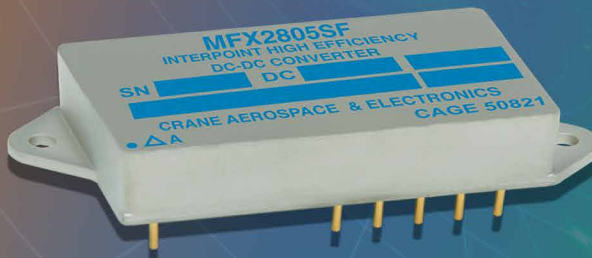
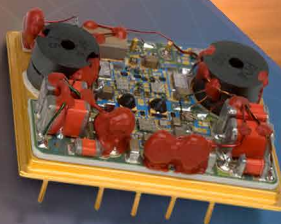


Power Solutions

Interpoint® DC-DC Converters
and EMI Filters

High Reliability Catalog



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



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Crane Aerospace & Electronics
Power Solutions - Interpoint Products
High Reliability Catalog Rev AC - 2020.01.29
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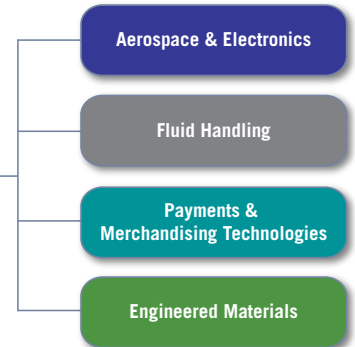
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Company Information

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.



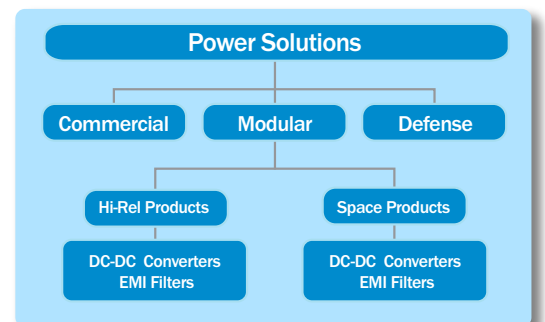
Crane Aerospace & Electronics

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.cranee.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.



Modular Power – High Reliability DC-DC Converters and EMI Filters

The Modular Power segment includes Interpoint DC-DC converter and EMI filter modules that have proven performance in extreme environments where high reliability is required and failure is not an option. These modules 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.

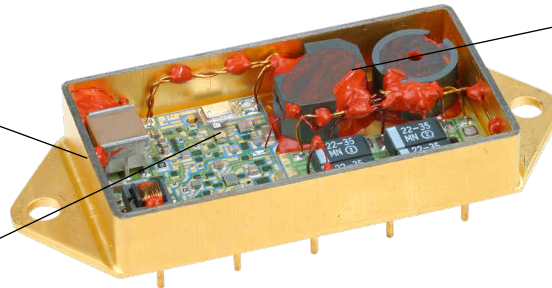
To meet demanding time and cost targets, choose a product from the standard converters and filters. We offer over 1,000 off-the-shelf high-reliability DC-DC power conversion products. For more information please visit www.cranee.com/interpoint.

Interpoint® DC-DC Converter and EMI Filter Overview

Interpoint Product Overview

High Temperature Operation
High temperature ceramic capacitors and all-metal thermally-conductive cases provide full power over the operating range of -55 to +125 °C (most products).

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
For highest reliability, a full range of our products are available as /883 products (Class H, QML). 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 aerospace, military/defense, space and industrial applications where size, weight and reliability are critical to program success. Our high reliability products are classified as EAR99, no license required for export. Our EAR99 products have been used in commercial satellites.

Modular Power Conversion

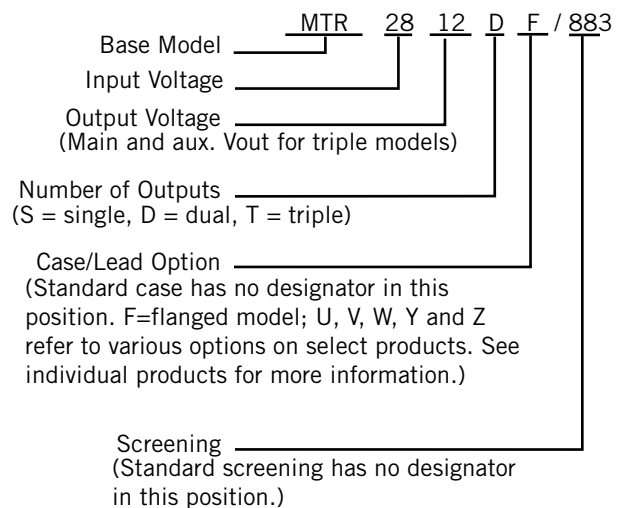
Choose from over 1,000 power conversion products. We were one of the first companies to qualify to MIL-STD-1772 (1987), which was DLA's microcircuit standard in 1987. Our first standard microcircuit drawing (SMD) for a Class H hybrid was issued in 1992, and our first Class K hybrid SMD was issued in 1997. In 1997, we were one of the first companies to certify manufacturing to Class K.

Technical Support

Applications Engineers are available to provide technical support by phone or email. Call +1 425-882-3100 or 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.

Part Numbering

Our part numbering indicates the series (family), input voltage, output voltage, number of outputs, package configuration and screening code.



Interpoint® High Reliability DC-DC Converters

Model (Series)	Input Voltage (V)	Output Voltage (V)	Output Power (W)	Efficiency (% typical)	Operating Temperature	Screening	EMI Filter ¹
MOR	16 to 40	3.3, 5, 6.3, 9.5, 12, 15 ±3.3, ±5, ±6.3 ±9.5, ±12, ±15	66 to 120	77 to 87	-55°C to +125°C	Standard, ES, or 883 (Class H-QML), Table 1 and Table 2	FMCE-1528
MHP270	160 to 400	5, 12, 15, 28 ±5, ±12, ±15	50 to 65	74 to 82	-55°C to +100°C	Standard or ES	FME270
MFL	16 to 40	3.3, 5, 12, 15, 28 ±5, ±12, ±15	40 to 65	76 to 87	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0828
MFX	16 to 50	3.3, 5, 9, 12, 15	50	89 to 91	-55°C to +125°C	Standard, ES, or screened to Class H	FMCE-0528
MWR	14 to 50	+3.3 & ±12, +3.3 & ±15 +5 & ±12, +5 & ±15	30 to 35	81 to 85	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0528
FMTR	17 to 40	3.3, 5, 12, 15 ±5, ±12, ±15	20 to 30	75 to 83	-55°C to +125°C	Product is on page 6. Standard or ES, Table 3	Built-in filter
MTR (50)	16 to 50	3.3, 5, 8.5, 12, 15 ±5, ±12, ±15	20 to 30	74 to 81	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0528
MTR (40)	16 to 40	3.3, 5, 12, 15, 18 ±5, ±12, ±15	20 to 30	76 to 84	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0528
		+5 & ±12, +5 & ±15		75			
MFK	16 to 50	1.8, 2.5, 3.3, 5, 5.2, 5.7, 12, 15, 28 ±5, ±7, ±12, ±15	10 to 25	72 to 86	-55°C to +125°C	Standard, ES, or 883 (Class H Screening) Table 1 and Table 2	FMCE-0528
MFP (POL)	3.0 to 6.0	0.8, 1.6, 2.5, 3.3 Continuous 0.8 to 3.5	5.6 to 16.5	73 to 92	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	Not Recommended
MHV	16 to 50	3.3, 5, 12, 15 ±5, ±12, ±15	10 to 15	72 to 83	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0528
		+5 & ±12, +5 & ±15	15	78			
MHF+	16 to 40	1.9, 3.3, 5, 5.2, 5.3, 12, 15, 28 ±5, ±12, ±15	6.65 to 15	62 to 84	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0328
	16 to 48	+5 & ±12 +5 & ±15	15	76			
NEW! MSA+	15 to 50	3.3, 5, 6.3, 12, 15 ±5, ±6.3, ±12, ±15	6	76	-55°C to +125°C	Standard, ES, or screened to Class H	FMCE-0328, FMCE-0528 or FMSA
MSA	16 to 40	5, 5.2, 12, 15 ±5, ±12, ±15	5	71 to 76	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0328 or FMSA
MGA	16 to 40	5, 12, 15 ±5, ±12, ±15	5	71 to 76	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0328 or FMGA
MCH	12 to 50	5, 12, 15 ±5, ±12, ±15	1.5	76 to 79	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0328 or FMSA
MGH	12 to 50	5, 12, 15 ±5, ±12, ±15	1.5	76 to 79	-55°C to +125°C	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	FMCE-0328 or FMGA

Note

1. The filters listed are suggested filters. Any of our high reliability filters can be used with our converters up to the filter's rated maximum current.

Interpoint® High Reliability DC-DC Converters

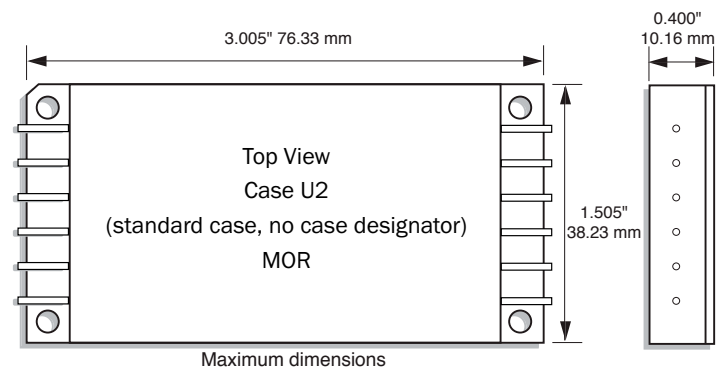
MOR SERIES™ CONVERTER—120 WATT OUR MOST VERSATILE CONVERTER

- Parallel operation with current share, up to 5 units (540 watts)
- Output flexibility, trim of 60% to 110%
- Operating temperature -55° to +125° C
- Input voltage 16 to 40 volts
- Transient protection 50 volts for 120 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense
- Inhibit function
- Sync In and Sync Out
- Indefinite short circuit protection
- High power density with up to 87% typical efficiency

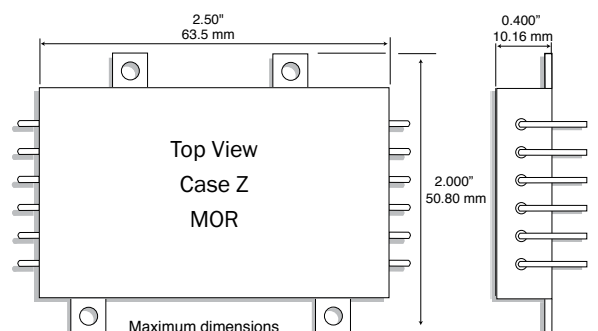
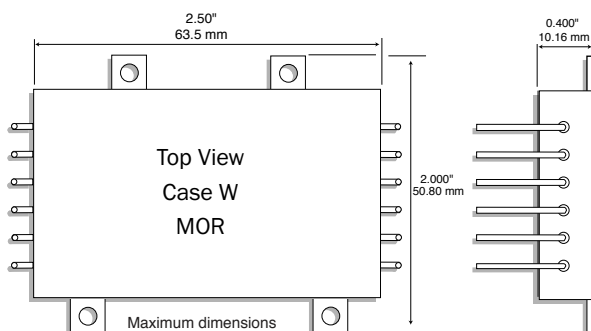
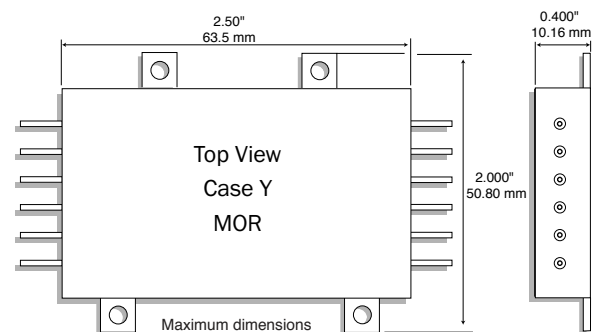
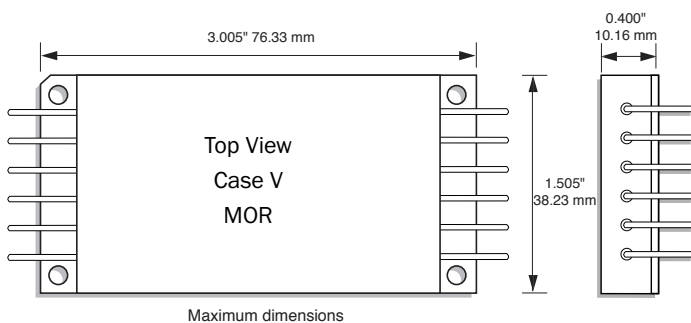
With up to 120 watts of output power, the MOR Series™ of DC-DC converters operates from a standard 28 volt bus with input voltage of 16 to 40 volts. Full operation over -55° to +125° C makes the MOR Series an ideal choice for aerospace, military, space and other high reliability applications. In compliance with MIL-STD-704D, the converters will withstand transients of up to 50 volts for up to 120 milliseconds. Use our FMCE-1528 EMI filter to pass MIL-STD-461C, CE03 requirements. See Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MOR283R3S	16 to 40	3.3	20.00	66	78
MOR2805S	16 to 40	5	20.00	100	81
MOR286R3S	16 to 40	6.3	16.00	100	83
MOR289R5S	16 to 40	9.5	11.00	105	84
MOR2812S	16 to 40	12	9.20	110	86
MOR2815S	16 to 40	15	8.00	120	87
MOR283R3D	16 to 40	±3.3	20.00 ¹	66 ¹	77
MOR2805D	16 to 40	±5	20.00 ¹	100 ¹	81
MOR286R3D	16 to 40	±6.3	16.00 ¹	100 ¹	83
MOR289R5D	16 to 40	±9.5	11.05 ¹	105 ¹	84
MOR2812D	16 to 40	±12	9.16 ¹	110 ¹	86
MOR2815D	16 to 40	±15	8.00 ¹	120 ¹	87

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.



Also available in package configurations V, W, Y and Z (not to scale):



Interpoint® High Reliability DC-DC Converters

MHP270 SERIES™ CONVERTERS—65 WATT

- Parallel operation with current share, up to 5 units (276 watts)
- Operating range -55 ° to +100 °C
- Transient protection 450 volts for 50 ms

The high power density MHP270 Series uses current mode voltage control to allow parallel current sharing for increased power. See Table 3.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% min.)
MHP27005S	160 to 400	5	10.00	50	76
MHP27012S	160 to 400	12	5.00	60	81
MHP27015S	160 to 400	15	4.33	65	80
MHP27028S	160 to 400	28	2.32	65	80
MHP27005D	160 to 400	±5	10.00 ¹	50 ¹	74
MHP27012D	160 to 400	±12	5.00 ¹	60 ¹	81
MHP27015D	160 to 400	±15	4.33 ¹	65 ¹	82

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

MFL SERIES™ CONVERTERS—65 WATT

- Parallel up to 3 units for up to 70% of the maximum available power
- -55 ° to +125 °C operation
- 50 volts for 120 ms transient protection
- Fully isolated, magnetic feedback
- Remote sense or output trim on single output models

The MFL Series converters offer up to 65 watts output power in a sealed metal case. Standard features include undervoltage lockout, remote sense and sync. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Screening Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MFL283R3S	16 to 40	3.3	12.12	40	76
MFL2805S	16 to 40	5	10.00	50	80
MFL2812S	16 to 40	12	5.00	60	86
MFL2815S	16 to 40	15	4.33	65	87
MFL2828S	16 to 40	28	2.32	65	86
MFL2805D	16 to 40	±5	10.00 ¹	50 ¹	80
MFL2812D	16 to 40	±12	5.00 ¹	60 ¹	86
MFL2815D	16 to 40	±15	4.33 ¹	65 ¹	87

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.

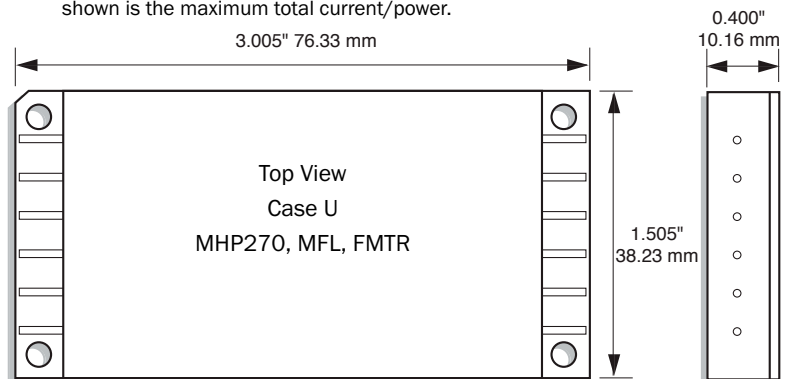
FMTR SERIES™ CONVERTERS—30 WATT

- EMI input filter, up to 50 dB attenuation
- High frequency output filter
- -55 ° to +125 °C operation
- 17 to 40 volts input
- Up to 50 volts for 50 ms transient protection
- Fully isolated, magnetic feedback
- Trim and remote sense on singles
- Inhibit and synchronization functions

The FMTR Series™ of DC-DC converters has a 2.7 amp EMI input filter that meets MIL-STD-461C, CE03 and allows filtering of additional converters through the filter output pins up to the current limit of the filter. Their hermetically sealed metal cases, making them ideal for use in aerospace, military and other high reliability applications. Available with Standard or ES environmental screening. See Table 3.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
FMTR283R3S	17 to 40	3.3	6.06	20	75
FMTR2805S	17 to 40	5	5.00	25	77
FMTR2812S	17 to 40	12	2.50	30	82
FMTR2815S	17 to 40	15	2.00	30	83
FMTR2805D	17 to 40	±5	5.00 ¹	25 ¹	77
FMTR2812D	17 to 40	±12	2.50 ¹	30 ¹	80
FMTR2815D	17 to 40	±15	2.00 ¹	30 ¹	82

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



Maximum dimensions

Interpoint® High Reliability DC-DC Converters

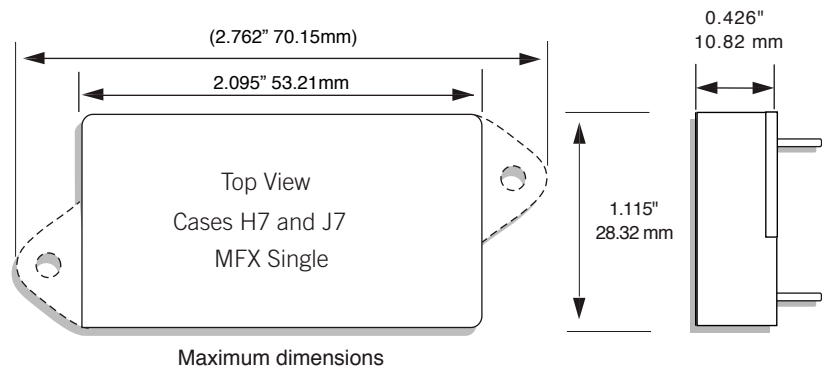
MFX SERIES™ CONVERTERS—50 WATT

SINGLE

- Up to 90% typical efficiency
- $\pm 10\%$ trimmable outputs
- Input voltage range 16 to 50 volts
- Transient protection up to 80 volts
- Operating temperature -55° to $+125^{\circ}\text{C}$
- Fully isolated, magnetic feedback
- Inhibit function
- Indefinite short circuit and overload protection
- Undervoltage lockout

The high efficiency MFX Series converters are in a hermetically sealed package. Also available in a flanged package. Features for the isolated, regulated units include inhibit, undervoltage lockout and voltage trim. Available with Standard or ES screening or screened to 883, Class H of MIL-PRF-38534. See Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MFX283R3S	16 to 50	3.3	15.15	50	89
MFX2805S	16 to 50	5	10.00	50	91
MFX2809S	16 to 50	9	5.56	50	92
MFX2812S	16 to 50	12	4.17	50	93
MFX2815S	16 to 50	15	3.33	50	93



MWR SERIES™ CONVERTERS—35 WATT

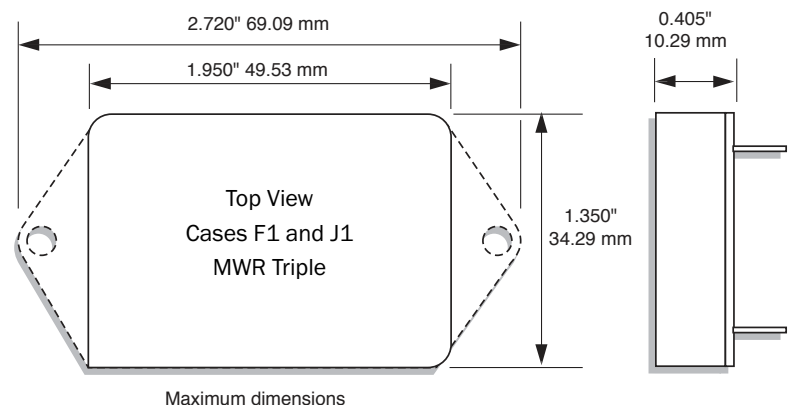
TRIPLE OUTPUT

- Input voltage range 14 to 50 volts
- Transient protection up to 80 volts for one second
- Operating temperature -55° to $+125^{\circ}\text{C}$
- Fully isolated, magnetic feedback
- Inhibit function, synchronization function
- Indefinite short circuit protection
- Undervoltage lockout
- Up to 33 W/in³, up to 85% typical efficiency

The MWR Series of high frequency DC-DC converters offers a wide input voltage range of 14 to 50 volts and up to 35 watts of output power. The units are capable of withstanding short term transients up to 80 volts for one second. The package is a hermetically sealed, welded metal case. Flanged and non-flanged models are available. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). SMD available. See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MWR283R312T	14 to 50	Main +3.3 & Aux. ± 12	3 1.67 ¹	10 20 ¹	81
MWR283R315T	14 to 50	Main +3.3 & Aux. ± 15	3 1.34 ¹	10 20 ¹	82
MWR28512T	14 to 50	Main +5 & Aux. ± 12	3 1.67 ¹	15 20 ¹	84
MWR28515T	14 to 50	Main +5 & Aux. ± 15	3 1.34 ¹	15 20 ¹	85

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



Interpoint® High Reliability DC-DC Converters

MTR (50) SERIES™ CONVERTERS—30 WATT SINGLE OR DUAL

- Input voltage range 16 to 50 volts
- Transient protection up to 80 V per MIL-STD-704A
- Operating temperature -55° to +125° C
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Indefinite short circuit and overload protection
- Up to 84% typical efficiency

The high frequency MTR Series converters are in a hermetically sealed package. Also available in a flanged package. Features for the isolated, regulated units include inhibit, remote sense, voltage trim and synchronization. The cover marking for the MTR 50 has "MTR (50) DC-DC CONVERTER" below the model number. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

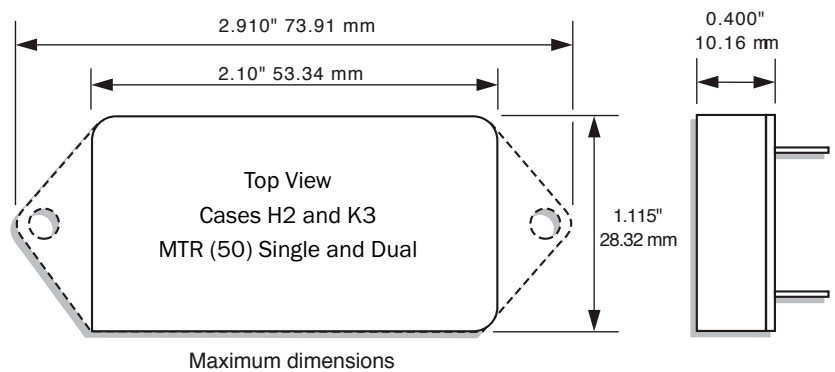
For information on ordering an MTR Series MTR 50, please contact your sale representative.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MTR283R3S	16 to 50	3.3	6.06	20	74
MTR2805S	16 to 50	5	5.00	25	77
MTR288R5S	16 to 50	8.5	2.94	25	81
MTR2812S	16 to 50	12	2.50	30	80
MTR2815S	16 to 50	15	2.00	30	80
MTR2805D	16 to 50	±5	5.00 ¹	25 ¹	79
MTR2812D	16 to 50	±12	2.50 ¹	30 ¹	80
MTR2815D	16 to 50	±15	2.00 ¹	30 ¹	80

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.



COVER MARKING FOR MTR (50) - 50 VIN



Interpoint® High Reliability DC-DC Converters

MTR (40) MTR SERIES™ CONVERTERS—30 WATT SINGLE, DUAL OR TRIPLE

- No cross-regulation error on triple output models
- Operating temperature -55° to +125°C
- Transient protection 50 volts for 50 ms
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Indefinite short circuit and overload protection

The high frequency MTR Series converters are in a hermetically sealed package. Also available in a flanged package. Features for the isolated, regulated units include inhibit, remote sense, voltage trim and synchronization.

Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

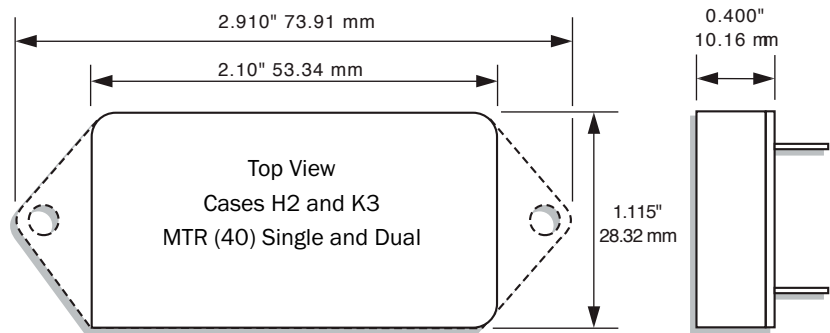
For information on ordering an MTR Series MTR 40, please contact your sale representative.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MTR283R3S	16 to 40	3.3	6.06	20	76
MTR2805S	16 to 40	5	5.00	25	78
MTR2812S	16 to 40	12	2.50	30	83
MTR2815S	16 to 40	15	2.00	30	84
MTR2818S	16 to 40	18	1.67	30	84
MTR2805D	16 to 40	±5	5.00 ¹	25 ¹	78
MTR2812D	16 to 40	±12	2.50 ¹	30 ¹	81
MTR2815D	16 to 40	±15	2.00 ¹	30 ¹	83
MTR28512T	16 to 40	Main +5 & Aux. ±12	4.00 0.830 ²	30 ²	75
MTR28515T	16 to 40	Main +5 & Aux. ±15	4.00 0.666 ²	30 ²	75

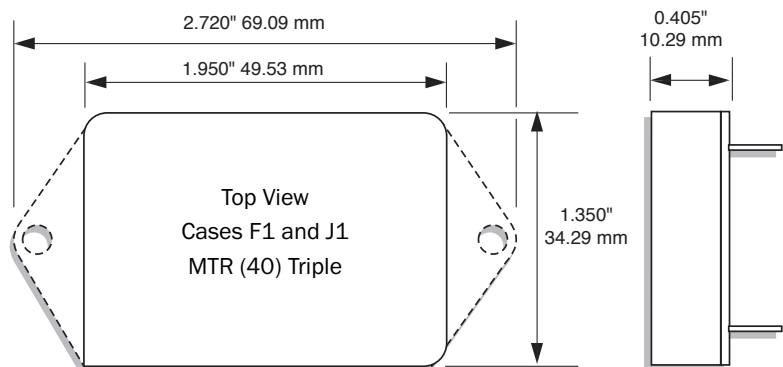
1. Up to 90% of the total current/power is available from either dual output, providing the opposite output is carrying at least 10% of the power in use. The specification shown is the maximum total current/power.
2. Up to 90% of the total auxiliary current/power is available from either auxiliary output, providing the opposite output is carrying at least 10% of the total auxiliary power in use. The specification shown is the maximum total current/power. Total from auxiliaries not to exceed 10 watts.



COVER MARKING FOR MTR - 40 VIN



Maximum dimensions



Maximum dimensions

Interpoint® High Reliability DC-DC Converters

MFK SERIES™ CONVERTERS—25 WATT

- 16 to 50 volt input
- Up to 87% typical efficiency, 42 W/in³
- 80 volt transient protection per MIL-STD-704A
- Undervoltage lockout
- -55 °C to +125 °C operation
- Fully isolated
- Magnetic feedback
- Fixed frequency, 500 kHz typical
- Inhibit and sync function
- Output short circuit protection

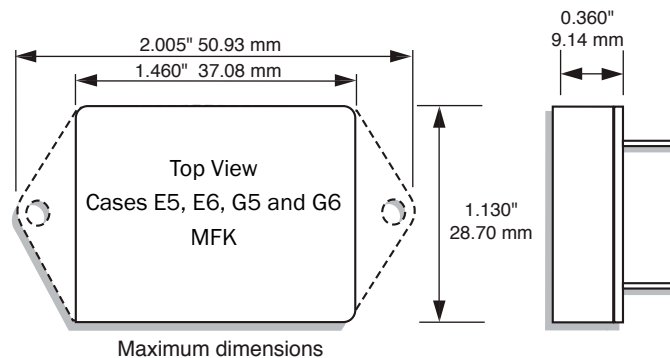
The MFK Series offers a new standard of performance for small size and high power density. At just 0.360 inch high and a total footprint of 1.7 in², this low profile package offers a total power density of up to 42 watts per cubic inch.

The wide input voltage range is further supplemented by an ability to withstand up to a 80 volt transient per MIL-STD-704A. Typical output ripple is as low as 40 mV at 25 °C.

The MFK converters current mode control system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB. Output voltage response for a 50% to 100% step load transient is as low as 4% with a 400 µs recovery time. Input ripple current is typically 35 mA p-p with output ripple voltage 30 mV p-p at 20 MHz bandwidth. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MFK281R8S	16 to 50	1.8	5.56	10	72
MFK282R5S	16 to 50	2.5	5.0	12.5	76
MFK283R3S	16 to 50	3.3	4.55	15	79
MFK2805S	16 to 50	5	4.0	20	82
MFK285R2S	16 to 50	5.2	4.0	20.8	82
MFK285R7S	16 to 50	5.7	4.0	22.8	82
MFK2812S	16 to 50	12	2.08	25	86
MFK2815S	16 to 50	15	1.67	25	87
MFK2828S	16 to 50	28	0.89	25	84
MFK2805D ¹	16 to 50	±5	4.0	20	81
MFK2807D ¹	16 to 50	±7	3.0 ¹	21 ¹	83
MFK2812D ¹	16 to 50	±12	2.08 ¹	25 ¹	85
MFK2815D ¹	16 to 50	±15	1.66 ¹	25 ¹	86

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.



Interpoint® High Reliability DC-DC Converters

MFP SERIES™ POINT OF LOAD CONVERTER

- No external components required
- Up to 92% typical efficiency, flat down to 30% load
- Qualified up to MIL-PRF-38534 Class H
- 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

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.

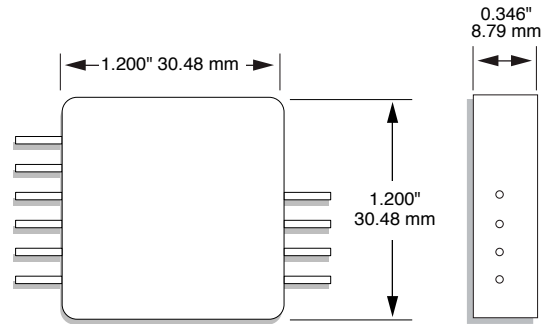
The non-isolated, feature-rich MFP uses a Buck converter design with synchronous rectification. The design allows the unit to operate synchronously to no output load, ensuring high efficiency at the lightest loads without switching off the synchronous devices. Important features include a solid state switch, inrush current limiting, synchronization with an external system clock and the ability to current share allowing multiple devices to supply a common load. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

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.

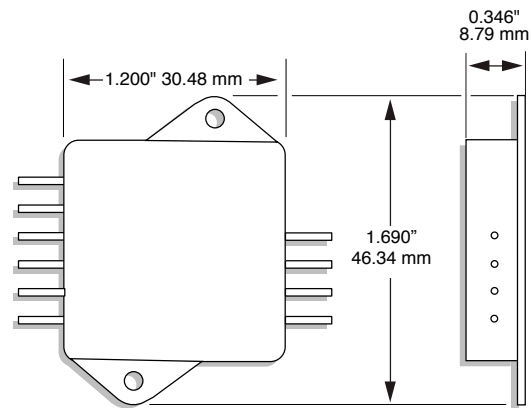
2. Continuously adjustable from 0.8 to 3.5 volts.

3. Efficiency at 25 °C.



Maximum dimensions

Flatness of base: 0.003 inch per inch



Maximum dimensions

Flatness of base: 0.003 inch per inch

Interpoint® High Reliability DC-DC Converters

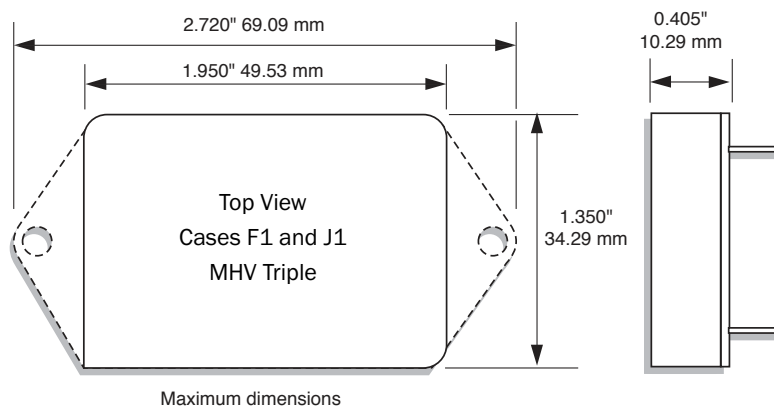
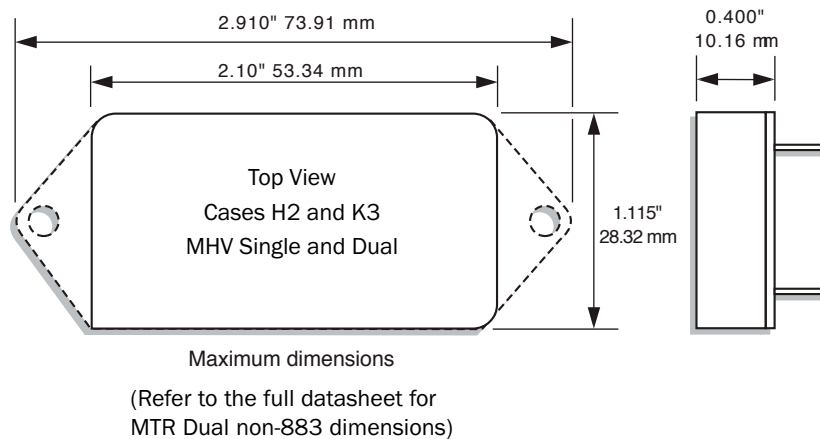
MHV SERIES™ CONVERTERS—15 WATT

- No cross-regulation error on dual outputs
- Operating temperature -55° to +125° C
- Input voltage range 16 to 50 volts
- Transient protection up to 80 volts for 120 ms
- Fixed frequency switching
- Output trim on single output models
- Inhibit and sync functions
- Up to 83% typical efficiency

The wide input voltage range is further supplemented by an ability to withstand an 80 volt transient for 120 milliseconds. Typical output ripple is as low as 15 mV at 20 MHz. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MHV283R3S	16 to 50	3.3	3.03	10	72
MHV2805S	16 to 50	5	3.00	15	77
MHV2812S	16 to 50	12	1.25	15	81
MHV2815S	16 to 50	15	1.00	15	81
MHV2805D	16 to 50	±5	3.00 ¹	15 ¹	79
MHV2812D	16 to 50	±12	1.25 ¹	15 ¹	83
MHV2815D	16 to 50	±15	1.00 ¹	15 ¹	83
MHV28512T	16 to 50	Main +5 & Aux. ±12	2.00 0.416 ²	15 ²	78
MHV28515T	16 to 50	Main +5 & Aux. ±15	2.00 0.333 ²	15 ²	78

1. Up to 7.5 watts is available from either dual output. The specification shown is the maximum total current/power.
2. Up to 80% of the total auxiliary current/power is available from either auxiliary output, providing the opposite auxiliary output is carrying at least 20% of the auxiliary power in use. Total auxiliary power not to exceed 5 watts. The specification shown is the maximum total current/power.



Interpoint® High Reliability DC-DC Converters

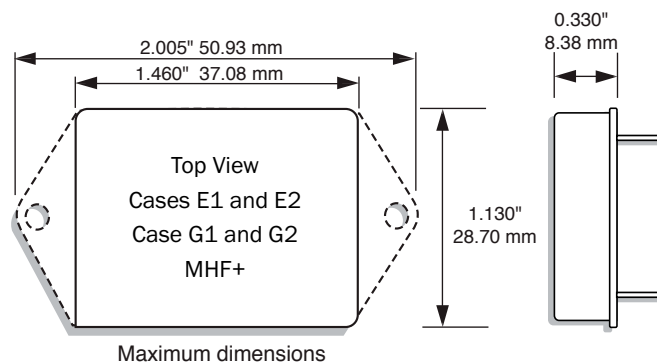
MHF+ SERIES™ CONVERTERS—15 WATT SINGLE, DUAL OR TRIPLE

- Hermetically sealed case
0.33 inches (8.38 mm) high
- Operating temperature -55° to +125° C
- Input voltage 16 to 40 volts (16 to 48 volts triple)
- Transient protection
 - Single and dual: 50 volts for 50 ms
 - Triple: 80 volts for 120 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit and synchronization functions
- Indefinite short circuit protection
- Up to 84% typical efficiency

MHF+ Series of converters provide up to 15 watts output power over the full -55 to +125° C temperature range. The converters are packaged in hermetically sealed metal cases using only 1.7 square inches of board area and are 0.330" high. Up to 84% typical efficiency. Single, dual and triple outputs available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MHF+281R9S	16 to 40	1.9	3.50	6.65	62
MHF+283R3S	16 to 40	3.3	2.40	8	75
MHF+2805S	16 to 40	5	2.40	12	77
MHF+285R2S	16 to 40	5.2	2.40	12.48	77
MHF+285R3S	16 to 40	5.35	2.83	15	77
MHF+2812S	16 to 40	12	1.25	15	79
MHF+2815S	16 to 40	15	1.00	15	80
MHF+2828S	16 to 40	28	0.536	15	84
MHF+2805D	16 to 40	±5	2.40 ¹	12 ¹	79
MHF+2812D	16 to 40	±12	1.25 ¹	15 ¹	83
MHF+2815D	16 to 40	±15	1.00 ¹	15 ¹	84
MHF+28512T ²	16 to 48	+5 & ±12	1.50 0.625 ²	15 ²	76
MHF+28515T ²	16 to 48	+5 & ±15	1.50 0.500 ²	15 ²	76

1. Up to 90% of the total current/power (80% for the MHF+2805D) is available from either dual output, providing the opposite output is carrying at least 10% of the power in use (20% for the MHF+2805D). The specification shown is the maximum total current/power.
2. The sum of the auxiliary output power may not exceed 7.5 watts. Up to 5 watts (approximately 66%) of the total auxiliary power is available from either output provided the opposite auxiliary is simultaneously carrying 2.5 watts (approximately 33%) of the total auxiliary power.



Interpoint® High Reliability DC-DC Converters

MSA+ SERIES™ CONVERTERS—6 WATT

- Trim function +10% ¹
- Small size, 1.13 in² (7.31 cm²)
- -55° to +125°C operation
- 15 to 50 volt input
- Low output ripple
- 80 volts for 1 second transient protection
- Magnetic isolation
- Fixed high frequency switching
- Inhibit function
- Indefinite short circuit protection
- Efficiency up to 76% typical

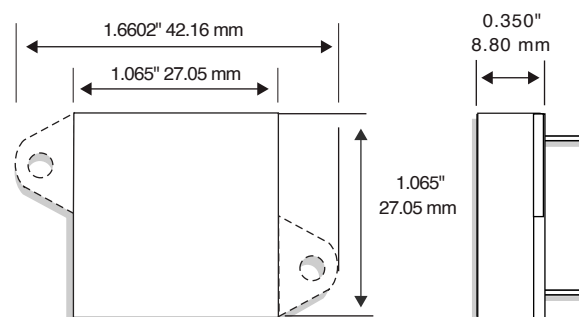
1. 3.3 single model's trim range is -5% and +10%

The Interpoint® MSA+ Series™ of DC-DC converters offers up to 6 watts of power. The low profile MSA+ converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed steel cases. Thick-film hybrid techniques provide military/aerospace reliability levels and optimum miniaturization. The hermetically sealed case is 1.065 by 1.065 inches with a height of 0.350 inches. Power density for the MSA+ Series converters is 15 watts per cubic inch.

PRELIMINARY

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MSA+283R3S	15 to 50	3.3	1.80	6	70
MSA+2805S	15 to 50	5	1.20	6	71
MSA+286R3S	15 to 50	6.3	1.20	6	71
MSA+2812S	15 to 50	12	0.500	6	76
MSA+2815S	15 to 50	15	0.400	6	76
MSA+2805D	15 to 50	±5	1.20 ¹	6 ¹	72
MSA+286R3D	15 to 50	±6.3	0.950 ¹	6 ¹	72
MSA+2812D	15 to 50	±12	0.500 ¹	6 ¹	75
MSA+2815D	15 to 50	±15	0.400 ¹	6 ¹	75

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



Interpoint® High Reliability DC-DC Converters

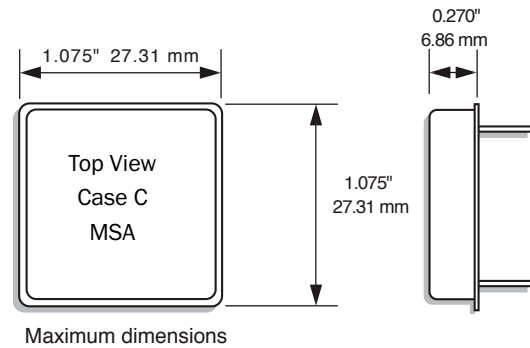
MSA SERIES™ CONVERTERS—5 WATT

- Small size of 1.16 in² (7.5 cm²)
- Operating temperature -55° to +125° C
- Input voltage range 16 to 40 volts
- Transient protection 50 volts for 50 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Indefinite short circuit protection
- Up to 74% typical efficiency

The MSA Series converters offer up to 5 watts output power in our low profile case—just 0.270 inches high. These regulated, isolated converters offer 500 kHz switching and full power operation over the full temperature range of -55° to +125° C. Audio rejection is up to 50 dB. No external capacitors are required. Metal hermetically sealed cases. Single and dual outputs. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MSA2805S	16 to 40	5	1.00	5	71
MSA285R2S	16 to 40	5.2	0.962	5	71
MSA2812S	16 to 40	12	0.417	5	76
MSA2815S	16 to 40	15	0.333	5	76
MSA2805D	16 to 40	±5	1.00 ¹	5 ¹	72
MSA2812D	16 to 40	±12	0.417 ¹	5 ¹	75
MSA2815D	16 to 40	±15	0.333 ¹	5 ¹	75

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



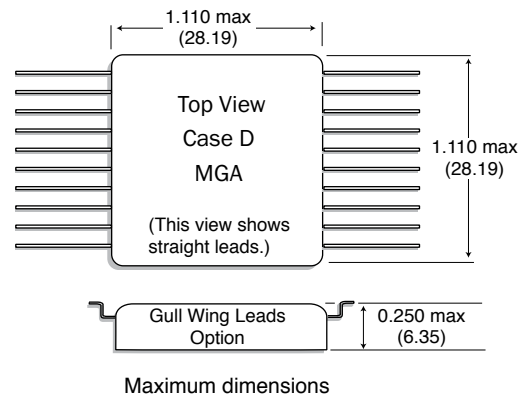
MGA SERIES™ CONVERTERS—5 WATT

- Surface mount package, 1.23 in² (7.9 cm²)
- Operating temperature -55° to +125° C
- Input voltage range 16 to 40 volts
- Transient protection 50 volts for 50 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Indefinite short circuit protection
- Up to 74% typical efficiency

The MGA Series converters offer up to 5 watts output power in our lowest profile case—just 0.250 inches high. These regulated, isolated converters offer 500 kHz switching and full power operation over the full temperature range of -55° to +125° C. Audio rejection is up to 50 dB. No external capacitors are required. Metal sealed cases. Single and dual outputs. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MGA2805S	16 to 40	5	1.00	5	71
MGA2812S	16 to 40	12	0.417	5	76
MGA2815S	16 to 40	15	0.333	5	76
MGA2805D	16 to 40	±5	1.00 ¹	5 ¹	72
MGA2812D	16 to 40	±12	0.417 ¹	5 ¹	75
MGA2815D	16 to 40	±15	0.333 ¹	5 ¹	75

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



Interpoint® High Reliability DC-DC Converters

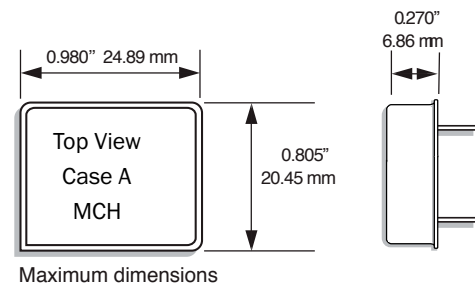
MCH SERIES™ CONVERTERS—1.5 WATT

- Small footprint of 0.79 in² (5.1 cm²)
- Operating temperature -55 °C to +125 °C
- Input voltage range 12 to 50 volts
- Transient protection 80 volts for up to 120 ms
- Up to 70 volts for the 15 volt single and dual models
- Fully isolated, magnetic feedback
- Fixed frequency switching
- Inhibit function
- Indefinite short circuit protection
- Undervoltage lockout
- Up to 79% typical efficiency

The MCH offers 1.5 watts in 0.8 square inches. The parts offer full power operation from 12 to 50 volts input over the full -55 ° to +125 °C temperature range. Single and dual outputs. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MCH2805S	12 to 50	5	0.300	1.5	77
MCH2812S	12 to 50	12	0.125	1.5	79
MCH2815S	12 to 50	15	0.100	1.5	79
MCH2805D	12 to 50	±5	±0.300 ¹	1.5 ¹	77
MCH2812D	12 to 50	±12	±0.125 ¹	1.5 ¹	77
MCH2815D	12 to 50	±15	±0.100 ¹	1.5 ¹	76

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



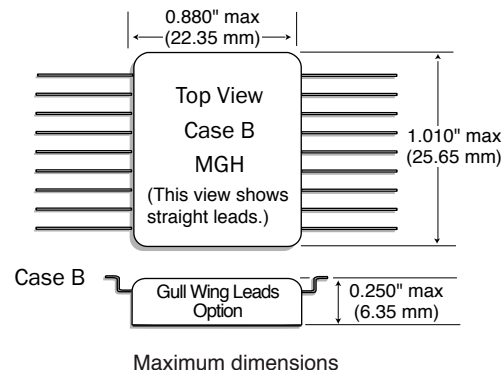
MGH SERIES™ CONVERTERS—1.5 WATT

- Surface mount package, 0.89 in² (5.7 cm²)
- Operation temperature -55 °C to +125 °C
- Input voltage range 12 to 50 volts
- Transient protection 80 volts for up to 120 ms
 - Up to 70 volts for the 15 volt single and dual models
- Fully isolated, magnetic feedback
- Fixed frequency switching
- Inhibit function
- Indefinite short circuit protection
- Undervoltage lockout
- Up to 79% typical efficiency

The MGH offers 1.5 watts of full power operation from 12 to 50 volts input over the full -55 ° to +125 °C temperature range. Single and dual outputs. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

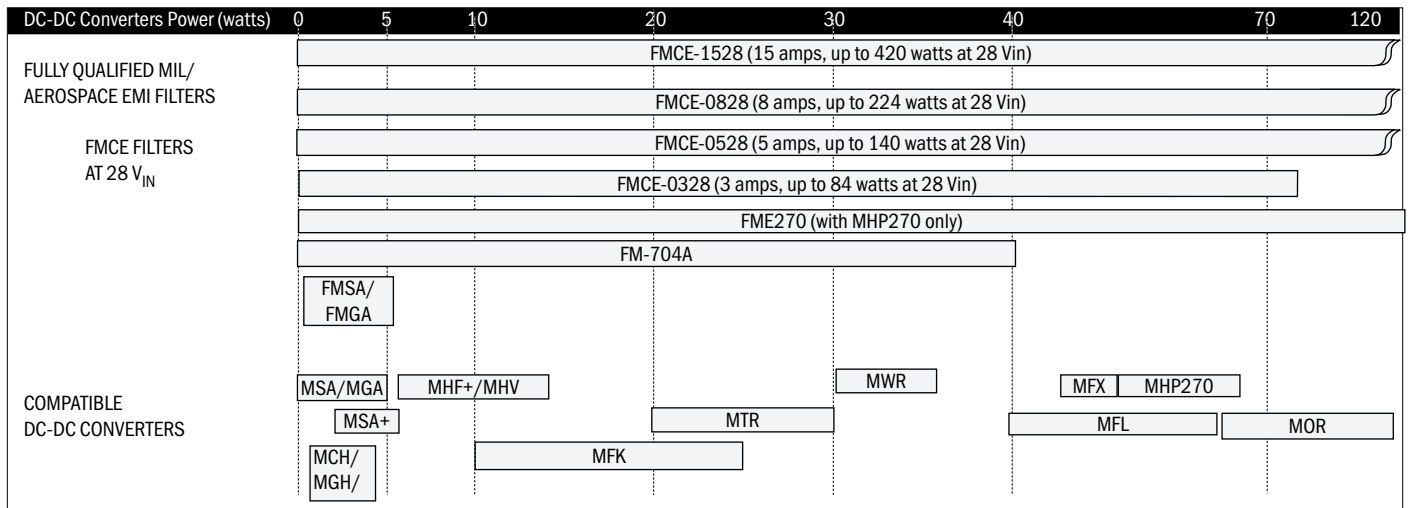
MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MGH2805S	12 to 50	5	0.300	1.5	77
MGH2812S	12 to 50	12	0.125	1.5	79
MGH2815S	12 to 50	15	0.100	1.5	79
MGH2805D	12 to 50	±5	±0.300 ¹	1.5 ¹	77
MGH2812D	12 to 50	±12	±0.125 ¹	1.5 ¹	77
MGH2815D	12 to 50	±15	±0.100 ¹	1.5 ¹	76

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



Interpoint® High Reliability EMI Filters

EMI FILTER GUIDE



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

Model	FMCE Drop-in Replacement for	Input Voltage (V)	Current (Max. A)	Minimum Attenuation (dB) @ 500 kHz	Screening	Compatible Converter
FMCE-1528	FME28-461	-0.5 to 50	15	60	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MOR, MFL, MFX, MWR, MTR, MFK, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FMCE-0828	FMD28-461	-.05 to 50	8	50	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MOR, MFL, MFX, MWR, MTR, MFK, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FMCE-0528	FMC-461	-.05 to 50	5	55	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MOR, MFL, MFX, MWR, MTR, MFK, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FMCE-0328	FMH-461	-.05 to 50	3	50	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MFX, MWR, MTR, MFK, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FM-704A ¹		16 to 40	2.5 @ 16 Vin 1.0 @ 40 Vin	60	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MOR, MFL, MFX, MWR, MTR, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FME270-461		0 to 400	1.5	40	Standard or ES	MHP270
FMSA-461		0 to 50	0.80	55	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MSA and MCH Series
FMGA-461		0 to 50	0.80	55	Standard, ES, or 883 (Class H-QML) Table 1 and Table 2	MGA and MGH Series

1. FM-704A has a transient suppression feature and cannot be used above a 40 volt dc input.

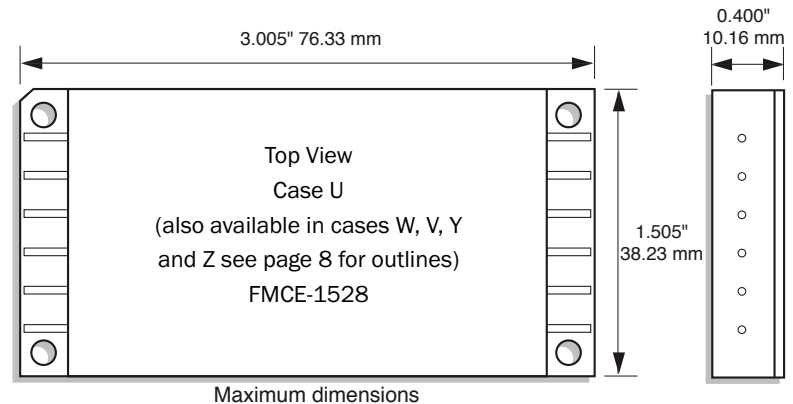
Interpoint® High Reliability EMI Filters

FMCE-1528™ EMI FILTER—15 AMP

- Attenuation to 70 dB at 500 kHz, typical
- Filter multiple converters up to the rated current
- Operating temperature -55° to +125° C
- Transient rating -0.5 to 80 volts for 1 second
- Up to 15 amps throughput current over the full input voltage range of -0.5 to 50 volts
- Compliant to
 - MIL-STD-461C,CE03
 - MIL-STD-461D, E and F CE102
 - MIL-STD-461C CS01
 - MIL-STD-461D, E and F CS101

The FMCE-1528 is a drop-in replacement for the FME28-461. One filter can be used with multiple converters up to the rated output current of the filter. Operating temperature is -55 to +125°C. FMCE-1528 filters are available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMCE-1528	-0.5 to 50	15 (Over the full temperature range and input voltage range.)	60 dB @ 500 kHz	MOR, MFL, MTR, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH

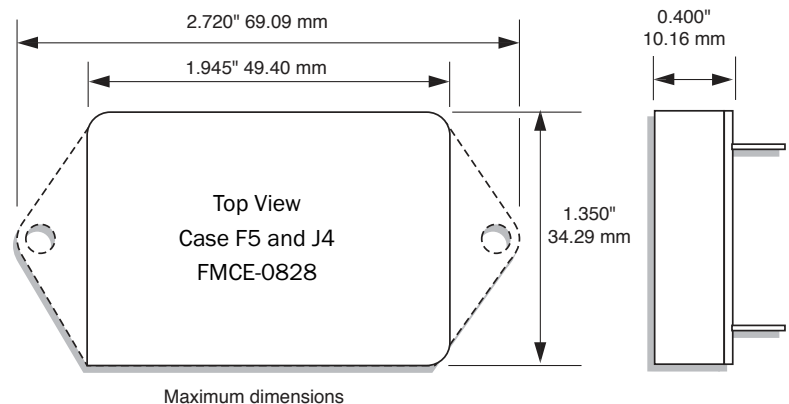
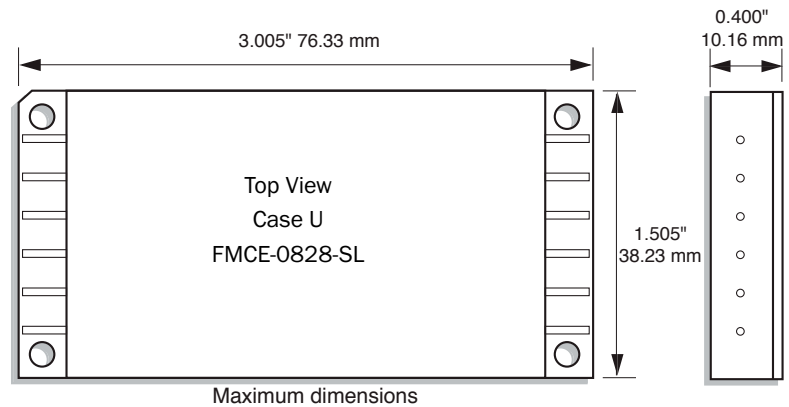


FMCE-0828™ EMI FILTERS—8 AMP

- Attenuation 60 dB at 500 kHz, typical
- Operating temperature -55° to +125° C
- Nominal 28 volt input, -0.5 to 50 volts operation
- Transient rating -0.5 to 80 volts for 1 second
- Up to 8 amps throughput current over the full input voltage range of -0.5 to 50 volts
- Compliant to
 - MIL-STD-461C CE03
 - MIL-STD-461D, E and F CE102
 - MIL-STD-461C CS01
 - MIL-STD-461D, E and F CS101

FMCE-0828 is a drop in replacement for the FMD28-461 EMI filter and has a higher current rating. FMCE-0828 filters minimize electromagnetic interference (EMI) for the MFL, MOR, MTR, MHV and MHF+ Series of converters. One filter can be used with multiple converters up to the rated output current of the filter. FMCE-0828 filters are available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMCE-0828	-0.5 to 50	8.00	50 dB @ 500 kHz	MOR, MFL, MTR, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH

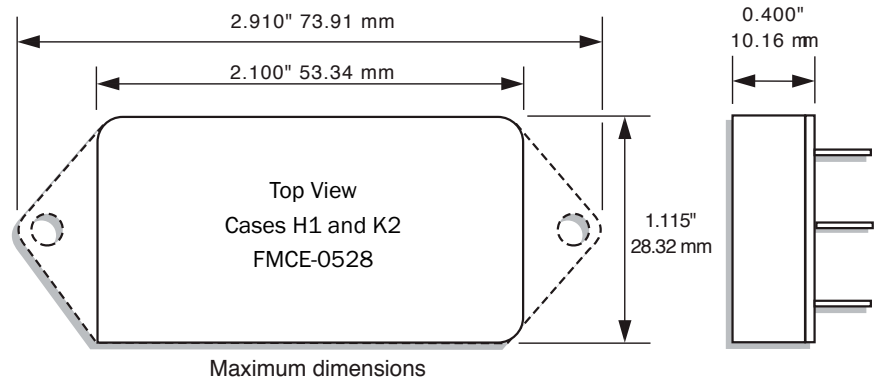


Interpoint® High Reliability EMI Filters

FMCE-0528™ EMI FILTER—5 AMPS

- Attenuation to 60 dB at 500 kHz, typical
- Operating temperature -55° to +125° C
- Nominal 28 volt input, -0.5 to 50 volts operation with or without transorb
- Transient rating -0.5 to 80 volts for 1 second
- Up to 5 amps throughput current over the full input voltage range -0.5 to 50 volts
- Compliant to
 - MIL-STD-461C CE03
 - MIL-STD-461D, E and F CE102
 - MIL-STD-461C CS01
 - MIL-STD-461D, E, and F CS101

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMCE-0528	-0.5 to 50	5	55 dB @ 500 kHz	MTR, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH

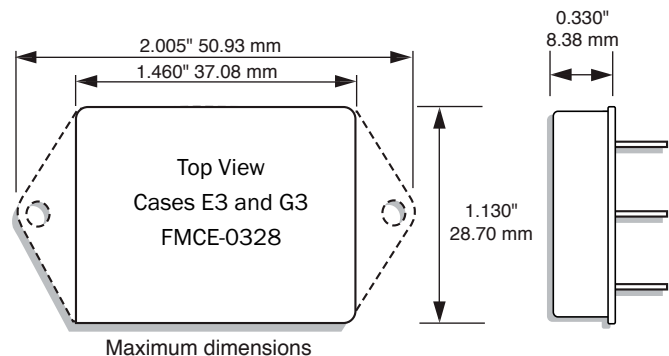


The FMCE-0528™ EMI filter is a drop-in replacement for the FMC-461 and has a higher current rating. The FME-0528-TR filter has a fast-reacting (1 pico second) transient suppressor, which begins clamping the input voltage at approximately 47 volts to protect the DC-DC converter from damage. The FMCE-0528 does not have a transorb. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

FMCE-0328™ EMI FILTER—3 AMPS

- Attenuation to 60 dB at 500 kHz, typical
- Operating temperature -55° to +125° C
- Nominal 28 volt input, -0.5 to 50 volts operation
- Transient rating -0.5 to 80 volts for 1 second
- Up to 3 amps throughput current over the full input voltage range of -0.5 to 50 volts
- Compliant to
 - MIL-STD-461C CE03
 - MIL-STD-461D, E and F CE102
 - MIL-STD-461C CS01
 - MIL-STD-461D, E and F CS101

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMCE-0328	-0.5 to 50	3	50 dB @ 500 kHz	MHV, MHF+, MSA+, MSA, MGA, MCH, MGH



The FMCE-0328™ EMI filter is a drop-in replacement for the FMH-461 and has a higher current rating. At 50 volts input (high line), the filter provides 150 watts of throughput power. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

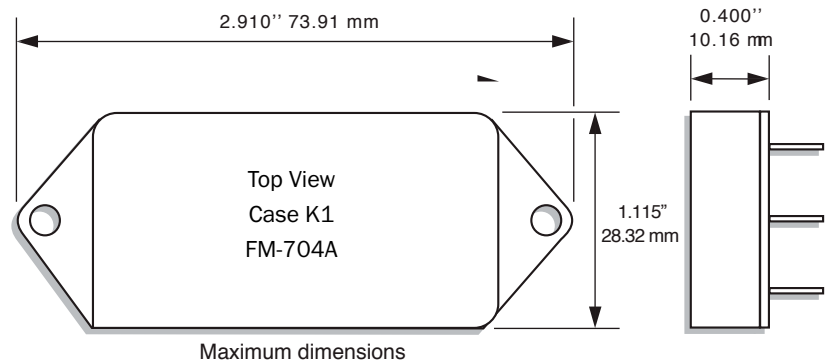
Interpoint® High Reliability EMI Filters

FM-704A™ EMI FILTER—40 WATT

- Active transient suppression
- Undervoltage lockout
- Operating temperature -55° to +125° C
- Nominal 28 volt input, 16 to 40 volts operation
- Inhibit function
- 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	SPIKE LIMIT	SURGE LIMIT
FM-704A	16 to 40	2.50 @ 16 Vin 1.00 @ 40 Vin	60 dB @500 kHz	400 V, 0.5 Ω impedance	100 V, 0.5 Ω impedance

The FM-704A protection module protects Interpoint high frequency converters against MIL-STD-1275A and MIL-STD-704A surges and MIL-STD-461 CS06 spikes. Its filter element brings MHF+, MSA, MCH and MHV converters within MIL-STD-461's CE03 noise limits. Up to 40 watts throughput from -55 to +125° C. Available with Standard, ES or 883 (Class H-QML), Quality Assurance screening. See Table 1 and Table 2.



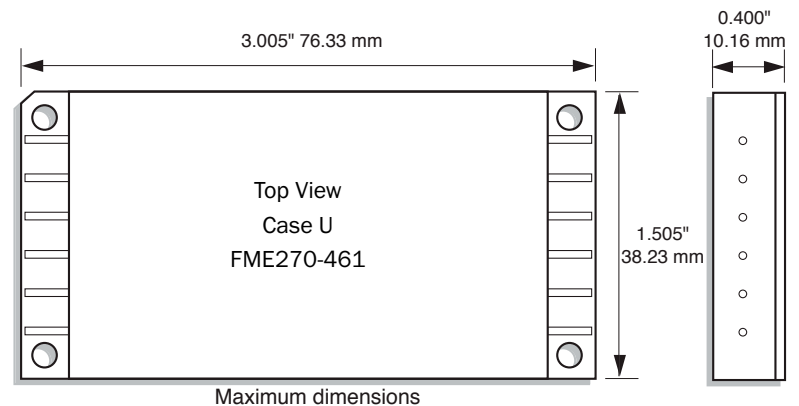
FME270-461™ EMI FILTERS—1.5 AMP

- Input voltage 270 volts
- Attenuation 50 dB at 500 kHz, typical
- Operating temperature -55° to +125° C
- Nominal 270 volt input, 0 to 400 volts operation
- Up to 1.5 amps throughput current
- Compliant to MIL-STD-461C CE-03
- Compatible with the MHP270 converters

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FME270-461	0 to 400	1.50	40 dB @ 500 kHz	MHP270

The FME270-461 filters will bring Interpoint high frequency power supplies into compliance with MIL-STD-461's CE03 limits for reflected ripple current. FME270 models are available in a flanged, side-leaded package (Case U). Operating temperature is -55 to +125° C.

FME270-461 filters are available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.



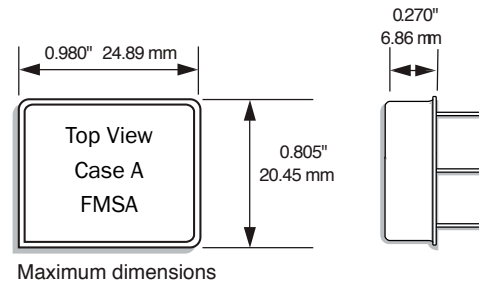
Interpoint® High Reliability EMI Filters

FMSA SERIES™ EMI FILTER—0.8 AMPS

- Small footprint, 0.79 in² (5.1 cm²)
- Attenuation 55 dB at 500 kHz
- Operating temperature -55° to +125°C
- Nominal 28 volt input, 0 to 50 volts operation
- Up to 0.8 amp throughput current
- Compatible with MIL-STD-704 A-E 28 volt power bus
- Compliant to MIL-STD-461C CE-03

The FMSA has been designed as a companion for our MSA and MCH converters. It can be used with multiple converters up to the rated current. The filter weighs 10.3 grams and is only 0.27 inches high. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMSA-461	0 to 50	0.80	55 dB @ 500 kHz	MSA+, MSA, MCH



FMGA SERIES™ EMI FILTER—0.8 AMPS

- Surface mount package, 0.89 in² (5.7 cm²)
- Attenuation 55 dB at 500 kHz
- Operating temperature -55° to +125°C
- Nominal 28 volt input, 0 to 50 volts operation
- Up to 0.8 amps throughput current
- Compatible with MIL-STD-704 A-E 28 volt power bus
- Compliant to MIL-STD-461C CE-03

Our surface mount FMGA-461™ EMI filter has been designed to work with our surface mount MGA and MGH Series DC-DC converters. Multiple MGA or MGH Series DC-DC converters can be operated from a single FMGA filter provided the total power/current line current does not exceed the filter's maximum rating. The FMGA filter will reduce the converter's power line reflected ripple current to within the limit of MIL-STD-461C, Method CE03. The filter uses only ceramic capacitors for reliable high-temperature operation.

The filters weigh 10.3 grams and are only 0.25 inches high. Available screening levels are Standard, ES or 883 (Class H of MIL-PRF-38534). See Table 1 and Table 2.

MODEL	INPUT (V)	MAXIMUM CURRENT (A)	MINIMUM ATTENUATION	COMPATIBLE CONVERTERS
FMGA-461	0 to 50	0.8	55 dB @ 500 kHz 50 dB @ 5 MHz	MGA, MGH

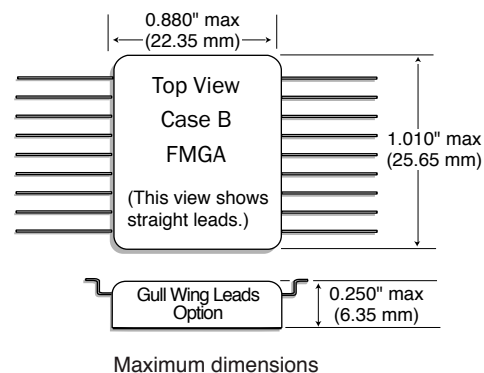


Table is for reference only. See individual Series' datasheets for specific screening.

ELEMENT EVALUATION ¹ HIGH RELIABILITY DC-DC CONVERTERS AND EMI FILTERS /883 (CLASS H)

COMPONENT-LEVEL TEST PERFORMED	QML	
	CLASS H /883	
	M/S ²	P ³
Element Electrical	■	■
Visual	■	■
Internal Visual	■	
Final Electrical	■	■
Wire Bond Evaluation	■	■

Notes

1. Element evaluation does not apply to standard and /ES product.
2. M/S = Active components (microcircuit and semiconductor die).
3. P = Passive components, Class H element evaluation. Not applicable to standard and /ES element evaluation.

TABLE 1: ELEMENT EVALUATION - HIGH RELIABILITY

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

ENVIRONMENTAL SCREENING HIGH RELIABILITY DC-DC CONVERTERS AND EMI FILTERS STANDARD, /ES, SX AND /883 (CLASS H)

TEST PERFORMED	NON-QML ¹			CLASS H QML ²	
	STANDARD	/ES	/883 SX ³	/883 CH ⁴	/883 QML ⁵
Pre-cap Inspection, Method 2017, 2032	■	■	■	■	■
Temperature Cycle (10 times)					
Method 1010, Cond. C, -65°C to +150°C, ambient			■	■	■
Method 1010, Cond. B, -55°C to +125°C, ambient		■			
Constant Acceleration					
Method 2001, 3000 g			■	■	■
Method 2001, 500 g		■			
PIND, Test Method 2020, Cond. A			■	■ ⁶	■ ⁶
Burn-in Method 1015, +125°C case, typical ⁷					
96 hours		■			
160 hours			■	■	■
Final Electrical Test, MIL-PRF-38534, Group A,					
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■	■	■
Subgroups 1 and 4, +25°C case	■	■			
Hermeticity Test, Method 1014					
Gross Leak, Cond. C ₁ , fluorocarbon		■	■	■	■
Fine Leak, Cond. A ₂ , helium		■	■	■	■
Gross Leak, Dip	■				
Final visual inspection, Method 2009	■	■	■	■	■

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

Notes

1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. SX screening is available on select models.
4. Class H QML products with no SMD number are marked "CH" per MIL-STD-38534 Rev J, 3.9.5.8.3, Table III.
5. Class H QML products have an SMD number
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 - HIGH RELIABILITY

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

ENVIRONMENTAL SCREENING DC-DC CONVERTERS AND EMI FILTERS STANDARD AND /ES ¹

TEST PERFORMED	STANDARD	/ES
Pre-cap Inspection Method 2017, 2032	■	■
Temperature Cycle (10 times) Method 1010, Cond. B, -55°C to +125°C, ambient		■
Constant Acceleration Method 2001, 500 g		■
Burn-in Method 1015 ² 96 hours		■
Final Electrical Test MIL-PRF-38534, Group A Subgroups 1 and 4: +25°C case	■	■
Hermeticity Test, Method 1014		
Gross Leak, Cond. C ₁ , fluorocarbon		■
Fine Leak, Cond. A ₂ , helium		■
Gross Leak, Dip	■	
Final visual inspection Method 2009	■	■

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

Notes

- Standard and /ES products may not meet all of the requirements of MIL-PRF-38534.
- Burn-in temperature designed to bring the case temperature to the maximum case temperature of the product. Refer to the specific product information for the maximum case temperature. Burn-in is a powered test.

TABLE 3: ENVIRONMENTAL SCREENING - HIGH RELIABILITY

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 134855:2016

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.



Building 1 of 4

Lynnwood, Washington, USA

16706 13th Avenue West

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)
MIL-PRF-38534 Qualified Manufacturers List (QML)s
- 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 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.
- 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" (DC-DC converters) and "H" (EMI filters) 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 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.

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."



Some of the major programs which use our products:

Aircraft - Commercial
Airbus A319 - A380
AC311

An-148-100B
An-158

ARJ21
Boeing 737 through 787
Bombardier Canadian Regional Jet - CRJ
Bombardier Q Series
C919 - China
MA 6000 - China
Tu-204SM

Aircraft - Military/Defense
AH-64 Apache Target Acquisition
Display - TADS
B-2 Stealth Bomber
B-52 Stratofortress
E-2C Hawkeye
Eurofighter Defensive Aids
Sub System - DASS
Eurofighter European Collaborative
Radar - ECR90
Eurofighter fuel measuring system
Eurofighter Oil Debris Monitoring - ODM
Eurofighter On-Board Oxygen
Generation System - OBOGS
Eurofighter Stick Sensor and
Interface Control Assembly - SSICA
Eurofighter Transmitter Receiver
F/A-18 Hornet
F-15 Eagle
F-16 Fighting Falcon
F-16 Fighting Falcon Integrated
Multi-Platform Launch
Controller - IMPLC
F-18 Integrated Defensive Electronic
Countermeasures - IDECM
F-2 Attack Fighter
F-22 Raptor
F-35 Joint Strike Fighter
GRIPEN
Dhruv Advanced Light Helicopter - ALH
Kawasaki OH-1 Helicopter
Kiowa OH-58 Helicopter
Jaguar Helicopter
Joint Strike Fighter - JSF
K8 Trainer
Light Combat Aircraft

LCH
LUH
Lynx Helicopters
NH90 Helicopters
Rafale Fighter
Tigre Helicopter
UH60JA Helicopter
V-22 Osprey

Commercial/Industrial
Gravimeter GT-1A
Oil and gas pipeline monitoring
Oil platform system controls
Oil Rig down hole instrumentation

Electronic Warfare
AEGIS Radar DDG-51 Arleigh Burke
AN/AAR-58 Common
Missile Warning - CMW
AN/ARC-164 Radio
Directional Infrared
Counter Measure - DIRCM
Erieye
Girafe Agile Multi Beam Radar
Identification Friend-or-Foe - IFF
Light Airborne Multipurpose
System Multimode Radar - LAMPS
Multifunctional Information
Distribution System - MIDS
Seer Radar Warning Receiver - RWR
Ocean Master
Navy Multiband Terminal - NMT

Land Systems
K1 Self Propelled Howitzer, Serbia
K9 Self Propelled Howitzer, S Korea
Light Armored Vehicle - LAV, Stryker
Leclerc Tank
Leopard Tank
Veicolo blindato medio
VBM [medium armored vehicle]
Challenger Tank
M1A1 Abrams Tank
Multiple Launch Rocket System - MLRS
Pz 2000 Self Propelled Howitzer, Germany

Missiles
Patriot Advanced Medium-Range,
Air-to-Air Missile - AMRAAM
Anti-Submarine Rocket - ASROC
Bamse Automatic
Command-to-Line-Of-Sight - ACLOS
Evolved Seasparrow Missile - ESSM
InfraRed Imaging System,
Tail/Thrust Vector controlled - IRIS-T
Joint Air-to-Surface
Standoff Missile - JASSM
Joint Strike Missile - JSM
Mobile Surface-to-Air-Missile - MSAM
Nag - India
Patriot Advanced Capability III - PAC
Standard Missile II, III and 6
Taurus
Tien Chien-II - TC
Terminal High Altitude
Area Defense - THAAD
Tomahawk
Trident Class Fleet Ballistic
Missile Submarine
Vertical Launch Antisubmarine - VLA

Unmanned Aerial Vehicle
Airborne Low Frequency Sonar - ALFS
RQ-4A Global Hawk
Hermes UAV
Predator
Sperwar
Tactical Automatic Landing System
- TALS
U-2
Unmanned Combat Aerial Vehicle X-45
- UCAV
Unmanned Aerial Vehicle X-47 - UAV
Watchkeeper