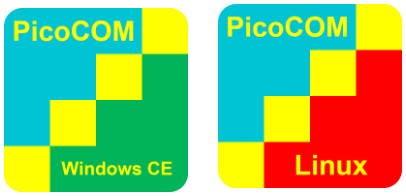
Hardware Documentation

PicoCOM1.2

Version 002
(2018-04-18)



Preliminary

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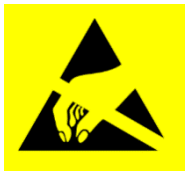
Untere Waldplätze 23
D-70569 Stuttgart
Fon: +49(0)711-123722-0
Fax: +49(0)711-123722-99

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
2016-07-07	001	PicoCOM1.2		*	Initial release	DB
2018-04-18	002		M		Edited Connector J1 table	DB

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

Table of Contents

1 Dimension

Board thickness:	1.6 mm ±10%
Max. Height of parts on top side:	2 mm
Max. Height of parts on bottom side (without connectors):	1 mm
Pin pitch of connector:	0.8 mm
Mounting hole diameter	2.8 mm

Mounting holes are isolated from signal ground

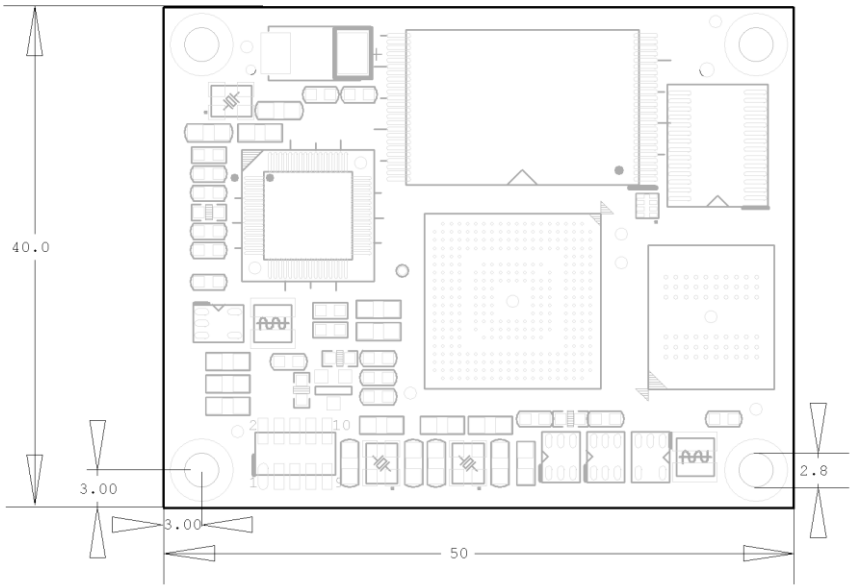


Figure 1: Top view

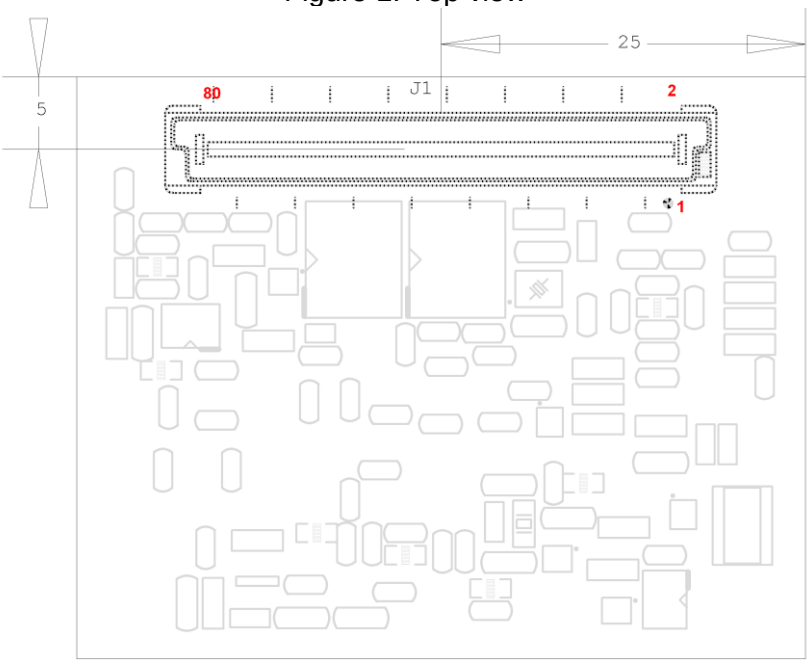


Figure 2: Bottom view

2 Technical Data

2.1 Interface connector

The PicoCOM is equipped with a
TycoElectronics 5177984-3 (80 pin, 0.8mm)
Connector from '0.8mm Free Height (FH) Connectors' series.

Matching connectors are:

5mm stacking height:	TycoElectronics	5177983-3
9mm stacking height:	TycoElectronics	5-5179009-3
13mm stacking height:	TycoElectronics	5-5179010-3

2.2 Feature list

Power Supply:	+3.3V DC / ±5%
Inputs/Outputs:	max. 52 I/O (shared with other interfaces)
Interfaces:	1x Ethernet 10/100Mbit
	6x Serial
	1x USB2.0 Host HS (High Speed 480Mbit/s)
	1x USB2.0 Device HS (High Speed 480Mbit/s)
	2x I2C
	2x SPI (1x with 3 CS)
	2x CAN2.0
	1x SD-Card-Slot (external)
	(see interface description for shared interfaces)
RAM:	256 MByte DDR3 SDRAM (up to 1GByte)
Flash:	256 MByte Flash (up to 512Mbyte)
CPU:	NXP i.MX6UL CPU
Operating Temperature:	0°C ... +70°C
	(optional –25°C … +85°C)
Dimensions:	40 x 50 x 5 mm (l x w x h) (without connectors)
Weight:	10 gr.

3 Connectors

3.1 Counting of the connector pins

The connector plug of PicoCOM will be treated as follows.
Pin 1 is marked on chapter 1 Dimension. The row with pin1 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.).

3.2 IO-Pin limitations

PicoCOMA7 is equipped with 52 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. These pins may carry active signals while the device is booting, which must be kept in mind when connecting external hardware. Pins that could toggle during boot are tagged in the following table.

3.3 Connector J1

J1					
Pin	**Signal**	**PU/PD on module** [3)]	**Use as GPIO**	**Pin Type**	**Remarks**
1	ETH TX-			Analog	
2	ETH RX-			Analog	
3	ETH TX+			Analog	
4	ETH RX+			Analog	
5	+3.3V			Power	
6	+3.3V			Power	
7	GND			Power	
8	GND			Power	
9	VBAT			Power	
10	nReset	10k PU		Digital	
11	I2C2 SCL	4,7k PU	Yes	Digital	
12	I2C2 SDA	4,7k PU	Yes	Digital	
13	COM2 TXD		Yes	Digital	
14	COM2 RXD		Yes	Digital	
15	COM2 RTS		Yes	Digital	
16	COM2 CTS		Yes	Digital	
17	COM1 TXD		Yes	Digital	
18	COM1 RXD			Digital	
19	USB Host DP			Analog	
20	USB Host DN			Analog	
21	USB Device DP			Analog	
22	USB Device DN			Analog	
23	USB Device Detect	1M PD		Analog	
24	USB Host Power On			Digital	
25	GND			Power	
26	GPIO1		Yes	Digital	
27	GPIO2		Yes	Digital	
28	GPIO3		Yes	Digital	
29	USBD Power On				
30	GPIO4		Yes	Digital	

J1					
Pin	**Signal**	**PU/PD on module** [3)]	**Use as GPIO**	**Pin Type**	**Remarks**
31	BOOTSEL	10k PU		Digital	
32	I2C1 SDA	4,7k PU	Yes	Digital	
33	I2C1 SCL	4,7k PU	Yes	Digital	
34	SD DAT0	100k PU	Yes	Digital	
35	SD DAT1		Yes	Digital	
36	SD DAT2		Yes	Digital	
37	SD DAT3		Yes	Digital	
38	SD CLK		Yes	Digital	
39	SD CMD	100k PU	Yes	Digital	
40	COM1 CTS		Yes	Digital	
41	COM1 RTS		Yes	Digital	
42	GND			Power	
43	COM3 TXD		Yes	Digital	1), 2)
44	COM3 RXD	100k PU	Yes	Digital	1), 2)
45	COM4 TXD		Yes	Digital	
46	COM4 RXD		Yes	Digital	
47	COM4 RTS		Yes	Digital	
48	COM4 CTS		Yes	Digital	
49	COM3 RTS		Yes	Digital	
50	COM3 CTS		Yes	Digital	
51	CAN1 RX		Yes	Digital	
52	CAN1 TX		Yes	Digital	
53	CAN2 RX		Yes	Digital	
54	CAN2 TX		Yes	Digital	
55	SPI1 MISO		Yes	Digital	
56	SPI1 MOSI		Yes	Digital	
57	SPI1 SCLK		Yes	Digital	
58	SPI1 PCS0		Yes	Digital	
59	SPI1 PCS1		Yes	Digital	
60	SPI1 PCS2		Yes	Digital	
61	GND			Power	
62	GND			Power	
63	COM5 TXD		Yes	Digital	
64	COM5 TXD		Yes	Digital	
65	COM5 RTS		Yes	Digital	

J1					
Pin	**Signal**	**PU/PD on module [3)]**	**Use as GPIO**	**Pin Type**	**Remarks**
66	COM5 CTS		Yes	Digital	
67	COM6 TXD		Yes	Digital	
68	COM6 RXD		Yes	Digital	
69	GPIO6		Yes	Digital	
70	PWM1		Yes	Digital	
71	ETH LED			Digital	
72	GND			Power	
73	GND			Power	
74	ADC1		Yes	Analog/Digital	
75	ADC2		Yes	Analog/Digital	
76	ADC3		Yes	Analog/Digital	
77	LineOut L			Analog	
78	LineOutR			Analog	
79	LineIn L			Analog	
80	LineIn R			Analog	

Table 1: J1 - main connector

[1)] Pins are active signals during boot. Don't drive during boot process.
[2)] Pins can be used as GPIO after boot
[3)] Mounted on HW. Some additional PU/PD can be switched on by software. Please refer SW manual or ask our support team.

All Signals are undefined after reset and should be pulled to a defined level with a resistor if needed.
All digital signals have 3.3V logic compliant level. The signals are **not** 5V tolerant!
See starterkit documentation for connection examples.

4 Interface and signal description

4.1 Ethernet connection

Ethernet TX+/- and LAN 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 then 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.

Ethernet Device Interface		
J1 Pin	Function	Description
1	ETH TX-	
2	ETH RX-	
3	ETH TX+	
4	ETH RX+	
71	ETH LED	

4.2 Serial port (UART)

The module provides a maximum of six different serial ports with 3.3V TTL signals.
If you don't need the serial port this pins can be used optional as GPIOs.

Uart Interface			
J1 Pin	Function	Description	Shared with
17	COM1 TXD	Transmit Data	
18	COM1 RXD	Receive Data	
41	COM1 RTS	Request to Send	SD WP
40	COM1 CTS	Clear to Send	SD CD
13	COM2 TXD	Transmit Data	
14	COM2 RXD	Receive Data	
15	COM2 RTS	Request to Send	
17	COM2 CTS	Clear to Send	
43	COM3 TXD	Transmit Data	
44	COM3 RXD	Receive Data	
49	COM3 RTS	Request to Send	
50	COM3 CTS	Clear to Send	
45	COM4 TXD	Transmit Data	
46	COM4 RXD	Receive Data	
47	COM4 RTS	Request to Send	
48	COM4 CTS	Clear to Send	
63	COM5 TXD	Transmit Data	SPI2 SCLK
64	COM5 RXD	Receive Data	SPI2 PCS0
65	COM5 RTS	Request to Send	SPI2 MISO
66	COM5 CTS	Clear to Send	SPI2 MOSI
67	COM6 TXD	Transmit Data	
68	COM6 RXD	Receive Data	

Table 2: UART Interfaces

4.3 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 USB_PWR signal is used to switch on the USB power on a current limiting IC.

The usb.org webpage provides "High Speed USB Platform Design Guidelines" with highly recommended informations for a proper working USB design.
ESD and EMV protection is required on baseboard.

If the USB port is not used please leave open.

USB Host Interface		
J1 Pin	Function	Description
19	USB DP	USB Data Positive
20	USB DN	USB Data Negative
24	USB Power On	Power On for external current switch

Table 3: USB Host Interface

4.4 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 detects a connected host by detecting the voltage. This signal is 5V tolerant and needs a level above 3.3V. A voltage divider can be used for compatibility with PicoCOM1 base boards.

ESD and EMV protection is required on baseboard.

If the USB device port is not used please leave open.

USB Device Interface		
J1 Pin	Function	Description
21	USB DP	USB Data Positive
22	USB DN	USB Data Negative
23	USB Device Detect	USD VBUS In (3.3V – 5V)
29	USB Power On	Power On for external current switch for OTG function

Table 4: USB Device Interface

4.5 SPI Interface

The module supports two Serial Peripheral Interfaces. SPI1 supports three chip selects.

SPI Interface			
J1 Pin	Function	Description	Shared with
55	SPI1 MISO	Data In	
56	SPI1 MOSI	Data Out	
57	SPI1 SCLK	Clock	
58	SPI1 PCS0	Chip Select 0	
59	SPI1 PCS1	Chip Select 1	
60	SPI1 PCS2	Chip Select 2	
63	SPI2 SCLK	Clock	COM5 TXD
64	SPI2 PCS0	Chip Select 0	COM5 RXD
65	SPI2 MISO	Data In	COM5 RTS
66	SPI2 MOSI	Data Out	COM5 CTS

Table 5: SPI Interface

4.6 I2C Interface

The module supports a maxiumum of two I2C interfaces. Signals have 3.3V level and don't have pullups on module. So please add 2.2 kOhm pullups to 3.3V on baseboard. The signals are **not** 5V tolerant, a level shifter.is needed for 5V devices.

The I2C signals have 4,7k on-board pull-ups.

I2C Interface			
J1 Pin	Function	Description	Shared with
32	I2C1 SDA	Data	
33	I2C1 SCL	Clock	
12	I2C2 SDA	Data	
11	I2C2 SCL	Clock	

Table 6: I2C Interface

4.7 CAN Interface

Two CAN interfaces with 3.3V logic level are provided. An external transceiver with 3.3V interface has to be connected.

CAN Interface			
J1 Pin	Function	Description	Shared with
51	CAN1 RX	Receive	
52	CAN1 TX	Transmit	
53	CAN2 RX	Receive	
54	CAN2 TX	Transmit	

Table 7: CAN Interface

4.8 SDcard

The interface is supporting a SD card channel. For specificiation and licensing please refer the website of the SD Association http://www.sdcard.org. Pullups are integrated on the module. Card detection and write protection are shared with other functions are are optional.

Unused signals should be left unconnected.

SD Card Interface			
J1 Pin	Function	Description	Shared with
34	SD DAT0	Data 0	
35	SD DAT1	Data 1	
36	SD DAT2	Data 2	
37	SD DAT3	Data 3	
38	SD CLK	Clock	
39	SD CMD	Command	
40	SD CD	Card Detect	COM1 CTS
41	SD WP	Write Protect	COM1 RTS

Table 8: SD Card Interface

4.9 Audio Interface

The onboard soundcodec supports a stereo analog input and a stereo analog output for 1Vpp audio signals. This signals needs serial capacitors. ESD and EMV protection is required on baseboard.

Audio Interface			
J1 Pin	Function	Description	Shared with
77	Line Out L	Output Left	
78	Line Out R	Output Right	
79	Line In L	Input Left	
80	Line In R	Input Right	

Table 9: Audio Interface

4.10 PWM

The PWM pins are connected to the processor hardware PWM unit.

PWM Interface			
J1 Pin	Function	Description	Shared with
70	PWM1		
74	PWM2		ADC1
75	PWM3		ADC2
76	PWM4		ADC3

Table 10: PWM Interface

4.11 ADC

The ADC pins use the ADC unit of the processor and are for low precision measurements. If you need a higher precision you can connect an external ADC via I2C or SPI.

ADC Interface			
J1 Pin	Function	Description	Shared with
74	ADC1		PWM2
75	ADC2		PWM3
76	ADC3		PWM4

Table 11: ADC Interface

4.12 GPIO / IRQ

Most pins can be used as GPIO with IRQ capability. See Table 1 for detailed information.

4.13 nReset

Reset input to drive with open drain or open collector 3.3V compliant from baseboard. We recommend to pull low this pin with a VCC voltage supervisor on power up with the power-good signal from power supply or using a voltage supervisor.

4.14 NAND Flash

By default, boot mode of PicoCOM1.2 is configured for NAND boot.
PicoCOM1.2 implements the following to get reliable boot over long time:

- Use of SLC NAND flash memory
- Boot loader stored two times in flash memory
- Flash data protected by 32 bit ECC
- Algorithm for block refresh
- Operating system Linux uses UBI as file system
- Operating system Windows can use F3S to be robust against power failures

4.14.1 NAND Flash Data Retention

The NAND Flash is based on “single level cell” (SLC) technology. This technology is ten times more robust compared to “multi level cell” (MLC) technology. It is important to know, that high temperature impacts data retention of SLC or MLC flash. Independent if the device is powered or not. Please contact us, if your device is constantly in an environment where temperature is higher than 50°C.

5 Electrical Data

5.1 Power supply

Power supply: 3.3V +/- 5%
maximum power consumption: TBD A
(theoretical value, Summary of max. datasheet value all chips on module w/o SD card, USB, backplane logic & transceiver)
Capacitor charge current on power on: TBD A
Typical Current Consumption @25°C

- L Idle: TBD mA
- CPU full load: TBD mA

Power supply RTC battery: 2.0 … 3.6 V
Power consumption @25°C: typ. 1µA

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

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	V
Vil	Low Level Input Voltage		0	0.3*VDD	V
Voh	High Level Output Voltage	Ioh=-1mA	VDD-0.15		V
Vol	Low Level Output Voltage	Ioh=1mA		0.15	V
R_{DRV}	Output driver impedance	VDD=3.3V	*1)	150	Ω

Table 12: electrical characteristic 3.3V IO pin

*1) Drive strength can be adjusted in software. Please refer to software manual to increase or decrease drive strength or ask our support.

6 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.

7 ESD and EMI requirements

I/O pins of the PicoCOM have no ESD or EMI protection. You have to implement ESD protection and EMI reduction circuits on your base board.
We strictly recommend having your baseboard with controlled impedance and wires as short as possible.

8 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.

9 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.

10 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.

11 Packaging

All F&S ESD-sensitive products are shipped either in trays or bags.
PicoCOM modules are shipped in trays. One tray can hold 10 boards. An empty tray is used as top cover.

Figure 3: PicoCOM tray

12 Matrix Code Sticker

All F&S hardware is shipped 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 4: matrix code sticker

13 Appendix

13.1 List of Figures

13.2 List of Tables

Important Notice

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