

# VPXtra™ 500M1 Data Sheet

## P/N 94089-1

### FEATURES

- Open VPX VITA 62 compliant
- 3U VPX, 1.0" pitch single slot
- Wide input range: 18-36V
- Input transient protection
- Two high power DC outputs: +12V/25A, +5V/80A, +3.3V/15A
- Multiple auxiliary DC outputs: +3.3V Aux/1A, -12V Aux/0.375A, +12V Aux/0.375A
- Low noise & ripple
- Parallelable outputs (+5V/80A, +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 VPXtra™500M1 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 VPXtra™500M1 is VITA 62, Open VPX compatible, 3U, power supply that delivers 460 Watts of DC power via six outputs. The +12V, +5V, and +3.3V output can be paralleled for higher power and redundancy. The VPXtra™500M1 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 VPXtra™500M1 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 VPXtra™500M1 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, +5V /80A Output (VS1 &VS3):

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 <sub>rms</sub>
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 <sub>rms</sub>
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 <sub>rms</sub>
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 <sub>rms</sub>
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		3.267	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 <sub>rms</sub>
Output Current Range		0		1	A
Output Overcurrent Protection			1.6	2.2	A

## General Characteristics:

Parameter	Notes	Min	Typical	Max	Units
Power			460		W
Efficiency 100% Load	+3.3V@15A, +5V@80A, -12V Aux@0.375A, +12V Aux@0.375A, +3.3V Aux@ 1A, 28V Input. See Figure 14		89		%
Efficiency 50% Load	+3.3V@7.5A, +5V@40A, -12V Aux@.150A, +12V AUX @0.150A. +3.3V Aux @ 0.5A, 28V <sub>in</sub>		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*	+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
<b>Present</b>	<b>Asserted (low)</b>	<b>Not asserted (high)</b>	<b>ON</b>	<b>ON</b>

## 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

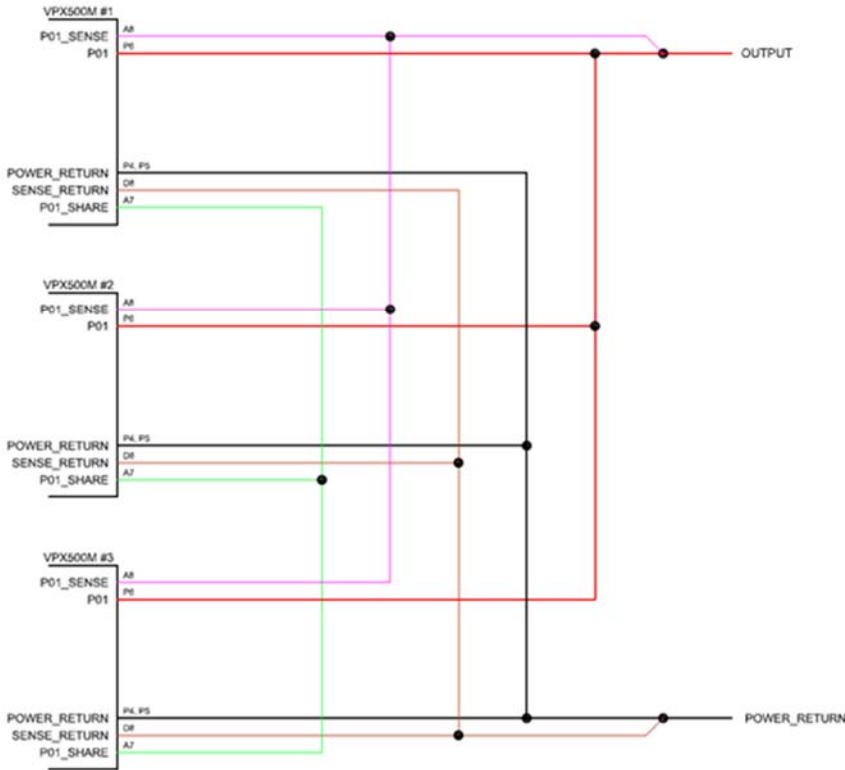
**Note 2:** All measurements are performed at Nominal Input (28VDC) and at ambient temperature of 25° C, unless otherwise specified.

**Paralleling Capabilities:**

Both main outputs (+5V/80A and +3.3V/15A) of Behlman’s VPXtra™500M1 series power supplies can be paralleled for higher output power and redundancy with one or more VPXtra™500M series power supplies. See Figure 1 below for connections required.

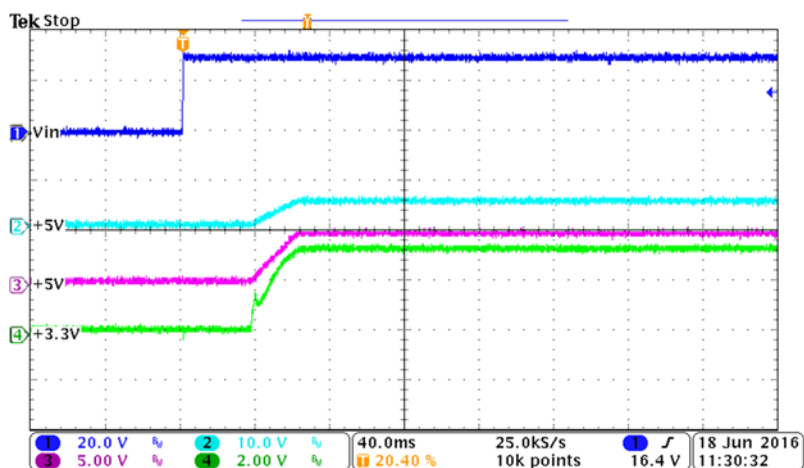
Analog Share

- 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 +5V output similar connections shall be made to parallel the +3.3V output

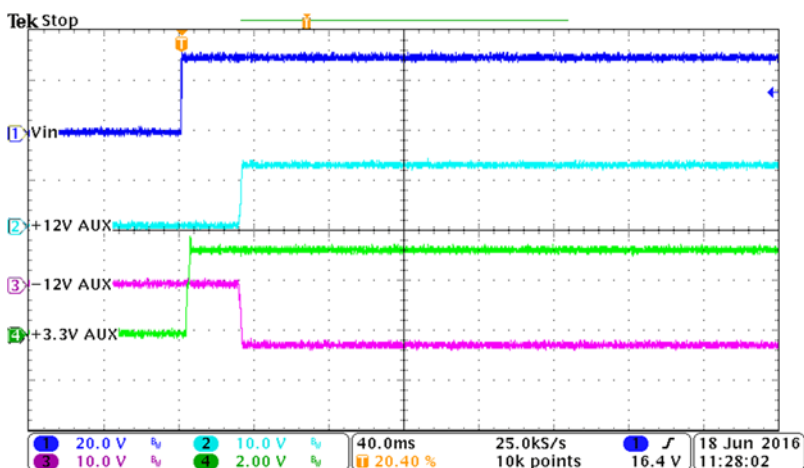


**Figure 1:** Connection Diagram for Parallel Operation of +5 V Output

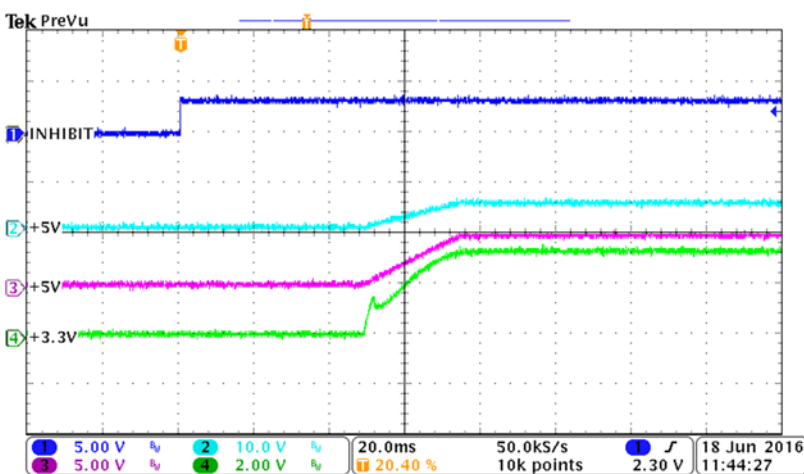
Output voltages start up sequence:



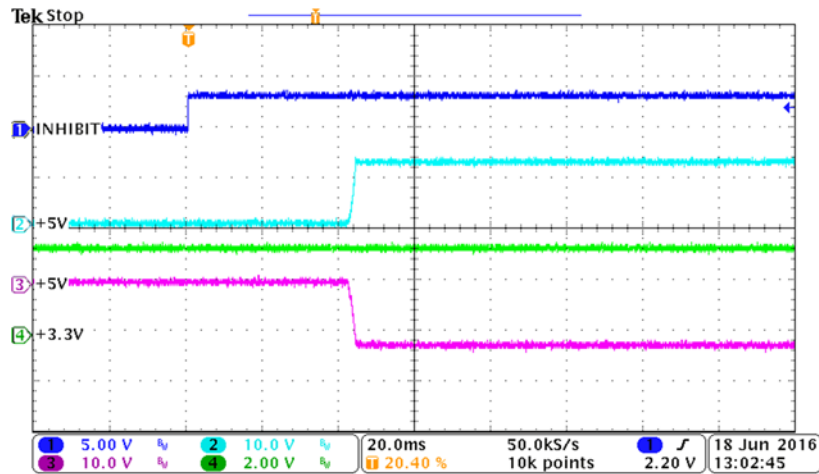
**Figure 2:** Turn-on delay from application of power, main outputs, ENABLE\* asserted, INHIBIT\* de-asserted



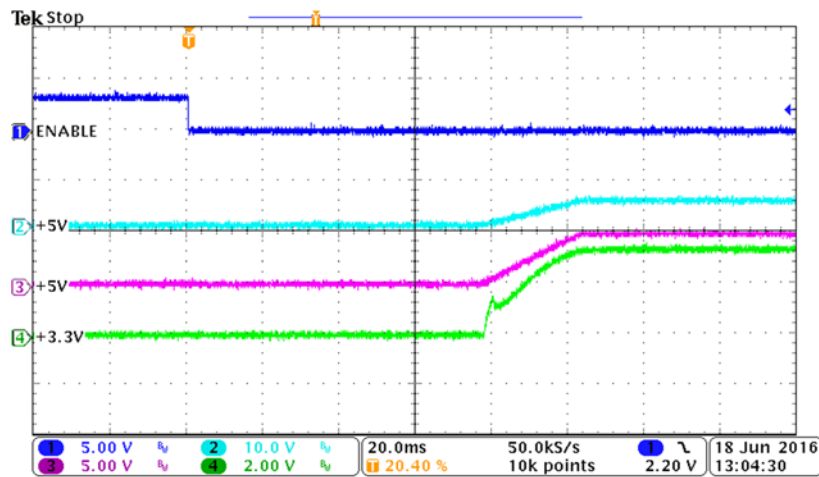
**Figure 3:** Turn-on delay from application of power, auxiliary outputs, ENABLE\* asserted, INHIBIT\* de-asserted



**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:

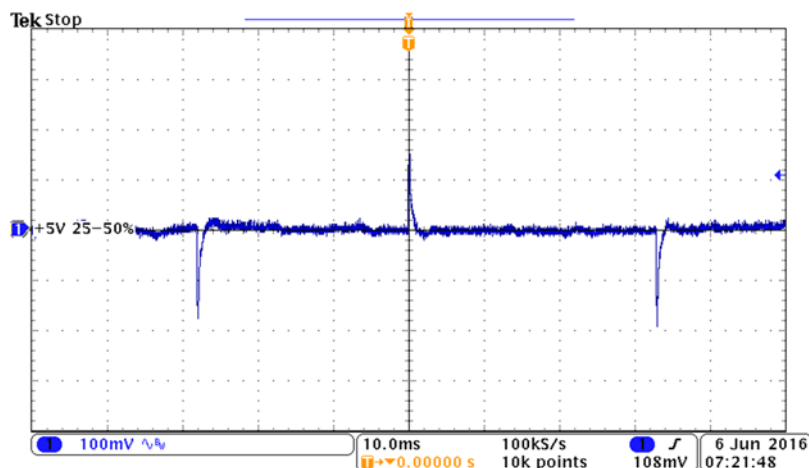


Figure 7: +5V output transient response, 50%-75% load change

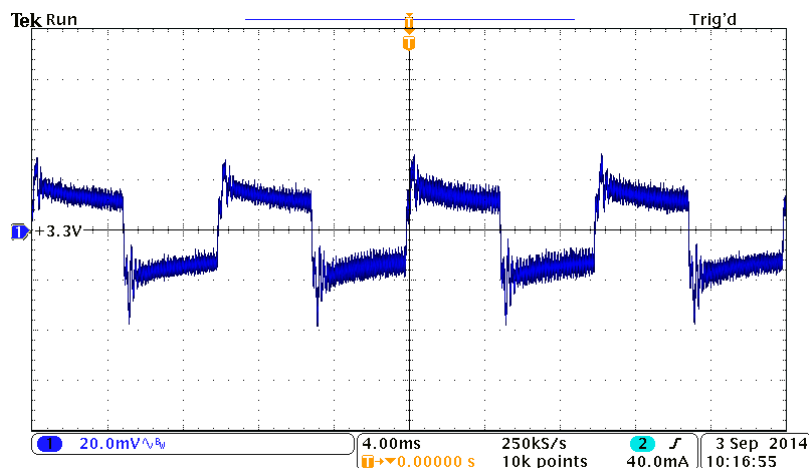


Figure 8: +3.3V output transient response, 50%-75% load change

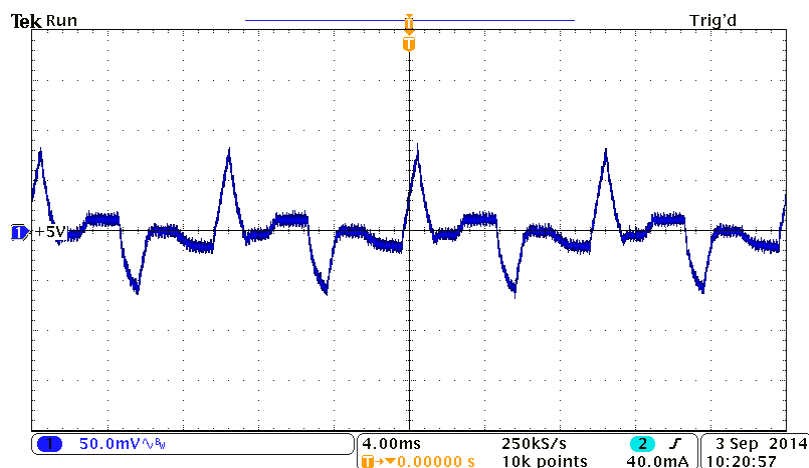


Figure 9: +5V output transient response, 50%-75% load change



Main outputs over current (V-A) characteristics:

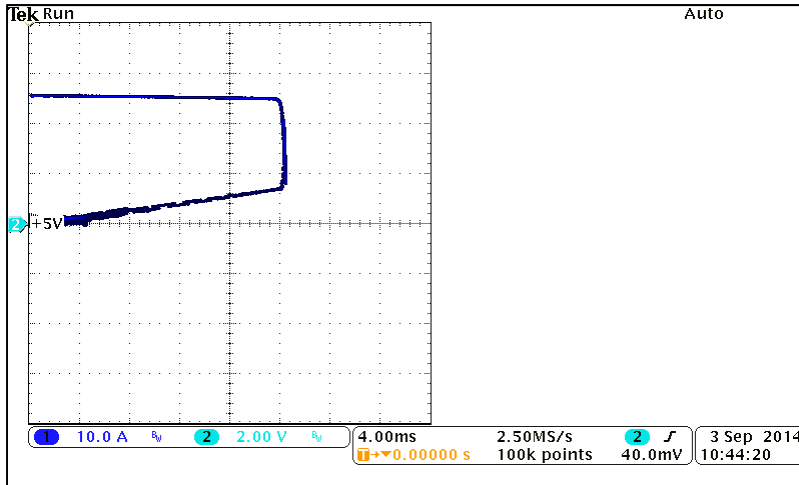


Figure 10: +5V Output over current characteristic

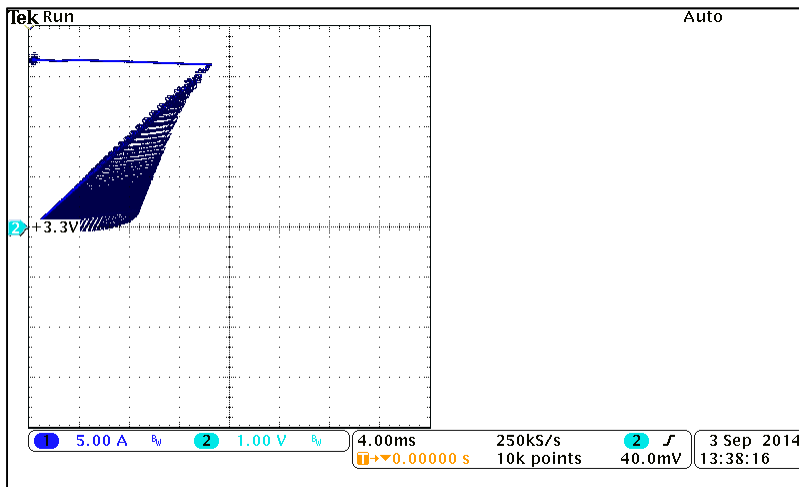
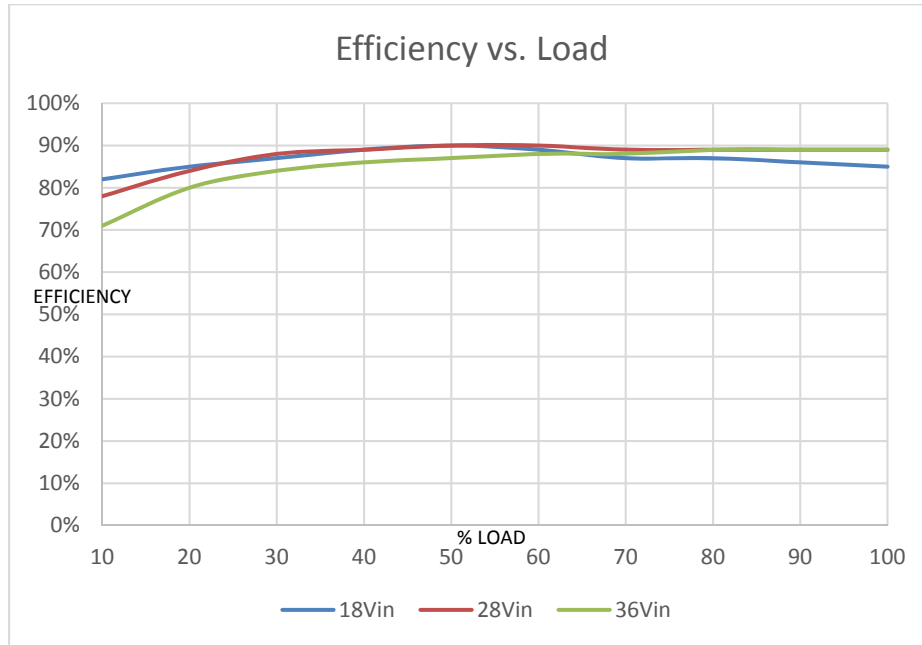
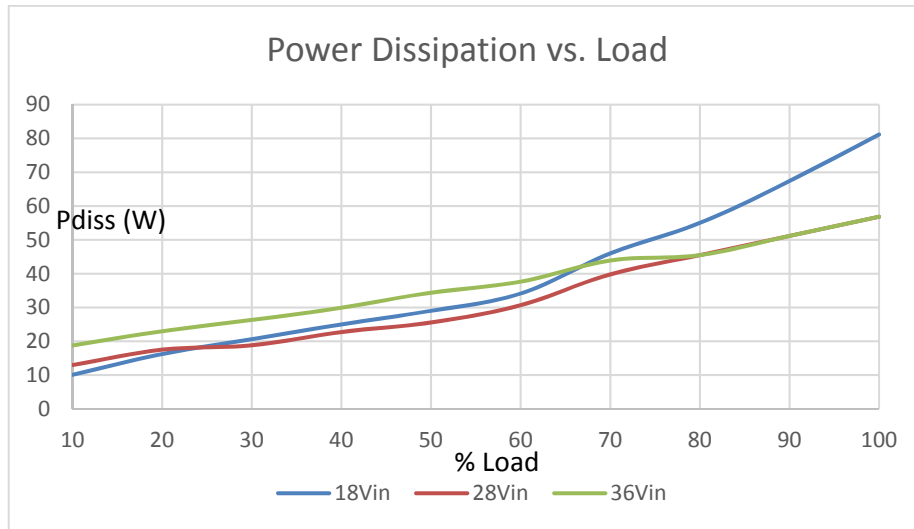


Figure 11: +3.3V Output over current characteristic

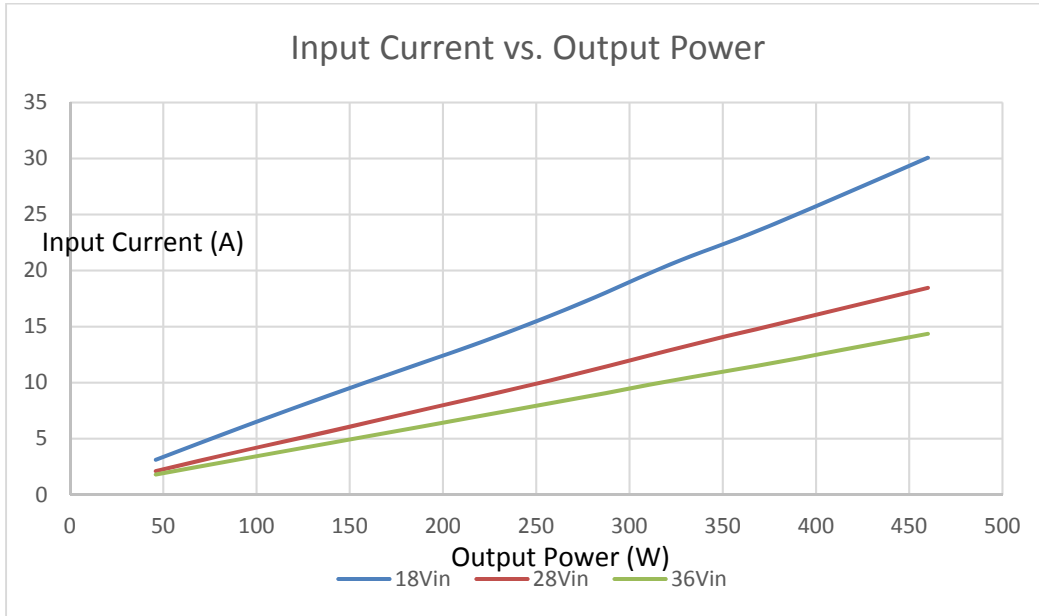
Efficiency and Input current graphs:



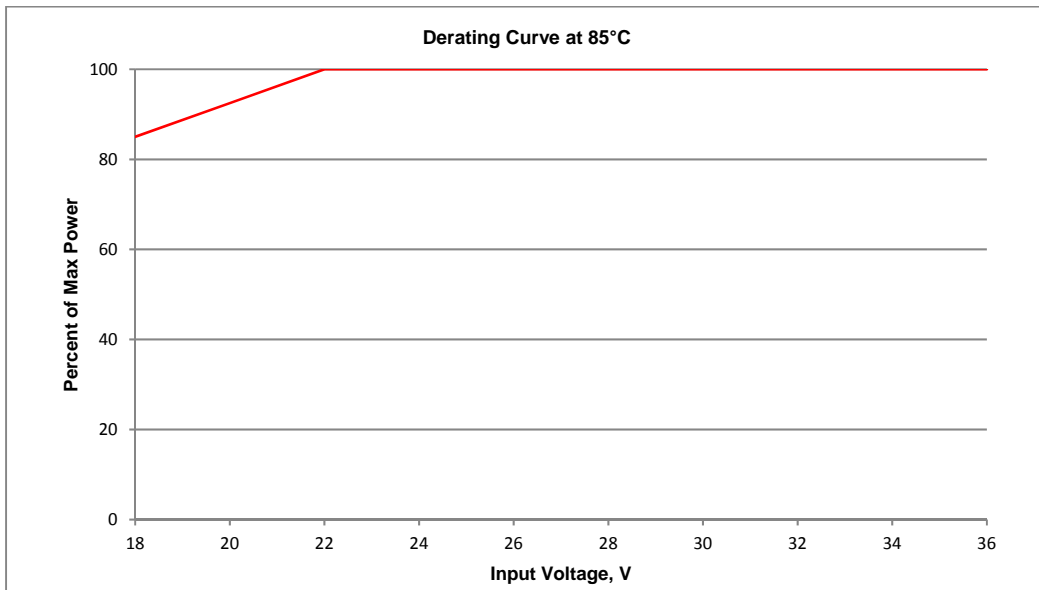
**Figure 72:** Efficiency vs. Load for Minimum, Nominal and Maximum input voltage



**Figure 83:** Power dissipation vs. Load for Minimum, Nominal and Maximum input voltage



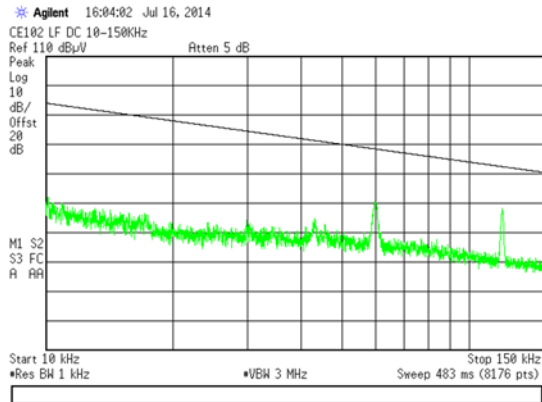
**Figure 94:** Input Current vs. Output Power



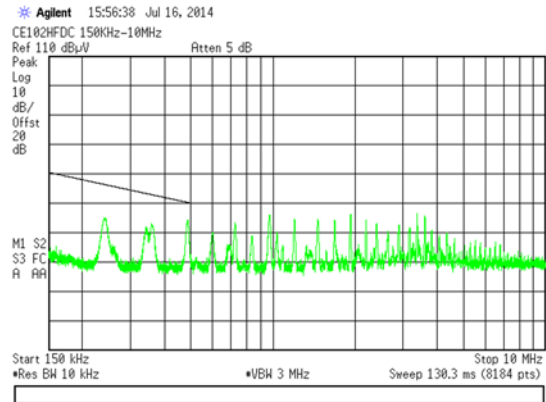
**Figure 105:** Derating curve for input voltage at 85°C

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

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



**Figure 11: CE102 low frequency band scan**



**Figure 12: CE102 high frequency band scan**

## Connector Pin Out and Descriptions:

### P0

CONNECTOR, POWER/SIGNAL  
 MANUFACTURER: T.E. CONNECTIVITY (TYCO).  
 MANUFACTURES P/N: 6450839-7

#### 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	} 1A MAX TOTAL OUTPUT CURRENT
C3	<1A	NED	N/U	
D3	<1A	NED_RETURN	N/U	
A4	<1.5A	3.3V_AUX	+3.3V AUX	
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	P01_SHARE	+5V2 SHARE	+5V2 OUTPUT CURRENT SHARE BUS CONNECT TO OTHER +5V SHARE LINES TO PARALLEL OUTPUTS
B7	<1A	P02_SHARE	+3.3V SHARE	+3.3V OUTPUT (P02) CURRENT SHARE BUS
C7	<1A	P03_SHARE	+5V1 SHARE	+5V1 OUTPUT CURRENT SHARE BUS CONNECT TO OTHER +5V SHARE LINES TO PARALLEL OUTPUTS
D7	<1A	SIGNAL_RETURN	SIGNAL RETURN	RETURN PATH FOR ALL CONTROL SIGNALS
A8	<1A	P01_SENSE	+5V2 SENSE	CONNECT TO P01
B8	<1A	P02_SENSE	+3.3V SENSE	CONNECT TO P02
C8	<1A	P03_SENSE	+5V1 SENSE	CONNECT TO P03
D8	<1A	SENSE_RETURN	SENSE RETURN	CONNECT TO POWER RETURN AT COMMON POINT
P3	40A	P03	+5V1	40A MAX, PARALLEL WITH +5V2 FOR 80A MAX USING P01 SHARE AND P03 SHARE,SEE NOTES 5&6
P4	40A	POWER_RETURN	POWER RETURN	POWER RETURN FOR ALL OUTPUTS
P5	40A	POWER_RETURN	POWER RETURN	
LP2	20A	P02	+3.3V	15A MAX
P6	40A	P01	+5V2	40A MAX, PARALLEL WITH +5V1 FOR 80A MAX USING P01_SHARE AND P03_SHARE,SEE NOTES 5&6

PART NUMBER	ROWS	POWER			SIGNAL								POWER					
		P1	P2	LP1	1	2	3	4	5	6	7	8	P3	P4	P5	LP2	P6	
6450839-7	D C B A	TT	TT	LT	Z5	Z5	Z5	Z5	Z5	Z5	Z5	Z5	TT	TT	TT	LT	TT	
		Y5	Y5	Y5	Y5	Y5	Y5	Y5	Y5	Y5	Y5	Y5	TT	TT	TT	LT	TT	
		R5	R5	R5	R5	R5	R5	R5	R5	R5	R5	R5	TT	TT	TT	LT	TT	
		O5	O5	O5	O5	O5	O5	O5	O5	O5	O5	O5	TT	TT	TT	LT	TT	

2ACP+1LP+32S+3HDP+1LP+1HDP

## CONNECTOR FACE VIEW DETAIL

**Mechanical Dimensions:**

