

# SFCS28-461 EMI Input Filters

## 28 VOLT INPUT – 5 AMP

### FEATURES

- Fully qualified to Class H or K
- Passive components used for maximum tolerance in space environments
- -55°C to +125°C operation
- Nominal 28 V input, 0 V to 50 V operation
- Up to 5 A throughput current
- 70 dB attenuation typical at 500KHz
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 A-E 28 VDC power bus



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

### DESCRIPTION

The SFCS-461™ Series 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's 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-STD-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 “Class H and K, MIL-PRF-38534 Screening” tables 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's 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 Series 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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### OPERATING CONDITIONS AND CHARACTERISTICS

#### Input Voltage Range

- 0 to 50 VDC continuous for 28 V models

#### Lead Soldering Temperature (10 sec per pin)

- 300°C

#### Storage Temperature Range (Case)

- -65°C to +150°C

#### Case Operating Temperature (Tc)

- -55°C to +125°C full power
- -55°C to +135°C absolute

#### Derating Output Power/Current

- Derate linearly from 100% at 125°C to 0% at 135°C case

#### Isolation

- 100 megohm minimum at 500 VDC
- Any pin to case

### MECHANICAL AND ENVIRONMENTAL

#### Size (maximum)

3.005 x 1.505 x 0.400 inches (76.33 x 38.23 x 10.16 mm)

See case U for dimensions.

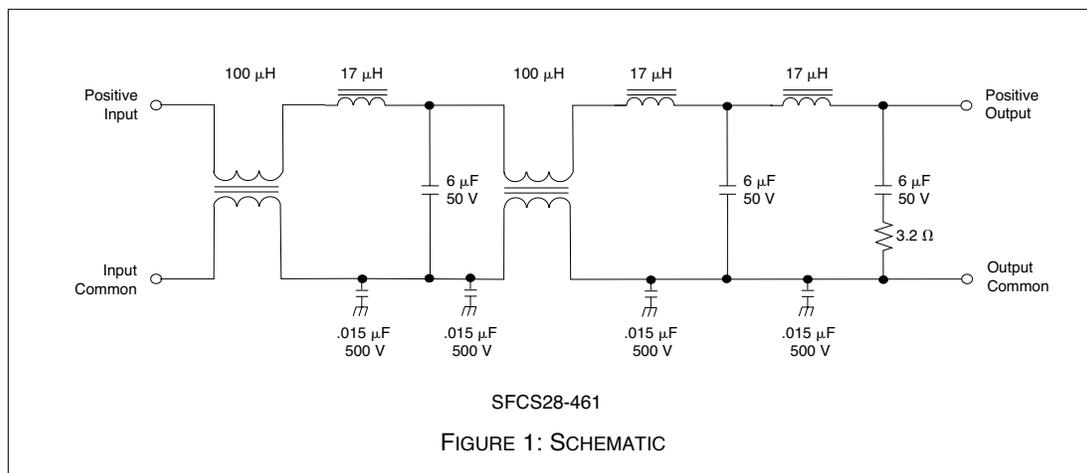
#### Weight (maximum)

110 grams maximum

#### Screening

Space Prototype (O), Class H, or Class K  
Radiation tolerant to Radiation Hardness Assurance (RHA) levels of “-” (O) or “H”, per MIL-STD-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 “Class H and K, MIL-PRF-38534 Screening” tables for more information. Available configurations: OO, HH, KH



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### 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—Case Ground <sup>2</sup>

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

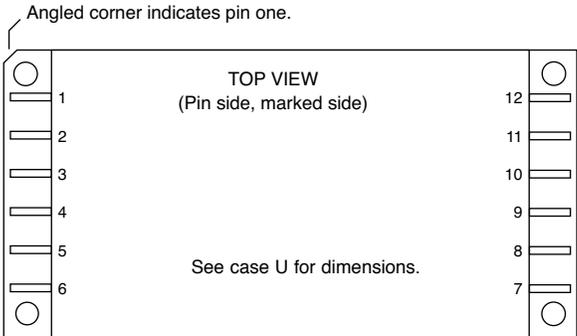


FIGURE 2: PIN OUT SFCS28-461



# SFCS28-461 EMI Input Filters

## 28 VOLT INPUT – 5 AMP

Electrical Characteristics: 25°C Tc, nominal Vin, unless otherwise specified.

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

Notes

1. Guaranteed by design, not tested.

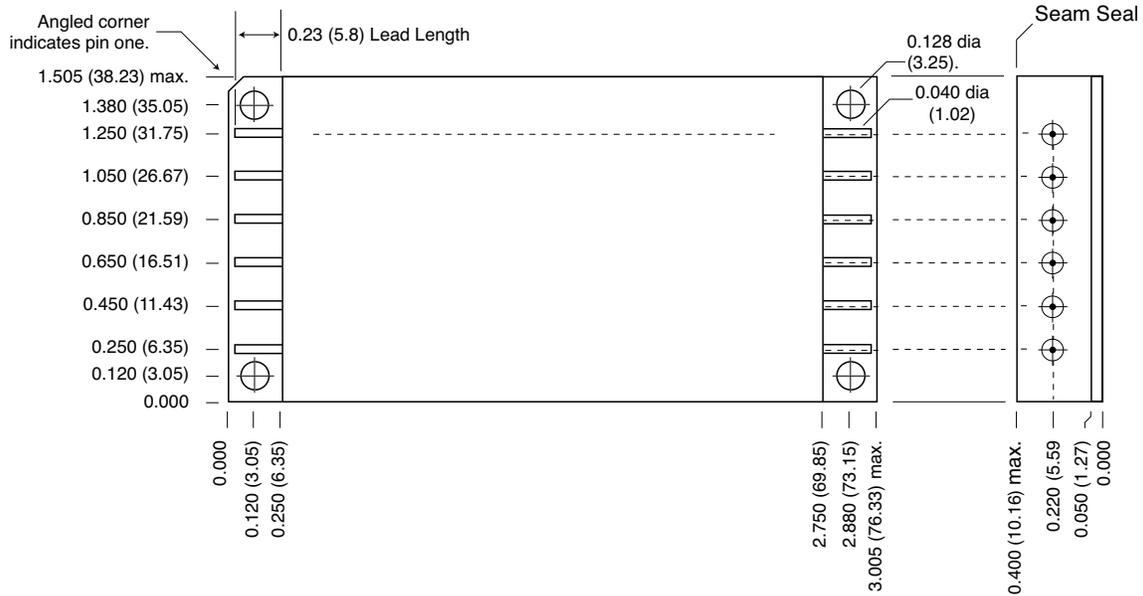
2. 28 V = 0.5 Ω source impedance.

# SFCS28-461 EMI Input Filter Cases

## 28 VOLT INPUT – 5 AMP

### TOP VIEW CASE U Flanged case, short-leaded

\*Case U does not require designator in Case Option position of model number.



#### 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/Nickel/Gold; compression glass seal

Case U, Rev C, 20060302

Please refer to the numerical dimensions for accuracy. All information is believed to be accurate, but no responsibility is assumed for errors or omissions. Interpoint reserves the right to make changes in products or specifications without notice.  
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FIGURE 32: CASE U

# SFCS28-461 EMI Input Filters

## 28 VOLT INPUT – 5 AMP

### CLASS H AND K, MIL-PRF-38534 ELEMENT EVALUATION

TEST PERFORMED (COMPONENT LEVEL)	SPACE PROTOTYPE O NON-QML <sup>1</sup>		CLASS H QML		CLASS K QML	
	M/S <sup>2</sup>	P <sup>3</sup>	M/S <sup>2</sup>	P <sup>3</sup>	M/S <sup>2</sup>	P <sup>3</sup>
	Element Electrical	yes	no	yes	yes	yes
Element Visual	no	no	yes	yes	yes	yes
Internal Visual	no	N/A	yes	N/A	yes	N/A
Temperature Cycling	no	no	no	no	yes	yes
Constant Acceleration	no	no	no	no	yes	yes
Interim Electrical	no	N/A	no	N/A	yes	N/A
Burn-in	no	N/A	no	N/A	yes	N/A
Post Burn-in Electrical	no	N/A	no	N/A	yes	N/A
Steady State Life	no	N/A	no	N/A	yes	N/A
Voltage Conditioning Aging	N/A	no	N/A	no	N/A	yes
Visual Inspection	no	no	N/A	no	N/A	yes
Final Electrical	no	no	yes	yes	yes	yes
Wire Bond Evaluation <sup>4</sup>	no	no	yes	yes	yes	yes
SEM	no	N/A	no	N/A	yes	N/A
SLAM™/C-SAM: Input capacitors only (Add'l test, not req. by H or K)	no	no	no	yes	no	yes

## Notes:

1. Non-QML products do not meet all of the requirements of MIL-PRF-38534.
2. M/S = Active components (Microcircuit and Semiconductor Die)
3. P = Passive components
4. Not applicable to EMI filters that have no wirebonds.

## Definitions:

Element Evaluation: Component testing/screening per MIL-STD-883 as determined by MIL-PRF-38534  
SEM: Scanning Electron Microscopy  
SLAM™: Scanning Laser Acoustic Microscopy  
C-SAM: C - Mode Scanning Acoustic Microscopy

# SFCS28-461 EMI Input Filters

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### CLASS H AND K, MIL-PRF-38534 ENVIRONMENTAL SCREENING

TEST PERFORMED (END ITEM LEVEL)	SPACE PROTOTYPE O NON-QML <sup>1</sup>	CLASS H, QML	CLASS K, QML
Non-destruct bond pull <sup>2</sup> Method 2023	no	yes <sup>3</sup>	yes
Pre-cap Inspection Method 2017, 2032	yes	yes	yes
Temperature Cycle (10 times) Method 1010, Cond. C, -65°C to 150°C, ambient	yes	yes	yes
Constant Acceleration Method 2001, 3000 g	yes	yes	yes
PIND Test Method 2020, Cond. A	no	yes <sup>3</sup>	yes
Pre burn-in test	yes	yes	yes
Burn-in Method 1015, 125°C case, typical			
96 hours	yes	no	no
160 hours	no	yes	no
2 x 160 hour (includes mid BI test)	no	no	yes
Final electrical test MIL-PRF-38534 Group A, Subgroups 1 through 6 -55°C, +25°C, +125°C case	yes	yes	yes
Radiography Method 2012	N/A	N/A	yes
Post Radiography Electrical Test Room temperature	N/A	N/A	yes <sup>3</sup>
Hermeticity test Fine Leak, Method 1014, Cond. A	yes	yes	yes
Gross Leak, Method 1014, Cond. C	yes	yes	yes
Final visual inspection Method 2009	yes	yes	yes

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

Notes:

1. Space Prototype (O), non-QML products, do not meet all of the requirements of MIL-PRF-38534.
2. Not applicable to EMI filters that have no wirebonds.
3. Not required by DSCC but performed to assure product quality.

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### CLASS H AND K, MIL-PRF-38534 RADIATION ASSURANCE

PRODUCT LEVEL AVAILABILITY	ENVIRONMENTAL SCREENING LEVELS		
	SPACE PROTOTYPE O NON-QML <sup>3</sup>	CLASS H QML	CLASS K QML
<b>RADIATION HARDNESS ASSURANCE LEVELS</b>			
<b>O<sup>2</sup></b> : Standard, no radiation guarantee	OO	HO	N/A
<b>H<sup>1, 5</sup></b> : Radiation tolerant – Tested lots Up to 1,000 K Rads (Si) total dose	N/A	HH <sup>4</sup>	KH <sup>4</sup>

Notes:

1. Our EMI filters are designed exclusively with passive components providing maximum tolerance for space environment requirements.
2. 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".
3. Space Prototype (O), non-QML products, do not meet all of the requirements of MIL-PRF-38534.
4. Redmond site, Interpoint, has a Radiation Hardness assurance plan on file with DSCC. Our SMD products with RHA "H" code meet DSCC requirements.
5. Space filters are only available with Radiation Hardness Assurance (RHA) levels of "O" and "H".