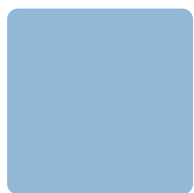


Hardware Documentation

FSSMBB *F&S SMARC V2.11 Carrier Board* *for HW Revision 1.10*

Version 004/02.2025



**Elektronik
Systeme**

© F&S Elektronik Systeme GmbH
Untere Waldplätze 23
D-70569 Stuttgart

www.fs-net.de

Phone: +49(0)711-123722-0

About This Document

This document describes how to use the F&S SMARC Base Board (further named as carrier) with mechanical and electrical information. The latest version of this document can be found at: www.fs-net.de.

ESD Requirements



All F&S hardware products are electrostatic discharge (ESD) sensitive. 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.

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.

History

Version/Date	Platform	Added (A) Removed (R) Modified (M)	Chapter	Description	Author
001/09.2024	-	-	All	Initial Version	SM
002/02.2025	-	M	All	New Revision, new template	SM
003/02.2025	-	-	-	Change filename	SM
004/02.2025	-	M	4.2	Change link	SM

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1 Overview

1.1 Additional Documentation

The carrier follows the SMARC V2.1.1 specification and is designed to support F&S SMARC modules (further called module). The latest versions of the documents can be found on www.fs-net.de.

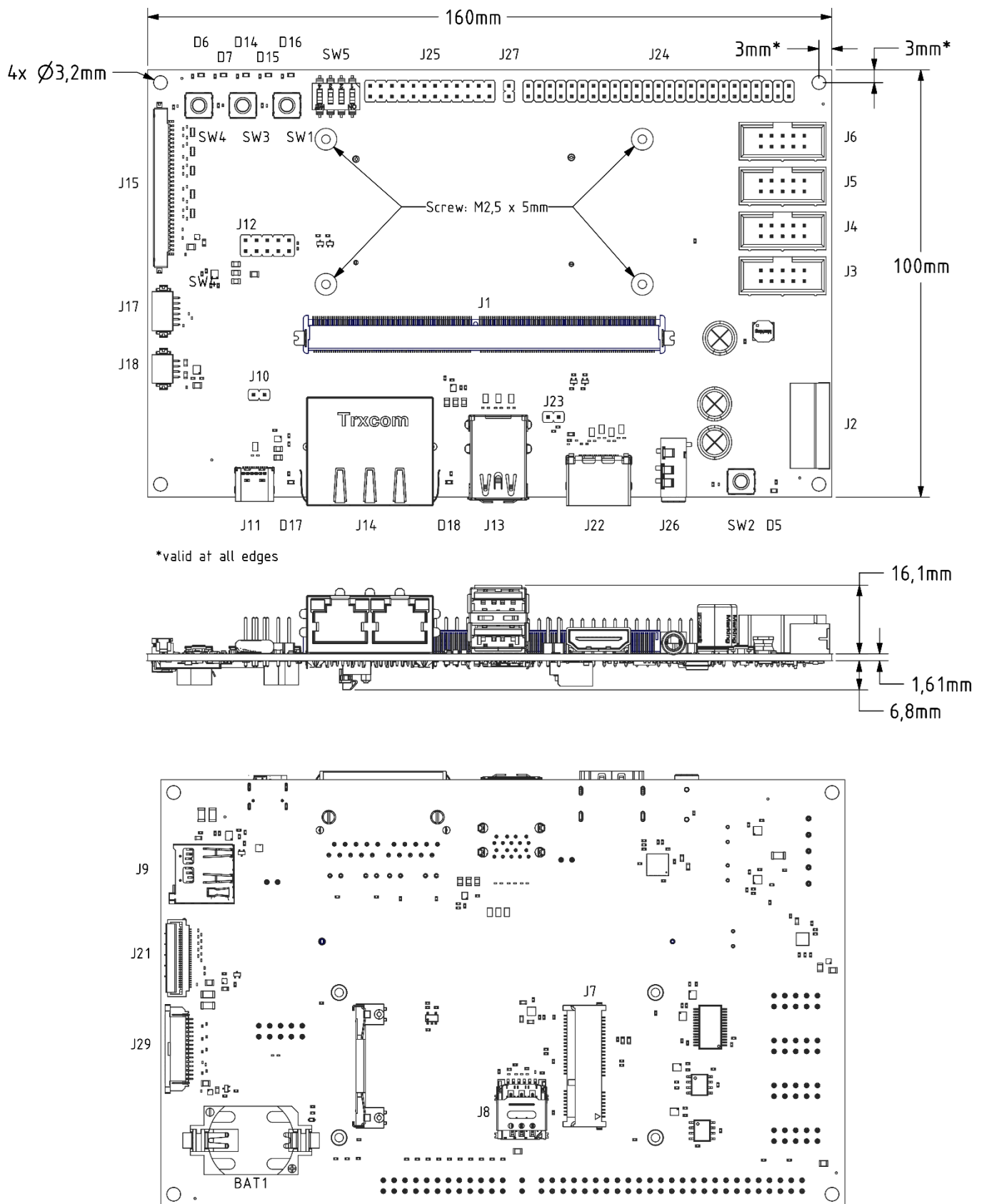
1.2 General Parameter

Parameter	Description
Dimension	160.0 mm x 100.0 mm x 25.5 mm
Weight	≈ 115.0 g
Operating Temperature	-20.0 °C ... +70.0 °C
Mounting Holes	4x Ø 3.2 mm
Mounting Holes SMARC Module	4x M 2.5 (recommended screw length: 5.0 mm)

Table 1: General parameter

1.3 Dimensions and Connectors

1.3.1 Technical Drawing



Note: All dimensions are in mm.

Figure 1: Technical drawing

1.3.2 Connectors

Ref.	Description	Connector Type	Counter Part
J1	Board-to-board connection	MXM3 314pos RM: 0,50mm	
J2	Power Input	Phoenix Contact, MC 1,5/5-G-3,81	Phoenix Contact, MC 1,5/ 5-ST-3,81 ¹
J3	UART A (RTS/CTS)	2x5 RM: 2.54 mm, shrouded	
J4	UART B	2x5 RM: 2.54 mm, shrouded	
J5	UART C	2x5 RM: 2.54 mm, shrouded	
J6	CAN A	2x5 RM: 2.54 mm, shrouded	
J7	Mini PCI Express	Full Size	
J8	SIM Card	Nano SIM	
J9	SD Card	Micro SD	
J10	SDIO WP (write protect)	1x2 pin header, RM: 2.54 mm	
J11	USB0 (USB 2.0, OTG)	Type C	
J12	USB1 & USB5 (USB 2.0)	2x5 pin header, RM: 2.54 mm	
J13	USB2 (top) & USB3 (bottom) (USB 3.0)	2x Typ A 3.0	
J14	GBE0 (right) & GBE1 (left)	2x RJ45 Gigabit Ethernet Connector	
J15	LVDS0&1 incl. I2C_LCD	Hirose, MDF76GW-30S-1H	Hirose, MDF76-30P-1C ¹
J17	General Purpose Connector (I2C_LCD, GPIO, 3.3 V)	Hirose, DF13-06	Hirose, DF13-6S-1.25C
J18	Backlight (5.0 V)	Hirose, DF13-04	Hirose, DF13-4S-1.25C ¹
J21	DSI CAM1	Hirose, FH41-28S-0.5SH(05)	FFC, 28pos, pitch: 0.5 mm, thickness: 0.3 mm ¹
J22	HDMI	Type A	
J23	HDMI CEC & HEC	1x2 pin header, RM: 2.54 mm	
J24	Feature Connector	2x25 pin header, RM: 2.54 mm	
J25	SMARC Signal Connector	2x12 pin header, RM: 2.54 mm	
J26	Audio Jack (Headphone & Microphone)	4 pin, 3.5 mm Audio Jack	
J27	5.0 V external (cooling fan)	1x2 pin header, RM: 2.54 mm	
J29	DSI CAM0	Amphenol, SFW15R-1	FFC/FPC, 15pos, pitch: 1.0 mm, thickness: 0.3 mm ¹
SW1	Force Recovery	Tactile button	
SW2	Power	Tactile button	
SW3	Sleep	Tactile button	
SW4	Reset	Tactile button	
SW5	Boot Select	DIP switch	
D5	V_MOD Indicator	LED yellow	
D6	V_5V0_PWON Indicator	LED yellow	
D7	V_3V3_STBY Indicator	LED yellow	
D14	mPCIe LED WWAN	LED yellow	
D15	mPCIe LED WLAN	LED yellow	
D16	mPCIe LED WPAN	LED yellow	
D17	GBE0 L100	LED yellow	
D18	GBE1 L100	LED yellow	
BAT1	RTC Battery	CR2032 3.0V	

¹Connectors and preassembled cables are available for purchase at www.fs-net.de.

Table 2: Connector description

1.4 Power Management

1.4.1 Power Supply

The power supply for the carrier has to be connected at J1. There are two different supplies. The RTC (Real Time Clock) only must be connected when needed.

If higher input voltages are needed, the ADP-NT24V4¹ power supply module can be directly connected.

¹More Information can be found on www.fs-net.de

Pin	Signal Name	Voltage	Description
1	n.c.		
2	V_3V0_RTC	3.0V	Voltage input for the RTC, parallel to BAT1 see 2.15
3	V_5V_IN	5.0V	Voltage Input, max. 8A ¹
4	GND		
5	n.c.		

¹Maximum possible power consumption of the carrier: 10 A. Please see "1.4.3 Power usage block diagram".

Table 3: J2 pin description

1.4.2 System Control

There are various buttons (see Table 4) to control the carrier and the mounted SMARC module. As simple indicators, three LEDs (see Table 5) shows the active voltages.

Ref	Signal Name	Voltage	Description
SW1	FORCE_RECOV#	-	Allows restoring from USB0 or invoke the native force recovery on the module
SW2	POWER_BTN#	-	Start standby voltage rails on module
SW3	SLEEP#	-	
SW4	RESET_IN#	-	Triggers a forced reset

Table 4: Button description

Ref	Signal Name	Voltage	Description
D5	V_MOD_IN	5.0 V	Main supply for the SMARC module
D6	V_5V0_PWON	5.0 V	Supply domain for USB, CAM, HDMI, Backlight, & 5V ext. (Fan)
D7	V_3V3_STBY	3.3 V	Supply domain for UART, CAN, mPCIe, Audio, LVDS, SDIO

Table 5: Indicator LED description

1.4.3 Power usage block diagram

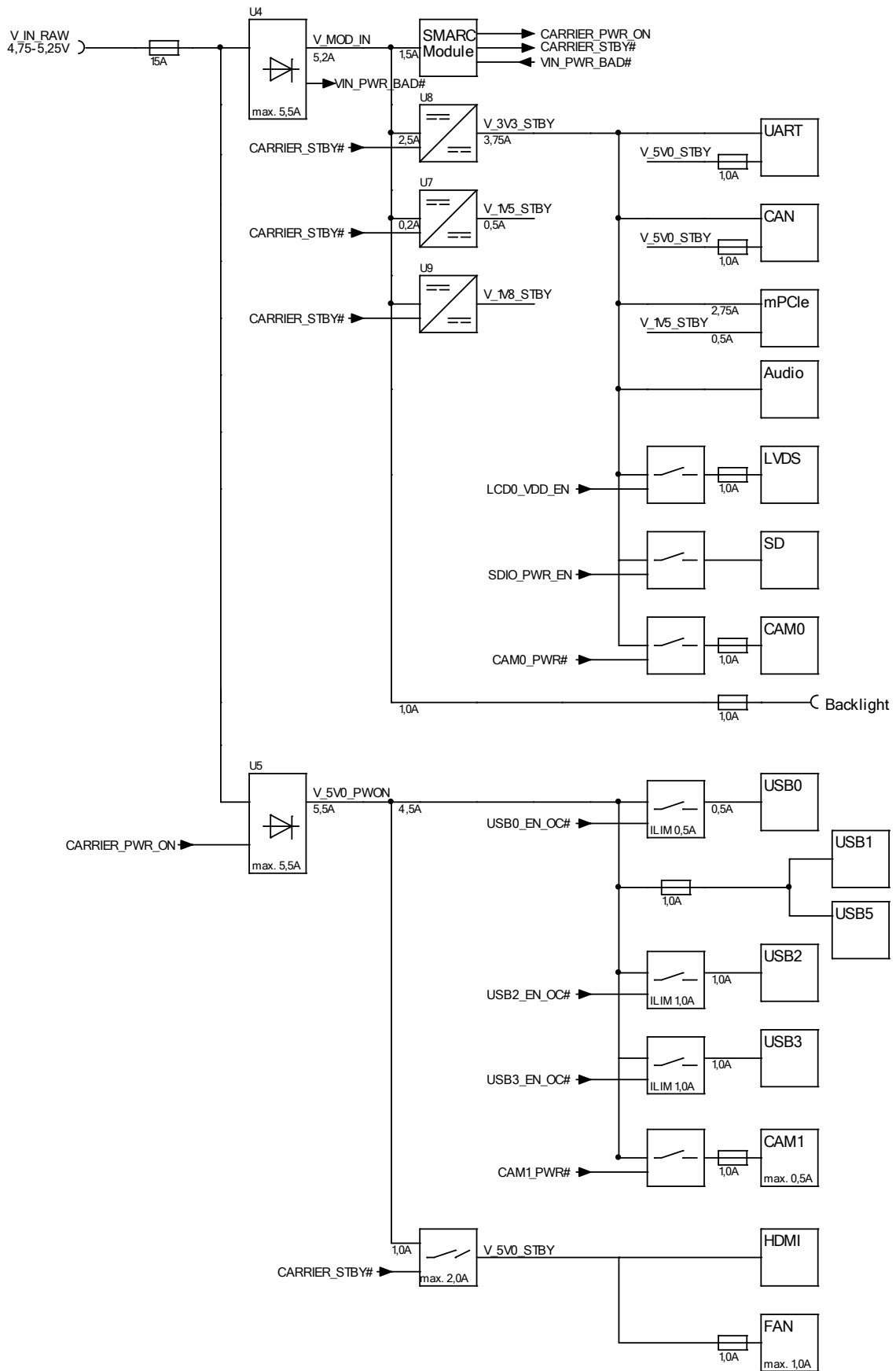


Figure 2: Power usage block diagram

1.5 Boot Select

The boot select signals are connected to dip switch SW5. The selectable boot sources are listed in table 7 and depend on the module.

Pos	Signal Name
1	BOOT_SEL2#
2	BOOT_SEL1#
3	BOOT_SEL0#
4	n.c.

Table 6: SW5 description

#	Boot select dip position			Boot source
	2	1	0	
0	ON	ON	ON	Not available on this carrier
1	ON	ON	OFF	Carrier SD Card
2	ON	OFF	ON	Not available on this carrier
3	ON	OFF	OFF	Carrier SPI (CS0#)
4	OFF	ON	ON	Module device (NAND, NOR) – vendor specific
5	OFF	ON	OFF	Remote boot (GBE, serial) – vendor specific
6	OFF	OFF	ON	Module eMMC Flash
7	OFF	OFF	OFF	Module SPI

Table 7: Truth table boot device

1.6 UART

The carrier supports four serial ports (SER0 to SER3). SER 3 is Connected to the feature connector without transceiver (see chapter „1.16 Feature Connector (J24)“).

1.6.1 SER0 (RS232) (J3)

Pin	Signal Name	Voltage	Description
3	UART_A_RX	5.5 V	
4	UART_A_RTS	5.5 V	
5	UART_A_TX	5.5 V	
6	UART_A_CTS	5.5 V	
9	GND		
10	V_UART_5V0	5.0 V	Max. 1.0 A, fused

Table 8: J3 pin description

1.6.2 SER1 (RS232) (J4)

Pin	Signal Name	Voltage	Description
3	UART_A_RX	5.5 V	
5	UART_A_RTS	5.5 V	
9	GND		
10	V_UART_5V0	5.0 V	Max. 1.0 A, fused

Table 9: J4 pin description

1.6.3 SER2 (RS485) (J5)

Pin	Signal Name	Voltage	Description
3	UART_C_N		
4	UART_C_P		
9	GND		
10	V_UART_5V0	5.0 V	Max. 1.0 A, fused

Table 10: J5 pin description

1.7 CAN

The carrier supports two CAN ports. CAN0 is connected to a transceiver, CAN1 is directly connected to the feature connector (see chapter „1.16 Feature Connector (J24)“).

1.7.1 CAN0 (J6)

Pin	Signal Name	Voltage	Description
1	V_CAN_5V0	5.0 V	Max. 1.0 A, fused
2	GND		
3	CAN_A_LOW		120 Ω terminated
4	CAN_A_HIGH		
5	GND		

Table 11: J3 pin description

1.8 USB

The carrier supports five USB ports.

1.8.1 USB 0: 2.0 OTG(J11)

EN/OC- (Enable / Overcurrent) and OTG- (On the Go) functionalities are supported. The current is limited to typ. 0.50 A. This port is used for recovery.

1.8.2 USB1 & USB5: 2.0 (J12)

The carrier does not support the EN/OC functionality for these ports.

Pin	Signal Name	Voltage	Description
1	USB15_VBUS	5.0 V	Max. 1.0 A, fused
2			
3	USB5_D_N		
4	USB1_D_N		
5	USB5_P_N		
6	USB1_P_N		
7	GND		
8	GND		

Table 12: J12 pin description

1.8.3 USB2 & USB3: 3.0 (13)

EN/OC functionality is supported. The current is limited to 1.0 A.

1.8.4 USB4: 2.0, Mini PCI Express

USB4 is connected to the mini PCI Express port. EN/OC is not supported.

1.9 Display

The carrier supports HDMI and 8 bit LVDS display signals.

1.9.1 LVDS0 & LVDS1 (J15)

Pin	Signal Name	Voltage	Description
1	LVDS0_D0_N		
2	LVDS0_D0_P		
3	LVDS0_D1_N		
4	LVDS0_D1_P		
5	LVDS0_D2_N		
6	LVDS0_D2_P		
7	GND		
8	LVDS0_CLK_N		
9	LVDS0_CLK_P		
10	LVDS0_D3_N		
11	LVDS0_D3_P		
12	LVDS1_D0_N		
13	LVDS1_D0_P		
14	GND		
15	LVDS1_D1_N		
16	LVDS1_D1_P		
17	GND		
18	LVDS1_D2_N		
19	LVDS1_D2_P		
20	LVDS1_CLK_N		
21	LVDS1_CLK_P		
22	LVDS1_D3_N		
23	LVDS1_D3_P		
24	GND		
25	I2C_LCD_SDA_3V3	3.3 V	
26	LCD0_IRQ_3V3	3.3 V	SMARC signal: LCD0_BKLT_EN
27	I2C_LCD_SCL_3V3	3.3 V	
28	LCD0_RST_3V3	3.3 V	SMARC signal: LCD0_BKLT_PWM
29	V_LCD_3V3_F1A	3.3 V	Max. 1.0 A, fused; switched with Signal LCD0_VDD_EN
30			

Table 13: J15 pin description

1.9.2 Backlight supply (J18)

J18 is meant to supply a backlight with 5.0 V, especially designed for F&S displays.

Pin	Signal Name	Voltage	Description
1	V_5V0_BKLT	5.0 V	Max. 1.0 A, fused
2	V_5V0_BKLT	5.0 V	Optional LCD1_BKLT_EN (3.3 V)
3	GND		Optional LCD1_BKLT_PWM (3.3 V)
4	GND		

Table 14: J18 pin description

1.9.3 HDMI (J22, J23)

Connector type (J22): HDMI Type A

The CEC and HEC signals are on J23 for development purposes.

1.10 Camera

The carrier supports two CSI camera ports.

1.10.1 CSIO: 2 bit (J29)

Pin	Signal Name	Voltage	Comment
1	GND		
2	CSIO_D0_N		
3	CSIO_D0_P		
4	GND		
5	CSIO_D1_N		
6	CSIO_D1_P		
7	GND		
8	CSIO_CLK_N		
9	CSIO_CLK_P		
10	GND		
11	CAM0_RST#		
12	CAM_MCK		
13	I2C_CAM0_SCL		
14	I2C_CAM0_SDA		
15	V_CAM0_3V3_F1A	3.3 V	Max. 0.5 A, fused. Switched with signal CAM0_PWR#

Table 15: J29 pin description

1.10.2 CSI1: 4 bit (J21)

The CSI1 connector pinning fits Basler's BCON for MIPI interface.

For more information see <https://docs.baslerweb.com/bcon-for-mipi-interface-description>.

Pin	Signal Name	Voltage	Description
1	GND		
2	CSIO_D3_P		
3	CSIO_D3_N		
4	GND		
5	CSIO_D2_P		
6	CSIO_D2_N		
7	GND		
8	CSIO_CLK_P		
9	CSIO_CLK_N		
10	GND		
11	CSIO_D1_P		
12	CSIO_D1_N		
13	GND		
14	CSIO_D0_P		
15	CSIO_D0_N		
16	GND		
17	n.c.		

18	n.c.		
19	GND		
20	I2C_CAM1_SCL		
21	I2C_CAM1_SDA		
22	GND		
23	n.c.		
24	n.c.		
25	V_CAM1_5V0_F1A	5.0 V	Max. 1.0A, fused Switched with signal CAM1_PWR#
26			
27			
28	GND		
S	Shield		Connected through 1 nF (opt. 1 M Ω) to GND

Table 16: J21 pin description

1.11 Gigabit Ethernet (J14)

The carrier supports two gigabit ethernet ports. GBE0 on the right and GBE1 on the left connector of J14.

The LEDs on J14 are connected to GBE_LINK_ACT# (yellow) and GBE_LINK1000# (green). The two separate LEDs (D17, D18) are connected to GBE_LINK100#.

1.12 Audio (J26)

A SGT5000 audio codec is mounted on the carrier. It is connected to I2S0 of the module. Headphone and microphone are connected to J26. Line in & out are connected to the feature connector (see chapter “2.14 Feature Connector”).

1.13 Mini PCI Express (J7)

The carrier supports one Full-Mini PCI express (mPCIe) module on the PCIE_A port of the SMARC module.

1.13.1 LEDs

D14, D15 & D15 on the carrier are connected to the WWAN, WLAN and WPAN signals of the mPCIe connector.

1.13.2 SIM (J8)

A nano sim socket is connected to the mPCIe connector for GSM functionalities.

1.14 Micro SD Card (J9)

The carrier has a micro SD card slot connected to the SDIO port of the module. With J10 (1x2 pin header, RM 2.54 mm) you can connect the signal SDIO_WP to GND.

1.15 General Purpose Connector (J17)

The general purpose connector is designed to connect a peripheral device like a touch sensor.

Pin	Signal Name	Voltage	Description
1	V_3V3_STBY	3.3 V	
2	I2C_LCD_SDA		
3	I2C_LCD_SDA		
4	GPIO12		
5	GPIO13		
6	GND		

Table 17: J17 pin description

1.16 Feature Connector (J24)

The feature connector includes several signals and buses for an easy access.

Pin	Signal Name	Voltage	Description
1	V_3V3_STBY	3.3 V	
2	V_5V0_STBY	5.0 V	
3	SPIO_CLK		
4	SPIO_CS0#		
5	SPIO_MOSI		
6	SPIO_MISO		
7	I2S2_SDIN		
8	GPIO4		
9	I2S2_SDOUT		
10	AU_MCLK		Audio master clock
11	GND		
12	I2S2_LRCLK		
13	SER3_TX		
14	I2S2_CLK		
15	SER3_RX		
16	I2C_GP_SCL		
17	I2C_GP_SDA		
18	SPIO_CS1#		
19	SPI1_CS0#		
20	SPI1_CS1#		
21	SPI1_CLK		
22	SPI1_MOSI		
23	SPI1_MISO		
24	CAN1_RX		No transceiver, no termination
25	V_1V8_STBY	1.8 V	
26	CAN1_TX		No transceiver, no termination
27	GND		
28	V_1V8_STBY	1.8 V	
29	I2C_PM_SDA		
30	I2C_PM_SCL		
31	GPIO5		
32	GPIO6		
33	GPIO7		
34	GPIO8		
35	GPIO9		
36	GPIO10		
37	GND		
38	GPIO11		
39	V_3V3_STBY	3.3 V	
40	V_5V0_STBY	5.0 V	
41	AU_MICIN		Microphone IN to audio codec, parallel to J26
42	GND		
43	n.c.		
44	FCON_A_LIN_R		LINE IN right to audio codec
45	FCON_A_LOUT_R		LINE OUT right from audio codec

46	GND		
47	GND		
48	FCON_A_LIN_L		LINE IN left to audio codec
49	FCON_A_LOUT_L		LINE OUT left from audio codec
50	GND		

Table 18: J24 pin description

1.17 SMARC Signal Connector (J25)

The SMARC signal connector includes some of the SMARC specific signals. The connector provides a 1 k Ω for each signal, to pull the signals down easily.

Pin	Signal Name	Description
1	GBE0_SDP	IEEE 1588 trigger signal for hardware implementation of PTP (Precision Time Protocol) on ethernet port GBE2.
2	n.c.	
3	GBE1_SDP	IEEE 1588 trigger signal for hardware implementation of PTP (Precision Time Protocol) on ethernet port GBE1.
4	n.c.	
5	USB3_ID	Input pin to announce OTG device insertion on USB port 3.
6	1 k Ω pull down	
7	USB4_EN_OC#	USB over-current sense for USB port 4.
8	1 k Ω pull down	
9	RESET_OUT#	General purpose reset output to carrier board.
10	1 k Ω pull down	
11	WDT_TIME_OUT#	Watch-Dog-Timer Output, low active
12	1 k Ω pull down	
13	SMB_ALERT#	SMBus Alert# (Interrupt) Signal
14	1 k Ω pull down	
15	LID#	Lid open/close indication to module. Low indicates lid closure. Carrier to float the line in inactive state.
16	1 k Ω pull down	
17	CHARGER_PRSENT#	Held low by Carrier if DC input for battery charger is present.
18	1 k Ω pull down	
19	CHARGING#	Held low by carrier during battery charging. Carrier to float the line when charge is complete.
20	1 k Ω pull down	
21	TEST#	Held LOW by carrier to invoke module vendor specific test functions.
22	1 k Ω pull down	
23	BATLOW#	Battery low indication to module. Carrier to float the line in inactive state.
24	1 k Ω pull down	

Table 19: J25 pin description

1.18 RTC Battery (BAT1)

To supply the RTC on the module, there is a CR2032 battery socket for a 3V lithium cell on the carrier. The battery is in parallel to the input connector pin 2.

Note: The battery cell is not part of the carrier.

1.19 Fan supply connector (J27)

Pin	Signal Name	Voltage	Description
1	GND		
2	V_5V0_FAN	5.0 V	Max. 1 A, fused

Table 20: J27 pin description

2 Characteristics

2.1 Absolute Maximum Ratings

Description	Min	Max	Unit
Power Input			
Supply voltage	0.00	6.00	V
Real time clock supply voltage	-0.50	6.50	V
Signal Input			
UART input voltage (SER0 to SER2)	-0.30	5.70	V
Signal input voltage from SMARC connector (SER, I2C, CAN, GPIO)	-0.50	4.60	V
I2S0 signal input voltage to Audio codec	-0.30	2.20	V
Input voltage CAN A signals	-58.00	58.00	V
USB input voltage, all ports	-0.50	29.00	V
USB0 CC signal input voltage	-0.50	3.60	V
Audio Line IN input voltage	-0.30	3.60	V
UART input voltage (SER0 to SER2)	-0.30	5.70	V

Table 21: Absolute maximum ratings

2.2 Recommended Operating Conditions

Parameter	Description	Condition	Min	Typ	Max	Unit
General						
V_IN_RAW	Carrier supply voltage		4.75	5.00	5.25	V
V_3V0_RTC	RTC supply voltage		2.20	3.00	3.45	V
Storage						
T _{STORE}	Storage time	room temperature, no humidity control		6		months
		t _{amb} = 25°C ± 5°C humidity max. 60%		12 ⁴		months

⁴ For longer storage time, vacuum dry packs are recommended

Table 22: Recommended operating conditions

3 Packaging & Labels

3.1 ESD

All F&S electrostatic discharge sensitive (ESDS) products are marked and will be shipped in ESD protective packaging.

3.2 Serial Number

All shipped F&S products are labeled with a matrix code sticker that includes the serial number. For product information visit www.fs-net.de/en/support/serial-number-info-and-rma/.

4 Appendix

4.1 Second source rules

The qualifications of products from a second source are done autonomously by F&S. 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.

4.2 RoHS and REACH statement

Please see the following webpage: <https://www.fs-net.de/en/support/certifications/>

4.3 Important Notice

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