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VICOR MIL COTS POWER



# Military Standards

| MIL-STD-704: Aircraft Electrical Power Characteristics                                                          |                                    |                                          |                                          |                    |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------|------------------------------------------|--------------------|
| Product                                                                                                         | MIL-STD-704A                       | MIL-STD-704D                             | MIL-STD-704E                             | MIL-STD-704F       |
| V•I Chip 28 Vdc                                                                                                 |                                    | •                                        | •                                        | •                  |
| MI-J2x-xx                                                                                                       | • <sup>[a]</sup>                   | •                                        | •                                        | •                  |
| MI-J6x-xx                                                                                                       | N/A                                | •                                        | •                                        | •                  |
| MI-22x-xx                                                                                                       | • <sup>[a]</sup>                   | •                                        | •                                        | •                  |
| MI-26x-xx                                                                                                       | N/A                                | •                                        | •                                        | •                  |
| MI-A22-xx                                                                                                       | •                                  | •                                        | •                                        | •                  |
| MI-A66-xx                                                                                                       | N/A                                | •                                        | •                                        | •                  |
| MI-AIM-xx                                                                                                       | •                                  | •                                        | •                                        | •                  |
| 24 / 28 Vin Maxi, Mini, Micro                                                                                   | • <sup>[d]</sup>                   | • <sup>[d]</sup>                         | • <sup>[b,d]</sup>                       | • <sup>[b,d]</sup> |
| 300 Vin Maxi, Mini, Micro                                                                                       | N/A                                |                                          | •                                        | •                  |
| M-FIAM3                                                                                                         | N/A                                |                                          | •                                        | •                  |
| M-FIAM5B                                                                                                        |                                    |                                          | •                                        | •                  |
| M-FIAM7, M-FIAM9                                                                                                | •                                  | •                                        | •                                        | •                  |
| MI-ComPAC 28 Vdc                                                                                                | •                                  | •                                        | •                                        | •                  |
| MI-ComPAC 270 Vdc                                                                                               | N/A                                | •                                        | •                                        | •                  |
| MI-MegaMod 28 Vdc                                                                                               | • <sup>[a]</sup>                   | •                                        | •                                        | •                  |
| MI-MegaMod 270 Vdc                                                                                              | N/A                                | •                                        | •                                        | •                  |
| MIL-VIPAC 28 Vdc                                                                                                | •                                  | •                                        | •                                        | •                  |
| MIL-STD-1275: Military Vehicle 28 Vdc Electrical Characteristics                                                |                                    |                                          |                                          |                    |
| Product                                                                                                         | MIL-STD-1275A                      | MIL-STD-1275B                            | MIL-STD-1275D                            |                    |
| MI-J2x-xx, MI-22x-xx                                                                                            | • <sup>[a]</sup>                   | • <sup>[a]</sup>                         | • <sup>[a]</sup>                         |                    |
| 24 / 28 Vin Maxi, Mini, Micro                                                                                   | • <sup>[d]</sup>                   | • <sup>[d]</sup>                         | • <sup>[d]</sup>                         |                    |
| V•I Chip 28 Vdc                                                                                                 | • <sup>[c]</sup>                   | • <sup>[c]</sup>                         | • <sup>[c]</sup>                         |                    |
| MI-A22-xx                                                                                                       | •                                  | •                                        | •                                        |                    |
| M-FIAM7, M-FIAM9                                                                                                | •                                  | •                                        | •                                        |                    |
| MI-ComPAC 28 Vdc                                                                                                | •                                  | •                                        | •                                        |                    |
| MIL-VIPAC 28 Vdc                                                                                                |                                    |                                          |                                          |                    |
| MIL-STD-1399: Interface Standard for Shipboard Systems                                                          |                                    |                                          |                                          |                    |
| Product                                                                                                         | MIL-STD-1399A                      | MIL-STD-1399B                            | MIL-STD-1399C                            |                    |
| MI-J5x-xx                                                                                                       | •                                  | •                                        | •                                        |                    |
| MI-25x-xx                                                                                                       | •                                  | •                                        | •                                        |                    |
| MI-MegaMod 155 Vdc                                                                                              | •                                  | •                                        | •                                        |                    |
| MIL-STD-461: Electromagnetic Emissions and Susceptibility Requirements                                          |                                    |                                          |                                          |                    |
| Product                                                                                                         | MIL-STD-461C                       | MIL-STD-461D                             | MIL-STD-461E                             |                    |
| MI-A22-xx, MI-A66-xx                                                                                            | CE01, CE03, CE07, CS01, CS02, CS06 | CE101, CE102, CS101, CS114, CS115, CS116 | CE101, CE102, CS101, CS114, CS115, CS116 |                    |
| M-FIAM3, M-FIAM5B, M-FIAM7, M-FIAM9, MQPI-18                                                                    |                                    |                                          | CE101, CE102, CS101, CS114, CS115, CS116 |                    |
| MI-AIM-xx                                                                                                       | CE102                              | CE102                                    |                                          |                    |
| MI-ComPAC 28 Vdc, 270 Vdc                                                                                       | CE01, CE03, CE07, CS01, CS02, CS06 | CE101, CE102, CS101, CS114, CS116        | CE101, CE102, CS101, CS114, CS115, CS116 |                    |
| MIL-VIPAC 28 Vdc                                                                                                |                                    |                                          | CE101, CE102, CS101, CS114, CS115, CS116 |                    |
| <sup>[a]</sup> with MI-IAM <sup>[b]</sup> with M-FIAM5B <sup>[c]</sup> with M-FIAM7 <sup>[d]</sup> with M-FIAM9 |                                    |                                          |                                          |                    |

# MIL-COTS Products Overview

## V•I Chip Solutions

### DC-DC Products

28 Vdc  EMI (MIL-STD-461) / Transient protection (MIL-STD-1275)  
Up to 10 A

28 Vdc  EMI Filter (MIL-STD-461)  
Up to 7 A

### DC-DC Products

 Regulator  Point-of-Load Current Multiplier  
16 – 50 Vin Up to 120 W 1 – 50 V  
Up to 100 A or 120 W

 Up to 120 W per module  Up to 100 A or 120 W

## Component Power Solutions: MI-200 & MI-J00 Series

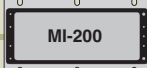
### AC-DC Products

115 Vac 47 – 440 Hz  Rectifier / EMI Filter  
Up to 250 W

### DC-DC Products

Nominal Input 18 – 400 Vdc  
28 Vdc, 270 Vdc  EMI Filter / Transient protection  
Up to 200 W

### DC-DC Products

 50 – 100 W per module 1 – 48 Vdc  
More Power? Add a Booster.  Output Ripple Attenuation Module

 10 – 50 W per module 1 – 48 Vdc

## Component Power Solutions: Maxi, Mini, Micro Series

### DC-DC Products

Nominal Input 18 – 425 Vdc  
24 Vdc, 300 Vdc  EMI filter / Transient protection  
Up to 20 A

### DC-DC Products

 Parallel for higher power  
Up to 600 W per module 1 – 54 Vdc

 Up to 300 W per module 1 – 48 Vdc  Output Ripple Attenuation Module combines active and passive filtering.

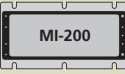
 Up to 150 W per module 1 – 48 Vdc

## Configurable Power Solutions

### MI-MegaMod Family (Chassis Mount)

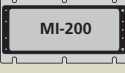
DC Inputs 18 – 400 Vdc  1 – 3 Outputs using MI-200 or MI-J00 Family modules

 Up to 150 W

 Up to 300 W

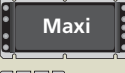
### MI-ComPAC Family

DC Inputs 28 Vdc, 270 Vdc  1 – 3 Outputs using MI-200 Family modules  
EMI filter / Transient protection

 Up to 300 W

### MIL-VIPAC Power Systems

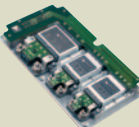
28 Vdc  1 – 3 Outputs using Maxi, Mini, Micro Family modules  
EMI filter / Transient protection

 Up to 400 W

 Up to 300 W

 Up to 150 W

### MIL-VIPAC Array Power Systems

DC Inputs 24, 300 Vdc  1 – 4 Outputs using Maxi, Mini, Micro Family modules

 Parallel for higher power

 Up to 650 W

 Up to 150 W



# Field Tested Proven Reliability

## Partial Listing

F-15 Fighter Aircraft

F-16 Fighting Falcon Multi-Role Fighter Aircraft

F/A-18 Super Hornet Strike Attack Aircraft

F/A-22 Raptor Advanced Tactical Fighter Aircraft

F-35 Joint Strike Fighter

Eurofighter Typhoon Aircraft

Rafale Multi-Role Combat Fighter

Tornado Multi-Role Combat Fighter

B-1B Lancer Strategic Bomber

B-52 Stratofortress Long-Range Multi-Role Bomber

CH-53 Super Stallion Heavy-Lift Helicopter

AH-64 Apache Attack Helicopter

CH-47/MH-47 Chinook Heavy-Lift Helicopter

Black Hawk Multi-Mission Helicopter

AWACS Airborne Warning & Control System

E-2C Hawkeye Airborne Early Warning Aircraft

EA-6B Prowler Electronic Warfare Aircraft

Global Hawk High Altitude, Long Endurance Unmanned Reconnaissance Aircraft

Predator Unmanned Aerial Vehicle

JSTARS Joint Surveillance & Target Attack Radar System

NIMROD MR4A Maritime Reconnaissance Aircraft

P-3C Orion Maritime Patrol & Anti-Submarine Warfare

T-50 Golden Eagle Jet Trainer & Light Attack Aircraft

C-130 Hercules Tactical Transport Aircraft

KC-135 Stratotanker Air-to-Air Refueling Aircraft

C-17 Globemaster Tactical Transport Aircraft

V-22 Osprey Medium-Lift, Multi-Mission, Tilt-Rotor Aircraft

Patriot Missile Air Defense System

THAAD Terminal High Altitude Area Defense Missile System



NASAMS Norwegian Surface-to-Air Missile System

MLRS Multiple Launch Rocket System

TOW Anti-Tank Missile

Tomahawk Cruise Missile

Harpoon Anti-Ship Missile

NSM Naval Strike Missile

TAURUS KEPD 350 Stand-off-Weapon

Sting Ray Lightweight Torpedo

Bradley M2/M3 Tracked Armored Fighting Vehicle

PUMA Tracked Infantry Fighting Vehicle

TETS Third Echelon Test System

Stryker 8-Wheel Drive Armored Combat Vehicle

Fire Finder Radar

Paladin 155mm Self-Propelled Howitzer

M1A1/M1A2 Abrams Main Battle Tank

CREW Counter Electronic Warfare

Blue Force Movement Tracking System

JTRS Joint Tactical Radio System

Falcon Tactical Radio

AEGIS Guided Missile Destroyer

DDG 1000 Zumwalt Class Destroyer

SSN Seawolf Class Attack Submarine

NSSN Virginia Class Attack Submarine

CEC Cooperative Engagement Capability

MCMV Hunt Class Mine Countermeasures Vehicle

NASA Space Shuttle

International Space Station

*Vicor Military COTS products have a long and successful record of supporting the most demanding applications.*



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Thermally enhanced package for V-I Chip family of DC-DC converters

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Multi output DC-DC power supplies for 28 Vdc systems

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Chassis mount DC-DC converters for 24 and 300 Vdc systems

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Web-based computer aided configuration tool for standard and semi-custom products

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# Custom Power

Total Solutions for Military & Aerospace Applications

**Small company  
RESPONSIVENESS,  
large company  
RESOURCES**

Vicor Custom Power has the capability to design, manufacture and certify semi-custom or full-custom power supplies. By utilizing standard Vicor component power modules (more than 8,000 active models), we can offer the shortest leadtime with the lowest risk.

Our experience providing unique and demanding power solutions for the military & aerospace market span over 20 years. We have invested in tools and resources that allow us to offer full service solutions from prototype to mass production.

Contact us to learn more about Vicor Custom Power solutions.

*Applications Support:*

800-496-5570

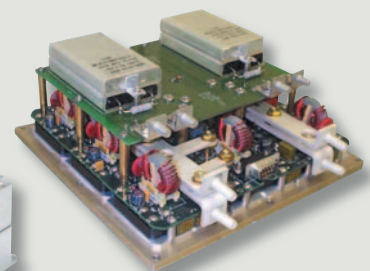
[apps@vicorcustom.com](mailto:apps@vicorcustom.com)

## General Capabilities

- Complete AC-DC or DC-DC turn-key solutions from prototype to production
- Conduction-cooled, fan-cooled or natural convection
- Harsh environment enclosures
- Environmental stress screening
- Radiation tolerant systems
- Mechanical and electrical design
  - Solidworks 3D modeling
  - AutoCAD
- Compliance certification
  - EMI
  - Input transients
  - Life testing
  - Environmental qualification
- Thermal and vibration analysis
- MTBF calculations
- Program management



[vicorcustom.com](http://vicorcustom.com)



### AC-DC Solutions

- 85 – 264 V single phase
- 208 – 480 V three phase
- Power Factor Correction (PFC)
- High frequency, up to 880 Hz

### DC-DC Solutions

- Inputs: 10 – 425 V
- Output power – watts to kilowatts
- Multiple outputs – up to 400 V

### Standards Compliance

- MIL-STD-461
- MIL-STD-704
- MIL-STD-1275
- MIL-STD-810
- MIL-STD-202
- MIL-STD-1399
- DO-160



## Vicor Custom Power Customers *Partial Listing*

AAI

AAR

Analogic

Areté

ArgonST

BAE

Boeing

Carlo Gavazzi

Cubic Defense

CSPI

DME

DRS

DRT

ELMA

Fairbanks Morse

FLIR

Gamber Johnson

General Dynamics

GE

Goodrich

Harris

Herley

HP

Hybricon

L-3

Lockheed Martin

Med-Eng / Allen  
Vanguard

Mercury Computer

NASA

NATO

Naval Undersea  
Warfare Center

Northrop Grumman

Raytheon

Rockwell Collins

Sanmina-SCI

SmartSat

Syracuse Research

US Marines

US Navy

### Custom Power Design Centers

#### Aegis Power Systems

Murphy, NC

Tel: 828-837-4029

[aegispower.com](http://aegispower.com)

#### Convertec Corporation

Roseville, MN

Tel: 651-604-0289

#### Freedom Power Systems

Cedar Park, TX

Tel: 512-259-0941

[freedompower.com](http://freedompower.com)

#### Granite Power Technologies

Manchester, NH

Tel: 603-623-3222

[granitepower.com](http://granitepower.com)

#### Mission Power Solutions

Oceanside, CA

Tel: 760-631-6846

[mpwrs.com](http://mpwrs.com)

#### Northwest Power Integrations

Milwaukie, OR

Tel: 503-652-6161

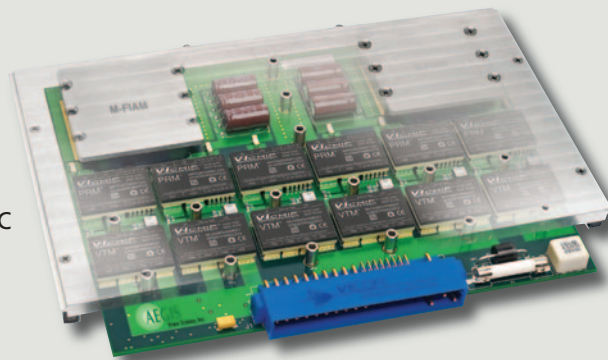
[npi-inc.com](http://npi-inc.com)

# Off-the-Shelf Configurable Power Supplies

## VME450™

### Features

- 28 Vdc per MIL-STD-704F
- 28 Vdc per MIL-STD-1275D
- Vin max range: 18 – 36 Vdc
- MIL-STD-461E conducted EMI
- Input power: 650 W
- Output power: 550 W
- Four isolated outputs
- Temperature: –40 to +85°C
- Utilizes Vicor's V•I Chips
- Single slot VME
- Lightweight: 2.4 lb.



The single-slot VME450 power supply — filtered 28 Vdc, four output (3.3, 5,  $\pm 12$  V), 550 W — is a MIL-COTS solution that is compliant to the vibration requirements of MIL-STD-810F and EMI per MIL-STD-461E. When compared to VME power supplies using conventional technology, the one-slot VME450 provides users with higher efficiency (85%), lower weight (2.4 pounds), and higher power (up to 550 W).

*Convection cooled options available, consult factory.*

## Badger™

The Badger is a rugged PFC multi-output power supply, capable of withstanding extreme environments and stresses often inherent with military applications.



| Product | Dimensions                                         | Input Voltage | Max # of Outputs | Maximum Power | Cooling       | Notes                            |
|---------|----------------------------------------------------|---------------|------------------|---------------|---------------|----------------------------------|
| Badger  | 2.55" x 7.0" x 13.75"<br>(64,8 x 177,8 x 349,3 mm) | 85 – 264 Vac  | 12               | 1,800 W       | Internal fans | OCP, OVP, and OTP on all outputs |

## Javelin™

The Javelin is an AC input power supply with a single DC output, capable of up to 5,400 W, in a rugged package suitable for industrial and military applications.



| Product     | Dimensions                                          | Input Voltage           | Max # of Outputs | Maximum Power   | Cooling       |
|-------------|-----------------------------------------------------|-------------------------|------------------|-----------------|---------------|
| Javelin I   | 4.9" x 7.0" x 10.75"<br>(124,5 x 177,8 x 273,05 mm) | 85 – 254 Vac            | 1                | 600 – 1,800 W   | Internal fans |
| Javelin II  | 4.9" x 7.0" x 9.5"<br>(124,5 x 177,8 x 241,3 mm)    | 85 – 254 Vac            | 1                | 600 – 1,800 W   | No fan        |
| Javelin III | 7.0" x 16.0" x 13.0"<br>(177,8 x 406,4 x 330,2 mm)  | 85 – 254 Vac<br>3-Phase | 1                | 1,800 – 5,400 W | Internal fans |

# 28 V V-I Chip™ DC-DC Modules

## PRM™ Regulator

### Highlights

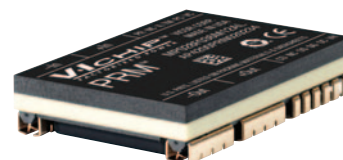
The **PRM** is a high-efficiency non-isolated regulator capable of both boosting and bucking a wide-range input voltage. PRMs may be used independently, as stand-alone regulators, or together with downstream Voltage Transformation Modules — fast, efficient, isolated low-noise point-of-load (POL) converters.

The MIL-COTS PRM operates from a wide input range of 16 – 50 Vdc, meeting many of the ground vehicle and airborne requirements of MIL-STD-1275 and MIL-STD-704. Rated for 120 W, the 28 V PRM produces a nominal Factorized Bus voltage of 36 Vdc, controllable over the range of 26 – 50 Vdc. The downstream isolated VTM™ (Current Multiplier) is available with twelve voltage division ratios to supply up to 100 A or 120 W from 1 – 50 Vdc.

### Features

- Input: 16 – 50 Vdc<sup>[a]</sup>
- Programmable output: 26 – 50 Vdc
- Power: Up to 120 W
- 1.3 MHz switching frequency
- Efficiency: 95%
- Size: 1.28" x 0.87" x 0.26" (32,5 x 22 x 6,6 mm)

*Input Filters Available • See page 11*



## General Specifications

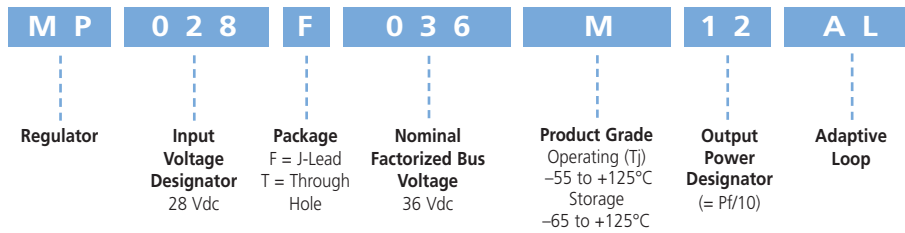
(28 Vin, 36 Vf, full load, 25°C ambient)

| Parameter                              | Min                 | Typ   | Max  | Unit | Note                                     |
|----------------------------------------|---------------------|-------|------|------|------------------------------------------|
| <b>Input Characteristics</b>           |                     |       |      |      |                                          |
| Input voltage range                    | 16.1 <sup>[a]</sup> | 28    | 50   | Vdc  |                                          |
| Input dV/dt                            |                     |       | 1.0  | V/μs |                                          |
| Input undervoltage turn-on             |                     | 15.9  | 16.1 | Vdc  | Increases as temp increases to 16.5 Vmax |
| Input undervoltage turn-off            | 12.2                | 13.5  |      | Vdc  |                                          |
| Input overvoltage turn-on              | 50.5                | 52.5  |      | Vdc  |                                          |
| Input overvoltage turn-off             |                     | 53    | 55.6 | Vdc  |                                          |
| Input quiescent current                |                     | 0.5   | 1.0  | mA   | PC low                                   |
| Input current                          |                     | 4.5   |      | Adc  |                                          |
| No load power dissipation              |                     | 2.75  | 5.5  | W    |                                          |
| Internal input capacitance             |                     | 5.0   |      | μF   | Ceramic                                  |
| Recommended external input capacitance |                     | 1,000 |      | μF   | Source impedance dependent               |

| Parameter                       | Min | Typ   | Max  | Unit | Note                                                               |
|---------------------------------|-----|-------|------|------|--------------------------------------------------------------------|
| <b>Output Characteristics</b>   |     |       |      |      |                                                                    |
| Output voltage range            | 26  | 36    | 50   | Vdc  | Factorized Bus voltage (Vf) set by Ros                             |
| Output power                    | 0   |       | 120  | W    |                                                                    |
| Output current                  | 0   |       | 3.33 | Adc  |                                                                    |
| DC current limit                | 3.5 | 3.9   | 4.4  | Adc  | IL pin floating                                                    |
| Average short circuit current   |     | 0.125 | 1.25 | A    | Auto recovery                                                      |
| Set point accuracy              |     | 1.5   |      | %    |                                                                    |
| Line regulation                 |     | 0.1   | 0.2  | %    | Low line to high line                                              |
| Load regulation                 |     | 0.1   | 0.2  | %    | No CD resistor                                                     |
| Load regulation (at VTM output) |     | 1.0   | 2.0  | %    | Adaptive Loop                                                      |
| Current share accuracy          |     | 5.0   | 10   | %    |                                                                    |
| Efficiency                      |     |       |      |      |                                                                    |
| Full load                       | 94  | 95.6  |      | %    |                                                                    |
| Output overvoltage set point    | 56  |       | 59.4 | Vdc  |                                                                    |
| Output ripple voltage           |     |       |      |      |                                                                    |
| No external bypass              |     | 1.8   | 2.7  | %    | Factorized Bus                                                     |
| With 10 μF capacitor            |     | 0.6   | 0.9  | %    | Factorized Bus                                                     |
| Switching frequency             | 1.2 | 1.3   | 1.45 | MHz  | Fixed frequency                                                    |
| Output turn-on delay            |     |       |      |      |                                                                    |
| From application of power       |     | 94    | 144  | ms   |                                                                    |
| From PC pin high                |     | 100   |      | μs   | Consult Applications Engineering if powering loads other than VTMs |
| Internal output capacitance     |     | 5.0   |      | μF   | Ceramic                                                            |

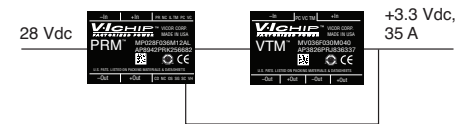
<sup>[a]</sup> Will operate down to 13.5 V after start up ≥16 V

## Part Numbering

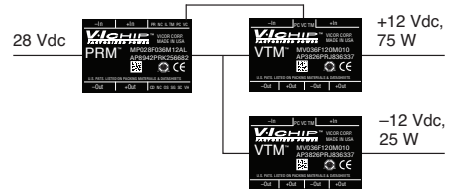


## Application Examples

### Tightly Regulated Single Output



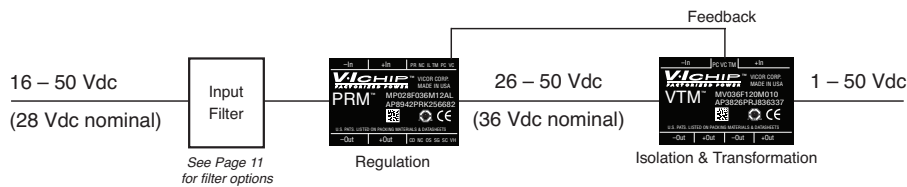
### Multiple Outputs with a Single PRM



### Parallel for Higher Power



## DC-DC Conversion Using PRM & VTM

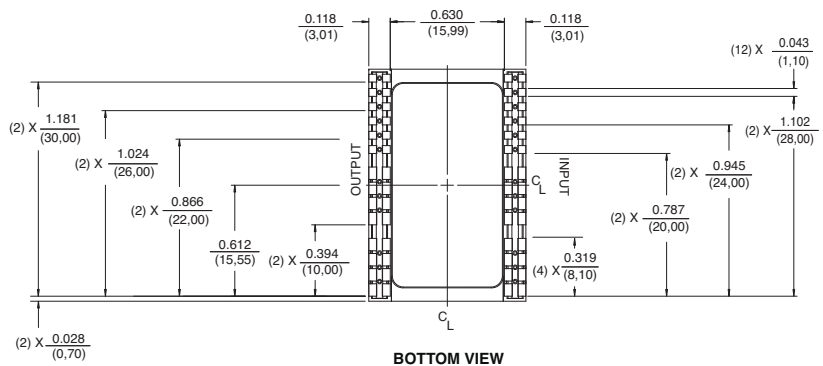
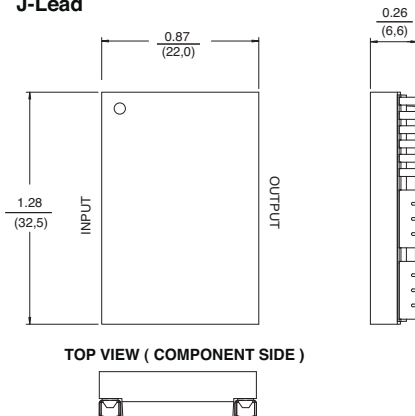


Together, the PRM and the VTM chip set provides the full functionality of a DC-DC converter, but with breakthrough performance and flexibility in a rugged, miniature package.

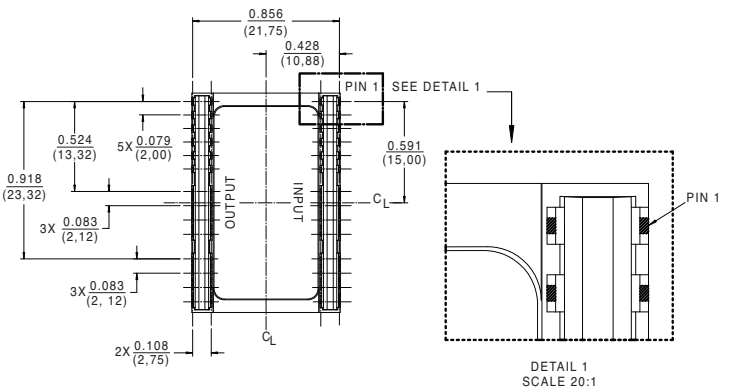
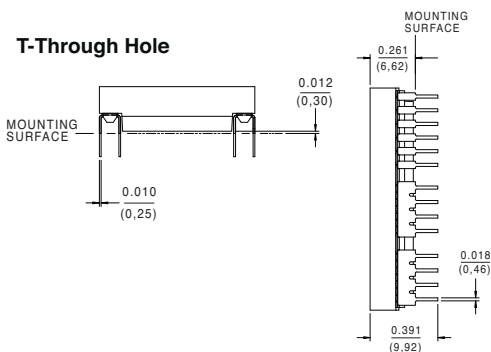
## Mechanical Drawing

$\frac{in}{(mm)}$

### J-Lead



### T-Through Hole



# 28 V V-I Chip™ DC-DC Modules

## VTM™ Point-of-Load Current Multiplier

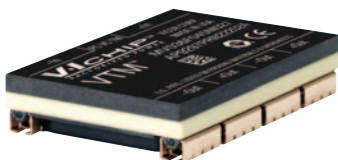
### Highlights

The **VTM** put isolated current multiplication and voltage division directly at the point-of-load (POL) and an upstream PRM controls the Factorized Bus voltage supplied to the VTM to provide line and load regulation. Utilizing a Sine Amplitude Converter (SAC), VTMs offer unprecedented performance in the critical areas of speed, noise, efficiency and density.

The isolated VTM is available with twelve voltage division ratios from 1:1 to 1:32 and provides the user with flexibility to supply up to 100 A or 120 W at any output voltage from 1 to 50 Vdc in a surface mount package occupying only 1 in<sup>2</sup>.

### Features

- Isolated 1 – 50 Vdc output
- Power: Up to 100 A or 120 W
- 1  $\mu$ s transient response
- 3 MHz switching frequency
- Efficiency: Up to 96.5%
- –55°C to +125°C operation (Tj)
- Size: 1.28" x 0.87" x 0.26"  
(32,5 x 22 x 6,6 mm)



## General Specifications

(36 Vin, full load, 25°C ambient)

| Parameter                  | Min  | Typ  | Max  | Unit       | Note                                            |
|----------------------------|------|------|------|------------|-------------------------------------------------|
| Input Characteristics      |      |      |      |            |                                                 |
| Input voltage range        | 26   | 36   | 50   | Vdc        | Operable down to zero V with VC voltage applied |
| Input dV/dt                |      |      | 1.0  | V/ $\mu$ s |                                                 |
| Input overvoltage turn-on  | 50.5 | 54.4 |      | Vdc        |                                                 |
| Input overvoltage turn-off |      | 55.5 | 57.5 | Vdc        |                                                 |
| Input current              |      |      | 3.5  | Adc        | Continuous                                      |
| No load power dissipation  | 1.5  | 3.0  | 6.0  | W          | Low line to high line                           |

| Parameter                        | Min         | Typ | Max      | Unit       | Note                                                            |
|----------------------------------|-------------|-----|----------|------------|-----------------------------------------------------------------|
| Output Characteristics           |             |     |          |            |                                                                 |
| Output voltage range             | See Table 1 |     |          | Vdc        |                                                                 |
| Rated DC current                 | 0           |     | 100      | Adc        | 26 – 50 Vin (see table)                                         |
| Peak repetitive current          |             |     | 150      | % Imax (A) | Pulse width 1 ms, max duty cycle 10%, baseline power 50%        |
| DC current limit                 |             | 160 |          | %Imax (A)  | Module will shut down when current limit is reached or exceeded |
| Current share accuracy           |             | 5.0 | 10       | %          |                                                                 |
| Efficiency                       |             |     | 96.5     | %          | Model dependent                                                 |
| Output overvoltage set point     |             | 110 | 115      | %          | Vout max                                                        |
| Output ripple voltage            |             |     |          | mV         |                                                                 |
| No external bypass               | 50          |     | 250      | mV         |                                                                 |
| With 10 $\mu$ F bypass capacitor | 2.0         |     | 20       | mV         |                                                                 |
| Switching frequency              | 2.5         | 3.0 | 3.6      | MHz        | Model dependent                                                 |
| Line regulation                  | 0.99K       | K   | 1.01K    |            | Vout = K•Vin at no load                                         |
| Load Regulation                  | Rout Min    |     | Rout Max | m $\Omega$ | See Table 1                                                     |
| Transient response               |             |     |          |            |                                                                 |
| Response time                    |             | 200 |          | ns         |                                                                 |
| Recovery time                    |             | 1.0 |          | $\mu$ s    |                                                                 |

| Parameter                                          | Min   | Typ                 | Max  | Unit       | Note                            |
|----------------------------------------------------|-------|---------------------|------|------------|---------------------------------|
| General Characteristics                            |       |                     |      |            |                                 |
| MTBF (MVO36F030M040)                               |       |                     |      |            |                                 |
| MIL-HDBK-217F                                      |       | 4,832<br>869<br>681 |      | 1,000 hrs  | 25°C, GB<br>50°C NS<br>65°C AIC |
| Isolation specifications                           |       |                     |      |            |                                 |
| Voltage                                            | 2,250 |                     |      | Vdc        | Input to Output                 |
| Capacitance                                        |       | 3,000               |      | pF         | Input to Output                 |
| Resistance                                         | 10    |                     |      | M $\Omega$ | Input to Output                 |
| Mechanical                                         |       |                     |      |            |                                 |
| Weight                                             |       | 0.53 / 15           |      | oz / g     |                                 |
| Dimensions                                         |       |                     |      |            |                                 |
| Length                                             |       | 1.28 / 32,5         |      | in / mm    |                                 |
| Width                                              |       | 0.87 / 22           |      | in / mm    |                                 |
| Height                                             |       | 0.26 / 6,6          |      | in / mm    |                                 |
| Thermal                                            |       |                     |      |            |                                 |
| Over temperature shut down                         | +125  | +130                | +135 | °C         | Junction temperature            |
| Thermal capacity                                   |       | 9.3                 |      | Ws/°C      |                                 |
| Junction-to-case thermal impedance (R $\theta$ JC) |       | 1.1                 |      | °C/W       |                                 |
| Junction-to-ambient (R $\theta$ JA)                |       | 5.0                 |      | °C/W       | With 0.25" heat sink            |



## Part Numbering

| M V                | 0 3 6                    | F                                         | 1 2 0                                          | M                                                                            | 0 1 0                                        |
|--------------------|--------------------------|-------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------|
| Current Multiplier | Input Voltage Designator | Package<br>F = J-Lead<br>T = Through Hole | Nominal Factorized Bus Voltage<br>(= Vout X10) | Product Grade<br>Operating (Tj)<br>-55 to +125°C<br>Storage<br>-65 to +125°C | Output Current Designator<br>(= Output Iout) |

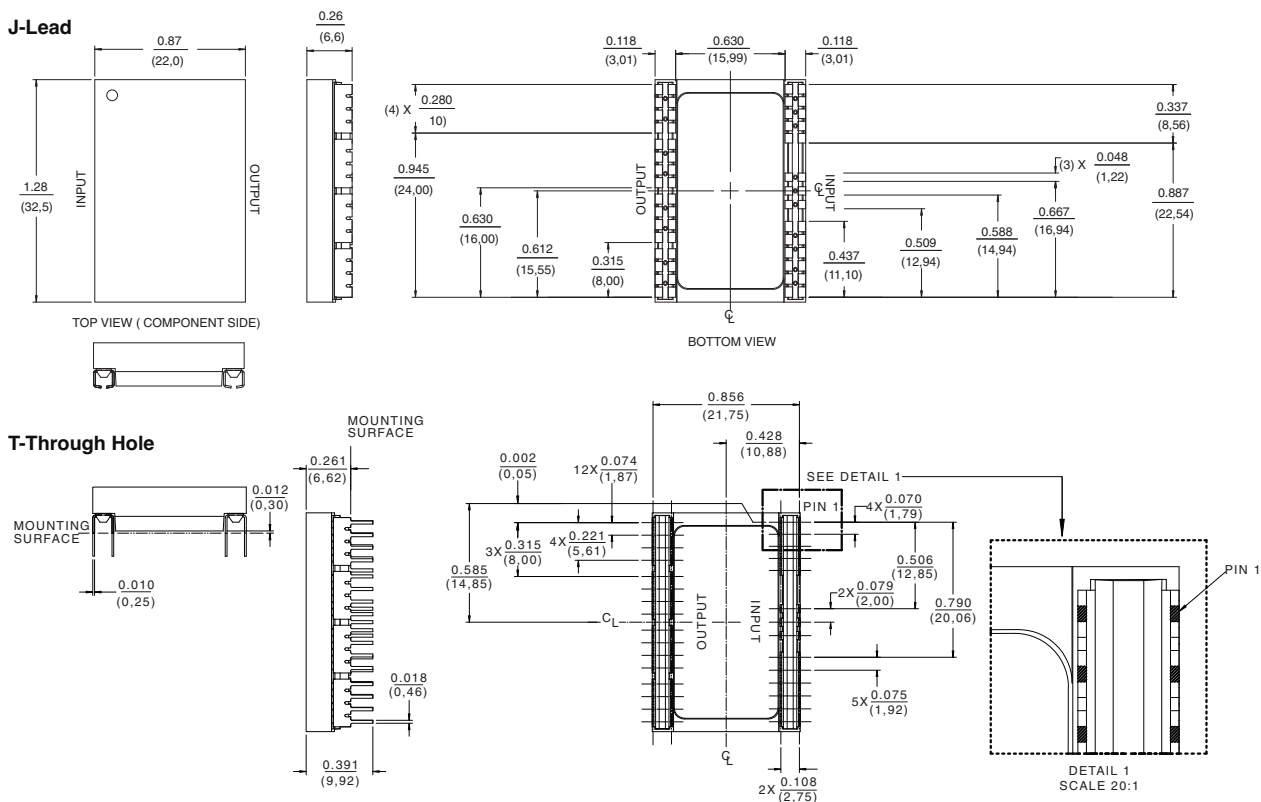
## VTM Family Part Numbers & Ranges

| Part Number                  | K-Factor | Nominal Vout Range (Vdc) | Rated Output Current (A) | Min  | Rout (mΩ)<br>Nom | Max  |
|------------------------------|----------|--------------------------|--------------------------|------|------------------|------|
| MV036F011M100                | 1/32     | 0.8 – 1.6                | 100                      | 0.5  | 0.85             | 1.3  |
| MV036F015M080                | 1/24     | 1.1 – 2.0                | 80                       | 1.0  | 1.25             | 1.5  |
| MV036F022M055                | 1/16     | 1.7 – 3.1                | 55                       | 1.4  | 1.75             | 2.0  |
| MV036F030M040                | 1/12     | 2.2 – 4.1                | 40                       | 1.45 | 2.4              | 3.4  |
| MV036F045M027                | 1/8      | 3.3 – 6.2                | 27                       | 3.5  | 5.1              | 6.6  |
| MV036F060M020                | 1/6      | 4.3 – 8.3                | 20                       | 5.0  | 8.0              | 10   |
| MV036F072M017 <sup>[a]</sup> | 1/5      | 6.4 – 10.0               | 16.6                     | 6.0  | 9.6              | 12   |
| MV036F090M013                | 1/4      | 6.5 – 12.5               | 13.3                     | 6.9  | 9.3              | 11.6 |
| MV036F120M010                | 1/3      | 8.7 – 16.6               | 10.0                     | 25   | 31               | 35   |
| MV036F180M007                | 1/2      | 13.0 – 25.0              | 6.7                      | 27.5 | 35.7             | 46.4 |
| MV036F240M005                | 2/3      | 17.4 – 33.3              | 5.0                      | 49.3 | 70.6             | 91.8 |
| MV036F360M003                | 1        | 26.0 – 50.0              | 3.3                      | 140  | 170              | 200  |

Table 1

<sup>[a]</sup> Low line input voltage 32 V

## Mechanical Drawing <sup>in</sup>(mm)



# VI BRICK™

## VI BRICK PRM / VTM

### Thermally Enhanced Package

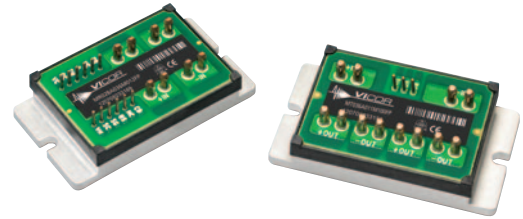
#### Highlights

The **PRM Regulator Module** is a very efficient non-isolated regulator specifically designed to provide a controlled Factorized Bus distribution voltage for powering downstream VI BRICK Voltage Transformation Modules. In combination, VI BRICK PRMs and VTMs form a complete DC-DC converter subsystem offering all of the unique benefits of Vicor's Factorized Power Architecture (FPA): high density and efficiency; low noise operation; architectural flexibility; extremely fast transient response; elimination of bulk capacitance at the point of load (POL); in a thermally enhanced package.

The thermally enhanced **VTM point-of-load current multiplier** excels at speed, density and efficiency to meet the demands of advanced power applications. Combined with the PRM regulator they create a DC-DC converter with flexibility to provide isolation and regulation where needed. The PRM can be located with the VTM at the point of load or remotely in the back plane or on a daughtercard.

#### Features

- 55°C to 100°C baseplate
- Sine Amplitude Converter (VTM)
- ZVS buck-boost regulator (PRM)
- Regulation 1% (Adaptive Loop)
- Small footprint: 1.64 and 2.08 in<sup>2</sup>
- 16 – 50 Vin
- 1 – 50 Vout
- Up to 120 W of output
- High efficiency: Up to 96.5%
- Low profile 0.37" flanged model
- Power density: Up to 156 Win<sup>3</sup>
- Flexible architecture
- Low noise
- Fast transient response



| PRM Model Number | Input Voltage (V)        | Output Voltage (V) | Output Power (W) |
|------------------|--------------------------|--------------------|------------------|
| MR028A036M012FP  | 16.1 – 50 <sup>[a]</sup> | 26 – 50            | 120              |

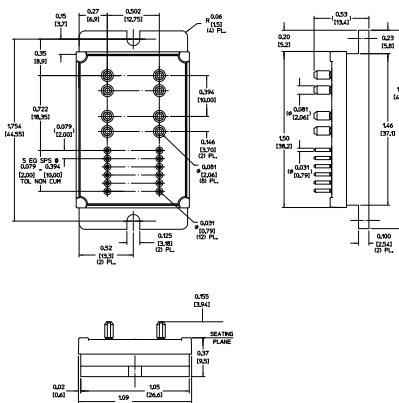
<sup>[a]</sup> will operate down to 13.5 V after start up  $\geq 16$  V

| VTM Model Number               | K-Factor | No Load Output Voltage (V) |        | Output Current (A) |
|--------------------------------|----------|----------------------------|--------|--------------------|
|                                |          | 26 Vin                     | 50 Vin |                    |
| MT036A011M100FP                | 1/32     | 0.82                       | 1.55   | 100                |
| MT036A015M080FP                | 1/24     | 1.1                        | 2.0    | 80                 |
| MT036A022M055FP                | 1/16     | 1.6                        | 3.1    | 55                 |
| MT036A030M040FP                | 1/12     | 2.2                        | 4.1    | 40                 |
| MT036A045M027FP                | 1/8      | 3.3                        | 6.2    | 27                 |
| MT036A060M020FP                | 1/6      | 4.3                        | 8.3    | 20                 |
| MT036A072M017FP <sup>[b]</sup> | 1/5      | 6.4 <sup>[b]</sup>         | 10.0   | 16.6               |
| MT036A090M013FP                | 1/4      | 6.5                        | 12.5   | 13.3               |
| MT036A120M010FP                | 1/3      | 8.7                        | 16.6   | 10.0               |
| MT036A180M007FP                | 1/2      | 13.0                       | 25.0   | 6.7                |
| MT036A240M005FP                | 2/3      | 17.4                       | 33.0   | 5.0                |
| MT036A360M003FP                | 1        | 26.0                       | 50.0   | 3.3                |

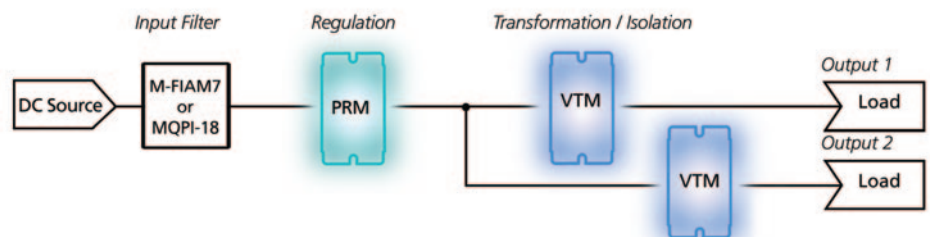
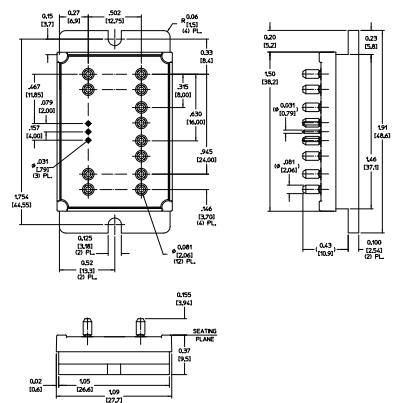
<sup>[b]</sup> Low line input voltage 32 V

## Mechanical Drawings

### VI BRICK PRM



### VI BRICK VTM



# V•I Chip™ Filters and Front Ends

## M-FIAM7 Filter Input Attenuator Module

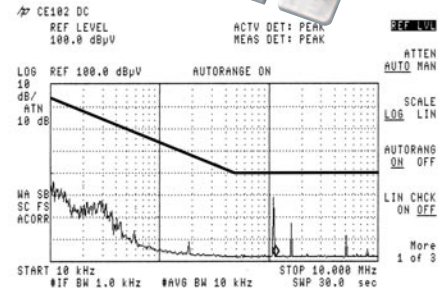
### Highlights

The **M-FIAM7** is a DC front-end module that provides EMI filtering and transient protection. The M-FIAM7 enables designers using Vicor's 28 V DC-DC V•I Chip or VI BRICK modules to meet conducted emission / conducted susceptibility per MIL-STD-461E; and input transients per MIL-STD-1275A/B/D, MIL-STD-704A-F and DO-160E. The M-FIAM7 accepts an input voltage of 14 – 50 Vdc and delivers output current up to 10 A.

M-FIAM7 is housed in an industry standard "half-brick" module measuring 2.28" x 2.2" x 0.5" and depending upon model selected, may be mounted onboard or inboard for height critical applications.

### Features

- EMI filtering per MIL-STD-461E
- Transient protection- MIL-STD-1275A/B/D, MIL-STD-704A-F and DO-160E
- Environments-MIL-STD-810, MIL-STD-202
- Environmental stress screening
- Low profile mounting options
- Output current up to 10 Amps
- Mini sized package
- Inrush current limiting
- Reverse polarity protection



Conducted Noise: M-FIAM7 and MP028F036M12AL + MV036F120M010 DC-DC V•I Chip modules operating at 28 Vdc, 120 W.

### Part Numbering

| M                | F I A M                        | 7                         | M                                                           | 2                                                                                                           | 1                                                            |
|------------------|--------------------------------|---------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Military Product | Filter Input Attenuator Module | Input Voltage<br>7 = 28 V | Product Grade<br>H = -40°C to +100°C<br>M = -55°C to +100°C | Pin Style<br>1 = Short<br>2 = Long<br>S = Short ModuMate <sup>[a]</sup><br>N = Long ModuMate <sup>[a]</sup> | Baseplate<br>1 = Slotted<br>2 = Threaded<br>3 = Through hole |

<sup>[a]</sup> Compatible with SurfMate and InMate socketing system.

## MQPI-18 Input EMI Filter

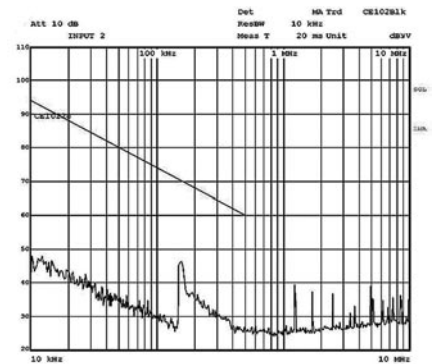
### Highlights

The **MQPI-18** is a surface mount DC front-end filter that provides EMI filtering for Vicor's 28 V DC-DC V•I Chip or VI BRICK modules. The MQPI-18 enables designers to meet conducted emission /conducted susceptibility per MIL-STD-461E. The MQPI-18 accepts an input voltage of 10 – 80 Vdc and delivers output current up to 7 A.

MQPI-18 is housed in a very compact 0.98" x 0.49" x 0.18" (24,8 x 12,4 x 4,5 mm) package requiring only 0.5 in<sup>2</sup> of board space and weighing only 2.4 grams.

### Features

- EMI filtering per MIL-STD-461E
- 80 Vdc (max input)
- Output current: Up to 7 A
- Small size: 0.98 x 0.49 x 0.18 in (24,8 x 12,4 x 4,5 mm)
- Low profile LGA package
- 55° to +100°C operating temperature
- Efficiency >99%



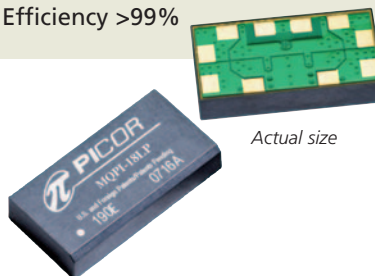
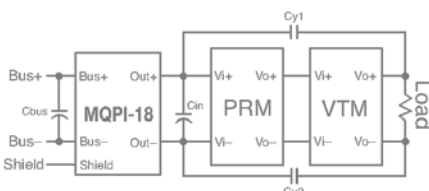
MIL-STD-461E, CE102 compliance with MIL-COTS V•I Chips.

### Part Numbering

| Part Number  | Description             |
|--------------|-------------------------|
| MQPI-18LP    | LGA, lidded package     |
| MQPI-18LP-01 | LGA, open frame package |

#### MQPI-18-CB1 Evaluation Board

The MQPI-18-CB1 evaluation board is a convenient, simple-to-use tool to evaluate the MQPI with the MIL-COTS 28 V DC-DC V•I Chip evaluation board.



Actual size

# MI-200™

## 50 to 100 W DC-DC Converter / Booster Module

### Highlights

The **MI-Family** is designed for applications utilizing distributed power architecture and is based on Vicor's VI-200 / VI-J00 family of zero-current switching, component level DC-DC converters. Operating at frequencies up to 1 MHz, the MI-Family offers exceptional performance in terms of power density, efficiency, noise, ease of use, and reliability.

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

Standard features such as wide output trimming / programming, current limiting, remote sense, output inhibit, and latching OVP and OTP combine to offer the highest degree of protection, versatility, and reliability for power systems.

### 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
- Efficiency: Up to 90%
- Remote sense
- Current limit
- OVP and thermal shut down
- Power boosters for higher power outputs
- ZCS power architecture
- Low noise FM control
- Size: 4.6" x 2.4" x 0.5"  
(116,8 x 61,0 x 12,7 mm)



### General Specifications

(At TBP = 25°C, nominal line and 75% load, unless otherwise specified)

| Parameter                                      | Min                     | Typ          | Max        | Unit              | Note                                       |
|------------------------------------------------|-------------------------|--------------|------------|-------------------|--------------------------------------------|
| <b>Input Characteristics</b>                   |                         |              |            |                   |                                            |
| Input voltage range                            | See input voltage chart |              |            |                   |                                            |
| No load power dissipation                      |                         | 1.35         | 2.0        | Watts             |                                            |
| <b>Output Characteristics</b>                  |                         |              |            |                   |                                            |
| Set point accuracy                             |                         | 0.5          | 1.0        | % Vnom            |                                            |
| Load / line regulation                         |                         | 0.05<br>0.2  | 0.2<br>0.5 | % Vnom<br>% Vnom  | LL to HL, 10% to FL<br>LL to HL, NL to 10% |
| Output temperature drift                       |                         | 0.01         | 0.02       | %/°C              |                                            |
| Output noise - pp                              |                         | 1.0<br>100   | 1.5<br>150 | % Vnom<br>mV      | } Whichever is greater<br>20 MHz BW        |
| Output voltage trimming <sup>[a]</sup>         | 50                      |              | 110        | % Vnom            |                                            |
| Remote sense compensation                      | 0.5                     |              |            | Vdc               |                                            |
| OVP set point                                  | 115                     | 125          | 135        | % Vnom            | Latching                                   |
| Current limit                                  | 105                     |              | 125        | % Inom            | Auto restart                               |
| Short circuit current <sup>[b]</sup>           | 20                      |              | 130        | % Inom            |                                            |
| <b>Control Pin Characteristics</b>             |                         |              |            |                   |                                            |
| Gate in high threshold                         |                         | 6.0          |            | Vdc               |                                            |
| Gate in low threshold                          | 0.65                    |              |            | Vdc               |                                            |
| Gate in low current                            |                         |              | 6.0        | mA                |                                            |
| Power sharing accuracy                         | 0.95                    |              | 1.05       |                   |                                            |
| <b>Isolation Characteristics</b>               |                         |              |            |                   |                                            |
| Isolation (input to output)                    | 3,000                   |              |            | Vrms              |                                            |
| Isolation (output to baseplate)                | 500                     |              |            | Vrms              |                                            |
| Isolation (input to baseplate)                 | 1,500                   |              |            | Vrms              |                                            |
| Input / output capacitance                     |                         | 50           | 75         | pF                |                                            |
| <b>Environmental – MIL-STD-810</b>             |                         |              |            |                   |                                            |
| Altitude - Method 500.2                        | 70,000                  |              |            | feet              | Procedure II                               |
| Humidity - Method 507.2                        | 88 / 240                |              |            | % / hrs           | Procedure I, cycle 1                       |
| Acceleration - Method 513.3                    | 9.0                     |              |            | g                 | Procedure II                               |
| Vibration - Method 514.3                       | 20                      |              |            | g                 | Procedure I, category 6                    |
| Shock - Method 516.3                           | 40                      |              |            | g                 | Procedure I                                |
| <b>Reliability – MIL-HDBK-217F (MI-22L-MW)</b> |                         |              |            |                   |                                            |
| 25°C Ground Benign: G.B.                       |                         | 3,552        |            | 1,000 hrs         |                                            |
| 50°C Naval Sheltered: N.S.                     |                         | 639          |            | 1,000 hrs         |                                            |
| 65°C Airborne Inhabited Cargo: A.I.C.          |                         | 501          |            | 1,000 hrs         |                                            |
| <b>Thermal Characteristics</b>                 |                         |              |            |                   |                                            |
| Efficiency                                     | 80 – 90                 |              |            | %                 |                                            |
| Baseplate to sink                              | 0.07                    |              |            | °C/W              | With thermal pads                          |
| Thermal shut down <sup>[c]</sup>               | +90                     | +95          | +105       | °C                | Latching                                   |
| Baseplate operating temperature                |                         |              | +85        | °C                | See product grade                          |
| Storage temperature                            |                         |              | +100       | °C                | See product grade                          |
| <b>Mechanical Specifications</b>               |                         |              |            |                   |                                            |
| Weight                                         |                         | 7.3<br>(208) |            | ounces<br>(grams) |                                            |

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

<sup>[b]</sup> Output voltages of 5 V or less incorporate foldback current limiting; outputs of 10 V and above provide constant current limiting

<sup>[c]</sup> No over temperature protection in booster modules

Configuration Chart

MI - 2

Semi-custom driver and booster modules available: Consult factory.

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

<sup>[e]</sup> These units rated at 75% load from 125 – 150 Vin:  
MI-26Z-xV • MI-26Y-xV • MI-260-xW

<sup>[f]</sup> 75 W max power for 28 V input

28 Vdc input per MIL-STD 704D/E/F  
155 Vdc input per MIL-STD-1399A  
270 Vdc input per MIL-STD-704D/E/F

| Input Voltage |                            |           |
|---------------|----------------------------|-----------|
| Nominal       | Range                      | Transient |
| 2 = 28 V      | 18 – 50 V <sup>[d]</sup>   | 60 V      |
| 5 = 155 V     | 100 – 210 V                | 230 V     |
| 6 = 270 V     | 125 – 400 V <sup>[e]</sup> | 475 V     |
| 7 = 165 V     | 100 – 310 V                |           |

| Output Voltage |                          |            |
|----------------|--------------------------|------------|
| Z = 2 V        | T = 6.5 V <sup>[f]</sup> | N = 18.5 V |
| Y = 3.3 V      | R = 7.5 V <sup>[f]</sup> | 3 = 24 V   |
| 0 = 5 V        | M = 10 V                 | L = 28 V   |
| X = 5.2 V      | 1 = 12 V                 | J = 36 V   |
| W = 5.5 V      | P = 13.8 V               | K = 40 V   |
| V = 5.8 V      | 2 = 15 V                 | 4 = 48 V   |

| Product Grade |   | Operating Temp. |
|---------------|---|-----------------|
| I             | = | –40°C to +85°C  |
| M             | = | –55°C to +85°C  |

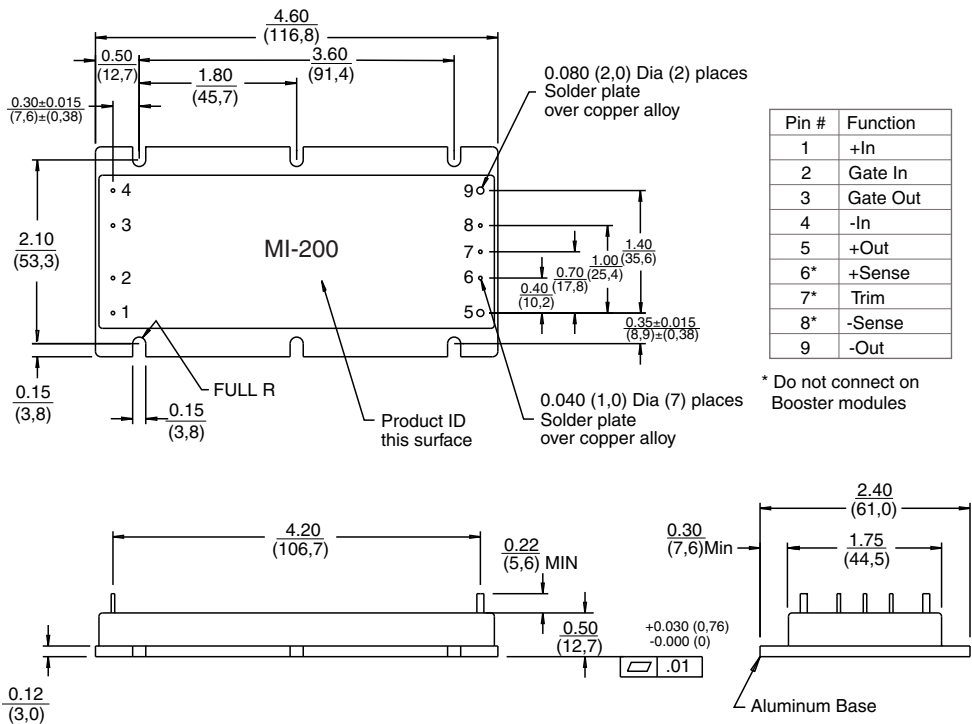
| Output Power / Current                                                                             |         |      |
|----------------------------------------------------------------------------------------------------|---------|------|
|                                                                                                    | ≥5 V    | <5 V |
| Y                                                                                                  | = 50 W  | 10 A |
| X                                                                                                  | = 75 W  | 15 A |
| W                                                                                                  | = 100 W | 20 A |
| V                                                                                                  | = —     | 30 A |
| For additional power, 100 W and 75 W booster modules are available. Change MI-2xx-xx to MI-Bxx-xx. |         |      |

Product Grade Specifications

| Parameter                                               | Product Grade     |                    |
|---------------------------------------------------------|-------------------|--------------------|
|                                                         | I-Grade           | M-Grade            |
| Storage temperature                                     | –55°C to +100°C   | –65°C to +100°C    |
| Operating temperature (baseplate)                       | –40°C to +85°C    | –55°C to +85°C     |
| Power cycling burn-in                                   | 12 hrs, 29 cycles | 96 hrs, 213 cycles |
| Temperature cycled with power off                       | 12 cycles         | 12 cycles          |
| 17°C per minute rate of change                          | –65°C to +100°C   | –65°C to +100°C    |
| Test data supplied at these temperatures <sup>[g]</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>[g]</sup> Test data available for review or download from vicorpower.com

Mechanical Drawing <sup>in</sup>/<sub>(mm)</sub>



# MI-J00™

## 10 to 50 W DC-DC Converter Modules

### Highlights

The **MI-J00** family of miniaturized 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.

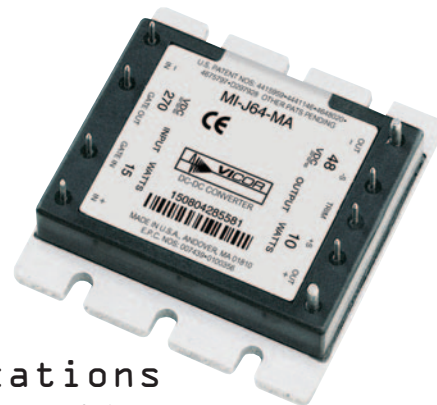
The MI-J00 family meets all steady-state, transient and under / overvoltage requirements of MIL-STD-704D/E/F for both 28 Vdc input (MI-J2X) and 270 Vdc input (MI-J6X), and the worst case envelope of MIL-STD-1399A for 155 Vdc input (MI-J5X).

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 units meet MIL-STD-810 environmental testing requirements for humidity, fungus, salt-fog, explosive atmosphere, acceleration, vibration, and shock.

### 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
- Efficiency: Up to 90%
- 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)



### General Specifications

(At TBP = 25°C, nominal line and 75% unless otherwise specified)

| Parameter                                      | Min                                      | Typ          | Max  | Unit              | Note                                |
|------------------------------------------------|------------------------------------------|--------------|------|-------------------|-------------------------------------|
| <b>Input Characteristics</b>                   |                                          |              |      |                   |                                     |
| Input voltage range                            | See input voltage chart on the next page |              |      |                   |                                     |
| No load power dissipation                      |                                          | 1.35         | 2.0  | Watts             |                                     |
| <b>Output Characteristics</b>                  |                                          |              |      |                   |                                     |
| Set point accuracy                             |                                          | 0.5          | 1.0  | % Vnom            |                                     |
| Load / line regulation                         |                                          | 0.05         | 0.2  | % Vnom            | LL to HL, 10% to FL                 |
|                                                |                                          | 0.2          | 0.5  | % Vnom            | LL to HL, NL to 10%                 |
| Output temperature drift                       |                                          | 0.01         | 0.02 | %/°C              |                                     |
| Output noise - pp                              |                                          | 1.0          | 1.5  | % Vnom            | } Whichever is greater<br>20 MHz BW |
|                                                |                                          | 100          | 150  | mV                |                                     |
| Output voltage trimming <sup>[a]</sup>         | 50                                       |              | 110  | % Vnom            |                                     |
| Remote sense compensation                      | 0.5                                      |              |      | Vdc               |                                     |
| Current limit                                  | 105                                      |              | 125  | % Inom            | Auto restart                        |
| Short circuit current                          | 105                                      |              | 130  | % Inom            |                                     |
| <b>Control Pin Characteristics</b>             |                                          |              |      |                   |                                     |
| Gate in high threshold                         |                                          | 6.0          |      | Vdc               |                                     |
| Gate in low threshold                          | 0.65                                     |              |      | Vdc               |                                     |
| Gate in low current                            |                                          |              | 6.0  | mA                |                                     |
| <b>Isolation Characteristics</b>               |                                          |              |      |                   |                                     |
| Isolation (input to output)                    | 3,000                                    |              |      | Vrms              |                                     |
| Isolation (output to baseplate)                | 500                                      |              |      | Vrms              |                                     |
| Isolation (input to baseplate)                 | 1,500                                    |              |      | Vrms              |                                     |
| Input / output capacitance                     |                                          | 50           | 75   | pF                |                                     |
| <b>Environmental – MIL-STD-810</b>             |                                          |              |      |                   |                                     |
| Altitude - Method 500.2                        | 70,000                                   |              |      | feet              | Procedure II                        |
| Humidity - Method 507.2                        | 88 / 240                                 |              |      | % / hrs           | Procedure I, cycle 1                |
| Acceleration - Method 513.3                    | 9.0                                      |              |      | g                 | Procedure II                        |
| Vibration - Method 514.3                       | 20                                       |              |      | g                 | Procedure I, category 6             |
| Shock - Method 516.3                           | 40                                       |              |      | g                 | Procedure I                         |
| <b>Reliability – MIL-HDBK-217F (MI-J2L-MY)</b> |                                          |              |      |                   |                                     |
| 25°C Ground Benign: G.B.                       |                                          | 3,732        |      | 1,000 hrs         |                                     |
| 50°C Naval Sheltered: N.S.                     |                                          | 672          |      | 1,000 hrs         |                                     |
| 65°C Airborne Inhabited Cargo: A.I.C.          |                                          | 526          |      | 1,000 hrs         |                                     |
| <b>Thermal Characteristics</b>                 |                                          |              |      |                   |                                     |
| Efficiency                                     |                                          | 80 – 90      |      | %                 |                                     |
| Baseplate to sink                              |                                          | 0.14         |      | °C/W              | With thermal pads                   |
| Thermal shut down                              |                                          | N/A          |      |                   |                                     |
| Baseplate operating temperature                |                                          |              | +100 | °C                | See product grade                   |
| Storage temperature                            |                                          |              | +125 | °C                | See product grade                   |
| <b>Mechanical Specifications</b>               |                                          |              |      |                   |                                     |
| Weight                                         |                                          | 3.7<br>(107) |      | ounces<br>(grams) |                                     |

10 V, 12 V, and 15 V outputs, standard trim range ±10%. Consult factory for wider trim range

MI - J   -  

<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

28 Vdc input per MIL-STD 704D/E/F  
155 Vdc input per MIL-STD-1399A  
270 Vdc input per MIL-STD-704D/E/F

| Output Voltage |            |            |
|----------------|------------|------------|
| Z = 2 V        | T = 6.5 V  | N = 18.5 V |
| Y = 3.3 V      | R = 7.5 V  | 3 = 24 V   |
| O = 5 V        | M = 10 V   | L = 28 V   |
| X = 5.2 V      | 1 = 12 V   | J = 36 V   |
| W = 5.5 V      | P = 13.8 V | K = 40 V   |
| V = 5.8 V      | 2 = 15 V   | 4 = 48 V   |

| Output Power / Current |                   |                |
|------------------------|-------------------|----------------|
|                        | $\geq 5\text{ V}$ | $< 5\text{ V}$ |
| A                      | = 10 W            | —              |
| Z                      | = 25 W            | 5 A            |
| Y                      | = 50 W            | 10 A           |

| Parameter                                               | Product Grade     |                    |
|---------------------------------------------------------|-------------------|--------------------|
|                                                         | 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 hrs, 29 cycles | 96 hrs, 213 cycles |
| Temperature cycled with power off                       | 12 cycles         | 12 cycles          |
| 17°C per minute rate of change                          | –65°C to +100°C   | –65°C to +100°C    |
| Test data supplied at these temperatures <sup>[d]</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>[d]</sup>Test data available for review or download from [vicorpower.com](http://vicorpower.com)

Technical drawing of a PCB assembly showing top and side views with dimensions and callouts.

**Top View Dimensions:**

- Overall width:  $2.28$  (57,9)
- Overall height:  $2.10$  (53,4)
- Top edge features:
  - Left:  $0.30 \pm 0.015$  (7,6)  $\pm$  (0,38)
  - Center:  $0.49$  (12,4)
  - Right:  $1.30$  (33,0)
- Internal features:
  - Top center:  $0.65$  (16,5)
  - Bottom center:  $0.15$  (3,8)
- Bottom edge features:
  - Left:  $0.15$  (3,8)
  - Center:  $0.15$  (3,8)
  - Right:  $0.35 \pm 0.015$  (8,9)  $\pm$  (0,38)
- Internal spacing:
  - Top:  $0.70$  (17,8)
  - Bottom:  $1.00$  (25,4)

**Callouts:**

- 0.080 Dia (2) places Solder plate over copper alloy
- 0.040 (1,0) Dia (7) places Solder plate over copper alloy
- Product ID this surface
- FULL R

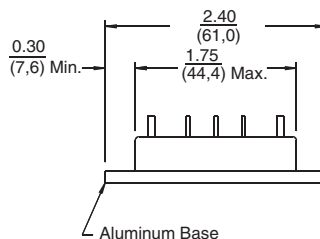
**Side View Dimensions:**

- Top width:  $1.90$  (48,3)
- Top thickness:  $0.22$  (5,6) Min.
- Bottom thickness:  $0.50$  (12,7)
- Bottom width:  $+0.030$  (0,76)  $-0.000$  (0)
- Bottom surface texture:  $0.12$  (3,0)

**Other Labels:**

- MI-J00
- 1, 2, 3, 4, 5, 6, 7, 8, 9

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



# Maxi, Mini, Micro Family

## DC-DC Converter Modules

### Highlights

Vicor's **Maxi, Mini, Micro Family** DC-DC converter modules use advanced power processing, control and packaging technologies to provide the performance, flexibility, reliability and cost effectiveness of a mature power component. High frequency ZCS/ZVS switching provides high power density with low noise and high efficiency.

Fully encapsulated, Vicor Maxi, Mini, Micro modules utilize a proprietary spin fill process that assures complete, void free encapsulation making them suitable for the most harsh environments. Two grades (H & M) are available with temperatures to -55°C operating and -65°C storage. H & M-Grade modules have been subjected to the environmental testing requirements of MIL-STD-810, MIL-S-901, MIL-STD-202 and undergo 100% environmental stress screening.

### Features

- 24 & 300 Vdc compliant to MIL-STD-704E/F
- Single outputs: 2 – 48 Vdc
- MIL-STD-810 environments
- Operating temperatures from -55°C to 100°C
- ZVS/ZCS power architecture
- Environmental stress screening
- Programmable output: 10 to 110% of Vnom
- OVP and thermal shut down
- Power density: Up to 100 W/in<sup>3</sup>
- Input undervoltage lockout
- Parallelable for increased power



## General Specifications

(See [vicorpower.com](http://vicorpower.com) for model specific data sheets)

| Parameter                             | Min         | Typ    | Max          | Unit   | Notes                                                             |
|---------------------------------------|-------------|--------|--------------|--------|-------------------------------------------------------------------|
| <b>Input Characteristics</b>          |             |        |              |        |                                                                   |
| Undervoltage turn-on                  | 24 V        | 24     | 17.5         | 17.9   | Vdc                                                               |
|                                       | 48 V        | 48     | 34.9         | 35.7   | Vdc                                                               |
|                                       | 300 V       | 300    | 174.6        | 178.2  | Vdc                                                               |
|                                       | 375 V       | 375    | 242.5        | 247.5  | Vdc                                                               |
| Undervoltage turn-off                 | 24 V        | 14.8   | 15.3         |        | Vdc                                                               |
|                                       | 48 V        | 29.4   | 30.5         |        | Vdc                                                               |
|                                       | 300 V       | 147.4  | 152.8        |        | Vdc                                                               |
|                                       | 375 V       | 204.7  | 212.2        |        | Vdc                                                               |
| Overvoltage turn-off / on             | 24 V        | 36.3   | 37.8         | 39.6   | Vdc                                                               |
|                                       | 48 V        | 75.7   | 78.8         | 82.5   | Vdc                                                               |
|                                       | 300 V       |        | Not Included |        | Vdc                                                               |
|                                       | 375 V       | 429.2  | 446.3        | 467.5  | Vdc                                                               |
| <b>Output Characteristics</b>         |             |        |              |        |                                                                   |
| Line regulation                       |             | ±0.02  | ±0.20        | %      | Low line to high line; full load                                  |
| Temperature regulation                |             | ±0.002 | ±0.005       | %/°C   | Over operating temp. range                                        |
| Power sharing accuracy                |             | ±2     | ±5           | %      | 10 to 100% of full load                                           |
| Programming range                     | 10          |        | 110          | % Vnom | For trimming below 90% of nominal, a minimum load may be required |
| Current limit                         |             | 115    |              | % Iout | Output voltage 95% of nominal                                     |
| Short circuit current                 |             | 115    |              | % Iout | Output voltage <250 mV                                            |
| <b>Isolation Characteristics</b>      |             |        |              |        |                                                                   |
| Isolation voltage (in to out)         |             | 3,000  |              | Vrms   | Complies with reinforced insulation requirements                  |
| Isolation voltage (in to base)        | 1,550       |        |              | Vrms   | Complies with basic insulation requirements                       |
| Isolation voltage (out to base)       | 500         |        |              | Vrms   | Complies with operational insulation requirements                 |
| Isolation resistance (in to out)      |             | 10     |              | MΩ     |                                                                   |
| <b>Thermal Characteristics</b>        |             |        |              |        |                                                                   |
| Operating temperature (H-grade)       | -40 to +100 |        |              | °C     | Baseplate                                                         |
| Storage temperature (H-grade)         | -55 to +125 |        |              | °C     |                                                                   |
| Operating temperature (M-grade)       | -55 to +100 |        |              | °C     | Baseplate                                                         |
| Storage temperature (M-grade)         | -65 to +125 |        |              | °C     |                                                                   |
| Temperature limiting (typical)        |             | +115   |              | °C     |                                                                   |
| <b>Environmental Stress Screening</b> |             |        |              |        |                                                                   |

See Page 38 for details

## Part Numbering

| V             | 300 | A                                            | 24             | M                                                           | 500          | B | L                                                                                                                             |                                                                  |
|---------------|-----|----------------------------------------------|----------------|-------------------------------------------------------------|--------------|---|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Input Voltage |     | Package<br>A = Maxi<br>B = Mini<br>C = Micro | Output Voltage | Product Grade<br>H = -40°C to +100°C<br>M = -55°C to +100°C | Output Power |   | Pin Style<br>Blank = Short Solder<br>L = Long Solder<br>S = Short ModuMate <sup>[a]</sup><br>N = Long ModuMate <sup>[a]</sup> | Baseplate<br>Blank = Slotted<br>2 = Threaded<br>3 = Through Hole |



Slotted, threaded and through hole baseplate options.

<sup>[a]</sup> Compatible with InMate and SurfMate socketing systems

## Examples

Maxi Converter  
**V300A24M500BL**  
300 Vin, Maxi, 24 Vout @ 500 W,  
long pins, slotted baseplate

Mini Converter  
**V300B15M250BL2**  
300 Vin, Mini, 15 Vout @ 250 W,  
long pins, threaded baseplate

Micro Converter  
**V300C24M150B3**  
300 Vin, Micro, 24 Vout @ 150 W,  
short pins, through hole baseplate

## Typical Input Voltages

| Nominal | Range                    | Transient                     | MIL Compliance                                                               |
|---------|--------------------------|-------------------------------|------------------------------------------------------------------------------|
| 24 V    | 16 – 36 V <sup>[b]</sup> | 50 V, 12.5 ms<br>100 V, 50 ms | MIL-STD-704E/F for 28 Vin <sup>[c]</sup><br>MIL-STD-1275A/B/D <sup>[d]</sup> |
| 28 V    | 10 – 36 V                | 50 V, 12.5 ms<br>100 V, 50 ms | MIL-STD-704E/F for 28 Vin <sup>[c]</sup><br>MIL-STD-1275A/B/D <sup>[d]</sup> |
| 48 V    | 36 – 75 V                | 100 V, 100 ms                 |                                                                              |
| 300 V   | 180 – 375 V              | 400 V, 100 ms                 | MIL-STD-704E/F                                                               |
| 375 V   | 250 – 425 V              | 500 V, 100 ms                 |                                                                              |

<sup>[b]</sup> The following models will operate down to 16 V at 75% rated power after start up at >17.9 V

Maxi — selected models

Mini — all models

Micro — all models

<sup>[c]</sup> With M-FIAM5B input filter

<sup>[d]</sup> With M-FIAM9 input filter

## Configuration Chart

Lower power options available, visit [vicorpower.com](http://vicorpower.com).

| Input Voltages  | Maximum Power available for Maxi (Full Brick) |       |       |       |       |       |       |       |       |
|-----------------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                 | Output Voltages                               |       |       |       |       |       |       |       |       |
|                 | 3.3 V                                         | 5 V   | 8 V   | 12 V  | 15 V  | 24 V  | 28 V  | 36 V  | 48 V  |
| 24 (18 – 36)    | 264 W                                         | 400 W | 300 W | 400 W | 400 W | 400 W | 400 W | 400 W | 400 W |
| 28 (10 – 36)    | 150 W                                         | 175 W | --    | 200 W | 200 W | 200 W | 200 W | 200 W | 200 W |
| 48 (36 – 75)    | 264 W                                         | 400 W | --    | 500 W | 500 W | 500 W | 500 W | 500 W | 500 W |
| 72 (43 – 110)   | 264 W                                         | 300 W | --    | 400 W | 400 W | 400 W | 400 W | 400 W | 400 W |
| 110 (66 – 154)  | 200 W                                         | 300 W | --    | 400 W | 400 W | 400 W | 400 W | 400 W | 400 W |
| 150 (100 – 200) | 264 W                                         | 400 W | 400 W | 500 W | 500 W | 500 W | 500 W | 500 W | 500 W |
| 300 (180 – 375) | 264 W                                         | 400 W | 400 W | 500 W | 500 W | 500 W | 500 W | 500 W | 500 W |
| 375 (250 – 425) | 264 W                                         | 400 W | 400 W | 600 W | 600 W | 600 W | 600 W | 600 W | 600 W |

| Input Voltages  | Maximum Power available for Mini (Half Brick) |       |       |       |       |       |       |       |       |
|-----------------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                 | Output Voltages                               |       |       |       |       |       |       |       |       |
|                 | 3.3 V                                         | 5 V   | 8 V   | 12 V  | 15 V  | 24 V  | 28 V  | 36 V  | 48 V  |
| 24 (18 – 36)    | 150 W                                         | 200 W | 200 W | 200 W | 200 W | 200 W | 200 W | 200 W | 200 W |
| 48 (36 – 75)    | 150 W                                         | 200 W | --    | 250 W | 250 W | 250 W | 250 W | 250 W | 250 W |
| 72 (43 – 110)   | 100 W                                         | 150 W | --    | 250 W | 250 W | 250 W | 250 W | 250 W | 250 W |
| 110 (66 – 154)  | 100 W                                         | 150 W | --    | 200 W | 200 W | 200 W | 200 W | 200 W | 200 W |
| 150 (100 – 200) | 150 W                                         | 200 W | 200 W | 250 W | 250 W | 250 W | 250 W | 250 W | 250 W |
| 300 (180 – 375) | 150 W                                         | 200 W | 200 W | 250 W | 250 W | 250 W | 250 W | 250 W | 250 W |
| 375 (250 – 425) | 150 W                                         | 200 W | 200 W | 300 W | 300 W | 300 W | 300 W | 300 W | 300 W |

| Input Voltages  | Maximum Power available for Micro (Quarter Brick) |       |       |       |       |       |       |       |       |
|-----------------|---------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                 | Output Voltages                                   |       |       |       |       |       |       |       |       |
|                 | 3.3 V                                             | 5 V   | 8 V   | 12 V  | 15 V  | 24 V  | 28 V  | 36 V  | 48 V  |
| 24 (18 – 36)    | 75 W                                              | 100 W | 100 W | 100 W | 100 W | 100 W | 100 W | 100 W | 100 W |
| 48 (36 – 75)    | 75 W                                              | 100 W | --    | 150 W | 150 W | 150 W | 150 W | 150 W | 150 W |
| 72 (43 – 110)   | 75 W                                              | 100 W | --    | 150 W | 150 W | 150 W | 150 W | 150 W | 150 W |
| 110 (66 – 154)  | 50 W                                              | 75 W  | --    | 100 W | 100 W | 100 W | 100 W | 100 W | 100 W |
| 150 (100 – 200) | 75 W                                              | 100 W | 100 W | 150 W | 150 W | 150 W | 150 W | 150 W | 150 W |
| 300 (180 – 375) | 75 W                                              | 100 W | 100 W | 150 W | 150 W | 150 W | 150 W | 150 W | 150 W |
| 375 (250 – 425) | 75 W                                              | 100 W | 100 W | 150 W | 150 W | 150 W | 150 W | 150 W | 150 W |

# Maxi, Mini, Micro Family

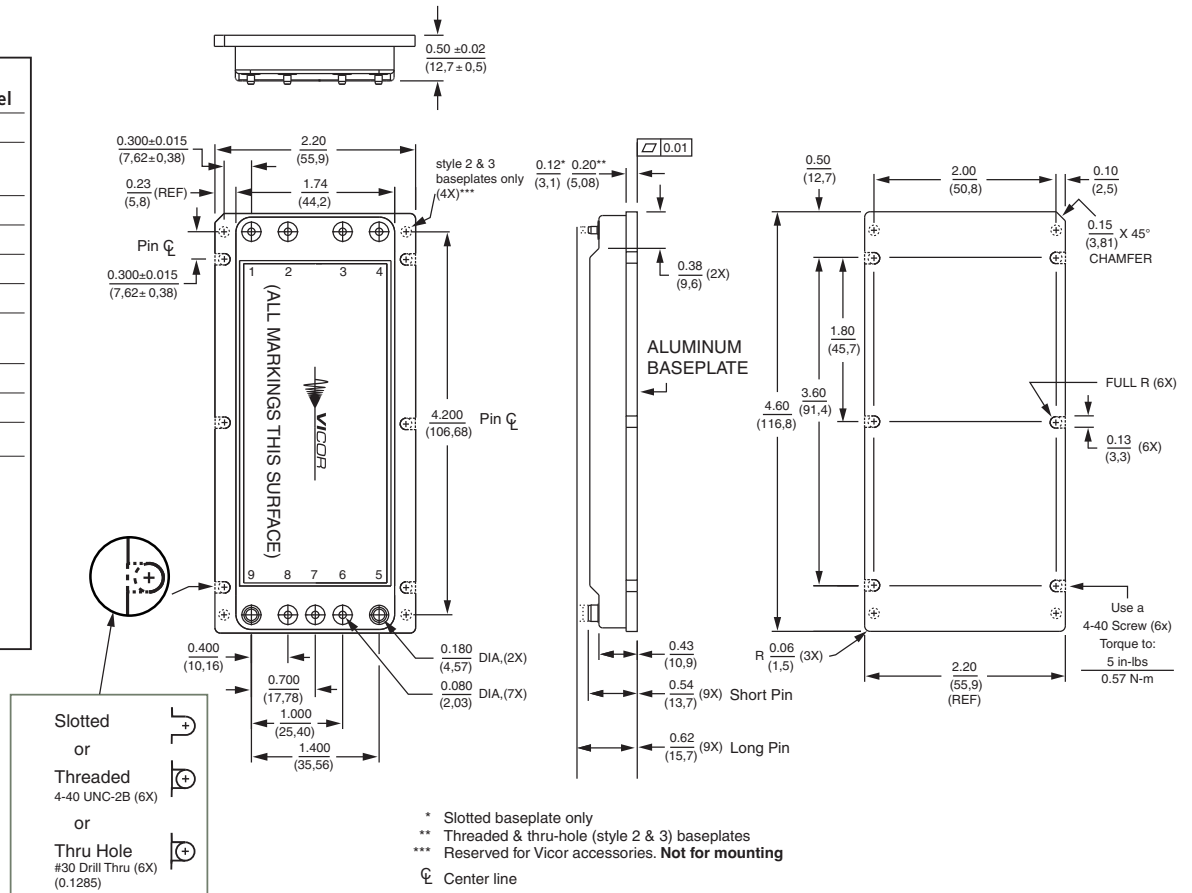
## Mechanical Drawings $\frac{in}{(mm)}$

### Maxi

| Converter Pins |                   |       |
|----------------|-------------------|-------|
| No.            | Function          | Label |
| 1              | +In               | +     |
| 2              | Primary Control   | PC    |
| 3              | Parallel          | PR    |
| 4              | -In               | -     |
| 5              | -Out              | -     |
| 6              | -Sense            | -S    |
| 7              | Secondary Control | SC    |
| 8              | +Sense            | +S    |
| 9              | +Out              | +     |

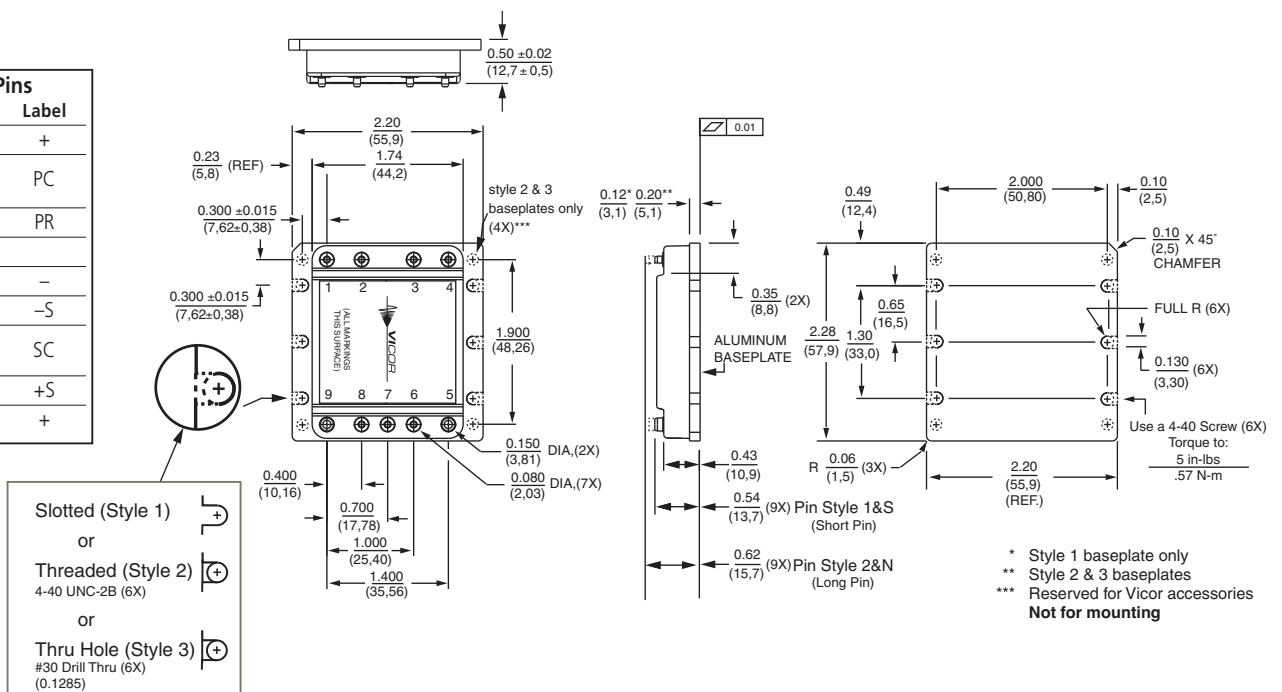
  

| Pin Styles           |                   |
|----------------------|-------------------|
| Tin / Lead           |                   |
| Hot Solder Dip       | (Pin Style 1 & 2) |
| Gold Plated Copper   | (Pin Style S & N) |
| Same on Mini & Micro |                   |



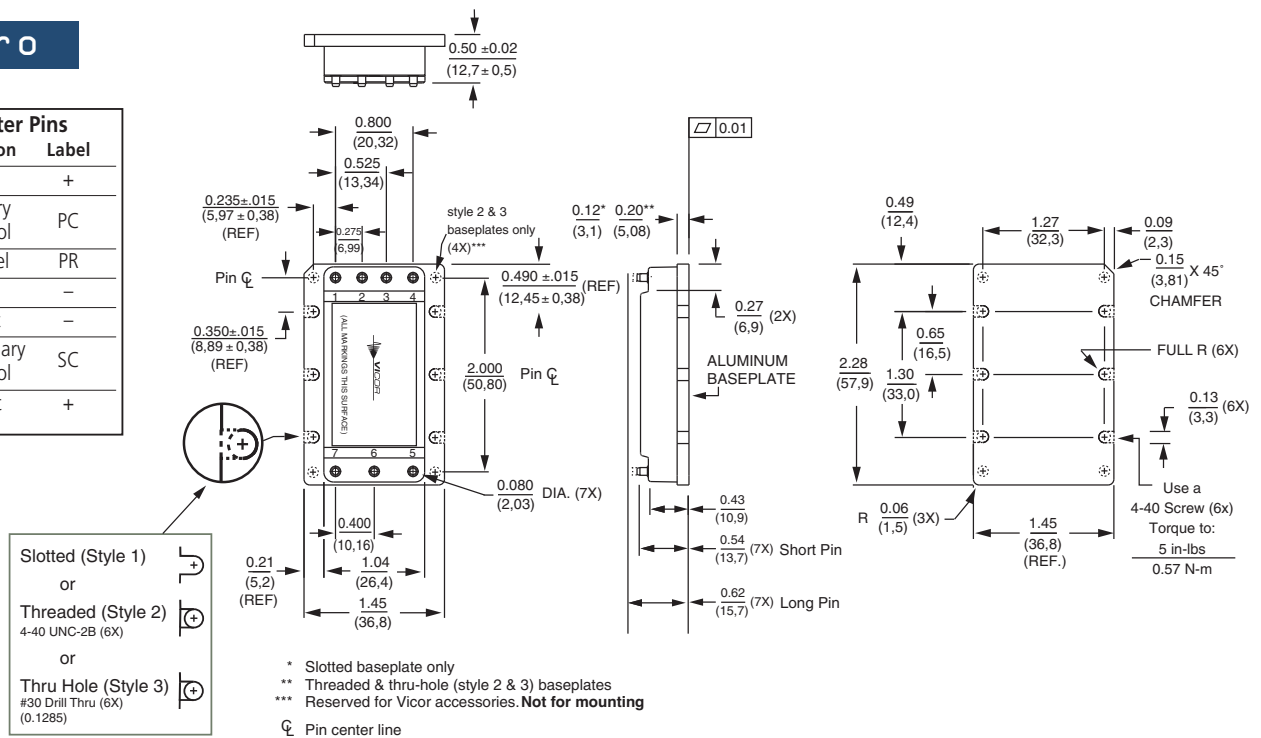
### Mini

| Converter Pins |                   |       |
|----------------|-------------------|-------|
| No.            | Function          | Label |
| 1              | +In               | +     |
| 2              | Primary Control   | PC    |
| 3              | Parallel          | PR    |
| 4              | -In               | -     |
| 5              | -Out              | -     |
| 6              | -Sense            | -S    |
| 7              | Secondary Control | SC    |
| 8              | +Sense            | +S    |
| 9              | +Out              | +     |



## Micro

| Converter Pins |                   |       |
|----------------|-------------------|-------|
| No.            | Function          | Label |
| 1              | +In               | +     |
| 2              | Primary Control   | PC    |
| 3              | Parallel          | PR    |
| 4              | -In               | -     |
| 5              | -Out              | -     |
| 6              | Secondary Control | SC    |
| 7              | +Out              | +     |



## Simple Steps to Your Power Solution

See pages 42 & 43



# Filter and Front-End Modules

## MI-IAM™

### Input Attenuator Modules

#### Highlights

The **MI-IAM** is an accessory product to Vicor's MI-Family of DC-DC converters that provides the EMI filtering and transient protection. Designed for use with all 28 V and 270 V input MI-200 or MI-J00 converters, the MI-IAM can drive any number of modules with output loads to 200 W.

The MI-IAM meets the conducted emissions specifications of MIL-STD-461C/D/E and offers complete input transient, surge, and spike protection to the most severe levels of MIL-STD-1275, MIL-STD-704 and DO-160E. Reverse polarity protection and overvoltage lockout provide additional safeguards against potentially damaging line conditions. High power arrays can be configured using the expansion port capability of the MI-IAM.

#### Features

- Inputs: 28 Vdc and 270 Vdc
- MIL-STD-461C/D/E EMI compliance
- MIL-STD-810 environments
- MIL-STD-704A-F, MIL-STD-1275A/B/D & DO-160E transients and spikes
- Reverse polarity protection
- Output power: Up to 200 W from any combination of MI-200 or MI-J00 modules
- Expansion port for additional power
- Short circuit protected
- Size: 2.28" x 2.4" x 0.5" (57,9 x 61,0 x 12,7 mm)



## General Specifications

(At TBP = 25°C, nominal line and 75% load, unless otherwise specified)

| Parameter             | Min                                  | Typ  | Max | Unit | Note                                   |
|-----------------------|--------------------------------------|------|-----|------|----------------------------------------|
| Input Characteristics |                                      |      |     |      |                                        |
| 28 Vdc modules        | Steady state input                   | 16   | 28  | 50   | Vdc                                    |
|                       | Input spike limit                    | -600 |     | 600  | Vdc 10 µs, per MIL-STD-704A            |
|                       |                                      | -250 |     | 250  | Vdc 70 µs, 15 mJ per MIL-STD-1275A/B/D |
|                       | Input surge limit                    |      |     | 100  | Vdc 50 ms, 0.5 µ per MIL-STD-1275A/B/D |
|                       |                                      |      |     | 80   | Vdc 100 ms per DO-160E                 |
|                       | Overvoltage shut down <sup>[a]</sup> | 50   |     |      | Vdc 100 ms, automatic recovery         |
|                       | Reverse polarity protection          |      |     |      | Shunt diode: input fuse required       |
| 270 Vdc modules       | Recommended fuse                     |      |     | 20   | Amps F03A type                         |
|                       | Steady state input                   | 125  | 270 | 400  | Vdc                                    |
|                       | Input spike limit                    |      |     | 800  | Vdc 10 µs, 50 Ω                        |
|                       |                                      | -600 |     | 600  | Vdc 100 µs, 15 mJ                      |
|                       | Input surge limit                    |      |     | 500  | Vdc 100 ms, 0.5 Ω                      |
|                       | Overvoltage shut down <sup>[a]</sup> | 400  |     |      | Vdc 100 ms, automatic recovery         |
|                       | Reverse polarity protection          |      |     |      | Shunt diode: input fuse required       |
| All models            | Recommended fuse                     |      |     | 4.0  | Amps F03A type                         |
|                       | No load power dissipation            |      | 0.5 | 1.5  | Watts                                  |
|                       | Inrush current                       |      | 110 | 125  | % IIN Steady state, lin 10 ms          |

#### EMI Characteristics MIL-STD-461

|                   |                          |                         |                |
|-------------------|--------------------------|-------------------------|----------------|
| Input power leads | Conducted emissions      | CE01, CE03, CE07        | MIL-STD-461C   |
|                   |                          | CE101, CE102            | MIL-STD-461D/E |
|                   | Conducted susceptibility | CS01, CS02, CS06, CS101 | MIL-STD-461C   |
|                   |                          | CS114, CS115, CS116     | MIL-STD-461D/E |

| Parameter | Min | Typ | Max | Unit | Note |
|-----------|-----|-----|-----|------|------|
|-----------|-----|-----|-----|------|------|

|                        |               |      |      |       |                                    |
|------------------------|---------------|------|------|-------|------------------------------------|
| Output Characteristics |               |      |      |       |                                    |
| Clamp voltage          | 28 Vdc input  |      | 60   | Vdc   |                                    |
|                        | 270 Vdc input |      | 420  | Vdc   |                                    |
| Output power           |               |      | 250  | Watts |                                    |
| Internal voltage drop  | 28 Vdc input  | 0.6  |      | Vdc   |                                    |
|                        | 270 Vdc input | 0.85 |      | Vdc   |                                    |
| Overload protection    | 28 Vdc input  | 20   | Amps |       | Foldback threshold; auto recovery  |
|                        | 270 Vdc input | 4    | Amps |       | with latched shut down after 10 ms |

#### Isolation Characteristics

|                |       |      |
|----------------|-------|------|
| Input to base  | 1,500 | Vrms |
| Output to base | 1,500 | Vrms |

#### Environmental – MIL-STD-810

|                             |          |        |                         |
|-----------------------------|----------|--------|-------------------------|
| Altitude - Method 500.2     | 70,000   | feet   | Procedure II            |
| Humidity - Method 507.2     | 88 / 240 | % /hrs | 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-A22-MU)

|                                       |       |           |
|---------------------------------------|-------|-----------|
| 25°C Ground Benign: G.B.              | 5,637 | 1,000 hrs |
| 50°C Naval Sheltered: N.S.            | 1,014 | 1,000 hrs |
| 65°C Airborne Inhabited Cargo: A.I.C. | 795   | 1,000 hrs |

#### Thermal Characteristics

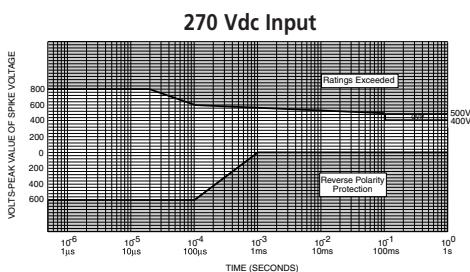
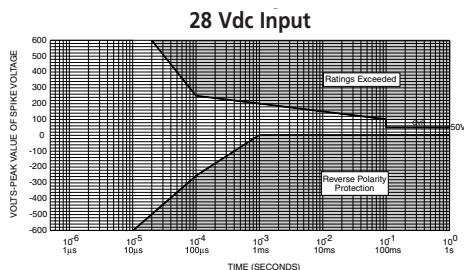
|                                  |      |                                     |
|----------------------------------|------|-------------------------------------|
| Efficiency                       | 97   | %                                   |
| Baseplate to sink                | 0.14 | °C /Watt                            |
| Operating temperature, baseplate | +100 | °C See product grade specifications |
| Storage temperature              | +125 | °C See product grade specifications |

#### Mechanical Specifications

|        |          |                |
|--------|----------|----------------|
| Weight | 3.0 (85) | ounces (grams) |
|--------|----------|----------------|

<sup>[a]</sup> The MI-IAM disables downstream converters and clamps the converter input voltage at a safe level

## Safe Operating Area [b]



[b] Refer to input characteristics on previous page.

## Model Selection Chart

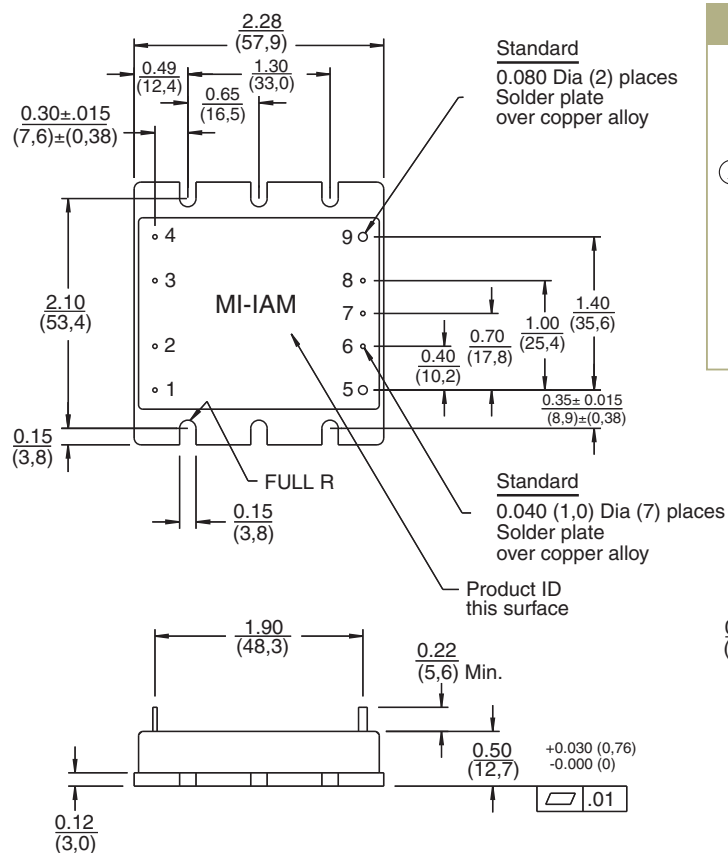
| Model Number | Nominal Input Voltage | Input Range   | Compatible MI-Family    | Converter |
|--------------|-----------------------|---------------|-------------------------|-----------|
| MI-A22-MU    | 28 Vdc                | 16 – 50 Vdc   | MI-22x-Mx and MI-J2x-Mx | M-Grade   |
| MI-A66-MU    | 270 Vdc               | 125 – 400 Vdc | MI-26x-Mx and MI-J6x-Mx | M-Grade   |
| MI-A22-IU    | 28 Vdc                | 16 – 50 Vdc   | MI-22x-Ix and MI-J2x-Ix | I-Grade   |
| MI-A66-IU    | 270 Vdc               | 125 – 400 Vdc | MI-26x-Ix and MI-J6x-Ix | I-Grade   |

## Product Grade Specifications

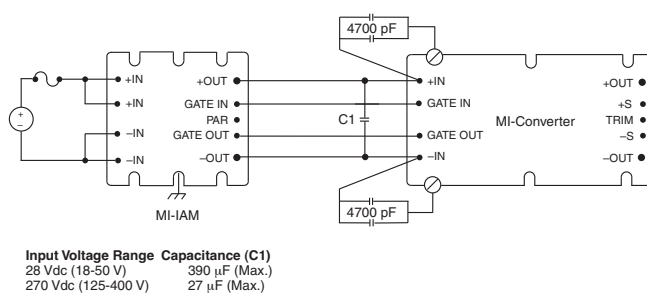
| Parameter                                                           | I-Grade                      | M-Grade                      |
|---------------------------------------------------------------------|------------------------------|------------------------------|
| Storage temperature                                                 | -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 hrs, 29 cycles            | 96 hrs, 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>[c]</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             |

[c] Test data available for review or download from vicorpower.com

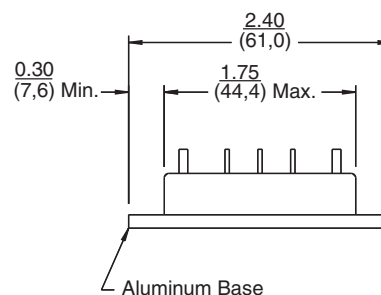
## Mechanical Drawing $\frac{in}{(mm)}$



### Typical Connection Diagram



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



# Filter and Front-End Modules

M-FIAM3 / M-FIAM5B / M-FIAM9™

Filter Input Attenuator Modules

## Highlights

The **M-FIAM** is a family of DC front-end modules that provide EMI filtering and transient protection. The M-FIAM3 / 5B / 9 enable designers using Vicor Maxi, Mini, Micro Family 24, 28, and 300 V DC-DC converters to meet conducted emission / conducted susceptibility per MIL-STD-461E; and input transients per MIL-STD-704E/F and MIL-STD-1275A/B/D.

## Features

- MIL-STD-461E EMI compliant
- MIL-STD-810, MIL-STD-202 environments
- MIL-STD-704 input transient protection
- MIL-STD-1275 input transient protection (M-FIAM9)
- Reverse polarity protection
- Environmental stress screening
- Low profile mounting options
- Inrush current limiting
- Size: 2.28" x 2.2" x 0.5" (57,9 x 55,9 x 12,7 mm)



### MVA-FIAM5B & MVA-FIAM9 A coldplate and connector option.

The MVA-FIAM5B and MVA-FIAM9 provide a coldplate and connector option for use with either 24 and 28 V input Maxi, Mini, Micro series DC-DC converters or VIPAC Arrays. Visit [vicorpower.com](http://vicorpower.com) for more details.



## General Specifications

(At TBP = 25°C, nominal line and 75% load, unless otherwise specified)

| Parameter                               |                          | Min | Typ | Max                        | Unit | Note                                          |
|-----------------------------------------|--------------------------|-----|-----|----------------------------|------|-----------------------------------------------|
| <b>Input Characteristics</b>            |                          |     |     |                            |      |                                               |
| 28 Vdc modules (M-FIAM5B)               | Steady state input       | 14  | 28  | 36                         | Vdc  | Continuous                                    |
|                                         | Input transient          |     |     | 50                         | Vdc  | 12.5 ms, MIL-STD-704E/F, continuous operation |
|                                         | Inrush limiting          |     |     | 0.007                      | A/μF |                                               |
| 28 Vdc modules (M-FIAM9)                | Steady state input       | 10  | 28  | 36                         | Vdc  | Continuous                                    |
|                                         | Input transient          |     |     | 100                        | Vdc  | 50 ms per MIL-STD-1275A/B/D                   |
|                                         |                          |     |     | 250                        | Vdc  | 70 μs per MIL-STD-1275A/B/D                   |
|                                         |                          |     |     | 70                         | Vdc  | 20 ms per MIL-STD-704A                        |
|                                         |                          |     |     | 30                         | Vdc  | 12.5 ms per MIL-ST-704E/F                     |
|                                         | Inrush limiting          |     |     | 0.007                      | A/μF |                                               |
| 270 Vdc modules (M-FIAM3)               | Steady state input       | 180 | 270 | 375                        | Vdc  |                                               |
|                                         | Input transient          |     |     | 400                        | Vdc  | 100 ms, MIL-STD-704E/F                        |
|                                         | Inrush limiting          |     |     | 0.018                      | A/μF |                                               |
| <b>EMI Characteristics MIL-STD-461E</b> |                          |     |     |                            |      |                                               |
| Input power leads                       | Conducted emissions      |     |     | CE101, CE102               |      |                                               |
|                                         | Conducted susceptibility |     |     | CS101, CS114, CS115, CS116 |      |                                               |

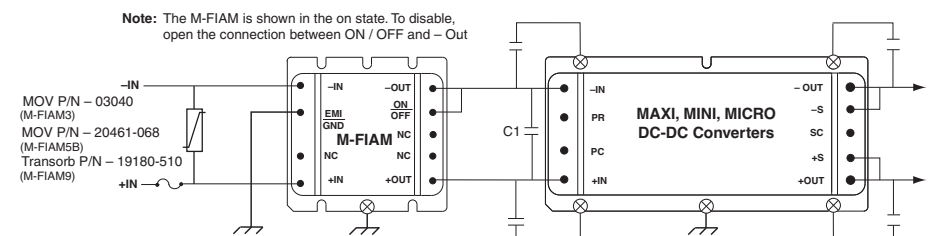
| Parameter                                  | Min   | Typ  | Max | Unit      | Note                        |
|--------------------------------------------|-------|------|-----|-----------|-----------------------------|
| <b>Output Characteristics</b>              |       |      |     |           |                             |
| Output current                             |       |      |     |           |                             |
| 28 Vdc input (M-FIAM5B)                    |       |      | 20  | Amps      |                             |
| 28 Vdc input (M-FIAM9)                     |       |      | 18  | Amps      |                             |
| 270 Vdc input (M-FIAM3)                    |       |      | 3.0 | Amps      |                             |
| Internal voltage drop                      |       |      |     |           |                             |
| 28 Vdc input (M-FIAM5B)                    |       | 0.5  | 1.0 | Vdc       | @ 20 A, 100°C baseplate     |
| 28 Vdc input (M-FIAM9)                     |       | 0.85 | 1.5 | Vdc       | @ 18 A, 25°C baseplate      |
| 270 Vdc input (M-FIAM3)                    |       | 3.0  | 5.0 | Vdc       | @ 3 A, 100°C baseplate      |
| <b>Isolation Characteristics</b>           |       |      |     |           |                             |
| Dielectric withstand                       | 1,500 |      |     | Vrms      | Input / output to baseplate |
|                                            | 2,121 |      |     | Vdc       | Input / output to baseplate |
| <b>Thermal Characteristics</b>             |       |      |     |           |                             |
| Efficiency                                 | 96    | 98   |     | %         |                             |
| Baseplate to sink; flat, greased surface   |       | 0.16 |     | °C / Watt |                             |
| Baseplate to sink; thermal pad (P/N 20264) |       | 0.1  |     | °C / Watt |                             |
| Baseplate to ambient                       |       | 7.9  |     | °C / Watt |                             |
| Baseplate to sink; 1000 LFM                |       | 2.2  |     | °C / Watt |                             |

## Part Numbering

| M                       | FIAM                                  | 5B                                                               | M                                                                  | 2                                                                                                                  | 1                                                                   |
|-------------------------|---------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Military Product</b> | <b>Filter Input Attenuator Module</b> | <b>Input Voltage</b><br>3 = 270 Vdc<br>5B = 28 Vdc<br>9 = 28 Vdc | <b>Product Grade</b><br>H = -40°C to +100°C<br>M = -55°C to +100°C | <b>Pin Style</b><br>1 = Short<br>2 = Long<br>S = Short ModuMate <sup>[a]</sup><br>N = Long ModuMate <sup>[a]</sup> | <b>Baseplate</b><br>1 = Slotted<br>2 = Threaded<br>3 = Through Hole |

<sup>[a]</sup> Compatible with SurfMate and InMate socketing systems

## M-FIAM3 / 5B / 9 Typical Connection



## Model Selection Chart

| Model Number | Nominal Input Voltage | Input Range | Compatible Products                  |
|--------------|-----------------------|-------------|--------------------------------------|
| M-FIAM3xxx   | 270 Vdc               | 180 – 375 V | V300 Maxi, Mini, Micro Family        |
| M-FIAM5Bxxx  | 28 Vdc                | 14 – 36 V   | V24 Maxi, Mini, Micro Family         |
| M-FIAM9xxx   | 28 Vdc                | 10 – 36 V   | V24 and V28 Maxi, Mini, Micro Family |

## MTBF per MIL-HDBK-217F

| Temp. | Environment                     | MTBF       |             |            | Unit      |
|-------|---------------------------------|------------|-------------|------------|-----------|
|       |                                 | M-FIAM3M21 | M-FIAM5BM21 | M-FIAM9M21 |           |
| 25°C  | Ground Benign: G.B.             | 3,646      | 2,943       | 3,587      | 1,000 hrs |
| 50°C  | Naval Sheltered: N.S.           | 656        | 456         | 1,108      | 1,000 hrs |
| 65°C  | Airborne Inhabited Cargo: A.I.C | 514        | 375         | 868        | 1,000 hrs |

## Product Grade Specifications

| Parameter                                               | Product Grade     |                   |
|---------------------------------------------------------|-------------------|-------------------|
|                                                         | H-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 hrs, 29 cycles | 24 hrs, 58 cycles |
| Temperature cycled with power off                       | 12 cycles         | 12 cycles         |
| 17°C per minute rate of change                          | –65°C to +100°C   | –65°C to +100°C   |
| Test data supplied at these temperatures <sup>[b]</sup> | –40°C, +100°C     | –55°C, +100°C     |
| Warranty                                                | 2 years           | 2 years           |
| Environmental compliance                                | MIL-STD-810       | MIL-STD-810       |

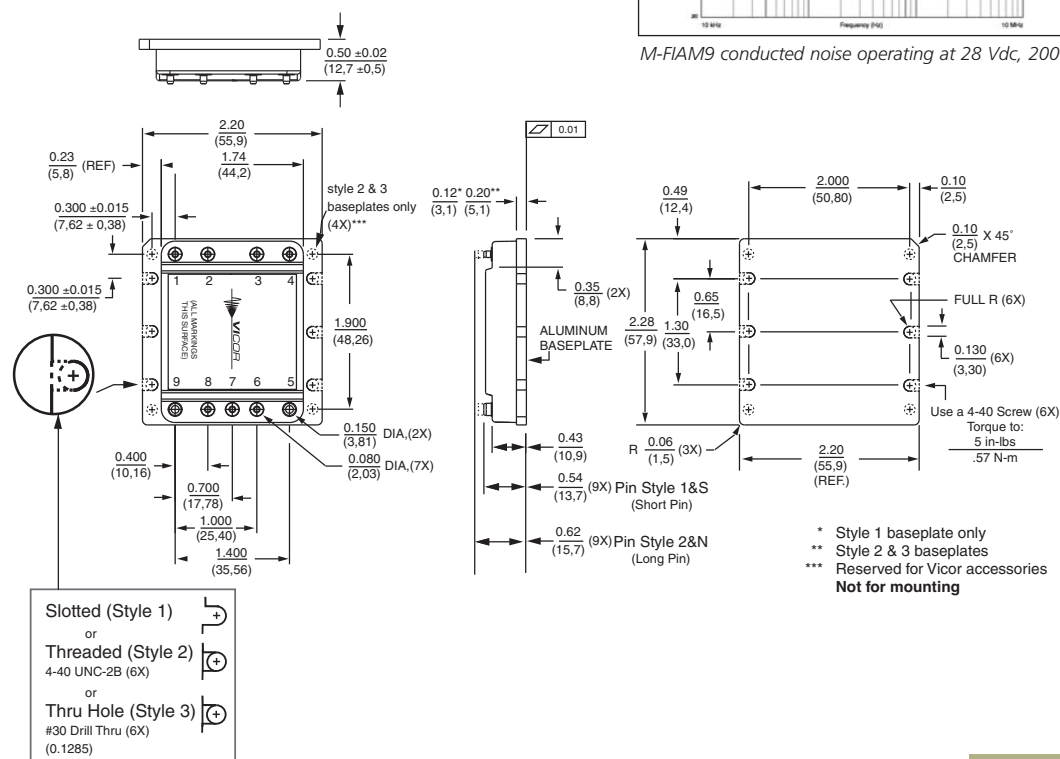
<sup>[b]</sup> Test data available for review or download from [vicorpower.com](http://vicorpower.com)

# Mechanical Drawing $\frac{in}{(mm)}$

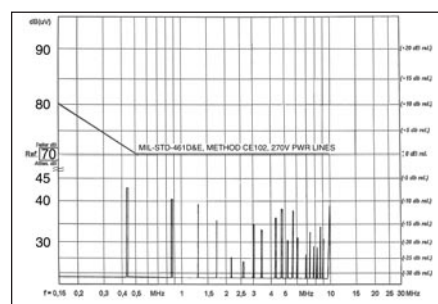
| Converter Pins |               |         |
|----------------|---------------|---------|
| No.            | Function      | Label   |
| 1              | +In           | +       |
| 2              | No Connection | NC      |
| 3              | Ground        | EMI/GND |
| 4              | -In           | -       |
| 5              | -Out          | -       |
| 6              | ON/OFF        | ON/OFF  |
| 7              | No Connection | NC      |
| 8              | No Connection | NC      |
| 9              | +Out          | +       |

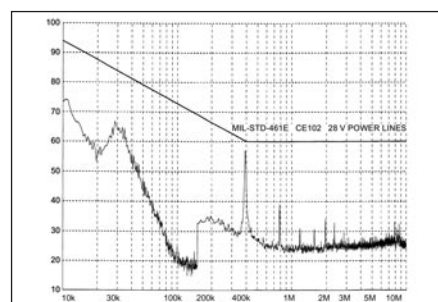
| Pin Styles         |  |
|--------------------|--|
| Tin / Lead         |  |
| Hot Solder Dip     |  |
| (Pin Style 1 & 2)  |  |
| Gold Plated Copper |  |
| (Pin Style S & N)  |  |



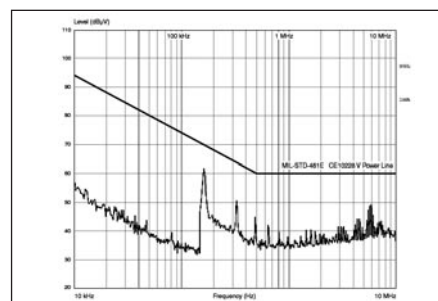
## EMI Compliance



*M-FIAM3 conducted noise operating at 180 Vdc, 130 W*



*M-FIAM5B conducted noise operating at 28 Vdc, 400 W*



*M-FIAM9 conducted noise operating at 28 Vdc, 200 W*

# Filter and Front-End Modules

## MI-AIM™

### Highlights

The **AC input module** interfaces directly with AC mains to provide line rectification, EMI filtering, transient protection, and inrush limiting. These front-end modules accept 115 Vac and provide 250 W of output power for any of Vicor's MI-x7x family of standard and junior-size modules.

The MI-AIM meets CE102 conducted emissions requirements of MIL-STD-461D/E and the transient and spike requirements of MIL-STD-704A-F.

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

### Features

- Inputs: 115 Vac 60/400 Hz
- Output power: 250 W
- MIL-STD-704A-F input transients protection
- MIL-STD-461D/E EMI compliant
- MIL-STD-810, MIL-STD-202 environments
- Compatible with MI-x7x family modules
- Efficiency: 95%
- Operating temperature to +100°C
- Size: 2.28" x 2.4" x 0.5" (57,9 x 61,0 x 12,7 mm)



## General Specifications

(At TBP = 25°C, unless otherwise specified)

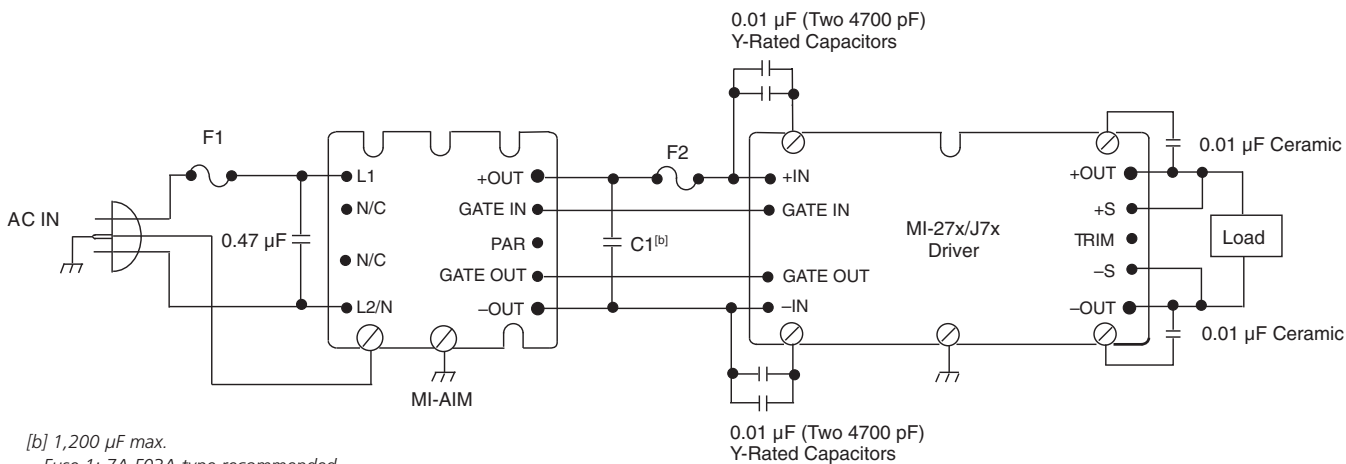
| Parameter                                       | Min                      | Typ   | Max      | Unit           | Note                             |
|-------------------------------------------------|--------------------------|-------|----------|----------------|----------------------------------|
| <b>Input Characteristics (per MIL-STD-704A)</b> |                          |       |          |                |                                  |
| Steady state input                              | (V)                      | 85    | 115      | 140            | Vrms                             |
|                                                 | (f)                      | 47    | 60 / 400 | 440            | Hz Operates over entire range    |
| Transient input                                 | (V)                      | 80    |          |                | Vrms 20 ms, per MIL-STD-704A     |
|                                                 |                          |       |          | 180            | Vrms 100 ms, per MIL-STD-704A    |
|                                                 | (f)                      |       |          | 480            | Hz Peak, per MIL-STD-704A        |
| Inrush current                                  |                          |       | 40       | A, peak        | 125 Vac                          |
| Conducted EMI                                   | CE102 per MIL-STD-461D/E |       |          |                | 100 – 125 Vac; 60 Hz             |
| Efficiency                                      |                          | 95    |          | %              | 115 Vac; 60 / 400 Hz             |
| Spikes                                          |                          |       | ±50      | %              | Nominal line voltage, 50 µs      |
| <b>Output Characteristics</b>                   |                          |       |          |                |                                  |
| Power                                           |                          | 250   |          | W              | 100°C                            |
| Ext. capacitance (C1)                           |                          | 1,200 | µF       |                | See connection diagram           |
| Isolation                                       |                          |       |          |                |                                  |
| Input to output                                 | none                     |       |          |                | Provided by converter            |
| Input to baseplate                              | 1500                     |       |          | Vrms           |                                  |
| <b>Environmental – MIL-STD-810</b>              |                          |       |          |                |                                  |
| Altitude - Method 500.2                         | 70,000                   |       |          | feet           | Procedure II                     |
| Humidity - Method 507.2                         | 88 / 240                 |       |          | % / hs         | Procedure I, cycle 1             |
| Acceleration - Method 513.3                     | 9.0                      |       |          | g              | Procedure II                     |
| Vibration - Method 514.3                        | 20                       |       |          | g              | Procedure I, category 6          |
| Shock - Method 516.3                            | 40                       |       |          | g              | Procedure I                      |
| <b>Reliability – MIL-HDBK-217F (MI-AIM-M1)</b>  |                          |       |          |                |                                  |
| 25°C Ground Benign: G.B.                        | 5,355                    |       |          | 1,000 hrs      |                                  |
| 50°C Naval Sheltered: N.S.                      | 964                      |       |          | 1,000 hrs      |                                  |
| 65°C Airborne Inhabited Cargo: A.I.C.           | 755                      |       |          | 1,000 hrs      |                                  |
| <b>Mechanical Characteristics</b>               |                          |       |          |                |                                  |
| Thermal resistance                              | 0.14                     |       |          | °C/W           | Baseplate to sink, w/thermal pad |
| Weight                                          | 3.5 (85)                 |       |          | ounces (grams) |                                  |

## Product Grade Specifications

| Parameter                                               | I-Grade           | Product Grade | M-Grade            |
|---------------------------------------------------------|-------------------|---------------|--------------------|
| Part number                                             | MI-AIM-I1         |               | MI-AIM-M1          |
| 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 hrs, 29 cycles |               | 96 hrs, 213 cycles |
| Temperature cycled with power off                       | 12 cycles         |               | 12 cycles          |
| 17°C per minute rate of change                          | –65°C to +100°C   |               | –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        |

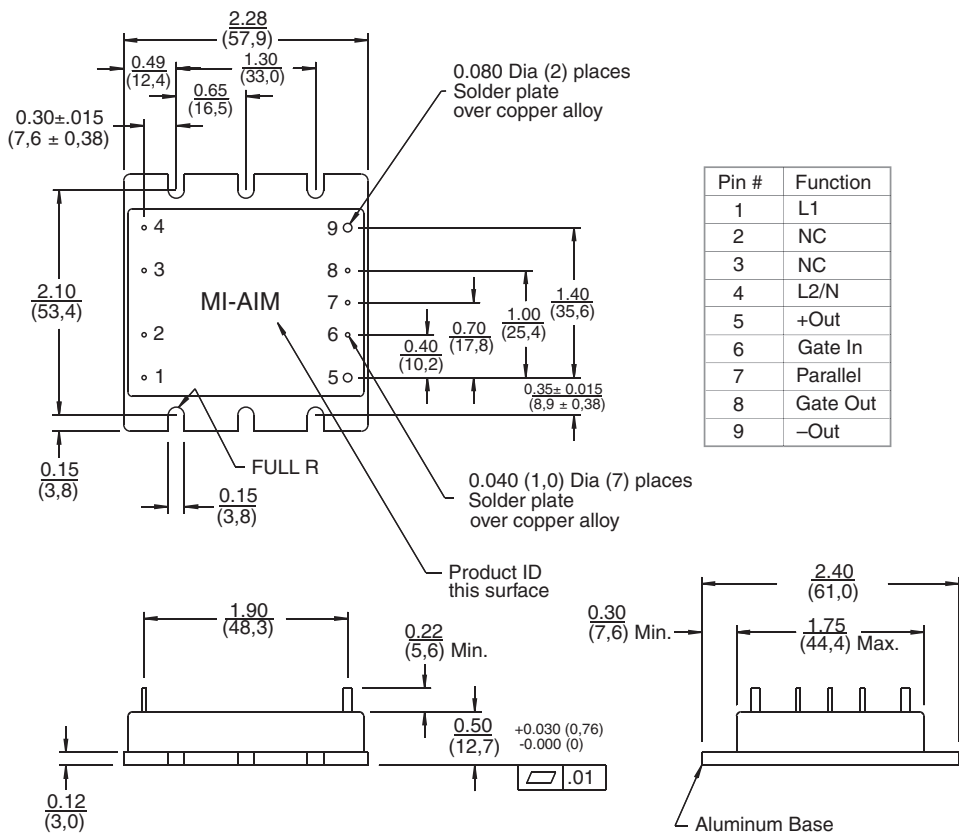
<sup>[a]</sup> Test data available for review or download from [vicorpower.com](http://vicorpower.com)

# Connection Diagram

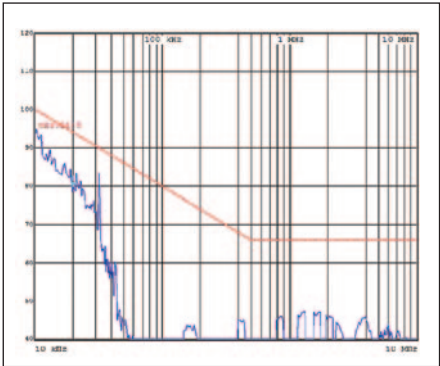


[b] 1,200 µF max.  
Fuse 1: 7A F03A type recommended  
Fuse 2: MI-x7x-xx – Buss PC – TRON 2 – 5 A (450 V)

# Mechanical Drawing



# EMI Compliance



MIL-STD-461E, CE102 compliance with MI-AIM and MI-200 operating at 115 Vac / 60 Hz input and 12 Vdc / 100 W output

# Filter and Front-End Modules

## MI-RAM™ Ripple Attenuator Module

### Highlights

The **MI-RAM** is designed for applications where extremely low noise outputs are required. When used with any Vicor MI-Family DC-DC converter, the MI-RAM reduces both line frequency related ripple and switching noise to less than 10 mV p-p, DC to 20 MHz.

The combination of the MI-RAM with an MI-Family converter provides the output noise performance of a linear supply at a power density in excess of 15 W/in<sup>3</sup>.

All of the features of the MI-Family converter remain available while using the MI-RAM, including output voltage trimming, OVP and OTP (MI-200 only), current limiting, remote sense, and output inhibit.

Full encapsulation in a low profile package enables the MI-RAM to meet MIL-STD-810 environmental testing requirements.

### Features

- Reduces output PARD to <10 mV pp
- Full attenuation up to 20 A load
- No adjustments required
- Compatible with all MI-Family converters from 5 – 50 Vdc output
- Efficiency: 93 – 99%
- Converter sense, trim, OV & OC retained
- MIL-STD-810 environments
- Size: 2.28" x 2.4" x 0.5" (57,9 x 61,0 x 12,7 mm)



## General Specifications (At TBP = 25°C)

| Parameter                                                      | Min  | Typ   | Max   | Unit    | Note                        |
|----------------------------------------------------------------|------|-------|-------|---------|-----------------------------|
| <b>Characteristics</b>                                         |      |       |       |         |                             |
| Output noise and ripple                                        |      | 2.0   | 3.0   | mV p-p  | MI-200; 10% to 100% load    |
|                                                                |      | 6.0   | 10.0  | mV p-p  | MI-J00; 10% to 100% load    |
| Input voltage range                                            | 5.0  |       | 50    | Vdc     |                             |
| Output voltage accuracy                                        | 99.5 |       | 100.5 | %       | Of MI source converter      |
| Full load current                                              |      |       | 10    | A       | MI-RAM-I1 and MI-RAM-M1     |
|                                                                |      |       | 20    | A       | MI-RAM-I2 and MI-RAM-M2     |
| DC voltage drop                                                | 0.34 |       | 0.38  |         | 10% to full load            |
| Dissipation = (DC voltage drop x load current) + (Vin x 15 mA) |      |       |       |         |                             |
| Isolation                                                      |      | 250   |       | Vrms    | Input / output to baseplate |
| Weight                                                         |      | 3.7   |       | ounces  |                             |
|                                                                |      | (105) |       | (grams) |                             |

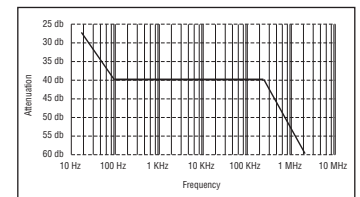
## Product Grade Specifications

| Parameter                                               | I-Grade           | Product 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 hrs, 29 cycles |               | 96 hrs, 213 cycles |
| Temperature cycled with power off                       | 12 cycles         |               | 12 cycles          |
| 17°C per minute rate of change                          | –65°C to +100°C   |               | –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        |

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

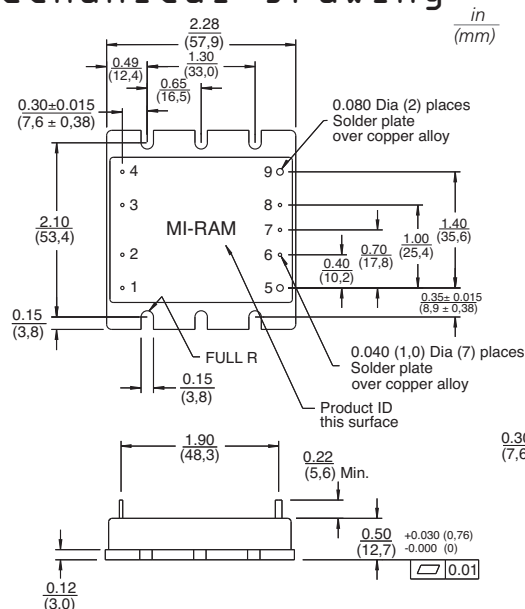
## Part Numbering

|                     |   |                      |                       |
|---------------------|---|----------------------|-----------------------|
| <b>MI-RAM</b>       | – | <b>M</b>             | <b>2</b>              |
| <b>Product Type</b> |   | <b>Product Grade</b> | <b>Current Rating</b> |
|                     |   | I = –40°C to +100°C  | 1 = Up to 10 A        |
|                     |   | M = –55°C to +100°C  | 2 = Up to 20 A        |

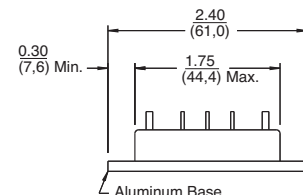


Attenuation vs. Frequency (typical)

## Mechanical Drawing



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



# Filter and Front-End Modules

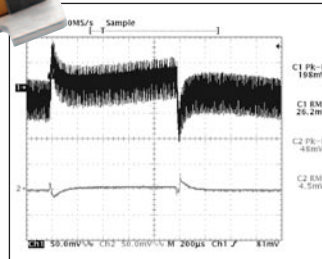
## MicroRAM™ Ripple Attenuation Module

### Highlights

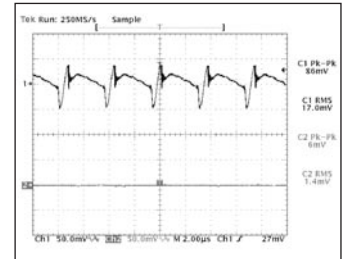
Vicor's **MicroRAM** output ripple attenuation module combines both active and passive filtering to achieve greater than 40 dB of noise attenuation from 60 Hz to 1 MHz. The MicroRAM operates over a range of 3 to 30 Vdc, is available in either 20 or 30 A models, and is compatible with all manufacturers switching converters including Vicor's MI-200, MI-J00 Family and Maxi, Mini, Micro Family DC-DC converters.

The MicroRAM's closed loop architecture greatly improves load transient response and with dual mode control, insures precise point-of-load voltage regulation. The MicroRAM supports redundant and parallel operation with its integrated ORing diode function.

It is available in Vicor's standard Micro package (quarter brick) with a variety of terminations for through-hole, socket, or surface-mount applications.



Typical input and output dynamic response. CTRAN; 35% of load



Typical input and output ripple @ 50% (10 A) load

## General Specifications

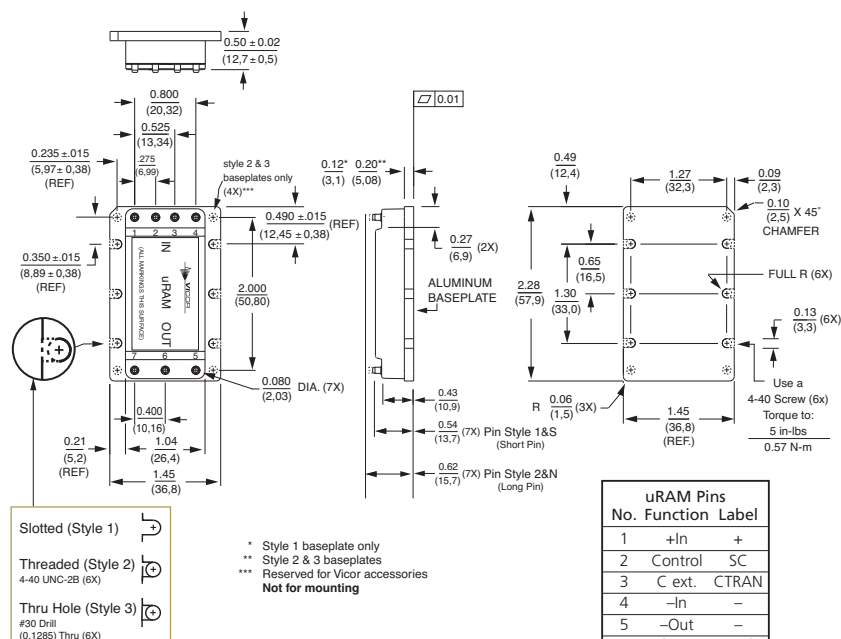
| Parameter                | Min  | Typ  | Max  | Unit   | Note                         |
|--------------------------|------|------|------|--------|------------------------------|
| <b>Characteristics</b>   |      |      |      |        |                              |
| Output ripple            |      |      | 10.0 | mV p-p |                              |
| Input voltage range      | 3.0  |      | 30.0 | Vdc    |                              |
| Operating current        |      |      |      |        |                              |
| uRAM2xxx                 | 0.02 |      | 20   | A      | No internal current limiting |
| uRAM3xxx                 | 0.02 |      | 30   | A      | No internal current limiting |
| <b>Power Dissipation</b> |      |      |      |        |                              |
| uRAM2xxx Vhr 380 mV@1 A  |      | 7.5  |      | W      | Vin 28 V; Iout 20 A          |
| uRAM3xxx Vhr 380 mV@1 A  |      | 11.5 |      | W      | Vin 28 V; Iout 30 A          |

## Part Numbering

| uRAM                | 2                     | M                                          | 2                                                                                                            | 1                                               |
|---------------------|-----------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>Product Type</b> | <b>Current Rating</b> | <b>Product Grade</b>                       | <b>Pin Style</b>                                                                                             | <b>Baseplate</b>                                |
|                     | 2 = 20 A<br>3 = 30 A  | H = -40°C to +100°C<br>M = -55°C to +100°C | 1 = Short Solder<br>2 = Long Solder<br>S = Short ModuMate <sup>[a]</sup><br>N = Long ModuMate <sup>[a]</sup> | 1 = Slotted<br>2 = Threaded<br>3 = Through Hole |

<sup>[a]</sup> Compatible with SurfMate and InMate socketing systems

## Mechanical Drawing



## Features

- >40 dB ripple attenuation from 60 Hz to 1 MHz
- 20 – 30 Amp ratings
- 3 – 30 Vdc input range
- Efficiency: Up to 98%
- Environmental stress screening
- Integrated ORing diode supports N+1 redundancy
- Combined active and passive filtering
- Size: 2.28" x 1.45" x 0.5" (57,9 x 36,8 x 12,7 mm)

# Configurable Solutions

## 28 V MIL-VIPAC

### Highlights

The **28 Vdc MIL-COTS VIPAC** family of power systems is a new class of user-defined, modular power solutions for the most demanding military applications. It incorporates preassembled and tested front ends (M-FIAM5B or M-FIAM9), Vicor Maxi, Mini and Micro Family DC-DC converters (H or M-Grade), and a choice of output connections and mechanical platforms. The 28 Vdc VIPAC can be specified with one, two or three outputs with voltages as low as 3.3 Vdc to as high as 48 Vdc and power levels from 50 to 400 W per output. Additionally, the wide trim range of the modules can provide operating voltages from 500 mV to 52.8 V. The MIL-VIPAC is available with an input of 28 Vdc in a variety of packages with profiles as low as 0.75".

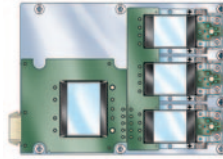
For additional technical or design information; or to create a 28 Vdc VIPAC tailored to your specific requirements using Vicor's online configurator, visit [vicorpower.com/powerbench](http://vicorpower.com/powerbench).

### Features

- 28 Vdc input
- -55°C operation
- MIL-STD-461E EMI compliance<sup>[a]</sup>
- MIL-STD-704A/E/F and MIL-STD-1275A/B/D input transient protection
- Compliant to MIL-STD-810F for vibration (Method 514.5, Procedure I) & shock (Method 516.5, Procedure I)
- One, two, or three outputs
- Outputs from 3.3 to 48 Vdc
- 50 to 400 W per output
- Environmental stress screening (modules only)
- Two output termination styles
- Low profile

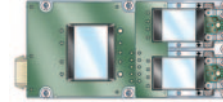
<sup>[a]</sup> CE102 compliant with loads in excess of 30% of rated output; loads below 30% may need additional input capacitance for compliance

### Configurations



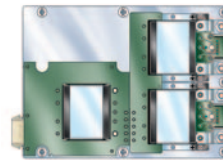
#### 3 Micros

- 4.96" x 6.8" (126,0 x 172,7 mm)
- 1.4 lbs (640 g)<sup>[b]</sup>
- Dual or triple output
- Up to 300 W



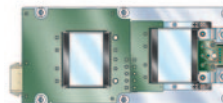
#### 2 Micros

- 3.15" x 6.8" (80,0 x 172,7 mm)
- 1.0 lbs (457 g)<sup>[b]</sup>
- Single or dual output
- Up to 200 W



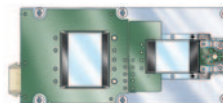
#### 2 Minis

- 4.96" x 6.8" (126,0 x 172,7 mm)
- 1.4 lbs (640 g)<sup>[b]</sup>
- Single or dual output
- Up to 400 W



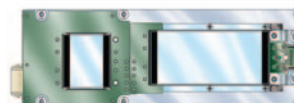
#### 1 Mini

- 3.15" x 6.8" (80,0 x 172,7 mm)
- 1.0 lbs (457 g)<sup>[b]</sup>
- Single output
- Up to 200 W



#### 1 Micro

- 3.15" x 6.8" (80,0 x 172,7 mm)
- 0.9 lbs (411 g)<sup>[b]</sup>
- Single output
- Up to 100 W



#### 1 Maxi

- 3.15" x 9.15" (80,0 x 234,4 mm)
- 1.3 lbs (594 g)<sup>[b]</sup>
- Single output
- Up to 400 W

<sup>[b]</sup> Weight is for the coldplate version only. Please refer to the VIPAC design guide for weight using finned heat sinks



## General Specifications

(Typical at 25°C, nominal line and load, unless otherwise specified)

### Input Characteristics

| Parameter                   | Min                                     | Typ | Max   | Unit | Note                                              |
|-----------------------------|-----------------------------------------|-----|-------|------|---------------------------------------------------|
| Input voltage               | 18                                      | 28  | 36    | Vdc  | Continuous                                        |
| Inrush limiting             |                                         |     | 0.007 | A/μF |                                                   |
| Transient immunity          | M-FIAM5B (MVC-xxx)<br>M-FIAM9 (MVX-xxx) |     | 50    | Vdc  | 12.5 ms per MIL-STD-704E/F, continuous operation  |
|                             |                                         |     | 100   | Vdc  | 50 ms per MIL-STD-1275A/B/D, continuous operation |
|                             |                                         |     | 250   | Vdc  | 70 μs per MIL-STD-1275A/B/D, continuous operation |
|                             |                                         |     | 70    | Vdc  | 20 ms per MIL-STD-704A, continuous operation      |
|                             |                                         |     | 50    | Vdc  | 12.5 ms per MIL-STD-704E/F, continuous operation  |
| EMI                         |                                         |     |       |      | MIL-STD-461E                                      |
| Conducted emissions         |                                         |     |       |      | CE101, CE102 <sup>[c]</sup>                       |
| Conducted susceptibility    |                                         |     |       |      | CS101, CS114, CS115, CS116                        |
| Reverse polarity protection |                                         |     |       |      | Internally fused                                  |

<sup>[c]</sup> CE102 compliant with loads in excess of 30% of rated output; loads below 30% may need additional input capacitance for compliance

### Output Characteristics

| Parameter                  | Min | Typ    | Max    | Unit       | Note                                                                                                      |
|----------------------------|-----|--------|--------|------------|-----------------------------------------------------------------------------------------------------------|
| Output voltage set point   |     |        | ±1     | %          | Vout nom                                                                                                  |
| Line regulation            |     | ±0.02  | ±0.2   | %          | Low line to high line; full load                                                                          |
| Temperature regulation     |     | ±0.002 | ±0.005 | %/°C       | Over operating temperature range                                                                          |
| Over temperature shut down |     | +115   |        | °C         |                                                                                                           |
| Power sharing accuracy     |     | ±2     | ±5     | %          |                                                                                                           |
| Programming range          | 10  |        | 110    | %          | Of nominal voltage (For trimming below 90% of nominal, a minimum load of 10% rated power may be required) |
| Current limit              |     | 115    |        | % Iout max | Output voltage 95% of nominal                                                                             |
| Short circuit current      |     | 115    |        | % Iout max | Output voltage <250 mV                                                                                    |



### Environmental Characteristics

| Parameter                               | Min           | Max | Unit       | Note                                       |
|-----------------------------------------|---------------|-----|------------|--------------------------------------------|
| Dielectric withstand, input to chassis  | 1,500 / 2,121 |     | Vrms / Vdc |                                            |
| Dielectric withstand, input to output   | 3,000 / 4,242 |     | Vrms / Vdc |                                            |
| Operating temperature, ambient          |               |     |            |                                            |
| H-Grade                                 | -40           | +65 | °C         | Max chassis temp; 95°C                     |
| M-Grade                                 | -55           | +65 | °C         | Max chassis temp; 95°C                     |
| Shock                                   |               |     |            |                                            |
| MIL-STD-810F, Method 516.5, Procedure I |               |     |            | 40 g for 15 – 23 ms,<br>75 g for 8 – 13 ms |
| Vibration                               |               |     |            |                                            |
| MIL-STD-810F, Method 514.5, Procedure I |               |     |            | 20 – 2,000 Hz at 5 G rms                   |

# Configurable Solutions

## MIL-VIPAC Array™ Chassis Mount DC-DC

### Highlights

**MIL-VIPAC Arrays** are a highly flexible system of DC input power building-blocks that can be configured with as many as four user-definable outputs on a low profile, coldplate chassis. Using Vicor's VCAD design tool, designers are able to specify MIL-VIPAC Arrays with Maxi, Mini and Micro Family H- or M-Grade converters with inputs of 24 or 300 Vdc (additional input voltages available) and outputs from 2 to 48 Vdc at power levels up to 500 W per output. MIL-VIPAC Arrays are ideal for use in distributed and modular power systems where power density and reliable operation are critical. Fully connectorized input and output terminations speed system installation and a versatile coldplate chassis simplifies thermal management.

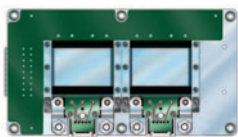
For additional technical or design information; or to create a MIL-VIPAC Array tailored to your specific requirements using Vicor's online configurator, visit [vicorpower.com/powerbench](http://vicorpower.com/powerbench).



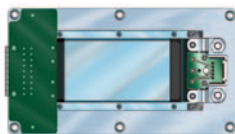
### Features

- 24 or 300 V input  
28, 48, 72, 110, 150, and 375 V inputs also available
- 55°C operation
- Configurable single, dual, triple & quad outputs
- Outputs 2 – 48 Vdc; Up to 650 W
- Compliant to MIL-STD-810F for shock (Method 516.5, Procedure I) & vibration (Method 514.5, Procedure I)
- Current share option for high power / redundant operation
- High temperature capability
- Rugged, low profile, coldplate chassis
- Fully connectorized input & output for simplified hook up

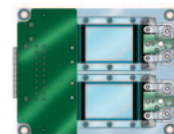
### Configurations



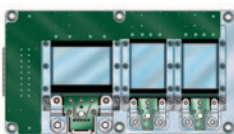
- 2 Minis**
- 3.62" x 6.69" (92,0 x 170,0 mm)
  - 1.25 lbs (567 g)
  - Single or dual outputs
  - Up to 500 W



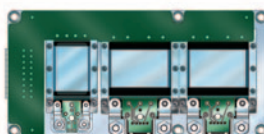
- 1 Maxi**
- 3.62" x 6.69" (92,0 x 170,0 mm)
  - 1.05 lbs (476 g)
  - Single output
  - Up to 500 W



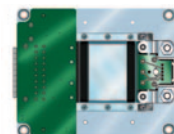
- 2 Micros**
- 3.62" x 4.39" (92,0 x 112,0 mm)
  - 0.7 lbs (318 g)
  - Single or dual outputs
  - Up to 300 W



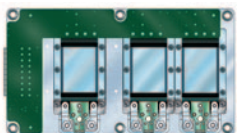
- 1 Mini, 2 Micros**
- 3.62" x 6.69" (92,0 x 170,0 mm)
  - 1.3 lbs (590 g)
  - Single, dual or triple outputs
  - Up to 550 W



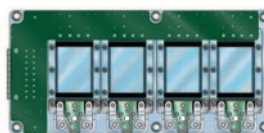
- 1 Micro, 2 Minis**
- 3.62" x 7.52" (92,0 x 191,0 mm)
  - 1.35 lbs (612 g)
  - Dual or triple outputs
  - Up to 650 W



- 1 Mini**
- 3.62" x 4.39" (92,0 x 112,0 mm)
  - 0.7 lbs (318 g)
  - Single output
  - Up to 250 W
  - Current share option



- 3 Micro**
- 3.62" x 6.69" (92,0 x 170,0 mm)
  - 1.3 lbs (590 g)
  - Dual or triple outputs
  - Up to 450 W



- 4 Micros**
- 3.15" x 6.8" (92,0 x 191,0 mm)
  - 1.3 lbs (590 g)
  - Dual, triple or quad outputs
  - Up to 600 W

Please contact Vicor for additional configuration options.

## General Specifications

(Typical at 25°C, nominal line and load, unless otherwise specified)

### Operating – 24 V Input

| Parameter                | Min | Typ | Max | Unit        | Note                              |
|--------------------------|-----|-----|-----|-------------|-----------------------------------|
| Operating input voltage  | 18  | 24  | 36  | Vdc         | For 16 V operation <sup>[a]</sup> |
| Input surge withstand    |     |     | 50  | Vdc         | <100 ms                           |
| Output voltage set point |     |     | ±1  | % Vout nom. | Nominal input; full load; 25°C    |

### Operating – 300 V Input

| Parameter                | Min | Typ | Max | Unit        | Note                           |
|--------------------------|-----|-----|-----|-------------|--------------------------------|
| Operating input voltage  | 180 | 300 | 375 | Vdc         |                                |
| Input surge withstand    |     |     | 400 | Vdc         | <100 ms                        |
| Output voltage set point |     |     | ±1  | % Vout nom. | Nominal input; full load; 25°C |

### Input – 24 V Input

| Parameter                 | Min  | Typ  | Max  | Unit | Note |
|---------------------------|------|------|------|------|------|
| Undervoltage turn-on      |      | 17.5 | 17.9 | Vdc  |      |
| Undervoltage turn-off     | 14.8 | 15.3 |      | Vdc  |      |
| Overvoltage turn-off / on | 36.3 | 37.8 | 39.6 | Vdc  |      |

### Input – 300 V Input

| Parameter                 | Min   | Typ   | Max   | Unit | Note         |
|---------------------------|-------|-------|-------|------|--------------|
| Undervoltage turn-on      |       | 174.6 | 178.2 | Vdc  |              |
| Undervoltage turn-off     | 147.4 | 152.8 |       | Vdc  |              |
| Overvoltage turn-off / on |       |       |       | Vdc  | Not included |

## Environmental

| Parameter                              | Min                                     | Typ | Max | Unit       | Note                                      |
|----------------------------------------|-----------------------------------------|-----|-----|------------|-------------------------------------------|
| Dielectric withstand, input to chassis | 1500 / 2121                             |     |     | Vrms / Vdc |                                           |
| Dielectric withstand, input to output  | 3000 / 4242                             |     |     | Vrms / Vdc |                                           |
| Operating temperature - Ambient        |                                         |     |     |            |                                           |
| H-Grade                                | –40                                     |     | +65 | °C         | Max chassis temp., 95°C                   |
| M-Grade                                | –55                                     |     | +65 | °C         |                                           |
| Shock                                  | MIL-STD-810F, Method 516.5, Procedure I |     |     |            | 40 g for 15 – 23 ms<br>75 g for 8 – 13 ms |
| Vibration                              | MIL-STD-810F, Method 514.5, Procedure I |     |     |            | 20 – 2000 Hz at 5 G rms                   |

<sup>[a]</sup> The following models will operate down to 16 V at 75% rated power after start up at >17.9 V

Maxi — selected models

Mini — all models

Micro — all models

# Configurable Solutions

## MI-MegaMod Chassis-Mount DC-DC Converter

### Highlights

Vicor's **MI-MegaMod** family of single, dual, and triple output DC-DC converters provide power system designers with cost-effective, high-performance, off-the-shelf solutions to applications that might otherwise require a custom supply.

Incorporating standard MI-200 or MI-J00 family converters in rugged, chassis mount packages, MegaMods can be ordered with single, dual, or triple outputs, having a combined output power of up to 300 W. Totally isolated outputs eliminate efficiency penalties and output interaction problems.

### Features

- Inputs: 28, 155, 165 and 270 Vdc
- One, two, or three outputs
- Output from 2 to 48 Vdc
- Up to 13.5 W/in<sup>3</sup>
- High efficiency
- Remote sense
- ZCS power architecture
- Low noise FM control



### Full-size MegaMod

| Parameter                              | Min   | Typ                    | Max                    | Units      | Notes                    |
|----------------------------------------|-------|------------------------|------------------------|------------|--------------------------|
| <b>Input Characteristics</b>           |       |                        |                        |            |                          |
| Inrush charge                          |       | 120 x 10 <sup>-6</sup> | 200 x 10 <sup>-6</sup> | Coulombs   | Nominal line, per module |
| Input reflected ripple current – pp    |       | 10                     |                        | % lin      | Nominal line, full load  |
| No load power dissipation              |       | 1.35                   | 2.0                    | Watts      | Per module               |
| <b>Output Characteristics</b>          |       |                        |                        |            |                          |
| Set point accuracy                     |       | 0.5                    | 1.0                    | % Vnom     |                          |
| Load / line regulation                 |       | 0.05                   | 0.2                    | % Vnom     | LL to HL, 10% to FL      |
| Load / line regulation                 |       | 0.2                    | 0.5                    | % Vnom     | LL to HL, NL to 10%      |
| Output temperature drift               |       | 0.01                   | 0.02                   | % / °C     | Over rated temperature   |
| Long term drift                        |       | 0.02                   |                        | % / 1K hrs |                          |
| Output ripple – p-p: <10 V             |       | 80                     | 150                    | mV         | 20 MHz bandwidth         |
| 12 – 48 V                              |       | 0.75                   | 1.5                    | %          | 20 MHz bandwidth         |
| Output voltage trimming <sup>[a]</sup> | 50    |                        | 110                    | % Vnom     |                          |
| Total remote sense compensation        | 0.5   |                        |                        | Vdc        | 0.25 V max. neg. leg     |
| OVP set point                          | 115   | 125                    | 135                    | % Vnom     | Recycle power            |
| Current limit                          | 105   |                        | 125                    | % Inom     | Automatic restart        |
| Short circuit current                  |       |                        | 130                    | % Inom     |                          |
| <b>Isolation Characteristics</b>       |       |                        |                        |            |                          |
| Isolation (input to output)            | 3,000 |                        |                        | Vrms       |                          |
| Isolation (output to baseplate)        | 500   |                        |                        | Vrms       |                          |
| Isolation (input to baseplate)         | 1,500 |                        |                        | Vrms       |                          |
| <b>Thermal Characteristics</b>         |       |                        |                        |            |                          |
| Efficiency                             |       | 80 – 90                |                        | %          |                          |
| Baseplate to chassis                   |       | 0.1                    |                        | °C/Watt    |                          |
| Thermal shut down                      | +90   | +95                    | +105                   | °C         |                          |

### Half-size MegaMod

| Parameter                              | Min   | Typ                   | Max                    | Units      | Notes                    |
|----------------------------------------|-------|-----------------------|------------------------|------------|--------------------------|
| <b>Input Characteristics</b>           |       |                       |                        |            |                          |
| Inrush charge                          |       | 60 x 10 <sup>-6</sup> | 100 x 10 <sup>-6</sup> | Coulombs   | Nominal line, per module |
| Input reflected ripple current – pp    |       | 10                    |                        | % lin      | Nominal line, full load  |
| No load power dissipation              |       | 1.35                  | 2.0                    | Watts      | Per module               |
| <b>Output Characteristics</b>          |       |                       |                        |            |                          |
| Set point accuracy                     |       | 0.5                   | 1.0                    | % Vnom     |                          |
| Load / line regulation                 |       | 0.05                  | 0.2                    | % Vnom     | LL to HL, 10% to FL      |
| Load / line regulation                 |       | 0.2                   | 0.5                    | % Vnom     | LL to HL, NL to 10%      |
| Output temperature drift               |       | 0.01                  | 0.02                   | % / °C     | Over rated temperature   |
| Long term drift                        |       | 0.02                  |                        | % / 1K hrs |                          |
| Output ripple – p-p: <10 V             |       | 80                    | 150                    | mV         | 20 MHz bandwidth         |
| 12 – 48 V                              |       | 0.75                  | 1.5                    | %          | 20 MHz bandwidth         |
| Output voltage trimming <sup>[a]</sup> | 50    |                       | 110                    | % Vnom     |                          |
| Total remote sense compensation        | 0.5   |                       |                        | Vdc        | 0.25 V max. neg. leg     |
| Current limit                          | 105   | 125                   | 135                    | % Inom     | Automatic restart        |
| <b>Isolation Characteristics</b>       |       |                       |                        |            |                          |
| Isolation (input to output)            | 3,000 |                       |                        | Vrms       |                          |
| Isolation (output to baseplate)        | 500   |                       |                        | Vrms       |                          |
| Isolation (input to baseplate)         | 1,500 |                       |                        | Vrms       |                          |
| <b>Thermal Characteristics</b>         |       |                       |                        |            |                          |
| Efficiency                             |       | 80 – 90               |                        | %          |                          |
| Baseplate to chassis                   |       | 0.1                   |                        | °C / Watt  |                          |

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

## Configuration Chart

### Full-size MegaMods

| Single Output                                                                          | Power       | Size                                           | Weight          | # of MI-200 |
|----------------------------------------------------------------------------------------|-------------|------------------------------------------------|-----------------|-------------|
| MI-L  | 50 – 100 W  | 4.9" x 2.5" x 0.62"<br>124,5 x 63,5 x 15,7 mm  | 9.0 oz. (255 g) | 1           |
| MI-M  | 150 – 200 W | 4.9" x 4.9" x 0.62"<br>124,5 x 124,5 x 15,7 mm | 1.2 oz. (525 g) | 2           |
| MI-N  | 300 W       | 4.9" x 7.3" x 0.62"<br>124,5 x 185,4 x 15,7 mm | 1.7 oz. (780 g) | 3           |

### Dual Outputs

|                                                                                        |             |                                                |                 |   |
|----------------------------------------------------------------------------------------|-------------|------------------------------------------------|-----------------|---|
| MI-P  | 100 – 200 W | 4.9" x 4.9" x 0.62"<br>124,5 x 124,5 x 15,7 mm | 1.2 oz. (525 g) | 2 |
| MI-Q  | 200 – 300 W | 4.9" x 7.3" x 0.62"<br>124,5 x 185,4 x 15,7 mm | 1.7 oz. (780 g) | 3 |

### Triple Outputs

|                                                                                        |             |                                                |                 |   |
|----------------------------------------------------------------------------------------|-------------|------------------------------------------------|-----------------|---|
| MI-R  | 150 – 300 W | 4.9" x 7.3" x 0.62"<br>124,5 x 185,4 x 15,7 mm | 1.7 oz. (780 g) | 3 |
|----------------------------------------------------------------------------------------|-------------|------------------------------------------------|-----------------|---|

### Half-size MegaMods

| Single Output                                                                          | Power     | Size                                          | Weight          | # of MI-J00 |
|----------------------------------------------------------------------------------------|-----------|-----------------------------------------------|-----------------|-------------|
| MI-U  | 10 – 50 W | 2.58" x 2.5" x 0.62"<br>65,5 x 63,5 x 15,7 mm | 4.5 oz. (127 g) | 1           |

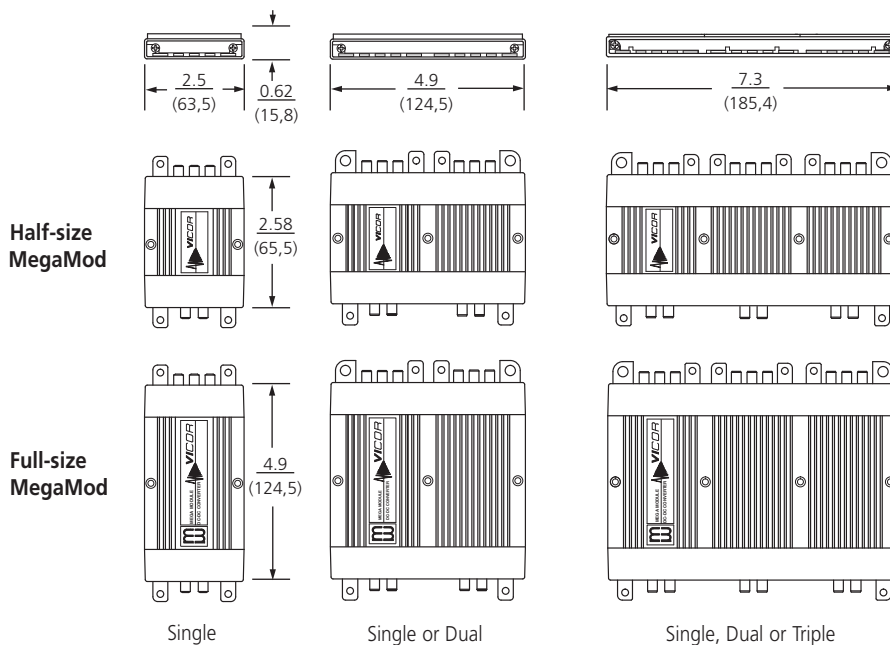
### Dual Outputs

|                                                                                          |            |                                                |                 |   |
|------------------------------------------------------------------------------------------|------------|------------------------------------------------|-----------------|---|
| MI-PJ  | 20 – 100 W | 2.58" x 4.9" x 0.62"<br>65,5 x 124,5 x 15,7 mm | 8.8 oz. (250 g) | 2 |
|------------------------------------------------------------------------------------------|------------|------------------------------------------------|-----------------|---|

### Triple Outputs

|                                                                                           |            |                                                |                  |   |
|-------------------------------------------------------------------------------------------|------------|------------------------------------------------|------------------|---|
| MI-RJ  | 30 – 150 W | 2.58" x 7.3" x 0.62"<br>65,5 x 185,4 x 15,7 mm | 13.3 oz. (377 g) | 3 |
|-------------------------------------------------------------------------------------------|------------|------------------------------------------------|------------------|---|

## Mechanical Drawing $\frac{in}{(mm)}$



### Input Voltage

| Nominal     | Range                      | Transient |
|-------------|----------------------------|-----------|
| 2 = 28 Vdc  | 18 – 50 V <sup>[b]</sup>   | 60 V      |
| 5 = 155 Vdc | 100 – 210 V                | 230 V     |
| 6 = 270 Vdc | 125 – 400 V <sup>[c]</sup> | 475 V     |
| 7 = 165 Vdc | 100 – 310 V <sup>[d]</sup> |           |

### Output Voltage

|           |                          |            |
|-----------|--------------------------|------------|
| Z = 2 V   | T = 6.5 V <sup>[e]</sup> | N = 18.5 V |
| Y = 3.3 V | R = 7.5 V <sup>[e]</sup> | 3 = 24 V   |
| O = 5 V   | M = 10 V                 | L = 28 V   |
| X = 5.2 V | 1 = 12 V                 | J = 36 V   |
| W = 5.5 V | P = 13.8 V               | K = 40 V   |
| V = 5.8 V | 2 = 15 V                 | 4 = 48 V   |

### Product Grade

#### Full Size

I = -40°C to +85°C  
M = -55°C to +85°C

#### Half Size

I = -40°C to +100°C  
M = -55°C to +100°C

### Output Power / Current

| Full Size |      | Half Size |      |
|-----------|------|-----------|------|
| ≥5 V      | <5 V | ≥5 V      | <5 V |
| Y = 50 W  | 10 A | A = 10 W  | —    |
| X = 75 W  | 15 A | Z = 25 W  | 5 A  |
| W = 100 W | 20 A | Y = 50 W  | 10 A |
| V = —     | 30 A |           |      |

### Output Power / Current

|     | ≥5 V  | <5 V |
|-----|-------|------|
| V = | 150 W | 30 A |
| U = | 200 W | —    |
| S = | —     | 60 A |

### Output Power / Current

|     | ≥5 V  | <5 V |
|-----|-------|------|
| S = | 300 W | —    |
| P = | —     | 90 A |

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

<sup>[c]</sup> These units rated at 75% load from

125 – 150 Vin: Full-size – 5 Vout @

100 W; 2 Vout and 3.3 Vout @ 30 A;

Half-Size – 5 Vout @ 50 W; 2 V and 3.3 V @ 10 A

<sup>[d]</sup> For use with Vicor's MI-AIM

<sup>[e]</sup> 75 W max module power for 28 V input

# Configurable Solutions

## MI-ComPAC™ DC-DC Power Supply Up to 300 W

### Highlights

The **MI-ComPAC** is a complete single, dual, or triple output DC-DC power supply that delivers up to 300 W from inputs of 28 Vdc or 270 Vdc.

The MI-ComPAC meets the conducted emissions and conducted susceptibility specifications of MIL-STD-461C/D/E and offers complete input transient, surge, and spike protection to the most severe levels of MIL-STD-1275, MIL-STD-704 and DO-160E.

Reverse polarity protection and over / undervoltage lockout provide additional safeguards against potentially damaging line conditions. The MI-ComPAC also features a master disable.

### Features

- Transient protection: 28 Vdc per MIL-STD-704A, MIL-STD 1275A/B/D & DO-160E, 270 Vdc per MIL-STD-704D/E/F
- One, two, or three outputs
- Outputs from 2 to 48 Vdc
- Up to 5 W/in<sup>3</sup>
- High efficiency
- Remote sense
- ZCS power architecture
- Low noise FM control
- MIL-STD-461C/D/E EMI compliance
- Reverse polarity protection



## General Specifications

At TBP = 25°C, nominal line and 75% load, unless otherwise specified

| Parameter                                                             | Min                 | Typ                | Max               | Units  | Notes                               |
|-----------------------------------------------------------------------|---------------------|--------------------|-------------------|--------|-------------------------------------|
| <b>Input Characteristics</b>                                          |                     |                    |                   |        |                                     |
| <b>28 Vdc input modules</b>                                           |                     |                    |                   |        |                                     |
| Steady state input                                                    | 18                  | 28                 | 50                | Vdc    |                                     |
| Low line lockout                                                      |                     |                    | 17.5              | Vdc    | Automatic recovery                  |
| Input spike limit                                                     | -600                |                    | +600              | Vdc    | 10 µs, 50 Ω per MIL-STD-704A        |
|                                                                       | -250                |                    | +250              | Vdc    | 70 µs, 15 mJ per MIL-STD-1275A/B/D  |
| Input surge limit                                                     |                     |                    | 100               | Vdc    | 50 ms, 0.5 Ω per MIL-STD-1275A/B/D  |
|                                                                       |                     |                    | 80                | Vdc    | 100 ms per DO-160E                  |
| Overvoltage shut down                                                 | 50                  |                    |                   | Vdc    | 100 ms automatic recovery           |
| Reverse polarity protection                                           |                     |                    |                   |        | Shunt diode: input fuse required    |
| Recommended fuse                                                      |                     |                    | 10 <sup>[a]</sup> | Amps   | F03A type                           |
| <b>270 Vdc input modules</b>                                          |                     |                    |                   |        |                                     |
| Steady state input                                                    | 125                 | 270                | 400               | Vdc    |                                     |
| Low line lockout                                                      |                     |                    | 125               | Vdc    | Automatic recovery                  |
| Input spike limit                                                     |                     |                    | +800              | Vdc    | 10 µs, 50 Ω                         |
|                                                                       | -600                |                    | +600              | Vdc    | 100 µs, 15 mJ                       |
| Input surge limit                                                     |                     |                    | 500               | Vdc    | 100 ms, 0.5Ω                        |
| Overvoltage shut down                                                 | 400                 |                    |                   | Vdc    | 100 µs automatic recovery           |
| Reverse polarity protection                                           |                     |                    |                   |        | Shunt diode: input fuse required    |
| Recommended fuse                                                      |                     |                    | 2 <sup>[a]</sup>  | Amps   | F03A type                           |
| <b>All models</b>                                                     |                     |                    |                   |        |                                     |
| No load power dissipation                                             |                     | 1.5 <sup>[a]</sup> | 2 <sup>[a]</sup>  | Watts  |                                     |
| Master disable input current <sup>[b]</sup><br>(Absolute max., 20 mA) | 4                   |                    |                   | mA     | Sink; disables all outputs          |
| Inrush current                                                        |                     | 110                | 125               | %, lin | Steady state lin, 10 ms             |
| <b>EMC Characteristics – MIL-STD-461C/D/E</b>                         |                     |                    |                   |        |                                     |
| <b>Input power leads</b>                                              |                     |                    |                   |        |                                     |
| Conducted emissions                                                   | CE01, CE03, CE07    |                    |                   |        | MIL-STD-461C — 1-up                 |
|                                                                       | CE101, CE102        |                    |                   |        | MIL-STD-461D — 1-up                 |
|                                                                       | CE101               |                    |                   |        | MIL-STD-461E — 2-up & 3-up          |
| Conducted susceptibility                                              | CS01, CS02, CS0     |                    |                   |        | MIL-STD-461C — 1-up                 |
|                                                                       | CS101, CS114, CS116 |                    |                   |        | MIL-STD-461D — 1-up                 |
|                                                                       | CS101, CS114, CS116 |                    |                   |        | MIL-STD-461E — 2-up & 3-up          |
| <b>Output Characteristics</b>                                         |                     |                    |                   |        |                                     |
| Set point accuracy                                                    | 0.5                 | 1.0                |                   | % Vnom |                                     |
| Load / line regulation                                                | 0.2                 | 0.5                |                   | % Vnom | LL to HL, NL to 10%                 |
|                                                                       | 0.05                | 0.2                |                   | % Vnom | LL to HL, 10% to FL                 |
| Output temperature drift                                              | 0.01                | 0.02               |                   | %/°C   |                                     |
| Output noise – p-p                                                    | 1.0                 | 1.5                |                   | % Vnom | } Whichever is greater<br>20 MHz BW |
|                                                                       | 100                 | 150                |                   | mV     |                                     |
| Output voltage trimming <sup>[c]</sup>                                | 50                  |                    | 110               | % Vnom |                                     |
| Remote sense compensation                                             | 0.5                 |                    |                   | Vdc    |                                     |
| OVP set point                                                         | 115                 | 125                | 135               | % Vnom | Latching                            |
| Current limit                                                         | 105                 |                    | 125               | % Inom | Auto restart                        |
| Short circuit current <sup>[d]</sup>                                  | 20                  |                    | 130               | % Inom |                                     |
| <b>Isolation Characteristics</b>                                      |                     |                    |                   |        |                                     |
| Input to output                                                       | 4,242               |                    |                   | Vrms   |                                     |
| Input to case                                                         |                     |                    |                   |        |                                     |
| 28 Vdc input                                                          | 2,121               |                    |                   | Vrms   |                                     |
| 270 Vdc input                                                         | 2,500               |                    |                   | Vrms   |                                     |
| Output to case                                                        | 500                 |                    |                   | Vrms   |                                     |
| <b>Thermal Characteristics</b>                                        |                     |                    |                   |        |                                     |
| Efficiency                                                            |                     | 81                 |                   | %      |                                     |
| Operating temperature, case                                           |                     |                    | +85               | °C     | See product grade                   |
| Storage temperature                                                   |                     |                    | +100              | °C     | See product grade                   |
| Shut down temperature                                                 | +90                 | +95                | +105              | °C     | Cool and recycle power to restart   |

<sup>[a]</sup> Per internal module configuration

<sup>[b]</sup> Multiply minimum x 2 for 2-ups and x 3 for 3-ups

<sup>[c]</sup> 10 V, 12 V, and 15 V outputs, standard trim range ±10%. Consult factory for wider trim range

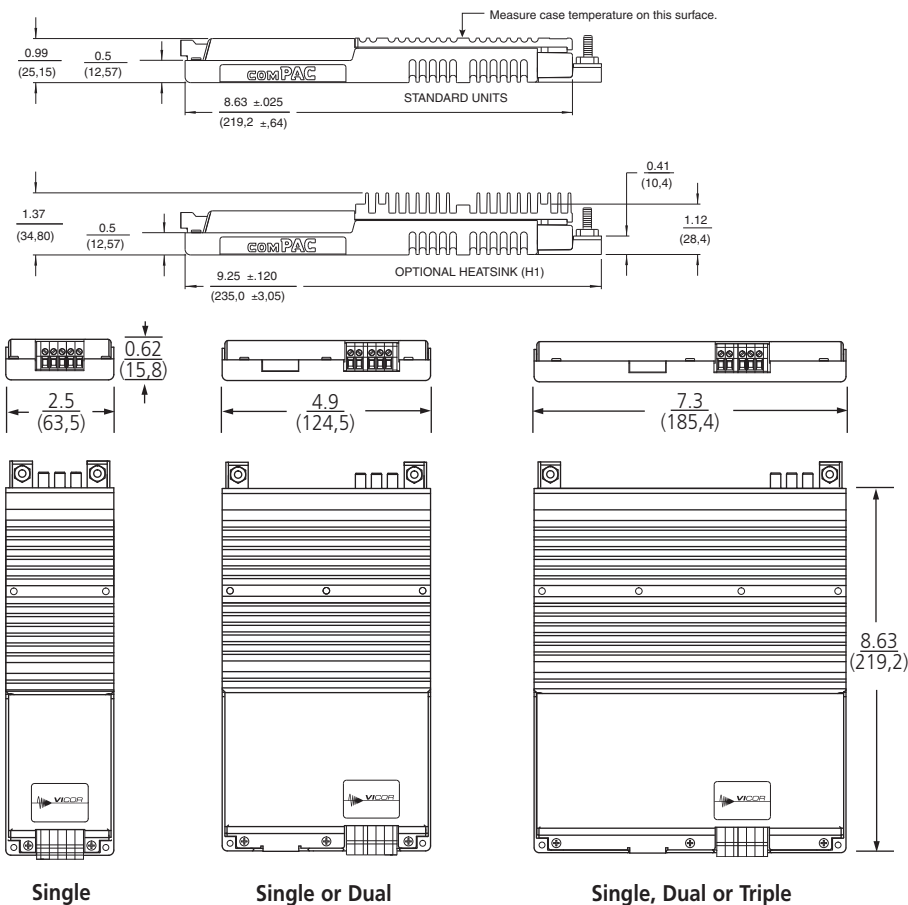
<sup>[d]</sup> Output ranges of 5 V or less incorporate foldback current limiting, outputs of 10 V and above incorporate straight line current limiting

# Configuration Chart

| Single Output                                                                           | Power       | Size                                           | Weight               | No. of Modules |
|-----------------------------------------------------------------------------------------|-------------|------------------------------------------------|----------------------|----------------|
| MI-LC  | 50 – 100 W  | 8.6" x 2.5" x 0.99"<br>219,2 x 64,5 x 25,1 mm  | 1.2 lbs.<br>(544 g)  | 1              |
| MI-MC  | 150 – 200 W | 8.6" x 4.9" x 0.99"<br>219,2 x 126,0 x 25,1 mm | 2.4 lbs.<br>(1248 g) | 2              |
| MI-NC  | 300 W       | 8.6" x 7.3" x 0.99"<br>219,2 x 187,5 x 25,1 mm | 3.6 lbs.<br>(1633 g) | 3              |
| <b>Dual Outputs</b>                                                                     |             |                                                |                      |                |
| MI-PC  | 100 – 200 W | 8.6" x 4.9" x 0.99"<br>219,2 x 126,0 x 25,1 mm | 2.4 lbs.<br>(1248 g) | 2              |
| MI-QC  | 200 – 300 W | 8.6" x 7.3" x 0.99"<br>219,2 x 187,5 x 25,1 mm | 3.6 lbs.<br>(1633 g) | 3              |
| <b>Triple Outputs</b>                                                                   |             |                                                |                      |                |
| MI-RC  | 150 – 300 W | 8.6" x 7.3" x 0.99"<br>219,2 x 187,5 x 25,1 mm | 3.6 lbs.<br>(1633 g) | 3              |

Conduction-cooled models available, add "-CC" to the end of the part number. (Consult factory for details)

## Mechanical Drawing $\frac{in}{(mm)}$



### Input Voltage

| Nominal     | Range                      | Transient |
|-------------|----------------------------|-----------|
| 2 = 28 Vdc  | 18 – 50 V <sup>[b]</sup>   | 60 V      |
| 5 = 155 Vdc | 100 – 210 V                | 230 V     |
| 6 = 270 Vdc | 125 – 400 V <sup>[c]</sup> | 475 V     |
| 7 = 165 Vdc | 100 – 310 V <sup>[d]</sup> |           |

### Output Voltage

|           |                          |            |
|-----------|--------------------------|------------|
| Z = 2 V   | T = 6.5 V <sup>[e]</sup> | N = 18.5 V |
| Y = 3.3 V | R = 7.5 V <sup>[e]</sup> | 3 = 24 V   |
| O = 5 V   | M = 10 V                 | L = 28 V   |
| X = 5.2 V | 1 = 12 V                 | J = 36 V   |
| W = 5.5 V | P = 13.8 V               | K = 40 V   |
| V = 5.8 V | 2 = 15 V                 | 4 = 48 V   |

### Product Grade

I = -40°C to +85°C

M = -55°C to +85°C

### Output Power / Current

| Full Size |      | Half Size |      |
|-----------|------|-----------|------|
| ≥5 V      | <5 V | ≥5 V      | <5 V |
| Y = 50 W  | 10 A | A = 10 W  | —    |
| X = 75 W  | 15 A | Z = 25 W  | 5 A  |
| W = 100 W | 20 A | Y = 50 W  | 10 A |
| V = —     | 30 A |           |      |

### Output Power / Current

|     | ≥5 V  | <5 V |
|-----|-------|------|
| V = | 150 W | 30 A |
| U = | 200 W | —    |
| S = | —     | 60 A |

### Output Power / Current

|     | ≥5 V  | <5 V |
|-----|-------|------|
| S = | 300 W | —    |
| P = | —     | 90 A |

[b] 16 V operation at 75% load

[c] These units rated at 75% load from

125 – 150 Vin: Full-size – 5 Vout @

100 W; 2 Vout and 3.3 Vout @ 30 A;

Half-Size – 5 Vout @ 50 W; 2 V and 3.3 V @ 10 A

[d] For use with Vicor's MI-ALM

[e] 75 W max module power for 28 V input

# Accessories

## For MI-200 / MI-J00 DC-DC Converters

### Mounting

#### Sockets

Sockets are available for all Vicor MI-200 / MI-J00 modules and are intended for applications requiring ease of module installation or removal. Vicor modules have nine pins; seven of which are 0.040" and two are 0.080".

| Pin Size         | Finish      | Part Number |
|------------------|-------------|-------------|
| 0.040" (1,01 mm) | Electro-tin | 30074       |
| 0.080" (2,03 mm) | Electro-tin | 30075       |

#### Module Standoffs

For mechanical mounting of MI-200 / MI-J00 modules. Also provides grounding of the module from the baseplate to the printed circuit board. (Sold individually)

| Description                    | Part Number |
|--------------------------------|-------------|
| 0.525" Long., 0.25" Hex        | 32183-01    |
| (13,3 mm) Long., (6,35 mm) Hex |             |



### Inductors/Capacitors

#### Inductors, Differential Mode

Output inductors may be used to reduce differential output noise by approximately 20 dB.

| Inductance @ max. A | DC Current max. | Part Number |
|---------------------|-----------------|-------------|
| 0.2 µH              | 40 A            | 30268       |



#### Inductors, Common Mode

Common-mode inductors provide a high level of attenuation of common-mode currents.

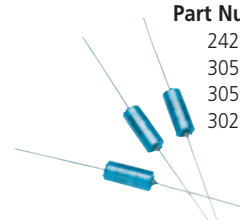
| Inductance/ Winding | DC Current/ Resistance | Part Number |
|---------------------|------------------------|-------------|
| 1000 µH             | 12 A / 6.5 mΩ          | 31743       |
| 3000 µH             | 7 A / 18 mΩ            | 31742       |



#### Capacitors, Tantalum

Solid tantalum capacitor used to reduce output ripple.

| Description   | Part Number |
|---------------|-------------|
| 270 µF / 10 V | 24252       |
| 120 µF / 20 V | 30506       |
| 68 µF / 30 V  | 30507       |
| 27 µF / 50 V  | 30259       |



#### Capacitors, Y-Type

For EMI considerations, Y capacitors should be used with any of Vicor's DC-DC converter modules.

| Description       | Part Number |
|-------------------|-------------|
| "Y" Cap., 1500 pF | 00770       |
| "Y" Cap., 4700 pF | 01000       |



### Thermal Management

#### ThermMate™ Thermal Pads

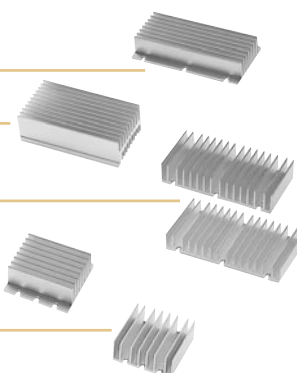
For use with Vicor modules, ThermMate thermal pads are a "dry" alternative to thermal compound and are pre-cut to the outline dimensions of the module.

| Thermal Pad      | Thickness        | Part Number         |
|------------------|------------------|---------------------|
| Full-Size MI-200 | 0.007" (0,177mm) | 20266 (10 pc. pkg.) |
| Half-Size MI-J00 | 0.007" (0,177mm) | 20267 (10 pc. pkg.) |



#### Heat Sinks

| Fin Style    | Module Style | Fin Height       | Part Number |
|--------------|--------------|------------------|-------------|
| Longitudinal | MI-200       | 0.90" (22,8 mm)  | 30089       |
| Longitudinal | MI-200       | 0.70" (17,7 mm)  | 30775       |
| Longitudinal | MI-200       | 1.45" (36,83 mm) | 30780       |
| Transverse   | MI-200       | 0.90" (22,8 mm)  | 30080       |
| Transverse   | MI-200       | 0.70" (17,7 mm)  | 30193       |
| Transverse   | MI-200       | 0.40" (10,16 mm) | 30194       |
| Longitudinal | MI-J00       | 0.90" (22,8 mm)  | 30191       |
| Transverse   | MI-J00       | 0.90" (22,8 mm)  | 30771       |
| Transverse   | MI-J00       | 0.40" (10,16 mm) | 30140       |



# Accessories

For Maxi, Mini, Micro and V•I Chip Products

## Mounting

### SurfMate™

#### Surface Mount Sockets

Packaged in five pair sets.

| Description | Pin Style | Part Number |
|-------------|-----------|-------------|
| Maxi        | S         | 16017       |
| Mini        | S         | 16021       |
| Micro       | S         | 16025       |



### InMate – Through hole Sockets

All sockets are supplied on InMate headers to assure proper alignment during installation. InMate through hole sockets are available for board thicknesses between 0.063" and 0.125". Min / Max 0.055" / 0.071".

InMates are packaged in five pair sets. See vicorpower.com for larger quantities.

| Board Thickness  | Mounting Style | Pin Style | Module Style | Part Number |
|------------------|----------------|-----------|--------------|-------------|
| 0.063" (1,60 mm) | Inboard        | S         | Maxi         | 18362       |
| 0.063" (1,60 mm) | Inboard        | S         | Mini         | 18366       |
| 0.063" (1,60 mm) | Inboard        | S         | Micro        | 18370       |
| 0.063" (1,60 mm) | Onboard        | N         | Maxi         | 18364       |
| 0.063" (1,60 mm) | Onboard        | N         | Mini         | 18368       |
| 0.063" (1,60 mm) | Onboard        | N         | Micro        | 18372       |
| 0.094" (2,38 mm) | Onboard        | N         | Maxi         | 18365       |
| 0.094" (2,38 mm) | Onboard        | N         | Mini         | 18369       |
| 0.094" (2,38 mm) | Onboard        | N         | Micro        | 18373       |
| 0.125" (3,17 mm) | Onboard        | N         | Maxi         | 21510       |
| 0.125" (3,17 mm) | Onboard        | N         | Mini         | 21511       |
| 0.125" (3,17 mm) | Onboard        | N         | Micro        | 21512       |



## Magnetics

### PR Bus Isolation Transformer

Developed for isolation of PR Bus signal when used with Maxi, Mini, Micro family parallel configurations. Consult Vicor for applications instruction.

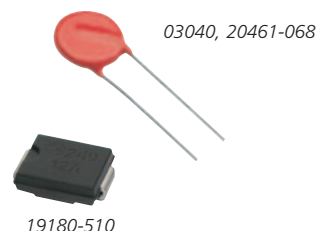
**Part Number**  
29768



## MOVs / Transorbs

### For M-FIAM Products

| Description          | Part Number |
|----------------------|-------------|
| MOV for M-FIAM3      | 03040       |
| MOV for M-FIAM5B     | 20461-068   |
| Transorb for M-FIAM7 | 19180-510   |
| Transorb for M-FIAM9 | 19180-510   |

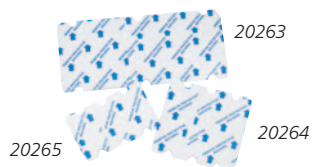


## Thermal Management

### ThermMate™ Thermal Pads

For use with Vicor modules, ThermMate thermal pads are a "dry" alternative to thermal compound and are pre-cut to the outline dimensions of the module baseplate.

| Thermal Pad | Thickness         | Part Number            |
|-------------|-------------------|------------------------|
| Maxi        | 0.007" (0,177 mm) | 20263<br>(10 pc. pkg.) |
| Mini        | 0.007" (0,177 mm) | 20264<br>(10 pc. pkg.) |
| Micro       | 0.007" (0,177 mm) | 20265<br>(10 pc. pkg.) |



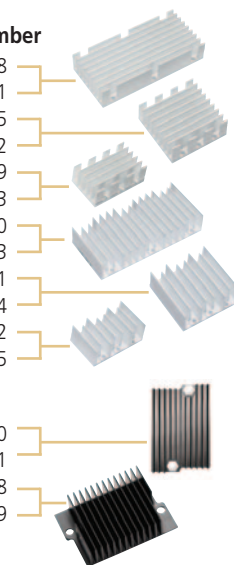
### Heat Sinks

| Fin Style    | Baseplate Style | Fin Height      | Module Style | Part Number |
|--------------|-----------------|-----------------|--------------|-------------|
| Longitudinal | Through Hole    | 0.4" (10,16 mm) | Maxi         | 30718       |
| Longitudinal | Through Hole    | 0.9" (22,8 mm)  | Maxi         | 30181       |
| Longitudinal | Through Hole    | 0.4" (10,16 mm) | Mini         | 30195       |
| Longitudinal | Through Hole    | 0.9" (22,8 mm)  | Mini         | 30182       |
| Longitudinal | Through Hole    | 0.4" (10,16 mm) | Micro        | 30719       |
| Longitudinal | Through Hole    | 0.9" (22,8 mm)  | Micro        | 30183       |
| Transverse   | Through Hole    | 0.4" (10,16 mm) | Maxi         | 30720       |
| Transverse   | Through Hole    | 0.9" (22,8 mm)  | Maxi         | 30723       |
| Transverse   | Through Hole    | 0.4" (10,16 mm) | Mini         | 30721       |
| Transverse   | Through Hole    | 0.9" (22,8 mm)  | Mini         | 30724       |
| Transverse   | Through Hole    | 0.4" (10,16 mm) | Micro        | 30722       |
| Transverse   | Through Hole    | 0.9" (22,8 mm)  | Micro        | 30725       |

### V•I Chip Heat Sinks

|              |              |                  |          |       |
|--------------|--------------|------------------|----------|-------|
| Longitudinal | Through Hole | 0.43" (10,92 mm) | V•I Chip | 32440 |
| Longitudinal | Through Hole | 0.25" (6,35 mm)  | V•I Chip | 32441 |
| Transverse   | Through Hole | 0.43" (10,92 mm) | V•I Chip | 32438 |
| Transverse   | Through Hole | 0.25" (6,35 mm)  | V•I Chip | 32439 |

| V•I Chip Push Pins  | Size             | Part Number |
|---------------------|------------------|-------------|
| 0.051" – 0.069" PCB | (1,29 – 1,75 mm) | 32434       |
| 0.070" – 0.104" PCB | (1,17 – 2,64 mm) | 32435       |
| 0.105" – 0.132" PCB | (2,66 – 3,35 mm) | 32436       |
| 0.133" – 0.156" PCB | (3,37 – 3,96 mm) | 32437       |



# Environmental Stress Screening

## Highlights

Every module undergoes extensive post-production environmental stress screening (ESS) before shipment to verify compliance with Vicor's high quality and performance standards and to eliminate early life failures. To ensure the most effective routine for precipitating module failures, Vicor continually evaluates its ESS program and makes appropriate changes as new data becomes available or as product improvements occur. After burn-in and temperature cycling, each module undergoes final electrical testing over the specified temperature range.

| MI-200 / MI-J00 Module Screening                                                                                                                                                |        | I-Grade                                                | M-Grade                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------|--------------------------------------------------------|
| Operating temperature                                                                                                                                                           | MI-200 | -40°C to +85°C                                         | -55°C to +85°C                                         |
|                                                                                                                                                                                 | MI-J00 | -40°C to +100°C                                        | -55°C to +100°C                                        |
| Storage temperature                                                                                                                                                             | MI-200 | -55°C to +100°C                                        | -65°C to +100°C                                        |
|                                                                                                                                                                                 | MI-J00 | -55°C to +125°C                                        | -65°C to +125°C                                        |
| Temperature cycling 17°C per minute<br>nominal rate of change, dwell time<br>until product stabilization                                                                        |        | 12 cycles<br>-65°C to +100°C                           | 12 cycles<br>-65°C to +100°C                           |
| Ambient test at 25°C                                                                                                                                                            |        | Yes                                                    | Yes                                                    |
| Power cycling burn-in power on 10 minute,<br>off 15 minute; module temperature cycling<br>35°C to 80°C; load up to 100 W; module<br>output continuously monitored while enabled |        | 12 hrs<br>29 cycles                                    | 96 hrs<br>213 cycles                                   |
| Functional and parametric ATE tests at<br>low / high temperature.                                                                                                               |        | -40°C / +85°C                                          | -55°C / +85°C                                          |
| Hi-Pot test                                                                                                                                                                     |        | Yes                                                    | Yes                                                    |
| Visual inspection before packing into<br>ESD containers                                                                                                                         |        | Yes                                                    | Yes                                                    |
| Test data                                                                                                                                                                       |        | <a href="http://vicorquality.com">vicorquality.com</a> | <a href="http://vicorquality.com">vicorquality.com</a> |

| Maxi, Mini, Micro Module Screening                                                                                                                                                    |  | H-Grade                                                | M-Grade                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------|--------------------------------------------------------|
| Operating temperature                                                                                                                                                                 |  | -40°C to +100°C                                        | -55°C to +100°C                                        |
| Storage temperature                                                                                                                                                                   |  | -55°C to +125°C                                        | -65°C to +125°C                                        |
| Temperature cycling 17°C per minute<br>nominal rate of change, dwell time<br>until product stabilization                                                                              |  | 12 cycles<br>-65°C to +100°C                           | 12 cycles<br>-65°C to +100°C                           |
| Ambient test at 25°C                                                                                                                                                                  |  | Yes                                                    | Yes                                                    |
| Power cycling burn-in<br>Power on 10 minutes, off 15 minutes;<br>Module temperature cycling 35°C to 80°C;<br>load up to 100 W; module output continuously<br>monitored while enabled. |  | 12 hrs<br>29 cycles                                    | 24 hrs<br>58 cycles                                    |
| Functional and parametric ATE tests at<br>low / high temperature.                                                                                                                     |  | -40°C to +100°C                                        | -55°C to +100°C                                        |
| Hi-Pot test                                                                                                                                                                           |  | Yes                                                    | Yes                                                    |
| Visual inspection before packing into<br>ESD containers                                                                                                                               |  | Yes                                                    | Yes                                                    |
| Test data                                                                                                                                                                             |  | <a href="http://vicorquality.com">vicorquality.com</a> | <a href="http://vicorquality.com">vicorquality.com</a> |



# MTBF



## Highlights

Because operating temperature is one of the most important factors in determining overall module reliability, it is imperative that the user's system design allow for efficient heat transfer from the baseplate to system ambient. Since temperature and failure rate are exponentially related, just a 10°C decrease in baseplate temperature can have a dramatic increase in MTBF. Due to patented zero-voltage / zero-current switching topology, Vicor converters are highly efficient compared to those with more traditional topologies. High efficiency translates into both smaller size and lower temperature rises. To minimize thermal impedance, all major power dissipating components are mounted directly to the baseplate.

Listed to the right are representative calculated MTBF values based on MIL-HDBK-217F. If you require information about a specific model, contact Vicor with the model number, expected baseplate temperature, and operating environment to obtain an individually prepared report.

| MI-200 / MI-J00 Modules |                 | MTBF in 1,000 Hours |       |        |       |
|-------------------------|-----------------|---------------------|-------|--------|-------|
| Model No.               | Baseplate Temp. | G.B.                | G.F.  | A.I.C. | N.S.  |
| MI-J71-MY               | 25°C            | 3,778               | 1,894 | 1,136  | 1,117 |
|                         | 50°C            | 2,311               | 1,155 | 693    | 682   |
|                         | 65°C            | 1,780               | 890   | 534    | 525   |
| MI-276-MW               | 25°C            | 3,755               | 1,878 | 1,127  | 1,108 |
|                         | 50°C            | 2,291               | 1,145 | 687    | 678   |
|                         | 65°C            | 1,765               | 882   | 529    | 521   |

| Maxi, Mini, Micro Modules |                 | MTBF in 1,000 Hours |       |        |       |
|---------------------------|-----------------|---------------------|-------|--------|-------|
| Model No.                 | Baseplate Temp. | G.B.                | G.F.  | A.I.C. | N.S.  |
| V24C3V3M75BL<br>(Micro)   | 25°C            | 6,235               | 3,117 | 1,870  | 1,839 |
|                           | 50°C            | 3,803               | 1,902 | 1,141  | 1,122 |
|                           | 65°C            | 2,930               | 1,465 | 879    | 864   |
| V24B5M200BL<br>(Mini)     | 25°C            | 4,205               | 2,102 | 1,201  | 1,240 |
|                           | 50°C            | 2,565               | 1,282 | 769    | 757   |
|                           | 65°C            | 1,976               | 988   | 593    | 583   |
| V24A12M400BL<br>(Maxi)    | 25°C            | 3,428               | 1,714 | 1,028  | 845   |
|                           | 50°C            | 2,091               | 1,045 | 627    | 617   |
|                           | 65°C            | 1,611               | 806   | 483    | 475   |

| 28 Vdc V•I Chip Modules      |                 | MTBF in 1,000 Hours |       |        |       |
|------------------------------|-----------------|---------------------|-------|--------|-------|
| Model No.                    | Baseplate Temp. | G.B.                | G.F.  | A.I.C. | N.S.  |
| MP028F036M12AL<br>(28 V PRM) | 25°C            | 3,173               | 1,588 | 952    | 936   |
|                              | 50°C            | 1,935               | 968   | 581    | 517   |
|                              | 65°C            | 1,491               | 746   | 447    | 440   |
| MV036F120M010<br>(12 V VTM)  | 25°C            | 4,797               | 2,399 | 1,439  | 1,415 |
|                              | 50°C            | 2,926               | 1,463 | 878    | 863   |
|                              | 65°C            | 2,255               | 1,127 | 676    | 665   |



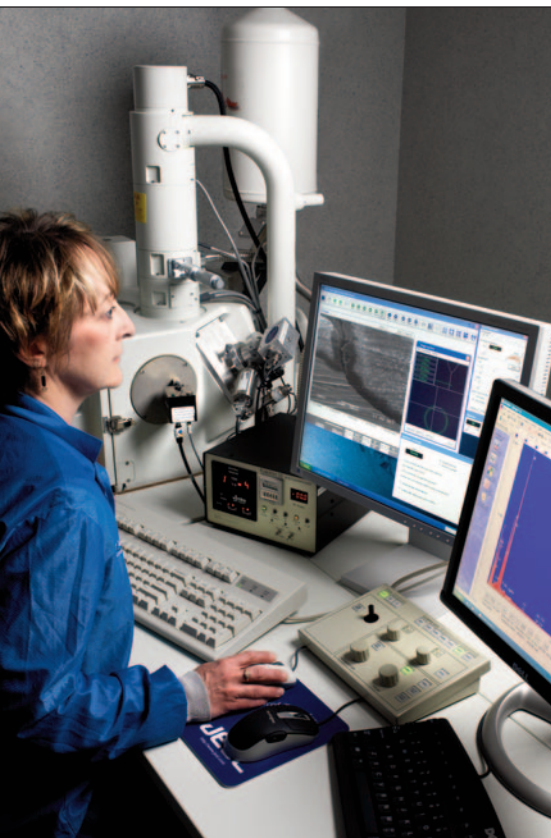
# Environmental Quality

## Highlights

As a manufacturer of reliable, high-density power components, Vicor's products are extremely rugged and suitable for the harshest environments, allowing designers to streamline development cycles and minimize time to market.

All Vicor products are manufactured in ISO 9001 registered facilities.

To verify the suitability of Vicor products for harsh application environments, modules have been subjected to the environmental testing requirements of MIL-STD-810, MIL-S-901, MIL-STD-202 and JEDEC. Many of these tests are performed at an independent laboratory. Additional environmental tests can be done upon individual customer request.

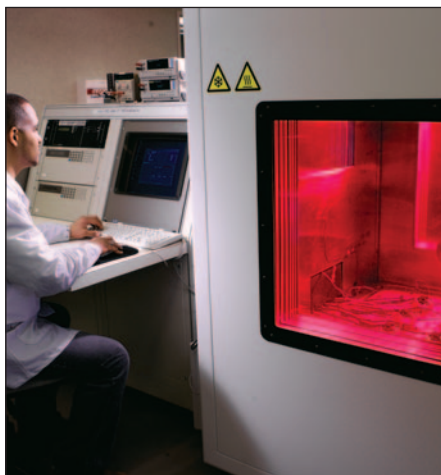
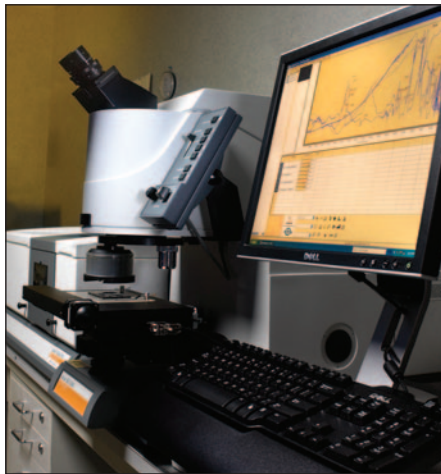


### MI-200 / MI-J00 Modules

|                      |                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Altitude             | MIL-STD-810D, Method 500.2, Procedure III, explosive decompression (40 K ft.).<br>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<br>MIL-STD-810D, Method 514.3 random: 10 – 300 Hz @ 0.02 g2/Hz, 2000 Hz @ 0.002 g2/Hz, 3.9 total G rms 3 hrs/axis<br>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<br>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<br>MIL-STD-202F, Method 213B, 18 pulses, 60 g, 9 msec<br>MIL-STD-202F, Method 213B, 75 g, 11 ms saw tooth shock<br>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                                                                                                                                                                                                                                                                                                                                             |

### Maxi, Mini, Micro Modules

|                      |                                                                                                                                                                                                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Altitude             | MIL-STD-810F, Method 500.4, Procedure I & II, 40,000 ft. and 70,000 ft. Operational                                                                                                                                                                                                                                          |
| Explosive Atmosphere | MIL-STD-810F, Method 511.4, Procedure I, Operational                                                                                                                                                                                                                                                                         |
| Vibration            | MIL-STD-810F, Method 514.5, Procedure I, category 14, sine and random vibration per Table 514.5C for helicopter AH-6J main rotor with overall level of 5.6 G rms for 4 hours per axis<br>MIL-STD-810F, Method 514.5C, general minimum integrity curve per Figure 514.5C-17 with overall level of 7.7 G rms for 1 hr per axis |
| Shock                | MIL-STD-810F, Method 516.5, Procedure I, functional shock, 40 g<br>MIL-S-901D, lightweight hammer shock, 3 impacts/axis, 1, 3, 5 ft.<br>MIL-STD-202F, Method 213B, 60 g, 9 ms half sine<br>MIL-STD-202F, Method 213B, 75 g, 11 ms saw tooth shock                                                                            |
| Acceleration         | MIL-STD-810F, Method 513.5, Procedure II, Table 513.5-II, Operational, 2 – 7 g, 6 directions                                                                                                                                                                                                                                 |
| Humidity             | MIL-STD-810F, Method 507.4                                                                                                                                                                                                                                                                                                   |
| Solder Test          | MIL-STD-202G, Method 208H, 8 hr aging                                                                                                                                                                                                                                                                                        |
| Fungus               | MIL-STD-810F, Method 508.5                                                                                                                                                                                                                                                                                                   |
| Salt-Fog             | MIL-STD-810F, Method 509.4                                                                                                                                                                                                                                                                                                   |



## 28 Vdc V+I Chip Modules

|                      |                                                                                                                                                                                                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Altitude             | <p>To observe low air pressure effects on either operational or non-operational design parameters.</p> <p><b>Standard:</b> MIL-STD-810D, Method 500.4, Procedure I &amp; II</p> <p><b>Environment:</b> 40,000 ft. and 70,000 ft. Operational</p>                                                                             |
| Explosive Atmosphere | <p>To determine the ability of equipment to operate in the presence of an explosive atmosphere.</p> <p><b>Standard:</b> MIL-STD-810F, Method 511.4, Procedure I, Operational</p> <p><b>Environment:</b> Fuel-Air Explosive Atmospheres</p>                                                                                   |
| Vibration            | <p>To evaluate the construction, materials and mounting of the device for ruggedness.</p> <p><b>Standard:</b> JESD22-B103B, Service Condition B</p> <p><b>Environment:</b> Vibration from 2 – 500 Hz, 30 minutes / axis, 3 axis, 90 minutes total</p>                                                                        |
| Shock                | <p>To determine the ability to withstand mechanical shocks from suddenly applied forces or an abrupt change in motion produced by handling, transportation or field operation.</p> <p><b>Standard:</b> JESD22-B104C, Service Condition C</p> <p><b>Environment:</b> 100 g, 2 ms shock, 10 shock / axis, 3 axis, 30 total</p> |
| Acceleration         | <p>To determine the ability of parts to withstand constant acceleration, as an indicator of the mechanical strength limits.</p> <p><b>Standard:</b> MIL-STD-810F, Method 513.5, Procedure II, Operational</p> <p><b>Environment:</b> Acceleration step 2 g, 6 direction</p>                                                  |
| Humidity             | <p>A humidity test simulates the moisture-laden air found in tropical regions.</p> <p><b>Standard:</b> MIL-STD-810F, Method 507.4</p> <p><b>Environment:</b> 240 hours, 95% RH</p>                                                                                                                                           |
| Solder Test          | <p>To evaluate the solderability of terminations that are normally joined by a soldering operation.</p> <p><b>Standard:</b> MIL-STD-202G, Method 208H</p> <p><b>Environment:</b> Continuous solder coating for a minimum of 95% surface area</p>                                                                             |
| Fungus               | <p>To determine if a material(s) will support the growth of specific fungi.</p> <p><b>Standard:</b> MIL-STD-810E, Method 508.4, Section II</p> <p><b>Environment:</b> Severe climate conditions</p>                                                                                                                          |
| Salt-Fog             | <p>To determine the resistance of the equipment to the effects of a salt atmosphere, primarily corrosion.</p> <p><b>Standard:</b> MIL-STD-810F, Method 509.4</p> <p><b>Environment:</b> Salt-fog harsh environment</p>                                                                                                       |

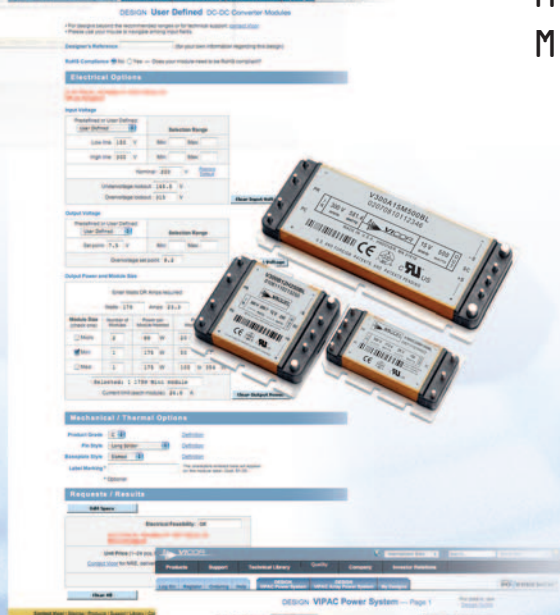
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Vicor designs, manufactures, and markets modular, high density power components and complete configurable power systems used primarily by original equipment manufacturers (OEMs) in the communications, data processing, industrial control, test equipment, medical, and defense electronics markets.

## World Class Manufacturing

The standardization in design for all Vicor products enables the company to use high speed automated mass production to dramatically reduce the time and cost of delivering products that conform to specific customer requirements. Flexible, highly computer-integrated processes allow Vicor to produce thousands of products a day in thousands of variations. The repeatable precision of automated manufacture ensures the consistent high quality of all our products at the most competitive prices and in the shortest time possible. Vicor's operations, at its headquarters in Andover, Massachusetts, are registered to the ISO 9001 international quality standard.



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- Support user needs through visits to customer facilities

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- Provide product price and delivery information
- Help select the most appropriate product for your application
- Arrange a visit to your site by a Vicor applications engineer or sales representative
- Fulfill literature requests
- Process purchase order requirements
- Get order status information



## USA

### Vicor Corporation

25 Frontage Road  
Andover, MA 01810-5413  
vicorpower.com

#### General Information

P: 1 978 470 2900  
F: 1 978 475 6715

#### Technical Support

P: 1 800 927 9474  
F: 1 978 749 3341  
email: apps@vicorpower.com

#### Sales Support

U.S. and Canada:  
800 735 6200  
F: 1 978 475 6715  
email: vicorexp@vicorpower.com

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Lombard, IL  
P: 1 630 769 8780  
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Sunnyvale, CA  
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Argentina: 800 555 4288  
Brazil: 0800 890 0288  
Mexico: 011 52 333 647 7881

## Europe

### Vicor France

P: +33 1 34 52 18 30  
France: 0800 419 419  
Benlux: 00 800 419 419 20  
F: +33 1 34 52 28 30  
email: vicorfr@vicorpower.com  
vicoreurope.com

### Vicor Germany

Tel: +49 89 962 439 0  
Germany: 0800 018 29 18  
Denmark: 00800 8426 7000  
Austria: 0800 20 37 27  
F: +49 89 962 439 39  
email: vicorde@vicorpower.com  
vicoreurope.com

### Vicor Italy

P: +39 02 22 47 23 26  
800 899 677  
F: +39 02 22 47 31 66  
email: vicorit@vicorpower.com  
vicoreurope.com

### Vicor U.K.

P: +44 1276 678222  
UK: 0800 980 8427  
Sweden: 020 794 143  
F: +44 1276 681269  
email: vicoruk@vicorpower.com  
vicoreurope.com

## Asia-Pacific

### Vicor Japan Co., Ltd.

P: +81 3 5487 5407  
F: +81 3 5487 3885  
vicr.co.jp

### Vicor Hong Kong

P: +852 2956 1782  
F: +852 2956 0782  
vicr.com.cn



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