VPX3G10 Series

Performance Rugged Conduction Cooled
3U VPX GPGPU Blade with NVIDIA GT745M

User's Manual

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Part No: 50-15100-1000

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Revision History

Revision	Release Date	Description of Change(s)
0.10	15/4/2015	Preliminary release

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Preface

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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.



Additional information, aids, and tips that help users perform tasks.



Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.



Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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1 Introduction

1.1 Overview

The VPX3G10 is a 3U VPX general-purpose computing on graphics processing unit (GPGPU) blade in single-slot (0.8") form factor featuring the 384 core NVIDIA GeForce GT 745M GPU with high resolution and high performance graphics capabilities for defense and aerospace applications. The VPX3G10 features 2GB of GDDR5 memory, providing high-bandwidth access to data during “massively parallel” GPGPU algorithm processing.

The VPX3G10 is rugged conduction cooled with conformal coating, making it ideal for mission critical applications such as military and aerospace platforms.

1.2 Features

- NVIDIA Kepler architecture GPU
- CUDA compute capability 3.0 for parallel computation and graphics processing
- High-resolution, high-performance platform for rugged video I/O and GPGPU applications
- Ideal for defense, radar, sonar, UAV and ground vehicles

1.3 Graphics

- NVIDIA GeForce GT 745M GPGPU
- 384 CUDA cores
- 548 MHz base clock
- Variable voltage
- High-Bandwith Digital Content Protection (HDCP) support
- OpenCL 1.2
- OpenGL 4.4
- GPU Boost 2.0
- DirectX 11.1
- NVIDIA Optimus
- Hardware H.264 video encoding

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- NVIDIA PureVideo Technology
- NVIDIA PhysX-ready

1.4 Display Support

- 1x analog output
  - 400 MHz integrated RAMDAC
  - Up to 2048x1536 30 bpp at 75 Hz
- 4x DVI outputs.
  - Internal single-link TMDS
  - Up to 1920x1200 32 bpp at 60 Hz

1.5 Cooling

- Conduction-cooled
- Air-cooled

1.6 OS Support

- Windows 8.1
- Windows 8
- Windows 7
- Linux

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1.7 Block Diagrams

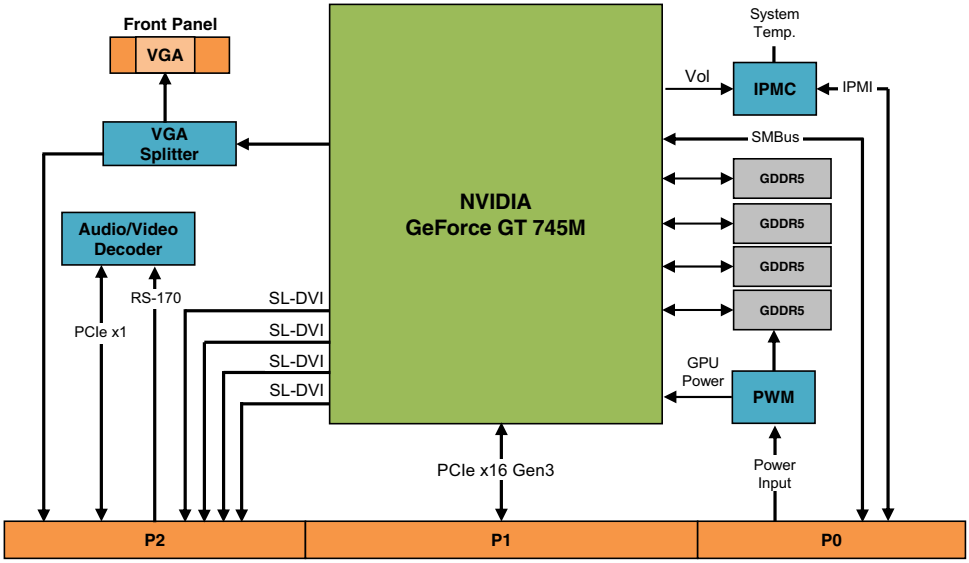


Figure 1-1: VPX3G10 Functional Block Diagram

1.8 Ruggedization Levels

- **R1:** Conduction cooled version supporting -40°C to +75°C at card edge
- **R2:** Conduction cooled version supporting -40°C to +85°C at card edge
- **A1:** Air cooled version supporting -40°C to +75°C ambient temperature

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1.9 Package Contents

The VPX3G10 is packaged with the following components. If any of the items on the contents list are missing or damaged, retain the shipping carton and packing material and contact the dealer for inspection. Please obtain authorization before returning any product to ADLINK. The packing contents of the VPX3G10 are non-standard configurations and may vary depending on customer requests.

GPGPU Blade

- VPX3G10
  - Thermal module is assembled on the board
- ADLINK Driver USB Flash Drive

Rear Transition Module

- VPX-R3G10
- DVI to VGA adapter

Test Backplane

- tBP-VPX3000 test backplane



The contents of non-standard VPX3G10 configurations may vary depending on the customer requirements.



This product must be protected from static discharge and physical shock. Never remove any of the components except at a static-free workstation. Use the anti-static bag shipped with the product when putting the board on a surface. Wear an anti-static wrist strap properly grounded on one of the system's ESD ground jacks when installing or servicing system components.

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2 Specifications

2.1 VPX3G10 Blade Specifications

VITA Standards	• VITA 46.0 VPX Base Standard • VITA 46.4 PCI Express on VPX Fabric Connector • VITA 48.0 Ruggedized Enhanced Design Implementation • Mechanical Base Specification: VITA 65 OpenVPX Architecture Framework for VPX
Mechanical	• IEEE 1101.1-1998 - Mechanical Core Specifications for Microcomputers • IEEE 1101.2-1992 - Conduction Cooled VME Mechanics • 3U 0.8" • Board size: 100mm x 160mm • P0, P1, P2 connectors; alignment key 1 & 2 equipped
Profiles	• MOD3-PER-2F-16.3.1-3 • SLT3-PER-2F-14.3.1
GPGPU	• GeForce GT 745M, core clock 548 MHz
Memory	• Intel® BD82QM77 Platform Controller Hub (PCH)
Memory	• 2 GB GDDR5, 128-bit, 2000 MHz clock
Maximum Power	• 23 W
Connectors	• VPX P0, P1, P2 • D-SUB
Video-In	• RS-170
IPMI Support	Yes
HDCP Support	Yes
Environmental	• Operating Temperature: -40°C to +75°C • Storage Temperature: -50°C to 100°C • Humidity: 20~90%, non-condensing • Shock: 40G peak-to-peak, 11ms duration, non-operating • Vibration: Operating 5Grms, 20-2000Hz, each axis
EMI	• CE EN55022 • FCC Class A

Table 2-1: VPX3G10 Blade Specifications

Note: Specifications are subject to change without prior notice.

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2.2 Power Consumption

This section provides information on the power consumption of the VPX3G10 measured with Unigine Heaven Benchmark 4.0.

GPU Core Frequency	FB Frequency	Voltage (V)	Current (A)		Power (W)	
			Max	Mean	Max	Mean
548MHz	2000MHz	4.81	3.79	3.60	18.23	17.32

Table 2-2: VPX3G10 Power Consumption

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3 Functional Description

The following sections describe the VPX3G10 features and functions.

3.1 GPGPU Features

- **Kepler GPU Architecture:** NVIDIA's Kepler GPU architecture has been designed from the ground up for maximum performance with DirectX 11 and optimal performance per watt. The new SMS streaming multiprocessor is twice as efficient as the prior generation and the new geometry engine draws triangles twice as fast. The result is world class performance and the highest image quality.
- **NVIDIA CUDA Technology:** Compute Unified Device Architecture, is a parallel computing platform and programming model that unlocks the power of the GPU's processor cores to accelerate the most demanding system tasks.
- **Microsoft DirectX 11 Support:** DirectX 11 GPU with Shader Model 5.0 support designed for ultra high performance with GPU-accelerated tessellation.
- **NVIDIA PhysX Technology:** A powerful physics engine enabling real-time physics that is is optimized for hardware acceleration by massively parallel processors. GeForce GPUs with PhysX provide an exponential increase in physics processing power.
- **NVIDIA FXAA Technology:** Shader-based antialiasing technology available from the NVIDIA Control Panel that enables ultra-fast antialiasing.
- **NVIDIA Adaptive Vertical Sync:** Adaptive V-Sync is a smarter way to render frames. At high frame rates, V-sync is enabled to eliminate tearing. At low frame rates, it is disabled to minimize stuttering.
- **HDMI and Blu-Ray 3D support:** HDMI output enables both high-definition video and audio signals to an HDTV via a single cable.

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- **High-Definition Audio Bitstreaming:** Full-support for high-definition audio bitstreaming, including Dolby TrueHD and DTS-HD formats.
- **Hardware Video Decode Acceleration:** The combination of high-definition video decode acceleration and post-processing that delivers stutter-free video, stunning picture clarity, accurate color, and precise image scaling with incredible energy efficiency.
- **PCI Express 3.0 & 2.0 Support:** Designed for the PCI Express 3.0 bus architecture offering the highest data transfer speeds while maintaining backwards compatibility with earlier PCI Express revisions.

3.2 GDDR5 Memory

GDDR5 double data rate type five synchronous graphics random access memory (SGRAM) conforms to the standards which were set out in the GDDR5 specification by JEDEC and it is specifically designed for use in graphics devices for the most demanding and memory-intensive graphics applications, such as 3D gaming and HD video editing. It is a dedicated memory for the Graphic Processing Unit (GPU). Such memory not only reduces the display and graphics related load on the computer's main memory, but also serves to improve the performance of the GPU and the system's display, providing much better visual experiences than would be possible with just the computer's integrated graphics.

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3.3 Display Interfaces

The VPX3G10 provides four digital output channels and one analog output channel. Four channels can be active at same time. The VPX3G10 utilizes the P2 rear I/O connector for single-link DVI and analog outputs. A D-sub connector for analog VGA output is available on the air-cooled version.

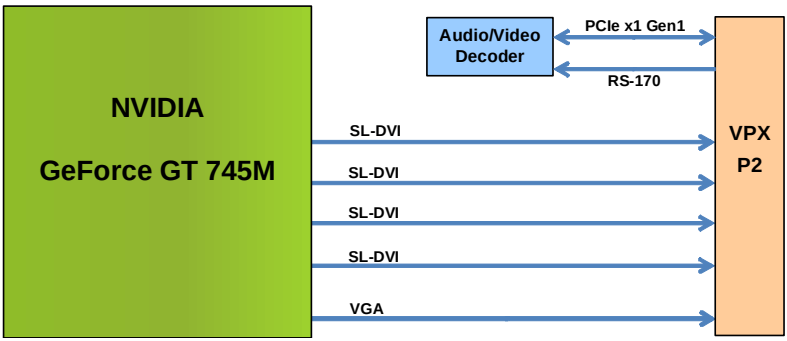


Figure 3-1: Graphics Output Block Diagram

Digital Output

The VPX3G10 has 4x single-link DVI to the P2 connector. The maximum resolution over DVI port is 1920 x 1200 x 32 bpp at 60 Hz. Additional circuitry is required on the RTM board for DVI output.

As shown in the schematic below, the DVIn_TX signals must be pulled to ground with two 499Ω (1%) pull-down resistors and a FET placed as close to the DVI connector as possible, to limit the leakage. Two AC coupling capacitors (0.1uF, 16V, 10%, X7R) must be placed between the VPX connector and the pull-down resistors.

The DDC channel (source-side) consists of a clock and a data line and operates at 3.3V. A 3.3V to 5V level shifter must be implemented on the RTM with DDC signals pulled high to 3.3V on the sink side, as shown below.

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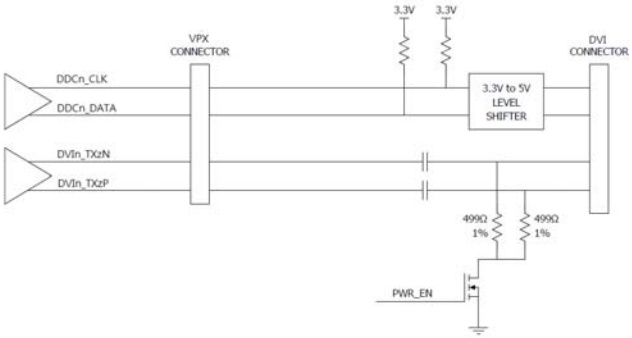


Figure 3-2: Additional circuitry for DVI output on RTM

Hot Plug

The VPX3G10 supports Hot Plug detect for four digital monitors.

Analog Output

The analog output ports provide Red, Green, Blue, Horizontal-Sync and Vertical-Sync and are routed to the P2 connector and D-sub by VGA splitter (not availability simultaneously). Display resolutions up to 2048 x 1536 x 30 bpp at 75 Hz are supported.

3.4 PCI Express Interface

The GeForce GT 745M has a native PCI Express x16 Gen3 bus interface supporting x16, x8, x4, x1 lane widths.

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4 Board Interfaces

4.1 VPX3G10 Board Layout

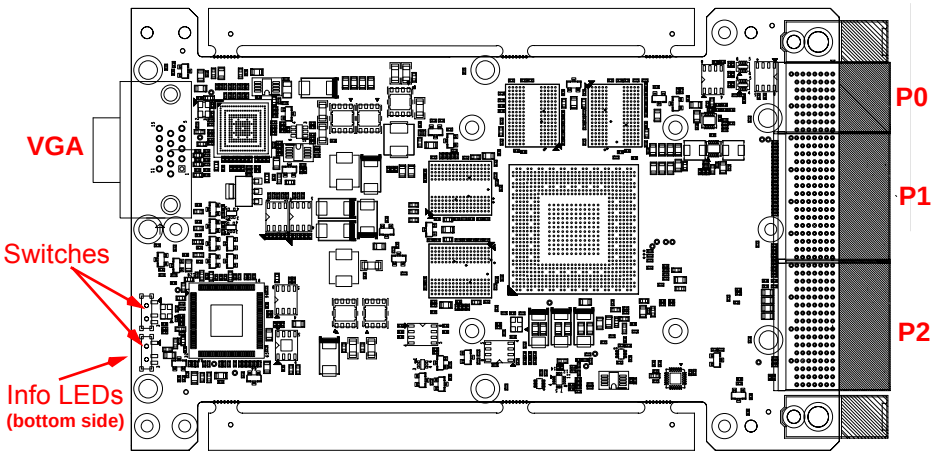


Figure 4-1: VPX3G10 Board Layout

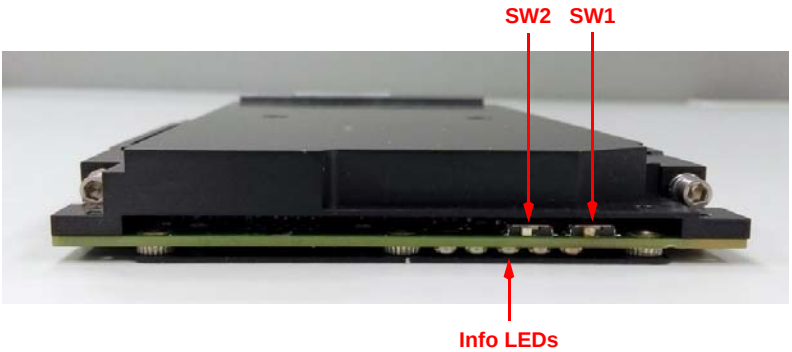
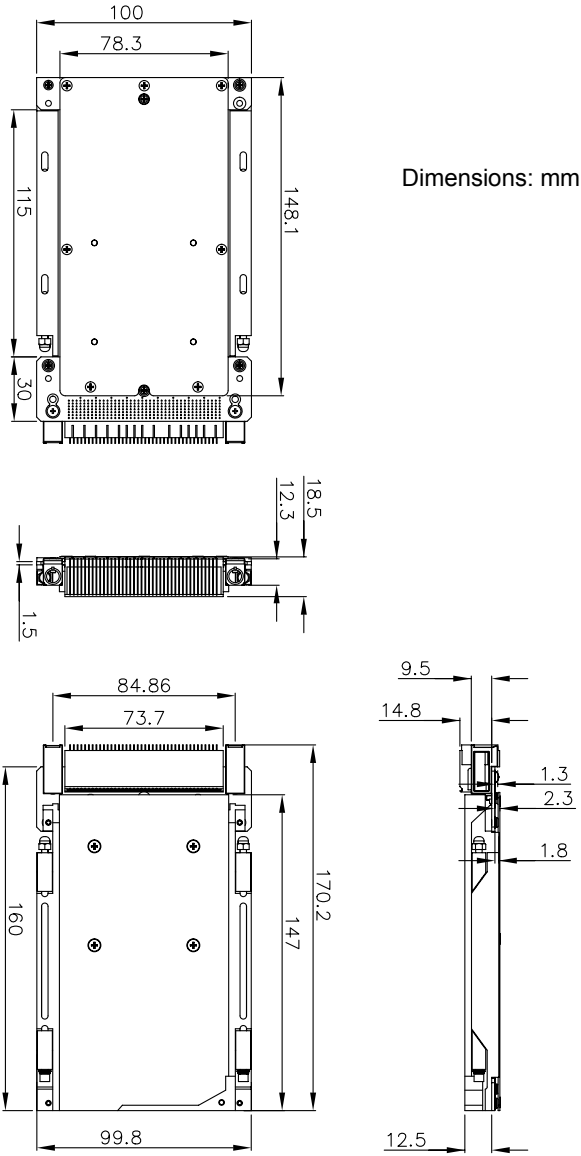


Figure 4-2: VPX31G0 Switch and LED locations

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4.2 VPX3G10 Mechanical Dimensions



Dimensions: mm

Figure 4-3: VPX3G10 Mechanical Drawing

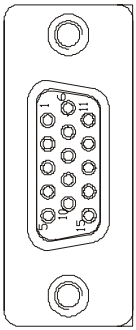
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Information LEDs

LED	Color	Function
LED 1	Green	All power is good
LED 2	Green	GPU is running
LED 3	Red	Critical temperature shutdown (GPU)
LED 4	Red	Failure of input power rail
LED 5	Yellow	High temperature of GPU (From GPU internal thermal diode)
LED 6	Yellow	High temperature of GPU (From IPMI, Option)

VGA Connector

Signal Name	Pin #	Pin #	Signal Name
Red	1	2	Green
Blue	3	4	N.C.
GND	5	6	Red_RET
Green_RET	7	8	Blue_RET
DDC_5V	9	10	GND
N.C.	11	12	DDC_DATA
HSYNC	13	14	VSYNC
DDC_CLK	15		



VPX Connectors

P0 Connector

Pin	G	F	E	D	C	B	A
1	Rsvd	Rsvd	Rsvd	No PAD	Rsvd	Rsvd	Rsvd
2	Rsvd	Rsvd	Rsvd	No PAD	Rsvd	Rsvd	Rsvd
3	P5V	P5V	P5V	No PAD	P5V	P5V	P5V
4	GPU_I2CS_CLK	GPU_I2CS_DAT	GND	Rsvd	GND	SYSRST	NVMRO
5	IPMI_GAP	IPMI_GA4	GND	P3V3_AUX	GND	SMCLK	SMDAT
6	IPMI_GA3	IPMI_GA2	GND	Rsvd	GND	IPMI_GA1	IPMI_GA0
7	TCLK	GND	TDO	TDI	GND	TMS	TRST
8	GND	REF_CLKN	REF_CLKP	GND	Rsvd	Rsvd	GND

P1 Connector

Pin	G	F	E	D	C	B	A
1	IPMI_PLD_TX	GND	L0-TX-	L0-TX+	GND	L0-RX-	L0-RX+
2	GND	L1-TX-	L1-TX+	GND	L1-RX-	L1-RX+	GND
3	Rsvd	GND	L2-TX-	L2-TX+	GND	L2-RX-	L2-RX+
4	GND	L3-TX-	L3-TX+	GND	L3-RX-	L3-RX+	GND
5	Rsvd	GND	L4-TX-	L4-TX+	GND	L4-RX-	L4-RX+
6	GND	L5-TX-	L5-TX+	GND	L5-RX-	L5-RX+	GND
7	Rsvd	GND	L6-TX-	L6-TX+	GND	L6-RX-	L6-RX+
8	GND	L7-TX-	L7-TX+	GND	L7-RX-	L7-RX+	GND
9	DDC3V_CLK	GND	L8-TX-	L8-TX+	GND	L8-RX-	L8-RX+
10	GND	L9-TX-	L9-TX+	GND	L9-RX-	L9-RX+	GND
11	DDC3V_DATA	GND	L10-TX-	L10-TX+	GND	L10-RX-	L10-RX+
12	GND	L11-TX-	L11-TX+	GND	L11-RX-	L11-RX+	GND
13	NODE_RESET	GND	L12-TX-	L12-TX+	GND	L12-RX-	L12-RX+
14	GND	L13-TX-	L13-TX+	GND	L13-RX-	L13-RX+	GND
15	IPMI_PLD_RX	GND	L14-TX-	L14-TX+	GND	L14-RX-	L14-RX+
16	GND	L15-TX-	L15-TX+	GND	L15-RX-	L15-RX+	GND

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P2 Connector

Pin	G	F	E	D	C	B	A
1	HOTPLUG1	GND	DVI1_ CLKN	DVI1_CLK P	GND	DVI1_TX0N	DVI1_TX0P
2	GND	DVI1_ TX1N	DVI1_ TX1P	GND	DVI1_TX2N	DVI1_TX2P	GND
3	DDC1_5V	GND	DDC4_ DATA	DDC4_CLK	GND	DDC3_DATA	DDC3_CLK
4	GND	DVI2_ CLKN	DVI2_ CLKP	GND	DVI2_ TX0N	DVI2_TX0P	GND
5	HOTPLUG2	GND	DVI2_ TX1N	DVI2_TX1P	GND	DVI2_TX2N	DVI2_TX2P
6	GND	DDC2_5V	DDC4_5V	GND	RSVD	RSVD	GND
7	DDC3_5V	GND	VSYNC3	HSYNC3	GND	DDC1_DATA	DDC2_CLK
8	GND	RS-170_ LUMA	RS-170_ CHROM	GND	DDC1_CLK	DDC2_DATA	GND
9	RTM_DET	GND	DVI3_ CLKN	DVI3_ CLKP	GND	HOTPLUG3	HOTPLUG4
10	GND	DVI3_ TX0N	DVI3_ TX0P	GND	VGA3_ RED RET	VGA3_RED	GND
11	RS-170_ PCIE_RST	GND	DVI3_ TX1N	DVI3_TX1P	GND	VGA3_ GREEN RET	VGA3_ GREEN
12	GND	DVI3_ TX2N	DVI3_ TX2P	GND	VGA3_ BLUE RET	VGA3_BLUE	GND
13	SEQ_IN	GND	DVI4_ CLKN	DVI4_ CLKP	GND	GND	FPSD
14	GND	DVI4_ TX0N	DVI4_ TX0P	GND	RS-170_PCIE _RX0N	RS-170_PCIE _RX0P	GND
15	SEQ_OUT	GND	DVI4_ TX1N	DVI4_TX1P	GND	RS-170_PCIE _TX0N	RS-170_PCIE _TX0P
16	GND	DVI4_ TX2N	DVI4_ TX2P	GND	RS-170_PCIE _CLKN	RS-170_PCIE _CLKP	GND

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4.3 Switches

Display Output Mode (SW1)

This switch sets the display output from either the display port(s) of the VGX3G10 or from the display outputs of the processor blade. In both settings, graphics processing is handled by the VGX3G10.

Setting	Function
Left	Display output from VPX3G10 (default)
Right	Display output from processor blade

VGA Front/Rear Output (SW2)

Sets the VGA display output of the VGX3G10 to either the rear or front VGA port (front VGA only available on air-cooled version)

Setting	Function
Left	Rear VGA output (default)
Right	Front VGA output

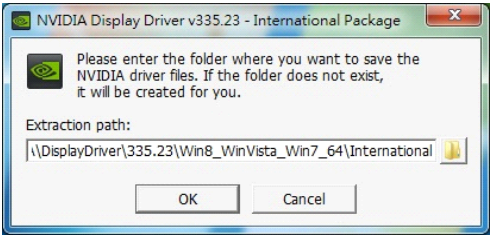
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5 Driver Installation

The VPX3G10 drivers are available from the ADLINK website: **www.adlinktech.com/PD/web/PD_detail.php?cKind=&pid=1372**. ADLINK provides validated drivers for Windows 7. We recommend using these drivers to ensure compatibility.

Install the Windows operating system before installing any driver. Most standard I/O device drivers are installed during Windows installation.

1. Install the chipset driver by extracting the contents of **NVIDIA_Graphic_WIN7_64_V_R340.52.zip** and running the program **setup.exe**.
2. The driver package will auto-extract to the default location. Change the path if desired.



3. Continue the driver installation as instructed.



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Important Safety Instructions

For user safety, please read and follow all **instructions**, **WARNINGS**, **CAUTIONS,** and **NOTES** marked in this manual and on the associated equipment before handling/operating the equipment.

- Read these safety instructions carefully.
- Keep this user's manual for future reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment:
  - Turn off power and unplug any power cords/cables.
- To avoid electrical shock and/or damage to equipment:
  - Keep equipment away from water or liquid sources;
  - Keep equipment away from high heat or high humidity;
  - Keep equipment properly ventilated (do not block or cover ventilation openings);
  - Make sure to use recommended voltage and power source settings;
  - Always install and operate equipment near an easily accessible electrical socket-outlet;
  - Secure the power cord (do not place any object on/over the power cord);
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings; and,
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.

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- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.

A Lithium-type battery may be provided for uninterrupted, backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type. Dispose of used batteries appropriately.

- Equipment must be serviced by authorized technicians when:
  - The power cord or plug is damaged;
  - Liquid has penetrated the equipment;
  - It has been exposed to high humidity/moisture;
  - It is not functioning or does not function according to the user's manual;
  - It has been dropped and/or damaged; and/or,
  - It has an obvious sign of breakage.

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Getting Service

Contact us should you require any service or assistance.

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Tel: +886-2-8226-5877
Fax: +886-2-8226-5717
Email: service@adlinktech.com

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San Jose, CA 95138, USA
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Toll Free: +1-800-966-5200 (USA only)
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