Product Information

CompactPCI® Serial • SBX-DUB

16 Port USB 3.0 Hostadapter

Document No. 7306 • 6 September 2016

SBX-DUB

General

The SBX-DUB is a peripheral slot board for PICMG® CompactPCI® Serial systems, equipped with four individual quad port USB 3.0 controllers, providing a total of 16 USB xHCI SuperSpeed channels. 12 USB 3.0 ports are available for rear I/O via the backplane connectors P3/P4. At the users choice, another set of 4 channels can be directed either to the USB 3.0 front panel receptacles, or can be used via rear I/O. Since any front panel connector is assigned to a separate SuperSpeed controller, a superior throughput can be achieved in total .

The SBX-DUB is provided with a PCI Express® 2.0 package switch for a PCIe x 4 uplink to the host, and can be installed into any peripheral slot of a CompactPCI® Serial backplane. A single PCIe lane would be sufficient for typical operation, but the optimum performance will be achieved when the SBX-DUB is inserted into a CompactPCI® Serial fat pipe slot, or an ordinary CompactPCI® Serial peripheral slot with support for PCIe x 4.
Suitable rear I/O modules (e.g. SBR-RIO) are available in addition to the SXB-DUB.

SBX-DUB

Feature Summary

General

- PICMG® CompactPCI® Serial standard (CPCI-S.0) peripheral slot card
- Single Size Eurocard 3U 4HP 100x160mm^2
- CPCI-S backplane connector P1 (PCIe x 4 or PCIe x 1 upstream to host)
- P4 - USB (rear I/O)
- P3 - USB (rear I/O)
- P2 - sideband (rear I/O)

PCI Express® Interface

- Five port PCI Express® Gen2 package switch
- Upstream port: PCI Express® Gen2 (5.0Gbps) or Gen1 (2.5Gbps) 1 x 4 or 1 x 1 supported
- Downstream ports PCI Express® Gen2 (5.0Gbps) 4 x 1 supported

USB Interfaces

- 4 x Texas Instruments PCI Express® to quad-port USB 3.0 controller
- PCI Express® x 1 Gen2 interface for optimum performance
- USB 3.0 xHCI (eXtensible host controller interface) SuperSpeed supported
- USB 2.0 high-speed, full-speed, low-speed supported
- Up to 16 USB channels available for rear I/O across P3/P4 backplane connectors (12 ports if USB front panel receptacles are in use)
- SBR-RIO Rear I/O module available (8 x rear panel USB, 8 x on-board USB)
- SBV-RIO Rear I/O module available (16 x on-board PicoBlade™ pin headers)
- Custom specific rear I/O module design offered
- Up to 4 x front panel Type A USB 3.0 host connectors, each assigned to an individual controller
- Direction front panel or rear I/O of 4 USB ports selected via analog USB 3.0 signal switches, individually setup by DIP switch configuration
- V_{BUS} (+5V) 1.5A high current power switches assigned to front panel connectors

Feature Summary

Environment & Regulation

- Designed & manufactured in Germany
- ISO 9001 certified quality management
- Long term availability
- Rugged solution (coating, sealing, underfilling on request)
- RoHS compliant
- Operating temperature: 0°C to +65°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
- MTBF 35.1years
- EC Regulations EN55022, EN55024, EN60950-1 (UL60950-1/IEC60950-1)

SBX-DUB Application Example

Theory of Operation

The SBX-DUB is equipped with 4 x TUSB7340 (PCI Express® to USB 3.0 bridge). Each xHCI (SuperSpeed) compliant host controller supports four downstream ports, which results in a total of 16 USB downstream ports available on the board. Each downstream port supports in addition USB 2.0 high-speed, full-speed, and low-speed

Up to 16 USB channels are available for rear I/O across the connectors P3/P4. A rear I/O module such as the SBR-RIO would be required for distribution of these ports to USB receptacles or USB devices.

As a configuration option, up to 4 USB ports can be used alternatively via front panel USB 3.0 connectors. These ports provide individual power control and overcurrent detection (V_{BUS} >1.5A). The selection between USB rear I/O usage or USB front panel connectors is made by a 4-fold DIP switch, which controls four analog USB 3.0 signal switches.

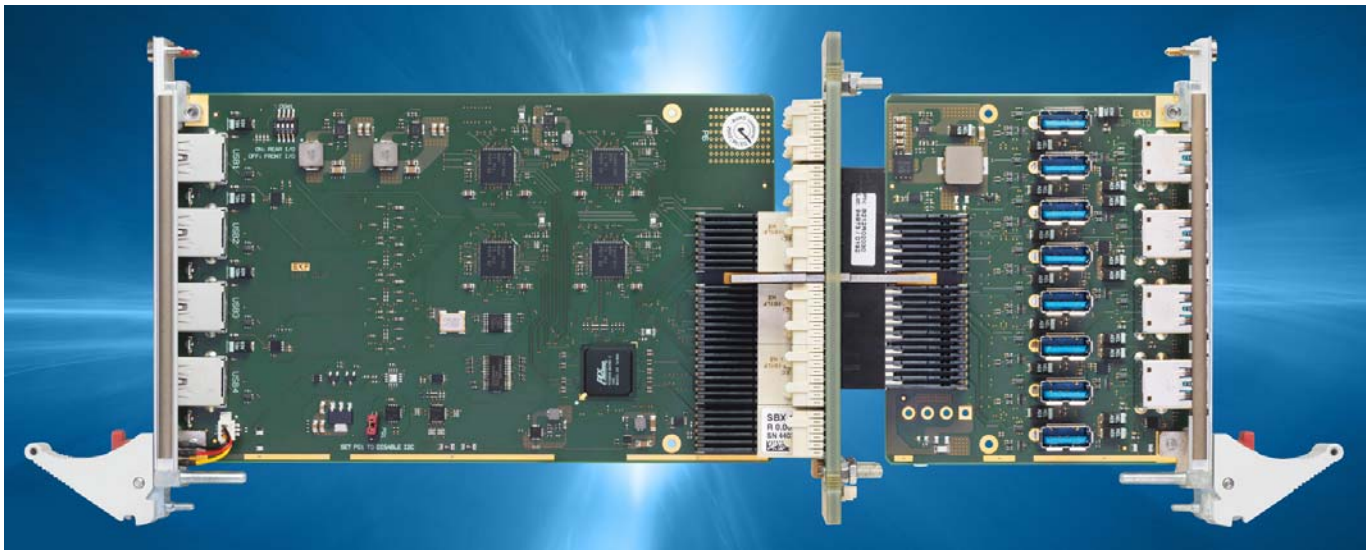
The SBX-DUB is based on PCI Express® 2.0 5.0Gbps technology. A PCIe packet switch is provided as flexible interface between one to four PCI Express® lanes derived from the CompactPCI® Serial backplane connector P1 (upstream port), and the on-board USB controllers (downstream ports).

When used in a CompactPCI® Serial plain peripheral slot, typically only one PCI Express® lane is available as upstream (host) connection to the PCIe packet switch, which may degrade the maximum performance of the SBX-DUB, especially with 2.5Gbps PCI Express® 1.0 sourced backplane slots.

If optimum data throughput is required, the SBX-DUB should be installed in a CompactPCI® Serial fat pipe slot, which offers a sufficient quantity of PCI Express® lanes on the J1 backplane connector, and with 5Gbps PCI Express® 2.0 technology more likely to be found here.

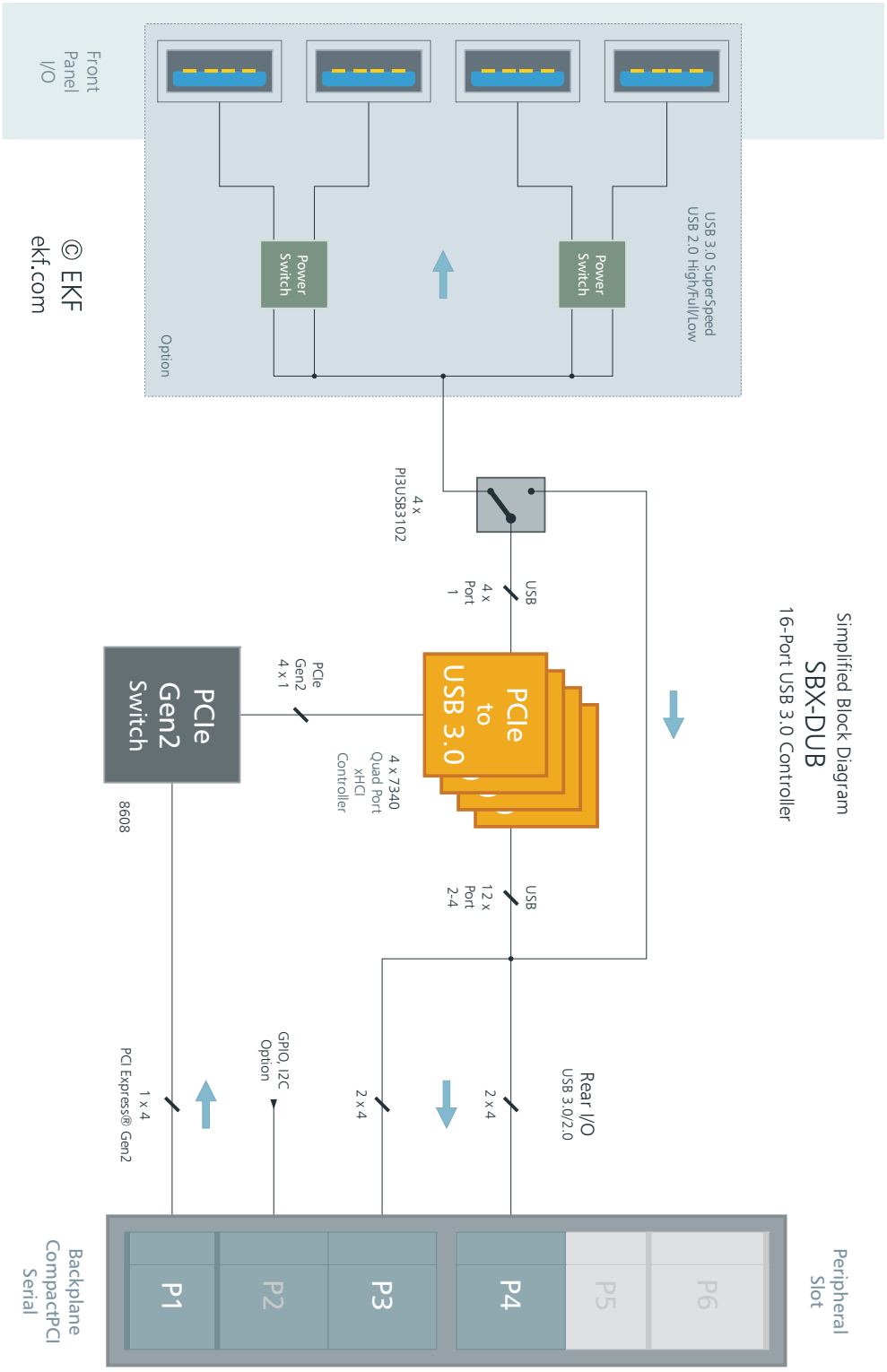
SBR-RIO Rear I/O Module

SBX-DUB with SBR-RIO

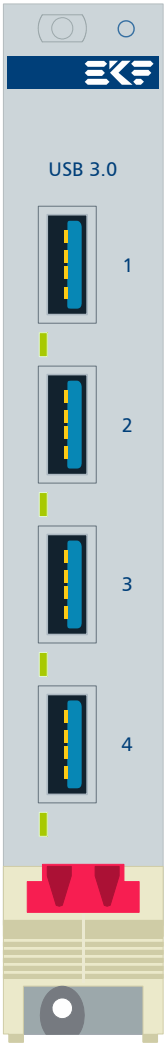


SBX-DUB with SBR-RIO

Block Diagram



Front Panel



SBX-DUB

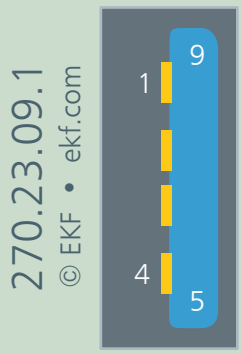
LED Function

Green - USB Power

Front Panel Connectors

The SBX-DUB is equipped with four front panel 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.

Any F/P USB port is attached to a dedicated USB 3.0 controller chip, thus assigning an individual SuperSpeed xHCI controller to each USB receptacle. If USB rear I/O is not in use simultaneously, the front panel jacks deliver superior aggregated SuperSpeed throughput compared to solutions with only a single chip USB controller.

USB 3.0 Receptacles		
	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. Front panel LEDs are provided to indicate the power state and initialization status of each F/P USB port.

A DIP switch on the SBX-DUB allows for redirection of each individual F/P USB port to the corresponding rear I/O connectors, as an alternate. The corresponding front panel LED will remain off for redirected USB ports.

Dip Switch DSW USB Port Redirection 			
1	2	3	4
ON = Rear I/O	ON = Rear I/O	ON = Rear I/O	ON = Rear I/O
Off = Front Panel	Off = Front Panel	Off = Front Panel	Off = Front Panel

CompactPCI® Serial Backplane Connectors

The CompactPCI® Serial specification describes up to 6 backplane connectors P1 - P6. With respect to a CompactPCI® Serial peripheral slot card, P2 (partially) and P3 - P5 (entirely) are available for user defined rear I/O. While P3 and P4 are assigned to 8 USB ports each on the SBX-DUB, P2 provides I^2C ports and GPIO lines (not necessary for USB operation). P1 is assigned to four PCI Express® lanes (upstream to the CompactPCI® Serial system slot controller aka CPU card). P5 and P6 are not in use on SBX-DUB.

A custom specific backplane and/or rear I/O module would be required in addition, for distribution of the USB channels to back panel connectors or system internal devices. EKF offers support for complete USB 3.0 rear I/O module design, with years of experience in high speed impedance controlled signal routing. For customers who are developing rear I/O circuitry on their own, EKF can provide suitable USB 3.0 port termination schematics (consider e.g. common mode chokes, TVS diodes, power switches).

P4 CompactPCI® Serial Peripheral Slot Backplane Connector
EKF Part #250.3.1208.20.00 • 96 pos. 12x8, 16mm Width

P4	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	1.2 USB2 D+	1.2 USB2 D-	GND	1.2 USB PWRON	1.2 USB OC#	GND	1.1 USB2 D+	1.1 USB2 D-	GND	1.1 USB PWRON	1.1 USB OC#
7	1.2 USB3 TX+	1.2 USB3 TX-	GND	1.2 USB3 RX+	1.2 USB3 RX-	GND	1.1 USB3 TX+	1.1 USB3 TX-	GND	1.1 USB3 RX+	1.1 USB3 RX-	GND
6	GND	1.4 USB2 D+	1.4 USB2 D-	GND	1.4 USB PWRON	1.4 USB OC#	GND	1.3 USB2 D+	1.3 USB2 D-	GND	1.3 USB PWRON	1.3 USB OC#
5	1.4 USB3 TX+	1.4 USB3 TX-	GND	1.4 USB3 RX+	1.4 USB3 RX-	GND	1.3 USB3 TX+	1.3 USB3 TX-	GND	1.3 USB3 RX+	1.3 USB3 RX-	GND
4	GND	2.2 USB2 D+	2.2 USB2 D-	GND	2.2 USB PWRON	2.2 USB OC#	GND	2.1 USB2 D+	2.1 USB2 D-	GND	2.1 USB PWRON	2.1 USB OC#
3	2.2 USB3 TX+	2.2 USB3 TX-	GND	2.2 USB3 RX+	2.2 USB3 RX-	GND	2.1 USB3 TX+	2.1 USB3 TX-	GND	2.1 USB3 RX+	2.1 USB3 RX-	GND
2	GND	2.4 USB2 D+	2.4 USB2 D-	GND	2.4 USB PWRON	2.4 USB OC#	GND	2.3 USB2 D+	2.3 USB2 D-	GND	2.3 USB PWRON	2.3 USB OC#
1	2.4 USB3 TX+	2.4 USB3 TX-	GND	2.4 USB3 RX+	2.4 USB3 RX-	GND	2.3 USB3 TX+	2.3 USB3 TX-	GND	2.3 USB3 RX+	2.3 USB3 RX-	GND

P3 CompactPCI® Serial Peripheral Slot Backplane Connector

EKF Part #250.3.1208.20.00 • 96 pos. 12x8, 16mm Width

P3	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	3.2 USB2 D+	3.2 USB2 D-	GND	3.2 USB PWRON	3.2 USB OC#	GND	3.1 USB2 D+	3.1 USB2 D-	GND	3.1 USB PWRON	3.1 USB OC#
7	3.2 USB3 TX+	3.2 USB3 TX-	GND	3.2 USB3 RX+	3.2 USB3 RX-	GND	3.1 USB3 TX+	3.1 USB3 TX-	GND	3.1 USB3 RX+	3.1 USB3 RX-	GND
6	GND	3.4 USB2 D+	3.4 USB2 D-	GND	3.4 USB PWRON	3.4 USB OC#	GND	3.3 USB2 D+	3.3 USB2 D-	GND	3.3 USB PWRON	3.3 USB OC#
5	3.4 USB3 TX+	3.4 USB3 TX-	GND	3.4 USB3 RX+	3.4 USB3 RX-	GND	3.3 USB3 TX+	3.3 USB3 TX-	GND	3.3 USB3 RX+	3.3 USB3 RX-	GND
4	GND	4.2 USB2 D+	4.2 USB2 D-	GND	4.2 USB PWRON	4.2 USB OC#	GND	4.1 USB2 D+	4.1 USB2 D-	GND	4.1 USB PWRON	4.1 USB OC#
3	4.2 USB3 TX+	4.2 USB3 TX-	GND	4.2 USB3 RX+	4.2 USB3 RX-	GND	4.1 USB3 TX+	4.1 USB3 TX-	GND	4.1 USB3 RX+	4.1 USB3 RX-	GND
2	GND	4.4 USB2 D+	4.4 USB2 D-	GND	4.4 USB PWRON	4.4 USB OC#	GND	4.3 USB2 D+	4.3 USB2 D-	GND	4.3 USB PWRON	4.3 USB OC#
1	4.4 USB3 TX+	4.4 USB3 TX-	GND	4.4 USB3 RX+	4.4 USB3 RX-	GND	4.3 USB3 TX+	4.3 USB3 TX-	GND	4.3 USB3 RX+	4.3 USB3 RX-	GND

P2 CompactPCI® Serial Peripheral Slot Backplane Connector
EKF Part #250.3.1208.20.00 • 96 pos. 12x8, 16mm Width

P2	A	B	C	D	E	F	G	H	I	J	K	L
8	GND	3 TUSB GPIO0	3 TUSB GPIO1	GND	3 TUSB GPIO2	3 TUSB GPIO3	GND	4 TUSB GPIO0	4 TUSB GPIO1	GND	4 TUSB GPIO2	4 TUSB GPIO3
7	1 TUSB GPIO0	1 TUSB GPIO1	GND	1 TUSB GPIO2	1 TUSB GPIO3	GND	2 TUSB GPIO0	2 TUSB GPIO1	GND	2 TUSB GPIO2	2 TUSB GPIO3	GND
6	GND	5 I2C Clock	5 I2C Data	GND	6 I2C Clock	6 I2C Data	GND	7 I2C Clock	7 I2C Data	GND	8 I2C Clock	8 I2C Data
5			GND			GND	3 I2C Clock	3 I2C Data	GND	4 I2C Clock	4 I2C Data	GND
4	GND	+5V	+5V	GND	* 4.1 +5V VBUS		GND	Reset# Out		GND		
3	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND
2	GND	*PE TX06+*	*PE TX06-*	GND	*PE RX06+*	*PE RX06-*	GND	*PE TX07+*	*PE TX07-*	GND	*PE RX07+*	*PE RX07-*
1	*PE TX04+*	*PE TX04-*	GND	*PE RX04+*	*PE RX04-*	GND	*PE TX05+*	*PE TX05-*	GND	*PE RX05+*	*PE RX05-*	GND

pin positions printed white: not connected

All TUSB7340 GPIO lines are +3.3V compliant - do not attach +5V signals to these I/O ports.

The I^2C interfaces are +3.3/+5V compliant and connected to the CPCI Serial backplane I^2C bus (refer to connector P1), across a TCA9548A 1:8 programmable I^2C switch and level translation circuit.

By default the SBX-DUB is provided with a DIP-switch for setup of the direction of the four USB ports *.1 (select from either front panel connectors or rear I/O connectors). As a *stuffing option*, the data direction can be programmed via the corresponding TUSB7340 GPIO0 signals, with *GPIO0=0 –> rear I/O USB, and *GPIO0=1 –> F/P USB (this is the initial state after reset). Do not use these GPIOs for rear I/O if they were assigned to on-board USB redirection programming.

+12V power is fed through from backplane connector P1. A maximum total current of 3A across the +12V pins should not be exceeded. There are no precautions on the SBX-DUB for a short circuit situation - be careful when attaching custom built hardware to P2.

+5V power is derived from an on-board voltage regulator. A maximum total current of 1A across the +5V pins should not be exceeded. An overcurrent condition may cause the SBX-DUB to fail.

* $+5V_{VBUS}$ - custom specific power pin - please do not connect

P1 CompactPCI® Serial Peripheral Slot Backplane Connector

EKF Part #250.3.1206.20.02 • 72 pos. 12x6, 14mm Width

P1	A	B	C	D	E	F	G	H	I	J	K	L
6	GND	PE TX02+	PE TX02-	GND	PE RX02+	PE RX02-	GND	PE TX03+	PE TX03-	GND	PE RX03+	PE RX03-
5	PE TX00+	PE TX00-	GND	PE RX00+	PE RX00-	GND	PE TX01+	PE TX01-	GND	PE RX01+	PE RX01-	GND
4	GND	*USB2+*	*USB2-*	GND	PE CLK+	PE CLK-	GND	*SATA TX+*	*SATA TX-*	GND	*SATA RX+*	*SATA RX-*
3	*USB3 TX+*	*USB3 TX-*	GA0	*USB3 RX+*	*USB3 RX-*	GA1	SATA SDI	SATA SDO	GA2	SATA SCL	SATA SL	GA3
2	GND	I2C SCL	I2C SDA	GND	RSV	RSV	GND	RST#	WAKE#	GND	PE EN#	SYS EN#
1	+12V	STBY	GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND

pin positions printed white: not connected

Rear I/O Backplane Slot for Usage w. SBR-RIO

SBX-DUB & SBR-RIO Assembly (Rear View)

SBV-0200-RIO for Internal Cabling

Board Assembly w. SBV-0200-RIO for System Internal Cabling

SBX-DUB Links	
SBX-DUB Home	www.ekf.com/s/sbx/sbx.html
SBR-RIO Home	www.ekf.com/s/sbr/sbr.html
SBV-RIO Home	www.ekf.com/s/sbv/sbv.html
CompactPCI® Serial Overview	www.ekf.com/s/smart_solution.pdf

Driver Software	
USB 3.0 TUSB7340 xHCI Driver	www.ti.com/product/tusb7340#toolssoftware

Ordering Information
For popular SBX-DUB SKUs please refer to www.ekf.com/liste/liste_21.html#SBX

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