**FEATURES**

- **–55° to +125°C operation**
- **16 to 40 VDC input**
- Fully Isolated
- Magnetic feedback
- Fixed frequency
- Topology – Single Ended Forward
- 50 V for up to 50 ms transient protection
- Inhibit and synchronization functions
- Indefinite short circuit protection
- Up to 84% efficiency, 21 watts/in$^3$

# DC/DC CONVERTERS 28 VOLT INPUT

# MHD SERIES 20 WATT




**MODELS**

**VDC OUTPUT**

| SINGLE | DUAL |
|---|---|
| 5 | ±5 |
| 12 | ±12 |
| 15 | ±15 |
| 18 | |

Size (max.): Non-flanged, case H2
2.125 x 1.125 x 0.400 inches (53.98 x 28.58 x 10.16 mm)
Flanged case, K3
2.910 x 1.125 x 0.400 inches (73.91 x 28.58 x 10.16 mm)
See Section B8, cases H2 and K3 for dimensions.
Weight: 52 grams max., flanged 55 grams max.
Screening: Standard, ES, or 883 (Class H). See Section C2 for screening options, see Section A5 for ordering information.

## DESCRIPTION

The MHD Series™ of DC/DC converters offers up to 20 watts of output power over the full military temperature range with up to 84% efficiency. Thick-film hybrid techniques provide military/aerospace reliability levels and optimum miniaturization. The MHD Series power density rating is up to 21 watts/in$^3$.

MHD converters are packaged in hermetically sealed metal cases, making them ideal for use in military, aerospace and other high reliability applications. Units are available with standard screening, "ES" screening, or fully compliant SMD versions (see Section C2 for screening conditions).

### CONVERTER DESIGN

The MHD converters are constant frequency, pulse-width modulated switching regulators which use a quasi-square wave, single ended, forward converter design. Tight load regulation (5 mV typical) is maintained via wide bandwidth magnetic feedback and, on single output models, through use of remote sense. On dual output models, the positive output is independently regulated and the negative output is cross regulated through the use of tightly coupled magnetics and shunt regulators.

Indefinite short circuit protection and overload protection are provided by a constant current-limit feature. This protective system senses current in the converter's secondary stage and limits it to approximately 115% of the maximum rated output current.

MHD converters are provided with internal filtering capacitors that help reduce the need for external components in normal operation. For systems that require compliance with MIL-STD-461C's CE03 standard, Interpoint offers filter/transient suppression modules (including the FMC-461, FMD-461 and FM-704A series filters) which will result in compliance. Contact your Interpoint representative for further details.

### SYNCHRONIZATION

The MHD offers a synchronization feature that allows the designer to match the switching frequency of the converter to the frequency of the system clock. In free-run (unsynchronized) mode, the MHD unit switches at 625 kHz (nominal). In sync mode, the converter will run at any frequency between 500 kHz and 675 kHz. The sync control operates with a quasi-TTL signal at any duty cycle between 40% and 60%.

Synchronizing the converter with the system clock allows the designer to confine switching noise to clock transitions, minimizing interference and reducing the need for filtering. The sync pin should be connected to input common pin when not in use.

### WIDE VOLTAGE RANGE

The MHD converters are designed to provide full power operation over a full 16 to 40 VDC voltage range. Operation below 16 volts, including MIL-STD-704E emergency power conditions is possible with derated power. Refer to the low line dropout graph (Figure 15) for details.

### IMPROVED DYNAMIC RESPONSE

The MHD feed-forward compensation system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB. The min. to maximum step line transient response is typically less than 4%.

### INHIBIT FUNCTION

MHD 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 V) 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 9 to 11 V. In the inhibit mode, a maximum of 8 mA must be sunk from the inhibit pin.

# MHD SERIES
# 20 WATT

# DC/DC CONVERTERS

### ABSOLUTE MAXIMUM RATINGS

**Input Voltage**
- 16 to 40 V

**Output Power**
- 15 to 20 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**
- Linearly from 100% at 125°C to 0% at 135° C

### SYNC AND INHIBIT

**Sync (500 to 675 kHz)**
- Duty cycle 40% min, 60% max
- Logic low 0.8 V max, 0.0 V min
- Logic high 4.0 V min, 10 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 8.0 mA max
- Referenced to input common
- Logic high (output enabled)
  Open collector

### TYPICAL CHARACTERISTICS

**Output Voltage Temperature Coefficient**
- 100 ppm/°C typical

**Input to Output Capacitance**
- 50 pF typical

**Current Limit**
- 115% of full load typical

**Isolation**
- 100 megohm minimum at 500 V

**Audio Rejection**
- 50 dB typical

**Conversion Frequency**
- Free run mode 625 kHz typical
  550 kHz. min, 650 kHz max
- External sync range 500 to 675 kHz

**Inhibit Pin Voltage (unit enabled)**
- 9 to 11 V

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

| SINGLE OUTPUT MODELS | | MHD2805S | | | MHD2812S | | | MHD2815S | | | MHD2818S | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITION** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **UNITS** |
| OUTPUT VOLTAGE | | 4.95 | 5.00 | 5.05 | 11.88 | 12.00 | 12.12 | 14.85 | 15.00 | 15.15 | 17.82 | 18.00 | 18.18 | VDC |
| OUTPUT CURRENT[1] | $V_{IN}$ = 16 to 40 VDC | 0 | — | 3 | 0 | — | 1.67 | 0 | — | 1.33 | 0 | — | 1.11 | A |
| OUTPUT POWER[1] | $V_{IN}$ = 16 to 40 VDC | 0 | — | 15 | 0 | — | 20 | 0 | — | 20 | 0 | — | 20 | W |
| OUTPUT RIPPLE | 10 kHz – 2 MHz | — | 35 | 50 | — | 25 | 40 | — | 25 | 40 | — | — | 40 | mV p |
| VOLTAGE | Tc = –55°C TO +125°C | — | 50 | 90 | — | 40 | 90 | — | 40 | 90 | — | — | 90 | |
| LINE REGULATION[2] | Vin = 16 to 40 VDC | — | 10 | 50 | — | 10 | 50 | — | 10 | 50 | — | — | 50 | mV |
| | Tc = –55°C TO +125°C | — | 15 | 50 | — | 15 | 50 | — | 15 | 50 | — | — | 50 | |
| LOAD REGULATION | NO LOAD TO FULL | — | 5 | 50 | — | 5 | 50 | — | 5 | 50 | — | — | 50 | mV |
| | Tc = –55°C TO +125°C | — | 15 | 50 | — | 15 | 50 | — | 15 | 50 | — | — | 50 | |
| INPUT VOLTAGE[1] | CONTINUOUS | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | VDC |
| NO LOAD TO FULL | TRANSIENT 50 ms | — | — | 50 | — | — | 50 | — | — | 50 | — | — | 50 | V |
| INPUT CURRENT | NO LOAD[1] | — | 35 | 75 | — | 35 | 75 | — | 35 | 75 | — | — | 75 | mA |
| | FULL LOAD | — | 0.70 | — | — | 0.87 | — | — | 0.85 | — | — | — | — | A |
| | INHIBITED[1] | — | 7 | 8 | — | 7 | 8 | — | 7 | 8 | — | — | 8 | mA |
| INPUT RIPPLE | 10 kHz – 10 MHz | | | | | | | | | | | | | |
| CURRENT | Tc = –55°C TO +125°C | — | 20 | 50 | — | 20 | 50 | — | 20 | 50 | — | — | 50 | mA p-p |
| EFFICIENCY | | 76 | 78 | — | 80 | 83 | — | 81 | 84 | — | 81 | — | — | % |
| LOAD FAULT[3] | SHORT CIRCUIT | | | | | | | | | | | | | |
| SHORT CIRCUIT TO | POWER DISSIPATION | — | — | 10 | — | — | 10 | — | — | 10 | — | — | 10 | A |
| FULL LOAD | RECOVERY[1, 3] | — | 1.4 | 5 | — | 1.4 | 5 | — | 1.4 | 5 | — | — | 5 | ms |
| STEP LOAD RESP. | 50% – 100% – 50% | — | ±200 | ±300 | — | ±250 | ±400 | — | ±350 | ±500 | — | — | ±600 | |
| TRANSIENT | 10% – 100% | — | –400 | –600 | — | –600 | –1000 | — | –800 | –1200 | — | — | — | mV pk |
| | 100% – 10% | — | +350 | +600 | — | +500 | +750 | — | +600 | +1000 | — | — | — | |
| | 50% – 100% – 50% | — | 60 | 200 | — | 60 | 200 | — | 60 | 200 | — | — | 200 | |
| RECOVERY[4] | 10% – 100% | — | 60 | 600 | — | 150 | 300 | — | 250 | 500 | — | — | — | µs |
| | 100% – 10% | — | 200 | 600 | — | 250 | 500 | — | 250 | 500 | — | — | — | |
| STEP LINE RESP. | 16 – 40 – 16 VDC | | | | | | | | | | | | | |
| | TRANSIENT[5] | — | ±200 | ±300 | — | ±400 | ±500 | — | ±500 | ±600 | — | — | ±600 | mV pk |
| | RECOVERY[4] | — | — | 300 | — | — | 300 | — | — | 300 | — | — | 300 | µs |
| START-UP[1] | DELAY | — | 1.4 | 5 | — | 1.4 | 5 | — | 1.4 | 5 | — | — | 5 | ms |
| | OVERSHOOT | | | | | | | | | | | | | |
| | FULL LOAD | — | 0 | 50 | — | 0 | 120 | — | 0 | 150 | — | — | 180 | mV pk |
| | NO LOAD | — | 50 | 250 | — | 120 | 600 | — | 150 | 750 | — | — | — | |

Notes
1. Tc = –55°C to +125°C
2. Operation is limited below 16V (see Figure 15).
3. Indefinite short circuit protection not guaranteed above 125°C case.
4. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
5. Transition time ≥ 10 µs.



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

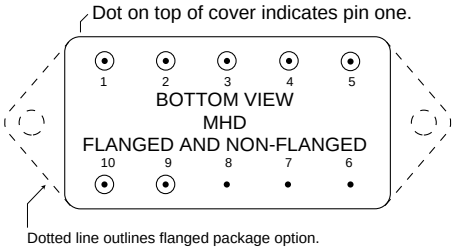
| DUAL OUTPUT MODELS | | | MHD2805D | | | MHD2812D | | | MHD2815D | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **UNITS** |
| OUTPUT VOLTAGE[1] | | $+V_{OUT}$ | 4.95 | 5.00 | 5.05 | 11.88 | 12.00 | 12.12 | 14.85 | 15.00 | 15.15 | VDC |
| | | $-V_{OUT}$ | 4.925 | 5.00 | 5.075 | 11.82 | 12.00 | 12.18 | 14.77 | 15.00 | 15.23 | |
| OUTPUT CURRENT[1,2] | $V_{IN}$ = 16 TO 40 VDC | | 0.30 | — | 3.0 | 0.13 | — | 1.25 | 0.10 | — | 1.00 | A |
| OUTPUT POWER[1,2] | $V_{IN}$ = 16 TO 40 VDC | | 0 | — | 15 | 0 | — | 15 | 0 | — | 15 | W |
| OUTPUT RIPPLE | 10 kHz - 2 MHz | | — | 20 | 50 | — | 30 | 80 | — | 25 | 80 | mV p-p |
| VOLTAGE +/– $V_{OUT}$ | Tc = –55°C TO +125°C | | — | 40 | 80 | — | 40 | 120 | — | 40 | 120 | |
| LINE REGULATION[3] | Tc = –55°C | $+V_{OUT}$ | — | 10 | 50 | — | 10 | 50 | — | 10 | 50 | mV |
| $V_{IN}$ = 16 TO 40 VDC | TO +125°C | $-V_{OUT}$ | — | 50 | 100 | — | 50 | 150 | — | 50 | 180 | |
| LOAD REGULATION | Tc = –55°C | $+V_{OUT}$ | — | 5 | 50 | — | 15 | 50 | — | 15 | 50 | mV |
| NO LOAD TO FULL | TO +125°C | $-V_{OUT}$ | — | 25 | 100 | — | 30 | 150 | — | 30 | 180 | |
| CROSS REGULATION | SEE NOTE 4 | | — | 7 | 12 | — | 4 | 8.3 | — | 3 | 8 | % |
| EFFECT ON $-V_{OUT}$ | SEE NOTE5 | | — | 4 | 6 | — | 4 | 6 | — | 4 | 6 | |
| INPUT VOLTAGE[1] | CONTINUOUS | | 16 | 28 | 40 | 16 | 28 | 40 | 16 | 28 | 40 | VDC |
| NO LOAD TO FULL | TRANSIENT 50 ms | | 0 | — | 50 | 0 | — | 50 | 0 | — | 50 | V |
| INPUT CURRENT | NO LOAD[1] | | — | 35 | 75 | — | 50 | 75 | — | 50 | 75 | mA |
| | FULL LOAD | | — | 0.70 | — | — | 0.88 | — | — | 0.86 | — | A |
| | INHIBITED[1] | | — | 7 | 8 | — | 7 | 8 | — | 7 | 8 | mA |
| INPUT RIPPLE CURRENT[1] | 10 kHz - 10 MHz | | — | 15 | 50 | — | 20 | 50 | — | 20 | 50 | mA p-p |
| EFFICIENCY | | | 76 | 78 | — | 79 | 81 | — | 80 | 83 | — | % |
| LOAD FAULT[6] | POWER DISSIPATION | | | | | | | | | | | |
| | SHORT CIRCUIT | | — | — | 10 | — | — | 10 | — | — | 10 | W |
| | RECOVERY[1, 7] | | — | 1.4 | 5.0 | — | 1.4 | 5.0 | — | 1.4 | 5.0 | ms |
| STEP LOAD | TRANSIENT | | | | | | | | | | | |
| RESPONSE ± $V_{OUT}$ | 50 – 100 – 50% | | — | ±200 | ±300 | — | ±150 | ±300 | — | ±200 | ±400 | mV pk |
| | 10 – 100 –10% | | — | ±400 | ±600 | — | ±200 | ±400 | — | ±300 | ±500 | |
| | RECOVERY[7] | | | | | | | | | | | |
| | 50 – 100 – 50% | | — | 100 | 200 | — | 100 | 200 | — | 100 | 200 | µs |
| | 10 – 100 – 10% | | — | 400 | 600 | — | 100 | 200 | — | 200 | 250 | |
| STEP LINE | 16 – 40 – 16 $V_{IN}$ | | | | | | | | | | | |
| RESPONSE ± $V_{OUT}$ | TRANSIENT[8] | | — | ±200 | ±400 | — | ±200 | ±400 | — | ±400 | ±500 | mV pk |
| | RECOVERY[7] | | — | — | 300 | — | — | 300 | — | — | 300 | µs |
| START–UP | DELAY | | — | 1.4 | 5 | — | 1.4 | 5 | — | 1.4 | 5 | ms |
| | OVERSHOOT | | — | 0 | 50 | — | 0 | 120 | — | 0 | 150 | mV pk |
| | NO LOAD | | — | 50 | 250 | — | 120 | 600 | — | 150 | 750 | |

Notes
1. Tc = –55°C to +125°C.
2. Up to 90% of the total output current/power is available from either output The minimum load on the positive output is 10% of full load.
3. Operation is limited below 16 V (see Figure 15).
4. Effect on the negative output under the following conditions: +Pout 20% to 80%; –Pout 80% to 20%
5. Effect on the negative output under the following conditions: +Pout 50%; –Pout 10% to 50%
6. Indefinite short circuit protection not guaranteed above 125°C case.
7. Recovery time is measured from application of the transient to point at which Vout is within 1% of final value.
8. Transition time ≥ 10 µs.

# DC/DC CONVERTERS

**PIN OUT**

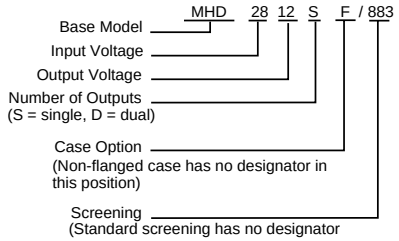
| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | Positive Input | Positive Input |
| 2 | Inhibit | Inhibit |
| 3 | No Connection | Positive Output |
| 4 | Output Common | Output Common |
| 5 | Positive Output | Negative Output |
| 6 | Case Ground | Case Ground |
| 7 | Case Ground | Case Ground |
| 8 | Case Ground | Case Ground |
| 9 | Sync Input | Sync Input |
| 10 | Input Common | Input Common |




Dotted line outlines flanged package option.
See Section B8, cases H2 and K3 for dimensions.

**FIGURE 1: PIN OUT**

**MODEL NUMBERING KEY**




**SMD NUMBERS**

| STANDARD MICROCIRCUIT DRAWING (SMD) | MHD SIMILAR MODEL NUMBER |
|---|---|
| NON-FLANGED CASE | |
| 5962–9465501HXC | MHD2805S/883 |
| 5962–9465601HXC | MHD2812S/883 |
| 5962–9465701HXC | MHD2815S/883 |
| 5962–9465801HXC | MHD2818S/883 |
| 5962–9465901HXC | MHD2805D/883 |
| 5962–9466001HXC | MHD2812D/883 |
| 5962–9466101HXC | MHD2815D/883 |
| FLANGED CASE | |
| 5962–9465501HZC | MHD2805SF/883 |
| 5962–9465601HZC | MHD2812SF/883 |
| 5962–9465701HZC | MHD2815SF/883 |
| 5962–9465801HZC | MHD2818SF/883 |
| 5962–9465901HZC | MHD2805DF/883 |
| 5962–9466001HZC | MHD2812DF/883 |
| 5962–9466101HZC | MHD2815DF/883 |

For exact specifications for an SMD product, refer to the SMD drawing. See Section A3, SMDs, for more information.



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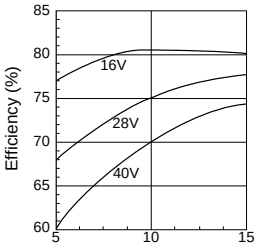
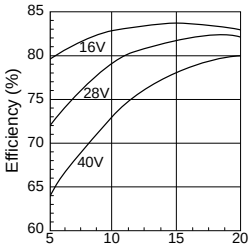
**Typical Performance Curves: 25°C Tc , 28 VDC Vin, 100% load, free run, unless otherwise specified.**



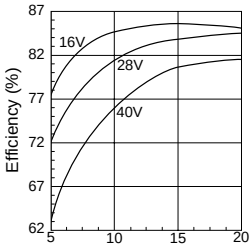

MHD2805S Efficiency

**FIGURE 2**



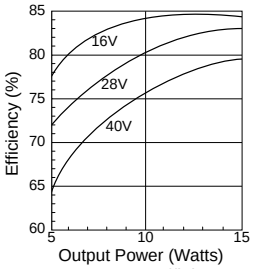

MHD2812S Efficiency

**FIGURE 3**



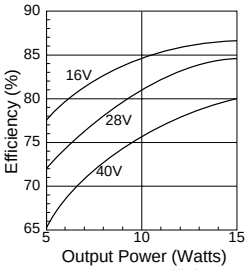

MHD2815S Efficiency

**FIGURE 4**



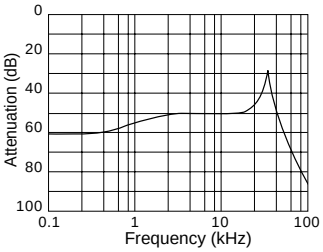

MHD2812D Efficiency

**FIGURE 5**



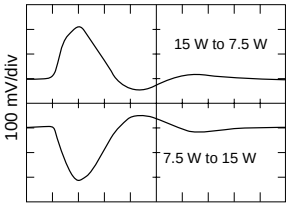

MHD2815D Efficiency

**FIGURE 6**



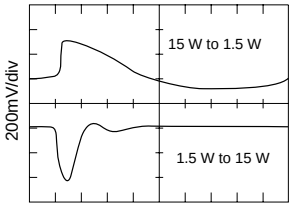

MHD Series Audio Rejection

**FIGURE 7**



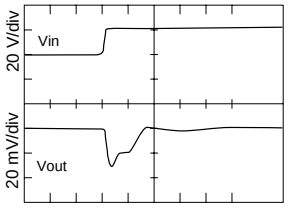

50% to 100% to 50%
MHD2805S Step Load Response

**FIGURE 8**




10% to 100% to 10%
MHD2805S Step Load Response

**FIGURE 9**

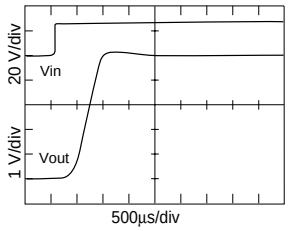



(16 TO 40V)
MHD2805S Step Line Response

**FIGURE 10**

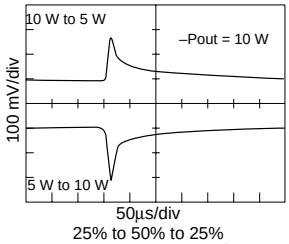
# DC/DC CONVERTERS

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



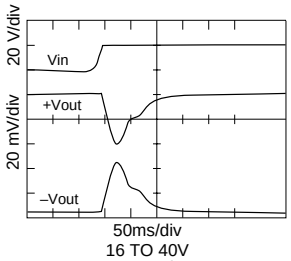

MHD2805S Turn On Into No Load

**FIGURE 11**



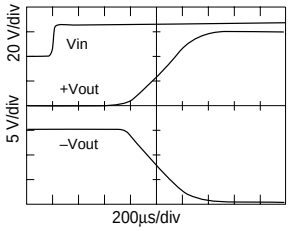

25% to 50% to 25%
MHD2815D +Vout Step Load Response

**FIGURE 12**



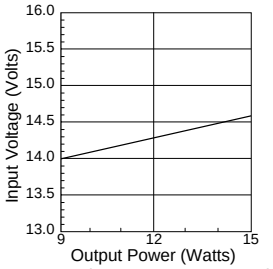

16 TO 40V
MHD2815D Step Line Response

**FIGURE 13**




MHD2815D Turn On Into No Load

**FIGURE 14**




Low Line Dropout vs. Load

**FIGURE 15**



21222-001-DTS Rev A DQ# 1008
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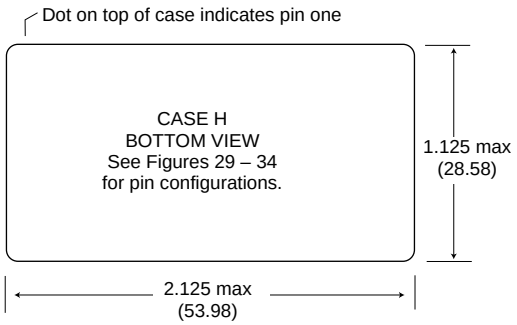



**Materials**

Header Cold Rolled Steel/Nickel/Gold
cases H1 and H2
Cold Rolled Steel/Nickel/Tin
cases H3, H4, and H5

Cover Kovar/Nickel
cases H1 and H2
Cold Rolled Steel/Nickel/Tin
cases H3, H4, and H5

Pins #52 alloy
ceramic seal
case H1
case H2 (except MHV Series Single and Dual)
compression glass seal
MHV Series Single and Dual
case H3, H4, H5

**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.

**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

**FIGURE 28: CASE H MAXIMUM DIMENSIONS**

BOTTOM VIEW CASE H1
FMC EMI Filter: Screening – Standard, ES, or 883
SFMC EMI Filter: Screening – Space Standard, H, or K

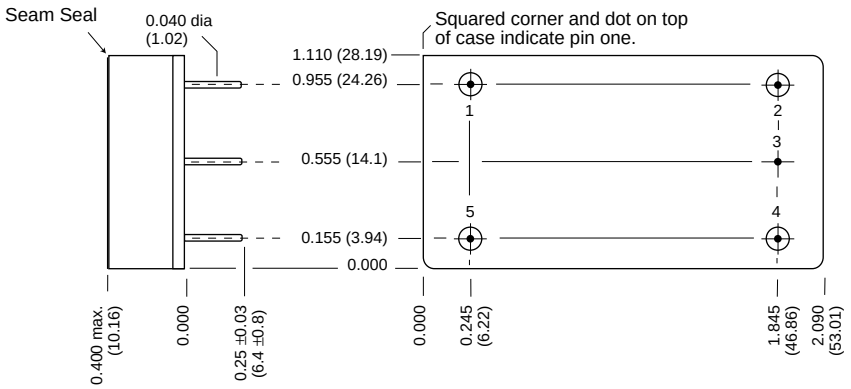



**FIGURE 29: CASE H1**

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.

BOTTOM VIEW CASE H2

MTR Series Single, MHV Series Single and Dual, and MHD Series:
Screening – Standard, ES, or 883
MTR Series Dual: Screening – 883
SMTR Series Single and Dual: Screening – Space Standard, H, or K

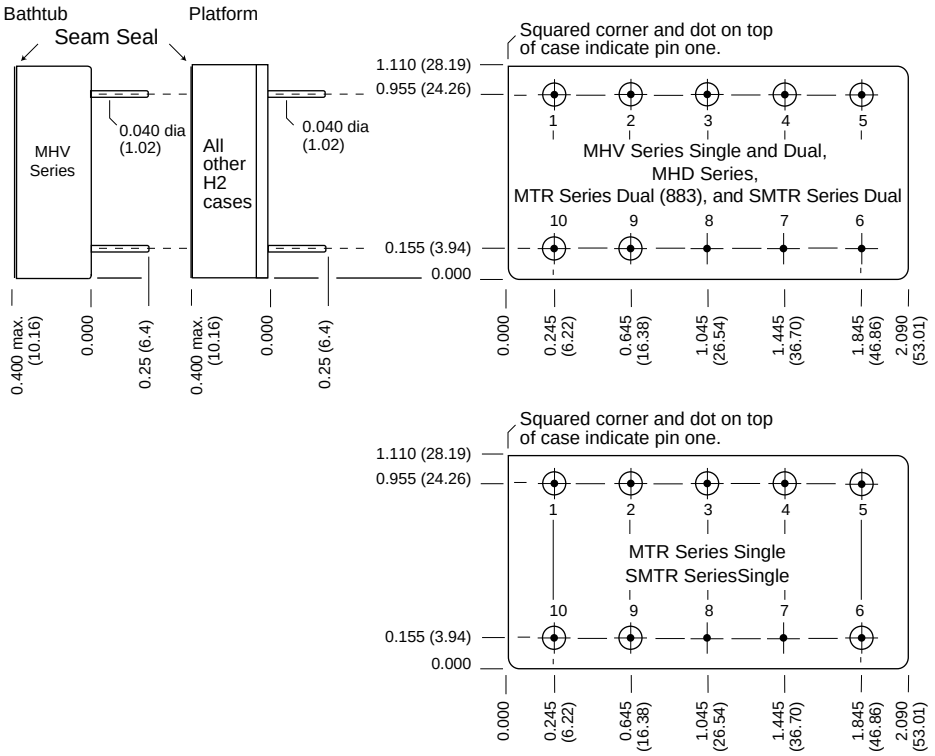
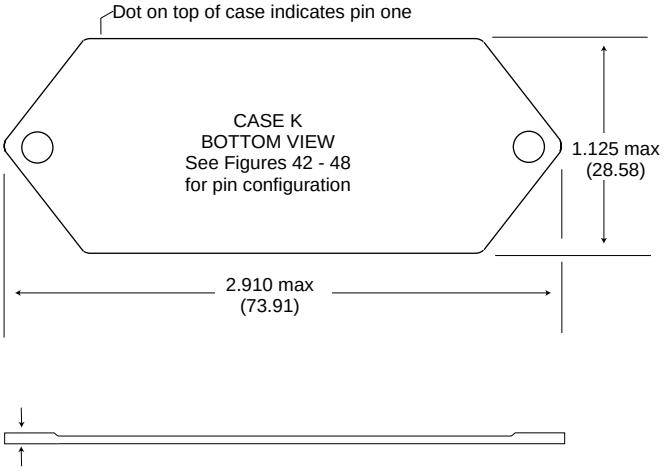



**FIGURE 30: CASE H2**

# CASES




**Flange Thickness:**

Cases K1, K2, K3 and MLP Series (K5)
0.060 (1.52)
Cases K4, K5 (except MLP Series), K6, K7, and K8
0.067 +0.005/-0.007 (1.70 +0.13/-0.8)

**Materials**

Header Case K1 - K3
Cold Rolled Steel/Nickel/Gold
Cases K4 - K8
Cold Rolled Steel/Nickel/Tin
Cover Case K1 - K3
Kovar/Nickel
Case K4 - K8
Cold Rolled Steel/Nickel/Tin
Pins #52 alloy (all cases)
Case K1, K2, and K3 (except MHV Series Single and Dual)
ceramic seal
Cases K4 - K8 and MHV Series Single and Dual (K3)
compression glass seal

**Case dimensions in inches (mm)**

Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.2) 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 41: CASE K MAXIMUM DIMENSIONS**

BOTTOM VIEW CASE K3

Flanged cases: Designator required in Case Option position of model number.
MTR Series Single, MHV Series Single and Dual, MHD Series:
Screening – Standard, ES, or 883
MTR Series Dual: Screening – 883
SMTR Series: Screening – Space Standard, H, or K

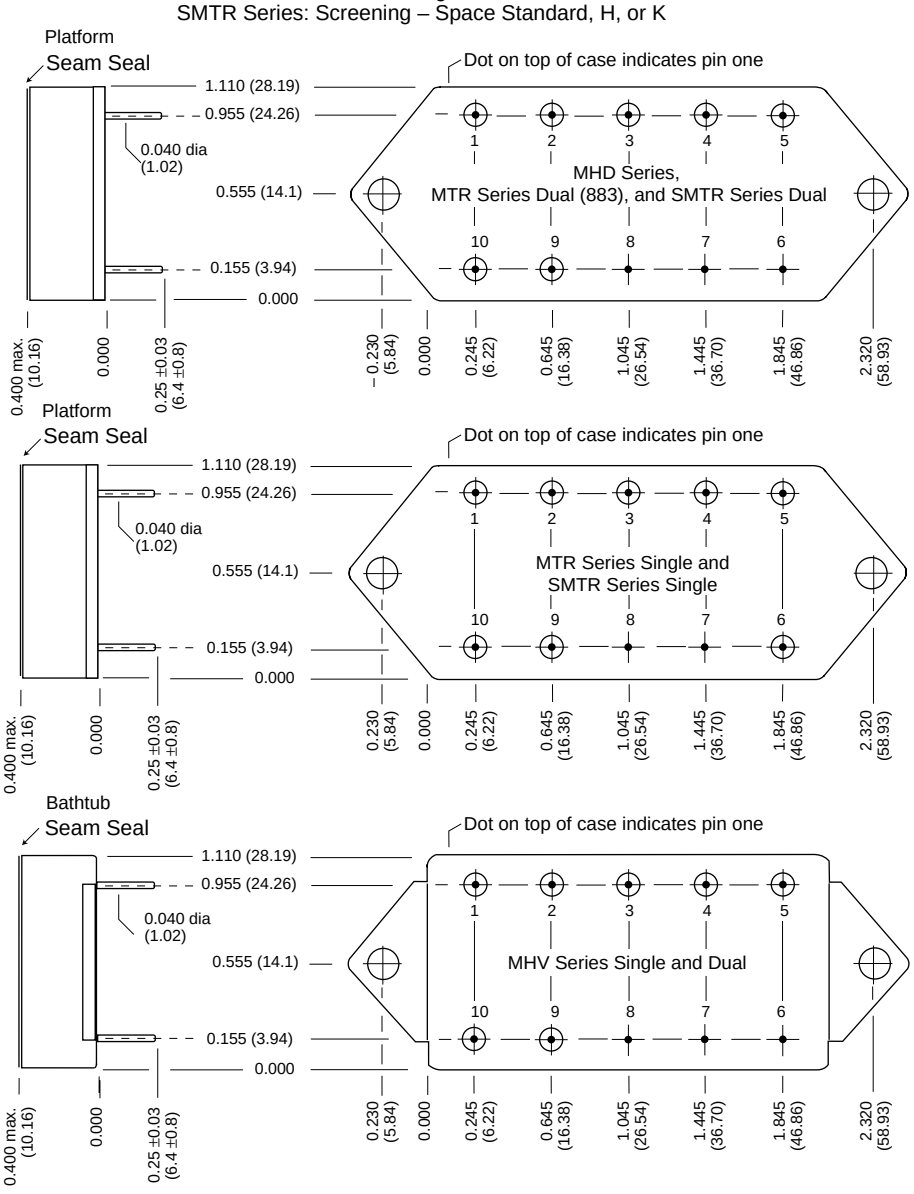



**FIGURE 44: CASE K3**



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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 ($1 \times 10^{-3}$) | 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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