EGX-MXM-P2000

NVIDIA® Pascal™ GP107 Quadro® P2000
Embedded Graphics Module

User's Manual



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Revision History

Revision	Release Date	Description of Change(s)
1.0	2019-11-21	Initial release

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Preface

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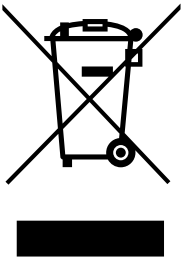
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Conventions

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 EGX-MXM-P2000 module features advanced NVIDIA® Quadro® Pascal™ architecture in the MXM 3.1 Type A form factor. The P2000 brings a new level of performance to visual graphics and computing applications, fully integrating hardware acceleration for both graphics and computing code, enabling hardware acceleration for a wider class of software applications than ever before.

The compact, module supports operability in an extended temperature range of -40°C to 85°C, suitable for mission-critical harsh environments. With its 768 CUDA core Pascal GPU, the EGX-MXM-P2000 supports 4 FHD displays, offering a flexible and easy solution for medical and gaming applications.

1.2 Features

- MXM 3.1 Type A form factor (82 x 70 mm)
- 768 CUDA cores
- 2.3 TFLOPS single precision (SP) peak performance
- 4 GB GDDR5 memory
- 96 GB/s maximal memory bandwidth
- Support for up to 4 UHD displays
- 58W Total Graphics Power (TGP)
- 5 year performance warranty
- Nvidia Quadro P2000 GPU
  - Package 29 x 29 mm
  - Base Clock @1455 MHz
  - Boost Clock @1480 MHz

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1.3 Specifications

1.3.1 Board Specifications

Graphics Core	
Architecture	NVIDIA® Pascal™ GP107
GPU	Quadro® P2000
Display Outputs	4x DisplayPort 1.4 digital video outputs Support for High Dynamic Range (HDR) video 4K at 98Hz with 10-bit color depth
Signal Interface	MXM 3.1, PCI Express Gen3 x16 support
GPGPU Computing	
CUDA Support	768 CUDA cores, 2.3TFLOPS SP Peak CUDA Toolkit 8.0, CUDA Compute version 6.1 OpenCL™ 1.2, DirectX® 12, OpenGL 4.5, Vulcan 1.0
Memory	
GDDR5 Memory	4GB
Memory Width	128-bit
Bandwidth	96 GB/s
Physical	
Dimensions	87 (W) x 70 (D) x 4.8 (H) mm
Locking Mechanism	Standard MXM 3.1 Type A
Environmental	
Operating Temp.	Standard: 0˚C to 55˚C, ETT: -40˚C to 85˚C
Storage Temp.	-40˚C to 85˚C
OS	
Supported OS	Windows 7/10, Linux 64-bit

Table 1-1: Board Specifications

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1.3.2 Memory Configuration

Memory	GDDR5@6Gbps
Configuration	256Mx32
Memory Bandwidth	128-bit
	82 GB/s data rate
	x32 GDDR5 DRAM device data width
Capacity	Total 4GB

Table 1-2: Memory Configuration

1.3.3 Display Support and Options

DisplayPort	▶ 1.2, 1.3, 1.4 ▶ Max. pixel clock: 1050 MP/s ▶ Max. bandwidth: 25.9 GB/s/connector
HDMI 2.0	Max. resolution: 4096 x 2160 at 60 Hz
HDCP Support	1.3 (DP), 2.2 (DP, HDMI)

Table 1-3: Display Support and Options

1.3.4 OS Support

- Windows 7/10 (64-bit)
- Linux (64-bit)

1.3.5 Software Support

Supported software packages include:

- CUDA Toolkit 8.0
- CUDA Compute version 6.1
- OpenCL™ 1.2
- DirectX® 12
- OpenGL 4.5
- Vulcan 1.0

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1.3.6 Graphics Options

The EGX-MXM-P2000 supports 4x DisplayPort by default. The graphics module display options are as shown.

Item	Detail			
MXM Port	DP_A	DP_B	DP_C	DP_D
NVIDIA Link	Link E	Link F	Link A	Link B

Table 1-4: Graphics Module Display Options

Link	Display Type
Link A	DisplayPort, DVI (Single Link or Dual Link with Link B)
Link B	DisplayPort, DVI (Dual Link with A)
Link C	Reserved (on GPU chip)
Link D	
Link E	DisplayPort, HDMI
Link F	DisplayPort

Table 1-5: NVIDIA Link Display Types

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1.4 Functional Block Diagram

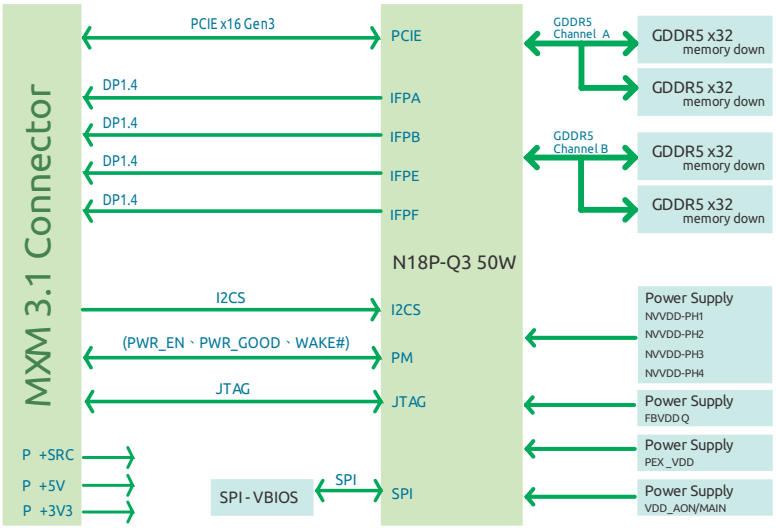


Figure 1-1: Functional Block Diagram

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1.5 Layout and I/O

All dimensions shown are in mm.

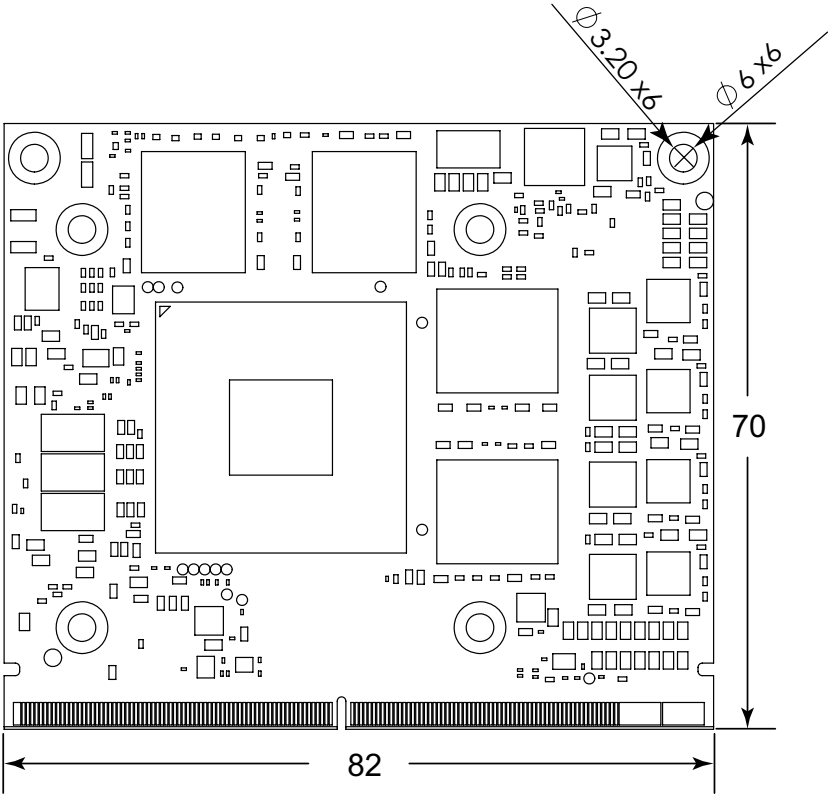


Figure 1-2: MXM Module Basic Dimensions

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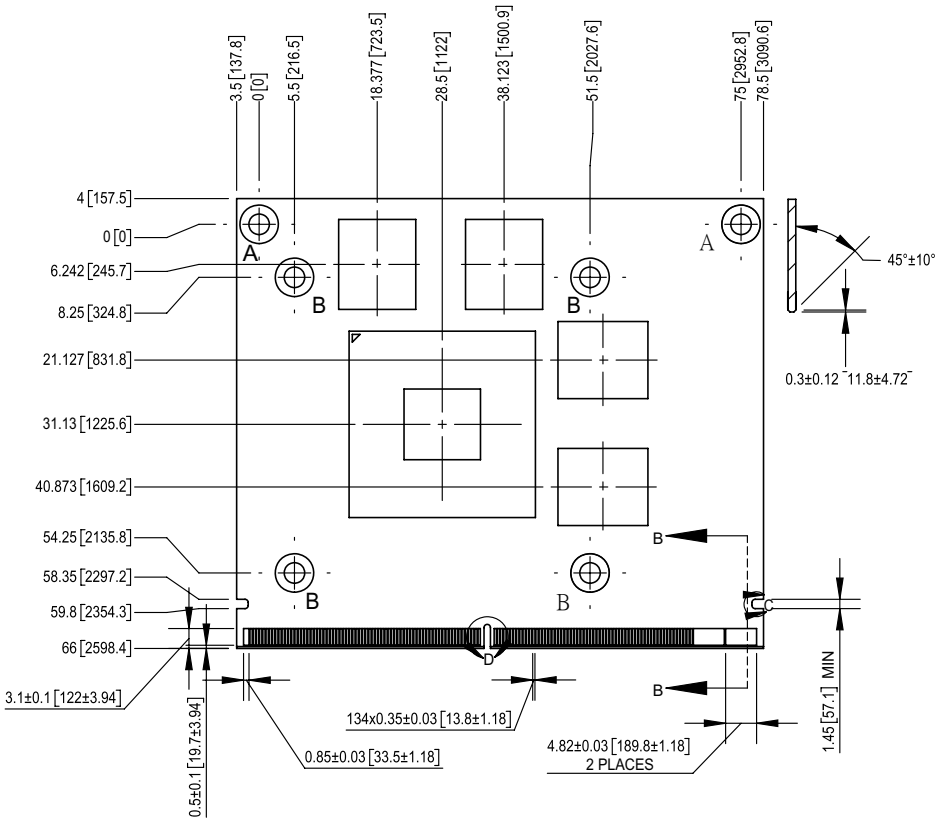


Figure 1-3: MXM Module Detailed Dimensions and Component Layout

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1.5.1 MXM Connector Pin Definition

Primary Side (Underside)			Secondary Side (Top Side)		
Pin	**Signal**	**PU/PD/NI**	**Pin**	**Signal**	**PU/PD/NI**
E1	PWR_SRC		E2	PWR_SRC	
E3	GND		E4	GND	
1	5V		2	PRSNT_R#	0Ω PD
3	5V		4	WAKE#	NI
5	5V		6	PWR_GOOD	NI
7	5V		8	PWR_EN	
9	5V		10	27MHZ_REF	NI
11	GND		12	GND	
13	GND		14	LVDS_U_HPD	NI
15	GND		16	JTAG_TESTEN	
17	GND		18	PWR_LEVEL	100K PU 3.3V
19	PEX_STD_SW#	NI	20	TH_OVERT#	100K PU 3.3V
21	VGA_DISABLE#	NI	22	TH_ALERT#	100K PU 3.3V
23	PNL_PWR_EN		24	TH_PWM	NI
25	PNL_BL_EN		26	GPIO0	NI
27	PNL_BL_PWM		28	GPIO1	NI
29	HDMI_CEC	NI	30	GPIO2	NI
31	LVDS_L_HPD	NI	32	SMB_DAT	10K PU 3.3V
33	LVDS_DDC_DAT	NI	34	SMB_CLK	10K PU 3.3V
35	LVDS_DDC_CLK	NI	36	GND	
37	GND		38	OEM0	NI
39	OEM1	NI	40	OEM2	NI
41	OEM3	NI	42	OEM4	NI
43	OEM5	NI	44	OEM6	NI
45	OEM7	NI	46	GND	

Table 1-6: MXM Connector Pin Definition

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Primary Side (Underside)			Secondary Side (Top Side)		
Pin	**Signal**	**PU/PD/NI**	**Pin**	**Signal**	**PU/PD/NI**
47	GND		48	PEX_TX15#	
49	PEX_RX15#		50	PEX_TX15	
51	PEX_RX15		52	GND	
53	GND		54	PEX_TX14#	
55	PEX_RX14#		56	PEX_TX14	
57	PEX_RX14		58	GND	
59	GND		60	PEX_TX13#	
61	PEX_RX13#		62	PEX_TX13	
63	PEX_RX13		64	GND	
65	GND		66	PEX_TX12#	
67	PEX_RX12#		68	PEX_TX12	
69	PEX_RX12		70	GND	
71	GND		72	PEX_TX11#	
73	PEX_RX11#		74	PEX_TX11	
75	PEX_RX11		76	GND	
77	GND		78	PEX_TX10#	
79	PEX_RX10#		80	PEX_TX10	
81	PEX_RX10		82	GND	
83	GND		84	PEX_TX9#	
85	PEX_RX9#		86	PEX_TX9	
87	PEX_RX9		88	GND	
89	GND		90	PEX_TX8#	
91	PEX_RX8#		92	PEX_TX8	
93	PEX_RX8		94	GND	
95	GND		96	PEX_TX7#	
97	PEX_RX7#		98	PEX_TX7	
99	PEX_RX7		100	GND	
101	GND		102	PEX_TX6#	
103	PEX_RX6#		104	PEX_TX6	
105	PEX_RX6		106	GND	

Table 1-6: MXM Connector Pin Definition

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Primary Side (Underside)			Secondary Side (Top Side)		
Pin	**Signal**	**PU/PD/NI**	**Pin**	**Signal**	**PU/PD/NI**
107	GND		108	PEX_TX5#	
109	PEX_RX5#		110	PEX_TX5	
111	PEX_RX5		112	GND	
113	GND		114	PEX_TX4#	
115	PEX_RX4#		116	PEX_TX4	
117	PEX_RX4		118	GND	
119	GND		120	PEX_TX3#	
121	PEX_RX3#		122	PEX_TX3	
123	PEX_RX3		124	GND	
125	GND		126	KEY	
127	KEY		128	KEY	
129	KEY		130	KEY	
131	KEY		132	KEY	
133	GND		134	GND	
135	PEX_RX2#		136	PEX_TX2#	
137	PEX_RX2		138	PEX_TX2	
139	GND		140	GND	
141	PEX_RX1#		142	PEX_TX1#	
143	PEX_RX1		144	PEX_TX1	
145	GND		146	GND	
147	PEX_RX0#		148	PEX_TX0#	
149	PEX_RX0		150	PEX_TX0	
151	GND		152	GND	
153	PEX_REFCLK#		154	PEX_CLK_REQ#	
155	PEX_REFCLK		156	PEX_RST#	
157	GND		158	VGA_DDC_DAT	NI
159	JTAG_TDO		160	VGA_DDC_CLK	NI
161	JTAG_TDI		162	VGA_VSYNC	NI
163	JTAG_TCLK		164	VGA_HSYNC	NI
165	JTAG_TMS		166	GND	

Table 1-6: MXM Connector Pin Definition

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Primary Side (Underside)			Secondary Side (Top Side)		
Pin	**Signal**	**PU/PD/NI**	**Pin**	**Signal**	**PU/PD/NI**
167	JTAG_TRST#		168	VGA_RED	NI
169	LVDS_UCLK#	NI	170	VGA_GREEN	NI
171	LVDS_UCLK	NI	172	VGA_BLUE	NI
173	GND		174	GND	
175	LVDS_UTX3#	NI	176	LVDS_LCLK#	NI
177	LVDS_UTX3	NI	178	LVDS_LCLK	NI
179	GND		180	GND	
181	LVDS_UTX2#	NI	182	LVDS_LTX3#	NI
183	LVDS_UTX2	NI	184	LVDS_LTX3	NI
185	GND		186	GND	
187	LVDS_UTX1#	NI	188	LVDS_LTX2#	NI
189	LVDS_UTX1	NI	190	LVDS_LTX2	NI
191	GND		192	GND	
193	LVDS_UTX0#	NI	194	LVDS_LTX1#	NI
195	LVDS_UTX0	NI	196	LVDS_LTX1	NI
197	GND		198	GND	
199	DP_C_L0#		200	LVDS_LTX0#	NI
201	DP_C_L0		202	LVDS_LTX0	NI
203	GND		204	GND	
205	DP_C_L1#		206	DP_D_L0#	
207	DP_C_L1		208	DP_D_L0	
209	GND		210	GND	
211	DP_C_L2#		212	DP_D_L1#	
213	DP_C_L2		214	DP_D_L1	
215	GND		216	GND	
217	DP_C_L3#		218	DP_D_L2#	
219	DP_C_L3		220	DP_D_L2	
221	GND		222	GND	
223	DP_C_AUX#		224	DP_D_L3#	
225	DP_C_AUX		226	DP_D_L3	

Table 1-6: MXM Connector Pin Definition

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Primary Side (Underside)			Secondary Side (Top Side)		
Pin	**Signal**	**PU/PD/NI**	**Pin**	**Signal**	**PU/PD/NI**
227	RSVD		228	GND	
229	RSVD		230	DP_D_AUX#	
231	RSVD		232	DP_D_AUX	
233	RSVD		234	DP_C_HPD	
235	RSVD		236	DP_D_HPD	
237	RSVD		238	RSVD	
239	RSVD		240	3V3	
241	RSVD		242	3V3	
243	RSVD		244	GND	
245	RSVD		246	DP_B_L0#	
247	RSVD		248	DP_B_L0	
249	RSVD		250	GND	
251	GND		252	DP_B_L1#	
253	DP_A_L0#		254	DP_B_L1	
255	DP_A_L0		256	GND	
257	GND		258	DP_B_L2#	
259	DP_A_L1#		260	DP_B_L2	
261	DP_A_L1		262	GND	
263	GND		264	DP_B_L3#	
265	DP_A_L2#		266	DP_B_L3	
267	DP_A_L2		268	GND	
269	GND		270	DP_B_AUX#	
271	DP_A_L3#		272	DP_B_AUX	
273	DP_A_L3		274	DP_B_HPD	
275	GND		276	DP_A_HPD	
277	DP_A_AUX#		278	3V3	
279	DP_A_AUX		280	3V3	

Table 1-6: MXM Connector Pin Definition

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1.6 Thermal Policy

The GPU core clock throttles at temperatures (T_J) past the thresholds shown with the behaviors as listed. Thermal throttling ensures that the highest temperature on the die does not exceed the sense temperature for prolonged periods of time.

Parameter	Value	Units
Thermal Resistance (Junction to Case, R_{JC})	0.03	°C/W
Thermal Resistance (Junction to PCB Board, R_{JB})	3.0	°C/W
GPU Maximum Operating Temperature[1]	94	°C
GPU Slowdown Temperature (THERM_ALERT)[2]	97	°C
GPU Shutdown Temperature (OVERT)[3]	102	°C

Table 1-7: Thermal Policy

NOTE:

1. Max.GPU operating temperature is the maximum at which the GPU is guaranteed to operate at target performance (base clock) under total board power level
2. THERM_ALERT generates a 50% (÷2) hardware clock slowdown.
3. OVERT generates a 87.5% (÷8) hardware clock slowdown

1.7 Unpacking Checklist

Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK. Ensure that the following items are included in the package.

- EGX-MXM-P2000 GPU module

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2 System Requirements

2.1 Power Sequencing

For initial power on, or to resume from S3 and S4, this sequence must be followed.

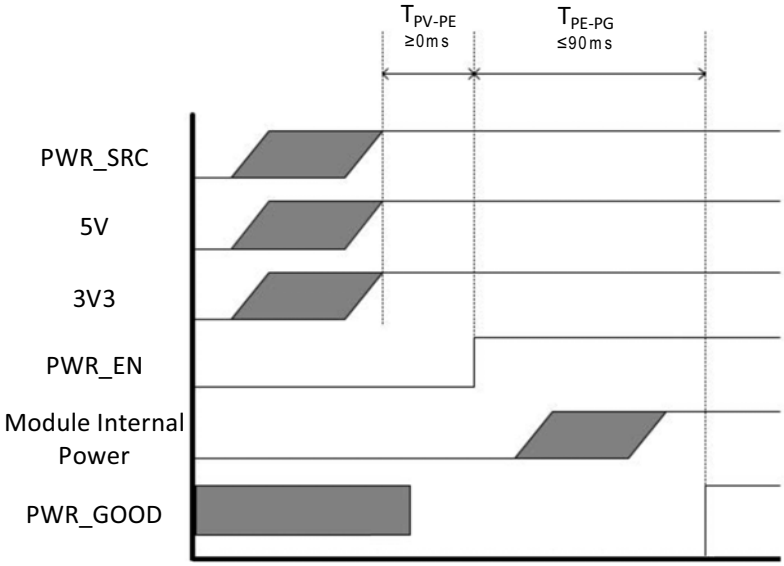


Figure 2-1: Power Sequencing

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2.2 Module Power Up and Down

Issuing the PWR_EN signal powers the MXM module down, and the system designer can decide whether to keep the module input power when the MXM module is powered down.

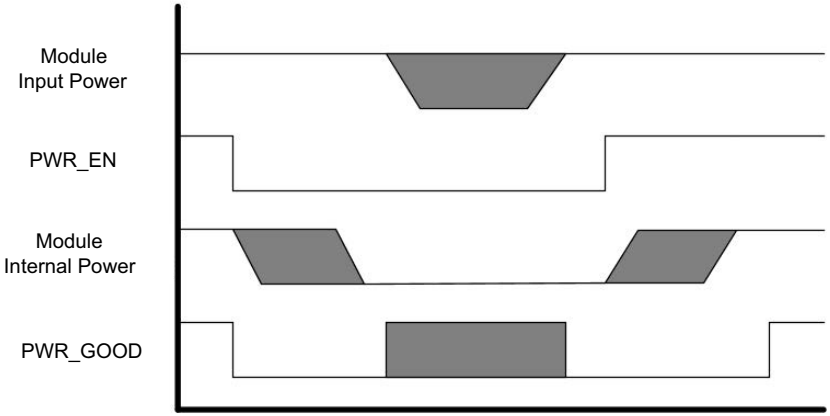


Figure 2-2: Module Power Down

2.3 Reset Requirements

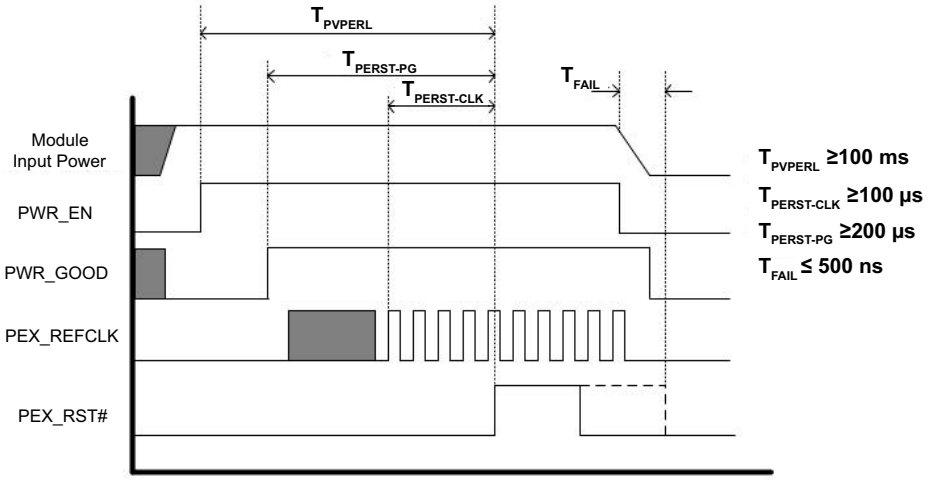


Figure 2-3: Reset Sequencing

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2.4 Dual Mode DisplayPort Implementation

The EGX-MXM-P2000 supports four dual mode DisplayPorts by default. HDMI is supported via dongle (see “Display Support and Options” on page 3.). The system requires a switch circuit to determine whether the AUX or DDC signal is output from the MXM module, and AC coupling capacitors should be placed on the system board.

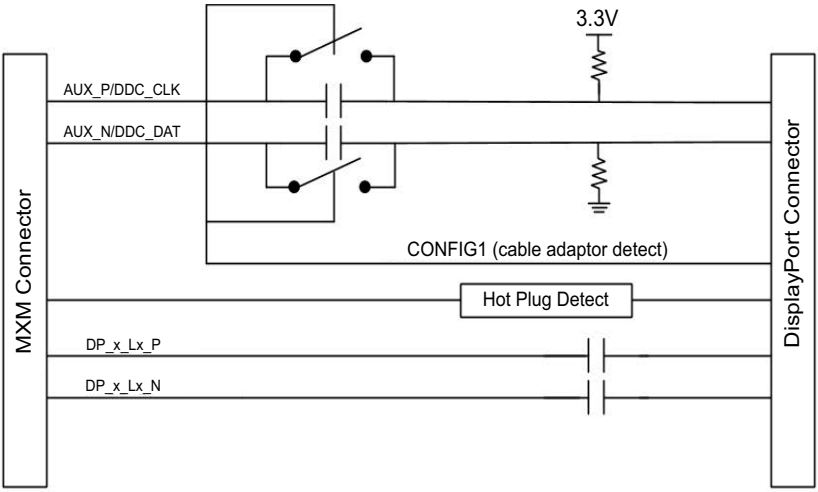


Figure 2-4: Dual Mode DisplayPort Implementation

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2.5 DVI/HDMI on DisplayPort Interface

DVI and HDMI connectors can both be implemented through the DisplayPort interface. Circuits required on the system board are as shown. 499Ω with 1% pulldown resistors to the ground on the DP lanes must placed on the DVI/HDMI connector side of the AC coupling, gated by a MOSFET to limit leakage.

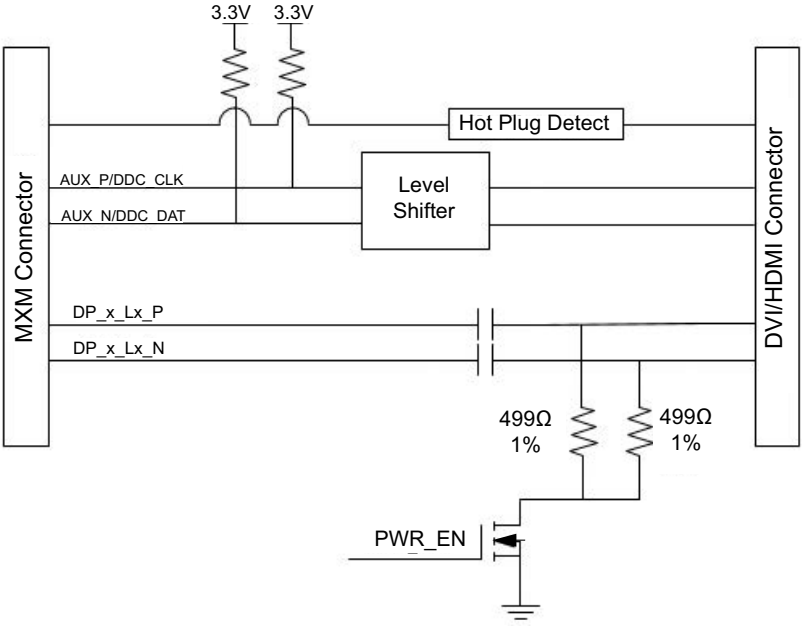


Figure 2-5: DVI/HDMI on DisplayPort Interface

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2.6 Driver Installation

Drivers can be downloaded from:
https://www.nvidia.com.tw/Download/index.aspx

2.7 Certifications & Agencies

- Windows Hardware Quality Lab (WHQL) certified Windows 7, and Windows 10
- EU Reduction of Hazardous Substances (EU-RoHS)
- Conformité Européenne (CE)
- Federal Communications Commission (FCC)

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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 device before handling/operating the device, to avoid injury or damage.

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil , pour éviter des blessures ou des dommages.

- Read these safety instructions carefully
- Keep the User's Manual for future reference
- Read the Specifications section of this manual for detailed information on the recommended operating environment
- The device can be operated at an ambient temperature of 50ºC
- When installing/mounting or uninstalling/removing device; or when removal of a chassis cover is required for user servicing:
  - Turn off power and unplug any power cords/cables
  - Reinstall all chassis covers before restoring power
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources
  - Keep device away from high heat or humidity
  - Keep device properly ventilated (do not block or cover ventilation openings)
  - Always use recommended voltage and power source settings
  - Always install and operate device near an easily accessible electrical outlet
  - Secure the power cord (do not place any object on/over the power cord)
  - Only install/attach and operate device on stable surfaces and/or recommended mountings
- If the device will not be used for long periods of time, turn off and unplug from its power source

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- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools
- 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; please dispose of used batteries appropriately.
Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location

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Getting Service

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