



# SL iMX8MM

Doc. Rev. 1.0

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 SL iMX8MM - USER GUIDE

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## Revision History

| Revision | Brief Description of Changes                                                          | Date of Issue     | Author/<br>Editor |
|----------|---------------------------------------------------------------------------------------|-------------------|-------------------|
| 0.1      | Basic draft                                                                           | 2019-September-19 | Gb                |
| 1.0      | Release Version<br>Modification general sections;<br>Updated Block-diagram and pinout | 2020-January-27   | Gb/KL             |

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## Symbols

The following symbols may be used in this user guide

### **⚠ DANGER**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### **⚠ WARNING**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### **NOTICE**

NOTICE indicates a property damage message.

### **⚠ CAUTION**

CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



#### **Electric Shock!**

This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.



#### **ESD Sensitive Device!**

This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.



#### **HOT Surface!**

Do NOT touch! Allow to cool before servicing.



#### **Laser!**

This symbol inform of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.



This symbol indicates general information about the product and the user guide.

This symbol also indicates detail information about the specific product configuration.



This symbol precedes helpful hints and tips for daily use.

## Special Handling and Unpacking Instruction

### NOTICE



#### ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

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## 1/ Introduction

This user guide describes the 30mmx30mm SoM form factor module – SL iMX8MM. The Advanced RISC Machines (ARM) based module is equipped with NXP i.MX8M Mini processor. The quad core SoC takes advantage of the optimized power consumption and performance ratio.

The use of this user guide implies a basic knowledge of PC hardware and software. This user guide is focused on describing the special features and is not intended to be a standard PC textbook. New users are recommended to study the short installation procedure, before switching on the power.

All configuration and setup of the module is performed using the u-Boot CLI.

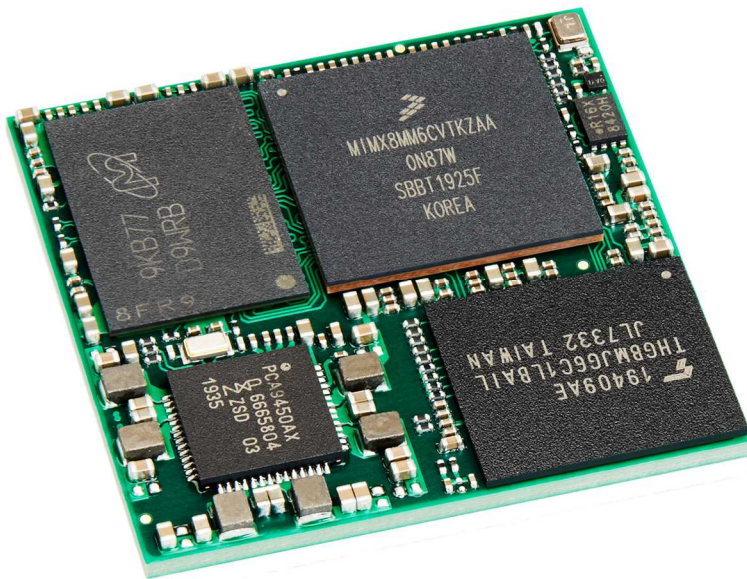
Latest revision of this user guide, datasheet, and BSPs (Board Support Packages) can be downloaded from Kontron Electronics Web Page.

## 2/ Description

The SL iMX8MM is a very small System-on-Module (SoM) using NXP's i.MX8M Mini processor with ARM Quad Cortex A53 and Cortex M4. The SL iMX8MM is a highly integrated, small sized module for integration in embedded systems with 30mmx30mm footprint.

The complexity of the DDR4 memory, power management and processor connection are contained in the 8-layer SOM and simplifies baseboard development.

Figure 1: 30x30mm SoM with LGA package



Main characteristics of the SL iMX8MM are:

- ▶ quad Arm® Cortex®-A53 core with up to 1.6 GHz and Cortex®-M4 400 MHz core processor is for low-power processing
- ▶ Up to 4 GB LPDDR4 memory down
- ▶ 4 to 64 GB eMMC
- ▶ 2 MB QSPI boot flash
- ▶ 2D GPU and 3D GPU (1x shader, OpenGL ES 2.0)
- ▶ 1x MIPI DSI (4-lane) with PHY
- ▶ 1x MIPI CSI (4-lane) with PHY
- ▶ Video Playback with 1080p60
- ▶ 2x USB 2.0 OTG controllers with integrated PHY
- ▶ 1x Gigabit Ethernet (MAC) with AVB and IEEE 1588, Energy Efficient Ethernet (EEE) for low power
- ▶ 1x PCIe 2.0 (1-lane) with L1 low power substates
- ▶ 5x SAI (12Tx + 16Rx external I2S lanes), 8ch PDM input
- ▶ 3x SDIO
- ▶ 4x UART
- ▶ 4x I2C
- ▶ 3x SPI

Please keep in mind, that not all interfaces are available simultaneously due to the amount of port pins and multiple multiplexing possibilities.

## 2.1. Product Variants and Accessories

Following variants are planned:

**Table 1: Product Variants of SL iMX8MM**

| Board                                 | Description                                                      | Product Number |
|---------------------------------------|------------------------------------------------------------------|----------------|
| SL iMX8MM Quad<br>1GB/8GB -25...+85°C | SoM with NXP I.MX8M MINI processor, 1 GB<br>LPDDR4 and 8 GB eMMC | 40099 175      |
| SL iMX8MM Quad<br>2GB/8GB -25...+85°C | SoM with NXP I.MX8M MINI processor, 2 GB<br>LPDDR4 and 8 GB eMMC | 40099 185      |

The following accessories are available:

- ▶ iMX8MM Quad Development Kit without Display (product no. 50099 059)

## 3/ System Specifications

### 3.1. Component Main Data

The table below summarizes the features of the SoM.

Table 2: Component Main Data

| SL iMX8M MINI                   |                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Form factor                     | 30x30mm with 256 LGA pads                                                                                                                                                                 |
| Processor                       | NXP's MIMX8MM6CVTKZAA with 14mm x 14mm BGA package in 0.5mm pitch (industrial version)                                                                                                    |
| Memory                          | 1.6 GHz 32-bit LPDDR4 <ul style="list-style-type: none"> <li>▶ 1 GByte: 1x 8 Gbit density 256 M x32 LPDDR4 parts</li> <li>▶ 2 GByte: 1x 16 Gbit density 512 M x32 LPDDR4 parts</li> </ul> |
| Boot Flash                      | 2 MB SPI NOR flash in USON (2x3mm) package connected on ECSP11                                                                                                                            |
| Bootloader/BIOS                 | U-Boot Bootloader                                                                                                                                                                         |
| embedded Multimedia Card (eMMC) | 4 to 64 GB MLC (Multi-level Cell) connected on SD1                                                                                                                                        |
| Display                         | <ul style="list-style-type: none"> <li>▶ 1x MIPI DSI (4-lane) with PHY</li> <li>▶ Resolution: up to Full-HD 1080p @60 fps</li> </ul>                                                      |
| Onboard Controllers             |                                                                                                                                                                                           |
| Ethernet Controller             | <ul style="list-style-type: none"> <li>▶ Gigabit Ethernet controller with support for Energy Efficient Ethernet (EEE), Ethernet AVB, and IEEE 1588, no phy on SoM</li> </ul>              |
| Watchdog Timer                  | CPU internal watchdog, configurable timeout counter with timeout periods from 0.5 to 128 seconds                                                                                          |
| System Management Controller    | No dedicated System Management Controller on module System settings can be arranged in U-Boot environment variables                                                                       |
|                                 |                                                                                                                                                                                           |
| H/W Status Monitor              | CPU internal temperature monitoring sensor                                                                                                                                                |
| Power management                | PCA9450AHN from NXP                                                                                                                                                                       |
| Operating System Support        | Linux Yocto                                                                                                                                                                               |
| Default Interfaces              |                                                                                                                                                                                           |
| I2C                             | 4x                                                                                                                                                                                        |
| LAN, USB                        | 1x Gigabit Ethernet, 2x USB 2.0 OTG                                                                                                                                                       |
| Display                         | 1x MIPI DSI (4-lane) with up to 1920 x 1080 @60fps                                                                                                                                        |
| SD-Card                         | 2x SDIO (1x 4bit, 1x 8bit)                                                                                                                                                                |
| UART                            | 4x                                                                                                                                                                                        |
| GPIO                            | 27x                                                                                                                                                                                       |
| PWM                             | 3x                                                                                                                                                                                        |

|                           |                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>other Connectivity</b> | <ul style="list-style-type: none"> <li>▶ 1x SAI</li> <li>▶ 2x SPI</li> <li>▶ 1x PCIe</li> <li>▶ 1x QSPI</li> </ul> |
| <b>Power</b>              |                                                                                                                    |
| <b>Consumption</b>        | Maximum Power consumption of the board is measured to <3,5 W                                                       |
| <b>Input Voltage</b>      | Single Supply 5V ±5%                                                                                               |

## 3.2. Environmental Conditions

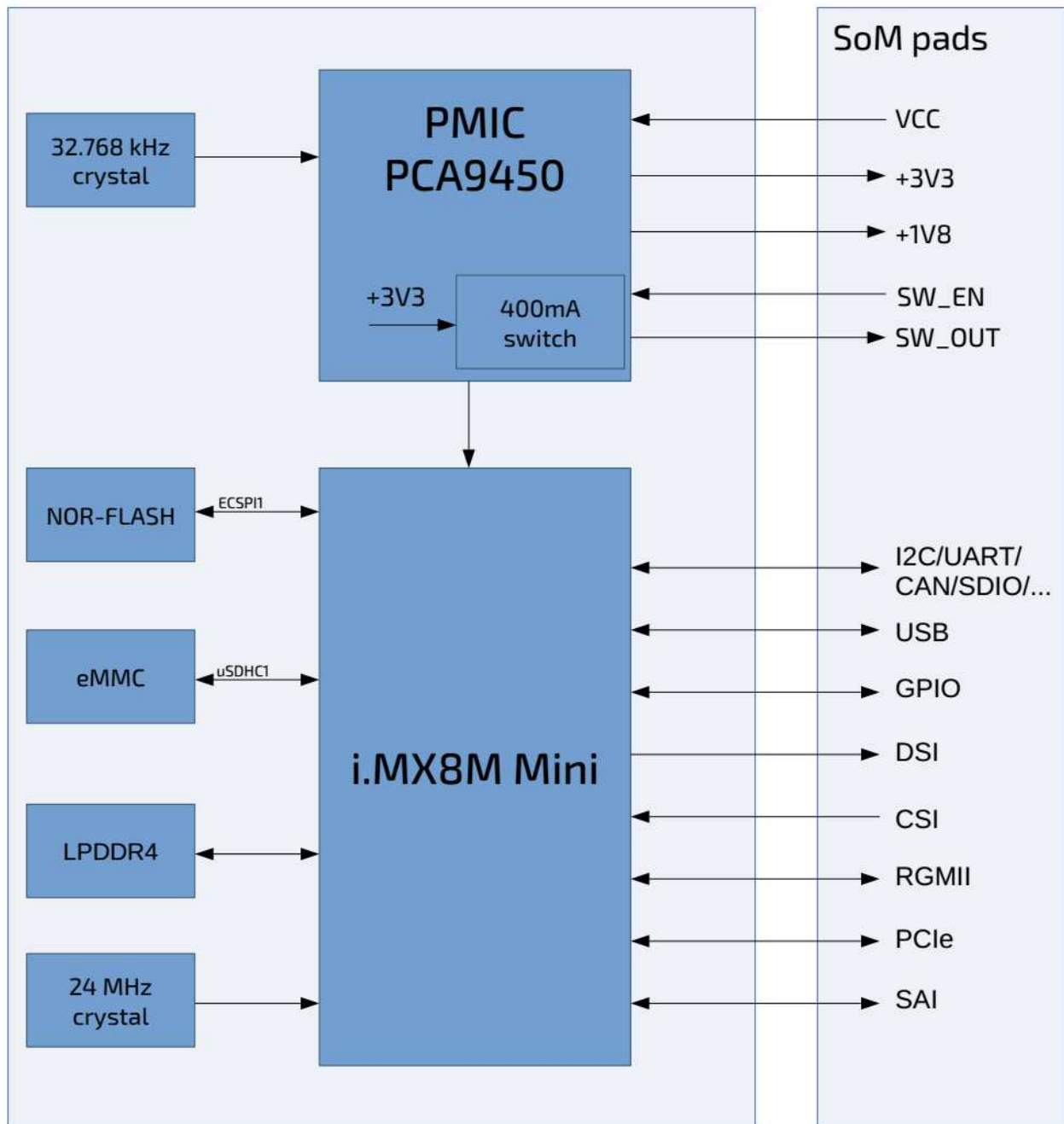
Table 3: Environmental Conditions

|                  |                                                                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Operating</b> | <ul style="list-style-type: none"> <li>▶ industrial: -25°C to 85°C</li> <li>▶ relative humidity (non-condensing) 10 % to 93 % at 40°C</li> </ul>        |
| <b>Storage</b>   | <ul style="list-style-type: none"> <li>▶ commercial grade: -40°C to +85°C</li> <li>▶ relative humidity (non-condensing) 10 % to 93 % at 40°C</li> </ul> |

### 3.3. Functional Block Diagram

The block diagram shows a detailed structure of the SL iMX8MM module.

Figure 2: Block Diagram





## 4/ Board and Connectors

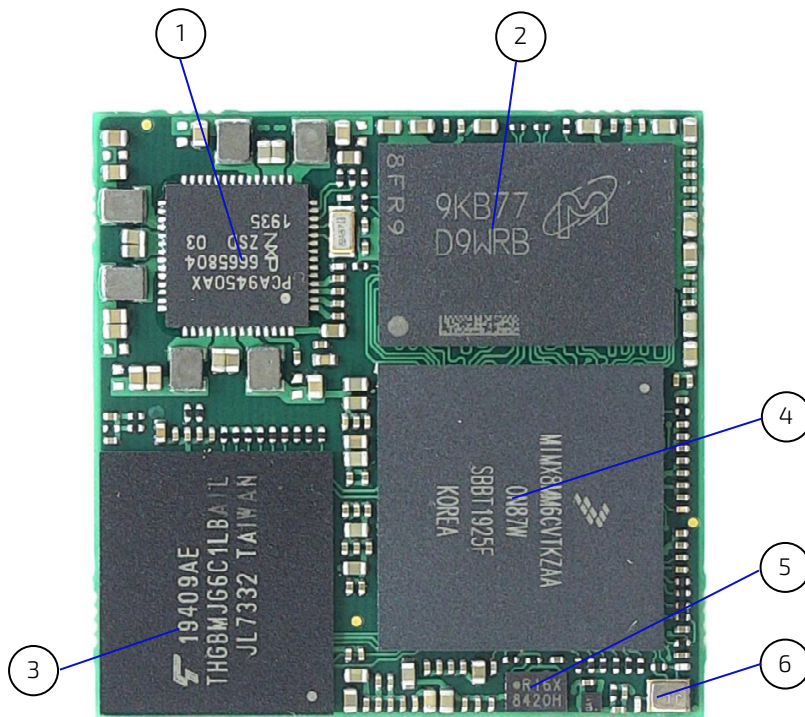
### 4.1.1. Connectors

Table 4: Connectors of SL iMX8MM

| Connector   | Function          | Remark     |
|-------------|-------------------|------------|
| LGA package | Central Interface | solderable |

### 4.2. SoM view and locations

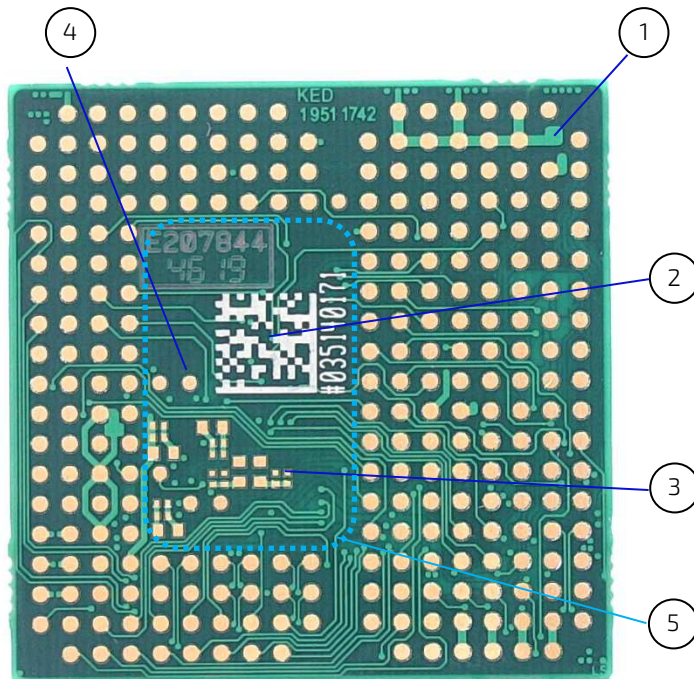
Figure 3: Top View



1. PMIC
2. LPDDR4
3. eMMC
4. i.MX8M Mini
5. NOR-Flash
6. Crystal

### 4.3. Bottom Side

Figure 4: Bottom View



1. Pin 1 marking (missing pin)
2. Unique ID
3. Optional Components
4. Test points (factory use only)
5. Keep out area on base board

## 4.4. Mechanical Drawings

Figure 5: Dimensions of SL iMX8MM

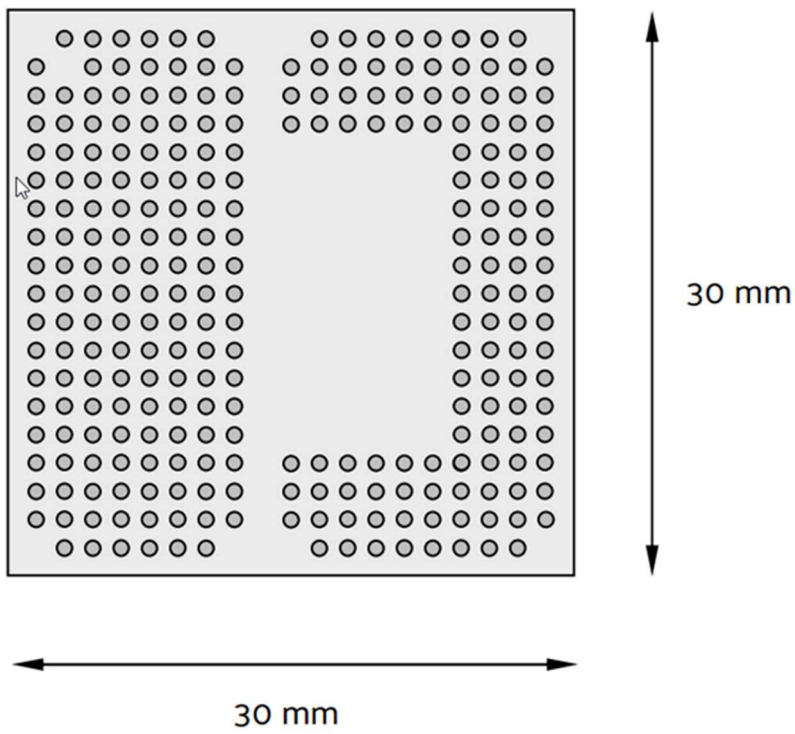


Figure 6: Footprint Grid

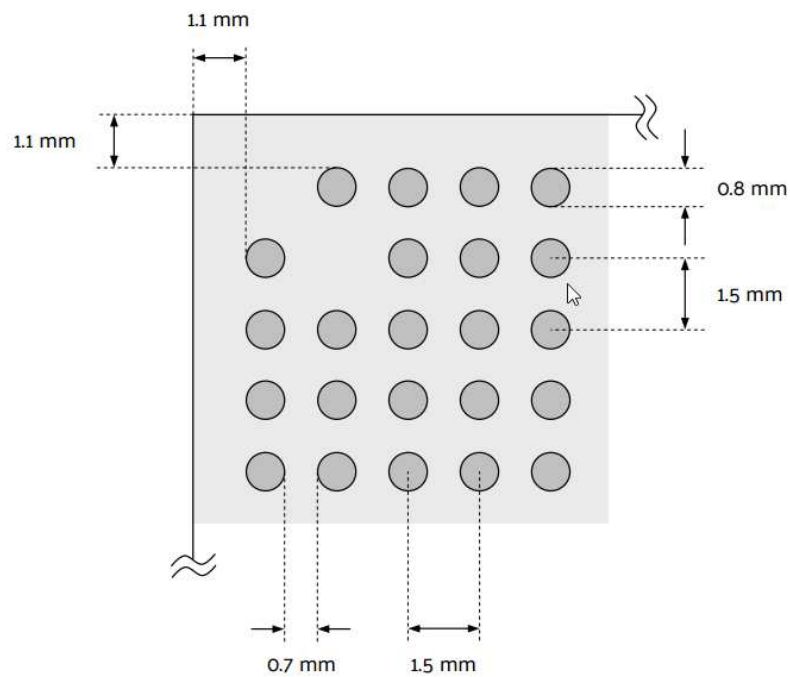
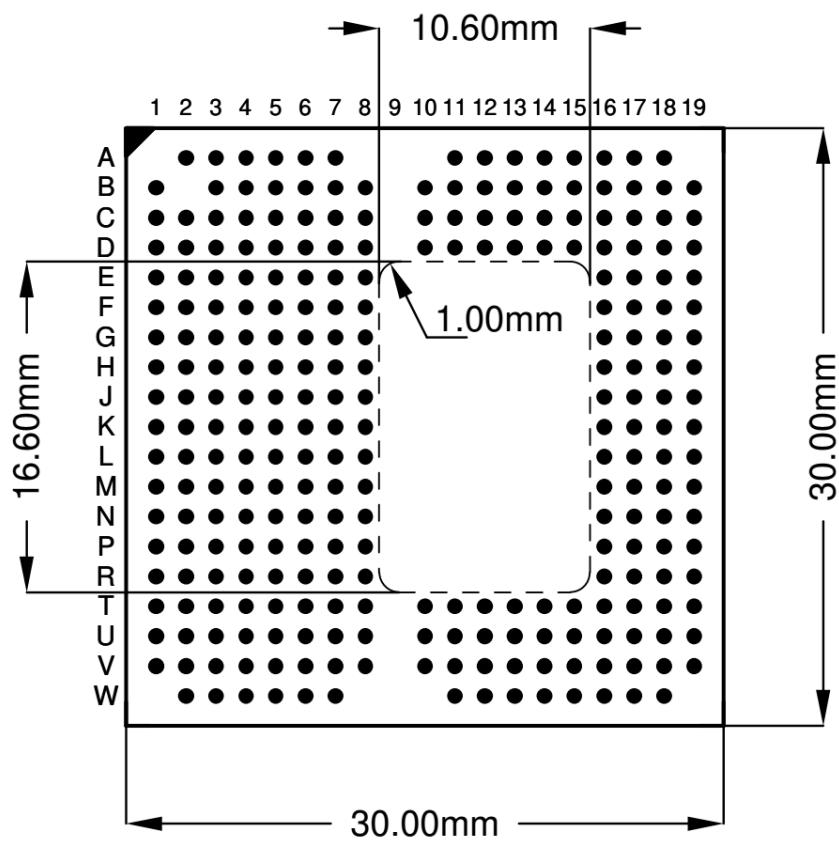
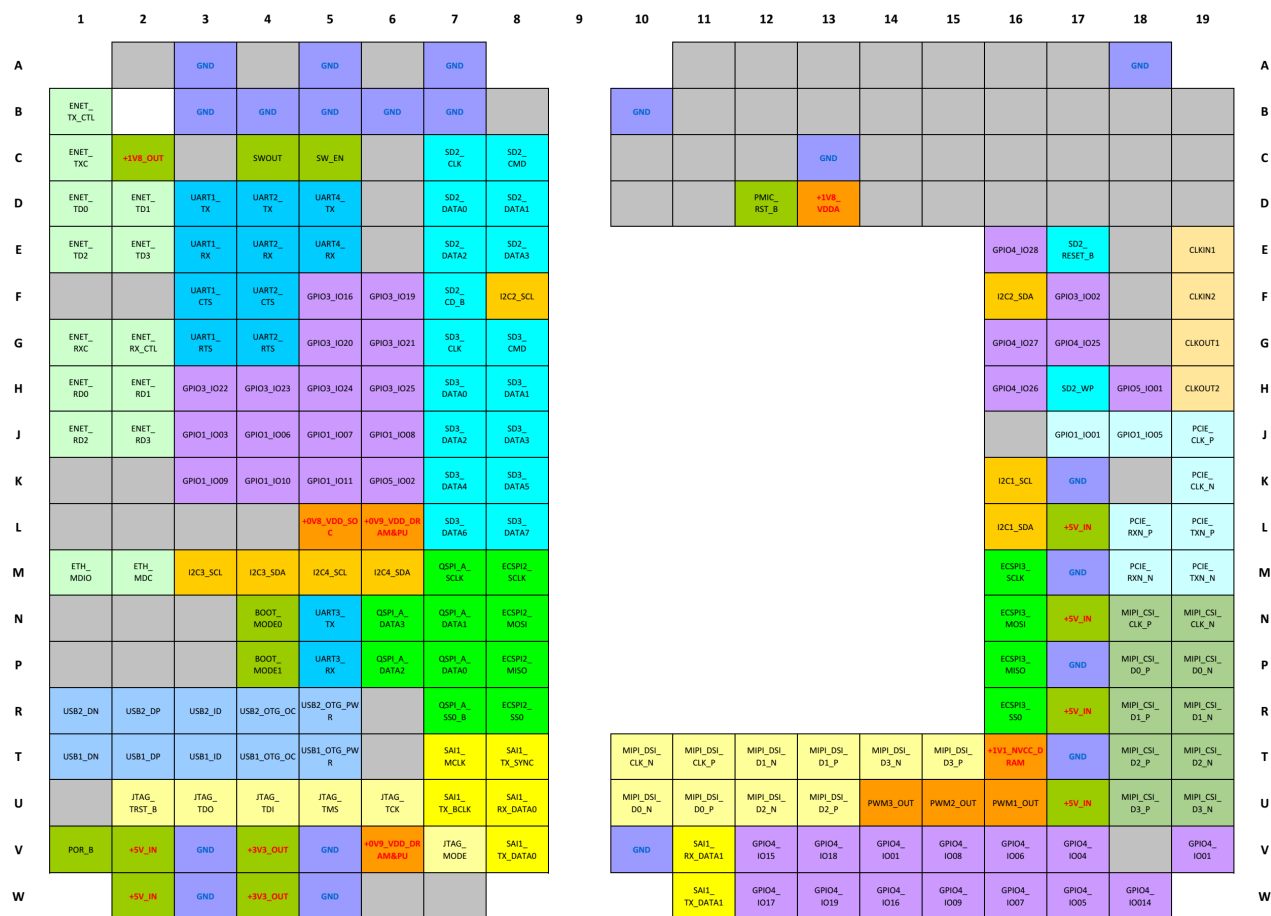


Figure 7: Keep out area on baseboard (top view)



## 4.5. Pinout diagram of SL iMX8MM

Figure 8: pin assignment (top view)



## 4.5.1. Pinout of SL iMX8MM

Table 5: Pinout of SL iMX8MM

| Pin | Signal             | Module Direction | Module Termination | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|--------------------|------------------|--------------------|--------------------|-------------|---------------------|
| A2  | -                  | -                | -                  | -                  | -           | -                   |
| A3  | GND                | -                | -                  | -                  | -           | -                   |
| A4  | -                  | -                | -                  | -                  | -           | -                   |
| A5  | GND                | -                | -                  | -                  | -           | -                   |
| A6  | -                  | -                | -                  | -                  | -           | -                   |
| A7  | GND                | -                | -                  | -                  | -           | -                   |
| A11 | -                  | -                | -                  | -                  | -           | -                   |
| A12 | -                  | -                | -                  | -                  | -           | -                   |
| A13 | -                  | -                | -                  | -                  | -           | -                   |
| A14 | -                  | -                | -                  | -                  | -           | -                   |
| A15 | -                  | -                | -                  | -                  | -           | -                   |
| A16 | -                  | -                | -                  | -                  | -           | -                   |
| A17 | -                  | -                | -                  | -                  | -           | -                   |
| A18 | GND                | -                | -                  | -                  | -           | -                   |
| B1  | ENET1_RGMII_TX_CTL | Out              | -                  | +1.8 V             | i.MX8M Mini | ENET_TX_CTL         |
| B3  | GND                | -                | -                  | -                  | -           | -                   |
| B4  | GND                | -                | -                  | -                  | -           | -                   |
| B5  | GND                | -                | -                  | -                  | -           | -                   |
| B6  | GND                | -                | -                  | -                  | -           | -                   |
| B7  | GND                | -                | -                  | -                  | -           | -                   |
| B8  | -                  | -                | -                  | -                  | -           | -                   |
| B10 | GND                | -                | -                  | -                  | -           | -                   |
| B11 | -                  | -                | -                  | -                  | -           | -                   |
| B12 | -                  | -                | -                  | -                  | -           | -                   |
| B13 | -                  | -                | -                  | -                  | -           | -                   |
| B14 | -                  | -                | -                  | -                  | -           | -                   |
| B15 | -                  | -                | -                  | -                  | -           | -                   |
| B16 | -                  | -                | -                  | -                  | -           | -                   |
| B17 | -                  | -                | -                  | -                  | -           | -                   |
| B18 | -                  | -                | -                  | -                  | -           | -                   |
| B19 | -                  | -                | -                  | -                  | -           | -                   |
| C1  | ENET1_RGMII_TXC    | Out              | -                  | +1.8 V             | i.MX8M Mini | ENET_TXC            |
| C2  | +1V8_OUT           | PWR Out          | -                  | -                  | PCA9450     | BUCK5               |
| C3  | -                  | -                | -                  | -                  | -           | -                   |
| C4  | SWOUT              | PWR Out          | -                  | -                  | PCA9450     | SWOUT               |
| C5  | SW_EN              | In               | -                  | +3.3 V             | PCA9450     | SW_EN               |
| C6  | -                  | -                | -                  | -                  | -           | -                   |
| C7  | USDHC2_CLK         | Out              | -                  | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_CLK             |
| C8  | USDHC2_CMD         | Bi-Dir           | -                  | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_CMD             |
| C10 | -                  | -                | -                  | -                  | -           | -                   |
| C11 | -                  | -                | -                  | -                  | -           | -                   |
| C12 | -                  | -                | -                  | -                  | -           | -                   |
| C13 | GND                | -                | -                  | -                  | -           | -                   |
| C14 | -                  | -                | -                  | -                  | -           | -                   |

| Pin | Signal          | Module Direction | Module Termination   | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|-----------------|------------------|----------------------|--------------------|-------------|---------------------|
| C15 | -               | -                | -                    | -                  | -           | -                   |
| C16 | -               | -                | -                    | -                  | -           | -                   |
| C17 | -               | -                | -                    | -                  | -           | -                   |
| C18 | -               | -                | -                    | -                  | -           | -                   |
| C19 | -               | -                | -                    | -                  | -           | -                   |
| D1  | ENET1_RGMII_TD0 | Out              | -                    | +1.8 V             | i.MX8M Mini | ENET_TD0            |
| D2  | ENET1_RGMII_TD1 | Out              | -                    | +1.8 V             | i.MX8M Mini | ENET_TD1            |
| D3  | UART1_TX        | Out              | -                    | +3.3 V             | i.MX8M Mini | SAI2_RXFS           |
| D4  | UART2_TX        | Out              | -                    | +3.3 V             | i.MX8M Mini | SAI3_TXC            |
| D5  | UART4_TX        | Out              | -                    | +3.3 V             | i.MX8M Mini | UART4_TXD           |
| D6  | -               | -                | -                    | -                  | -           | -                   |
| D7  | USDHC2_DATA0    | Bi-Dir           | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_DATA0           |
| D8  | USDHC2_DATA1    | Bi-Dir           | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_DATA1           |
| D10 | -               | -                | -                    | -                  | -           | -                   |
| D11 | -               | -                | -                    | -                  | -           | -                   |
| D12 | PMIC_RST_B      | In               | PU to +1V8_NVCC_SNV5 | +1V8               | PCA9450     | PMIC_RST_B          |
| D13 | +1V8_VDDA       | PWR              | -                    | -                  | PCA9450     | LD03                |
| D14 | -               | -                | -                    | -                  | -           | -                   |
| D15 | -               | -                | -                    | -                  | -           | -                   |
| D16 | -               | -                | -                    | -                  | -           | -                   |
| D17 | -               | -                | -                    | -                  | -           | -                   |
| D18 | -               | -                | -                    | -                  | -           | -                   |
| D19 | -               | -                | -                    | -                  | -           | -                   |
| E1  | ENET1_RGMII_TD2 | Out              | -                    | +1.8 V             | i.MX8M Mini | ENET_TD2            |
| E2  | ENET1_RGMII_TD3 | Out              | -                    | +1.8 V             | i.MX8M Mini | ENET_TD3            |
| E3  | UART1_RX        | In               | -                    | +3.3 V             | i.MX8M Mini | SAI2_RXC            |
| E4  | UART2_RX        | In               | -                    | +3.3 V             | i.MX8M Mini | SAI3_TXFS           |
| E5  | UART4_RX        | In               | -                    | +3.3 V             | i.MX8M Mini | UART4_RXD           |
| E6  | -               | -                | -                    | -                  | -           | -                   |
| E7  | USDHC2_DATA2    | Bi-Dir           | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_DATA2           |
| E8  | USDHC2_DATA3    | Bi-Dir           | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_DATA3           |
| E16 | GPIO4_I028      | Bi-Dir           | -                    | +3.3 V             | i.MX8M Mini | SAI3_RXFS           |
| E17 | USDHC2_RESET_B  | Out              | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_RESET_B         |
| E18 | -               | -                | -                    | -                  | -           | -                   |
| E19 | CLKIN1          | In               | -                    | +1.8 V             | i.MX8M Mini | CLKIN1              |
| F1  | -               | -                | -                    | -                  | -           | -                   |
| F2  | -               | -                | -                    | -                  | -           | -                   |
| F3  | UART1_CTS       | Out              | -                    | +3.3 V             | i.MX8M Mini | SAI2_TXFS           |
| F4  | UART2_CTS       | Out              | -                    | +3.3 V             | i.MX8M Mini | SAI3_RXC            |
| F5  | GPIO3_I016      | Bi-Dir           | -                    | +3.3 V             | i.MX8M Mini | NAND_READY_B        |
| F6  | GPIO3_I019      | Bi-Dir           | -                    | +3.3 V             | i.MX8M Mini | SAI5_RXFS           |
| F7  | USDHC2_CD_B     | In               | -                    | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_CD_B            |
| F8  | I2C2_SCL        | In               | -                    | +3.3 V             | i.MX8M Mini | I2C2_SCL            |
| F16 | I2C2_SDA        | Bi-Dir           | -                    | +3.3 V             | i.MX8M Mini | I2C2_SDA            |
| F17 | GPIO3_I002      | Bi-Dir           | -                    | +3.3 V             | i.MX8M Mini | NAND_CE1_B          |
| F18 | -               | -                | -                    | -                  | -           | -                   |

| Pin | Signal             | Module Direction | Module Termination | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|--------------------|------------------|--------------------|--------------------|-------------|---------------------|
| F19 | CLKIN2             | In               | -                  | +1.8 V             | i.MX8M Mini | CLKIN2              |
| G1  | ENET1_RGMII_RXC    | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RXC            |
| G2  | ENET1_RGMII_RX_CTL | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RX_CTL         |
| G3  | UART1_RTS          | In               | -                  | +3.3 V             | i.MX8M Mini | SAI2_RXD0           |
| G4  | UART2_RTS          | In               | -                  | +3.3 V             | i.MX8M Mini | SAI3_RXD            |
| G5  | GPIO3_IO20         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_RXC            |
| G6  | GPIO3_IO21         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_RXD0           |
| G7  | USDHC3_CLK         | Out              | -                  | +3.3 V             | i.MX8M Mini | NAND_WE_B           |
| G8  | USDHC3_CMD         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_WP_B           |
| G16 | GPIO4_IO27         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI2_MCLK           |
| G17 | GPIO4_IO25         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI2_TXC            |
| G18 | -                  | -                | -                  | -                  | -           | -                   |
| G19 | CLKOUT1            | Out              | -                  | +1.8 V             | i.MX8M Mini | CLKOUT1             |
| H1  | ENET1_RGMII_RD0    | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RD0            |
| H2  | ENET1_RGMII_RD1    | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RD1            |
| H3  | GPIO3_IO22         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_RXD1           |
| H4  | GPIO3_IO23         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_RXD2           |
| H5  | GPIO3_IO24         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_RXD3           |
| H6  | GPIO3_IO25         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI5_MCLK           |
| H7  | USDHC3_DATA0       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA04         |
| H8  | USDHC3_DATA1       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA05         |
| H16 | GPIO4_IO26         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI2_TXD0           |
| H17 | USDHC2_WP          | In               | -                  | +1.8 V/+3.3 V      | i.MX8M Mini | SD2_WP              |
| H18 | GPIO5_IO01         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI3_TXD            |
| H19 | CLKOUT2            | Out              | -                  | +1.8 V             | i.MX8M Mini | CLKOUT2             |
| J1  | ENET1_RGMII_RD2    | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RD2            |
| J2  | ENET1_RGMII_RD3    | In               | -                  | +1.8 V             | i.MX8M Mini | ENET_RD3            |
| J3  | GPIO1_IO03         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO03          |
| J4  | GPIO1_IO06         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO06          |
| J5  | GPIO1_IO07         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO07          |
| J6  | GPIO1_IO08         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO08          |
| J7  | USDHC3_DATA2       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA06         |
| J8  | USDHC3_DATA3       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA07         |
| J16 | -                  | -                | -                  | -                  | -           | -                   |
| J17 | GPIO1_IO01         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO01          |
| J18 | GPIO1_IO05         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO05          |
| J19 | PCIE_CLK_P         | Out              | -                  | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_CLK_P          |
| K1  | -                  | -                | -                  | -                  | -           | -                   |
| K2  | -                  | -                | -                  | -                  | -           | -                   |
| K3  | GPIO1_IO09         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO09          |
| K4  | GPIO1_IO10         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO10          |
| K5  | GPIO1_IO11         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | GPIO1_IO11          |
| K6  | GPIO5_IO02         | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI3_MCLK           |
| K7  | USDHC3_DATA4       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_RE_B           |
| K8  | USDHC3_DATA5       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_CE2_B          |
| K16 | I2C1_SCL           | Out              | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C1_SCL            |
| K17 | GND                | -                | -                  | -                  | -           | -                   |



| Pin | Signal           | Module Direction | Module Termination | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|------------------|------------------|--------------------|--------------------|-------------|---------------------|
| K18 | -                | -                | -                  | -                  | -           | -                   |
| K19 | PCIE_CLK_N       | Out              | -                  | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_CLK_N          |
| L1  | -                | -                | -                  | -                  | -           | -                   |
| L2  | -                | -                | -                  | -                  | -           | -                   |
| L3  | -                | -                | -                  | -                  | -           | -                   |
| L4  | -                | -                | -                  | -                  | -           | -                   |
| L5  | +0V8_VDD_SOC     | PWR              | -                  | -                  | PCA9450     | BUCK1               |
| L6  | +0V9_VDD_DRAM&PU | PWR              | -                  | -                  | PCA9450     | BUCK3               |
| L7  | USDHC3_DATA6     | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_CE3_B          |
| L8  | USDHC3_DATA7     | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_CLE            |
| L16 | I2C1_SDA         | Bi-Dir           | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C1_SDA            |
| L17 | +5V_IN           | PWR              | -                  | -                  | -           | -                   |
| L18 | PCIE_RXN_P       | In               | -                  | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_RXN_P          |
| L19 | PCIE_TXN_P       | Out              | Seriell-100n       | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_TXN_P          |
| M1  | ENET1_MDIO       | Bi-Dir           | -                  | +1.8 V             | i.MX8M Mini | ENET_MDIO           |
| M2  | ENET1_MDC        | Out              | -                  | +1.8 V             | i.MX8M Mini | ENET_MDC            |
| M3  | I2C3_SCL         | Out              | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C3_SCL            |
| M4  | I2C3_SDA         | Bi-Dir           | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C3_SDA            |
| M5  | I2C4_SCL         | Out              | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C4_SCL            |
| M6  | I2C4_SDA         | Bi-Dir           | PU-4k75            | +3.3 V             | i.MX8M Mini | I2C4_SDA            |
| M7  | QSPIA_SCLK       | Out              | -                  | +3.3 V             | i.MX8M Mini | NAND_ALE            |
| M8  | ECSPI2_SCLK      | Out              | -                  | +3.3 V             | i.MX8M Mini | ECSPI2_SCLK         |
| M16 | ECSPI3_SCLK      | Out              | -                  | +3.3 V             | i.MX8M Mini | UART1_RXD           |
| M17 | GND              | -                | -                  | -                  | -           | -                   |
| M18 | PCIE_RXN_N       | In               | -                  | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_RXN_N          |
| M19 | PCIE_TXN_N       | Out              | Seriell-100n       | +1.8 V/LVDS PCIe   | i.MX8M Mini | PCIE_TXN_N          |
| N1  | -                | -                | -                  | -                  | -           | -                   |
| N2  | -                | -                | -                  | -                  | -           | -                   |
| N3  | -                | -                | -                  | -                  | -           | -                   |
| N4  | BOOT_MODE0       | In               | PD                 | +3.3 V             | i.MX8M Mini | BOOT_MODE0          |
| N5  | UART3_TX         | Out              | -                  | +3.3 V             | i.MX8M Mini | UART3_TXD           |
| N6  | QSPIA_DATA3      | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA03         |
| N7  | QSPIA_DATA1      | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA01         |
| N8  | ECSPI2_MOSI      | Out              | -                  | +3.3 V             | i.MX8M Mini | ECSPI2_MOSI         |
| N16 | ECSPI3_MOSI      | Out              | -                  | +3.3 V             | i.MX8M Mini | UART1_TXD           |
| N17 | +5V_IN           | PWR              | -                  | -                  | -           | -                   |
| N18 | MIPI_CSI_CLK_P   | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_CLK_P      |
| N19 | MIPI_CSI_CLK_N   | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_CLK_N      |
| P1  | -                | -                | -                  | -                  | -           | -                   |
| P2  | -                | -                | -                  | -                  | -           | -                   |
| P3  | -                | -                | -                  | -                  | -           | -                   |
| P4  | BOOT_MODE1       | In               | PD                 | +3.3 V             | i.MX8M Mini | BOOT_MODE1          |
| P5  | UART3_RX         | In               | -                  | +3.3 V             | i.MX8M Mini | UART3_RXD           |
| P6  | QSPIA_DATA2      | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA02         |
| P7  | QSPIA_DATA0      | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | NAND_DATA00         |
| P8  | ECSPI2_MISO      | In               | -                  | +3.3 V             | i.MX8M Mini | ECSPI2_MISO         |
| P16 | ECSPI3_MISO      | In               | -                  | +3.3 V             | i.MX8M Mini | UART2_RXD           |

| Pin | Signal         | Module Direction | Module Termination | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|----------------|------------------|--------------------|--------------------|-------------|---------------------|
| P17 | GND            | -                | -                  | -                  | -           | -                   |
| P18 | MIPI_CSI_D0_P  | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D0_P       |
| P19 | MIPI_CSI_D0_N  | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D0_N       |
| R1  | USB2_DN        | Bi-Dir           | -                  | USB                | i.MX8M Mini | USB2_DN             |
| R2  | USB2_DP        | Bi-Dir           | -                  | USB                | i.MX8M Mini | USB2_DP             |
| R3  | USB2_ID        | In               | -                  | +1.8 V             | i.MX8M Mini | USB2_ID             |
| R4  | USB2_OTG_OC    | In               | -                  | +3.3 V             | i.MX8M Mini | GPIO1_I015          |
| R5  | USB2_OTG_PWR   | Out              | -                  | +3.3 V             | i.MX8M Mini | GPIO1_I014          |
| R6  | -              | -                | -                  | -                  | -           | -                   |
| R7  | QSPI_A_SS0_B   | Out              | PU-10k             | +3.3 V             | i.MX8M Mini | NAND_CE0_B          |
| R8  | ECSPi2_SS0     | Out              | -                  | +3.3 V             | i.MX8M Mini | ECSPi2_SS0          |
| R16 | ECSPi3_SS0     | Out              | -                  | +3.3 V             | i.MX8M Mini | UART2_TXD           |
| R17 | +5V_IN         | PWR              | -                  | -                  | -           | -                   |
| R18 | MIPI_CSI_D1_P  | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D1_P       |
| R19 | MIPI_CSI_D1_N  | In               | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D1_N       |
| T1  | USB1_DN        | Bi-Dir           | -                  | USB                | i.MX8M Mini | USB1_DN             |
| T2  | USB1_DP        | Bi-Dir           | -                  | USB                | i.MX8M Mini | USB1_DP             |
| T3  | USB1_ID        | In               | -                  | +1.8 V             | i.MX8M Mini | USB1_ID             |
| T4  | USB1_OTG_OC    | In               | -                  | +3.3 V             | i.MX8M Mini | GPIO1_I013          |
| T5  | USB1_OTG_PWR   | Out              | -                  | +3.3 V             | i.MX8M Mini | GPIO1_I012          |
| T6  | -              | -                | -                  | -                  | -           | -                   |
| T7  | SAI1_MCLK      | Out              | -                  | +3.3 V             | i.MX8M Mini | SAI1_MCLK           |
| T8  | SAI1_TX_SYNC   | Out              | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXFS           |
| T10 | MIPI_DSI_CLK_N | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_CLK_N      |
| T11 | MIPI_DSI_CLK_P | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_CLK_P      |
| T12 | MIPI_DSI_D1_N  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D1_N       |
| T13 | MIPI_DSI_D1_P  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D1_P       |
| T14 | MIPI_DSI_D3_N  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D3_N       |
| T15 | MIPI_DSI_D3_P  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D3_P       |
| T16 | +1V1_NVCC_DRAM | PWR              | -                  | -                  | PCA9450     | BUCK6               |
| T17 | GND            | -                | -                  | -                  | -           | -                   |
| T18 | MIPI_CSI_D2_P  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D2_P       |
| T19 | MIPI_CSI_D2_N  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D2_N       |
| U1  | -              | -                | -                  | -                  | -           | -                   |
| U2  | JTAG_TRST_B    | In               | -                  | +3.3 V             | i.MX8M Mini | JTAG_TRST_B         |
| U3  | JTAG_TDO       | Out              | -                  | +3.3 V             | i.MX8M Mini | JTAG_TDO            |
| U4  | JTAG_TDI       | In               | -                  | +3.3 V             | i.MX8M Mini | JTAG_TDI            |
| U5  | JTAG_TMS       | In               | -                  | +3.3 V             | i.MX8M Mini | JTAG_TMS            |
| U6  | JTAG_TCK       | In               | -                  | +3.3 V             | i.MX8M Mini | JTAG_TCK            |
| U7  | SAI1_TX_BCLK   | Out              | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXC            |
| U8  | SAI1_RX_DATA0  | In               | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD0           |
| U10 | MIPI_DSI_D0_N  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D0_N       |
| U11 | MIPI_DSI_D0_P  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D0_P       |
| U12 | MIPI_DSI_D2_N  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D2_N       |
| U13 | MIPI_DSI_D2_P  | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_DSI_D2_P       |
| U14 | PWM3_OUT       | Out              | -                  | +3.3 V             | i.MX8M Mini | SPDIF_TX            |
| U15 | PWM2_OUT       | Out              | -                  | +3.3 V             | i.MX8M Mini | SPDIF_RX            |

| Pin | Signal           | Module Direction | Module Termination | Voltage Level/Type | Controller  | Controller Pin Name |
|-----|------------------|------------------|--------------------|--------------------|-------------|---------------------|
| U16 | PWM1_OUT         | Out              | -                  | +3.3 V             | i.MX8M Mini | SPDIF_EXT_CLK       |
| U17 | +5V_IN           | PWR              | -                  | -                  | -           | -                   |
| U18 | MIPI_CSI_D3_P    | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D3_P       |
| U19 | MIPI_CSI_D3_N    | Out              | -                  | +1.8 V/LVDS D-PHY  | i.MX8M Mini | MIPI_CSI_D3_N       |
| V1  | POR_B            | In               | PU-100k            | +1.8 V             | i.MX8M Mini | POR_B               |
| V2  | +5V_IN           | PWR              | -                  | -                  | -           | -                   |
| V3  | GND              | -                | -                  | -                  | -           | -                   |
| V4  | +3V3_OUT         | PWR Out          | -                  | -                  | PCA9450     | BUCK4               |
| V5  | GND              | -                | -                  | -                  | -           | -                   |
| V6  | +0V9_VDD_DRAM&PU | PWR              |                    |                    | PCA9450     | BUCK3               |
| V7  | JTAG_MODE        | In               | PD-4k75            | +3.3 V             | i.MX8M Mini | JTAG_MOD            |
| V8  | SAI1_TX_DATA0    | Out              | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD0           |
| V10 | GND              | -                | -                  | -                  | -           | -                   |
| V11 | SAI1_RX_DATA1    | In               | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD1           |
| V12 | GPIO4_I015       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD3           |
| V13 | GPIO4_I018       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD6           |
| V14 | GPIO4_I001       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXF5           |
| V15 | GPIO4_I008       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD6           |
| V16 | GPIO4_I006       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD4           |
| V17 | GPIO4_I004       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD2           |
| V18 | -                | -                | -                  | -                  | -           | -                   |
| V19 | GPIO4_I001       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXC            |
| W2  | +5V_IN           | PWR              | -                  | -                  | -           | -                   |
| W3  | GND              | -                | -                  | -                  | -           | -                   |
| W4  | +3V3_OUT         | PWR Out          | -                  | -                  | PCA9450     | BUCK4               |
| W5  | GND              | -                | -                  | -                  | -           | -                   |
| W6  | -                | -                | -                  | -                  | -           | -                   |
| W7  | -                | -                | -                  | -                  | -           | -                   |
| W11 | SAI1_TX_DATA1    | Out              | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD1           |
| W12 | GPIO4_I017       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD5           |
| W13 | GPIO4_I019       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD7           |
| W14 | GPIO4_I016       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD4           |
| W15 | GPIO4_I009       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD7           |
| W16 | GPIO4_I007       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD5           |
| W17 | GPIO4_I005       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_RXD3           |
| W18 | GPIO4_I014       | Bi-Dir           | -                  | +3.3 V             | i.MX8M Mini | SAI1_TXD2           |

## 5/ Installation

### 5.1. Power Control

#### 5.1.1. Power Supply

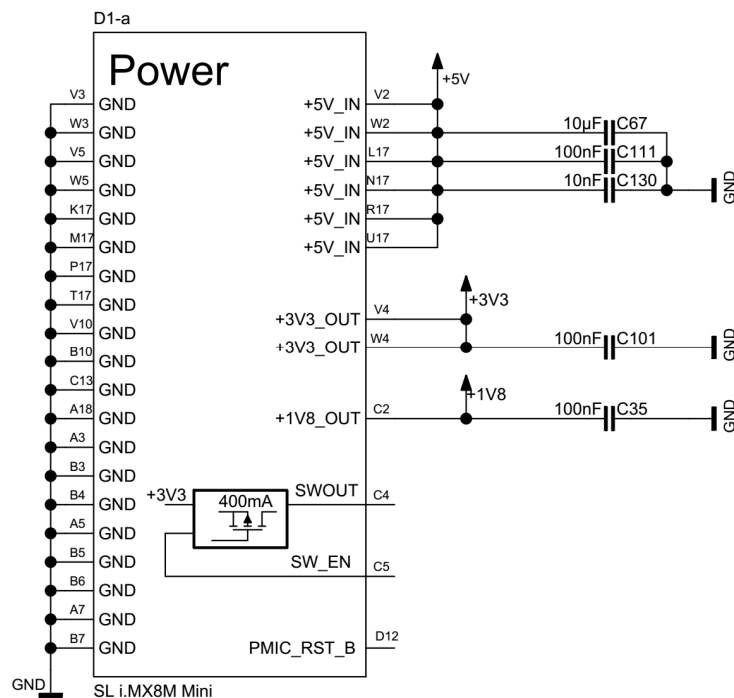
The SoM can be powered from a single 5V power source at +5V\_IN pin.

The power pins +1V8\_OUT (C2) and +3V3\_OUT (V4/W4) can be used to power peripherals on the mainboard with a maximum load of 1 A each.

#### NOTICE

There is no current limiting device for the voltage outputs. Drawing to much current may damage the device and/or lead to malfunction.

Figure 9: power supply scheme



The following parameters should be delivered from the carrier board:

- ▶ Voltage Ripple maximum 100 mV peak to peak 0-20 MHz to 20 ms rise time from input voltage <10% to nominal VCC

#### 5.1.2. Supply voltage

Table 6: Supply voltage

| Voltage | nominal | min | max |
|---------|---------|-----|-----|
| +5V_IN  | 5       | 4.5 | 5.5 |

### 5.1.3. Supply current

The supply current is measured on the SoM using the following commands:

Stresstest on all 4 CPUs:

```
stress-ng --matrix 0 -t 0
```

Stresstest on all 4 CPUs and RAM:

```
stress-ng --matrix 0 -t 0 --vm 4 --vm-bytes 50%
```

**Table 7: Supply current**

| Use case                    | mean   | max peak |
|-----------------------------|--------|----------|
| Linux running               | 170 mA |          |
| stresstest on 4xCPU         | 355 mA |          |
| stresstest on 4xCPU and RAM | 500 mA |          |
|                             |        |          |
|                             |        |          |

## 5.2. Reset pin

A low level at POR\_B triggers a reset. The module will stay in reset as long as POR\_B is grounded. Connect an open drain output or ground switch to POR\_B. If unused, this pin can be left floating. No external components are required.

## 5.3. Boot Mode

The BOOT\_MODE Pins have internal pull-downs. By default, these pins can be left floating to stay in "Boot from Fuses" mode. In this mode the SoM boots as programmed by Kontron.

### 5.3.1. SD/MMC manufacture mode

If no valid boot image is found on the programmed boot devices the SoM switches to SD/MMC manufacture mode before the serial download mode. In the manufacture mode, one-bit bus width is used on uSDHC2 interface to load a boot image from SD card.

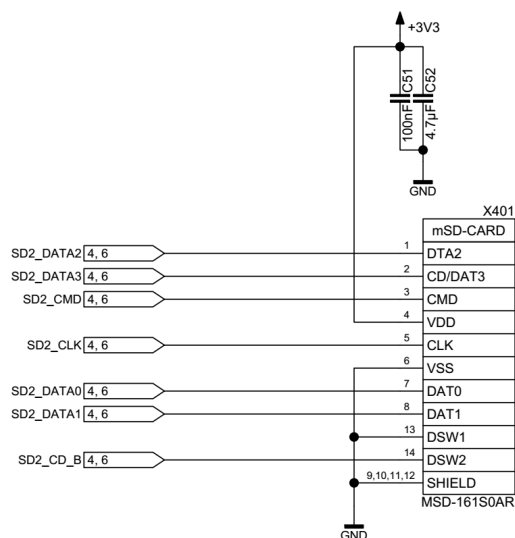
### 5.3.2. Serial Downloader

The Serial Downloader provides a means to download a program image to the chip over the USB OTG1 serial connection.

## 5.4. SD card

The i.MX8M Mini has three uSDHC interfaces that are compliant to SD/SDIO 3.0 with 200 MHz SDR signalling to support up to 100 MB/sec.

Figure 10: SD-Card connection example



If UHS-I mode is required uSDHC2 should be used as this interface is powered from a dedicated LDO and the supply can be switched from +3.3 V to +1.8 V by GPIO1\_I004 (SD2\_VSELECT).

## 6/ Thermal considerations



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TO BE DEFINED  
CONTENT FOLLOWS WITH NEXT DOCUMENT VERSION

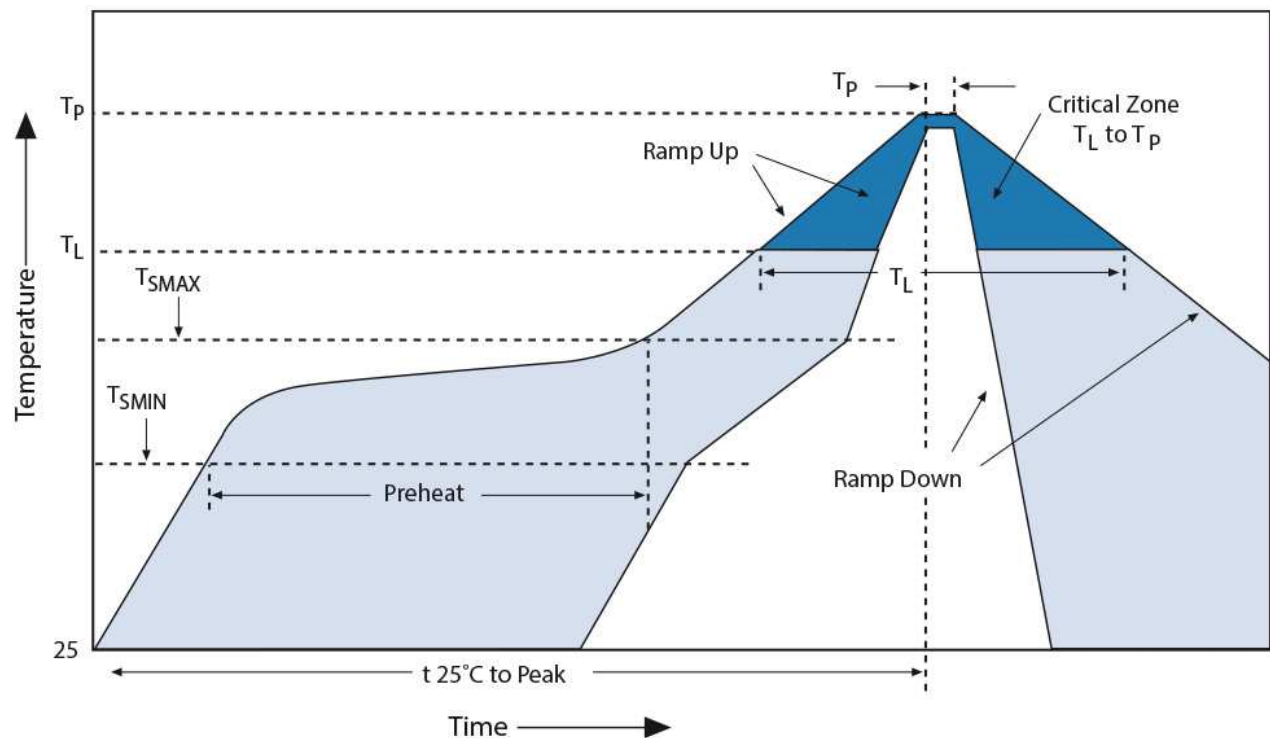
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## 7/ Reflow profile

Table 8: Reflow profile

| Profile Feature                                                | Pb-Free Assembly |
|----------------------------------------------------------------|------------------|
| Average Ramp-Up Rate ( $T_{S\text{MAX}}$ to $T_P$ )            | 3°C/second max.  |
| <b>Preheat</b>                                                 |                  |
| Temperature Min ( $T_{S\text{MIN}}$ )                          | 150 °C           |
| Temperature Max ( $T_{S\text{MAX}}$ )                          | 200 °C           |
| Time ( $t_s$ ) from ( $T_{S\text{MIN}}$ to $T_{S\text{MAX}}$ ) | 60-120 seconds   |
| Liquidous temperature ( $T_L$ )                                | 217 °C           |
| Time ( $t_L$ ) maintained above $T_L$                          | 60-80 seconds    |
| Peak/Classification Temperature ( $T_P$ )                      | 250 °C           |
| Time within 5 °C of actual peak temperature ( $t_p$ )          | 20 seconds       |
| Ramp-down rate                                                 | 6°C/second max   |
| Time 25 °C to peak temperature                                 | 8 minutes max    |

Figure 11: Reflow Classification Profile



To minimize the stress for the components, it is strongly recommended to solder the SoM during the last reflow cycle of the carrier board manufacturing process.



## 8/ Technical Support

### 8.1. First Steps – Startup-Information Baseboard

For the first startup of your Board, which includes the SL iMX8MM SoM, you will find more information about the Software / BSP and additional hardware information at the online documentation.

Please follow the link <https://docs.kontron-electronics.de/yocto-ktn/build-ktn-imx/>

The online documentation is primarily intended for our Eval-Kit / Evalboard, but will help you also to put your board into operation. Additionally, you will find information how to get access to the Yocto based GitLab software repository and how to make your own software images.

### 8.2. Extended Support

For detailed technical support please contact:

▶ E-Mail: [support@kontron-electronics.de](mailto:support@kontron-electronics.de)

### 8.3. Disclaimer & License Information

The software contained in the device (BSP) contains parts which were licensed as free respectively open source software under the GNU General Public License, version 2 and/or 3, respectively the GNU Lesser General Public License, versions 2.1 and/or 3.0.

You can obtain a copy of the source code of the BSP by following the instructions in the manual at <https://docs.kontron-electronics.de/build-system> or contact:

Kontron Electronics GmbH  
Kantstr. 10  
72663 Großbettlingen  
Germany  
Web: [www.kontron-electronics.de](http://www.kontron-electronics.de)  
E-Mail: [support@kontron-electronics.de](mailto:support@kontron-electronics.de)

## About Kontron Electronics

Kontron Electronics is your complete supplier of electronics and automation solutions. We offer

- ▶ own control products for the automation of machines and devices,
- ▶ Development and production for individual, complex electronic modules
- ▶ Production services for your existing electronic assemblies
- ▶ Assembly services for complete systems

With our existing control, visualisation and automation systems, we can put together turnkey complete solutions for your machines and equipment in the shortest possible time.

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