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# VPXtra™ 500M Data Sheet
# P/N 94089

## FEATURES



- **Open VPX VITA 62 compliant**
- **3U VPX, 1.0" pitch single slot**
- **Wide input range: 18-36V**
- **Input transient protection**
- **Three high power DC outputs: +12V/25A, +5V/40A, +3.3V/15A**
- **Multiple auxiliary DC outputs: +3.3V Aux/1A, -12V Aux/0.375A, +12V Aux/0.375A**
- **Low noise & ripple**
- **Parallelable outputs (+12V/25A, +5V/40A, +3.3V/15A)**
- **Input-output isolation**
- **Excellent load regulation**
- **Overcurrent, Overvoltage, Over temperature protection**
- **Efficiency of 90% typical**
- **High power density**
- **Conduction cooled at card edge**
- **Conformal coating on PCB**
- **MIL-STD-461F, CE-102 compliance**
- **ENABLE*, INHIBIT* controls per VITA 62**
- **Output voltage FAIL* signal**
- **LED indication**

## OVERVIEW

The Behlman VP*Xtra*™500M series COTS DC to DC power supply is a rugged, highly reliable, conduction cooled, switch mode unit built for high-end industrial and military applications. The VP*Xtra*™500M is VITA 62, Open VPX compliant, 3U, power supply that delivers 550 Watts of DC power via six outputs. The +12V, +5V, and +3.3V output can be paralleled for higher power and redundancy. The VP*Xtra*™500M accepts 28 VDC input, IAW MIL-STD-704, and can supply a high power DC output at various power levels dependent on cooling capability.

The VP*Xtra*™500M power supply has no minimum load requirement and has overvoltage and short circuit protection as well as over current and thermal protection. The power supply is designed to support the rigors of mission critical airborne, shipboard, vehicle and mobile applications.

Designed and manufactured with *Xtra-Cooling*™ technology, *Xtra-Reliable*™ design and *Xtra-Rugged*™ construction makes the Behlman VP*Xtra*™*500M* your best choice.

### Absolute Maximum Ratings:

**(Stresses above those listed below may cause permanent damage to the unit)**

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Input Voltage | | 18 | | 36 | V |
| Input Current | | | | 38 | A |
| Operating Temperature | Measured at Card Edge | -40 | | 85 | °C |
| Storage Temperature | | -55 | | 105 | °C |
| Isolation Voltage | Input to Output | | | 500 | V |
| Isolation Voltage | Input to Case | | | 500 | V |
| Isolation Voltage | Output to Case | | | 500 | V |
| Isolation Resistance | Input to Case | 10 | | | MΩ |

## Input Characteristics:

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Operating Input Voltage Range | | 18 | 28 | 36 | V |
| Turn-On Threshold | | | 17.6 | | V |
| Turn-Off Threshold | | | 16.9 | | V |
| Input Standby Current | 28V Input, Enable De-asserted (Input Off), Inhibit Asserted (Output Off) | | 20 | | mA |
| Input Standby Current | 28V Input, Enable Asserted (Input On), Inhibit Asserted (Output Off) | | 40 | | mA |
| Input No Load Current | 28V Input, Enable Asserted (Input On) and Inhibit De-asserted (Output On) | | 750 | | mA |

## Output Characteristics, +12V/25A Output:

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | 11.80 | 12.00 | 12.17 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.05 | 0.25 | % |
| Load Regulation | (28V input) | | 0.05 | 0.25 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | 80 | 120 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 50 | $mV_{rms}$ |
| Maximum Capacitive Load | | | | 12,000 | uF |
| Output Current Range | | 0 | | 25 | A |
| Output Overvoltage Protection | | 14.2 | 14.8 | 15.4 | V |
| Output Overcurrent Protection | | 27.5 | 30 | 32.5 | A |
| Transient Response | See Figure 8 | | | | |

## Output Characteristics, +5V /40A Output:

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | 4.95 | 5.00 | 5.05 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.1 | 0.3 | % |
| Load Regulation | (28V input) | | 0.75 | 1 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | | 50 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 25 | $mV_{rms}$ |
| Maximum Capacitive Load | | | | 12,000 | uF |
| Output Current Range | | 0 | | 40 | A |
| Output Overvoltage Protection | | 5.9 | 6.1 | 6.4 | V |
| Output Overcurrent Protection | | 44 | 48 | 56 | A |
| Transient Response | See Figure 10 | | | | |

**Output Characteristics, +3.3V /15A Output:**

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | 3.267 | 3.300 | 3.333 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.1 | 0.3 | % |
| Load Regulation | (28V input) | | 0.75 | 1 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | | 50 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 25 | $mV_{rms}$ |
| Max. Capacitive Load | | | | 10,000 | uF |
| Output Current Range | | 0 | | 15 | A |
| Output Overvoltage Protection | | 4.0 | 4.3 | 4.6 | V |
| Output Overcurrent Protection | | 16.5 | 18 | 20 | A |
| Transient Response | See Figure 9 | | | | |

**Output Characteristics, -12V Aux /0.375A Output:**

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | -11.88 | -12.00 | -12.12 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.1 | 0.3 | % |
| Load Regulation | (28V input) | | 1 | 2 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | | 120 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 25 | $mV_{rms}$ |
| Output Current Range | | 0 | | 0.375 | A |
| Output Overcurrent Protection | | | 0.500 | 0.540 | A |

**Output Characteristics, +12V Aux/0.375A Output:**

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | 11.4 | 12.0 | 12.6 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.1 | 0.3 | % |
| Load Regulation | (28V input) | | 1 | 2 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | | 120 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 25 | $mV_{rms}$ |
| Output Current Range | | 0 | | 0.375 | A |
| Output Overcurrent Protection | | | 0.500 | 0.650 | A |

### Output Characteristics, +3.3V Aux/1A:

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Output Voltage Set Point | | 2.267 | 3.3 | 3.333 | V |
| Line Regulation | (18-36V input range, 100% Output Load) | | 0.1 | 0.3 | % |
| Load Regulation | (28V input) | | 0.5 | 1 | % |
| Output Ripple/Noise Peak to Peak | See Note 1 | | | 50 | mVp-p |
| Output Ripple/Noise RMS | See Note 1 | | | 25 | $mV_{rms}$ |
| Output Current Range | | 0 | | 1 | A |
| Output Overcurrent Protection | | | 1.6 | 2.2 | A |

### General Characteristics:

| Parameter | Notes | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| Power | | | 550 | | W |
| Efficiency 100% Load | +12V@25A, +3.3V@15A, +5V@40A, -12V Aux@0.375A, +12V Aux@0.375A, +3.3V Aux@ 1A, 28V Input. See Figure 14 | | 89 | | % |
| Efficiency 50% Load | +12V@12A, +3.3V@7.5A, +5V@20A , -12V Aux@.150A, +12V AUX @0.150A. +3.3V Aux @ 0.5A, $28V_{in}$ | | 90.5 | | % |
| Turn-On Delay, 3.3V output | From application of input power (ENABLE* is asserted). See Figures 2 & 3 | | 50 | | ms |
| Turn-On Delay, +12V output | From INHIBIT* de-assertion. See Figures 4 & 5. | | 80 | | ms |

### Controls and Signals (per VITA 62):

| Name | Function | Description |
|---|---|---|
| ENABLE* (Input) | Input power control | Active Low, referenced to SIG RTN. When asserted, internal input power bus is enabled |
| INHIBIT* (Input) | Output power control for +12V, +5V, +3.3V, -12V Aux and +12V Aux outputs | Active Low, referenced to SIG RTN. When asserted, +12V, +5V, +3.3V, -12V Aux and +12V Aux outputs are disabled. |
| FAIL* (Output) | Reports out of tolerance output voltages | Open Drain Output (3.3V, 20mA) external pull up required. Logic low indicates output voltage(s) out of tolerance. |

### Output Power Status vs. Input Power and Control Signals:

| Input Power | ENABLE* | INHIBIT* | +12V, +5V, +3.3V, ±12V Aux outputs | +3.3V Aux output |
|---|---|---|---|---|
| Not present | X | X | OFF | OFF |
| Present | Not asserted (high) | X | OFF | OFF |
| Present | Asserted (low) | Asserted (low) | OFF | ON |
| **Present** | **Asserted (low)** | **Not asserted (high)** | **ON** | **ON** |

**Indicators:**

| Indicator | Description |
|---|---|
| DC Status, Bi-Color LED (Red and Green) | Red LED indicates outputs off or out of range; Green LED indicates outputs on. |

**Note 1:** Ripple and noise measured at output connector, across parallel connection of 10uF tantalum and 0.1uF ceramic capacitors, 20MHz Bandwidth
**Note 2:** All measurements are performed at Nominal Input (28VDC) and at ambient temperature of 25° C, unless otherwise specified.

## Paralleling Capabilities:

All three main outputs (+12V/25A, +5V/40A and +3.3V/15A) of Behlman's VP*Xtra*™500M series power supplies can be paralleled for higher output power and redundancy with one or more VP*Xtra*™500M power supplies. See Figure 1 below for connections required.

Analog Share

- An analog signal passed via the share line for each output transmits output current information to maintain current sharing less than 3% between modules. Connecting share lines of multiple cards together enables sharing.
- Up to three modules can be paralleled in this way.
- Outputs of each voltage shared must be connected between paralleled power supplies
- Output sense lines of all paralleled cards must be connected at same point.
- Figure 1 Shows typical connection diagram for parallel operation of +12V output similar connections shall be made to parallel both the +5V and +3.3V output

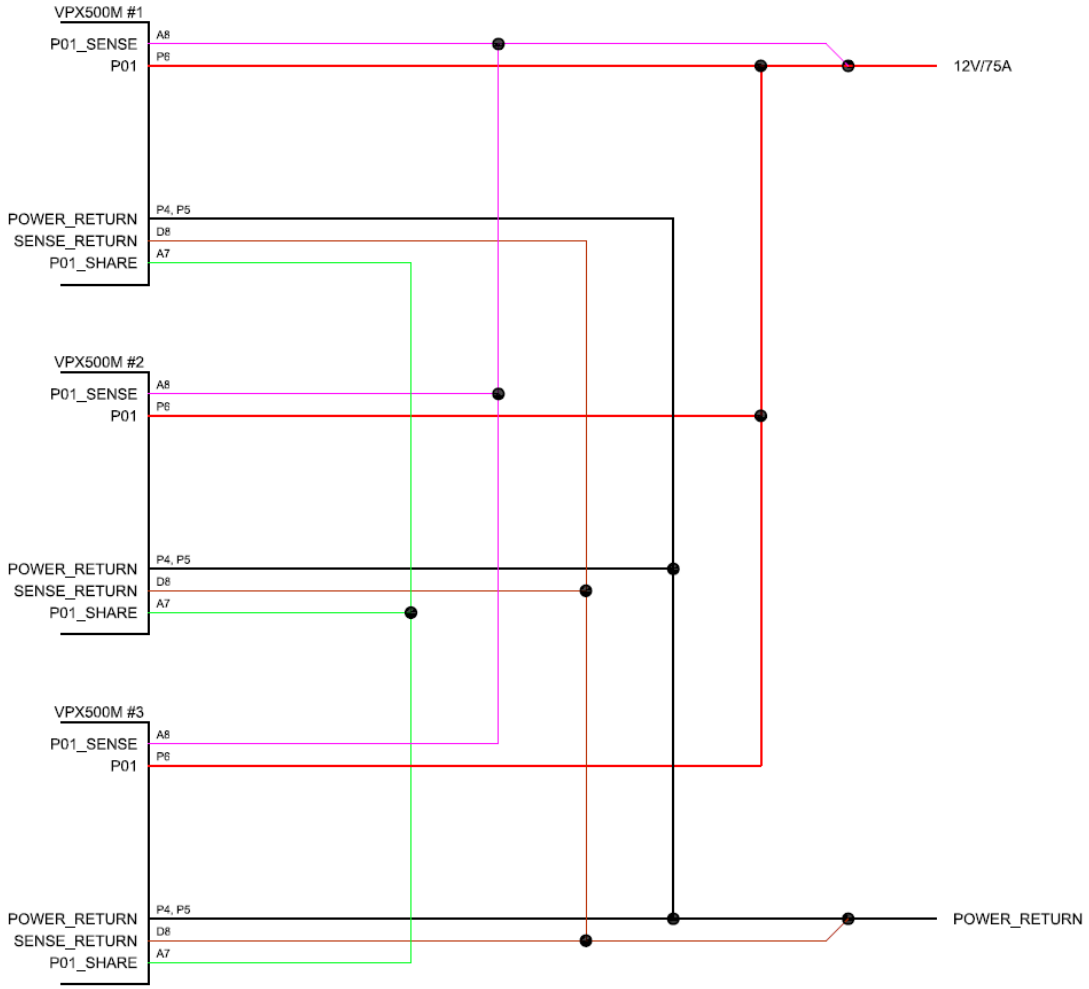



**Figure 1:** Connection Diagram for Parallel Operation of +12V Output

**Output voltages start up sequence:**

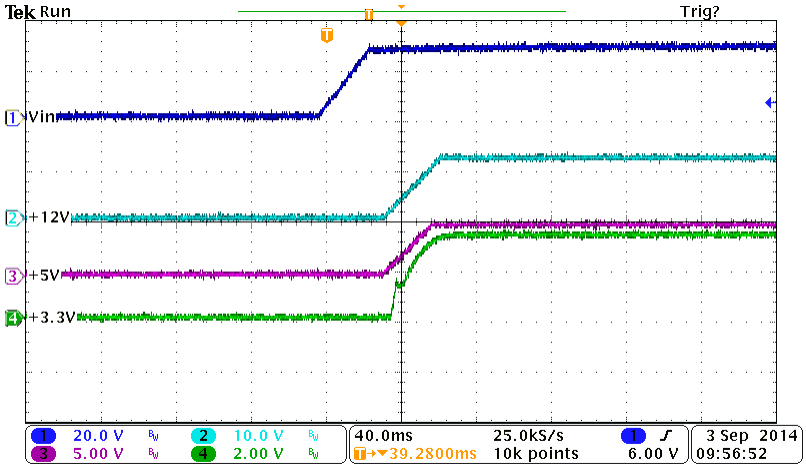



**Figure 2:** Turn-on delay from application of power, main outputs, ENABLE* asserted, INHIBIT* de-asserted

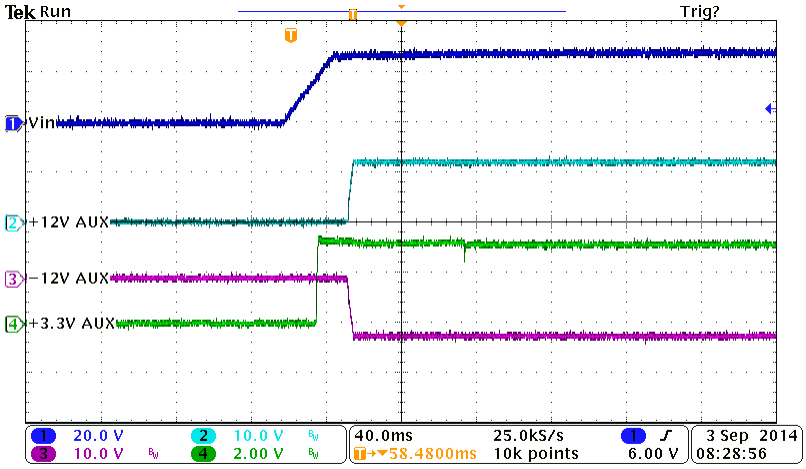



**Figure 3:** Turn-on delay from application of power, auxiliary outputs, ENABLE* asserted, INHIBIT* de-asserted

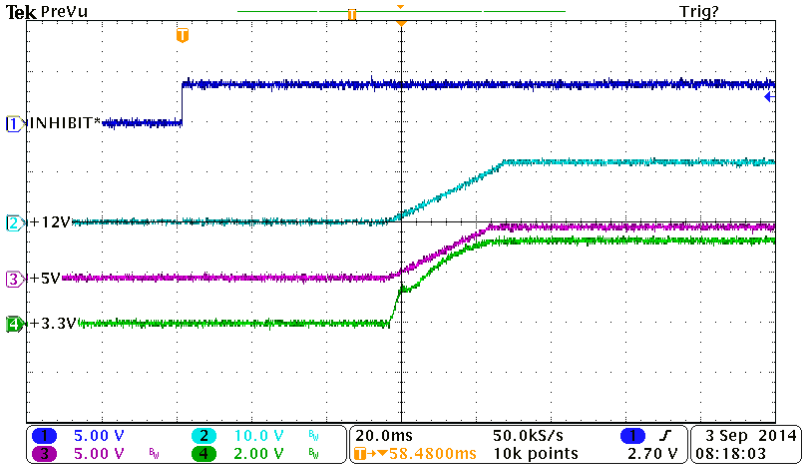



**Figure 4:** Turn-on delay from INHIBIT* de-assertion, main outputs

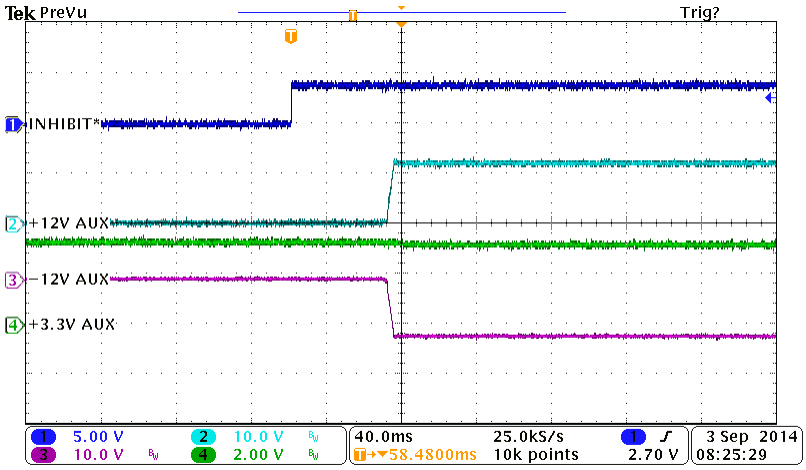



**Figure 5:** Turn-on delay from INHIBIT* de-assertion, auxiliary outputs

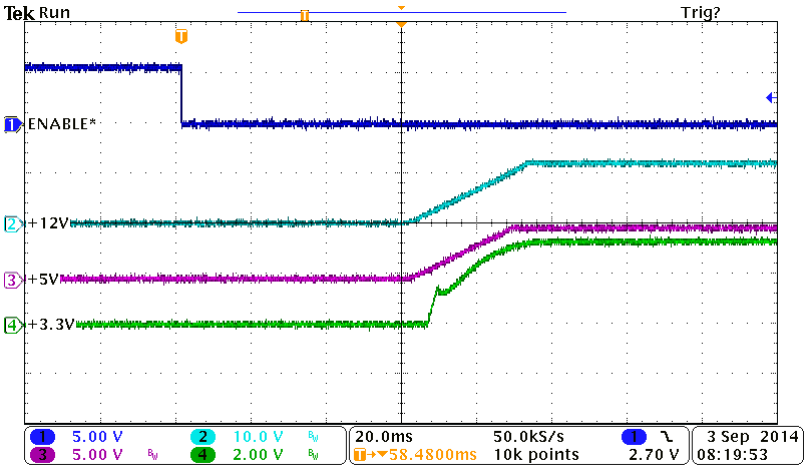



**Figure 6:** Turn-on sequence main outputs, ENABLE* asserted, INHIBIT* de-asserted

**Main outputs load transient responses:**

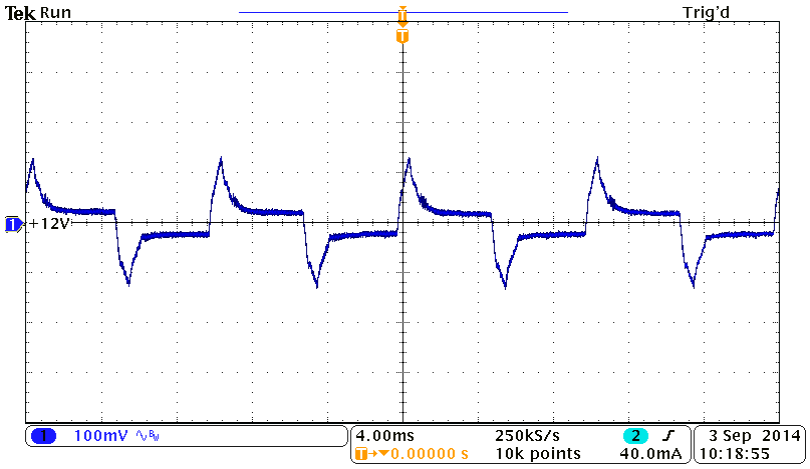



**Figure 7:** +12V output transient response, 50%-75% load change

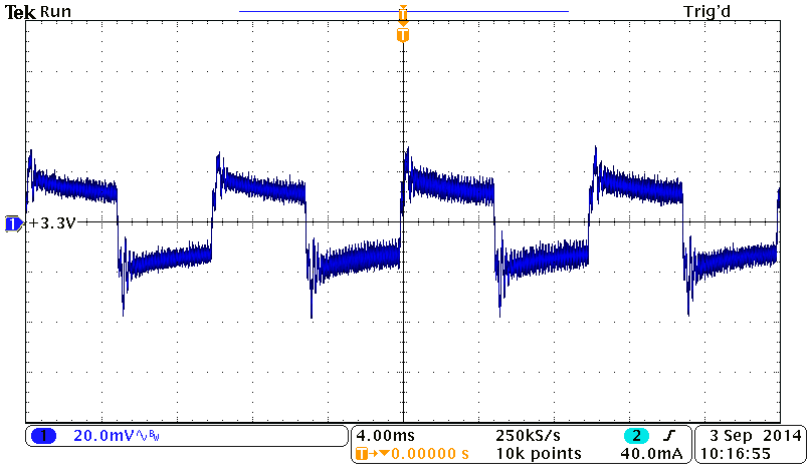



**Figure 8:** +3.3V output transient response, 50%-75% load change

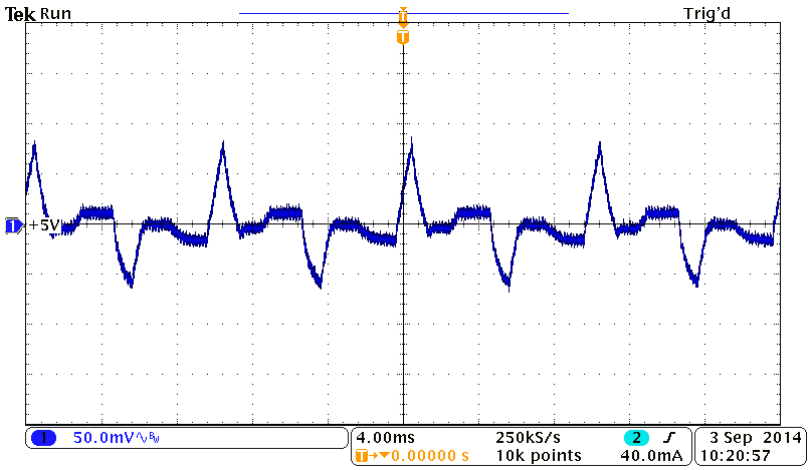



**Figure 9:** +5V output transient response, 50%-75% load change

## Main outputs over current (V-A) characteristics:

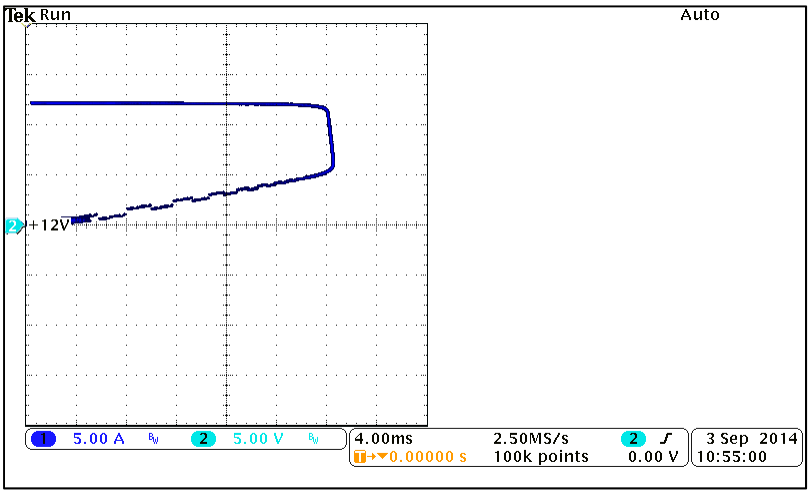



**Figure 70:** +12V Output over current characteristic

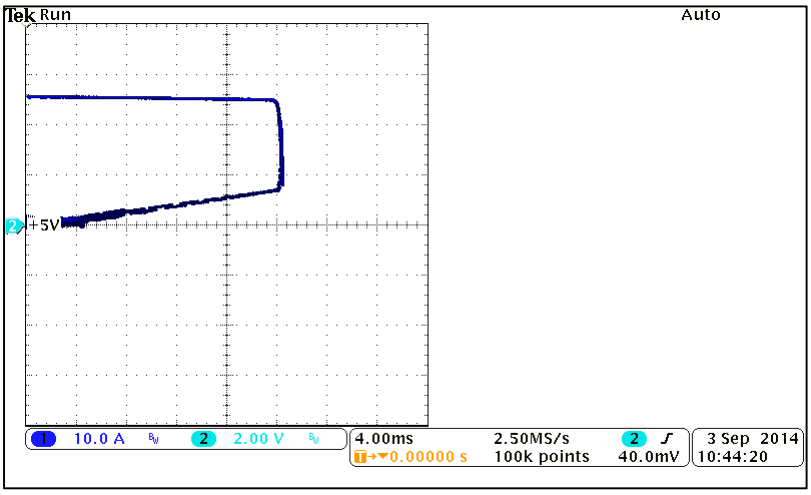



**Figure 81:** +5V Output over current characteristic

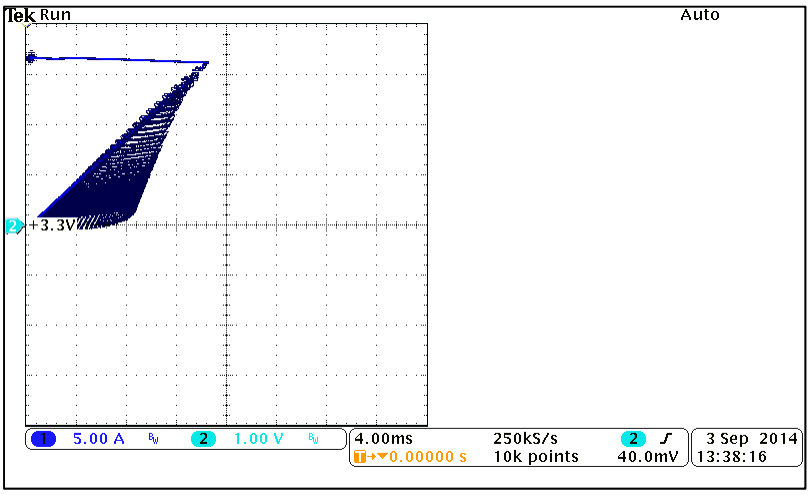



**Figure 92:** +3.3V Output over current characteristic

**Efficiency and Input current graphs:**

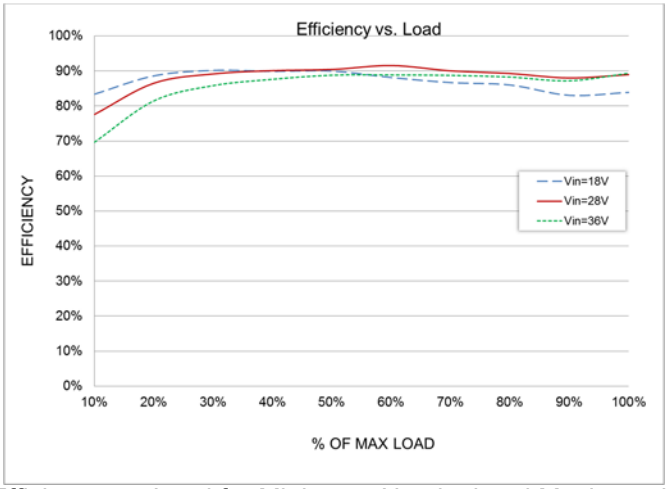



**Figure 10:** Efficiency vs. Load for Minimum, Nominal and Maximum input voltage

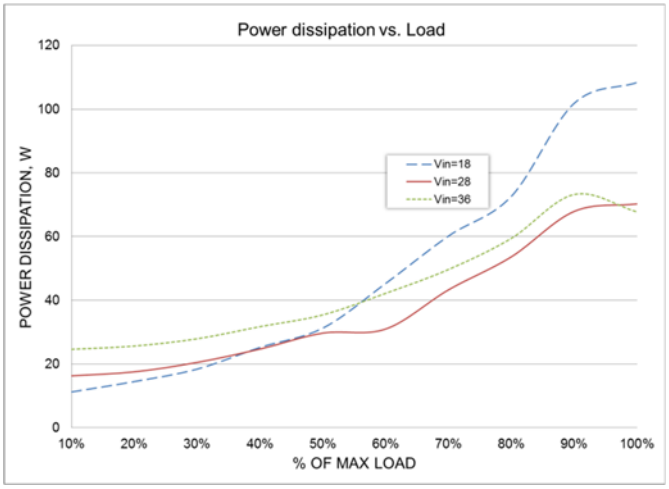



**Figure 114:** Power dissipation vs. Load for Minimum, Nominal and Maximum input voltage

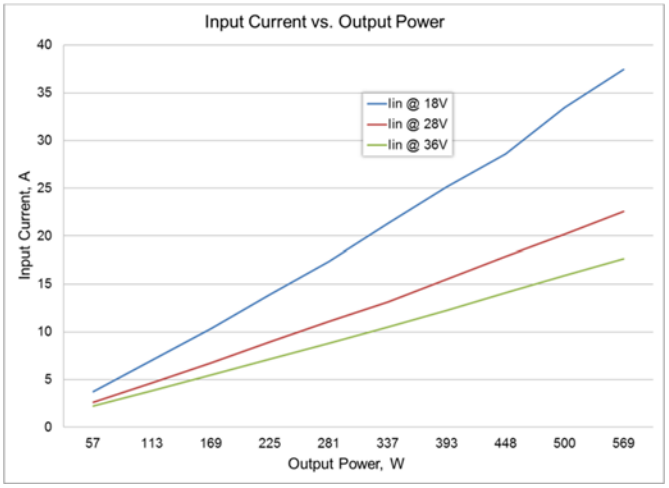



**Figure 12:** Input Current vs. Output Power

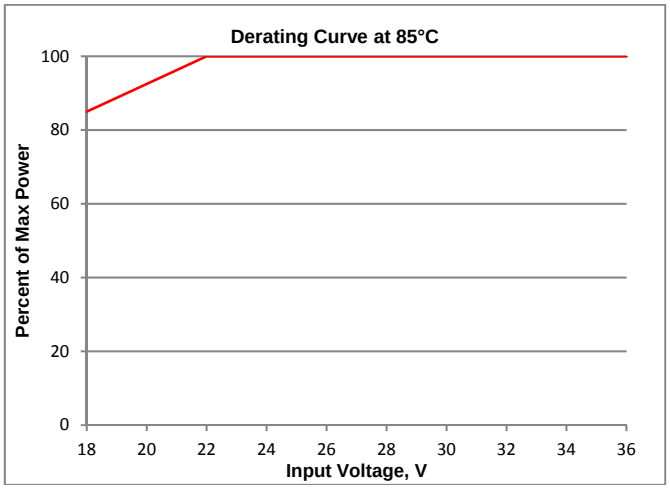



**Figure 13:** Derating curve for input voltage at 85°C

**MIL-STD-461, CE-102 Test Results**

Vin=28V, 100% Output load, No external filtering

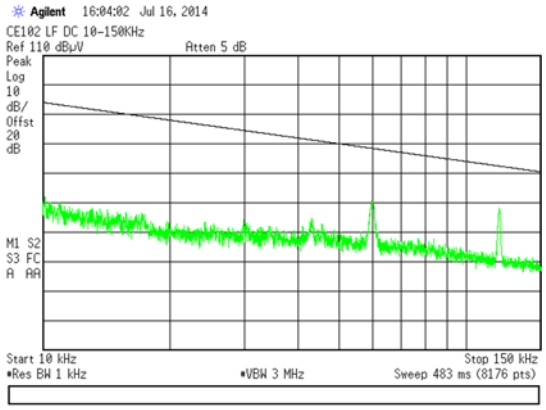



**Figure 14:** CE102 low frequency band scan

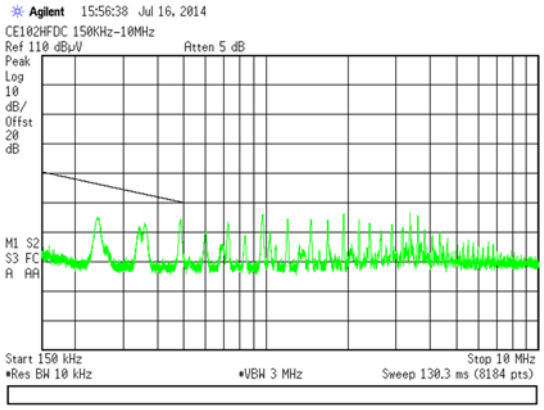



**Figure 15:** CE102 high frequency band scan

## Connector Pin Out and Descriptions:

### P0

CONNECTOR, POWER/SIGNAL
MANUFACTURER: T.E. CONNECTIVITY (TYCO).
MANUFACTURES P/N: 6450849-7

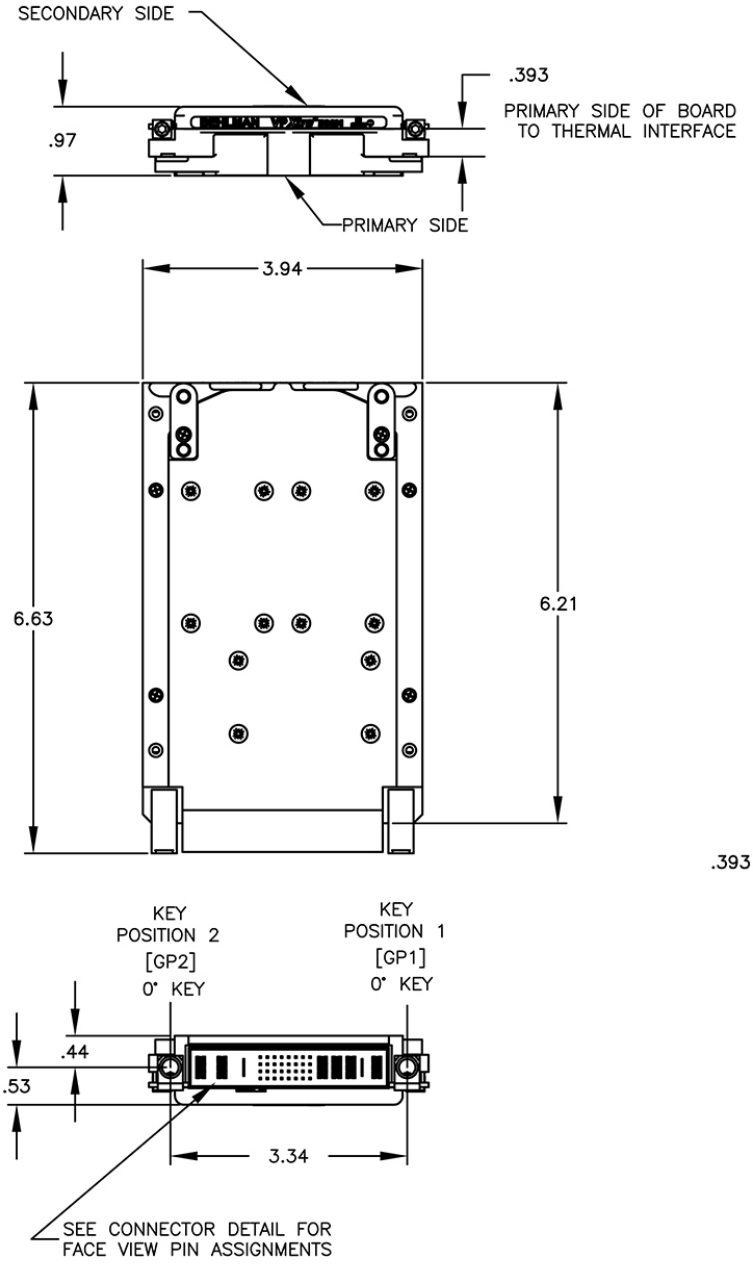
3U P0 CONNECTOR PIN OUT

| PIN NUMBER | RATED CURRENT (A) | PIN NAME | FUNCTION | COMMENTS |
|---|---|---|---|---|
| P1 | 40A | -DC_IN/ACN | INPUT POWER RTN | +28VDC NOMINAL INPUT VOLTAGE (18V TO 36V ) |
| P2 | 40A | +DC_IN/ACL | INPUT POWER POS | |
| LP1 | 20A | CHASSIS | CHASSIS | |
| A1 | <1A | UD1 | N/U | |
| B1 | <1A | UD2 | N/U | |
| C1 | <1A | UD3 | N/U | |
| D1 | <1A | UD4 | N/U | |
| A2 | <1A | VBAT | N/U | |
| B2 | <1A | FAIL* | OUTPUT VOLT MON | OPEN-DRAIN (EXTERNAL PULL-UP REQUIRED), HIGH: OK, LOW: FAULT |
| C2 | <1A | INHIBIT* | OUTPUT INHIBIT | CONNECT TO SIGNAL_RTN TO DISABLE ALL OUTPUTS EXCEPT 3.3V AUX |
| D2 | <1A | ENABLE* | INPUT ENABLE | CONNECT TO SIGNAL_RTN TO ENABLE INPUT POWER |
| A3 | <1A | UD0 | N/U | |
| B3 | <1.5A | +12_AUX | +12V AUX | 0.375A MAX OUTPUT CURRENT |
| C3 | <1A | NED | N/U | |
| D3 | <1A | NED_RETURN | N/U | |
| A4 | <1.5A | 3.3V_AUX | +3.3V AUX | 1A MAX TOTAL OUTPUT CURRENT |
| B4 | <1.5A | 3.3V_AUX | +3.3V AUX | |
| C4 | <1.5A | 3.3V_AUX | +3.3V AUX | |
| D4 | <1.5A | 3.3V_AUX | +3.3V AUX | |
| A5 | <1A | GA0* | N/U | |
| B5 | <1A | GA1* | N/U | |
| C5 | <1A | SM0 | N/U | |
| D5 | <1A | SM1 | N/U | |
| A6 | <1A | SM2 | N/U | |
| B6 | <1A | SM3 | N/U | |
| C6 | <1.5A | -12V_AUX | -12V AUX | 0.375A MAX TOTAL OUTPUT CURRENT |
| D6 | <1A | SYSRESET* | N/U | |
| A7 | <1A | PO1_SHARE | +12V SHARE | +12V OUTPUT (PO1) CURRENT SHARE BUS |
| B7 | <1A | PO2_SHARE | +3.3V SHARE | +3.3V OUTPUT (PO2) CURRENT SHARE BUS |
| C7 | <1A | PO3_SHARE | +5V SHARE | +5V OUTPUT (PO3) CURRENT SHARE BUS |
| D7 | <1A | SIGNAL_RETURN | SIGNAL RETURN | RETURN PATH FOR ALL CONTROL SIGNALS |
| A8 | <1A | PO1_SENSE | +12V SENSE | CONNECT TO PO1 |
| B8 | <1A | PO2_SENSE | +3.3V SENSE | CONNECT TO PO2 |
| C8 | <1A | PO3_SENSE | +5V SENSE | CONNECT TO PO3 |
| D8 | <1A | SENSE_RETURN | SENSE RETURN | CONNECT TO POWER RETURN AT COMMON POINT |
| P3 | 40A | PO3 | +5V | 40A MAX |
| P4 | 40A | POWER_RETURN | POWER RETURN | POWER RETURN FOR ALL OUTPUTS |
| P5 | 40A | POWER_RETURN | POWER RETURN | |
| LP2 | 20A | PO2 | +3.3V | 12A MAX |
| P6 | 40A | PO1 | +12V | 25A MAX |

| PART NUMBER | ROWS | | POWER | | | SIGNAL | | | | | | | | POWER | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P1 | P2 | LP1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | P3 | P4 | P5 | LP2 | P6 |
| 6450849-7 | D | | TT | TT | LT | Z5 | Z5 | Z5 | Z5 | Z5 | Z5 | Z5 | Z5 | TT | TT | TT | LT | TT |
| | C | | | | | Y5 | Y5 | Y5 | Y5 | Y5 | Y5 | Y5 | Y5 | | | | | |
| | B | | | | | R5 | R5 | R5 | R5 | R5 | R5 | R5 | R5 | | | | | |
| | A | | | | | O5 | O5 | O5 | O5 | O5 | O5 | O5 | O5 | | | | | |
| 2ACP+1LP+32S+3HDP+1LP+1HDP | | | | | | | | | | | | | | | | | | |

CONNECTOR FACE VIEW DETAIL

## Mechanical Dimensions:



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