User Guide

SC8-FLUTE • CompactPCI® Serial CPU Card

Intel® Atom™ x6000 Series Processor • Elkhart Lake SoC

Contents

About this Manual

This manual describes the technical aspects of the SC8-FLUTE, required for installation and system integration. It is intended for the experienced user only.

Edition History

Ed.	Contents	Author	Date
1	User Manual SC8-FLUTE, english, preliminary edition (formal structure and basic content), Text #10074, File: sc8_ug.wpd	jj	8 June 2022
2	Preliminary edition 2: Added photos SC8-FLUTE (pano/halboffen), USB controller uPD720201 (PCB rev.1)	jj	26 April 2023
2.1	Preliminary edition 2.1: Added photos SC8-FLUTE w. SODIMM mounted	jj	6 July 2023
2.2	Preliminary edition 2.2: Added EHL CPU SKUs, added MTBF, added photos SC8 w. mezzanine cards	jj	10 August 2023
2.3	Some photos updated	jj	18 August 2023
2.4	Added UEFI Release, S02-M12, F/P illustration updated	jj	22 September 2023
2.5	Photos SC8 w. S42/SCJ/SCL updated (8HP heatsink)	jj	11 April 2024

Please note: If an EKF product has been labelled with  this special sign according to ISO 7010 M002, please contact support@ekf.com for availability of additional documentation which may be important for proper usage.

Related Documents

Related Information SC8-FLUTE	
SC8-FLUTE Home	www.ekf.com/s/sc8/sc8.html
SC8-FLUTE Product Information	www.ekf.com/s/sc8/sc8_pi.pdf

Nomenclature

Signal names used herein with an attached '#' designate active low lines.

Trade Marks

Some terms used herein are property of their respective owners, e.g.

- XEON®, Core™: ® Intel
- CompactPCI, CompactPCI PlusIO, CompactPCI Serial: ® PICMG
- Windows: ® Microsoft
- EKF, ekf system: ® EKF

EKF does not claim this list to be complete.

Legal Disclaimer - Liability Exclusion

This manual has been edited as carefully as possible. We apologize for any potential mistake. Information provided herein is designated exclusively to the proficient user (system integrator, engineer). EKF can accept no responsibility for any damage caused by the use of this manual.

Standards

Reference Documents		
Term	Document	Origin
CompactPCI® Serial	CompactPCI® Serial Specification, PICMG® CPCI-S.0	www.picmg.org
DisplayPort	VESA DisplayPort Standard Version 1.4a, DisplayPort Alt Mode on USB Type-C	www.vesa.org
Ethernet	IEEE Std 802.3 2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-T IEEE Std 1588-2008 Precision Time Protocol	standards.ieee.org
HD Audio	High Definition Audio Specification Rev.1.0a	www.intel.com
eSPI	Intel Enhanced Serial Peripheral Interface Bus Interface Base Specification Rev. 1.0	www.intel.com
M.2	PCI Express M.2 Specification Revision 4.0	www.pcisig.com
NVMe	NVM Express 2.0 specification	www.nvmexpress.org
PCI Express®	PCI Express® Base Specification 3.1 PCI Express® Base Specification 4.0	www.pcisig.com
SATA	Serial ATA 3.0 & 3.1 Specification	www.sata-io.org
TPM	Trusted Platform Module 2.0	www.trustedcomputinggroup.org
UEFI	Unified Extensible Firmware Interface UEFI Specification Version 2.9 UEFI Shell Specification Version 2.2 ACPI Specification Version 6.3	www.uefi.org
USB	Universal Serial Bus 3.2 Specification Rev.1.0 Universal Serial Bus 4 Specification Version1.0 Type-C Cable and Connector Specification Rev. 2.1 Type-C Locking Connector Specification Rev. 1.0 Universal Serial Bus Power Delivery Specification Rev. 3.1	www.usb.org

General

The SC8-FLUTE is a low power CompactPCI® Serial CPU board, based on an Intel® Atom™ x6000RE (Elkhart Lake Industrial) System-on-Chip processor. The front panel is provided with three 2.5Gbps RJ45 Ethernet jacks, and three Type-C USB3/DisplayPort connectors. The board is equipped with 16GB directly soldered DDR4 IBECC RAM, and in addition a DDR4 SODIMM socket for another 16GB.

High speed PCIe® x4 SSD mass storage is available via low profile mezzanine modules (4HP assembly), or multi-function side cards (8HP). The SC8-FLUTE backplane connectors comply with the CompactPCI® Serial system board specification, suitable for reasonable system expansion via 3 x PCIe®, 4 x SATA (two ports configurable as hardware RAID 0/1), and USB3.

Feature Summary

Feature Summary

General

- CompactPCI® Serial (PICMG® CPCI-S.0) System Slot Controller
- Form factor single size Eurocard (board dimensions 100x160mm^2)
- Mounting height 3U
- Front panel width 4HP (8HP/12HP assembly with optional mezzanine side card)
- Front panel I/O for versatile system configuration (3 x USB3/DisplayPort, 3 x 2.5Gbps Ethernet)
- Backplane communication via CompactPCI® Serial connectors
- On-board PCIe® mezzanine expansion option for mass storage modules or side cards
- Side cards and low profile mass storage modules available as COTS and also as custom specific

SoC (Processor)

- Intel® Atom® Industrial SoC x6000RE Series (Elkhart Lake)
- x6425RE • 4 Cores • 1.9GHz • 12W TDP • 400MHz/32EUs Gfx
- x6416RE • 4 Cores • 1.7GHz • 9W TDP • 450MHz/16EUs Gfx
- x6414RE • 4 Cores • 1.5GHz • 9W TDP • 400MHz/16EUs Gfx
- x6214RE • 2 Cores • 1.4GHz • 6W TDP • 400MHz/16EUs Gfx
- x6212RE • 2 Cores • 1.2GHz • 6W TDP • 350MHz/16EUs Gfx

all frequencies not final and subject to change

- *Intel® Atom® Embedded SoC x6000E Series (Elkhart Lake)*
- *x6425E • 4 Cores • 2.0GHz • 12W TDP • 500MHz/32EUs Gfx*
- *x6413E • 4 Cores • 1.5GHz • 9W TDP • 500MHz/16EUs Gfx*
- *x6211E • 2 Cores • 1.3GHz • 6W TDP • 350MHz/16EUs Gfx*

- *Intel® Atom® Industrial FuSa SoC x6000FE Series (Elkhart Lake)*
- *x6427FE • 4 Cores • 1.9GHz • 12W TDP • 400MHz/32EUs Gfx • FuSa*
- *x6200FE • 2 Cores • 1.0GHz • 4.5W TDP • tbd MHz/tbd EUs Gfx • FuSa*

italic grey: SKUs not plan of release

- In-band ECC
- Intel® Programmable Services Engine
- Intel® Time Coordinate Computing (Intel® TCC) and TSN
- Operating life 10 years up to 100% active
- T_a -40°C to 85°C

Feature Summary

Firmware

- Phoenix® UEFI (Unified Extensible Firmware Interface) V2.7 with CSM*
- Phoenix® SCT (SecureCore Technology) Release V4.3.0
- ACPI tbd
- Fully customizable by EKF
- Secure Boot and Measured Boot supported
- Windows®, Linux and other (RT)OS' supported

** CSM (Compatibility Support Module) emulates a legacy BIOS environment, which allows to boot a legacy operating system such as DOS, 32-bit Windows and some RTOS'*

Main Memory

- Integrated memory controller fo up to 32GB DDR4 w. IBECC, 3200MT/s
- 16GB Soldered memory for rugged applications
- 16GB SODIMM socket

Mass Storage

- 128Mbit SPI Flash (UEFI firmware and customer application data)
- Option e•MMC (embedded MMC 5.0 64GByte soldered)
- PCIe® based SSD module options via P-HSE1 & P-HSE2 mezzanine connectors
- M.2 socket(s) on low profile mezzanine modules (4HP) or side cards (8HP)
- Up to 2 x M.2 NVMe SSD size 2280, PCIe x4 (P-HSE1) and PCIe x1 (P-HSE2)
- Up to 2 x 1TB as of current
- Option custom specific mezzanine mass storage board design on request

Graphics

- Intel® UHD Graphics, 4kp60 (4096x2160@60Hz) on three simultaneous displays
- 2D/3D Hardware acceleration
- H.265/HEVC Decode/Encode
- H.264 Decode/Encode
- MPEG2 Decode
- VC1/WMV9 Decode
- VP8 Decode
- VP9 Decode/Encode
- JPEG/MPEG Decode/Encode
- HDCP 2.3, PAVP
- 3 x Type-C front panel connectors (DisplayPort Alternate Mode)
- DisplayPort™ 1.4 MST (multiple displays if monitor is equipped with bridge chip)

Feature Summary

Networking

- Up to 11 Gigabit Ethernet networking interfaces in total
- 3 x 2.5GBASE-T RJ45 front ports via integrated MACs & SGMII PHYs Marvell® AQR115C
- 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 backplane w. S83-P6 mezzanine module - 4 x Intel® I226-IT NIC
- Option 4 x 2.5GBASE-T RJ45 front w. SCJ-VEENA short side card - 4 x Intel® I226-IT NIC (8HP)
- Option 4 x 1000BASE-T M12-X front w. SCL-RHYTHM short side card - 4 x Intel® I210-IT NIC (8HP)
- Option RJ45 port 1 jack replacement by M12-X connector w. S02-M12 mezzanine (8HP)
- TSN Precision time protocol (Time-Sensitive-Networking) as required for OPC UA and OpenAvnu
- Enables ultra-reliable low-latency communication (URLLC)
- Intel® Time Coordinated Computing (Intel® TCC) for time synchronisation and timeliness

EHL SoC I/O Usage

- 3 x USB Type-C front panel connectors (DP Alt Mode)
- 3 x 2.5GBASE-T SGMII PHYs to RJ45 front ports
- 4 x PCIe® Gen3 to HSE1 mezzanine connector (configurable 1x4 or 4x1 links)
- 4 x PCIe® Gen3 to HSE2 mezzanine connector (4x1 links via Gen3 switch)
- 3 x PCIe® Gen3 to backplane connectors (x1 links, 1 derived from SoC, 2 x via Gen3 switch)
- 1 x PCIe® Gen3 to 1:7 switch (1 x USB controller, 2 x backplane use, 4 x HSE2 mezzanine)
- e•MMC 5.1(ordering option, mass storage device up to 64GB)
- 1 x SATA 3.2 for backplane usage
- eSPI, Audio, I2C, UART, CAN-FD, Time Sync to mezzanine expansion connector N-EXP
- TPM 2.0 module

Additional Building Blocks

- Additional on-board devices, PCIe® based
- PCIe® Gen3 packet switch PI7C9X3G808GP (8-port, 8-lane)
- Quad port PCIe® USB3 controller uPD720201 (Type-C, backplane, HSE1, RAID controller)
- Option JMS562 USB to SATA RAID 0/1 controller (backplane SATA)

Security

- Trusted Platform Module
- TPM 2.0 for highest level of certified platform protection
- Infineon Optiga™ SLM9670 cryptographic processor
- Conforming to TCG 2.0 specification
- AES hardware acceleration support (Intel® AES-NI)

Feature Summary

Front Panel I/O (4HP)

- 3 x 2.5 Gigabit Ethernet RJ45 (2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-Te)
- 3 x DisplayPort (Type-C Alt Mode)
- 3 x USB 3 Type-C (same as DP connectors), 1 x USB 3.1 Gen1 5G (top connector), 2 x USB 3.1 Gen2 10G (mid & lower receptacles)

Front Panel I/O (8HP)

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

CompactPCI® Serial Backplane Resources

- PICMG® CompactPCI® Serial CPU card (system slot controller)
- Support for up to three PCIe® based peripheral boards, Gen3 x1 links
- 1 x PCIe® derived from EHL SoC, 2 x PCIe® via PI7C9X3G808GP switch
- Support for 1 x native SATA (6Gbps)
- Option 3 x SATA in addition with JMS562 controller (2 x SATA RAID 0/1)
- Support for 1 x USB2/3 (5Gbps) via uPD720201 controller
- Option 8 x Gigabit Ethernet Switch (S80-P6 low profile mezzanine module)
- Option 4 x Gigabit Ethernet NICs (S82-P6 low profile mezzanine module)
- Option 4 x 2.5Gigabit Ethernet NICs (S83-P6 low profile mezzanine module)

Feature Summary

Local Expansion

- Mezzanine side card connectors for optional local expansion
- HSE1 - High speed expansion connector, PCIe® Gen3 fully configurable, derived from EHL SoC
- HSE2 - High speed expansion connector, PCIe® Gen3 configured 4x1, via PCIe® packet switch
- EXP - Sideband expansion connector, e.g. eSPI, Audio, UART (from EHL SoC)

- 4HP Low profile mezzanine module options (to be ordered separately)
- S20-NVME Mezzanine module - 1 x 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 Connector
- S42-MC Mezzanine module - 1 x M.2 2280 NVME SSD socket, 2 x Mini Card sockets
- S48-SSD Mezzanine Module - 2 x M.2 2280 NVME SSD sockets, 1 x USB Type-C
- S80-P6 Mezzanine module - 1 x M.2 2280 NVMe SSD socket, 8 x Gigabit Ethernet via P6 backplane connector
- S82-P6 Mezzanine module - M.2 NVMe SSD & 4 x GbE NIC via P6 backplane connector
- S83-P6 Mezzanine module - M.2 NVMe SSD & 4 x 2.5GbE NIC via P6 backplane connector
- Custom specific module design

- 8HP Mezzanine side card option (to be ordered separately)
- SCJ-VEENA Quad RJ45 2.5GbE NIC & M.2 SSD storage
- SCL-RHYTHM Quad M12-X GbE NIC & M.2 SSD storage
- SCZ-NVM Dual M.2 NVMe SSD, quad UART
- S02-M12 - RJ45 port 1 replacement by M12-X connector (top or bottom mount)
- Custom specific side card design

Environmental & Regulatory

- 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 -40°C to +85°C (industrial temperature range)
- 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 20.6 years (MIL-HDBK-217F, SN29500 @+40°C)
- EC Regulatory EN55035, EN55032, EN62368-1 (CE)

Feature Summary

RT OS Board Support Packages & Driver

- Please contact sales@ekf.de

Applications

- General low power industrial computing, for x86 based software
- Rugged systems (e.g. transportation, construction machines, harvester)
- Data concentrator, router, gateway, kiosk systems, IoT
- Stand-alone computer (fog computing), scalable via mezzanine I/O expansion options
- Small modular CompactPCI® Serial systems for expansion with up to four peripheral cards

all items are subject to changes w/o further notice

SC8-FLUTE - Soldered RAM Top/Bottom

SC8-FLUTE - SODIMM on Top of Soldered RAM

CompactPCI® Serial

While mechanically compliant to CompactPCI® Classic, CompactPCI® Serial (PICMG® CPCIS.0) defines a well established card slot system, 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 SC8-FLUTE, 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 (up to PCIe® x 8).

The SC8-FLUTE is a low power CompactPCI® Serial CPU card, optimized for small to medium sized systems, e.g. the BLUBRICK® box solution, or even stand-alone operation.


DP
USB
COM B
Power
Fault
2.5G
USB
100-240V~
50/60Hz
COM A


GbE
VGA
DVI
DP
USB
GbE
Power
Fault
2.5G
100-240V~
50/60Hz

Mezzanine Expansion

The SC8-FLUTE 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® and USB3. The socket N-EXP is used as a legacy interface (e.g. HD Audio, UART) and not necessary 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).

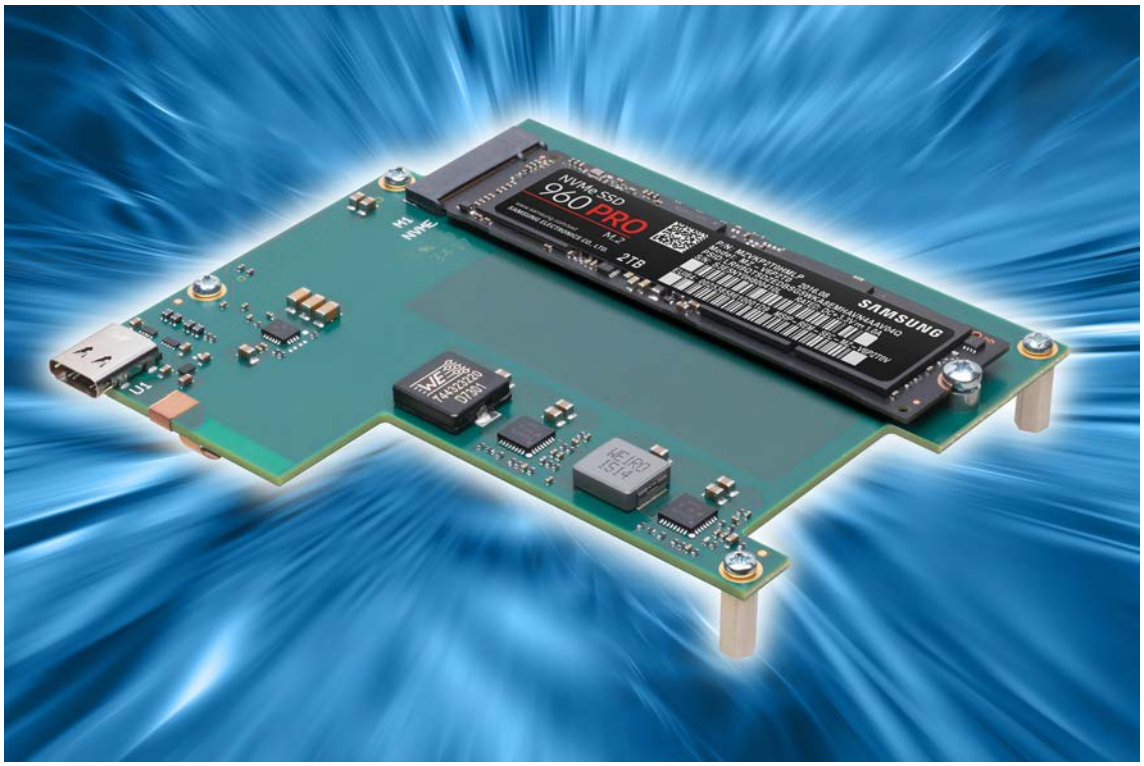
HSE1 is assigned to a PCIe® Gen3 x4 capable link, derived directly from the EHL SoC. On a 4HP low profile mezzanine module or 8HP side card this link is wired to a fast NVMe SSD housed in an M.2 socket, typically used as boot device and general mass storage. In addition, HSE1 brings also an USB3 port,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

HSE2 provides another four PCIe® Gen3 lanes, configured as x1 links, via a fan-out PCIe® switch.

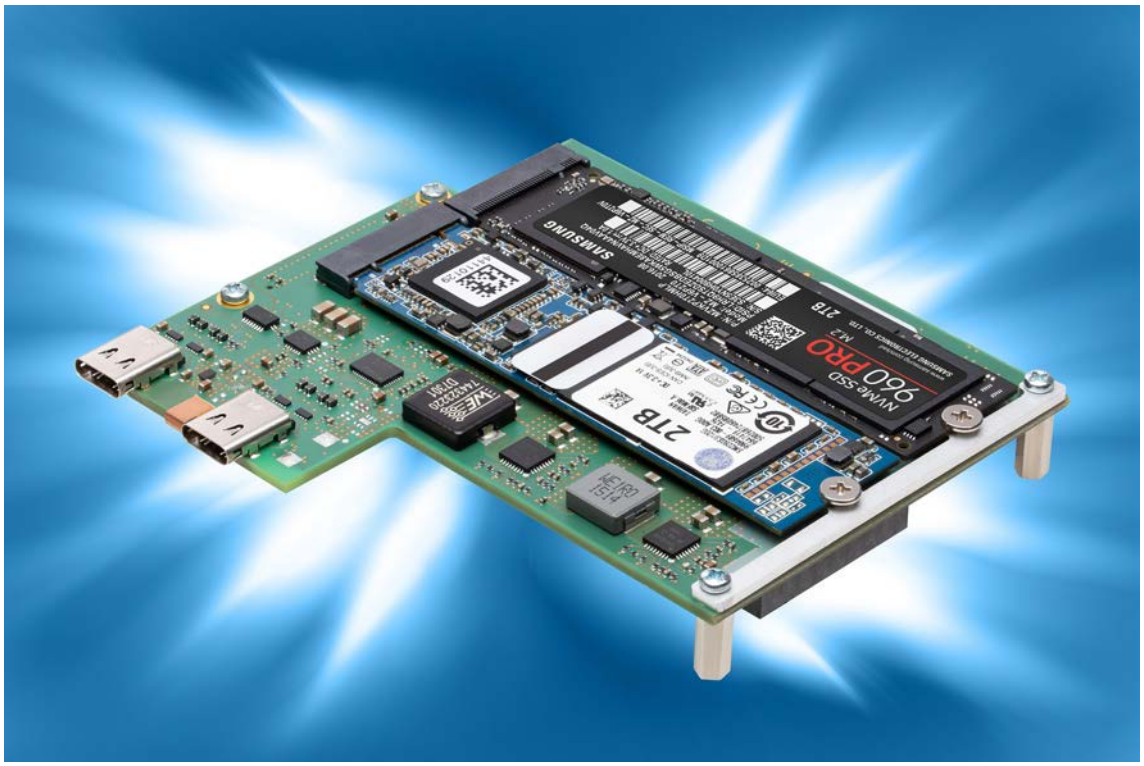
Some mezzanine modules such as the S20 get along with the HSE1 connector alone, others such as S40, S48 or S80 depend on both HSE1 and HSE2 for full functionality.

Related Information Mezzanine Connectors

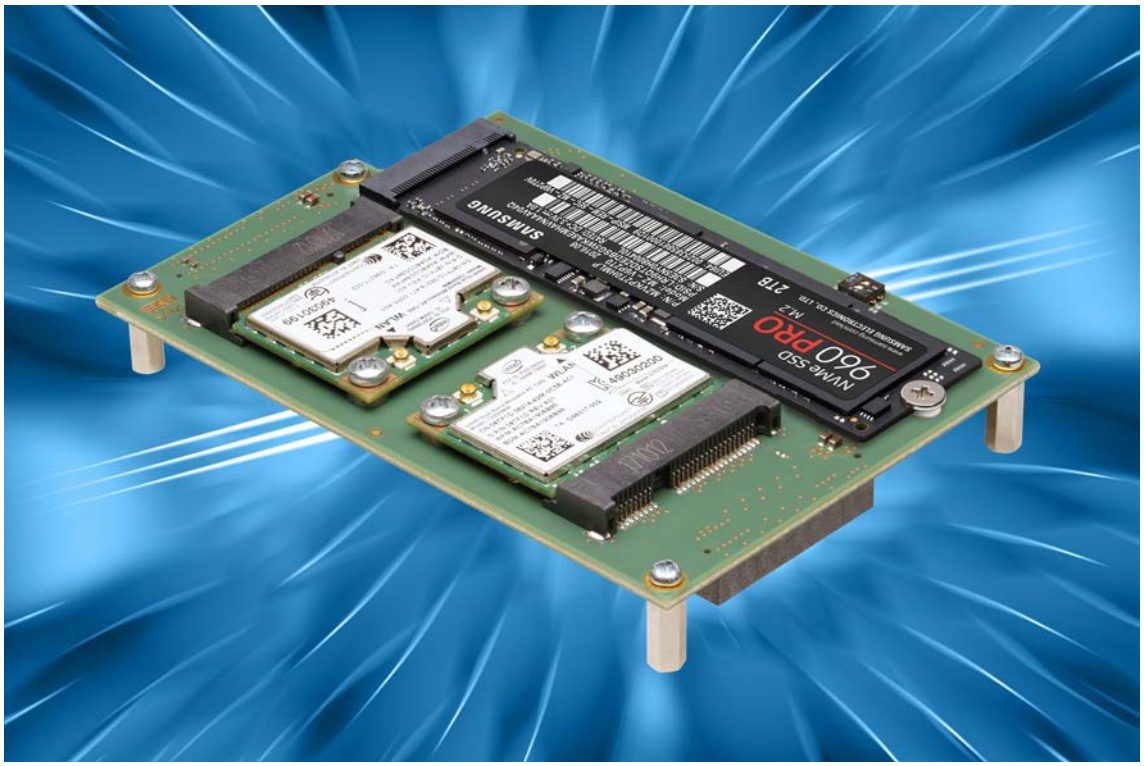
https://www.ekf.com/s/mezzanine_connectors.pdf



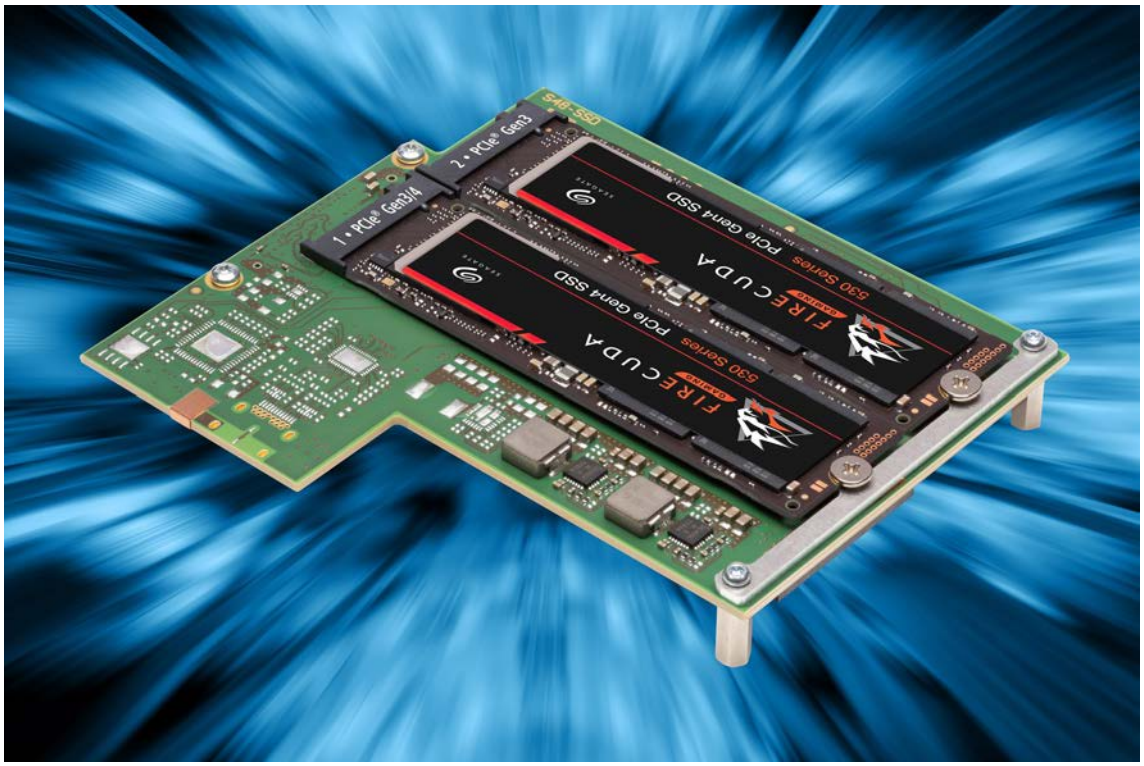
S20-NVME Low Profile Mezzanine Module



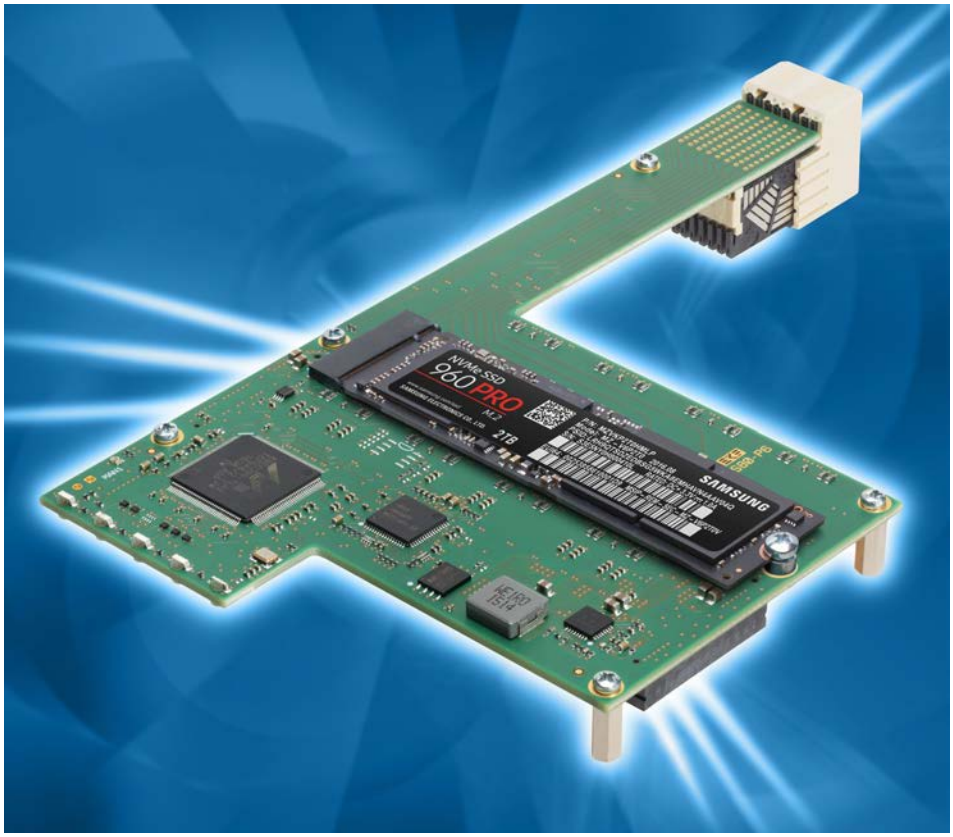
S40-NVME Low Profile Mezzanine Module



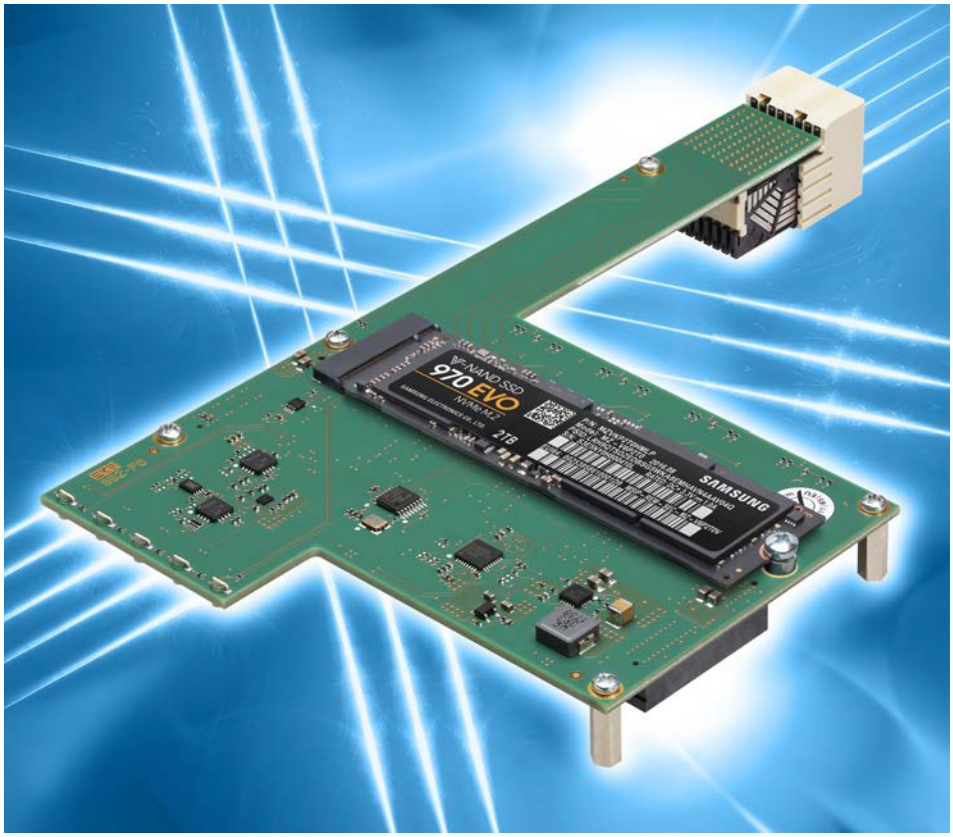
S42-MC Low Profile Mezzanine Module



S48-SSD Low Profile Mezzanine Module



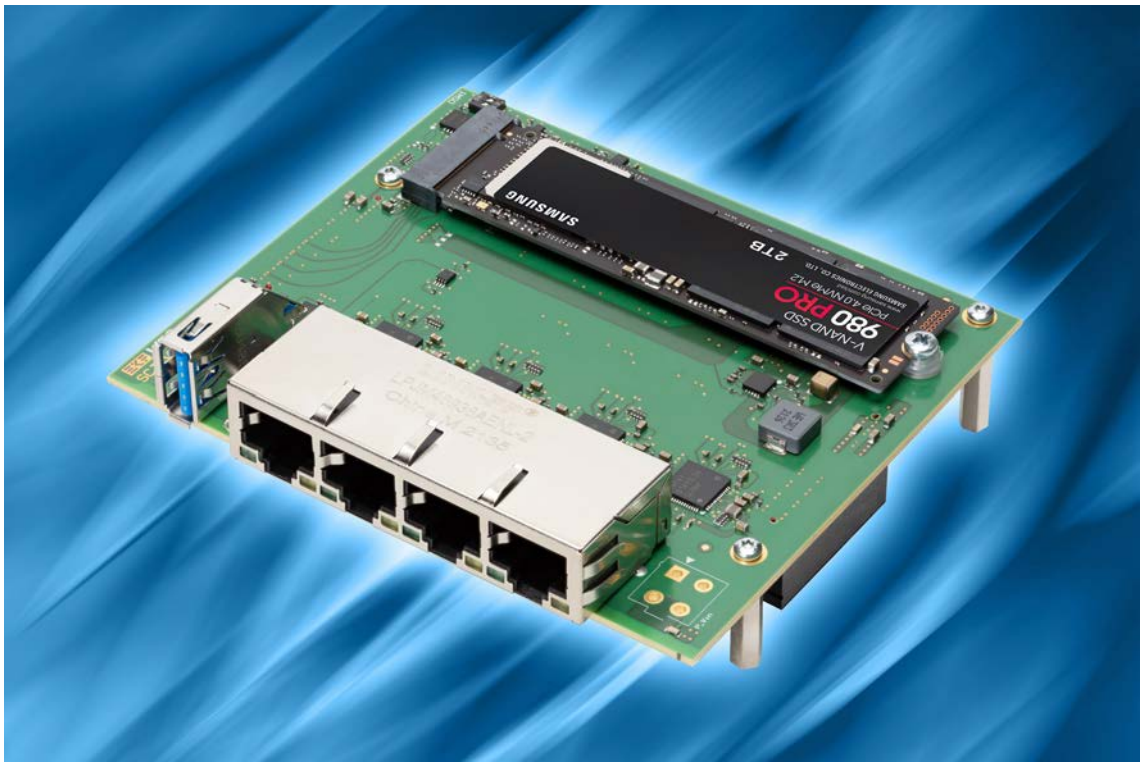
S80-P6 Low Profile Mezzanine Module



S82-P6 Low Profile Mezzanine Module

Sample 8HP/12HP Side Card Assemblies

SCJ-VEENA 8HP Assembly



SCJ-VEENA

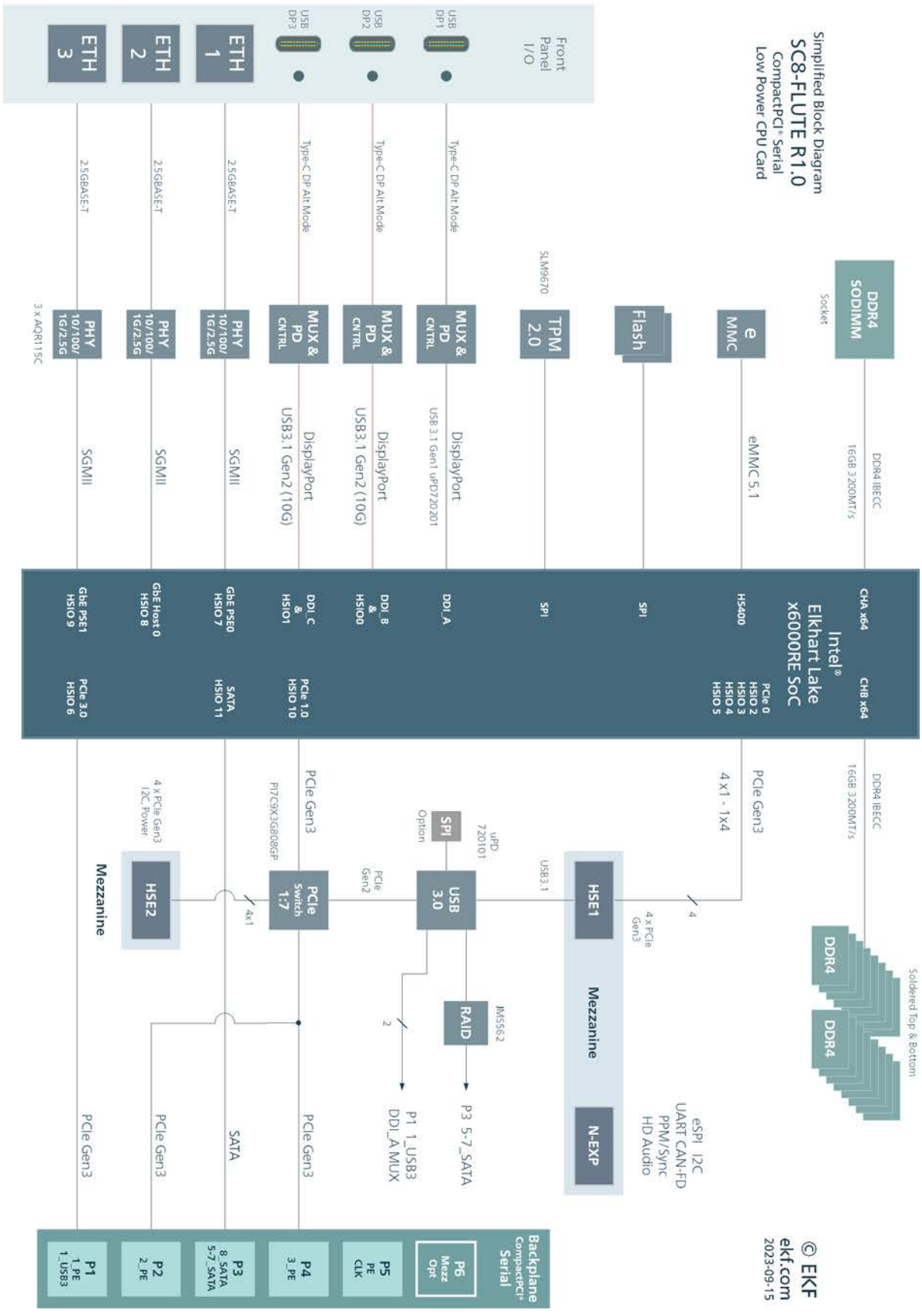
SCL-RHYTHM 8HP Assembly

SCZ-NVM 8HP Assembly

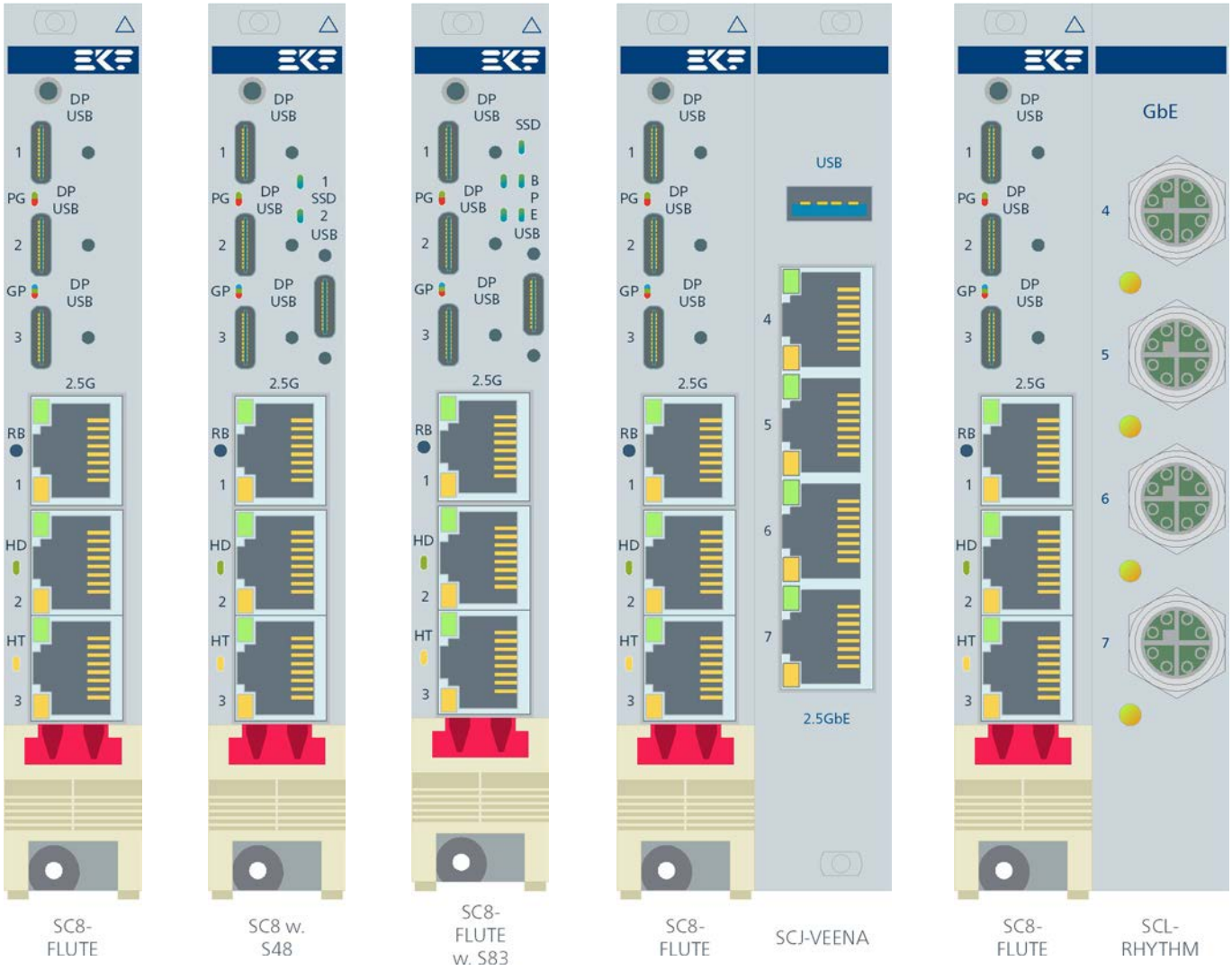
SCZ-NVM 8HP/12HP Assembly

Related Mezzanine Modules and Side Cards	
S20-NVME M.2 NVMe SSD	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
S83-P6 Low Profile Mezzanine	www.ekf.com/s/s83/s83.html
SCJ-VEENA Mezzanine Side Card	www.ekf.com/s/scj/scj.html
SCL-RHYTHM Mezzanine Side Card	www.ekf.com/s/scl/scl.html
SCZ-NVM Mezzanine Side Card	www.ekf.com/s/scz/scz.html

Block Diagram



Front Panel


DP
USB
1
PG
DP
USB
2
GP
DP
USB
3
2.5G
RB
1
HD
2
HT
3
SC8-
FLUTE
SC8 w.
S48
SSD
1
SSD
2
USB
SC8-
FLUTE
w. S83
BPE
USB
USB
4
5
6
7
2.5GbE
SC8-
FLUTE
SCJ-VEENA
GbE
SC8-
FLUTE
SCL-
RHYTHM

Front Panel Connectors

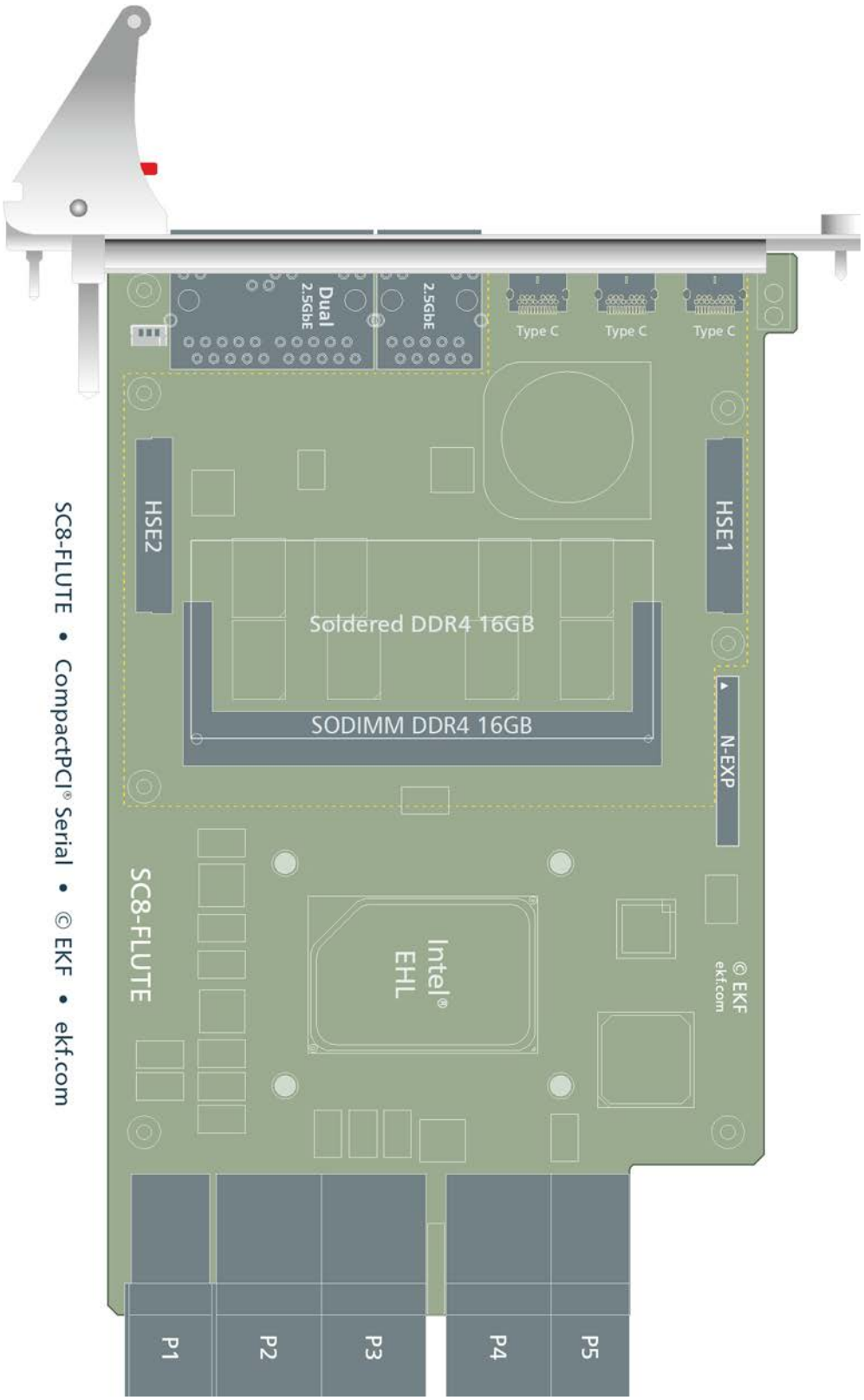
USB/DP 1-3	Type-C USB 3.1 & DisplayPort 1.4 Alternate Mode USB 3.1 Gen1 5G speed (upper connector) USB 3.1 Gen2 10G speed (mid & lower connector) USB-PD downstream facing ports, V_{BUS} 5V up to 3A (maximum power not available concurrently on any port) DP 4096x2160 @60Hz, MST capable Front panel w. threaded M2x0.4 holes optionally available for screw locked cable assemblies (single screw USB Type-C locking plug)
Ethernet 1-3	RJ45 2.5GBASE-T (4-speed) EHL SoC integrated 2.5GbE TSN MACs, AQR115C PHYs

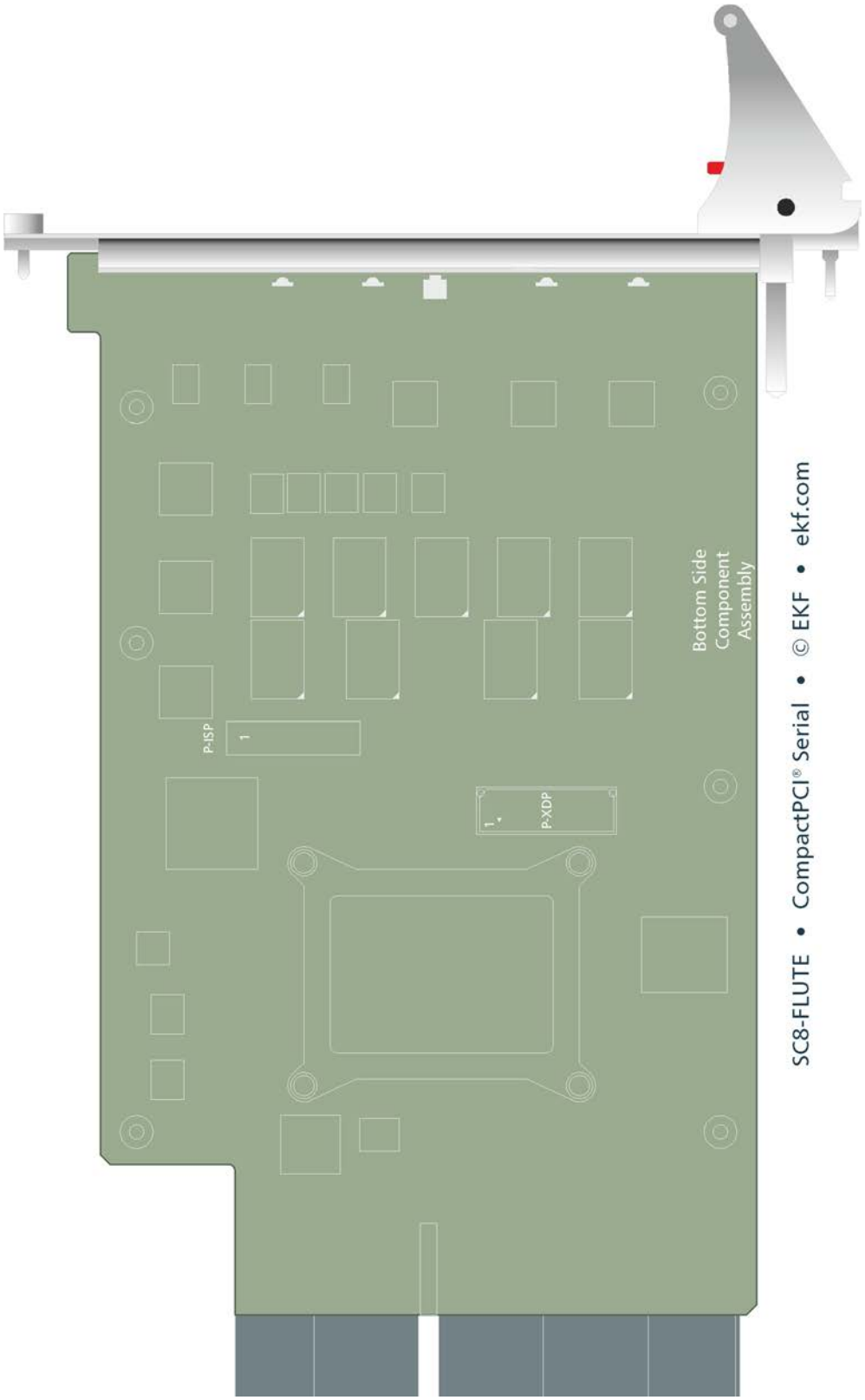
Front Panel Switches & Indicators

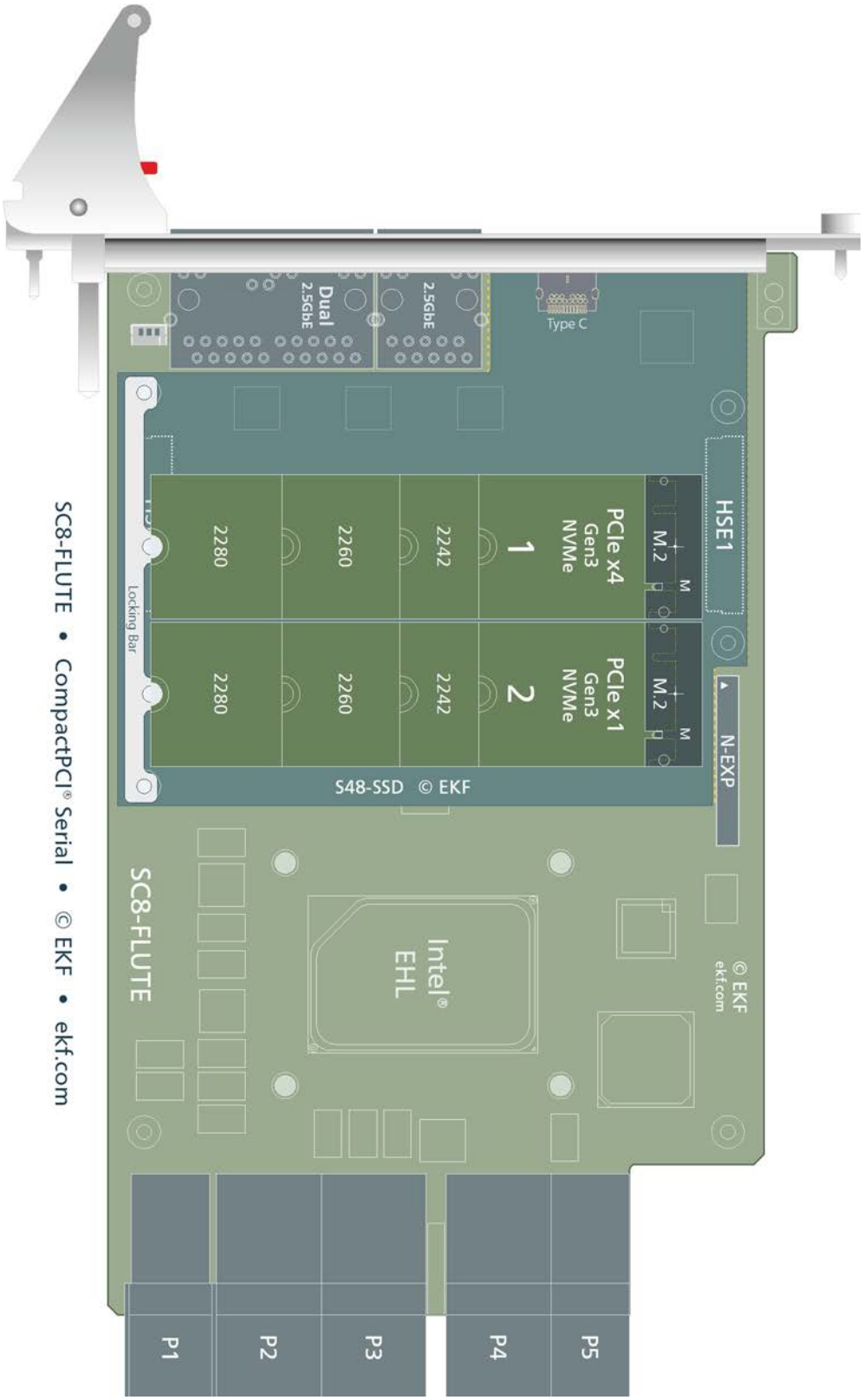
FPH	Front Panel Handle integrated microswitch (red button) Programmable function, power event button by default
GP	General Purpose bicolour LED
HD	LED indicating any activity on SATA ports
HT	LED indicating CPU or voltage regulator high temperature (yellow)
PG	Power Good/Board Healthy bicolour LED
RB	System Reset Button (Option)

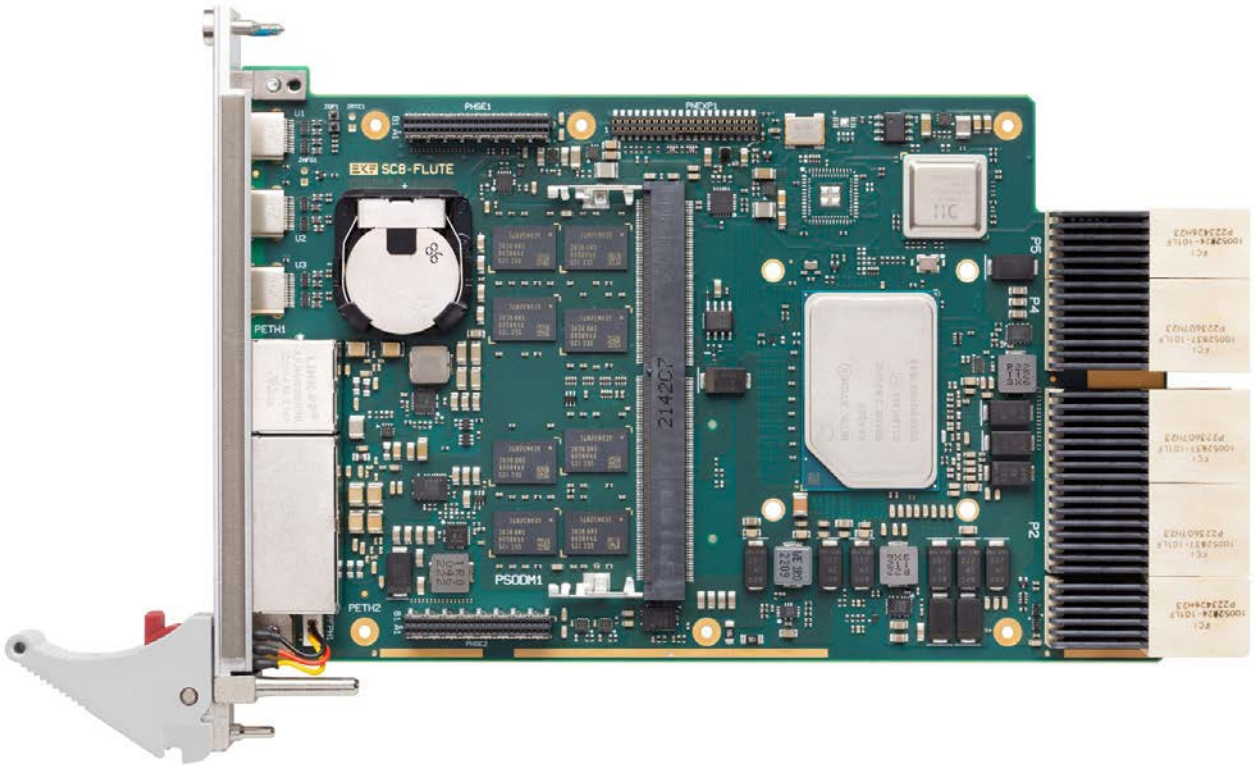
LED			Status
PG Green/Red	GP Green/Red	HD Green	
OFF	GREEN	GREEN	Sleep State S5 (Soft Off)
OFF	GREEN	OFF	Sleep State S4 (Suspend to Disk/Hibernate)
OFF	OFF	GREEN	Sleep State S3 (Suspend to RAM/Standby)
GREEN	RED BLINK	X	After Reset
GREEN	X	X	Board Healthy and in S0 State
GREEN BLINK	X	X	Front panel handle is unlocked
RED	X	X	Hardware Failure - Power Fault
RED BLINK	X	X	Software Failure

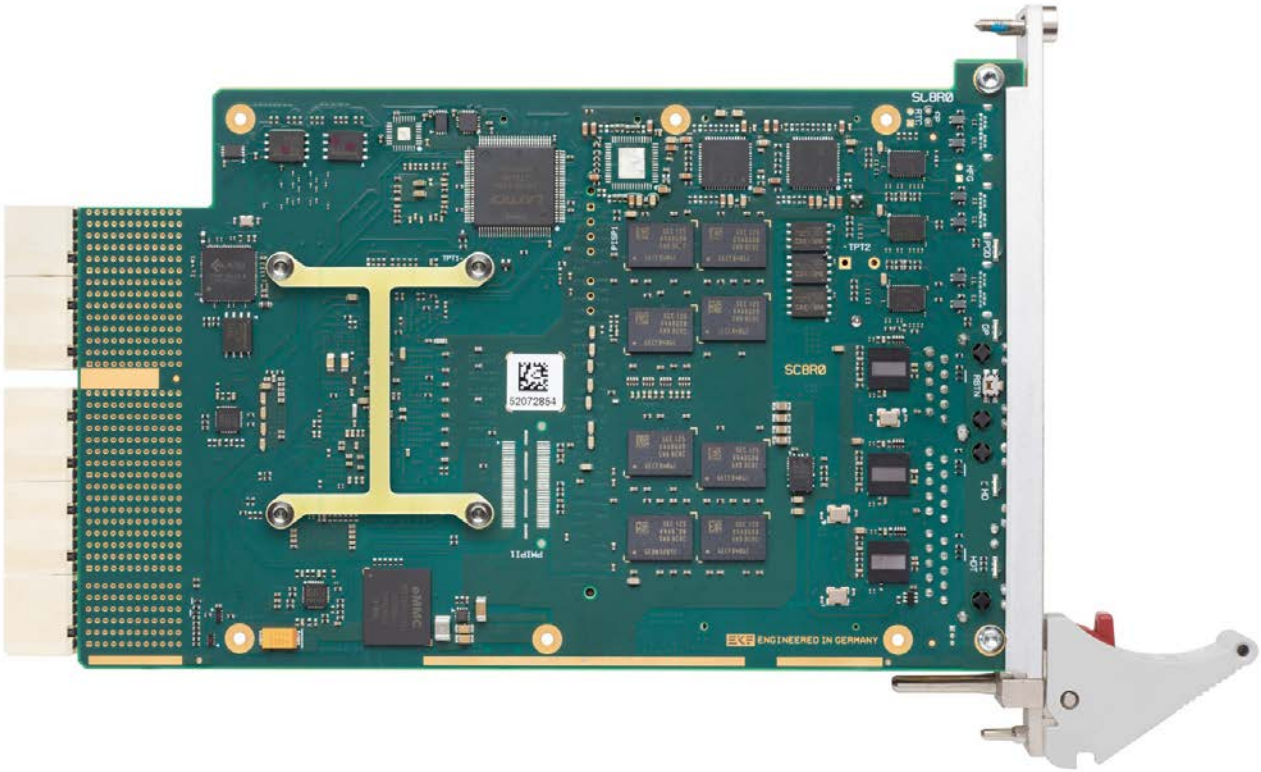
Component Orientation

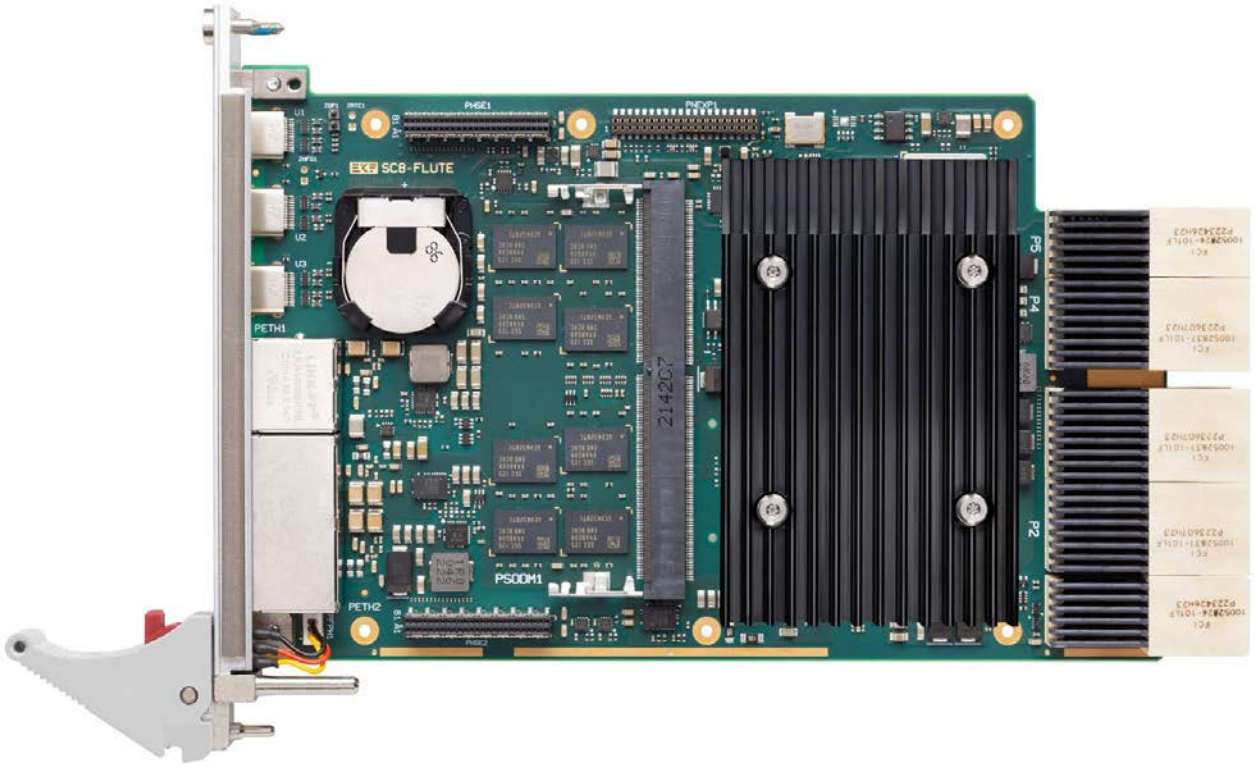



Bottom Side
Component
Assembly
P-ISP
1
P-XDP
1
SC8-FLUTE • CompactPCI® Serial • © EKF • ekf.com


SC8-FLUTE • CompactPCI® Serial • © EKF • ekf.com
Dual 2.5GbE
2.5GbE
Type C
HSE1
PCIe x4 Gen3 NVMe
1
PCIe x1 Gen3 NVMe
2
M.2 M
2242
2260
2280
Locking Bar
S48-SSD © EKF
N-EXP
SC8-FLUTE
Intel® EHL
© EKF ekf.com
P1
P2
P3
P4
P5


SC8-FLUTE
PETH1
PETH2
PSODM1
P5
P4
P2

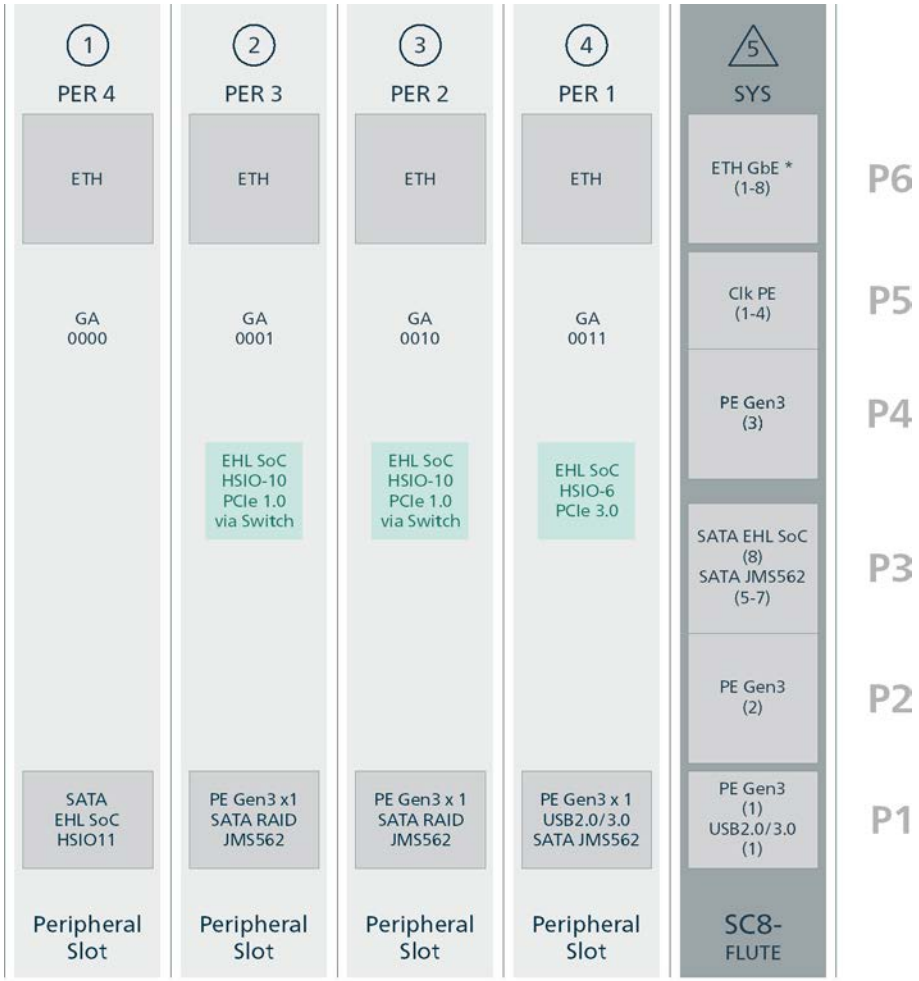

SL8R0
SC8R0
ENGINEERED IN GERMANY


SC8-FLUTE
PETH1
PETH2
PSODM1
P5
P4
P2

Overview On-Board Connectors & Jumpers

N-EXP	Mezzanine	Utility Expansion Interface Connector (e.g. eSPI, HD Audio, SMBus) Interface to optional mezzanine side card
HSE1		High Speed Expansion Connector 1 (PCIe® Gen4 1x4, USB 3.2 Gen 2x1) Interface to low profile mezzanine module or side card
HSE2		High Speed Expansion Connector 2 (PCIe® Gen3 4x1, DisplayPort) Interface to optional low profile mezzanine module or side card
P1	Backplane	CompactPCI® Serial Type A Connector
P2-P4		CompactPCI® Serial Type B Connectors
P5		CompactPCI® Serial Type C Connector
P6		CompactPCI® Serial Type D Connector Option with a S8x-P6 series low profile mezzanine module
SODM	Memory	260-pin DDR4 ECC Memory Module (ECC SODIMM)
FPH	Handle	Connector to Front Panel Handle integrated switch
ISP	Manufacturing	In System Programming - bottom side manufacturing interface - not populated
J-MFG		Jumper to enter Manufacturing Mode, not populated
J-GP	Setup	Jumper to reset UEFI/BIOS setup to EKF factory defaults IEEE 1588 Pulse per Second Output
J-RTC		Jumper to reset RTC circuitry, not populated

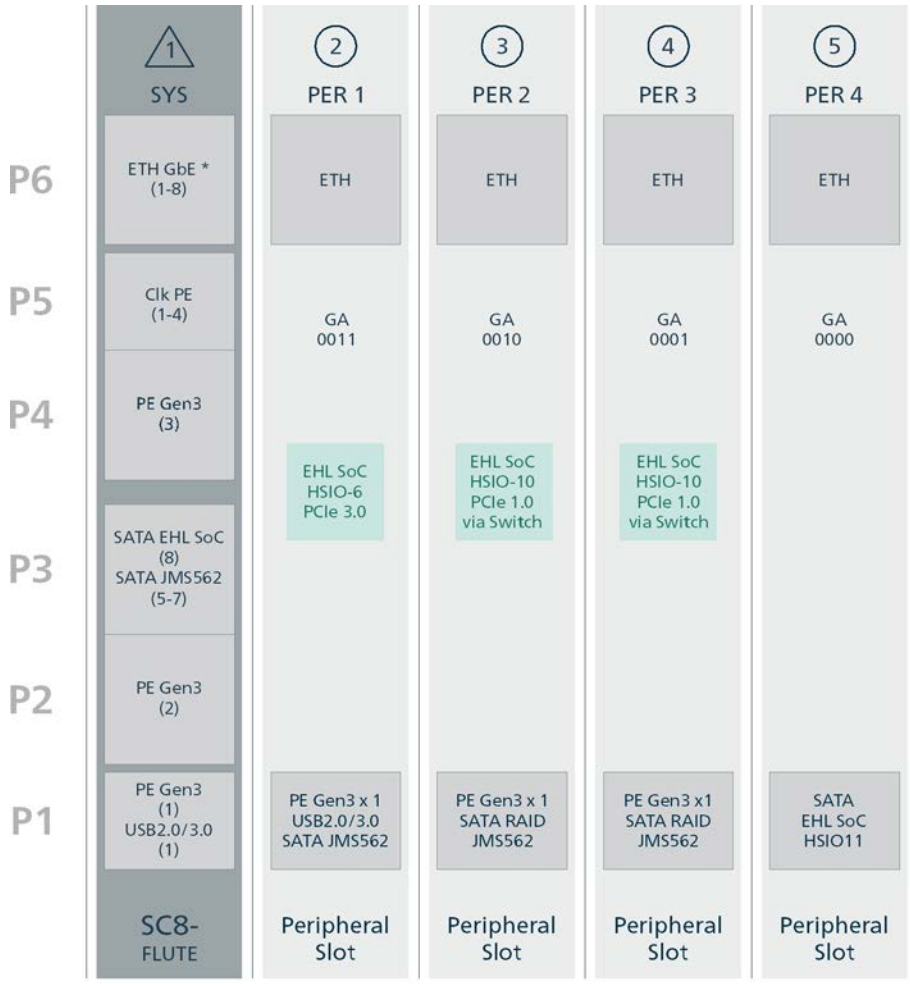
Backplane Resources



1+4 Slots backplane resources (system slot right)

* Ethernet via P6 requires low profile mezzanine module S80 or S82

SC8-FLUTE • © EKF • ekf.com



1+4 Slots backplane resources (system slot left)

* Ethernet via P6 requires low profile mezzanine module S80 or S82

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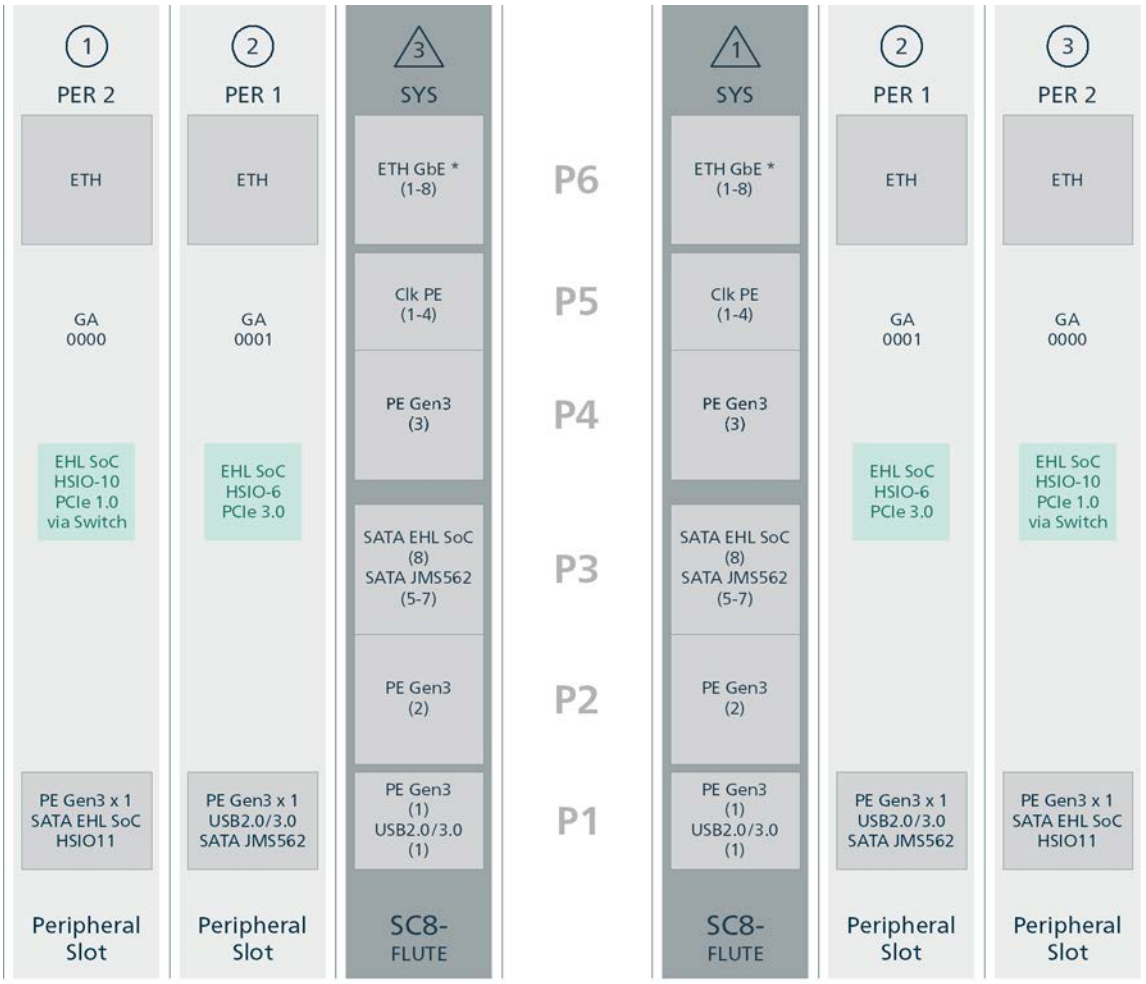

1+2 Slots backplane resources (system slot right)

1+2 Slots backplane resources (system slot left)

* Ethernet via P6 requires low profile mezzanine module S80 or S82

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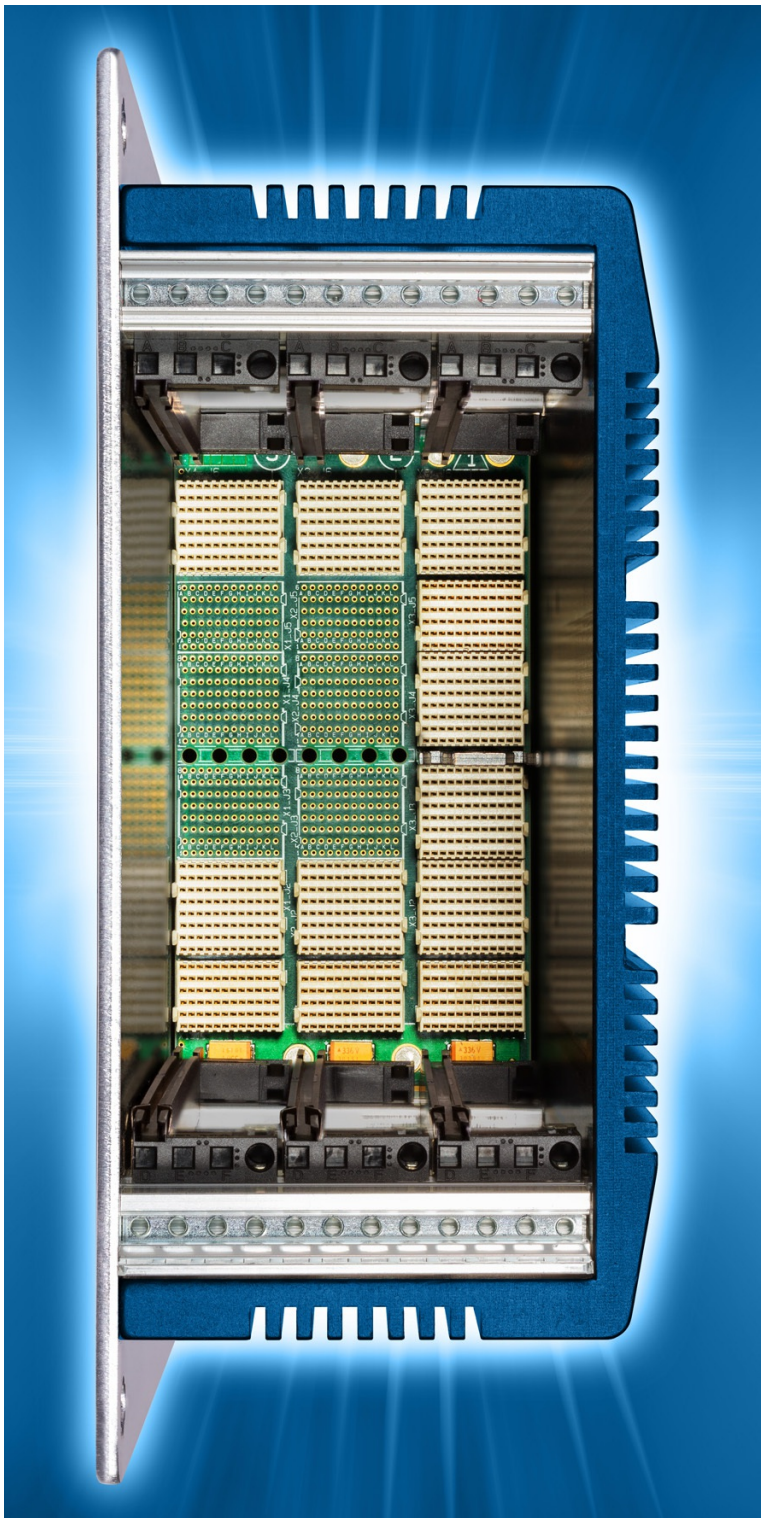
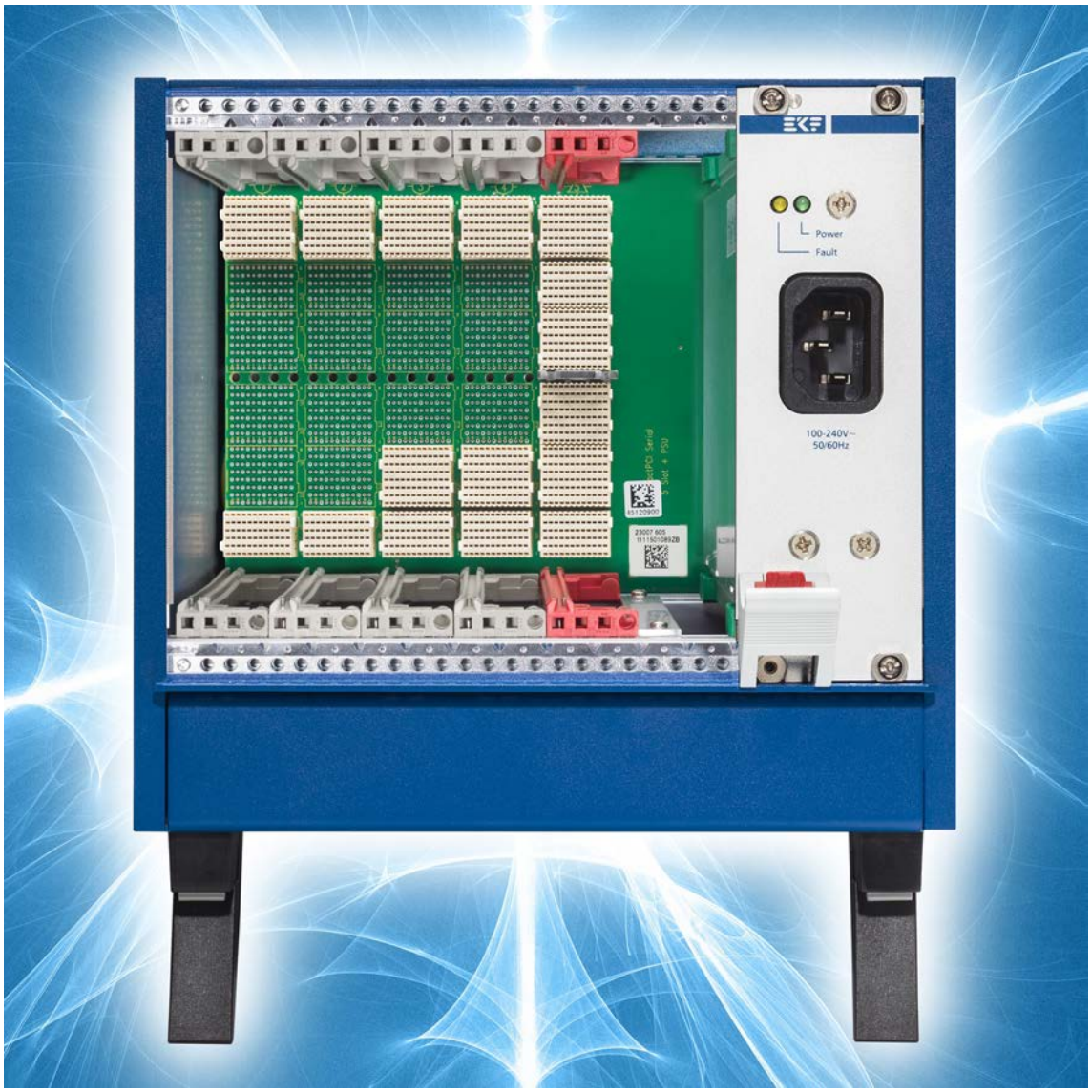
Recommended System Solutions



SRS-1201-BLUBRICK



SRS-3201-BLUBOXX

System-on-Chip

The SC8-FLUTE is equipped with an Intel® Atom® x6000RE Series SoC (aka Elkhart Lake), intended for industrial usage, which means an operating life (reliability) of 10 years, up to 100% active. The compute die and the PCH are integrated into a common package.

Intel® x6000RE Processors (Industrial Use Case)										
EKF SKU	SoC	Cores	Clock GHz	Cache LLC MB	Gfx MHz EU	Ambient Temp. °C	TDP W	IB-ECC	TCC/ TSN	Intel® PSE
SC8-tbd	x6425RE	4	1.9	4	400 32	-40 to +85	12	✓	✓	✓
SC8-tbd	x6414RE	4	1.5	4	400 16	-40 to +85	9	✓	✓	✓
SC8-tbd	x6212RE	2	1.2	4	350 16	-40 to +85	6	✓	✓	✓

Memory

The x6000RE SoC features two memory controller channels x64 for DDR4 SDRAMs with in-band support of ECC (Error Correction Code). On the SC8-FLUTE, one channel is realized with 16 memory devices 8Gb, soldered to the board (Memory Down), and delivers a capacity of up to 16GB in total at a clock frequency of 3200MHz.

The 2nd memory controller channel is wired to a socket, for installing an optional 260-pin SODIMM module, thus allowing a simple expansion of system memory (max. module height = 1.25 inch). Supported are unbuffered DDR4 SODIMMs with V_{DD}=1.2V featuring on-die termination (ODT), according to the PC4-3200 specification. Maximum module size is 16GB. For best performance the module memory capacity should be equal/symmetric to the memory down capacity. Since the SODIMM socket may be hidden below a low profile mezzanine module or side card, it is recommended that the SODIMM module should be assembled by EKF.

In addition, the SC8-FLUTE is equipped with SPI Flash non-volatile memory, for UEFI/BIOS and firmware storage, and up to 64GB e•MMC.

Mass Storage

The SC8-FLUTE base board is not provided with any mass storage device. Instead, EKF offers several low profile mezzanine modules such as the S48-SSD, with two M.2 sockets for PCIe® 2280 SSDs. Alternatively, peripheral boards are available for either SATA or PCIe® based mass storage, attached to CompactPCI® Serial backplane card slots.

Mezzanine mass storage comes as an assembly with the SC8-FLUTE, either 4HP front panel width (low profile module), or 8HP (side card). Before ordering the SC8-FLUTE, discuss your need for a low profile mezzanine mass storage module or side card with sales@ekf.com.

Graphics

The x6000RE Elkhart Lake SoC is provided with an Intel® Gen 11 graphics and media controller, for attachment of up to three DisplayPort™ 1.4 monitors, up to 4096x2160 @60Hz resolution. The ports are available from the SC8-FLUTE front panel via Type-C receptacles (DP Alt Mode). For monitors w/o Type-C video connector use an adapter cable Type-C to DisplayPort™. Suitable Type-C cable connectors can be screw locked optionally via M2 threads in the front panel (single screw connector type.

Graphics drivers can be downloaded from the Intel® website.

The front panel Type-C receptacles can be used for attachment of either DisplayPort™ monitors, or USB devices. With respect to USB, the SC8-FLUTE front panel Type-C receptacles conform to USB 3.1(5Gbps data transfer rate). Thunderbolt is not supported on the SC8-FLUTE.

Networking

The x6000RE SoC is provided with three 2.5GbE TSN MACs. These are wired on the SC8-FLUTE via discrete 2.5GBASE-T PHYs to the front panel RJ45 jacks, for 4-speed networking (2.5GBASE-T, 1000BASE-T, 100BASE-TX, 10BASE-T).

TCC/TSN are both enhancements for low-latency operation, as required for real-time applications, e.g. OPC Unified Architecture and OpenAvnu.

TSN (Time-Sensitive Networking) refers to a collection of IEEE Ethernet standards:

802.1Qav	Credit-based Shaper for Bounded Latency
802.1 AS	Precision Time Protocol
802.1Qbv	Time-Aware Shaper
802.1Qbu/3br	Frame Preemption
802.3az	Energy-Efficient Ethernet

Intel® TCC (Intel® Time Coordinated Computing) defines additional in-system mechanisms for Time Synchronization and Timeliness.

If equipped with an S8x-P6 low profile mezzanine module, the SC8-FLUTE in addition provides CompactPCI® Serial backplane Ethernet, either switch based, or via NICs.

8HP assembly mezzanine side cards such as the SCJ-VEENA allow to expand the number of front panel 2.5GbE jacks to seven in total.

Trusted Platform Module (TPM)

The SC8-FLUTE provides a Trusted Platform Module according to TPM2.0. The Infineon Optiga™ SLx 9670 TPM2.0 is connected to the SoC by an SPI interface, and supports various cryptographic algorithms. The chip contains sophisticated cryptographic hardware modules (crypto processor and cryptographic engines) and is TPM2.0 compliant according to TCG test suites.

TPM Main Features

- Random Number Generator (RNG) according to NIST SP800-90A
- RSA-1024 and RSA-2048
- ECC NIST P256
- ECC BN256
- Compliant to TPM Main Specification, Family “2.0”, Level 00, Revision 1.38
- Certification according Common Criteria EAL4+

Serial ATA (SATA)

The SC8-FLUTE provides four 6Gbps Serial ATA (SATA) ports in total for backplane usage.

The 8_SATA backplane port is wired directly to the EHL SoC, for best SATA 6G performance and suitable for boot devices. Activity is signalled via the HD LED in the SC8-FLUTE front panel.

Another three backplane ports 5_SATA - 7_SATA are enabled by the JMS562 USB to SATA bridge (please refer also to Section 'Backplane Resources'). The 6_SATA and 7_SATA ports provide hardware RAID0 (striping) or RAID1 (mirror), or Span. Controller firmware and settings are stored in an SPI Flash and can be modified by a so called 'MP' tool (by JMicron). By factory default, RAID operation is disabled, i.e. both 6_SATA and 7_SATA attached drives are treated individually as PM (primary master).

The HD status LED located in the front panel signals only disk activity over the EHL SoC SATA port.

PCI Express®

The SC8-FLUTE is mainly based on PCI Express® (PCIe®) technology for on-board communication, CompactPCI® Serial backplane support, and mezzanine I/O expansion.

Six PCI Express® Gen3 lanes are provided by the Elkhart Lake SoC. Four lanes are wired to the expansion connector HSE1, typically for use as x4 link by an NVMe® SSD as boot device and fast mass storage media. For custom mezzanine solutions the HSE1 lanes can be also configured as 4x1.

The second mezzanine connector HSE2 is PCIe® Gen3 4x1 configured, typically in use for I/O components on a mezzanine card, e.g. networking controllers. The HSE2 lanes/links are all derived from a PCIe® packet switch.

For backplane use, a PCIe® Gen3 x1 link is wired directly from the EHL as 1_PE. Another two links 2_PE and 3_PE are available via the on-board PCIe® Gen3 packet switch.

Universal Serial Bus (USB)

The SC8-FLUTE provides five USB 3.1 ports in total, 3 x front panel, 1 x backplane, 1 x mezzanine usage.

Two USB 3.1 (5Gbps data transfer rate) interfaces derived from the EHL SoC are wired to Type-C front panel connectors USB/DP2 & USB/DP3. With respect to USB, the USB/DP1 connector is wired to an on-board USB controller uPD720201. Any Type-C connector can be used alternatively for video output signals (DP Alt Mode).

The Type-C ports are assisted by power delivery controllers (USB-PD), configured for downstream facing applications. The maximum available V_{BUS} power for an attached device to any Type-C receptacle is 5V/3A (not concurrent an all ports). Adapters or adapter cables are throughout available for attachment of external devices with need for Type-A receptacles.

A single USB 3.1 port is available for the CompactPCI® Serial backplane, by means of the on-board USB controller uPD720201.

Another USB 3.1 connection from the uPD720201 is available via the HSE1 connector for mezzanine expansion.

The remaining uPD720201 USB port is wired on-board to the JMS562 USB to SATA bridge (please refer to chapter 'Serial ATA'.

SPI Flash

The SC8-FLUTE is equipped with two non-volatile serial Flash memory devices, 64Mbit each, or (16MB in total, for UEFI/BIOS and firmware program storage. These components are attached to the EHL SoC, and can be updated if necessary by the user. EKF provides programming tools and maintains BIOS long-term support with respect to feature updates and security issues.

https://www.ekf.com/s/sc8/firmware/

Real-Time Clock (RTC)

The SC8-FLUTE has a time-of-day clock and 100-year calendar, integrated into the EHL SoC. A battery on the board keeps the clock current when the computer is turned off. The SC8-FLUTE uses a holder to keep a CR2032 lithium coin cell, giving an autonomy of more than 5 years. Under normal conditions, replacement should be superfluous during lifetime of the board.

Alternately a CR2032 battery can be soldered to the board when board coating or shock/vibration is an interest.

In applications were the use of a battery is not permitted, a SuperCap can be soldered instead of the battery.

It is also possible to use the SC8-FLUTE without any battery or SuperCap. In this case the Real-Time Clock can't keep its time and date. Per default an error message is reported by the UEFI/BIOS during boot in all cases, where the Real-Time clock settings are bad:

```
00C08270: Real Time Clock Error - Check Date and Time settings
00C08251: System CMOS Checksum bad
```

To suppress these messages a setup node exists within the UEFI/BIOS:

- After Power-On press function key <F2> to enter setup menu
- Advanced→Advanced Menu→Miscellaneous Options→Ignore Battery Error→Enabled
- Advanced→Advanced Menu→Management Engine Configuration→ME Unconfig on RTC Clear →Disabled

Replacement of the Battery

Some versions of SC8-FLUTE are delivered with a battery holder for replacement of the coin cell. Use a CR2032 cell as replacement. Be careful when removing the old cell and inserting the new one. For boards with a soldered battery the old battery must be desoldered, and the new one soldered. We suggest that you send back the board to EKF for battery replacement.

Warning

Danger of explosion if the battery is incorrectly replaced or shorted. Replace only with the same or equivalent type. Do not expose a battery to fire. Battery cells could explode and cause personal injury!

Watchdog

An important reliability feature is a software programmable watchdog function. The SC8-FLUTE contains two of these watchdogs. One is part of the EHL SoC and also known as TCO watchdog. Operating systems e.g. Linux offer a driver interface to the TCO watchdog. For TCO details please refer to the 'Intel® Atom® x6000E Series External Design Specification'.

The behaviour of the 2nd watchdog is defined within a MachXO2 PLD of the SC8-FLUTE, which activates/deactivates the watchdog and controls its time-out period. The time-out delay is adjustable in the steps 2, 10, 50 and 255 seconds. After programming the time-out value and arming the WD, the related software (e.g. application program) must trigger the watchdog periodically. For details on programming the watchdog see section 'Technical Reference - Board Control and Status Register (BCSR)' in this manual.

This watchdog is in a passive state after a system reset. There is no need to trigger it at boot time. The watchdog is activated on the first trigger request. If the duration between two trigger requests exceeds the programmed period, the watchdog times out and a full system reset will be generated. The watchdog remains in the active state until the next system reset. There is no way to disable it once it has been put on alert, whereas it is possible to reprogram its time-out value at any time.

Reset

To force a manual board reset, the SC8-FLUTE offers a small tactile switch within the front panel. This push-button is indent mounted and requires a tool, e.g. a pen to be pressed, preventing from being inadvertently activated.

The handle within the front panel contains a micro switch that is used to generate a power button event. By pressing the handles red push button a pulse is triggered.

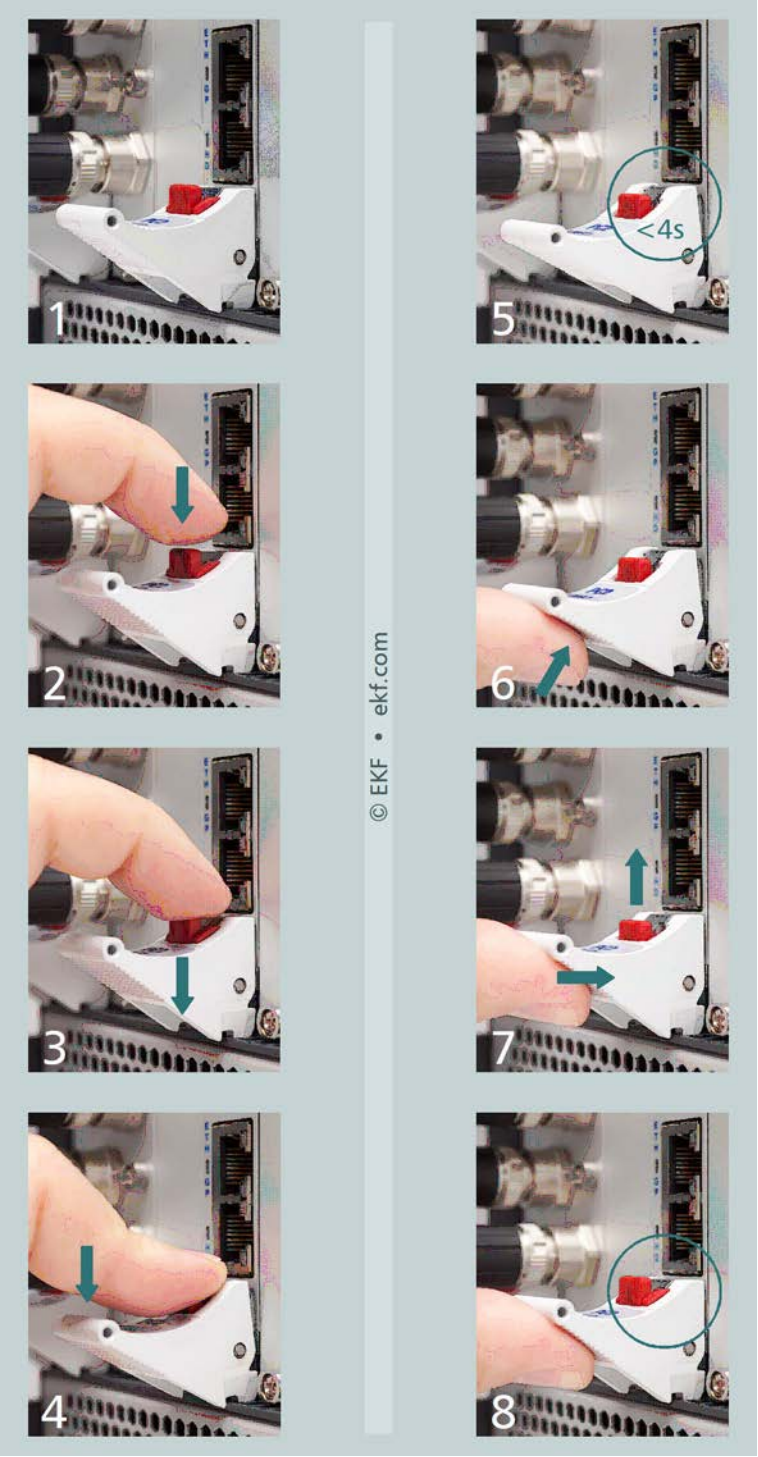
NOTE: To prevent the board to cause a power button override, the handle should be closed immediately after unlocking the front panel handle. A power button override is triggered by opening the front panel handle for at least 4 seconds, which results in bringing the board to power state S5 (Soft Off). In case of entering this state, unlock and lock the front panel handle a 2nd time to reenter normal power state S0 again. See also section 'PG (Power Good) LED' to see how the SC8-FLUTE indicates the different power states.

The SC8-FLUTE will enter the power state S5 if the front panel handle is not closed properly when the system powers up. An open handle is signalled by a yellow blinking ‘PG LED’.

The manual reset push-button and the power button functionality of the front panel handle could be reversed or passivated by UEFI/BIOS settings.

An alternative (and recommended) way to generate a system reset is to activate the signal PRST# located on CompactPCI® Serial connector P1 pin H2. Pulling this signal to GND will have the same effect as to push the tactile reset switch.

The SC8-FLUTE is provided with several supervisor circuits to monitor supply rails like the CPU core voltage, 1.2V, 3.3V or 5V. The healthy state of the SC8-FLUTE is indicated by the LED PG (Power Good) located in the front panel. This bicoloured LED signals different states of the board (see section below). As soon as this LED begins to lite green, all power voltages are within their specifications and the reset signal has been deasserted.



https://www.ekf.com/c/ccpu/img/reset_400.gif

Power Requirements

The SC8-FLUTE must be supplied with +12V ±10% via its backplane connector P1. A maximum current value of 6.65A has been defined by the CompactPCI® Serial specification for a card slot. The maximum current actually required for the SC8-FLUTE will be by far lower and depends on the particular processor populated and mezzanine expansion module in use.

For some applications a standby voltage +5V ±10% can be useful in addition, e.g. Wake-on-LAN. The maximum STANDBY current is defined as 0.95A by the CompactPCI® Serial specification. A standby power source is an option only and not mandatory for regular operation of the SC8-FLUTE.

Main Power Supply Control (PS_ON#)

The SC8-FLUTE draws its power from the +12V main supply rail defined by the CompactPCI® Serial specification. The board has been designed to control this main power supply by use of the signal PS_ON# (backplane connector P1 pin E2). If the system enters the sleep state S5 (Soft Off), the signal PS_ON# is pulled high, hence the main power supply is switched-off. The SC8-FLUTE is held in soft off state until a power management event (e.g. power button event triggered by the front panel handle) brings back the system to the S0 state.

In order to work as described above and to generate clean signals on PS_ON#, the +5V standby voltage (STANDBY) mentioned above is necessary. This optional power rail, tied to connector P1 pin B1, is also part of the CompactPCI® Serial specification. The stand-by power rail must be always switched-on, independent of the state of PS_ON#.

Nevertheless, STANDBY is not mandatory to operate the SC8-FLUTE. If no standby power is available, the board creates this voltage from the main power rail. In this case it is important that the PS_ON# signal is pulled down somewhere in the system or the power supply delivers its voltage independent of a PS_ON# signal.

Power Supply Status (PWR_FAIL#)

Power supply failures may be detected before the system crashes down by monitoring the signal PWR_FAIL#. This active low line (connector P1 pin F3) is an addition to the CompactPCI® Serial specification and may be driven by the power supply. PWR_FAIL# signals the possible failure of the main supply voltage +12V. On the SC8-FLUTE the signal PWR_FAIL# is routed to GPP_D7 of the PCH to analyse the state of the power supply unit.

Thermal Considerations

In order to avoid malfunctioning of the SC8-FLUTE, take care of appropriate cooling of the processor and system, e.g. by a cooling fan suitable to the maximum power consumption of the CPU chip actually in use. The processor contains digital thermal sensors (DTS) that are readable via special CPU registers or via PECI bus. DTS allows to get the temperatures of each CPU core separately.

Two further temperature sensors, one of it located in the system hardware monitor NCT7491, allows for acquisition of the boards surface temperature and the thermal state of the onboard system memory channel. Beside this the NCT7491 also keeps a PECI 3.0 master for CPU DTS monitoring and supervises most of the supply voltages. A suitable tool on Microsoft Windows® systems to display both, the temperatures as well as the supply voltages, would be HWiNFO64, which can be downloaded from the web.

The SC8-FLUTE is equipped with a passive heatsink. Its height takes into account the 4HP limitation in mounting space of a CompactPCI® Serial board. In addition, a forced vertical airflow through the system enclosure (e.g. bottom mount fan unit) is strongly recommended (>20m^3/h or 2m/s (400LFM) around the CPU slot). Be sure to thoroughly discuss your actual cooling needs with EKF. Generally, the faster the CPU speed the higher its power consumption. For higher ambient temperatures, consider increasing the forced airflow to 3m/s (600LFM) or more.

Together with a short side card such as the SCJ-VEENA also 8HP heatsink solutions are available.

Peripheral Slot Operation

Beyond the typical role as system slot card, the SC8-FLUTE is operable in periphery slots as well. In this case it acts as a satellite system, linked to other (processor-) boards by its backplane Ethernet connections. The other resources associated with the backplane like PCI Express®, SATA or USB are not usable in this situation.

Some of the following, system slot dedicated control signals get an altered function or will be disconnected from the backplane:

- PWRBTN# (Connector P1 Pin C3) becomes GA0
- PWR_FAIL# (Connector P1 Pin F3) becomes GA1
- PRST# (Connector P1 Pin H2) becomes RST# and will be disconnected
- WAKE# (Connector P1 Pin I2) will be disconnected

One result of that is, that a SC8-FLUTE plugged into a peripheral slot will not get a reset even if the system controller forces the reset signal on the backplane to an active state.

Board Hot-Plug

Hot-plug of the SC8-FLUTE itself is not supported, no matter whether it is working as a system controller or satellite board. But the SC8-FLUTE can detect and handle hot-plug events of CompactPCI® Serial peripheral cards. This feature is supported on all interfaces fed to the backplane, i.e.

- PCI Express®
- SATA
- USB 2/3
- Gigabit Ethernet

Apart from PCI Express®, hot-plug is enabled on the other interfaces by default. For PCIe® the UEFI/BIOS setup of the SC8-FLUTE provides settings to switch on or off the hot-plug feature, for Fat Pipe or Standard peripheral slots on different menu places:

- After Power-On press function key <F2> to enter setup menu
- Fat Pipe Slots:
  Advanced→Advanced Menu→PCI Configuration→SA PCI Express Configuration→Hot-Plug
- Standard Slots:
  Advanced→Advanced Menu→PCI Configuration→PCI Express Configuration
  PCIe Root Port [5-8/11-15]→Hot-Plug

Supplementary Information

Related Information	
SC8-FLUTE Home	www.ekf.com/s/sc8/sc8.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
S83-P6 Low Profile Mezzanine	www.ekf.com/s/s83/s83.html
S84-P6 Low Profile Mezzanine	*1 x 10G Backplane Ethernet (KR)*
S85-P6 Low Profile Mezzanine	*4 x 5G Backplane Ethernet (5GBASE-T)*
SCG-MULTIGIG Mezzanine Side Card	*2 x 10GBASE-T M12-X*
SCI-MULTIGIG Mezzanine Side Card	*2 x 10GBASE-T RJ45*
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 SC8-FLUTE SKUs please refer to www.ekf.com/liste/liste_21.html#SC8
For new mezzanine connector based low profile modules please refer to www.ekf.com/liste/liste_21.html#S20

Technical Reference

Local PCI® Devices

The following table shows the on-board PCI® devices and their location within the PCI® configuration space. Several devices are part of the EHL SoC.

Bus	Device	Function	Vendor	Device	Description
0	0	0	0x8086	0x9A36	Processor Host Bridge/DRAM Controller
0	1	0	0x8086	0x9A01	Processor PCI Express Controller (→ x8 CPCI-S.0)
0	1	1	0x8086	0x9A05	Processor PCI Express Controller (→ x8 CPCI-S.0)
0	2	0	0x8086	0x9A60	Processor Integrated Graphics Device
0	6	0	0x8086	0x9A0F	Processor PCI Express Controller (→ x4 HSE1)
0	8	0	0x8086	0x9A11	Gaussian Mixture Model Device
0	13	0	0x8086	0x9A17	USB 3.2 xHCI Gen 2 Controller (→ Type-C Sub System)
0	20	0	0x8086	0x43ED	USB 3.2 xHCI Gen 2 Controller
0	20	2	0x8086	0xA131	Thermal Subsystem
0	21	0-1	0x8086	0x43E8-43E9	I^2C Controller #0-1
0	22	0-1	0x8086	0x43E0-43E1	Intel CSME Interface #1-2
0	22	2	0x8086	0x43E2	Intel CSME IDE Redirection
0	22	3	0x8086	0x43E3	Intel CSME Keyboard Text Redirection
0	22	4-5	0x8086	0x43E4-43E5	Intel CSME Interface #3-4
0	23	0	0x8086	0x43D3 0x43D7	SATA: AHCI Mode [1] SATA: RAID 0/1/5/10 Capable [2]
0	27	0-3	0x8086	0x43C4-43C7	PCH PCI Express Root Port #21-24 (→ x4 HSE2)
0	28	0	0x8086	0x43BB	PCH PCI Express Port #4 (→ Intel i226IT)
0	28	4-7	0x8086	0x43BC-43BF	PCH PCI Express Port #5-8 (→ x4 CPCI-S.0)
0	29	0-1	0x8086	0x43B0-43B1	PCH PCI Express Port #9-10 (→ 2x Intel i226IT)
0	29	2-6	0x8086	0x43B2-43B6	PCH PCI Express Port #11-15 (→ x1 CPCI-S.0)
0	30	0-1	0x8086	0x43A8-43A9	UART Controller #0-1
0	31	0	0x8086	0x438x	eSPI Controller
0	31	3	0x8086	0x43C8	Intel High Definition Audio
0	31	4	0x8086	0x43A3	SMBus Controller
0	31	5	0x8086	0x43A3	SPI (Flash) Controller
2 [3]	00	0	0x8086	0x125D	Ethernet Controller NC1 (Intel i226IT)
3 [3]	00	0	0x8086	0x125D	Ethernet Controller NC2 (Intel i226IT)
4 [3]	00	0	0x8086	0x125D	Ethernet Controller NC3 (Intel i226IT)

1) Depends on UEFI/BIOS settings.

2) Depending on UEFI/BIOS settings different RAID modes may lead to other Device IDs.

3) Bus number can vary depending on the PCI enumeration schema implemented in UEFI/BIOS.

Local SMB/I²C Devices

The SC8-FLUTE contains devices that are attached to the System Management Bus (SMBus). These are the SPD EEPROMs for the on-board memory or the possibly plugged SODIMM, a general purpose serial EEPROM containing board configuration data, the supply voltage/temperature monitoring device NCT7491, a counter for operating hours and reset events, a set of board control and status registers as well as two dual general purpose, non-volatile electronic jumpers. Additional devices may be connected to the different I²C controllers of the EHL SoC via the CompactPCI® Serial backplane signals I²C_SCL (P1 B2) and I²C_SDA (P1 C2) or the mezzanine expansion connectors HSE2 or N-EXP.

Controller	Address	Description
SMBus	0x23	Non-volatile Electronic Jumpers 3/4
SMBus	0x2C	Hardware Monitor/Memory Down Temperature Sensor (NCT7491)
SMBus	0x2E	Board Control/Status
SMBus	0x2F	Non-volatile Electronic Jumpers 1/2
SMBus	0x50 0x30	SPD EEPROM of On-board Memory 4KBit EEPROM Select Bank 0/1
SMBus	0x52 0x32	SPD EEPROM of SODIMM 4KBit EEPROM Select Bank 0/1
SMBus	0x57	General Purpose EEPROM 2KBit
SMBus	0x6B	operating hours/reset counters (DS1683)
I2C[0]	[1)]	P-HSE2 (Pins A22/A23), N-EXP (Pins 29/30)
I2C[1]	[1)]	Serial Backplane Connector P1 (Pins B2/C2)

[1)] Address depends on devices attached

Hardware Monitor NCT7491

Attached to the SMBus, the SC8-FLUTE is provided with the hardware monitor NCT7491. This device is capable to observe the temperatures of the board, processor cores, and on-board memory, as well as several supply voltage rails with a resolution of 10 bit. The following table shows the mapping of the voltage inputs of the NCT7491 to the corresponding supply voltages of the SC8-FLUTE:

Input	Source	Resolution	Register (MSB/LSB)
VCCP	Processor Core Voltage	2.93mV	0x21/0x76[3:2]
VTT	Processor Sustain Voltage (+1.05V)	2.20mV	0x1E/0x1F[5:4]
+2.5V/THERM#	+1.2V	3.26mV	0x20/0x76[1:0]
VCC	+3.3V	4.29mV	0x22/0x76[5:4]
+5Vin	Coin Cell Voltage (V_{CCRTC})	6.54mV	0x23/0x76[7:6]
+12Vin	+12V	15.92mV	0x24/0x77[1:0]
PECI	Core #0 absolute Temperature	1°C	0x04
PECI	Core #1 absolute Temperature	1°C	0x05
PECI	Core #2 absolute Temperature	1°C	0x06
PECI	Core #3 absolute Temperature	1°C	0x07
D1+/D1-	Memory Down absolute Temperature	0.25°C	0x25/0x77[3:2]
Local TEMP	SC9 Surface Temperature	0.25°C	0x26/0x77[5:4]

Besides continuous measuring of temperatures and voltages the NCT7491 may compare these values against programmable upper and lower boundaries. As soon as a measurement violates the allowed value range, the NCT7491 can request an over-temperature event on GPP_D11 input of the EHL SoC or an interrupt via the GPP_D12 input (which may result in a system management interrupt).

Board Control and Status Registers (BCSR)

A set of board control and status registers allow to program special features on the SC8-FLUTE:

- Assert a full reset
- Control activity of front panel reset and power event button
- Program time-outs and trigger a watchdog
- Get access to two LEDs in the front panel
- Get power fail and watchdog status of last board reset

The register set consists of five registers located on the SMBus at Device ID=0x2E on the following addresses:

- 0xA0: CMD_CTRL0_WR: Write to Control Register 0 (Write-Only)
- 0xA1: CMD_CTRL0_RD: Read from Control Register 0 (Read-Only)
- 0xB0: CMD_STAT0_WR: Write to Status Register 0 (Write-Clear)
- 0xB1: CMD_STAT0_RD: Read from Status Register 0 (Read-Only)
- 0xB2: CMD_STAT1_WR: Write to Status Register 1 (Write-Clear)
- 0xB3: CMD_STAT1_RD: Read from Status Register 1 (Read-Only)
- 0xC1: CMD_PLDREV_RD: Read from PLD Revision Register (Read-Only)

To prevent malfunction, access to these registers should be done by SMBus “Byte Data” commands. Further more, writes to read-only or reads to write-only registers should be avoided.

Write/Read Control Register 0

Write: SMBus Address 0xA0
Read: SMBus Address 0xA1

Default after reset: 0x00

Bit	Description CMD_CTRL0
7	GPLED 0=Green part of the front panel LED GP is off (Default) 1=Green part of the front panel LED GP is on
6	FPDIS 0=Enable the front panel handle switch (Default) 1=Disable the front panel handle switch
5	FERP# 0=The front panel handle switch generates a power event (Default) 1=The front panel handle switch generates a system reset
4:3	WDGT0:WDGT1 Maximum Watchdog retrigger time: 0:0 2 sec 1:0 10 sec 0:1 50 sec 1:1 250 sec
2	WDGTRG Retrigger Watchdog. Any change of this bit will retrigger the watchdog. After a system reset the watchdog is in an inactive state. The watchdog is armed on the 1st edge of this bit.
1	PGLED 0=Red part of the front panel LED PG is off (Default) 1=Red part of the front panel LED PG is blinking
0	SRES 0=Normal operation (Default) 1=A full system reset is performed

Read/Clear Status Register 0

Write: SMBus Address 0xB0
Read: SMBus Address 0xB1

Bit	Description CMD_STAT0
7	RESERVED Always read as 0
6	RESERVED Always read as 0
5	PF18A 0=Normal operation 1=Last system reset may be caused by a power failure of the +V1.8A voltage regulator
4	PF25S4 0=Normal operation 1=Last system reset may be caused by a power failure of the +V2.5S4 voltage regulator
3	PF12S4 0=Normal operation 1=Last system reset may be caused by a power failure of the +V1.2S4 voltage regulator
2	PFVRST 0=Normal operation 1=Last system reset may be caused by a power failure of the +VCCST_CPU load switch
1	PFVRAX 0=Normal operation 1=Last system reset may be caused by a power failure of the IMVP-9 +VCCAUX voltage regulator
0	PFVRC 0=Normal operation 1=Last system reset may be caused by a power failure of the IMVP-9 +VCC_CPU voltage regulator

The bits in this register are sticky, i.e. their state will be kept even if a system reset occurs. To clear the bits a write to the register with arbitrary data may be performed.

Read/Clear Status Register 1

Write: SMBus Address 0xB2
Read: SMBus Address 0xB3

Bit	Description CMD_STAT1
7	WDGARMD 0=Normal operation 1=The watchdog is armed and has to be retriggered within its time-out period
6	WDGRST 0=Normal operation 1=Last system reset may be caused by a watchdog time-out
5	WDGHT 0=Normal operation 1=The watchdog already has elapsed half of its time-out period
4	PF5PS 0=Normal operation 1=Last system reset may be caused by a power failure of the +V5PS voltage regulator
3	PF5S 0=Normal operation 1=Last system reset may be caused by a power failure of the +V5S voltage regulator
2	PF33A1 0=Normal operation 1=Last system reset may be caused by a power failure of the +V3.3A1ST voltage regulator
1	PF33A 0=Normal operation 1=Last system reset may be caused by a power failure of the +V3.3A load switch
0	PF33S 0=Normal operation 1=Last system reset may be caused by a power failure of the +V3.3S voltage regulator

Except of WDGHT and WDGARMD the bits in this register are sticky, i.e. their state will be kept even if a system reset occurs. To clear the bits a write to the register with arbitrary data may be performed.

Read PLD Revision Register

Write: Not allowed
Read: SMBus Address 0xC1

Bit	Description CMD_PLDREV
7:0	PLDREV Read PLD Revison Number

Configuration Jumpers

J-GP - Loading UEFI/BIOS Setup Defaults & IEEE 1588 Pulse per Second

The jumper J-GP may be used to reset the UEFI/BIOS configuration settings to a default state. The UEFI/BIOS on SC8-FLUTE stores most of its settings in an area within the UEFI/BIOS flash, e.g. the actual boot devices. Using the jumper J-GP is only necessary, if it is not possible to enter the setup of the UEFI/BIOS. To reset the settings mount a jumper on J-GP and perform a system reset. As long as the jumper is stuffed the UEFI/BIOS will use the default configuration values after any system reset. To get normal operation again, the jumper has to be removed.

To fulfill the above functionality pin 1 of J-GP (the pin with the square pad) is connected to GPP_B11 of the EHL SoC..

There is also an alternate function available on J-GP. Pin 1 of this jumper carries a Pulse per Second (PPS) signal according the IEEE 1588 specification when enabled by UEFI/BIOS settings. A wire may be connected to trigger events on external devices.

NOTE: The PPS signal is also available at the CompactPCI® Serial connector P1 pin J3 (SATA-SCL).

J-GP	Function
Jumper Removed [1)]	Normal operation
Jumper Installed	UEFI/BIOS configuration reset performed

[1)] This setting is the factory default

J-MFG - Manufacturer Mode Jumper

The jumper J-MFG is used to bring the board into the manufacturer mode. This is necessary only on board production time and should not used by customers. For normal operation the jumper should be removed. The pin header J-MFG is not stuffed on the SC8-FLUTE by default.

J-MFG	Function
Jumper Removed [1)]	Normal operation
Jumper Installed	Entering Manufacturer Mode

[1)] This setting is the factory default

J-RTC - RTC Reset

The jumper J-RTC may be used to reset certain register bits of the battery backed RTC core within the PCH RM590E. This can be necessary under rare conditions (e.g. battery undervoltage), if the CPU fails to enter the UEFI/BIOS POST after power on. Note that installing of jumper J-RTC will neither set UEFI/BIOS Setup to EKF Factory Defaults nor resets the time and date register values of the RTC (Real Time Clock). To reset the RTC core the board must be removed from the system rack. Short-circuit the pins of J-RTC for about 1 sec. Thereafter reinstall the board to the system and switch on the power. The pin header J-RTC is not stuffed on the SC8-FLUTE by default.

NOTE: It is important to execute the RTC reset while the board has no power.

J-RTC	Function
Jumper Removed [1)]	Normal operation
Jumper Installed	RTC reset performed

[1)] This setting is the factory default.

Connectors

This section describes pin-assignments of on-board connectors e.g. for mezzanine expansion, and CompactPCI® Serial backplane connectors.

Front panel connectors (3 x USB Type-C DP Alt Mode, 3 x RJ45 Ethernet) follow well known standards and can be used with ready assembled cables and adapters throughout available. The F/P connectors are therefore not described in detail in this section.

Caution

SC8-FLUTE mezzanine connectors provide operating voltage (3.3V, 5V and 12V) to devices inside the system chassis, such as mezzanine cards or system internal peripherals. Not all of these power rails are short circuit protected. Do not use these internal connectors for powering devices external to the computer chassis. A fault in the load presented by the external devices could cause damage to the board, the interconnecting cable and the external devices themselves.

Power to external devices delivered by USB Type-C front panel receptacles is internally short circuit protected.

Mezzanine Connectors

Three connectors are available for SC8-FLUTE mezzanine expansion. Two high speed signal connectors (HSE1, HSE2) and in addition a side band I/F connector (N-EXP) are populated on top of the CPU board.

EKF offers low profile mezzanine modules which fit into the 4HP envelope of the CPU carrier card, with varying B2B clearance from 10.0mm to 10.8mm, and also side cards for additional 4HP mounting pitch (8HP in total assembly, 18.7mm B2B). The female connector N-EXP is identically populated on carrier and mezzanine and requires a suitable pin header (stacker) as contact element between carrier and mezzanine in addition. The HSE1/HSE2 connectors of carrier and mezzanine are female (CPU) and male (mezzanine) pairs, selected to match the individual B2B height requirements:

HSE1/HSE2 Mezzanine Connectors	
Mezzanine Series, B2B	Connector
CPU Carrier	8mm female ERNI Microspeed 275.90.08.068.01
S2*, S4*, B2B 10.0mm	Supplement 2mm male connector for nominal height 10mm
S6*, S8*, B2B 10.8mm	Supplement 2mm male connector for nominal height 10mm
SC* side card, B2B 18.7mm	Supplement 8mm male connector for nominal height 18mm

The S8* mezzanines are intended to complement the CPU carrier card with respect to the P6 backplane connector, for up to 8 Gigabit Ethernet ports. The SC8-FLUTE itself does not provide the P6 connector, according the CompactPCI® Serial Mezzanine Concept.

Series	Board to Board Space	HSE1	HSE2	M.2 Style	Type-C Front I/O	P6 Ethernet	Side Card Option 8HP (HSE2)
S2*	10.0mm	PCIe x4, USB3	1)	D3	✓	○	✓
S4*	10.0mm	PCIe x4, USB3	PCIe x4, DP	D3	✓	○	○
S6*	10.8mm	PCIe x4, USB3	1)	S3	○	✓	✓
S8*	10.8mm	PCIe x4, USB3	PCIe x4, DP	S3	○ ✓ 2)	✓	○

1) HSE2 recessed on mezzanine PCB - available for additional 8HP side card (option)
2) Type-C available for S83 only - the Type-C cable connector may overlap the 4HP front panel slightly (right edge)

✓ Feasible (option)
○ Not scheduled or infeasible

D3 Double sided M.2 (top 1.5mm, bottom 1.35mm) or single sided M.2
S3 Single sided M.2 only (top 1.5mm)

HSE1 Mezzanine Connector

High Speed Expansion HSE1			
GND	a1	b1	GND
1_PCIE_TXP	a2	b2	3_PCIE_TXP
1_PCIE_TXN	a3	b3	3_PCIE_TXN
GND	a4	b4	GND
1_PCIE_RXN	a5	b5	3_PCIE_RXN
1_PCIE_RXP	a6	b6	3_PCIE_RXP
GND	a7	b7	GND
2_PCIE_TXP	a8	b8	4_PCIE_TXP
2_PCIE_TXN	a9	b9	4_PCIE_TXN
GND	a10	b10	GND
2_PCIE_RXN	a11	b11	4_PCIE_RXN
2_PCIE_RXP	a12	b12	4_PCIE_RXP
GND	a13	b13	GND
1_USB2_P	a14	b14	2_USB3_TXP
1_USB2_N	a15	b15	2_USB3_TXN
GND	a16	b16	GND
2_USB2_P	a17	b17	2_USB3_RXP
2_USB2_N	a18	b18	2_USB3_RXN
GND	a19	b19	GND
1_2_USB_OC#	a20	b20	PCIE_CLK_P
PLTRST#	a21	b21	PCIE_CLK_N
+3.3VS [1)]	a22	b22	+5VS [1)]
+3.3VS [1)]	a23	b23	+5VS [1)]
+3.3VA [3)]	a24	b24	+5VPS [2)]
+12VPS [2)]	a25	b25	+12VPS [2)]

1) Power rail switched on in S0 state only
2) Power rail switched on in S0-S4 state
3) Power always on

The HSE1 PCIe® lanes are derived from the EHL SoC
1x4 configured by default

HSE2 Mezzanine Connector

High Speed Expansion P-HSE2			
1_PCIE_TXP	a1	b1	3_PCIE_TXP
1_PCIE_TXN	a2	b2	3_PCIE_TXN
GND	a3	b3	GND
1_PCIE_RXN	a4	b4	3_PCIE_RXN
1_PCIE_RXP	a5	b5	3_PCIE_RXP
GND	a6	b6	GND
2_PCIE_TXP	a7	b7	4_PCIE_TXP
2_PCIE_TXN	a8	b8	4_PCIE_TXN
GND	a9	b9	GND
2_PCIE_RXN	a10	b10	4_PCIE_RXN
2_PCIE_RXP	a11	b11	4_PCIE_RXP
GND	a12	b12	GND
DP_LANE0_P	a13	b13	*DP_LANE2_P*
DP_LANE0_N	a14	b14	*DP_LANE2_N*
GND	a15	b15	GND
DP_LANE1_P	a16	b16	*DP_LANE3_P*
DP_LANE1_N	a17	b17	*DP_LANE3_N*
GND	a18	b18	GND
PCIE_CLK_P	a19	b19	*DP_AUX_P*
PCIE_CLK_N	a20	b20	*DP_AUX_N*
GND	a21	b21	*DP_CFG1*
I2C_SCL [1)]	a22	b22	*DP_HPD*
I2C_SDA [1)]	a23	b23	PLTRST#
+12VPS [2)]	a24	b24	+12VPS [2)]
+12VPS [2)]	a25	b25	+12VPS [2)]

1) Connected to EHL SoC I^2C Bus Controller 1
2) Power rail switched on in S0-S4 state

The HSE2 PCIe® lanes are derived from the on-board PI7C9X3G808GP Gen3 packet switch in a 4x1 fixed configuration.

pins shown grey/italic are reserved

N-EXP Mezzanine Connector

N-EXP • Next Gen Expansion Board Interface			
GND	1	2	+3.3VS [1]
eSPI_CLK	3	4	PLTRST#
eSPI_IO[0]	5	6	eSPI_IO[1]
eSPI_IO[2]	7	8	eSPI_IO[3]
eSPI_CS0#	9	10	eSPI_RST#
GND	11	12	+3.3VS [1]
TIME_SYNC0	13	14	eSPI_ALERT#
PPM (TSN)	15	16	PPS (TSN)
UART2_TXD	17	18	UART2_RXD
TIME_SYNC1	19	20	UART2_RTS#
GND	21	22	+5VS [1]
UART1_TXD	23	24	UART1_RTS#
UART1_RXD	25	26	UART1_CTS#
UART2_CTS#	27	28	RESET_IN# [4]
EXP_SCL [3]	29	30	EXP_SDA [3]
GND	31	32	+5VS [1]
HDA_SDOUT	33	34	HDA_SDIN0
HDA_RST#	35	36	HDA_SYNC
HDA_BITCLK	37	38	VCC_RTC [5]
SPEAKER	39	40	+12VPS [2]

pin orientation shows CPU carrier board top view

1) Power rail switched on in S0 state only
2) Power rail switched on in S0-S4 state
3) Connected to I2C controller 1 of the EHL SoC
4) Connected to the PLD reset logic to force hardware reset
5) Can be used as an alternate way to supply the RTC well

CompactPCI® Serial Backplane Connectors

The SC8-FLUTE is provided with five high speed backplane connectors P1 - P5, compliant with the CompactPCI® Serial specification (pin mapping for system boards with respect to SC8-FLUTE).

The PCI Express® link 1_PE has been derived directly from the EHL SoC (Gen3 x1). The 2_PE and 3_PE links are wired to the on-board packet switch PI7C9X3G808GP (Gen3 x1).

The CompactPCI® Serial connector pin assignment distinguishes positive/negative (+/-) PCIe® differential signals. However, polarity inversion may be used on several lanes for optimum PCB routing. This is allowed according the PCI Express® Base Specification and has no effect on function or performance of the respective link. The pin-out shown is as per specification.

If backplane Ethernet shall be supported, P6 is available as an option on a low profile mezzanine module (S8* series), with up to 8 ports (switch based) or 4 ports (NICs). A pin assignment for P6 is not part of this document. Instead, refer to the mezzanine modules Technical Information, e.g. https://www.ekf.com/s/s80/s80.html or https://www.ekf.com/s/s82/s82.html.

P1

P1 CompactPCI® Serial System Slot Backplane Connector Type A 72 pos. 12x6, 14mm Width												
P1	A	B	C	D	E	F	G	H	I	J	K	L
6	GND	1 PE TX02+	1 PE TX02-	GND	1 PE RX02+	1 PE RX02-	GND	1 PE TX03+	1 PE TX03-	GND	1 PE RX03+	1 PE RX03-
5	1 PE TX00+	1 PE TX00-	GND	1 PE RX00+	1 PE RX00-	GND	1 PE TX01+	1 PE TX01-	GND	1 PE RX01+	1 PE RX01-	GND
4	GND	1 USB2+	1 USB2-	GND	RSV	RSV	GND	1 SATA TX+	1 SATA TX-	GND	1 SATA RX+	1 SATA RX-
3	1 USB3 TX+	1 USB3 TX-	PWR BTN#	1 USB3 RX+	1 USB3 RX-	PWR_ FAIL#	SATA SDI 1)	SATA SDO 1)	GA2	SATA SCL 1)	SATA SL 1)	GA3
2	GND	I2C SCL 2)	I2C SDA 2)	GND	PS_ ON#	RST#	GND	PRST#	WAKE_ IN#	GND	RSV	SYS EN# 6)
1	+12V	+5V STBY	GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND

pin positions printed grey: reserved/nc

1) 10kÙ Pull-Up resistor to +3.3V when board is inserted into system controller slot.
2) These pins are connected to the EHL SoC I^2C Controller 0

P2

P2 CompactPCI® Serial Slot Backplane Connector Type B 96 pos. 12x8, 16mm Width												
P2	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	BPID SCL 1)	BPID SDA 1)	GND	2 USB2+	2 USB2-	GND	3 USB2+	3 USB2-	GND	4 USB2+	4 USB2-
7	IO	IO	GND	IO	IO	GND	IO	IO	GND	IO	IO	GND
6	GND	2 PE TX06+	2 PE TX06-	GND	2 PE RX06+	2 PE RX06-	GND	2 PE TX07+	2 PE TX07-	GND	2 PE RX07+	2 PE RX03-
5	2 PE TX04+	2 PE TX04-	GND	2 PE RX04+	2 PE RX04-	GND	2 PE TX05+	2 PE TX05-	GND	2 PE RX05+	2 PE RX05-	GND
4	GND	2 PE TX02+	2 PE TX02-	GND	2 PE RX02+	2 PE RX02-	GND	2 PE TX03+	2 PE TX03-	GND	2 PE RX03+	2 PE RX03-
3	2 PE TX00+	2 PE TX00-	GND	2 PE RX00+	2 PE RX00-	GND	2 PE TX01+	2 PE TX01-	GND	2 PE RX01+	2 PE RX01-	GND
2	GND	1 PE TX06+	1 PE TX06-	GND	1 PE RX06+	1 PE RX06-	GND	1 PE TX07+	1 PE TX07-	GND	1 PE RX07+	1 PE RX07-
1	1 PE TX04+	1 PE TX04-	GND	1 PE RX04+	1 PE RX04-	GND	1 PE TX05+	1 PE TX05-	GND	1 PE RX05+	1 PE RX05-	GND

pin positions printed grey: reserved/nc

1) These signals are subject of CompactPCI® Serial R3.0 and connected to EHL SoC I2C Controller 2

P3

P3 CompactPCI® Serial Slot Backplane Connector Type B 96 pos. 12x8, 16mm Width												
P3	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	7 SATA TX+	7 SATA TX-	GND	7 SATA RX+	7 SATA RX-	GND	8 SATA TX+	8 SATA TX-	GND	8 SATA RX+	8 SATA RX-
7	5 SATA TX+	5 SATA TX-	GND	5 SATA RX+	5 SATA RX-	GND	6 SATA TX+	6 SATA TX-	GND	6 SATA RX+	6 SATA RX-	GND
6	GND	3 SATA TX+	3 SATA TX-	GND	3 SATA RX+	3 SATA RX-	GND	4 SATA TX+	4 SATA TX-	GND	4 SATA RX+	4 SATA RX-
5	8 USB3 TX+	8 USB3 TX-	GND	8 USB3 RX+	8 USB3 RX-	GND	2 SATA TX+	2 SATA TX-	GND	2 SATA RX+	2 SATA RX-	GND
4	GND	6 USB3 TX+	6 USB3 TX-	GND	6 USB3 RX+	6 USB3 RX-	GND	7 USB3 TX+	7 USB3 TX-	GND	7 USB3 RX+	7 USB3 RX-
3	4 USB3 TX+	4 USB3 TX-	GND	4 USB3 RX+	4 USB3 RX-	GND	5 USB3 TX+	5 USB3 TX-	GND	5 USB3 RX+	5 USB3 RX-	GND
2	GND	2 USB3 TX+	2 USB3 TX-	GND	2 USB3 RX+	2 USB3 RX-	GND	3 USB3 TX+	3 USB3 TX-	GND	3 USB3 RX+	3 USB3 RX-
1	5 USB2+	5 USB2-	GND	6 USB2+	6 USB2-	GND	7 USB2+	7 USB2-	GND	8 USB2+	8 USB2-	GND

pin positions printed grey: reserved/nc

P4

P4 CompactPCI® Serial Slot Backplane Connector Type B 96 pos. 12x8, 16mm Width												
P4	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	6 PE TX02+	6 PE TX02-	GND	6 PE RX02+	6 PE RX02-	GND	6 PE TX03+	6 PE TX03-	GND	6 PE RX03+	6 PE RX03-
7	6 PE TX00+	6 PE TX00-	GND	6 PE RX00+	6 PE RX00-	GND	6 PE TX01+	6 PE TX01-	GND	6 PE RX01+	6 PE RX01-	GND
6	GND	5 PE TX02+	5 PE TX02-	GND	5 PE RX02+	5 PE RX02-	GND	5 PE TX03+	5 PE TX03-	GND	5 PE RX03+	5 PE RX03-
5	5 PE TX00+	5 PE TX00-	GND	5 PE RX00+	5 PE RX00-	GND	5 PE TX01+	5 PE TX01-	GND	5 PE RX01+	5 PE RX01-	GND
4	GND	4 PE TX02+	4 PE TX02-	GND	4 PE RX02+	4 PE RX02-	GND	4 PE TX03+	4 PE TX03-	GND	4 PE RX03+	4 PE RX03-
3	4 PE TX00+	4 PE TX00-	GND	4 PE RX00+	4 PE RX00-	GND	4 PE TX01+	4 PE TX01-	GND	4 PE RX01+	4 PE RX01-	GND
2	GND	3 PE TX02+	3 PE TX02-	GND	3 PE RX02+	3 PE RX02-	GND	3 PE TX03+	3 PE TX03-	GND	3 PE RX03+	3 PE RX03-
1	3 PE TX00+	3 PE TX00-	GND	3 PE RX00+	3 PE RX00-	GND	3 PE TX01+	3 PE TX01-	GND	3 PE RX01+	3 PE RX01-	GND

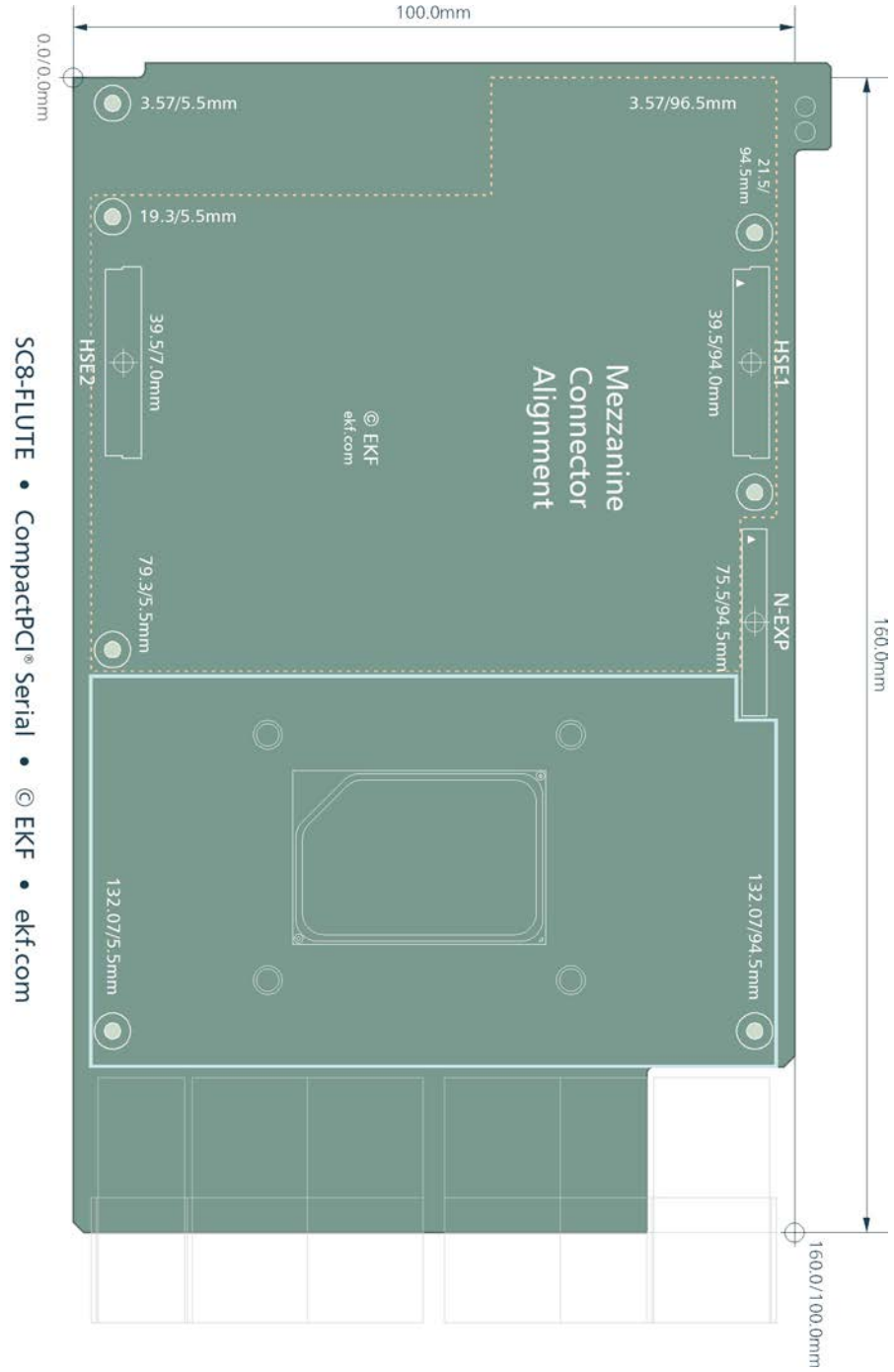
pin positions printed grey: reserved/nc

P5

P5 CompactPCI® Serial Slot Backplane Connector Type C 72 pos. 12x6, 12mm Width												
P5	A	B	C	D	E	F	G	H	I	J	K	L
6	5 PE CLKE#	5 PE CLK+	5 PE CLK-	6 PE CLKE#	6 PE CLK+	6 PE CLK-	7 PE CLKE#	7 PE CLK+	7 PE CLK-	8 PE CLKE#	8 PE CLK+	8 PE CLK-
5	1 PE CLK+	1 PE CLK-	1 PE CLKE#	2 PE CLK+	2 PE CLK-	2 PE CLKE#	3 PE CLK+	3 PE CLK-	3 PE CLKE#	4 PE CLK+	4 PE CLK-	4 PE CLKE#
4	GND	8 PE TX02+	8 PE TX02-	GND	8 PE RX02+	8 PE RX02-	GND	8 PE TX03+	8 PE TX03-	GND	8 PE RX03+	8 PE RX03-
3	8 PE TX00+	8 PE TX00-	GND	8 PE RX00+	8 PE RX00-	GND	8 PE TX01+	8 PE TX01-	GND	8 PE RX01+	8 PE RX01-	GND
2	GND	7 PE TX02+	7 PE TX02-	GND	7 PE RX02+	7 PE RX02-	GND	7 PE TX03+	7 PE TX03-	GND	7 PE RX03+	7 PE RX03-
1	7 PE TX00+	7 PE TX00-	GND	7 PE RX00+	7 PE RX00-	GND	7 PE TX01+	7 PE TX01-	GND	7 PE RX01+	7 PE RX01-	GND

pin positions printed grey: reserved/nc

PCB Dimensions



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