

# **SLS Multiple USB Solutions on a Single Chip using MAX10FPGA**

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## **Quick Start Guide**



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## Introduction

This document describes the steps for evaluating reference design of Multiple USB Solutions on a Single Chip using MAX10FPGA.

Table below shows the revision history of this document.

Version	Date	Description
1.1	June 2015	Updated steps and figures for USB to I2C Bridge and USB based ADC Interface
1.0	April 2015	First release

## How to Contact SLS

For the most up-to-date information about SLS products, go to the SLS worldwide website at <http://www.slscorp.com>. For additional information about SLS products, consult the source shown below.

Information Type	E-mail
Product literature services, SLS literature services, Non-technical customer services, Technical support.	<a href="mailto:support@slscorp.com">support@slscorp.com</a>

# Typographic Conventions

The document uses the typographic conventions shown as below.

Visual Cue	Meaning
Bold Type with Initial Capital Letters	All Headings and Sub Headings Titles in a document are displayed in bold type with initial capital letters; Example: <b>Introduction</b>
Bold Type with Italic Letters	All Definitions, Figure and Table Headings are displayed in Italics. Examples: <b>Figure 1. USB to I2C Bridge</b>
1. 2.	Numbered steps are used in a list of items, when the sequence of items is important. such as steps listed in procedure.
• ■	Bullets are used in a list of items when the sequence of items is not important.
	The hand points to information that requires special attention.
	The caution indicates required information that needs special consideration and understanding and should be read prior to starting or continuing with the procedure or process.
	The warning indicates information that should be read prior to starting or continuing the procedure or processes.
	The feet direct you to more information on a particular topic.

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# Getting Started With SLS USB Solution using MAX10FPGA

This document explains the steps for evaluating reference design of USB based bridges listed below.

- USB to I2C Bridge
- USB based ADC Interface
- USB to UART Bridge

## Hardware Requirements

Hardware Requirements for evaluating the reference design:

- [Altera MAX 10 FPGA Evaluation Kit](#)
- [SLS MAX 10 Evaluation Kit Add On board](#)
- USB mini cable (For Device Connection and as a Power Cable)
- USB Blaster
- For USB to UART Bridge, you may require the other UART Hardware for testing purpose



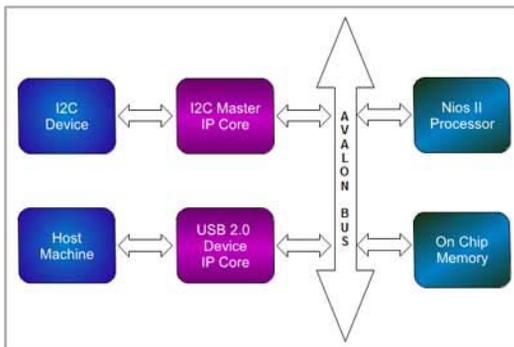
Please [contact us](#) for evaluation License regarding SLS IP Cores.

Below section describes the details of individual USB bridge and steps for testing on MAX10 Evaluation Kit Add on board.

## USB to I2C Bridge

Aim of this bridge is to access I2C slave Device using an USB Interface. On the MAX10 Evaluation Kit Add On Board, we have AT24C01C PROM with I2C interface. In order to access this device, SLS has develop a Host application which will read and write the PROM using USB interface. As shown in [Figure 1.](#), this design uses the SLS USB 2.0 Device IP Core and I2C Master IP Core to communicate with the I2C Slave device and the Host machine.

Figure 1. USB to I2C Bridge



Follow the steps to test USB to I2C Bridge using SLS Host Application.

1. Connect the MAX 10 Evaluation Kit Add On Board on MAX 10 Evaluation Kit.
2. Connect the USB Blaster to the board.
3. Power **ON** the board.
4. Go to <MAX10 EV Kit AOB Installation Path>/hardware/demo/i2c\_adc\_intf\_max10ev folder.
5. Double click on i2c\_adc\_intf\_max10ev.bat file. This will program SOF file on the board. You will see the message as shown in [Figure 2](#).
6. After successful downloading USB 2.0 device detected in the Host machine. Install USB 2.0 device driver from <MAX10 EV Kit AOB Installation Path>/software/driver folder.

Figure 2. Console Message Window for USB to I2C Bridge

```

SLS USB to I2C Bridge Demo
-----
// Welcome to USB to I2C Bridge Demo //
-----

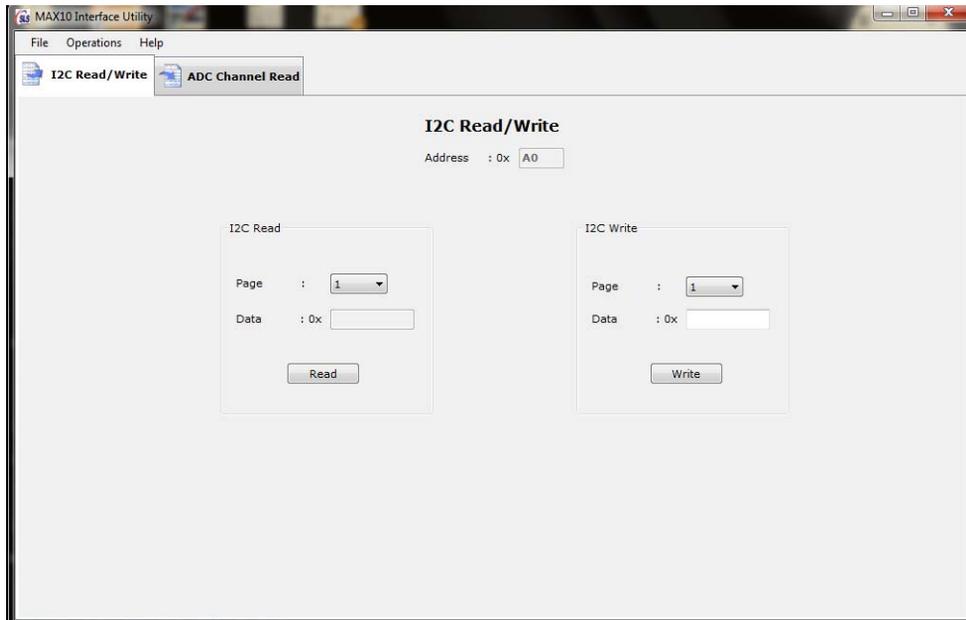
Which test would you like to run??
1 - USB to I2C Bridge and internal ADC
2 - USB to UART Bridge

Please enter number..
1
File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains one or more time-limited megafunctions that support the OpenCore Plus feature that will not work after the hardware evaluation time expires. Refer to the Messages window for evaluation time details.
Info (210040): SRAM Object File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains time-limited megafunction that supports OpenCore Plus feature -- Vendor: 0x5750, Product: 0x0004
Info (210040): SRAM Object File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains time-limited megafunction that supports OpenCore Plus feature -- Vendor: 0x5750, Product: 0x0004
Info: *****
Info: Running Quartus II 64-Bit Programmer
Info: Version 14.1.0 Build 186 12/03/2014 SJ Full Version
Info: Copyright (C) 1991-2014 Altera Corporation. All rights reserved.
Info: Your use of Altera Corporation's design tools, logic functions and other software and tools, and its AMPD partner logic functions, and any output files from any of the foregoing (including device programming or simulation files), and any Info: associated documentation or information are expressly subject Info: to the terms and conditions of the Altera Program License Info: Subscription Agreement, the Altera Quartus II License Agreement, Info: the Altera MegaCore Function License Agreement, or other Info: applicable license agreement, including, without limitation, Info: that your use is for the sole purpose of programming logic Info: devices manufactured by Altera and sold by Altera or its Info: authorized distributors. Please refer to the applicable Info: agreement for further details.
Info: Processing started: Mon Jun 22 14:35:43 2015
Info: Command: quartus_pgm -a jtag -c usb-blasterusb-01 -o p;sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof
Info (213045): Using programming cable "USB-Blaster (USB-01)"
Info (213011): Using programming file sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof with checksum 0x00753C2D for device 10M088SE14C8GES01
Info (209060): Started Programmer operation at Mon Jun 22 14:35:44 2015
Info (209016): Configuring device index 1
Info (209012): Device 1 contains JTAG ID code 0x031820DD
Info (209007): Configuration succeeded -- 1 device(s) configured
Info (209011): Successfully performed operation(s)
Info (209064): End of Programmer operation at Mon Jun 22 14:35:44 2015
Please enter i for info and q to quit:

```

7. Open Host Interface utility available in <MAX10 EV Kit AOB Installation Path>/software/utility folder. Figure 3. shows the MAX10 Evaluation Kit Add On Board Interface Utility.
8. To read any page from I2C Slave PROM device, enter page number and press **“Read”** button. Read data will be displayed on Utility.
9. To write any page to I2C Slave PROM device, enter page number, data (8 bytes) and press **“Write”** button.

*Figure 3. MAX10 Evaluation Kit Add On Board Interface Utility for I2C Interface*

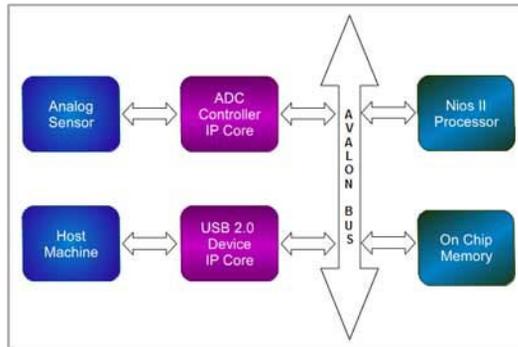


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## USB based ADC Interface

Aim of this design is to provide the ADC interface over USB interface. The MAX10 Evaluation Kit Add On Board is having Analog GPIO headers which is directly connected to Altera MAX10 FPGA. As shown in [Figure 4.](#), this design uses the SLS USB 2.0 Device IP Core and Altera's ADC interface IP Core. On successful enumeration, the MAX10 Evaluation Kit Add On Board interface utility provides the option to select ADC channels to display the analog input signals.

Figure 4. USB based ADC Interface



Follow the steps to read ADC channels.

1. Connect the MAX 10 Evaluation Kit Add On Board on MAX 10 Evaluation Kit.
2. Connect the USB Blaster to the board.
3. Power **ON** the board.
4. Go to `<MAX10 EV Kit AOB Installation Path>/hardware/demo/i2c_adc_intf_max10ev` folder.
5. Double click on `i2c_adc_intf_max10ev.bat` file. This will program SOF file on the board. You will see the message as shown in [Figure 5](#).

Figure 5. Console Message Window for USB based ADC Interface

```

SLS USB to I2C Bridge Demo
-----
// Welcome to USB to I2C Bridge Demo //
-----

Which test would you like to run??
1 - USB to I2C Bridge and internal ADC
2 - USB to UART Bridge

Please enter number..
1
File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains one or more time-limited megafunctions that support the OpenCore Plus feature that will not work after the hardware evaluation time expires. Refer to the Messages window for evaluation time details.
Info (210040): SRAM Object File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains time-limited megafunction that supports OpenCore Plus feature -- Vendor: 0x5750, Product: 0x0004
Info (210040): SRAM Object File sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof contains time-limited megafunction that supports OpenCore Plus feature -- Vendor: 0x5750, Product: 0x0004
Info: *****
Info: Running Quartus II 64-Bit Programmer
Info: Version 14.1.0 Build 186 12/03/2014 SJ Full Version
Info: Copyright (C) 1991-2014 Altera Corporation. All rights reserved.
Info: Your use of Altera Corporation's design tools, logic functions and other software and tools, and its AMPSP partner logic functions, and any output files from any of the foregoing (including device programming or simulation files), and any associated documentation or information are expressly subject to the terms and conditions of the Altera Program License Subscription Agreement, the Altera Quartus II License Agreement, the Altera MegaCore Function License Agreement, or other applicable license agreement, including, without limitation, that your use is for the sole purpose of programming logic devices manufactured by Altera and sold by Altera or its authorized distributors. Please refer to the applicable agreement for further details.
Info: Processing started: Mon Jun 22 14:35:43 2015
Info: Command: quartus_pgm -a jtag -c usb-Blaster(usb-01) -o p:sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof
Info (213045): Using programming cable "USB-Blaster (USB-01)"
Info (213011): Using programming file sls_max10_addon_refdes_adc_nd_i2c_time_limited.sof with checksum 0x00753C2D for device 10M088SE144C8GES01
Info (209060): Started Programmer operation at Mon Jun 22 14:35:44 2015
Info (209016): Configuring device index 1
Info (209012): Device 1 contains JTAG ID code 0x031820DD
Info (209007): Configuration succeeded -- 1 device(s) configured
Info (209011): Successfully performed operation(s)
Info (209064): Enter Programmer operation at Mon Jun 22 14:35:44 2015
Please enter i for info and q to quit:

```

6. After successful downloading USB 2.0 device detected in the Host machine. Install USB 2.0 device driver from <MAX10 EV Kit AOB Installation Path>/software/driver folder.
7. After successful enumeration of USB 2.0 device, open the Host interface application from <MAX10 EV Kit AOB Installation Path>/software/utilities folder.
8. Go to **ADC Channel Read** tab. Figure 6. shows the screen shot of the MAX10 Evaluation Kit Add On Board interface utility for ADC interface.
9. Select the channels as per analog signal input and press “Start” button. User can observe graph of selected channels.
10. User can stop the conversion by pressing “Stop” button.

Figure 6. MAX10 Evaluation Kit Add On Board Interface Utility for ADC Interface

