1. Product Overview

The function of **DF1A50-N2R7-S-535V** EMI filter is to prevent the conduction of common mode and differential mode noise between the primary power supply and the secondary power supply, and to meet the requirements of CE102 for system electromagnetic compatibility. According to the input current of the DC/DC converter used in the system at the low end of the input, and considering the design margin, select the appropriate filter type. The device has an input voltage of 0 V ± 50 V, an output current of 2.7 A, and no internal surge current suppression.

2. Features:

- Circuit structure - common mode filter circuit, differential mode filter circuit
- Quality grade - CAST C/SAST
- Irradiation index - immunity

3. Main parameters and technical specifications:

- Input voltage range: 20 V to 50 V, nominally 28 V and 42 V
- Output current: 2.7 A
- Operating temperature (T_C): -55 °C … + 125 °C
- Overall dimensions: 51.00 mm × 28.94 mm × 8.38 mm max.
- Package type: UPP5328 metal dual in-line housing with mounting flange
- Weight: 54 g ± 5 g

4. Absolute Maximum Rating

Table 1. Absolute maximum rating

Parameter	Rating	Unit	Notes
Input voltage	0 V ± 60 V	V	
Output current	3.24	A	
Shell working temperature	-55 … +125	°C	
Storage temperature	-65 … +150	°C	
Soldering temperature resistance of lead	300	°C	10 s

Note: Two or more absolute maximum rating conditions cannot be applied to the device at the same time.

5. Recommended operating conditions

Table 2. Recommended operating conditions

Parameter	Rating	Unit	Notes
Input voltage	20 V ± 50 V	V	
Output current	2.7	A	
Shell working temperature	-55 … +125	°C	

6. Electrical Specifications

Table 3. Electrical Characteristics

Parameter	A group	Symbol	Condition (Unless otherwise specified, -55 °C ≤ T_C ≤ 125 °C, V_I = 28V ± 0.5V and V_I = 42V ± 0.5V)	Value			Unit
				Min.	Max.	Measu-red	
Input Voltage [a]	1,2,3	V_I	Continuity	0	50	0-50	V
Output current [a]	1,2,3	I_O	V_I = 20Vx50V, full load	-	2.7	2.7	A
Output Voltage Dip	1	V_{OD}	V_I = 20V, 28V, 42V, 50V at full load	-	0.54	0.36	V
Noise	4,5,6	N_O	Test frequency 1 kHz	-1	1	0.6	dB
	4,5,6		Test frequency 500 kHz	55	-	70	
	4,5,6		Test frequency: 1MHz	60	-	70	
	4,5,6		Test frequency: 5MHz	60	-	73	
DC resistance	1	R_{DC}	I_O=2.7A	-	0.2	0.13	Ohm
Power consumption	1	P_I	I_O=2.7A	-	1.458	1.0	W
Insulation Resistance	1	R_{ISO}	500 V DC voltage is applied between the input and output terminals and the enclosure (except terminal 3)	100	-	100	Mohm
Capacitance	1	C_O	Between any outgoing terminal (except terminal 3) and the enclosure	-	48000	28000	pF

Note: [a] is verified when the test output voltage drops, and is not tested separately.

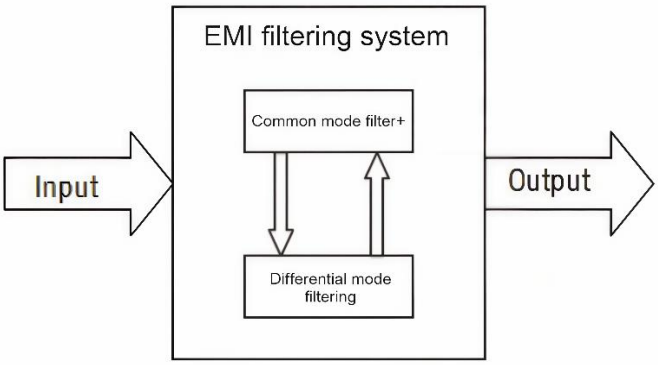

Figure 1. Functional Block Diagram

7. Usage Specification

Table 4. Usage Specification

Q/HW 32664-2016	Hybrid integrated circuit detail specification for type DF1A50-N2R7-S-535V radiation hardened DC/DC converter
CASTPS12/189-2018	Procurement Specification for EMI Filters for Low-Voltage Input Radiation-Hardened DC/DC Converters in Hybrid Integrated Circuits for Spacecraft
SASTYPS0102/0118-2019	Procurement Specification for EMI Filters for Low-Voltage Input Radiation-Hardened DC/DC Converters in Hybrid Integrated Circuits for Spacecraft

8. Typical Application Circuit and description

8.1 Treatment of Shell Ground

The housing of the device must be in good contact with the system ground or the device will not have the conduction suppression it was designed for.

8.2 Overcurrent and short circuit precautions

The device has no short-circuit protection function. When the output positive terminal and the output negative terminal are short-circuited or the device is overcurrent, the device has no protection mode, which is easy to cause thermal burnout of the device. Check whether the output terminal is short-circuited before powering on. If yes, the power can be turned on only after the fault is removed.

8.3 Overvoltage/undervoltage protection

The device has no input overvoltage and output overvoltage protection, so attention shall be paid during use.

8.4 Reliability recommendations

- Pay attention to the working voltage, working current and leakage current when selecting the filter;

- Thermal performance data: Test at T_C= 60 ℃ (the temperature of the temperature control platform is 60 ℃), input 28 V, output full load, the maximum temperature rise of the internal magnetic core is 8 ℃, the power consumption of the device is 1 W, and the internal thermal resistance is 8 ℃/W.

- The device is packaged with salt-fog resistant metal (10 # steel), and the device can be coated with "three-proof" paint to enhance the adaptability of the system to harsh environments;

8.5 Installation Precautions

- Before installation, check whether the appearance of the module is deformed, the surface is rusted, and the insulator is broken.

- The outer pins of the module are mainly used for electrical connection and are not allowed to be used as mechanical supports for the module.

- When the module should be fixed by mechanical reinforcement, the module must be fixed first, and then the soldering between the pins and the PCB must be carried out, and the operation sequence cannot be reversed.

- There shall be no raised through hole or solder joint on the PCB board contacting with the bottom of the module, and the heat dissipation device shall be flat to avoid affecting the contact.

- Pay attention to electrostatic protection during installation.

'- The installation principle of the filter is to effectively isolate the main power supply from the DC/DC power supply. If the EMI filter is installed incorrectly, the performance of the filter will not work properly, or even have a negative effect. Only when the filter is installed properly can good results be achieved:

1. It is better to install the filter at the outlet of the interference source (power supply), and then shield the interference source and the filter. If the inner cavity space of the interference source is limited, the filter shell and the interference source shell shall be well lapped near the outside of the power line outlet of the interference source;

2. The input and output lines of the filter must be separated to prevent the coupling between the input line and the output line and reduce the characteristics of the filter. A clapboard-type chassis is usually used to fix the filter, and if an isolation method cannot be implemented, shielded leads are used to reduce common impedance coupling;

3. The connection of the filter is preferably twisted-pair, which can eliminate part of the high-frequency interference;

4. The low frequency characteristic of the filter is related to the volume, and if the low frequency characteristic is desired to be good, the volume is generally sacrificed;

5. The grounding wire of the filter shall be as short as possible to minimize the electromagnetic coupling between the input end and the output end of the filter without damaging the suppression effect of the shielding structure of the system equipment on the electromagnetic interference noise.

An ideal EMI power filter installation is shown in Figure 1.

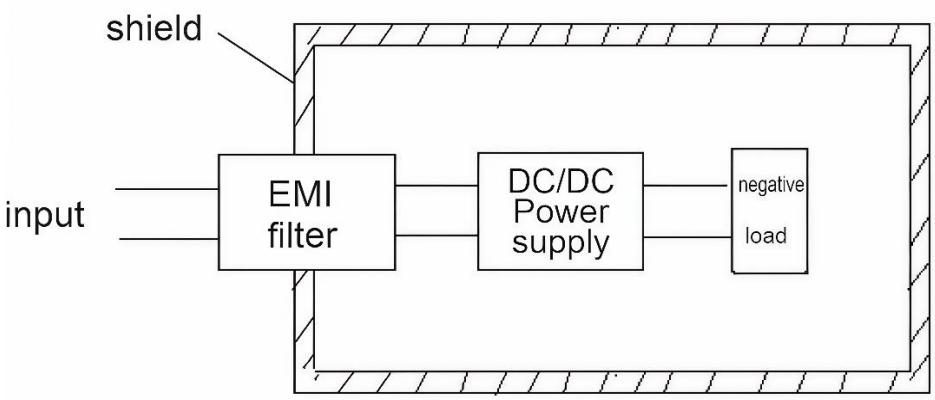

Figure 2. Installation method of ideal EMI power filter

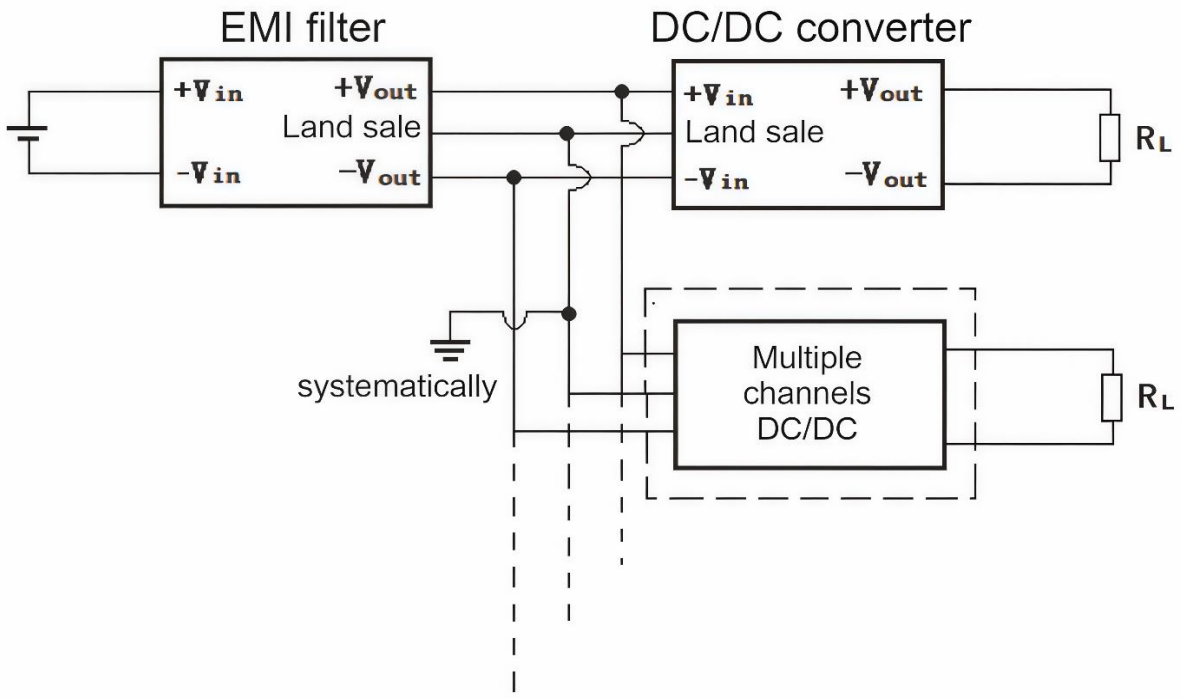

Figure 3. Typical Application Circuit

9. Mechanical Diagrams and package outlines

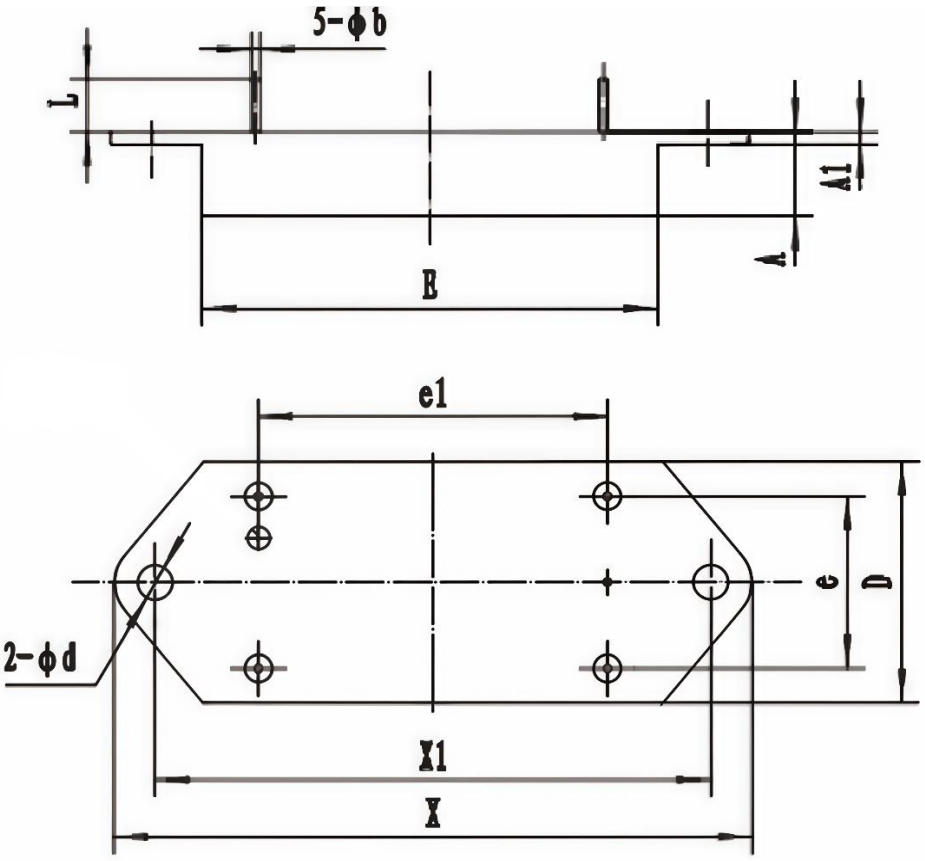

Figure 4. Outline Drawing

Table 5. Dimensions (in mm)

Symbol	Value		
	Minimum	Nominal	Maximum
A	-	-	10.16
A1	1.30	-	1.70
ϕb	0.87	-	1.13
ϕd	3.90	-	4.30
D	-	-	28.69
E	-	-	53.58
e	-	20.32	
e1	-	40.64	
L	5.35	-	
X	-	-	73.91
X1	64.57	-	64.97

Note: e and E1 are interchangeability dimensions, which are guaranteed by shell manufacturing and inspection, and are not required to be examined in this specification.

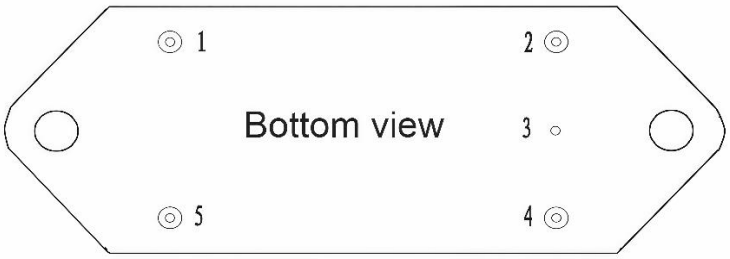

Figure 5. Pinout of the module

Table 6. Pin Designations

Pin number	Label	Function	Pin number	Label	Function
1	VI	Enter the positive terminal	4	GNDO	Output ground
2	V_O	Output positive	5	GNDI	Input ground
3	Case	Package			

10. Typical Characteristic Curves

Figure 6. Insertion Loss

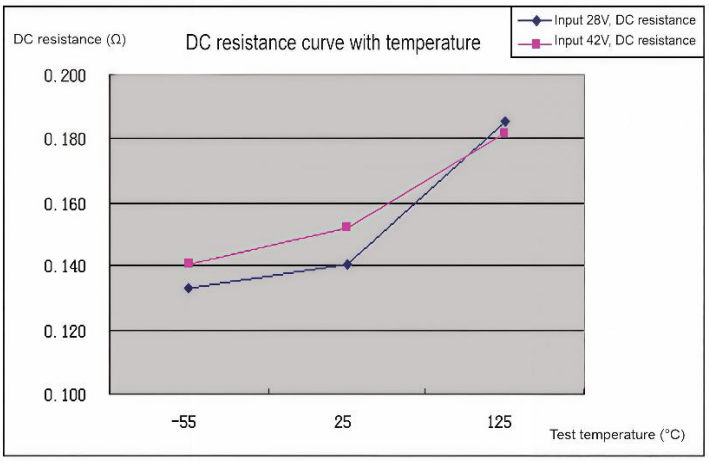

Figure 7. DC Resistance-Temperature Curve

11. Limiting characteristic

- Electrical stress limit characteristics: maximum input voltage 80 V, minimum input voltage 0 V, insulation resistance up to 800 V.

- Temperature limit characteristics: the maximum working temperature can reach 150 ℃, the minimum working temperature can reach -65 ℃, and it can pass 100 times of temperature cycle and 100 times of temperature shock test in GJB548B-2005 method.

- Mechanical limit characteristics: it can pass the mechanical shock test under the condition C and the random vibration test under the condition F in GJB548B-2005.

12. Part Numbering

Table 7. Orderable Part number Guide

Company Name	Type	Series Name	Input voltage	Outputs number	Output Current	Temperature Grade	Case
D	**F**	**1A**	**50**	**N**	**2R7**	**S**	**535V**
SmartPower	DC/DC Filter	1A Rad-hard module	20…50V	single	2.7A	-55...+125°C	535V Flanged