IR Receiver Board

Reference Manual

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About this Manual

Introduction

This manual provides full information about the SLS IR Receiver Board.

Table below shows the revision history of the board's reference manual.

Version	Date	Description
1.4	June 2008	• Added IR Receiver Board components and interfaces table.
1.3	December 2007	• Added document part no, product code, board version information. • Added Appendix : Using IR board with IR keyboard.
0.1.2	July 2007	Second publication of the IR Receiver Board reference manual. • Added general purpose LED description. • Changed pin assignments as per new IR Receiver Board.
0.1.1	September 2006	First Publication of the IR Snap On Board reference manual

How to find Information

- The Adobe Acrobat Find feature allows you to search the contents of a PDF file. Use Ctrl + F to open the Find dialog box. Use Shift + Ctrl + N to open to the Go To Page dialog box.
- Bookmarks serve as an additional table of contents.
- Thumbnail icons, which provide miniature preview of each page, provide a link to the pages.
- Numerous links shown in Navy Blue color allow you to jump to related information.

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Typographic Conventions

This document uses the typographic conventions as shown 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: **Introduction, Features**
Bold Type with Italic Letters	All Definitions, Figure and Table Headings are displayed in Italics. Examples: **Figure 2-1. IR Receiver Board - Components, Table 2-1. IR Receiver Board Signals Mapping.**
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 special 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.

Contents

1. Introduction

The IR Receiver Board is designed to provide the IR (Infra Red) interface (isolated) to the Development Boards having Altera Standard Santa Cruz Expansion Connector or DE1/2 Expansion Connector. The board is designed with the intent to give a ready made solution for wireless IR interface. The board uses IR sensors to communicate with IR Devices such as IR keyboard through Infra Red radiation.

Functions of the board are as follows:

- To sense the IR Signal transmitted by the transmitter.
- To demodulate the Signal and to give output to the FPGA.

This document describes the hardware features of the board including detailed pin-out information to enable designers to create custom FPGA designs that interface with all components on the board..

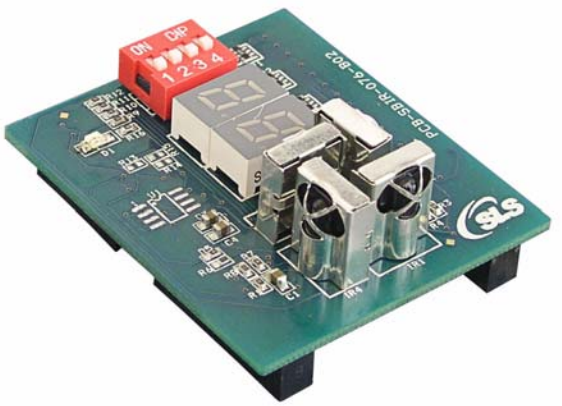
Features

The board provides following features:

- Provides IR Interface for IR devices
- Reduce cost and increase reliability for data communication.

Figure 1-1. shows the board's side view.

Figure 1-1. IR Receiver Board Side View



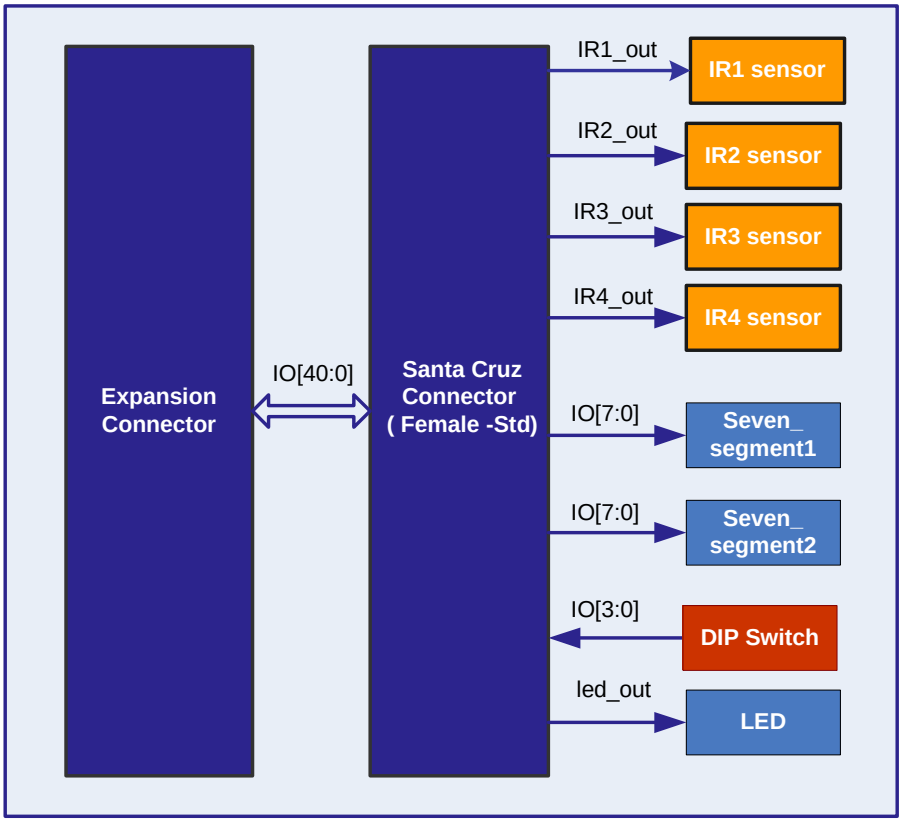
Block Diagram

The board includes following components:

- 4 IR Sensors
- 4-way DIP switch
- 2 Seven segment LEDs Display
- 1 user defined LED
- Headers(F), JP1,JP2,JP3

Figure 1-2. below shows block diagram of the board.

Figure 1-2. IR Receiver Board Block Diagram



Next Chapter explains overview of all the board components.

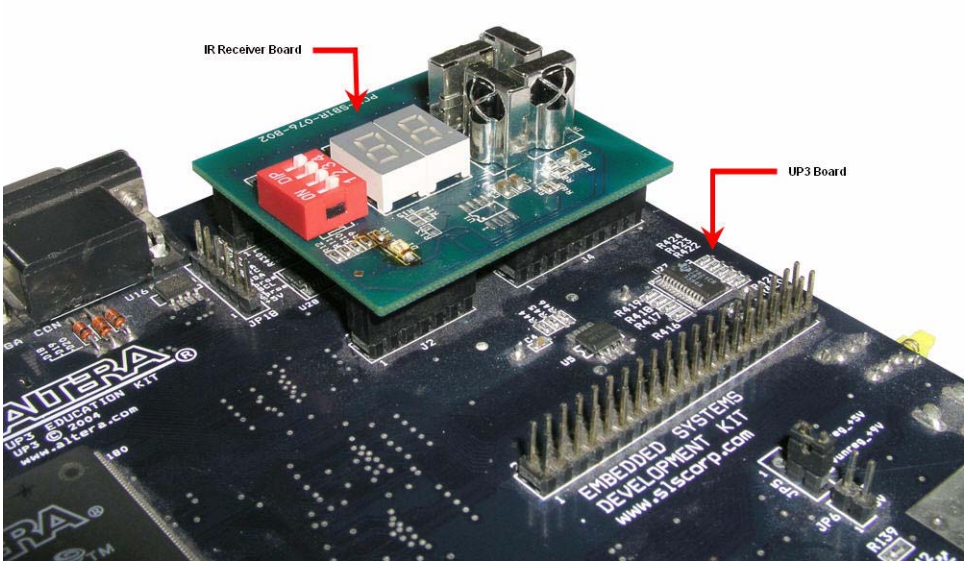
Board Connections

The board expands the capability of a development board to wireless IR interface by snapping on expansion headers. The three (Female) connectors (J1, J2, J3) on the bottom side of the board are used for this purpose.

The Figure 2-2. below shows the connections of the board with the UP3 1C6 board

For any board having Altera standard Santa Cruz Connector, it snaps directly, while for either of DE1/DE2 board, E-Gasket board is required as an inteface.

Figure 1-3. Connection of the IR Receiver Board with the UP3 1C6 Board



Please refer IR Receiver Quick Start Guide for connection to DE boards.

2. Board Components

This chapter provides operational and connectivity detail for the board's major components and interfaces. Figure 2-1. below shows the components on the board.

Figure 2-1. IR Receiver Board Components, Front View

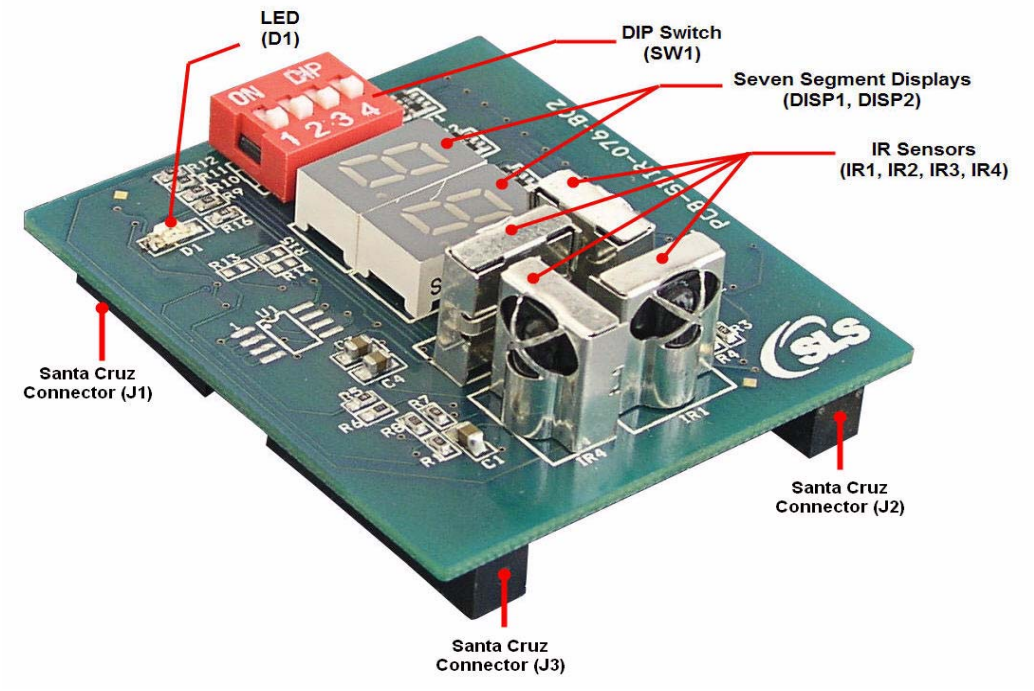


Table 2-1 lists the components on the IR Receiver board and the related interfaces.

Table 2-1. IR Receiver Board Components & Interfaces

Board Reference	Name	Description	Page
Featured Device			
IR1, IR2, IR3, IR4	IR Sensors	Used to sense the IR signals transmitted by the IR transmitter	5
User Interfaces			
Disp1, Disp2	Seven Segment Display	Used for displaying the character	7
D1	User Defined LED	Used for monitoring sensor output	8
SW1	DIP Switch	Used for external input	9
Santa Cruz Connectors			
J1, J2, J3	Santa Cruz Connectors	Female connectors used for mounting board (In this case it is IR Board) on the Development Kit having standard Santa Cruz short expansion male interface.	10

IR Sensors

The board contains 4 IR Sensors, which sense the IR signals transmitted by the IR transmitter. The board uses the TSOP1738 IR sensor which contains 3 pins and operates at 5 volts.

These sensors tune to the 38 KHz modulation frequency. PIN diode and preamplifier are assembled on the lead frame. The epoxy package is designed as IR filter. The IR filter gives demodulated output and this output signal can directly be given to the IR Receiver IP core inside the FPGA. Each sensor's directivity is 90 degree because of which four IR sensor senses the IR signal from omnidirections.

Table 2-2 displays IR Sensor signals with its type & functionality.

Table 2-2. IR Sensors Pin Table

IR Sensor Pin No.	Pin Name	Type	Description
1	VCC	VCC	+5 V Supply
2	GND	GND	Ground signal
3	VOUT	Out	Sensor Output (Active Low)

Figure 2-2. shows the IR sensors in the board schematic.

Figure 2-2. Schematic view of IR Sensors

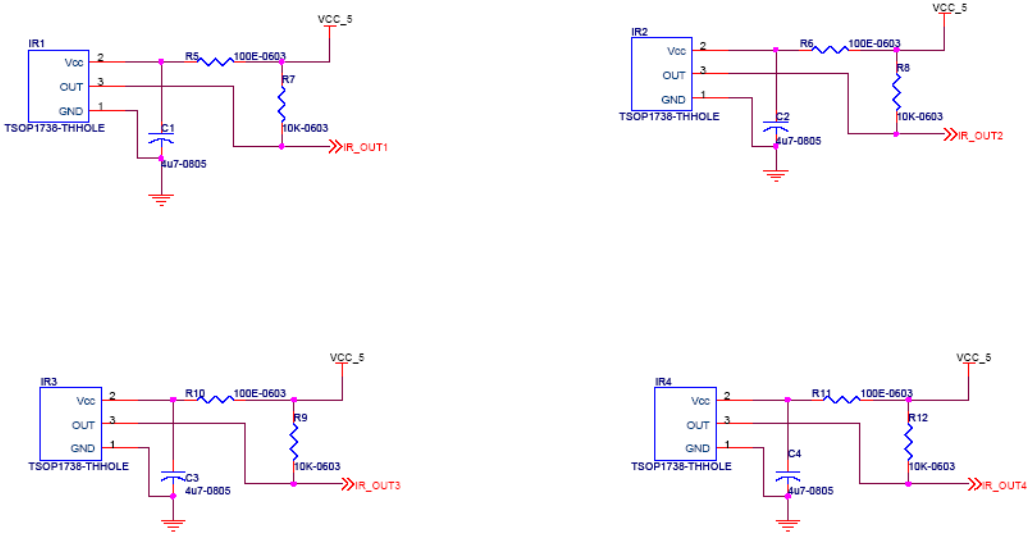


Table 2-3 shows the mapping of IR Sensor pins with header.

Table 2-3. IR Sensors Pin Mapping

IR Sensor Pin No.	IR Sensor Signal Name	Header(F) Pin No.
IR1.3	IR_OUT1	JP2.37
IR2.3	IR_OUT2	JP2.39
IR3.3	IR_OUT3	JP2.33
IR4.3	IR_OUT4	JP2.35

Seven Segment Display

The board includes two Seven Segment Displays which are used to display data.

Figure 2-3. shows the seven segment display in the board schematic.

Figure 2-3. Schematic view of Seven Segment Display

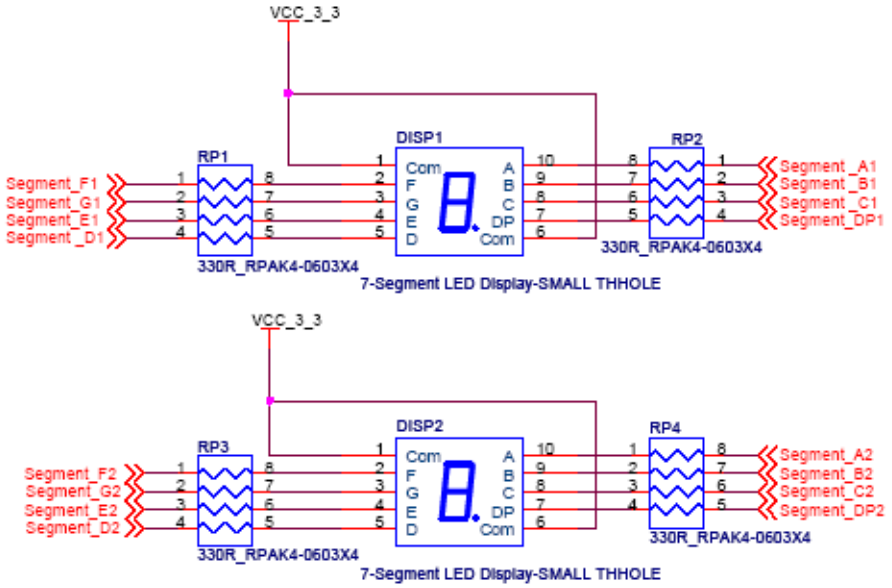


Table 2-4 shows the mapping of Seven Segment Display pins with header.

Table 2-4. Seven Segments Display Pin Mapping

Seven Segment Display Pin No.	Seven Segment Display Signal Name	Header (F) Pin No.
DISP1.10	Segment_A1	JP2.17
DISP1.9	Segment_B1	JP2.15
DISP1.8	Segment_C1	JP2.13
DISP1.5	Segment_D1	JP2.3
DISP1.4	Segment_E1	JP2.5
DISP1.2	Segment_F1	JP2.9
DISP1.3	Segment_G1	JP2.7
DISP1.7	Segment_DP1	JP2.11
DISP2.10	Segment_A2	JP2.27
DISP2.9	Segment_B2	JP2.25
DISP2.8	Segment_C2	JP2.29
DISP2.5	Segment_D2	JP1.13
DISP2.4	Segment_E2	JP1.11
DISP2.2	Segment_F2	JP2.21
DISP2.3	Segment_G2	JP2.23
DISP2.7	Segment_DP2	JP2.31

User Defined LED

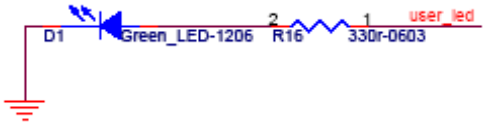
The board is provided with one user defined LED. This LED is mounted on the board with the purpose of monitoring sensor output. It can also be used for other purposes. Table 2-5 shows the mapping of User Defined LED with header.

Table 2-5. User Defined LED Pin Mapping

User Defined LED Pin No.	User Defined LED Signal Name	Header(F) Pin No.
D1	user_led	JP2.28

Figure 2-4. shows the user defined LED in the board schematic.

Figure 2-4. Schematic view of user defined LED



DIP Switch

The board includes a 4-way DIP Switch, which can be used to provide external input.

Figure 2-5. shows the DIP switch in the board schematic.

Figure 2-5. Schematic View of DIP switch

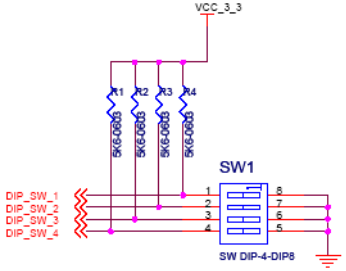


Table 2-6 shows the mapping of DIP Switch pins with header.

Table 2-6. DIP Switch Pin Mapping

DIP Switch Pin No.	DIP Switch Signal Name	Header(F) Pin No.
SW1.1	DIP_SW_1	JP1.8
SW1.2	DIP_SW_2	JP1.10
SW1.3	DIP_SW_3	JP1.12
SW1.4	DIP_SW_4	JP1.14

Santa Cruz Connector

The board provides Santa Cruz Connector as shown in Figure 2-1. Using the three (Female) Santa Cruz Connector (J1, J3, J2), the board snaps on any development board having Santa Cruz Expansion Header.

Figure 2-6. shows the Santa Cruz Connector in the board schematic.

Figure 2-6. Schematic view of Santa Cruz Connector

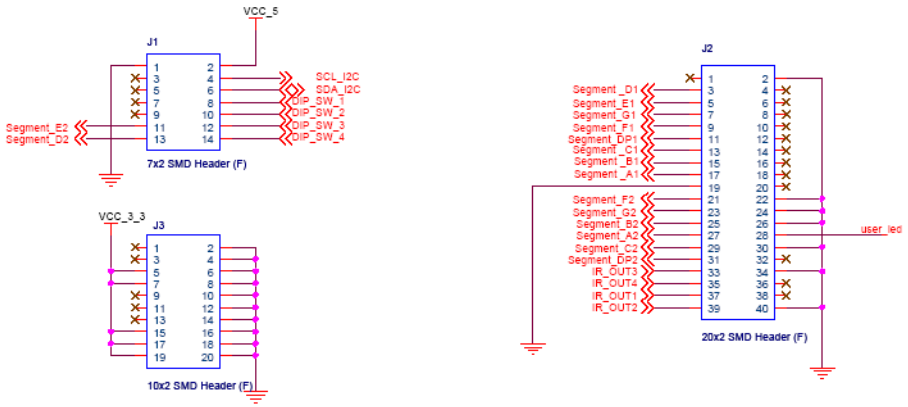
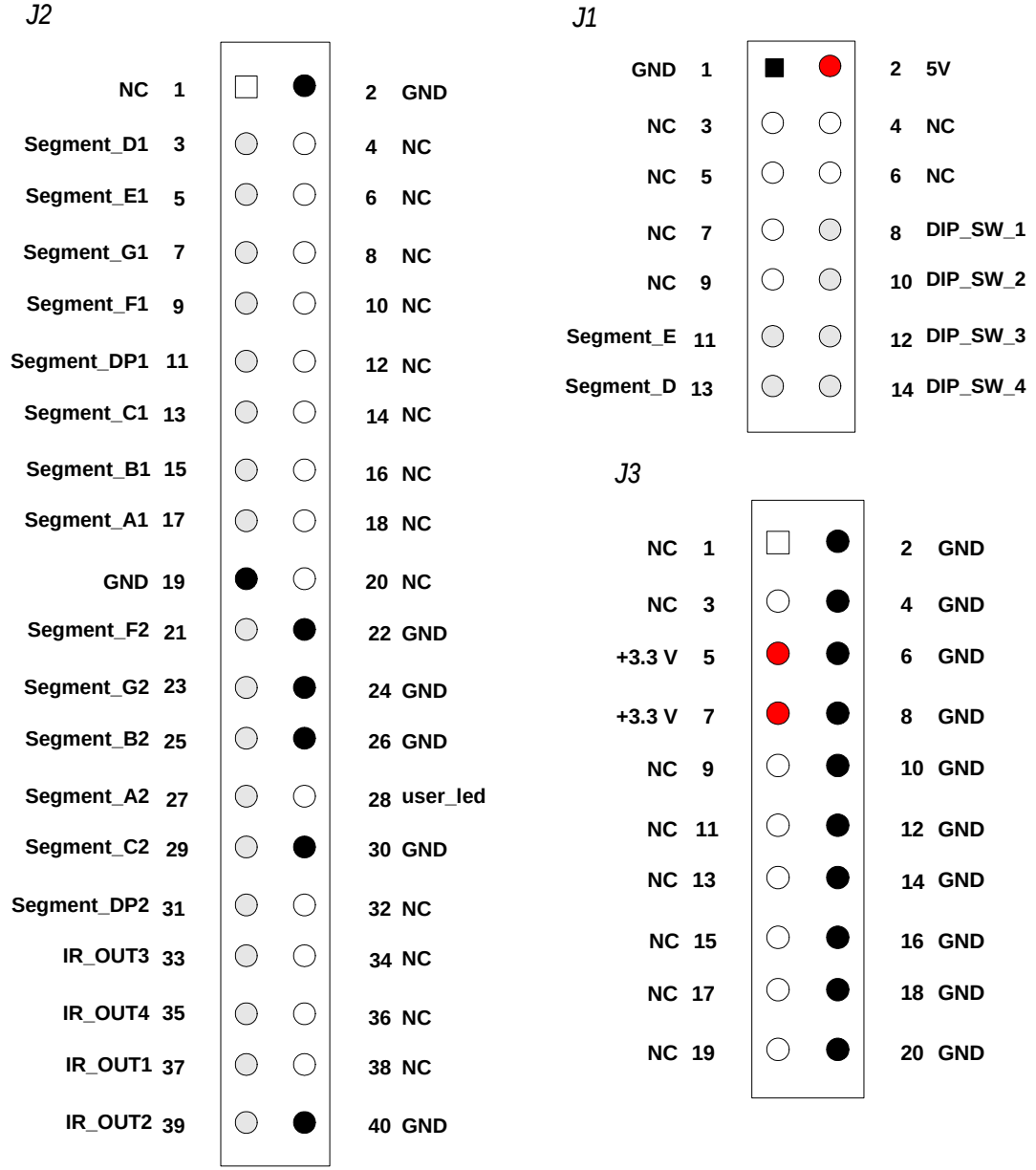


Figure 2-7. shows the Santa Cruz Connector - J1, J2, J3 pin description.

Figure 2-7. Santa Cruz Connector (F) - J1, J2, J3



3. Signal Mapping (Board Specific)

This chapter provides IR Receiver Board's components pin mapping table in order to use the board with UP3 1C6, DE1, DE2 Board.

IR Sensors

Table 3-1 shows the IR Sensors pin mapping information with UP3 1C6, DE1, DE2 Board.

Table 3-1. IR Sensors Pin Mapping (Board Specific)

IR Sensor Pin No.	IR Sensor Signal Name	UP3 FPGA Pin No.	DE1 FPGA Pin No.	DE2 FPGA Pin No.
IR1.3	IR_OUT1	PIN_174	PIN_H18	PIN_U21
IR2.3	IR_OUT2	PIN_173	PIN_N21	PIN_V25
IR3.3	IR_OUT3	PIN_203	PIN_H17	PIN_R19
IR4.3	IR_OUT4	PIN_176	PIN_G17	PIN_T19

Seven Segment Display

Table 3-2 shows the Seven Segment Display pin mapping information with UP3 1C6, DE1, DE2 Board.

Table 3-2. Seven Segments Display Pin Mapping (Board Specific)

Seven Segment Display Pin No.	Seven Segment Display Signal Name	UP3 FPGA Pin No.	DE1 FPGA Pin No.	DE2 FPGA Pin No.
Segment_A1	Segment_A1	PIN_214	PIN_C19	PIN_T23
Segment_B1	Segment_B1	PIN_213	PIN_F20	PIN_T20
Segment_C1	Segment_C1	PIN_208	PIN_D14	PIN_P24
Segment_D1	Segment_D1	PIN_217	PIN_H13	PIN_K26
Segment_E1	Segment_E1	PIN_216	PIN_G15	PIN_M23
Segment_F1	Segment_F1	PIN_206	PIN_G16	PIN_M21
Segment_G1	Segment_G1	PIN_215	PIN_E15	PIN_M20
Segment_DP1	Segment_DP1	PIN_207	PIN_F13	PIN_M25

Table 3-2. Seven Segments Display Pin Mapping (Board Specific)

Seven Segment Display Pin No.	Seven Segment Display Signal Name	UP3 FPGA Pin No.	DE1 FPGA Pin No.	DE2 FPGA Pin No.
DISP2.10	Segment_A2	PIN_202	PIN_F20	PIN_T20
DISP2.9	Segment_B2	PIN_201	PIN_E20	PIN_T21
DISP2.8	Segment_C2	PIN_205	PIN_E18	PIN_U25
DISP2.5	Segment_D2	PIN_187	PIN_B17	PIN_F26
DISP2.4	Segment_E2	PIN_188	PIN_B16	PIN_J20
DISP2.2	Segment_F2	PIN_199	PIN_D19	PIN_T25
DISP2.3	Segment_G2	PIN_200	PIN_D20	PIN_T18
DISP2.7	Segment_DP2	PIN_204	PIN_G20	PIN_U23

User Defined LED

Table 3-3 shows the User Defined LED pin mapping information with UP3 1C6, DE1, DE2 Board.

Table 3-3. User Defined LED Pin Mapping (Board Specific)

User Defined LED Pin No.	User Defined LED Signal Name	UP3 FPGA Pin No.	DE1 FPGA Pin No.	DE2 FPGA Pin No.
D1	user_led	PIN_196	PIN_E19	PIN_U26

DIP Switch

Table 3-4 shows the DIP Switch pin mapping information with UP3 1C6, DE1, DE2 Board.

Table 3-4. DIP Switch Pin Mapping (Board Specific)

DIP Switch Pin No.	DIP Switch Signal Name	UP3 FPGA Pin No.	DE1 FPGA Pin No.	DE2 FPGA Pin No.
SW1.1	DIP_SW_1	PIN_184	PIN_A15	PIN_F24
SW1.2	DIP_SW_2	PIN_183	PIN_A16	PIN_J21
SW1.3	DIP_SW_3	PIN_182	PIN_A17	PIN_F25
SW1.4	DIP_SW_4	PIN_198	PIN_A18	PIN_N18

This document is prepared as per the new revision of the IR Receiver Board (PCB-SBIR-076-B02). For users having the previous version of the board, please contact support@slscorp.com specifying the number on the PCB for any queries.

Appendix A. Signal Mapping (Board Specific)

The IR Keyboard along with the IR Receiver IP Core is provided as a deliverable with the SLS IR Receiver board that snaps on Altera standard Santa Cruz header. To create your Nios II application using the IR keyboard, you require the information about the codes that the keyboard sends out at every key press. This document provides you the information about the key codes of the IR Keyboard.

The Figure A-1. below shows the picture of IR Receiver board and the IR Keyboard.

Figure A-1. IR Keyboard with IR Receiver Board

Keys on IR Keyboard

The IR Keyboard does not follow the PS/2 protocol. It sends some code to the IR Receiver which is decoded by the IR Receiver IP core and sent to Nios which is to be controlled by the 'C' application. Therefore, at the end, the user has to handle an 8 digit key code. The table below lists the key codes for different keys on the IR keyboard.

Table A-1. IR Keyboard Key Codes

Key	Key Code	Key	Key Code	Key	Key Code
Esc	01011110	W	01000001	, or <	00110011

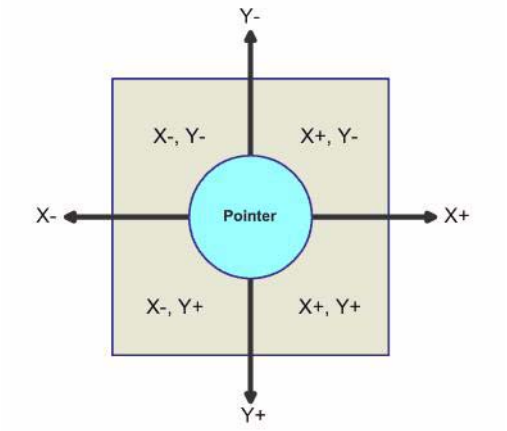
Table A-1. IR Keyboard Key Codes					
F1	01100010	E	00000001	. or >	01010011
F2	00100010	R	01110001	/ or ?	00010011
F3	01000010	T	00110001	R. Shift	00101011
F4	00000010	Y	01010001	Ctrl	01000000
F5	01110010	U	00010001	Alt	01001011
F6	00110010	I	01101001	Home(sym)	01011100
F7	01010010	O	00101001	Num	01111011
F8	00010010	P	01001001	Space	00111011
F9	01101010	[or {	00001001	Delete	01101000
F10	00101010	] or }	01111001	Insert	01111100
F11	01001010	\ or |	00111001	Page Left	00110100
F12	00001010	Caps Lock	01011001	Key Up	00000000
Print	01001000	A	00011001	Page Right	01101100
Num Lock	01111010	S	01100111	Key Left	00011100
Scroll Lock	00111010	D	00100111	Key Down	01110000
Pause/Break	01011010	F	01000111	Key Right	00101000
` or ~	00100101	G	00000111	Home	01100000
1 or !	01000101	H	01110111	Page Up	00110000
2 or @	00000101	J	00110111	Page Down	01010000
3 or #	01110101	K	01010111	End	00100000
4 or $	00110101	L	00010111	Sm. Button	00011110
5 or %	01010101	; or :	01101111	Big Button	00001110
6 or ^	00010101	‘ or “	00101111	Black	01000100
7 or &	01101101	Enter	00001111	Green	00000100
8 or *	00101101	L. Shift	01111111	Parrot	00100100
9 or (	01001101	Z	01011111	Blue	01110100
0 or)	00001101	X	00011111	Red	01101011
- or _	01111101	C	01100011	Violet	00011011
= or +	00111101	V	00100011	Sky	00010100

Table A-1. IR Keyboard Key Codes					
Backspace	00011101	B	01000011	White	00101100
Tab	01100001	N	00000011		
Q	00100001	M	01110011		

IR Keyboard Joystick

When the IR Keyboard joystick is moved in either direction, a 40 bit code is sent to the sensor on the IR Receiver board. This is then decoded by the IR IP Core into codes for X and Y directions. The Figure A-2. below shows the polarities for X and Y directions in the joystick.

Figure A-2. Polarities for X and Y directions in Joystick



Following is the example code which can be received from IR Keyboard when pointer is moved one unit in a particular X or Y direction by keeping other direction constant.

Table A-2. Example of joystick code transmitted by the keyboard					
Direction	Constant Code	X value	Pointer code sign	Y value	End bit
Up (Y-)	011111100110	00000000	110	11111111	1

Table A-2. Example of joystick code transmitted by the keyboard					
Down (Y+)	011111100110	00000000	110	10000000	1
Left (X-)	011111100110	11111111	110	00000000	1
Right (X+)	011111100110	10000000	110	00000000	1

Now to design your system with DE1, refer the tutorial “Designing IR System from Scratch for DE1” and to design your system with DE2, refer the tutorial “Designing IR Receiver System from Scratch for DE2”.

for getting started with IR Receiver board refer “IR Receiver Board Quick Start Guide”.