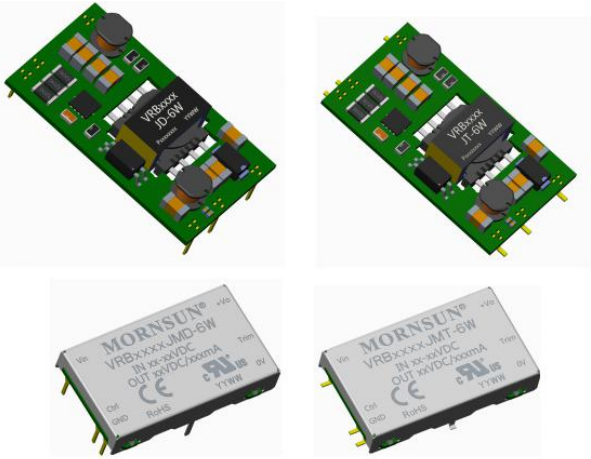


# DC/DC Converter

## VRB\_J(M)D/T-6W Series

6W, Wide input, isolated & regulated single output, DIP/SMD package, DC-DC converter



**UL** **us** **CE** **CB** Patent Protection **RoHS**



## FEATURES

- Wide input voltage range (2:1)
- High efficiency up to 86%
- No-load power consumption as low as 0.12W
- Isolation test voltage 500VAC
- Operating ambient temperature range: -40°C to +85°C
- Input under-voltage protection, output short-circuit, over-current, over-voltage protection
- International standard pin-out
- IEC 62368/ UL 62368/ EN 62368 approved

VRB\_J(M)D/T-6W series are isolated 6W DC-DC products feature with 2:1 input voltage, 500VAC 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 <sup>③</sup> (%Min./Typ.) @ Full Load	Max. Capacitive Load (μF)
		Nominal (Range)	Max. ②	Output Voltage (VDC)	Output Current (mA) (Max./Min.)		
UL/CE/CB	VRB1205J(M)D/T-6W	12 (9-18)	20	5	1200/0	79/81	1000
	VRB1212J(M)D/T-6W			12	500/0	83/85	680
	VRB1215J(M)D/T-6W			15	400/0	84/86	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:

- ① VRBxxxxJ(M)D/T-6W contains 4 types of products, include VRBxxxxJD-6W (DIP package without case), VRBxxxxJMD-6W (DIP package with case), VRBxxxxJT-6W (SMD package without case) and VRBxxxxJMT-6W (SMD package with case);
- ② Exceeding the maximum input voltage may cause permanent damage;
- ③ Efficiency 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	--	625/7	641/25	mA
		12V output	--	595/10	610/30	
		15V output	--	588/9	603/30	
	24VDC nominal input series, nominal input voltage	3.3V output	--	265/3	272/15	
		5V output	--	305/4	313/18	
		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		
Start-up Voltage	12VDC nominal input series	--	--	9		
	24VDC nominal input series	--	--	18		

Under-voltage Protection	12VDC nominal input series	5.5	6.5	--	VDC
	24VDC nominal input series	13	15	--	
Input Filter		PI filter			
Hot Plug		Unavailable			
Ctrl *	Module on	Ctrl pin open or pulled low to GND(0-0.3VDC)			
	Module off	Ctrl pin pulled high(2-12VDC)			
	Input current when off	--	5	10	mA

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

## Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit		
Accuracy	0% -100% load	--	±1	±3	%		
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5			
Load Regulation <sup>①</sup>	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	%/°C		
Ripple & Noise <sup>②</sup>	20MHz bandwidth, 5% -100% load	--	50	100	mVp-p		
Over-voltage Protection	Input voltage range	110	--	160	%Vo		
Over-current Protection		110	140	200	%Io		
Short-circuit Protection		Continuous, self-recovery					

Note: ① Load regulation for 0%-100% load is ±5%;  
② Ripple & Noise at ≤ 5% load is 5%Vo. Max. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information.

## General Specification

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output Electric Strength test for 1 minute with a leakage current of 5mA max.	500	--	--	VAC
	Input/Output-case Electric Strength test for 1 minute with a leakage current of 5mA max. (Only for VRB_JMD/JMT-6W series products)	500	--	--	
Insulation Resistance	Input-output insulation at 500VDC	100	--	--	MΩ
	Input/Output-case insulation at 500VDC (Only for VRB_JMD/JMT-6W series products)	100	--	--	
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	1000	--	pF
Operating Temperature	see Fig. 1	-40	--	85	°C
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	°C
Reflow Soldering Temperature	Only for VRB_J(M)T-6W series products	Peak temp. ≤245°C, maximum duration time ≤60s at 217°C. For actual application, please refer to IPC/JEDEC J-STD-020D.1.			
Vibration		10-55Hz, 2G, 30 Min. along X, Y and Z			
Switching Frequency *	PWM mode	--	330	--	KHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	K hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 1			

Note: \* Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

Mechanical Specifications

Case Material	Aluminum alloy	
Dimensions	VRB_JD-6W series	31.60 x 18.10 x 6.10mm
	VRB_JT-6W series	33.78 x 18.10 x 6.30mm
	VRB_JMD-6W series	32.60 x 19.10 x 6.80mm
	VRB_JMT-6W series	33.78 x 19.10 x 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)	

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS A (without external components)/ CLASSB (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 ±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: It is suggested to connect case to ground during EMC testing( only for VRB\_JMD/T-6W series).

Typical Characteristic Curves

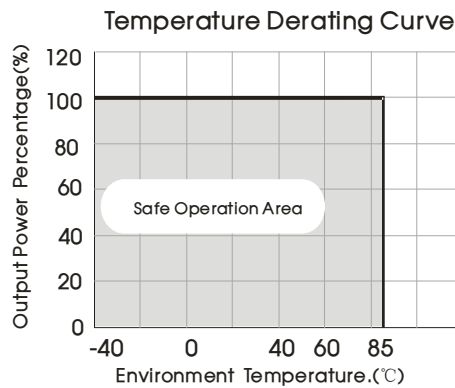


Fig. 1

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  $C_{in}$  and  $C_{out}$  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

$V_{out}(VDC)$	$C_{out}(\mu F)$	$C_{in}(\mu F)$
3.3/5/12/15	10	100

2. EMC compliance circuit

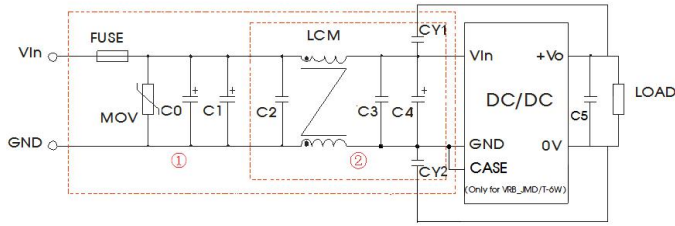


Fig. 3

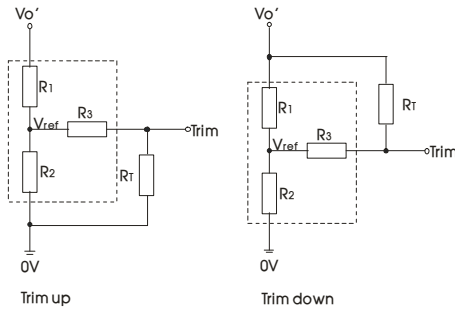
Notes:

1. For EMC tests we use Part ① in Fig. 3 for immunity and part ② for emissions test. Selecting based on needs.

Parameter description:

Model	Vin: 12VDC/24VDC
FUSE	Choose according to actual input current
MOV	S20K30
C0	680μF/100V
C1	330μF/100V
C2/C3	4.7μF/50V
C4	330μF/50V
C5	10μF/25V
LCM	2.2 mH, recommended to use MORNSUN's FL2D-10-222
CY1/CY2	1000pF/≥500VAC

3. TRIM resistor connection (dashed line shows internal resistor network)



Calculating Trim resistor values:

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

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

$R_T$  is Trim resistance

$a$  is a self-defined parameter, with no real meaning.

$V_o'$  for the actual needs of the up or down regulated voltage

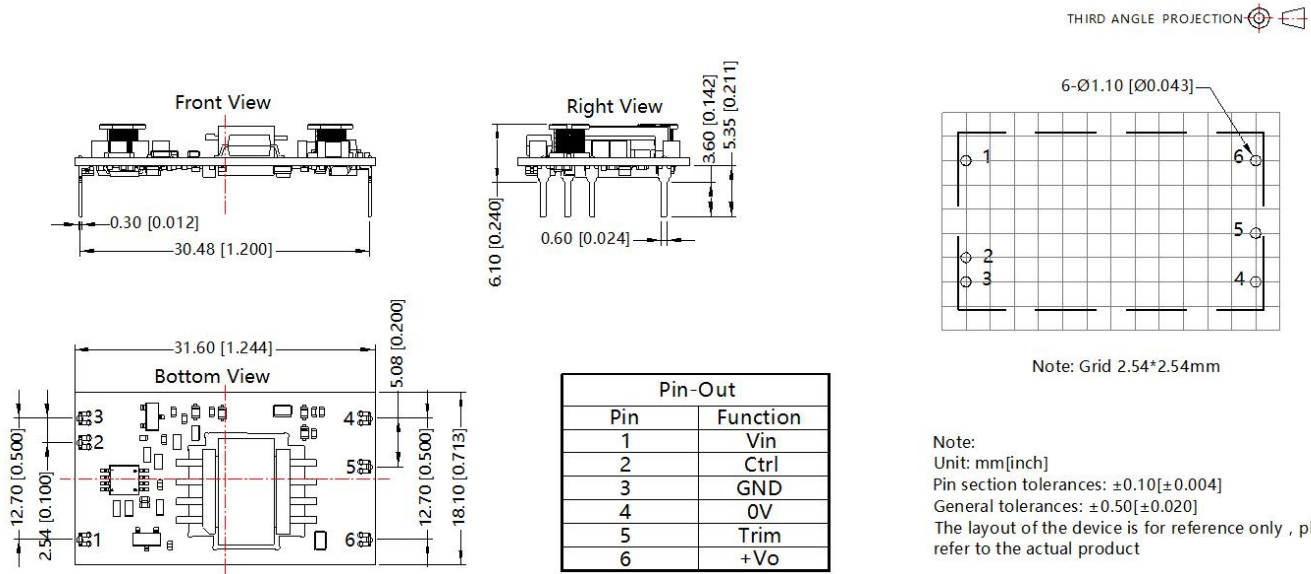
Applied circuits of Trim (Part in broken line is the interior of models)

Part No.	R1(K.Ω)	R2(K.Ω)	R3(K.Ω)	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

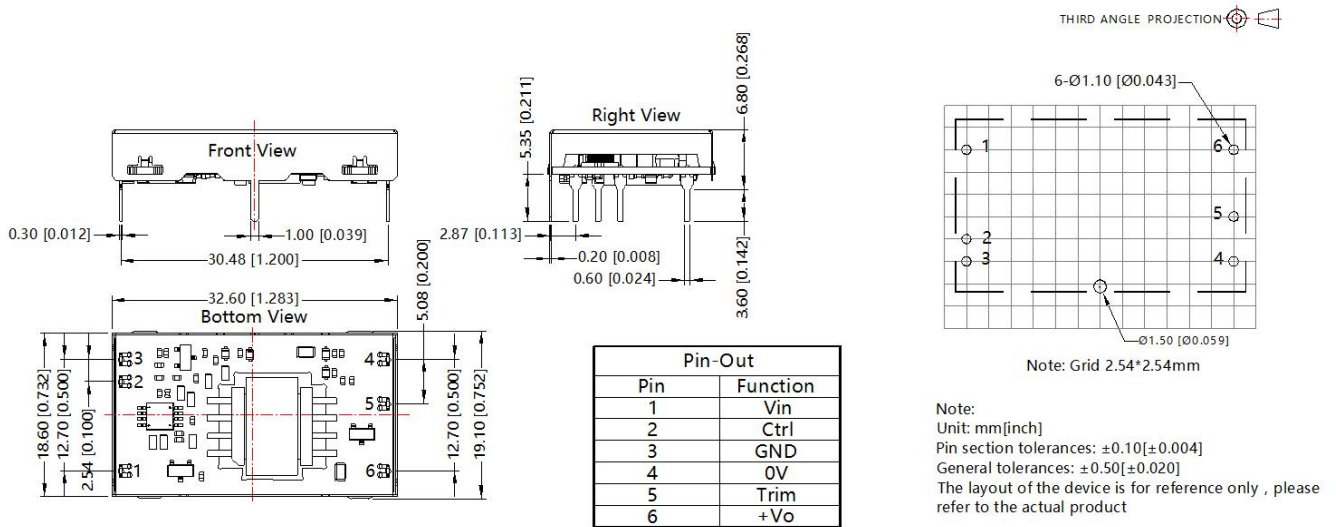
4. The products do not support parallel connection of their output

5. For additional information please refer to DC-DC converter application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

VRB\_JD-6W (DIP package without case) Dimensions and Recommended Layout

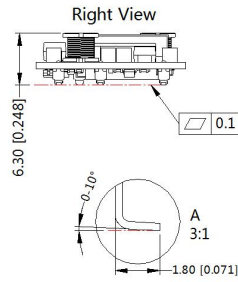
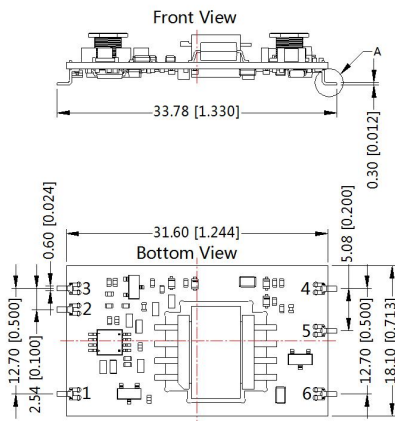


VRB\_JMD-6W (DIP package with case) Dimensions and Recommended Layout

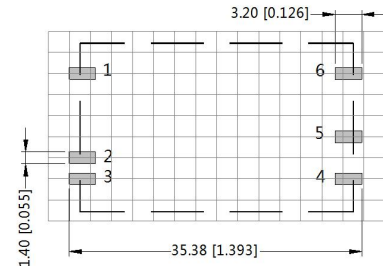


VRB\_JT-6W (SMD package without case) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



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

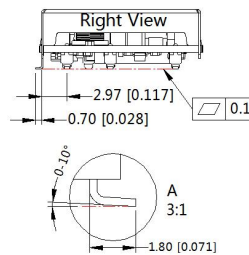
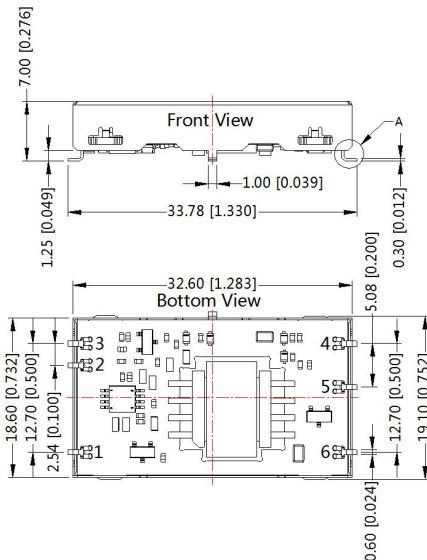


Note: Grid 2.54\*2.54mm

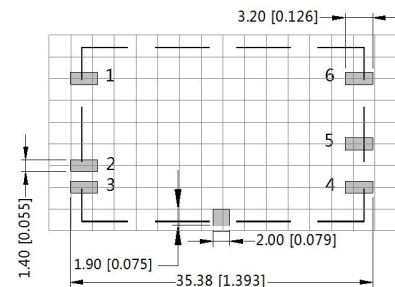
Note:  
Unit: mm[inch]  
Pin section tolerances:  $\pm 0.10[\pm 0.004]$   
General tolerances:  $\pm 0.50[\pm 0.020]$   
The layout of the device is for reference only, please refer to the actual product

VRB\_JMT-6W (SMD package with case) Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



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



Note: Grid 2.54\*2.54mm

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

Note:

- For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). The Packaging bag number: 58210056;
- The maximum capacitive load offered were tested at input voltage range and full load;
- 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;
- All index testing methods in this datasheet are based on company corporate standards;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- 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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