



Product Information

SP4-MAMBO

CompactPCI® Serial • PCI Express® Mini Card Carrier
Supports Wireless Technologies: 4G/LTE, WiFi, GNSS

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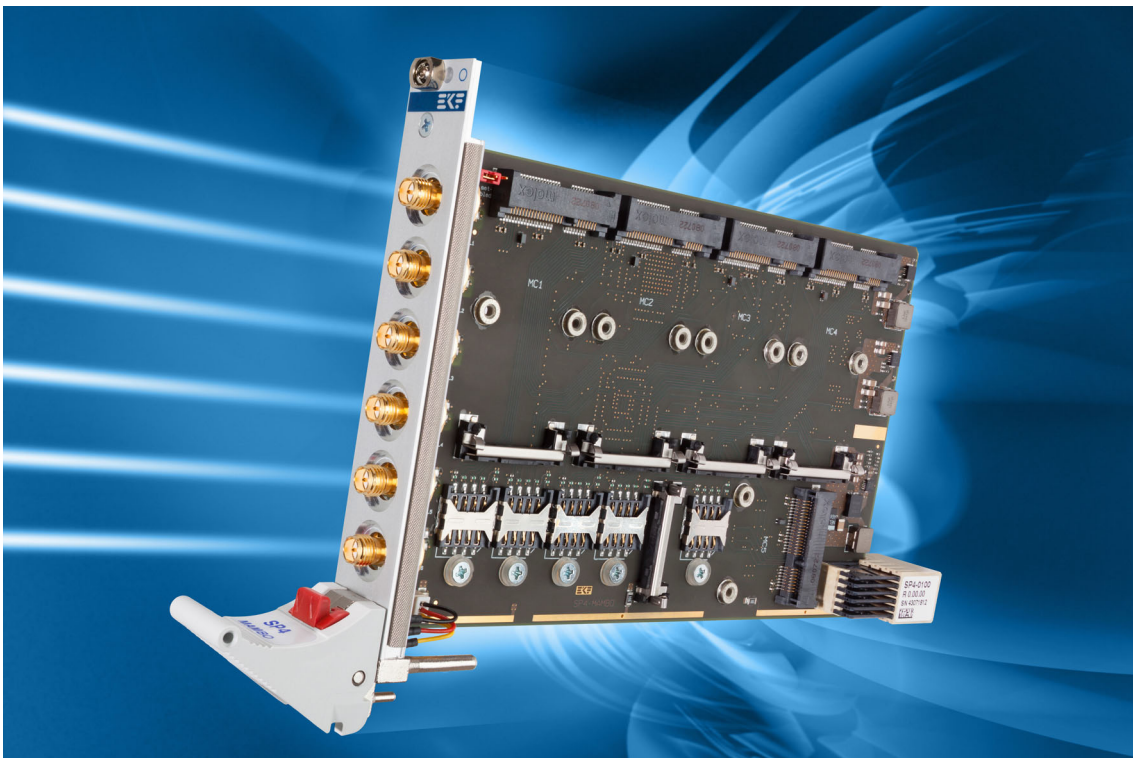


General

The SP4-MAMBO is a peripheral board for CompactPCI® Serial systems and serves as a quad PCI Express® Mini Card carrier, either full- or half-size style. An additional socket is provided for an optional mSATA module. Up to six SMA antenna connectors are available via the front panel, for MIMO operation of wireless Mini Cards, such as WiFi (WLAN) or 4G/LTE (WWAN). Any module socket is wired to an individual Micro SIM card holder.

Each PCI Express® Mini Card socket can accommodate either an USB or PCIe based module. The mSATA socket is suitable for either a SATA SSD, or an USB controlled Mini Card.

The SP4-MAMBO is equipped with an on-board Gen2 PCI Express® packet switch and a PCIe to USB 2.0 bridge, and can be installed into any peripheral slot of a CompactPCI® Serial backplane.



SP4-MAMBO

Feature Summary

General

- ▶ PICMG® CompactPCI® Serial standard (CPCI-S.0) peripheral slot card
- ▶ Single Size Eurocard 3U 4HP 100x160mm²
- ▶ Backplane connector P1 (PCIe x 1, USB 2.0, SATA)

PCI Express® Interface

- ▶ Gen2 PCI Express® 6-port packet switch
- ▶ Upstream port: PCI Express® x 1 Gen2 (5.0Gbps) or Gen1 (2.5Gbps) supported
- ▶ Downstream ports: 4 x PCIe Mini Card, 1 x PCIe quad port USB controller

PCI Express® Mini Card

- ▶ 4 x PCI Express® Mini Card sockets, full-size or half-size modules
- ▶ 4 x Micro SIM card holder associated (15mm x 12mm ETSI TS 102 221 V9.0.0, Mini-UICC)
- ▶ PCI Express® Mini Cards of both styles supported: USB and PCIe based
- ▶ Six F/P antenna connectors SMA R/P for MIMO wireless applications
- ▶ Custom specific F/P design for additional pigtail antenna connectors (8HP width)

mSATA Socket

- ▶ Socket suitable for a SATA SSD storage module or USB type Mini Card
- ▶ SATA 6G redrivers on-board for optimum signal integrity
- ▶ Micro SIM card holder associated (15mm x 12mm)
- ▶ mSATA requires SATA channel available from P1 backplane connector
- ▶ USB style Mini Card (mSATA socket) requires USB available from P1 backplane connector

Applications

- ▶ Wireless networking (WWAN LTE) with or w/o data transfer rate aggregation
- ▶ Industrial WLAN/Bluetooth communication - IoT
- ▶ Popular Mini Card sockets for general use, either PCIe based or USB 2.0 based Mini Cards

Feature Summary

Environment & Regulation

- ▶ Designed & Manufactured in Germany
- ▶ ISO 9001 certified quality management
- ▶ Long term availability
- ▶ Rugged solution (coating, sealing, underfilling on request)
- ▶ RoHS compliant
- ▶ Operating temperature: 0°C to +70°C (industrial temperature range on request)
- ▶ Storage temperature: -40°C to +85°C, max. gradient 5°C/min
- ▶ Humidity 5% ... 95% RH non condensing
- ▶ Altitude -300m ... +3000m
- ▶ Shock 15g 0.33ms, 6g 6ms
- ▶ Vibration 1g 5-2000Hz
- ▶ MTBF 39.6 years
- ▶ EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)

Theory of Operation

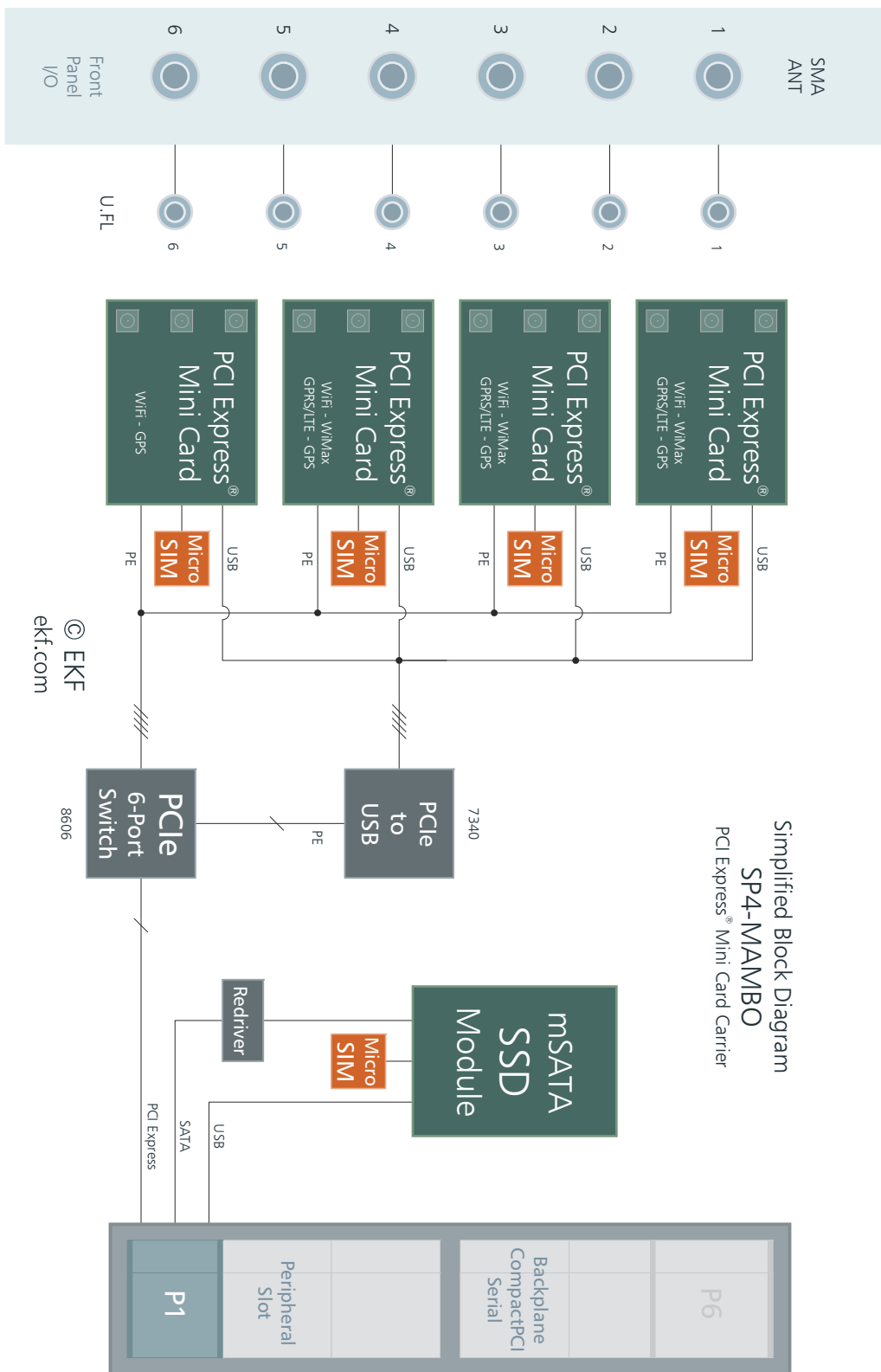
The SP4-MAMBO requires a single PCI Express® lane from the backplane, passed over across the connector P1 to a PCIe Gen2 packet switch (upstream port). The PCIe downstream ports from the switch are used to supply each Mini Card socket with an individual PCI Express® link, as required e.g. by WLAN Mini Cards. Another port from the PCIe packet switch feeds an on-board USB 2.0 controller, which is required for USB type Mini Cards, such as most modems. The related SIM card holders are suitable for 15mm x 12mm Micro SIM cards, which are most widely in use.

Any CompactPCI® Serial peripheral slot - in addition to its PCIe link - *may* provide a SATA channel and also an USB port, available from the backplane via connector P1. These ports are both routed to the optional on-board mSATA socket (SSD storage module). The SATA Rx/Tx signals are reconditioned by a 6Gbps SATA redriver, for optimum signal integrity. The mSATA connector can be used also with an USB style Mini Card. The associated Micro SIM card holder is positioned below the Mini Card module itself, due to space restrictions on the SP4-MAMBO PCB.

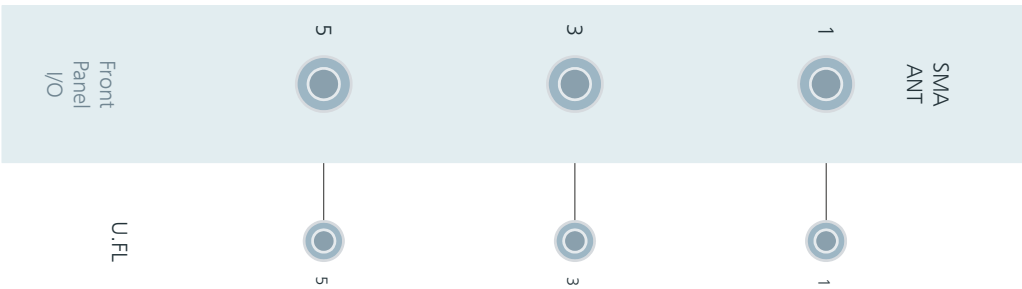


SP4-MAMBO • 4+1 Mini Card Sockets

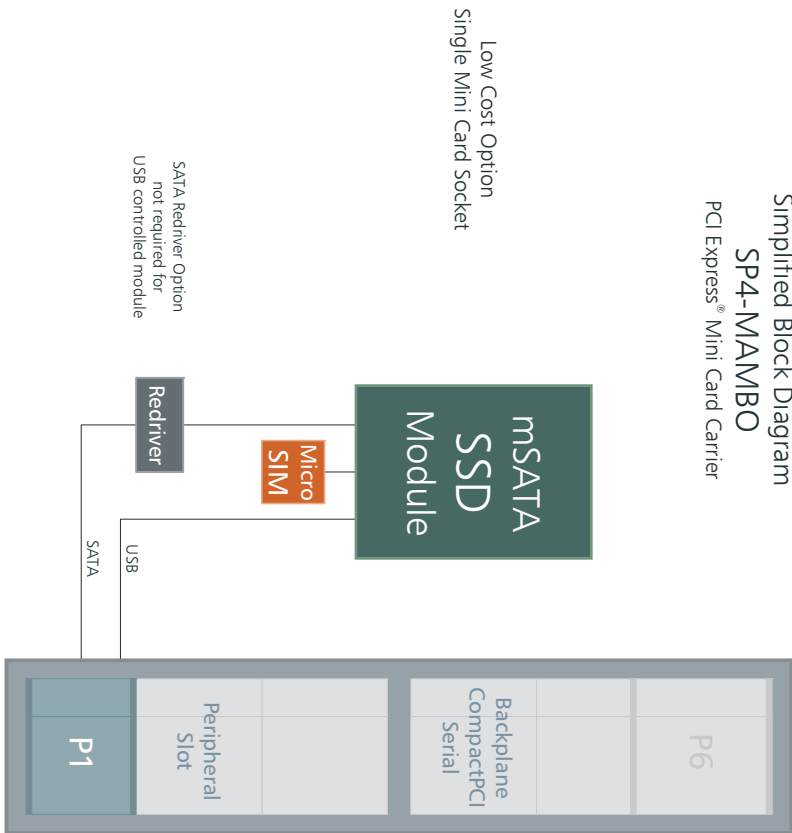
Block Diagram



SP4-MAMBO • MC1-MC5 Populated



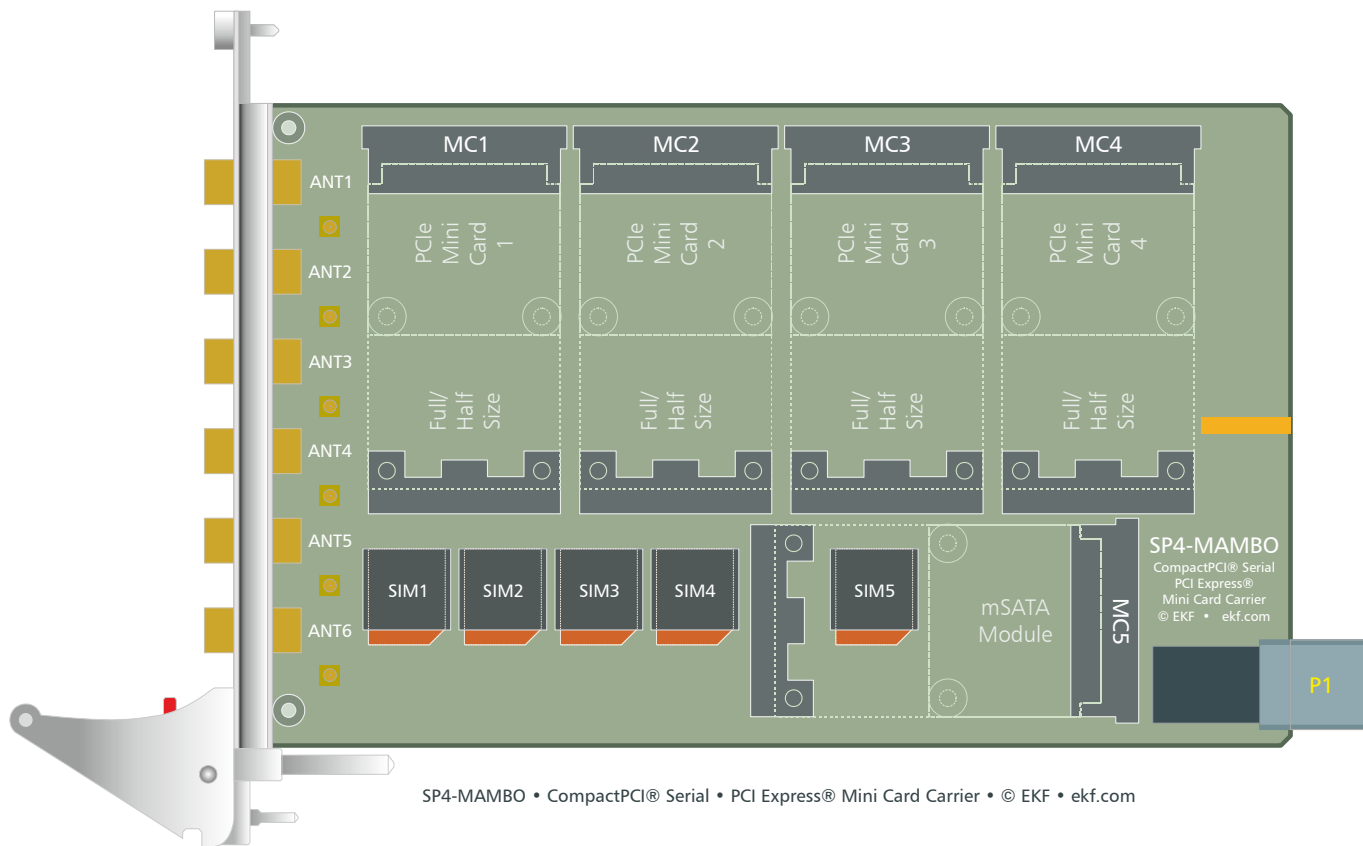
Simplified Block Diagram
 SP4-MAMBO
 PCI Express® Mini Card Carrier



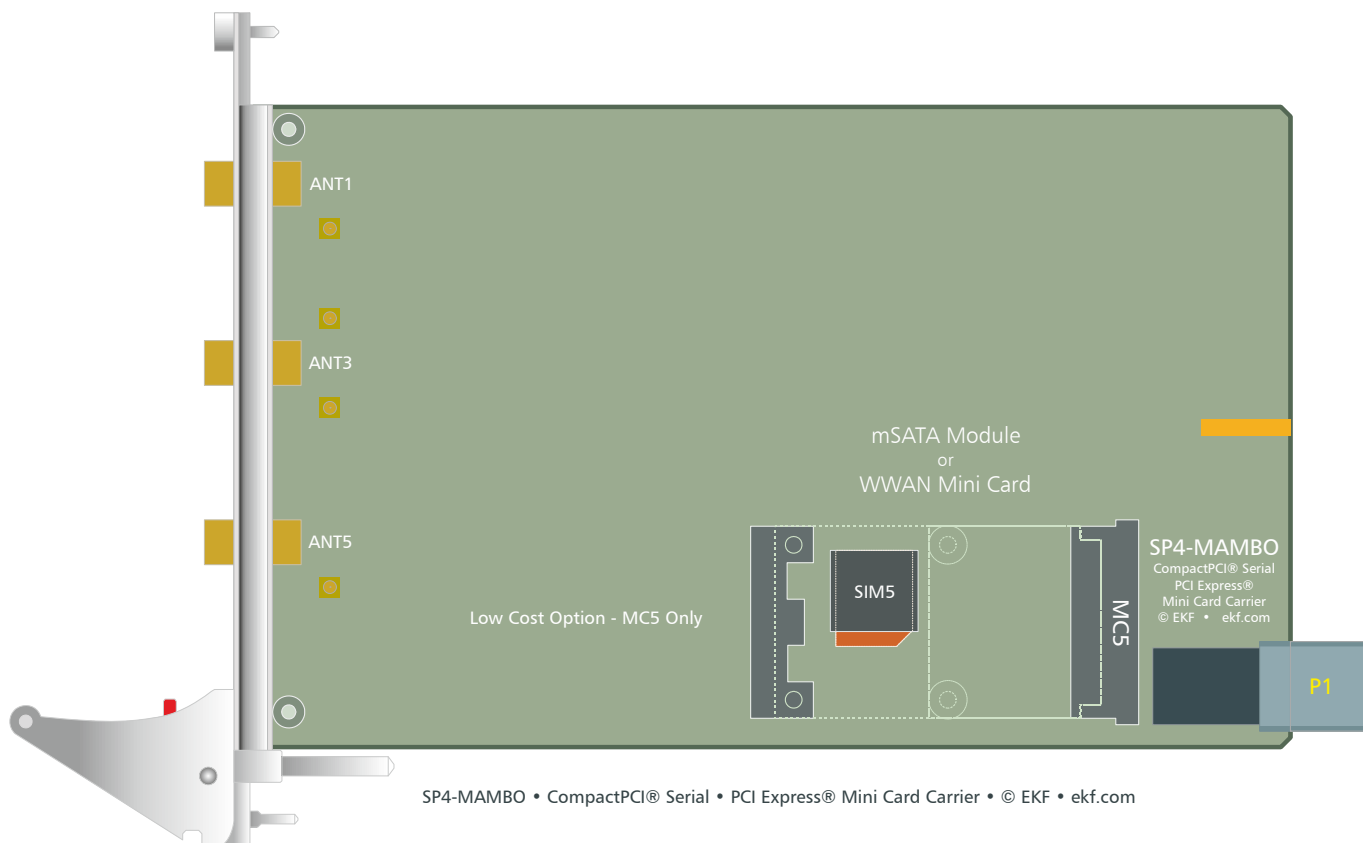
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SP4-MAMBO • MC5 Populated

Component Assembly



SP4-MAMBO • MC1-MC5 Populated



SP4-MAMBO • MC5 Populated



SP4-MAMBO

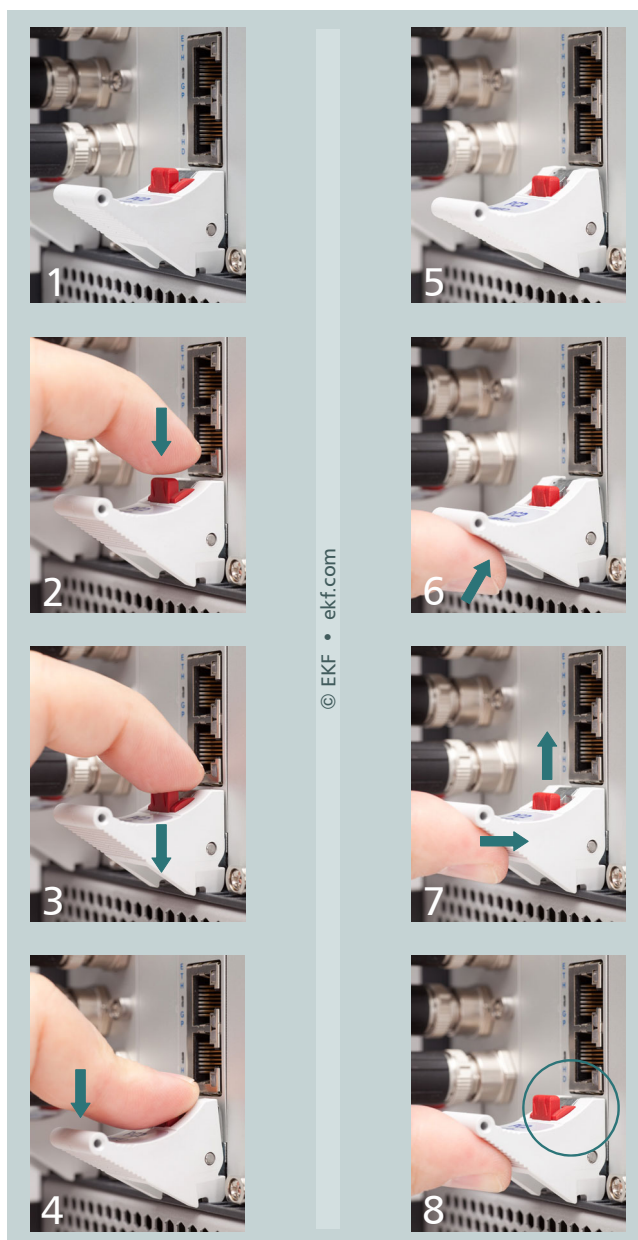
Front Panel



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SP4-MAMBO

Please note: The front handle is provided with a built-in microswitch, which is used to disable the on-board power circuit when released. Vice versa, the *on-board devices are enabled not before the handle gets locked*. Please refer to the illustration below and make sure that the eject lever has reached its final position for proper board operation, as shown in picture 8. A gentle click should be audible, when the red actuator pin moves into its raised position, indicating that the board is locked and ready for use.



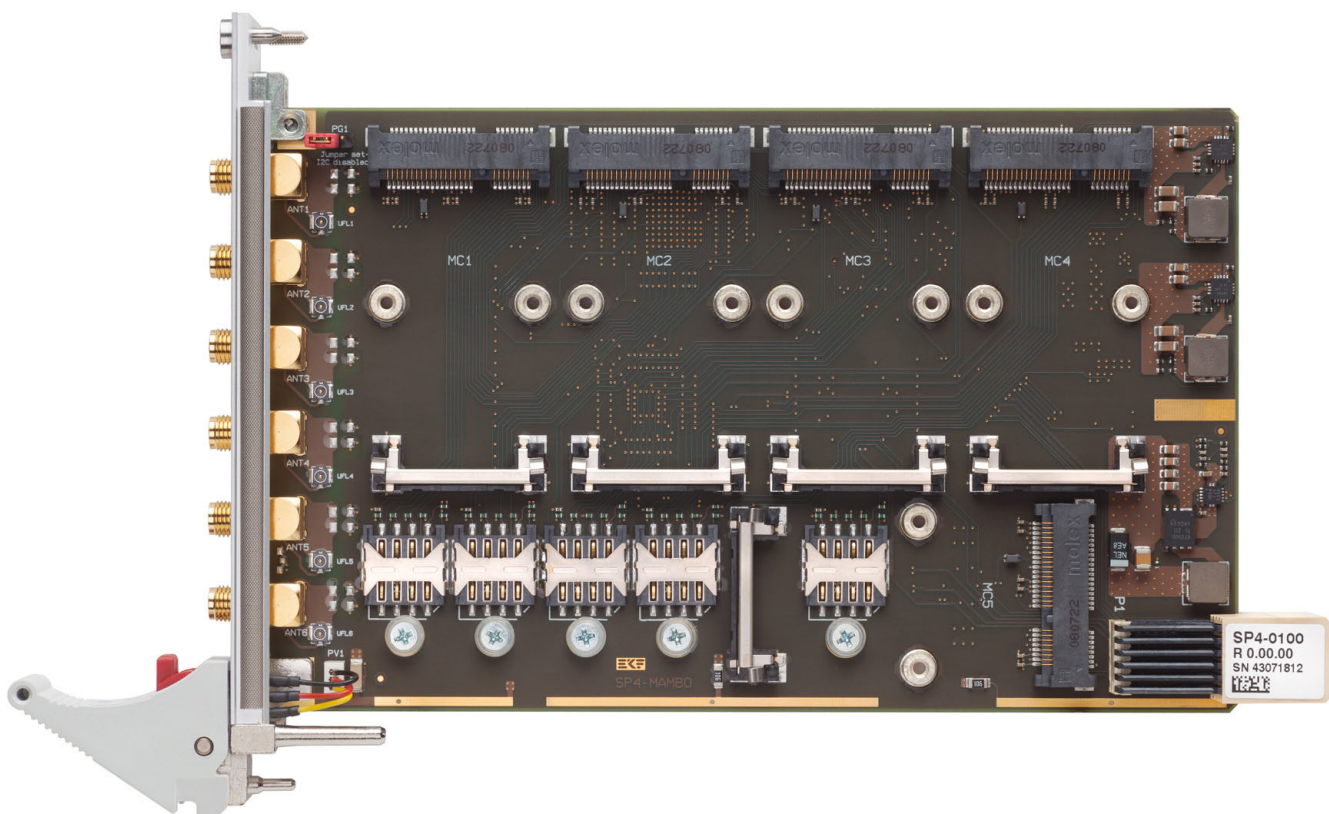
1 - 4: remove board
5 - 8: install board

1 & 8: on-board power enabled
2-7: on-board power disabled

Mini Card Host Connectors MC1 - MC4

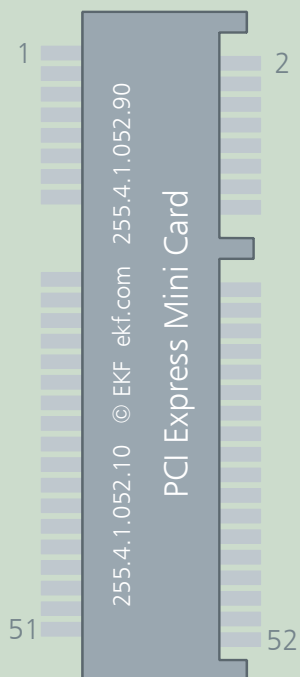
The SP4-MAMBO is provided with four PCI Express® Mini Card host connectors. These are suitable for PCIe based modules, and also USB 2.0 driven Mini Card modules. After inserted, the Mini Card has to be fixed by a snap-in latch (full-size modules 50.80mm length), or will have to be secured manually by screws (mini size modules 26.80mm length), in order to withstand shock and vibration.

The on-board quad port USB controller is a Texas Instruments TUSB7340 which is USB 2.0 & USB3.0 compliant. With respect to the mini card sockets, only the USB 2.0 high speed internal controller section is in use, with native driver support by any recent operating system. Mature Windows® versions however may show an alert in the device manager table for the xHCI (SuperSpeed) USB 3.0 controller section, which could be ignored. Just in order to remove this misleading alert, a suitable xHCI driver can be downloaded from <http://www.ti.com/product/tusb7340#toolssoftware>. Installation of this driver should have no further impact otherwise on the SP4-MAMBO mini card sockets.



MC1 - MC4

PCI Express® Mini Card Socket (255.4.1.052.14) & Latch (255.4.1.052.94)



PCIE_WAKE#	1	2	+3.3V
COEX1 (GPIO2/6/10/14)	3	4	GND
COEX2 (GPIO3/7/11/15)	5	6	+1.5V
CLKREQ# (NC)	7	8	UIM_C1
GND	9	10	UIM_C7
PCIE_CLK-	11	12	UIM_C3
PCIE_CLK+	13	14	UIM_C2
GND	15	16	UIM_C6
UIM_C8	17	18	GND
UIM_C4	19	20	W_DIS1# (GPIO0/4/8/12)
GND	21	22	RST#
PCIE_RN	23	24	+3.3V
PCIE_RP	25	26	GND
GND	27	28	+1.5V
GND	29	30	SMB_CLK
PCIE_TN	31	32	SMB_DAT
PCIE_TP	33	34	GND
GND	35	36	USB_D-
GND	37	38	USB_D+
+3.3V	39	40	GND
+3.3V	41	42	LED_WWAN#
GND	43	44	LED_WLAN#
RSV (NC)	45	46	LED_WPAN#
RSV (NC)	47	48	+1.5V
RSV (NC)	49	50	GND
W_DIS2# (GPIO1/5/9/13)	51	52	+3.3V

Power: Any socket MC1 - MC5 can supply a Mini Card with +3.3V/1.5A (7.5Amax. in total) and +1.5V/1A (5Amax. in total).

The Mini Card sockets are not suitable for some proprietary modules, which may provide special services, e.g. voice I/O, resulting in conflicts with the host connector pin assignment. Be sure that your Mini Card complies with the PCI Express® Mini Card Specification (PCI-SIG). Furthermore, mSATA modules are not supported on MC1 - MC4 (use MC5 for a mSATA SSD instead).

Full size Mini Cards are fixed by a latching (snap-in) element at the module end. A half size Mini Card must be fastened manually by screws M2.5x4mm through corresponding M2.5 soldered nuts provided on the SP4-MAMBO PCB. 0.5mm height nylon washers are required in addition as spacing elements between the PCB nuts and the half size Mini Card. Another approach would be to use a mechanical extender on half size Mini Cards, as shown below:



U.FL style connectors are assigned to each front panel SMA antenna connector. Suitable U.FL double ended plug RF cable assemblies will be required between radio Mini Cards and the chosen F/P antenna connector, e.g. EKF part #268.4.09.2.13.100 (100mm length) or #268.4.09.2.13.150 (150mm). As an option, EKF can provide a 8HP front panel for the SP4-MAMBO, if more than 6 antenna connectors in total would be required. The additional antenna connectors are mounted directly into the front panel, by means of the #268.4.09.2.14.100 (100mm length) SMA to U.FL cable assembly.

Some radio module based applications may require operation under software control (e.g. cross-border railway). Typically, WWAN cards can be disabled if the pin 20 (wireless disable) of the corresponding socket MC1 - MC4 is pulled to low. This can be achieved through GPIO lines, which are provided by the on-board PCI Express® packet switch. Initially (after reset) all GPIO ports are set high, which enables all populated Mini Card RF radios. Please refer to the PLX PEX8606 datasheet for setting the GPIO(0-15) outputs to low in order to disable/enable a particular modem.

PEX8606 GPIO Usage		
GPIO	Function	MC 1-4 Pin
0 - 4 - 8 - 12	W_DIS1#	20
1 - 5 - 9 - 13	W_DIS2#	51
2 - 6 - 10 - 14	COEX1	3
3 - 7 - 11 - 15	COEX2	5



F/P SMA Connectors to be Used with Swivel Antennas or Coax Cables



Coax Connector Removing Tool



mSATA Host Connector MC5

Optionally, the SP4-MAMBO is provided with a mSATA Card host connector, for use with a mSATA SSD module. As an alternate, this socket is also suitable for population with an USB 2.0 driven Mini Card module. MC5 cannot be used with a PCIe controlled Mini Card module (PCIe lane signals replaced by SATA channel).

Usage of MC5 requires operation of the SP4-MAMBO in a CompactPCI® Serial backplane slot, which provides SATA and/or USB resources via backplane connector P1. The on-board SATA 6G redriver ensures optimum signal integrity.

A SIM card holder is associated to MC5, below the module. No software control is provided for a WWAN module populated on MC5 (W_DIS1/2# pins terminated with PU).

MC5			
PCI Express® Mini Card Socket (255.4.1.052.14) & Latch (255.4.1.052.94)			
PCIE_WAKE#	1	2	+3.3V
COEX1 (NC)	3	4	GND
COEX2 (NC)	5	6	+1.5V
CLKREQ# (NC)	7	8	UIM_C1
GND	9	10	UIM_C7
PCIE_CLK-	11	12	UIM_C3
PCIE_CLK+	13	14	UIM_C2
GND	15	16	UIM_C6
UIM_C8	17	18	GND
UIM_C4	19	20	W_DIS1# (PU)
GND	21	22	RST#
SATA_RXP	23	24	+3.3V
SATA2_RXN	25	26	GND
GND	27	28	+1.5V
GND	29	30	SMB_CLK
SATA2_TXN	31	32	SMB_DAT
SATA_TXP	33	34	GND
GND	35	36	USB1(2)_D-
GND	37	38	USB1(2)_D+
+3.3V	39	40	GND
+3.3V	41	42	LED_WWAN#
OR to GND	43	44	LED_WLAN#
RSV (NC)	45	46	LED_WPAN#
RSV (NC)	47	48	+1.5V
RSV (NC)	49	50	GND
W_DIS2# (PU)	51	52	+3.3V

Micro SIM Card Holders SIM1 - SIM5

The SP4-MAMBO is populated with five Micro SIM 3FF card sockets for 15x12mm SIM cards. After insertion, the cards must be fixed by screws, in order to withstand shock and vibration.

The sockets were constructed for 0.76mm thick Micro SIM cards. However, often Micro SIM cards come as pre-cut assembly with a Nano SIM in its center, which is defined for a thickness of only 0.67mm. In rare cases, this may lead to contact problems.

As a professional solution, the Nano SIM 4FF can be put into an adapter for use with devices designed for 3FF SIMs. A simple workaround to improve contact pressure would be to attach a suitable self-adhesive Kapton label on the SIM card assembly back side, in order to bridge the gap of 0.09mm.



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Nano SIM to Micro SIM Adapter

Related Documents

Module Carrier Cards

SP4-MAMBO (Quad Mini Card Carrier)	www.ekf.com/s/sp4/sp4.html
SP2-LUTE (Dual Mini Card Carrier)	www.ekf.com/s/sp2/sp2.html
SF1-STUDIO (Mini Card Carrier for Fieldbus Modules)	www.ekf.com/s/sf1/sf1.html
SPX-PHASE (Quad M.2 WWAN Module Carrier)	www.ekf.com/s/spx/spx.html

Overview

Concise Overview CompactPCI® Serial Boards	www.ekf.com/s/serial_concise.pdf
The Smart Solution - CompactPCI® Serial Concept	www.ekf.com/s/smart_solution.pdf

Suitable CPU Cards

PC3-ALLEGRO	CompactPCI® PlusIO CPU Card, for Hybrid Backplanes www.ekf.com/p/pc3/pc3.html
PC4-PRESTO	CompactPCI® PlusIO CPU Card, for Hybrid Backplanes www.ekf.com/p/pc4/pc4.html
SC2-PRESTO	CompactPCI® Serial CPU Card, for CompactPCI® Serial Backplanes www.ekf.com/s/sc2/sc2.html
SC3-LARGO	CompactPCI® Serial CPU Card, for CompactPCI® Serial Backplanes www.ekf.com/s/sc3/sc3.html

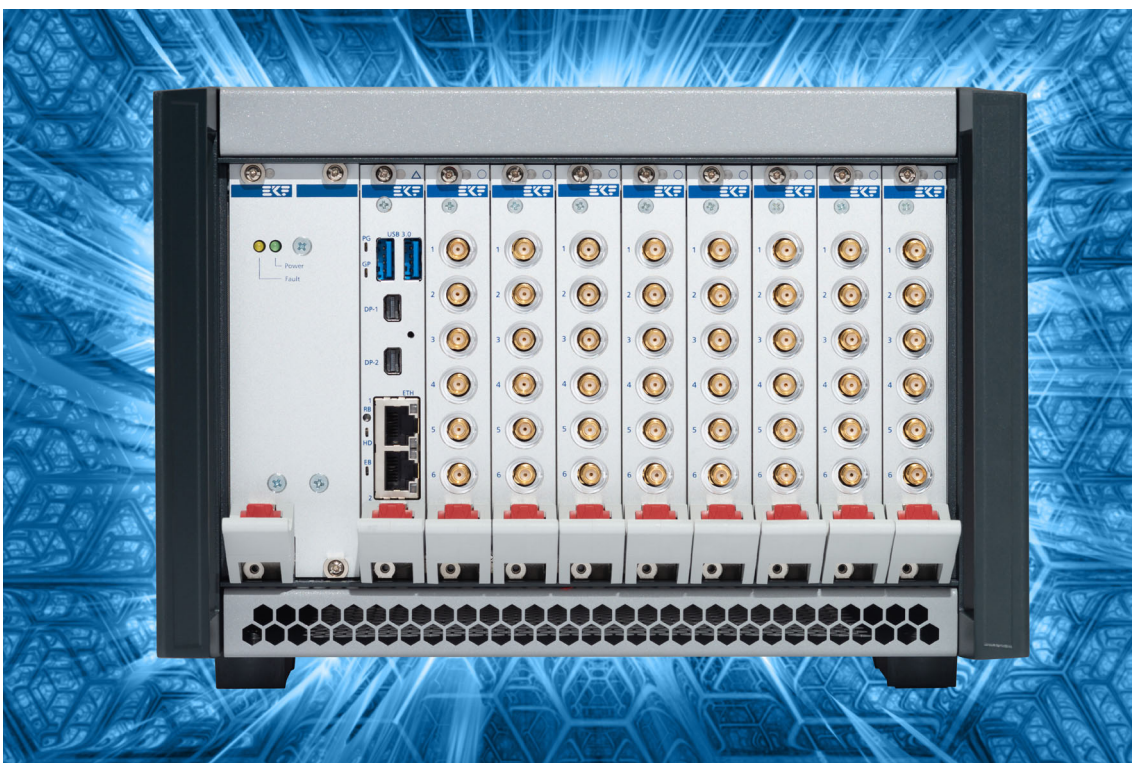
Reference Documents

Term	Document	Origin
mSATA	Jedec MO-300B mSATA SSD Assembly	www.jedec.org
PCI Express® Mini Card	PCI Express® Mini Card Electromechanical Specification	www.pcisig.com
SATA	Serial ATA Specification	www.sata-io.org
USB	Universal Serial Bus Specification	www.usb.org

Ordering Information

For popular SP4-MAMBO SKUs please refer to www.ekf.com/liste/liste_21.html#SP4





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