For Technology
in Quality

User's Manual

STK-MB5329

STK MB5329 UM 100

18.03.2010

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Revision history

Rev.:	Date:	Name:	Pos.:	Modification:
100	18.03.2010	Petz		Document created

1. About this manual

1.1 Tips on safety

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

1.2 Terms and conventions

Symbol / Tag	Meaning
	This symbol represents the handling of electrostatic-sensitive modules and / or components. These components are often damaged / destroyed with 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 greater 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.
Filename.ext	This specification is used to state the complete file name with its corresponding extension.
`Instructions / Examples`	Examples of an application. e.g., • specifying memory partitions • processing a script • .....
Reference	Cross-reference to another section, figure or table.

Table 1: Terms and conventions

1.3 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: not to 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 was switched off. Violation of this guideline may result in damage / destruction of the module and be dangerous to your health. Improper handling of your TQ-product would render the guarantee invalid.

Proper ESD handling

	The electronic components of your TQ-product are sensitive to electrostatic discharge (ESD). Always wear antistatic clothing and 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.

1.4 Registered trademarks

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1.5 Imprint

TQ-Components GmbH

Gut Delling, Mühlstraße 2

D-82229 Seefeld

Tel.: +49 (0)8153 9308-0
Fax: +49 (0)8153 9308-134

Email: info@tqc.de
Web: http://www.tq-components.com

1.6 Copyright

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1.8 Copyright and licence expenses

The drivers and utilities for the used components as well as the BIOS are subject to the copyrights of the respective manufacturers. The licence conditions of the respective manufacturer are to be adhered to.

Bootloader-licence expenses are paid by TQ and are included in the price.

Licence expenses for the operating system and applications are not taken into consideration and must be separately calculated / declared.

1.9 Further applicable documents / presumed knowledge

1.9.1 Specifications and manual of the used modules

These documents describe the service, functionality and special characteristics of the used module (incl. BIOS).

1.9.2 Specifications of the used components

The manufacturer's specifications of the used components, for example Compact-Flash cards, are to be taken note of. They contain if applicable additional information, which must be taken note of for safe and reliable operation. These documents are stored at TQ.

1.9.3 General expertise

Expertise in electrical engineering / computer engineering is required for the installation and the use of the device.

1.10 Acronyms and definitions

The following terminology and abbreviations are used:

Acronym	Meaning
BDM	Background Debug Mode
BGA	Ball Grid Array
BST	Boundary Scan Test
CAN	Controller Area Network
CCR	Clock/Control Register
CiA	CAN in Automation
CMOS	Complementary Metal Oxide Semiconductor
CPU	Central Processing Unit
DIP	Dual In-line Package
DVI	Digital Visual Interface
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electromagnetic Compatibility
ESD	ElectroStatic Discharge
FEC	Fast Ethernet Controller
FET	Field Effect Transistor
GPIO	General Purpose Input/Output
HD-D-sub	High Density D-sub
I²C	Inter-Integrated Circuit
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
Mbps	Mega Bit Per Second
MSB	Most Significant Bit
n.c.	Not Connected
NC	Not Connected
OTG	On-The-Go
PCB	Printed Circuit Board
ppm	Parts Per Million
RFU	Reserved for Future Use
RoHS	Restriction of Hazardous Substances
RTC	Real-Time Clock
SDR	Single Data Rate
SDRAM	Synchronous Dynamic Random Access Memory
SPI	Serial Peripheral Interface
TSOP	Thin Small Outline Package
TSSOP	Thin-Shrink Small Outline Package
TVS	Transient Voltage Suppressor (diode)
UART	Universal Asynchronous Receiver/Transmitter
ULPI	UTMI+ Low Pin Interface
USB	Universal Serial Bus
VGA	Video Graphics Array
WVGA	Wide VGA (800 × 480)
ZIF	Zero Insertion Force

Table 2: Acronyms

2. Technical description

2.1 Brief description

The STK-MB5329 is designed to be powered by TQ modules based on the Freescale ColdFire CPU MCF5329. In combination with the module TQM5329 and a display with touch screen it offers PC core functionalities and standard interfaces.

2.2 System architecture

The STK-MB5329 is a compact Starterkit unit with display.

The STK-MB5329 offers the following system interfaces:

- 1 × Ethernet 10/100 Mbit/s
- 1 × USB host
- 1 × USB OTG
- 1 × Serial RS232
- 1 × Serial RS232 or RS485 (optionally)
- 1 × CAN 2.0B
- 12 × GPIO

2.2.1 Block diagram

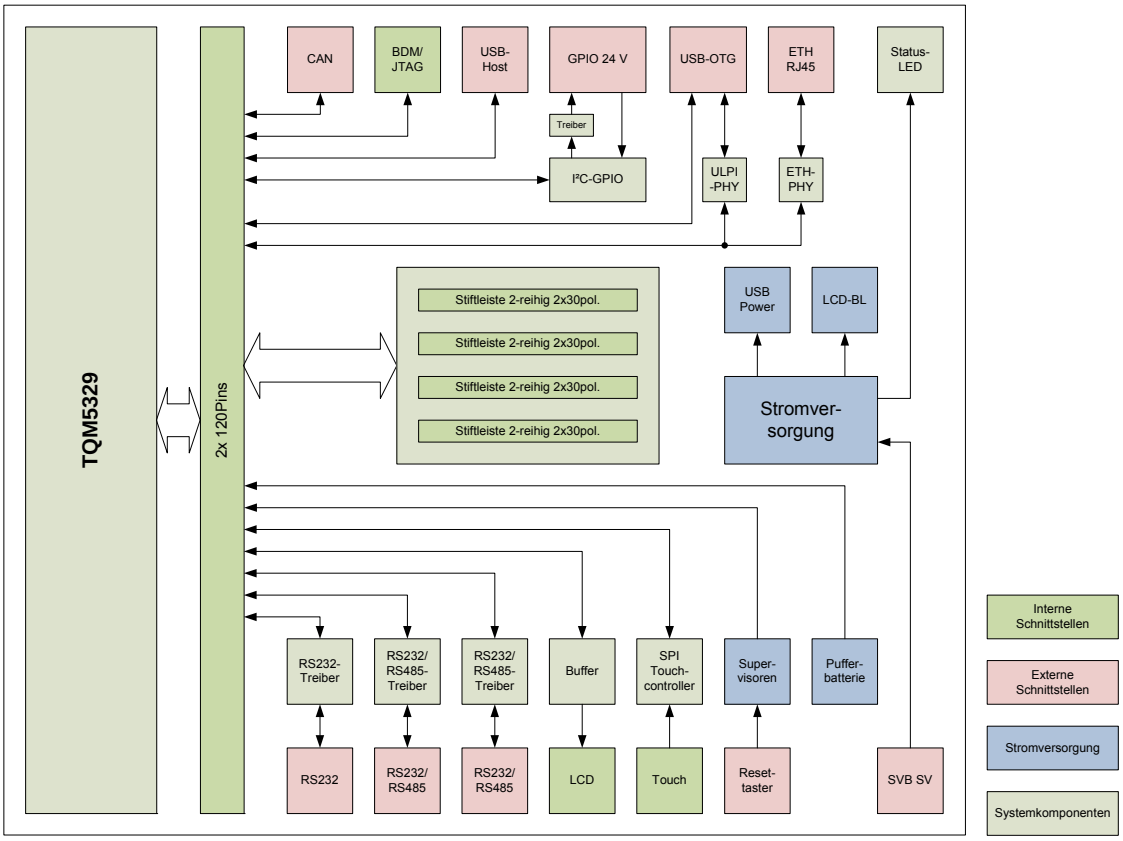

Illustration 1: Block diagram STK-MB5329

3. Electronics specification

3.1 System components

3.1.1 Processor board

The CPU module TQM5329 serves as the central processor unit for the STK-MB5329, which is equipped with the following features:

- Freescale CPU MCF5329
- SDR SDRAM 32 Mbyte
- Flash-RAM 16 Mbyte
- USBOTG charge pump
- Watchdog / RTC / EEPROM
- Temperature sensor
- Power supply 1.5 V and 3.3 V
- Voltage supervision 1.5 V and 3.3 V

3.1.2 Input filter

The STK-MB5329 is equipped with an input filter with an active inverse-polarity protection and a fuse with a rated current of 2.5 A.

3.1.3 Ground concept

There are different reference potentials in the system:

- DGND
- GND_CAN
- GND_RS485_1
- GND_RS485_2

3.1.4 RTC, Watchdog

The RTC and the watchdog are implemented using the Intersil ISL12028.

VBAT voltage range	1.8 V … 5.5 V
Max. current consumption	1.2 µA
Time deviation (with 20 ppm oscillator)	±10 min/year

Table 3: Technical parameters RTC

The I²C address of the EEPROM in the ISL12028 is 0b1010111, the address of the clock/control unit is 0b1101111 (address table of I²C bus see Table 6).

3.1.5 SDR SDRAM

3.1.5.1 Supported memory

The following types are applicable:

Manufacturer	64 Mbit (16 bit bus)	128 Mbit (16 bit bus)	256 Mbit (16 bit bus)	512 Mbit (16 bit bus)
ISSI	IS42S16400D-7TL	IS42S16800D-7TL	IS42S16160B-7TL	IS42S16320B-7TL

Table 4: Type of memory SDR SDRAM

The standard memory size is 128 Mbit ISSI IS42S16800D-7TL.
To achieve a memory width of 32 bits, two memory devices are used per TQM5329.
A memory size of 32 Mbytes is thereby achieved.

3.1.6 Flash

3.1.6.1 Supported memory

Several types of flash are available from different manufacturers. A TSOP56 footprint is placed on top of a BGA64 (for alternative component placement) thereby achieving a high flexibility in the component placement. The necessary software adaptions should be taken note of.

The used flash memory is a NOR type flash in MirrorBit ™ technology. The position of the protected blocks needs to be taken into account by the software (suffix 02/B is „lowest block protected“). Bottom-boot flashes are used.

Manufacturer	64 Mbit (16 bit bus)	128 Mbit (16 bit bus)	256 Mbit (16 bit bus)	512 Mbit (16 bit bus)	1 Gbit (16 bit bus)
Intel TSSOP	JS28F640P33B85	JS28F128P33B85	JS28F256P33B85	-	-

Table 5: Type of memory flash

The standard memory size is 128 Mbit Intel JS28F128P33B85. A memory size of 16 Mbytes is thereby achieved.

3.1.7 EEPROM

In addition to the 512-byte-EEPROM in the ISL12028 an additional EEPROM type M24C32-WDW6TP with a size of 4 Kbyte is implemented on the TQM5329. It is connected to the local I²C bus. More EEPROMs can be addressed on the main board by the I²C bus.

The I²C address of the EEPROM is set to 0b1010000 (I²C bus address map see Table 6). Pull-up resistors are provided as a placement option at the inputs E[0:2] of the EEPROM, which represent the three LSB of the I²C address.. The I²C address of the EEPROM can therefore be configured afterwards.

3.1.8 Temperature sensor

As a temperature sensor a LM73, which is read out via the I²C bus is used.

The I²C address of the sensor is set to 0b1001000 (I²C bus address map see Table 6). A pull-up and a pull-down resistor are provided as a placement option at the input ADDR of the sensor, which influences the two LSB of the I²C address. The I²C address of the sensor can therefore be configured afterwards.

The temperature sensor is placed close to the CPU on the top side of the module.

3.1.9 I²C bus

Table 6 shows the I²C address map. If the device allows the address to be set, corresponding pull-ups and pull-downs are provided at the address inputs.

Device	Address range of component	Chosen address	Remark
USB-OTG MAX3353	0x2C … 0x2D	0x2C (0101 100b)	On TQM5329
EEPROM M24C32	0x50 … 0x57	0x50 (1010 000b)	On TQM5329
Temperature sensor LM73	0x48 … 0x4A	0x48 (1001 000b)	On TQM5329
EEPROM ISL12028	0x57	0x57 (1010 111b)	On TQM5329
CCR ISL12028	0x6F	0x6F (1101 111b)	On TQM5329
PCA9554D	**0x20 … 0x27**	**0x20 (0100 000b)**	**On STK-MB5329**
PCA9554D	**0x20 … 0x27**	**0x21 (0100 001b)**	**On STK-MB5329**

Table 6: I²C address map

3.2 External interfaces

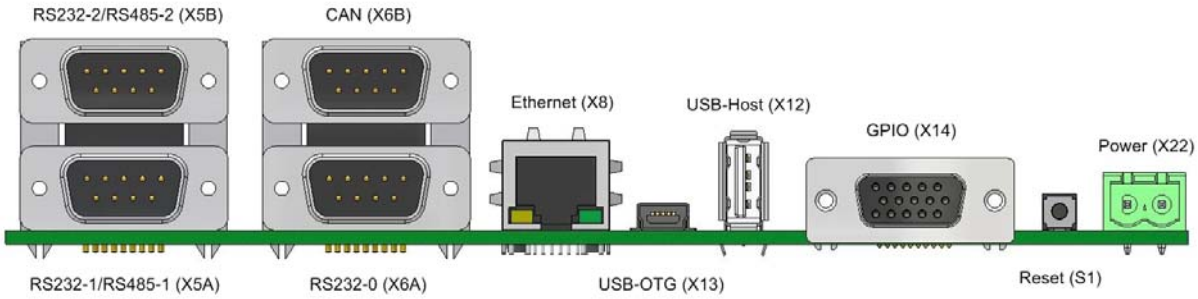

Illustration 2: External interfaces

Attention: destruction or malfunction!	
	1) Reverse polarity of the input voltage at the power connector (X22) can damage the device! The correct polarity is described under 3.2.1! 2) An identical D-sub connector is used for RS232 (X5, X6A) and CAN (X6B). Incorrect connection is possible! 3) The 15-pin HD-D-sub connector for GPIO (X14) looks like a VGA-monitor output. No monitor may be connected there!

3.2.1 Power supply – X22

The supply voltage range of the STK-MB5329 is 24 V DC –37.5% to +25% (15 V to 30 V DC).

A CE-certified DC power supply can be connected via a 2-pin Phoenix connector type MSTBA2,5/2-G-5,08.

Manufacturer	Type	Description
Phoenix	MSTBA2,5/2-G-5,08	Grid 5.08 mm Max. 250 V, 12 A

Table 7: Power supply connector

The plug connector is assigned as follows:

Pin	Signal name	Remark
1	VCC	VCC_{IN} 15 V … 30 V DC
2	GND	Ground

Table 8: Pin assignment power supply connector – X22

Notes concerning current load and protection circuit: see 5.1 Power supply.

Please ensure that the power connector is connected to the STK-MB5329 (X22) **before connecting the power supply to mains!**

3.2.2 RS232 / RS485 – X5, X6A

The TQM5329 offers up to three UART interfaces. The signals RxD, TxD, RTS# and CTS# are available for all three interfaces.

UART0 is implemented as an RS232 interface. UART1 and UART2 are designed as an RS232 or as galvanically separated RS485. RS232 and RS485 cannot be active simultaneously. Illustration 3 shows the basic circuit of how the UART interfaces of the TQM5329 are connected to the external plug connectors of the STK-MB5329.

For both interfaces a MAX3222 is used as an RS232 driver. For RS485 interfaces a Sipex SP491 is used as a driver. All transceivers are equipped with an integrated ESD protection of up to ±15 kV.

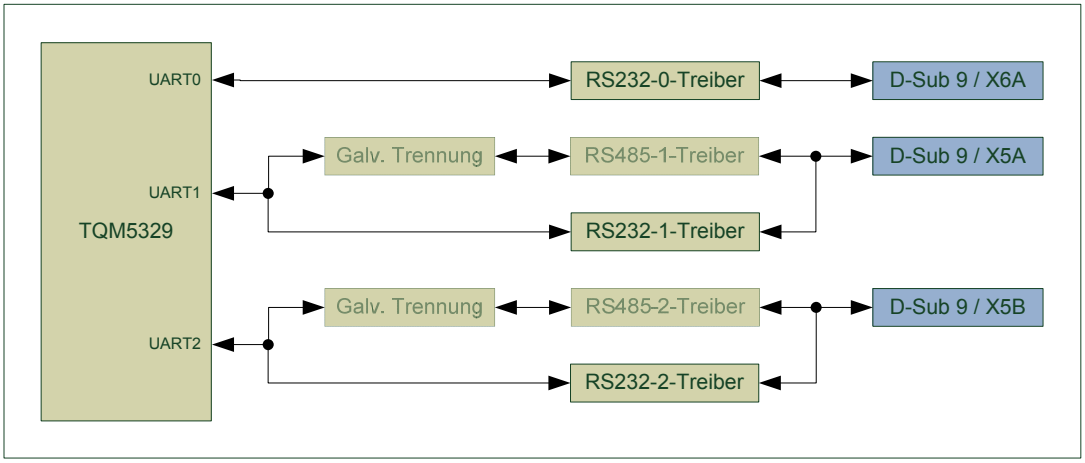

Illustration 3: Block diagram RS232 / RS485

Table 9 shows the configuration of the 9-pin D-sub connector with RS232 or RS485 signals:

Pin	X6A	X5A		X5B		Description
	RS232-0	RS232-1	RS485-1	RS232-2	RS485-2	
1	-	-	Y	-	Y	TX+ (RS485)
2	RXD	RXD	-	RXD	-	To RS232 transceiver
3	TXD	TXD	-	TXD	-	From RS232 transceiver
4	-	-	A	-	A	RX+ (RS485)
5	DGND	DGND	-	DGND	-	Ground
6	-	-	Z	-	Z	TX- (RS485)
7	RTS#	RTS#	-	RTS#	-	From RS232 transceiver
8	CTS#	CTS#	-	CTS#	-	To RS232 transceiver
9	-	-	B	-	B	RX- (RS485)

Table 9: Plug connector RS232 / RS485 – X5, X6A

Attention: destruction or malfunction!

Due to four physically identical 9-pin D-sub connectors there is the danger of confusion between RS232, RS485 and CAN.
The exact arrangement of the interfaces is shown in Illustration 2.

3.2.3 CAN – X6B

Depending on the length of the connected cable, the maximum transfer rate is 1 Mbps.
The CAN bus can be terminated with 120 Ω by means of DIP switches on the STK-MB5329.

The CAN bus can optionally be galvanically decoupled.

The CAN bus is equipped with a protection circuit. The protection circuit consists of a current-compensated filter and bidirectional protective diodes for CAN LOW and CAN HIGH.

As a plug connector half a dual 9-pin D-sub connector is used. Table 10 shows the pin assignment of the plug connector according to the recommendation of the CiA (CiA Draft standard 102 V2.0):

Pin	Signal	Type	Description
1	-	-	(Reserved)
2	CAN_L	I/O	Signal CAN_L
3	CAN_GND	P	Signal GND
4	-	-	(Reserved)
5	-	-	CAN_SHLD (optional)
6	-	-	GND (optional)
7	CAN_H	I/O	Signal CAN_H
8	-	-	(Reserved)
9	-	P	CAN_V+ (optional)

Table 10: Plug connector CAN – X6B

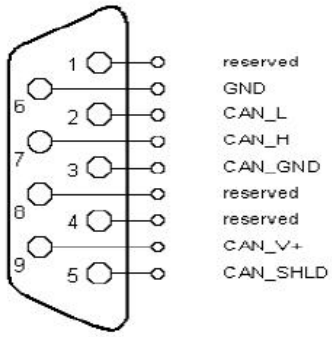

Illustration 4: Configuration CAN connector

Attention: destruction or malfunction!
Due to four physically identical 9-pin D-sub connectors there is the danger of confusion between RS232, RS485 and CAN. The exact arrangement of the interfaces is shown in Illustration 2.

3.2.4 10/100 Mbit Ethernet – X8

An LXT971 is used as a PHY. The device is connected to the TQM5329 via the MII.

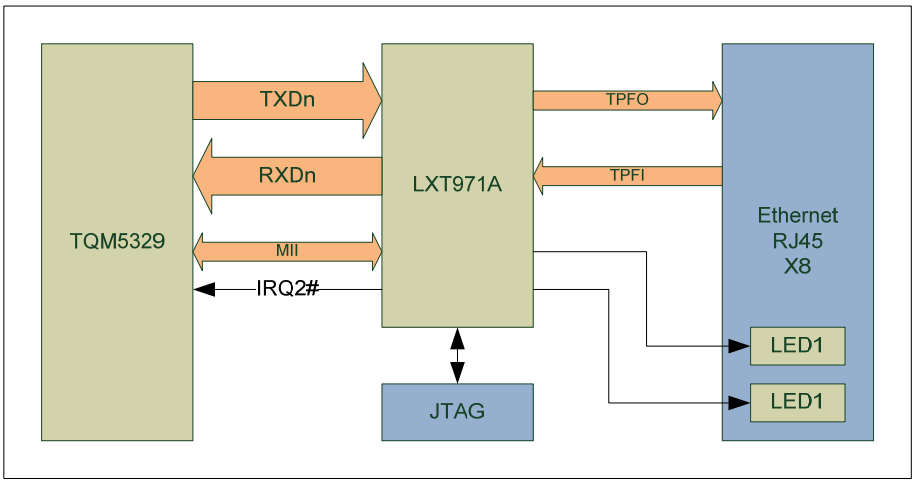

Illustration 5: Block diagram Ethernet

The following table shows the configuration of the Ethernet plug connector:

Pin	Configuration
1	FEC_TPFO+
2	FEC_TCT
3	FEC_TPFO-
4	FEC_TPFI+
5	FEC_RCT
6	FEC_TPFI-
7	NC
8	DGND

Table 11: Plug connector Ethernet – X8

Table 12 shows the pull-up and pull-down resistors for configuration of the PHY at the LXT971:

Signal	Function	Configuration
MDDIS	Management data disable	Disabled
SD/TP#	Signal detect/twisted pair	Twisted-pair mode
TXSLEW[0:1]	Tx output slew control	11 = 4.4 ns
ADDR[0:4]	Address	00001
PAUSE	Pause during auto negotiation	Disabled
SLEEP	Slow power sleep mode	Disabled
PWRDWN	Power down mode	Disabled
CFG[1:3]	Configuration inputs	111 = auto-neg. enabled / 10/100 / full or half

Table 12: Hardware configuration LXT971

3.2.5 USB-OTG – X13

On the TQM5329 the USB OTG power supply is implemented including switchable pull-ups / pull-downs (MAX3353). On the STK-MB5329 ESD and EMC protection is provided.

A connector type Mini-AB is used as a plug connector for USB, which is either connected to the ULPI-PHY signals or to the USB-OTG signals of the STK-MB5329. An alternative assembly by 0 Ω bridges allow these modes to be toggled. The configuration of the Mini-AB connector is shown in Table 13.

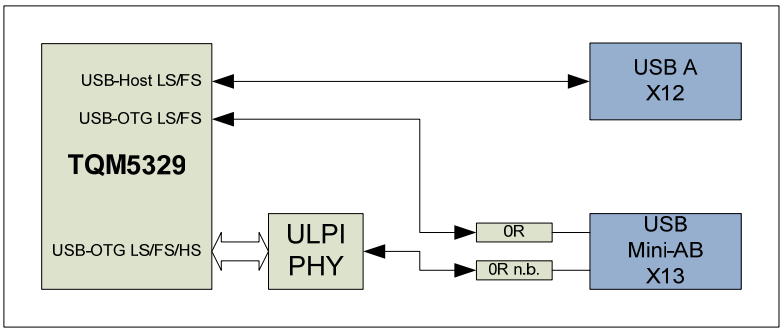

Illustration 6: Block diagram USB connector

The following table shows the configuration of the USB-Mini-AB connector with the USB signals:

Pin	Signal plug connector X13	USB-OTG signals	ULPI signals
1	USBOTG-VBUS	USBOTG_VBUS	ULPI_VBUS
2	USBOTG-DM	USBOTG_D-	ULPI_D-
3	USBOTG-DP	USBOTG_D+	ULPI_D+
4	USBOTG-ID	USBOTG_ID	ULPI_ID
5	DGND		
Shield	DGND		

Table 13: Plug connector USB-OTG / ULPI – X13

3.2.6 USB host – X12

No driver is provided on the STK-MB5329 for the USB host interface, because the CPU of the TQM5329 already offers an internal transceiver. On the main board ESD and EMC protection is provided.

The control of the required VBUS voltage is done on the STK-MB5329. A power distribution switch of type Micrel MIC2026 is used.

A standard USB plug connector type A with following configuration is provided:

Pin	Name
1	5 V USB
2	USB–
3	USB+
4	DGND
Shield	DGND

Table 14: Plug connector USB host – X12

3.2.7 GPIOs – X14

The STK-MB5329 offers eight generals purpose outputs and four general purpose inputs at an external plug connector. The GPIOs are not galvanically separated.

A voltage of 24 V ±20 % supplied to the GPIO plug connector serves as a power supply.

The GPIOs are generated by two 8 bits I²C bus I/O port circuits.

Illustration 7 shows the basic circuit of the GPIO connection on the STK-MB5329. The remaining four I/O ports are made available on an optional header and are additionally connected via a driver to an optional LED.

The digital inputs and outputs are made available via a 15-pin HD-D-sub connector.

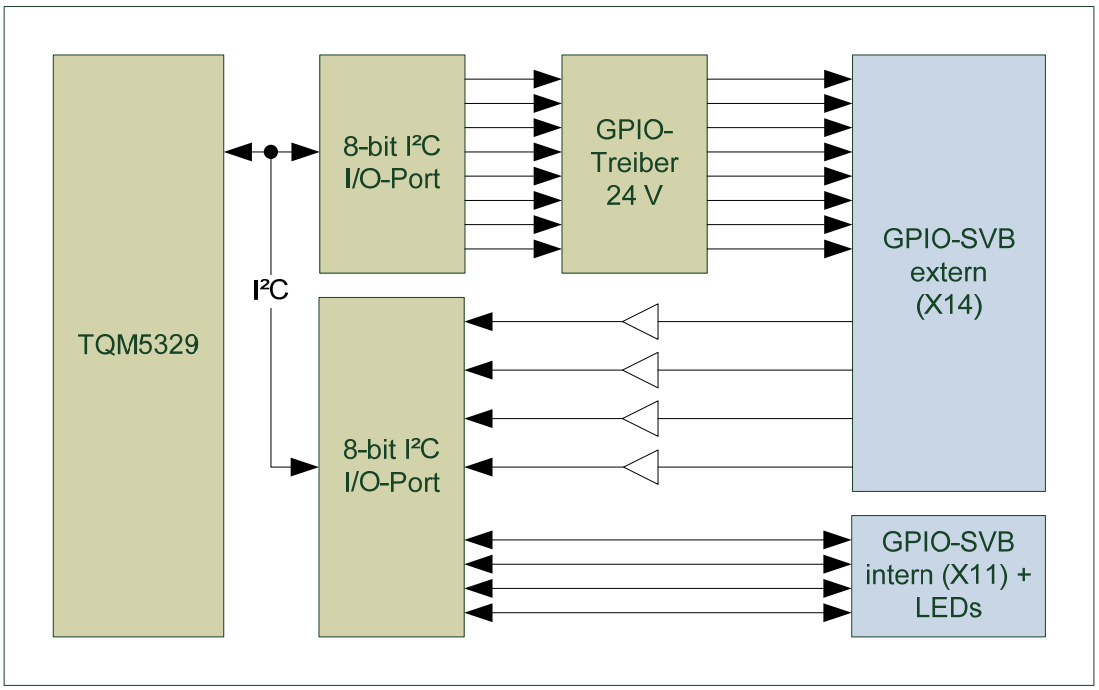

Illustration 7: Block diagram GPIO

The following table shows the characteristics of the GPIOs:

Parameter	Value
Maximum input / output frequency	1 kHz
Input voltage U_{IN}	0 V … 24 V ±20 %
Input current	Typical 1.7 mA
Trigger level $U_{thr(neg)}$, $U_{thr(pos)}$	12 V / app. 2 V … 4 V
Output voltage	0 / 24 V
Max. output current of a single output	0.7 A
Max. output current all outputs combined	4 A
Type of output driver	High side switch (according to SPS standard)
Electrical isolation to GND	No
Common reference potential of inputs and outputs	Yes
Number of outputs	8
Number of inputs	4

Table 15: Characteristics of the GPIOs

The following table shows the pin assignment of the GPIOs – 15-pin HD-D-sub:

Pin	Signal	Type	Description
1	IN1	I	Input 1
2	IN2	I	Input 2
3	IN3	I	Input 3
4	IN4	I	Input 4
5	DGND	P	Ground
6	VCC24V_EX	P	Power-input for GPIO 24 V ±20 %
7	DGND	P	Ground
8	OUT8	O	Output 8
9	OUT7	O	Output 7
10	OUT6	O	Output 6
11	OUT5	O	Output 5
12	OUT4	O	Output 4
13	OUT3	O	Output 3
14	OUT2	O	Output 2
15	OUT1	O	Output 1

Table 16: Pin assignment GPIO – X14

3.2.7.1 Inputs

The STK-MB5329 offers four digital inputs. The input signals are divided by a resistor divider and routed to the Schmitt trigger inputs of a digital inverter.

The inputs are read via the I²C I/O expander on the main board of the STK-MB5329.

- Interface: I²C
- I²C addresses: 0x20 (010 0000b)
- I²C addresses: 0x21 (010 0001b)
- Protection circuit: TVS diode (bidirectional)

3.2.7.2 Outputs

The STK-MB5329 offers eight digital outputs. The outputs are implemented by a high side driver (STMicroelectronics VN808CM-E), which offers an output current of up to 0.7 A per output.
In addition, the driver offers an integrated protective circuit, which protects the outputs against short circuits. All outputs combined may not be loaded with more than 4 A.

The driver is supplied with the voltage, which is fed via the GPIO plug connector (V_{IN}_EX = 24 V ±20 %). The voltage at the driver's outputs can be switched between approx. 0 V and the supply voltage of the device.

The outputs are controlled via the I²C I/O expander on the main board of the STK-MB5329.
After a Power-On-Reset all I/O expander ports are configured as inputs. The control signals of the high side driver are therefore pulled to ground with pull-down resistors by default to avoid undefined states after turning on the device.

The driver device offers a status output, to indicate error states in the driver, which can be caused for example by a short circuit at one of the outputs. This status pin can likewise be polled via the I²C I/O expander.

Bidirectional TVS diodes protect against excess voltage-transient at each output.

- Output level: 0 V … 1.4 V (low), V_{IN}_EXT –0.5 V (high)
- Current limitation: 0.7 A … 1.4 A

3.3 Internal interfaces

3.3.1 Slot for TQM5329 module – D11.X1, D11.X2

Plug connector: 2 × header 120 pin, 0.8 mm, coded
5 mm board-to-board distance

Pin assignment: Suitable for the TQM5329

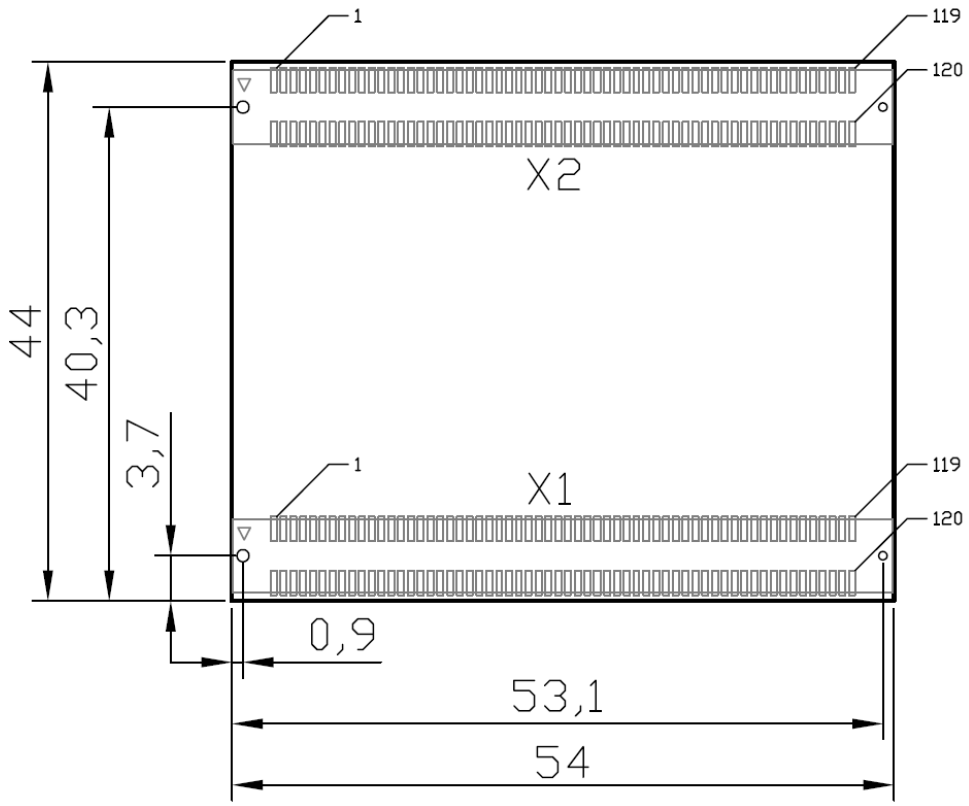

Illustration 8: TQM5329 module plug connectors

In the following the pin assignment of the two board-to-board connectors is shown:

3.3.1.1 Module plug connector D11.X1

Pin module	Port name module	CPU pin function 1	CPU pin function 2	CPU pin function 3	CPU pin function 4	Dir module	Remark
D11.X1-1	RFU	-	-	-	-	-	
D11.X1-2	RFU	-	-	-	-	-	
D11.X1-3	RFU	-	-	-	-	-	
D11.X1-4	FEC_MDIO	FEC_MDIO	PFECCI2C2	I2C_SDA	-	I/O_{PU}	Ethernet
D11.X1-5	GND	-	-	-	-	P	
D11.X1-6	FEC_MDC	FEC_MDC	PFECCI2C3	I2C_SCL	-	I/O_{PU-CPU}	Ethernet
D11.X1-7	FEC_TXD3	FEC_TXD3	PFECL7	ULPI_DATA3	-	I/O_{PU}	Ethernet/ULPI
D11.X1-8	FEC_TXD2	FEC_TXD2	PFECL6	ULPI_DATA2	-	I/O_{PU}	
D11.X1-9	FEC_TXD1	FEC_TXD1	PFECL5	ULPI_DATA1	-	I/O_{PU}	
D11.X1-10	FEC_TXD0	FEC_TXD0	PFECH5	ULPI_DATA0	-	I/O_{PU}	
D11.X1-11	FEC_TXEN	FEC_TXEN	PFECH6	-	-	O	Ethernet
D11.X1-12	GND	-	-	-	-	P	
D11.X1-13	FEC_TXER	FEC_TXER	PFECL4	-	-	O	Ethernet
D11.X1-14	FEC_TXCLK	FEC_TXCLK	PFECH7	-	-	I_{PU}	
D11.X1-15	GND	-	-	-	-	P	
D11.X1-16	FEC_CRS	FEC_CRS	PFECH0	ULPI_DIR	-	I_{PU}	Ethernet/ULPI
D11.X1-17	GND	-	-	-	-	P	
D11.X1-18	FEC_COL	FEC_COL	PFECH4	ULPI_CLK	-	I/O_{PU}	Ethernet/ULPI
D11.X1-19	FEC_RXD3	FEC_RXD3	PFECL3	ULPI_DATA7	-	I/O_{PU}	
D11.X1-20	FEC_RXD2	FEC_RXD2	PFECL2	ULPI_DATA6	-	I/O_{PU}	
D11.X1-21	FEC_RXD1	FEC_RXD1	PFECL1	ULPI_DATA5	-	I/O_{PU}	
D11.X1-22	FEC_RXD0	FEC_RXD0	PFECH1	ULPI_DATA4	-	I/O_{PU}	
D11.X1-23	FEC_RXDV	FEC_RXDV	PFECH2	ULPI_STP	-	I_{PU}	
D11.X1-24	GND	-	-	-	-	P	
D11.X1-25	FEC_RXER	FEC_RXER	PFECL0	-	-	I_{PU}	Ethernet
D11.X1-26	FEC_RXCLK	FEC_RXCLK	PFECH3	ULPI_NXT	-	I_{PU}	Ethernet/ULPI
D11.X1-27	GND	-	-	-	-	P	
D11.X1-28	U0CTS#	U0CTS#	PUARTL3	-	-	I_{PU}	RS232-0
D11.X1-29	GND	-	-	-	-	P	
D11.X1-30	U0RTS#	U0RTS#	PUARTL2	-	-	O	RS232-0
D11.X1-31	RFU	-	-	-	-	-	
D11.X1-32	U1CTS#	U1CTS#	PUARTL7	SSI_BCLK	-	I/O_{PU}	RS232-1 / RS485-1
D11.X1-33	U0RXD	U0RXD	PUARTL0	-	-	I_{PU}	RS232-0
D11.X1-34	U1RTS#	U1RTS#	PUARTL6	SSI_FS	-	I/O_{PU}	RS232-1 / RS485-1
D11.X1-35	U0TXD	U0TXD	PUARTL1	-	-	O	RS232-0
D11.X1-36	GND	-	-	-	-	P	
D11.X1-37	U1RXD	U1RXD	PUARTL4	SSI_RXD	-	I_{PU}	RS232-1 / RS485-1
D11.X1-38	SCL	I2C_SCL	PFECI2C1	CANTX	U2TXD	I/O_{PU}	I2C
D11.X1-39	U1TXD	U1TXD	PUARTL5	SSI_TXD	-	O	RS232-1 / RS485-1
D11.X1-40	SDA	I2C_SDA	PFECI2C0	CANRX	U2RXD	I/O_{PU}	I2C
D11.X1-41	GND	-	-	-	-	P	
D11.X1-42	SSI_FS	SSI_FS	PSSI2	U2RTS#	PWM5	I/O_{PU}	RS232-2 / RS485-2
D11.X1-43	SSI_MCLK	SSI_MCLK	PSSI4	-	-	I/O_{PU}	
D11.X1-44	SSI_RXD	SSI_RXD	PSSI1	U2RXD	CANRX	I_{PU}	CAN
D11.X1-45	SSI_TXD	SSI_TXD	PSSI0	U2TXD	CANTX	O	
D11.X1-46	SSI_BCLK	SSI_BCLK	PSSI3	U2CTS#	PWM7	I/O_{PU}	RS232-2 / RS485-2
D11.X1-47	SPI_SOUT	QSPI_DOUT	PQSPI0	I2C_SDA	-	I/O_{PU-CPU}	Touch
D11.X1-48	GND	-	-	-	-	P	
D11.X1-49	SPI_SIN	QSPI_DIN	PQSPI1	U2CTS#	-	I_{PU}	Touch
D11.X1-50	SPI_SCK	QSPI_CLK	PQSPI2	I2C_SCL	-	I/O_{PU-CPU}	
D11.X1-51	SPI_CS1	QSPI_CS1	PQSPI4	PWM7	USBOTG_PU_EN	I/O	
D11.X1-52	SPI_CS2	QSPI_CS2	PQSPI5	U2RTS#	-	O	
D11.X1-53	GND	-	-	-	-	P	
D11.X1-54	SPI_CS0	QSPI_CS0	PQSPI3	PWM5	-	O	Touch
D11.X1-55	TIN3	DT3IN	PTIMER3	DT3OUT	U2RXD	I_{PU}	RS232-2 / RS485-2
D11.X1-56	TIN2	DT2IN	PTIMER2	DT2OUT	U2TXD	I/O_{PU}	
D11.X1-57	TIN1	DT1IN	PTIMER1	DT1OUT	DACK1#	I_{PU}	
D11.X1-58	TIN0	DT0IN	PTIMER0	DT0OUT	DREQ0#	I_{PU}	
D11.X1-59	LCD_PS	LCD_PS	PLCDCTLL2	-	-	O	
D11.X1-60	GND	-	-	-	-	P	
D11.X1-61	LCD_REV	LCD_REV	PLCDCTLL1	-	-	O	
D11.X1-62	LCD_LSCLK	LCD_LSCLK	PLCDCTLL3	-		O	LCD

Pin module	Port name module	CPU pin function 1	CPU pin function 2	CPU pin function 3	CPU pin function 4	Dir module	Remark
D11.X1-63	LCD_SPL_SPR	LCD_SPL_SPR	PLCDCTLL0	-		O	
D11.X1-64	LCD_CONTRAST	LCD_CONTRAST	PLCDCTLL6	-		O	LCD-BL
D11.X1-65	GND	-	-	-	-	P	
D11.X1-66	LCD_CLS	LCD_CLS	PLCDCTLL7	-		O	
D11.X1-67	LCD_FLM LCD_VSYNC	LCD_FLM LCD_VSYNC	PLCDCTLL5	-		O	
D11.X1-68	LCD_ACD LCD_OE	LCD_ACD LCD_OE	PLCDCTLH0	-		O	LCD
D11.X1-69	LCD_LP LCD_HSYNC	LCD_LP LCD_HSYNC	PLCDCTLL4	-		O	
D11.X1-70	LCD_D16	LCD_D16	PLCDDH0	CANRX		I/O_{PU}	LCD
D11.X1-71	LCD_D17	LCD_D17	PLCDDH1	CANTX		O	
D11.X1-72	GND	-	-	-	-	P	
D11.X1-73	LCD_D15	LCD_D15	PLCDDM7	-		O	LCD
D11.X1-74	LCD_D14	LCD_D14	PLCDDM6	-		O	
D11.X1-75	LCD_D13	LCD_D13	PLCDDM5	-		O	
D11.X1-76	LCD_D12	LCD_D12	PLCDDM4	-		O	
D11.X1-77	GND	-	-	-	-	P	
D11.X1-78	LCD_D10	LCD_D10	PLCDDM2	-		O	LCD
D11.X1-79	LCD_D11	LCD_D11	PLCDDM3	-		O	
D11.X1-80	LCD_D8	LCD_D8	PLCDDM0	-		O	
D11.X1-81	LCD_D9	LCD_D9	PLCDDM1	-		O	
D11.X1-82	LCD_D6	LCD_D6	PLCDDL6	-		O	
D11.X1-83	LCD_D7	LCD_D7	PLCDDL7	-		O	
D11.X1-84	GND	-	-	-	-	P	
D11.X1-85	LCD_D5	LCD_D5	PLCDDL5	-		O	LCD
D11.X1-86	LCD_D4	LCD_D4	PLCDDL4	-		O	
D11.X1-87	LCD_D3	LCD_D3	PLCDDL3	-		O	
D11.X1-88	LCD_D2	LCD_D2	PLCDDL2	-		O	
D11.X1-89	GND	-	-	-	-	P	
D11.X1-90	LCD_D0	LCD_D0	PLCDDL0	-		O	LCD
D11.X1-91	LCD_D1	LCD_D1	PLCDDL1	-		O	
D11.X1-92	A22	A22	-	FB_CS4#	-	O	
D11.X1-93	A23	A23	-	FB_CS5#	-	O	
D11.X1-94	A20	A20	-	-	-	O	
D11.X1-95	A21	A21	-	-	-	O	
D11.X1-96	GND	-	-	-	-	P	
D11.X1-97	A19	A19	-	-	-	O	
D11.X1-98	A18	A18	-	-	-	O	
D11.X1-99	A17	A17	-	-	-	O	
D11.X1-100	A16	A16	-	-	-	O	
D11.X1-101	GND	-	-	-	-	P	
D11.X1-102	A14	A14	-	SD_BA0	-	O	
D11.X1-103	A15	A15	-	SD_BA1	-	O	
D11.X1-104	A12	A12	-	SD_A12	-	O	
D11.X1-105	A13	A13	-	SD_A13	-	O	
D11.X1-106	A10	A10	-		-	O	
D11.X1-107	A11	A11	-	SD_A11	-	O	
D11.X1-108	GND	-	-	-	-	P	
D11.X1-109	A9	A9	-	SD_A9	-	O	
D11.X1-110	A8	A8	-	SD_A8	-	O	
D11.X1-111	A7	A7	-	SD_A7	-	O	
D11.X1-112	A6	A6	-	SD_A6	-	O	
D11.X1-113	GND	-	-	-	-	P	
D11.X1-114	A4	A4	-	SD_A4	-	O	
D11.X1-115	A5	A5	-	SD_A5	-	O	
D11.X1-116	A2	A2	-	SD_A2	-	O	
D11.X1-117	A3	A3	-	SD_A3	-	O	
D11.X1-118	A0	A0	-	SD_A0	-	O	
D11.X1-119	A1	A1	-	SD_A1	-	O	
D11.X1-120	GND	-	-	-	-	P	

Table 17: Module plug connector D11.X1

3.3.1.2 Module plug connector D11.X2

Pin module	Port name module	CPU pin function 1	CPU pin function 2	CPU pin function 3	CPU pin function 4	Dir module	Remark
D11.X2-1	VCC3V3	-	-	-	-	P	
D11.X2-2	VCC3V3	-	-	-	-	P	
D11.X2-3	VCC3V3	-	-	-	-	P	
D11.X2-4	VCC3V3	-	-	-	-	P	
D11.X2-5	VCC3V3	-	-	-	-	P	
D11.X2-6	VCC3V3	-	-	-	-	P	
D11.X2-7	VCC3V3	-	-	-	-	P	
D11.X2-8	VBAT	-	-	-	-	P	RTC battery
D11.X2-9	GND	-	-	-	-	P	
D11.X2-10	GND	-	-	-	-	P	
D11.X2-11	GND	-	-	-	-	P	
D11.X2-12	GND	-	-	-	-	P	
D11.X2-13	GND	-	-	-	-	P	
D11.X2-14	GND	-	-	-	-	P	
D11.X2-15	GND	-	-	-	-	P	
D11.X2-16	GND	-	-	-	-	P	
D11.X2-17	GND	-	-	-	-	P	
D11.X2-18	IRQ6#	IRQ6#	PIRQ6	USBHOST_ VBUS_EN	-	I/O_{PU-CPU}	USB-Host
D11.X2-19	IRQ7#	IRQ7#	PIRQ7	-	-	I_{PU-CPU}	
D11.X2-20	IRQ4#	IRQ4#	PIRQ4	SSI_MCLK	-	I/O_{PU-CPU}	Touch
D11.X2-21	IRQ5#	IRQ5#	PIRQ5	USBHOST_ VBUS_OC	-	I_{PU-CPU}	USB-Host
D11.X2-22	IRQ2#	IRQ2#	PIRQ2	USB_CLKIN	-	I_{PU-CPU}	Ethernet
D11.X2-23	IRQ3#	IRQ3#	PIRQ3		-	I_{PU-CPU}	Touch
D11.X2-24	GND	-	-	-	-	P	
D11.X2-25	IRQ1#	IRQ1#	PIRQ1	DREQ1#	SSI_CLKIN	I_{PU-CPU}	
D11.X2-26	RFU	-	-	-	-	-	
D11.X2-27	RFU	-	-	-	-	-	
D11.X2-28	DDATA2	DDATA2	-	-	-	O	BDM
D11.X2-29	GND	-	-	-	-	P	
D11.X2-30	DDATA0	DDATA0	-	-	-	O	BDM
D11.X2-31	DDATA3	DDATA3	-	-	-	O	
D11.X2-32	PST2	PST2	-	-	-	O	
D11.X2-33	DDATA1	DDATA1	-	-	-	O	
D11.X2-34	PST0	PST0	-	-	-	O	
D11.X2-35	PST3	PST3	-	-	-	O	
D11.X2-36	GND	-	-	-	-	P	
D11.X2-37	PST1	PST1	-	-	-	O	BDM
D11.X2-38	JTAG_EN	JTAG_EN	-	-	-	I_{PD-CPU}	BDM/JTAG
D11.X2-39	DSCLK	DSCLK	-	TRST#	-	I_{PU}	BDM/JTAG
D11.X2-40	DSI	DSI	-	TDI	-	I_{PU}	
D11.X2-41	GND	-	-	-	-	P	
D11.X2-42	DSO	DSO	-	TDO	-	O	BDM/JTAG
D11.X2-43	RSTIN#		-	-	-	I_{PU}	
D11.X2-44	BKPT#	BKPT#	-	TMS	-	I_{PU}	BDM/JTAG
D11.X2-45	RSTOUT#	RSTOUT#	-	-	-	O	
D11.X2-46	PSTCLK	PSTCLK	-	TCLK	-	I/O_{PU}	BDM/JTAG
D11.X2-47	PORESET#	-	-	-	-	O	
D11.X2-48	GND	-	-	-	-	P	
D11.X2-49	USBOTG_VBUS	-	-	-	-	P	USB-OTG
D11.X2-50	USBOTG_D-	USBOTG_M	-	-	-	I/O	
D11.X2-51	USBOTG_ID	-	-	-	-	I	
D11.X2-52	USBOTG_D+	USBOTG_P	-	-	-	I/O	
D11.X2-53	GND	-	-	-	-	P	
D11.X2-54	GND	-	-	-	-	P	
D11.X2-55	RFU	-	-	-	-	-	
D11.X2-56	USB_D-	USBHOST_M	-	-	-	I/O	USB-Host
D11.X2-57	PWM7	PWM7	PPWM7	-	-	I/O_{PU}	Ethernet/ULPI
D11.X2-58	USB_D+	USBHOST_P	-	-	-	I/O	USB-Host
D11.X2-59	PWM5	PWM5	PPWM5	-	-	O	LCD-BL
D11.X2-60	GND	-	-	-	-	P	
D11.X2-61	PWM3	PWM3	PPWM3	DT3OUT	DT3IN	I/O_{PU}	

Pin module	Port name module	CPU pin function 1	CPU pin function 2	CPU pin function 3	CPU pin function 4	Dir module	Remark
D11.X2-62	CLKOUT	FB_CLK	-	-	-	O	
D11.X2-63	PWM1	PWM1	PPWM1	DT2OUT	DT2IN	I/O_{PU}	
D11.X2-64	RFU	-	-	-	-	-	
D11.X2-65	GND	-	-	-	-	P	
D11.X2-66	CS4#	FB_CS4#	PCS4	-	-	O	
D11.X2-67	CS5#	FB_CS5#	PCS5	-	-	O	
D11.X2-68	CS2#	FB_CS2#	PCS2	-	-	O	
D11.X2-69	CS3#	FB_CS3#	PCS3	-	-	O	
D11.X2-70	CS0#	FB_CS0#	-	-	-	O	
D11.X2-71	CS1#	FB_CS1#	PCS1	-	-	O	
D11.X2-72	GND	-	-	-	-	P	
D11.X2-73	TA#	TA#	PBUSCTL2	-	-	I_{PU}	BDM
D11.X2-74	R/W#	R/W#	PBUSCTL1	-	-	O	
D11.X2-75	TS#	TS#	PBUSCTL0	DACK0#	-	O	
D11.X2-76	OE#	OE#	PBUSCTL3	-	-	O	
D11.X2-77	GND	-	-	-	-	P	
D11.X2-78	BE#/BWE2#	BE#/BWE2#	PBE2	SD_DQM2#	-	O	
D11.X2-79	BE#/BWE3#	BE#/BWE3#	PBE3	SD_DQM3#	-	O	
D11.X2-80	BE#/BWE0#	BE#/BWE0#	PBE0	SD_DQM0#	-	O	
D11.X2-81	BE#/BWE1#	BE#/BWE1#	PBE1	SD_DQM1#	-	O	
D11.X2-82	D30	D30	-	SD_D30	-	I/O_{PU}	
D11.X2-83	D31	D31	-	SD_D31	-	I/O_{PU}	
D11.X2-84	GND	-	-	-	-	P	
D11.X2-85	D29	D29	-	SD_D29	-	I/O_{PU}	
D11.X2-86	D28	D28	-	SD_D28	-	I/O_{PU}	
D11.X2-87	D27	D27	-	SD_D27	-	I/O_{PU}	
D11.X2-88	D26	D26	-	SD_D26	-	I/O_{PU}	
D11.X2-89	GND	-	-	-	-	P	
D11.X2-90	D24	D24	-	SD_D24	-	I/O_{PU}	
D11.X2-91	D25	D25	-	SD_D25	-	I/O_{PU}	
D11.X2-92	D22	D22	-	SD_D22	-	I/O_{PU}	
D11.X2-93	D23	D23	-	SD_D23	-	I/O_{PU}	
D11.X2-94	D20	D20	-	SD_D20	-	I/O_{PU}	
D11.X2-95	D21	D21	-	SD_D21	-	I/O_{PU}	
D11.X2-96	GND	-	-	-	-	P	
D11.X2-97	D19	D19	-	SD_D19	-	I/O_{PU}	
D11.X2-98	D18	D18	-	SD_D18	-	I/O_{PU}	
D11.X2-99	D17	D17	-	SD_D17	-	I/O_{PU}	
D11.X2-100	D16	D16	-	SD_D16	-	I/O_{PU}	
D11.X2-101	GND	-	-	-	-	P	
D11.X2-102	D14	D14	-	FB_D30	-	I/O_{PU}	
D11.X2-103	D15	D15	-	FB_D31	-	I/O_{PU}	
D11.X2-104	D12	D12	-	FB_D28	-	I/O_{PU}	
D11.X2-105	D13	D13	-	FB_D29	-	I/O_{PU}	
D11.X2-106	D10	D10	-	FB_D26	-	I/O_{PU}	
D11.X2-107	D11	D11	-	FB_D27	-	I/O_{PU}	
D11.X2-108	GND	-	-	-	-	P	
D11.X2-109	D9	D9	-	FB_D25	-	I/O_{PU}	
D11.X2-110	D8	D8	-	FB_D24	-	I/O_{PU}	
D11.X2-111	D7	D7	-	FB_D23	-	I/O_{PU}	
D11.X2-112	D6	D6	-	FB_D22	-	I/O_{PU}	
D11.X2-113	GND	-	-	-	-	P	
D11.X2-114	D4	D4	-	FB_D20	-	I/O_{PU}	
D11.X2-115	D5	D5	-	FB_D21	-	I/O_{PU}	
D11.X2-116	D2	D2	-	FB_D18	-	I/O_{PU}	
D11.X2-117	D3	D3	-	FB_D19	-	I/O_{PU}	
D11.X2-118	D0	D0	-	FB_D16	-	I/O_{PU}	
D11.X2-119	D1	D1	-	FB_D17	-	I/O_{PU}	
D11.X2-120	GND	-	-	-	-	P	

Table 18: Module plug connector D11.X2

	Signals used on STK-MB5329
	Power
	BDM/JTAG-Interface

Table 19: Legend colours TQM5329

3.3.1.3 TQM5329 signals on headers X1, X2, X3, X4

All signals of the TQM5329, except those of the USB data lines, are led optionally on a double row 60-pin header with 2.54 mm grid. The headers X1 and X2 are next to module plug connector D11.X1, the headers X3 and X4 are next to module plug connector D11.X2.
The headers are as assigned follows:

3.3.1.3.1 Header X1

Module	Signal	X1		Signal	Module
D11.X1-1	RFU	1	2	RFU	D11.X1-3
D11.X1-5	GND	3	4	FEC0_TXD3	D11.X1-7
D11.X1-9	FEC0_TXD1	5	6	FEC0_TXEN	D11.X1-11
D11.X1-13	FEC0_TXER	7	8	GND	D11.X1-15
D11.X1-17	GND	9	10	FEC0_RXD3	D11.X1-19
D11.X1-21	FEC0_RXD1	11	12	FEC0_RXDV	D11.X1-23
D11.X1-25	FEC0_RXER	13	14	GND	D11.X1-27
D11.X1-29	GND	15	16	RFU	D11.X1-31
D11.X1-33	U0RXD	17	18	U0TXD	D11.X1-35
D11.X1-37	U1RXD	19	20	U1TXD	D11.X1-39
D11.X1-41	GND	21	22	SSI_MCLK	D11.X1-43
D11.X1-45	SSI_TXD	23	24	SPI_SOUT	D11.X1-47
D11.X1-49	SPI_SIN	25	26	SPI_CS1	D11.X1-51
D11.X1-53	GND	27	28	TIN3	D11.X1-55
D11.X1-57	TIN1	29	30	LCD_PS	D11.X1-59
D11.X1-61	LCD_REV	31	32	LCD_SPL_SPR	D11.X1-63
D11.X1-65	GND	33	34	LCD_FLM/LCD_VSYNC	D11.X1-67
D11.X1-69	LCD_LP/LCD_HSYNC	35	36	LCD_D17	D11.X1-71
D11.X1-73	LCD_D15	37	38	LCD_D13	D11.X1-75
D11.X1-77	GND	39	40	LCD_D11	D11.X1-79
D11.X1-81	LCD_D9	41	42	LCD_D7	D11.X1-83
D11.X1-85	LCD_D5	43	44	LCD_D3	D11.X1-87
D11.X1-89	GND	45	46	LCD_D1	D11.X1-91
D11.X1-93	A23/CS5#	47	48	A21	D11.X1-95
D11.X1-97	A19	49	50	A17	D11.X1-99
D11.X1-101	GND	51	52	A15	D11.X1-103
D11.X1-105	A13	53	54	A11	D11.X1-107
D11.X1-109	A9	55	56	A7	D11.X1-111
D11.X1-113	GND	57	58	A5	D11.X1-115
D11.X1-117	A3	59	60	A1	D11.X1-119

Table 20: Module signals, header – X1

3.3.1.3.2 Header X2

Module	Signal	X2		Signal	Module
D11.X1-2	RFU	1	2	FEC0_MDIO	D11.X1-4
D11.X1-6	FEC0_MDC	3	4	FEC0_TXD2	D11.X1-8
D11.X1-10	FEC0_TXD0	5	6	GND	D11.X1-12
D11.X1-14	FEC0_TXCLK	7	8	FEC0_CRS	D11.X1-16
D11.X1-18	FEC0_COL	9	10	FEC0_RXD2	D11.X1-20
D11.X1-22	FEC0_RXD0	11	12	GND	D11.X1-24
D11.X1-26	FEC0_RXCLK	13	14	U0CTS#	D11.X1-28
D11.X1-30	U0RTS#	15	16	U1CTS#	D11.X1-32
D11.X1-34	U1RTS#	17	18	GND	D11.X1-36
D11.X1-38	SCL	19	20	SDA	D11.X1-40
D11.X1-42	SSI_FS	21	22	SSI_RXD	D11.X1-44
D11.X1-46	SSI_BCLK	23	24	GND	D11.X1-48
D11.X1-50	SPI_SCK	25	26	SPI_CS2	D11.X1-52
D11.X1-54	SPI_CS0	27	28	TIN2	D11.X1-56
D11.X1-58	TIN0	29	30	GND	D11.X1-60
D11.X1-62	LCD_LSCLK	31	32	LCD_CONTRAST	D11.X1-64
D11.X1-66	LCD_CLS	33	34	LCD_ACD/ LCD_OE	D11.X1-68
D11.X1-70	LCD_D16	35	36	GND	D11.X1-72
D11.X1-74	LCD_D14	37	38	LCD_D12	D11.X1-76
D11.X1-78	LCD_D10	39	40	LCD_D8	D11.X1-80
D11.X1-82	LCD_D6	41	42	GND	D11.X1-84
D11.X1-86	LCD_D4	43	44	LCD_D2	D11.X1-88
D11.X1-90	LCD_D0	45	46	A22	D11.X1-92
D11.X1-94	A20	47	48	GND	D11.X1-96
D11.X1-98	A18	49	50	A16	D11.X1-100
D11.X1-102	A14	51	52	A12	D11.X1-104
D11.X1-106	A10	53	54	GND	D11.X1-108
D11.X1-110	A8	55	56	A6	D11.X1-112
D11.X1-114	A4	57	58	A2	D11.X1-116
D11.X1-118	A0	59	60	GND	D11.X1-120

Table 21: Module signals, header – X2

3.3.1.3.3 Header X3

Modul	Signal	X3		Signal	Modul
D11.X2-1	VCC3V3	1	2	VCC3V3	D11.X2-3
D11.X2-5	VCC3V3	3	4	VCC3V3	D11.X2-7
D11.X2-9	GND	5	6	GND	D11.X2-11
D11.X2-13	GND	7	8	GND	D11.X2-15
D11.X2-17	GND	9	10	IRQ7#	D11.X2-19
D11.X2-21	IRQ5#	11	12	IRQ3#	D11.X2-23
D11.X2-25	IRQ1#	13	14	RFU	D11.X2-27
D11.X2-29	GND	15	16	DTATA3	D11.X2-31
D11.X2-33	DTATA1	17	18	PST3	D11.X2-35
D11.X2-37	PST1	19	20	DSCLK	D11.X2-39
D11.X2-41	GND	21	22	RST_IN#	D11.X2-43
D11.X2-45	RST_OUT#	23	24	PORESET#	D11.X2-47
D11.X2-49	USBOTG_VBUS	25	26	USBOTG_ID	D11.X2-51
D11.X2-53	GND	27	28	RFU	D11.X2-55
D11.X2-57	PWM7	29	30	PWM5	D11.X2-59
D11.X2-61	PWM3	31	32	PWM1	D11.X2-63
D11.X2-65	GND	33	34	CS5#	D11.X2-67
D11.X2-69	CS3#	35	36	CS1#	D11.X2-71
D11.X2-73	TA#	37	38	TS#	D11.X2-75
D11.X2-77	GND	39	40	BE#/BWE3#	D11.X2-79
D11.X2-81	BE#/BWE1#	41	42	D31	D11.X2-83
D11.X2-85	D29	43	44	D27	D11.X2-87
D11.X2-89	GND	45	46	D25	D11.X2-91
D11.X2-93	D23	47	48	D21	D11.X2-95
D11.X2-97	D19	49	50	D17	D11.X2-99
D11.X2-101	GND	51	52	D15	D11.X2-103
D11.X2-105	D13	53	54	D11	D11.X2-107
D11.X2-109	D9	55	56	D7	D11.X2-111
D11.X2-113	GND	57	58	D5	D11.X2-115
D11.X2-117	D3	59	60	D1	D11.X2-119

Table 22: Module signals, header – X3

3.3.1.3.4 Header X4

Module	Signal	X4		Signal	Module
D11.X2-2	VCC3V3	1	2	VCC3V3	D11.X2-4
D11.X2-6	VCC3V3	3	4	VBAT	D11.X2-8
D11.X2-10	GND	5	6	GND	D11.X2-12
D11.X2-14	GND	7	8	GND	D11.X2-16
D11.X2-18	IRQ6#	9	10	IRQ4#	D11.X2-20
D11.X2-22	IRQ2#	11	12	GND	D11.X2-24
D11.X2-26	RFU	13	14	DDATA2	D11.X2-28
D11.X2-30	DDATA0	15	16	PST2	D11.X2-32
D11.X2-34	PST0	17	18	GND	D11.X2-36
D11.X2-38	JTAG_EN	19	20	DSI	D11.X2-40
D11.X2-42	DSO	21	22	BKPT#	D11.X2-44
D11.X2-46	PSTCLK	23	24	GND	D11.X2-48
D11.X2-50	RFU	25	26	RFU	D11.X2-52
D11.X2-54	GND	27	28	RFU	D11.X2-56
D11.X2-58	RFU	29	30	GND	D11.X2-60
D11.X2-62	CLKOUT	31	32	RFU	D11.X2-64
D11.X2-66	CS4#	33	34	CS2#	D11.X2-68
D11.X2-70	CS0#	35	36	GND	D11.X2-72
D11.X2-74	R/W#	37	38	OE#	D11.X2-76
D11.X2-78	BE#/BWE2#	39	40	BE#/BWE0#	D11.X2-80
D11.X2-82	D30	41	42	GND	D11.X2-84
D11.X2-86	D28	43	44	D26	D11.X2-88
D11.X2-90	D24	45	46	D22	D11.X2-92
D11.X2-94	D20	47	48	GND	D11.X2-96
D11.X2-98	D18	49	50	D16	D11.X2-100
D11.X2-102	D14	51	52	D12	D11.X2-104
D11.X2-106	D10	53	54	GND	D11.X2-108
D11.X2-110	D8	55	56	D6	D11.X2-112
D11.X2-114	D4	57	58	D2	D11.X2-116
D11.X2-118	D0	59	60	GND	D11.X2-120

Table 23: Module signals, header – X4

3.3.2 Connectors for LCD – X15, X16

The connection of the LCD is carried out via an 18 bit (6 bit red, 6 bit green, 6 bit blue) CMOS interface. Neither LVDS nor DVI displays are directly supported.

The following plug connector is used: Yamaichi, FPC-98210-4021, 40-pin ZIF connector.

Depending on the display used it is either connected via X15 (PowerView and CPT) or X16 (Admatec).

X15	X16	Signal	Type	Description	18 bit
1	–	VCC3V3	–	VCC3V3	
2	–	VCC3V3	–	VCC3V3	
3	–	VCC3V3	–	VCC3V3	
4	37	VCC3V3	–	VCC3V3	
5	38	n.c.	–	No Connection	
6	39	Display Enable	O	DRDY → 22R, direct from TQMa31	
7	40	Ground	–	DGND	
8	–	n.c.	–	No Connection	
9	35	Ground	–	DGND	
10	34	n.c.	–	No Connection	
11	32	Ground	–	DGND	
12	30	Blue 5 (MSB)	O	IPP_DO_DISPB_DATA[5] → 22R, direct from TQMa31	B5
13	29	Blue 4	O	IPP_DO_DISPB_DATA[4] → 22R, direct from TQMa31	B4
14	28	Blue 3	O	IPP_DO_DISPB_DATA[3] → 22R, direct from TQMa31	B3
15	27	Ground	–	DGND	
16	26	Blue 2	O	IPP_DO_DISPB_DATA[2] → 22R, direct from TQMa31	B2
17	25	Blue 1	O	IPP_DO_DISPB_DATA[1] → 22R, direct from TQMa31	B1
18	24	Blue 0 (LSB)	O	IPP_DO_DISPB_DATA[0] → 22R, direct from TQMa31	B0
19	23	Ground	–	DGND	
20	22	Green 5 (MSB)	O	IPP_DO_DISPB_DATA[11] → 22R, direct from TQMa31	G5
21	21	Green 4	O	IPP_DO_DISPB_DATA[10] → 22R, direct from TQMa31	G4
22	20	Green 3	O	IPP_DO_DISPB_DATA[9] → 22R, direct from TQMa31	G3
23	19	Ground	–	DGND	
24	18	Green 2	O	IPP_DO_DISPB_DATA[8] → 22R, direct from TQMa31	G2
25	17	Green 1	O	IPP_DO_DISPB_DATA[7] → 22R, direct from TQMa31	G1
26	16	Green 0 (LSB)	O	IPP_DO_DISPB_DATA[6] → 22R, direct from TQMa31	G0
27	15	Ground	–	DGND	
28	14	Red 5 (MSB)	O	IPP_DO_DISPB_DATA[17] → 22R, direct from TQMa31	R5
29	13	Red 4	O	IPP_DO_DISPB_DATA[16] → 22R, direct from TQMa31	R4
30	12	Red 3	O	IPP_DO_DISPB_DATA[15] → 22R, direct from TQMa31	R3
31	11	Ground	–	DGND	
32	10	Red 2	O	IPP_DO_DISPB_DATA[14] → 22R, direct from TQMa31	R2
33	9	Red 1	O	IPP_DO_DISPB_DATA[13] → 22R, direct from TQMa31	R1
34	8	Red 0 (LSB)	O	IPP_DO_DISPB_DATA[12] → 22R, direct from TQMa31	R0
35	7	n.c.	–	No Connection	
36	5	Ground	–	DGND	
37	4	Ground	–	DGND	
38	3	DCLK	O	FPSHIFT → 22R, direct from TQMa31	
39	2	Ground	–	DGND	
40	1	Ground	–	DGND	
–	6	n.c.			
–	31	n.c.			
–	33	n.c.			
–	36	n.c.			

- low active signal, ↑ - element to VCC (pull up), ↓ - element to ground (pull down), → element in series

Table 24: Pin assignment LCD plug connectors X15, X16

3.3.3 Backlight connectors – X19, X20

The following plug connector is used: JST, SM02B-BHSS-1-TB, 2-pin, single row, 90° bent

The following table shows the pin assignment of the backlight connector:

Pin	Signal	Type	Description
1	VLEDA	-	LED anode
2	VLEDC	-	LED cathode

- low active signal, ↑ - element to VCC (pull up), ↓ - element to ground (pull down), → element in series

Table 25: Pin assignment backlight – X21

3.3.4 Touch screen connectors – X17, X18

The following plug connector is used: JST, SM02B-BHSS-1-TB, 2-pin, single row, 90° bent.

The STK-MB5329 supports the types of touch panel listed in the following table. The table also includes the pin assignment of the touch connectors X17 and X18.

Signal	X17 Admatec RTP070F13N	X18 DMC AST-070A080A
Touch_L	3	4
Touch_R	1	2
Touch_T	2	3
Touch_B	4	1

Table 26: Pin assignment touch screen – X17, X18

3.3.5 BDM / JTAG Debug ports – X21, X10

To connect a JTAG debugger for the MCF5329 on the TQM5329 a 14-pin header is used – X10.

The JTAG interface is a subset of the BDM interface. To switch between BDM and JTAG mode, a 10 kΩ pull-up resistor to VDD is provided. In the default configuration of the STK-MB5329 BDM is active.

The following table shows the pin assignment of the JTAG debugger.

Pin	Signal	Type	Description
1	DSO/TDO	O	JTAG Test Data Out
2	NC		Not connected
3	DSI/TDI	I	JTAG Test Data In, Pull-Up on TQM5329
4	DSCLK/TRST#	I	JTAG Test Reset, Pull-Up on TQM5329
5	NC		Not connected
6	VCC3V3	P	Power Out via 220 Ohm
7	PSTCLK/TCLK	I	JTAG Test Clock, Pull-Up on TQM5329
8	NC		Not connected
9	BKPT#/TMS	I	JTAG Test Mode Select, Pull-Up on TQM5329
10	NC		Not connected
11	NC		Not connected
12	DGND	P	Digital Ground
13	RESIN#	I	Reset In (Hard Reset), Pull-Up on TQM5329
14	NC		Not connected
15	NC		Not connected
16	DGND	P	Digital Ground

Table 27: Pin assignment JTAG debugger – X10

The following table shows the pin assignment of the BDM debugger.

Pin	Signal	Type	Description
1	TCK	I	Clock Signal
2	DGND	-	Signal Ground
3	TDO	O	Data from device
4	VCC (TRGT)	-	Target power supply
5	TMS	I	JTAG state machine control
6	n.c.	-	Reserved
7	n.c.	-	Reserved
8	n.c.	-	Reserved
9	TDI	I	Data to device
10	DGND	-	Signal ground

Table 28: Pin assignment BDM debugger – X21

3.4 User's interfaces

3.4.1 Display

The STK-MB5329 comes with a 7" WVGA LCD in a separate housing.
The maximum resolution of the display is 800 × 480 pixels.

Different display modules are provided for the use in combination with the STK-MB5329.

3.4.2 Touch screen

The display unit of the STK-MB5329 offers an integrated 4-wire touch screen, which allows inputs via a graphical interface. The touch screen has a horizontal resolution of 0.21 mm and a vertical resolution of 0.15 mm.

Attention: destruction or malfunction!	
	The touch screen may only be operated with fingers or specially designed pens. No sharp or pointed objects may be used, as they may damage the touch screen!

3.4.3 Reset button – S1

To be able to reset the STK-MB5329 at any time to a defined state, a reset button is available at the connector panel.

3.4.4 Indicator LEDs

A blue LED serves to display the correct function of the supply voltages.

The plug connector of the Ethernet interface offers two status LEDs.

Name / Function	LED	Remark
Power On	LED blue	VCC3V3 / VCC5V
GPIO internal	LED yellow	GPIO[4 … 7]
Ethernet	LED green	Link Status / Activity
Ethernet	LED yellow	Speed

Table 29: Overview LEDs

3.4.5 DIP switches

The STK-MB5329 is equipped with six DIP switches whose functions are shown in the following table:

Switch	Function
S2 – 1	Termination 120 Ω CAN
S2 – 2	Not used
S4 – 1	Termination 120 Ω RS485-1_A/B
S4 – 2	Termination 120 Ω RS485-1_Y/Z
S3 – 1	Termination 120 Ω RS485-2_A/B
S3 – 2	Termination 120 Ω RS485-2_Y/Z

Table 30: Function DIP switches

3.5 Battery

To supply the RTC of the STK-MB5329, a lithium battery with very low self-discharge is used. The battery is socketed and can therefore be easily exchanged.

Manufacturer	Type	Description
Sony	CR2032	Lithium battery, typical capacity approx. 200 mAh / 3 V

Table 31: RTC battery

The battery is protected against reverse polarity and overload with a resistor of 1 kΩ in series to the battery. The battery has a product life of approx. 650 h with a discharge current of 0.3 mA. The RTC located on the module needs a maximum current of 1.2 µA. Hence, only the self-discharge of the battery is authoritative for the battery life's consideration.

Attention: destruction or malfunction!
 Reverse polarity of the battery can damage or destroy the device. Attention must be paid to the correct polarity of the battery.

4. Mechanics specification

4.1 Dimensions mainboard

Dimensions	Details
Outer dimensions (L × W)	175 mm × 120 mm (plus protruding plug connectors)
Printed circuit board thickness	Max. 2 mm
Max component height top side	10 mm and 29 mm
Max component height bottom side	4 mm

Table 32: Mechanical data

4.2 Component placement diagrams

The component placement diagrams of the top and the bottom side are displayed in the following.

4.2.1 Mainboard – component placement top

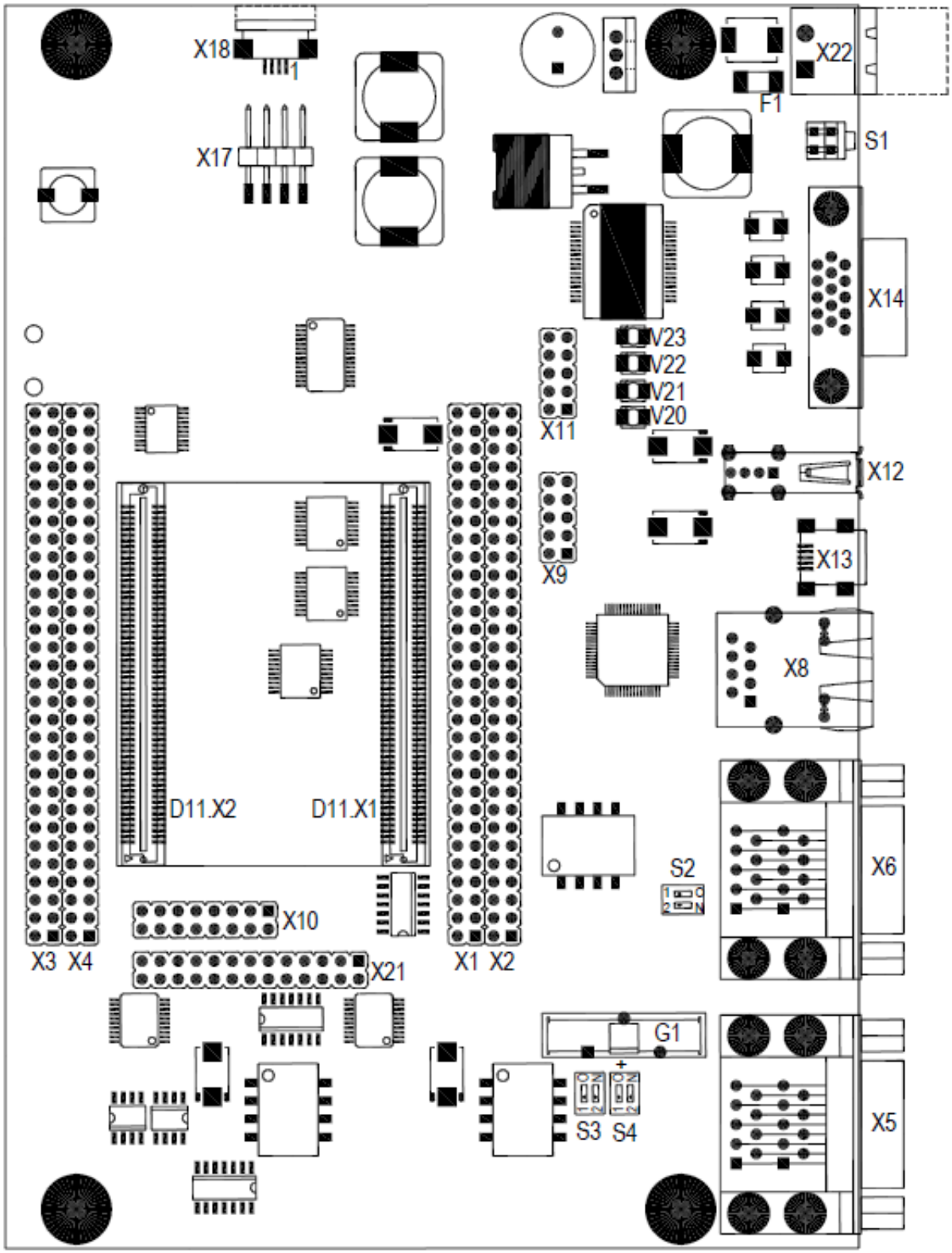

Illustration 9: Mainboard – component placement top

4.2.2 Mainboard – component placement bottom

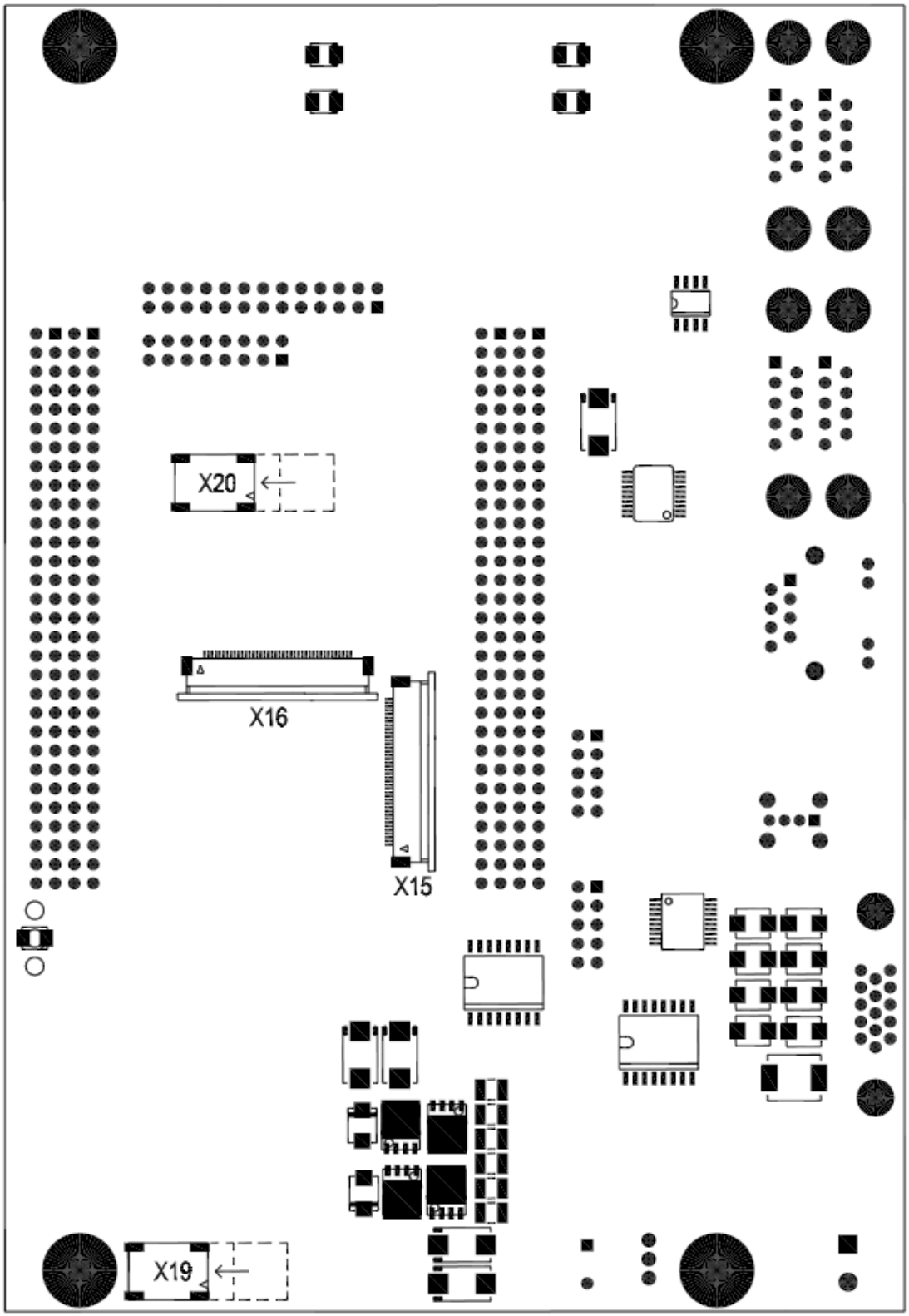

Illustration 10: Mainboard – component placement bottom

5. Technical data

5.1 Power supply

Function	Details
Input voltage	15 V - 30 V DC (corresponds to 24 V DC, -37.5 % … +25 %) The voltage is measured directly at the power connector of the STK-MB5329.
Input current	Supply: U = 18 V, I = 240 mA
Power consumption	P_{typ} = 4.3 W
Reverse voltage protection	Yes, actively via serial FET (max. 32 V for both polarities allowed)
Excess voltage protection	No. At an excess voltage of more than 32 V DC the supply has to switch off within 1 ms.
Filter	Integrated filters for the power supply input.

Table 33: Power supply specification

The specified standard power supply for the STK-MB5329 is the following:

- IPCX86MM NT REV.100 => 18 V (max. 3.9 A)
  (The DC supply cord is prefabricated suitable for iPCbox EX and IPCG3)

With the abovementioned power supply the low voltage directives according to EN 60950 are met. In the case where another power supply is used or if the device is supplied from a 24 V power grid, it is the customers responsibility to make sure the specified maximum ratings and standards are met.

5.2 Vibration load

Parameter	Details
Oscillation, sinusoidal	According to DIN EN 60068-2-6
Frequency ranges	2 – 9 Hz, 9 – 200 Hz, 200 – 500 Hz
Wobble rate	1.0 octaves / min
Excitation axes	X-Y-Z axis
Amplitude	2 Hz … 9 Hz: 3.5 ms^{-2} 9 Hz … 200 Hz: 10 ms^{-2} 200 Hz … 500 Hz: 15 ms^{-2}

Table 34: Vibration test requirements

5.3 Shock load

Parameter	Details
Shocks	According to DIN EN 60068-2-27
Shock form	Half sine
Acceleration	30 g
Residence time	10 ms
Number of shocks	3 shocks per direction
Excitation axes	6X, 6Y, 6Z

Table 35: Shock test requirements

6. Safety requirements and protective regulations

6.1 Operational safety and personal security

A separate test can be omitted on account of the occurring voltages (≤35 V DC).

6.2 Environment protection

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment.

To be able to reuse the product, 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.

Printed pc-boards are delivered in reusable packaging. Modules and devices are delivered in an outer packaging of paper, cardboard or other recyclable material.

Due to technical reasons a battery is necessary for this project. Batteries containing mercury (Hg), cadmium (Cd) or lead (Pb) are not used. To allow a separate disposal, batteries are generally only mounted in sockets.

No use of PCB containing capacitors and transformers (**p**oly**c**hlorinated **b**iphenyls).

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)

6.2.1 RoHS compliance

The STK-MB5329 is manufactured RoHS compliant.

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

7. Climatic and operational conditions

- Ambient temperature:
  - Standard temperature range: 0 °C … +50 °C
  - Extended temperature range: –30 °C … +70 °C
- Relative air humidity (operation / storing): 10 % … 90 % (not condensing)
- Protection class: IP00

7.1 Reliability and product life

The device is designed for a product life of approx. 40,000 hrs @ +40 °C, excepting the lithium cell, which should be renewed after approximately 3 years.

7.1.1 Interfaces and plug connectors

Plug connectors of middle grade, which guarantee at least 100 mating cycles are used for all external accessible interfaces.

Please ensure that the power connector is connected to the STK-MB5329 (X22)
before connecting the power supply to mains!

8. Software:

Supported software: µC Linux 2.6.