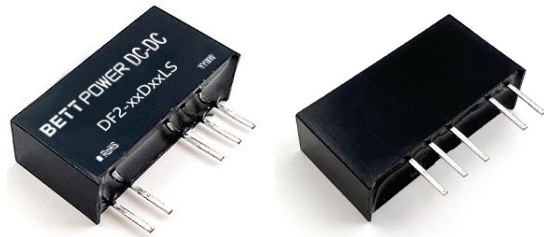


# DF2-xxDxxLS Series

DC-DC Converter | 2W | SIP7 | Fixed voltage input, unregulated output | 3000VDC



## Features

- SIP7 Package
- Operating Temperature Range: -40°C ~ +105°C
- Isolation Voltage: 3000VDC
- Full Load Efficiency: up to 88% (typ.)
- Continuous Short Circuit Protection
- Designed to meet IEC/EN/BS EN/UL 62368

## Product Description



The DF2-xxDxxLS series is 2W unregulated DC/DC converters that are typically used in cost sensitive general purpose power isolation and voltage matching applications. Typical applications are digital interfaces, voltage conversion in distributed powersy stems, general low-frequency analog circuits, relay drive circuits, data switching circuits etc.

## Selection Guide

Certification	Part No.	Input Voltage	Output			Full Load Efficiency (%)	Capacitive Load (μF)
		Nominal (Range) (VDC)	Voltage (VDC)	Current (mA) Min.	Current (mA) Max.		
EN/UL Pending	DF2-03D03LS	3.3 (2.97~3.63)	3.3	40	400	76	2400
	DF2-03D05LS	3.3 (2.97~3.63)	5	40	400	83	2400
	DF2-05D03LS	5 (4.5~5.5)	3.3	40	400	81	2400
	DF2-05D05LS	5 (4.5~5.5)	5	40	400	83	2400
	DF2-05D09LS	5 (4.5~5.5)	9	22	222	86	1000
	DF2-05D12LS	5 (4.5~5.5)	12	16	167	85	560
	DF2-05D15LS	5 (4.5~5.5)	15	13	133	86	560
	DF2-05D24LS	5 (4.5~5.5)	24	8	83	85	220
	DF2-12D03LS	12 (10.8~13.2)	3.3	40	400	82	2400
	DF2-12D05LS	12 (10.8~13.2)	5	40	400	83	2400
	DF2-12D09LS	12 (10.8~13.2)	9	22	222	84	1000
	DF2-12D12LS	12 (10.8~13.2)	12	16	167	87	560
	DF2-12D15LS	12 (10.8~13.2)	15	13	133	87	560

## Selection Guide

Certification	Part No.	Input Voltage	Output			Full Load Efficiency (%) Typ.	Capacitive Load(μF) Max.*
		Nominal(Range) (VDC)	Voltage (VDC)	Current (mA) Min.	Current (mA) Max.		
EN/UL Pending	DF2-12D24LS	12 (10.8~13.2)	24	8	83	87	220
	DF2-15D03LS	15 (13.5~16.5)	3.3	40	400	82	2400
	DF2-15D05LS	15 (13.5~16.5)	5	40	400	83	2400
	DF2-15D09LS	15 (13.5~16.5)	9	22	222	85	1000
	DF2-15D12LS	15 (13.5~16.5)	12	16	167	87	560
	DF2-15D15LS	15 (13.5~16.5)	15	13	133	88	560
	DF2-15D24LS	15 (13.5~16.5)	24	8	83	88	220
	DF2-24D03LS	24 (21.6~26.4)	3.3	40	400	82	2400
	DF2-24D05LS	24 (21.6~26.4)	5	40	400	84	2400
	DF2-24D09LS	24 (21.6~26.4)	9	22	222	85	1000
	DF2-24D12LS	24 (21.6~26.4)	12	16	167	88	560
	DF2-24D15LS	24 (21.6~26.4)	15	13	133	88	560
	DF2-24D24LS	24 (21.6~26.4)	24	8	83	88	220

Note:

- \*The capacitive load of the two outputs for positive and negative output is the same.
- The above 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)	3.3VDC Input	3.3VDC Output	--	787/10	808/15	mA
		5VDC Output	--	767/10	787/15	mA
	5VDC Input	3.3VDC Output	--	488/8	500/15	mA
		5VDC Output	--	465/8	476/15	mA
		9/12/15VDC Output	--	465/10	476/15	mA
		24VDC Output	--	455/25	465/35	mA
	12VDC Input	3.3VDC Output	--	203/7	208/15	mA
		5VDC Output	--	194/7	198/15	mA
		Others	--	189/8	194/15	mA
	15VDC Input	3.3VDC Output	--	161/6	165/15	mA
		5/9/12VDC Output	--	157/6	161/15	mA
		Others	--	150/6	153/15	mA
	24VDC Input	3.3VDC Output	--	98/4	100/15	mA
		5/9VDC Output	--	97/4	99/15	mA
		Others	--	94/5	96/15	mA
Reflected Ripple Current			--	15	--	mA
Surge Voltage	3.3VDC Input		-0.7	--	5	VDC
	5VDC Input		-0.7	--	9	VDC
	12VDC Input		-0.7	--	18	VDC
	15VDC Input		-0.7	--	21	VDC
	24VDC Input		-0.7	--	30	VDC
Input Filter Type			Capacitance Filter			
Hot Plug			Unavailable			

## Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy			See Output Regulation Curve			
Line Regulation	Input Voltage Variation: $\pm 1\%$	3.3V	--	$\pm 1.5$	--	%
		Other Output Voltages	--	$\pm 1.2$	--	%
Load Regulation	10%~100% Load	3.3VDC Output	--	12	--	%
		5VDC Output	--	12	--	%
		9VDC Output	--	8	--	%
		12VDC Output	--	8	--	%
		15VDC Output	--	8	--	%
		24VDC Output	--	6	--	%
Ripple & Noise	20MHz Bandwidth, 100% Load, Using Parallel Line Test Method		--	60	120	mV

Temperature Coefficient	Full load	--	±0.02	--	%/°C
Short Circuit Protection		Continuous, self-recovery			

Note: Ripple & noise are measured at 20MHz of bandwidth with a 10uF electrolytic capacitor and a 1uF ceramic capacitor connected inparallel at the output.

## General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-output, test time 1 minute, leakage current less than 1mA	3000	--	--	VDC
Insulation Resistance	Input-output, insulated voltage 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-Output, 100KHz/0.1V	--	20	--	pF
Operating Temperature	Derating when operating temperature ≥ 85°C (See Temperature derating curve chart)	-40	--	105	°C
Storage Temperature		-55	--	125	°C
Case Temperature Rise	Ta=25°C, Nominal Input, Full Load	--	25	--	°C
Storage Humidity	Non-condensing	5	--	95	%RH
Soldering Profile	Wave soldering	260±5°C; Time: 5~10 seconds			
	Manual soldering	360±10°C; time: 3~5 seconds			
Switching Frequency	Full load, nominal input voltage	--	220	--	kHz
MTBF	MIL-HDBK-217F@25°C	>3500Kh			

## Mechanical Specifications

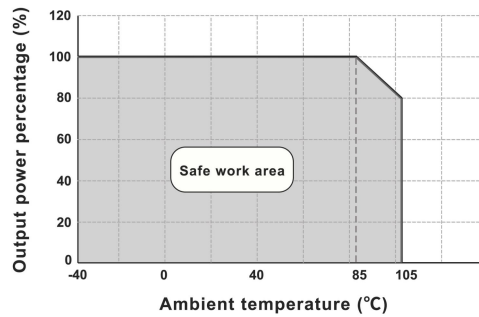
Case Material	Black flame-retardant and heat-resistant plastic (UL94V-0)
Mechanical Dimensions	19.60 * 7.05 * 10.10mm
Weight	2.4g (typ.)
Cooling Method	Free air convection

## Electromagnetic Compatibility (EMC)

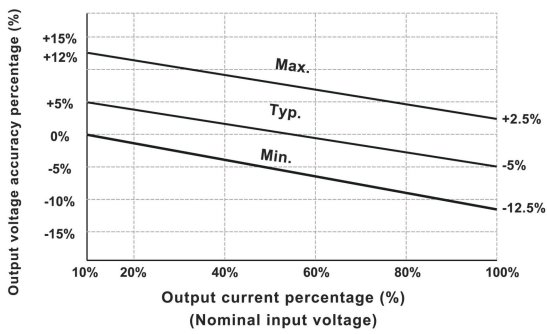
EMI	CE	CISPR32/EN55032 CLASS B (EMC recommended circuit see Fig. 2)
	RE	CISPR32/EN55032 CLASS B (EMC recommended circuit see Fig. 2)
EMS	ESD	IEC/EN61000-4-2 Contact ±6KV
		perf. Criteria B

Product Characteristic Curve

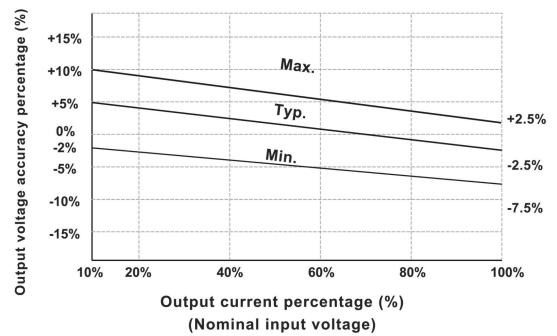
Temperature Derating Curve



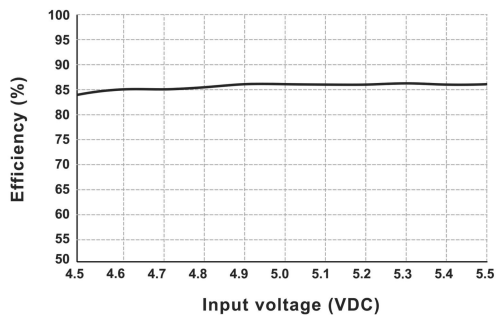
Output Regulation Curve(3.3V Output)



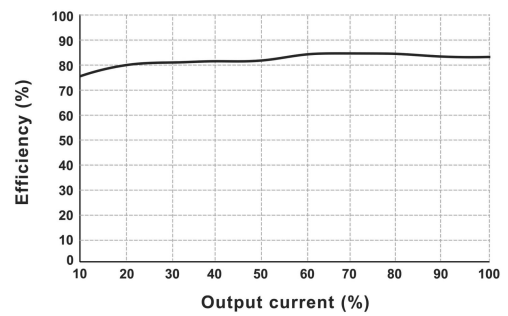
Output Regulation Curve (Others)



Efficiency VS Input Voltage (Full Load, DF2-05D05LS)

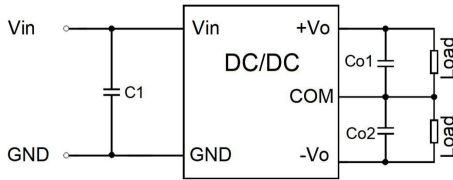


Efficiency VS Output Load (Vin=5V, DF2-05D05LS)



## Design Reference - Application circuit

Application circuit



(Figure 1)

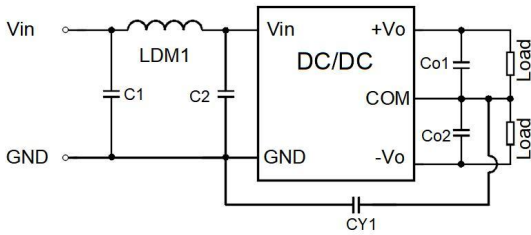
Recommended Capacitive Load Value Table

Vin	C1	Vo	Co1/Co2
3.3/5VDC	10uF/16V	3.3/5VDC	10uF/16V
12VDC	4.7uF/25V	9/12VDC	2.2uF/25V
15VDC	2.2uF/25V	15VDC	1.0uF/25V
24VDC	1.0uF/50V	24VDC	1.0uF/50V

All DC/DC converters in this series are tested according to the recommended application circuit (Figure 1) before the shipment. To further reduce input and output ripple, external capacitors can be added to the input and output. Increase C1/Co1/Co2 or select capacitors with low equivalent series impedance. For each output, under safe and reliable operating conditions, the maximum capacitance of the filter capacitor must not exceed the maximum capacitive load of the product.

## Design Reference - EMC Solutions - Recommended Circuits

EMC Recommended Circuit Design and Application



(Figure 2)

Recommended parameter values

C1	4.7μF /50V
C2	4.7μF /50V
Co1/Co2	Refer to Cout parameter in Figure 1
CY1	1000pF/3kV
LDM1	6.8μH

Note:

### 1. Typical Application

If further reduction of input and output ripple is required, a Capacitance Filter network can be connected at the input and output terminals. The application circuit is shown in Figure 1. However, care should be taken to select the appropriate filter capacitor. If the capacitor is too large, it may cause startup issues. For each output, under conditions ensuring safe and reliable operation, the recommended capacitive load values are detailed in the table.

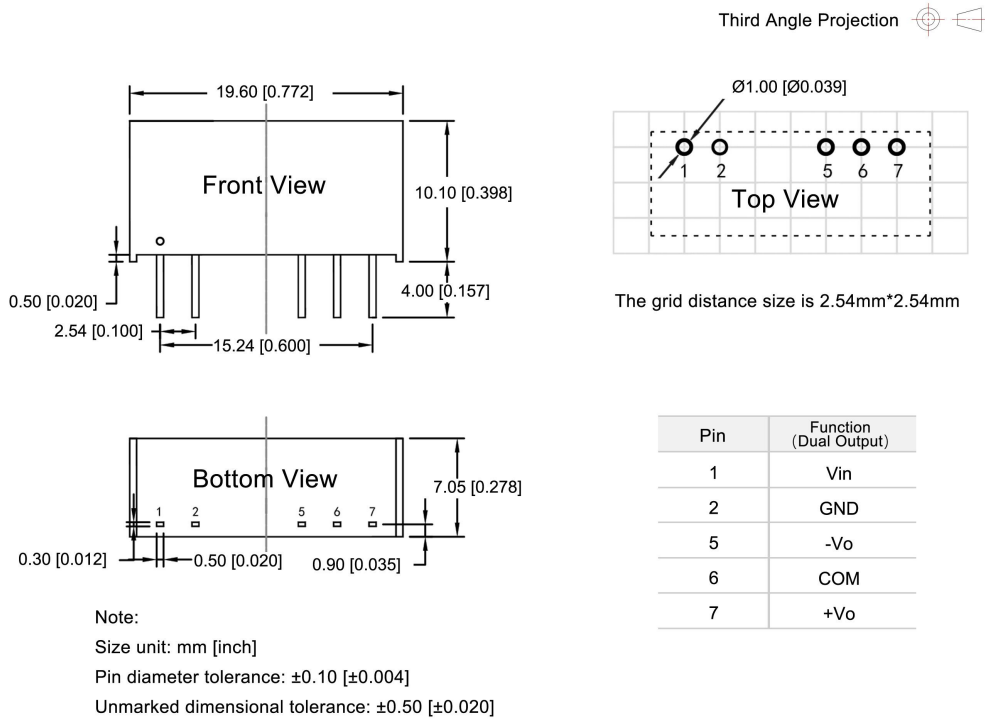
### 2. EMC Recommended Circuit: See Figure 2

### 3. Output Load Requirements

To ensure the module operates efficiently and reliably, the minimum output load during use must not be less than 10% of the rated load. If the required power is indeed small, please connect a resistor in parallel at the output (the sum of the resistor's power dissipation and the actual usage power must be greater than or equal to 10% of the rated power).

## Dimensions and Recommended Layout

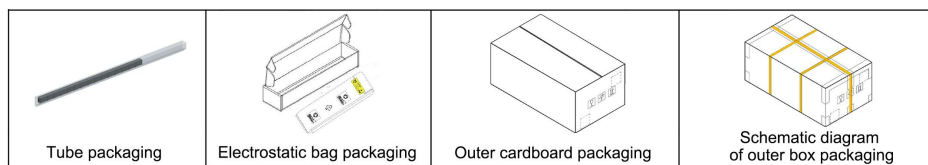
### DF2-xxDxxLS Dimensions and Recommended Layout



## Packaging Information

Model series (Tube packaging)	Quantity per tube (pcs/ tube)	Quantity of electrostatic bag (pcs/ bag)	Quantity of inner box (pcs/ box)	Full box Quantity (pcs)
DF2-xxDxxLS	26	416	1664	6656

The schematic diagram of tube packaging is shown below:



## Product precautions

1. The input voltage should not exceed the specified range value, otherwise it may cause permanent and irreparable damage;
2. It is recommended to use at a load of over 5%. If the load is below 5%, the ripple index of the product may exceed the specifications, but it does not affect the reliability of the product;
3. The maximum capacitive load is tested within the input voltage range and under full load conditions;
4. Unless otherwise specified, all indicators in this manual are measured at  $T_a=25\text{ }^\circ\text{C}$ , humidity<75% RH, nominal input voltage, and output rated load;
5. All indicator testing methods in this manual are based on our company's corporate standards;
6. Our company can provide product customization, and specific requirements can be directly contacted by our technical personnel;
7. Product specifications are subject to change without prior notice.

## Manufacturer contact information

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