

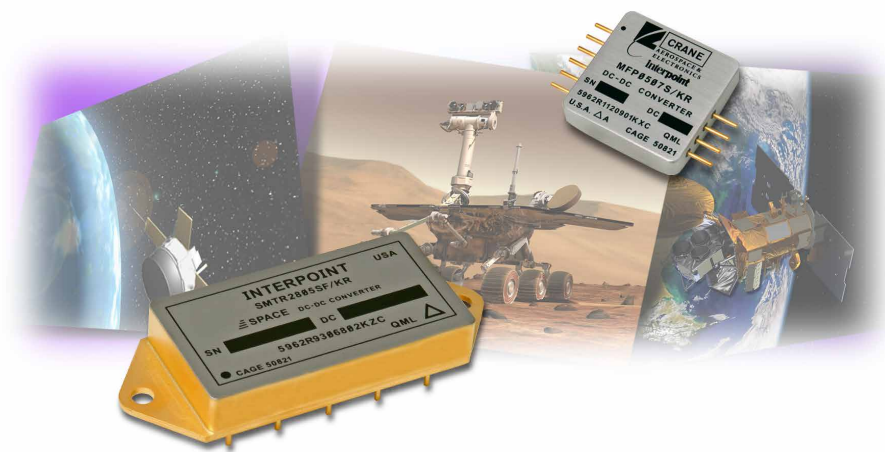
Power Solutions

Interpoint® DC-DC Converters
and EMI Filters

Space Catalog



Crane Aerospace & Electronics
Power Solutions
Interpoint® DC-DC Converters and EMI Filters
Space Catalog



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Crane Aerospace & Electronics
Power Solutions - Interpoint® Products
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Company Information

Crane Company

Crane Company has delivered innovation and technology-led solutions to its customers since its founding in 1855. Today, Crane is a leading manufacturer of highly engineered components for challenging, mission-critical applications focused on the aerospace, defense, space and process flow industry end markets. The company is comprised of two strategic growth platforms, Aerospace & Electronics and Process Flow Technologies, as well as the Engineered Materials segment. Crane has approximately 7,000 employees in the Americas, Europe, the Middle East, Asia and Australia. For more information, visit www.craneco.com.



Aerospace & Electronics

Fluid Handling

Payments & Merchandising Technologies

Engineered Materials

Cabin Systems



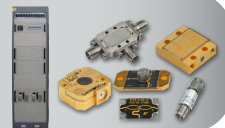
Landing Systems



Electrical Power Solutions



Microwave Solutions



Fluid Management



Sensing Components & Systems



Crane Aerospace & Electronics

Crane Aerospace & Electronics delivers mission-critical and innovative components, systems, and services for commercial aircraft, defense, and space markets. Products and services are organized into six integrated solutions: Cabin Systems, Electrical Power Solutions, Fluid Management, Landing Systems, Microwave Solutions, and Sensing Components & Systems. For more information, visit www.craneeae.com.

Electrical Power Solutions

Crane Aerospace & Electronics provides high-integrity, rugged power products supported by our heritage brands ELDEC, Keltec and Interpoint. With nearly 60 years of experience in power conversion, we offer a full line of off-the-shelf and custom power solutions for commercial aviation, defense, and space markets. As a trusted industry leader in power and advanced packaging solutions, our products meet the requirements for flight and mission critical applications while delivering the efficiency and reliability that our customers demand.

From the Mars Science Lab to commercial aircraft, missiles to fighter aircraft, our range of power products include custom, semi-custom or off-the-shelf products have proven their ability to operate in the most demanding environments. Our quality systems ensure reliable, repeatable, processes and performance.

Power Solutions

Commercial

Modular

Defense

Hi-Rel Products

Space Products

DC-DC Converters
EMI Filters

DC-DC Converters
EMI Filters

Power Solutions

Power Solutions offers ELDEC, Interpoint and Keltec brand power conversion, power distribution and battery systems for the commercial aerospace, defense and space for use in avionics, ATA Chapter 24 Power Systems, communications, electronic countermeasures, missiles, radar, navigation, guidance and utility systems. Our power products, which are well known for high performance and high reliability, have proven performance in military/defense, aerospace, space and industrial applications. From modular power supplies to custom-designed power sub-systems, we can deliver what you need. Our range of power offerings include custom, semi-custom or off-the-shelf products. Our quality systems ensure reliable, repeatable, processes and performance.

DC-DC Converters and EMI Filters

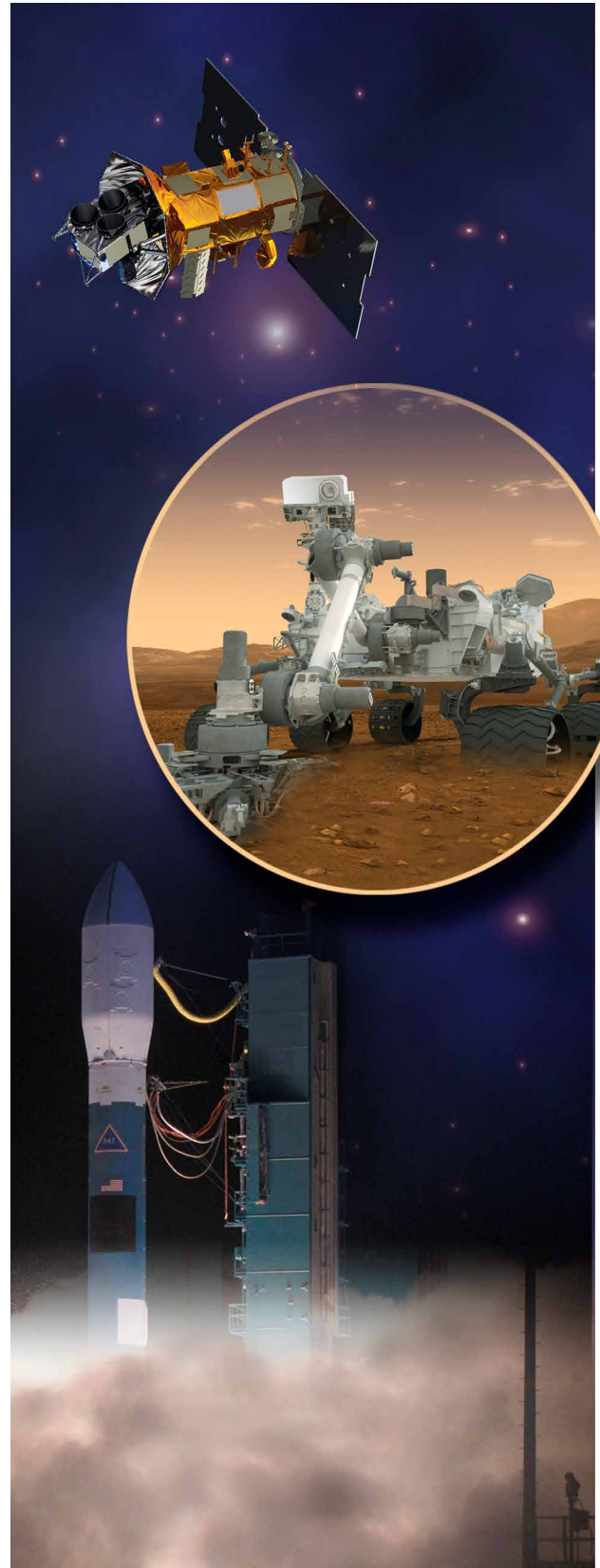
Interpoint DC-DC converter and EMI filter modules have proven performance in extreme environments where high reliability is required and failure is not an option. They are ideal for aerospace, military/defense, space, medical and industrial applications. We offer a standard line of high reliability DC-DC power converters fully qualified up to Class K, QML of MIL-PRF-38534. To meet demanding time and cost targets, choose a product from the standard converters and filters. Over 1,000 off-the-shelf high-reliability DC-DC power conversion products are available. For more information please visit www.craneae.com/interpoint.

Space Qualified DC-DC Converters and EMI Filters

Our Interpoint space qualified DC-DC converters and EMI filters are in the power systems of the Mars Rovers, Mars Science Laboratory, Phoenix Lander, Hubble Space Telescope, Cassini-Huygens and other out-of-this-world applications.

The converters are available as Class H or K of MIL-PRF-38534 on Standard Microcircuit Drawings (SMD) with Radiation Hardness Assurance (RHA) levels of "O" (prototypes) with no RHA level, "P" 30 krad(Si), "L" 50 krad(Si) or "R" 100 krad(Si). Single event effects (SEE) LET performance to 86 MeV cm²/mg

Our EMI Filters are designed exclusively with passive components providing maximum tolerance for space environment requirements. They are available with RHA level O (no RHA) or RHA level "H" 1000 krad(Si).



Interpoint DC-DC Converters and EMI filters Overview

Interpoint Product Overview

High Temperature Operation
High temperature ceramic capacitors and all-metal thermally-conductive cases provide full power operation over DLA's Class H and K temperature range of -55° to +125°C.

Constant Frequency Design
Our proprietary pulse-width-modulated forward converter design produces constant frequency operation and excellent transient response.



Full Hermeticity
Hermetically sealed cases provide optimum protection for all components ensuring high reliability operation in harsh environments.

Advanced Performance
Advanced magnetics and our patented Asymmetrical Power Transfer provides high power density, high efficiency and low height.

Standard Military Drawings
Our DC-DC converters are available on Standard Microcircuit Drawings (SMD) and EMI filters are available on DLA Drawings.

Innovative Solutions

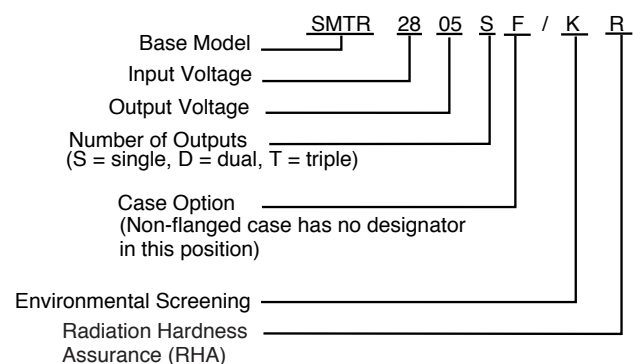
With over forty years of experience, we are your first source for power conversion products for high reliability applications. We have provided innovative power solutions for space aerospace, military/defense and industrial applications where size, weight and reliability are critical to program success. Our space products are available as prototype (OO), Class H-QML or Class K-QML. The products are classified as EAR99 with the exception of 100 krad (RHA R) products. Our space DC-DC converters are rated to 86 MeV cm²/mg for single event effects (SEE) linear event transfer (LET) performance.

Standard Power Conversion

We offer a standard line of DC-DC power converters fully qualified up to MIL-PRF-38534 Class H or K, QML. To meet demanding time and cost targets, choose a product from the standard converters and filters. We offer over 1,000 power conversion products.

Part Numbering

Our part numbering indicates the series (family), input voltage, output voltage, number of outputs, package configuration, screening and radiation hardness assurance (RHA) level.



Technical Support

Applications Engineers are available to provide technical support by phone or email. Call +1 425-882-3100, email powerapps@craneae.com. For the fastest response to a voice message or email please include your name, company name, a phone number, the model number and a brief statement of the problem.

Interpoint Space Qualified DC-DC Converters

| Model (Series) | Input Voltage (V) | Output Voltage (V) | Output Power (W) | Efficiency (% typical) | Operating Temperature | Screening | EMI Filter |
|----------------|-------------------|---|-----------------------------|-----------------------------|-----------------------|--|-------------------------|
| SMFLHP | 19 - 40 | 3.3, 5, 12, 15 ±5, ±12, ±15 | 53 - 100 | 72 - 87 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFME28-461 |
| SMFL | 16 - 40 | 3.3, 5, 12, 15 ±5, ±12, ±15 | 40 - 65 | 72 - 85 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFME28-461 |
| SMP120 | 80 - 160 | 5, 28 | 40 (5 volt) 49 (28 volt) | 75 (5 volt) 83 (28 volt) | -55° to +125°C | Prototype (0) non-QML, Screened to Class H-QML or K-QML Tables 1, 2 and 4 | ±10% trim |
| SMRT | 19 - 56 | 3.3, 5, 8.7, 12, 15 ±5, ±12, ±15 | 23 - 35 | 64 - 80 | -55° to +125°C | Prototype (0) non-QML, Class E-QML Tables 1, 3 and 4 | Built in filter |
| | | 3.3 & ±12, 3.3 & ±15, 5 & ±7, 5 & ±12, 5 & ±15 | | | | | |
| SMTR | 16 - 40 | 3.3, 5, 12, 15 ±5, ±12, ±15 | 18 - 30 | 70 - 83 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFMC28-461 |
| MFP | 3 - 6 | 0.64 to 3.5 | 5.6 - 16.5 | 73 - 92 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 5 and 6 | Not Recommended |
| SMHF42 | 35 - 55 | 3.3, 5, 5.2, 12, 15 ±5, ±12, ±15 | 8 - 15 | 73 - 82 | -55° to +125°C | Prototype (0) non-QML, Screened to Class H-QML or K-QML Tables 1, 2 and 4 | SFMC28-461 |
| SMHF | 16 - 45 | 3.3, 5, 5.2, 12, 15 ±5, ±12, ±15 | 8 - 15 | 73 - 82 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFMC28-461 |
| SMSA | 16 - 40 | 3.3, 5, 5.2, 12, 15 ±5, ±12, ±15 | 5 | 65 - 74 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFMC28-461 STF28-461 |
| SLH | 16 - 40 | 5, 12, 15 ±5, ±12, ±15 | 1.5 | 79 - 88 | -55° to +125°C | Prototype (0) non-QML, Class H-QML or K-QML Tables 1, 2 and 4 | SFMC28-461 STF28-461 |

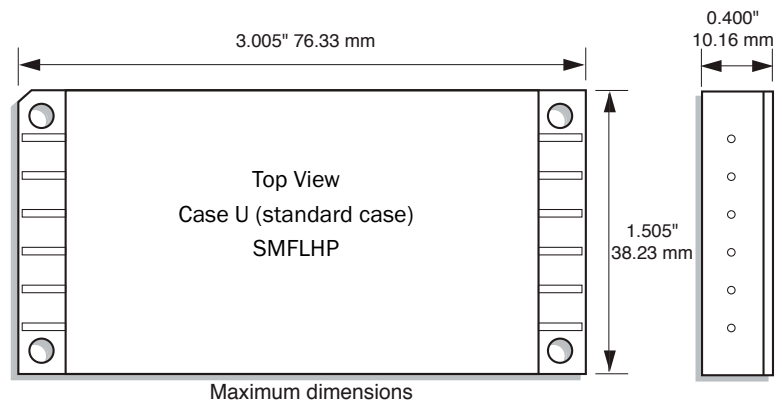
Interpoint Space Qualified DC-DC Converters

SMFLHP SERIES™ CONVERTERS—100 WATT

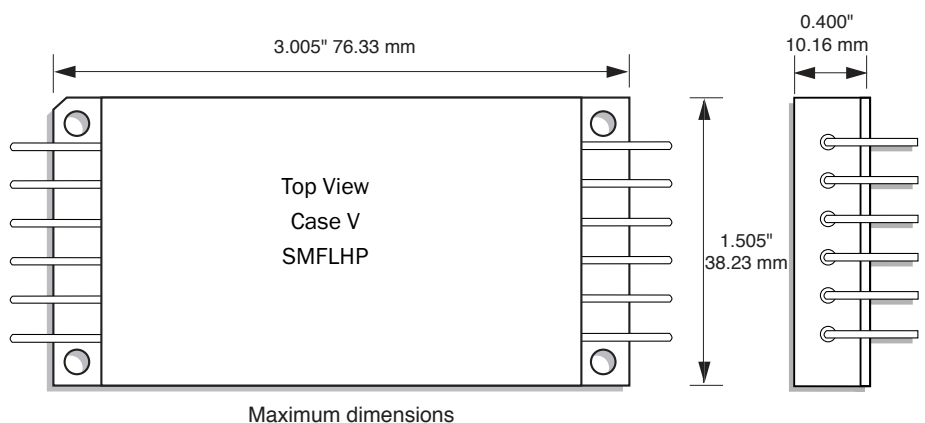
- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Parallel up to 3 converters—maximum recommended power is 80% of the total available power.
- Operating temperature -55 °C to +125 °C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 19 to 40 volts
- Transient protection up to 80 volts for 50 ms
- Converter will shut down at an input voltage above approximately 45 volts
- Fully isolated, magnetic feedback
- Fixed high switching frequency
- Remote sense and output trim on single output models
- Primary and secondary inhibit function
- Synchronization input and output
- Indefinite short circuit protection
- High power density with up to 87% typical efficiency

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|--------------|-----------|---------------------|--------------------|------------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMFLHP283R3S | 19 to 40 | 3.3 | 16.00 | 53 | 72 |
| SMFLHP2805S | 19 to 40 | 5 | 16.00 | 80 | 80 |
| SMFLHP2812S | 19 to 40 | 12 | 7.50 | 90 | 86 |
| SMFLHP2815S | 19 to 40 | 15 | 6.67 | 100 | 87 |
| SMFLHP2805D | 19 to 40 | ±5 | 16.00 ¹ | 80 ¹ | 80 |
| SMFLHP2812D | 19 to 40 | ±12 | 7.50 ¹ | 90 ¹ | 86 |
| SMFLHP2815D | 19 to 40 | ±15 | 6.67 ¹ | 100 ¹ | 87 |

1. Up to 70% of the total power is available from either output providing the opposite output is carrying at least 30% of the power in use. The specification shown is the maximum total current/power.



The SMFLHP Series uses a unique dual loop feedback technique that controls output current with an inner feedback loop and output voltage with a cascaded voltage mode feedback loop. The additional secondary current mode feedback loop improves transient response in a manner similar to primary current mode control and allows for ease of paralleling. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening with Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



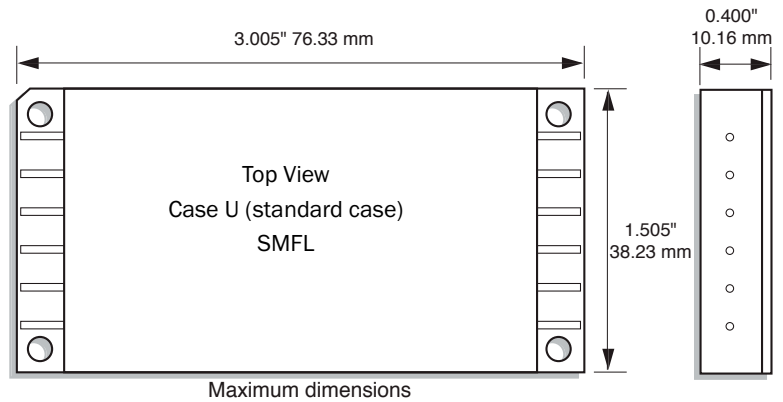
Interpoint Space Qualified DC-DC Converters

SMFL SERIES™ CONVERTERS—65 WATT

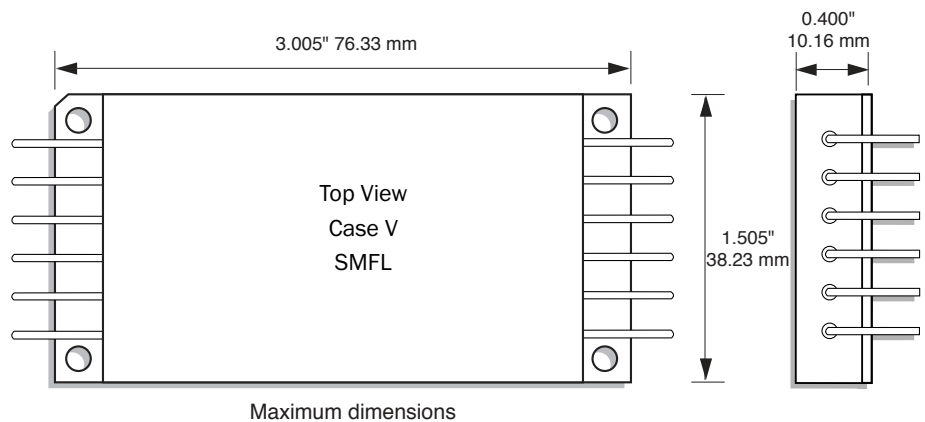
- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Parallel up to 3 converters—maximum recommended power is 80% of the total available power.
- Operating temperature -55 °C to +125 °C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 40 volts
- Transient protection up to 80 volts for 50 ms
- Converter will shut down at an input voltage above approximately 45 volts
- Fully isolated, magnetic feedback
- Fixed high switching frequency
- Remote sense and output trim on single output models
- Primary and secondary inhibit function
- Synchronization input and output
- Indefinite short circuit protection
- High power density with up to 85% typical efficiency

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|------------|-----------|---------------------|--------------------|-----------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMFL283R3S | 16 to 40 | 3.3 | 12.12 | 40 | 72 |
| SMFL2805S | 16 to 40 | 5 | 10.00 | 50 | 78 |
| SMFL2812S | 16 to 40 | 12 | 5.00 | 60 | 84 |
| SMFL2815S | 16 to 40 | 15 | 4.33 | 65 | 85 |
| SMFL2805D | 16 to 40 | ±5 | 10.00 ¹ | 50 ¹ | 78 |
| SMFL2812D | 16 to 40 | ±12 | 5.00 ¹ | 60 ¹ | 84 |
| SMFL2815D | 16 to 40 | ±15 | 4.33 ¹ | 65 ¹ | 85 |

1. Up to 70% of the total current/power is available from either output providing the opposite output is carrying at least 30% of the power in use. The specification shown is the maximum total current/power.



The SMFL Series converters have two inhibit terminals (INH1—primary side and INH2—secondary side) that can be used to disable power conversion, resulting in a very low quiescent input current and no generation of switching noise. The SMFL uses a unique dual loop feedback technique that controls output current with an inner feedback loop and an output voltage with a cascaded voltage mode feedback loop. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening, with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

SMP120 SERIES™ CONVERTERS—49 WATT

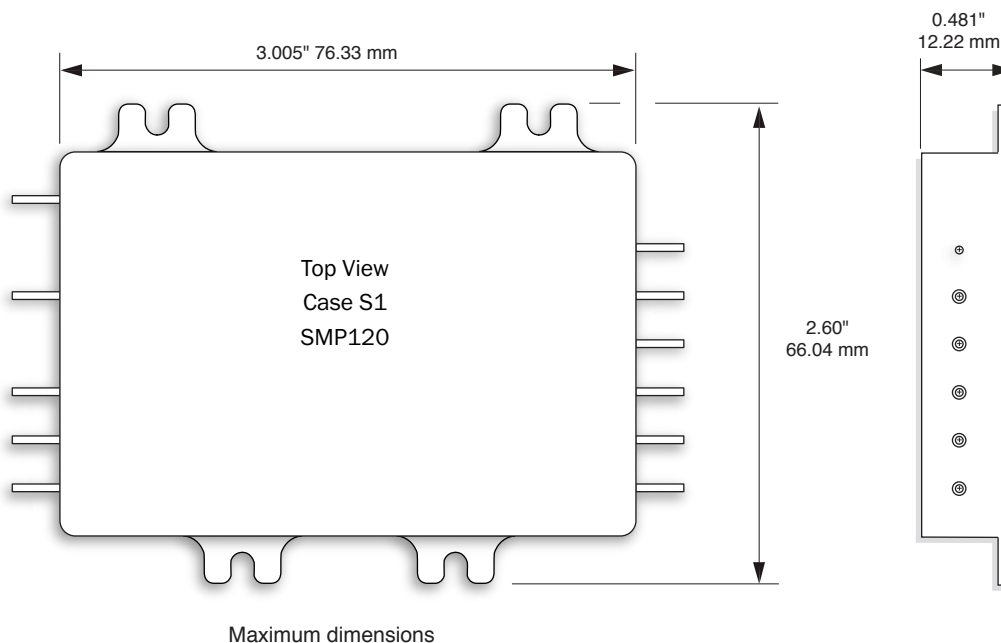
- Radiation hardened space converter
 - SEB (no burn-out) 43 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Output overvoltage protection
- Inrush current limit
- Output trim ±10%
- Operating temperature -55° to +125°C
- Screened to MIL-PRF-38534 Class H and K
- Input voltage range 80-160 volts
- Transient protection 180 volts for 100 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense
- Inhibit function, synchronization input
- Indefinite short circuit protection

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|-----------|-----------|---------------------|-------------|----------------|--------------|
| | | | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMP12005S | 80 to 160 | 5 | 8 | 40 | 75 |
| SMP12028S | 80 to 160 | 28 | 1.75 | 49 | 83 |

The Interpoint® SMP120 Series™ of DC-DC converters offers up to 49 watts of power in a radiation hardened design. The low profile SMP120 converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class K production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability, small size, and high levels of radiation hardness assurance.

The SMP120 converters are switching regulators which use a current mode control single switch forward design with a nominal switching frequency of 500 kHz. Close regulation is maintained with advanced constant frequency pulse width modulation design techniques. The SMP120's current mode control topology provides high levels of input-to-output ripple rejection.

Available with Space Prototype (non-QML), or screened to Class H-QML or Class K with an RHA level available up to "R" per MIL-PRF-38534, pending product qualification. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

SMRT SERIES™ CONVERTERS—35 WATT SINGLE, DUAL OR TRIPLE

- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Built in MIL-STD-461 EMI filter
- Output trim from 51% to 124% of nominal
- Operating temperature -55° to +125° C
- Input voltage range 19 to 56 volts
- Transient protection 80 volts for 120 ms
- Fully isolated, 5 port isolation
- Dual magnetic feedback
- Fixed high frequency switching
- Remote sense
- Inhibit function
- Synchronization input
- Indefinite short circuit protection
- Meets MIL-STD-704A transient standards

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|--------------|-----------|---------------------|---------------------------|----------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMRT283R3S | 19 to 56 | 3.3 | 6.97 | 23 | 64 |
| SMRT2805S | 19 to 56 | 5 | 6.00 | 30 | 71 |
| SMRT288R7S | 19 to 56 | 8.7 | 4.00 | 35 | 75.5 |
| SMRT2812S | 19 to 56 | 12 | 2.92 | 35 | 78 |
| SMRT2815S | 19 to 56 | 15 | 2.33 | 35 | 80 |
| SMRT2805D | 19 to 56 | ±5 | ±3.00 ¹ | 30 | 70 |
| SMRT2812D | 19 to 56 | ±12 | ±1.46 ¹ | 35 | 76 |
| SMRT2815D | 19 to 56 | ±15 | ±1.17 ¹ | 35 | 80 |
| SMRT283R312T | 19 to 56 | 3.3 & ±12 | 4.50 1.25 ² | 30 | 70.5 |
| SMRT283R315T | 19 to 56 | 3.3 & ±15 | 4.50 1.00 ² | 30 | 71 |
| SMRT28507T | 19 to 56 | 5 & ±7 | 3.00 2.00 ² | 29 | 71 |
| SMRT28512T | 19 to 56 | 5 & ±12 | 3.00 1.25 ² | 30 | 75 |
| SMRT28515T | 19 to 56 | 5 & ±15 | 3.00 1.00 ² | 30 | 75 |

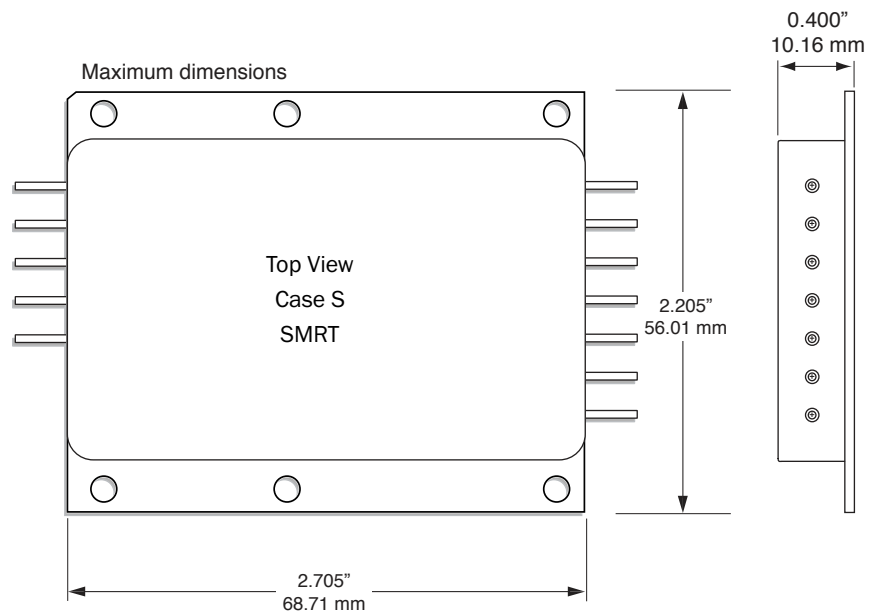
1. The specified maximum current is available from each output.
2. Up to the maximum specified auxiliary output current is available from either auxiliary output provided the total auxiliary output power does not exceed 15 watts. The specification shown is the maximum total current/power.

Two independent feedback loops are used to regulate the dual and triple outputs, one feedback loop regulates the two-phased single output. Each set of outputs is electrically isolated from the other and from the input. This product configuration eliminates cross regulation effects between output sets.

Configurations:

- **Single Output: One dual-phase output**
- **Dual Output: Two isolated single-phase outputs**
- **Triple Output: One single-phased output (Main) isolated from one single-phase dual output (± Auxiliary)**

The output voltage of each set can be trimmed upward or downward by as much as 51% to 124% of nominal. Available with Space Prototype (non-QML) or Class E-QML, Quality Assurance screening and a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

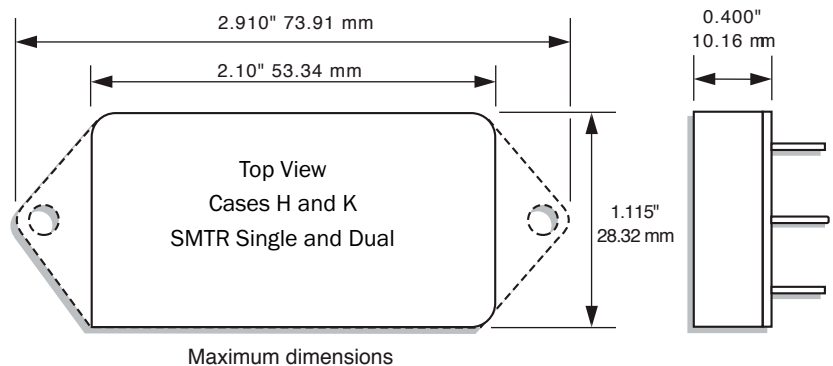
SMTR SERIES™ CONVERTERS—30 WATT

- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Operating temperature -55° to +125° C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 40 volts
- Transient protection 50 volts for 50 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching, 600 kHz typical
- Trim function or remote sense on single output models
- Inhibit and synchronization functions
- Indefinite short circuit protection
- Typical efficiency up to 83%

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|------------|-----------|---------------------|-------------------|-----------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMTR283R3S | 16 to 40 | 3.3 | 5.45 | 18 | 73 |
| SMTR2805S | 16 to 40 | 5 | 5.00 | 25 | 78 |
| SMTR2812S | 16 to 40 | 12 | 2.50 | 30 | 83 |
| SMTR2815S | 16 to 40 | 15 | 2.00 | 30 | 83 |
| SMTR2805D | 16 to 40 | ±5 | 5.00 ¹ | 25 ¹ | 76 |
| SMTR2812D | 16 to 40 | ±12 | 2.50 ¹ | 30 ¹ | 80 |
| SMTR2815D | 16 to 40 | ±15 | 2.00 ¹ | 30 ¹ | 81 |

1. Up to 90% of the total current/power is available from either dual output, providing the opposite output is carrying at least 10% of the power in use. The specification shown is the maximum total current/power.

The SMTR Series™ of 28 volt DC-DC converters offers up to 30 watts of output power from single or dual output configuration. They operate over the full military temperature range of -55° to +125° C with up to 84% efficiency. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

MFP SERIES™ POINT OF LOAD CONVERTER

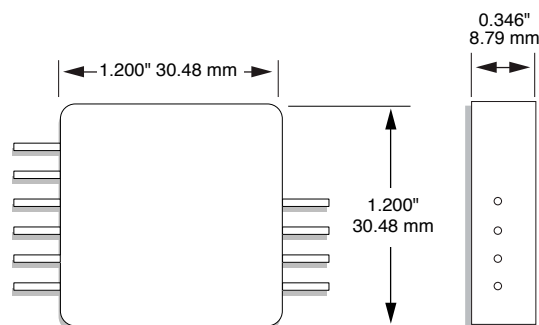
- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 85 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- No external components required
- Up to 92% typical efficiency, flat down to 30% load
- Qualified up to MIL-PRF-38534 Class K
- Input voltage range 3.0 to 6.0 volts dc
- Input transient survivability to 15 volts for up to 1 sec.
- Inhibit and sync functions
- Current monitoring,
- Current sharing pin for parallel operation
- Four pin-selectable, preset voltages: 0.8, 1.6, 2.5 and 3.3
- Output voltage continuously adjustable from 0.8 to 3.5 volts with resistors
- Indefinite output short circuit protection
- Remote sense and voltage margining
- Case available as standard or flanged

| MODEL | INPUT (V) 1, 2 | OUTPUT AT FULL LOAD | | | |
|----------|---------------------|---------------------|-------------|----------------|---------------------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) ³ |
| MFP0507S | 3.0 min. to 6.0 max | 0.8 | 7 | 5.6 | 73 |
| | 3.0 min. to 6.0 max | 1.6 | 6.4 | 10.2 | 84 |
| | 3.3 min to 6.0 max. | 2.5 | 5.0 | 12.5 | 89 |
| | 4.5 min to 6.0 max. | 3.3 | 5.0 | 16.5 | 92 |

1. 0.64 volts is an additional pin selectable voltage.

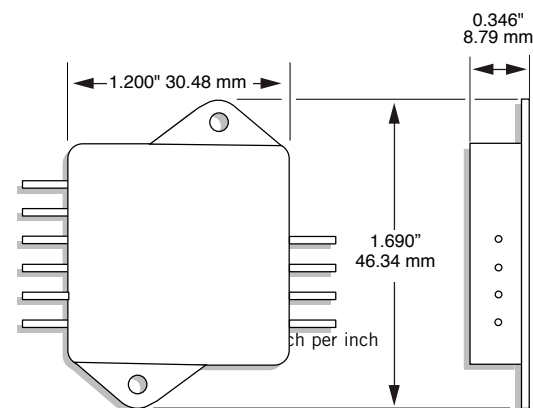
2. Continuously adjustable from 0.8 to 3.5 volt.

3. Efficiency at 25°C.



Maximum dimensions

Flatness of base: 0.003 inch per inch



Maximum dimensions

The MFP Series™ of DC-DC converters do not require any external components to achieve all specified performance levels. They are a high-reliability, high-efficiency point of load converter for use with a 3.3 or a 5 volt input bus. The MFP0507S model has the flexibility to be set for any output voltage from 0.64 to 3.5 volts. The converter operates from an input of 3.0 to 6.0 V_{IN} with an undervoltage shutdown below 3 volts and an overvoltage shutdown above 6 volts. The converter can withstand up to a 15 volt transient for up to 1 second.

The non-isolated, feature-rich MFP uses a Buck converter design with synchronous rectification. The design allows the unit to operate synchronously to no output load, ensuring high efficiency at the lightest loads without switching off the synchronous devices. Important features include a solid state switch, inrush current limiting, synchronization with an external system clock and the ability to current share allowing multiple devices to supply a common load. Radiation hardened, with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.

Interpoint Space Qualified DC-DC Converters

SMHF42 SERIES™ CONVERTERS—15 WATTS

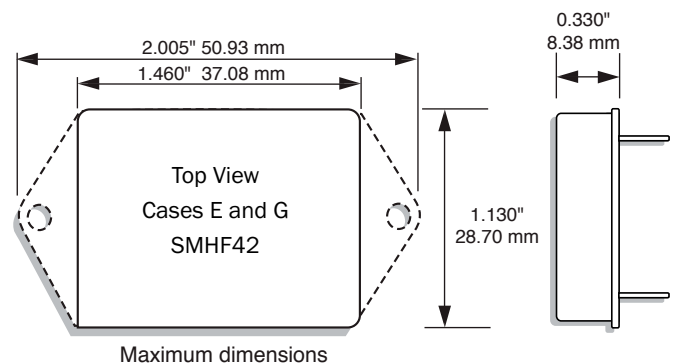
- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg 1
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) 1 L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A) 1
 - 10 mrad(Si)/sec dose rate (Condition D) 1
- Operating temperature -55°C to +125°C
- Screened to MIL-PRF-38534 Class H and K 1
- Input voltage range 35 to 55 volts
- Transient protection 80 volts for 50 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Synchronization input
- Indefinite short circuit protection
- Undervoltage lockout

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|------------|-----------|---------------------|-------------------|-------------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMHF423R3S | 35 to 55 | 3.3 | 2.40 | 8 | 72 |
| SMHF4205S | 35 to 55 | 5 | 2.40 | 12 | 79 |
| SMHF425R2S | 35 to 55 | 5.2 | 2.40 | 12.5 | 80 |
| SMHF4212S | 35 to 55 | 12 | 1.25 | 15 | 80 |
| SMHF4215S | 35 to 55 | 15 | 1.00 | 15 | 81 |
| SMHF4205D | 35 to 55 | ±5 | 2.40 ¹ | 12 ¹ | 79 |
| SMHF4207D | 35 to 55 | ±12 | 1.25 ¹ | 11.9 ¹ | 80 |
| SMHF4212D | 35 to 55 | ±12 | 1.25 ¹ | 15 ¹ | 80 |
| SMHF4215D | 35 to 55 | ±15 | 1.00 ¹ | 15 ¹ | 82 |

1. Up to 70% of the total current/power is available from either dual output, providing the opposite output is carrying at least 30% of the power in use. The specification shown is the maximum total current/power.

The Interpoint® SMHF42 Series™ of 42 volt DC-DC converters offers up to 15 watts of power in a radiation hardened design. The low profile SMHF42 converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class K production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability, small size, and high levels of radiation hardness assurance. They are targeted for operation on a 42 volt satellite power bus. The units are capable of withstanding transients up to 80 volts for up to 50 ms.

Available with Space Prototype (non-QML), or screened to Class H-QML or Class K with an RHA level available up to "R" per MIL-PRF-38534, pending product qualification. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

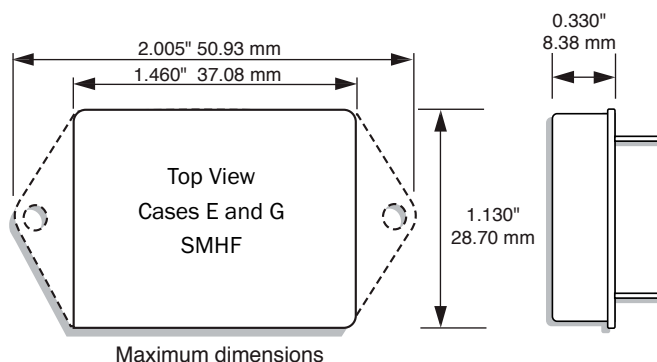
SMHF SERIES™ CONVERTERS—15 WATTS

- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Operating temperature -55°C to +125°C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 45 volts
- Transient protection 50 volts for 50 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Synchronization input
- Indefinite short circuit protection
- Undervoltage lockout

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|------------|-----------|---------------------|-------------------|-----------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMHF283R3S | 16 to 45 | 3.3 | 2.40 | 8 | 71 |
| SMHF2805S | 16 to 45 | 5 | 2.40 | 12 | 76 |
| SMHF285R2S | 16 to 45 | 5.2 | 2.40 | 12.5 | 78 |
| SMHF2812S | 16 to 45 | 12 | 1.25 | 15 | 79 |
| SMHF2815S | 16 to 45 | 15 | 1.00 | 15 | 78 |
| SMHF2805D | 16 to 45 | ±5 | 2.40 ¹ | 12 ¹ | 77 |
| SMHF2812D | 16 to 45 | ±12 | 1.25 ¹ | 15 ¹ | 80 |
| SMHF2815D | 16 to 45 | ±15 | 1.00 ¹ | 15 ¹ | 82 |

1. Up to 70% of the total current/power is available from either dual output, providing the opposite output is carrying at least 30% of the power in use. The specification shown is the maximum total current/power.

The SMHF Series™ synchronization feature allows the user to match the switching frequency of the converter to the frequency of the system clock. This allows the user to adjust the nominal 550 kHz operating frequency to any frequency within the range of 500 kHz to 600 kHz by applying a compatible input of the desired frequency to pin 5. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening, with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified DC-DC Converters

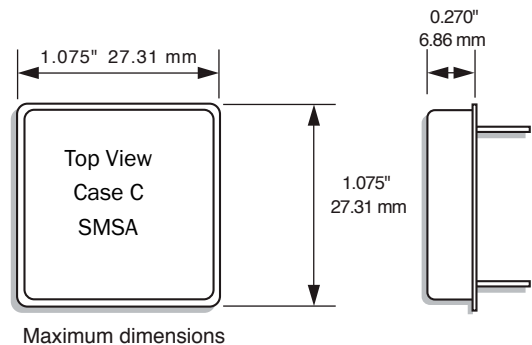
SMSA SERIES™ CONVERTERS—5 WATT

- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) P = 30 krad(Si), L = 50 krad(Si), R = 100 krad(Si)
 - 50 - 300 rad(Si)/sec dose rate (Condition A)
 - 10 mrad(Si)/sec dose rate (Condition D)
- Operating temperature -55 °C to +125 °C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 40 volts
- Transient protection 50 volts for 50 ms
- Fully isolated, Inhibit function
- High power density, up to 74% typical efficiency

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|------------|-----------|---------------------|--------------------|----------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SMSA283R3S | 16 to 40 | 3.3 | 1.20 | 4 | 65 |
| SMSA2805S | 16 to 40 | 5 | 1.00 | 5 | 74 |
| SMSA285R2S | 16 to 40 | 5.2 | 0.962 | 5 | 74 |
| SMSA2812S | 16 to 40 | 12 | 0.417 | 5 | 74 |
| SMSA2815S | 16 to 40 | 15 | 0.333 | 5 | 74 |
| SMSA2805D | 16 to 40 | ±5 | 1.00 ¹ | 5 ¹ | 70 |
| SMSA2812D | 16 to 40 | ±12 | 0.417 ¹ | 5 ¹ | 73 |
| SMSA2815D | 16 to 40 | ±15 | 0.333 ¹ | 5 ¹ | 73 |

1. Up to 80% of the total current/power is available from either dual output, providing the opposite output is carrying at least 20% of the power in use. The specification shown is the maximum total current/power.

The SMSA Series™ provides excellent dynamic response and noise rejection. SMSA converters inhibit feature can disable internal switching resulting in low standby current and no generation of switching noise. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening, with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables on page 13 and page 13.



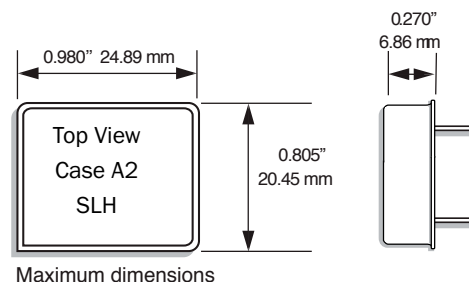
SLH SERIES™ CONVERTERS—1.5 WATT

- Radiation hardened space DC-DC converter
 - Single event effects (SEE) LET performance to 86 MeV cm²/mg
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) L = 50 krad(Si), R = 100 krad(Si)
- Operating temperature -55 °C to +125 °C
- Qualified to MIL-PRF-38534 Class H and K
- Input voltage range 16 to 40 V
- Transient protection 50 V for 50 ms
- Fully isolated magnetic feedback
- Inhibit function

| MODEL | INPUT (V) | OUTPUT AT FULL LOAD | | | |
|----------|-----------|---------------------|--------------------|------------------|--------------|
| | | OUTPUT (V) | CURRENT (A) | POWER MAX. (W) | EFF (% typ.) |
| SLH2805S | 16 to 40 | 5 | 0.300 | 1.5 | 79 |
| SLH2812S | 16 to 40 | 12 | 0.125 | 1.5 | 87 |
| SLH2815S | 16 to 40 | 15 | 0.100 | 1.5 | 88 |
| SLH2805D | 16 to 40 | ±5 | 0.300 ¹ | 1.5 ¹ | 75 |
| SLH2812D | 16 to 40 | ±12 | 0.125 ¹ | 1.5 ¹ | 87 |
| SLH2815D | 16 to 40 | ±15 | 0.100 ¹ | 1.5 ¹ | 87 |

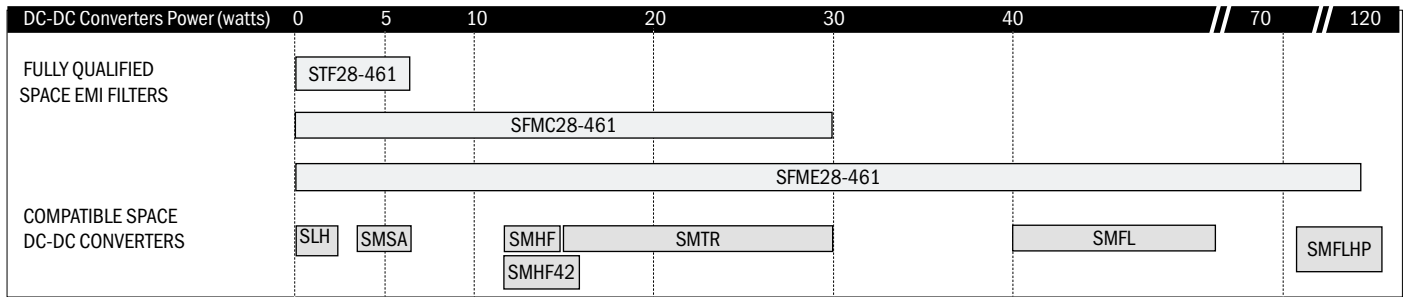
1. Up to 80% of the total current/power is available from either dual output, providing the opposite output is carrying at least 20% of the power in use. The specification shown is the maximum total current/power.

At just 0.79 square inches, the SLH Series™ of 28 V DC-DC converters delivers 1.5 watts of power while saving significant board area. Connecting the load between positive and negative outputs on the dual models, leaving the common unconnected, results in double the output voltage. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening with a Radiation Hardness Assurance (RHA) level available up to "R" per MIL-PRF-38534. See Screening Tables 1, 2 and 3.



Interpoint Space Qualified EMI Filters

EMI FILTER GUIDE



All filters may be used with multiple converters up to the rated current of the filter.

| Model | Input Voltage (V) | Current (Max. A) | Minimum Attenuation (dB) @ 500 kHz | Screening | Compatible Converter |
|------------|-------------------|------------------|------------------------------------|--|-------------------------------------|
| SFME28-461 | 0 - 50 | 10.0 | 60 | Prototype (O) non-QML, Class H-QML or K-QML Tables 5 and 6 | SMFLHP, SMFL, SMTR, SMHF, SMSA, SLH |
| SFMC28-461 | 0 - 50 | 2.7 | 55 | Prototype (O) non-QML, Class H-QML or K-QML Tables 5 and 6 | SMTR, SMHF, SMSA, SLH |
| STF28-461 | 0 - 50 | 0.8 | 50 | Prototype (O) non-QML, Class H-QML or K-QML Tables 5 and 6 | SMSA, SLH |

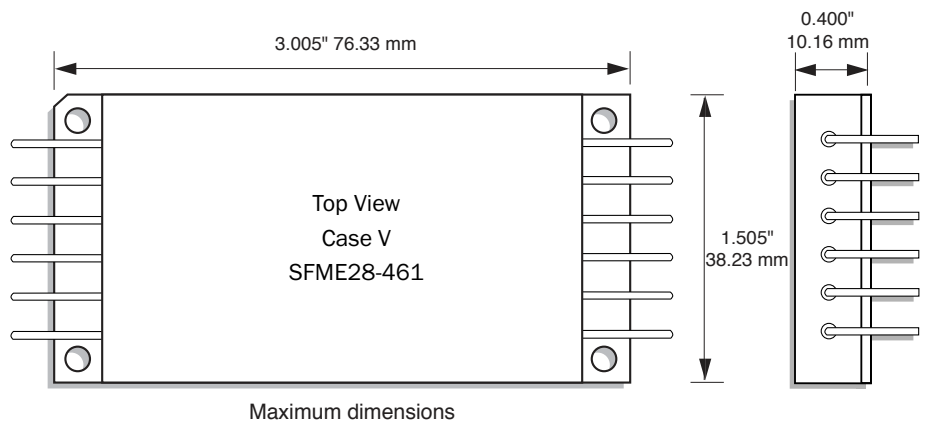
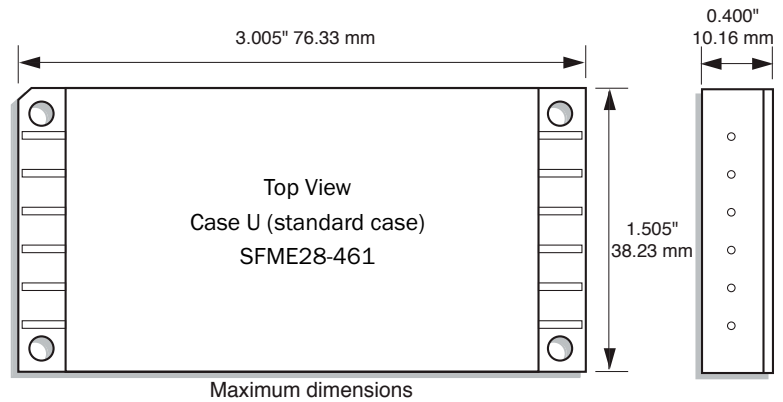
Interpoint Space Qualified EMI Filters

SFME28-461™ EMI FILTER—10 AMPS

- Radiation hardened space EMI filter
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) H, 1000 krad(Si)
 - Passive components used for maximum tolerance in space environments
- Attenuation 70 dB at 500 kHz and 1 MHz, typical
- Operating temperature -55° to +125°C
- Qualified to MIL-PRF-38534 Class H and
- Nominal 28 V input, 0 V to 50 V operation
- Up to 10 A throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 A-E 28 volt power bus

The SFME28-461™ EMI filter modules are designed to reduce the reflected input ripple current of high frequency DC-DC converters. These filters are intended for use in 28 volt applications which require MIL-STD-461 levels of conducted emissions. One filter can be used with multiple converters up to the rated throughput current of the filter. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening. See Screening Tables 4 and 5.

| MODEL | INPUT (V) | MAXIMUM CURRENT (A) | MINIMUM ATTENUATION | COMPATIBLE CONVERTERS |
|------------|-----------|---------------------|---------------------------|-----------------------|
| SFME28-461 | 0 to 50 | 10 | 60 dB @ 500 kHz and 1 MHz | SMFLHP, SMFL, SMTR |

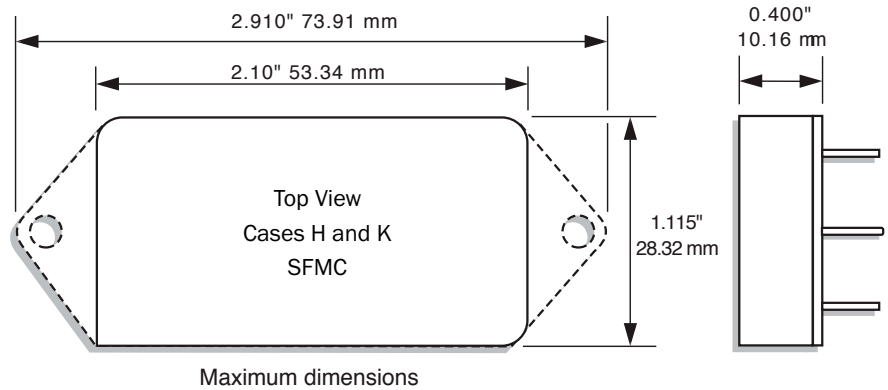


Interpoint Space Qualified EMI Filters

SFMC28-461™ EMI FILTER—2.7 AMPS

- Radiation hardened space EMI filter
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) H, 1000 krad(Si)
 - Passive components used for maximum tolerance in space environments
- Attenuation 55 dB minimum at 500 kHz
- Operating temperature -55° to +125° C
- Qualified to MIL-PRF-38534 Class H and K
- Nominal 28 V input, 0 V to 50 V operation
- Up to 2.7 A throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 B-E 28 volt power bus

| MODEL | INPUT (V) | MAXIMUM CURRENT (A) | MINIMUM ATTENUATION | COMPATIBLE CONVERTERS |
|------------|-----------|---------------------|--|-----------------------|
| SFMC28-461 | 0 to 50 | 2.7 | 55 dB @ 500 kHz 60 dB @ 1 and 5 MHz | SMTR, SMHF, SMSA, SLH |

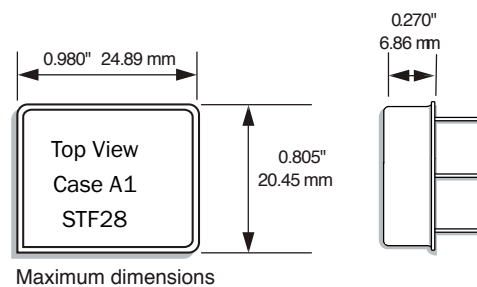


All SFMC28-461™ filters designated level O, indicating standard environmental screening, are electrically comparable to filters designated level K, the highest environmental screening level. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening. See Screening Tables 4 and 5.

STF28-461™ EMI FILTER—0.8 AMPS

- Radiation hardened space EMI filter
 - Total ionizing dose (TID) guaranteed per MIL-STD-883 method 1019, radiation hardness assurance (RHA) H, 1000 krad(Si)
 - Passive components used for maximum tolerance in space environments
- Attenuation 50 dB minimum at 500 kHz
- Small size, 0.79 in² (5.1 cm²)
- Operating temperature -55° to +125° C
- Qualified to MIL-PRF-38534 Class H and K
- Nominal 28 V input, 0 V to 50 V operation
- Up to 0.8 A throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with MIL-STD-704 A-E 28 volt power bus

| MODEL | INPUT (V) | MAXIMUM CURRENT (A) | MINIMUM ATTENUATION | COMPATIBLE CONVERTERS |
|-----------|-----------|---------------------|------------------------------|-----------------------|
| STF28-461 | 0 to 50 | 0.8 | 50 dB @ 500 kHz and 1 MHz | SMSA, SLH |

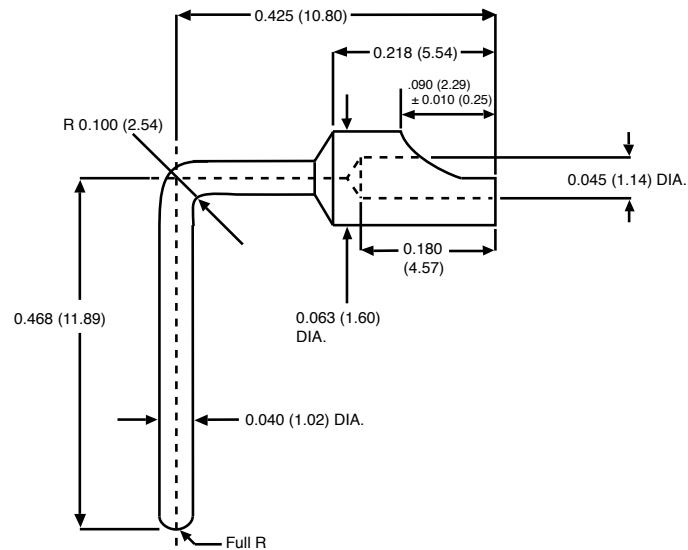


The STF28-461™ EMI filter module has been designed for use with the SMSA flyback power converters. Multiple SMSA power converters can be operated from a single filter provided the total power line current does not exceed the filter maximum rating. The STF filter will reduce the SMSA's power line reflected ripple current to the limits of MIL-STD-461C CE-03. Available with Space Prototype (non-QML), Class H-QML and Class K-QML Quality Assurance screening. See Screening Tables 4 and 5.

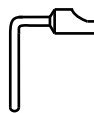
PIN TERMINAL ADAPTOR

- Adapts Interpoint flanged, side-leaded cases to uplead or downlead configurations
- Compatible with many families of Interpoint products for use in high reliability applications
- Low resistance
- Copper alloy with solder plating over nickel

Our side-leaded packages can be adapted with PIN terminal adapters to fit a variety of configurations. These versatile adapters slide over the ends of side-leaded package terminals and are intended to be soldered to the leads to provide an up-lead or down-lead configuration.



Drawing enlarged to show detail



Actual size

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

ELEMENT EVALUATION SPACE DC-DC CONVERTERS

PROTOTYPE, CLASS H, E AND K

| COMPONENT-LEVEL TEST PERFORMED | NON-QML ¹ | QML | | | | | |
|---|----------------------|------------------|----------------|------------------|----------------|------------------|----------------|
| | PROTOTYPE | CLASS H | | CLASS E | | CLASS K | |
| | /O | /H | | /E ² | | /K | |
| | M/S ³ | M/S ³ | P ⁴ | M/S ³ | P ⁴ | M/S ³ | P ⁴ |
| Element Electrical | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Visual | | ■ | ■ | ■ | ■ | ■ | ■ |
| Internal Visual | | ■ | | ■ | | ■ | |
| Temperature Cycling | | | | ■ | ■ | ■ | ■ |
| Constant Acceleration | | | | ■ | ■ | ■ | ■ |
| Interim Electrical | | | | ■ | | ■ | |
| Burn-in | | | | ■ | | ■ | |
| Post Burn-in Electrical | | | | ■ | | ■ | |
| Steady State Life | | | | ■ | | ■ | |
| Voltage Conditioning Aging | | | | | ■ | | ■ |
| Visual Inspection | | | | | ■ | | ■ |
| Final Electrical | | ■ | ■ | ■ | ■ | ■ | ■ |
| Wire Bond Evaluation | | ■ | ■ | ■ | ■ | ■ | ■ |
| SEM | | | | ■ | | ■ | |
| C-SAM: Input capacitors only ⁵ | | | ■ | | ■ | | ■ |

Notes

1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. Class E is based on Class K requirements of MIL-PRF-38534 with the exception that Constant Acceleration is limited to 3000 g maximum including qualification testing.
3. M/S = Active components (microcircuit and semiconductor die)
4. P = Passive components, Class H, E and K element evaluation. Not applicable to space prototype ("O") element evaluation.
5. Additional test not required by H, E or K.

Definitions

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

SEM: scanning electron microscopy

C-SAM: C – Mode Scanning Acoustic Microscopy

TABLE 1: ELEMENT EVALUATION—DC-DC CONVERTERS PROTOTYPE, CLASS H, E AND K

Interpoint Product Quality Assurance Screening

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

ENVIRONMENTAL SCREENING SPACE DC-DC CONVERTERS PROTOTYPE, CLASS H, E AND K, RHA P, L AND R

| TEST PERFORMED | NON-QML ¹ | QML ^{2, 3} | | | | | | | | |
|---|----------------------|---------------------|----------------|----------------|----------------------|----------------|----------------|----------------|----------------|----------------|
| | PROTOTYPE | CLASS H | | | CLASS E ⁴ | | | CLASS K | | |
| | /OO ⁵ | /HP | /HL | /HR | /EKP | /EKL | /EKR | /KP | /KL | /KR |
| Non-destruct wire bond pull, Method 2023 | | ■ ⁶ | ■ ⁶ | ■ 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 | | ■ ⁶ | ■ ⁶ | ■ ⁶ | ■ | ■ | ■ | ■ | ■ | ■ |
| Pre burn-in test, Group A, Subgroups 1 and 4 | ■ | ■ ⁶ | ■ ⁶ | ■ ⁶ | ■ | ■ | ■ | ■ | ■ | ■ |
| Burn-in Method 1015, +125°C case, typical ⁷ | | | | | | | | | | |
| 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 | | | | | ■ ⁶ | ■ ⁶ | ■ ⁶ | ■ ⁶ | ■ ⁶ | ■ ⁶ |
| Final visual inspection, Method 2009 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

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

Notes

1. Non-QML prototype products may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. Class H or K QML products that have no SMD number are marked "CHP, CHL, CHR, CKP, CKL or CKR" per MIL-STD-38534, Table III instead of "QML".
4. Class E is based on Class K requirements of MIL-PRF-38534 with the exception that Constant Acceleration is limited to 3000 g maximum including qualification testing.

5. "O" in the RHA designator position in Interpoint model numbers indicates DLA RHA "-" defined as no RHA.

6. Not required by DLA but performed to assure product quality.

7. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 2: ENVIRONMENTAL SCREENING DC-DC CONVERTERS PROTOTYPE, CLASS H, E AND CLASS K

SPACE RADIATION HARDNESS ASSURANCE SCREENING

DC-DC CONVERTERS CLASS H, E AND K, RHA ¹ P, L AND R

| QUALIFICATION PER MIL-STD | NON-QML ² | QML ³ | | | | | | | | |
|--|----------------------|------------------|-----|-----|----------------------|------|------|---------|-----|-----|
| | PROTOTYPE | CLASS H | | | CLASS E ⁴ | | | CLASS K | | |
| | /OO ⁵ | /HP | /HL | /HR | /EKP | /EKL | /EKR | /KP | /KL | /KR |
| RHA P: 30 krad(Si) total dose ^{1, 6, 7} | | ■ | | | ■ | | | ■ | | |
| RHA L: 50 krad(Si) total dose ^{1, 6, 7} | | | ■ | | | ■ | | | ■ | |
| RHA R: 100 krad(Si) total dose ^{1, 6, 7} | | | | ■ | | | ■ | | | ■ |
| SEE, LET 86 MeV cm²/mg ^{1, 8} | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

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 "P", "L" or "R" code meet DLA requirements.
- Non-QML prototype products may not meet all of the requirements of MIL-PRF-38534.
- Class H or K QML products that have no SMD number are marked "CHP, CHL, CHR, CKP, CKL or CKR" per MIL-STD-38534, Table III instead of "QML".
- Class E is based on Class K requirements of MIL-PRF-38534 with the exception that Constant Acceleration is limited to 3000 g maximum including qualification testing.
- "O" in the RHA designator position in Interpoint model numbers indicates DLA RHA "-" defined as no RHA.
- Radiation sensitive components internal to the devices are procured with radiation guarantees or undergo radiation lot acceptance testing (RLAT) performed per condition A, method 1019 of MIL-STD-883.
- Representative devices were initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD 883 to ensure RHA designator levels. Representative devices have also been Low Dose Rate (LDR) tested using condition D of method 1019 of MIL-STD-883 to the RHA designator levels. Representative devices will also be re-tested after design or process changes that can affect RHA response of this device.
- Single event testing was performed on a converter to 86 MeV-cm²/mg using 15 MeV/ nucleon gold ions with no latch-up, burn-out, functional interrupts, or gate ruptures exhibited. Single event upsets (output voltage transients) may be present up to 86 MeV-cm²/mg.

Table 3: Space Radiation Hardness Assurance DC-DC Converters Class H, E, and K with RHA P, L and R

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

ELEMENT EVALUATION SPACE EMI FILTERS PROTOTYPE, CLASS H AND K

| COMPONENT-LEVEL TEST PERFORMED | NON-QML ¹ | QML | |
|--------------------------------|----------------------|----------------|----------------|
| | PROTOTYPE | CLASS H | CLASS K |
| | /O | /H | /K |
| | | P ² | P ² |
| 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 4: ELEMENT EVALUATION SPACE EMI FILTERS PROTOTYPE, CLASS H AND K

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

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 | ■ | ■ | ■ |
| Radiation tolerance ^{1, 9} | | | |
| 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-STD-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.
- 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 5: ENVIRONMENTAL SCREENING SPACE EMI FILTERS PROTOTYPE, CLASS H AND K, RHA H

Locations

Lynnwood Operations

Interpoint® products

All Class K products are built in Lynnwood

Lynnwood, Washington, USA

Facility: 81,000 square feet

Founded: 1969

Quality Certifications

- Defense Logistics Agency's (DLA)
MIL-PRF-38534 Qualified Manufacturers List (QML)
- NASA's Preferred Parts List (PPL)
- Products qualified to Class H or Class K, QML
- ISO 9001:2015/AS9100D
- ISO 13485:2016

Crane was one of the first manufacturers to achieve certification to Class K, QML, per MIL-PRF-38534 and to qualify a Class K, QML, hybrid DC-DC converter to a Standard Microcircuit Drawing. This followed in the tradition of being one of the first manufacturers to certify to Class H per MIL-STD-1772. The tradition continues at our Lynnwood location.

Our DC-DC converters and EMI filters are well known for their reliable performance in military/aerospace applications and in the far reaches of space.



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Lynnwood, Washington 98037
Tel: +1 425-882-3100
Email: power@craneae.com
URL: www.craneae.com/interpoint

Kaohsiung Operations

Kaohsiung, Taiwan

Facility: 35,000 square feet (built in 2017)

Founded: 1983

Quality Certifications

- Defense Logistics Agency's (DLA, formerly DSCC)
MIL-PRF-38534 Qualified Manufacturers List (QML)
- Products qualified to Class H-QML
- ISO 9001:2015/AS9100D



Kaohsiung, Taiwan

Quality Systems Overview–Lynnwood and Kaohsiung

- The quality management system of Crane Electronics, Inc., Lynnwood and Crane Electronics Corporation, Kaohsiung have been certified to ISO 9001:2015 and AS9100D on certificates 1655 and 1657 by the International Standards Authority, Inc. (www.isaregistrar.com).
- Our Lynnwood and Kaohsiung facilities are on the Defense Logistics Agency's (DLA) Qualified Manufacturers List (QML) of hybrid microcircuits with products compliant up to Class H (Lynnwood and Kaohsiung) and Class K (Lynnwood) of MIL-PRF-38534. Our manufacturing facilities are audited by a US government organization with customer participation.
- Standard Microcircuit Drawings (SMD) of our DC-DC converters are available to Class H and K of MIL-PRF-38534. DLA Drawing EMI filters are available to Class H and K of MIL-PRF-38534. The government documents may be viewed at <https://landandmaritimeapps.dla.mil/programs/smcr/>.
- Components and materials used in product assembly are purchased against published revision controlled source control drawings (SCD). Characteristics and allowed suppliers are controlled by specific SCDs. A system is in place to review components and materials prior to stocking. Instruments such as the X-ray fluorescence (XRF) are used to ensure that supplier certifications accurately describe the material. Our high reliability QML products comply with MIL-PRF-38534 specifications, which do not allow the use of pure tin. Our other products may have pure tin. Refer to our "Lead and Other RoHS Materials" letter for more information.
- Components and materials used in product assembly are purchased against published revision controlled source control drawings (SCD).
- Documented revision controlled procedures and work instructions are in use for all operations that affect quality.
- Radiation hardness assurance (RHA) levels available referenced to MIL-PRF-38534. Our Lynnwood facility has a DLA approved RHA plan for Interpoint power products. Our SMD products with RHA "P," "L," "R" and "H" level meet DLA RHA requirements.
- Travelers are used to sequence and control operations at in-process, final and special inspection situations.
- Quality documents are specifically identified and retained as specified in our document control procedure. The standard retention period for critical documents is 15 years.
- Quality manual QA-040 (www.interpoint.com/012) is the controlling document for the quality system.
- Personnel performing quality functions are given the responsibility, authority and organizational freedom to identify and evaluate quality concerns as well as to initiate corrective action.
- Contracts are reviewed to identify and make timely provisions for special or unusual circumstances.
- As a minimum, self audits of the quality system are completed annually.

Interpoint Product Quality Systems and Certifications

Certifications, Qualifications and Standards-Lynnwood and Kaohsiung

- ANSI/ESD S20.20—Electrostatic Discharge Control Program. We use a multi-level ESD damage prevention approach including operator training, continuously monitoring wrist grounding-straps, static dissipative smocks for personnel, static dissipative work surfaces and floors, air ionizers at work stations and faraday cages for parts movement.
- ANSI/IPC-A-600—Acceptability of Printed Boards
- ANSI/IPC-A-610—Acceptability of Electronic Assemblies. The Lynnwood facility has IPC-610 certified operators.
- ANSI-Z540—Calibration Laboratories and Measuring and Test Equipment—General Requirements
- ASQC-Z1.4—Procedures, Sampling and Tables for Inspection by Attributes
- ISO 9001:2008/AS9100C—Quality Systems. Model for quality assurance in design, development, production, installation, and servicing. Lynnwood and Kaohsiung facilities are registered with QMI-SAI Global for ISO 9001:2008/AS9100C.
- ISO 14644—Cleanrooms and Controlled Environments. Particle count monitoring, laminar flow benches and contamination preventing smocks for personnel all contribute to maintaining the required levels of cleanliness.
- MIL-STD-883—Test Method Standard for Microcircuits
- MIL-PRF-38534—Hybrid Microcircuits, General Specifications for
- Quality Certification—Employees who work with products are individually certified in the required skills. Training and certification are documented and records are maintained. Inspectors are tested for color vision and visual acuity.
- QML-38534—Qualified Manufacturer's List of Products Qualified under Performance Specification MIL-PRF-38534 Hybrid Microcircuits, General Requirements for
- Restriction of Hazardous Substances (RoHS), Waste Electrical and Electronic Equipment (WEEE) and Registration, Evaluation, and Authorization of Chemicals (REACH) are addressed in "Lead and Other RoHS Materials".



Radiation Tolerance: Radiation Hardness Assurance (RHA)

Radiation hardness assurance (RHA) refers to the levels specified in MIL-PRF-38534, Appendix G and indicates the levels of radiation products or components will withstand. Our Lynnwood facility has a DLA approved RHA plan.

Our model numbers use an "O" in the RHA designator position to indicate the "-" (dash) RHA level of MIL-PRF-38534, which is defined as "no RHA."

The RHA levels offered are:

| RHA LEVEL | TOTAL IONIZING DOSE (TID) rad(Si) |
|-----------|--------------------------------------|
| O | (NA) |
| P | 30 k |
| L | 50 k |
| R | 100 k |
| H | 1,000 k (EMI filters only) |

Some of the major programs which use our products:

GEO/LEO Satellites

Amazonas
Aquarius
CloudSat
Direct TV
EchoStar
Environmental Mapping and Analysis Program – EnMAP
eRosita – extended ROentgen Survey with an Imaging Telescope Array
FormoSat
Galileo GPS (ESA)
Geostationary Lightening Mapper – GLM
Geostationary Operational Environmental Satellites – GOES
Global Change Observation Mission – GCOM
Global Navigation Satellite System – GLONASS
Gonets
Gravity Recovery and Interior Lab – GRAIL
Hubble Space Telescope
Ice Cloud and Land Elevation Satellite – ICESat

India Remote Sensing Satellite – IRS
Intelsat
International Gamma Ray and Astrophysics Lab – INTEGRAL
International Space Station – ISS
Joint Polar Satellite System – JPSS
Kepler
Landsat
Malaysia East Asia Satellite – MEASAT
NASA Polar
Nimiq
Optus
Proba
QuetzSat
Stratospheric Aerosol and Gas Experiment III-ISS – SAGE
SES
Soil Moisture Active Passive – SMAP
Spectr-Roentgen-Gamma – SRG
Telstar
TerreStar
Thor
ViaSat
Wind Mission

Crew Equipment and Vehicles

Advanced Neutron Spectrometer
Orion Multi-Purpose Crew Vehicle
MPCV

Land Observatory

Chandra X-Ray Observatory

Launch Vehicles and Support

Ariane
Cyclone 4
Epsilon
Spacelift Range System – SLRS

Mars

ExoMars Trace Gas Orbiter – TGO
InSight Mars Lander
Mars Exploration Rovers – MER
Mars Reconnaissance Orbiter – MRO
Mars Science Lab – MSL, Curiosity

Solar System

Cassini-Huygens – Saturn
Dawn – Solar System
Luna Glob – Moon
Solar Orbiter

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