Make-Ps®
DC/DC CONVERTER

# 500 series

## Single & Dual Output DC/DC Converter

### Features

- Low Output Noise/Ripple
- -40°C to +75°C Operating Temperature Range
- ±0.03% Line/Load Regulation
- Full Input/Output Protection
- UL1950, CSA 22.2-950, VDE/EN 60950 Approved
- >1,000,000 Hours MTBF

### Descriptions

The 500 series is a family of compact, high performance, low noise 5W DC/DC converters. High performance features include 1000 VDC input/output isolation, continuous short circuit protection with automatic restart and a maximum line/load regulation of only ± 0.03%. Thirty-six models operate from power busses of 5, 12, 18, 24, 28 or 48 VDC and provide single or dual output of 5, 12, 15, ±5, ±12 or ±15 VDC. Standard features include an internal Pi filter to reduce reflected ripple current, efficiency as high as 82% and low noise operation (20 mV Pk-Pk).

### Output Characteristics

| | Min | Typ | Max | Unit/Comments |
|---|---|---|---|---|
| Output Voltage Set Point | | ±0.5 | ±1.0 | % Output voltage at nominal line & FL |
| Output Voltage Balance | | | ±50 | mV; Equal Output Loads |
| Line Regulation | | ±0.01 | ±0.03 | % Output voltage measured from min. input line to maximum |
| Load Regulation | | ±0.01 | ±0.03 | % Output voltage measured from FL to 10% load |
| Ripple/Noise | | | 20 | mV p-p, Nom.Line @FL, 20MHz B.W., using 1 µf bypass capacitor |
| Short Circuit Protection | | | | Limited, Automatic Recovery |
| Transient Response Deviation | | | ±5 | % deviation of Vout for a 25% load change |
| Transient Recovery Time | | | 50 | µS for 25% load change, to within 1% |
| Temperature Coefficient | | | ±0.02 | % per °C |

### Input Characteristics

| | Min | Typ | Max | Unit/Comments |
|---|---|---|---|---|
| Input Voltage | | | | |
| 5 VDC Input Models | 4.65 | 5 | 5.25 | VDC |
| 12 VDC Input Models | 10.9 | 12 | 13.2 | VDC |
| 18 VDC Input Models | 16.4 | 18 | 19.8 | VDC |
| 24 VDC Input Models | 21.6 | 24 | 26.4 | VDC |
| 28 VDC Input Models | 25.2 | 28 | 30.8 | VDC |
| 48 VDC Input Models | 43.2 | 48 | 52.8 | VDC |
| Input Fuse Requirements | | | | |
| 5 VDC Input Models | | 2000 | | mA; Slow blow type |
| 12 VDC Input Models | | 1000 | | mA; Slow blow type |
| 18 VDC Input Models | | 750 | | mA; Slow blow type |
| 24 VDC Input Models | | 500 | | mA; Slow blow type |
| 28 VDC Input Models | | 350 | | mA; Slow blow type |
| 48 VDC Input Models | | 200 | | mA; Slow blow type |
| Reverse Polarity Input Current | | | 5 | Amp |
| Input Filter | | | | Pi Filter |

### General Characteristics

| | Min | Typ | Max | Unit/Comments |
|---|---|---|---|---|
| Switching Frequency | | 150 | | kHz |
| Isolation Voltage | 1000 | | | VDC, 1 minute |
| Isolation Resistance | 1000 | | | Mohm, 500VDC |
| Isolation Capacitance | | 70 | | pF, 100kHz, 1Volt |
| MTBF (MIL-HBK-217F) | 1 | | | Million Hours, +25°C, Ground Benign |

## Environmental Specifications

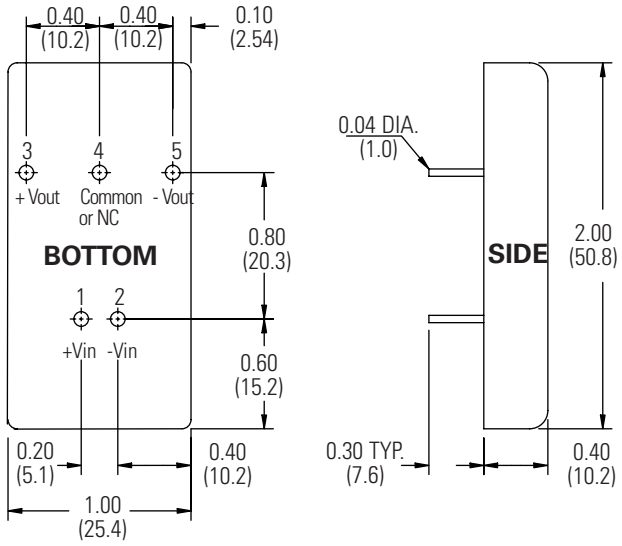
| | Min | Typ | Max | Unit/Comments |
|---|---|---|---|---|
| Operating Temp. Range | -40 | | +75 | °C; Ambient |
| Storage Temp. Range | -50 | | +125 | °C |
| Relative Humidity | | | +95 | % Humidity; non-condensing |
| Cooling | | | | Free-Air Convection |

## Physical Characteristics

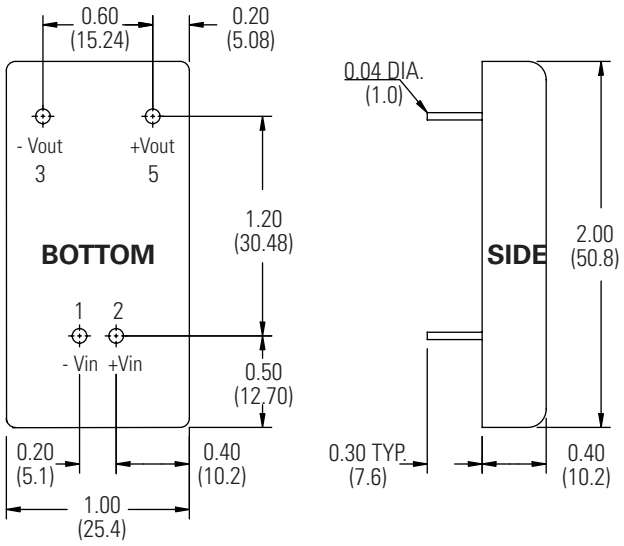
| | Unit/Comments |
|---|---|
| Case Size | 1.0 X 2.0 X 0.40 inches (25.5 X 51.0 X 10.2 mm) |
| Case Material | Painted Metal with Non-Conductive Base |
| Shield Connection | |
| Single Output | Negative Output Pin |
| Dual Output | Common Output Pin |
| Flammability | UL94V-0 |
| Weight | 39.25 Grams |

## Outline Drawing

### Case "D"




### Case " D1" (Optional)




## Pin Out Chart - Case "D"

| Pins | Single | Dual |
|---|---|---|
| 1 | + Vin | + Vin |
| 2 | - Vin | - Vin |
| 3 | + Vout | + Vout |
| 4 | NC | Common |
| 5 | - Vout | - Vout |

NC = No Connection

## Pin Out Chart - Case " D1 " (Optional)

| Pins | Single |
|---|---|
| 1 | - Vin |
| 2 | + Vin |
| 3 | - Vout |
| 5 | + Vout |

Notes:

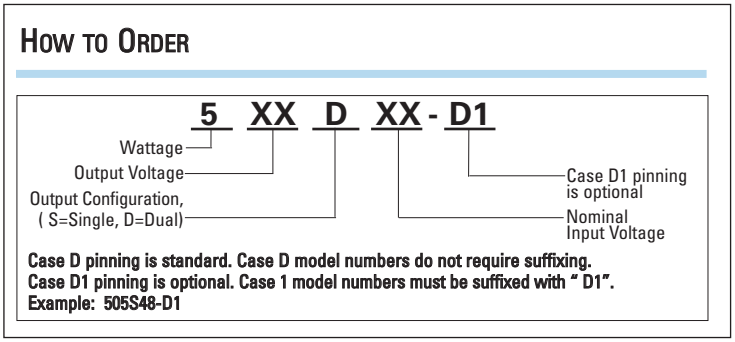
1. Unless otherwise specified dimensions are in inches (mm).

| Tolerances | Inches | mm |
|---|---|---|
| | X.XX = ±0.02 | X.X = ±0.5 |
| | X.XXX= ±0.010 | X.XX = ±0.25 |

2. Case D pinning is standard. Case D model numbers do not require suffixing.
3. Case D1 pinning is optional. Case D1 model numbers must be suffixed with "D1". Example: 505S48-D1

All specifications are typical at nominal input, nominal load and 25° C unless otherwise specified.
External, low ESR, 10 microfarad (minimum) capacitor across output is recommended for operation.

## How To Order



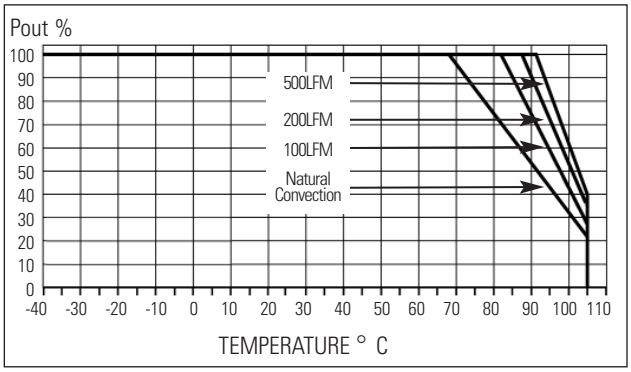

## Model Selection Chart

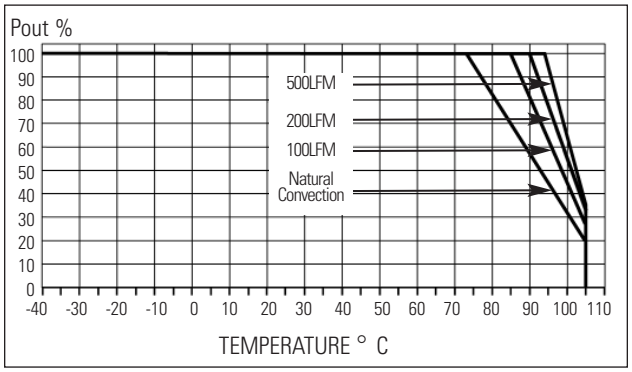
| Model | Nominal Input Voltage (VDC) | Output Voltage (VDC) | Full Load Output Current (mA) | No Load Input Current (mA) | Full Load Input Current (mA) | Reflected Ripple Current (mA) | Efficiency @ FL (%) | Case Style |
|---|---|---|---|---|---|---|---|---|
| 505S5 | 5 | 5 | 1000 | 107 | 1830 | 80 | 55 | D or D1 |
| 512S5 | 5 | 12 | 420 | 110 | 1430 | 80 | 70 | D or D1 |
| 515S5 | 5 | 15 | 340 | 160 | 1390 | 80 | 72 | D or D1 |
| 505D5 | 5 | ±5 | ±500 | 112 | 1790 | 80 | 56 | D |
| 512D5 | 5 | ±12 | ±210 | 140 | 1550 | 80 | 65 | D |
| 515D5 | 5 | ±15 | ±170 | 170 | 1500 | 80 | 66 | D |
| 505S12 | 12 | 5 | 1000 | 35 | 680 | 40 | 61 | D or D1 |
| 512S12 | 12 | 12 | 420 | 35 | 630 | 40 | 66 | D or D1 |
| 515S12 | 12 | 15 | 340 | 35 | 528 | 40 | 79 | D or D1 |
| 505D12 | 12 | ±5 | ±500 | 50 | 670 | 40 | 62 | D |
| 512D12 | 12 | ±12 | ±210 | 50 | 650 | 40 | 64 | D |
| 515D12 | 12 | ±15 | ±170 | 70 | 600 | 40 | 70 | D |
| 505S18 | 18 | 5 | 1000 | 30 | 450 | 35 | 62 | D or D1 |
| 512S18 | 18 | 12 | 420 | 30 | 391 | 35 | 71 | D or D1 |
| 515S18 | 18 | 15 | 340 | 36 | 375 | 35 | 74 | D or D1 |
| 505D18 | 18 | ±5 | ±500 | 30 | 447 | 35 | 62 | D |
| 512D18 | 18 | ±12 | ±210 | 30 | 391 | 35 | 71 | D |
| 515D18 | 18 | ±15 | ±170 | 35 | 375 | 35 | 74 | D |
| 505S24 | 24 | 5 | 1000 | 15 | 350 | 20 | 60 | D or D1 |
| 512S24 | 24 | 12 | 420 | 15 | 292 | 20 | 71 | D or D1 |
| 515S24 | 24 | 15 | 340 | 21 | 283 | 20 | 75 | D or D1 |
| 505D24 | 24 | ±5 | ±500 | 22 | 325 | 20 | 64 | D |
| 512D24 | 24 | ±12 | ±210 | 21 | 292 | 20 | 72 | D |
| 515D24 | 24 | ±15 | ±170 | 30 | 270 | 20 | 77 | D |
| 505S28 | 28 | 5 | 1000 | 20 | 290 | 20 | 61 | D or D1 |
| 512S28 | 28 | 12 | 420 | 20 | 250 | 20 | 71 | D or D1 |
| 515S28 | 28 | 15 | 340 | 20 | 228 | 20 | 78 | D or D1 |
| 505D28 | 28 | ±5 | ±500 | 16 | 300 | 20 | 60 | D |
| 512D28 | 28 | ±12 | ±210 | 16 | 238 | 20 | 75 | D |
| 515D28 | 28 | ±15 | ±170 | 20 | 226 | 20 | 79 | D |
| 505S48 | 48 | 5 | 1000 | 10 | 153 | 15 | 68 | D or D1 |
| 512S48 | 48 | 12 | 420 | 10 | 133 | 15 | 78 | D or D1 |
| 515S48 | 48 | 15 | 340 | 15 | 130 | 15 | 80 | D or D1 |
| 505D48 | 48 | ±5 | ±500 | 10 | 165 | 15 | 63 | D |
| 512D48 | 48 | ±12 | ±210 | 12 | 150 | 15 | 70 | D |
| 515D48 | 48 | ±15 | ±170 | 13 | 126 | 15 | 82 | D |

>> B-66

## Derating Curves

**MODEL 500 5V**




**MODEL 500 12V & 15V**