FEATURES

- **–55° to +125°C operation**
- **16 to 40 VDC input (19 to 40 VDC for 15 volt outputs)**
- Fully Isolated
- Optocoupler feedback
- Fixed frequency 600 kHz typical
- Forward converter topology
- 50 V for up to 50 ms transient protection
- Inhibit function
- Indefinite short circuit protection
- Up to 83% efficiency, 22 W/in^3

DC/DC CONVERTERS 28 VOLT INPUT

MHF SERIES 12 WATT



MODELS VDC OUTPUT	
SINGLE	DUAL
5	±12
12	±15
15	

Size (max.): 1.460 x 1.130 x 0.330 inches (37.08 x 28.70 x 8.38 mm)
See Section B8, case E1 for dimensions.
Weight: 21 grams typical.
Screening: Standard or ES.
See section C2 for screening options.

DESCRIPTION

The MHF Series™ of DC/DC converters offer up to 12 watts of power from single or dual outputs in a single package over a the full military temperature range. Thick film hybrid manufacturing technology produces high levels of miniaturization, giving the MHF Series converters a low profile (0.330 inch), small board area (1.65 square inches), and high power density (22 watt/in^3).

The parts are packaged in hermetically sealed steel enclosures, making them ideal for use in military, aerospace, and high reliability industrial applications.

DESIGN METHODOLOGY

The MHF converters are switching regulators which use a quasi-square wave, single ended forward converter design with a nominal switching frequency of 600 kHz. Isolation between input and output circuits is provided with a transformer in the forward power loop and a temperature insensitive optical link in the feedback control loop. Output regulation is accomplished with constant frequency pulse width modulation. Both line and load regulation are typically within 10 mV.

On dual output models, the positive output is independently regulated and the negative output is cross-regulated. Figures 7 and 8 illustrate what effects load changes have on the negative output.

Indefinite short circuit protection and overload protection are provided by sensing output load current and restricting the output current to approximately 125% of full load output current. Since the output current is sensed in the secondary stage, the result is a predictable, constant output current control with no foldback characteristics. MHF converters are provided with internal filtering elements on both the input and output to help reduce the need for external components. For information about filtering to meet MIL-STD-461's CE03 test, contact your Interpoint representative.

WIDE VOLTAGE RANGE

The MHF Series is designed to provide full power operation over the input voltage range of 16 to 40 volts. The 15 volt models provide a 19 to 40 volt range. Operation below 16 volts (or 19 volts for the 15 volt models), including operation in MIL-STD-704E emergency power conditions, is possible with derated output power. Please refer to the low line drop-out graphs, Figures 9 and 10.

MILITARY TEMPERATURE RANGE

The MHF Series provides full power operation at case temperatures from –55°C up to +125°C. All 12 and 15 volt models in both single and dual output configurations provide full power operation at +125°C with derated power to 135°C. The +5 volt model provides full power at 110°C derated to 0% at 130°C. Depending on operating levels, air flow, and ambient temperature; heat sinking may be required.

INHIBIT FEATURE

An inhibit terminal is provided that can be used to disable internal switching, resulting in a very low quiescent input current. An open collector TTL compatible low (≤0.8V) is required to control the inhibit function. This level may be supplied by an open collector gate since the inhibit pin is provided with an internal pull-up resistor.

MHF SERIES
12 WATT

DC/DC CONVERTERS

ABSOLUTE MAXIMUM RATINGS

Input Voltage
- 16 to 40 VDC (19 to 40 VDC 15 volt output)

Output Power
- 12 watts (10 watts MHF2805S)

Lead Soldering Temperature (10 sec per lead)
- 300°C

Storage Temperature Range (Case)
- –55°C to +135°C

INHIBIT

Inhibit TTL Open Collector
- Logic low (output disabled)
  Logic low 0.8 V max
  Inhibit pin current 4 mA max
- Referenced to input common
- Logic high (output enabled)
  Open collector

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range
- 16 to 40 VDC continuous
- 19 to 40 VDC 15 volt outputs continuous
- 50 V for 50 msec transient

Case Operating Temperature (Tc)
- –55°C to +125°C full power
- –55°C to +110°C full power for MHF2805S
- –55°C to +135°C absolute
- –55°C to +130°C absolute for MHF2805S

Derating Output Power/Current
- Linearly from 100% at 125°C to 0% at 135°C
- Linearly from 100% at 110°C to 0% at 130°C for MHF2805S

TYPICAL CHARACTERISTICS

Output Voltage Temperature Coefficient
- 150 ppm/°C, typical

Input to Output Capacitance
- 50 pF, typical

Current Limit
- 125% of full load, typical

Isolation
- 100 megohm minimum at 500 V

Conversion Frequency
- 600 kHz typical

Inhibit Pin Voltage (unit enabled)
- 8 to 11 V

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

SINGLE OUTPUT MODELS		MHF2805S			MHF2812S			MHF2815S			
PARAMETER	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
OUTPUT VOLTAGE		4.95	5.0	5.05	11.88	12	12.12	14.85	15	15.15	VDC
OUTPUT CURRENT		—	—	2.0	—	—	1.0	—	—	0.8	A
OUTPUT POWER	MIN. TO MAX. V_{IN}	—	—	10	—	—	12	—	—	12	W
OUTPUT RIPPLE	10 kHz to 2 MHz	—	40	60	—	30	60	—	25	50	mV p-p
LINE REGULATION	MIN. TO MAX. V_{IN}	—	10	50	—	10	50	—	10	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	10	50	—	10	50	—	10	50	mV
INPUT VOLTAGE	CONTINUOUS	16	28	40	16	28	40	19	28	40	VDC
	TRANSIENT 50 ms	—	—	50	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	20	30	—	20	30	—	20	30	mA
	FULL LOAD	—	—	483	—	—	557	—	—	535	
	INHIBITED	—	2	3	—	2	3	—	2	3	
INPUT RIPPLE CURRENT	10 kHz TO 2 MHz	—	135	180	—	150	200	—	150	220	mA p-p
EFFICIENCY		74	77	—	77	81	—	80	83	—	%
LOAD FAULT[1]	POWER DISSIPATION OVERLOAD	—	—	5	—	—	5	—	—	5	W
	SHORT CIRCUIT	—	–	3.5	—	—	2.8	—	—	2	
START-UP	DELAY	—	180	300	—	80	200	—	150	250	ms

Notes
1. Indefinite short circuit protection not guaranteed above 125°C case temperature (110°C case for MHF2805S).

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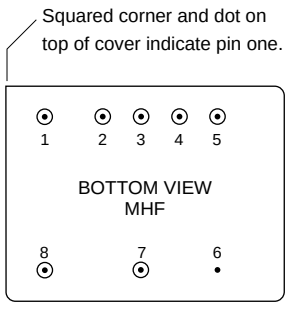
Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

DUAL OUTPUT MODELS		MHF2812D			MHF2815D			
PARAMETER	**CONDITION**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
OUTPUT VOLTAGE	$+V_{OUT}$	11.88	12.0	12.12	14.85	15.0	15.15	VDC
	$-V_{OUT}$	11.82	12.0	12.18	14.77	15.0	15.23	
OUTPUT CURRENT[1, 2]		—	0.5	1.0	—	0.4	0.8	A
OUTPUT POWER[2]	$+V_{OUT}$	—	—	10.8	—	—	10.8	W
	$-V_{OUT}$	—	—	10.8	—	—	10.8	
	TOTAL	—	—	12	—	—	12	
OUTPUT RIPPLE VOLTAGE	10 kHz TO 2 MHz	—	30	60	—	30	60	mV p-p
LINE REGULATION MIN. TO MAX. V_{IN}	$+V_{OUT}$	—	5	50	—	5	50	mV
LOAD REGULATION NO LOAD TO FULL	$+V_{OUT}$	—	5	50	—	10	50	mV
CROSS REGULATION	20% TO 80% LOAD[3]	—	5	10	—	4	8	%
	50% LOAD[4]	—	4	5	—	3	5	
INPUT VOLTAGE	CONTINUOUS	16	28	40	19	28	40	VDC
NO LOAD TO FULL	TRANSIENT 50 ms	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	25	35	—	25	35	mA
	FULL LOAD	—	—	550	—	—	536	
	INHIBITED	—	1.9	3	—	1.9	3	
INPUT RIPPLE CURRENT	10 kHz TO 2 MHz	—	175	240	—	175	240	mA p-p
EFFICIENCY		78	81	—	80	83	—	%
LOAD FAULT[5]	POWER DISSIPATION SHORT CIRCUIT	—	—	2.8	—	—	2	W
	OVERLOAD	—	—	5	—	—	5	
START-UP	DELAY	—	150	250	—	150	250	ms

Notes
1. Applies to both outputs.
2. Maximum combined output power is 12 watts. A maximum of 90% is available from either output.
3. 20% to 80% load on the positive output and 80% to 20% on the negative output. See Figure 8.
4. 50% load on the positive output and 50% to 20% load on the negative output. 50% load on the negative output and 50% to 20% load on the positive output. See Figure 7.
5. Indefinite short circuit protection not guaranteed above 125°C case temperature.

PIN OUT

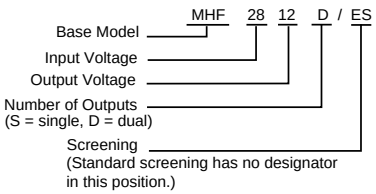
Pin	Single Output	Dual Output
1	Inhibit	Inhibit
2	No connection	Positive Output
3	Output Common	Output Common
4	Positive Output	Negative Output
5	No connection	No connection
6	Case Ground	Case Ground
7	Input Common	Input Common
8	Positive Input	Positive Input



See Section B8, case E1, for dimensions.

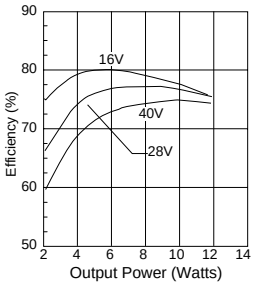
FIGURE 1: PIN OUT

MODEL NUMBER KEY



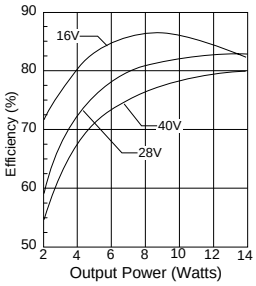
DC/DC CONVERTERS

Typical Performance Curves: 25°C Tc , 28 VDC Vin, 100% load, unless otherwise specified.



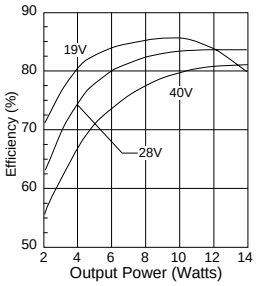
MHF2805S Efficiency

FIGURE 2



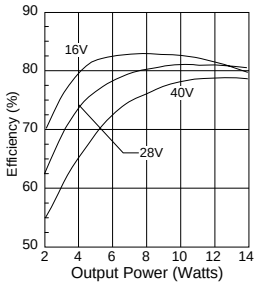
MHF2812S Efficiency

FIGURE 3



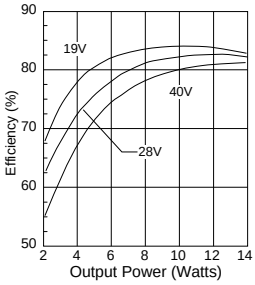
MHF2815S Efficiency

FIGURE 4



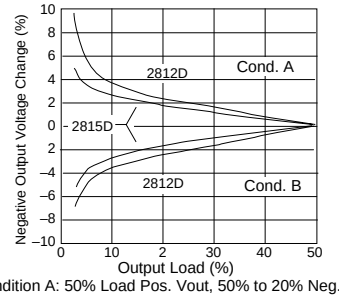
MHF2812D Efficiency

FIGURE 5



MHF2815D Efficiency

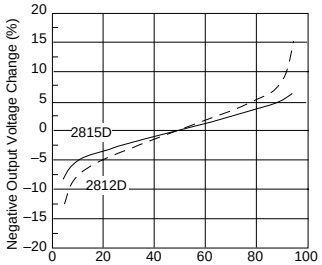
FIGURE 6



Condition A: 50% Load Pos. Vout, 50% to 20% Neg. Vout
Condition B: 50% Load Neg. Vout, 50% to 20% Pos. Vout

MHF Negative Output Voltage
Cross Regulation

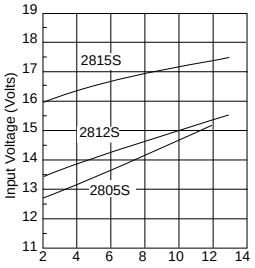
FIGURE 7



Positive Output 20% to 80% Load
Negative Output 80% to 20% Load

MHF Dual Negative Output Voltage
Cross Regulation

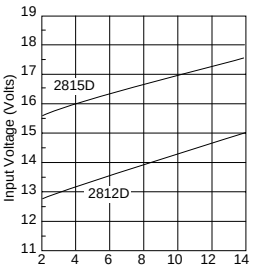
FIGURE 8



50 mV Drop

MHF Single Low Line Dropout

FIGURE 9



50 mV Drop

MHF Dual Low Line Dropout

FIGURE 10

218211-001-DTS Rev A DQ# 1011

All technical 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. MHF Series is a trademark of Interpoint.
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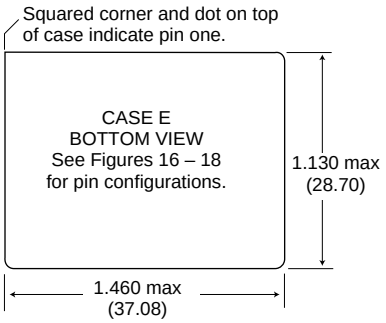

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Kovar/Nickel (SMHF Series Cold Rolled Steel/Nickel/Gold)
Pins	#52 alloy/Gold compression glass seal

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.

FIGURE 15: CASE E MAXIMUM DIMENSIONS

BOTTOM VIEW CASE E1

MHF+ Series Single and Dual: Screening – Standard, ES, or 883
MHF Series and LIM5050 Module: Screening – Standard or ES
SMHF Series Single and Dual and SLIM5050 Module:
Screening – Space Standard, H, or K
HR120 Series: No screening options

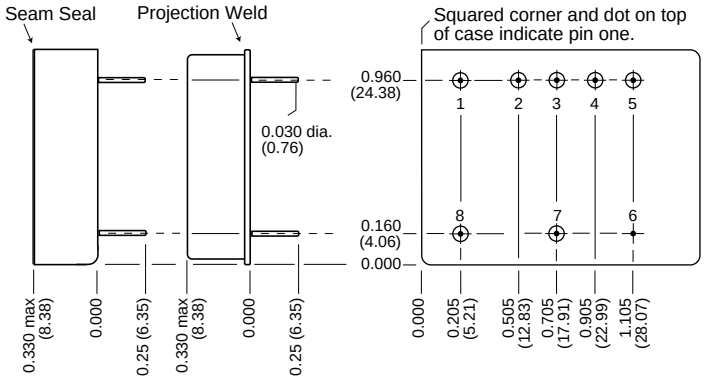

FIGURE 16: CASE E1

Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.

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125°C PRODUCTS

TEST (125°C Products)	STANDARD	/ES	/883 (Class H)*
PRE-CAP INSPECTION			
Method 2017, 2032	yes	yes	yes
TEMPERATURE CYCLE (10 times)			
Method 1010, Cond. C, -65°C to 150°C	no	no	yes
Method 1010, Cond. B, -55°C to 125°C	no	yes	no
CONSTANT ACCELERATION			
Method 2001, 3000 g	no	no	yes
Method 2001, 500 g	no	yes	no
BURN-IN			
Method 1015, 160 hours at 125°C	no	no	yes
96 hours at 125°C case (typical)	no	yes	no
FINAL ELECTRICAL TEST MIL-PRF-38534, Group A			
Subgroups 1 through 6: -55°C, +25°C, +125°C	no	no	yes
Subgroups 1 and 4: +25°C case	yes	yes	no
HERMETICITY TESTING			
Fine Leak, Method 1014, Cond. A	no	yes	yes
Gross Leak, Method 1014, Cond. C	no	yes	yes
Gross Leak, Dip (1×10^{-3})	yes	no	no
FINAL VISUAL INSPECTION			
Method 2009	yes	yes	yes

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

*883 products are built with element evaluated components and are 100% tested and guaranteed over the full military temperature range of –55°C to +125°C.

Applies to the following products

MOR Series	MHD Series	MGH Series	FMGA EMI Filter
MFLHP Series	MHV Series	MCH Series	FMSA EMI Filter
MFL Series	MHF+ Series	FM-704A EMI Filter	HUM Modules**
MHP Series	MHF Series**	FMD**/FME EMI Filter	LCM Modules**
MTR Series	MGA Series	FMC EMI Filter	LIM Modules
MQO Series**	MSA Series	FMH EMI Filter	

**MFLHP Series, MQO Series, MHF Series, FMD EMI Filters, Hum Modules, and LCM Modules do not offer ‘883” screening.

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