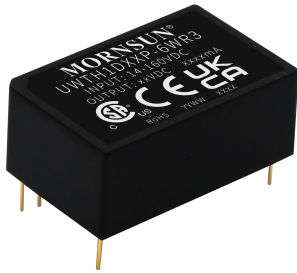


6W isolated DC-DC converter
Ultra-wide input and regulated single output



Patent Protection



CSA62368



EN62368-1
EN50155
EN45545



BS EN62368-1



IEC62368-1



FEATURES

- Ultra-wide 12:1 input voltage range: 14 -160VDC
- High efficiency up to 83%
- Reinforced insulation, I/O isolation test voltage 3k VAC
- Operating ambient temperature range -40°C to +105°C
- Input under-voltage protection, output over-voltage, over-current, short-circuit protection
- Meets AREMA standards

UWTH1D_P-6WR3 series is a high-performance product specifically designed for a variety of railway applications. The output power is 6W. It features ultra-wide input voltage of 14-160VDC, which is compatible with nominal input type of 24V, 36V, 48V, 72V, 96V and 110V. Meets EN50155 standard for voltage fluctuations. The reinforced high insulation 3000VAC ensures that the system can still be used safely in 5000m high altitude applications. The allowable operating temperature is -40°C to +105°C. It integrates multiple protection functions to ensure the safety and high reliability of the system. It is widely used in vehicle-mounted switches, train control systems, traction control systems and associated equipment.

Selection Guide

Certification	Part No.	Input Voltage (VDC)		Output		Full Load Efficiency ^② (%) Min./Typ.	Capacitive Load (μF)Max.
		Nominal (Range)	Max. ^①	Voltage (VDC)	Current (mA) Max./Min.		
CSA/EN/BS EN/IEC	UWTH1D03P-6WR3	110 (14-160)	160	3.3	1454/0	73/75	1000
	UWTH1D05P-6WR3			5	1200/0	78/80	1000
	UWTH1D12P-6WR3			12	500/0	81/83	470
	UWTH1D15P-6WR3			15	400/0	81/83	470
	UWTH1D24P-6WR3			24	250/0	81/83	220

Notes:

- ① Exceeding the maximum input voltage may cause permanent damage;
② Efficiency is tested at 48VDC nominal input voltage and full load at +25°C ambient;
③ At 14V-16.8V / 160V-200V input, the product can work for 0.1s / 1s respectively.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Input Current (full load)	24VDC input	3.3V output	--	270	278	mA
		5V output	--	320	329	
		Others	--	309	317	
	36VDC input	3.3V output	--	178	183	
		5V output	--	208	214	
		Others	--	203	208	
	48VDC input	3.3V output	--	133	137	
		5V output	--	156	160	
		Others	--	151	154	
	72VDC input	3.3V output	--	88.9	91.3	
		5V output	--	104	107	
		Others	--	103	105	
	96VDC input	3.3V output	--	68.5	70.4	
		5V output	--	80.2	82.2	
		Others	--	77.2	79.1	

Input Current (full load)	110VDC input	3.3V output	--	59.8	61.5	mA
		5V output	--	70.8	72.7	
		Others	--	68.2	69.9	
Input Current (no-load)	Nominal input voltage		--	5	12	VDC
Reflected Ripple Current			--	50	--	
Surge Voltage (1sec. max.)			-0.7	--	200	
Start-up Voltage			--	--	14	
Input Under-voltage Protection			9	11.5	--	
Start-up Time	Nominal input voltage & constant resistance load		--	10	120	ms
Input Filter			Pi filter			
Hot Plug			Unavailable			

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Voltage Accuracy ^①	5%-100% load	--	±1	±3	%	
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5		
Load Regulation ^②	5%-100% load	--	±0.5	±1		
Transient Recovery Time	25% load step change, nominal input voltage	--	250	500	μs	
Transient Response Deviation	25% load step change, input voltage range	3.3V/5V output	--	±5	±8	%
		Others output	--	±3	±5	
Temperature Coefficient	Full load	--	--	±0.03	%/°C	
Ripple & Noise ^③	20MHz bandwidth, 5%-100% load	--	80	150	mV p-p	
Over-voltage Protection	Input voltage range	110	130	160	%Vo	
Over-current Protection		110	180	260	%Io	
Short-circuit Protection		Hiccup, continuous, self-recovery				

Note:
 ①Output voltage accuracy for 0%-5% load is ±5% max;
 ②Load regulation for 0% -100% load increases to ±3%;
 ③The "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 5mA max.	3000	--	--	VAC
Insulation Resistance	Input-output resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	500	--	pF
Type of insulation	Input-output	Reinforced insulation			
Operating Temperature	See Fig. 1	-40	--	+105	°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
Cooling Test		EN60068-2-1			
Dry Heat		EN60068-2-2			
Damp Heat		EN60068-2-30			
Pollution Level		PD 3			
Shock and Vibration Test		IEC/EN61373 Class B			
Fire & Smoke Compliance		EN45545-2, HL3			
Salt Mist Test		EN60068-2-11, Ka			
Cyclic Damp Heat Test		EN60068-2, Db variant 2			
Low Temperature Start-up and Storage Test		EN60068-1, Ad and Ab			
Switching Frequency ^①	PWM mode	--	170	--	kHz

Altitude ②		5000m			
MTBF	MIL-HDBK-217F@25℃	1000	--	--	k hours
Note: ①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement; ②When the altitude is above 2000m, the product surface max.temperature must be below 105℃.					

Mechanical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant (UL94 V-0)
Dimensions	31.60 x 20.30 x 12.50 mm
Weight	17.0g(Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC) (EN62368)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig.4 or Fig.5 for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig.4 or Fig.5 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±6kV/Air ±8kV	perf. Criteria A
	RS	IEC/EN61000-4-3	10V/m (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2kV (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	Surge	IEC/EN61000-4-5	line to line ±2kV (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	CS	IEC/EN61000-4-6	3 Vr.m.s (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A

Electromagnetic Compatibility (EMC) (EN50121-3-2)

Emissions	CE	EN50121-3-2	EN55016-2-1	150kHz-500kHz	99dBuV (see Fig.4 or Fig.5 for recommended circuit)	
		EN55032	EN55032-11	500kHz-30MHz	93dBuV (see Fig.4 or Fig.5 for recommended circuit)	
Immunity	RE	CISPR16-2-3	30MHz-230MHz	40dBuV/m at 10m	(see Fig.4 or Fig.5 for recommended circuit)	
			230MHz-1GHz	47dBuV/m at 10m	(see Fig.4 or Fig.5 for recommended circuit)	
			1GHz-6GHz	47dBuV/m at 10m	(see Fig.4 or Fig.5 for recommended circuit)	
	ESD	EN61000-4-2	Contact ±6kV/Air ±8kV			perf. Criteria A
	RS	EN61000-4-3	80 – 800MHz	20V/m		perf. Criteria A
		800 – 1000MHz	20V/m			
			1400 – 2000MHz	10V/m		
			2000 – 2700MHz	5V/m		
			5100 – 6000MHz	3V/m		
			(see Fig.4 or Fig.5 for recommended circuit)			
	EFT	EN61000-4-4	±2kV	5/50ns	5kHz (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	Surge	EN61000-4-5	line to line ±1kV (42Ω, 0.5μF) line to ground ±2kV(42Ω, 0.5μF) (see Fig.4 or Fig.5 for recommended circuit)			perf. Criteria A
			line to line ±1kV (2Ω, 18μF) line to ground ±2kV(12Ω, 9μF) (see Fig.4 or Fig.5 for recommended circuit)			
	CS	EN61000-4-6	0.15MHz-80MHz	10V r.m.s	(see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A

Electromagnetic Compatibility (EMC) (AREMA)

Emissions	CE	CISPR16-2-1	150kHz-500kHz	79dBuV (see Fig.4 or Fig.5 for recommended circuit)	
		CISPR16-1-2	500kHz-30MHz	73dBuV (see Fig.4 or Fig.5 for recommended circuit)	
	RE	CISPR16-2-3	30MHz-230MHz	40dBuV/m at 10m (see Fig.4 or Fig.5 for recommended circuit)	
			230MHz-1GHz	47dBuV/m at 10m (see Fig.4 or Fig.5 for recommended circuit)	
Immunity	ESD	IEC61000-4-2	Contact ±6kV/Air ±8kV		perf. Criteria A
			RS	IEC61000-4-3	
160 – 165MHz	20V/m				
450 – 470MHz	20V/m				
800 – 960MHz	20V/m				
1400 – 2000MHz	20V/m				
2100 – 2500MHz	5V/m				
			(see Fig.4 or Fig.5 for recommended circuit)		

Immunity	EFT	IEC61000-4-4	±2kV 5/50ns 5kHz	(see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	Surge	IEC61000-4-5	line to line ±2kV (2Ω, 18μF) line to ground ±2kV(2Ω, 18μF)	(see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	CS	IEC61000-4-6	0.15MHz-80MHz 10V r.m.s	(see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	MS	IEC61000-4-8	60Hz 100A/m 60Hz 300A/m	(see Fig.4 or Fig.5 for recommended circuit) (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A

Typical Performance Curves

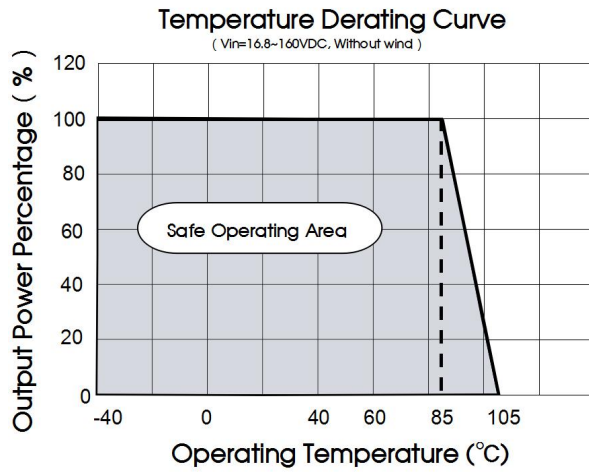
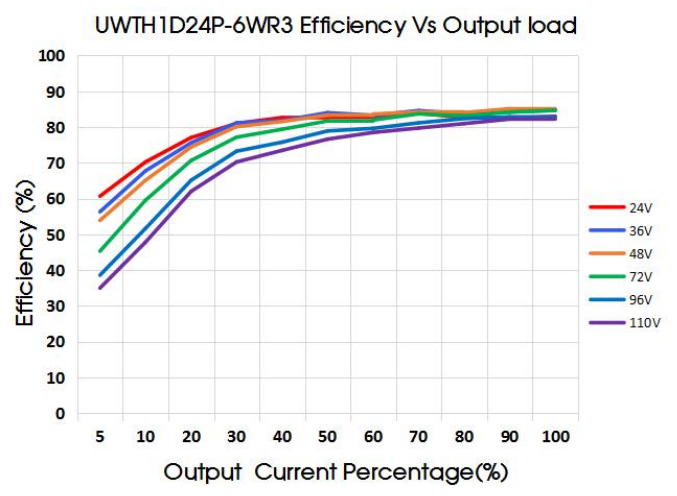
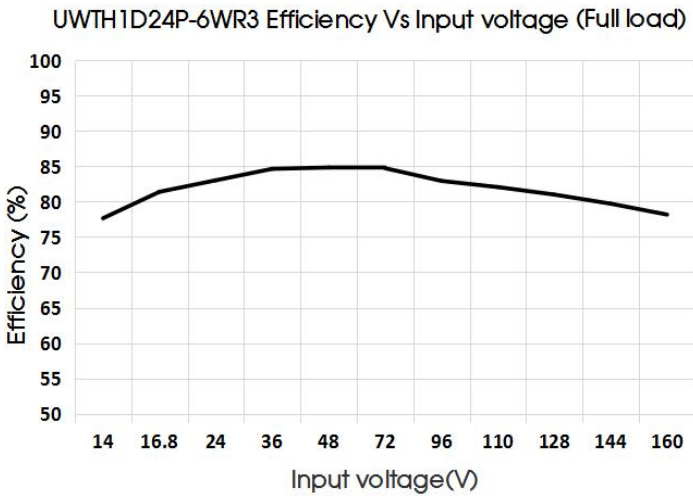


Fig.1



Design Reference

1. Ripple & Noise

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.



Fig. 2

Vout (VDC)	C1	C2	C3
3.3/5	100uF /200V	1uF/16V	10uF/16V
12/15		1uF/25V	10uF/25V
24		1uF/50V	10uF/50V

Note: C1 is the electrolytic capacitor, C2 is the chip capacitor and C3 is the tantalum capacitor.

2. Typical application

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.

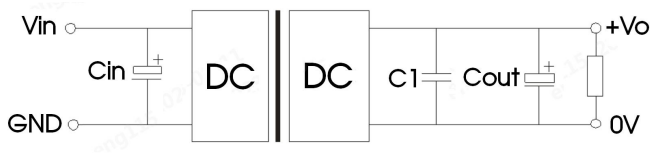


Fig.3

Vout (VDC)	Cin	C1	Cout
3.3/5	100uF /200V	1uF/16V	10uF/16V
12/15		1uF/25V	10uF/25V
24		1uF/50V	10uF/50V

3. EMC compliance circuit

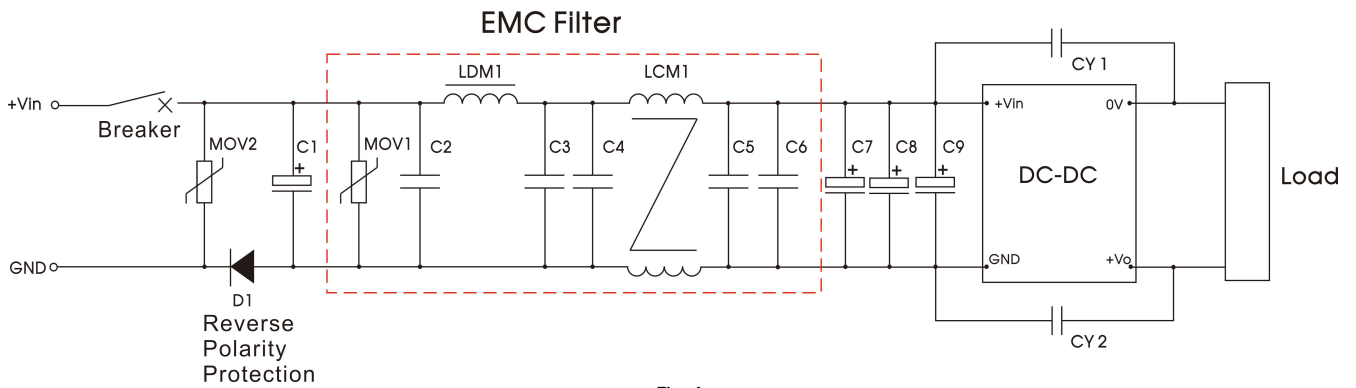


Fig.4

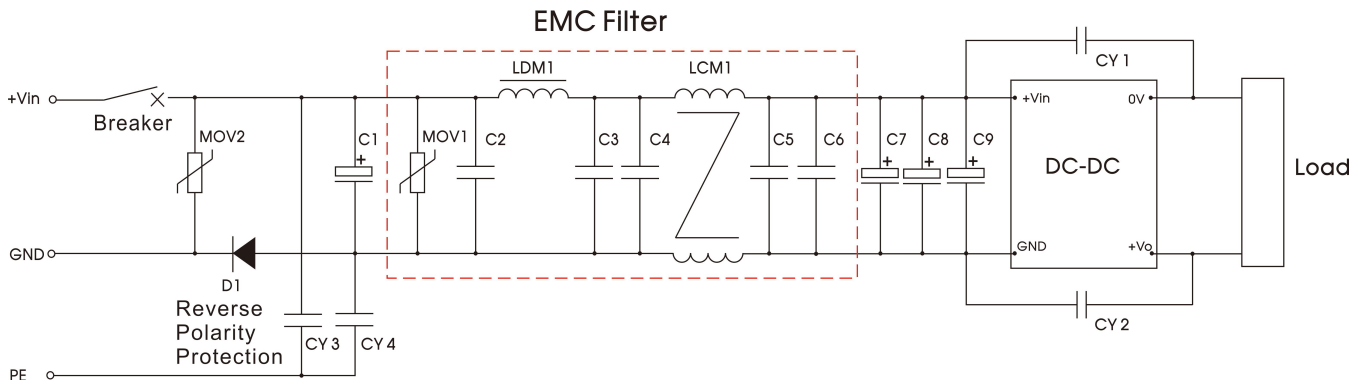


Fig.5

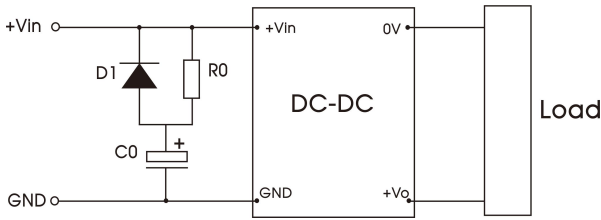
Components	Value	Recommended Component
Breaker	0.8A < Fusing current < 3A	/
CY3/CY4	1000pF/400VAC	Y1 safety Y capacitor
C1	330uF	Voltage ≥ 200V
MOV1/MOV2	S10K140	Varistor
D1	2A/600V	/
C2	2.2uF	Voltage ≥ 250V
LDM1	10uH	Differential Mode Inductance
C3/C4/C5/C6	0.1uF	Voltage ≥ 250V
LCM1	1.5mH	PH-3161LF
C7/C8/C9	100uF	Voltage ≥ 200V
CY1/CY2	2200 pF /400VAC	Y1 safety Y capacitor

Note: It is recommended to use MORNSUN filter P/N: FC-CZ8D for the red frame part, self-design circuits is also available.

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

5. Recommended capacitance for Hold-up time

Recommended formula for calculating capacitance:



$$C_0 = \frac{2P_o\Delta t}{(V_{input}^2 - V_{shutdown}^2) \cdot \eta} \times 10^3$$

Note:
Po(W): Output power;
η : Efficiency;
Δt(ms): Hold-up time.

Fig.6

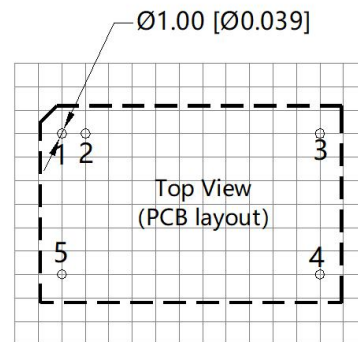
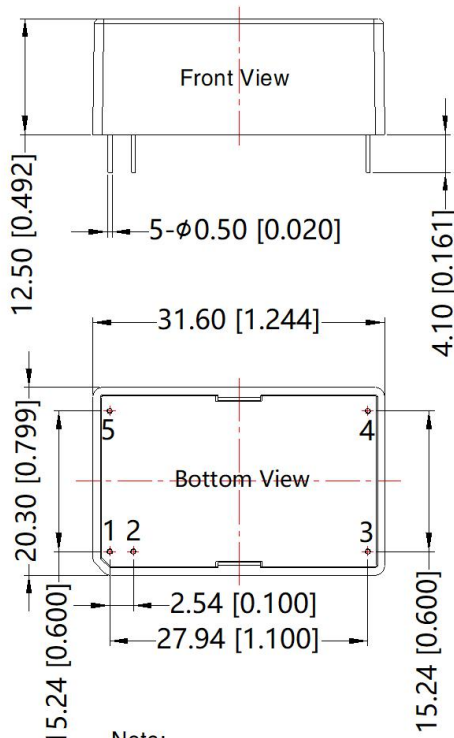
10ms Hold-up time can be compared with the following table:

Vin (V)	24	36	48	72	96	110	
Po (W)	6	6	6	6	6	6	
Turn-off voltage (V)	14	14	14	14	14	14	
D1	3A/250V						
R0	200Ω/5W						
C0 (uF)	Δt: 10ms	660	270	200	100	68	27
VCo		35V	50V	63V	100V	150V	150V

6. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



Note: Grid 2.54*2.54mm

Pin-Out	
Pin	Mark
1	GND
2	GND
3	+Vo
4	0V
5	+Vin

Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10 [± 0.004]
General tolerances: ± 0.50 [± 0.020]

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58000150;
2. We suggest to use module at load of over 5%, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. 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;
5. All index testing methods in this datasheet are based on company corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. 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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