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# **NEMA<sup>®</sup> | pico VG 1000 Graphics Processing Unit**

## **Hardware User Manual**

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Version v23.10

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## 1 Overview

NEMA®| pico VG 1000, member of the NEMA-GPU Series, brings high quality graphics for User Interfaces in a very small silicon/ power budget targeting the Microcontrollers Market (MCU). NEMA®| pico VG 1000 is the perfect candidate to support entry level IoT-platforms, wearable and embedded devices with low cost and ultra-low power requirements supporting SoC's with a 32/64-bit MCU (e.g. ARM Cortex-M processors) and provide fluid graphics experience for a wide range of applications. Developers are able to create compelling Graphical User Interfaces (GUIs) and software applications with ultra-long battery life at a significantly lower cost for power-memory-area constrained IoT devices.

### 1.1 Features

- Hardware Components:
  - Programmable Shader engine with a VLIW instruction set
  - Command list based DMAs to minimize CPU overhead
  - Primitive Rasterizer
  - Texture Mapping unit (with radial fill capability)
  - Blending unit
- Drawing Primitives:
  - Pixel/Line drawing
  - Filled rectangles
  - Triangles (Gouraud Shaded)
  - Quadrilateral
- Color formats
  - 32-bit RGBA8888/BGRA8888/ABGR8888
  - 24-bit RGB
  - 16-bit AL88/RGBA5551/BGRA5551/ARGB1555/ABGR1555/RGB565/BGR565/RGBA4444/BGRA4444/ARGB4444/ABGR4444
  - 8-bit A8/L8/AL44/RGB332/RGBA2222/ABGR2222/BGRA2222/ARGB2222
  - 4-bit A4/L4
  - 2-bit A2/L2
  - 1-bit A1/L1
  - YUV (Read only)
  - TSC™
- Compression schemes (Optional)
  - TSC™ 4(4 bits per pixel)
  - TSC™ 6/ TSC™ 6a(6 bits per pixel with/out Alpha)
  - TSC™ 12/ TSC™ 12a(12 bits per pixel with/out Alpha)

- Image transformation
  - Texture mapping
  - Point sampling
  - Bilinear filtering
  - Blit support
  - Rotation any angle
  - Mirroring
  - Stretch (independently on x and y axis )
  - Source and/or destination color keying
  - Format conversions on the fly
  - 2.5D Perspective Correct Projections
- Text rendering supports
  - Bitmap antialiased A1/A2/A4/A8
  - Font Kerning
  - Unicode(UTF8)
- Blending Support
  - Fully Programmable Alpha blending modes(Source and Destination)
  - Source/Destination color keying
- Antialiasing
  - 8x MSAA
  - Quaddrilaterals per edge Antialising
  - Triangles per edge Antialiasing
  - Antialiased Thick lines
  - Antialiased Circles

## 1.2 Configuration Options

NEMA®| pico VG 1000 can be customized during design time by configuring a number of parameters that enable/disable several features of the design. The NEMA®| pico VG 1000 GUI Configurator, a Graphical User Interface Configurator Tool, is used for the configuration of NEMA®| pico VG 1000 parameters.

- Cache Sizes
- Compression Schemes
  - TSC™ 4
  - TSC™ 6 / TSC™ 6a
  - TSC™ 12 / TSC™ 12a
- Master Interface
  - AMBA AHB 32bit
  - AMBA AXI4 32/ 64/ 128bit

## 1.3 Integration - Verification

The NEMA®| pico VG 1000 GPU IP Platform is available in Verilog/SystemVerilog code and is easily integrated and verified. The NEMA®| pico VG 1000 ASIC reference designs have been evaluated in various process technologies and has been verified through extensive simulation and rigorous code coverage measurements. It is accompanied with a complete verification suite that compares reference images with rendered images.

## 1.4 Software

- OS support
  - Bare Metal (no-OS)
  - RTOS (NEMA®| GFX Library in ANSI C)
  - Linux
- Graphics API support
  - NEMA®| GFX API library in pure C
  - NEMA®| GFX - VG Extensions
  - Video Overlay Extensions
  - DirectFB
  - Qt
- Software Emulators and suites
  - NEMA®| pix-presso
  - NEMA®| gui-builder
  - NEMA®| Bits

NEMA®| GFX library which is available in pure ANSI C with no dependencies, allows easy portability to systems running RTOS or even to OS-less systems. The software package includes OS drivers for Linux and Software Libraries for supporting 2D Graphics APIs such as DirectFB and Qt

- NEMA®| GFX: Enables high quality 2.5D graphics on RTOS and OS-less systems. NEMA®| GFX is a proprietary low level library that interfaces directly with the NEMA GPUs and provides a software abstraction layer to organize and employ drawing commands with ease and efficiency. NEMA®| GFX can be used as a back-end to existing APIs and as a standalone Graphics API.
- DirectFB: Enables software development with application and Graphic User Interface (GUI) creation frameworks, such as GTK. DirectFB (Direct Frame Buffer) is a set of graphics APIs implemented on top of the Linux Frame Buffer abstraction layer.

The software package includes Linux drivers, Software Libraries for 2D Graphics APIs and comes together with:

- NEMA®| gui-builder, a graphical cross-platform software framework enabling rapid high-end Graphics User Interface (GUI) development on low resource hard-

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ware (non-commercial version, free download [https://www.think-silicon.com/?section=2335&language=en\\_US](https://www.think-silicon.com/?section=2335&language=en_US))

- NEMA®| pix-presso, a utility software for converting images to/from formats suitable for low power embedded devices (non-commercial version, free download [https://www.think-silicon.com/?section=2335&language=en\\_US](https://www.think-silicon.com/?section=2335&language=en_US))
- NEMA®| Bits, an EVK Kit for technology evaluation and pre-silicon application development

## 2 Register Specification (RDL)

### 2.1 Registers' Memory Map

The memory organization of the register map is shown in the tables of this section:

Address	Access	Reset Value	Name
0x0000	rw	0x0	NEMA_TEX0_BASE
0x0004	rw	0x0	NEMA_TEX0_FSTRIDE
0x0008	rw	0x0	NEMA_TEX0_RESXY
0x0010	rw	0x0	NEMA_TEX1_BASE
0x0014	rw	0x0	NEMA_TEX1_FSTRIDE
0x0018	rw	0x0	NEMA_TEX1_RESXY
0x001c	rw	0x0	NEMA_TEX_COLOR
0x0020	rw	0x0	NEMA_TEX2_BASE
0x0024	rw	0x0	NEMA_TEX2_FSTRIDE
0x0028	rw	0x0	NEMA_TEX2_RESXY
0x0030	rw	0x0	NEMA_TEX3_BASE
0x0034	rw	0x0	NEMA_TEX3_FSTRIDE
0x0038	rw	0x0	NEMA_TEX3_RESXY
0x0048	rw	0x0	NEMA_TSC_NEW_BLOCK_TRIG
0x004c	rw	0x0	NEMA_TSC_NEW_BLOCK_SEL
0x0080	rw	0x0	NEMA_BREAKPOINT
0x008c	rw	0x0	NEMA_BREAKPOINT_MASK
0x0094	rw	0x0	NEMA_CGCTRL
0x0098	rw	0xffffffff	NEMA_DIRTYMIN
0x009c	r	0x0	NEMA_DIRTYMAX
0x00c0	rw	0x0	NEMA_BUS_CTRL
0x00c4	rw	0x0	NEMA_IMEM_ADDR
0x00c8	rw	0x0	NEMA_IMEM_DATA_LOW
0x00cc	rw	0x0	NEMA_IMEM_DATA_HIGH



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Address	Access	Reset Value	Name
0x00d0	rw	0x0	NEMA_BURST_SIZE
0x00e4	rw	0x80640007	NEMA_FLUSH_CTRL
0x00e8	rw	0x0	NEMA_CMDSTATUS
0x00ec	rw	0x0	NEMA_CMDRINGSTOP
0x00f0	rw	0x0	NEMA_CMDADDR
0x00f4	rw	0x0	NEMA_CMDSIZE
0x00f8	rw	0x0	NEMA_INTERRUPT
0x00fc	rw	0x0	NEMA_STATUS
0x0100	rw	0x0	NEMA_DRAW_CMD_NOHOLD
0x0104	rw	0x0	NEMA_DRAW_STARTXY
0x0108	rw	0x0	NEMA_DRAW_ENDXY
0x010c	rw	0x0	DRAW_FAN_X
0x0110	rw	0x0	NEMA_CLIPMIN
0x0114	rw	0x7fff7fff	NEMA_CLIPMAX
0x0118	rw	0x05000000	NEMA_MATMULT
0x011c	rw	0x0	NEMA_CODEPTR
0x0120	rw	0x0	NEMA_DRAW_PT0_X
0x0124	rw	0x0	NEMA_DRAW_PT0_Y
0x0128	rw	0x0	DRAW_FAN_Y
0x012c	rw	0x0	NEMA_DRAW_COLOR
0x0130	rw	0x0	NEMA_DRAW_PT1_X
0x0134	rw	0x0	NEMA_DRAW_PT1_Y
0x0138	rw	0x0	NEMA_BYPASS_ADDR
0x013c	rw	0x0	BYPASS_DATA
0x0140	rw	0x0	NEMA_DRAW_PT2_X
0x0144	rw	0x0	NEMA_DRAW_PT2_Y
0x0148	rw	0x0	NEMA_CLID
0x0150	rw	0x0	NEMA_DRAW_PT3_X
0x0154	rw	0x0	NEMA_DRAW_PT3_Y

Address	Access	Reset Value	Name
0x0158	rw	0x0	NEMA_CLIPMIN1
0x015c	rw	0x7fff7fff	NEMA_CLIPMAX1
0x0160	rw	0x0	NEMA_MM00
0x0164	rw	0x0	NEMA_MM01
0x0168	rw	0x0	NEMA_MM02
0x016c	rw	0x0	NEMA_MM10
0x0170	rw	0x0	NEMA_MM11
0x0174	rw	0x0	NEMA_MM12
0x0178	rw	0x0	NEMA_MM20
0x017c	rw	0x0	NEMA_MM21
0x0180	rw	0x0	NEMA_MM22
0x0184	rw	0x0	NEMA_DEPTH_START_L
0x0188	rw	0x0	NEMA_DEPTH_START_H
0x018c	rw	0x0	NEMA_DEPTH_DX_L
0x0190	rw	0x0	NEMA_DEPTH_DX_H
0x0194	rw	0x0	NEMA_DEPTH_DY_L
0x0198	rw	0x0	NEMA_DEPTH_DY_H
0x01a0	rw	0x0	NEMA_RED_DX
0x01a4	rw	0x0	NEMA_RED_DY
0x01a8	rw	0x0	NEMA_GRE_DX
0x01ac	rw	0x0	NEMA_GRE_DY
0x01b0	rw	0x0	NEMA_BLU_DX
0x01b4	rw	0x0	NEMA_BLU_DY
0x01b8	rw	0x0	NEMA_ALF_DX
0x01bc	rw	0x0	NEMA_ALF_DY
0x01c0	rw	0x0	NEMA_RED_INIT
0x01c4	rw	0x0	NEMA_GRE_INIT
0x01c8	rw	0x0	NEMA_BLU_INIT
0x01cc	rw	0x0	NEMA_ALF_INIT

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Address	Access	Reset Value	Name
0x01d0	rw	0x0	NEMA_ROPBLENDER_BLEND_MODE
0x01d4	rw	0x0	NEMA_ROPBLENDER_DST_CKEY
0x01d8	rw	0x0	NEMA_ROPBLENDER_CONST_COLOR
0x01dc	r	0x00231000	NEMA_IP_VERSION
0x01e0	rw	0x0	NEMA_CODEPTR2
0x01ec	r	0x86362000	NEMA_IDREG
0x01f0	r	0xd4010104	NEMA_CONFIG
0x01f4	r	0x000003e3	NEMA_CONFIGH
0x0200	w	0x0	NEMA_C0_REG
0x0204	w	0x0	NEMA_C1_REG
0x0208	w	0x0	NEMA_C2_REG
0x020c	w	0x0	NEMA_C3_REG
0x0320	w	0x0	DRAW_PT0_X
0x0324	w	0x0	DRAW_PT0_Y
0x0328	w	0x0	DRAW_FP_FAN_X
0x032c	w	0x0	DRAW_FP_FAN_Y
0x0330	w	0x0	DRAW_PT1_X
0x0334	w	0x0	DRAW_PT1_Y
0x0340	w	0x0	DRAW_PT2_X
0x0344	w	0x0	DRAW_PT2_Y
0x0350	w	0x0	DRAW_PT3_X
0x0354	w	0x0	DRAW_PT3_Y
0x0360	rw	0x3f800000	VMM00
0x0364	rw	0x0	VMM01
0x0368	rw	0x0	VMM02
0x036c	rw	0x0	VMM10
0x0370	rw	0x3f800000	VMM11
0x0374	rw	0x0	VMM12
0x0378	rw	0x0	VMM20

Address	Access	Reset Value	Name
0x037c	rw	0x0	VMM21
0x0380	rw	0x3f800000	VMM22
0x04d0	rw	0x00000fff	NEMA_COORD_MASK
0x04d4	rw	0x00008000	DRAW_FLATNESS
0x0ff0	rw	0x0	NEMA_IRQ_ID
0x0ff4	rw	0x0	NEMA_GP_FLAGS
0x0ff8	rw	0x0	NEMA_SYS_INTERRUPT
0x0ffc	rw	0x0	NEMA_BUSERROR_MASK

## 2.2 Registers' Description

The following section is a detailed description of the register file. All registers are 32 bits wide.

**NEMA\_TEX0\_BASE**

Address	Access	Reset	Description
0x0000	rw	0x0	Base address of drawing surface 0.

**Fields**

BASE	
31	0
0	
Reset	

**Fields Description****BASE**

Specifies the base address of drawing surface 0.

## NEMA\_TEX0\_FSTRIDE

Address	Access	Reset	Description
0x0004	rw	0x0	Image 0 Mode and Stride

### Fields

DITH		FORMAT		RADFILL		RSVD		TILE		WRAP		RSVD		MODE		STRIDE		
31	30	24	23	22	21	20	19	18	17	16	15	0						
0	0		0	0	0	0	0	0	0	0	0							Reset

### Fields Description

#### STRIDE

Specifies the image stride distance in bytes from one scanline to another (signed)

#### MODE

Specifies the image mode (applicable only for Textures not for Framebuffer)

- \* 0x0 Point sampling
- \* 0x1 Bilinear filtering

#### WRAP

Specifies the image wrapping mode (applicable only for Textures not for Framebuffer).

- \* 0x0 Clamp
- \* 0x1 Repeat
- \* 0x2 Border
- \* 0x3 Mirror

#### TILE

Enables the Tile Mode.

#### RADFILL

Radial fill enable

#### FORMAT

Specifies the image format

- \* 0x00 RGBX8888
- \* 0x01 RGBA8888
- \* 0x02 XRGB8888
- \* 0x03 ARGB8888
- \* 0x04 RGBA5650
- \* 0x05 RGBA5551
- \* 0x06 RGBA4444
- \* 0x08 RGBA0008 (Only available as input format)
- \* 0x09 L8
- \* 0x0B L1 (Only available as input format)

- \* 0x0C A1 (Only available as input format)
- \* 0x0D UYVY (Only available as input format)
- \* 0x0E ABGR8888 (Only available as input format)
- \* 0x10 BGRA (Only available as input format)
- \* 0x11 BGRX (Only available as input format)
- \* 0x12 TSC4
- \* 0x16 TSC6
- \* 0x17 TSC6A
- \* 0x4C TSC12
- \* 0x4D TSC12A
- \* 0x27 A1LE (Only available as input format)
- \* 0x28 A2LE (Only available as input format)
- \* 0x29 A4LE (Only available as input format)
- \* 0x2A L1LE (Only available as input format)
- \* 0x2B L2LE (Only available as input format)
- \* 0x2C L4LE (Only available as input format)
- \* 0x30 A2 (Only available as input format)
- \* 0x31 L2 (Only available as input format)
- \* 0x34 A4 (Only available as input format)
- \* 0x35 L4 (Only available as input format)
- \* 0x38 RGBA3320 (Only available as input format)
- \* 0x39 BGR24
- \* 0x3C RGB24
- \* 0x40 RGBA2222
- \* 0x41 ABGR2222
- \* 0x42 BGRA2222
- \* 0x43 ARGB2222

#### **DITH**

If set for destination texture, enables color dithering.  
(Applicable to output formats RGBA5650, RGBA5551, RGBA4444).

## NEMA\_TEX0\_RESXY

Address	Access	Reset	Description
0x0008	rw	0x0	Image 0 Resolution

### Fields

RESY		RESX	
31	16	15	0
0		0	
		Reset	

### Fields Description

#### RESX

Specifies the size of resolution X

#### RESY

Specifies the size of resolution Y



**NEMA\_TEX1\_BASE**

Address	Access	Reset	Description
0x0010	rw	0x0	Base address of drawing surface 1.

**Fields**

BASE	
31	0
0	
Reset	

**Fields Description****BASE**

Specifies the base address of drawing surface 1.

## NEMA\_TEX1\_FSTRIDE

Address	Access	Reset	Description
0x0014	rw	0x0	Image 1 Mode and Stride

### Fields

DITH		FORMAT			RADFILL		RSVD		TILE		WRAP		RSVD		MODE		STRIDE		
31	30			24	23	22	21	20	19	18	17	16	15						0
0	0			0	0	0	0	0	0	0	0	0	0					Reset	

### Fields Description

#### STRIDE

Specifies the image stride distance in bytes from one scanline to another (signed)

#### MODE

Specifies the image mode (applicable only for Textures not for Framebuffer)

- \* 0x0 Point sampling
- \* 0x1 Bilinear filtering

#### WRAP

Specifies the image wrapping mode (applicable only for Textures not for Framebuffer).

- \* 0x0 Clamp
- \* 0x1 Repeat
- \* 0x2 Border
- \* 0x3 Mirror

#### TILE

Enables the Tile Mode.

#### RADFILL

Radial fill enable

#### FORMAT

Specifies the image format

- \* 0x00 RGBX8888
- \* 0x01 RGBA8888
- \* 0x02 XRGB8888
- \* 0x03 ARGB8888
- \* 0x04 RGBA5650
- \* 0x05 RGBA5551
- \* 0x06 RGBA4444
- \* 0x08 RGBA0008 (Only available as input format)
- \* 0x09 L8
- \* 0x0B L1 (Only available as input format)

- \* 0x0C A1 (Only available as input format)
- \* 0x0D UYVY (Only available as input format)
- \* 0x0E ABGR8888 (Only available as input format)
- \* 0x10 BGRA (Only available as input format)
- \* 0x11 BGRX (Only available as input format)
- \* 0x12 TSC4
- \* 0x16 TSC6
- \* 0x17 TSC6A
- \* 0x4C TSC12
- \* 0x4D TSC12A
- \* 0x27 A1LE (Only available as input format)
- \* 0x28 A2LE (Only available as input format)
- \* 0x29 A4LE (Only available as input format)
- \* 0x2A L1LE (Only available as input format)
- \* 0x2B L2LE (Only available as input format)
- \* 0x2C L4LE (Only available as input format)
- \* 0x30 A2 (Only available as input format)
- \* 0x31 L2 (Only available as input format)
- \* 0x34 A4 (Only available as input format)
- \* 0x35 L4 (Only available as input format)
- \* 0x38 RGBA3320 (Only available as input format)
- \* 0x39 BGR24
- \* 0x3C RGB24
- \* 0x40 RGBA2222
- \* 0x41 ABGR2222
- \* 0x42 BGRA2222
- \* 0x43 ARGB2222

#### **DITH**

If set for destination texture, enables color dithering.  
(Applicable to output formats RGBA5650, RGBA5551, RGBA4444).

## NEMA\_TEX1\_RESXY

Address	Access	Reset	Description
0x0018	rw	0x0	Image 1 Resolution

### Fields

RESY		RESX	
31	16	15	0
0		0	
		Reset	

### Fields Description

#### RESX

Specifies the size of resolution X

#### RESY

Specifies the size of resolution Y

**NEMA\_TEX\_COLOR**

Address	Access	Reset	Description
0x001c	rw	0x0	Texture Map's default color (for use with Luminance and Alpha-only color formats)

**Fields**

ALPHA				BLUE				GREEN				RED			
31		24		23		16		15		8		7		0	
0				0				0				0			

Reset

**Fields Description****RED**

Specifies the Red (R) value

**GREEN**

Specifies the Green (G) value

**BLUE**

Specifies the Blue (B) value

**ALPHA**

Specifies the Alpha (A) value

## NEMA\_TEX2\_BASE

Address	Access	Reset	Description
0x0020	rw	0x0	Base address of drawing surface 2.

### Fields

BASE		
31	0	
0		Reset

### Fields Description

#### BASE

Specifies the base address of drawing surface 2.

## NEMA\_TEX2\_FSTRIDE

Address	Access	Reset	Description
0x0024	rw	0x0	Image 2 Mode and Stride

### Fields

DITH		FORMAT		RADFILL		RSVD		TILE		WRAP		RSVD		MODE		STRIDE	
31	30	24	23	22	21	20	19	18	17	16	15	0					
0	0		0	0	0	0	0	0	0	0	0						Reset

### Fields Description

#### STRIDE

Specifies the image stride distance in bytes from one scanline to another (signed)

#### MODE

Specifies the image mode (applicable only for Textures not for Framebuffer)

- \* 0x0 Point sampling
- \* 0x1 Bilinear filtering

#### WRAP

Specifies the image wrapping mode (applicable only for Textures not for Framebuffer).

- \* 0x0 Clamp
- \* 0x1 Repeat
- \* 0x2 Border
- \* 0x3 Mirror

#### TILE

Enables the Tile Mode.

#### RADFILL

Radial fill enable

#### FORMAT

Specifies the image format

- \* 0x00 RGBX8888
- \* 0x01 RGBA8888
- \* 0x02 XRGB8888
- \* 0x03 ARGB8888
- \* 0x04 RGBA5650
- \* 0x05 RGBA5551
- \* 0x06 RGBA4444
- \* 0x08 RGBA0008 (Only available as input format)
- \* 0x09 L8
- \* 0x0B L1 (Only available as input format)

- \* 0x0C A1 (Only available as input format)
- \* 0x0D UYVY (Only available as input format)
- \* 0x0E ABGR8888 (Only available as input format)
- \* 0x10 BGRA (Only available as input format)
- \* 0x11 BGRX (Only available as input format)
- \* 0x12 TSC4
- \* 0x16 TSC6
- \* 0x17 TSC6A
- \* 0x4C TSC12
- \* 0x4D TSC12A
- \* 0x27 A1LE (Only available as input format)
- \* 0x28 A2LE (Only available as input format)
- \* 0x29 A4LE (Only available as input format)
- \* 0x2A L1LE (Only available as input format)
- \* 0x2B L2LE (Only available as input format)
- \* 0x2C L4LE (Only available as input format)
- \* 0x30 A2 (Only available as input format)
- \* 0x31 L2 (Only available as input format)
- \* 0x34 A4 (Only available as input format)
- \* 0x35 L4 (Only available as input format)
- \* 0x38 RGBA3320 (Only available as input format)
- \* 0x39 BGR24
- \* 0x3C RGB24
- \* 0x40 RGBA2222
- \* 0x41 ABGR2222
- \* 0x42 BGRA2222
- \* 0x43 ARGB2222

**DITH**

If set for destination texture, enables color dithering.  
(Applicable to output formats RGBA5650, RGBA5551, RGBA4444).



**NEMA\_TEX2\_RESXY**

Address	Access	Reset	Description
0x0028	rw	0x0	Image 2 Resolution

**Fields**

RESY																RESX																
31								16								15								0								
0																0																Reset

**Fields Description****RESX**

Specifies the size of resolution X

**RESY**

Specifies the size of resolution Y

## NEMA\_TEX3\_BASE

Address	Access	Reset	Description
0x0030	rw	0x0	Base address of drawing surface 3.

### Fields

BASE		
31	0	
0		Reset

### Fields Description

#### BASE

Specifies the base address of drawing surface 3.

## NEMA\_TEX3\_FSTRIDE

Address	Access	Reset	Description
0x0034	rw	0x0	Image 3 Mode and Stride

### Fields

DITH		FORMAT			RADFILL		RSVD		TILE		WRAP		RSVD		MODE		STRIDE					
31	30	24			23	22	21	20	19	18	17	16	15	0								
0	0			0	0	0	0	0	0	0	0	0						Reset				

### Fields Description

#### STRIDE

Specifies the image stride distance in bytes from one scanline to another (signed)

#### MODE

Specifies the image mode (applicable only for Textures not for Framebuffer)

- \* 0x0 Point sampling
- \* 0x1 Bilinear filtering

#### WRAP

Specifies the image wrapping mode (applicable only for Textures not for Framebuffer).

- \* 0x0 Clamp
- \* 0x1 Repeat
- \* 0x2 Border
- \* 0x3 Mirror

#### TILE

Enables the Tile Mode.

#### RADFILL

Radial fill enable

#### FORMAT

Specifies the image format

- \* 0x00 RGBX8888
- \* 0x01 RGBA8888
- \* 0x02 XRGB8888
- \* 0x03 ARGB8888
- \* 0x04 RGBA5650
- \* 0x05 RGBA5551
- \* 0x06 RGBA4444
- \* 0x08 RGBA0008 (Only available as input format)
- \* 0x09 L8
- \* 0x0B L1 (Only available as input format)

- \* 0x0C A1 (Only available as input format)
- \* 0x0D UYVY (Only available as input format)
- \* 0x0E ABGR8888 (Only available as input format)
- \* 0x10 BGRA (Only available as input format)
- \* 0x11 BGRX (Only available as input format)
- \* 0x12 TSC4
- \* 0x16 TSC6
- \* 0x17 TSC6A
- \* 0x4C TSC12
- \* 0x4D TSC12A
- \* 0x27 A1LE (Only available as input format)
- \* 0x28 A2LE (Only available as input format)
- \* 0x29 A4LE (Only available as input format)
- \* 0x2A L1LE (Only available as input format)
- \* 0x2B L2LE (Only available as input format)
- \* 0x2C L4LE (Only available as input format)
- \* 0x30 A2 (Only available as input format)
- \* 0x31 L2 (Only available as input format)
- \* 0x34 A4 (Only available as input format)
- \* 0x35 L4 (Only available as input format)
- \* 0x38 RGBA3320 (Only available as input format)
- \* 0x39 BGR24
- \* 0x3C RGB24
- \* 0x40 RGBA2222
- \* 0x41 ABGR2222
- \* 0x42 BGRA2222
- \* 0x43 ARGB2222

**DITH**

If set for destination texture, enables color dithering.  
(Applicable to output formats RGBA5650, RGBA5551, RGBA4444).

**NEMA\_TEX3\_RESXY**

Address	Access	Reset	Description
0x0038	rw	0x0	Image 3 Resolution

**Fields**

RESY																RESX																
31																0																
0																0																Reset

**Fields Description****RESX**

Specifies the size of resolution X

**RESY**

Specifies the size of resolution Y

## NEMA\_TSC\_NEW\_BLOCK\_TRIG

Address	Access	Reset	Description
0x0048	rw	0x0	Trigger to reset TSc block.

### Fields

RSVD	
31	0
0	
Reset	

### Fields Description

**NEMA\_TSC\_NEW\_BLOCK\_SEL**

Address	Access	Reset	Description
0x004c	rw	0x0	Select how TSc block will be reset.

**Fields**

RSVD		SEL	
31	2	1	0
0		0	Reset

**Fields Description****SEL**

- 0: Reset TSc block when NEMA\_DRAW\_CMD\_NOHOLD is written or tessellator starts new geometry or NEMA\_TSC\_NEW\_BLOCK\_TRIG is written.
- 1: Reset TSc block when NEMA\_DRAW\_CMD\_NOHOLD is written or NEMA\_TSC\_NEW\_BLOCK\_TRIG is written.
- 2: Reset TSc block when NEMA\_TSC\_NEW\_BLOCK\_TRIG is written.

## NEMA\_BREAKPOINT

Address	Access	Reset	Description
0x0080	rw	0x0	Debug feature. Specifies a Breakpoint on the Command List

### Fields

NEMA_BREAKPOINT	
31	0
0	
Reset	

### Fields Description

#### NEMA\_BREAKPOINT

Specifies the Breakpoint ID



**NEMA\_BREAKPOINT\_MASK**

Address	Access	Reset	Description
0x008c	rw	0x0	Debug feature. Specifies a Breakpoint Mask.

**Fields**

MASK	
31	0
0	
Reset	

**Fields Description****MASK**

Specifies the Breakpoint Mask

## NEMA\_CGCTRL

Address	Access	Reset	Description
0x0094	rw	0x0	Clock gating controller

### Fields

ALL	RSVD	RSVD	RSVD	MEM_C0	RSVD	RSVD	RSVD	C0	RSVD	RSVD	RSVD	SCH_C0	RSVD	RSVD	RSVD	RF_C0	RSVD	RSVD	RSVD	PIPE_C0	RSVD	RSVD	RSVD	BUS_TEX_C0	RSVD	RSVD	RSVD	ROP_C0	RAST	RF	CL
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Reset

### Fields Description

#### CL

Disable clock gating for the Command List Processor

#### RF

Disable clock gating for the NemaP Configuration Register File

#### RAST

Disable clock gating for the NemaP Rasterizer

#### ROP\_C0

Disable clock gating for the Render Output Unit of core 0

#### BUS\_TEX\_C0

Disable clock gating for the BusInterface (memory System) and Core 0 Texture Map

#### PIPE\_C0

Disable clock gating for Core 0 Pipeline

#### RF\_C0

Disable clock gating for Core 0 Register File

#### SCH\_C0

Disable clock gating for Core 0 Scheduler

#### C0

Disable clock gating for Core 0

#### MEM\_C0

Disable clock gating for Core 0 Instruction Memory

#### ALL

Disable clock gating for all modules

**NEMA\_DIRTYMIN**

Address	Access	Reset	Description
0x0098	rw	0xffffffff	Read the Dirty_Min value. Resets dirty region to resolution size on write function.

**Fields**

DIRTYMIN	
31	0
FFFFFFFF	
Reset	

**Fields Description****DIRTYMIN**

Write any value to reset dirty region to resolution size  
Read the Dirty\_min value

## NEMA\_DIRTYMAX

Address	Access	Reset	Description
0x009c	r	0x0	Read the Dirty_Max value

### Fields

DIRTYMAX	
31	0
0	
Reset	

### Fields Description

#### DIRTYMAX (*Read only*)

Read the Dirty\_max value

## NEMA\_BUS\_CTRL

Address	Access	Reset	Description
0x00c0	rw	0x0	Indicates the value of the AWCACHE and the ARCACHE signals of the AXI Bus Interface.

## Fields

RSVD								AWCACHE		ARCACHE	
31							8	7	4	3	0
0								0		0	

Reset

## Fields Description

### ARCACHE

Specifies the value of the output ARCACHE signal of the AXI Master Read Bus Interface

### AWCACHE

Specifies the value of the output AWCACHE signal of the AXI Master Write Bus Interface

## NEMA\_IMEM\_ADDR

Address	Access	Reset	Description
0x00c4	rw	0x0	Load shader instruction memory address. This register can be auto incremented. Its content should be considered volatile

### Fields

RSVD				ADDR	
31			4	3	0
		0		0	Reset

### Fields Description

#### ADDR

Specifies the load shader instruction memory address

**NEMA\_IMEM\_DATA\_LOW**

Address	Access	Reset	Description
0x00c8	rw	0x0	The lower bits (31-0) of the 64-bit load shader instruction memory data

**Fields**

IMEM_DATA_LOW	
31	0
0	
Reset	

**Fields Description****IMEM\_DATA\_LOW**

Specifies the lower bits (31-0) of the load shader instruction memory data

## NEMA\_IMEM\_DATA\_HIGH

Address	Access	Reset	Description
0x00cc	rw	0x0	The higher bits (63-32) of the 64-bit load shader instruction memory data

### Fields

IMEM_DATA_HIGH	
31	0
0	
Reset	

### Fields Description

#### IMEM\_DATA\_HIGH

Specifies the higher bits (63-32) of the load shader instruction memory data



**NEMA\_BURST\_SIZE**

Address	Access	Reset	Description
0x00d0	rw	0x0	Controls the size of the burst for the texture and framebuffer read.

**Fields****Fields Description****TEX\_BURST\_SIZE**

Value of the texture read burst size in log2(bytes).  
 Value of 0 or greater than log2(UNEMA\_TEX\_BURST) will result in burst size equal to UNEMA\_TEX\_BURST (biggest possible).  
 Value of 1 or smaller than log2(UNEMA\_AXI\_WIDTH\_M/8) will result in burst size equal to UNEMA\_AXI\_WIDTH\_M/8 (smallest possible).  
 Value should be greater or equal to the texture format size used, e.g. TSc6 (12 bytes) mode requires a value greater or equal to 4.

**FB\_BURST\_SIZE**

Value of the framebuffer read burst size in log2(bytes).  
 Value of 0 or greater than log2(UNEMA\_FB\_BURST) will result in burst size equal to UNEMA\_FB\_BURST (biggest possible).  
 Value of 1 or smaller than log2(UNEMA\_AXI\_WIDTH\_M/8) will result in burst size equal to UNEMA\_AXI\_WIDTH\_M/8 (smallest possible).  
 Value should be greater or equal to the framebuffer format size used, e.g. TSc6 (12 bytes) mode requires a value greater or equal to 4.

## NEMA\_FLUSH\_CTRL

Address	Access	Reset	Description
0x00e4	rw	0x80640007	Controls the system flush

### Fields

WCACHE_EN		WCACHE_TIMEOUT														RSVD		WRITE_FLUSH		RSVD		WRITE_FLUSH_HOST		RSVD		WRITE_FLUSH_CMD		RSVD		READ_FLUSH_HOST		RSVD		READ_FLUSH_CMD	
31	30															16	15	14	13	12	11	10	8	7	6	5	4	3	1	0					
1	64														0	0	0	0	0			0	0	0	0	3	1	Reset							

### Fields Description

#### READ\_FLUSH\_CMD

If set to 1, the read caches are flushed when the Command List Processor triggers the Rasterizer (Register NEMA\_DRAW\_CMD\_NOHOLD)

#### READ\_FLUSH\_HOST

If set to 1, the read caches are flushed when the Host triggers the Rasterizer (Register NEMA\_DRAW\_CMD\_NOHOLD)

#### READ\_FLUSH

When set to 1, flush read caches

#### WRITE\_FLUSH\_CMD

If set to 1, the write caches are flushed when the Command List Processor triggers the Rasterizer (Register NEMA\_DRAW\_CMD\_NOHOLD)

#### WRITE\_FLUSH\_HOST

If set to 1, the write caches are flushed when the Host triggers the Rasterizer (Register NEMA\_DRAW\_CMD\_NOHOLD)

#### WRITE\_FLUSH

When set to 1, flush write caches

#### WCACHE\_TIMEOUT

Timeout for the lines of the WCache

#### WCACHE\_EN

When set to 1, write cache is enabled

Address	Access	Reset	Description
0x00e8	rw	0x0	On read, returns internal CL processor status. On write, resets CL processor. Its content should be considered volatile.

BUSY_CMD				SYSTEM_DATA				FIFO_READ_DATA				CMDMEM_BUSY				RSVD								FIFO_AVAIL								RSVD				STK_PNT_ADDR				RSVD				CMD_FSM				RSVD				CMD_FSM_FETCH			
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																								
0	0	0	0	0		0													0		0		0		0			0		0		Reset																							

Indicates if the Command List Processor is busy

## NEMA\_CMDRINGSTOP

Address	Access	Reset	Description
0x00ec	rw	0x0	Ring Buffer's pointer.

### Fields

CMDRINGSTOP	
31	0
0	
Reset	

### Fields Description

#### CMDRINGSTOP

Stores the Ring Buffer's last written address

**NEMA\_CMDADDR**

Address	Access	Reset	Description
0x00f0	rw	0x0	Command list base address.

**Fields**

CMDADDR	
31	0
0	
Reset	

**Fields Description****CMDADDR**

Specifies the base address of every new command list ready to be executed

## NEMA\_CMDSIZE

Address	Access	Reset	Description
0x00f4	rw	0x0	Command list length in words(32-bits)

### Fields

CMDSIZE	
31	0
0	
Reset	

### Fields Description

#### CMDSIZE

Specifies the length of the command list ready to be executed.

**NEMA\_INTERRUPT**

Address	Access	Reset	Description
0x00f8	rw	0x0	Interrupt control register

**Fields**

CLK_DVFS		RSVD		THROTTLE		RSVD																		CLEAR		DRAW		CL		POLARITY	
31	30	29	28	27	26																	4	3	2	1	0					
0		0		0		0																0		0		0		0		Reset	

**Fields Description****POLARITY**

1: IRQ signal is active low

0: IRQ signal is active high

**CL**

When set to 1, signals an interrupt at the end of a command list

**DRAW**

When set to 1, signals an interrupt at the end of a drawing command

**CLEAR**

When set to 1, the interrupt in the NEMA\_IRQ\_ID register is cleared

**THROTTLE**

When set to 1, the throttle signal will be ignored.

**CLK\_DVFS**

Specify the core\_clk\_dvfs output

Address	Access	Reset	Description
0x00fc	rw	0x0	On read, returns Nema's status. On writes, resets the GPU.

[illegible]

Indicates if the Bus Interface Unit is busy



## NEMA| pico VG 1000 Graphics Processing Unit

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### **SYSTEM**

Indicates if the system is busy

## NEMA\_DRAW\_CMD\_NOHOLD

Address	Access	Reset	Description
0x0100	rw	0x0	Rasterizer Command (e.g. draw triangle, rectangle etc)

### Fields

DRAW_TILE_SIZE										DRAW_TILE										DRAW_POS_CULLING										DRAW_NEG_CULLING										DRAW_GRADIENT										AA_EDGE_0										AA_EDGE_1										AA_EDGE_2										AA_EDGE_3										RSVD										DRAW_CMD									
31	30	29	28	27	26	25	24	23	22											4	3	0																																																																																							
0	0	0	0	0	0	0	0	0	0	0										0										Reset																																																																															

### Fields Description

#### DRAW\_CMD

- Draw Command
- \* 0x01 Draw Line
  - \* 0x02 Draw Rectangle
  - \* 0x03 Draw Point
  - \* 0x04 Draw Triangle
  - \* 0x05 Draw Quadrilateral
  - \* 0x06 Draw Quadratic Bezier
  - \* 0x07 Draw Cubic Bezier
  - \* 0x08 Draw Quadratic Bezier Line
  - \* 0x09 Draw Cubic Bezier Line
  - \* 0x0A Stroke line (1 pixel width)
  - \* 0x0B Draw Triangle Fan

#### AA\_EDGE\_3

When set to 1, Antialiasing feature is enabled for edge 3

#### AA\_EDGE\_2

When set to 1, Antialiasing feature is enabled for edge 2

#### AA\_EDGE\_1

When set to 1, Antialiasing feature is enabled for edge 1

#### AA\_EDGE\_0

When set to 1, Antialiasing feature is enabled for edge 0

#### DRAW\_GRADIENT

When set to 1, color gradient is enabled

#### DRAW\_NEG\_CULLING

When set to 1, negative culling (clockwise) is enabled

**DRAW\_POS\_CULLING**

When set to 1, positive culling (counter-clockwise) is enabled

**DRAW\_TILE**

When set to 1, tile mode is enabled

**DRAW\_TILE\_SIZE**

When set to 1, tile size is 2x2

## NEMA\_DRAW\_STARTXY

Address	Access	Reset	Description
0x0104	rw	0x0	Vertex 0 drawing primitive. This register is used only for integer values. For greater accuracy NEMA_DRAW_START_X and NEMA_DRAW_START_Y registers are used which accept 16.16 fixed point values. This register is updated also by NEMA_DRAW_START_X and NEMA_DRAW_START_Y. Its content should be considered volatile.

### Fields

START_Y																START_X																
31															16	15														0		
0																0																Reset

### Fields Description

#### START\_X

Specifies the X coordinate (integer value) of vertex 0

#### START\_Y

Specifies the Y coordinate (integer value) of vertex 0

Address	Access	Reset	Description
0x0108	rw	0x0	Vertex 1 drawing primitive. This register is used only for integer values. For greater accuracy NEMA_DRAW_END_X and NEMA_DRAW_END_Y registers are used which accept 16.16 fixed point values. This register is updated also by NEMA_DRAW_END_X and NEMA_DRAW_END_Y. Its content should be considered volatile.

END_Y		END_X	
31	16	15	0
0		0	

Reset

**END X**

Specifies the X coordinate (integer value) of vertex 1

**END Y**

Specifies the Y coordinate (integer value) of vertex 1

## DRAW\_FAN\_X

Address	Access	Reset	Description
0x010c	rw	0x0	X coordinate of the Fan center point. Its content should be considered volatile.

### Fields

X		
31	0	
0		Reset

### Fields Description

- X** Specifies the X coordinate of bezier vertex 4 drawing primitive (fixed point 16.16 format)

Address	Access	Reset	Description
0x0110	rw	0x0	Clipping Rectangle upper left vertex

CLIPMIN_Y		CLIPMIN_X	
31	16	15	0
0		0	

Reset

Define the upper left Y coordinate

Address	Access	Reset	Description
0x0114	rw	0x7fff7fff	Clipping Rectangle bottom right vertex

CLIPMAX_Y		CLIPMAX_X	
31	16	15	0
7FFF		7FFF	

Reset

Define the bottom left Y coordinate



**NEMA\_MATMULT**

Address	Access	Reset	Description
0x0118	rw	0x5000000	Rasterizer matrix multiplication control. This register is partially updated by other registers. Its content should be considered volatile.

**Fields**

RSVD		ADD_HALF		BYPASS_MM		RSVD		RSVD		BYPASS_VMM		RSVD																			0
31	30	29	28	27	26	25	24	23																				0			
0		0	0	1		0	1	0															Reset								

**Fields Description****BYPASS\_VMM**

When set to 1, the vertex matrix multiplications are bypassed

**BYPASS\_MM**

When set to 1, the matrix multiplications are bypassed

**ADD\_HALF**

When set to 1, the 0.5 value is added to the X and Y coordinates

## NEMA\_CODEPTR

Address	Access	Reset	Description
0x011c	rw	0x0	Shader code pointer

### Fields

BCG		FRG	
31	16	15	0
0		0	
		Reset	

### Fields Description

#### FRG

Specifies the pointer for the instruction that will be executed for the foreground pixels

#### BCG

Specifies the pointer for the instruction that will be executed for the background pixels

**NEMA\_DRAW\_PT0\_X**

Address	Access	Reset	Description
0x0120	rw	0x0	X coordinate of vertex 0 drawing primitive. The value is 16.16 fixed point. This register is updated also by NEMA_DRAW_PT0 and NEMA_DRAW_PT1. Its content should be considered volatile.

**Fields**

X	
31	0
0	
Reset	

**Fields Description****X**

Specifies the X coordinate of vertex 0 drawing primitive (16.16 fixed point)

## NEMA\_DRAW\_PT0\_Y

Address	Access	Reset	Description
0x0124	rw	0x0	Y coordinate of vertex 0 drawing primitive. The value is 16.16 fixed point. This register is updated also by NEMA_DRAW_PT0 and NEMA_DRAW_PT1. Its content should be considered volatile.

## Fields

Y	
31	0
0	
Reset	

## Fields Description

**Y** Specifies the Y coordinate of vertex 0 drawing primitive (16.16 fixed point)

**DRAW\_FAN\_Y**

Address	Access	Reset	Description
0x0128	rw	0x0	Y coordinate of the Fan center point. Its content should be considered volatile.

**Fields**

Y		
31	0	
0		Reset

**Fields Description****Y**

Specifies the X coordinate of bezier vertex 4 drawing primitive (fixed point 16.16 format)

## NEMA\_DRAW\_COLOR

Address	Access	Reset	Description
0x012c	rw	0x0	Rasterizer drawing color for filling primitives

### Fields

DRAW_COLOR		
31	0	
0		Reset

### Fields Description

#### DRAW\_COLOR

Specifies the drawing color for filling primitives

**NEMA\_DRAW\_PT1\_X**

Address	Access	Reset	Description
0x0130	rw	0x0	X coordinate of vertex 1 drawing primitive. The value is 16.16 fixed point. This register is updated also by NEMA_DRAW_PT0 and NEMA_DRAW_PT1. Its content should be considered volatile.

**Fields**

X	
31	0
0	
Reset	

**Fields Description****X**

Specifies the X coordinate of vertex 1 drawing primitive (16.16 fixed point)

## NEMA\_DRAW\_PT1\_Y

Address	Access	Reset	Description
0x0134	rw	0x0	Y coordinate of vertex 1 drawing primitive. The value is 16.16 fixed point. This register is updated also by NEMA_DRAW_PT0 and NEMA_DRAW_PT1. Its content should be considered volatile.

### Fields

Y	
31	0
0	
Reset	

### Fields Description

**Y** Specifies the Y coordinate of vertex 1 drawing primitive (16.16 fixed point)



**NEMA\_BYPASS\_ADDR**

Address	Access	Reset	Description
0x0138	rw	0x0	Address of bypass mode of rasterizer setup access

**Fields**

NEMA_BYPASS_ADDR	
31	0
0	
Reset	

**Fields Description****NEMA\_BYPASS\_ADDR**

Address of bypass mode of rasterizer setup access

## BYPASS\_DATA

Address	Access	Reset	Description
0x013c	rw	0x0	Data and enable of bypass mode of rasterizer

### Fields

NEMA_BYPASS_DATA	
31	0
0	
Reset	

### Fields Description

#### NEMA\_BYPASS\_DATA

Data and enable of bypass mode of rasterizer

**NEMA\_DRAW\_PT2\_X**

Address	Access	Reset	Description
0x0140	rw	0x0	X coordinate of vertex 2 drawing primitive. The value is 16.16 fixed point

**Fields**

X		
31	0	
0		Reset

**Fields Description****X**

Specifies the X coordinate of vertex 2 drawing primitive (16.16 fixed point)

## NEMA\_DRAW\_PT2\_Y

Address	Access	Reset	Description
0x0144	rw	0x0	Y coordinate of vertex 2 drawing primitive. The value is 16.16 fixed point

### Fields

Y		
31	0	
0		Reset

### Fields Description

**Y**  
Specifies the Y coordinate of vertex 2 drawing primitive (16.16 fixed point)

**NEMA\_CLID**

Address	Access	Reset	Description
0x0148	rw	0x0	Command List ID Key

**Fields**

CLID	
31	0
0	
Reset	

**Fields Description****CLID**

Specifies the last executed command list

## NEMA\_DRAW\_PT3\_X

Address	Access	Reset	Description
0x0150	rw	0x0	X coordinate of vertex 3 drawing primitive. The value is 16.16 fixed point

### Fields

X		
31	0	
0		Reset

### Fields Description

**X**  
Specifies the X coordinate of vertex 3 drawing primitive (16.16 fixed point)

**NEMA\_DRAW\_PT3\_Y**

Address	Access	Reset	Description
0x0154	rw	0x0	Y coordinate of vertex 3 drawing primitive. The value is 16.16 fixed point

**Fields**

Y		
31	0	
0		Reset

**Fields Description**

**Y**  
Specifies the Y coordinate of vertex 3 drawing primitive (16.16 fixed point)

## NEMA\_CLIPMIN1

Address	Access	Reset	Description
0x0158	rw	0x0	Second Clipping Rectangle upper left vertex

### Fields

CLIPMIN_Y		CLIPMIN_X	
31	16	15	0
0		0	

Reset

### Fields Description

#### CLIPMIN\_X

Define the upper left X coordinate

#### CLIPMIN\_Y

Define the upper left Y coordinate



**NEMA\_CLIPMAX1**

Address	Access	Reset	Description
0x015c	rw	0x7fff7fff	Second Clipping Rectangle bottom right vertex

**Fields**

CLIPMAX_Y		CLIPMAX_X	
31	16	15	0
7FFF		7FFF	
		Reset	

**Fields Description****CLIPMAX\_X**

Define the bottom left X coordinate

**CLIPMAX\_Y**

Define the bottom left Y coordinate

## NEMA\_MM00

Address	Access	Reset	Description
0x0160	rw	0x0	(0,0) matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		MM00	
31	21	20	0
0		0	
Reset			

## Fields Description

### MM00

Specifies the (0,0) element

**NEMA\_MM01**

Address	Access	Reset	Description
0x0164	rw	0x0	(0,1) matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		MM01	
31	21	20	0
0		0	
Reset			

**Fields Description****MM01**

Specifies the (0,1) element

## NEMA\_MM02

Address	Access	Reset	Description
0x0168	rw	0x0	(0,2) matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		MM02	
31	21	20	0
0		0	
Reset			

## Fields Description

### MM02

Specifies the (0,2) element

**NEMA\_MM10**

Address	Access	Reset	Description
0x016c	rw	0x0	(1,0) matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		MM10	
31	21	20	0
0		0	
Reset			

**Fields Description****MM10**

Specifies the (1,0) element

## NEMA\_MM11

Address	Access	Reset	Description
0x0170	rw	0x0	(1,1) matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		MM11	
31	21	20	0
0		0	
Reset			

## Fields Description

### MM11

Specifies the (1,1) element

**NEMA\_MM12**

Address	Access	Reset	Description
0x0174	rw	0x0	(1,2) matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		MM12	
31	21	20	0
0		0	
Reset			

**Fields Description****MM12**

Specifies the (1,2) element

## NEMA\_MM20

Address	Access	Reset	Description
0x0178	rw	0x0	(2,0) matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		MM20	
31	21	20	0
0		0	
Reset			

## Fields Description

### MM20

Specifies the (2,0) element



**NEMA\_MM21**

Address	Access	Reset	Description
0x017c	rw	0x0	(2,1) matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		MM21	
31	21	20	0
0		0	
Reset			

**Fields Description****MM21**

Specifies the (2,1) element

## NEMA\_MM22

Address	Access	Reset	Description
0x0180	rw	0x0	(2,2) matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		MM22	
31	21	20	0
0		0	
Reset			

## Fields Description

### MM22

Specifies the (2,2) element

**NEMA\_DEPTH\_START\_L**

Address	Access	Reset	Description
0x0184	rw	0x0	Depth value of the STARTXY pixel. This register defines the integral part of the depth value which is the lower 32 bits

**Fields**

START_L	
31	0
0	
Reset	

**Fields Description****START\_L**

Specifies the fractional part of the depth value of the STARTXY pixel

## NEMA\_DEPTH\_START\_H

Address	Access	Reset	Description
0x0188	rw	0x0	Depth value of the STARTXY pixel. This register defines the integral part of the depth value which is the higher 32 bits

### Fields

START_H	
31	0
0	
Reset	

### Fields Description

#### START\_H

Specifies the integral value of the depth value of the STARTXY pixel

**NEMA\_DEPTH\_DX\_L**

Address	Access	Reset	Description
0x018c	rw	0x0	For each step at x-axis, depth value is added. This register defines the fractional part of the depth value which is the lower 32 bits

**Fields**

DX_L	
31	0
0	
Reset	

**Fields Description****DX\_L**

Specifies the fractional part of the added depth value for each step at x-axis

## NEMA\_DEPTH\_DX\_H

Address	Access	Reset	Description
0x0190	rw	0x0	For each step at x-axis, depth value is added. This register defines the integral part of the depth value which is the higher 32 bits

### Fields

DX_H	
31	0
0	
Reset	

### Fields Description

#### DX\_H

Specifies the integral part of the added depth value for each step at x-axis

**NEMA\_DEPTH\_DY\_L**

Address	Access	Reset	Description
0x0194	rw	0x0	For each step at y-axis, depth value is added. This register defines the fractional part of the depth value which is the lower 32 bits

**Fields**

DY_L	
31	0
0	
Reset	

**Fields Description****DY\_L**

Specifies the fractional part of the added depth value for each step at y-axis

## NEMA\_DEPTH\_DY\_H

Address	Access	Reset	Description
0x0198	rw	0x0	For each step at y-axis, depth value is added. This register defines the integral part of the depth value which is the higher 32 bits

### Fields

DY_H	
31	0
0	
Reset	

### Fields Description

#### DY\_H

Specifies the integral part of the added depth value for each step at y-axis



## NEMA\_RED\_DX

Address	Access	Reset	Description
0x01a0	rw	0x0	For each step at x-axis, Red (R) value is added. The value is 16,16 fixed point

### Fields

DX		
31	0	
0		Reset

### Fields Description

#### DX

Specifies the added Red (R) value for each step at x-axis

## NEMA\_RED\_DY

Address	Access	Reset	Description
0x01a4	rw	0x0	For each step at y-axis, Red (R) value is added. The value is 16,16 fixed point

### Fields

DY		
31	0	
0		Reset

### Fields Description

#### DY

Specifies the added Red (R) value for each step at y-axis

## NEMA\_GRE\_DX

Address	Access	Reset	Description
0x01a8	rw	0x0	For each step at x-axis, Green (G) value is added. The value is 16,16 fixed point

### Fields

DX		
31		0
0		Reset

### Fields Description

#### DX

Specifies the added Green (G) value for each step at x-axis

## NEMA\_GRE\_DY

Address	Access	Reset	Description
0x01ac	rw	0x0	For each step at y-axis, Green (G) value is added. The value is 16,16 fixed point

### Fields

DY		
31	0	
0		Reset

### Fields Description

#### DY

Specifies the added Green (G) value for each step at y-axis

**NEMA\_BLU\_DX**

Address	Access	Reset	Description
0x01b0	rw	0x0	For each step at x-axis, Blue (B) value is added. The value is 16,16 fixed point

**Fields**

DX	
31	0
0	
Reset	

**Fields Description****DX**

Specifies the added Blue (B) value for each step at x-axis

## NEMA\_BLU\_DY

Address	Access	Reset	Description
0x01b4	rw	0x0	For each step at y-axis, Blue (B) value is added. The value is 16,16 fixed point

### Fields

DY		
31	0	
0		Reset

### Fields Description

#### DY

Specifies the added Blue (B) value for each step at y-axis

**NEMA\_ALF\_DX**

Address	Access	Reset	Description
0x01b8	rw	0x0	For each step at x-axis, Alpha (A) value is added. The value is 16,16 fixed point

**Fields**

DX	
31	0
0	
Reset	

**Fields Description****DX**

Specifies the added Alpha (A) value for each step at x-axis

## NEMA\_ALF\_DY

Address	Access	Reset	Description
0x01bc	rw	0x0	For each step at y-axis, Alpha (A) value is added. The value is 16,16 fixed point

### Fields

DY		
31	0	
0		Reset

### Fields Description

#### DY

Specifies the added Alpha (A) value for each step at y-axis



**NEMA\_RED\_INIT**

Address	Access	Reset	Description
0x01c0	rw	0x0	Red (R) value of the STARTXY pixel. The value is 16,16 fixed point

**Fields**

INIT	
31	0
0	
Reset	

**Fields Description****INIT**

Specifies the Red (R) value of the STARTXY pixel

## NEMA\_GRE\_INIT

Address	Access	Reset	Description
0x01c4	rw	0x0	Green (G) value of the STARTXY pixel. The value is 16,16 fixed point

### Fields

INIT		
31	0	
0		Reset

### Fields Description

#### INIT

Specifies the Green (G) value of the STARTXY pixel

**NEMA\_BLU\_INIT**

Address	Access	Reset	Description
0x01c8	rw	0x0	Blue (B) value of the STARTXY pixel. The value is 16,16 fixed point

**Fields**

INIT	
31	0
0	
Reset	

**Fields Description****INIT**

Specifies the Blue (B) value of the STARTXY pixel

## NEMA\_ALF\_INIT

Address	Access	Reset	Description
0x01cc	rw	0x0	Alpha (A) value of the STARTXY pixel. The value is 16,16 fixed point

### Fields

INIT		
31	0	
0		Reset

### Fields Description

#### INIT

Specifies the Alpha (A) value of the STARTXY pixel

**NEMA\_ROPBLENDER\_BLEND\_MODE**

Address	Access	Reset	Description
0x01d0	rw	0x0	Blending Modes for different calculations between the source (Fragment Processing Core) and destination (Frame Buffer) colors

**Fields**

CLKEY_DST CLKEY_SRC		RSVD				BLD_OFF				RSVD				ANTIALIASING				RSVD		DEST		RSVD		SOURCE	
31	30	29	26	25	24	17	16	15	12	11	8	7	4	3	0										
0	0	0				0	0				0	0		0		0		0		0		0		Reset	

Reset

**Fields Description****SOURCE**

Blending mode of the current pixel (source pixel)

**DEST**

Blending mode of the stored pixel in the FrameBuffer (destination pixel)

**ANTIALIASING**

If set, disables Antialiasing

**BLD\_OFF**

If set, enables Negative Destination Color Keying.

**CLKEY\_SRC**

If set, enables Source Color Keying

**CLKEY\_DST**

If set, enables Destination Color Keying

## NEMA\_ROPBLENDER\_DST\_CKEY

Address	Access	Reset	Description
0x01d4	rw	0x0	When Color Keying is enabled. The new pixel is written in the Frame Buffer, only if the destination pixel has the same RGB value with the Destination Color Key, which is the value of this register

### Fields

ALPHA				BLUE				GREEN				RED			
31		24		23		16		15		8		7		0	
0				0				0				0			

Reset

### Fields Description

#### RED

Specifies the Red (R) value

#### GREEN

Specifies the Green (G) value

#### BLUE

Specifies the Blue (B) value

#### ALPHA

Specifies the Alpha (A) value

**NEMA\_ROPBLENDER\_CONST\_COLOR**

Address	Access	Reset	Description
0x01d8	rw	0x0	Constant Color value which is used for blending when the blending modes. DSBF_CONSTCOLOR and DSBF_CONSTALPHA are configured in the NEMA_ROPBLENDER_BLEND_MODE Register. * if the blending mode is DSBF_CONSTALPHA then the Constant Alpha value Ca is obtained from bits 31-24 * if the blending mode is DSBF_CONSTCOLOR then the Constant Alpha value Cc is obtained from bits 31-0

**Fields**

ALPHA		BLUE		GREEN		RED	
31	24	23	16	15	8	7	0
0		0		0		0	

Reset
**Fields Description****RED**

Specifies the Red (R) value

**GREEN**

Specifies the Green (G) value

**BLUE**

Specifies the Blue (B) value

**ALPHA**

Specifies the Alpha (A) value

## NEMA\_IP\_VERSION

Address	Access	Reset	Description
0x01dc	r	0x231000	Returns the current GPU IP version

### Fields

UNEMA_VERSION	
31	0
231000	
Reset	

### Fields Description

#### UNEMA\_VERSION (*Read only*)

The current version of the GPU IP



**NEMA\_CODEPTR2**

Address	Access	Reset	Description
0x01e0	rw	0x0	Shader code pointer

**Fields**

BCG		FRG	
31	16	15	0
0		0	
Reset			

**Fields Description****FRG**

Specifies the pointer for the instruction that will be executed for the foreground pixels if we are working on neg\_area geometries (rasterizer)

**BCG**

Specifies the pointer for the instruction that will be executed for the background pixels if we are working on neg\_area geometries (rasterizer)

## NEMA\_IDREG

Address	Access	Reset	Description
0x01ec	r	0x86362000	GPU ID Register (fixed value)

### Fields

IDREG	
31	0
86362000	
Reset	

### Fields Description

#### IDREG (*Read only*)

The fixed value is 0x86362000

## NEMA\_CONFIG

Address	Access	Reset	Description
0x01f0	r	0xd4010104	GPU configuration status

### Fields

BUS						BL		TSC6		BLENDER		ASYNC		DIRTY		RSVD				COMPRESS		CG		RSVD		CORES		THREADS	
31	30	29	28	27	26	25					18	17	16	15	12		11			8	7					0			
1	1	0	1	0	1	0				0	1	0		1		4		Reset											

### Fields Description

#### THREADS (Read only)

Indicates the log2 number of threads

#### CORES (Read only)

Indicates the number of cores

#### CG (Read only)

When set to 1, indicates that clock gating is enabled

#### COMPRESS (Read only)

When set to 1, indicates that TSC compression mode is enabled

#### DIRTY (Read only)

When set to 1, indicates that Dirty Region is enabled

#### ASYNC (Read only)

When set to 1, Bus to Memory is Asynchronous to core clock

#### BLENDER (Read only)

When set to 1, indicates that H/W Blender is enabled

#### TSC6 (Read only)

When set to 1, indicates that TSC6 compression mode is enabled.

#### BL (Read only)

When set to 1, indicates that Bilinear filtering is enabled

#### BUS (Read only)

When set to 1, indicates that the master bus is AXI

When set to 0, indicates that the master bus is AHB

## NEMA\_CONFIGH

Address	Access	Reset	Description
0x01f4	r	0x3e3	GPU configuration status (high bits)

### Fields

RSVD											NEMA_CONFIGH_TSC12 NEMA_CONFIGH_VG NEMA_CONFIGH_RADFILL GPFLAGS MBIST TEX_CHAN YUV_COEF GAMMA CONFIGH_10BIT DEC AA											
31											11	10	9	8	7	6	5	4	3	2	1	0
0											0	1	1	1	1	1	0	0	0	1	1	Reset

### Fields Description

#### AA (*Read only*)

Indicates that the Antialiasing feature is enabled

#### DEC (*Read only*)

Indicates that the TSc Framebuffer/Texture Decompression is enabled

#### CONFIGH\_10BIT (*Read only*)

Indicates that 10-bit precision is selected

#### GAMMA (*Read only*)

Indicates that Gamma Correction is enabled

#### YUV\_COEF (*Read only*)

Indicates that YUV coefficients are present

#### TEX\_CHAN (*Read only*)

Indicates that Texture map unit has two channels

#### MBIST (*Read only*)

Indicates that separate logic/mem Clock Gating is enabled

#### GPFLAGS (*Read only*)

Indicates that external debug interface (GP\_FLAG, SYSERROR\_IRQ, FREEZE) is enabled

#### NEMA\_CONFIGH\_RADFILL (*Read only*)

Indicates that Radial Fill is enabled

#### NEMA\_CONFIGH\_VG (*Read only*)

Indicates that NemaVG is enabled

#### NEMA\_CONFIGH\_TSC12 (*Read only*)

When set to 1, indicates that TSC12 compression mode is enabled

**NEMA\_C0\_REG**

Address	Access	Reset	Description
0x0200	w	0x0	A 32-bit integer RGBA value is stored in constant register 0 for fragment calculations.

**Fields**

ALPHA				BLUE				GREEN				RED			
31		24		23		16		15		8		7		0	
0				0				0				0			

Reset

**Fields Description****RED (Write only)**

Specifies the Red (R) value

**GREEN (Write only)**

Specifies the Green (G) value

**BLUE (Write only)**

Specifies the Blue (B) value

**ALPHA (Write only)**

Specifies the Alpha (A) value

## NEMA\_C1\_REG

Address	Access	Reset	Description
0x0204	w	0x0	A 32-bit integer RGBA value is stored in constant register 1 for fragment calculations.

### Fields

ALPHA		BLUE		GREEN		RED	
31	24	23	16	15	8	7	0
0		0		0		0	

Reset

### Fields Description

#### **RED (Write only)**

Specifies the Red (R) value

#### **GREEN (Write only)**

Specifies the Green (G) value

#### **BLUE (Write only)**

Specifies the Blue (B) value

#### **ALPHA (Write only)**

Specifies the Alpha (A) value

**NEMA\_C2\_REG**

Address	Access	Reset	Description
0x0208	w	0x0	A 32-bit integer RGBA value is stored in constant register 2 for fragment calculations.

**Fields**

ALPHA				BLUE				GREEN				RED			
31		24		23		16		15		8		7		0	
0				0				0				0			

Reset

**Fields Description****RED (Write only)**

Specifies the Red (R) value

**GREEN (Write only)**

Specifies the Green (G) value

**BLUE (Write only)**

Specifies the Blue (B) value

**ALPHA (Write only)**

Specifies the Alpha (A) value

## NEMA\_C3\_REG

Address	Access	Reset	Description
0x020c	w	0x0	A 32-bit integer RGBA value is stored in constant register 3 for fragment calculations.

### Fields

ALPHA				BLUE				GREEN				RED			
31		24		23		16		15		8		7		0	
0				0				0				0			

Reset

### Fields Description

#### **RED (Write only)**

Specifies the Red (R) value

#### **GREEN (Write only)**

Specifies the Green (G) value

#### **BLUE (Write only)**

Specifies the Blue (B) value

#### **ALPHA (Write only)**

Specifies the Alpha (A) value



**DRAW\_PT0\_X**

Address	Access	Reset	Description
0x0320	w	0x0	X coordinate of bezier vertex 0 drawing primitive. This register is written in FP32 IEEE format and can be read from the corresponding PT_X (0x162) register. Its content should be considered volatile.

**Fields**

X	
31	0
0	
Reset	

**Fields Description****X (Write only)**

Specifies the X coordinate of bezier vertex 0 drawing primitive (fp32 format)

## DRAW\_PT0\_Y

Address	Access	Reset	Description
0x0324	w	0x0	Y coordinate of bezier vertex 0 drawing primitive. This register is written in FP32 IEEE format and can be read from the corresponding PT_Y (0x162) register. Its content should be considered volatile.

### Fields

Y	
31	0
0	
Reset	

### Fields Description

#### Y (*Write only*)

Specifies the Y coordinate of bezier vertex 0 drawing primitive (fp32 format)

**DRAW\_FP\_FAN\_X**

Address	Access	Reset	Description
0x0328	w	0x0	X coordinate of the Fan center point. Its content should be considered volatile.

**Fields**

X		
31	0	
0		Reset

**Fields Description****X (Write only)**

Specifies the X coordinate of bezier vertex 4 drawing primitive (fp32 format)

## DRAW\_FP\_FAN\_Y

Address	Access	Reset	Description
0x032c	w	0x0	Y coordinate of the Fan center point. Its content should be considered volatile.

### Fields

Y		
31	0	
0		Reset

### Fields Description

#### Y (*Write only*)

Specifies the X coordinate of bezier vertex 4 drawing primitive (fp32 format)

**DRAW\_PT1\_X**

Address	Access	Reset	Description
0x0330	w	0x0	X coordinate of bezier vertex 1 drawing primitive. This register is written in FP32 IEEE format and can be read from the corresponding PT_X (0x163) register. Its content should be considered volatile.

**Fields**

X	
31	0
0	
Reset	

**Fields Description****X (Write only)**

Specifies the X coordinate of bezier vertex 1 drawing primitive (fp32 format)

## DRAW\_PT1\_Y

Address	Access	Reset	Description
0x0334	w	0x0	Y coordinate of bezier vertex 1 drawing primitive. This register is written in FP32 IEEE format and can be read from the corresponding PT_Y (0x163) register. Its content should be considered volatile.

### Fields

Y	
31	0
0	
Reset	

### Fields Description

#### Y (*Write only*)

Specifies the Y coordinate of bezier vertex 1 drawing primitive (fp32 format)

**DRAW\_PT2\_X**

Address	Access	Reset	Description
0x0340	w	0x0	X coordinate of bezier vertex 2 drawing primitive.

**Fields**

X		
31	0	
0		Reset

**Fields Description****X (Write only)**

Specifies the X coordinate of bezier vertex 2 drawing primitive (fp32 format)

## DRAW\_PT2\_Y

Address	Access	Reset	Description
0x0344	w	0x0	Y coordinate of bezier vertex 2 drawing primitive.

### Fields

Y		
31	0	
0		Reset

### Fields Description

#### Y (*Write only*)

Specifies the Y coordinate of bezier vertex 2 drawing primitive (fp32 format)



**DRAW\_PT3\_X**

Address	Access	Reset	Description
0x0350	w	0x0	X coordinate of bezier vertex 3 drawing primitive.

**Fields**

X		
31	0	
0		Reset

**Fields Description****X (Write only)**

Specifies the X coordinate of bezier vertex 3 drawing primitive (fp32 format)

## DRAW\_PT3\_Y

Address	Access	Reset	Description
0x0354	w	0x0	Y coordinate of bezier vertex 3 drawing primitive.

### Fields

Y		
31	0	
0		Reset

### Fields Description

#### Y (*Write only*)

Specifies the Y coordinate of bezier vertex 3 drawing primitive (fp32 format)

**VMM00**

Address	Access	Reset	Description
0x0360	rw	0x3f800000	(0,0) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		VMM00	
		31 30	0
0		3F800000	Reset

**Fields Description****VMM00**

Specifies the (0,0) element

## VMM01

Address	Access	Reset	Description
0x0364	rw	0x0	(0,1) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		VMM01	
		31 30	0
0		0	Reset

## Fields Description

### VMM01

Specifies the (0,1) element

**VMM02**

Address	Access	Reset	Description
0x0368	rw	0x0	(0,2) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		VMM02	
		31	30
0			0
			Reset

**Fields Description****VMM02**

Specifies the (0,2) element

## VMM10

Address	Access	Reset	Description
0x036c	rw	0x0	(1,0) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		VMM10	
		31 30	0
0		0	Reset

## Fields Description

### VMM10

Specifies the (1,0) element

**VMM11**

Address	Access	Reset	Description
0x0370	rw	0x3f800000	(1,1) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		VMM11	
		31 30	0
0		3F800000	
			Reset

**Fields Description****VMM11**

Specifies the (1,1) element

## VMM12

Address	Access	Reset	Description
0x0374	rw	0x0	(1,2) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		VMM12	
		31 30	0
0		0	Reset

## Fields Description

### VMM12

Specifies the (1,2) element



**VMM20**

Address	Access	Reset	Description
0x0378	rw	0x0	(2,0) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		VMM20	
		31 30	0
0		0	Reset

**Fields Description****VMM20**

Specifies the (2,0) element

## VMM21

Address	Access	Reset	Description
0x037c	rw	0x0	(2,1) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

## Fields

RSVD		VMM21	
		31 30	0
0		0	Reset

## Fields Description

### VMM21

Specifies the (2,1) element

**VMM22**

Address	Access	Reset	Description
0x0380	rw	0x3f800000	(2,2) Bezier Vertex Transformation matrix floating point element. On read return the floating point value with the selected characteristics

**Fields**

RSVD		VMM22	
		31 30	0
0		3F800000	
			Reset

**Fields Description****VMM22**

Specifies the (2,2) element

## NEMA\_COORD\_MASK

Address	Access	Reset	Description
0x04d0	rw	0xfff	Inverted mask for rasterizer coordinates

### Fields

NEMA_COORD_MASK	
31	0
FFF	
Reset	

### Fields Description

#### NEMA\_COORD\_MASK

Inverted mask for rasterizer coordinates

**DRAW\_FLATNESS**

Address	Access	Reset	Description
0x04d4	rw	0x8000	Width in pixels of Bezier Curve flatness. (Lower values improve accuracy)

**Fields**

FLATNESS	
31	0
8000	
Reset	

**Fields Description****FLATNESS**

Specifies the convergence point of de Casteljau's Algorithm for drawing Bezier Curves (fixed point 16.16 format)

## NEMA\_IRQ\_ID

Address	Access	Reset	Description
0x0ff0	rw	0x0	Signals an interrupt when written

### Fields

IRQ_ID	
31	0
0	
Reset	

### Fields Description

#### IRQ\_ID

Write any value to signal an interrupt

Address	Access	Reset	Description
0x0ff4	rw	0x0	Stop/Break the command list when debugging

[illegible]

GP\_FLAG\_irqmask when set to 1 masks/enables the generation of the I/O SYSEERROR from line 0

**IRQSYSERR\_MASK\_1**

GP\_FLAG\_irqmask when set to 1 masks/enables the generation of the IRQ\_SYSERROR from line 1

**IRQSYSERR\_MASK\_2**

GP\_FLAG\_irqmask when set to 1 masks/enables the generation of the IRQ\_SYSERROR from line 2

**IRQSYSERR\_MASK\_3**

GP\_FLAG\_irqmask when set to 1 masks/enables the generation of the IRQ\_SYSERROR from line 3

**BRK\_0**

When set to 1, set breakpoint for GP\_FLAG line 0 if NEMA\_GP\_FLAGS[0] bit value is high.

**BRK\_1**

When set to 1, set breakpoint for GP\_FLAG line 0 if NEMA\_GP\_FLAGS[1] bit value is high.

**BRK\_2**

When set to 1, set breakpoint for GP\_FLAG line 0 if NEMA\_GP\_FLAGS[2] bit value is high.

**BRK\_3**

When set to 1, set breakpoint for GP\_FLAG line 0 if NEMA\_GP\_FLAGS[3] bit value is high.



**NEMA\_SYS\_INTERRUPT**

Address	Access	Reset	Description
0x0ff8	rw	0x0	On Read: Returns the SYSERROR_IRQ ID. On write: Clears the SYSERROR_IRQ.

**Fields**

RSVD												ERROR_BUS_ERR		ERROR_BUS_CODE2		ERROR_BUS_CODE1		ERROR_BUS_CODE0		ERROR_LINE_3		ERROR_LINE_2		ERROR_LINE_1		ERROR_LINE_0			
31											12	11	10		7	6	5	4	3	2	1	0							
0												0	0		0		0	0	0	0	0	0	0	Reset					

**Fields Description****ERROR\_LINE\_0**

Indicates that IRQ\_SYSERROR due to GP\_FLAG line 0.

**ERROR\_LINE\_1**

Indicates that IRQ\_SYSERROR due to GP\_FLAG line 1.

**ERROR\_LINE\_2**

Indicates that IRQ\_SYSERROR due to GP\_FLAG line 2.

**ERROR\_LINE\_3**

Indicates that IRQ\_SYSERROR due to GP\_FLAG line 3.

**ERROR\_BUS\_CODE0**

Indicates the Interface Error Code(AXI only).

0: SLVERR

1: DECERR

**ERROR\_BUS\_CODE1**

Indicates the Bus Error Code occurrence direction (AXI only).

01: Read Direction

10: Write Direction

**ERROR\_BUS\_CODE2**

Indicates the Bus Error Code Interface.

1000: AHB/AXI Slave Port

0100: AHB/AXI M0 Master Port

0010: AHB/AXI M1 Master Port

0001: AXI CL Master Port

**ERROR\_BUS\_ERR**

Indicates that a bus error has occurred.

## NEMA\_BUSERROR\_MASK

Address	Access	Reset	Description
0x0ffc	rw	0x0	Sets the mask for the Buserror Interrupt.

### Fields

RSVD							MASK2		MASK1		RSVD
31						7	6	3	2	1	0
0							0		0		0
											Reset

### Fields Description

#### MASK1

Sets the mask for the Bus Error Code occurrence direction (AXI only).

01: Read Direction

10: Write Direction

#### MASK2

Sets the mask for the Bus Error Code Interface.

1000: AHB/AXI Slave Port

0100: AHB/AXI M0 Master Port

0010: AHB/AXI M1 Master Port

0001: AXI CL Master Port