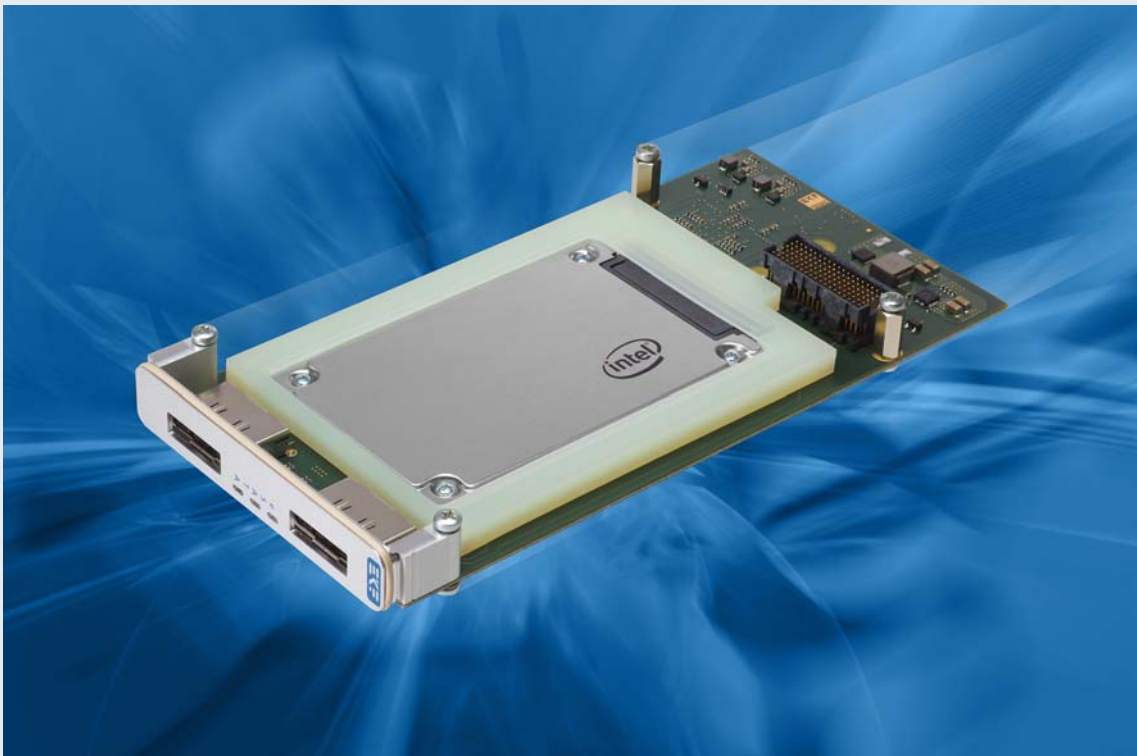# EKF

SYSTEM

Technical Information

DX2-COUGAR

XMC Module

Quad Channel SATA 6Gbps Controller
Option on-Board Micro SATA SSD

Document No. 6777 • Ed. 7 • 17 February 2016

Contents

About this Manual

This manual is a short form description of the technical aspects of the DX2-COUGAR, required for installation and system integration. It is intended for the advanced user only.

Edition History

Ed.	Contents/*Changes*	Author	Date
1	Technical Information DX2-COUGAR, preliminary edition Text #6777, File: dx2_ti.wpd	jj	26 July 2012
2	Added set of photos, added XMC 2.0 option	jj	13 November 2012
3	Added photo CK2/DX2 exploded view, modified chapter BIOS Flash	jj	19 November 2012
4	Changed operating temperature	jj	5 November 2013
5	Address information amended	jj	13 May 2014
6	Added photos XMC 2.0 connector P15	jj	13 August 2014
7	MTBF added, table 'Activity LEDs' added	jj	17 February 2016

Related Documents

Related Information	
DX2-COUGAR XMC Module SATA I/O	www.ekf.com/d/dide/dx2/dx2_e.html
CCK-MARIMBA XMC Carrier Side Board	www.ekf.com/c/ccpu/cck/cck_tie.pdf
CK2-SESSION CompactPCI® Classic XMC Carrier Card	www.ekf.com/c/cpcc/ck2/ck2.html
SK2-SESSION CompactPCI® Serial XMC Carrier Card	www.ekf.com/s/sk2/sk2.html

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.

▸ 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 document 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®	CompactPCI Specification, PICMG® 2.0 R3.0, Oct. 1, 1999	www.picmg.org
CompactPCI® PlusIO	CompactPCI PlusIO Specification, PICMG® 2.30 R1.0, November 11, 2009	www.picmg.org
CompactPCI® Serial	CompactPCI Serial Specification, PICMG® CPCI-S.0 R1.0, March 2, 2011	www.picmg.org
Micro SATA	SFF-8144 Specification	ftp://ftp.seagate.com/sff
PCI Express®	PCI Express® Base Specification 3.0	www.pcisig.com
SATA	Serial ATA Rev. 3.0 Specification, June 2, 2009	www.sata-io.org
XMC	ANSI/VITA 42.0 & 42.3, IEEE P1386.1 / Draft 2.4 & Draft 2.4a	www.vita.com
XMC 2.0	ANSI/VITA 61.0 November 2011	www.vita.com

Summary of Features

| Feature Summary |
|---|
| ▸ Form factor XMC single-width mezzanine card 149mm x 74mm |
| ▸ Stack height 10mm XMC to host |
| ▸ Host I/F Connector P15 XMC (Option XMC 2.0) |
| ▸ x 1 or x 2 PCI Express® 2.0 (5.0 Gbps), single or dual lane |
| ▸ Typically +3.3V only operated (VPWR not in use) |
| |
| ▸ Marvell® PCI Express® 2.0 to SATA III host controller |
| ▸ Four SATA 6Gbps interface ports (backward support 3Gbps and 1.5Gbps) |
| ▸ Native Command Queuing |
| ▸ Hardware RAID 0/1/10 |
| ▸ On-the-fly AES encryption 128/256-bit |
| ▸ AHCI driver support |
| |
| ▸ Two front bezel eSATA connectors for attachment of external devices |
| ▸ eSATA is limited to 3Gbps by SATA specification |
| ▸ eSATA is limited to 2m external cable length by SATA specification |
| ▸ 6Gbps data rate and/or 5m eSATA cable length with suitable peripheral eSATA devices |
| ▸ RAID option for dual external drives |
| |
| ▸ Option on-board 1.8-inch Micro SATA SSD (top side mounted) |
| ▸ Option secondary 1.8-inch Micro SATA SSD (bottom side mounted) |
| ▸ Various brands of Micro SATA SSDs available (e.g. Intel, Micron) |
| ▸ RAID option for dual drive configuration |
| |
| ▸ Long term availability |
| ▸ Designed & manufactured in Germany |
| ▸ ISO 9001 certified quality management |
| ▸ Coating, sealing, underfilling on request |
| ▸ RoHS compliant 2002/95/EC |
| ▸ Operating temperature: 0°C to +70°C |
| ▸ 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 89.4 years |
| ▸ EC Regulatory EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1) |

Short Description

The DX2-COUGAR is a XMC style mezzanine card, equipped with a four-channel PCI Express® to SATA 6Gbps controller, and one or two on-board 1.8-inch Micro SATA solid state drives (SSD) as an option. The Marvell® SATA 3.0 controller allows RAID or non RAID operation, and incorporates speed negotiation to backward support 3Gbps and 1.5Gbps. Two front bezel eSATA connectors are provided for attachment of external SATA storage devices. The other two SATA ports are reserved for 1.8-inch size Micro SATA on-board drives. As of current, suitable on-board mounting Micro SATA solid state drives are available with up to 512GB Flash storage capacity each, and up to 6G SATA III interface speed (please refer to e.g. Micron®, Intel®).

A single drive can be optionally mounted on the DX2-COUGAR component side (XMC side 1, facing the carrier board when module is engaged). In addition, a second drive may be accommodated on the back side of the mezzanine card (module side 2, on top of the stack when assembly is mounted).

The DX2-COUGAR connects SATA III devices to a PCIe 2.0 host, delivering up to 1 Gigabyte-per-second (GBps) bandwidth when a two-lane 5.0 Gbps interface is available. In addition, hardware RAID operation is supported, running with an enhanced ARM-based processor to offload the host CPU, and Marvell® HyperDuo technology for automated SSD/HDD tiering.
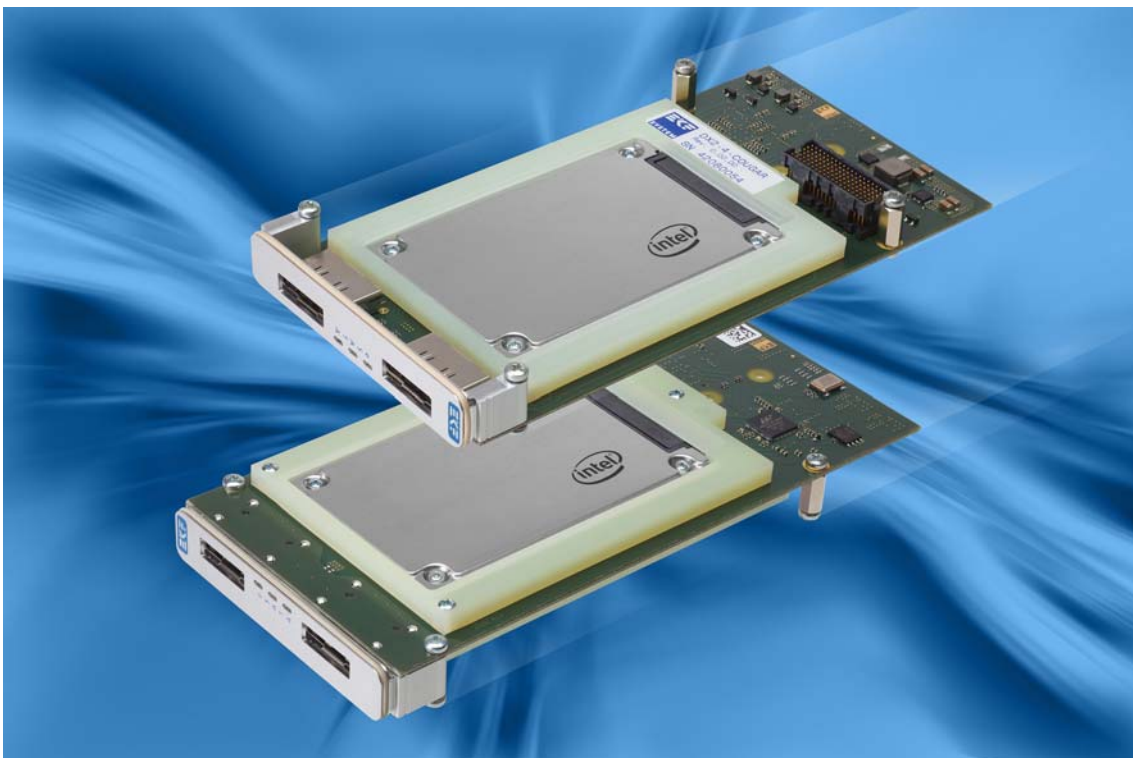
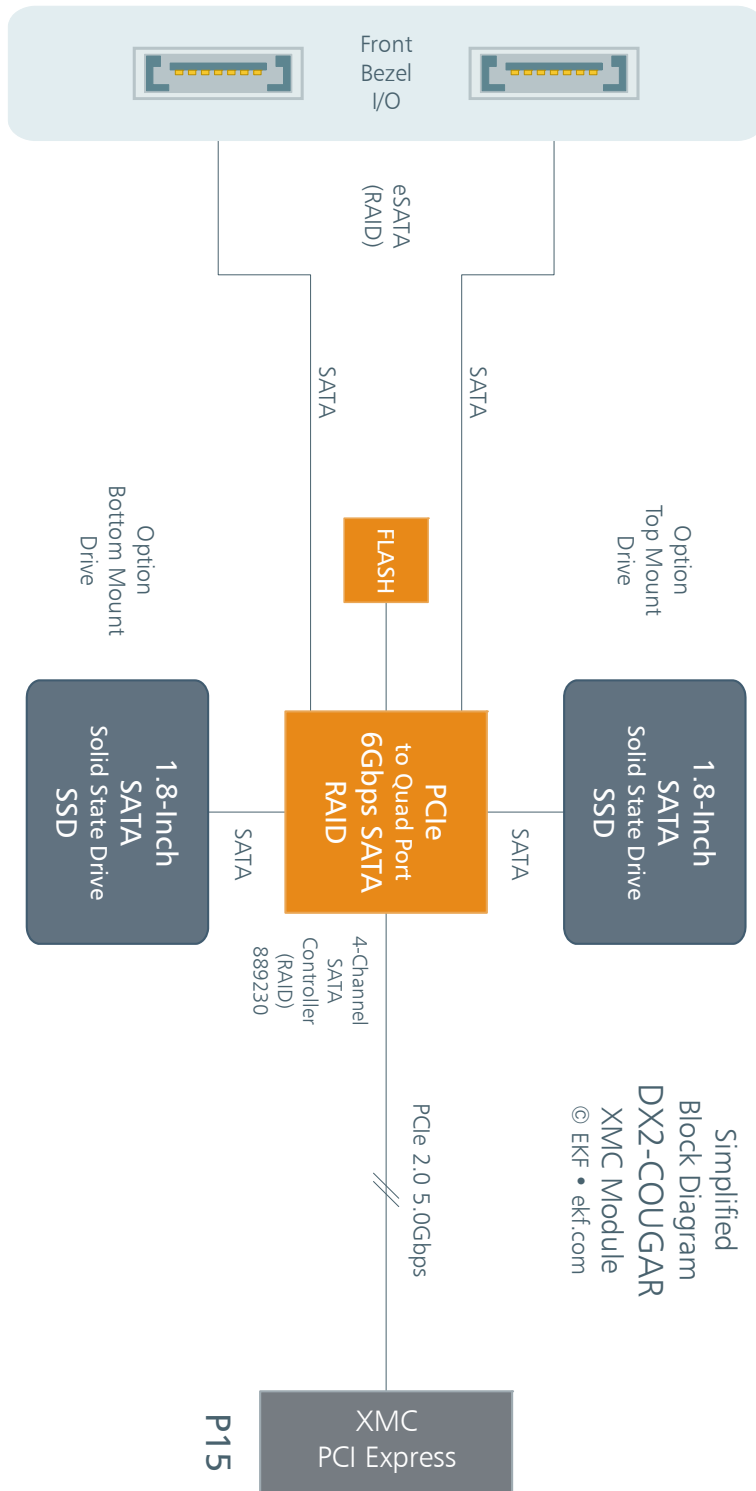DX2-COUGAR w. Dual SSD Drives Top/Bottom

Intel® 1.8-Inch Micro SATA SSD

Micron 1.8-Inch Micro SATA SSD

Block Diagram

Front Bezel I/O

eSATA (RAID)

SATA

SATA

Option Bottom Mount Drive

Option Top Mount Drive

FLASH

1.8-Inch SATA Solid State Drive SSD

PCIe to Quad Port 6Gbps SATA RAID

1.8-Inch SATA Solid State Drive SSD

SATA

SATA

4-Channel SATA Controller (RAID) 889230

PCIe 2.0 5.0Gbps

Simplified Block Diagram DX2-COUGAR XMC Module © EKF • ekf.com
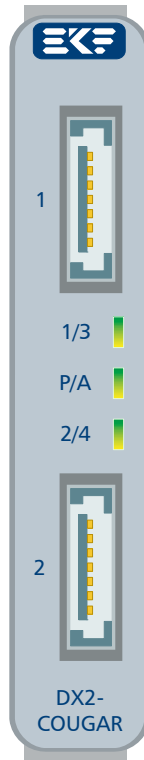
P15

XMC PCI Express

Top View

DX2-COUGAR w. Primary SSD

Back Side View

DX2-COUGAR w. Secondary SSD

Front Bezel

Activity LEDs (Front Bezel)	
LED 1 - green	Front Bezel eSATA Connector 1 Activity (SATA Port 1)
LED 3 - yellow	Top Mount (Primary) Micro SATA Drive Activity (SATA Port 3)
LED P - green	XMC Module Power Good
LED A - yellow	SATA Controller Activity
LED 2 - green	Front Bezel eSATA Connector 2 Activity (SATA Port 2)
LED 4 - yellow	Bottom Mount (Secondary) Micro SATA Drive Activity (SATA Port 4)
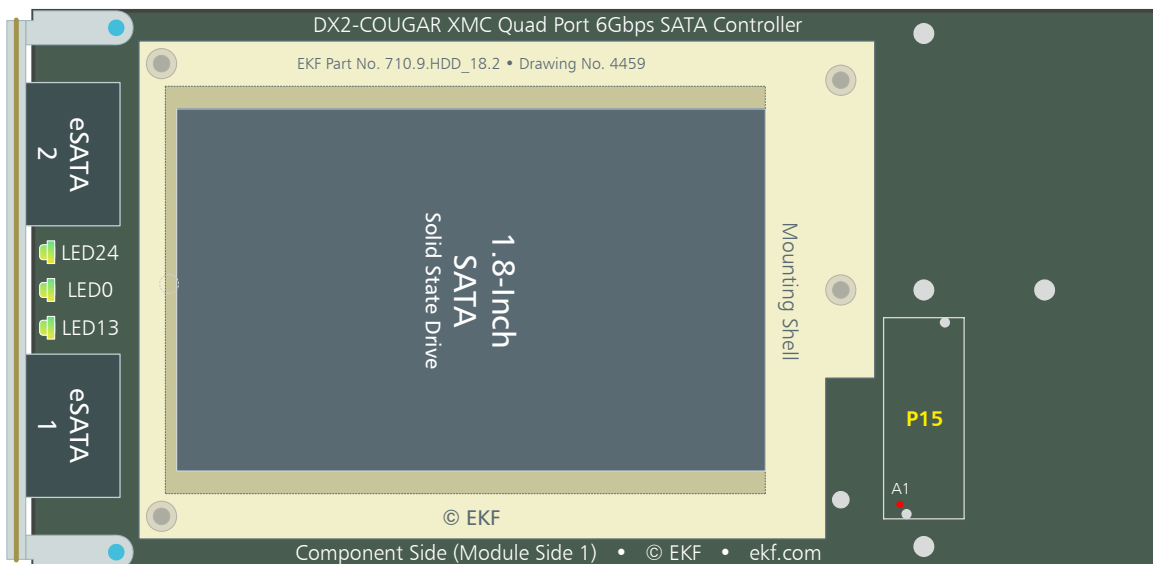
Typical Assembly on XMC Carrier

DX2-COUGAR XMC Quad Port 6Gbps SATA Controller

EKF Part No. 710.9.HDD_18.2 • Drawing No. 4459

1.8-Inch
SATA
Solid State Drive

Mounting Shell

© EKF

Back Side (Module Side 2) • © EKF • ekf.com

CK2-SESSION

J1

DX2-COUGAR on a CompactPCI® Classic Carrier Board • © EKF • ekf.com

DX2-COUGAR XMC Quad Port 6Gbps SATA Controller

EKF Part No. 710.9.HDD_18.2 • Drawing No. 4459

1.8-Inch
SATA
Solid State Drive

Mounting Shell

© EKF

Back Side (Module Side 2) • © EKF • ekf.com

SK2-SESSION

P1

DX2-COUGAR on a CompactPCI® Serial Carrier Board • © EKF • ekf.com

DX2-COUGAR (Single SSD) over SK2-SESSION Carrier

DX2-COUGAR (Dual SSD) over SK2-SESSION Carrier

DX2-COUGAR (Dual SSD) on Top of CPU Card Assembly Stack

Installing and Replacing Components

Before You Begin

Warnings

The procedures in this chapter assume familiarity with the general terminology associated with industrial electronics and with safety practices and regulatory compliance required for using and modifying electronic equipment. Disconnect the system from its power source and from any telecommunication links, networks or modems before performing any of the procedures described in this chapter. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage. Some parts of the system can continue to operate even though the power switch is in its off state.

Caution

Electrostatic discharge (ESD) can damage components. Perform the procedures described in this chapter only at an ESD workstation. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis or board front panel. Store the board only in its original ESD protected packaging. Retain the original packaging (antistatic bag and antistatic box) in case of returning the board to EKF for repair.

Installing the Board Assembly

Warning

This procedure should be done only by qualified technical personnel. Disconnect the system from its power source before doing the procedures described here. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage.

Typically you will perform the following steps:

- Switch off the system, remove the AC power cord

- Attach your antistatic wrist strap to a metallic part of the system

- Remove the board packaging, be sure to touch the board only at the front panel

- Identify the related CompactPCI slot (peripheral slot for I/O boards, system slot for CPU boards, with the system slot typically most right or most left to the backplane)

- Insert card carefully (be sure not to damage components mounted on the bottom side of the board by scratching neighboured front panels)

- A card with onboard connectors requires attachment of associated cabling now

- Lock the ejector lever, fix screws at the front panel (top/bottom)

- Retain original packaging in case of return

Removing the Board Assembly

Warning

This procedure should be done only by qualified technical personnel. Disconnect the system from its power source before doing the procedures described here. Failure to disconnect power, or telecommunication links before you open the system or perform any procedures can result in personal injury or equipment damage.

Typically you will perform the following steps:

• Switch off the system, remove the AC power cord

• Attach your antistatic wrist strap to a metallic part of the system

• Identify the board, be sure to touch the board only at the front panel

• unfasten both front panel screws (top/bottom), unlock the ejector lever

• Remove any onboard cabling assembly

• Activate the ejector lever

• Remove the card carefully (be sure not to damage components mounted on the bottom side of the board by scratching neighboured front panels)

• Store board in the original packaging, do not touch any components, hold the board at the front panel only

Warning

Do not expose the card to fire. Battery cells and other components could explode and cause personal injury.

EMC Recommendations

CE

In order to comply with the CE regulations for EMC, it is mandatory to observe the following rules:

- The chassis or rack including other boards in use must comply entirely with CE

- Close all board slots not in use with a blind front panel

- Front panels must be fastened by built-in screws

- Cover any unused front panel mounted connector with a shielding cap

- External communications cable assemblies must be shielded (shield connected only at one end of the cable)

- Use ferrite beads for cabling wherever appropriate

- Some connectors may require additional isolating parts

Reccomended Accessories

|		
Blind CPCI Front Panels	EKF Elektronik	Widths currently available (1HP=5.08mm): with handle 4HP/8HP without handle 2HP/4HP/8HP/10HP/12HP
Ferrit Bead Filters	ARP Datacom, 63115 Dietzenbach	Ordering No. 102 820 (cable diameter 6.5mm) 102 821 (cable diameter 10.0mm) 102 822 (cable diameter 13.0mm)
Metal Shielding Caps	Conec-Polytronic, 59557 Lippstadt	Ordering No. CDFA 09 165 X 13129 X (DB9) CDSFA 15 165 X 12979 X (DB15) CDSFA 25 165 X 12989 X (DB25)

Technical Reference - Connectors and Jumpers

Caution

Some of the connectors may provide operating voltage (e.g. +12V, +5V and +3.3V) to devices inside the system chassis, such as internal peripherals. Not all of these connectors are overcurrent protected. Do not use these 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.

Please Note

The DX2-COUGAR mezzanine module may be equipped with several on-board or front bezel connectors for system internal or external usage. Not all of these connectors may be present on a particular board (manufacturing options). Be sure to specify your individual needs when ordering the DX2-COUGAR board. Characteristic features and the pin assignments of each connector are described on the following pages.
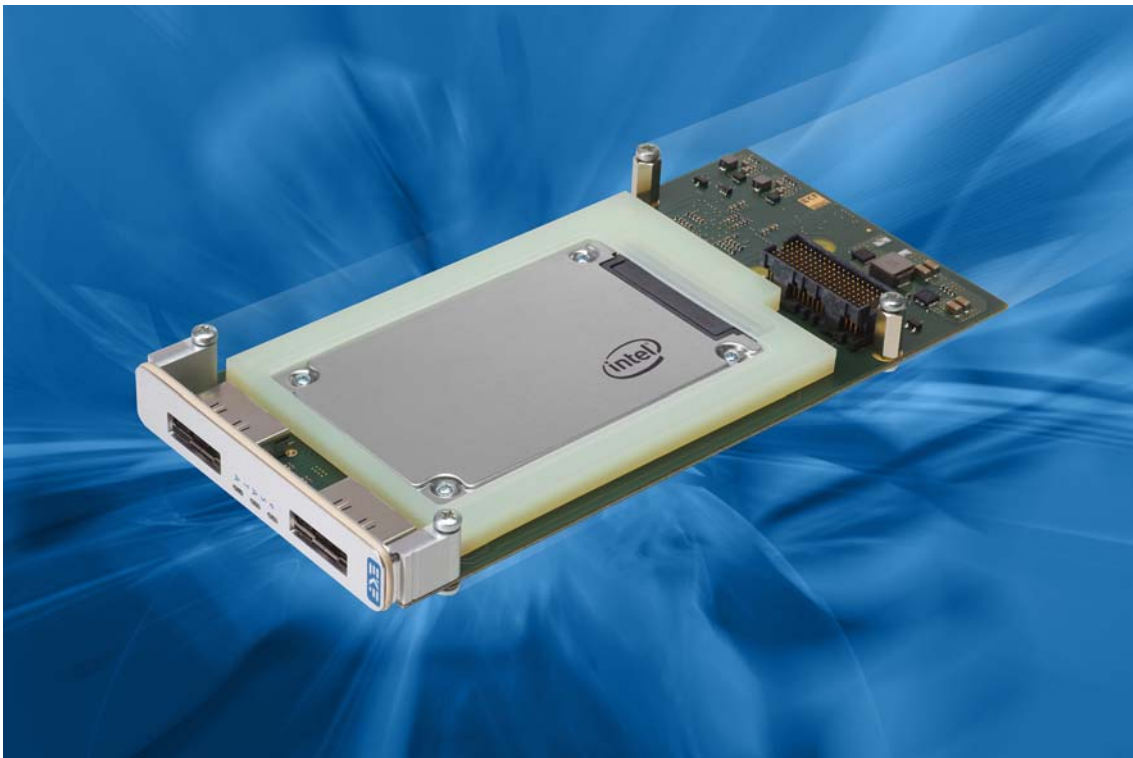
BIOS Flash

The DX2-COUGAR will is equipped with a 4Mb SPI Flash memory, which contains the 88SE9230 BIOS and RAID firmware, as required for system boot and for hardware RAID operation, enabled by an integrated ARM processor.

While being AHCI compatible, there is no need for installation of proprietary drivers for the 88SE9230. As an option however, Marvell® SATA drivers can be downloaded from the DX2-COUGAR home at www.ekf.com/d/dide/dx2/dx2.html. In addition, RAID management support is available here.

Micro SATA Docking Connectors

The DX2-COUGAR can accommodate one or even two 1.8-inch SATA standard form factor drive(s) according to the SFF-8144 specification, which results in a 5.0 mm maximum height, and 78.5mm x 54.0mm dimensions. The Micro SATA connector in use is defined in Serial ATA Rev. 2.6. Devices with 8.0mm height (probably only legacy hard disk) should be avoided.

A mounting frame is used to hold each drive, for extremely rugged applications.

DX2-COUGAR on a CPCI Carrier Board - Sectional Drawing • © EKF • ekf.com
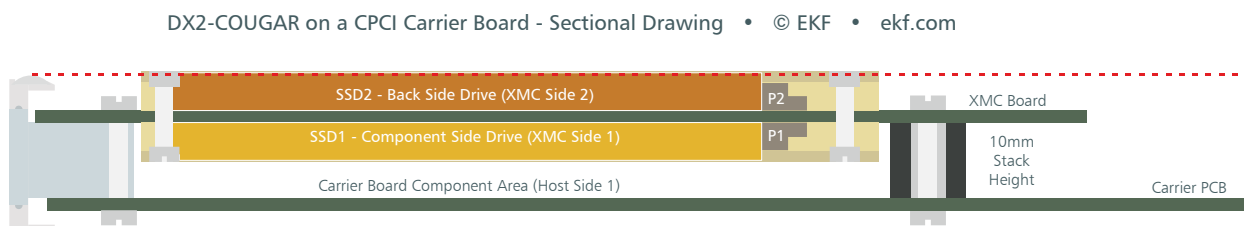
The DX2-COUGAR can be provided with up to two Micro SATA docking connectors (P3/P4). While the component side connector P3 and the associated 5mm height drive SSD1 fully comply with the VITA 42 (XMC) specification, the back side connector P4 and attached drive SSD2 would slightly exceed the maximum component height defined by IEEE 1386 (CMC). This may be tolerable however for typical carrier boards with 4HP front panel width and a 10mm XMC to host stack height - please verify before ordering.

Population of the on-board SATA host connectors is optional (assembly option during manufacturing). In particular, the back side docking connector P4 is subject to customers request - please consider before ordering.

If two or more drives are attached to the DX2-COUGAR (any combination of internal - external), the Marvell SATA controller can be operated in a low level RAID mode (0/1/10), as an option. Please refer to the DX2-COUGAR home at www.ekf.com/d/dide/dx2/dx2.html for current driver support available.

The DX2-COUGAR can be delivered with or w/o on-board SSD devices attached. Please specify your needs to sales@ekf.de.

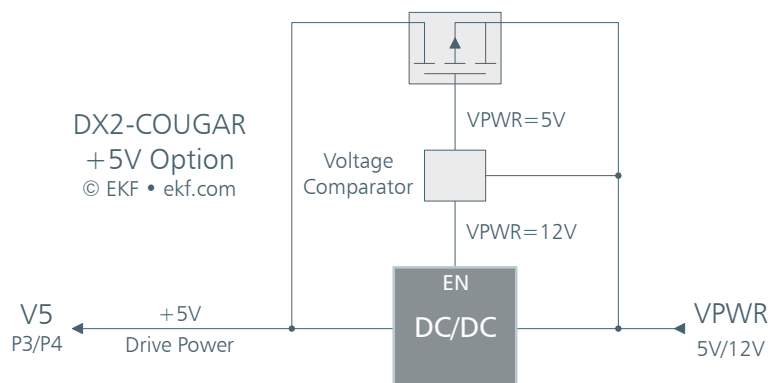## P3 / P4 • Micro SATA Docking Connectors 7+9 • 256.016.10.01

Pin	Signal
S1	GND
S2	TX+ SATA0/1
S3	TX- SATA0/1
S4	GND
S5	RX- SATA0/1
S6	RX+ SATA0/1
S7	GND
P1	+3.3V
P2	+3.3V
P3	GND
P4	GND
P5	+5V
P6	+5V
P7	DAS (R to GND)
P8	NC
P9	NC

Part No. 256.016.10.01 • Micro SATA Receptacle • © EKF • ekf.com

Signal designations RX/TX are assigned with respect to the SATA host controller (88SE9230). The SATA channel 2 is dedicated to P3, and SATA channel 3 corresponds to P4.

Typical Micro SATA SSD devices are powered from a single +3.3V rail. Power is supplied from the host carrier board, across the DX2-COUGAR mezzanine connector P15 (3.3V pins).
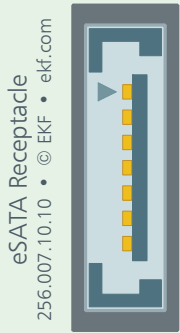
As an option, the DX2-COUGAR can be equipped with a voltage regulator, which converts the XMC mezzanine connector rail VPWR (either 12V or 5V variable power) to +5V, for use at the docking connector P3/P4 +5V power pins. Normally this voltage converter will not be needed and is consequently not stuffed by default.

DX2-COUGAR
+5V Option
© EKF • ekf.com

VPWR=5V

Voltage
Comparator

VPWR=12V

EN

DC/DC

V5
P3/P4

+5V
Drive Power

VPWR
5V/12V

Front Bezel eSATA Connectors

The DX2-COUGAR front bezel is provided with two eSATA receptacles P1/P2 for attachment of external SATA devices. P1 and P4. P3 corresponds to the Marvell 88SE9230 SATA controller port 0, and P2 is wired to SATA channel 1.

TX/RX designation of signals are shown with respect to the SATA controller. High quality shielded SATA cable assemblies are recommended for optimum performance and reliable industrial usage. By specification, eSATA is limited to 3Gbps and 2m cable length. However, there are cable assemblies available up to 5m. For testing, suitable peripheral eSATA devices may be operated at 6Gbps and/or cable length >2m.

P1/P2 2 x Front Bezel eSATA #256.007.10.10		
	1	GND
	2	SATA_TX+
	3	SATA_TX-
	4	GND
	5	SATA_RX-
	6	SATA_RX+
	7	GND

The typical external cable length should not exceed 2m. Remember that SATA is a high speed data link. Chose the minimum distance possible for locating the external SATA device, and use high quality cable assemblies for reliable industrial operation. Compared to internal SATA cabling, the eSATA front bezel connectors offer superior shielding and provide EMI protection. eSATA cable harnesses used must adhere to the design specifications recommended by the Serial ATA International Organization (SATA-IO).

The eSATA connectors provided on the DX2-COUGAR do not comprise eSATAp (Power over eSATA) pins. Hence, attached eSATA(p) devices must be self powered, or may optionally +5V powered from an additional USB port by means of a suitable splitter cable.

P15 Mezzanine Connector

The DX2-COUGAR is equipped with a high speed **XMC** mezzanine connector P15, mating with the host board J15 and establishing the data path (PCI Express) and power link to the carrier. The pin assignment of P15/J15 is specified by VITA 42.3. The DX2-COUGAR is organized as dual-lane single-link PCI Express device.

A1

F19

275.22.10.114.01
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XMC Module
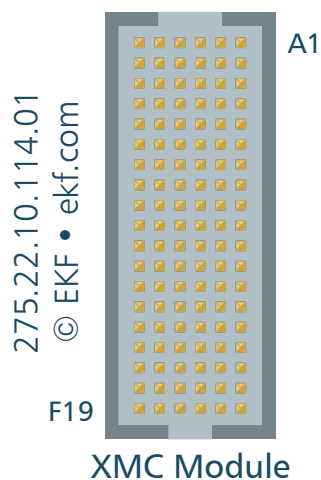
ANSI/VITA 42.3 defines a primary XMC connector P15, which is mandatory (for PCIe fabric), and a secondary XMC connector P16, which is optional (either fabric or user I/O). The DX2-COUGAR does not make use of P16. Suitable carrier cards are available from EKF, e.g. the SK2-SESSION CompactPCI® Serial XMC module carrier board.

As an option, the DX2-COUGAR can be equipped with a **XMC 2.0** type connector P15, as specified by VITA 61.0. With MIL/Aero environment in mind, the new connector incorporates a number of features for improved mechanical performance, and has been electrically characterized to support 5GHz allowing PCI Express® 2.0 (the VITA 42 connector in contrast has only been characterized to 3.125 Ghz). Since XMC (VITA 42) and XMC 2.0 (VITA 61) connectors are not intermateable, both the XMC carrier card and the XMC module must be populated with the same type of connector. The VITA 61 XMC 2.0 connector housing is off-white in colour as a visual key to differentiate it from the black VITA 42 legacy connector. Please specify your needs to sales@ekf.com when ordering the DX2-COUGAR.

|	A	B	C	D	E	F
XMC Connector P15 - PCIe Fabric • EKF Part No. 275.22.10.114.01
1	PET0P0	PET0N0	+3.3V	PET0P1	PET0N1	VPWR [2]
2	GND	GND	TRST# [1]	GND	GND	MRSTI#
3	PET0P2	PET0N2	+3.3V	PET0P3	PET0N3	VPWR [2]
4	GND	GND	TCK	GND	GND	MRSTO#
5	PET0P4	PET0N4	+3.3V	PET0P5	PET0N5	VPWR [2]
6	GND	GND	TMS	GND	GND	+12V
7	PET0P6	PET0N6	+3.3V	PET0P7	PET0N7	VPWR [2]
8	GND	GND	TDI	GND	GND	-12V
9	RFU	RFU	RFU	RFU	RFU	VPWR [2]
10	GND	GND	TDO	GND	GND	GA0 [1]
11	PER0P0	PER0N0	MBIST#	PER0P1	PER0N1	VPWR [2]
12	GND	GND	GA1 [1]	GND	GND	MPRESENT#
13	PER0P2	PER0N2	+3.3V_AUX	PER0P3	PER0N3	VPWR [2]
14	GND	GND	GA2 [1]	GND	GND	MSDA [1]
15	PER0P4	PER0N4	RFU	PER0P5	PER0N5	VPWR [2]
16	GND	GND	MVMRO	GND	GND	MSCL [1]
17	PER0P6	PER0N6	RFU	PER0P7	PER0N7	RFU
18	GND	GND	RFU	GND	GND	RFU
19	CLKP_XMC	CLKN_XMC	RFU	WAKE#	ROOT0#	RFU

pin positions printed italic/gray: reserved by specification / not connected

1)   Serial EEPROM not populated by default (no IPMI)

2)   VPWR typically is not required - both the SATA controller and the SSD are sourced from +3.3V
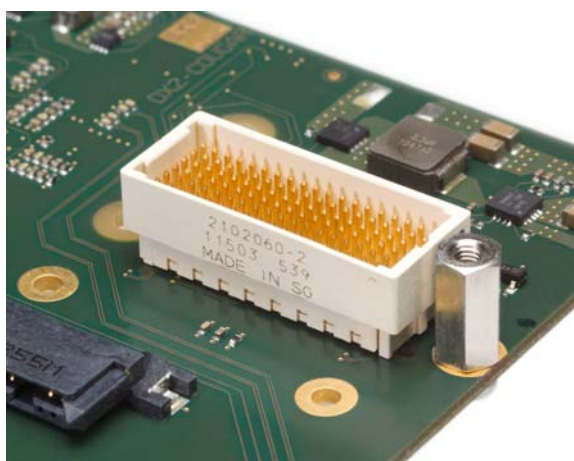
Black = VITA 42 XMC
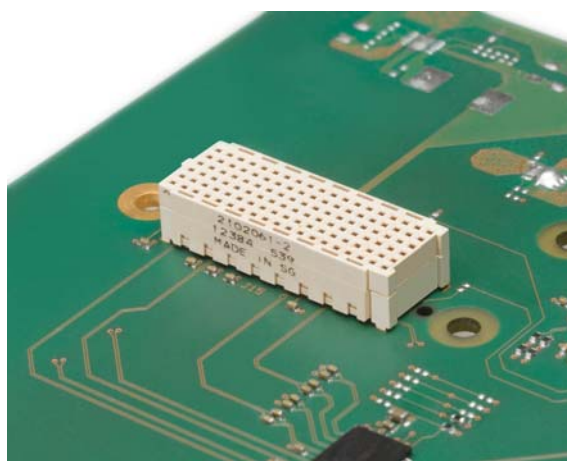Off-white = VITA 61 XMC 2.0
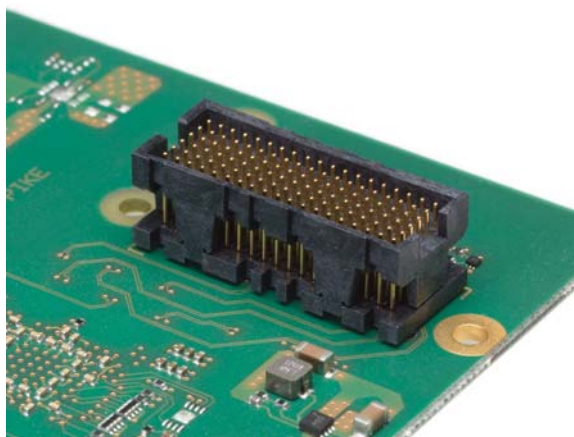
XMC Connector P15
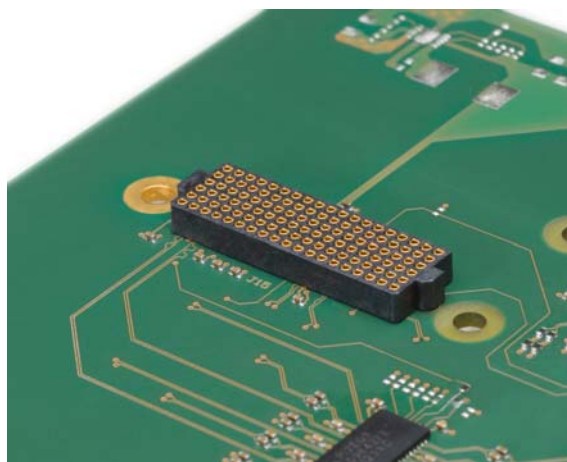
XMC Connector J15

XMC 2.0 Connector P15

XMC 2.0 Connector J15

SK2-SESSION • CompactPCI® Serial • XMC Module Carrier Board

www.ekf.com/s/sk2/sk2.html

SK2-SESSION • CompactPCI® Serial • XMC Module Carrier Board

CK2-SESSION • CompactPCI® Classic • XMC Module Carrier Board

Schematics

Complete circuit diagrams for this product are available for customers on request. Signing of a non-disclosure agreement would be needed. Please contact sales@ekf.de for details.

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boards.   systems.   solutions.