Hardware Documentation

PicoMODA9
PicoMODA9.2

Version 1.10
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Elektronik Systeme

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About This Document

This document describes the hardware of the PicoMODA9-digital for LVDS display interface. For the TTL display interface version of this product there is a separate document. The latest version of this document can be found at https://www.fs-net.de/.

History

Date	V	Platform	A,M,R	Chapter	Description	Au
20.01.2014		PicoMODA9	A	-	Hardware documentation, preliminary	KW
22.07.2014	0.01	PicoMODA9	M	*	Changed to new company CI	JG
07.06.16	1.00	PicoMODA9	A A	5 6	Add power consumption, operat. cond. Add storage cond	KW
01.09.2023	1.10	PicoMODA9	M	1	Add info for new touchcontroller	DB

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

Table of Content

1 Technical Data

1.1 Touch Controller

Due to EOL, the touch controller is changed from SX8674 to TSC2004.
Boards with the new touchcontroller are named PicoMODA9.2.
New operating system software is required for PicoMODA9.2.

1.2 Connectors

The PicoMODA9 is equipped with a TycoElectronics 5177984-6 (140 pin, 0.8mm) connector from ‘0.8mm Free Height (FH) Connectors’ series.
For position and orientation please look chapter 4 “Dimensions”

Matching connectors are:

5mm stacking height:	TycoElectronics 5177983-6
9mm stacking height:	TycoElectronics 5-5179009-6
13mm stacking height:	TycoElectronics 5-5179010-6

2 Connectors

2.1 Counting of the connector pins

The connector plug of PicoMODA9 LVDS will be treated as follows.
Pin 1 is marked in Figure 1. The row with pin 1 contains all odd-numbered pins (1, 3, 5, 7 etc.), and corresponding to this, the row without pin 1 contains all even-numbered pins (2, 4, 6, 8 etc.).

2.2 IO-Pin limitations

PicoMODA9 LVDS is equipped with 45 pins that can be used as digital-IO. Most of these pins are multiplexed, so you have to make sure that these pins are used for one purpose only. For example, if you intend to use IO0 to IO3 you have to make sure that the COM2 is disabled. Additionally there are some IO-Pins which are used internally and whose primary function can't be disabled completely.

2.3 Connector J1 (main connector)

J1			
Pin	**Signal**	**Default Interface**	**Alternative Function**
1	IO64	SPI CS	I/O-Pin 64
2	IO65	SPI CLK	I/O-Pin 65
3	IO66	SPI MISO	I/O-Pin 66
4	IO67	SPI MOSI	I/O-Pin 67
5	CAN-TX	CAN2.0 TX	
6	CAN-RX	CAN2.0 RX	
7	RX-	Ethernet RX-	
8	TX-	Ethernet TX-	
9	RX+	Ethernet RX+	
10	TX+	Ethernet TX+	
11	V33	+3,3V ±5% DC	
12	V33	+3,3V ±5% DC	
13	GND	GND	
14	GND	GND	
15	/PONRES	CPU Reset (active low)	
16	VBAT	+3V … +3,6V DC (Battery buffering RTC) (*)	
17	IO1	COM2 TxD	
18	IO0	COM2 RxD	
19	IO3	COM2 RTS	
20	IO2	COM2 CTS	
21	IO5	COM1 TxD	
22	IO4	COM1 RxD	
23	IO7	COM3 TxD	I/O-Pin 7
24	IO6	COM3 RxD	I/O-Pin 6
25	OTGDM	USB2.0 OTG Dev./Host -	
26	USBDN	USB2.0 Host -	
27	OTGDP	USB2.0 OTG Dev./Host +	
28	USBDP	USB2.0 Host +	
29	IO9	I/O-Pin 9 / GPIO5	
30	IO8	USB Host Power On	I/O-Pin 8
31	IO11	I2C SDA	I/O-Pin 11

J1			
Pin	**Signal**	**Default Interface**	**Alternative Function**
32	IO10	USB Device Detect	I/O-Pin 10
33	IO76	I/O-Pin 76	
34	IO12	I2C SCL	I/O-Pin 12
35	BOOTSEL0	NC (do not use)	
36	IO77	I/O-Pin 77	
37	BOOTSEL1	NC (do not use)	
38	BOOTSEL2	NC (do not use)	
39	GND	GND	
40	GND	GND	
41	IO14	I/O-Pin 14 / GPIO1	
42	IO13	I/O-Pin 13 / GPIO0	
43	IO16	I/O-Pin 16 / GPIO3	
44	IO15	I/O-Pin 15 / GPIO2	
45	IO18	SD-Card CLK	I/O-Pin 18
46	IO17	I/O-Pin 17 / GPIO4	
47	IO20	SD-Card DAT0	I/O-Pin 20
48	IO19	SD-Card CMD	I/O-Pin 19
49	IO22	SD-Card DAT2	I/O-Pin 22
50	IO21	SD-Card DAT1	I/O-Pin 21
51	IO24	SD-Card Detect	I/O-Pin 24
52	IO23	SD-Card DAT3	I/O-Pin 23
53	IO26	SD-Card Write Protect	I/O-Pin 26
54	IO25	SD-Card Power Enable	I/O-Pin 25
55	IO28	LCD DEN (Display enable)	I/O-Pin 28
56	IO27	LCD Enable	I/O-Pin 27
57	IO30	LCD VCFL On	I/O-Pin 30
58	IO29	LCD VLCD On	I/O-Pin 29
59	GND	GND	
60	IO31	LCD VEEK	I/O-Pin 31
61	VIO0	LCD VD0	I/O-Pin 32
62	GND	GND	
63	VIO2	LCD VD2	I/O-Pin 34
64	VIO1	LCD VD1	I/O-Pin 33
65	VIO4	LCD VD4	I/O-Pin 36
66	VIO3	LCD VD3	I/O-Pin 35
67	VIO6	LCD VD6	I/O-Pin 38
68	VIO5	LCD VD5	I/O-Pin 37
69	VIO8	LCD VD12	I/O-Pin 40
70	VIO7	LCD VD7	I/O-Pin 39
71	VIO10	LCD VD14	I/O-Pin 42
72	VIO9	LCD VD13	I/O-Pin 41
73	VIO12	LCD VD18	I/O-Pin 44
74	VIO11	LCD VD15	I/O-Pin 43
75	VIO14	LCD VD20	I/O-Pin 46
76	VIO13	LCD VD19	I/O-Pin 45
77	VIO16	LCD VD22	I/O-Pin 48
78	VIO15	LCD VD21	I/O-Pin 47
79	VIO18	LCD VLINE	I/O-Pin 50
80	VIO17	LCD VD23	I/O-Pin 49
81	VIO20	LCD VM	I/O-Pin 52
82	VIO19	LCD VFRAME	I/O-Pin 51
83	GND	GND	
84	GND	GND	
85	GND	GND	
86	VIO21	LCD VCLK	I/O-Pin 53
87	IO70	I/O-Pin 70	
88	IO71	I/O-Pin 71	

J1			
Pin	**Signal**	**Default Interface**	**Alternative Function**
89	/WAIT	Bus Wait (active low)	
90	IO72	I/O-Pin 72	
91	CS4	Chip Select 2	
92	CS5	Chip Select 3	
93	IO73	I/O-Pin 73	
94	IOxx	I/O-Pin	
95	IOxx	I/O-Pin	
96	/OE	Output Enable	
97	/WE	Write Enable	
98	IO74	I/O-Pin 74	
99	A0	Address 0	
100	A1	Address 1	
101	A2	Address 2	
102	A3	Address 3	
103	A4	Address 4	
104	A5	Address 5	
105	A6	Address 6	
106	A7	Address 7	
107	A8	Address 8	
108	A9	Address 9	
109	A10	Address 10	
110	D0	Data 0	
111	D1	Data 1	
112	D2	Data 2	
113	D3	Data 3	
114	D4	Data 4	
115	D5	Data 5	
116	D6	Data 6	
117	D7	Data 7	
118	D8	Data 8	
119	D9	Data 9	
120	D10	Data 10	
121	D11	Data 11	
122	D12	Data 12	
123	D13	Data 13	
124	D14	Data 14	
125	D15	Data 15	
126	IO75	I/O-Pin 75	
127	CS0	Chip Select 1	
128	ETH-ACT	Ethernet Activity	
129	STA1	Status 1	
130	STA2	Status 2	
131	LOUT	Audio Left Out	
132	ROUT	Audio Right Out	
133	LIN	Audio Left In	
134	RIN	Audio Right In	
135	MICIN	Microphone In	
136	MICBIAS	Microphone Bias	
137	X+	Touch X+	
138	X-	Touch X-	
139	Y+	Touch Y+	
140	Y-	Touch Y-	

See PicoMODA9 Starter kit documentation for connection examples.
See software documentation for configuration of alternative functions.

2.4 Connector J2 LVDS

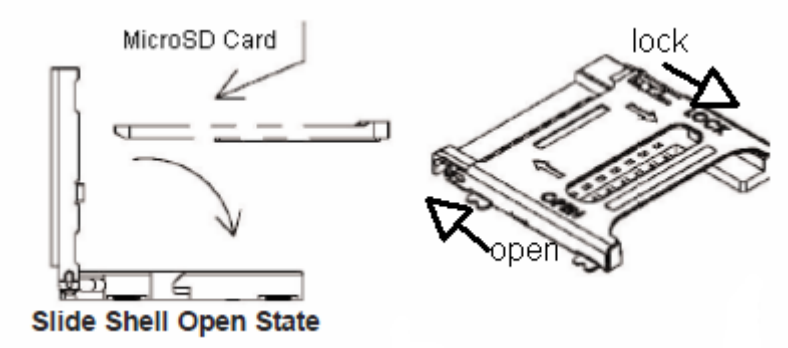
J2		
Pin	**Signal**	**Description**
1	VLCD	LCD Voltage 3.3V switched (max. 1.2A)
2	VLCD	LCD Voltage 3.3V switched (same as on pin 1)
3	GND	Ground
4	GND	Ground
5	TX0-	LVDS Transmit 1 negative
6	TX0+	LVDS Transmit 1 positive
7	GND	Ground
8	TX1-	LVDS Transmit 2 negative
9	TX1+	LVDS Transmit 2 positive
10	GND	Ground
11	TX2-	LVDS Transmit 3 negative
12	TX2+	LVDS Transmit 3 positive
13	GND	Ground
14	CLK-	LVDS Clock negative
15	CLK+	LVDS Clock positive
16	GND	Ground
17	TX3-/NC	LVDS Transmit 3 negative (only with 24bit version)
18	TX3+/NC	LVDS Transmit 3 positive (only with 24bit version)
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	VLCD	LCD Voltage 3.3V switched (same as on pin 1)
24	VCFL_ON	Backlight On Signal 3.3V active high
25	BL_PWM	Backlight Dimming PWM Signal 3.3V

Connector on the PicoMODA9 is a JAE FI-S25P-HFE. Mating connector is JAE FI-S25S. This connector is optional mounted only in mounting versions with LVDS.

2.5 microSD connector

The on board microSD connector can be used on same time as the SD interface on J1. There is no sharing with any signal of the connector J1. There is no hot plug detection for this connector, so the software can't detect a card insert after switching on the board.

Figure 1: microSD connector



3 Interface and Signal description

3.1 Ethernet connection

LAN TX+/- and RX+/- 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 4 inch = 100 mm) to the module connector. The RX pair should have a 0.2 inch min. distance to TX pair to avoid crosstalk. The intra pair mismatch of each differential pair should be <50 mil (1.27mm). Please also refer our "Ethernet Routing Guidelines" on our web download area and refer the comments at our forum.
The LED signals are low active to drive a 3.3V powered LED with 5mA directly.
If Ethernet is not used please leave signals unconnected.

3.2 Serial port

Serial ports are provided with 3.3V TTL signals. These signals are not 5V compliant. Please use a transceiver with 3.3V power supply.
If you don't need the serial port this pins can be used optional as GPIOs.

3.3 USB Host

The 90 Ohm differential pair of USB signals doesn't need any termination. For external ports EMV protection is required nearby the USB connector.
With the USB_PWR signal you can switch on the USB power on your current limiting IC.
From the usb.org webpage you can download "High Speed USB Platform Design Guidelines" which provides highly recommended information for a proper working USB design.
If the USB port is not used please leave open.

3.4 USB device

The 90 Ohm differential pair of USB signals doesn't need any termination. For external ports ESD and EMV protection is required nearby the USB connector.
The USB_CNX signal is for detecting a connection to a host. This signal connects directly to the USB 5V power (4.75 - 5.25V). A buffer can be added to prevent excessive current flow from the USB connector to the board.
From the usb.org webpage you can download "High Speed USB Platform Design Guidelines" which provide highly recommended information for a proper working USB design.
If the USB device port is not used please leave open.

3.5 SPI

The module supports a HS SPI (Serial Peripheral Interface) with a chip select. Signals are 3.3V compliant.

3.6 I2C

The module supports an I2C interface. Signals are 3.3V compliant and don't have pull-ups on module. Please add 2.2 kOhm pull-ups to 3.3V on baseboard. 5V devices on baseboard need a level shifter.
I2C for camera and HDMI is soft I2C on GPIO, see starter kit schematics for connection examples.

3.7 CAN

The module provides the CAN TX and CAN RX signals with .3.3V TTL level
The RX signal has an internal pull-up and can be left unconnected when not used.
A 3.3V transceiver like SN65HVD230 is needed to connect to the CAN bus.

3.8 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. Pull-ups are integrated on the module. Signals are 3.3V compliant.
Unused signals should be left unconnected.
Signals can be optional used as GPIO.

3.9 Touch

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

3.10 Audio I/F

The onboard sound codec supports an analog stereo input and an analog stereo output with 1 V_{RMS} signal level. These signals need serial capacitors.

3.11 IO/ IRQ

Multiple general purpose pins with 3.3V logic signal level.

3.12 /PONRES

Reset input. Drive with open drain or open collector 3.3V compliant signal. We recommend to pull low this pin with the powergood signal from power supply or using a voltage supervisor. For proper function this signal must be connected.

3.13 Address/Data-Bus

The PicoMODA9 module does provide an address/data bus to connect ICs for additional functions. Bus supports 3.3V TTL level. This interface can be used to implement a NetDCU compatible FS-Bus (8bit with data/address select)

Address	A10..0
Data	D15..0
Chip select	/CS0
Output Enable	/OE
Write Enable	/WE

4 Dimensions

Board thickness:	1.6 mm
Height of parts on top side:	3.0 mm
Height of parts on bottom side (without connectors):	2.0 mm
Pin pitch of connector:	0.8 mm
Mounting hole diameter:	2.8 mm

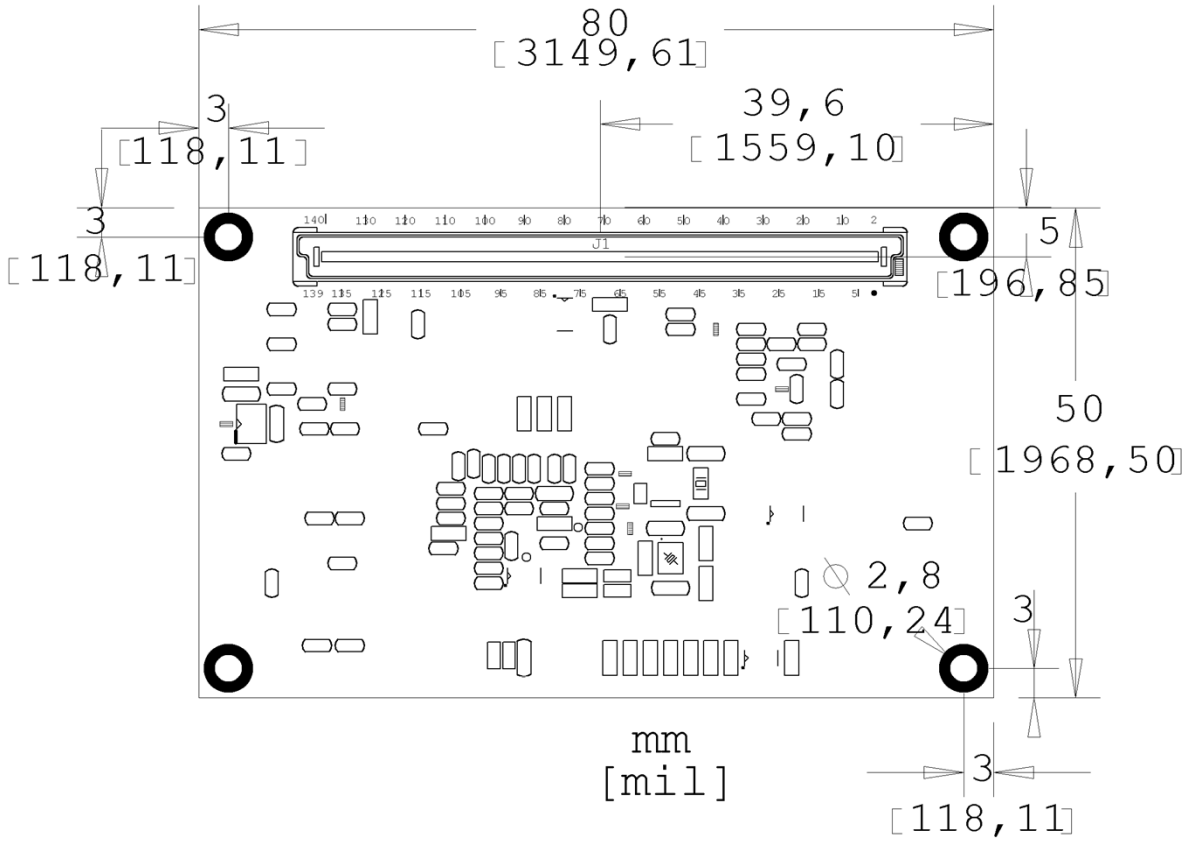


Figure 2: Bottom view – dimension

All values can have tolerances of ±0.5mm.
To avoid EMC and ripple pickup the mounting holes are isolated and not connected to any voltage.

5 Technical Data

Power Supply:	+3.3V DC / ±5%
Power supply VBAT	2.0 … 3.6 V
power consumption	
typical current consumption BATT:	1.2 µA
maximum power consumption BATT:	10 µA @25°C
Thermal design power (summary all chips)	
With Solo CPU	5.5 Watt @25°C
With Duallight CPU, eMMC	7 Watt @25°C

Power consumption of connected devices like display, USB devices, SD card, miniPCIe card has to be added for power calculation.

Inputs/Outputs:	max. 45 I/O lines (shared with dedicated interfaces)
Touch-Screen:	4 wire touch input, resistive
Interfaces:	1x Ethernet 10/100Mbit 3x Serial with 3,3V-level (1x with RTS/CTS) or 4x Serial without RTS/CTS 1x USB2.0 Device or USB2.0Host (high speed 480Mbit/s) 1x USB2.0 Host (high speed 480Mbit/s) 1x CAN2.0 1x I2C 1x SPI 1x Audio (Line in, Line out, Micro in) 1x microSD slot onboard 1x SD-Card (external) 1x Address/Data-Bus interface
TFT LCD-interface:	1x 18bit RGB 1x 18/24bit LVDS
RAM:	256 MByte DDR3-RAM (optional 1GByte)
Flash:	128 MByte Flash (optional 1GByte)
CPU:	Freescale i.MX6 Solo or DualLite
Operating Temperature:	0°C … +85°C
Dimensions (l x w x h):	80 x 50 x 4 mm without connector 80 x 50 x 8 mm with connector
Weight:	20 gr.

5.1 Thermal Specification

	Min	Typ	Max	Unit
Operating temperature	0		+70[1]	°C
Operating temperature (“I”)[2]	-20		+85[1]	°C
Junction temperature i.MX6	-20		+105	°C
Junction temperature i.MX6 (“I”) [2]	-20		+105	°C
Junction to Top of i.MX6 (Psi-JT)[3]		2		°C/W

[1] Depending on cooling solution. See also: Operating conditions, Power Consumption and cooling

[2] Optional

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

5.2 DC electrical characteristics for 3.3V IO pins

VDD= 3.3V +/- 5%

Parameter	Description	Condition	Min	Max	Unit
Vih	High Level Input Voltage		0.7*VDD	VDD+0.3	V
Vil	Low Level Input Voltage		-0.3	0.3*VDD	V
Voh	High Level Output Voltage	Ioh=-100µA	VDD-0.2		V
Vol	Low Level Output Voltage	Ioh=100µA		0.2	V
Io	Output current	VDD=3.3V		2.6	mA

5.3 Operating conditions, Power consumption and cooling

The operating humidity range is 10 - 90% r. H. non condensing.
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 or the golden cooling plate on top of the module and **shouldn’t exceed the maximum operating temperature of the board** (85°C for the most of our armStoneA9r2 boards).
The maximum power consumption of the board could be 7 Watt. This value is with 100% working of 4 cores and full working 3D engines. Calculating with this scenario does need an expensive cooling.
Depend your application and your worst case scenario the maximum power consumption is much lower. This will save money on your cooling solution. We recommend to measure this with your application. We see values between max. 3 and 4,5 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

- AN4579 from freescale.com
- 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

6 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.

7 Appendix

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