



Technical Information

CE3-GIG • **CompactPCI**[®] Quad Port SATA & USB Controller

3 x Front Panel eSATA/USB Combo Connectors • Option On-Board SATA SSD

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About this Manual

This manual is a short form description of the technical aspects of the CE3-GIG, required for installation and system integration. It is intended for the advanced user only.

Edition History

Ed.	Contents/Changes	Author	Date
1	Technical Information CE3-GIG, english, preliminary edition Text #6479, File: ce3_ti.wpd	jj	5 September 2011
2	Modified front panel illustration	jj	29 September 2011
3	Added photos CE3-GIG	jj	26 January 2012
4	Removed a typo from chapter 'Technical Reference - Please Note'	jj	27 August 2012
5	Photos changed with respect to PCB revision 1 Chapter 'System Boot' added	jj	21 September 2012
6	eSATA connectors are 'Power over eSATA' style by default, for +12V supply to external devices, modified description on pages 21 & 28	jj	28 September 2012
7	Some typos fixed	jj	5 October 2012
8	Added images of CE3-GIG with on-board Half-Slim SATA SSD	jj	28 November 2012
9	Added MTBF	jj	11 July 2013
10	PXI® ready note	jj	5 May 2014

Related Documents

Related Information CE3-GIG	
CE3-GIG Home	www.ekf.com/c/cide/ce3/ce3.html
Ordering Numbers	http://www.ekf.com/liste/liste_20.html#CE3
SATA Drivers	ftp://driver.jmicron.com.tw/SATA_Controller/

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 XP, Windows 7: ® 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®	CompactPCI Specification, PICMG® 2.0 R3.0, Oct. 1, 1999	www.picmg.org
PCI Express®	PCI Express® Base Specification 3.0	www.pcisig.com
PCI Local Bus	PCI 2.2/2.3/3.0 Standards PCI SIG	www.pcisig.com
SATA	Serial ATA 2.5/2.6 Specification	www.sata-io.org
USB	Universal Serial Bus Specification	www.usb.org

Technical Features

Feature Summary

Feature Summary

- ▶ *CompactPCI*[®] Peripheral Card 3U 4HP (single size Eurocard)
- ▶ Backplane connector J1 32-bit PCI 33/66MHz, +5V or +3.3V V_{IO} (J1 w/o key)
- ▶ Internally based on PCI Express[®] technology (PCI to PCIe bridge)
- ▶ Ready for usage within PXI[®] systems
- ▶ Two independent dual-port PCIe SATA controllers (four SATA channels in total)
- ▶ Three front panel eSATA receptacles (combo connectors USB/eSATA) for external devices
- ▶ On-Board SATA docking connector for 2.5-inch SSD/HDD
- ▶ Quad port USB 2.0 controller
- ▶ Four front panel USB connectors: 3 x combo USB/eSATA, 1 x standard USB connector
- ▶ +5V only design
- ▶ Optional on-Board +3.3V/8A regulator can supply other CPCI cards on the backplane
- ▶ Optional on-Board +12V/0.8A regulator can supply other CPCI cards on the backplane
- ▶ Long Term Availability
- ▶ Coating, Sealing, Underfilling on Request
- ▶ RoHS compliant 2002/95/EC
- ▶ Operating temperature: 0°C to +70°C (industrial temperature range on request)
- ▶ Storage temperature: -40°C to +85°C, max. gradient 5°C/min
- ▶ Humidity 5% ... 95% RH non condensing
- ▶ Altitude -300m ... +3000m
- ▶ Shock 15g 0.33ms, 6g 6ms
- ▶ Vibration 1g 5-2000Hz
- ▶ EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)
- ▶ MTBF 54.1 years

Short Description

The CE3-GIG has been developed to satisfy the demand for additional SATA and USB ports in a CompactPCI® environment. Three front panel eSATA/USB combo connectors are provided, for attachment of either USB 2.0 or eSATA external devices. A fourth F/P connector is available for USB devices only.

The front panel combo connectors are 'Power over eSATA' compliant, with +12V power and ground pins.

In addition, a docking connector is provided for mounting an on-board 2.5-inch SATA hard disk (HDD) or solid state drive (SSD).



CE3-GIG

Theory of Operation

Hardware

A *CompactPCI*[®] *Classic* backplane is based on the PCI Local Bus Specification. Current components however require a PCI Express[®] interface. Therefore the CE3-GIG is provided with a PCI to PCIe bridge. The PLX PEX 8112 is a proven solution for a 32-bit 33/66MHz PCI system and offers a single 2.5Gbps PCIe lane.

The CE3-GIG is equipped with two individual SATA controllers (JMicron JMB362), which results in the need for two PCIe lanes. Hence a PCI Express[®] packet switch is in use in the middle between the PCI to PE bridge and the SATA controllers.

The PCIe packet switch (Pericom PI7C9X442SLB) incorporates in addition the quad port USB 2.0 controller bridge.

Each JMicron JMB362 SATA controller allows for optional RAID level 0/1/10 operation across its two channels. The eSATA/USB front panel combo connectors 1 and 2 are recommended for employment if this feature is required. The other JMB362 SATA channels are distributed on-board (docking connector) and F/P, which seems to be an inconvenient configuration in most cases with respect to RAID.

Some *CompactPCI*[®] systems are provided with a +5V single rail power supply. Consequently, the CE3-GIG requires only +5V power. As an option however, the CE3-GIG can be equipped with DC-DC converters from +5V to +3.3V/8A and/or +12V/0.8A, in order to supply other *CompactPCI*[®] cards which may have need for either voltage.

Software

A Flash BIOS memory is attached to each JMicron SATA controller, which allows to boot the system from any CE3-GIG SATA channel. JMicron drivers are available for Windows and Linux, either RAID or non RAID mode at ftp://driver.jmicron.com.tw/SATA_Controller/.

No efforts are made to enable system boot from a USB mass storage device attached to the CE3-GIG. On request, when a system is equipped with a CPU card from EKF, the CPU BIOS can be modified in order to boot even from a CE3-GIG USB port.

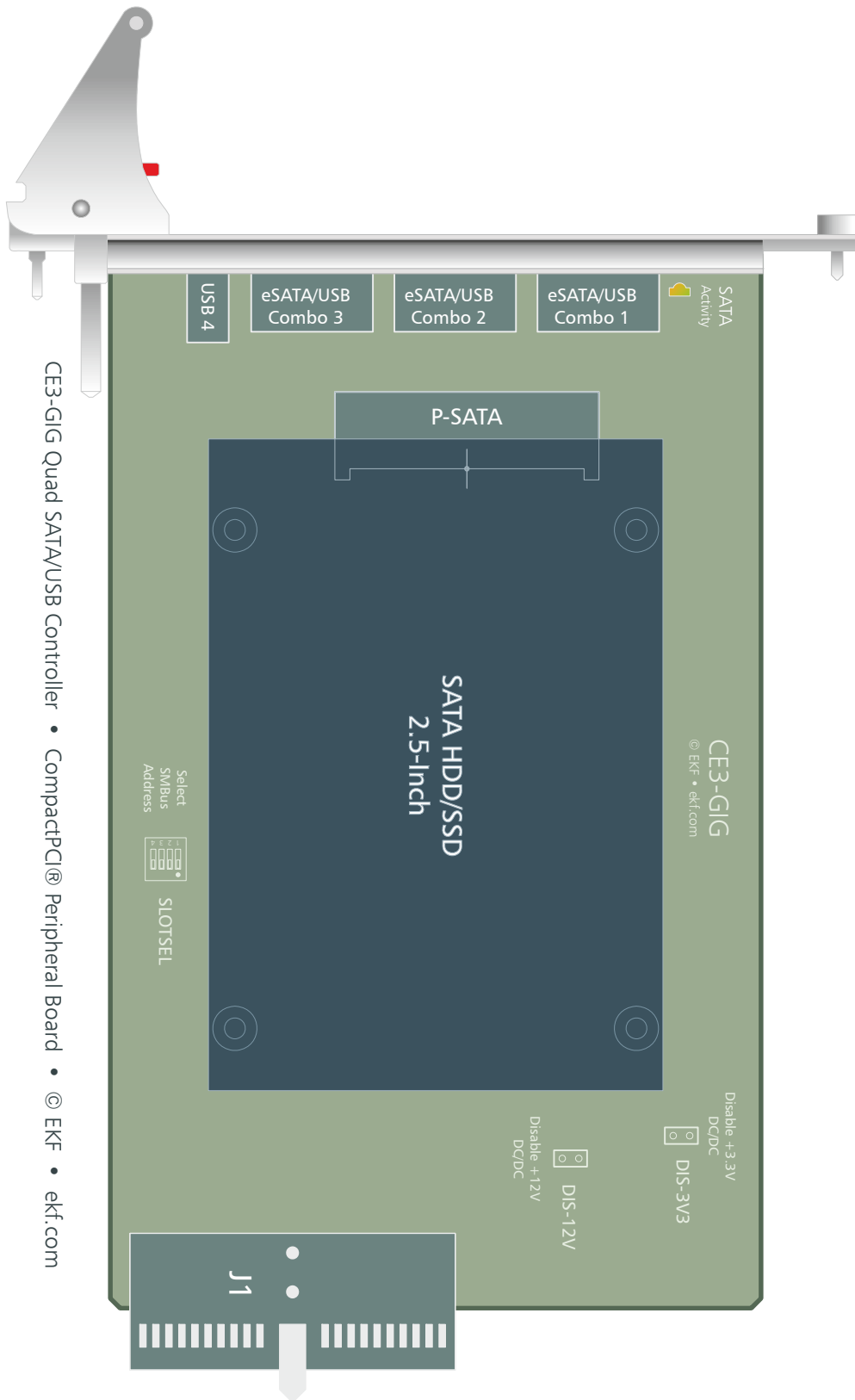
Performance Considerations

As with any *CompactPCI*[®] *Classic* peripheral card, the backplane bandwidth is the limiting parameter if performance is discussed. Needless to say, that all SATA and USB ports on the CE3-GIG have to share the available data throughput of the *CompactPCI*[®] backplane. Hence, with this bottleneck in mind, no further improvement would have been achieved if high priced silicon (6Gbps SATA, 5Gbps PCIe, USB 3.0) had been spent on the CE3-GIG.

As an alternate for applications which require maximum performance, you might consider a similar peripheral card based on *CompactPCI*[®] *Serial* (www.ekf.com/s/serial.html).

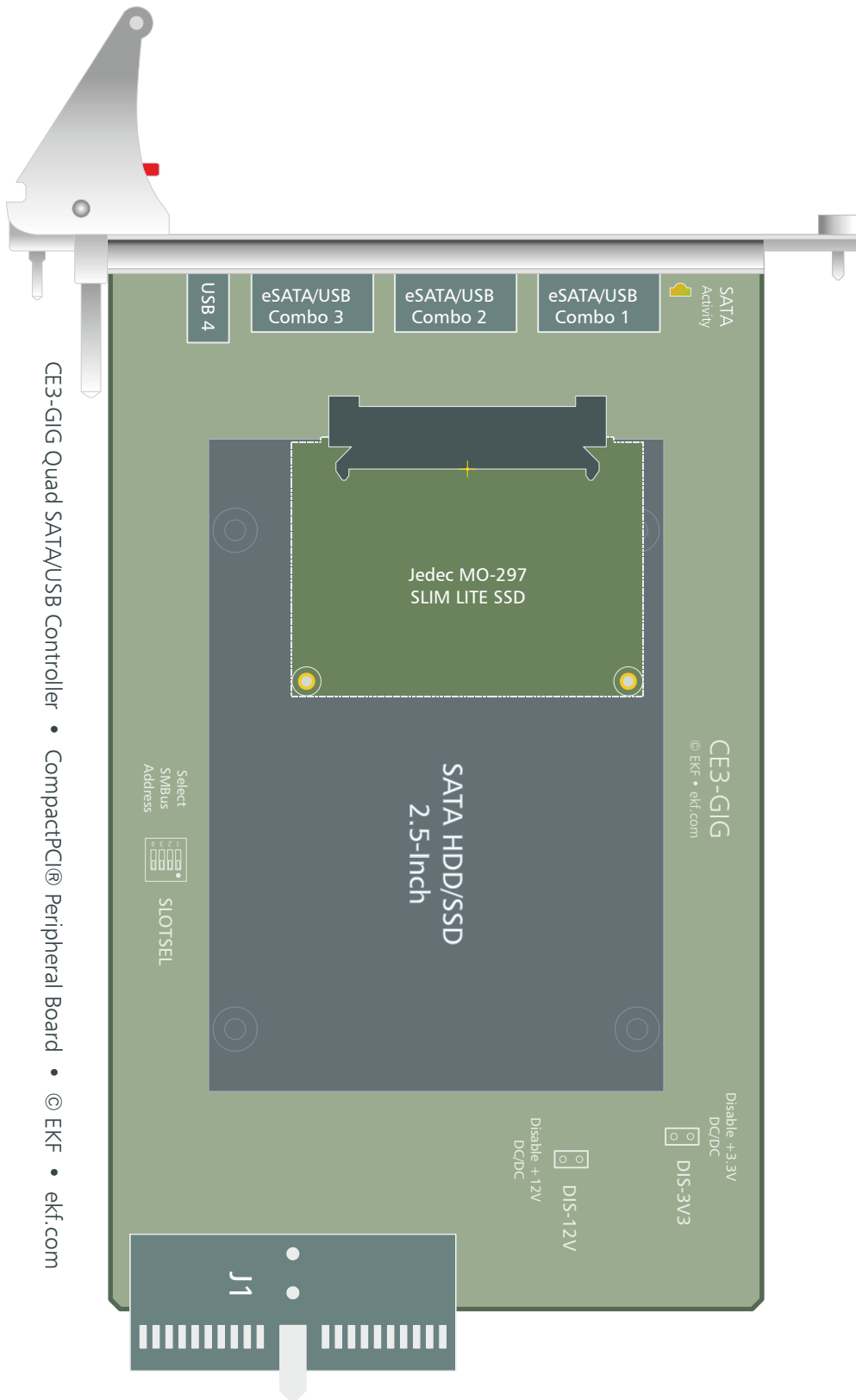
Beyond the bandwidth discussion, the CE3-GIG is a reliable and economic SATA/USB storage solution, which can be simply integrated in any industrial *CompactPCI*[®] system.

Assembly Drawing



CE3-GIG Quad SATA/USB Controller • CompactPCI® Peripheral Board • © EKF • ekf.com

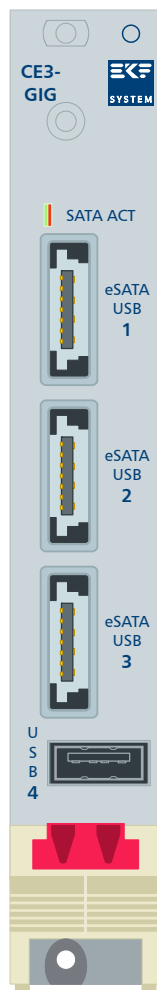
CE3-GIG w. 2.5-Inch SATA SSD



CE3-GIG Quad SATA/USB Controller • CompactPCI® Peripheral Board • © EKF • ekf.com

CE3-GIG w. Half Slim SATA SSD

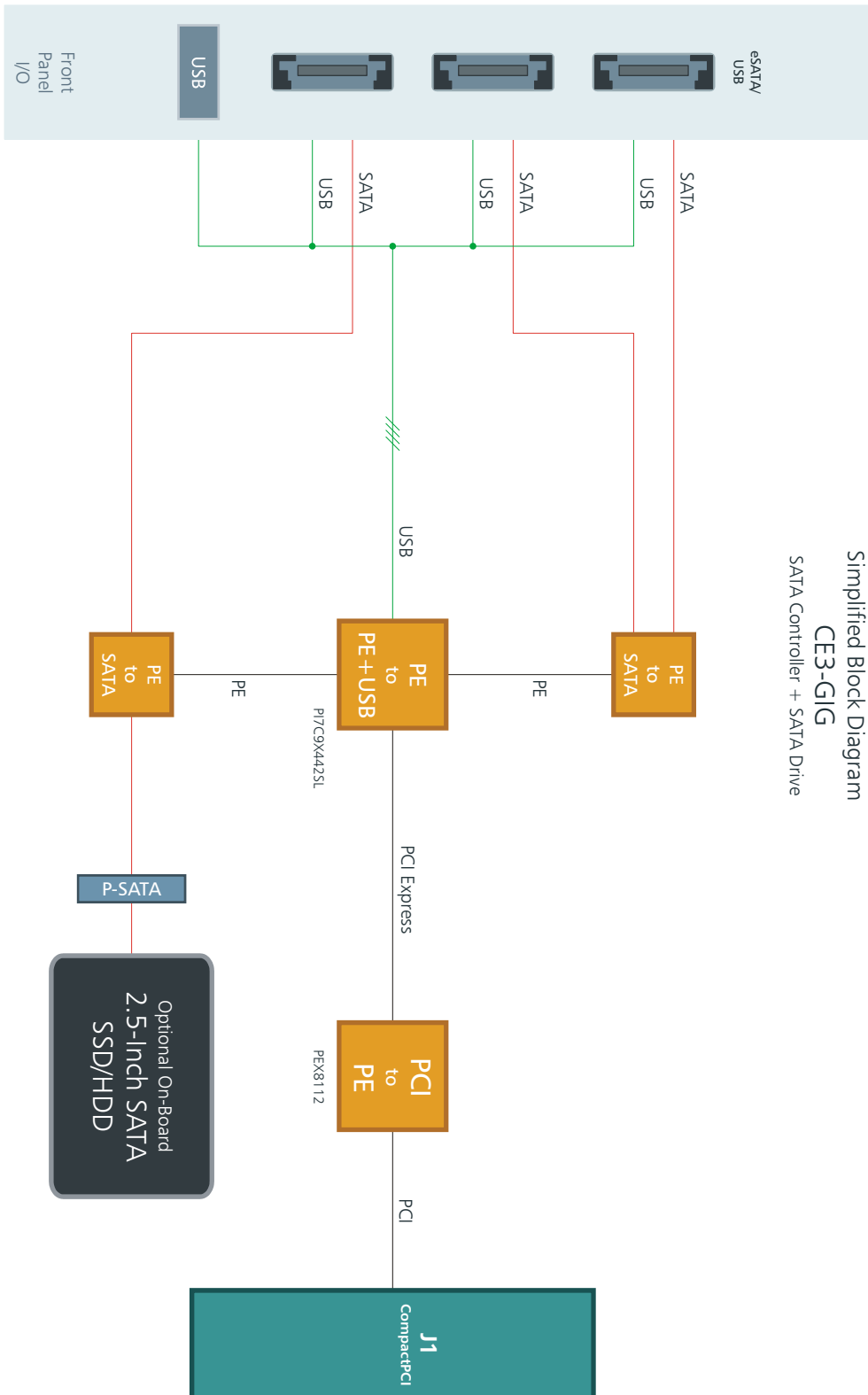
Front Panel

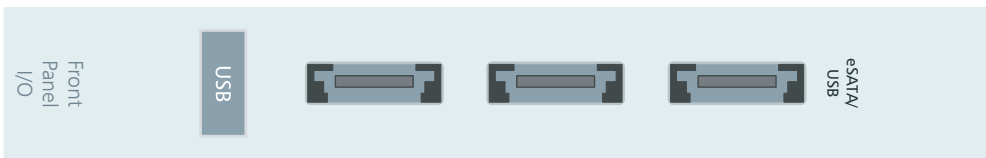


© EKF • draft - do not scale • ekf.com

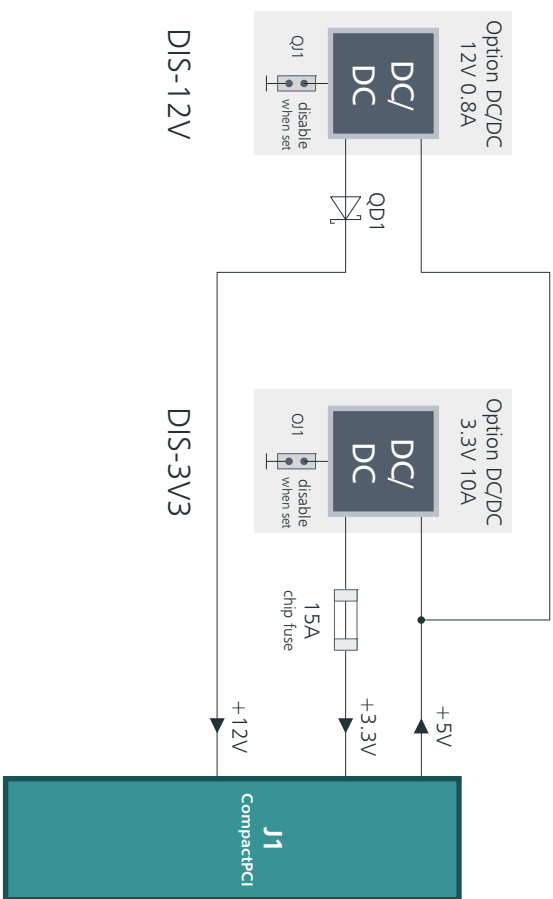
CE3-GIG

Block Diagram CE3-GIG





Simplified Block Diagram
CE3-GIG
Option DC/DC +3.3V +12V



© EKF
ekf.com

Front Panel Connectors

eSATA/USB 1	Combo connector suitable for either eSATA or USB 2.0 cable connector SATA RAID operation optional when combined with eSATA/USB 2
eSATA/USB 2	Combo connector suitable for either eSATA or USB 2.0 cable connector SATA RAID operation optional when combined with eSATA/USB 1
eSATA/USB 3	Combo connector suitable for either eSATA or USB 2.0 cable connector
USB 4	Type A Receptacle suitable for USB 2.0 cable connector

Front Panel Indicator

SATA ACT	SATA Activity LED bicolour green = eSATA/USB 1/2 connectors orange = internal drive and eSATA/USB 3 connector
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On-Board Connector

P-SATA	SATA docking connector 7 + 15 position, suitable for a 2.5-inch on board drive, or for use with an Half Slim SATA SSD module (Jedec MO-297 SLIM LITE SSD)
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Backplane Connector

J1	CompactPCI® 32-bit peripheral slot connector
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Jumpers & Switches

DIS-3V3	Jumper to disable the optional +3.3V DC/DC converter (not stuffed by default)
DIS-12V	Jumper to disable the optional +12V DC/DC converter (not stuffed by default)
SLOTSEL	Switch to setup board SMBus address (not stuffed by default)



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

Installing the Board

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:

- Power down 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 on-board connectors may require 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

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
- Carefully remove any on-board 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 to the enclosure 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
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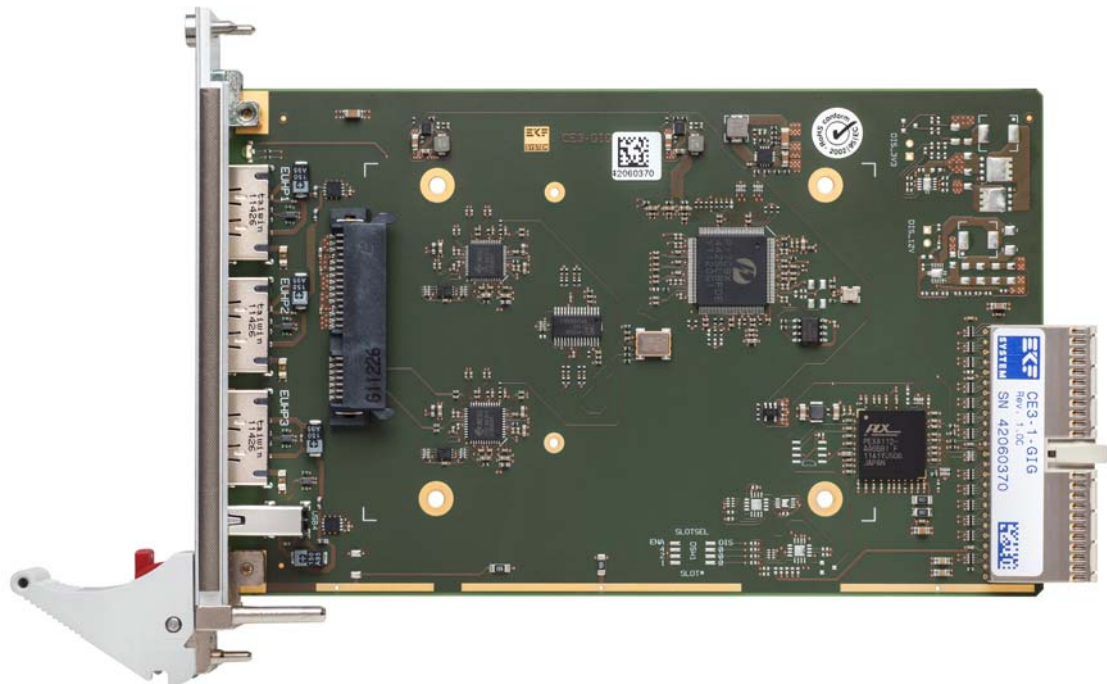
Technical Reference

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 CE3-GIG may be equipped with several connectors for system internal and/or external usage. Not all of these connectors may be present on a particular board. Be sure to specify your individual needs when ordering the CE3-GIG board. Characteristic features and the pin assignments of each connector are described on the following pages (connector designation in alphabetical order within the groups 'front panel connectors', 'on-board connectors', and 'backplane connectors').

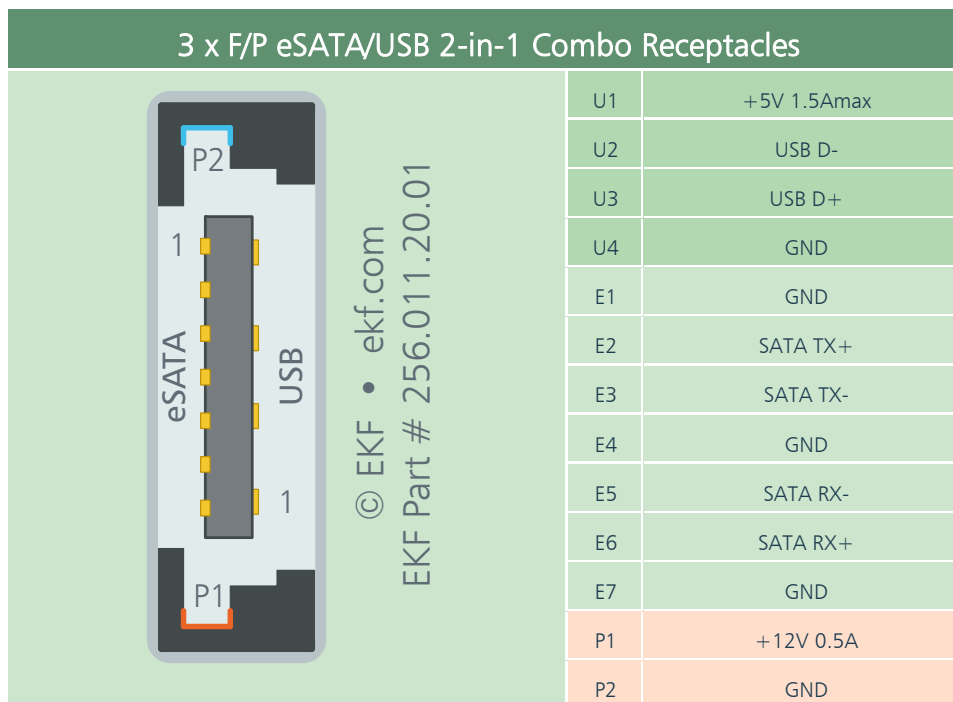


CE3-GIG Top View

Front Panel Connectors

eSATA/USB Combo Connectors

The CE3-GIG is equipped with three front panel 2-in-1 eSATA/USB combo connectors. These receptacles are suitable for either plug-in of an ordinary USB 2.0 cable connector (type A, USB root hub), or an eSATA cable harness. Signal designations RX/TX are shown with respect to the SATA host controller.




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 CE3-GIG eSATA front panel 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).

Special third party cable assemblies are available, which make use of the USB +5V power pin for an attached eSATA drive. The nominal maximum current across each connector is 1.5A. Electronic switches on the CE3-GIG are provided in order to control the maximum USB current. Since the electronic switches have to be enabled by the USB controller (Pericom PI7C9X442SL), potential interaction with the USB driver software must be considered when using +5V USB power for an external eSATA drive. Furthermore, the CE3-GIG is equipped with enhanced Power over eSATA combo connectors, which provide additional contacts (orange/blue) for +12V/0.5A power and ground to an external SATA device (requires +12V power present via CompactPCI® backplane connector J1/P1).

With respect to the SATA channels, the front panel combo connectors 1 and 2 belong to the same JMB362 SATA controller. Hence, if SATA hardware RAID operation is considered, usage of the F/P connectors 1 and 2 is recommended. Activity on either channel of this SATA controller lights the orange F/P led.

USB Connector

The CE3-GIG is equipped with an additional front panel USB connector. This receptacle is suitable for plug-in of an ordinary USB 2.0 cable connector (type A, USB root hub).

USB 4 Receptacle		
 <p>#270.20.04.2 ©EKF • ekf.com</p>	1	+5V 1.5Amax
	2	USB D-
	3	USB D+
	4	GND

The USB controller Pericom PI7C9X442SL is a quad port USB root hub, OHCI and EHCI compliant. No proprietary driver software is required, since all popular operating systems provide native OHCI and EHCI USB device drivers. The PI7C9X442SL has two OHCI (low-speed, full-speed) and one EHCI (high speed) controllers built-in, shared across the ports.

The nominal maximum current across each USB connector is 1.5A. Electronic switches on the CE3-GIG are provided in order to control the maximum USB current.

On-Board Connectors

P-SATA Docking Header

As an option, the CE3-GIG can be equipped with an on-board 2.5-inch SATA drive, either hard disk (HDD), or silicon state (SSD). As an alternate, a Half-Slim SATA SSD module can be populated (Jedec MO-297 SLIM LITE SSD) . The 22-position SATA docking header P-SATA allows for direct attachment of any drive, without a cable assembly. Signal designations RX/TX are shown with respect to the SATA host controller.

P-SATA • SATA Docking Connector 15+7	
S1	GND
S2	TX+ SATA01
S3	TX- SATA01
S4	GND
S5	RX- SATA01
S6	RX+ SATA01
S7	GND
P1	+3.3V
P2	+3.3V
P3	+3.3V
P4	GND
P5	GND
P6	GND
P7	+5V
P8	+5V
P9	+5V
P10	GND
P11	DAS
P12	GND
P13	+12V
P14	+12V
P15	+12V



Part No. 256.022.10.02 • SATA Host Receptacle • © EKF • ekf.com

The P-SATA docking header is wired to the same JMB362 SATA controller, which also controls the front panel combo connector eSATA/USB 3. Activity on either channel of this SATA controller lights the green F/P led.

The P-SATA connector has a standoff, since the space below the drive is used for other components on the PCB. The SSD or HDD therefore has to be fixed by four screws and in addition spacers, e.g EKF part numbers 4 x 440.16.030.008 screw M3x8 and 4 x 440.26.030.020 self-retaining washer 3mm height.

EKF recommends a Solid State Drive (SSD) for use with the CE3-GIG, due to advantages such as a wider operation temperature range, improved shock and vibration immunity, less power consumption and the superior data transfer speed, compared to a Hard Disk Drive (HDD).



Sample Solid State Drive



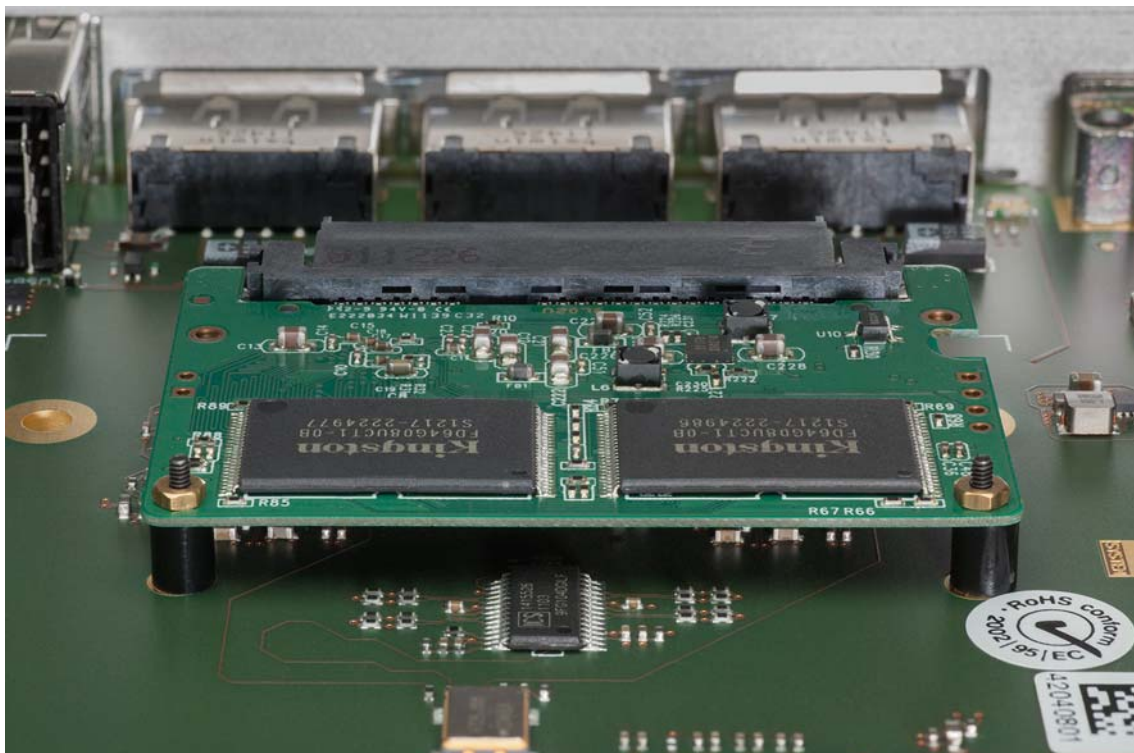
CE3-GIG w. on-Board SATA SSD



CE3-GIG w. on-Board Half-Slim SATA SSD



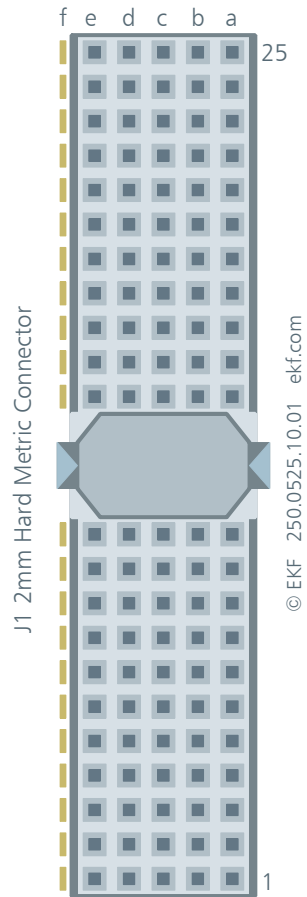
Due to lower inertia and dimensions compared to a classic 2.5-inch SSD, a Half-Slim SATA SSD (Jedec MO-297 SLIM LITE SSD) may be used as on-board mass storage device for even more overall ruggedness.



Half-Slim SATA SSD Properly Fixed

Backplane Connectors

A hard metric backplane connector is specified as J1/P1 by the PICMG® CompactPCI 2.0. A mechanical key defines the V_{IO} Voltage. The CE3-GIG is suitable for either +5V and +3.3V V_{IO} , which results in a 'no key' J1 connector. J1 conveys prominently the 32-bit PCI parallel bus.



J1

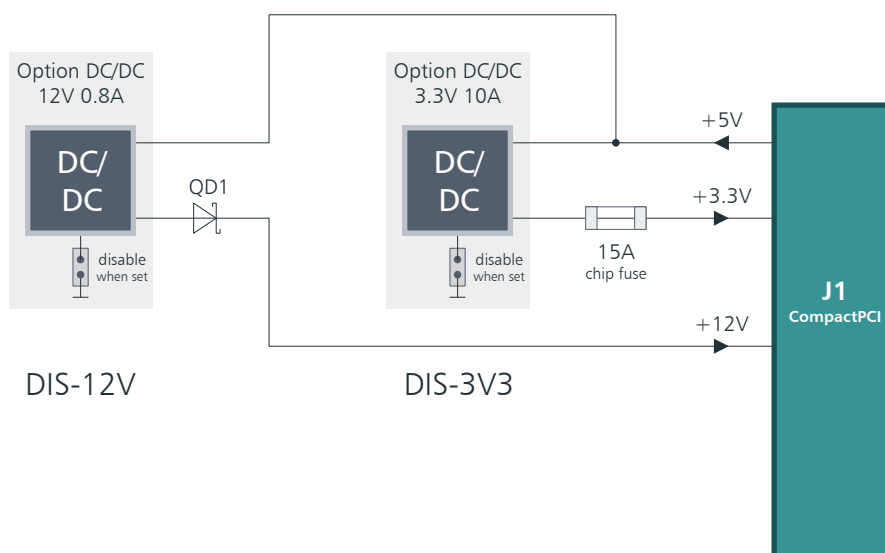
J1	A	B	C	D	E
25	5V	REQ64#	ENUM#	3.3V	5V
24	AD1	5V	V(I/O)	AD0	ACK64#
23	3.3V	AD4	AD3	5V	AD2
22	AD7	GND	3.3V	AD6	AD5
21	3.3V	AD9	AD8	M66EN	C/BE0#
20	AD12	GND	V(I/O)	AD11	AD10
19	3.3V	AD15	AD14	GND	AD13
18	SERR#	GND	3.3V	PAR	C/BE1#
17	3.3V	IPMB SCL	IPMB SDA	GND	PERR#
16	DEVSEL#	GND	V(I/O)	STOP#	LOCK#
15	3.3V	FRAME#	IRDY#	BD_SEL#	TRDY#
14	KEY AREA - No Key				
13					
12					
11	AD18	AD17	AD16	GND	C/BE2#
10	AD21	GND	3.3V	AD20	AD19
9	C/BE3#	GND	AD23	GND	AD22
8	AD26	GND	V(I/O)	AD25	AD24
7	AD30	AD29	AD28	GND	AD27
6	REQ#	GND	3.3V	CLK	AD31
5	BRSVP1A5	BRSVP1B5	RST#	GND	GNT#
4	IPMB PWR	HEALTHY#	V(I/O)	INTP	INTS
3	INTA#	INTB#	INTC#	5V	INTD#
2	TCK ⁵⁾	5V	TMS	TDO 1)	TDI 1)
1	5V	-12V	TRST#	+12V	5V

1) TDO - TDI internally connected

The CE3-GIG has been designed for +5V only operation. As an option, the board can feed +3.3V and/or +12V to the backplane, which are generated from the +5V rail via DC-DC converters.


DC/DC 3.3V Regulator Option

The CE3-GIG has been designed for +5V only operation. As an option, an on-board switching regulator from +5V to +3.3V is available, which can be used to feed back +3.3V up to 10A to the CompactPCI® backplane in systems with a single +5V power supply. This can be useful for small and rugged systems which are equipped only with a single +5V power supply, but employing a CPCI card with need for +3.3V in addition, such as many CPU boards.



The switched regulator operates with an efficiency of $\sim 95\%$. Components are dimensioned for a peak output current of 10A and more. A fast acting 15A chip fuse is provided on the board. Two on-board LEDs are populated for diagnostic: OLED1 is lit when the regulator signals its power good state, and OLED2 is lit when +3.3V backplane power is available. Both LEDs should be normally on simultaneously, however, if the chip fuse has been blown for any reason, OLED2 would be off.

The DC/DC regulator begins its soft start phase as soon as +5V are applied to the CE3-GIG. If the regulator is not required for an application, the jumper DIS-3V3 should be installed, which disables the regulator, for power saving.

DIS-3V3 • 3.3V DC/DC Regulator Disable		
2.54mm Pitch Pin Header		
 #240.1.02 ©EKF • ekf.com	1	ENABLE +3.3V DC/DC
	2	GND

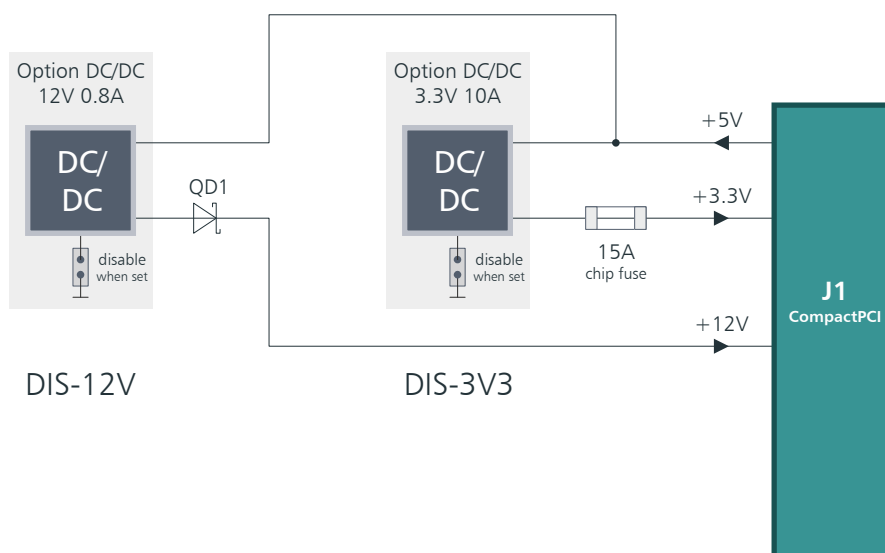
Warning:

There are no additional provisions made against a back-driving situation. A CE3-GIG with on-board +3.3V regulator must not be used in a system with a multi-voltage output CompactPCI® power supply which delivers also +3.3V to the backplane. Results are unpredictable - damage to the CE3-GIG and/or the external power supply might occur.

Usage of a CE3-GIG with on-board +3.3V DC/DC regulator populated together with a +3.3V supplied CompactPCI® backplane requires the jumper DIS-3V3 to be set and the 15A chip fuse to be removed (desoldered). EKF recommends to send the board back in order to have this modification done, since lead free SMD soldering equipment and experienced personnel would be essential.


DC/DC 12V Regulator Option

The CE3-GIG has been designed for +5V only operation. As an option, an on-board switching regulator from +5V to +12V is available, which can be used to feed back +12V up to 1A to the CompactPCI® backplane in systems with a single +5V power supply. This can be useful for small and rugged systems which are equipped only with a single +5V power supply, but employing a CPCI card with need for +12V in addition.



Components are dimensioned for an peak output current of 1A. +12V would also be distributed over the front panel combo connectors, which are special 'Power over eSATA' receptacles. Each combo connector is provided with a +12V 0.5A self resetting polyfuse. A continuous current of 0.8A in total for all combo connectors and feeding current to the CPCI backplane must not be exceeded.

The DC/DC regulator starts as soon as +5V are applied to the CE3-GIG. If the regulator is not required for an application, the jumper DIS-12V should be installed, which disables the regulator, for power saving.

DIS-12V • 12V DC/DC Regulator Disable		
2.54mm Pitch Pin Header		
 #240.1.02 ©EKF • ekf.com	1	ENABLE +12V DC/DC
	2	GND

Warning:

There are no additional provisions made against a back-driving situation. A CE3-GIG with on-board +12V regulator must not be used in a system with a multi-voltage output CompactPCI® power supply which delivers also +12V to the backplane. Results are unpredictable - damage to the CE3-GIG and/or the external power supply might occur.

Usage of a CE3-GIG with on-board +12V DC/DC regulator populated together with a +12V supplied CompactPCI® backplane requires the jumper DIS-12V set and the QD1 Schottky diode to be removed (desoldered). EKF recommends to send in the board in order to have this modification done, since lead free SMD soldering equipment and experienced personnel would be essential.

System Boot

The CE3-GIG supports booting from external self-powered SATA devices, due to the on-board SATA expansion BIOS Flash. If an external SATA device is powered from the USB +5V power however, any attempt to boot from this device will fail, since the USB VBUS power line is not switched on until the operating system has initialized the USB controller Pericom PI7C9X442SL.

The CE3-GIG does not support booting from an attached USB device. No USB expansion BIOS ROM is provided on-board, and also no non-chipset USB BIOS boot support is available with EKF CPU cards as of current. Furthermore, if an external USB device is powered from the USB +5V power, any attempt to boot from this device will fail, since the USB power rail is not switched on until the operating system has initialized the USB controller Pericom PI7C9X442SL.

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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