TB-FMCH-OPT10
Hardware User Manual

Rev.1.00

Revision History

Version	Date	Description	Publisher
Rev.1.00	2015/03/31	Release version	Goto Odajima

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Introduction

Thank you for purchasing the **TB-FMCH-OPT10** board. Before using the product, be sure to carefully read this user manual and fully understand how to correctly use the product. First read through this manual, then always keep it handy.

SAFETY PRECAUTIONS

Be sure to observe these precautions

Observe the precautions listed below to prevent injuries to you or other personnel or damage to property.

- **Before using the product, read these safety precautions carefully to assure correct use.**
- **These precautions contain serious safety instructions that must be observed.**
- **After reading through this manual, be sure to always keep it handy.**

The following conventions are used to indicate the possibility of injury/damage and classify precautions if the product is handled incorrectly.

Danger	Indicates the high possibility of serious injury or death if the product is handled incorrectly.
Warning	Indicates the possibility of serious injury or death if the product is handled incorrectly.
Caution	Indicates the possibility of injury or physical damage in connection with houses or household goods if the product is handled incorrectly.

The following graphical symbols are used to indicate and classify precautions in this manual.
(Examples)

	Turn off the power switch.
	Do not disassemble the product.
	Do not attempt this.

Warning	
	**In the event of a failure, disconnect the power supply.** If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately and contact our sales personnel for repair.
	**If an unpleasant smell or smoking occurs, disconnect the power supply.** If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately. After verifying that no smoking is observed, contact our sales personnel for repair.
	**Do not disassemble, repair or modify the product.** Otherwise, a fire or electric shock may occur due to a short circuit or heat generation. For inspection, modification or repair, contact our sales personnel.
	**Do not touch a cooling fan.** As a cooling fan rotates in high speed, do not put your hand close to it. Otherwise, it may cause injury to persons. Never touch a rotating cooling fan.
	**Do not place the product on unstable locations.** Otherwise, it may drop or fall, resulting in injury to persons or failure.
	**If the product is dropped or damaged, do not use it as is.** Otherwise, a fire or electric shock may occur.
	**Do not touch the product with a metallic object.** Otherwise, a fire or electric shock may occur.
	**Do not place the product in dusty or humid locations or where water may splash.** Otherwise, a fire or electric shock may occur.
	**Do not get the product wet or touch it with a wet hand.** Otherwise, the product may break down or it may cause a fire, smoking or electric shock.
	**Do not touch a connector on the product (gold-plated portion).** Otherwise, the surface of a connector may be contaminated with sweat or skin oil, resulting in contact failure of a connector or it may cause a malfunction, fire or electric shock due to static electricity.

Caution	
	Do not use or place the product in the following locations. • Humid and dusty locations • Airless locations such as closet or bookshelf • Locations which receive oily smoke or steam • Locations exposed to direct sunlight • Locations close to heating equipment • Closed inside of a car where the temperature becomes high • Staticky locations • Locations close to water or chemicals Otherwise, a fire, electric shock, accident or deformation may occur due to a short circuit or heat generation.
	Do not place heavy things on the product. Otherwise, the product may be damaged.

■ Disclaimer

This product is a board intended for **Optical Module** Interface. Tokyo Electron Device Limited assumes no responsibility for any damages resulting from the use of this product for purposes other than those stated.

Even if the product is used properly, Tokyo Electron Device Limited assumes no responsibility for any damages caused by:

(1) Earthquake, thunder, natural disaster or fire resulting from the use beyond our responsibility, acts by a third party or other accidents, the customer's willful or accidental misuse or use under other abnormal conditions.
(2) Secondary impact arising from use of this product or its unusable state (business interruption or others)
(3) Use of this product against the instructions given in this manual.
(4) Malfunctions due to connection to other devices.

Tokyo Electron Device Limited assumes no responsibility or liability for:

(1) Erasure or corruption of data arising from use of this product.
(2) Any consequences or other abnormalities arising from use of this product, or
(3) Damage of this product not due to our responsibility or failure due to modification

This product has been developed by assuming its use for research, testing or evaluation. It is not authorized for use in any system or application that requires high reliability.

Repair of this product is carried out by replacing it on a chargeable basis, not repairing the faulty devices. However, non-chargeable replacement is offered for initial failure if such notification is received within two weeks after delivery of the product.

The specification of this product is subject to change without prior notice.

The product is subject to discontinuation without prior notice.

1. Related Documents and Accessories

Related documents:

All documents relating to this board can be downloaded from our website. Please see attached paper on the products.

Board accessories:

- QSFP+ module: x2, AFBR-79EQDZ (Avago)
- SFP+ module: x2, AFBR-709SMZ (Avago)
- QSFP+ Cable : x2, TLF28-M2M-00S-2M (Furukawa Electric)
- QSFP+ Cable for Loopback : x1, TLF28-M3M-00-LOOP (Furukawa Electric)
- SFP+ Cable : x2, TLF28-M2S-002-2M (Furukawa Electric)
- FMC spacer set

2. Overview

This board provides optical interface capability via FMC(HPC) connector.
It connect to FMC(HPC) connector with FPGA hi-speed SERDES.

Notice:
This board is mounted AFBR-79EQDZ(QSFP+) and AFBR-709SMZ(SFP+) modules.
Cable combination is only tested attached cables.

3. Feature

FMC Connector: HPC(Samtec)
QSFP+ module socket: 76971-0006 (Molex)
SFP+ module socket: 74441-0001 (Molex)
Clock: On board 156.25MHz and MMCX connectors for FPGA Reference clock input

4. Block Diagram

Fllowing Figure is block diagram of TB-FMCH-OPT10

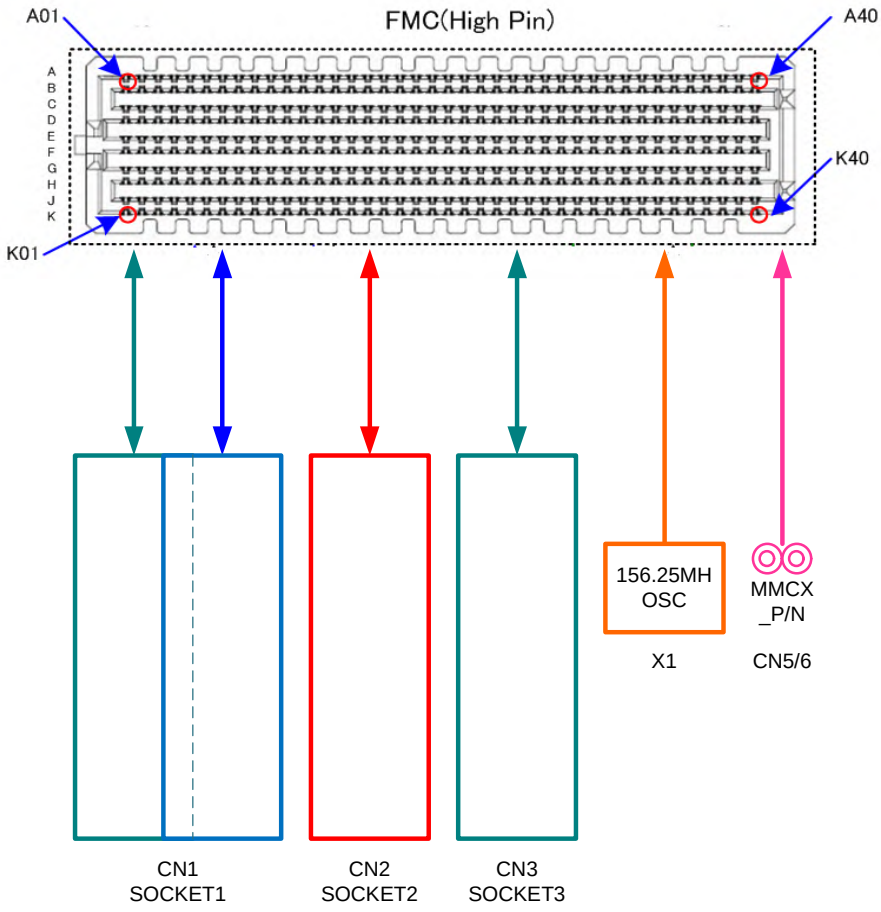

Figure 4-1 Block Diagram

5. External View of the Board

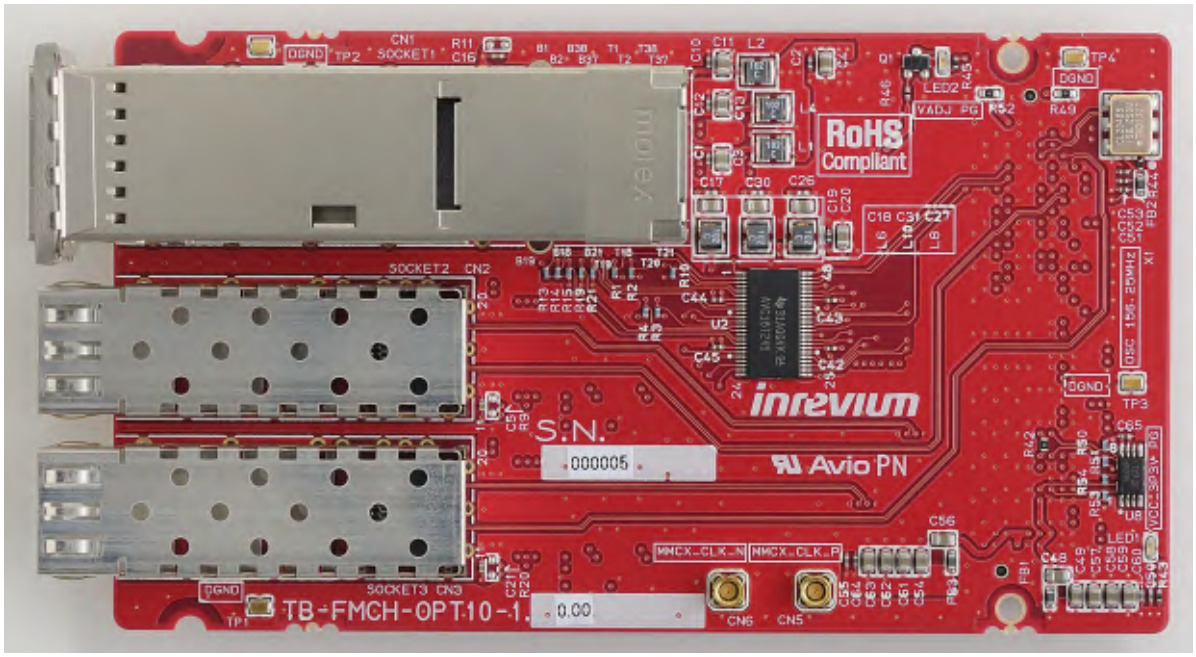

Figure 5-1 Component Side

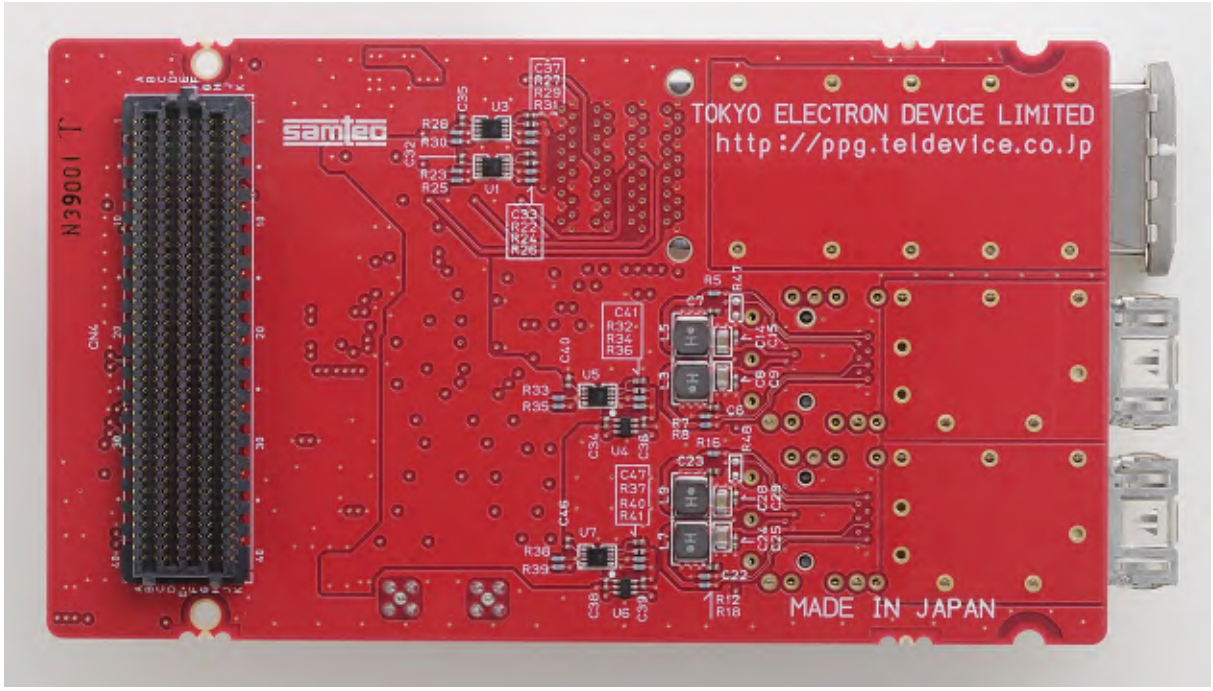

Figure 5-2 Solder Side

6. Board Specifications

Figure 6-1 shows the board specifications.

External Dimensions:	121.4 mm (W) x 69 mm (H)
Number of Layers:	8 layers
Board Thickness:	1.6 mm
Material:	MEG6
FMC Connector:	Samtec ASP-134488-01
QSFP+ socket	Molex 76971-0006
SFP+ socket	Molex 74441-0001

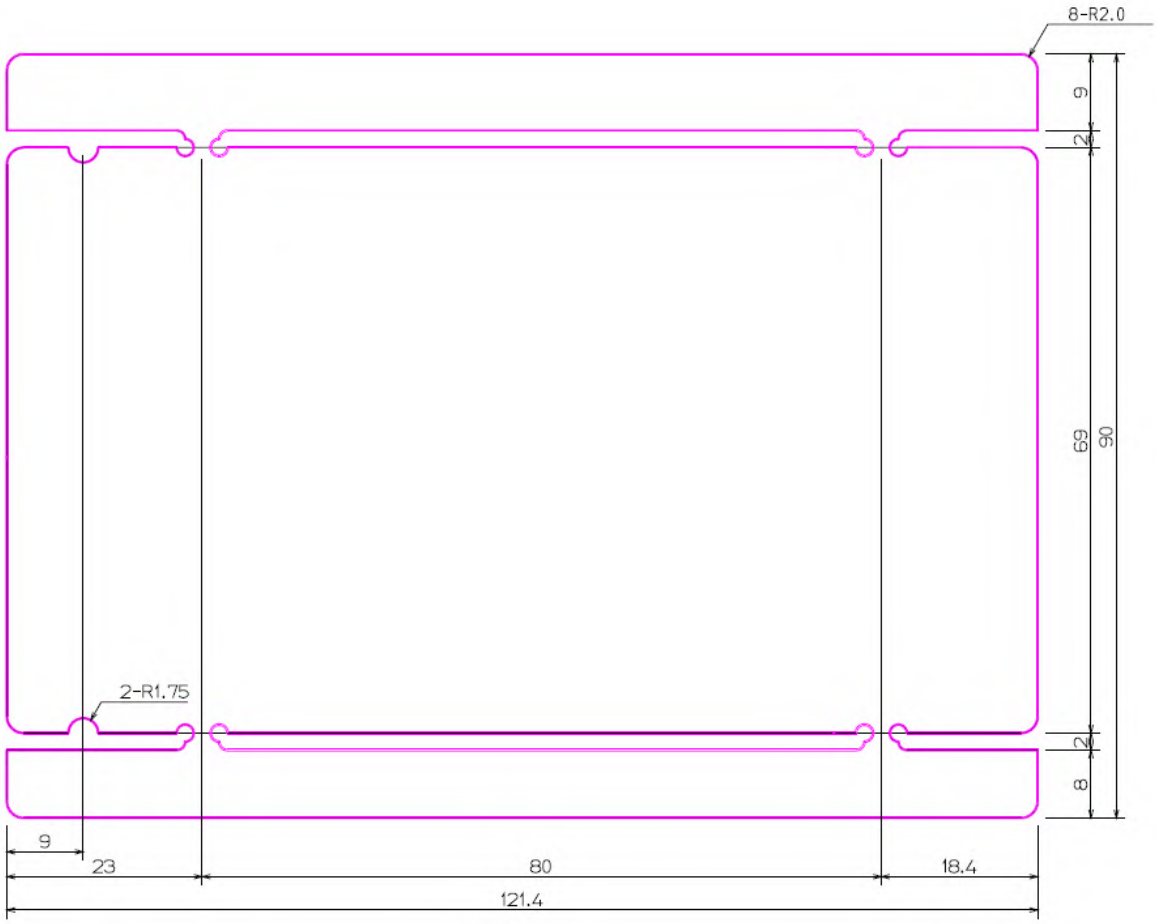

Figure 6-1 Board Dimensions (inclusive of wastable substrate)

7. Description of Components

7.1. QSFP+ Socket

QSFP+ socket (CN1) has two slot for modules. Please refer below Figure.
Upper side is “CN1A” on schematic and lower side is “CN1B”.

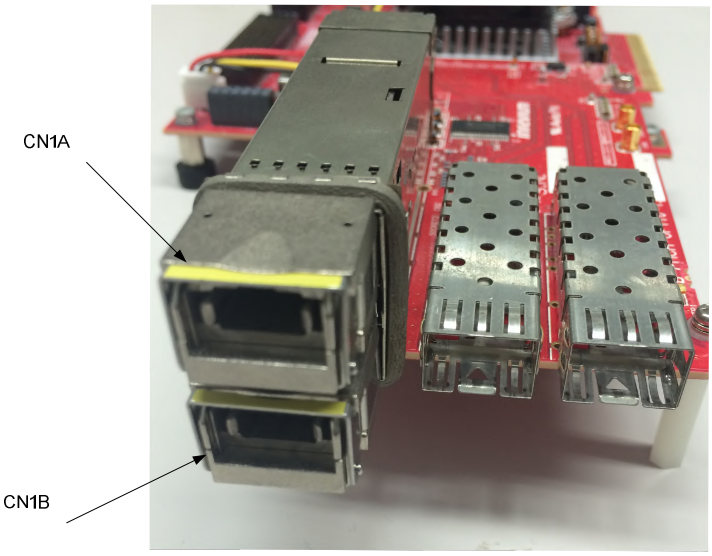

Figure 7-1 QSFP+ Socket

7.2. On board Clock Circuit

This board has an oscillator and MMCX connector for input user clock.
This board does not terminate clock signal. Please check your main board.

Table 7-1 Connection of clock signals

Signal Name	FMC Side		Note
	Pin No.	FMC Pin Name	
CLK_156.25M_P	D4	GBTCLK0_M2C_P	Oscillator
CLK_156.25M_N	D5	GBTCLK0_M2C_N	Oscillator
MMCX_CLK_P	B20	GBTCLK1_M2C_P	MMCX Connector
MMCX_CLK_N	B21	GBTCLK1_M2C_N	MMCX Connector

7.3. QSFP+ and SFP+ control signals and FMC connection

Control signals of optical modules are connecting to FMC via level shifter.
Control signal level is related to IO Power “VCC_ADJ” from Main Board.
FPGA should control these signals.

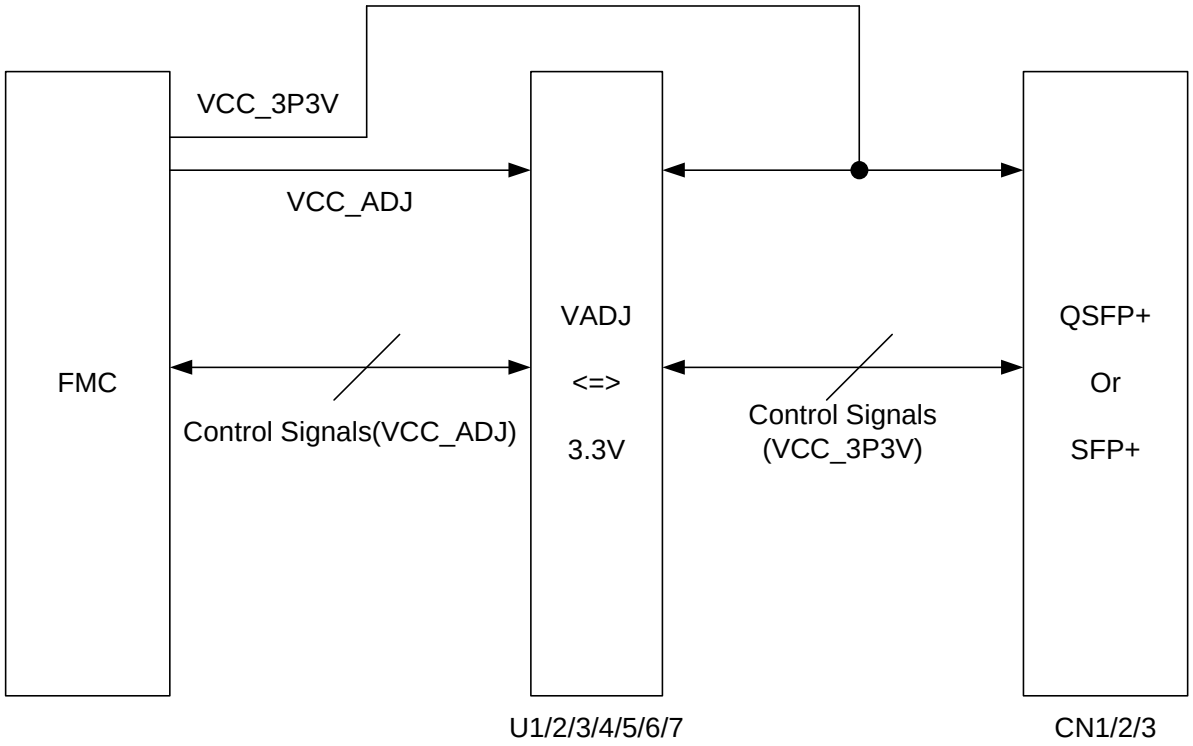

Figure 7-2 Control signals connection

Table 7-2 CN1A signals connection

CN1A Side	Signal Name	FMC Side	
Pin No.		Pin No.	FMC Pin Name
10,29,30	* 1 VCC_3P3V	-	-
1,4,7,13,16,19,20, 23,26,32,35,38	GND	-	GND
9	QSFPT_RESETL	G6	LA00_P_CC
8	QSFPT_MODSELL	G7	LA00_N_CC
31	QSFPT_LPMODE	D8	LA01_P_CC
27	QSFPT_MODPRSL	D9	LA01_N_CC
28	QSFPT_INTL	H7	LA02_P
11	QSFPT_SCL	H8	LA02_N
12	QSFPT_SDA	G9	LA03_P
36	DP_C2M_P0(TX1P)	C2	DP0_C2M_P
37	DP_C2M_N0(TX1N)	C3	DP0_C2M_N
3	DP_C2M_P1(TX2P)	A22	DP1_C2M_P
2	DP_C2M_N1(TX2N)	A23	DP1_C2M_N
33	DP_C2M_P2(TX3P)	A26	DP2_C2M_P
34	DP_C2M_N2(TX3N)	A27	DP2_C2M_N
6	DP_C2M_P3(TX4P)	A30	DP3_C2M_P
5	DP_C2M_N3(TX4N)	A31	DP3_C2M_N
17	DP_M2C_P0(RX1P)	C6	DP0_M2C_P
18	DP_M2C_N0(RX1N)	C7	DP0_M2C_N
22	DP_M2C_P1(RX2P)	A2	DP1_M2C_P
21	DP_M2C_N1(RX2N)	A3	DP1_M2C_N
14	DP_M2C_P2(RX3P)	A6	DP2_M2C_P
15	DP_M2C_N2(RX3N)	A7	DP2_M2C_N
25	DP_M2C_P3(RX4P)	A10	DP3_M2C_P
24	DP_M2C_N3(RX4N)	A11	DP3_M2C_N

Notice: 3.3V Power is provided from main board.

Pin number has “T” which means “TOP” on the schematic.

Table 7-3 CN1B signals connection

CN1B Side	Signal Name	FMC Side	
Pin No.		Pin No.	FMC Pin Name
10,29,30	* 1 VCC_3P3V	-	-
1,4,7,13,16,19,20, 23,26,32,35,38	GND	-	GND
9	QSFPB_RESETL	G10	LA03_N
8	QSFPB_MODSELL	H10	LA04_P
31	QSFPB_LPMODE	H11	LA04_N
27	QSFPB_MODPRSL	D11	LA05_P
28	QSFPB_INTL	D12	LA05_N
11	QSFPB_SCL	C10	LA06_P
12	QSFPB_SDA	C11	LA06_N
36	DP_C2M_P4(TX1P)	A34	DP4_C2M_P
37	DP_C2M_N4(TX1N)	A35	DP4_C2M_N
3	DP_C2M_P5(TX2P)	A38	DP5_C2M_P
2	DP_C2M_N5(TX2N)	A39	DP5_C2M_N
6	* 3 DP_C2M_P6(TX4P)	B36	DP6_C2M_P
5	* 3 DP_C2M_N6(TX4N)	B37	DP6_C2M_N
33	* 3 DP_C2M_P7(TX3P)	B32	DP7_C2M_P
34	* 3 DP_C2M_N7(TX3N)	B33	DP7_C2M_N
17	DP_M2C_P4(RX1P)	A14	DP4_M2C_P
18	DP_M2C_N4(RX1N)	A15	DP4_M2C_N
22	DP_M2C_P5(RX2P)	A18	DP5_M2C_P
21	DP_M2C_N5(RX2N)	A19	DP5_M2C_N
25	* 3 DP_M2C_P6(RX4P)	B16	DP6_M2C_P
24	* 3 DP_M2C_N6(RX4N)	B17	DP6_M2C_N
14	* 3 DP_M2C_P7(RX3P)	B12	DP7_M2C_P
15	* 3 DP_M2C_N7(RX3N)	B13	DP7_M2C_N

Notice: 3.3V Power is provided from main board.

Pin number has “B” which means “Bottom” on the schematic.

P/N signals are swapped to FPGA. Because of PCB layout.

Table 7-4 CN2 signals connection

CN2 Side	Signal Name	FMC Side	
Pin No.		Pin No.	FMC Pin Name
15,16,	* 1 VCC_3P3V	-	-
1,10,11,14,17,20	GND	-	GND
2	SFP0_TX_FAULT	H13	LA07_P
3	SFP0_TX_DISABLE	G15	LA12_P
6	SFP0_MOD_ABS	H14	LA07_N
5	SFP0_SCL	G13	LA08_N
4	SFP0_SDA	D14	LA09_P
8	SFP0_RX_LOS	G12	LA08_P
18	DP_C2M_P8(TD+)	B28	DP8_C2M_P
19	DP_C2M_N8(TD-)	B29	DP8_C2M_N
13	DP_M2C_P8(RD+)	B8	DP8_M2C_P
12	DP_M2C_N8(RD-)	B9	DP8_M2C_N
7	RS0(connect to GND)		
9	RS1(connect to GND)		

Notice: 3.3V Power is provided from main board.

Table 7-5 CN3 signals connection

CN2 Side	Signal Name	FMC Side	
Pin No.		Pin No.	FMC Pin Name
15,16,	* 1 VCC_3P3V	-	-
1,10,11,14,17,20	GND	-	GND
2	SFP1_TX_FAULT	D15	LA09_N
3	SFP1_TX_DISABLE	G16	LA12_N
6	SFP1_MOD_ABS	C14	LA10_P
5	SFP1_SCL	H16	LA11_P
4	SFP1_SDA	H17	LA11_N
8	SFP1_RX_LOS	C15	LA10_N
18	DP_C2M_P9(TD+)	B24	DP9_C2M_P
19	DP_C2M_N9(TD-)	B25	DP9_C2M_N
13	DP_M2C_P9(RD+)	B4	DP9_M2C_P
12	DP_M2C_N9(RD-)	B5	DP9_M2C_N
7	RS0(connect to GND)		
9	RS1(connect to GND)		

Notice: 3.3V Power is provided from main board.

8. Appendix

	K	J	H	G	F	E	D	C	B	A
1	VREF_B_M2C	GND	VREF_A_M2C	GND	PG_M2C	GND	PG_C2M	GND	RES1	GND
2	GND	CLK3_M2C_P	PRSNT_M2C_L	CLK1_M2C_P	GND	HA01_P_CC	GND	DP0_C2M_P	GND	DP1_M2C_P
3	GND	CLK3_M2C_N	GND	CLK1_M2C_N	GND	HA01_N_CC	GND	DP0_C2M_N	GND	DP1_M2C_N
4	CLK2_M2C_P	GND	CLK0_M2C_P	GND	HA00_P_CC	GND	GBTCLK0_M2C_P	GND	DP9_M2C_P	GND
5	CLK2_M2C_N	GND	CLK0_M2C_N	GND	HA00_N_CC	GND	GBTCLK0_M2C_N	GND	DP9_M2C_N	GND
6	GND	HA03_P	GND	LA00_P_CC	GND	HA05_P	GND	DP0_M2C_P	GND	DP2_M2C_P
7	HA02_P	HA03_N	LA02_P	LA00_N_CC	HA04_P	HA05_N	GND	DP0_M2C_N	GND	DP2_M2C_N
8	HA02_N	GND	LA02_N	GND	HA04_N	GND	LA01_P_CC	GND	DP8_M2C_P	GND
9	GND	HA07_P	GND	LA03_P	GND	HA09_P	LA01_N_CC	GND	DP8_M2C_N	GND
10	HA06_P	HA07_N	LA04_P	LA03_N	HA08_P	HA09_N	GND	LA06_P	GND	DP3_M2C_P
11	HA06_N	GND	LA04_N	GND	HA08_N	GND	LA05_P	LA06_N	GND	DP3_M2C_N
12	GND	HA11_P	GND	LA08_P	GND	HA13_P	LA05_N	GND	DP7_M2C_P	GND
13	HA10_P	HA11_N	LA07_P	LA08_N	HA12_P	HA13_N	GND	GND	DP7_M2C_N	GND
14	HA10_N	GND	LA07_N	GND	HA12_N	GND	LA09_P	LA10_P	GND	DP4_M2C_P
15	GND	HA14_P	GND	LA12_P	GND	HA16_P	LA09_N	LA10_N	GND	DP4_M2C_N
16	HA17_P_CC	HA14_N	LA11_P	LA12_N	HA15_P	HA16_N	GND	GND	DP6_M2C_P	GND
17	HA17_N_CC	GND	LA11_N	GND	HA15_N	GND	LA13_P	GND	DP6_M2C_N	GND
18	GND	HA18_P	GND	LA16_P	GND	HA20_P	LA13_N	LA14_P	GND	DP5_M2C_P
19	HA21_P	HA18_N	LA15_P	LA16_N	HA19_P	HA20_N	GND	LA14_N	GND	DP5_M2C_N
20	HA21_N	GND	LA15_N	GND	HA19_N	GND	LA17_P_CC	GND	GBTCLK1_M2C_P	GND
21	GND	HA22_P	GND	LA20_P	GND	HB03_P	LA17_N_CC	GND	GBTCLK1_M2C_N	GND
22	HA23_P	HA22_N	LA19_P	LA20_N	HB02_P	HB03_N	GND	LA18_P_CC	GND	DP1_C2M_P
23	HA23_N	GND	LA19_N	GND	HB02_N	GND	LA23_P	LA18_N_CC	GND	DP1_C2M_N
24	GND	HB01_P	GND	LA22_P	GND	HB05_P	LA23_N	GND	DP9_C2M_P	GND
25	HB00_P_CC	HB01_N	LA21_P	LA22_N	HB04_P	HB05_N	GND	GND	DP9_C2M_N	GND
26	HB00_N_CC	GND	LA21_N	GND	HB04_N	GND	LA26_P	LA27_P	GND	DP2_C2M_P
27	GND	HB07_P	GND	LA25_P	GND	HB09_P	LA26_N	LA27_N	GND	DP2_C2M_N
28	HB06_P_CC	HB07_N	LA24_P	LA25_N	HB08_P	HB09_N	GND	GND	DP8_C2M_P	GND
29	HB06_N_CC	GND	LA24_N	GND	HB08_N	GND	TCK	GND	DP8_C2M_N	GND
30	GND	HB11_P	GND	LA29_P	GND	HB13_P	TDI	SCL	GND	DP3_C2M_P
31	HB10_P	HB11_N	LA28_P	LA29_N	HB12_P	HB13_N	TDO	SDA	GND	DP3_C2M_N
32	HB10_N	GND	LA28_N	GND	HB12_N	GND	3P3VAUX	GND	DP7_C2M_P	GND
33	GND	HB15_P	GND	LA31_P	GND	HB19_P	TMS	GND	DP7_C2M_N	GND
34	HB14_P	HB15_N	LA30_P	LA31_N	HB16_P	HB19_N	TRST_L	GA0	GND	DP4_C2M_P
35	HB14_N	GND	LA30_N	GND	HB16_N	GND	GA1	12P0V	GND	DP4_C2M_N
36	GND	HB18_P	GND	LA33_P	GND	HB21_P	3P3V	GND	DP6_C2M_P	GND
37	HB17_P_CC	HB18_N	LA32_P	LA33_N	HB20_P	HB21_N	GND	12P0V	DP6_C2M_N	GND
38	HB17_N_CC	GND	LA32_N	GND	HB20_N	GND	3P3V	GND	GND	DP5_C2M_P
39	GND	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	DP5_C2M_N
40	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	RES0	GND
			LPC Connector	LPC Connector			LPC Connector	LPC Connector		

Figure 8-1 FMC(HPC) Pin Assign

TOKYO ELECTRON DEVICE

PLD Solution Dept. PLD Division
URL: **http://solutions.inrevium.com/**
E-mail: psd-support@teldevice.co.jp

HEAD Quarter: Yokohama East Square, 1-4 Kinko-cho, Kanagawa-ku, Yokohama City,
Kanagawa, Japan 221-0056
TEL: +81-45-443-4016 FAX: +81-45-443-4058