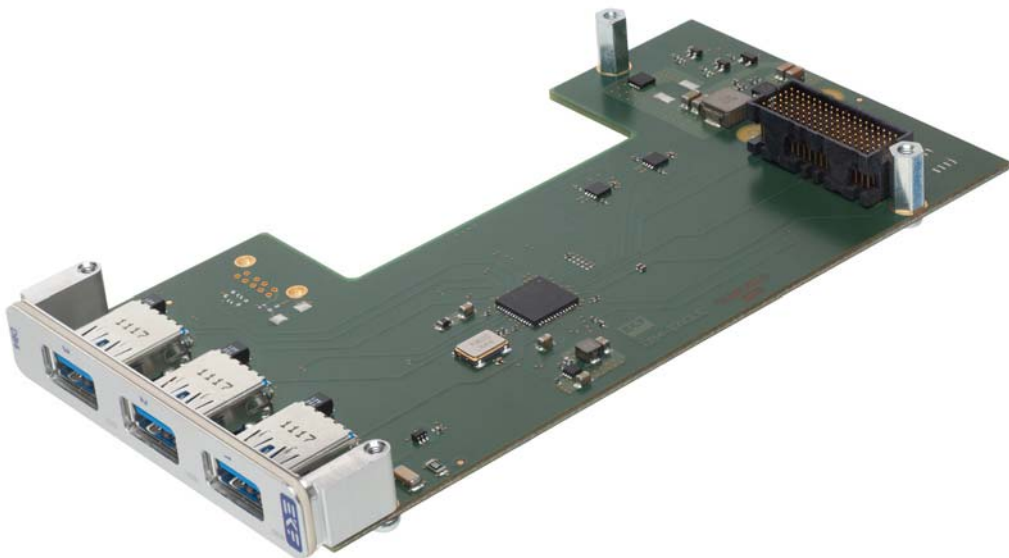# EKF
SYSTEM

Technical Information

DB4-EAGLE

XMC Module

USB 3.0 SuperSpeed Controller

Document No. 6527 • Ed. 8 • 5 March 2015

Contents

About this Manual

This manual is a short form description of the technical aspects of the DB4-EAGLE, required for installation and system integration. It is intended for the advanced user only.

Edition History

Ed.	Contents/*Changes*	Author	Date
1	Technical Information DB4-EAGLE, english, preliminary edition Text #6527, File: db4_ti.wpd	jj	12 October 2011
2	Addred photos	jj	6 February 2012
3	Addred photos showing internal USB connector	jj	29 March 2012
4	Addred photo showing DB4-EAGLE on a SK2-SESSION carrier card	jj	30 March 2012
5	Added photos SK2-SESSION	jj	4 April 2012
6	Added photo SK2-SESSION w. DB4-EAGLE exploded view	jj	5 April 2012
7	Added images XMC 2.0 connector	jj	13 August 2014
8	Changed operating temperature to industrial	jj	5 March 2015

DB4-EAGLE

Related Documents

Related Information	
DB4-EAGLE Home	www.ekf.com/d/dusb/db4/db4.html
CCK-MARIMBA XMC Carrier Side Board	www.ekf.com/c/ccpu/cck/cck_tie.pdf
SK2-SESSION CompactPCI® Serial XMC Carrier Card	www.ekf.com/s/serial.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
PCI Express®	PCI Express® Base Specification 3.0	www.pcisig.com
USB	Universal Serial Bus Specification 3.0 & 2.0	www.usb.org
xHCI	eXtensible Host Controller Interface for Universal Serial Bus (xHCI) Rev. 1.0 2010-05-21	www.intel.com
XMC XMC 2.0	ANSI/VITA 42.0 & 42.3, IEEE P1386.1 / Draft 2.4 & Draft 2.4a ANSI/VITA 61	www.vita.com

Technical Features

Feature Summary

| Feature Summary |
|---|
| ‣ Form factor XMC single-width mezzanine card 139mm x 74mm |
| ‣ Stack height 10mm XMC to host |
| ‣ Host I/F Connector P15 XMC - PCI Express, single lane, single link |
| ‣ Option P15 connector according to XMC 2.0 (white housing) |
| ‣ VPWR either +5V or +12V self-adjusting |
| |
| ‣ PCIe to quad-port USB 3.0 controller |
| ‣ PCIe x1 Gen2 interface for optimum performance |
| ‣ USB 3.0 xHCI (eXtensible host controller interface) SuperSpeed |
| ‣ USB 2.0 high-speed, full-speed, low-speed supported |
| ‣ Three front bezel USB 3.0 type A receptacles for attachment of external devices |
| ‣ Option on-board USB 3.0 connector for system internal cabling |
| |
| ‣ Designed & Manufactured in Germany |
| ‣ ISO 9001 Certified Quality Management |
| ‣ Long Term Availability |
| ‣ Coating, Sealing, Underfilling on Request |
| ‣ RoHS compliant |
| ‣ Operating temperature: -40°C to +85°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 tbd |
| ‣ EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1) |

Short Description

The DB4-EAGLE is a XMC standard single-width mezzanine card, equipped with a PCI Express® to USB 3.0 quad-port controller. Three USB 3.0 receptacles are available from the front bezel for attachment of external USB 2.0 and USB 3.0 compliant devices. As an option, an additional USB 3.0 connector can be populated on-board, for system-internal usage.

The USB controller supports all USB data transfer protocols on any connector, SuperSpeed (USB 3.0 xHCI) as well as high-speed, full-speed, and low-speed. Since the DB4-EAGLE requires only a single PCI Express® lane (Gen2 for optimum performance), the module can be combined with any XMC carrier card.
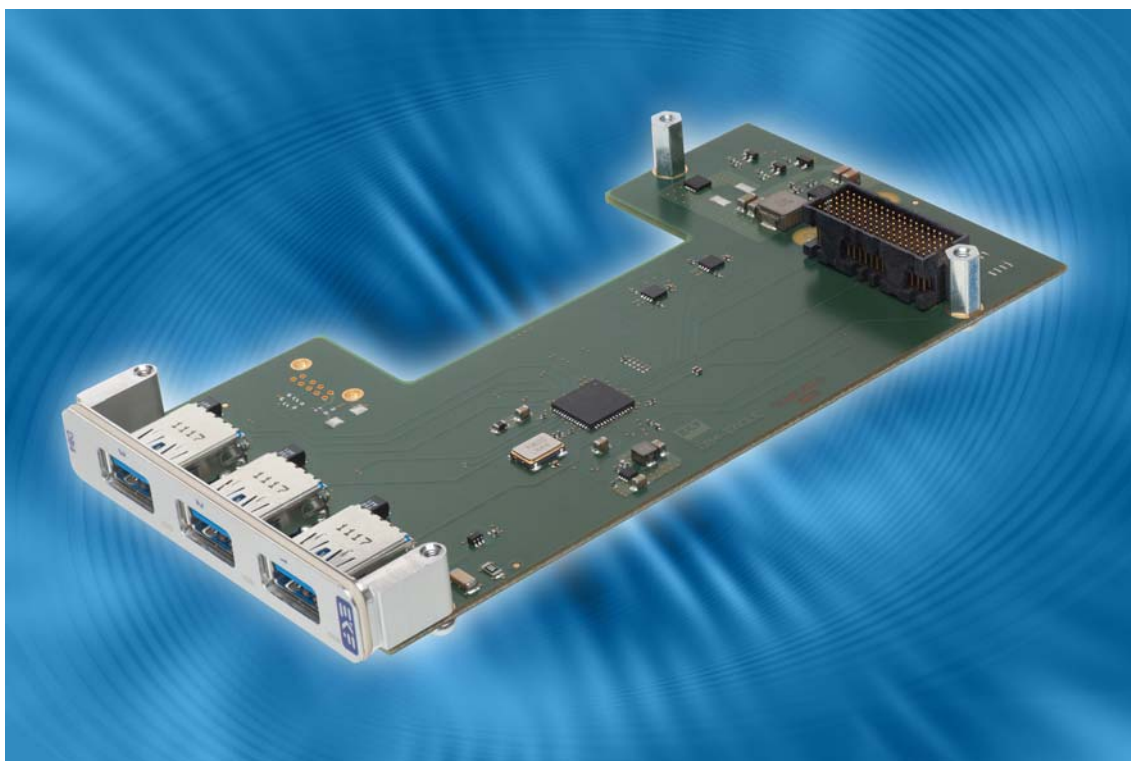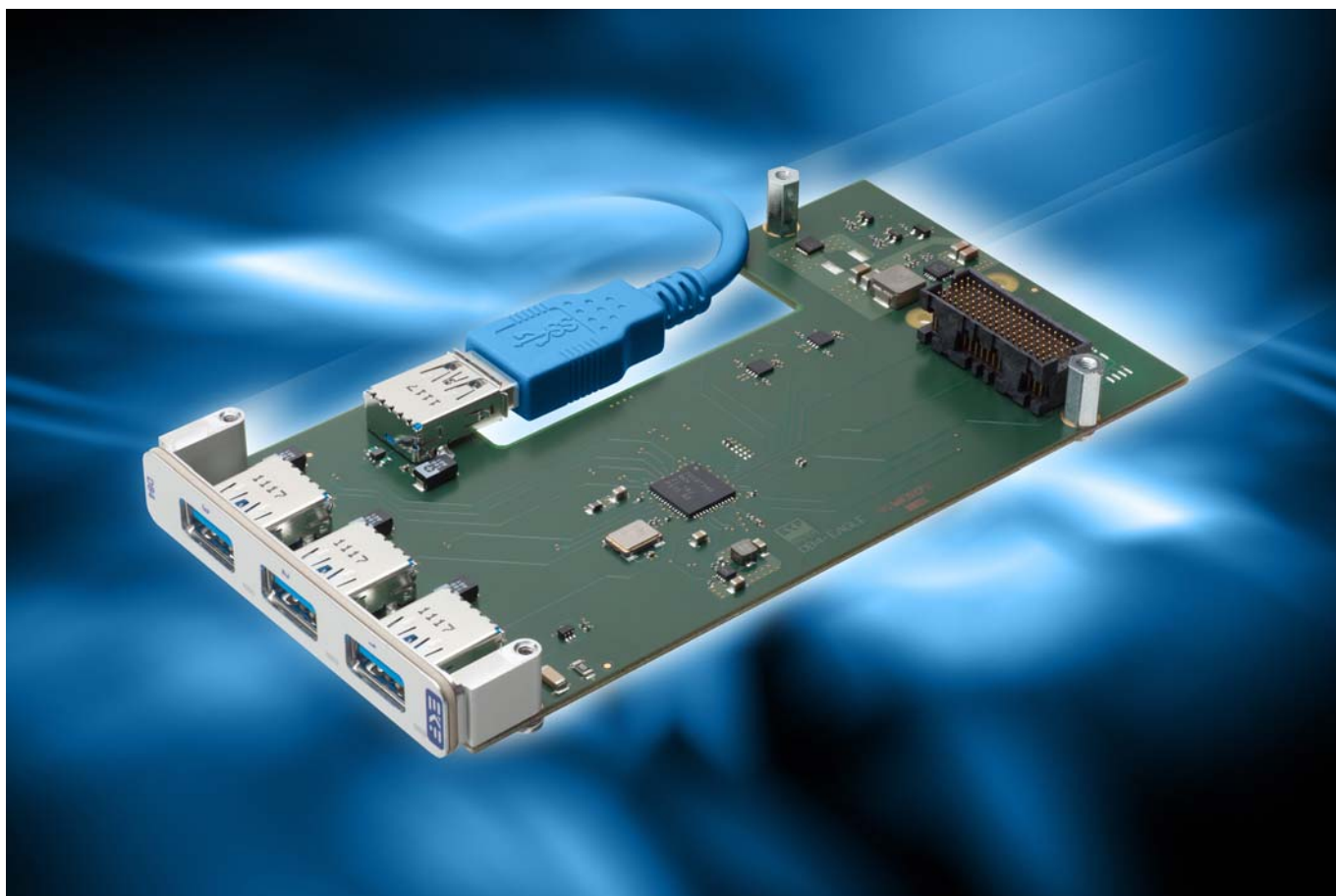

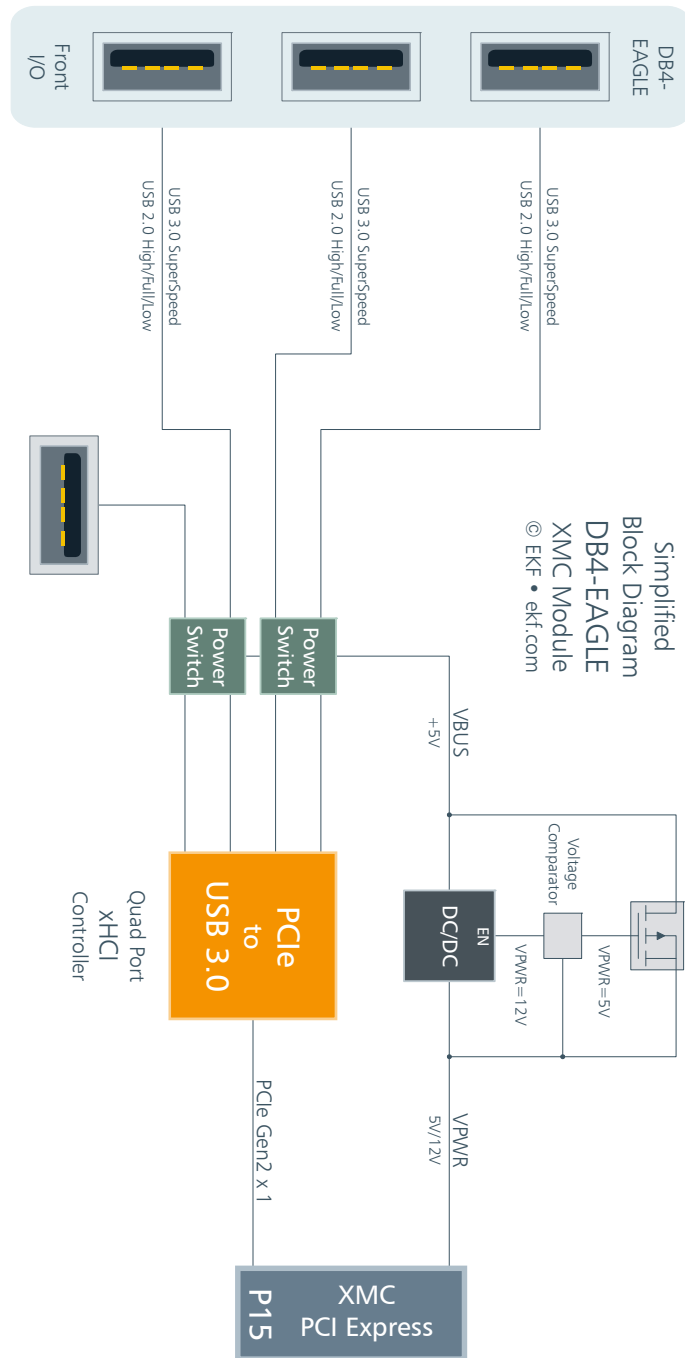DB4-EAGLE

Theory of Operation

The DB4-EAGLE is equipped with the TI TUSB7340 single chip PCI Express® to USB 3.0 bridge. The xHCI (SuperSpeed) compliant host controller supports up to four downstream ports. Each downstream port may be independently enabled and has individual power control and overcurrent detection.

SuperSpeed USB 3.0 offers ten times the data speed of USB 2.0 (5 Gbit/s compared to 480 Mbit/s). The bandwidth of the xHCI controller is shared over all TUSB7340 downstream ports. Texas Instruments provides xHCI compliant Windows® drivers for download at www.ti.com/product/tusb7340#toolssoftware.
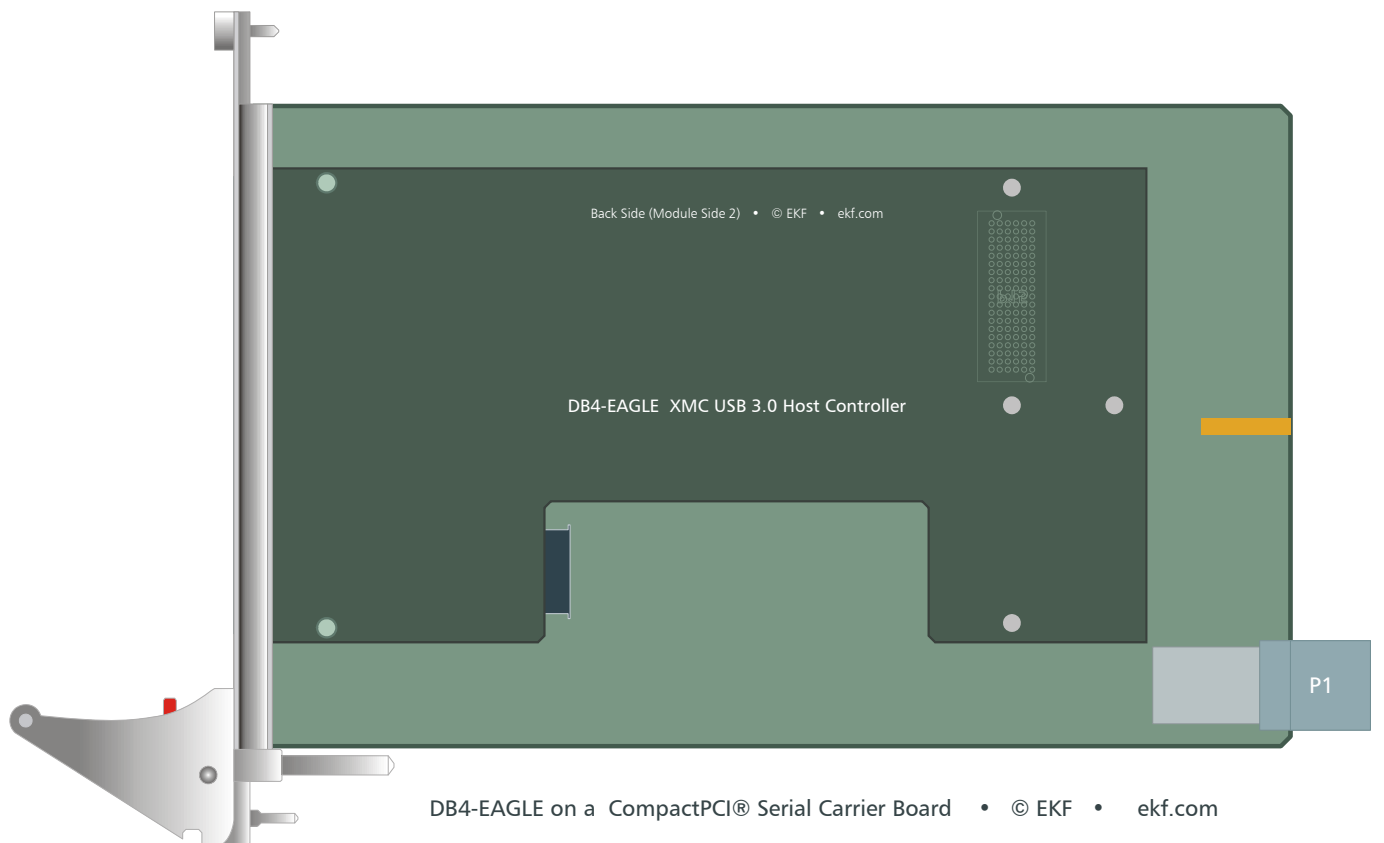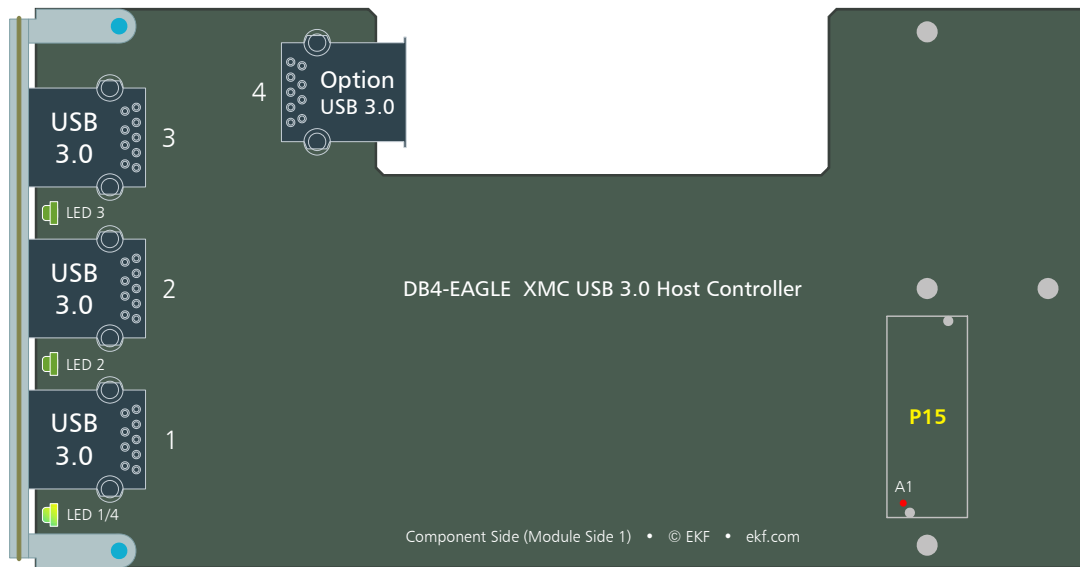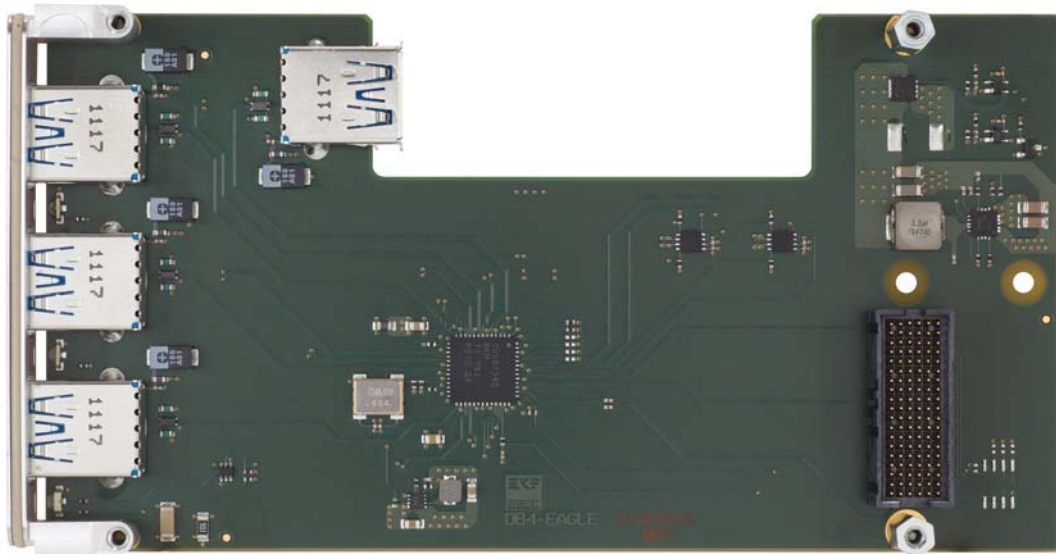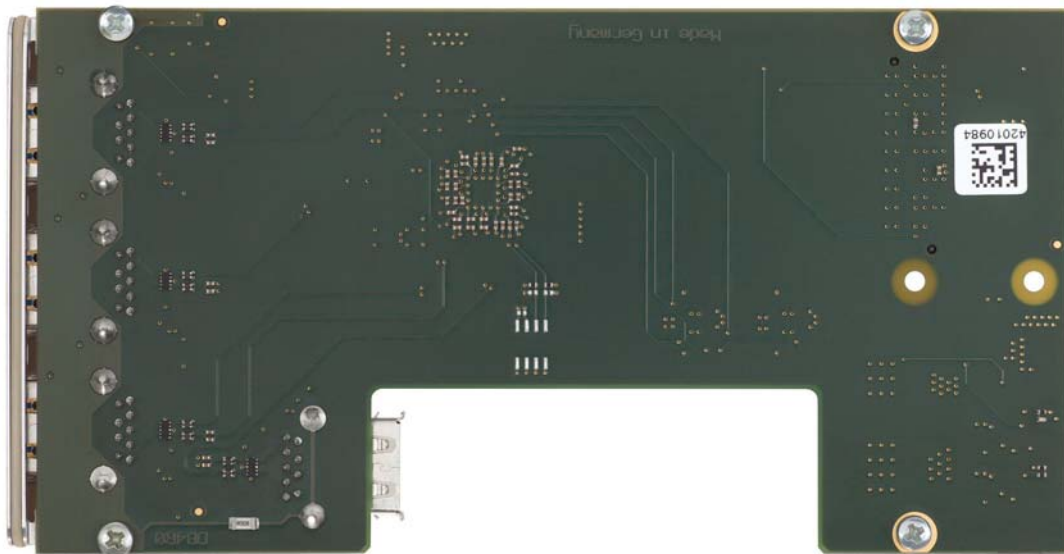

DB4-EAGLE w. Internal USB Connector

Block Diagram

Simplified
Block Diagram
DB4-EAGLE
XMC Module
© EKF • ekf.com

Top View

USB 3.0 — 3

LED 3

USB 3.0 — 2

LED 2

USB 3.0 — 1

LED 1/4

4 — Option USB 3.0

DB4-EAGLE XMC USB 3.0 Host Controller

P15

A1

Component Side (Module Side 1) • © EKF • ekf.com

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

DB4-EAGLE XMC USB 3.0 Host Controller

P1

DB4-EAGLE on a CompactPCI® Serial Carrier Board • © EKF • ekf.com

Bottom View

Front Bezel

LEDs (green) are provided as USB VBUS (+5V) indicator, associated to the particular receptacles. The upper bicolour LED is in addition assigned to the optional internal USB connector (yellow). Since VBUS is controlled by the USB driver software, the LEDs are lit when a connector is ready for use. Vice versa, a LED is off if the respective USB port is not initialized, intentionally switched off, or a short-circuit situation is detected, presented by the connected device.
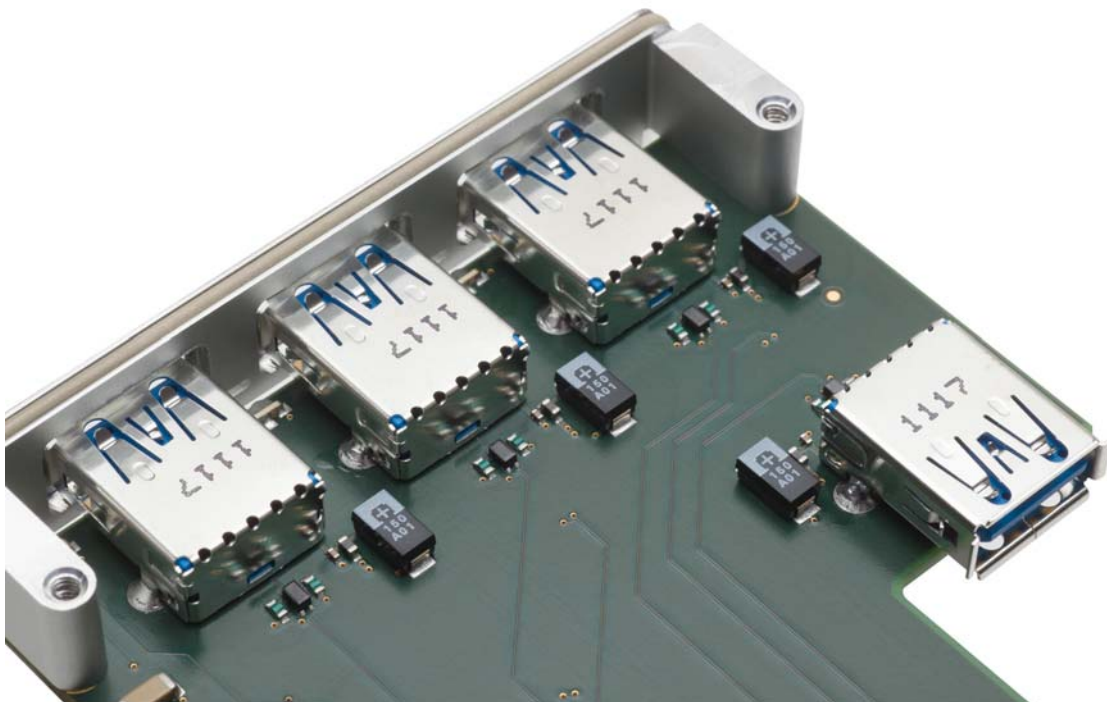
Installing and Replacing Components

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.
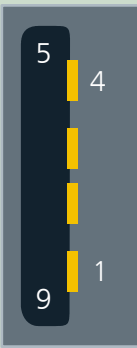
EMC Recommendations

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

## Technical Reference - Connectors

USB 3.0 Connectors

The DB4-EAGLE is equipped with three front bezel receptacles for USB 3.0 or USB 2.0 type A cable connectors (USB root hub). When connected to USB 2.0 compliant devices, only the classic 4 contacts (data pair, +5V and GND) are in use. USB 3.0 devices in addition communicate via the SuperSpeed differential transmit and receive signal pairs, available across another 5 contact pins.

USB 3.0 Receptacle		
	1	VBUS +5V 1.5Amax
	2	USB D-
	3	USB D+
	4	GND
	5	SS RX-
	6	SS RX+
	7	GND
	8	SS TX-
	9	SS TX+

Each connector provides +5V (VBUS) for powering external devices. Electronic switches limit the maximum output current of each individual USB connector to a safe level. The VBUS power has been derived from the XMC module VPWR rail. Dependent of the XMC carrier card, the VPWR voltage can be either +5V or +12V. The DB4-EAGLE features an on-board voltage comparator to detect the VPWR voltage actually present. If VPWR is +5V, it is directly used to feed the USB power switches. If VPWR is +12V, a DC-DC converter from +12V to +5V on the DB4-EAGLE will be enabled instead.

The maximum total VBUS output current is predominantly limited by the VPWR resources of the XMC carrier card. The electronic switches used on the DB4-EAGLE for USB VBUS are rated at >2A current limit typically, which is suitable even for applications where heavy capacitive loads are likely to be encountered. In total, if the voltage on the VPWR pins is +5V, this would imply a maximum current of >8A to be delivered from the XMC carrier card. When the VPWR voltage is +12V, the total permanently available USB VBUS current is limited mainly by the DB4-EAGLE on-board DC-DC regulator to ~4A maximum.
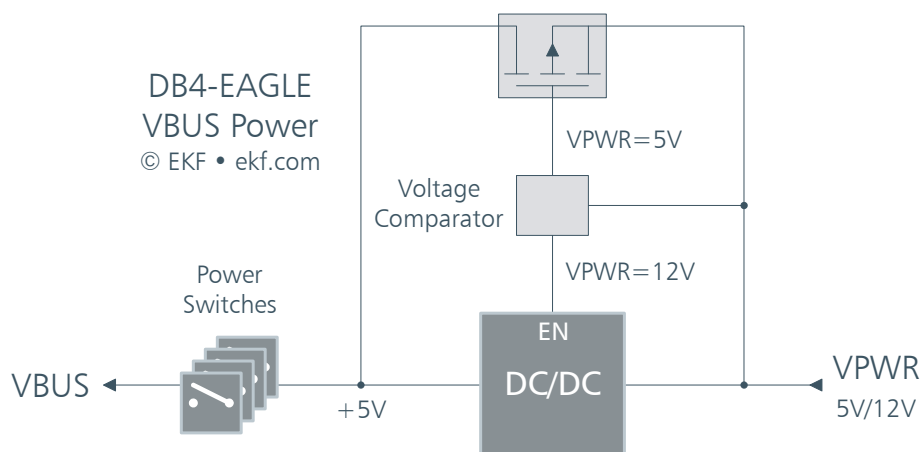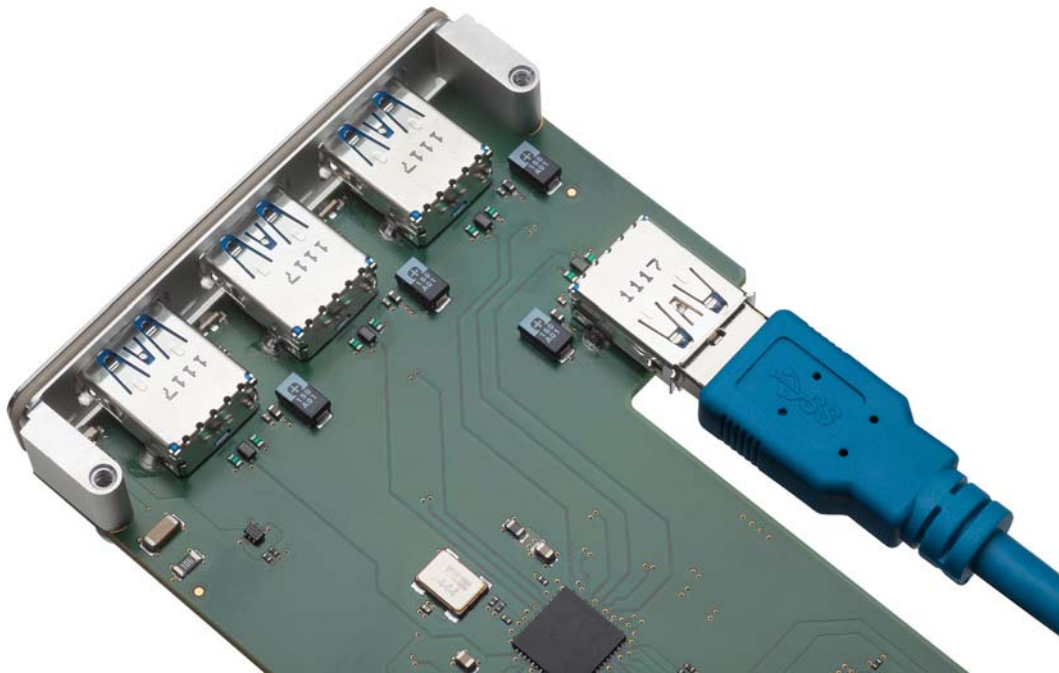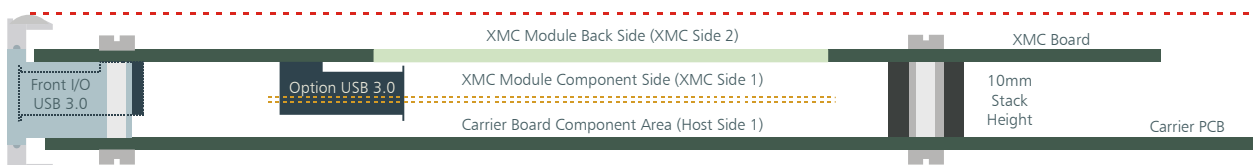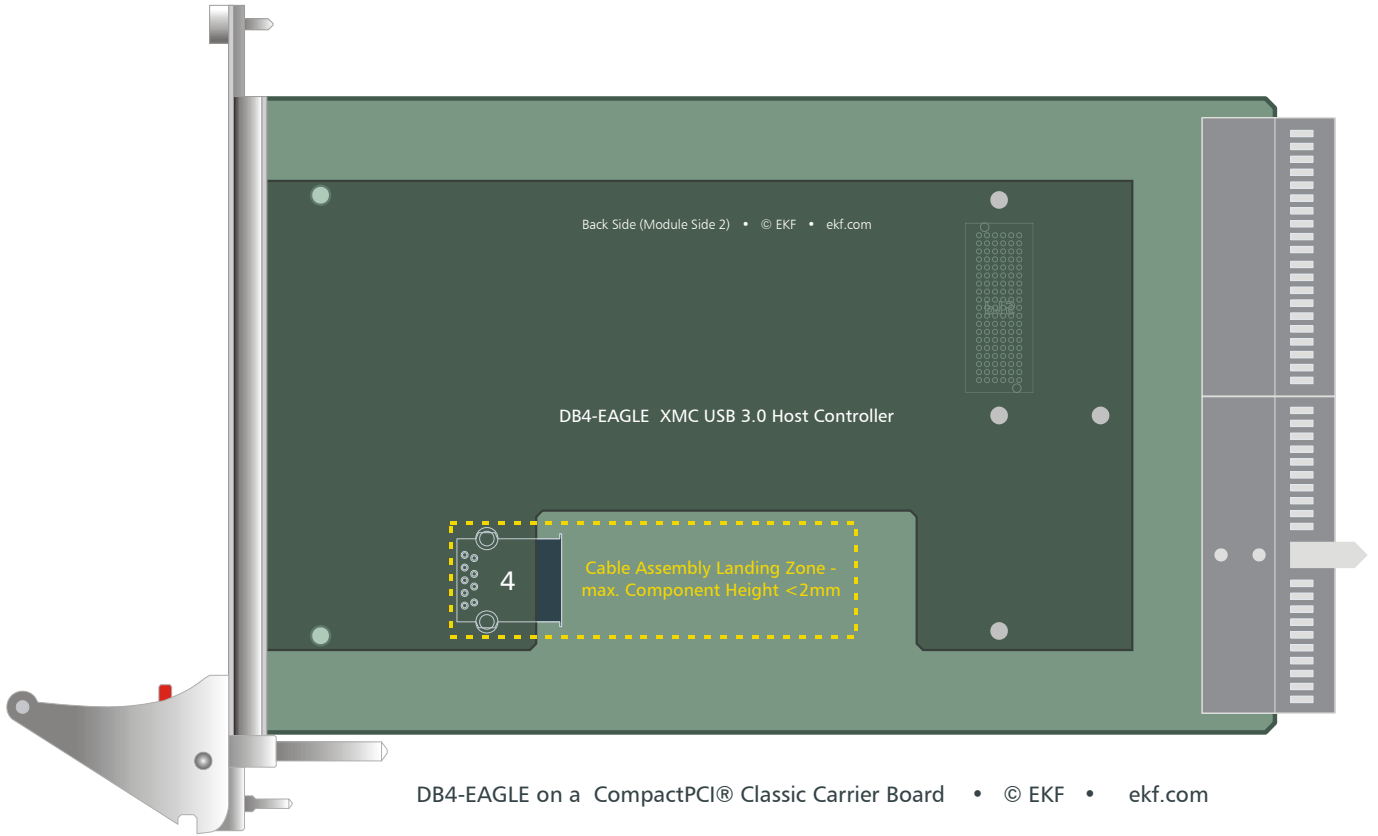
As an option, a 4th USB 3.0 connector may be populated on the DB4-EAGLE, for attachment of system internal devices. However, the connector height exceeds the XMC specification. In case of considering the additional on-board connector, the maximum component height on the carrier board must be checked first.

Vis-à-vis the optional 4th receptacle and associated USB 3.0 cable connector, a suitable landing zone would be required on the carrier board, with a maximum allowable component height of <2mm (the XMC specification allows for 4.7mm).

DB4-EAGLE on a CPCI Carrier Board - Sectional Drawing • © EKF • ekf.com

XMC Module Back Side (XMC Side 2)

XMC Board

Front I/O
USB 3.0

Option USB 3.0

XMC Module Component Side (XMC Side 1)

10mm
Stack
Height

Carrier Board Component Area (Host Side 1)

Carrier PCB

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

DB4-EAGLE XMC USB 3.0 Host Controller

4

Cable Assembly Landing Zone -
max. Component Height <2mm

DB4-EAGLE on a CompactPCI® Classic Carrier Board • © EKF • ekf.com

Check Landing Zone for Internal USB3 Cable Assembly

DB4-EAGLE on a SK2-SESSION CompactPCI® Serial Carrier Card

P15 Mezzanine Connector

The DB4-EAGLE 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 DB4-EAGLE is organized as single-lane single-link PCI Express® device.

A1

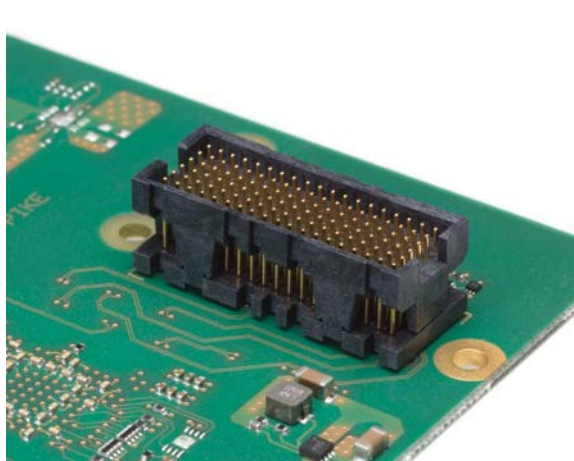275.22.10.114.01
© EKF • ekf.com

F19

XMC Module
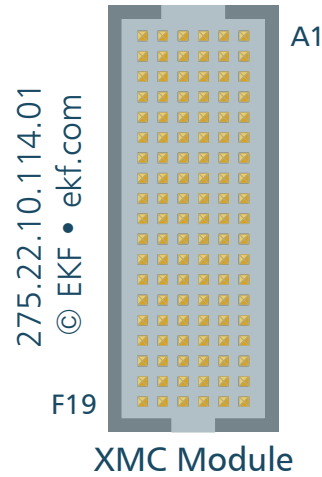
ANSI/VITA 42.3 defines a primary XMC connector P15, which is mandatory (for PCIe fabric), and a secondary XMC connector P16, which is optional (either fabric or user I/O). The DB4-EAGLE does not make use of P16. Suitable carrier cards are available from EKF, e.g. the SK2-SESSION CompactPCI® Serial XMC module carrier board.
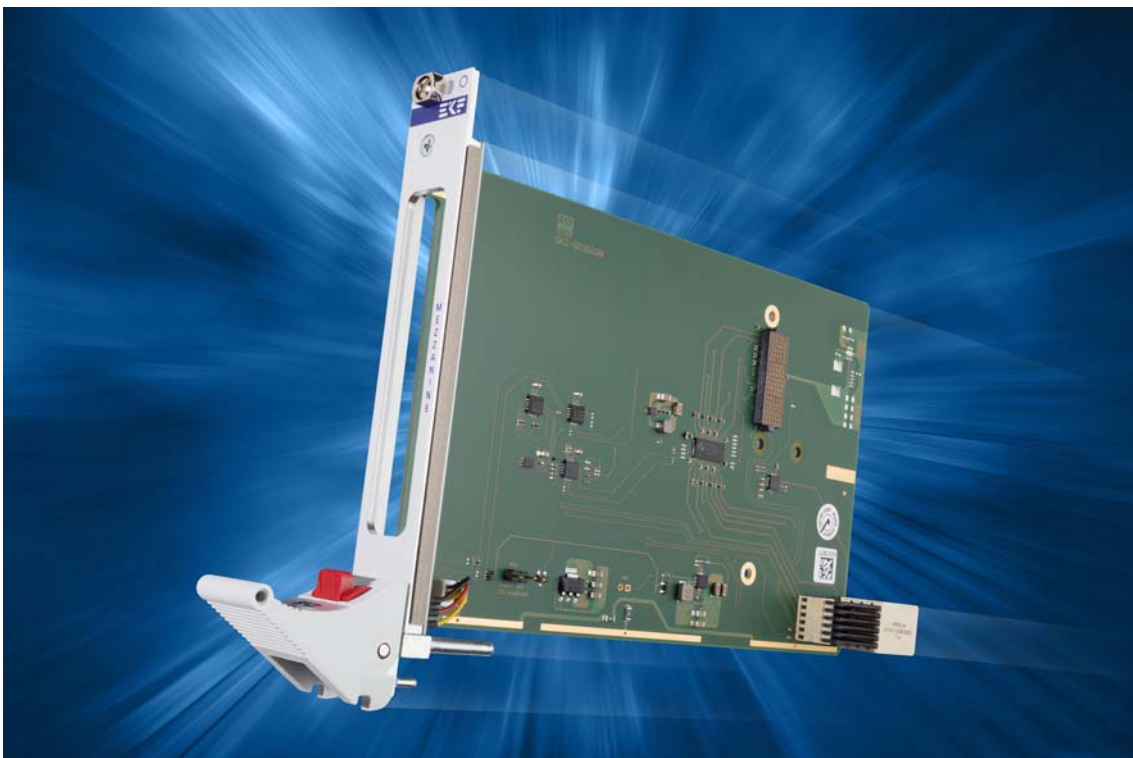
SK2-SESSION • CompactPCI® Serial • XMC Module Carrier Board

As an option, the DB4-EAGLE can be equipped with a P15 connector according to the XMC 2.0 style, as defined by VITA 61.0. Carrier card and module connectors J15/P15 must match - VITA 61 and VITA 42 XMC connectors are not intermateable. Both connector styles can be easily distinguished from each other by the connector body colour as visual key.
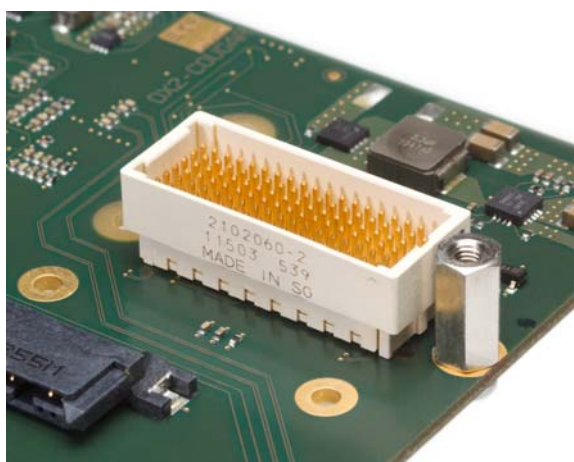
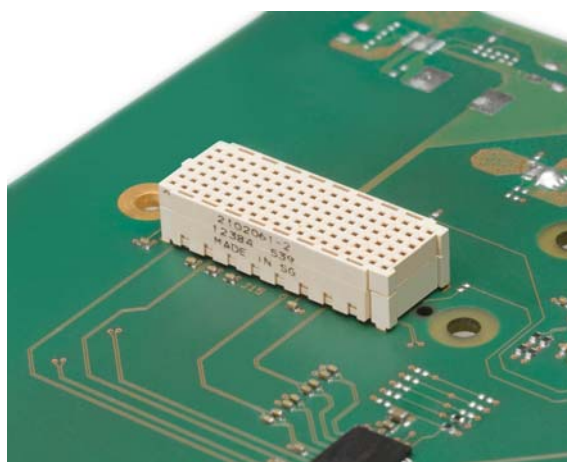Black = VITA 42 XMC
Off-white = VITA 61 XMC 2.0

XMC Connector P15
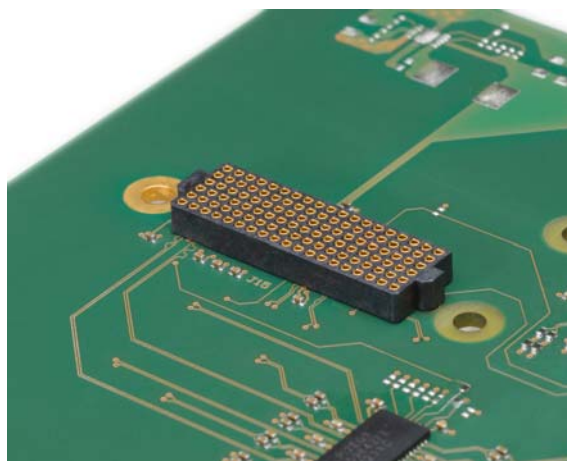
XMC Connector J15

XMC 2.0 Connector P15

XMC 2.0 Connector J15

ekf.com

XMC Connector P15 - PCIe Fabric • EKF Part No. 275.22.10.114.01					
	A	B	C	D	E	F
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 is required for USB BusPower, +12V or +5V self-adjusting

Drivers

As of current (2012-04), some operating systems such as Ubuntu Linux provide already suitable drivers for the TUSB7340 quad port XHCI controller, unlike Windows® 7. Hence, Windows® drivers must be installed first before taking the advantage of SuperSpeed USB. Texas Instruments provides xHCI compliant Windows® drivers for download at

www.ti.com/product/tusb7340#toolssoftware

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.

EKF reserves the right to refuse distribution of confidential information material for any reason that EKF may consider substantial.
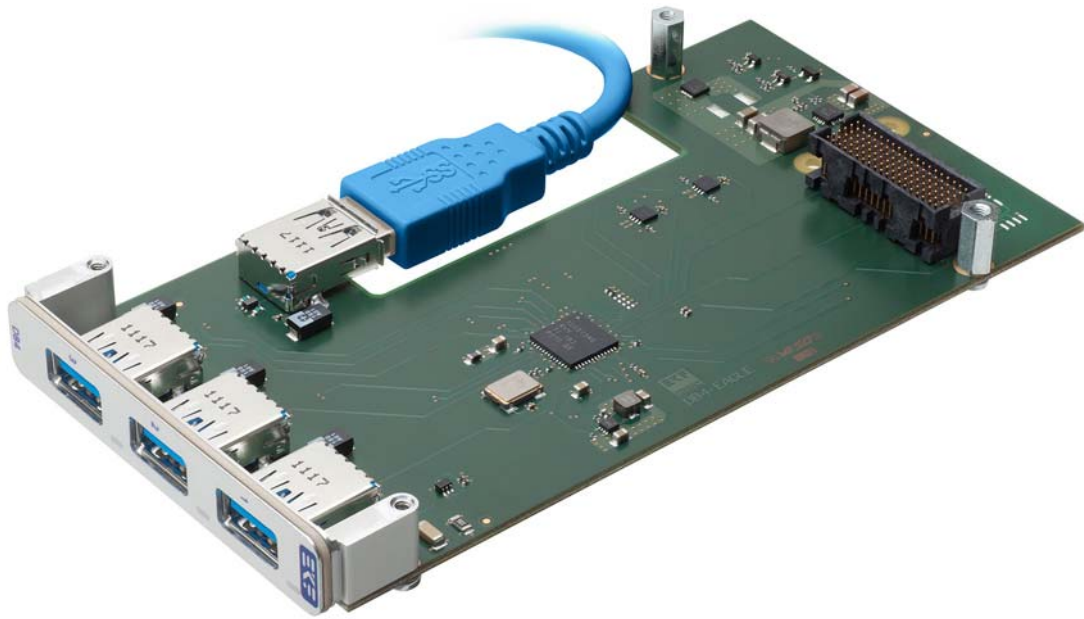
Internal Connector Option

DB4-EAGLE

SK2-SESSION CompactPCI® Serial XMC Module Carrier Card

SK2-SESSION w. DB4-EAGLE

Industrial Computers Made in Germany
boards.   systems.   solutions.