



Product Information

SC9-TOCCATA • CompactPCI® Serial CPU Card

11th Generation Intel® Core™ & XEON® W Processors
Tiger Lake H

Preliminary Edition

General

The SC9-TOCCATA is a rich featured high performance 4HP/3U CompactPCI® Serial CPU board, equipped with an Intel® 11th Generation XEON® Processor (Tiger Lake H45 platform) for demanding industrial applications.

The SC9-TOCCATA front panel is provided with three 2.5Gbps Ethernet jacks for networking (2 x TCC/TSN capable) and three 10Gbps USB Type-C receptacles (DisplayPort Alternate Mode enabled) for versatile device and display attachment.

On-board mass-storage solutions are based on low profile mezzanine expansion cards, which accommodate up to two M.2 style SSD modules. One of the M.2 sockets is suitable for a fast NVMe (PCI Express® Gen4 x 4) module.

The SC9-TOCCATA is equipped with up to 64GB DDR4 ECC RAM. Up to 32GB memory-down are provided for rugged applications, and another 32GB are available via the DDR4 ECC SODIMM socket.

The 11th Generation XEON® and Core™ processors are accompanied by the RM590E mobile PCH, for a maximum of high speed I/O resources (e.g. PCI Express®, SATA, USB). Altogether with the processor, 25 PCIe® lanes in total are provided for backplane use, and another 8 lanes for local mezzanine expansion up to PCIe® Gen4 speed.

As an option, up to eight additional Gigabit Ethernet ports (either switch or NICs) are available via the backplane connector P6 by means of a mezzanine module.

Feature Summary

General

- ▶ PICMG® CompactPCI® Serial (CPCI-S.0) CPU card
- ▶ Form factor single size Eurocard (board dimensions 100x160mm²)
- ▶ Mounting height 3U
- ▶ Front panel width 4HP (8HP/12HP assembly with optional mezzanine side card)
- ▶ Front panel I/O connectors for typical system configuration (3 x 10Gbps USB Type-C DP Alt Mode, 3 x 2.5Gbps Ethernet RJ45)
- ▶ Backplane communication via PCI Express® Gen3, SATA 6G, USB 3.2, Gigabit Ethernet
- ▶ Local mezzanine expansion option, COTS and custom specific boards

Processor

- ▶ Intel® 11th Generation Mobile XEON® W or Core™ processor
- ▶ Tiger Lake H45 platform
- ▶ Up to 8-core, up to 3MB cache per core
- ▶ DDR4 3200 ECC RAM
- ▶ Gen 12 graphics, 4 displays up to 8k60
- ▶ TCC/TSN
- ▶ Extended temperature operation
- ▶ Embedded & industrial use conditions
- ▶ 45/35W configurable TDP, 25W TDP
- ▶ BGA soldered for optimum reliability
- ▶ Mobile Intel® Series 500 PCH (RM590E IOTG)

- ▶ Intel® Xeon® W processors (Industrial Use Case *)
- ▶ Up to 8 cores, 24MB cache, 32EU, Intel® vPro™ eligible
- ▶ W-11865MRE | 8c 24M | 4.7GHz | 45/35W | 32EU 1350MHz | ECC | TCC/TSN | VPro | -40°C to +100°C | SC9-650D-TOCCATA
- ▶ W-11555MRE | 6c 12M | 4.5GHz | 45/35W | 32EU 1350MHz | ECC | TCC/TSN | VPro | -40°C to +100°C
- ▶ W-11155MRE | 4c 8M | 4.4GHz | 45/35W | 16EU 1250MHz | ECC | TCC/TSN | -40°C to +100°C
- ▶ W-11865MLE | 8c 24M | 4.5GHz | 25W | 32EU 1350MHz | ECC | TCC/TSN | VPro | 0°C to +100°C | SC9-440D-TOCCATA
- ▶ W-11555MLE | 6c 12M | 4.4GHz | 25W | 32EU 1350MHz | ECC | TCC/TSN | VPro | 0°C to +100°C
- ▶ W-11155MLE | 4c 8M | 3.1GHz | 25W | 16EU 1250MHz | ECC | TCC/TSN | 0°C to +100°C | SC9-340D-TOCCATA
- * disable core/graphics turbo for industrial use condition

- ▶ Intel® Core™ processors (Embedded Use Case)
- ▶ i7-11850HE | 8c 24M | 4.7GHz | 45/35W | 32EU 1350MHz | VPro | 0°C to +100°C
- ▶ i5-11500HE | 6c 12M | 4.5GHz | 45/35W | 32EU 1350MHz | VPro | 0°C to +100°C
- ▶ i3-11100HE | 4c 8M | 4.4GHz | 45/35W | 16EU 1250MHz | 0°C to +100°C
- ▶ 6600HE | 2c 8M | 2.6GHz | 35W | 16EU 1100MHz | 0°C to +100°C | SC9-140D-TOCCATA

Feature Summary

Firmware

- ▶ Phoenix® UEFI (Unified Extensible Firmware Interface)
- ▶ Fully customizable by EKF
- ▶ Secure Boot and Measured Boot supported - meeting all demands as specified by Microsoft®
- ▶ Windows®, Linux and other (RT)OS supported
- ▶ Intel® AMT supported (disabled by default, must be enabled via BIOS setup)

Main Memory

- ▶ Integrated memory controller up to 64GB DDR4 3200 with hardware ECC *
 - ▶ DDR4 +ECC soldered memory up to 32GB (ultra rugged basic memory)
 - ▶ DDR4 +ECC SO-DIMM memory module socket up to 32GB (memory expansion option)
 - ▶ Total memory encryption
- * ECC with XEON® processor SKUs (industrial use)

Feature Summary

Graphics

- ▶ Integrated Xe Gen 12 graphics engine, 4 displays
- ▶ Codec support HEVC/SCC/VP9/AV1
- ▶ HDR support power optimized
- ▶ Decode up to 8k60:
 - ▶ 2x 4k60 8b 4:2:0 AVC
 - ▶ 5k60 12b 4:2:2/4:4:4 HEVC/VP9/SCC
 - ▶ 8k60 12b 4:2:0 HEVC/VP9/SCC
 - ▶ 4k60 10b 4:2:0 AV1
- ▶ Encode up to 8k30:
 - ▶ 2x 4k60 8b 4:2:0 AVC
 - ▶ 5k60 10b 4:4:4 HEVC/VP9/SCC
 - ▶ 8k30 10b 4:2:0 HEVC/VP9/SCC
- ▶ 2x 4k HEVC encode speed
- ▶ Up to 4 displays supported:
 - ▶ 1 Display: 8k60 HDR
 - ▶ 2 Displays: 8k60 SDR or 4k120 HDR + 5k120 HDR
 - ▶ 3 Displays: 4k60 HDR
 - ▶ 4 Displays: 4k60 HDR
- ▶ DisplayPort DP1.4a HBR3
- ▶ Multi-Stream Transport (MST) - display daisy chaining
- ▶ Integrated DP Alt Mode MUX
- ▶ Integrated audio

- ▶ Display front panel options:
 - ▶ 3 x Type-C connectors for either DisplayPort and USB usage
 - ▶ 4th DisplayPort optional via Type-C connector on low profile mezzanine card S40 or S48

Networking

- ▶ Up to 11 Ethernet networking interfaces in total
- ▶ 3 x Front 2.5GBASE-T RJ45 - 3 x Intel® I226-IT NIC
- ▶ 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-T connections
- ▶ RJ45 Front port 1 - Intel® I226-IT, Intel® vPRO™/AMT (Wake on LAN)
- ▶ RJ45 Front port 2 - Intel® I226-IT, TCC/TSN capable, PPS/PPM
- ▶ RJ45 Front port 3 - Intel® I226-IT, TCC/TSN capable
- ▶ Integrated TCC/TSN controller for front ports 2 & 3 (RM590E PCH) - Real Time networking
- ▶ TSN Precision time protocol (Time-Sensitive-Networking) as required e.g. for OPC UA and OpenAvnu
- ▶ Enables ultra-reliable low-latency communication (URLLC)
- ▶ Intel® Time Coordinated Computing (Intel® TCC) for time synchronisation and timeliness
- ▶ Option 8 x 1000BASE-T backplane w. S80-P6 mezzanine module - Marvell® Peridot switch
- ▶ Option 4 x 1000BASE-T backplane w. S82-P6 mezzanine module - 4 x Intel® I210-IT NIC
- ▶ Option 4 x 2.5GBASE-T RJ45 front w. SCJ-VEENA side card - 4 x Intel® I226-IT NIC (8HP assembly)
- ▶ Option 4 x 1000BASE-T M12-X front w. SCL-RHYTHM side card - 4 x Intel® I210-IT NIC (8HP assembly)

Feature Summary

Security

- ▶ Total memory encryption - hardware based
- ▶ ROP attack prevention - hardware based protection against browser malware attacks
- ▶ Advanced Crypto Key protection - hardware based

- ▶ Trusted Platform Module SLM9670
- ▶ TPM 2.0 for highest level of certified platform protection
- ▶ Infineon Optiga™ cryptographic processor
- ▶ Conforming to TCG 2.0 specification

Front Panel I/O (4HP)

- ▶ 3 x 2.5Gbps Ethernet RJ45 receptacles
- ▶ 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-Te
- ▶ Intel® vPRO™/AMT support
- ▶ Port 2 & 3 TCC/TSN enabled

- ▶ 3 x 10Gbps USB Type-C receptacles DisplayPort Alt Mode
- ▶ USB and/or DisplayPort usage
- ▶ USB 3.2 Gen 2x1 (formerly USB 3.1 Gen2) SuperSpeed+ 10Gbps
- ▶ USB-PD downstream facing ports 5V/3A (Infineon CYPD5225 EZ-PD™ CCG5 controller)
- ▶ DisplayPort 1.4
- ▶ Additional Type-C front I/O with low profile mezzanine S40 or S48

Front Panel I/O (8/12HP)

- ▶ Variety of side cards available, common front panel 8HP/12HP with CPU card
- ▶ For backplanes with system slot right aligned
- ▶ Various I/O ports e.g. UART, Audio, RJ45 Ethernet, M12-X Ethernet, Wireless (SMA)
- ▶ Custom specific front panel and side card design

Feature Summary

CompactPCI® Serial Backplane Resources

- ▶ PICMG® CPCI-5.0 CPU card & system slot controller
- ▶ 16 x PCIe Gen3 ¹ 8GT/s (2 links x8 for two fat pipe slots, derived directly from the Xeon® or Core™ CPU)
- ▶ 9 x PCIe Gen3 8GT/s (1 link x4, 5 links x1 for peripheral slots, derived from the PCH)
- ▶ 5 x SATA 6G (from the PCH)
- ▶ 8 x USB3 ² (from the PCH)
- ▶ Option 8 x Gigabit Ethernet Marvell 88E6390 switch (S80-P6 low profile mezzanine expansion card)
- ▶ Option 4 x Gigabit Ethernet Intel® I210-IT NIC (S82-P6 low profile mezzanine expansion card)

¹ The CPU is PCIe® Gen4 capable on these links (not specified for CompactPCI® Serial)

² USB 3.2 Gen 2x1 SuperSpeed+ 10Gbps

Local Expansion & Mezzanine Mass Storage Options

- ▶ Mezzanine side card connectors for optional local expansion
- ▶ Low profile mezzanine modules available (4HP front panel)
- ▶ Side cards available (8HP F/P assembly)
- ▶ HSE1 - PCIe Gen4 x4, 1 x USB3 10Gbps & 2 x USB2
- ▶ HSE2 - PCIe Gen3 x4 (configurable also 2x2, 4x1), 4th DisplayPort
- ▶ EXP - Legacy interface (eSPI, Audio, UART, I2C, GPIO)

- ▶ 4HP Low profile mezzanine module preferred options:
 - ▶ S20-NVME Mezzanine module - M.2 2280 NVME SSD socket, 1 x Type-C USB F/P connector
 - ▶ S40-NVME Mezzanine module - 1 x M.2 2280 NVME SSD socket, 1 x M.2 2280 SATA SSD socket, 2 x Type-C USB F/P connectors (1 connector enabled for DisplayPort alternate mode)
 - ▶ S42-MC Mezzanine module - M.2 2280 NVME SSD socket, 2 x PCIe® Mini Card sockets
 - ▶ S48-SSD Mezzanine module - 1 x M.2 2280 PCIe® x4 Gen4 SSD socket, 1 x M.2 2280 PCIe® x4 Gen3 SSD socket, Type-C USB F/P connector (enabled for DisplayPort alternate mode - 4th display)
 - ▶ S80-P6 Mezzanine module - M.2 2280 NVMe SSD socket, 8 x Gigabit Ethernet via P6 backplane connector (switch based solution)
 - ▶ S82-P6 Mezzanine module - M.2 NVMe SSD socket, 4 x GbE NIC via P6 backplane connector
 - ▶ Custom specific storage & I/O module design

- ▶ 8HP Mezzanine side card options:
 - ▶ SCJ-VEENA Short side card - M.2 2280 NVMe SSD socket, 4 x 2.5GbE NIC, front panel RJ45, USB3
 - ▶ SCL-RHYTHM Short side card - M.2 2280 NVMe SSD socket, 4 x GbE NIC, front panel M12-X
 - ▶ SCX-PCIE - M.2 2280 NVMe/SATA SSD socket, PCIe® Mini Card socket, 3 x USB3, 3 x GbE RJ45 connectors, coupler for secondary CompactPCI® Serial backplane
 - ▶ SCZ-NVM - M.2 22110 NVMe SSD socket, quad UART, DisplayPort & USB3 connectors
 - ▶ ECX-PCIE - Front I/O same as SCX, coupler for CompactPCI® Express secondary backplane
 - ▶ Custom specific side card design - I/O and storage

Feature Summary

RT OS Board Support Packages

- ▶ Available on request

Applications

- ▶ High performance industrial and embedded computing, for x86 based software
- ▶ Automation, process control, test systems, demanding applications

Environmental & Regulatory

- ▶ Suitable e.g. for industrial, transportation & instrumentation applications
- ▶ Designed & manufactured in Germany
- ▶ ISO 9001 certified quality management
- ▶ Long term availability
- ▶ Rugged solution
- ▶ Coating, sealing, underfilling on request
- ▶ Lifetime application support
- ▶ RoHS compliant
- ▶ Operating temperature 0°C to +70°C
- ▶ Operating temperature -40°C to +85°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 tbd years
- ▶ EC Regulatory EN55024, EN55032, EN62368-1



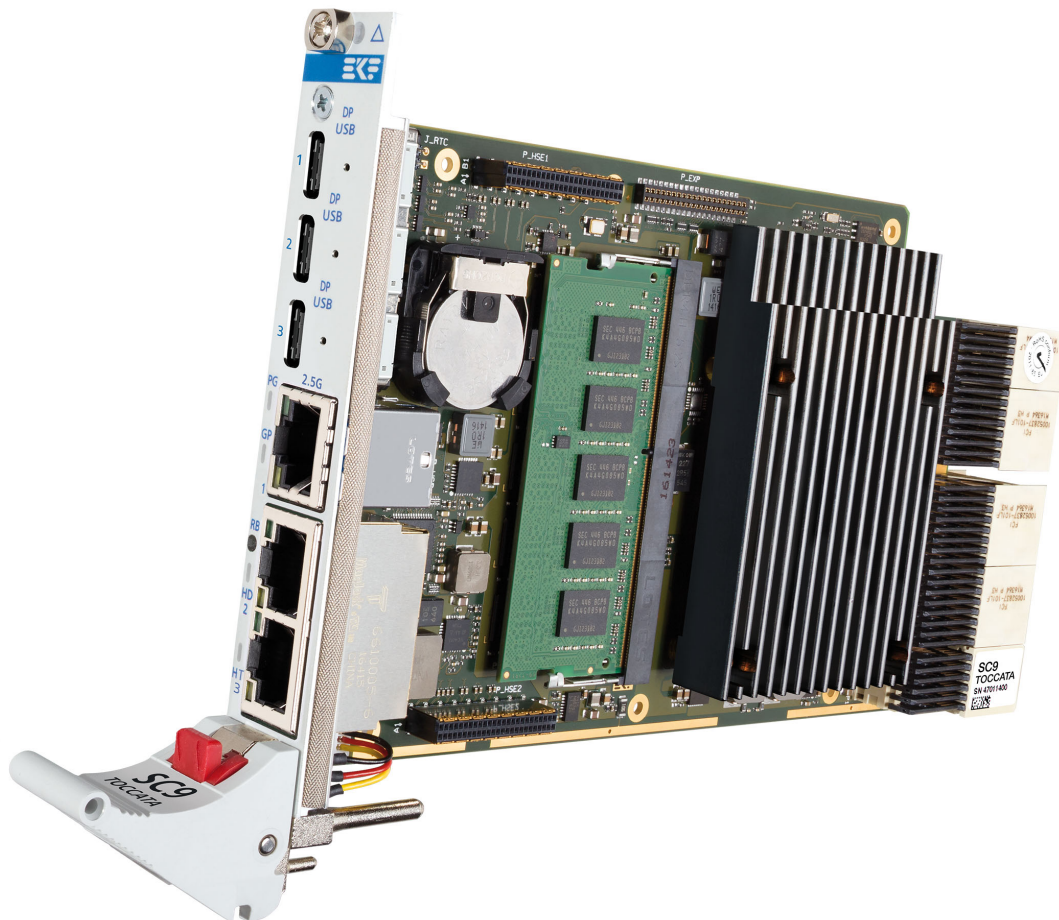
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partner
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CompactPCI® Serial

While mechanically compliant to CompactPCI® Classic, CompactPCI® Serial (PICMG® CPCIS.0) defines a completely new card slot, based on PCI Express®, SATA, Gigabit Ethernet and USB serial data lines. Up to 6 high-speed backplane connectors P1 - P6 are provided on a system slot controller such as the SC9-TOCCATA, which can be considered as a root hub with respect to most signal lines. A passive backplane is used for distribution of a defined subset of I/O channels from the system slot to each of up to eight peripheral slots in a CompactPCI® Serial system.

Most CompactPCI® Serial peripheral slot cards require only the backplane connector P1, which comprises PCIe®, SATA and USB signals, resulting in a concise and inexpensive peripheral board design. More powerful peripheral cards profit from two so called Fat Pipe slots (PCIe® x 8).

The SC9-TOCCATA is a native CompactPCI® Serial CPU card, suitable for usage in a pure CPCI Serial environment. Due to its generous backplane capabilities (25 x PCI Express® Gen3, 8 x USB3, 5 x SATA 6G, up to 8 x GbE), very powerful industrial systems can be built.



Local Expansion

The SC9-TOCCATA is equipped with a set of high-speed local expansion interface connectors, which can be optionally used to attach either a low profile mezzanine module (fits into the 4HP front panel envelope) or a side card for an 8HP or even 12HP assembly in total.

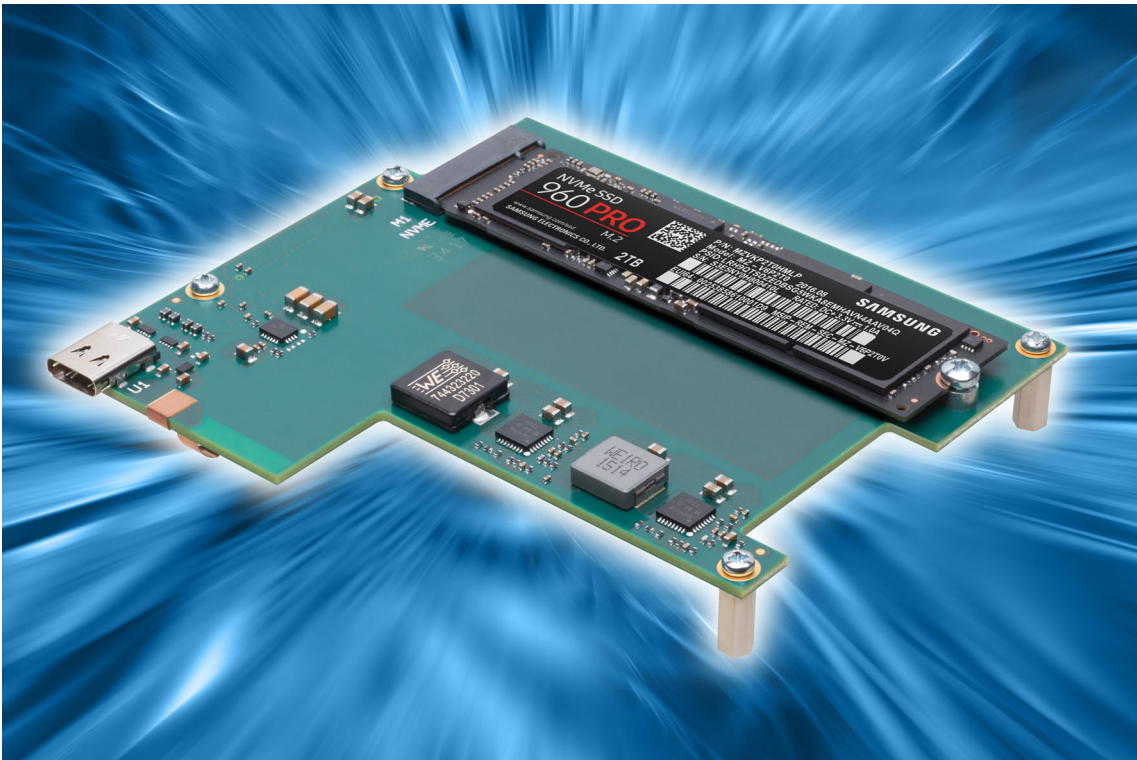
The connectors HSE1 and HSE2 are high speed connectors, as required for PCI Express® Gen4 and USB3 10Gbps. The socket EXP is used as a legacy interface (e.g. HD Audio, UART) and not required for many mezzanine modules. All mezzanine connectors allow board-to-board heights of 10.0mm (S20, S40, S48), 10.8mm (S80, S82), and 18.7mm (e.g. SCJ, SCL side cards 8HP assembly).

HSE1 is assigned to a PCIe® Gen4 x4 link, derived directly from the CPU. On a 4HP low profile mezzanine module or 8HP side card this link is wired to a fast Gen3 or Gen4 NVMe SSD housed in an M.2 socket, typically used as boot device and general mass storage. In addition, HSE1 brings a 10Gbps USB3 port, often used for front I/O.

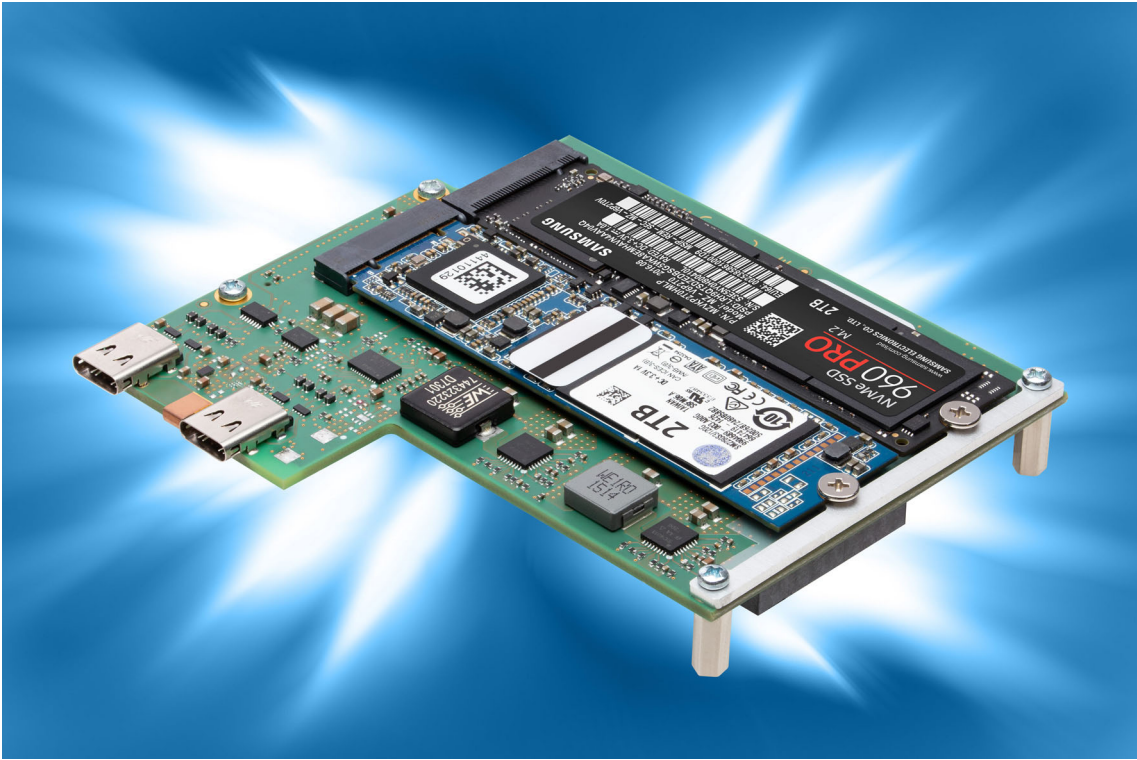
HSE2 provides another four PCIe® Gen3 lanes, configurable for versatile link width and combinations, and in addition a 4th DisplayPort video output. Some mezzanine modules such as the S20 get along with the HSE1 connector alone, others such as S40, S48 or S80 depend on both HSE1 and HSE2 for full functionality.

Related Information Mezzanine Connectors

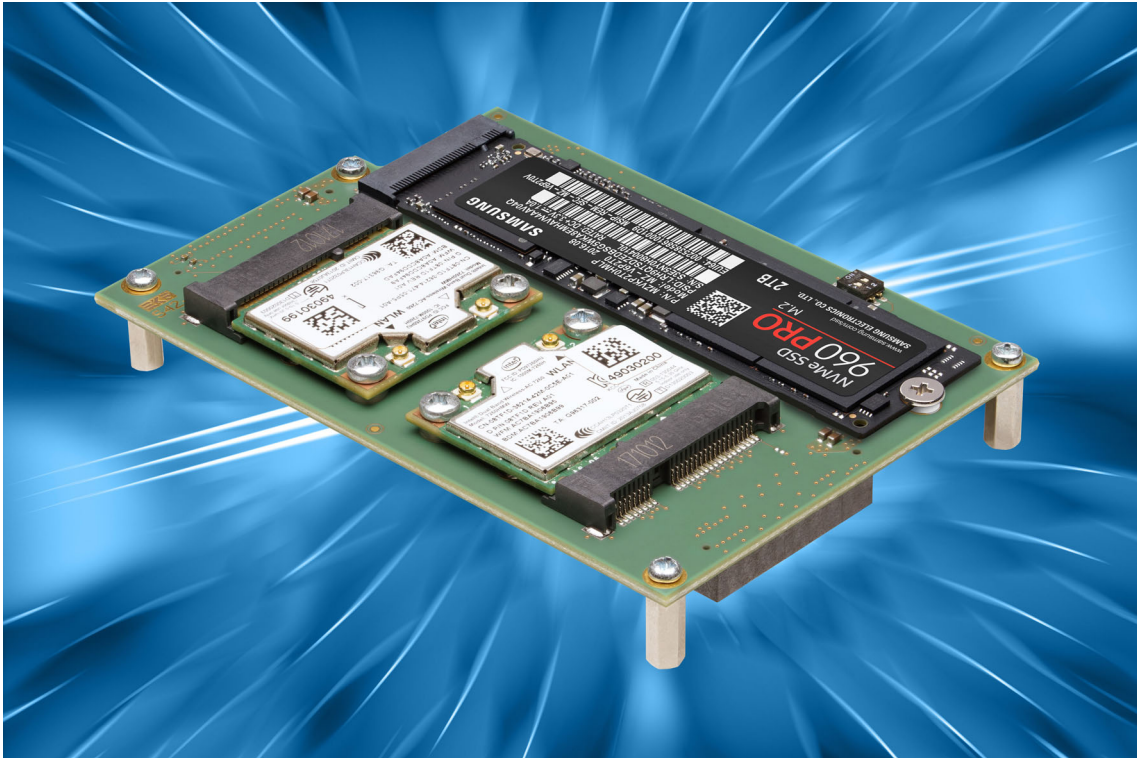
https://www.ekf.com/s/mezzanine_connectors.pdf



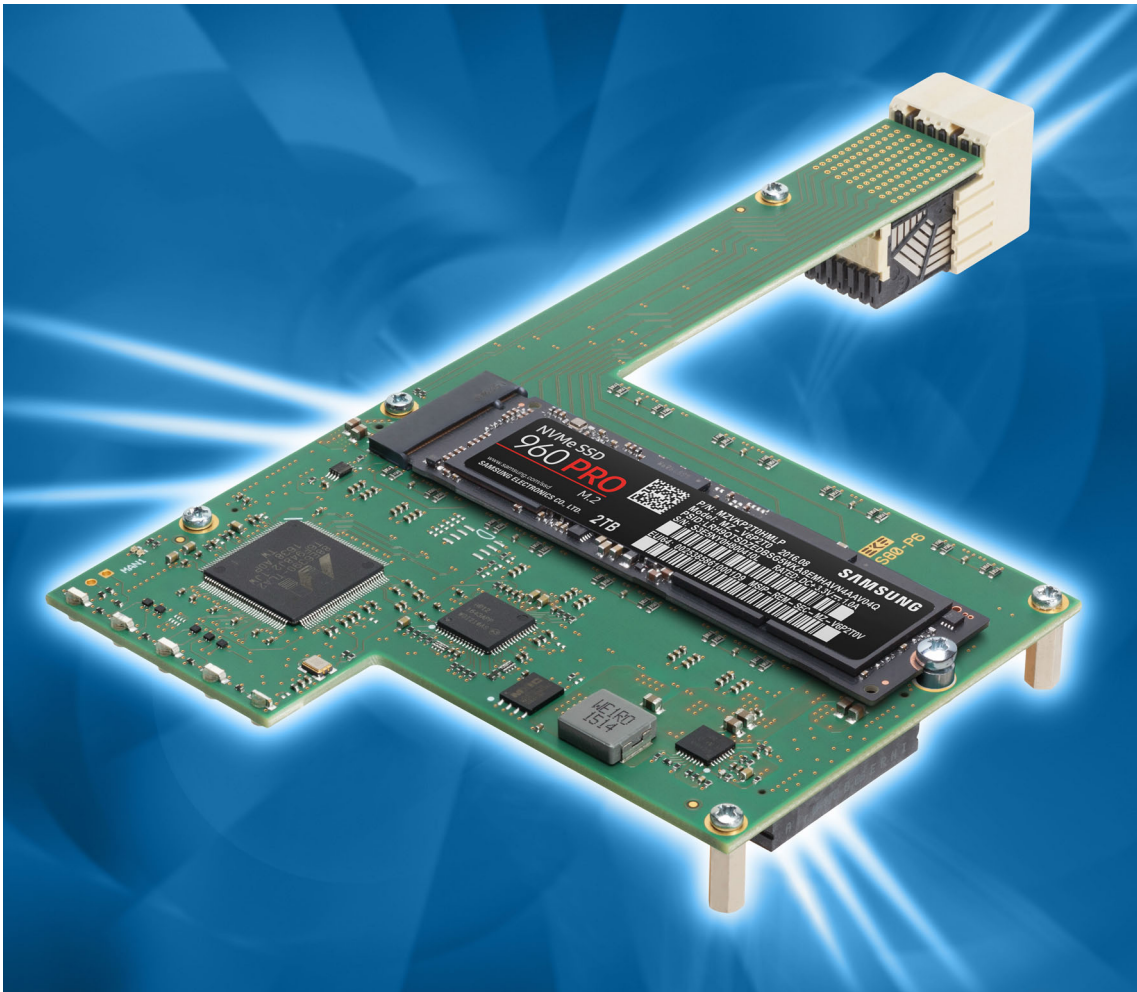
S20-NVME Low Profile Mezzanine Module



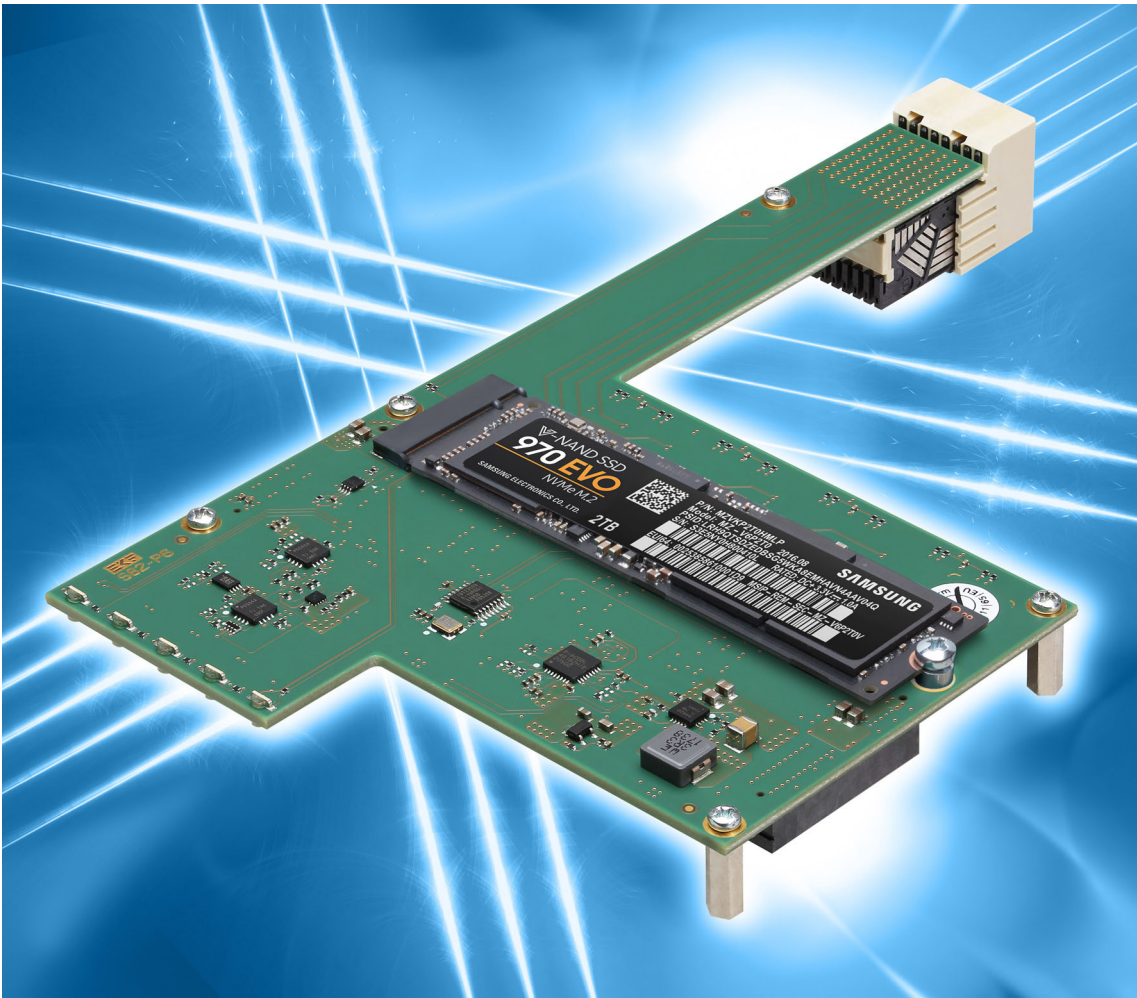
S40-NVME Low Profile Mezzanine Module



S42-MC Low Profile Mezzanine Module

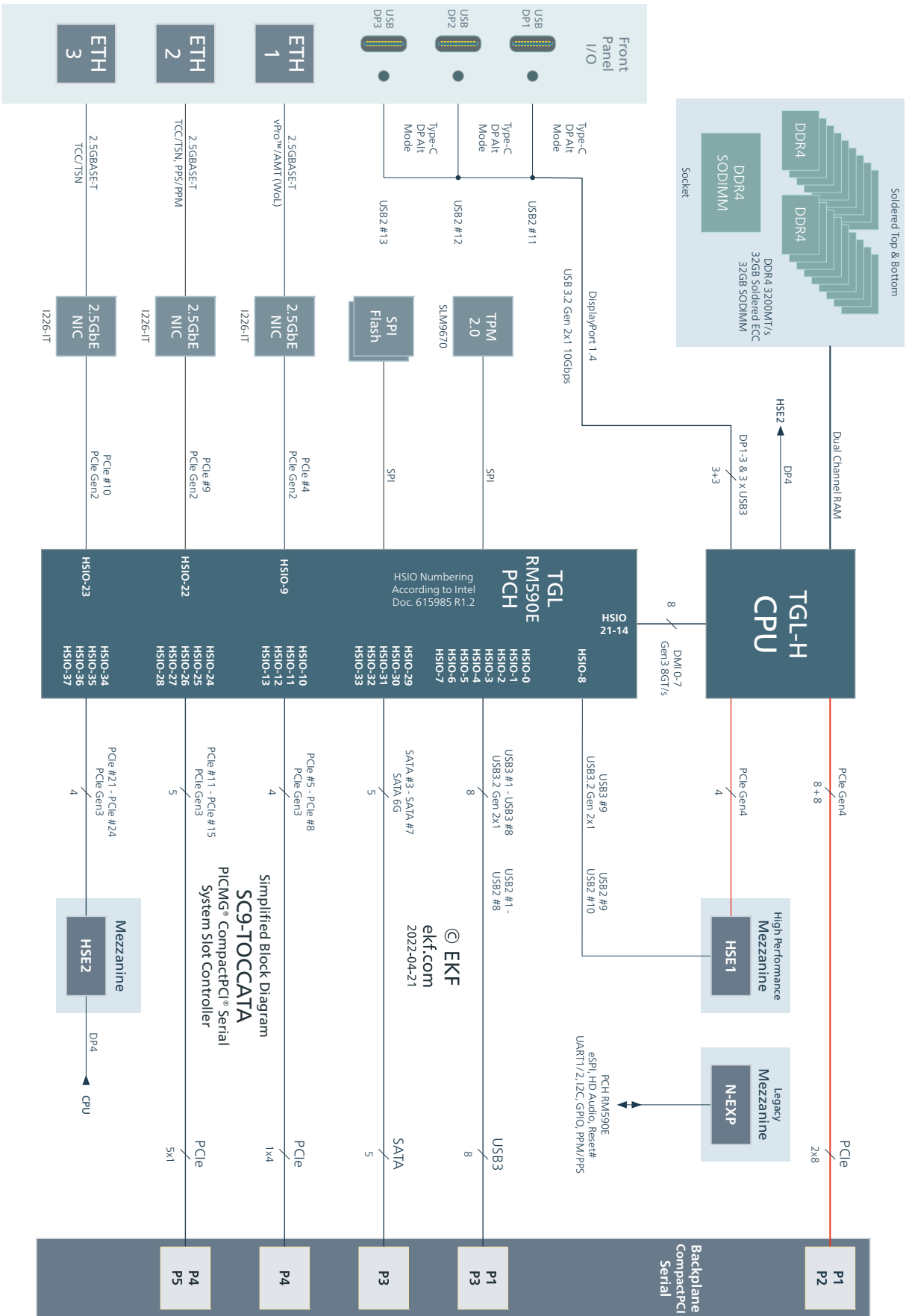


S80-P6 Low Profile Mezzanine Module



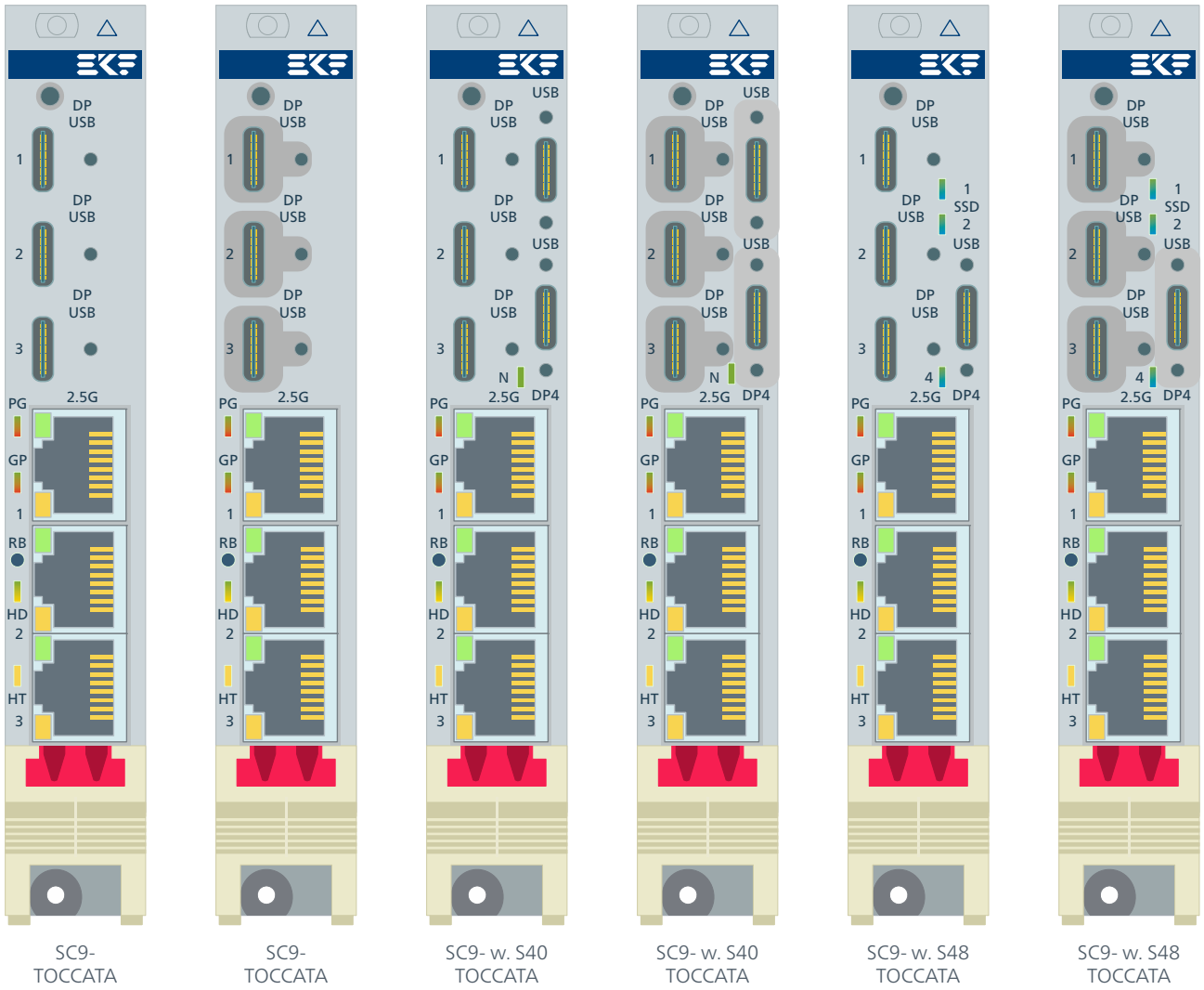
S82-P6 Low Profile Mezzanine Module

Block Diagram

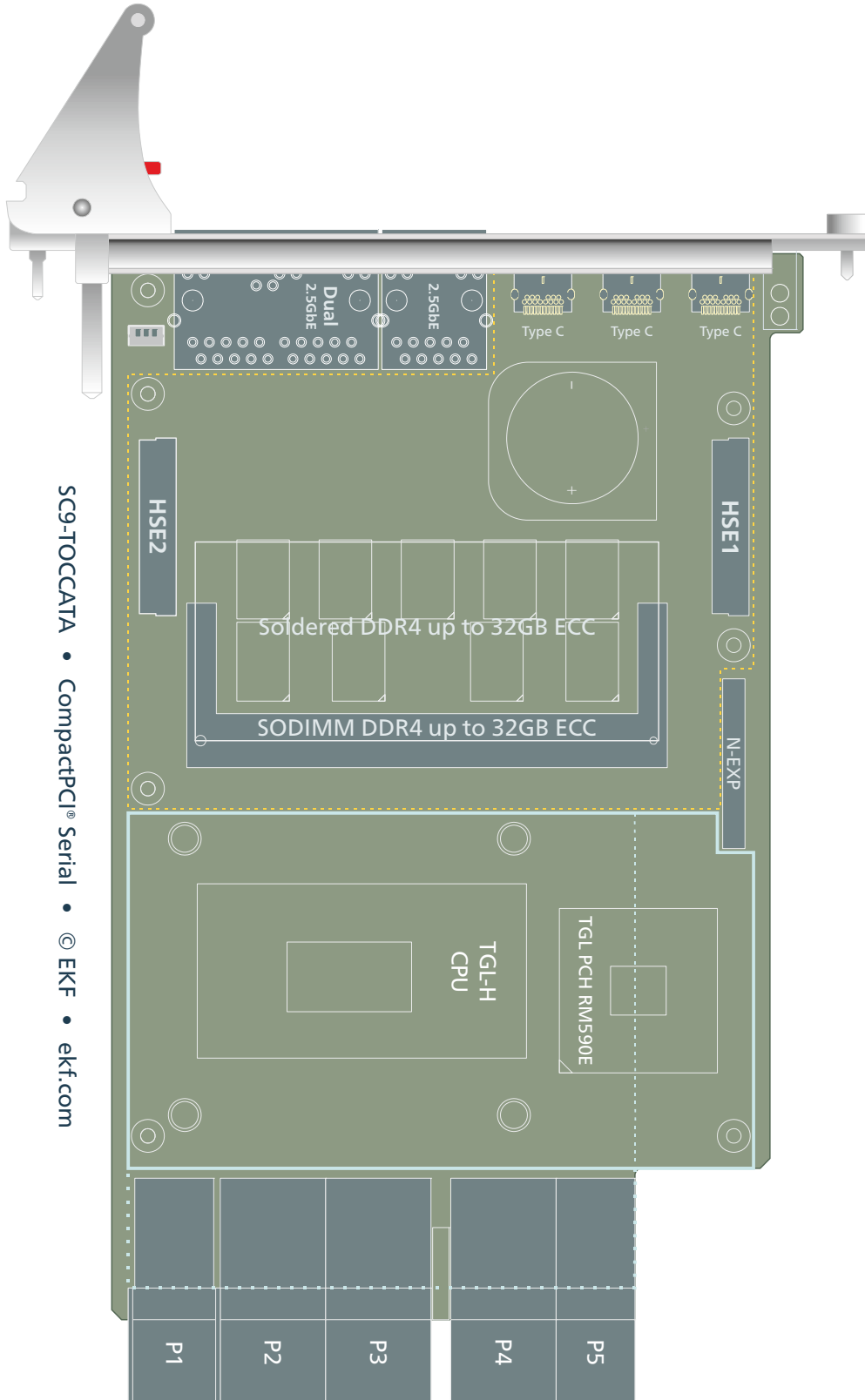


www.ekf.com/s/sc9/img/sc9_blk.pdf

Front Panel



Component Orientation



SC9-TOCCATA • CompactPCI® Serial • © EKF • ekf.com

Backplane Resources

SC9-TOCCATA • Resources w. 1+8 Slots Backplane (System Slot Left Aligned Version)

	1	2	3	4	5	6	7	8	9	
P6	△ SYS GbE*** (1-8) Clk PE (1-8) PE Gen3 x1 (7-8) PE Gen3 x1 (4-6) PE Gen3 x4 (3)	GbE*** (1) GA 111 PER 1 CPU TGL-H	GbE*** (2) GA 110 PER 2 CPU TGL-H	GbE*** (3) GA 101 PER 3 PCH RM590E HSI0 10-13 PCIe #5-8	GbE*** (4) GA 100 PER 4 PCH RM590E HSI0 24 PCIe #11	GbE*** (5) GA 011 PER 5 PCH RM590E HSI0 25 PCIe #12	GbE*** (6) GA 010 PER 6 PCH RM590E HSI0 26 PCIe #13	GbE*** (7) GA 001 PER 7 PCH RM590E HSI0 27 PCIe #14	GbE*** (8) GA 000 PER 8 PCH RM590E HSI0 28 PCIe #15	GbE*** (8) GA 000 PER 8 PCH RM590E HSI0 28 PCIe #15
P5										
P4										
P3	SATA (4-8) USB3.2** (2-8) PE Gen4* x8 (2) ½ PE Gen4* x8 (1)									
P2	½ PE Gen4* x8 (1) PE Gen4* x8 (1)									
P1	½ PE Gen4* x8 (1) USB3.2** (1)	PE Gen4* x8 USB3.2**	PE Gen4* x8 USB3.2**	PE Gen3 x4 USB3.2**	PE Gen3 x1 SATA USB3.2**	PE Gen3 x1 SATA USB3.2**	PE Gen3 x1 SATA USB3.2**	PE Gen3 x1 SATA USB3.2**	PE Gen3 x1 SATA USB3.2**	
	SC9-TOCCATA	Fat Pipe Slot	Fat Pipe Slot	Peripheral Slot	Peripheral Slot	Peripheral Slot	Peripheral Slot	Peripheral Slot	Peripheral Slot	

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system slot connector assignment numbers in brackets e.g. SATA (4-8) according to the CPCI-5.0 specification table 44/45

* PCIe® Gen4 not specified by CPCI-5.0 R2.0 - subject to PICMG® working group

** USB3.2 Gen2x1 (10G) not specified by CPCI-5.0 R2.0 - subject to PICMG® working group

*** P6 Gigabit Ethernet requires e.g. S80/S82 low profile mezzanine module

SC9-TOCCATA • Resources w. 1+8 Slots Backplane (System Slot Right Aligned Version)

	①	②	③	④	⑤	⑥	⑦	⑧	⑨ SYS
P6	GbE*** (8)	GbE*** (7)	GbE*** (6)	GbE*** (5)	GbE*** (4)	GbE*** (3)	GbE*** (2)	GbE*** (1)	GbE*** (1-8)
P5	GA 000	GA 001	GA 010	GA 011	GA 100	GA 101	GA 110	GA 111	CLKPE (1-8)
P4	PER 8	PER 7	PER 6	PER 5	PER 4	PER 3	PER 2	PER 1	PE Gen3 x1 (7-8)
P3	PCH RM590E HSIO 28 PCIe #15	PCH RM590E HSIO 27 PCIe #14	PCH RM590E HSIO 26 PCIe #13	PCH RM590E HSIO 25 PCIe #12	PCH RM590E HSIO 24 PCIe #11	PCH RM590E HSIO 10-13 PCIe #5-8	CPU TGL-H	CPU TGL-H	PE Gen3 x1 (4-6)
P2									PE Gen3 x4 (3)
P1	PE Gen3 x1 SATA USB3.2***	PE Gen3 x1 SATA USB3.2***	PE Gen3 x1 SATA USB3.2***	PE Gen3 x1 SATA USB3.2***	PE Gen3 x1 SATA USB3.2***	PE Gen3 x4 USB3.2***	PE Gen4* x8 USB3.2***	PE Gen4* x8 USB3.2***	SATA (4-8) USB3.2** (2-8)
									PE Gen4* x8 (2)
									1/2 PE Gen4* x8 (1)
									1/2 PE Gen4* x8 (1)
									SC9-TOCCATA

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system slot connector assignment numbers in brackets e.g. SATA (4-8) according to the CPCI-5.0 specification table 44/45

* PCIe® Gen4 not specified by CPCI-5.0 R2.0 - subject to PICMG® working group

** USB3.2 Gen2x1 (10G) not specified by CPCI-5.0 R2.0 - subject to PICMG® working group

*** P6 Gigabit Ethernet requires e.g. S80/S82 low profile mezzanine module

Related Information	
SC9-TOCCATA Home	www.ekf.com/s/sc9/sc9.html
S20-NVME Low Profile Mezzanine	www.ekf.com/s/s20/s20.html
S40-NVME Low Profile Mezzanine	www.ekf.com/s/s40/s40.html
S42-MC Low Profile Mezzanine	www.ekf.com/s/s42/s42.html
S48-SSD Low Profile Mezzanine	www.ekf.com/s/s48/s48.html
S80-P6 Low Profile Mezzanine	www.ekf.com/s/s80/s80.html
S82-P6 Low Profile Mezzanine	www.ekf.com/s/s82/s82.html
<i>S84-P6 Low Profile Mezzanine</i>	<i>1 x 10G Backplane Ethernet (KR)</i>
<i>S85-P6 Low Profile Mezzanine</i>	<i>4 x 5G Backplane Ethernet (5GBASE-T)</i>
<i>SCG-MULTIGIG Mezzanine Side Card</i>	<i>2 x 10GBASE-T M12-X</i>
<i>SCI-MULTIGIG Mezzanine Side Card</i>	<i>2 x 10GBASE-T RJ45</i>
SCJ-VEENA Mezzanine Side Card	www.ekf.com/s/scj/scj.html
SCL-RHYTHM Mezzanine Side Card	www.ekf.com/s/scl/scl.html
SCX-PCIE Mezzanine Side Card	www.ekf.com/s/scx/scx.html
SCZ-NVM Mezzanine Side Card	www.ekf.com/s/scz/scz.html
ECX-PCIE Mezzanine Side Card	www.ekf.com/e/ecx/ecx.html
Mezzanine Connectors Explained	www.ekf.com/s/mezzanine_connectors.pdf

General Information CompactPCI® Serial	
CompactPCI® Serial Concise Overview	www.ekf.com/s/serial_concise.pdf
CompactPCI® Serial All You Need to Know	www.ekf.com/s/smart_solution.pdf
CompactPCI® Serial Home	www.ekf.com/s/serial.html

Ordering Information
For popular SC9-TOCCATA SKUs please refer to www.ekf.com/liste/liste_21.html#SC9
For new mezzanine connector based low profile modules please refer to www.ekf.com/liste/liste_21.html#S20

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