XMC-G1050TI-R

Rugged Conduction Cooled GPGPU XMC Module
with NVIDIA GeForce GTX G1050Ti

User's Manual



Preliminary

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Leading **EDGE COMPUTING**

Revision History

Revision	Release Date	Description of Change(s)
0.1	2018/04/20	Preliminary release

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Preface

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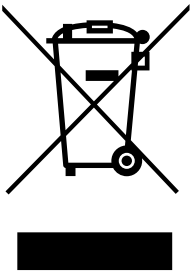
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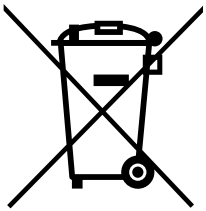
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Conventions

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


NOTE:

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


CAUTION:

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


WARNING:

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 ADLINK XMC-G1050TI-R is a rugged conduction cooled XMC module equipped with the CUDA-enabled 768-core NVIDIA GeForce GTX G1050Ti GPU, utilizing the NVIDIA "Pascal" architecture and yielding the unprecedented levels of graphics processing performance for defense and aerospace applications. The GeForce GTX 1050Ti features 4096MB of GDDR5 memory, ensuring high-capacity and high-bandwidth access to data during "massively parallel" GPGPU algorithm processing. ADLINK recognizes the trend towards implementing General Purpose computing on Graphics Processing Units (GPGPU) for parallel computing for increased processing performance and the XMC-G1050TI is targeted at a variety of high-performance computing application that can take advantage of this technology.

1.2 Features

- NVIDIA GeForce® GTX 1050 Ti GPU with Pascal™ architecture
- 768 CUDA cores
- 2.3 TFLOPS
- XMC form factor, adaptable to VPX and CompactPCI systems
- 4 independent displays through XMC P16 I/O connector
- 30W max. power consumption, supports TDP configuration
- Rugged conduction-cooled
- I/O and GPGPU applications
- High-performance CUDA platform, ideal for GPU computing, defense, radar, sonar, UAV and ground vehicles

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1.2.1 GPU

- NVIDIA Pascal™ architecture
- NVIDIA GeForce GTX 1050Ti
- CUDA cores: 768
- Core clock: 1493MHz (boost: 1620MHz)
- Voltage: variable
- Package size: 29 mm x 29 mm, 908 ball flip-chip, plastic ball grid array (FCPBGA)
- 8-lanes PCI Express 3.0 capable (x8/x4/x1)
- High-Bandwith Digital Content Protection (HDCP) support

1.2.2 Memory Support

- Memory clock: 3500 MHz (7 Gbps)
- Interface: 128-bit
- Local frame buffer: 4 GB (4 pieces 256M x 32 GDDR5, FBGA-170 package)

1.2.3 Display Support

- 4x DisplayPort outputs. (optional; via XMC P16 I/O connector)
  - Maximum resolution over digital port: 7680 x 4320 at 60 Hz
- 1x analog RGB outputs. (optional; via XMC P16 I/O connector)
  - Maximum resolution over digital port: 1920 x 1200 at 60 Hz
- HDCP 1.3 and 2.2 Support

1.2.4 Mechanical Specifications

- XMC form factor
- Dimensions: 143.75 mm x 74mm (single width)
- Board power: 30 W max.

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1.2.5 Technology Support

- VIDIA CUDA Technology (Compute capability 6.1)
- NVIDIA Optimus
- NVIDIA H.265 video encoding
- OpenCL 1.2
- OpenGL 4.5
- Vulkan
- Microsoft DirectX 12

1.2.6 Cooling

- Conduction-cooled

1.2.7 Supported OS

- Windows 10
- Windows 8
- Windows 7
- Linux

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1.3 Functional Block Diagram

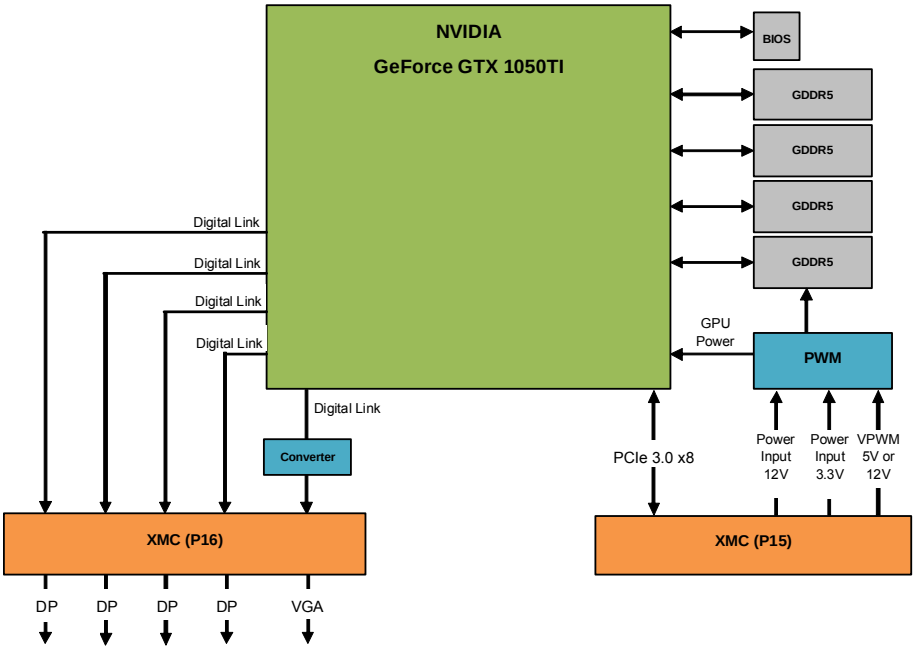
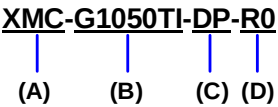


Figure 1-1: XMC-G1050TI Functional Block Diagram

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1.4 Model Number Decoder



(

(A) Formfactor

- ▷ XMC = Standard XMC Formfactor

(B) GPU

- ▷ G1050TI = NVIDIA GeForce GTX 1050Ti

(C) Function

- ▷ Blank = GPGPU only, no display output
- ▷ DP = Discrete GPU; DisplayPort output

(D) Ruggedized Level Code

- ▷ R0 = Conduction Cooled version supporting 0°C to +50°C at card edge
- ▷ R1 = Conduction Cooled version supporting -40°C to +75°C at card edge

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1.5 Package Contents

The XMC-G1050TI 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.

- XMC-G1050TI module



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 XMC-G1050TI

Graphics	
GPU	NVIDIA GeForce GT 1050Ti
CUDA Cores	768
Graphics Clock	1493MHz (boost: 1620MHz)
Floating Point Performance	2.3 TFLOPS
Memory	
Memory Size	4GB GDDR5
Memory Clock	3500MHz (7.0 Gbps)
Memory Interface Width	128-bit
Feature Support	
Bus Type	PCI x8 Gen3 (x8/x4/x1)
OpenGL	4.2
OpenCL	1.2
DirectX	12
NVIDIA CUDA	CUDA Compute Capability 6.1
NVIDIA Optimus	supported
NVIDIA PhysX	supported
NVIDIA Direct Compute	supported
Operating System	Windows 10 Windows 8 Windows 7 Linux

Table 2-1: XMC-G1050TI Power Consumption

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Display Outputs	
DisplayPort	4x DisplayPort outputs. (optional, via XMC P16 I/O connector) Maximum resolution over digital port: 7680 x 4320 at 60 Hz
VGA	1x analog RGB outputs. (optional; via XMC P16 I/O connector) Maximum resolution over digital port: 1920 x 1200 at 60 Hz
Mechanical and Power	
Form Factor	XMC module
Conduction cooled version	143.75mm x 74 mm
Power Consumption	30 W (max.)

Table 2-1: XMC-G1050TI Power Consumption (con't)


NOTE:

Specifications are subject to change without notice.

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2.2 Configurations

Specification	XMC-G1050TI-DP-RX	XMC-G1050TI-RX
Chip	GeForce GTX 1050Ti	GeForce GTX 1050Ti
Core clock	620MHz	620MHz
Memory clock	3504MHz (7.0 Gbps)	3504MHz (7.0 Gbps)
Frame buffer	4 GB GDDR5	4 GB GDDR5
Memory interface	128-bit	128-bit
Memory type	256M x 32 GDDR5 FBGA-170 package	256M x 32 GDDR5 FBGA-170 package
Memory AVL	Samsung K4G80325FB-HC28	Samsung K4G80325FB-HC28
Maximum board power	30 W	30 W
Connectors	XMC (P15 & P16)	XMC (P15)
Display	Four Display port & One VGA port	N/A
HDCP support	Yes	Yes
Supplementary Power Connector	N/A	N/A
Operating Temperature	R0: 0°C to +50°C R1: -40°C to +75°C	R0: 0°C to +50°C R1: -40°C to +75°C
Storage Temperature	-40°C to 125°C	-40°C to 125°C
Operating Humidity	10~90%, No Condensation.	10~90%, No Condensation.

Table 2-2: XMC-G1050TI Configurations

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2.3 Power Consumption

The power consumption data of the XMC-G1050TI was measured using 3D Mark06 at different engine clock frequencies (memory clock fixed at 3504 MHz).

Unigine Heaven Benchmark 4.0						
GPU Core Frequency	Memory Frequency	Voltage (V)	Current (A)		Power (W)	
			Max	Mean	Max	Mean
1721 MHz	3504 MHz	12.04	6.06	6.01	72.99	72.36
1493 MHz	3504 MHz	12.09	4.54	4.34	54.91	52.51
810 MHz	3504 MHz	12.13	3.26	3.17	39.53	38.43
620 MHz	3504 MHz	12.13	2.27	2.18	27.58	26.44

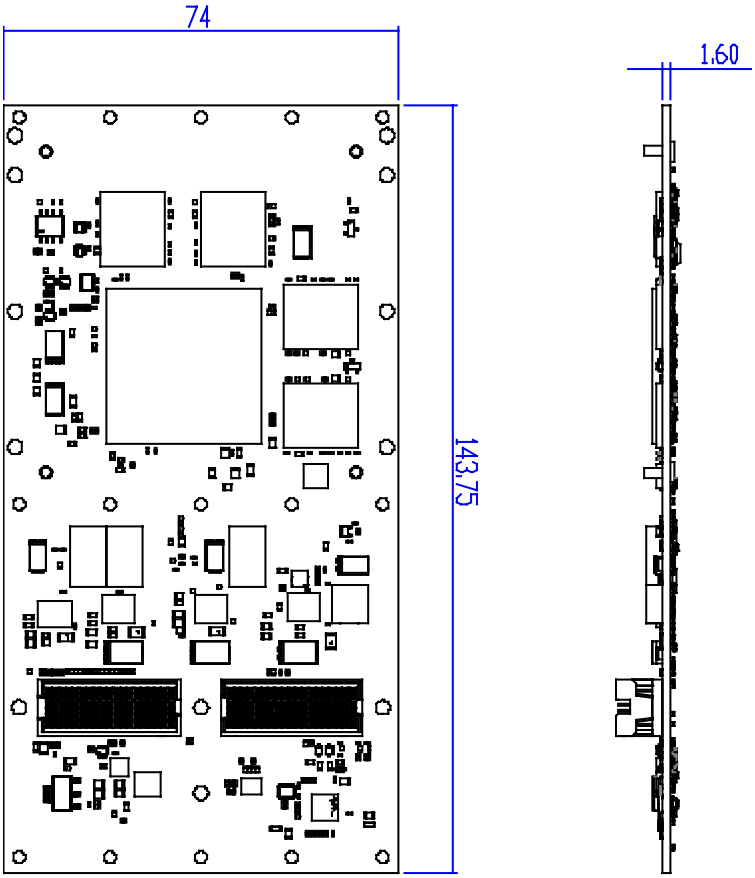
Table 2-3: XMC-G1050TI Power Consumption

NOTE: The XMC-G1050TI default setting is GPU Core Frequency 620MHz.

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2.4 Mechanical Drawing



Dimensions in mm

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3 Functional Description

The following sections describe the VPX3G10 features and functions.

3.1 GPGPU Features

- **Pascal GPU Architecture:** The GeForce GTX 1050Ti Pascal architecture is the most efficient GPU design ever built. 764 single-precision CUDA Cores, the GeForce GTX 1050Ti is the world's fastest GPU. With an intense focus on craftsmanship in chip and board design, NVIDIA's engineering team achieved unprecedented results in frequency of operation and energy efficiency.
- **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 12 Support:** Developers can tap into the newest graphics API to bring powerful GPU graphics to their most innovative titles. GeForce GTX 10-series GPUs support advanced DX12 features enabling new visual effects.
- **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 TXAA Technology:** TXAA anti-aliasing creates a smoother, clearer image than any other anti-aliasing solution by combining high-quality MSAA multisample anti-aliasing, post processes, and NVIDIA-designed temporal filters.
- **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.

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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.

3.3 Display Interfaces

Supports 4 independent video outputs.

The XMC-G1050TI graphics card outputs 4 independent video channels through the rear XMC P16 I/O connector, supporting 4 DisplayPort 1.4 and 1 VGA, up to 8K resolution at 60Hz,10-bit color depth with HEVC/H.265 encode and decode.

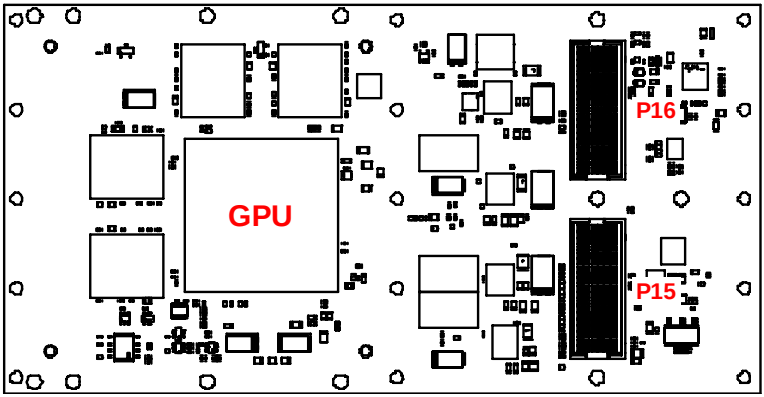
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4 Board Interfaces

This chapter illustrates the board layout and connector pin assignments.

4.1 XMC-G1050TI Board Layout (conduction cooled)



P15	XMC Connector: PCIe x16 Gen3	**P16**	XMC I/O: 4x DisplayPort and 1x VGA
GPU	GeForce GTX 1050Ti		

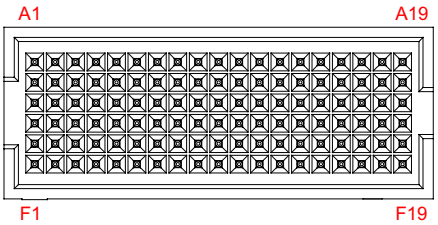
Figure 4-1: XMC-G1050TI Board Layout (conduction cooled)

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4.2 Connector Pin Assignments

XMC Site Connector - PCIe Bus Signals (P15)



PCIe_TX
PCIe_RX
PCIe_CLK
Power
JTAG

Pin#	A	B	C	D	E	F
1	PCIe_TX0+	PCIe_TX0-	+3D3V	PCIe_TX1+	PCIe_TX1-	VPWR
2	GND	GND	JTAG_TRST#	GND	GND	MRSTI#
3	PCIe_TX2+	PCIe_TX2-	+3D3V	PCIe_TX3+	PCIe_TX3-	VPWR
4	GND	GND	JTAG_TCLK	GND	GND	MRSTO#
5	PCIe_TX4+	PCIe_TX4-	+3D3V	PCIe_TX5+	PCIe_TX5-	VPWR
6	GND	GND	JTAG_TMS	GND	GND	+12V
7	PCIe_TX6+	PCIe_TX6-	+3D3V	PCIe_TX7+	PCIe_TX7-	VPWR
8	GND	GND	JTAG_TDI	GND	GND	NC
9	NC	NC	NC	NC	NC	VPWR
10	GND	GND	JTAG_TDO	GND	GND	XMC_GA0
11	PCIe_RX0+	PCIe_RX0-	NC (MBIST#)	PCIe_RX1+	PCIe_RX1-	VPWR
12	GND	GND	XMC_GA1	GND	GND	MPRESENT#
13	PCIe_RX2+	PCIe_RX2-	NC	PCIe_RX3+	PCIe_RX3-	VPWR
14	GND	GND	XMC_GA2	GND	GND	NC (MSDA)
15	PCIe_RX4+	PCIe_RX4-	NC	PCIe_RX5+	PCIe_RX5-	VPWR
16	GND	GND	NVMRO	GND	GND	NC (MSCL)
17	PCIe_RX6+	PCIe_RX6-	NC	PCIe_RX7+	PCIe_RX7-	NC
18	GND	GND	NC (FPGAIO1)	GND	GND	NC
19	PCIe_CLK+	PCIe_CLK-	NC	NC (WAKE#)	NC (ROOT#)	NC (FPGAIO2)

Table 4-1: XMC Site Connector Pin Definition

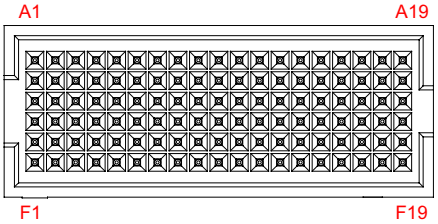
NOTE:

VPWR power pins carry either 12V or 5V power from the carrier to the XMC.

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XMC I/O Connector - Display Signals (P16)



DP0
DP1
DP2
DP3
RGB0
Power

Pin#	A	B	C	D	E	F
1	DP0_L2+	DP0_L2-	NC	DP0_L2+	DP0_L2-	NC
2	DGND	DGND	NC	DGND	DGND	NC
3	DP0_L0+	DP0_L0-	NC	DP0_L3+	DP0_L3-	NC
4	DGND	DGND	NC	DGND	DGND	NC
5	DP2_L2+	DP2_L2-	NC	DP2_L1+	DP2_L1-	NC
6	DGND	DGND	NC	DGND	DGND	NC
7	DP2_L0+	DP2_L0-	NC	DP2_L3+	DP2_L3-	NC
8	DGND	DGND	NC	DGND	DGND	NC
9	DP3_L2+	DP3_L2-	DP3_AUX+	DVI3_L1+	DP3_L1-	DP3_AUX-
10	DGND	DGND	DP1_AUX+	DGND	DGND	NC
11	DP1_L2+	DP1_L2-	DP1_AUX-	DP1_L1+	DP1_L1-	DP1_HPD
12	DGND	DGND	DP0_AUX+	DGND	DGND	DP2_AUX-
13	DP1_L0+	DP1_L0-	DP0_AUX-	DP1_L3+	DP1_L3-	DP2_AUX+
14	DGND	DGND	DP0_HPD	DGND	DGND	DP2_HPD
15	DP3_L0+	DP3_L0-	DP3_HPD	DP3_L3+	DP3_L3-	DDC_5V
16	DGND	DGND	RGB0_SDA	DGND	DGND	DDC_5V
17	NC	NC	RGB0_H	NC	NC	RGB0_B
18	DGND	DGND	RGB0_SCL	DGND	DGND	RGB0_G
19	NC	NC	RGB0_V	NC	NC	RBG0_R

Table 4-2: XMC I/O Connector Pin Definition

NOTE:

VGA and quad DP support only 4 simultaneous outputs.

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Signal Descriptions

Signal	Description
DPn_AUX+/-	Display AUX Channel (output, n=0~3).
DGND	Digital ground.
DPn_HPD	Hot plug detection of DP monitor presence (n=0~3).
DPn_Lp+/-	DVI CHn transmit differential signal (n=0~3, p=0~3).
GND	Digital ground (use by PCIE bus).
Hot Plug Detect	Hot-plug detection of DVI monitors presence.
JTAG_TCLK, TDO, TDI, TMS, TRST	JTAG signals.
MRSTI#	System Reset.
NC	The connector pin is not tracked to any location.
PCIe_RXn +/-	GPU Differential 8 lanes PCI Express receive signals (n=0~7).
PCIe_TXn +/-	GPU Differential 8 lanes PCI Express transmit signals (n=0~7).
RGB0_SCL	Analog Display Data Channel Clock (output).
RGB0_SDA	Analog Display Data Channel Data (input/output).
RGB0_H/V	Analog Horizontal/Vertical Synchronization signal channel.
RGB0_R/G/B	Analog Red/Green/Blue signals Channel.
VPWR	+5V or +12V Supply voltage.
+3D3V	+3.3V Supply voltage.
+5 V Power	Display Data Channel 5V Supply to Monitor.

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5 Getting Started

5.1 Installing the Module

1. Carefully align the male connectors of the XMC module (component-side down) to the female connectors of the host board and firmly press down.
2. Secure the XMC module with the four screws provided from the bottom side of the host board.

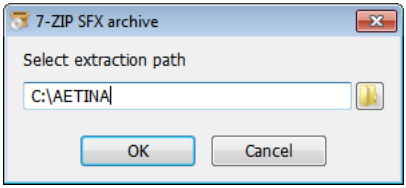
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5.2 Driver Installation

The XMC-G1050TI drivers are available from the ADLINK website: **www.adlinktech.com**. ADLINK provides validated drivers for Windows 7/8/10. We recommend using these drivers to ensure compatibility. Driver installation procedures are described below, using Windows 7/8 as an example.

1. Install the Windows operating system before installing any driver. Most standard I/O device drivers are installed during Windows installation.
2. Extract the contents of the archive **388.00-XMC-G1050TI-win8-win7-64bit.rar** and run the executable file.
3. The driver package will auto-extract to the default location. Change the path if desired.



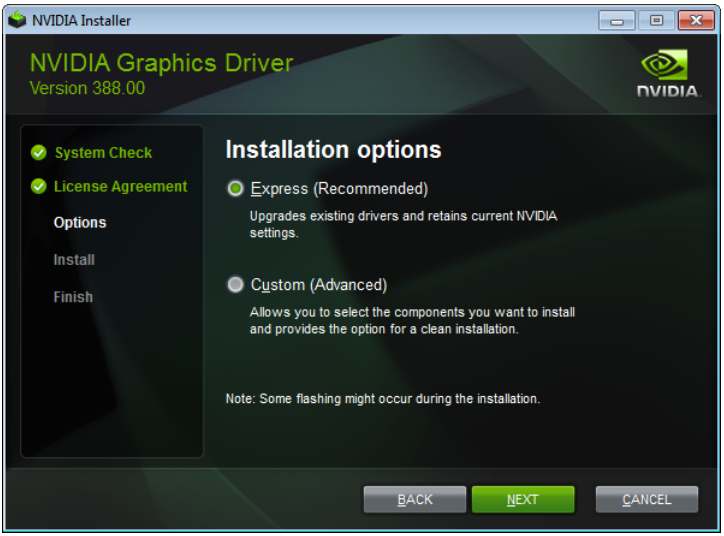
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4. Navigate to the path where the package was extracted to and run the file **setup.exe**.
5. Click *Agree and Continue* to begin installing the driver.



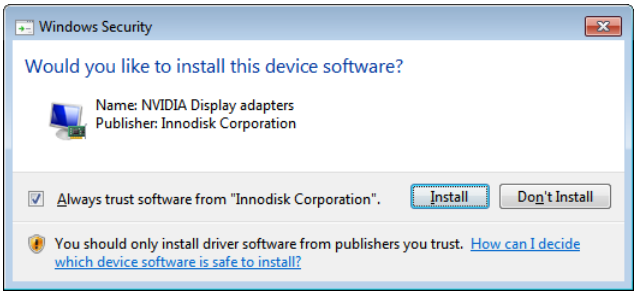
6. Click *Next* to continue.



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7. Click *Always trust ...* and Install.



8. Click *Restart Now* to complete the driver installation.



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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

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