

# DF2-xxDxxLT Series

DC-DC Converter | 2W | SMD12 | Fixed voltage input, unregulated output | 3000VDC



## Features

- SMD12 Package
- Operating Temperature Range: -40°C ~ +105°C
- Isolation Voltage: 3000VDC
- Full Load Efficiency: up to 90% (typ.)
- Continuous Short Circuit Protection
- Designed to meet IEC/EN/BS EN/UL 62368

## Product Description



The DF2-xxDxxLT series is 2W unregulated DC/DC converters that are ideal and economical solutions for on-board power applications where an isolated voltage is required. Typical applications are digital interfaces, voltage conversion in distributed power systems, general low-frequency analog circuits, relay drive circuits, data exchange circuits, etc. For automated SMD production lines, this series can be supplied in standard tape and reel package.

## 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	DF2-05D03LT	5 (4.5~5.5)	±3.3	30	±303	82	1000
	DF2-05D05LT	5 (4.5~5.5)	±5	20	±200	86	1000
	DF2-05D09LT	5 (4.5~5.5)	±9	11	±111	86	470
	DF2-05D12LT	5 (4.5~5.5)	±12	8	±84	86	220
	DF2-05D15LT	5 (4.5~5.5)	±15	6	±67	87	220
	DF2-05D24LT	5 (4.5~5.5)	±24	4	±42	88	100
	DF2-12D03LT	12 (10.8~13.2)	±3.3	30	±303	82	1000
	DF2-12D05LT	12 (10.8~13.2)	±5	20	±200	86	1000
	DF2-12D09LT	12 (10.8~13.2)	±9	11	±111	88	470
	DF2-12D12LT	12 (10.8~13.2)	±12	8	±84	88	220
	DF2-12D15LT	12 (10.8~13.2)	±15	6	±67	89	220
	DF2-12D24LT	12 (10.8~13.2)	±24	4	±42	89	100
	DF2-15D03LT	15 (13.5~16.5)	±3.3	30	±303	83	1000

## 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	DF2-15D05LT	15 (13.5~16.5)	±5	20	±200	85	1000
	DF2-15D09LT	15 (13.5~16.5)	±9	11	±111	86	470
	DF2-15D12LT	15 (13.5~16.5)	±12	8	±84	87	220
	DF2-15D15LT	15 (13.5~16.5)	±15	6	±67	90	220
	DF2-15D24LT	15 (13.5~16.5)	±24	4	±42	89	100
	DF2-24D03LT	24 (21.6~26.4)	±3.3	30	±303	85	1000
	DF2-24D05LT	24 (21.6~26.4)	±5	20	±200	86	1000
	DF2-24D09LT	24 (21.6~26.4)	±9	11	±111	87	470
	DF2-24D12LT	24 (21.6~26.4)	±12	8	±84	89	220
	DF2-24D15LT	24 (21.6~26.4)	±15	6	±67	90	220
	DF2-24D24LT	24 (21.6~26.4)	±24	4	±42	90	100

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)	5VDC Input	3.3VDC Output	--	488/8	500/15	mA
		5VDC Output	--	465/8	476/15	mA
		9/12VDC Output	--	465/10	476/15	mA
		15/24VDC Output	--	460/25	470/35	mA
	12VDC Input	3.3VDC Output	--	203/7	208/15	mA
		5VDC Output	--	194/7	198/15	mA
		Other Output	--	189/8	194/15	mA
	15VDC Input	3.3VDC Output	--	161/6	165/15	mA
		5/9/12VDC Output	--	157/6	161/15	mA
		Other Output	--	150/6	153/15	mA
	24VDC Input	3.3VDC Output	--	98/4	100/15	mA
		5/9VDC Output	--	97/4	99/15	mA
Other Output		--	94/5	96/15	mA	
Reflected Ripple Current		--	15	--	mA	
Surge Voltage	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 $\pm 1\%$	3.3VDC Output	--	$\pm 1.5$	--	%
		Others	--	$\pm 1.2$	--	%
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(Peak-to-Peak)	Others	--	45	120	mVp-p
Temperature Coefficient	Full Load	--	$\pm 0.02$	--	%/°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 in parallel 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 $\geq 85^{\circ}\text{C}$ (See Temperature derating curve chart)	-40	--	105	$^{\circ}\text{C}$
Storage Temperature		-55	--	125	$^{\circ}\text{C}$
Case Temperature Rise	Ta=25 $^{\circ}\text{C}$ , Nominal Input, Full Load	--	25	--	$^{\circ}\text{C}$
Storage Humidity	Non-condensing	5	--	95	%RH
Reflow Soldering Temperature	Peak temperature Tc $\leq 245^{\circ}\text{C}$ , maximum time above 217 $^{\circ}\text{C}$ is 60 seconds				
Switching Frequency	Full Load, Nominal Input Voltage	--	270	--	kHz
MTBF	MIL-HDBK-217F@25 $^{\circ}\text{C}$	>3500Kh			

## Mechanical Specifications

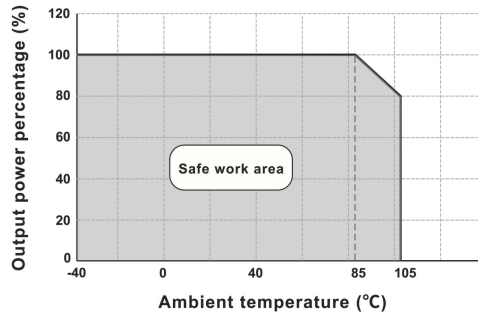
Case Material	Black flame-retardant and heat-resistant plastic (UL94V-0)
Mechanical Dimensions	15.24 * 11.40 * 7.25mm
Weight	1.7g(typ.)
Cooling Method	Free air convection

## EMC Characteristics

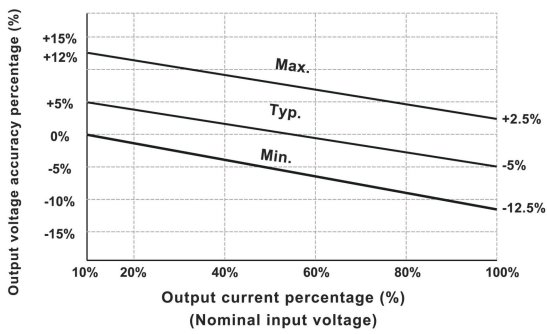
EMI	CE	CISPR32/EN55032 CLASS B (EMC recommended circuit see Fig. 2)
	RE	CISPR32/EN55032 CLASS B (EMC recommended circuit see Fig. 2)
EMS	ESD	IEC/EN61000-4-2 Contact $\pm 6\text{KV}$ , Air $\pm 8\text{KV}$ perf. Criteria B

Product Characteristic Curve

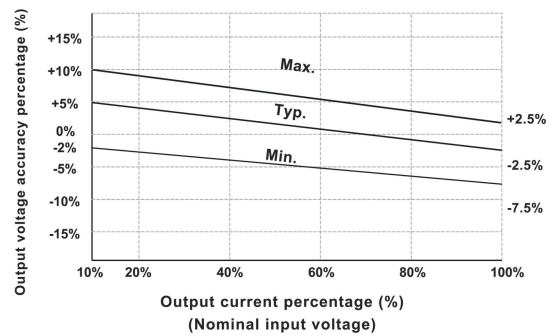
Temperature Derating Curve



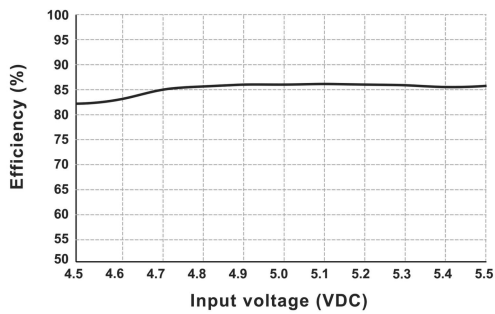
Output Regulation Curve (3.3V Output)



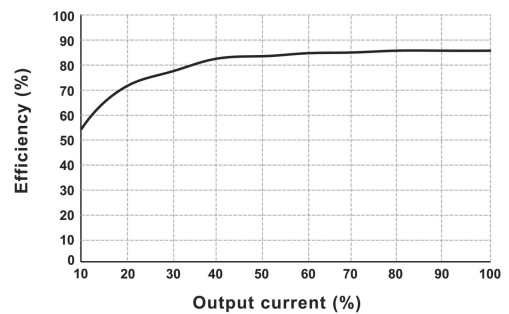
Output Regulation Curve (Others)



Efficiency vs Input Voltage (Full Load, DF2-05D05LT)

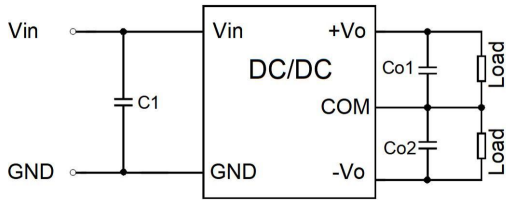


Efficiency vs Output Load (Vin=5V, DF2-05D05LT)



## Design Reference - Application circuit

Application circuit



(Figure 1)

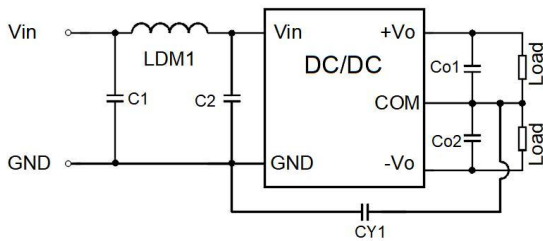
Recommended Capacitive Load Value Table

Vin	C1	Vo	Co1/Co2
5VDC	4.7uF/16V	3.3/5VDC	10μF/16V
9/12VDC	2.2uF/25V	9/12VDC	4.7μF/25V
15VDC	1.0uF/25V	15VDC	1.0μF/25V
24VDC	1.0uF/50V	24VDC	0.47μF/50V

All DC/DC converters in this series are tested according to the recommended application circuit (Figure 1) before the shipment. If further reduction of input and output ripple is required, the external capacitors C1, Co1/Co2 at the input and output terminal can be increased in value, or capacitors with low equivalent series impedance can be selected. 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



(Fig. 2)

Recommended Parameter Table

C1	4.7μF /50V
C2	4.7μF /50V
C3	Refer to Cout parameter in Fig. 1
CY	1000pF/4kV
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, appropriate filter capacitors should be selected. 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.

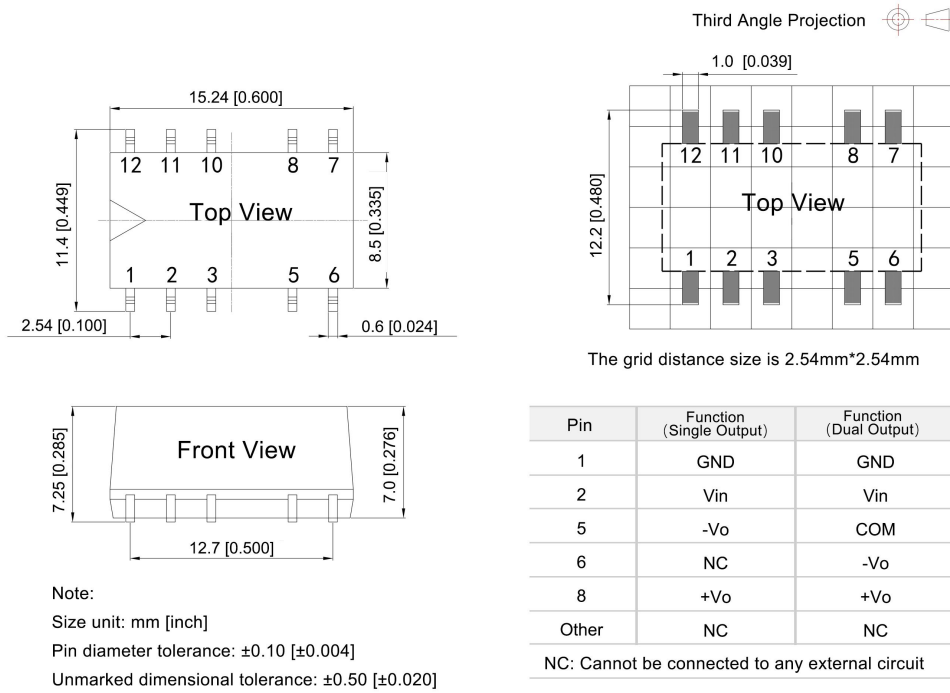
### 2. EMC Recommended Circuit: See Figure 2

### 3. Output Load Requirements

To ensure efficient and reliable operation of the module, 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 used power should be greater than or equal to 10% of the rated power).

## Dimensions and Recommended Layout

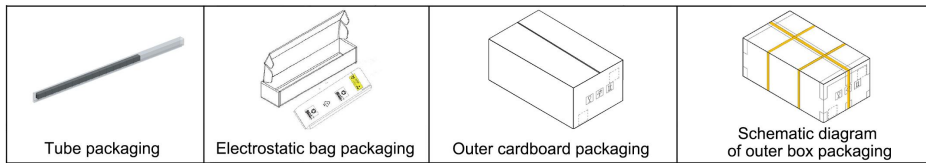
DF2-xxDxxLT Dimensions and Recommended Layout



## Packaging Information

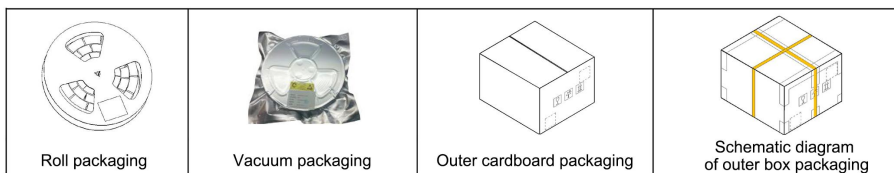
Model series (Tube packaging)	Quantity per tube (pcs/ tube)	Quantity of electrostatic bag (pcs/ bag)	Quantity of inner box (pcs/ box)	Full box Quantity (pcs)
DF2-xxDxxLT	38	760	2280	9120

The schematic diagram of tube packaging is shown below:

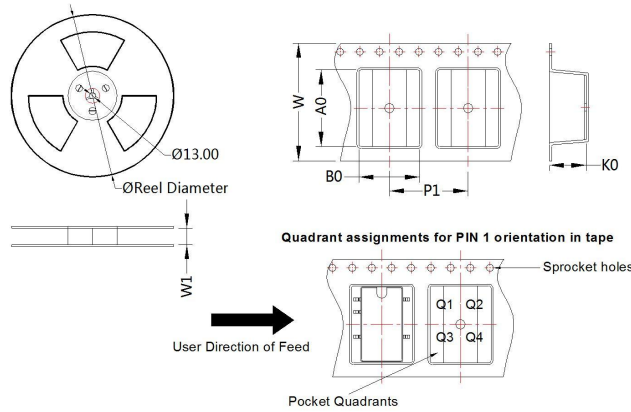


Model series (Reel packaging)	Quantity of products carried (pcs/ROLL)	Quantity of electrostatic bag (pcs/ bag)	Quantity of inner box (pcs/ box)	Full box Quantity (pcs)
DF2-xxDxxLT	500	500	1500	3000

The schematic diagram of Reel packaging is shown below:



Package type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1(mm)	A0(mm)	B0(mm)	K0(mm)	P1(mm)	W(mm)	Pin1 Quadrant
SMD	10	500	330	24.5	15.6	12.4	7.45	16	24	Q1



## 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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