

# SFCS28-461 EMI Input Filters

## 28 VOLT INPUT – 5 AMP

### FEATURES

- Attenuation 70 dB at 500 kHz
- 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 5 amp throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 A-E 28 volt power bus



INPUT VOLTAGE AND CURRENT	
Model	Current (A)
SFCS28-461	5

### DESCRIPTION

The Interpoint® SFCS28-461™ EMI Filter modules are specifically designed to reduce the reflected input ripple current of high frequency DC-DC converters. SFCS28-461 filters minimize electromagnetic interference (EMI) for Interpoint space application converters. These filters are intended for use in 28 volt applications which must meet MIL-STD-461 levels of conducted emissions. One filter can be used with multiple converters up to the rated throughput current of the filter.

### SCREENING

The SFCS28-461 filter offers three screening options - Space Prototype (O), Class H, or Class K. 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 7 for more information.

### INPUT RIPPLE AND EMI

Switching DC-DC converters naturally generate two noise components on the power input line: differential noise and common mode noise. Input ripple current refers to both of these components.

Differential noise occurs between the positive input and input common. Most Interpoint converters have an input filter that reduces differential noise which is sufficient for most applications.

Common mode noise occurs across stray capacitance between the converter’s power train components and the baseplate (bottom of the package) of the converter.

Where low noise currents are required to meet CE03 of MIL-STD-461C, a power line filter is needed. The SFCS28-461 Series of EMI power line filters reduces the common mode and differential noise generated by the converters. SFCS28-461 filters reduce input ripple current by at least 60 dB at 500 kHz, 1 MHz, and 5 MHz when used in conjunction with Interpoint DC-DC converters. The filter must be placed as close as possible to the converter for optimum performance. The baseplates of the filter and the converter should be connected with the shortest and widest possible conductors. For the best connection, mount the filter’s and converter’s baseplates on or above a small ground plane.

### OPERATION AND TEMPERATURE

All SFCS28-461 filters are rated for full power operation from -55°C to +125°C case temperature. Current is derated linearly to zero at +135°C case temperature.

### INSERTION LOSS

The maximum DC insertion loss at full load and nominal input voltage represents a power loss of less than 4%.

### PACKAGING

SFCS28-461 filters are sealed in metal hermetic side-leaded packages. For more information contact your Interpoint representative.

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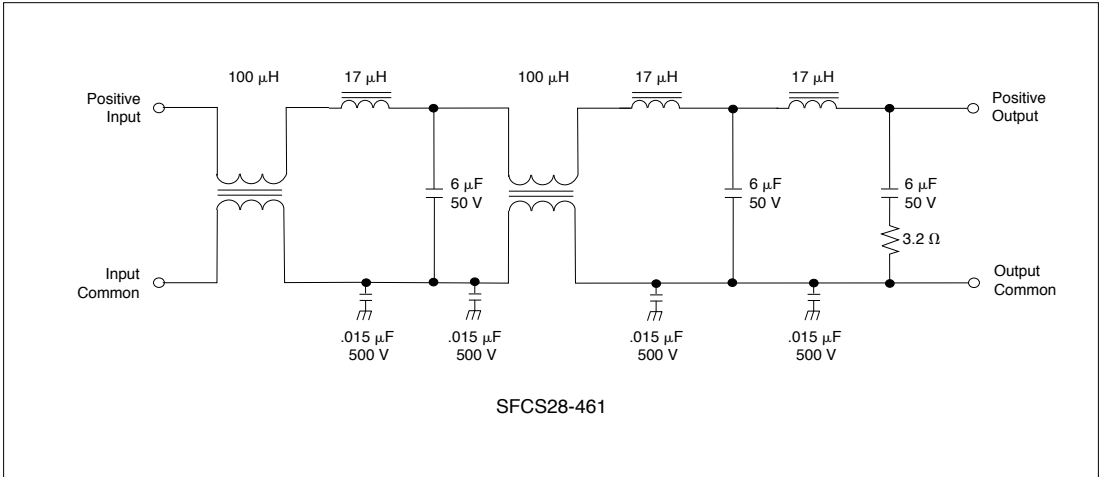


FIGURE 1: BLOCK DIAGRAM

PIN OUT	
Pin <sup>1</sup>	Designation
1, 2, 3	Positive Input
4, 5, 6	Input Common
7, 8, 9	Output Common
10, 11, 12	Positive Output
Baseplate	Case Ground <sup>2</sup>

TABLE 1: PIN OUT

- Notes
1. All pins must be connected.
  2. The baseplate is the only case ground connection and should directly contact chassis ground.

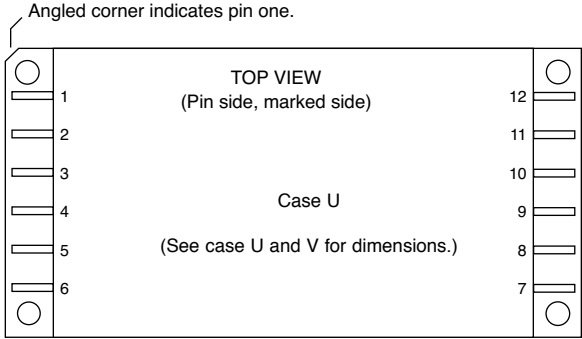
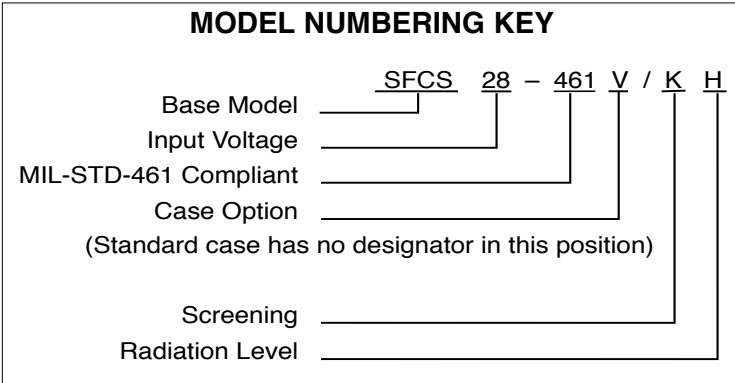


FIGURE 2: PIN OUT

# SFCS28-461 EMI Input Filters

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DLA NUMBERS	
DLA DRAWING (5915)	SFCS28-461 SIMILAR PART
00003-01HXC	SFCS28-461/HH
00003-01KXC	SFCS28-461/KH
For exact specifications for a DLA product, refer to the DLA drawing. DLA drawings can be downloaded from: <a href="http://www.landandmaritime.dla.mil/programs/smcr">http://www.landandmaritime.dla.mil/programs/smcr</a>	

TABLE 2: SMD NUMBER CROSS REFERENCE

FIGURE 3: MODEL NUMBERING KEY

<b>MODEL NUMBER OPTIONS <sup>1</sup></b> <b>TO DETERMINE THE MODEL NUMBER</b> ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.				
CATEGORY	Base Model and Input Voltage	Case Option <sup>2</sup>	Screening <sup>3</sup>	RHA <sup>4</sup>
<b>OPTIONS</b>	<b>SFCS28-461</b>	(side-leaded case, leave blank) V (leads bent down)	O H K	O H
<b>FILL IN FOR MODEL #</b>	<b>SFCS28-461</b>	_____ /	_____	_____
Notes: 1. See Model Numbering Key above for an example of a model number. 2. Case Options: For the standard case, Case U, leave the case option blank. For Case V with leads bent down, insert the letter V in the Case Option position. 3. Screening: A screening level of O is a Space Prototype and is only used with RHA O. See Screening Tables 1 and 2 for more information. "H" indicates Class H and "K" indicates Class K of MIL-PRF-38534. 4. 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 Screening Table 2 for more information.				

TABLE 3: MODEL NUMBER OPTIONS

# SFCS28-461 EMI Input Filters

## 28 VOLT INPUT – 5 AMP

TABLE 4: OPERATING CONDITIONS: 28 V<sub>IN</sub>, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

PARAMETER	CONDITIONS	SFCS28-461			UNITS
		MIN	TYP	MAX	
LEAD SOLDERING TEMPERATURE <sup>1</sup>	10 seconds max.	—	—	300	°C
STORAGE TEMPERATURE <sup>1</sup>		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+125	°C
	ABSOLUTE <sup>1</sup>	-55	—	+135	
DERATING OUTPUT POWER/CURRENT <sup>1</sup>	LINEARLY	From 100% at 125°C to 0 at 135°C			
ISOLATION, ANY PIN TO CASE EXCEPT CASE PIN	@ 500 VDC AT 25°C	100	—	—	Megohms

## Notes

1. Guaranteed by characterization test and/or analysis. Not a production test.

TABLE 5: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C CASE, 28 V<sub>IN</sub>, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

PARAMETER	CONDITIONS	SFCS28-461			UNITS
		MIN	TYP	MAX	
INPUT VOLTAGE	CONTINUOUS	0	28	50 <sup>1</sup>	V
	TRANSIENT 100 ms <sup>1, 2, 3</sup>	—	—	100	V
NOISE REJECTION	500 kHz	60	70	—	dB
	1 MHz	60	70	—	
	5 MHz	60	70	—	
POWER DISSIPATION	MAX CURRENT T <sub>C</sub> = 25°C	—	—	5 <sup>1</sup>	W
DC RESISTANCE (R <sub>DC</sub> )	T <sub>C</sub> = 25°C	—	—	0.2	ohms
CAPACITANCE T <sub>C</sub> = 25°C	ANY PIN TO CASE	50	60	70	nF
OUTPUT VOLTAGE	STEADY STATE	V <sub>OUT</sub> = V <sub>IN</sub> - I <sub>IN</sub> (R <sub>DC</sub> )			V
OUTPUT CURRENT <sup>1</sup>	STEADY STATE	—	—	5 <sup>1</sup>	A

## Notes

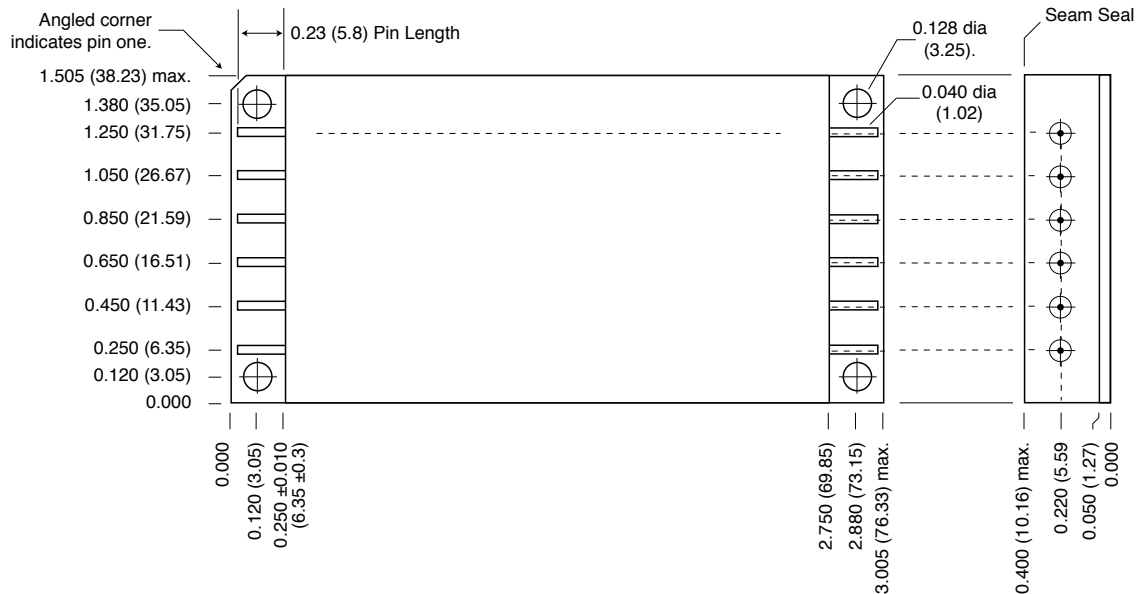
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. 28 V = 0.5 Ω source impedance.
3. The filter will not be damaged by a 100 volt transient but the transient will be passed on to the converter.

# SFCS28-461 EMI Input Filter Cases

## 28 VOLT INPUT – 5 AMP

### TOP VIEW CASE U Flanged case, short leads

Case "U" does not require a designator in the Case Option position of the model number.



**Weight:** 86 grams maximum

#### Case dimensions in inches (mm)

Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (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  
 Gold plating of 50 - 150 microinches is included in pin diameter  
 Seal Hole: 0.120  $\pm 0.002$  (3.05  $\pm 0.05$ )

Case U, Rev K, 2014.03.03

Please refer to the numerical dimensions for accuracy.

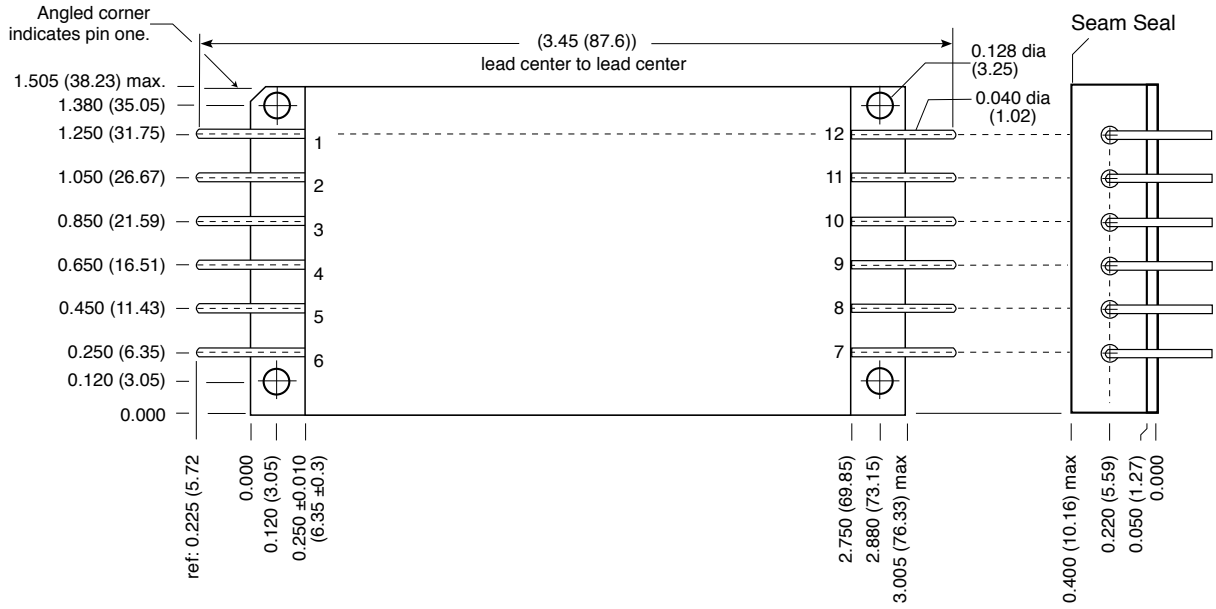
FIGURE 4: CASE U

# SFCS28-461 EMI Input Filter Cases

## 28 VOLT INPUT – 5 AMP

### TOP VIEW CASE V Flanged case, down leaded

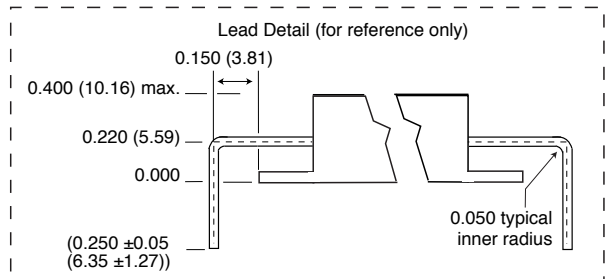
Case "V" requires a "V" in the Case Option position of the model number.



**Weight:** 86 grams maximum

**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: OFHC copper/gold, compression glass seal
- Gold plating of 50 - 150 microinches is included in pin diameter
- Seal Hole: 0.120 ± 0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 5: CASE V

# SFCS28-461 EMI Input Filters

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### ELEMENT EVALUATION SPACE EMI FILTERS PROTOTYPE, CLASS H AND CLASS K

COMPONENT-LEVEL TEST PERFORMED	NON-QML <sup>1</sup>	QML	
	PROTOTYPE	CLASS H	CLASS K
	/O	/H	/K
		P <sup>2</sup>	P <sup>2</sup>
Element Electrical	■	■	■
Visual		■	■
Temperature Cycling			■
Constant Acceleration			■
Voltage Conditioning Aging			■
Visual Inspection			■
Final Electrical		■	■

#### Notes

1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. P = Passive components, Class H and K element evaluation.

#### Definitions

Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534

TABLE 6: ELEMENT EVALUATION

# SFCS28-461 EMI Input Filter Cases

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Table is for reference only. See individual Series' datasheets for specific screening.

### ENVIRONMENTAL SCREENING SPACE EMI FILTERS PROTOTYPE, A, B, CLASS H AND CLASS K, MIL-PRF-38534 AND RHA<sup>1</sup>

TEST PERFORMED	NON-QML <sup>2</sup>	QML <sup>3</sup>	
	PROTOTYPE <sup>4</sup>	CLASS H	CLASS K
	/OO <sup>5</sup>	/HH <sup>5</sup>	/KH <sup>5</sup>
<b>Pre-cap Inspection, Method 2017, 2032</b>	■	■	■
<b>Temperature Cycle (10 times)</b> (Qual 100 times) Method 1010, Cond. C, -65°C to +150°C, ambient	■	■	■
<b>Constant Acceleration</b> Method 2001, 3000 g (Qual 5000 g)	■	■	■
<b>PIND, Test Method 2020, Cond. A</b>		■ <sup>6</sup>	■
<b>Pre burn-in test, Group A, Subgroups 1 and 4</b>	■	■	■
<b>Burn-in Method 1015, +125°C case, typical<sup>7</sup></b>			
96 hours	■		
160 hours		■	
2 x 160 hours (includes mid-BI test)			■
<b>Final Electrical Test, MIL-PRF-38534, Group A,</b>			
Subgroups 1 and 4: +25°C case	■		
Subgroups 1 through 6, -55°C, +25°C, +125°C case		■	■
<b>Hermeticity Test, Method 1014</b>			
Gross Leak, Cond. B <sub>2</sub> , Kr85			■
Gross Leak, Cond. C <sub>1</sub> , fluorocarbon	■	■	
Fine Leak, Cond. B <sub>1</sub> , Kr85			■
Fine Leak, Cond. A <sub>2</sub> , helium	■	■	
<b>Radiography, Method 2012</b>			■
<b>Post Radiography Electrical Test, +25°C case</b>			■ <sup>6</sup>
<b>Final visual inspection, Method 2009</b>	■	■	■
<b>Radiation tolerant<sup>1, 8</sup></b>			
Passive components, radiation tolerant by design		■	■

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

#### Notes

- Our Redmond facility has a DLA approved RHA plan for Interpoint power products.
- Non-QML products prototype, A and B may not meet all of the requirements of MIL-PRF-38534.
- All processes are QML qualified and performed by certified operators.
- "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.
- Interpoint EMI filters are designed exclusively with passive components providing a maximum tolerance for space environment requirements.

TABLE 7: ENVIRONMENTAL SCREENING