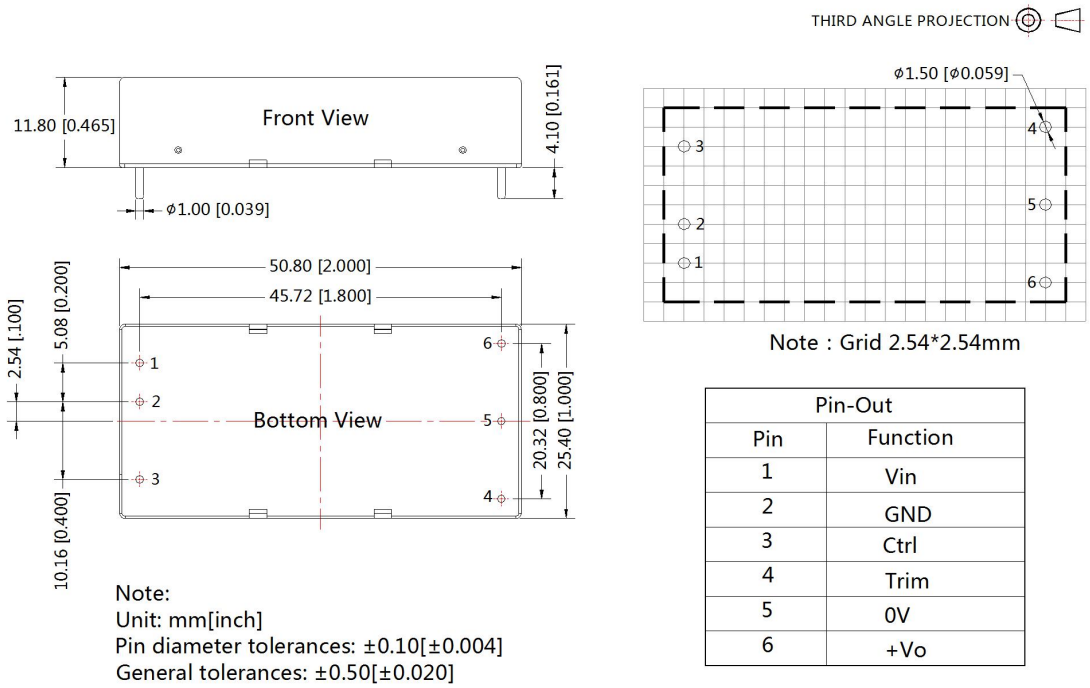
RT= Trim Resistor value;
a= self-defined parameter.
Vo'= actual needs of the up or down regulated voltage

Nominal input voltage	Vout	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
24/48	3.3	4.788	2.87	12.4	1.24
24/48	5	2.87	2.87	10	2.5
24/48	12	11	2.87	15	2.5
24/48	15	15	3	17.4	2.5
48	24	26	3	15	2.5
24	24	20	2.308	15	2.5

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

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

Horizontal Package Dimensions (without heat sink)

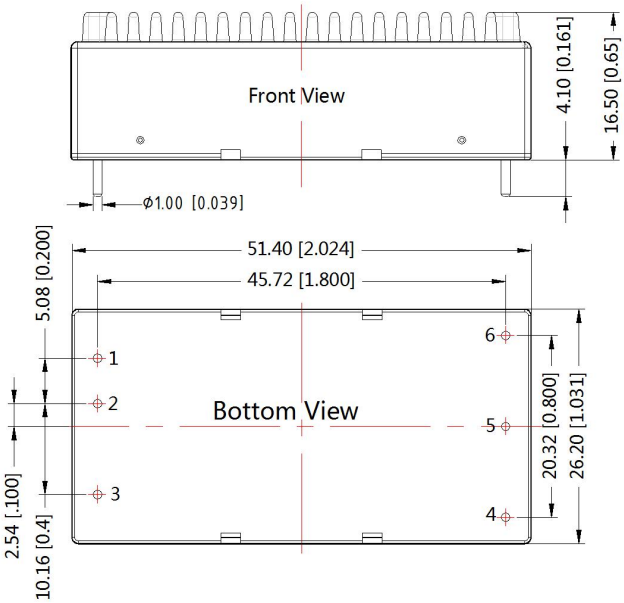


Note:
Unit: mm[inch]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]

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

Horizontal Package Dimensions (with heat sink)

THIRD ANGLE PROJECTION

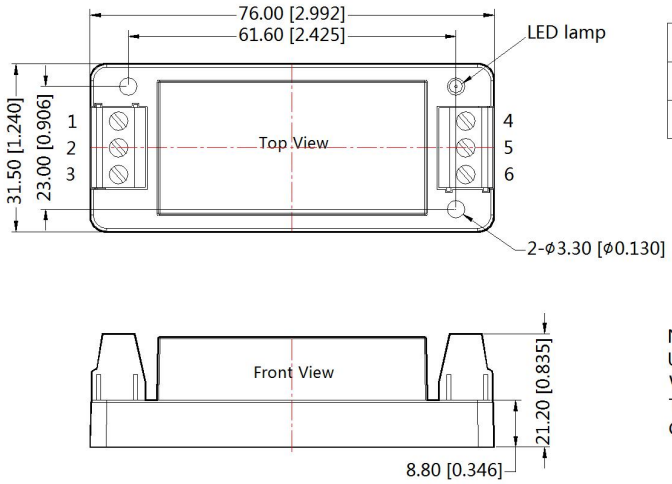


Pin-Out	
Pin	Function
1	Vin
2	GND
3	Ctrl
4	Trim
5	0V
6	+Vo

Note:
Unit: mm[inch]
General tolerances: ±0.50[±0.020]

A2S Package Dimensions (without heat sink)

THIRD ANGLE PROJECTION

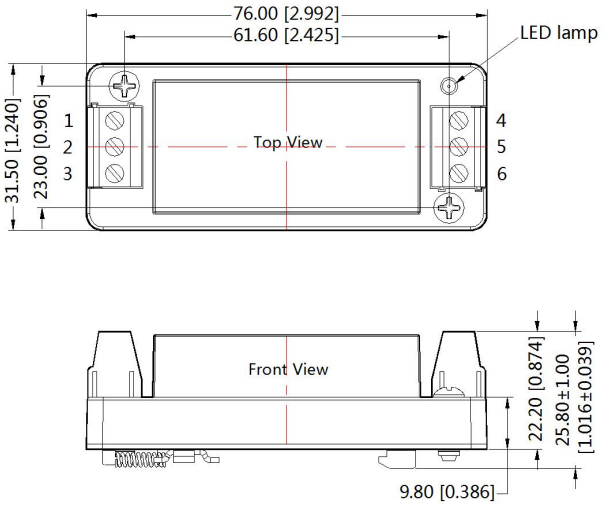


Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo

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

A4S Package Dimensions (without heat sink)

THIRD ANGLE PROJECTION

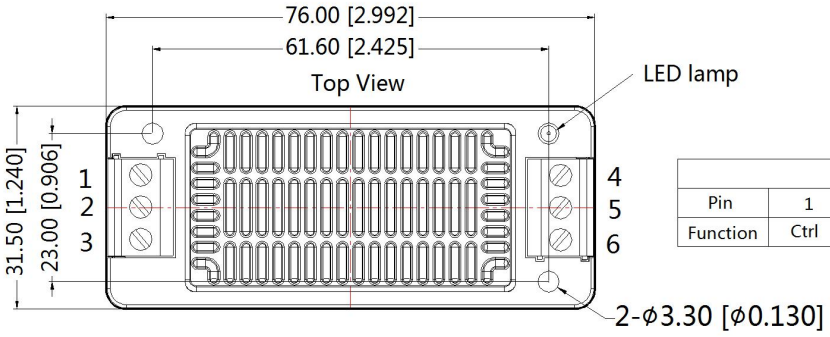


Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo

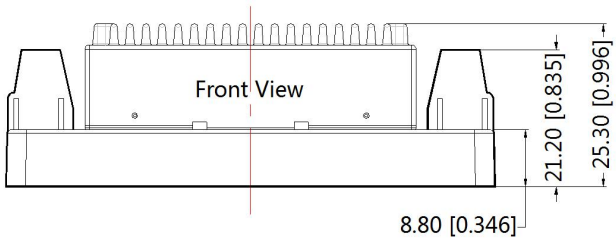
Note:
Unit: mm[inch]
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±0.50[±0.020]

A2S Package Dimensions (with heat sink)

THIRD ANGLE PROJECTION



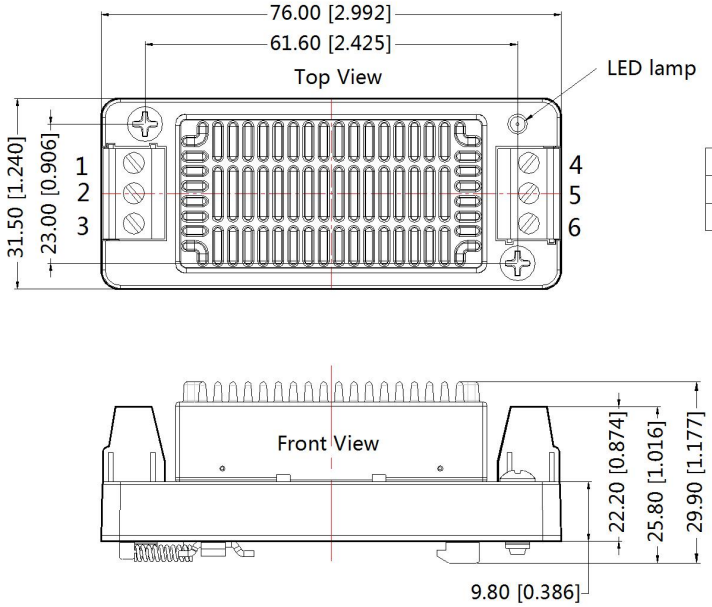
Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	Trim	0V	+Vo



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

A4S Package Dimensions (with heat sink)

THIRD ANGLE PROJECTION



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

Note:
Unit: mm[inch]
Mounting rail: TS35
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
General tolerances: ±1.00[±0.039]

Notes:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. The Packaging bag number of Horizontal packaging: 58200035(without heat sink), 58200051(with heat sink), A2S/A4S packaging number: 58220022;
2. Recommended used in more than 5% load, if the load is lower than 5%, then the ripple index of the product may exceed the specification, but does not affect the reliability of the product;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. 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;
5. All index testing methods in this datasheet are based on company corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. 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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