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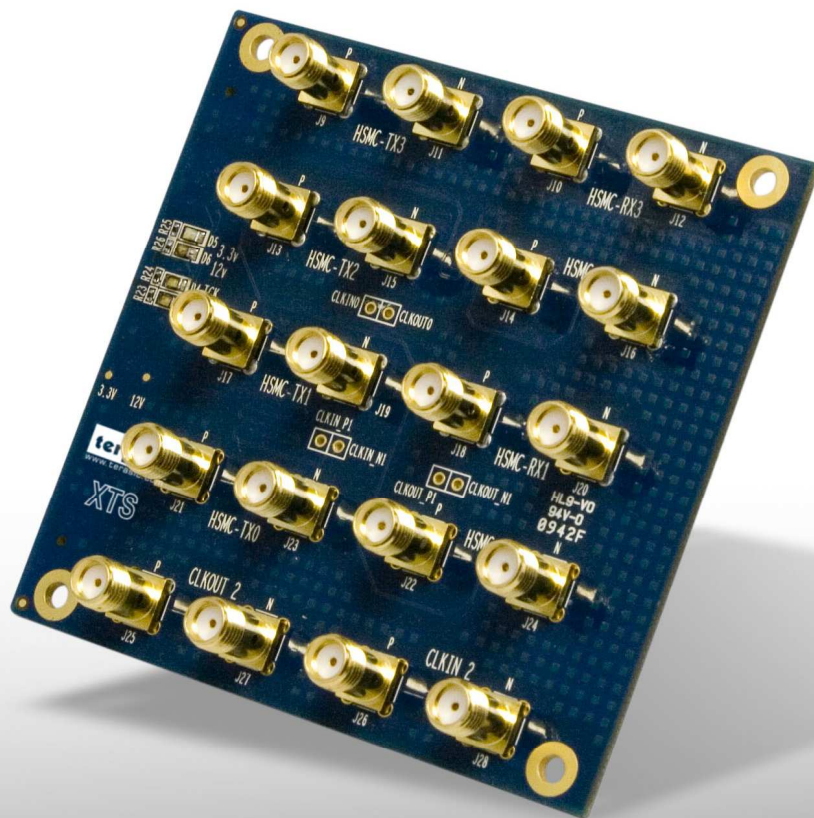
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# XTS

## Terasic XTS Daughter Card

### User Manual



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The XTS daughter card is designed to convert FPGA transceiver channels to SMA connectors through a High-Speed Mezzanine Connector (HSMC) interface. It is intended to allow users to evaluate the performance of transceiver-based host boards with HSMC interface specifically Stratix IV GX, Stratix II GX, Arria II GX, and Cyclone IV GX with integrated transceivers. Through the SMA connectors, the FPGA transceiver signals can be easily connected to measurement instruments as well as allowing gigabit data rate communication between multiple FPGA boards. The XTS daughter card is the ideal platform to allow users to prototype and test their high-speed interfaces quickly and easily in support of transceiver performance for jitter, protocol compliance, and equalization.

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## 1.1 Features

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Figure 1.1 shows the photo of the XTS card. The important functions of the XTS card are listed below:

- Convert transceiver channels to SMA connectors through HSMC interface
- Support 4 transceiver channels
- SMA connectors for PLL input and output differential clock
- Applicable for large volume applications that require high-speed (Gigabit) data transfer

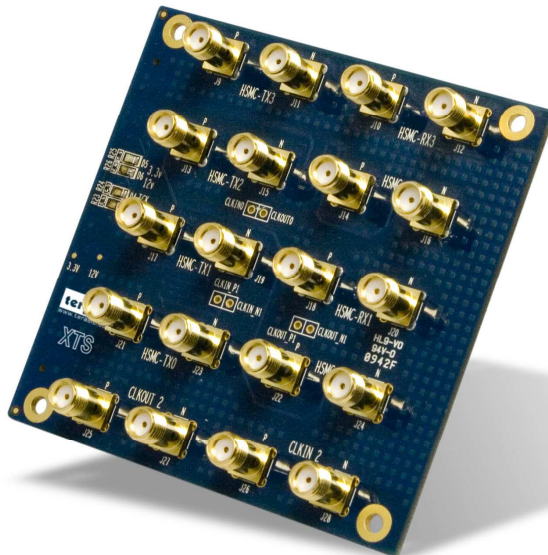


Figure 1.1. The picture of the XTS card

## 1.2 About the KIT

This section describes the package content

- XTS Card x 1
- System CD-ROM x 1

The CD contains technical documents of the XTS card

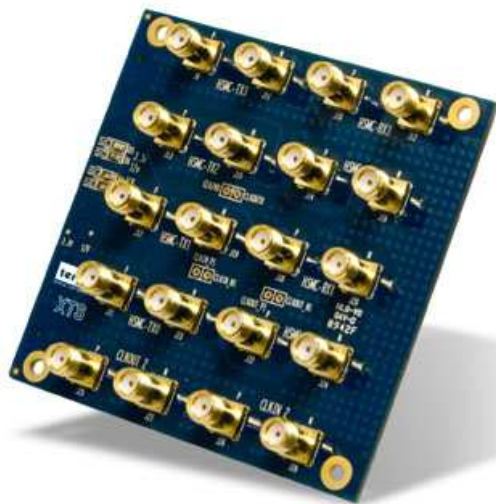


Figure 1.2 XTS Card Package

## 1.2 Getting Help

Here are some places to get help if you encounter any problem:

- ✓ Email to [support@terasic.com](mailto:support@terasic.com)
- ✓ Taiwan & China: +886-3-550-8800
- ✓ Korea : +82-2-512-7661
- ✓ Japan: +81-428-77-7000

This chapter describes the architecture of the XTS card including block diagram and components.

## 2.1 Layout and Componets

The picture of the XTS is shown in Figure 2.1 and Figure 2.2. It depicts the layout of the board and indicates the locations of the connectors and key components.

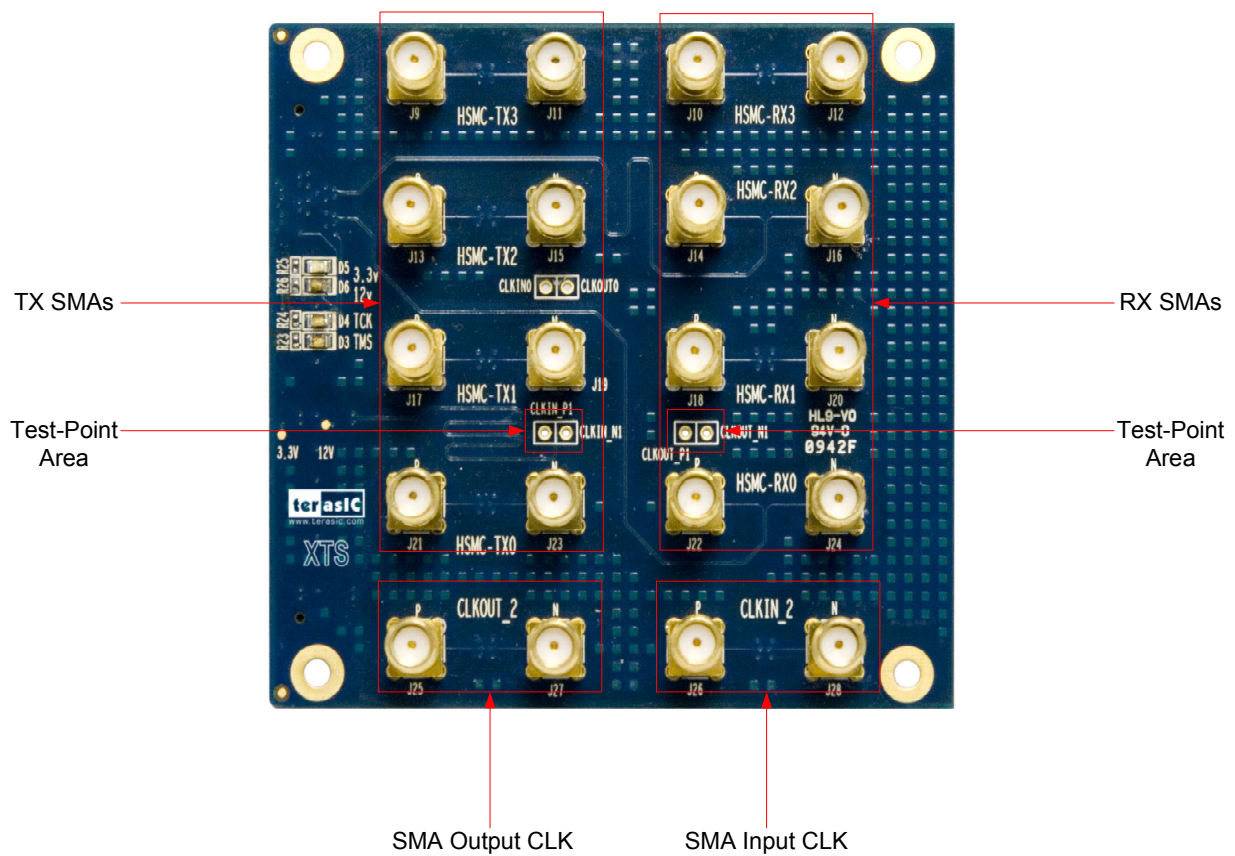


Figure 2.1 The XTS Card PCB and component diagram

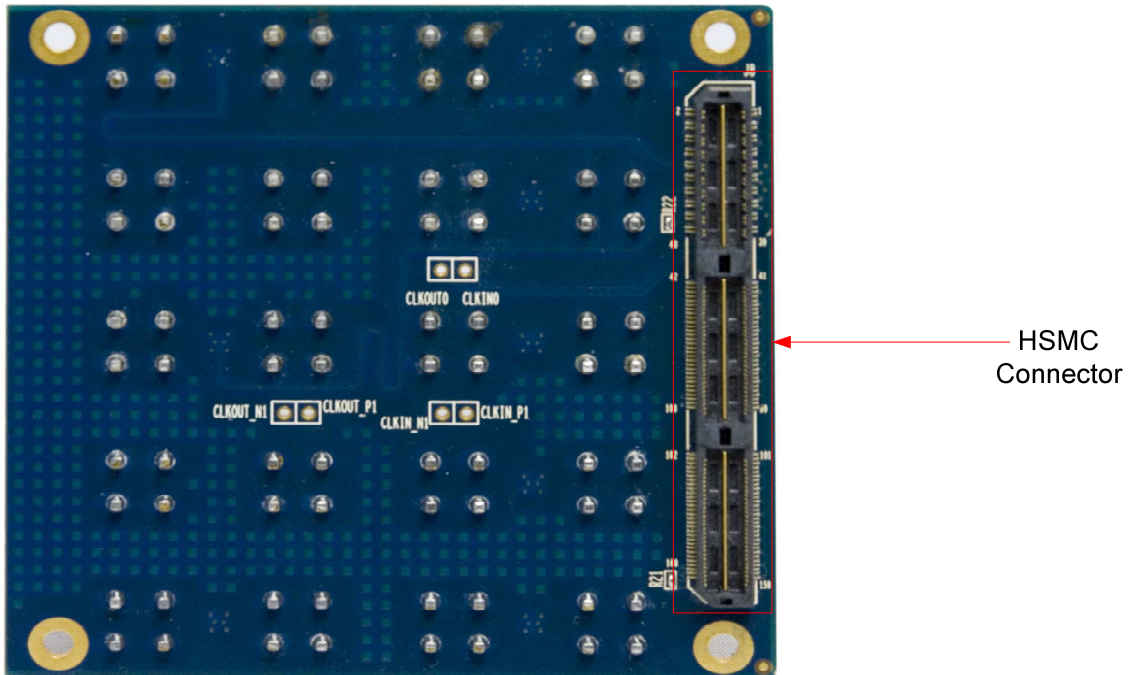


Figure 2.2 The XTS card back side – HSMC connector view

The following components are provided on the XTS card :

- HSMC expansion connector (J8)
- TX SMAs (J9,J11,J13,J15,J17,J19,J21,J23)
- RX SMAs (J10,J12,J14,J16,J18,J20,J22,J24)
- SMA Output CLK (J25,J27)
- SMA Input CLK (J26,J28)

## 2.2 Block Diagram

Figure 2.3 shows the block diagram of the XTS card.

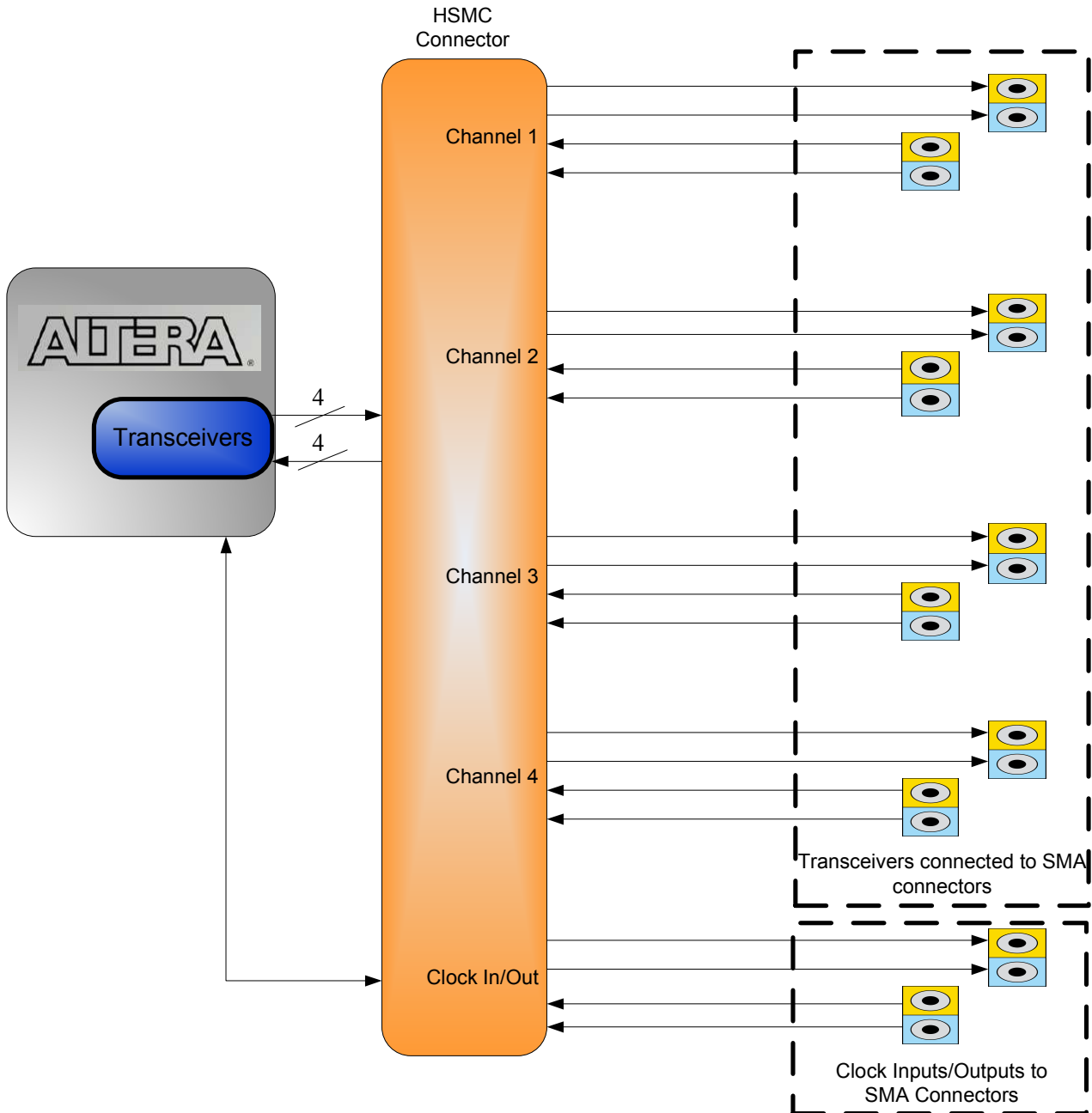


Figure 2.3. The block diagram of the XTS Card



This section will describe the detailed information of the components, connector interfaces, and the pin mappings on the XTS card.

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## 3.1 HSMC Expansion Connector

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This section describes the HSMC connector on the XTS card

The XTS card contains an Altera standard HSMC connector. All the other interfaces on the XTS card are connected to the HSMC connector. Figure 3.1 shows the pin-outs of the HSMC connector and Table 3.1 lists the description of each signals corresponding to the HSMC connector.

# Board Components

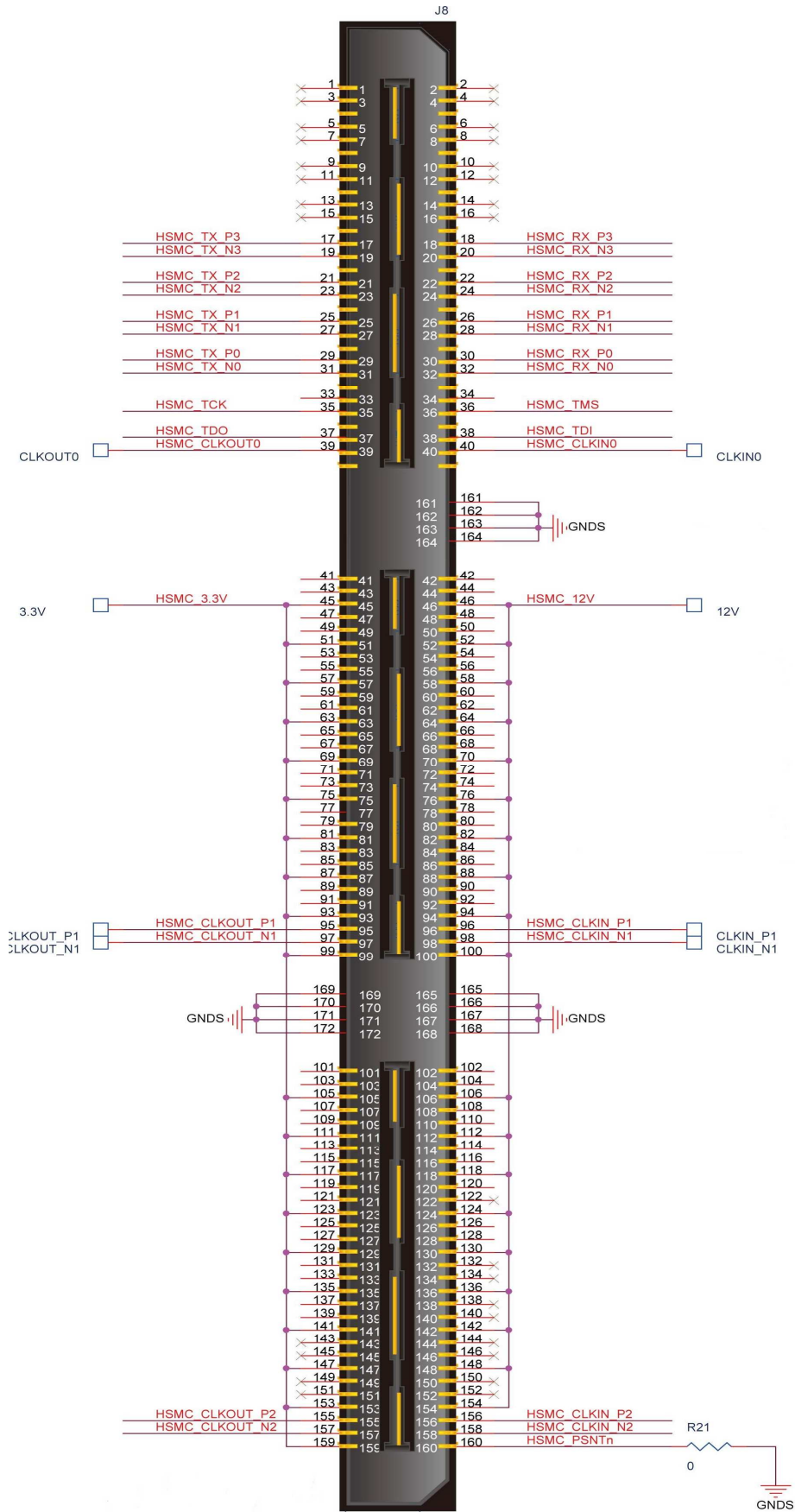


Figure 3.1 The pin-outs of the HSMC connector.

## Board Components

Table 3.1 below lists the HSMC signal direction and description

Pin Numbers	Name	Direction	Description
1	N.C.	N/A	Not Connect
2	N.C.	N/A	Not Connect
3	N.C.	N/A	Not Connect
4	N.C.	N/A	Not Connect
5	N.C.	N/A	Not Connect
6	N.C.	N/A	Not Connect
7	N.C.	N/A	Not Connect
8	N.C.	N/A	Not Connect
9	N.C.	N/A	Not Connect
10	N.C.	N/A	Not Connect
11	N.C.	N/A	Not Connect
12	N.C.	N/A	Not Connect
13	N.C.	N/A	Not Connect
14	N.C.	N/A	Not Connect
15	N.C.	N/A	Not Connect
16	N.C.	N/A	Not Connect
17	HSMC_TX_P3	Output	SMA Transceiver Output
18	HSMC_RX_P3	Input	SMA Transceiver Input
19	HSMC_TX_N3	Output	SMA Transceiver Output
20	HSMC_RX_N3	Input	SMA Transceiver Input
21	HSMC_TX_P2	Output	SMA Transceiver Output
22	HSMC_RX_P2	Input	SMA Transceiver Input
23	HSMC_TX_N2	Output	SMA Transceiver Output
24	HSMC_RX_N2	Input	SMA Transceiver Input
25	HSMC_TX_P1	Output	SMA Transceiver Output
26	HSMC_RX_P1	Input	SMA Transceiver Input
27	HSMC_TX_N1	Output	SMA Transceiver Output
28	HSMC_RX_N1	Input	SMA Transceiver Input
29	HSMC_TX_P0	Output	SMA Transceiver Output
30	HSMC_RX_P0	Input	SMA Transceiver Input
31	HSMC_TX_N0	Output	SMA Transceiver Output
32	HSMC_RX_N0	Input	SMA Transceiver Input
33	N.C.	N/A	Not Connect
34	N.C.	N/A	Not Connect
35	HSMC_TCK	Inout	JTAG

**Board Components**

36	HSMC_TMS	Inout	JTAG
37	HSMC_TDO	Inout	JTAG
38	HSMC_TDI	Inout	JTAG
39	HSMC_CLKOUT0	N/A	CLKOUT0 Test-Point
40	HSMC_CLKIN0	N/A	CLKIN0 Test-Point
41	N.C.	N/A	Not Connect
42	N.C.	N/A	Not Connect
43	N.C.	N/A	Not Connect
44	N.C.	N/A	Not Connect
45	3V3	Power	Power 3.3V
46	12V	Power	Power 12V
47	N.C.	N/A	Not Connect
48	N.C.	N/A	Not Connect
49	N.C.	N/A	Not Connect
50	N.C.	N/A	Not Connect
51	3V3	Power	Power 3.3V
52	12V	Power	Power 12V
53	N.C.	N/A	Not Connect
54	N.C.	N/A	Not Connect
55	N.C.	N/A	Not Connect
56	N.C.	N/A	Not Connect
57	3V3	Power	Power 3.3V
58	12V	Power	Power 12V
59	N.C.	N/A	Not Connect
60	N.C.	N/A	Not Connect
61	N.C.	N/A	Not Connect
62	N.C.	N/A	Not Connect
63	3V3	Power	Power 3.3V
64	12V	Power	Power 12V
65	N.C.	N/A	Not Connect
66	N.C.	N/A	Not Connect
67	N.C.	N/A	Not Connect
68	N.C.	N/A	Not Connect
69	3V3	Power	Power 3.3V
70	12V	Power	Power 12V
71	N.C.	N/A	Not Connect
72	N.C.	N/A	Not Connect
73	N.C.	N/A	Not Connect



## Board Components

74	N.C.	N/A	Not Connect
75	3V3	Power	Power 3.3V
76	12V	Power	Power 12V
77	N.C.	N/A	Not Connect
78	N.C.	N/A	Not Connect
79	N.C.	N/A	Not Connect
80	N.C.	N/A	Not Connect
81	3V3	Power	Power 3.3V
82	12V	Power	Power 12V
83	N.C.	N/A	Not Connect
84	N.C.	N/A	Not Connect
85	N.C.	N/A	Not Connect
86	N.C.	N/A	Not Connect
87	3V3	Power	Power 3.3V
88	12V	Power	Power 12V
89	N.C.	N/A	Not Connect
90	N.C.	N/A	Not Connect
91	N.C.	N/A	Not Connect
92	N.C.	N/A	Not Connect
93	3V3	Power	Power 3.3V
94	12V	Power	Power 12V
95	HSMC_CLKOUT_P1	N/A	Differential CLKOUT Test-Point
96	HSMC_CLKIN_P1.	N/A	Differential CLKIN Test-Point
97	HSMC_CLKOUT_N1	N/A	Differential CLKOUT Test-Point
98	HSMC_CLKIN_N1	N/A	Differential CLKIN Test-Point
99	3V3	Power	Power 3.3V
100	12V	Power	Power 12V
101	N.C.	N/A	Not Connect
102	N.C.	N/A	Not Connect
103	N.C.	N/A	Not Connect
104	N.C.	N/A	Not Connect
105	3V3	Power	Power 3.3V
106	12V	Power	Power 12V
107	N.C.	N/A	Not Connect
108	N.C.	N/A	Not Connect
109	N.C.	N/A	Not Connect
110	N.C.	N/A	Not Connect
111	3V3	Power	Power 3.3V

## Board Components

112	12V	Power	Power 12V
113	N.C.	N/A	Not Connect
114	N.C.	N/A	Not Connect
115	N.C.	N/A	Not Connect
116	N.C.	N/A	Not Connect
117	3V3	Power	Power 3.3V
118	12V	Power	Power 12V
119	N.C.	N/A	Not Connect
120	N.C.	N/A	Not Connect
121	N.C.	N/A	Not Connect
122	N.C.	N/A	Not Connect
123	3V3	Power	Power 3.3V
124	12V	Power	Power 12V
125	N.C.	N/A	Not Connect
126	N.C.	N/A	Not Connect
127	N.C.	N/A	Not Connect
128	N.C.	N/A	Not Connect
129	3V3	Power	Power 3.3V
130	12V	Power	Power 12V
131	N.C.	N/A	Not Connect
132	N.C.	N/A	Not Connect
133	N.C.	N/A	Not Connect
134	N.C.	N/A	Not Connect
135	3V3	Power	Power 3.3V
136	12V	Power	Power 12V
137	N.C.	N/A	Not Connect
138	N.C.	N/A	Not Connect
139	N.C.	N/A	Not Connect
140	N.C.	N/A	Not Connect
141	3V3	Power	Power 3.3V
142	12V	Power	Power 12V
143	N.C.	N/A	Not Connect
144	N.C.	N/A	Not Connect
145	N.C.	N/A	Not Connect
146	N.C.	N/A	Not Connect
147	3V3	Power	Power 3.3V
148	12V	Power	Power 12V
149	N.C.	N/A	Not Connect

**Board Components**

150	N.C.	N/A	Not Connect
151	N.C.	N/A	Not Connect
152	N.C.	N/A	Not Connect
153	3V3	Power	Power 3.3V
154	12V	Power	Power 12V
155	HSMC_CLKOUT_P2	Output	SMA differential Output CLK
156	HSMC_CLKIN_P2	Input	SMA differential Input CLK
157	HSMC_CLKOUT_N2	Output	SMA differential Output CLK
158	HSMC_CLKIN_N2	Input	SMA differential Input CLK
159	3V3	Power	Power 3.3V
160	HSMC_PSNTn	Power	Power Ground

This chapter illustrates the reference design for the XTS HSMC card

## 4.1 Introduction

This section describes the functionality of the demonstration briefly.

The demonstration illustrates a loopback test for transceiver channels using the XTS daughter card and the Stratix IV GX FPGA Development board. Figure 4.1 depicts the basic block diagram for this demonstration. The demonstration is intended for users to provide a basic introduction to the XTS daughter card with the procedures to control different hardware and software settings.

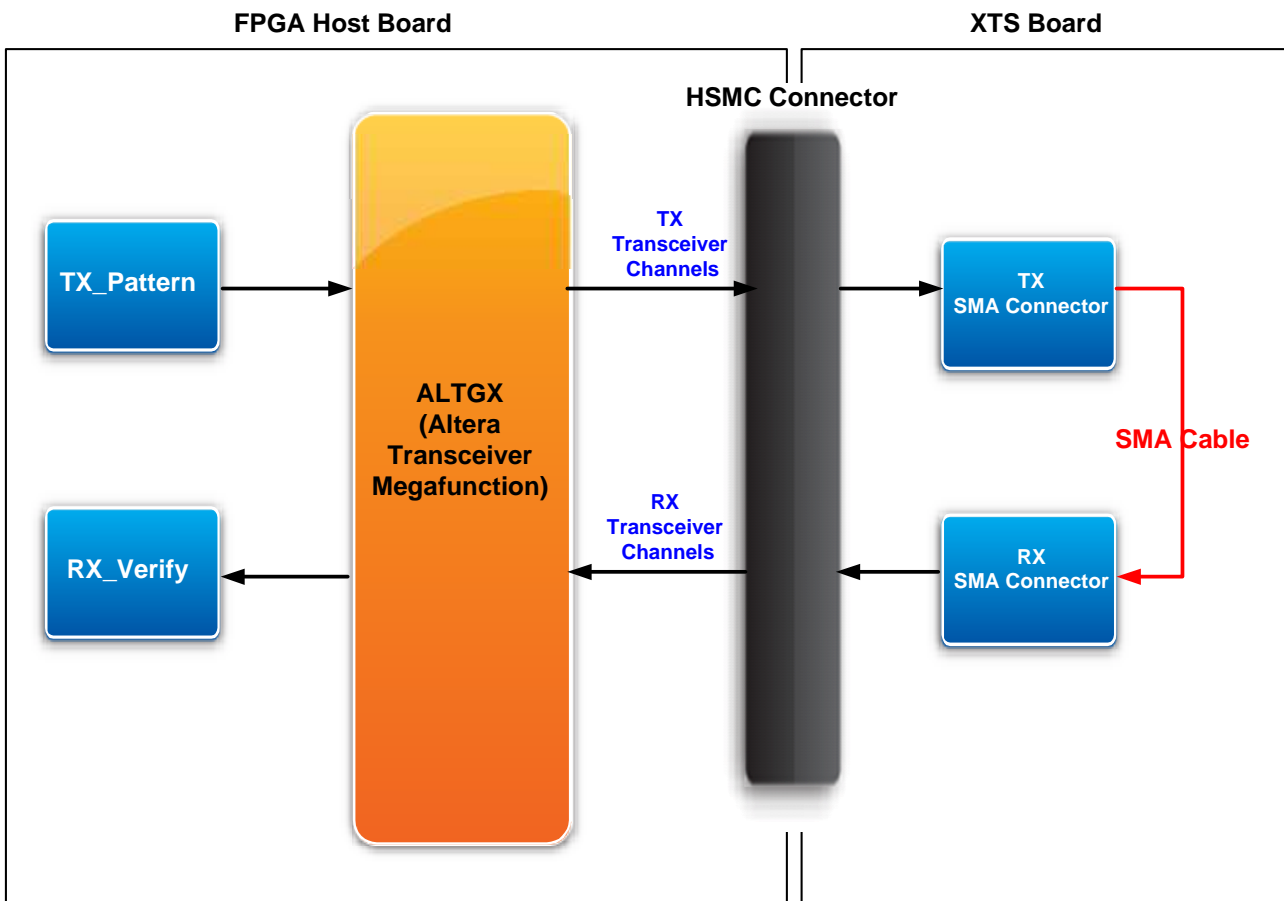


Figure 4.1 Block diagram of the loopback test function



## 4.2 System Requirements

The following items are required for the XTS loopback demonstration.

- XTS x 1
- Stratix IV GX FPGA Development Board x 1
- SMA Cable x 8

## 4.3 Setup the Demonstration

Figure 4.2, 4.3, 4.4 and 4.5 shows how to setup hardware for the XTS demonstration.

- i. Connect SMA Cable to J21 and J23 as shown in Figure 4.2 to short the positive signal of the transceiver channel 0 (HSMC-TX0p).

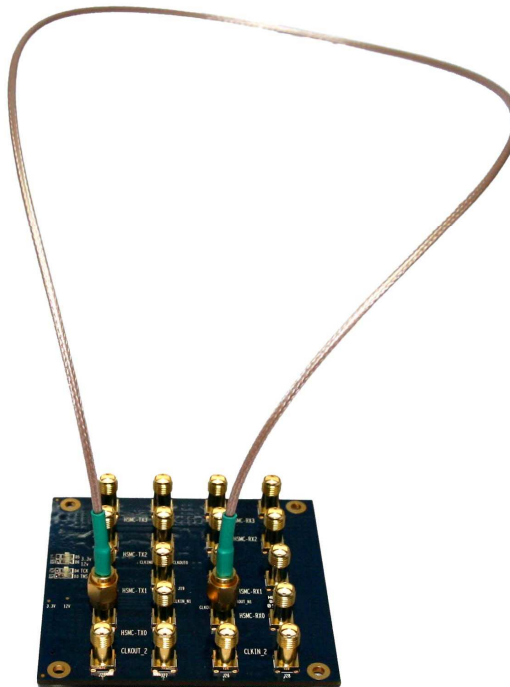


Figure 4.2 Short J21 and J22 via SMA Cable

- ii. Connect SMA Cable to J22 and J24 as shown in Figure 4.3 to short the negative signal of the transceiver channel 0 (HSMC-TX0n).

## Demonstration

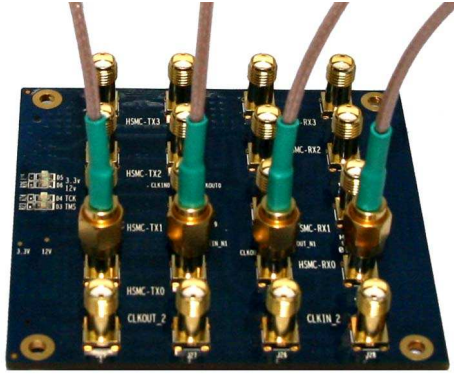


Figure 4.3 Short J23 and J24 via SMA Cable

- iii. Repeat steps i and ii to short the other transceiver channels as shown in Figure 4.4.

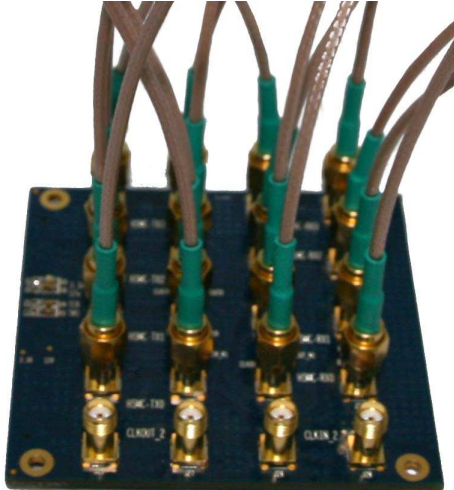


Figure 4.4 Short all the transceiver channels

- iv. Connect the XTS card to Stratix IV GX FPGA Development Board (See Figure 4.5).

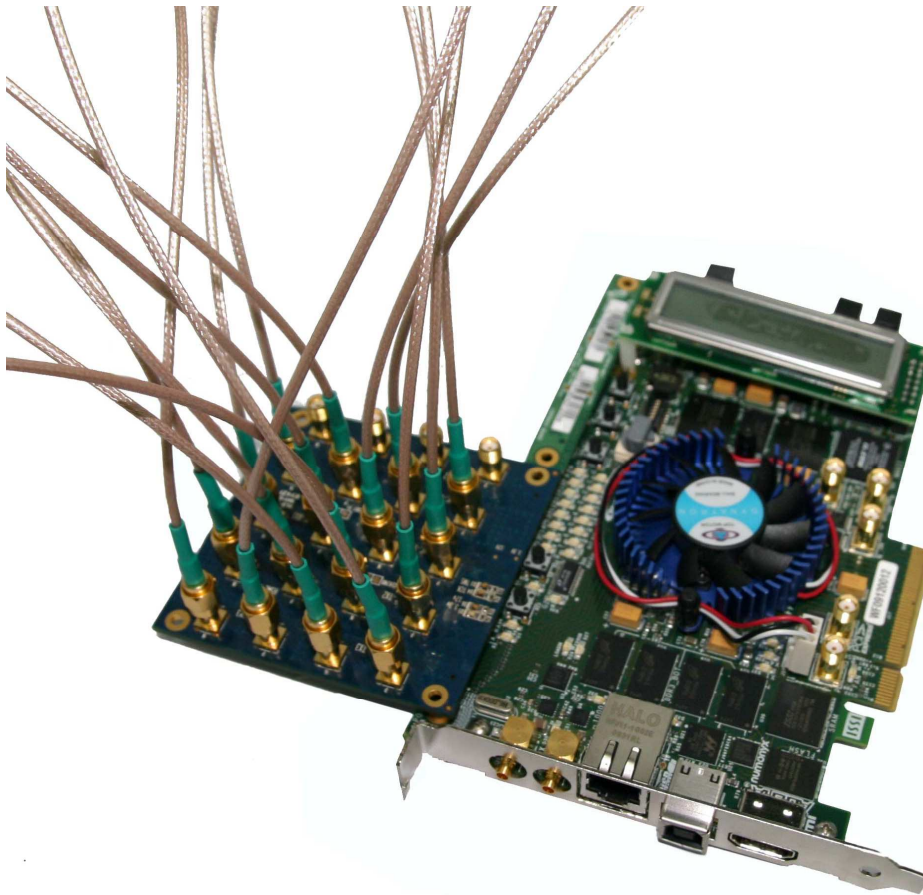


Figure 4.5 Transceiver loopback test setup

Note: The XTS card must be connected to HSMC Slot “A” of the Stratix IV GX FPGA Development Board for this demonstration

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## 4.4 Demo Operation

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This section describes the procedures of running the demonstration

FPGA Configuration

Demonstration Setup, File Locations, and Instructions

**Transceiver Loopback Test Demo:**

- Project directory: xts\_loopback\_test\_s4gfp
- Bit Stream used: xts\_loopback\_test\_s4gfp.sof
- Stratix IV GX FPGA Development Kit Setup
  - ✓ Set SW4 switches 1, 2, 4 in the “up” position and switches 3, 5, 6, 8 in the “down” position
  - ✓ Set the rotary switch (SW2) to the 0 position
- Power on the Stratix IV GX FPGA Development Board and download the SOF file (xts\_loopback\_test\_s4gfp.sof)
- LED0~LED3 shows the test results for transceiver channels 0~3, respectively. If the LED is blinking, it

indicates the test has passed.

- Remove one of the SMA cable from one of the connector so that the loopback will fail. A Failure is indicated on the Stratix IV GX FPGA Dev Kit when the LED turns ON
- To reset the board test system, press and release the PB0 reset button on the host board
- Press and release PB1 can insert error pattern and create failure condition.



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## 5.1 Revision History

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Date	Change Log
DEC 29, 2009	Initial Version
JAN 12, 2010	Added demonstration chapter

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## 5.2 Always Visit XTS Webpage for New Main board

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We will be continuing providing interesting examples and labs on our XTS

webpage. Please visit [www.altera.com](http://www.altera.com) or [xts.terasic.com](http://xts.terasic.com) for more information.