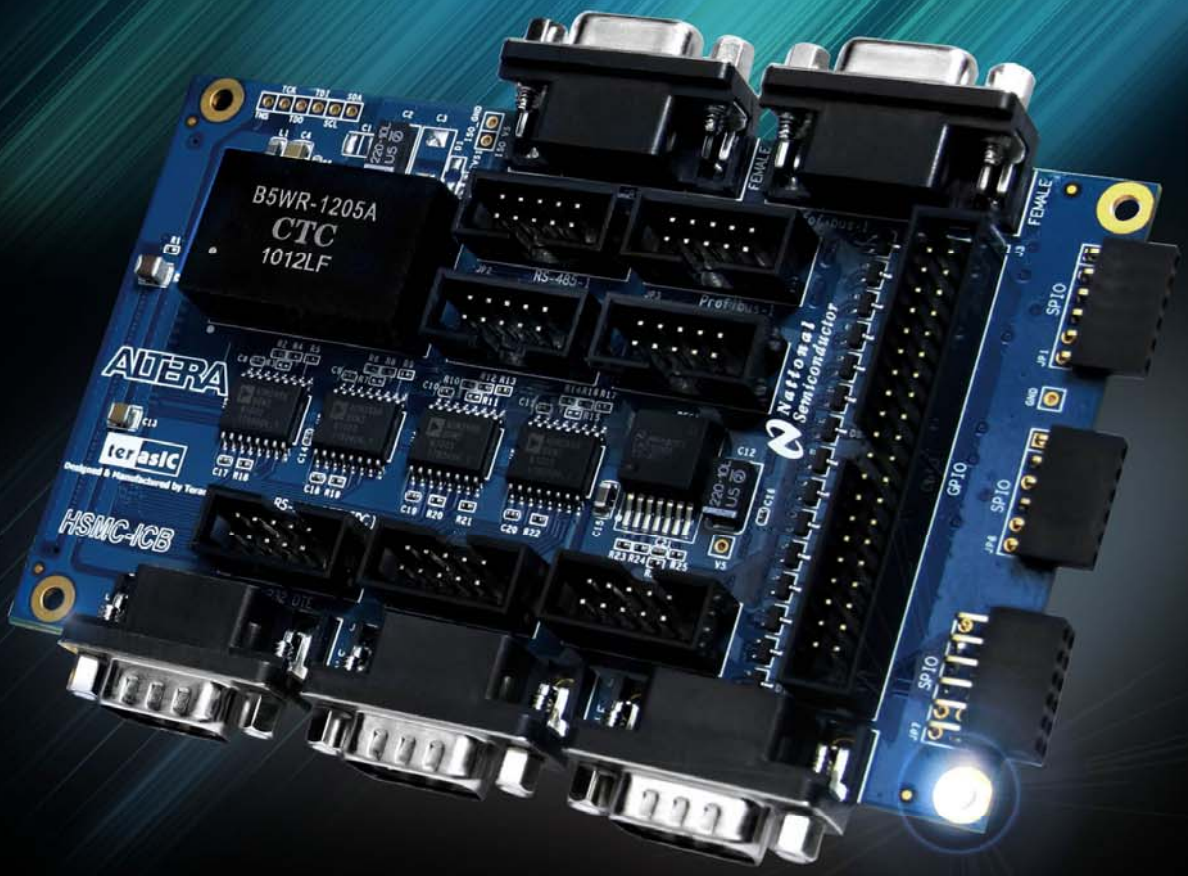
ICB-HSMC

User Manual



terasIC
www.terasic.com

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CONTENTS

Chapter 1 Introduction 2

1.1 Features 2

1.2 Getting Help 3

Chapter 2 ICB Architecture 4

2.1 Layout and Components 4

2.2 Block Diagram of the ICB 5

Chapter 3 Board Components 7

3.1 HSMC Expansion Connector 7

3.2 GPIO Interface 10

3.3 RS-232 Interface 11

3.4 RS-485 Interface 12

3.5 CAN Interface 14

3.6 PIO Interface 14

Chapter 4 Assembling the ICB Card 16

4.1 Assemble ICB with DE2-115 16

4.2 Generate ICB Project via DE2-115 System Builder 17

Chapter 5 ICB Demonstrations 21

5.1 System Requirements 21

5.2 RS-232 Communication 21

5.3 RS-485 Loopback Test 23

5.4 CAN Loopback Test 25

Chapter 6 Appendix 28

6.1 Revision History 28

6.2 Copyright Statement 28

Chapter 1

Introduction

The Industrial Communication Board (ICB-HSMC) is designed to provide common industry standard interfaces for FPGA platforms that support RS-232, RS-485, and CAN connectivity through a High-Speed Mezzanine Connector (HSMC). It allows users to setup a communication network for industrial use through the industrial standard interfaces on the ICB. This board features one RS-232 interface, one GPIO interface, four RS-485 interfaces, two CAN interfaces, and four PIO interfaces. The ICB is an ideal addition to the DE2-115 platform for developing industrial networking solutions on Altera FPGAs.

1.1 Features

Figure 1-1 shows a photograph of the ICB.

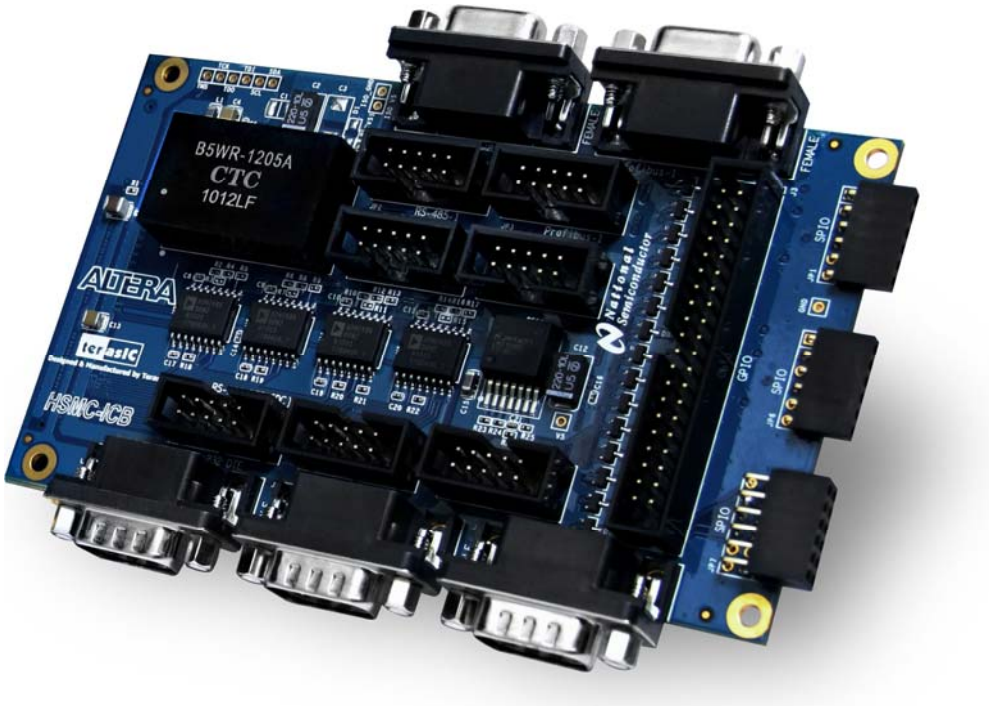


Figure 1-1 Layout of the ICB

The key features of the card are listed below:

- HSMC Connector
- 40-Pin GPIO interface
  - 36 user I/Os

- Two 6-Pin PIO interfaces
  - 4 user I/Os per interface

- 12-Pin PIO interface
  - 8 user I/Os

- RS-232 interface
  - Maxim RS-232 transceiver (MAX3238) support streaming transmission up to 250kbps
  - Complete RS-232 signal interface
  - 1 male DB9 Connector and one 10-pin header (shares pins with DB9 Connector)

- RS-485 interface
  - Analog Device isolated RS-485 transceiver (AMD2486), Profibus compliant
  - Half-duplex transmission with data rate up to 20Mbps
  - 4 channel transceivers, two channels output with DB9 female connectors and 10-pin headers (share pins with DB9), two channels output with 10-pin headers

- CAN interface
  - Maxim Low-Supply-Current CAN transceiver (MAX3051)
  - High speed operation up to 1Mbps
  - 2 male DB9 and two 10-pin headers (share pins with Connectors)

- Power
  - Isolated 5V power supply for RS-485 transceiver bus side
  - 5V/3.3V power supply

1.2 Getting Help

Here is information of how to get help if you encounter any problems:

- Terasic Technologies
- Tel: +886-3-575-0880
- Email: support@terasic.com

Chapter 2

ICB Architecture

This chapter describes the architecture of the ICB including block diagram and components.

2.1 Layout and Components

The picture of the ICB is shown in **Figure 2-1** and **Figure 2-2**. It depicts the layout of the board and indicates the locations of the connectors and key components.

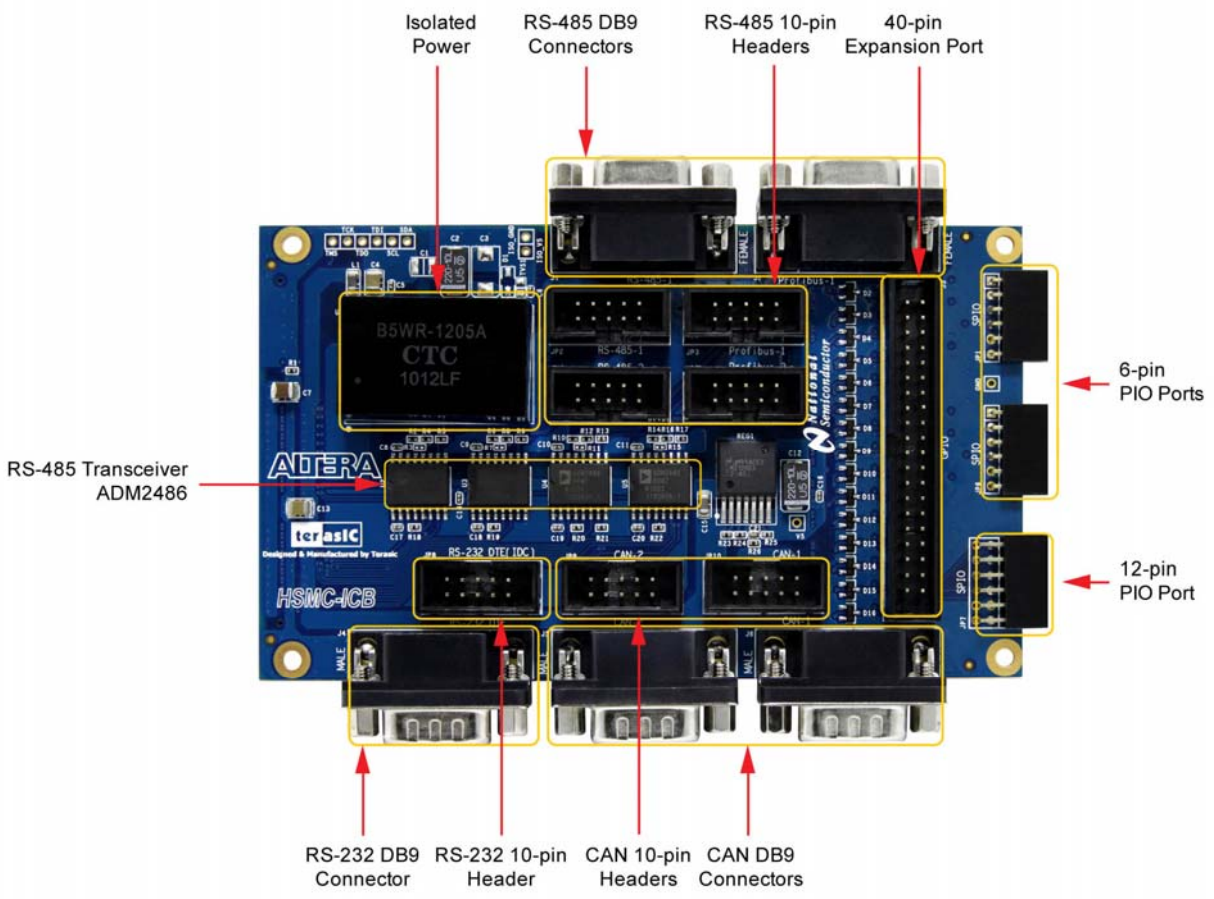


Figure 2-1 The ICB-HSMC PCB and component diagram (top view)

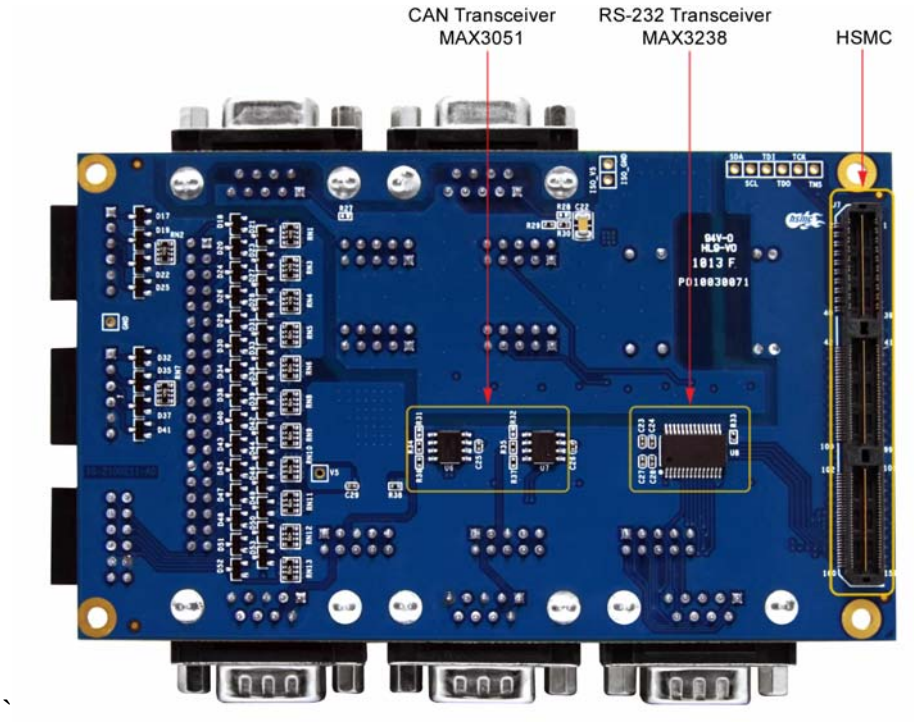


Figure 2-2 The ICB-HSMC PCB and component diagram (bottom view)

The following interfaces are provided on the ICB:

- HSMC Connector (J7)
- 40-pin GPIO Header (J3)
- 6-pin Header (JP1/JP6)
- 12-pin Header(JP7)
- 10-pin Header (JP2/JP3/JP4/JP5/JP6/JP9/JP10)
- DB9 Connector (J1/J2/J4/J5/J6)

2.2 Block Diagram of the ICB

Figure 2-3 shows the block diagram of the ICB-HSMC. The HSMC connector houses all the wires from peripheral interfaces and makes to the FPGA on the main board.

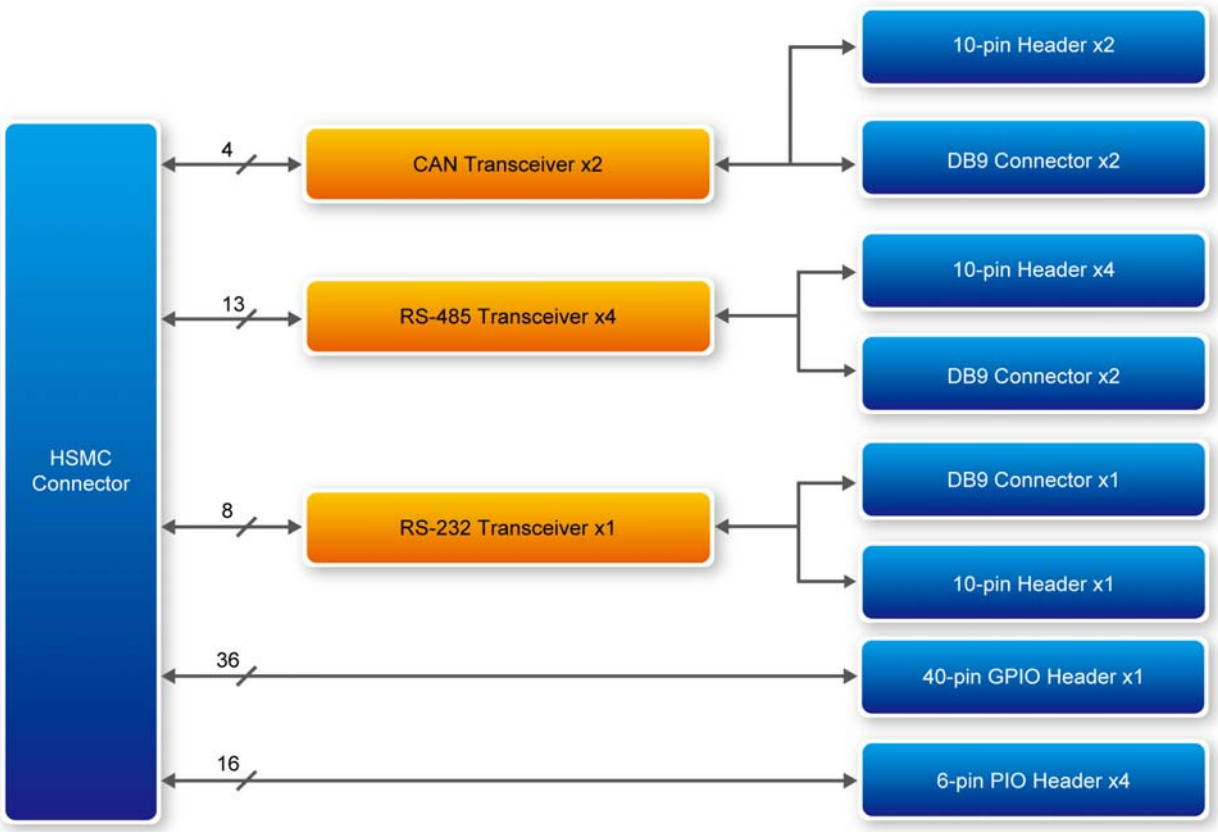


Figure 2-3 Block diagram of ICB-HSMC

Chapter 3

Board Components

This chapter describes the components, connectors, and pin assignments on the ICB.

3.1 HSMC Expansion Connector

The HSMC interface provides a mechanism to extend the peripheral set of an FPGA host board by means of a mezzanine card, which can address today's high speed signaling requirement as well as standard or legacy low-speed device interface support. Table 3-1 lists the pin assignments of the HSMC connector.

Table 3-1 Pin assignments and descriptions on HSMC connector

Pin Numbers	*Name*	*Direction*	*Description*
1-32	-	-	-
33	HSMC_SDA	Input/Output	HSMC serial address/data I/O
34	HSMC_SCL	Output	HSMC serial clock
35	HSMC_TCK	Output	JTAG clock
36	HSMC_TMS	Output	JTAG mode select
37	HSMC_TDO	Input	JTAG test data out
38	HSMC_TDI	Output	JTAG test data in
39	-	-	-
40	-	-	-
41	GPIO_DATA34	Input/Output	GPIO data
42	GPIO_DATA33	Input/Output	GPIO data
43	GPIO_DATA35	Input/Output	GPIO data
44	GPIO_DATA32	Input/Output	GPIO data
45	VCC3P3	Power	Power 3.3V
46	VCC12	Power	Power 12V
47	GPIO_DATA4	Input/Output	GPIO data
48	GPIO_DATA0	Input/Output	GPIO data
49	GPIO_DATA5	Input/Output	GPIO data
50	GPIO_DATA1	Input/Output	GPIO data
51	VCC3P3	Power	Power 3.3V
52	VCC12	Power	Power 12V

53	GPIO_DATA6	Input/Output	GPIO data
54	GPIO_DATA2	Input/Output	GPIO data
55	GPIO_DATA7	Input/Output	GPIO data
56	GPIO_DATA3	Input/Output	GPIO data
57	VCC3P3	Power	Power 3.3V
58	VCC12	Power	Power 12V
59	GPIO_DATA12	Input/Output	GPIO data
60	GPIO_DATA8	Input/Output	GPIO data
61	GPIO_DATA13	Input/Output	GPIO data
62	GPIO_DATA9	Input/Output	GPIO data
63	VCC3P3	Power	Power 3.3V
64	VCC12	Power	Power 12V
65	GPIO_DATA14	Input/Output	GPIO data
66	GPIO_DATA10	Input/Output	GPIO data
67	GPIO_DATA15	Input/Output	GPIO data
68	GPIO_DATA11	Input/Output	GPIO data
69	VCC3P3	Power	Power 3.3V
70	VCC12	Power	Power 12V
71	GPIO_DATA20	Input/Output	GPIO data
72	GPIO_DATA16	Input/Output	GPIO data
73	GPIO_DATA21	Input/Output	GPIO data
74	GPIO_DATA17	Input/Output	GPIO data
75	VCC3P3	Power	Power 3.3V
76	VCC12	Power	Power 12V
77	GPIO_DATA22	Input/Output	GPIO data
78	GPIO_DATA18	Input/Output	GPIO data
79	GPIO_DATA23	Input/Output	GPIO data
80	GPIO_DATA19	Input/Output	GPIO data
81	VCC3P3	Power	Power 3.3V
82	VCC12	Power	Power 12V
83	GPIO_DATA28	Input/Output	GPIO data
84	GPIO_DATA24	Input/Output	GPIO data
85	GPIO_DATA29	Input/Output	GPIO data
86	GPIO_DATA25	Input/Output	GPIO data
87	VCC3P3	Power	Power 3.3V
88	VCC12	Power	Power 12V
89	GPIO_DATA30	Input/Output	GPIO data
90	GPIO_DATA26	Input/Output	GPIO data
91	GPIO_DATA31	Input/Output	GPIO data
92	GPIO_DATA27	Input/Output	GPIO data
93	VCC3P3	Power	Power 3.3V
94	VCC12	Power	Power 12V
95	RS232_RI	Output	RS-232 RI
96	RS232_RTS	Input	RS-232 RTS
97	RS232_CTS	Output	RS-232 CTS
98	RS232_DTR	Input	RS-232 DTR
99	VCC3P3	Power	Power 3.3V
100	VCC12	Power	Power 12V

101	PIO1_DATA0	Input/Output	PIO1 data
102	PIO0_DATA0	Input/Output	PIO0 data
103	PIO1_DATA1	Input/Output	PIO1 data
104	PIO0_DATA1	Input/Output	PIO0 data
105	VCC3P3	Power	Power 3.3V
106	VCC12	Power	Power 12V
107	PIO1_DATA2	Input/Output	PIO1 data
108	PIO0_DATA2	Input/Output	PIO0 data
109	PIO1_DATA3	Input/Output	PIO1 data
110	PIO0_DATA3	Input/Output	PIO0 data
111	VCC3P3	Power	Power 3.3V
112	VCC12	Power	Power 12V
113	PIO3_DATA0	Input/Output	PIO3 data
114	PIO2_DATA0	Input/Output	PIO2 data
115	PIO3_DATA1	Input/Output	PIO3 data
116	PIO2_DATA1	Input/Output	PIO2 data
117	VCC3P3	Power	Power 3.3V
118	VCC12	Power	Power 12V
119	PIO3_DATA2	Input/Output	PIO3 data
120	PIO2_DATA2	Input/Output	PIO2 data
121	PIO3_DATA3	Input/Output	PIO3 data
122	PIO2_DATA3	Input/Output	PIO2 data
123	VCC3P3	Power	Power 3.3V
124	VCC12	Power	Power 12V
125	RS485_2_RXD	Input	RS-485 channel 2 RXD
126	RS485_0_RXD	Input	RS-485 channel 0 RXD
127	RS485_2_TXD	Output	RS-485 channel 2 TXD
128	RS485_0_TXD	Output	RS-485 channel 0 TXD
129	VCC3P3	Power	Power 3.3V
130	VCC12	Power	Power 12V
131	RS485_2_RTS	Output	RS-485 channel 2 RTS
132	RS485_0_RTS	Output	RS-485 channel 0 RTS
133	RS485_3_RXD	Input	RS-485 channel 3 RXD
134	RS485_1_RXD	Input	RS-485 channel 1 RXD
135	VCC3P3	Power	Power 3.3V
136	VCC12	Power	Power 12V
137	RS485_3_TXD	Output	RS-485 channel 3 TXD
138	RS485_1_TXD	Output	RS-485 channel 1 TXD
139	RS485_3_RTS	Output	RS-485 channel 3 RTS
140	RS485_1_RTS	Output	RS-485 channel 1 RTS
141	VCC3P3	Power	Power 3.3V
142	VCC12	Power	Power 12V
143	RS232_DSR	Output	RS-232 DSR
144	POWER_VALID	Output	RS-485 0,1,2,3 power valid
145	RS232_TXD	Output	RS-232 TXD
146	RS232_DCD	Output	RS-232 DCD
147	VCC3P3	Power	Power 3.3V

148	VCC12	Power	Power 12V
149	CAN1_T	Output	CAN channel 1 TXD
150	CAN0_T	Output	CAN channel 0 TXD
151	CAN1_R	Input	CAN channel 1 RXD
152	CAN0_R	Input	CAN channel 0 RXD
153	VCC3P3	Power	Power 3.3V
154	VCC12	Power	Power 12V
155	-	-	-
156	RS232_RXD	Input	RS-232 RXD
157	-	-	-
158	-	-	-
159	VCC3P3	Power	Power 3.3V
160	GND	Power	Power Ground

3.2 GPIO Interface

This section describes the GPIO interface on the ICB

The ICB contains a GPIO interface with a 40-pin header. **Figure 3-1** shows the pin names defined on the GPIO connector used in general purpose applications. For pin mapping information between the GPIO and HSMC connector, please refer to **Table 3-1,** using pin names here as indexes.

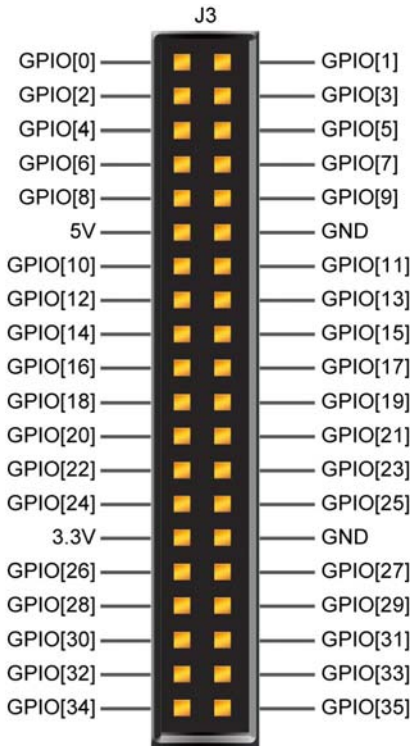


Figure 3-1 Pin names defined on GPIO connector

GPIO is widely used for housing various application needs such as video processing or image acquisition, etc. It supports up to 50Mbps data rate using a reliable cable connection. Each data pin on the GPIO is connected to an extra protection circuit made up of two clamping diodes and one

serial resistor. Figure 3-2 shows the protection circuitry that is on each of the 36 data pins on the 40-pin header.

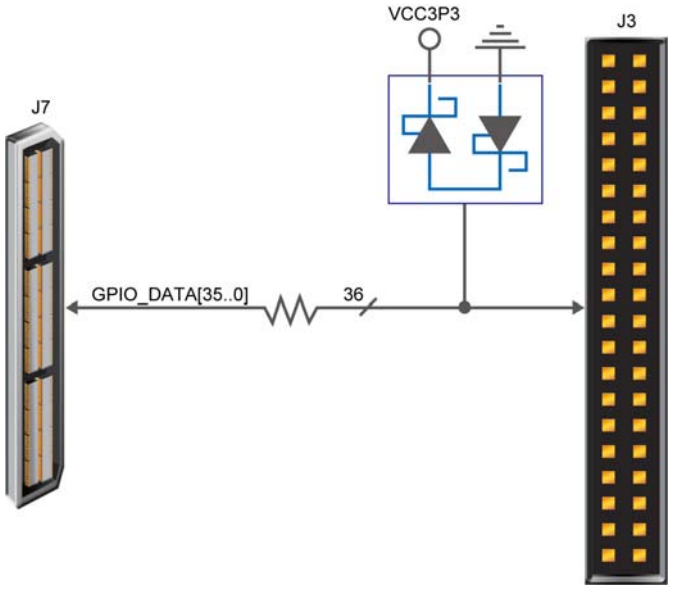


Figure 3-2 Protection circuit for data pins on GPIO

3.3 RS-232 Interface

This section describes the RS-232 interface on the ICB-HSMC.

The ICB provides a full featured RS-232 interface using a Maxim 3238 chip with a guaranteed data rate of 250 Kbps. Figure 3-3 shows the I/O connectors J4 and JP8 for the RS-232 signals.

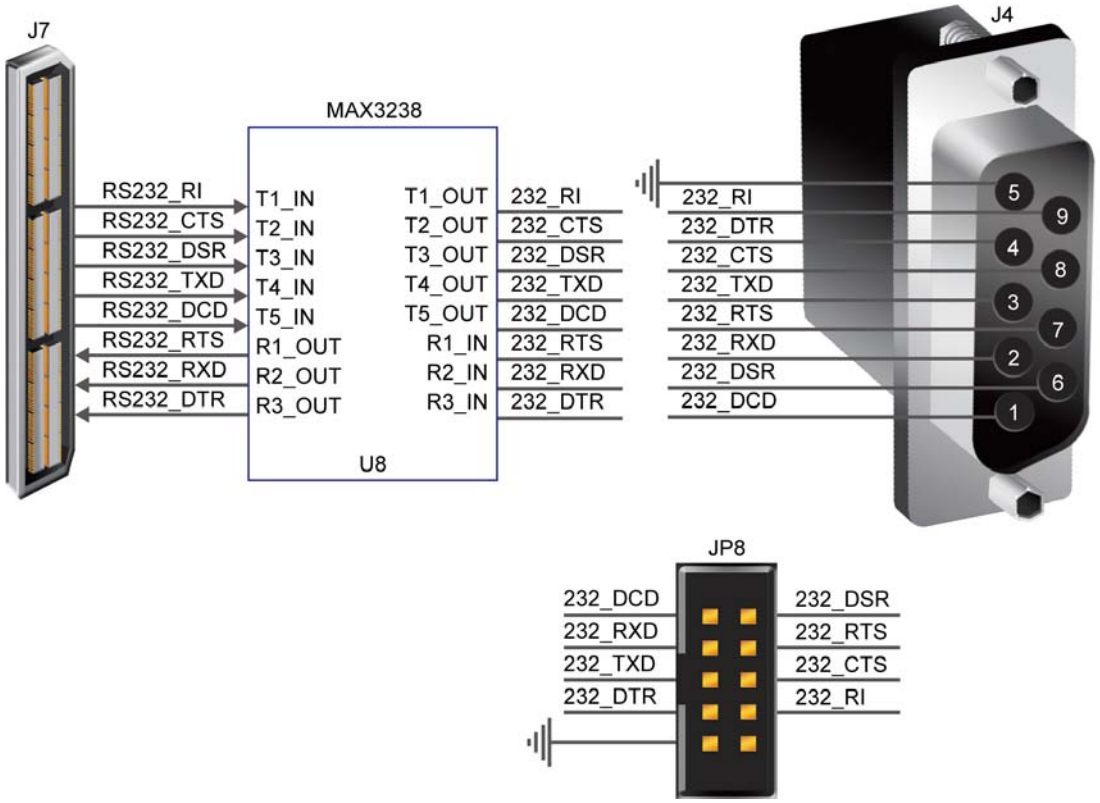


Figure 3-3 Wiring between the HSMC and RS-232 interface

The male RS-232 connector provides the industrial standard cabling interface, in addition to a 10-pin header used for simple communication conditions where a specific cable is not needed.

3.4 RS-485 Interface

This section describes RS-485 interface on the ICB-HSMC.

There are four RS-485 links from the HSMC connector to two female DB9 connectors and four 10-pin headers. Two of the 10-pin headers share pins with the two DB9 connectors. Within the four ports, two ports are compliant with the profibus specification and are suitable of using as physical link in industrial multi-terminal control applications. **Figure 3-4** shows the hardware wiring between the HSMC and one RS-485 channel.

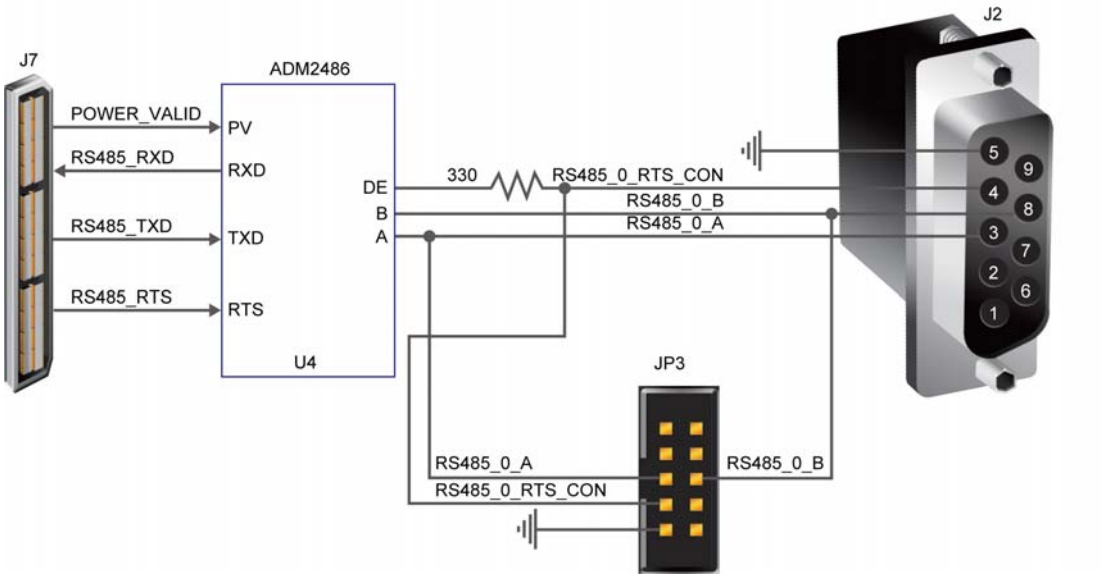


Figure 3-4 Wiring between HSMC and RS-485 interface

Table 3-2 gives the pin assignments on 10-pin headers and DB9 connectors for RS-485 signals.

Table 3-2 Pin assignments and descriptions for RS-485 interfaces

RS-485 Channel	*Signal Name*	*10-pin Header*	*DB9 connector*
Channel 0 (Profibus compliance)*	RS485_0_A	5(JP3)	3(J2)
	RS485_0_B	6(JP3)	8(J2)
	RS485_0_RTS_CON	7(JP3)	4(J2)
	VCC5_ISO	2(JP3)	6(J2)
	GND	9(JP3)	5(J2)
Channel 1	RS485_1_A	6(JP2)	8(J1)
	RS485_1_B	5(JP2)	3(J1)
	RS485_1_RTS_CON	7(JP2)	4(J1)
	VCC5_ISO	2(JP2)	6(J1)
	GND	9(JP2)	5(J1)
Channel 2 (Profibus compliance)*	RS485_2_A	5(JP5)	-
	RS485_2_B	6(JP5)	-
	RS485_2_RTS_CON	7(JP5)	-
	VCC5_ISO	2(JP5)	-
	GND	9(JP5)	-
Channel 3	RS485_3_A	6(JP4)	-
	RS485_3_B	5(JP4)	-
	RS485_3_RTS_CON	7(JP4)	-
	VCC5_ISO	2(JP4)	-
	GND	9(JP4)	-

**Note, the Profibus implementation is not fully tested on the ICB.*

3.5 CAN Interface

This section describes the CAN interface on the ICB-HSMC.

The board features two CAN links from the HSMC connector to two DB9 male connectors and two 10-pin headers. These two 10-pin headers share the same pins with two DB9 connectors. **Figure 3-5** shows the connections between the HSMC and the CAN interface through a CAN transceiver chip.

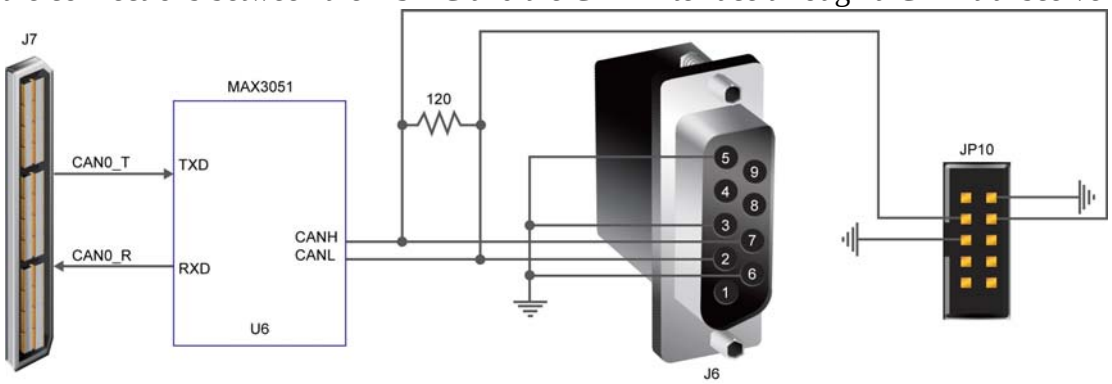


Figure 3-5 Wiring between HSMC and CAN interface

Table 3-3 gives the pin assignments on 10-pin headers and DB9 connectors for CAN signals.

Table 3-3 Pin assignments and descriptions for CAN interfaces

CAN Channel	*Signal Name*	*10-pin Header*	*DB9 Connector*
Channel 0	CANH	4(JP10)	7(J6)
	CANL	3(JP10)	2(J6)
	GND	2,5(JP10)	3,5,6(J6)
Channel 1	CANH	4(JP9)	7(J5)
	CANL	3(JP9)	2(J5)
	GND	2,5(JP9)	3,5,6(J5)

3.6 PIO Interface

This section describes the PIO interface on the ICB-HSMC.

The board has four PIO links from the HSMC connector with two 6-pin ports and one 12-pin port (dual PIO link). The 6-pin PIO port not only provides four general-purpose I/Os but also has one 3.3V power supply and one ground pin. **Figure 3-6** gives the related schematic of the PIO connector.

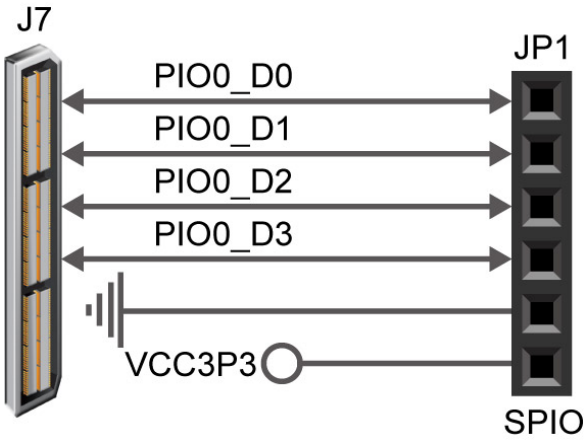


Figure 3-6 Wiring between HSMC and PIO interface

Chapter 4

Assembling the ICB Card

This chapter gives instructions for connecting the ICB to versatile host boards.

4.1 Assemble ICB with DE2-115

For connecting the ICB to the DE2-115 board, plug the ICB to the HSMC 'socket' (JP8) of the DE2-115 board. Users could additionally screw on and tighten the connection for extra mechanical stability. **Figure 4-1** shows the assembled hardware.

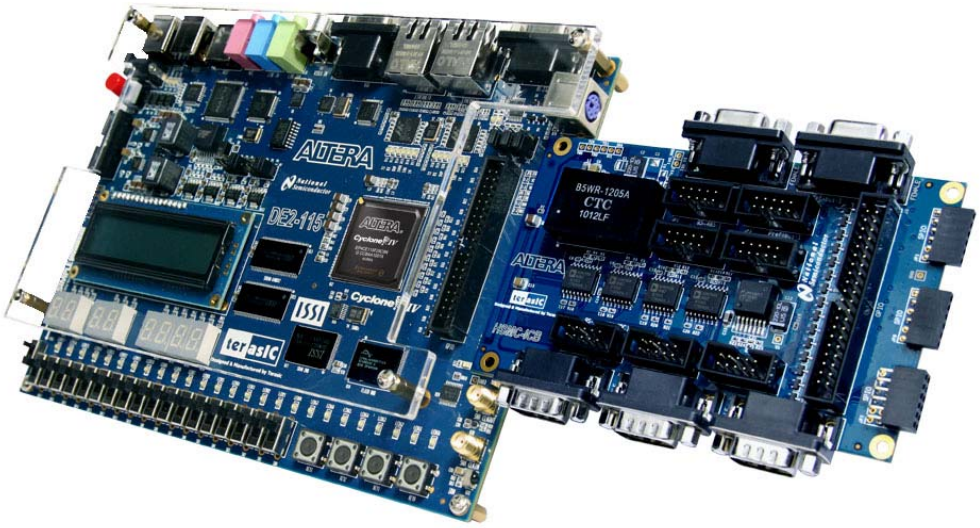


Figure 4-1 Assembling ICB with DE2-115 board

Note that the ICB is designed to use the 3.3V or 2.5V I/O signaling standard. Before powering on the DE2-115 board, set the desired I/O standard for the HSMC connector. **Figure 4-2** shows the header for setting the HSMC power supply voltage.

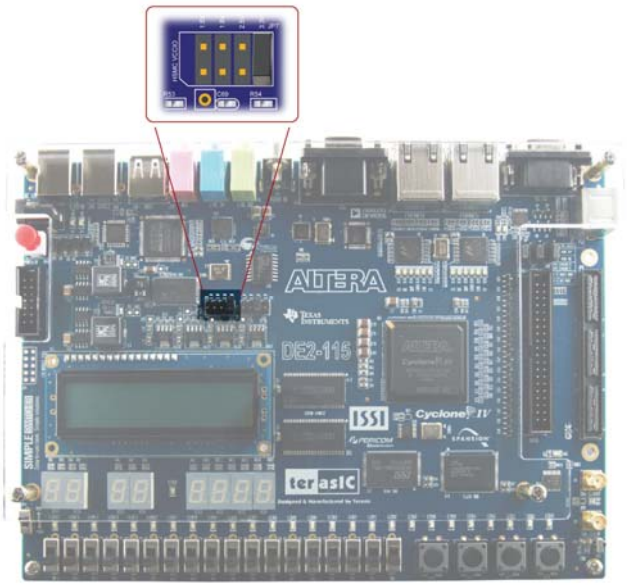


Figure 4-2 HSMC VCCIO supply voltage setting header (JP7)

4.2 Generate ICB Project via DE2-115 System Builder

The DE2-115 board comes with a useful utility that helps users generate top level design and pin assignment files that include specific HSMC daughter card information. The automatically generated top level design and Quartus II setting file eliminate potential common mistakes encountered when manually typing in the signal wires between DE2-115 and daughter card.

■ Install and launch the DE2-115 System Builder

The DE2-115 System Builder is available from the INK system CD-ROM, under the INK_tools folder. Users can copy the entire folder to a host PC without installing the utility. Before using the DE2-115 System Builder, execute the DE2_115_SystemBuilder.exe on the host computer as shown in **Figure 4-3**.

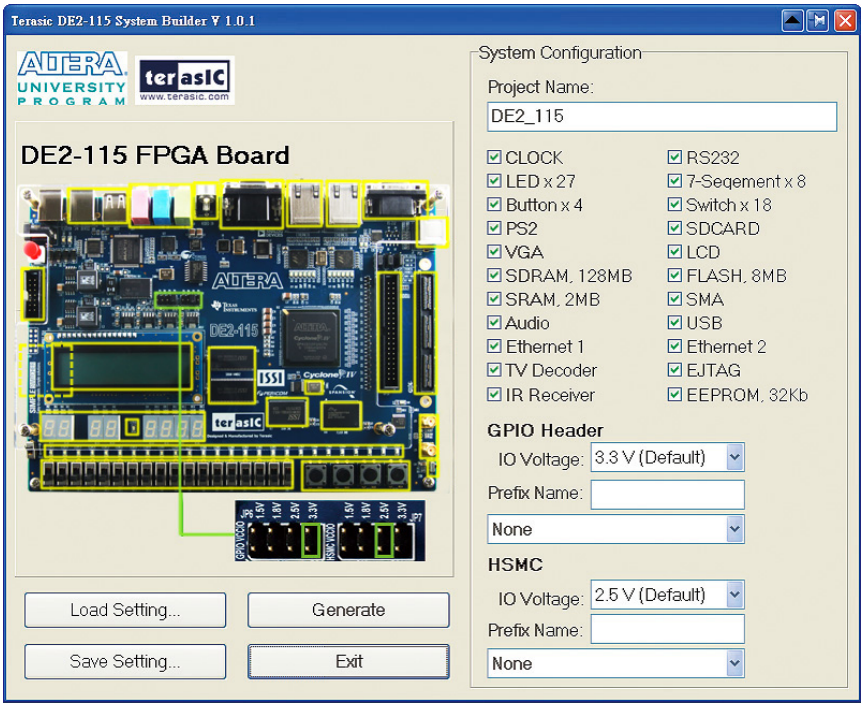


Figure 4-3 The DE2-115 System Builder window

■ Input Project Name

Input project name as show in **Figure 4-4**.

Project Name: Type in an appropriate name here, it will automatically be assigned as the name of your top-level design entity.

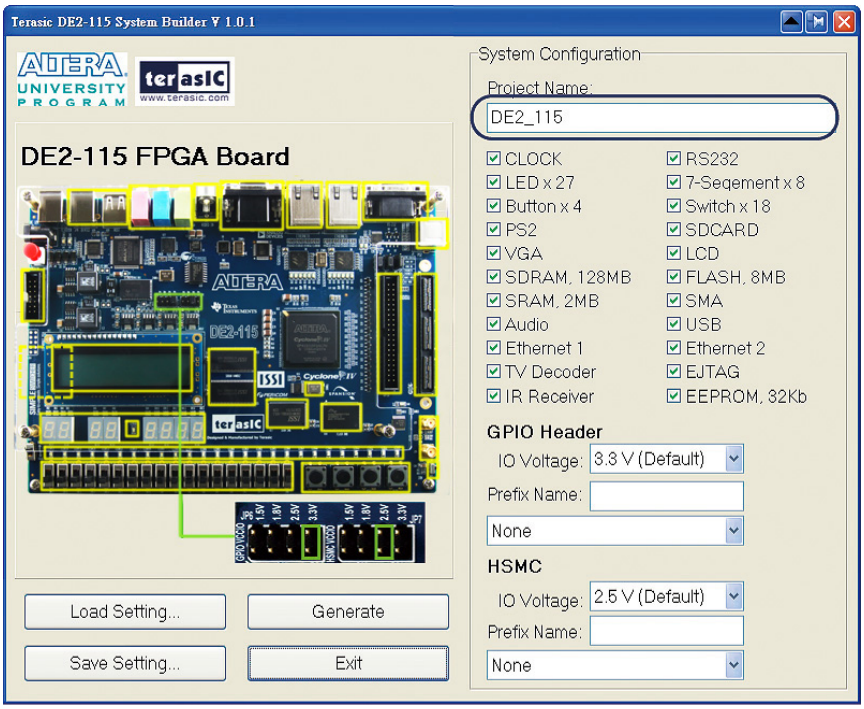


Figure 4-4 The DE2-115 Board Type and Project Name

■ System Configuration

Under System Configuration, users can enable the desired components on the FPGA host board as shown in Figure 4-5. If the component is enabled, the DE2-115 System Builder will automatically generate the associated pin assignments, including the pin names, pin locations, pin directions, and I/O standards.

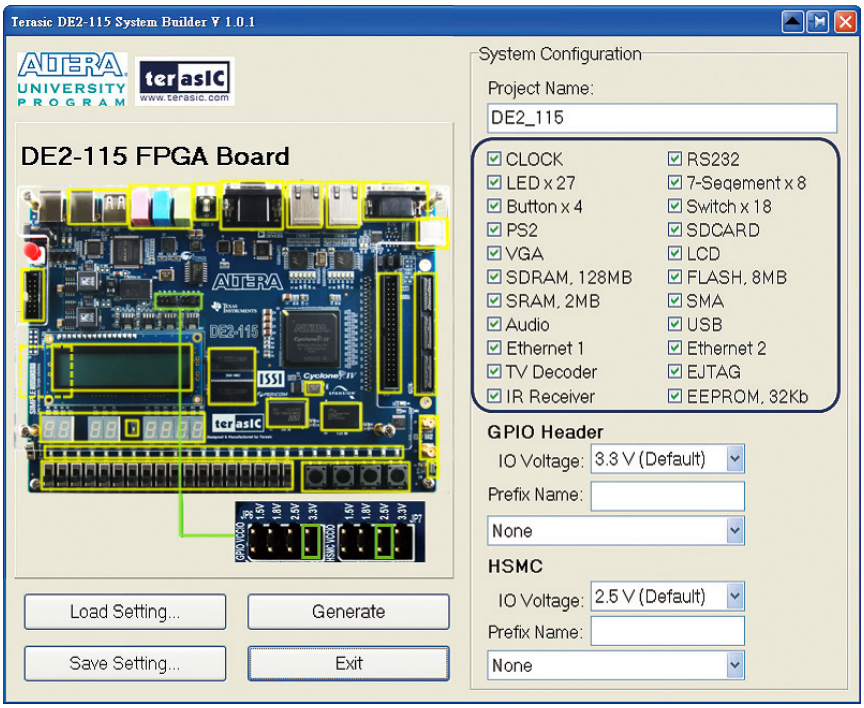


Figure 4-5 System Configuration Group

■ HSMC Expansion

Figure 4-6 illustrates the usage of the DE2-115 System Builder specifying ICB connecting to the HSMC interface. This will automatically generate wiring connections between the host board and ICB-HSMC.

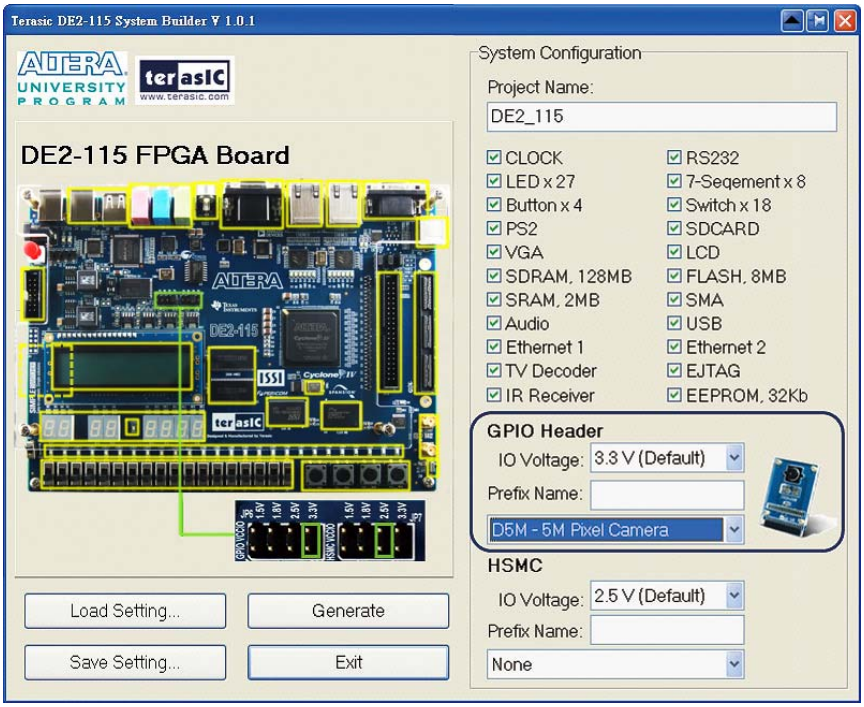


Figure 4-6 HSMC Expansion Group

The "Prefix Name" is an optional feature that denotes the pin name of the daughter card assigned in your design. Users may leave this field empty.

Figure 4-7 illustrates the generated top level design file contains information on the ICB-HSMC connections.

```
////////////// HSMC ///////////
input                    CAN0_R;
output                      CAN0_T;
input                    CAN1_R;
output                      CAN1_T;
inout         [35:0]     GPIO_DATA;
inout          [3:0]     PIO0_DATA;
inout          [3:0]     PIO1_DATA;
inout          [3:0]     PIO2_DATA;
inout          [3:0]     PIO3_DATA;
output                      POWER_VALID;
output                      RS232_CTS;
output                      RS232_DCD;
output                      RS232_DSR;
input                    RS232_DTR;
output                      RS232_RI;
input                    RS232_RTS;
input                    RS232_RXD;
output                      RS232_TXD;
output                      RS485_0_RTS;
input                    RS485_0_RXD;
output                      RS485_0_TXD;
output                      RS485_1_RTS;
input                    RS485_1_RXD;
output                      RS485_1_TXD;
output                      RS485_2_RTS;
input                    RS485_2_RXD;
output                      RS485_2_TXD;
output                      RS485_3_RTS;
input                    RS485_3_RXD;
output                      RS485_3_TXD;
```

Automatically generated wiring information between host board and ICB

Figure 4-7 Top level design file includes ICB-HSMC information

Chapter 5

ICB Demonstrations

This chapter mainly depicts how to use the ICB through a set of demonstrations located on the software CD. From running the demonstrations, users will know how to implement codes on the DE2-115 for controlling the ICB-HSMC. The demos include communication between RS-232 and PC, RS-485 loopback test, and CAN loopback test.

5.1 System Requirements

Here are boards and connecting wires used to run the demonstrations:

- DE2-115 board 1
- ICB-HSMC 1
- RS232 cable (DB9 female-female cross cable) 1
- Connecting wires 4

5.2 RS-232 Communication

This demonstration illustrates how to construct a communication channel between a PC and RS-232 port on the ICB card. Set up of the RS-232 port as follows:

- Baud rate: 9600 bps
- Data bits: 8 bits
- Stop bit: none
- Parity check bit: 1 bit

The demonstration also provides PC-side UART terminal communication software using the above parameters. The software running on the PC transmits characters out to the RS-232 port on ICB. Through the HSMC connector, the UART controller implemented on the DE2-115 board buffers the received characters and then sends back to the RS-232 link. The terminal software on PC side senses the receive channel and displays the information in a software window. The system block diagram is shown in **Figure 5-1**.

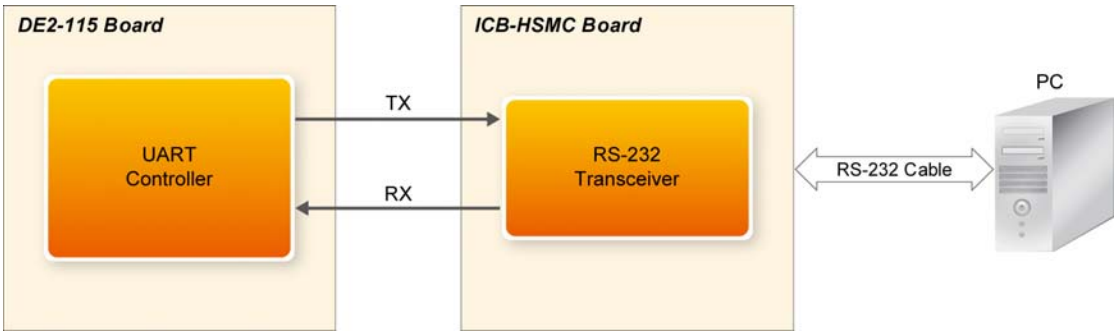


Figure 5-1 Block diagram of RS-232 communication

■ Demonstration source code

- Project Directory: \INK_demonstrations\ICB\DE2_115_ICB_RS232
- Bit Stream Used: DE2_115_ICB_RS232.sof

■ PC terminal software

- Software Directory: \INK_demonstrations\ICB \DE2_115_ICB_RS232\SW
- Executable File : UartTerminal.exe

■ Demonstration batch file

- Batch File Folder: \INK_demonstrations\ICB \DE2_115_ICB_RS232\demo_batch
- Batch File: DE2_115_ICB_RS232.bat, test_bashrc
- FPGA Configuration File: DE2_115_ICB_RS232.sof

■ Demonstration setup:

- Assemble the ICB with the DE2-115.
- Power on the DE2-115 board. The green LED (D40) near the HSMC connector will indicate a valid connection.
- Connect the DE2-115 to the PC using the USB-Blaster cable and then run the demo batch DE2_115_ICB_RS232.bat under the \INK_demonstrations\ICB \ DE2_115_ICB_RS232\demo_ batch\ folder.
- Connect the RS-232 port on the ICB to the PC using a DB9 female-to-female cross cable (Tx and Rx lines are cross connected on two headers to form a peer-to-peer connection).
- Run the UartTerminal.exe on the PC, and then select COM1 as the transceiver channel. The software will initiate COM1 and display the success information as shown in **Figure 5-2**.
- Input characters for transmission in the edit box and then press Transmit.
- Press Receive for showing the received data.

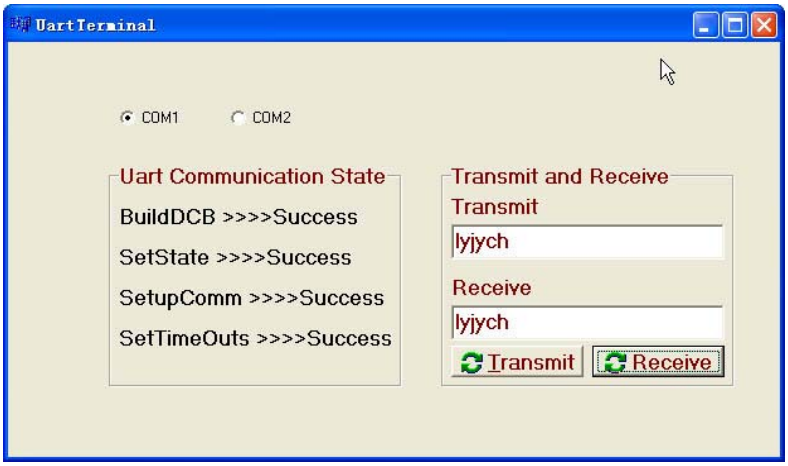


Figure 5-2 Terminal software interface

5.3 RS-485 Loopback Test

This demonstration illustrates a loopback test through RS-485 interfaces using the UART protocol. Channel 0 of the RS-485 interface (marked as Profibus-1) connects to RS-485 channel 1. Software running on Nios II will first set channel 0 on transmit state and channel 1 on receive state, then it initiates one data transfer with its content set by SW7-0 through channel 0. Once the data is received by the RS-485 controller on channel 1 side, software will set channel 1 on transmit state and channel 0 on receive state then sends data back to the loop. The RS-485 controller on channel 0 side finally gets the passed back data and compares it to the original data. The same procedure will be carried out for channel 2 and 3 except transmit data is set by SW15-8. The result will be indicated on HEX3-0 and HEX7-4 as well as Nios II IDE. Figure 5-3 shows the block diagram of the test system.

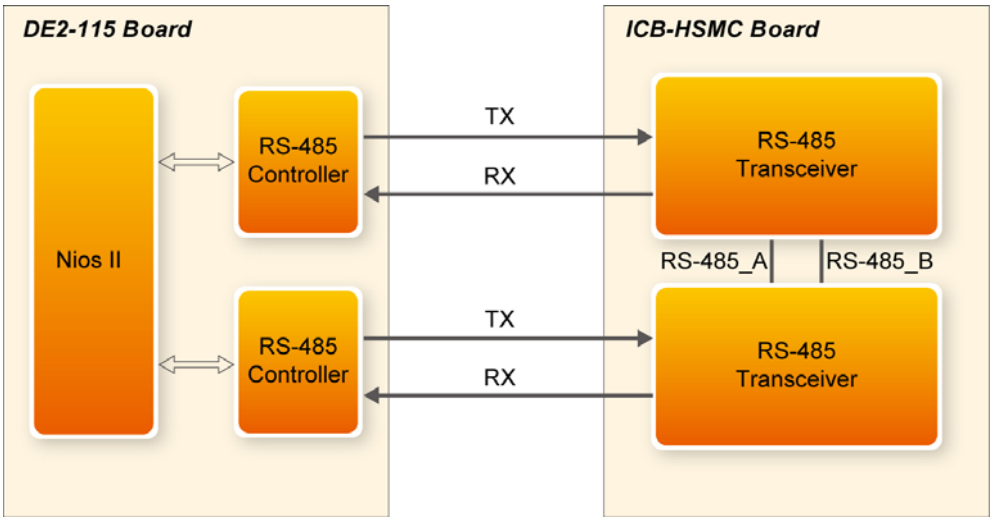


Figure 5-3 Block diagram of the RS-485 loopback test

■ Demonstration source code

- Project Directory: \INK_demonstrations\ICB \ DE2_115_ICB_RS485
- Bit Stream Used: DE2_115_ICB_RS485.sof
- NIOS II Workspace: \INK_demonstrations\ICB \ DE2_115_ICB_RS485\software

■ Demonstration batch file

- Batch File Folder: \INK_demonstrations\ICB \DE2_115_ICB_RS485\demo_batch
- Batch File: DE2_115_ICB_RS485.bat, test_bashrc
- FPGA Configuration File: DE2_115_ICB_RS485.sof

■ Demonstration setup:

- Connect ICB to DE2-115.
- Establish the loopback by connecting RS-485 channel 0 with channel 1. Note profibus ports (JP3, JP5) have wires A & B swapped. **Figure 5-4** shows the wiring diagram for two loops.
- Power on DE2-115 board. Validate the connection by examining the status of the green LED near the HSMC connector.
- Change the transmit contents by setting the values of SW7-0 for loop pair 1(channel 0 and 1), SW15-8 for loop pair 2(channel 2 and 3).
- Connect the DE2-115 to the PC using USB-Blaster cable, and execute DE2_115_ICB_RS485.bat under the \INK_demonstrations\ICB \ DE2_115_ICB_RS485\demo_batch\ folder.
- The prompt window will give test result information as shown in **Figure 5-5**.
- On the DE2-115 board, HEX3-0 indicates loopback information between channel 0 and 1. HEX7-4 indicates loopback information between channel 2 and 3. **Table 5-1** depicts the information indicated on the HEXs.

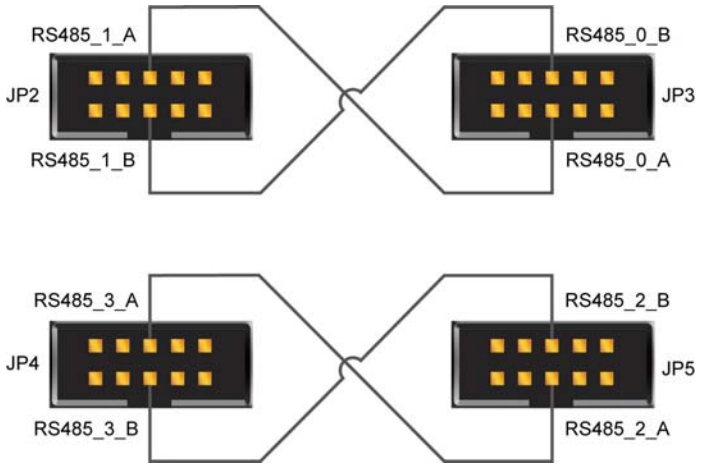


Figure 5-4 Wiring for the RS-485 loopbacks

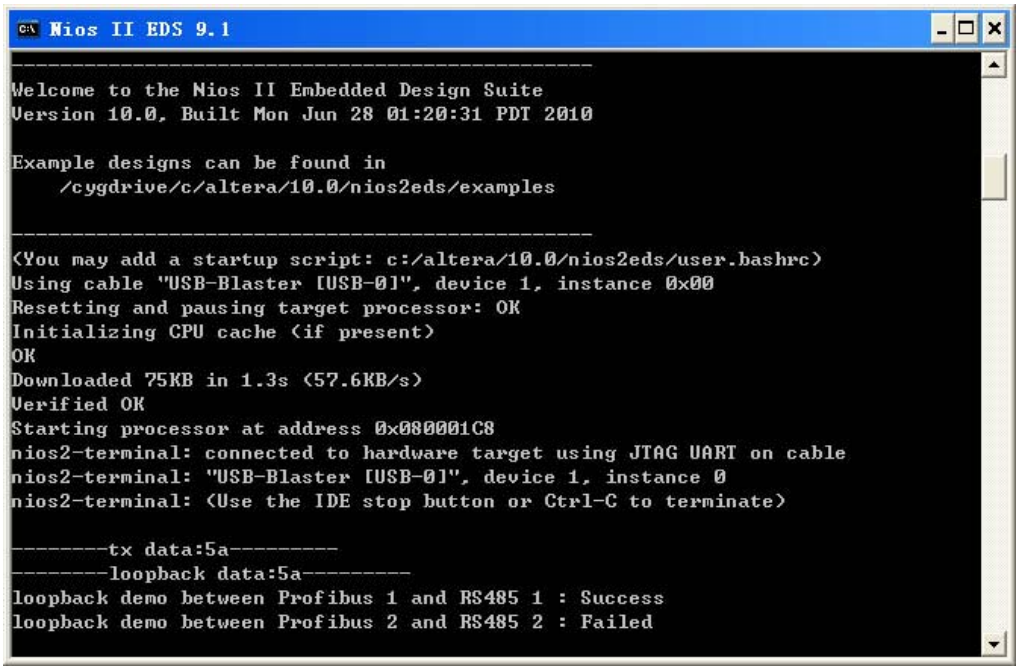


Figure 5-5 Test results on the prompt window

Table 5-1 Loopback test result on HEXs for RS-485

Test Pass Info.	*Test failed info.*
S-<test data*>	**FAIL**

**test data represents the value set by SW15-8 or SW7-0.*

5.4 CAN Loopback Test

This demonstration illustrates how to construct a communication loop between two CAN interfaces where one initiates the data transfer and the other receives data then sends it back to the loop. SW7-0 is used to set up the transmit data contents. The data loopback flow for CAN is the same as RS-485. In this demonstration, the Nios II processor in the FPGA on the DE2-115 board takes charge of the control work and gives the test result information. The block diagram of the CAN loopback test is as shown in **Figure 5-6**.

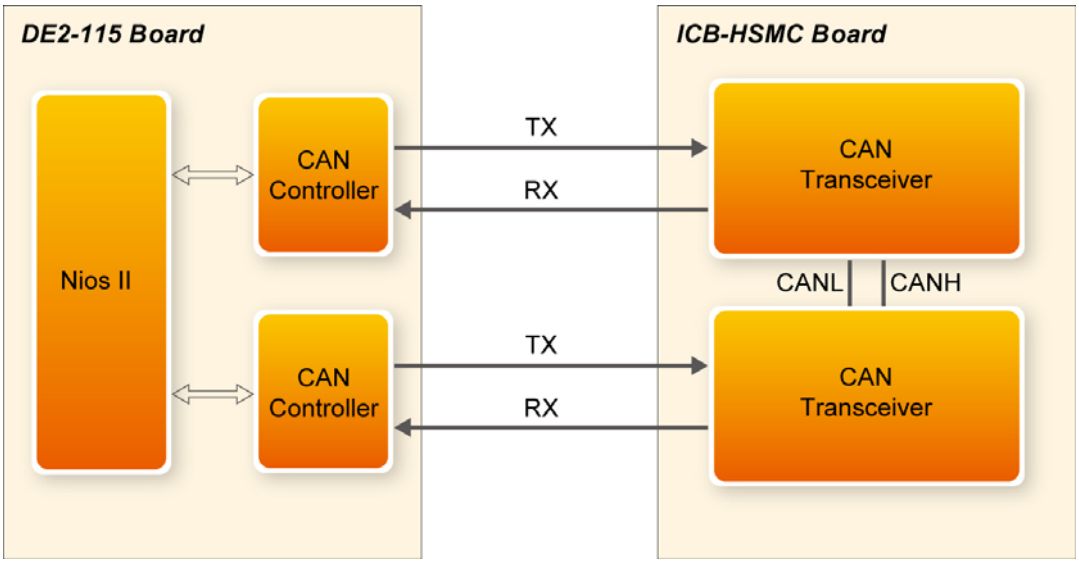


Figure 5-6 Block diagram of CAN loopback test

■ Demonstration source code

- Project Directory: \INK_demonstrations\ICB \ DE2_115_ICB_CAN
- Bit Stream Used: DE2_115_ICB_CAN.sof
- NIOS II Workspace: \INK_demonstrations\ICB \ DE2_115_ICB_CAN\software

■ Demonstration batch file

- Batch File Folder: \INK_demonstrations\ICB \DE2_115_ICB_ CAN\ demo_batch
- Batch File: DE2_115_ICB_ CAN.bat, test_bashrc
- FPGA Configuration File: DE2_115_ICB_ CAN.sof
- NIOS II Program: DE2_115_ICB_ CAN.elf

■ Demonstration setup:

- Connect ICB to DE2-115.
- Connect 'H' and 'L' wire of CAN 0 and CAN1 respectively. **Figure 5-7** shows the wiring manner for the CAN loopback test.
- Power on DE2-115 board. Validate the connection by examining the status of the green LED near the HSMC connector.
- Set the transmitting data for the loop by toggling SW7-0.
- Execute the DE2_115_ICB_CAN.bat in the \INK_demonstrations\ICB \ DE2_115_ICB_CAN \demo batch\ folder.
- The prompt window will display the test result information as shown in **Figure 5-8**.
- HEX3-0 on the DE2-115 also prints out the loopback test information. **Table 5-2** depicts the information indicated on the HEXs.

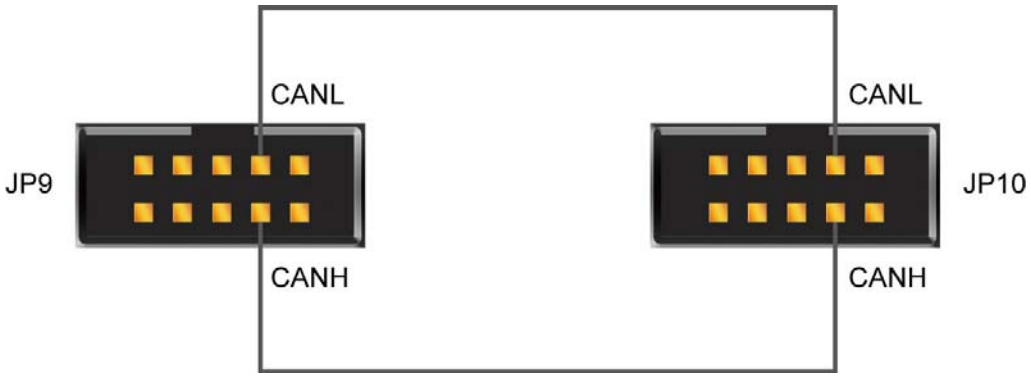


Figure 5-7 Wiring for CAN loopback test

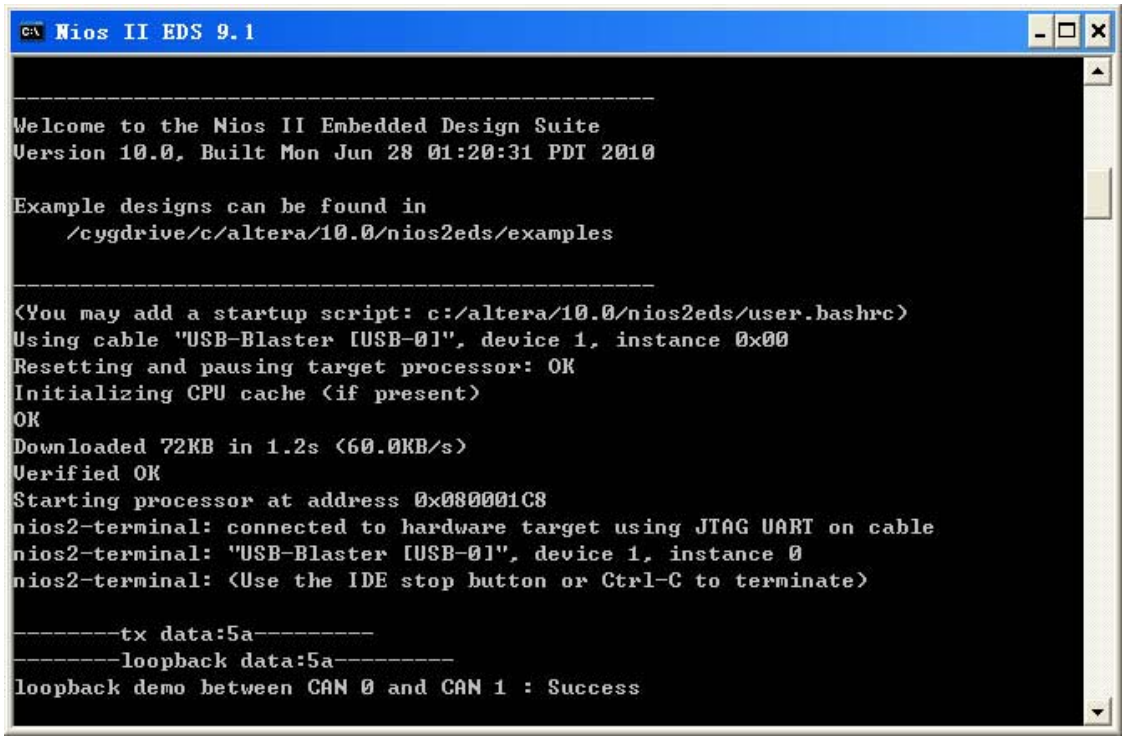


Figure 5-8 Prompt information while running the test

Table 5-2 Loopback test result on HEXs for CAN

Test Pass Info.	*Test failed info.*
S-<test data*>	**FAIL**

***test data represents the value set by SW7-0.*

Chapter 6

Appendix

6.1 Revision History

Version	*Change Log*
V1.0	Initial Version (Preliminary)
V1.1	Delete What's inside the kit

6.2 Copyright Statement

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