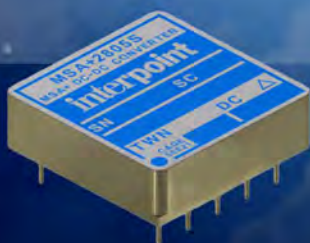


- **HIGH**
- **RELIABILITY**
- **CATALOG**

Interpoint®
DC-DC Converters
and EMI Filters

HI-REL



- - - - **HIGH RELIABILITY CATALOG**

Interpoint®
DC-DC Converters
and EMI Filters

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Crane Aerospace & Electronics
Power Solutions - Interpoint Products
High Reliability Catalog Rev AF - 2025.09.16
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Crane Electronics, Inc. reserves the right to make changes that do not affect form, fit or function of Class H products or specifications without notice.

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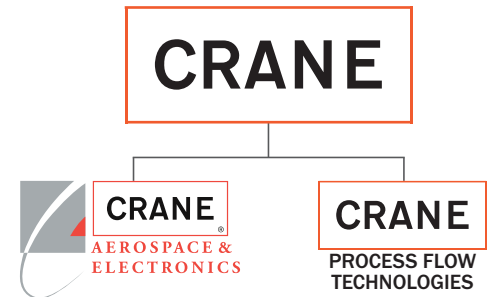
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Company Information

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.



Sensing Components & Systems



Landing Systems



Fluid Management Solutions



Cabin Systems



Electrical Power Solutions



Microwave Solutions

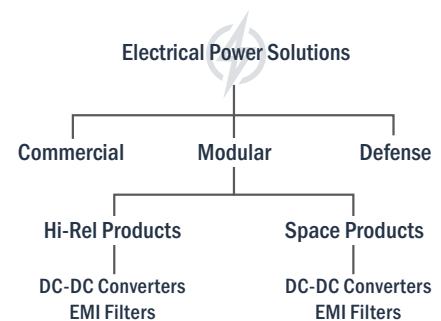
Crane Aerospace & Electronics

Crane Aerospace & Electronics delivers innovative systems, components, and services for commercial aircraft, defense platforms, and space systems which have proven reliability in mission-critical environments. Products and services are organized into six integrated solutions: Electrical Power Solutions, Fluid Management Solutions, Landing Systems, Microwave Solutions, Cabin Systems and Sensing Components & Systems. For more information, visit www.craneae.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 highreliability DC-DC power conversion products. For more information please visit www.craneae.com/interpoint.

Interpoint® DC-DC Converter and EMI Filter Overview

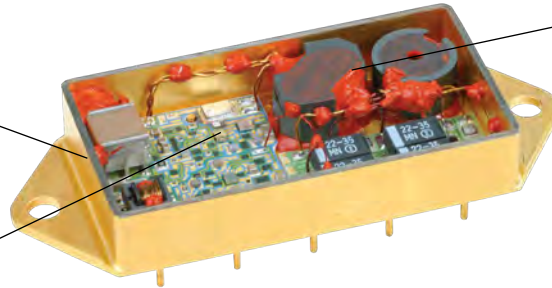
Interpoint Product Overview

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

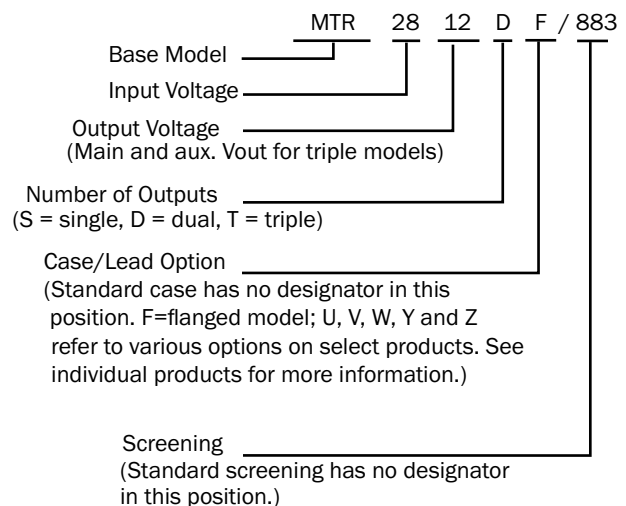
Choose from over 1,000 power conversion products. We were one of the first companies to qualify to MIL-STD-1772 (1987), which was DLA's microcircuit standard in 1987. Our first standard microcircuit drawing (SMD) for a Class H hybrid was issued in 1992, and our first Class K hybrid SMD was issued in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



POWERING YOUR MISSION



Power Conversion Solutions for:

- Deep Space (Class K)
- New Space
- Rugged Defense (Class H)
- Hi-Rel COTS

Powering the Future of Aerospace and Defense

Leveraging years of power conversion expertise, technology investment and a rich Interpoint brand heritage, the Interpoint xMOR product family is an innovative collection of four 120-watt DC-DC power converters offering solutions for a range of applications.

Our aerospace and defense industry is ever evolving, proving out new technology that tests the limits of space exploration and military capability. From low-orbit satellites to deep space missions, long mission drones to advanced next-gen missiles – a broad range of innovations require a broad range of solutions. The 'x' in our Interpoint brand xMOR product family represents a customers' variable, the power conversion solution needed to enable innovation. With our 120-watt Interpoint xMOR product family of cMOR, hMOR, rMOR and sMOR converters, we look forward to Powering Your Mission.

cMOR DC-DC Converters (COTS)

An excellent match for ground vehicles, missile systems and aircraft – offering improved performance over Class H products at a lower price.

- Cost effective solution
- Synchronous rectification design
- Forward Clamp Switching
- Hi-Rel COTS tested to MIL-STD 883

hMOR DC-DC Converters (Class H Defense)

A rugged 120-watt Class H defense-tailored power conversion unit for customers that require the utmost reliability.

- Low ripple
- High efficiency
- Light weight
- MIL-PRF 38534 Class H compliant

Interpoint® High Reliability DC-DC Converters

MODEL (SERIES)	INPUT VOLTAGE (V _{DC})	OUTPUT VOLTAGE (V _{DC})	OUTPUT POWER (W)	TYPICAL EFFICIENCY (%)	OPERATING TEMPERATURE (°C)	AVAILABLE SCREENING	EMI FILTER ^{1,2,3}
cMOR	15 to 50	3.3, 5, 6.3, 9.5, 12, 15, 28 ±3.3, ±5, ±6.3, ±9.5, ±12, ±15	Up to 120	86 to 91	-55 to +105	Standard, ES	FMCE-1528
hMOR	15 to 50	3.3, 5, 6.3, 9.5, 12, 15, 28 ±3.3, ±5, ±6.3, ±9.5, ±12, ±15	Up to 120	78 to 81	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883 Class H	FMCE-1528
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 to +125	Non-QML Standard, ES or QML 883, Class H-QML	FMCE-1528
MFL	16 to 40	3.3, 5, 12, 15, 28 ±5, ±12, ±15	50 to 65	76 to 86	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883, Class H-QML	FMCE-1528 FMCE-0828
MFX	16 to 50	3.3, 5, 9, 12, 15	50	89 to 91	-55 to +125	Non-QML Standard/SX /ES	FMCE-0528 ⁴
MWR	16 to 50	±3.3 & ±12, ±3.3 & ±15 +5 & ±12, +5 & ±15	30 to 35	81 to 85	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883, Class H	FMCE-0528 ⁴
MTR 40	16 to 40	3.3, 5, 12, 15, 18 ±5, ±12, ±15 +5 & ±12, +5 & ±15	20 to 30	76 to 84	-55 to +125	Non-QML Standard, ES or QML 883, Class H-QML	FMCE-0328 FMCE-0528 ⁴
MTR 50 ²	16 to 50	3.3, 5, 8.5, 12, 15 ±5, ±12, ±15	20 to 30	76 to 84	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883, Class H-QML	FMCE-0828 FMCE-0528 ⁴
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 to +125	Non-QML Standard, ES or QML 883, Class H-QML	FMCE-0528 ⁴
MHV	16 to 50	3.3, 5, 12, 15 ±5, ±12, ±15	10 to 15	72 to 83	-55 to +125	Non-QML Standard, ES or QML 883, Class H-QML	FMCE-0528 ⁴
		+5 & ±12, +5 & ±15	10 to 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 to +125	Non-QML Standard, ES or QML 883, Class H-QML	FMCE-0328
	16 to 48	+5 & ±12 +5 & ±15	15	75			
MSA+ ²	15 to 50	3.3, 5, 6.3, 12, 15 ±5, ±6.3, ±12, ±15	6	76	-55 to +125	Non-QML Standard, ES or screened to QML 883 Class H-QML without SMD number	FMCE-0328, FMCE-0528 ⁴ or FMSA
MFP POL ²	3 to 6	0.8 to 3.5 Four pin-selectable, preset volt- ages, 0.8, 1.6, 2.5 and 3.3	5.6 to 16.5	73 to 92	-55 to +125	Side-Leaded, up to Class H-QML, Class K-QML	NA
MSA/ MGA ²	16 to 40	5, 5.2(MSA only), 12, 15 ±5, ±12, ±15	1.2 to 5	71 to 80	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883,, Class H-QML	FMSA
MCH ² / MGH ²	12 to 50	5, 12, 15 ±5, ±12, ±15	1.5	76 to 79	-55 to +125	Non-QML Standard/SX /ES or screened to QML 883,, Class H-QML	FMSA

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

3. Interpoint converters used with EMI input filters will meets MIL-STD-461C CE03 and CS01 and MIL-STD-461D, E and F CE102 and CS101 levels of conducted emissions.
4. FMCE-0528-TR has active transient suppression, FMCE-0528 does not.

Interpoint® High Reliability DC-DC Converters

cMOR CONVERTER – 15 to 50 VOLT - UP TO 120 WATT

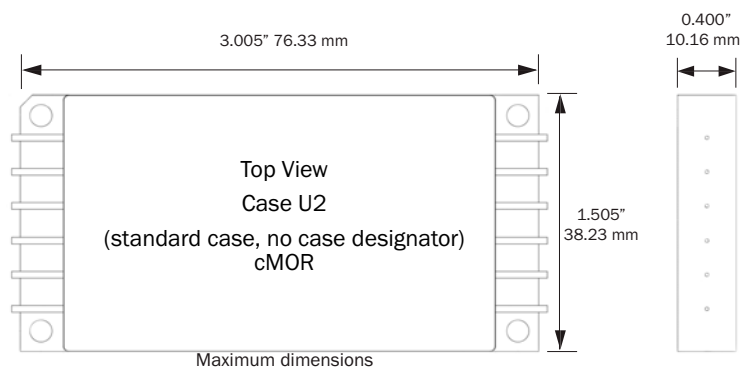
- Parallel operation with current share, up to 5 units (540 watts)
- Output flexibility, trim of 80% to 110%
- Operating temperature -55 °C to +105 °C
- Input voltage 15 to 50 V
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense on single output models
- Inhibit function
- Sync In and Sync Out
- Indefinite short circuit protection
- High power density with up to 90% peak efficiency
- Soft-start function limits inrush current during start-up

MODELS OUTPUT VOLTAGE (V)	
SINGLE	DUAL
3.3	N/A
5	±5
6.3	±6.3
9.5	±9.5
12	±12
15	±15
28	N/A

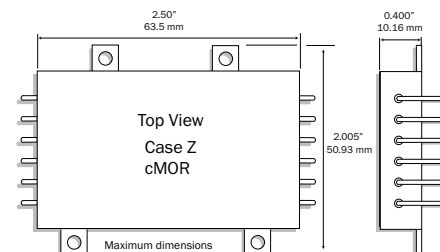
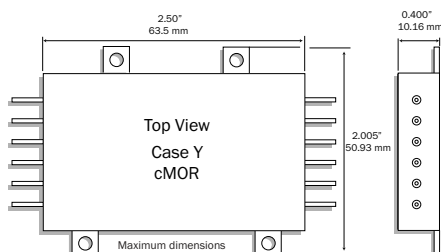
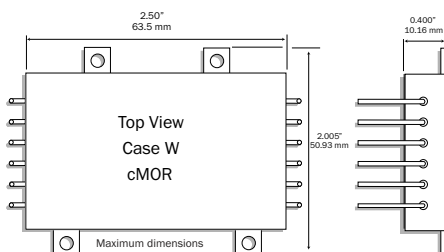
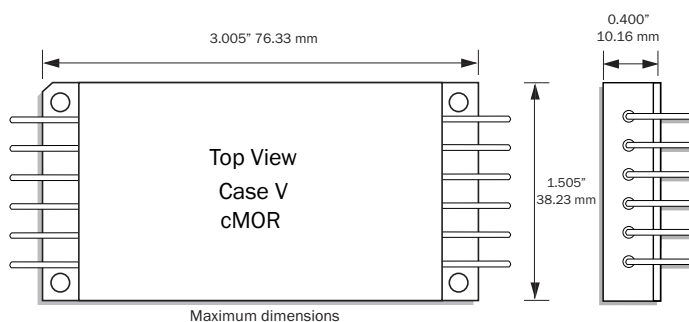
The Interpoint cMOR Series™ of DC-DC converters offers up to 120 watts of power in a low profile package with a 15 to 50 volt input. The cMOR converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H or class K production facility and packaged in hermetically sealed steel cases. cMOR converters are ideal for use in programs requiring high reliability, small size, and high efficiency. Full operation over the temperature range, -55°C to +105°C, makes the cMOR Series an ideal choice for military, aerospace, space, and other high reliability applications. Use Interpoint FMCE-1528 EMI filter to meet the requirements of MIL-STD-461C CE03 and MIL-STD-461D-G CE102 levels of conducted emissions.

The converters are offered standard screening or “ES” screening.

The cMOR Series converters uses an active-clamp reset, single-ended forward converter with synchronous rectification design. It uses a constant frequency Pulse Width Modulator (PWM) current mode control design with a constant switching frequency of 500 kHz.



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



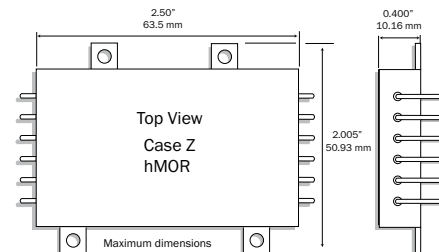
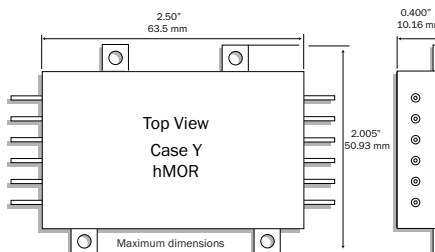
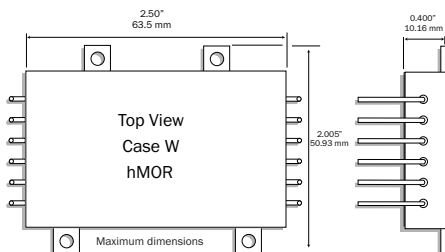
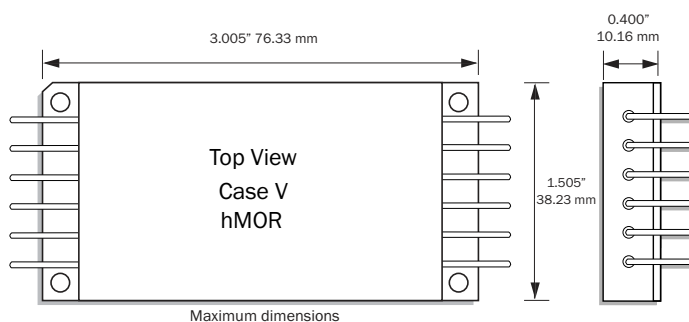
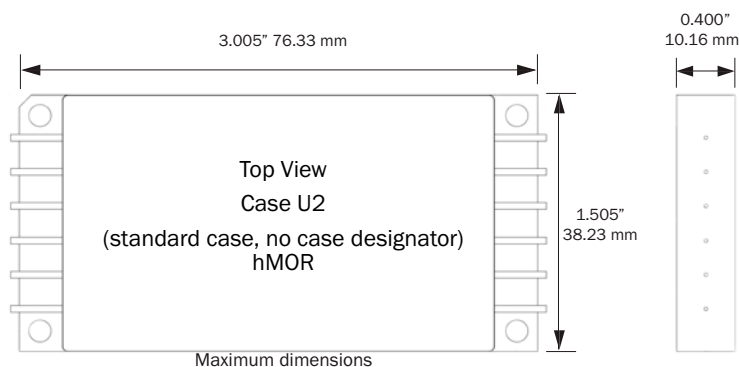
Interpoint® High Reliability DC-DC Converters

hMOR CONVERTER – 15 to 50 VOLT - UP TO 120 WATT

- Parallel operation with current share, up to 5 units (540 watts)
- Output flexibility, trim of 80% to 110%
- Operating temperature -55 °C to +125 °C
- Input voltage 15 to 50 V
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Remote sense on single output models
- Inhibit function
- Sync In and Sync Out
- Indefinite short circuit protection
- High power density with up to 87% peak efficiency
- Soft-start function limits inrush current during start-up

MODELS OUTPUT VOLTAGE (V)	
SINGLE	DUAL
3.3	N/A
5	±5
6.3	±6.3
9.5	±9.5
12	±12
15	±15
28	N/A

The Interpoint hMOR Series™ of DC-DC converters offers up to 120 watts of power in a low profile package with a 15 to 50 volt input. The hMOR converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability, small size, and high efficiency. Full operation over the military temperature range, -55°C to +125°C, makes the hMOR Series an ideal choice for military, aerospace, space, and other high reliability applications. Use Interpoint FMCE-1528 EMI filter to meet the requirements of MIL-STD-461C CE03 and MIL-STD-461D, E and F CE102 levels of conducted emissions. The converters are offered with standard screening, “ES” screening, or fully compliant to “883” MIL-PRF-38534 Class H screening. The hMOR Series converters incorporate a single-ended forward topology which uses a constant frequency Pulse Width Modulator (PWM) current mode control design and switches at 500 kHz, nominal.



Interpoint® High Reliability DC-DC Converters

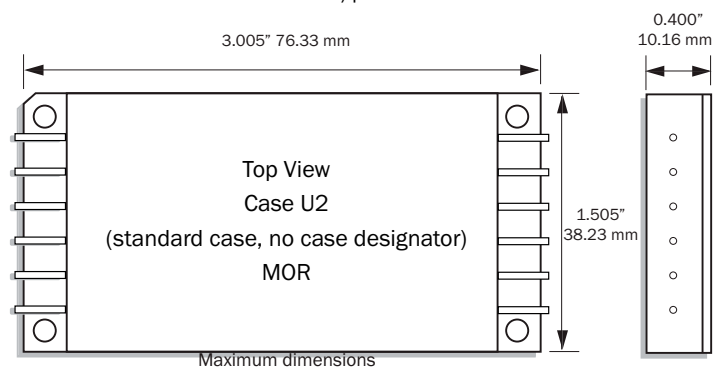
MOR SERIES™ CONVERTER—120 WATT OUR MOST VERSATILE CONVERTER

- 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

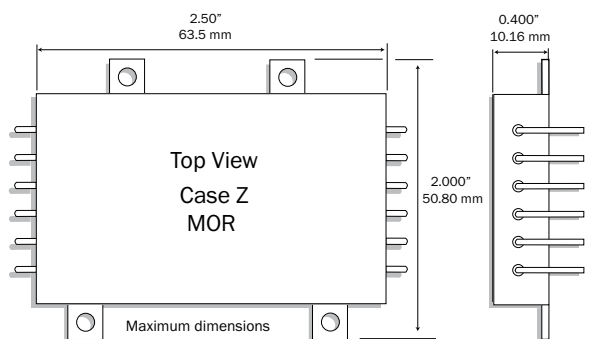
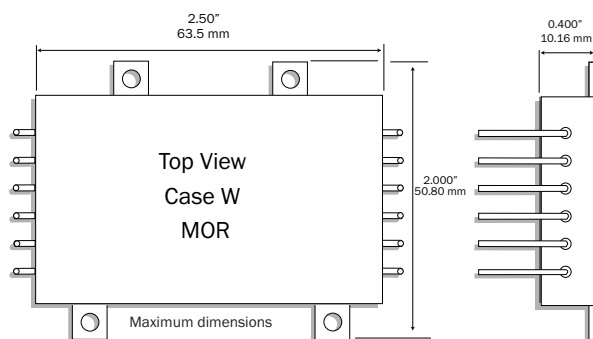
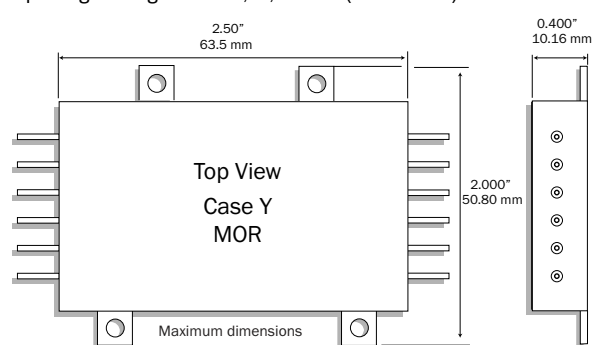
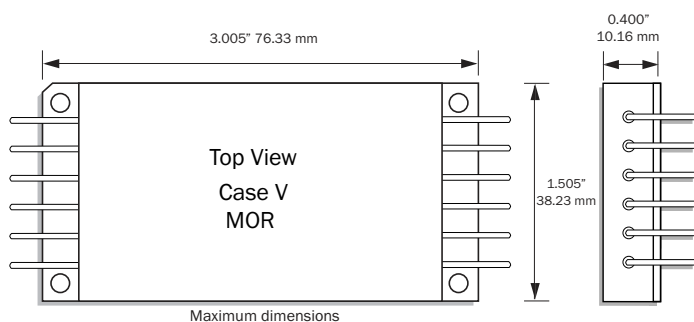
With up to 120 watts of output power, the MOR Series™ of DC-DC converters operates from a standard 28 volt bus with input voltage of 16 to 40 volts. Full operation over -55° to +125° C makes the MOR Series an ideal choice for aerospace, military, space and other high reliability applications. In compliance 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.

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 2.

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

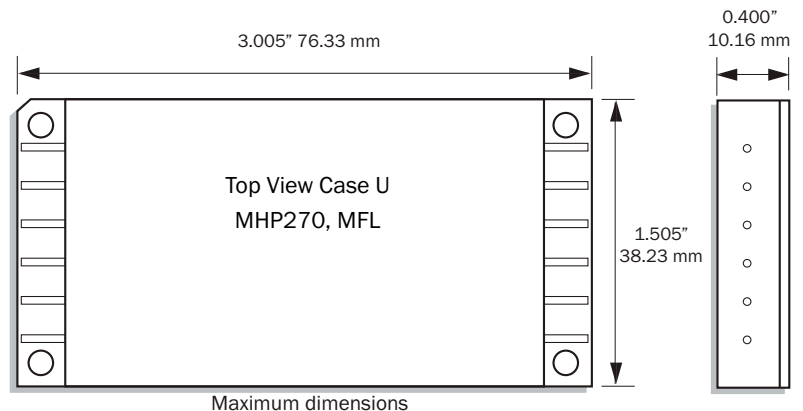
1. Up to 80% of the total current/power is available from either output providing the opposite output is carrying at least 20% of the power in use. The specification shown is the maximum total current/power.

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 MILPRF-38534). See Screening 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



Interpoint® High Reliability DC-DC Converters

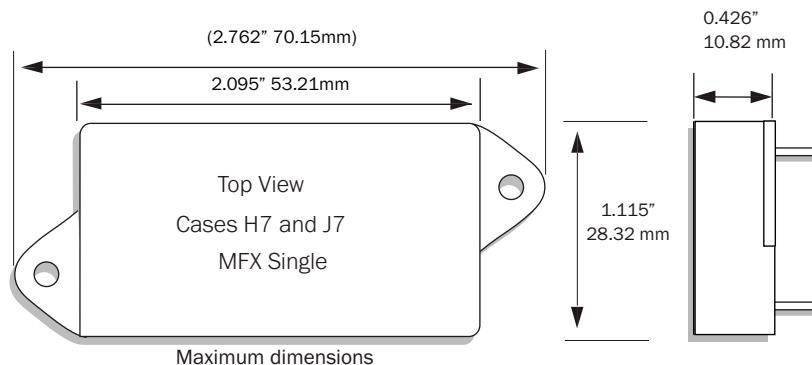
MFX SERIES™ CONVERTERS—50 WATT

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 1.

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

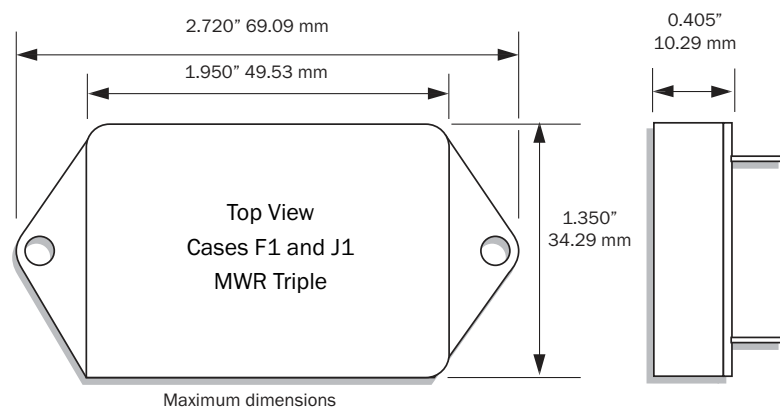
TRIPLE OUTPUT

- Input voltage range 16 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 16 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.

MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MWR283R312T	16 to 50	Main +3.3 & Aux. ± 12	3 1.67 ¹	10 20 ¹	81
MWR283R315T	16 to 50	Main +3.3 & Aux. ± 15	3 1.34 ¹	10 20 ¹	82
MWR28512T	16 to 50	Main +5 & Aux. ± 12	3 1.67 ¹	15 20 ¹	84
MWR28515T	16 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 MILPRF-38534). See Table 1.

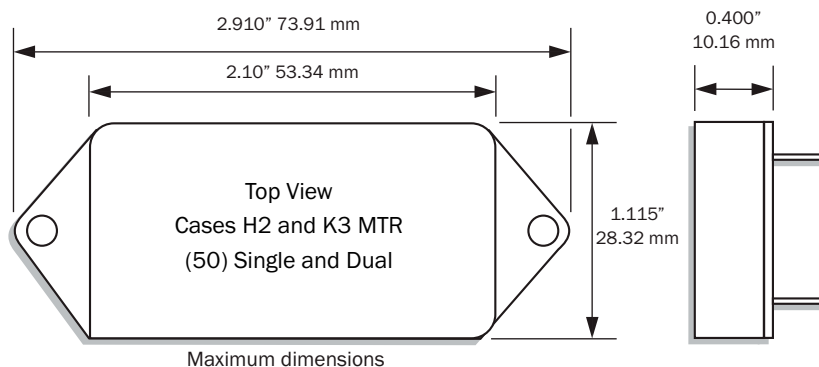
For information on ordering an MTR Series MTR 50, please contact your sale representative.

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



Maximum dimensions

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.

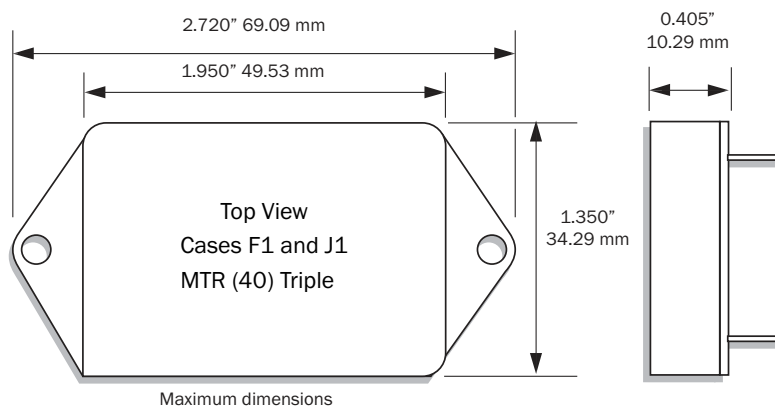
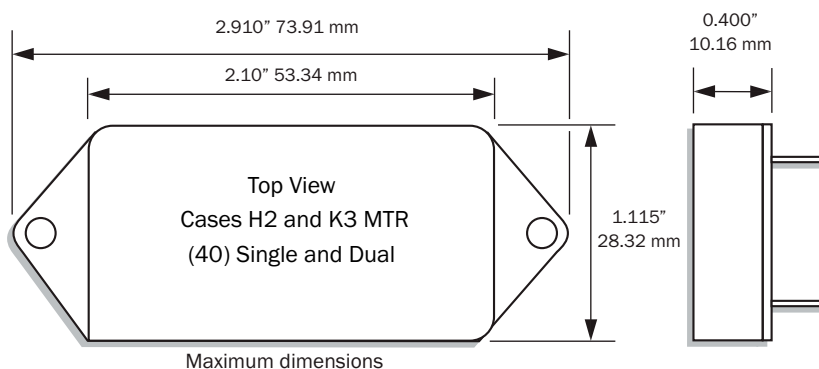
For information on ordering an MTR Series MTR 40, please contact your sale representative.

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



Interpoint® High Reliability DC-DC Converters

MFK SERIES™ CONVERTERS—25 WATT

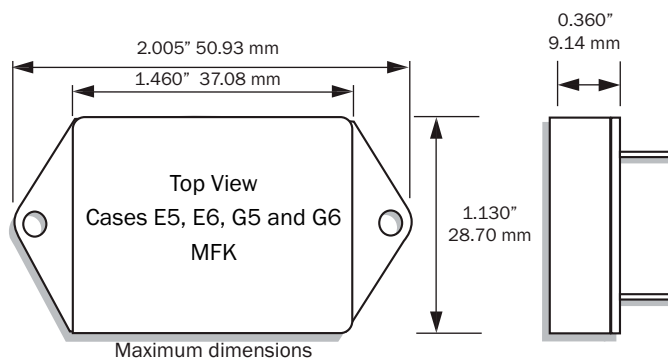
- 16 to 50 volt input
- Up to 87% typical efficiency, 42 W/in₃
- 80 volt transient protection per MIL-STD-704A
- Undervoltage lockout
- -55°C to +125°C operation
- Fully isolated
- Magnetic feedback
- Fixed frequency, 500 kHz typical
- Inhibit and sync function
- Output short circuit protection

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.

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

MHV SERIES™ CONVERTERS—15 WATT

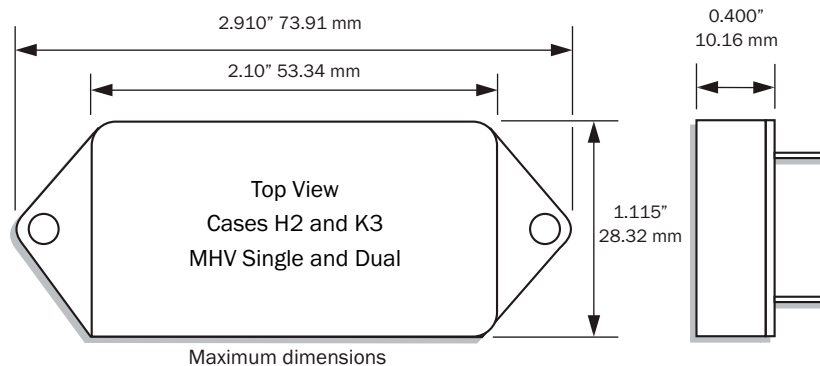
- No cross-regulation error on dual outputs
- Operating temperature -55° to +125°C
- Input voltage range 16 to 50 volts
- Transient protection up to 80 volts for 120 ms
- Fixed frequency switching
- Output trim on single output models
- Inhibit and sync functions
- Up to 83% typical efficiency

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.

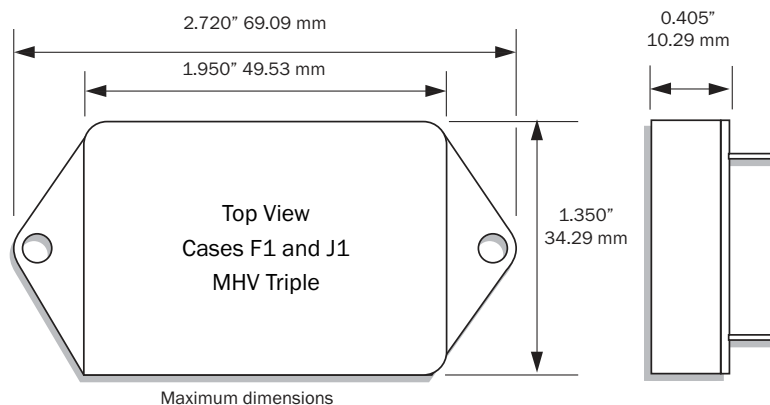
MODEL	INPUT (V)	OUTPUT AT FULL LOAD			
		OUTPUT (V)	CURRENT (A)	POWER MAX. (W)	EFF (% typ.)
MHV283R3S	16 to 50	3.3	3.03	10	72
MHV2805S	16 to 50	5	3.00	15	77
MHV2812S	16 to 50	12	1.25	15	81
MHV2815S	16 to 50	15	1.00	15	81
MHV2805D	16 to 50	±5	3.00 ¹	15 ¹	79
MHV2812D	16 to 50	±12	1.25 ¹	15 ¹	83
MHV2815D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



(Refer to the full datasheet for MTR Dual non-883 dimensions)



Interpoint® High Reliability DC-DC Converters

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

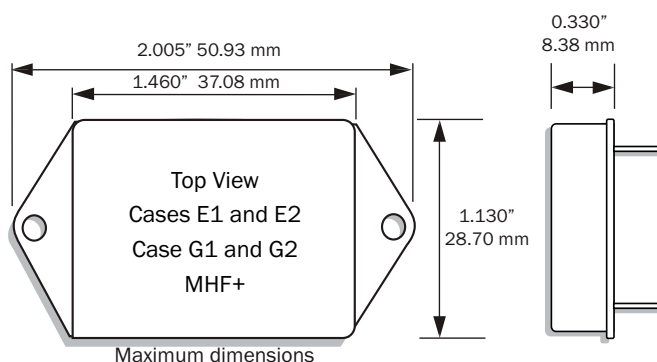
- Hermetically sealed case 0.33 inches (8.38 mm) high
- Operating temperature -55° to +125° C
- Input voltage 16 to 40 volts (16 to 48 volts triple)
- Transient protection
 - Single and dual: 50 volts for 50 ms
 - Triple: 80 volts for 120 ms
- Fully isolated
- Fixed high frequency switching
- Inhibit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

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

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.

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 $\pm 10\%$, single and duals *
- 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

*MSA+283R3S trim range is -5% and $\pm 10\%$

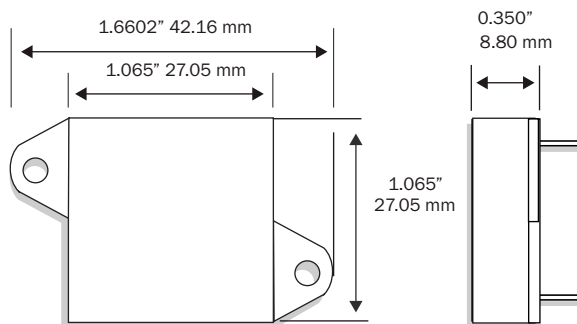
PRELIMINARY

(Pending DLA approval)

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.

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 MILPRF-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. See Table 1.



Interpoint® High Reliability DC-DC Converters

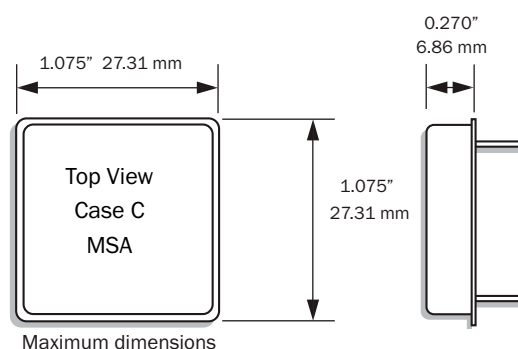
MSA SERIES™ CONVERTERS—5 WATT

- 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.

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.



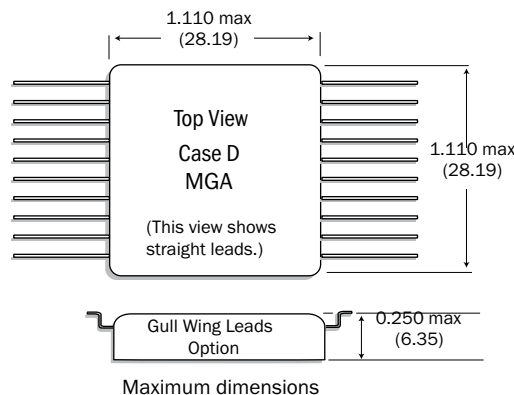
MGA SERIES™ CONVERTERS—5 WATT

- 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.

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

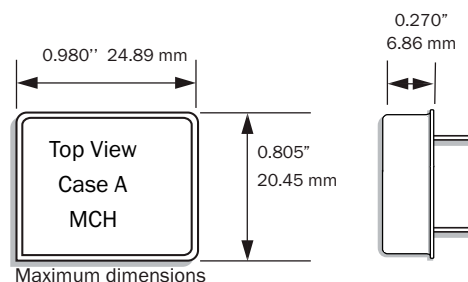
MCH SERIES™ CONVERTERS—1.5 WATT

- 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.

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.



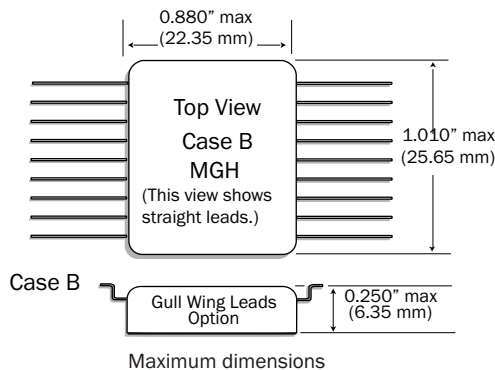
MGH SERIES™ CONVERTERS—1.5 WATT

- 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.

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

DC-DC Converters Power (watts)	0	5	10	20	30	40	70	120
FULLY QUALIFIED MIL/ AEROSPACE EMI FILTERS	FMCE-1528 (15 amps, up to 420 watts at 28 Vin)							
	FMCE-0828 (8 amps, up to 224 watts at 28 Vin)							
	FMCE-0528 (5 amps, up to 140 watts at 28 Vin)							
	FMCE-0328 (3 amps, up to 84 watts at 28 Vin)							
	FME270 (with MHP270 only)							
	FM-704A							
FMCE FILTERS AT 28 V _{IN}	FMSA/ FMGA							
	MSA/MGA	MHF+/MHV			MWR	MFX	MHP270	
	MSA+			MTR		MFL	MOR	
	MCH/ MGH/		MFK					
COMPATIBLE DC-DC CONVERTERS								

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	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	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	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	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	MOR, MFL, MFX, MWR, MTR, MHV, MHF+, MSA+, MSA, MGA, MCH, MGH
FME270-461		0 to 400	1.5	40	Standard or ES See Table 1	MHP270
FMSA-461		0 to 50	0.80	55	Standard, ES, or 883 (Class H-QML) Table 1	MSA, MSA+, and MCH Series
FMGA-461		0 to 50	0.80	55	Standard, ES, or 883 (Class H-QML) Table 1	MGA and MGH Series

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

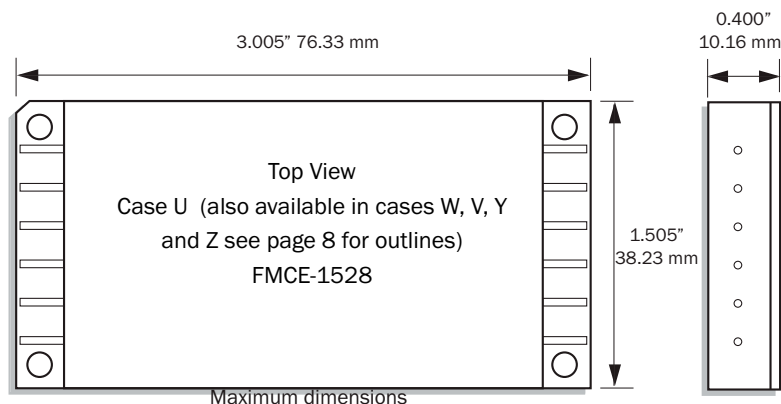
Interpoint® High Reliability EMI Filters

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 FME28461. 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.

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

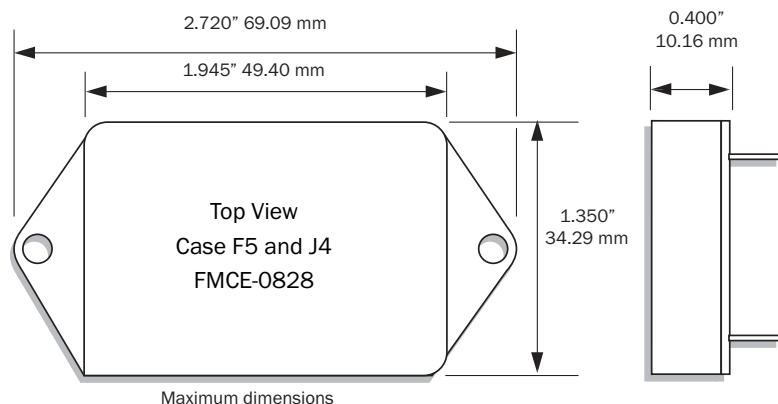
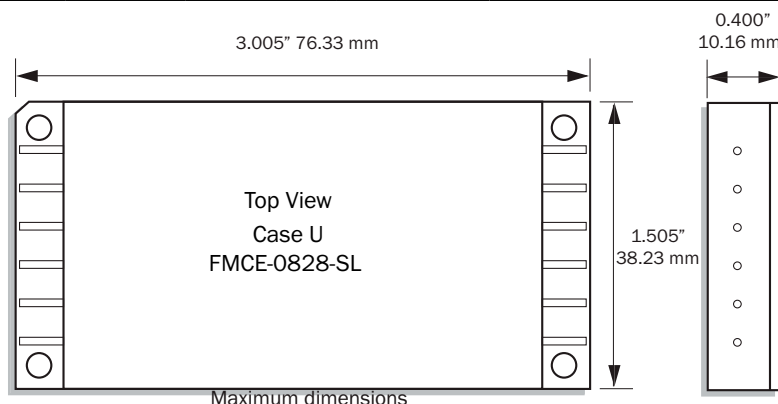


FMCE-0828™ EMI FILTERS— 8 AMP

- 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.

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



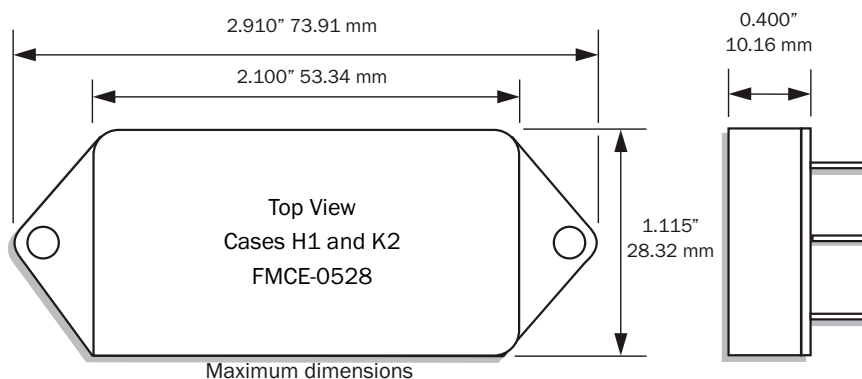
Interpoint® High Reliability EMI Filters

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

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.

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

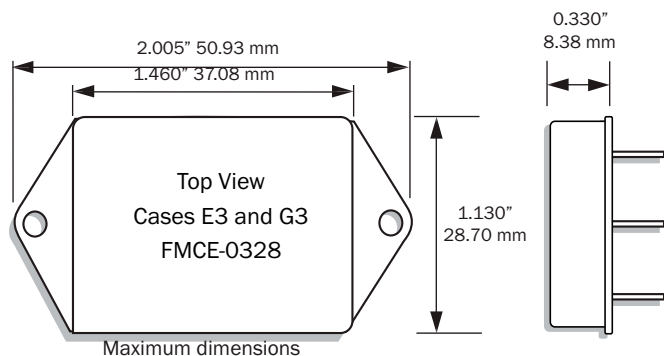


FMCE-0328™ EMI FILTER—3 AMPS

- 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

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.

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



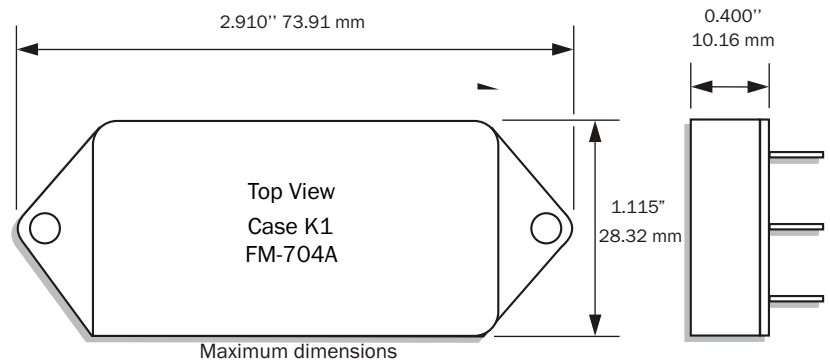
Interpoint® High Reliability EMI Filters

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

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.

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

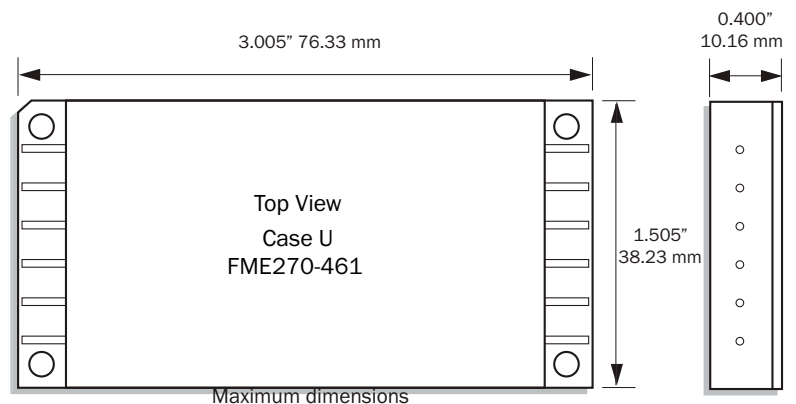


FME270-461™ EMI FILTERS—1.5 AMP

- 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

The FME270-461 filters will bring Interpoint high frequency power supplies into compliance with MILSTD-461's CE03 limits for reflected ripple current. FME270 models are available in a flanged, sideleaded 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 MILPRF-38534). See Table 1.

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



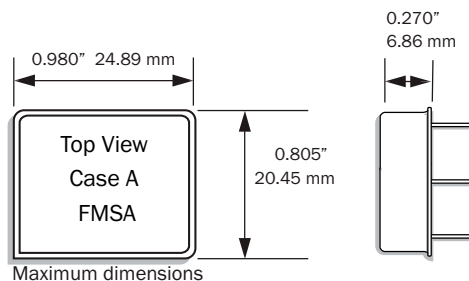
Interpoint® High Reliability EMI Filters

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.

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 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.

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

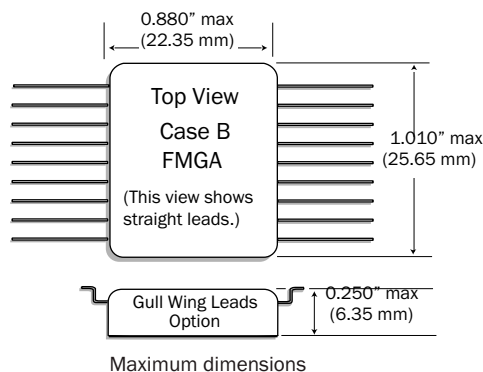


Table is for reference only. See individual Series' datasheets for specific screening.

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, typical⁷					
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 1: 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

1. Standard and /ES products may not meet all of the requirements of MIL-PRF-38534.
2. 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 2: 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: powerapps@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/smcrl/>.
- 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 Multitmode 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

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