Hardware Design Document
Arrow iMX8M HMI Platform

Version	2.0
Status	Baseline
Date	25th March 2019

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1 DOCUMENT DETAILS

1.1 Document History

Version	Author		Reviewer		Approver	
	Name	Date (DD-MM-YYYY)	Name	Date (DD-MM-YYYY)	Name	Date (DD-MM-YYYY)
Draft 0.1	Vaidehi Patel	29-10-2018	Anirudha Chougule/Richa Prajapati	30-10-2018		
Draft 0.2	Vaidehi Patel	31-10-2018	Anirudha Chougule	1-11-2018		
Draft 0.3	Vaidehi Patel	1-11-2018	Kinjan Patel	6-11-2018		
Draft 0.4	Vaidehi Patel	12-11-2018	Anirudha Chougule	22-11-2018	Kinjan Patel	23-11-2018
Baseline 1.0	Vaidehi Patel	23-11-2018				
Draft 1.1	Vaidehi Patel	13-02-2019	Anirudha Chougule	25-03-2019	Kinjan Patel	25-03-2019
Baseline 2.0	Vaidehi Patel	25-03-2019				

Table 1: Document History

Version	Description of Change
Draft 0.1	Initial draft version created
Draft 0.2	Implemented internal review comments
Draft 0.3	Implemented internal review comments
Draft 0.4	Implemented internal review comments
Baseline 1.0	Document Baselined
Draft 1.1	Improvements from Alpha and changes of Beta added
Baseline 2.0	Document Baselined

Table 2: Description of Change

1.2 Definition, Acronyms and Abbreviations

Definition/ Acronym/ Abbreviation	Description
HRS	Hardware Requirement Specification
USB	Universal Serial Bus
BT	Bluetooth
DSI	Display Serial Interface
LPDDR	Low Power Double Data Rate
MIPI	Mobile Industry Processor Interface
PCB	Printed Circuit Board
QA	Quality Assurance
RAM	Random Access Memory
RoHS	Restriction of Hazardous Substances
SD	Secure Digital

Definition/ Acronym/ Abbreviation	Description
SOW	Scope of Work
TBD	To Be Decided
SPI	Serial Peripheral Interface
I2C	Inter-Integrated Circuit
HDMI	High-Definition Multimedia Interface
RTC	Real Time Clock
PMIC	Power Management IC
CRN	Change Request Note
GPU	Graphics Processing Unit
QTS	Query Tracking Sheet
RTM	Requirement Traceability Matrix
CE	Consumer Edition
HMI	Human Machine Interface
A2B	Automotive Audio Bus
iMX8M HMI Platform	i.MX 8M Human Machine Interface Platform

Table 3: Definition, Acronyms and Abbreviation

1.3 References

#	Document	Version	Remarks
1	96BoardsCESpecificationv1.0-EA1	1.0 (January 2015)	96Boards Consumer Edition Low Cost Hardware Platform Specification
2	eI_Arrow_iMX8M_HMI_Platform_BlockDiagram	2.1	Block Diagram
3	Proposal-Draft	Draft version	Initial Proposal to Customer
4	eInfochips SOW#4_iMX8_HMI_Platfrom-Rev1-NC_reviewa	004	SOW
5	eI_Arrow_iMX8_HMI_QueryTrackingSheet	Draft	QTS updated as per Discussion with Customer
6	eI_Arrow_iMX8M_HMI_Platform_BOM_Major Components	2.0	Component selection is as per Arrow preferred vendor list
7	eI_Arrow_iMX8M_HMI_Platform_SCHEMATIC.dsn	2.1	Schematic version 2.1
8	eI_Arrow_iMX8M_HMI_Platform_BOM.xls	2.2	BOM version 2.2
9	eI_Arrow_iMX8M_HMI_Platform_Layout.brd	2.0	Layout file of Board
11	eI_Arrow_iMX8M_HMI_Platform_HRS.pdf	2.0	HRS file
12	eI_Arrow_iMX8M_HMI_Platform_PowerBudgetAnalysis.xls	1.1	Power Budget

Table 4: References

2 INTRODUCTION

This document enlists the design details for the Arrow iMX8M HMI Platform which includes:

a) **Design requirements**: These are mentioned more elaborately in Hardware requirement specifications.

b) **High level design**: The system design and hardware block diagrams based on the requirements.

c) **Design Considerations**: This includes various measures that were taken to meet the design specifications

d) **Design Decisions**: Decisions taken during the design: This includes the various design decisions that were taken during the design execution

2.1 Specifications

2.1.1 Electrical Specifications:

These are the electrical specifications of the design. This may vary from the design requirements as they may include optional interfaces or design changes

Device	Specification	
Microprocessor	Processor name (Package): iMX8M QUAD (17x17 mm, 621 pins) Part Number: MIMX8MQ6CVAHZAA Manufacturer: NXP	
	Internal core operation	Four ARM Cortex-A53 (1.3 GHz) One ARM Cortex-M4 (266 MHz)
	Bus Frequency	LPDDR4 Clock Speed: 1.6GHz (Maximum)
	External Oscillator (for processor)	1) Main Clock Part Number: TSX-3225 25.0000MF10P-C3 Frequency: 25MHz 2) HDMI Clock Part Number: ECS-270-10-33B-CKM-TR Frequency: 27MHz 3) RTC clock Part Number: ASH7K-32.768KHZ-T Frequency: 32.678kHz
	Core Power Supply	Core power supplies is designed by one LT8642, one ADP5014 as per power sequence provided by Processor and PMIC PF4210
	Peripheral Power supply	Peripheral power supplies is designed by two LT8642, one ADP5014, two ADP1710 as per power sequence requirement of processor
Memory Peripherals	2GB LPDDR4 SDRAM	Model Name : MT53B512M32D2NP-062 WT:D Manufacturer : Micron Size : 2GB Number of devices :1 Dimension : 10x14.5 mm
	NOR FLASH	Model Name : W25Q256JWPIQ Manufacturer : Winbond Size : 256 Mb Dimension : 8x6 mm
	EEPROM	Model Name : M24128-DRMF3TG/K Manufacturer : ST Microelectronics Size : 128 Kb Dimension : 2x3 mm
	SD Card	Micro SD card Connector : 2201778-1 (TE) Maximum memory support : 64GB
Surrounding Interface	Camera (MIPI CSI1)	Lane : 4 Lane interface At High speed expansion connector : 1-5177983-2 (TE)
	Camera (MIPI CSI2)	Lane : 2 Lane interface At High speed expansion connector : 1-5177983-2 (TE)
	Display (MIPI DSI)	1) DSI0: Output Lane : 4 Lane interface At High speed expansion connector : 1-5177983-2 (TE) 2) DSI_HDMI: Output Lane : 3 Lane interface MIPI DSI to HDMI Bridge : ADV7535 (ADI) At HDMI Connector : 10029449-111RLF (FCI)
	HDMI	Lane : 3 Lane interface At HDMI connector : 10029449-111RLF (FCI) Display : At HDMI Connector

	USB	1. 2 x USB 3.0 Type A slave ports 1932258-1 (TE) 2. 1 x USB 2.0 Type Micro AB OTG port 0475890001 (Molex) 3. 1 x USB 2.0 At High speed expansion connector: 1-5177983-2 (TE) 4. 1 x USB to UART: CP2102N (Silicon Labs)
	Debug UART	UART1: UART1 connections from processor are provided to TMS-103-02-G-S Connector (Samtec)
	Wi-Fi + BT	Module Part Number : LBEE5HY1MW-TEMP Manufacturer : Murata Wi-Fi IEEE 802.11 a/b/g/n/ac Bluetooth 4.2 (Bluetooth Low Energy)
	ZigBee	Module Part Number : MGM111A256V2 Manufacturer : Silicon Labs ZigBee & Thread IEEE 802.15.4
	JTAG	JTAG Connector Number: 20021111-00010T4LF (FCI) No of pins : 10
	IOT Security	Model Name : A71CH Manufacturer : NXP Interface : I2C
	Audio Codec	Model Name : ADAU1361 Manufacturer : Analog Devices Inc. Audio Jack: MIC IN with Headphone out Connector : SJ2-35464B-SMT-TR (CUI Inc.)
	A2B	Model Name : AD2428W Manufacturer : Analog Devices Inc. Connector : 5023520200 (Molex)
	Ethernet RGMII	Transceiver Part Number : KSZ9031RNXIC Manufacturer : Microchip Technology Ethernet Connector : 1-2301994-2 (TE)
	CAN	CAN Controller Part Number : MCP2515 Manufacturer : Microchip Technology CAN Connector : 440055-2 (TE) Transreceiver Part Number : ADM3054 Manufacturer : Analog Devices Inc.
User Control	Switches/Buttons	1. Power ON/OFF Button 2. Processor RESET Button 3. Boot Mode(x4) selection Switch
Clock	Crystal	External Crystal/Oscillator: FA-118T 26.0000MF12Z-AC3 (USB HUB) → 26 MHz 8Y-20.000MAAE-T (CAN) → 20 MHz DSC1104CI2-027.0000T (HDMI) → 27 MHz TSX-3225 25.0000MF10P-C3 (RGMII) → 25 MHz ASCO2-12.288MHZ-EK-T3 (Audio Codec) → 12.288 MHz
Power Supply	Input	+12V DC typical(8V-18V DC@60W) from adapter to DC jack connector PJ-041H (CUI)
	Power Regulators	Regulator1 : LT8642SEV#PBF (x2) Regulator2 : ADP5014 Converter : ADUM5020-5BRWZ LDO : ADP1710AUJZ-R7 (x2) PMIC : MC34PF4210A1ES Manufacturer : Analog Devices Inc.
Board Specifications	Board Size	85 x 100 mm (96boards Extended-B form factor)
	Number of Layers	12 Layers

Table 5: Outline Specification

2.1.2 Mechanical

2.1.2.1 Specifications

Mechanical outline will be followed as per 96boards CE specification for extended-B form factor. Please refer page number 26 of 96boards standard.
https://www.96boards.org/documentation/Specifications/96Boards-CE-Specification.pdf

The below image shows the board dimension with fixed placement locations of necessary connectors. The component placement and layout design of the board will meet the 96Boards Extended B criteria.

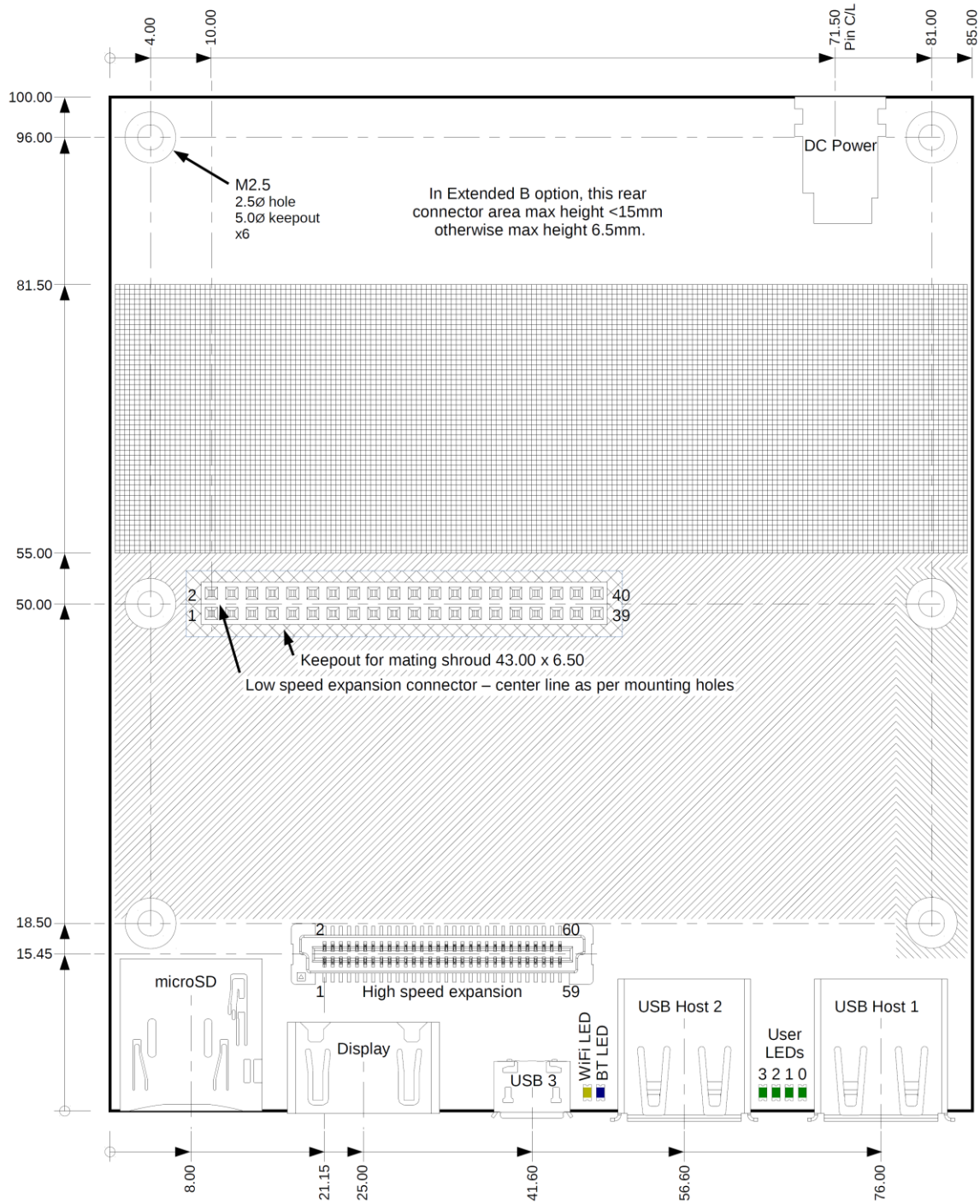

Figure 1 : 96Boards Extended B Dimensions

2.1.2.2 Design Consideration

The iMX8M HMI Platform mechanical is intended to be designed to work for the temperature range of 0^{o}C to +55^{o}C.
FAN and Heat Sink provision will be used if heating issue observed during bring up activity.

2.1.3 Environmental

2.1.3.1 Specifications

- iMX8M HMI Platform is having operating temperature range of 0^{o}C to +55^{o}C.
- Mechanical enclosure will be designed in a way to manage the heat dissipation from the electronics parts.

2.1.3.2 Design Justification

- All the components selected for iMX8M HMI Platform supports the operating temperature range of 0^{o}C to +55^{o}C.

- Refer below path for Bill Of Materials "eI_Arrow_iMX8M_HMI_Platform_BOM":

  iMX8M_HMI_SVN\13. Hardware Specific\Schematics\Arrow-IMX8M HMI Platform_MotherBoard\16_00666_02

2.1.3.3 EOL, ROHS, REACH Compliance Report

- Refer below path for EOL, ROHS, REACH Report "Report_Silicon Expert_18_00666_02":

  iMX8M_HMI_SVN\13. Hardware Specific\Schematics\Arrow-IMX8M HMI Platform_MotherBoard\Reference Documents\Silicon expert report

3 SYSTEM BLOCK DIAGRAM

Below is the system block diagram for iMX8M HMI Platform.

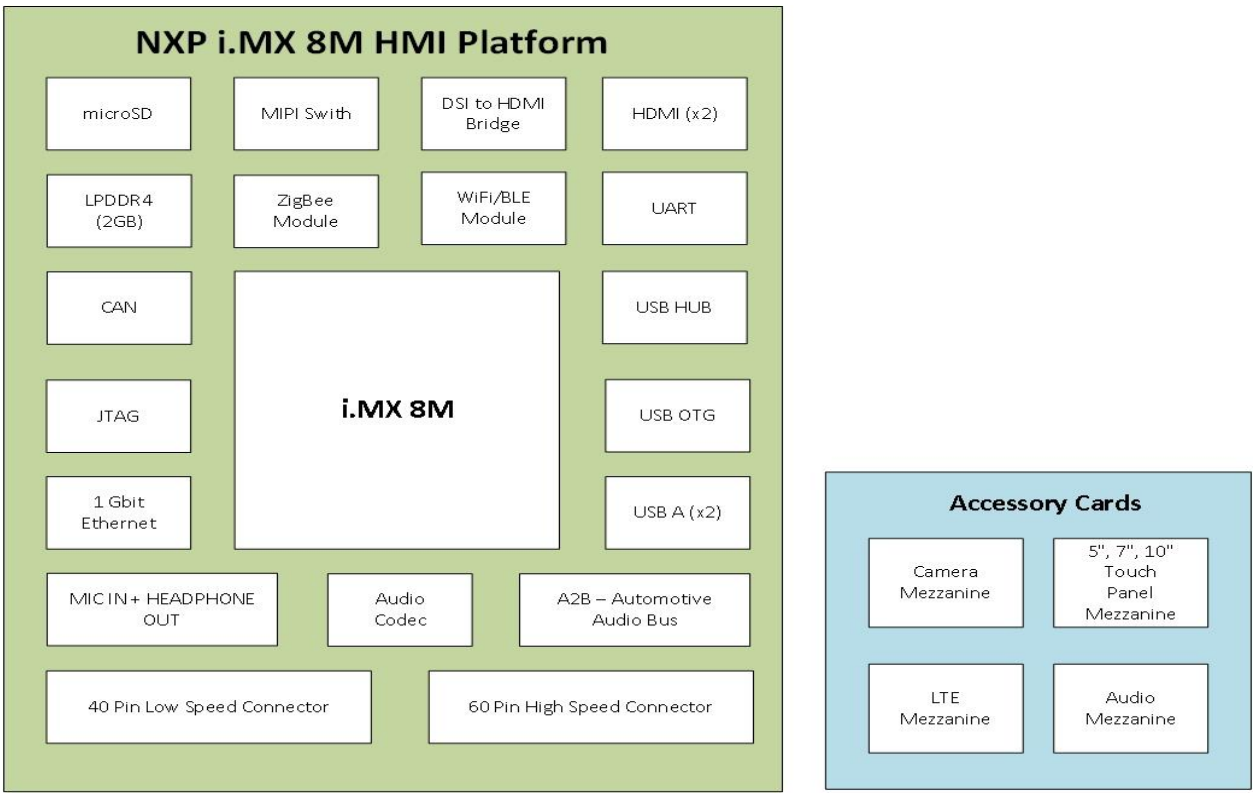

Figure 2 : High Level Design Diagram

- i.MX8M HMI Platform will be a Reference design based on i.MX8M processor and comply with 96board Consumer Edition Extended-B form factor.

- This board will be used to demonstrate:

    1. Home automation control panel with sensor aggregation (BLE/ZigBee/Thread), streaming data to cloud as a gateway.
    2. Industrial HMI panel (SCADA like) to display information from sensors and monitor/control process, display charts, process overview, etc.
    3. Support Alexa to control actuators.
    4. Multi-display demo - one from local memory, one received over RTSP/RTP, h.265.

- This Board will support various mezzanines to interface Camera, Display, Sensors, LTE Module, and Audio interface.

- Design & Development of i.MX8M processor based Single Board Computer Platform features:

    1. 96board Consumer Edition Extended-B form factor baseboard
    2. Integration & support 5”, 7”, 10” touch panels
    3. Integration & support camera accessory card
    4. Alexa integration support
    5. Control and capture of BLE/ZigBee enabled sensors
    6. Cloud Connectivity over LTE mezzanine or Wi-Fi
    7. Off the shelf open frame enclosure

4 HARDWARE BLOCK DIAGRAM

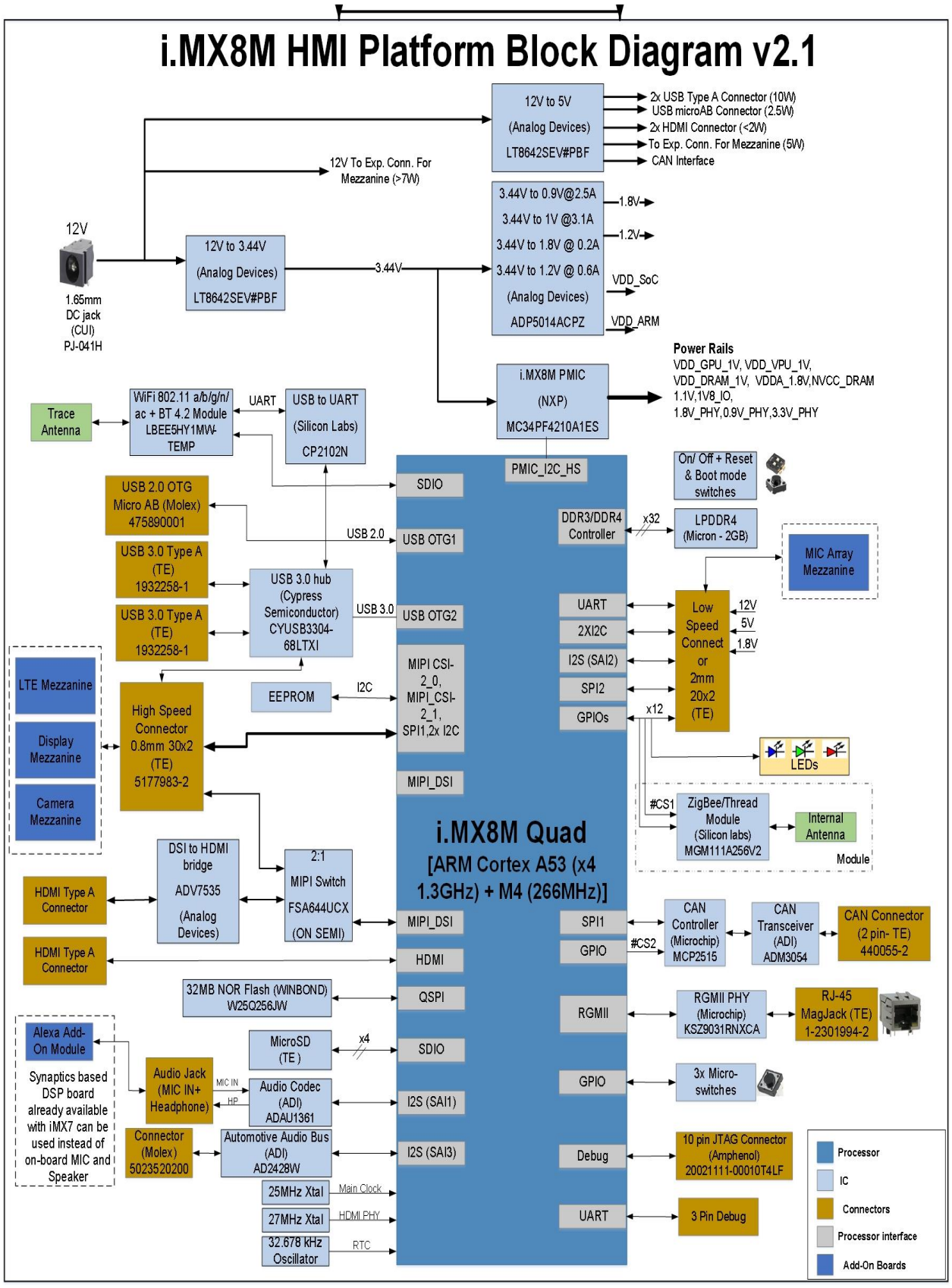

Figure 3 : Hardware Block Diagram

- Above diagram depicts High Level architecture of this platform that includes:

1. 96Boards Extended-B form factor
2. i.MX8M Processor having 4x Cortex-A35 cores and 1x M4 core
3. 2GB LPDDR4 RAM
4. Micro SDHC Socket for up to 64GB on-board or expansion flash storage
5. Wi-Fi 802.11a/b/g/n/ac and Bluetooth 4.2
6. ZigBee Interface
7. CAN Interface with 2.5 KV Isolation
8. Dual Display: one HDMI Display and one DSI to HDMI Display using MIPI Switch
9. UART, SPI, I2C Interfaces
10. USB HUB with 4 Downstream USB Ports and USB OTG
11. Gigabit Ethernet
12. Audio Codec with one MIC IN + Headphone Out and one LINE OUT
13. On Board Connectors and I/O expansion
    - 2x USB Type A (USB3.0)
    - 1x USB Micro-AB OTG (USB2.0)
    - 2x HDMI Type A for Display output
    - 40 Pin Expansion Connector for low speed interfaces
    - 60 pin Expansion Connector for high speed interface
    - Board power from DC Jack connector
    - 1x Mic-In + 1x Line Out
    - 1x Gigabit Ethernet
    - 1x Isolated CAN interface
    - 1x JTAG Debug
    - A2B Master
14. Apart from these on-board interfaces, the platform will support below mezzanines over High Speed and Low Speed connectors
    - LTE mezzanine
    - Audio mezzanine
    - Camera Mezzanine
    - HMI Display Mezzanine

5 ADDRESS MAP

Memory address Map will be included in Firmware package.

6 CPU DESIGN CONSIDERATIONS

The functional specifications of the iMX8M QUAD processor are explained in the following sub-sections

6.1 CPU Power

Voltage Name	Min(V)	Typical (V)	Max(V)	Description
VDD_ARM_1V0	0.95	1.0	1.05	Power supply for Quad-A53
VDD_SOC_0V9	0.855	0.9	0.945	Power supply for SoC logic
VDD_GPU_1V0	0.95	1.0	1.05	Power supply for GPU
VDD_VPU_1V0	0.95	1.0	1.05	Power supply for VPU
VDD_SNVS_0V9	0.855	0.9	0.945	Backup battery supply range
NVCC_SNVS_3V3	3.135	3.3	3.465	Power supply for 3.3 V only
VDD_DRAM_1V0	0.95	1.0	1.05	Power supply for Core voltage
VDDA_1V8	1.65	1.80	1.95	Power supply for Analog Domain
VDDA_DRAM	1.65	1.80	1.95	Power supply for PLL 1.8 V
NVCC_DRAM_1V1	1.045	1.1	1.155	Power supply for LPDDR4 I/O
NVCC_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_JTAG_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_GPIO_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_UART_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_NAND_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_SAI1_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_I2C_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_ECSPI_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_ENET_1V8	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_SD1	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
NVCC_SD2	1.65	1.80	1.95	Power supplies of GPIO supporting both 1.8V or 3.3V
VDD_PHY_3V3	3.135	3.3	3.465	Power supplies of USB IOs
VDD_PHY_1V8	1.65	1.80	1.95	Power supplies of HDMI, MIPI IOs
VDD_PHY_0V9	0.855	0.9	0.945	Power supplies of USB, HDMI, MIPI IOs

6.2 CPU Clocks

Clock Name	Typical	Min	Max	Description
RTC_XTALI Oscillator	32.768KHz	-	-	RTC Clock
XTALI Oscillator	25MHz	-	-	Processor Main Clock
XTALI Oscillator	27MHz	-	-	Processor Main Clock

6.3 CPU Boot Mode settings

BOOT_CONFIG[1:0]	Boot mode description
0x00	Boot from fuses
0x01	Serial Downloader
0x10	Internal Boot
0X11	Reserved

7 BOARD POWER AND RESET CONSIDERATIONS

Board level power requirements are mentioned here

7.1 Voltage generation diagram

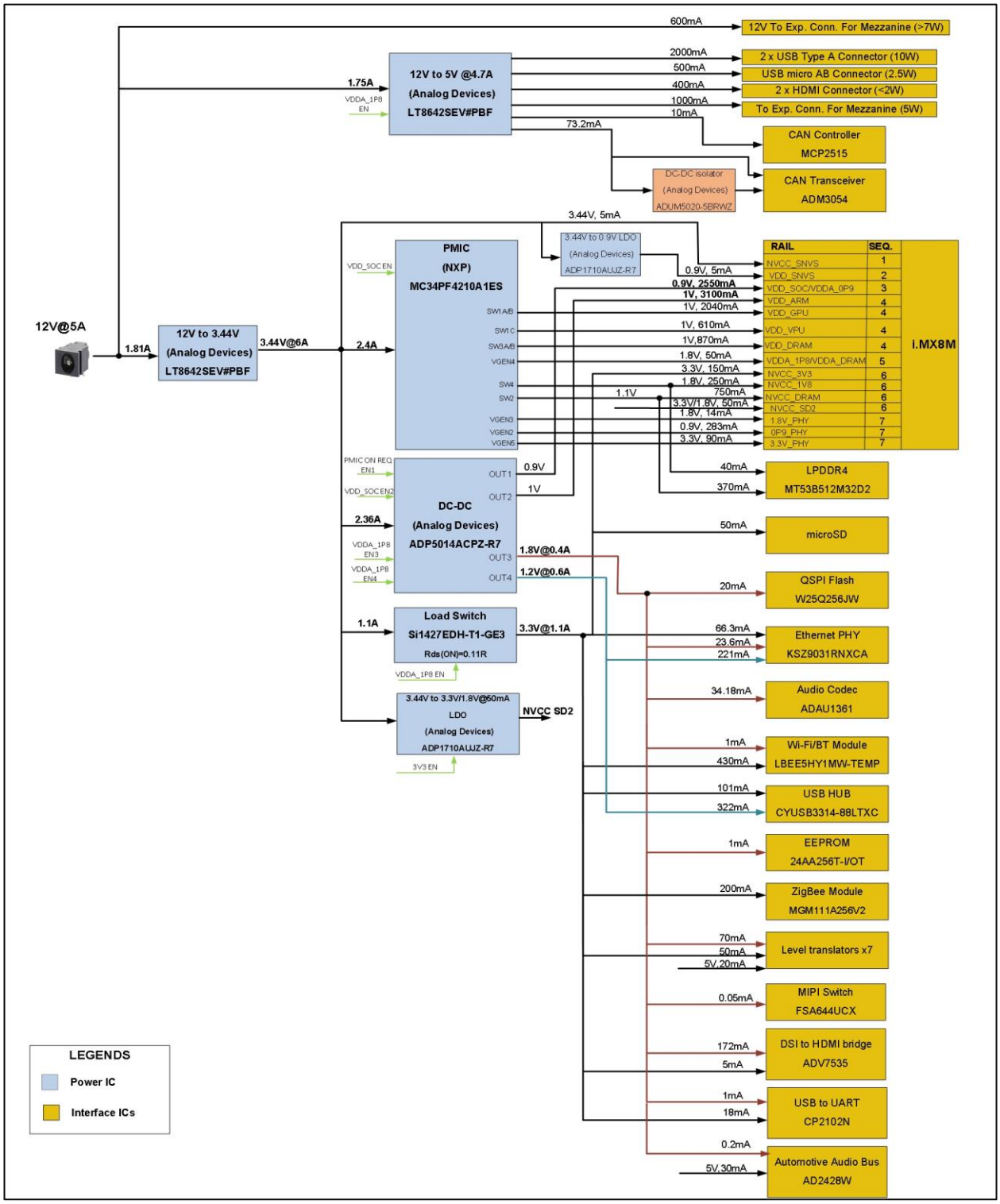

Figure 4 : System Voltage Generation

Refer below path for Power Budget Analysis document
“eI_Arrow_iMX8M_HMI_Platform_PowerBudgetAnalysis” :

iMX8M_HMI_SVN \13. Hardware Specific\Documents\Design Documents\Power Estimation

7.2 Power Sequencing

Supply Groups	Voltage			
Group 1	**3.3V**			
	NVCC_SNVS			
Group 2	**0.9V**			
	VDD_SNVS			
Group 3	**0.9V**			
	VDD_SOC/VDDA_0P9			
Group 4	**1V**			
	VDD_ARM			
	VDD_GPU			
	VDD_VPU			
	VDD_DRAM			
Group 5	**1.8V**			
	VDDA_1P8/VDDA_DRAM			
Group 6	**3.3V**	**1.8V**	**1.1V**	**3.3V/1.8V**
	NVCC_3V3	NVCC_1V8	NVCC_DRAM	NVCC_SD2
Group 7	**1.8V**	**3.3V**	**0.9V**	
	1.8V_PHY	3.3V_PHY	0P9_PHY	

Power up

The device has the following power-up sequence requirements:

- Supply group 1 (NVCC_SNVS) must be powered first. It is expected that group 1 will typically remain always on after the first power-on.
- Supply group 2 (VDD_SNVS) and group 1 must both be powered to their nominal values prior to boot. They must power up after or simultaneously with group 1.
- Supply group 3 (VDD_SOC) must power up after or simultaneously with group 2.
- Supply group 4 consists of Quad A53 power supplies, core voltages. Group 4 must power up after or simultaneously with group 3.
- Supply group 5 must power up after or simultaneously with group 4.
- Supply group 6 consists of GPIO power supplies of all interfaces.
- Supply group 7 must power up after or simultaneously with group 6.

Power Down

The device processor has the following power-down sequence requirements:

- Supply group 1 must be turned off last, after all other supplies.
- Supply group 2 can be turned off just prior to group 1.

7.3 Reset Flow

Below is Reset flow diagram for iMX8M HMI Platform.

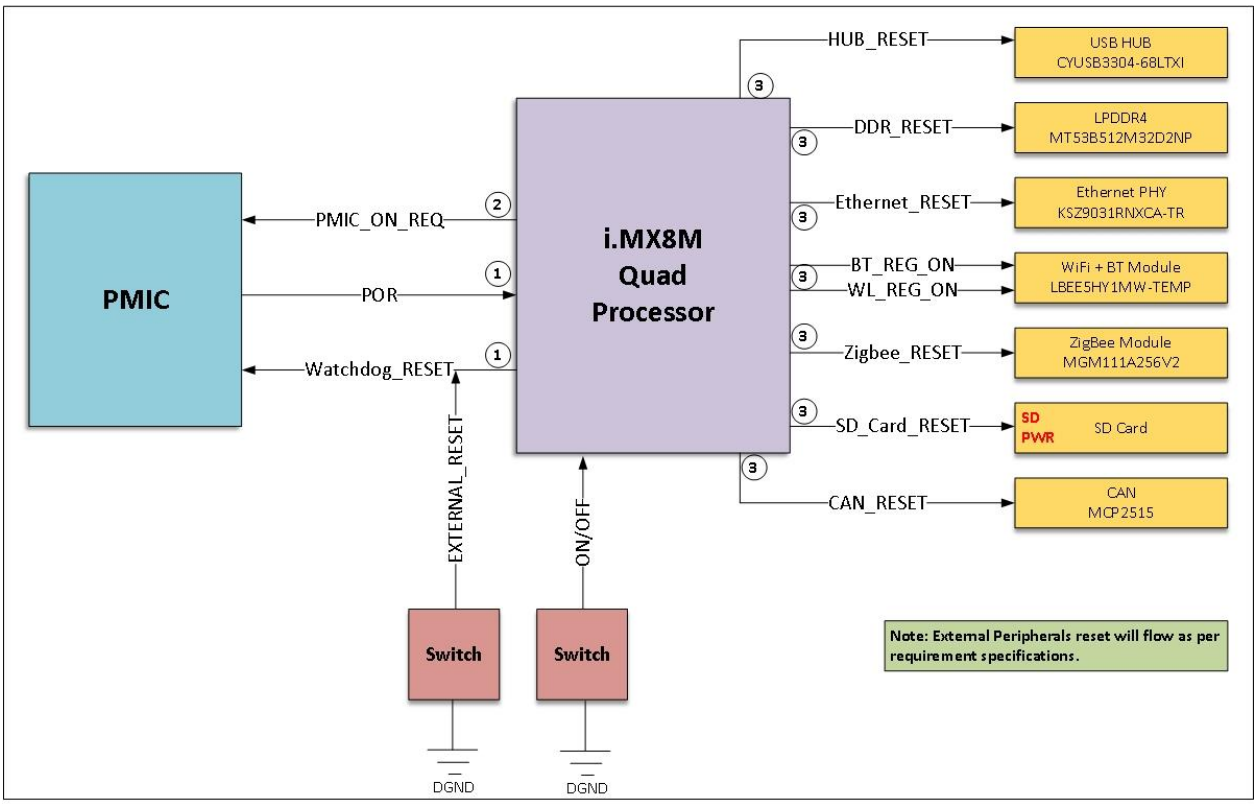

Figure 5 : RESET flow of iMX8M HMI Platform

8 PIN FUNCTIONS

8.1 Processor GPIO Pin Description

GPIO BANK1

GPIO1	ECSPI1_SS1	OUTPUT
GPIO2	nWDOG (WATCHDOG TIMER)	OUTPUT
GPIO3	LS_GPIO1_J	BIDIRECTIONAL
GPIO4	SD2_VSELECT (SD2 VOLTAGE SELECT)	OUTPUT
GPIO5	LS_GPIO1_L	BIDIRECTIONAL
GPIO6	GPIO_CAN_nINT (INTERRUPT FROM CAN)	INPUT
GPIO7	PMIC_nINT (INTERRUPT FROM PMIC)	INPUT
GPIO8	ECSPI2_SS1	OUTPUT
GPIO9	ENET_nRST (ETHERNET PHY nRESET)	OUTPUT
GPIO10	USB1_OTG_ID	INPUT
GPIO11	ENET_nINT (INTERRUPT FROM ETHERNET PHY)	INPUT
GPIO12	USB1_OTG_PWR	OUTPUT
GPIO13	USB1_OTG_OC	INPUT

Figure 6 : iMX8M Processor GPIO Bank1 pin Assignment

GPIO BANK2

GPIO6	GPIO_CAN_TX0RTS	OUTPUT
GPIO7	LS_GPIO2_E	BIDIRECTIONAL
GPIO8	LS_GPIO2_G	BIDIRECTIONAL
GPIO9	GPIO_CAN_RX0BF	INPUT
GPIO10	LS_GPIO2_A	BIDIRECTIONAL
GPIO11	LS_GPIO2_B	BIDIRECTIONAL

Figure 7 : iMX8M Processor GPIO Bank2 pin Assignment

GPIO BANK3

GPIO2	LS_GPIO3_H	BIDIRECTIONAL
GPIO3	WL_REG_ON	OUTPUT
GPIO4	DSI_SW_SEL	OUTPUT
GPIO5	BT_REG_ON	OUTPUT
GPIO10	nWAKE_ZigBee	OUTPUT
GPIO11	nINT_ZigBee	INPUT
GPIO12	LS_GPIO3_I	BIDIRECTIONAL
GPIO13	LS_GPIO3_K	BIDIRECTIONAL
GPIO14	BT_HOST_WAKE	INPUT
GPIO15	DSI_INT_OUT	INPUT
GPIO16	mSW1	INPUT
GPIO17	mSW3	INPUT
GPIO18	mSW2	INPUT
GPIO20	LS_GPIO3_D	BIDIRECTIONAL
GPIO21	LS_GPIO3_F	BIDIRECTIONAL
GPIO22	BT_DEV_WAKE	OUTPUT
GPIO24	LS_GPIO3_C	BIDIRECTIONAL
GPIO25	CAN_RST#	OUTPUT

Figure 8 : iMX8M Processor GPIO Bank3 pin Assignment

GPIO BANK4

GPIO0	BT_LED	OUTPUT
GPIO1	WL_LED	OUTPUT
GPIO21	USER_LED1	OUTPUT
GPIO22	USER_LED2	OUTPUT
GPIO27	FAN ON	OUTPUT
GPIO28	USER_LED3	OUTPUT
GPIO29	USER_LED4	OUTPUT

Figure 9 : iMX8M Processor GPIO Bank4 pin Assignment

GPIO BANK5

GPIO2	HP_DET_B (HEADPHONE DETECT)	INPUT
GPIO4	nRESET_ZigBee	OUTPUT
GPIO5	USB_HUB_RST	OUTPUT

Figure 10 : iMX8M Processor GPIO Bank5 pin Assignment

8.2 Processor I2C Pin Description

DEVICE	DEVICE ADDRESS	I2C Interface	IO LEVEL
PMIC PF4210	0x08	I2C 1	1.8V
LOW SPEED EXPANSION	NA	I2C 1	1.8V
LOW SPEED EXPANSION	NA	I2C 2	1.8V
HIGH SPEED EXPANSION	NA	I2C 3	1.8V
HIGH SPEED EXPANSION	NA	I2C 4	1.8V
EEPROM	0x50	I2C 2	1.8V
Audio Codec ADAU1361	0x38	I2C 2	1.8V
DSI to HDMI	0X72	I2C 1	1.8V
USB HUB CYUSB3304	0X60	I2C 4	3.3V
A71CH Security IC	0X49	I2C 3	1.8V
AD2428W (A2B)	0X68	I2C 2	1.8V

Figure 11 : iMX8M HMI Platform I2C pin Description

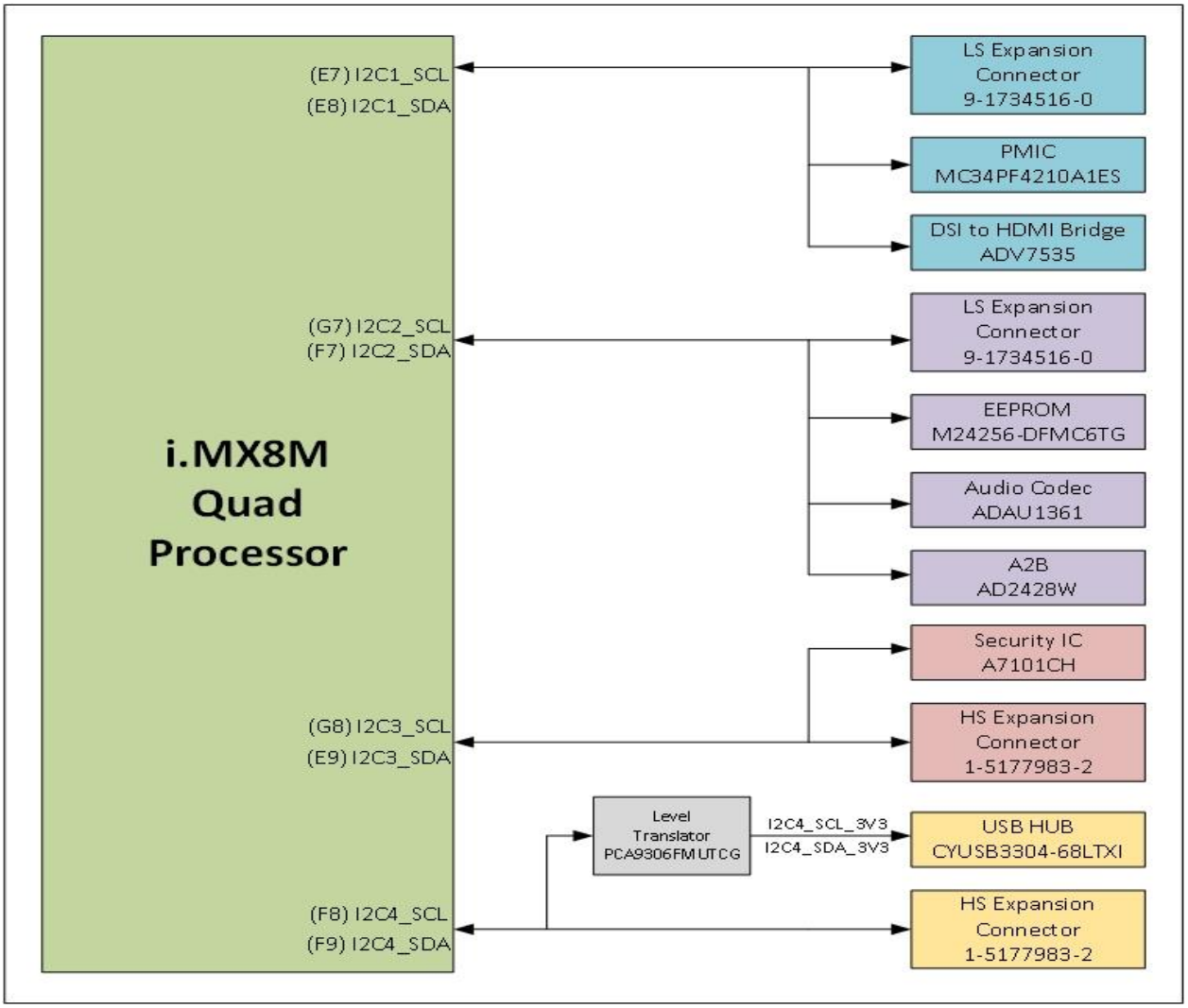

Figure 12 : iMX8M HMI Platform I2C Topology

9 TIMING REQUIREMENTS

Timing requirement and measurements of all the interfaces will be recorded in Electrical Design Validation Testing (EDVT) document.

SI Analysis is performed for below high speed interface in hyperlynx tool.

1. LPDDR4
2. MIPI CSI
3. MIPI DSI
4. USB
5. HDMI
6. QUAD SPI
7. ETHERNET
8. USDHC
9. DSI to HDMI
10. SDIO

Refer below path for SI Report “eI_Arrow_iMX8M_HMI_Platform_SI_Report” :

iMX8M_HMI_SVN \13. Hardware Specific\Layout\Arrow-IMX8M HMI Platform_MotherBoard\Reference Documents\SI Analysis

10 PRODUCT CHARACTERISTICS AND OPERATING CONDITIONS

Index	Function	Specifications
1	Input power supply	8V-18V (60W Maximum)
2	External accessories requirement	Mezzanine Cards, Adapters, USB Cables, SD card, Debug Cable, Ethernet Cables
3	Handling requirements	Mechanical Enclosure
4	Operating Temperature Range	0°C to 55°C
5	Storage Temperature Range	NA

Table 6: Product operating condition

11 HARDWARE INTERFACES

This section describes the interface features of the processor (iMX8M QUAD) and its peripherals used for HMI Platform. Each interface is described in details with timing requirement, selected major component details and other design guidelines as recommended in datasheet of respective component

11.1 System Processor – iMX8M QUAD

IMX8M QUAD processor includes a customized 64-bit ARM Cortex-A53 compliant Quad-core application processor which targets humans and machines to interact (HMI) platform application.

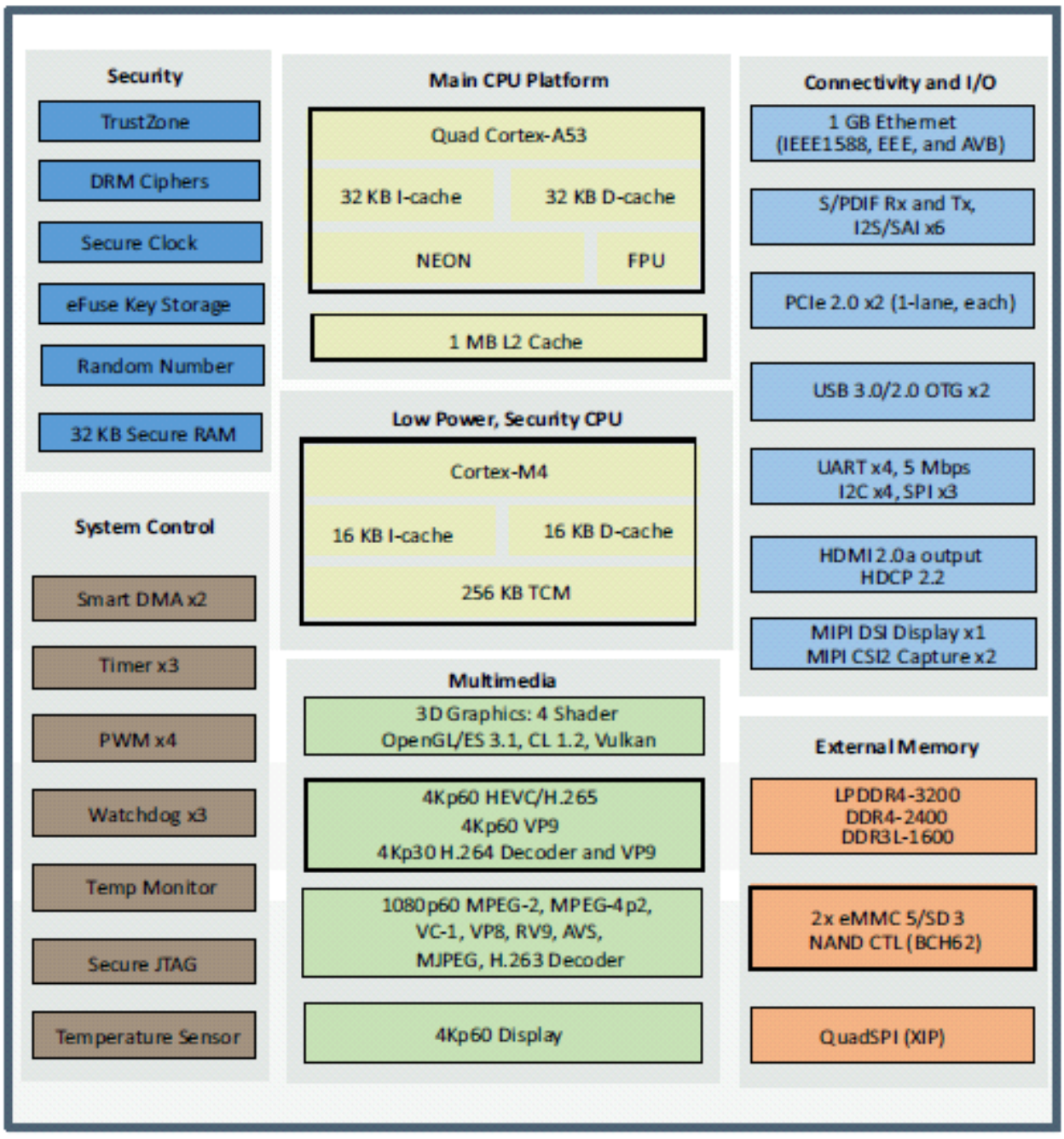

Figure 13 : iMX8M QUAD Processor Architecture

11.1.1 Interface Features

- Quad symmetric Cortex-A53 processors
- Support of 64-bit Armv8-A architecture
- Arm Cortex-M4 core platform
- Multimedia: Video Processing Unit (VPU), Graphics Processing Unkit (GPU), HDMI Display, MIPI DSI Display, Audio, Camera inputs

11.1.2 Interface Description

- IMX8M QUAD is used as main processing unit on the iMX8M HMI Platform to control overall operation of the unit.
- The processor supports 4-lane DSI Display, two 4-lane CSI interface. The processor supports other interfaces like 2 x USB, 2 x SDIO, HDMI, RGMII, 2 x PCIe, 4 x UART, 4 x I2C, 3 x SPI, 6 x I2S(SAI) and SPDIF Rx & Tx.
- The processor also supports External memory like LPDDR4-3200/DDR4-2400/DDR3L-1600, 2 x eMMC/SD Card/NAND and QuadSPI (QSPI).
- External 25 MHz crystal is used as input clock for Main clock in processor.
- External 27 MHz crystal is used as input clock for HDMI in processor.
- External 32.768 KHz oscillator is used as RTC for processor.

Part Number	Manufacturer	Description	Package
MIMX8MQ6CVAHZAA	NXP Semiconductor	1.3 GHz Quad core processor	621 pin FBGA

Table 7: CPU Component Details

11.1.3 iMX8 Interfaces

Sr. No.	iMX8 Interfaces	iMX8M_HMI_Platform Interfaces Used
1	1 x 4-lane DSI Interface	1 x 4-lane DSI Interface
2	2 x 4-lane CSI interface	A) 1 x 4-lane CSI interface B) 1 x 2-lane CSI interface
3	2 x USB	A) 1 x Micro AB B) 1 x USB HUB
4	2 x SDIO	2 x SDIO
5	1 x HDMI	1 x HDMI
6	1 x RGMII	1 x RGMII
7	2 x PCIe	Not used
8	4 x UART	A) 2 x Half UART – (Debug, LS) B) 1 Full x UART – (WiFi+BT)
9	4 x I2C	4 x I2C
10	3 x SPI	2 x SPI
11	6 x SAI	3 x SAI
12	SPDIF Rx & Tx	Not used
13	LPDDR4-3200/DDR4-2400/DDR3L-1600	LPDDR4-3200
14	2 x eMMC/SD Card/NAND and QuadSPI	1 x QSPI Flash

Table 8: iMX8M_HMI_Platform Interfaces List

11.1.4 Pin Mapping

Refer below path for Pin Mapping of iMX8M Processor “eI_Arrow_iMX8M_HMI_Platform_PinMap” :

iMX8M_HMI_SVN\13. Hardware Specific\Documents\Design Documents\Processor Pin Mapping

11.2 LPDDR4 Memory Interface

- 2GB LPDDR4 memory is provided on iMX8M_HMI_Platform device interfaced with processor.
- Higher memory part (3GB/4GB) can also be used instead of 2GB part.
- The processor supports LPDDR4 operating at 1600 MHz clock rate.

11.2.1 Interface Features

IMX8M QUAD supports LPDDR4 SDRAM interface. It supports 32-bit LPDDR4 SDRAM.

11.2.2 Interface Description

2GB RAM is to be provided on iMX8M_HMI_Platform device.

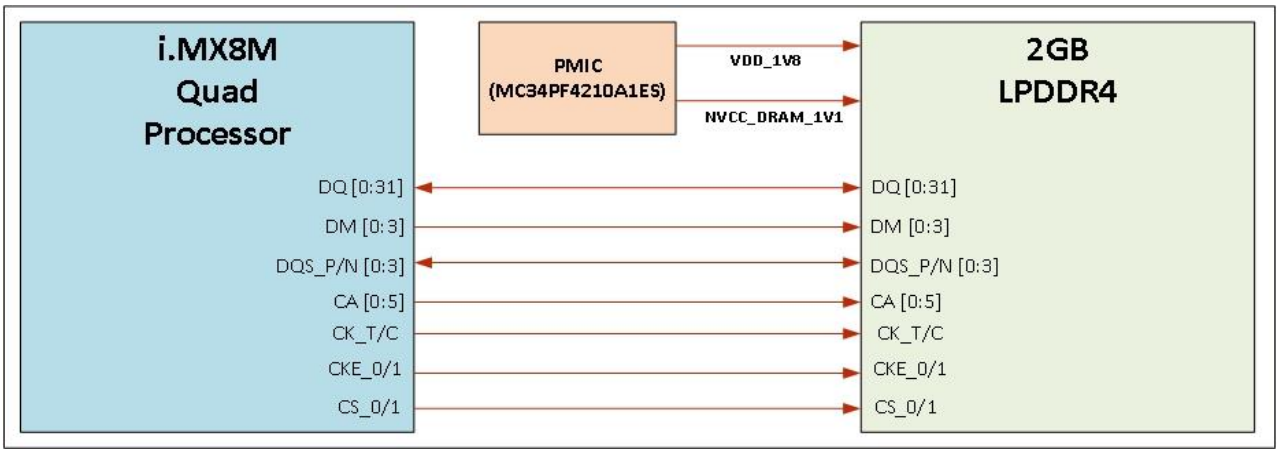

Figure 14 : LPDDR4 Interface Block Diagram

11.2.3 Component Details

Part Number	Manufacturer	Description	Package
MT53B512M32D2NP-062 WT	Micron	LPDDR4 2GB	10X14.5 mm 200 WFBGA

Table 9: LPDDR4 Component Details

11.3 SD card Memory Interface

SD card – Secure digital card memory provided on iMX8M_HMI_Platform as a main non-volatile memory. It will be used for booting and storing SW binaries, data, Android applications etc.

11.3.1 Interface Features

Processor iMX8M QUAD supports:

- USDHC interface
- Maximum clock up to 50 MHz
- Data Rage up to 100 Mbit/sec per line

11.3.2 Interface Description

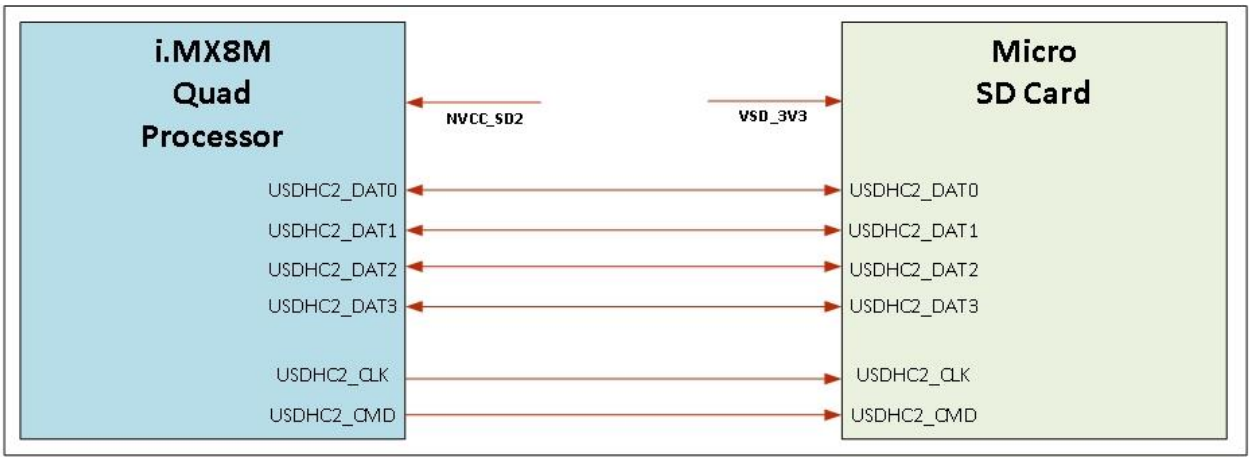

Figure 15 : SD card Interface Block Diagram

11.4 MIPI DSI Display Interface

- iMX8M QUAD supports 4-lane DSI port, which can support one display resolution up to 1920 x 1080 at 60 Hz.
- In iMX8M_HMI_Platform, DSI0 port is connected to HS connector and using switch(FSA644UCX) it is converted into DSI to HDMI converter
  1. DSI0 port connected to High speed connector
  2. DSI_HDMI converted to HDMI for display (through ADV7535)

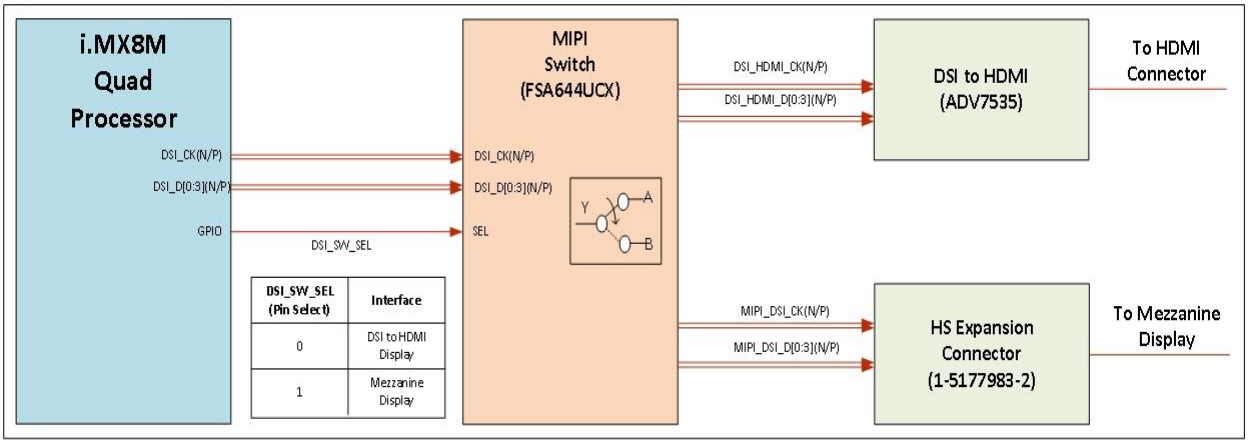

Figure 16: MIPI DSI Interface Block Diagram

11.4.1 DSI to HDMI Bridge (ADV7535) Features

Following point describes the detailed features of ADV7535 Chipset.

- Output support 24-bit RGB 4:4:4 (also support 30 and 36 bit)
- Audio inputs accept logic levels from 1.8 V to 3.3 V
- Supports up to 891 Mbps per lane
- Video resolutions up to 1080p at 60 Hz
- Automatic input video format timing detection (CEA-861E)
- Supports standard S/PDIF for stereo LPCM or compressed audio up to 192 kHz
- 5 V tolerant I2C and HPD inputs/outputs (I/Os), no extra device needed
- HDMI Maximum output clock up to 148.5 MHz

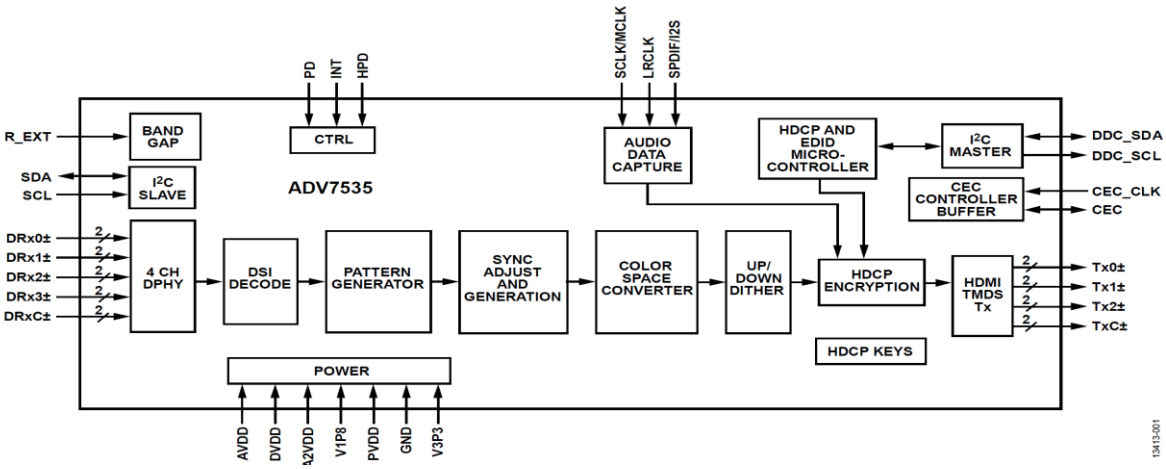

Figure 17: ADV7535 functional block diagram

11.4.2 DSI to HDMI Interface Description

iMX8M_HMI_Platform will support one 4-lane MIPI DSI interface to convert it into HDMI output supporting 1080P resolution via DSI to HDMI Bridge Chip.

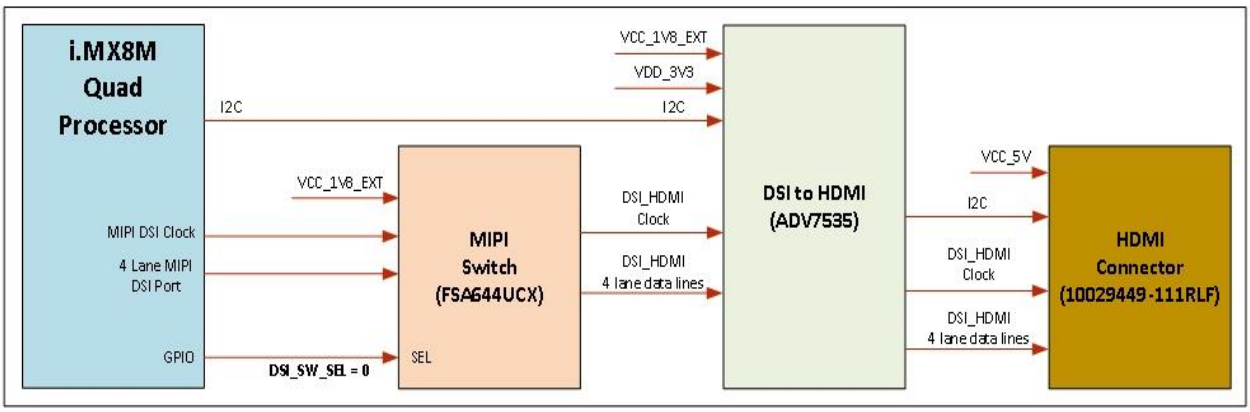

Figure 18: DSI to HDMI Interface Diagram

11.4.3 Components for DSI to HDMI interface

Part Number	Manufacturer	Description	Package
ADV7535	Analog Devices Inc.	DSI to HDMI Converter	49-Ball WLCSP
FSA644UCX	ON Semiconductor	MIPI SWITCH SPDT	36-WLCSP
10029449-111RLF	Amphenol FCI	HDMI Connector	Through Hole, Right Angle

Table 10: DSI to HDMI Interface Component Details

11.4.4 MIPI DSI0 Interface Description

iMX8M_HMI_Platform will support one 4-lane MIPI DSI interface to connect with high speed expansion connector.
Display will be at Mezzanine card which will be mounted on iMX8M_HMI_Platform.

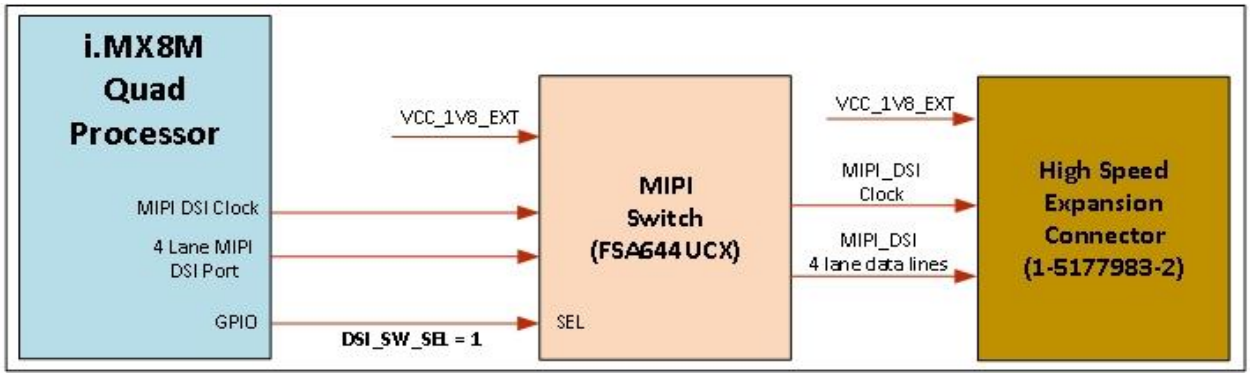

Figure 19: MIPI DSI0 Interface Diagram

11.4.5 Components for MIPI DSI0 interface

Part Number	Manufacturer	Description	Package
FSA644UCX	ON Semiconductor	MIPI SWITCH SPDT	36-WLCSP
1-5177983-2	TE Connectivity	60 pin connector	SMD

Table 11: MIPI DSI0 Interface Component Detail

11.5 MIPI CSI Display Interface

iMX8M QUAD supports one 4-lane CSI1 port and one 2-lane CSI2 port which used to connect high speed expansion connector as per 96boards standard.

11.5.1 Interface Features

MIPI CSI port is used to capture input video data from camera at Mezzanine card.

11.5.2 CSI Interface Description

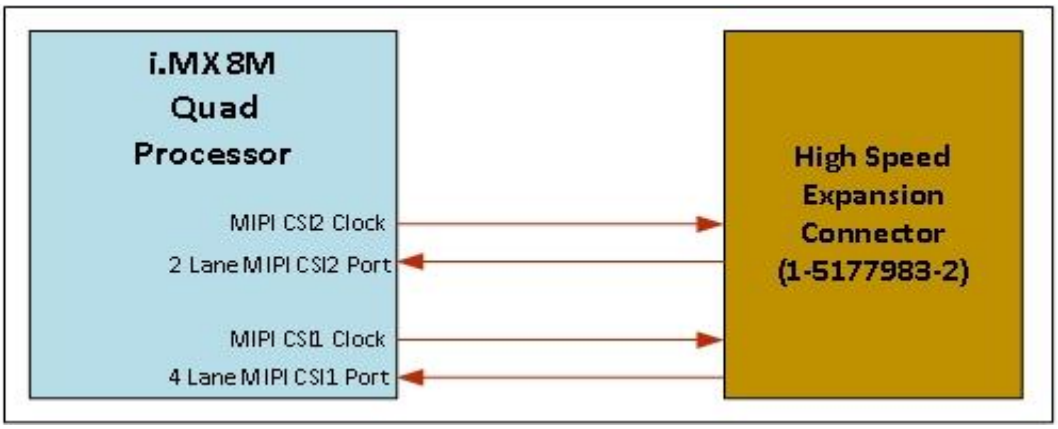

Figure 20: CSI Interface Diagram

11.5.3 Components for CSI1 interface

Part Number	Manufacturer	Description	Package
1-5177983-2	TE Connectivity	60 pin connector	SMD

Table 12: CSI1 Interface Component Details

11.5.4 Components for CSI2 interface

Part Number	Manufacturer	Description	Package
1-5177983-2	TE Connectivity	60 pin connector	SMD

Table 13: CSI2 Interface Component Details

11.6 Wi-Fi/BT Interface:

- iMX8M_HMI_Platform supports Wi-Fi (802.11 a/b/g/n/ac, 2.4GHz and 5GHz) and Bluetooth (BT 4.2) through LBEE5HY1MW-TEMP module.
- Wi-Fi will be mainly used for cloud connectivity and Bluetooth is used Audio streaming and BLE sensor communication.

11.6.1 Interface Features

Following point describes the detailed features of LBEE5HY1MW-TEMP Module

- Compliant with IEEE802.11a/b/g/n/ac WLAN
- Compliant with Bluetooth specification v4.2
- SAW filter inside
- SDIO interface for W-LAN
- Operating temperature: -40°C to +85°C
- Compact design based on Cypress CYW43455 SoC

11.6.2 Interface Description

- To support the Hi-speed data transfer between the Wi-Fi module and the host processor, SDIO interface of the IMX8M QUAD is used and for the Bluetooth interface- serial UART communication is used to transfer data between processor and connected Bluetooth device.
- UART interface is used for Audio streaming over Bluetooth.
- Module is certified with PCB trace antenna. Same antenna is used on iMX8M HMI platform too.
- Following figure shows the basic level interface between the processor iMX8M QUAD and the wireless Module.

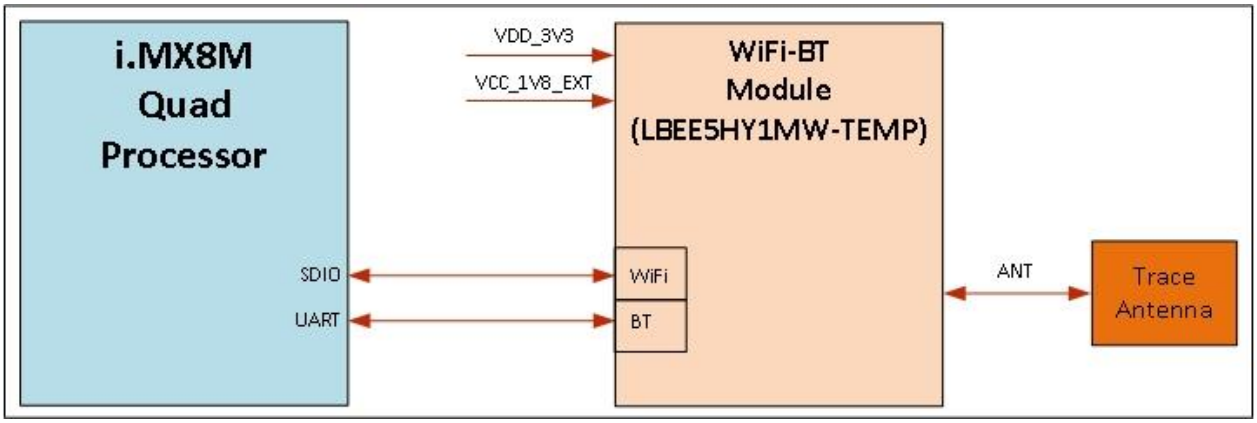

Figure 21: Wi-Fi + BT Module Interface Diagram

11.6.3 Component Details

Part Number	Manufacturer	Description
LBEE5HY1MW-TEMP	Murata	2.4/5 GHz Wi-Fi + BT Module

Table 14: Wi-Fi + BT Interface Component Details

11.6.4 Antenna Guidelines

Antenna DXF provided by Murata should be used for Trace antenna design.
Refer “Type1MW_certification_antenna_design_P2ML6161” at below path in SVN:

iMX8M_HMI_SVN\13. Hardware Specific\Layout\Arrow-IMX8M HMI Platform_MotherBoard\Reference Documents\Reference Layout Files\WiFi_BT module

11.7 HDMI Interface

- iMX8M_HMI_Platform device is having one dedicated HDMI Display output supporting 4096 x 2160 at 60 Hz resolution using HDMI connector.
- External 27 MHz oscillator is used for HDMI Interface.

11.7.1 Interface Features

iMX8M QUAD Processor is having one dedicated HDMI Display for video application.

- HDMI 2.0a supporting one display: resolution up to 4096 x 2160 at 60 Hz
- S/PDIF input and output
- Audio Return Channel (ARC) on HDMI
- Upscale HD graphics to 4K for display
- Downscale 4K video to HD for display
- Embedded Display Port

11.7.2 Interface Description

HDMI Display is to be interfaced directly with processor over HDMI interface.

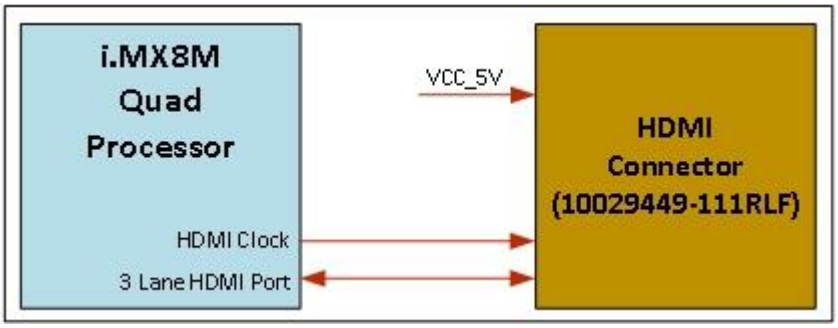

Figure 22: HDMI Interface Diagram

11.7.3 Component Details

Part Number	Manufacturer	Description	Package
10029449-111RLF	Amphenol FCI	HDMI Connector	Rectangular

Table 15: HDMI Interface Component Details

11.8 Audio Interface

- iMX8M_HMI_Platform device supports Audio Codec (Mic-In + Headphone out) and Automotive Audio Bus (A2B) in Master mode.
- Main clock is sourced from processor and external 12.288 MHz crystal is given as clock for Audio Codec.

11.8.1 Audio Codec

11.8.1.1 Interface Features

iMX8M QUAD Processor has SAI Interface which is used for interfacing Audio Codec for MIC IN + Headphone out in one connector.

ADAU1361 Audio codec is selected for this requirement and its features include:

- 24-bit stereo audio ADC and DAC: >98 dB SNR
- Sampling rates from 8 kHz to 96 kHz
- Flexible analog input/output mixers
- Stereo digital microphone input
- Analog outputs: 2 differential stereo, 2 single-ended stereo, 1 mono headphone output driver
- I2C and SPI control interfaces
- Digital audio serial data I/O: stereo and time-division multiplexing (TDM) modes

11.8.1.2 Interface Description

Audio Codec ADAU1361 is to be interfaced with processor over I2S interface for Audio and I2C interface for control.

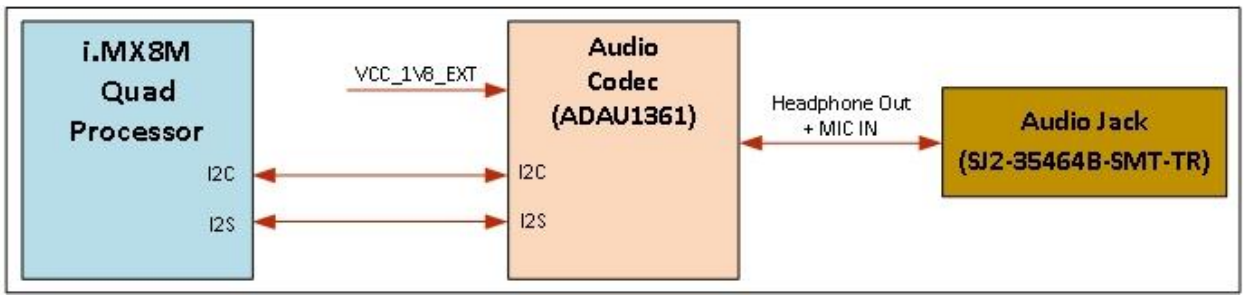

Figure 23: Audio Codec Interface Diagram

11.8.1.3 Component Details

Part Number	Manufacturer	Description	Package
ADAU1361BCPZ-R7	Analog Devices Inc.	Audio Codec	32LFCSP
SJ2-35464B-SMT-TR	CUI Inc.	Audio Jack	Surface Mount, Right Angle

Table 16: Audio Codec Interface Component Details

11.8.2 Automotive Audio Bus (A2B)

11.8.2.1 Interface Features

A2B interface and on board connector to support Automotive Audio Bus (A2B) application.

AD2428W A2B is selected for this requirement and its features include:

- Configurable as A2B bus master or slave
- I2C interface
- 8-bit to 32-bit multichannel I2S/TDM interface
- PDM inputs for 4 high dynamic range microphones on masters or slaves
- Support for receiving I2S data on nodes with up to 4 PDM microphones
- Unique ID register for each transceiver

11.8.2.2 Interface Description

A2B Master is to be interfaced with processor over I2S interface for Audio and I2C interface for control.

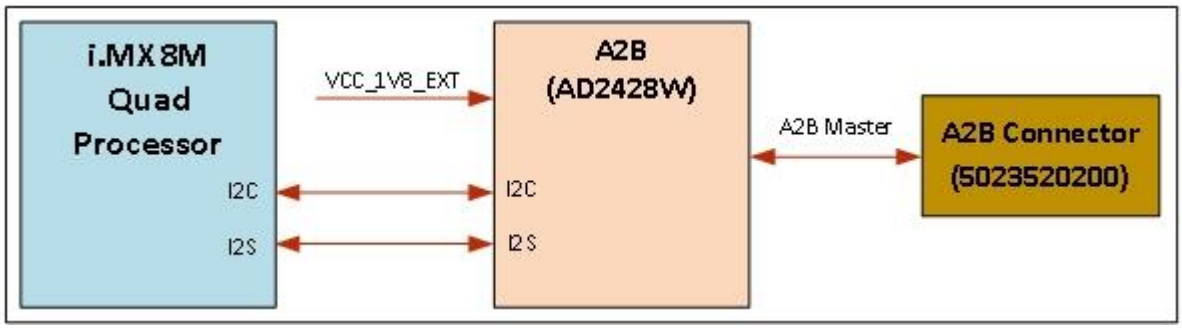

Figure 24: A2B Master Diagram

11.8.2.3 Component Details

Part Number	Manufacturer	Description	Package
AD2428W	Analog Devices Inc.	Automotive Audio Bus	32LFCSP
5023520200	Molex	A2B Connector	Surface Mount, Right Angle

Table 17: A2B Master Component Details

11.9 USB Interface

- iMX8M QUAD supports two USB controller with USB 3.0 and USB 2.0 support, which can be configured to Host/Device as per user application.
- External 26 MHz crystal is used as input clock for USB HUB.

11.9.1 USB 3.0 Interface Description

- iMX8M_HMI_Platform will have one USB 3.0 HUB (CYUSB3304-68LTXI from Cypress), connected to USB 3.0 port of iMX8M QUAD.
- USB hub supports 4 downstream ports:

1. **USB 3.0 Host:**
   - Two downstream port used as USB 3.0 Host port with a USB 3.0 Type-A connector.
   - Separate load switches on iMX8M_HMI_Platform will limit USB current on USB 3.0 ports as per USB specifications. This will protect iMX8M_HMI_Platform in case of short circuit.
   - USB bandwidth will be shared between devices if more than one devices are attached to USB HUB.

2. **High Speed Connector:**
   - One downstream port is used for High speed connector.

3. **USB to UART:**
   - iMX8M QUAD has limited UART ports as per iMX8M_HMI_Platform requirements. So we are using one USB to UART Bridge for Full UART connection for WiFi-BT Module.
   - One downstream port is used for USB to UART conversion to support Full UART requirement for WiFi-BT Module.

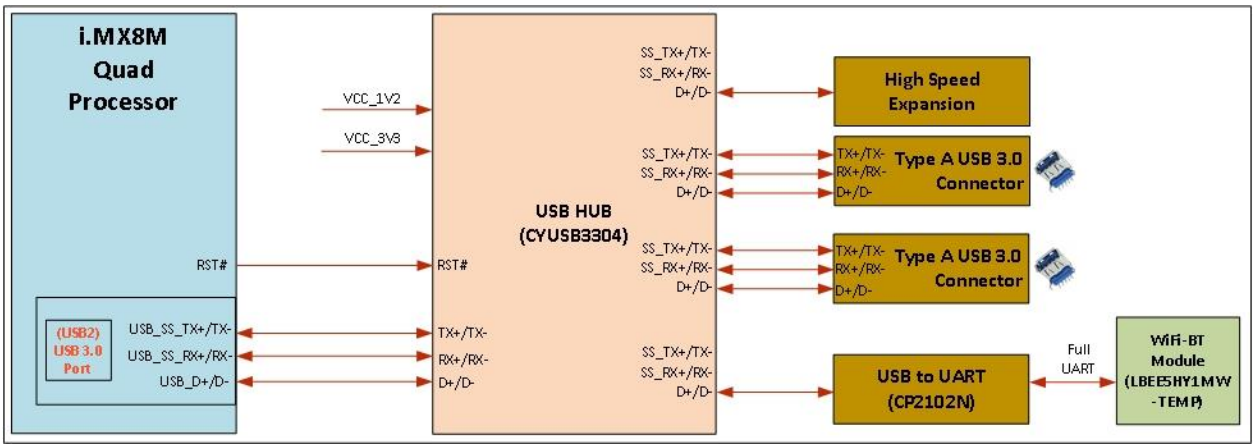

Figure 25 : USB 3.0 Top Level Interface Diagram

11.9.2 Component details

Part Number	Manufacturer	Description	Package
CYUSB3304-68LTXI	Cypress	IC 3.0 HUB	68 QFN
1932258-1 (2 Qty)	TE Connectivity	USB 3.0 Type A Connector	Through Hole, Right Angle
1-5177983-2	TE Connectivity	60 pin High speed expansion connector	SMD
CP2102N	Silicon Labs	USB to UART Bridge	24QFN
LBEE5HY1MW-TEMP	Murata	WiFi-BT Module	Module

Table 18: USB 3.0 Interface Component Details

11.9.3 USB 2.0 Interface Description

iMX8M_HMI_Platform will have one USB2.0 OTG port with micro-AB connector.

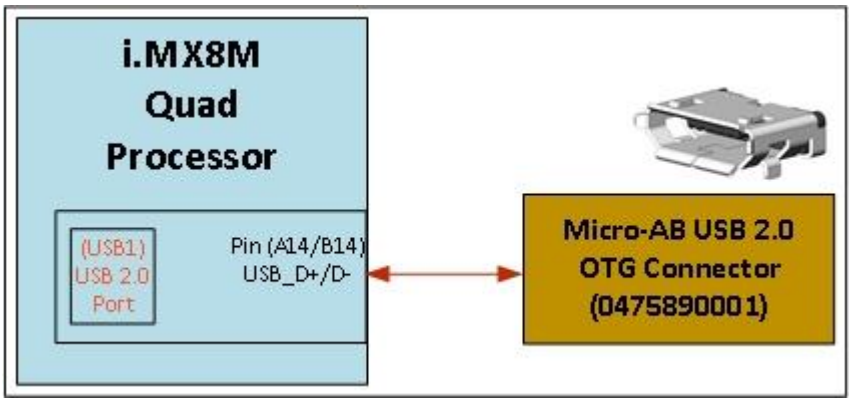

Figure 26 : USB 2.0 Top Level Interface Diagram

11.9.4 Component details

Part Number	Manufacturer	Description	Package
0475890001	Molex	USB Micro-AB OTG	5 Pin

Table 19: USB 2.0 Interface Component Details

11.10 Switches/ Sensor/FAN/EEPROM/NOR & GPIO's

There will be 3 switches (ON/OFF, RESET and Boot device selection), 3 micro switches (User Input), FAN, Security IC and other GPIOs on iMX8M_HMI_Platform

11.10.1 Interface Description

1) ON/OFF switch is used to indicate various modes of system based on the time the switch is pressed
2) Boot device selection switch is used to set by default booting option for processor
3) Micro switches are used to give user inputs
4) FAN is used to cool down the temperature of processor
5) Security IC is used for IOT security application
6) EEPROM is used to store product ID and other permanent detail
7) NOR flash is used as additional booting device option

11.10.2 Component details

Part Number	Manufacturer	Description	Package
EVP-AA802Q	Panasonic	SWITCH TACTILE SPST-NO 0.02A 15V	SMD
218-4LPSTJ	CTS	SWITCH SLIDE DIP SPST 25MA 24V	SMD
A7101CHTK2/T0BC2VJ	NXP	SECURE AUTHENTICATION	8-VDFN
1734709-2	TE Connectivity	FAN Connector	2 pin SMD
EVP-AA802Q (3 Qty) (3 Micro Switches)	Panasonic	SWITCH TACTILE SPST-NO 0.02A 15V	SMD
W25Q256JWPIQ	Winbond	256M bit Serial Flash Memory	8-WSON
M24256-DFMC6TG	STMicroelectronics	EEPROM	8-UFDFN

Table 20: Component Detail of Switches, EEPROM, NOR and FAN connector

11.11 Debug UART Interface

iMX8M QUAD processor console is supported through debug UART using FTR-103-02-S-S connector which is connected to A53 core.

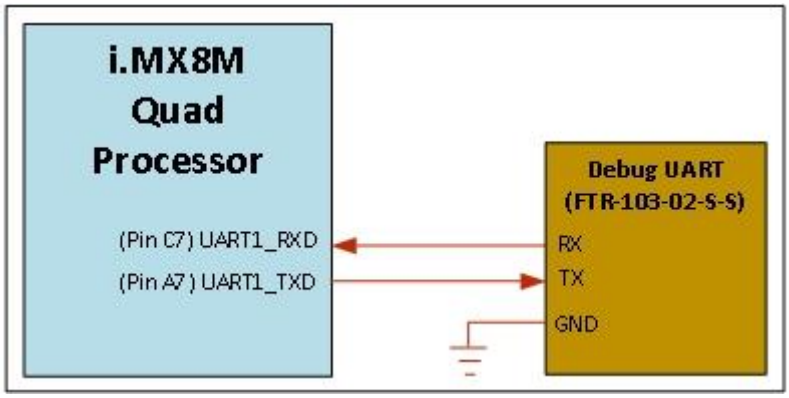

Figure 27: Debug UART Interface Diagram

11.11.1 Component details

Part Number	Manufacturer	Description	Package
TMS-103-02-G-S	Samtec Inc.	3 pin Connector	Through hole

Table 21: Debug UART Interface Component Details

11.12 Debug JTAG Interface

- iMX8M QUAD processor can be programmed through JTAG emulator.
- JTAG 10 pin connector is provided for JTAG debug and programming.

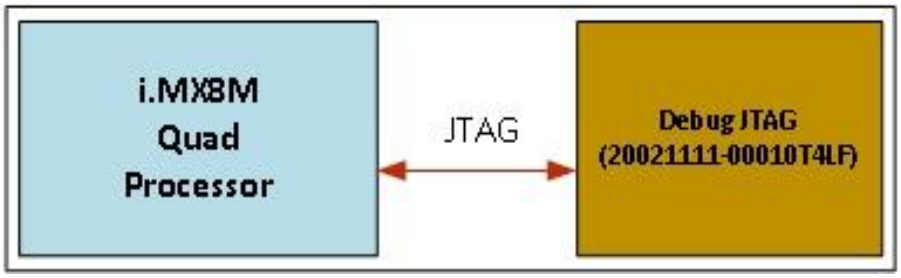

Figure 28: Debug JTAG Interface

11.12.1 Component details

Part Number	Manufacturer	Description	Package
20021111-00010T4LF	Amphenol FCI	10 pin Connector	Through hole

Table 22: Debug JTAG Interface Component Details

11.13 ZigBee Interface

iMX8M_HMI_Platform can support ZigBee and Thread protocol using MGM111 module for connecting to sensors

11.13.1 Interface Features

Below are features of ZigBee Module Part Number MGM111

- Fully-integrated, pre-certified module
- Antenna: internal chip
- Industry-leading mesh networking (ZigBee/Thread) software and development tools
- TX power: up to +10 dBm, RX sensitivity: down to -99 dBm
- 32-bit ARM® Cortex®-M4 at 40 MHz
- Flash memory: 256 kB, RAM: 32 kB

11.13.2 Interface Description

- ZigBee Module MGM111A256V2 is used through Level translator from Processor as per below image.
- ZigBee will be interfaced on SPI interface of processor.
- Module will have integrated antenna for wireless communication.
- Application is to control and communicate with the external ZigBee sensors.
- Module will support data rate of up to 250kbps.
- The device supports ZigBee and Thread protocol.

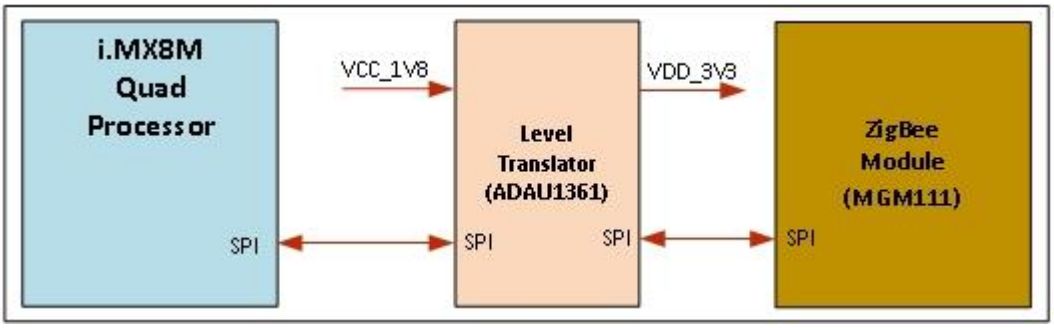

Figure 29: ZigBee Interface Diagram

11.13.3 Component Details

Part Number	Manufacturer	Description	Package
MGM111A256V2	Silicon Labs	ZigBee Module	Module
NLSX5014MUTAG	ON Semiconductor	Level Translator	12UQFN

Table 23: ZigBee Interface Component Details

11.14 CAN Interface

- iMX8M_HMI_Platform supports CAN interface for industrial application using CAN controller and CAN transceiver with 5kV isolation.
- External 20 MHz crystal is used as input clock for CAN controller.

11.14.1 CAN controller Features

Below are features of CAN controller

- Implements CAN V2.0B at 1 Mb/s
- Supports High-Speed SPI Interface (10 MHz)
- Receive Buffers, Masks and Filters
- Data Byte Filtering on the First Two Data Bytes (applies to standard data frames)
- Three Transmit Buffers with Prioritization and Abort Features
- Clock Out Pin with Programmable Prescaler
- Low-Power CMOS Technology

11.14.2 CAN Transceiver Features

Below are features of CAN transceiver

- 5 kVrms signal isolated CAN transceiver
- 5 V or 3.3 V operation on VDD1
- 5 V operation on VDD2 VDD2
- VSENSE to detect loss of power on VDD2
- Complies with ISO 11898 standard
- High speed data rates of up to 1 Mbps

11.14.3 CAN Interface Description

- CAN controller MCP2515 is used through Level translator from Processor as per below image.
- Output of CAN controller is given to isolator for 5kV isolation.
- SPI protocol is used for communication in CAN Protocol.

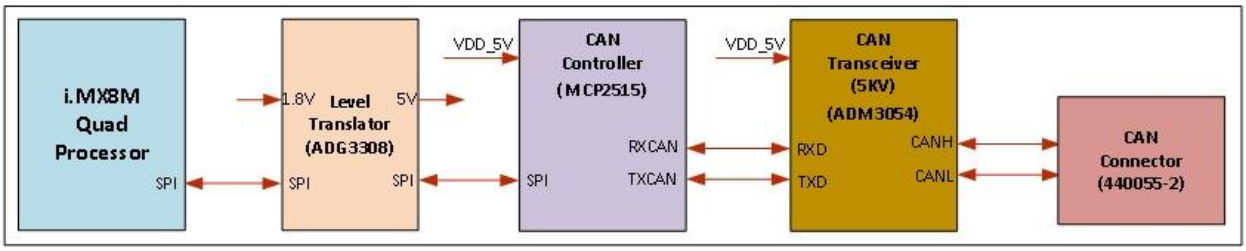

Figure 30: CAN Interface Diagram

11.14.4 Component Details

Part Number	Manufacturer	Description	Package
MCP2515T-I/ML	Microchip Technology	CAN Controller	20-QFN
ADG3308BCPZ-REEL7	Analog Devices	Level Translator	20LFCSP
ADM3054	Analog Devices	CAN Transceiver	16SOIC
440055-2	TE Connectivity	CAN connector	Through Hole

Table 24: CAN Interface Component Details

11.15 Ethernet Interface

- iMX8M_HMI_Platform supports 1Gbps Ethernet connection.
- iMX8M Quad supports RGMII interface which is connected to KSZ9031RNXIC-TR PHY from Microchip for Ethernet connectivity.
- External 25 MHz crystal is used as input clock for RGMII PHY.

11.15.1 Interface Features

Below are features of Ethernet PHY IC KSZ9031RNXIC-TR

- Single-Chip 10/100/1000 Mbps Ethernet Transceiver Suitable for IEEE 802.3 Applications
- RGMII with 3.3V/2.5V/1.8V Tolerant I/Os
- On-Chip Termination Resistors for the Differential Pairs
- Programmable LED Outputs for Link, Activity, and Speed
- Power-Down and Power-Saving Modes

11.15.2 Interface Description

Microchip PHY KSZ9031RNXIC-TR used between RJ45 connector and Processor as per below image.

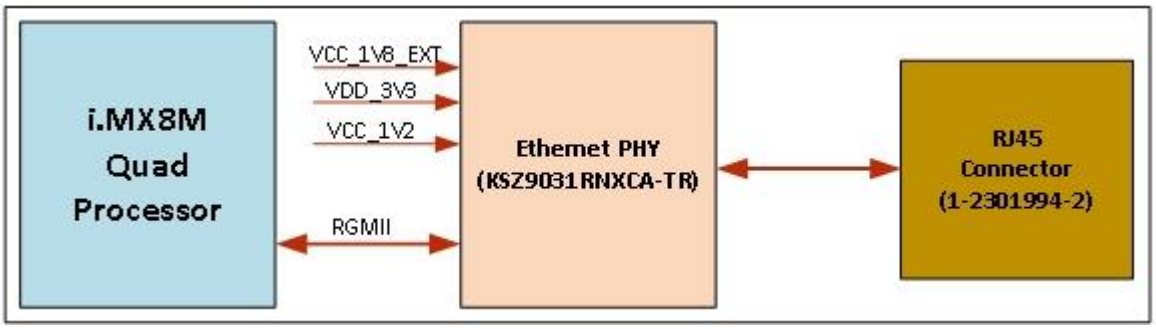

Figure 31: Ethernet Interface Diagram

11.15.3 Component Details

Part Number	Manufacturer	Description	Package
KSZ9031RNXCA-TR	Microchip Technology	IC ETHERNET	48QFN
2301994-2	TE Connectivity	RJ45 Connector	Through Hole

Table 25: Ethernet Interface Component Details

11.16 Power Supply

iMX8M_HMI_Platform device will have 12VDC (+8V to 18V @60W) for the input supply to power up processor and all its peripherals.

The processor and peripherals requires different voltage supplies and current for their normal functionality. The power supply section is designed to generate all required voltage rails with respective current requirements.

11.16.1 Input Power Supply

For protection of input power supply, below components are used

1. Fuse
2. TVS Diodes

For EMI EMC protection, below components are used

1. Common mode choke

For Input current sensing, below components are used

1. 0.01E Sense Resistor in series of input supply path
2. Two pins header across sense resistor

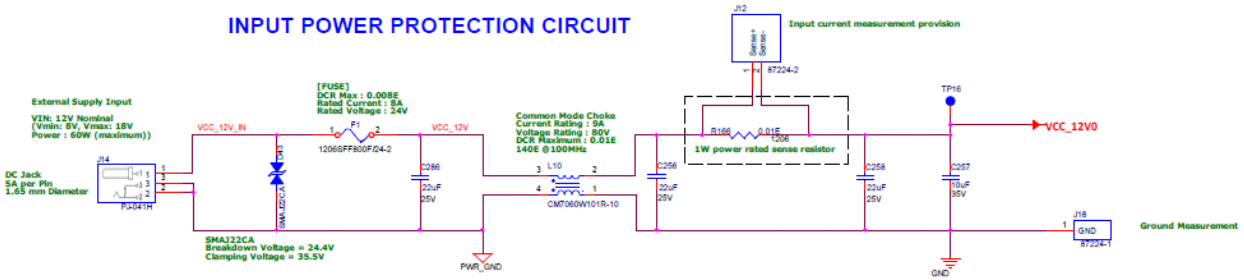

Figure 32: Input Power supply Design

11.16.2 12V to 5V@4A Regulator LT8642SEV#PBF

- Regulator LT8642SEV#PBF is selected to convert 5V from 8-18V input power supply.
- This Regulator is in always in ON condition.

11.16.3 12V to 3.44V@6A Regulator LT8642SEV#PBF

- Regulator LT8642SEV#PBF is selected to convert 3.44V from 8-18V input power supply.
- This Regulator is in always in ON condition.

11.16.4 Regulator ADP5014ACPZ-R7

- Regulator ADP5014ACPZ-R77 is selected to generate four Low Noise Current through Buck Regulator for processor.
- Enable of two power supply is provided by PMIC and enable of two power supply is provided by 1.8V supply.

11.16.5 PMIC (MC34PF4210A1ES)

- PF4210 is used to provide sequencing to the processor and it is controlled through I2C.

- PMIC provides a highly programmable/configurable architecture with fully integrated power devices and minimal external components.
- PMIC provides up to six buck converters, six linear regulators, RTC supply, and a coin cell charger.
- PMIC designed as per datasheet.

Below are the features of PF4210:

- Four to six buck converters, depending on configuration
  - Single/dual phase/parallel options
  - DDR termination tracking mode option
- Boost regulator to 5.0 V output
- Six general purpose linear regulators
- Programmable output voltage, sequence, and timing
- OTP (one-time programmable) memory for device configuration
- DDR termination reference voltage
- Power control logic with processor interface and event detection

11.16.6 Linear Regulator ADP1710AUJZ-R7

- Two ADP1710 is used in design for low noise output voltage.
- One LDO is used for processor supply VDD_SNVS_0.9V and other for SD card voltage selection option
- Maximum output current is 150mA.
- Input voltage range is 2.5V to 5.5V

Below are the features of ADP1710:
- Low shutdown current: <1 µA
- Low dropout voltage: 150 mV @ 150 mA load
- Initial accuracy: ±1%
- Stable with small 1µF ceramic output capacitor
- Adjustable output voltage option: 0.8 V to 5.0 V (ADP1710 Adjustable)
- Logic controlled enable
- 5-lead TSOT package

11.16.7 CAN Supply isolator ADUM5020-5BRWZ

- ADUM5020 is used for isolation of voltage supply for CAN interface.
- 5V for CAN interface is isolated with DC-DC converter

Below are the features of ADUM5020:

- isoPower integrated, isolated dc-to-dc converter 100 mA output current for ADUM5020
- 16-lead SOIC_W package with 7.8 mm minimum creepage
- High temperature operation: 125°C maximum

12 POWER SUPPLIES RAIL INFORMATION

All the power supplies of Design along with its current rating and voltage level are described in below table.

Sr#	Section Name	Net name	Max Current	Typical Voltage Range
1	Input power supply before common mode choke	VCC_12V_IN	5A	8V-18V
2	Input power supply after common mode choke	VCC_12V0	5A	8V-18V
3	VCC_12V0 (12V) to VCC_5V (5V)	VCC_5V	4A	5V
4	DCDC_3V3	DCDC_3V3	5A	3.3V
5	NVCC_SNVS_3V3	NVCC_SNVS_3V3	0.1A	3.3V
6	VDD_3V3	VDD_3V3	1.5A	3.3V
7	VDD_SNVS_0V9	VDD_SNVS_0V9	0.1A	0.9V
8	VDD_GPU_1V0	VDD_GPU_1V0	2.5A	1.0V
9	VDD_VPU_1V0	VDD_VPU_1V0	1A	1.0V
10	NVCC_DRAM_1V1	NVCC_DRAM_1V1	1A	1.1V
11	VDD_DRAM_1V0	VDD_DRAM_1V0	1A	1V
12	NVCC_1V8	NVCC_1V8	0.5A	1.8V
13	NVCC_SD1	NVCC_SD1	0.1A	3.3V/1.8V
14	VDD_PHY_0V9	VDD_PHY_0V9	0.5A	0.9V
15	VDD_PHY_1V8	VDD_PHY_1V8	0.1A	1.8V
16	VDD_PHY_3V3	VDD_PHY_3V3	0.1A	3.3V
17	VDDA_1V8	VDDA_1V8	0.1A	1.8V
18	VREFDDR	VREFDDR	0.5A	0.55V
19	VDD_SOC_0V9	VDD_SOC_0V9	3A	0.9V
20	VDD_ARM_1V0	VDD_ARM_1V0	3.5A	1V
21	VCC_1V8_EXT	VCC_1V8_EXT	0.5A	1.8V
22	VCC_1V2	VCC_1V2	1A	1.2V

13 PCB LAYER STACKUP

Below 12 Layer stack up considered for this design according to space, size and through hole via technology.

Refer below path for Layer Stackup “eI_Arrow_iMX8M_HMI_Platform_Stackup_12L”

iMX8M_HMI_SVN\13. Hardware Specific\Layout\Arrow-IMX8M HMI Platform_MotherBoard\Reference Documents\Layer Stackup

Layer	Cu Thick. (mils)	Cu Foil wt (oz)	DK	Lam. Thick. (mils)	Description
1	1.80	.333 oz			Foil .333 oz
			3.76	3.64	Prepreg 185HR 1080(72)
2	1.20	.333 oz			Foil .333 oz
			3.76	3.55	Prepreg 185HR 1080(72)
3	0.80	.333 oz			Foil .333 oz
			4.03	4.97	Prepreg 185HR 2116(57)
4	1.15	1 oz			
			4.03	4.00	Core 185HR 4.00mils 1x3313 0.5 oz / 1 oz
5	0.55	0.5 oz			
			3.76	5.45	Prepreg 185HR 106(72)/1080(72)
6	1.15	1 oz			
			4.03	5.00	Core 185HR 5.00mils 1x2116 1 oz / 1 oz
7	1.15	1 oz			
			3.76	5.49	Prepreg 185HR 1080(72)/106(72)
8	0.55	0.5 oz			
			4.03	4.00	Core 185HR 4.00mils 1x3313 0.5 oz / 1 oz
9	1.15	1 oz			
			4.03	4.97	Prepreg 185HR 2116(57)
10	0.80	.333 oz			Foil .333 oz
			3.76	3.54	Prepreg 185HR 1080(72)
11	1.20	.333 oz			Foil .333 oz
			3.76	3.64	Prepreg 185HR 1080(72)
12	1.80	.333 oz			Foil .333 oz

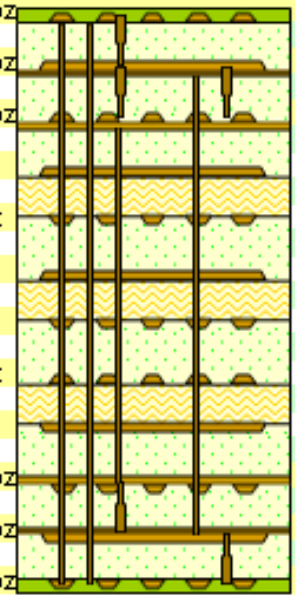

Figure 33 : PCB Layer Stack up

14 MAJOR COMPONENTS - BILL OF MATERIAL

Sr #	Qty	Part Number	Manufacturer	Description
1	1	2201778-1	TE Connectivity AMP Connectors	MICRO SD PUSH PUSH LOW PROFILE T
2	1	0475890001	Molex	CONN RCPT STD MICRO USB TYPE AB
3	2	1932258-1	TE Connectivity AMP Connectors	USB 3.0 RA REC TH TYPE A
4	2	2069486-2	TE Connectivity AMP Connectors	HDMI REC SMT W/O FLANGE
5	1	1-2301994-2	TE Connectivity AMP Connectors	CONN MOD JACK 8P8C R/A SHIELDED
6	1	5177983-2	TE Connectivity AMP Connectors	CONN RECEPT 60POS .8MM DUAL SMD
7	1	9-1734516-0	TE Connectivity AMP Connectors	CONN RECEPT 40POS 2MM STR DL SMD
8	1	5023520200	Molex	CONN HEADER SMD R/A 2POS 2MM
9	1	PJ-041H	CUI Inc.	CONN PWR JACK 1.75X4.75MM
10	1	SJ2-35464B-SMT-TR	CUI Inc.	CONN AUDIO JACK 3.5mm
11	1	440055-2	TE Connectivity AMP Connectors	CONN HEADER 2POS R/A 2MM T/H for CAN Interface
12	1	MCP2515T-I/ML	Microchip Technology	IC CAN Controller
13	1	ADAU1361BCPZ-R7	Analog Devices	IC Audio Code for Line-In/ Line-Out
14	1	MT53B512M32D2NP-062 WT:D	Micron Technology Inc.	IC LPDDR4 2GB FBGA
15	1	MIMX8MQ6CVAHZAA	NXP USA Inc.	I.MX8M QUAD 17X17, Industrial 1.3GHz
16	1	MC34PF4210A1ES	NXP USA Inc.	IC PMIC
17	1	ADM3054	Analog Devices	IC 5KV Isolated CAN transceiver
18	1	20021111-00010T4LF	Amphenol FCI	JTAG Connector
19	1	CYUSB3304-68LTXI	Cypress Semiconductor	IC USB Hub 3.0
20	1	MGM111A256V2	Silicon Labs	ZigBee Module
21	1	LT8642SEV#PBF	Analog Devices	IC, Buck Regulator, Adjustable, 10A
22	1	ADP5014ACPZ-R7	Analog Devices	IC, Buck Regulator, Adjustable, Quad Output
23	1	KSZ9031RNXCA	Microchip Technology	IC, Ethernet PHY
24	1	M24256-DFMC6TG	STMicroelectronics	IC, I2C 256Kb EEPROM
25	1	W25Q256JW	Winbond	IC NOR FLASH SERIAL 32MB
26	1	FSA644UCX	ON Semiconductor	IC SWITCH SPDT 36-WLCSP
27	1	ADV7535BCBZ-RL7	Analog Devices	IC, MIPI DSI to HDMI bridge
28	1	LBEE5HY1MW-TEMP	Murata	Module, WiFi Dual Band + Bluetooth 4.2
29	1	CP2102N-A01-GQFN24R	Silicon Labs	USB to UART bridge
30	1	AD2428W	Analog Devices	Automotive Audio Bus Master

Table 26: Major Components Bill of Material

Refer below path for “eI_Arrow_iMX8M_HMI_Platform_BOM_Major Components” document:

iMX8M_HMI_SVN\13. Hardware Specific\Documents\Design Documents\Major Components

15 APPENDIX

15.1 APPENDIX A: Low Speed Expansion Connector Pinout

The signals listed in the below pinout table will be used for the Low Speed Expansion Connector, the pinouts meet the 96Boards specification and are finalized based on the available ports from the iMX8M processor.

Pin No.	Signal	Voltage level	Remarks
1	GND		
2	GND		
3	UART0_CTS	1.8V	
4	PWR_BTN_N	1.8V	
5	UART0_TxD	1.8V	
6	RST_BTN_N	1.8V	
7	UART0_RxD	1.8V	
8	SPI0_SCLK	1.8V	
9	UART0_RTS	1.8V	
10	SPI0_DIN	1.8V	
11			
12	SPI0_CS	1.8V	
13			
14	SPI0_DOUT	1.8V	
15	I2C0_SCL	1.8V	
16	PCM_FS	1.8V	
17	I2C0_SDA	1.8V	
18	PCM_CLK	1.8V	
19	I2C1_SCL	1.8V	
20	PCM_DO	1.8V	
21	I2C1_SDA	1.8V	
22	PCM_DI	1.8V	
23	GPIO-A	1.8V	
24	GPIO-B	1.8V	
25	GPIO-C	1.8V	
26	GPIO-D	1.8V	
27	GPIO-E	1.8V	
28	GPIO-F	1.8V	
29	GPIO-G	1.8V	
30	GPIO-H	1.8V	
31	GPIO-I	1.8V	
32	GPIO-J	1.8V	
33	GPIO-K	1.8V	
34	GPIO-L	1.8V	
35	+1V8	1.8V	
36	SYS_DCIN	12V	12V
37	+5V	5V	
38	SYS_DCIN	12V	12V
39	GND		
40	GND		

Table 27. Low Speed Expansion Connector Pinouts

15.2 APPENDIX B: High Speed Expansion Connector Pinout

The signals listed in the below pinout table will be used for the High Speed Expansion Connector, the pinouts meet the 96Boards specification and are finalized based on the available ports from the iMX8M processor.

Pin No.	Signal	Voltage level	Remarks
1	SPI1_DOUT	1.8V	
2	CSI0_C+	1.2V	
3			NC
4	CSI0_C-	1.2V	
5			NC
6	GND		
7	SPI1_CS	1.8V	
8	CSI0_D0+	1.2V	
9	SPI1_SCLK	1.8V	
10	CSI0_D0-	1.2V	
11	SPI1_DIN	1.8V	
12	GND		
13	GND		
14	CSI0_D1+	1.2V	
15	CSI0_MCLK	1.8V	
16	CSI0_D1-	1.2V	
17	CSI1_MCLK	1.8V	
18	GND		
19	GND		
20	CSI0_D2+	1.2V	
21	DSI_CLK+	1.2V	
22	CSI0_D2-	1.2V	
23	DSI_CLK-	1.2V	
24	GND		
25	GND		
26	CSI0_D3+	1.2V	
27	DSI_D0+	1.2V	
28	CSI0_D3-	1.2V	
29	DSI_D0-	1.2V	
30	GND		
31	GND		
32	I2C2_SCL	1.8V	
33	DSI_D1+	1.2V	
34	I2C2_SDA	1.8V	
35	DSI_D1-	1.2V	
36	I2C3_SCL	1.8V	
37	GND		
38	I2C3_SDA	1.8V	
39	DSI_D2+	1.2V	
40	GND		

41	DSI_D2-	1.2V	
42	CSI1_D0+	1.2V	
43	GND		
44	CSI1_D0-	1.2V	
45	DSI_D3+	1.2V	
46	GND		
47	DSI_D3-	1.2V	
48	CSI1_D1+	1.2V	
49	GND		
50	CSI1_D1-	1.2V	
51	USB_D+		
52	GND		
53	USB_D-		
54	CSI1_C+	1.2V	
55	GND		
56	CSI1_C-	1.2V	
57			NC
58	GND		
59			NC
60	RESERVED		

Table 28. High Speed Expansion Connector Pinouts

15.3 APPENDIX C: Length Match Report

Refer below path for Length Match Report for all the interfaces “eI_IMX8M_HMI_PLATFORM_Length match_report”

iMX8M_HMI_SVN\13. Hardware Specific\Layout\Arrow-IMX8M HMI Platform_MotherBoard\Reference Documents\Length Match Report

15.4 APPENDIX D: Selection of Major Components

- The critical parts identified in the architecture phase in agreement with customer.
- Refer below path for selection of major components “el_Arrow_iMX8M_HMI_Platform_BOM_Major Components” document:

  iMX8M_HMI_SVN\13. Hardware Specific\Documents\Design Documents\Major Components

- Refer below path to decide components values of ADP5014 Voltage Regulator “ADP5014_BuckDesigner_Release”:

  iMX8M_HMI_SVN\13. Hardware Specific\Documents\Design Documents\Power Estimation\Simulations

15.5 APPENDIX E: Placement in iMX8M_HMI_Platform board

Below is detailed placement of all components in iMX8M HMI Platform board.

TOP SIDE PLACEMENT

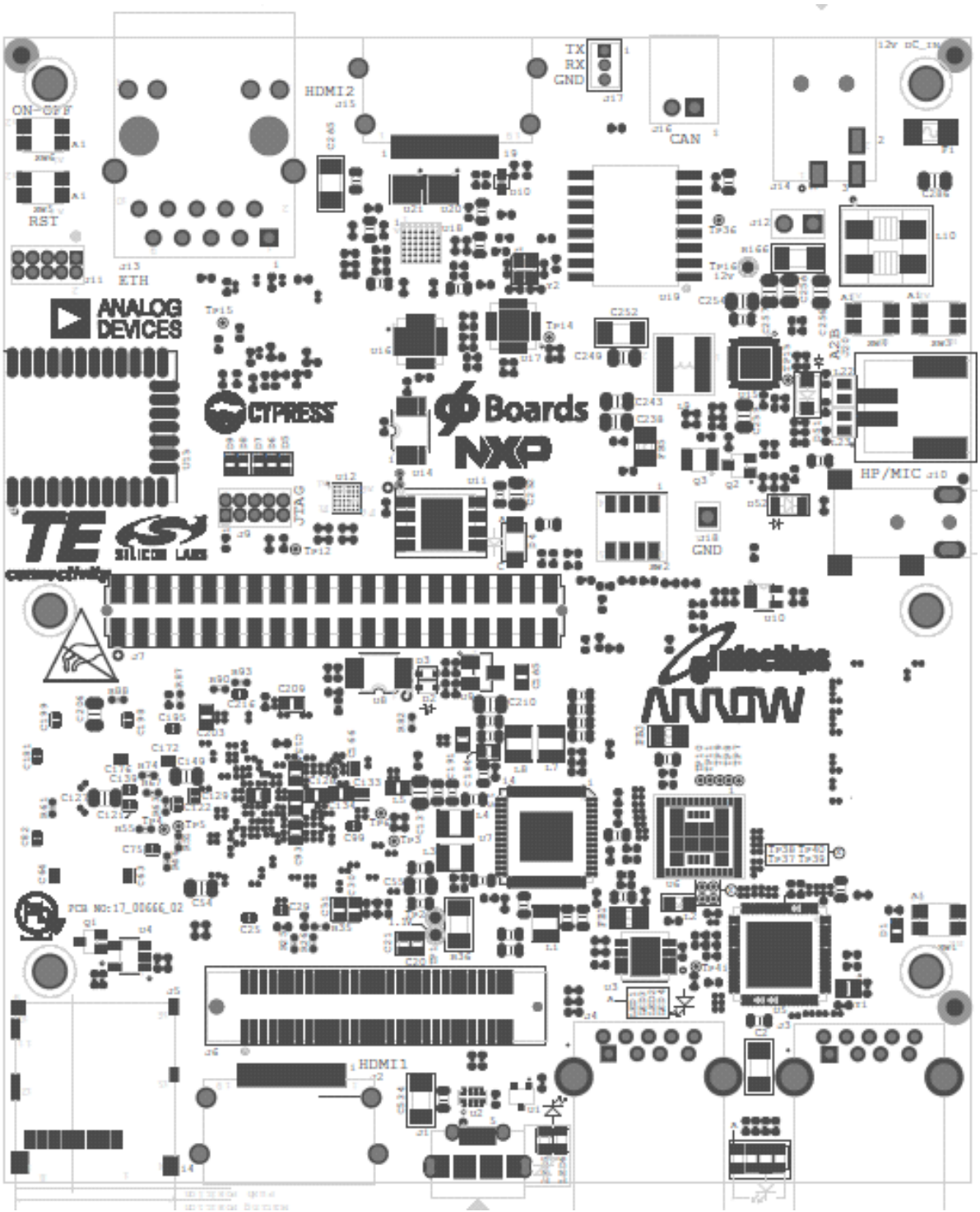

Figure 34 : iMX8M HMI Platform top side placement

BOTTOM SIDE PLACEMENT

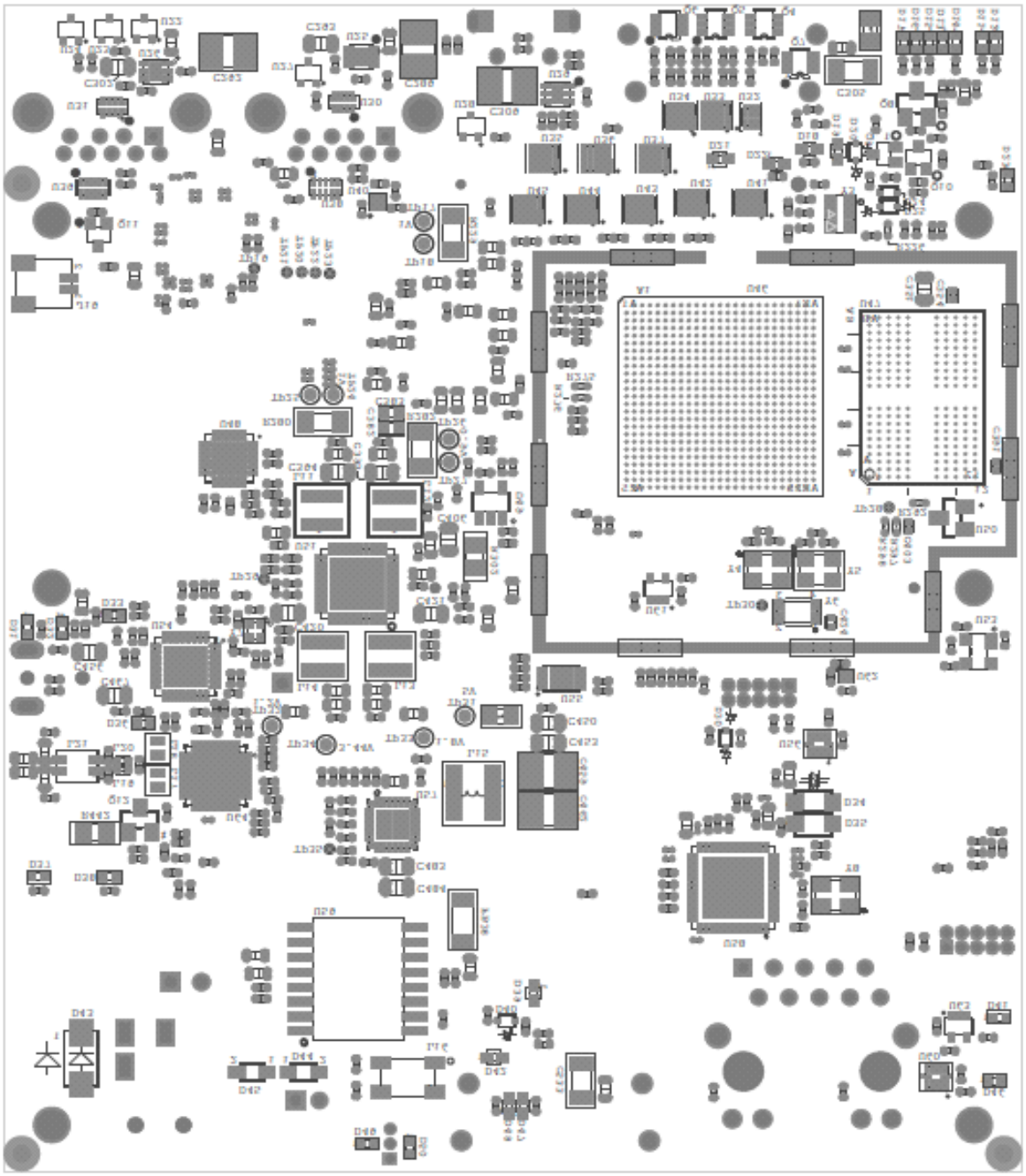

Figure 35 : iMX8M HMI Platform bottom side placement