

FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

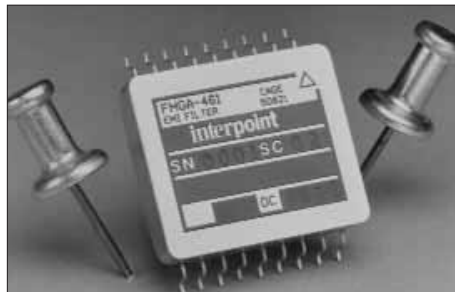
FEATURES

- –55°C to +125°C operation
- 50 dB min. attenuation at 500 kHz differential mode
- 45 dB min. attenuation at 5MHz common mode
- Compliant to MIL-STD-461C, CE03
- Compatible with MIL-STD-704E DC power bus
- Compatible with MIL-STD-704A through E (FMGA)



MODEL

FMSA-461	0.8 amp
FMGA-461	0.8 amp



FMSA SERIES™ EMI FILTER

The FMSA-461 EMI filter modules have been designed as a companion for Interpoint MSA flyback power converters. Multiple MSA power converters can be operated from a single filter provided the total power line current does not exceed the filter maximum rating. The FMSA filter will reduce the MSA's power line reflected ripple current to within the limit of MIL-STD-461C, Method CE03, as shown in the example of Figures 4 and 5.

The FMSA is fabricated using thick film hybrid technology and is sealed in a metal package for military, aerospace and other applications requiring EMI suppression. The filter uses only ceramic capacitors for reliable high temperature operation.

OPERATION

The MSA power converter has an internal 2 μ F capacitor across its input power terminals. When the MSA and FMSA filters are used together, this capacitor becomes part of the filter and forms its final LC output section. When 2 or 3 MSAs are used with a single filter, this capacitor becomes 4 μ F or 6 μ F respectively, rather than 2 μ F, improving the rejection vs. frequency.

The FMSA filter can also be used with other types of Interpoint power converters (MHF, MHF+, MHE, MHD, and DCH series) to

comply with CE03. For MHF, MHF+, MHD, and MHE models, the converter has an LC type line filter such that an inductor is seen looking into its positive input terminal. For these converters, it is necessary to terminate the filter with a capacitor to insure unconditionally stable operation. A capacitor across the filter output terminals of greater than 4 μ F or the optional damping circuit shown on the connection diagram will be adequate for stable operation. No capacitor is required for MSA, or DCH models.

OPTIONAL DAMPING CIRCUIT

The optional damping circuit (Figure 2) can be used to prevent filter overshoot caused by MIL-STD-704A 80 V, or other, transients having rise times of less than 200 μ Sec. This damping can be alternately provided with a 1.50 Ω resistor in series with the filter positive input where the additional line loss can be tolerated. For transients with rise times of greater than 200 μ sec, there is no overshoot and the damping circuit is not required.

LAYOUT REQUIREMENTS

The case of the filter must be connected to the case of the converter through a low impedance connection to minimize EMI.

FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

FMGA SERIES™ EMI FILTER

Interpoint's surface mount FMGA-461™ EMI filter has been designed to work with Interpoint's 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 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 as shown in Figures 4 through 7. The filter uses only ceramic capacitors for reliable high-temperature operation.

CONNECTION AND OPERATION

Where more than one pin has the same designation (e.g. pins 7, 8, and 9 are Positive Output), all of those pins must be connected for output performance to meet the specifications.

The MGA Series has an internal $2\ \mu\text{F}$ capacitor its input terminals and the MGH Series has an internal $0.47\ \mu\text{F}$ capacitor across its input power terminals. When the MGA or MGH converters are used with the FMGA filter, this capacitor becomes part of the filter and forms its final LC output section. When 2 or 3 MGA or MGH converters are used with a single filter, this capacitor becomes larger, improving the rejection versus frequency.

TRANSIENT DAMPING

The optional damping circuit shown in Figure 2 will prevent filter overshoot caused by 80 V transients with rise times of less than 200

microseconds. The damping circuit can be used with a $1.50\ \Omega$ resistor in series with the filter's positive input where the additional line loss can be tolerated. For transients with rise times of greater than 200 microseconds, there is no overshoot and the damping circuit is not required.

SURFACE MOUNT PACKAGE

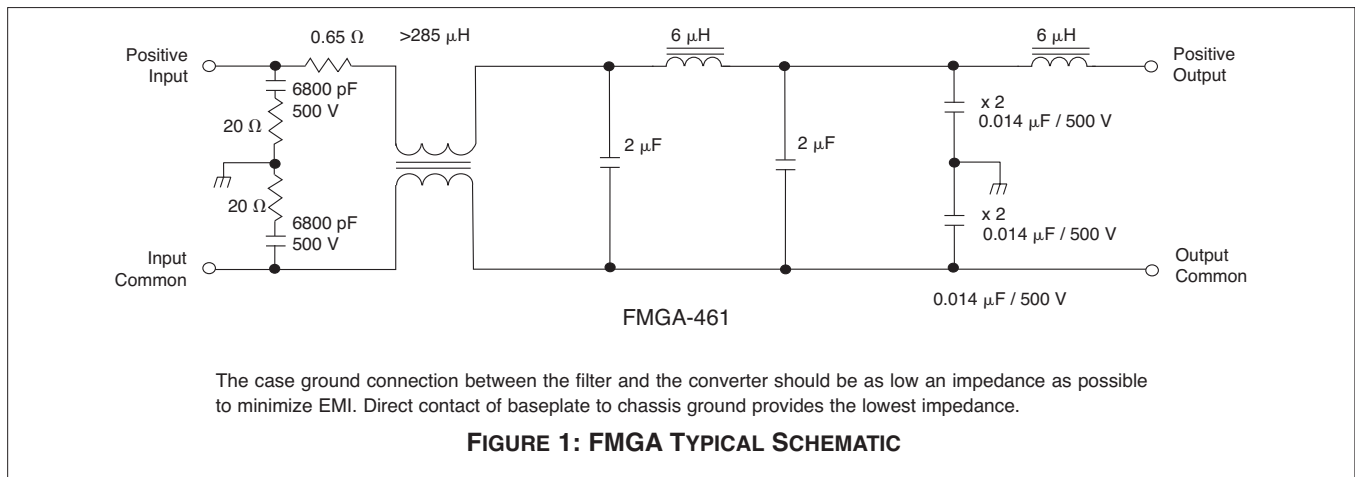
The FMGA EMI filter can be surface mounted with pick-and-place equipment or manually. It is recommended that the case be attached with flexible epoxy adhesive or silicone which is thermally conductive ($>1\ \text{watt /meter/}^\circ\text{K}$).

Internal components are soldered with SN96 (melting temperature 221°C) to prevent damage during reflow. Maximum reflow temperature for surface mounting the FMGA filter is 220°C for a maximum of 30 seconds. SN60, 62, or 63 are the recommended types of solder. Hand soldering should not exceed 300°C for 10 seconds per pin.

The hermetically sealed metal cases are available in two different lead configurations. See case B for dimensions and options.

LAYOUT REQUIREMENTS

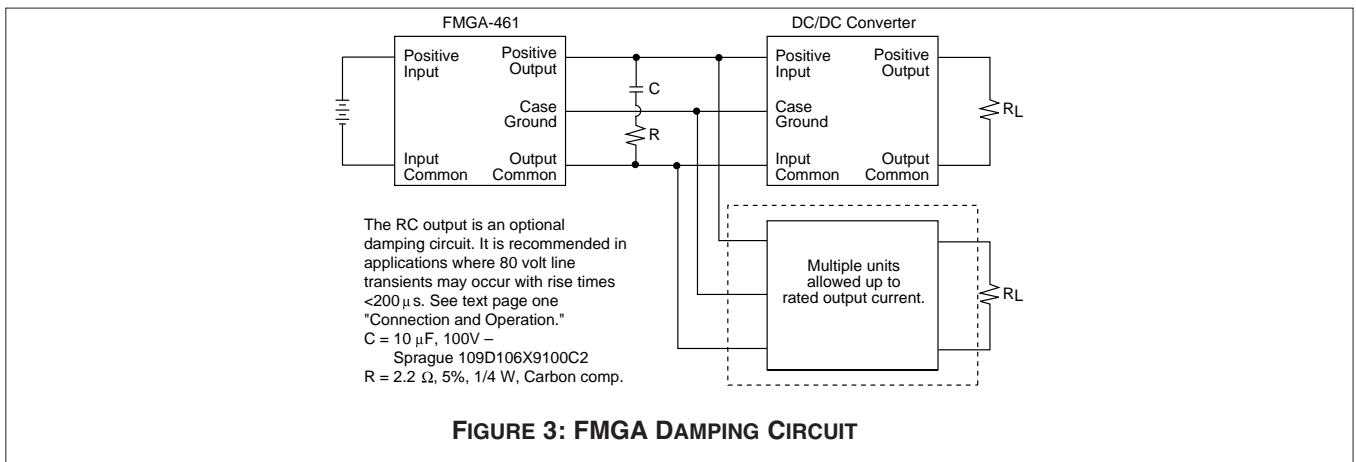
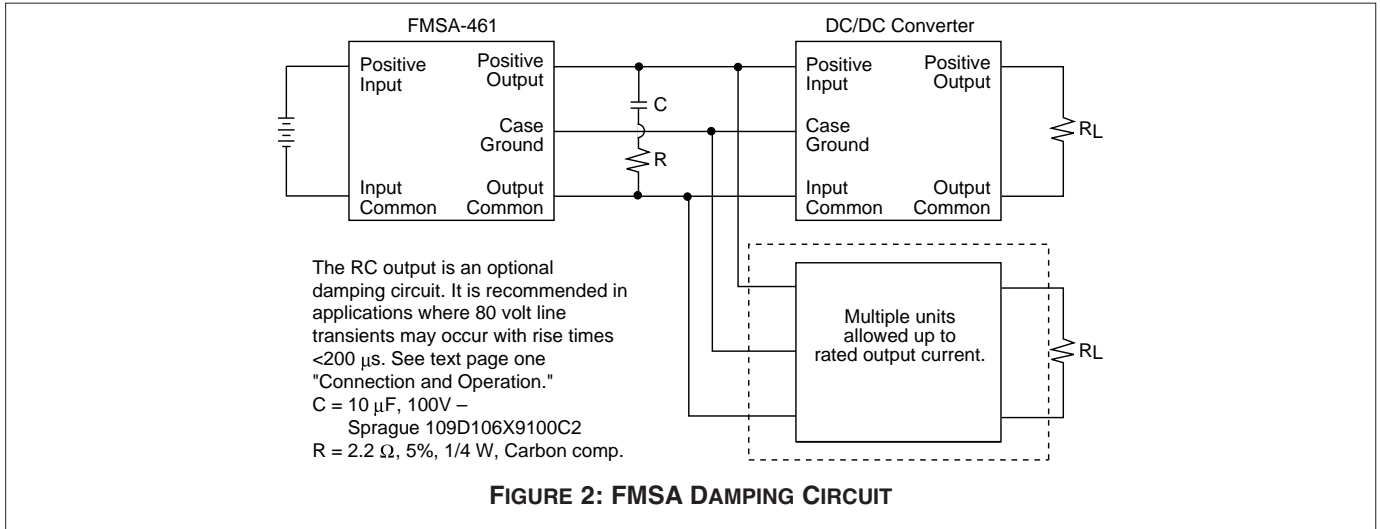
The case of the filter must be connected to the case of the converter through a low impedance connection to minimize EMI.



FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

DAMPING CIRCUITS



FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

OPERATING CONDITIONS AND CHARACTERISTICS

Input Voltage Range

- 0 to 50 VDC continuous FMSA models
- 16 to 40 VDC continuous FMGA models
- 80 V for 100 ms transient

Lead Soldering Temperature (10 sec per lead)

- 300°C

Storage Temperature Range (Case)

- -65°C to +150°C

Case Operating Temperature (Tc)

- -55°C to +125°C full power

Derating Input/Output Current

- Derate linearly from 100% at 100°C to 0.60 amps at 125°C case. Above 125°C derate to 0%.

Capacitance

- 0.045 μF max, any pin to case

Isolation

- 100 megohm minimum at 500 V
- Any pin to case, except case pin

MECHANICAL AND ENVIRONMENTAL

Size (maximum)

FMSA models 0.980 x 0.805 x 0.270 (24.89 x 20.45 x 6.86 mm)

See case A1 for dimensions.

FMGA models 1.010 x 0.880 x 0.250 inches (25.65 x 22.35 x 6.35 mm)

Shown with “gull wing” lead option, also available with straight leads. See case B for dimensions and options.

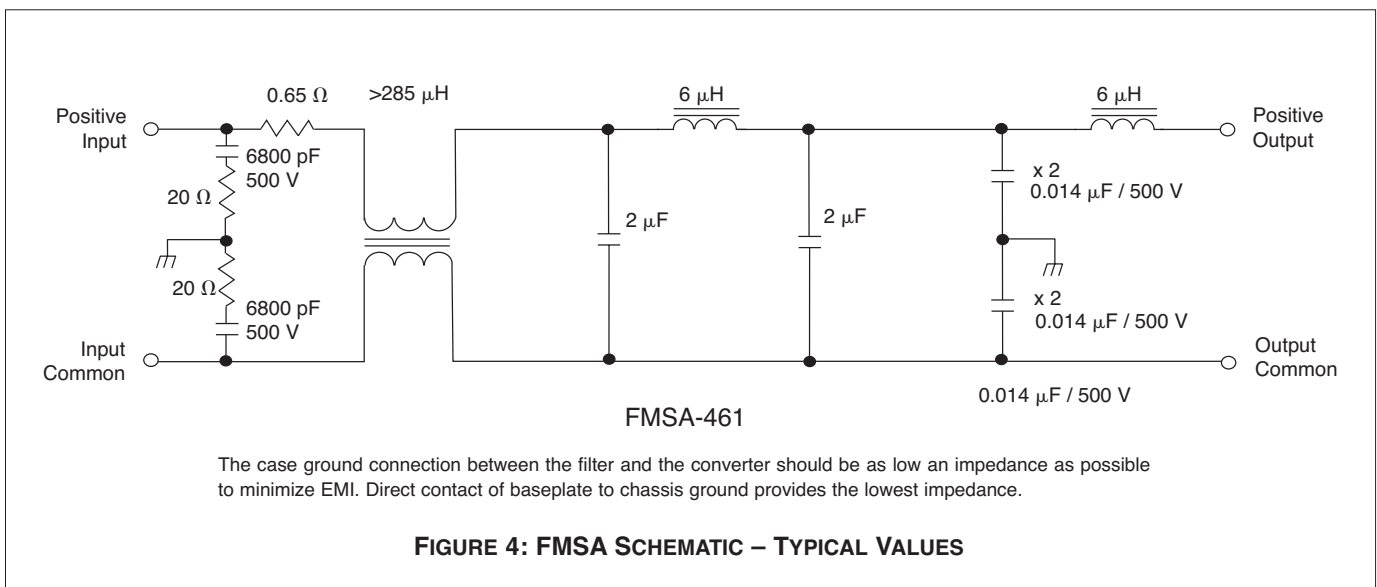
Weight (maximum)

10.3 grams typical, 11.5 grams maximum

Screening*

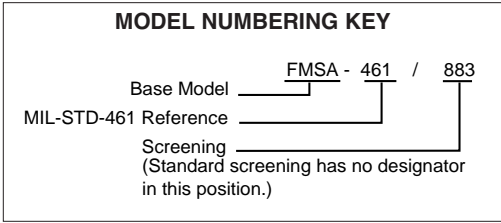
Standard, ES. See “883, Class H, QML Products – Element Evaluation” and “883, Class H, QML Products – Environmental Screening” for more information.

* FMGA model has the option of Class H screening, while FMSA does not.



FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP



DSCC NUMBER	
DSCC DRAWING (5915)	FMSA-461 FILTER SIMILAR PART
96003-01HXC	FMSA-461/883

For exact specifications for a DSCC product, refer to the DSCC drawing. DSCC drawings can be downloaded from: <http://www.dsccl.dla.mil/programs/smcr>

Model Selection

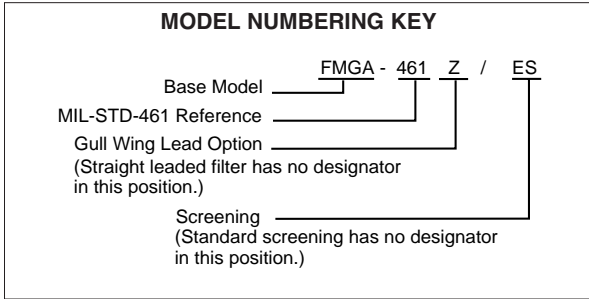
<u>FMSA</u> <i>Base model</i>	<u>461</u> <i>MIL-STD-461 ref.</i>	<u> </u> <i>Screening</i>
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Choose one from each of the following rows

Case option	No case options	
Screening	standard screening, leave blank	/ES (ES screening), /883 (Class H, QML)

FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP



DSCC NUMBER

DSCC DRAWING (5915)	FMGA-461 FILTER SIMILAR PART
96003-01HYC	FMGA-461/883

For exact specifications for a DSCC product, refer to the DSCC drawing. For the gull wing lead option, replace the Y in the DSCC number (HYC) with a Z (HZC). DSCC drawings can be downloaded from:
<http://www.dscclia.mil/programs/smcr>

Model Selection

<u>FMGA</u> <i>Base model</i>	<u>461</u> <i>MIL-STD-461 ref.</i>	<u> </u> <i>Screening</i>
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Choose one from each of the following rows

Case option	straight leaded, leave blank	Gull Wing lead, "Z"
Screening	standard screening, leave blank	/ES (ES screening), /883 (Class H, QML)

FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

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

PARAMETER	CONDITIONS	FMSA-461			UNITS
		MIN	TYP	MAX	
INPUT VOLTAGE	CONTINUOUS	0	28	40	VDC
	TRANSIENT ¹ , 100 ms	—	—	80	V
INPUT CURRENT ¹		—	—	0.80	A
NOISE REJECTION	500 kHz	50	—	—	dB
	1 MHz	50	—	—	
NOISE REJECTION	5 MHz	45	—	—	dB
DC RESISTANCE (R _{DC})	TC = 25°C	—	—	1.2	Ω
OUTPUT VOLTAGE	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN}(R_{DC})$			VDC
OUTPUT CURRENT	STEADY STATE (<100°C CASE)	—	—	0.80	A
INTERNAL POWER DISSIPATION	MAXIMUM CURRENT	—	—	0.96	W

PARAMETER	CONDITIONS	FMGA-461			UNITS
		MIN	TYP	MAX	
INPUT VOLTAGE ¹	CONTINUOUS	0	28	40	VDC
	TRANSIENT 100 ms	—	—	80	V
INPUT CURRENT ¹		—	—	0.80	A
DIFFERENTIAL MODE NOISE REJECTION	500 kHz	55	—	—	dB
	5 MHz	50	—	—	
COMMON MODE NOISE REJECTION	2 MHz - 50 MHz	40	—	—	dB
DC RESISTANCE (R _{DC})	TC = 25°C	—	—	1.2	Ω
OUTPUT VOLTAGE	STEADY STATE	$V_{OUT} = V_{IN} - I_{IN}(R_{DC})$			VDC
OUTPUT CURRENT ¹	STEADY STATE (<100°C CASE)	—	—	0.80	A
INTERNAL POWER DISSIPATION ¹	MAXIMUM CURRENT	—	—	0.77	W

Notes:

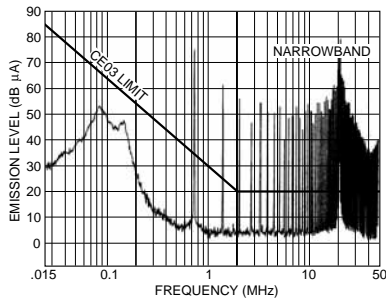
1. Guaranteed by design, not tested.

FMSA/FMGA EMI Input Filters

28 VOLT INPUT – 0.8 AMP

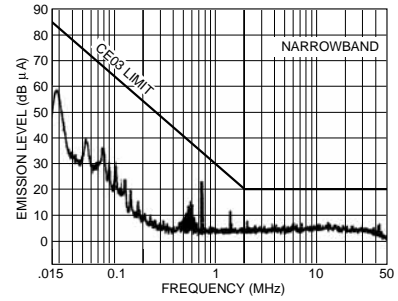
Typical Performance Curves: 25°C Tc, nominal Vin, unless otherwise specified.

FMSA EMI FILTERS



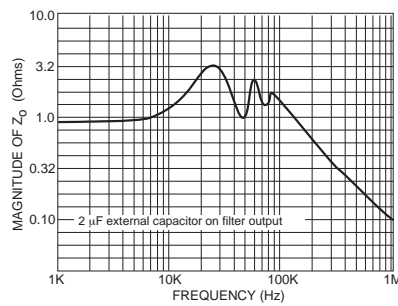
MSA2805S converter without a filter.

FIGURE 7



MSA2805S converters at full load with an FMSA-461 EMI filter

FIGURE 8



Typical Output Impedance (Z)
With Input Shorted
FMSA-461 EMI Filter

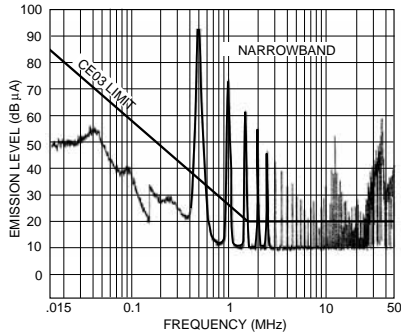
FIGURE 9

FMSA/FMGA EMI Input Filters

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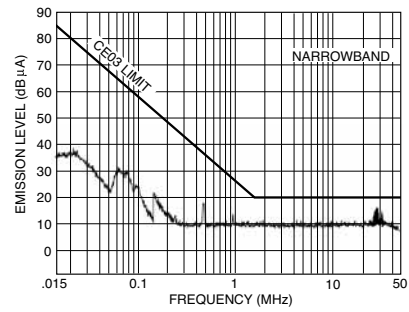
Typical Performance Curves: 25°C Tc, nominal Vin, unless otherwise specified.

FMGA EMI FILTERS



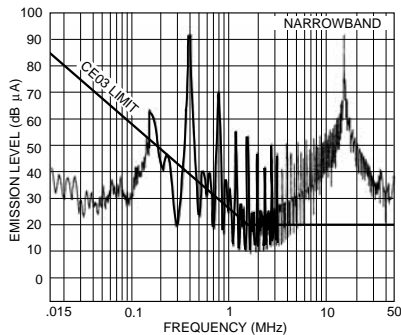
TWO MGA 2805S CONVERTERS AT FULL LOAD
WITHOUT FILTERING
TYPICAL POWER LINE SPECTRAL NOISE CURRENT

FIGURE 10



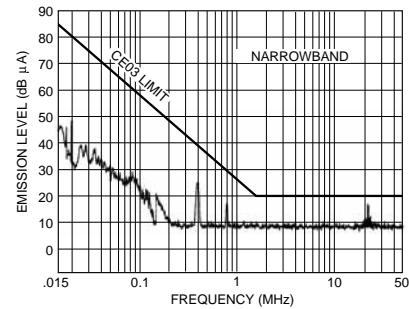
TWO MGA 2805S CONVERTERS AT FULL LOAD
WITH FMGA-461 POWER LINE FILTERING
TYPICAL POWER LINE SPECTRAL NOISE CURRENT

FIGURE 11



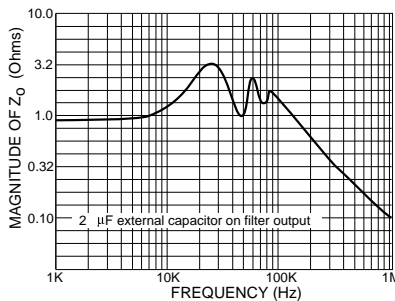
TWO MGH 2805S CONVERTERS AT FULL LOAD
WITHOUT FILTERING
TYPICAL POWER LINE SPECTRAL NOISE CURRENT

FIGURE 12



TWO MGH 2805S CONVERTERS AT FULL LOAD
WITH FMGA-461 POWER LINE FILTERING
TYPICAL POWER LINE SPECTRAL NOISE CURRENT

FIGURE 13



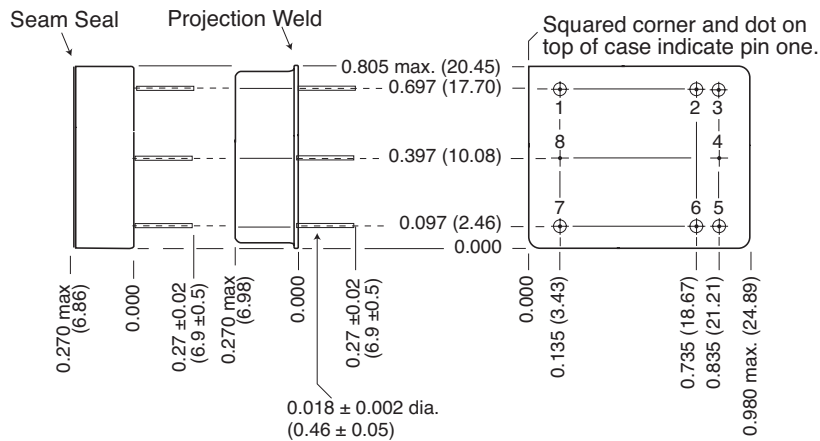
Typical Output Impedance (Z)
With Input Shorted - FMGA

FIGURE 14

FMSA/FMGA EMI Input Filter Cases

28 VOLT INPUT – 0.8 AMP

BOTTOM VIEW CASE A1



Seal hole: 0.056 ±0.002 (1.42 ±0.05)

Case dimensions in inches (mm)

Tolerance ±0.005 (0.13) for three decimal places
 ±0.01 (0.3) for two decimal places
 unless otherwise specified

CAUTION

Heat from reflow or wave soldering may damage the device.
 Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin

Materials

Header Kovar/Nickel/Gold
 Cover Kovar/Nickel
 Pins Kovar/Nickel/Gold matched glass seal

Case A1, Rev C, 20060110

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

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FIGURE 15: CASE A1

FMSA/FMGA EMI Input Filters

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883, CLASS H, QML PRODUCTS – ELEMENT EVALUATION

ELEMENT EVALUATION TEST PERFORMED (COMPONENT LEVEL)	STANDARD (NON-QML) ¹		CLASS H, QML	
	M/S ²	P ³	M/S ²	P ³
Element Electrical (probe)	yes	no	yes	yes
Element Visual	no	no	yes	yes
Internal Visual	no	no	yes	no
Final Electrical	no	no	yes	yes
Wire Bond Evaluation ⁴	no	no	yes	yes
SLAM™/C-SAM: Input Capacitors only (Add'l test, not req. by H or K)	no	no	no	yes

Definitions:

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

SLAM™: Scanning Laser Acoustic Microscopy

C-SAM: C - Mode Scanning Acoustic Microscopy

Notes:

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

FMSA/FMGA EMI Input Filters

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883, CLASS H, QML PRODUCTS – ENVIRONMENTAL SCREENING

TEST	125°C STANDARD non-QML	125°C /ES non-QML	Class H /883 QML
Pre-cap Inspection Method 2017, 2032	yes	yes	yes
Temperature Cycle (10 times) Method 1010, Cond. C, -65°C to 150°C, ambient Method 1010, Cond. B, -55°C to 125°C, ambient	no no	no yes	yes no
Constant Acceleration Method 2001, 3000 g Method 2001, 500g	no no	no yes	yes no
Burn-In Method 1015, 160 hours at 125°C case, typical 96 hours at 125°C case, typical	no no	no yes	yes no
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	no yes	no yes	yes no
Hermeticity Test Fine Leak, Method 1014, Cond. A Gross Leak, Method 1014, Cond. C Gross Leak, Dip (1 x 10 ⁻³)	no no yes	yes yes no	yes yes no
Final Visual Inspection Method 2009	yes	yes	yes

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