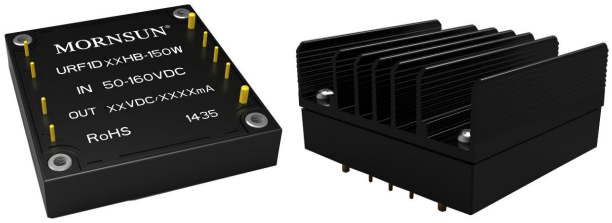
DC/DC Converter

URF1D_HB-150W Series

MORNSUN®

150W isolated DC-DC converter in ½-Brick package, Wide input voltage and regulated single output



Patent Protection RoHS

3 years Warranty

FEATURES

- Wide input voltage range: 50-160VDC
- High efficiency up to 91%
- No-load input current as low as 3mA
- I/O isolation test voltage 3k VDC
- Operating ambient temperature range: -40℃ ~ +100℃
- Input under-voltage , output over-voltage, over-current, short-circuit, over-temperature protection
- Industry standard ½-Brick package and pin-out
- Meets requirements of railway standard EN50155

URF1D_HB-150W series is a high-performance product specifically designed for a variety of railway applications. The DC-DC converters feature 150W output power with no requirement for minimum load, wide input voltage from 50-160VDC, and allowing operating out-case temperature as high as 100℃. Additional product features include input under-voltage protection, output over-voltage, short-circuit, over-current and over-temperature protection, remote On/Off control, remote sense compensation, output voltage trim adjustment. The products meet EN50155 railway standards and are widely used in the on-board electronic system and associated equipment.

Selection Guide

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.)		
URF1D12HB-150W	110	(66-160)	170	12	12500/0	87/89	10000
		(50-66)			10000/0		
URF1D15HB-150W		(66-160)		15	10000/0	87/89	6800
		(50-66)			8000/0		
URF1D24HB-150W		(66-160)		24	6250/0	89/91	4400
		(50-66)			5000/0		

Note:
①Use "H" suffix for heat sink mounting; We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
②Exceeding the maximum input voltage may cause permanent damage.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load / no-load)	Nominal input	--	1532/3	1567/10	mA
Reflected Ripple Current	Nominal input	--	80	--	
Surge Voltage (1sec. max.)		-0.7	--	180	VDC
Start-up Voltage		--	47	50	
Under-voltage Protection		35	43	50	
Start-up Time		--	25	--	mS
Input Filter		Pi filter			
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	--	2	5	mA
Hot Plug		Unavailable			

Note: * The Ctrl pin voltage is referenced to input GND (-Vin).

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	Nominal input,10%-100% load	--	±1	±3	%

Linear Regulation	Input voltage variation from low to high at full load		--	--	±0.3	%
Load Regulation	Nominal input,10%-100% load		--	--	±0.5	
Transient Recovery Time	25% load step change		--	300	500	μs
Transient Response Deviation		15V, 24V output	--	±3	±5	%Vo
		12V output	--	±4	±8	
Temperature Coefficient	Full load		--	--	±0.03	%/℃
Ripple & Noise *	20MHz bandwidth (with 10%-100% load)		--	60	150	mVp-p
Trim			95	--	110	%Vo
Sense			--	--	105	
Over-voltage Protection	Input voltage range		110	--	140	%Vo
Over-current Protection			110	130	180	%Io
Short-circuit Protection	Nominal input		Hiccup, continuous, self-recovery			
Note: * For ripple and noise measuring method, please refer to Fig. 2.						

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input - Output	Input-output Electric Strength test for 1 minute with a leakage current of 1mA max.	3000	--	--	VDC
	Input - Out-case		1500	--	--	
	Output - Out-case		1000	--	--	
Insulation Resistance		Input-output insulation at 500VDC	1000	--	--	MΩ
Isolation Capacitance		Input-output capacitance at 100KHz/0.1V	--	2500	--	pF
Operating Temperature		See Temperature Derating Curve Fig. 1	-40	--	100	℃
Out-case Temperature		Within the operating temperature curve	-40	--	100	
Storage Temperature			-55	--	125	
Over-temperature Protection		Out-case Temperature	100	--	120	
Pin Soldering Resistance Temperature		Soldering spot is 1.5mm away from case for 10 seconds	--	--	300	
Storage Humidity		Non-condensing	5	--	95	%RH
Thermal Resistance	URF1D12HB-150W URF1D15HB-150W URF1D24HB-150W	Natural convection	7.8	--	--	℃/W
		200LFM convection	4.44	--	--	
		400LFM convection	3.39	--	--	
		1000LFM convection	2.52	--	--	
	URF1D12HB-150WH URF1D15HB-150WH URF1D24HB-150WH	Natural convection	3.7	--	--	
		200LFM convection	2.2	--	--	
		400LFM convection	1.76	--	--	
		1000LFM convection	1.28	--	--	
Switching Frequency		PWM mode	--	160	--	KHz
MTBF		MIL-HDBK-217F@ (Plate Tb=70℃, GB)	500	--	--	K hours
Shock and Vibration Test			IEC61373-Category 1, Grade B			

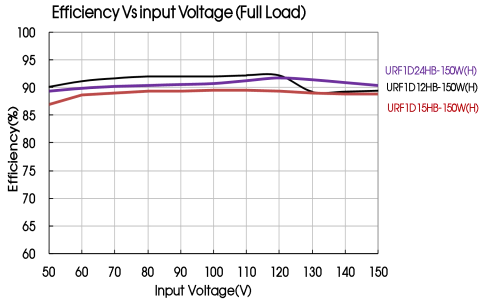
Mechanical Specifications

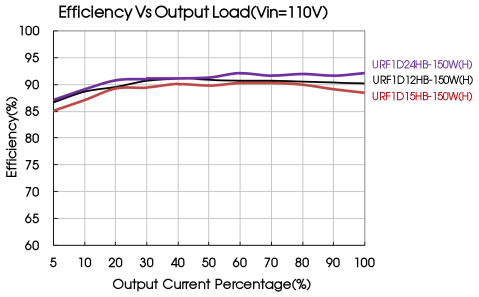
Case Material	Aluminum plate + plastic case	Black Epoxy resin; flame-retardant and heat-resistant (UL94-V0)
	Heatsink	Aluminum Alloy
Weight	URF1D12HB-150W, URF1D15HB-150W, URF1D24HB-150W	70.0g (Typ.)
	URF1D12HB-150WH, URF1D15HB-150WH, URF1D24HB-150WH	120.0g (Typ.)
Cooling method		Natural convection or Forced air convection

Electromagnetic Compatibility (EMC)

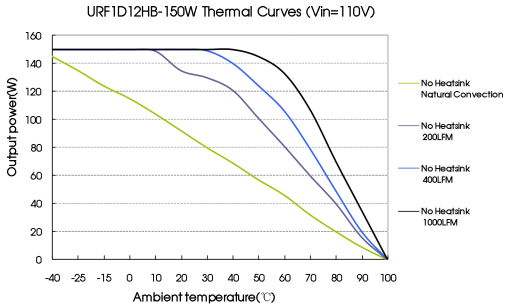
Emissions	CE	CISPR32/EN55032	Class B (see Fig.4)	
	RE	CISPR32/EN55032	Class B (see Fig.4)	
Immunity	ESD	IEC/EN61000-4-2 GB/T17626.2	Contact ±6KV, Air ±8KV	perf.Criteria B
	RS	IEC/EN61000-4-3 GB/T17626.3	10V/m	perf.Criteria A
	CS	IEC/EN61000-4-6 GB/T17626.6	10Vr.m.s	perf.Criteria A
	EFT	IEC/EN61000-4-4 GB/T17626.4	±2KV(5KHz/100KHz) see Fig. 4 for recommended circuit	perf.Criteria B
	Surge	IEC/EN61000-4-5 GB/T17626.5	±2KV(1.2μs/50μs 2Ω) (see Fig. 4 for recommended circuit	perf.Criteria B

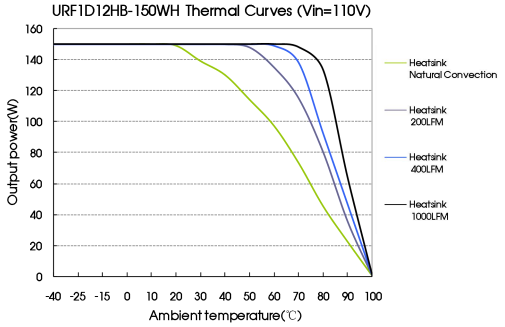
Efficiency Curves

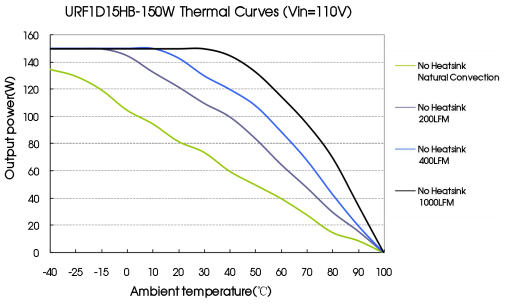


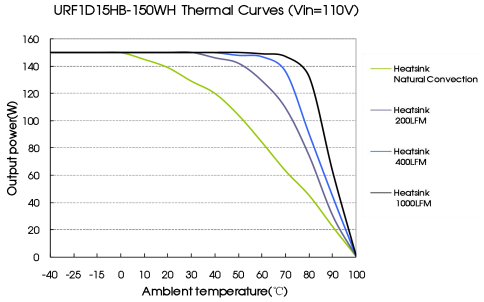


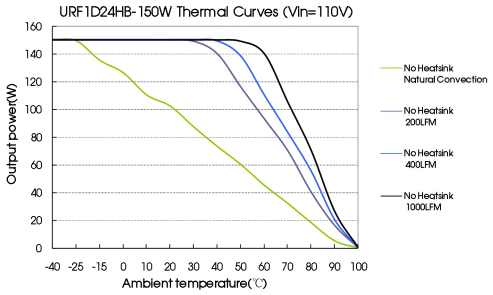
Temperature Derating Curve











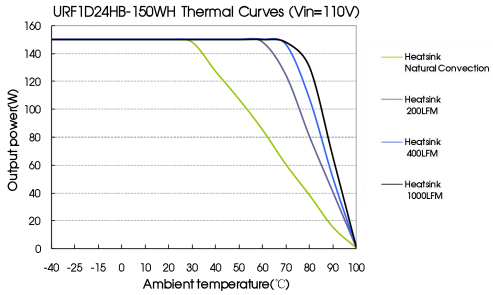
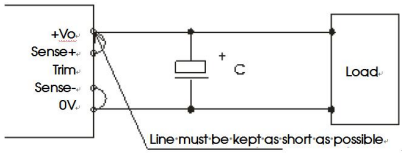


Fig. 1

Remote Sense Application

1. Remote Sense Connection if not used

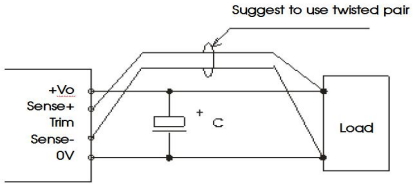


Short at pin root

Notes：

1. If the sense function is not used for remote regulation the user must connect the +Sense to + Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only.
2. The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation



Notes:

(1) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible.

(2) In cables and discrete wiring applications, twisted pair or other techniques should be implemented.

(3) Using remote sense with long wires long wires may cause unstable operation. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.

(4) We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.

Design Reference

1. Ripple & noise

All DC-DC converters of this series have been tested according to the following recommended test circuit before leaving the factory (see Fig. 2) and ripple & noise tests are performed according to Fig. 3.

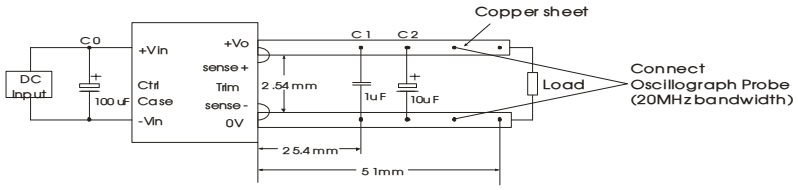


Fig. 2

2. Typical application

We recommended using Mornsun's EMC circuit, otherwise please ensure that at least a 100 μF electrolytic capacitors is connected at the input in order to ensure adequate voltage surge suppression and protection.

Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout 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.

Capacitor Value / Output Voltage	Cout(μF)	Cin(μF)
12V、15V、24V	220	100

3. EMC compliance circuit

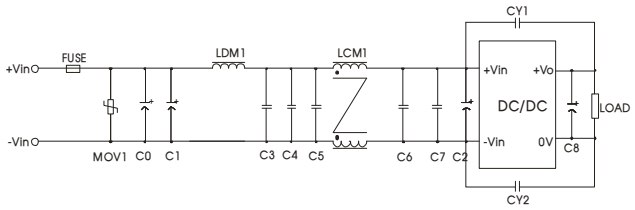


Fig. 4

Element model	Recommended value
FUSE	Choose according to actual input current
MOV1	S20K130 (Varistor)
C0	220uF/200V (electrolytic capacitor)
C1/C2	100uF/200V (electrolytic capacitor)
C3/C4/C5/C6/C7	2.2uF/250V
C8	220 uF/50V(electrolytic capacitor)
CY1	2200pF/400VAC (Y Safety capacitor)
CY2	3300pF/400VAC (Y Safety capacitor)
LDM1	10uH (Shielded inductor)
LCM1	1.0mH, recommended to use MORNSUN's FL2D-30-102

4. Thermal design

The maximum operating out-case Temperature TB is 100 ℃. As long as the users thermal application keeps TB <100 ℃, the converter can be used with its full rated power. When using a heatsink attached to the out-case of the converter the power derating curve can be calculated accordingly. It is only necessary to determine the selected heatsinks thermal resistance Rth(B-A) between Out-case and ambient for a given airflow rate. This information is usually available from the heatsink vendor.

The following formula can be used to determine the maximum power the converter can dissipate for a given thermal condition with the Out-case is to be maintained at a temperature no higher than 100 ℃.

$$P_{diss}^{\max} = \frac{100℃ - T_A}{Rth_{(B-A)}}$$

T_A = ambient temperature

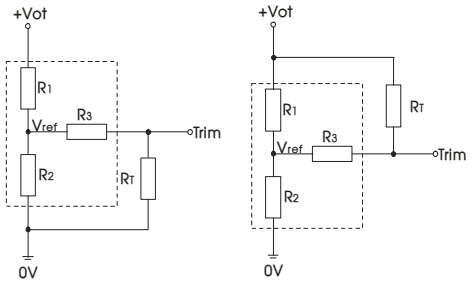
The maximum available power of the module at a certain ambient temperature can be calculated by the power dissipation according to following formula which allows customers to choose the appropriate heatsink according to the actual application:

$$Po_{\max} = \frac{P_{diss}^{\max}}{(\frac{1}{\eta} - 1)}$$

η = converter efficiency

Therefore, customers can according to the actual application to choose the right heatsink.

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



TRIM resistor connection (dashed line shows internal resistor network)

Calculation formula of Trim resistance:

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

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

Note: Value for R1, R2, R3, and V_{ref} refer to the above table 1. R_T: Resistance of Trim. a: User-defined parameter, no actual meanings. Vo': The trim up/down voltage.

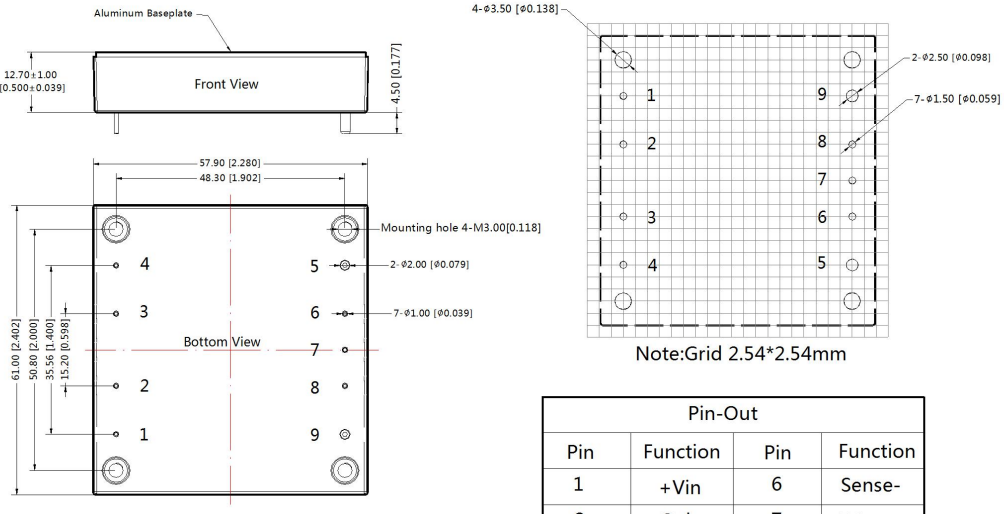
table 1

Parameter \ Vo	12(VDC)	15(VDC)	24(VDC)
R1(KΩ)	11	14.49	24.87
R2(KΩ)	2.87	2.87	2.87
R3(KΩ)	17.8	20	20
Vref(V)	2.5	2.5	2.5

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

7. For additional information about our EMC Filter products, refer to www.mornsun-power.com and our application notes.

Dimensions and Recommended Layout (Without heatsink)

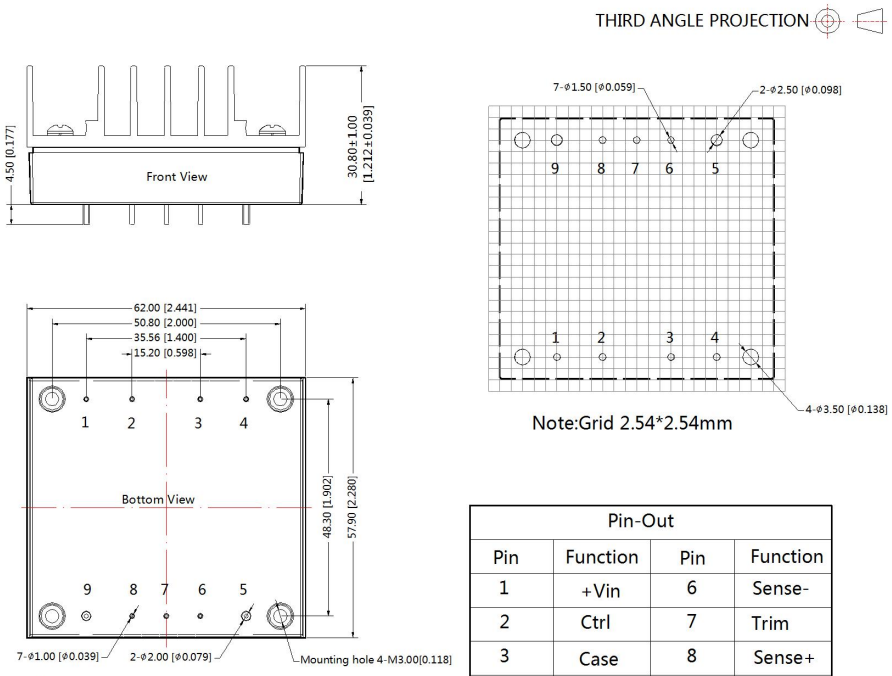


Note:Grid 2.54*2.54mm

Pin-Out			
Pin	Function	Pin	Function
1	+Vin	6	Sense-
2	Ctrl	7	Trim
3	Case	8	Sense+
4	-Vin	9	+Vo
5	0V		

Note:
Unit:mm[inch]
Pin1,2,3,4,6,7,8's diameter:1.00[0.039]
Pin5,9's diameter:2.00[0.079]
Pin diameter tolerances:±0.10[±0.004]
General tolerances:±0.50[±0.020]
Mounting hole screwing torque: Max 0.4 N·m

Dimensions (With heatsink)



Note:Grid 2.54*2.54mm

Pin-Out			
Pin	Function	Pin	Function
1	+Vin	6	Sense-
2	Ctrl	7	Trim
3	Case	8	Sense+
4	-Vin	9	+Vo
5	0V		

Note:
Unit:mm[inch]
Pin1,2,3,4,6,7,8's diameter:1.00[0.039]
Pin5,9's diameter:2.00[0.079]
Pin diameter tolerances:±0.10[±0.004]
General tolerances:±0.50[±0.020]
Mounting hole screwing torque: Max 0.4 N·m

Note

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58200069(without heatsink), 58200061(with heatsink);
2. The max capacitive load should be tested within the input voltage range and under full load conditions;
3. It is recommended that customers use enamel film or thermal grease between the heat sink and the module when using the heat sink to ensure good heat dissipation.
4. 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;
5. when used in lower than 10% load , the ripple & noise index of the product is 3%Vo;
6. All index testing methods in this datasheet are based on our company corporate standards;
7. The performance parameters of the product models listed in this manual are as above, but some parameters of non-standard model products may exceed the requirements mentioned above. Please contact our technicians directly for specific information;
8. We can provide product customization service, please contact our technicians directly for specific information;
9. Products are related to laws and regulations: see "Features" and "EMC";
10. 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 www.mornsun-power.com