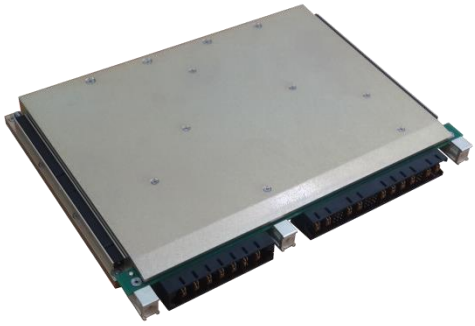
M4069 SERIES

6U VITA 62 COMPLIANT HIGH DENSITY, FIVE OUTPUTS, SINGLE-PHASE AC / DC CONVERTERS

Up to 1kW



Applications

Military (Airborne, ground-fix, shipboard), Ruggedized, Telecom, Industrial

Special Features

- VITA 62 / 6U / 1.0 Pitch
- High efficiency
- Wide input range
- Input / Output isolation
- Power Factor Correction
- Remote sense
- Fixed switching frequency
- EMI filters included
- I^2C communication
- Remote Inhibit (Off/On)
- Remote Enable (On/Off)
- Indefinite short circuit protection with auto-recovery
- Over-voltage shutdown with auto-recovery
- Over temperature shutdown with auto-recovery

Electrical Specifications

AC Input

85 to 265 V_{AC}
50/60/400
Single-Phase

DC Outputs (standard version)

PO1/PO2	12 V_{DC} / 60 A	Sense
PO3	5 V_{DC} / 35 A	Sense
3.3V_Aux	3.3 V_{DC} / 35 A	Sense
+12V_Aux	+12 V_{DC} / 1 A	
-12V_Aux	-12 V_{DC} / 1 A	

Total power output: 1030 W

Isolation

Input to Output: 500 V_{DC}
Input to Case: 500 V_{DC}
Output to Case: 200 V_{DC}

Output Voltage Regulation

±1% or better
(no load to full load, low line to high line, –55 °C to +70 °C).

Power Factor

≥ 97% (115 V_{AC}, 60 Hz, full load)

EMC

Designed to meet MIL-STD-461F (with 5 µH LISNs) CE101, CE102, CS101, CS114, CS115, CS116

Ripple and Noise

Less than 50 mV_{p-p}, typical, without external capacitance. When connected to system capacitance ripple drops significantly.

Transient Over-and-under-shoot

Output resistance at load change of 50%-100% is 30-120 mΩ (adding output capacitance lowers the output resistance at load). Output back to steady stated within 300 to 500 µs.

Efficiency

Typical 85% (Nominal line, nominal load, room temperature)

Protections (Thresholds and protections can be modified / removed – please consult factory).

Input

- **Inrush Current Limiter**: peak value of 5 x I_{IN} for less than 1 ms.
- **Under Voltage Lock-Out** Unit protects itself (no damage) below 72 V_{AC}.
- **Catastrophic Failure Protection** Fuses are available to protect from catastrophic failure. The fuses are rated not to engage due to any normal type operation.

Output

- **Active Over Voltage Protection** Set to engage at 120% ± 10% of nominal voltage.
- **Passive Over Voltage Protection** Set to engage at 135% ± 15% of nominal voltage.
- **Overload / Short Circuit Protection** Continuous protection (5-35% above maximum current) for unlimited time (Hiccup).

General

- **Over temperature protection:** Shutdown at temperature of +105 °C ± 10 °C. Automatic recovery when temperature drops below +95 °C ± 10 °C.

Environmental Conditions

Designed to meet MIL-STD-810F

Temperature
Operating: –55 °C to +70 °C (at plug-in card wedgelock, IAW VITA 62)
Storage: –55 °C to +125 °C

Humidity
Method 507.4
Up to 95%.

Altitude
Method 500.4
Procedures I & II, 40,000 ft. and 70,000 ft. Operational

Vibration and
Method 514.5
Procedure I
Category 24 - General minimum integrity exposure IAW figure 514.5C-17, 1 hour per axis.

Salt Fog
Method 509.4

Shock
Method 516.6
20 g, 11 ms terminal peak saw-tooth.

Reliability

100’000 hours, calculated IAW MIL-STD-217F Notice 2 at +40 °C at card wedgelock, Ground Fix conditions.

Detailed Information

1. M4069 Input Voltage Operation

The M4069 operates from a single phase universal AC input ($85V_{AC}$-$265V_{AC}$/50Hz-400Hz).

1.1 Low Line Turn-on and Turn-off Limits

To avoid Turn-on and Turn-off glitch the unit has about $8V_{AC}$ Hysteresis. The Turn-on threshold is over 80V and turn-off under 72V.

Those limits can be adjusted, contact Factory for more information.

2. Outputs regulation The M4069 contains accurate internal sense lines to keep output voltage at less than 1% regulation for all Line/ Load and temperature range. For parallel configuration output regulation please contact Factory.

Output	**12V**	**3.3V**	**5V**	**+12VAux**	**-12VAux**
Voltage Range	**12.12 ÷ 11.88**	**3.33 ÷ 3.27**	**5.05 ÷ 4.95**	**12.12 ÷ 11.88**	**(-)11.88 ÷ (-)12.12**

3. Sense Lines

Sense Lines are provided for VS1, VS2 and VS3 output to compensate line voltage drop. Sense Lines proper connection is shown in Figure 1. Each VSx output has its own Sense Lines.

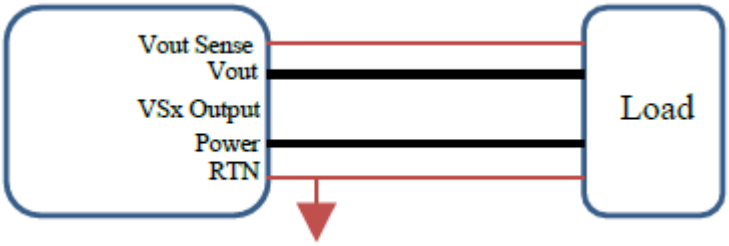


Figure 1: M4069 Sense line connection

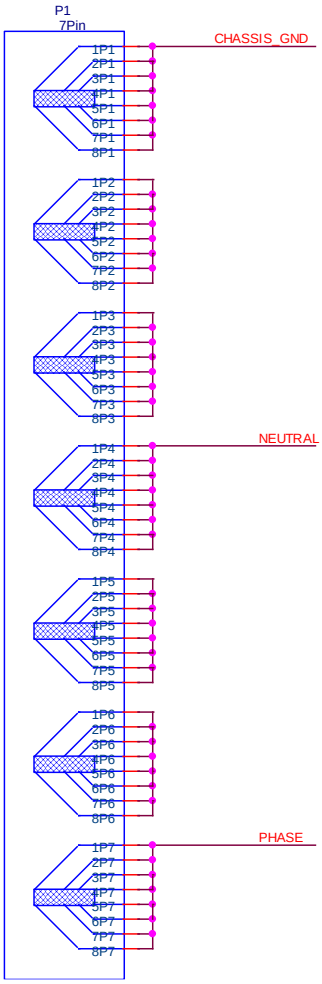
4. Output Power

The basic configuration of the M4069 supports up to 1030W with the standard configuration of power per output. Configuration is shown in table 4. Contact Factory for more details.

Total Power Output	12V	3.3V	5V	+12VAux	-12VAux
1030W	**60A**	**35A**	**35A**	**1A**	**1A**

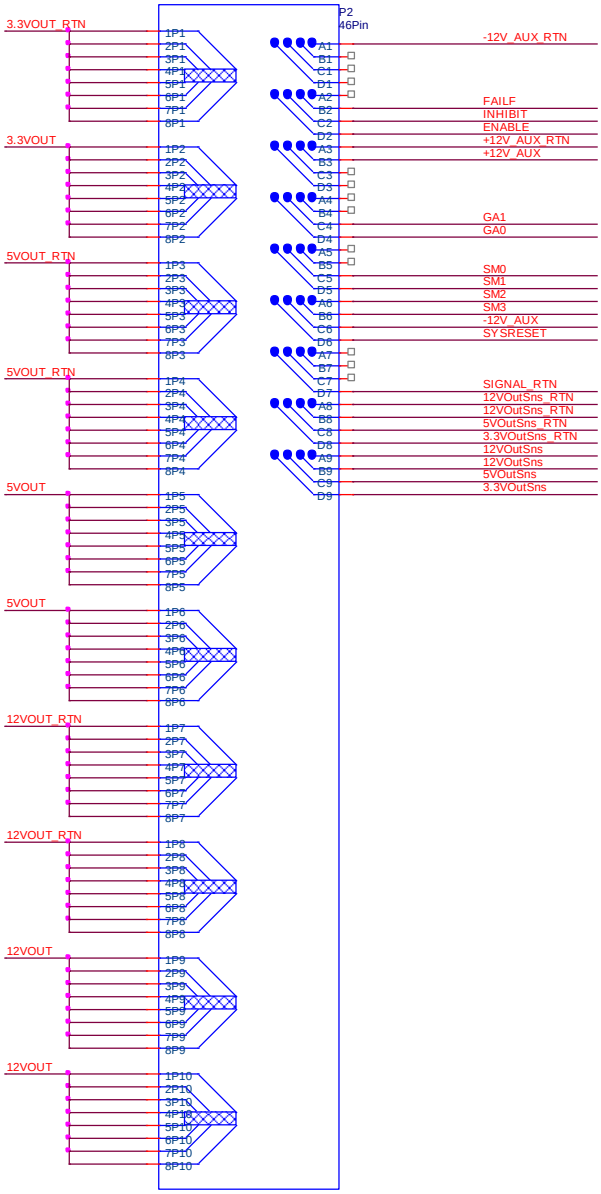
Pin Assignment

Connector P0:



Pin Number	Signal Name
P7	PHASE
P6	N/C
P5	N/C
P4	NEUTRAL
P3	N/C
P2	N/C
P1	CHASSIS_GND

Connector P1:



Pin Number	Signal Name
P10	12V
P9	12V
A9	12V_SENSE
B9	12V_SENSE
C9	5V_SENSE
D9	3.3V_SENSE
A8	12V_SENSE_RTN
B8	12V_SENSE_RTN
C8	5V_SENSE_RTN
D8	3.3V_SENSE_RTN
A7	NC
B7	NC
C7	NC
D7	SIGNAL_RTN
P8	12V_RTN
P7	12V_RTN
A6	SM2 (SCL)
B6	SM3 (SDA)
C6	-12V_AUX
D6	SYSRESET
A5	NC
B5	NC
C5	SM0 (SCL)
D5	SM1 (SDA)
A4	NC
B4	NC
C4	GA1
D4	GA0
A3	+12V_AUX_RTN
B3	+12V_AUX
C3	NC
D3	NC
P6	5V
P5	5V
P4	5V_RTN
P3	5V_RTN
A2	NC4
B2	FAIL
C2	INHIBIT
D2	ENABLE
A1	-12V_AUX_RTN
B1	NC
C1	NC
D1	NC
P2	3.3V
P1	3.3V_RTN

Functions and Signals (According to VITA 62 standard)

Signal No.	Signal Name	Type	Description
1	FAIL*	Output	Indicates to other modules in the system that a failure has occurred in one of the outputs.
2	INHIBIT*	Input	Controls power supply outputs. Please refer to Table 1 for combination of **INHIBIT** & **ENABLE**.
3	ENABLE*	Input	Controls the input power to the power supply. This signal in conjunction with **INHIBIT** turns the output power ON and OFF. Please refer to Table 1 for combination of **INHIBIT** & **ENABLE**.
4	SYSRESET*	Input	Indicates to other modules in the system that all outputs are within their working level.
5	GA0*, GA1*	Input	Used for geographical addressing. GA1 is the most significant bit and GA0 is the least significant bit.
6	SCL, SDA	Bidirectional	I^2C bus Clock and Data respectively. Through this bus the voltage and temperature readouts can be shared.
7	VOUT SENSE	Input	The SENSE is used to achieve accurate load regulations at load terminals (this is done by connecting the pins directly to the load's terminals). The use of remote sense has a limit of voltage dropout between converter's output and load terminals of 2-10% of voltage output.

Control Inputs		Power Outputs	
ENABLE*	**INHIBIT***	**3.3V_AUX**	**12V, 3.3V, 5V +12V_AUX, and -12V_AUX**
High	High	OFF	OFF
High	Low	OFF	OFF
Low	High	ON	ON
Low	Low	ON	OFF

Communication Protocol

Unit communication protocol is I^2C.

Electrical Parameters

VCC:	3.3VDC
Pull-up:	5kOhm
Input Capacitance:	56pF

Slave Device Addressing

- Baud rate: 200kHz maximum
- 7 bit protocol
- Support slot addressing per VITA 62

Voltage & Temperature Telemetries

The address for getting the voltage & temperature telemetry is determined by GAx signals per VITA 62 and described in the following table:

`	MSB							LSB
Slot Number	A6	A5	A4	A3	A2	A1/*GA1	A0/*GA0	R/W
Slot0	1	0	0	1	0	0	0	
Slot1	1	0	0	1	0	0	1	
Slot2	1	0	0	1	0	1	0	
Slot3	1	0	0	1	0	1	1	

The read command for the telemetry is:

Description	7/MSB	6	5	4	3	2	1	0/LSB
Temperature	1	0	0	0	0	0	0	0
12V/30A	1	1	0	0	0	0	0	0
3.3V/15A	1	0	0	1	0	0	0	0
5V/35A	1	1	0	1	0	0	0	0
12V/1A	1	0	1	0	0	0	0	0
-12V/1A	1	1	1	0	0	0	0	0

The answer is always 1 byte long with the following conversion:

- **Temperature**:

$$T = \left(Byte * \frac{33}{6067.2} + 1.2\right) * \frac{10^6}{5620} - 273\ [C^\circ]$$

- **12V/30A**:

$$V = Byte * \frac{3.3}{256 * 0.21}$$

- **3.3V/15A**:

$$V = Byte * \frac{3.3}{256 * 0.756}$$

- **5V/35A**:

$$V = Byte * \frac{3.3}{256 * 0.49}$$

- **12V/1A**:

$$V = Byte * \frac{3.3}{256 * 0.21}$$

- **-12V/1A**:

$$V = Byte * \frac{3.3}{256 * 0.21}$$

Reading Telemetries

The default on/off status of the outputs is on. The address for the output on/off controller is:

	MSB							LSB
Slot Number	A6	A5	A4	A3	A2	A1/*GA1	A0/*GA0	R/W
Slot0	1	1	1	0	1	0	0	
Slot1	1	1	1	0	1	0	1	
Slot2	1	1	1	0	1	1	0	
Slot3	1	1	1	0	1	1	1	

Before sending any command to turn on/off any output, a one-time command sequence, containing 2 commands, needs to be sent to enable the on/off commands. The one-time command sequence which must be sent is:

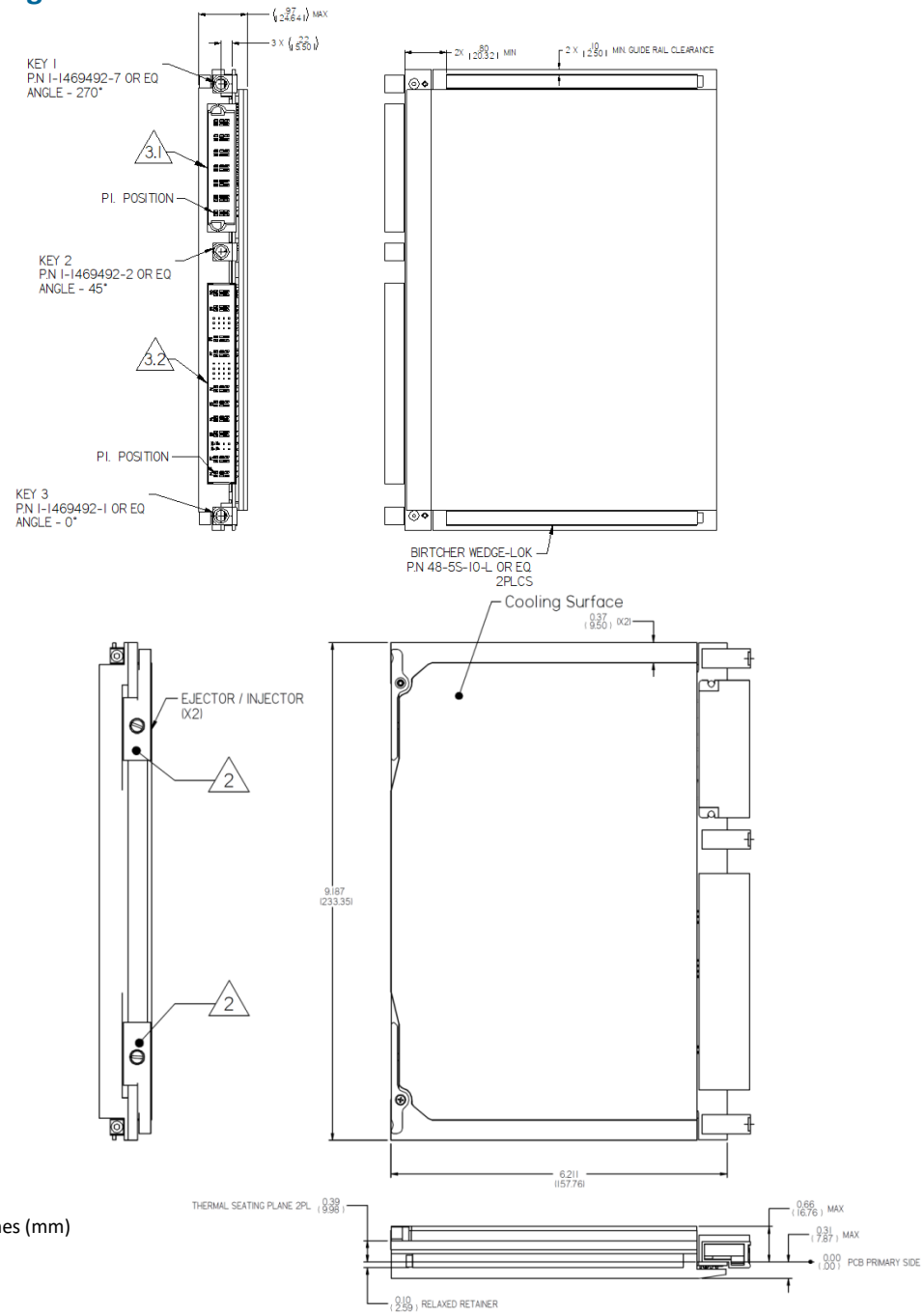
1) **Command 1**: sending a **WRITE** command to the on/off controller with the command byte 0x02 and the information byte of 0x00.
2) **Command 2**: sending a **WRITE** command to the on/off controller with the command byte 0x06 and the information byte of 0x00.

To change the state of the outputs, a write command to the on/off controller with the command byte 0x02 needs to be sent. The information byte has the following order:

Description	7/MSB	6	5	4	3	2	1	0/LSB
Output Control	X	X	-12V_AUX	+12V_AUX	5V	5V & +-12V	3.3V	12V

1) **0/LSB**: This bit controls the on/off status of the 12V output. A value of '0' causes the output to go ON and a value of '1' causes the output to go OFF.
2) **Bit 1**: This bit controls the on/off status of the 3.3V output. A value of '0' causes the output to go ON and a value of '1' causes the output to go OFF.
3) **Bit 2**: This bit controls the on/off status of the 5V and the ±12V_AUX outputs. A value of '0' causes the outputs to go ON and a value of '1' causes the outputs to go OFF.
4) **Bit 3**: This bit controls the on/off status of the 5V output. A value of '0' causes the output to go ON and a value of '1' causes the output to go OFF.
5) **Bit 4**: This bit controls the on/off status of the +12V_AUX output. A value of '0' causes the output to go ON and a value of '1' causes the output to go OFF.
6) **Bit 5**: This bit controls the on/off status of the -12V_AUX output. A value of '0' causes the output to go ON and a value of '1' causes the output to go OFF.
7) **Bit 6 & Bit 7/MSB**: these bits are don't care.

Outline Drawing



Notes

1. Dimensions are in inches (mm)
2. Tolerance is:
   .XX ±0.01 in
   .XXX ±0.005 in
3. Weight: 4lbs max

Note: Specifications are subject to change without prior notice by the manufacturer.