Gizmo II User Guide

REVISION HISTORY

Date	Revision	Description
September 2014	0.51	Preliminary release.

INTRODUCTION

Gizmo II is the second generation open source x86 development board presented by GizmoSphere. Like the first Gizmo design, Gizmo II provides the power of a supercomputer and the I/O capabilities of a microcontroller.

Built upon the award-winning AMD Embedded G-Series System-on-Chip (FT3), Gizmo II offers a high-performance, low-power affordable solution for a wide range of development projects. Gizmo II can be used in do-it-yourself (DIY) designs, embedded development, PC replacement, microcontroller applications, parallel processing, multicore engineering, and much more.

The AMD Embedded G-Series SOC brings improvements to this newest offering in the line of Gizmo boards with the following benefits:

- Up to 113 percent improved CPU performance compared to the prior generation AMD Embedded G-Series APU.
- Support for DirectX® 11.1, OpenGL 4.2x and OpenCL™ 1.2, enabling parallel processing and high-performance graphics processing, and yielding up to a 20 percent graphics improvement over the previous AMD Embedded G-Series APU.
- Supported operating systems include Windows® Embedded 8 and Linux®.
- Suitable for a wealth of embedded applications including industrial control and automation, digital signage, electronic gaming systems, SMB storage, IP-TV, medical and network appliances, set-top boxes and more.

Gizmo II comes with an updated list of peripheral interfaces including the much-requested and anticipated HDMI™ dedicated port, an mSATA port for connecting SSDs and a microSD card slot.

In every significant manner, Gizmo II strives for greater flexibility and ease of use for embedded developers and DIY enthusiasts.

GIZMO II FEATURES

- AMD G-Series SOC (FT3)
- 1GB DDR3-1600 SDRAM
- HDMI Video/Audio Output
- HD Audio In/Out
- mSATA/mini PCIe® Connector
- microSD Card Slot
- Onboard Gigabit Ethernet
- USB 3(2) and 2(2) Connectors
- AMD Debug Header
- High-speed and Low-speed Special Features Card Edge Connectors
- 4” x 4” Form Factor

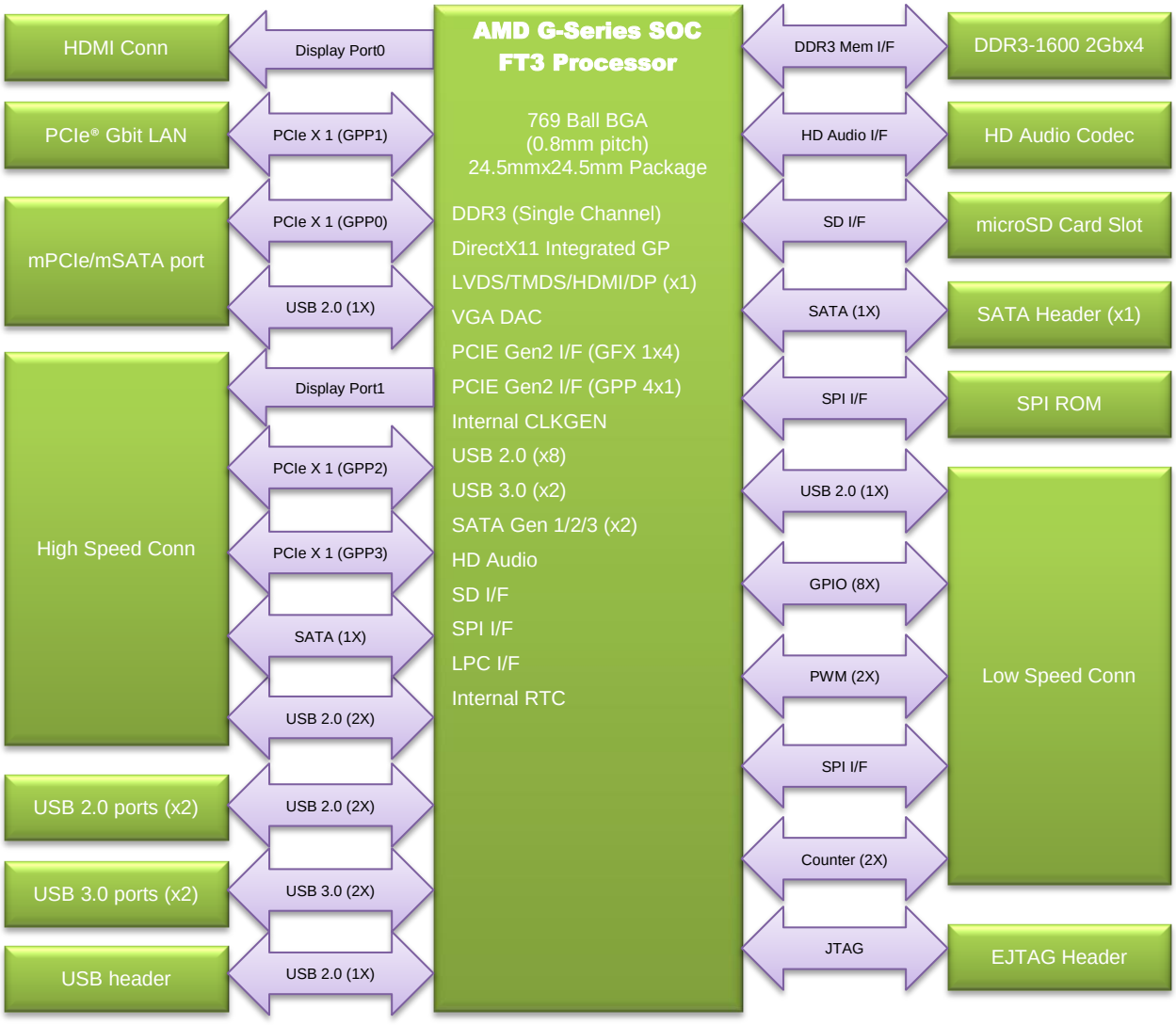

Figure 1 Gizmo II Block Diagram

Figure 2 Gizmo II Board and Power Supply

CONNECTORS AND INTERFACES

The following figures show the locations of major Gizmo II board components and connections.

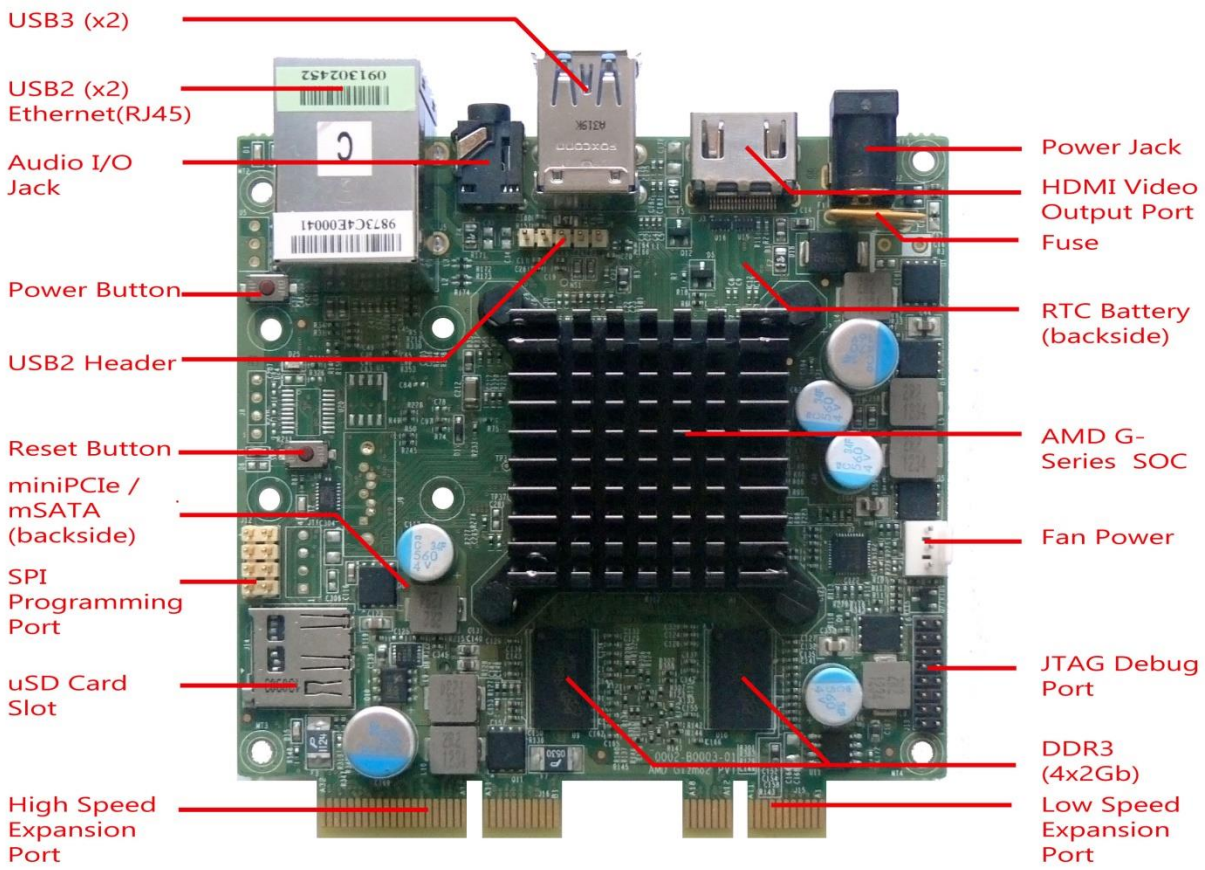

Figure 3 Gizmo II Board Connector Locations

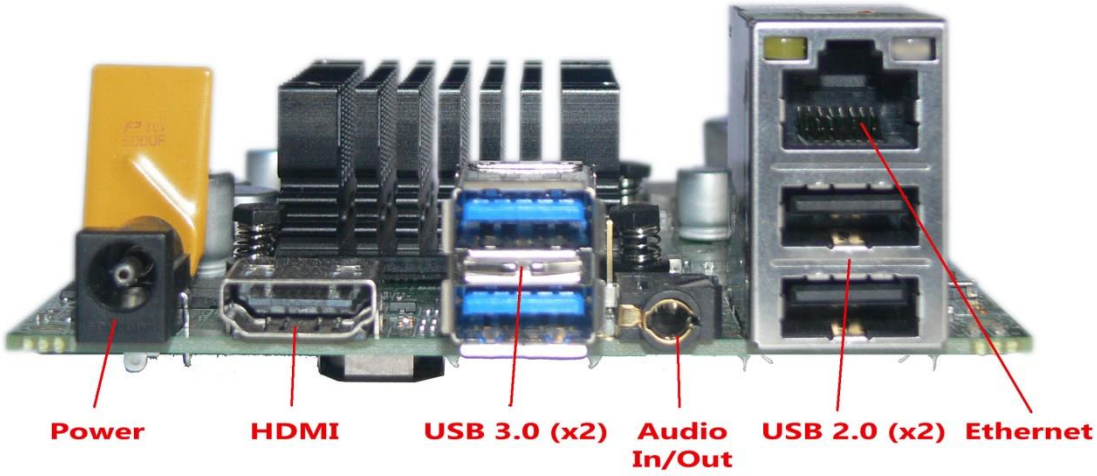

Figure 4 Gizmo II Board Back Panel

J1 – DC Power Jack

The Gizmo II board supports a wide range of input power specifications. Input voltage can range from 12V to 24V DC limited to 4A with a resettable fuse (F1). The included AC/DC power supply provides 12V@2A, 24W. Additional power (up to 24V@4A, 96W) may be required when using the Gizmo board with power-hungry USB or SATA devices and/or external boards connected to the high speed and/or low speed expansion ports. Power is connected to the Gizmo II board through the power jack J1. The center pin (Pin 1) carries the positive voltage input while the casing and shielding is ground.

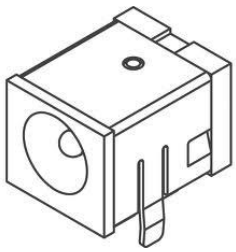

Figure 5 Power Jack J1 Pinout

J2 – Dual USB3.0

Two USB3.0 ports are available from the Gizmo II board back panel. These connectors are colored blue to identify them as USB3.0. The top connector is connected to the SOC's USB8 port while the bottom connector is connected to the SOC's USB 9 port. The USB power pins are +5V fused through a 1A resettable PTC fuse (F5).

J3 - HDMI

The Gizmo II board's primary display port is through the HDMI connector J3. (Note: Enable/Disable HDMI Audio Feature – Mount resistor R236 to enable HDMI Audio; mount

resistor R240 to disable HDMI Audio. Default is HDMI Audio enabled.) The connector pins are connected as shown in the table below:

Table 1 HDMI Connector J3 Pinout

Pin	Connector Pin Name	Signal
1	TMDS DATA2+	CON_DP0_TXDP
2	TMDS DATA2 SHLD	GND
3	TMDS DATA2-	CON_DP0_TSDN
4	TMDS DATA1+	CON_DP0_TX1P
5	TMDS DATA1 SHLD	GND
6	TMDS DATA1-	CON_DP0_TX1N
7	TMDS DATA0+	CON_DP0_TX2P
8	TMDS DATA0 SHLD	GND
9	TMDS DATA0-	CON_DP0_TX2N
10	TMDS CLK+	CON_DP0_TX3P
11	TMDS CLK SHLD	GND
12	TMDS CLK-	CON_DP0_TX3N
13	CEC	HDMI_CEC
14	RSVD	N/C
15	SCL	CON_DP0_AUXP
16	SDA	CON_DP0_AUXN
17	DCC/CEC GND	GND
18	+5V PWR	Fused +5V (fuse F2 0.5A)
19	HOT PLUG DTCT	CON_DP0_HPD
20	M1	GND
21	M2	GND
22	M3	GND
23	M4	GND

J4 – HD Audio I/O

A RealTek HD Audio CODEC (ALC272) is connected to the audio jack J4. The pinout for the jack is shown in the figure below:

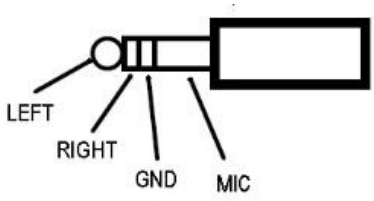

Figure 6 Audio Jack J4 Pinout

J5 – Combined USB2.0/RJ45 Ethernet Connector

Two USB2.0 ports are available from the back panel along with an RJ45 Gigabit Ethernet port in a stack combined connector. The USB ports are colored black to distinguish them from the

USB3.0 ports, which are blue. The USB power pins are +5V fused through a 1A resettable PTC fuse (F4). The Ethernet port is controlled by a RealTek RTL8111EP Gigabit Ethernet Controller.

J6 – USB2.0 Header

An additional USB2.0 port is available through header J6. This header is connected to the SOC's USB3 port. The pinout of this header is shown in the table below:

Table 2 USB2.0 Header J6 Pinout

Pin	Signal
1	Fused +5V (resettable PTC fuse F6 0.5A)
2	Data-
3	Data+
4	GND
5	N/C

J8 – RCC Programming Header

The Gizmo II board contains an STM8S003F3 8-bit microcontroller with EEPROM to handle power-up and reset states. This controller is accessible through the J8 programming header. (Note: Under most normal operations the programming of this microcontroller should not be modified. The header is not populated on the board to prevent users from erasing or reprogramming the device inadvertently, which will result in the board no longer functioning.) The pinout of this header is shown in the table below:

Table 3 RCC Programming Header J8 Pinout

Pin	Signal	Description
1	+3.3V_PROG	3.3V Board Power Rail
2	SWIM	Single Wire Interface Module for Programming
3	GND	Ground
4	SWIM_RST	Reset - refer to the STM8 SWIM communication protocol and debug module user manual (UM0470)

J9 – SATA Data Connector

By default this connector is not populated in the Gizmo II boards since an mSATA connector is available. The SATA interface on the AMD SOC supports port sharing, which means that multiple devices may be connected to the same SATA port. When populated, the J9 connector allows for a SATA device to be connected to the SOC SATA0 interface using a standard SATA cable. The pinout of the connector is shown in the table below:

Table 4 SATA Data Connector J9 Pinout

Pin	Signal	Description
1	GND	Ground
2	SATA_TX0+	Transmit Positive
3	SATA_TX0-	Transmit Negative
4	GND	Ground

5	SATA_RX0-	Receive Negative
6	SATA_RX0+	Receive Positive
7	GND	Ground
8	GND	Ground
9	GND	Ground

J10 – APU Fan Connector

The SOC Fan Connector provides power and speed monitoring to the fan. The pinout of the fan connector is shown in the table below:

Table 5 APU Fan Connector J10 Pinout

Pin	Signal	Description
1	GND	Ground
2	FAN	Fan Power
3	TACH	Fan Speed

J11 – SATA Power Connector

When populated, the SATA power connector allows a low power (non-rotating media) SSD-type drive to receive its power from the Gizmo II board. The connector provides only a 5V supply for devices that require less than one amp. The pinout of the connector is shown in the table below:

Table 6 SATA Power Connector Header J11 Pinout

Pin	Signal	Description
1	+5V	5V Power Rail
2	GND	Ground
3	N/C	No Connect
4	N/C	No Connect

J12 – SPI Programming Header

The onboard SPI ROM can be programmed, read, and emulated through the SPI Programming Header. The header pinout is shown in the table below:

Table 7 SPI Programming Header J12 Pinout

Pin	Signal	Description
1	3.3V SPI	3.3V SPI Power Rail
2	GND	Ground
3	SPI_CS#	SPI Device Chip Select
4	SPI_CLK	SPI Clock
5	SPI_DATAIN	SPI Data In
6	SPI_DATAOUT	SPI Data Out
7	N/C	No Connect
8	N/C	No Connect

J14 – MicroSD Card Socket

The microSD card socket permits the Gizmo II board to read/write microSD card media. The Gizmo II board uses a G1745010 microSD Card Connector from Molex (http://www.molex.com/molex/products/family?key=microsd&channel=products&chanName=family&pageTitle=Introduction). The connector pins are connected as shown in the table below:

Table 8 microSD Card Socket J14 Pinout

Pin	Conn Pin Name	Signal
1	P9	SD_Data2
2	P1	SD_Data3
3	P2	SD_CMD
4	P4	3.3V
5	P5	SD_Clk
6	P6	GND
7	P7	SD_Data0
8	P8	SD_Data1
9A	CD1	SD_CD#
9B	CD2	SD_CD#
10A	T1	GND
10B	T2	GND

J15 – Low Speed Card Edge Connector

The low speed card edge connector makes available several bus interfaces for developers to access in their prototype builds. The card edge connector is physically a PCIe 36-pin connector with a custom pinout.

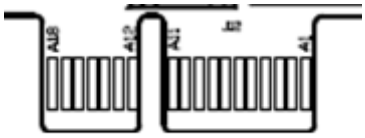

Figure 7 Low Speed Card Edge Connector (J15)

The pinout is shown in the table below:

Table 9 Low Speed Card Edge Connector J15 Pinout

Pin	Signal	Description
A1	GEVENT0	General Purpose Event
A2	GPIO_0	General Purpose I/O
A3	GPIO_2	General Purpose I/O
A4	GPIO_4	General Purpose I/O
A5	PWM1(FANOUT1)	FanOut 1
A6	COUNTER1(FANIN1)	FanIn 1
A7	GND	Ground
A8	PWM2(FANOUT2)	FanOut2

A9	COUNTER2(FANIN2)	FanIn 2
A10	GND	Ground
A11	SCL0	Serial Clock
A12	GND	Ground
A13	ADC0	Analog/Digital Converter 0
A14	ADC1	Analog/Digital Converter 1
A15	VDCIN (12V-24V)	Fused Board Power (Resettable Fuse F7 0.5A)
A16	SYS_PBTN#	System Power Button
A17	USB0_DP	USB Data+ (USB1 from SOC)
A18	USB0_DN	USB Data- (USB1 from SOC)
B1	GEVENT1#	General Purpose Event1
B2	GPIO_1	General Purpose I/O
B3	GPIO_3	General Purpose I/O
B4	GPIO_5	General Purpose I/O
B5	GND	Ground
B6	SPI_CE	SPI Bus Chip Enable
B7	SPI_CLK	Serial Clock
B8	GND	Ground
B9	SPI_SO	SPI Bus Data Out
B10	SPI_SI	SPI Bus Data In
B11	SDA0	Serial Data
B12	GND	Ground
B13	DAC0	Digital/Analog Converter
B14	DAC1	Digital/Analog Converter
B15	+3.3V	Fused +3.3V (Resettable PTC Fuse F8 0.5A)
B16	SYS_RST#	System Reset Signal
B17	GND	Ground
B18	GND	Ground

J16 – High Speed Card Edge Connector

The high speed card edge connector makes available several bus interfaces for developers to use in their prototype builds. The connector is physically identical to a PCIe x4 edge connector with custom pinout.

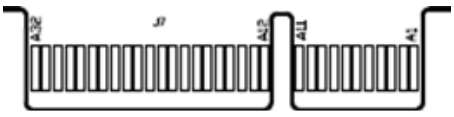

Figure 8 High Speed Card Edge Connector J16

The pinout for the connector is shown in the table below:

Table 10 High Speed Card Edge Connector J16 Pinout

Pin	Signal	Description
A1	DP0_TX1_P	Display Port 0 Transmitter 1+
A2	DP0_TX1_N	Display Port 0 Transmitter 1-
A3	GND	Ground
A4	DP0_TX3_P	Display Port 0 Transmitter 3+
A5	DP0_TX3_N	Display Port 0 Transmitter 3-
A6	GND	Ground
A7	DP0_AUX_P	Display Port 0 Aux+
A8	DP0_AUX_N	Display Port 0 Aux-
A9	GND	Ground
A10	DP0_HPD	Display Port0 Hot Plug Detect
A11	+3.3V	Fused 3.3V (Resettable PTC Fuse F9 1A)
A12	N/C	No Connect
A13	N/C	No Connect
A14	N/C	No Connect
A15	+3.3V	Fused 3.3V (Resettable PTC Fuse F9 1A)
A16	PCIE_RX0_P	PCIe Receiver 0+
A17	PCIE_RX0_N	PCIe Receiver 0-
A18	GND	Ground
A19	PCIE_RX1_P	PCIe Receiver 1+
A20	PCIE_RX1_N	PCIe Receiver 1-
A21	GND	Ground
A22	SATA_C_RX0_P	SATA Receiver 0+
A23	SATA_C_RX0_N	SATA Receiver 0-
A24	GND	Ground
A25	N/C	No Connect
A26	N/C	No Connect
A27	GND	Ground
A28	USBP1	USB 1+ (USB4)
A29	USBN1	USB 1- (USB4)
A30	USBP2	USB 2+ (USB5)
A31	USBN2	USB 2- (USB5)
A32	VIN_IN (12V-24V)	Fused Board Input Voltage (Resettable PTC Fuse F3 1.1A)
B1	GND	Ground
B2	DP0_TX0_P	Display Port0 Transmitter 0+
B3	DP0_TX0_N	Display Port 0 Transmitter 0-
B4	GND	Ground
B5	DP0_TX2_P	Display Port 0 Transmitter 2+
B6	DP0_TX2_N	Display Port 0 Transmitter 2-
B7	GND	Ground
B8	LVDS_VARY_BL	Panel Backlight Brightness Control
B9	LVDS_DIGON	Display Power Enable

B10	LVDS_BLON	Backlight Enable
B11	GND	Ground
B12	N/C	No Connect
B13	N/C	No Connect
B14	GND	Ground
B15	PCIE_TX0_P	PCIe Transmitter 0+
B16	PCIE_TX0_N	PCIe Transmitter 0-
B17	GND	Ground
B18	PCIE_TX1_P	PCIe Transmitter 1+
B19	PCIE_TX1_N	PCIe Transmitter 1-
B20	GND	Ground
B21	PCIE_CLK_P	PCIe Clock+
B22	PCIE_CLK_N	PCIe Clock-
B23	GND	Ground
B24	SATA_C_TX0_P	SATA Transmitter 0+
B25	SATA_C_TX0_N	SATA Transmitter 0-
B26	GND	Ground
B27	N/C	No Connect
B28	N/C	No Connect
B29	GND	Ground
B30	RESET	System Reset
B31	GND	Ground
B32	VIN_IN (12V-24V)	Fused Board Input Voltage (Resettable PTC Fuse F3 1.1A)

J17 – miniPCIe/mSATA Combined Port

The miniPCIe/mSATA combined port will accept either miniPCIe devices or mSATA devices and will automatically configure itself to the protocol of the connected device. This port can be used to connect SSD drives which have an mSATA connection or miniPCIe devices such as WIFI adapters. Non-compliant mSATA cards can be connected to this port, but mPCIe will have to be disabled first by removing resister R1 or by removing the gold finger pin43 on the mSATA card. The pinout of the connecter is shown in the table below:

Table 11 miniPCIe/mSATA Combined Connector J17 Pinout

Pin	Signal	Description
1	WAKE#	PCIe Wakeup
2	+3.3Vaux#2	Unfused 3.35V ALW
3	COEX1	No Connect
4	GND#4	Ground
5	COEX2	No Connect
6	1.5V_1	Unfused 1.5V ALW
7	CLKREQ#	PCIe Mini CLK REQ
8	UIM_PWR	No Connect
9	GND#9	Ground
10	UIM_DATA	No Connect
11	REFCLK-	GPP CLK0-

12	UIM_CLK	No Connect
13	REFCLK+	GPP CLK0+
14	UIM_RESET	No Connect
15	GND#15	Ground
16	UIM_VPP	No Connect
17	UIM_C8	No Connect
18	GND#18	Ground
19	UIM_C4	No Connect
20	W_DISABLE#	WL Disable 0
21	GND#21	Ground
22	PERST#	PCI Disable
23	PERn0	PCIe or SATA Receive-
24	+3.3Vaux#24	Unfused 3.35V ALW
25	PERp0	PCIe or SATA Receive+
26	GND#26	Ground
27	GND#27	Ground
28	1.5V_2	Unfused 1.5V ALW
29	GND#29	Ground
30	SMB_CLK	Serial CLK (Sideband I/F)
31	PETn0	PCIe or SATA Transmit-
32	SMB_DATA	Serial DATA (Sideband I/F)
33	PETp0	PCIe or SATA Transmit+
34	GND#34	Ground
35	GND#35	Ground
36	USB_D-	USB2.0 (USB6) DataN
37	GND#37	Ground
38	USB_D+	USB2.0 (USB6) DataP
39	+3.3Vaux#39	Unfused 3.35V ALW
40	GND#40	Ground
41	+3.3Vaux#41	Unfused 3.35V ALW
42	LED_WWAN#	Gizmo Board LED (D15) Control Output by Wireless LAN
43	GND43	Ground
44	LED_WAN#	Gizmo Board LED (D15) Control Output by Wireless LAN
45	RSV#45	No Connect
46	LED_WPAN#	Gizmo Board LED (D15) Control Output by Wireless LAN
47	RSV#47	No Connect
48	1.5V_3	Unfused 1.5V ALW
49	RSV#49	No Connect
50	GND#50	Ground
51	RSV#51	No Connect
52	+3.3Vaux#52	Unfused 3.35V ALW
53	PAD#53	Ground
54	PAD#54	Ground

COMPONENTS

AMD G-Series SOC (FT3)

The primary feature of the Gizmo II board is the AMD G-Series SOC (FT3). This processor is AMD's first generation SOC design, which integrates Controller Hub functionality into the same package containing the CPU, Graphics Processor and North Bridge.

The SOC on the Gizmo II board contain dual core Jaguar CPU cores with 2MB shared L2 cache.

The embedded Graphics Processor provides support for DirectX 11.1 and realizes a significant compute performance (GFLOP) increase over the previous G-Series APUs. Two simultaneous displays are supported. On the Gizmo II board, one of these display outputs can be accessed through the HDMI connector. The other can be accessed on the High Speed Expansion card edge connector as a 4-lane DisplayPort 1.2, DVI, HDMI, or 18bpp single channel LVDS.

The G-Series SOC has a single-channel DDR3 memory interface which supports DDR3-1600 devices. The Gizmo II comes with four 2Gb DDR3-1600 chips soldered down for a total of 1GB system memory. The board layout supports 4Gb chips which could provide up to 2GB of available memory.

The controller hub functionality embedded into the G-Series SOC provides the following available interconnect:

- Four x1 links of PCIe Gen 2 for GPPs
- One x4 link of PCIe Gen 2 for discrete GPU
- Eight USB2.0 and 2 USB3.0
- Two SATA 2.x/3.x (up to 6Gb/s)
- SD Card Reader v3.0 or SDIO controller

Further information on the AMD Embedded G-Series SOC platform is available in the product brief and white paper.

Audio CODEC (ALC272)

The Realtek ALC272 is a High Definition Audio Codec, which features two stereo DACs, two stereo ADCs, legacy analog input to analog output mixing, one stereo digital microphone converter, and two independent SPDIF output converters.

The ALC272 integrates two stereo ADCs and two stereo digital microphone converters to support simultaneous analog microphone recording and up to 4-channel digital microphone array recording, and features Acoustic Echo Cancellation (AEC), Beam Forming (BF), and Noise Suppression (NS) for voice applications.

The HPOUT port is connected to the card edge audio jack and can drive a low noise signal to a connected audio input device or headphones.

The same audio jack supports a MIC input which is connected to the ALC272 stereo microphone input port (the same signal is connected to both L and R).

For added flexibility, the ALC272 can be used to act as AD/DA converter for projects that require an analog input or output. There are two AD pins available on the low speed connector, which are connected to the audio codec's line2 L and R inputs. The codec's SURR L and R outputs are connected to the DA pins on the low speed connector and can be used as general purposed analog output.

For more information on the Realtek Audio Codec or to download drivers, visit the Realtek Audio Codec website.

Gigabit Ethernet Controller

The Realtek RTL8111 Gigabit Ethernet controller combines a triple-speed IEEE 802.3 compliant Media Access Controller (MAC) with a triple-speed Ethernet transceiver, PCI Express bus controller, and embedded memory. With state-of-the-art DSP technology and mixed-mode signal technology, it offers high-speed transmission over CAT 5 UTP cable or CAT 3 UTP (10Mbps only) cable. Functions such as Crossover Detection & Auto-Correction, polarity correction, adaptive equalization, cross-talk cancellation, echo cancellation, timing recovery, and error correction are implemented to provide robust transmission and reception capability at high speeds.

The device supports the PCI Express 1.0a bus interface for host communications with power management and is compliant with the IEEE 802.3u specification for 10/100Mbps Ethernet and the IEEE 802.3ab specification for 1000Mbps Ethernet. It also supports an auxiliary power auto-detect function, and will auto-configure related bits of the PCI power management registers in PCI configuration space.

The Ethernet controller device is physically connected to the PCIe x1 GPP Port 1. The Ethernet port of the RTL8111 is connected to the RJ45 jack on the Gizmo II's back panel.

SPI ROM

The Gizmo II board contains a MX25L3239E 32Mb SPI ROM which is preloaded with the SageBIOS BSP (Board Support Package). This is a full boot solution with minimal footprint that is based on the open source coreboot project. The ROM can be reprogrammed through the SPI programming header J12.

mSATA/miniPCIe Connector

The mSATA/miniPCIe connector located on the bottom side of the board can be used for SATA 2.x/3.x (up to 6Gb/s) storage devices.

DDR3 Memory

There are four 2Gb x 16 DDR3-1600 components soldered to the Gizmo II board. These are connected to the single channel DDR3 memory port on the AMD SOC. The address connections on the PCB will support device sizes up to 4Gb, which would give a maximum RAM capacity of 2GB. This is a manufacturing option only. It is not recommended that users attempt to remove or resolder the BGA memory components.

Power Button

The Power button initiates the power-up sequence. Press once to power up the board. Press and hold to power down the board.

Reset Button
Pressing the Reset button causes a hard reset of the board.

RTC Battery (backside)
The 3V coin battery (included) provides power for the realtime clock (RTC). The battery must be installed for proper operation of the board.

GIZMO II SWITCH, LED, HEADER, AND TEST POINT LIST

Table 12 Diodes, Switches, Connectors and Headers

Item	Function	GPIO
SW1	Power Button	
SW2	Reset Button	
D12	Red LED – SD Card Activity	45
D24	Green LED – IR Activity	184
D15	Red LED – Wireless Activity	
D6	Red LED – DASH RCC SYS Alert	
D1	Red LED – Standby Power	
D3	Red LED – S5 Power Indicator	
D4	Green LED – SATA Activity	
J1	Power Jack	
J2	Dual USB3 Connectors	
J3	HDMI Connector	
J4	Audio Jack	
J5	Dual USB2/RJ45 Connector	
J6	USB2 Port 3 Header	
J8	RCC Programming Header	
J9	SATA0 Connector	
J10	APU Fan Header	
J11	SATA Power Connector (5V only)	
J12	SPI ROM Programming Header	
J13	AMD Debug Header	

Table 13 Gizmo II Board Test Points

Item	Function	GPIO
TP1	SATA_X1	
TP2	SATA_X2	
TP3	SD_WP	
TP4	SD_PWR_CNTL	
TP5	APU_TEST16	
TP6	APU_TEST17	
TP7	APU_TEST14	
TP8	APU_TEST15	
TP9	APU_TEST34	
TP10	USBCLK14M_CLK	
TP13	TEST2	
TP14	TEST1/TMS	
TP15	USB_OC#	
TP16	APU_TEST43 – USB_ATEST1	
TP17	APU_TEST42 – USB_ATEST0	
TP18	48M_CLK	
TP19	TEST0	
TP20	DAC_SCL	
TP21	DAC_VSYNC	
TP22	DAC_SDA	
TP23	AP_TEST36	
TP24	APU_TEST6	
TP25	APU_TEST37	
TP26	APU_TEST4	
TP27	APU_TEST5	
TP28	APU_TEST41 – TMON_CAL	
TP29	APU_TEST40 – M_ANALOGOUT	
TP30	APU_TEST39 – M_ANALOGIN	
TP31	APU_TEST31	
TP32	APU_TEST28_L	
TP33	APU_TEST28_H	
TP34	M_VREFDQ	
TP36	GPIO55	55
TP37	GPIO69	69