4 x 5 SoM Integration Guide

Table of Content

Power and Signal Pin Assignment

How to Use This Guide

- This guide is split into two tables:
  - **Module Power Connection Table** section shows the power source of the different FPGA banks and components of the different module boards as well as the power and group location on the B2B connectors of the module site.
  - **Carrier Board Power Connection Table** section shows the power source of the B2B connectors with pins, schematic names and available options of the different carrier boards as well as the power location on the B2B connectors of the carrier site.
- The PCBs have fixed and variable user supplied I/O voltage pins. Variable power supply pins are colored in four groups (VCCIOA, VCCIOB, VCCIOC and VCCIOD).

1. Find your module model on the **Module Power Connection Table** and check the power supply of the different FPGA banks.
2. If the power supply is variable(colored), go to the **Carrier Board Power Connection Table** and see how it's connected on your carrier board. Often the power source can be selected by jumper, resistor or variable used from other connector pin of the carrier board. So use the schematic name or the component designator from the table to search for the available options in the PCB schematics or TRM.
3. Additional Master Pinout Viewer/XDC-Generator is available on Trenz Electronic Download - Pinout

Module Power Connection Table

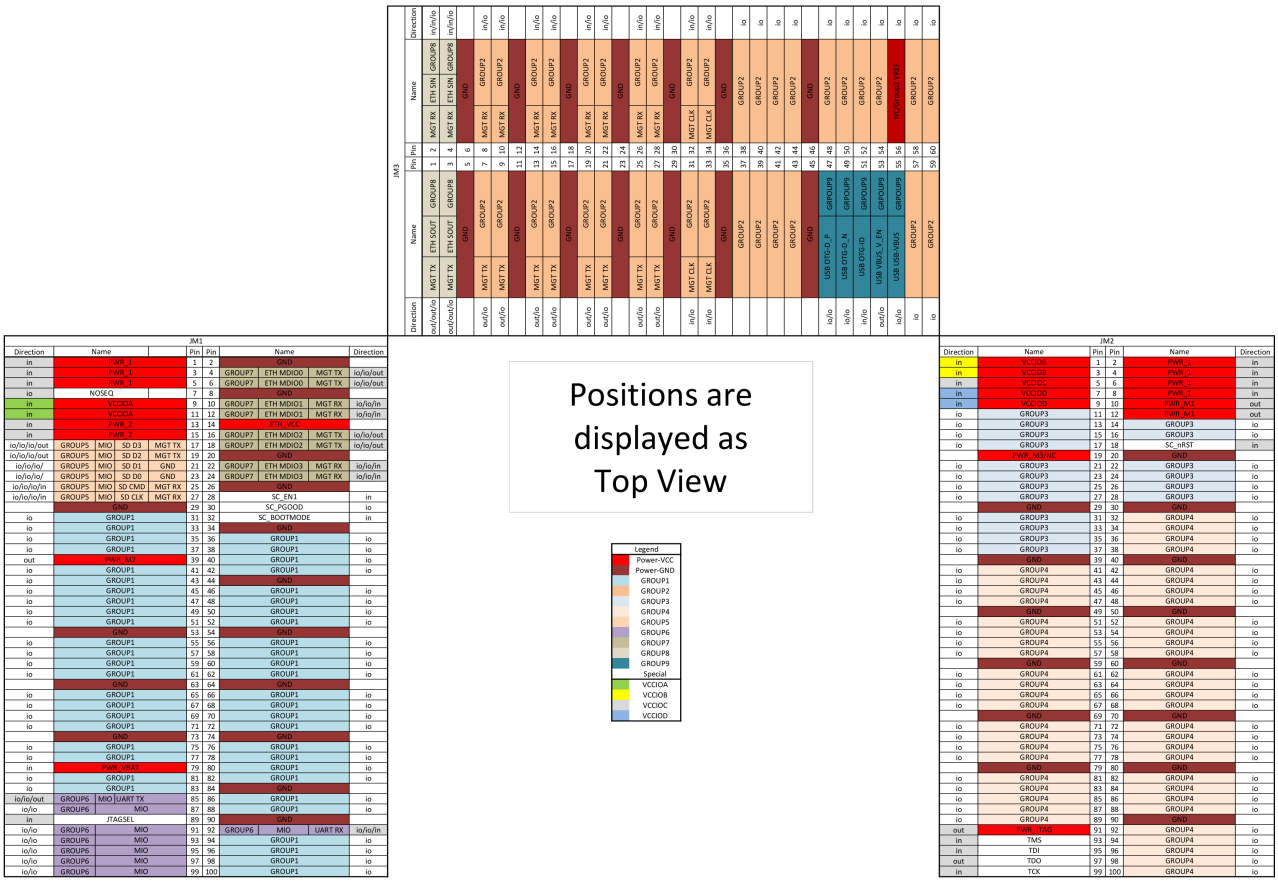
Group	1				2				3				4				5				6				7				8	9	special
Module Model	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage	Bank	IOs	Type	Voltage			
TE0710	B15	48	HR	VCCIOA	-	-	-	-	-	-	-	-	B34	50	HR	VCCIOD	B16	6	HR	3.3V	B14	8	HR	3.3V	2x 100Mbit ETH						
TE0711	B15	48	HR	VCCIOA	B34	36	HR	VCCIOB	B14	18	HR	3.3V	B35	50	HR	VCCIOD	B16	6	HR	1.8V	B14	8	HR	3.3V	B34	8	HR	VCCIOB	B34(4)	USB	
TE0712	B16	48	HR	VCCIOA	B13	20	HR	VCCIOB	B14	18	HR	3.3V	B15	50	HR	VCCIOD	B13	6	HR	VCCIOB	B14	8	HR	3.3V	1x 100Mbit ETH / B13	4	HR	VCCIOB		B14	4x GTP on G2
TE0713																															4x GTP on G2
TE0715 with Z-7015	B13	48	HR	VCCIOA	B34	16	HR	VCCIOC	B34	18	HR	VCCIOC	B35	50	HR	VCCIOD	B501	6	MIO	1.8V	B500	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	4x GTP on G2

TE0715 with Z-7030	B13	48	HR	VCCIOA	B34	16	HP	VCCIOC	B34	18	HP	VCCIOC	B35	50	HP	VCCIOD	B501	6	MIO	1.8V	B500	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	4x GTP on G2
TE0720	B35	48	HR	VCCIOA	B34	36	HR	VCCIOB	B33	18	HR	VCCIOC	B13	50	HR	VCCIOD	B501	6	MIO	1.8V	B500	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	
TE0820*	B66	48	HP	VCCIOA	B65	16	HP	VCCIOC	B65	18	HP	VCCIOC	B64	50	HP	VCCIOD	B501	6	MIO	3.3V	B501	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	4x GTR on G2
TE0821*	B26	48	HD	VCCIOA	B65	16	HP	VCCIOC	B65	18	HP	VCCIOC	B24	48	HD	VCCIOD	B501	6	MIO	3.3V	B501	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	4x GTR on G2
TE0823*	B66	48	HP	VCCIOA	B65	16	HP	VCCIOC	B65	18	HP	VCCIOC	B64	50	HP	VCCIOD	B501	6	MIO	3.3V	B501	8	MIO	3.3V	1x Gbit ETH				SGMII	USB	4x GTR on G2
TE0741	B13	48	HR	VCCIOA	B16	16	HR	VCCIOB	B15	18	HR	VCCIOC	B12	50	HR	VCCIOD	1x GTX	1 Lane			B14	8	HR	3.3V	2x GTX	2 Lanes			1x GTX		4x GTX on G2
TE0742*																															
TE0841	B64	48	HR	VCCIOA	B66	16	HP	VCCIOB	B68	18	HP	VCCIOC	B67	50	HP	VCCIOD	1x GTH	1 Lane			B65	8	HR	3.3V	2x GTH	2 Lanes			1x GTH		4x GTH on G2
TE0842*																															

I/O resource comparison for all 4x5 modules. There are maximum 4 user supplied I/O voltages (VCCIOA, VCCIOB, VCCIOC and VCCIOD).

*Attention: Maximum supply voltage for HP banks is 1.8V.
Module B2B FPGA-Banks and Voltages

Module Pinout Overview



Module basic power and group pin assignment, recommended to verify with Schematics

Carrier Board Power Connection Table

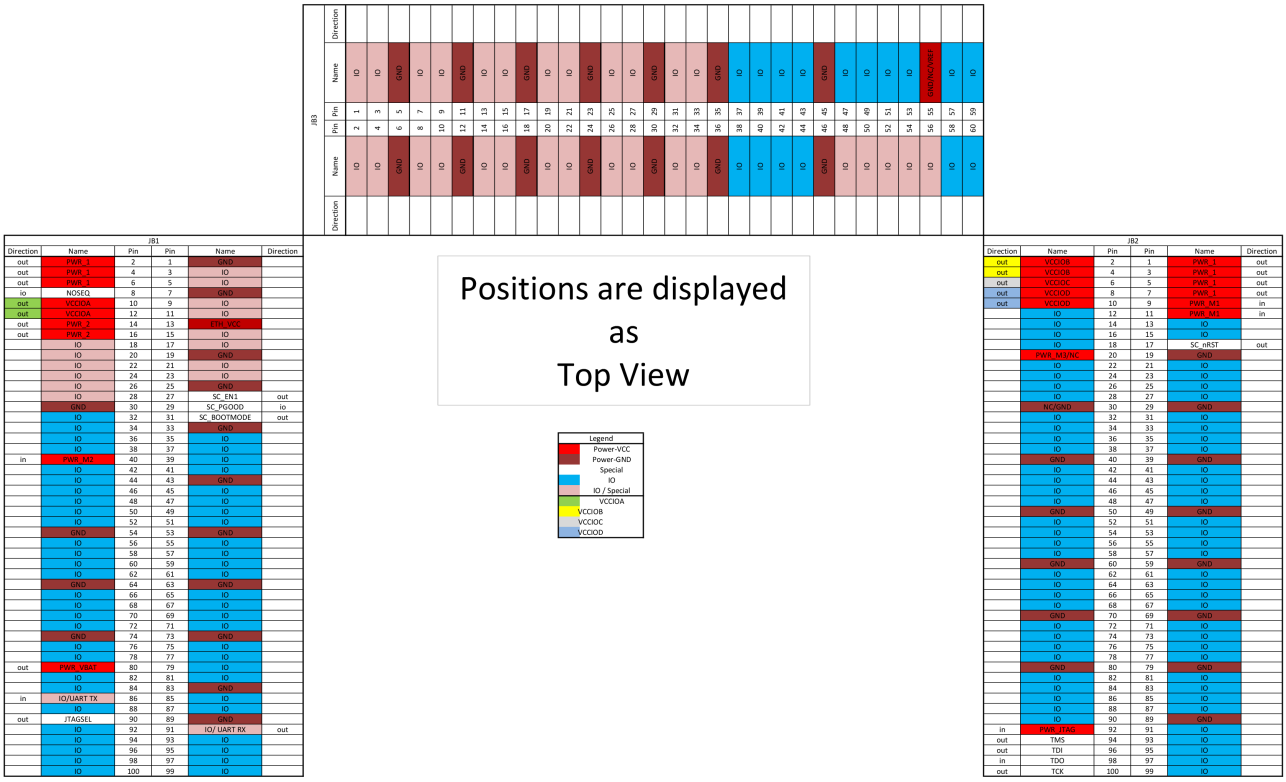
IO Voltage		B2B Connector		Carrier Boards													
Name	Direction*	JB1	JB2	TE0701		TE0703 Rev01 - Rev04		TE0703 Rev 05		TE0705		TE0706		TEBA0841		TEBA0841 REV01	
		Pin	Pin	Schematic Name	Value, Option, Comp.	Schematic Name	Value, Option, Comp.	Schematic Name	Value,Option, Comp.	Schematic Name	Value, Option, Comp.	Schematic Name	Value,Option, Comp.	Schematic Name	Value,Option, Comp.	Schematic Name	Value,Option, Comp.
PWR_1	out	2,4,6	1,3,5,7	5V0	5V	3.3V	3.3V	3.3V	3.3V	5V0	5V	3.3V	3.3V	3.3V	use ext. 3.3V power supply	3.3V	use ext. 3.3V power supply
VCCIOA	out	10,12		VIOTB	FMC_VADJ 2V5 3.3VOUT	VCCIO35	R23M3.3VOUT J1B-B1	VCCIOA	J5M3.3VOUT, M1.8VOUT R23M3.3VOUT J1-B1	VIOTB	FMC_VADJ 2V5 3.3VOUT	VCCIO35	R20->M3.3VOUT/J6B-B32	VCCIOA	J26 M1.8VOUT, 2.5V, 3.3V_OUT J20-6,J20-45	VCCIOA	J26 M1.8VOUT, 2.5V, 3.3V_OUT J20-6,J20-45

VCCIOD	out		8,10	VIOTB	FMC_VADJ 2V5 3.3VOUT	VCCIO13	R26M3.3VOUT J2B-B1	VCCIOD	J10M3.3VOUT, M1.8VOUT R26M3.3VOUT J2B-B1	VIOTB	FMC_VADJ 2V5 3.3VOUT	VCCIO13	R22->M3.3VOUT/J6B-B1	VCCIOD	J27 M1.8VOUT, 2.5V, 3.3V_OUT J17-6,J17-45	VCCIOD	J27 M1.8VOUT, 2.5V, 3.3V_OUT J17-6,J17-45
PWR_2	out	14,16		3V3IN	3.3V	3.3V	3.3V	3.3V	3.3V	3V3IN	3.3V	3.3V	3.3V	3.3V	use ext. 3.3V power supply	3.3V	use ext. 3.3V power supply
VCCIOB	out		2,4	no name / VIOTA	FMC_VADJ 2V5 3.3VOUT	VCCIO34	J5M3.3VOUT J1B-B32	VCCIOB	J8M3.3VOUT, M1.8VOUT J2B-B32	VIOTB	FMC_VADJ 2V5 3.3VOUT	1.8V	1.8V	VCCIOB	J5 M1.8VOUT, 2.5V, 3.3V_OUT	VCCIOB	NC
VCCIOC	out		6	no name / VIOTA	FMC_VADJ 2V5 3.3VOUT	VCCIO33	R25M3.3VOUT J2B-B32	VCCIOC	J9M3.3VOUT, M1.8VOUT R25M3.3VOUT J2B-B32	VIOTB	FMC_VADJ 2V5 3.3VOUT	VCCIO33	R21->M3.3VOUT	VCCIOC	J6 M1.8VOUT, 2.5V, 3.3V_OUT	VCCIOC	NC
PWR_M1	in		9,11	3.3 VOUT	3.3V	3.3 VOUT	3.3V	M3.3VOUT	3.3V	3.3 VOUT	3.3V	M3.3VOUT	3.3V	3.3 V_OUT	3.3V	3.3 V_OUT	3.3V
PWR_M2	in	40		VIOB	1.8V	M1.8VOUT	1.8V	M1.8VOUT	1.8V	VIOB	1.8V	M1.8VOUT	1.8V	M1.8VOUT	1.8V	M1.8VOUT	1.8V
PWR_M3	in		20	NC		NC		NC		NC		NC			NC		NC
PWR_VBAT	out	80		VBAT	B1	VBAT	J7	VBAT	J7	NC		VBAT	J9	VBAT	NC	VBAT	NC
PWR_JTAG	in		92	VCCJTAG		VCCJTAG		VCCJTAG		VCCJTAG		VCCJTAG		VCCJTAG		VCCJTAG	NC

Power comparison of all 4x5 carrier boards. ***Power direction based on carrier boards view.**There are 4 variable user supplied I/O voltages (VCCIOA, VCCIOB, VCCIOC and VCCIOD). PWR_1 and PWR_2 are fixed from carrier boards. PWR_M1 and PWR_M2 normally use default value from module. NC=Not Connected

Attention: On some carrier boards the user supplied I/O voltages are connected together (red colored schematic names).
Power Pin Connection on different Carrierboards

Carrier Pinout Overview



Carrierboard basic power and group pin assignment (Top View), recommended to verify with Schematics

4x5 Module Controller IOs

Name	Module B2B Pin	Carrier B2B Pin	Direction (Module view)	Description	Recommendation
JTAGSEL	JM1-89	JB1-90	in	JTAG Chain multiplexer. Low FPGA, High CPLD. For module with CPLD only.	Connect Pulldown on carrier. DIP switch possible.
SC_EN1	JM1-28	JB1-27	in	Module power. Set high to enable module power. Note: Power management depends on module. Sometimes this is a only used as Power ON Reset like SC_nRST	Connect Pullup on carrier. DIP switch possible
SC_NOSEQ	JM1-7	JB1-8	in / **inout**	Module Power management. Set high to disable CPLD power management. Note: Power management depends on module and not all modules support extended power management with CPLD.	Connect Pullup or force to GND over zero ohm resistor on carrier. DIP switch possible.
SC_PGOOD	JM1-30	JB1-29	out / **inout**	Power Good signal. Is Low, if SC_EN1 is set to zero or if power is not ready, otherwise high impedance output. Note: Power management depends on module.	Connect Pullup on carrier. Do **not** use this signal to enable FPGA Bank voltages. It's only for monitoring. To Enable FPGA Banks, use 3.3V(PWR_M1) or 1.8V(PWR_M2) module output.

SC_BOOTMODE	JM1-32	JB1-31	in	Boot Mode selection Pin for Zynq module only. Default low for primary SD boot and high for primary QSPI boot. Note: Depends also on module CPLD firmware	Connect Pullup on carrier. DIP switch possible.
SC_nRST	JM2-18	JB2-17	in	Low active module reset. Pin force Power one reset on FPGA /SoC. Note: Depending from module CPLD or voltage supervisor is used.	Connect Pullup on carrier. DIP switch possible.

It's planned to use SC_PGOOD of also additional Boot Mode Pin (Pin is bidirectional, pull up or force to zero), to additionally set JTAG only boot mode (to avoid programming problems with some vivado versions, see: AR#00002 - QSPI Programming issues)

4x5 Module Controller IOs

Remove 4x5 module

Always loosen the screws only a little step by step so that the module is evenly squeezed out. Otherwise solder contacts can break.

Compatibility Guide

Ethernet LED'S

TE07xx 4x5 modules do not have dedicated pins for the Ethernet PHY LED's, also there are no fix pins on the baseboards for the PHY LED's or any other LED's.

If Ethernet JACKs on Baseboard have LED's then those should be connected to some free PL I/O pins, and then routed in the FPGA logic from the PHY to the I/O Pin in the B2B Connector.

Recommended connections would be to use JM2.89 and JM2.100 for the PHY LED's, those positions support baseboard ETH LED's for TE0701 and TE0703 and TE0706.

JM2 pins 1, 3 (TE0720 Bank 34 Voltage)

To be compatible with TE0720 JM2 pins 1,3 must be connected to some valid VCCIO voltage.

When JM2 pins 1, 3 are not powered TE0720 would not boot, and may not be recognized in JTAG chain as well.

When those pins are not used on the module (TE0710) then to be compatible with TE0720:

Solution A: connect to 3.3V out from the module, option compatible to all modules except those with HP banks (TE0715-01-30)

Solution B: connect to 1.8V out from the module, option compatible with all modules.

Carrier Board Checklist

Schematic Checklist

1	Are B2B pin numbers on the connectors mirrored compared to the module pin numbers?	As B2B connectors are "unisex" type the do mirror pin numbers when connecting. That is pin1 connects to pin2, and pin2 to pin1, etc.
2	Are B2B connectors named JB1, JB2, JB3?	This is not a hard requirement, but it helps to use the same identifiers.
3	Are all GND pins connected to a common ground net?	
4	Are all VIN pins connected together?	
5	Is JB2 pin 92 pin used as VREF for the JTAG interface?	for future compatibility only, currently all modules have 3.3V JTAG
6	For 7 Series Zynq module only: Are external circuits/buffers connecting to MIO bank 1 pins powered from JB1 pin 40?	JB1 pins 18, 20, 22, 24, 26, 28 use voltage at pin 40 as VCCIO. Currently it is 1.8V for 4x5 Zynq Modules. Note: Different Power supply on TE0820(3.3V MIO Bank) and normal FPGA modules(check schematics)

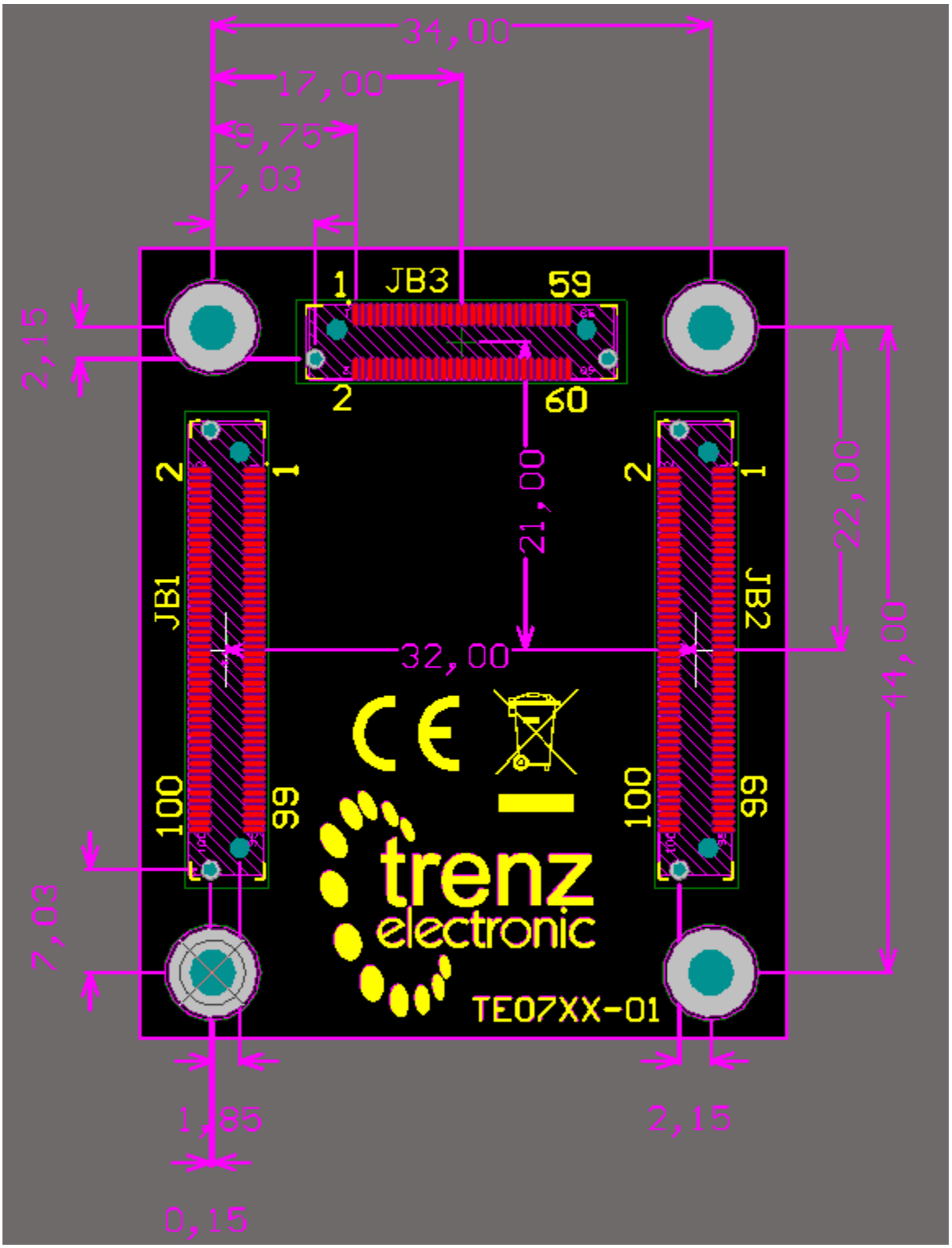
PCB Checklist

1	Are mounting holes placed properly?	Four Mounting holes should always be used. They are required for mounting screws and for module extraction. The mounting holes will also help in dissipating some heat from the module to the carried board PCB. Four holes with a 3.2mm diameter should be placed exactly at the corners of a 34mm by 44mm rectangle.
2	Are B2B headers properly placed?	B2B headers must be placed and aligned very precisely or the module will not align correctly (in the worst case module insertion could destroy the connectors or the PCB). The B2B headers should be locked on the PCB, and it is recommended that the position and placement be checked against placement dimensions before submitting the PCB files.
3	Are B2B headers rotated properly?	As B2B header pin numbers differ from module to the carrier (swap of odd and even numbers), it is recommended that the rotation is checked in the PCB design.
4	Height clearance below module	Components can be placed below the module but height clearance rules must be obeyed.
5	Power dissipation of components below module	It is not recommended to place any components with high power dissipation below the module, as there will be almost no airflow below the module.

Visual Check of Module placement

It is highly recommended to use the Base board Template designs as a starting point for new PCB designs. If that is not possible, then adding linear dimensions in the design helps to check that all connectors and mounting holes are properly placed.

This placement is same for all 4x5 Modules!



Top view of the Carrier Board.

Connector numbers as on base! (pin JB1.1 on base would mate to pin JM1.2 on module).