

# MORNSUN®

## VRB\_LD-30WR2

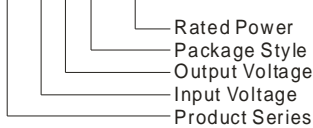
### 30W, WIDE INPUT, ISOLATED & REGULATED SINGLE OUTPUT DC-DC CONVERTER



Patent Protection RoHS

#### PART NUMBER SYSTEM

VRB2405LD-30WR2



#### FEATURES

- Efficiency up to 89%
- 2:1 wide input voltage range
- 1.5KVDC isolation
- Six-sided metal shield
- Short circuit protection (automatic recovery)
- Operating temperature range: -40°C ~ +85°C
- Industry standard pinout
- Low ripple and noise
- Meet CISPR22/EN55022 CLASS A

#### APPLICATION

The VRB\_LD-30WR2 series offer 30W of output, with 2:1 wide input voltage of 18-36VDC, 36-75VDC and features 1500VDC isolation, over current and short-circuit protection etc, as well as six-sided metal shielding. All models are particularly suitable for industrial, electric power, instrumentation, telecommunication applications.

#### SELECTION GUIDE

Model Number	Input Voltage (VDC)		Output Voltage (VDC)	Output Current (mA)		Input Current (mA)(typ.)		reflection ripple Current (mA,typ.)	Max. Capacitor Load (max,µF)	Efficiency (% ,typ.) @ Max. load
	Nominal (Range)	Max*		Max.	Min.	@ Max.load	@ No load			
VRB2403LD-30WR2	24 (18-36)	40	3.3	6000	600	960	120	48	6800	87
VRB2405LD-30WR2			5	6000	600	1460	120	73	6800	88
VRB2412LD-30WR2			12	2500	250	1440	20	72	680	88
VRB2415LD-30WR2			15	2000	200	1440	20	72	680	89
VRB4803LD-30WR2	48 (36-75)	80	3.3	6000	600	500	80	25	6800	87
VRB4805LD-30WR2			5	6000	600	730	80	36.5	6800	88
VRB4812LD-30WR2			12	2500	250	720	20	36	680	89
VRB4815LD-30WR2			15	2000	200	720	20	36	680	89

Note:\* Input voltage can't exceed this value, or will cause the permanent damage.

#### INPUT SPECIFICATIONS

Item	Test conditions	Min.	Typ.	Max.	Unit
Input Surge Voltage (1000 ms)	24VDC input	-0.7	--	50	VDC
	48VDC input	-0.7	--	100	
Start-up Voltage	24VDC input	--	17.8	18	
	48VDC input	--	35.8	36	
Under Voltage Shutdown	24VDC input	16	--	--	
	48VDC input	32	--	--	
Start-up Time	Nominal input & constant resistance load	--	10	--	ms
Ctrl*	Models ON	Ctrl open or connect TTL high level (3-40VDC)			
	Models OFF	Ctrl connect GND or low level (0-1.2VDC)			
	Input current at shutdown	--	1	--	mA
Input Filter		π Filter			

Note:\*The CTRL control pin voltage is refer to GND.

#### OUTPUT SPECIFICATIONS

Item	Test conditions	Min.	Typ.	Max.	Unit
Output Power		3	--	30	W
Output Voltage Accuracy	Refer to recommended circuit	--	±1	±3	%
Line Voltage Regulation	Input voltage from low to high at 100% load	--	±0.2	±0.5	
Load Regulation	From 10% to 100% load Nominal input	--	±0.5	±1	
Transient Recovery Time	25% load step change	--	300	500	µs
Transient Response Deviation		--	±3	±5	%

Temperature Drift	100% load	--	±0.02	--	%/°C	
Ripple & Noise *	20MHz bandwidth	--	50	120	mVp-p	
Output Voltage Range (Trim)		--	±10%Vo	--	VDC	
Over Voltage Protection	Full input voltage	3.3VDC output	--	3.9		--
		5VDC output	--	6.2		--
		12VDC output	--	15		--
		15VDC output	--	18	--	
Over Current Protection	Full input voltage	120	130	150	%	
Short Circuit Protection		Hiccup, automatic recovery				
Note: *Ripple and noise tested by "parallel cable" method. See detailed operation instructions at Testing of Power Converter section, application notes.						

### COMMON SPECIFICATIONS

Item	Test conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Tested for 1 minute and leakage current less than 1 mA	1500	--	--	VDC
Isolation Resistance	Test at 500VDC	1000	--	--	MΩ
Isolation Capacitance	input / output, 100KHz/0.1V	--	2000	--	pF
Switching Frequency		--	300	--	KHz
MTBF	MIL-HDBK-217F @25°C	1000	--	--	K hours
Safety Approvals		UL/EN60950(Pending)			
Case Material		Aluminum Alloy			
Weight	Without heatsink	--	28	--	g
	With heatsink	--	36	--	

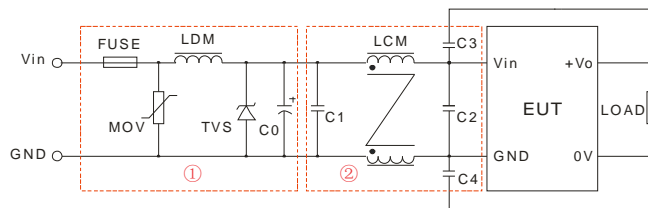
### ENVIRONMENTAL SPECIFICATIONS

Item	Test conditions	Min.	Typ.	Max.	Unit
Storage Humidity	Non condensing	5	--	95	%
Operating Temperature	See Temperature Derating Curve	-40	--	85	°C
Storage Temperature		-55	--	125	
The Max. Case Temperature	Operating Temperature curve range	--	--	105	
Lead Temperature	1.5mm from case for 10 seconds	--	--	300	
Cooling		Free Air Convection			
Shake		10-55Hz, 10G, 30 Min. along X, Y and Z			

### EMC SPECIFICATIONS

EMI	CE	CISPR22/EN55022	CLASS A (Without External Circuit) / CLASS B (External Circuit Refer to Figure1-②)	
	RE	CISPR22/EN55022	CLASS A (Without External Circuit) / CLASS B (External Circuit Refer to Figure1-②)	
EMS	ESD	IEC/EN61000-4-2	Contact ±4KV /Air ±8KV	perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2KV	perf. Criteria B (External Circuit Refer to Figure1-①)
	Surge	IEC/EN61000-4-5	±2KV	perf. Criteria B (External Circuit Refer to Figure1-①)
	CS	IEC/EN61000-4-6	10 Vr.m.s	perf. Criteria B
	Voltage dips, short and interruptions immunity	IEC/EN61000-4-29	0%-70%	perf. Criteria B

### EMC RECOMMENDED CIRCUIT

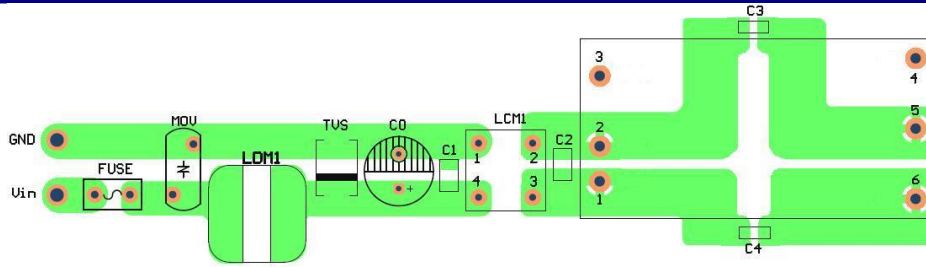


(Figure 1)

Note: In Figure 1, part① is EMS Recommended external circuit, part② is EMI recommended external circuit. Choose according to requirements.

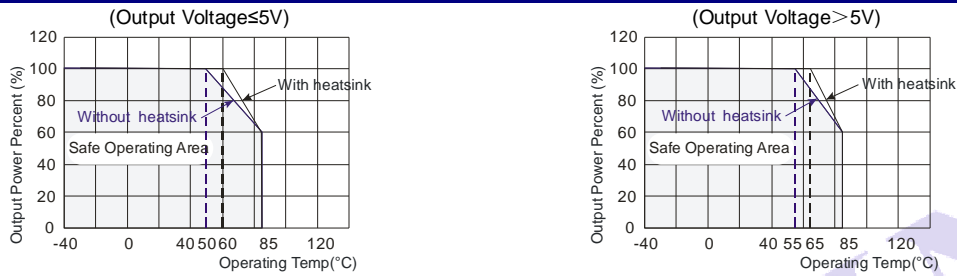
Recommended external circuit parameters			
EMS	Model	VRB24_LD-30WR2	VRB48_LD-30WR2
	FUSE	Choose according to practical input current	
	MOV	10D560K	10D101K
	LDM	56μH	56μH
	TVS	SMCJ48A	SMCJ90A
EMI	C0	120μF/50V	120μF/100V
	C1, C2	4.7μF /50V	2.2μF /100V
	LCM	TS7 T13*7*5 1mH	
	C3, C4	1nF/2KV	1nF/2KV

## EMC RECOMMENDED CIRCUIT PCB LAYOUT

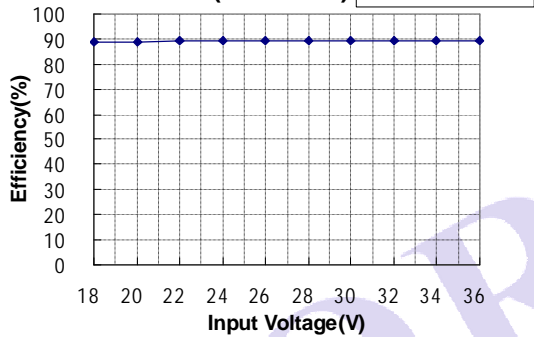


(Figure 2)

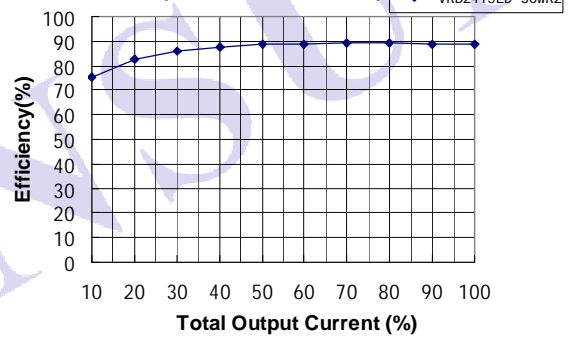
## PRODUCT TYPICAL CURVE



### Efficiency VS Input Voltage curve (Full Load)



### Efficiency VS Output Load curve (Vin=Vin-nominal)



## OUTLINE DIMENSIONS, RECOMMENDED FOOTPRINT & PACKAGING

### MECHANICAL DIMENSIONS

Front View dimensions: 11.80 [0.465], 4.10 [0.161], 1.00 [0.039]

Bottom View dimensions: 50.80 [2.000], 45.72 [1.800], 5.08 [0.200], 10.16 [0.400], 10.16 [0.400], 25.40 [1.000], 10.16 [0.400]

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

Note:  
Unit: mm[inch]  
Pin diameter tolerances: ± 0.10mm [± 0.004inch]  
Pin height tolerances: ± 0.50mm [± 0.020inch]  
General tolerances: ± 0.30mm [± 0.012inch]

### RECOMMENDED FOOTPRINT

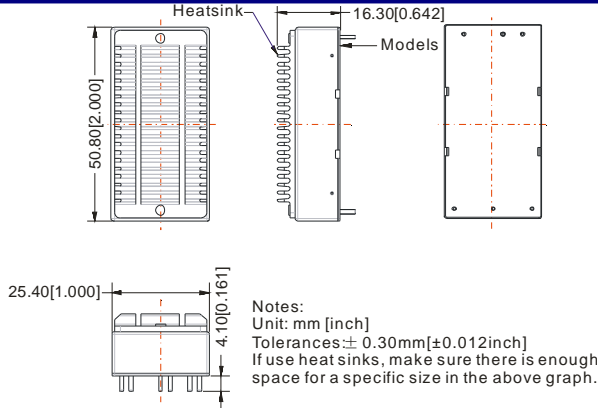
Note: grid 2.54\*2.54mm

### TUBE OUTLINE DIMENSIONS(WITHOUT HEATSINK)

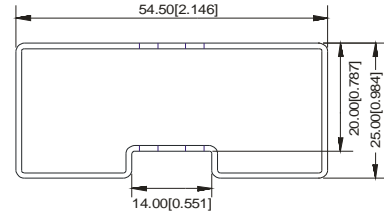
Dimensions: 54.30 [2.138], 13.20 [0.520], 15.00 [0.591], 20.00 [0.787]

Note:  
Unit: mm[inch]  
General tolerances: ± 0.50mm [± 0.020inch]  
L=220mm [8.661inch] Pcs/Tube: 7  
Short tube inner package dimensions: L\*W\*H= 255\*170\*80mm  
Short tube outer package dimensions(with six inner package boxes): L\*W\*H= 375\*280\*270mm

## HEATSINK ASSEMBLY



## TUBE OUTLINE DIMENSIONS (WITH HEATSINK)

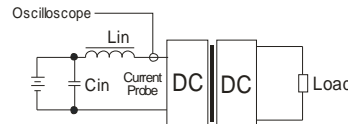


Unit :mm[inch]  
General tolerances: ± 0.50mm[± 0.020inch]  
L=220mm[8.661inch] Pcs/Tube:7  
Inner package dimensions: L\*W\*H= 255\*170\*80mm  
Outer package dimensions(with six inner packaging boxes)  
L\*W\*H= 375\*280\*270mm

## TEST CONFIGURATIONS

### Input Reflected-Ripple Current Test Setup

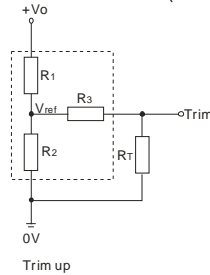
Input reflected-ripple current is measured with an inductor  $L_{in}$  and Capacitor  $C_{in}$  to simulate source impedance.



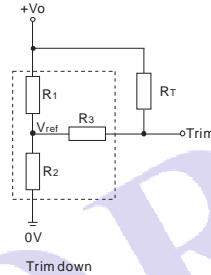
$L_{in}(4.7\mu H)$   $C_{in}(220\mu F, ESR < 1.0\Omega \text{ at } 100 \text{ KHz})$

## TRIM APPLICATION & TRIM RESISTANCE

Application circuit for Trim (Part in broken line is the interior of models) Formula for resistance of Trim



Trim up



Trim down

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

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

Note: Leave open if not used. Value for  $R_1$ ,  $R_2$ ,  $R_3$ , and  $V_{ref}$  refer to the above table 1.  $R_T$ : Resistance of Trim.  $a$ : User-defined parameter, no actual meanings.  $V_o$ : The trim up/down voltage.

(TABLE 1)

Parameter	$V_o$	3.3(VDC)	5(VDC)	12(VDC)	15(VDC)
$R_1(K\Omega)$		4.801	2.883	10.971	14.497
$R_2(K\Omega)$		2.863	2.864	2.864	2.864
$R_3(K\Omega)$		15	10	17.8	17.8
$V_{ref}(V)$		1.24	2.5	2.5	2.5

## DESIGN CONSIDERATIONS

### 1) Requirement on output load

To ensure this module can operate efficiently and reliably, During operation, the minimum output load **could not be less than 10% of the full load**. If the actual output power is very small, please connect a resistor with proper resistance at the output end in parallel to increase the load.

### 2) Recommended circuit

All the VRB\_LD-30WR2 series have been tested according to the following recommended testing circuit before leaving factory. This series should be tested under load. Never be tested under no load (see Figure 3).

If you want to further decrease the output ripple, you can increase capacitance properly or choose capacitors with low ESR. However, the capacitance can't exceed the maximum capacitor load in the list (Table 2).



(Figure 3)

EXTERNAL CAPACITOR TABLE (TABLE 2)

Output Voltage	Capacitance	$C_{out}(\mu F)$	$C_{in}(\mu F)$
3.3V, 5V		220	100
		100	
12V, 15V		100	

### 3) Cannot use in parallel and hot swap

Note:

1. Min. load shouldn't be less than 10%, otherwise ripple maybe increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specification listed.
2. Max. Capacitive Load tested at input voltage range and full load.
3. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
4. In this datasheet, all the test methods of indications are based on our corporate standards.
5. All characteristics are for listed model only, non-standard models may perform differently, please contact our technical staff for more detail.
6. Contact us for your specific requirement.
7. Specifications subject to change without prior notice.

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