DC/DC Converter

VRB_J(M)D/T-6W Series
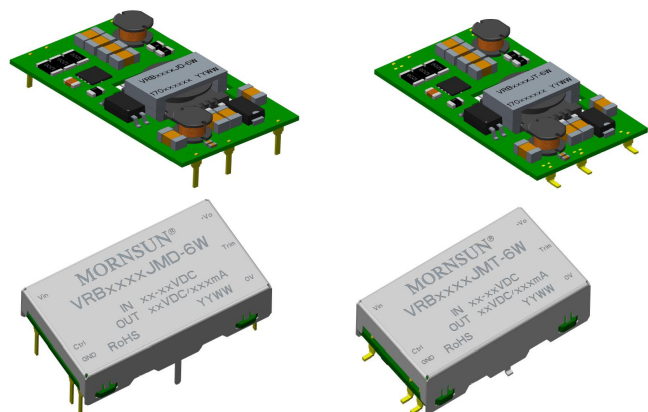
6W, wide input, isolated & regulated single output, DIP/SMD package, DC-DC converter

FEATURES

- Wide input voltage range (2:1)
- High efficiency up to 86%
- No-load power consumption as low as 0.12W
- Isolation voltage : 500VAC/1500VDC
- Operating temperature range: -40℃ to +85℃
- Input under-voltage protection, output short circuit, over-current, over-voltage protection
- Optional package:DIP/SMD

Patent Protection RoHS

VRB_J(M)D/T-6W series are isolated 6W DC-DC products with 2:1 input voltage. 500VAC/500VDC isolation, input under-voltage protection, output over-voltage, over-current, short circuit protection, which make them widely applied in industrial control, electricity, instruments, communication fields.

Selection Guide

Certification	Part No. [1]	Input Voltage (VDC)		Output		Efficiency[3] (%,Min./Typ.) @ Full Load	Max. Capacitive Load (µF)
		Nominal (Range)	Max.[2]	Output Voltage (VDC)	Output Current (mA) (Max./Min.)		
--	VRB1205J(M)D/T-6W	12 (9-18)	20	5	1200/0	79/81	1000
	VRB1212J(M)D/T-6W			12	500/0	82/84	680
	VRB1215J(M)D/T-6W			15	400/0	83/85	470
	VRB2403J(M)D/T-6W	24 (18-36)	40	3.3	1500/0	77/79	1800
	VRB2405J(M)D/T-6W			5	1200/0	81/83	1000
	VRB2412J(M)D/T-6W			12	500/0	83/85	680
	VRB2415J(M)D/T-6W			15	400/0	84/86	470

Notes：
①VRB_J(M)D/T-6W contains 4 types of products, include VRB_JD-6W（DIP package without housing）、VRB_JMD-6W（DIP package with housing）、VRB_JT-6W（SMD package without housing） and VRB_JMT-6W（SMD package with housing）;
②Absolute maximum rating without damage on the converter, but it isn't recommended;
③Efficiency is measured In nominal input voltage and rated output load.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (full load / no-load)	12VDC nominal input series, nominal input voltage	5V output	--	617/7	633/25	mA
		12V output	--	595/10	610/30	
		15V output	--	588/9	603/30	
	24VDC nominal input series, nominal input voltage	3.3V output	--	261/3	268/15	
		5V output	--	301/4	308/18	
		12V output	--	294/5	302/20	
		15V output	--	291/5	298/20	
Reflected Ripple Current			--	20	--	
Surge Voltage (1sec. max.)	12VDC nominal input series		-0.7	--	25	VDC
	24VDC nominal input series		-0.7	--	50	
Starting Voltage	12VDC nominal input series		--	--	9	
	24VDC nominal input series		--	--	18	

Shutdown Voltage	12VDC nominal input series	5.5	6.5	--	VDC
	24VDC nominal input series	13	15	--	
Input Filter		Pi filter			
Hot Plug		Unavailable			
Ctrl [1]	Module switch on	Ctrl suspended or connected to TTL low level (0-0.3VDC)			
	Module switch off	Ctrl pin connected to high level (2-12VDC)			
	Input current when switched off	--	5	10	mA

Note: ① The voltage of Ctrl pin is relative to input pin GND.

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 voltage to high voltage		--	±0.2	±0.5	%
Load Regulation [1]	5% -100% load		--	±0.5	±1	
Transient Recovery Time	25% load step change,nominal input voltage		--	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	%/℃
Ripple & Noise [2]	20MHz bandwidth, 5% -100% load		--	--	100	mVp-p
Trim			--	±5	--	%Vo
Over-voltage Protection			110	--	160	
Over-current Protection	Input voltage range		110	140	200	%Io
Short circuit Protection			Continuous, self-recovery			

Note: ① When testing from 0% -100%load working conditions, load regulation index of ±5%;
　　　② 0% - 5% load ripple&Noise is no more than 5%Vo.Ripple and noise are measured by "parallel cable" method, please see DC-DC Converter Application Notes for specific operation.

General Specification

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Insulation Voltage	Input-output, with the test time of 1 minute and the leak current lower than 5mA	500	--	--	VAC
	Input-case, with the test time of 1 minute and the leak current lower than 5mA (Only for VRB_JMD/JMT-6W series products)	500	--	--	
	output-case, with the test time of 1 minute and the leak current lower than 5mA (Only for VRB_JMD/JMT-6W series products)	500	--	--	
	Input-output, with the test time of 1 minute and the leak current lower than 1mA	1500	--	--	VDC
	Input-case, with the test time of 1 minute and the leak current lower than 1mA (Only for VRB_JMD/JMT-6W series products)	1500	--	--	
	output-case, with the test time of 1 minute and the leak current lower than 1mA (Only for VRB_JMD/JMT-6W series products)	1500	--	--	
Insulation Resistance	Input-output, insulation voltage 500VDC, Ta=25℃, humidity=70%RH	100	--	--	MΩ
	Input-case, insulation voltage 500VDC, Ta=25℃, humidity=70%RH (Only for VRB_JMD/JMT-6W series products)	100	--	--	
	output-case, insulation voltage 500VDC, Ta=25℃, humidity=70%RH (Only for VRB_JMD/JMT-6W series products)	100	--	--	
Isolation Capacitance	Input-output, 100KHz/0.1V	--	1000	--	pF
Operating Temperature	see Fig. 1	-40	--	+85	℃
Storage Humidity	Without condensation	5	--	95	%RH
Storage Temperature		-55	--	+125	℃
Pin Welding Resistance Temperature	Welding spot is 1.5mm away from the casing, 10 seconds	--	--	300	

Reflow Soldering Temperature	Only for VRB_J(M)T-6W series	Peak temp.≤245℃, maximum duration time≤60s at 217℃. For actual application, please refer to IPC/JEDEC J-STD-020D.1.			
Vibration		10-150Hz, 5G, 90 Min. along X, Y and Z			
Switching Frequency ①	PWM mode	--	330	--	KHz
MTBF	MIL-HDBK-217F@25℃	1000	--	--	K hours

Note: ①This 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

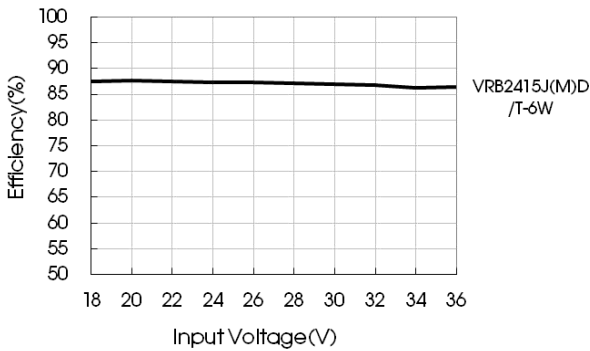| Casing Material		Aluminum alloy
Dimension	VRB_JD-6W series	31.60*18.10*6.10mm
	VRB_JT-6W series	33.78*18.10*6.30mm
	VRB_JMD-6W series	32.60*19.10*6.80mm
	VRB_JMT-6W series	33.78*19.10*7.00mm
Weight	VRB_JD/JT-6W series	4.7g(Typ.)
	VRB_JMD/JMT-6W series	5.7g(Typ.)
Cooling method		Free air convection（20LFM）

EMC Specifications

EMI	CE	CISPR32/EN55032	CLASS A (without external components)/ CLASSB (see Fig.3-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig.3-③ for recommended circuit)	
EMS	ESD	IEC/EN61000-4-2	Contact ±6KV	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

Note: For the product which is with casing package(VRB_JMD/T-6W series), the case needs to connect to input pin GND when testing the EMC performance.
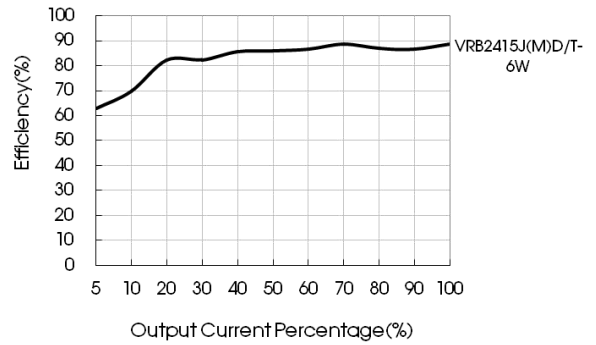
Product Characteristic Curve

Temperature Derating Curve

Fig. 1

Efficiency Vs Input Voltage (Full Load)

VRB1205J(M)D/T-6W

Efficiency Vs Output Load(Vin=12VDC)

VRB1205J(M)D/T-6W

Efficiency Vs Input Voltage (Full Load)

VRB2415J(M)D/T-6W
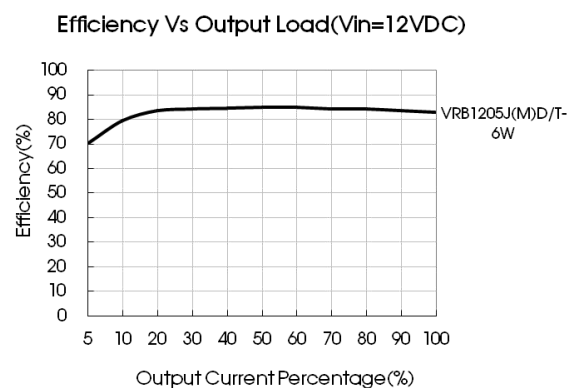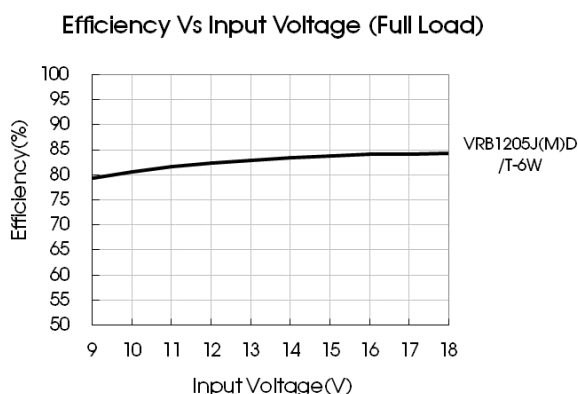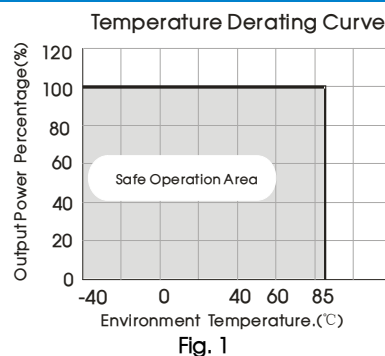
Efficiency Vs Output Load(Vin=24VDC)

VRB2415J(M)D/T-6W

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 Cin and Cout 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)	Cin(uF)	Cout(uF)
3.3/5/12/15	10	10

2. EMC solution-recommended circuit
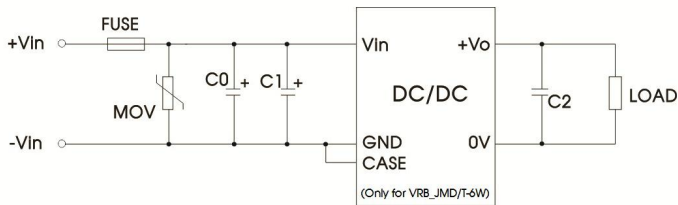
Fig. 3-①

Parameter description:

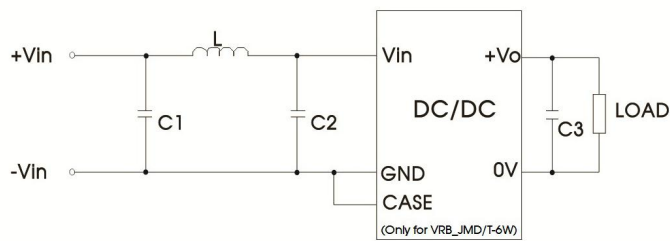| Model	Vin: 12VDC/24VDC
FUSE	Choose according to actual input current
MOV	S20K30
C0	680µF/100V
C1	330µF/100V
C2	10µF/25V

Fig. 3-②

Parameter description:

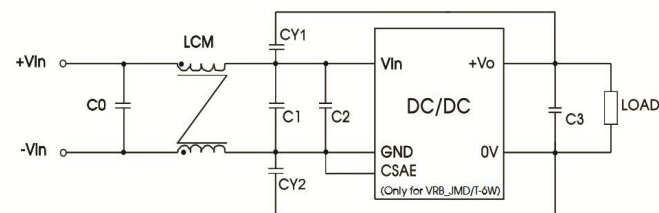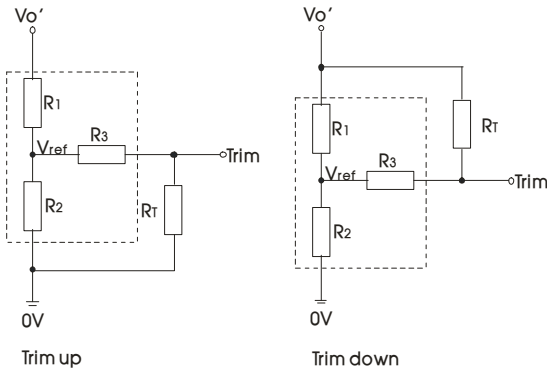| Vin(VDC)	C1/C2	L	C3
12/24	4.7µF/50V	4.7µH	10µF/25V

Fig. 3-③

Parameter description:

Model	Vin: 12VDC/24VDC
C0	4.7µF/50V
C1	4.7µF/50V
C2	4.7µF/50V
C3	10µF/25V
LCM	3.3mH
CY1/CY2	1000pF/≥2000VDC

Fig. 3

3. Application of Trim and calculation of Trim resistance

Calculation formula of Trim resistance:

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

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

R_T is Trim resistance ,a is a self-defined parameter, with no real meaning.
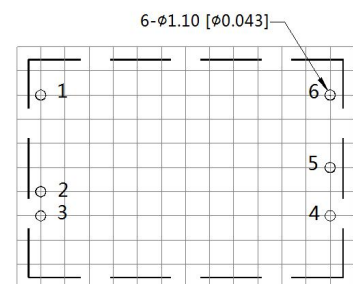Vo' for the actual needs of the up or down regulated voltage

Trim up

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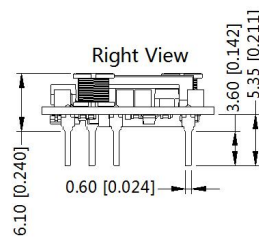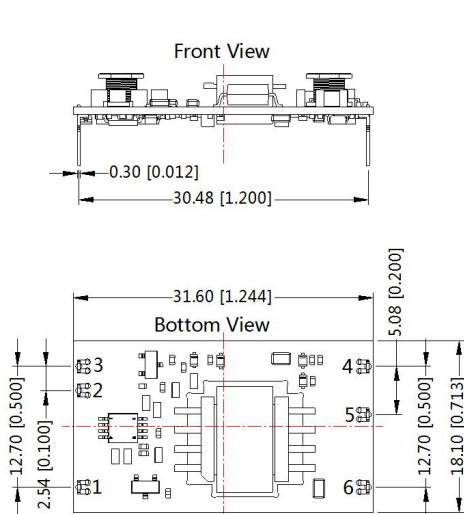
Applied circuits of Trim (Part in broken line is the interior of models)

Part No.	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
VRB2403J(M)D/T-6W	4.8	2.87	12	1.24
VRB2405J(M)D/T-6W	2.94	2.87	15	2.5
VRB2412J(M)D/T-6W	11	2.87	33	2.5
VRB2415J(M)D/T-6W	14.5	2.87	15	2.5
VRB1205J(M)D/T-6W	2.94	2.87	10	2.5
VRB1212J(M)D/T-6W	11	2.87	15	2.5
VRB1215J(M)D/T-6W	14.5	2.87	15	2.5

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

VRB_JD-6W (DIP package without housing) Dimensions and Recommended Layout
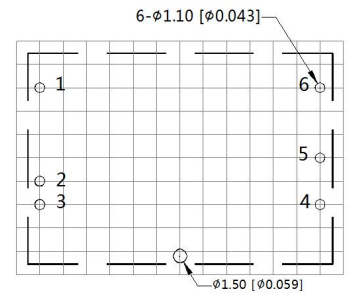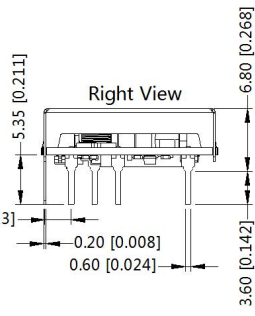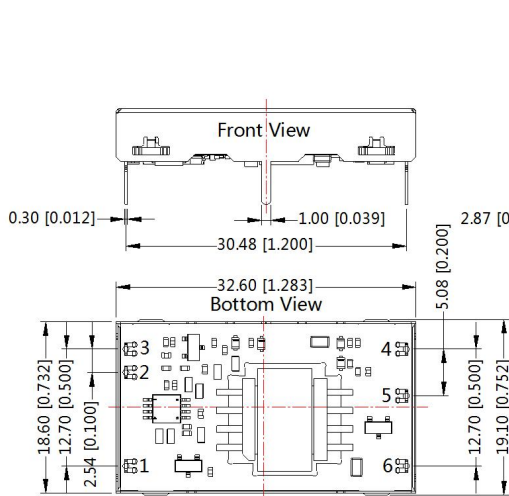
THIRD ANGLE PROJECTION

Front View

0.30 [0.012]
30.48 [1.200]

Right View

3.60 [0.142]
5.35 [0.211]
6.10 [0.240]
0.60 [0.024]

6-φ1.10 [φ0.043]

1   6
2   5
3   4

Note: Grid 2.54*2.54mm

Bottom View

31.60 [1.244]
5.08 [0.200]
12.70 [0.500]
2.54 [0.100]
12.70 [0.500]
18.10 [0.713]

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

Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only , please refer to the actual product

VRB_JMD-6W (DIP package with housing) Dimensions and Recommended Layout
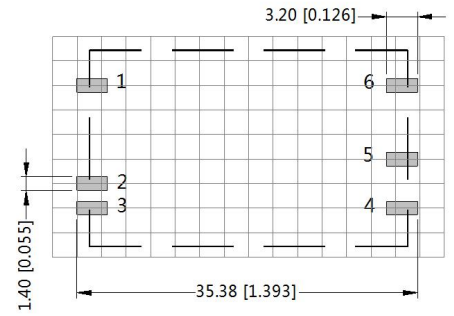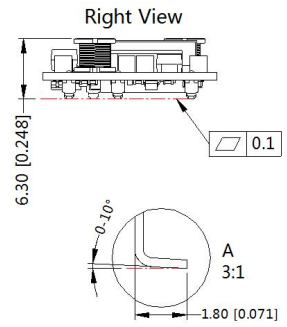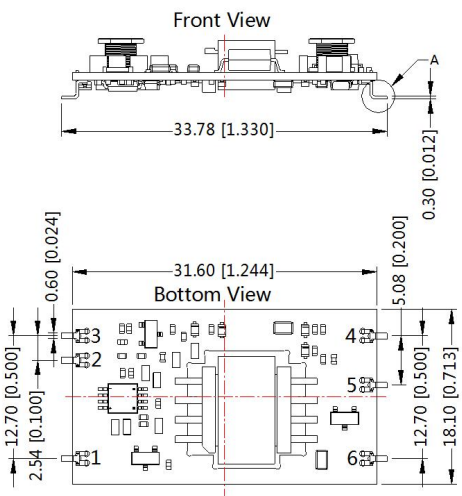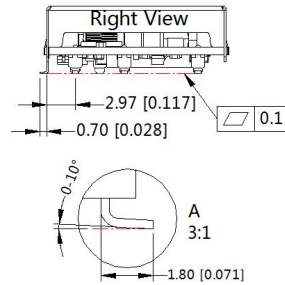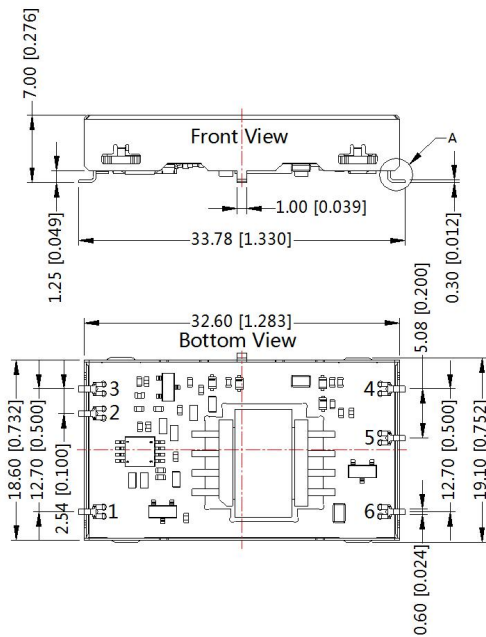
THIRD ANGLE PROJECTION

Front View

Right View

Bottom View

6-Φ1.10 [Φ0.043]

Φ1.50 [Φ0.059]

Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only , please refer to the actual product

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

VRB_JT-6W (SMD package without housing) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Front View

Right View

Bottom View

Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only , please refer to the actual product

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

VRB_JMT-6W (SMD package with housing) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Front View

7.00 [0.276]

1.00 [0.039]

33.78 [1.330]

1.25 [0.049]

5.08 [0.200]

0.30 [0.012]

Bottom View

32.60 [1.283]

18.60 [0.732]

12.70 [0.500]

2.54 [0.100]

12.70 [0.500]

19.10 [0.752]

0.60 [0.024]

Right View

2.97 [0.117]

0.70 [0.028]

0.1

0-10°

A
3:1

1.80 [0.071]

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

3.20 [0.126]

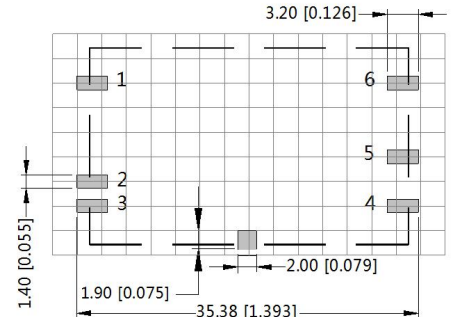1.40 [0.055]

1.90 [0.075]

2.00 [0.079]

35.38 [1.393]

Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only , please refer to the actual product

Note:
1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com.Packing bag number : 58210056;
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's 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.