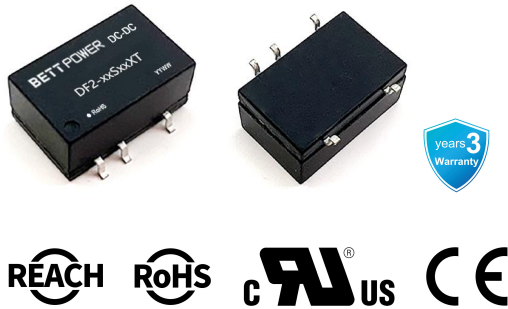


# DF2-xxSxxXT Series

DC-DC Converter | 2W | SMD8 | Fixed voltage input, unregulated output | 3000VDC



## Features

- Compact SMD8 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-xxSxxXT series is 2W unregulated DC/DC converters that are an 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	DF2-03S03XT	5 (4.5~5.5)	3.3	40	400	76	2400
	DF2-03S05XT	5 (4.5~5.5)	5	40	400	83	2400
	DF2-03S09XT	5 (4.5~5.5)	9	22	222	85	1000
	DF2-03S12XT	5 (4.5~5.5)	12	16	167	85	560
	DF2-03S15XT	5 (4.5~5.5)	15	13	133	85	560
	DF2-03S24XT	5 (4.5~5.5)	24	8	83	85	220
	DF2-05S03XT	5 (4.5~5.5)	3.3	40	400	81	2400
	DF2-05S05XT	5 (4.5~5.5)	5	40	400	83	2400
	DF2-05S09XT	5 (4.5~5.5)	9	22	222	86	1000
	DF2-05S12XT	5 (4.5~5.5)	12	16	167	85	560
	DF2-05S15XT	5 (4.5~5.5)	15	13	133	86	560
	DF2-05S24XT	5 (4.5~5.5)	24	8	83	85	220
	DF2-12S03XT	12 (10.8~13.2)	3.3	40	400	82	2400

## 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	DF2-12S05XT	12 (10.8~13.2)	5	40	400	83	2400
	DF2-12S09XT	12 (10.8~13.2)	9	22	222	84	1000
	DF2-12S12XT	12 (10.8~13.2)	12	16	167	87	560
	DF2-12S15XT	12 (10.8~13.2)	15	13	133	87	560
	DF2-12S24XT	12 (10.8~13.2)	24	8	83	87	220
	DF2-15S03XT	15 (13.5~16.5)	3.3	40	400	82	2400
	DF2-15S05XT	15 (13.5~16.5)	5	40	400	83	2400
	DF2-15S09XT	15 (13.5~16.5)	9	22	222	85	1000
	DF2-15S12XT	15 (13.5~16.5)	12	16	167	87	560
	DF2-15S15XT	15 (13.5~16.5)	15	13	133	88	560
	DF2-15S24XT	15 (13.5~16.5)	24	8	83	88	220
	DF2-24S03XT	24 (21.6~26.4)	3.3	40	400	82	2400
	DF2-24S05XT	24 (21.6~26.4)	5	40	400	84	2400
	DF2-24S09XT	24 (21.6~26.4)	9	22	222	85	1000
	DF2-24S12XT	24 (21.6~26.4)	12	16	167	88	560
	DF2-24S15XT	24 (21.6~26.4)	15	13	133	88	560
	DF2-24S24XT	24 (21.6~26.4)	24	8	83	88	220

Note: 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	--	526/10	538/15	mA
		5VDC Output	--	730/10	748/15	mA
		Others	--	713/12	730/18	mA
	5VDC Input	3.3VDC Output	--	326/8	343/15	mA
		5VDC Output	--	465/8	476/15	mA
		9/12/15VDC Output	--	470/10	494/15	mA
		24VDC Output	--	470/25	494/35	mA
	12VDC Input	3.3VDC Output	--	134/7	142/15	mA
		5/9VDC Output	--	200/7	211/15	mA
		Others	--	191/8	201/15	mA
	15VDC Input	3.3/5VDC Output	--	107/6	113/15	mA
		9VDC Output	--	157/6	165/15	mA
		Others	--	153/6	161/15	mA
	24VDC Input	3.3VDC Output	--	67/4	71/15	mA
		5/9VDC Output	--	99/4	105/15	mA
Others		--	94/5	100/15	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 $\pm 1\%$	3.3VDC output	--	$\pm 1.5$	--	%
		Other outputs	--	$\pm 1.2$	--	%
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)		--	60	120	mVp-p

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 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 ≥ 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
Reflow Soldering Temperature	Peak temperature Tc ≤ 245 °C, maximum time above 217 °C is 60 seconds				
Switching Frequency	Full load, nominal input voltage	--	220	--	kHz
MTBF	MIL-HDBK-217F@25°C	>3500Kh			

## Mechanical Characteristics

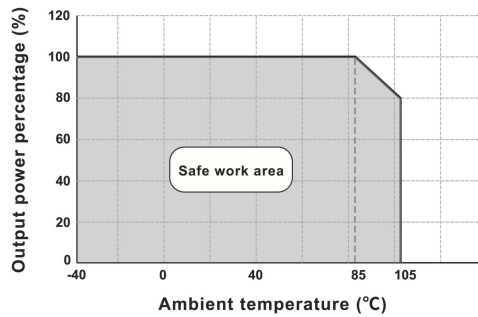
Case Material	Black flame-retardant heat-resistant plastic (UL94V-0)
Mechanical Dimensions	13.50 * 11.10 * 7.25mm
Weight	1.2g (typ.)
Cooling Method	Free air convection

## Electromagnetic Compatibility (EMC)

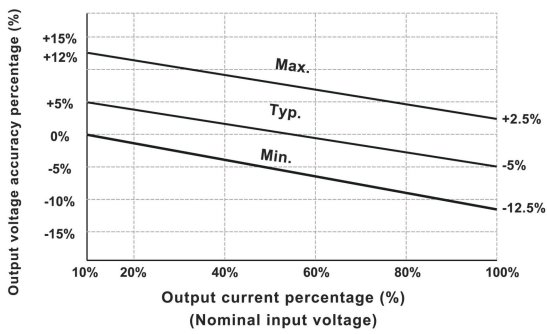
EMI	CE	CISPR32/EN55032 CLASS B (EMC Recommended Circuit Figure 2)
	RE	CISPR32/EN55032 CLASS B (EMC Recommended Circuit Figure 2)
EMS	ESD	IEC/EN61000-4-2 Contact ±6KV Perf. Criteria B

Product Characteristic Curve

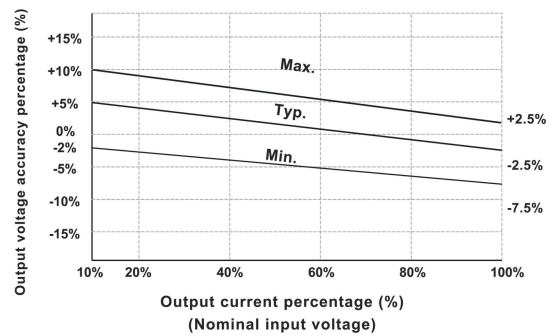
Temperature Derating Curve



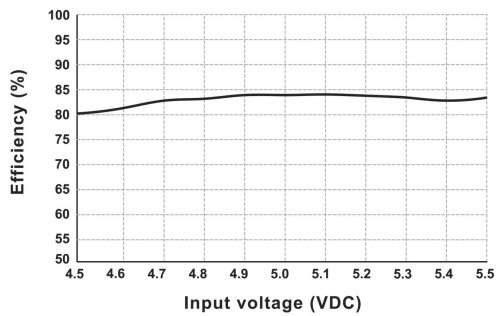
Output Regulation Curve (3.3V Output)



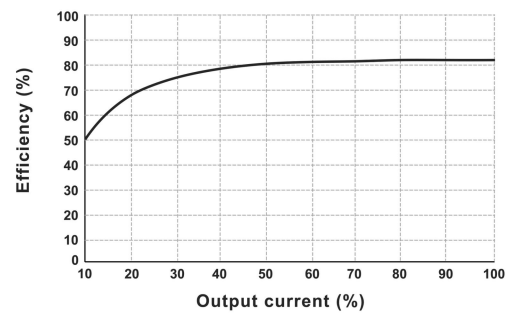
Output Regulation Curve (Others)



Efficiency vs Input Voltage (Full Load, DF2-05S05XT)



Efficiency vs Output Load (Vin=5V, DF2-05S05XT)



## Design Reference - Application Circuit

Application circuit



(Figure 1)

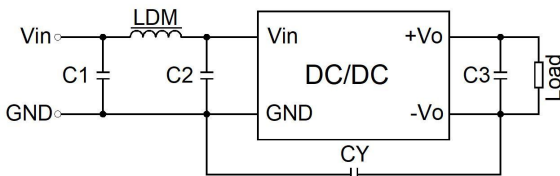
Recommended Capacitive Load Value Table

Vin	Cin	Vo	Cout
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. If further reduction of input and output ripple is required, the external capacitors  $C_{in}$  and  $C_{out}$  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



(Figure 2)

Recommended Parameter Table

C1	4.7μF /50V
C2	4.7μF /50V
C3	Refer to Cout parameter in Figure 1
CY	1000pF /2kVDC
LDM	6.8μH

Note:

1. Typical Application

To further reduce input and output ripple, 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.

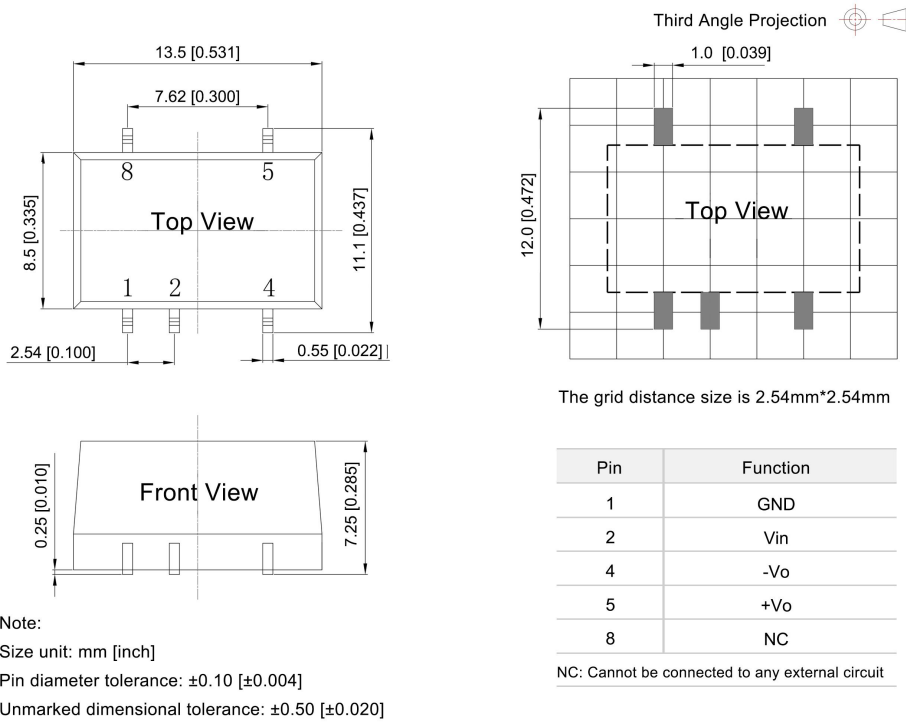
2. EMC Recommended Circuit: See Figure 2

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, connect a resistor in parallel at the output terminal (the sum of the resistor's power dissipation and the actual used power must be greater than or equal to 10% of the rated power).

## Dimensions and Recommended Layout

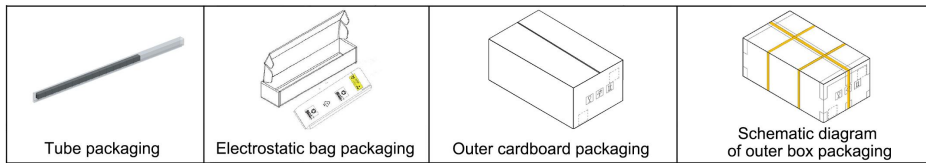
DF2-xxSxxXT Dimensions and Recommended Layout



## Packaging Information

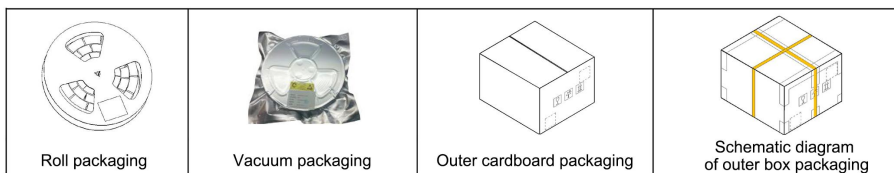
Model series (Tube packaging)	Quantity per tube (pcs/ tube)	Quantity of electrostatic bag (pcs/ bag)	Quantity of inner box (pcs/ box)	Full box Quantity (pcs)
DF2-xxSxxXT	38	760	3040	12160

The schematic diagram of tube packaging is shown below:

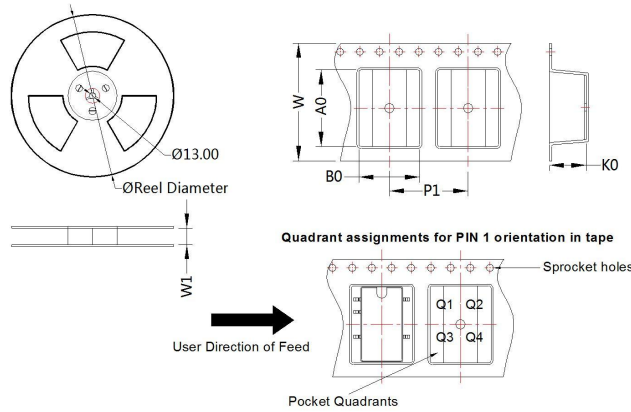


Model series (Reel packaging)	Quantity of products carried (pcs/ROLL)	Quantity of electrostatic bag (pcs/ bag)	Quantity of inner box (pcs/ box)	Full box Quantity (pcs)
DF2-xxSxxXT	500	500	1500	3000

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	5	500	330	24.5	13.9	11.7	7.5	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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