

MORNSUN®

WRF_MT-3W Series

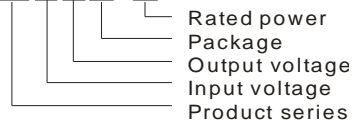
**3W, WIDE INPUT, ISOLATED & REGULATED
SINGLE OUTPUT, DC-DC CONVERTER**



Patent Protected RoHS

PART NUMBER SYSTEM

WRF2405MT-3W



FEATURES

- Efficiency up to 83%
- 2:1 wide input voltage range
- Operating Temperature range: -40 ~ +85°C
- No Power derating ($\leq 85^\circ\text{C}$)
- 3.0KVDC isolation
- Ultra-Miniature, SMD Package
- Short Circuit Protection (automatic recovery)
- Low no-load power consumption
- External On/Off control

APPLICATION

The WRF_MT-3W Series are specially designed for applications where a wide range input voltage power supplies are isolated from the input power supply in a distributed power supply system on a circuit board. For these DC-DC converters, You can reduce the design point of failure and save the development of micro power supply's manpower, material and time costs, also better ensure product quality stability, protect safety and reliability of the end of products.

These products apply to where:

- 1) Input voltage range $\leq 2:1$;
- 2) 3.0KVDC input and output isolation;
- 3) Regulated and low ripple noise is required.

SELECTION GUIDE

Model	Input Voltage(VDC)		Output Voltage (VDC)	Output Current (mA)		Input Current (mA)(Typ.)		Reflected Ripple Current (mA, Typ.)	Max. Capacitive Load (μF)	Efficiency (% , Typ.) @Max. Load
	Nominal (Range)	Max. ①		Max.	Min.	@Max. Load	@No Load			
WRF1203MT-3W	12 (9-18)	20	3.3	909	45	342	20	30	2700	74
WRF1205MT-3W			5	600	30	323				77
WRF1212MT-3W			12	250	12	316				79
WRF1215MT-3W			15	200	10	316				79
WRF2403MT-3W	24 (18-36)	40	3.3	909	45	166	7	110	2700	74
WRF2405MT-3W			5	600	30	156				81
WRF2412MT-3W			12	250	12	152				82
WRF2415MT-3W			15	200	10	152				82
WRF2424MT-3W			24	125	6	157				80
WRF4803MT-3W	48 (36-75)	80	3.3	909	45	84	7	45	2700	74
WRF4805MT-3W			5	600	30	78				80
WRF4812MT-3W			12	250	12	74				83
WRF4815MT-3W			15	200	10	74				83

Note: ①. Absolute maximum rating without damage on the converter.

INPUT SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Input Surge Voltage (1sec. max.)	12VDC input	-0.7	--	25	VDC
	24VDC input	-0.7	--	50	
	48VDC input	-0.7	--	100	
Start-up Voltage	12VDC input	4.5	--	9	
	24VDC input	11	--	18	
	48VDC input	24	--	36	
Input Filter		Capacitor			

Ctrl*	Models ON	Ctrl open or be insulated
	Models OFF	Connect high level voltage, and ensure the current into Ctrl to be 5-10mA
Note: *Please refer to "DESIGN CONSIDERATIONS" as the direction for use of Ctrl .		

OUTPUT SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	5% to 100% load	--	±1	±3	%
No-load Output Voltage Accuracy	Input voltage range	--	±1.5	±5	
Line Regulation	Full load, Input voltage from low to high	--	±0.2	±0.5	
Load Regulation	5% to 100% load	--	±0.2	±0.8	
Transient Recovery Time	25% load step change	--	0.5	3	
Transient Response Deviation		--	±2.5	±5	%
Temperature coefficient	100% load	--	±0.02	±0.03	%/°C
Ripple*	20MHz Bandwidth	--	30	45	mVp-p
Noise*		--	45	100	
Output Short Circuit Protection	Input voltage range	Continuous, automatic recovery			
Note: * Ripple and noise tested with "parallel cable" method. See detailed operation instructions at DC-DC Application Notes.					

COMMON SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-Output, Tested for 1 minute, leakage current less than 1 mA	3000	--	--	VDC
Isolation Resistance	Input-Output, Test at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-Output, 100KHz / 0.1V	--	35	45	pF
Switching Frequency(PFM Mode)	100% load, Nominal Input voltage	--	250	--	KHz
MTBF	MIL-HDBK-217F @25°C	1000	--	--	K hours
Case Material		Epoxy Resin (UL94-V0)			
Weight		--	4.8	--	g

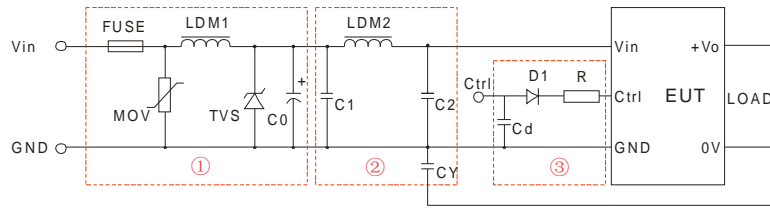
ENVIRONMENTAL SPECIFICATIONS

Item	Test Conditions	Min.	Typ.	Max.	Unit
Storage Humidity	Non condensing	--	--	95	%
Operating Temperature	Power derating (above85°C ,see Figure 5)	-40	--	85	°C
Storage Temperature		-55	--	125	
Temp. rise at full load	Ta=25°C	--	25	--	
Lead Temperature	1.5mm from case for 10 seconds	--	--	300	
Cooling		Free air convection			

EMC SPECIFICATIONS

EMI	CE	CISPR22/EN55022	CLASS B(Recommended Circuit Refer to Figure1-② or Figure 3)			
	RE	CISPR22/EN55022	CLASS B(Recommended Circuit Refer to Figure1-② or Figure 3)			
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	(Recommended Circuit Refer to Figure1-①)		perf. Criteria B
		IEC/EN61000-4-4	±4KV	(Recommended Circuit Refer to Figure 3)		perf. Criteria B
	Surge	IEC/EN61000-4-5	±2KV	(Recommended Circuit Refer to Figure1-① or Figure 3)		perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s		perf. Criteria A	
	Voltage dips, short and interruptions immunity	IEC/EN61000-4-29	0%-70%		perf. Criteria B	

EMC RECOMMENDED CIRCUIT



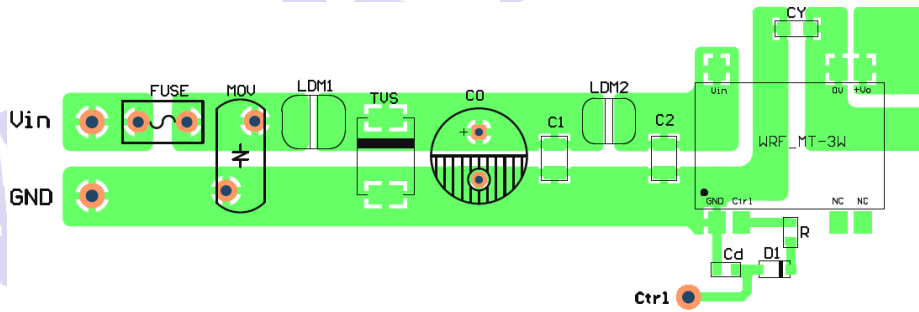
(Figure 1)

Recommended external circuit parameters:

Model	Vin:12V	Vin:24V	Vin:48V
FUSE	Slow blow ,choose according to actual input current		
MOV	--	S14K35	S14K60
LDM1	--	56μH	56μH
TVS	SMCJ28A	SMCJ48A	SMCJ90A
C0	680uF/50V	330μF/50V	330μF/100V
C1	4.7μF/50V		4.7μF/100V
LDM2	12μH		
C2	4.7μF/50V		4.7μF/100V
CY	1nF/3KV		
D1	RB160M-60/1A		
R	Follows: $R = \frac{V_C - V_D - 1.0}{I_C} - 300$		
Cd	47nF/100V		

Note: 1. In Figure 1, part ① is the recommended external circuit for EMS, and part ② is for EMI. Choose according to requirements;
 2. If there is no recommended parameters, the model no require the external component;
 3. VC is the voltage Between Ctr1 and GND, VD is the forward conduction voltage drop of D1, IC is the current through Ctr1 pin which is normally 5-10mA, the external circuit of Ctr1 is as shown in figure1-③.

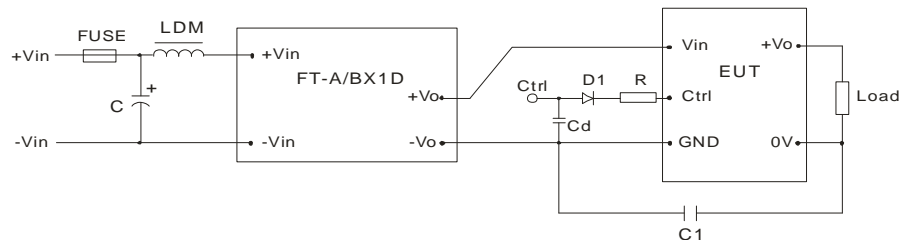
EMC RECOMMENDED CIRCUIT PCB LAYOUT



(Figure 2)

Note: The pad space between input and output GND (CY) must be ≥2mm.

EMC MODULE APPLICATION CIRCUIT



FT-A/BX1D is MORNSUN's EFT suppresser. For specific model, please refer to the selection guide.

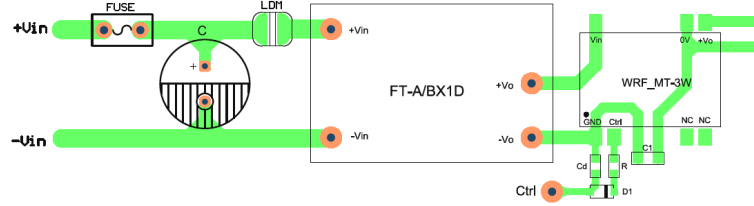
For nominal voltage <48V, C≥330μF/50V

For nominal voltage =48V, C≥330μF/100V

LDM=12uH, C1=1nF/3000V

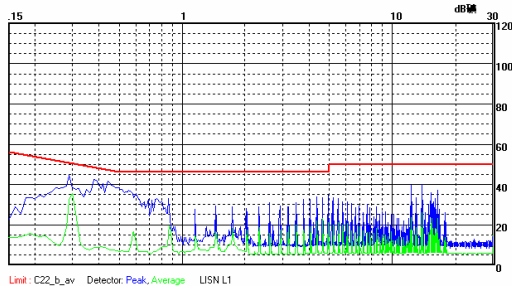
(Figure 3)

EMC MODULE RECOMMENDED CIRCUIT PCB LAYOUT

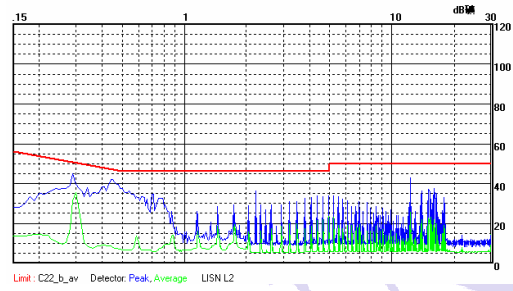


(Figure 4)

EMI TEST WAVEFORM (NOMINAL AND FULL LOAD)

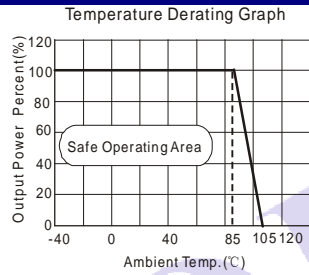


WRF2405MT-3W CE(Class B, Positive line)

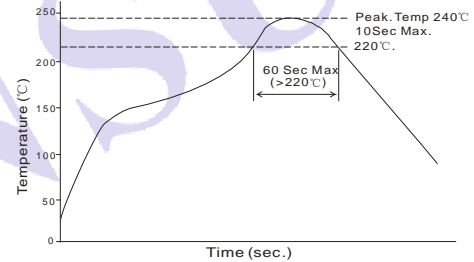


WRF2405MT-3W CE(Class B, Negative line)

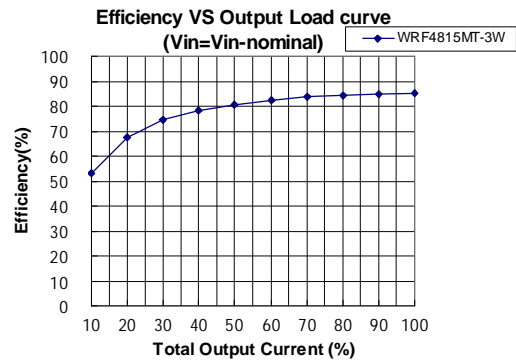
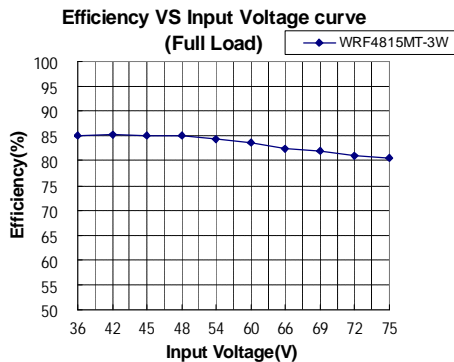
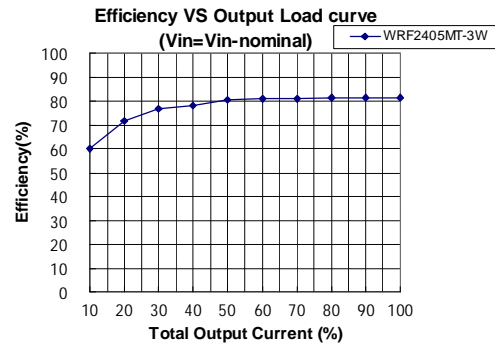
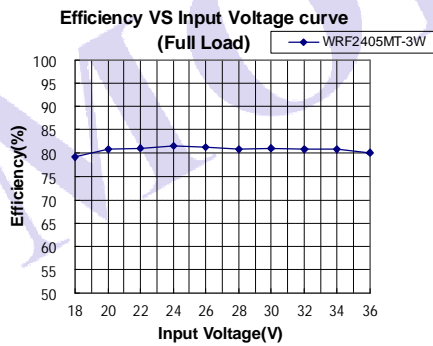
PRODUCT TYPICAL PERFORMANCE CURVE



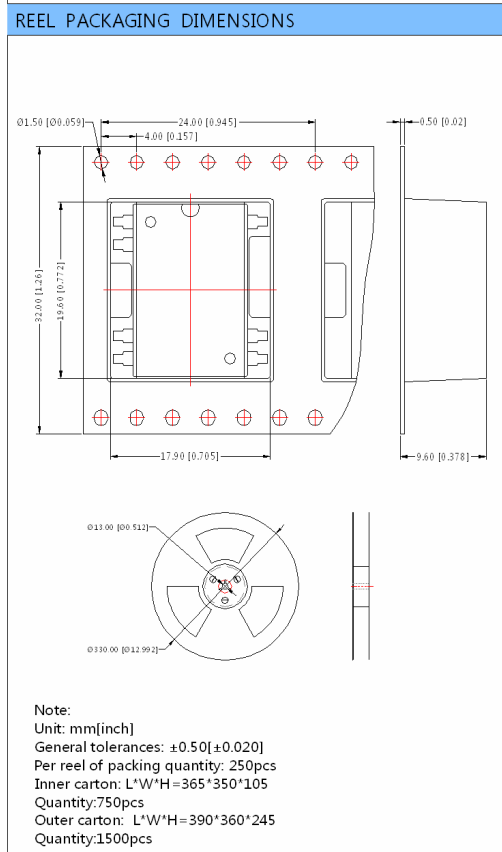
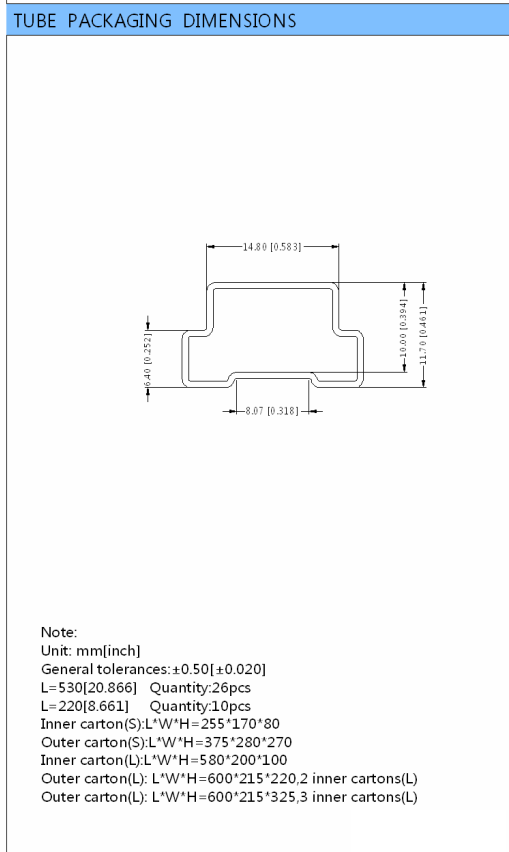
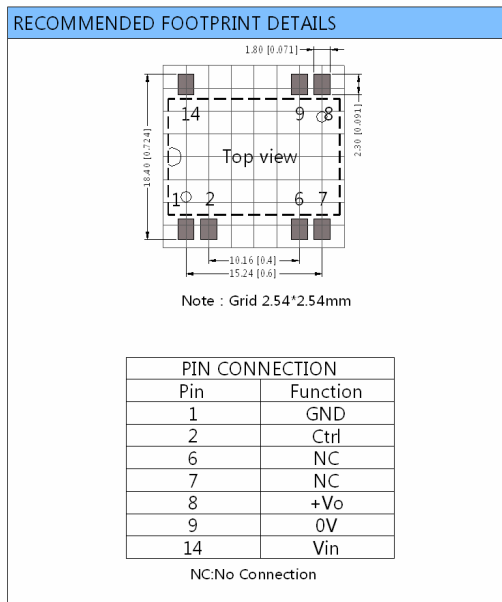
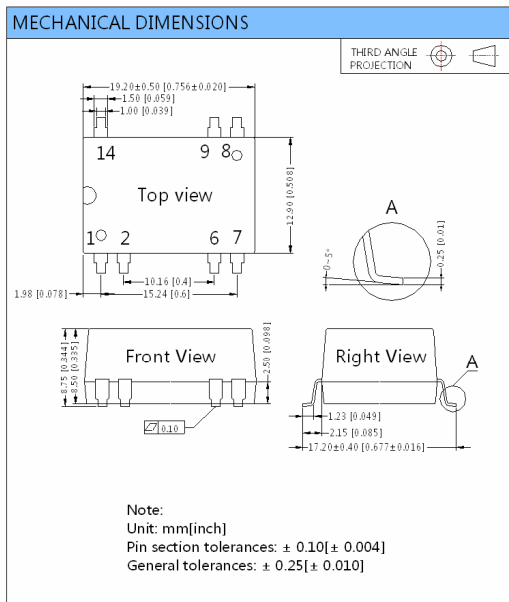
(Figure 5)



Note: The curve only applies to the hot air reflow soldering



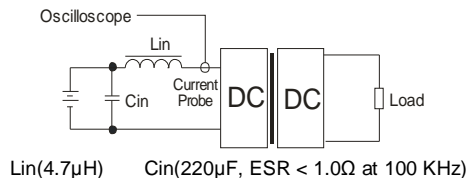
DIMENSIONS, RECOMMENDED FOOTPRINT & PACKAGING



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 the source impedance.



DESIGN CONSIDERATIONS

1) Requirement of output load

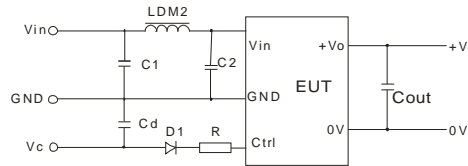
To ensure this module operate efficiently and reliably, during operation, the minimum output load could not be less than 5% of the full load, otherwise ripple maybe increase dramatically. To ensure this module operate normally, the load must be more than 5% of the full load.

2) Recommended circuit

All the WRF_MT-3W Series have been tested according to the following recommended test circuit (see Figure 6).

If you want to further decrease the input/output ripple, increase a capacitance-values properly or choose capacitors with low ESR. However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. Provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor must be less than the Max. Capacitive Load.

Recommended circuit refer to "EMC RECOMMENDED CIRCUIT".



(Figure 6)

3)Ctrl Terminal

When open or high impedance, the converter works well. When this pin is 'high', the converter shut down. It should be note that the input current should be between 5-10mA, exceeding the maximum 20mA will cause permanent damage to the converter. The value of R can be derived as follows:

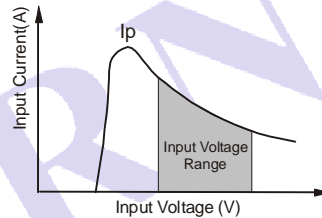
$$R = \frac{V_C - V_D - 1.0}{I_C} - 300$$

For detailed parameter, please refer to "EMC RECOMMENDED CIRCUIT".

4)Input current

When it is used in unregulated power supply, be sure that the fluctuating range of the power supply and the rippled voltage do not exceed the module standard. Input current of power supply should afford the flash startup current of this kind of DC/DC module (Figure 7).

General: Vin=12V Ip=675mA
 Vin=24V Ip=320mA
 Vin=48V Ip=160mA



(Figure 7)

5) It is not recommended to increase the output power capability by connecting two or more converters in parallel. The product is not hot-swappable

Note:

1. Min. load shouldn't be less than 5%, otherwise ripple maybe increased dramatically. If the product operates under min. load, it may not be guaranteed to meet all specifications listed. Operation with minimum load will not damage the converter.
2. Recommended Dual output models unbalanced load is $\leq \pm 5\%$, if the product operates $> \pm 5\%$, it may not be guaranteed to meet all specifications listed. Please contact our technical support for more details.
3. Max. Capacitive Load is tested at nominal input voltage and full load.
4. All specifications measured at $T_a = 25^\circ\text{C}$, humidity $< 75\%$, nominal input voltage and rated output load unless otherwise specified.
5. In this datasheet, all test methods are based on our corporate standards.
6. All characteristics are for listed models, and non-standard models may perform differently. Please contact our technical support for more details.
7. Please contact our technical support for any specific requirement.
8. Specifications of this product are subject to changes without prior notice.

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