



# Data Sheet

## MI-J00

### DC-DC Converters

### 10 to 50 Watts



#### Features

- Inputs:
  - 28 Vdc per MIL-STD-704D/E/F
  - 155 Vdc per MIL-STD-1399A
  - 270 Vdc per MIL-STD-704D/E/F
- Single output: 2 – 48 Vdc
- Up to 23 W/in<sup>3</sup>
- MIL-STD-810 environments
- Up to 90% efficiency
- Remote sense
- Current limit
- ZCS power architecture
- Low noise FM control
- Size: 2.28" x 2.4" x 0.5" (57,9 x 61,0 x 12,7 mm)

#### Product Highlights

The MI-J00 family of DC-DC converters is designed for applications utilizing distributed power architectures. Based on Vicor's VI-200 / VI-J00 family of zero-current switching, component-level DC-DC converters, the MI-J00 family offers exceptional performance in terms of power density, efficiency, noise, ease of use, and reliability.

The MI-J00 family meets all steady-state, transient and under/overvoltage requirements of MIL-STD-704D/E/F for both 28 Vdc input (MI-J2X) and 270 Vdc input (MI-J6X), and the worst case envelope of MIL-STD-1399A for 155 Vdc input (MI-J5X).

The output voltage can be externally trimmed or programmed from 50% to 110% of nominal output. Current limiting, remote sense, and an inhibit pin all combine to offer a high degree of protection, versatility, and reliability for power systems.

Fully encapsulated in Vicor's industry standard package, the MI-J00 family meets MIL-STD-810 environmental testing requirements for humidity, fungus, salt-fog, explosive atmosphere, acceleration, vibration, and shock.

#### Packaging Options

**Standard:** Slotted baseplate

**SlimMod:** Flangeless baseplate, option suffix: - S  
Example: MI - JXX - XX - S

**FinMod:** Finned heat sink, option suffix:  
- F1, -F2, -F3 and - F4

Examples:

MI - JXX - XX -F1, 0.25" fins, longitudinal  
MI - JXX - XX -F2, 0.50" fins, longitudinal  
MI - JXX - XX -F3, 0.25" fins, transverse  
MI - JXX - XX -F4, 0.50" fins, transverse

#### Converter Selection Chart

### MI-J

Semi-custom modules available, consult factory.

#### Input Voltage

| Nominal   | Range                      | Transient <sup>[a]</sup> | Notes                              |
|-----------|----------------------------|--------------------------|------------------------------------|
| 2 = 28 V  | 18 – 50 V <sup>[b]</sup>   | 60 V                     | 28 Vdc input per MIL-STD 704D/E/F  |
| 5 = 155 V | 100 – 210 V                | 230 V                    | 155 Vdc input per MIL-STD-1399A    |
| 6 = 270 V | 125 – 400 V <sup>[c]</sup> | 475 V                    | 270 Vdc input per MIL-STD-704D/E/F |
| 7 = 165 V | 100 – 310 V                | n/a                      |                                    |

<sup>[a]</sup> Transient voltage for 1 second.

<sup>[b]</sup> 16 V operation at 75% load.

<sup>[c]</sup> These units rated at 75% load from 125 – 150 Vin: MI-J6Z-xY, MI-J6Y-xY, MI-J60-xY

#### Output Voltage

|           |            |
|-----------|------------|
| Z = 2.0 V | 1 = 12 V   |
| Y = 3.3 V | P = 13.8 V |
| 0 = 5.0 V | 2 = 15 V   |
| X = 5.2 V | N = 18.5 V |
| W = 5.5 V | 3 = 24 V   |
| V = 5.8 V | L = 28 V   |
| T = 6.5 V | J = 36 V   |
| R = 7.5 V | K = 40 V   |
| M = 10 V  | 4 = 48 V   |

#### Product Grade Temperatures (°C)

| Operating       | Storage         |
|-----------------|-----------------|
| I = -40 to +100 | I = -55 to +125 |
| M = -55 to +100 | M = -65 to +125 |

#### Output Power/Current Vout

| ≥ 5 V    | < 5 V    |
|----------|----------|
| A = 10 W | A = —    |
| Z = 25 W | Z = 5 A  |
| Y = 50 W | Y = 10 A |

## CONVERTER SPECIFICATIONS

(typical at  $T_{BP} = 25^{\circ}\text{C}$ , nominal line and 75% load, unless otherwise specified)

### ■ INPUT SPECIFICATIONS

| Parameter                           | Min | Typ                                               | Max                  | Units    | Test Conditions         |
|-------------------------------------|-----|---------------------------------------------------|----------------------|----------|-------------------------|
| Inrush charge                       |     | $60 \times 10^{-6}$                               | $100 \times 10^{-6}$ | Coulombs | Nominal line            |
| Input reflected ripple current – pp |     | 10%                                               |                      | $I_{IN}$ | Nominal line, full load |
| Input ripple rejection              |     | $30 + 20 \log\left(\frac{V_{in}}{V_{out}}\right)$ |                      | dB       | 120 Hz, nominal line    |
|                                     |     | $20 + 20 \log\left(\frac{V_{in}}{V_{out}}\right)$ |                      | dB       | 2400 Hz, nominal line   |
| No load power dissipation           |     | 1.35                                              | 2                    | Watts    |                         |

### ■ OUTPUT CHARACTERISTICS

| Parameter                       | Min | Typ  | Max  | Units                  | Test Conditions                          |
|---------------------------------|-----|------|------|------------------------|------------------------------------------|
| Setpoint accuracy               |     | 0.5  | 1    | % $V_{NOM}$            |                                          |
| Load/line regulation            |     | 0.05 | 0.2  | % $V_{NOM}$            | LL to HL, 10% to Full Load               |
|                                 |     | 0.2  | 0.5  | % $V_{NOM}$            | LL to HL, No Load to 10%                 |
| Output temperature drift        |     | 0.01 | 0.02 | % / $^{\circ}\text{C}$ | Over rated temperature                   |
| Long term drift                 |     | 0.02 |      | %/1K hours             |                                          |
| Output ripple – pp              |     | 100  | 150  | mV                     | Whichever is greater<br>20 MHz bandwidth |
|                                 |     | 1.0  | 1.5  | % $V_{NOM}$            |                                          |
| Trim range <sup>[a]</sup>       | 50  |      | 110  | % $V_{NOM}$            |                                          |
| Total remote sense compensation | 0.5 |      |      | Volts                  |                                          |
| Current limit                   | 105 |      | 125  | % $I_{NOM}$            | Automatic restart                        |
| Short circuit current           | 105 |      | 130  | % $I_{NOM}$            |                                          |

<sup>[a]</sup> 10 V, 12 V and 15 V outputs, standard trim range  $\pm 10\%$ . Consult factory for wider trim range.

### ■ CONTROL PIN SPECIFICATIONS

| Parameter              | Min  | Typ  | Max | Units | Test Conditions    |
|------------------------|------|------|-----|-------|--------------------|
| Gate out impedance     |      | 50   |     | -     |                    |
| Gate in impedance      |      | 1000 |     | -     |                    |
| Gate in high threshold |      |      | 6   | Volts | Use open collector |
| Gate in low threshold  | 0.65 |      |     | Volts |                    |
| Gate in low current    |      |      | 6   | mA    |                    |

## CONVERTER SPECIFICATIONS (cont.)

### ■ DIELECTRIC WITHSTAND CHARACTERISTICS

| Parameter                   | Min   | Typ | Max | Units            | Test Conditions   |
|-----------------------------|-------|-----|-----|------------------|-------------------|
| Input to output             | 3,000 |     |     | V <sub>RMS</sub> | Baseplate earthed |
| Output to baseplate         | 500   |     |     | V <sub>RMS</sub> |                   |
| Input to baseplate          | 1,500 |     |     | V <sub>RMS</sub> |                   |
| Input to output capacitance |       | 50  | 75  | pF               |                   |

### ■ THERMAL CHARACTERISTICS

| Parameter         | Min | Typ      | Max | Units   | Test Conditions   |
|-------------------|-----|----------|-----|---------|-------------------|
| Efficiency        |     | 80 – 90% |     |         |                   |
| Baseplate to sink |     | 0.14     |     | °C/Watt | With thermal pads |

### ■ ENVIRONMENTAL – MIL-STD-810D

| Parameter                   | Min    | Typ | Max | Units   | Test Conditions         |
|-----------------------------|--------|-----|-----|---------|-------------------------|
| Altitude - method 500.2     | 70,000 |     |     | feet    | Procedure II            |
| Humidity - method 507.2     | 88/240 |     |     | %/hours | Procedure I, cycle 1    |
| Acceleration - method 513.3 | 9      |     |     | g       | Procedure II            |
| Vibration - method 514.3    | 20     |     |     | g       | Procedure I, category 6 |
| Shock - method 516.3        | 40     |     |     | g       | Procedure I             |

### ■ RELIABILITY - MIL-HDBK-217F (MI-J2L-MY)

| Parameter                                | Min | Typ   | Max | Units       | Test Conditions |
|------------------------------------------|-----|-------|-----|-------------|-----------------|
| 25°C Ground Benign: G.B.                 |     | 3,732 |     | 1,000 hours |                 |
| 50°C Naval Sheltered: N.S.               |     | 672   |     | 1,000 hours |                 |
| 65°C Airborne Inhabited<br>Cargo: A.I.C. |     | 526   |     | 1,000 hours |                 |

### ■ MECHANICAL SPECIFICATIONS

| Parameter | Min        | Typ        | Max        | Units           | Test Conditions |
|-----------|------------|------------|------------|-----------------|-----------------|
| Weight    | 3.5<br>101 | 3.7<br>107 | 3.8<br>109 | Ounces<br>Grams |                 |

## CONVERTER SPECIFICATIONS (cont.)

### ■ PRODUCT GRADE SPECIFICATIONS

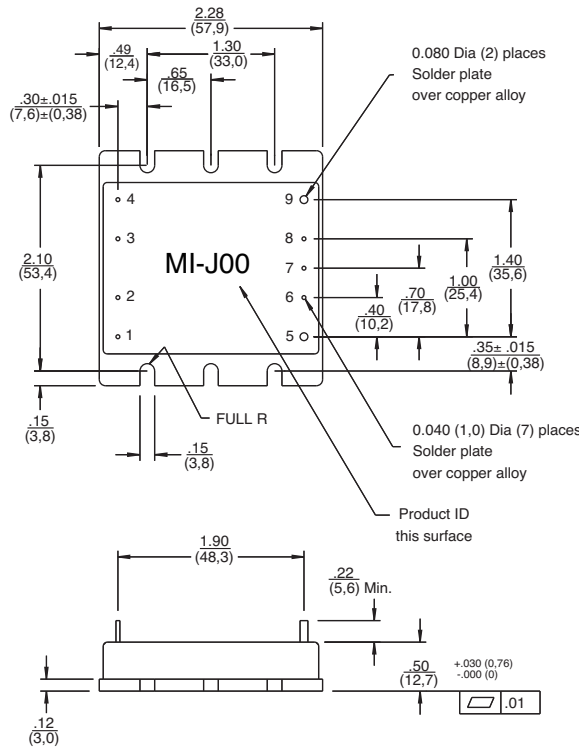
| Parameter                                                           | I-Grade                      | M-Grade                      |
|---------------------------------------------------------------------|------------------------------|------------------------------|
| Storage temperature                                                 | -55°C to +125°C              | -65°C to +125°C              |
| Operating temperature (baseplate)                                   | -40°C to +100°C              | -55°C to +100°C              |
| Power cycling burn-in                                               | 12 hours, 29 cycles          | 96 hours, 213 cycles         |
| Temperature cycled with power off<br>17°C per minute rate of change | 12 cycles<br>-65°C to +100°C | 12 cycles<br>-65°C to +100°C |
| Test data supplied at these temperatures <sup>[a]</sup>             | -40°C, +80°C                 | -55°C, +80°C                 |
| Warranty                                                            | 2 years                      | 2 years                      |
| Environmental compliance                                            | MIL-STD-810                  | MIL-STD-810                  |
| Derating                                                            | NAVMAT P-4855-1A             | NAVMAT P-4855-1A             |

<sup>[a]</sup> Test data available for review or download from vicorpower.com

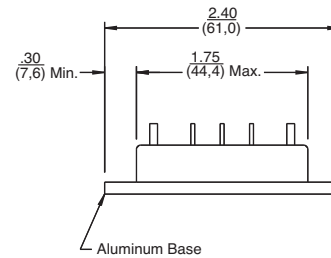
### ■ ENVIRONMENTAL QUALIFICATIONS

| Parameter            | Qualification                                                                                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Altitude             | MIL-STD-810D, Method 500.2, Procedure III, explosive decompression (40 K ft.).                                                                                                                                                         |
|                      | MIL-STD-810D, Method 500.2, Procedure II, 40,000 ft., 1000 – 1500 ft./min. to 70,000 ft., unit functioning                                                                                                                             |
| Explosive Atmosphere | MIL-STD-810C, Method 511.1, Procedure I                                                                                                                                                                                                |
| Vibration            | MIL-STD-810D, Method 514.3, Procedure I, category 6, helicopter, 20 g                                                                                                                                                                  |
|                      | MIL-STD-810D, Method 514.3 random: 10 – 300 Hz @ 0.02 g <sup>2</sup> /Hz, 2000 Hz @ 0.002 g <sup>2</sup> /Hz, 3.9 total G rms<br>3 hrs/axis. Sine: 30 Hz @ 20 g, 60 Hz @ 10 g, 90 Hz @ 6.6 g, 120 Hz @ 5.0 g, 16.0 total G rms, 3 axes |
|                      | MIL-STD-810E, Method 514.4, Table 514.4-VII, ±6 db/octave, 7.7 G rms, 1hr/axis                                                                                                                                                         |
| Shock                | MIL-STD-810D, Method 516.3, Procedure I, functional shock, 40 g                                                                                                                                                                        |
|                      | MIL-STD-202F, Method 213B, 18 pulses, 60 g, 9 msec                                                                                                                                                                                     |
|                      | MIL-STD-202F, Method 213B, 75 g, 11 ms saw tooth shock                                                                                                                                                                                 |
|                      | MIL-STD-202F, Method 207A, 3 impacts / axis, 1, 3, 5 feet                                                                                                                                                                              |
| Acceleration         | MIL-STD-810D, Method 513.3, Procedure II Operational test, 9 g for 1 minute along 3 mutually perpendicular axes                                                                                                                        |
| Humidity             | MIL-STD-810D, Method 507.2, Procedure I, cycle I, 240 hrs, 88% relative humidity                                                                                                                                                       |
| Solder Test          | MIL-STD-202, Method 208, 8 hr. aging                                                                                                                                                                                                   |
| Fungus               | MIL-STD-810C, Method 508.1                                                                                                                                                                                                             |
| Salt-Fog             | MIL-STD-810C, Method 509.1                                                                                                                                                                                                             |

## MECHANICAL DRAWING



| Pin # | Function |
|-------|----------|
| 1     | +In      |
| 2     | Gate In  |
| 3     | Gate Out |
| 4     | -In      |
| 5     | +Out     |
| 6     | +Sense   |
| 7     | Trim     |
| 8     | -Sense   |
| 9     | -Out     |



Note: For alternate package options refer to the mechanical drawing page of [vicorpower.com](http://vicorpower.com)

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