Descriptions

6W isolated，DC-DC Converter



RoHS

CE Report EN62368-1

UKCA Report BS EN62368-1

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℃ to +105℃
- Input under-voltage protection, output over-voltage, over-current, short-circuit protection
- Meets AREMA standards

Applications

- Vehicle-mounted switches
- Train control systems
- Traction control systems

Selection Guide

Certification	Part No.	Input Voltage (VDC)		Output		Full Load Efficiency② (%) Min./Typ.	Capacitive Load (μF)Max.
		Nominal (Range)	Max.①	Voltage (VDC)	Current (mA) Max./Min.		
EN/BS EN	DRUP6-F1D03	110 (14-160)	160	3.3	1454/0	73/75	1000
	DRUP6-F1D05			5	1200/0	78/80	1000
	DRUP6-F1D12			12	500/0	81/83	470
	DRUP6-F1D15			15	400/0	81/83	470
	DRUP6-F1D24			24	250/0	81/83	220

Notes:
①Exceeding the maximum input voltage may cause permanent damage;
②Efficiency is tested at 48VDC nominal input voltage and full load at +25℃ ambient;
③At 14V-16.8V / 160V-200V input, the product can work for 0.1s / 1s respectively;
④Product images are for reference only; the actual product shall prevail.

Specifications

Product Specifications	Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Specifications	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	
			5V output	--	70.8	72.7	
			Others	--	68.2	69.9	
	Input Current (no-load)	Nominal input voltage		--	5	12	
	Reflected Ripple Current			--	50	--	
	Surge Voltage (1sec. max.)			-0.7	--	200	VDC
	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	Voltage Accuracy①	5%-100% load		--	±1	±3	%
	Linear Regulation	Input voltage variation from low to high at full load		--	±0.2	±0.5	
	Load Regulation②	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	%/℃
	Ripple & Noise③	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			
General Specifications	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	℃
	Storage Temperature		-55	--	+125	
	Storage Humidity	Non-condensing	5	--	95	%RH
	Pin Soldering Resistance Temperature④	Soldering spot is 1.5mm away from the case, 10 seconds max.	--	--	+300	℃
		Wave soldering, maximum 10 seconds	255	260	265	
	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 Frequency⑤	PWM mode	--	170	--	kHz
	Altitude⑥		5000m			
	MTBF	MIL-HDBK-217F@25℃	1000	--	--	k hours
Mechanical Specifications	Case Material	Black plastic; flame-retardant and heat-resistant (UL94 V-0)				
	Dimensions	31.60 × 20.30 × 12.50 mm				
	Weight	17.0g(Typ.)				
	Cooling Method	Free air convection				

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.

④The pin soldering temperature tolerance is not the actual temperature set by the soldering iron but the temperature required for proper solder joints. The actual temperature set by the customer should be determined comprehensively based on factors such as PCB thickness, copper coverage, soldering iron power, and soldering iron tip selection;

⑤Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement;

⑥When the altitude is above 2000m, the product surface max.temperature must be below 105℃.

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) 500kHz-30MHz 93dBuV (see Fig.4 or Fig.5 for recommended circuit)	
		EN55032	EN55032 150kHz-500kHz 79dBuV (see Fig.4 or Fig.5 for recommended circuit) 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) 1GHz-6GHz 47dBuV/m at 10m (see Fig.4 or Fig.5 for recommended circuit)	
Immunity	ESD	EN61000-4-2	Contact ±6kV/Air ±8kV	perf. Criteria A
	RS	EN61000-4-3	80 - 800MHz 20V/m 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)	perf. Criteria A
	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) line to line ±1kV (2Ω, 18μF) line to ground ±2kV(12Ω, 9μF) (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A
	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	80 - 1000MHz 10V/m 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)	perf. Criteria A
	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 (see Fig.4 or Fig.5 for recommended circuit) 60Hz 300A/m (see Fig.4 or Fig.5 for recommended circuit)	perf. Criteria A

Characteristic Curve

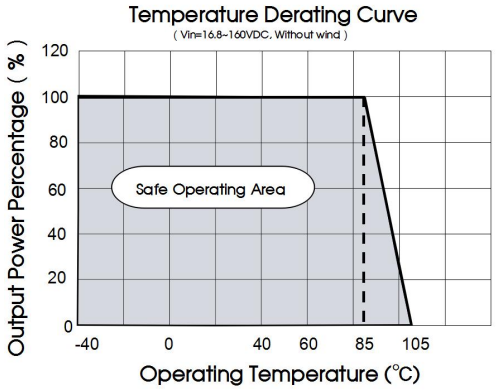
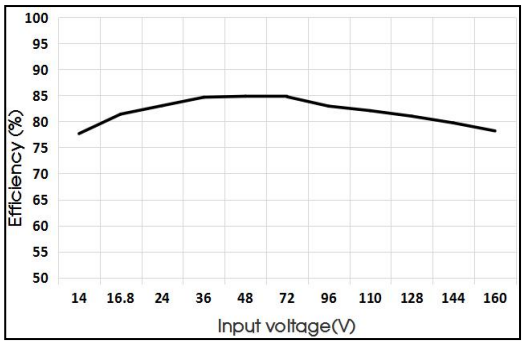


Fig.1

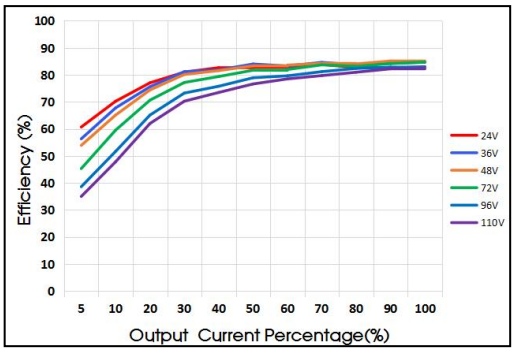
24V output

Efficiency Vs Input voltage (Full load)



24V output

Efficiency Vs Output load



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 capacito 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 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.



Fig.3

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

3. EMC compliance circuit

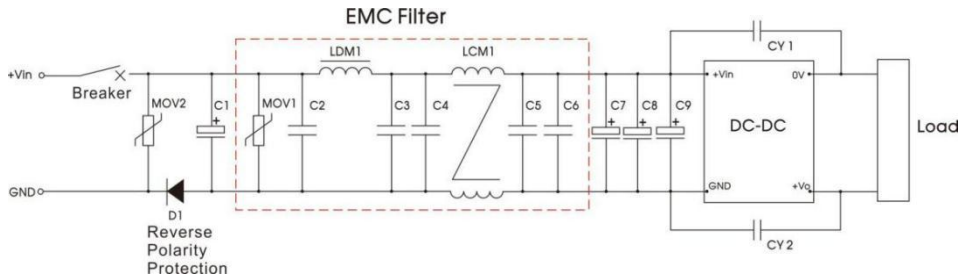


Fig.4

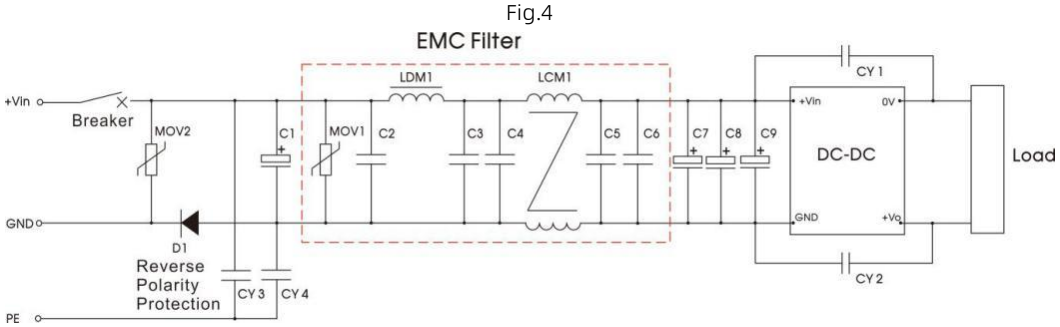


Fig.5

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

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

5. Recommended capacitance for Hold-up time

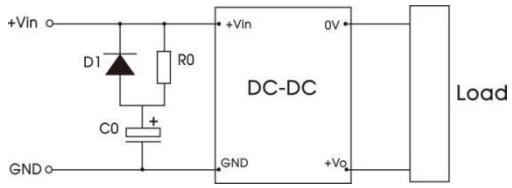


Fig.6

Recommended formula for calculating capacitance:

$$C_0 = \frac{2P_O\Delta t}{\left(V_{input}^{\ 2} - V_{shutdown}^{\ 2}\right)\bullet \eta} \times 10^3$$

Note:

P_O(W): Output power;

η: Efficiency;

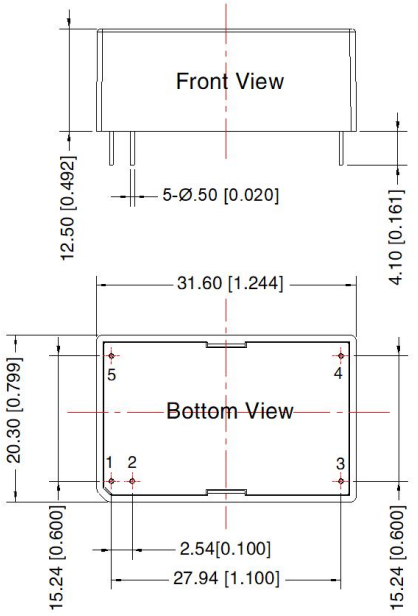
△t(ms): Hold-up time.

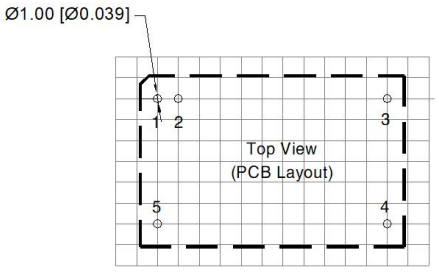
10ms Hold-up time can be compared with the following table:

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)	△t: 10ms	660	270	200	100	68	27
V_{C0}		35V	50V	63V	100V	150V	150V

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 diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]

Notes:

1. 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;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. 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;
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;
8. The image certification marks are for reference only; please refer to the selection table for actual specifications. Certification is based on the physical mark or packaging label.