



# Data Conversion HSMC

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## Reference Manual



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## General Description

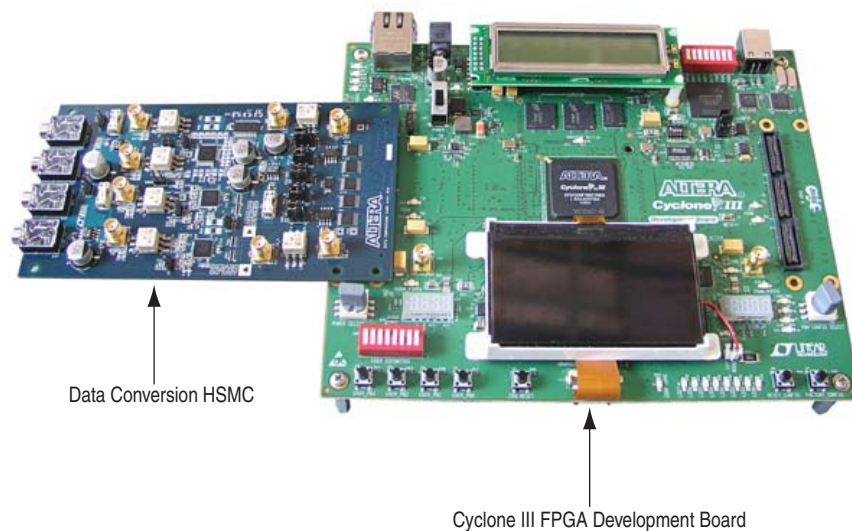
This manual provides information about the Data Conversion High-Speed Mezzanine Card (HSMC). You can use the HSMC to develop digital signal processing (DSP) applications with Altera® development boards that feature the HSMC connector.

The Data Conversion HSMC provides a set of analog to digital (A/D) and digital to analog (D/A) interfaces including an audio coder/decoder (CODEC) interface. This manual describes each of the hardware interfaces on the Data Conversion HSMC.

 For the latest information about HSMC, go to [www.altera.com/products/devkits/kit-index.html](http://www.altera.com/products/devkits/kit-index.html).

**Figure 1–1** shows the Data Conversion HSMC connected to the Cyclone® III FPGA development board.

**Figure 1–1.** Data Conversion HSMC Connected to the Cyclone III FPGA Development Board



 For more information, refer to the *DSP Development Kit Getting Started User Guide*.

# Components and Block Diagram

## Components

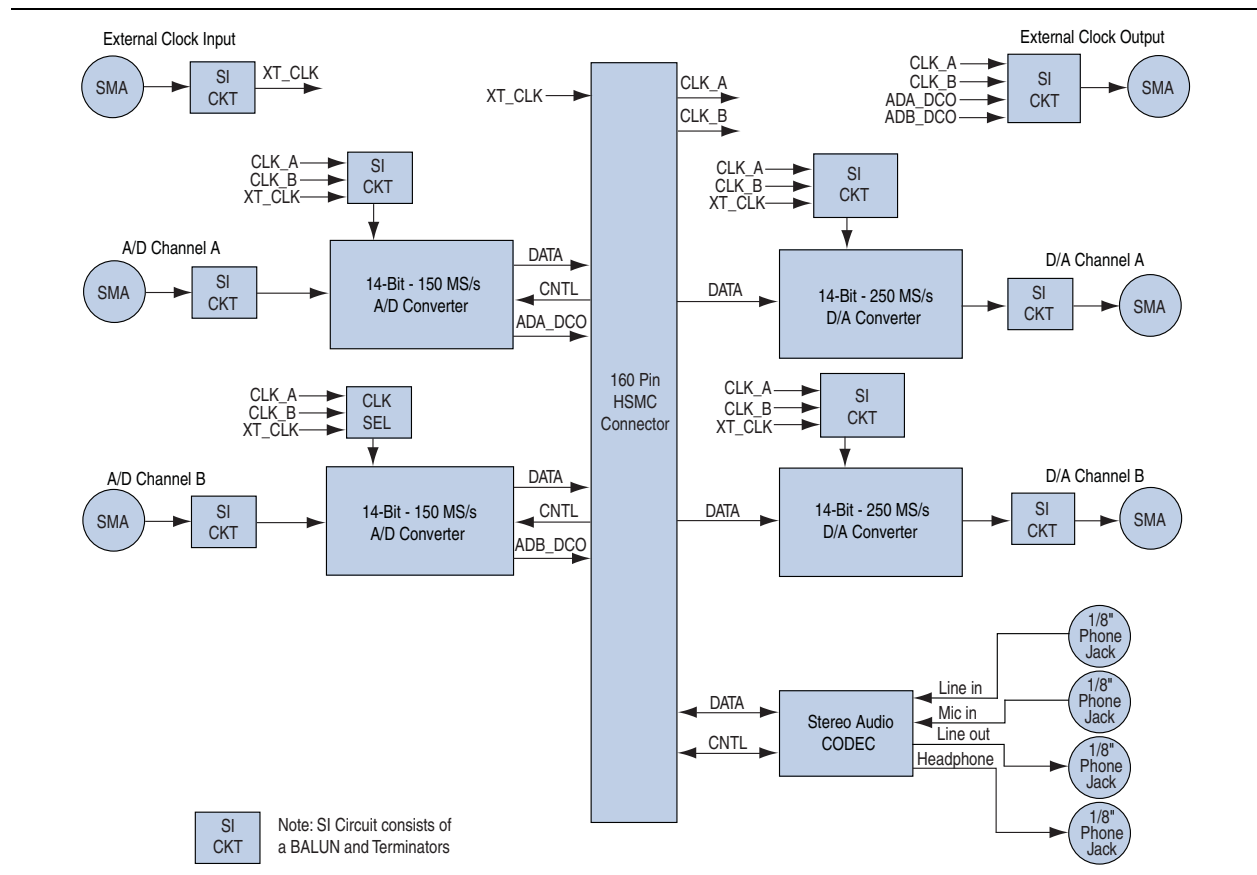
The Data Conversion HSMC contains the following components:

- Interfaces
  - HSMC interface
  - Audio CODEC interface
  - External Clock In interface
  - External Clock Out interface
  - A/D Converter Channels A and B Input interface
  - D/A Converter Channels A and B Output interface
- Power Supply
- I<sup>2</sup>C Serial EEPROM

## Block Diagram

Figure 1-2 shows the functional block diagram of the Data Conversion HSMC.

Figure 1-2. Data Conversion HSMC Block Diagram



### Board Overview

This chapter provides operational and connectivity details about the Data Conversion HSMC's major components and interfaces.

Board schematics, board layout database, and assembly files for the Data Conversion HSMC are included in the `board_design_files` subdirectory of the installed kit directory. For information about powering up the Data Conversion HSMC and installing the demo software and examples, refer to the user guide provided with your kit.

Figure 2–1 shows the layout and components of the Data Conversion HSMC.

**Figure 2–1.** Data Conversion HSMC Layout and Components

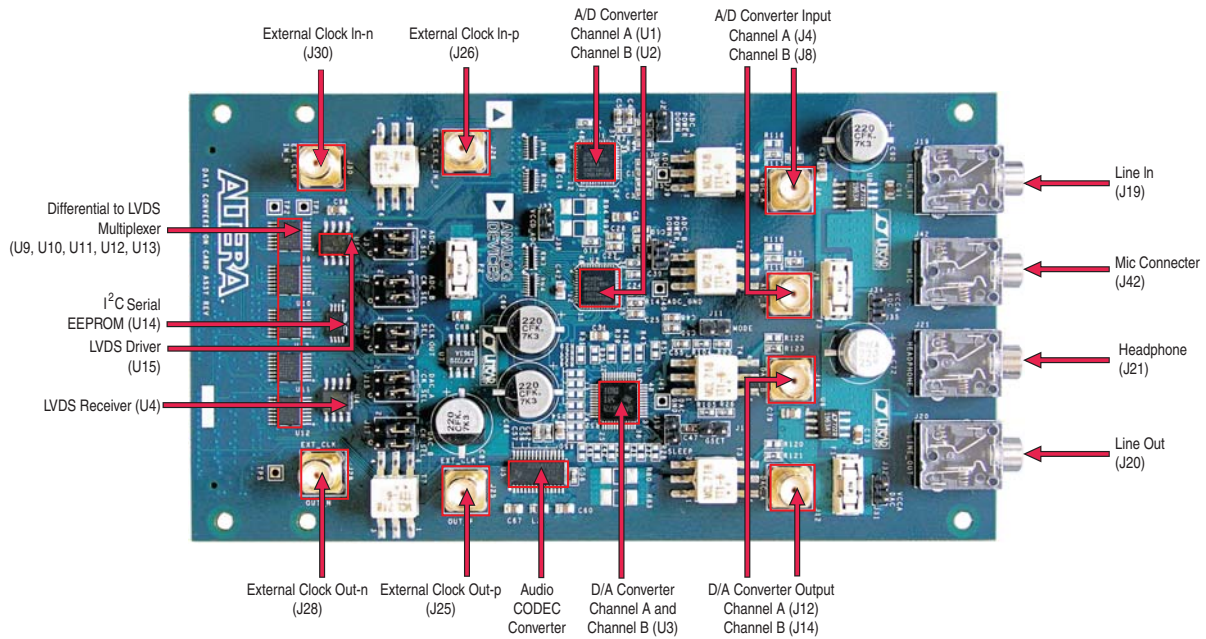


Figure 2-2 shows the back view of the Data Conversion HSMC.

**Figure 2-2.** Data Conversion HSMC—Back View

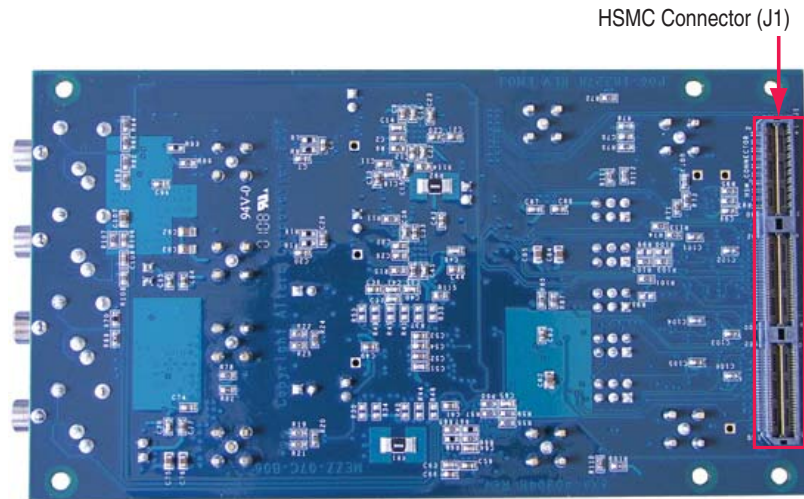


Table 2-1 lists the components and their corresponding board references.

**Table 2-1.** Data Conversion HSMC Feature Overview (Part 1 of 2)

Board Reference	Name	Description	Page
<b>Configuration, Status, and Setup Elements</b>			
J3 (Channel A) J7 (Channel B)	A/D converter clock select jumper	Controls which of the three input clock signals (FPGA clock A, B, or the external SMA clock) is routed to the A/D converter.	2-3
J2 (Channel A) J6 (Channel B)	Power down select jumper	Controls whether the A/D converter operates in power down or power up state.	2-4
J15 (Channel A) J17 (Channel B)	D/A converter clock select jumper	Controls which of the three input clock signals (FPGA clock A, B, or the external SMA clock) is routed to the D/A converter.	2-4
J11	Mode select jumper	Controls whether the D/A converter operates in dual bus mode or interleaved mode.	2-5
J10	Gain setting select jumper	Controls whether the D/A converter channel's gain is set through one or two resistors.	2-5
J13	Sleep select jumper	Controls whether the D/A converter operates in power down or power up state.	2-5
J23	External clock output select jumper	Selects which of the four input clocks (FPGA clock A, B or A/D converter Data Clock Output) is routed to the SMA clock out (J28).	2-6
<b>Clock</b>			
J26 (External Clock In-p) J30 (External Clock In-n)	External clock input SMA connectors	SMA connectors for a differential clock input.	2-6

**Table 2-1.** Data Conversion HSMC Feature Overview (Part 2 of 2)

Board Reference	Name	Description	Page
J25 (External Clock Out-p) J28 (External Clock Out-n)	External clock output SMA connectors	SMA connectors for a differential clock output	2-7
<b>Components and Interfaces</b>			
U1 (Channel A) U2 (Channel B)	A/D converter	Analog Devices AD9254. 14-bit, 150 MS/s ADC	2-7
J4 (Channel A) J8 (Channel B)	A/D converter input SMAs	SMAs that drive the A/D converter inputs	2-11
U3 (Channels A and B)	D/A converter	Texas Instruments DAC5672. 14-bit, 175 MS/s D/A converter	2-11
J12 (Channel A) J14 (Channel B)	D/A converter output SMAs	SMA outputs for the D/A converters	2-14
U5	Audio CODEC	Texas Instruments TLV320AK23. Stereo Audio CODEC, 96 KHz, with integrated headphone amplifier	2-14
J19	Line-in audio jack	3.5-mm audio connector for line-in	2-15
J20	Line-out audio jack	3.5-mm audio connector for line-out	2-15
J21	Headphone jack	3.5-mm audio connector for headphone	2-15
J42	Mic jack	3.5-mm audio connector for microphone	2-15
J1	HSMC	Expansion connector used to interface with Altera development boards	2-15
U14	I <sup>2</sup> C EEPROM	ISSI EEPROM IS24C02B, 2 Kbits	2-16

## Configuration, Status, and Setup Elements

This section describes configuration, status, and setup elements.

### A/D Converter Clock Select Jumper (J3, J7)

Table 2-2 lists the J3 (channel A) and J7 (channel B) jumper settings used to select the A/D converter clock.

**Table 2-2.** A/D Converter Clock Select Jumper (J3, J7) Settings (Part 1 of 2)

Clock Source	Board Reference	Schematic Signal Name (1), (2), (3)	A/D Converter Clock Select (J3 or J7) Jumper Setting
FPGA Clock	HSMC Connector	FPGA_CLK_A_P FPGA_CLK_A_N	Pins 3 and 5 Pins 4 and 6
FPGA Clock	HSMC Connector	FPGA_CLK_B_P FPGA_CLK_B_N	Pins 1 and 3 Pins 4 and 6
External Clock	External Clock Input SMA	XT_IN_P XT_IN_N	Pins 3 and 5 Pins 2 and 4

**Table 2-2.** A/D Converter Clock Select Jumper (J3, J7) Settings (Part 2 of 2)

Clock Source	Board Reference	Schematic Signal Name (1), (2), (3)	A/D Converter Clock Select (J3 or J7) Jumper Setting
No Clock	—	NO_CLK_P NO_CLK_N	Pins 1 and 3 Pins 2 and 4

**Notes to Table 2-2:**

- (1) Refer to the appendices for FPGA pin numbers for specific development boards.
- (2) On the schematic, MUX (U9) output signal names are ADA\_CLK\_SEL\_P and ADA\_CLK\_SEL\_N.
- (3) On the schematic, MUX (U10) output signal names are ADB\_CLK\_SEL\_P and ADB\_CLK\_SEL\_N.

**Power Down Select Jumper (J2, J6)**

The power down configuration of the A/D converter is selectable through J2 (channel A) or J6 (channel B). Table 2-3 lists the jumper settings for power down options. A/D converters should be powered down when not used to reduce spurious noise output.

**Table 2-3.** Power Down Select Jumper Settings for AD9254 A/D Converter (U1, U2)

A/D Converter	Jumper Settings (1)	Description
U1 (Channel A)	J2 Jumper OFF	A/D converter channel A in normal (operational) state
U1 (Channel A)	J2 Jumper ON	A/D converter channel A in power down
U2 (Channel B)	J6 Jumper OFF	A/D converter channel B in normal (operational) state
U2 (Channel B)	J6 Jumper ON	A/D converter channel B in power down

**Note to Table 2-3:**

- (1) If jumper pins are left open, A/D converter will be in normal state.

**D/A Converter Clock Select Jumper (J15, J17)**

Table 2-4 lists the J15 (channel A) and J17 (channel B) jumper settings used to select the D/A converter clock.

**Table 2-4.** D/A Converter Clock Select Jumper (J15, J17) Settings

Clock Source	Board Reference	Schematic Signal Name (1), (2)	D/A Converter Clock Select (J15 or J17) Jumper Setting
FPGA Clock	HSMC Connector	FPGA_CLK_A_P FPGA_CLK_A_N	Pins 3 and 5 Pins 4 and 6
FPGA Clock	HSMC Connector	FPGA_CLK_B_P FPGA_CLK_B_N	Pins 1 and 3 Pins 4 and 6
External Clock	External Clock Input SMA	XT_IN_P XT_IN_N	Pins 3 and 5 Pins 2 and 4
No Clock	—	NO_CLK_P NO_CLK_N	Pins 1 and 3 Pins 2 and 4

**Notes to Table 2-4:**

- (1) On the schematic, MUX (U11) output signal names are DAC\_CLK\_1\_P and DAC\_CLK\_1\_N.
- (2) On the schematic, MUX (U12) output signal names are DAC\_CLK\_2\_P and DAC\_CLK\_2\_N.

## Mode Select Jumper (J11)

The mode select jumper is used to put the D/A converter in either dual bus or interleaved mode. It is selectable through J11 (channel A and channel B). [Table 2-5](#) lists the jumper settings for mode select options.

**Table 2-5.** Mode Select Jumper (J11) Settings for DAC5672 D/A Converter

Jumper Settings (J11)	Description
Jumper ON	Interleaved mode
Jumper OFF	Dual bus mode

## Gain Select Jumper (J10)

The gain setting select jumper is used to set gain of the D/A converter's channels. It is selectable through J10 (channel A and channel B). [Table 2-6](#) lists the jumper settings for gain settings options.

**Table 2-6.** Gain Select Jumper (J10) Settings for DAC5672 D/A Converter

Jumper Settings (J10)	Description
Jumper ON	Sets gain of channel A through RSET on BiasJ_A pin, and of channel B through RSET on BiasJ_B pin.
Jumper OFF	Gain of channels A and B is set through RSET on BiasJ_A pin only and RSET on BiasJ_B pin is ignored.

## Sleep Select Jumper (J13)

The sleep select jumper is used to put the D/A converter in power down mode. It is selectable through J13 (channel A and channel B). [Table 2-7](#) lists the jumper settings for sleep select options. The D/A converter when not in use should be put in sleep mode.

**Table 2-7.** Sleep Select Jumper (J13) Settings for DAC5672 D/A Converter

Jumper Settings (J13)	Description
Jumper ON	Puts D/A converter in power down mode
Jumper OFF	D/A converter in normal state

## External Clock Output Select Jumper (J23)

Table 2-8 lists the external clock output select jumper (J23) settings.

**Table 2-8.** External Clock Output Select Jumper (J23) Settings

Clock Source	Board Reference	Schematic Signal Name (1)	External Clock Output Select Jumper (J23) Settings
FPGA Clock	HSMC Connector	FPGA_CLK_A_P FPGA_CLK_A_N	Pins 3 and 5 Pins 4 and 6
FPGA Clock	HSMC Connector	FPGA_CLK_B_P FPGA_CLK_B_N	Pins 1 and 3 Pins 4 and 6
A/D A DCO	A/D Channel A	ADA_DCO_P ADA_DCO_N	Pins 3 and 5 Pins 2 and 4
A/D B DCO	A/D Channel B	ADB_DCO_P ADB_DCO_N	Pins 1 and 3 Pins 2 and 4

**Note to Table 2-8:**

(1) On the schematic, MUX (U13) output signal names are RX\_CLK\_P and RX\_CLK\_N.

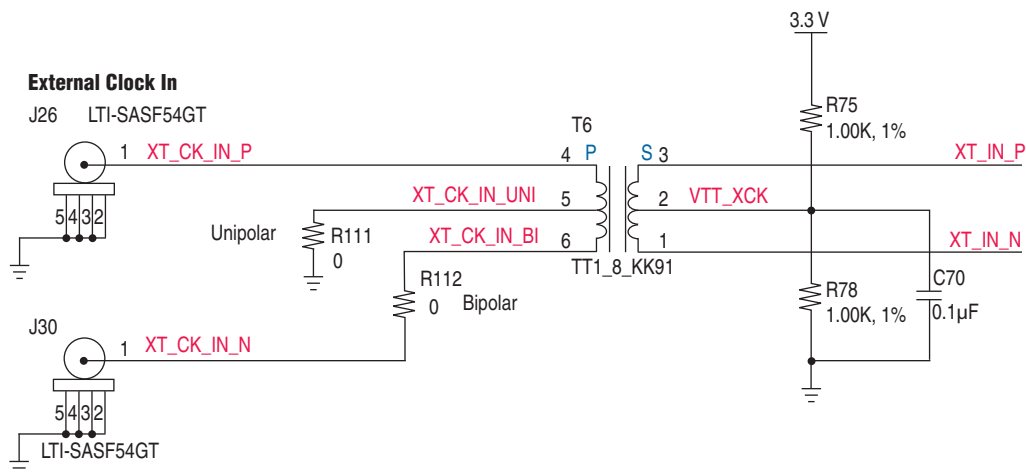
## Clocks

This section describes the external clock input and output SMA connectors.

### External Clock Input SMA Connectors (J26, J30)

The CLK SMA connector (J26 or J30) provides an external clock input. It can be selected to be the input to U1, U2, and U3 (Figure 2-3). An external clock input provides (while using a particular design) the flexibility to use the same external clock source for the entire system under test. If you choose to use a single-ended clock, R112 must be removed and R111 be installed.

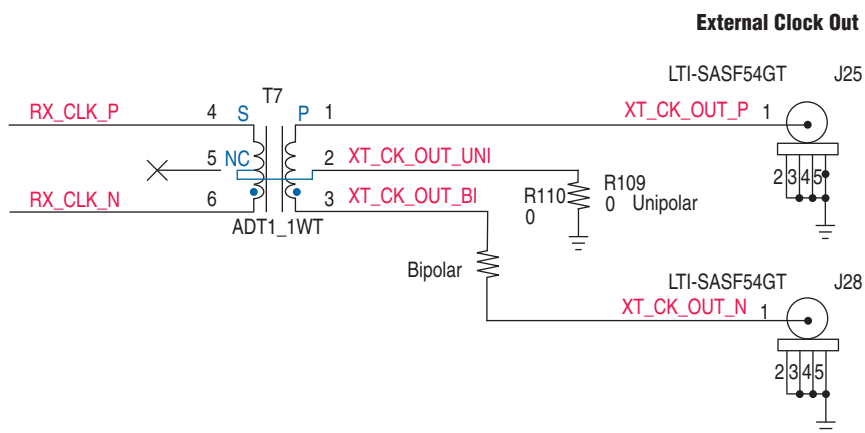
**Figure 2-3.** External Clock Input Schematic



## External Clock Output SMA Connectors (J25, J28)

The CLK SMA connector (J25 or J28) provides an external clock output. Different clocks can be selected by using differential LVDS multiplexer (U13) and clock select jumper (J23) (Figure 2-4). The external clock source provides (while using a particular design) the flexibility to alter the input frequency to verify  $f_{MAX}$  tolerances. If you choose to use a single-ended clock, R110 must be removed and R109 be installed.

Figure 2-4. External Clock Output Schematic



## Component Interfaces

This section describes the user interfaces, which consist of the A/D converter, D/A converter, audio CODEC converter, HSMC connector, and I<sup>2</sup>C Serial EEPROM.

### A/D Converter (U1, U2)

The Data Conversion HSMC contains two AD9254 14-bit 150 MS/s A/D converters. This device is designed for high-speed and high-performance applications.

The inputs to these A/D converters are transformer-coupled in order to create a balanced input. The signal-to-noise ratio for the system is up to 72 dB for input signals from 1 MHz to the Nyquist frequency of the converter. The maximum differential input voltage to the converter is 2 V<sub>PP</sub>. Usable voltage input to the SMA connector is approximately 512 mV when driven from a 50-Ω source.

Table 2-9 lists the A/D converter board reference and manufacturing information.

Table 2-9. A/D Converter Component Reference

Board Reference	Device Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
U1, U2	14-bit, 150 MS/s A/D converter	Analog Device	AD9254	<a href="http://www.analog.com">www.analog.com</a>

Table 2-10 provides the pin-out details of the A/D converter channel A.

**Table 2-10.** A/D converter Channel A (U1) Pin-Out Information

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
ADA_D0	79	D0	45	Data Output Bit 0
ADA_D1	77	D1	46	Data Output Bit 1
ADA_D2	73	D2	1	Data Output Bit 2
ADA_D3	71	D3	2	Data Output Bit 3
ADA_D4	67	D4	3	Data Output Bit 4
ADA_D5	65	D5	4	Data Output Bit 5
ADA_D6	61	D6	5	Data Output Bit 6
ADA_D7	59	D7	6	Data Output Bit 7
ADA_D8	55	D8	9	Data Output Bit 8
ADA_D9	53	D9	10	Data Output Bit 9
ADA_D10	49	D10	11	Data Output Bit 10
ADA_D11	47	D11	12	Data Output Bit 11
ADA_D12	43	D12	13	Data Output Bit 12
ADA_D13	41	D13	14	Data Output Bit 13
ADA_OR	83	OR	15	Out-of-Range Indicator
AD_SDIO	91	SDIO/DCS	18	Serial Port Interface (SPI) Data Input/Output (Serial Port Mode)
AD_SCLK	92	SCLK/DFS	19	Serial Port Interface Clock (Serial Port Mode)
ADA_SPI_CS	89	CSB	20	Serial Port Interface Chip Select (Active Low)
ADA_OE	85	OEB	43	Output Enable (Active Low)
ADA_DCO	156	DCO	44	Data Clock Output
—	—	ADA_CLK_P	38 (1)	Clock Input
—	—	ADA_CLK_N	39 (2)	Clock Input
—	—	ADA_PWDN	36 (3)	Power-Down Function Select

**Notes to Table 2-10:**

- (1) This pin is connected to Multiplexer pin U9.15.
- (2) This pin is connected to Multiplexer pin U9.14.
- (3) This pin is connected to Jumper pin J2.2.

Table 2-11 provides the pin-out details of the A/D converter channel B.

**Table 2-11.** A/D Converter Channel B (U2) Pin-Out Information (Part 1 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
ADB_D0	80	D0	45	Data Output Bit 0
ADB_D1	78	D1	46	Data Output Bit 1
ADB_D2	74	D2	1	Data Output Bit 2
ADB_D3	72	D3	2	Data Output Bit 3

**Table 2-11.** A/D Converter Channel B (U2) Pin-Out Information (Part 2 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
ADB_D4	68	D4	3	Data Output Bit 4
ADB_D5	66	D5	4	Data Output Bit 5
ADB_D6	62	D6	5	Data Output Bit 6
ADB_D7	60	D7	6	Data Output Bit 7
ADB_D8	56	D8	9	Data Output Bit 8
ADB_D9	54	D9	10	Data Output Bit 9
ADB_D10	50	D10	11	Data Output Bit 10
ADB_D11	48	D11	12	Data Output Bit 11
ADB_D12	44	D12	13	Data Output Bit 12
ADB_D13	42	D13	14	Data Output Bit 13
ADB_OR	84	OR	15	Out-of-Range Indicator
AD_SDIO	91	SDIO/DCS	18	Serial Port Interface (SPI) Data Input/Output (Serial Port Mode)
AD_SCLK	92	SCLK/DFS	19	Serial Port Interface Clock (Serial Port Mode)
ADB_SPI_CS	90	CSB	20	Serial Port Interface Chip Select (Active Low)
ADB_OE	86	OEB	43	Output Enable (Active Low)
ADB_DCO	158	DCO	44	Data Clock Output
—	—	ADB_CLK_P	38 (1)	Clock Input
—	—	ADB_CLK_N	39 (2)	Clock Input
—	—	ADB_PWDN	36 (3)	Power-Down Function Select

**Notes to Table 2-11:**

- (1) This pin is connected to Multiplexer pin U10.15.
- (2) This pin is connected to Multiplexer pin U10.14.
- (3) This pin is connected to Jumper pin J6.2.

### A/D Converter Clocks

Figure 2-5 shows the components involved in selecting the clock signal to be sent to the AD9254 A/D converter (U1 for channel A, U2 for channel B). J3 (channel A) or J7 (channel B) selects the A/D clock from the FPGA clock A, the FPGA clock B, or the external SMA clock (J26 and J30). The selected A/D clock passes through a differential to LVDS clock multiplexer (U9 for channel A, U10 for channel B), which provides the clock signal to the AD9254.

Figure 2-5. A/D Converter Clocking Options

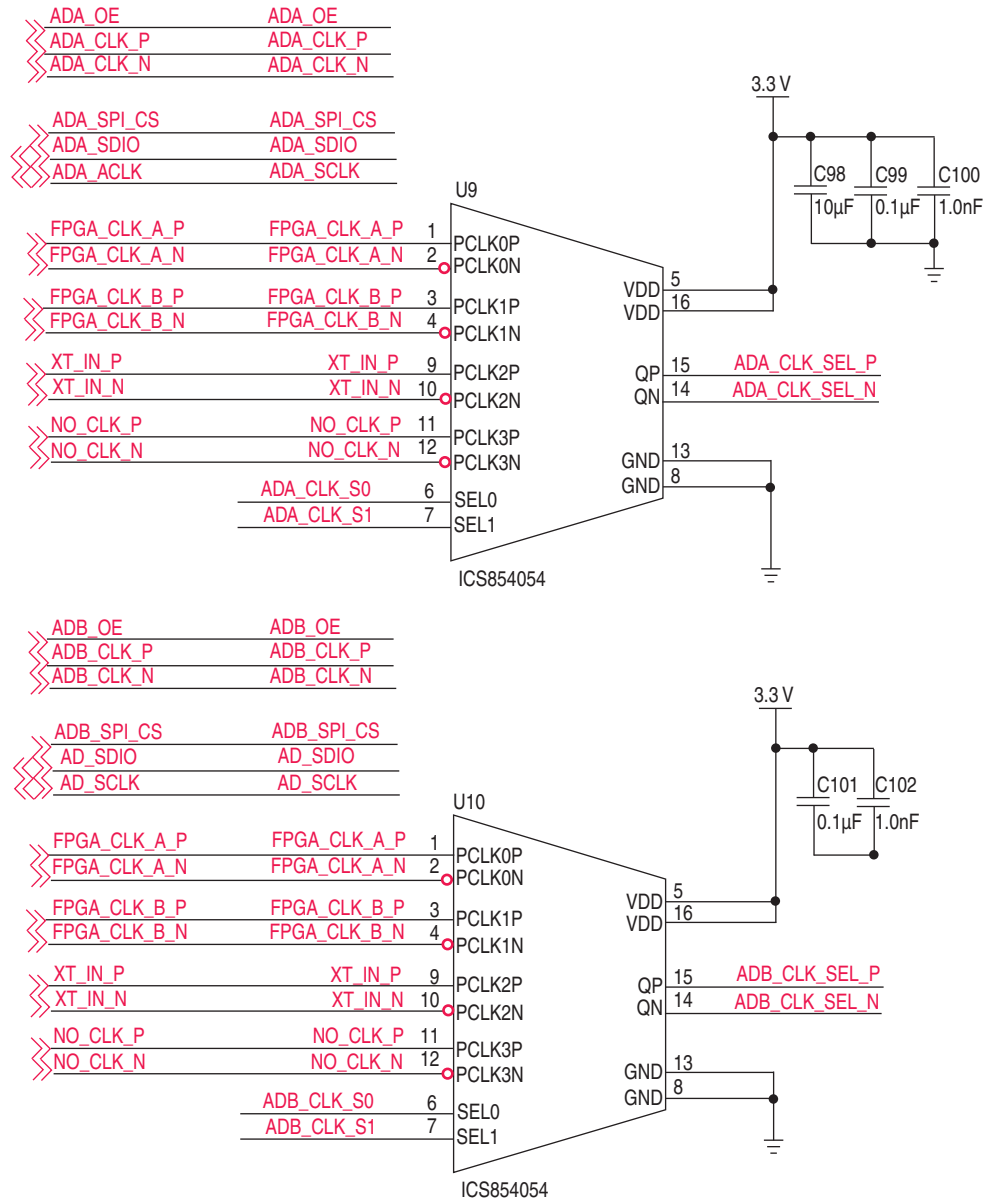


Table 2-12 provides the differential to LVDS clock multiplexer pin-out details.

Table 2-12. Differential to LVDS Clock Multiplexer (U9, U10) Pin-Out Information (Part 1 of 2)

Schematic Signal	HSMC Connector Pin Number	Device Signal	Device Pin Number	Description
FPGA_CLK_A_P	95	PCLK0P	1	Non-inverting Differential clock input
FPGA_CLK_A_N	97	PCLK0N	2	Inverting Differential clock input
FPGA_CLK_B_P	155	PCLK1P	3	Non-inverting Differential clock input
FPGA_CLK_B_N	157	PCLK1N	4	Inverting Differential clock input

**Table 2-12.** Differential to LVDS Clock Multiplexer (U9, U10) Pin-Out Information (Part 2 of 2)

Schematic Signal	HSMC Connector Pin Number	Device Signal	Device Pin Number	Description
XT_IN_P	96	PCLK2P	9	Non-inverting Differential clock input
XT_IN_N	98	PCLK2N	10	Inverting Differential clock input
AD (A, B) _CLK_SEL_P	—	QP	15	Non-inverting Differential Clock Output
AD (A, B) _CLK_SEL_N	—	QN	14	Inverting Differential Clock Output

## A/D Converter Input SMA Connector (J4, J8)

J4 (channel A) and J8 (channel B) are standard through-hole SMA connectors used to interface the AD9254 A/D converter input with SMA cables.

## D/A Converter (U3)

The D/A converter (U3 for channels A and B) on the Data Conversion HSMC provides 14-bit resolution and produces samples at rates up to 275 MS/s. It is a high-speed TI DAC5672 D/A converter and is set up to drive a differential-to-single output through a transformer. The output is transformer coupled and can be found on the SMA connector (J12 for channel A, J14 for channel B). The output of the TI DAC5672 D/A converter is set to the maximum output current of 20 mA. The signal-to-noise ratio for the system is up to 60 dB for output signals from 1 MHz to the Nyquist frequency of the converter.

Table 2-13 lists the D/A converter board reference and manufacturing information.

**Table 2-13.** D/A Converter Component Reference

Board Reference	Device Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
U3	14-bit, 275 MS/s D/A converter	Texas Instruments	DAC5672	<a href="http://www.ti.com">www.ti.com</a>

Table 2-14 provides the pin-out details of the D/A converter channel A and channel B.

**Table 2-14.** D/A Converter Channel A and Channel B (U3) Pin-Out Information (Part 1 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
DA0	139	DA0	14	Data port A0
DA1	137	DA1	13	Data port A1
DA2	133	DA2	12	Data port A2
DA3	131	DA3	11	Data port A3
DA4	127	DA4	10	Data port A4
DA5	125	DA5	9	Data port A5
DA6	121	DA6	8	Data port A6
DA7	119	DA7	7	Data port A7
DA8	115	DA8	6	Data port A8
DA9	113	DA9	5	Data port A9

**Table 2-14.** D/A Converter Channel A and Channel B (U3) Pin-Out Information (Part 2 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
DA10	109	DA10	4	Data port A10
DA11	107	DA11	3	Data port A11
DA12	103	DA12	2	Data port A12
DA13	101	DA13	1	Data port A13
DB0	140	DB0	36	Data port B0
DB1	138	DB1	35	Data port B1
DB2	134	DB2	34	Data port B2
DB3	132	DB3	33	Data port B3
DB4	128	DB4	32	Data port B4
DB5	126	DB5	31	Data port B5
DB6	122	DB6	30	Data port B6
DB7	120	DB7	29	Data port B7
DB8	116	DB8	28	Data port B8
DB9	114	DB9	27	Data port B9
DB10	110	DB10	26	Data port B10
DB11	108	DB11	25	Data port B11
DB12	104	DB12	24	Data port B12
DB13	102	DB13	23	Data port B13
—	—	CLKA	18 (1)	Clock input for DACA, CLKIQ in interleaved mode
—	—	CLKB	19 (2)	Clock input for DACB, RESETIQ in interleaved mode
—	—	GSET	42 (3)	Gain-setting mode: H – 1 resistor, L – 2 resistors. Internal pull-up.
—	—	MODE	48 (4)	Mode Select: H – Dual Bus, L – Interleaved. Internal pull-up.
—	—	SLEEP	37 (5)	Sleep function control input: H – DAC in power-down mode, L – DAC in operating mode. Internal pull-down.

**Notes to Table 2-14:**

- (1) This pin is connected to Differential Receiver pin U4.7.
- (2) This pin is connected to Differential Receiver pin U4.6.
- (3) This pin is connected to Jumper pin J10.1.
- (4) This pin is connected to Jumper pin J11.1.
- (5) This pin is connected to Jumper pin J13.2.

### D/A Converter Clocks

Figure 2-6 shows the components involved in selecting the clock signal to be sent to the DAC5672 (U3 for channels A and B). J15 (channel A) or J17 (channel B) selects the D/A clock from the FPGA clock A, the FPGA clock B, or the SMA clock (J26 and J30). The selected D/A clock passes through a differential to LVDS clock multiplexer (U11 for channel A, U12 for channel B), which provides the clock signal to 2-bit high-speed differential receiver FIN1028, which in turn outputs clock to the DAC5672 (refer to “D/A Converter Clock Select Jumper (J15, J17)” on page 2-4.)

Figure 2-6. D/A Converter Clocking Options

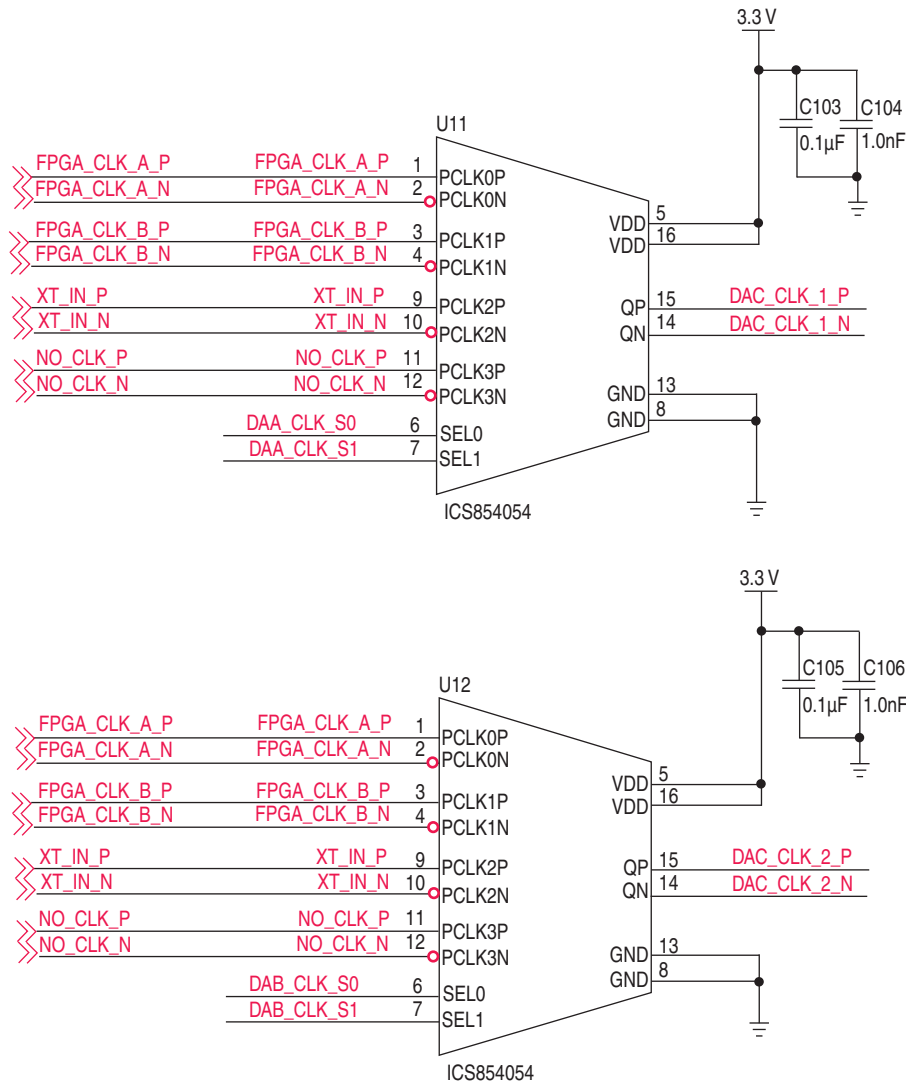


Table 2-15 provides the differential to LVDS clock multiplexer pin-out details.

**Table 2-15.** Differential to LVDS Clock Multiplexer (U11, U12) Pin-Out Information

Schematic Signal	HSMC Connector Pin Number	Device Signal	Device Pin Number	Description
FPGA_CLK_A_P	95	PCLK0P	1	Non-inverting Differential clock input
FPGA_CLK_A_N	97	PCLK0N	2	Inverting Differential clock input
FPGA_CLK_B_P	155	PCLK1P	3	Non-inverting Differential clock input
FPGA_CLK_B_N	157	PCLK1N	4	Inverting Differential clock input
XT_IN_P	96	PCLK2P	9	Non-inverting Differential clock input
XT_IN_N	98	PCLK2N	10	Inverting Differential clock input
DA (A, B) _CLK_SEL_P	—	QP	15	Non-inverting Differential Clock Output
DA (A, B) _CLK_SEL_N	—	QN	14	Inverting Differential Clock Output

### D/A Converter Output SMA Connector (J12, J14)

J12 (channel A) and J14 (channel B) are standard through-hole SMA connectors used to interface the DAC5672 D/A converter output with SMA cables.

### Audio CODEC Converter (U5)

The Data Conversion HSMC contains three stereo jack and one mic jack connectors which provide one stereo output, one stereo input, one amplified stereo headphone output, and one microphone input. The stereo jacks are driven by a stereo audio CODEC running at 8 to 96 kHz. Table 2-16 lists the audio CODEC board reference and manufacturing information.

**Table 2-16.** Audio CODEC Converter Component Reference

Board Reference	Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
U5	Stereo Audio CODEC, 8–96 KHz, with Integrated Headphone Amplifier	Texas Instruments	TLV320AIC23	<a href="http://www.ti.com">www.ti.com</a>

Table 2-17 provides the TI TLV320AIC23 audio CODEC pin-out details.

**Table 2-17.** Audio CODEC Converter (U5) Pin-Out Information (Part 1 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
AIC_XCLK	150	XTI/MCLK	25	Crystal or external-clock input. Used for derivation of all internal clocks on the AIC23B.
AIC_LRCOUT	146	LRCOUT	7	I2S A/D converter-word clock signal. In audio master mode, the AIC23B generates this framing signal and sends it to the DSP. In audio slave mode, the signal is generated by the DSP.
AIC_LRCIN	145	LRCIN	5	I2S D/A converter-word clock signal. In audio master mode, the AIC23B generates this framing signal and sends it to the DSP. In audio slave mode, the signal is generated by the DSP.

**Table 2-17.** Audio CODEC Converter (U5) Pin-Out Information (Part 2 of 2)

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
AIC_DIN	143	DIN	4	I2S format serial data input to the sigma-delta stereo D/A converter.
AIC_DOUT	144	DOOUT	6	I2S format serial data output from the sigma-delta stereo A/D converter.
AD_SCLK	92	SCLK	24	Control-port serial-data clock. For serial peripheral interface (SPI) and 2-wire control modes, this is the serial-clock input.
AD_SDIO	91	SDIN	23	I2S format serial data input to the sigma-delta stereo D/A converter.
AIC_SPI_CS	151	CS_n	21	Serial Control Interface Chip Select (Active Low).
AIC_BCLK	149	BCLK	3	I2S serial-bit clock. In audio master mode, the AIC23B generates this signal and sends it to the DSP. In audio slave mode, the signal is generated by the DSP.

### Audio Jacks (J19, J20, J21, J42)

The Data Conversion HSMC contains the following audio connectors:

- J19—an audio connector for line-in
- J20—an audio connector for line-out
- J21—an audio connector for amplified line-out
- J42—an audio connector for microphone

### HSMC Connector (J1)

The Data Conversion HSMC connects to Altera FPGA starter and development boards through a single HSMC connector (J6).

Table 2-18 lists the HSMC connector board reference and manufacturing information.

**Table 2-18.** Audio CODEC Converter Component Reference

Board Reference	Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
J1	High-Speed Mezzanine Card Connector	Samtec	ASP-122952-01	<a href="http://www.samtec.com">www.samtec.com</a>

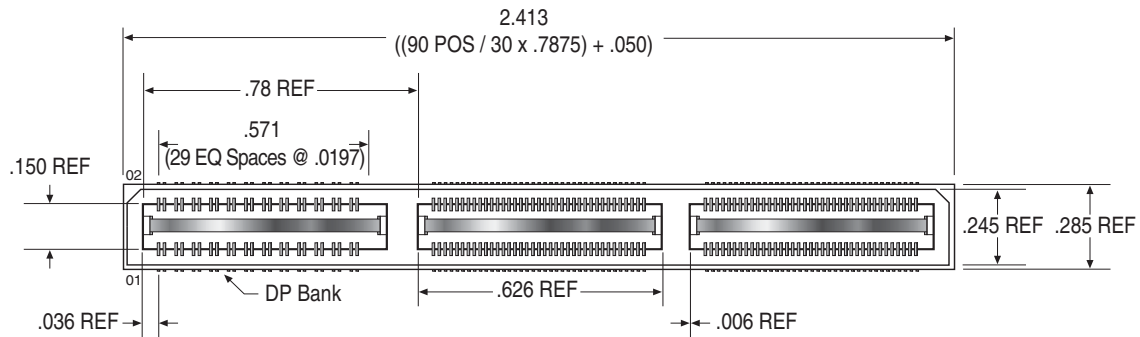
The HSMC connector is a modified version of the standard high-speed Samtec connectors. To provide better integrity between host boards and daughter cards when using high-speed transceivers, the standard high-speed Samtec connector is modified by removing every third pin in bank 1.



CMOS utilization of the HSMC pins is assumed and no options for supporting other differential signaling are provided with the board. The eight clock-data-recovery high-speed transceiver channels are not connected on this HSMC.

Figure 2-7 shows the HSMC connector layout.

**Figure 2-7.** Samtec Header Connector



## I<sup>2</sup>C Serial EEPROM (U14)

There is a 2-Kbit I<sup>2</sup>C Serial EEPROM on the Data Conversion HSMC. Table 2-19 lists the I<sup>2</sup>C Serial EEPROM board reference and manufacturing information.

**Table 2-19.** I<sup>2</sup>C Serial EEPROM Component Reference

Board Reference	Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
U14	2-Kbit I <sup>2</sup> C Serial EEPROM	ISSI	IS24C02B	<a href="http://www.issi.com">www.issi.com</a>

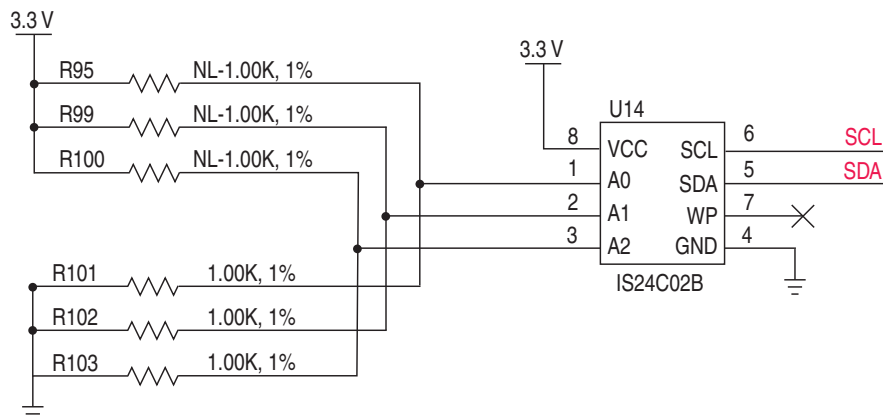
Table 2-20 provides the pin-out details of the I<sup>2</sup>C Serial EEPROM with HSMC connector.

**Table 2-20.** I<sup>2</sup>C Serial EEPROM (U14) Pin-Out Information

HSMC Signal	HSMC Pin	Device Signal	Device Pin Number	Description
SCL	34	SCL	6	Serial Clock Input
SDA	33	SDA	5	Serial Address/Data I/O

Figure 2-8 shows the I<sup>2</sup>C Serial EEPROM schematic.

Figure 2-8. I<sup>2</sup>C Serial EEPROM Schematic



## Power Supply

### A/D Power Supplies (U6, U7, U8)

The power supply block distributes clean power from the 12-V and 3.3-V input supply (from the host board through the HSMC connector) to the Data Conversion HSMC through on-board regulators. To provide various voltage options, the board uses several Linear Technologies regulators.

Table 2-21 lists the Power Supplies board reference and manufacturing information.

Table 2-21. Power Supplies Component Reference

Board Reference	Description	Manufacturer	Manufacturing Part Number	Manufacturer Website
U6, U7, U8	LT1963A - 1.5A, Low Noise, Fast Transient Response LDO Regulators	Linear Technologies	LT1963	<a href="http://www.linear.com">www.linear.com</a>





# A. Pin-Out Information for the Cyclone III (3C120) Development Board

Table A-1 provides the HSMC Port A interface pin-out information for the Cyclone III EP3C120F780 development board.

**Table A-1.** HSMC Port A Interface Pin-Out Information (Part 1 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
33	Management serial data	SDA	HSMA_SDA	2.5 V	AC1
34	Management serial clock	SCL	HSMA_SCL	2.5 V	AC3
41	Dedicated CMOS I/O bit 0	ADA_D13	HSMA_D0	2.5 V	AB6
42	Dedicated CMOS I/O bit 1	ADB_D13	HSMA_D1	2.5 V	AF2
43	Dedicated CMOS I/O bit 2	ADA_D12	HSMA_D2	2.5 V	AE3
44	Dedicated CMOS I/O bit 3	ADB_D12	HSMA_D3	2.5 V	AC5
47	LVDS TX or CMOS I/O bit 0	ADA_D11	HSMA_TX_D_P0	LVDS or 2.5 V	R7
48	LVDS RX or CMOS I/O bit 0	ADB_D11	HSMA_RX_D_P0	LVDS or 2.5 V	AB2
49	LVDS TX or CMOS I/O bit 0	ADA_D10	HSMA_TX_D_N0	LVDS or 2.5 V	R6
50	LVDS RX or CMOS I/O bit 0	ADB_D10	HSMA_RX_D_N0	LVDS or 2.5 V	AB1
53	LVDS TX bit 1p or CMOS I/O data 8	ADA_D9	HSMA_TX_D_P1	LVDS or 2.5 V	V4
54	LVDS RX bit 1p or CMOS I/O data 9	ADB_D9	HSMA_RX_D_P1	LVDS or 2.5 V	Y4
55	LVDS TX bit 1n or CMOS I/O data bit 10	ADA_D8	HSMA_TX_D_N1	LVDS or 2.5 V	V3
56	LVDS RX bit 1n or CMOS I/O data bit 11	ADB_D8	HSMA_RX_D_N1	LVDS or 2.5 V	Y3
59	LVDS TX bit 2p or CMOS I/O data bit 12	ADA_D7	HSMA_TX_D_P2	LVDS or 2.5 V	T4
60	LVDS RX bit 2p or CMOS I/O data bit 13	ADB_D7	HSMA_RX_D_P2	LVDS or 2.5 V	U3
61	LVDS TX bit 2n or CMOS I/O data bit 14	ADA_D6	HSMA_TX_D_N2	LVDS or 2.5 V	T3
62	LVDS RX bit 2n or CMOS I/O data bit 15	ADB_D6	HSMA_RX_D_N2	LVDS or 2.5 V	U4
65	LVDS TX bit 3p or CMOS I/O data bit 16	ADA_D5	HSMA_TX_D_P3	LVDS or 2.5 V	R3

**Table A-1.** HSMC Port A Interface Pin-Out Information (Part 2 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
66	LVDS RX bit 3p or CMOS I/O data bit 17	ADB_D5	HSMA_RX_D_P3	LVDS or 2.5 V	W2
67	LVDS TX bit 3n or CMOS I/O data bit 18	ADA_D4	HSMA_TX_D_N3	LVDS or 2.5 V	R4
68	LVDS RX bit 3n or CMOS I/O data bit 19	ADB_D4	HSMA_RX_D_N3	LVDS or 2.5 V	W1
71	LVDS TX bit 4p or CMOS I/O data bit 20	ADA_D3	HSMA_TX_D_P4	LVDS or 2.5 V	M8
72	LVDS RX bit 4p or CMOS I/O data bit 21	ADB_D3	HSMA_RX_D_P4	LVDS or 2.5 V	V2
73	LVDS TX or 4n CMOS I/O data bit 22	ADA_D2	HSMA_TX_D_N4	LVDS or 2.5 V	M7
74	LVDS RX 4n or CMOS I/O data bit 23	ADB_D2	HSMA_RX_D_N4	LVDS or 2.5 V	V1
77	LVDS TX 5p or CMOS I/O data bit 24	ADA_D1	HSMA_TX_D_P5	LVDS or 2.5 V	P2
78	LVDS RX 5p or CMOS I/O data bit 25	ADB_D1	HSMA_RX_D_P5	LVDS or 2.5 V	U2
79	LVDS TX 5n or CMOS I/O data bit 26	ADA_D0	HSMA_TX_D_N5	LVDS or 2.5 V	P1
80	LVDS RX 5n or CMOS I/O data bit 27	ADB_D0	HSMA_RX_D_N5	LVDS or 2.5 V	U1
83	LVDS TX 6p or CMOS I/O data bit 28	ADA_OR	HSMA_TX_D_P6	LVDS or 2.5 V	M4
84	LVDS RX 6p or CMOS I/O data bit 29	ADB_OR	HSMA_RX_D_P6	LVDS or 2.5 V	U6
85	LVDS TX 6n or CMOS I/O data bit 30	ADA_OE	HSMA_TX_D_N6	LVDS or 2.5 V	M3
86	LVDS RX 6n or CMOS I/O data bit 31	ADB_OE	HSMA_RX_D_N6	LVDS or 2.5 V	U5
89	LVDS TX 7p or CMOS I/O data bit 32	ADA_SPI_CS	HSMA_TX_D_P7	LVDS or 2.5 V	M2
90	LVDS RX 7p or CMOS I/O data bit 33	ADB_SPI_CS	HSMA_RX_D_P7	LVDS or 2.5 V	R2
91	LVDS TX 7n or CMOS I/O data bit 34	AD_SDIO	HSMA_TX_D_N7	LVDS or 2.5 V	M1
92	LVDS RX 7n or CMOS I/O data bit 35	AD_SCLK	HSMA_RX_D_N7	LVDS or 2.5 V	R1
95	LVDS or CMOS clock out	FPGA_CLK_A_P	HSMA_CLK_OUT_P1	LVDS or 2.5 V	G6

**Table A-1.** HSMC Port A Interface Pin-Out Information (Part 3 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
96	LVDS or CMOS clock in	XT_IN_P	HSMA_CLK_IN_P1	LVDS or 2.5 V	Y2
97	LVDS or CMOS clock out	FPGA_CLK_A_N	HSMA_CLK_OUT_N1	LVDS or 2.5 V	G5
98	LVDS or CMOS clock in	XT_IN_N	HSMA_CLK_IN_N1	LVDS or 2.5 V	Y1
101	LVDS TX 8p or CMOS I/O data bit 40	DA13	HSMA_TX_D_P8	LVDS or 2.5 V	L7
102	LVDS RX 8p or CMOS I/O data bit 41	DB13	HSMA_RX_D_P8	LVDS or 2.5 V	N4
103	LVDS TX 8n or CMOS I/O data bit 42	DA12	HSMA_TX_D_N8	LVDS or 2.5 V	L6
104	LVDS RX 8n or CMOS I/O data bit 43	DB12	HSMA_RX_D_N8	LVDS or 2.5 V	N3
107	LVDS TX 9p or CMOS I/O data bit 44	DA11	HSMA_TX_D_P9	LVDS or 2.5 V	K8
108	LVDS RX 9p or CMOS I/O data bit 45	DB11	HSMA_RX_D_P9	LVDS or 2.5 V	L4
109	LVDS TX 9n or CMOS I/O data bit 46	DA10	HSMA_TX_D_N9	LVDS or 2.5 V	L8
110	LVDS RX 9n or CMOS I/O data bit 47	DB10	HSMA_RX_D_N9	LVDS or 2.5 V	L3
113	LVDS TX 10p or CMOS I/O data bit 48	DA9	HSMA_TX_D_P10	LVDS or 2.5 V	K4
114	LVDS RX 10p or CMOS I/O data bit 49	DB9	HSMA_RX_D_P10	LVDS or 2.5 V	L2
115	LVDS TX 10n or CMOS I/O data bit 50	DA8	HSMA_TX_D_N10	LVDS or 2.5 V	K3
116	LVDS RX 10n or CMOS I/O data bit 51	DB8	HSMA_RX_D_N10	LVDS or 2.5 V	L1
119	LVDS TX 11p or CMOS I/O data bit 52	DA7	HSMA_TX_D_P11	LVDS or 2.5 V	J4
120	LVDS RX 11p or CMOS I/O data bit 53	DB7	HSMA_RX_D_P11	LVDS or 2.5 V	K2
121	LVDS TX 11n or CMOS I/O data bit 54	DA6	HSMA_TX_D_N11	LVDS or 2.5 V	J3
122	LVDS RX 11n or CMOS I/O data bit 55	DB6	HSMA_RX_D_N11	LVDS or 2.5 V	K1
125	LVDS TX 12p or CMOS I/O data bit 56	DA5	HSMA_TX_D_P12	LVDS or 2.5 V	J7

**Table A-1.** HSMC Port A Interface Pin-Out Information (Part 4 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
126	LVDS RX 12p or CMOS I/O data bit 57	DB5	HSMA_RX_D_P12	LVDS or 2.5 V	J6
127	LVDS TX 12n or CMOS I/O data bit 58	DA4	HSMA_TX_D_N12	LVDS or 2.5 V	K7
128	LVDS RX 12n or CMOS I/O data bit 59	DB4	HSMA_RX_D_N12	LVDS or 2.5 V	J5
131	LVDS TX 13p or CMOS I/O data bit 60	DA3	HSMA_TX_D_P13	LVDS or 2.5 V	G2
132	LVDS RX 13p or CMOS I/O data bit 61	DB3	HSMA_RX_D_P13	LVDS or 2.5 V	H4
133	LVDS TX 13n or CMOS I/O data bit 62	DA2	HSMA_TX_D_N13	LVDS or 2.5 V	G1
134	LVDS RX 13n or CMOS I/O data bit 63	DB2	HSMA_RX_D_N13	LVDS or 2.5 V	H3
137	LVDS TX 14p or CMOS I/O data bit 64	DA1	HSMA_TX_D_P14	LVDS or 2.5 V	F5
138	LVDS TX 14p or CMOS I/O data bit 65	DB1	HSMA_RX_D_P14	LVDS or 2.5 V	G4
139	LVDS RX 14n or CMOS I/O data bit 66	DA0	HSMA_TX_D_N14	LVDS or 2.5 V	F4
140	LVDS RX 14n or CMOS I/O data bit 67	DB0	HSMA_RX_D_N14	LVDS or 2.5 V	G3
143	LVDS RX 15p or CMOS I/O data bit 68	AIC_DIN	HSMA_TX_D_P15	LVDS or 2.5 V	E2
144	LVDS TX 15p or CMOS I/O data bit 69	AIC_DOUT	HSMA_RX_D_P15	LVDS or 2.5 V	F2
145	LVDS RX 15n or CMOS I/O data bit 70	AIC_LRCIN	HSMA_TX_D_N15	LVDS or 2.5 V	E1
146	LVDS TX 15n or CMOS I/O data bit 71	AIC_LRCOUT	HSMA_RX_D_N15	LVDS or 2.5 V	F1
149	LVDS RX 16p or CMOS I/O data bit 72	AIC_BCLK	HSMA_TX_D_P16	LVDS or 2.5 V	D3
150	LVDS TX 16p or CMOS I/O data bit 73	AIC_XCLK	HSMA_RX_D_P16	LVDS or 2.5 V	E3
151	LVDS TX 16n or CMOS I/O data bit 74	AIC_SPI_CS	HSMA_TX_D_N16	LVDS or 2.5 V	G2
155	LVDS or CMOS clock out	FPGA_CLK_B_P	HSMA_CLK_OUT_P2	LVDS	D2
156	LVDS or CMOS clock in	ADA_DCO	HSMA_CLK_IN_P2	LVDS	J2
157	LVDS or CMOS clock out	FPGA_CLK_B_N	HSMA_CLK_OUT_N2	2.5 V	D1
158	LVDS or CMOS clock in	ADB_DCO	HSMA_CLK_IN_N2	2.5 V	J1

Table A-2 provides the HSMC Port B interface pin-out information for the Cyclone III EP3C120F780 development board.

**Table A-2.** HSMC Port B Interface Pin-Out Information (Part 1 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
33	Management serial data	SDA	HSMB_SDA	2.5 V	H26
34	Management serial clock	SCL	HSMB_SCL	2.5 V	H25
41	Dedicated CMOS I/O bit 0	ADA_D13	HSMB_D0	2.5 V	G24
42	Dedicated CMOS I/O bit 1	ADB_D13	HSMB_D1	2.5 V	H23
43	Dedicated CMOS I/O bit 2	ADA_D12	HSMB_D2	2.5 V	G25
44	Dedicated CMOS I/O bit 3	ADB_D12	HSMB_D3	2.5 V	H24
47	LVDS TX 0p or CMOS I/O data bit 4	ADA_D11	HSMB_TX_D_P0	LVDS or 2.5 V	J25
48	LVDS RX 0p or CMOS I/O data bit 5	ADB_D11	HSMB_RX_D_P0	LVDS or 2.5 V	F27
49	LVDS TX 0n or CMOS I/O data bit 6	ADA_D10	HSMB_TX_D_N0	LVDS or 2.5 V	J26
50	LVDS RX 0n or CMOS I/O data bit 7	ADB_D10	HSMB_RX_D_N0	LVDS or 2.5 V	F28
53	LVDS TX 1p or CMOS I/O data bit 8	ADA_D9	HSMB_TX_D_P1	LVDS or 2.5 V	L23
54	LVDS RX 1p or CMOS I/O data bit 9	ADB_D9	HSMB_RX_D_P1	LVDS or 2.5 V	G27
55	LVDS TX 1n or CMOS I/O data bit 10	ADA_D8	HSMB_TX_D_N1	LVDS or 2.5 V	L24
56	LVDS RX 1n or CMOS I/O data bit 11	ADB_D8	HSMB_RX_D_N1	LVDS or 2.5 V	G28
59	LVDS TX 2p or CMOS I/O data bit 12	ADA_D7	HSMB_TX_D_P2	LVDS or 2.5 V	M25
60	LVDS RX 2p or CMOS I/O data bit 13	ADB_D7	HSMB_RX_D_P2	LVDS or 2.5 V	K25
61	LVDS TX 2n or CMOS I/O data bit 14	ADA_D6	HSMB_TX_D_N2	LVDS or 2.5 V	M26
62	LVDS RX 2n or CMOS I/O data bit 15	ADB_D6	HSMB_RX_D_N2	LVDS or 2.5 V	K26
65	LVDS TX 3p or CMOS I/O data bit 16	ADA_D5	HSMB_TX_D_P3	LVDS or 2.5 V	N25
66	LVDS RX 3p or CMOS I/O data bit 17	ADB_D5	HSMB_RX_D_P3	LVDS or 2.5 V	K27
67	LVDS TX 3n or CMOS I/O data bit 18	ADA_D4	HSMB_TX_D_N3	LVDS or 2.5 V	N26
68	LVDS RX 3n or CMOS I/O data bit 19	ADB_D4	HSMB_RX_D_N3	LVDS or 2.5 V	K28

**Table A-2.** HSMC Port B Interface Pin-Out Information (Part 2 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
71	LVDS TX 4p or CMOS I/O data bit 20	ADA_D3	HSMB_TX_D_P4	LVDS or 2.5 V	R27
72	LVDS RX 4p or CMOS I/O data bit 21	ADB_D3	HSMB_RX_D_P4	LVDS or 2.5 V	L27
73	LVDS TX 4n or CMOS I/O data bit 22	ADA_D2	HSMB_TX_D_N4	LVDS or 2.5 V	R28
74	LVDS RX 4n or CMOS I/O data bit 23	ADB_D2	HSMB_RX_D_N4	LVDS or 2.5 V	L28
77	LVDS TX 5p or CMOS I/O data bit 24	ADA_D1	HSMB_TX_D_P5	LVDS or 2.5 V	R25
78	LVDS RX 5p or CMOS I/O data bit 25	ADB_D1	HSMB_RX_D_P5	LVDS or 2.5 V	M27
79	LVDS TX 5n or CMOS I/O data bit 26	ADA_D0	HSMB_TX_D_N5	LVDS or 2.5 V	R26
80	LVDS RX 5n or CMOS I/O data bit 27	ADB_D0	HSMB_RX_D_N5	LVDS or 2.5 V	M28
83	LVDS TX 6p or CMOS I/O data bit 28	ADA_OR	HSMB_TX_D_P6	LVDS or 2.5 V	U25
84	LVDS RX 6p or CMOS I/O data bit 29	ADB_OR	HSMB_RX_D_P6	LVDS or 2.5 V	P25
85	LVDS TX 6n or CMOS I/O data bit 30	ADA_OE	HSMB_TX_D_N6	LVDS or 2.5 V	U26
86	LVDS RX 6n or CMOS I/O data bit 31	ADB_OE	HSMB_RX_D_N6	LVDS or 2.5 V	P26
89	LVDS TX 7p or CMOS I/O data bit 32	ADA_SPI_CS	HSMB_TX_D_P7	LVDS or 2.5 V	V27
90	LVDS RX 7p or CMOS I/O data bit 33	ADB_SPI_CS	HSMB_RX_D_P7	LVDS or 2.5 V	P27
91	LVDS TX 7n or CMOS I/O data bit 34	AD_SDIO	HSMB_TX_D_N7	LVDS or 2.5 V	V28
92	LVDS RX 7n or CMOS I/O data bit 35	AD_SCLK	HSMB_RX_D_N7	LVDS or 2.5 V	P28
95	LVDS or CMOS clock out	FPGA_CLK_A_P	HSMB_CLK_OUT_P1	LVDS or 2.5 V	AC26
96	LVDS or CMOS clock in	XT_IN_P	HSMB_CLK_IN_P1	LVDS or 2.5 V	J27
97	LVDS or CMOS clock out	FPGA_CLK_A_N	HSMB_CLK_OUT_N1	LVDS or 2.5 V	AD26
98	LVDS or CMOS clock in	XT_IN_N	HSMB_CLK_IN_N1	LVDS or 2.5 V	J28

**Table A-2.** HSMC Port B Interface Pin-Out Information (Part 3 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
101	LVDS TX 8p or CMOS I/O data bit 40	DA13	HSMB_TX_D_P8	LVDS or 2.5 V	V25
102	LVDS RX 8p or CMOS I/O data bit 41	DB13	HSMB_RX_D_P8	LVDS or 2.5 V	P21
103	LVDS TX 8n or CMOS I/O data bit 42	DA12	HSMB_TX_D_N8	LVDS or 2.5 V	V26
104	LVDS RX 8n or CMOS I/O data bit 43	DB12	HSMB_RX_D_N8	LVDS or 2.5 V	R21
107	LVDS TX 9p or CMOS I/O data bit 44	DA11	HSMB_TX_D_P9	LVDS or 2.5 V	W25
108	LVDS RX 9p or CMOS I/O data bit 45	DB11	HSMB_RX_D_P9	LVDS or 2.5 V	R22
109	LVDS TX 9n or CMOS I/O data bit 46	DA10	HSMB_TX_D_N9	LVDS or 2.5 V	W26
110	LVDS RX 9n or CMOS I/O data bit 47	DB10	HSMB_RX_D_N9	LVDS or 2.5 V	R23
113	LVDS TX 10p or CMOS I/O data bit 48	DA9	HSMB_TX_D_P10	LVDS or 2.5 V	Y25
114	LVDS RX 10p or CMOS I/O data bit 49	DB9	HSMB_RX_D_P10	LVDS or 2.5 V	T25
115	LVDS TX 10n or CMOS I/O data bit 50	DA8	HSMB_TX_D_N10	LVDS or 2.5 V	Y26
116	LVDS RX 10n or CMOS I/O data bit 51	DB8	HSMB_RX_D_N10	LVDS or 2.5 V	T26
119	LVDS TX 11p or CMOS I/O data bit 52	DA7	HSMB_TX_D_P11	LVDS or 2.5 V	AA25
120	LVDS RX 11p or CMOS I/O data bit 53	DB7	HSMB_RX_D_P11	LVDS or 2.5 V	U27
121	LVDS TX 11n or CMOS I/O data bit 54	DA6	HSMB_TX_D_N11	LVDS or 2.5 V	AA26
122	LVDS RX 11n or CMOS I/O data bit 55	DB6	HSMB_RX_D_N11	LVDS or 2.5 V	U28
125	LVDS TX 12p or CMOS I/O data bit 56	DA5	HSMB_TX_D_P12	LVDS or 2.5 V	AB25
126	LVDS RX 12p or CMOS I/O data bit 57	DB5	HSMB_RX_D_P12	LVDS or 2.5 V	U22
127	LVDS TX 12n or CMOS I/O data bit 58	DA4	HSMB_TX_D_N12	LVDS or 2.5 V	AB26
128	LVDS RX 12n or CMOS I/O data bit 59	DB4	HSMB_RX_D_N12	LVDS or 2.5 V	V22

**Table A-2.** HSMC Port B Interface Pin-Out Information (Part 4 of 4)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
131	LVDS TX 13p or CMOS I/O data bit 60	DA3	HSMB_TX_D_P13	LVDS or 2.5 V	Y23
132	LVDS RX 13p or CMOS I/O data bit 61	DB3	HSMB_RX_D_P13	LVDS or 2.5 V	W28
133	LVDS TX 13n or CMOS I/O data bit 62	DA2	HSMB_TX_D_N13	LVDS or 2.5 V	Y24
134	LVDS RX 13n or CMOS I/O data bit 63	DB2	HSMB_RX_D_N13	LVDS or 2.5 V	W27
137	LVDS TX 14p or CMOS I/O data bit 64	DA1	HSMB_TX_D_P14	LVDS or 2.5 V	AE27
138	LVDS TX 14p or CMOS I/O data bit 65	DB1	HSMB_RX_D_P14	LVDS or 2.5 V	V23
139	LVDS RX 14n or CMOS I/O data bit 66	DA0	HSMB_TX_D_N14	LVDS or 2.5 V	AE28
140	LVDS RX 14n or CMOS I/O data bit 67	DB0	HSMB_RX_D_N14	LVDS or 2.5 V	V24
143	LVDS RX 15p or CMOS I/O data bit 68	AIC_DIN	HSMB_TX_D_P15	LVDS or 2.5 V	W22
144	LVDS TX 15p or CMOS I/O data bit 69	AIC_DOUT	HSMB_RX_D_P15	LVDS or 2.5 V	AB27
145	LVDS RX 15n or CMOS I/O data bit 70	AIC_LRCIN	HSMB_TX_D_N15	LVDS or 2.5 V	Y22
146	LVDS RX 15n or CMOS I/O data bit 70	AIC_LRCOUT	HSMB_RX_D_N15	LVDS or 2.5 V	AB28
149	LVDS RX 16p or CMOS I/O data bit 72	AIC_BCLK	HSMB_TX_D_P16	LVDS or 2.5 V	V21
150	LVDS TX 16p or CMOS I/O data bit 73	AIC_XCLK	HSMB_RX_D_P16	LVDS or 2.5 V	AC27
151	LVDS TX 16n or CMOS I/O data bit 74	AIC_SPI_CS	HSMB_TX_D_N16	LVDS or 2.5 V	W21
155	LVDS or CMOS clock out	FPGA_CLK_B_P	HSMB_CLK_OUT_P2	LVDS	AD27
156	LVDS or CMOS clock in	ADA_DCO	HSMB_CLK_IN_P2	LVDS	Y27
157	LVDS or CMOS clock out	FPGA_CLK_B_N	HSMB_CLK_OUT_N2	2.5 V	AD28
158	LVDS or CMOS clock in	ADB_DCO	HSMB_CLK_IN_N2	2.5 V	Y28



## B. Pin-Out Information for the Stratix III (3SL150) Development Board

Table B-1 provides the HSMC Port A interface pin-out information for the Stratix III (3SL150) development board.

**Table B-1.** HSMC Port A Interface Pin-Out Information (Part 1 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
33	Management serial data	SDA	HSMA_SDA	2.5 V	P8
34	Management serial clock	SCL	HSMA_SCL	2.5 V	AA32
41	Dedicated CMOS I/O bit 0	ADA_D13	HSMA_D0	2.5 V	AK9
42	Dedicated CMOS I/O bit 1	ADB_D13	HSMA_D1	2.5 V	AJ9
43	Dedicated CMOS I/O bit 2	ADA_D12	HSMA_D2	2.5 V	AL7
44	Dedicated CMOS I/O bit 3	ADB_D12	HSMA_D3	2.5 V	AL9
47	LVDS TX or CMOS I/O bit 0	ADA_D11	HSMA_TX_P0	LVDS or 2.5 V	AC11
48	LVDS RX or CMOS I/O bit 0	ADB_D11	HSMA_RX_P0	LVDS or 2.5 V	AJ4
49	LVDS TX or CMOS I/O bit 0	ADA_D10	HSMA_TX_N0	LVDS or 2.5 V	AB10
50	LVDS RX or CMOS I/O bit 0	ADB_D10	HSMA_RX_N0	LVDS or 2.5 V	AJ3
53	LVDS TX or CMOS I/O bit 1	ADA_D9	HSMA_TX_P1	LVDS or 2.5 V	AC9
54	LVDS RX or CMOS I/O bit 1	ADB_D9	HSMA_RX_P1	LVDS or 2.5 V	AG4
55	LVDS TX or CMOS I/O bit 1	ADA_D8	HSMA_TX_N1	LVDS or 2.5 V	AC8
56	LVDS RX or CMOS I/O bit 1	ADB_D8	HSMA_RX_N1	LVDS or 2.5 V	AG3
59	LVDS TX or CMOS I/O bit 2	ADA_D7	HSMA_TX_P2	LVDS or 2.5 V	AH5
60	LVDS RX or CMOS I/O bit 2	ADB_D7	HSMA_RX_P2	LVDS or 2.5 V	AM2
61	LVDS TX or CMOS I/O bit 2	ADA_D6	HSMA_TX_N2	LVDS or 2.5 V	AH4
62	LVDS RX or CMOS I/O bit 2	ADB_D6	HSMA_RX_N2	LVDS or 2.5 V	AM1
65	LVDS TX or CMOS I/O bit 3	ADA_D5	HSMA_TX_P3	LVDS or 2.5 V	AE8
66	LVDS RX or CMOS I/O bit 3	ADB_D5	HSMA_RX_P3	LVDS or 2.5 V	AL2
67	LVDS TX or CMOS I/O bit 3	ADA_D4	HSMA_TX_N3	LVDS or 2.5 V	AE7
68	LVDS RX or CMOS I/O bit 3	ADB_D4	HSMA_RX_N3	LVDS or 2.5 V	AL1
71	LVDS TX or CMOS I/O bit 4	ADA_D3	HSMA_TX_P4	LVDS or 2.5 V	AF6
72	LVDS RX or CMOS I/O bit 4	ADB_D3	HSMA_RX_P4	LVDS or 2.5 V	AJ2
73	LVDS TX or CMOS I/O bit 4	ADA_D2	HSMA_TX_N4	LVDS or 2.5 V	AF5
74	LVDS RX or CMOS I/O bit 4	ADB_D2	HSMA_RX_N4	LVDS or 2.5 V	AK1
77	LVDS TX or CMOS I/O bit 5	ADA_D1	HSMA_TX_P5	LVDS or 2.5 V	AD7
78	LVDS RX or CMOS I/O bit 5	ADB_D1	HSMA_RX_P5	LVDS or 2.5 V	AH2
79	LVDS TX or CMOS I/O bit 5	ADA_D0	HSMA_TX_N5	LVDS or 2.5 V	AD6
80	LVDS RX or CMOS I/O bit 5	ADB_D0	HSMA_RX_N5	LVDS or 2.5 V	AJ1

**Table B-1.** HSMC Port A Interface Pin-Out Information (Part 2 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
83	LVDS TX or CMOS I/O bit 6	ADA_OR	HSMA_TX_P6	LVDS or 2.5 V	AE6
84	LVDS RX or CMOS I/O bit 6	ADB_OR	HSMA_RX_P6	LVDS or 2.5 V	AF4
85	LVDS TX or CMOS I/O bit 6	ADA_OE	HSMA_TX_N6	LVDS or 2.5 V	AE5
86	LVDS RX or CMOS I/O bit 6	ADB_OE	HSMA_RX_N6	LVDS or 2.5 V	AF3
89	LVDS TX or CMOS I/O bit 7	ADA_SPI_CS	HSMA_TX_P7	LVDS or 2.5 V	AD4
90	LVDS RX or CMOS I/O bit 7	ADB_SPI_CS	HSMA_RX_P7	LVDS or 2.5 V	AG1
91	LVDS TX or CMOS I/O bit 7	AD_SDIO	HSMA_TX_N7	LVDS or 2.5 V	AD3
92	LVDS RX or CMOS I/O bit 7	AD_SCLK	HSMA_RX_N7	LVDS or 2.5 V	AH1
95	LVDS or CMOS clock out	FPGA_CLK_A_P	HSMA_CLK_OUT_P1	LVDS or 2.5 V	V10
96	LVDS or CMOS clock in	XT_IN_P	HSMA_CLK_IN_P1	LVDS or 2.5 V	Y4
97	LVDS or CMOS clock out	FPGA_CLK_A_N	HSMA_CLK_OUT_N1	LVDS or 2.5 V	W9
98	LVDS or CMOS clock in	XT_IN_N	HSMA_CLK_IN_N1	LVDS or 2.5 V	W3
101	LVDS TX or CMOS I/O bit 8	DA13	HSMA_TX_P8	LVDS or 2.5 V	AC6
102	LVDS RX or CMOS I/O bit 8	DB13	HSMA_RX_P8	LVDS or 2.5 V	AF2
103	LVDS TX or CMOS I/O bit 8	DA12	HSMA_TX_N8	LVDS or 2.5 V	AC5
104	LVDS RX or CMOS I/O bit 8	DB12	HSMA_RX_N8	LVDS or 2.5 V	AF1
107	LVDS TX or CMOS I/O bit 9	DA11	HSMA_TX_P9	LVDS or 2.5 V	AB6
108	LVDS RX or CMOS I/O bit 9	DB11	HSMA_RX_P9	LVDS or 2.5 V	AE2
109	LVDS TX or CMOS I/O bit 9	DA10	HSMA_TX_N9	LVDS or 2.5 V	AB5
110	LVDS RX or CMOS I/O bit 9	DB10	HSMA_RX_N9	LVDS or 2.5 V	AE1
113	LVDS TX or CMOS I/O bit 10	DA9	HSMA_TX_P10	LVDS or 2.5 V	AB8
114	LVDS RX or CMOS I/O bit 10	DB9	HSMA_RX_P10	LVDS or 2.5 V	AE4
115	LVDS TX or CMOS I/O bit 10	DA8	HSMA_TX_N10	LVDS or 2.5 V	AC7
116	LVDS RX or CMOS I/O bit 10	DB8	HSMA_RX_N10	LVDS or 2.5 V	AE3
119	LVDS TX or CMOS I/O bit 11	DA7	HSMA_TX_P11	LVDS or 2.5 V	Y6
120	LVDS RX or CMOS I/O bit 11	DB7	HSMA_RX_P11	LVDS or 2.5 V	AC2
121	LVDS TX or CMOS I/O bit 11	DA6	HSMA_TX_N11	LVDS or 2.5 V	Y5
122	LVDS RX or CMOS I/O bit 11	DB6	HSMA_RX_N11	LVDS or 2.5 V	AD1
125	LVDS TX or CMOS I/O bit 12	DA5	HSMA_TX_P12	LVDS or 2.5 V	AA7
126	LVDS RX or CMOS I/O bit 12	DB5	HSMA_RX_P12	LVDS or 2.5 V	AB2
127	LVDS TX or CMOS I/O bit 12	DA4	HSMA_TX_N12	LVDS or 2.5 V	AA6
128	LVDS RX or CMOS I/O bit 12	DB4	HSMA_RX_N12	LVDS or 2.5 V	AC1
131	LVDS TX or CMOS I/O bit 13	DA3	HSMA_TX_P13	LVDS or 2.5 V	Y8
132	LVDS RX or CMOS I/O bit 13	DB3	HSMA_RX_P13	LVDS or 2.5 V	AA1
133	LVDS TX or CMOS I/O bit 13	DA2	HSMA_TX_N13	LVDS or 2.5 V	Y7
134	LVDS RX or CMOS I/O bit 13	DB2	HSMA_RX_N13	LVDS or 2.5 V	AB1
137	LVDS TX or CMOS I/O bit 14	DA1	HSMA_TX_P14	LVDS or 2.5 V	Y10

**Table B-1.** HSMC Port A Interface Pin-Out Information (Part 3 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
138	LVDS RX or CMOS I/O bit 14	DB1	HSMA_RX_P14	LVDS or 2.5 V	AC4
139	LVDS TX or CMOS I/O bit 14	DA0	HSMA_TX_N14	LVDS or 2.5 V	Y9
140	LVDS RX or CMOS I/O bit 14	DB0	HSMA_RX_N14	LVDS or 2.5 V	AB3
143	LVDS TX or CMOS I/O bit 15	AIC_DIN	HSMA_TX_P15	LVDS or 2.5 V	W12
144	LVDS RX or CMOS I/O bit 15	AIC_DOUT	HSMA_RX_P15	LVDS or 2.5 V	AB4
145	LVDS TX or CMOS I/O bit 15	AIC_LRCIN	HSMA_TX_N15	LVDS or 2.5 V	Y11
146	LVDS RX or CMOS I/O bit 15	AIC_LRCOUT	HSMA_RX_N15	LVDS or 2.5 V	AA3
149	LVDS TX or CMOS I/O bit 16	AIC_BCLK	HSMA_TX_P16	LVDS or 2.5 V	AA12
150	LVDS RX or CMOS I/O bit 16	AIC_XCLK	HSMA_RX_P16	LVDS or 2.5 V	AA4
151	LVDS TX or CMOS I/O bit 16	AIC_SPI_CS	HSMA_TX_N16	LVDS or 2.5 V	AB11
155	LVDS or CMOS clock out	FPGA_CLK_B_P	HSMA_CLK_OUT_P2	LVDS	W8
156	LVDS or CMOS clock in	ADA_DCO	HSMA_CLK_IN_P2	LVDS	T2
157	LVDS or CMOS clock out	FPGA_CLK_B_N	HSMA_CLK_OUT_N2	2.5 V	W7
158	LVDS or CMOS clock in	ADB_DCO	HSMA_CLK_IN_N2	2.5 V	T1

Table B-2 provides the HSMC Port B interface pin-out information for the Stratix III (3SL150) development board.

**Table B-2.** HSMC Port B Interface Pin-Out Information (Part 1 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
33	Serial data	SDA	HSMB_SDA	2.5 V	U11
34	Serial clock	SCL	HSMB_SCL	2.5 V	AD31
41	Dedicated CMOS I/O bit 0	ADA_D13	HSMB_D0	2.5 V	AB24
42	Dedicated CMOS I/O bit 1	ADB_D13	HSMB_D1	2.5 V	AB25
43	Dedicated CMOS I/O bit 2	ADA_D12	HSMB_D2	2.5 V	AF32
44	Dedicated CMOS I/O bit 3	ADB_D12	HSMB_D3	2.5 V	AF31
47	LVDS TX or CMOS I/O bit 0	ADA_D11	HSMB_TX_P0	LVDS or 2.5 V	P11
48	LVDS RX or CMOS I/O bit 0	ADB_D11	HSMB_RX_P0	LVDS or 2.5 V	R4
49	LVDS TX or CMOS I/O bit 0	ADA_D10	HSMB_TX_N0	LVDS or 2.5 V	P10
50	LVDS RX or CMOS I/O bit 0	ADB_D10	HSMB_RX_N0	LVDS or 2.5 V	R3
53	LVDS TX or CMOS I/O bit 1	ADA_D9	HSMB_TX_P1	LVDS or 2.5 V	T9
54	LVDS RX or CMOS I/O bit 1	ADB_D9	HSMB_RX_P1	LVDS or 2.5 V	P4
55	LVDS TX or CMOS I/O bit 1	ADA_D8	HSMB_TX_N1	LVDS or 2.5 V	T8
56	LVDS RX or CMOS I/O bit 1	ADB_D8	HSMB_RX_N1	LVDS or 2.5 V	P3
59	LVDS TX or CMOS I/O bit 2	ADA_D7	HSMB_TX_P2	LVDS or 2.5 V	T7

**Table B-2.** HSMC Port B Interface Pin-Out Information (Part 2 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
60	LVDS RX or CMOS I/O bit 2	ADB_D7	HSMB_RX_P2	LVDS or 2.5 V	P2
61	LVDS TX or CMOS I/O bit 2	ADA_D6	HSMB_TX_N2	LVDS or 2.5 V	U6
62	LVDS RX or CMOS I/O bit 2	ADB_D6	HSMB_RX_N2	LVDS or 2.5 V	R1
65	LVDS TX or CMOS I/O bit 3	ADA_D5	HSMB_TX_P3	LVDS or 2.5 V	T5
66	LVDS RX or CMOS I/O bit 3	ADB_D5	HSMB_RX_P3	LVDS or 2.5 V	N2
67	LVDS TX or CMOS I/O bit 3	ADA_D4	HSMB_TX_N3	LVDS or 2.5 V	T4
68	LVDS RX or CMOS I/O bit 3	ADB_D4	HSMB_RX_N3	LVDS or 2.5 V	P1
71	LVDS TX or CMOS I/O bit 4	ADA_D3	HSMB_TX_P4	LVDS or 2.5 V	R10
72	LVDS RX or CMOS I/O bit 4	ADB_D3	HSMB_RX_P4	LVDS or 2.5 V	M1
73	LVDS TX or CMOS I/O bit 4	ADA_D2	HSMB_TX_N4	LVDS or 2.5 V	R9
74	LVDS RX or CMOS I/O bit 4	ADB_D2	HSMB_RX_N4	LVDS or 2.5 V	N1
77	LVDS TX or CMOS I/O bit 5	ADA_D1	HSMB_TX_P5	LVDS or 2.5 V	R7
78	LVDS RX or CMOS I/O bit 5	ADB_D1	HSMB_RX_P5	LVDS or 2.5 V	L2
79	LVDS TX or CMOS I/O bit 5	ADA_D0	HSMB_TX_N5	LVDS or 2.5 V	R6
80	LVDS RX or CMOS I/O bit 5	ADB_D0	HSMB_RX_N5	LVDS or 2.5 V	L1
83	LVDS TX or CMOS I/O bit 6	ADA_OR	HSMB_TX_P6	LVDS or 2.5 V	N9
84	LVDS RX or CMOS I/O bit 6	ADB_OR	HSMB_RX_P6	LVDS or 2.5 V	K4
85	LVDS TX or CMOS I/O bit 6	ADA_OE	HSMB_TX_N6	LVDS or 2.5 V	N8
86	LVDS RX or CMOS I/O bit 6	ADB_OE	HSMB_RX_N6	LVDS or 2.5 V	K3
89	LVDS TX or CMOS I/O bit 7	ADA_SPI_CS	HSMB_TX_P7	LVDS or 2.5 V	M7
90	LVDS RX or CMOS I/O bit 7	ADB_SPI_CS	HSMB_RX_P7	LVDS or 2.5 V	J4
91	LVDS TX or CMOS I/O bit 7	AD_SDIO	HSMB_TX_N7	LVDS or 2.5 V	M6
92	LVDS RX or CMOS I/O bit 7	AD_SCLK	HSMB_RX_N7	LVDS or 2.5 V	J3
95	LVDS or CMOS clock out	FPGA_CLK_A_P	HSMB_CLK_OUT_P1	LVDS or 2.5 V	P6
96	LVDS or CMOS clock in	XT_IN_P	HSMB_CLK_IN_P1	LVDS or 2.5 V	N4
97	LVDS or CMOS clock out	FPGA_CLK_A_N	HSMB_CLK_OUT_N1	LVDS or 2.5 V	P5
98	LVDS or CMOS clock in	XT_IN_N	HSMB_CLK_IN_N1	LVDS or 2.5 V	N3
101	LVDS TX or CMOS I/O bit 8	DA13	HSMB_TX_P8	LVDS or 2.5 V	L7
102	LVDS RX or CMOS I/O bit 8	DB13	HSMB_RX_P8	LVDS or 2.5 V	H2
103	LVDS TX or CMOS I/O bit 8	DA12	HSMB_TX_N8	LVDS or 2.5 V	L6
104	LVDS RX or CMOS I/O bit 8	DB12	HSMB_RX_N8	LVDS or 2.5 V	J1
107	LVDS TX or CMOS I/O bit 9	DA11	HSMB_TX_P9	LVDS or 2.5 V	L5
108	LVDS TX or CMOS I/O bit 9	DB11	HSMB_RX_P9	LVDS or 2.5 V	G2
109	LVDS RX or CMOS I/O bit 9	DA10	HSMB_TX_N9	LVDS or 2.5 V	L4
110	LVDS RX or CMOS I/O bit 9	DB10	HSMB_RX_N9	LVDS or 2.5 V	H1
113	LVDS TX or CMOS I/O bit 10	DA9	HSMB_TX_P10	LVDS or 2.5 V	K6
114	LVDS RX or CMOS I/O bit 10	DB9	HSMB_RX_P10	LVDS or 2.5 V	F1

**Table B-2.** HSMC Port B Interface Pin-Out Information (Part 3 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Stratix III Pin Number
115	LVDS TX or CMOS I/O bit 10	DA8	HSMB_TX_N10	LVDS or 2.5 V	K5
116	LVDS RX or CMOS I/O bit 10	DB8	HSMB_RX_N10	LVDS or 2.5 V	G1
119	LVDS TX or CMOS I/O bit 11	DA7	HSMB_TX_P11	LVDS or 2.5 V	J7
120	LVDS RX or CMOS I/O bit 11	DB7	HSMB_RX_P11	LVDS or 2.5 V	H4
121	LVDS TX or CMOS I/O bit 11	DA6	HSMB_TX_N11	LVDS or 2.5 V	J6
122	LVDS RX or CMOS I/O bit 11	DB6	HSMB_RX_N11	LVDS or 2.5 V	H3
125	LVDS TX or CMOS I/O bit 12	DA5	HSMB_TX_P12	LVDS or 2.5 V	H6
126	LVDS RX or CMOS I/O bit 12	DB5	HSMB_RX_P12	LVDS or 2.5 V	E2
127	LVDS TX or CMOS I/O bit 12	DA4	HSMB_TX_N12	LVDS or 2.5 V	H5
128	LVDS RX or CMOS I/O bit 12	DB4	HSMB_RX_N12	LVDS or 2.5 V	E1
131	LVDS TX or CMOS I/O bit 13	DA3	HSMB_TX_P13	LVDS or 2.5 V	K8
132	LVDS RX or CMOS I/O bit 13	DB3	HSMB_RX_P13	LVDS or 2.5 V	C1
133	LVDS TX or CMOS I/O bit 13	DA2	HSMB_TX_N13	LVDS or 2.5 V	K7
134	LVDS RX or CMOS I/O bit 13	DB2	HSMB_RX_N13	LVDS or 2.5 V	D1
137	LVDS TX or CMOS I/O bit 14	DA1	HSMB_TX_P14	LVDS or 2.5 V	L9
138	LVDS RX or CMOS I/O bit 14	DB1	HSMB_RX_P14	LVDS or 2.5 V	D3
139	LVDS TX or CMOS I/O bit 14	DA0	HSMB_TX_N14	LVDS or 2.5 V	L8
140	LVDS RX or CMOS I/O bit 14	DB0	HSMB_RX_N14	LVDS or 2.5 V	D2
143	LVDS TX or CMOS I/O bit 15	AIC_DIN	HSMB_TX_P15	LVDS or 2.5 V	M10
144	LVDS RX or CMOS I/O bit 15	AIC_DOUT	HSMB_RX_P15	LVDS or 2.5 V	G5
145	LVDS TX or CMOS I/O bit 15	AIC_LRCIN	HSMB_TX_N15	LVDS or 2.5 V	M9
146	LVDS RX or CMOS I/O bit 15	AIC_LRCOUT	HSMB_RX_N15	LVDS or 2.5 V	G4
149	LVDS TX or CMOS I/O bit 16	AIC_BCLK	HSMB_TX_P16	LVDS or 2.5 V	N11
150	LVDS RX or CMOS I/O bit 16	AIC_XCLK	HSMB_RX_P16	LVDS or 2.5 V	F4
151	LVDS TX or CMOS I/O bit 16	AIC_SPI_CS	HSMB_TX_N16	LVDS or 2.5 V	N10
155	LVDS or CMOS clock out	FPGA_CLK_B_P	HSMB_CLK_OUT_P2	LVDS	R12
156	LVDS or CMOS clock in	ADA_DCO	HSMB_CLK_IN_P2	LVDS	U4
157	LVDS or CMOS clock out	FPGA_CLK_B_N	HSMB_CLK_OUT_N2	2.5 V	T11
158	LVDS or CMOS clock in	ADB_DCO	HSMB_CLK_IN_N2	2.5 V	U3





## C. Pin-Out Information for the Cyclone III (3C25) Starter Board

Table C-1 provides the HSMC port interface pin-out information for the Cyclone III (3C25) starter board.

**Table C-1.** HSMC Port Interface Pin-Out Information (Part 1 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
33	Serial EEPROM data	SDA	HSMC_SDA	2.5 V	E1
34	Serial EEPROM clock	SCL	HSMC_SCL	2.5 V	F3
41	A/D A bit 13 to Host	ADA_D13	HSMC_D0	2.5 V	H6
42	A/D B bit 13 to Host	ADB_D13	HSMC_D1	2.5 V	D3
43	A/D A bit 12 to Host	ADA_D12	HSMC_D2	2.5 V	M5
44	A/D B bit 12 to Host	ADB_D12	HSMC_D3	2.5 V	L6
47	A/D A bit 11 to Host	ADA_D11	HSMC_D4	2.5 V	T1
48	A/D B bit 11 to Host	ADB_D11	HSMC_D5	2.5 V	M3
49	A/D A bit 10 to Host	ADA_D10	HSMC_D6	2.5 V	N7
50	A/D A bit 10 to Host	ADB_D10	HSMC_D7	2.5 V	T2
53	A/D A bit 9 to Host	ADA_D9	HSMC_D8	2.5 V	N8
54	A/D B bit 9 to Host	ADB_D9	HSMC_D9	2.5 V	H15
55	A/D A bit 8 to Host	ADA_D8	HSMC_D10	2.5 V	J13
56	A/D B bit 8 to Host	ADB_D8	HSMC_D11	2.5 V	H16
59	A/D A bit 7 to Host	ADA_D7	HSMC_D12	2.5 V	N10
60	A/D B bit 7 to Host	ADB_D7	HSMC_D13	2.5 V	N16
61	A/D A bit 6 to Host	ADA_D6	HSMC_D14	2.5 V	N11
62	A/D B bit 6 to Host	ADB_D6	HSMC_D15	2.5 V	N15
65	A/D A bit 5 to Host	ADA_D5	HSMC_D16	2.5 V	K17
66	A/D A bit 5 to Host	ADB_D5	HSMC_D17	2.5 V	R16
67	A/D A bit 4 to Host	ADA_D4	HSMC_D18	2.5 V	P11
68	A/D B bit 4 to Host	ADB_D4	HSMC_D19	2.5 V	T16
71	A/D A bit 3 to Host	ADA_D3	HSMC_TX_p4	2.5 V	B2
72	A/D B bit 3 to Host	ADB_D3	HSMC_RX_p4	2.5 V	C2
73	A/D A bit 2 to Host	ADA_D2	HSMC_TX_n4	2.5 V	B1
74	A/D B bit 2 to Host	ADB_D2	HSMC_RX_n4	2.5 V	C1
77	A/D A bit 1 to Host	ADA_D1	HSMC_TX_p5	2.5 V	G2
78	A/D B bit 1 to Host	ADB_D1	HSMC_RX_p5	2.5 V	H2
79	A/D A bit 0 to Host	ADA_D0	HSMC_TX_n5	2.5 V	G1
80	A/D B bit 0 to Host	ADB_D0	HSMC_RX_n5	2.5 V	H1

**Table C-1.** HSMC Port Interface Pin-Out Information (Part 2 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
83	A/D A Overrun to Host	ADA_OR	HSMC_TX_p6	2.5 V	K2
84	A/D B Overrun to Host	ADB_OR	HSMC_RX_p6	2.5 V	K5
85	A/D A Output Enable from Host	ADA_OE	HSMC_TX_n6	2.5 V	K1
86	A/D B Output Enable from Host	ADB_OE	HSMC_RX_n6	2.5 V	L5
89	A/D A SPI CS from Host	ADA_SPI_CS	HSMC_TX_p7	2.5 V	L2
90	A/D B SPI CS from Host	ADB_SPI_CS	HSMC_RX_p7	2.5 V	L4
91	Common A/D SDIO from Host	AD_SDIO	HSMC_TX_n7	2.5 V	L1
92	Common A/D SCLK from Host	AD_SCLK	HSMC_RX_n7	2.5 V	L3
95	A/D Clock A from Host Differential P	FPGA_CLK_A_P	HSMC_CLKOUT_p1	LVDS	D14
96	External Clock from SMAs to Host Differential P	XT_IN_P	HSMC_CLKIN_p1	LVDS	F17
97	A/D Clock A from Host Differential N	FPGA_CLK_A_N	HSMC_CLKOUT_n1	LVDS	C14
98	External Clock from SMAs to Host Differential N	XT_IN_N	HSMC_CLKIN_n1	LVDS	F18
101	D/A A bit 13 from Host	DA13	HSMC_TX_p8	2.5 V	M2
102	D/A A bit 13 from Host	DB13	HSMC_RX_p8	2.5 V	P2
103	D/A A bit 12 from Host	DA12	HSMC_TX_n8	2.5 V	M1
104	D/A B bit 12 from Host	DB12	HSMC_RX_n8	2.5 V	P1
107	D/A A bit 11 from Host	DA11	HSMC_TX_p9	2.5 V	R2
108	D/A B bit 11 from Host	DB11	HSMC_RX_p9	2.5 V	T3
109	D/A A bit 10 from Host	DA10	HSMC_TX_n9	2.5 V	R1
110	D/A B bit 10 from Host	DB10	HSMC_RX_n9	2.5 V	R3
113	D/A A bit 9 from Host	DA9	HSMC_TX_p10	2.5 V	E17
114	D/A B bit 9 from Host	DB9	HSMC_RX_p10	2.5 V	G17
115	D/A A bit 8 from Host	DA8	HSMC_TX_n10	2.5 V	E18
116	D/A B bit 8 from Host	DB8	HSMC_RX_n10	2.5 V	G18
119	D/A A bit 7 from Host	DA7	HSMC_TX_p11	2.5 V	H17
120	D/A B bit 7 from Host	DB7	HSMC_RX_p11	2.5 V	K18
121	D/A A bit 6 from Host	DA6	HSMC_TX_n11	2.5 V	H18
122	D/A B bit 6 from Host	DB6	HSMC_RX_n11	2.5 V	L18
125	D/A A bit 5 from Host	DA5	HSMC_TX_p12	2.5 V	L17
126	D/A B bit 5 from Host	DB5	HSMC_RX_p12	2.5 V	L16
127	D/A A bit 4 from Host	DA4	HSMC_TX_n12	2.5 V	M18
128	D/A B bit 4 from Host	DB4	HSMC_RX_n12	2.5 V	M17

**Table C-1.** HSMC Port Interface Pin-Out Information (Part 3 of 3)

Data Conversion HSMC Schematic			Development Board Schematic		
Board Reference (J1)	Description	Schematic Signal Name	Schematic Signal Name	I/O Standard	Cyclone III Pin Number
131	D/A A bit 3 from Host	DA3	HSMC_TX_p13	2.5 V	L14
132	D/A B bit 3 from Host	DB3	HSMC_RX_p13	2.5 V	L13
133	D/A A bit 2 from Host	DA2	HSMC_TX_n13	2.5 V	L15
134	D/A B bit 2 from Host	DB2	HSMC_RX_n13	2.5 V	M14
137	D/A A bit 1 from Host	DA1	HSMC_TX_p14	2.5 V	P17
138	D/A B bit 1 from Host	DB1	HSMC_RX_p14	2.5 V	R17
139	D/A A bit 0 from Host	DA0	HSMC_TX_n14	2.5 V	P18
140	D/A B bit 0 from Host	DB0	HSMC_RX_n14	2.5 V	R18
143	Audio Codec Data In from Host	AIC_DIN	HSMC_TX_p15	2.5 V	R5
144	Audio Codec Data Out to Host	AIC_DOUT	HSMC_RX_p15	2.5 V	M6
145	Audio Codec L/R In from Host	AIC_LRCIN	HSMC_TX_n15	2.5 V	R4
146	Audio Codec L/R Out to Host	AIC_LRCOUT	HSMC_RX_n15	2.5 V	N6
149	Audio Codec Bclk from Host	AIC_BCLK	HSMC_TX_p16	2.5 V	T17
150	Audio Codec XT1/MCLK from Host	AIC_XCLK	HSMC_RX_p16	2.5 V	M13
151	Audio Codec SPI Chip Select from Host	AIC_SPI_CS	HSMC_TX_n16	2.5 V	T18
155	A/D Clock B from Host Differential P	FPGA_CLK_B_P	HSMC_CLKOUT_p2	LVDS	U18
156	A/D A Data Clock Out to Host	ADA_DCO	HSMC_CLKIN_p2	2.5 V	N17
157	A/D Clock B from Host Differential N	FPGA_CLK_B_N	HSMC_CLKOUT_n2	LVDS	V18
158	A/D B Data Clock Out to Host	ADB_DCO	HSMC_CLKIN_n2	2.5 V	N18



## Revision History

The following table displays the revision history for this reference manual.

Date	Version	Changes Made
November 2008	1.1	Updated pin-out information in the appendices.
March 2008	1.0	First publication

## How to Contact Altera

For the most up-to-date information about Altera products, refer to the following table.






Contact <i>(Note 1)</i>	Contact Method	Address
Technical support	Website	<a href="http://www.altera.com/support">www.altera.com/support</a>
Technical training	Website	<a href="http://www.altera.com/training">www.altera.com/training</a>
	Email	<a href="mailto:custrain@altera.com">custrain@altera.com</a>
Product literature	Website	<a href="http://www.altera.com/literature">www.altera.com/literature</a>
Non-technical support (General) (Software Licensing)	Email	<a href="mailto:nacomp@altera.com">nacomp@altera.com</a>
	Email	<a href="mailto:authorization@altera.com">authorization@altera.com</a>

**Note to Table:**

(1) You can also contact your local Altera sales office or sales representative.

## Typographic Conventions

This document uses the typographic conventions shown in the following table.

Visual Cue	Meaning
<b>Bold Type with Initial Capital Letters</b>	Indicates command names, dialog box titles, dialog box options, and other GUI labels. For example, <b>Save As</b> dialog box.
<b>bold type</b>	Indicates directory names, project names, disk drive names, file names, file name extensions, and software utility names. For example, <b>\qdesigns</b> directory, <b>d:</b> drive, and <b>chiptrip.gdf</b> file.
<i>Italic Type with Initial Capital Letters</i>	Indicates document titles. For example, <i>AN 519: Stratix IV Design Guidelines</i> .
<i>Italic type</i>	Indicates variables. For example, $n + 1$ . Variable names are enclosed in angle brackets (<>). For example, <file name> and <project name>. <b>.pof</b> file.
Initial Capital Letters	Indicates keyboard keys and menu names. For example, Delete key and the Options menu.
“Subheading Title”	Quotation marks indicate references to sections within a document and titles of Quartus II Help topics. For example, “Typographic Conventions.”
Courier type	Indicates signal, port, register, bit, block, and primitive names. For example, <code>data1</code> , <code>tDi</code> , and <code>input</code> . Active-low signals are denoted by suffix <code>n</code> . For example, <code>resetn</code> .  Indicates command line commands and anything that must be typed exactly as it appears. For example, <code>c:\qdesigns\tutorial\chiptrip.gdf</code> .  Also indicates sections of an actual file, such as a Report File, references to parts of files (for example, the AHDL keyword <code>SUBDESIGN</code> ), and logic function names (for example, <code>TRI</code> ).
1., 2., 3., and a., b., c., and so on.	Numbered steps indicate a list of items when the sequence of the items is important, such as the steps listed in a procedure.
■ ■	Bullets indicate a list of items when the sequence of the items is not important.
	The hand points to information that requires special attention.
	A caution calls attention to a condition or possible situation that can damage or destroy the product or your work.
	A warning calls attention to a condition or possible situation that can cause you injury.
	The angled arrow instructs you to press Enter.
	The feet direct you to more information about a particular topic.