

Case Study: Solving the low temperature and rapid temperature change demands on DC/DC converters in aircraft

A very common cause of DC/DC converter failures is heat. The expansion and contraction of potting materials can cause it to crack, which can lead to cracking of addition components inside of a DC/DC converter.



MEGA was tasked by a commercial aviation instrumentation manufacturer to create a converter to handle the rigors of being mounted in the wing of an aircraft. The manufacturer needed a converter that was guaranteed to start up at a -55C and be able to handle rapid increases and decreases in the temperature range that are experienced by an airplane that might be sitting on the runway in Vegas at 120 degrees Fahrenheit and 10 minutes later be at 30,000 feet and at -30F. Rather than reinvent the wheel, MEGA took an existing product line, our CD15IDD series, and made a few modifications, including the use of a high quality silicon potting material, to meet the temperature requirements.

MEGA is now testing each of the converters to confirm the -55C start up temperature is met during our manufacturing process, eliminating failures of completed converters. MEGA's customer had a stringent incoming test for this start up temperature that destroyed half the incoming parts previously being supplied by our competitor and had another 25% failure rate in the field. MEGA's testing before leaving the factory has eliminated the incoming test at the customer, resulting in a 0% defect rate over the past two years. As this is used to run a number of sensors in the wing, this is saving the end user millions of dollars in down time.

Please see attached the spec for MEGA CD15IDD12D4U/X1 and the CD15IDD series on which this modified part is based. For more information contact us at info@megaelectronics.com or 732-249-2656.

DC-DC POWER MODULE FOR HARSH ENVIRONMENTS

15W DUAL OUTPUTS

4:1 Input Range

I/O Isolation

Input Pi Filter

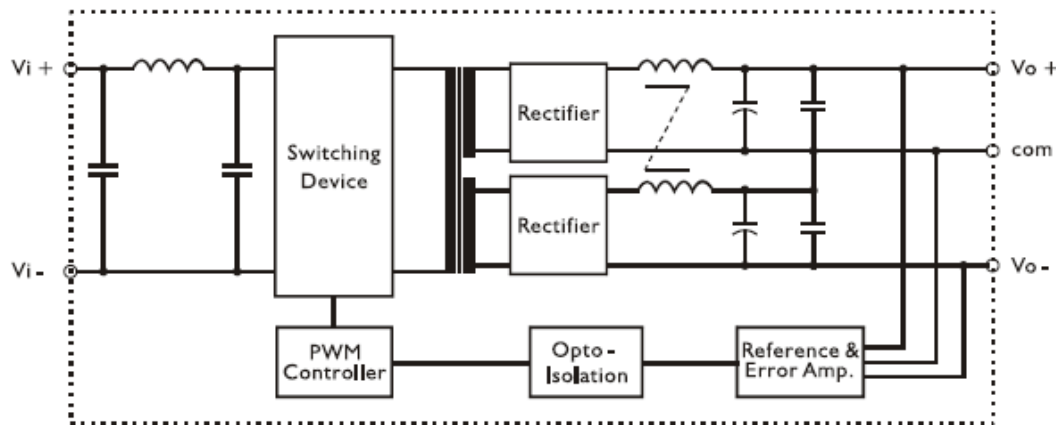
Short Circuit Protection



Each individual converter is tested to a -55C start up temperature before released from production. The converters have Silicon Potting Material. Cover plate material is PPS (GS-40), with case Acrylic coating. The base metal material in copper, pin material is Tin plated on the Nickel plated copper.

| DUAL OUTPUT MODELS | | | | | | |
|--------------------|---------------|----------------|----------------|----------------|----------------------|----------------------|
| Part Number | Input Voltage | Output Wattage | Output Voltage | Output Current | Efficiency (typical) | Efficiency (minimum) |
| CD15IDD12D4U/X1 | 9-36 VDC | 15 Watts | +/-12VDC | +/-630mA | 82% | 80% |

CIRCUIT SCHEMATIC



All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

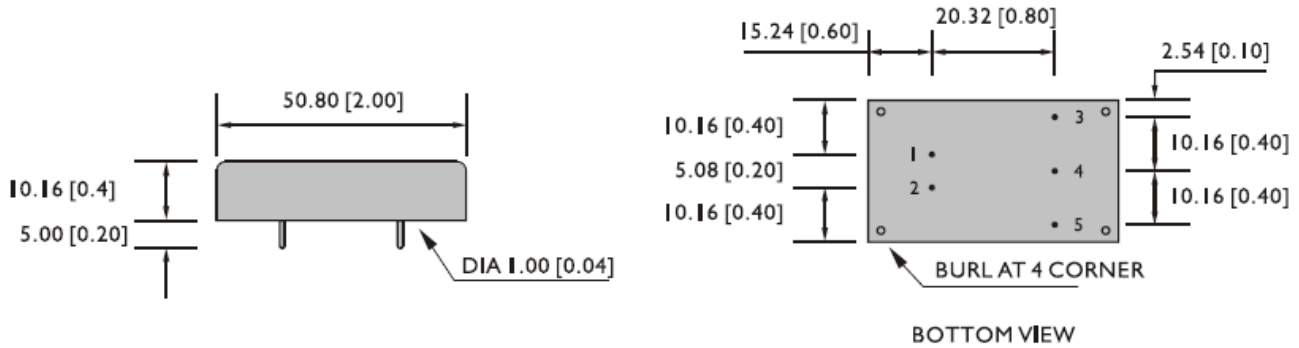
| GENERAL | | | | | |
|----------------------|-----------------------------|--------------------|-----|------|------------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Switching frequency | Vi nom, Io nom | | 200 | | KHz |
| Isolation Voltage | Input/Output | 1,500 | | | VDC |
| Isolation Resistance | Input/Output, @500VDC | 100 | | | M Ω |
| Ambient Temp | Operating at Vi nom, Io nom | -55 | | +71 | C |
| Case Temperature | Operating at Vi nom, Io nom | | | +100 | C |
| Derating | Vi nom | See derating curve | | | %/C |
| Storage Temp. | Non Operational | -55 | | +100 | C |
| Cooling | Free air convection | | | | |

| INPUT SPECIFICATIONS | | | | | |
|-----------------------------|-------------------------|-----|-----|-----|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Input Voltage Range | Ta min...Ta Max, Io nom | 9 | 24 | 36 | VDC |
| No load input current | Vi = nom, Io = 0 | | | 25 | mA |
| Input voltage w/o damage | Io Nom | | | 40 | VDC |
| Startup voltage | Io Nom | | 8.5 | | VDC |
| Input filter | PI type | | | | |

| OUTPUT SPECIFICATIONS | | | | | |
|------------------------------|--|-----|-----|---------|---------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Output voltage accuracy | Vi nom, Io nom | | | +/-2 | % |
| Minimum load | Vi nom dual output model (each output) | 10 | | | % |
| Line regulation | Io nom, Vi min ... Vi max | | | +/-1 | % |
| Load regulation | Vi nom, Io 0 ... Io nom, single output models | | | +/-2 | % |
| | Vi nom, Io min ... Io nom, dual output models | | | +/-5 | % |
| Transient recovery time | 25% load, step change | | 500 | | μ S |
| Temperature coefficient | Vi nom, Io nom | | | +/-0.02 | %/C |
| Ripple & Noise | Vi nom, Io nom, BW =20MHz | | | 150 | mV |

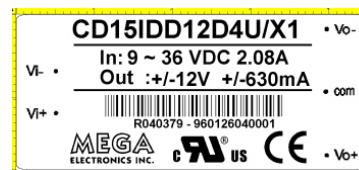
| Control & Protection | |
|----------------------|---|
| Input Reversed | Shunt diode built in, external fuse recommended |
| Output short circuit | Continuous |

mm [inch]



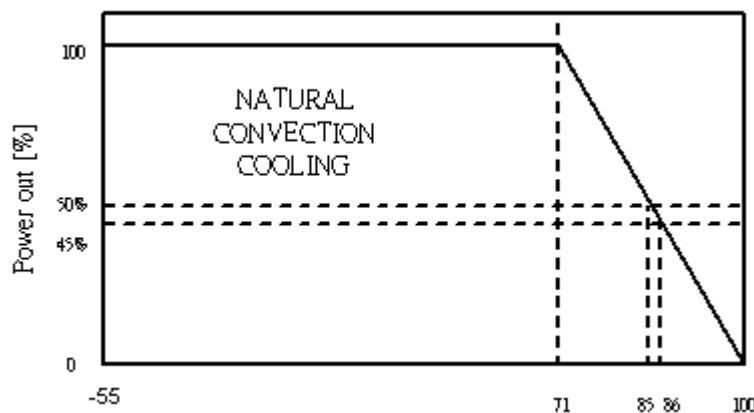
Metal case, weight 33 g

Case Label



| PIN ASSIGNMENT | | | | | |
|----------------|-----|-----|-----|-----|-----|
| Pin No | 1 | 2 | 3 | 4 | 5 |
| DUAL | Vi+ | Vi- | Vo+ | com | Vo- |

DERATING @ Ambient Temperature C



DC-DC POWER MODULE
13.2~15W SINGLE & DUAL OUTPUTS
2:1 & 4:1 Input Range
I/O Isolation
Input Pi Filter
Short Circuit Protection



| SINGLE OUTPUT MODELS | | | | | | |
|----------------------|---------------|----------------|----------------|----------------|----------------------|----------------------|
| Part Number | Input Voltage | Output Wattage | Output Voltage | Output Current | Efficiency (typical) | Efficiency (minimum) |
| CD15IDD03S1U | 9~18 VDC | 13.2 Watts | 3.3 VDC | 4000mA | 82% | 80% |
| CD15IDD05S1U | 9~18 VDC | 15 Watts | 5VDC | 3000mA | 84% | 82% |
| CD15IDD12S1U | 9~18 VDC | 15 Watts | 12VDC | 1250mA | 87% | 85% |
| CD15IDD15S1U | 9~18 VDC | 15 Watts | 15VDC | 1000mA | 89% | 87% |
| CD15IDD03S2U | 18~36 VDC | 13.2 Watts | 3.3 VDC | 4000mA | 83% | 81% |
| CD15IDD05S2U | 18~36 VDC | 15 Watts | 5VDC | 3000mA | 85% | 83% |
| CD15IDD12S2U | 18~36 VDC | 15 Watts | 12VDC | 1250mA | 88% | 86% |
| CD15IDD15S2U | 18~36 VDC | 15 Watts | 15VDC | 1000mA | 89% | 87% |
| CD15IDD03S3U | 35~75 VDC | 13.2 Watts | 3.3 VDC | 4000mA | 83% | 81% |
| CD15IDD05S3U | 35~75 VDC | 15 Watts | 5VDC | 3000mA | 85% | 83% |
| CD15IDD12S3U | 35~75 VDC | 15 Watts | 12VDC | 1250mA | 88% | 86% |
| CD15IDD15S3U | 35~75 VDC | 15 Watts | 15VDC | 1000mA | 89% | 87% |

| DUAL OUTPUT MODELS | | | | | | |
|--------------------|---------------|----------------|----------------|----------------|----------------------|----------------------|
| Part Number | Input Voltage | Output Wattage | Output Voltage | Output Current | Efficiency (typical) | Efficiency (minimum) |
| CD15IDD05D1U | 9~18 VDC | 15 Watts | +/-5VDC | +/-1500mA | 84% | 82% |
| CD15IDD12D1U | 9~18 VDC | 15 Watts | +/-12VDC | +/-630mA | 87% | 85% |
| CD15IDD15D1U | 9~18 VDC | 15 Watts | +/-15VDC | +/-500mA | 87% | 85% |
| CD15IDD05D2U | 18~36 VDC | 15 Watts | +/-5VDC | +/-1500mA | 86% | 84% |
| CD15IDD12D2U | 18~36 VDC | 15 Watts | +/-12VDC | +/-630mA | 88% | 86% |
| CD15IDD15D2U | 18~36 VDC | 15 Watts | +/-15VDC | +/-500mA | 89% | 87% |
| CD15IDD05D3U | 35~75 VDC | 15 Watts | +/-5VDC | +/-1500mA | 86% | 84% |
| CD15IDD12D3U | 35~75 VDC | 15 Watts | +/-12VDC | +/-630mA | 88% | 86% |
| CD15IDD15D3U | 35~75 VDC | 15 Watts | +/-15VDC | +/-500mA | 89% | 87% |

All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

| GENERAL | | | | | |
|----------------------|-----------------------------|--------------------|-----|------|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Switching frequency | Vi nom, Io nom | | 200 | | KHz |
| Isolation Voltage | Input/Output | 1,500 | | | VDC |
| Isolation Resistance | Input/Output, @500VDC | 100 | | | MΩ |
| Ambient Temp | Operating at Vi nom Io nom | -40 | | +71 | C |
| Case Temperature | Operating at Vi nom, Io nom | | | +100 | C |
| Derating | Vi nom | See derating curve | | | %/C |
| Storage Temp. | Non Operational | -40 | | +100 | C |
| Cooling | Free air convection | | | | |

| INPUT SPECIFICATIONS | | | | | |
|--------------------------|-------------------------|------------|-----|-----|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Input Voltage Range | Ta min...Ta Max, Io nom | 9 | 12 | 18 | VDC |
| | | 18 | 24 | 36 | VDC |
| | | 35 | 48 | 75 | VDC |
| No load input current | Vi nom, Io = 0 | 12V models | 25 | | mA |
| | | 24V models | 20 | | mA |
| | | 48V models | 15 | | mA |
| Input voltage w/o damage | Io Nom | 12V models | | 20 | VDC |
| | | 24V models | | 40 | VDC |
| | | 48V models | | 80 | VDC |
| Startup voltage | Io Nom | 12V models | 8.5 | | VDC |
| | | 24V models | 16 | | VDC |
| | | 48V models | 33 | | VDC |
| Input filter | PI type | | | | |

| OUTPUT SPECIFICATIONS | | | | | |
|-------------------------|---|-----------------|-----|---------|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Output voltage accuracy | Vi nom, Io nom | | | +/-2 | % |
| Minimum load | Vi nom single output model | 0 | | | % |
| | Vi nom dual output model (each output) | 10 | | | % |
| Line regulation | Io nom, Vi min ... Vi max | | | +/-1 | % |
| Load regulation | Vi nom, Io 0 ... Io nom, single output models | | | +/-2 | % |
| | Vi nom, Io min ... Io nom, dual output models | | | +/-5 | % |
| Transient recovery time | 25% load, step change | | 500 | | uS |
| Temperature coefficient | Vi nom, Io nom | | | +/-0.02 | %/C |
| Ripple & Noise | Vi nom, Io nom, BW =20MHz | 3.3V & 5V | | 100 | mV |
| | | 12V, 15V & Dual | | 150 | |

DC-DC POWER MODULE
13.2W~15WW SINGLE & DUAL OUTPUTS
4:1 Input Range
I/O Isolation
Input Pi Filter
Short Circuit Protection



| SINGLE OUTPUT MODELS | | | | | | |
|----------------------|---------------|----------------|----------------|----------------|----------------------|----------------------|
| Part Number | Input Voltage | Output Wattage | Output Voltage | Output Current | Efficiency (typical) | Efficiency (minimum) |
| CD15IDD03S4U | 9~36 VDC | 13.2 Watts | 3.3 VDC | 4000mA | 80% | 78% |
| CD15IDD05S4U | 9~36 VDC | 15 Watts | 5VDC | 3000mA | 83% | 81% |
| CD15IDD12S4U | 9~36 VDC | 15 Watts | 12VDC | 1250mA | 84% | 82% |
| CD15IDD15S4U | 9~36 VDC | 15 Watts | 15VDC | 1000mA | 84% | 82% |
| CD15IDD03S5U | 18~75 VDC | 13.2 Watts | 3.3 VDC | 4000mA | 80% | 78% |
| CD15IDD05S5U | 18~75 VDC | 15 Watts | 5VDC | 3000mA | 83% | 81% |
| CD15IDD12S5U | 18~75 VDC | 15 Watts | 12VDC | 1250mA | 84% | 82% |
| CD15IDD15S5U | 18~75 VDC | 15 Watts | 15VDC | 1000mA | 84% | 82% |

| DUAL OUTPUT MODELS | | | | | | |
|--------------------|---------------|----------------|----------------|----------------|----------------------|----------------------|
| Part Number | Input Voltage | Output Wattage | Output Voltage | Output Current | Efficiency (typical) | Efficiency (minimum) |
| CD15IDD05D4U | 9~36 VDC | 15 Watts | +/-5VDC | +/-1500mA | 82% | 80% |
| CD15IDD12D4U | 9~36 VDC | 15 Watts | +/-12VDC | +/-630mA | 82% | 80% |
| CD15IDD15D4U | 9~36 VDC | 15 Watts | +/-15VDC | +/-500mA | 84% | 82% |
| CD15IDD05D5U | 18~75 VDC | 15 Watts | +/-5VDC | +/-1500mA | 83% | 81% |
| CD15IDD12D5U | 18~75 VDC | 15 Watts | +/-12VDC | +/-630mA | 82% | 80% |
| CD15IDD15D5U | 18~75 VDC | 15 Watts | +/-15VDC | +/-500mA | 83% | 81% |

All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

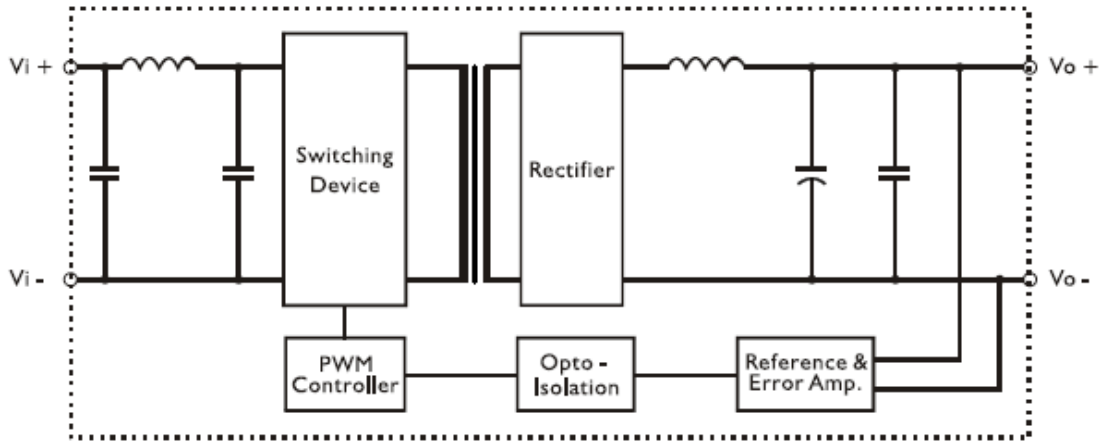
| GENERAL | | | | | |
|----------------------|-----------------------------|--------------------|-----|------|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Switching frequency | Vi nom, Io nom | | 200 | | KHz |
| Isolation Voltage | Input/Output | 1,500 | | | VDC |
| Isolation Resistance | Input/Output, @500VDC | 100 | | | MΩ |
| Ambient Temp | Operating at Vi nom, Io nom | -40 | | +71 | C |
| Case Temperature | Operating at Vi nom, Io nom | | | +100 | C |
| Derating | Vi nom | See derating curve | | | %/C |
| Storage Temp. | Non Operational | -40 | | +100 | C |
| Cooling | Free air convection | | | | |

| INPUT SPECIFICATIONS | | | | | |
|--------------------------|-------------------------|------------|-----|-----|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Input Voltage Range | Ta min...Ta Max, Io nom | 9 | 24 | 36 | VDC |
| | | 18 | 48 | 75 | VDC |
| No load input current | Vi = nom, Io = 0 | 24V models | | 25 | mA |
| | | 48V models | | 15 | mA |
| Input voltage w/o damage | Io Nom | 24V models | | 40 | VDC |
| | | 48V models | | 80 | VDC |
| Startup voltage | Io Nom | 24V models | 8.5 | | VDC |
| | | 48V models | 16 | | VDC |
| Input filter | PI type | | | | |

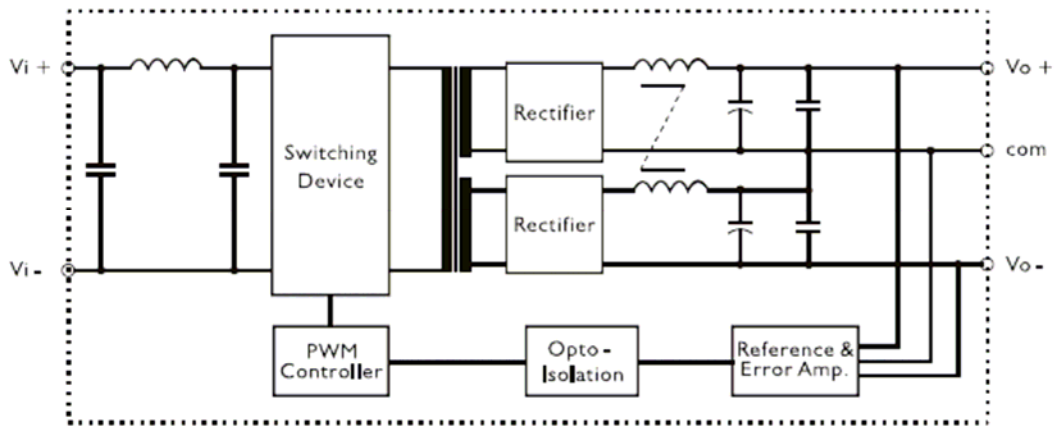
| OUTPUT SPECIFICATIONS | | | | | |
|-------------------------|--|-----------------|-----|---------|------|
| Characteristics | Conditions | Min | Typ | Max | Unit |
| Output voltage accuracy | Vi nom, Io nom | | | +/-2 | % |
| Minimum load | Vi nom single output model | 0 | | | % |
| | Vi nom dual output model (each output) | 10 | | | % |
| Line regulation | Io nom, Vi min ... Vi max | | | +/-1 | % |
| Load regulation | Vi nom, Io 0 ... Io nom, single output models | | | +/-2 | % |
| | Vi nom, Io min ... Io nom, dual output models | | | +/-5 | % |
| Transient recovery time | 25% load, step change | | 500 | | μS |
| Temperature coefficient | Vi nom, Io nom | | | +/-0.02 | %/C |
| Ripple & Noise | Vi nom, Io nom, BW =20MHz | 3.3V & 5V | | 100 | mV |
| | | 12V, 15V & Dual | | 150 | |

CIRCUIT SCHEMATIC

Block diagram for CD15IDDxxxxU series with single output 2:1 and 4:1 input

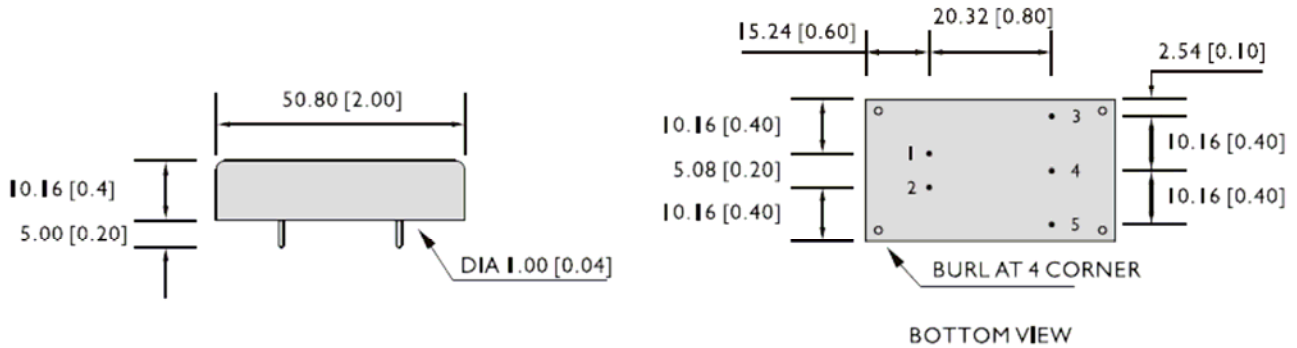


Block diagram for CD15IDDxxxxU series with dual output 2:1 and 4:1 input



| Control & Protection | |
|----------------------|---|
| Input Reversed | Shunt diode built in, external fuse recommended |
| Output short circuit | Continuous |

mm [inch]



Metal case, weight 33 g

PIN ASSIGNMENT

| Pin No | 1 | 2 | 3 | 4 | 5 |
|--------|-----|-----|-----|--------|-----|
| SINGLE | Vi+ | Vi- | Vo+ | No Pin | Vo- |
| DUAL | Vi+ | Vi- | Vo+ | com | Vo- |

DERATING @ Ambient Temperature C

