

FEATURES

- -55° to +125°C operation
- 16 to 40 VDC input
- Fully isolated
- Optocoupler feedback
- Fixed frequency, 550 kHz typical
- Topology – Single Ended Forward
- 50 V for up to 50 ms transient protection
- Inhibit and sync functions
- Indefinite short circuit protection
- Undervoltage lockout
- Up to 84% efficiency, 28 W/in³

DC/DC CONVERTERS 28 VOLT INPUT



Size (max.): Non flanged 1.460 x 1.130 x 0.330 (37.08 x 28.70 x 8.38 mm)
Flanged 2.005 x 1.130 x 0.330 (50.93 x 28.70 x 8.38 mm)
Weight: 30 grams maximum.
Screening: Standard, ES, or 883 (Class H).

MHF+ SERIES SINGLE & DUAL 15 WATT

| MODELS | |
|------------|------|
| VDC OUTPUT | |
| SINGLE | DUAL |
| 3.3 | ±5 |
| 5 | ±12 |
| 5.2 | ±15 |
| 12 | |
| 15 | |
| 28 | |

DESCRIPTION

The MHF+ Series™ of high frequency DC/DC converters offers a wide input voltage range of 16 to 40 volts and up to 15 watts of output power. The units are capable of withstanding short term transients up to 50 volts. The package is a hermetically sealed, welded metal case. Flanged and non-flanged models are available.

CONVERTER DESIGN

The MHF+ converters are switching regulators that use a quasi-square wave, single-ended forward converter design with a constant switching frequency of 550 kHz. Isolation between input and output circuits is provided with a transformer in the forward path and a temperature compensated optical link in the feedback control loop.

For the MHF+ dual output models, good cross regulation is maintained by tightly coupled output magnetics. Up to 90% of the total output power (80% on 2805D) is available from either output, providing the opposite output is simultaneously carrying 10% of the total output power (20% on 2805D models). Predictable current limit is accomplished by directly monitoring the output load current and providing a constant current output above the overload point.

HIGHER POWER DENSITY

The MHF+ Series offers a new standard of performance for small size and high power density. At just 0.33 inch high and a total footprint of 1.7 in², this low profile package offers a total power density of up to 28 watts per cubic inch.

LOW NOISE, HIGH AUDIO REJECTION

The MHF+ converters' feed-forward compensation system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB. Typical output voltage response for a 50% to 100% step load transient is as low as 1.3% with a 150 msec recovery time. Input ripple current is typically 35 mA p-p with output ripple voltage typically 30 mV p-p.

INHIBIT FUNCTION

MHF+ converters provide an inhibit terminal that can be used to disable internal switching, resulting in no output and very low quiescent input current. The converter is inhibited when a TTL compatible low (≤ 0.8 – output disabled) is applied to the inhibit pin. The unit is enabled when the pin, which is internally connected to a pull-up resistor, is left unconnected or is connected to an open-collector gate. The open circuit output voltage associated with the inhibit pin is 8.5 to 12 V. In the inhibit mode, a maximum of 4 mA must be sunk from the inhibit pin.

SYNCHRONIZATION

A synchronization feature is included with the MHF+ Series that allows the user to match the switching frequency of the converter to the frequency of the system clock. An external synchronization feature is included that allows the user to adjust the nominally 550 kHz operating frequency to any frequency within the range of 500 kHz to 600 kHz. This is initiated by applying a TTL compatible input of the desired frequency to pin 5.

SHORT CIRCUIT PROTECTION

MHF+ Series converters provide short circuit protection by restricting the output current to approximately 115% of the full load output current. The output current is sensed in the secondary stage to provide highly predictable and accurate current limiting, and to eliminate foldback characteristics.

UNDERVOLTAGE LOCKOUT

Undervoltage lockout prevents the units from operating below approximately 12 VDC input voltage to keep system current levels smooth, especially during initialization or re-start operations.

MHF+ SERIES DC/DC CONVERTERS

SINGLE AND DUAL

15 WATT

ABSOLUTE MAXIMUM RATINGS

- Input Voltage**
- 16 to 40 VDC
- Power Dissipation (Pd)**
- 6 W
- Output Power**
- 12 to 15 watts depending on model
- Lead Soldering Temperature (10 sec per lead)**
- 300°C
- Storage Temperature Range (Case)**
- -65°C to +150°C

RECOMMENDED OPERATING CONDITIONS

- Input Voltage Range**
- 16 to 40 VDC continuous
 - 50 V for up to 50 msec transient
- Case Operating Temperature (Tc)**
- -55°C to +125°C full power
 - -55°C to +135°C absolute
- Derating Output Power/Current (Tc)**
- Linearly from 100% at 125°C to 0% at 135°C

SYNC AND INHIBIT

- Sync In (500 to 600 kHz)**
- Duty cycle 40% to 60%
 - Logic low 0.8 V max
 - Logic high 4.5 V min, 5 V max
 - Referenced to input common
 - If not used, connect to input common
- Inhibit TTL Open Collector**
- Logic low (output disabled)
 - Logic low voltage ≤ 0.8 V
 - Inhibit pin current 4.0 mA max
 - Referenced to input common
 - Logic high (output enabled)
 - Open collector or unconnected

TYPICAL CHARACTERISTICS

- Output Voltage Temperature Coefficient**
- 100 ppm/°C typical
 - 150 ppm/°C maximum
- Input to Output Capacitance**
- 60 pF typical
- Undervoltage Lockout**
- 12 V input typical
- Current Limit**
- 115% of full load typical
- Isolation**
- 100 megohm minimum at 500 V
- Audio Rejection**
- 50 dB typical
- Conversion Frequency (55°C to +125°C Tc)**
- Free run 550 kHz typical
 - 480 kHz min, 620 kHz max
- Inhibit Pin Voltage (unit enabled)**
- 8.5 to 12 V

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

| SINGLE OUTPUT MODELS | | MHF+283R3S | | | MHF+2805S | | | MHF+285R2S | | | UNITS |
|-------------------------------|---|------------|------|------|-----------|------|------|------------|------|-------|--------|
| PARAMETER | CONDITION | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | | 3.27 | 3.30 | 3.33 | 4.95 | 5.00 | 5.05 | 5.16 | 5.20 | 5.24 | VDC |
| OUTPUT CURRENT | V _{IN} = 16 to 40 VDC | 0 | — | 2.4 | 0 | — | 2.4 | 0 | — | 2.4 | A |
| OUTPUT POWER | V _{IN} = 16 to 40 VDC | 0 | — | 8 | 0 | — | 12 | 0 | — | 12.48 | W |
| OUTPUT RIPPLE VOLTAGE | 10 kHz - 2 MHz Tc = -55°C to +125°C | — | 30 | 80 | — | 30 | 80 | — | 30 | 50 | mV p-p |
| LINE REGULATION | V _{in} = 16 to 40 VDC | — | 5 | 100 | — | 5 | 50 | — | 5 | 35 | mV |
| LOAD REGULATION | NO LOAD TO FULL | — | 20 | 50 | — | 20 | 50 | — | 20 | 35 | mV |
| INPUT VOLTAGE NO LOAD TO FULL | CONTINUOUS | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | VDC |
| | TRANSIENT 50 ms | — | — | 50 | — | — | 50 | — | — | 50 | V |
| INPUT CURRENT | NO LOAD | — | 25 | 65 | — | 25 | 40 | — | 25 | 42 | mA |
| | FULL LOAD | — | — | 397 | — | 560 | 624 | — | 560 | 605 | |
| | INHIBITED | — | 5 | 12 | — | 5 | 12 | — | 5 | 12 | |
| INPUT RIPPLE CURRENT | 10 kHz - 10 MHz Tc = -55°C to +125°C | — | 45 | 80 | — | 35 | 80 | — | 35 | 100 | mA pp |
| | | — | — | 120 | — | — | 100 | — | — | 100 | |
| EFFICIENCY | | 72 | 75 | — | 75 | 77 | — | 75 | 77 | — | % |
| LOAD FAULT ¹ | SHORT CIRCUIT | — | 5 | 8 | — | 3.5 | 6 | — | 3.5 | 6 | W |
| | POWER DISSIPATION RECOVERY ² | — | 7.5 | 30 | — | 7.5 | 30 | — | 7.5 | 30 | |
| STEP LOAD RESP. | 50% - 100% - 50% | | | | | | | | | | mV pk |
| | TRANSIENT RECOVERY ² | -400 | 150 | 500 | -400 | 150 | 400 | -400 | 150 | 400 | |
| | | — | 150 | 300 | — | 150 | 300 | — | 150 | 300 | μs |
| STEP LINE RESP. | 16 - 40 - 16 VDC | | | | | | | | | | mV pk |
| | TRANSIENT ³ | -800 | 550 | 800 | -800 | 550 | 800 | -800 | 550 | 800 | |
| | RECOVERY ² | — | 0.8 | 1.2 | — | 0.8 | 1.2 | — | 0.8 | 1.2 | ms |
| START-UP | DELAY | — | 10 | 25 | — | 10 | 25 | — | 10 | 25 | ms |
| | OVERSHOOT ⁴ | — | 200 | 300 | — | 100 | 600 | — | 100 | 600 | mV pk |

Notes

1. Indefinite short circuit protection not guaranteed above 125°C (case)
2. Recovery time is measured from application of the transient to the point at which Vout is within regulation.
3. Input step transition time >10 μs.
4. Input step transition time <100 μs.

DC/DC CONVERTERS

MHF+ SERIES SINGLE AND DUAL 15 WATT

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

| SINGLE OUTPUT MODELS | | MHF+2812S | | | MHF+2815S | | | MHF+2828S | | | UNITS |
|-------------------------------|----------------------------------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|--------|
| PARAMETER | CONDITION | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | | 11.88 | 12.00 | 12.12 | 14.85 | 15.00 | 15.15 | 27.72 | 28.00 | 28.28 | VDC |
| OUTPUT CURRENT | V _{IN} = 16 to 40 VDC | 0 | — | 1.25 | 0 | — | 1.00 | 0 | — | 0.54 | A |
| OUTPUT POWER | V _{IN} = 16 to 40 VDC | 0 | — | 15 | 0 | — | 15 | 0 | — | 15 | W |
| OUTPUT RIPPLE VOLTAGE | 10 kHz - 2 MHz | — | 30 | 80 | — | 30 | 80 | — | 60 | 120 | mV p-p |
| | T _c = -55°C to +125°C | — | 50 | 120 | — | 50 | 120 | — | 100 | 180 | |
| LINE REGULATION | V _{in} = 16 to 40 VDC | — | 5 | 50 | — | 5 | 50 | — | 50 | 150 | mV |
| LOAD REGULATION | NO LOAD TO FULL | — | 20 | 50 | — | 20 | 50 | — | 50 | 150 | mV |
| INPUT VOLTAGE NO LOAD TO FULL | CONTINUOUS | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | VDC |
| | TRANSIENT 50 ms | — | — | 50 | — | — | 50 | — | — | 50 | V |
| INPUT CURRENT | NO LOAD | — | 25 | 50 | — | 25 | 62 | — | 25 | 60 | mA |
| | FULL LOAD | — | 680 | 752 | — | 670 | 752 | — | 640 | 760 | |
| | INHIBITED | — | 5 | 12 | — | 5 | 12 | — | 5 | 12 | |
| INPUT RIPPLE CURRENT | 10 kHz - 10 MHz | — | 35 | 80 | — | 35 | 80 | — | 35 | 80 | mA pp |
| | T _c = -55°C to +125°C | — | — | 120 | — | — | 120 | — | — | 120 | |
| EFFICIENCY | | 78 | 79 | — | 78 | 80 | — | 82 | 84 | — | % |
| LOAD FAULT ¹ | SHORT CIRCUIT | — | — | — | — | — | — | — | — | — | W |
| | POWER DISSIPATION | — | 3.5 | 6 | — | 3.5 | 6 | — | 3.5 | 6 | |
| | RECOVERY ² | — | 7.5 | 30 | — | 7.5 | 30 | — | 7.5 | 30 | |
| STEP LOAD RESP. | 50% - 100% - 50% | — | — | — | — | — | — | — | — | — | mV pk |
| | TRANSIENT | -500 | 150 | 500 | -600 | 200 | 600 | -800 | 600 | 800 | |
| | RECOVERY ² | — | 150 | 300 | — | 150 | 300 | — | 200 | 400 | |
| STEP LINE RESP. | 16 - 40 - 40 VDC | — | — | — | — | — | — | — | — | — | mV pk |
| | TRANSIENT ³ | -800 | 550 | 800 | -800 | 550 | 800 | -1200 | 1100 | 1200 | |
| | RECOVERY ² | — | 0.8 | 1.2 | — | 0.8 | 1.2 | — | 0.8 | 1.2 | |
| START-UP | DELAY | 0 | 10 | 25 | 0 | 10 | 25 | 0 | 10 | 25 | ms |
| | OVERSHOOT ⁴ | 0 | 200 | 1200 | 0 | 200 | 1500 | 0 | 200 | 280 | mV pk |

Notes

- Indefinite short circuit protection not guaranteed above 125°C (case)
- Recovery time is measured from application of the transient to point at which V_{out} is within regulation.
- Input step transition time >10 μs.
- Input step transition time <100 μs.

MHF+ SERIES SINGLE AND DUAL 15 WATT

DC/DC CONVERTERS

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

| DUAL OUTPUT MODELS | | MHF+2805D | | | MHF+2812D | | | MHF+2815D | | | UNITS |
|--|--------------------------------|-----------|------|------|-----------|--------|-------|-----------|--------|-------|--------|
| PARAMETER | CONDITIONS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | +V _{OUT} | 4.95 | 5.00 | 5.05 | 11.88 | 12.00 | 12.12 | 14.85 | 15.00 | 15.15 | VDC |
| | -V _{OUT} | 4.92 | 5.00 | 5.08 | 11.82 | 12.00 | 1218 | 14.78 | 15.00 | 15.23 | |
| OUTPUT CURRENT ¹ | V _{IN} = 16 to 40 VDC | — | ±1.2 | 1.92 | — | ±0.625 | 1.125 | — | ±0.500 | 0.900 | A |
| OUTPUT POWER ¹ | V _{IN} = 16 to 40 VDC | — | — | 12 | — | — | 15 | — | — | 15 | W |
| OUTPUT RIPPLE VOLTAGE ±V _{OUT} | 10 kHz - 2 MHz | — | 30 | 80 | — | 30 | 80 | — | 30 | 80 | mV p-p |
| | Tc = -55°C to +125°C | — | 60 | 120 | — | 60 | 120 | — | 50 | 120 | |
| LINE REGULATION Vin = 16 to 40 VDC | BALANCED +V _{OUT} | — | 5 | 50 | — | 5 | 50 | — | 5 | 50 | mV |
| | LOAD -V _{OUT} | — | — | 80 | — | — | 100 | — | — | 100 | |
| LOAD REGULATION | BALANCED +V _{OUT} | — | 20 | 50 | — | 20 | 50 | — | 20 | 50 | mV |
| | LOAD -V _{OUT} | — | — | 100 | — | — | 100 | — | — | 100 | |
| CROSS REGULATION ² | NEGATIVE V _{OUT} | — | 6 | 7.5 | — | 3 | 6 | — | 3 | 6 | % |
| INPUT VOLTAGE | CONTINUOUS | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | VDC |
| NO LOAD TO FULL | TRANSIENT 50 msec | — | — | 50 | — | — | 50 | — | — | 50 | V |
| INPUT CURRENT | NO LOAD | — | 20 | 40 | — | 25 | 50 | — | 25 | 50 | mA |
| | FULL LOAD | — | 540 | 600 | — | 645 | 754 | — | 638 | 754 | |
| | INHIBITED | — | 6 | 12 | — | 5 | 12 | — | 5 | 12 | |
| INPUT RIPPLE CURRENT | 10 kHz - 10 MHz | — | 20 | 50 | — | 35 | 60 | — | 35 | 60 | mA p-p |
| | Tc = -55°C to +125°C | — | 40 | 80 | — | 50 | 100 | — | 50 | 100 | |
| EFFICIENCY | | 77 | 79 | — | 76 | 83 | — | 76 | 84 | — | % |
| LOAD FAULT | SHORT CIRCUIT ³ | — | — | — | — | — | — | — | — | — | W |
| | POWER DISSIPATION | — | 3 | 6 | — | 3 | 6 | — | 3 | 6 | |
| | RECOVERY ⁴ | — | 7.5 | 30 | — | 7.5 | 50 | — | 7.5 | 50 | |
| STEP LOAD RESP. ⁵ BALANCED LOADS | 50% - 100% - 50% | — | — | — | — | — | — | — | — | — | mV pk |
| | TRANSIENT +V _{OUT} | -600 | 200 | 600 | -600 | 300 | 600 | -600 | 300 | 600 | |
| | TRANSIENT -V _{OUT} | -600 | 150 | 600 | -600 | 100 | 500 | -600 | 100 | 600 | |
| | RECOVERY ⁴ | — | 150 | 500 | — | 200 | 400 | — | 200 | 500 | µs |
| STEP LINE RESP. ± V _{OUT} | 16 - 40 - 40 VDC | — | — | — | — | — | — | — | — | — | mV pk |
| | TRANSIENT ⁶ | -800 | 600 | 800 | -750 | 550 | 750 | -750 | 550 | 750 | |
| | RECOVERY ⁴ | — | 0.8 | 1.2 | — | 0.8 | 1.2 | — | 0.8 | 1.2 | ms |
| START-UP | DELAY | — | 12 | 20 | — | 12 | 25 | — | 12 | 25 | ms |
| | OVERSHOOT ⁷ | 0 | 100 | 250 | 0 | 200 | 750 | 0 | 200 | 750 | mV pk |

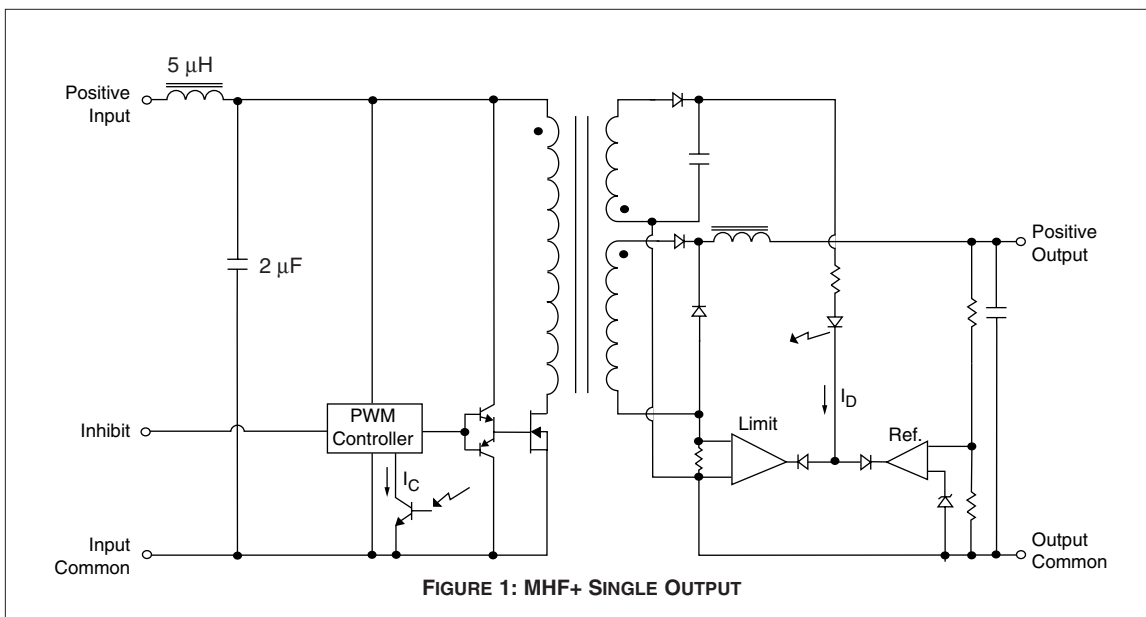
Notes

- Up to 13.5 watts, 90% (9.6W, 80% for 2805D) of the total output power is available from either output providing the opposite output is simultaneously carrying 10% (20% for 2805D) of the total output power. Each output must carry a minimum of 10% (20% for 2805D) of the total output power in order to maintain regulation on the negative output.
- Effect on -V_{out} for the following conditions:
+Po = 50% to 10% and -Po = 50%
+Po = 50% and -Po = 50% to 10%
- Indefinite short circuit protection not guaranteed above 125°C (case)
- Recovery time is measured from application of the transient to point at which V_{out} is within regulation.
- Response of either output with the opposite output held at half of the total output power.
- Input step transition time >10 µs.
- Input step transition time <100 µs.

DC/DC CONVERTERS

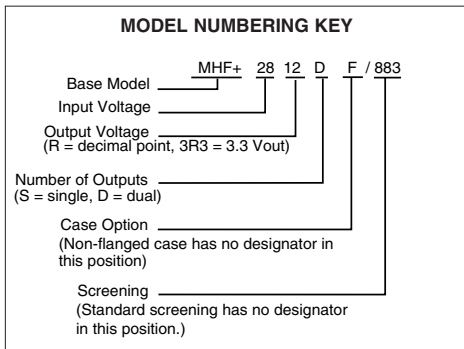
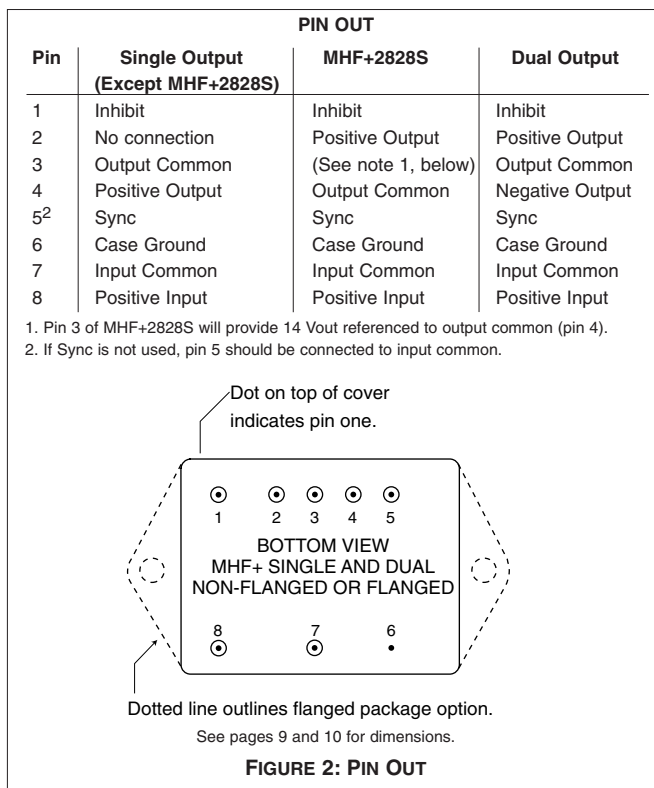
MHF+ SERIES SINGLE AND DUAL 15 WATT

BLOCK DIAGRAM



**MHF+ SERIES
SINGLE AND DUAL
15 WATT**

DC/DC CONVERTERS



| SMD NUMBERS | |
|-------------------------------------|-------------------|
| STANDARD MICROCIRCUIT DRAWING (SMD) | MHF+ SIMILAR PART |
| IN PROCESS | MHF+283R3S/883 |
| 5962-9213901HXC | MHF+2805S/883 |
| IN PROCESS | MHF+285R2S/883 |
| 5962-9166401HXC | MHF+2812S/883 |
| 5962-9160101HXC | MHF+2815S/883 |
| 5962-9689801HXC | MHF+2828S/883 |
| 5962-9555901HXC | MHF+2805D/883 |
| 5962-9214401HXC | MHF+2812D/883 |
| 5962-9161401HXC | MHF+2815D/883 |

Flanged SMDs have the suffix HZC instead of HXC.

For exact specifications for an SMD product, refer to the SMD drawing. Call your Interpoint representative for status on the MHF+ SMD releases which are "in process". SMDs can be downloaded from <http://www.dscc.dla.mil/programs/smcr>

DC/DC CONVERTERS

MHF+ SERIES SINGLE AND DUAL 15 WATT

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

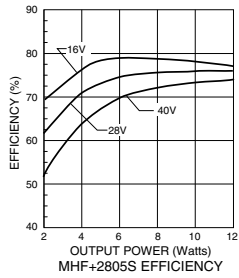


FIGURE 3

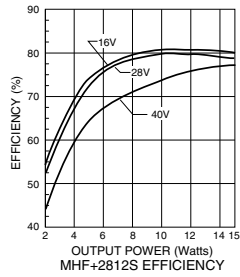


FIGURE 4

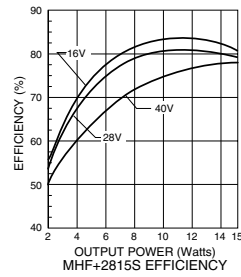


FIGURE 5

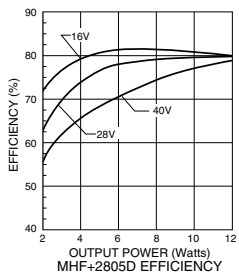


FIGURE 6

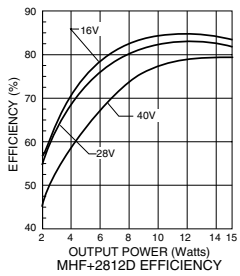


FIGURE 7

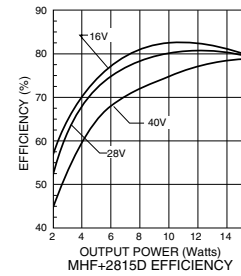


FIGURE 8

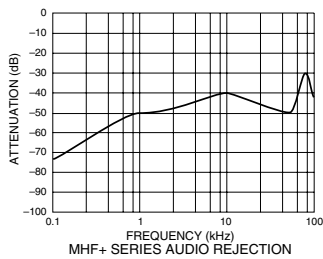


FIGURE 9

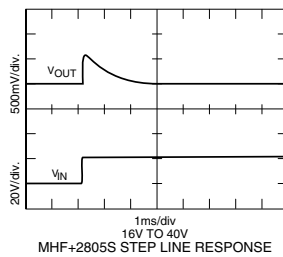


FIGURE 10

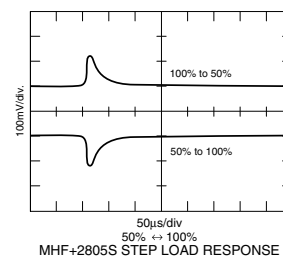
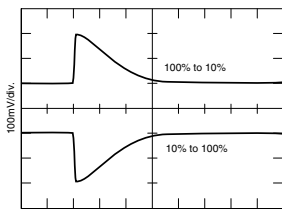


FIGURE 11

MHF+ SERIES SINGLE AND DUAL 15 WATT

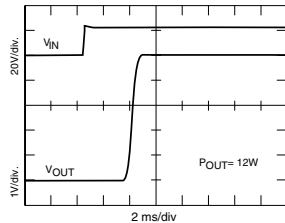
DC/DC CONVERTERS

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



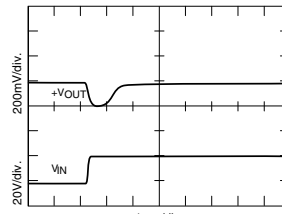
MHF+2805S STEP LOAD RESPONSE

FIGURE 12



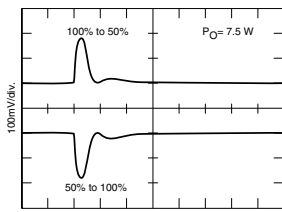
MHF+2805S TURN-ON INTO FULL LOAD

FIGURE 13



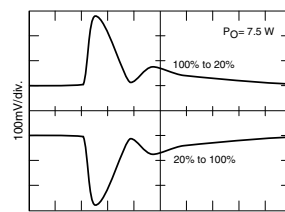
MHF+2815D STEP LINE RESPONSE

FIGURE 14



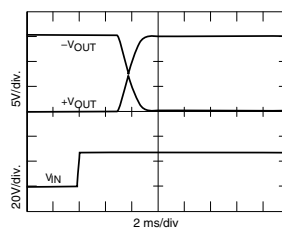
MHF+2815D +V_{OUT} STEP LOAD RESPONSE

FIGURE 15



MHF+2815D +V_{OUT} STEP LOAD RESPONSE

FIGURE 16



MHF+2815D TURN-ON INTO FULL LOAD

FIGURE 17

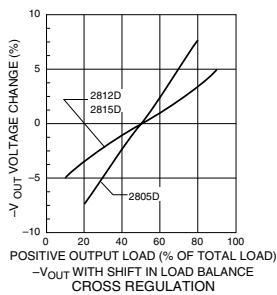


FIGURE 18

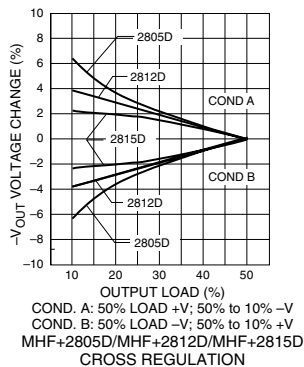


FIGURE 19

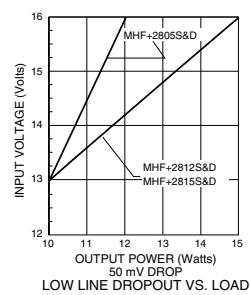
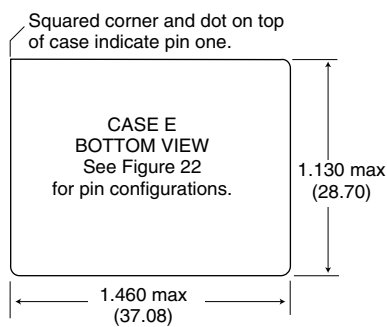


FIGURE 20

DC/DC CONVERTERS

MHF+ SERIES SINGLE AND DUAL 15 WATT



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 21: CASE E MAXIMUM DIMENSIONS

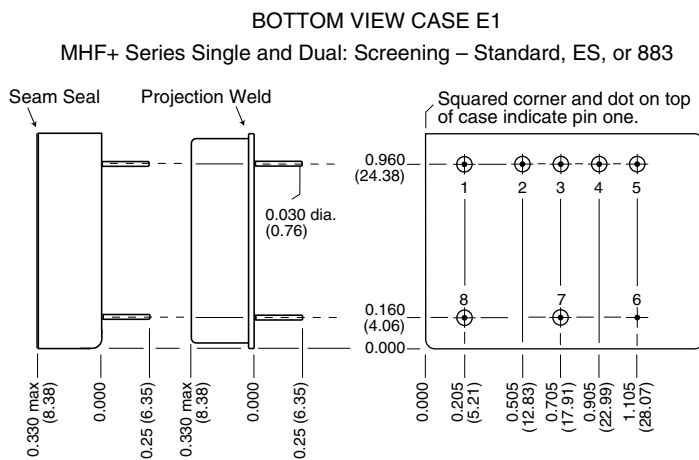
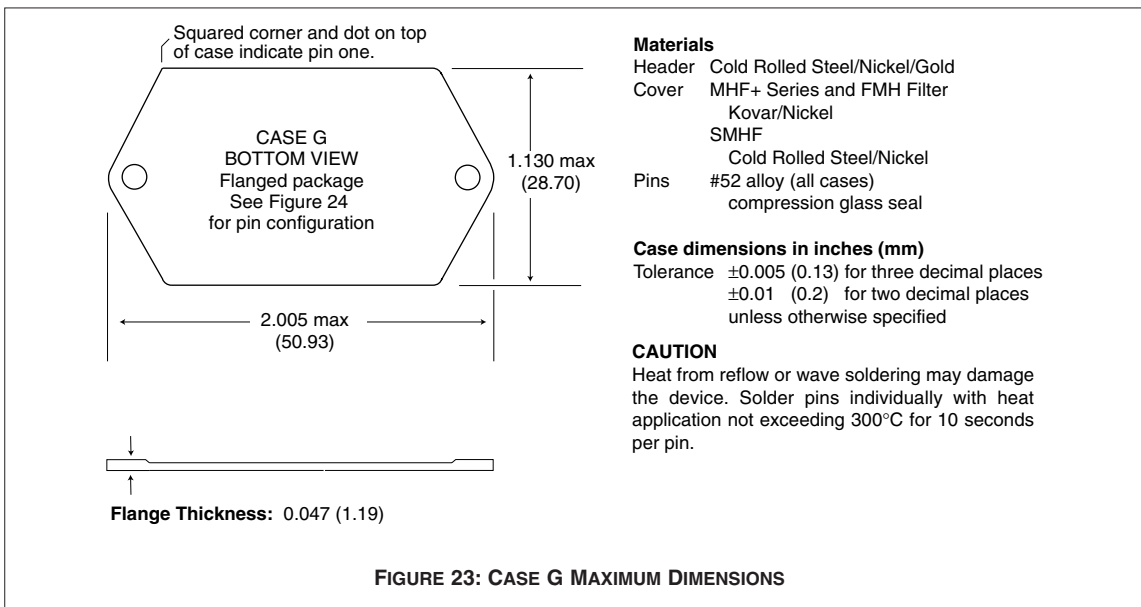


FIGURE 22: CASE E1

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.

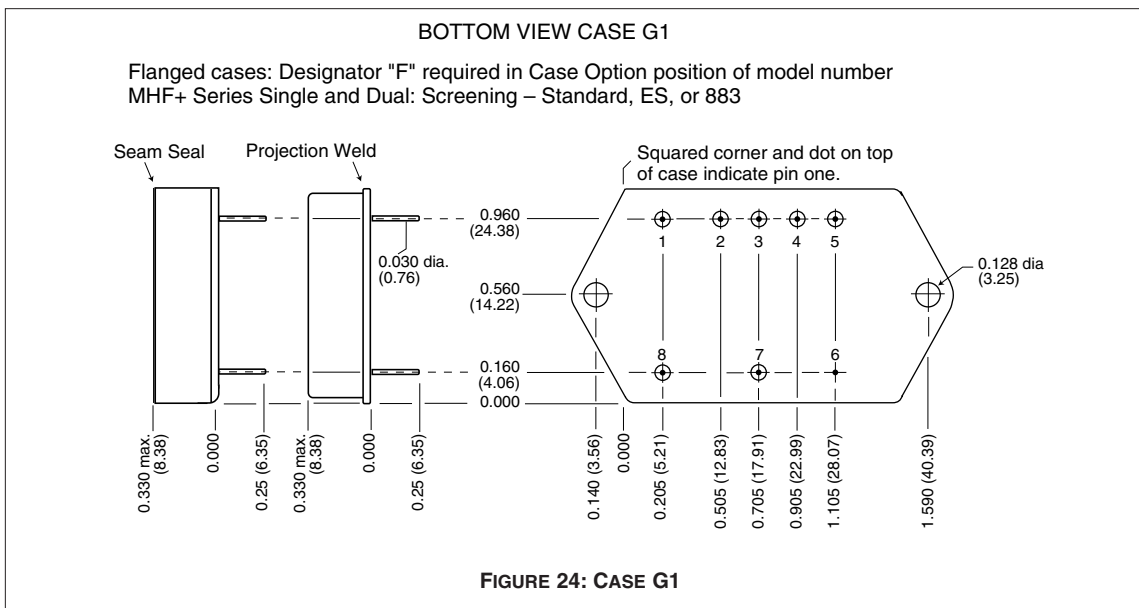
**MHF+ SERIES
SINGLE AND DUAL
15 WATT**

DC/DC CONVERTERS



DC/DC CONVERTERS

MHF+ SERIES SINGLE AND DUAL 15 WATT



MHF+ SERIES SINGLE AND DUAL 15 WATT

DC/DC CONVERTERS

TABLE 1: ENVIRONMENTAL SCREENING

| TEST | 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 Method 1010, Cond. B, -55°C to 125°C | no no | no yes | yes no |
| CONSTANT ACCELERATION Method 2001, 3000 g Method 2001, 500 g | no no | no yes | yes no |
| BURN-IN Method 1015, 160 hours at 125°C 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 Subgroups 1 and 4: +25°C case | no yes | no yes | yes no |
| HERMETICITY TESTING 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.

*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.

Contact Information:

www.interpoint.com

Interpoint Headquarters USA
Phone: 1-800-822-8782
+425-882-3100
Email: power@intp.com

Interpoint UK
Phone: +44-1252-815511
Email: poweruk@intp.com

Interpoint France
Phone: +33-134285455
Email: powerfr@intp.com

FEATURES

- -55° to +125°C operation
- 16 to 48 VDC input
- Fully Isolated
- Optocoupler feedback
- Fixed frequency 450 kHz
- Topology – Current Mode Flyback
- Transient protection 80 V/120 ms
- Inhibit and sync functions
- Indefinite short circuit protection
- Undervoltage lockout
- Up to 76% efficiency

DC/DC CONVERTERS 28 VOLT INPUT

MHF+ SERIES TRIPLE 15 WATT



| MODELS |
|---------------|
| VDC OUTPUT |
| TRIPLE OUTPUT |
| +5 and ±12 |
| +5 and ±15 |

Size (max.): Non flanged, case E2, 1.460 x 1.130 x 0.330 inches (37.08 x 28.70 x 8.38 mm)
Flanged, case G2, 2.005 x 1.130 x 0.330 inches (50.93 x 28.70 x 8.38 mm)
See Figures 13 - 16 for dimensions.

Weight: 32 grams maximum.

Screening: Standard, ES, or 883 (Class H). See Table 1 for screening options.

DESCRIPTION

Interpoint's MHF+ Series™ Triple DC/DC converters provide a wide input voltage range of 16 to 48 VDC delivering 15 watts of total output power with output voltages of +5 and ±12 or +5 and ±15 VDC. The main output, +5 VDC, will supply up to 7.5 watts and the auxiliaries will supply up to 7.5 watts of combined power. Full power operation at -55° C to +125°C plus the ability to withstand transients of up to 80 V for up to 120 milliseconds make these converters an ideal choice for your high reliability systems.

CONVERTER DESIGN

MHF+ Triple Series of DC/DC converters incorporate dual-phase, phase-shifted technology with a continuous flyback topology. This design eliminates a minimum load requirement on the main output and eliminates cross regulation effects between the main output voltage and the auxiliary output voltages. The phase-shifted design offers a further benefit in reduced input and output ripple.

INHIBIT FUNCTION

An open collector, TTL compatible, inhibit terminal (pin 1) provides shut-down and start-up control. Applying a logic level low (<0.8 V), referenced to input common, will disable the output of the converter. When inhibited input current is reduced to 5 mA or less and there is no generation of switching noise. The inhibit terminal typically sinks 3 mA when the converter is inhibited.

Leaving the terminal open or pulling it high will enable the converter. Use an open collector interface for logic high voltages of up to 11 volts. (Refer to Figure 2 for a connection diagram.) An open collector interface is not required if the logic high is in excess of the open circuit voltage of the inhibit terminal, 11 volts, but less than 40 volts.

SOFT START FEATURE

The soft-start feature provides a controlled 20 milliseconds turn-on to minimize inrush current and reduce overshoot at initial start-up or when inhibit is released.

SYNCHRONIZATION

To synchronize the converter's switching frequency to a system clock apply the clock signal to the sync terminal (pin 7). When multiple converters are powered from a single power source, asynchronous (free run) operation will result in lower peak noise for common spectral peaks, but synchronous operation will eliminate any possibility of interference frequencies in the low audio band. Source impedance of the signal should be less than 100 ohms and the transition time should be less than 100 nanoseconds. The capacitively coupled sync input will synchronize on a differential signal of as low as 4 volts to as high as 10 volts. If the sync function is not used, the terminal should be left open.

SHORT CIRCUIT PROTECTION

Internal current limiting circuitry protects all three outputs against short circuits. When output power exceeds approximately 130% of maximum output power, the output currents are limited. In addition, separate current limiting circuitry protects each output individually resulting in normal operation of either the main or the auxiliaries, whichever is not in a shorted condition.

PACKAGING

MHF+ Triple converters are packaged in hermetically sealed metal cases. MHF+ Triple converters can be purchased in a flanged or non-flanged case. The flanged option provides increased heat dissipation and also provides greater stability when mechanically secured.

MHF+ SERIES TRIPLE DC/DC CONVERTERS

15 WATT

ABSOLUTE MAXIMUM RATINGS

- Input Voltage**
- 16 to 48 VDC
- Power Dissipation (Pd)**
- 12 watts
- Output Power**
- 15 watts
- Lead Soldering Temperature (10 sec per pin)**
- 300°C
- Storage Temperature Range (Case)**
- -65°C to +150°C

RECOMMENDED OPERATING CONDITIONS

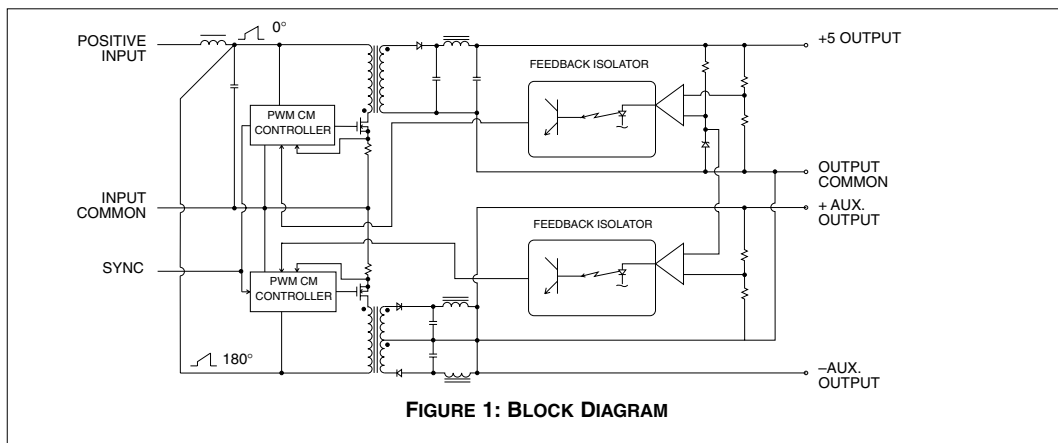
- Input Voltage Range**
- 16 to 48 VDC continuous
 - 80 V for up to 120 msec
- Case Operating Temperature (Tc)**
- -55°C to +125°C full power
 - -55°C to +135°C absolute
- Derating Output Power/Current**
- Linearly from 100% at 125°C to 0% at 135°C

SYNC AND INHIBIT

- Sync 400 to 600 kHz**
- Duty cycle 40% to 60%
 - Logic low 0.8 V max
 - Logic high 4.5 V min, 10.0 V max
 - If not used, leave unconnected
 - Referenced to input common
- Inhibit: TTL Open Collector**
- Logic low (output disabled)
Logic low voltage ≤ 0.8 V max
Inhibit pin current 3.0 typ, 5.0 max
 - Referenced to input common
Logic high (output enabled)
Open collector
Unconnected or 11 to 40 V

TYPICAL CHARACTERISTICS

- Output Voltage Temperature Coefficient**
- 150 ppm/°C typical
- Current Limit**
- 130% typical
- Isolation**
- 100 megohm minimum at 500 V
- Conversion Frequency**
- Free run 375 minimum, 500 kHz maximum
 - External sync range 400 to 600 kHz
- Inhibit Pin Voltage (unit enabled)**
- 10 V typical



DC/DC CONVERTERS MHF+ SERIES TRIPLE 15 WATT

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

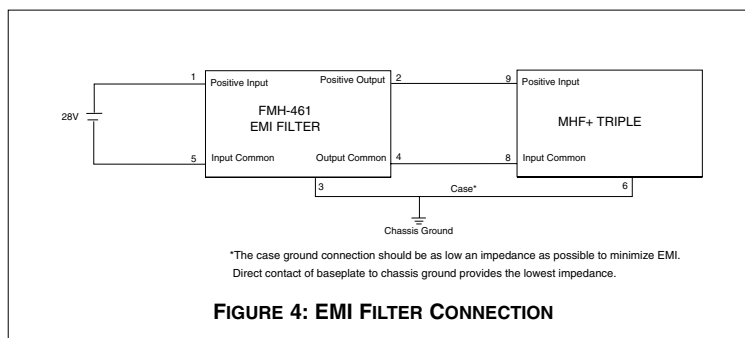
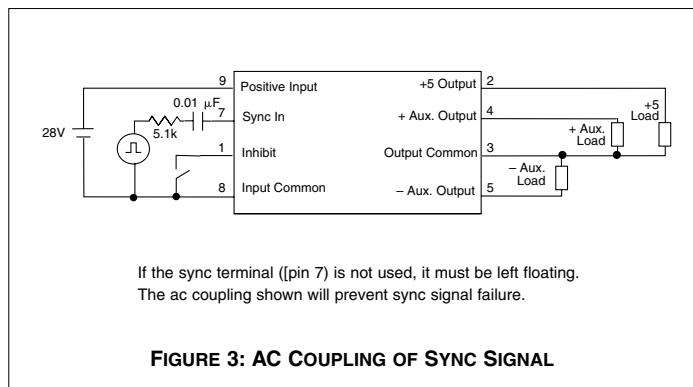
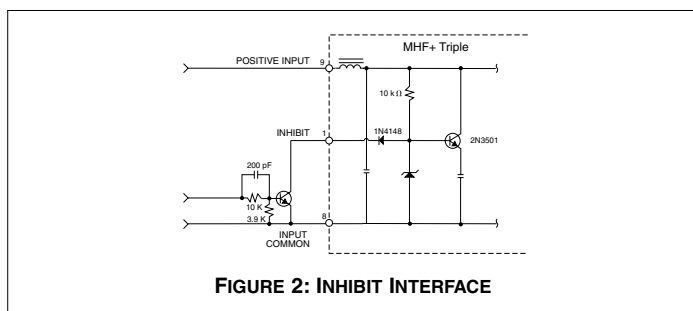
| PARAMETER | CONDITION | MHF+28512T | | | MHF+28515T | | | UNITS |
|--|--|-------------------|------|-------|------------|------|-------|--------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| OUTPUT VOLTAGE | MAIN | 4.95 | 5.0 | 5.05 | 4.925 | 5.0 | 5.05 | VDC |
| | + AUXILIARY | 11.64 | 12.0 | 12.36 | 14.55 | 15.0 | 15.45 | |
| | - AUXILIARY | 11.64 | 12.0 | 12.36 | 14.55 | 15.0 | 15.45 | |
| OUTPUT CURRENT ¹ | MAIN | 0 | — | 1.5 | 0 | — | 1.5 | A |
| | + AUXILIARY | — | — | 0.416 | — | — | 0.333 | |
| | - AUXILIARY | — | — | 0.416 | — | — | 0.333 | |
| | TOTAL | — | — | 2.125 | — | — | 2.0 | |
| OUTPUT POWER ² | MAIN | — | — | 7.5 | — | — | 7.5 | W |
| | + AUXILIARY | — | — | 5 | — | — | 5 | |
| | - AUXILIARY | — | — | 5 | — | — | 5 | |
| | TOTAL | — | — | 15 | — | — | 15 | |
| OUTPUT RIPPLE VOLTAGE | 10 kHz to 2 MHz MAIN | — | 20 | 75 | — | 20 | 75 | mV p-p |
| | 10 kHz to 2 MHz ± AUXILIARY | — | 30 | 90 | — | 30 | 112 | |
| LINE REGULATION ³ VIN = MIN. TO MAX. | MAIN | — | 25 | 75 | — | 25 | 75 | mV |
| | ±AUXILIARY | — | 120 | 240 | — | 150 | 300 | |
| LOAD REGULATION ^{3, 4} | MAIN | — | 25 | 60 | — | 25 | 60 | mV |
| | ± AUXILIARY | — | 120 | 240 | — | 150 | 300 | |
| CROSS REGULATION ⁵ | - AUXILIARY | — | — | 1200 | — | — | 1500 | mV |
| INPUT VOLTAGE | CONTINUOUS | 16 | 28 | 48 | 16 | 28 | 48 | VDC |
| | TRANSIENT 120 ms | — | — | 80 | — | — | 80 | V |
| INPUT CURRENT | NO LOAD ³ | — | 20 | 35 | — | 20 | 35 | mA |
| | FULL LOAD | — | 705 | 724 | — | 705 | 724 | |
| | INHIBITED ³ | — | 3 | 5 | — | 3 | 5 | |
| INPUT RIPPLE CURRENT | 10 kHz to 10 MHz | — | 20 | 50 | — | 20 | 50 | mA p-p |
| EFFICIENCY | | 74 | 76 | — | 74 | 76 | — | % |
| LOAD FAULT ⁶ | POWER DISSIPATION MAIN ³ | — | — | 12 | — | — | 12 | W |
| | ±AUXILIARY | — | — | 12 | — | — | 12 | |
| STEP LOAD RESPONSE ^{3, 7, 8} | TRANSIENT MAIN | — | — | 850 | — | — | 850 | mV pk |
| | ± AUXILIARY | — | — | 750 | — | — | 750 | |
| | RECOVERY MAIN | — | 5 | 8 | — | 5 | 8 | ms |
| | RECOVERY ±AUX. | — | 2 | 3 | — | 2 | 3 | |
| | START-UP ³ | DELAY EACH OUTPUT | — | 10 | 25 | — | 10 | |

Notes

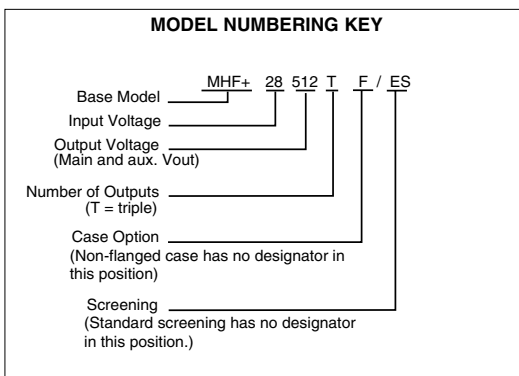
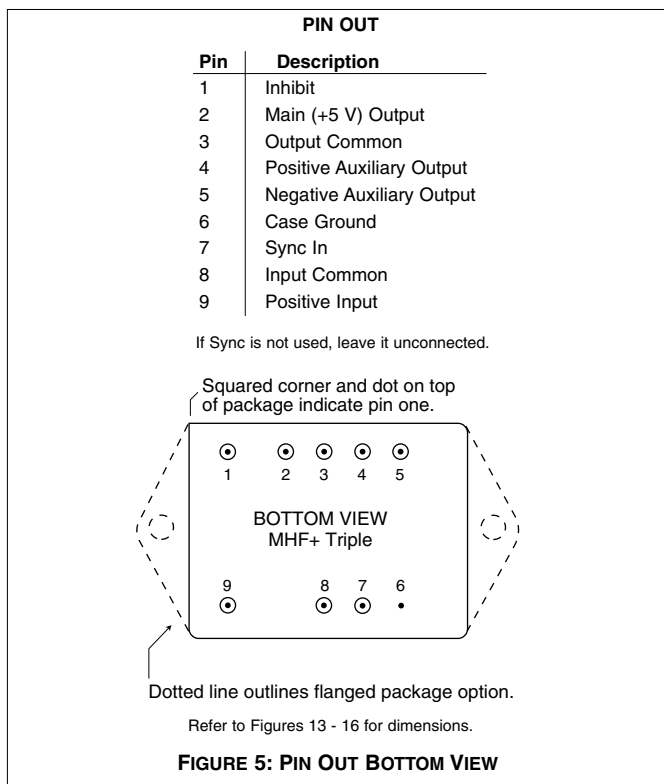
- The sum of the 12 volt auxiliary output currents may not exceed 625 mA.
The sum of the 15 volt auxiliary output currents may not exceed 500 mA.
- The sum of the auxiliary output power may not exceed 7.5 watts.
- Case temperature -55°C to +125°C.
- Load regulation for the +5 is specified at 0.0 to 1.5 A with the aux. both held at 3.76 W (313 mA for the ±12, 250 mA for the ±15). Load regulation for the aux. is specified as both aux. from 0.0 to 3.76 W (313 mA for ±12, 250 mA for ±15) at the same time with the +5 held at 1.5 A.
- Cross regulation only occurs between the two auxiliaries and is measured on -aux. +5 is held constant at 1.0 A. Cross regulation is specified for two conditions:
Negative aux.= 3.76 W; positive aux.= 0.37 W to 3.76 W.
Negative aux. = 0.37 W to 3.76 W; positive aux. = 3.76 W.
- Load fault = <0.05 Ω.
- Transition time is 2 – 10 μs.
- Time to settle to within 1% of Vout final value.

MHF+ SERIES TRIPLE DC/DC CONVERTERS 15 WATT

CONNECTION DIAGRAMS



DC/DC CONVERTERS MHF+ SERIES TRIPLE 15 WATT



SMD NUMBERS

| STANDARD MICROCIRCUIT DRAWING (SMD) | MHF+ SIMILAR PART |
|--|----------------------|
| 5962-9560101HXC | MHF+28512T/883 |
| 5962-9560201HXC | MHF+28515T/883 |

Flanged SMDs have the suffix HZC instead of HXC.

For exact specifications for an SMD product, refer to the SMD drawing. SMDs can be downloaded from <http://www.dscc.dla.mil/programs/smcr>

MHF+ SERIES TRIPLE DC/DC CONVERTERS

15 WATT

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

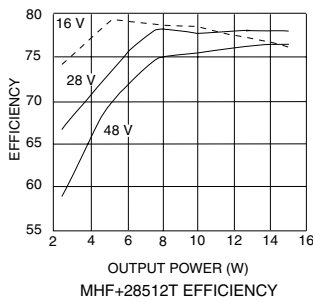


FIGURE 6

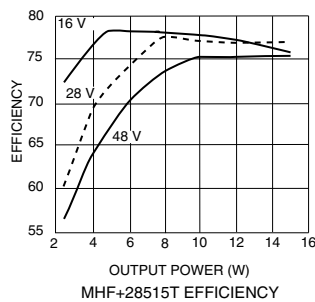


FIGURE 7

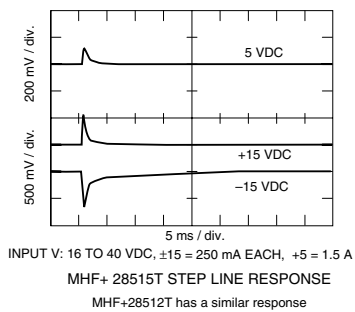


FIGURE 8

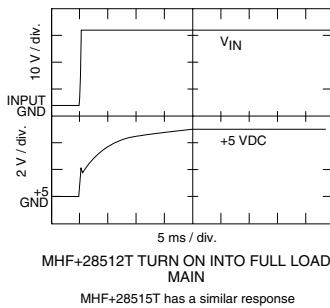


FIGURE 9

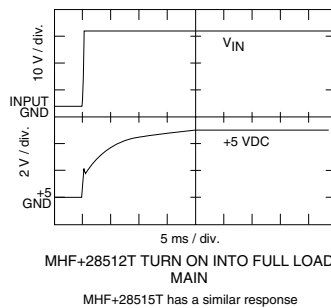


FIGURE 10

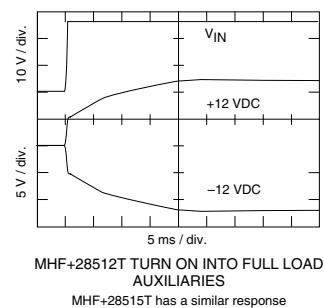


FIGURE 11

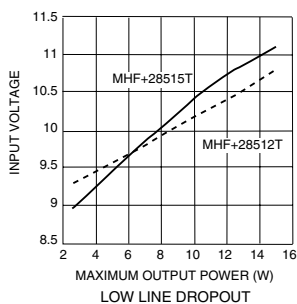
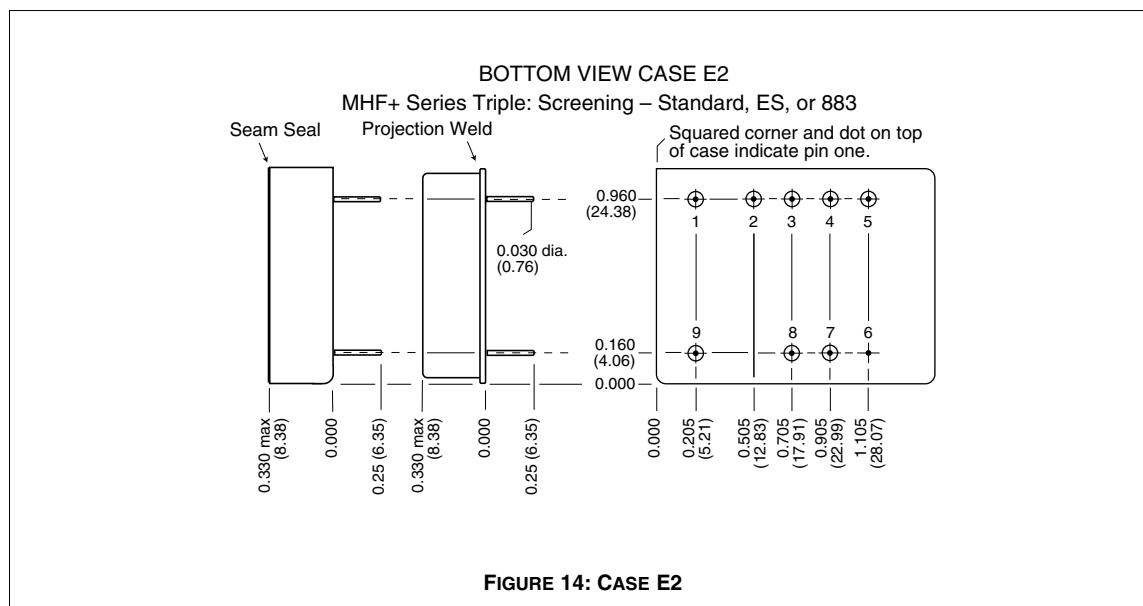
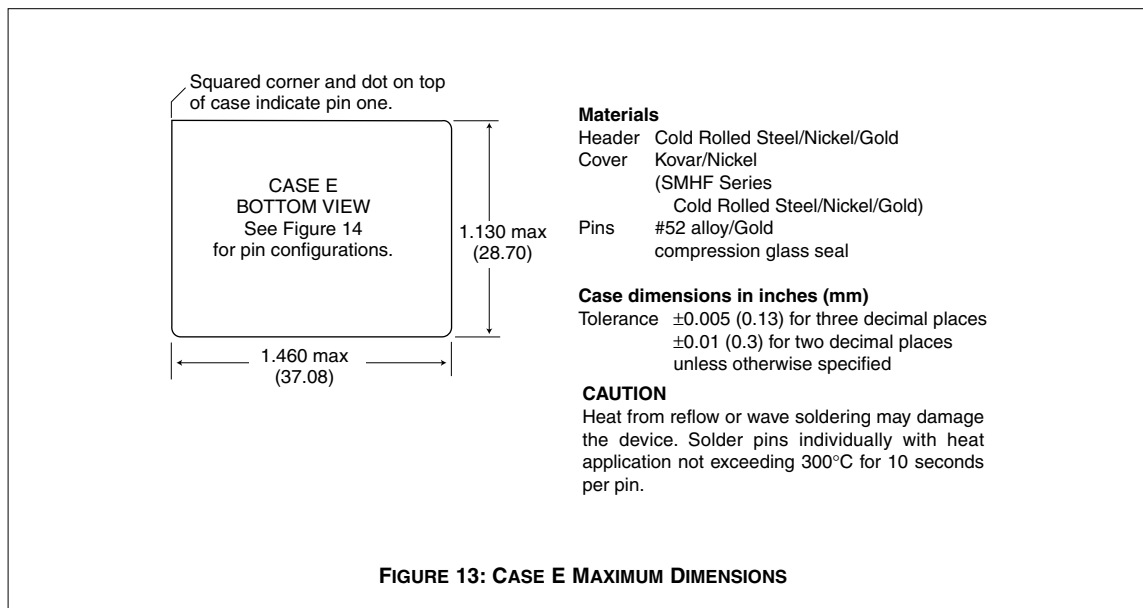


FIGURE 12

MHF+ SERIES TRIPLE DC/DC CONVERTERS

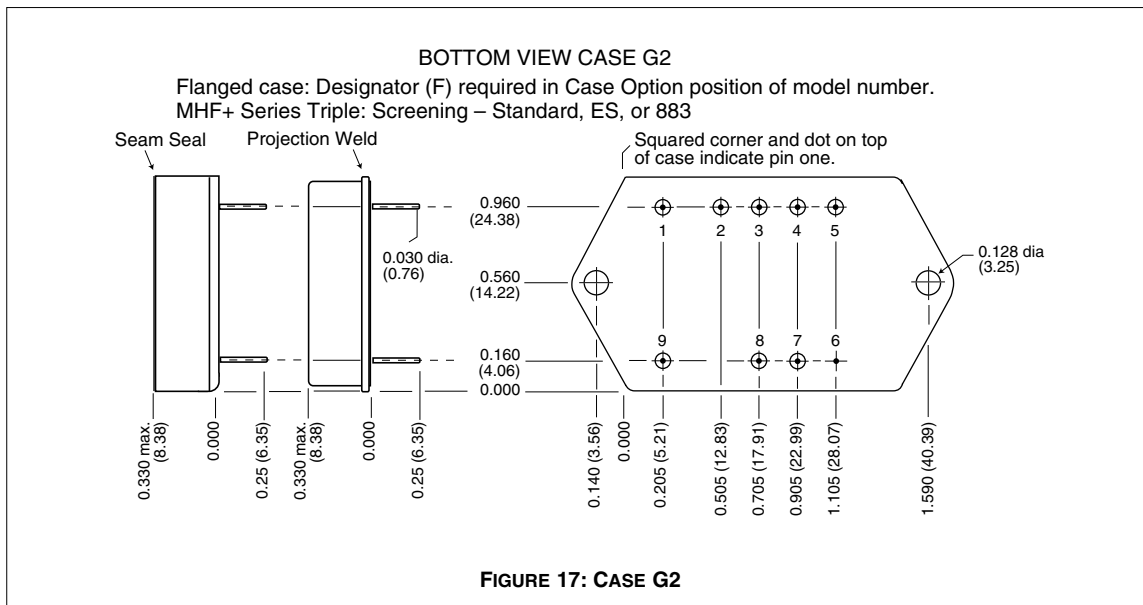
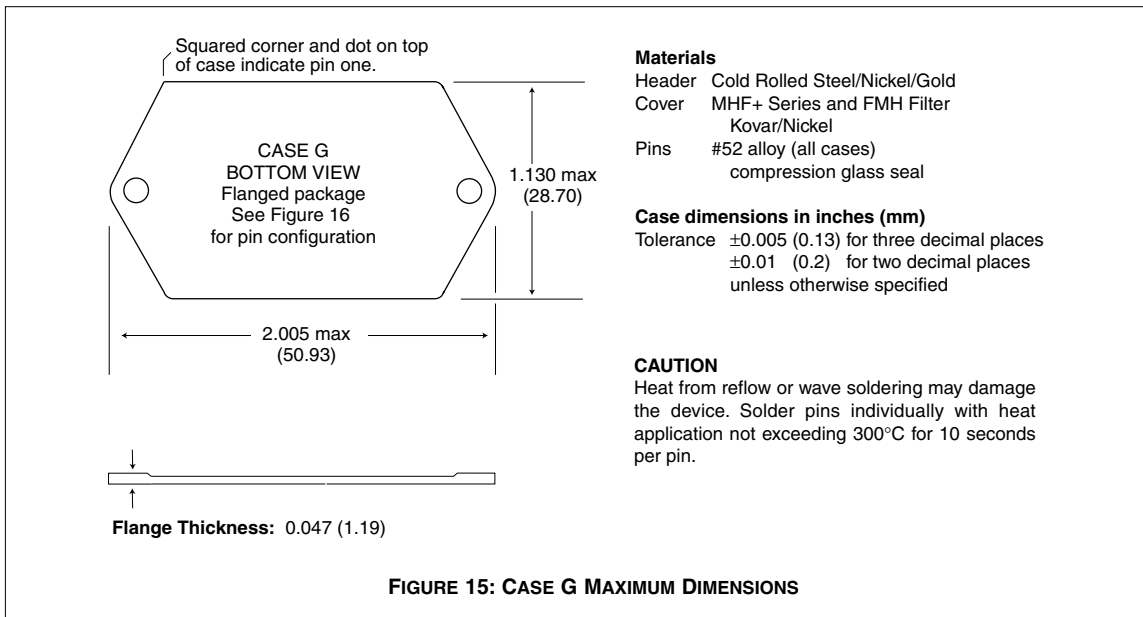
15 WATT



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.

DC/DC CONVERTERS

MHF+ SERIES TRIPLE 15 WATT



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.

MHF+ SERIES TRIPLE DC/DC CONVERTERS

15 WATT

TABLE 1: ENVIRONMENTAL SCREENING

| TEST | 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 Method 1010, Cond. B, -55°C to 125°C | no no | no yes | yes no |
| CONSTANT ACCELERATION Method 2001, 3000 g Method 2001, 500 g | no no | no yes | yes no |
| BURN-IN Method 1015, 160 hours at 125°C 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 Subgroups 1 and 4: +25°C case | no yes | no yes | yes no |
| HERMETICITY TESTING 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.

*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.

Contact Information:

www.interpoint.com

Interpoint Headquarters USA
 Phone: 1-800-822-8782
 +425-882-3100
 Email: power@intp.com

Interpoint France
 Phone: +33-134285455
 Email: powerfr@intp.com

Interpoint UK
 Phone: +44-1252-815511
 Email: poweruk@intp.com

21623-002-DTS Rev B This revision supercedes all previous releases.
 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.
 Copyright © 1995 - 1999 Interpoint. All rights reserved.



A CRANE CO. COMPANY