THDB-H2S

Terasic HSMC to Santa Cruz Daughter Board

User Manual

CHAPTER 1. Introduction

THDB-H2S is an adapter board for converting High Speed Mezzanine Card (HSMC) connector to Santa Cruz (SC) interface which allows users to use the SC interface boards on a board with a HSMC connector. Also, the source signals form the HSMC connector to the SC header on the THDB-H2S board pass through level shifters to adjust the logic level difference between the HSMC and SC interface board.

Features

Figure 1.1 shows the photo of the THDB-H2S board. The important features are listed below:

- HSMC and Santa Cruz interface conversion
- Adjustable logic levels between HSMC and SC interface signals
- One Mictor Connector for logic analyzer debug interface
- One SMA Connector for external clock input
- One DB9 Connector for RS232 serial I/O interface
- Four Push buttons for general user-interface
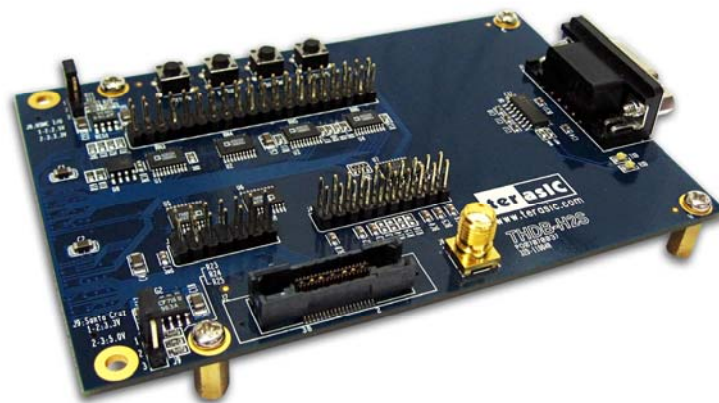
Figure 1.1. The THDB-H2S board

Getting Help

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

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

CHAPTER 2 Architecture

This chapter describes the architecture of the THDB-H2S board including its PCB and block diagram.

Layout and Componets

The picture of the TDRB-H2S board is shown in Figure 2.1 and Figure 2.2. It depicts the layout of the board and indicates the location of the connectors and key components.
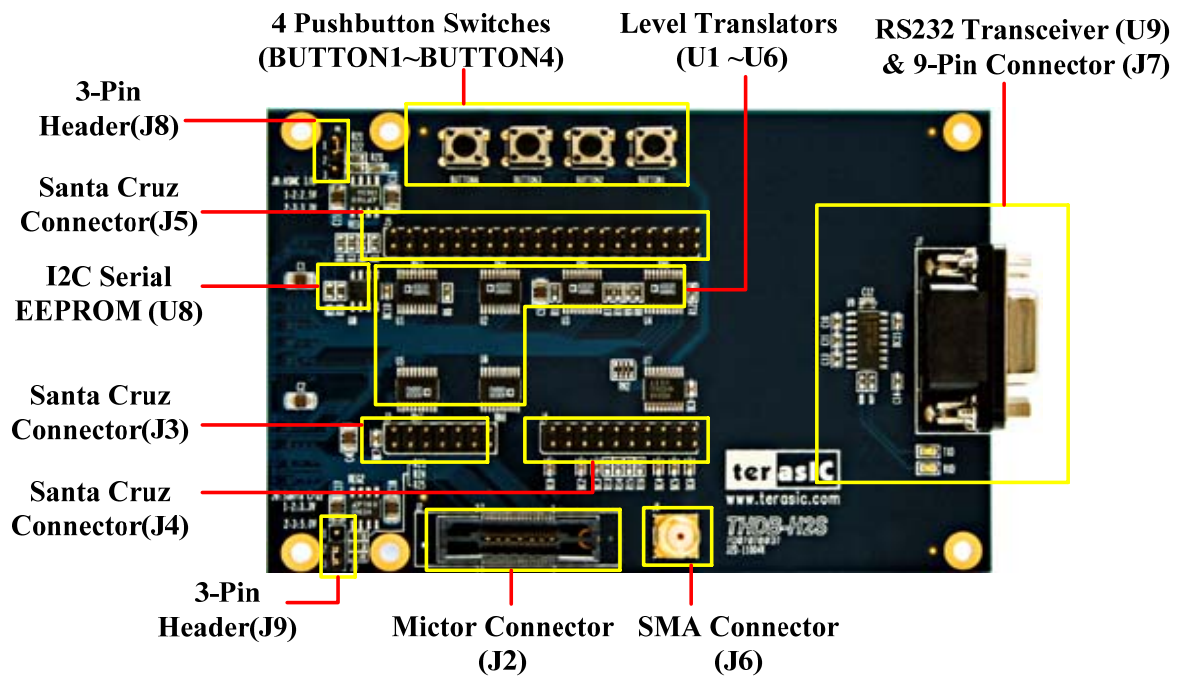
Figure 2.1 The TDRB-H2S PCB and Component diagram

HSMC Connector(J1)
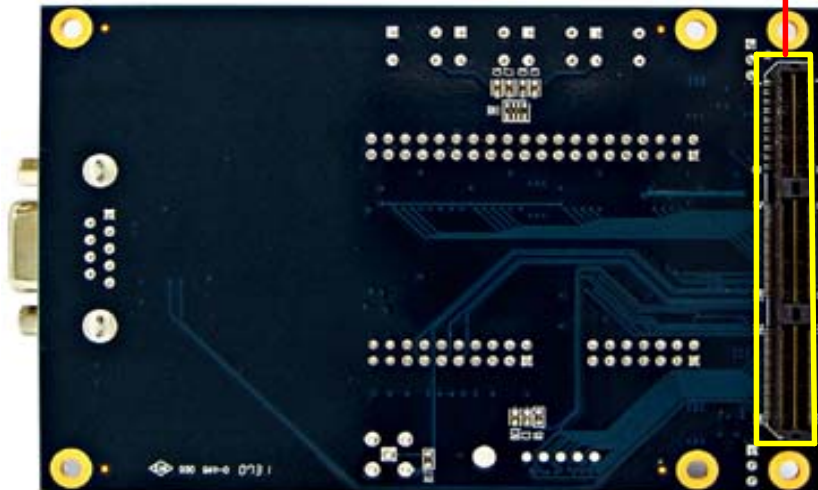
Figure 2.2 The TDRB-H2S Back side – HSMC connector view

The following components are provided on the THDB-H2S board :

- HSMC expansion connector (J1)
- Santa Cruz Headers(J3,J4,J5)
- Mictor connector (J2)
- SMA connector (J6)
- 9-pin connector (J7) and RS232 Transceiver (U9)
- 4 Push buttons (BUTTON1~BUTTON4)
- Logic level configuration headers (J8,J9)
- I2C serial EEPROM (U8)
- Level translator (U1~U6)

Block Diagram

Figure 2.3 shows the block diagram of the THDB-H2S board
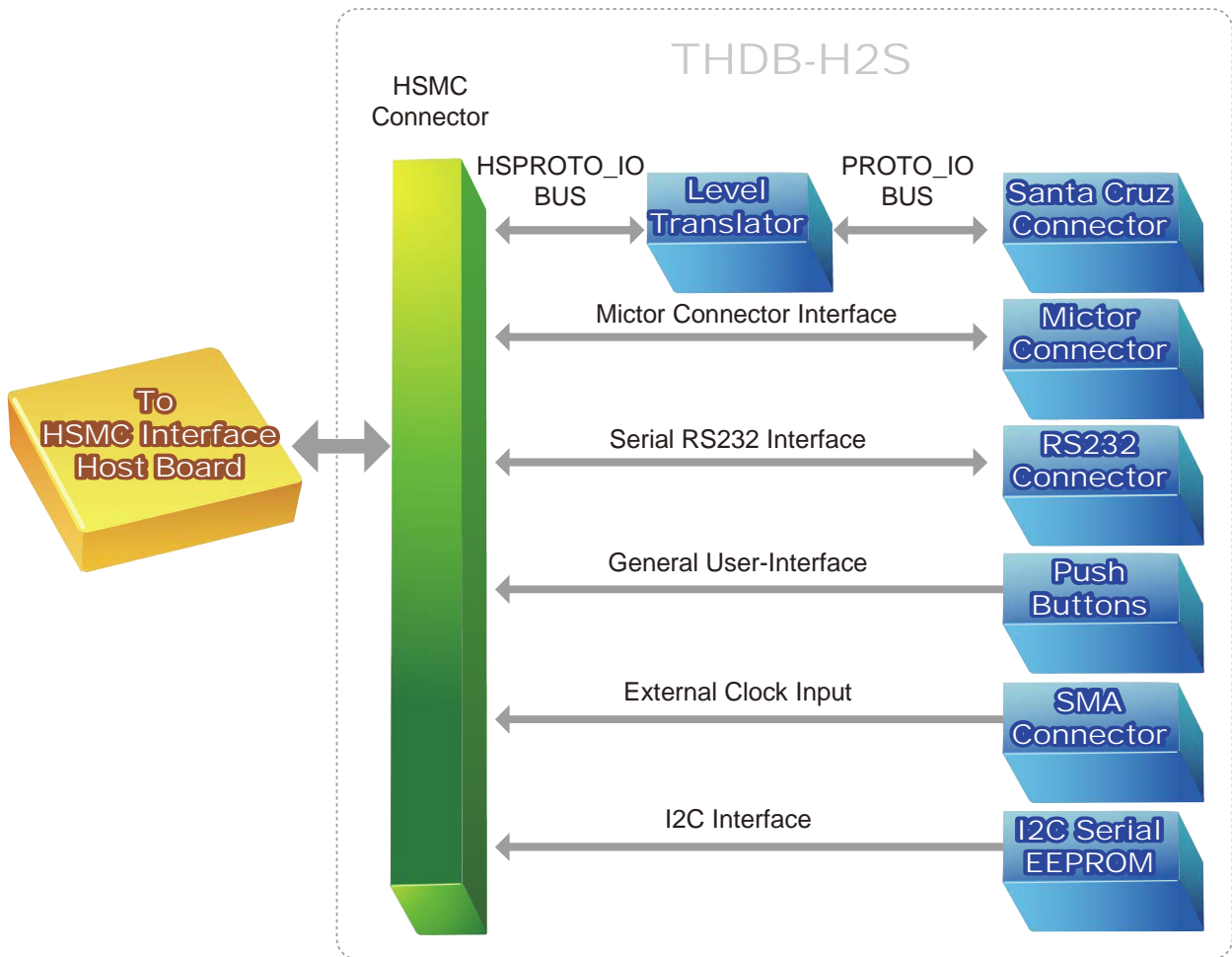
Figure 2.3. The block diagram of the THDB-H2S board

CHAPTER

3 Board Components ter asIC
www.terasic.com

This section will describe the detailed information of the components, connector interfaces, and the pin mapping tables of the THDB-H2S board

The HSMC Connector

This section describes the HSMC connector on the THDB-H2S board

THDB-H2S board contains an Altera standard HSMC connector. All the other connector interfaces on the THDB-H2S board are connected to the HSMC connector. Figure 3.1, Figure 3.2, and Figure 3.3 show the pin-outs of the HSMC connector.

NC	2		1	NC
NC	4		3	NC
NC	6		5	NC
NC	8		7	NC
NC	10		9	NC
NC	12		11	NC
NC	14		13	NC
NC	16		15	NC
NC	18		17	NC
NC	20		19	NC
NC	22		21	NC
NC	24		23	NC
NC	26		25	NC
NC	28		27	NC
NC	30		29	NC
NC	32		31	NC
HSMC_SCL	34		33	HSMC_SDA
HSMC_TMS	36		35	HSMC_TCK
HSMC_TDI	38		37	HSMC_TDO
NC	40		39	NC
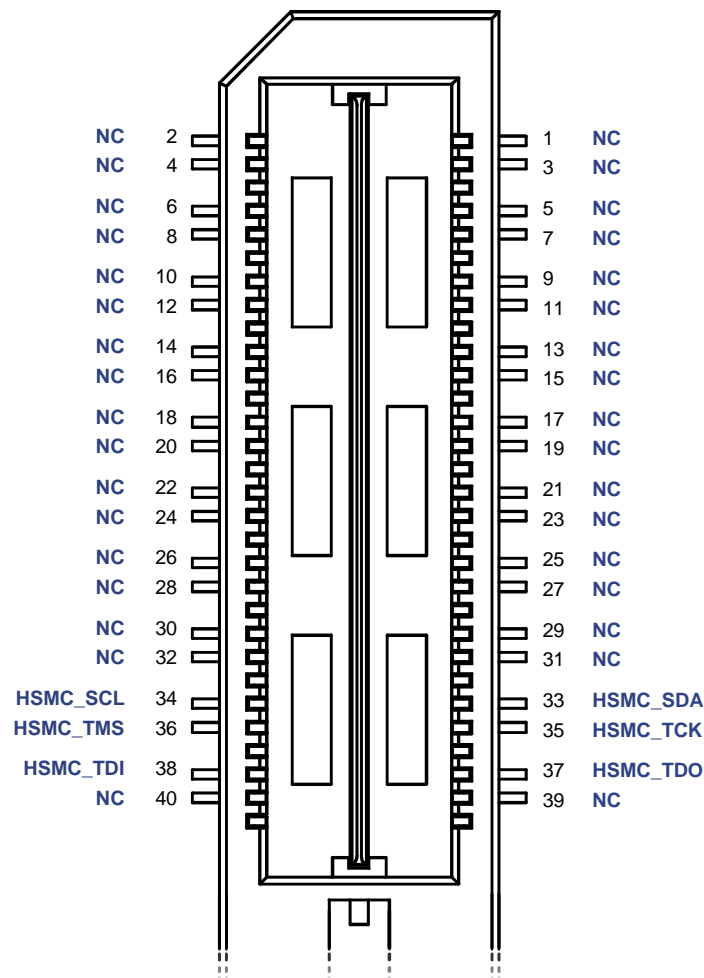
Figure 3.1 The pin-outs of Bank 1 on the HSMC connector

HSPROTO_IO0	42		41	HSPROTO_RESET
HSPROTO_IO2	44		43	HSPROTO_IO1
12V	46		45	VCC33
HSPROTO_IO4	48		47	HSPROTO_IO3
HSPROTO_IO6	50		49	HSPROTO_IO5
12V	52		51	VCC33
HSPROTO_IO8	54		53	HSPROTO_IO7
HSPROTO_IO10	56		55	HSPROTO_IO9
12V	58		57	VCC33
HSPROTO_IO12	60		59	HSPROTO_IO11
HSPROTO_IO14	62		61	HSPROTO_IO13
12V	64		63	VCC33
HSPROTO_IO16	66		65	HSPROTO_IO15
HSPROTO_IO18	68		67	HSPROTO_IO17
12V	70		69	VCC33
HSPROTO_IO20	72		71	HSPROTO_IO19
HSPROTO_IO22	74		73	HSPROTO_IO21
12V	76		75	VCC33
HSPROTO_IO24	78		77	HSPROTO_IO23
HSPROTO_IO26	80		79	HSPROTO_IO25
12V	82		81	VCC33
HSPROTO_CARDSEL	84		83	HSPROTO_IO27
HSPROTO_IO40	86		85	HSPROTO_IO28
12V	88		87	VCC33
HSMC_RX_IO30	90		89	HSPROTO_IO29
HSMC_RX_IO32	92		91	HSPROTO_IO31
12V	94		93	VCC33
CLK2	96		95	CLK1
EXT_CLK	98		97	OSC
12V	100		99	VCC33

Figure 3.2 The pin-outs of Bank 2 of the HSMC connector.

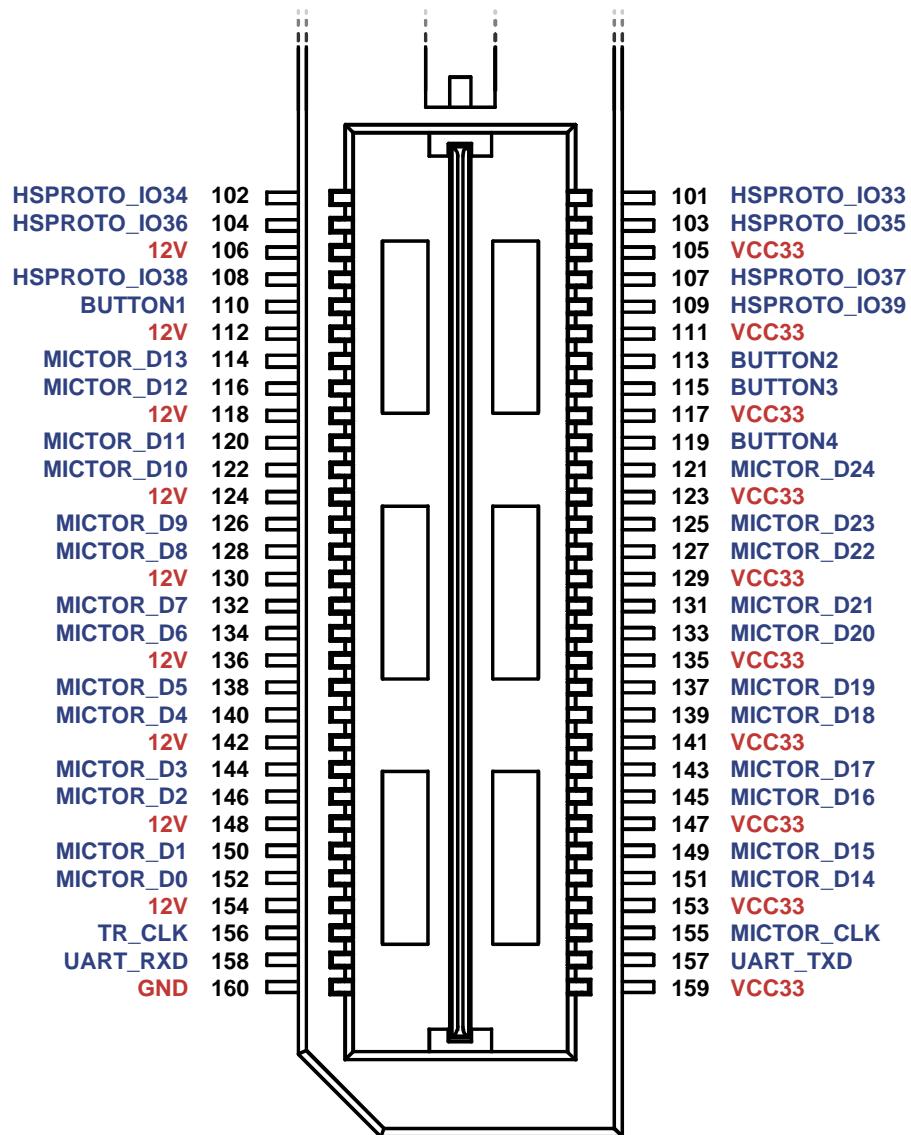|				
HSPROTO_IO34	102		101	HSPROTO_IO33
HSPROTO_IO36	104		103	HSPROTO_IO35
12V	106		105	VCC33
HSPROTO_IO38	108		107	HSPROTO_IO37
BUTTON1	110		109	HSPROTO_IO39
12V	112		111	VCC33
MICTOR_D13	114		113	BUTTON2
MICTOR_D12	116		115	BUTTON3
12V	118		117	VCC33
MICTOR_D11	120		119	BUTTON4
MICTOR_D10	122		121	MICTOR_D24
12V	124		123	VCC33
MICTOR_D9	126		125	MICTOR_D23
MICTOR_D8	128		127	MICTOR_D22
12V	130		129	VCC33
MICTOR_D7	132		131	MICTOR_D21
MICTOR_D6	134		133	MICTOR_D20
12V	136		135	VCC33
MICTOR_D5	138		137	MICTOR_D19
MICTOR_D4	140		139	MICTOR_D18
12V	142		141	VCC33
MICTOR_D3	144		143	MICTOR_D17
MICTOR_D2	146		145	MICTOR_D16
12V	148		147	VCC33
MICTOR_D1	150		149	MICTOR_D15
MICTOR_D0	152		151	MICTOR_D14
12V	154		153	VCC33
TR_CLK	156		155	MICTOR_CLK
UART_RXD	158		157	UART_TXD
GND	160		159	VCC33

Figure 3.3 The pin-outs of Bank 3 of the HSMC connector

Level Translators and Configuration Headers

This section describes how to use the level translators and configuration headers on the THDB-H2S board

The level translators of the THDB-H2S board convert the signal levels between the HSMC and Santa Cruz connectors according to the configurations of the headers (J8, J9). Figure 3.4 shows the block diagram of such function. Table 3.1 and Table 3.2 list the configurations of the HSPROTO_IO BUS and the PROTO_IO BUS, respectively

The voltage level of the HSPROTO_IO BUS is controlled by VHSMC(VCCA pin); the voltage level of the PROTO_IO_BUS is controlled by VSC(VCCB pin), as shown in Figure 3.4. Therefore, Shorting Pin 1 and Pin 2 of J8 provides 2.5V to HSPROTO_IO BUS. Alternatively, shorting Pin 2 and Pin 3 of the J8 provides 3.3V to the HSPROTO_IO BUS. Similarly shorting Pin 1 and Pin 2 of J9 provides 3.3V to the PROTO_IO BUS. Shorting Pin 2 and Pin 3 provides 5V to the PROTO_IO BUS.

Note:

1. **Headers J8 and J9 must be configured with jumpers. If the pin1, pin2, and pin3 are opened at the same time, the level translator will NOT work.**
2. **Because of the characteristic of the level translators, the data rate of the HSPROTO_IO and PROTO_IO bus should be under 50 Mbps.**
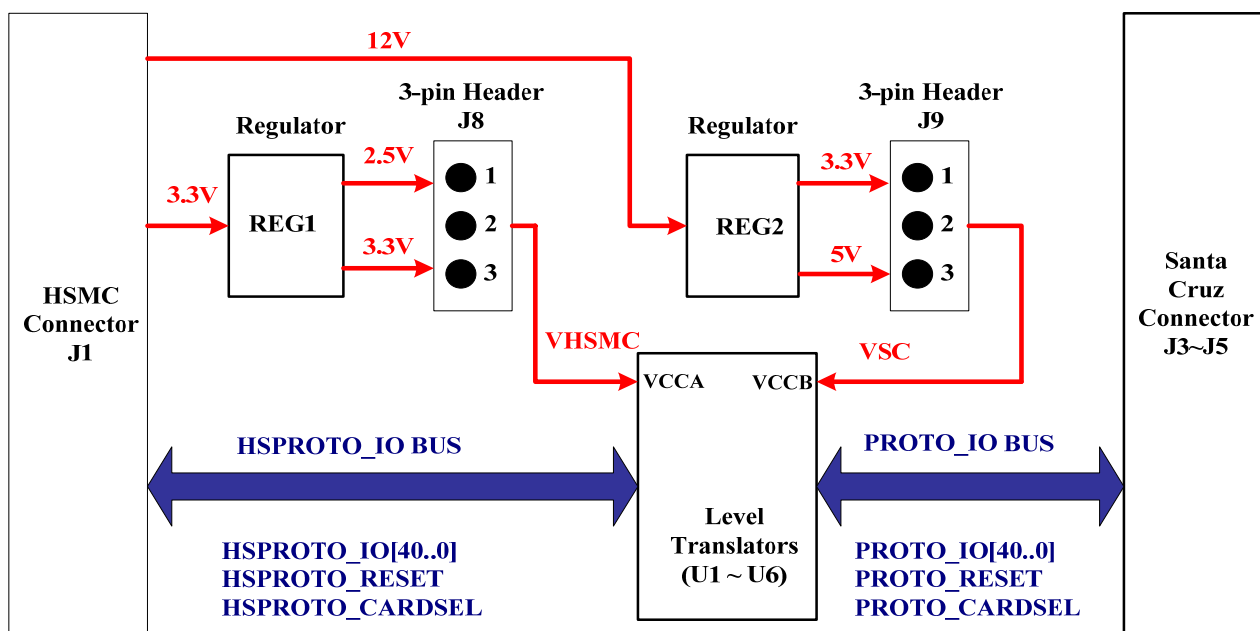

Figure 3.4 The diagram of the voltage-controlling circuit block

Table 3.1 The configuration of the logic level on the HSPROTO_IO BUS

Configuration of J8	Logic level of the HSPROTO_IO BUS
Short pins 1 and 2	2.5 volts
Short pins 2 and 3	3.3 volts

Table 3.2 The configuration of the logic level on the PROTO_IO BUS

Configuration of J9	Logic level of the PROTO_IO BUS
Short pins 1 and 2	3.3 volts
Short pins 2 and 3	5 volts

Santa Cruz Connector

This section describes the Santa Cruz connector on the THDB-H2S board

The THDB-H2S board comes with Santa Cruz connectors (J3, J4 and J5) to connect to a daughter board with Santa Cruz interface. Figure 3.5 shows the pin-outs of the Santa Cruz connector. Detailed pin mappings between J3, J4, and J5 to the HSMC connector is listed in Table 3.3, Table 3.4, and Table 3.5, respectively.
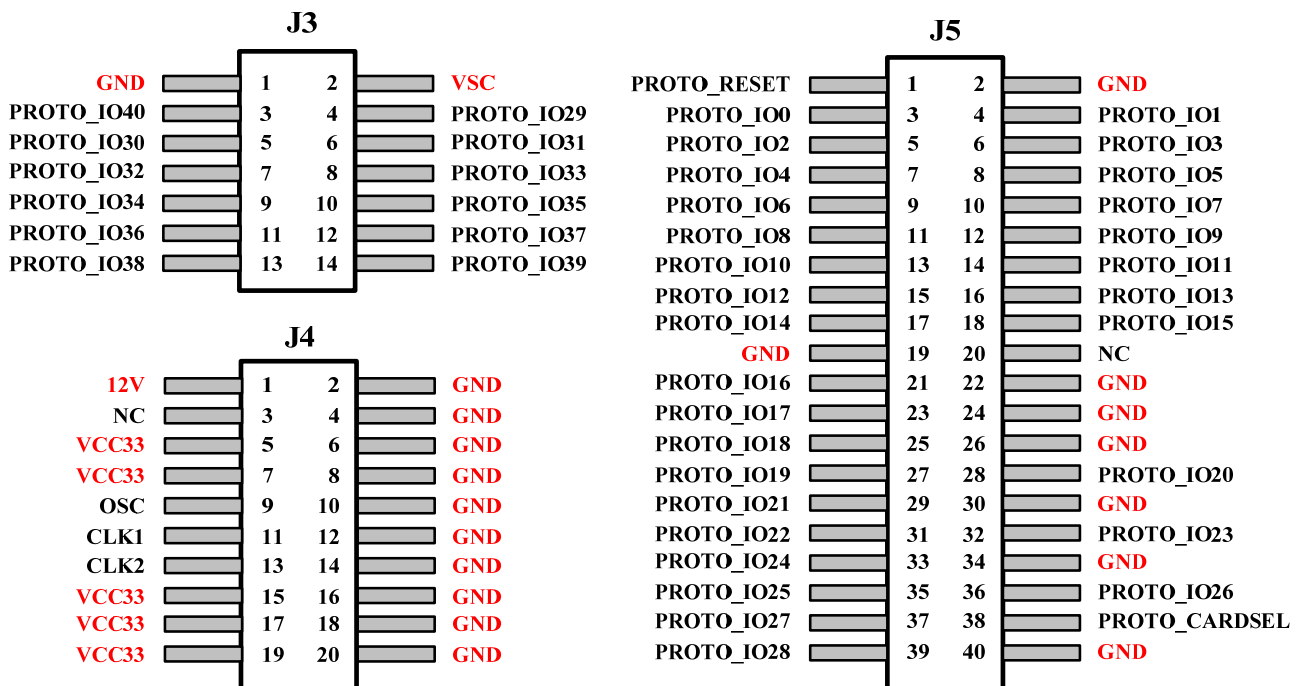

J3

GND	1	2	VSC
PROTO_IO40	3	4	PROTO_IO29
PROTO_IO30	5	6	PROTO_IO31
PROTO_IO32	7	8	PROTO_IO33
PROTO_IO34	9	10	PROTO_IO35
PROTO_IO36	11	12	PROTO_IO37
PROTO_IO38	13	14	PROTO_IO39

J4

12V	1	2	GND
NC	3	4	GND
VCC33	5	6	GND
VCC33	7	8	GND
OSC	9	10	GND
CLK1	11	12	GND
CLK2	13	14	GND
VCC33	15	16	GND
VCC33	17	18	GND
VCC33	19	20	GND

J5

PROTO_RESET	1	2	GND
PROTO_IO0	3	4	PROTO_IO1
PROTO_IO2	5	6	PROTO_IO3
PROTO_IO4	7	8	PROTO_IO5
PROTO_IO6	9	10	PROTO_IO7
PROTO_IO8	11	12	PROTO_IO9
PROTO_IO10	13	14	PROTO_IO11
PROTO_IO12	15	16	PROTO_IO13
PROTO_IO14	17	18	PROTO_IO15
GND	19	20	NC
PROTO_IO16	21	22	GND
PROTO_IO17	23	24	GND
PROTO_IO18	25	26	GND
PROTO_IO19	27	28	PROTO_IO20
PROTO_IO21	29	30	GND
PROTO_IO22	31	32	PROTO_IO23
PROTO_IO24	33	34	GND
PROTO_IO25	35	36	PROTO_IO26
PROTO_IO27	37	38	PROTO_CARDSEL
PROTO_IO28	39	40	GND

Figure 3.5 Santa Cruz connector pin-outs

Table 3.3 The pin assignments of the Santa Cruz connector J3

Santa Cruz connector J3			
SC Pin Number	SC Signal Name	HSMC Pin Number	HSMC Pin Signal Name
3	PROTO_IO40	86	HSPROTO_IO40
4	PROTO_IO29	89	HSPROTO_IO29
5	PROTO_IO30	90	HSPROTO_IO30
6	PROTO_IO31	91	HSPROTO_IO31
7	PROTO_IO32	92	HSPROTO_IO32
8	PROTO_IO33	101	HSPROTO_IO33
9	PROTO_IO34	102	HSPROTO_IO34
10	PROTO_IO35	103	HSPROTO_IO35
11	PROTO_IO36	104	HSPROTO_IO36
12	PROTO_IO37	107	HSPROTO_IO37
13	PROTO_IO38	108	HSPROTO_IO38
14	PROTO_IO39	109	HSPROTO_IO39

Table 3.4 The pin assignments of the Santa Cruz connector J4

Santa Cruz connector J4			
SC Pin Number	SC Signal Name	HSMC Pin Number	HSMC Pin Signal Name
9	OSC	97	OSC
11	CLK1	95	CLK1
13	CLK2	96	CLK2

Table 3.5 The pin assignments of the Santa Cruz connector J5

Santa Cruz connector J5			
SC Pin Number	SC Signal Name	HSMC Pin Number	HSMC Pin Signal Name
1	PROTO_RESET	41	HSPROTO_RESET
3	PROTO_IO0	42	HSPROTO_IO0
4	PROTO_IO1	43	HSPROTO_IO1
5	PROTO_IO2	44	HSPROTO_IO2
6	PROTO_IO3	47	HSPROTO_IO3
7	PROTO_IO4	48	HSPROTO_IO4
8	PROTO_IO5	49	HSPROTO_IO5
9	PROTO_IO6	50	HSPROTO_IO6

10	PROTO_IO7	53	HSPROTO_IO7
11	PROTO_IO8	54	HSPROTO_IO8
12	PROTO_IO9	55	HSPROTO_IO9
13	PROTO_IO10	56	HSPROTO_IO10
14	PROTO_IO11	59	HSPROTO_IO11
15	PROTO_IO12	60	HSPROTO_IO12
16	PROTO_IO13	61	HSPROTO_IO13
17	PROTO_IO14	62	HSPROTO_IO14
18	PROTO_IO15	65	HSPROTO_IO15
21	PROTO_IO16	66	HSPROTO_IO16
23	PROTO_IO17	67	HSPROTO_IO17
25	PROTO_IO18	68	HSPROTO_IO18
27	PROTO_IO19	71	HSPROTO_IO19
28	PROTO_IO20	72	HSPROTO_IO20
29	PROTO_IO21	73	HSPROTO_IO21
31	PROTO_IO22	74	HSPROTO_IO22
32	PROTO_IO23	77	HSPROTO_IO23
33	PROTO_IO24	78	HSPROTO_IO24
35	PROTO_IO25	79	HSPROTO_IO25
36	PROTO_IO26	80	HSPROTO_IO26
37	PROTO_IO27	83	HSPROTO_IO27
38	PROTO_CARDSEL	84	HSPROTO_CARDSEL
39	PROTO_IO28	85	HSPROTO_IO28

Mictor Connector

This section describes how to use the Mictor connector on the THDB-H2S board

The Mictor connector (J2) can be used for logic analysis on the HSMC-interfaced host board by connecting an external scope or a logic analyzer to it. Figure 3.6 shows the pin-outs of the Mictor connector. Table 3.6 shows the detailed pin mappings between the Mictor connector and the HSMC connector.
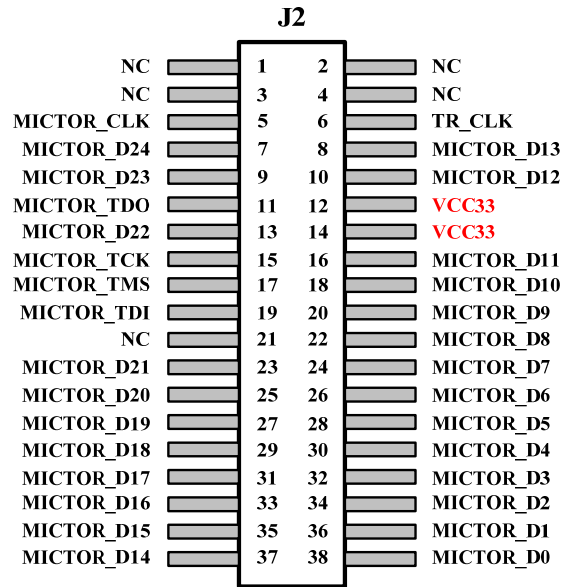
J2

Figure 3.6 Mictor connector pin-outs

Table 3.6 The pin assignments of the Mictor connector (J2)

Mictor Connector Pin Number	Mictor Connector Signal Name	HSMC Pin Number
5	MICTOR_CLK	155
6	TR_CLK	156
7	MICTOR_D24	121
8	MICTOR_ D13	114
9	MICTOR_ D23	125
10	MICTOR_ D12	116
11	MICTOR_TDO	37
13	MICTOR_D22	127
15	MICTOR_TCK	35
16	MICTOR_D11	120
17	MICTOR_TMS	36
18	MICTOR_D10	122
19	MICTOR _TDI	38
20	MICTOR _D9	126
22	MICTOR _D8	128
23	MICTOR _D21	131
24	MICTOR _D7	132
25	MICTOR _D20	133
26	MICTOR _D6	134
27	MICTOR _D19	137
28	MICTOR _D5	138

29	MICTOR _D18	139
30	MICTOR _D4	140
31	MICTOR _D17	143
32	MICTOR _D3	144
33	MICTOR _D16	145
34	MICTOR _D2	146
35	MICTOR _D15	149
36	MICTOR _D1	150
37	MICTOR _D14	151
38	MICTOR _D0	152

To use this interface, user needs to configure the JTAG interface on the HSMC interface host board. For example, the steps of controlling the Cyclone III start board using Mictor interface is shown below:

1. Connecting the THDB-H2S board to the Cyclone III Start Board.
2. Removing the jumpers of JP1 and JP2 of the Cyclone III Start Board to connect the JTAG interface between Cyclone III FPGA and the THDB-H2S board.
3. Short the TDI and TDO pins of the JTAG connector(J4), as shown in Figure 3.7
4. Disable the built-in USB blaster by shorting JP8 on the Cyclone III Starter Board

The above FOUR steps will make a closed JTAG chain as shown in Figure 3.8
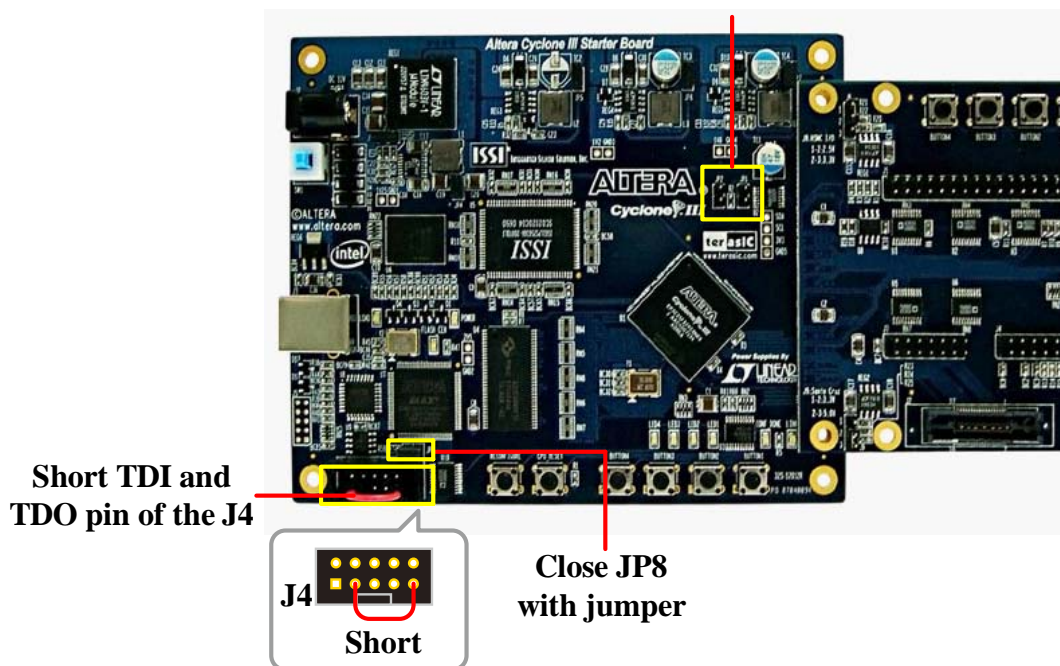
Figure 3.7 The configuration of the Cyclone III start board for controlling the JTAG chain using the Mictor connector
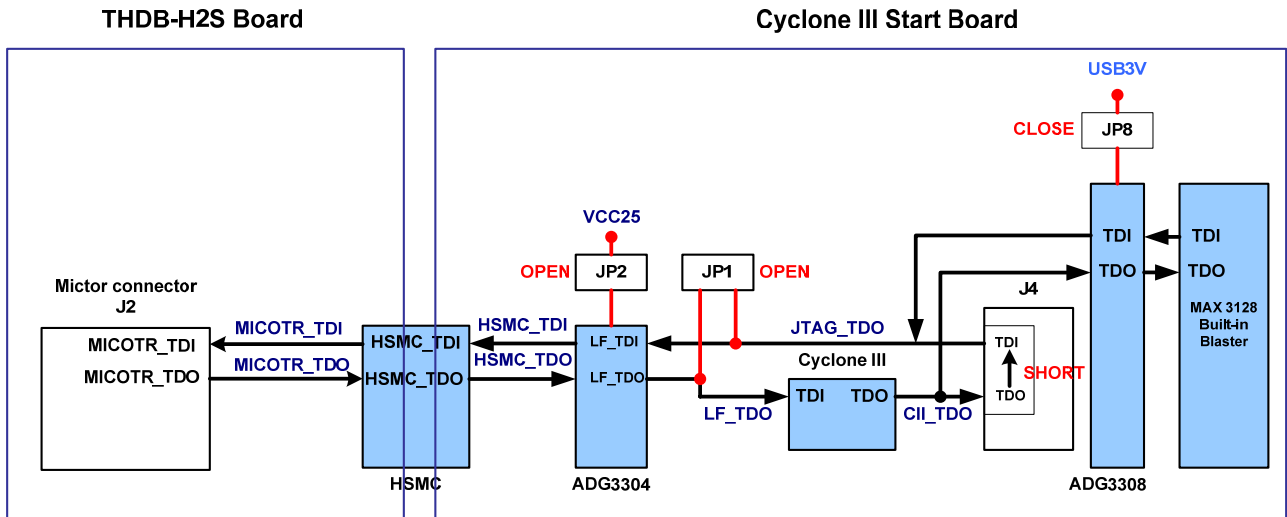
THDB-H2S Board

Cyclone III Start Board

Figure 3.8 The JTAG chain between the THDB-H2S board and Cyclone III Start Board

RS232 Transceiver and the 9-Pin Connector

This section describes the RS232 Transceiver and 9-Pin Connector on the THDB-H2S board

The THDB-H2S is equipped with a RS232 transceiver (U9) and a 9-pin connector (J7) to provide RS232 serial I/O interface to the HSMC interface host board. The pin assignments of the RS232 interface are shown in Table3.7.

Table 3.7 The pin assignments of the RS232 interface

RS232 Transceiver Pin Number	RS232 Transceiver Signal Name	HSMC Pin Number
U9-11	UART_TXD	157
U9-12	UART_RXD	158

SMA Connector

This section describes the SMA connector on the THDB-H2S board

The THDB-H2S board provides a SMA connector (J6) for external clock input. The pin assignments of the SMA connector are shown in table 3.8.

Table 3.8 The pin assignments of the SMA connector

SMA	SMA	HSMC Pin

I2C Serial EEPROM

This section describes the I2C Serial EEPROM on the THDB-H2S board

The THDB-H2S board provides an EEPROM (U8) which can be configured by the I2C interface. The size of the EEPROM is 128 bit that can store the board information or user's data. The detailed pin description between EEPROM and HSMC connector is listed in the Table 3.9.

Table 3.9 The pin assignments of the I2C serial EEPROM

EEPROM Pin Number	EPPROM Signal Name	HSMC Pin Number
U8-5	HSMC_SDA	33
U8-6	HSMC_SCL	34

Power Supply

This section describes the power supply on the THDB-H2S board

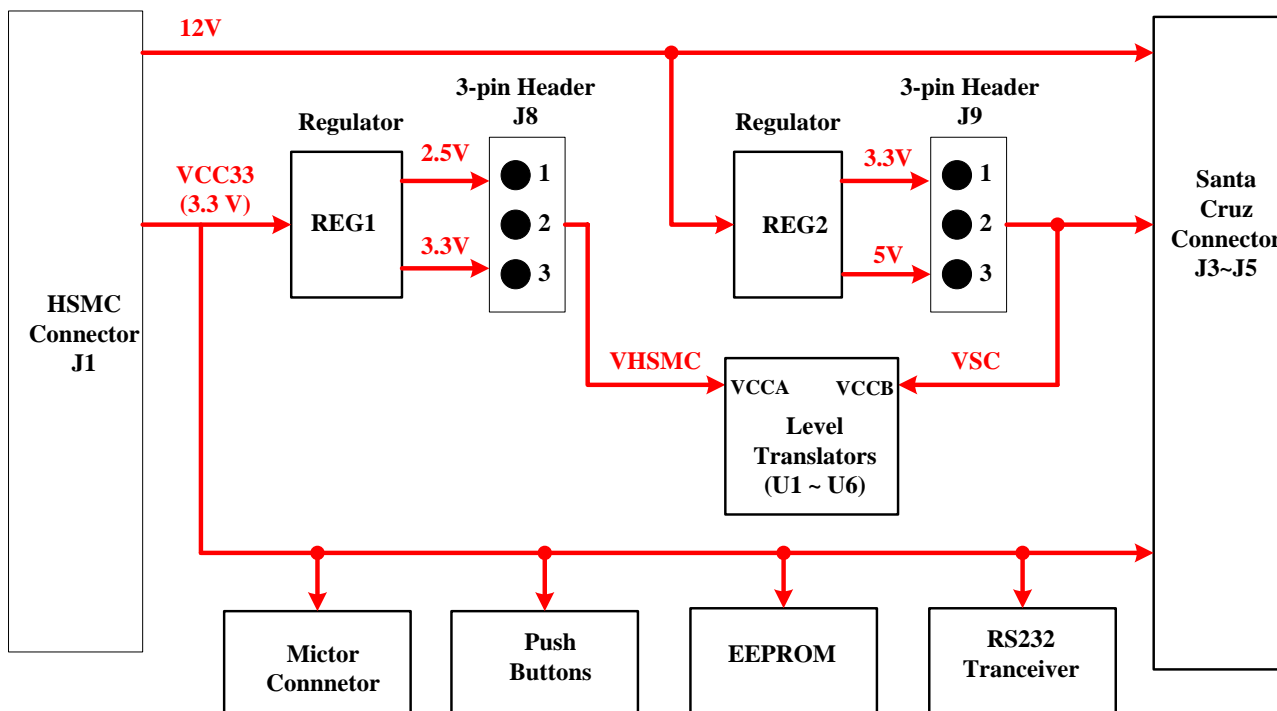The power distribution on the THDB-H2S board is shown in Figure 3.9.

Figure 3.9 THDB-H2S board power distribution diagram.

4 Demonstration

This chapter illustrates how to connect the THDB-H2S board to a HSMC interface host board using a Cyclone III Starter Board as an example

Connecting THDB-H2S Board to Cyclone III Start Board

This section describes how to use THD-H2S board the Cyclone III start board and what users need to know during the operation
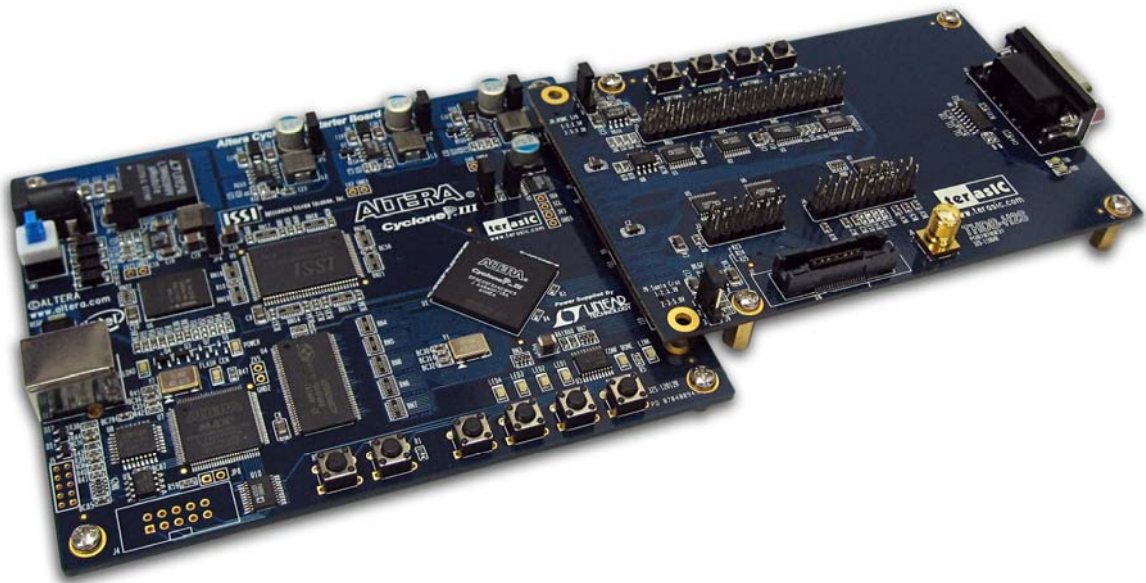

Figure 4.1 Connecting the THDB-H2S board to the Cyclone III start board

To correctly operate the THDB-H2G board with the Cyclone III start board, users need to pay attention to the following notes:

1. Observe the orientation of the HSMC connector when connecting the THDB-H2S to the Cyclone III Starter Board.

2. Users **MUST** short Pin 1 and Pin 2 of the J8 on the THDB-H2S to force the voltage level to 2.5V to match the 2.5V IO pins of the Cyclone III board.

3. Configure J9 of the THDB-H2S according to the logic level of the Santa Cruz daughter board (refer to Table 3.2)

4. Please note that there are two LVDS pairs on the HSMC connector: the HSMC_CLK_p1/n1 (form a close loop via R3) and HSMC_CLKIN_p2/n2 (form a close loop via R4). Therefore, using any one of the signal in a LVDS pair under single-ended mode will prevent users from using the other signal in the same pair.

5 Appendix

Revision History

Date	Change Log
AUG 15, 2007	Initial Version

Always Visit THDB-H2S Webpage for New Main board

We will be continuing providing interesting examples and labs on our THDB-H2S

webpage. Please visit www.altera.com or h2s.terasic.com for more information.