



FMC_FIREFLY_HT3

EH1701003011

Reference Manual

November 2017 ver0.1



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Revision History

Date	Rev	Comment
Nov 2017	v0	Initial version

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FMC_FIREFLY_HT3

IMPORTANT!

ESD



The HAPS®FMC_FIREFLY_HT3 Transceiver Card, as with all other electronic equipment, is sensitive to electrostatic discharge (ESD). When handling the transceiver card:

- Transport the card in an ESD bag
- Wear an anti-static wrist strap
- Make sure the work area is equipped with an ESD mat

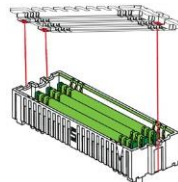
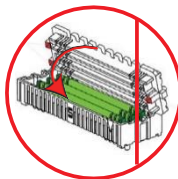
Warning

Never hot-plug interface cards, daughter boards or cables. Always power down the HAPS system when adding or removing a board, card, or cable to avoid damage to both the system and peripheral.

HapsTrak® 3 Connector Considerations

The HT3 connectors must be attached carefully! If connected improperly socket pins can be deformed or holding rail ends can become damaged.

When connecting daughter boards and HT3 cable connectors, they should be held parallel to the FMC_FIREFLY_HT3 connector throughout the mating process.



Overview

This document is the FMC_FIREFLY_HT3 Reference Manual and describes the functions of the FMC_FIREFLY_HT3 daughter board

The FMC_FIREFLY_HT3 daughter board includes three FireFly transceiver connectors that support up to ten high-speed serial links over three FireFly cables.

The FMC connector that provide a standard mezzanine card form factor, connectors, and modular interface to HAPs system through four HT3 connectors. Figure 1 shows a standard mezzanine card with a HAPS-80 system.



Figure 1: FMC_FIREFLY_HT3 mounted on HAPS-80 system.

FMC_FIREFLY_HT3 daughter board consists of:

- 1 HAPS 10-pin 3.3V-level GPIO Headers
- 4 High-Speed 10-pin VCCO-level GPIO Headers
- 1 HPC FMC Connector
- 4 HT3 Connectors
- 3 FIREFLY Connectors
- 4 pairs of Differential MMCX Clock Connectors (2 pairs for HT3 output)

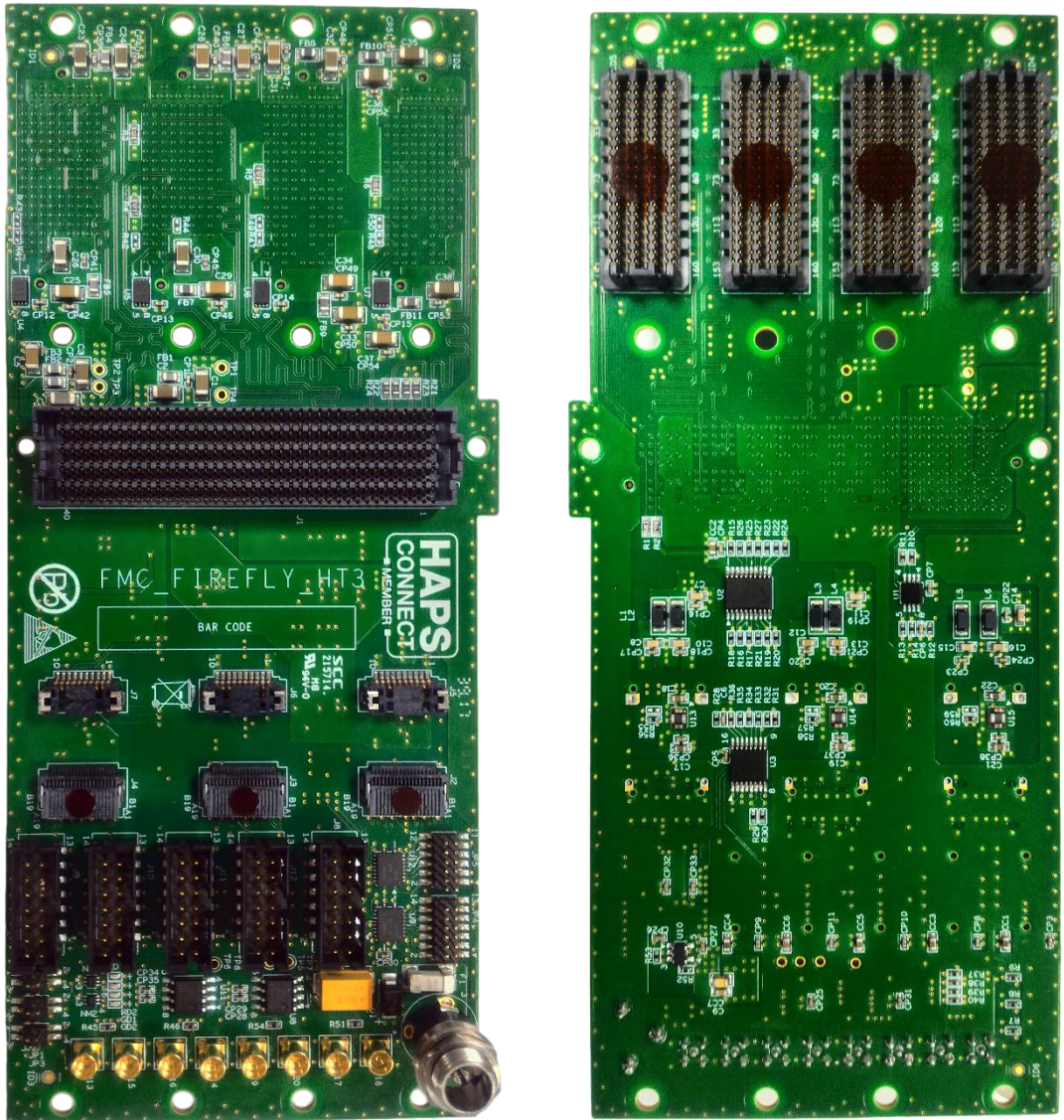


Figure 1.1: Top and Bottom View of FMC_FIREFLY_HT3

Layout

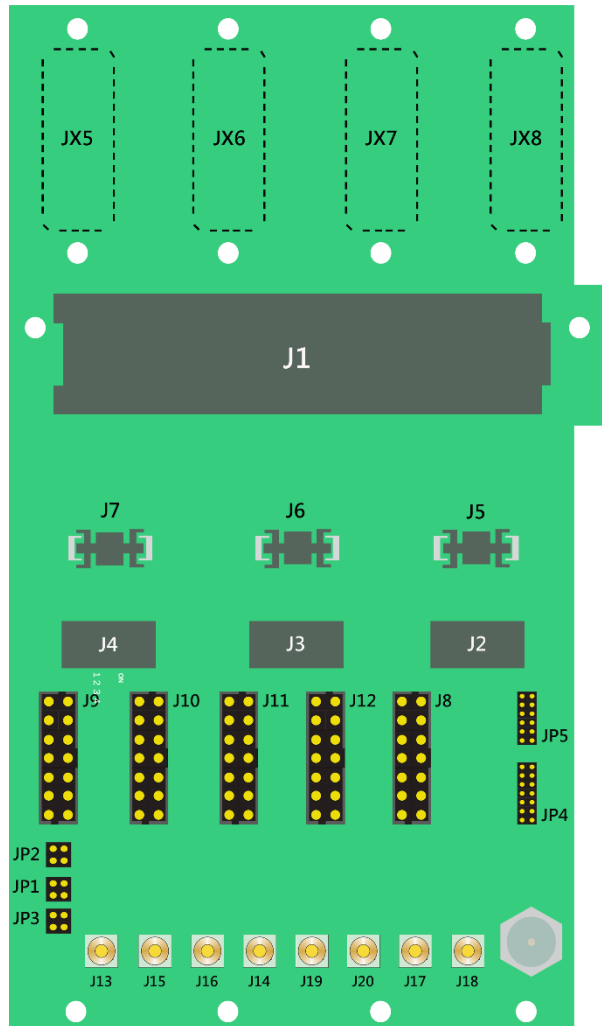


Figure 2: Top and Bottom (dotted line) FMC_FIREFLY_HT3 Card Layout

Block Diagram

Figures 3 and 4 show the connectivity between the FMC_FIREFLY_HT3 daughterboard's headers and connectors to the HT3 and FMC connector. The I/O pins mapping are described on [page 19](#).

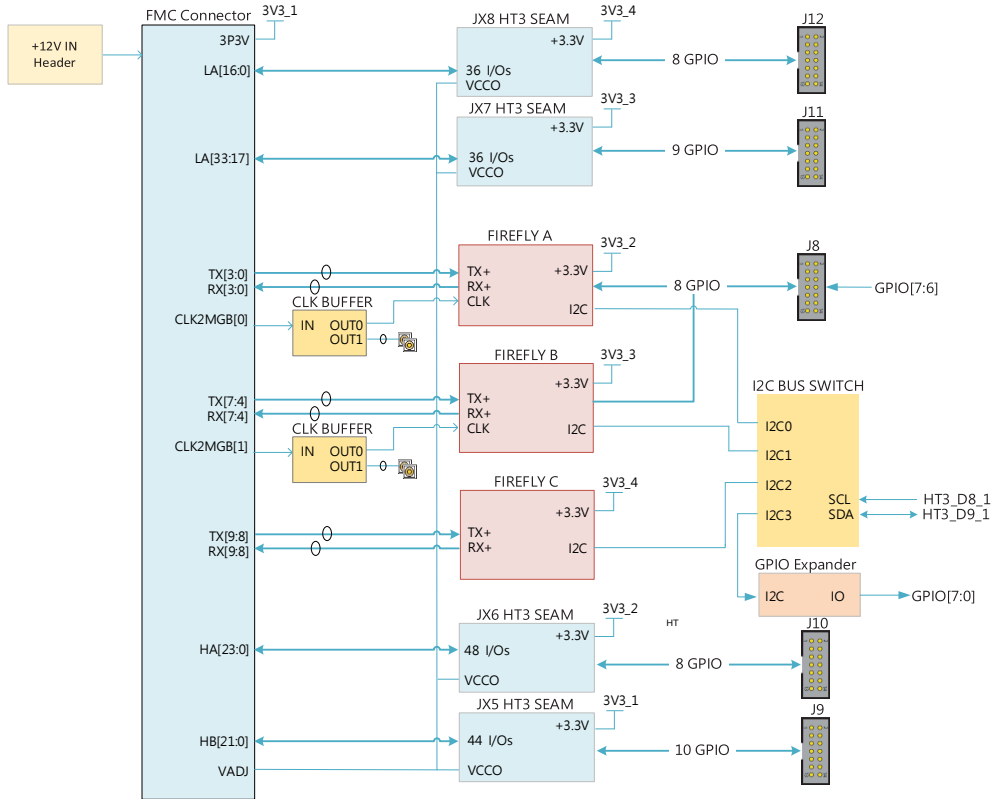


Figure 3: FMC_FIREFLY_HT3 Block Diagram

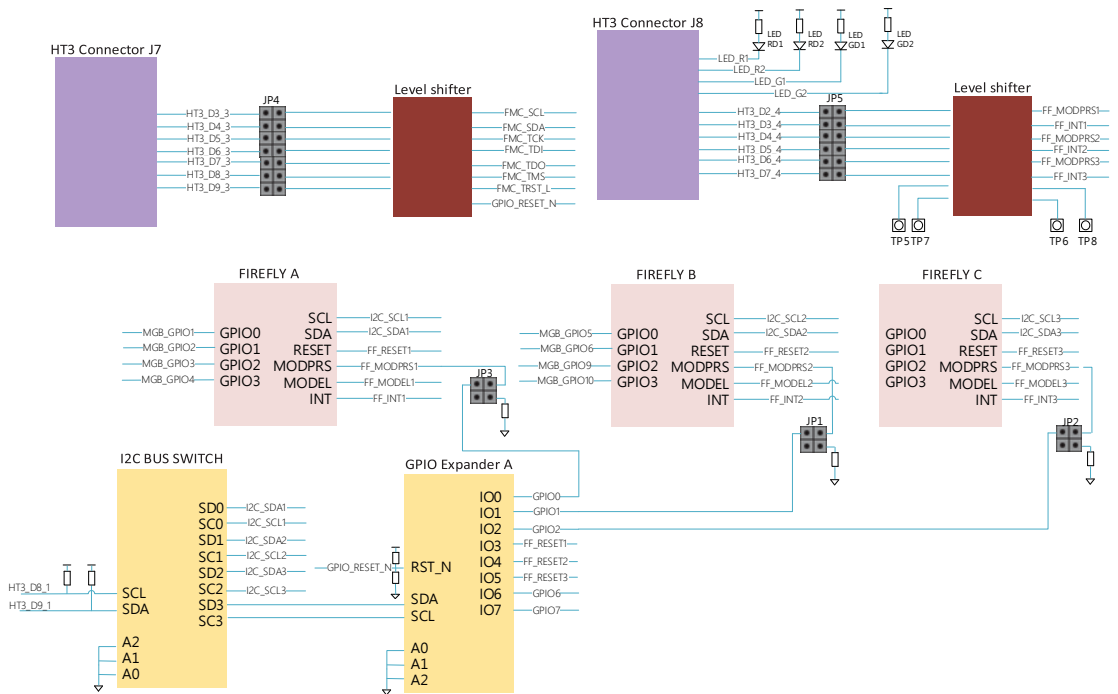


Figure 4: I/O Block Diagram

Card Placement

HAPS-80

HAPS-80 systems include 24 HT3 Connector for each FPGA. The Haps Trak 3 (HT3) is a 160-pin connector containing 52 signal pins, most of which can be used for single ended or differential signaling. All signals in a connector are associated with the same FPGA I/O bank voltage (VCCO). The I/O voltage dictates which electrical I/O standards can be used for the signal pins.

The FMC_FIREFLY_HT3 card connected to HAPS-80 through four HT3 connectors, Figure 4 is the example of card installed

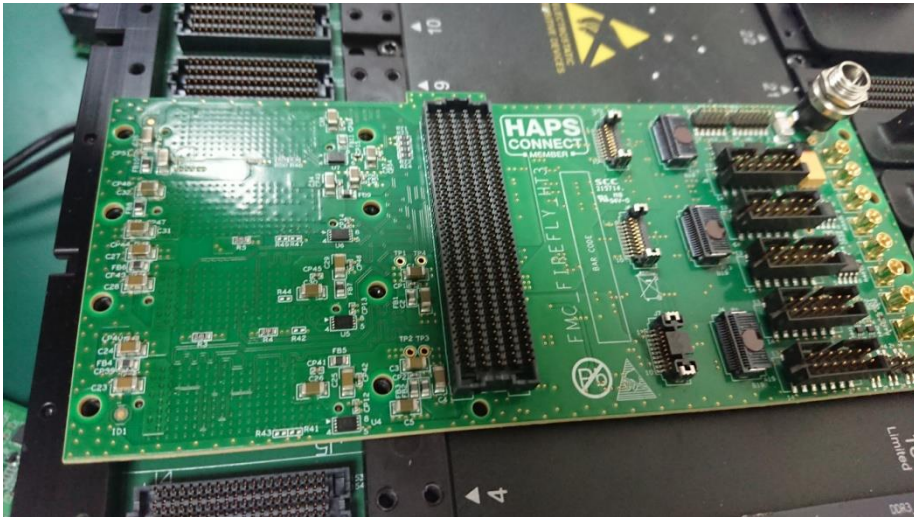


Figure 5: FMC_FIREFLY_HT3 Card Installed on HAPS-80 system

HAPS GPIO Headers

Standard 3.3V GPIO Headers

Connectors J8 is standard 3.3V level HAPS GPIO Headers. The I/O pins mapping are described on [page 26](#).

The GPIO headers are available for any design specific application including:

- HAPS BIO1 Board
- I2C/SPI host adapter to access debug logic inside the FPGA (adapter cable may be required)
- Pmod modules (adapter cable required for module connectors)

Part Number: 87832-1420

High-Speed VCCO GPIO Headers

Special high-speed VCCO level GPIO headers (J9, J10, J11 and J12) allow access to HT3 I/O signals at a VCCO level. The I/O pins mapping are described on [page 26](#).

Note: All pins in the high-speed VCCO GPIO headers are directly connected to HT3 I/O pins, therefore caution is advised.

To create a cable for accessing the signals use a Male-on-Wire Connector from Tyco.

Part Number: 87832-1420

Jumpers and Headers

Jumpers provide different configuration options dependent on the user requirements. The FMC_FIREFLY_HT3 has Three 2x2 jumpers, one 2x6 jumpers and one 2x7 jumpers. Refer to the I/O Block Diagram in [Figure 4, on page 11](#).

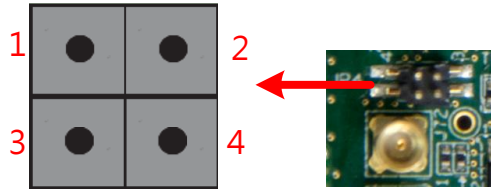


Figure 6: Header Strip

JP1-JP3 is populated by jumpers that connect FireFly transceiver module control signals (FF_MODPRS1, FF_MODPRS2, FF_MODPRS3) directly to Output signals of GPIO expander.

JP4-JP5 is populated by jumpers that connect FMC and FireFly module control signals directly to HT3 I/O signals.

If these signals are not used to generate the control signals, the pins can be accessed for design-specific use directly from header JP1-JP5. Tables 1 and Tables 2 list various ways of connecting the control signals using jumper headers available on the FMC_FIREFLY_HT3 card

Control Pin	Jumper	Source Configuration
FF_MODPRS1	JP3	Pin 1-2: GPIO0 when JP3 pin 1-2
	JP5	Pin 1-2: HT3_D2_4 when JP5 pin 1-2
FF_MODPRS2	JP1	Pin 1-2: GPIO1 when JP1 pin 1-2
	JP5	Pin 5-6: HT3_D4_4 when JP5 pin 5-6
FF_MODPRS3	JP2	Pin 1-2: GPIO2 when JP2 pin 1-2
	JP5	Pin 9-10: HT3_D6_4 when JP5 pin 9-10
FF_INT1	JP5	Pin 3-4: HT3_D3_4 when JP5 pin 3-4
FF_INT1	JP5	Pin 7-8: HT3_D5_4 when JP5 pin 7-8
FF_INT1	JP5	Pin 11-12: HT3_D7_4 when JP5 pin 11-12

Table 1: FireFly module Control Signals

Control Pin	Jumper	Source Configuration
FMC_SCL	JP4	Pin 1-2: HT3_D3_3 when JP4 pin 1-2
FMC_SDA	JP4	Pin 3-4: HT3_D4_3 when JP4 pin 3-4
FMC_TCK	JP4	Pin 5-6: HT3_D5_3 when JP4 pin 5-6
FMC_TDI	JP4	Pin 7-8: HT3_D6_3 when JP4 pin 7-8
FMC_TDO	JP4	Pin 9-10: HT3_D7_3 when JP4 pin 9-10
FMC_TMS	JP4	Pin 11-12: HT3_D8_3 when JP4 pin 11-12
FMC_TRST_L	JP4	Pin 13-14: HT3_D9_3 when JP4 pin 13-14

Table 2: FMC module Control Signals

Clocks

MMCX connectors for clock connections between the user FPGA and other components in a hardware setup.

Output Clocks

Output clocks are internal signals (FPGA generated clocks or HAPS global clocks) that travel from the HAPS system through the FMC_FIREFLY_HT3 daughter board.

Access to the HAPS system's differential global clock (GCLK) signals are available through the Output clock SMB connector pairs on the FMC_FIREFLY_HT3 daughter board. Table 3 is a list of clock connections for each MMCX connector.

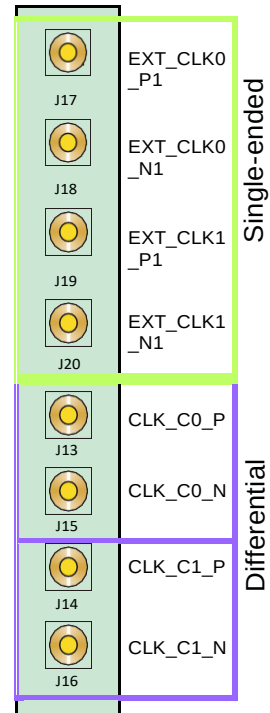


Figure 7: SE and DIFF Clocks

MMCX Connector	Differential or Single- ended	Direction	Source or Destination	
J13/J15	DIFF	Output	Source	HT3
J14/J16	DIFF	Output		HT3
J17	DIFF/SE	Output	Source	FMC
J18	DIFF/SE	Output		FMC
J19	DIFF/SE	Output		FMC
J20	DIFF/SE	Output		FMC

Table 3: MMCX Clock Connections

I2C BUS SWITCH and GPIO Expanders

I2C BUS SWITCH

I2C BUS SWITCH is a quad bi-directional translating switch controlled by the I2C bus.

The I2C upstream pair fans out to four downstream pairs.

Any individual channel can be selected, determined by the contents of the programmable Control Register. For additional information on the NXP PCA9544 4-channel I2C switch, refer to the PCA9544 data sheet on the <http://www.nxp.com> website.

Pin	Function	Note
SCL	HT3_D8_1	I2C BUS SWITCH upstream pair
SDA	HT3_D9_1	
SD0	I2C_SDA0	Downstream pair. The control interface to the FireFly A connector.
SC0	I2C_SCL0	
SD1	I2C_SDA1	Downstream pair. The control interface to the FireFly B connector.
SC1	I2C_SCL1	
SD2	I2C_SDA2	Downstream pair. The control interface to the FireFly C connector.
SC2	I2C_SCL2	
SD3	I2C_SDA3	Downstream pair. The control interface to the GPIO Expander.
SC3	I2C_SCL3	

Table 4: I2C BUS SWITCH I/O Pins

GPIO Expanders

There is a GPIO expander available for providing additional I/O capability.

For additional information on the NXP PCA9557 I/O expander and how to access the I/O ports, refer to the PCA9557 data sheet on the <http://www.nxp.com> website.

Pin	Function	Note
IO0	GPIO0	
IO1	GPIO1	
IO2	GPIO2	
IO3	FF_RESET1	
IO4	FF_RESET2	
IO5	FF_RESET3	
IO6	GPIO6	
IO7	GPIO7	

Table 5: GPIO Expander I/O Pins

LEDs

There are four LEDs on the FMC_FIREFLY_HT3. User-defined LEDs can be configured through HT3 connector J8 to use them according to specific user cases. Some LED inputs are shared with general use I/Os, see [Figure 4, on page 11](#).

LED	Connector	Pin	function
LED_RD1	HT3	D8	User configured
LED_RD2	HT3	D10	User configured
LED_GD1	HT3	D9	User configured
LED_GD2	HT3	D11	User configured

Table 6: LED Configuration Table

Pin Tables

J1 FMC Connector

	A	B	C	D	E	F	G	H	I	J
1	GND	CLK_DIR	GND		GND	+3V3_1	GND		GND	
2	TX_P1	GND	RX_P0	GND	HA_P_1	GND	CLK1_M2C_P	+3V3_1	CLK3_BIDIR_P	GND
3	TX_N1	GND	RX_N0	GND	HA_N_1	GND	CLK1_M2C_N	GND	CLK3_BIDIR_N	GND
4	GND	TX_P9	GND	CLK2MGB_P0	GND	HA_P_0	GND	CLK0_M2C_P	GND	CLK2_BIDIR_P
5	GND	TX_N9	GND	CLK2MGB_N0	GND	HA_N_0	GND	CLK0_M2C_N	GND	CLK2_BIDIR_N
6	TX_P2	GND	TX_P0	GND	HA_P_5	GND	LA_P_0	GND	HA_P_3	GND
7	TX_N2	GND	TX_N0	GND	HA_N_5	HA_P_4	LA_N_0	LA_P_2	HA_N_3	HA_P_2
8	GND	TX_P8	GND	LA_P_1	GND	HA_N_4	GND	LA_N_2	GND	HA_N_2
9	GND	TX_N8	GND	LA_N_1	HA_P_9	GND	LA_P_3	GND	HA_P_7	GND
10	TX_P3	GND	LA_P_6	GND	HA_N_9	HA_P_8	LA_N_3	LA_P_4	HA_N_7	HA_P_6
11	TX_N3	GND	LA_N_6	LA_P_5	GND	HA_N_8	GND	LA_N_4	GND	HA_N_6
12	GND	TX_P7	GND	LA_N_5	HA_P_13	GND	LA_P_8	GND	HA_P_11	GND
13	GND	TX_N7	GND	GND	HA_N_13	HA_P_12	LA_N_8	LA_P_7	HA_N_11	HA_P_10
14	TX_P4	GND	LA_P_10	LA_P_9	GND	HA_N_12	GND	LA_N_7	GND	HA_N_10
15	TX_N4	GND	LA_N_10	LA_N_9	HA_P_16	GND	LA_P_12	GND	HA_P_14	GND
16	GND	TX_P6	GND	GND	HA_N_16	HA_P_15	LA_N_12	LA_P_11	HA_N_14	HA_P_17
17	GND	TX_N6	GND	LA_P_13	GND	HA_N_15	GND	LA_N_11	GND	HA_N_17
18	TX_P5	GND	LA_P_14	LA_N_13	HA_P_20	GND	LA_P_16	GND	HA_P_18	GND
19	TX_N5	GND	LA_N_14	GND	HA_N_20	HA_P_19	LA_N_16	LA_P_15	HA_N_18	HA_P_21
20	GND	CLK2MGB_P1	GND	LA_P_17	GND	HA_N_19	GND	LA_N_15	GND	HA_N_21
21	GND	CLK2MGB_N1	GND	LA_N_17	HB_P_3	GND	LA_P_20	GND	HA_P_22	GND
22	RX_P1	GND	LA_P_18	GND	HB_N_3	HB_P_2	LA_N_20	LA_P_19	HA_N_22	HA_P_23
23	RX_N1	GND	LA_N_18	LA_P_23	GND	HB_N_2	GND	LA_N_19	GND	HA_N_23
24	GND	RX_P9	GND	LA_N_23	HB_P_5	GND	LA_P_22	GND	HB_P_1	GND
25	GND	RX_N9	GND	GND	HB_N_5	HB_P_4	LA_N_22	LA_P_21	HB_N_1	HB_P_0
26	RX_P2	GND	LA_P_27	LA_P_26	GND	HB_N_4	GND	LA_N_21	GND	HB_N_0
27	RX_N2	GND	LA_N_27	LA_N_26	HB_P_9	GND	LA_P_25	GND	HB_P_7	GND
28	GND	RX_P8	GND	GND	HB_N_9	HB_P_8	LA_N_25	LA_P_24	HB_N_7	HB_P_6
29	GND	RX_N8	GND	FMC_TCK	GND	HB_N_8	GND	LA_N_24	GND	HB_N_6
30	RX_P3	GND	FMC_SCL	FMC_TDI	HB_P_13	GND	LA_P_29	GND	HB_P_11	GND
31	RX_N3	GND	FMC_SDA	FMC_TDO	HB_N_13	HB_P_12	LA_N_29	LA_P_28	HB_N_11	HB_P_10
32	GND	RX_P7	GND	FMC_3V3	GND	HB_N_12	GND	LA_N_28	GND	HB_N_10
33	GND	RX_N7	GND	FMC_TMS	HB_P_19	GND	LA_P_31	GND	HB_P_15	GND
34	RX_P4	GND	GND	FMC_TRST_L	HB_N_19	HB_P_16	LA_N_31	LA_P_30	HB_N_15	HB_P_14
35	RX_N4	GND	FMC_12V	GND	GND	HB_N_16	GND	LA_N_30	GND	HB_N_14
36	GND	RX_P6	GND	FMC_3V3	HB_P_21	GND	LA_P_33	GND	HB_P_18	GND
37	GND	RX_N6	FMC_12V	GND	HB_N_21	HB_P_20	LA_N_33	LA_P_32	HB_N_18	HB_P_17
38	RX_P5	GND	GND	FMC_3V3	GND	HB_N_20	GND	LA_N_32	GND	HB_N_17
39	RX_N5	GND	FMC_3V3	GND	FMC_VADJ	GND	FMC_VADJ	GND	FMC_VIO_B_M2C	GND
40	GND		GND	FMC_3V3	GND	FMC_VADJ	GND	FMC_VADJ	GND	FMC_VIO_B_M2C

FIREFLY Connector

FireFly Connector J2/J3/J4 to FMC Connector J1 and header J8

Connector J2		FMC J1	Header J8
Pin	Trace Name	Pin	Pin
A1	GND		
A2	TX_N0	C7	
A3	TX_P0	C6	
A4	GND		
A5	TX_N2	A7	
A6	TX_P2	A6	
A7	GND		
A8			
A9			
A10	GND		
A11	MGB_GPIO2		4
A12	MGB_GPIO1		3
A13	GND		
A14	RX_P3	A30	
A15	RX_N3	A31	
A16	GND		
A17	RX_P1	A22	
A18	RX_N1	A23	
A19	GND		
B1	GND		
B2	TX_N1	A3	
B3	TX_P1	A2	
B4	GND		
B5	TX_N3	A11	
B6	TX_P3	A10	
B7	GND		
B8	CLK2MGB_P0	D4	
B9	CLK2MGB_N0	D5	
B10	GND		
B11	MGB_GPIO4		6
B12	MGB_GPIO3		5
B13	GND		
B14	RX_P2	A26	
B15	RX_N2	A27	
B16	GND		
B17	RX_P0	C2	
B18	RX_N0	C3	
B19	GND		

Connector J3		FMC J1	Header J8
Pin	Trace Name	Pin	Pin
A1	GND		
A2	TX_N4	A15	
A3	TX_P4	A14	
A4	GND		
A5	TX_N6	B17	
A6	TX_P6	B16	
A7	GND		
A8			
A9			
A10	GND		
A11	MGB_GPIO6		8
A12	MGB_GPIO5		7
A13	GND		
A14	RX_P7	B32	
A15	RX_N7	B33	
A16	GND		
A17	RX_P5	A38	
A18	RX_N5	A39	
A19	GND		
B1	GND		
B2	TX_N5	A19	
B3	TX_P5	A18	
B4	GND		
B5	TX_N7	B13	
B6	TX_P7	B12	
B7	GND		
B8	CLK2MGB_P1	B20	
B9	CLK2MGB_N2	B21	
B10	GND		
B11	MGB_GPIO10		10
B12	MGB_GPIO9		9
B13	GND		
B14	RX_P6	B36	
B15	RX_N6	B37	
B16	GND		
B17	RX_P4	A34	
B18	RX_N4	A35	
B19	GND		

FireFly Connector J4 to FMC Connector J1

Connector J4		FMC J1
Pin	Trace Name	Pin
A1	GND	
A2	TX_N8	B9
A3	TX_P8	B8
A4	GND	
A5	-	
A6	-	
A7	GND	
A8	-	
A9	-	
A10	GND	
A11	-	
A12	-	
A13	GND	
A14	-	
A15	-	
A16	GND	
A17	RX_P9	B24
A18	RX_N9	B25
A19	GND	
B1	GND	
B2	TX_N9	B4
B3	TX_P9	B5
B4	GND	
B5	-	
B6	-	
B7	GND	
B8	-	
B9	-	
B10	GND	
B11	-	
B12	-	
B13	GND	
B14	-	
B15	-	
B16	GND	
B17	RX_P8	B28
B18	RX_N8	B29
B19	GND	

HT3 Connectors

JX5

JX5									
(A0-B13)					(C0-C1P)				
Pin	Trace Name	Connector			Pin	Trace Name	Connector		
A0	HB_P_0	J1	3.3V		C0	HB_P_17	J1	3.3V	
A1	HB_N_0				C1	HB_N_17			
A2	HB_P_1				C2	HB_P_12			
A3	HB_N_1				C3	HB_N_12			
A4	HB_P_2				C4	HB_P_13			
A5	HB_N_2				C5	HB_N_13			
A6	HB_P_3				C6	HB_P_14			
A7	HB_N_3				C7	HB_N_14			
A8	HB_P_4				C8	HB_P_15			
A9	HB_N_4				C9	HB_N_15			
A10	HB_P_5				C10	HB_P_16			
A11	HB_N_5				C11	HB_N_16			
A12	HT3_A12_1	J9	VCCO		C12	HT3_C12_1	J9	VCCO	
A13	HT3_A13_1				C13	HT3_C13_1			
B0	HB_P_6	J1	3.3V		D0	HB_P_18	J1	3.3V	
B1	HB_N_6				D1	HB_N_18			
B2	HB_P_7				D2	HB_P_19			
B3	HB_N_7				D3	HB_N_19			
B4	HB_P_8				D4	HB_P_20			
B5	HB_N_8				D5	HB_N_20			
B6	HB_P_9				D6	HB_P_21			
B7	HB_N_9				D7	HB_N_21			
B8	HB_P_10				D8	HT3_D8_1	U1	VCCO	
B9	HB_N_10				D9	HT3_D9_1			
B10	HB_P_11				D10	HT3_D10_1	J9	VCCO	
B11	HB_N_11				D11	HT3_D11_1			
B12	HT3_B12_1	J9	VCCO		D12	HT3_D12_1			
B13	HT3_B13_1				D13	HT3_D13_1			
					C0N	CLK_C0_N	J15	VCCO	DIFF
					C0P	CLK_C0_P	J13		
					C1N	CLK_C1_N	J16		
					C1P	CLK_C1_P	J14		

	J1 FMC
	J9 GPIO header
	J12/J13/J15/J17 Differential Clock
	U1 VOLT-LEVEL TRANSLATOR

JX6

JX6									
(A0-B13)					(C0-C1P)				
Pin	Trace Name	Connector			Pin	Trace Name	Connector		
A0	HA_P_0	J1	3.3V		C0	HA_P_17	J1	3.3V	
A1	HA_N_0				C1	HA_N_17			
A2	HA_P_2				C2	HA_P_12			
A3	HA_N_2				C3	HA_N_12			
A4	HA_P_3				C4	HA_P_13			
A5	HA_N_3				C5	HA_N_13			
A6	HA_P_4				C6	HA_P_14			
A7	HA_N_4				C7	HA_N_14			
A8	HA_P_5				C8	HA_P_15			
A9	HA_N_5				C9	HA_N_15			
A10	HA_P_6				C10	HA_P_16			
A11	HA_N_6				C11	HA_N_16			
A12	HT3_A12_2	J10	VCCO		C12	HT3_C12_2	J10	VCCO	
A13	HT3_A13_2				C13	HT3_C13_2			
B0	HA_P_1	J1	3.3V		D0	HA_P_18	J1	3.3V	
B1	HA_N_1				D1	HA_N_18			
B2	HA_P_7				D2	HA_P_19			
B3	HA_N_7				D3	HA_N_19			
B4	HA_P_8				D4	HA_P_20			
B5	HA_N_8				D5	HA_N_20			
B6	HA_P_9				D6	HA_P_21			
B7	HA_N_9				D7	HA_N_21			
B8	HA_P_10				D8	HA_P_22			
B9	HA_N_10				D9	HA_N_22			
B10	HA_P_11				D10	HA_P_23			
B11	HA_N_11				D11	HA_N_23			
B12	HT3_B12_2	J10	VCCO		D12	HT3_D12_2	J10	VCCO	
B13	HT3_B13_2				D13	HT3_D13_2			
					C0N				
					C0P				
					C1N				
					C1P				

J1 FMC
 J10 GPIO header

JX7

JX7

(A0-B13)					(C0-C1P)					
Pin	Trace Name	Connector			Pin	Trace Name	Connector			
A0	LA_P_17	J1	3.3V		C0	CLK1_M2C_P	J1	3.3V	DIFF	
A1	LA_N_17				C1	CLK1_M2C_N				
A2	LA_P_19				C2	LA_P_29				
A3	LA_N_19				C3	LA_N_29				
A4	LA_P_20				C4	LA_P_30				
A5	LA_N_20				C5	LA_N_30				
A6	LA_P_21				C6	LA_P_31				
A7	LA_N_21				C7	LA_N_31				
A8	LA_P_22				C8	LA_P_32				
A9	LA_N_22				C9	LA_N_32				
A10	LA_P_23				C10	LA_P_33				
A11	LA_N_23				C11	LA_N_33				
A12	HT3_A12_3	J11	VCCO		C12	HT3_C12_3	J11	VCCO		
A13	HT3_A13_3				C13	HT3_C13_3				
B0	LA_P_18	J1	3.3V		D0	CLK3_BIDIR_P	J1	3.3V	DIFF	
B1	LA_N_18				D1	CLK3_BIDIR_N				
B2	LA_P_24				D2	CLK_DIR_VADJ	U10	VCCO		
B3	LA_N_24				D3	HT3_D3_3	U9	VCCO		
B4	LA_P_25				D4	HT3_D4_3				
B5	LA_N_25				D5	HT3_D5_3				
B6	LA_P_26				D6	HT3_D6_3				
B7	LA_N_26				D7	HT3_D7_3				
B8	LA_P_27				D8	HT3_D8_3				
B9	LA_N_27				D9	HT3_D9_3				
B10	LA_P_28				D10	HT3_D10_3				
B11	LA_N_28				D11	HT3_D11_3	J11	VCCO		
B12	HT3_B12_3	J11	VCCO		D12	HT3_D12_3				
B13	HT3_B13_3				D13	HT3_D13_3				
					C0N					
					C0P					
					C1N					
					C1P					

J1 FMC

J11 GPIO header

U9 Level-Shifting

U10 CLK FIR

JX8

JX8

(A0-B13)					(C0-C1P)					
Pin	Trace Name	Connector				Pin	Trace Name	Connector		
A0	LA_P_0	J1	3.3V			C0	CLK0_M2C_P	J1	3.3V	DIFF
A1	LA_N_0					C1	CLK0_M2C_N			
A2	LA_P_2					C2	LA_P_12			
A3	LA_N_2					C3	LA_N_12			
A4	LA_P_3					C4	LA_P_13			
A5	LA_N_3					C5	LA_N_13			
A6	LA_P_4					C6	LA_P_14			
A7	LA_N_4					C7	LA_N_14			
A8	LA_P_5					C8	LA_P_15			
A9	LA_N_5					C9	LA_N_15			
A10	LA_P_6					C10	LA_P_16			
A11	LA_N_6					C11	LA_N_16			
A12	HT3_A12_4	J12	VCCO		C12	HT3_C12_4	J12	VCCO		
A13	HT3_A13_4				C13	HT3_C13_4				
B0	LA_P_1	J1	3.3V		D0	CLK2_BIDIR_P	J1	3.3V	DIFF	
B1	LA_N_1				D1	CLK2_BIDIR_N				
B2	LA_P_7				U12	VCCO		D2	HT3_D2_4	
B3	LA_N_7							D3	HT3_D3_4	
B4	LA_P_8							D4	HT3_D4_4	
B5	LA_N_8							D5	HT3_D5_4	
B6	LA_P_9							D6	HT3_D6_4	
B7	LA_N_9							D7	HT3_D7_4	
B8	LA_P_10				D8	LED_R1	RD1	3.3V		
B9	LA_N_10				D9	LED_G1	GD1			
B10	LA_P_11				D10	LED_R2	RD2			
B11	LA_N_11				D11	LED_G2	GD2	J12	VCCO	
B12	HT3_B12_4	J12	VCCO	D12	HT3_D12_4					
B13	HT3_B13_4			D13	HT3_D13_4					
					C0N					
					C0P					
					C1N					
					C1P					

J1 FMC

J12 GPIO header

U12 Level-Shifting

RD1/RD2/GD1/GD2 LED

GPIO Connectors

J8 3.3V

Pin	Trace Name
1	+3V3_1
2	GND
3	MGB_GPIO1
4	MGB_GPIO2
5	MGB_GPIO3
6	MGB_GPIO4
7	MGB_GPIO5
8	MGB_GPIO6
9	MGB_GPIO9
10	MGB_GPIO10
11	GPIO7
12	GPIO6
13	GND
14	GND

J9 VCCO

Pin	Trace Name
1	VCCO_1
2	GND
3	HT3_A13_1
4	HT3_A12_1
5	HT3_B13_1
6	HT3_B12_1
7	HT3_C13_1
8	HT3_C12_1
9	HT3_D11_1
10	HT3_D10_1
11	HT3_D13_1
12	HT3_D12_1
13	GND
14	GND

J10 VCCO

Pin	Trace Name
1	VCCO_2
2	GND
3	HT3_A13_2
4	HT3_A12_2
5	HT3_B13_2
6	HT3_B12_2
7	HT3_C13_2
8	HT3_C12_2
9	HT3_D13_2
10	HT3_D12_2
11	-
12	-
13	GND
14	GND

J11 VCCO

Pin	Trace Name
1	VCCO_3
2	GND
3	HT3_A13_3
4	HT3_A12_3
5	HT3_B13_3
6	HT3_B12_3
7	HT3_C13_3
8	HT3_C12_3
9	HT3_D11_3
10	HT3_D12_3
11	HT3_D13_3
12	-
13	GND
14	GND

J12 VCCO

Pin	Trace Name
1	VCCO_4
2	GND
3	HT3_A13_4
4	HT3_A12_4
5	HT3_B13_4
6	HT3_B12_4
7	HT3_C13_4
8	HT3_C12_4
9	HT3_D13_4
10	HT3_D12_4
11	-
12	-
13	GND
14	GND