MicroSys

Creating Embedded Systems

miriac SBC-S32V234

User Manual

V 1.1

1 General Notes

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1.5 Symbols, Conventions and Abbreviations

1.5.1 Symbols

Throughout this document, the following symbols will be used:

	Information marked with this symbol MUST be obeyed to avoid the risk of severe injury, health danger, or major destruction of the unit and its environment
	Information marked with this symbol MUST be obeyed to avoid the risk of possible injury, permanent damage or malfunction of the unit.
	Information marked with this symbol gives important hints upon details of this manual, or in order to get the best use out of the product and its features.

Table 1 Symbols

1.5.2 Conventions

Symbol	explanation
#	denotes a low active signal
←	denotes the signal flow in the shown direction
→	denotes the signal flow in the shown direction
↔	denotes the signal flow in both directions
→	denotes the signal flow in the shown direction with additional logic / additional ICs in the signal path
I/O	denotes a bidirectional pin
Input	denotes an input pin
matched	denotes the according signal to be routed impedance controlled and length matched
Output	denotes an output pin
Pin 1	refers to the numeric pin of a component package
Pin a1	refers to the array position of a pin within a component package
XXX-	denotes the negative signal of a differential pair
XXX+	denotes the positive signal of a differential pair
XXX	denotes an optional not mounted or fitted part

Table 2 Conventions

2 Introduction

Thank you for choosing the MicroSys MPX-S32V234 module. This manual should help you to get the best performance and details out all of its features.

2.1 Safety and Handling Precautions

	**ALWAYS use the correct type and polarity of the power supply!** **DO NOT exceed the rated maximum values for the power supply! This may result in severe permanent damage to the unit, as well as possible serious injury.** **ALWAYS keep the unit dry, clean and free of foreign objects. Otherwise, irreparable damage may occur.**
	**Parts of the unit may become hot during operation. Take care not to touch any parts of the circuitry during operation to avoid burns, and operate the unit in a well-ventilated location. Provide an appropriate cooling solution as required.**
	**ALWAYS consider ESD when handling the unit.** **Many pins on external connectors are directly connected to the CPU or other ESD sensitive devices.** **Make or break connections ONLY while the unit is switched OFF.** **Otherwise, permanent damage to the unit may occur, which is not covered by warranty.**
	**There is no separate SHIELD connection.** **All the metal sheaths of shielded connectors are connected to GND.** **Also, all mounting holes of the carrier board are connected to GND.** **The module's mounting holes are not connected to GND** **Take this into account when handling and mounting the unit.**

Table 3 Safety and Handling Precautions

2.2 Short Description

The miriac MPX-S32V234 is a member of the MPX module family, based on NXP's S32V234 vision processing MPU

It targets the evaluation of the main interfaces of the S32V234 processor

2.3 Ordering Information

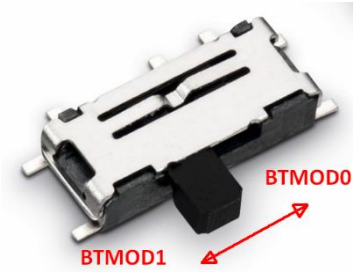
The MPX-S32V234 System-on-Module (SoM) is available in the following configurations:

Part No.	Title	Description
854901	miriac MPX-S32V234 SoM	NXP S32V234@1GHz CPU, 2GB DDR3L, standard temp 0C to +70C, no CSE
854902	miriac MPX-S32V234 SoM	NXP S32V234@1GHz CPU, 2GB DDR3L, extended temp -40C to +70C, no CSE
854903	miriac MPX-S32V234 SoM	NXP S32V234@1GHz CPU, 2GB DDR3L, extended temp -40C to +70C, with Cryptographic Service Engine (CSE)
854904	miriac MPX-S32V234 SoM	NXP S32V234@1GHz CPU, 2GB DDR3L, standard temp 0C to +70C, with Cryptographic Service Engine (CSE)

2.4 Board Preparation

- Make sure the BMD switch, located on the MPX-S32V module, is set properly in order to select the correct boot source.
  For more details see chapter **4.2 Boot Mode Configuration**

Figure 1: BMD Switch



- Make sure the GPU switch, located on the MPX-S32V234 module, is set properly in order to select the correct GPU supply.
  For more details see chapter **5.5 Switches**

Figure 2: GPU Switch

2.5 Software

When ordering MPX-S32V234 SoMs they are delivered with a version of U-Boot in the onboard eMMC which was used in the factory to test the module on MicroSys' CRX-32V carrier.
Assuming you are intending to mount the module on your own carrier, then you will need to modify U-Boot accordingly.

The SBC-S32V234 (which is the MPX-S32V234 module mounted on the CRX-32V carrier) is supported by NXP's automotive Linux BSP for S32. You can download the latest Linux BSP from:

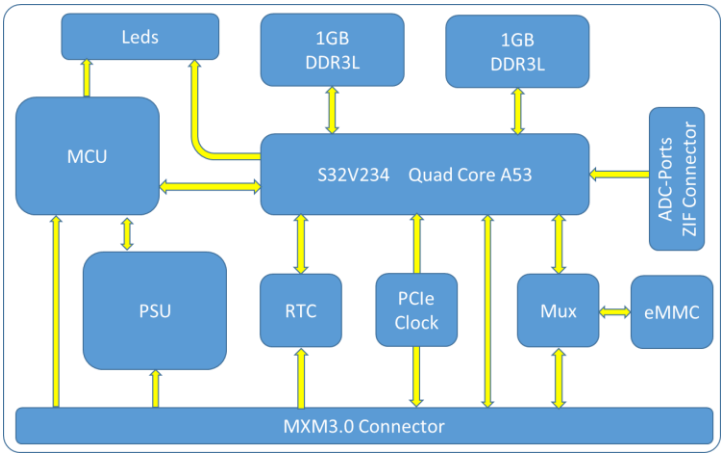
https://source.codeaurora.org/external/autobsps32/auto_yocto_bsp/

This should serve as your starting point for modifying U-Boot and Linux.
NXP has a release cadence of once every 3 months. As of September 2020, the current release is BSP 25.1

3 Module Description

This section describes all parts of the MPX-S32V234 module.

3.1 Block Diagram MPX-S32V234 Module



3.2 Feature Overview

Feature	Type	Description
CPU	NXP S32V234	Core Clock 1GHz Quad-Cortex®-A53 Single-Cortex®-M4
SDRAM	Dual 32-bit DDR3L interface	2 x up to 1GByte up to 1066MT/s
Mass Storage	8-bit eMMC	16 GByte
PCI Express	via MXM Connector	Rev.2.0 5Gbps Lane x1 RC/EP 100MHz Clock Source I2C support
Removable Media	via MXM Connector	For microSD cards 4/8-bit support
Ethernet	via MXM Connector	RGMII
Grahics Output	via MXM Connector	Parallel 24-bit
Video Input	MIPI-CSI-A	4 Lanes + Clock
	MIPI-CSI-B	4 Lanes + Clock
Serial Interfaces	via MXM Connector	UART0
	via MXM Connector	UART1
CAN Interface	via MXM Connector	CAN0
	via MXM Connector	CAN1
RTC	Time/Date	PCF85263A external backup
Board Control	S9KEAZN64A	Voltage supervision Reset logic Boot configuration Status LED
Switches	Sliding Swicthes	RCON/Serial Select GPU Power ON/Off
Indicators	LEDs	MCU Status Reset Status User GPIO1 User GPIO2
Connectors	Module Connectors	ADC Channel 0-7
		MCU Programming Port 314-pin MXM Conncetor

3.3 Mechanical Dimensions

3.3.1 MPX-S32V234 Module

The following drawing shows the mechanical outline of the MPX-S32V234 module that is plugged into the CRX-S32V carrier board.

NOTE

This drawing is not to scale.

NOTE

For 3D data files please contact MicroSys.

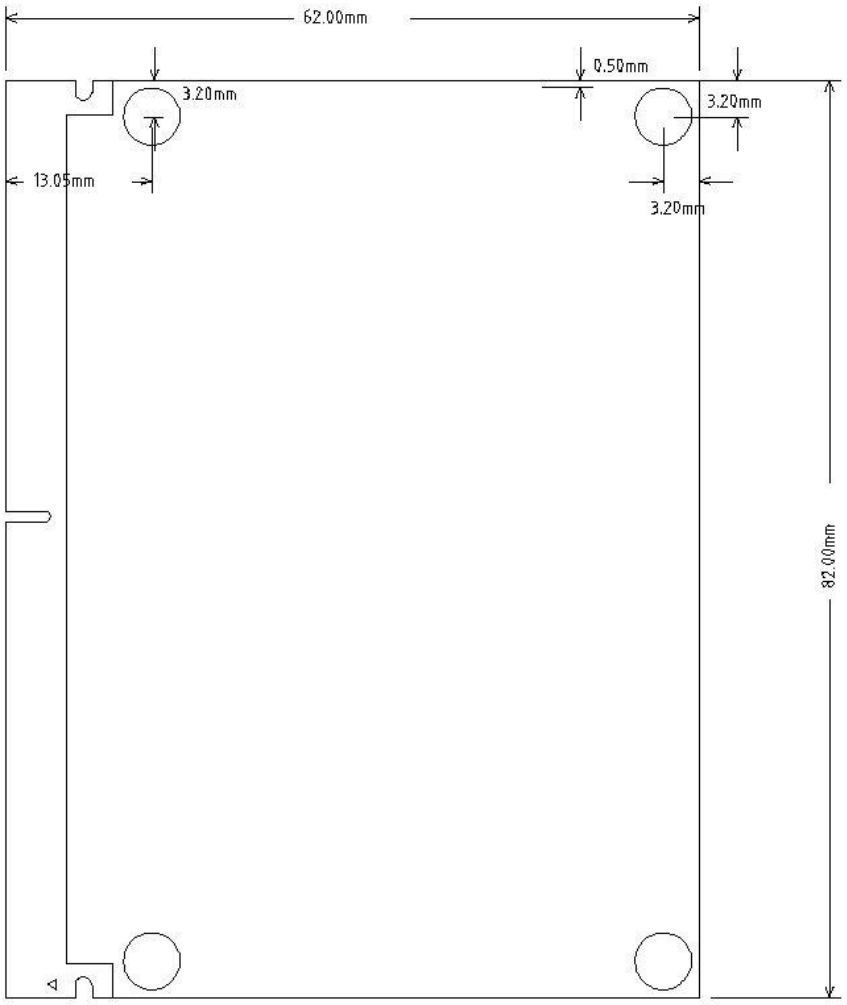
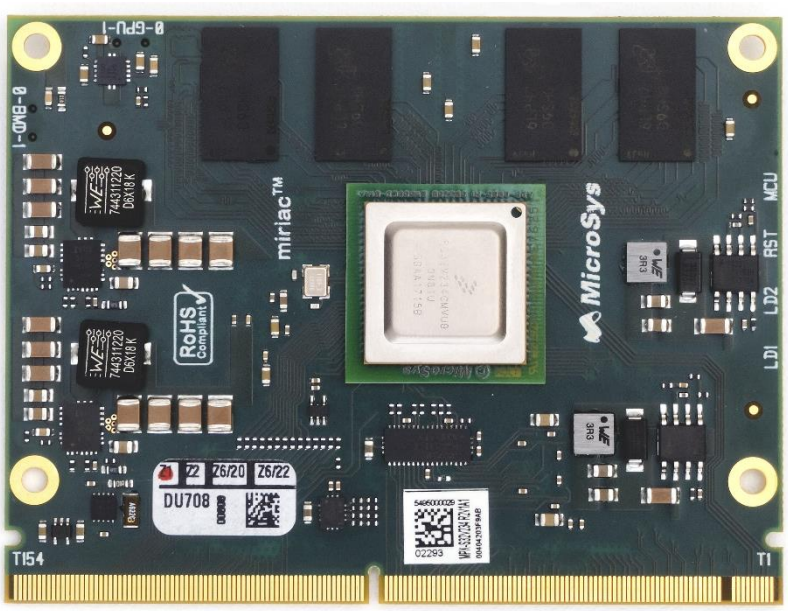
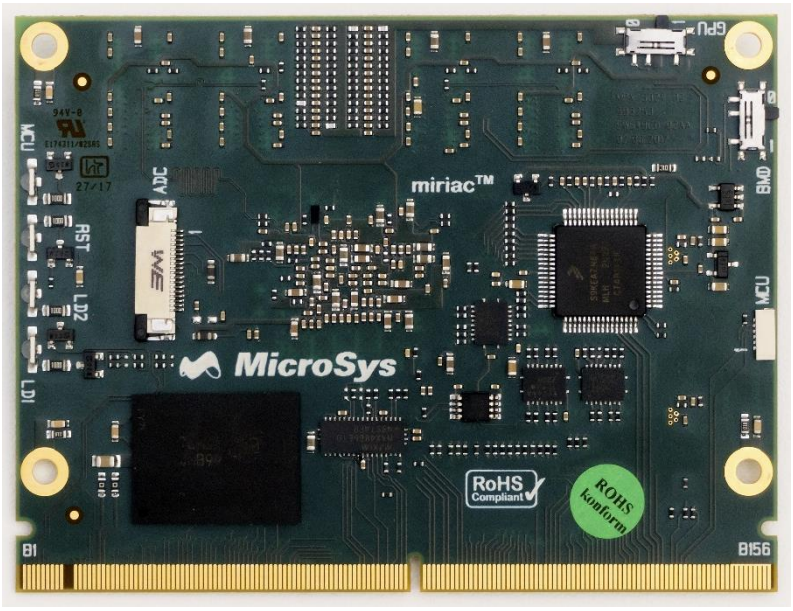


Figure 3 Mechanical Dimensions

3.4 Module Top Side



3.5 Module Bottom Side



3.7 System Environment

3.7.1 Temperature Ratings

The MPX-S32V234 contains parts with the following ambient, junction or case temperature ratings. Due to these limits, the system function is only guaranteed, if none of them are exceeded at any time. The MPX-S32V234 requires an adequate heatsink.

Part	Tmin	Tmax
C-0402-NP0-Series	-55°C	125°C
C-0402-X5R-Series	-55°C	85°C
C-0402-X7R-Series	-55°C	125°C
C-0603-226-X5R-Z	-55°C	85°C
C-0603-X7R-Series	-55°C	125°C
C-0805-X7R-Series	-55°C	125°C
C-1206-X7R-Series	-55°C	125°C
C-EEEFK1H331AQ	-55°C	105°C
CML-744-227	-40°C	125°C
CML-744-233-670	-40°C	85°C
D-B320A-13-F	-55°C	150°C
D-BAS70	-65°C	150°C
D-BAT54S	-55°C	125°C
D-SD2114S040S5R0	-55°C	125°C
FB-742-792-XXX	-55°C	125°C
HEADER-2.54-180-M-1X2	-40°C	125°C
HEADER-2.54-180-SM-1X5	-40°C	163°C
IC-BTS462T	-40°C	150°C
IC-DSC1001CI2-027.0000	-40°C	85°C
IC-DSC557-0344FI1	-40°C	85°C
IC-FT232RQ	-40°C	85°C
IC-IR347xMTRPBF	-40°C	125°C
IC-KSZ9031RNXIA	-40°C	85°C
IC-MAX4886ETO	-40°C	85°C
IC-MC33662BLEF	-40°C	125°C
IC-MT41K256M16HA-107-IT	-40°C	95°C
IC-MTFC16GAKAENA-4M-IT	-40°C	85°C
IC-NCV8715SQ50T2G	-40°C	125°C
IC-PCA9517ADP	-40°C	85°C
IC-PCF85263ATL	-40°C	85°C
IC-PS32V234CMN0VUB	-40°C	125°C
IC-REF3030AIDBZ	-40°C	125°C
IC-S9KEAZN64AMLH	-40°C	85°C

Part	Tmin	Tmax
IC-SN74LVC1G125DCK	-40°C	125°C
IC-SN74LVC244ARGYR	-40°C	125°C
IC-TPS22920LYZP	-40°C	85°C
IC-TPS51200DRC	-40°C	85°C
IC-TPS5433xDDAR	-40°C	150°C
IC-TPS70933DBV	-40°C	125°C
L-744-311-220	-55°C	125°C
L-744-383-56033	-40°C	85°C
L-744-383-57068	-40°C	85°C
LD-155124xx73200	-40°C	85°C
PCB-ADP-8065-01	-40°C	85°C
PCB-MPX-S32V234-02	-40°C	85°C
R-0402-Serie	-55°C	155°C
R-0603-Serie	-55°C	155°C
R-0805-Serie	-55°C	155°C
R-1206-Serie	-55°C	155°C
R-2010-Serie	-55°C	155°C
ST-WE-687-118-140-22	-25°C	85°C
SW-WE-450-404-015-514	-40°C	85°C
T-BSS138LT1	-55°C	150°C
T-FDT434P	-55°C	150°C
T-PDTA114YT	-55°C	150°C
T-PDTC123JT	-65°C	150°C
XT-FT13A-40.00000/8-20-20/48	-40°C	85°C

3.7.2 Power Dissipation

Component	max.Temperature	Power Dissipation
CPU	Tj125° C	7W
DDR	Tc95° C	1.5W
Core Regulator	Tj125° C	1.2W
DDR Regulator	Tj125° C	0.3W

(j=junction, c=case, a=ambient)

3.8 Power Supply

3.8.1 Input Supply Rating

The MPX-S32V234 module runs from a single power supply with the following ratings:

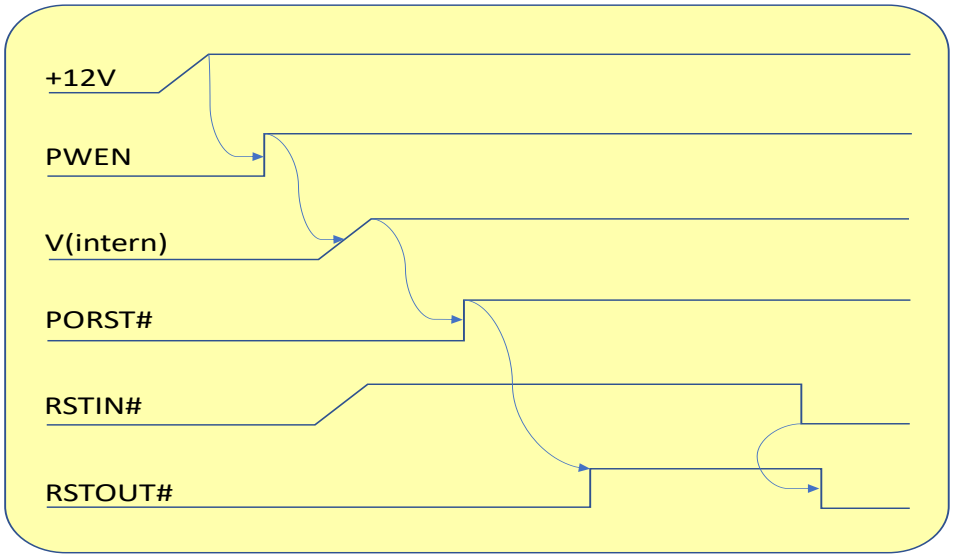
Input Voltage Operating Range:	**12V DC +/-25%**
Typical Current Consumption (room temperature / U-Boot prompt):	**0,40A @12V**

The input of the MPX-S32V234 system is **not** protected against wrong polarity and over-current

DO NOT exceed the rated maximum values for the power supply! This may result in severe permanent damage to the unit, as well as possible serious injury.

3.8.2 Power-Up

During a power-up sequence, the MCU first checks the input voltage to be within their necessary limits. After that, the POL (Point Of Load) regulators on the module will be activated. Any regulators on the carrier board should track the corresponding voltages on pins B15 and B16 of the module connector. If all module voltages are o.k. the reset sequence will be started. If there is no external reset request, e.g. via RSTIN# from the reset key, the RESET# will be released after 100ms. A low level on the RSTIN# line extends this time. During normal operation, a falling edge at RSTIN# initiates a reset sequence for the whole system, which is at least 100ms long. As long the reset line is low, the system will be held in the reset state. If the signal is released, the CPU will fetch its power-up configuration and starts up with its BIST and/or boot sequence. The RSTOUT# signal will directly follow the state of the RESET# signal. As long the RSTOUT# is active all connected devices must be held in a reset state in order not to block the power-up configuration settings.



If the MCU detects any overvoltage, it will turn off all internal point of load regulators.

3.9 Reset Structure

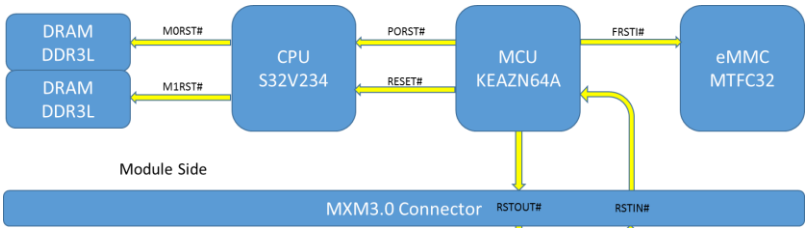


Figure 3-3 Reset Structure

Signal Name	Function	Type
RSTIN#	System Global Reset Input	4K7 Pullup
RSTOUT#	System Global Reset Output	Totem Pole
PORST#	Power-On Reset for CPU	Totem Pole
RESET#	Reset for CPU	Open Drain
M0RST#	Reset for Memory Bank 0	Totem Pole
M1RST#	Reset for Memory Bank 1	Totem Pole
(# denotes an active low signal)		

Table 3-3 Reset signal overview

4 System Core, Boot Configuration

4.1 Processor NXP S32V234

The S32V234 is a vision processing MPU with four ARM® Cortex®-A53 cores and a single Cortex-M4 core. The four CPU cores run at a maximum clock speed of 1000MHz.

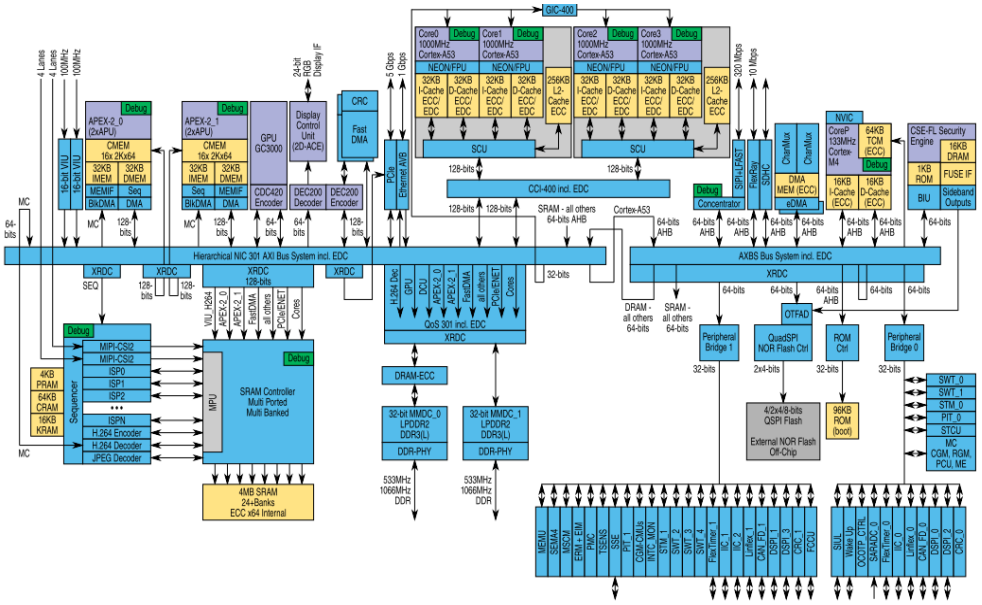


Figure 4-7 Processor Block diagram

4.2 Boot Mode Configuration

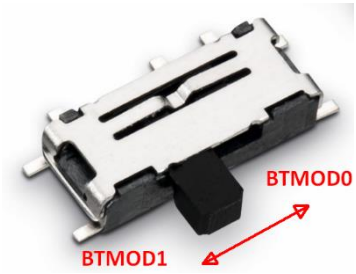
The MPX-S32V234 module offers several different boot modes to choose from. The settings can be done via the sliding switch BMD on the module and two BOOT-SEL signals on the MXM connectorr according to the following table.
The switch BMD sets the BMODE[0] and BMODE[1] signals of the CPU to low, while the two configuration resistors BMD0 and BMD1 are used to set a fixed low value on these lines.
The BMD, BMD0 and BMD1 parts are located on the MPX-S32V234 module.

Boot Mode	BMD-Switch	BMD0[1)]	BMD1[1)]
Serial Download, virgin device	No function	installed	installed
Serial Download, virgin device	Position 0	removed	installed
Serial Download, prog. device	Position 1	removed	installed
RCON Boot, if no fuses	Position 0	installed	removed
Serial Download, prog. device	Position 1	installed	removed
RCON Boot, no fuses	Position 0	removed	removed
Serial Download, prog. device	Position 1	removed	removed

green denotes the default configuration

Note 1) BMD0 and BMD1 are soldered resistors (size 0402) and not intended to be changed by user.

Figure 4: BMD Switch



Shown positions set the corresponding BTMOD0/1 line to low. BTMOD0 controls the CPU configuration port PC9, i.e. BOOTMOD(0), while BTMOD1 is connected to the CPU configuration port PC10, i.e. BOOTMOD(1).

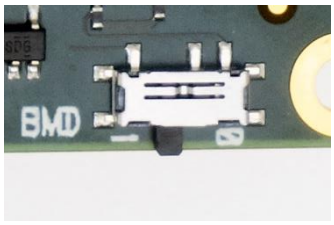


Figure 6: Position BTM1=low

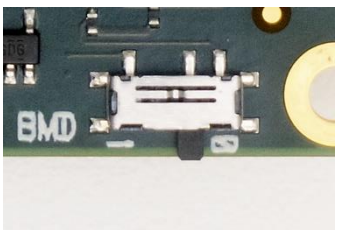


Figure 5: Position BTM0=low

4.3 BOOT-SEL Signals

The two signals BOOT-SEL1 and BOOT-SEL2 located on the MXM connector B130 and B131 allow the following default boot modes, when the BMD switch is set to position RCON. If the BMD switch is set to serial download, these signals have no function.

BOOT-SEL1	BOOT-SEL2	Boot Device
high	high	Cortex A53 via SDHC-A
low	high	Cortex A53 via eMMC
high	low	Cortex M4 via SDHC-A
low	low	Cortex M4 via eMMC

If the eMMC or the SDHC are to be used after previously having booted from the other device, then BOOT-SEL1 must be set correctly and the “mmc rescan” command must be executed from within U-Boot. The “mmc info” command will then show the new active storage device.

4.4 Power-Up Configuration

The S32V234 is configured during power-up by the state of 32 I/O signals, which are controlled by the MCU. Within the MCU, the four most popular RCON boot configurations are implemented and can be selected via the BOOT DIP switch located on the carrier board.

These configurations are only valid, if the Boot Mode Configuration is set to RCON Boot!

Signal	RCON	Port	eSDHC Mode	eMMC Mode
FLXR-TENB	RCON[0]	PA[7]	0	0
FLXR-TXD	RCON[1]	PA[8]	0	0
FLXR-RXD	RCON[2]	PA[9]	0	0
UART0-RXD	RCON[3]	PA[11]	0	0
UART0-TXD	RCON[4]	PA[12]	0	1
UART1-RXD	RCON[5]	PA[13]	0	0
UART1-TXD	RCON[6]	PA[14]	0	1
I2C0-SDA	RCON[7]	PA[15]	1	1
I2C0-SCL	RCON[8]	PB[0]	0	0
I2C1-SDA	RCON[9]	PB[1]	0	0
I2C1-SCL	RCON[10]	PB[2]	0	0
I2C2-SDA	RCON[11]	PB[3]	0	1
SPI0-SCK	RCON[12]	PB[5]	0	0
SPI0-SOUT	RCON[13]	PB[6]	0	0
SPI0-SIN	RCON[14]	PB[7]	0	0
SPI0-CS0#	RCON[15]	PB[8]	0	1
SPI1-SCK	RCON[16]	PB[9]	0	1
SPI1-SOUT	RCON[17]	PB[10]	0	0
SPI1-SIN	RCON[18]	PB[11]	0	0
SPI1-CS0#	RCON[19]	PB[12]	0	0
SPI2-SCK	RCON[20]	PB[13]	0	0
SPI2-SOUT	RCON[21]	PB[14]	1	1
SPI2-SIN	RCON[22]	PB[15]	0	0
SPI2-CS0#	RCON[23]	PC[0]	0	0
SPI3-SCK	RCON[24]	PC[1]	0	0
SPI3-SOUT	RCON[25]	PC[2]	0	0
SPI3-SIN	RCON[26]	PC[3]	0	0
SPI3-CS0#	RCON[27]	PC[4]	0	0
FXT0-CH0	RCON[28]	PC[5]	0	0
FXT0-CH1	RCON[29]	PC[6]	0	0
FXT0-CH2	RCON[30]	PC[7]	0	0
FXT0-CH3	RCON[31]	PC[8]	1	1

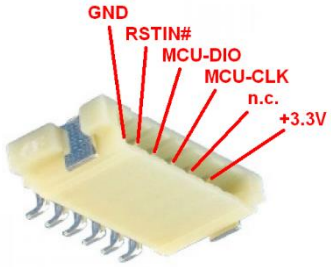
4.5 MCU Programming Port

The MCU, a Kinetis S9KEAZN64AMLH, controls the power-on and the reset sequence. It monitors all module generated supply voltages and drives all configuration lines of the S32V234 CPU. The controller can be either programmed via a module connector or a connector on the carrier board, both named MCU. As the module connector is very tiny and has a pitch of 0.6mm, the connector on the carrier with its 1.5mm pitch is the preferred one.

MPX-S32V234 Connector MCU

Manufacturer:	JST
Type:	SM06B-XSRS-ETB
mates with:	06XSR-36S

Figure 7: Module MCU Connector



The module connector is supplied by the direct MCU supply with 3.3V.

4.5.1 MCU Pinout

MCU			Board	S32V234		Function
Pin	Port	Dir	Signal	Signal	RCON	
1	PTD1	Out	BCFG23	SPI2_CS0#	RCON[23]	Configuration
2	PTD0	Out	BCFG29	FXT0_CH1	RCON[29]	Configuration
3	PTH7	Out	BCFG22	SPI2_SIN	RCON[22]	Configuration
4	PTH6	Out	BCFG6	UART1_TXD	RCON[6]	Configuration
5	PTE7	Out	RSTOUT#			Modul Rest Output
6	PTH2		n.c.			not connected
7		In	+3V3			Supply
8		In	VREFH			+3.0V
9		In	VREFL			Reference Ground
10			GND			Reference Ground
11	PTB7	Out	FRSTI#			eMMC Reset
12	PTB6	Out	PWEN			PSU enable
13			GND			Reference Ground
14	PTH1	In	QSPI-SEL	GPIO[158]		FLASH/SDHC Mux
15	PTH0	IO	TRTC#			Time Stamp RTC
16	PTE6	In	IRTC#			Interrupt RTC
17	PTE5	Out	PORST#	EXT_POR#		PowerOnReset
18	PTB5	Out	RESET#	RESET#		Reset
19	PTB4	In	FCCU-F0	FCCU_F0		Failure Check&Correction
20	PTC3	In	LD4			yellow Led
21	PTC2	In	+3V3			ADC Divider 3:4
22	PTD7	Out	NMI	NMI		Interrupt
23	PTD6	Out	FCCU-F1	FCCU_F1		Failure Check&Correction
24	PTD5	OUT	BCFGE#			Configuration Enable
25	PTC1	In	+3.3V			ADC Divider 3:4
26	PTC0	In	+1.8V			ADC direct
27	PTF7	In	+1.35V			ADC direct
28	PTF6	In	+1.0V			ADC direct
29	PTF5	In	+VIN			ADC Divider 1:11
30	PTF4	Out	BCFG2	FLXR_RXD	RCON[2]	Configuration
31	PTB3	Out	BCFG0	FLXR_TENB	RCON[0]	Configuration
32	PTB2	Out	BCFG1	FLXR_TXD	RCON[1]	Configuration
33	PTB1	Out	BCFG3	UART0_RXD	RCON[3]	Configuration
34	PTB0	Out	BCFG4	UART0_TXD	RCON[4]	Configuration
35	PTF3	Out	BCFG7	I2C0_SDA	RCON[7]	Configuration
36	PTF2	Out	BCFG8	I2C0_SCL	RCON[8]	Configuration
37	PTA7	Out	BCFG9	I2C1_SDA	RCON[9]	Configuration
38	PTA6	Out	BCFG10	I2C1_SCL	RCON[10]	Configuration
39	PTE4	Out	BCFG14	SPI0_SIN	RCON[14]	Configuration
40			GND			Reference Ground
41		In	+3V3			Supply

MCU			Board	S32V234		Function
42	PTF1	Out	BCFG15	SPI0_CS0#	RCON[15]	Configuration
43	PTF0	Out	BCFG12	SPI0_CLK	RCON[12]	Configuration
44	PTD4	Out	BCFG13	SPI0_SOUT	RCON[13]	Configuration
45	PTD3	Out	BCFG24	SPI3_CLK	RCON[24]	Configuration
46	PTD2	Out	BCFG5	UART1_RXD	RCON[5]	Configuration
47	PTA3	Out	BCFG25	SPI3_SOUT	RCON[25]	Configuration
48	PTA2	Out	BCFG18	SPI1_SIN	RCON[18]	Configuration
49	PTA1	Out	BCFG17	SPI1_SOUT	RCON[17]	Configuration
50	PTA0	Out	BCFG31	FXT0_CH3	RCON[31]	Configuration
51	PTC7	Out	BCFG26	SPI3_SIN	RCON[26]	Configuration
52	PTC6	Out	BCFG30	FXT0_CH2	RCON[30]	Configuration
53	PTE3	Out	BCFG11	I2C2_SDA	RCON[11]	Configuration
54	PTE2	Out	BCFG16	SPI1_CLK	RCON[16]	Configuration
55	PTG3	Out	BCFG19	SPI1_CS0#	RCON[19]	Configuration
56	PTG2	Out	BCFG21	SPI2_SOUT	RCON[21]	Configuration
57	PTG1	Out	BCFG28	FXT0_CH0	RCON[28]	Configuration
58	PTG0	Out	BCFG27	SPI3_CS0#	RCON[27]	Configuration
59	PTE1	Out	BCFG20	SPI2_CLK	RCON[20]	Configuration
60	PTE0	In	BOOT-SEL1			Boot Mode
61	PTC5	In	BOOT-SEL2			Boot Mode
62	PTC4	In	MCU-CLK			Programming Interface
63	PTA5	In	RSTIN#			Programming Interface
64	PTA4	IO	MCU-DIO			Programming Interface

5 MPX Module

The MPX-S32V234 miriac module has a 314-pin MXM connector and must be mounted with a heatsink. It can be fixed with M2.5 screws through four 2.7mm holes in the PCB.

MPX-S32V234 MXM Connector

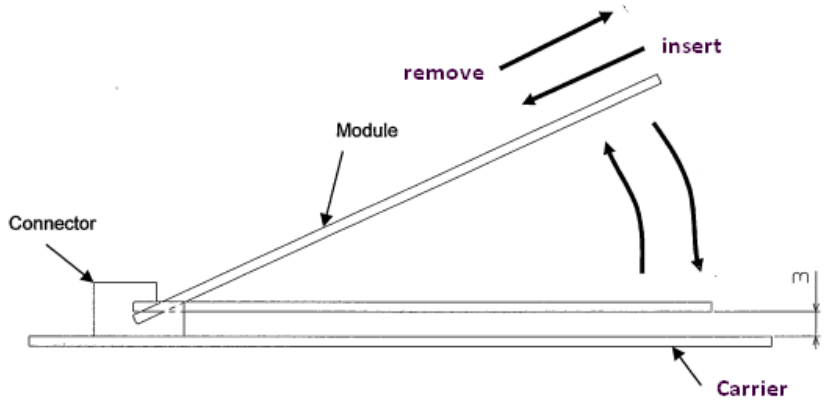
Manufacturer:	JAE
Type:	MM70-314-310-B1-1
mates with:	PCB Edge Connector

5.1 Mounting/Unmounting

The mounting or unmounting of the module should only be made in a static free area with full ESD precautions, i.e. as a minimum, a grounded dissipative work surface of sufficient size and a grounded skin contact wrist strap are necessary. Make sure, that all parts, the carrier, the module and the heatsink are placed on the same static free area to avoid any discharges between them during assembly.

To mount the MPX-S32V234 module, make sure that the carrier is disconnected from any power or other IO interfaces. Both connector surfaces of the module must be clean as well as the carrier connector should be checked for bent or dirty contacts. Check the module and the carrier for foreign or loose parts, which do not belong to the boards. The screws should have clean threads and be tightened with a maximum torque of 30Ncm.

Insert or remove the MPX-S32V234 module always by an angle of about 25° as shown in the following figure.



The thermal conduction between cooler and CPU must be performed via a thermal pad. Make sure that this thermal pad has the correct thickness and is placed over the CPU package before mounting the heatsink.

For the removal of the module, first unplug all connections to the system. Remove the inner screws, then the outer ones. The thermal pad may cause the heatsink to stick to the module, so take care when pulling them apart to avoid damaging any part of the module. Lift the module to about 25°and remove it from the connector. Store the parts on a static free area.

5.2 DRAM

The module is fitted with two individual DDR3L memory blocks, each 32-bit wide and with 1GByte capacity. The parts used are 4Gbit devices organized in 256M x 16 bits with 15 row, 10 column and 3 bank addresses. The refresh rate depends on the operating temperature and must be set according to the following table:

Case Temperature	Refresh Cycle Time
Tc<85°C	7.8us
85°C<Tc<95°C	3.9us
95°C<Tc<105°C	1.95us

The DDR3L command bus is actively terminated and routed in a fly-by topology. The following table shows all trace lengths, in case write leveling needs to be adjusted. The layer stack, together with the FR4 material, causes a signal delay time of 6.8ps/mm.

DRAM	Signal Group	Trace Length		Description
Bank0	Command	J1->J2	54.0mm	CPU->DRAM
Bank0	Command	J2->J3	13.1mm	DRAM->DRAM
Bank0	Byte 0	J1->J2	25.7mm	CPU->DRAM
Bank0	Byte 1	J1->J2	22.7mm	CPU->DRAM
Bank0	Byte 2	J1->J3	23.1mm	CPU->DRAM
Bank0	Byte 3	J1->J3	18.3mm	CPU->DRAM
Bank1	Command	J1->J4	54.5mm	CPU->DRAM
Bank1	Command	J4>J5	13.9mm	DRAM->DRAM
Bank1	Byte 0	J1->J4	25.3mm	CPU->DRAM
Bank1	Byte 1	J1->J4	22.9mm	CPU->DRAM
Bank1	Byte 2	J1->J5	19.0mm	CPU->DRAM
Bank1	Byte 3	J1->J5	17.2mm	CPU->DRAM

5.3 eMMC

The local boot device of the MPX-S32V234 module is realized as an eMMC. The MTFC16GAKAENA-4M-IT from Micron uses the 8-bit wide data bus, provided by the µSDHC module of the S32V234. This interface is shared between the external storage devices on the carrier board and the local eMMC. The selection can be either made by the setting of a CPU GPIO pin or via the MCU. Per default, the multiplexing is done through the MCU by the setting of the boot mode switch.

The reset input of the eMMC device is connected to port PTB7 of the MCU. In case this port is not configured, the FRSTI# signal is tied to +3.3V by a pullup resistor.

5.4 LEDs

There are four LEDs onboard the MPX-S32V234 module. The user LEDs 1 and 2 can be controlled by two CPU GPIO pins, LED 3 indicates state of the reset line and LED 4 is connected to the MCU port PTC3.

Led	Color	ON	OFF	Description
LD1	green	CPU-PG5=high	CPU-PG5=low	LDG1 installed / LDG3 not installed
LD2	green	CPU-PG6=high	CPU-PG6=low	LDG2 installed / LDG4 not installed
LD1	green	CPU-PB1=high	CPU-PB1=low	LDG3 installed / LDG1 not installed
LD2	green	CPU-PB2=high	CPU-PB2=low	LDG4 installed / LDG2 not installed
LD3	red	RESET#=low	RESET#=high	Reset state indicator
LD4	yellow	MCU-PTC3=high	MCU-PTC3=low	MCU status led

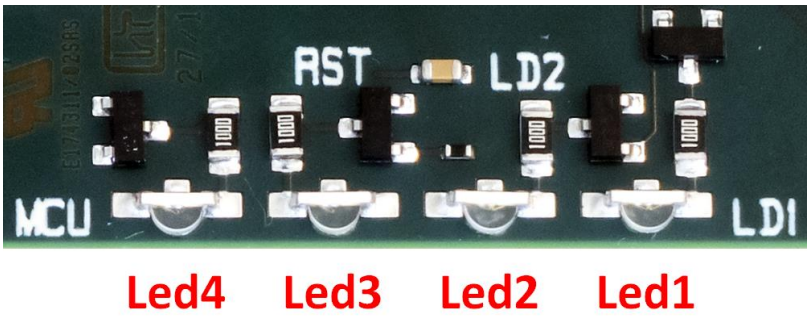


Figure 8: MPX-LEDs

5.5 Switches

The GPU sliding switch on the MPX-S32V234 module is used to disconnect the GPU power pins to reduce power consumption, in case the GPU is not used. The other sliding switch BMD is used to select between RCON-controlled and serial boot mode. Both switches are located at the PCB edge on the bottom of the MPX-S32V234 module.

Figure 9: GPU switch

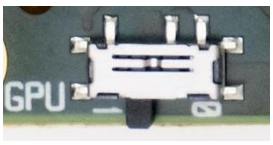


Figure 11: GPU Power On (default)

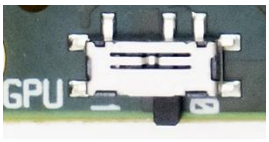
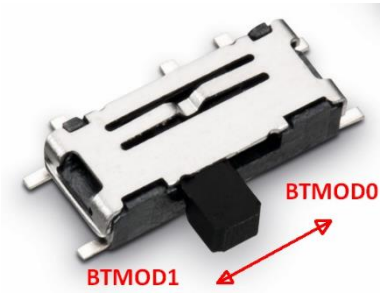


Figure 10: GPU Power Off

Figure 12: BMD Switch



NOTE

Any handling of these switches must be done exclusively using non-conductive tools to avoid short circuits between carrier board and module.

5.6 Module Connector

A carrier board must provide an MXM connector.

Manufacturer:	JAE
Type:	MM70-314-310-B1-1-R300

5.7 Module Connections

MPX-S32V234		IO
Pin	Signal	Voltage
B1	IIC1-SDA	3.3V
T1	GND	
B2	GND	
T2	CAN-FD0-TX	3.3V
B3	IIC1-SCL	3.3V
T3	CAN-FD0-RX	3.3V
B4	JTAG-TCK	3.3V
T4	GND	
B5	JTAG-TDI	3.3V
T5	CAN-FD1-TX	3.3V
B6	JTAG-TRST#	3.3V
T6	CAN-FD1-RX	3.3V
B7	JTAG-TMS	3.3V
T7	GND	
B8	GND	
T8	CSI1-DT0+	1.0V
B9	JTAG-TDO	3.3V
T9	CSI1-DT0-	1.0V
B10	FLXR-TENB	3.3V
T10	GND	
B11	FLXR-TENA	3.3V
T11	CSI1-DT1-	1.0V
B12	FLXR-TXD	3.3V
T12	CSI1-DT1+	1.0V
B13	FLXR-RXD	3.3V
T13	GND	
B14	GND	
T14	CSI1-DT2+	1.0V
B15	3.3V rail output	
T15	CSI1-DT2-	1.0V
B16	1.8V rail output	
T16	GND	
B17	GND	
T17	CSI1-DT3-	1.0V
B18	CSI0-CLK+	1.0V
T18	CSI1-DT3+	1.0V
B19	CSI0-CLK-	1.0V
T19	GND	
B20	GND	
T20	CSI0-DT0+	1.0V

B21	CSI1-CLK+	1.0V
T21	CSI0-DT0-	1.0V
B22	CSI1-CLK-	1.0V
T22	GND	
B23	GND	
T23	CSI0-DT1-	1.0V
B24	CSI0-DT2+	1.0V
T24	CSI0-DT1+	1.0V
B25	CSI0-DT2-	1.0V
T25	GND	
B26	CSI0-DT3-	1.0V
T26	VIU0-D17	3.3V/1.8V
B27	CSI0-DT3+	1.0V
T27	VIU0-D18	3.3V/1.8V
B28	GND	
T28	GND	
B29	VIU0-D08	3.3V/1.8V
T29	VIU0-D19	3.3V/1.8V
B30	VIU0-D09	3.3V/1.8V
T30	VIU0-D20	3.3V/1.8V
B31	GND	
T31	GND	
B32	VIU0-D10	3.3V/1.8V
T32	VIU0-D21	3.3V/1.8V
B33	VIU0-D11	3.3V/1.8V
T33	VIU0-D22	3.3V/1.8V
B34	VIU0-D12	3.3V/1.8V
T34	GND	
B35	VIU0-D13	3.3V/1.8V
T35	VIU0-D23	3.3V/1.8V
B36	GND	
T36	VIU0-PCLK	3.3V/1.8V
B37	VIU0-D14	3.3V/1.8V
T37	GND	
B38	VIU0-D15	3.3V/1.8V
T38	VIU0-VSYNC	3.3V/1.8V
B39	VIU0-D16	3.3V/1.8V
T39	VIU0-HSYNC	3.3V/1.8V
B40	VIU1-D08	3.3V/1.8V
T40	GND	
B41	GND	
T41	DCU-B0	1.8V
B42	VIU1-D09	3.3V/1.8V
T42	DCU-B1	1.8V
B43	VIU1-D10	3.3V/1.8V
T43	GND	
B44	VIU1-D11	3.3V/1.8V

T44	DCU-B2	1.8V
B45	VIU1-D12	3.3V/1.8V
T45	DCU-B3	1.8V
B46	VIU1-D13	3.3V/1.8V
T46	GND	
B47	VIU1-D14	3.3V/1.8V
T47	DCU-B4	1.8V
B48	VIU1-D15	3.3V/1.8V
T48	DCU-B5	1.8V
B49	VIU1-D16	3.3V/1.8V
T49	GND	
B50	GND	
T50	DCU-B6	1.8V
B51	VIU1-D17	3.3V/1.8V
T51	DCU-B7	1.8V
B52	VIU1-D18	3.3V/1.8V
T52	GND	
B53	VIU1-D19	3.3V/1.8V
T53	DCU-DE	1.8V
B54	VIU1-D20	3.3V/1.8V
T54	DCU-PCLK	1.8V
B55	GND	
T55	GND	
B56	VIU1-D21	3.3V/1.8V
T56	DCU-HSYNC	1.8V
B57	VIU1-D22	3.3V/1.8V
T57	DCU-VSYNC	1.8V
B58	VIU1-D23	3.3V/1.8V
T58	GND	
B59	VIU1-PCLK	3.3V/1.8V
T59	DCU-TAG	1.8V
B60	VIU1-HSYNC	3.3V/1.8V
T60	DCU-G0	1.8V
B61	VIU1-VSYNC	3.3V/1.8V
T61	GND	
B62	DCU-R0	1.8V
T62	DCU-G1	1.8V
B63	DCU-R1	1.8V
T63	DCU-G2	1.8V
B64	DCU-R2	1.8V
T64	GND	
B65	DCU-R3	1.8V
T65	DCU-G3	1.8V
B66	DCU-R4	1.8V
T66	DCU-G4	1.8V
B67	DCU-R5	1.8V
T67	GND	

B68	GND	
T68	DCU-G5	1.8V
B69	DCU-R6	1.8V
T69	DCU-G6	1.8V
B70	DCU-R7	1.8V
T70	GND	
B71	SDHC-D7	3.3V
T71	DCU-G7	1.8V
B72	SDHC-D6	3.3V
T72		
B73	GND	
T73	GND	
B74	SDHC-D5	3.3V
T74	SDHC-D4	3.3V
B75	SDHC-CMD	3.3V
T75	SDHC-D3	3.3V
B76	GND	
T76	GND	
B77	SDHC-CLK	3.3V
T77	SDHC-D2	3.3V
B78	SDHC-WP	3.3V
T78	SDHC-D1	3.3V
B79	GND	
T79	GND	
B80	SDHC-RST	3.3V
T80	SDHC-D0	3.3V
B81	SDHC-VSEL	3.3V
T81	GND	
B82	GND	
T82	PCIE-TX-	1.0V
B83	UART1-TXD	1.8V
T83	PCIE-TX+	1.0V
B84	UART1-RXD	1.8V
T84	GND	
B85	GND	
T85	PCIE-RX-	1.0V
B86	UART0-TXD	3.3V
T86	PCIE-RX+	1.0V
B87	UART0-RXD	3.3V
T87	GND	
B88	GND	
T88	PCIE-CLK+	1.0V
B89	I2C2-SDA	1.8V
T89	PCIE-CLK-	1.0V
B90	I2C2-SCL	1.8V
T90	GND	
B91	SPI3-CS0#	1.8V

T91	LFAST-TX-	1.6V
B92	SPI3-SCK	1.8V
T92	LFAST-TX+	1.6V
B93	SPI3-SIN	1.8V
T93	GND	
B94	SPI3-SOUT	1.8V
T94	LFAST-RX-	1.6V
B95	SPI0-CS0#	1.8V
T95	LFAST-RX+	1.6V
B96	SPI0-SCK	1.8V
T96	GND	
B97	SPI0-SIN	1.8V
T97	EMI-MDC	1.8V
B98	SPI0-SOUT	1.8V
T98	EMI-MDIO	1.8V
B99	SPI1-SIN	1.8V
T99	GND	
B100	SPI1-SOUT	1.8V
T100	EC-COL	1.8V
B101	GND	
T101	EC-TXCK	1.8V
B102	SPI1-SCK	1.8V
T102	GND	
B103	SPI1-CS0#	1.8V
T103	EC-TXD3	1.8V
B104	FXT0-CH0	1.8V
T104	EC-RXDV	1.8V
B105	FXT0-CH1	1.8V
T105	GND	
B106	FXT0-CH2	1.8V
T106	EC-RXD1	1.8V
B107	GND	
T107	EC-TXD2	1.8V
B108	FXT0-CH3	1.8V
T108	GND	
B109	FXT1-CH0	1.8V
T109	EC-RXD0	1.8V
B110	FXT1-CH1	1.8V
T110	EC-CRS	1.8V
B111	SPI2-SOUT	1.8V
T111	GND	
B112	GND	
T112	EC-RXER	1.8V
B113	SPI2-SCK	1.8V
T113	EC-TXER	1.8V
B114	SPI2-SIN	1.8V
T114	GND	

B115	GND	
T115	EC-RXD3	1.8V
B116	SPI2-CS0#	1.8V
T116	EC-TXEN	1.8V
B117	ENET-T0	1.8V
T117	GND	
B118	ENET-T1	1.8V
T118	EC-RXD2	1.8V
B119	ENET-T2	3.3V
T119	EC-TXD0	1.8V
B120	TRACE-D00	1.8V
T120	GND	
B121	TRACE-D02	1.8V
T121	EC-RXCK	1.8V
B122	TRACE-D04	1.8V
T122	EC-TXD1	1.8V
B123	TRACE-D06	1.8V
T123	GND	
B124	GND	
T124	TRACE-CLK	1.8V
B125	TRACE-D08	1.8V
T125	TRACE-D01	1.8V
B126	TRACE-D10	1.8V
T126	GND	
B127	TRACE-D12	1.8V
T127	TRACE-D03	1.8V
B128	TRACE-D14	1.8V
T128	TRACE-D05	1.8V
B129	GND	
T129	GND	
B130	BOOT-SEL1	3.3V
T130	TRACE-D07	1.8V
B131	BOOT-SEL2	3.3V
T131	TRACE-D09	1.8V
B132	RSTIN#	3.3V
T132	GND	
B133	VRTC	3.3V
T133	TRACE-D11	1.8V
B134	GND	
T134	TRACE-D13	1.8V
B135	I2C0-SCL	3.3V
T135	TRACE-D15	1.8V
B136	I2C0-SDA	3.3V
T136	RSTOUT#	3.3V
B137	MCU-DIO	3.3V
T137	GND	
B138	MCU-CLK	3.3V

T138	GND	
B139	GND	
T139	GND	
B140	GND	
T140	GND	
B141	GND	
T141	GND	
B142	GND	
T142	GND	
B143	GND	
T143	GND	
B144	GND	
T144	GND	
B145	GND	
T145	GND	
B146	GND	
T146	+VIN	
B147	GND	
T147	+VIN	
B148	+VIN	
T148	+VIN	
B149	+VIN	
T149	+VIN	
B150	+VIN	
T150	+VIN	
B151	+VIN	
T151	+VIN	
B152	+VIN	
T152	+VIN	
B153	+VIN	
T153	+VIN	
B154	+VIN	
T154	+VIN	
B155	+VIN	
B156	+VIN	

6 JTAG Chain

6.1.1 JTAG Devices

The JTAG chain of the MPX-S32V234 only includes the S32V234 processor. The JTAG port is directly connected to the MXM connector.

7 ADC

7.1.1 ADC Channles

The ADC converter contained in the S32V234 processor has 8 multiplexed single-ended channels. They can be directly accessed via the 18-pin ZIF connector ADC on the bottom side of the module.

There is no protection on any ADC line against overvoltage or wrong polarity. Refer to the S32V234 datasheet for maximum ratings

8 I²C Structure

The MPX-S32V234 operates three different I²C busses.

I²C Bus 0 and 1 are not used onboard the MPX-S32V234.

I²C Bus 2 controls all devices on the module.

8.1.1 Bus Map

I²C Bus 0:

Address	Reference	Device	Function
0x00-0x7F	---	---	External devices

Table 4 I²C0 bus map

I²C Bus 1:

Address	Reference	Device	Function
0x00-0x7F	---	---	External devices

Table 5 I²C1 bus map

I²C Bus 2:

Address	Reference	Device	Function
0x51	J25	PCF85263A	Real Time Clock

Table 6 I²C2 bus map

8.1.2 I²C Devices

8.1.2.1 RTC

The RTC PCF85263A provides year, month, day, weekday, hours, minutes, seconds and 100th seconds. It can be protected against data loss by the backup battery located on the CRX-S32V carrier.

It is accessible via I²C Bus 2 at the 7-bit address 0x51. It offers a time stamp input and an interrupt output, which are both connected to the MCU.

8.1.2.2 RTC Backup Battery

The battery back can be accessed via the MXM connector on pin B133. It should not exceed a maimum voltage of 3.3V. The battery type should have a nominal voltage of 3.0V. The backup is necessary to keep time and date of the real-time clock on the MPX-S32V234 module.

9 Appendix

9.1 Acronyms

These acronyms are being used within the document; note that this list does not claim to be complete or exhaustive:

ADAS ..... *Advanced Driver Assistance Systems*
ARM ..... *Advanced RISC Machine*
BaseT ..... *Ethernet over twisted pair technologies*
BIST ..... *Built In Self-Test*
CAN-FD ..... *Controller Area Network with Flexible Data rate*
CEC ..... *Consumer Electronics Control*
Cortex-M4 ..... *ARMv7E-M architecture*
CPU ..... *Central Processing Unit*
CR2032 ..... *IEC standard button cell*
CSI ..... *Camera Serial Interface*
DDC ..... *Display Data Channel*
eMMC ..... *embedded Multimedia Card*
ESD ..... *Electrostatic Discharge*
FR4 ..... *flame retardant 4*
GND ..... *Ground*
GPIO ..... *General Purpose IO*
GPL ..... *General Public License*
GPU ..... *Graphic Processing Unit*
HDMI ..... *High-Definition Multimedia Interface*
I²C ..... *Inter-Integrated Circuit*
JTAG ..... *Joint Test Action Group*
Kinetis ..... *ARM® Cortex-M0+ core*
LAN ..... *Local Area Network*
LED ..... *Light Emitting Diode*
LIN ..... *Local Interconnect Network*
MCU ..... *Microcontroller Unit*
MIPI ..... *Mobile Industry Processor Interface*
MPX ..... *MicroSys miriac Module*
MXM ..... *Mobile PCI-Express Module*
POL ..... *Point Of Load*
PPTC ..... *Polymeric Positive Temperature Coefficient*
RCON ..... *Reset Configuration*
RJ45 ..... *Registered Jack 45*
RTC ..... *Real Time Clock*
SBC ..... *Single Board Computer*
SOM ..... *System On Module*
TFTP ..... *Trivial File Transfer Protocol*
TVS ..... *Transient Voltage Suppressor*
UART ..... *Universal Asynchronous Receiver Transmitter*
U-Boot ..... *The Universal Boot Loader*
USB ..... *Universal Serial Bus*

10 History

Date	Version	Change Description
2018-12-07	**1.0**	Initial Release Version
2020-09-08	**1.1**	Corrected Part Numbers

Table 7 Document history