



## Features

The Stratix<sup>®</sup> EP1S80 DSP development board is included with the *DSP Development Kit, Stratix Professional Edition* (ordering code: DSP-BOARD/S80). This board is a powerful development platform for digital signal processing (DSP) designs, and features the Stratix EP1S80 device in the speed grade (-6) 956-pin package.

## Components

- Analog I/O
  - Two 12-bit 125-MHz A/D converters
  - Two 14-bit 165-MHz D/A converters
  - Single-ended or differential inputs, and single-ended outputs
- Memory subsystem
  - 2 Mbytes of 7.5-ns synchronous SRAM configured as two independent 36-bit buses
  - 64 Mbits of flash memory
- Configuration options
  - On-board configuration via the 64-Mbits flash memory, plus the Altera<sup>®</sup> EPM7064 programmable logic device (PLD)
  - Download configuration data using ByteBlasterMV<sup>™</sup> download cables
- Dual seven-segment display
- One 8-pin dual in-line package (DIP) switch
- Three user-definable pushbutton switches
- One 9-pin RS-232 connector
- Two user-definable LEDs
- On-board 80-MHz oscillator
- Single 5-V DC power supply (adapter included)

## Debugging Interfaces

- Two Micror-type connectors for Agilent Technologies logic analyzers
- Several 0.1-inch headers

## Expansion Interfaces

- Two connectors for Analog Devices A/D converter daughter cards
- Connector for Texas Instruments Evaluation Module (TI-EVM) daughter cards
- Altera Expansion Prototype Connector

- Footprint for a front panel data port (FPDP)
- Prototyping area

## General Description

The Stratix EP1S80 DSP development board provides a hardware platform designers can use to start developing DSP systems based on Stratix devices immediately. Combined with DSP intellectual property (IP) from Altera and Altera Megafunction Partners Program (AMPP<sup>SM</sup>) partners, users can quickly develop powerful DSP systems. Altera's unique OpenCore<sup>®</sup> Plus technology allows users to try out these IP cores in hardware prior to licensing them. DSP Builder (version 2.2.1) includes a library for the Stratix EP1S80 DSP development board. This library allows algorithm development, simulation, and verification on the board, all from within The MathWorks MATLAB/Simulink system-level design tools. Additionally, the Stratix DSP development board has a Texas Instruments' EVM (cross-platform) daughter card connector, which enables development and verification of FPGA co-processors.

## Components & Interfaces

Figure 1 shows a top view of the board components and interfaces.

**Figure 1. Stratix EP1S80 DSP Development Board Components & Interfaces**

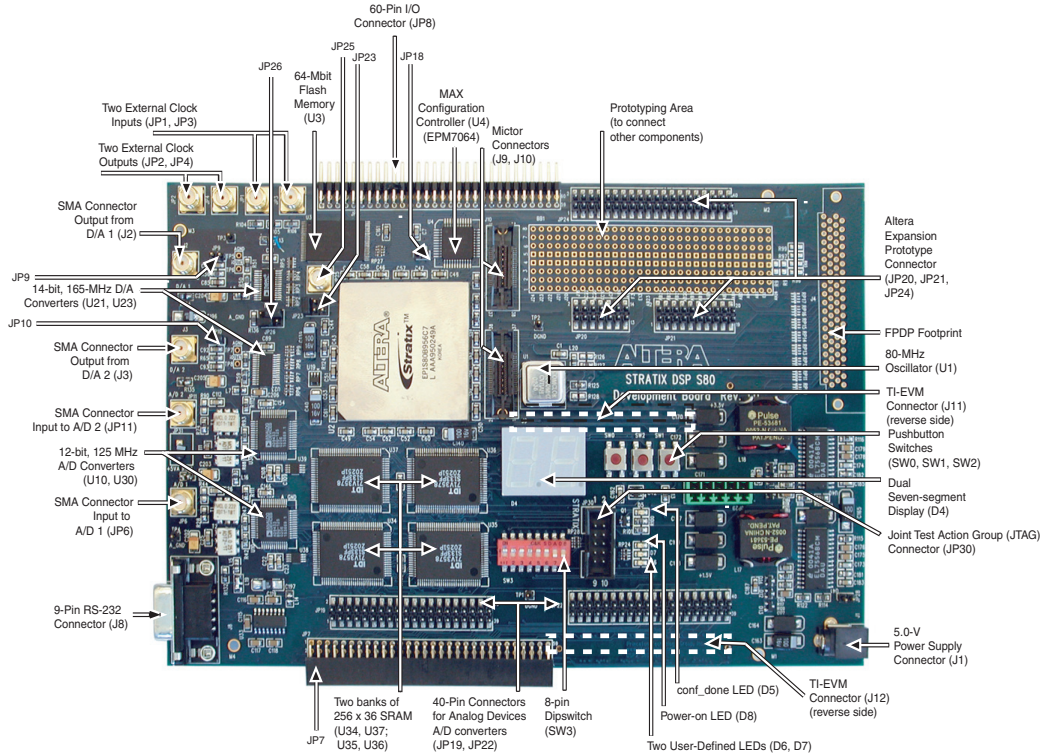


Table 1 describes the components on the board and the interfaces it supports.

<b>Table 1. Stratix EP1S80 DSP Development Board Components &amp; Interfaces (Part 1 of 3)</b>			
<b>Component/Interface</b>	<b>Type</b>	<b>Board Designation</b>	<b>Description</b>
<b>Components</b>			
A/D converters	I/O	U10, U30	The board has two 12-bit 125-MHz A/D converters
D/A converters	I/O	U21, U23	The board has two 14-bit 165-MHz D/A converters
2 Mbytes SRAM	Memory	U34, U35, U36, U37	The board has 2 MBytes of 7.5-ns synchronous SRAM configured as two independent 36-bit buses.

**Table 1. Stratix EP1S80 DSP Development Board Components & Interfaces (Part 2 of 3)**

Component/ Interface	Type	Board Designation	Description
64 Mbits of flash	Memory	U3	The board has 64 Mbits of flash memory.
SMA external clock input connectors	Input	JP1, JP3	The board has two SMA connector inputs connected to clocks, and terminated in 50 Ω.
SMA external clock output connectors	Output	JP2, JP4	The board has two SMA connector outputs with a source impedance of 50 Ω.
Dual seven-segment display	Display	D4	The board has a dual seven-segment display.
DIPswitch	I/O	SW3	The board has eight DIP switches, which are user-definable as logic inputs.
Pushbutton switches	I/O	SW0, SW1, SW2	The board has three pushbutton switches, which are user-definable as logic inputs.
User-defined LEDs	Display	D6, D7	The board has two user-definable LEDs.
Power-on LED	Display	D8	The board has an LED that illuminates when power is supplied to the board.
conf_done LED	Display	D5	The board has an LED that illuminates upon successful configuration of the Stratix device.
RS-232 connector	I/O	J8	The board has a DB9 connector, which is configured as a DTE serial port. The interface voltages are converted to 3.3-V signals and brought to the Stratix device, which must be configured to generate and accept transmissions.
On-board 80MHz oscillator	Clock	U1	The board has a socked on-board 80-MHz oscillator.
Single 5.0-V DC power supply	Input	J1 (adapter)	A 5.0-V DC power supply and a board adapter is included.
User I/O pins	I/O	JP7, JP8	The board has ninety general-purpose I/O pins on the 0.1-inch headers (45 on JP8; 45 on JP7). The Stratix pins that drive the JP8 header also drive headers JP20, JP21, and JP24. Similarly, the Stratix pins that drive the JP7 header also drive headers JP19, and JP22.
<b>Debugging Interfaces</b>			
Mictor connectors	I/O	J9, J10	The board has two Mictor headers, each connected to 33 Stratix pins (32 data, 1 clock) for use with an external logic analyzer.
<b>Expansion Interfaces</b>			
Analog Devices connector (1)	Expansion	JP19, JP22	The board provides an interface to Analog Device's A/D converters via two 40-pin connectors.
TI-EVM connectors	Expansion	J11, J12	The board provides an interface to the TI-EVM. The connectors can be found on the reverse side of the board, as shown in <a href="#">Figure 1</a> .

**Table 1. Stratix EP1S80 DSP Development Board Components & Interfaces (Part 3 of 3)**

Component/ Interface	Type	Board Designation	Description
Altera Expansion Prototype Header	Expansion	JP20, JP21, JP24	The board provides a custom interface to Altera expansion cards via a 74-pin header.
FPDP Footprint	Expansion	J4	Four rows of pins comprise a footprint for an FPDP, which can be added to the board.
Prototyping area	Expansion	N/A	The board provides a grid of plated through-holes on 0.1-inch centers. Thirty Stratix I/O pins are connected to the grid.

**Note to Table 1:**

- (1) The two debug headers designated in this table can be used to interface to Analog Devices A/D converter evaluation boards. They are designated as JP19 and JP22, and interface to Analog Devices AD6645/9433/9430 external A/D converters. Note that the JP19 and JP22 headers share Stratix pins with JP7.

## Environmental Requirements

The Stratix EP1S80 DSP development board must be stored between  $-40^{\circ}\text{C}$  and  $100^{\circ}\text{C}$ . The recommended operating temperature is between  $0^{\circ}\text{C}$  and  $55^{\circ}\text{C}$ .



The Stratix EP1S80 DSP development board can be damaged without proper anti-static handling.

## Using the Board

When power is applied to the board, the Power On LED illuminates. At this time, the Stratix device is automatically configured and, upon successful configuration, the `conf_done` LED illuminates.




JP18 allows the user to load one of two Stratix configuration images upon power-up. If the jumper on JP18 is not present, the *factory configuration* loads. If the jumper is present, the *user configuration* loads. See [“Non-Volatile Configuration” on page 7](#) for more details.

To configure the board with a new design, the designer should perform the following steps, explained in detail in this section.


1. Apply power to the board.
2. Configure the Stratix device.

## Apply Power

Apply power to the board by connecting the 5.0-V DC power supply adapter, provided in the *DSP Development Kit, Stratix Professional Edition*, to connector J1 (see [Figure 1 on page 3](#)). All of the board components draw power either directly from this 5.0-V supply, or through the 3.3-V and 1.5-V regulators that are powered from the 5.0-V supply.

 The 3.3-V supply provides  $V_{CCIO}$  to the Stratix device and LVTTTL board components. The 1.5-V supply provides  $V_{CCINT}$  to the Stratix device.

When power is applied to the board, the Power On LED (D8) illuminates.

 The Stratix EP1S80 device, the A/D and D/A converters, and the board's heat sink become hot as the board is used. Because their surface temperature may significantly increase, **do not touch these devices while there is power applied to the board.**

## Configure the Stratix Device Directly

You can configure the Stratix device directly, without turning off power, using the Quartus® II software and the ByteBlasterMV cable, as follows.

1. Attach the cable to JP30.
2. Open a Quartus II SRAM Object File (.sof), which launches the Quartus II Programmer.
3. Select **ByteBlasterMV** as the hardware.
4. Set the mode to **JTAG**.
5. Click **Start**.

On successful configuration, the **conf\_done** LED (D5) illuminates.



For instructions on how to use the ByteBlasterMV cable, see the Quartus II Help.

## Non-Volatile Configuration

The Stratix device is SRAM-based, therefore, the designer must reconfigure it each time power is applied to the Stratix DSP development board. For designers who want to power up the board and have a design immediately present in the Stratix device, the board has a non-volatile configuration scheme. This scheme consists of a configuration controller (U4), which is an Altera EPM7064 PLD, and flash memory. The configuration controller device is non-volatile (that is, it does not lose its configuration data when the board is powered down) and it comes factory-programmed with logic that configures the Stratix EP1S80B956C6 device (U2) from data stored in flash (U3) on power-up. Upon power-up, the configuration controller begins reading data from the flash memory. The flash memory, Stratix device, and configuration controller are connected so that data from the flash configures the Stratix device in fast passive-parallel mode.

### Configuration Data

The Quartus II software can (optionally) produce Hexadecimal Output Files (**.hexout**) that are suitable for download and storage in the flash memory as configuration data. The designer can create a **.hexout** file using the Quartus II version 4.2. software in one of the following ways:

- Write a **.hexout** at the end of compilation
- Convert a SOF to a **.hexout**

#### *Write a .hexout at the End of Compilation*

To set up a project so that the Quartus II software writes a **.hexout** at the end of compilation, perform the following steps:

1. Choose **Settings** (Assignments menu).
2. Click **Device** under **Compiler Settings**.
3. Click **Device and Pin Options**.
4. Click the **Programming Files** tab.
5. Turn on the **Hexadecimal (Intel-Format) Output File (.hexout)** option. With this option turned on, the Quartus II software generates a **.hexout** at the end of a successful compilation.

### *Convert a .sof to a .hexout*

The designer can convert a **.sof** file into a **.hexout** by performing the following steps in the Quartus II software:

1. Choose **Convert Programming Files** (File menu).
2. Under **Output programming file**, choose **Hexadecimal (Intel-Format) Output File for SRAM (.hexout)** from the **Programming file type** list box.
3. Specify an output file name in the **File name** box. The default is **output\_file.hexout**.
4. Click **SOF Data** under **Input files to convert**.
5. Click **Add File**.
6. Browse to the **.sof** to convert and click **OK**. The Quartus II software converts the file and saves the output file to the directory specified.



Intel-format **.hexout** contain data that is not actually written to the flash memory. The **Write2Flash** executable file (provided in the *<installation directory>/utilities/Flash\_Programmer* directory) parses the **.hexout** and creates a **.hexout.flash** that contains the data to be written to flash memory. The designer can then send this file serially to the board via an RS-232 cable and write it to flash memory by the factory configuration as described in “[Factory & User Configurations](#)”.

## Factory & User Configurations

The configuration controller can manage two separate Stratix device configurations (**.hexout**) stored in flash memory, a *user configuration* and a *factory configuration*. Upon power-up the configuration controller reads one of the two (user or factory) configurations from the flash memory and into the Stratix device. The user can select which configuration loads into the Stratix device by adding or removing the jumper on JP18. If the jumper is present on JP18, the controller configures the Stratix device with the user configuration. If the jumper is removed, the factory configuration is loaded.

The factory-provided user configuration, which loads into flash if the JP18 jumper is present and power is applied to the board, is a simple design that exercises the seven segment display. Switches 1 and 2 (SW1 and SW2) on the board control what/how the display is exercised. It either counts in hex from 00 to FF and loops or it illuminates the edges of the seven segment display in a round-robin fashion. SW1 switches back

and forth between the counter or the edge illuminations, and SW2 controls the speed of the counting or the illuminating, depending on which one is currently running. This test design allows the designer to verify that the board is working correctly with a user configuration.

The factory configuration contains a design that allows the designer to write a user configuration to the flash memory. To download the Quartus II-generated **.hexout** to the board, use the Altera-provided **Write2Flash.exe** utility, which is located in the **Flash\_Programmer** directory. This utility downloads the **.hexout** to the development board via the PC's serial port. If the factory configuration is loaded, it writes the **.hexout** to the flash memory. When the jumper at JP18 is in place and the power to the board is cycled, the user configuration is read from the flash memory and written to the Stratix device.

To download a user configuration into flash memory, perform the following steps:

1. Use the Quartus II software to generate a **.hexout** file as described in [“Configuration Data” on page 7](#).
2. Connect a serial cable from the board to the PC (note whether you are using COM 1 or COM 2).
3. Remove the jumper at JP18 if it is present.
4. Power up the board. The factory configuration is loaded in the Stratix device. The seven segment display should read FF.
5. Press SW1 on the board to erase the previous user configuration from flash memory. The seven-segment display should read 00. It actually counts backwards in hex from the value 20h (32 decimal) to 00. Depending on how fast the configuration erases, you may or may not see the counting.
6. Run the **Write2Flash.exe** utility in the *<installation path>*/**utilities/Flash\_Programmer** directory.
7. In the **Write2Flash** user interface, select the **.hexout** to store in flash memory as the user configuration.

8. Select the appropriate COM port (1 or 2).



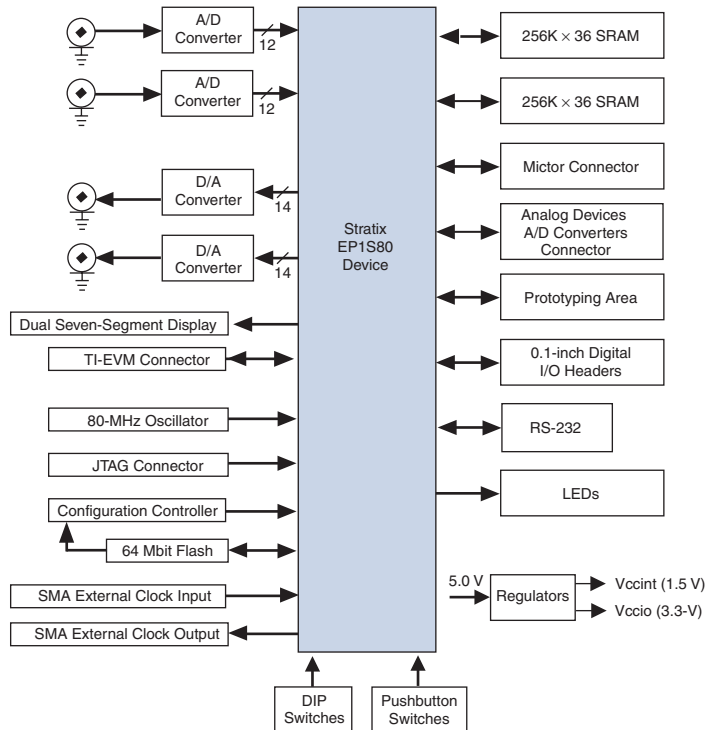
The **Region Setting** option must be turned on for PCs that have an operating system with double byte code set (DBCS), or unicode characters. For example, Microsoft Windows uses DBCS, instead of ASCII, for some of its language versions, including Chinese, Korean, and Japanese.

9. Click **Begin**. Transmission begins and takes about 15 minutes. The seven segment display counts when data transmission begins. It counts to the digits FE, and the **Write2Flash** utility reports that it has successfully downloaded the **.hexout**.
10. Ensure that the jumper at JP18 is in place and cycle the power on the Stratix board. The user configuration is loaded in the Stratix device.

## Functional Description

This section describes the elements of the Stratix EP1S80 DSP development board. [Figure 2](#) shows a block diagram of the board and, as mentioned earlier in this data sheet, [Figure 1 on page 3](#) shows a photograph of the board indicating names and locations of all components and interfaces.

**Figure 2. Stratix EP1S80 Development Board Block Diagram**



## Power

The 12-layer development board has eight signal layers and four ground/VCC planes. The board is powered from a single, well-regulated 5.0-V supply.

Regulators on the board are used to develop the  $V_{CCINT}$  (1.5 V) and  $V_{CCIO}$  (3.3 V) voltages. The board includes a Power On LED that indicates the presence of  $V_{CCIO}$ .

The following board elements are 3.3 V:

- LEDs
- Switches
- Crystal oscillator

Table 2 presents the specifications for the 5-V power supply, which connects from the wall socket to the DSP development board.

Item	Description
Board reference	N/A (power supply adapter)
Part number	DTS050400UDC-P5-SZ
Device description	Model EPA-201DA-05 5.0-VDC power supply Input: AC 100 V – 240 V, 45-60VA Output: DC 4A/20W
Manufacturer	CUI
Manufacturer web site	<a href="http://www.cui.com">www.cui.com</a>

## Stratix Device

The EP1S80 device on the board features 79,040 logic elements (LEs) in a speed-grade (-6) 956-pin BGA package. The device has 7,427,520 total RAM bits.



For more information on Stratix devices, see the *Stratix Programmable Logic Device Family Data Sheet*.

Table 3 describes the Stratix device features.

Feature	EP1S80B956-6
Logic elements (LEs)	79,040
M512 RAM Blocks (32 × 18 bits)	767
M4K RAM Blocks (128 × 36 bits)	364
M-RAM Blocks	9
Total RAM bits	7,427,520
DSP Blocks	22
Embedded multipliers (based on 9 × 9)	176
PLLs	12

**Table 3. Stratix Device Features (Part 2 of 2)**

Feature	EP1S80B956-6
Maximum user I/O pins	679
Package type	956-pin BGA
Board reference	U1
Voltage	1.5-V internal, 3.3-V I/O

## Clocks & Clock Distribution

Table 4 lists the clocks and their signal distribution throughout the board.

**Table 4. Clock Signal Distribution Signals**

Signal Name	Comes From	Goes To
CLK_DEBUGA	Stratix pin AL17 (PLL6_OUT_3n)	J9 pins 5, 6 (Mictor A)
CLK_DEBUGB	Stratix pin B17 (PLL5_OUT_3p)	J10 pins 5, 6 (Mictor B)
CLK_TI_OUT/2	J11 pin 78 (TI-EVM connector)	Stratix pin R29 (CLK0p)
CLK_DTOA1_STRATIX	Stratix pin AL16 (PLL6_OUT_0n)	JP26 pin 5 (D/A1 converter)
CLK_DTOA2_STRATIX	Stratix pin AK16 (PLL6_OUT_0p)	JP26 pin 6 (D/A2 converter)
CLK_SRAM1	Stratix pin AK15 (PLL6_OUT_1p)	U34 pin 89, U35 pin 89 (SRAM Bank 1)
CLK_SRAM2	Stratix pin AL15 (PLL6_OUT_1n)	U36 pin 89, U37 pin 89 (SRAM Bank 2)
CLK_OPT_A2D	Stratix pin B16 (PLL5_OUT_0p)	JP23 pin 4 (1)
CLK_OSC	80-MHz oscillator	Stratix pin A18 (CLK14p) Stratix pin AL18 (CLK4p) JP23 pin 2 (1)
CLK_DTOA_SMA_IN	JP25	JP26 pins 1 and 2
CLK_SMA_IN1	JP1	Stratix pin C18 (CLK15p) Stratix pin AJ18 (CLK5p) JP23 pin 6 (1)
CLK_SMA_IN2	JP3	Stratix pin D18 (CLK15n) Stratix pin AH18 (CLK5n)
CLK_SMA_OUT1	Stratix pin C17 (PLL5_OUT_2n)	JP4
CLK_SMA_OUT2	Stratix pin D17 (PLL5_OUT_2p)	JP2
CLK_EVALIO_IN44	JP7 pin 59	Stratix pin T31 (CLK1P)
CLK_EVALIO_OUT44	Stratix pin AK17 (PLL6_OUT_3p)	JP8 pin 59

**Note to Table 4:**

- (1) JP23 controls which clock is routed to the A/D converters after it passes through a differential LVPECL buffer. See Table 10 on page 18 for details.

The Stratix EP1S80 DSP development board can obtain a clock source from one or more of the following sources:

- The on-board crystal oscillator
- An external clock (through an SMA connector or Stratix pin)

The board can provide independent clocks from both the enhanced and fast PLLs to the A/D converters, the D/A converters, and the other components that require stable clock sources.

To implement this concept, the enhanced PLL5-dedicated pins drive the A/D converters and associated functions, and the enhanced PLL6-dedicated pins drive the D/A converters and associated functions.

Figure 3 is a diagram of each clock and their distribution throughout the board.

**Figure 3. Clock Distribution**

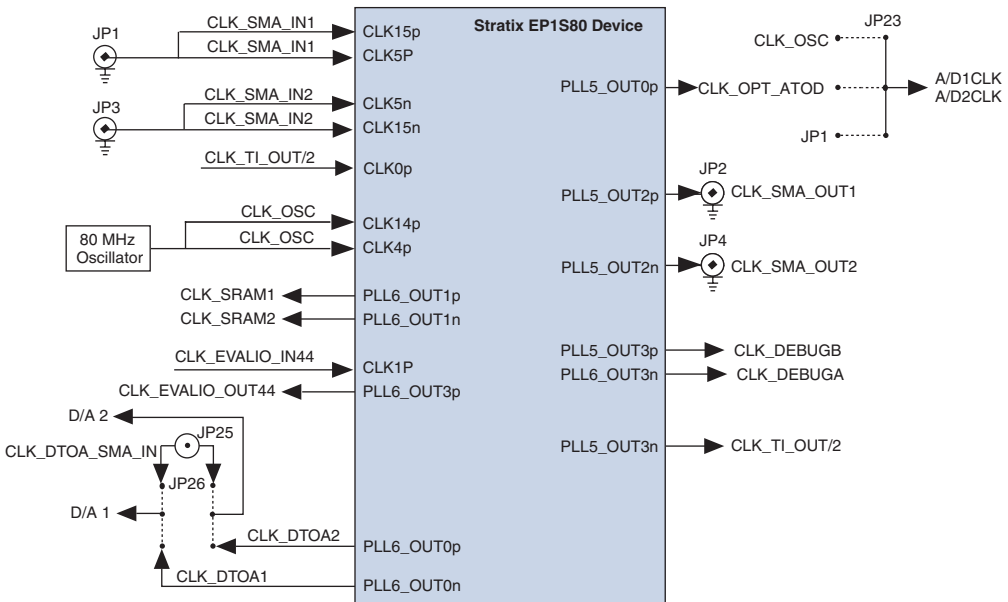


Table 5 lists the reference information for the 80-MHz on-board oscillator.

<b>Table 5. 80-MHz On-Board Oscillator Reference</b>	
<b>Item</b>	<b>Description</b>
Board reference	U1
Part number	ECS-2200B
Device description	Oscillator
Manufacturer	ECS Inc.
Manufacturer web site	<a href="http://www.ecsxtal.com">www.ecsxtal.com</a>

## Board Components

The following sections describe the development board components.

### Switch Inputs

The board has eight DIP switches and three pushbutton switches, which are user-definable as logic inputs as shown in Table 6. Each pushbutton signal is defined as a logic 1 when in its normal state; when pressed, it becomes a logic 0; when released it goes back to logic 1.

The DIP switches drive a logic 1 to the Stratix device when in the off position, and a logic 0 into the Stratix device when in the on position.

<b>Table 6. Switch Pin-Outs</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
<b>Pushbuttons</b>	
SW0	AF14
SW1	AK13
SW2	AK12
<b>DIP Switches</b>	
SW3p1	AK11
SW3p2	AK10
SW3p3	AK9
SW3p4	J20
SW3p5	J22
SW3p6	J21
SW3p7	N29
SW3p8	L11

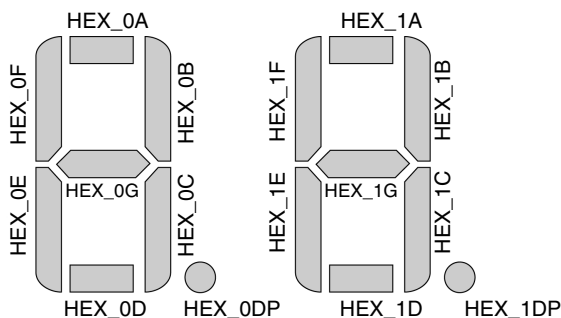
## Dual Seven-Segment Display & LEDs

A dual seven-segment display and two LEDs are provided as shown in [Table 7](#). The segments and LEDs illuminate if the Stratix pin to which they are connected drives a logic-0. They will appear unlit when the Stratix pin to which they are connected drives a logic-1.

<b>Table 7. Seven Segment Display &amp; LED Pin-Outs</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
<b>Dual Seven Segment Display</b>	
HEX_0A	K25
HEX_0B	K26
HEX_0C	K28
HEX_0D	L27
HEX_0E	K29
HEX_0F	D25
HEX_0G	K24
HEX_0DP	K27
HEX_1A	L29
HEX_1B	E13
HEX_1C	L19
HEX_1D	L24
HEX_1E	L25
HEX_1F	L28
HEX_1G	L21
HEX_1DP	L26
<b>LEDs</b>	
LED0	L12
LED1	L14

Figure 4 shows the name allocation of the seven-segment display.

**Figure 4. Pin-Out Diagram for the Dual Seven-Segment Display**



## Serial Interface

The board contains a DB9 connector, which provides a bidirectional RS-232C serial I/O interface. The board contains the transceiver, however the Stratix device must implement the logic controller. Table 8 describes the device used to implement the RS-232C interface.

**Table 8. RS-232C Interface Device Reference**

Item	Description
Board reference	None
Part number	MAX221E
Device description	RS-232 transceiver
Voltage	3.3 V
Manufacturer	Maxim
Manufacturer web site	<a href="http://www.maxim-ic.com">www.maxim-ic.com</a>

Table 9 shows the pin-outs for the RS-232 interface.

**Table 9. RS-232 Serial Interface Pin-Out**

Signal Name	Stratix Pin
ROUT	L16
TIN	J19

## A/D Converters

The Stratix EP1S80 DSP development board has two 12-bit A/D converters that produce samples at a maximum rate of 125 million-samples per second (MSPS). The A/D subsystem of the board has the following features:

- The data output format from each A/D converter to the Stratix device is in two's complement format.
- The circuit has a wideband, AC-coupled, differential input useful for IF sampling. The analog inputs are transformer-coupled to the A/D converter in order to create a balanced input. To maximize performance, two transformers are used in series. The Analog Devices data sheet for the AD9433 describes the detailed operation of this circuit.
- The converters' analog inputs can be configured as single-ended or differential, with a 0- $\Omega$  resistor (R28, R74). The default configuration is single-ended with the resistor installed.
- Any required anti-aliasing filtering can be performed externally.
- If needed, users can purchase in-line SMA filters from a variety of manufacturers, such as Mini-Circuits ([www.minicircuits.com](http://www.minicircuits.com)).



The transformer-coupled AC circuit has a lower 3-dB frequency, of approximately 1 MHz. The A/D converter is recommended for analog bandwidths up to 350 MHz.

The clock signal that drives the A/D converters can originate from the Stratix device, the external clock input, or the on-board 80-MHz oscillator. Jumper JP23 controls which clock is used. [Table 10](#) provides an explanation of how to select these three clock signals. The selected clock will pass through a differential LVPECL buffer before arriving at the clock input to both A/D converters.

<b>JP23 Setting</b>	<b>Clock Source</b>	<b>Signal Name</b>
Pins 1 and 2	On-board 80-MHz oscillator	CLK_OSC
Pins 3 and 4	Stratix pin B16	CLK_OPT_ATOD
Pins 5 and 6	SMA connector JP1	CLK_SMA1_IN

Table 11 lists reference information for the A/D converters.

<b>Table 11. A/D Converter Reference</b>	
<b>Item</b>	<b>Description</b>
Board reference	JP6, JP11
Part number	AD9433
Device description	12-bit, 125-MSPS A/D converter
Voltage	3.3-V digital $V_{DD}$ , 5.0-V analog $V_{DD}$
Manufacturer	Analog Devices
Manufacturer web site	<a href="http://www.analog.com">www.analog.com</a>

### *A/D Stratix Pin-Outs*

Table 12 and Table 13 show the A/D1 (U10, JP6) and A/D2 (U30, JP11) Stratix pin-outs.

<b>Table 12. A/D (U10, JP6) Stratix Pin-Outs</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
ATOD1_b0 (LSB) (1)	C5
ATOD1_b1	C4
ATOD1_b2	B3
ATOD1_b3	B4
ATOD1_b4	B5
ATOD1_b5	B6
ATOD1_b6	B7
ATOD1_b7	B8
ATOD1_b8	B9
ATOD1_b9	B10
ATOD1_b10	B11
ATOD1_b11 (MSB) (2)	B12

#### **Notes to Table 12:**

- (1) LSB is the least significant bit.
- (2) MSB is the most significant bit.


**Table 13. A/D2 (U30, JP11) Stratix Pin-Outs**

Signal Name	Stratix Pin
ATOD2_b0 (LSB)	C28
ATOD2_b1	C27
ATOD2_b2	C26
ATOD2_b3	C25
ATOD2_b4	C24
ATOD2_b5	C23
ATOD2_b6	C22
ATOD2_b7	C21
ATOD2_b8	C20
ATOD2_b9	C19
ATOD2_b10	D27
ATOD2_b11 (MSB)	D26

## D/A Converters

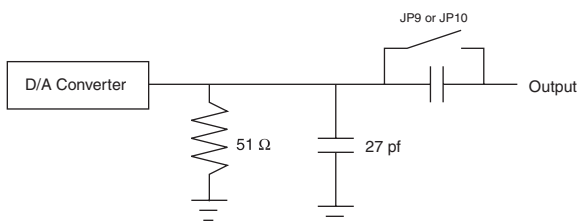
The Stratix EP1S80 DSP development board has two D/A converters. The D/A subsystem of the board has the following features:

- The converters produce 14-bit samples at a maximum rate of 165 MSPS.
- The analog output from each D/A converter is single-ended.

 The D/A converters expect data in an unsigned binary format.

The D/A clock signals are output directly from the Stratix device to the converters.

**Figure 5** shows the on-board circuitry after the D/A converter. The output of the D/A converter chip, DAC904, consists of a current source whose maximum value is 20 mA. This output is connected to ground on the board using a 51-Ω resistor, creating a Thevenin equivalent voltage source of 1 V in series with a 51-Ω resistor. When loaded with an external 50-Ω termination, the output swing is reduced to 0.5 V<sub>PP</sub>. Additionally there is a 27-pF capacitor in parallel with the output resistor resulting in a single-pole, low-pass with an upper 3-dB frequency of approximately 230 MHz when externally loaded. The output is then brought to an SMA connector through a series capacitor, providing a lower 3-dB frequency of approximately 16-KHz when externally loaded. This output capacitor is, by default, bypassed, resulting in a response down to DC. If the jumper is removed, the output is AC-coupled.

**Figure 5. On-Board Circuitry after D/A Converter**

The DSP kit contains the SLP-50 anti-aliasing filter from Mini-Circuits. This filter provides a 55-MHz cut-off frequency. For systems with other bandwidth requirements, a variety of anti-aliasing filters are available from commercial manufacturers to suit the system requirements.

Table 14 shows the reference information for the anti-aliasing filter. This filter is included with the development but is not connected to the board.

<b>Table 14. Anti-Aliasing Filter Reference</b>	
<b>Item</b>	<b>Description</b>
Board reference	N/A
Manufacturer	Mini-circuits
Description	Anti-aliasing filter
Part number	SLP-50
Manufacturer web site	<a href="http://www.minicircuits.com">www.minicircuits.com</a>

Table 15 lists reference information for the D/A converters.

<b>Table 15. D/A Converter Reference</b>	
<b>Item</b>	<b>Description</b>
Board reference	J3, J2
Part number	DAC904
Device description	14-bit, 165-MSPS D/A converter
Voltage	3.3-V digital $V_{DD}$ , 5.0-V analog $V_{DD}$
Manufacturer	Texas Instruments
Manufacturer web site	<a href="http://www.ti.com">www.ti.com</a>

The clocks for the D/A convertor can originate from either the SMA connector at JP25 or from the Stratix device. JP26 controls this clock selection. See [Table 16](#).

JP26 Setting	Clock Source	Signal Name
Pins 3 and 5	Stratix pin AL16	CLK_DTOA1_STRATIX
Pins 1 and 3	SMA connector JP25	CLK_DTOA_SMA_IN

### D/A Stratix Pin-Outs

[Table 17](#) and [Table 19](#) show the D/A1 (U21, J2) and D/A2 (U23, J3) Stratix pin-outs.

Signal Name	Stratix Pin
DTOA1_b13 (MSB) (1)	B13
DTOA1_b12	B19
DTOA1_b11	B20
DTOA1_b10	B21
DTOA1_b9	B22
DTOA1_b8	B23
DTOA1_b7	B24
DTOA1_b6	B25
DTOA1_b5	B26
DTOA1_b4	B27
DTOA1_b3	B28
DTOA1_b2	B29
DTOA1_b1	A28
DTOA1_b0 (LSB)	A27

**Note to [Table 17](#):**

- (1) The Texas Instruments (TI) naming conventions differ from those of Altera Corporation. The TI data sheet for the DAC 904 D/A converter lists bit 1 as the MSB and bit 14 as the LSB. For bus naming consistency, this data sheet refers to bit 13 as the MSB, and bit 0 as the LSB.



Jumper JP9 is the range select for D/A converter 1. If the jumper is present, the output is DC-coupled. If the jumper is removed, the output is AC-coupled.

Table 18 shows the D/A2 clock source settings.

JP26 Setting	Clock Source	Signal Name
Pins 4 and 6	Stratix pin AK16	CLK_DTOA2_STRATIX
Pins 2 and 4	SMA connector JP25	CLK_DTOA_SMA_IN

Table 19 shows the D/A 2 Stratix pin-outs.

Signal Name	Stratix Pin
DTOA2_b13 (MSB) (1)	A4
DTOA2_b12	A5
DTOA2_b11	A6
DTOA2_b10	A7
DTOA2_b9	A8
DTOA2_b8	A9
DTOA2_b7	A10
DTOA2_b6	A12
DTOA2_b5	A20
DTOA2_b4	A22
DTOA2_b3	A23
DTOA2_b2	A24
DTOA2_b1	A25
DTOA2_b0 (LSB)	A26

**Note to Table 19:**

- (1) The Texas Instruments (TI) naming conventions differ from those of Altera Corporation. The TI data sheet for the DAC 904 D/A converter lists bit 1 as the MSB and bit 14 as the LSB. For bus naming consistency, this data sheet refers to bit 13 as the MSB, and bit 0 as the LSB.



Jumper JP10 is the range select to D/A Converter 2. If the jumper is present, the output is DC-coupled. If the jumper is removed, the output is AC-coupled.

## Memory

The Stratix EP1S80 DSP development board has two banks of 7.5-ns synchronous  $256 \times 36$  SRAM, using four 18-bit wide memory chips. The SRAM can be used independently, or combined to have a 36-bit wide organization. To support high data rates and multiple concurrent processing, use the memory as two independent 36-bit wide memory buses.

The second component of the memory subsystem is comprised of a single on-board 64-Mbit flash memory device.

### SRAM

Table 20 lists reference information for the SRAM memories.

<b>Table 20. Memory Reference</b> <i>Note (1)</i>	
<b>Item</b>	<b>Description</b>
Board reference	U34, U35, U36, U37
Part number	CY7C1325A
Device description	3.3V, 7.5-ns 128K $\times$ 18 SRAM
Manufacturer	Cypress Semiconductor
Manufacturer web site	<a href="http://www.cypress.com">www.cypress.com</a>

**Note to Table 20:**

- (1) Periodically, SRAM devices from Alliance Corporation or IDT may be used. Both of these devices are pin-to-pin compatible with Cypress Semiconductor SRAM devices. The equivalent Alliance part number is AS7C33256PFS18A-TOC. The equivalent IDT part number is 71V3578.

Table 21 lists the characteristics of the SRAM memories on the board.

<b>Table 21. Memory Characteristics</b>				
<b>Type</b>	<b>Address Lines</b>	<b>Data Lines</b>	<b>Memory Organization</b>	<b>Size (MB)</b>
SRAM 1	18	36	256K $\times$ 36	1
SRAM 2	18	36	256K $\times$ 36	1

## SRAM Bank 1

Table 22 lists the pin-outs for SRAM Bank 1.

<b>Table 22. SRAM Bank 1 (U34, U35) (Part 1 of 3)</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
CLK_SRAM1	AK15
SRAM1_A0	G14
SRAM1_A1	H3
SRAM1_A2	G13
SRAM1_A3	G12
SRAM1_A4	F9
SRAM1_A5	C8
SRAM1_A6	C9
SRAM1_A7	G11
SRAM1_A8	G10
SRAM1_A9	G9
SRAM1_A10	G8
SRAM1_A11	G7
SRAM1_A12	G6
SRAM1_A13	G5
SRAM1_A14	G4
SRAM1_A15	G3
SRAM1_A16	C6
SRAM1_A17	C7
SRAM1_ADSC_n	V3
SRAM1_ADSP_n	V4
SRAM1_ADV_n	D21
SRAM1_D0	D10
SRAM1_D1	L5
SRAM1_D2	L4
SRAM1_D3	L3
SRAM1_D4	K8
SRAM1_D5	K7
SRAM1_D6	K6
SRAM1_D7	J13

**Table 22. SRAM Bank 1 (U34, U35) (Part 2 of 3)**

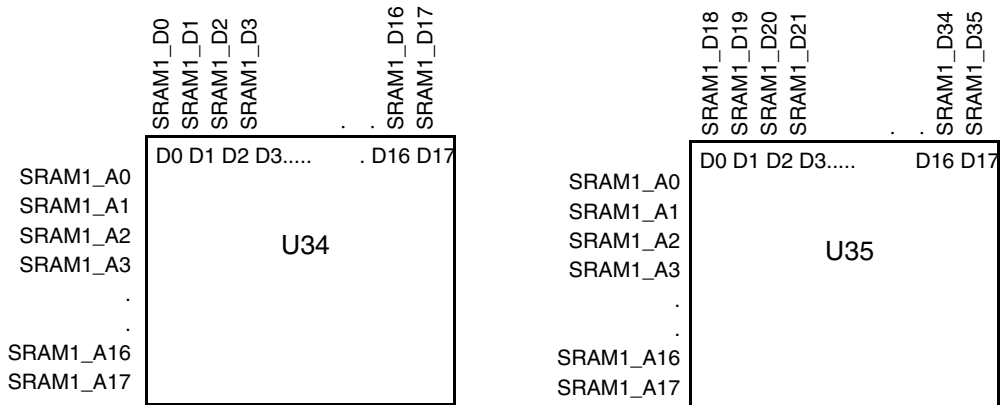
Signal Name	Stratix Pin
SRAM1_D8	K5
SRAM1_D9	K4
SRAM1_D10	K3
SRAM1_D11	D4
SRAM1_D12	D9
SRAM1_D13	J12
SRAM1_D14	J11
SRAM1_D15	J10
SRAM1_D16	J8
SRAM1_D17	J7
SRAM1_D18	P2
SRAM1_D19	N9
SRAM1_D20	N8
SRAM1_D21	N7
SRAM1_D22	N6
SRAM1_D23	N5
SRAM1_D24	N4
SRAM1_D25	D13
SRAM1_D26	D11
SRAM1_D27	L8
SRAM1_D28	L7
SRAM1_D29	L6
SRAM1_D30	M8
SRAM1_D31	M7
SRAM1_D32	M6
SRAM1_D33	M5
SRAM1_D34	M4
SRAM1_D35	D12
SRAM1A_BWE_n	N24
SRAM1A_CE2_n	V25
SRAM1A_OE_n	V6
SRAM1A_WEH_n	N26
SRAM1A_WEL_n	P3

**Table 22. SRAM Bank 1 (U34, U35) (Part 3 of 3)**

Signal Name	Stratix Pin
SRAM1B_BWE_n	P1
SRAM1B_CE2_n	V7
SRAM1B_OE_n	V5
SRAM1B_WEH_n	N25
SRAM1B_WEL_n	V26
MODE	D20

SRAM Bank 1 consists of devices U34 and U35. The control signals for U34 are denoted with an “A,” and the control signals for U35 are denoted with a “B.” For example, SRAM1A\_OE\_n is the output enable for U34, and SRAM1B\_OE\_n is the output enable for U35.

As shown in Figure 6, data bits [17..0] are on U35, and data bits [35..18] are on U34. All address lines are shared.

**Figure 6. SRAM1 Data Bits on U34 & U35**

*SRAM Bank 2*

Table 23 lists the pin-outs for SRAM bank 2.

<b>Table 23. SRAM Bank 2 Pin-Outs (U36, U37) (Part 1 of 3)</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
CLK_SRAM2	AL15
SRAM2_A0	J6
SRAM2_A1	C12
SRAM2_A2	C13
SRAM2_A3	J5
SRAM2_A4	J4
SRAM2_A5	J3
SRAM2_A6	H13
SRAM2_A7	H12
SRAM2_A8	H11
SRAM2_A9	H10
SRAM2_A10	H9
SRAM2_A11	H8
SRAM2_A12	C10
SRAM2_A13	C11
SRAM2_A14	H7
SRAM2_A15	H6
SRAM2_A16	H5
SRAM2_A17	H4
SRAM2_ADSC_n	E14
SRAM2_ADSP_n	H24
SRAM2_ADV_n	F13
SRAM2_D0	AE7
SRAM2_D1	Y7
SRAM2_D2	AA7
SRAM2_D3	AA6
SRAM2_D4	AB7
SRAM2_D5	AB6
SRAM2_D6	AC7
SRAM2_D7	AD7

**Table 23. SRAM Bank 2 Pin-Outs (U36, U37) (Part 2 of 3)**

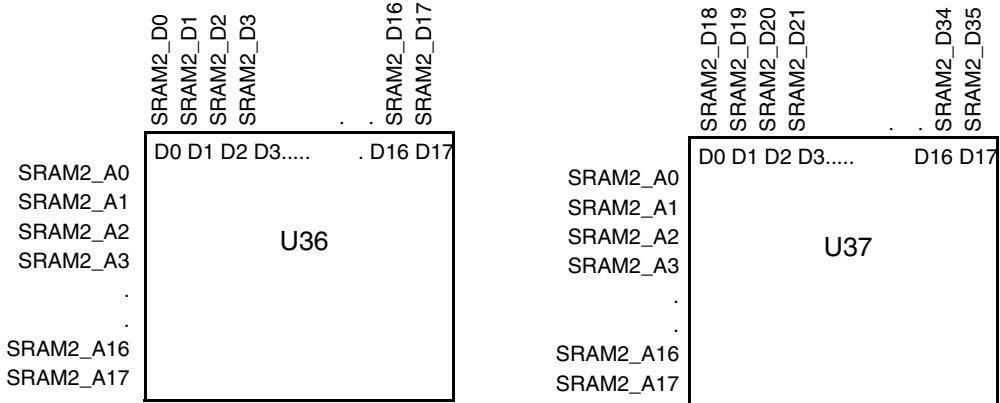
Signal Name	Stratix Pin
SRAM2_D8	AD6
SRAM2_D9	AF4
SRAM2_D10	AF6
SRAM2_D11	AF5
SRAM2_D12	AE8
SRAM2_D13	AD8
SRAM2_D14	AC8
SRAM2_D15	AB8
SRAM2_D16	AA8
SRAM2_D17	Y8
SRAM2_D18	N28
SRAM2_D19	N27
SRAM2_D20	E4
SRAM2_D21	E5
SRAM2_D22	P30
SRAM2_D23	P29
SRAM2_D24	P28
SRAM2_D25	P27
SRAM2_D26	P26
SRAM2_D27	P25
SRAM2_D28	P24
SRAM2_D29	P23
SRAM2_D30	E6
SRAM2_D31	D8
SRAM2_D32	R1
SRAM2_D33	P9
SRAM2_D34	P8
SRAM2_D35	P7
SRAM2C_BWE_n	D22
SRAM2C_CE2_n	H28
SRAM2C_OE_n	H26
SRAM2C_WEH_n	G22
SRAM2C_WEL_n	G21

<b>Table 23. SRAM Bank 2 Pin-Outs (U36, U37) (Part 3 of 3)</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
SRAM2D_BWE_n	D24
SRAM2D_CE2_n	H27
SRAM2D_OE_n	H25
SRAM2D_WEH_n	G23
SRAM2D_WEL_n	H29
MODE	D20

SRAM Bank 2 consists of chips U36 and U37. The control signals for U36 are denoted with a “C,” and the control signals for U37 are denoted with a “D.” For example, SRAM1C\_OE\_n is the output enable for U36, and SRAM1D\_OE\_n is the output enable for U37.

As shown in Figure 7, data bits [17..0] are on U37, and data bits [35..18] are on U36. All address lines are shared.

**Figure 7. SRAM2 Data Bits on U36 & U37**



## Flash Device Description

The specifications and pin-outs for the 64-Mbit flash memory device on the Stratix EP1S80 DSP development board are given in this section.

Table 24 gives details on the specifications and manufacturer for the flash memory device.

<b>Table 24. Flash Memory Device Reference</b>	
<b>Feature</b>	<b>Flash Memory</b>
Board reference	U3
Part number	AM29DL640D
Device description	64 Mbit flash memory
Voltage	3.3-V
Manufacturer	AMD
Manufacturer web site	<a href="http://www.amd.com">www.amd.com</a>

### Flash Pin-Outs

Table 25 lists pin-outs for the flash memory device.

<b>Table 25. Flash Pin-Outs (Part 1 of 3)</b>	
<b>Signal Name</b>	<b>Stratix Pin</b>
Flash_addr1	AJ26
Flash_addr2	G24
Flash_addr3	AJ25
Flash_addr4	AJ24
Flash_addr5	AJ23
Flash_addr6	AJ22
Flash_addr7	AJ21
Flash_addr8	AJ20
Flash_addr9	AJ19
Flash_addr10	AH27
Flash_addr11	AJ30
Flash_addr12	AJ29
Flash_addr13	AJ28
Flash_addr14	AJ27

**Table 25. Flash Pin-Outs (Part 2 of 3)**

Signal Name	Stratix Pin
Flash_addr15	U27
Flash_addr16	U26
Flash_addr17	AH30
Flash_addr18	AH28
Flash_addr19	AH26
Flash_addr20	AH25
Flash_addr21	AJ2
Flash_addr22 (1)	AG30
Flash_byte_n	E20
Flash_CS_n	E7
Flash_data0	E15 and AK29
Flash_data1	C16
Flash_data2	F15
Flash_data3	G17
Flash_data4	G19
Flash_data5	F20
Flash_data6	F21
Flash_data7	G20
Flash_data8	AK28
Flash_data9	AK27
Flash_data10	AK26
Flash_data11	AK25
Flash_data12	AK24
Flash_data13	AK23
Flash_data14	AK22
Flash_data15 (2)	AK21
Flash_OE_n	F5
Flash_R/W_n	D23
Flash_rdy/bsy_n	Y30
Flash_reset_n	AG7

**Table 25. Flash Pin-Outs (Part 3 of 3)**

Signal Name	Stratix Pin
Flash_WP_ACC_n	AG6

**Notes to Table 25:**

- (1) Flash address 22 is connected to jumper JP18. If this jumper is in place, signal Flash\_addr22 is pulled down to GND. If the connector is removed, Flash\_addr22 is pulled up to V<sub>CCIO</sub>. Stratix pin AG30 can over-power the pull-up or pull-down.
- (2) Flash\_data15 doubles as flash address bit 0 when the flash is in byte mode.

## Debugging Interfaces

The Stratix EP1S80 DSP development board has the following two interfaces to allow users to debug their designs:

- Two Mictor-type connectors to support Agilent logic analyzers
- 90 digital I/O signals, available on the 0.1-inch headers, and connected directly to the Stratix device

### Logic Analyzer Interface (Mictor Connectors)

The Stratix EP1S80 DSP development board has two Mictor-type connectors to support Agilent logic analyzers, or a high-speed off-board solution.

#### Mictor Connector A

Table 26 provides the pin-outs for Mictor connector A.

**Table 26. Mictor Connector A (J9) Stratix Pin-Outs (Part 1 of 2)**

Signal Name	Stratix Pin
DEBUG_A0	AA24
DEBUG_A1	AA25
DEBUG_A2	AA26
DEBUG_A3	AA27
DEBUG_A4	AA28
DEBUG_A5	AC19
DEBUG_A6	AC20
DEBUG_A7	AC21
DEBUG_A8	AJ6
DEBUG_A9	AJ7

**Table 26. Mictor Connector A (J9) Stratix Pin-Outs (Part 2 of 2)**

Signal Name	Stratix Pin
DEBUG_A10	AC22
DEBUG_A11	AC24
DEBUG_A12	AC25
DEBUG_A13	AC26
DEBUG_A14	AC27
DEBUG_A15	AD19
DEBUG_A16	AD20
DEBUG_A17	AD21
DEBUG_A18	AD22
DEBUG_A19	AD24
DEBUG_A20	AD25
DEBUG_A21	AD26
DEBUG_A22	AD27
DEBUG_A23	AD28
DEBUG_A24	AD29
DEBUG_A25	AA21
DEBUG_A26	AJ3
DEBUG_A27	AJ4
DEBUG_A28	AH13
DEBUG_A29	AH12
DEBUG_A30	AC13
DEBUG_A31	AC12
CLK_DEBUGA	AL17

**Mictor Connector B**

Table 27 gives the pin-outs for Mictor connector B.

**Table 27. Mictor Connector B (J10) Stratix Pin-Outs (Part 1 of 2)**

Signal Name	Stratix Pin
DEBUG_B0	AF15
DEBUG_B1	AF7
DEBUG_B2	AF13

**Table 27. Mictor Connector B (J10) Stratix Pin-Outs (Part 2 of 2)**

Signal Name	Stratix Pin
DEBUG_B3	AF8
DEBUG_B4	AF22
DEBUG_B5	AF23
DEBUG_B6	AF24
DEBUG_B7	AF25
DEBUG_B8	AF26
DEBUG_B9	AF27
DEBUG_B10	AF28
DEBUG_B11	AF10
DEBUG_B12	G25
DEBUG_B13	G26
DEBUG_B14	F22
DEBUG_B15	G29
DEBUG_B16	G28
DEBUG_B17	G27
DEBUG_B18	AE28
DEBUG_B19	AE27
DEBUG_B20	AE26
DEBUG_B21	AE25
DEBUG_B22	AE24
DEBUG_B23	AE23
DEBUG_B24	AE22
DEBUG_B25	AE21
DEBUG_B26	AE20
DEBUG_B27	AE19
DEBUG_B28	AE18
DEBUG_B29	AE14
DEBUG_B30	AE13
DEBUG_B31	AE12
CLK_DEBUGB	B17

## 0.1-Inch Digital I/O Headers

The board has a total of 90 digital I/O signals, available on the 0.1-inch headers, and connected directly to the Stratix device. Additionally, the connectors contain ground signals to ensure the integrity of the signals, and to provide for the Analog Devices external A/D connectors.

JP7 and JP8 are a matched pair of right-angle connectors, which allow the user to join two DSP boards by connecting the JP7 connector on one board to the JP8 connector on the second.



The Stratix pins connected to JP19 and J22 are also connected to JP7. Similarly, the Stratix pins which drive JP8 also drive JP20, JP21, and JP24. See [Table 28](#) and [Table 29](#) for details on which Stratix pins are connected to both places.

When connecting these pins to external circuitry, the user must adhere to the voltage restrictions specified in the *Stratix Programmable Logic Device Family Data Sheet*. Specifically, the I/O pins are not 5.0-V tolerant and should not be directly connected to logic powered from a 5.0-V supply.

### Digital I/O Headers (JP7, JP19, JP22)

[Table 28](#) shows the pin-outs for the digital I/O headers JP7, JP19, and JP22.

Signal Name	Stratix Pin	JP7 (1)	JP19 (2)	JP22 (3)
EVALIO_IN0	C2	1	3	-
EVALIO_IN1	C3	2	5	-
EVALIO_IN2	D3	3	7	-
EVALIO_IN3	D2	5	9	-
EVALIO_IN4	E3	6	11	-
EVALIO_IN5	E2	7	13	-
EVALIO_IN6	F2	9	15	-
EVALIO_IN7	F1	10	17	-
EVALIO_IN8	G2	11	19	-
EVALIO_IN9	G1	13	21	-
EVALIO_IN10	H2	14	23	-
EVALIO_IN11	H1	15	25	-

**Table 28. Digital I/O Headers (JP7, JP19, JP22) (Part 2 of 3)**

Signal Name	Stratix Pin	JP7 (1)	JP19 (2)	JP22 (3)
EVALIO_IN12	J2	17	27	-
EVALIO_IN13	J1	18	29	-
EVALIO_IN14	K2	19	31	-
EVALIO_IN15	K1	21	33	-
EVALIO_IN16	L2	22	37	-
EVALIO_IN17	L1	23	-	3
EVALIO_IN18	N2	25	-	5
EVALIO_IN19	M2	26	-	7
EVALIO_IN20	N3	27	-	9
EVALIO_IN21	M3	29	-	11
EVALIO_IN22	V1	30	-	13
EVALIO_IN23	V2	31	-	15
EVALIO_IN24	U1	33	-	17
EVALIO_IN25	U2	34	-	19
EVALIO_IN26	W2	35	-	21
EVALIO_IN27	W3	37	-	23
EVALIO_IN28	Y2	38	-	25
EVALIO_IN29	Y3	39	-	27
EVALIO_IN30	AA1	41	-	29
EVALIO_IN31	AA2	42	-	31
EVALIO_IN32	AB1	43	-	33
EVALIO_IN33	AB2	45	-	37
EVALIO_IN34	AC1	46	-	-
EVALIO_IN35	AC2	47	-	-
EVALIO_IN36	AD1	49	-	-
EVALIO_IN37	AD2	50	-	-
EVALIO_IN38	AE1	51	-	-
EVALIO_IN39	AE2	53	-	-
EVALIO_IN40	AF1	54	-	-
EVALIO_IN41	AF2	55	-	-
EVALIO_IN42	AG13	57	-	-
EVALIO_IN43	AG2	58	-	-

**Table 28. Digital I/O Headers (JP7, JP19, JP22) (Part 3 of 3)**

Signal Name	Stratix Pin	JP7 (1)	JP19 (2)	JP22 (3)
CLK_EVALIO_IN44	T31	59	-	-

**Notes to Table 28:**

- (1) Pins 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, and 60, which are not listed, are tied to ground.
- (2) Pins 1, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 35, and 36, which are not listed, are tied to ground.
- (3) Pins 1, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 35, and 36, which are not listed, are tied to ground.

*Digital I/O Headers (JP20, JP21, JP24, JP8)*

Table 29 lists the pin-outs for digital I/O headers JP20, JP21, JP24, and JP8.

<b>Signal Name</b>	<b>Stratix Pin</b>	<b>JP20 (1)</b>	<b>JP21 (2)</b>	<b>JP24 (3)</b>	<b>JP8 (4)</b>
EVALIO_OUT0	C29	-	-	3	1
EVALIO_OUT1	C30	-	-	4	2
EVALIO_OUT2	D29	-	-	5	3
EVALIO_OUT3	D30	-	-	6	5
EVALIO_OUT4	E29	-	-	7	6
EVALIO_OUT5	E30	-	-	8	7
EVALIO_OUT6	F30	-	-	9	9
EVALIO_OUT7	F31	-	-	10	10
EVALIO_OUT8	G30	-	-	11	11
EVALIO_OUT9	G31	-	-	12	13
EVALIO_OUT10	H30	-	-	13	14
EVALIO_OUT11	H31	-	-	14	15
EVALIO_OUT12	J30	-	-	15	17
EVALIO_OUT13	J31	-	-	16	18
EVALIO_OUT14	K30	-	-	17	19
EVALIO_OUT15	K31	-	-	18	21
EVALIO_OUT16	L30	-	-	21	22
EVALIO_OUT17	L31	-	-	23	23
EVALIO_OUT18	M29	-	-	25	25
EVALIO_OUT19	M30	-	-	27	26
EVALIO_OUT20	W29	-	-	28	27
EVALIO_OUT21	W30	-	-	29	29
EVALIO_OUT22	U30	-	-	31	30
EVALIO_OUT23	U31	-	-	32	31
EVALIO_OUT24	V31	-	-	33	33
EVALIO_OUT25	V30	-	-	35	34
EVALIO_OUT26	AA31	-	-	36	35
EVALIO_OUT27	AA30	-	-	37	37
EVALIO_OUT28	AB30	-	-	39	38
EVALIO_OUT29	AB31	4	-	-	39

**Table 29. Digital I/O Headers (JP20, JP21, JP24, JP8) (Part 2 of 2)**

Signal Name	Stratix Pin	JP20 (1)	JP21 (2)	JP24 (3)	JP8 (4)
EVALIO_OUT30	AC31	5	-	-	41
EVALIO_OUT31	AC30	6	-	-	42
EVALIO_OUT32	AD31	7	-	-	43
EVALIO_OUT33	AD30	8	-	-	45
EVALIO_OUT34	AE31	9	-	-	46
EVALIO_OUT35	AE30	10	-	-	47
EVALIO_OUT36	AF31	11	-	-	49
EVALIO_OUT37	AE29	12	-	-	50
EVALIO_OUT38	AG29	13	-	-	51
EVALIO_OUT39	AF30	14	-	-	53
EVALIO_OUT40	AF29	-	-	38	54
EVALIO_OUT41	AG28	-	-	1	55
EVALIO_OUT42	AG27	-	9	-	57
EVALIO_OUT43	AH29	-	11	-	58
CLK_2p	T29	-	13	-	-
CLK_EVALIO_OUT44	AK17	-	-	-	59

**Notes to Table 29:**

- (1) Pins 1, 2, and 3, which are not listed, are tied to ground.
- (2) Pins 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, and 13 through 20, which are not listed, are tied to ground. Even-numbered pins are tied to ground. Pin 1 is tied to +5.0 V-VCC. Pins 5 and 7 are tied to +3.3 V-VCC. Pins 15, 17, and 19 are open.
- (3) Pins 2, 19, 20, 22, 24, 26, 30, 34, and 40, which are not listed, are tied to ground.
- (4) Pins 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56 and 60, which are not listed, are tied to ground.

## Expansion Interfaces

There are five ways in which the Stratix EP1S80 DSP development board was designed to interface with other boards and devices. The board is equipped with the following interfaces:

- A TI-EVM, located on the underside of the board (J11, J12)
- A Front Panel Data Port (FPDP) Footprint (J4)
- Two 0.1-inch headers specifically designed to be used with external analog-to-digital devices made by Analog Devices Corporation (JP19, JP22)
- An Altera expansion prototype connector
- A breadboard/prototype area that allows for the connection of custom components

## TI-EVM

The TI-EVM is specifically designed to work with TI boards that have the EVM interface. See the Texas Instruments web site for details on which of their boards feature this connector.



A portion of the Stratix pins routed to the TI-EVM connector (J11, J12) are also routed to the four rows of through-holes, labeled J4. These four rows of pins comprise a footprint for an FPDP, which can be added to the board.

### TI-EVM Connector / FPDP Connector

Table 30 lists the pin-outs for the TI-EVM and FPDP connectors.

TI-EVM Signal Name	FPDP Signal Name	Stratix Pin
<b>J11</b>		
TI_CLKX0	-	F25
TI_FSX0	-	F24
TI_CLKR0	-	AG25
TI_FSR0	-	AG24
TI_STAT0	-	AG22
TI_DRO	-	AG14
CLK_TI_OUT2	-	R29
TI_DMAC0	-	AG23
TI_CNTL0	-	AG21
TI_INUM0	-	AG20
TI_IACK	-	AG19
TI_DX0	-	F6
<b>J12</b>		
TI_ARDY	-	AG5
TI_CE1_N	-	F4
TI_AOE_N	-	AG4
TI_AWE_N	-	AG3
TI_ARE_N	-	AG12
TI_A2	-	AH24
TI_A3	-	AH23
TI_A4	-	AH22

**Table 30. TI-EVM Connector (J11, J12) / FPDP Connector (J4) (Part 2 of 3)**

TI-EVM Signal Name	FPDP Signal Name	Stratix Pin
TI_A5	-	AH21
TI_A6	-	AH20
TI_A7	-	AH19
TI_A8	-	AH16
TI_A9	-	F8
TI_A10	-	F7
TI_A11	-	AJ8
TI_A12	-	AH2
TI_A13	-	AH3
TI_A14	-	AH4
TI_A15	-	AH5
TI_A16	-	AH6
TI_A17	-	AH7
TI_A18	-	AH8
TI_A19	-	AH9
TI_A20	-	AH10
TI_A21	-	AH11
TI_BE_N0	-	AG8
TI_BE_N1	-	AG9
TI_BE_N2	-	AG10
TI_BE_N3	-	AG11
TI_D0	FPDP_D0	AK3
TI_D1	FPDP_D1	AK4
TI_D2	FPDP_D2	AK5
TI_D3	FPDP_D3	AK6
TI_D4	FPDP_D4	AK7
TI_D5	FPDP_D5	AK8
TI_D6	FPDP_D6	AJ10
TI_D7	FPDP_D7	AK20
TI_D8	FPDP_D8	AJ9
TI_D9	FPDP_D9	AJ11
TI_D10	FPDP_D10	AJ12
TI_D11	FPDP_D11	W23

**Table 30. TI-EVM Connector (J11, J12) / FPDP Connector (J4) (Part 3 of 3)**

TI-EVM Signal Name	FPDP Signal Name	Stratix Pin
TI_D12	FPDP_D12	W24
TI_D13	FPDP_D13	W25
TI_D14	FPDP_D14	W26
TI_D15	FPDP_D15	W27
TI_D16	FPDP_D16	W28
TI_D17	FPDP_D17	AA29
TI_D18	FPDP_D18	E23
TI_D19	FPDP_D19	E22
TI_D20	FPDP_D20	R30
TI_D21	FPDP_D21	R31
TI_D22	FPDP_D22	AC28
TI_D23	FPDP_D23	AC29
TI_D24	FPDP_D24	AB24
TI_D25	FPDP_D25	AB25
TI_D26	FPDP_D26	AB26
TI_D27	FPDP_D27	AB27
TI_D28	FPDP_D28	AB28
TI_D29	FPDP_D29	AB29
TI_D30	FPDP_D30	E24
TI_D31	FPDP_D31	E26
-	FPDP_STROB	Y23
-	FPDP_NRDY_N	Y24
-	FPDP_DIR_N	Y25
-	FPDP_SUSPEND_N	Y26
-	FPDP_P102	Y27
-	FPDP_P101	Y28
-	FPDP_STROBE_N	AJ17
-	FPDP_PSTROBE	AH16
-	FPDP_DVALID_N	P4
-	FPDP_SYNC_N	Y29

## Analog Devices Corporation External A/D Support

The Stratix EP1S80 DSP development board supports Analog Devices A/D converters via two 40-pin 0.1-inch digital I/O headers (JP19, JP22). The Analog Devices converters also require a clock, which can be sourced from the CLK\_SMAOUT1 (JP2) or CLK\_SMAOUT2 (JP4) external clock outputs. These two dual-purpose digital I/O headers can support a maximum of the following three converters.

- Two AD9433 converters
- Two AD6645 converters
- One AD9430 converter



The Stratix pins connected to JP19 and JP22 are also connected to JP7. Similarly, the Stratix pins that drive JP8 also drive JP20, JP21, and JP24. See [Table 28 on page 36](#) and [Table 29 on page 39](#) for details on which Stratix pins are connected to both places.

## Altera Expansion Prototype Connector

Headers JP20, JP21, and JP24 collectively form a standard-footprint, mechanically-stable connection that may be used (for example) as an interface to a special-function daughter card.



Contact your Altera sales representative for a list of available expansion daughter cards that can be used with the Stratix EP1S80 DSP development board.

The 3.3-V expansion prototype connector interface includes the following.

- 40 Stratix device general-purpose I/O signals
- A Stratix device clock-input (for daughter cards that drive a clock to the programmable logic device)
- Two regulated 3.3-V power-supply pins (500 mA total maximum load)
- An unregulated power-supply pin (connects directly to the J1 power-input plug)
- Numerous ground connections

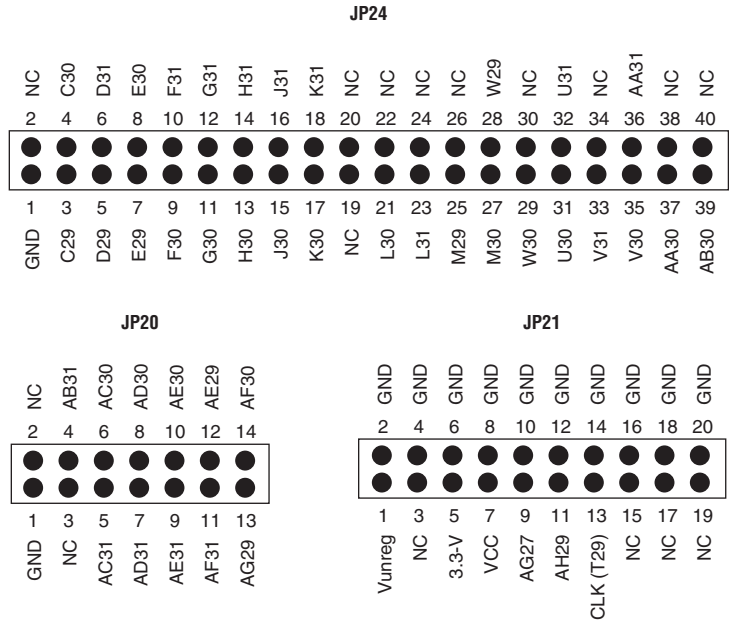


The Stratix pins that drive JP8 also drive JP20, JP21, and JP24. See [Table 28 on page 36](#) and [Table 29 on page 39](#) for details on which Stratix pins are connected to both places.

### JP20, JP21, JP24 Connector Pin-Outs

Figure 8 shows the relative orientation of the connectors and pins for JP20, JP21, and JP24.

Figure 8. Pin-Outs for Headers JP20, JP21, JP24



### Prototyping Area

The prototyping area of the board provides room for adding user-selected electronic components. This area is a grid of plated through-holes on 0.1-inch centers. Thirty Stratix I/O pins are connected to the inside column (the column closest to the middle of the board) of pins in the grid. These pins, and each column, are labeled on the board for easy identification. As shown in Table 31, one column of ground pins and one column of 3.3 V  $V_{CCIO}$  pins provide power to the grid. The remaining columns (labeled 2, 3, 6, 7, and 8 on the board) are not connected to any power or pins, and are available for the addition of custom components.

Table 31 shows the column functions in the prototyping area of the board.

Column	Function
1	Stratix pins (see Table 32)
2	Unconnected
3	Unconnected
4	V <sub>CCIO</sub> (3.3 V)
5	GND
6	Unconnected
7	Unconnected
8	Unconnected

#### *Prototyping Area Pin-Out*

Table 32 shows the pin-outs for the prototyping area of the Stratix EP1S80 DSP development board.

Signal Name	Stratix Pin
PROTO1	J29
PROTO2	J28
PROTO3	J27
PROTO4	J26
PROTO5	J25
PROTO6	J24
PROTO7	AL28
PROTO8	AL27
PROTO9	AL26
PROTO10	AL25
PROTO11	AL24
PROTO12	AL23
PROTO13	F3
PROTO14	E11
PROTO15	AL9
PROTO16	AL10
PROTO17	AL8

**Table 32. Prototyping Area Pin-Outs (Part 2 of 2)**

Signal Name	Stratix Pin
PROTO18	AL7
PROTO19	AL6
PROTO20	AL5
PROTO21	AL4
PROTO22	Y4
PROTO23	W9
PROTO24	W8
PROTO25	W7
PROTO26	W6
PROTO27	W5
PROTO28	W4
PROTO29	E10
PROTO30	AL12

## Jumper Settings

Table 33 summarizes the jumper settings for the Stratix EP1S80 DSP development board.

**Table 33. Jumper Settings**

Number	Function	Setting	Selected Option
JP9	D/A1 AC/DC coupling select	Not Jumpered	AC Coupled
		Jumpered	DC Coupled
JP10	D/A2 AC/DC coupling select	Not Jumpered	AC Coupled
		Jumpered	DC Coupled
JP23	A/D clock select	1 and 2	80-MHz oscillator
		3 and 4	Stratix pin B16
		5 and 6	External Clock
JP18 (by C48)	Flash top/bottom select	Not Jumpered	Flash Address pin 21 = VCC
		Jumpered	Flash Address pin 21 = GND
JP26, pins 1, 3, 5	D/A1 clock select.	1 and 3	JP25
		3 and 5	Stratix pin AL16
JP26, pins 2, 4, 6	D/A 2 clock select.	2 and 4	JP25
		4 and 6	Stratix pin AK16



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