**FEATURES**

- **–55°C to +85°C operation**
- **4 to 8 VDC input**
- Fully isolated
- Opto-coupler feedback
- Fixed frequency, 210 kHz typ.
- Inhibit function
- Indefinite short circuit protection
- Up to 80% efficiency

# DC/DC CONVERTERS 5 VOLT INPUT

# MHL SERIES 15 WATT


| MODELS VDC OUTPUT |
|---|
| DUAL |
| ±12 |
| ±15 |

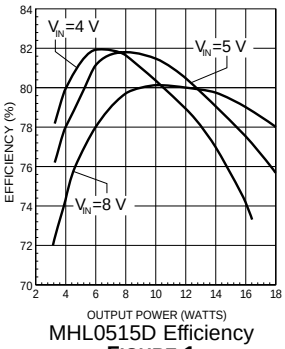
Size (max.): Non-flanged, case F4
1.950 x 1.350 x 0.505 inches (49.53 x 34.29 x 12.83 mm)
Flanged, case J5
2.720 x 1.350 x 0.505 inches (69.09 x 34.29 x 12.83 mm)
See Section B8, cases F4 and J5, for dimensions.
Weight: 57 grams typical
Screening: Standard or ES. See Section C2 for screening options, see Section A5 for ordering information.

## DESCRIPTION

The MHL Series™ of DC/DC converters offers either ±12 or ±15 volt outputs in a single package. MHL converters offer the high efficiency and wide input range of switching regulators with excellent load and line regulation. Input and output grounds are isolated from one another and from case ground. No external components are required for operation. The units are built using thick-film hybrid technology and are sealed in metal packages for military, aerospace, and other high-reliability applications. Unscreened models are sealed with solder and are guaranteed to pass a gross leak test (maximum leak rate of 1 x $10^{-3}$ atm.-cc/sec). Environmentally screened models (/ES) are hermetically sealed with solder and will pass a fine leak and gross leak test as described in Section C2.

The MHL converters employ pulse-width modulated switching regulator techniques in the forward mode, with a nominal clock frequency of 210 kHz. Isolation is achieved through the use of a transformer in the forward power circuit and an opto-coupler in the feedback/control loop. The full load output power (15 watts) is available over the input range of 4 to 8 VDC. Up to 14.3 watts can be obtained from a single output up to a combined load of 15 watts.

**Typical Performance Curve**




MHL0515D Efficiency
**FIGURE 1**

The efficiency is high over the entire input voltage range and from approximately 25% of full load to full load. This feature makes the converters ideal for either battery or aircraft power applications.

An inhibit function is provided to allow power shut-down and start-up from a logic input. An open circuit on the inhibit terminal produces normal operation, and a low level disables the converter. Input current in the inhibit mode is typically 20 mA. The converter features a “soft-start” function which provides a controlled 20 millisecond turn-on upon application of input power or inhibit release.

An input filter is incorporated in the unit to reduce input reflected ripple current. Both outputs are indefinitely protected against short circuits to ground or to one another by automatic current limiting circuitry. This feature adjusts the converter’s output current, indefinitely maintaining it below approximately 125% of the rated maximum during a full short circuit condition.

The MHL Series of converters is rated to operate at full load at a case temperature of 85°C, with the output power derated linearly to zero at 115°C (0.5W/°C). Because of the unit’s high efficiency, heat sinking requirements are minimized, but due consideration should be given to removing self-generated heat when operating the device at maximum ratings. To increase dissipation, heat conducting material (PCB, copper sheet, heat sink, or Interpoint’s TMP accessory) should be brought into contact with the converter’s baseplate.

When the MHL is used in applications requiring full-power operation for extended periods of time, or in shock and vibration environments, it is highly recommended that the flange-mount case option be used. This option provides improved thermal transfer capabilities as well as mechanically secure mounting configuration.

# MHL SERIES
# 15 WATT

# DC/DC CONVERTERS

**ABSOLUTE MAXIMUM RATINGS**

**Input Voltage**
- 4 to 8 VDC

**Output Power**
- 15 watts

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

**Storage Temperature Range (Case)**
- –55°C to +125°C

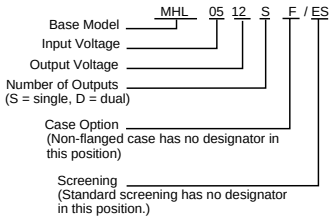
**RECOMMENDED OPERATING CONDITIONS**

**Input Voltage Range**
- 4 to 8 VDC continuous

**Case Operating Temperature (Tc)**
- –55°C to +85°C full power
- –55°C to +115°C absolute

**Derating Output Power/Current**
- Linearly from 100% at 85°C to 0% at 115° C

**MODEL NUMBERING KEY**




**INHIBIT**

**Inhibit TTL Open Collector**
- Logic low (output disabled)
- Referenced to input common
- Logic high (output enabled)
  Open collector

**TYPICAL CHARACTERISTICS**

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

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

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

**Conversion Frequency**
- 210 kHz, typical

**Electrical Characteristics: 25°C Tc, 5 VDC Vin, 100% load, unless otherwise specified.**

| | | MHL0512D | | | MHL0515D | | | |
|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** | **UNITS** |
| OUTPUT VOLTAGE | $+V_{OUT}$ | 11.88 | 12.00 | 12.12 | 14.85 | 15.00 | 15.15 | VDC |
| | $-V_{OUT}$ | 11.88 | 12.00 | 12.12 | ±14.85 | 15.00 | 15.15 | |
| OUTPUT CURRENT[1] | | — | — | 1.25 | — | — | 1.00 | A |
| OUTPUT POWER[1] | Tc = –55°C TO +85°C | — | — | 15.0 | — | — | 15.0 | W |
| OUTPUT RIPPLE | BW = 1 MHz | — | 40 | 100 | — | 40 | 120 | mV p-p |
| LINE REGULATION | $+V_{OUT}$ | — | 0.05 | 0.10 | — | 0.05 | 0.10 | % |
| 4 TO 8 $V_{IN}$ | $-V_{OUT}$ | — | 0.05 | 0.15 | — | 0.05 | 0.15 | |
| LOAD REGULATION | $+V_{OUT}$ | — | 0.05 | 0.15 | — | 0.03 | 0.10 | % |
| NO LOAD TO FULL | $-V_{OUT}$ | — | 0.25 | 0.50 | — | 0.20 | 0.40 | |
| CROSS REGULATION[2] | $+V_{OUT}$ | — | 2.2 | 3.5 | — | 1.9 | 3.0 | % |
| | $-V_{OUT}$ | — | 2.2 | 3.5 | — | 1.9 | 3.0 | |
| INPUT VOLTAGE | Tc = –55°C TO +85°C | 4 | 5 | 8 | 4 | 5 | 8 | VDC |
| INPUT CURRENT | NO LOAD | — | 120 | 150 | — | 140 | 180 | mA |
| | FULL LOAD | — | — | 4500 | — | — | 4500 | |
| | INHIBITED | — | 20 | — | — | 20 | — | |
| INPUT RIPPLE CURRENT | | — | 50 | 120 | — | 70 | 150 | mA p-p |
| EFFICIENCY | FULL LOAD | — | 78 | — | — | 78 | — | % |

Notes
1. 95% of the maximum current or power is available from either output. The total of both outputs must not exceed the maximum specification.
2. The effect on the positive output when it is held at 50 mA while the negative output is varied from 50 to 950 mA. The effect on the negative output when it is held at 50 mA while the positive output is varied from 50 to 950 mA.

**PIN OUT**

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

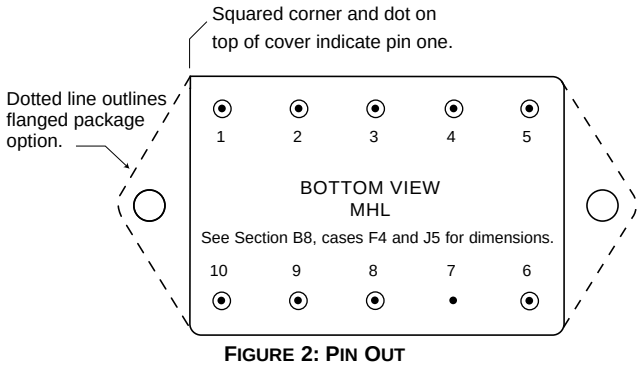



**FIGURE 2: PIN OUT**

23002-001-DTS Rev A DQ# 1018

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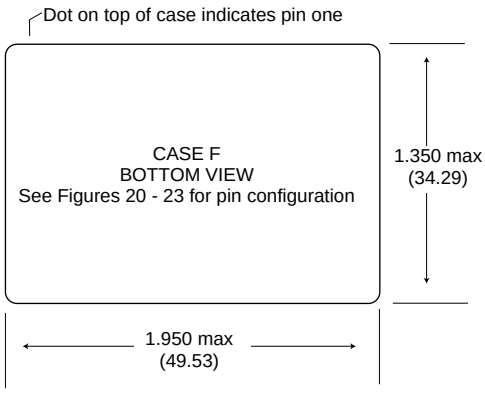


**Materials**

Header Case F1
Cold Rolled Steel/Nickel/Gold
Cases F2 - F4
Cold Rolled Steel/Nickel/Tin
Cover Case F1
Kovar/Nickel
Cases F2 - F4
Cold Rolled Steel/Nickel/Tin
Pins #52 alloy (all cases)
MHV Series Triple – compression glass seal
MTR Series Triple, case F1 – ceramic seal
MTR Series Triple, case F2 – compression glass seal
HUM40 – compression glass seal or ceramic seal
Case F3 – compression glass seal
Case F4 – compression glass seal or ceramic seal

**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 (0.2) for two decimal places
unless otherwise specified

**FIGURE 19: CASE F MAXIMUM DIMENSIONS**

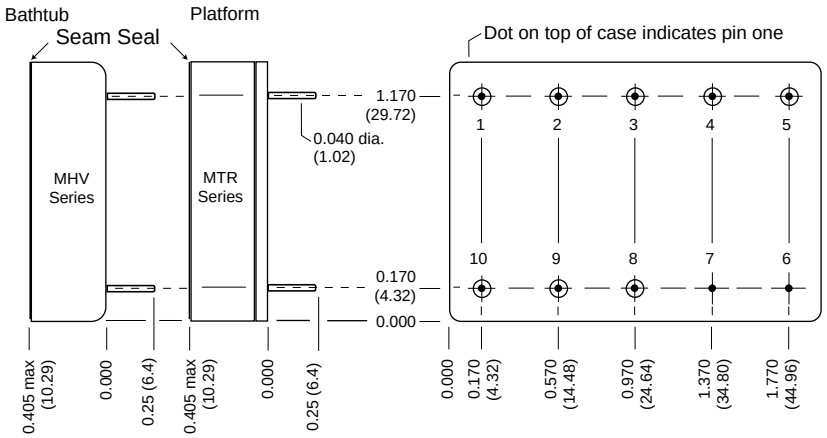


**FIGURE 20: CASE F1**

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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BOTTOM VIEW CASE F4
MTO and MHL Series: Screening – Standard or ES
HR153 Series: no screening options

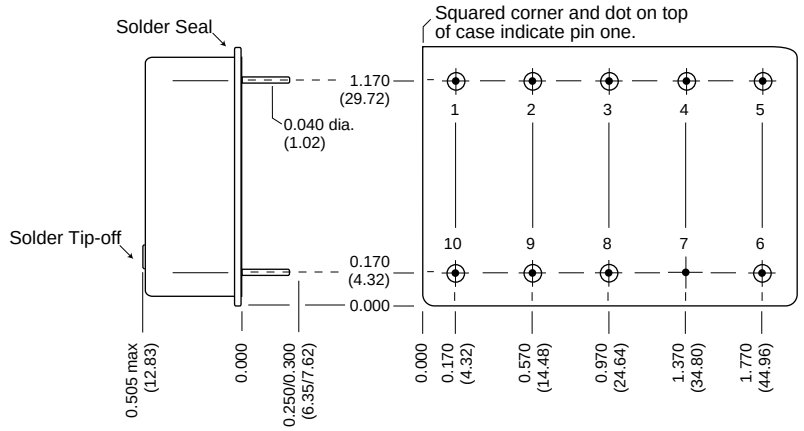


**FIGURE 23: CASE F4**



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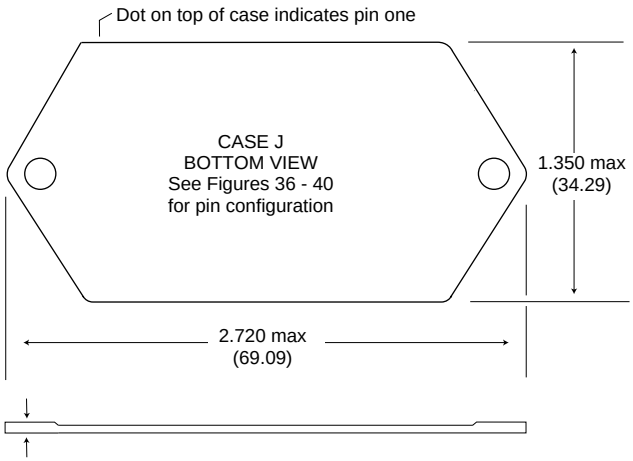
# CASES




**Flange Thickness:**

| | |
|---|---|
| Cases J1 and J5 | 0.060 (1.52) |
| Case J2 | 0.073 (1.85) max |
| Cases J3 and J4 | 0.067 +0.005/-0.007 (1.70 +0.13/-0.8) |

**Materials**

Header Case J1
Cold Rolled Steel/Nickel/Gold
Cases J2 - J5
Cold Rolled Steel/Nickel/Tin
Cover Case J1
Kovar/Nickel
Case J2 - J5
Cold Rolled Steel/Nickel/Tin
Pins #52 alloy (all cases)
Case J1
MHV Series Triple – compression glass seal
MTR Series Triple – ceramic seal
Cases J2 - J5
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 35: CASE J MAXIMUM DIMENSIONS**

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 J4

Flanged cases: Designator required in Case Option position of model number.
FMD28-461 EMI Filter (down-leaded): Screening – Standard or ES

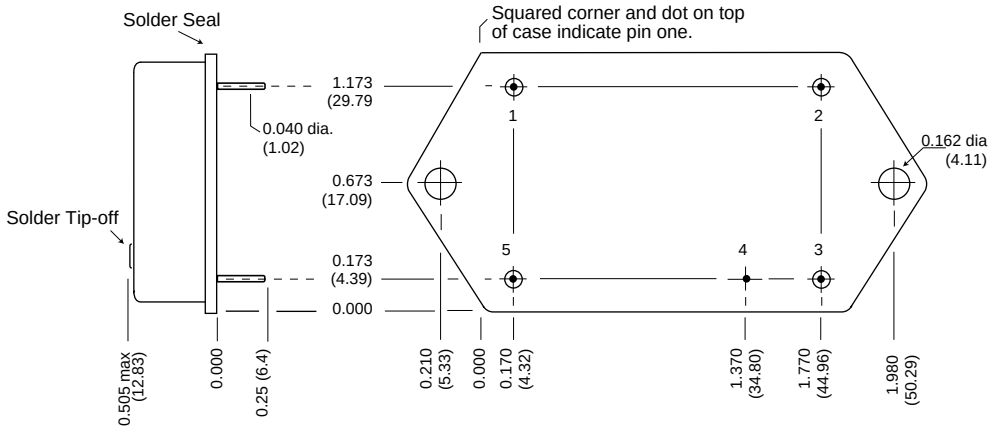



**FIGURE 39: CASE J4**

BOTTOM VIEW CASE J5

Flanged cases: Designator required in Case Option position of model number for MHL Series and MTO Series only.
MHL Series, MTO Series, MTW Series: Screening – Standard or ES
HR300 Series: no screening options

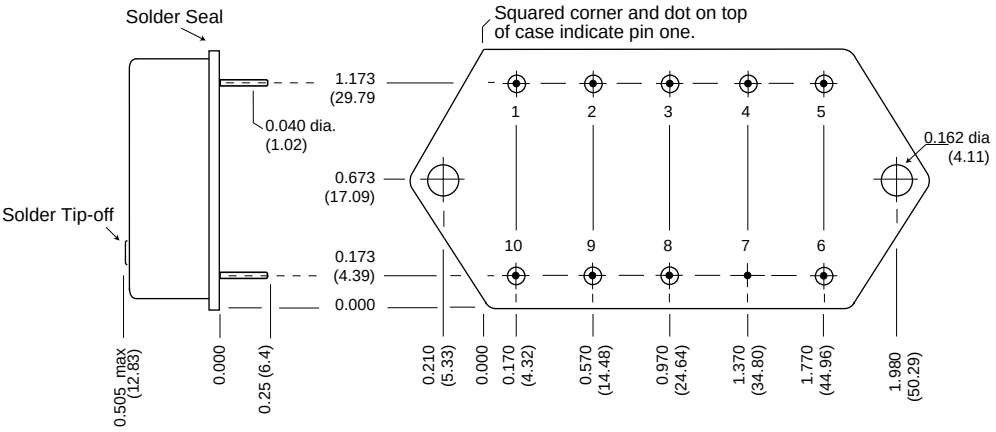



**FIGURE 40: CASE J5**

# 85°C PRODUCTS

| TEST (85°C Products excluding HR products) | STANDARD | /ES |
|---|---|---|
| PRE-CAP INSPECTION | | |
| Method 2017 | yes | yes |
| TEMPERATURE CYCLE (10 times) | | |
| Method 1010, Cond. B, -55°C to 125°C | no | yes |
| CONSTANT ACCELERATION | | |
| Method 2001, 500 g | no | yes |
| BURN-IN | | |
| 96 hours at 70°C ambient (typical) | no | yes |
| FINAL ELECTRICAL TEST MIL-PRF-38534, Group A | | |
| Subgroups 1 and 4: +25°C case | yes | yes |
| HERMETICITY TESTING | | |
| Fine Leak, Method 1014, Cond. A | no | yes |
| Gross Leak, Method 1014, Cond. C | no | yes |
| Gross Leak, Dip ($1 \times 10^{-3}$) | yes | no |
| FINAL VISUAL INSPECTION | | |
| Method 2009 | yes | yes |

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

Applies to the following products:

MFW Series
MTW Series
MHE/MLP Series
MHL Series
MRH Series
MTO Series
MSR Series
DCH Series
FM/FMA/FMB EMI Filters
MSF EMI Filter