SynQor®

MultiQor™ Plate
MTQ-Px-DC28

Military COTS

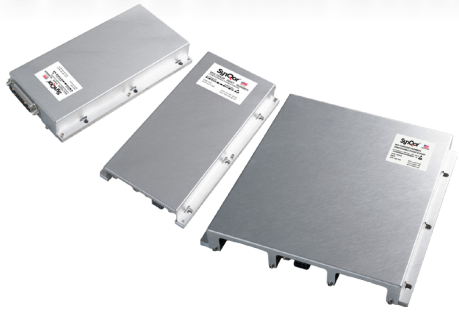
Configurable Multi-Output DC-DC Power Supply

1 Output	16V to 40V	Up to 1500W	90%-95%
Standard Configuration	Continuous Operating Input	Total Output Power	Typical Efficiency

Operation: -55°C to 100°C (at cold plate)

The MultiQor Plate format of military-grade DC-DC power supplies provides one customer defined output voltage that is isolated from the input and the cold plate. Using SynQor's Mil-COTS line of high efficiency, high reliability, fixed switching frequency DC-DC converters, this supply is designed to comply with MIL-STD-704 for a 28Vin system when continuous full system power operation is only needed down to 16Vin. The complete assembly is designed to withstand the harsh environments of the Military and Aerospace industries and is compliant with MIL-STD-810G requirements.

MultiQor™ Plate
DC-DC Power Supply



Made in USA

Operational Features
- Designed to comply with MIL-STD-704 (A - F) Steady State
- High efficiency converters (90%-95%)
- Fixed frequency switching provides predictable EMI
- No minimum load requirement
- Soft start of all outputs

Control Features
- System On/Off control (isolated)
- Output voltage Inhibit control (isolated)
- Remote Sense for the output voltage
- Output voltage trim available
- Input Good signal (isolated)

Optional Features
- Remote Sense Jumpers
- Output current sharing

Mechanical Features
- Multiple physical formats
  - P1: 3.80" x 6.90" x 0.97" (Single output)
  - P2: 3.80" x 6.90" x 0.97" (Single output)
  - P3: 6.70" x 6.93" x 0.97" (Single output)
- Refer to mechanical diagrams for weight
- Cold plate with mounting holes for connection to heat removal system
- Cover

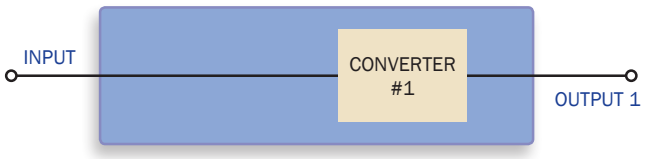
Safety Features
- 1500Vdc @ 30 MΩ input-to-output isolation
- Internal input fuse

Protection Features
- Input under-voltage lockout
- Output current limit and short circuit protection
- Output over-voltage protection
- Thermal shutdown
- Automatic restart for all of the above
- Active back bias current limit

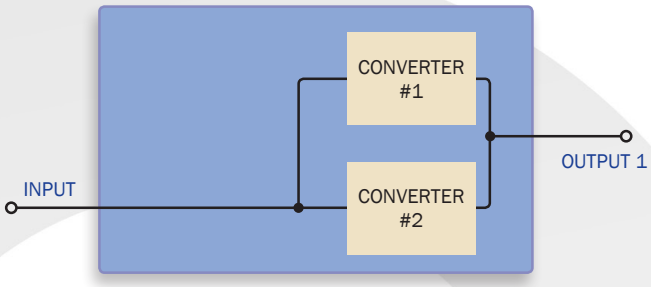
Contents

Configurations

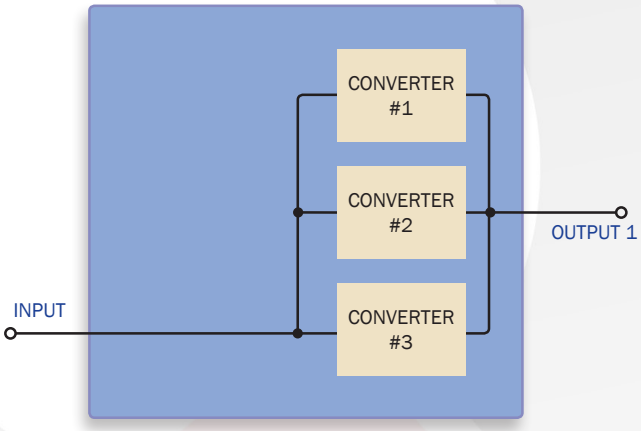
P1 **SINGLE OUTPUT**



P2 **DUAL OUTPUT**



P3 **TRIPLE OUTPUT**



P1 DC-DC CONVERTER OPTIONS:

- Any Half-Brick converter from the MCOTS-28 Family
- Size: 3.80” x 6.90” x 0.97”
- Typical Weight: 1.2 LBS (1 HB)
- Mechanical Drawing P1

P2 DC-DC CONVERTER OPTIONS:

- Any Half-Brick converters from the MCOTS-28 Family
- Size: 3.80” x 6.90” x 0.97”
- Typical Weight: 1.3 LBS (2HB)
- Mechanical Drawing P2 - 2 Output Terminal
  (For Total Iout ≤ 60 A)
- Mechanical Drawing P2 - 4 Output Terminal
  (For Total Iout > 60 A)

P3 DC-DC CONVERTER OPTIONS:

- Any Half-Brick converters from the MCOTS-28 Family
- Size: 6.70” x 6.93” x 0.97”
- Typical Weight: 2.5 LBS (3 HB)
- Mechanical Drawing P3

Converters Listed by Vout

Available MCOTS-28 DC-DC Converters

Half-Brick Zeta Series (MCOTS-C-28-xx-HZ)											
Vout	**1.8**	**3.3**	**5.0***	**7.0**	**12.0**	**15.0**	**24.0**	**28.0**	**40.0**	**48.0**	**50.0**
Power†			300W		504W	510W	504W	504W			500W
Output Current‡			60A		42A	34A	21A	18A			10A
Efficiency @ Full Load (28Vin)			92%		94%	94%	93%	93%			94%
Ripple & Noise (28Vin, pk to pk)			135mV		100mV	100mV	250mV	100mV			250mV
Output OVP Setpoint (28Vin)			6.2V		14.8V	18.5V	29.5V	36.4V			—
No Load Input Current (28Vin)			290mA		310mA	340mA	300mA	340mA			340mA

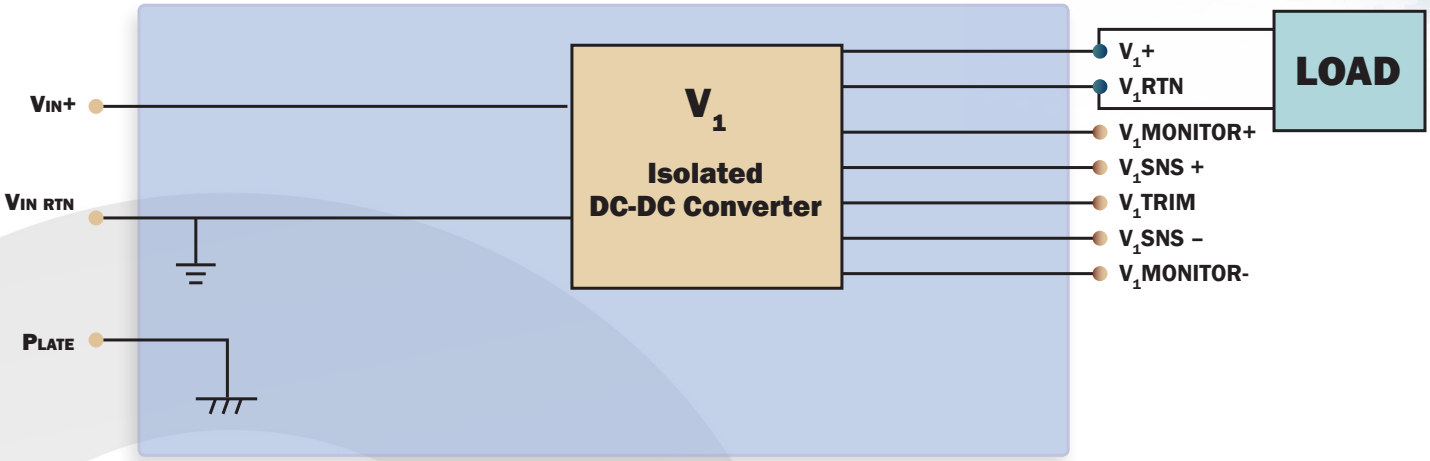
Full system power operation at –55 °C to +100 °C, designed for Mil-COTS applications.

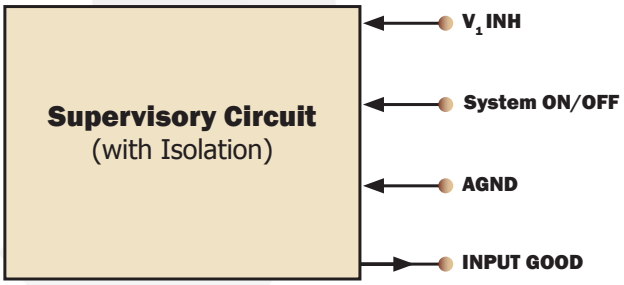
* 5V output option does not require output power derating; full-power is available across the entire input range of 16-40Vin.

† Available output power is derated based on operating input voltage. See charts on page 8 for derating curves.

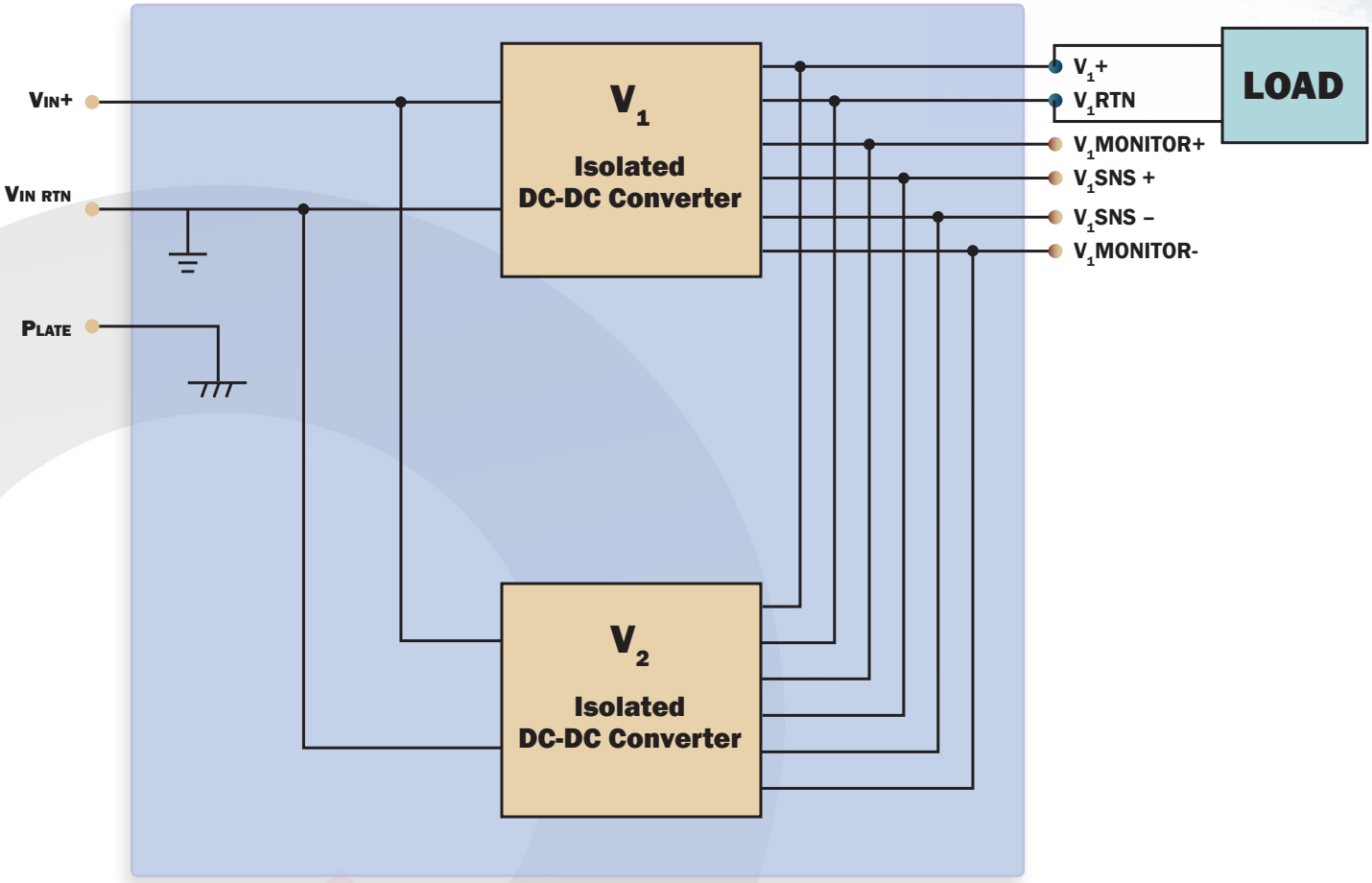
‡ Multiple output cables wired in parallel may be required depending on desired output current and configuration selected.

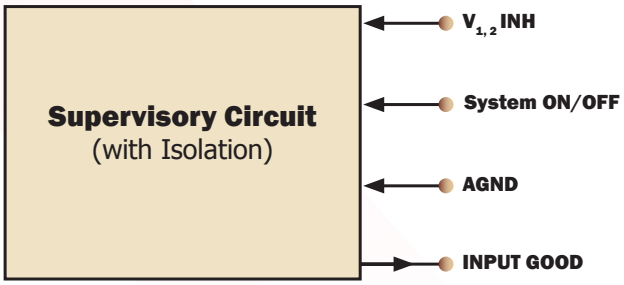
Block Diagram for P1



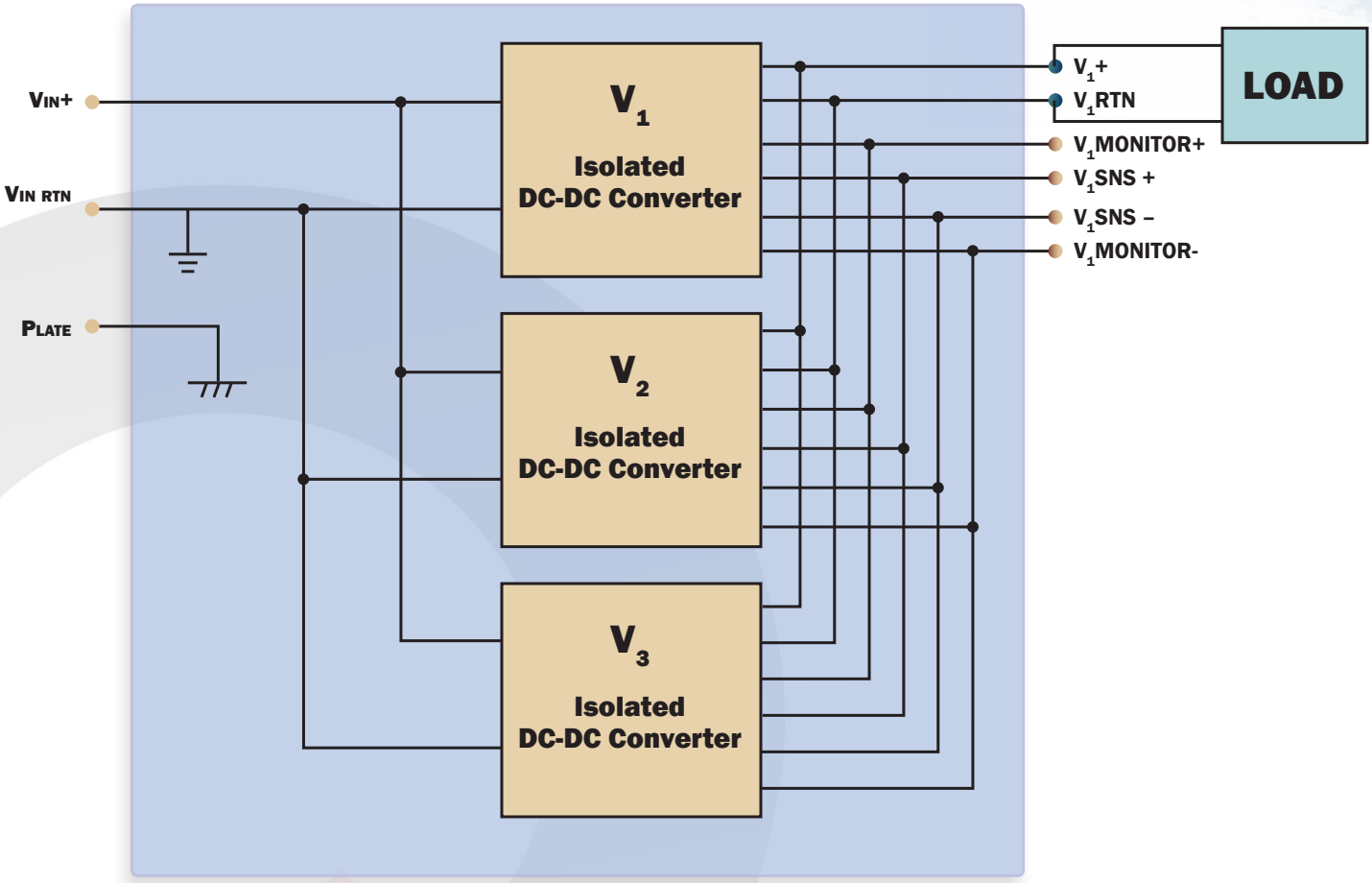


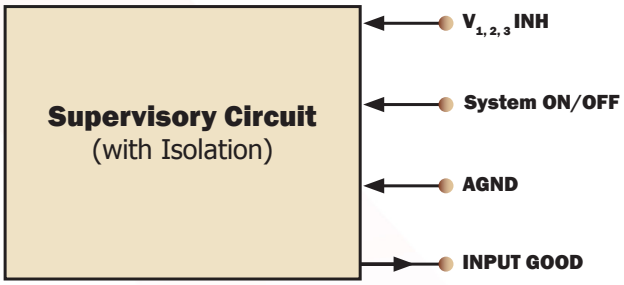
Block Diagram for P2





Block Diagram for P3





MTQ-Px-DC28 Family Input Characteristics

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous	-1		60	V	Non-Operationg
Transient (≤ 1 s)			50	V	100ms transient, square
Isolation Voltage	-1500		1500	V	Input/Output to Plate
Operating Temperature	-55		100	°C	Plate Temperature
Storage Temperature	-65		135	°C	
ELECTRICAL CHARACTERISTICS					
Input Voltage					
Continuous	16		40	V	
Transient			50	V	50V transient for 100ms
Under-Voltage Lockout					
Turn-On Input Voltage Threshold	15.1	15.4	15.7	V	
FEATURE CHARACTERISTICS					
System On/Off Control					Pin 9 (P1/P2) or Pin 10 (P3) of J5, referenced to AGND
System On-State Voltage	-0.5		0.7	V	Pin can also be left open
System Off-State Voltage	2.5		8	V	
Inhibit Control					Pin 2 (P1/P2) or Pin 5 (P3) of J5, referenced to AGND
Converter On-State Voltage	-0.5		0.7	V	Pin can also be left open
Converter Off-State Voltage	2.5		8	V	

See individual DC-DC Converter and Filter Datasheets for more information regarding performance specifications, (MCOTS-C-28-xx-HZ).

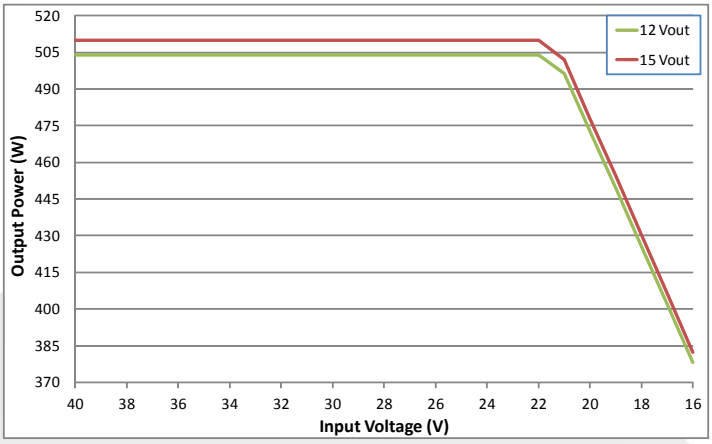


Figure 1. MTQ-P1 12V/15V Output Power Derating Across Entire Input/ Thermal Operating Range

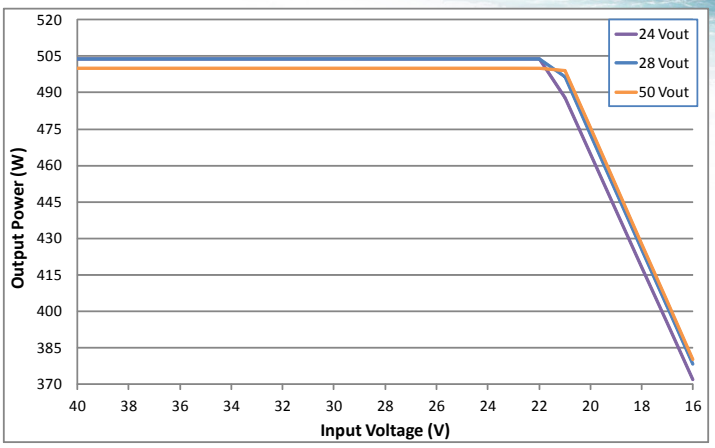


Figure 2. MTQ-P1 24V/28V/50V Output Power Derating Across Entire Input/ Thermal Operating Range

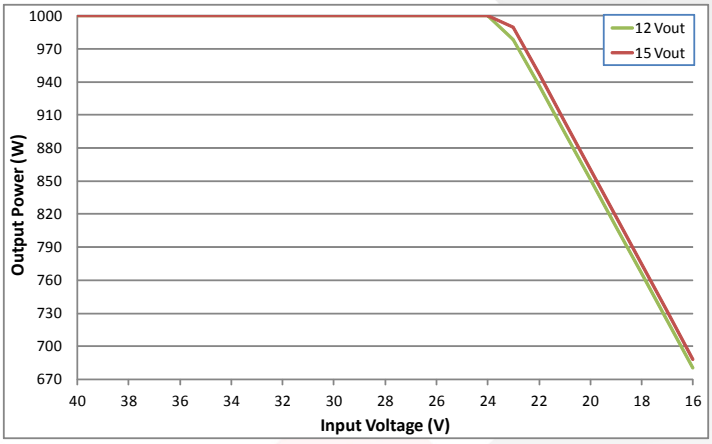


Figure 3. MTQ-P2 12V/15V Output Power Derating Across Entire Input/ Thermal Operating Range

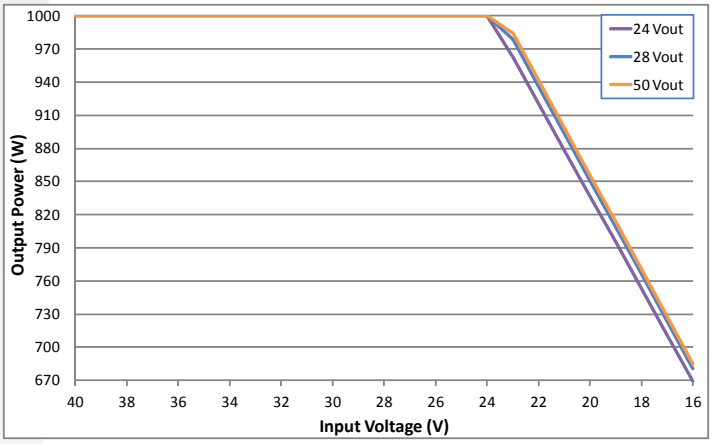


Figure 4. MTQ-P2 24V/28V/50V Output Power Derating Across Entire Input/ Thermal Operating Range

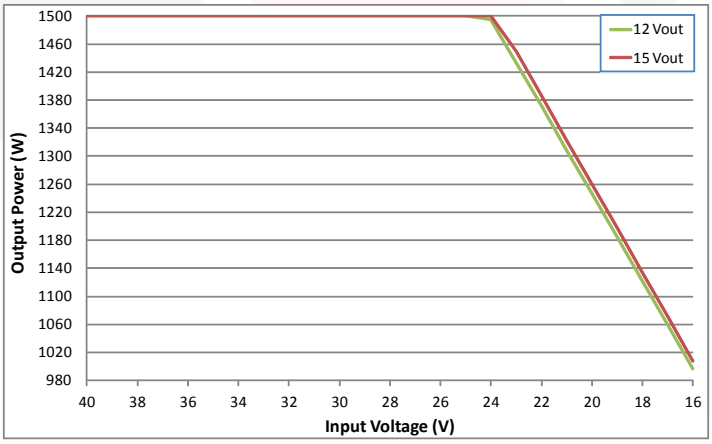


Figure 5. MTQ-P3 12V/15V Output Power Derating Across Entire Input/ Thermal Operating Range

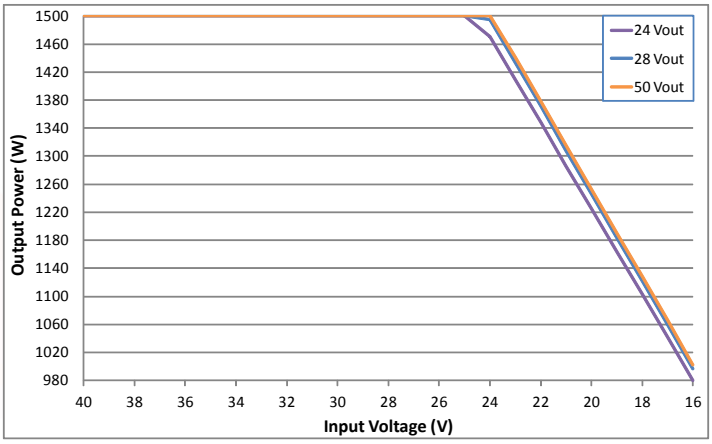


Figure 6. MTQ-P3 24V/28V/50V Output Power Derating Across Entire Input/ Thermal Operating Range

Mil-COTS DC-DC Converter Qualification

Test Name	Details	# Tested (# Failed)	Consistent with MIL-STD-883F Method	Consistent with MIL-STD-883F Method 5005
Life Testing	Visual, mechanical and electrical testing before, during and after 1000 hour burn-in @ full load	15 (0)	Method 1005.8	
Shock-Vibration	Visual, mechanical and electrical testing before, during and after shock and vibration tests	5 (0)		MIL-STD-202, Methods 201A & 213B
Humidity	+85˚C, 95%RH, 1000 hours, 2 minutes on/6 hours off	8 (0)	Method 1004.7	
Temperature Cycling	500 cycles of -55˚C to +100˚C (30 minute dwell at each temperature	10 (0)	Method 1010.8	Condition A
Solderability	15 pins	15 (0)	Method 2003	
DMT	-65˚C to +110˚C across full line and load specifications in 5˚C steps	7 (0)		
Altitude	70,000 feet (21 km), see Note	2 (0)		

Note: A conductive cooling design is generally needed for high altitude applications because of naturally poor convective cooling at rare atmospheres.

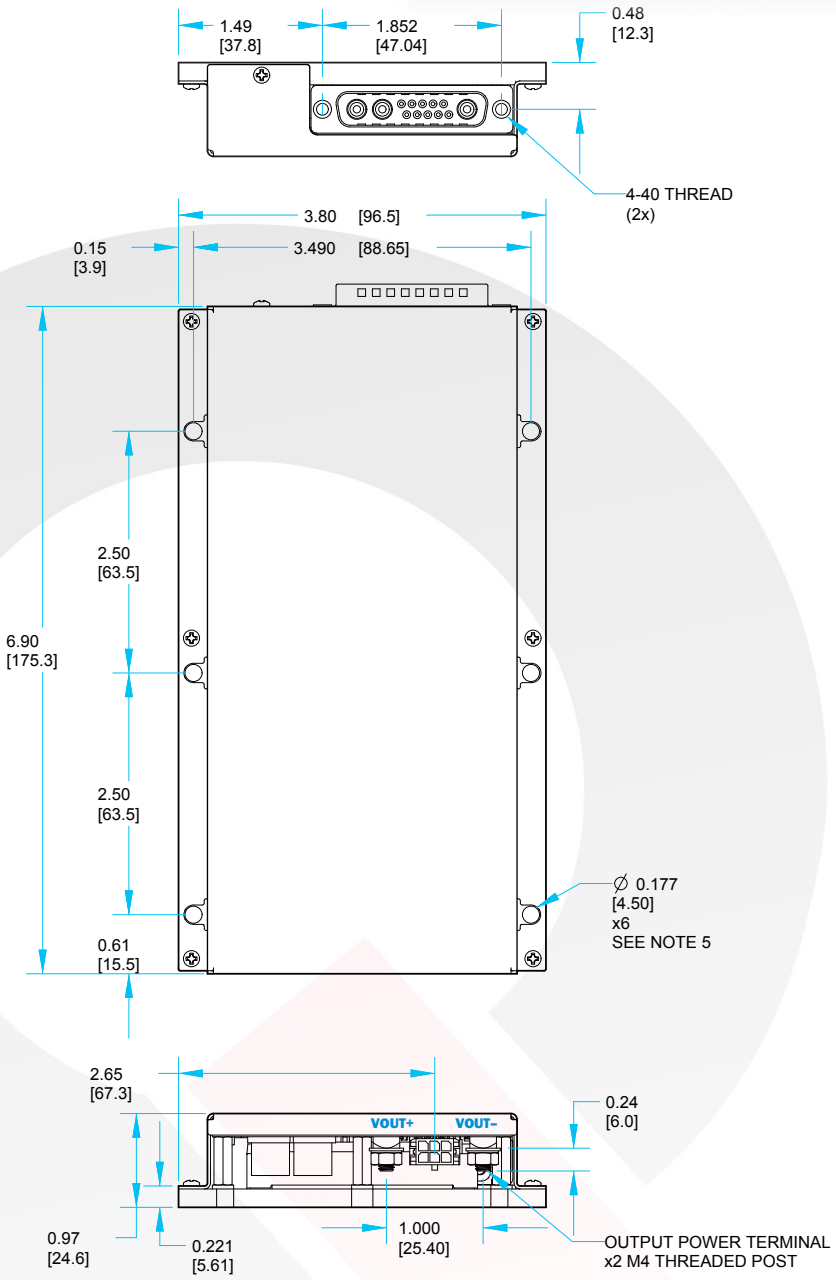
Mil-COTS DC-DC Converter Screening

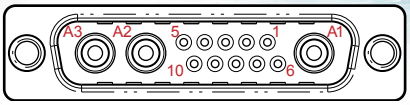
Screening	Process Description	S-Grade	M-Grade
Baseplate Operating Temperature		-55˚C to +100˚C	-55˚C to +100˚C
Storage Temperature		-65˚C to +135˚C	-65˚C to +135˚C
Pre-Cap Inspection	IPC-610, Class III	Yes	Yes
Temperature Cycling	Method 1010, Condition B, 10 Cycles		Yes
Burn-In	100˚C Baseplate	12 Hours	96 Hours
Final Electrical Test	100%	25˚C	-55˚C, +25˚C, +100˚C
Final Visual Inspection	MIL-STD-2008	Yes	Yes

MTQ-Px-DC28 Assembly Qualification

Environment Tests	Process Description	Details	Specification
Vibration	Method 514.6	Procedure I	20G's (0.2 g 2/Hz); 10-2000Hz
Shock/Drop	Method 516.6	Procedure I	40G's (11ms); 75G'speak (6ms); Sawtooth Pulse
ESD	EN 61000-4-2	Contact Discharge	Level 2

Mechanical Drawing P1





Input Connector (J5) 13W3

Pin	Name	Function
1	AGND	Analog Ground[1]
2	INH	Inhibit [Ref to AGND]
3	NC	Not Connected
4	NC	Not Connected
5	NC	Not Connected
6	INPUT_GOOD	[Ref to AGND]
7	NC	Not Connected
8	NC	Not Connected
9	ON/OFF	[Ref to AGND]
10	VIN–	[Signal Connection][2]
A1	COM IN	Chassis
A2	VIN–	[Power connection]
A3	VIN+	[Power connection]

NOTES:

1. AGND, Pin 1, is the reference for control inputs INH, ON/OFF, and control output INPUT_GOOD. It should be connected to the reference of the external drivers and receivers of these signals. It is isolated from VIN- and VIN+.
2. Vin-, Pin 10, should not be connected externally to Vin-, Pin A2. It can be connected to AGND, Pin 1, externally if the user wishes the control signal reference to be local to the MTQ assembly.

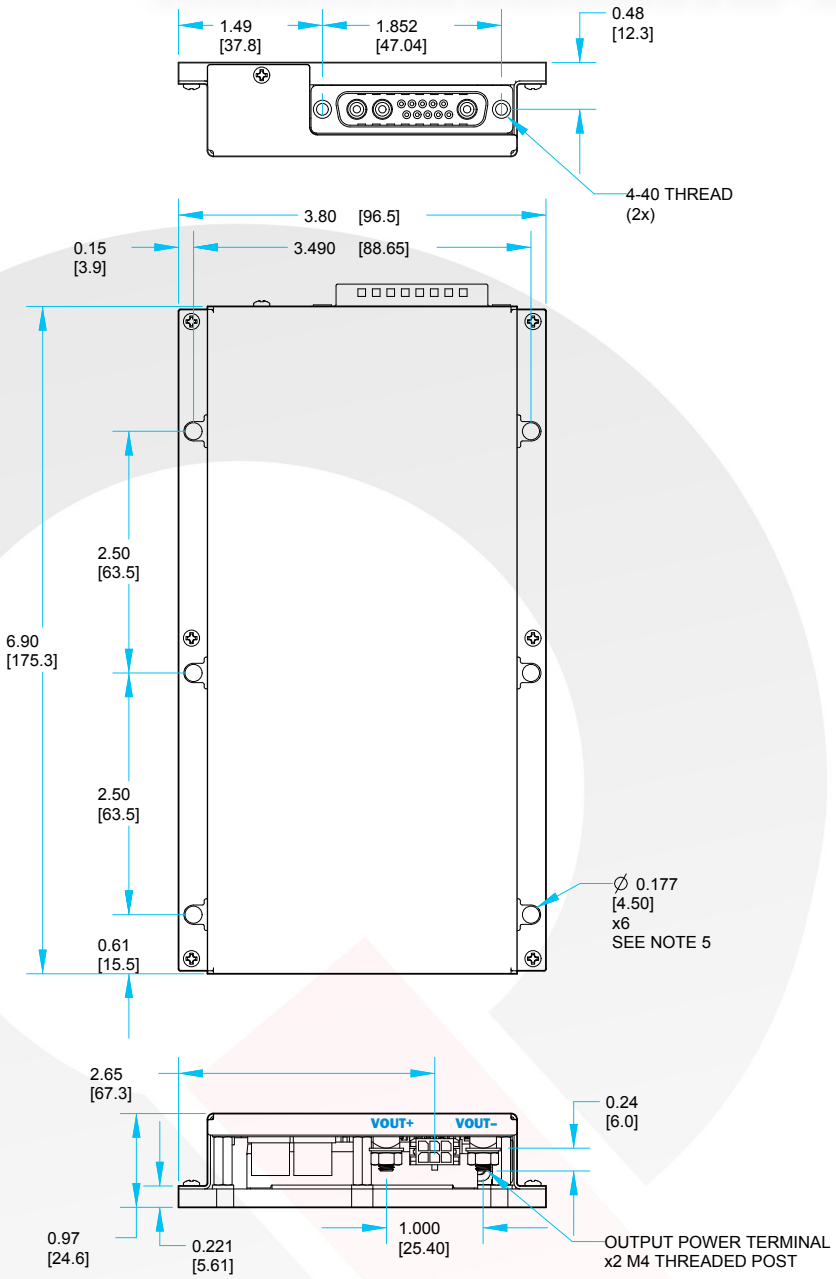
Output Connector (J1)

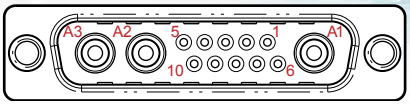
Pin	Name	Function
1	MONITOR+	Output Monitor Positive
2	NC	Not Connected
3	MONITOR–	Output Monitor Negative
4	VSENSE+	Sense Positive
5	TRIM	Trim Pin
6	VSENSE–	Sense Negative

NOTES:

1. All dimensions in inches [MM]
2. Tolerances: X.XX ±0.02 IN [±0.5MM]
   X.XXX ±0.010 IN [±0.25MM]
3. Connector Part Numbers:
   J5 COMBO-D 13W3 MALE
   J1 MOLEX 430450606
4. Weight: Total assembly weight depends on actual converter used.
   Typical Weight: 1.16 LBS (1 HB)
5. Torque Spec for Mounting Holes and Output Terminals, 6in—lbs.

Mechanical Drawing P2 - 2 Output Terminal





Input Connector (J5) 13W3

Pin	Name	Function
1	AGND	Analog Ground[1]
2	INH	Inhibit [Ref to AGND]
3	NC	Not Connected
4	NC	Not Connected
5	NC	Not Connected
6	INPUT_GOOD	[Ref to AGND]
7	NC	Not Connected
8	NC	Not Connected
9	ON/OFF	[Ref to AGND]
10	VIN–	[Signal Connection][2]
A1	COM IN	Chassis
A2	VIN–	[Power connection]
A3	VIN+	[Power connection]

NOTES:

1. AGND, Pin 1, is the reference for control inputs INH, ON/OFF, and control output INPUT_GOOD. It should be connected to the reference of the external drivers and receivers of these signals. It is isolated from VIN- and VIN+.
2. Vin-, Pin 10, should not be connected externally to Vin-, Pin A2. It can be connected to AGND, Pin 1, externally if the user wishes the control signal reference to be local to the MTQ assembly.

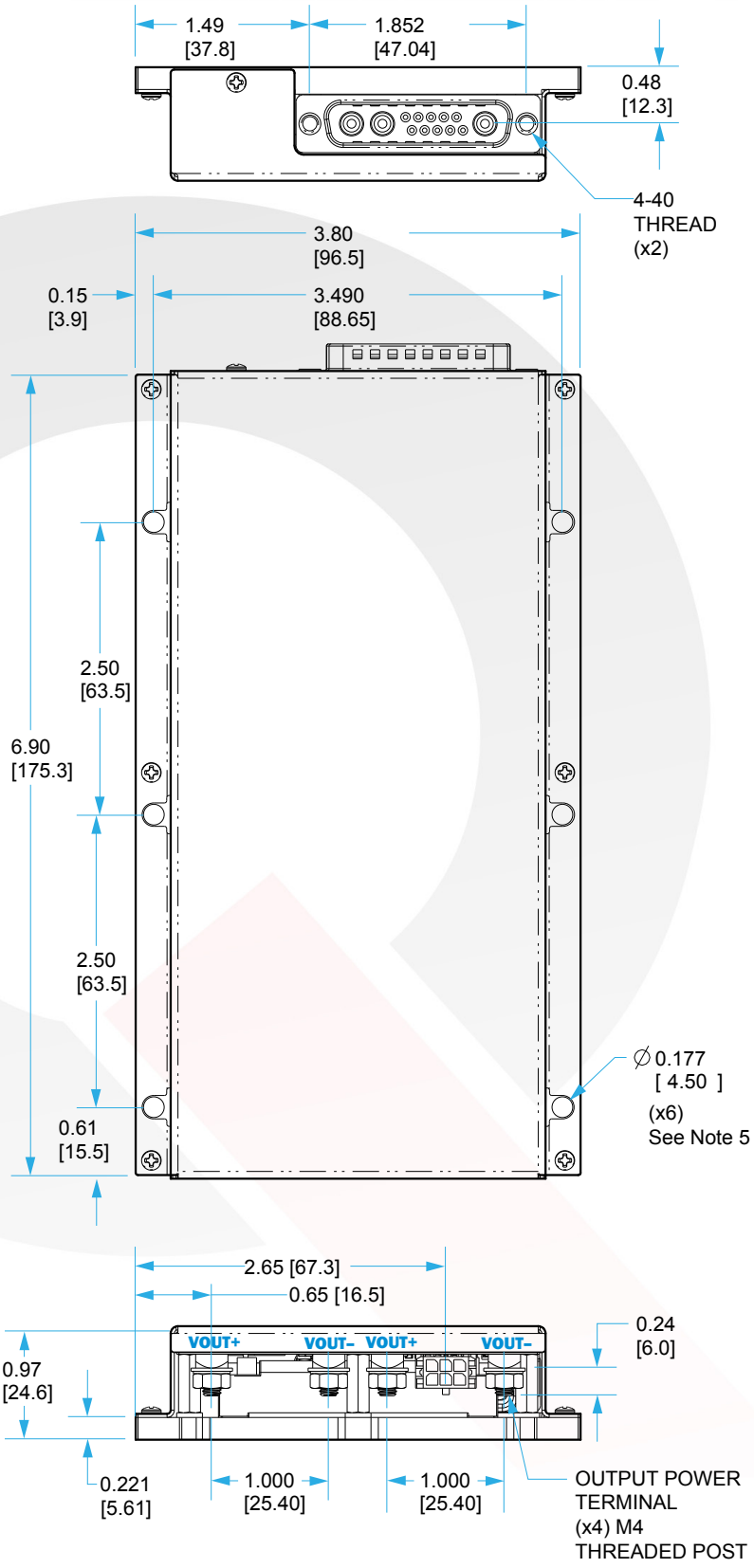
Output Connector (J1)

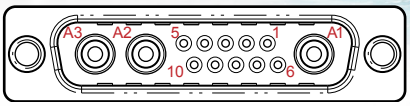
Pin	Name	Function
1	MONITOR+	Output Monitor Positive
2	NC	Not Connected
3	MONITOR–	Output Monitor Negative
4	VSENSE+	Sense Positive
5	NC	Not Connected
6	VSENSE–	Sense Negative

NOTES:

1. All dimensions in inches [MM]
2. Tolerances: X.XX ±0.02 IN [±0.5MM]
   X.XXX ±0.010 IN [±0.25MM]
3. Connector Part Numbers:
   J5 COMBO-D 13W3 MALE
   J1 MOLEX 430450606
4. Weight: Total assembly weight depends on actual converter used.
   Typical Weight: 1.49 LBS (2 HB)
5. Torque Spec for Mounting Holes and Output Terminals, 6in—lbs.
6. 2 Output Terminals used for Total Iout ≤ 60A

Mechanical Drawing P2 - 4 Output Terminal





Input Connector (J5) 13W3

Pin	Name	Function
1	AGND	Analog Ground[1]
2	INH	Inhibit [Ref to AGND]
3	NC	Not Connected
4	NC	Not Connected
5	NC	Not Connected
6	INPUT_GOOD	[Ref to AGND]
7	NC	Not Connected
8	NC	Not Connected
9	ON/OFF	[Ref to AGND]
10	VIN–	[Signal Connection][2]
A1	COM IN	Chassis
A2	VIN–	[Power connection]
A3	VIN+	[Power connection]

NOTES:

1. AGND, Pin 1, is the reference for control inputs INH, ON/OFF, and control output INPUT_GOOD. It should be connected to the reference of the external drivers and receivers of these signals. It is isolated from VIN- and VIN+.
2. Vin-, Pin 10, should not be connected externally to Vin-, Pin A2. It can be connected to AGND, Pin 1, externally if the user wishes the control signal reference to be local to the MTQ assembly.

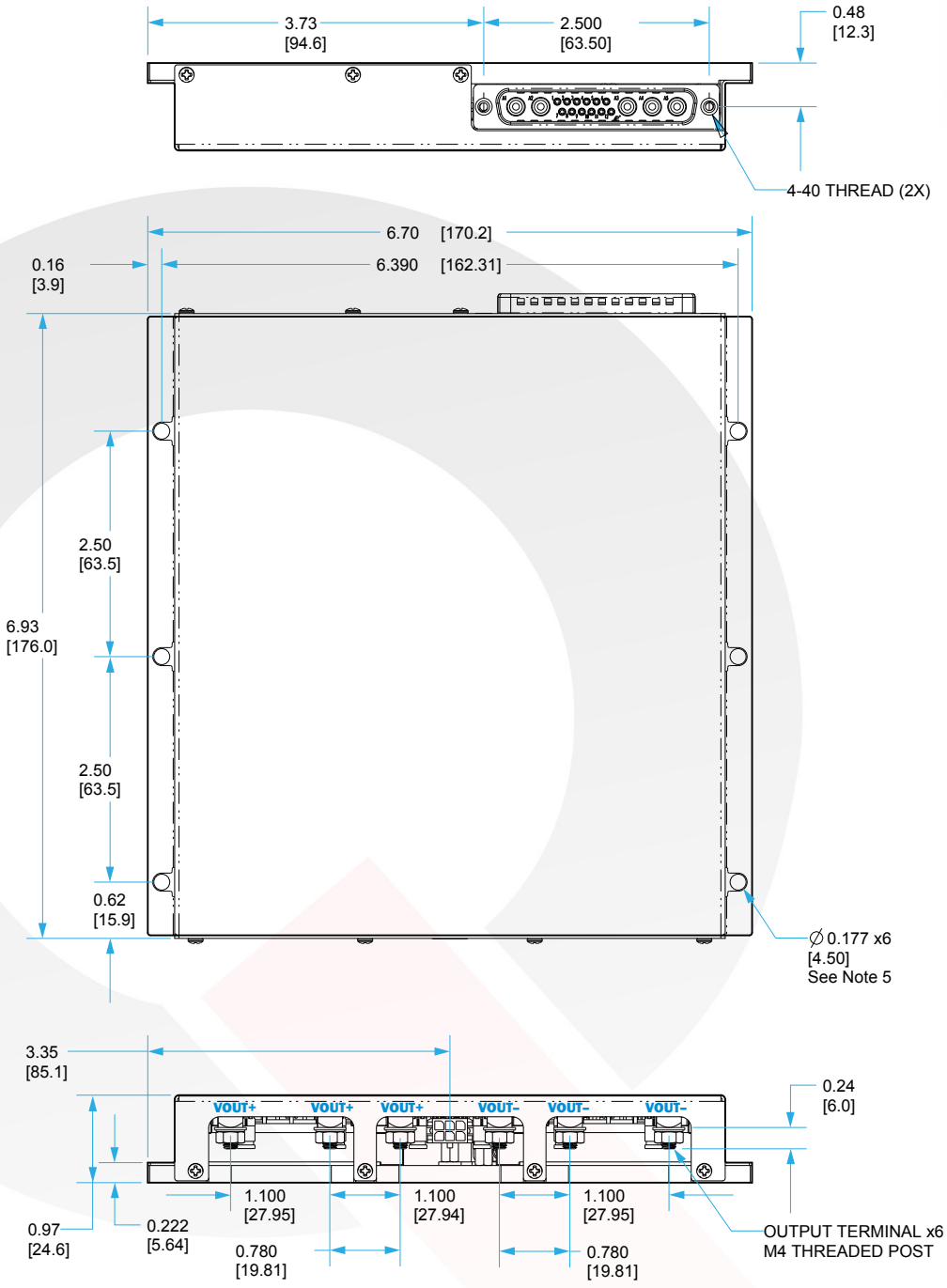
Output Connector (J1)

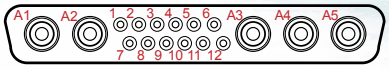
Pin	Name	Function
1	MONITOR+	Output Monitor Positive
2	NC	Not Connected
3	MONITOR–	Output Monitor Negative
4	VSENSE+	Sense Positive
5	NC	Not Connected
6	VSENSE–	Sense Negative

NOTES:

1. All dimensions in inches [MM]
2. Tolerances: X.XX ±0.02 IN [±0.5MM]
   X.XXX ±0.010 IN [±0.25MM]
3. Connector Part Numbers:
   J5 COMBO-D 13W3 MALE
   J1 MOLEX 430450606
4. Weight: Total assembly weight depends on actual converter used.
   Typical Weight: 1.49 LBS (2 HB)
5. Torque Spec for Mounting Holes and Output Terminals, 6in—lbs.
6. 4 Output Terminals needed for Total Iout > 60A

MECHANICAL DRAWING P3





Input Connector (J5) 17W5

Pin	Name	Function
1	INPUT_GOOD	[Ref to AGND]
2	NC	Not Connected
3	NC	Not Connected
4	NC	Not Connected
5	INH	Inhibit [Ref to AGND]
6	AGND	Analog Ground[1]
7	NC	Not Connected
8	NC	Not Connected
9	VIN–	[Signal Connection][2]
10	ON/OFF	[Ref to AGND]
11	NC	Not Connected
12	NC	Not Connected
A1	VIN+	[Power connection]
A2	VIN+	[Power connection]
A3	VIN–	[Power connection]
A4	VIN–	[Power connection]
A5	COM IN	Chassis

NOTES:

1. AGND, Pin 6, is the reference for control inputs INH, ON/OFF, and control output INPUT_GOOD. It should be connected to the reference of the external drivers and receivers of these signals. It is isolated from VIN- and VIN+.
2. Vin-, Pin 9, should not be connected externally to Vin-, Pins A3 and A4. It can be connected to AGND, Pin 6, externally if the user wishes the control signal reference to be local to the MTQ assembly.

Output Connector (J1)

Pin	Name	Function
1	MONITOR+	Output Monitor Positive
2	NC	Not Connected
3	MONITOR–	Output Monitor Negative
4	VSENSE+	Sense Positive
5	NC	Not Connected
6	VSENSE–	Sense Negative

NOTES:

1. All dimensions in inches [MM]
2. Tolerances: X.XX ±0.02 IN [±0.5MM]
   X.XXX ±0.010 IN [±0.25MM]
3. Connector Part Numbers:
   J5 COMBO-D 17W5 MALE
   J1 MOLEX 430450606
4. Weight: Total assembly weight depends on actual converter used.
   Typical Weight: 2.49 LBS (3 HB)
5. Torque Spec for Mounting Holes and Output Terminals, 6in—lbs.

MultiQor Control Circuitry Features

The MTQ-Px-DC28 has control feature signals available on the connector, J5.

Converter SYSTEM ON/OFF:

The MTQ-Px-DC28T has two options for the user to control when a converter is on or off. There is a SYSTEM ON/OFF control, shown in Figure A. The SYSTEM ON/OFF pin, Pin 9 (P1/P2) or Pin 10 (P3) of J5, must be pulled high to turn all the converters off. The SYSTEM ON/OFF controls are referenced to AGND, Pin 1 (P1/P2) or Pin 6 (P3) of J5.

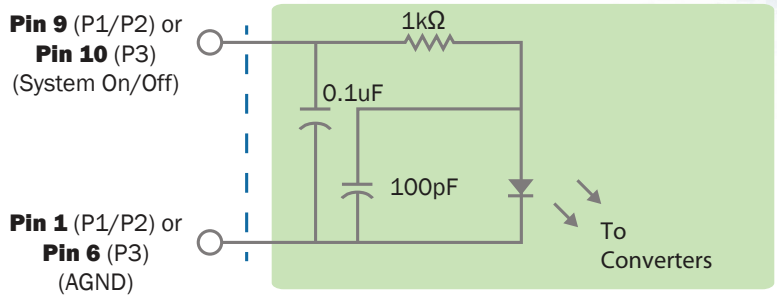


Figure A: An equivalent circuit looking into the SYSTEM ON/OFF pin.

INHIBIT Controls:

MTQ-Px-DC28 has an INHIBIT control, shown in Figure B. The specific INHIBIT pin, Pin 2 (P1/P2) or Pin 5 (P3) of J5, must be pulled high to keep the converter(s) off even when the SYSTEM ON/OFF pin is low. The INHIBIT controls are referenced to AGND, Pin 1 (P1/P2) or Pin 6 (P3) of J5.

Control Summary

System On/Off	Inhibit	Output(s)
Low	Low	On
High	High	Off
High	x	Off
x	High	Off

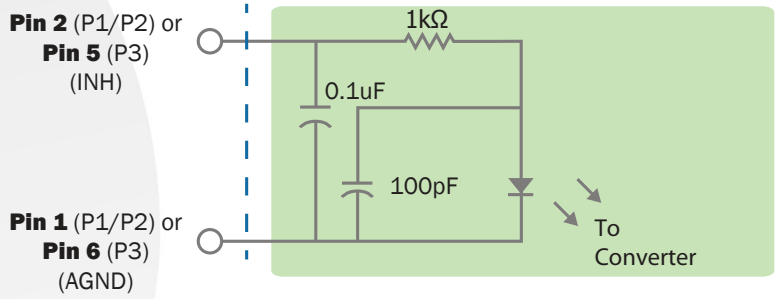


Figure B: An equivalent circuit looking into the INHIBIT pin.

INPUT GOOD:

The INPUT GOOD signal, Pin 6 (P1/P2) or Pin 1 (P3) of J5, is an open collector output which is pulled low when the converters have an input voltage above 16V. This signal is referenced to AGND, Pin 1 (P1/P2) or Pin 6 (P3) of J5. An example external 5V pull-up circuit is shown in Figure C.

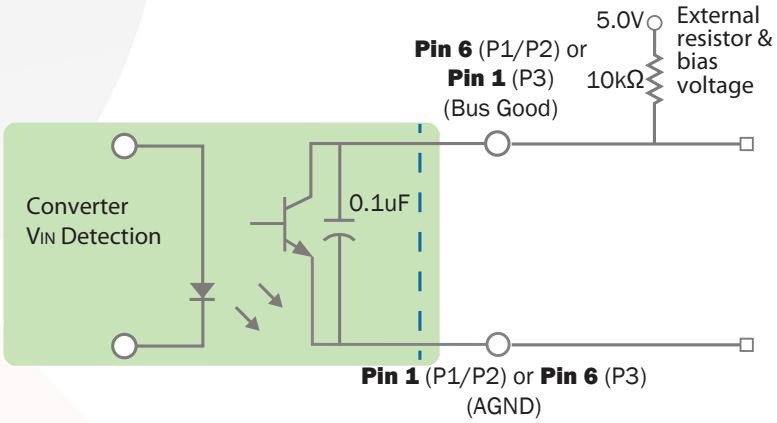
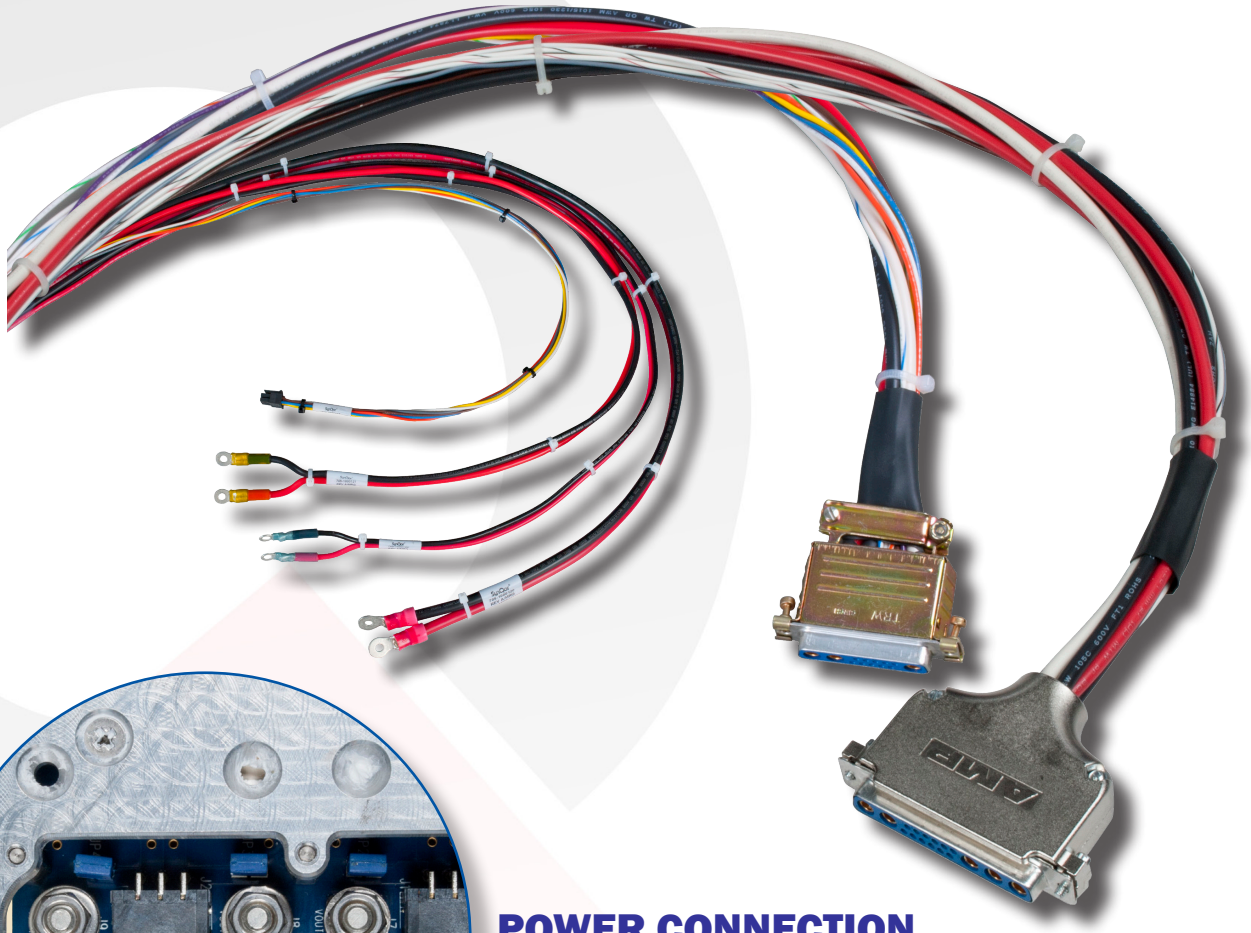


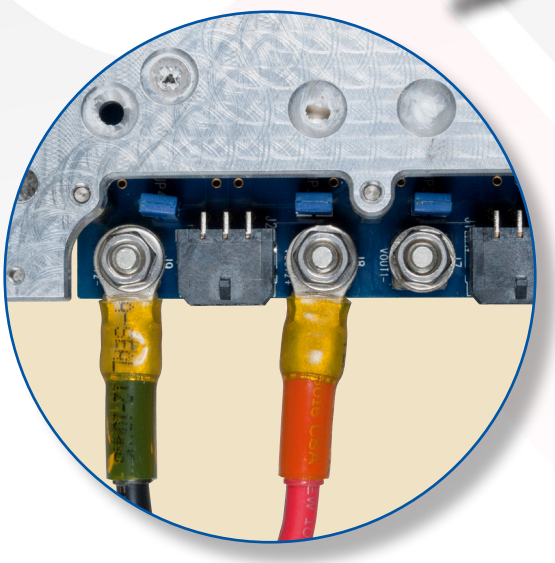
Figure C: An equivalent circuit looking into the INPUT GOOD pin with an example external pull-up circuit.

MultiQor Plate Cables

These cables can be used with MultiQor Plates and Adaptor Boards with multiple output options to accommodate different levels of output current.

Description	Part Number
Input mating cable with pre-stripped wire ends (36”) P1	MTQ-CBL-INPUT1C
Input mating cable with pre-stripped wire ends (36”) P2	MTQ-CBL-INPUT3C
Input mating cable with pre-stripped wire ends (36”) P3	MTQ-CBL-INPUT2C
Output signal mating cable with pre-stripped wire ends (36”)	MTQ-CBL-OUT1CS
Output power mating cable (20A) with pre-stripped wire ends (36”)	MTQ-CBL-OUT1CP20
Output power mating cable (40A) with pre-stripped wire ends (36”)	MTQ-CBL-OUT1CP40
Output power mating cable (60A) with pre-stripped wire ends (36”)	MTQ-CBL-OUT1CP60





POWER CONNECTION

NOTE: J1 - J4 Monitor Pins are not rated to carry the converter’s output.

Output terminal studs should be used as shown.

Ordering Information / Part Numbering

MTQ - P1 - DC28 - XXXXXXXX - S V

Family	Plate Format (# of Converters)	MIL-STD Compliance	8 Digit Application Identification Number	Screening	Optional Character
MTQ	**P1:** 1 converter **P2:** 2 converters **P3:** 3 converters	**DC28:** MIL-STD-704 (A-F) (Steady State)	8 Digit Application Identification Number	**S:** S-Grade **M:** M-Grade	**V:** Cover

Not all combinations make valid part numbers, please contact SynQor to order a configured solution.

Example: MTQ-P3-DC28-XXXXXXXX-SV

Contact SynQor for further information and to order:

Phone:	978-849-0600
Toll Free:	888-567-9596
Fax:	978-849-0602
E-mail:	power@synqor.com
Web:	www.synqor.com
Address:	155 Swanson Road Boxborough, MA 01719 USA

PATENTS

SynQor holds numerous U.S. patents, one or more of which apply to most of its power conversion products. Any that apply to the product(s) listed in this document are identified by markings on the product(s) or on internal components of the product(s) in accordance with U.S. patent laws. SynQor's patents include the following:

6,545,890 6,594,159 6,894,468 6,896,526 6,927,987 7,050,309
7,085,146 7,119,524 7,765,687 7,787,261 8,149,597 8,644,027
9,143,042

WARRANTY

SynQor offers a two (2) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.