



Data Conversion HSMC

Reference Manual



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Additional Information

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General Description

This manual provides technical information about the Data Conversion HSMC. This High Speed Mezzanine Card (HSMC) can be used for developing DSP applications with Altera Development boards that feature the High Speed Mezzanine Card (HSMC) connector. [Figure 1-1](#) shows a topside view of the Data Conversion HSMC.

The Data Conversion HSMC was created to provide a set of Analog to Digital and Digital to Analog interfaces including an Audio Codec interface. The purpose of this reference manual is to describe each of the hardware interfaces on the Data Conversion HSMC.



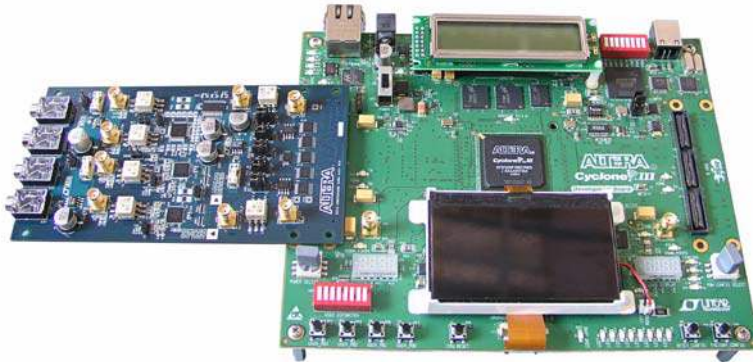
For the latest information about High Speed Mezzanine Cards (HSMCs), go to www.altera.com/products/devkits/kit-index.html.

Figure 1-1. Data Conversion HSMC Topside View



Figure 1–2 shows the Data Conversion HSMC in the DSP Development Kit, Cyclone III edition.

Figure 1–2. Data Conversion HSMC in the DSP Development Kit, Cyclone III Edition



For more information, refer *DSP Development Kit, Cyclone III Edition, Getting Started User Guide*.

Components and Block Diagram

Components

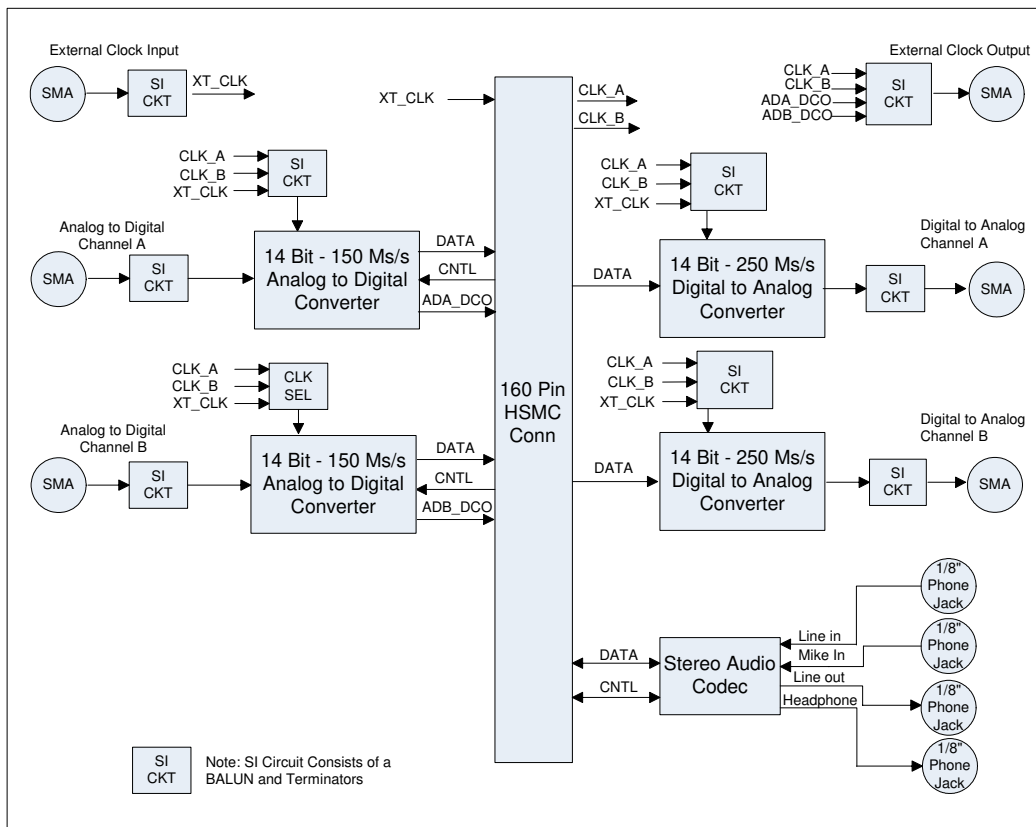
The Data Conversion HSMC contains the following components.

- Interfaces
 - HSMC Interface
 - Audio CODEC Interface
 - External Clock In Interface
 - External Clock Out Interface
 - ADC Channel A and B Input Interface
 - DAC Channel A and B Output Interface
- Power supply
- I2C Serial EEPROM

Block Diagram

Figure 1–3 shows a functional block diagram of the Data Conversion HSMC.

Figure 1–3. Data Conversion HSMC Block Diagram



Board Overview

This chapter provides operational and connectivity details for 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 on 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 top view of the Data Conversion HSMC.

Figure 2-1. Top View of the the Data Conversion HSMC

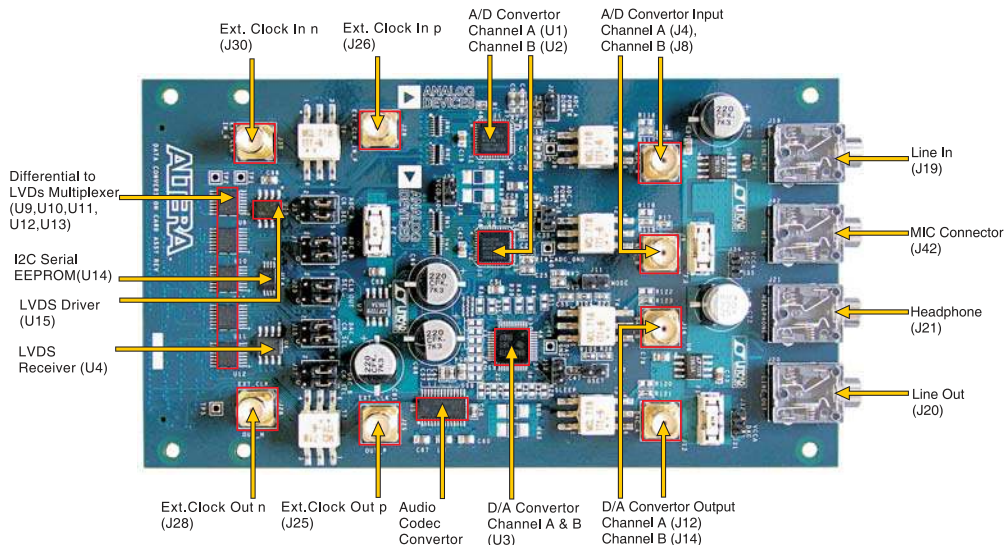


Figure 2-2 shows the back view of the Data Conversion HSMC.

Figure 2–2. Back View of the the Data Conversion HSMC

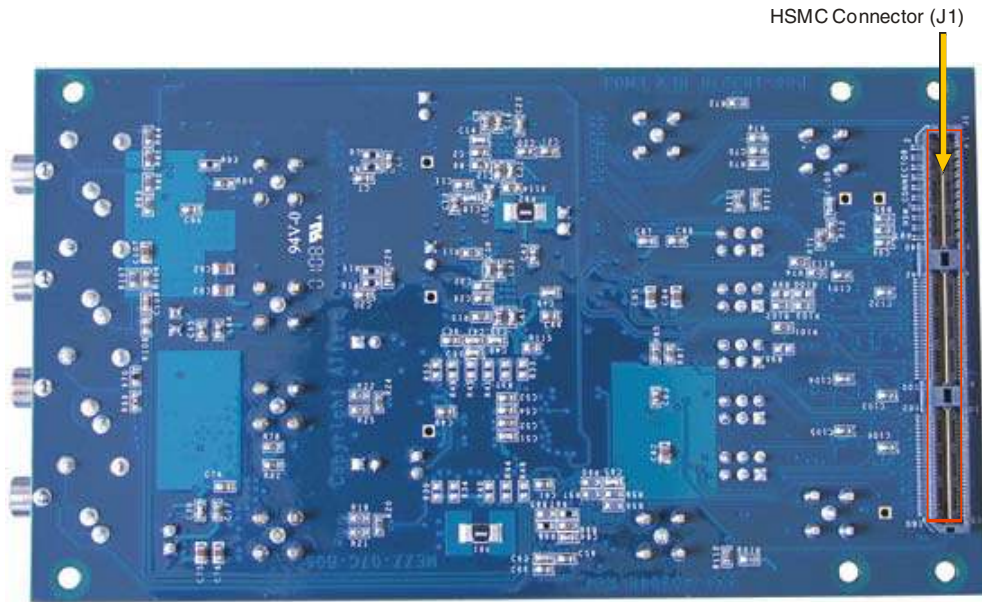


Table 2–1 lists the components and their corresponding board references.

| Table 2–1. Data Conversion HSMC Feature Overview | | | |
|---|-----------------------------------|---|-------------|
| Board Reference | Name | Description | Page |
| Configuration, Status and Setup Elements | | | |
| 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 | 2–4 |
| J2 (Channel A) J6 (Channel B) | Power down select jumper | Controls whether the ADC 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 | 2–5 |
| J11 | Mode select jumper | Controls whether the DAC operates in dual bus mode or interleaved mode | 2–5 |
| J10 | Gain setting select jumper | Controls whether the DAC channel's gain is set through one or two resistors | 2–6 |

Table 2–1. Data Conversion HSMC Feature Overview

| Board Reference | Name | Description | Page |
|--|--------------------------------------|--|------|
| J13 | Sleep select jumper | Controls whether the DAC operates in power down or power up state | 2–6 |
| 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 |
| Clock | | | |
| J26 (External Clock In-p) J30 (External Clock In-n) | External clock input SMA connectors | SMA connectors for a differential clock input | 2–7 |
| J25 (External Clock In-p) J28 (External Clock In-n) | External clock output SMA connectors | SMA connectors for a differential clock output | 2–8 |
| Components and Interfaces | | | |
| U1 (Channel A) U2 (Channel B) | A/D converter | Analog Devices AD9254. 14 bit, 150MS/s Analog to Digital converter | 2–8 |
| J4 (Channel A) J8 (Channel B) | A/D converter input SMA's | SMA's that drive the A/D converter inputs | 2–13 |
| U3 (Channel A and B) | D/A converter | Texas Instruments DAC5672. 14 bit, 175 MS/s Digital to Analog converter | 2–13 |
| J12 (Channel A) J14 (Channel B) | D/A converter output SMA's | SMA outputs for the D/A converters | 2–17 |
| U5 | Audio CODEC | Texas Instruments TLV320AK23. Stereo Audio CODEC, 96KHz, with integrated headphone amplifier | 2–17 |
| J19 | Line-in audio jack | 3.5mm audio connector for line-in | 2–18 |
| J20 | Line-out audio jack | 3.5mm audio connector for line-out | 2–18 |
| J21 | Headphone jack | 3.5mm audio connector for headphones | 2–18 |
| J42 | MIC jack | 3.5mm audio connector for MIC | 2–18 |
| J1 | HSMC | Expansion connector used to interface with Altera development boards | 2–19 |
| U14 | I2C EEPROM | ISSI EEPROM IS24C02B, 2kbit | 2–20 |

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.

| 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 |
| No Clock | - | NO_CLK_P NO_CLK_N | Pins 1 and 3, Pins 2 and 4 |

Notes:

(1) See the appendices for FPGA pin-numbers for specific development boards.

(2) On the schematic MUX (U9) output signal names are ADA_CLK_SEL_P, ADA_CLK_SEL_N

(3) On the schematic MUX (U10) output signal names are ADB_CLK_SEL_P, ADB_CLK_SEL_N

Power Down Select Jumper (J2, J6)

The power down configuration of 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.

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

Notes:

(1) If jumper pins are left open, ADC 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:
 (1) On the schematic MUX (U11) output signal names are DAC_CLK_1_P, DAC_CLK_1_N
 (2) On the schematic MUX (U12) output signal names are DAC_CLK_2_P, DAC_CLK_2_N

Mode Select Jumper (J11)

The mode select jumper is used to put D/A converter in either dual bus or interleaved mode. It is selectable through J11 (channel A & 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 D/A converter's channels. It is selectable through J10 (channel A & channel B) [Table 2-6](#) lists the jumper settings for gain settings options.

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

| Jumper Settings (J13) | Description |
|-----------------------|-----------------------------|
| Jumper ON | Puts DAC in power down mode |
| Jumper OFF | DAC in normal state |

External Clock Output Select Jumper (J23)

[Table 2-8](#) lists 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 |

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 |
|--------------|-----------------|------------------------------|--|
| A/D B DCO | A/D Channel B | ADB_DCO_P ADB_DCO_N | Pins 1 and 3, Pins 2 and 4 |

Notes:
 (1) On the schematic MUX (U13) output signal names are RX_CLK_P, RX_CLK_N

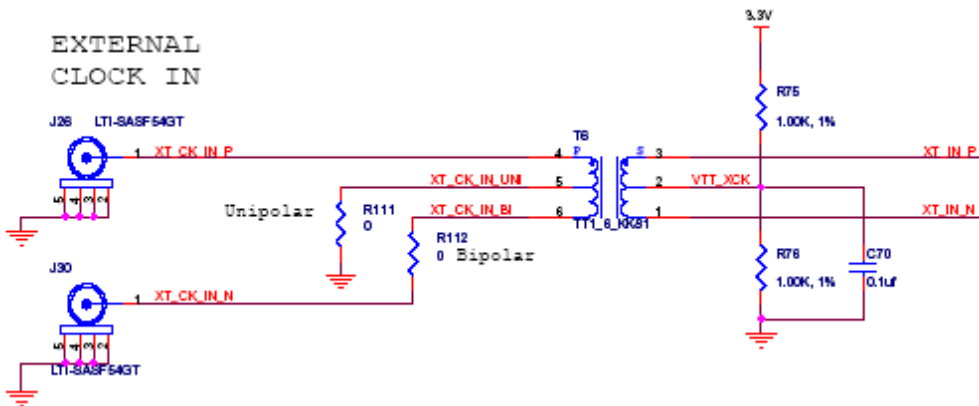
Clocks

This section describes External Clock Input and Output SMA connectors.

External Clock Input SMA Connectors (J26, J30)

The CLK SMA connector (J26, J30) provides an external clock input. It can be selected to be the input to U1, U2 and U3. See [Figure 2–3](#). An external clock input provides designers, 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 should be removed and R111 should be installed.

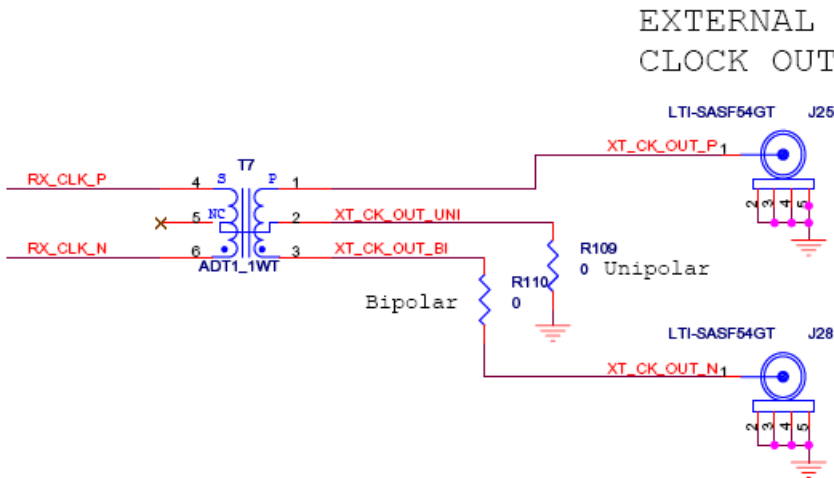
Figure 2–3. External Clock Input Schematic



External Clock Output SMA Connectors (J25, J28)

The CLK SMA connector (J25, J28) provides an external clock output. Different clocks can be selected by using differential LVDS multiplexer (U13) and clock select jumper (J23). See Figure 2–4. The external clock source provides designers, 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 should be removed and R109 should be installed.

Figure 2–4. External Clock Output Schematic



Component Interfaces

This section describes the user interfaces, which consist of A/D converter, D/A converter, Audio Codec Converter, HSMC Connector, and I2C Serial EEPROM.

A/D Converter (U1, U2)

The Data Conversion HSMC contains two AD9254 14-bit 150 MSPS 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_{PP} . Usable voltage input to the SMA connector is approximately 512 mV when driven from a 50 Ohm source.

Table 2–9 lists the A/D converter references.

| Item | Description |
|-----------------------|--|
| Board reference | U1, U2 |
| Part Number | AD9254 |
| Device description | 14 bit, 150 MSPS Analog to Digital converter |
| Manufacturer | Analog Device |
| Manufacturer web site | www.analog.com |

Table 2–10 lists the pinouts of ADC Channel A.

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | Description |
|-------------|----------|---------------|----------------|--|
| ADA_D0 | 79 | D0 | 45 | Data Output Bit 0 |
| ADA_D1 | 77 | D1 | 46 | Data Output Bit1 |
| 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) |

Table 2–10. ADC Channel A (U1) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | Description |
|-------------|----------|---------------|----------------|--|
| 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:

- (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 shows the pinout details of ADC Channel B.

Table 2–11. ADC Channel B (U2) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | 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 |
| 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) |

Table 2–11. ADC Channel B (U2) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | Description |
|-------------|----------|---------------|----------------|--|
| 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:

- (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

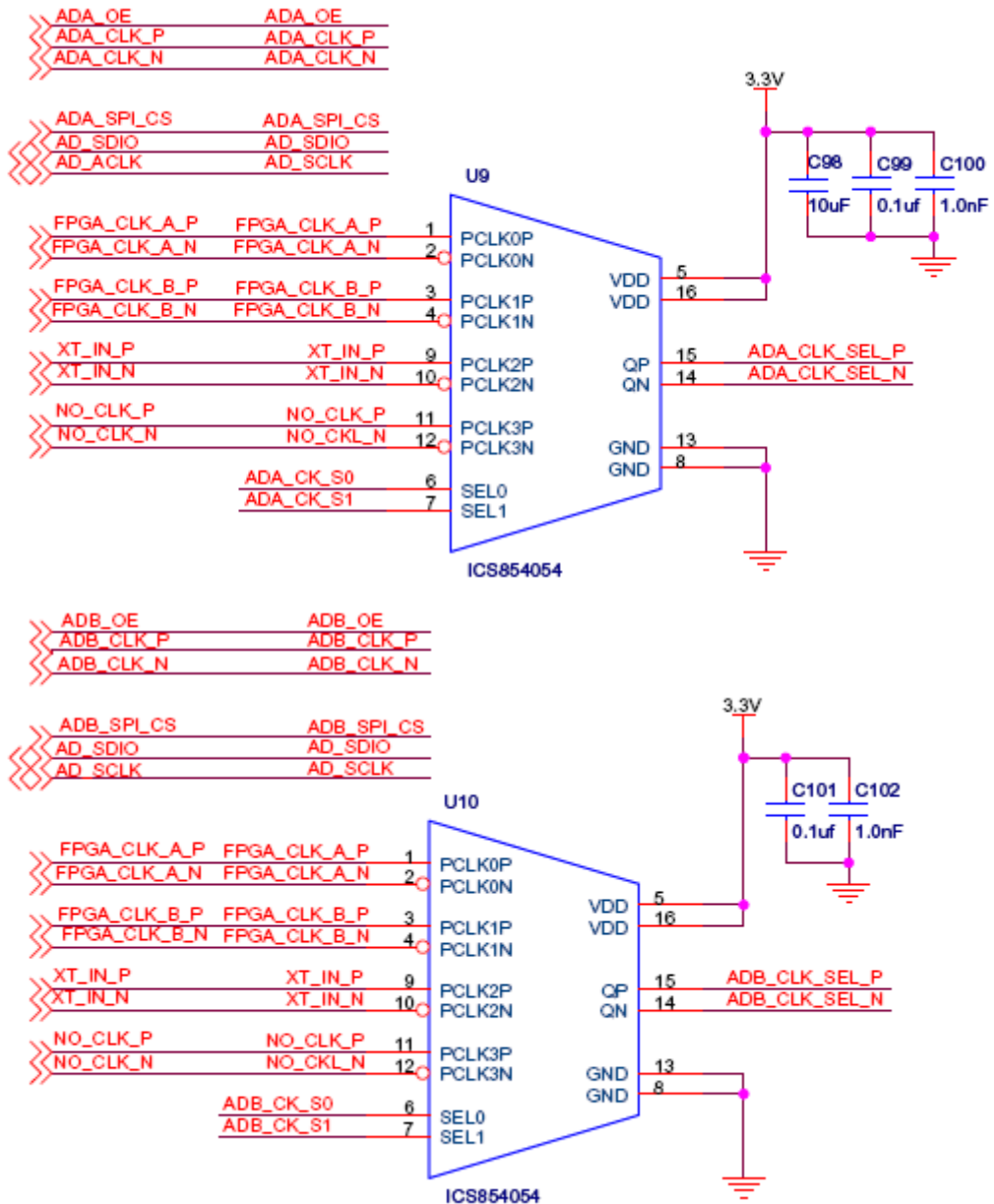


Table 2–12 lists the differential to LVDS clock multiplexer pinouts.

| Schematic Signal | HSMC Connector Pin Number | Device Signal | Device Pin No. | 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 |
| 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 channel A and B) on the Data Conversion HSMC provides 14-bit resolution and produces samples at rates up to 275 MSPS. 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 references.

| Item | Description |
|--------------------|--|
| Board reference | U3 |
| Part Number | DAC5672 |
| Device description | 14 bit, 275 MSPS Digital to Analog converter |

Table 2–13. D/A Converter Component Reference

| Item | Description |
|-----------------------|--|
| Manufacturer | Texas Instruments |
| Manufacturer web site | www.ti.com |

Table 2–14 lists the pinouts of DAC Channel A and Channel B.

Table 2–14. DAC Channel A and Channel B (U3) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | 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 |
| 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 |

Table 2–14. DAC Channel A and Channel B (U3) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | Description |
|-------------|----------|---------------|----------------|--|
| 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:

- (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 channel 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. (see “D/A Converter Clock Select Jumper (J15, J17)” on page 2–5.)

Figure 2–6. D/A Converter Clocking Options

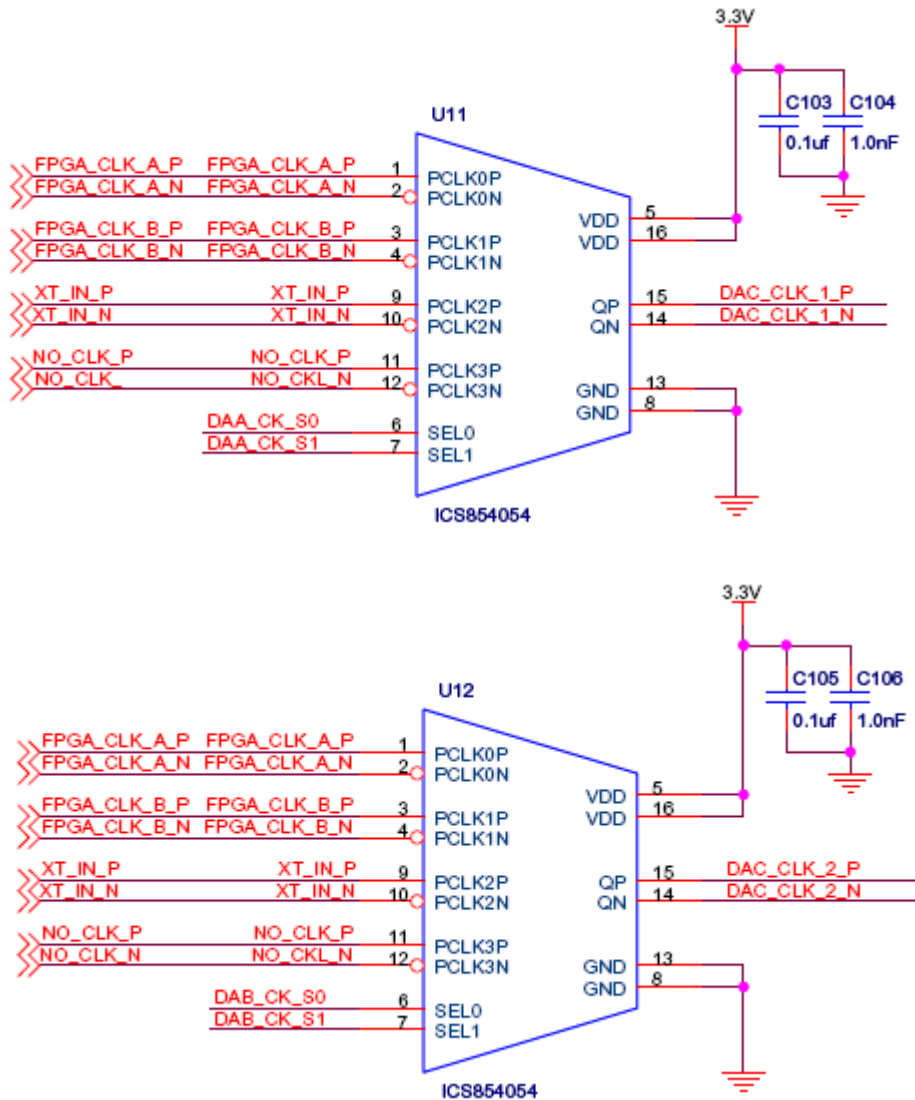


Table 2–15 lists the differential to LVDS clock multiplexer pinouts.

| Schematic Signal | HSMC Connector Pin Number | Device Signal | Device Pin No. | 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 8-96 kHz.

Table 2–16 lists the audio CODEC references.

| Item | Description |
|-----------------------|--|
| Board reference | U5 |
| Part Number | TLV320AIC23 |
| Device description | Stereo Audio Codec, 8 to 96 KHz, with Integrated Headphone Amplifier |
| Manufacturer | Texas Instruments |
| Manufacturer web site | www.ti.com |

Table 2–17 lists the TI TLV320AIC23 audio CODEC pin-outs.

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | 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 ADC-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 DAC-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_DIN | 143 | DIN | 4 | I2S format serial data input to the sigma-delta stereo DAC |
| AIC_DOUT | 144 | DOUT | 6 | I2S format serial data output from the sigma-delta stereo ADC |
| AD_SCLK | 92 | SCLK | 24 | Control-port serial-data clock. For 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 DAC |
| 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 mic


HSMC Connector (J1)

The Data Conversion HSMC connects to Altera FPGA Starter and Development Boards via a single High Speed Mezzanine Card (HSMC) connector (J6).

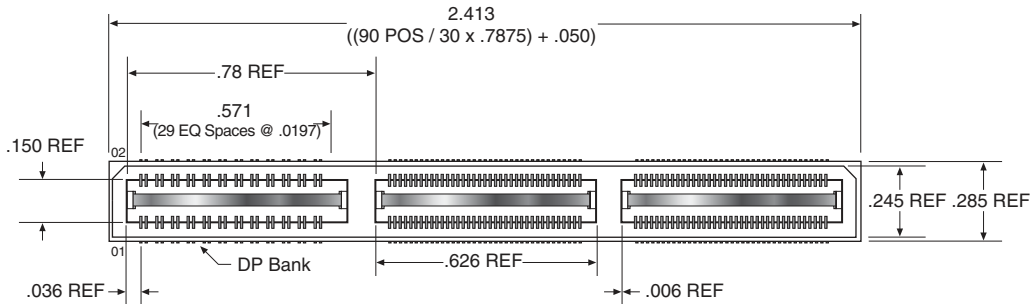
Table 2–18 below lists HSMC connector board reference and manufacturing information.

| <i>Table 2–18. HSMC Connector Component Reference</i> | |
|---|---|
| Item | Description |
| Board reference | J1 |
| Part Number | ASP-122952-01 |
| Device description | High Speed Mezzanine Card Connector |
| Manufacturer | Samtec |
| Manufacturer web site | http://www.samtec.com/signal_integrity/altera.asp |

The HSMC connector is a modified version of 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.

The HSMC connector layout is shown in Figure 2–7 below.

Figure 2–7. Samtec Header Connector

I2C Serial EEPROM (U14)

There is a 2k-bits I2C Serial EEPROM on the Data Conversion HSMC. [Table 2–19](#) below lists I2C Serial EEPROM board reference and manufacturing information.

Table 2–19. I2C Serial EEPROM Component Reference

| Item | Description |
|-----------------------|--|
| Board reference | U14 |
| Part Number | IS24C02B |
| Device description | 2k-bits I2C Serial EEPROM |
| Manufacturer | ISSI |
| Manufacturer web site | www.issi.com |

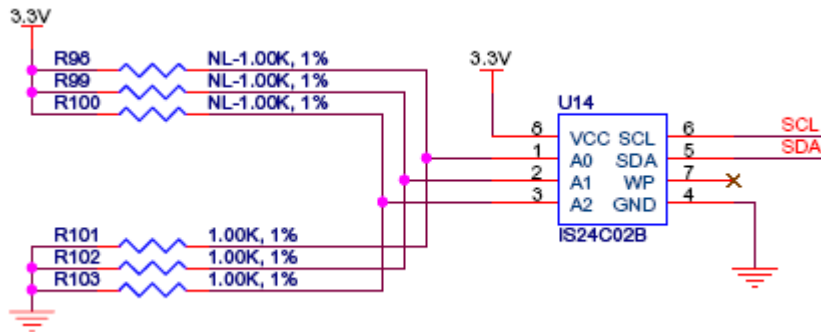
[Table 2–20](#) shows the pinout of I2C Serial EEPROM with HSMC Connector.

Table 2–20. I2C Serial EEPROM (U14) Pinouts

| HSMC Signal | HSMC Pin | Device Signal | Device Pin No. | Description |
|-------------|----------|---------------|----------------|-------------------------|
| SCL | 34 | SCL | 6 | Serial Clock Input |
| SDA | 33 | SDA | 5 | Serial Address/Data I/O |

[Figure 2–8](#) shows the I2C Serial EEPROM schematic.

Figure 2–8. I2C Serial EEPROM Schematic



Power Supply

Analog to Digital 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 below lists Power Supplies board reference and manufacturing information.

| <i>Table 2–21. Power Supplies Component Reference</i> | |
|---|---|
| Item | Description |
| Board reference | U6, U7, U8 |
| Part Number | LT1963 |
| Device description | LT1963A - 1.5A, Low Noise, Fast Transient Response LDO Regulators |
| Manufacturer | Linear Technology |
| Manufacturer web site | www.linear.com |



Appendix A. Pinouts for the Cyclone III (3C120) Development Board

Introduction

The section below describes the HSMC Port A interface pinouts for the Cyclone III EP3C120F780 Development board. See [Table A-1](#).

Table A-1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 33 | SDA | HSMA_SDA | AC1 |
| 34 | SCL | HSMA_SCL | AC3 |
| 41 | ADA_D13 | HSMA_D0 | AB6 |
| 42 | ADB_D13 | HSMA_D1 | AF2 |
| 43 | ADA_D12 | HSMA_D2 | AE3 |
| 44 | ADB_D12 | HSMA_D3 | AC5 |
| 47 | ADA_D11 | HSMA_TX_D_P0 | R7 |
| 48 | ADB_D11 | HSMA_RX_D_P0 | AB2 |
| 49 | ADA_D10 | HSMA_TX_D_N0 | R6 |
| 50 | ADB_D10 | HSMA_RX_D_N0 | AB1 |
| 53 | ADA_D9 | HSMA_TX_D_P1 | V4 |
| 54 | ADB_D9 | HSMA_RX_D_P1 | Y4 |
| 55 | ADA_D8 | HSMA_TX_D_N1 | V3 |
| 56 | ADB_D8 | HSMA_RX_D_N1 | Y3 |
| 59 | ADA_D7 | HSMA_TX_D_P2 | T4 |
| 60 | ADB_D7 | HSMA_RX_D_P2 | U3 |
| 61 | ADA_D6 | HSMA_TX_D_N2 | T3 |
| 62 | ADB_D6 | HSMA_RX_D_N2 | U4 |
| 65 | ADA_D5 | HSMA_TX_D_P3 | R3 |
| 66 | ADB_D5 | HSMA_RX_D_P3 | W2 |
| 67 | ADA_D4 | HSMA_TX_D_N3 | R4 |
| 68 | ADB_D4 | HSMA_RX_D_N3 | W1 |
| 71 | ADA_D3 | HSMA_TX_D_P4 | M8 |
| 72 | ADB_D3 | HSMA_RX_D_P4 | V2 |

Table A–1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 73 | ADA_D2 | HSMA_TX_D_N4 | M7 |
| 74 | ADB_D2 | HSMA_RX_D_N4 | V1 |
| 77 | ADA_D1 | HSMA_TX_D_P5 | P2 |
| 78 | ADB_D1 | HSMA_RX_D_P5 | U2 |
| 79 | ADA_D0 | HSMA_TX_D_N5 | P1 |
| 80 | ADB_D0 | HSMA_RX_D_N5 | U1 |
| 83 | ADA_OR | HSMA_TX_P6 | AE6 |
| 84 | ADB_OR | HSMA_RX_P6 | AF4 |
| 85 | ADA_OE | HSMA_TX_N6 | AE5 |
| 86 | ADB_OE | HSMA_RX_N6 | AF3 |
| 89 | ADA_SPI_CS | HSMA_TX_P7 | AD4 |
| 90 | ADB_SPI_CS | HSMA_RX_P7 | AG1 |
| 91 | AD_SDIO | HSMA_TX_N7 | AD3 |
| 92 | AD_SCLK | HSMA_RX_N7 | AH1 |
| 95 | FPGA_CLK_A_P | HSMA_CLK_OUT_P1 | V10 |
| 96 | XT_IN_P | HSMA_CLK_IN_P1 | Y4 |
| 97 | FPGA_CLK_A_N | HSMA_CLK_OUT_N1 | W9 |
| 98 | XT_IN_N | HSMA_CLK_IN_N1 | W3 |
| 101 | DA13 | HSMA_TX_P8 | AC6 |
| 102 | DB13 | HSMA_RX_P8 | AF2 |
| 103 | DA12 | HSMA_TX_N8 | AC5 |
| 104 | DB12 | HSMA_RX_N8 | AF1 |
| 107 | DA11 | HSMA_TX_P9 | AB5 |
| 108 | DB11 | HSMA_RX_P9 | AB6 |
| 109 | DA10 | HSMA_TX_N9 | AE2 |
| 110 | DB10 | HSMA_RX_N9 | AE1 |
| 113 | DA9 | HSMA_TX_P10 | AB8 |
| 114 | DB9 | HSMA_RX_P10 | AE4 |
| 115 | DA8 | HSMA_TX_N10 | AC7 |

Table A-1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 116 | DB8 | HSMA_RX_N10 | AE3 |
| 119 | DA7 | HSMA_TX_P11 | Y6 |
| 120 | DB7 | HSMA_RX_P11 | AC2 |
| 121 | DA6 | HSMA_TX_N11 | Y5 |
| 122 | DB6 | HSMA_RX_N11 | AD1 |
| 125 | DA5 | HSMA_TX_P12 | AA7 |
| 126 | DB5 | HSMA_RX_P12 | AB2 |
| 127 | DA4 | HSMA_TX_N12 | AA6 |
| 128 | DB4 | HSMA_RX_N12 | AC1 |
| 131 | DA3 | HSMA_TX_P13 | Y8 |
| 132 | DB3 | HSMA_RX_P13 | AA1 |
| 133 | DA2 | HSMA_TX_N13 | Y7 |
| 134 | DB2 | HSMA_RX_N13 | AB1 |
| 137 | DA1 | HSMA_TX_P14 | AC4 |
| 138 | DB1 | HSMA_RX_P14 | Y10 |
| 139 | DA0 | HSMA_TX_N14 | Y9 |
| 140 | DB0 | HSMA_RX_N14 | AB3 |
| 143 | AIC_DIN | HSMA_TX_P15 | W12 |
| 144 | AIC_DOUT | HSMA_RX_P15 | AB4 |
| 145 | AIC_LRCIN | HSMA_TX_N15 | Y11 |
| 146 | AIC_LRCOUT | HSMA_RX_N15 | AA3 |
| 149 | AIC_BCLK | HSMA_TX_P16 | AA12 |
| 150 | AIC_XCLK | HSMA_RX_P16 | AA4 |
| 151 | AIC_SPI_CS | HSMA_TX_N16 | AB11 |
| 155 | FPGA_CLK_B_P | HSMA_CLK_OUT_P2 | W8 |
| 156 | ADA_DCO | HSMA_CLK_IN_P2 | T2 |
| 157 | FPGA_CLK_B_N | HSMA_CLK_OUT_N2 | W7 |
| 158 | ADB_DCO | HSMA_CLK_IN_N2 | T1 |

The section below describes HSMC Port B interface pinouts for the Cyclone III EP3C120F780 Development board. See [Table A-2](#).

| Table A-2. HSMC Port B Interface Pinout | | | |
|--|--------------------|------------------------------------|-------------------------|
| Data Conversion HSMC Schematic | | Development Board Schematic | |
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 33 | SDA | HSMB_SDA | H26 |
| 34 | SCL | HSMB_SCL | H25 |
| 41 | ADA_D13 | HSMB_D0 | G24 |
| 42 | ADB_D13 | HSMB_D1 | H23 |
| 43 | ADA_D12 | HSMB_D2 | G25 |
| 44 | ADB_D12 | HSMB_D3 | H24 |
| 47 | ADA_D11 | HSMB_TX_D_P0 | J25 |
| 48 | ADB_D11 | HSMB_RX_D_P0 | F27 |
| 49 | ADA_D10 | HSMB_TX_D_N0 | J26 |
| 50 | ADB_D10 | HSMB_RX_D_N0 | F28 |
| 53 | ADA_D9 | HSMB_TX_D_P1 | L23 |
| 54 | ADB_D9 | HSMB_RX_D_P1 | G27 |
| 55 | ADA_D8 | HSMB_TX_D_N1 | L24 |
| 56 | ADB_D8 | HSMB_RX_D_N1 | G28 |
| 59 | ADA_D7 | HSMB_TX_D_P2 | M25 |
| 60 | ADB_D7 | HSMB_RX_D_P2 | K25 |
| 61 | ADA_D6 | HSMB_TX_D_N2 | M26 |
| 62 | ADB_D6 | HSMB_RX_D_N2 | K26 |
| 65 | ADA_D5 | HSMB_TX_D_P3 | N25 |
| 66 | ADB_D5 | HSMB_RX_D_P3 | K27 |
| 67 | ADA_D4 | HSMB_TX_D_N3 | N26 |
| 68 | ADB_D4 | HSMB_RX_D_N3 | K28 |
| 71 | ADA_D3 | HSMB_TX_D_P4 | R27 |
| 72 | ADB_D3 | HSMB_RX_D_P4 | L27 |
| 73 | ADA_D2 | HSMB_TX_D_N4 | R28 |
| 74 | ADB_D2 | HSMB_RX_D_N4 | L28 |
| 77 | ADA_D1 | HSMB_TX_D_P5 | R25 |
| 78 | ADB_D1 | HSMB_RX_D_P5 | M27 |

Table A–2. HSMC Port B Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 79 | ADA_D0 | HSMB_TX_D_N5 | R26 |
| 80 | ADB_D0 | HSMB_RX_D_N5 | M28 |
| 83 | ADA_OR | HSMB_TX_D_P6 | U25 |
| 84 | ADB_OR | HSMB_RX_D_P6 | P25 |
| 85 | ADA_OE | HSMB_TX_D_N6 | U26 |
| 86 | ADB_OE | HSMB_RX_D_N6 | P26 |
| 89 | ADA_SPI_CS | HSMB_TX_D_P7 | V27 |
| 90 | ADB_SPI_CS | HSMB_RX_D_P7 | P27 |
| 91 | AD_SDIO | HSMB_TX_D_N7 | V28 |
| 92 | AD_SCLK | HSMB_RX_D_N7 | P28 |
| 95 | FPGA_CLK_A_P | HSMB_CLK_OUT_P1 | AC26 |
| 96 | XT_IN_P | HSMB_CLK_IN_P1 | J27 |
| 97 | FPGA_CLK_A_N | HSMB_CLK_OUT_N1 | AD26 |
| 98 | XT_IN_N | HSMB_CLK_IN_N1 | J28 |
| 101 | DA13 | HSMB_TX_D_P8 | V25 |
| 102 | DB13 | HSMB_RX_D_P8 | P21 |
| 103 | DA12 | HSMB_TX_D_N8 | V26 |
| 104 | DB12 | HSMB_RX_D_N8 | R21 |
| 107 | DA11 | HSMB_TX_D_P9 | W25 |
| 108 | DB11 | HSMB_RX_D_P9 | R22 |
| 109 | DA10 | HSMB_TX_D_N9 | W26 |
| 110 | DB10 | HSMB_RX_D_N9 | R23 |
| 113 | DA9 | HSMB_TX_D_P10 | Y25 |
| 114 | DB9 | HSMB_RX_D_P10 | T25 |
| 115 | DA8 | HSMB_TX_D_N10 | Y26 |
| 116 | DB8 | HSMB_RX_D_N10 | T26 |
| 119 | DA7 | HSMB_TX_D_P11 | AA25 |
| 120 | DB7 | HSMB_RX_D_P11 | U27 |
| 121 | DA6 | HSMB_TX_D_N11 | AA26 |
| 122 | DB6 | HSMB_RX_D_N11 | U28 |
| 125 | DA5 | HSMB_TX_D_P12 | AB25 |

Table A–2. HSMC Port B Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 126 | DB5 | HSMB_RX_D_P12 | U22 |
| 127 | DA4 | HSMB_TX_D_N12 | AB26 |
| 128 | DB4 | HSMB_RX_D_N12 | V22 |
| 131 | DA3 | HSMB_TX_D_P13 | Y23 |
| 132 | DB3 | HSMB_RX_D_P13 | W28 |
| 133 | DA2 | HSMB_TX_D_N13 | Y24 |
| 134 | DB2 | HSMB_RX_D_N13 | W27 |
| 137 | DA1 | HSMB_TX_D_P14 | AE27 |
| 138 | DB1 | HSMB_RX_D_P14 | V23 |
| 139 | DA0 | HSMB_TX_D_N14 | AE28 |
| 140 | DB0 | HSMB_RX_D_N14 | V24 |
| 143 | AIC_DIN | HSMB_TX_D_P15 | W22 |
| 144 | AIC_DOUT | HSMB_RX_D_P15 | AB27 |
| 145 | AIC_LRCIN | HSMB_TX_D_N15 | Y22 |
| 146 | AIC_LRCOUT | HSMB_RX_D_N15 | AB28 |
| 149 | AIC_BCLK | HSMB_TX_D_P16 | V21 |
| 150 | AIC_XCLK | HSMB_RX_D_P16 | AC27 |
| 151 | AIC_SPI_CS | HSMB_TX_D_N16 | W21 |
| 155 | FPGA_CLK_B_P | HSMB_CLK_OUT_P2 | AD27 |
| 156 | ADA_DCO | HSMB_CLK_IN_P2 | Y27 |
| 157 | FPGA_CLK_B_N | HSMB_CLK_OUT_N2 | AD28 |
| 158 | ADB_DCO | HSMB_CLK_IN_N2 | Y28 |



Appendix B. Pinouts for the Stratix III (3SL150) Development Board

Introduction

The section below describes the HSMC Port A interface pinouts for the Stratix III (3SL150) Development board. See [Table B-1](#)

Table B-1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 33 | SDA | HSMA_SDA | P8 |
| 34 | SCL | HSMA_SCL | AA32 |
| 41 | ADA_D13 | HSMA_D0 | AK9 |
| 42 | ADB_D13 | HSMA_D1 | AJ9 |
| 43 | ADA_D12 | HSMA_D2 | AL7 |
| 44 | ADB_D12 | HSMA_D3 | AL9 |
| 47 | ADA_D11 | HSMA_TX_P0 | AC11 |
| 48 | ADB_D11 | HSMA_RX_P0 | AJ4 |
| 49 | ADA_D10 | HSMA_TX_N0 | AB10 |
| 50 | ADB_D10 | HSMA_RX_N0 | AJ3 |
| 53 | ADA_D9 | HSMA_TX_P1 | AC9 |
| 54 | ADB_D9 | HSMA_RX_P1 | AG4 |
| 55 | ADA_D8 | HSMA_TX_N1 | AC8 |
| 56 | ADB_D8 | HSMA_RX_N1 | AG3 |
| 59 | ADA_D7 | HSMA_TX_P2 | AH5 |
| 60 | ADB_D7 | HSMA_RX_P2 | AM2 |
| 61 | ADA_D6 | HSMA_TX_N2 | AH4 |
| 62 | ADB_D6 | HSMA_RX_N2 | AM1 |
| 65 | ADA_D5 | HSMA_TX_P3 | AE8 |
| 66 | ADB_D5 | HSMA_RX_P3 | AL2 |
| 67 | ADA_D4 | HSMA_TX_N3 | AE7 |

Table B-1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 68 | ADB_D4 | HSMA_RX_N3 | AL1 |
| 71 | ADA_D3 | HSMA_TX_P4 | AF6 |
| 72 | ADB_D3 | HSMA_RX_P4 | AJ2 |
| 73 | ADA_D2 | HSMA_TX_N4 | AF5 |
| 74 | ADB_D2 | HSMA_RX_N4 | AK1 |
| 77 | ADA_D1 | HSMA_TX_P5 | AD7 |
| 78 | ADB_D1 | HSMA_RX_P5 | AH2 |
| 79 | ADA_D0 | HSMA_TX_N5 | AD6 |
| 80 | ADB_D0 | HSMA_RX_N5 | AJ1 |
| 83 | ADA_OR | HSMA_TX_P6 | AE6 |
| 84 | ADB_OR | HSMA_RX_P6 | AF4 |
| 85 | ADA_OE | HSMA_TX_N6 | AE5 |
| 86 | ADB_OE | HSMA_RX_N6 | AF3 |
| 89 | ADA_SPI_CS | HSMA_TX_P7 | AD4 |
| 90 | ADB_SPI_CS | HSMA_RX_P7 | AG1 |
| 91 | AD_SDIO | HSMA_TX_N7 | AD3 |
| 92 | AD_SCLK | HSMA_RX_N7 | AH1 |
| 95 | FPGA_CLK_A_P | HSMA_CLK_OUT_P1 | V10 |
| 96 | XT_IN_P | HSMA_CLK_IN_P1 | Y4 |
| 97 | FPGA_CLK_A_N | HSMA_CLK_OUT_N1 | W9 |
| 98 | XT_IN_N | HSMA_CLK_IN_N1 | W3 |
| 101 | DA13 | HSMA_TX_P8 | AC6 |
| 102 | DB13 | HSMA_RX_P8 | AF2 |
| 103 | DA12 | HSMA_TX_N8 | AC5 |
| 104 | DB12 | HSMA_RX_N8 | AF1 |
| 107 | DA11 | HSMA_TX_P9 | AB5 |
| 108 | DB11 | HSMA_RX_P9 | AB6 |
| 109 | DA10 | HSMA_TX_N9 | AE2 |

Table B-1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 110 | DB10 | HSMA_RX_N9 | AE1 |
| 113 | DA9 | HSMA_TX_P10 | AB8 |
| 114 | DB9 | HSMA_RX_P10 | AE4 |
| 115 | DA8 | HSMA_TX_N10 | AC7 |
| 116 | DB8 | HSMA_RX_N10 | AE3 |
| 119 | DA7 | HSMA_TX_P11 | Y6 |
| 120 | DB7 | HSMA_RX_P11 | AC2 |
| 121 | DA6 | HSMA_TX_N11 | Y5 |
| 122 | DB6 | HSMA_RX_N11 | AD1 |
| 125 | DA5 | HSMA_TX_P12 | AA7 |
| 126 | DB5 | HSMA_RX_P12 | AB2 |
| 127 | DA4 | HSMA_TX_N12 | AA6 |
| 128 | DB4 | HSMA_RX_N12 | AC1 |
| 131 | DA3 | HSMA_TX_P13 | Y8 |
| 132 | DB3 | HSMA_RX_P13 | AA1 |
| 133 | DA2 | HSMA_TX_N13 | Y7 |
| 134 | DB2 | HSMA_RX_N13 | AB1 |
| 137 | DA1 | HSMA_TX_P14 | AC4 |
| 138 | DB1 | HSMA_RX_P14 | Y10 |
| 139 | DA0 | HSMA_TX_N14 | Y9 |
| 140 | DB0 | HSMA_RX_N14 | AB3 |
| 143 | AIC_DIN | HSMA_TX_P15 | W12 |
| 144 | AIC_DOUT | HSMA_RX_P15 | AB4 |
| 145 | AIC_LRCIN | HSMA_TX_N15 | Y11 |
| 146 | AIC_LRCOUT | HSMA_RX_N15 | AA3 |
| 149 | AIC_BCLK | HSMA_TX_P16 | AA12 |
| 150 | AIC_XCLK | HSMA_RX_P16 | AA4 |
| 151 | AIC_SPI_CS | HSMA_TX_N16 | AB11 |

Table B–1. HSMC Port A Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 155 | FPGA_CLK_B_P | HSMA_CLK_OUT_P2 | W8 |
| 156 | ADA_DCO | HSMA_CLK_IN_P2 | T2 |
| 157 | FPGA_CLK_B_N | HSMA_CLK_OUT_N2 | W7 |
| 158 | ADB_DCO | HSMA_CLK_IN_N2 | T1 |

The section below describes the HSMC Port B interface pinouts for the Stratix III (3SL150) Development board. See [Table B–2](#)

Table B–2. HSMC Port B Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 33 | SDA | HSMB_SDA | U11 |
| 34 | SCL | HSMB_SCL | AD31 |
| 41 | ADA_D13 | HSMB_D0 | AB24 |
| 42 | ADB_D13 | HSMB_D1 | AB25 |
| 43 | ADA_D12 | HSMB_D2 | AF32 |
| 44 | ADB_D12 | HSMB_D3 | AF31 |
| 47 | ADA_D11 | HSMB_TX_P0 | P11 |
| 48 | ADB_D11 | HSMB_RX_P0 | R4 |
| 49 | ADA_D10 | HSMB_TX_N0 | P10 |
| 50 | ADB_D10 | HSMB_RX_N0 | R3 |
| 53 | ADA_D9 | HSMB_TX_P1 | T9 |
| 54 | ADB_D9 | HSMB_RX_P1 | P4 |
| 55 | ADA_D8 | HSMB_TX_N1 | T8 |
| 56 | ADB_D8 | HSMB_RX_N1 | P3 |
| 59 | ADA_D7 | HSMB_TX_P2 | T7 |
| 60 | ADB_D7 | HSMB_RX_P2 | P2 |

Table B–2. HSMC Port B Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 61 | ADA_D6 | HSMB_TX_N2 | U6 |
| 62 | ADB_D6 | HSMB_RX_N2 | R1 |
| 65 | ADA_D5 | HSMB_TX_P3 | T5 |
| 66 | ADB_D5 | HSMB_RX_P3 | N2 |
| 67 | ADA_D4 | HSMB_TX_N3 | T4 |
| 68 | ADB_D4 | HSMB_RX_N3 | P1 |
| 71 | ADA_D3 | HSMB_TX_P4 | R10 |
| 72 | ADB_D3 | HSMB_RX_P4 | M1 |
| 73 | ADA_D2 | HSMB_TX_N4 | R9 |
| 74 | ADB_D2 | HSMB_RX_N4 | N1 |
| 77 | ADA_D1 | HSMB_TX_P5 | R7 |
| 78 | ADB_D1 | HSMB_RX_P5 | L2 |
| 79 | ADA_D0 | HSMB_TX_N5 | R6 |
| 80 | ADB_D0 | HSMB_RX_N5 | L1 |
| 83 | ADA_OR | HSMB_TX_P6 | N9 |
| 84 | ADB_OR | HSMB_RX_P6 | K4 |
| 85 | ADA_OE | HSMB_TX_N6 | N8 |
| 86 | ADB_OE | HSMB_RX_N6 | K3 |
| 89 | ADA_SPI_CS | HSMB_TX_P7 | M7 |
| 90 | ADB_SPI_CS | HSMB_RX_P7 | J4 |
| 91 | AD_SDIO | HSMB_TX_N7 | M6 |
| 92 | AD_SCLK | HSMB_RX_N7 | J3 |
| 95 | FPGA_CLK_A_P | HSMB_CLK_OUT_P1 | P6 |
| 96 | XT_IN_P | HSMB_CLK_IN_P1 | N4 |
| 97 | FPGA_CLK_A_N | HSMB_CLK_OUT_N1 | P5 |
| 98 | XT_IN_N | HSMB_CLK_IN_N1 | N3 |
| 101 | DA13 | HSMB_TX_P8 | L7 |
| 102 | DB13 | HSMB_RX_P8 | H2 |

| <i>Table B–2. HSMC Port B Interface Pinout</i> | | | |
|--|-------------|-----------------------------|-----------------|
| Data Conversion HSMC Schematic | | Development Board Schematic | |
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 103 | DA12 | HSMB_TX_N8 | L6 |
| 104 | DB12 | HSMB_RX_N8 | J1 |
| 107 | DA11 | HSMB_TX_N9 | L4 |
| 108 | DB11 | HSMB_TX_P9 | L5 |
| 109 | DA10 | HSMB_RX_P9 | G2 |
| 110 | DB10 | HSMB_RX_N9 | H1 |
| 113 | DA9 | HSMB_TX_P10 | K6 |
| 114 | DB9 | HSMB_RX_P10 | F1 |
| 115 | DA8 | HSMB_TX_N10 | K5 |
| 116 | DB8 | HSMB_RX_N10 | G1 |
| 119 | DA7 | HSMB_TX_P11 | J7 |
| 120 | DB7 | HSMB_RX_P11 | H4 |
| 121 | DA6 | HSMB_TX_N11 | J6 |
| 122 | DB6 | HSMB_RX_N11 | H3 |
| 125 | DA5 | HSMB_TX_P12 | H6 |
| 126 | DB5 | HSMB_RX_P12 | E2 |
| 127 | DA4 | HSMB_TX_N12 | H5 |
| 128 | DB4 | HSMB_RX_N12 | E1 |
| 131 | DA3 | HSMB_TX_P13 | K8 |
| 132 | DB3 | HSMB_RX_P13 | C1 |
| 133 | DA2 | HSMB_TX_N13 | K7 |
| 134 | DB2 | HSMB_RX_N13 | D1 |
| 137 | DA1 | HSMB_RX_P14 | D3 |
| 138 | DB1 | HSMB_TX_P14 | L8 |
| 139 | DA0 | HSMB_TX_N14 | L9 |
| 140 | DB0 | HSMB_RX_N14 | D2 |
| 143 | AIC_DIN | HSMB_TX_P15 | M10 |
| 144 | AIC_DOUT | HSMB_RX_P15 | G5 |

Table B-2. HSMC Port B Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 145 | AIC_LRCIN | HSMB_TX_N15 | M9 |
| 146 | AIC_LRCOUT | HSMB_RX_N15 | G4 |
| 149 | AIC_BCLK | HSMB_TX_P16 | N11 |
| 150 | AIC_XCLK | HSMB_RX_P16 | F4 |
| 151 | AIC_SPI_CS | HSMB_TX_N16 | N10 |
| 155 | FPGA_CLK_B_P | HSMB_CLK_OUT_P2 | R12 |
| 156 | ADA_DCO | HSMB_CLK_IN_P2 | U4 |
| 157 | FPGA_CLK_B_N | HSMB_CLK_OUT_N2 | T11 |
| 158 | ADB_DCO | HSMB_CLK_IN_N2 | U3 |



Appendix C. Pinouts for the Cyclone III (3C25) Starter Board

Introduction

The section describes the HSMC port interface pinout for the Cyclone III (3C25) Starter board. See [Table C-1](#)

Table C-1. HSMC Port Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 33 | SDA | HSMC_SDA | E1 |
| 34 | SCL | HSMC_SCL | F3 |
| 41 | ADA_D13 | HSMC_D0 | H6 |
| 42 | ADB_D13 | HSMC_D1 | D3 |
| 43 | ADA_D12 | HSMC_D2 | M5 |
| 44 | ADB_D12 | HSMC_D3 | L6 |
| 47 | ADA_D11 | HSMC_D4 | M5 |
| 48 | ADB_D11 | HSMC_D5 | M3 |
| 49 | ADA_D10 | HSMC_D6 | N7 |
| 50 | ADB_D10 | HSMC_D7 | T2 |
| 53 | ADA_D9 | HSMC_D8 | N8 |
| 54 | ADB_D9 | HSMC_D9 | H15 |
| 55 | ADA_D8 | HSMC_D10 | J13 |
| 56 | ADB_D8 | HSMC_D11 | H16 |
| 59 | ADA_D7 | HSMC_D12 | N10 |
| 60 | ADB_D7 | HSMC_D13 | N16 |
| 61 | ADA_D6 | HSMC_D14 | N11 |
| 62 | ADB_D6 | HSMC_D15 | N15 |
| 65 | ADA_D5 | HSMC_D16 | K17 |
| 66 | ADB_D5 | HSMC_D17 | R16 |
| 67 | ADA_D4 | HSMC_D18 | P11 |

| Table C-1. HSMC Port Interface Pinout | | | |
|--|--------------------|------------------------------------|-------------------------|
| Data Conversion HSMC Schematic | | Development Board Schematic | |
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 68 | ADB_D4 | HSMC_D19 | T16 |
| 71 | ADA_D3 | HSMC_TX_p4 | B2 |
| 72 | ADB_D3 | HSMC_RX_p4 | C2 |
| 73 | ADA_D2 | HSMC_TX_n4 | B1 |
| 74 | ADB_D2 | HSMC_RX_n4 | C1 |
| 77 | ADA_D1 | HSMC_TX_p5 | G2 |
| 78 | ADB_D1 | HSMC_RX_p5 | H2 |
| 79 | ADA_D0 | HSMC_TX_n5 | G1 |
| 80 | ADB_D0 | HSMC_RX_n5 | H1 |
| 83 | ADA_OR | HSMC_TX_p6 | K2 |
| 84 | ADB_OR | HSMC_RX_p6 | K5 |
| 85 | ADA_OE | HSMC_TX_n6 | K1 |
| 86 | ADB_OE | HSMC_RX_n6 | L5 |
| 89 | ADA_SPI_CS | HSMC_TX_p7 | L2 |
| 90 | ADB_SPI_CS | HSMC_RX_p7 | L4 |
| 91 | AD_SDIO | HSMC_TX_n7 | L1 |
| 92 | AD_SCLK | HSMC_RX_n7 | L3 |
| 95 | FPGA_CLK_A_P | HSMC_CLKOUT_p1 | D14 |
| 96 | XT_IN_P | HSMC_CLKIN_p1 | F17 |
| 97 | FPGA_CLK_A_N | HSMC_CLKOUT_n1 | C14 |
| 98 | XT_IN_N | HSMC_CLKIN_n1 | F18 |
| 101 | DA13 | HSMC_TX_p8 | M2 |
| 102 | DB13 | HSMC_RX_p8 | P2 |
| 103 | DA12 | HSMC_TX_n8 | M1 |
| 104 | DB12 | HSMC_RX_n8 | P1 |
| 107 | DA11 | HSMC_TX_p9 | R2 |
| 108 | DB11 | HSMC_RX_p9 | T3 |
| 109 | DA10 | HSMC_TX_n9 | R1 |

Table C-1. HSMC Port Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|-------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 110 | DB10 | HSMC_RX_n9 | R3 |
| 113 | DA9 | HSMC_TX_p10 | E17 |
| 114 | DB9 | HSMC_RX_p10 | G17 |
| 115 | DA8 | HSMC_TX_n10 | E18 |
| 116 | DB8 | HSMC_RX_n10 | G18 |
| 119 | DA7 | HSMC_TX_p11 | H17 |
| 120 | DB7 | HSMC_RX_p11 | K18 |
| 121 | DA6 | HSMC_TX_n11 | H18 |
| 122 | DB6 | HSMC_RX_n11 | L18 |
| 125 | DA5 | HSMC_TX_p12 | L17 |
| 126 | DB5 | HSMC_RX_p12 | L16 |
| 127 | DA4 | HSMC_TX_n12 | M18 |
| 128 | DB4 | HSMC_RX_n12 | M17 |
| 131 | DA3 | HSMC_TX_p13 | L14 |
| 132 | DB3 | HSMC_RX_p13 | L13 |
| 133 | DA2 | HSMC_TX_n13 | L15 |
| 134 | DB2 | HSMC_RX_n13 | M14 |
| 137 | DA1 | HSMC_TX_p14 | P17 |
| 138 | DB1 | HSMC_RX_p14 | R17 |
| 139 | DA0 | HSMC_TX_n14 | P18 |
| 140 | DB0 | HSMC_RX_n14 | R18 |
| 143 | AIC_DIN | HSMC_TX_p15 | R5 |
| 144 | AIC_DOUT | HSMC_RX_p15 | M6 |
| 145 | AIC_LRCIN | HSMC_TX_n15 | R4 |
| 146 | AIC_LRCOUT | HSMC_RX_n15 | N6 |
| 149 | AIC_BCLK | HSMC_TX_p16 | T17 |
| 150 | AIC_XCLK | HSMC_RX_p16 | M13 |
| 151 | AIC_SPI_CS | HSMC_TX_n16 | T18 |

Table C-1. HSMC Port Interface Pinout

| Data Conversion HSMC Schematic | | Development Board Schematic | |
|--------------------------------|--------------|-----------------------------|-----------------|
| Connector (J1) Pin No. | Signal Name | Signal Name | FPGA Pin No. |
| 155 | FPGA_CLK_B_P | HSMC_CLKOUT_p2 | U18 |
| 156 | ADA_DCO | HSMC_CLKIN_p2 | N17 |
| 157 | FPGA_CLK_B_N | HSMC_CLKOUT_n2 | V18 |
| 158 | ADB_DCO | HSMC_CLKIN_n2 | N18 |



Additional Information

Revision History The table below displays the revision history for the chapters of the manual.

| Chapter | Date | Version | Changes Made |
|---------|------------|---------|----------------------|
| All | March 2008 | 1.0.0 | • First publication. |

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Note to table:

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

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| Visual Cue | Meaning |
|---|--|
| Bold Type with Initial Capital Letters | Command names, dialog box titles, checkbox options, and dialog box options are shown in bold, initial capital letters. Example: Save As dialog box. |
| bold type | External timing parameters, directory names, project names, disk drive names, filenames, filename extensions, and software utility names are shown in bold type. Examples: f_{MAX} , lqdesigns directory, d: drive, chiptrip.gdf file. |
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| Visual Cue | Meaning |
|---|--|
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|  | Bullets are used in a list of items when the sequence of the items is not important. |
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|  | The hand points to information that requires special attention. |
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