

Features

- ◆ Ultra-wide 4:1 input voltage range
- ◆ High efficiency up to 93.8%
- ◆ No-load power consumption as low as 0.24W
- ◆ I/O isolation test voltage 1600V_{DC}
- ◆ Input under-voltage protection, output short-circuit, over-current, over-voltage protection
- ◆ Operating ambient temperature range:-40℃ to +70℃
- ◆ Industry standard pin-out
- ◆ Warranty period of three years

60W isolated DC-DC converter in DIP package
Ultra-wide input and regulated single output



Selection Guide

Certification	Part No.	Input Voltage(Vdc)		Output		Full Load Efficiency® (%)Min./Typ.	Capacitive Load (μF)Max.
		Nominal (Range)	Max. ①	Voltage(Vdc)	Current(mA) Max./Min.		
	CFDM60-48S05	48 (18-75)	80	5.0	12000/0	90/92.5	20000
	CFDM60-48S12			12	5000/0	91/93	5000
	CFDM60-48S15			15	4000/0	91/93.3	3500
	CFDM60-48S24			24	2500/0	91/93.8	2000

Notes:

① Exceeding the maximum input voltage may cause permanent damage;

② Efficiency is measured at nominal input voltage and rated output load.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current(full load/no-load)	Nominal input voltage	--	1345/10	1389/15	mA
Surge Voltage(1sec.max.)		-0.7	--	100	V _{DC}
Start-up Voltage		--	--	18	
Input Filter		PI filter			
Hot Plug		Unavailable			
CNT *	Module on	CNTpin open or pulled high TTL(3-12V _{DC})			
	Module off	CNTpin pulled low to-Vin(0-1.2V _{DC})			

Note: *The CNT pin voltage is referenced to input -Vin.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	5%-100% load	--	±1	±2	%
	0%-5% load	--	±2	±5	
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5	
Load Regulation	5%-100% load	--	±0.5	±1	
Transient Response Deviation	25% load step change, input voltage range	5V output	±3	±10	
		Other output	±3	±5	

Transient Recovery Time	25% load step change, nominal input voltage		--	250	500	μs
Ripple/Noise ^①	20MHz bandwidth, nominal input voltage	5%-100% load	--	100	--	mVp-p
		0%-5% load	--	--	5	%Vo
Over-voltage Protection	Input voltage range		110	140	160	
Over-current Protection			110	140	200	%Io
Short-circuit Protection			Continuous, self-recovery			

Note: ①By measuring method is used for Ripple and Noise test, please refer to Fig. 2. for recommended circuit.

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.	1600	--	--	V _{DC}
	Input/output-Case Electric Strength Test for 1 minute with a leakage current of 1mA max.	1000	--	--	
Insulation Resistance	Input-output resistance at 500V _{DC}	100	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	2200	--	pF
Operating Temperature	See Fig.1	-40	--	+70	°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		10-150Hz, 5G, 0.75mm. along X, Y and Z			
Switching Frequency ^①	PWM mode	--	370	--	kHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours

Note: ①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

Mechanical Specifications

Case Material	Aluminum alloy		
Dimensions	Without heat sink	Horizontal package	50.8×25.4×11.8mm
	Heat sink		51.4x26.2x23.0mm
Weight	Without heat sink		40.0g
	Heat sink		49.8g
Cooling Method	Free air convection		

Electromagnetic Compatibility(EMC)

Emissions	CE	CISPR32/EN55032 CLASS A (see Fig. 3-①for recommended circuit) / CLASS B (see Fig. 3-②for recommended circuit)			
	RE	CISPR32/EN55032 CLASS A (see Fig. 3-①for recommended circuit) / CLASS B (see Fig. 3-②for recommended circuit)			
Immunity	ESD	IEC/EN61000-4-2	Contact ±6kV		perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m		perf. Criteria A
	EFT	IEC/EN61000-4-4	100kHz ±2kV (see Fig. 3-②for recommended circuit)		perf. Criteria A
	Surge	IEC/EN61000-4-5	line to line ±2kV (see Fig. 3-②for recommended circuit)		perf. Criteria A
	CS	IEC/EN61000-4-6	10Vr.m.s		perf. Criteria A

Typical Characteristic Curves

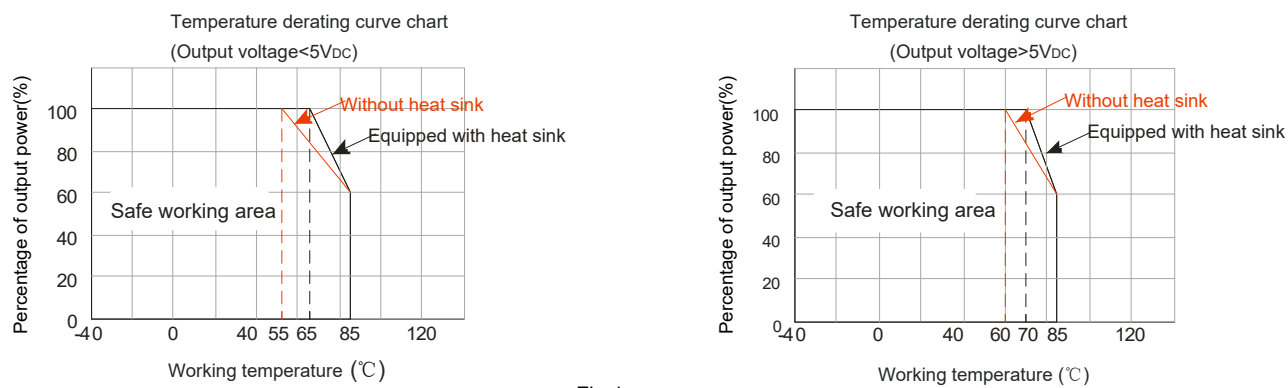


Fig 1

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.

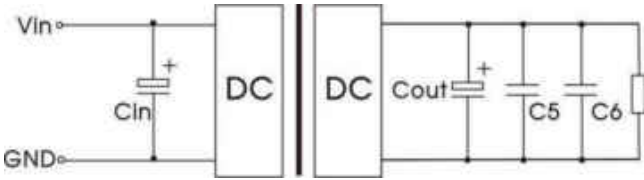


Fig. 2

Vout (Vdc)	Cin	Cout	C5	C6
5	100μF/ 100V	330μF/50V	1μF/16V	10μF/16V
12			1μF/25V	10μF/25V
15		100μF/50V	1μF/25V	10μF/25V
24			1μF/50V	10μF/50V

2. EMC compliance circuit

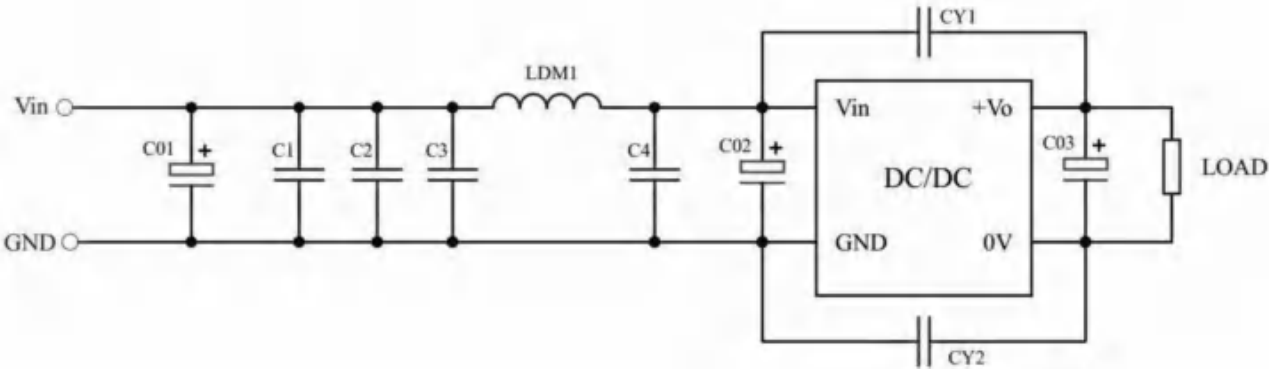


Fig. 3-①

Table1: recommended component parameters

Model	Parameter	Parameter description
C 1/C2	4.7μF	100V
C3/C4	20μF	100V
C01	1000μF	100V
C02	470μF	100V
C03	330μF	50V
CY1/CY2	2.2nF	1808/3000Vbc
LDM1	2.2uH	/

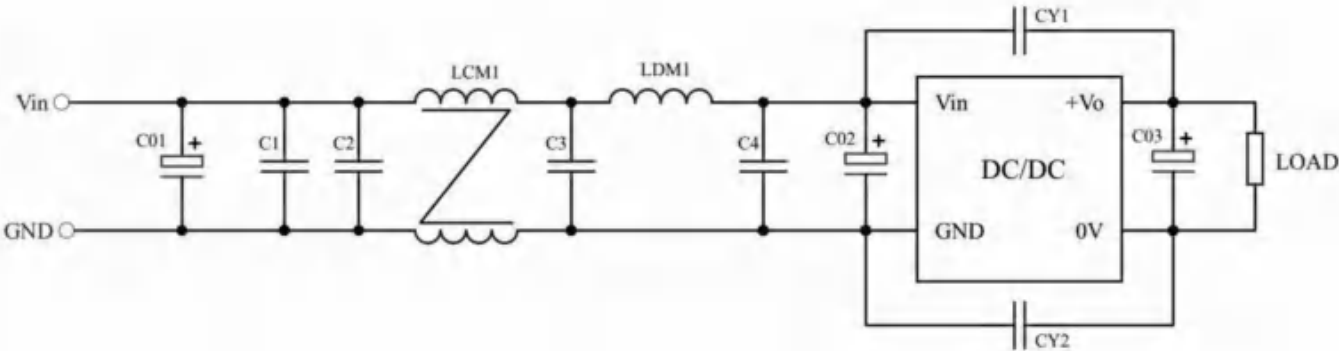
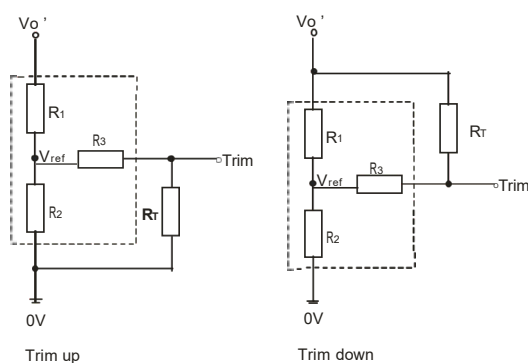


Fig. 3-②

Table 2 : recommended componen tparameters

Model	Parameter	Parameter description
C 1/C2	4.7μF	100V
C3/C4	20μF	100V
C01	1000μF	100V
C02	470μF	100V
C03	330μF	50V
CY1/CY2	2.2nF	1808/3000VDC
LCM1	10mH	10.0mH Min/180mΩ Max
LDM1	2.2uH	/

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



Trim resistor connections (dashed line shows internal resistor network)

Calculating Trim resistor values:

$$\begin{aligned}
 \text{up: } R_T &= \frac{aR_2}{R_2 - a} - R_3 & a &= \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1 \\
 \text{down: } R_T &= \frac{aR_1}{R_1 - a} - R_3 & a &= \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2
 \end{aligned}$$

R_T =Trim Resistor value
 a =self-defined parameter
 V_o' =desired output voltage

Vout(VDC)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
05	2.97	2.87	8.1	2.5
12	10.91	2.87	15	2.5
15	14.35	2.87	12.1	2.5
24	24.77	2.87	6.1	2.5

4. Recommended solution for thermal testing

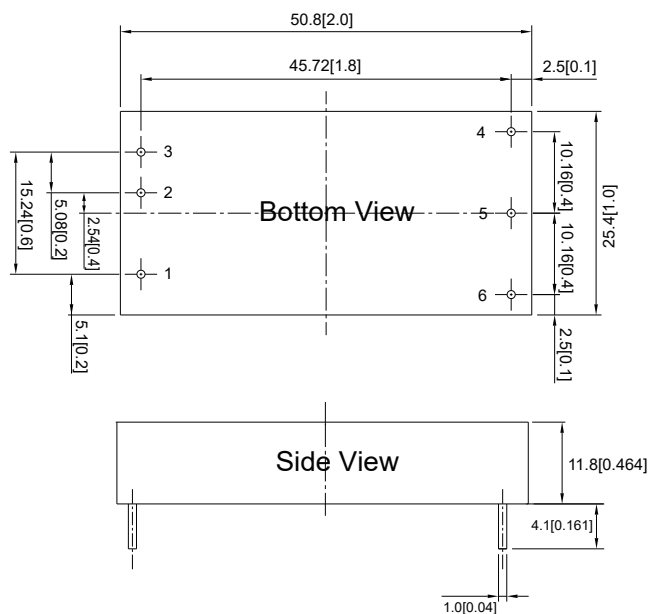
During the application process, the thermal design of the product can be evaluated in combination with the temperature derating curve of the product, or it can be determined by testing the temperature at point A, it is a safe operating area if the temperature lower than 100℃.



Fig.4

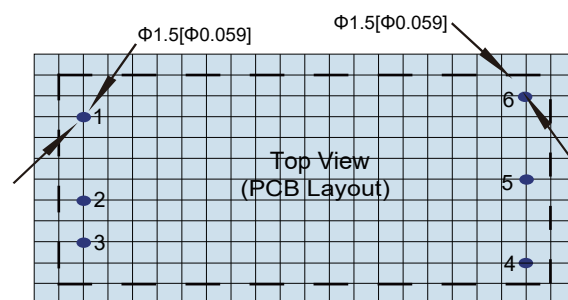
5. The products do not support parallel connection of their output

Packaging size and printing layout:



Note:

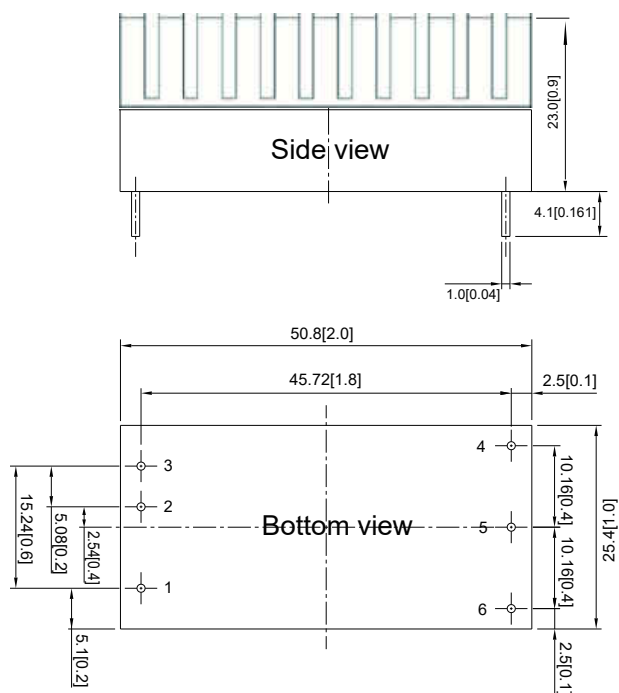
Unit: mm[inch]

Pin diameter tolerances: $\pm 0.1[\pm 0.004]$ General tolerances: $\pm 0.5[\pm 0.02]$ Third angle projection 

Grid distance: 2.54 * 2.54mm

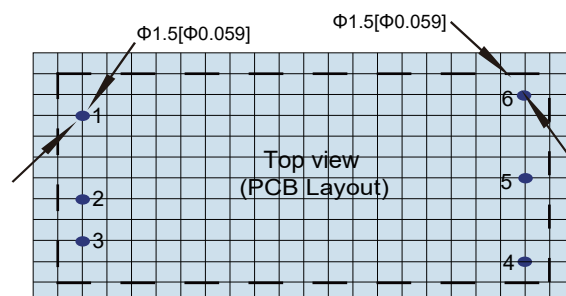
Pin-Out	
Pin	Mark
1	CNT
2	-Vin
3	+Vin
4	+Vo
5	-Vo
6	Trim

Size with heat sink:



Note:

Unit: mm[inch]

Pin diameter tolerances: $\pm 0.1[\pm 0.004]$ General tolerances: $\pm 0.5[\pm 0.02]$ Third angle projection 

Grid distance: 2.54 * 2.54mm

Pin-Out	
Pin	Mark
1	CNT
2	-Vin
3	+Vin
4	+Vo
5	-Vo
6	Trim



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