webdyn

Flexitron group

MTX-StarRoad II

Hardware User Guide

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Important Information

This technical description contains important information for the startup and use of the MTX-StarRoad II device. Read it carefully before you start working with the MTX-StarRoad II device. The warranty will be void should damage occur due to non-compliance with these instructions for use. We cannot accept any responsibility for consequential loss.

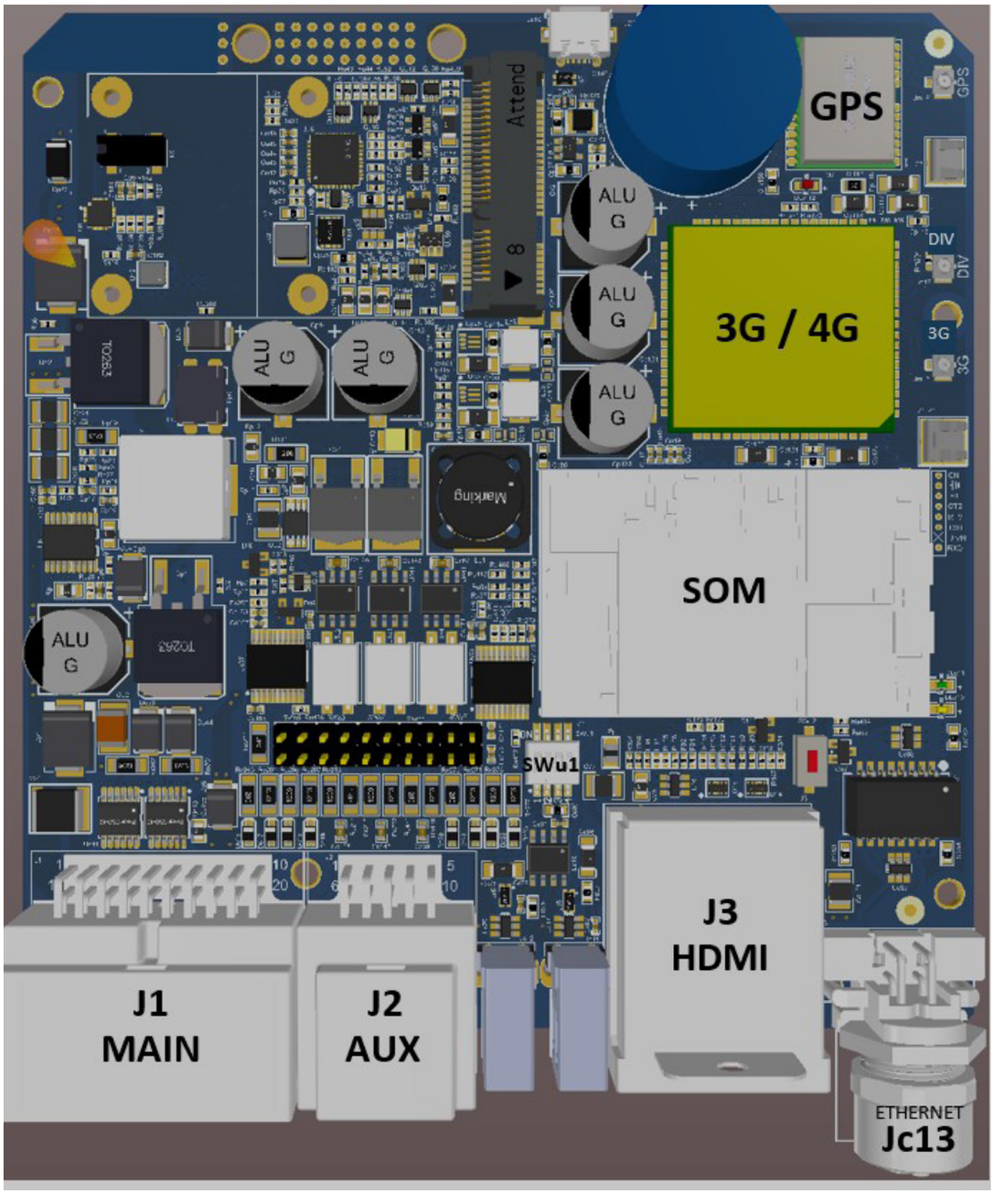
Revision Information

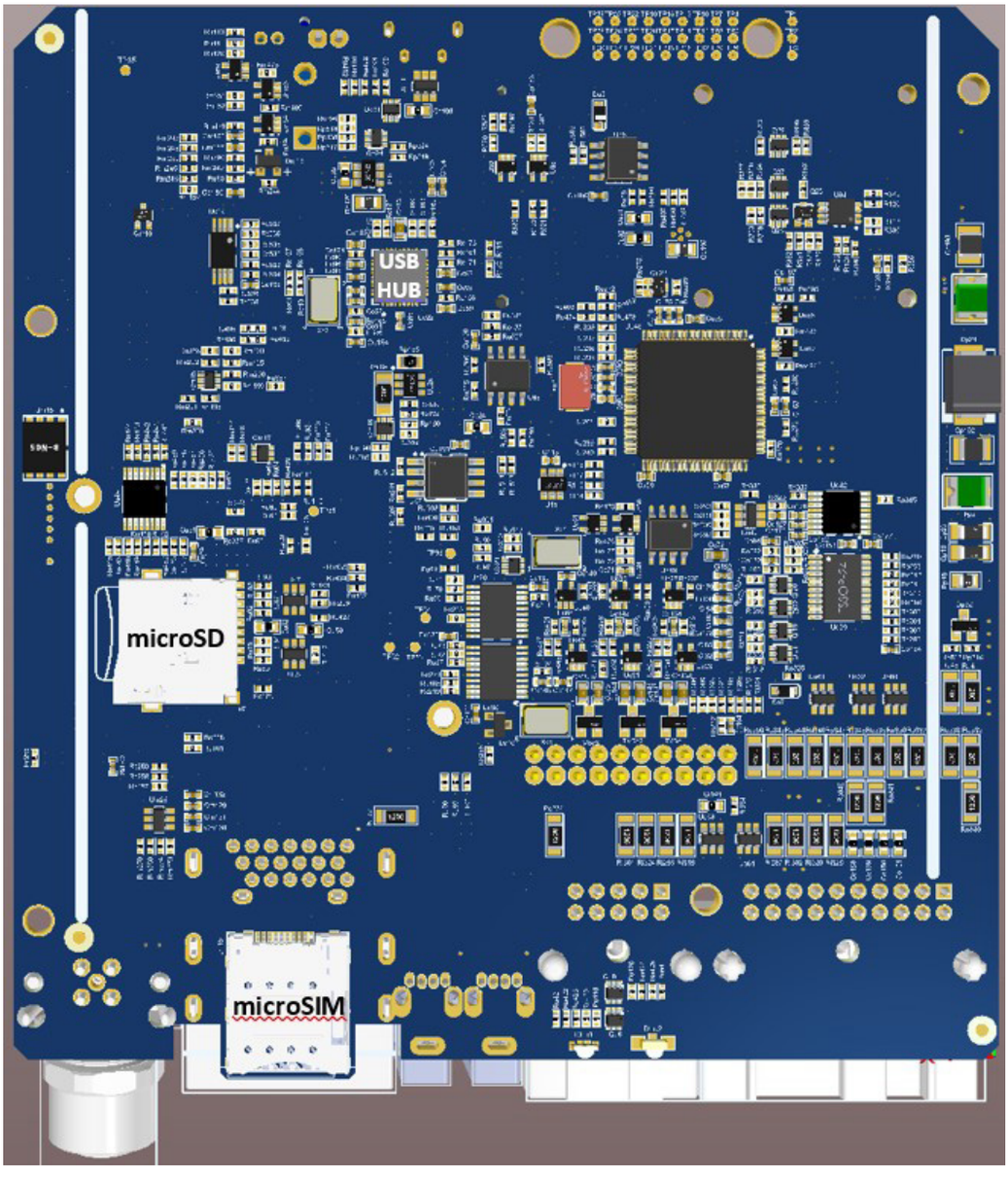
REVISION	DATE	AUTHOR	CHANGES
1.0	2020/08	JR	Initial release

Hardware User Guide

1. MTX-StarRoad II Carrier Board

MTX-StarRoad II carrier board provides internal and external connectivity.

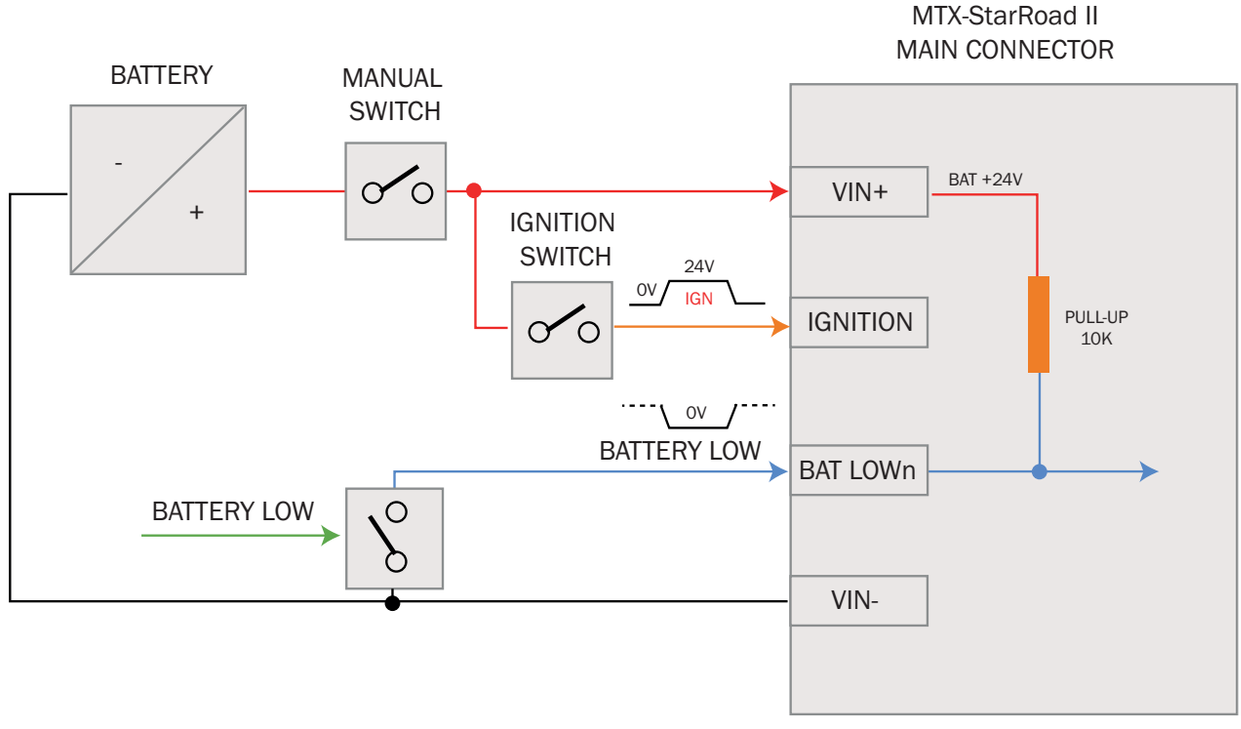


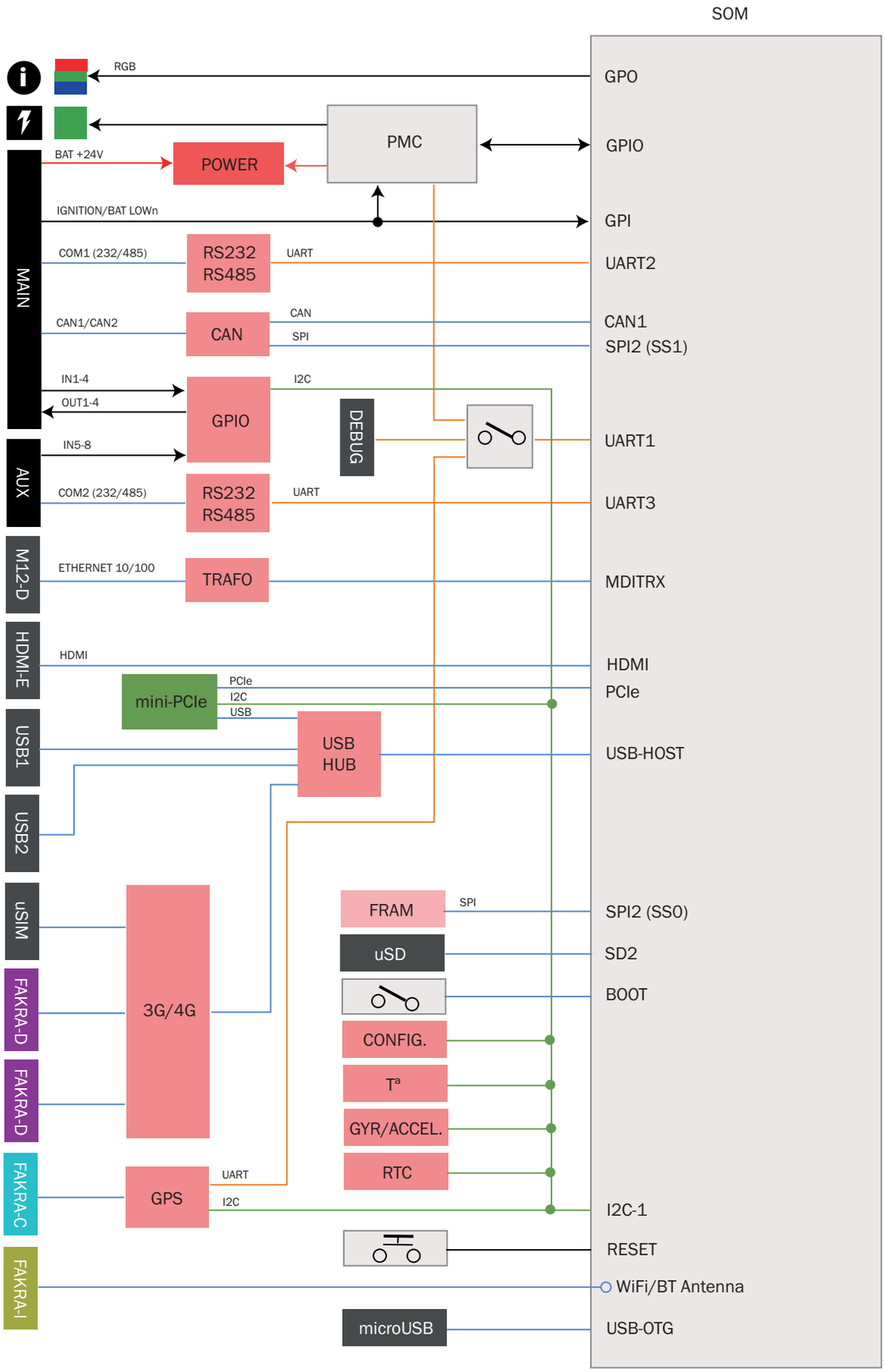

USB
HUB
microSD
microSIM

1.1 Specifications

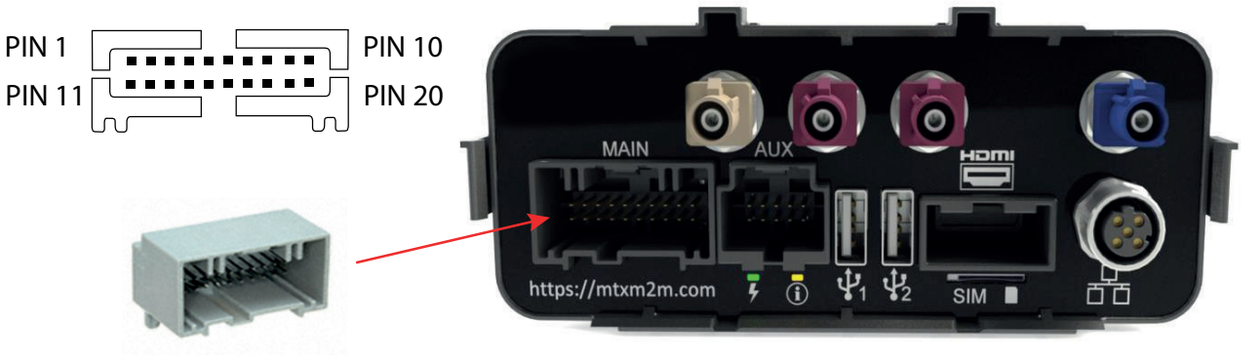
	VALUE		COMMENTS
	MIN.	MAX.	
Voltage	+9VDC	+36VDC	Nominal +24VDC.
Power consumption	TBD	TBD	
Temperature	-40°C	+85°C	Operation w/o WiFi/BT option
	-20°C	+70°C	Operation with WiFi/BT option
	-20°C	+70°C	Storage
Dimensions	155x154x55mm		Length x width x height
Weight	<500g		

1.2 System Power Connection and Block Diagram





1.3 Main Connector



Signals available at MAIN connector are detailed in Table 1.

J1 - MAIN			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	VIN+	Power supply	Positive pole
2	IGNITION	Control input	Power on/power off signal
3	OUT1	Output	Protected general purpose output
4	OUT2	Output	Protected general purpose output
5	OUT3	Output	Protected general purpose output
6	OUT4	Output	Protected general purpose output
7	COM1_RXA	RS485	COM1 port, RS485 bus RXA line
8	COM1_TXA	RS485	COM1 port, RS485 bus TXA line
9	CAN1_H	CAN	CAN1 port, high level line
10	CAN2_H	CAN	CAN2 port, high level line
11	VIN-	Power supply	Negative pole
12	BAT_LOWn	Control input	Vehicle battery level, active low
13	IN1	Input	Protected general purpose input

14	IN2	Input	Protected general purpose input
15	IN3	Input	Protected general purpose input
16	IN4	Input	Protected general purpose input
17	COM1_RXB_RX	RS485/RS232	COM1 port, RS485 bus RXB line, RS232-RX
18	COM1_TXB_TX	RS485/RS232	COM1 port, RS485 bus TXB line, RS232-TX
19	CAN1_L	CAN	CAN1 port, low level line
20	CAN2_L	CAN	CAN2 port, low level line

External mate connector:

- Housing: MOLEX 30700-1207
- Terminal (for AWG 18-20 wire): TYCO 1393366-1
- Terminal (for AWG 22 wire): TYCO 1393367-1

1.4 AUX Connector

Signals available at AUX connector are detailed in Table 12.

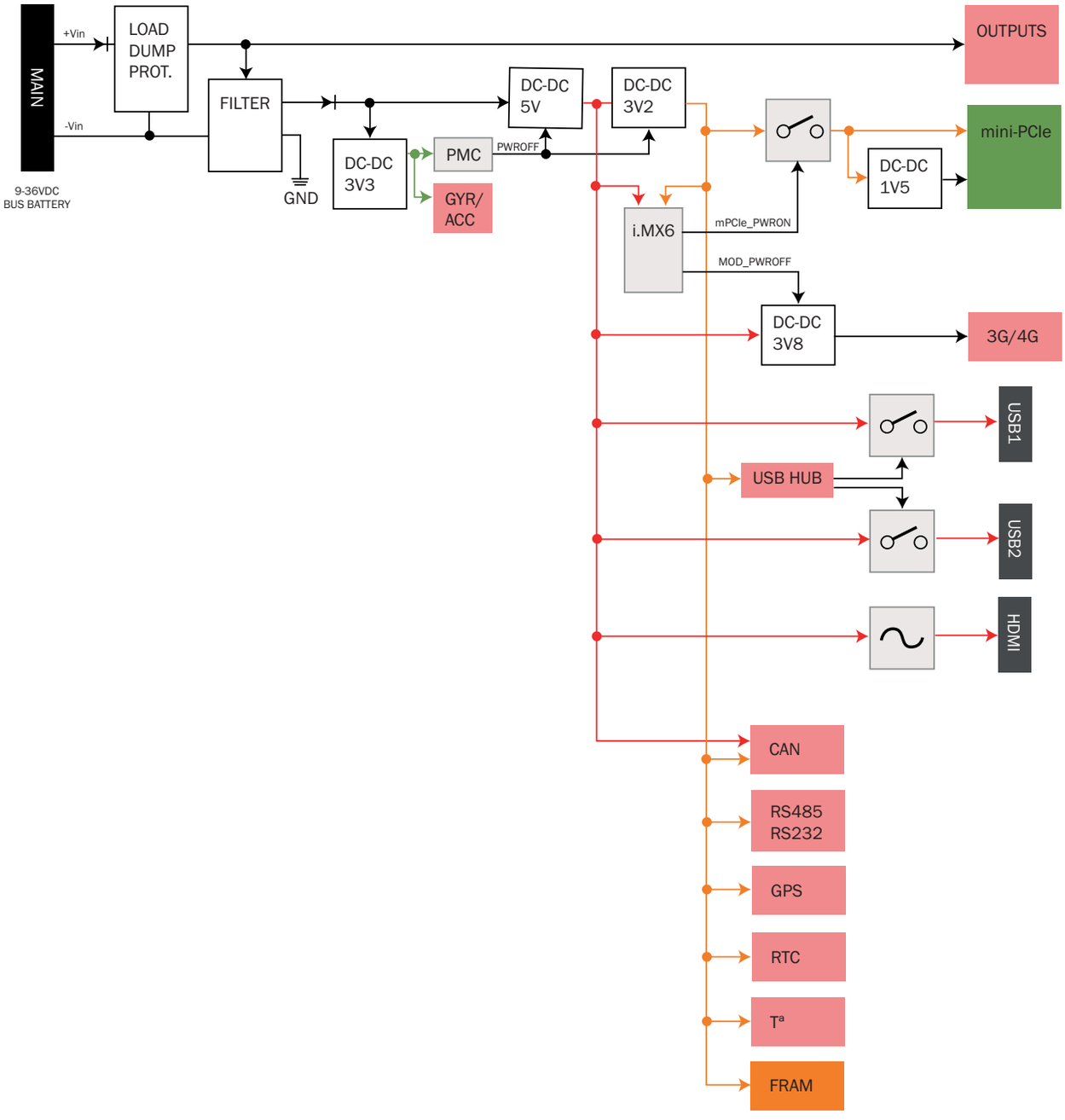
J2 - AUX			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	--	--	Not used
2	IN7	Input	Protected general purpose input
3	IN8	Input	Protected general purpose input
4	COM2_RXA	RS485	COM2 port, RS485 bus RXA line
5	COM2_TXA	RS485	COM2 port, RS485 bus TXA line
6	--	--	Not used
7	IN5	Entrada	Protected general purpose input
8	IN6	Entrada	Protected general purpose input
9	COM2_RXB_RX	RS485/RS232	COM2 port, RS485 bus, RXB line, RS232-RX
10	COM2_TXB_TX	RS485/RS232	COM2 port, RS485 bus TXB line, RS232-TX

External mate connector:

- Housing: MOLEX 30700-1101
- Terminal (for AWG 18-20 wire): TYCO 1393366-1
- Terminal (for AWG 22 wire): TYCO 1393367-1

1.5 Power Supply

System is powered through MAIN connector. Power supply voltage range is within 9VDC - 36VDC and is protected against reverse polarity as well as voltage transients up to 140V.



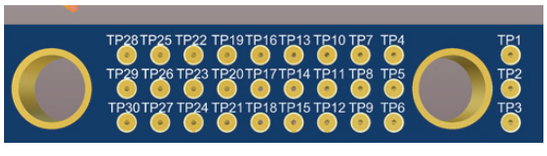
1.6 Power Supply

Close to miniPCIe connector, a number of tespoints are grouped to access interfaces such us microcontroller programming and Linux debug port.

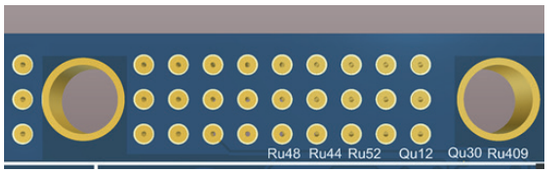
TP	SIGNAL	TYPE	COMMENTS
TP1	VCCPWR	Power supply	Protected and filtered power supply input
TP2	VIN-	Power supply	Power supply input negative pole
TP3	VPWR+	Power supply	Protected power supply input
TP4	Reserved	----	----
TP5	Reserved	----	----
TP6	Reserved	----	----
TP7	Reserved	----	----
TP8	Reserved	----	----
TP9	GND	Power supply	GND
TP10	SWD_CLK	Programming	CYPRESS programming– SWD-CLK
TP11	XRES	Programming	CYPRESS programming – XRES
TP12	VTARG	Programming	CYPRESS programming – VTARG
TP13	SWD_IO	Programming	CYPRESS programming – SWD-IO
TP14	VCC3V2	Power supply	Internal DC/DC 3.2V
TP15	GND	Power supply	GND
TP16	VBAT RTC	Power supply	RTC backup voltage
TP17	VSUPERCAP	Power supply	Supercap voltage
TP18	VBCKP_GPS	Power supply	GPS backup voltage
TP19	GND	Power supply	GND

TP20	VBAT3V3	Power supply	Internal DC/DC 3.3V
TP21	VCC5V	Power supply	Internal DC/DC 5V
TP22	UART1_DBG_RX	Input (3V3 level)	UART1 RX for Linux Debug purposes
TP23	SEL_DEBUG	DEBUG selection	Selects DEBUG connecting to 3V2
TP24	UART1_TX	Output (3V3 level)	UART1 TX for Linux Debug purposes
TP25	VCC3V3PCIE	Power supply	Tensión de alimentación interna 3.3V para mPCIe
TP26	VCC1V5PCIE	Power supply	Tensión de alimentación interna 1.5V para mPCIe
TP27	VCC3V8	Power supply	Tensión de alimentación interna 3.8V para 3G/4G
TP28	MOD_VDDLP	Power supply	Tensión de alimentación interna VDDLP de 3G/4G
TP29	MOD_V180	Power supply	Tensión de alimentación interna V180 de 3G/4G
TP30	MOD_VCORE	Power supply	Tensión de alimentación interna VCORE de 3G/4G

BOT

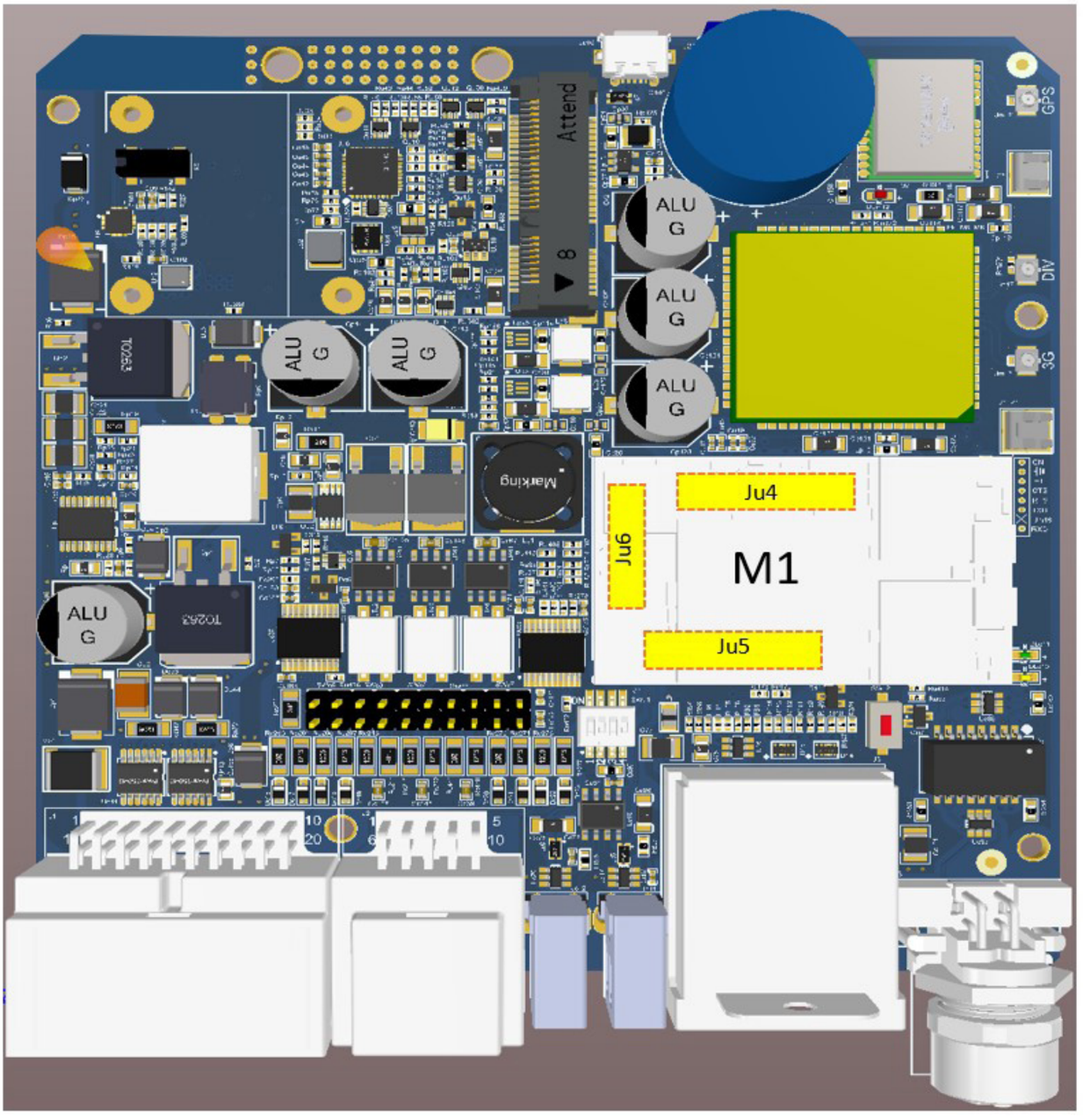


TOP



1.7 System On Module (SOM)

Connectors Ju4, Ju5 y Ju6 are used to connect System On Module M1 (SOM).



The table below shows hardware function assigned to each SOM signal at connectors Ju4, Ju5 y Ju6:

JU5						
PIN	BALL	DEFAULT FUNCTION	USED FUNCTION	PORT	LINUX/DEV	HW FUNCTION
1	D7	CLK1_P	miniPCIe	PCIe		Slot miniPCie
2	B1	PCIE_RXM	miniPCIe	PCIe		Slot miniPCie
3	C7	CLK1_N	miniPCIe	PCIe		Slot miniPCie
4	B2	PCIE_RXP	miniPCIe	PCIe		Slot miniPCie
5		GND				
6		GND				
7	A3	PCIE_TXM	miniPCIe	PCIe		Slot miniPCie
8	E4	CSI_D0M	NOT CONNECTED	MIPI		NOT USED
9	B3	PCIE_TXP	miniPCIe	PCIe		Slot miniPCie
10	E3	CSI_D0P	NOT CONNECTED	MIPI		NOT USED
11		GND				
12		GND				
13	F3	CSI_CLK0P	NOT CONNECTED	MIPI		NOT USED
14	D1	CSI_D1M	NOT CONNECTED	MIPI		NOT USED
15	F4	CSI_CLK0M	NOT CONNECTED	MIPI		NOT USED
16	D2	CSI_D1P	NOT CONNECTED	MIPI		NOT USED
17		GND				
18		GND				
19	K4	HDMI_D2P	HDMI	HDMI		HDMI Video Output
20	E1	CSI_D2M	NOT CONNECTED	MIPI		NOT USED
21	K3	HDMI_D2M	HDMI	HDMI		HDMI Video Output
22	E2	CSI_D2P	NOT CONNECTED	MIPI		NOT USED
23		GND				
24		GND				
25	J4	HDMI_D1P	HDMI	HDMI		HDMI Video Output
26	F2	CSI_D3M	NOT CONNECTED	MIPI		NOT USED
27	J3	HDMI_D1M	HDMI	HDMI		HDMI Video Output
28	F1	CSI_D3P	NOT CONNECTED	MIPI		NOT USED
29		GND				
30		GND				
31	K6	HDMI_D0P	HDMI	HDMI		HDMI Video Output
32	H2	DSI_D1M	NOT CONNECTED	MIPI		NOT USED

33	K5	HDMI_D0M	HDMI	HDMI	HDMI Video Output
34	H1	DSI_D1P	NOT CONNECTED	MIPI	NOT USED
35		GND			
36		GND			
37	J6	HDMI_CLKP	HDMI	HDMI	HDMI Video Output
38	G2	DSI_D0M	NOT CONNECTED	MIPI	NOT USED
39	J5	HDMI_CLKM	HDMI	HDMI	HDMI Video Output
40	G1	DSI_D0P	NOT CONNECTED	MIPI	NOT USED
41		GND			
42		GND			
43	W4	CAN1_RX	Native CAN – CAN1	CAN	CAN BUS Native RxD
44	H3	DSI_CLK0M	NOT CONNECTED	MIPI	NOT USED
45	U5	HDMI_TX_DDC_SCL	HDMI	HDMI	HDMI Video Output
46	H4	DSI_CLK0P	NOT CONNECTED	MIPI	NOT USED
47	T7	HDMI_TX_DDC_SDA	HDMI	HDMI	HDMI Video Output
48		GND			
49	K1	HDMI_HPD	HDMI	HDMI	HDMI Video Output
50	R1	SPDIF_OUT	GPIO7_IO12	GPIO7	IN – DETECTS V180 AVAILABLE ON 3G/4G MODULE
51	W5	AUD5_TXC	I2S BIT CLOCK	I2S	NOT USED
52	M1	UART1_TX_DATA	UART TX	CSI0	DEBUG CONSOLE / GPS / PMC / CAN_SPC
53	V6	AUD5_TXD	I2S DATA OUTPUT	I2S	NOT USED
54	M3	UART1_RX_DATA	UART RX	CSI0	DEBUG CONSOLE / GPS / PMC / CAN_SPC
55	U7	AUD5_TXFS	I2S FRAME CLOCK	I2S	NOT USED
56	T4	USB_OTG_ID	USB-OTG		USB-OTG ID signal
57	U23	AUD5_RXD	I2S DATA INPUT	I2S	NOT USED
58		GND			
59	R4	CCM_CLKO1	I2S MASTER CLOCK	I2S	NOT USED
60	U2	LVDS0_TX0_N	LVDS	LVDS	NOT USED
61		GND			
62	U1	LVDS0_TX0_P	LVDS	LVDS	NOT USED
63	A17	CCM_CLKO2	GPIO6_IO15	GPIO6	IN – SELECTS UART1 FOR LINUX DEBUG
64		GND			

65	C11	POR_B	POR_B	RESET		RESET
66	U4	LVDS0_TX1_N	LVDS	LVDS		NOT USED
67	T6	USB_OTG_OC	PULLED-DOWN ON CARRIER	GPIO4		NOT USED
68	U3	LVDS0_TX1_P	LVDS	LVDS		NOT USED
69	R7	USB_H1_OC	GPIO1_IO03	GPIO1	/sys/class/gpio/gpio3	IN/PULL-UP – CAN2_INTn
70		GND				
71	B8	USB_OTG_CHD_B	NOT CONNECTED			NOT USED
72	V2	LVDS0_TX2_N	LVDS	LVDS		NOT USED
73	U6	SD2_VSELECT	GPIO4_IO09	GPIO4	/sys/class/gpio/gpio105	IN/PULL-UP – GPS_1PPS
74	V1	LVDS0_TX2_P	LVDS	LVDS		NOT USED
75		GND				
76		GND				
77	W1	LVDS0_TX3_P	LVDS	LVDS		NOT USED
78	V4	LVDS0_CLK_N	LVDS	LVDS		NOT USED
79	W2	LVDS0_TX3_N	LVDS	LVDS		NOT USED
80	V3	LVDS0_CLK_P	LVDS	LVDS		NOT USED

JU4

PIN	BALL	DEFAULT FUNCTION	USED FUNCTION	PORT	LINUX/ DEV	HW FUNCTION
1	19	MDI_TRXN3	ETHERNET	ETHERNET PHY		ETHERNET
2		GND				
3	18	MDI_TRXP3	ETHERNET	ETHERNET PHY		ETHERNET
4	B14	SATA_RXP	NOT CONNECTED	SATA		NOT USED
5		GND				
6	A14	SATA_RXN	NOT CONNECTED	SATA		NOT USED
7	16	MDI_TRXN2	ETHERNET	ETHERNET PHY		ETHERNET
8		GND				
9	15	MDI_TRXP2	ETHERNET	ETHERNET PHY		ETHERNET
10	B12	SATA_TXN	NOT CONNECTED	SATA		NOT USED
11		GND				
12	A12	SATA_TXP	NOT CONNECTED	SATA		NOT USED

13	13	MDI_TRXN1	ETHERNET	ETHERNET PHY	ETHERNET
14		GND			
15	12	MDI_TRXP1	ETHERNET	ETHERNET PHY	ETHERNET
16	A6	USB_OTG_DP	USB OTG	USB OTG	USB-OTG CONNECTOR
17		GND			
18	B6	USB_OTG_DN	USB OTG	USB OTG	USB OTG CONNECTOR
19	10	MDI_TRXN0	ETHERNET	ETHERNET PHY	ETHERNET
20		GND			
21	9	MDI_TRXP0	ETHERNET	ETHERNET PHY	ETHERNET
22	E10	USB_HOST_DP	USB HOST	USB HOST	USB HUB (miniPCIe, USB1, USB2, 3g/4G Module)
23		GND			
24	F10	USB_HOST_DN	USB HOST	USB HOST	USB HUB (miniPCIe USB1, USB2, 3G/4G module)
25	22	LED_10_100 _1000	ETHERNET	ETHERNET PHY	ETHERNET LED
26		GND			
27	21	LED_ACT	ETHERNET	ETHERNET PHY	ETHERNET LED
28	T5	USB_H1_PE	GPIO1_IO00	GPIO1	IN/PULL-UP – CAN1_INTn
29		ETH_TCT	ETHERNET	ETHERNET PHY	ETHERNET TRAFO POL.
30	E23	USB_OTG_PE	NOT CONNECTED		NOT USED
31	F21	I2C3_SCL	I2C3_SCL	I2C3	SPC_CAN
32	K20	ECSPI2_SS0 (BOOT_CFG4[5])	SPI2_SS0	SPI2	SPI-SS FRAM MEMORY
33	D24	I2C3_SDA	I2C3_SDA	I2C3	SPC_CAN
34	K22	ECSPI2_SS1 (BOOT_CFG4[2])	SPI2_SS1	SPI2	SPI-SS MCP2515 CAN2
35		GND			
36		GND			
37	D14	SD3_CLK	NOT CONNECTED		NOT AVAILABLE WITH INTERNAL eMMC SOM
38	C21	SD2_CLK	SD2_CLK	SD2	MICRO-SD SOCKET

39	B13	SD3_CMD	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
40	F19	SD2_CMD	SD2_CMD	SD2		MICRO-SD SOCKET
41	T25	PWM2_OUT	PWM			OUT-LED RGB GREEN
42	A22	SD2_DATA0	SD2_DATA0	SD2		MICRO-SD SOCKET
43	E9	USB_OTG_VBUS	+5V	USB OTG		USB OTG PHY 5V
44	E20	SD2_DATA1	SD2_DATA1	SD2		MICRO-SD SOCKET
45	J24	ECSPI2_MISO	SPI2_MISO	SPI2		SPI-MISO
46	A23	SD2_DATA2	SD2_DATA2	SD2		MICRO-SD SOCKET
47	J23	ECSPI2_MOSI	SPI2_MOSI	SPI2		SPI_MOSI
48	B22	SD2_DATA3	SD2_DATA3	SD2		MICRO-SD SOCKET
49	H24	ECSPI2_SCLK	SPI2_SCLK	SPI2		SPI_SCLK
50	R6	SD2_CD_B	SD2_CD_B	SD2		MICRO-SD SOCKET
51	G23	I2C1_SDA	I2C1_SDA	I2C1		I2C1 (I2C1 CONNECTED DEVICES)
52	D10	USB_H1_VBUS	+5V	USB HOST		USB HOST PHY 5V
53	H20	I2C1_SCL	I2C1_SCL	I2C1		I2C1 (I2C1 CONNECTED DEVICES)
54	K25	DISP1_DATA03 (BOOT_CFG1[6])	BOOT_CFG1[6])	BOOT		IN -BOOT CONFIG
55	B19	PWM3_OUT	PWM3_OUT	PWM		OUT - LED RGB BLUE
56	L25	DISP1_DATA02 (BOOT_CFG1[7])	GPIO3_IO07	GPIO3	/sys/class/gpio/gpio71	OUT - 3G/4G MODULE RESET SIGNAL
57	F17	PWM4_OUT	NOT CONNECTED			NOT USED
58	K24	DISP1_DATA06 (BOOT_CFG1[3])	GPIO3_IO03	GPIO3		RESERVED FOR INTENAL USE
59	----	__NC__SPDIF_ CLK_IN	NOT CONNECTED			NOT USED
60	L24	DISP1_DATA01 (BOOT_CFG2[0])	GPIO3_IO08	GPIO3	/sys/class/gpio/gpio72	OUT - 3G/4G MODULE ON SIGNAL
61	G17	NVCC_SD2	+3.2V			
62	L22	DISP1_DATA05 (BOOT_CFG1[4])	NOT CONNECTED			NOT USED

63	G14	NVCC_SD3	+3.2V			
64	L23	DISP1_DATA04 (BOOT_CFG1[5])	BOOT_CFG1[5]	BOOT		IN-BOOT CONFIG
65		NVCC_EIM0	+3.2V			
66	M21	DISP1_DATA00 (BOOT_CFG2[1])	GPIO3_IO09	GPIO3	/sys/class/gpio/gpio73	OUT - 3G/4G MODULE POWER OFF SIGNAL
67		NVCC_EIM0	+3.2V			
68	R22	PWM1_OUT	PWM1_OUT	PWM	/sys/class/gpio/gpio125	OUT - LED RGB RED (GPIO4_IO29)
69		VSNVS_3V0	+3.2V			
70		GND				
71		VIN_5V0				
72		GND				
73		VIN_5V0				
74		GND				
75		VIN_5V0				
76		GND				
77		VIN_5V0				
78		GND				
79		VIN_5V0				
80		GND				

JU6

PIN	BALL	DEFAULT FUNCTION	USED FUNCTION	PORT	LINUX/ DEV	HW FUNCTION
1	M25	EIM_WAIT (BOOT_CFG4[1])	GPIO5_IO00	GPIO5		OUT – INOUT I2C EXPANDER, RESET SIGNAL
2	F13	SD3_DATA7	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
3	C12	BOOT_MODE0	BOOT_MODE0	BOOT		BOOT CONFIG
4	E13	SD3_DATA6	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
5	F12	BOOT_MODE1	BOOT_MODE1	BOOT		BOOT CONFIG
6	C13	SD3_DATA5	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
7	E11	TAMPER	NOT CONNECTED			NOT USED
8	D13	SD3_DATA4	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM

9	F11	PMIC_STBY_REQ	NOT CONNECTED			NOT USED
10		GND				
11	G21	EIM_D19	GPIO3_IO19			IN –MCP2515_CAN2_ RX1BFn INTERRUPT SIGNAL
12	W6	FLEXCAN1_TX	CAN1			CAN1 NATIVE TxD
13	D12	MX6_ONOFF	NOT CONNECTED			NOT USED
14	R3	GPIO7	GPIO1_IO07			IN – RTC RTC_FOUT_ IRQn INTERRUPT SIGNAL
15	D11	PMIC_ON_REQ	NOT CONNECTED			NOT USED
16	GND					
17	H19	EIM_A25	HDMI_CEC	HDMI		HDMI PORT – CEC SIGNAL
18	B15	SD3_DATA3	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
19	C25	EIM_D16	GPIO3_IO16	GPIO3		IN – MCP2515 CAN2_ RX0BFn INTERRUPT SIGNAL
20	A15	SD3_DATA2	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
21	N22	EIM_BCLK	GPIO6_IO31	GPIO6		IN – INOUT I2C EXPANSOR, INTERRUPT SIGNAL
22	F14	SD3_DATA1	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
23	G20	EIM_D20	GPIO3_IO20	GPIO3	/sys/class/gpio/ gpio84	IN – IGNITION SIGNAL AT MAIN CONNECTOR
24	E14	SD3_DATA0	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
25	D25	EIM_D23	GPIO3_IO23	GPIO3	/sys/class/gpio/ gpio87	IN – BATLOWn SIGNAL AT MAIN CONNECTOR
26	D15	SD3_RST	NOT CONNECTED			NOT AVAILABLE WITH INTERNAL eMMC SOM
27	J19	EIM_D29	GPIO3_IO29	GPIO3		IN – ACCEL/GYROSC INT1n INTERRUPT SIGNAL
28	P6	SD3_VSELECT	GPIO7_IO13	GPIO7		IN – 3G/4G MODULE VCORE SIGNAL DETECTION
29	F22	UART3_TXD	SPI2_SS2	SPI2		RESERVED FOR INTERNAL USE
30		GND				
31	G22	EIM_D25	GPIO3_IO25	GPIO3		RESERVED FOR FUTURE USE

32	E16	SD4_CLK	UART3_RX	UART3		COM2 – RS232 / RS485 PORT
33		GND				
34	B17	SD4_CMD	UART3_TX	UART3		COM2 – RS232 / RS485 PORT
35	W23	SPDIF_IN	GPIO1_IO24	GPIO1		IN – RTC INT2n INTERRUPT SIGNAL
36	D18	SD4_DATA0	GPIO2_IO08	GPIO2		NOT USED
37	E22	EIM_EB2 (BOOT_CFG4[6])	GPIO2_IO30	GPIO2		RESERVED FOR FUTURE USE
38	A20	SD4_DATA3	GPIO2_IO11	GPIO2		NOT USED
39	F23	EIM_EB3 (BOOT_CFG4[7])	GPIO2_IO31	GPIO2		RESERVED FOR FUTURE USE
40	J20	DISP1_DATA21	UART3_CTSn	UART3		OUT – UART3 DIR TRANSCEIVER SIGNAL
41	M20	DI1_PIN02 (BOOT_CFG2[3])	BOOT_CFG2[3])	BOOT		BOOT CONFIG
42	H21	WDOG1_B	WDOG1n	WDOG		OUT – CONNECTED TO PMC MICROCONTROLLER
43	M22	DI1_PIN15 (BOOT_CFG2[2])	GPIO3_IO10	GPIO3		OUT – SELECTS UART1 FOR PMC
44	E18	UART2_RX_DATA	UART2_RX	UART2		UART2 - COM1 RS232/ RS485
45	M23	DI1_D0_CS (BOOT_CFG2[5])	NOT CONNECTED	BOOT		BOOT CONFIG – PULL UP ON CARRIER BOARD
46	D19	UART2_TX_DATA	UART2_TX	UART2		UART2 - COM1 RS232/ RS485
47		GND				
48	B20	UART2_CTS_B	UART2_CTSn	UART2		OUT – UART2 DIR TRANSCEIVER SIGNAL
49	N23	DI1_D1_CS (BOOT_CFG2[6])	NOT CONNECTED			NOT USED
50	C19	UART2_RTS_B	GPIO2_IO13			OUT – UART2 ON TRANSCEIVER SIGNAL
51	M24	DI1_PIN03 (BOOT_CFG2[4])	BOOT_CFG2[4])	BOOT		BOOT CONFIG
52		GND				
53	N24	DI1_PIN01 (BOOT_CFG2[7])	NOT CONNECTED			NOT USED
54	H25	DI1_DISP_CLK (BOOT_CFG3[0])	GPIO2_IO22	GPIO2	/sys/class/gpio/ gpio53	OUT – MCP2515_ CAN2_RSTn SIGNAL
55	J25	DISP1_DATA08 (BOOT_CFG1[1])	GPIO3_IO01	GPIO3		OUT – PMC IM6_ST (ECO) SIGNAL

56	J21	DISP1_DATA18 (BOOT_CFG3[7])	GPIO6_IO06	GPIO6		OUT – UART3 ON TRANSCEIVER SIGNAL
57	K23	DISP1_DATA10 (BOOT_CFG4[4])	GPIO2_IO29	GPIO2		OUT -WATCHDOG REFRESH SIGNAL
58	H21	DISP1_DATA20	GPIO3_IO31	GPIO3		IN – ACCEL/GYROSC. INT2n INTERRUPT SIGNAL
59	G24	DISP1_DATA12 (BOOT_CFG3[1])	GPIO2_IO21	GPIO2		RESERVED FOR INTERNAL USE
60	L20	DISP1_DATA09 (BOOT_CFG1[0])	GPIO3_IO00	GPIO3		OUT – PMC DISABLE WATCHDOG
61	E24	DISP1_DATA22	GPIO3_IO26	GPIO3		NOT USED
62	H22	DISP1_DATA15 (BOOT_CFG3[4])	GPIO2_IO18	GPIO2		OUT – miniPCIe PERST SIGNAL
63	G25	DISP1_DATA14 (BOOT_CFG3[3])	GPIO2_IO19	GPIO2		OUT – miniPCIe W_ DISABLE SIGNAL
64	J22	DISP1_DATA13 (BOOT_CFG3[2])	GPIO2_IO20	GPIO2		OUT – miniPCIe PWRON SIGNAL
65	E25	DISP1_DATA23	GPIO3_IO27	GPIO3		OUT – CAN2 TRANSCEIVER STANDBY SIGNAL
66	H23	DISP1_DATA16 (BOOT_CFG3[5])	GPIO2_IO17	GPIO2		OUT – UART2 SLEW RATE CONTROL SIGNAL
67	F25	DISP1_DATA19 (BOOT_CFG4[0])	GPIO5_IO04	GPIO5		NOT USED
68	K21	DISP1_DATA11 (BOOT_CFG4[3])	GPIO2_IO28	GPIO2		OUT – UART1 SELECTION FOR GPS MODULE
69	F24	DISP1_DATA17 (BOOT_CFG3[6])	GPIO2_IO16	GPIO2		OUT – UART3 SLEW RATE CONTROL SIGNAL
70	L21	DISP1_DATA07 (BOOT_CFG1[2])	GPIO3_IO02	GPIO3	/sys/class/gpio/ gpio66	OUT – GPS MODULE RESET SIGNAL

1.8 System On Module (SOM) Debug

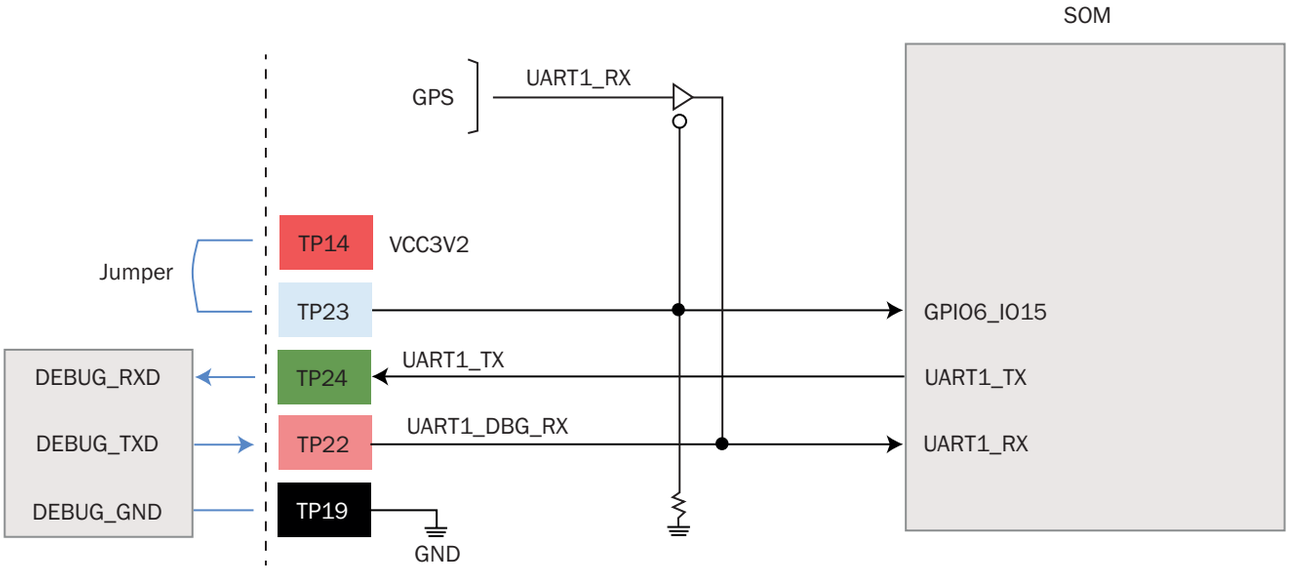
Located at testpoints group, Carrier Board provides SOM UART1 connection to be used for LINUX Debug Console. Please, be aware of voltage levels. TX and RX levels are 3.3V so it is required to use an external UART adapter/converter as needed, with TX and RX levels of 3.3V.

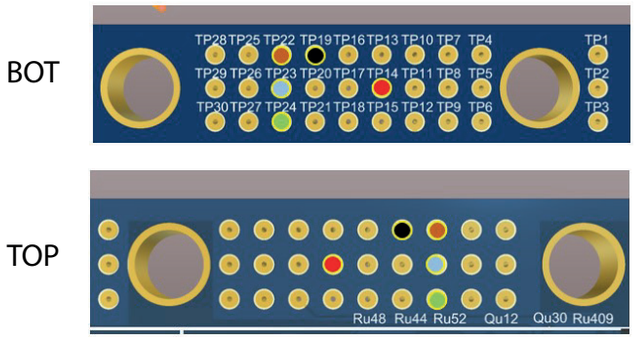
TP	SIGNAL	TYPE	COMMENTS
TP19	GND	Power Supply	GND
TP22	UART1_DBG_RX	Input (3V3 level)	UART1 RX
TP24	UART1_TX	Output (3V3 level)	UART1 TX

TP23	SEL_DEBUG	Selection	Allows DEBUG selection if connected to 3V2
TP14	3V2	Power Supply	

SOM UART1 is shared. Besides Linux Debug port, it is also used by SOM to communicate with GPS device.

To allow sharing, a tri-state buffer has been included to disable RX from GPS. Connecting TP23 to 3V2, buffer is tri-stated and SOM UART1 RX is only connected to DEBUG. This selection can be detected with GPIO6_IO15





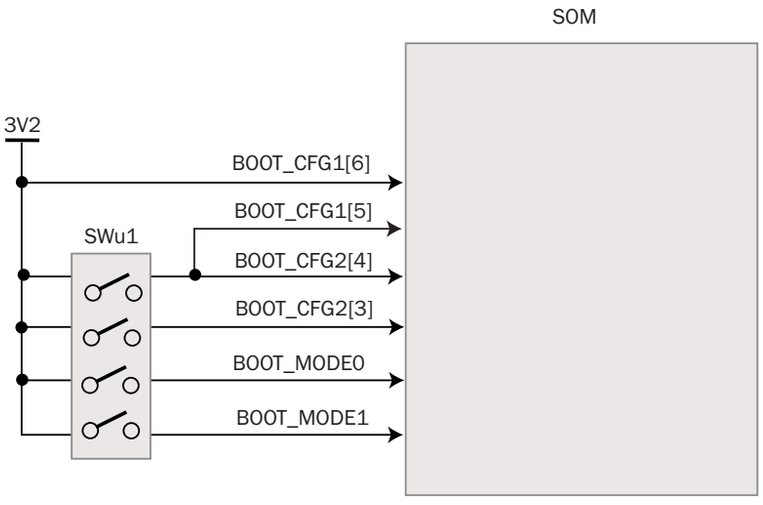
1.9 Micro-SD Card Socket

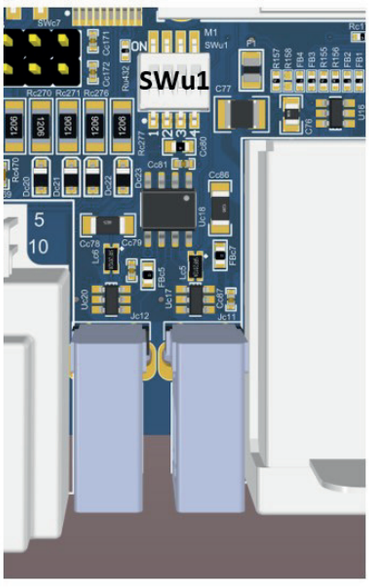
Carrier Board populates a micro-SD card socket connected to SOM SD2 bus with a 4-bits data interface. It located on BOTTOM side and cannot be accesed externally.

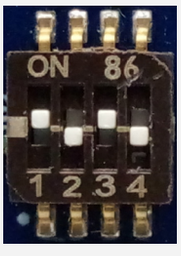
System can be configured to boot from SD card (see paragraph 1.10).

1.10 BOOT Selection

Dip switch SWu1 is used to configure boot mode.





SWu1  				BOOT_CFG1[6] – Pull-up to 3V2 SWu1- 1 -> BOOT_MODE_1 SWu1- 2 -> BOOT_MODE_0 SWu1- 3 -> DI1_PIN02 - BOOT_CFG2[3] SWu1- 4 -> DI1_PIN03 - BOOT_CFG2[4] SWu1- 4 -> DISP1_DATA04 - BOOT_CFG1[5]
1	2	3	4	Boot configuration
OFF	OFF	X	X	Boot according processor internal fuses (note 1)
OFF	ON	X	X	Serial downloader USB-OTG boot
ON	OFF	OFF	OFF	Not valid (note 2)
ON	OFF	OFF	ON	SOM internal eMMC boot (SD3)
ON	OFF	ON	OFF	Carrier board micro-SD boot (SD2)
ON	OFF	ON	ON	Not valid (note 2)
ON	ON	X	X	Not valid (note 1)

NOTE 1: According to processor reference manual page 372, BOOT options.

NOTE 2: According to processor reference manual page 386, it is configured to boot from SD1 interface, and SD1 is connected to SOM internal WiFi module.

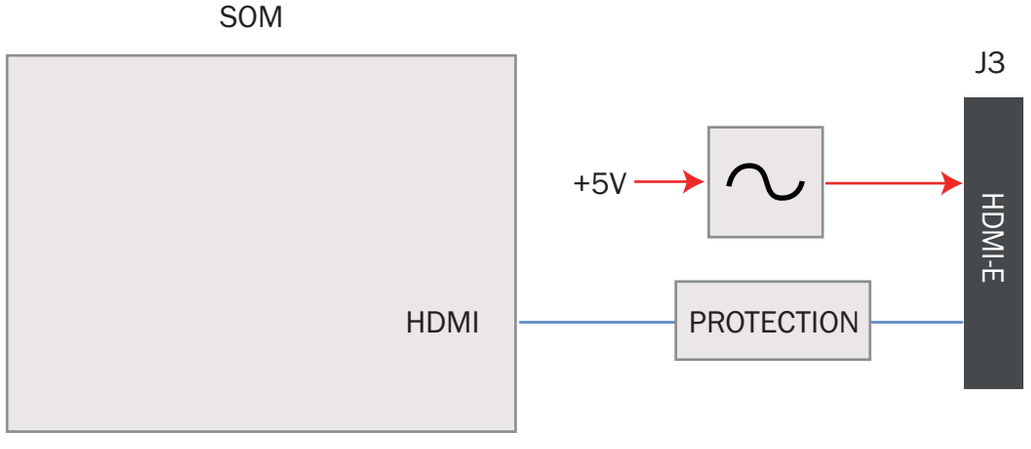
1.11 HDMI

Video output HDMI 1.4 is available at connector J3. It is HDMI-E type with a robust mechanical lock.

J3 - HDMI			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	TMDS D2+	TMDS	Data 2 +
2	TMDS D2S	TMDS	Common reference
3	TMDS D2-	TMDS	Data 2 -
4	TMDS D1+	TMDS	Data 1 +
5	TMDS D1S	TMDS	Common reference
6	TMDS D1-	TMDS	Data 1 -
7	TMDS D0+	TMDS	Data 0 +
8	TMDS D0S	TMDS	Common reference
9	TMDS D0-	TMDS	Data 0 -
10	TMDS CLK+	TMDS	Clock +
11	TMDS CLKS	TMDS	Common reference

12	TMDS CLK-	TMDS	Clock -
13	CEC		
14	RESERVADO		Not connected
15	DDC_SCL		DDC Clock
16	DDC_SDA		DDC Data
17	DDC/CEC_GND		DDC/CEC common
18	+5V		Protected 5V output
19	HDP		Hot Plug Detect

SOM provides full connectivity for HDMI and 5V output is protected with a 375mA PTC type fuse



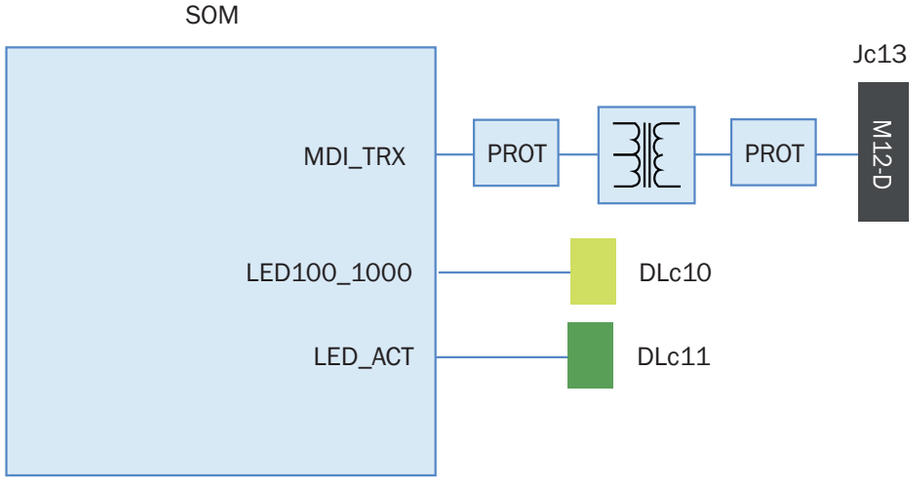
1.12 Ethernet

Ethernet connection is available at Jc13. It is a M12 type D coded.

Jc13 - ETHERNET			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	TX+	Ethernet	10/100Mbps
2	RX+	Ethernet	10/100Mbps
3	TX-	Ethernet	10/100Mbps
4	RX-	Ethernet	10/100Mbps

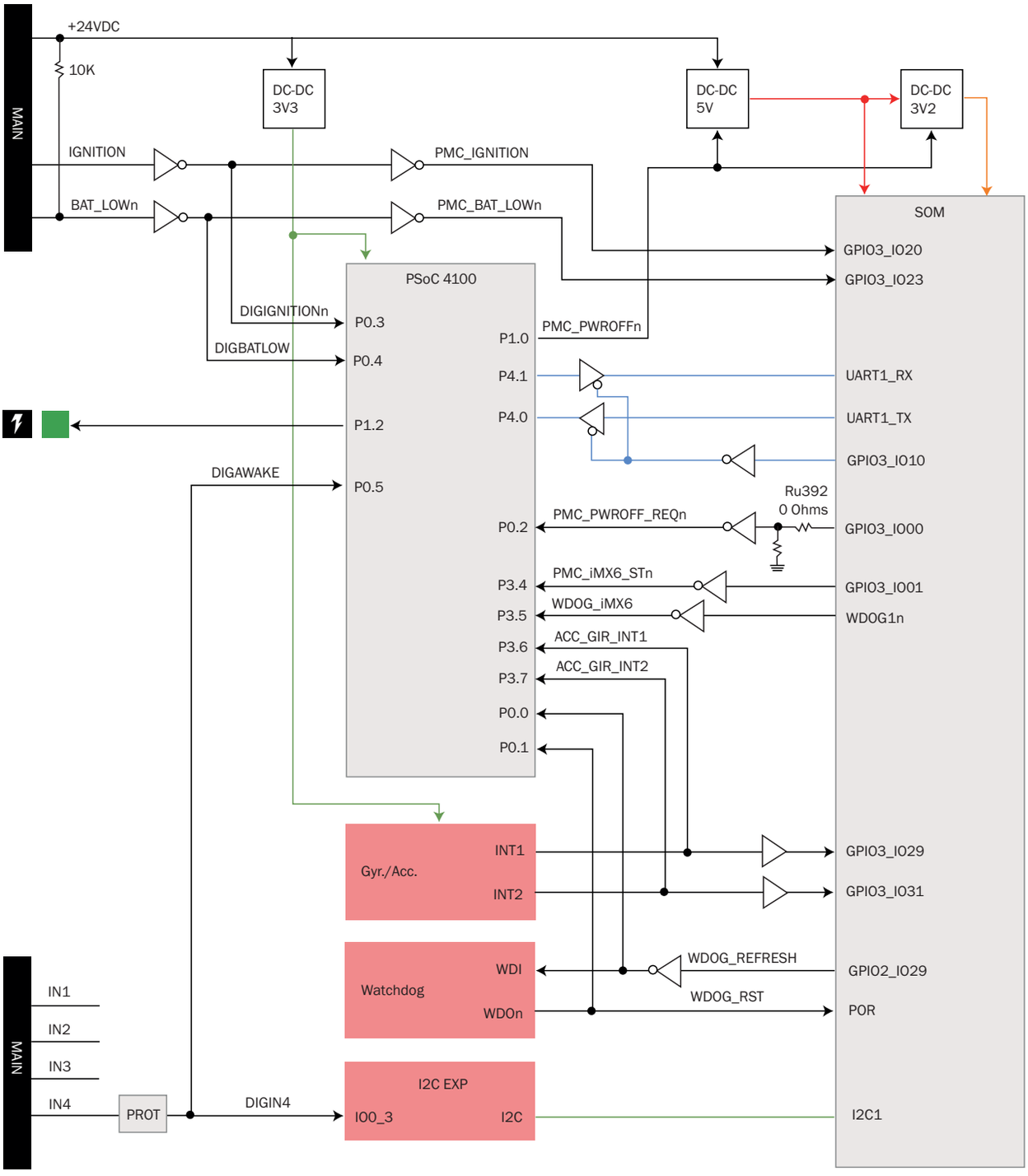
Status LEDs:

- DLc10: yellow, speed 10/100Mbps
- DLc11: green, for activity status



1.13 PMC

Power Management Controller is based on microcontroller Uu6, a Cypress PSoC-4100. This block controls system power on/off based on external IGNITION and BATTERY LOW inputs.



ITxPT defines 5 states regarding to power status:

- OFF: device completely unpowered
- SLEEP: very low current consumption, needed when vehicle is out of service with engine turned off. IGNITION input is not activated
- ECO2: low current consumption with basic network connectivity
- ECO1: minimum current consumption to keep full network connectivity
- ECO: regular current consumption with vehicle engine turned on

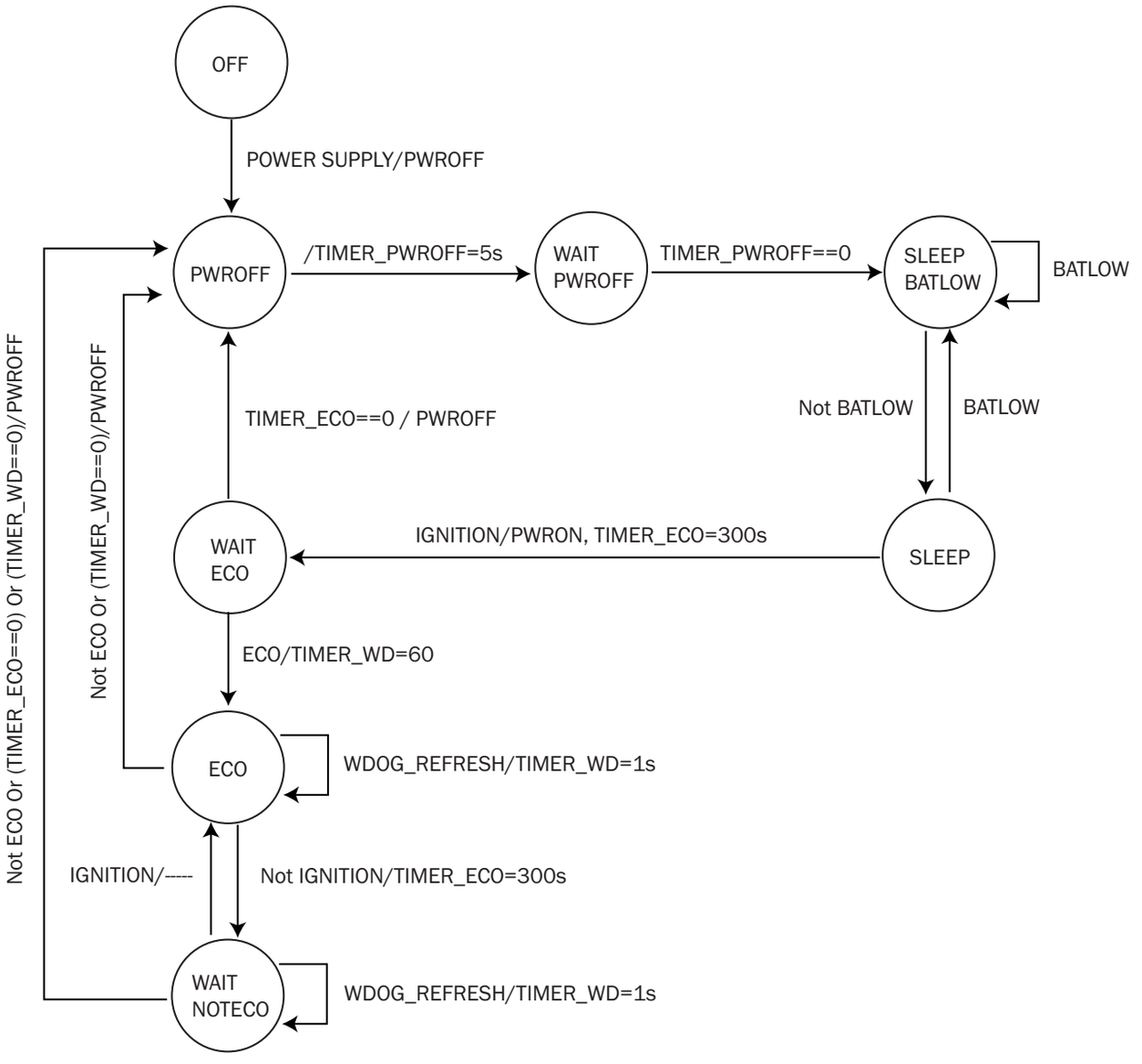
IGNITION and BATTERY_LOW inputs accept maximum input voltage levels equal to power supply voltage.

BATTERY LOW input has an internal de pull-up 10K resistor so it can be unconnected if no Battery Low signal is available.

SIGNAL	PMC	PORT	DIR	VALUES
PWROFF	PMC_PWROFFn	P1.0	OUT	H- PWRON: turn-on DC-DCs VCC5 and VCC3V2 L- PWROFF: turn-off DC-DCs VCC5 and VCC3V2
LED_ POWER	PMC_LED_G	P1.2	OUT	H: turn-off Led L: turn-on Led
ECO	PMC_iMX6_STn	P3.4	IN	H: SOM SLEEP status L: SOM ECO status
WDOG_ iMX6n	WDOG_iMX6	P3.5	IN	Not used
ACC_GIR_ INT1n	ACC_GIR_INT1	P3.6	IN	Not implemented
ACC_GIR_ INT2n	ACC_GIR_INT2	P3.6	IN	Not implemented
WDOG_ REFRESH	PMC_WDOG_ REFRESH	P0.0	IN	H->L: edge to refresh watchdog L->H: edge to refresh watchdog
	PMC_WDOG_ RSTn	P0.1	IN	Not used

PMC_ PWROFF_ REQ	PMC_PWROFF_ REQn	P0.2	IN	Only for debug purpose, with Ru392 populated! H: watchdog on PMC enabled L: watchdog on PMC disabled
IGNITION	DIGIGNITIONn	P0.3	IN	H- Turn-off DC-DCs waiting for ECO active or Timeout L- Turn-on DC-DCs
BATLOW	DIGBATLOW	P0.4	IN	H: external Battery Low Signal L: external Battery High Signal
	PMC_RXD0	P4.0	IN	UART - RXD
	PMC_TXD0	P4.1	OUT	UART - TXD
	PMC_BAT_LOW	P4.2	IN	Not used
	PMC_ INGNITIONn	P4.3	IN	Not used

Following state diagram shows states transitions depending on input signals.



Signal to be considered are:

- TIMER_PWROFF: internal timer (seconds) to manage power turn-off
- TIMER_ECO: internal timer (seconds) to manage SOM generated ECO signal
- TIMER_WD: internal timer (seconds) to manage WatchDog in PMC
- IGNITION: external signal asserted when vehicle is connected
- BATLOW: external signal. Vehicle low battery level
- ECO: SOM generated to signal that it is operating (any ECOx state)
- WDOG_REFRESH: SOM generated signal to refresh PMC on both rising and falling edge
- PWROFF: PMC generated. Turn-off DC-DCs VCC5 and VCC3V2 (both voltages power SOM)

- PWRON: PMC generated. Turn-on DC-DCs VCC5 and VCC3V2 (both voltages power SOM)
- PMC_PWROFF_REQ: Only for debugging purposes, with Ru392 populated! SOM generated to disable Watchdog in PMC microcontroller, SOM sets GPIO3_IO00 (PMC_PWROFF_REQ) to high level and is inverted before reaching PMC microcontroller input at P0.2 (PMC_PWROFF_REQn) with low level value. Ru392 is not factory assembled

Operating states defined for PMC are:

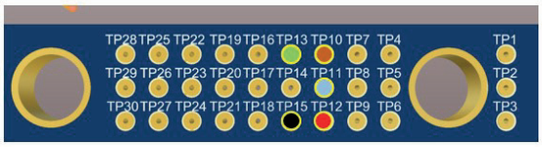
- OFF: device is completely powered-off
- PWROFF: device just powered and starts initial timer to keep SOM switched off
- WAIT-PWROFF: keeps SOM switched-off the required time
- SLEEP BATLOW: vehicle is out of service and cannot be waked-up as long as BATTERY-LOW signal is asserted (low level)
- SLEEP: vehicle is out of service and keeps SOM switched-off waiting for IGNITION signal to be activated
- WAITECO: PMC waits for SOM to activate ECO signal. If maximum time expires and ECO signal is not activated, SOM is switched off and restarts power cycle from PWROFF
- ECO: SOM is active as long as IGNITION signal is asserted and starts shut-down cycle when IGNITION signal is de-asserted
- WAIT-NOTECO: PMC waits for SOM signalling that is ready to be switched-off. If signal is not activated within expected maximum time, SOM is forced to be switched-off

PMC microcontroller is CY8C4125LQI-483, a CYPRESS product, which datasheet can be found at https://www.cypress.com/part/cy8c4125lqi-483.

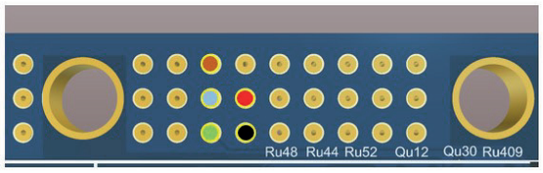
This microcontroller can be programmed with Cypress MiniProg3 device. Programming lines are available at Testpoints group as shown below:

TP10		SWD_CLK	CYPRESS – SWD-CLK: connect to SCLK on MiniProg3
TP11		XRES	CYPRESS – XRES: connect to XRES on MiniProg3
TP12		VTARG	CYPRESS – VTARG: connect to VTARG on MiniProg3
TP13		SWD_IO	CYPRESS – SWD-IO: connect to SDAT on MiniProg3
TP15		GND	GND: connect to GND on MiniProg3

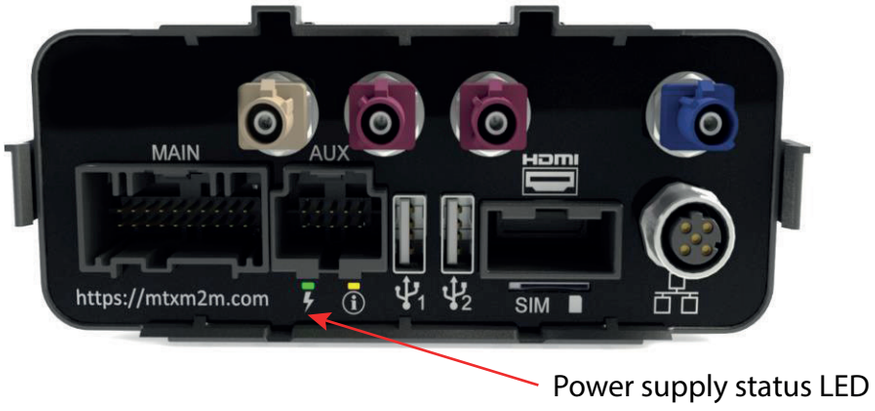
BOT



TOP



Green LED on front panel (identified with icon) is controlled by PMC microcontroller to show power status.



Bellow table shows Green LED status signalling.

STATUS	LED	COMMENTS
OFF	Turned-off	Unpowered
PWROFF (controlled)	Turned-off	
PWROFF (WatchDog)	Flash 100ms every 200ms	Fast blinking
SLEEP BATLOW	Flash 100ms every 4 seconds	
SLEEP	Flash 100ms every 2 seconds	
WAITECO	Flash 100ms every 500ms	Waits for SOM to be active
ECO	ON	
WAITSLEEP	Flash 100ms every 500ms	Waits for SOM to be shut-down

1.14 Watchdog

PMC microcontroller includes a WatchDog process active on ECO and WAITNOTECO states.

Additionally, PMC microcontroller has an internal hardware WatchDog as a safety mechanism to prevent system to hang-up.

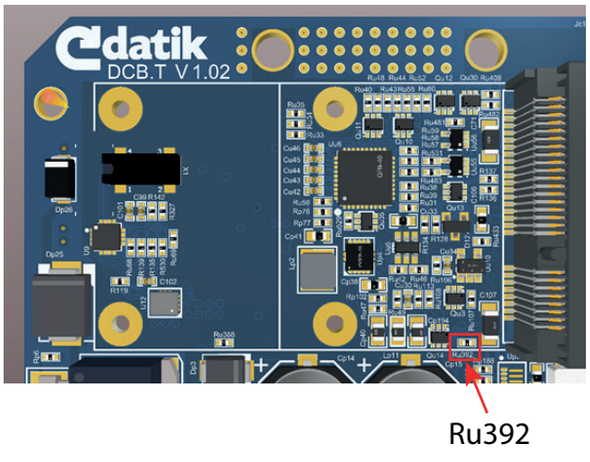
WatchDog process reads P0.0 (PMC_WDOG_REFRESH) to detect rising and falling edges as refresh signal.

Initial timer value before entering ECO state is 60 seconds and every time a refresh signal is detected, restarts timer to 1 second time.

If timer countdown reaches 0 value, without detecting any refresh signal, a System Hardware Reset is asserted resetting output P1.0 (PMC_PWROFFn) to switch-off 5V and 3V2 DC/DCs.

Only for debugging purposes, PMC microcontroller reads input P0.2 (PMC_PWROFF_REQn). A high level on this input enables WatchDog process and a low level disables it. If resistor Ru392 (0 Ohms) is populated , !only recommended for debugging! SOM can control if WatchDog process is running on PMC setting GPIO3_IO00 (PMC_PWROFF_REQ) to high level or stopped setting GPIO3_IO00 (PMC_PWROFF_REQ) to low level.

Next figure shows location of resistor Ru392.



1.15 USB

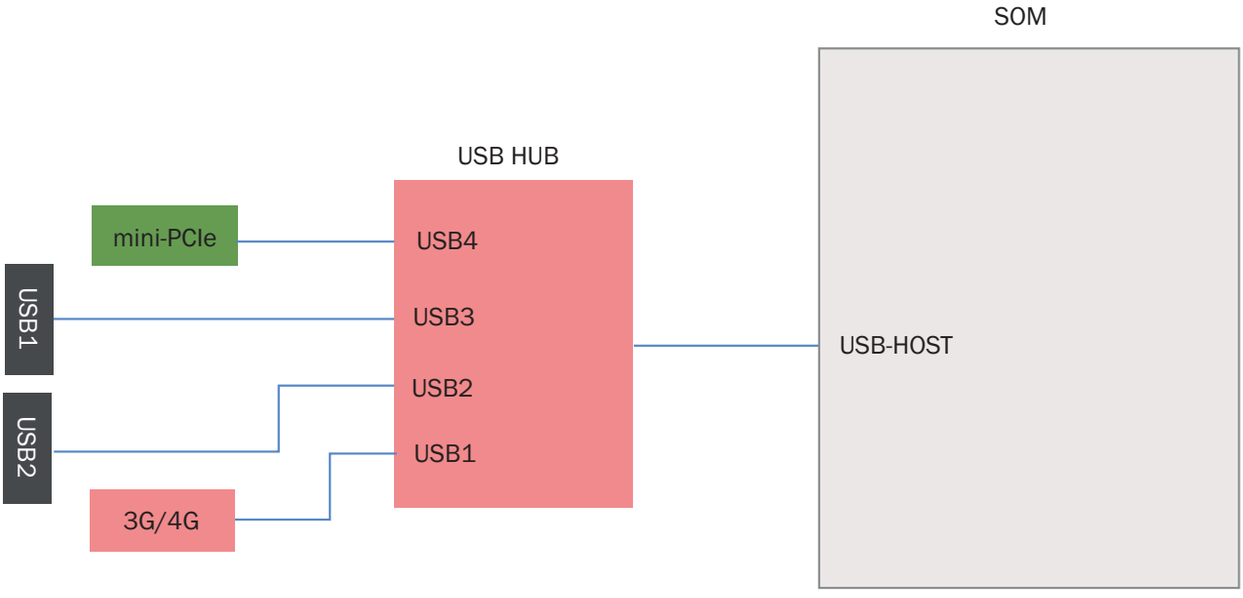
Carrier provides 2 USB ports for external Access on Type A connectors, with current limited to 500mA.

Jc11/JC12 - USB PORTS			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	5V	Power Supply	5V from 500mA current limiter
2	USB D-	USB	USB Data -
3	USB D+	USB	USB Data +
4	GND	Power Supply	GND

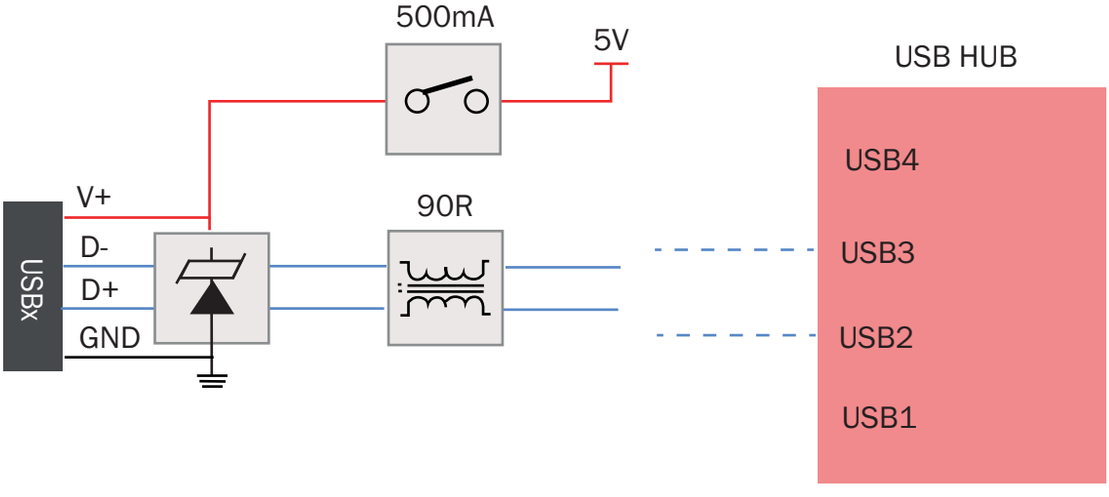
Carrier Board has a 4 ports USB HUB, connected to SOM USB Host interface to provide connectivity to:

- External USB1 port
- External USB2 port
- Internal 3G/4G module
- Internal miniPCIe slot

Next figure shows internal connection.



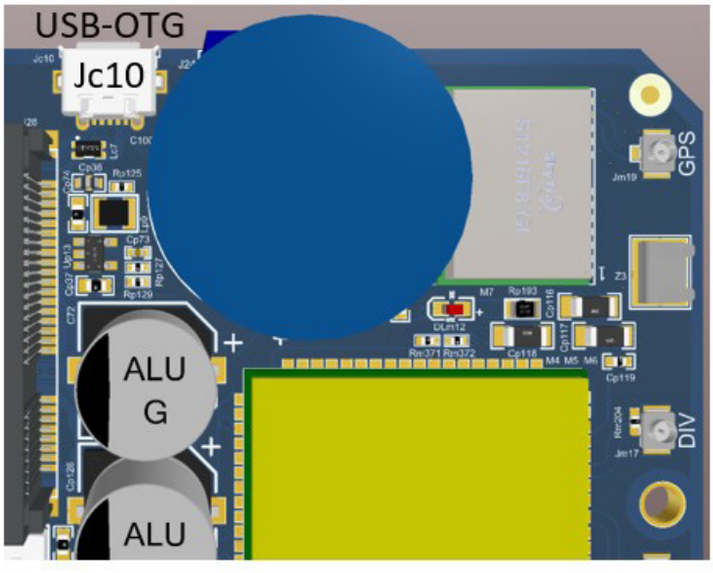
Both external USB ports are filtered and protected as show below figure.



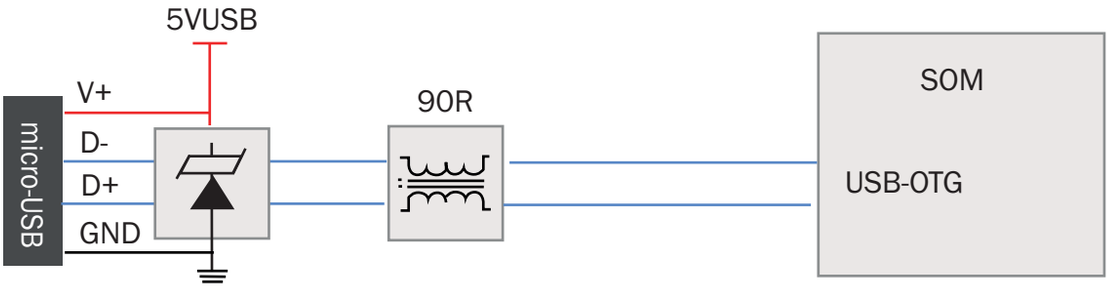
1.16 USB-OTG

Carrier Board provides also connectivity with SOM USB-OTG through micro-USB connector Jc10.

Jc10 - USB-OTG			
PIN	**SIGNAL**	**TYPE**	**COMMENTS**
1	5V	Power supply	Not connected
2	USB-OTG D-	USB	USB Data -
3	USB-OTG D+	USB	USB Data +
4	ID	Input	Connecting cable with micro-USB-B side to Jc10, keeps unconnected ID line to let SOM as DEVICE
5	GND	Alimentación	GND



USB_OTG port can only be accessed internally or on a carrier board without enclosure.



1.17 Temperature Sensor

LM73CIMK-0 is selected as temperature sensor to measure circuit temperature. It is placed on BOTTOM side and connected to SOM I2C1 bus (see details on paragraph I2C Devices). Datasheet is available at http://www.ti.com/lit/ds/symlink/lm73.pdf.

Sensor resolution range is 0.25ºC - 0.03125ºC and accuracy depends on temperature according bellow table:

TEMPERATURE RANGE	ACCURACY
-10ºC y +80ºC	±1ºC
-25ºC y +115ºC	±1.5ºC
-40ºC y +150ºC	±2ºC

Regarding I2C addressing, allows 3 possibilities, defined by connection of ADDRESS input. On Carrier board, ADDRESS pin in not connected so it is floating.

ADDRESS PIN	ADDRESS (7-BIT)
Floating	1001 000 – 0x48
GND	1001 001 – 0x49
3V2	1001 010 – 0x4A

1.18 Gyroscope and Accelerometer

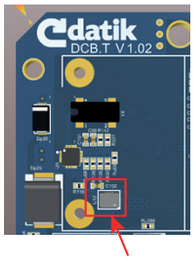
ST reference LSMDS3 is chosen as gyrospoce and accelerometer and is connected to SOM I2C1 bus (see details on paragraph I2C devices).

It is an inertial module with both accelerometer and gyroscope sensors. Accelerometer with full scale from ±2g up to ±16g and gyroscope with configurable full scale from ±125 up to ±2000 dps. Datasheet is available at https://www.st.com/resource/en/datasheet/lsm6ds3.pdf.

Regarding I2C addressing, it has two possibilities depending on connection of input SDO/SA0. On Carrier Board this input is connected to GND.

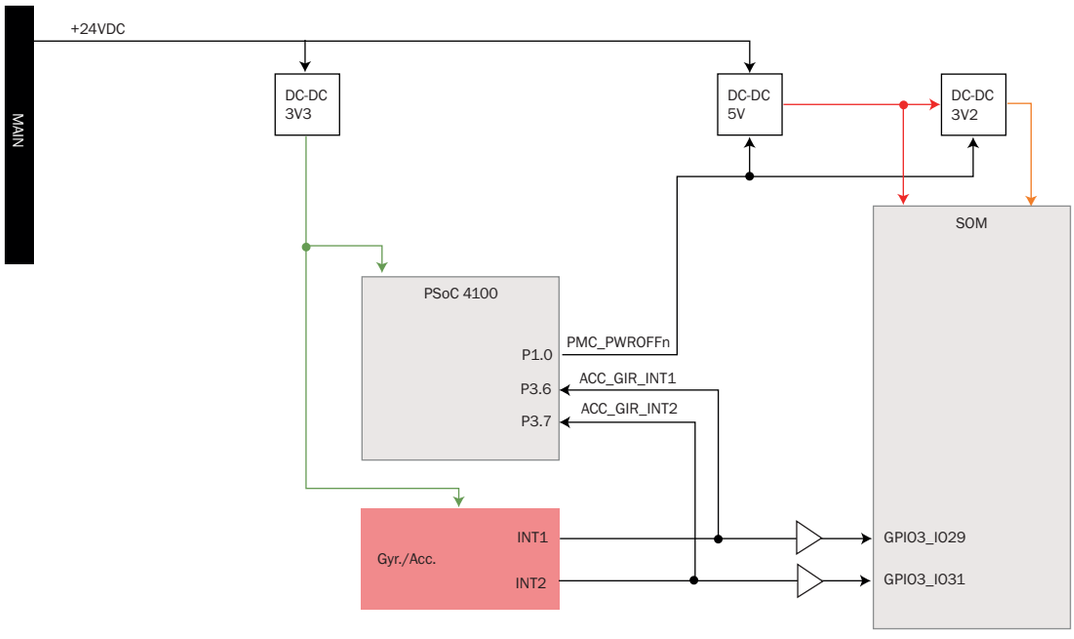
SDO/SA0	ADDRESS (7-BIT)
GND	1101 010 – 0x6A
3V2	1101 011 – 0x6B

It is located closed to miniPCIe slot.



Accelerometer + Gyroscope

Sensor is powered to 3.3V with a dedicated DC/DC connected to main input in order to keep it continuously powered regardless PMC state.



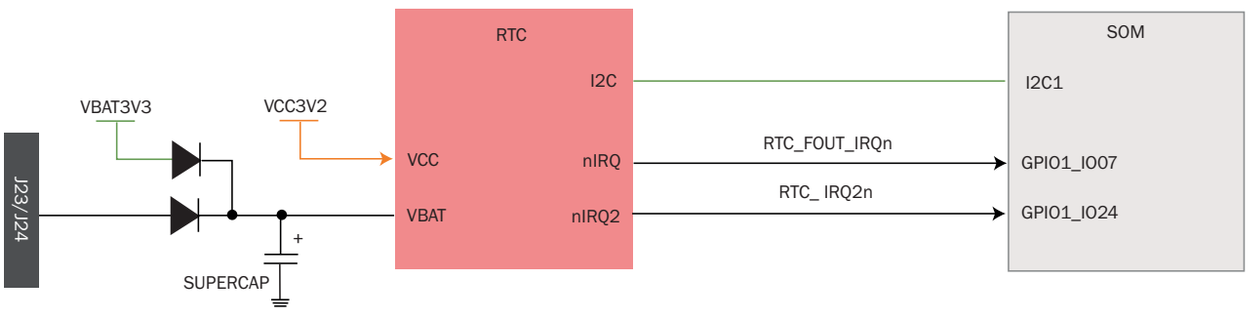
1.19 RTC: Real Time Clock

AB0805-T3 is included as RTC. It is connected to SOM I2C1 bus. Datasheet is available at https://abracon.com/Precisiontiming/AB08X5-RTC.PDF.

RTC ADDRESS (7-BIT)
1101 001 – 0x69

Following diagram shows connection of RTC. Additionally, a Supercapacitor maintains backup voltage to let RTC keep running in case of Carrier Board is completely disconnected and unpowered.

Optionally, Carrier Board allows assembly of a connector (J23 o J24) instead of Supercap (it has to be removed) to connect an external primary cell (not rechargable) with a voltage lower than 3.8V.



1.20 3G/4G Module

Carrier Board allows assembly of any of the following modules:

- (M5) EHS6: 3G module
- (M6) ELS61-E R2: 4G Cat. 1 module
- (M4) ELS81-E: 4G Cat. 4 module

EHS6	
Frequency bands	Quad band 850/900/1800/1900MHz UMTS/HSPA+: Five band 800/850/900/1900/2100MHz
GSM Class	Small MS

Output power	Class 4 (+33dBm ±2dB) for EGSM850
	Class 4 (+33dBm ±2dB) for EGSM900
	Class 1 (+30dBm ±2dB) for GSM1800
	Class 1 (+30dBm ±2dB) for GSM1900
	Class E2 (+27dBm ± 3dB) for GSM 850 8-PSK
	Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK
	Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK
	Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK
	Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD BdI
	Class 3 (+24dBm +1/-3dB) for UMTS 1900,WCDMA FDD BdII
	Class 3 (+24dBm +1/-3dB) for UMTS 900, WCDMA FDD BdVIII
	Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV
	Class 3 (+24dBm +1/-3dB) for UMTS 800, WCDMA FDD BdVI
HSPA	DL 7.2Mbps, UL 5.7Mbps
3GPP Release 6, 7	HSDPA Cat.8/HSUPA Cat.6 data rates
	Compressed mode(CM) according to 3GPP TS25.212
UMTS	PS data rate – 384 kbps DL/384 kbps UL
3GPP Release 4	CS data rate – 64 kbps DL/64 kbps UL

GSM/GPRS/EGPRS	GPRS: • GPRS: • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B CSD: • V.110, RLP, non-transparent • 9.6kbps • USSD
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus SMS locations in mobile equipment
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Gemalto M2M AT commands for RIL compatibility

Java™ Open Platform	Java™ Open Platform com • Java™ profile IMP-NG & CLDC 1.1 HI • Secure data transmission via HTTPS/SSL • Multi-threading programming and multi-application execution The memory space available for Java programs is around 10MB in the flash file system and around 10MB RAM. Application code and data share the space in the flash file system and in RAM
SIM Application Toolkit	SAT Release 99
Firmware update	Generic update from host application over ASC0 or USB modem

4G CAT.1, ELS61-E R2	
Frequency bands	GSM/GPRS/EDGE: Dual band 900/1800MHz UMTS/HSPA+: Dual band 900 (BdVIII)/2100MHz (BdI) LTE: Penta band 700 (Bd28)/800 (Bd20)/900 (Bd8)/1800 (Bd3)/2100 MHz (Bd1)
GSM Class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class 3 (+23.5dBm +1.5/-2.5dB) for UMTS 2100,WCDMA FDD BdI Class 3 (+23.5dBm +1.5/-2.5dB) for UMTS 900, WCDMA FDD BdVIII
Output power (according to Release 99)	Class 3 (+23dBm +1dB/-2dB) for LTE 700, LTE FDD Bd28 Class 3 (+23dBm +1dB/-2dB) for LTE 800, LTE FDD Bd20 Class 3 (+23dBm +1dB/-2dB) for LTE 900, LTE FDD Bd8 Class 3 (+23dBm +1dB/-2dB) for LTE 1800, LTE FDD Bd3 Class 3 (+23dBm +1dB/-2dB) for LTE 2100, LTE FDD Bd1
LTE 3GPP Release 9	UE CAT 1 supported DL 10.2Mbps, UL 5.2Mbps

HSPA 3GPP Release 8	DL 7.2Mbps, UL 5.7Mbps HSDPA Cat.8/HSUPA Cat.6 data rates Compressed mode (CM) supported according to 3GPP TS25.212
UMTS 3GPP Release 4	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL
GSM/GPRS/EGPRS	GPRS: • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus SMS locations in mobile equipment
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Gemalto M2M AT commands for RIL compatibility

Java™ Open Platform	Java™ Open Platform with: • Java™ profile IMP-NG & CLDC 1.1 HI • Secure data transmission via HTTPS/SSL1 • Multi-threading programming and multi-application execution The memory space available for Java programs is 30MB in the flash file system and 18MB RAM. Application code and data share the space in the flash file system and in RAM.
SIM Application Toolkit	SAT letter classes b, c, e; with BIP
Firmware update	Generic update from host application over ASC0 or USB modem

4G CAT.4, ELS81-E	
Frequency bands	GSM/GPRS/EDGE: Dual band 900/1800MHz UMTS/HSPA+: Dual band 900 (BdVIII)/2100MHz (BdI) LTE: Penta band 700 (Bd28)/800 (Bd20)/900 (Bd8)/1800 (Bd3)/2100 MHz (Bd1)
GSM Class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class 3 (+23.5dBm +1.5/-2.5dB) for UMTS 2100,WCDMA FDD BdI Class 3 (+23.5dBm +1.5/-2.5dB) for UMTS 900, WCDMA FDD BdVIII
Output power (according to Release 8)	Class 3 (+23dBm +1dB/-2dB) for LTE 700, LTE FDD Bd28 Class 3 (+23dBm +1dB/-2dB) for LTE 800, LTE FDD Bd20 Class 3 (+23dBm +1dB/-2dB) for LTE 900, LTE FDD Bd8 Class 3 (+23dBm +1dB/-2dB) for LTE 1800, LTE FDD Bd3 Class 3 (+23dBm +1dB/-2dB) for LTE 2100, LTE FDD Bd1
LTE 3GPP Release 9	UE CAT 4 supported DL 150Mbps, UL 50Mbps

HSPA 3GPP Release 8	DL 7.2Mbps, UL 5.7Mbps HSDPA Cat.10 / HSUPA Cat.6 data rates Compressed mode (CM) supported according to 3GPP TS25.212
UMTS 3GPP Release 4	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL
GSM/GPRS/EGPRS	GPRS: • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus SMS locations in mobile equipment
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Gemalto M2M AT commands for RIL compatibility

Java™ Open Platform	Java™ Open Platform with • Java™ profile IMP-NG & CLDC 1.1 HI • Secure data transmission via HTTPS/SSL1 • Multi-threading programming and multi-application execution The memory space available for Java programs is 30MB in the flash file system and 18MB RAM. Application code and data share the space in the flash file system and in RAM.
SIM Application Toolkit	SAT letter classes b, c, e; with BIP
Firmware update	Generic update from host application over ASC0 or USB modem.

Next diagram shows connection of 3G/4G module with SOM. Any reference to 3G/4G means that both 3G and 4G modules are affected, and if just 4G is referred, it applies only to 4G modules (ELS61-E R2 and ELS81-E).

3G/4G module is connected to SOM through USB-HUB, which is connected to SOM USB-HOST port.

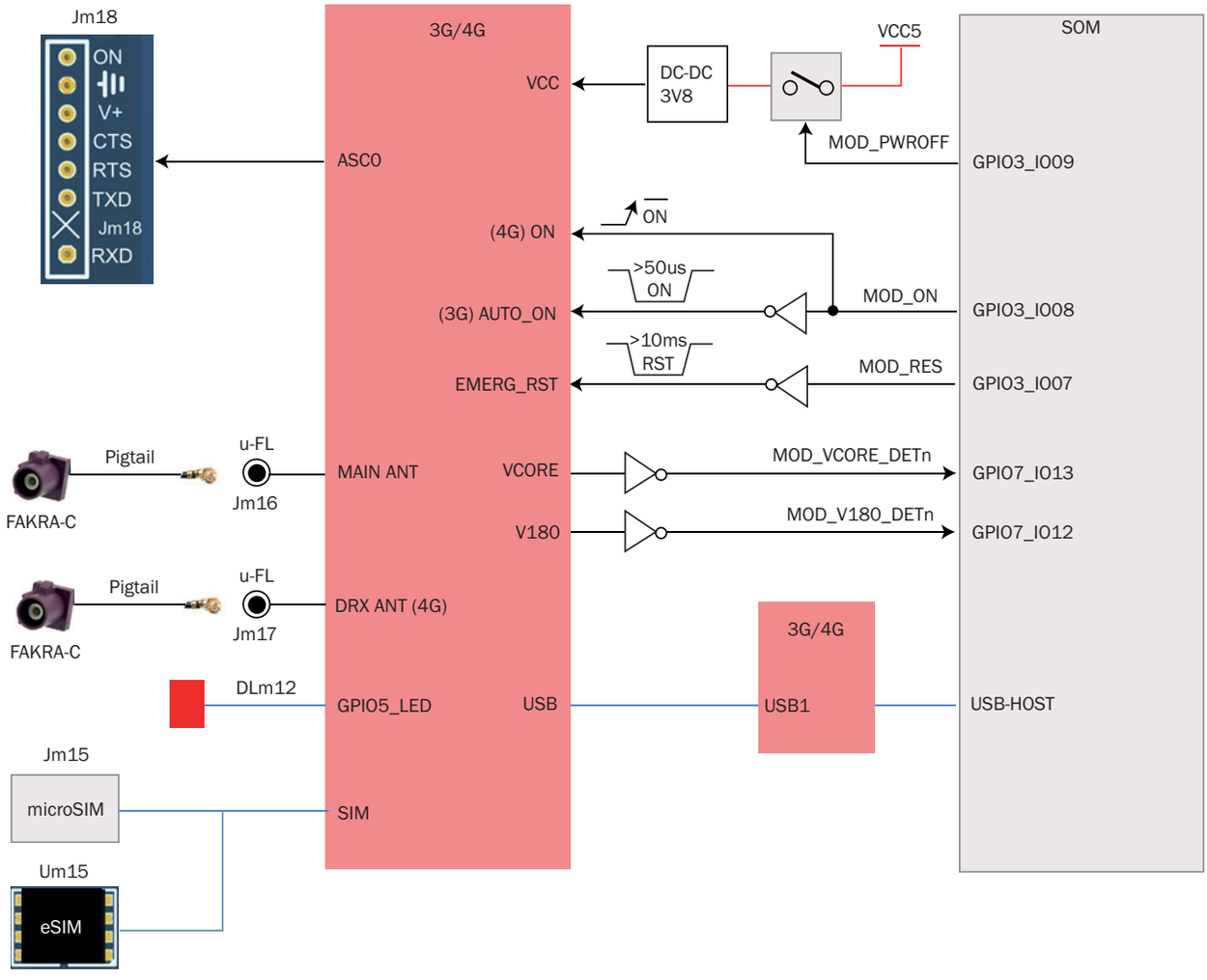
Power supply of 3G/4G module can be controlled with SOM GPIO3_IO09. High level forces to power off and a low level connects power supply to the module.

Additionally, 3G module can be turned on with AUTO_ON signal, asserting SOM a high level pulse (at least 50us long) on GPIO3_IO08.

In case of 4G module, it can be turned on with ON signal, asserting SOM a rising edge transition on GPIO3_IO08.

An emergency reset to 3G/4G can be forced asserting SOM a high level pulse of at least 10ms long on GPIO3_IO07.

3G/4G power status can be checked reading VCORE with GPIO7_IO13 and V180 with GPIO7_IO12 status signals.

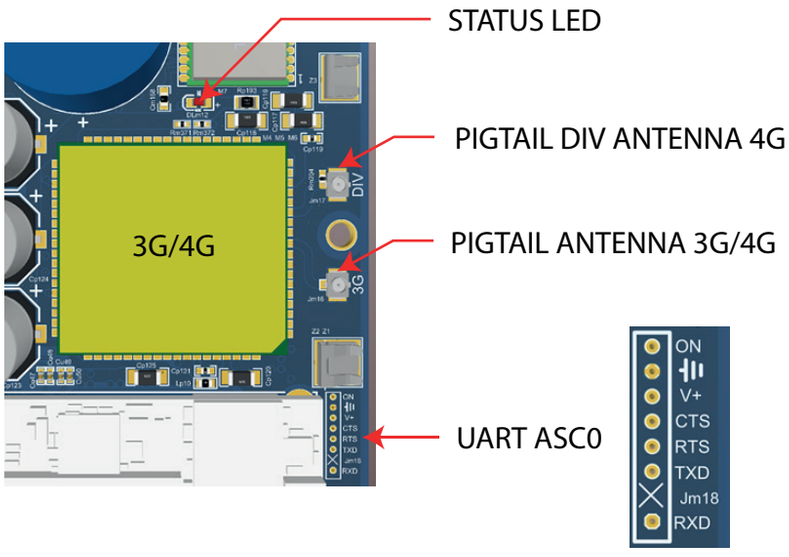


LED DLm12 shows activation status of 3G/4G module according to module configuration.

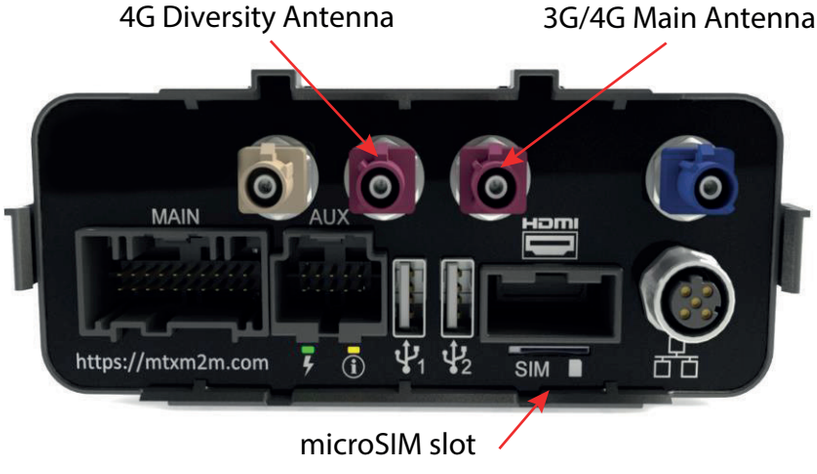
3G/4G microSIM is installed on a microSIM socket, which can be accessed externally on front panel (bellow HDMI connector).

Connector Jm18 on Carrier Board provides connection to 3G/4G module UART ASC0 signals, as well as ON signal.

Next figure shows placement of 3G/4G module on carrier board.



FAKRA-D (Claret Violet) connectors for external antenas and microSIM slot are located on front panel.

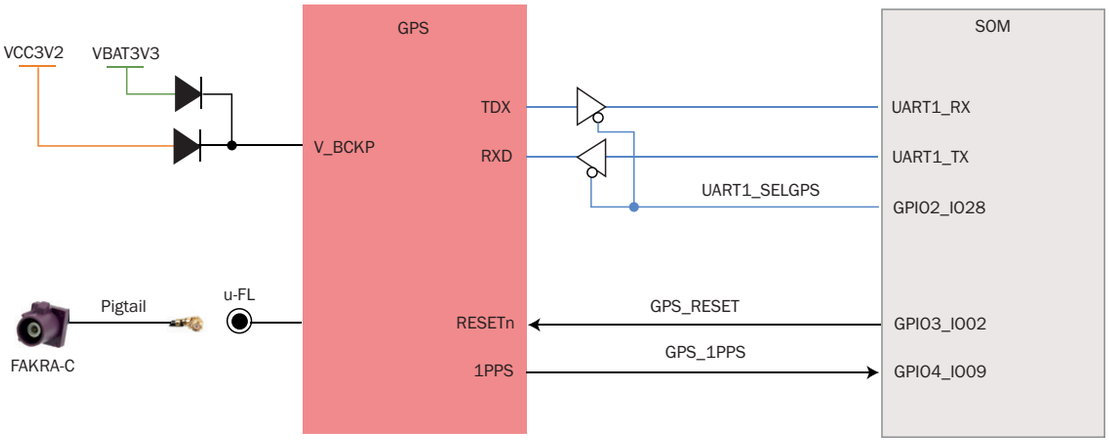


1.21 GPS

GPS module S1216F8-GL of SKYTRACK (datasheet is available at http://www.skytraq.com.tw/datasheet/S1216V8_v0.9.pdf.). It is connected to SOM UART1, that is shared as well with Linux DEBUG Port and PMC, therefore SOM has to choose device to connect to. For this purpose to select GPS UART, SOM has to set a low level value on GPIO2_IO28 and remind not to select LINUX console (see SOM Debug chapter).

GPS module can be reset with SOM, setting a low level voltage on GPIO3_IO02.

1PPS signal generated by GPS module can be read by SOM at GPIO4_IO09.



External GPS antenna connection on FAKRA-C (Blue).

There is 3V DC bias output on antenna line with a maximum current of 30mA for powering external active antenna with capabilities for active antenna detection and short protection.

1.22 WiFi - Bluetooth

MTX-STAROAD II can optionally provide WiFi connectivity by adding a specific SOM with onboard WiFi/BT module with following features:

- WiFi/BT co-existence support.
- WiFi:
  - Integrated RF front end, power amplified, DC-DC, crystal, switches, filters power mngmt.

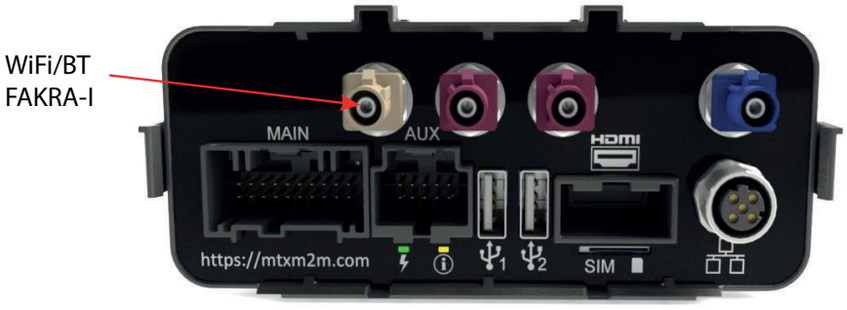
- SDIO based interface (connected via the i.MX6 SD1 interface)
- 2.4 GHz or 5 GHz (depending on model) 802.11 a/b/g/n
- 20 and 40 MHz channels on 2.4/5 GHz bands
- WiFi direct multi-role multi-channel
- Up to 10 clients supported in AP role

- Bluetooth:
  - Fully supports Bluetooth 4.0 + EDR including Bluetooth low energy
  - High speed UART (max 4Mbps) and PCM for Bluetooth support (connected via i.MX6 UART4 interface)

Operation Temperature range for WiFi/BT SOM is reduced to -20°C up to +70°C.

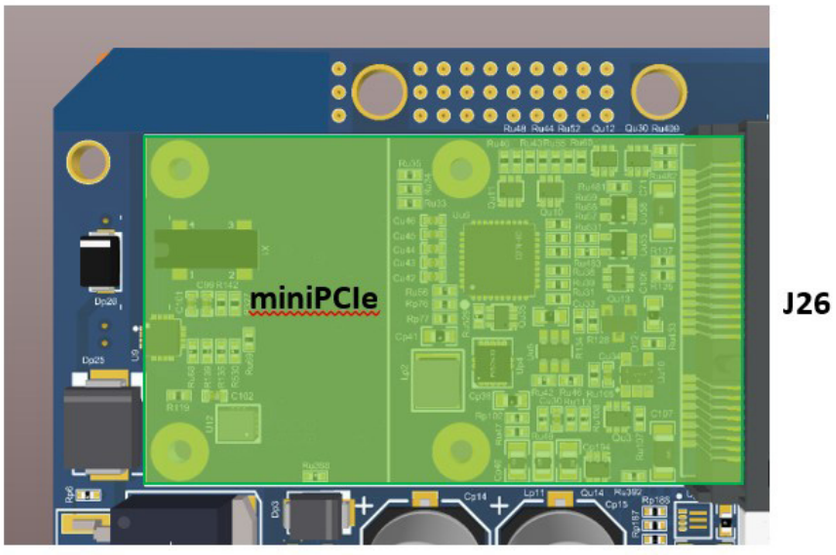
SOM includes u.FL type connector for WiFi/BT antenna pigtail.

Front panel provides FAKRA-I (Beige) connector for a WiFi/BT antenna.



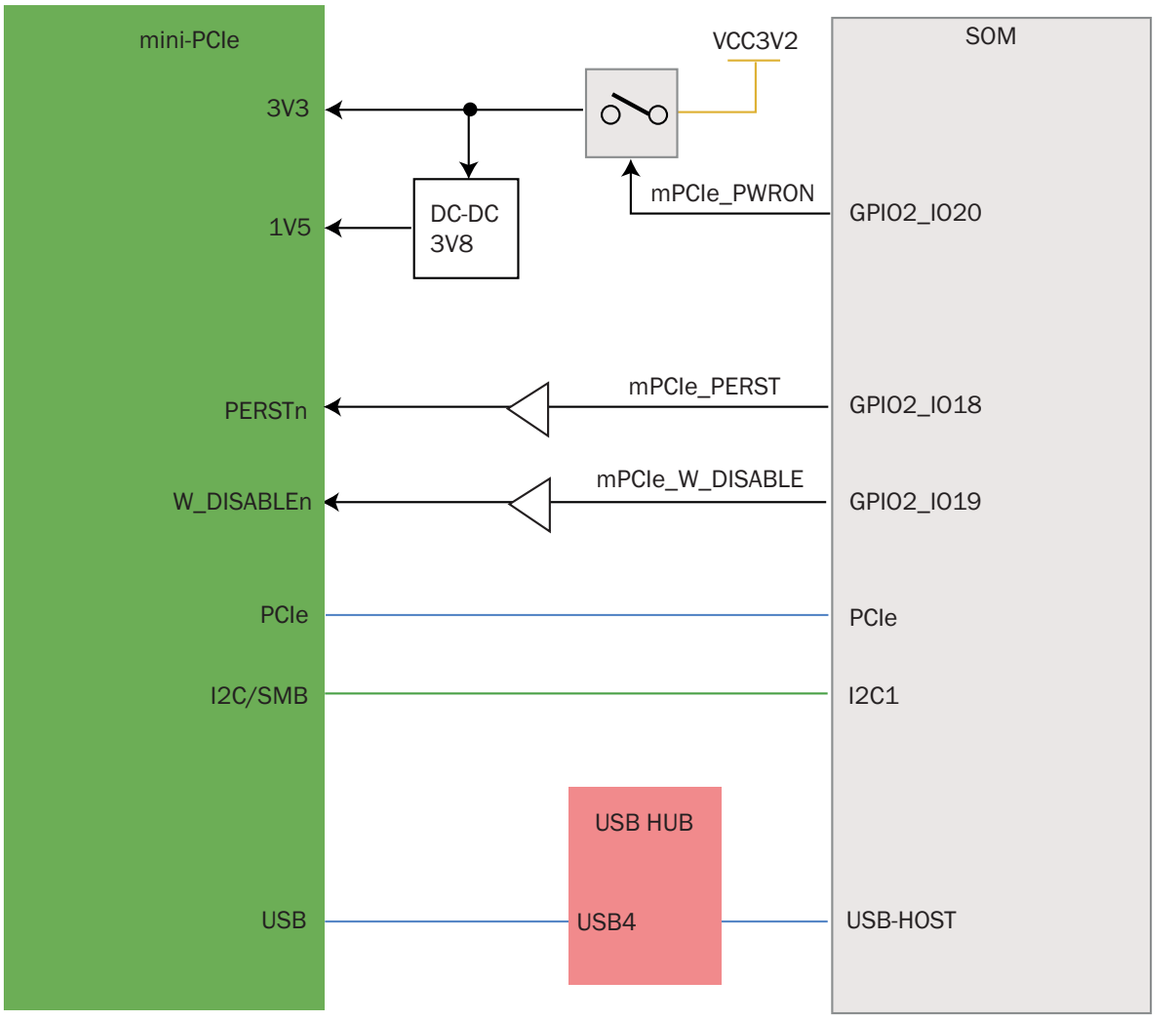
1.23 1.23 MiniPCIe

As an option, Carrier Board can include a miniPCIe slot on connector J26 with PCIe, USB, I2C interfaces).



MiniPCIe slot is powered with both 3.3V and 1.5V and can be controlled (activated and deactivated) from SOM setting a low level value on GPIO_IO20.

Next figure shows miniPCIe connection with SOM.



1.24 General Purpose Inputs

MTX-STAROAD II has 8 general purpose inputs, IN1, IN2, IN3 and IN4 on MAIN connector and IN5, IN6, IN7 and IN8 on AUX connector (see chapters MAIN and AUX connectors for terminal number assigned).

All of eight inputs has the same topology and allows input voltage range equal to power supply and are protected against overvoltage and reverse voltage.

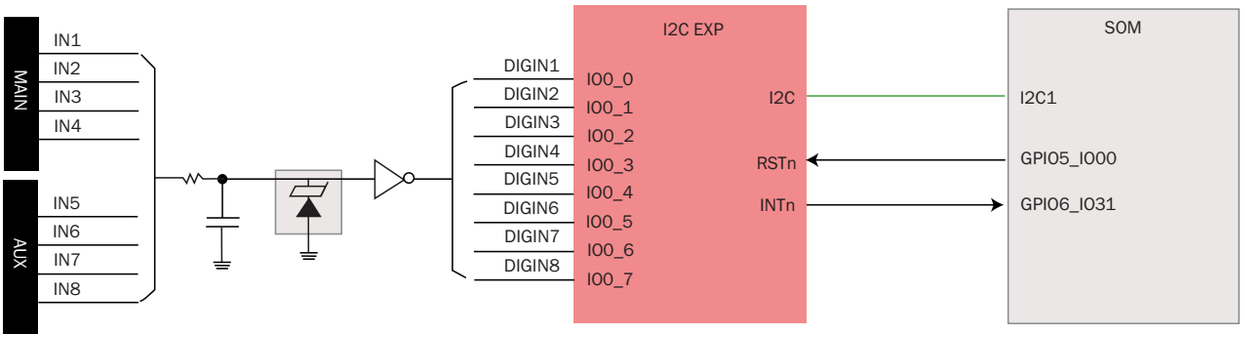
SOM can read input level status by means I2C1 expander TCA9539, which datasheet is available at http://www.ti.com/lit/ds/symlink/tca9539.pdf. I2C address of expander is set on Carrier Board to 0x74.

A1	A0	ADDRESS (7-BIT)
GND	GND	1110 100 – 0x74

GND	3V2	1110 101 – 0x75
3V2	GND	1110 110 – 0x76
3V2	3V2	1110 111 – 0x77

There is no internal pull-up so to activate any input, a minimum voltage of 10V has to be applied.

Next figure shows input topology and connection to SOM.

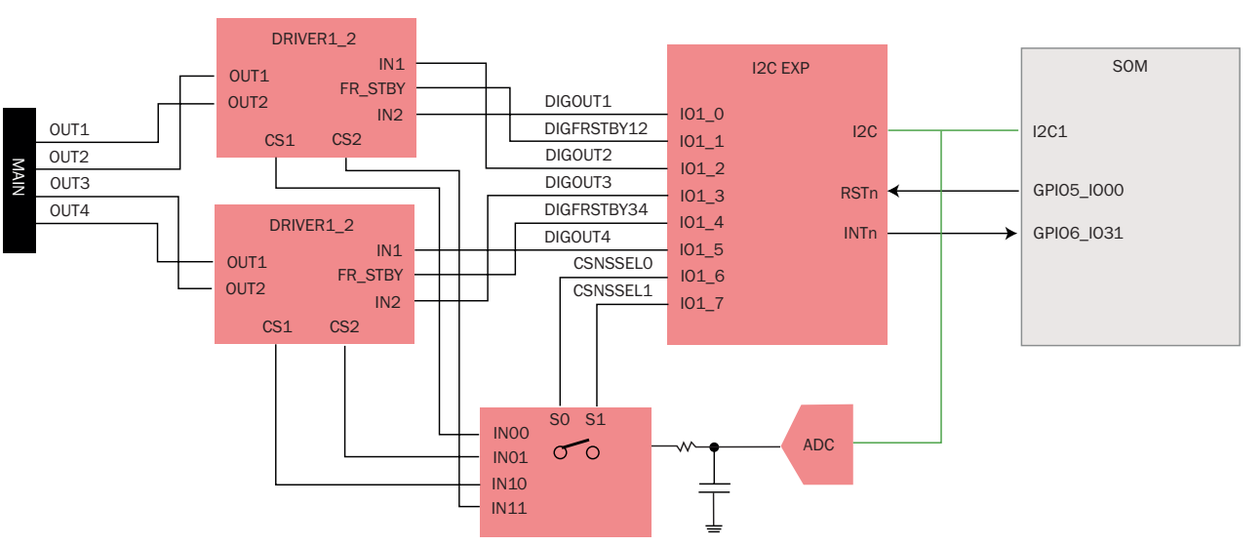


1.25 General Purpose Outputs

MTX-STAROAD II has 4 general purpose power outputs, OUT1, OUT2, OUT3 and OUT4, located at MAIN connector (see chapter MAIN connector terminals numbering).

VND5T100AJ-E is used as output driver, which datasheet is available at https://www.st.com/resource/en/datasheet/vnd5t100aj-e.pdf. It has capability of diagnostic functions and output current sensing. All of four outputs has the same topology and supply a voltage range up to power supply voltage value. Provide as well overcurrent protection. SOM can control output status through I2C1 expander TCA9539 (same expander shared for inputs and outputs).

Next figure shows output drivers connection.



Output driver has the capability to sense output current so Carrier Board includes the ADC ADC081C027CIMK, which datasheet is available at http://www.ti.com/lit/ds/symlink/adc081c021.pdf, to convert sensed voltage value generated and a MUX to select channel to convert. ADC is connected to I2C1 SOM. Following table shows selection values for each channel.

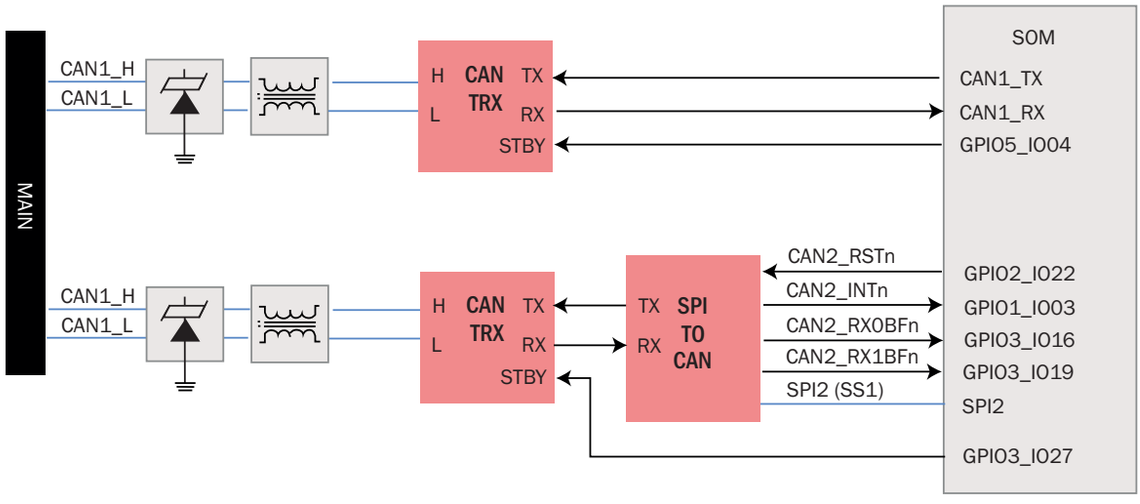
CSNSSEL1	CSNSSEL0	CANAL SELECCIONADO
0	0	Current Sense OUT2
0	1	Current Sense OUT3
1	0	Current Sense OUT4
1	1	Current Sense OUT1

ADC I2C address is connected on Carrier Board to GND so address es 0x51.

ADDRESS PIN	ADDRESS (7-BIT)
Floating	1010 000 – 0x50
GND	1010 001 – 0x51
3V2	1010 010 – 0x52

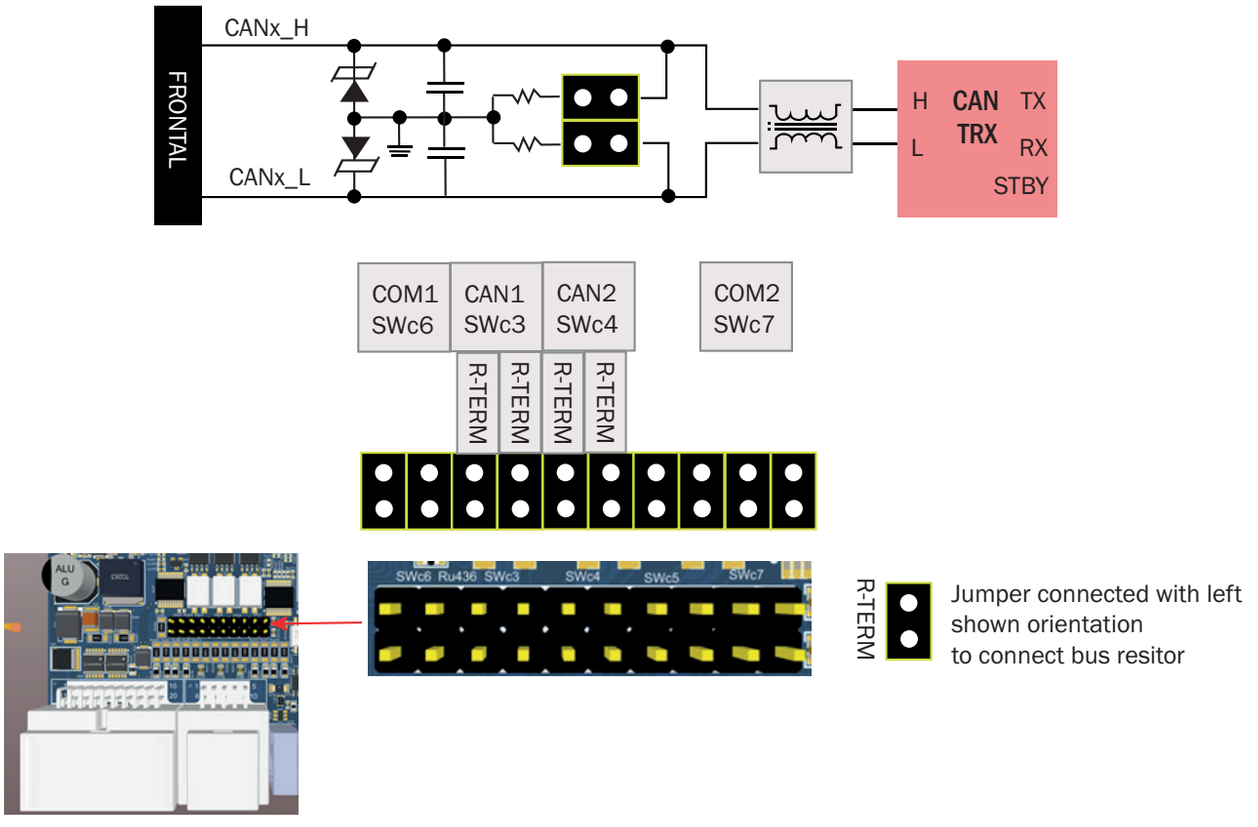
1.26 CAN Ports

MTX-STAROAD II has 2 CAN ports available on MAIN connector (see Main Connector section). CAN1 port is native on SOM and CAN2 port is obtained with a CAN controller with SPI interface. Next figure shows CAN ports connection to SOM.



CAN controller with SPI interface is a Microchip MCP2515, which datasheet is available at http://ww1.microchip.com/downloads/en/DeviceDoc/MCP2515-Stand-Alone-CAN-Controller-with-SPI-20001801J.pdf. It is a full CAN 2.0B controller with a maximum speed of 1Mbps. Besides SPI conection to SOM, signals INTn, RX0BFn and RX1BFn are also connected as well as RESET signal as shown on above figure. CAN transceiver is TCAN1042HVDRQ1, which datasheet is available at http://www.ti.com/lit/ds/symlink/tcan1042gv-q1.pdf. It is an automotive qualified transceiver.

Both CAN ports has internal bus termination resistors that can be selected with jumpers.

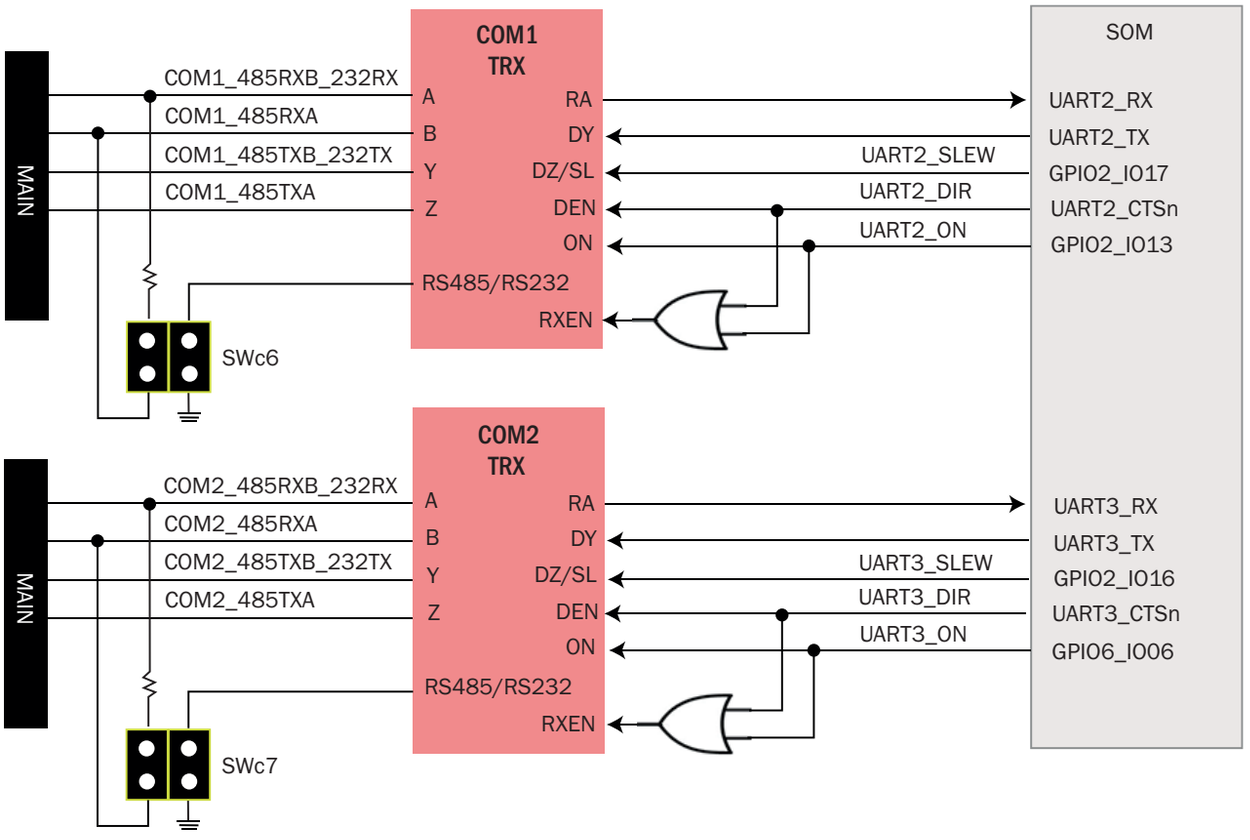


1.27 RS232/RS485 Ports

MTX-STAROAD II has 2 x RS232/RS485 configurable ports, COM1 and COM2. COM1 is on MAIN connector and COM2 is on AUX connector (see chapters MAIN and AUX connectors for terminal numbering).

RS232/RS485 transceiver is a RENESAS ISL3330IAZ, which datasheet is available at https://www.renesas.com/eu/en/doc/datasheet/isl3330-31.pdf, and allows to be configured for RS485 full duplex operation or 3 wires RS232 TX/RX. Physical protocol selection for each transceiver is made with a jumper.

Next figure shows connection of RS232/RS485 transveivers with SOM.

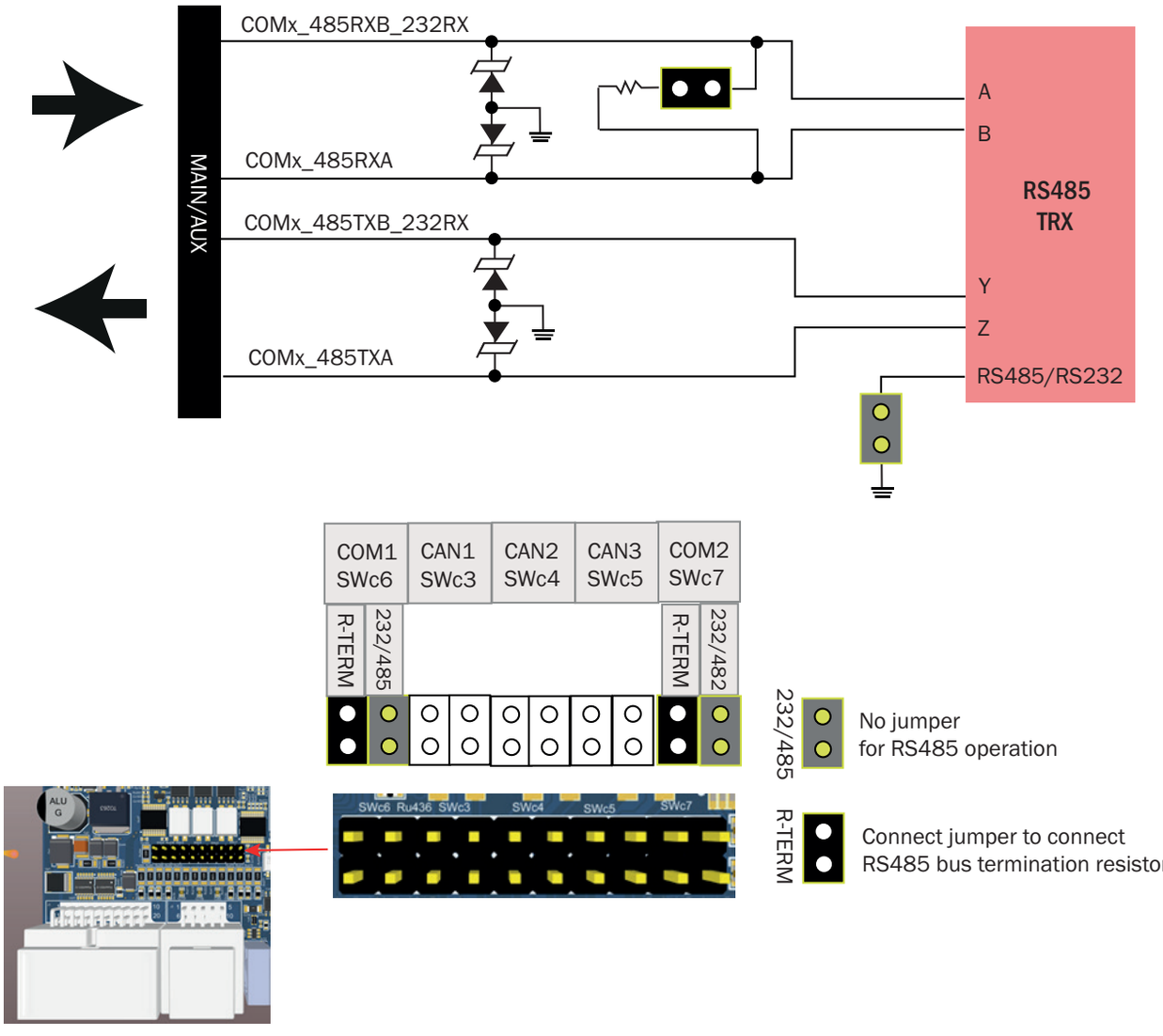


485/232	ON	RXEN	DEN	SLEW	RA	RB	Y	Z	Speed	ChPump	LB	MODE	OPCIONES
0	1	0	0	N/A	Z	Z	Z	Z	-----	ON	OFF	RS232	INVALIDA
0	1	0	1	N/A	Z	Z	ON	ON	0.46	ON	OFF	RS232	INVALIDA
0	1	1	0	N/A	ON	ON	Z	Z	-----	ON	OFF	RS232	RS232 (RX)
0	1	1	1	N/A	ON	ON	ON	ON	0.46	ON	OFF	RS232	RS232 (RX+TX)
0	0	0	1	N/A	Z	Z	ON	Z	0.46	ON	OFF	RS232	INVALIDA
0	0	1	0	N/A	Z	ON	ON	Z	0.46	ON	OFF	RS232	INVALIDA
0	0	1	1	N/A	ON	ON	ON	ON	0.46	ON	ON	RS232	RS232 (LOOPBACK)
X	0	0	0	X	Z	Z	Z	Z	----	OFF	OFF	SHUTDOWN	SHUTDOWN
1	1	0	0	X	Z	Z	Z	Z	----	OFF	OFF	RS485	INVALIDA
1	X	0	1	1/0	Z	Z	ON	ON	20/0.46	OFF	OFF	RS485	INVALIDA
1	0	1	0	X	ON	Z	Z	Z	-	OFF	OFF	RS485	INVALIDA
1	1	1	0	X	ON	Z	Z	Z	-	OFF	OFF	RS485	RS485 (RX)
1	1	1	1	1/0	ON	Z	ON	ON	20/0.46	OFF	OFF	RS485 TX	RS485 (RX+TX)
1	0	1	1	1/0	ON	Z	ON	ON	20/0.46	OFF	ON	RS485 TX	RS485 (LOOPBACK)

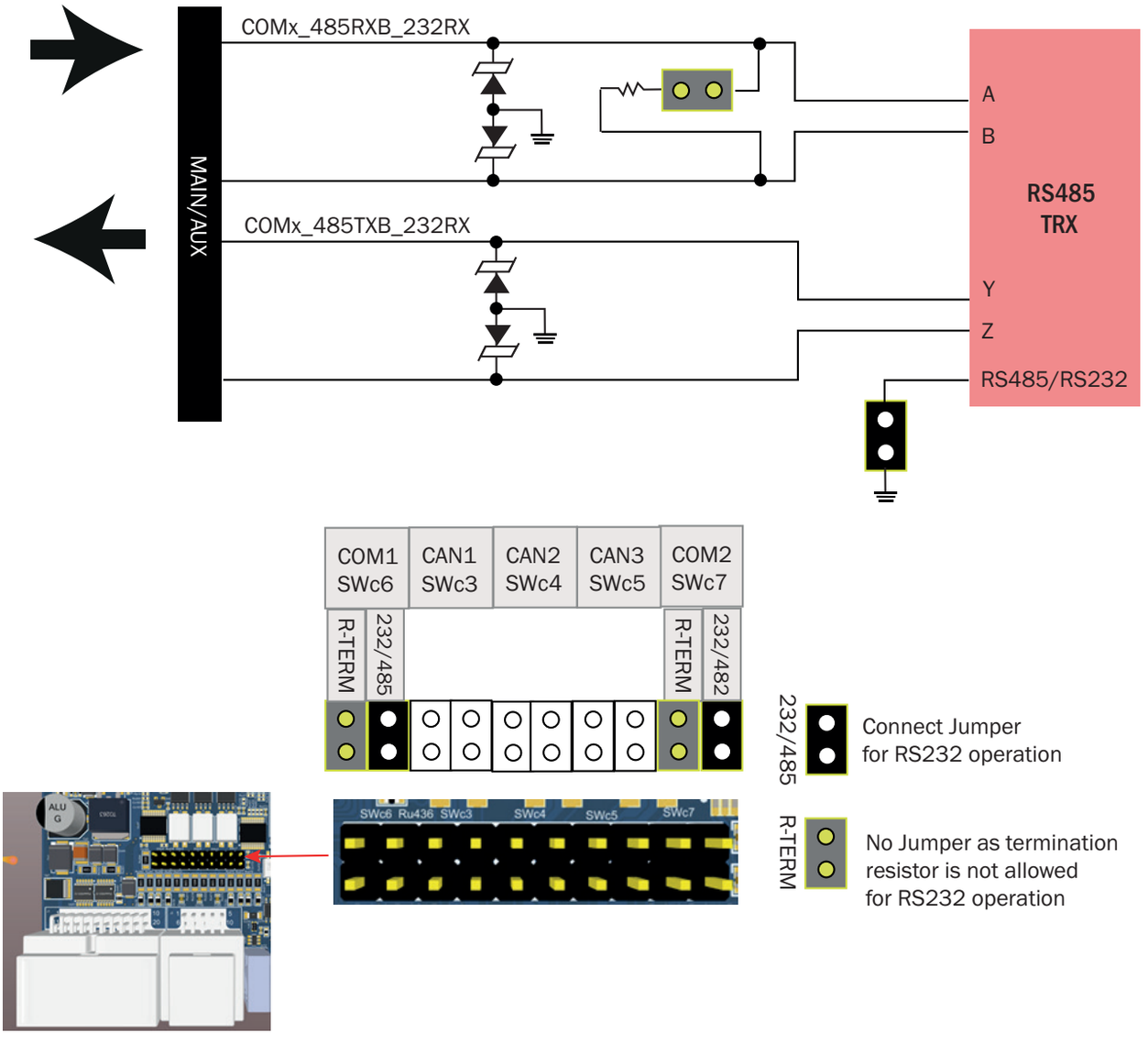
When COM1 or COM2 are configured for RS485 operation, termination resistors are populated con Carrier Board and can be connected internally with jumpers.

Remind to remove termination resistor jumper when transceiver is configured for RS232 operation.

Next figure shows configuration jumpers for COM1 and COM2 transceivers in RS485 mode.



Next figure shows configuration jumpers for COM1 and COM2 transceivers in RS232 mode.



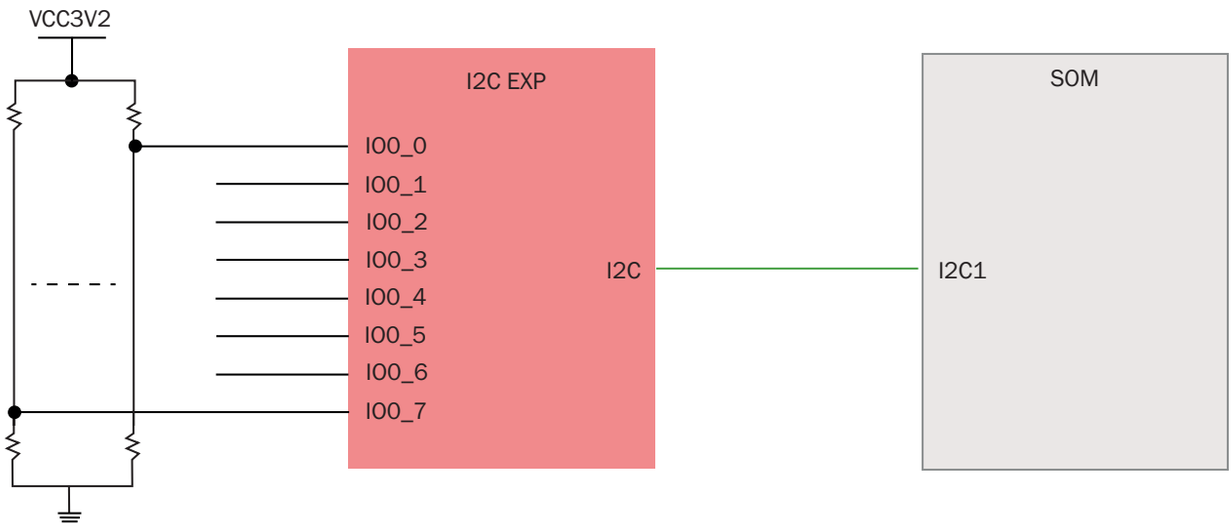
1.28 Hardware Identification

Carrier Board includes I2C expander PCA9557, which datasheet can be downloaded at http://www.ti.com/lit/ds/symlink/pca9557.pdf. It is connected to I2C1 SOM with I2C address configured on carrier board to be 0x18.

A2	A1	A0	ADDRESS (7-BIT)
GND	GND	GND	0011 000 – 0x18

The purpose is to configure with populated and not populated resistors the identification code for a specific PCB and assembly variant so Linux can identify hardware to configure software as needed.

Next figure shows internal connection for this I2C expander.



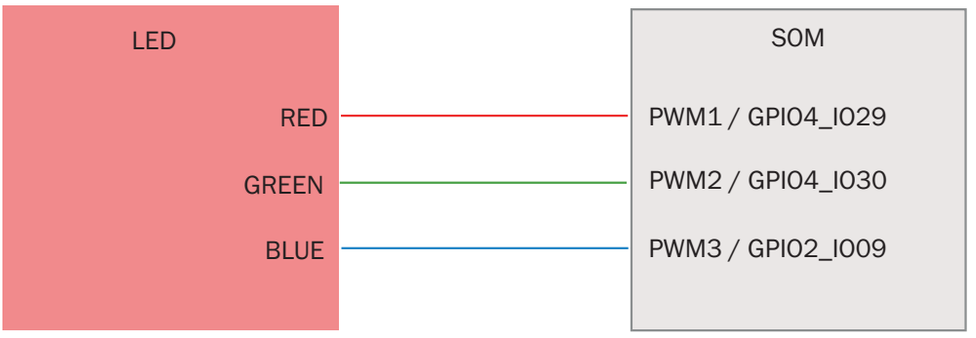
Currently defined IDs for MTX-STAROAD II are:

ID	VARIANT
0x00	PROTOTYPE
0x11	STANDARD

1.29 RGB LED

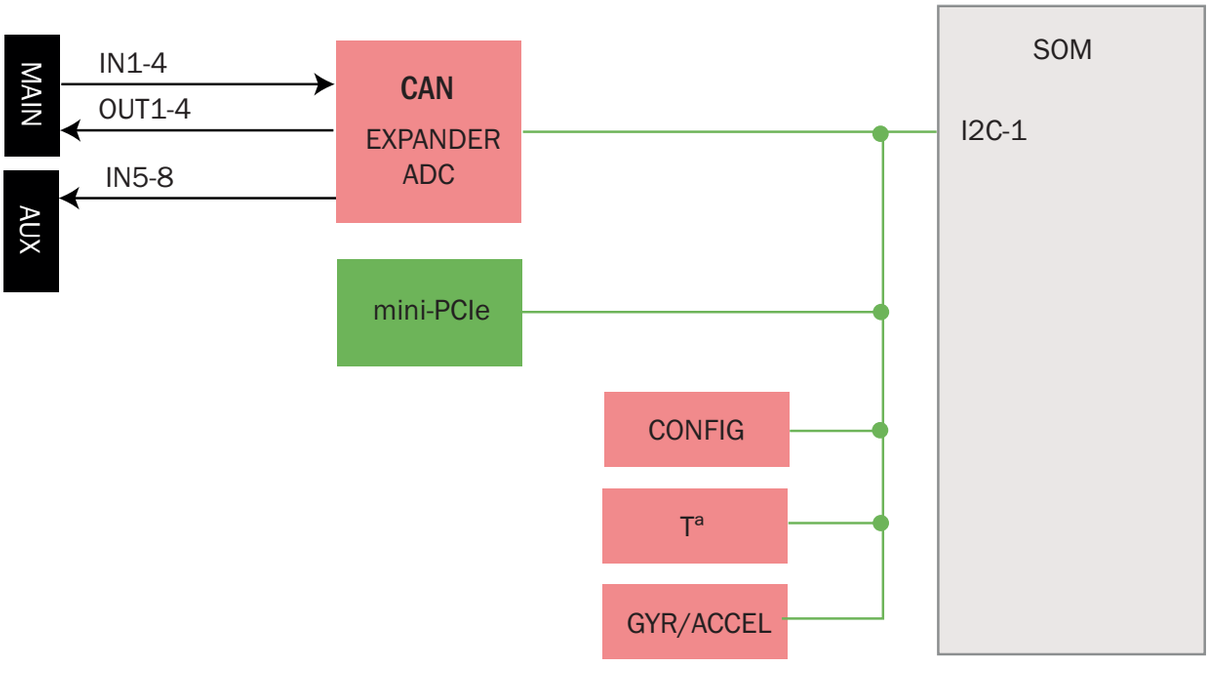
MTX-STAROAD II has a RGB led on Front Panel (identified with icon) that is controlled by SOM to show system status.

Next figure shows RGB Led connection with SOM.



1.30 I2C Connected Devices

Bellow figure shows a summary of every I2C devices on carrier board.



DEVICES CONNECTED TO SOM I2C1	
ADDRESS (7-BIT)	**DEVICE**
0011 000 – 0x18	Hardware identification expander
1001 000 – 0x48	Temperature sensor
1010 001 – 0x51	ADC for general purpose output current sensing

1101 010 – 0x6A	Gyroscope + accelerometer
1110 100 – 0x74	General purpose input/output expander
TBD	Remind any device connected to miniPCIe slot

1.31 FRAM Memory

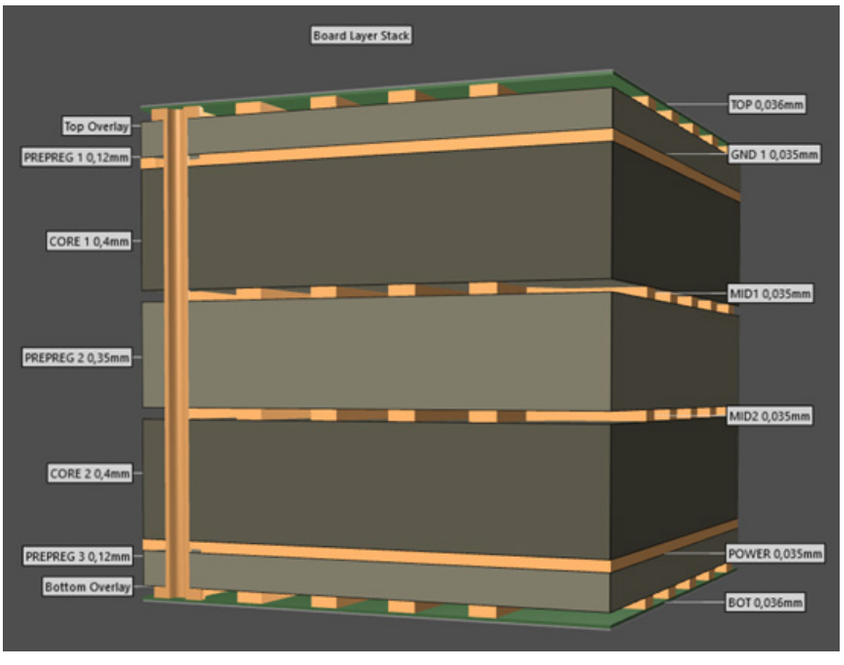
Carrier board has a 64Kbits (8KB) FerroRAM technology non volatile memory. It is a Cypress FM25CL64 which datasheet can be available at https://www.cypress.com/file/41676/download.

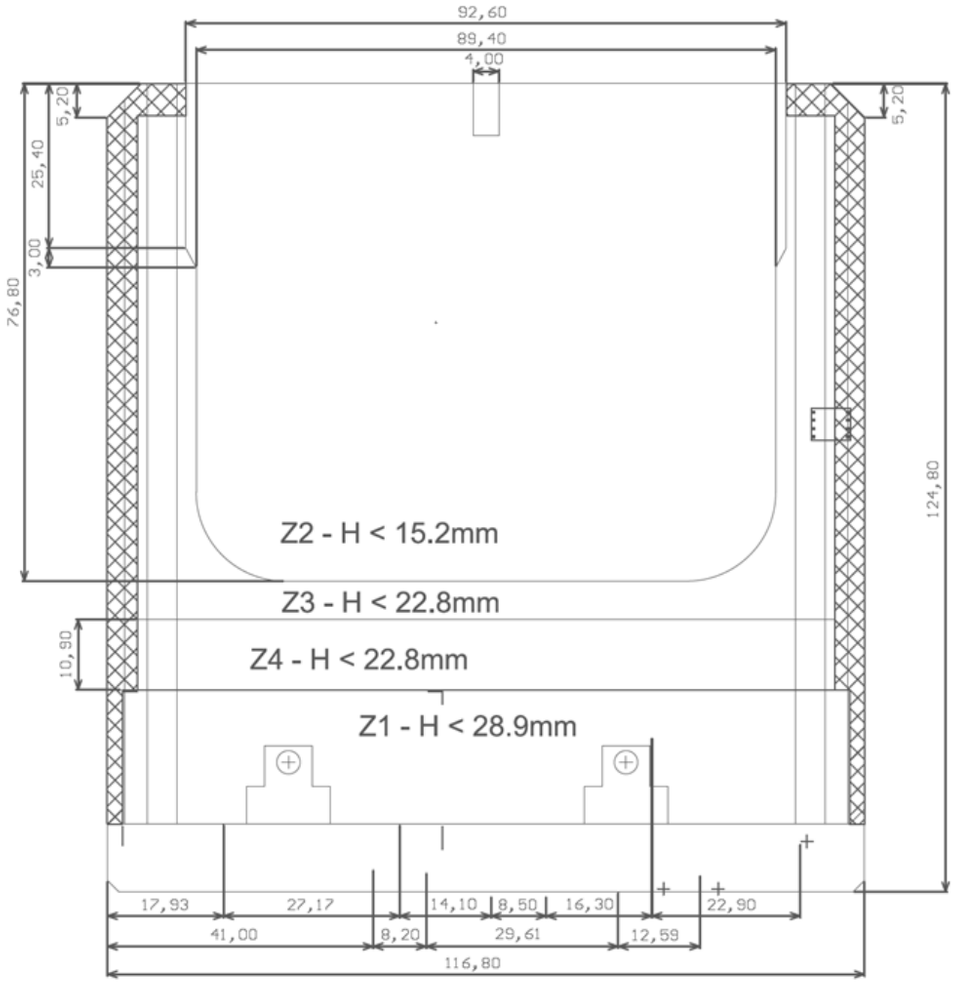
As can be shown on main diagram block (see chapter 1.2) it is connected to SOM SPI2 with SS0 as grant signal.

Such a memory can be used as a fast temporary non-volatile buffer without memory aging (theoretically allows up to 1014cycles) and no need for write delay time.

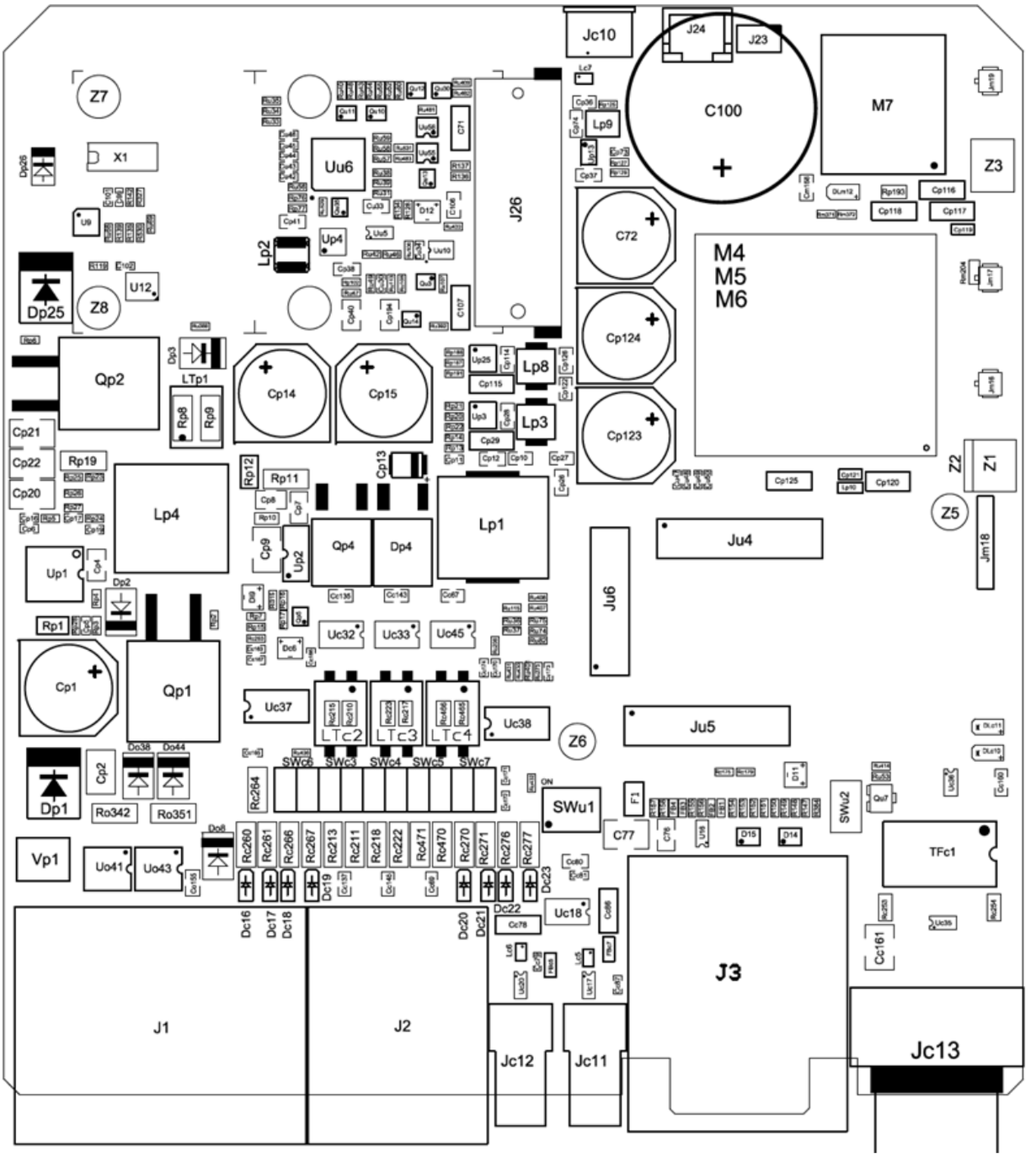
1.32 Carrier Board

Carrier Board PCB is a six sided 1.6mm thickness stack-up as shows next figure.

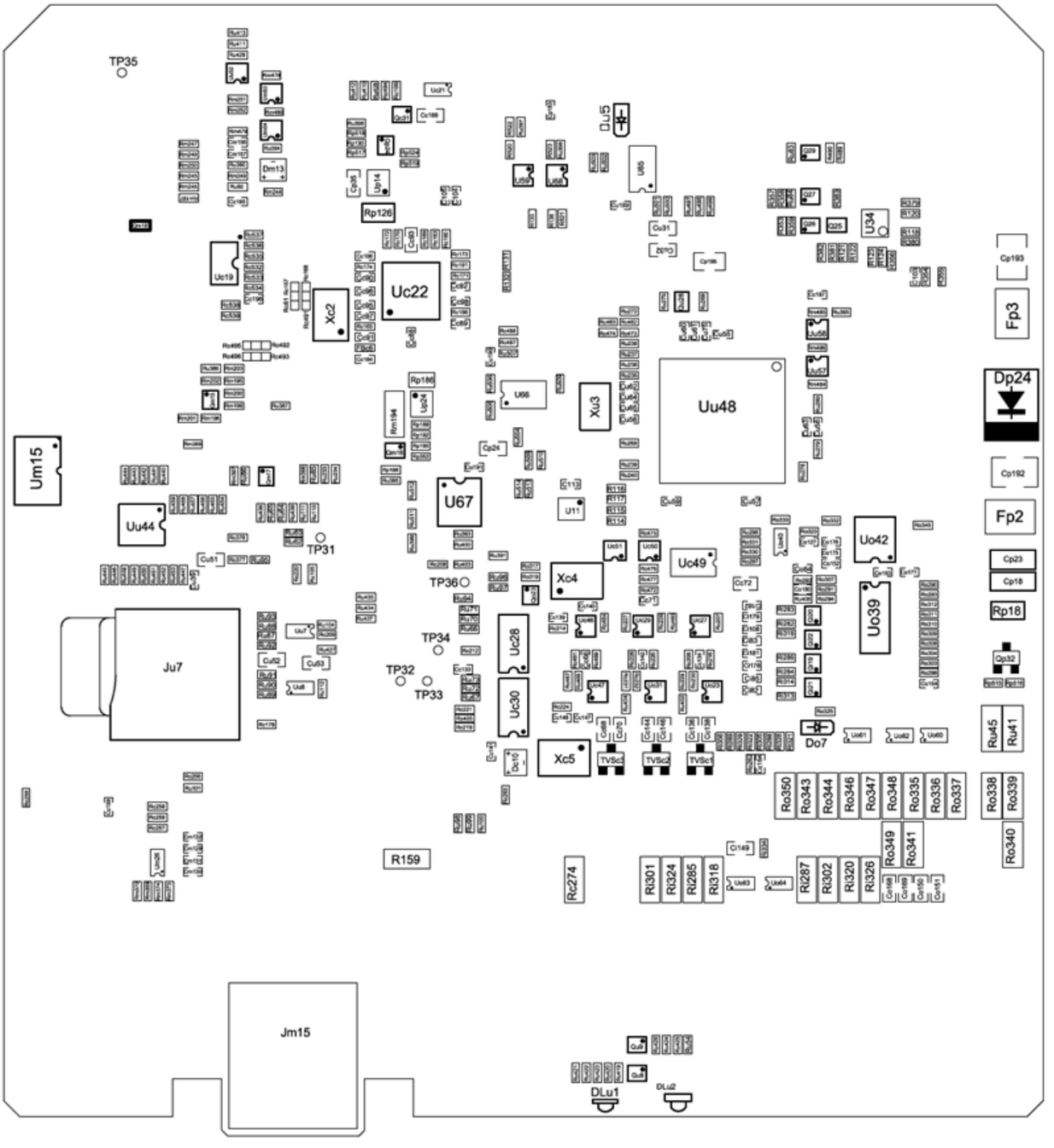



92,60
89,40
4,00
5,20
25,40
3,00
76,80
5,20
124,80
Z2 - H < 15.2mm
Z3 - H < 22.8mm
Z4 - H < 22.8mm
Z1 - H < 28.9mm
10,90
17,93
27,17
14,10
8,50
16,30
22,90
41,00
8,20
29,61
12,59
116,80

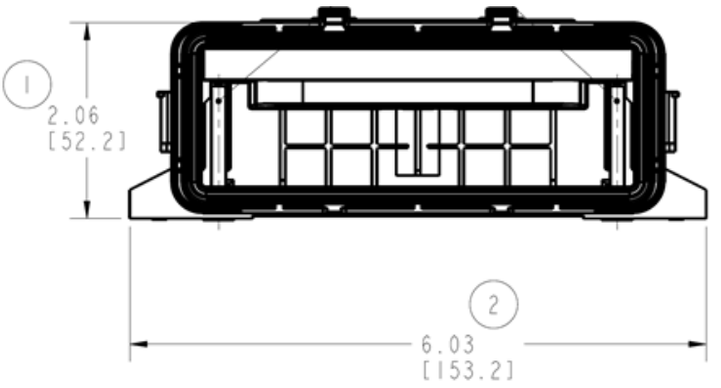
This figure shows top side components location.

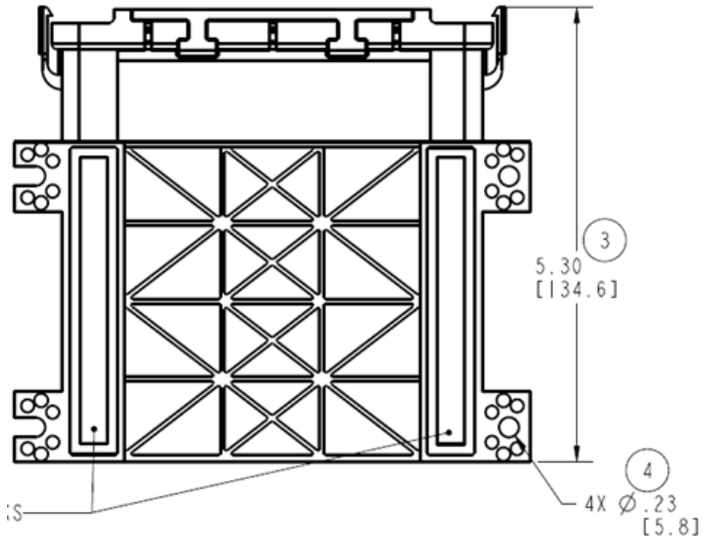


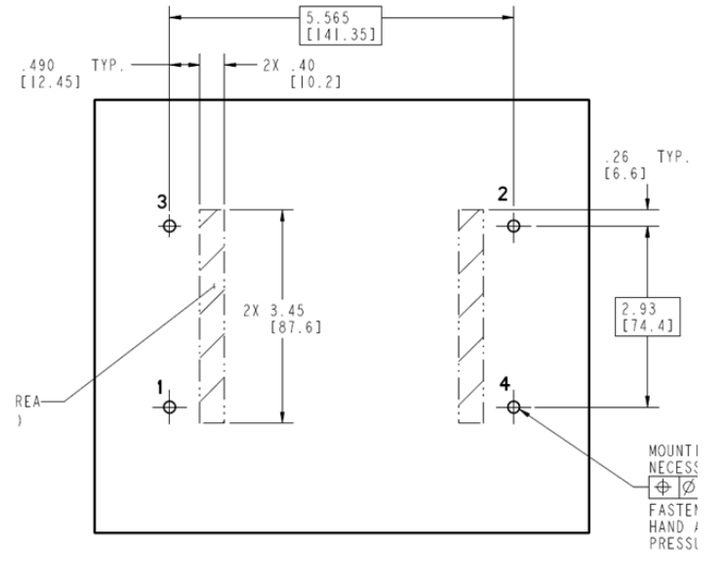
This figure shows bottom side components location.



1.33 Enclosure







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