Hardware Documentation

PicoCOM™A7
HW Revision 1.10

Version 002
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About This Document

This document describes how to use the PicoCOM™A7 board with mechanical and electrical information. The latest version of this document can be found at:

http://www.fs-net.de.

ESD Requirements

All F&S hardware products are ESD (electrostatic sensitive devices). All products are handled and packaged according to ESD guidelines. Please do not handle or store ESD-sensitive material in ESD-unsafe environments. Negligent handling will harm the product and warranty claims become void.

History

Date	V	Platform	A,M,R	Chapter	Description	Au
10.09.2019	001	All		-	Initial Version	MD
19.08.2021	002	All	M	-	Changes for HW Revision 1.10	MW

V	Version
A, M, R	Added, Modified, Removed
Au	Author

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1 Block Diagram

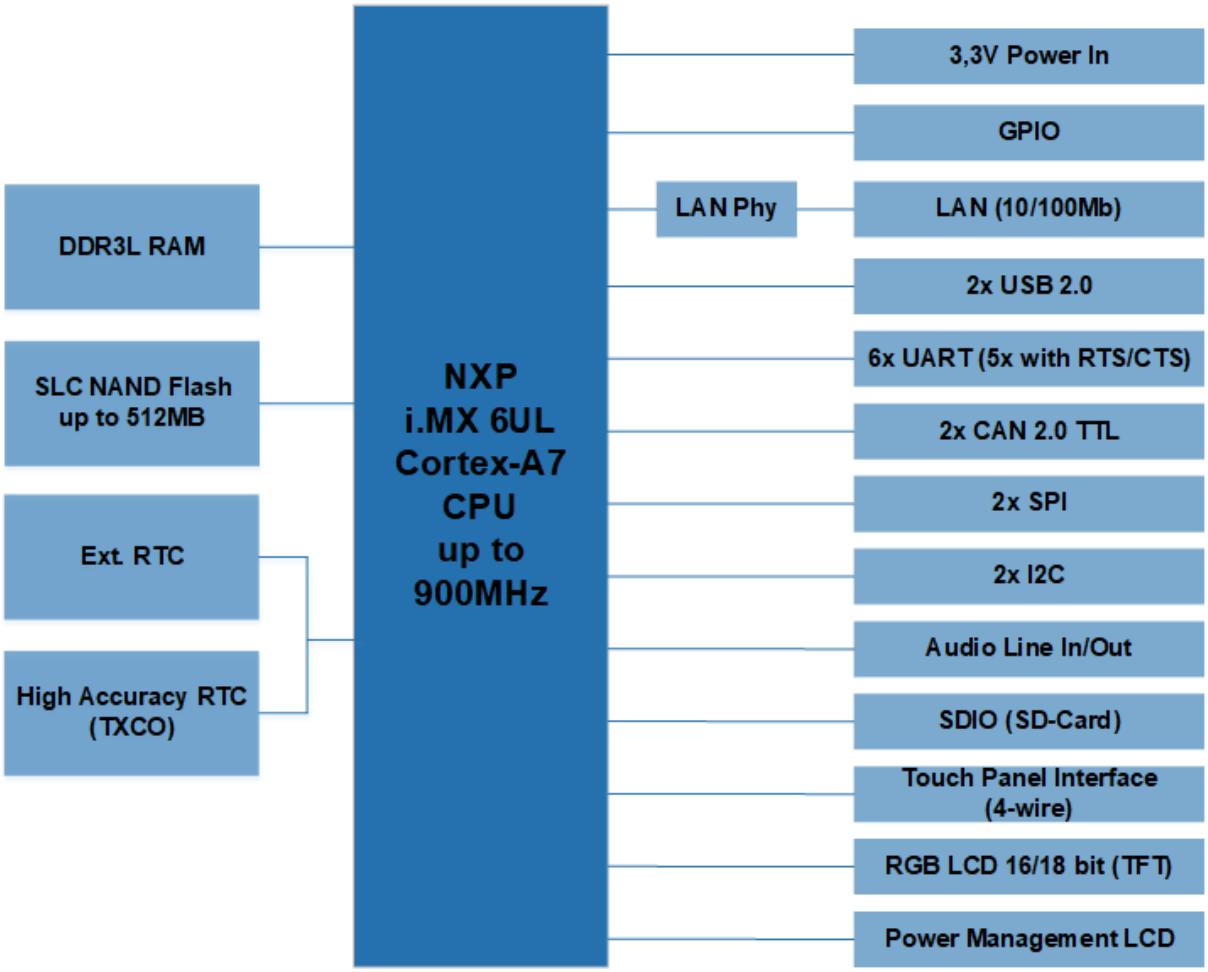

Figure 1: Block Diagram

2 Mechanical Dimensions

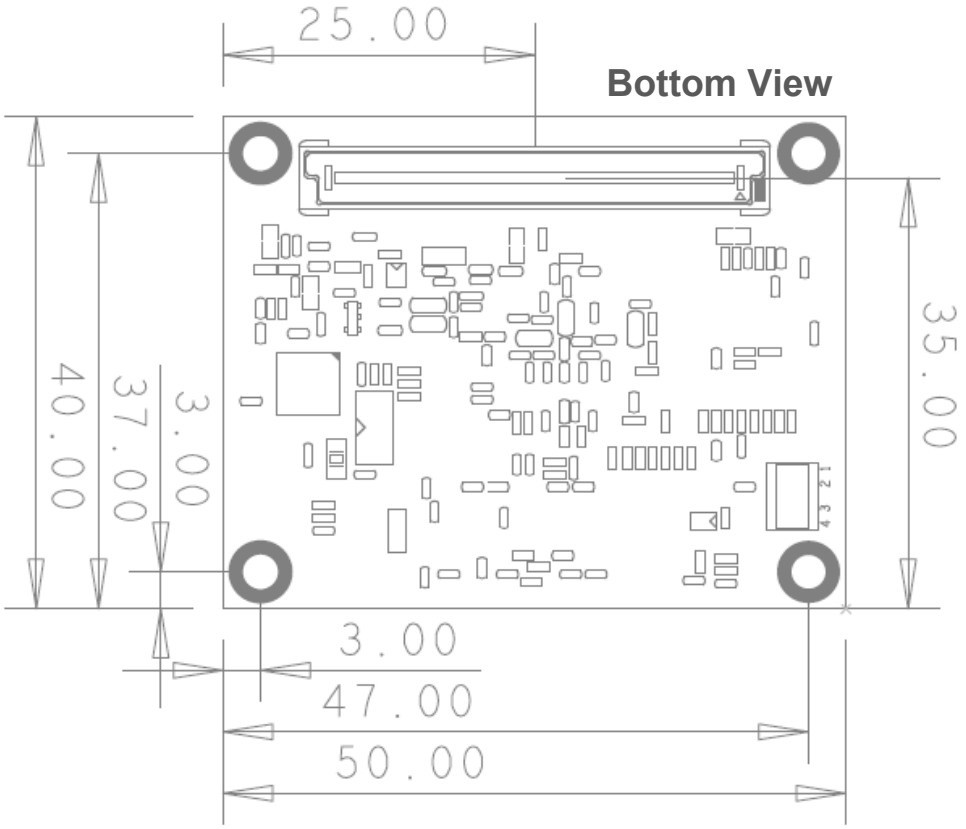

Figure 2: Mechanical Dimensions [mm]

Dimensions	Description
Size	50mm x 40mm
PCB Thickness	1.5mm ± 0.1mm
Height of the parts on the top side	3.9mm
Height of the parts on the bottom side	4.6mm
Weight	14gr

Table 1: Mechanical Dimensions

3D Step model available, please contact support@fs-net.de

3 Interface and signal description

3.1 B2B connector (J3)

J3 Pin	Signal Name	CPU Pad	I/O	Voltage	Remarks
1	ETH1_TX-	-	I/O	3.3V	
2	ETH1_RX-	-	I/O	3.3V	
3	ETH1_TX+	-	I/O	3.3V	
4	ETH1_RX+	-	I/O	3.3V	
5	+V3.3S	-	PWR	3.3V	
6	+V3.3S	-	PWR	3.3V	
7	GND	-	PWR	GND	
8	GND	-	PWR	GND	
9	VBAT	-	PWR	3.0V	2.2V < VBAT < 3.45V
10	RESETINn	-	I	3.3V	
11	UART5_CTS	UART1_CTS	O	3.3V	
12	SD1_CD	UART1_RTS	I	3.3V	
13	UART2_TXD	UART2_TX_DATA	O	3.3V	
14	UART2_RXD	UART2_RX_DATA	I	3.3V	
15	UART2_RTS | UART3_TXD	UART3_TX_DATA	I/O	3.3V	
16	UART2_CTS | UART3_RXD	UART3_RX_DATA	I/O	3.3V	
17	UART5_TXD	UART5_TX_DATA	O	3.3V	
18	UART5_RXD	UART5_RX_DATA	I	3.3V	Pulled up to 3.3V
19	USB_H1_DP	USB_OTG2_DP	I/O		
20	USB_H1_DN	USB_OTG2_DN	I/O		
21	USB_OTG_DP	USB_OTG1_DP	I/O		
22	USB_OTG_DN	USB_OTG1_DN	I/O		
23	USB_OTG_VBUS	-	O	5V	
24	USB_H1_PWR	UART4_TX_DATA	O		
25	GND	-	PWR	GND	
26	ECSPI2_MISO	CSI_DATA03	I	3.3V	
27	ECSPI2_MOSI	CSI_DATA02	O	3.3V	

J3 Pin	Signal Name	CPU Pad	I/O	Voltage	Remarks
28	ECSPI2_SCLK	CSI_DATA00	O	3.3V	
29	ECSPI2_SS0	UART4_RX_DATA	I	3.3V	
30	CAN1_TX | I2C2_SDA	CSI_VSYNC	I/O	3.3V	Pulled up to 3.3V
31	CAN1_RX | I2C2_SCL	CSI_HSYNC	I/O	3.3V	Pulled up to 3.3V
32	I2C1_SDA | CAN2_TX	CSI_MCLK	I/O	3.3V	Pulled up to 3.3V
33	I2C1_SCL | CAN2_RX	CSI_PIXCLK	I/O	3.3V	Pulled up to 3.3V
34	SD1_DATA0	SD1_DATA0	I/O	3.3V	Pulled up to 3.3V
35	SD1_DATA1	SD1_DATA1	I/O	3.3V	
36	SD1_DATA2	SD1_DATA2	I/O	3.3V	
37	SD1_DATA3	SD1_DATA3	I/O	3.3V	
38	SD1_CLK	SD1_CLK	O	3.3V	
39	SD1_CMD	SD1_CMD	I/O	3.3V	Pulled up to 3.3V
40	GPIO1	GPIO1_IO09	I/O	3.3V	Swapped in HW Revision 1.10 with UART5_RTS
41	ETH2_LED | PWM	-	I/O	3.3V	LED_LINK of Ethernet Phy0
42	GND	-	PWR	GND	
43	LCD_R1	LCD_DATA01	O	3.3V	
44	LCD_R2	LCD_DATA02	O	3.3V	
45	LCD_R3	LCD_DATA03	O	3.3V	
46	LCD_R4	LCD_DATA04	O	3.3V	
47	LCD_R5	LCD_DATA05	O	3.3V	
48	LCD_G0	LCD_DATA06	O	3.3V	
49	LCD_G1	LCD_DATA07	O	3.3V	
50	LCD_G2	LCD_DATA08	O	3.3V	
51	LCD_G3	LCD_DATA09	O	3.3V	
52	LCD_G4	LCD_DATA10	O	3.3V	
53	LCD_G5	LCD_DATA11	O	3.3V	
54	LCD_B1	LCD_DATA13	O	3.3V	
55	LCD_B2	LCD_DATA14	O	3.3V	
56	LCD_B3	LCD_DATA15	O	3.3V	
57	LCD_B4	LCD_DATA16	O	3.3V	
58	LCD_B5	LCD_DATA17	O	3.3V	
59	LCD_CLK	LCD_CLK	O	3.3V	
60	LCD_DE	LCD_EANBLE	O	3.3V	

J3 Pin	Signal Name	CPU Pad	I/O	Voltage	Remarks
61	GND	-	PWR	GND	
62	GND	-	PWR	GND	
63	LCD_HSYNC | LCD_B0	LCD_HASNC / LCD_DATA12	O	3.3V	
64	LCD_VSYNC | LCD_R0	LCD_VSYNC / LCD_DATA00	O	3.3V	
65	BL_CTRL	LCD_DATA18	O	3.3V	
66	VLCD_ON	LCD_DATA20	O	3.3V	Pulled-Up to 3.3V
67	VCFL_ON	LCD_DATA21	O	3.3V	Pulled-Up to 3.3V
68	LCD_DEN	LCD_DATA19	O	3.3V	
69	UART5_RTS	GPIO1_IO08	I	3.3V	Swapped in HW Revision 1.10 with GPIO1
70	ETH1_LED	-	O	3.3V	LED_LINK of Ethernet Phy1
71	TOUCH_X+	GPIO1_IO04	I/O		
72	GND	-	PWR	GND	
73	GND	-	PWR	GND	
74	TOUCH_X-	GPIO1_IO03	I/O		
75	TOUCH_Y+	GPIO1_IO02	I/O		
76	TOUCH_Y-	GPIO1_IO01	I/O		
77	LINEOUT_L | ETH2_TX-	-	I/O		
78	LINEOUT_R | ETH2_RX-	-	I/O		
79	LINEIN_L | ETH2_TX+	-	I/O		
80	LINEIN_R | ETH2_RX+	-	I/O		

Table 2: B2B Connector Pin Layout

4 Interfaces

4.1 Ethernet

On PicoCOMA7™ board there are 1 standard and 1 optional Ethernet connections. Ethernet TX+/- and RX+/- lines are 100 ±20% Ohm differential pairs to a 1:1/1:1 transformer. We recommend a connector with integrated transformer in short distance (less than 1 inch = 25.4 mm) to the module connector. The RX pair should have a 0.1 inch min. distance to TX pair to avoid crosstalk. The intra pair mismatch of each differential pair should be <10 mil (0.254mm). The transformer midpoint should be connected to the 3.3V power supply. LED signal is able to drive a 3.3V powered LED with 5mA directly to GND. If Ethernet is not used please leave signals unconnected.

The Ethernet2 Signals are shared with the Audio Signals. Only one of these features can be used.

J3 Pin	Signal Name	Alternative	Description
1	ETH1_TX-		Ethernet1 Transmit-
2	ETH1_RX-		Ethernet1 Receive-
3	ETH1_TX+		Ethernet1 Transmit+
4	ETH1_RX+		Ethernet1 Receive+
77	ETH2_TX-	LINEOUT_L	Ethernet2 Transmit-
78	ETH2_RX-	LINEOUT_R	Ethernet2 Receive-
79	ETH2_TX+	LINEIN_L	Ethernet2 Transmit+
80	ETH2_RX+	LINEIN_R	Ethernet2 Receive+

Table 3: Ethernet Interface

4.2 USB

PicoCOMA7™ provides 1 USB OTG and 1 USB Host Mode connections. The 90 Ohm differential pair of USB signals do not need any termination. For external ports EMV and ESD protection is required nearby the USB connector on the base board. If the USB port is not used please leave open.

J3 Pin	Signal Name	Alternative	Description
19	USB_H1_DP	x	USB Host Mode Data+
20	USB_H1_DN	x	USB Host Mode Data-
21	USB_OTG_DP	x	USB OTG Data+
22	USB_OTG_DN	x	USB OTG Data-
23	USB_OTG_VBUS	x	USB OTG Supply Voltage (+5V)
24	USB_H1_PWR	x	USB Host Mode Power On

Table 4: USB Interface

4.3 Serial Interfaces

On PicoCOMA7™ board it is allowed for the users to use these serial interfaces, which are given below. All of these serial Interfaces are 3.3V compliant.

- UART: 2 x standard UART with RTS/CTS (UART2 and UART5) and 1 x optional UART without RTS/CTS (UART3)
- I2C: 1 x standard I2C (I2C1) and 1 x optional I2C (I2C2)
- SPI: 1 x SPI (ECSPI2)
- CAN: 1 x standard CAN2.0 Bus (CAN1) and 1 x optional CAN2.0 Bus (CAN2)

Because of a Hardware Bug the Signals “UART5_CTS” and “UART5_RTS” are exchanged. To use flow control exchange signals on your Baseboard.

J3 Pin	Signal Name	Alternative	Description
11	UART5_CTS	X	UART5 Clear to Send
13	UART2_TXD	X	UART2 Transmit Data
14	UART2_RXD	X	UART2 Receive Data
15	UART2_RTS	UART3_TXD	UART2 Request to Send | UART3 Transmit Data
16	UART2_CTS	UART3_RXD	UART2 Clear to Send | UART3 Receive Data
17	UART5_TXD	X	UART5 Transmit Data
18	UART5_RXD	X	UART5 Receive Data
69	UART5_RTS	X	UART5 Request to Send

Table 5: Serial Interfaces – UART

J3 Pin	Signal Name	Alternative	Description
30	CAN1_TX	I2C2_SDA	CAN1 Bus Transmit Data | I2C2 Serial Data Line
31	CAN1_RX	I2C2_SCL	CAN1 Bus Receive Data | I2C2 Serial Clock Line
32	I2C1_SDA	CAN2_TX	I2C1 Serial Data Line | CAN2 Bus Transmit Data
33	I2C1_SCL	CAN2_RX	I2C1 Serial Clock Line | CAN2 Bus Receive Data

Table 6: Serial Interfaces – I2C & CAN

J3 Pin	Signal Name	Alternative	Description
26	ECSPI2_MISO	X	SPI2 Master In Slave Out
27	ECSPI2_MOSI	X	SPI2 Master Out Slave In
28	ECSPI2_SCLK	X	SPI2 Serial Clock
29	ECSPI2_SS0	X	SPI2 Slave Select

Table 7: Serial Interfaces – SPI

4.4 Audio

PicoCOMA7™ board provides stereo analog input and output lines. SGTL5000 is used as audio codec. The module also supports digital audio input and output over I2S protocol. For mounting option with I2S codec on baseboard please ask our technical support. To avoid ESD and EMV problems, it is necessary to have a protection on the baseboard.

The Audio Signals are shared with the Ethernet 2 Signals. Only one of these features can be used.

J3 Pin	Signal Name	Alternative	Description
77	LINEOUT_L	ETH2_TX-	Analog Stereo Line Out Left
78	LINEOUT_R	ETH2_RX-	Analog Stereo Line Out Right
79	LINEIN_L	ETH2_TX+	Analog Stereo Line In Left
80	LINEIN_R	ETH2_RX+	Analog Stereo Line In Right

Table 8: Audio Interface

4.5 SD Card

The interface is supporting a SD card channel. For specification and licensing please refer the website of the SD Association http://www.sdcard.org. Pullups are integrated on the module. Card detection signal and write protection signal are not supported by the PicoCOM™ standard. Unused signals should be left unconnected. Signals can be optional used as GPIO.

J3 Pin	Signal Name	Alternative	Description
34	SD1_DATA0	X	SD Card Data Line 0
35	SD1_DATA1	X	SD Card Data Line 1
36	SD1_DATA2	X	SD Card Data Line 2
37	SD1_DATA3	X	SD Card Data Line 3
38	SD1_CLK	X	SD Card Clock Signal
39	SD1_CMD	X	SD Command Signal

Table 9: SD Card

4.6 LCD Display Connection

All signals are working with 3.3V logic level. For all LCD signals we strictly recommend serial resistors nearby the module connector to reduce EMI.

	TFT				
J3 Pin	Signal Name	18 bit (without HSYNC/VSYNC)	18 bit (with HSYNC/VSYNC)	16 bit	15 bit
43	LCD_R1	R1	R1	R0 (LSB)	R0 (LSB)
44	LCD_R2	R2	R2	R1	R1
45	LCD_R3	R3	R3	R2	R2
46	LCD_R4	R4	R4	R3	R3
47	LCD_R5	R5 (MSB)	R5 (MSB), R0 (LSB)	R4 (MSB)	R4 (MSB)
48	LCD_G0	G0 (LSB)	G0 (LSB)	G0 (LSB)	---
49	LCD_G1	G1	G1	G1	G0 (LSB)
50	LCD_G2	G2	G2	G2	G1
51	LCD_G3	G3	G3	G3	G2
52	LCD_G4	G4	G4	G4	G3
53	LCD_G5	G5 (MSB)	G5 (MSB)	G5 (MSB)	G4 (MSB)
54	LCD_B1	B1	B1	B0 (LSB)	B0 (LSB)
55	LCD_B2	B2	B2	B1	B1
56	LCD_B3	B3	B3	B2	B2
57	LCD_B4	B4	B4	B3	B3
58	LCD_B5	B5 (MSB)	B5 (MSB), B0 (LSB)	B4 (MSB)	B4 (MSB)
59	LCD_CLK	LCD Clock			
63	LCD_HSYNC | LCD_B0	B0 (LSB)	HSYNC	HSYNC	HSYNC
64	LCD_VSYNC | LCD_R0	R0 (LSB)	VSYNC	VSYNC	VSYNC
60	LCD_DE	DE	DE	DE	DE
68	LCD_DEN	---	---	---	---
65	BL_CTRL	Backlight PWM			
66	VLCD_ON	LCD Power On (Active Low)			
67	VCFL_ON	Backlight Power On (Active Low)			

Table 10: RGB-LCD Connection

4.7 Touch Control Interface

The integrated resistive touch controller will support 4 wire analog resistive touch panels without any additional circuit.

J3 Pin	Signal Name	Alternative	Description
71	TOUCH_X+	X	4-wire Touchscreen : X+ Electrode
74	TOUCH_X-	X	4-wire Touchscreen : X- Electrode
75	TOUCH_Y+	X	4-wire Touchscreen : Y+ Electrode
76	TOUCH_Y-	X	4-wire Touchscreen : Y- Electrode

Table 11: Touch Control Interface

4.8 JTAG

J1 Pin	Signal Name	I/O	Voltage	Description
1	+V3.3S	PWR	3.3V	
2	JTAG_TMS	X		JTAG Test Mode Select
3	GND	PWR	GND	
4	JTAG_TCK	X		JTAG Test Clock
5	GND	PWR	GND	
6	JTAG_TDO	X		JTAG Test Data Out
7	JTAG_nTRST	X		JTAG Test Reset
8	JTAG_TDI	X		JTAG Test Data In
9	GND	PWR	GND	
10	JTAG_nSRST	X		JTAG System Reset

Table 12: JTAG Interface

- For debug only
- Leave unconnected, if you don't use JTAG
- Don't put them in a JTAG chain, because different power sequence and power level could kill the CPU

4.9 Power and Power Control Pins

J3 Pin	Signal Name	I/O	Voltage	Description
5, 6	+V3.3S	PWR In	3.3V	Main Power Supply Input Please refer Electrical characteristic (Ch6)
9	VBAT	PWR In	3V	RTC Battery Input, leave open if not used Please refer Electrical characteristic (Ch6)
23	USB_OTG_VBUS	I	5V	USB Supply Voltage
10	RESETINn	I	3.3V	Power On Reset Input, 10K Pull-Up
	GND	PWR	GND	Connect all GND pins to a GND plane

Table 13: Power and Power Control

By using a battery for VBAT you have to follow regulation rules. Please check with your test laboratory.

3.3V is the DCDC power supply of the module powered from +V3.3S. Use as enable for baseboard power regulators.

RESETIN is a Reset Input for the module. Will just reset the CPU.

5 RTC

There is a NXP PCA8565 or compatible implemented on board. The accuracy is limited because the warming of the crystal on the board in operation. The RTC could drift over the day.

6 Electrical characteristic

6.1 Absolute maximum ratings

Description	Min	Max	Unit
Input Voltage range 3.3V IO pins	-0.3	OVDD*+0.3	V
Voltage on any IO with VIN off		0.3	V
USB VBUS	-0.3	5.6	V

Table 14: Absolute Maximum Ratings

6.2 DC Electrical Characteristics

Parameter	Description	Min.	Typ.	Max.	Unit
VIN	PicoCOMA7™ input supply voltage	3.135	3.3	3.465	V
I_{IN}	Input Current			1.0	A
VBAT	RTC Power Supply	2.2	3.0	3.45	V
P_{VBAT}	Power Consumption		0.22	0.6*	µA
USB_OTG_VBUS	USB supply voltage	4.4	5.5		V
I_{VBUS}	USB supply current		100		mA
VDD_SNVS_IN	SNVS supply	2.4	3.6		V
V_{ih}	High Level Input Voltage	0.7*OVDD	OVDD		V
V_{il}	Low Level Input Voltage	0	0.3*OVDD		V
I_o	Output current IOs		5.0		mA

**0.6 µA @85°C*

Table 15: DC Electrical Characteristics

7 Thermal Specification

	Min	Typ	Max	Unit
Operating temperature	0		+70[1]	°C
Operating temperature (“I”)[2]	-20		+85[1]	°C
Junction temperature i.MX6ULL	0		+95	°C
Junction temperature i.MX6ULL (“I”) [2]	-40		+105	°C
Junction to Top of i.MX6ULL (Psi-JT)[3]		2,3		°C/W

Table 16: Thermal Specifications

[1] Depending on cooling solution. See also: *Power consumption and cooling*

[2] Optional

[3] Temperature difference between package top and the junction temperature per JEDEC JESD51-2. Valid for 14x14mm package.

8 Review service

F&S provide a schematic review service for your baseboard implementation. Please send your schematic as searchable PDF to support@fs-net.de.

9 ESD and EMI Implementation

Because there is no connector to „out of case" there is no ESD protection for any interface. It needs ESD protection on every connector out of the case on your baseboard. To reduce EMI the PicoCOMA7™ supports Spread spectrum. This will normally reduce EMI between 9 and 12 dB and so this decrease your shielding requirements. We strictly recommend having your baseboard with controlled impedance and wires as short as possible.

A helpful guide is available from TI; just search for slva680 at ti.com.

10 Second source rules

F&S qualifies their second sources for parts autonomously, as long as this does not touch the technical characteristics of the product. This is necessary to guarantee delivery times and product life. A setup of release samples with released second sources is not possible.

F&S does not use broker components without the consent of the customer.

11 Power consumption and cooling

Depend you product version you will have different temperature range and power consumption of the module.

The operating temperature can be measured on the mounting holes on top of the module and **should not exceed the maximum operating temperature of the board**.

The maximum power consumption of the board could be 5.5 Watt. This value is with 100% working of cores and full working graphic engines. Calculating with this scenario does need an expensive cooling.

Dependent from your application and your worst-case scenario the maximum power consumption is much lower. This will save money on your cooling solution. We recommend measuring this with your application. We see values between one and max. 3.5 Watt on different custom applications.

Because the different environments for air temperature, airflow, thermal radiation, power consumption of the board on your application and the power consumption of other components like power supply and LCD inside the system you have to calculate a working cooling solution for the board.

Just cooling the CPU with 70-90% of the power consumption of the entire board is the best way to cool the board.

To calculate your cooling we recommend this helpful literature and the CPU datasheet (VK package starting page 27)

- i.MX6ULL C-Temp CPU datasheet from NXP
- i.MX6ULL I-Temp CPU datasheet from NXP
- AN4579 from NXP: Thermal management guidelines
- AN5337 from NXP: i.MX 6ULL Product Lifetime Usage Estimates
- fischerelektronik.de/web_fisch…eKataloge/Heatsinks/#/18/
- http://www.eetimes.com/document.asp?doc_id=1276748
- http://www.eetimes.com/document.asp?doc_id=1276750

12 Storage conditions

Maximum storage on room temperature with non-condensing humidity: 6 months
Maximum storage on controlled conditions 25 ±5 °C, max. 60% humidity: 12 months
For longer storage, we recommend vacuum dry packs.

13 ROHS and REACH statement

All F&S designs are created from lead-free components and are completely ROHS compliant.

The products we supply do not contain any substance on the latest candidate list published by the European Chemicals Agency according to Article 59(1,10) of Regulation (EC) 1907/2006 (REACH) in a concentration above 0.1 mass %.
Consequently, the obligations in No. 1 and 2 paragraphs in Annex are not relevant here.
Please understand that F&S is not performing any chemical analysis on its products to testify REACH compliance and is therefore not able to fill out any detailed inquiry forms.

14 Packaging

All F&S ESD-sensitive products will shipping either in trays or in bags.
These modules ship in trays. One tray can hold 10 boards. An empty tray will be used as top cover.

15 Matrix Code Sticker

All F&S hardware will ship with a matrix code sticker including the serial number. Enter your serial number here https://www.fs-net.de/en/support/serial-number-info-and-rma/ to get information on shipping date and type of board.

Figure 3: Matrix Code Sticker

16 Appendix

Important Notice

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