SynQor®

# VPX-3U

## VPX-3U-DC28TH-001

# MILITARY COTS

# VITA 62 COMPLIANT POWER SUPPLY

| 18V - 40V | EMI Filtering | 6 | 500W | 91% |
|---|---|---|---|---|
| Continuous Input Voltage | Long Holdup | Outputs | Maximum Output Power | Typical Efficiency |

**Operation: -40°C to 85°C (at Card Edge)**


## VPX Features

- **Outputs:**

| | | | | |
|---|---|---|---|---|
| VS1: | +12V | @ | 40A= | 480W |
| VS2: | +3.3V | @ | 20A= | 66W |
| VS3: | +5.0V | @ | 40A = | 200W |
| (AUX) | $+3.3V_{AUX}$ | @ | 6A = | 20W |
| (AUX) | $+12V_{AUX}$ | @ | 1A = | 12W |
| (AUX) | $-12V_{AUX}$ | @ | 1A = | 12W |

- **Maximum Total Output Power: 500W**
- **Extended Holdup Time of over 50ms at 500W**
- **Input Transient Protection up to 100V**
- **Reverse Polarity Protection**
- **Input EMI Filtering**
- **-40°C to 85°C Operating Temperature**
- **Over-current, over-voltage and over-temperature protection**
- **Current Sharing on VS1, VS2 and VS3**
- **Standard VITA 62 Controls**
- **$I^2C$ Function**
  - **Supports IPMI/PMBus/VITA 46.11**

- **Compliance:**

*(Full Load Operation Down to 18Vin)*

- **VITA 62**
- **MIL-STD-461**
  - **CE101 ▪ CE102 ▪ CS101 ▪ CS106**
  - **CS114 ▪ CS115 ▪ CS116**
- **VITA 47 / MIL-STD-810G**
  - **ESD Protection**
  - **Shock**
  - **Vibration**
  - **Rapid Decompression**
  - **Corrosion Resistance**
  - **Fungus Resistance**
  - **Altitude**
  - **Humidity**

- **Designed to be compliant with:**
- **MIL-STD-704 (A-F)**

Made in USA



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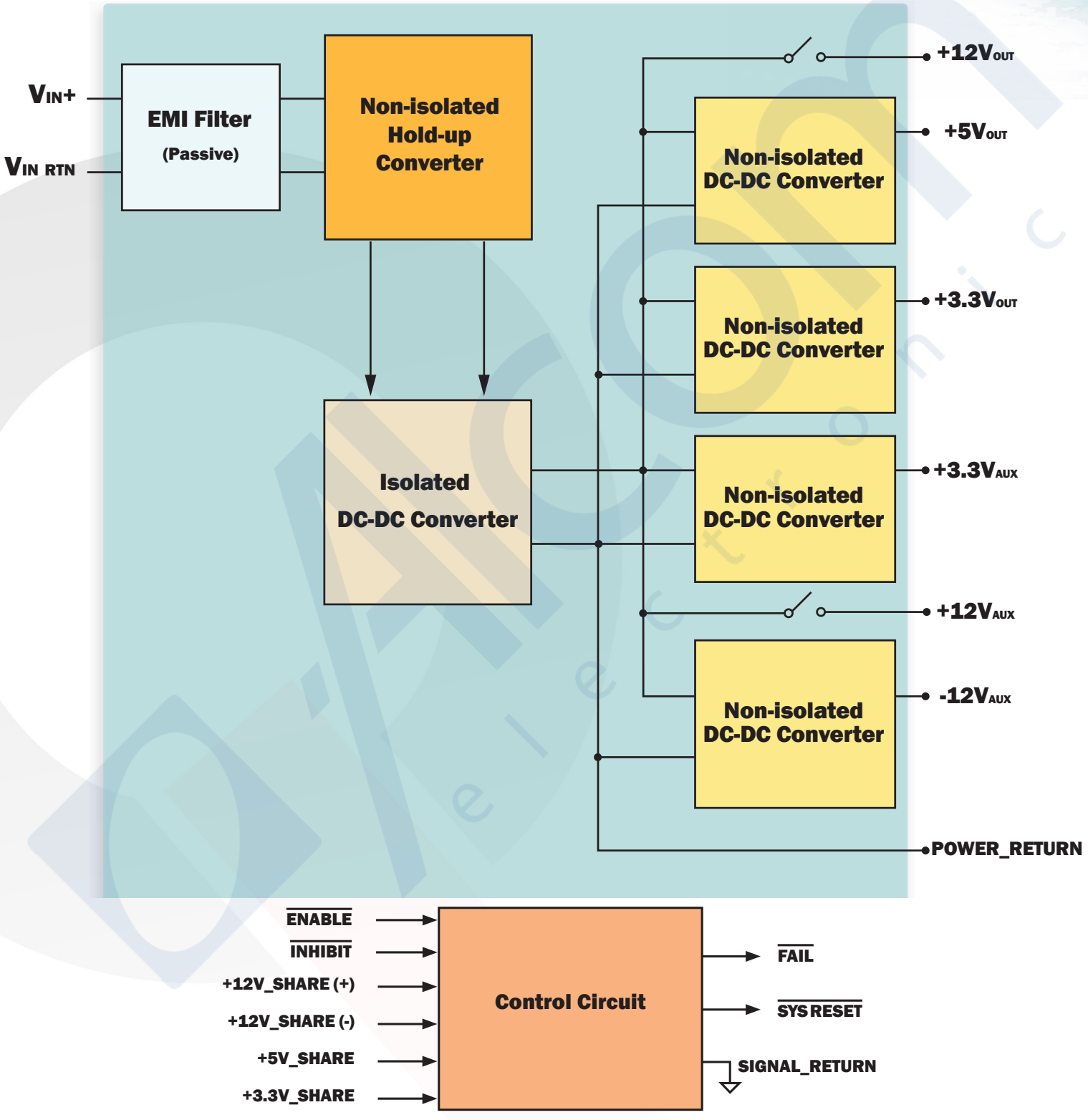
# Block Diagram for VPX-3U-DC28TH-001



# VPX-3U-DC28TH-001 Input Characteristics

| Parameter | Min. | Typ. | Max. | Units | Notes & Conditions |
|---|---|---|---|---|---|
| **ABSOLUTE MAXIMUM RATINGS** | | | | | |
| **Input Voltage** | | | | | |
| Non-Operating | -1 | | 60 | V | Continuous |
| Operating | | | 40 | V | Continuous |
| Operating Transient Protection | | | 100 | V | 100ms transient |
| **Isolation Voltage** | | | 1500 | V | Input to Output and Input/Output to Case |
| **Operating Temperature** | -40 | | 85 | °C | Card edge temperature |
| **Storage Temperature** | -40 | | 105 | °C | |
| **ELECTRICAL CHARACTERISTICS** | | | | | |
| **Input Voltage** | | | | | |
| Continuous | 18 | | 40 | V | See Figure 1 for output de-rating |
| Transient | 18 | | 100 | V | 100V Transient for 100ms |
| **Under-Voltage Lockout** | | | | | |
| Turn-On Input Voltage Threshold | 16 | 17 | 18 | V | |
| **FAIL*/SYSRESET* Signal** | | | | | |
| Pull-up resistance | 100 | | | Ω | Pull-up to 3.3V on backplane, compliant to VITA 46.0 |
| Sinking current | | | 40 | mA | Pull-up to 3.3V on backplane, compliant to VITA 46.0 |
| **FEATURE CHARACTERISTICS** | | | | | |
| **VITA 62 ON/OFF Control** | | | | | Control signals referenced to SIGNAL_RETURN |
| ENABLE* high-state Voltage | 2 | | 3.6 | V | ENABLE* regards a no-connect as a high |
| ENABLE* low-state Voltage | | | 0.8 | V | |
| INHIBIT* high-state Voltage | 2 | | 3.6 | V | INHIBIT* regards a no-connect as a high |
| INHIBIT* low-state Voltage | | | 0.8 | V | |
| **HOLD-UP CHARACTERISTICS** | | | | | |
| **Hold-up Time** | | | | | |
| 500W Output Power | 50 | | | ms | Full temperature range, See Figure 2 for other loads |
| **RELIABILITY CHARACTERISTICS** | | | | | |
| Calculated MTBF (MIL-217) MIL-HDBK-217F | | 1670 | | kHrs | Ground Benign, $T_A$ = 25°C |
| Calculated MTBF (MIL-217) MIL-HDBK-217F | | 182 | | kHrs | Ground Mobile, $T_A$ = 25°C |

# Input Voltage Spike

| INPUT VOLTAGE SPIKE SUPPRESSION | |
|---|---|
| **Module Operates through these Spikes** | |
| Input Voltage Spike (Centered on Vin) | |
| ±250V, 100µs, Emax = 15mJ | MIL-STD-1275D |
| ±200V, 10µs, Rs ≤ 0.5Ω | MIL-STD-461C (CS06); DEF-STAN 61-5 |
| ±400V, 5µs, Rs ≤ 0.5Ω | MIL-STD-461C (CS06) |
| ±600V, 10µs, Rs = 50Ω | RTCA/DO-160E |

Regarding EMC testing with LISNs, the 2 x 50 uH series inductance of standard LISNs adversely affects the performance of the VPX holdup controller when switching full power loads. Such a large series source inductance (50 uH in each power lead) is not generally encountered in a 28 V DC source of such high power rating. Therefore, SynQor recommends that when testing with 50 uH LISNs, the setup should include a 5 mF or larger differential capacitor across the VPX power input leads. Alternately, 5 uH LISNs may be used with no additional capacitor.

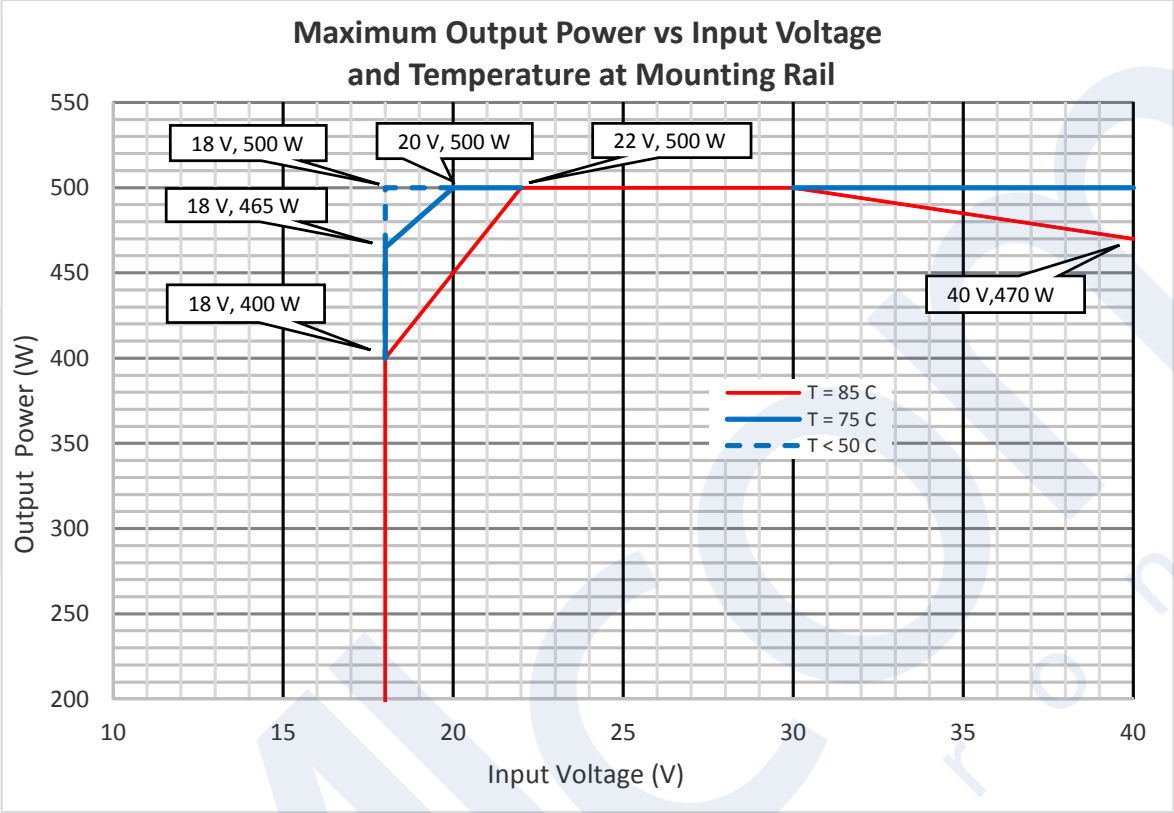



*Figure 1: Maximum Output Power vs Input Voltage and Temperature*

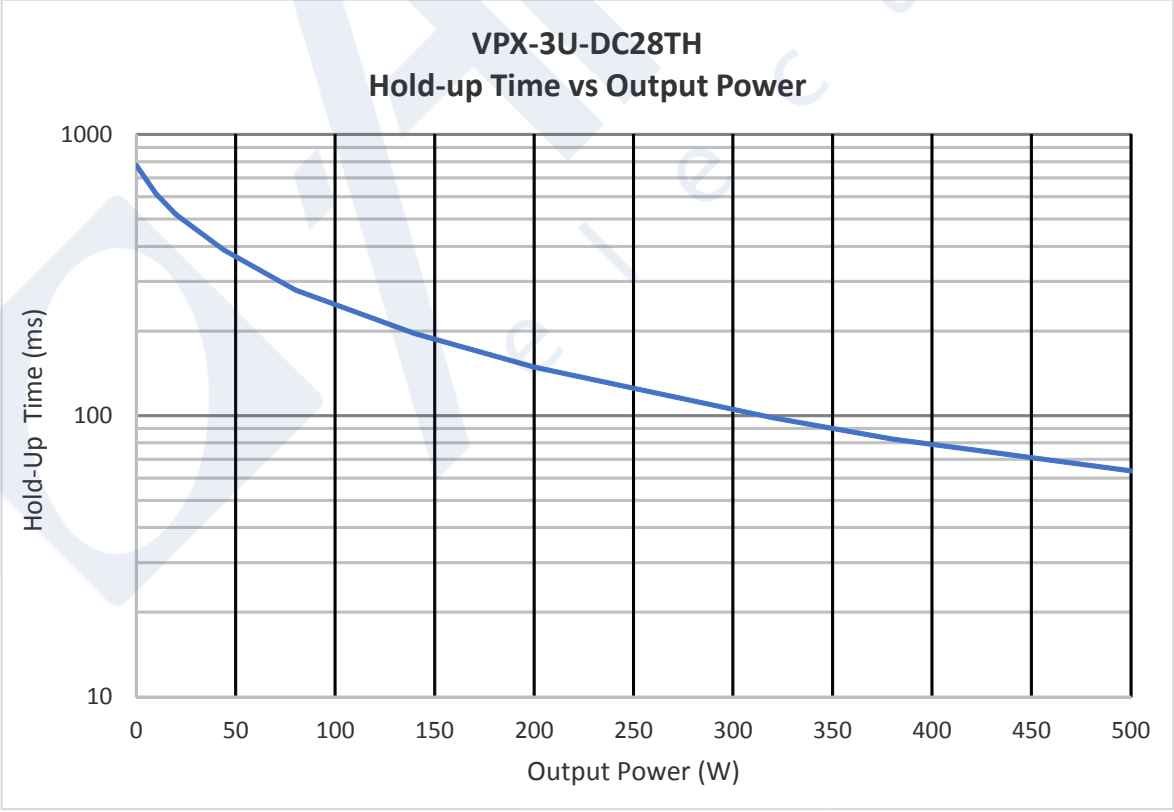



*Figure 2: Hold-up Time vs Output Power*

# VPX-3U-DC28TH-001 Output Characteristics

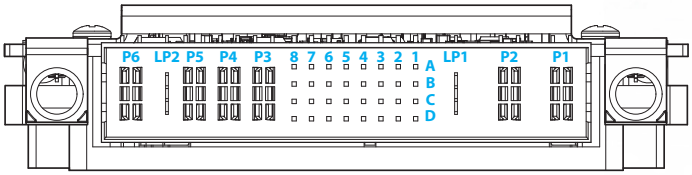
| Parameter | +12V | +5V | +3.3V | +3.3V$_{AUX}$ | +12V$_{AUX}$ | -12V$_{AUX}$ |
|---|---|---|---|---|---|---|
| **OUTPUT CHARACTERISTICS** | | | | | | |
| **Output Voltage Set Point** See Note 1 | **12V** (+/-1.5%) | **5V** (+/-1.5%) | **3.3V** (+/-1.5%) | **3.3V** (+/-1.5%) | **12V** (+/-1.5%) | **-12V** (+/-1.5%) |
| **Total Output Voltage Range** See Note 2 | **12V** (+/-4%) | **5V** (+/-3%) | **3.3V** (+/-3%) | **3.3V** (+/-2%) | **12V** (+/-4%) | **-12V** (+/-3%) |
| **Output Voltage Ripple (pk-pk)** See Note 3 | **80mV** | **50mV** | **40mV** | **40mV** | **80mV** | **80mV** |
| **Operating Current Range** Maximum Total Output Power = 500W | **0-40A** | **0-40A** | **0-20A** | **0-6A** | **0-1A** | **0-1A** |
| **Over-Voltage Protection** | **14.8V** | **6.0V** | **6.0V** | **6.0V** | **14.8V** | **NA** |
| **Current-Limit Inception** | **50.4A** | **80A** | **40A** | **40A** | **2A** | **1.8A** |
| **Maximum Output Capacitance** | **10mF** | **10mF** | **10mF** | **10mF** | **1mF** | **10mF** |
| **MAXIMUM TOTAL OUTPUT POWER** | **500W** | | | | | |

**Note 1:** 28Vin, 50% load
**Note 2:** Over line, load, temperature
**Note 3:** Full Load, measured with 1µF capacitor and 10uF tantalum capacitor

**Maximum Total Output Power=500W (Full Temperature Range)**

Temperature specifications are relative to the temperature at the thermal interface, on the flange opposite the wedge locks.

# Pin Descriptions

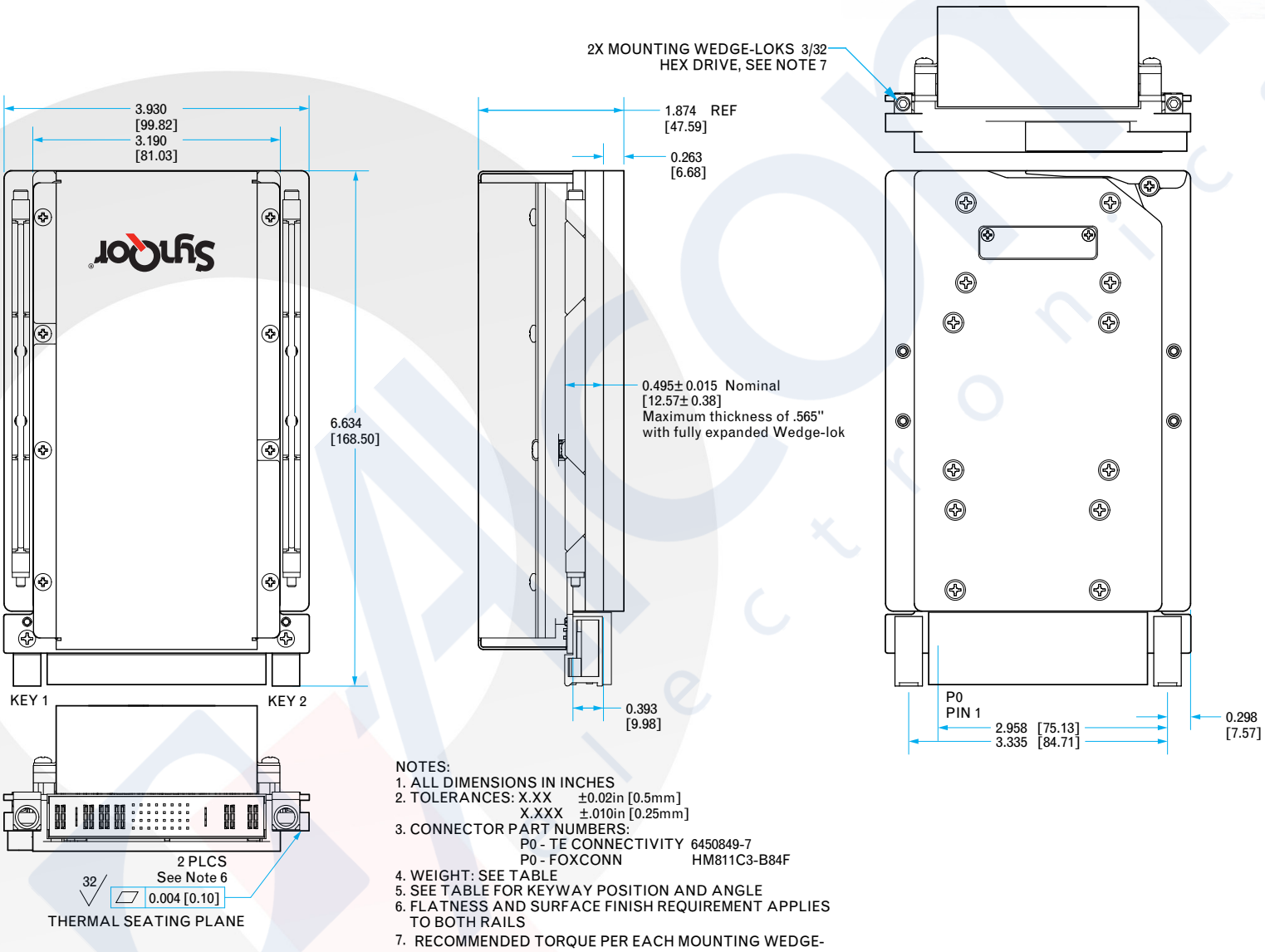



3U P0 Connector

| PIN | Function | DESCRIPTION |
|---|---|---|
| P1 | -DC_IN | Vin- |
| P2 | +DC_IN | Vin+ |
| LP1 | CHASSIS | Chassis |
| A1 | STARTUP_SYNC | Startup synchronization |
| B1 | HU_GOOD* | Output signal pin will be driven low to indicate the hold-up feature is armed. Open drain 12 V maximum. |
| C1 | HU_ACTIVE* | Output signal pin will be driven low to indicate the hold-up feature is delivering load power. Open drain 12 V maximum. |
| D1 | HU_WARN* | Output signal pin will be driven low to indicate less than 50% of hold-up energy storage remains. Open drain 12 V maximum. |
| A2 | No Connection | |
| B2 | FAIL* | When any of the output is not within specification, FAIL* signal will be driven low to indicate a failure |
| C2 | INHIBIT* | Input control signal as defined in VITA 62, referenced to SIGNAL_RETURN |
| D2 | ENABLE* | Input control signal as defined in VITA 62, referenced to SIGNAL_RETURN |
| A3 | +3.3V_SHARE | Active current share for +3.3V_MAIN |
| B3 | +12V_AUX | +12V auxiliary output voltage, 1A rated |
| C3 | No Connection | |
| D3 | No Connection | |
| A4<br>B4<br>C4<br>D4 | +3.3V_AUX | +3.3V auxiliary output voltage, 6A rated (1.5A per pin) |
| A5 | GA0* | Geographical Address, See Note 1 |
| B5 | GA1* | Geographical Address, See Note 1 |
| C5 | SM0 | Primary I²C Clock Line, See Note 1 |
| D5 | SM1 | Primary I²C Data Line, See Note 1 |
| A6 | SM2 | Redundant I²C Clock Line, See Note 1 |
| B6 | SM3 | Redundant I²C Data Line, See Note 1 |
| C6 | -12V_AUX | -12V auxiliary output voltage, 1A rated |
| D6 | SYSRESET* | System Reset is actively low. It will float when all outputs are within specification |
| A7 | +12V_SHARE(+) | Active current share differential pair for +12V_MAIN |
| B7 | +12V_SHARE(-) | |
| C7 | +5V_SHARE | Active current share for +5V_MAIN |
| D7 | SIGNAL_RETURN | Ground pin for control signals |
| A8 | +12V_SENSE(+) | Should be connected to +12V_MAIN either remotely or at the connector |
| B8 | +3.3V_SENSE(+) | Should be connected to +3.3V_MAIN either remotely or at the connector |
| C8 | +5V_SENSE(+) | Should be connected to +5V_MAIN either remotely or at the connector |
| D8 | SENSE_RETURN | Should be connected to POWER_RETURN either remotely or at the connector |
| P3 | +5V_MAIN | +5V main output voltage, 40A rated |
| P4 | POWER_RETURN | Common output voltage return pin, 40A rated per pin |
| P5 | POWER_RETURN | |
| LP2 | +3.3V_MAIN | +3.3V main output voltage, 20A rated |
| P6 | +12V_MAIN | +12V main output voltage, 40A rated |

**Note 1: Refer to SynQor "VPX 3U I²C Operator's Guide" for details regarding the I²C interface.**

## Mechanical Diagram




NOTES:
1. ALL DIMENSIONS IN INCHES
2. TOLERANCES: X.XX ±0.02in [0.5mm]
   X.XXX ±.010in [0.25mm]
3. CONNECTOR PART NUMBERS:
   P0 - TE CONNECTIVITY 6450849-7
   P0 - FOXCONN HM811C3-B84F
4. WEIGHT: SEE TABLE
5. SEE TABLE FOR KEYWAY POSITION AND ANGLE
6. FLATNESS AND SURFACE FINISH REQUIREMENT APPLIES TO BOTH RAILS
7. RECOMMENDED TORQUE PER EACH MOUNTING WEDGE-LOK: 7 IN-LBS [80 N-CM].

| VPX-3U-DC28HT-001 | | |
|---|---|---|
| Weight | | 2.4lbs (1.1kg) |
| Key Position | Alignment Angle | TE Connectivity Part Number |
| 1 | 0° | 1-1469492-1 |
| 2 | 0° | 1-1469492-1 |

# Application Notes

## Control Features

| | |
|---|---|
| **ENABLE*** | Standard VITA 62 control signal. It is used to turn off all of the output voltages when it is high, including +3.3V_AUX. When it is pulled low to SIGNAL_RETURN, +3.3V_AUX will be turned on and the status of the other outputs will be dependent on the state of INHIBIT*. ENABLE* signal regards a no-connect as a high. |
| **INHIBIT*** | Standard VITA 62 control signal. It is used to turn off all the output voltages except +3.3V_AUX. When it is pulled low to SIGNAL_RETURN, VS1, VS2, VS3, +12V_AUX and -12V_AUX will be turned off. INHIBIT* signal regards a no-connect as a high. At power-on, if ENABLE* and INHIBIT* are configured to turn all outputs on, +3.3V_AUX will be powered up 100ms prior to when the other outputs are powered up. |
| **FAIL*** | FAIL* signal is used to indicate a failure has occurred. It will be pulled low when any of the outputs are outside the voltage specification. FAIL* is an active low open-drain signal. It is expected there will be a pull-up resistor on the backplane to 3.3V. A typical resistor value is 4.7kΩ. |
| **SYSRESET*** | SYSRESET* signal is an output generated from the module. It is used to indicate that startup has completed. At power-on, SYSRESET* is pulled low. It will be high impedance when all outputs are within voltage specification. It will be pulled low if any failure has occurred or if the outputs are disabled by the user during operation. SYSRESET* signal is an active low open-drain signal. It is expected there will be a pull-up resistor on the backplane to 3.3V. A typical resistor value is 4.7kΩ. |
| **HU_GOOD*** | HU_GOOD* is an output signal generated from the module. It indicates that the hold-up feature is armed with stored energy. HU_GOOD* is an active-low open-drain signal. The signal will be pulled low when the hold-up is armed, and high impedance otherwise. It is expected there will be a pull-up resistor on the backplane to 3.3V. A typical resistor value is 4.7kΩ. |
| **HU_ACTIVE*** | HU_ACTIVE* is an output signal generated from the module. It indicates that the hold-up feature is in operation, using stored energy to power the load. HU_ACTIVE* is an active-low open-drain signal. The signal will be pulled low when hold-up is running, and high impedance otherwise. It is expected there will be a pull-up resistor on the backplane to 3.3V. A typical resistor value is 4.7kΩ. |
| **HU_WARN*** | HU_WARN* is an output signal generated from the module. It indicates that the hold-up feature is in operation and more than 50% of initial stored energy has been consumed by the load. HU_WARN* is an active-low open-drain signal. The signal will be pulled low when more than 50% of initial stored energy has been depleted, and high impedance otherwise. It is expected there will be a pull-up resistor on the backplane to 3.3V. A typical resistor value is 4.7kΩ. |

## VITA 62 Control States

| ENABLE* | INHIBIT* | +3.3V_AUX | VS1, VS2, VS3, +12V_AUX, -12V_AUX |
|---|---|---|---|
| HIGH | HIGH | OFF | OFF |
| LOW | HIGH | ON | ON |
| HIGH | LOW | OFF | OFF |
| LOW | LOW | ON | OFF |

## Parallel Operation

| | |
|---|---|
| **+12V_MAIN** | Active current sharing on +12V_MAIN is supported on like models. To implement the current share function, +12V_SHARE(+) and +12V_SHARE(-) pins should be routed between all paralleled modules as a differential pair. ENABLE*, INHIBIT* and STARTUP_SYNC should be connected together. High speed data communication is transmitted on these two lines. Control state is transmitted between themaster unit and slave units on a cycle-by-cycle basis. Adding capacitance to these share lines must be avoided. |
| **+5V_MAIN & +3.3V_MAIN** | Active current sharing on +5V_MAIN and +3.3V_MAIN is also supported on like models, but with an analog sharing scheme that is different than the digital sharing scheme for the +12V_MAIN. To implement the current sharing function, +5V_SHARE, +3.3V_SHARE, ENABLE*, INHIBIT* and STARTUP_SYNC should be connected together between all paralleled modules. These SHARE pins are referenced to POWER_RETURN. A clean ground plane is important, and ground drop between each module should be minimized. |
| **+3.3V_AUX, +12V_AUX & -12V_AUX** | Active current sharing is not supported on auxiliary outputs. However, all these auxiliary rails have OR'ing MOSFETs or OR'ing diodes implemented, so that they can still be operated in parallel. Total output current on these rails should not exceed the current rating of a single module. |

## VPX Module Qualification (VITA 47 Compliant)

| Test Name | Method |
|---|---|
| **Random Vibration** | **MIL-STD-810, 514.6 - Procedure I, Class V3** |
| **Shock** | **MIL-STD-810, 516.6 - Procedure I, VI, Class OS2** |
| **Altitude** | **MIL-STD-810, 500.5 - Procedure I, II, III** |
| **Fungus Resistance** | **MIL-STD-810, 508.6** |
| **Corrosion Resistance** | **ASTM G85, Annex A4** |
| **Humidity** | **MIL-STD-810, 507.5 - Procedure II** |
| **High Temperature** | **MIL-STD-810, 501.5 - Procedure I, II** |
| **Low Temperature** | **MIL-STD-810, 502.5 - Procedure I, II** |
| **Temperature Cycling** | **MIL-STD-202, 107 - Class C4** |
| **ESD** | **EN61000-4-2, Level 3; 8kV Air Discharge** |

**Internal Mil-COTS Converter and Filter Module 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-A-610, Class III | • | • |
| **Temperature Cycling** | MIL-STD-883F, Method 1010, Condition B, 10 Cycles | | • |
| **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-883F, Method 2009 | • | • |

# Ordering Information / Part Numbering

| Series | | Package Size (U) | | Input Range | Mil Std Filtering | | Output Voltage Combination Code | | Packaging Options |
|---|---|---|---|---|---|---|---|---|---|
| VPX | - | 3U | - | DC28 | TH | - | 001 | - | Y1Y2Y3 |
| VPX | - | 3U | - | **DC28:** 28V | **TH:** Input Transient Protection<br>Extended Holdup Time | - | **001:** 001 | - | **Y1:** Internal Module Screening<br>S - Standard (MCOTS)<br>M - Military (MCOTS)<br>**Y2:** Conformal Coating<br>N - No Conformal Coating<br>C - Conformal Coating<br>Y3: I²C Function<br>2 - I²C |

## Examples:

**VPX-3U-DC28TH-001-SN2**

**VPX-3U-DC28TH-001-MC2**

Not all combinations make valid part numbers, please contact SynQor for availability.

### 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:

7,050,309 7,765,687 7,787,261
8,149,597 8,644,027

### WARRANTY

SynQor offers a one (1) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.