

# DP-eMMC High Speed IO Module Hardware User Guide

Version 1.0

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## 1 Document Control

**Document Version:** 1.0

**Document Date:** 4 November 2024

## 2 Version History

Version	Date	Comment
1.0	11/04/2024	Initial Release

## 3 Introduction

The DP-eMMC High Speed IO (HSIO) Module is an accessory expansion card solution that is intended to be paired with Tria Technologies AMD platforms containing the mating High Speed IO connectors.

- Offering an expansion port conversion from HSIO connector to Mini DisplayPort connector. Allows two lanes of high-resolution DisplayPort video output with a max resolution of 4Kx2K at 30fps.
- Includes a 32 GB eMMC memory adding the essential feature of a rugged bootable SSD storage.
- Target many applications for development, including:
  - Machine Vision
  - Artificial Intelligence
  - Industrial IoT and Smart Sensors
  - Smart Home Appliances
  - Prototyping and Experimentation
  - Digital Video Application

## 4 Architecture and Features

The DP-eMMC High Speed IO Module provides a hardware environment for developing designs targeting the Tria Technologies portfolio of AMD offerings. The High-Speed IO (HSIO) connector exists on platforms that include the Zynq UltraScale+ such as the low cost ZUBoard and K24 Development Kit.

The DP-eMMC High Speed IO module includes Micron eMMC memory and dual-lane DisplayPort for high-resolution video output (up to 4K 30fps). By integrating DisplayPort video and eMMC SSD storage, this add-on board enhances development boards with high-definition video support and reliable bootable storage.

The details for the DP-eMMC High Speed IO Module features are described in Functional Description sections that follow.

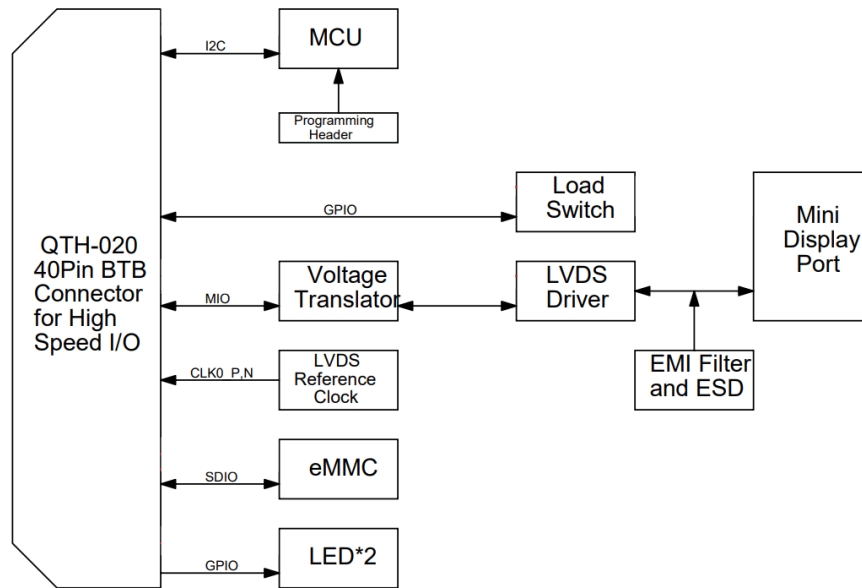
### 4.1 List of Features

The DP-eMMC High Speed IO Modules supports the following features:

- High-Speed IO Board-to-Board Connector
  - Samtec Q-Strip High Performance 40-Pin 0.5mm Differential Pair Array
    - Part Number: **QTH-020-01-F-D-DP-A-K-TR**
- Programmable MCU for information sharing between DP-eMMC HSIO Module and the host platform.
  - Microchip AVR ATTiny Microcontroller 8-Bit
    - Part Number: **ATTINY44A-SSNR/SSUR/SSFR**
- Mini Display Port
  - TE Connectivity Female Conn Display Port RCP 20 POS Card Edge Connector
    - Part Number: **2129320-3**
- eMMC Memory
  - Micron Technology 32 GB eMMC
    - Part Number: **MTFC32GAZAQHD-W**
- ESD Protection Diode
  - Onsemi Low Capacitance Array for High-Speed Video Interfaces
    - Part Number: **ESD8040MUTAG**
- GPIO LEDs x2
  - Everlight Electronics Co Ltd Led Red Diffused 2SMD
    - Part Number: **EAST0603RA0**

### 4.2 Block Diagram

The following figure is a high-level block diagram of the DP-eMMC HSIO Module:



**Figure 1 – DP-eMMC HSIO Block Diagram**

### 4.3 What's In The Box

The DP-eMMC HSIO Module box includes only the DP-eMMC HSIO Module and a Quick Start Card. This accessory kit is meant for HSIO expansion connector evaluation on Tria Technologies AMD platforms allowing for the integration of many off-the-shelf interfaces and peripherals. The Development Kit includes the following in the box:

- DP-eMMC HSIO Module
- Quick Start Card

Customers need to acquire an appropriate Tria Technologies platform that includes the mating HSIO connector.

- Tria Technologies ZUBoard-1CG: <http://avnet.me/zuboard-1cg>
- Tria Technologies K24 Development Kit: <http://avnet.me/k24-dk>



## 5 Functional Description

The following sections provide brief descriptions of each feature provided on the DP-eMMC HSI0 Module.

### 5.1 Interfaces and Connectors

The following figure provides an overview of the physical connections, their designators, and relative position on the DP-eMMC HSI0 Module.

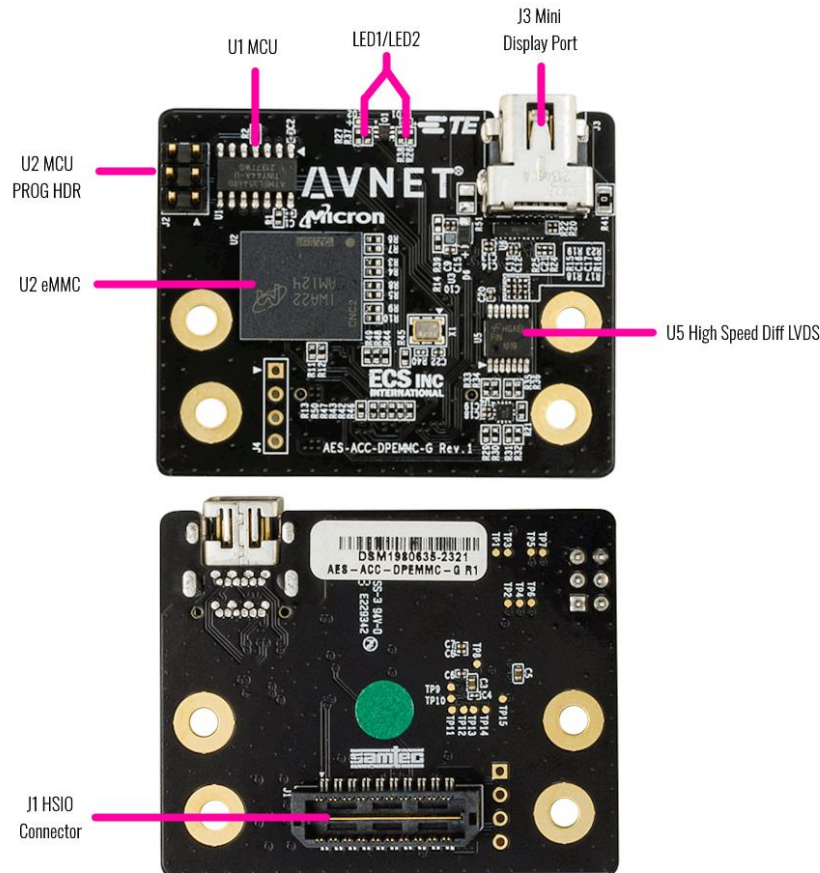


Figure 2 – Interfaces and Connectors

### 5.2 HSI0 Expansion Interface

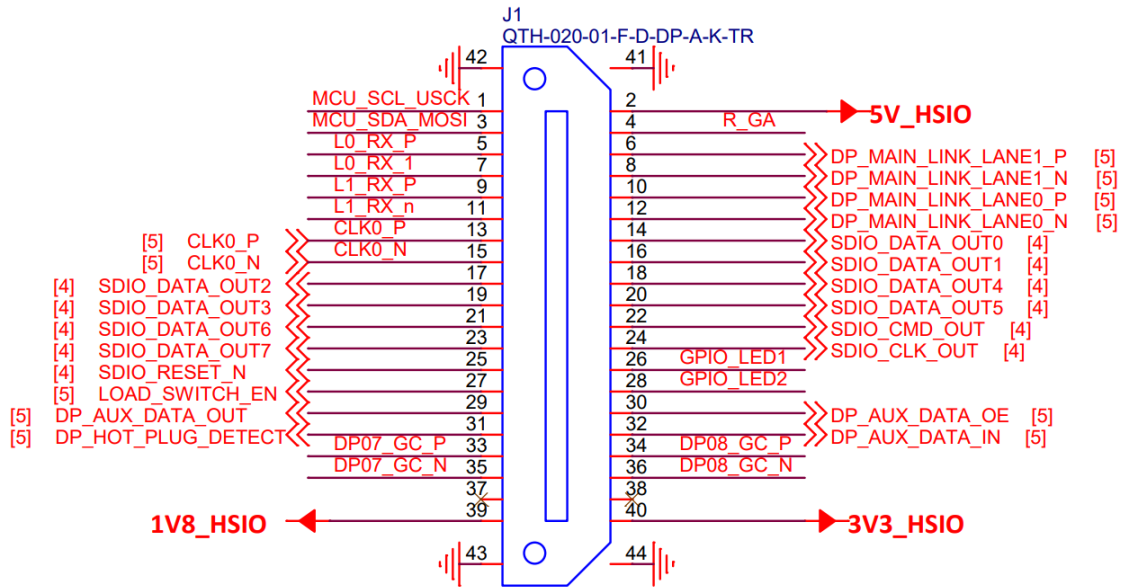
The DP-eMMC HSI0 Module offers a Samtec connector for the HSI0 (high-speed I/O) expansion interface as the main board-to-board connector, **J1**. This board-to-board interface contains a mix of high-speed data lanes known as SDIOs (Secure Digital Input Output) and digital display signals DPs. How these pins are interfaced to will depend on the Carrier Board that is utilized with the DP-eMMC HSI0 Module.

When designing with the DP-eMMC HSI0 Module the user will be expected to map appropriate interfaces and voltage standards to the DP-eMMC HSI0 module. To do this, the user should review the schematics of the mating Carrier Boards HSI0 expansion connector and map that through the **J1** HSI0 connector on the DP-eMMC HSI0 Module to the respective Mini DisplayPort and eMMC memory. The Mini DisplayPort and eMMC sections will define the expected voltages on the interfaces.

A Samtec **QTH-020-01-F-D-DP-A-K-TR** connector is used to provide the HSIO expansion interface which is also known as a TXR2 MIO expansion interface. It is expected that this module be implemented with a Zynq UltraScale+ solution that maps GTR transceivers to the DP lanes and processor MIO pins to the SDIO interface on the HSIO connector.

Figure 4 and Table 1 shows the pinout of the HSIO expansion interface and interfaces that are mapped to the connector.

- Manufacturer: Samtec
- Part Number: **QTH-020-01-F-D-DP-A-K-TR**
- 0.50mm / 40-position differential array connector



**Figure 3 – HSIO Expansion Interface**

HSIO Interface (J1) Pin Numbers	Schematic Net Name	Connection on DP-eMMC Module
1	MCU_SCL_USCK	MCU I2C Clock Pin
3	MCU_SDA_MOSI	MCU I2C Data Pin
5 / 7	LO_RX_P/N	Shared RX Lane 0 Diff Pair
6 / 8	DP_MAIN_LINK_LANE1_P/N	Mini Display Port Lane 1 Diff Pair
9 / 11	L1_RX_P/N	Shared RX Lane 1 Diff Pair
10 / 12	DP_MAIN_LINK_LANE0_P/N	Mini Display Port Lane 0 Diff Pair
13 / 15	CLK0_P/N	LVDS Reference Clock Diff Pair
14	SDIO_DATA_OUT0	eMMC Interface Data 0
16	SDIO_DATA_OUT1	eMMC Interface Data 1
17	SDIO_DATA_OUT2	eMMC Interface Data 2
18	SDIO_DATA_OUT4	eMMC Interface Data 4
19	SDIO_DATA_OUT3	eMMC Interface Data 3
20	SDIO_DATA_OUT5	eMMC Interface Data 5
21	SDIO_DATA_OUT6	eMMC Interface Data 6
22	SDIO_CMD_OUT	eMMC Interface Command
23	SDIO_DATA_OUT7	eMMC Interface Data 7
24	SDIO_CLK_OUT	eMMC Interface Clock
25	SDIO_RESET_N	eMMC Interface Reset#
26	GPIO_LED1	GPIO Led 1 Pin
27	LOAD_SWITCH_EN	Load Switch Enable Signal
28	GPIO_LED2	GPIO Led 1 Pin
29	DP_AUX_DATA_OUT	Voltage Translator Data A1
30	DP_AUX_DATA_OE	Voltage Translator Data A0
31	DP_HOT_PLUG_DETECT	Voltage Translator Data A3
32	DP_AUX_DATA_IN	Voltage Translator Data A2
33 / 35	DP07_GC_P/N	J4 Pin Header 1/2
34 / 36	DP08_GC_P/N	J4 Pin Header 3/4

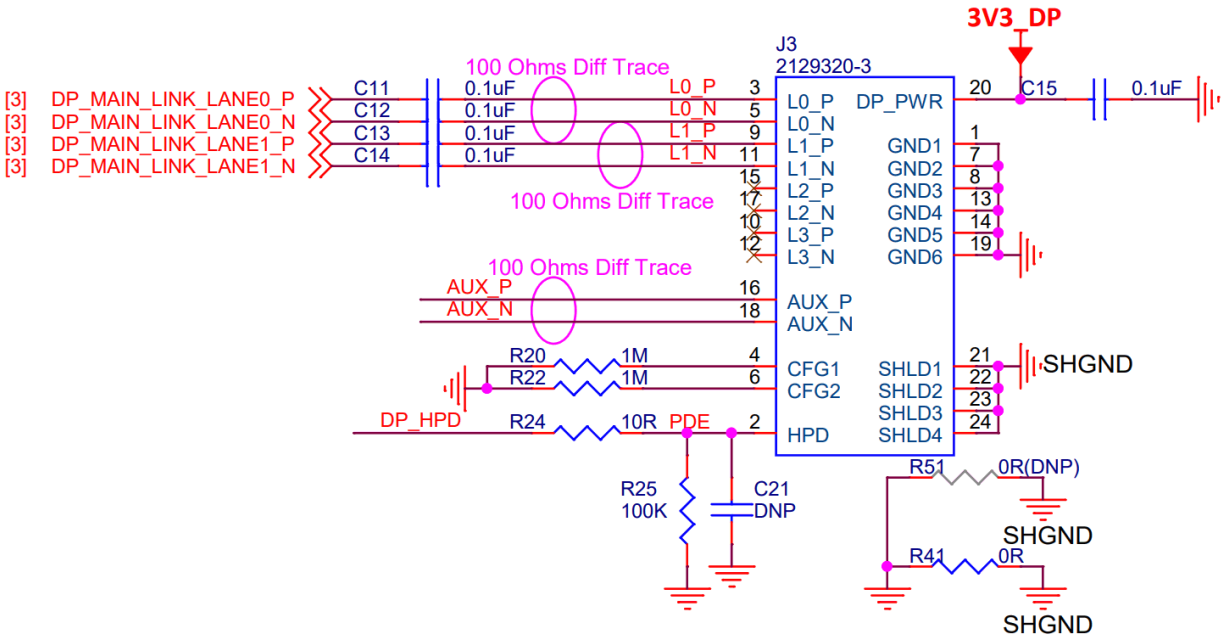
**Table 1 – HSIO Expansion Interface Connections**

### 5.3 Mini Display Port

The DP-eMMC HSIO Module offers a TE Connectivity Display Port Interface, **J3**. This connector interface makes connections to the HSIO expansion connector, **J1**, going through a Voltage Translator, **U4**, and a LVDS Driver, **U5**.

A TE Connectivity **2129320-3** provides the Mini DisplayPort connectivity. Figure 5 and Table 2 shows the pinout of the Connector interface and how the interface is mapped to the HSIO expansion connector, **J1**.

- Manufacturer: TE Connectivity
- Part Number: **2129320-3**
- Female Conn Display Port RCP 20 POS Card Edge Connector



**Figure 4 – Mini DisplayPort Interface**

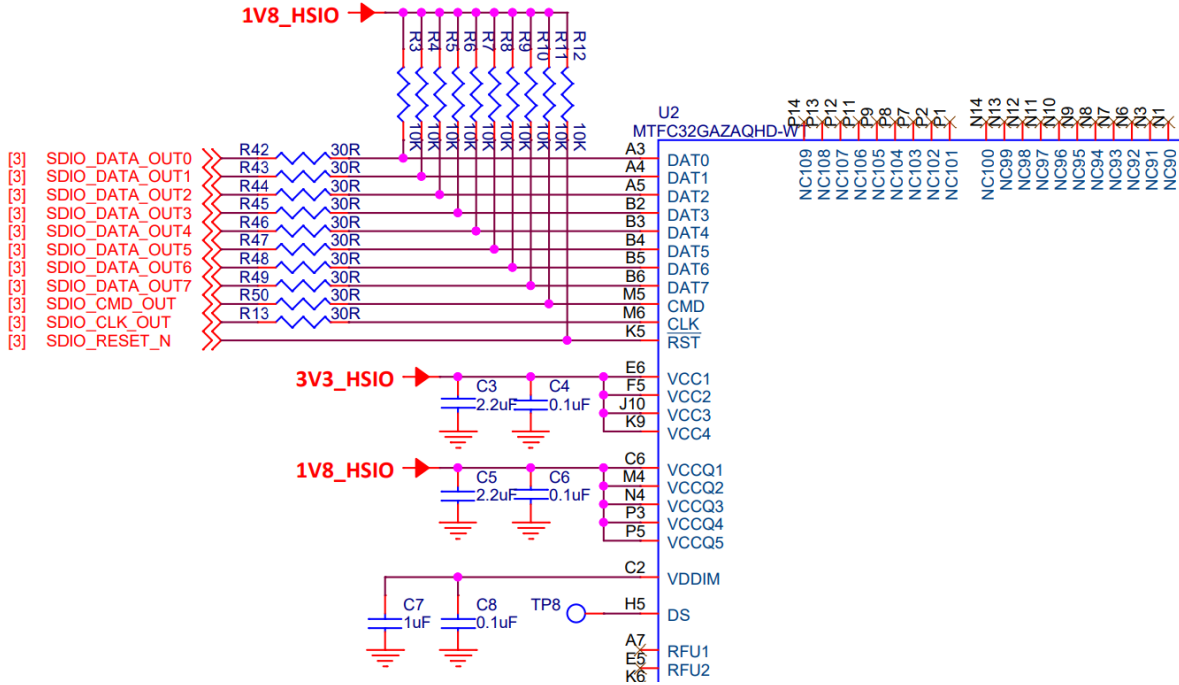
Component	Pin Number	Schematic Net Name	HSIO Connector (J1)
J3	L0_P (3)	DP_MAIN_LINK_LANE0_P	12
J3	L0_N (5)	DP_MAIN_LINK_LANE0_N	14
J3	L1_P (9)	DP_MAIN_LINK_LANE1_P	8
J3	L1_N (11)	DP_MAIN_LINK_LANE1_N	10
U4	A0 (3)	DP_AUX_DATA_OE	30
U4	A1 (4)	DP_AUX_DATA_OUT	29
U4	A2 (5)	DP_AUX_DATA_IN	32
U4	A3 (6)	DP_HOT_PLUG_DETECT	31

**Table 2 – Mini DisplayPort Interface Connections**

## 5.4 eMMC

The DP-eMMC HSIO Module offers a 32 GB eMMC as flash memory. Figure 6 and Table 3 shows the pinout of the eMMC component and how the interface is mapped to the HSIO expansion connector, **J1**.

- Manufacturer: Micron Technology
- Part Number: **MTFC32GAZAQHD-W**
- High-capacity NAND Flash memory



**Figure 5 – eMMC Interface**

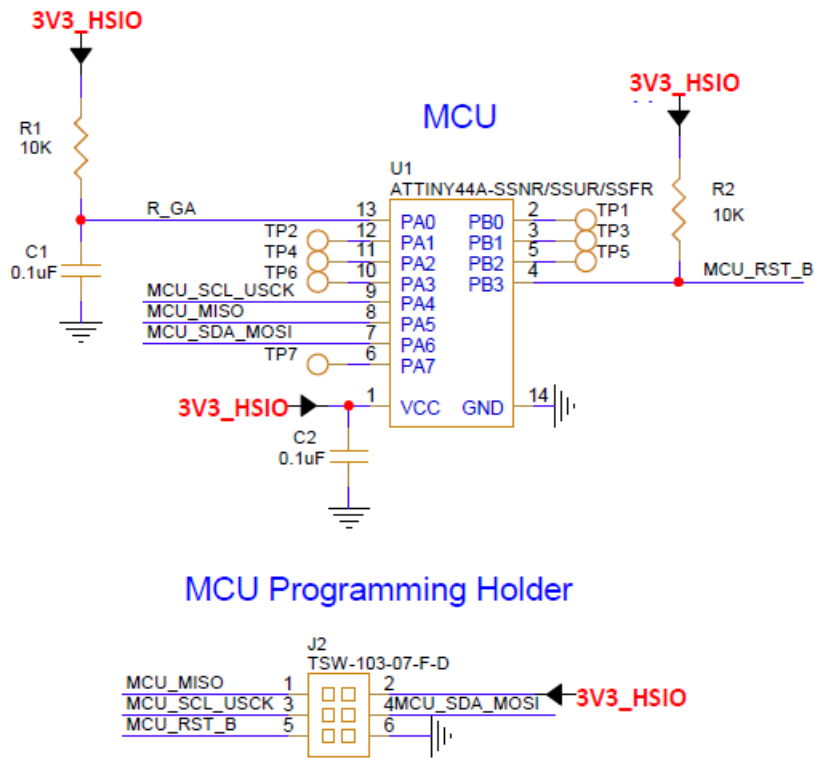
eMMC (U2) Name and Number	Schematic Net Name	HSIO Interface (J1)
DAT0 (A3)	SDIO_DATA_OUT0	14
DAT1 (A4)	SDIO_DATA_OUT1	16
DAT2 (A5)	SDIO_DATA_OUT2	17
DAT3 (B2)	SDIO_DATA_OUT3	19
DAT4 (B3)	SDIO_DATA_OUT4	18
DAT5 (B4)	SDIO_DATA_OUT5	20
DAT6 (B5)	SDIO_DATA_OUT6	21
DAT7 (B6)	SDIO_DATA_OUT7	23
CMD (M5)	SDIO_CMD_OUT	22
CLK (M6)	SDIO_CLK_OUT	24
RST (K5)	SDIO_RESET_N	25

**Table 3 – eMMC Interface Connections**

## 5.5 Microcontroller

The DP-eMMC HSIO Module implements an on-board MCU that is connected to the HSIO Connector I2C interface or via the programming header, **J2**, SPI interface. Figure 7 shows the MCU connections.

- Manufacturer: Microchip
- Part Number: **ATTINY44A-SSNR/SSUR/SSF**
- AVR® ATtiny Microcontroller IC 8-Bit 20MHz 4KB (2K x 16) FLASH 14-SOIC

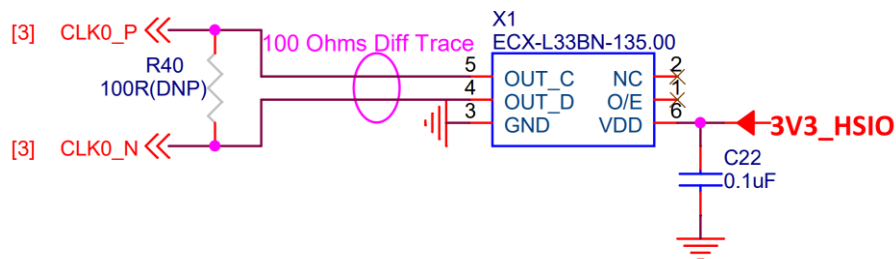


**Figure 6 – MCU Implementation**

## 5.6 Clock Generator

The DP-eMMC HSI0 Module implements a Frequency Configurable SMD crystal-controlled oscillator, **X1**, to handle the creation of the clocks for the HSI0 connector. The Microchip **ECX-L33BN-135.00** is a low jitter, low current Clock Generator that generates the 135MHz clocks required on the various interfaces.

- Manufacturer: ECS
- Part Number: **ECX-L33BN-135.00**
- ECX-L LVDS Oscillator



**Figure 7 – Clock Generator Implementation**

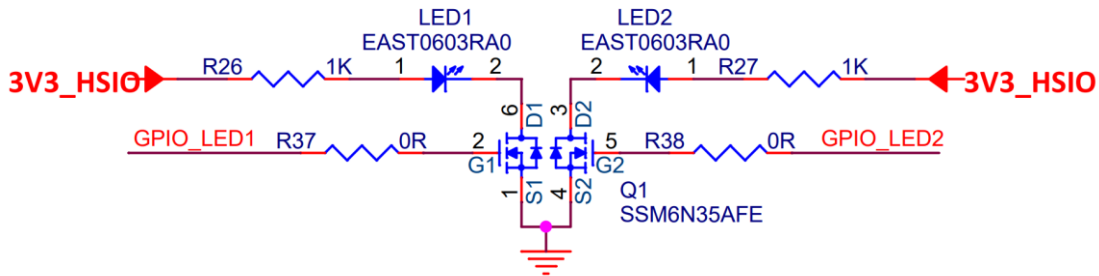
## 5.7 LEDs

The DP-eMMC HSIO Module implements 2 Red Diffused 2SMD LEDs controlled via active-high signals mapped to the HSIO connector.

GPIO\_LED1 is mapped to pin 26 on **J1** HSIO Connector.

GPIO\_LED2 is mapped to pin 28 on **J1** HSIO Connector.

- Manufacturer: Everlight Electronics Co Ltd
- Part Number: **EAST0603RA0**
- + 3.3V

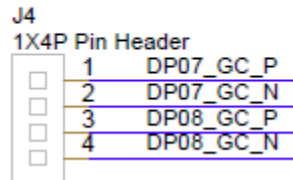


**Figure 8 – LEDs Implementation**

## 5.8 Spare Pins

The DP-eMMC HSIO Module after implementation of required interfaces has four IO available for potential use by the end user. To provide access to those four available IO the signals were routed from the HSIO Connector, **J1**, to a 100-mil pitch header, **J4**, that is not populated allowing the user to solder to the individual holes provided for each available IO. Figure 9 shows how these IO targets header **J4**.

### Pin Header(DNP)



**Figure 9 – Unused IO from HSIO Connector**

## 5.9 Recommended Operating Conditions

This section contains the recommended operating conditions when using the DP-eMMC HSIO Module. Values listed are those available at the time of publication. Users may want to consult the latest device manufacturer's specifications if their application approaches any of the limits.

It is important that you review the mating board connections to the HSIO expansion connector interface to ensure proper operation. Please check that the voltage provided by the HSIO expansion connectors agree with the table for recommended input voltages.

Parameter	Min	Max	Units	Notes
Operating Temperature	-25	85	°C	Micron 32GB e.MMC Memory

**Table 4 – Recommended Temperature Range**

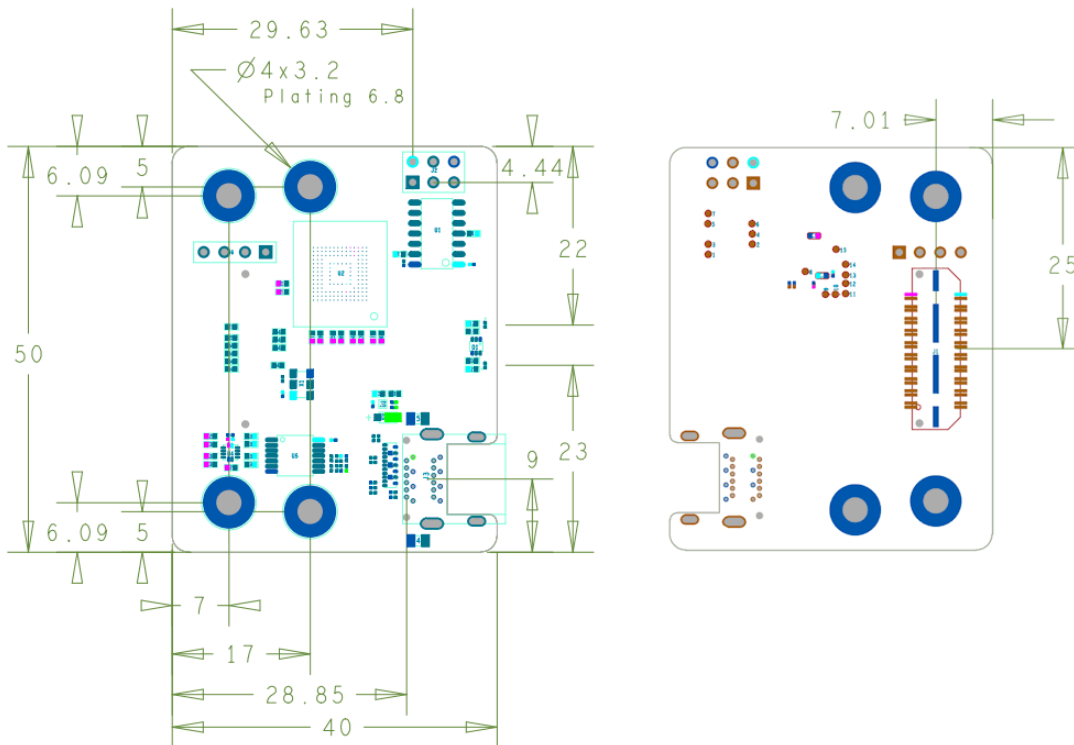
Parameter	Min	Max	Units	Notes
5V Input Voltage	4.85	5.15	V	HSIO Connector 5V +/- 3%
3.3V Input Voltage	3.20	3.40	V	HSIO Connector 3.3V +/- 3%
1.8V Input Voltage	1.746	1.854	V	HSIO Connector 1.8V +/- 3%

**Table 5 – Recommended Input Voltages**

### 5.10 Mechanical

The DP-eMMC HSIO Module is designed with a form factor intended to mate to Carrier Boards HSIO expansion sites. The board measures 40mm x 50mm (approximately 1.57" x 1.97").

The maximum vertical dimension of the board is fixed by the HSIO Connector and the Mini DisplayPort. A STEP model / DXF file of the PCB and its components can be made available to end users that may require it.



**Figure 10 – Mechanical Dimensions**



## 6 Getting Help and Support

If additional support is required, TRIA Technologies has many avenues to search depending on your needs.

For general question regarding DP-eMMC HSIO, please visit our website at <http://avnet.me/dpemmc-pdp>. Here you can find any available documentation, technical specifications, videos and tutorials, reference designs and other support.

Here are some interesting links on some posted references:

### **ZUBoard - Boot Linux from eMMC**

Hackster.IO Project: <https://www.hackster.io/tom-curran/zuboard-boot-linux-from-emmc-5d9447>

### **ZUBoard - Petalinux Archive 2022.2 Tools**

Avnet Sharepoint: [http://avnet.me/zub1cg\\_sbc\\_base\\_2022\\_2\\_bsp](http://avnet.me/zub1cg_sbc_base_2022_2_bsp)

### **ZUBoard – HSIO Hat-Trick (Using DP-eMMC HSIO, DP-eMMC HSIO, and DualCam HSIO)**

<https://www.hackster.io/AlbertaBeef/supercharge-your-zuboard-with-the-hailo-8-ai-accelerator-79dd76>

Detailed questions regarding DP-eMMC HSIO Module hardware design, software application development, using AMD tools, training and other topics can be posted on the Avnet Boards Community pages at the Element14 Support Forums. Avnet's technical support team monitors the forum during normal business hours in North America.

Those interested in customer-specific options on K24 Development Kit can send inquiries to [customize@avnet.com](mailto:customize@avnet.com).

## 7 Certification Disclaimer

CE certification is necessary for system level products in those countries governed by this regulatory bodies.

Because Avnet boards are intended for evaluation kits only and destined for professionals (you) to be used solely at research and development facilities for such purposes, they are considered exempt from the EU product directives and normally are not tested for CE or FCC compliance.

If you choose to use your board to transmit using an antenna, it is your responsibility to make sure that you are in compliance with all laws for the country, frequency, and power levels in which the device is used. Additionally, some countries regulate reception in certain frequency bands. Again, it is the responsibility of the user to maintain compliance with all local laws and regulations.

## 8 Regulatory Compliance



**WEEE Statement:** Correct Disposal of this product.

This marking indicates that this product should not be disposed with other household wastes throughout the EU. To prevent possible harm to the environment or human health from uncontrolled waste disposal, recycle it responsibly to promote the sustainable reuse of material resources. To return your used device, please use the return and collection systems or contact the retailer where the product was purchased. They can take this product for environmentally safe recycling.

## 9 Safety Warnings

This product shall only be connected to a Carrier Card that provides the required current need to operate the HSIO expansion connector. Any external power supply used with the mating Carrier Card shall comply with relevant regulations and standards applicable in the country of intended use.

The connection of incompatible devices may affect compliance or result in damage to the unit and void the warranty.

This product shall be operated in a well-ventilated environment. If an enclosure is used, it shall have adequate ventilation. Use caution when handling the board when powered.