



MBa62LxxO-S Preliminary User's Manual

MBa62LxxO-S UM 0001
07.10.2026





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1.6 Tips on safety

Improper or incorrect handling of the product can substantially reduce its life span.

1.7 Symbols and typographic conventions

Table 1: Terms and Conventions

Symbol	Meaning
	This symbol represents the handling of electrostatic-sensitive modules and / or components. These components are often damaged / destroyed by the transmission of a voltage higher than about 50 V. A human body usually only experiences electrostatic discharges above approximately 3,000 V.
	This symbol indicates the possible use of voltages higher than 24 V. Please note the relevant statutory regulations in this regard. Non-compliance with these regulations can lead to serious damage to your health and also cause damage / destruction of the component.
	This symbol indicates a possible source of danger. Acting against the procedure described can lead to possible damage to your health and / or cause damage / destruction of the material used.
	This symbol represents important details or aspects for working with TQ-products.
Command	A font with fixed-width is used to denote commands, file names, or menu items.

1.8 Handling and ESD tips

General handling of your TQ-products

	The TQ-product may only be used and serviced by certified personnel who have taken note of the information, the safety regulations in this document and all related rules and regulations. A general rule is: do not touch the TQ-product during operation. This is especially important when switching on, changing jumper settings or connecting other devices without ensuring beforehand that the power supply of the system has been switched off. Violation of this guideline may result in damage / destruction of the MBa62LxxO-S and be dangerous to your health. Improper handling of your TQ-product would render the guarantee invalid.
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Proper ESD handling

	The electronic components of your TQ-product are sensitive to electrostatic discharge (ESD). Always wear antistatic clothing, use ESD-safe tools, packing materials etc., and operate your TQ-product in an ESD-safe environment. Especially when you switch modules on, change jumper settings, or connect other devices.
---	---

1.9 Naming of signals

A hash mark (#) at the end of the signal name indicates a low-active signal.

Example: RESET#

If a signal can switch between two functions and if this is noted in the name of the signal, the low-active function is marked with a hash mark and shown at the end.

Example: C / D#

If a signal has multiple functions, the individual functions are separated by slashes when they are important for the wiring.

The identification of the individual functions follows the above conventions.

Example: WE2# / OE#

1.10 Further applicable documents / presumed knowledge

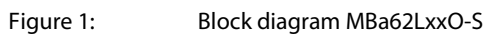
- **Specifications and manual of the modules used:**
These documents describe the service, functionality and special characteristics of the module used (incl. BIOS).
- **Specifications of the components used:**
The manufacturer's specifications of the components used, for example CompactFlash cards, are to be taken note of. They contain, if applicable, additional information that must be taken note of for safe and reliable operation. These documents are stored at TQ-Systems GmbH.
- **Chip errata:**
It is the user's responsibility to make sure all errata published by the manufacturer of each component are taken note of. The manufacturer's advice should be followed.
- **Software behaviour:**
No warranty can be given, nor responsibility taken for any unexpected software behaviour due to deficient components.
- **General expertise:**
Expertise in electrical engineering / computer engineering is required for the installation and the use of the device.

The following documents are required to fully comprehend the following contents:

- MBa62LxxO-S circuit diagram
- TQMa62LxxOA-S Preliminary User's Manual
- Sitara AM62L Data Sheets
- U-Boot documentation: www.denx.de/wiki/U-Boot/Documentation
- PTXdist documentation: www.ptxdist.de
- TQ-Support Wiki: support.tq-group.com/doku.php?id=en:arm:tqma62lxxoa-s

3. TECHNICAL DATA

3.1.1 Block diagram



The following interfaces / functions and user's interfaces are provided on the MBa62LxxO-S:

Interface	Qty.	Type of connector	Remark
Ethernet 1000BASE-T	1	RJ45 receptacle	receptacle with integrated magnetics and PoE+
CAN	2	Phoenix basic housing	gal. separated, 3-pole
USB2.0 OTG	1	USB receptacle Type AB (Micro)	USB2.0 OTG
USB 2.0 Host	2	USB receptacle Type A (stacked)	max. 500 mA per port
Debug-USB	1	USB receptacle Type Micro B	2 x COM ports for Debug-UART
SD card	1	Push-Push-Type (Micro)	SDR104 Speed-grade (UHS-I)
DSI	1	FPC connector	compatibel with RPI Display
M.2 E-Socket	1	M.2 Key-E	WLAN and WPAN interfaces: USB, SDIO, PCM, UART, I2C
M.2 B Socket + SIM Card	1	M.2 Key-B	only USB
	1	Micro SIM Card Holder	SIM Card Holder
Header	1	Header, 2.54 mm pitch	1 x GPIOs
Battery holder	1	CR2032 holder	Backup battery RTC of TQMa62LxxOA-S
SPI NOR-Flash	1	-	internal NOR-Flash
TPM	1	-	TPM chip



Table 3: Overview diagnose and user's interfaces

Interface	Qty.	Component	Remark
Status-LEDs	2	LED blue	Input supply 24 V – Power IN USB debug interface
	2	LED green / red	SoM / carrier status
	1	LED yellow	User-LED
	1	LED green / yellow	Ethernet LEDs (activity / speed)
Reset buttons	2	Push button	Power cycle module Wakeup
User buttons	2	Push button	CPU Reset (warm) GPIO (user button)
Boot-Mode configuration	1	DIP switch	4 x Boot mode configuration
CAN termination	2	DIP switch	120 Ohm termination
JTAG	1	20-pole header, 1.27 mm pitch	cTI 20-pin header
Power In	1	Phoenix contact MC1,5/2-G-3,5	11.4 V to 12.6 V (typ. 12 V)
	1	RJ45 with PoE	

4. ELECTRONICS

4.1 System components

4.1.1 TQMa62LxxOA-S

The TQMa62LxxOA-S with the AM62Lx CPU is the central system component. It provides LPDDR4 SDRAM, eMMC, and EEPROM memory. The available signals are routed to LGA pads. When using the processor signals, it is essential to observe the multiple assignment of the pins by different processor-internal function units (multiplexing). The TQMa62LxxOA-S boot behaviour can be customised.

More detailed information is to be taken from the accompanying TQMa62LxxOA-S User's Manual.

4.1.2 I²C address mapping

The accessible I²C buses are I2C_A and I2C_B. The following devices are connected on the MBa62LxxO-S

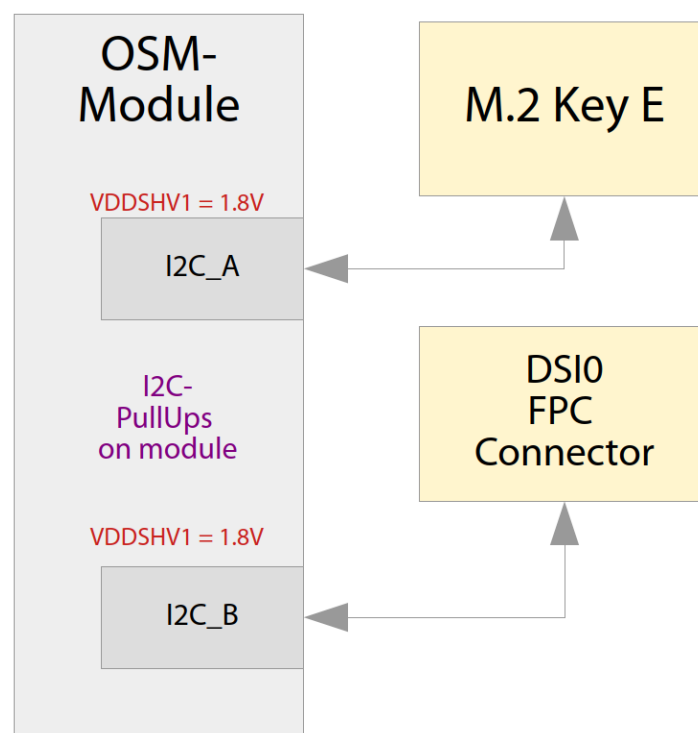


Figure 2: Block diagram I²C bus of the TQMa62LxxOA-S module

The following table shows the used addresses of all I²C buses:

Table 4: I2C1 slave address mapping of the TQMa62LxxOA-S module

Bus	Component	Address	Note
I2C_A	M.2 Key E	depends on usage	X10
I2C_B	DSI	depends on usage	X9

4.1.3 RTC backup supply

For the backup supply of the RTC on the TQMa62LxxOA-S a lithium battery (3 V coin cell type CR2032) with very low self-discharge is used on the MBa62LxxO-S. The TQMa62LxxOA-S is supplied via pin RTC_PWR.

4.1.4 Reset structure

On the MBa62LxxO-S different possibilities are available for a complete or partial reset (periphery) of the module.

The following signals from the TQMa62LxxOA-S are used on the MBa62LxxO-S:

Table 5: Reset signals

Signal	Type	Level	Description
TQM_HARD_RST#	I	5.0 V	- Activates power sequencing on module after approx. 150 ms delay (LOW --> HIGH) - Pull-up on module - Connect to GND to activate (e.g. push button)
RESET_IN# (PORz)	I	1.8 V	- Control of a cold reset - Pull-up on module - Connect to GND to activate (e.g. push button) - Default: not connected
EXT_WAKEUP0/1	I	1.8 V	- Control of the Standby-mode - Pull-up on mainboard - Connect to GND to activate (e.g. push button)
TRST#	I	1,8 V	- Connects directly to the TRST# of the module - Pull-down on module
RESETSTATz	O	1.8 V	- Status signal for a warm reset of the Main domain - Pull-down on mainboard
CARRIER_PWR_EN	O	1.8 V	Status signal that is used to indicate the power sequencing on the module
GPIOx	O	3.3 V / 1.8 V	- Activates RESET of various peripherals on the mainboard - Is controlled by software

Attention: Damage



The periphery on the base board should never be supplied before the module, otherwise the module may be damaged. This is ensured by the signal CARRIER_PWR_EN.

4.1.5 Power supply

The MBa62LxxO-S main power supply (11.4 V to 12.6 V) is provided by VIN (X1 / X8 via PoE).

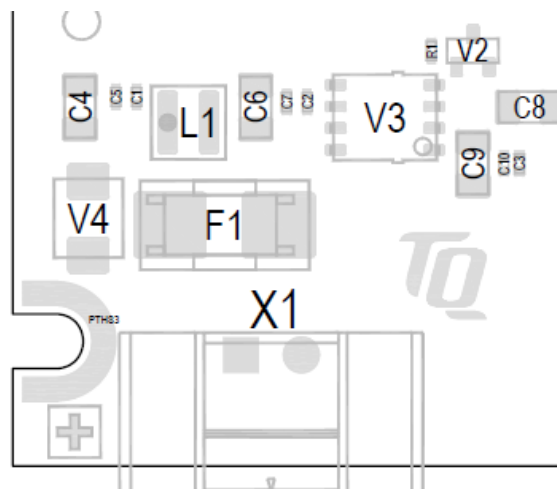


Figure 3: Position X1

On the MBa62LxxO-S there is a two part supply:

- 12 V and 5 V supply
 - Permanently activated as soon as the MBa62LxxO-S is supplied
 - Module supply / Reset button / LED
- Remaining Power Supply
 - Supply of the periphery
 - Switched by PGOOD
 - Switched off if CARRIER_PWR_EN is not present on the module

The following figure shows all voltage rails on the mainboard. In order to comply with the required power sequencing, the signal PGOOD is used to control the respective rails.

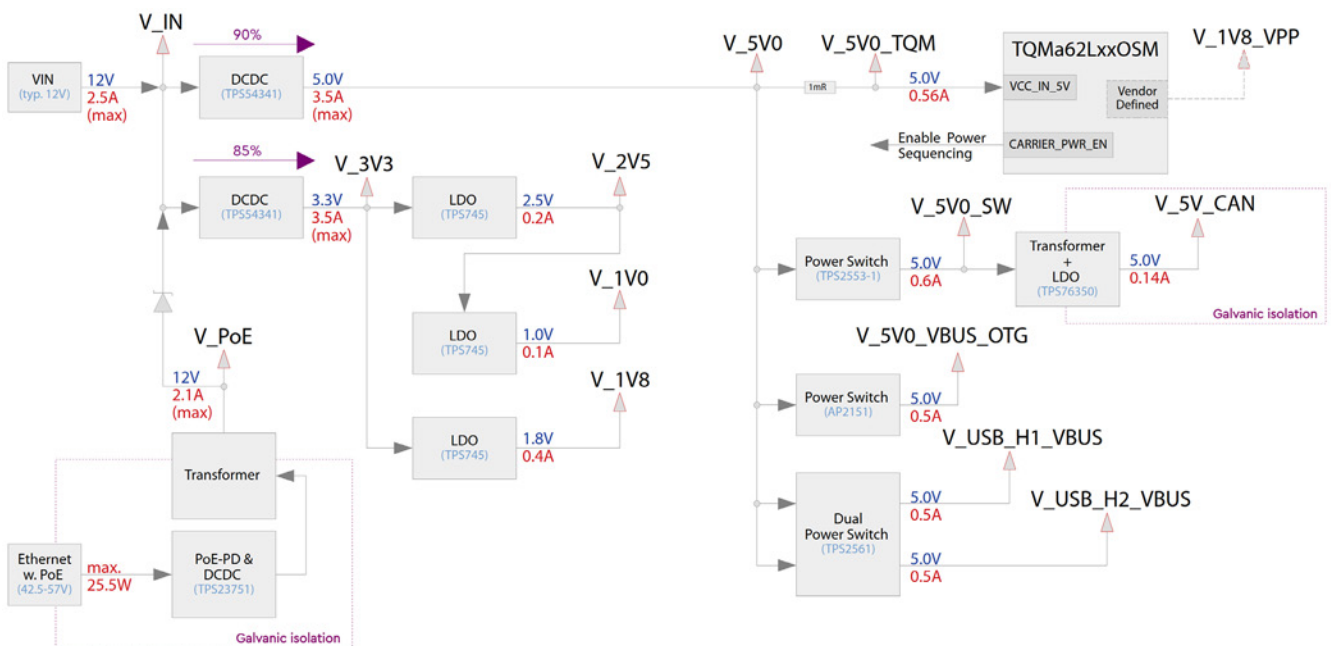


Figure 4: Block diagram power supply chain

The following protective circuits are implemented for the input voltage of the MBa62LxxO-S:

- Fuse 2.5 A, slow blow
- Excess voltage protection diode
- PI filter
- Inverse-polarity protection
- Capacitors for voltage smoothing

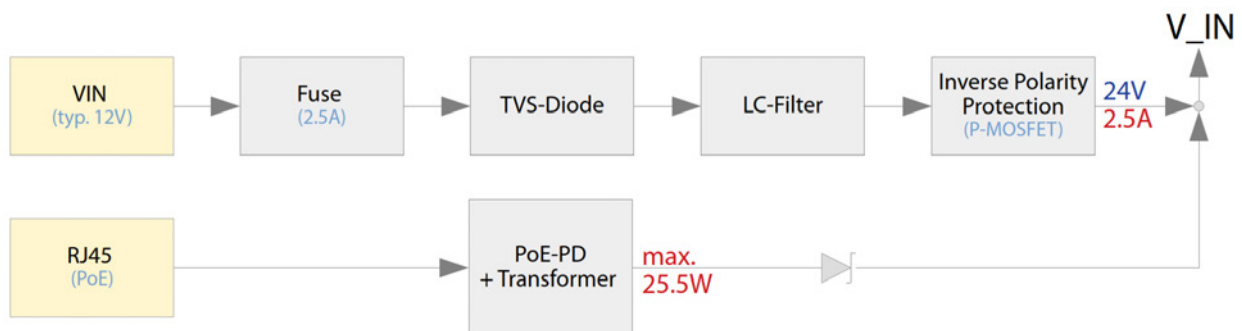


Figure 5: MBa62LxxO-S Input circuit

The overvoltage limitation is 13.3 V to 14.7 V.

The mainboard MBa62LxxO-S, including TQMa62LxxOA-S, consumes approximately 30 W under full load (all supply voltages are loaded with maximum current, e.g. by connecting external modules to the pin headers). The power supply used must be selected accordingly. In most applications, however, the power consumption will be significantly lower.

Attention: Overload	
	The internal voltages (3.3 V, 5 V) provided at the MBa62LxxO-S pin headers are not additionally protected. Technically, an overload of the fuse is therefore possible. The resulting total current consumption of the MBa62LxxO-S should be observed.

The power sequencing of the mainboard MBa62LxxO-S is defined as following:

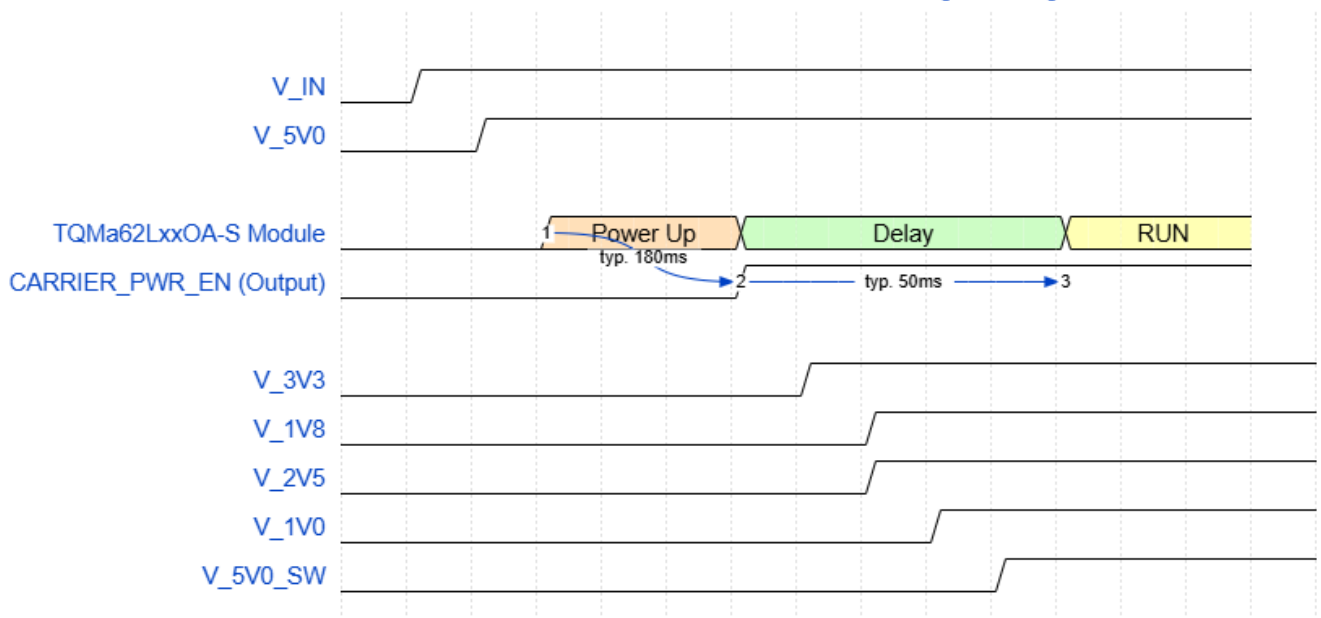


Figure 6: MBa62LxxO-S Power up sequence

- The 5.0 V supply to the TQMa62LxxOA-S is continuously active when the V_IN supply ('always' ON) is connected.
- The TQMa62LxxOA-S executes the power sequencing independently and returns a CARRIER_PWR_EN signal for the MBa62LxxO-S.
- As soon as the CARRIER_PWR_EN signal is present, the MBa62LxxO-S performs the power sequencing independently. The used switching regulators / LDOs are controlled by EN and PGOOD signals.
- The time constant between PGOOD and reset of the CPU is approx. 50 ms.

4.1.6 NOR-Flash

A NOR-Flash is connected to SPI_A on the MBa62LxxO-S. The Extended SPI (SDR) Mode is used with 1-4-4 Read and 1-1-4 Write (Clock = max. 83.33 MHz)

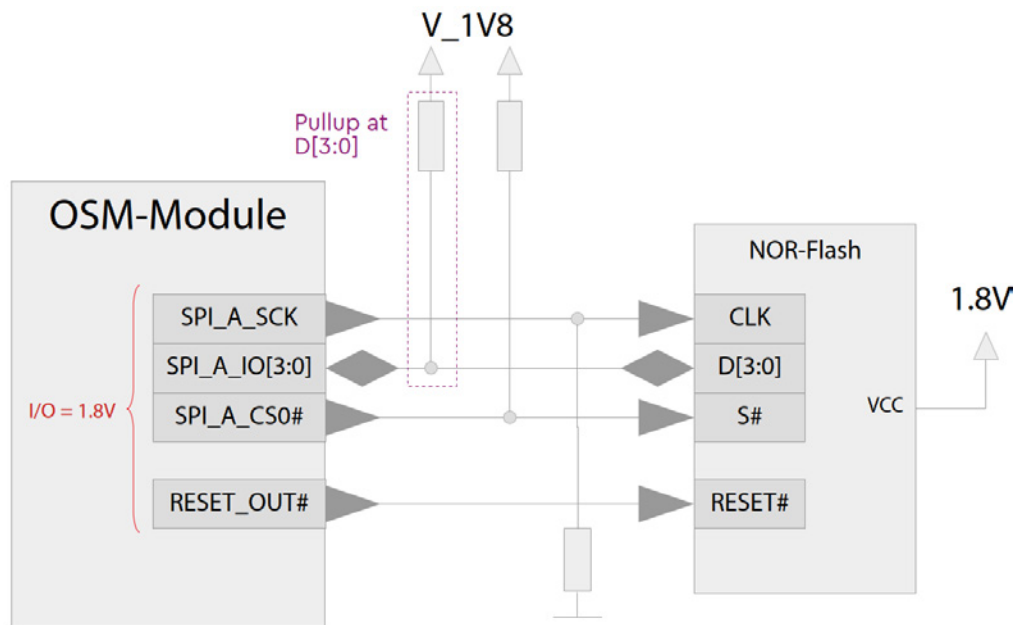


Figure 7: Block diagram NOR-Flash

4.2 Communication interfaces

4.2.1 UART- / Debug-interface

To get debug outputs of the CPU, the UART Console and UART_A interface of the CPU is used. The used UART of the CPU is connected to a Micro USB connector (X3) via a USB-to-UART bridge.

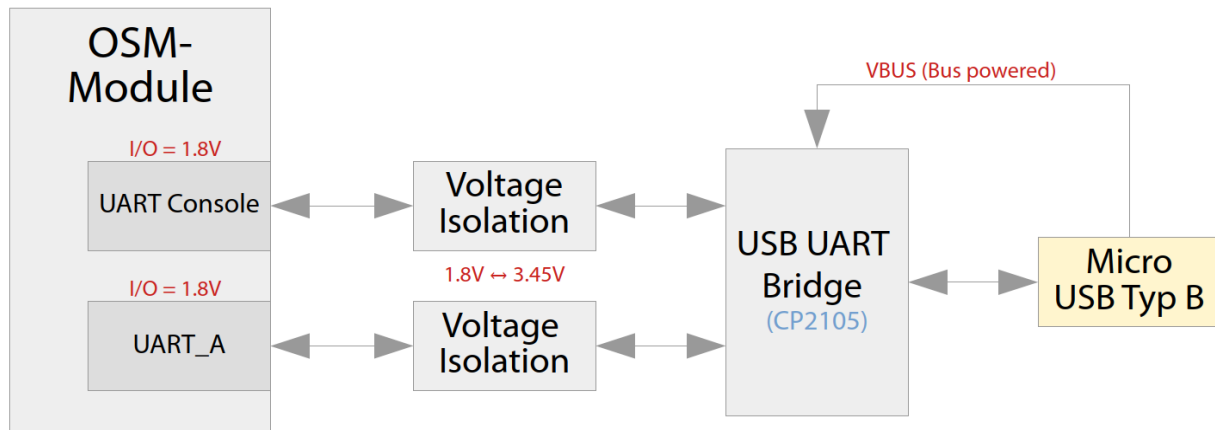


Figure 8: Block diagram UART- / Debug-interface

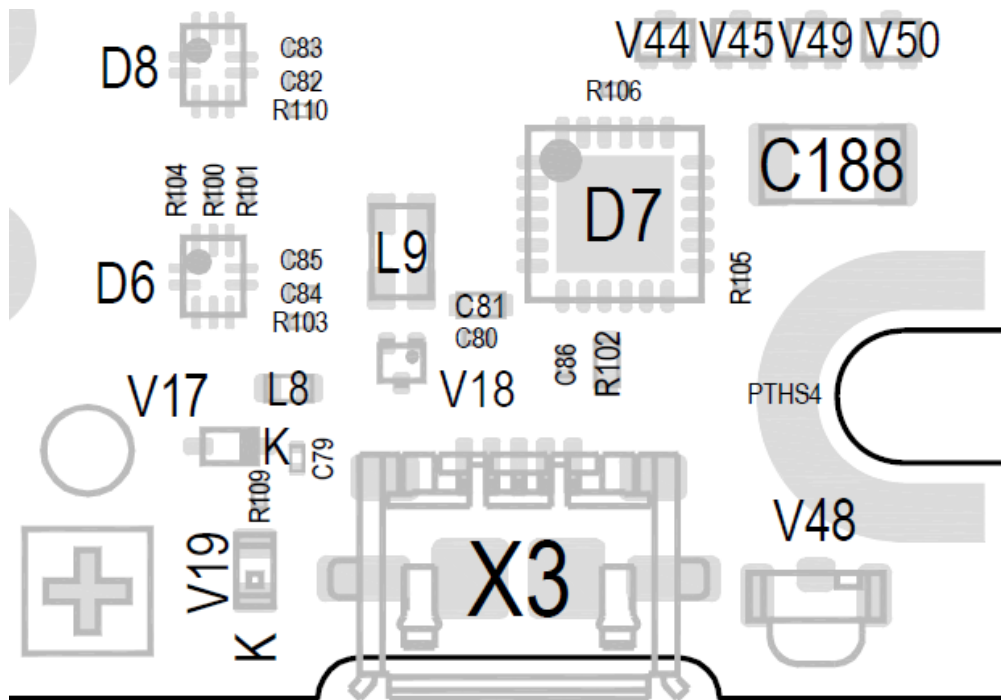


Figure 9: Position X3

4.2.2 USB interface

An overview of USB usage on the MBa62LxxO-S:

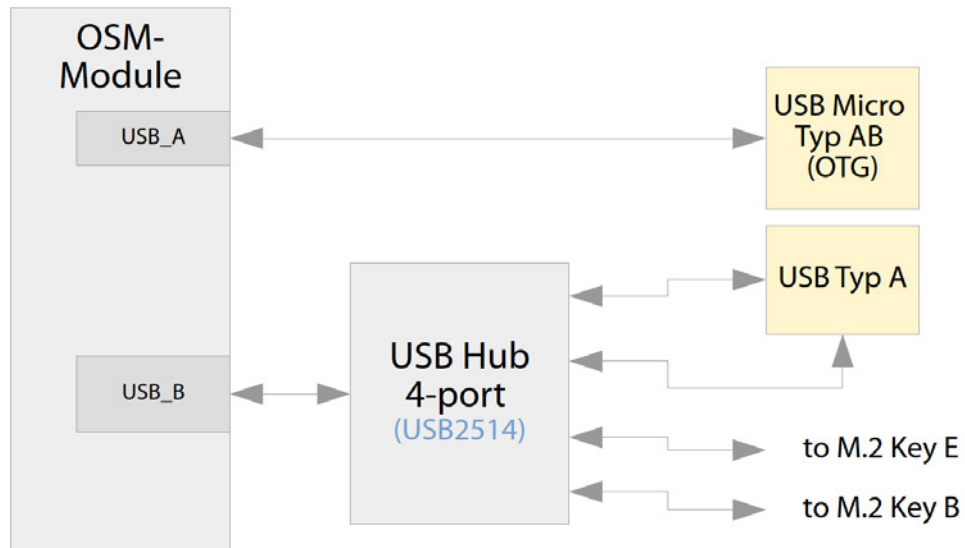


Figure 10: Block diagram USB

4.2.2.1 USB OTG

The MBa62LxxO-S provides a USB2.0 OTG interface (X5). The USB2.0 interface also serves as boot source (see also chapter 4.7.4).

- Protection circuit for USB_A_VBUS according to Reference Manual (1).
- 5 V power switch depending on USB_A_ID.

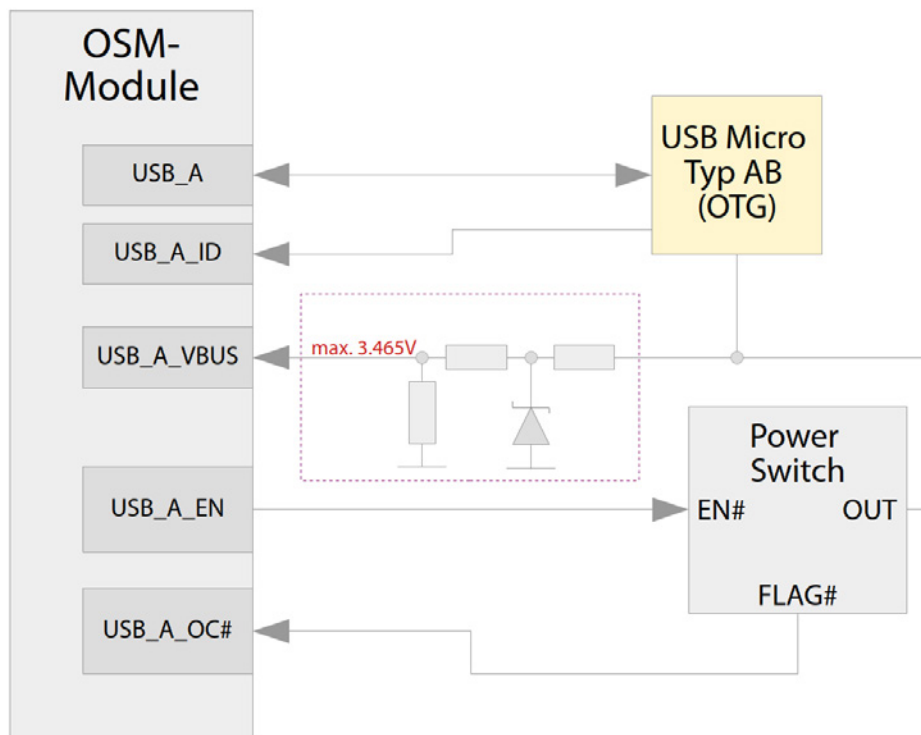


Figure 11: Block diagram USB OTG interface

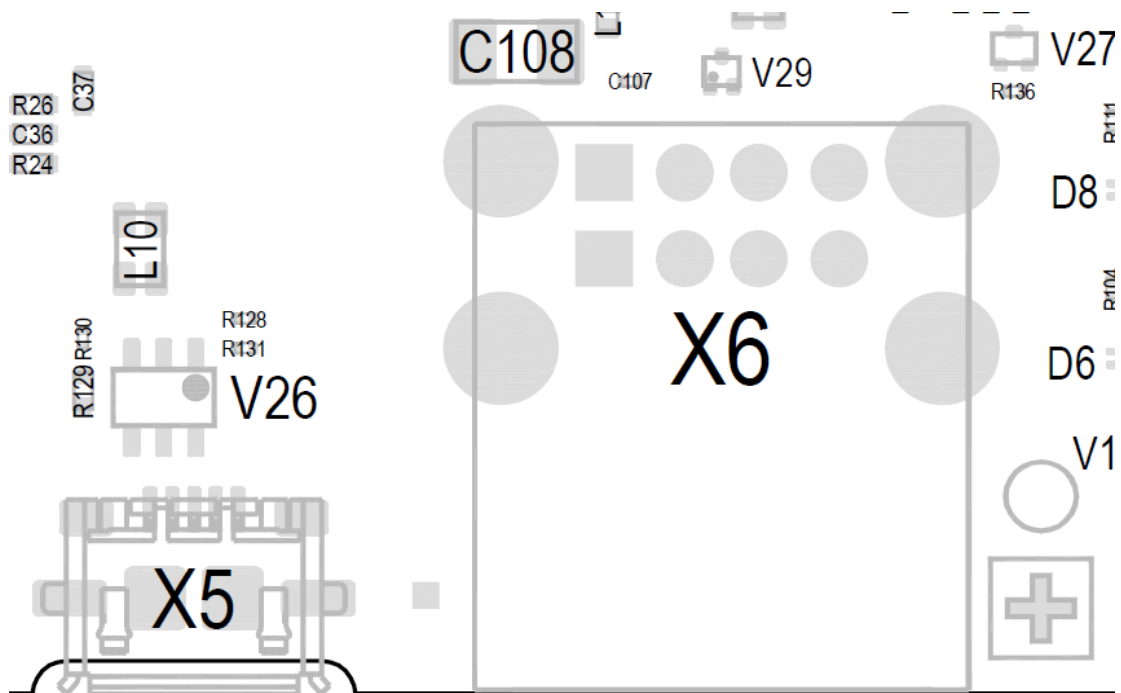


Figure 12: Position of USB interface X5 and X6

4.2.2.2 USB Hub

The MBa62LxxO-S also provides a 4-port USB host via USB_B of the CPU. This results in a double socket (X11) for the use of USB host (e.g. USB stick) as well as the use of M.2 Key E und M.2 Key B.

Protective circuit for USB1_VBUS according to Reference Manual (1).

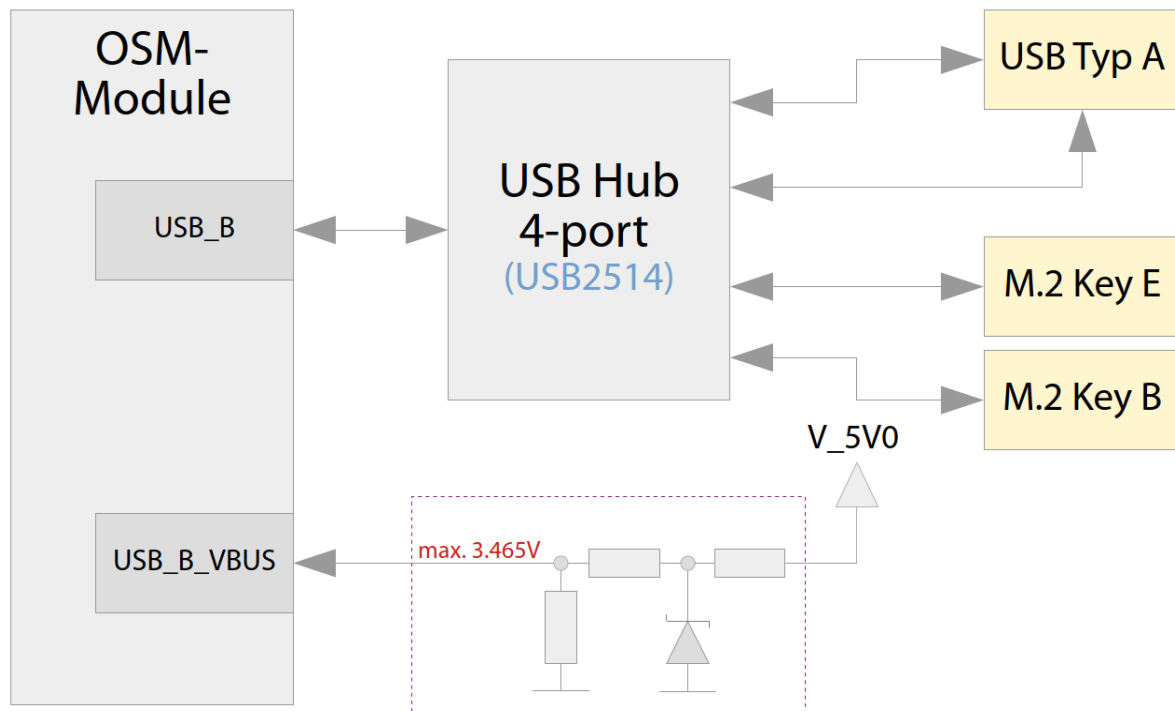


Figure 13: Block Diagram USB hub

4.2.3 Ethernet Interface

The MBa62LxxO-S features a Gigabit Ethernet Interface with PoE+ functionality for powering the board. It utilises the DP83867ISRZGZ PHY from TI, which supports IEEE 802.3 10BASE-TE, 100BASE-TX and 1000BASE-T. The RGMII with PoE+ is used on X8.

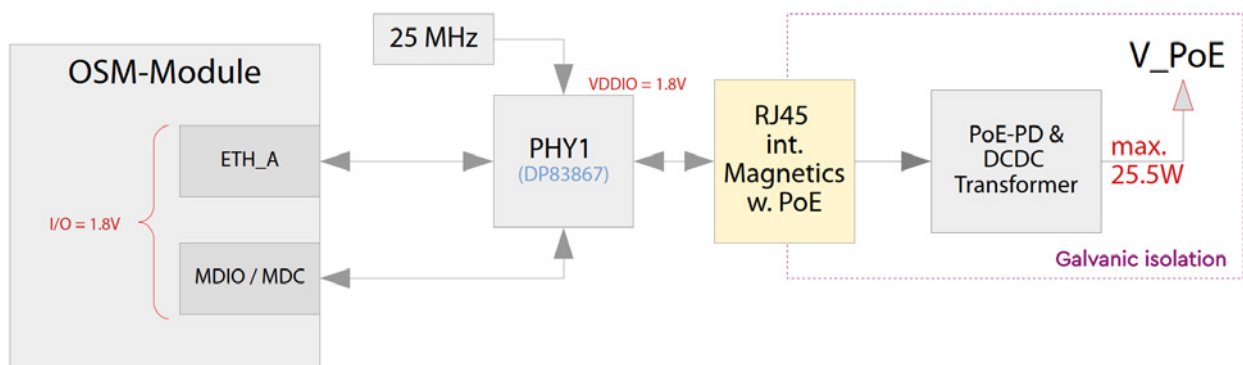


Figure 14: Block diagram Ethernet interface

4.2.4 MIPI-DSI Interface

The MBa62LxxO-S provides a DSI-Interface directly on the X9 FPC connector.

- Media type: MIPI-DSI
- Compatibility: MIPI-DSI v1.3
- Data rate: Supports 1, 2, 3 or 4 data lane modes up to 2.5 Gbps
- ESD protection: ± 12 kV contact discharge in accordance with IEC 61000-4-2
- Voltage / Current: typ. 3.3 V / max. 1 A (FPC connector)

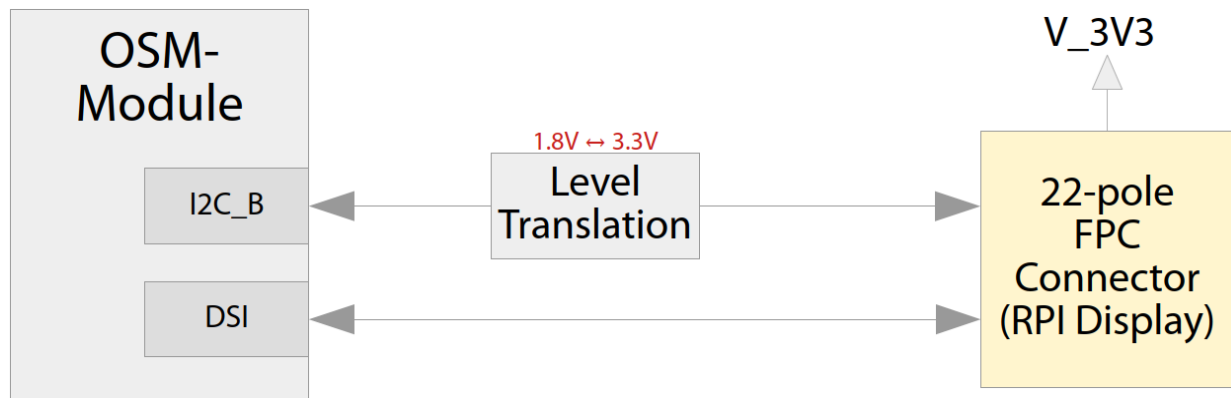


Figure 15: Block diagram MIPI-DSI

The X9 connector is selected to match the 22-pin pinout for Raspberry Pi displays.

Table 6: MIPI-DSI pinout X9

Pin	Signal	Type	Level	Note
1	DGND	P	0 V	Ground
2	I2C3_3V3_SDA	I/O	3.3 V	Data for I2C Configuration-Interface
3	I2C3_3V3_SCL	I/O	3.3 V	Data for I2C Configuration-Interface
4	DGND	P	0 V	Ground
5	NC	-	-	Not connected
6	NC	-	-	Not connected
7	DGND	P	0 V	Ground
8	DSI0_DATA3_P_L	O	1.8 V	DSI-Interface (Lane 3)
9	DSI0_DATA3_N_L	O	1.8 V	DSI-Interface (Lane 3)
10	DGND	P	0 V	Ground
11	DSI0_DATA2_P_L	O	1.8 V	DSI-Interface (Lane 2)
12	DSI0_DATA2_N_L	O	1.8 V	DSI-Interface (Lane 2)
13	DGND	P	0 V	Ground
14	DSI0_CLK_P_L	O	1.8 V	DSI-Interface (Clock)
15	DSI0_CLK_N_L	O	1.8 V	DSI-Interface (Clock)
16	DGND	P	0 V	Ground
17	DSI0_DATA1_P_L	O	1.8 V	DSI-Interface (Lane 1)
18	DSI0_DATA1_N_L	O	1.8 V	DSI-Interface (Lane 1)
19	DGND	P	0 V	Ground
20	DSI0_DATA0_P_L	O	1.8 V	DSI-Interface (Lane 0)
21	DSI0_DATA0_N_L	O	1.8 V	DSI-Interface (Lane 0)
22	DGND	P	0 V	Ground

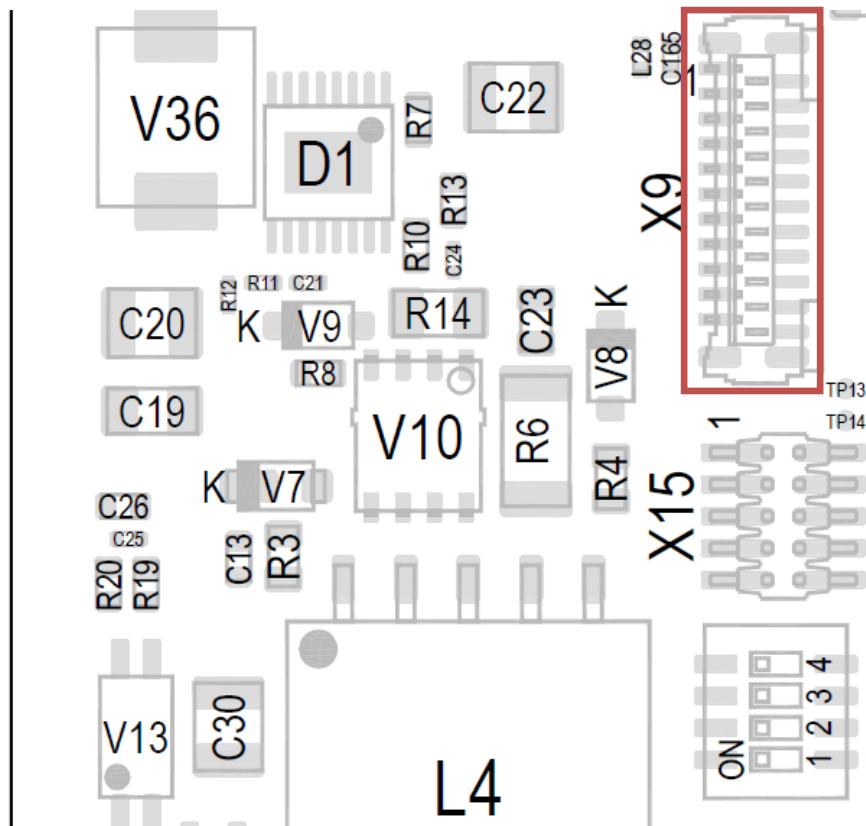


Figure 16: Position X9

4.2.5 CAN

Two CAN interfaces are implemented on MBa62LxxO-S according to the ISO 11898 standard. The signals are each provided on a 3-pin socket X7 and X14 (Type: Phoenix Contact MC 1,5/ 3-G-3,5).

Both interfaces are galvanically isolated with an isolation voltage of 1 kV, but not from each other.

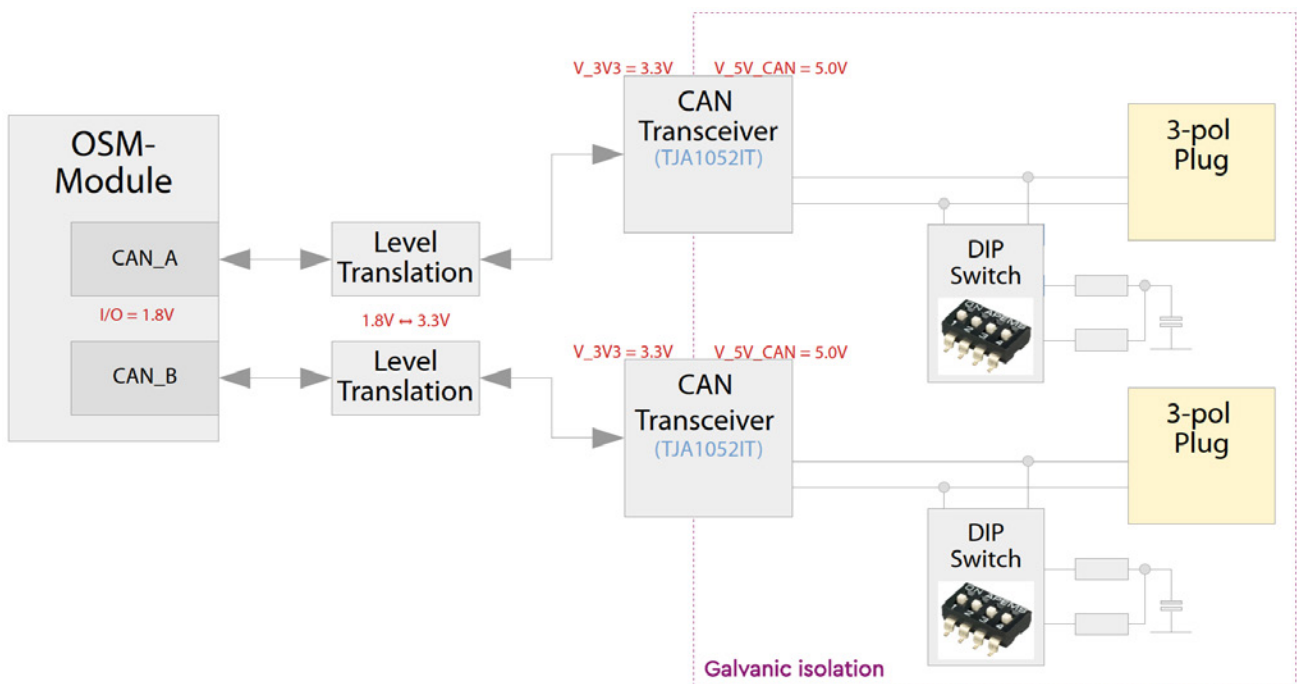


Figure 17: Block diagram CAN

The following tables show the pin assignment of the CAN connectors and the DIP switch for the 120 Ω CAN signal termination:

Table 7: CAN0 pinout (X7)

Pin	Pin name	Signal	I/O	Note
1	CAN_H	CAN0_H	I/O	galvanically isolated
2	CAN_L	CAN0_L	I/O	galvanically isolated
3	DGND	DGND_CAN	P	galvanically isolated

Table 8: CAN1 pinout (X14)

Pin	Pin name	Signal	I/O	Note
1	CAN_H	CAN1_H	I/O	galvanically isolated
2	CAN_L	CAN1_L	I/O	galvanically isolated
3	DGND	DGND_CAN	P	galvanically isolated

Table 9: CAN termination

DIP-Switch	Interface	ON	OFF
S1	CAN0	Termination CAN0 with 120 Ω	No termination CAN0
S4	CAN1	Termination CAN1 with 120 Ω	No termination CAN1

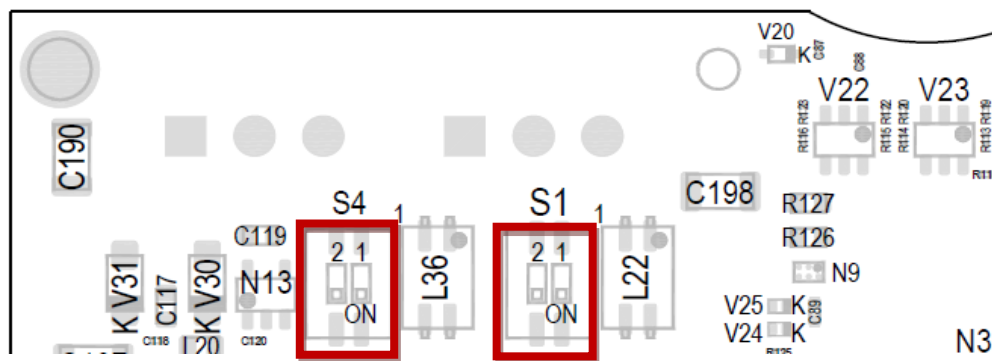


Figure 18: Position of CAN termination DIP switch S1 and S4

4.2.6 SD card

On the MBa62LxxO-S a SDIO (SDIO_A) interface of the CPU is implemented for a SD card connection (connector X4):

- MMC1 interface with 4 bit bus width
- Module provides an adapted supply voltage SDIO_A_IOPWR (1.8 V / 3.3 V) depending on the mode
- SDIO_A_IOPWR can be used for pull-up supply
- Power switch (3.3 V) provided for SD card supply
 - Power Cycle at RESET_OUT# and via SDIO_A_PWR_EN

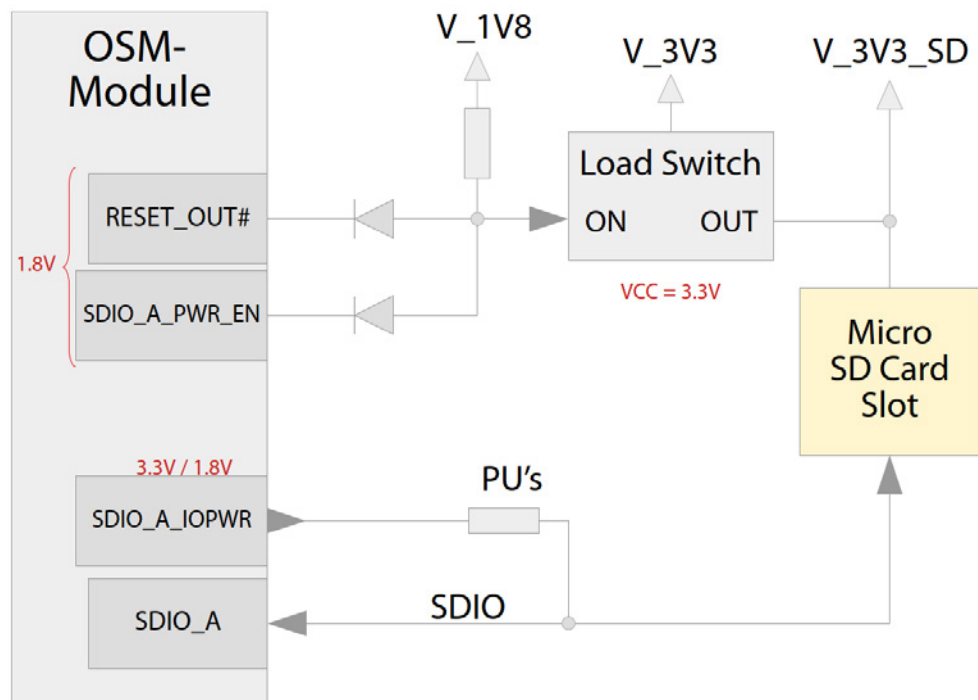


Figure 19: Block diagram SD card slot, X4

4.2.7 TPM

A TPM is optionally connected to SPI_B on the MBa62LxxO-S.

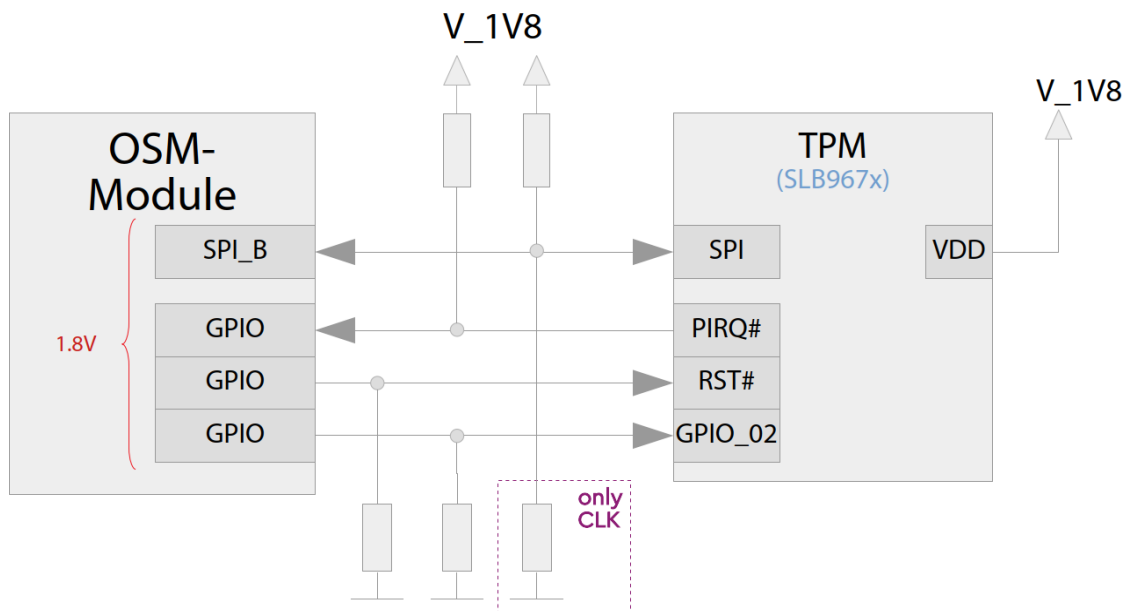


Figure 20: Block diagram TPM interface

4.2.8 JTAG interface

The JTAG signals of the CPU are provided on the 10-pin header X15.

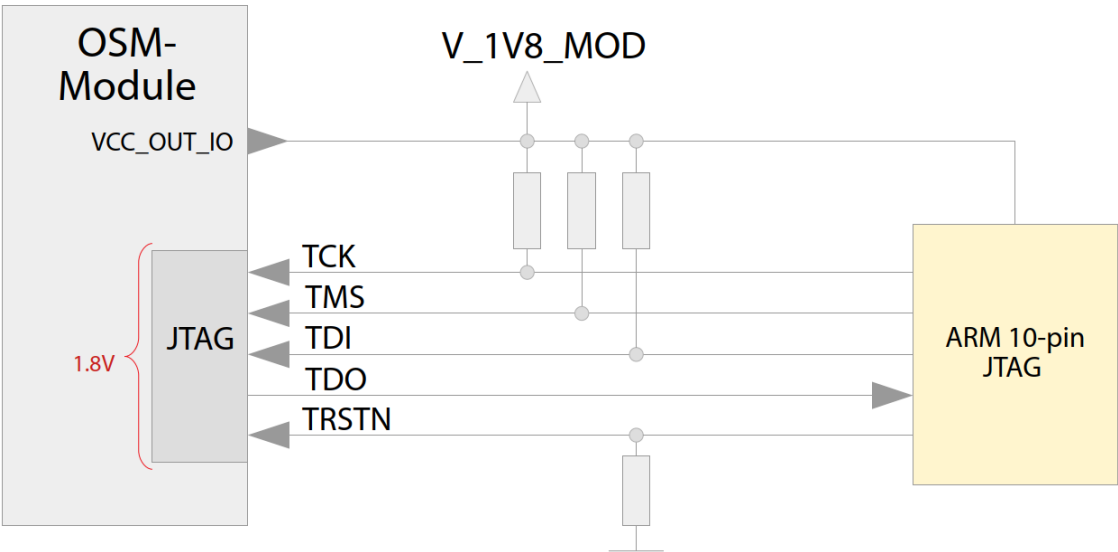


Figure 21: Block diagram JTAG

Table 10: JTAG signals

Signal / Multiplexing	I/O	Power group	Note
TCK	I	V_1V8 (1.8 V)	10 kΩ Pull-Up on mainboard
TDI	I		10 kΩ Pull-Up on mainboard
TDO	O		
TMS	I		10 kΩ Pull-Up on mainboard
TRST#	I		4.7 kΩ Pull-Up on mainboard
EMU[1:0]	IO		Optional signals, not required for JTAG

Table 11: Pinout JTAG interface X15

Signal	Pin	Pin	Signal
VCC	1	2	TMS
GND	3	4	TCK
GND	5	6	TDO
Key	7	8	TDI
GND	9	10	TRST#

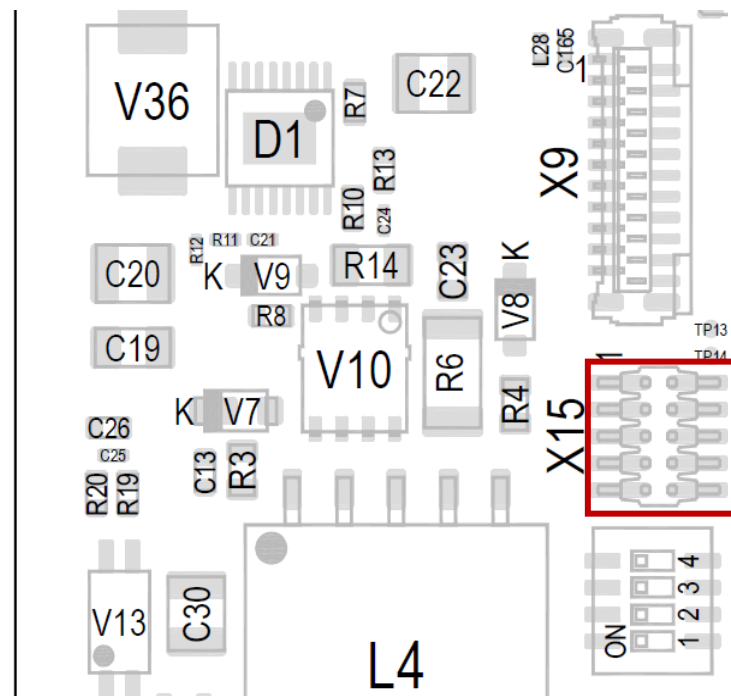


Figure 22: Position of JTAG, X15

4.3 M.2 slots + SIM card

On the MBa62LxxO-S, the two M.2 slots are configured as follows: Key E (form factor 2230) for use with, for example, Wi-Fi/WPAN, and Key B (form factor 3042) for use with, for example, LTE/GPS, plus a SIM card holder X11.

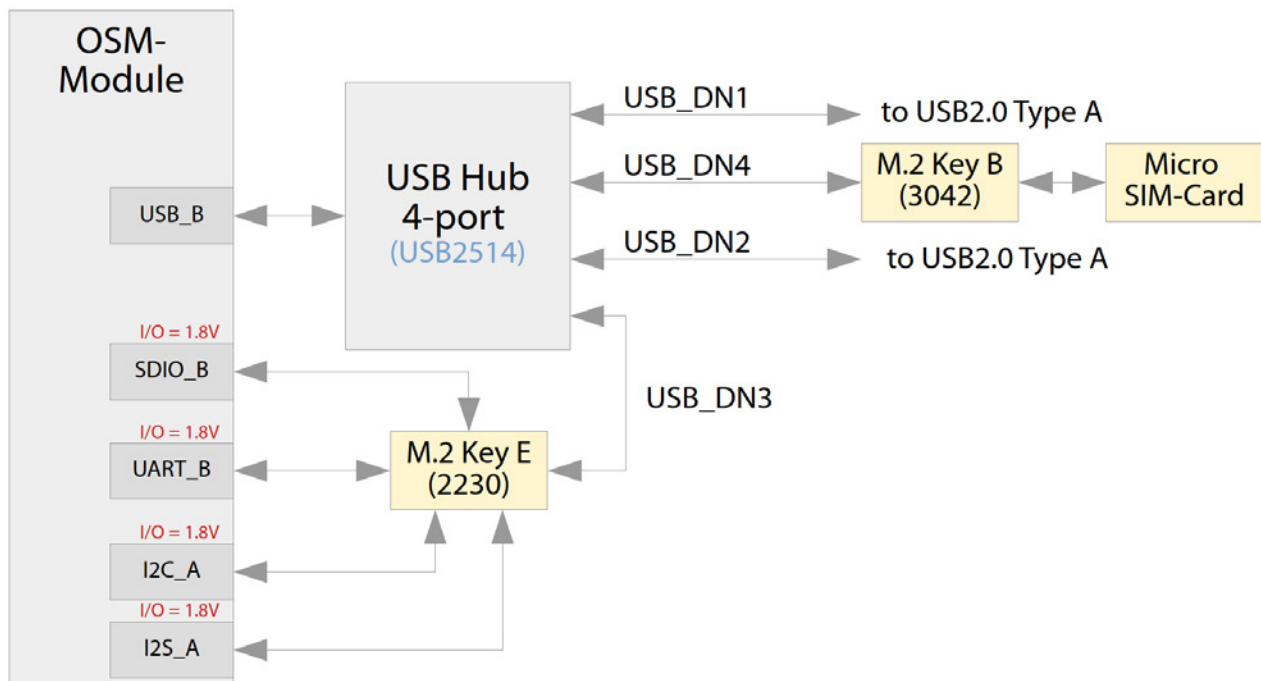


Figure 23: Block diagram M.2 Key B + SIM Card and M.2 Key E

4.4 GPIO-Header X13

Bidirectional 3.3V GPIOs are provided in the form of a Raspberry Pi-compatible pin header X13.

Table 12: Pinout header X13

Pin	Signal	I/O	AM62L specific
1	V_3V3	P	
2	V_5V0_SW	P	
3	GPIO2	I/O	I2C3_SDA/GPIO0_16
4	V_5V0_SW	P	
5	GPIO3	I/O	I2C3_SCL/GPIO0_15
6	DGND	P	
7	GPIO4	I/O	GPIO0_29
8	GPIO14	I/O	UART2_TXD/GPIO0_24
9	DGND	P	
10	GPIO15	I/O	UART2_RXD/GPIO0_23
11	GPIO17	I/O	GPIO0_36
12	GPIO18	I/O	MCASP1_ACLKX/GPIO0_35
13	GPIO27	I/O	GPIO0_26
14	DGND	P	
15	GPIO22	I/O	GPIO0_40
16	GPIO23	I/O	GPIO0_38
17	V_3V3	P	
18	GPIO24	I/O	GPIO0_39
19	GPIO10	I/O	SPI1_D0/GPIO0_17
20	DGND	P	
21	GPIO9	I/O	SPI1_D1/GPIO0_18
22	GPIO25	I/O	GPIO0_21
23	GPIO11	I/O	SPI1_CLK/GPIO0_20
24	GPIO8	I/O	SPI1_CS0/GPIO0_19
25	DGND	P	
26	GPIO7	I/O	SPI1_CS1/GPIO0_22
27	GPIO0	I/O	GPIO0_31
28	GPIO1	I/O	GPIO0_27
29	GPIO5	I/O	GPIO0_41
30	DGND	P	
31	GPIO6	I/O	GPIO0_42
32	GPIO12	I/O	EHRPWM0_A/GPIO0_28
33	GPIO13	I/O	EHRPWM1_A/GPIO0_30
34	DGND	P	
35	GPIO19	I/O	MCASP1_AFSX/GPIO0_37
36	GPIO16	I/O	GPIO0_32
37	GPIO26	I/O	GPIO0_25
38	GPIO20	I/O	MCASP1_AXR0/GPIO0_34
39	DGND	P	
40	GPIO21	I/O	MCASP1_AXR1/GPIO0_33

4.5 Diagnosis- and user interfaces

4.5.1 Diagnosis LEDs

The MBa62LxxO-S provides the following status LEDs to indicate the system condition:

Table 13: Status LEDs

Reference	Description	Control signal	Colour
V46	User LED	USER_LED1	Green
X8	ETH - LINK/ACTIVITY	PHY LED Signals	Green / Yellow
V19	USB Debug Self-Power (5V)	5 V Input from X3	Blue
V42	Power V_IN	V_IN	Blue
V43	SoM Status	CARRIER_PWR_EN	Red / Green
V48	Carrier Status	RESET_OUT# / PG_MB	Red / Green

4.5.2 Reset buttons

Two reset buttons are available to the user on the MBa62LxxO-S.

Table 14: Reset buttons

Reference	Description	Control signal
S2	Activates the power sequencing on the module	TQM_HARD_RST#
S3	Default: Control from standby mode	EXT_WAKEUP0/1
	Optional: Cold reset	RESET_IN#

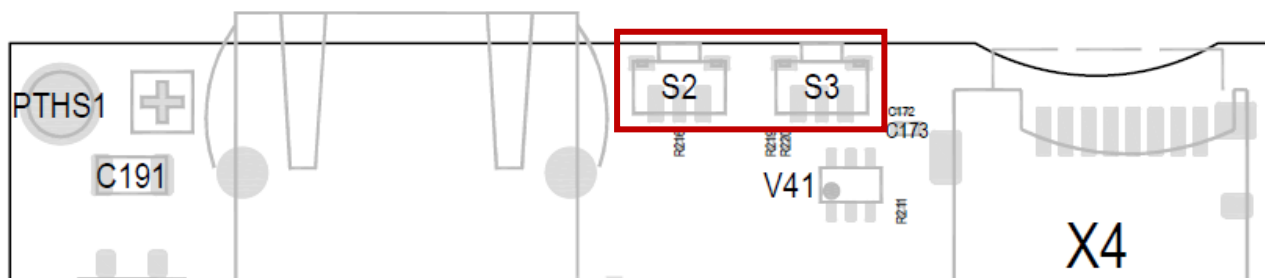


Figure 24: Position Reset buttons S2 / S3

4.5.3 Boot-Mode configuration

The MBa62LxxO-S supports the following boot sources for the TQMa62LxxOA-S:

- MMC0 via eMMC Flash (module internal)
- MMC1 via SD Card
- QSPI via NOR-Flash
- USB0 DFU-mode via USB-OTG-Connector (X5)

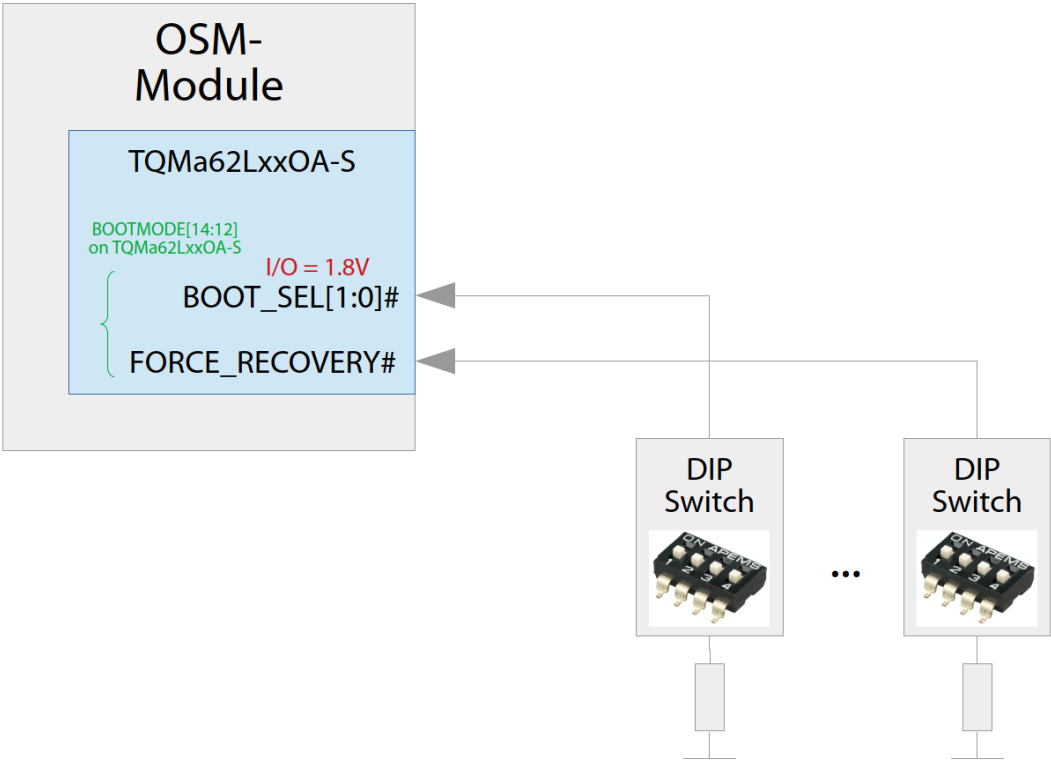


Figure 25: Block diagram boot source

The boot source is selected via the corresponding boot strap pins which can be set via DIP switches. The following table shows the settings of the DIP switch configuration.

Table 15: Boot mode configuration

DIP-Switch	Signal	eMMC	SPI-NOR	SD-Card	USB
S5	1 BOOT_SEL0# (BOOTMODE12)	ON	OFF	ON	OFF
	2 BOOT_SEL1# (BOOTMODE13)	ON	ON	OFF	OFF
	3 FORCE_RECOVERY# (BOOTMODE14)	OFF	OFF	OFF	ON
	4 -	-	-	-	-

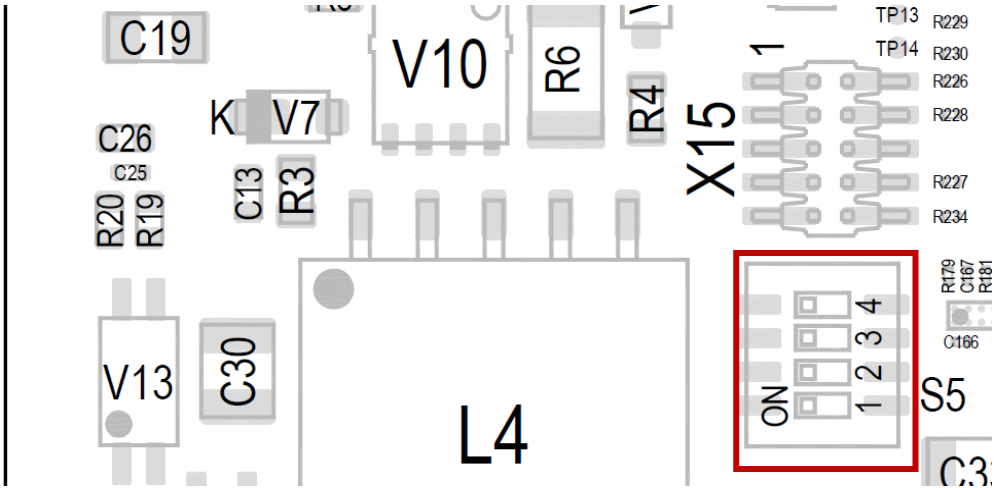


Figure 26: Placement DIP switch S5 for boot source

5. SOFTWARE

No software is required for the MBa62LxxO-S.

Suitable software is only required on the module TQMa62LxxOA-S and is not a part of this specification.

More information can be found in the [Support Wiki for the TQMa62LxxOA-S](#).

6. MECHANICS

6.1 Dimensions

The MBa62LxxO-S has overall dimensions (length $\times$ width) of 100 mm $\times$ 100 mm ($\pm$ 0.1 mm).

There are holes for four housing fixings with 3.2 mm Ø each.

Weight: 90.3 g (± 2 g)

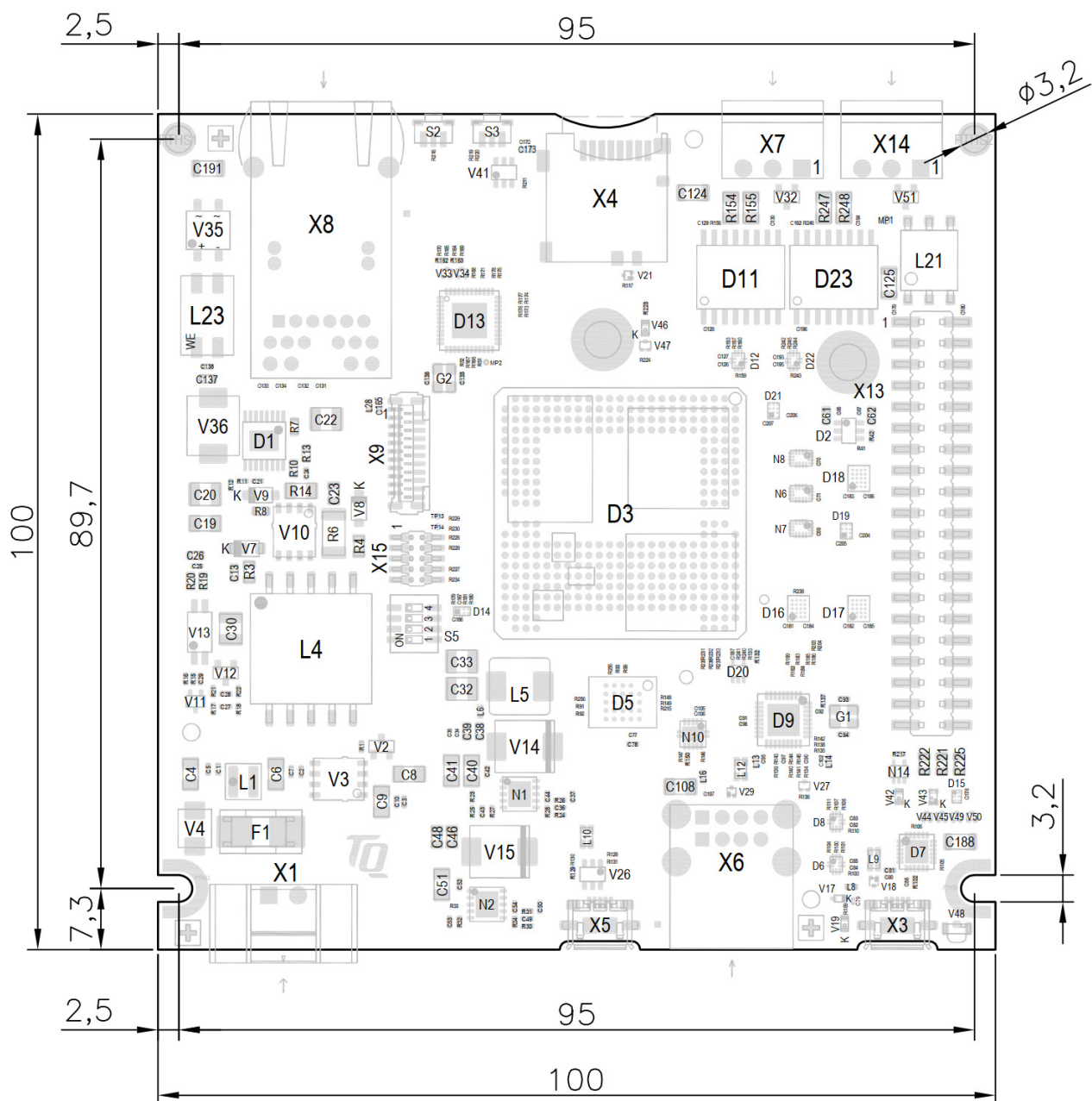


Figure 27: Dimensions MBa62LxxO-S

6.2 MBa62LxxO-S assembly

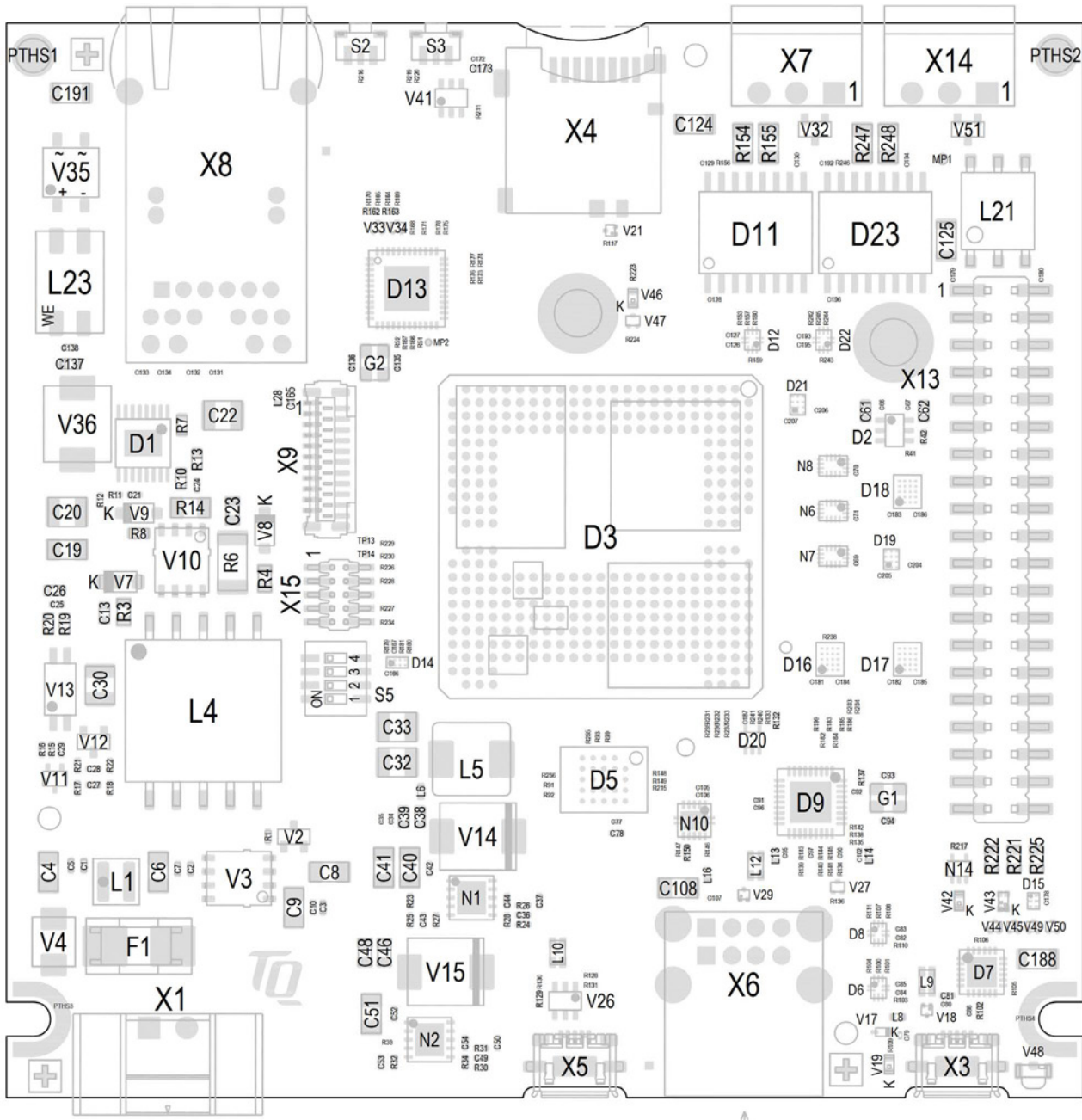
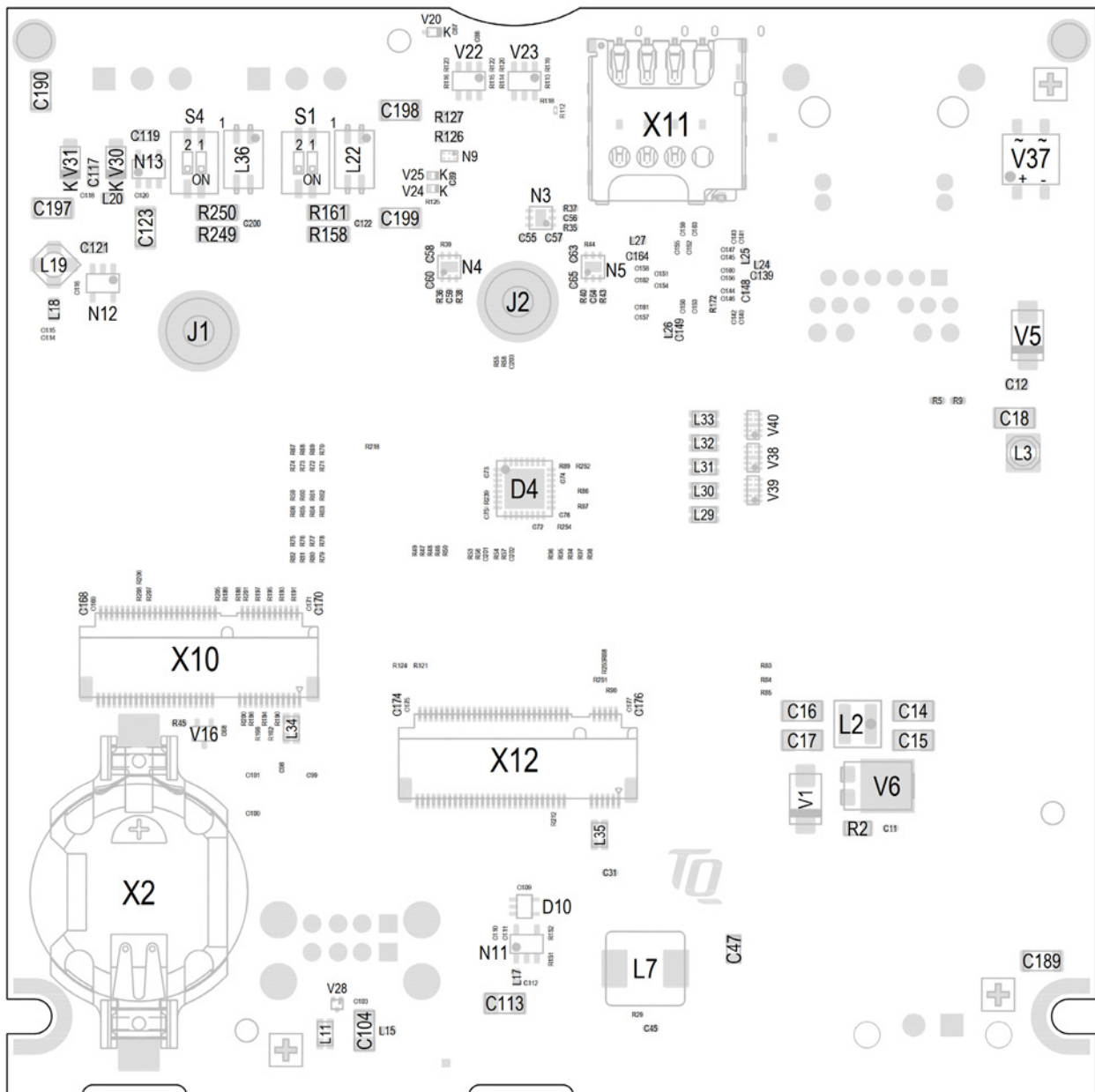


Figure 28: MBa62LxxO-S, component placement top





6.3 Label placement

TBD

Figure 30: Label placement MBa62LxxO-S

Table 16: Labels

Name	Note
AK1	TQ Serial number and article description

7. SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

7.1 EMC

The MBa62LxxO-S was developed according to the requirements of electromagnetic compatibility (EMC). Depending on the target system, anti-interference measures may still be necessary to guarantee the adherence to the limits for the overall system.

Following measures are recommended:

- Robust ground planes (adequate ground planes) on the printed circuit board
- A sufficient number of blocking capacitors in all supply voltages
- Fast or permanently clocked lines (e.g., clock signals) should be kept short; avoid interference of other signals by distance and/or shielding, also pay attention to frequencies and signal rise times
- Filtering of all signals, which can be connected externally (also "slow signals" and DC can radiate RF indirectly)
- Direct signal routing without stubs for multi-pole interfaces (e.g. LC display)

7.2 ESD

In order to avoid interspersions on the signal path from the input to the protection circuit in the system, the protection against electrostatic discharge should be provided directly at the inputs of a system. As these measures always have to be implemented on the carrier board, no special protective measures were provided on the MBa62LxxO-S.

The following measures are recommended for a carrier board:

- Generally applicable: Shielding of inputs (shielding connected well to ground / housing on both ends)
- Supply voltages: Suppressor diodes
- Slow signals: RC filtering, Zener diodes
- Fast signals: Protection components, e.g., suppressor diode arrays

7.3 Operational safety and personal security

Due to the occurring voltages (≤ 30 V DC), tests with respect to the operational and personal safety haven't been carried out.

7.4 Cyber Security

A Threat Analysis and Risk Assessment (TARA) must always be performed by the customer for their individual end application, as the MBa62LxxO-S is only a sub-component of an overall system.

7.5 Export Control and Sanctions Compliance

The customer is responsible for ensuring that the product purchased from TQ is not subject to any national or international export/import restrictions. If any part of the purchased product or the product itself is subject to said restrictions, the customer must procure the required export/import licenses at its own expense. In the case of breaches of export or import limitations, the customer indemnifies TQ against all liability and accountability in the external relationship, irrespective of the legal grounds. If there is a transgression or violation, the customer will also be held accountable for any losses, damages or fines sustained by TQ. TQ is not liable for any delivery delays due to national or international export restrictions or for the inability to make a delivery as a result of those restrictions. Any compensation or damages will not be provided by TQ in such instances.

The classification according to the European Foreign Trade Regulations (export list number of Reg. No. 2021/821 for dual-use-goods) as well as the classification according to the U.S. Export Administration Regulations in case of US products (ECCN according to the U.S. Commerce Control List) are stated on TQ's invoices or can be requested at any time. Also listed is the Commodity code (HS) in accordance with the current commodity classification for foreign trade statistics as well as the country of origin of the goods requested/ordered.

7.6 Warranty

TQ-Systems GmbH warrants that the product, when used in accordance with the contract, fulfills the respective contractually agreed specifications and functionalities and corresponds to the recognized state of the art.

The warranty is limited to material, manufacturing and processing defects. The manufacturer's liability is void in the following cases:

- Original parts have been replaced by non-original parts.
- Improper installation, commissioning or repairs.
- Improper installation, commissioning or repair due to lack of special equipment.



- Incorrect operation
- Improper handling
- Use of force
- Normal wear and tear

8. CLIMATIC AND OPERATIONAL CONDITIONS

The permissible temperature range of the module depends strongly on the installation situation (heat dissipation through heat conduction and convection) and the use. Therefore, no fixed value can be given for the entire module group. In general, reliable operation is ensured if the following conditions are met:

Table 17: Climatic and operational conditions MBa62LxxO-S

Parameter	Range	Remark
Temperature range	-40 °C to +85 °C	Without Lithium battery
Storage temperature	-40 °C to +100 °C	–
Relative air humidity (operation / storing)	10 % to 90 %	Not condensing

Attention:



The CPU belongs to a performance category in which a cooling system may be essential in certain applications. It is the user's responsibility to define a suitable cooling method depending on the specific mode of operation (e.g., dependence on clock frequency, stack height, airflow, and software). When connecting the heat sink, special attention must be paid to the tolerance chain (PCB thickness, PCB curvature, BGA balls, BGA package, thermopad, heat sink). The CPU is not the highest component in every case. A defective cooling connection can lead to overheating of the module and thus to malfunctions, premature aging or destruction.

8.1 Protection against external effects

Protection class IP00 was defined for the MBa62LxxO-S. There is no protection against foreign objects, touch or humidity.

8.2 Reliability and service life

No detailed MTBF calculation has been done for the MBa62LxxO-S.

The MBa62LxxO-S is designed to be insensitive to vibration and impact.

Service life limiting components such as electrolytic capacitors were not used.



9. ENVIRONMENT PROTECTION

9.1 RoHS

The MBa62LxxO-S is manufactured RoHS compliant.

- All components and assemblies are RoHS compliant
- The soldering processes are RoHS compliant

9.2 WEEE®

The final distributor is responsible for compliance with the WEEE® regulation.

Within the scope of the technical possibilities, the MBa62LxxO-S was designed to be recyclable and easy to repair.

9.3 REACH®

The EU-chemical regulation 1907/2006 (REACH® regulation) stands for registration, evaluation, certification and restriction of substances SVHC (Substances of very high concern, e.g., carcinogen, mutagen and/or persistent, bio accumulative and toxic). Within the scope of this juridical liability, TQ-Systems GmbH meets the information duty within the supply chain with regard to the SVHC substances, insofar as suppliers inform TQ-Systems GmbH accordingly.

9.4 EuP

The Ecodesign Directive, also Energy using Products (EuP), is applicable to products for the end user with an annual quantity >200,000. The MBa62LxxO-S must therefore always be seen in conjunction with the complete device.

The available standby and sleep modes of the components on the MBa62LxxO-S enable compliance with EuP requirements for the MBa62LxxO-S.

9.5 Statement on California Proposition 65

California Proposition 65, formerly known as the Safe Drinking Water and Toxic Enforcement Act of 1986, was enacted as a ballot initiative in November 1986. The proposition helps protect the state's drinking water sources from contamination by approximately 1,000 chemicals known to cause cancer, birth defects, or other reproductive harm ("Proposition 65 Substances") and requires businesses to inform Californians about exposure to Proposition 65 Substances.

The TQ device or product is not designed or manufactured or distributed as consumer product or for any contact with end-consumers. Consumer products are defined as products intended for a consumer's personal use, consumption, or enjoyment. Therefore, our products or devices are not subject to this regulation and no warning label is required on the assembly.

Individual components of the assembly may contain substances that may require a warning under California Proposition 65. However, it should be noted that the Intended Use of our products will not result in the release of these substances or direct human contact with these substances. Therefore you must take care through your product design that consumers cannot touch the product at all and specify that issue in your own product related documentation.

TQ reserves the right to update and modify this notice as it deems necessary or appropriate.

9.6 Packaging

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment. To be able to reuse the MBa62LxxO-S, it is produced in such a way (a modular construction) that it can be easily repaired and disassembled. The energy consumption of this subassembly is minimised by suitable measures. The MBa62LxxO-S is delivered in reusable packaging.

9.7 Batteries

9.7.1 General notes

Due to technical reasons a battery is necessary for the MBa62LxxO-S. Batteries containing mercury (Hg), cadmium (Cd) or lead (Pb) are not used.

If this is for technical reasons unavoidable, the device is marked with the corresponding hazard note.

To allow a separate disposal, batteries are generally only mounted in sockets. During disposal, the device must not be exposed to fire or mechanical crushing while the battery is still installed.

9.7.2 Lithium batteries

The requirements concerning special provision 188 of the ADR (section 3.3) are complied with for Lithium batteries.

There is therefore no classification as dangerous goods:

- Basic lithium content per cell not more than 1 g (except for lithium ion and lithium polymer cells for which a lithium content of not more than 1.5 g per cell applies (equals 5 Ah)).



- Basic lithium content per battery not more than 2 g
(except for lithium ion batteries for which a lithium content of not more than 8 g per cell applies (equals 26 Ah)).
- Lithium cells and batteries are examined according to UN document ST/SG/AC.10-1.

During transport a short circuit or discharging of the socketed lithium battery is prevented by extricable insulating foils or by other suitable insulating measures.

9.8 Other entries

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment. To be able to reuse the MBa62LxxO-S, it is produced in such a way, that it can be easily repaired and disassembled. The energy consumption of this subassembly is minimised by suitable measures. Due to the fact that at the moment there is still no technical equivalent alternative for printed circuit boards with bromine-containing flame protection (FR-4 material), such printed circuit boards are still used. No use of PCB containing capacitors and transformers (polychlorinated biphenyls). These points are an essential part of the following laws:

- The law to encourage the circular flow economy and assurance of the environmentally acceptable removal of waste as at 27.9.94
(Source of information: BGBl I 1994, 2705)
- Regulation with respect to the utilization and proof of removal as at 1.9.96
(Source of information: BGBl I 1996, 1382, (1997, 2860))
- Regulation with respect to the avoidance and utilization of packaging waste as at 21.8.98
(Source of information: BGBl I 1998, 2379)
- Regulation with respect to the European Waste Directory as at 1.12.01
(Source of information: BGBl I 2001, 3379)

This information is to be seen as notes. Tests or certifications were not carried out in this respect.

10. APPENDIX

10.1 Acronyms and definitions

The following acronyms and abbreviations are used in this document.

Table 18: Acronyms

Acronym	Meaning
ADC	Analog/Digital Converter
BIOS	Basic Input/Output System
BSP	Board Support Package
CAN	Controller Area Network
CPU	Central Processing Unit
DDR3L	DDR3 Low Voltage
DIN	German industry standard (Deutsche Industrie Norm)
DIP	Dual In-line Package
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
eMMC	embedded Multimedia Card (Flash)
EN	European standard (Europäische Norm)
ESD	Electrostatic Discharge
EuP	Energy using Products
FET	Field Effect Transistor
FFC	Flat Flex Cable
FR-4	Flame Retardant 4
GPIO	General Purpose Input/Output
HP	Headphone
I/O	Input/Output
I ² C	Inter-Integrated Circuit
IEEE®	Institute of Electrical and Electronics Engineers
IP00	Ingress Protection 00
JTAG®	Joint Test Action Group
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LSB	Least Significant Bit
LVDS	Low Voltage Differential Signal
MCASP	Multichannel Audio Serial Port
MII	Media Independent Interface
MMC	Multimedia Card
MSB	Most Significant Bit
MTBF	Mean operating Time Between Failures

Table 18: Acronyms (continued)

Acronym	Meaning
n.c.	Not Connected
NOR	Not-Or
NP	Not Placed
OTG	On-The-Go
PCB	Printed Circuit Board
PCIe	Peripheral Component Interconnect express
PCMCIA	People Can't Memorize Computer Industry Acronyms
PD	Pull-Down
PHY	Physical (OSI model layer)
PMIC	Power Management Integrated Circuit
PRU	Programmable Real-Time Unit
PU	Pull-Up
REACH®	Registration, Evaluation, Authorisation (and restriction of) Chemicals
RGMII	Reduced Gigabit Media Independent Interface
RJ45	Registered Jack 45
RMS	Root Mean Square
RoHS	Restriction of (the use of certain) Hazardous Substances
RS-232, RS-485	Recommended Standard (serial interface)
RTC	Real-Time Clock
SD card	Secure Digital card
SD/MMC	Secure Digital Multimedia Card
SDRAM	Synchronous Dynamic Random Access Memory
SIM	Subscriber Identification Module
SMD	Surface-Mounted Device
SMT	Surface-Mount Technology
SPI	Serial Peripheral Interface
THD	Through-Hole Device
THT	Through-Hole Technology
UART	Universal Asynchronous Receiver/Transmitter
UIM	User Identity Module
USB	Universal Serial Bus
WEEE®	Waste Electrical and Electronic Equipment
WLAN	Wireless Local Area Network
WP	Write-Protection
WPAN	Wireless Personal Area Network
WWAN	Wireless Wide Area Network



10.2 References

Table 19: Further applicable documents

No.	Name	Rev. / Date	Company
(1)	AM62L Sitara Processors Technical Reference Manual	A / Sep. 2025	Texas Instruments
(2)	AM62L Sitara Processors Datasheet	B / Nov. 2025	Texas Instruments
(3)	AM62Lx Processor Errata	B / Oct. 2025	Texas Instruments
(4)	TQMa62LxxOA-S User's Manual	– current –	TQ-Systems
(5)	Support-Wiki for the TQMa62LxxOA-S	– current –	TQ-Systems

