



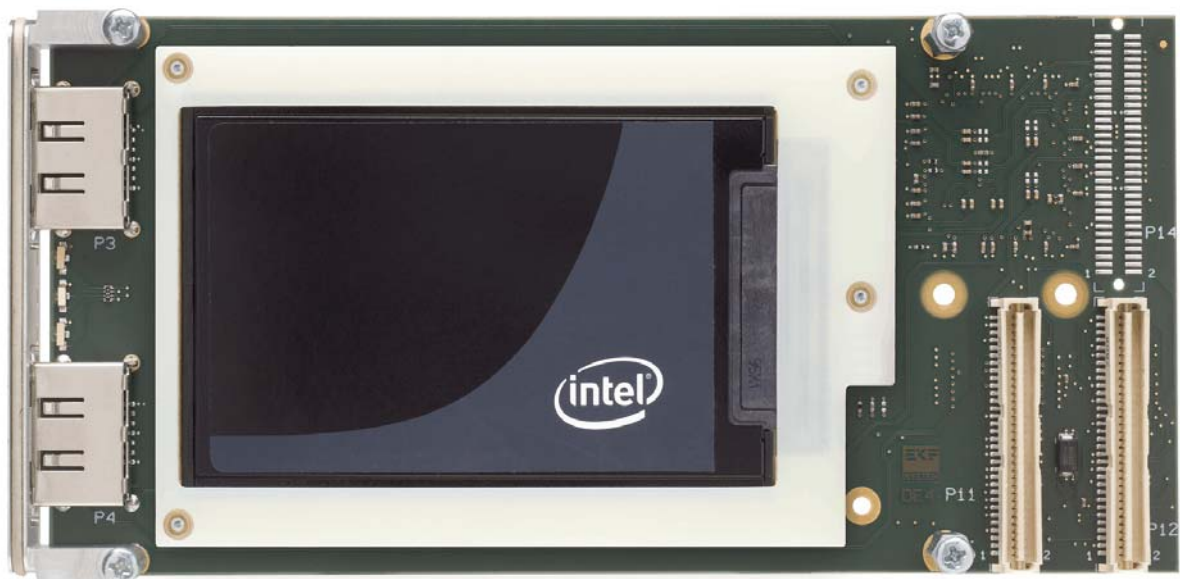
Technical Information

DE4-FOX

PMC-Module

Micro SATA SSD
Solid State Drive Mezzanine Module

Document No. 1124 • Ed. 7 • 9 April 2010



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About this Manual

This manual is a short form description of the technical aspects of the DE4-FOX, required for installation and system integration. It is intended for the advanced user only.

Edition History

EKF Document	Ed.	Contents/Changes	Author	Date
Text # 1124 de4_tie.wpd	1	Technical Information DE4-FOX English, Preliminary Edition	jj	14 May 2009
	2	Changed illustration 'Sectional Drawing'	jj	18 May 2009
	3	Added photos top/bottom view	jj	28 October 2009
	4	Added photos panorama view	jj	9 November 2009
	5	Added photo of assembly stack CCG CCK DE4	jj	12 November 2009
	6	Added photo of assembly stack CCG CCK DE4 C20	jj	24 November 2009
	7	Minor review	jj	9 April 2010

Related Documents

For a description of the CCK-MARIMBA card, which may act as a PMC host (carrier board) with respect to the DE4-FOX, please refer to the correspondent Technical Information, available by download from www.ekf.com/c/ccpu/cck/cck_tie.pdf.

The DE4-FOX is a PMC style mezzanine card (i.e. PCI based). A similar XMC solution (PCI Express® based) is available as an alternate, named DX1-LYNX. Please refer to www.ekf.com/d/dide/dx1/dx1_e.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.

- ▶ Intel, Pentium, Celeron, Core 2 Duo, Merom, Penryn, iAMT: ® Intel
- ▶ Santa Rosa Platform, Crestline Chipset GM965: Intel
- ▶ Montevina Platform, Cantiga Chipset GS45: Intel
- ▶ **CompactPCI**® : ® PICMG
- ▶ Windows XP, WEPOS, Windows Vista, Windows 7: ® 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

Specifications/Standards	
Micro SATA	SFF-8144 Specification (ftp://ftp.seagate.com/sff)
SATA	Serial ATA 2.5/2.6 Specification (www.sata-io.org)
PMC	IEEE P1386.1 / Draft 2.4 & Draft 2.4a

Summary of Features

Feature Summary	
Form Factor	<ul style="list-style-type: none"> ▶ PMC single-width mezzanine card 149mm x 74mm ▶ Stack height 10mm PMC to host
Host I/F Connectors	<ul style="list-style-type: none"> ▶ P11/P12 PMC - PCI 32-bit 33/66MHz ▶ P14 PMC (Option) - Rear I/O SATA
SATA Controller	<ul style="list-style-type: none"> ▶ SiI3114 PCI to SATA controller ▶ Quad-channel SATA 1.5Gbps ▶ Drivers available at www.siliconimage.com/support/searchresults.aspx?pid=28&cat=3
Solid State Drive	<ul style="list-style-type: none"> ▶ Module suitable for 1.8-inch Micro SATA SSD (alternatively hard disk drive), dimensions according to SFF-8144 (54mm x 78.5mm x 5mm) ▶ Variety of industrial grade Micro SATA SSD manufacturers, e.g. Intel, Micron, Samsung, SanDisk, STEC, Supertalent, 64GB or beyond, SLC or MLC available, high speed data transfer ▶ SSD can be provided by EKF or by customer ▶ Single- or dual-drive option
SATA Connectors	<ul style="list-style-type: none"> ▶ Two SATA channels are permanently assigned to the on-board drive(s) ▶ Another two SATA channels are related either to the front bezel eSATA receptacles, or to the rear I/O connector (these are permanent manufacturing options, consider before ordering) ▶ P1: 15-pos. Micro SATA connector, suitable for 1.8-inch top mount drive (side 1 - module component side), option ▶ P2: 15-pos. Micro SATA connector, suitable for 1.8-inch bottom mount drive (side 2 - module back side), option ▶ P3, P4: Front bezel eSATA receptacles, option exclusive to P14 ▶ P14: PMC rear I/O connector, option exclusive to P3/P4
Thermal Conditions	<ul style="list-style-type: none"> ▶ Operating temperature: 0°C ... +70°C ▶ Storage temperature: -40°C ... +85°C, max. gradient 5°C/min ▶ Humidity 5% ... 95% RH non condensing
Environmental Conditions	<ul style="list-style-type: none"> ▶ Altitude -300m ... +3000m ▶ Shock 15g 0.33ms, 6g 6ms ▶ Vibration 1g 5-2000Hz
EC Regulations	<ul style="list-style-type: none"> ▶ EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1) ▶ 2002/95/EC (RoHS)
MTBF	tbd

Not all of the connectors may be present or functional on your actual DE4-FOX board; assembly is highly custom specific. Options may be exclusive, i.e. not necessarily concurrently present. Discuss your needs with EKF before ordering.

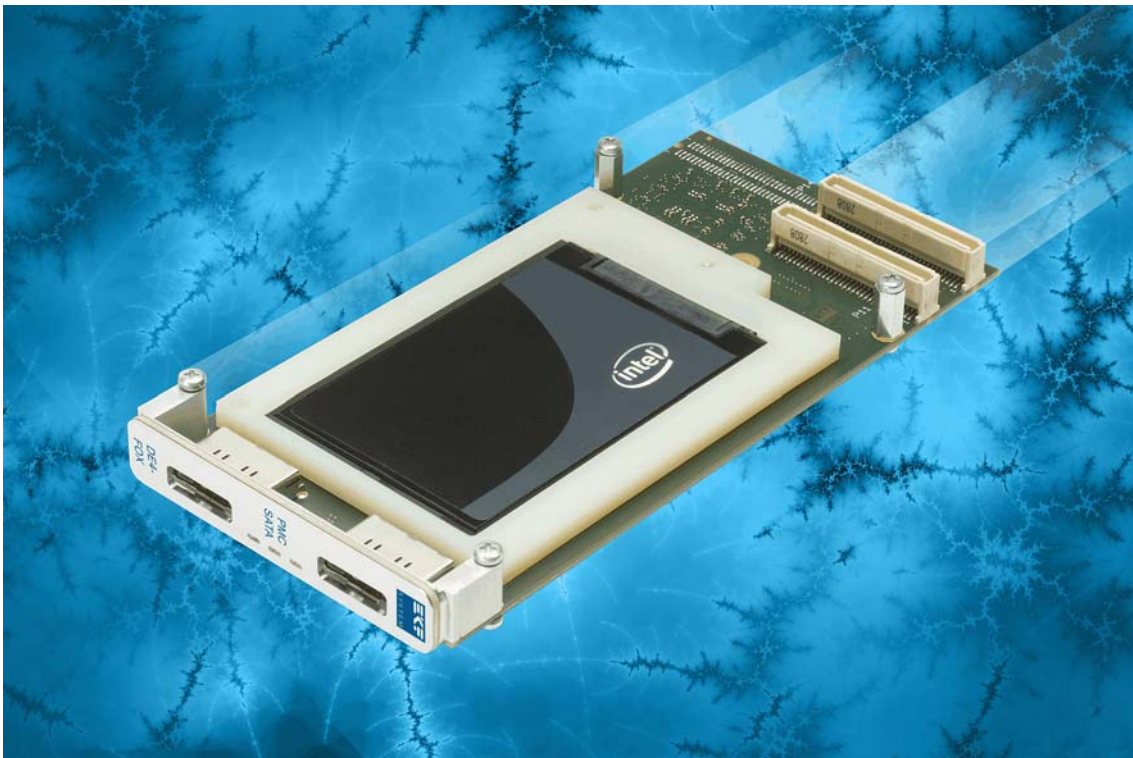
Short Description

The DE4-FOX is a PMC style single-width mezzanine card, equipped with a quad-channel PCI to SATA controller, and one or two 1.8-inch Micro SATA solid state drives (SSD) or hard disk drives. In addition to the on-board drive(s), another two SATA channels can be used for attachment of external SATA storage devices, either through the front bezel connectors (eSATA type), or via rear I/O (across the P14 connector to a suitable host carrier board).

As of current, suitable on-board mounting Micro SATA solid state drives are available with 64GB and beyond storage capacity, delivering sufficient space for installation of any popular operating system.

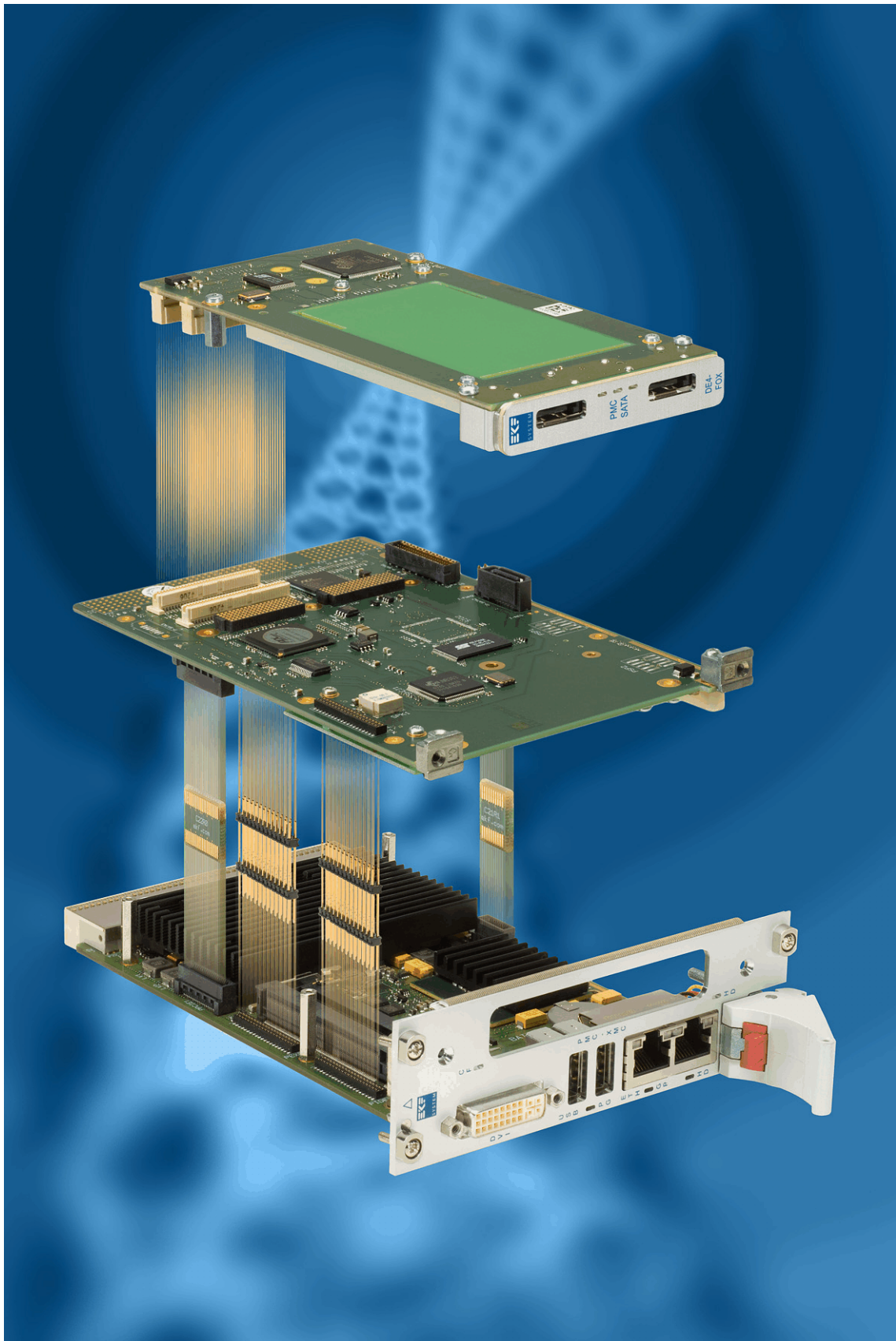
A single drive will be mounted on the component side (side 1) of the mezzanine card (facing the carrier board when module is engaged). As an option, a second drive can be accommodated on the back side (module side 2, on top of the stack when mezzanine card is engaged).

Flash technology based SATA drives, both SLC and also MLC architecture, provide significant advantages compared to rotating memory solutions (aka hard disk), e.g. less power consumption, faster data I/O transfers, lower latency time, industrial temperature grade and superior immunity against shock and vibration.



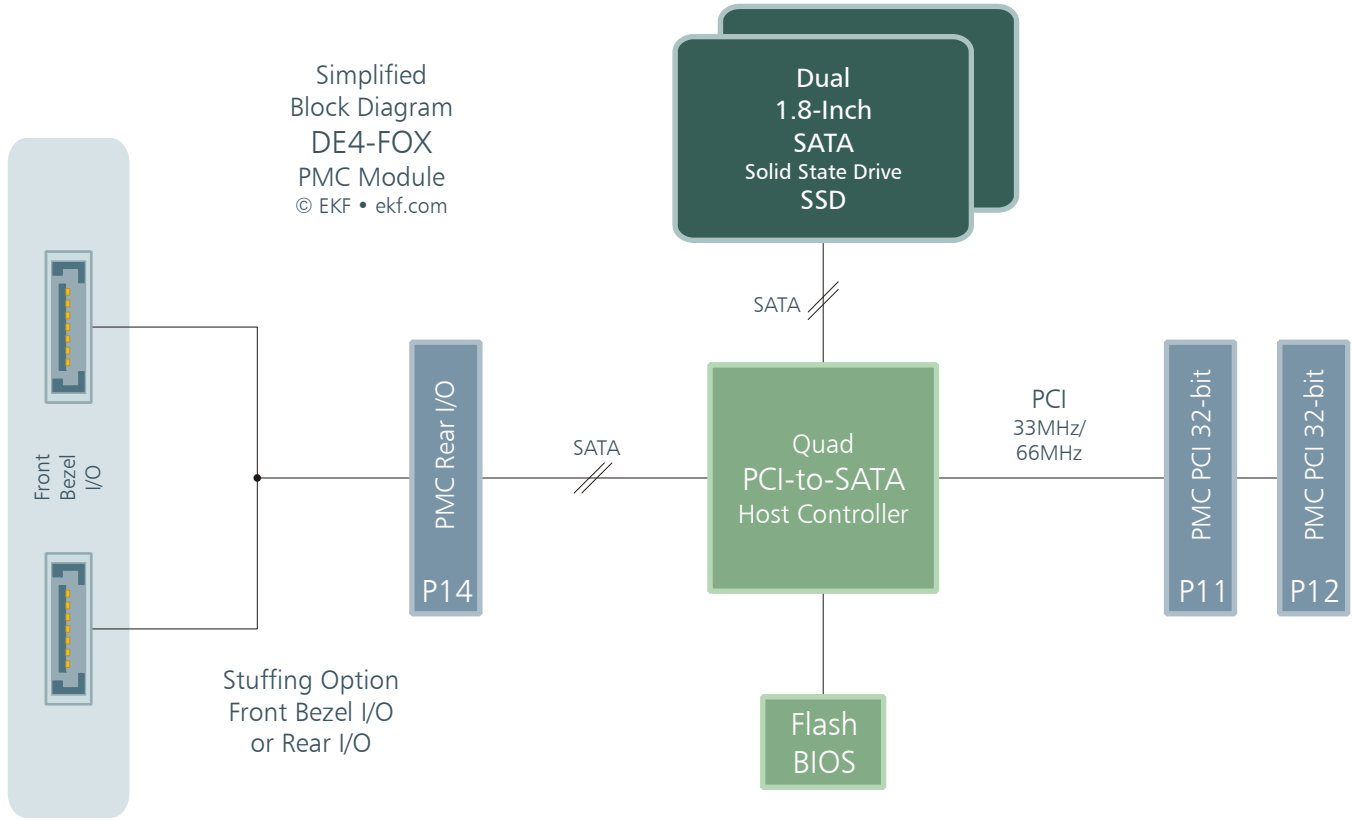


Intel MicroSATA SSD (Top View)

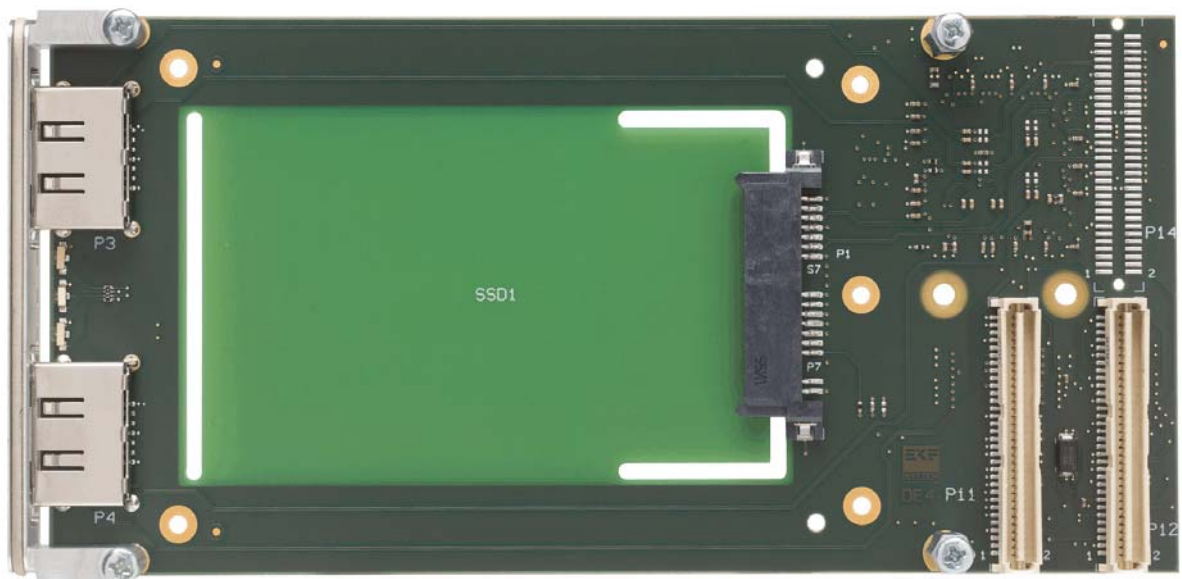
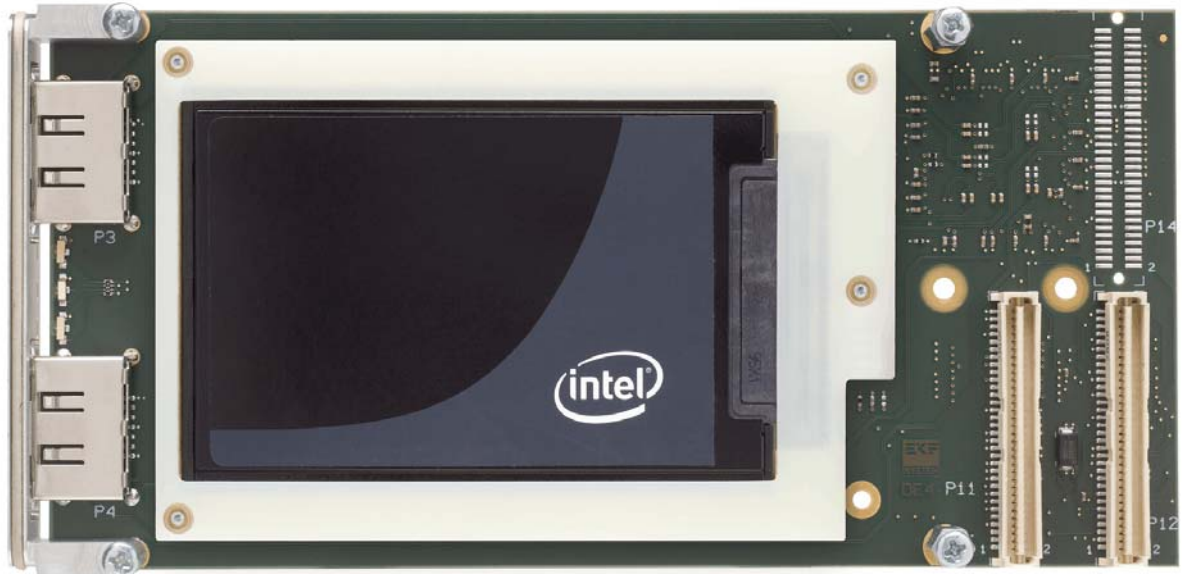


CPU Board (Bottom) PMC/XMC Carrier Side Card (Middle) PMC/XMC Module (Top)

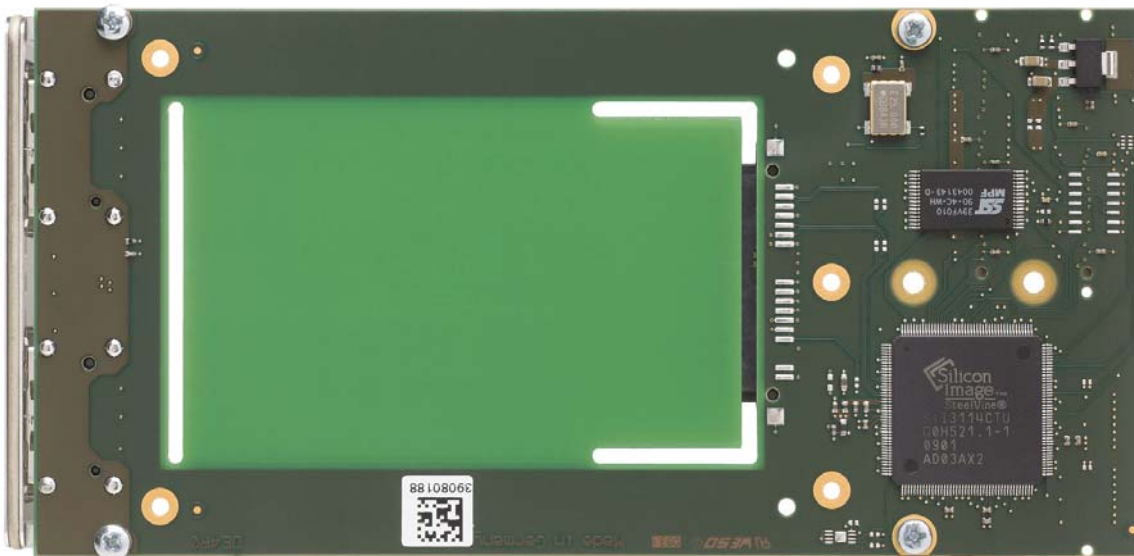
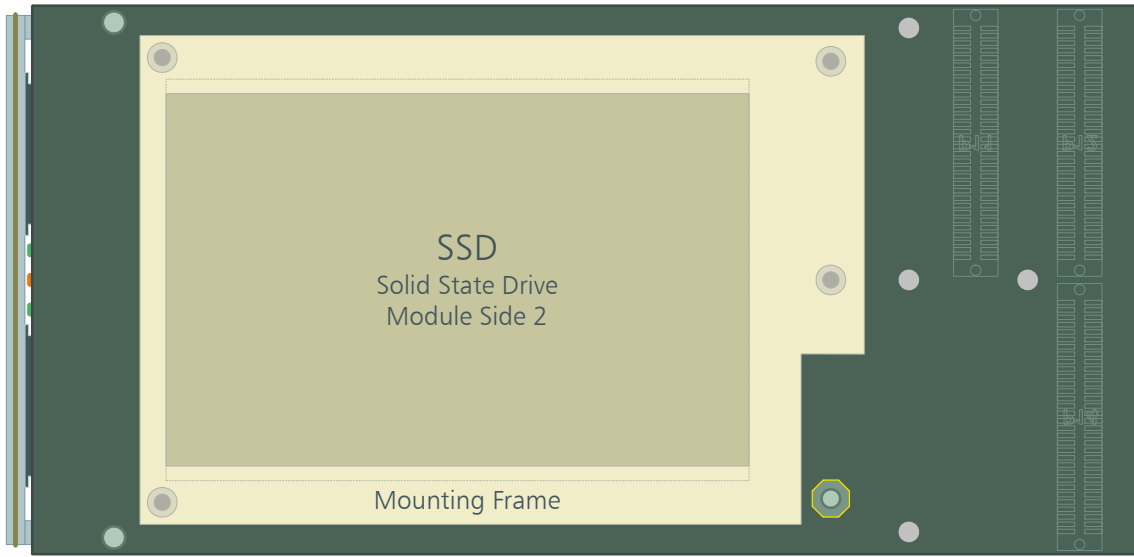
Block Diagram



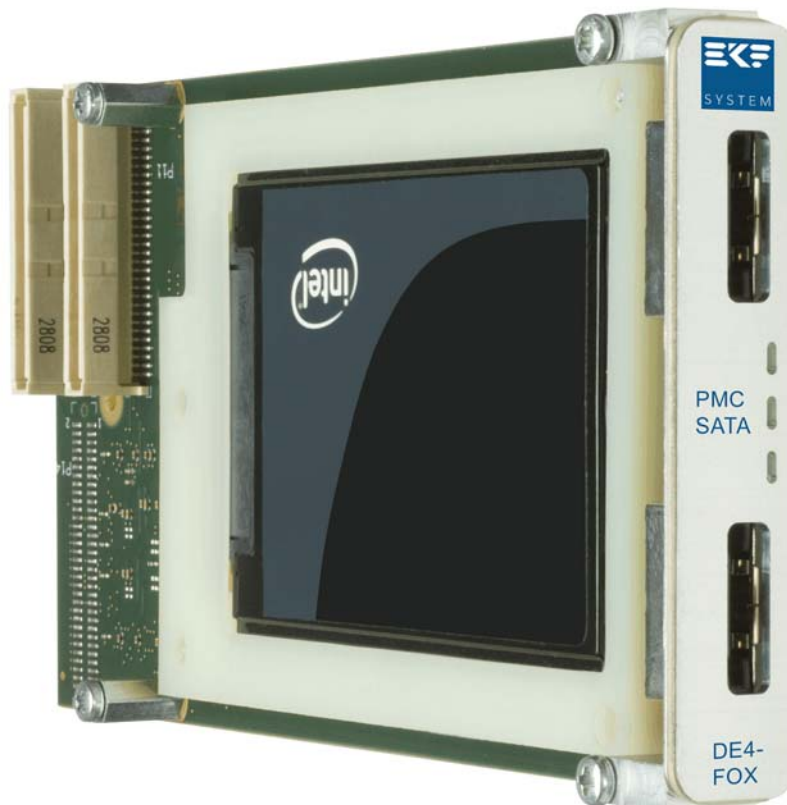
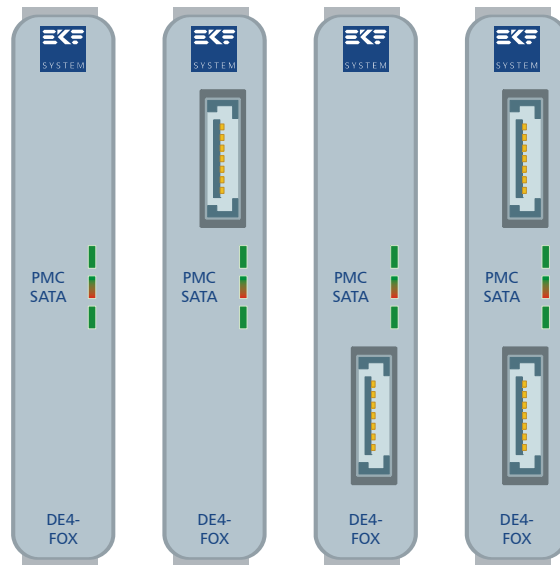
Top View



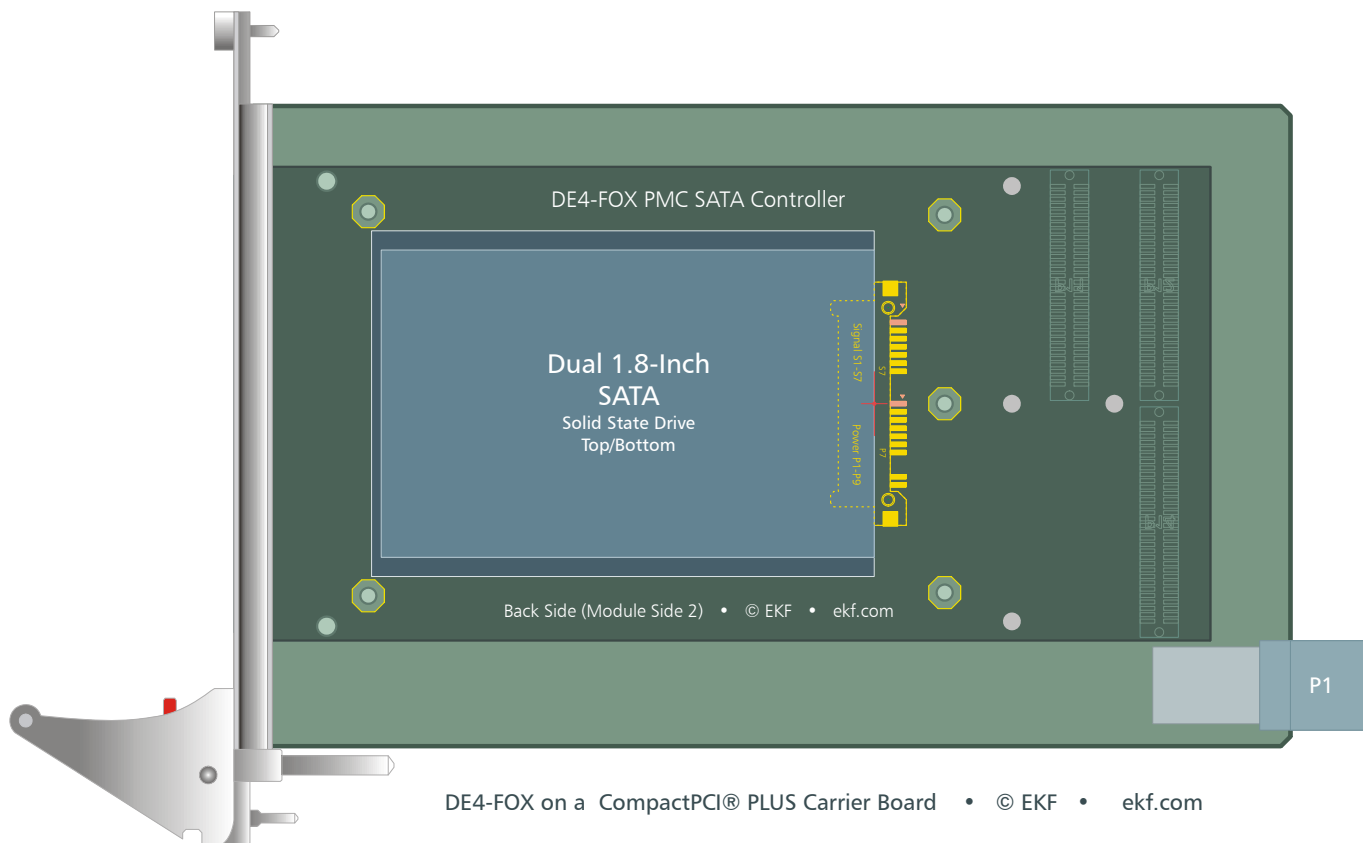
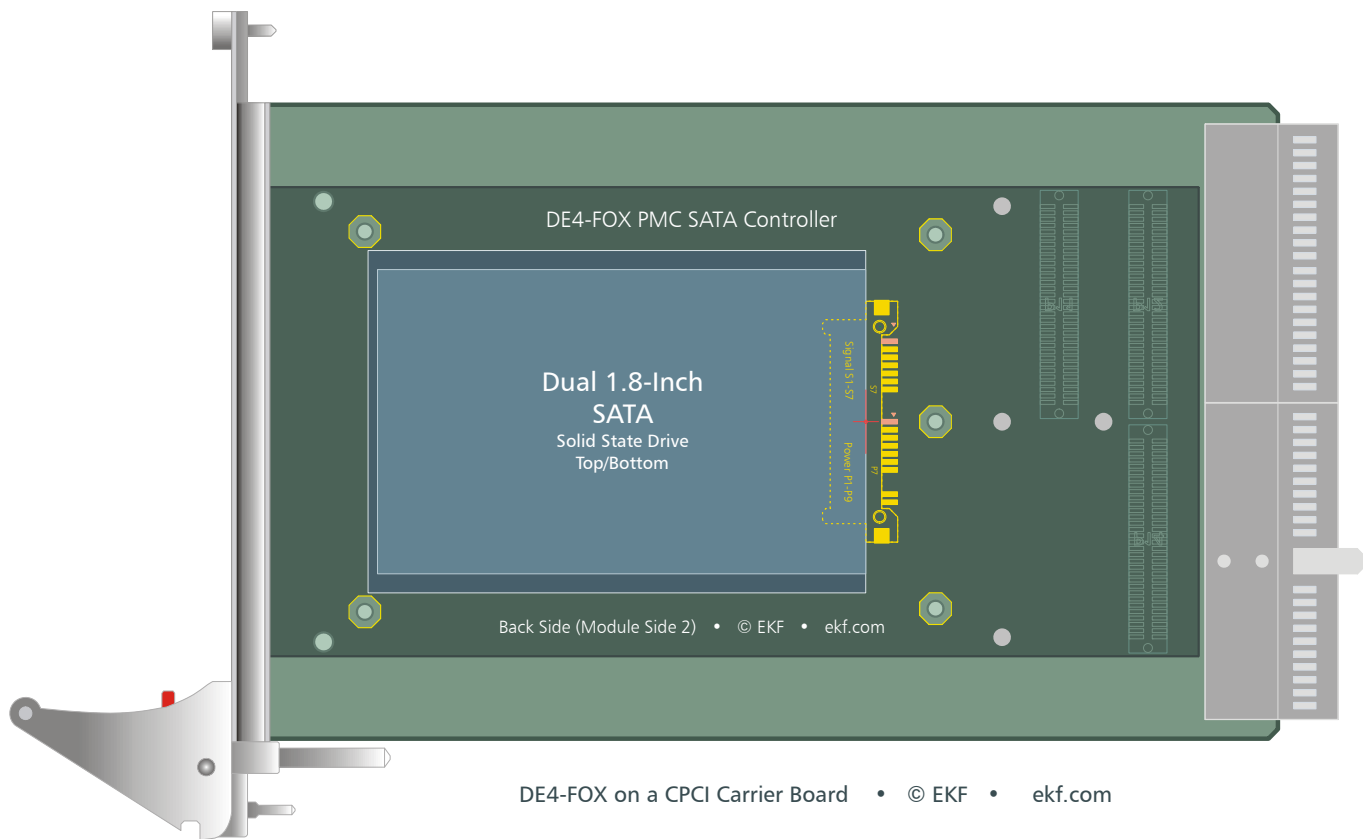
Back Side View



Front Bezel



Typical Assembly on Host Carrier



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 any telecommunication links, networks or procedures described in this chapter. Failure links before you open the system or perform or equipment damage. Some parts of the the power switch is in its off state.



the system from its power source and from modems before performing any of the to disconnect power, or telecommunication any procedures can result in personal injury system can continue to operate even though

Caution

Electrostatic discharge (ESD) can damage components. Perform the procedures described in this chapter only at an ESD workstation. If such a some ESD protection by wearing an metal part of the system chassis or board original ESD protected packaging. Retain the antistatic box) in case of returning the board to EKF for repair.



station is not available, you can provide antistatic wrist strap and attaching it to a front panel. Store the board only in its original packaging (antistatic bag and



Assembly Stack: CCG-RUMBA (CPU) - CCK-MARIMBA (PMC Carrier) - DE4-FOX

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 neighbored 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 neighbored 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

Recommended 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 DE4-FOX 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 DE4-FOX board. Characteristic features and the pin assignments of each connector are described on the following pages.



BIOS

Typically, the DE4-FOX is equipped with a 128kx8 Flash memory, which contains the Sil3114 BIOS, as required for non-RAID operation system boot.

The Flash BIOS will be required for the boot-phase only, at system startup time, with the operation system being installed on a drive attached to the DE4-FOX. If the DE4-FOX is intended for use as a non-boot mass storage controller, the Flash memory can be omitted.

For RAID operation, Silicon Image provides an alternate BIOS, which can be downloaded from www.siliconimage.com/support/searchresults.aspx?pid=28&cat=15.

Since the Flash is directly soldered to the PCB, this is a stuffing option - please consider before ordering.

In addition, Sil drivers must be installed, suitable for the particular operation system in use. Latest drivers (Windows, Linux) are available for download at:

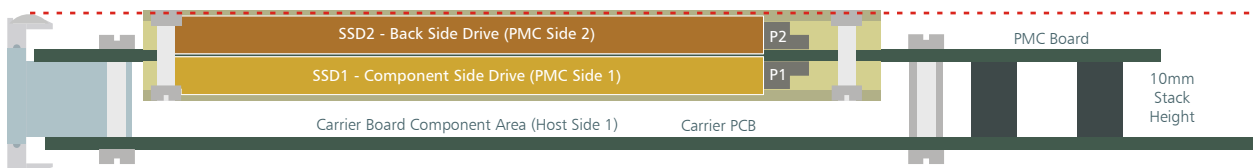
www.siliconimage.com/support/searchresults.aspx?pid=28&cat=3

P1 P2 Micro SATA Receptacles

The DE4-FOX 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 hard disk) should be avoided.

Due to the cutout area of 72mm x 48mm in the DE4-FOX PCB, which exactly matches the profile of an SFF-8144 compliant device, the 1.8-inch drive will be fixed in all 4 directions. In addition, a mounting frame is used to hold each drive in its position, for extremely rugged applications.

DE4-FOX on a CPCI Carrier Board - Sectional Drawing • © EKF • ekf.com



The DE4-FOX can be provided with up to two Micro SATA docking connectors. While the component side connector P1 and the associated 5mm height drive fully comply with the PMC specification, P2 and a back side drive 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 PMC to host stack height - please verify before ordering.

P1 / P2 • Micro SATA Docking Connectors 7+9 • 256.016.10.01



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

Signal designations RX/TX are assigned with respect to the SATA host controller (Si3114). The SATA channel 0 is dedicated to P1, and SATA channel 1 corresponds to P2.

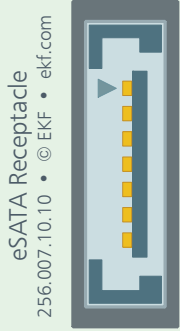
Typical Micro SATA SSD devices are powered from a single +3.3V rail. Power is supplied from the host carrier board, across the DE4-FOX mezzanine connectors P11/P12.

Note: Do not confuse the Micro SATA connector specified by Serial ATA Rev. 2.6 with the proprietary 'Special SATA' connector as defined by Samsung (refer to *Samsung 1.8" Form Factor Proposal*).

P3 P4 eSATA Connectors

The DE4-FOX front bezel may provide up to two eSATA receptacles P3 and P4 for attachment of external SATA devices. P3 corresponds to the Sil3114 SATA controller channel 2, and P4 is wired to SATA channel 3.

TX/RX designation of signals are shown with respect to the SATA controller Sil3114. Shielded external SATA cable assemblies are recommended for reliable industrial usage.

P3/P4 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. Choose the minimum distance possible for locating the external SATA device, and use high quality cable assemblies for reliable industrial operation, such as the Molex 68782 series (EKF part no. 256.007.82.10 and 256.007.82.20). Compared to internal SATA cabling, the eSATA front bezel connectors offer superior shielding and provide EMI protection. eSATA connectors and cable harnesses used or supplied by EKF adhere to the design specifications recommended by the Serial ATA International Organization (SATA-IO).

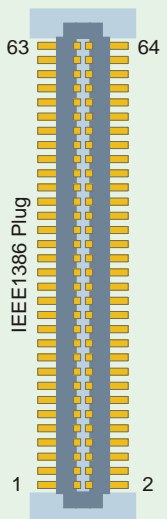
For experimental purposes, there are also adapter cable assemblies available from eSATA to SATA (EKF part no. 256.007.81.10).

Assembly of the P3 eSATA is exclusive to P14 (SATA channel 2 rear I/O usage). Stuffing of the P4 eSATA is exclusive to P14 (SATA channel 3 rear I/O usage). These are assembly options (manufacturing phase) and cannot be configured by the customer itself - please consider before ordering a DE4-FOX version which is suitable to your individual needs.

If at least two drives are attached to the DE4-FOX (any combination of internal - external - rear I/O), the Sil3114 SATA controller can be operated in a suitable level RAID mode (e.g. 0/1/10), as an option. Drivers and BIOS, either RAID or non RAID, are available for download from:

www.siliconimage.com/products/product.aspx?pid=28

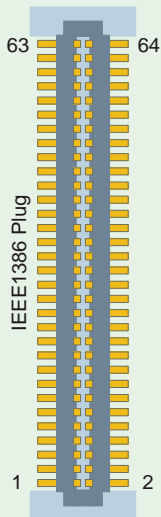
P11 Mezzanine Connector

P11 • PCI • 275.02.08.064.03				
	GND	63	64	<i>req64#</i>
	ad0	61	62	+5V
	ad2	59	60	ad1
	<i>Vio</i>	57	58	ad3
	ad4	55	56	GND
	ad6	53	54	ad5
	GND	51	52	<i>c/be0#</i>
	ad9	49	50	+5V
	ad12	47	48	ad11
	<i>Vio</i>	45	46	ad15
	par	43	44	GND
	<i>rsvd</i>	41	42	<i>rsvd</i>
	GND	39	40	<i>lock#</i>
	devsel#	37	38	+5V
	GND	35	36	irdy#
	frame#	33	34	GND
	<i>Vio</i>	31	32	ad17
	ad19	29	30	+5V
	ad22	27	28	ad21
	GND	25	26	<i>c/be3#</i>
	ad25	23	24	GND
	ad28	21	22	ad27
	<i>Vio</i>	19	20	ad31
	req#	17	18	+5V
	GND	15	16	gnt#
	clk	13	14	GND
	GND	11	12	<i>3.3Vaux</i>
	<i>intd#</i>	09	10	<i>rsvd</i>
busmode1#	07	08	+5V	
<i>intb#</i>	05	06	<i>intc#</i>	
GND	03	04	inta#	
tck	01	02	-12V	

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P12 Mezzanine Connector

P11 • PCI • 275.02.08.064.03				
	GND	63	64	<i>rsvd</i>
	<i>ack64#</i>	61	62	+3.3V
	GND	59	60	<i>rsvd</i>
	<i>rsvd</i>	57	58	<i>rsvd</i>
	<i>rsvd</i>	55	56	GND
	+3.3V	53	54	<i>rsvd</i>
	ad7	51	52	<i>rsvd</i>
	ad8	49	50	+3.3V
	m66en	47	48	ad10
	ad14	45	46	ad13
	<i>c/be1#</i>	43	44	GND
	+3.3V	41	42	<i>serr#</i>
	<i>perr#</i>	39	40	GND
	GND	37	38	<i>stop#</i>
	<i>trdy#</i>	35	36	+3.3V
	GND	33	34	<i>rsvd</i>
	ad16	31	32	<i>c/be2#</i>
	ad18	29	30	GND
	+3.3V	27	28	ad20
	<i>idsel</i>	25	26	ad23
	ad24	23	24	+3.3V
	GND	21	22	ad26
	ad30	19	20	ad29
	<i>pme#</i>	17	18	GND
	3.3V	15	16	<i>busmode4#</i>
	<i>rst#</i>	13	14	<i>busmode3#</i>
	<i>busmode2#</i>	11	12	+3.3V
	<i>rsvd</i>	09	10	<i>rsvd</i>
	GND	07	08	<i>rsvd</i>
	<i>tdi</i>	05	06	GND
	<i>tms</i>	03	04	<i>tdo</i>
	+12V	01	02	<i>trst#</i>



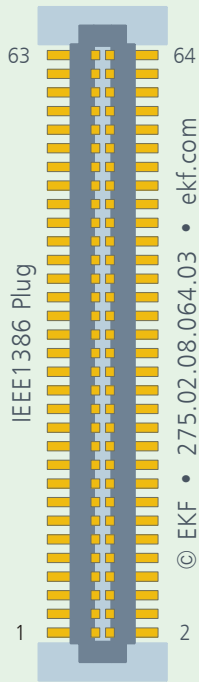
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P14 Mezzanine Connector

As an option, one or both SATA channels can be made available for rear I/O usage via P14, a PMC style plug. P14 mates with J14 on a host carrier board. A suitable rear I/O transition module must be attached in addition to the PMC/PMC carrier card.

Assembly of P14 is exclusive to P3 (SATA channel 2 front bezel I/O), and also exclusive to P4 (SATA channel 3 front bezel I/O). These are assembly options (manufacturing phase) and cannot be configured by the customer itself - please consider before ordering a DE4-FOX version which is suitable to your individual needs.

P14 • Rear I/O Option • 275.02.08.064.03



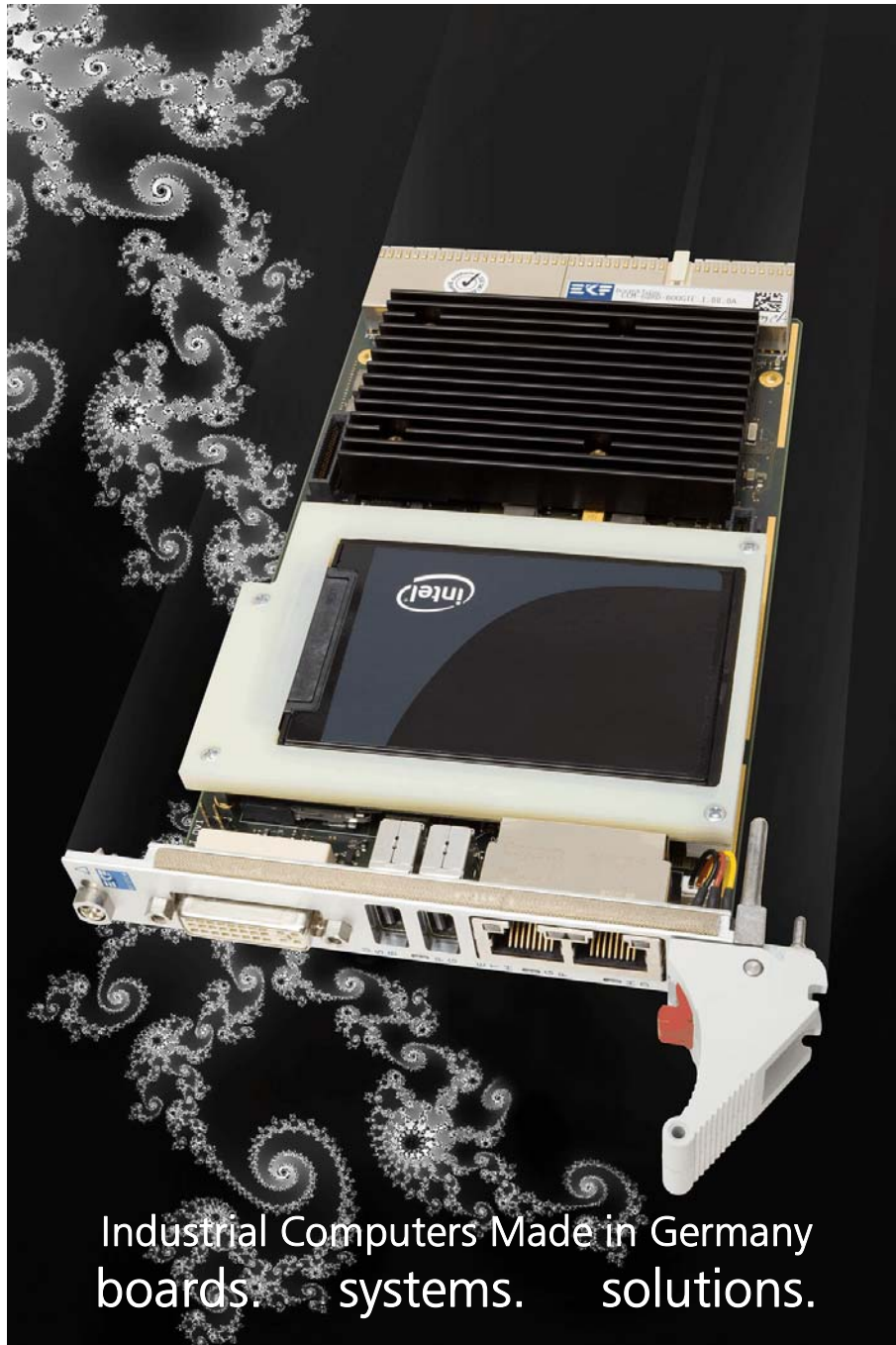
	63	64	
	61	62	
GND	59	60	GND
SATA2_RX+	57	58	GND
SATA2_RX-	55	56	GND
GND	53	54	GND
SATA2_TX-	51	52	GND
SATA2_TX+	49	50	GND
GND	47	48	GND
LED2#	45	46	GND
+3.3V	43	44	GND
	41	42	
GND	39	40	GND
SATA3_RX+	37	38	GND
SATA3_RX-	35	36	GND
GND	33	34	GND
SATA3_TX-	31	32	GND
SATA3_TX+	29	30	GND
GND	27	28	GND
LED3#	25	26	GND
+3.3V	23	24	GND
	21	22	
	19	20	
	17	18	
	15	16	
	13	14	
	11	12	
	09	10	
	07	08	
	05	06	
	03	04	
	01	02	

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.





Industrial Computers Made in Germany
boards. systems. solutions.

EKF Elektronik GmbH
Philipp-Reis-Str. 4
59065 Hamm
Germany



Phone +49 (0)2381/6890-0
Fax +49 (0)2381/6890-90
Internet www.ekf.com
E-Mail sales@ekf.com