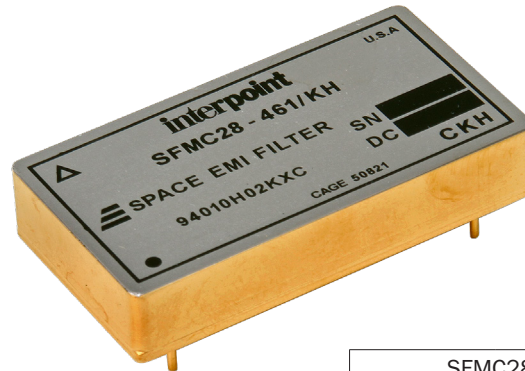


SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

FEATURES

- Attenuation 60 dB at 500 kHz, typical
- Operating temperature -55° to +125°C
- Qualified to MIL-PRF-38534 Class H and K
- Passive components used for maximum tolerance in space environments
- Nominal 28 volt input, 0 to 50 volt operation
- Up to 2.7 amps throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 B-E 28 volt power bus



SFMC28-461	
INPUT (V)	CURRENT (A)
0 - 50	2.7

DESCRIPTION

The Interpoint® SFMC28-461 Series™ of EMI filters offers up to 2.7 amps of throughput current in a low profile package. The FMC-461 filters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H and K production facility. They are packaged in hermetically sealed steel cases and are ideal for use in programs requiring high reliability and small size. Use an SFMC28-461 filter with our SMTR, SMHF and SMSA series of DC-DC converters to meet MIL-STD-461C levels of conducted emission (CE01, CE03). The SFMC filters are designed exclusively with passive components providing maximum tolerance for space environments.

SCREENING

The SFMC28-461 EMI filters offer environmental screening levels to Space Prototype (O), Class H, or Class K requirements. Radiation tolerant to Radiation Hardness Assurance (RHA) levels of “-” (O) or “H”, per MIL-PRF-38534. Interpoint model numbers use an “O” in the RHA designator position to indicate the “-” (dash) Radiation Hardness Assurance level of MIL-PRF-38534, which is defined as “no RHA”. See Table 6 on page 9 for more information.

RIPPLE REDUCTION

The SFMC28-461 EMI filter, when used with Interpoint’s converters, reduces reflected input ripple current by a minimum of 55 dB at 500 kHz and 60 dB at 1 MHz. The filter and converter combination performance exceeds the CE03 requirements of MIL-STD-461C.

INSERTION LOSS

The maximum DC insertion loss for the SFMC28-461 filter (at a load of 22 watts) represents a power loss of less than 2% at nominal input voltage.

FILTER DESIGN

SFMC28-461 filters incorporate thick-film hybrid technology and use only high quality ceramic capacitors for reliable high temperature operation.

All SFMC28-461 filters are built to the same assembly drawing regardless of environmental screening or radiation tolerance level. Filters designated level OO, indicating standard environmental screening, are electrically comparable to filters designated level KH, the highest environmental screening level. This ensures consistency between your prototype or test system using level OO filters and your flight system using filters with higher levels of environmental screening and radiation tolerance. Element evaluation (screening at the component level) of Class H or Class K filters ensures even greater reliability. See Table 6 on page 9 for more information.

OPERATING TEMPERATURE

The filter operates at full load over the temperature range of -55°C to +125°C case. Above +125°C, the current must be derated as specified in Table 4 on page 5.

PACKAGING

SFMC28-461 EMI filters weigh just 48 grams with a small footprint of 2.100 inches (53.34 mm) by 1.115 inches (28.32 mm) by 0.400 inches (10.16 mm) which minimizes the board area needed for the filter.

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

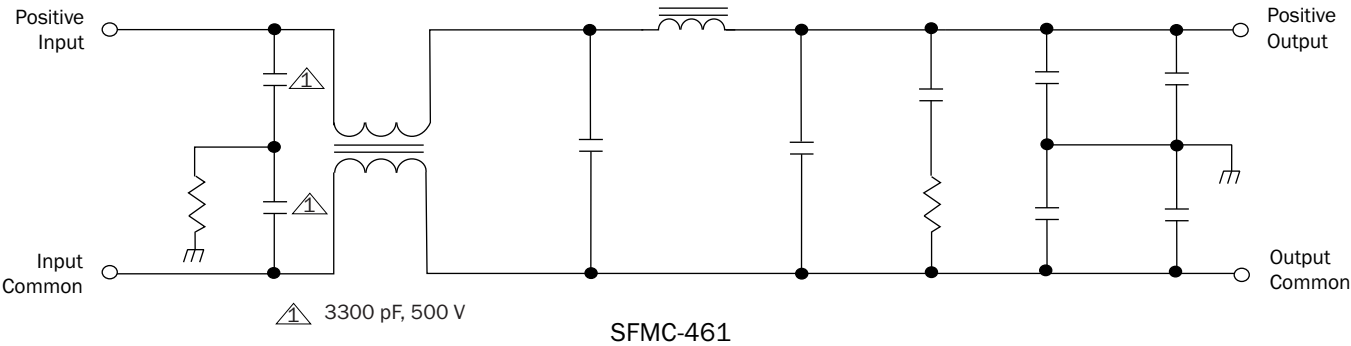
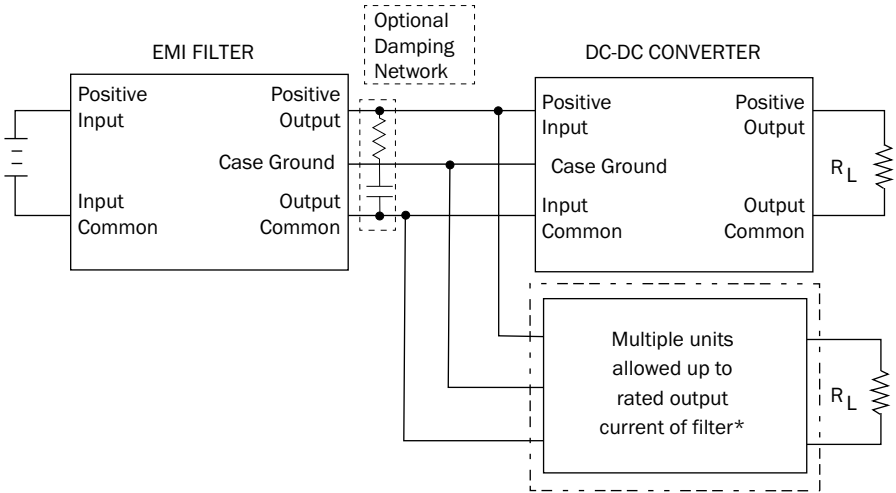


Figure 1: SFMC28-461 Schematic



Output impedance of the filter must be less than the combined input impedance of the DC-DC converters.

Figure 2: Connection Diagram

The case ground connection between the filter and the converter should be as low an impedance as possible to minimize EMI. Direct contact of baseplate to chassis ground provides the lowest impedance.

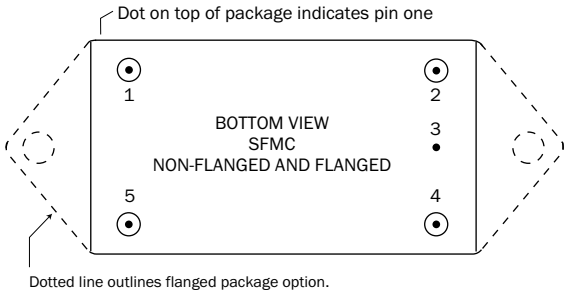
An external RC damping network may need to be added across the output of the FMC-461 to lower its impedance in comparison to the impedance of the converters it will be paired with. See our EMI Conducted Interference application note or contact our Application Engineers at powerapps@craneae.com or call +1 425.882.3100.

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

PIN OUT	
Pin	Designation
1	Positive Input
2	Positive Output
3	Case Ground
4	Output Common
5	Input Common

TABLE 1: PIN OUT



See Figure 8 on page 7 and Figure 9 on page 8 for dimensions.

FIGURE 3: PIN OUT

DLA NUMBERS	
DLA DRAWING (5915)	SFMC28-461 SIMILAR PART
94010H02HXC	SFMC28-461/HH
94010H02HZC	SFMC28-461F/HH
94010H02KXC	SFMC28-461/KH
94010H02KZC	SFMC28-461F/KH
<p>The DLA Drawing numbers shown are for RHA level H, screening level Class K, standard case (X), non-solder dipped pins (C). For other options please refer to the DLA Drawing for the DLA number and the vendor similar number. All DLA Drawing numbers are listed on the DLA Drawing at the end of the document. For exact specifications for a DLA Drawing product, refer to the DLA Drawing. DLA Drawings can be downloaded from https://landandmaritimeapps.dla.mil/programs/smcr</p>	

Table 2: DLA DRAWING CROSS REFERENCE

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

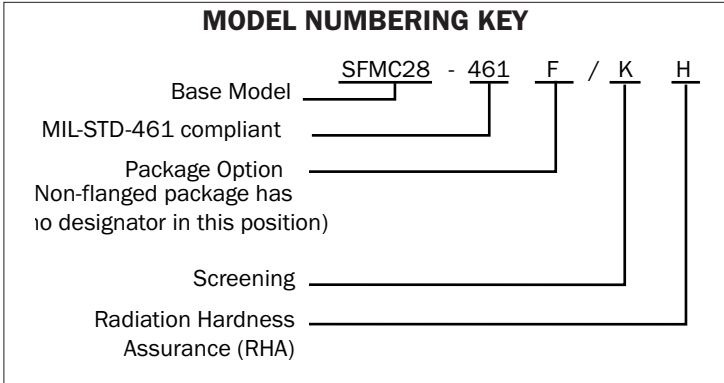


FIGURE 4: MODEL NUMBERING KEY

MODEL NUMBER OPTIONS				
TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.				
CATEGORY	Base Model and Input Voltage	Case Option ¹	Screening ²	RHA ³
OPTIONS	SFMC28-461	(Standard, leave blank) F (flanged)	O H K	O H
FILL IN FOR MODEL # ⁴	SFMC28-461	_____	_____ /	_____

Notes

1. Case Options: For the standard case, Figure 8 on page 7, leave the case option blank. For the flanged case option, Figure 9 on page 8, insert the letter F in the Case Option position.
2. Screening: A screening level of O is a Space Prototype and is only used with RHA O. See Table 6 on page 9 for more information. "H" indicates Class H and "K" indicates Class K of MIL-PRF-38534.
3. RHA: Interpoint model numbers use an "O" in the RHA designator position to indicate the "-" (dash) Radiation Hardness Assurance level of MIL-PRF-38534, which is defined as "no RHA." RHA O is only available with Screening level O. See Table 6 on page 9 for more information.
4. If ordering by model number add a "-Q" to request solder dipped leads (SFMC28-461/KH-Q).

TABLE 3: MODEL NUMBER OPTIONS

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

TABLE 4: OPERATING CONDITIONS: 28 VIN, UNLESS OTHERWISE SPECIFIED.

PARAMETER	CONDITIONS	SFMC28-461			UNITS
		MIN	TYP	MAX	
LEAD SOLDERING TEMPERATURE ¹	10 SECONDS MAX.	–	–	300	°C
STORAGE TEMPERATURE ¹		-65	–	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	–	+125	°C
	ABSOLUTE ¹	-55	–	+135	
DERATING OUTPUT POWER/CURRENT ¹	LINEARLY	From 100% at 125°C to 0% at 135°C			
ISOLATION ²	@ 500 VDC AT 25°C	100	–	–	Megohms

Notes

- Guaranteed by characterization test and/or analysis. Not a production test.
- Tested with all pins, except case pin, tied together. When testing isolation, discharge the pins before and after testing.

TABLE 5: ELECTRICAL CHARACTERISTICS: -55 TO +125°C CASE, 28 VIN, UNLESS OTHERWISE SPECIFIED.

MODEL	PARAMETER	CONDITIONS	SFMC28-461			UNITS
			MIN	TYP	MAX	
	INPUT VOLTAGE	CONTINUOUS	0	28	50	V
	NOISE REJECTION	500 kHz	55	60	–	dB
		1 MHz	60	–	–	
		5 MHz	55	–	–	
	DC RESISTANCE (R _{DC})	T _C = 25°C	–	–	0.2	Ω
	OUTPUT VOLTAGE ²	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN} (R_{DC})$			V
	CAPACITANCE ³	T _C = 25°C	–	–	48,000	pF
	OUTPUT CURRENT	STEADY STATE	–	–	2.7	A
	POWER DISSIPATION ¹	T _C = 25°C	–	–	1.5	W

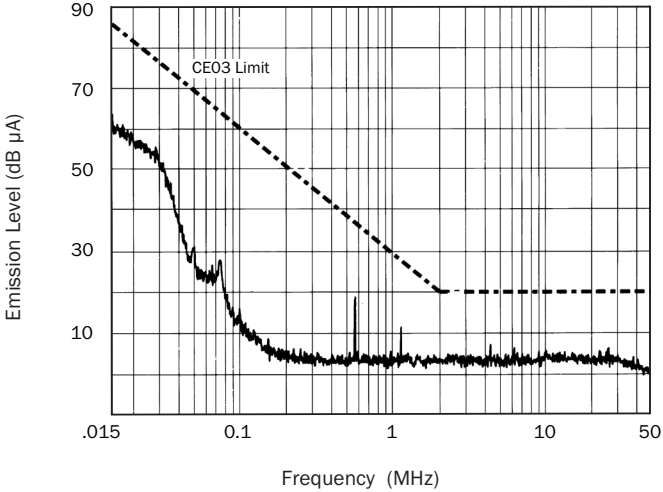
Notes

- Guaranteed by characterization test and/or analysis. Not a production test.
- Typical applications result in V_{out} within 2% of V_{in}.
- Tested with all pins tied together except case pin.

SFMC28-461 EMI Input Filters

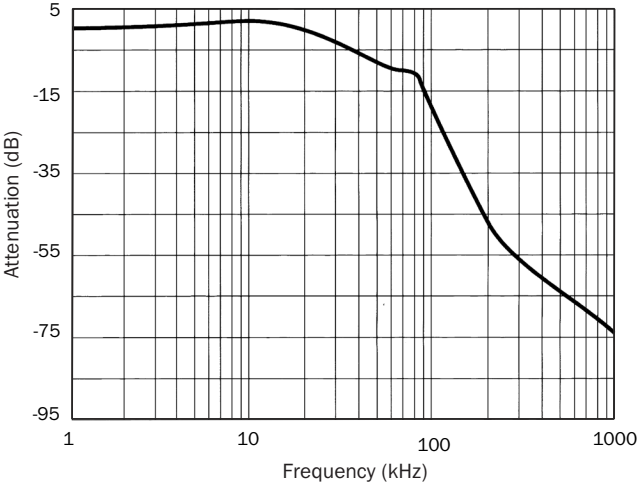
0 TO 50 VOLT INPUT - 2.7 AMP

TYPICAL PERFORMANCE PLOTS: 25 °C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



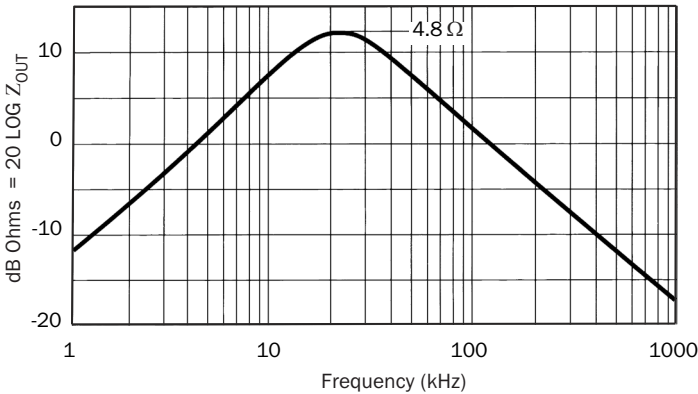
DC-DC Converter Typical EMI With SFMC28-461 Filter

FIGURE 5



SFMC28-461 Typical Amplitude Response vs. Frequency

FIGURE 6



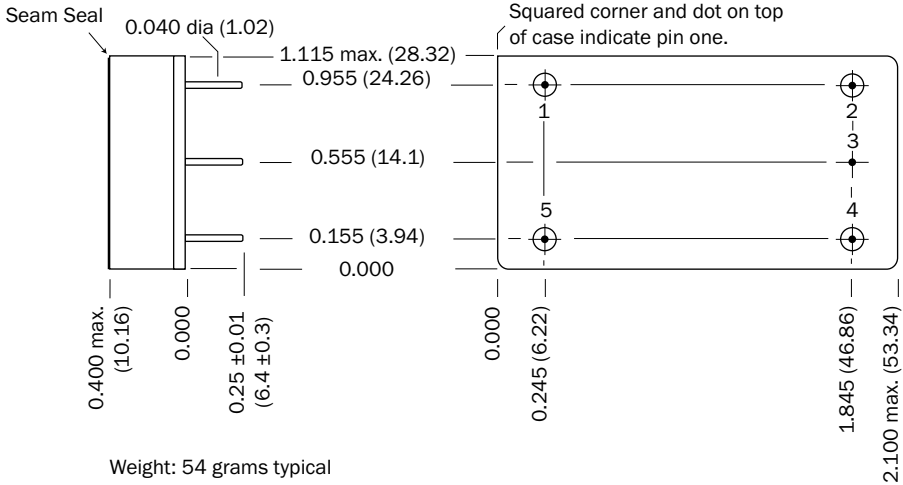
Typical Output Impedance (Z) With Input Shorted

FIGURE 7

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

BOTTOM VIEW CASE H1



Weight: 54 grams typical

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device.
Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials
Header Cold Rolled Steel/Nickel/Gold
Cover Kovar/Nickel
Pins #52 alloy/Gold, ceramic seal
Seal hole 0.120 ±0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

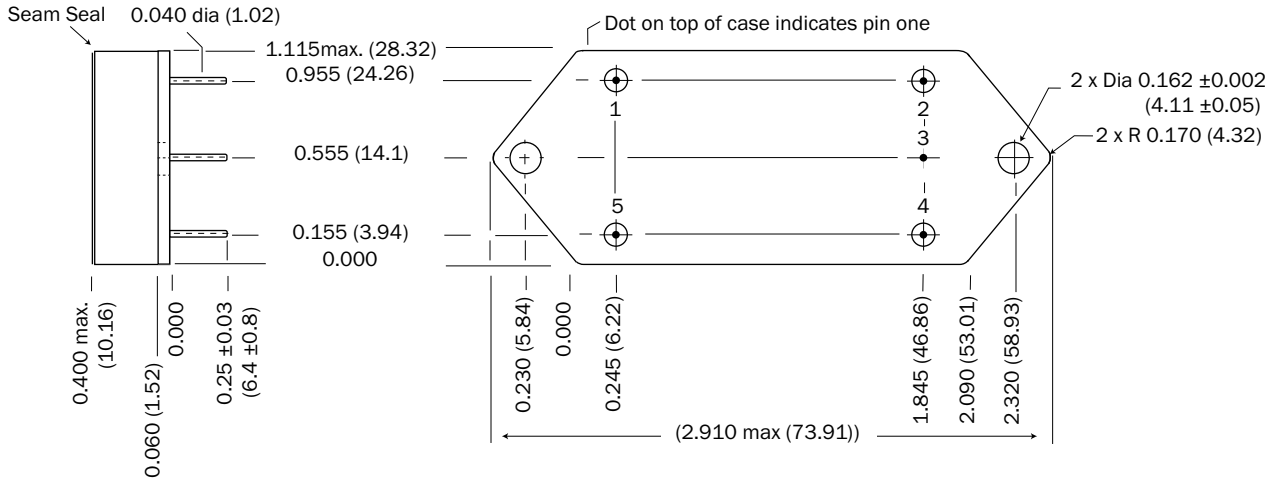
FIGURE 8: SFMC28-461 CASE H1

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

BOTTOM VIEW CASE K2

Flanged cases: Designator "F" required in Case Option position of model number.



Weight: 54 grams typical

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials
Header Cold Rolled Steel/Nickel/Gold
Cover Kovar/Nickel
Pins #52 alloy/Gold, ceramic seal.
Seal Hole: 0.120 ±0.002 (3.05 ±0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 9: SFMC28-461 FLANGED CASE K2

SFMC28-461 EMI Input Filters

0 TO 50 VOLT INPUT - 2.7 AMP

ELEMENT EVALUATION TABLES FOR QML PRODUCTS ARE IN "APP-009 QUALITY AND CERTIFICATION", APPENDIX A, IN COMPLIANCE WITH MIL-PRF-38534 REVISION L.
(LINK [HTTPS://WWW.CRANEEAE.COM/QUALITY-ASSURANCE-MODULAR-POWER](https://www.craneeae.com/quality-assurance-modular-power))

ENVIRONMENTAL SCREENING SPACE EMI FILTERS PROTOTYPE, CLASS H AND K, RHA ¹ H

TEST PERFORMED	NON-QML ²	QML ^{3, 4}	
	PROTOTYPE ⁵	CLASS H	CLASS K
	/OO ⁶	/HH ⁶	/KH ⁶
Pre-cap Inspection, Method 2017, 2032	■	■	■
Temperature Cycle (10 times) Method 1010, Cond. C, -65°C to +150°C, ambient	■	■	■
Constant Acceleration, Method 2001, 3000 g	■	■	■
PIND, Test Method 2020, Cond. A		■ ⁷	■
Pre burn-in test, Group A, Subgroups 1 and 4	■	■	■
Burn-in Method 1015, +125°C case, typical ⁸			
96 hours	■		
160 hours		■	
2 x 160 hours (includes mid-BI test)			■
Final Electrical Test, MIL-PRF-38534, Group A,			
Subgroups 1 and 4: +25°C case	■		
Subgroups 1 through 6, -55°C, +25°C, +125°C case		■	■
Hermeticity Test, Method 1014			
Gross Leak, Cond. B ₂ , Kr85			■
Gross Leak, Cond. C ₁ , fluorocarbon	■	■	
Fine Leak, Cond. B ₁ , Kr85			■
Fine Leak, Cond. A ₂ , helium	■	■	
Radiography, Method 2012			■
Post Radiography Electrical Test, +25°C case			■ ⁷
Final visual inspection			
Method 2009 of MIL-STD-883		■	■
Magnification 1X ⁹	■		
Radiation tolerance ^{1, 10}			
Passive components, radiation tolerant		■	■

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

Notes

- DLA has approved the RHA plan for Interpoint power products. Our SMD products with RHA "H" code meet DLA requirements.
- Non-QML products, prototype (OO), may not meet all of the requirements of MIL-PRF-38534.
- All processes are QML qualified and performed by certified operators.
- Class H or K QML products that have no SMD number are marked "CHH, CKH" per MIL-PRF-38534, Table III instead of "QML".
- "O" in the RHA designator position in Interpoint model numbers indicates DLA RHA "-" defined as no RHA
- Our EMI filters are designed exclusively with passive components providing maximum tolerance for space environment requirements.
- Not required by DLA but performed to assure product quality.
- Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.
- Visual inspection is performed per an internal document. Product may contain cosmetic irregularities such as dents, dings, scratches, etc. that do not affect form, fit or function.
- Interpoint EMI filters are designed exclusively with passive components providing maximum tolerance for space environment requirements. RHA level H is guaranteed to 1000 krad(Si).

TABLE 6: ENVIRONMENTAL SCREENING SPACE EMI FILTERS PROTOTYPE, CLASS H AND K, RHA H

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