

# DC/DC Converter

## URF\_LP-20WR3 Series

20W isolated DC-DC converter in DIP package  
Ultra-wide input and regulated single output



### FEATURES

- Ultra-wide 4:1 input voltage range
- High efficiency up to 89%
- No-load power consumption as low as 0.12W
- I/O isolation test voltage 3K VDC
- Operating ambient temperature range: -40°C to +85°C
- Input under-voltage protection, output short-circuit, over-voltage, over-current protection
- CISPR32/EN55032 CLASS A EMI compliant without external components
- Industry standard pin-out
- Input reverse polarity protection available with chassis (A2S) or 35mm DIN-Rail mounting (A4S) version
- IEC60950, UL60950, EN60950 Approved



CE c PA us CB Patent Protection RoHS

URF\_LP-20WR3 series are isolated 20W DC-DC converter products with a 4:1 input voltage range. They feature efficiencies of up to 89%, 3000VDC input to output isolation, operating ambient temperature of -40°C to +85°C, input under-voltage protection, output short circuit, over-voltage and over-current protection. The products meet CLASS A of CISPR32/EN55032 EMI standards, optional packages are offered for chassis or DIN-rail mounting (A2S, A4S), adding additional input reverse polarity protection. They are widely used in applications of requiring ultra-wide input voltage and high isolation, such as electrical power industry, data transmission, battery powered devices, telecommunication, distributed power systems, hybrid module system, remote control systems, industrial robotics, etc.

### Selection Guide

Certification	Part No. ①	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Max. Capacitive Load(μF)
		Nominal (Range)	Max. ②	Voltage (VDC)	Current (mA) (Max./Min.)		
UL/CE/CB	URF2403LP-20WR3	24 (9-36)	40	3.3	5000/0	84/86	10000
	URF2405LP-20WR3			5	4000/0	87/89	10000
	URF2409LP-20WR3			9	2222/0	86/88	4700
	URF2412LP-20WR3			12	1667/0	86/88	1600
	URF2415LP-20WR3			15	1334/0	87/89	1000
--	URF2418LP-20WR3			18	1111/0	87/89	680
UL/CE/CB	URF2424LP-20WR3			24	833/0	87/89	500
	URF4803LP-20WR3	48 (18-75)	80	3.3	5000/0	84/86	10000
	URF4805LP-20WR3			5	4000/0	86/88	10000
	URF4812LP-20WR3			12	1667/0	86/88	1600
	URF4815LP-20WR3			15	1334/0	87/89	1000
	URF4824LP-20WR3			24	833/0	87/89	500

**Notes:**

- ① Use "A2S" suffix for chassis mounting and "A4S" suffix for DIN-Rail mounting;
- ② Exceeding the maximum input voltage may cause permanent damage;
- ③ Efficiency 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 input	3.3V output	--	799/40	819/45	mA
		5V output	--	936/40	958/45	
		Other output	--	947/10	969/20	
	48VDC input	3.3V output	--	400/20	410/25	
		5V output	--	473/20	485/25	
		Other output	--	473/5	485/8	
Reflected Ripple Current	24VDC input	--	30	--		
	48VDC input	--	30	--		
Surge Voltage (1sec. max.)	24VDC input	-0.7	--	50	VDC	
	48VDC input	-0.7	--	100		
Start-up Voltage	24VDC input	--	--	9		
	48VDC input	--	--	18		
Input Under-voltage Protection	24VDC input	5.5	6.5	--		
	48VDC input	12.0	15.5	--		
Start-up Time	Nominal input& constant resistance load	--	10	--	ms	
Input Filter		Pi filter				
Hot Plug		Unavailable				
Ctrl*	Module on	Ctrl pin open or pulled high (3.5-12VDC)				
	Module off	Ctrl pin pulled low to GND (0-1.2VDC)				
	Input current when off	--	4	7	mA	

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

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Voltage Accuracy	0%-100% load	--	±1	±3	%	
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5		
Load Regulation	0%-100% load	--	±0.5	±1		
Transient Recovery Time		--	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*	20MHz bandwidth, 5%-100% load	--	50	100	mV p-p	
Over-voltage Protection	Input voltage range	110	--	160	%Vo	
Trim		--	±10	--	%Vo	
Over-current Protection		110	--	190	%Io	
Short-circuit Protection		Hiccup, continuous, self-recovery				

Note: \*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 Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output Electric Strength test for 1 minute with a leakage current of 1mA max.	3000	--	--	VDC
Insulation Resistance	Input-output insulation at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100KHz/0.1V	--	500	--	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
Vibration		10-55Hz, 2G, 30 Min. along X, Y and Z			
Switching Frequency *	PWM mode	--	270	--	KHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	K hours

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	Black plastic; flame-retardant and heat-resistant (UL94 V-0)				
Dimensions	Horizontal package	51.50 x 26.50 x 12.00 mm			
	A2S chassis package	76.00 x 31.50 x 21.20 mm			
	A4S Din-rail package	76.00 x 31.50 x 25.80 mm			
Weight	Horizontal package/A2S chassis package/A4S Din-rail package	23.7g/46.0g/66.0g (Typ.)			
Cooling Method	Free air convection				

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032 CLASS A (without extra components)/ CLASS B (see Fig.3-② for recommended circuit)			
	RE	CISPR32/EN55032 CLASS A (without extra components)/ 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.3-①for recommended circuit)	perf. Criteria B		
	CS	IEC/EN61000-4-6 3 Vr.m.s	perf. Criteria A		
	Voltage dips, short interruptions and voltage variations immunity	IEC/EN61000-4-29 0%, 70%	perf. Criteria B		

Typical Characteristic Curves

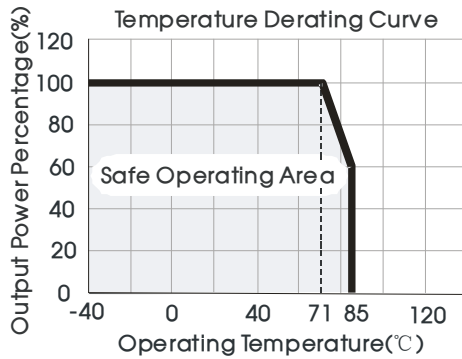
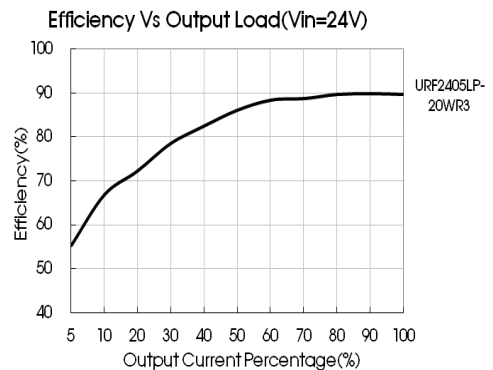
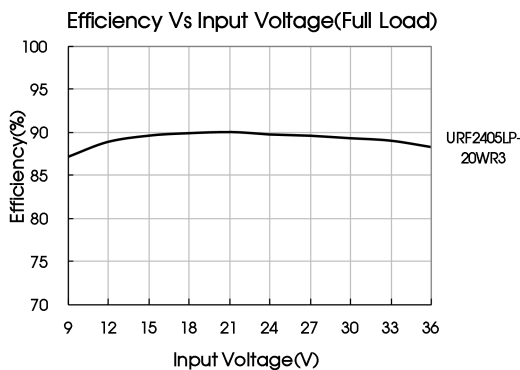
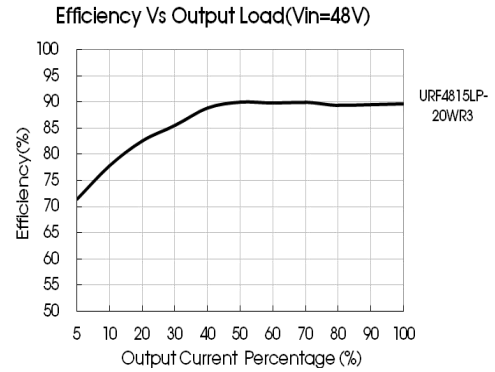
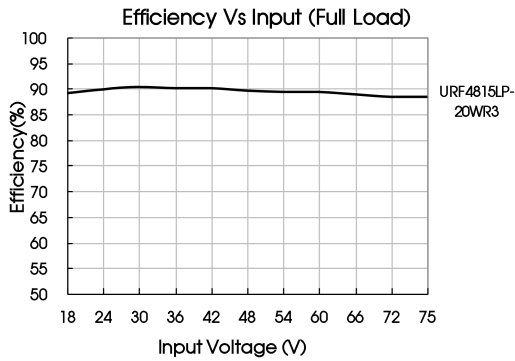


Fig. 1





## 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.

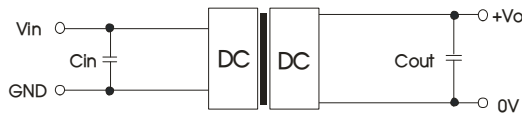


Fig. 2

Vin(VDC)	Cout(μF)	Cin(μF)
3.3/5	470	100
9/12/15	220	
18/24	100	

### 2. EMC compliance circuit

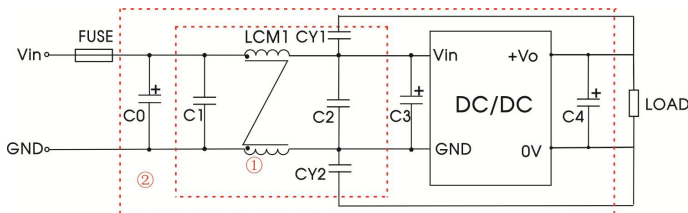


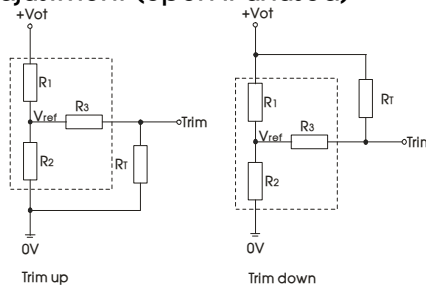
Fig. 3

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

#### Parameter description

Model	Vin:24V	Vin:48V
FUSE	Choose according to actual input current	
C0	1000μF/50V	680μF/100V
C1/C2	1μF/50V	1μF/100V
C3	330μF/50V	330μF/100V
C4	Refer to the Cout in Fig.2	
LCM1	6.8mH	
CY1, CY2	1nF/3KV	

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



TRIM resistor connection (dashed line shows internal resistor network)

#### Trim resistor calculation

$$\text{up: } R_T = \frac{\alpha R_2}{R_2 - \alpha} - R_3$$

$$\alpha = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$$

$R_T$  = Trim Resistor value;  
 $\alpha$  = self-defined parameter.

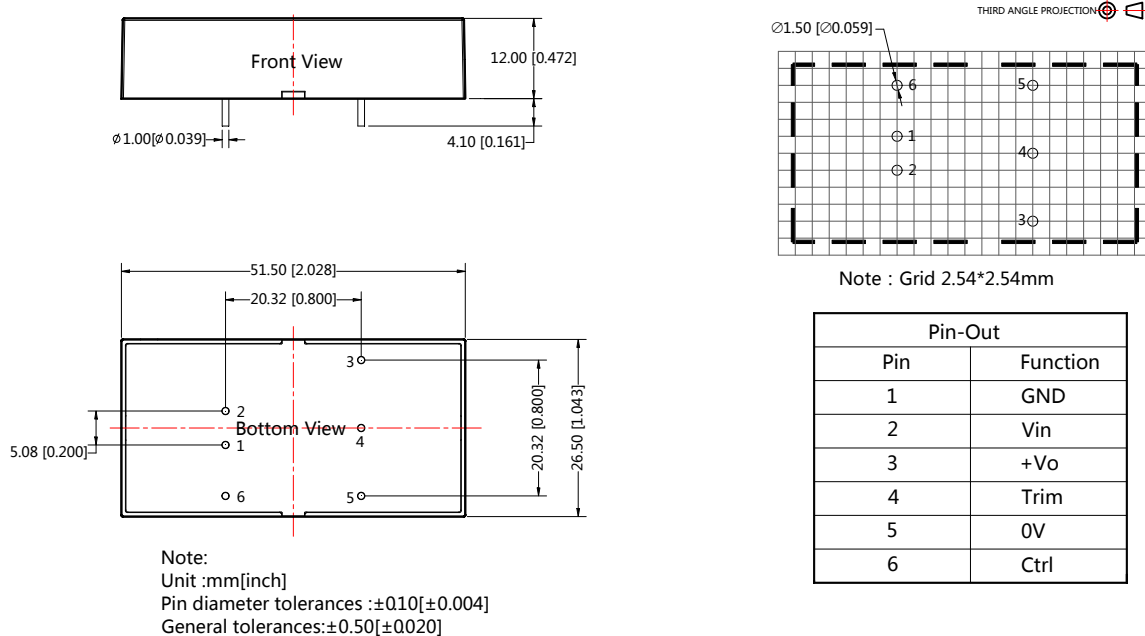
$$\text{down: } R_T = \frac{\alpha R_1}{R_1 - \alpha} - R_3$$

$$\alpha = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

Vout(V)	R1(K $\Omega$ )	R2(K $\Omega$ )	R3(K $\Omega$ )	Vref(V)
3.3	4.801	2.87	12.4	1.25
5	2.883	2.87	10	2.5
9	7.500	2.87	15	2.5
12	11.000	2.87	15	2.5
15	14.494	2.87	15	2.5
18	17.953	2.87	17.4	2.5
24	24.872	2.87	17.8	2.5

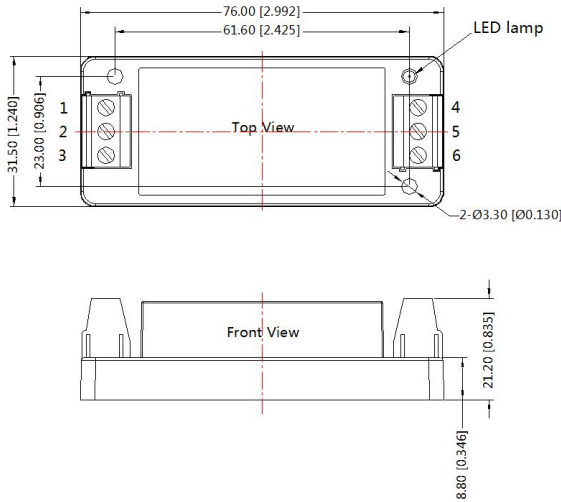
- 4.The products do not support parallel connection of their output  
5.For additional information please refer to DC-DC converter application notes on  
[www.mornsun-power.com](http://www.mornsun-power.com)

### URF\_LP-20WR3 Dimensions and Recommended Layout



URF\_LP-20WR3A2S Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

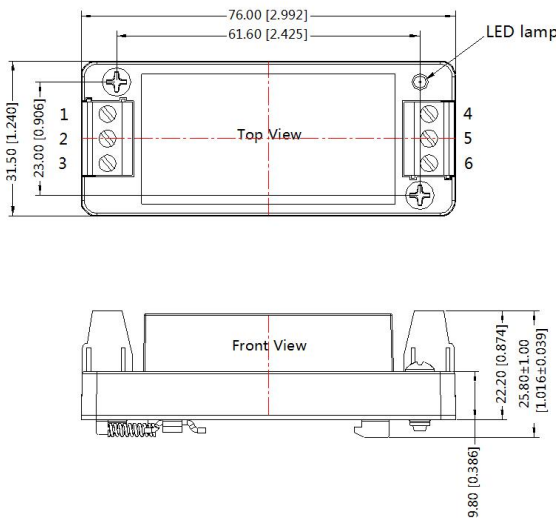


Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	0V	Trim	+Vo

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

URF\_LP-20WR3A4S Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



Pin-Out						
Pin	1	2	3	4	5	6
Function	Ctrl	GND	Vin	0V	Trim	+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](http://www.mornsun-power.com). The Packaging bag number of Horizontal packaging: 58210039, A2S/A4S packaging number: 58220022;
- 2.The maximum capacitive load offered were tested at input voltage range and full load;
- 3.Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated load;
- 4.All index testing methods in this datasheet are based on company 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.

Mornsun Guangzhou Science & Technology Co., Ltd.

Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. China  
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: [info@mornsun.cn](mailto:info@mornsun.cn) [www.mornsun-power.com](http://www.mornsun-power.com)