



VPX 3U CONDUCTION COOLED LOAD CARD  
User Manual

# Table of Contents

## Contents

Introduction .....	1
Product Features .....	1
Front Panel Control & Monitoring .....	2
Side Panel Control & Monitoring .....	3
Operating Instructions .....	4
a. Go-No-Go LEDs .....	4
b. External Voltage Measurements .....	5
c. Remote Load Control .....	6
d. Remote Voltage/Signal Monitoring .....	7
e. Temperature Monitoring .....	8
f. Over-Temperature Protection .....	9

## Appendix

VPX 3U Module Connector Pin Diagrams .....	9-10
Power Wafer Current Ratings .....	11

## Introduction

### Introduction

In a given system platform, there is a general need of a hardware that can test the power handling and dissipation capabilities within a given environment. Keeping this in mind Elma Electronic Inc. has developed a Conduction Cooled Load Card in 3U form factor to test the conduction cooled VPX based system platforms.

VPX 3U Conduction Cooled Load Card gives a step loading capability to the user to test the VPX based system power supplies under a given environment. It can act as a thermal load to evaluate the system's thermal performance. The user can either monitor the power supply voltage at various loads by monitoring the Go-No-Go LEDs on the front panel or perform an external measurement with a multimeter or scope.

The VPX 3U Conduction Cooled Load Card will simply be referred to as Load Card from here onwards.

### Product Features

The Load Card is built around the electronic load elements as compared to traditional resistive load approach. The loads are BJT based constant current sources. This allows for the high power load elements to fit in a compact space. Given below is the list of features of the Load Card.

- A total load capacity of 90W is provided using six VPX voltages.
- A stepped load control is provided by user accessible jumpers on the side of the Load Card.
- Six visual bicolor Go-No-Go LEDs for Vs1=12V, Vs2=3.3V, Vs3=5V, +12V\_Aux, -12V\_Aux and 3.3V\_Aux are provided.
- Seven test point outputs are provided to monitor the voltage externally via a multimeter or a scope. SYSRESET signal is provided on a separate test point.
- Two K-Type thermocouple outputs are provided on high density DSUB-15 to monitor temperature of thermal management interfaces independently.
- The above mentioned seven test point outputs are also provided on high density DSUB-15 connector for remote monitoring.
- Remote control of the electronic load elements using external voltage source is provided.
- Operating temperature range is between -40°C to 70°C.
- Built in over-temperature protection.
- The design is based on the ANSI/VITA 46.0 and the ANSI/VITA 48.2 specification.
- The Load Card has 5HP pitch.
- The Load Card has 4HP pitch to enable testing of both 4HP and 5HP pitch backplane/enclosure designs.

### Front/Side Panel Control and Monitoring

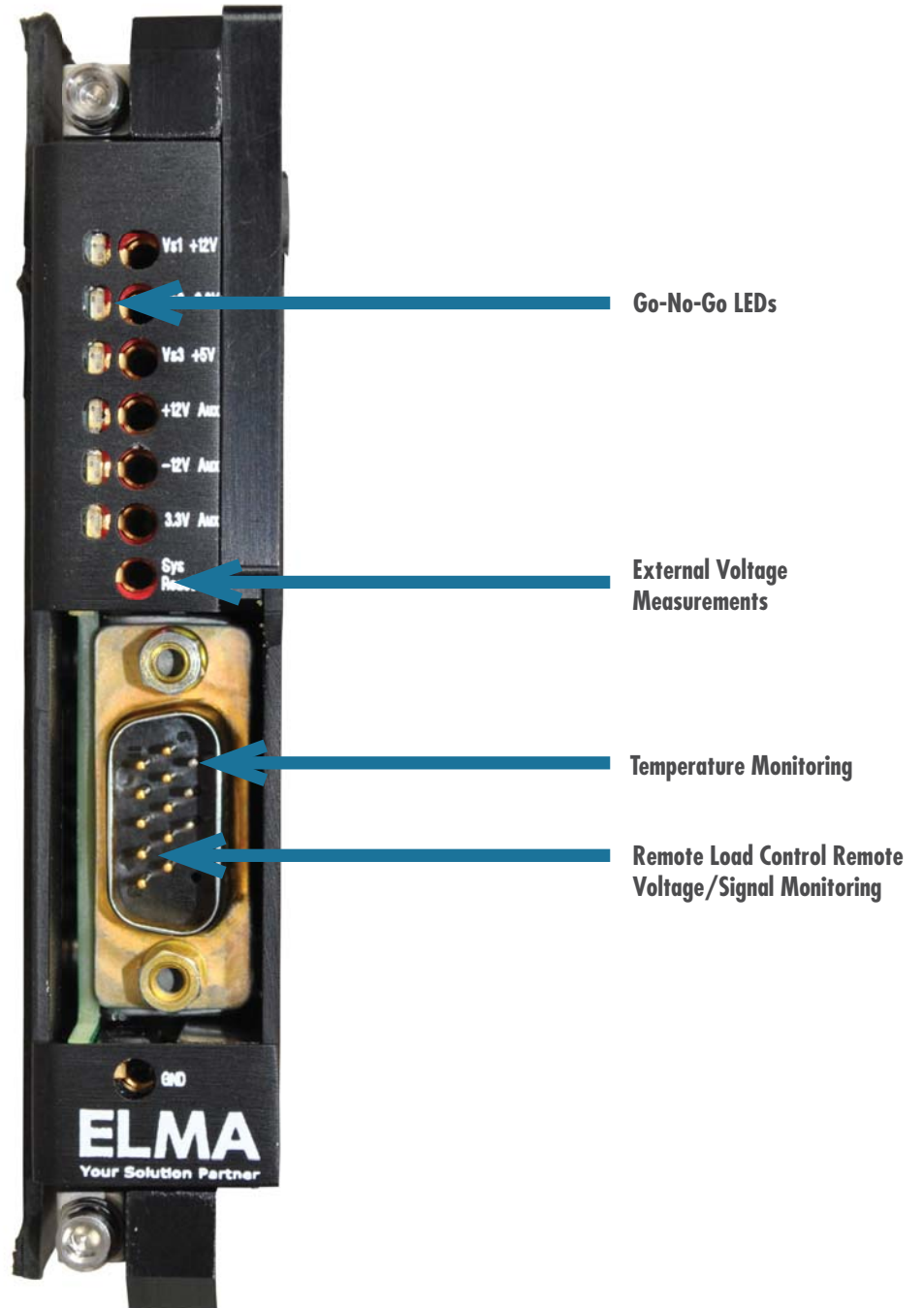
Based on the Load Card functionality the front panel controls can be grouped in six categories as shown in figure 1 and figure 2.

- Go-No-Go LEDs
- External Voltage Measurements
- Temperature Monitoring
- Remote Load Control
- Remote Voltage/Signal Monitoring
- Local Load Stepping

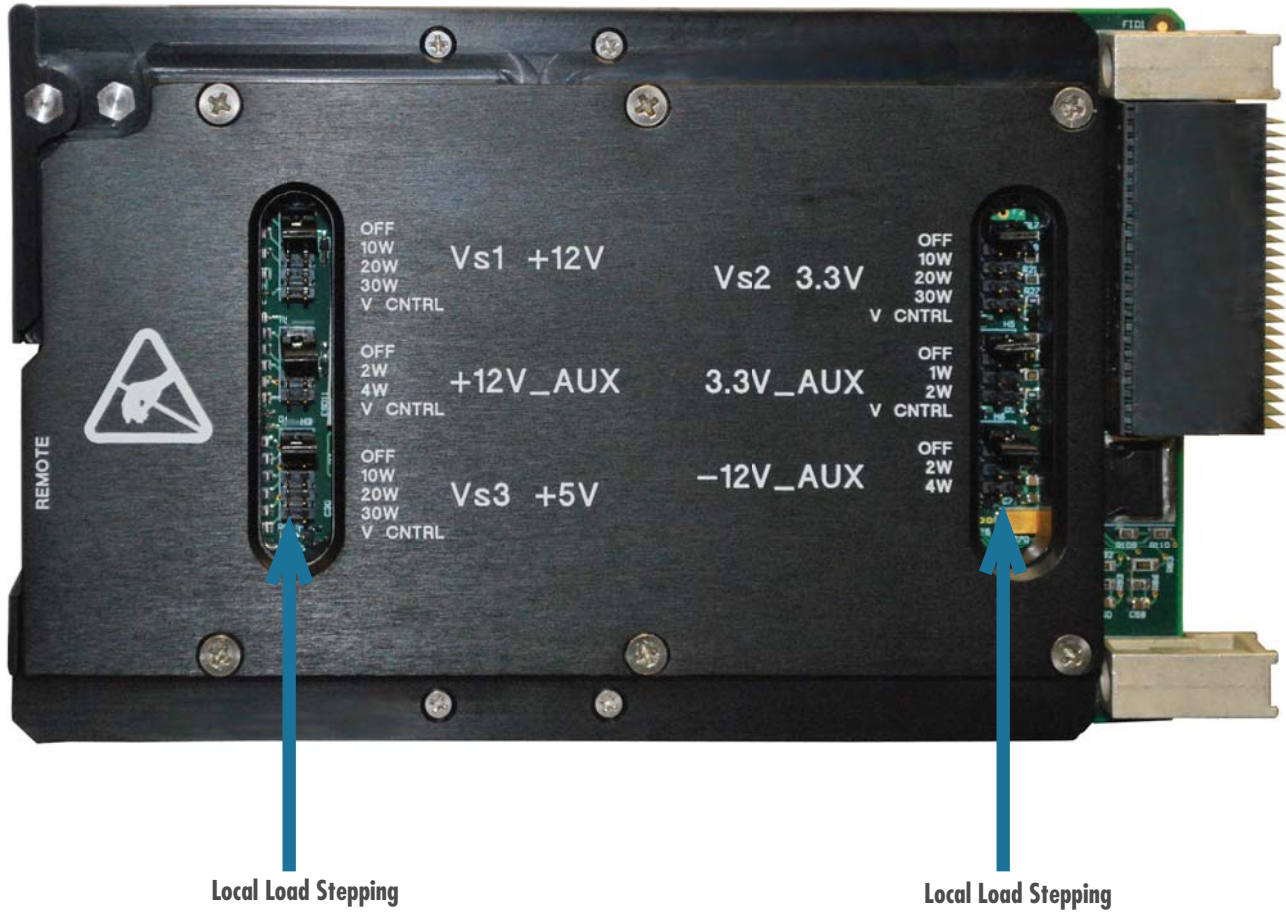


**CAUTION**

Load card is an ESD sensitive hardware. Use ESD protection during handling.



**Figure 1**



**Figure 2**

The operation of the Load Card is described based on the grouping of the control and monitoring sections shown in Figure 1 and Figure 2.

## Go-No-Go LEDs

The Load Card has an 8-bit microcontroller based circuit to monitor the six VPX voltages. The microcontroller continuously monitors the voltages and compares them against the minimum and maximum limits set in the software. If any of the six VPX system voltages are out of range then the corresponding Go-No-Go LED will go RED. If all the voltages are within the range then the corresponding Go-No-Go LEDs will be GREEN. Table 3 below indicates the valid voltage limits on all six VPX supplies per ANSI/VITA 46.0 specification. Table 1 below indicates the voltage limits.

Front Panel VPX PSU Voltage Designators	Voltage Lower Limit	Voltage Upper Limit
Vs1 12V	11.4V	12.6V
Vs2 3.3V	3.45V	3.25V
Vs3 5V	4.875V	5.25V
+12V_Aux	11.4V	12.6V
-12V_Aux	-12.6V	-11.4V
3.3V_Aux	3.135V	3.465V

**Table 1**

## External Voltage Measurements

The test points provided on the front panel provides the voltage measurement points for all the six VPX voltages. There are total eight test points. Six test points are for voltage measurements and the seventh test point is provided to monitor the SYSRESET signal. The eighth test jack is the GND reference for all the test points. Table 2 below shows the nominal voltage outputs on the test points.

Front Panel VPX Voltage Designators	Voltage Lower Limit	Voltage Nominal	Voltage Upper Limit
Vs1 12V	11.4V	12V	12.6V
Vs2 12V	11.4V	12V	12.6V
Vs3 5V	4.875V	5V	5.25V
+12V_Aux	11.4V	12V	12.6V
-12V_Aux	-12.6V	-12V	-11.4V
3.3V_Aux	3.135V	3.3V	3.465V
SYSRESET	N/A	2.94V	N/A

**Table 2**

*Note: The voltage output limits are defined by ANSI/VITA 46.0.*

The size of the test points is selected to mate with the standard Fluke multimeter probes.

## Local Load Stepping

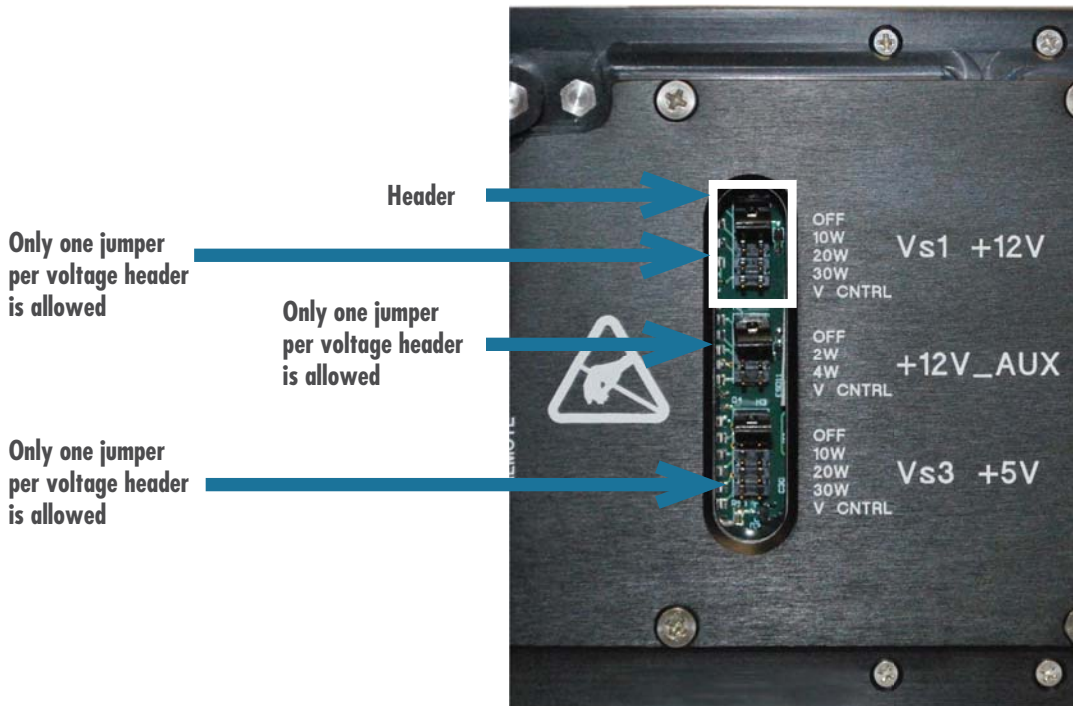
Local Load Stepping jumpers allows the loading of each of the six VPX voltages independently. One jumper is provided for each header to ensure that only one step is set at a time for each supply header. Table 3 below provides all the load values at each header location when the jumper is placed on it.

VPX Voltage Name	OFF Jumper	10W Jumper	20W Jumper	30W Jumper
Vs1+12V	0W	10W	20W	30W
Vs2+3.3V	0W	10W	20W	
Vs3+5V	0W	10W	20W	30W
	OFF Jumper	2W Jumper	4W Jumper	
+12V_Aux	0W	2W	4W	
-12V_Aux	0W	2W	4W	
	OFF Jumper	1W Jumper	2W Jumper	
3.3V_Aux	0W	1W	2W	

**Table 3**

For example, to set a load of 30W on voltage Vs1= +12V, first locate the header next to silkscreen marking Vs1 +12V. Then insert the jumper in the location labeled 30W. If no load is needed on the voltage Vs1 +12V then the jumper should be inserted in the location labeled OFF.

**Warning: Placing multiple jumpers on any header can damage the electronic load.**



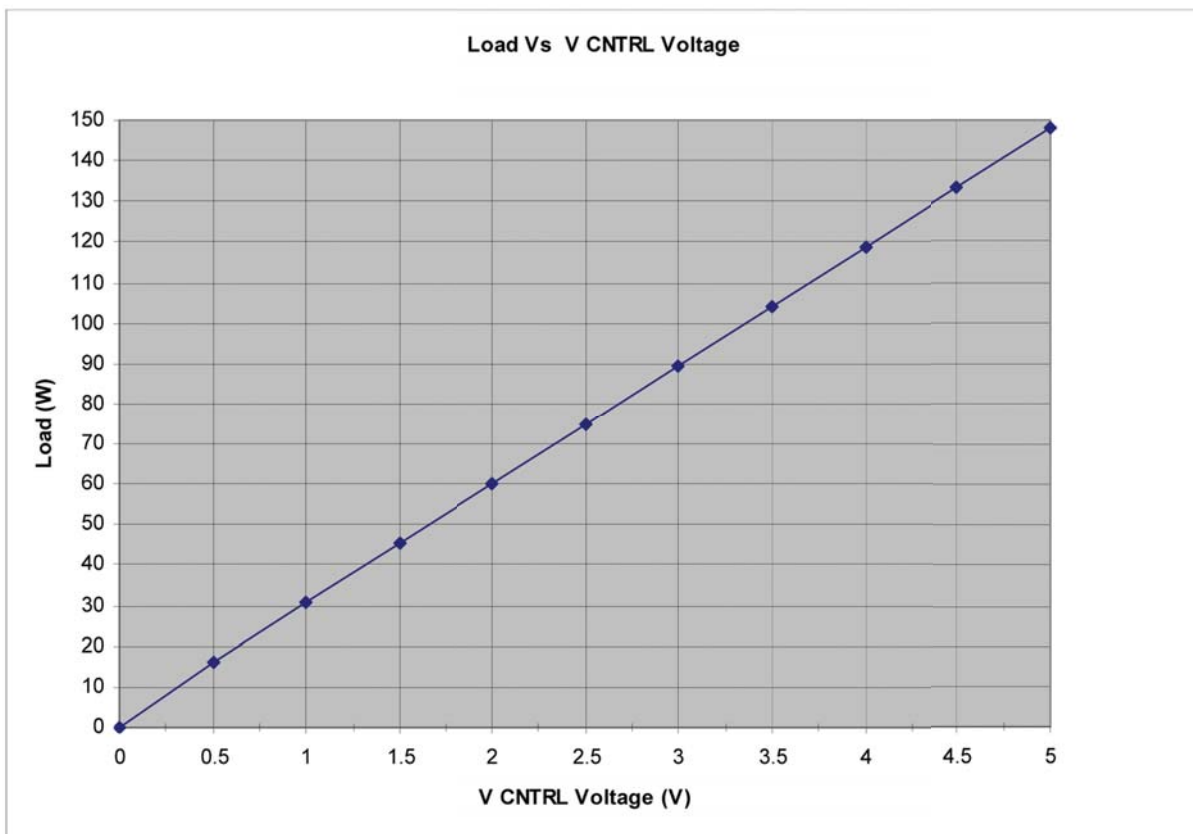
**Figure 3**

## Remote Load Control

Along with Local Load Stepping an option to remotely control the loads via external voltage is provided. This option is provided to test an enclosed chassis where there will be no access to Local Load Stepping jumpers. This control provides variable wattage steps anywhere from 0W to 86W using external voltage source.

In order to use the remote load control feature, set the Local Load Stepping jumpers labeled V CNTRL for all the VPX supply voltages that need to be remotely controlled. Local Load Stepping on the VPX supplies that are not set for remote control can still work in local mode. Connect an external 0V to 5V variable PSU to pins 14 and 15 on high density DBSUB-15, where pin 14 connects to the GND, and pin 15 connects to the positive voltage. The external PSU should be able to source 20mA of current per load card. The graph in figure 3 shows the relationship between the load wattage and V CNTRL voltage.

*Warning: Applying more than 5V to V CNTRL can overheat and damage the loads.*



**Figure 4**

*Note: The -12V\_Aux supply is not available for remote control but can be used in local mode during remote control.*

## Remote Voltage/Signal Monitoring

VPX supply voltages and SYSRESET signal can be monitored remotely from an enclosed chassis. All the signals are pinned on the DSUB-15 connector. Table 4 provides the DSUB-15 connector pin out.

Pin Name	Signal
1	CHROMEL(+) ( White Pin, Yellow Wire, Top Thermocouple)
2	ALUMEL(-) (Green Pin, Red Wire, Top Thermocouple)
3	CHROMEL(+) ( White Pin, Yellow Wire, Bottom Thermocouple)
4	ALUMEL(-) (Green Pin, Red Wire, Bottom Thermocouple)
5	No Connection
6	-12V Aux (Remote Voltage Monitoring)
7	+12V Aux (Remote Voltage Monitoring)
8	Vs3 +5V (Remote Voltage Monitoring)
9	Vs2 +3.3V (Remote Voltage Monitoring)
10	Vs1 +12V (Remote Voltage Monitoring)
11	3.3V Aux (Remote Voltage Monitoring)
12	SYSRESET (Remote Signal Monitoring)
13	GND (Remote Voltage/Signal Monitoring GND)
14	V CNTRL GND (Voltage Control GND)
15	V CNTRL (Voltage Control)

**Table 4**

Any standard high density DSUB-15 mating female connector and pins can be used to connect to the DSUB-15 connector on the load card. The only exception is the set of pins used for K-Type thermocouples. This is discussed in the next section.

## Temperature Monitoring

The thermal impedance of the thermal management interfaces is very critical in order to transfer all the heat generated by plug-in modules. Therefore two K-Type thermocouples are placed inside each thermal management interface to monitor their temperature. Any standard off the shelf K-Type thermocouple acquisition hardware can be used to record the temperature for analysis. The thermocouple output connections are provided on the high density DSUB-15 connector using K-Type thermocouple crimps. When making a harness to connect to the thermocouples mating pins, the K-Type extension wire with KType crimps must be used. Using regular crimps and wire to interface to the thermocouple on high density DSUB-15 connector would give incorrect temperature readings. Table 5 provides the recommended crimp and wire part numbers available from Omega and Positronic.

Part Description	Positronic Part number
CHROMEL(+) K-Type crimp	FC8022D2CH
ALUMEL(-) K-Type crimp	FC8022D2AL
High Density DSUB-15 with crimps	ODD15M20000/AA

Part Description	Omega Part number
Extension Wire K-Type	FF-K-24-25

**Table 5**

### Over Temperature Protection

Each Load Card has an over temperature protection feature which shuts off the loads in case of excessive heating. The temperature switch used on the load card has a trip point set at 110°C.

## VPX 3U Module Connector Pin Diagrams

Tables 1 to 4 below are the pin outs of VPX 3U Module connectors based on ANSI/VITA 46.0 specification.

### P0 Connector Pin Out

	Wafer Type	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	Power	Vs1	Vs1	Vs1	No Pad	Vs2	Vs2	Vs2
2	Power	Vs1	Vs1	Vs1	No Pad	Vs2	Vs2	Vs2
3	Power	Vs3	Vs3	Vs3	No Pad	Vs3	Vs3	Vs3
4	Single-ended	SM2	SM3	GND	-12V AUX	GND	SYSRESET*	NVMRO
5	Single-ended	GAP*	GA4*	GND	3.3V AUX	GND	SM0	SM1
6	Single-ended	GA3*	GA2*	GND	+12V AUX	GND	GA1*	GA0*
7	Differential	TCK	GND	IDO	IDI	GND	TMS	TRST*
8	Differential	GND	REF_CLK-	REF_CLK+	GND	RES_BUS-	RES_BUS+	GND

Table 1

### P1 Connector Pin Out

	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	P1-RES_BUS_SE	GND	P1-DP1-	P1-DP1+	GND	P1-DP0-	P1-DP0+
2	GND	P1-DP3-	P1-DP3+	GND	P1-DP2-	P1-DP2+	GND
3	P1-VBAT	GND	P1-DP5-	P1-DP5+	GND	P1-DP4-	P1-DP4+
4	GND	P1-DP7-	P1-DP7+	GND	P1-DP6-	P1-DP6+	GND
5	SYS_CON*	GND	P1-DP9-	P1-DP9+	GND	P1-DP8-	P1-DP8+
6	GND	P1-DP11-	P1-DP11+	GND	P1-DP10-	P1-DP10+	GND
7	P1-REF_CLK_SE	GND	P1-DP13-	P1-DP13+	GND	P1-DP12-	P1-DP12+
8	GND	P1-DP15-	P1-DP15+	GND	P1-DP14-	P1-DP14+	GND
9	P1-SE4	GND	P1-DP17-	P1-DP17+	GND	P1-DP16-	P1-DP16+
10	GND	P1-DP19-	P1-DP19+	GND	P1-DP18-	P1-DP18+	GND
11	P1-SE5	GND	P1-DP21-	P1-DP21+	GND	P1-DP20-	P1-DP20+
12	GND	P1-DP23-	P1-DP23+	GND	P1-DP22-	P1-DP22+	GND
13	P1-SE6	GND	P1-DP25-	P1-DP25+	GND	P1-DP24-	P1-DP24+
14	GND	P1-DP27-	P1-DP27+	GND	P1-DP26-	P1-DP26+	GND
15	P1-SE7	GND	P1-DP29-	P1-DP29+	GND	P1-DP28-	P1-DP28+
16	GND	P1-DP31-	P1-DP31+	GND	P1-DP30-	P1-DP30+	GND

Table 2

**P2 Connector Differential Pin Out**

	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	P2-SE0	GND	P2-DP1-	P2-DP1+	GND	P2-DP0-	P2-DP0+
2	GND	P2-DP3-	P2-DP3+	GND	P2-DP2-	P2-DP2+	GND
3	P2-SE1	GND	P2-DP5-	P2-DP5+	GND	P2-DP4 -	P2-DP4+
4	GND	P2-DP7-	P2-DP7+	GND	P2-DP6-	P2-DP6+	GND
5	P2-SE2	GND	P2-DP9-	P2-DP9+	GND	P2-DP8-	P2-DP8+
6	GND	P2-DP11-	P2-DP11+	GND	P2-DP10-	P2-DP10+	GND
7	P2-SE3	GND	P2-DP13-	P2-DP13+	GND	P2-DP12-	P2-DP12+
8	GND	P2-DP15-	P2-DP15+	GND	P2-DP14-	P2-DP14+	GND
9	P2-SE4	GND	P2-DP17-	P2-DP17+	GND	P2-DP16-	P2-DP16+
10	GND	P2-DP19-	P2-DP19+	GND	P2-DP18-	P2-DP18+	GND
11	P2-SE5	GND	P2-DP21-	P2-DP21+	GND	P2-DP20-	P2-DP20+
12	GND	P2-DP23-	P2-DP23+	GND	P2-DP22-	P2-DP22+	GND
13	P2-SE6	GND	P2-DP25-	P2-DP25+	GND	P2-DP24-	P2-DP24+
14	GND	P2-DP27-	P2-DP27+	GND	P2-DP26-	P2-DP26+	GND
15	P2-SE7	GND	P2-DP29-	P2-DP29+	GND	P2-DP28-	P2-DP28+
16	GND	P2-DP31-	P2-DP31+	GND	P2-DP30-	P2-DP30+	GND

**Table 3**

**P2 Connector Single Ended Pin Out**

	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	P2-SE04	P2-SE03	GND	P2-SE02	GND	P2-SE01	P2-SE00
2	P2-SE09	P2-SE08	GND	P2-SE07	GND	P2-SE06	P2-SE05
3	P2-SE14	P2-SE13	GND	P2-SE12	GND	P2-SE11	P2-SE10
4	P2-SE19	P2-SE18	GND	P2-SE17	GND	P2-SE16	P2-SE15
5	P2-SE24	P2-SE23	GND	P2-SE22	GND	P2-SE21	P2-SE20
6	P2-SE29	P2-SE28	GND	P2-SE27	GND	P2-SE26	P2-SE25
7	P2-SE34	P2-SE33	GND	P2-SE32	GND	P2-SE31	P2-SE30
8	P2-SE39	P2-SE38	GND	P2-SE37	GND	P2-SE36	P2-SE35
9	P2-SE44	P2-SE43	GND	P2-SE42	GND	P2-SE41	P2-SE40
10	P2-SE49	P2-SE48	GND	P2-SE47	GND	P2-SE46	P2-SE45
11	P2-SE54	P2-SE53	GND	P2-SE52	GND	P2-SE51	P2-SE50
12	P2-SE59	P2-SE58	GND	P2-SE57	GND	P2-SE56	P2-SE55
13	P2-SE64	P2-SE63	GND	P2-SE62	GND	P2-SE61	P2-SE60
14	P2-SE69	P2-SE68	GND	P2-SE67	GND	P2-SE66	P2-SE65
15	P2-SE74	P2-SE73	GND	P2-SE72	GND	P2-SE71	P2-SE70
16	P2-SE79	P2-SE78	GND	P2-SE77	GND	P2-SE76	P2-SE75

**Table 4**

## Power Wafer Current Rating

Using the table 5 (from ANSI/VITA 46.0 specification) below, the maximum power handling capacity of VPX 3U module can be calculated.

Power Wafer Current Rating for 30°C Temp. Rise (at Wafer Pad and Backplane Connector Contact Interfaces)						
Power plane thickness in plug-in module and backplane	2 ounce copper			1 ounce copper		
	3 wafers	2 wafers	1 wafer	3 wafers	2 wafers	1 wafer
Number of Wafers across which power is dissipated						
Current Allowed per pad (A)	6	8	11.5	5	7	11
Current Allowed per wafer (A)	12	16	23	10	14	22
Total Current Allowed per connector (A)	36	32	23	30	28	22

**Table 5**