



Data Sheet

MI-200

DC-DC Converters

50 to 100 Watts



Features

- Inputs:
 - 28 Vdc per MIL-STD-704D/E/F
 - 155 Vdc per MIL-STD-1399A
 - 270 Vdc per MIL-STD-704D/E/F
- Single output: 2 – 48 Vdc
- Up to 23 W/in³
- MIL-STD-810 environments
- Up to 90% efficiency
- Remote sense
- Current limit
- OVP and thermal shutdown
- 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)

Product Highlights

The MI-200 family of DC-DC converters is designed for applications utilizing distributed power architectures. Based on Vicor's VI-200 / VI-J00 family of zero-current switching, component level DC-DC converters, the MI-200 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-Series 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.

Packaging Options

Standard: Slotted baseplate

SlimMod: Flangeless baseplate, option suffix: - S
Example: MI - 2XX - XX - S

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

Examples:

- MI - 2XX - XX -F1, 0.25" fins, longitudinal
- MI - 2XX - XX -F2, 0.50" fins, longitudinal
- MI - 2XX - XX -F3, 0.25" fins, transverse
- MI - 2XX - XX -F4, 0.50" fins, transverse

Converter Selection Chart

MI-2

Semi-custom driver and booster modules available, consult factory.

Input Voltage

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

^[a] Transient voltage for 1 second

^[b] 16 V operation at 75% load

^[c] MI-26Z-xV, MI-26Y-xV rated at 75% load from 125 – 150 VIN

Output Voltage

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

^[d] 75 W max power for 28 V input

Product Grade Temperature (°C)

Operating	Storage
I = -40 to +85	I = -55 to +100
M = -55 to +85	M = -65 to +100
Overtemperature shutdown 95°C typical (recycle power to restart)	

Output Power/Current Vout

≥ 5 V	< 5 V
Y = 50 W	Y = 10 A
X = 75 W	X = 15 A
W = 100 W	W = 20 A
V = —	V = 30 A
For additional output power, 100 W and 75 W booster modules available Change (MI-2xx-xx) to (MI-Bxx-xx)	

CONVERTER SPECIFICATIONS

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

■ INPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Units	Test Conditions
Inrush charge		120×10^{-6}	200×10^{-6}	Coulombs	Nominal line
Input reflected ripple current – pp		10%		I_{IN}	Nominal line, full load
Input ripple rejection		$30 + 20 \log\left(\frac{V_{IN}}{V_{OUT}}\right)$		dB	120 Hz, nominal line
		$20 + 20 \log\left(\frac{V_{IN}}{V_{OUT}}\right)$		dB	2400 Hz, nominal line
No load power dissipation		1.35	2	Watts	

■ OUTPUT CHARACTERISTICS

Parameter	Min	Typ	Max	Units	Test Conditions
Setpoint accuracy		0.5%	1%	V_{NOM}	
Load/line regulation		0.05%	0.2%	V_{NOM}	LL to HL, 10% to Full Load
		0.2%	0.5%	V_{NOM}	LL to HL, No Load to 10%
Output temperature drift		0.01	0.02	% / $^{\circ}\text{C}$	Over rated temperature
Long term drift		0.02		%/1K hours	
Output ripple – pp		100	150	mV	Whichever is greater 20 MHz bandwidth
		1.0%	1.5%	V_{NOM}	
Trim range ^[a]	50%		110%	V_{NOM}	
Total remote sense compensation	0.5			Volts	
OVP set point ^[b]	115%	125%	135%	V_{NOM}	latching
Current limit	105%		125%	I_{NOM}	Automatic restart
Short circuit current ^[c]	20%		130%	I_{NOM}	

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

3.3 V output trim range 2.20 to 3.63 V

[b] No over temperature or voltage protection in booster modules

[c] Output voltages of 5 V or less incorporate foldback current limiting; outputs of 10 V and above provide constant current limiting.

■ CONTROL PIN SPECIFICATIONS

Parameter	Min	Typ	Max	Units	Test Conditions
Gate out impedance		50		Ohms	
Gate in impedance		1000		Ohms	
Gate in open circuit voltage		6		Volts	Use open collector
Gate in low threshold	0.65			Volts	
Gate in low current			6	mA	
Power sharing accuracy	0.95		1.05		

CONVERTER SPECIFICATIONS (cont.)

■ DIELECTRIC WITHSTAND CHARACTERISTICS

Parameter	Min	Typ	Max	Units	Test Conditions
Input to output	3,000			V _{RMS}	Baseplate earthed
Output to baseplate	500			V _{RMS}	
Input to baseplate	1,500			V _{RMS}	
Input to output capacitance		50	75	pF	

■ THERMAL CHARACTERISTICS

Parameter	Min	Typ	Max	Units	Test Conditions
Efficiency		80 – 90%			
Baseplate to sink thermal impedance		0.07		°C/Watt	With thermal pads
Thermal shutdown ^[d] (Drivers only)	90	95	105	°C	Cool and recycle power to restart

^[d] No over temperature or voltage protection in booster modules

■ ENVIRONMENTAL – MIL-STD-810D

Parameter	Min	Typ	Max	Units	Test Conditions
Altitude - method 500.2	70,000			feet	Procedure II
Humidity - method 507.2	86/240			%/hours	Procedure I, cycle 1
Acceleration - method 513.3	9			g	Procedure II
Vibration - method 514.3	20			g	Procedure I, category 6
Shock - method 516.3	40			g	Procedure I

■ RELIABILITY - MIL-HDBK-217F (MI-22L-MW)

Parameter	Min	Typ	Max	Units	Test Conditions
25°C Ground Benign: G.B.		3,552		1,000 hours	
50°C Naval Sheltered: N.S.		639		1,000 hours	
65°C Airborne Inhabited Cargo: A.I.C.		501		1,000 hours	

■ MECHANICAL SPECIFICATIONS

Parameter	Min	Typ	Max	Units	Test Conditions
Weight	7.2 205	7.3 208	7.4 210	Ounces Grams	

CONVERTER SPECIFICATIONS (cont.)

■ PRODUCT GRADE SPECIFICATIONS

Parameter	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 hours, 29 cycles	96 hours, 213 cycles
Temperature cycled with power off 17°C per minute rate of change	12 cycles -65°C to +100°C	12 cycles -65°C to +100°C
Test data supplied at these temperatures ^[e]	-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

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

■ ENVIRONMENTAL QUALIFICATIONS

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

The drawing shows the MI-200 component with the following dimensions and features:

- Top View Dimensions:**
 - Overall width: 4.60 (116.8)
 - Pin 1 to Pin 4 spacing: 1.80 (45.7)
 - Pin 4 to Pin 9 spacing: 3.60 (91.4)
 - Pin 1 to Pin 9 spacing: 4.60 (116.8)
 - Pin 1 to Pin 2 spacing: 0.30 ± 0.015 (7.6 ± 0.38)
 - Pin 2 to Pin 3 spacing: 0.50 (12.7)
 - Pin 3 to Pin 4 spacing: 0.50 (12.7)
 - Pin 4 to Pin 5 spacing: 0.50 (12.7)
 - Pin 5 to Pin 6 spacing: 0.50 (12.7)
 - Pin 6 to Pin 7 spacing: 0.50 (12.7)
 - Pin 7 to Pin 8 spacing: 0.50 (12.7)
 - Pin 8 to Pin 9 spacing: 0.50 (12.7)
 - Pin 1 to Pin 9 spacing: 4.60 (116.8)
 - Pin 1 to Pin 2 spacing: 0.30 ± 0.015 (7.6 ± 0.38)
 - Pin 2 to Pin 3 spacing: 0.50 (12.7)
 - Pin 3 to Pin 4 spacing: 0.50 (12.7)
 - Pin 4 to Pin 5 spacing: 0.50 (12.7)
 - Pin 5 to Pin 6 spacing: 0.50 (12.7)
 - Pin 6 to Pin 7 spacing: 0.50 (12.7)
 - Pin 7 to Pin 8 spacing: 0.50 (12.7)
 - Pin 8 to Pin 9 spacing: 0.50 (12.7)
- Side View Dimensions:**
 - Overall height: 2.10 (53.3)
 - Pin 1 to Pin 9 spacing: 4.60 (116.8)
 - Pin 1 to Pin 2 spacing: 0.30 ± 0.015 (7.6 ± 0.38)
 - Pin 2 to Pin 3 spacing: 0.50 (12.7)
 - Pin 3 to Pin 4 spacing: 0.50 (12.7)
 - Pin 4 to Pin 5 spacing: 0.50 (12.7)
 - Pin 5 to Pin 6 spacing: 0.50 (12.7)
 - Pin 6 to Pin 7 spacing: 0.50 (12.7)
 - Pin 7 to Pin 8 spacing: 0.50 (12.7)
 - Pin 8 to Pin 9 spacing: 0.50 (12.7)
- Detail View Dimensions:**
 - Pin 1 to Pin 9 spacing: 4.60 (116.8)
 - Pin 1 to Pin 2 spacing: 0.30 ± 0.015 (7.6 ± 0.38)
 - Pin 2 to Pin 3 spacing: 0.50 (12.7)
 - Pin 3 to Pin 4 spacing: 0.50 (12.7)
 - Pin 4 to Pin 5 spacing: 0.50 (12.7)
 - Pin 5 to Pin 6 spacing: 0.50 (12.7)
 - Pin 6 to Pin 7 spacing: 0.50 (12.7)
 - Pin 7 to Pin 8 spacing: 0.50 (12.7)
 - Pin 8 to Pin 9 spacing: 0.50 (12.7)

Pinout Table:

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

* Do not connect on booster modules

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