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EDGE Spartan6 FPGA Development Board User Manual

Introduction

EDGE Spartan6 FPGA Development board is the feature rich development board with Spartan6 FPGA, SPI FLASH, Wi-Fi, Bluetooth, ADC, DAC, LCD, 7 segment Display, VGA, PS2, Stereo Jack, buzzer, Push Button, Slide Switch, LED, Temperature Sensor and LDR. The Board also provides additional interface like CMOS Camera and TFT Display at the expansion connectors. The EDGE board provides USB JTAG interface for Programming and Debugging. It also provides USB UART interface.

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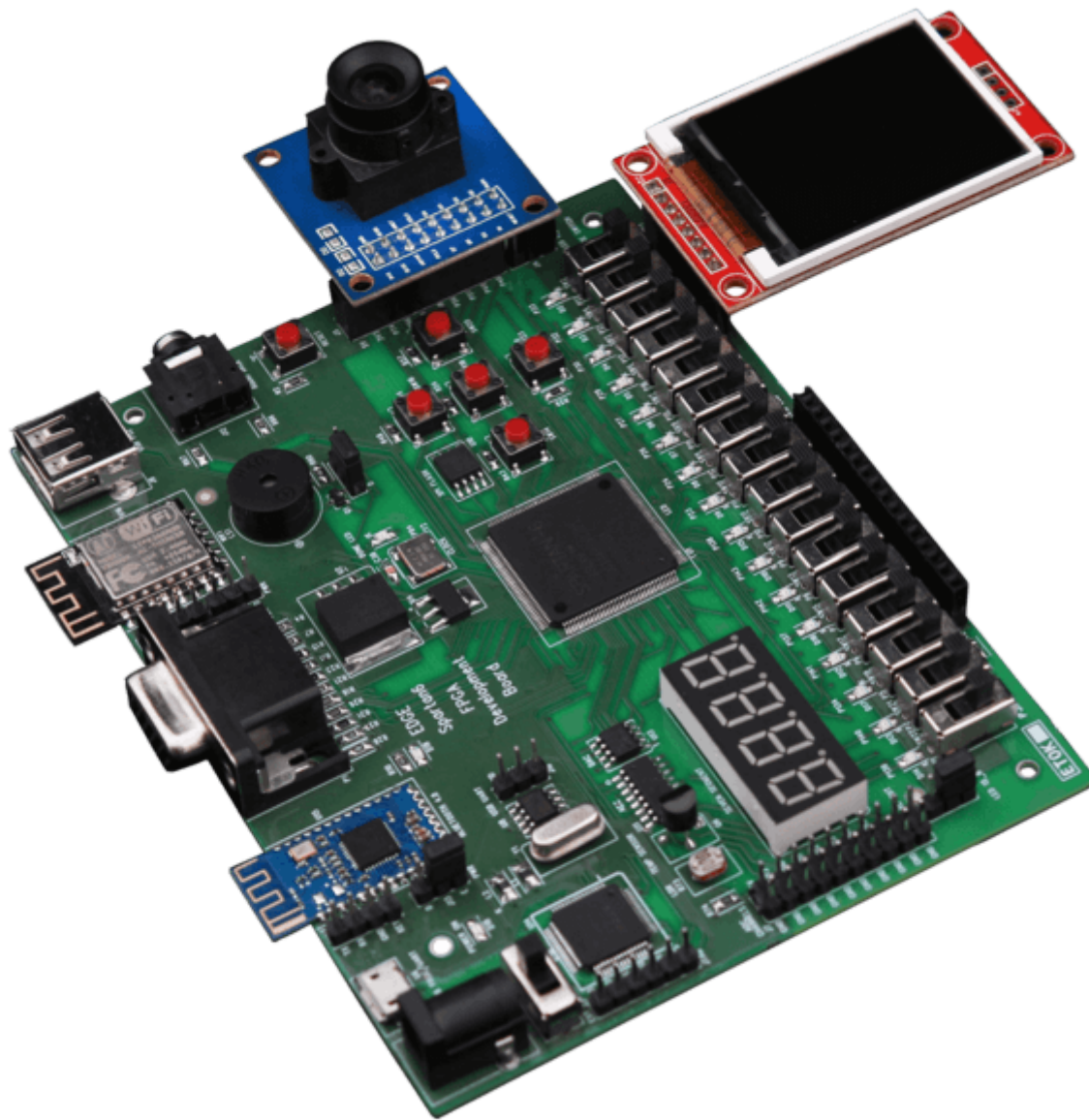
Buzzer

Clock

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20 Pin Expansion Connector / CMOS Camera Interface

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Programming EDGE Board Spartan 6 FPGA using Xilinx iMPACT

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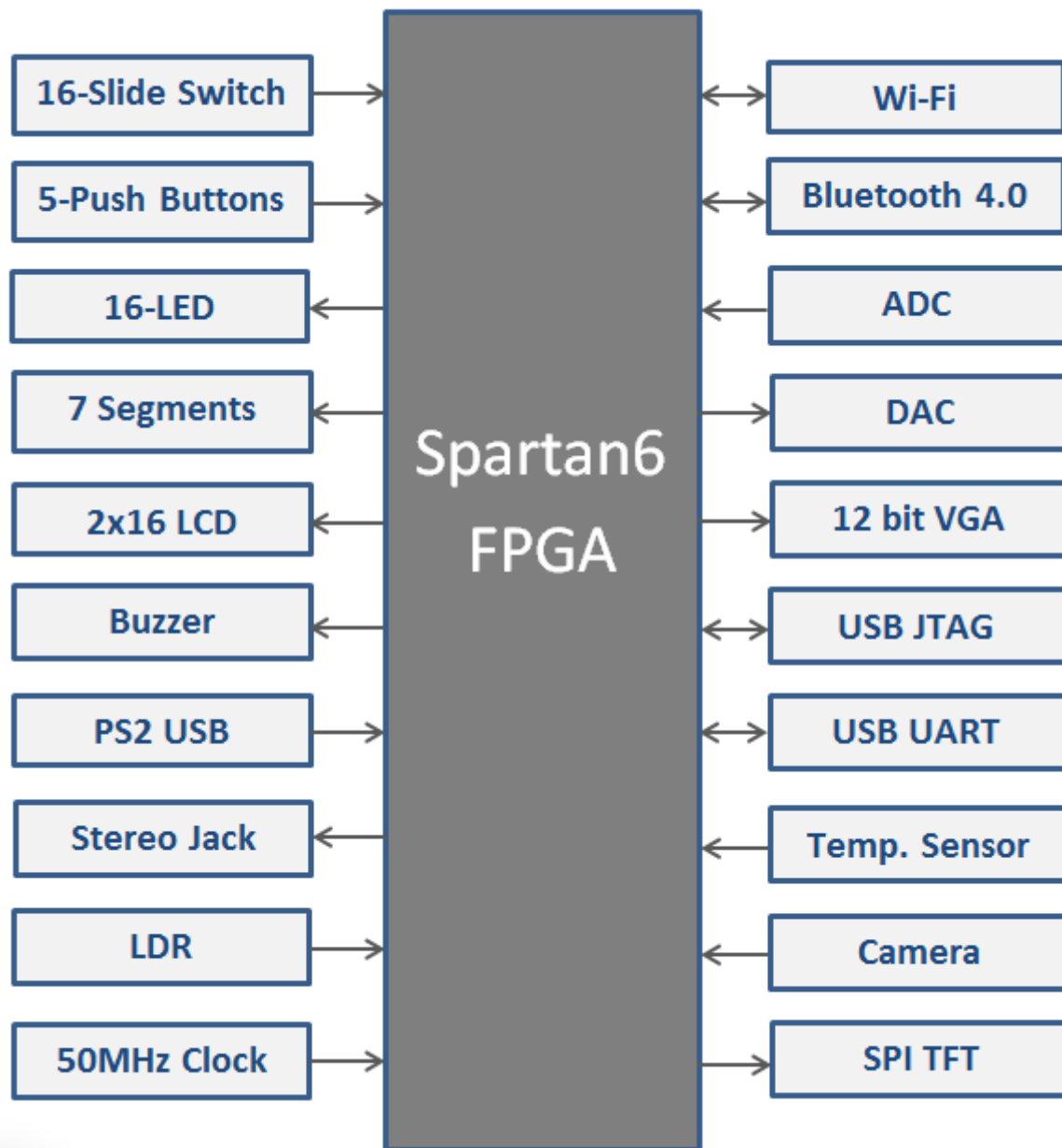
ard Applications

- Wireless control
- Environment monitor
- IoT (Internet of Things)
- Product Prototyping
- Image Processing
- Video Processing
- Audio Processing

Board Features

- Xilinx XC6SLX9 TQG144C Spartan-6 FPGA IC
- 8MB SPI FLASH Memory
- On-Board USB JTAG Programmer
- USB to UART Interface
- WIFI Interface
- Low Power Bluetooth Interface
- 12 bit VGA Interface
- 8 Channel SPI ADC
- Temperature Sensor
- LDR Interface
- SPI DAC
- 2×16 LCD Display
- 4 Digit Seven Segment Display
- 5v Buzzer
- PS2 compatible USB interface
- CMOS Camera Interface
- T Display Interface

Block Diagram of EDGE Spartan 6 FPGA Development Board

| 16-Slide Switch	Spartan6 FPGA	Wi-Fi
5-Push Buttons		Bluetooth 4.0
16-LED		ADC
7 Segments		DAC
2x16 LCD		12 bit VGA
Buzzer		USB JTAG
PS2 USB		USB UART
Stereo Jack		Temp. Sensor
LDR		Camera
50MHz Clock		SPI TFT

Power Supply

EDGE Spartan6 development board can get 5V power from either USB JTAG Port U6 or External Power Supply connector J1. Switch SW3 can be used to select the source of power from USB or External Power Supply.

Board consist of 2 Voltage regulators 3.3v and 1.2v. The Kit requires 3.3v supply for FPGA I/O and Auxiliary supply, Clock, USB Port, ADC, DAC, FLASH, and so on. The 1.2v power supply is dedicated for FPGA Core voltage.

Caution: Only 5v Supply must be provided to the board either from external source or USB connector.

Programming hardware

FPGA can be configured either from USB JTAG using Xilinx software or by on-board SPI FLASH Memory.

FPGA configured through JTAG gets erased when the power supply is removed or by pressing reset button SW1.

To store the data permanently on FPGA, we have to store the configuration bit file to SPI FLASH Memory. It automatically reconfigures the FPGA after reset or Power on.

The EDGE Spartan6 FPGA Development board is fully compatible with Xilinx ISE, EDK, System Generator and Chipscope Pro Tools at ease with on-board USB JTAG Interface.

USB UART

The EDGE Board includes FT2232 IC acts as USB UART Bridge to communicate board with windows PC COM port interface.

The UART Transmitter and Receiver lines of FTDI chip is directly connected to the Spartan6 FPGA I/O pins for USB UART Communication.
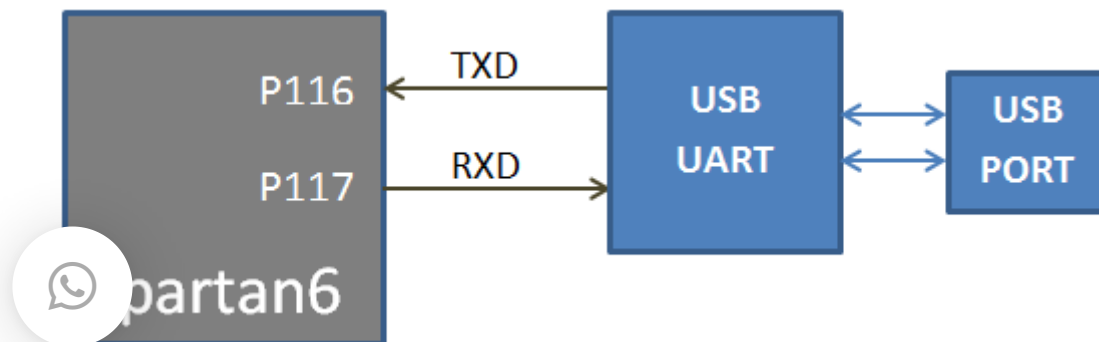
WIFI Communication

The EDGE Board contains On-board ESP8266 12F WIFI Module connected with Spartan6 FPGA through serial interface. The ESP WIFI Modem helps to communicate FPGA with cloud. The Data can be stored and retrieved from the cloud with the help of AT Commands. The range of communication for WIFI modem is 50 – 100 meter distance.
Note: To enable power supply to the WIFI Modem, place jumper at Enable and centre pin of J11. To disable power, place jumper at Disable and centre pin of J11.
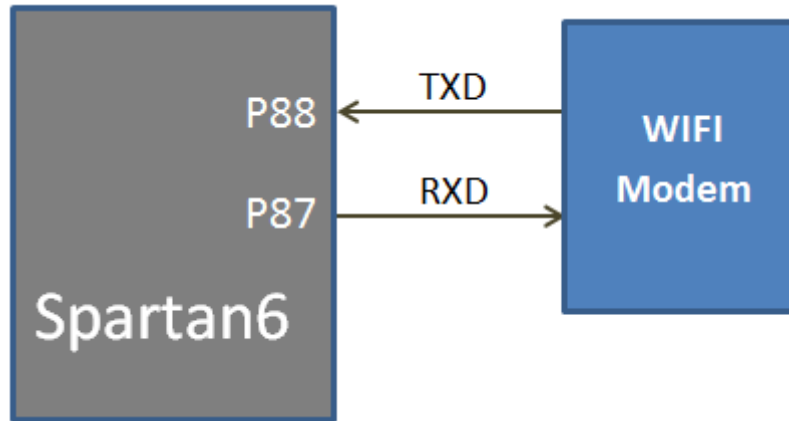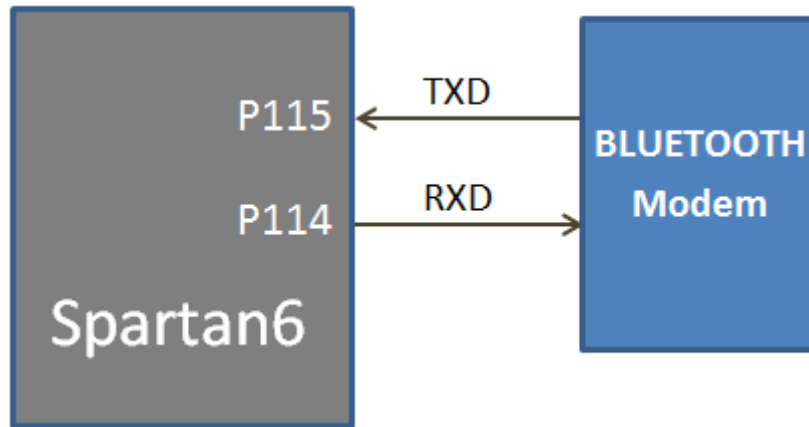

Bluetooth Communication

The EDGE contains low power Bluetooth 4.0 BLE interface on-board. The Bluetooth is serially interfaced with FPGA with Transmit and Receive lines.
Note: To enable power supply to the Bluetooth Modem, place jumper at Enable and centre pin of J13. To disable power, place jumper at Disable and centre pin of J13.
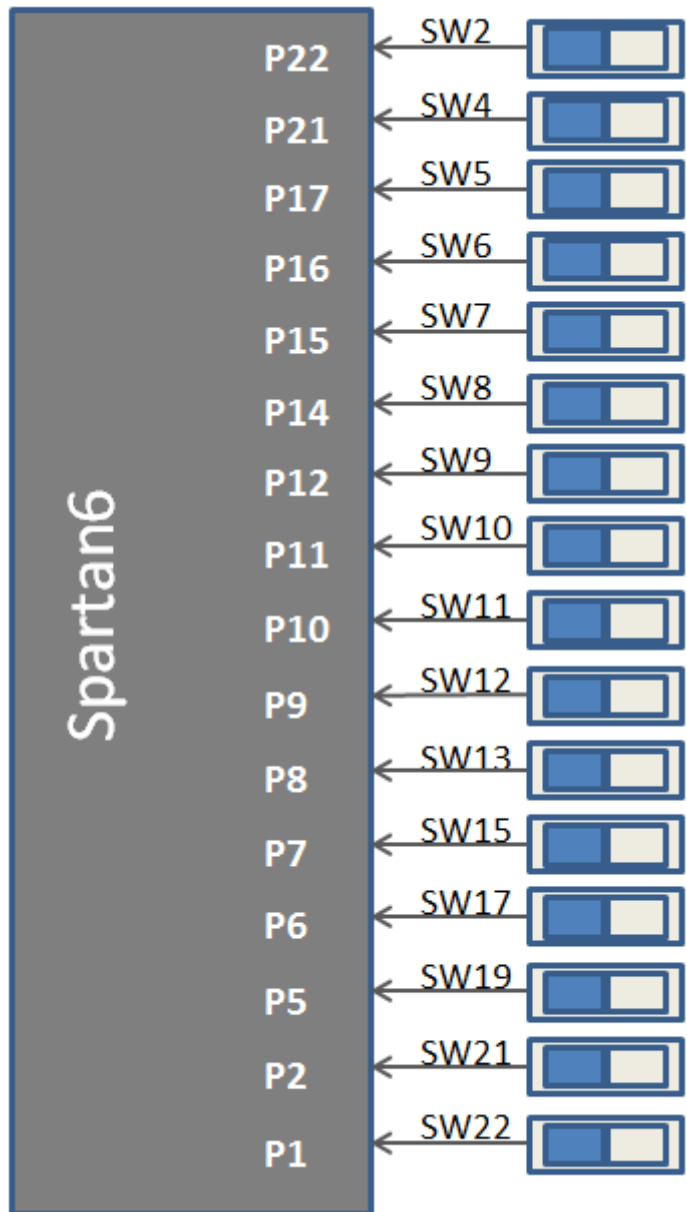
Slide Switches

The EDGE board includes 16 SPDT slide switches for digital input. These digital inputs are connected to Spartan6 FPGA through resistors for protection against short circuit. Slide switch outputs constant high or constant low based on the user changing its position.

Spartan6

Pin	Switch
P22	SW2
P21	SW4
P17	SW5
P16	SW6
P15	SW7
P14	SW8
P12	SW9
P11	SW10
P10	SW11
P9	SW12
P8	SW13
P7	SW15
P6	SW17
P5	SW19
P2	SW21
P1	SW22

sh Buttons

The Board contains 5 Push buttons for providing momentary digital inputs. They are connected to FPGA lines through resistors to prevent short circuit. By default the switch is in Active low. When the user pressed the push button they are driven high.
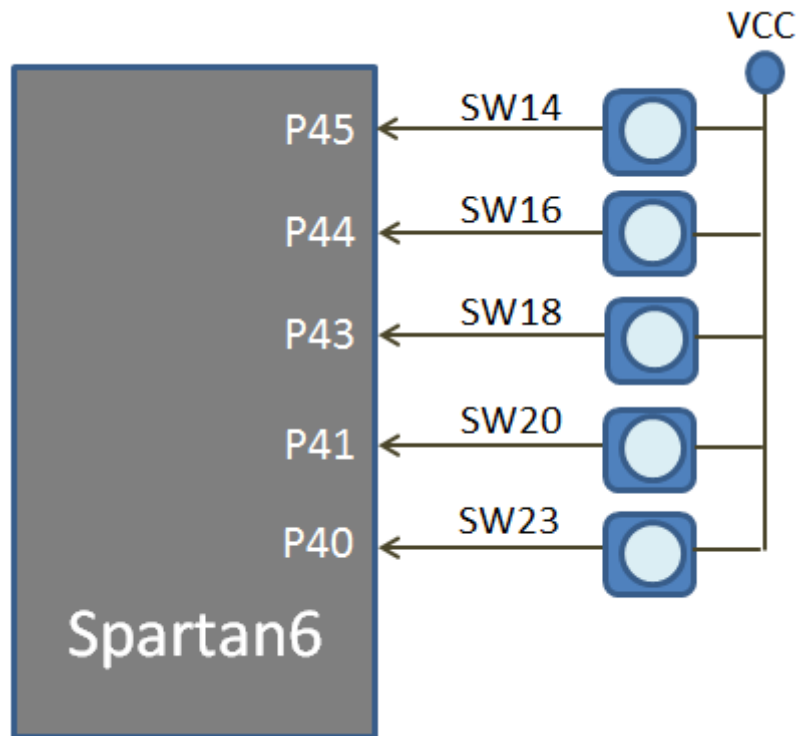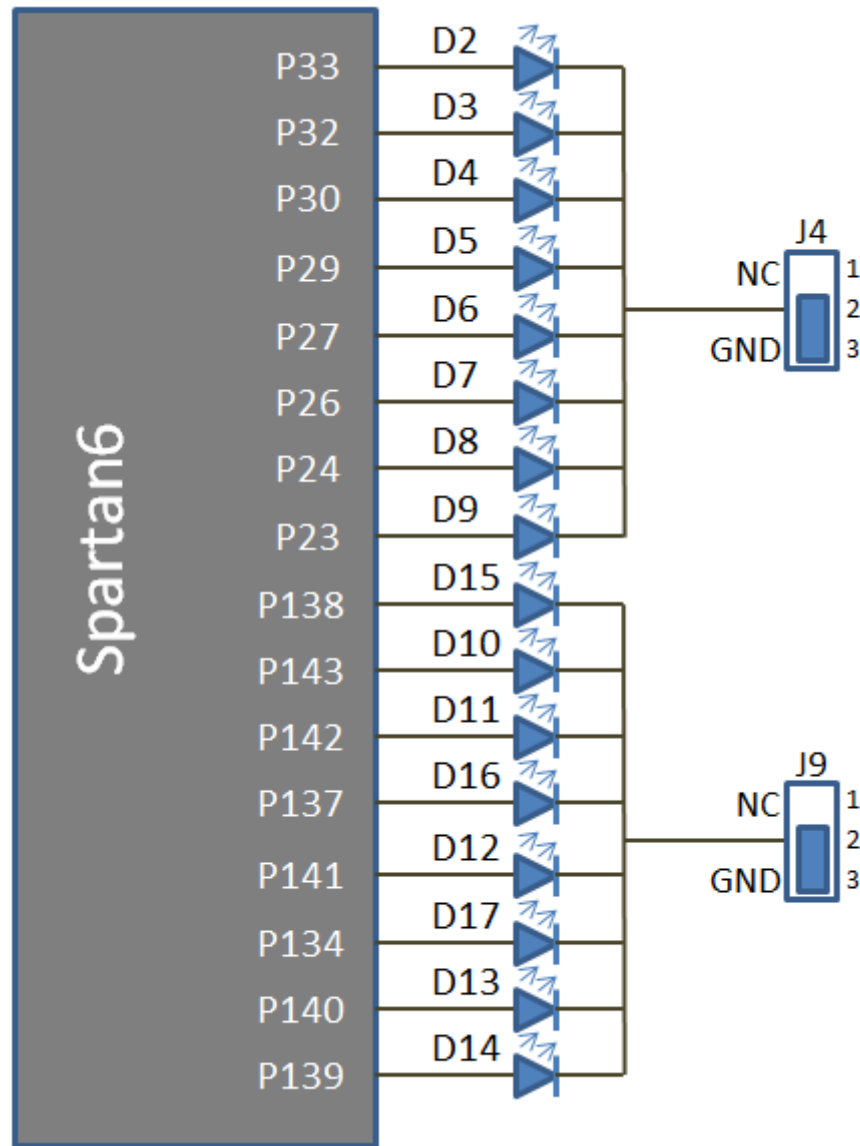

LEDs

The Kit consists of 16 LEDs for displaying digital outputs. These LED's are connected with FPGA through a series resistor. Logic High signal turns ON LED and Logic Low signal turns OFF LED to demonstrate the digital output.
Note: To enable LEDs, Jumper needs to be placed at ground position at J4 and J9.
The J4 connector enables LEDs D2 to D9.
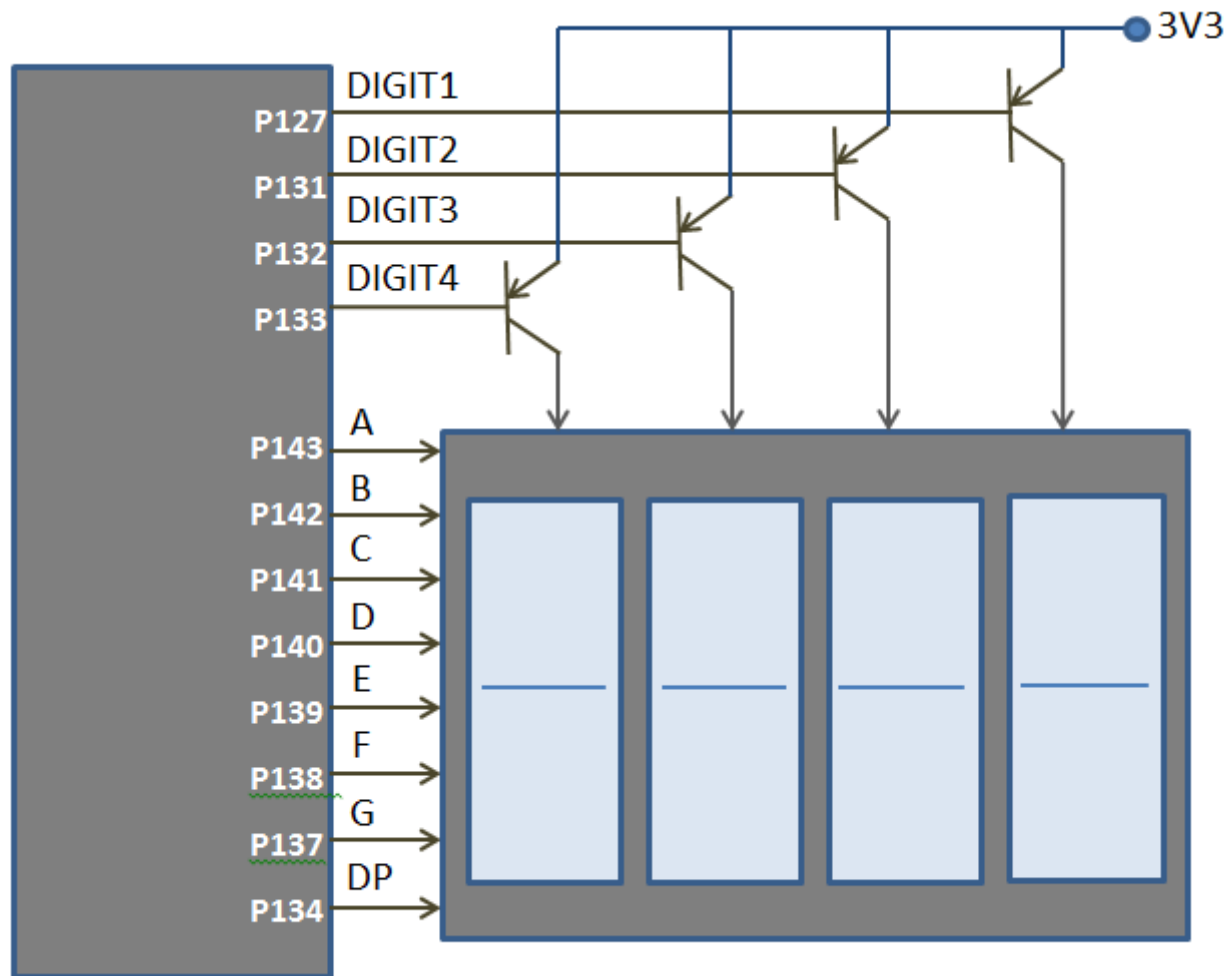J9 connector enables LEDs D10 to D17.

Seven segment Display

EDGE Board consist of 4 digit 7 segment displays with common anode. Each of the seven segment contains LEDs can be turned on by sending active low signal.
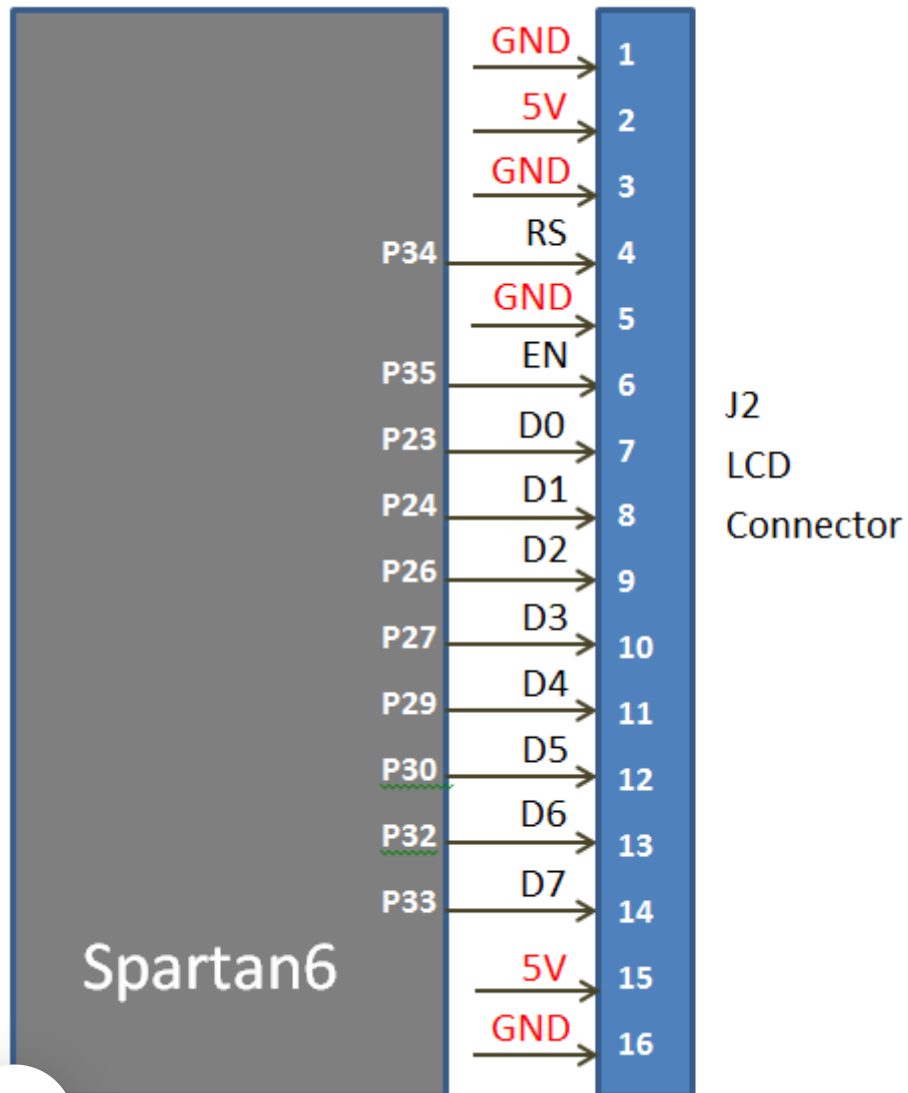
For example, to display digit 8 in the seven segments display. All the segments are enabled using active low '0' signal.

16 LCD

The EDGE board consist of 2×16 LCD interface at the female connector J2. LCD displays is interfaced in the 8 bit data mode, RS pin are used to select data/command mode and En are used to enable the LCD.

Note: R/W pin is connected to ground to keep LCD in always write mode.

Spartan6		J2 LCD Connector
	GND	1
	5V	2
	GND	3
P34	RS	4
	GND	5
P35	EN	6
P23	D0	7
P24	D1	8
P26	D2	9
P27	D3	10
P29	D4	11
P30	D5	12
P32	D6	13
P33	D7	14
	5V	15
	GND	16

SPI ADC

The EDGE board contains Microchip MCP3208 8-channel 12-bit SPI ADC. ADC is connected to FPGA through 4 SPI lines. The SPI signals are Serial Clock, Data in, Data out, chip select.

Input Analog signal to ADC channel Ch0 – Ch5 are provided at male connector J7.

Light Detect Resistor LDR is connected at the ADC channel Ch6. LDR provides variable resistance based on the light intensity that falls upon it.

Temperature Sensor LM35 is connected at the ADC channel Ch7.

Refer MCP3208 Datasheet to learn more about its working.
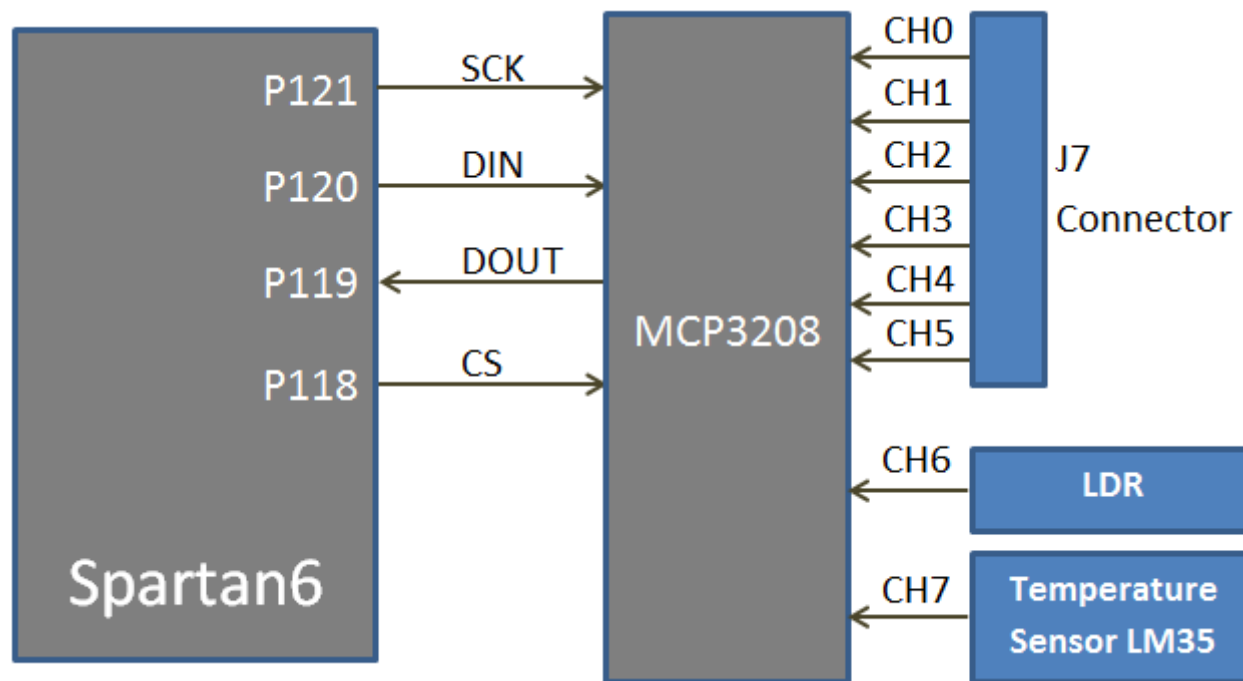
SPI DAC

The EDGE Board consist of Microchip MCP4921 SPI DAC to perform digital to analog conversion. The output is available at the male connector J7.
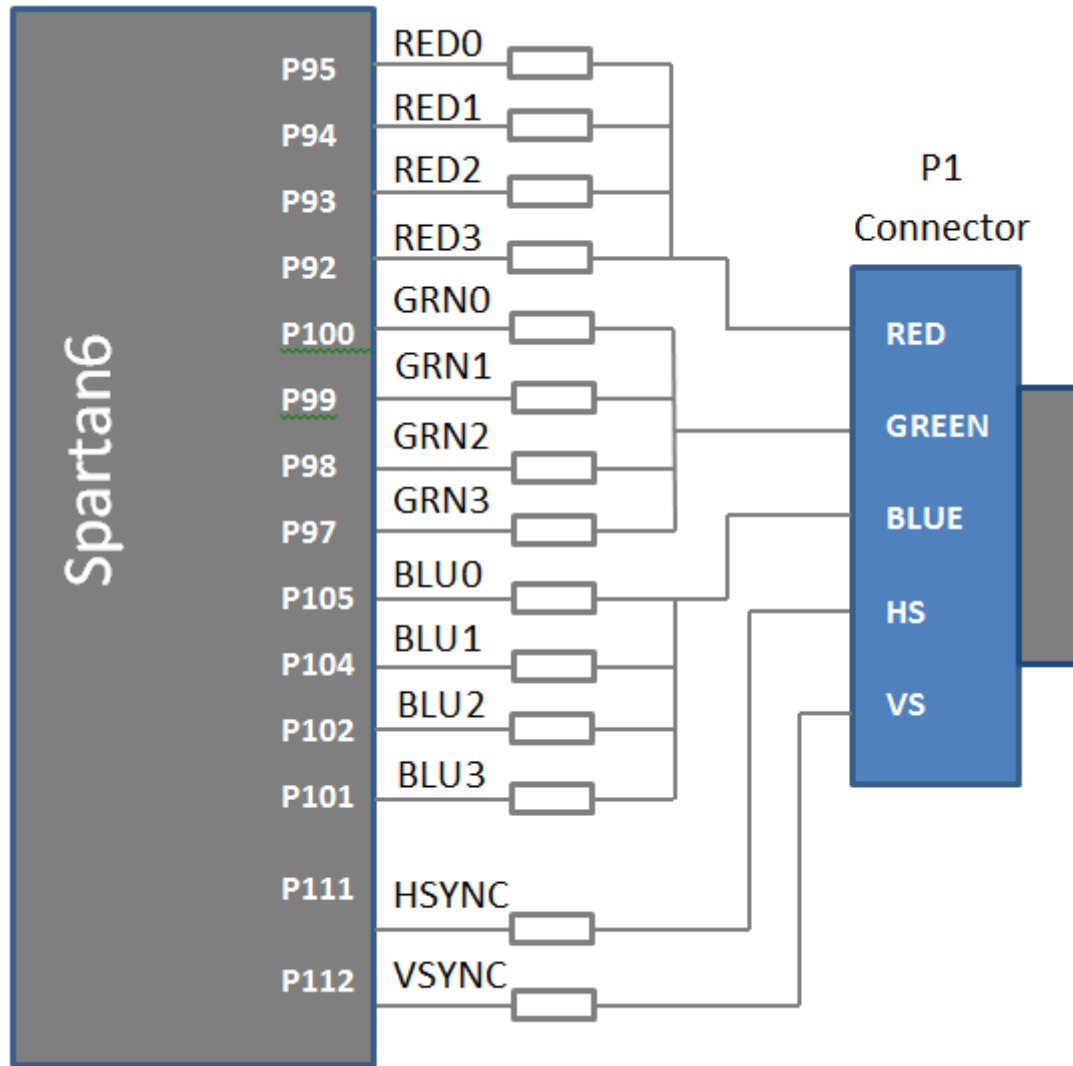
SPI interface provides Serial clock, Data input and chip select to FPGA with DAC. Spartan6 FPGA act as master and MCP4921 act as slave device.
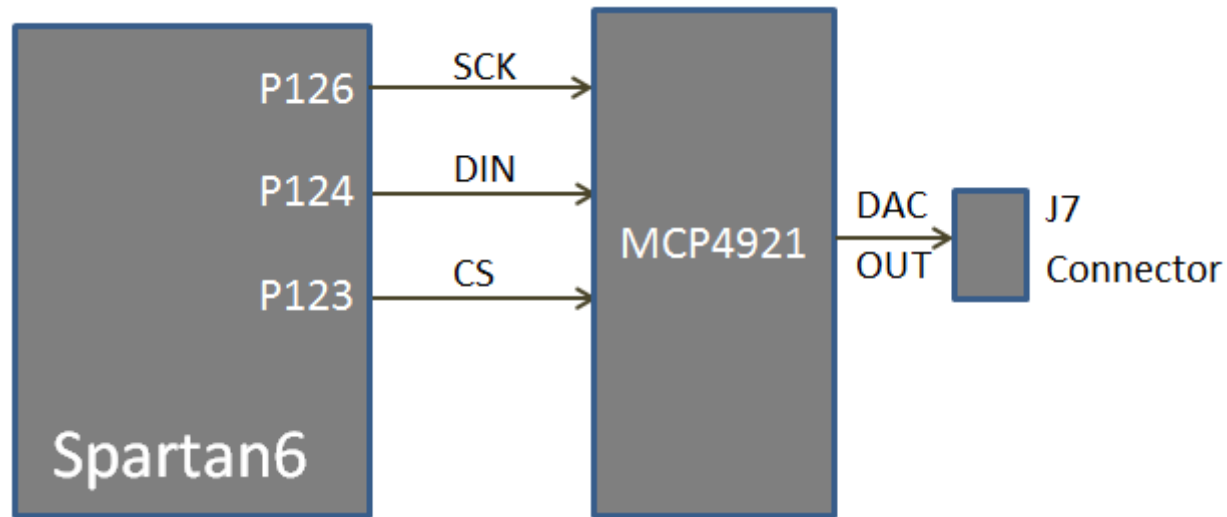
VGA

The EDGE Board contains 12 bit VGA interface to generate VGA signals from FPGA and display the output in the VGA monitor. The 12 bit VGA output the depth of 4096 colours in the Monitor. Series resistors are used to construct DAC to implement VGA interface.

Spartan6

Pin	Signal
P95	RED0
P94	RED1
P93	RED2
P92	RED3
P100	GRN0
P99	GRN1
P98	GRN2
P97	GRN3
P105	BLU0
P104	BLU1
P102	BLU2
P101	BLU3
P111	HSYNC
P112	VSYNC

P1 Connector

RED
GREEN
BLUE
HS
VS

PS2

EDGE board contains PS2 interface connected with FPGA through clock and data lines. PS2 interface is directly provided in SB connector. Only USB keyboard reverse compatible with ps2 connector work on this port.
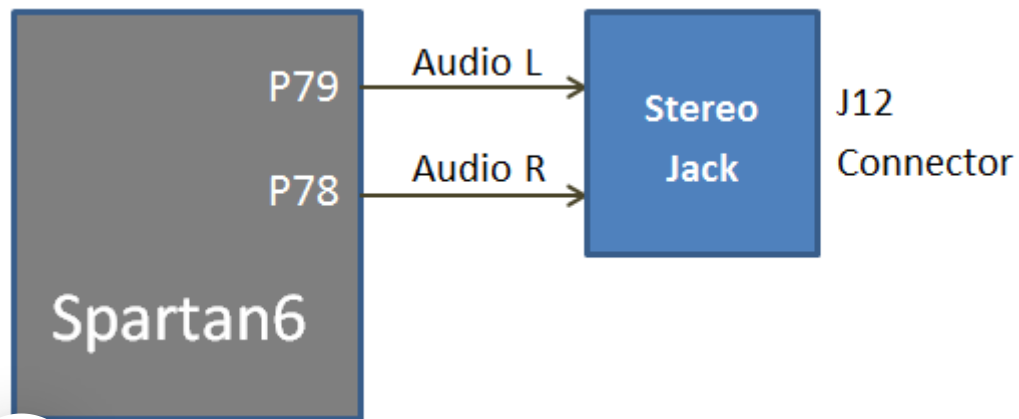
Note: 3.3v supply is provided to the PS2 interface to prevent over voltage on FPGA I/O lines.
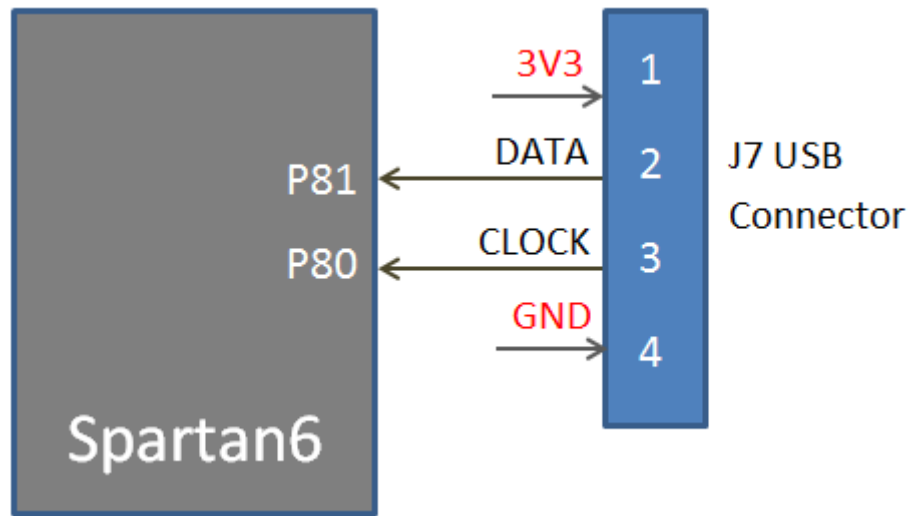
Stereo Jack

Stereo Audio Jack with low pass filter is connected on the FPGA I/O lines on the EDGE Board. Stereo Jack provides delta sigma audio output.


Buzzer

The Edge board contains piezo buzzer interface with FPGA through transistor. 5v Buzzer is used provide alert tone. Buzzer's resonant frequency is 3.8 kHz (where you can expect its best performance).

Note: To enable Buzzer, place jumper at Enable and centre pin of J6. To disable power, place jumper at Disable and centre pin of J6.
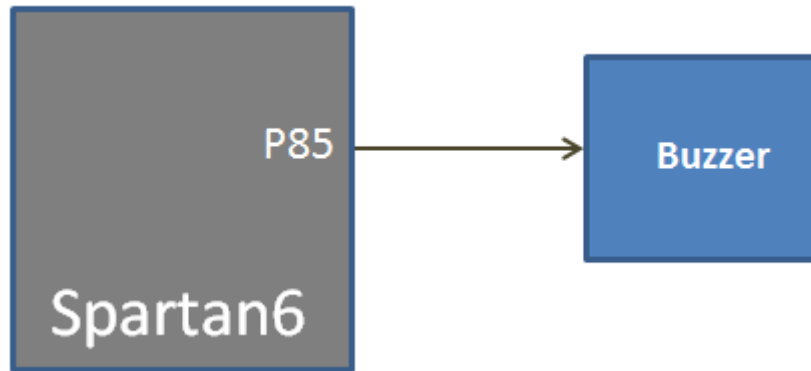

Clock

The Edge board contains 50 MHz Oscillator to provide clock input to the FPGA. The input clock can drive any or all of the four clock management tiles in the Spartan-6. Each tile includes two Digital Clock Managers (DCMs) and four Phase-Locked Loops (PLLs).
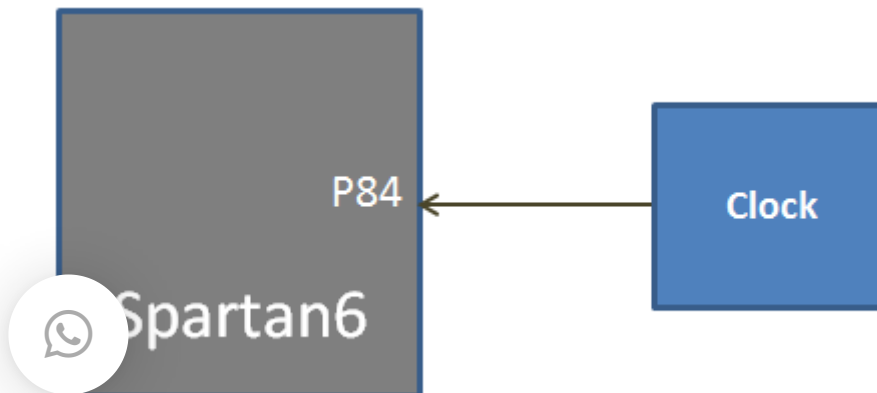
TFT Display

The EDGE Board contains TFT display interface at the J14 connector. TFT display communicates with FPGA through SPI protocol. SPI TFT is made of ST7732S SPI controller with 160×128 Display .
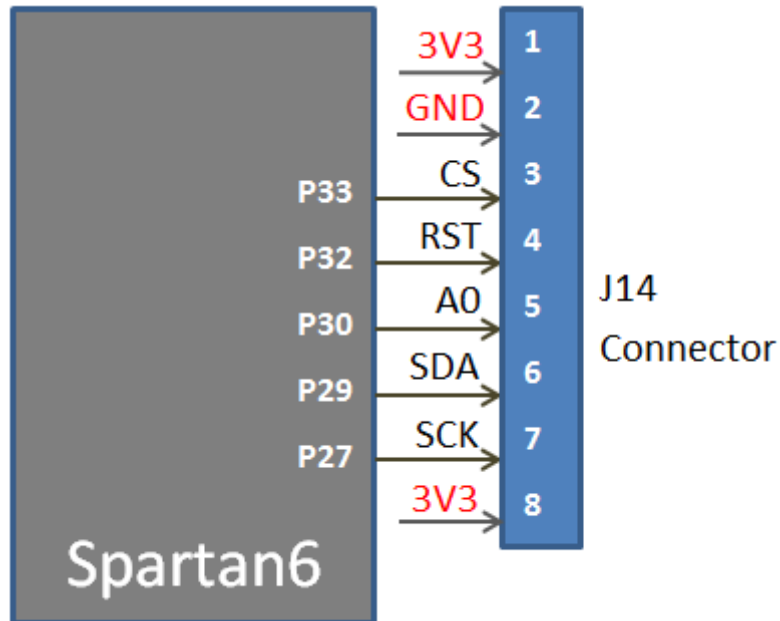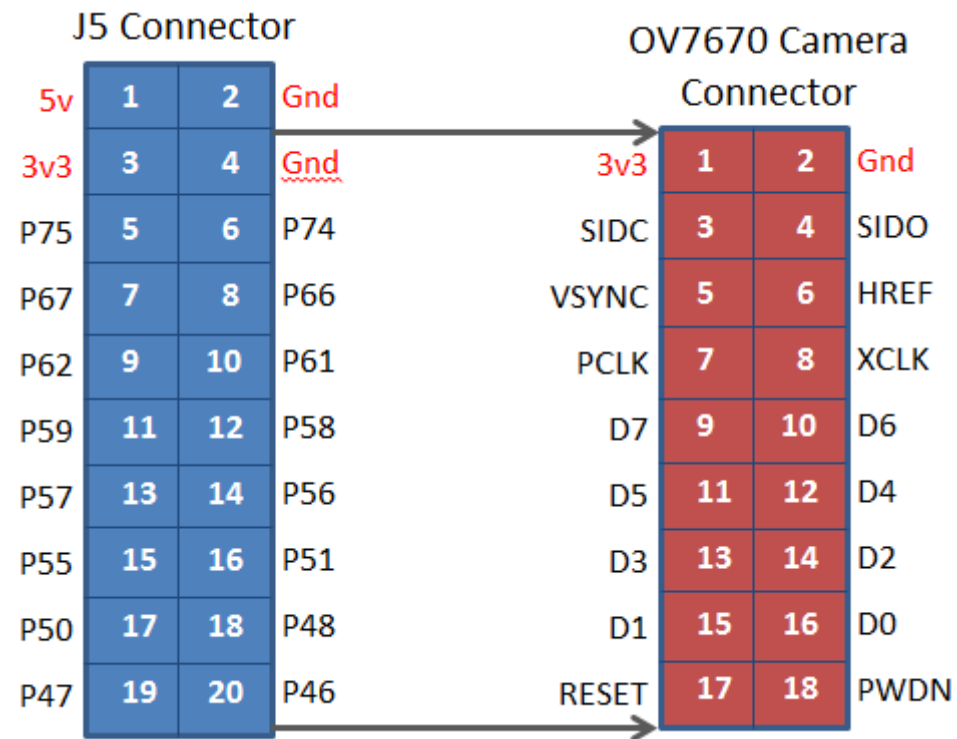

20 Pin Expansion Connector / CMOS Camera Interface

Expansion connector J5 provides 16 I/O lines from spartan6 FPGA to the external interface.
Note: To interface OV7670 CMOS Camera with EDGE Board. Leave pin1 and pin2 unconnected. Connect pin3 of expansion connector to pin1 of CMOS Camera.

J5 Connector

5v	1	2	Gnd
3v3	3	4	Gnd
P75	5	6	P74
P67	7	8	P66
P62	9	10	P61
P59	11	12	P58
P57	13	14	P56
P55	15	16	P51
P50	17	18	P48
P47	19	20	P46

OV7670 Camera Connector

3v3	1	2	Gnd
SIDC	3	4	SIDO
VSYNC	5	6	HREF
PCLK	7	8	XCLK
D7	9	10	D6
D5	11	12	D4
D3	13	14	D2
D1	15	16	D0
RESET	17	18	PWDN

Driver Installation

Step1: Download and install virtual com port USB Driver for FTDI Chip.
http://www.ftdichip.com/Drivers/VCP.htm

Step2: Install driver by right click downloaded file and run as administrator

Step3: Connect Micro USB cable to FPGA kit U2 Port and another end to PC USB Port.

Step4: Open Device Manager. There are 2 other devices detected without drivers as shown in figure.
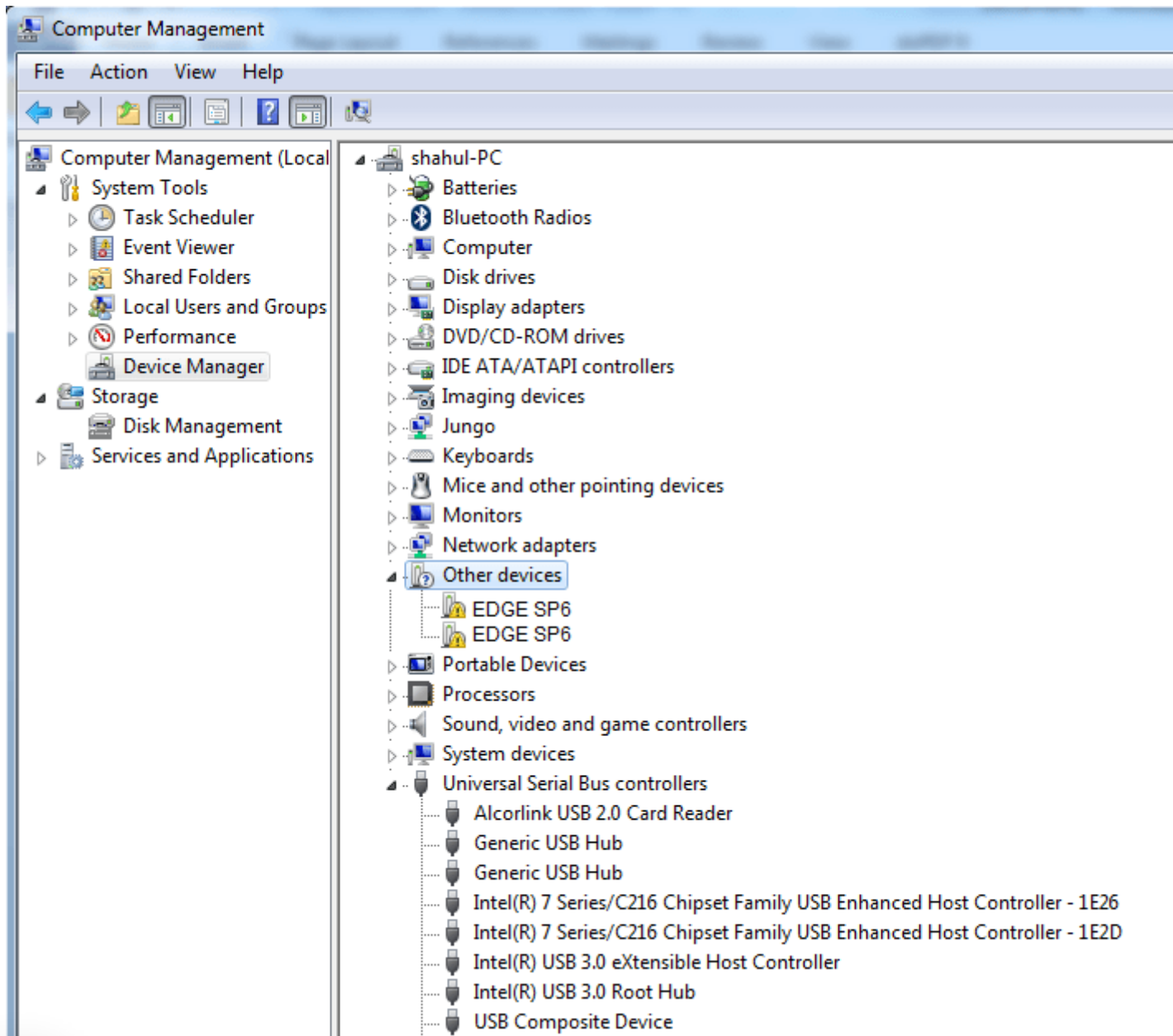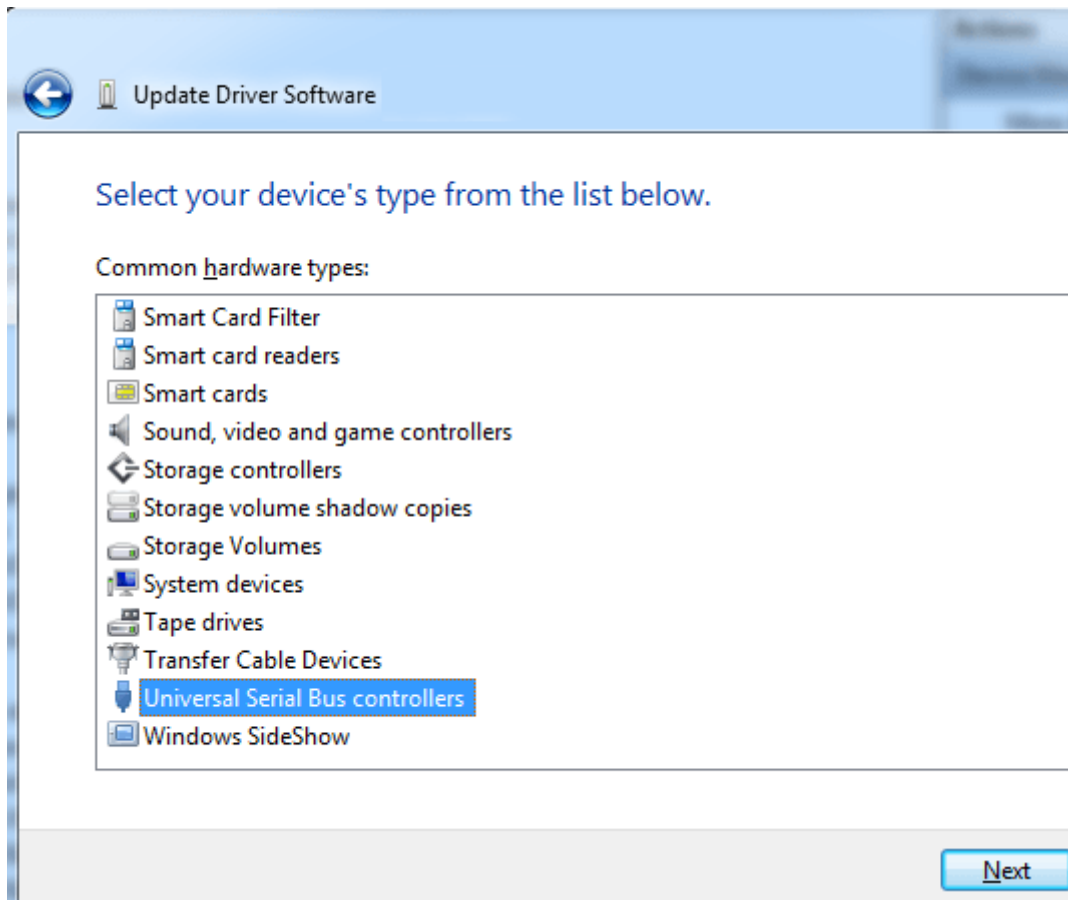
5: Right Click on the first unknown device and select update driver.
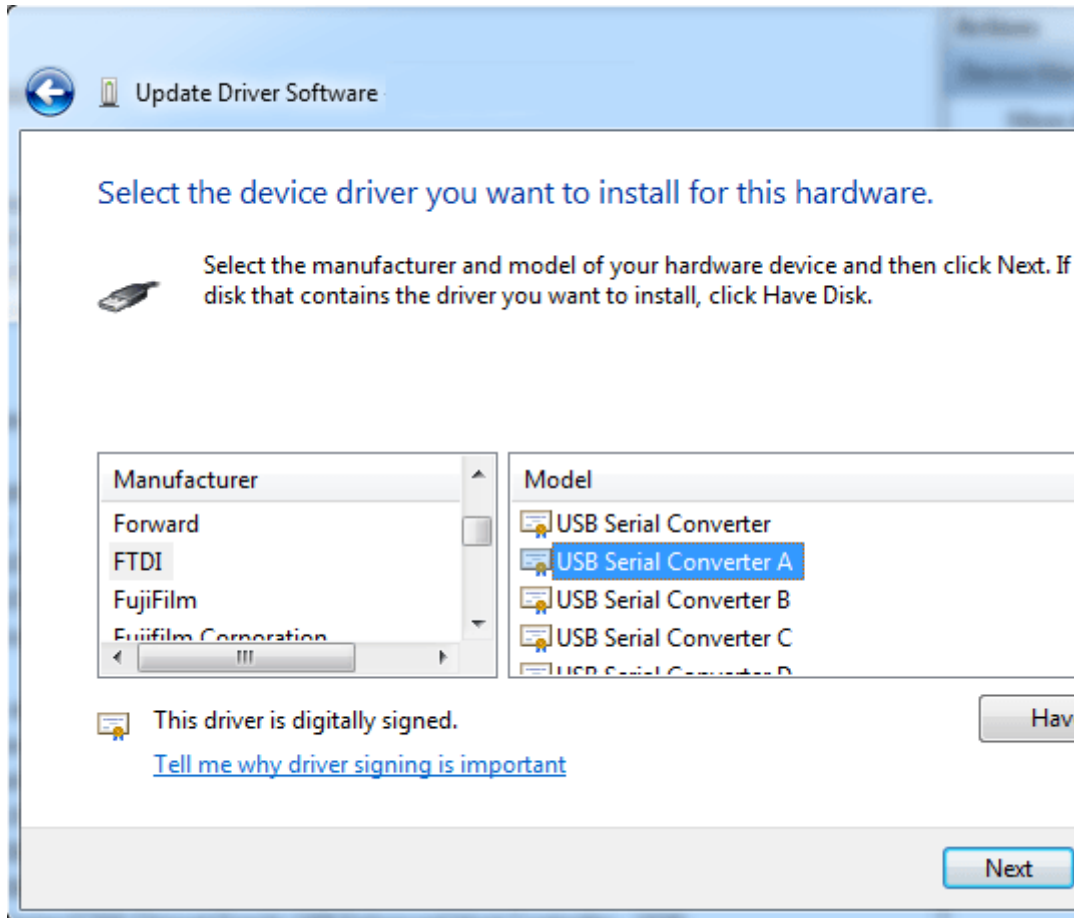Now select let me pick from the list of device drivers from my computer as shown below.
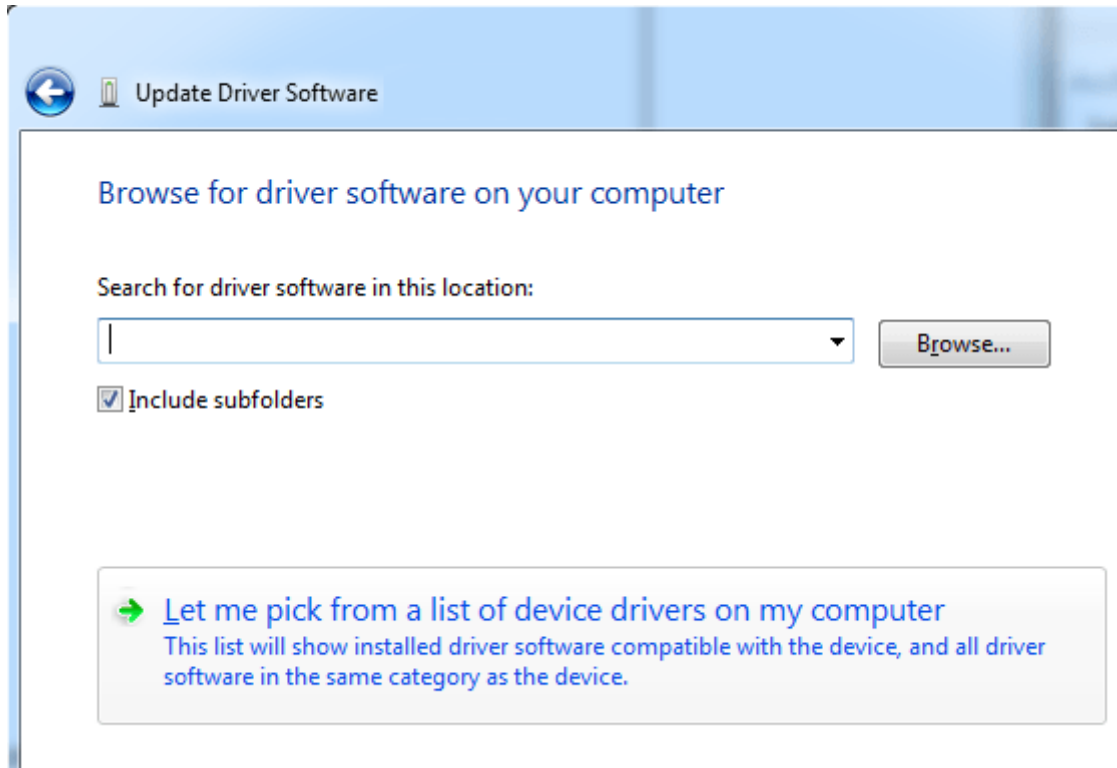
Step6: Now Select USB Serial Bus Controllers and click next.

Step7: Select FTDI under manufacturer and select USB Serial converter A under model. (If multiple driver with Serial converter A present select latest version)

Update Driver Software

Select the device driver you want to install for this hardware.

Select the manufacturer and model of your hardware device and then click Next. If y
disk that contains the driver you want to install, click Have Disk.

Manufacturer	Model
Forward	USB Serial Converter
FTDI	USB Serial Converter A
FujiFilm	USB Serial Converter B
Fujifilm Corporation	USB Serial Converter C
	USB Serial Converter D

This driver is digitally signed.

Tell me why driver signing is important

Have

Next

Step8: Repeat step 5 to step 7 for second unknown device. On step 7 select USB Serial Converter B instead A.
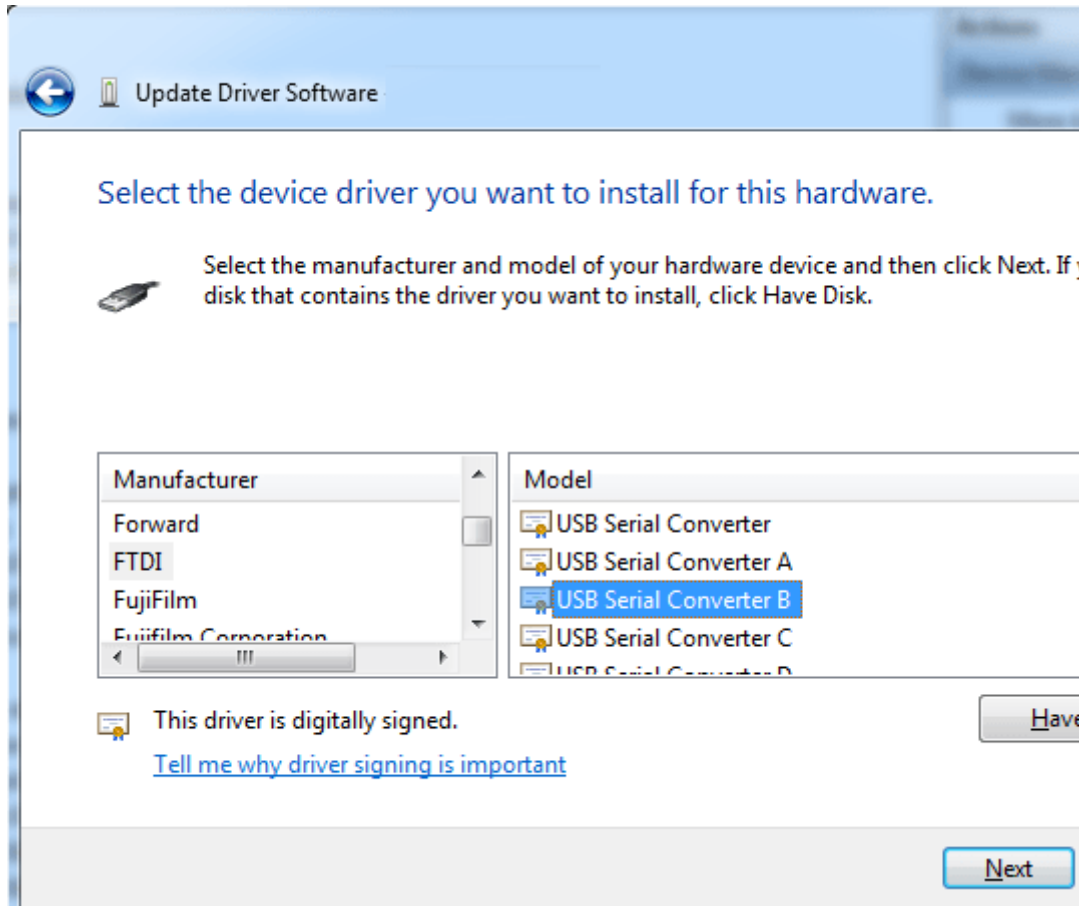
Step9: Now both USB Serial Convertor A and USB Serial Convertor B are detected under USB Controllers. But there another driver needs to be installed for USB Serial Port.

```
▷ ⌨ Keyboards
▷ 🖰 Mice and other pointing devices
▷ 🖥 Monitors
▷ 📶 Network adapters
◢ 📇 Other devices
     ⚠ USB Serial Port
▷ 📱 Portable Devices
▷ 🖳 Processors
▷ 🔊 Sound, video and game controllers
▷ 🖥 System devices
◢ 🔌 Universal Serial Bus controllers
     🔌 Alcorlink USB 2.0 Card Reader
     🔌 Generic USB Hub
     🔌 Generic USB Hub
     🔌 Intel(R) 7 Series/C216 Chipset Family USB Enhanced Host Controller - 1E26
     🔌 Intel(R) 7 Series/C216 Chipset Family USB Enhanced Host Controller - 1E2D
     🔌 Intel(R) USB 3.0 eXtensible Host Controller
     🔌 Intel(R) USB 3.0 Root Hub
     🔌 USB Composite Device
     🔌 USB Composite Device
     🔌 USB Root Hub
     🔌 USB Root Hub
     🔌 USB Serial Converter A
     🔌 USB Serial Converter B
```

Step10: To install USB Serial Port, Right click and select update drive. Now select Browse computer for driver software and select let me pick from the list of device drivers from my computer as shown below.

Step11: Select Ports option and click next.
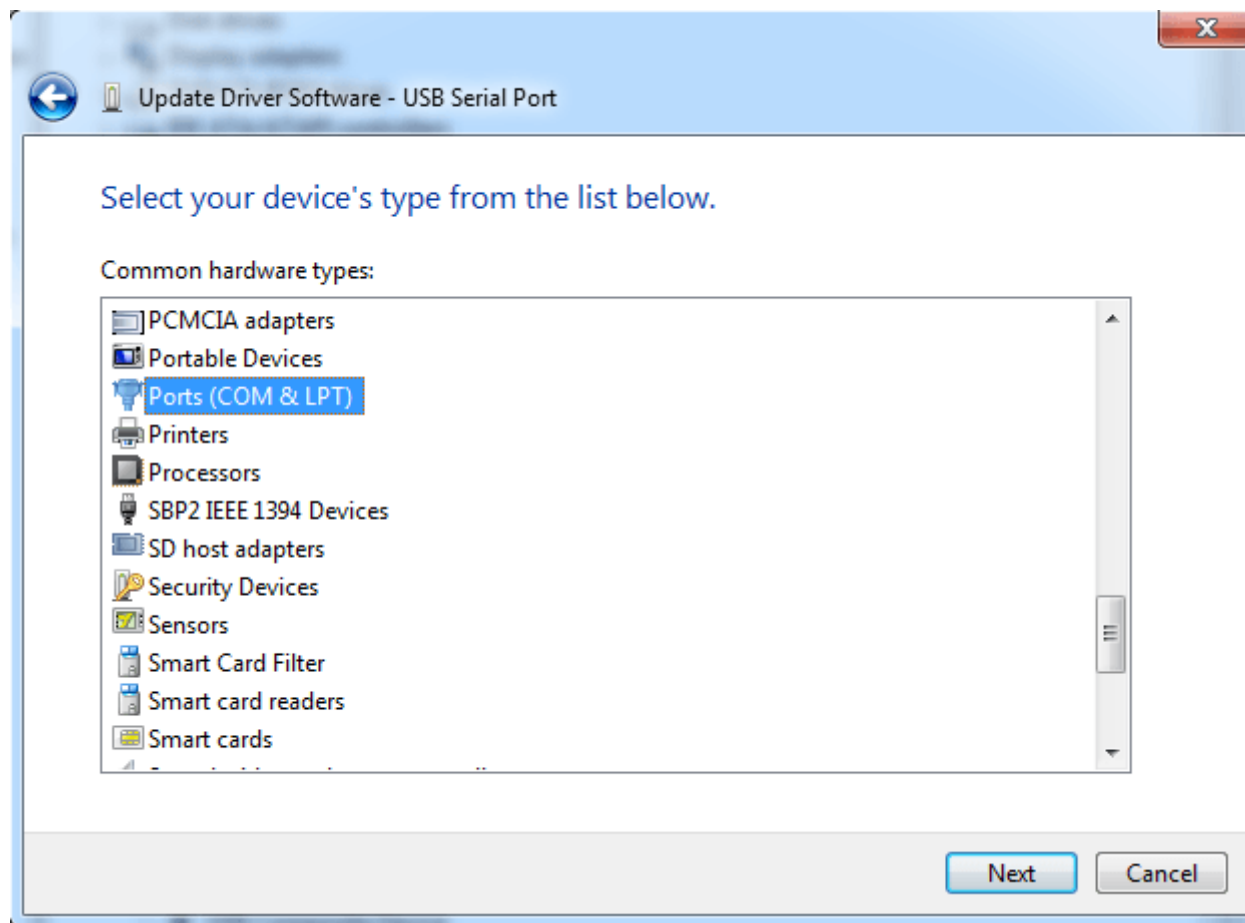
Step12: Select FTDI under manufacturer and Select USB Serial Port under Model.

Manufacturer	Model
FTDI	USB Serial Port Version: 2.12.0.0 [26-08-2014]
Gadget Factory (www.gadgetfact	USB Serial Port Version: 2.12.24.0 [28-09-2016]
Hewlett Packard	USB Serial Port Version: 2.12.28.0 [16-08-2017]
Microsoft	USB Serial Port Version: 2.8.28.0 [18-01-2013]

This driver is digitally signed.
Tell me why driver signing is important

Have

Next
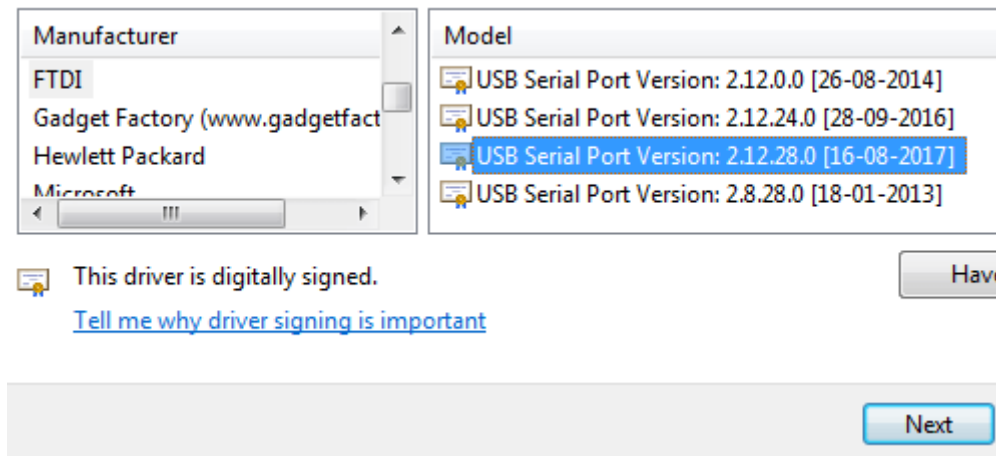
Step13: Now Drivers are installed and devices are detected under Ports and USB Controllers section.

Ports (COM & LPT)
    USB Serial Port (COM48)
Processors
Sound, video and game controllers
System devices
Universal Serial Bus controllers
    Alcorlink USB 2.0 Card Reader
    Generic USB Hub
    Generic USB Hub
    Intel(R) 7 Series/C216 Chipset Family USB Enhanced Host Controller - 1E26
    Intel(R) 7 Series/C216 Chipset Family USB Enhanced Host Controller - 1E2D
    Intel(R) USB 3.0 eXtensible Host Controller
    Intel(R) USB 3.0 Root Hub
    USB Composite Device
    USB Composite Device
    USB Root Hub
    USB Root Hub
    USB Serial Converter A
    USB Serial Converter B

Programming EDGE Board Spartan 6 FPGA using Xilinx iMPACT

After Generating Programming File Select Manage Configuration Project to open iMPACT
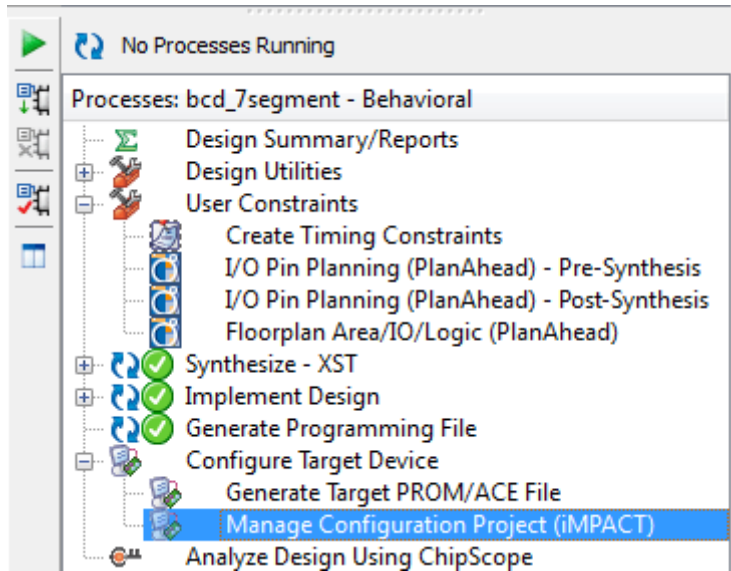
Now double click on Boundary scan option opens blank window on the right side.

Right click on the blank window and select Initialize Chain.
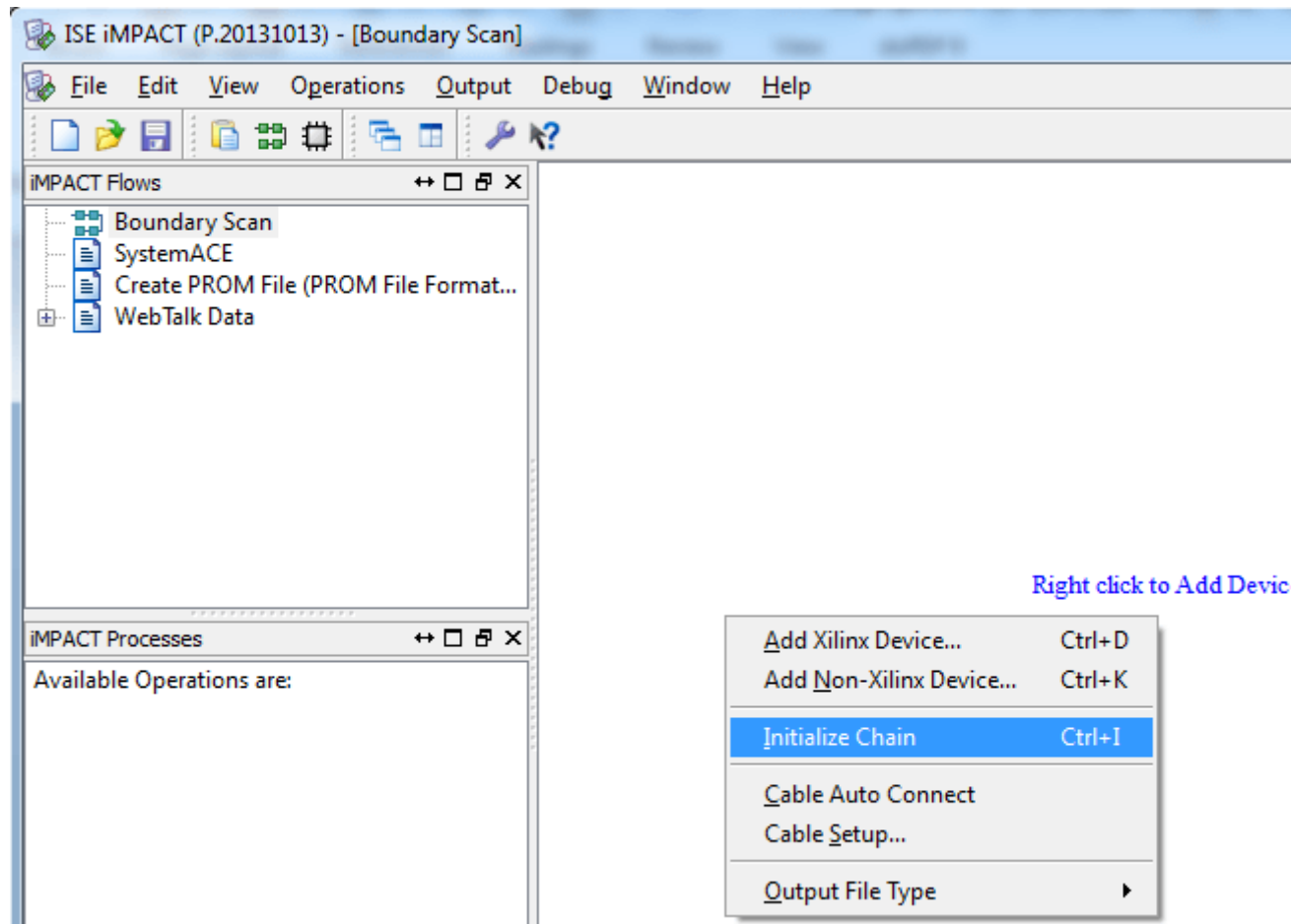
Now XC6SLX9 FPGA detected and asking to assign configuration file to it. Click yes.
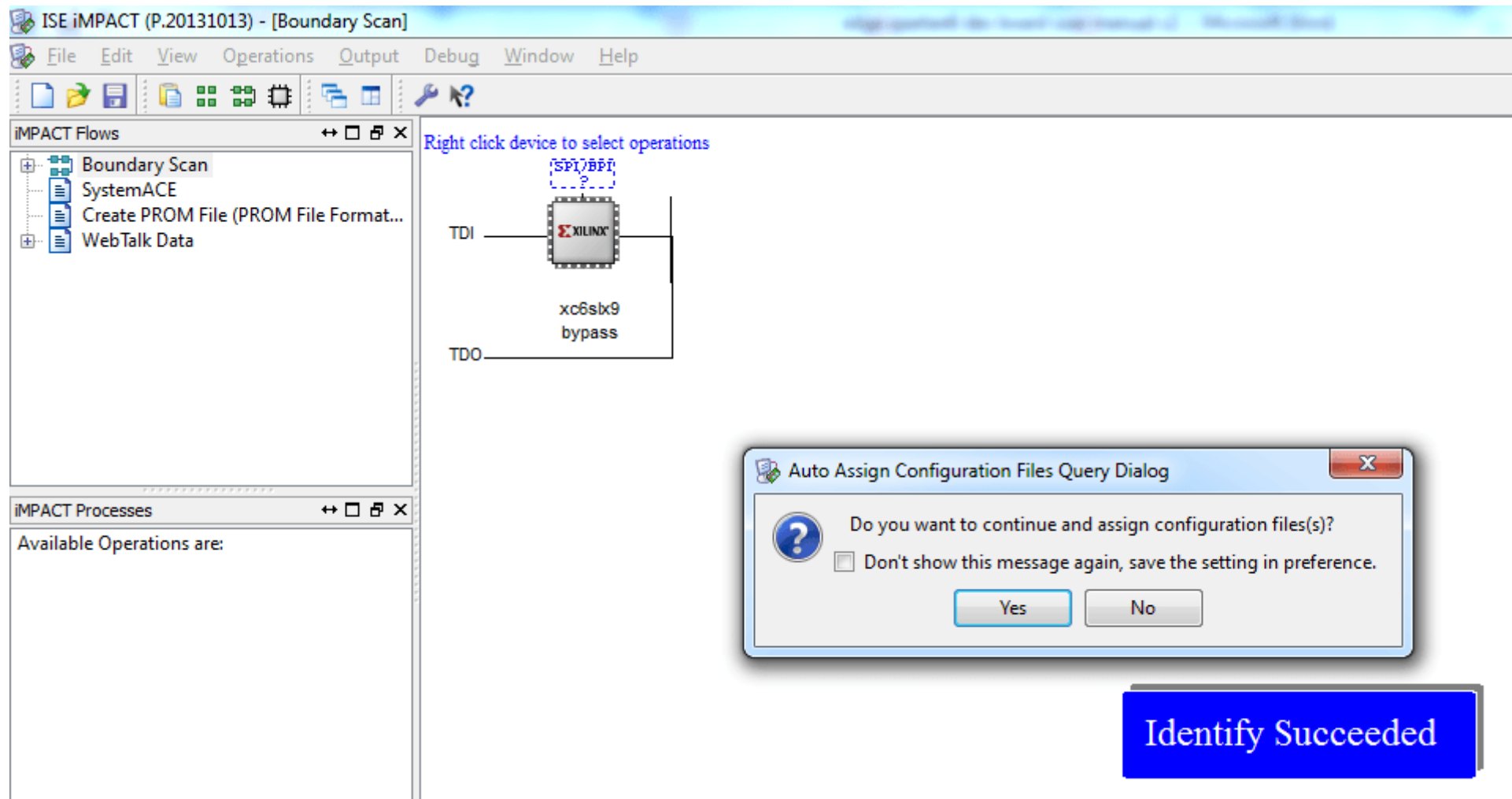
Now select filename.bit file

SPI/BPI
?

TDI

XILINX

xc6slx9
bypass

TDO

Assign New Configuration File

Look in: D:\project_codes\edge_v2_codes\bcd_7segment

My Comp...
shahul

_ngo
_xmsgs
ipcore_dir
iseconfig
planAhead_run_1
xlnx_auto_0_xdb
xst
bcd_7segment.bit

File name: bcd_7segment.bit

Files of type: All Design Files (*.bit *.rbt *.nky *.isc *.bsd)

Open
Cancel
Bypass
Cancel All
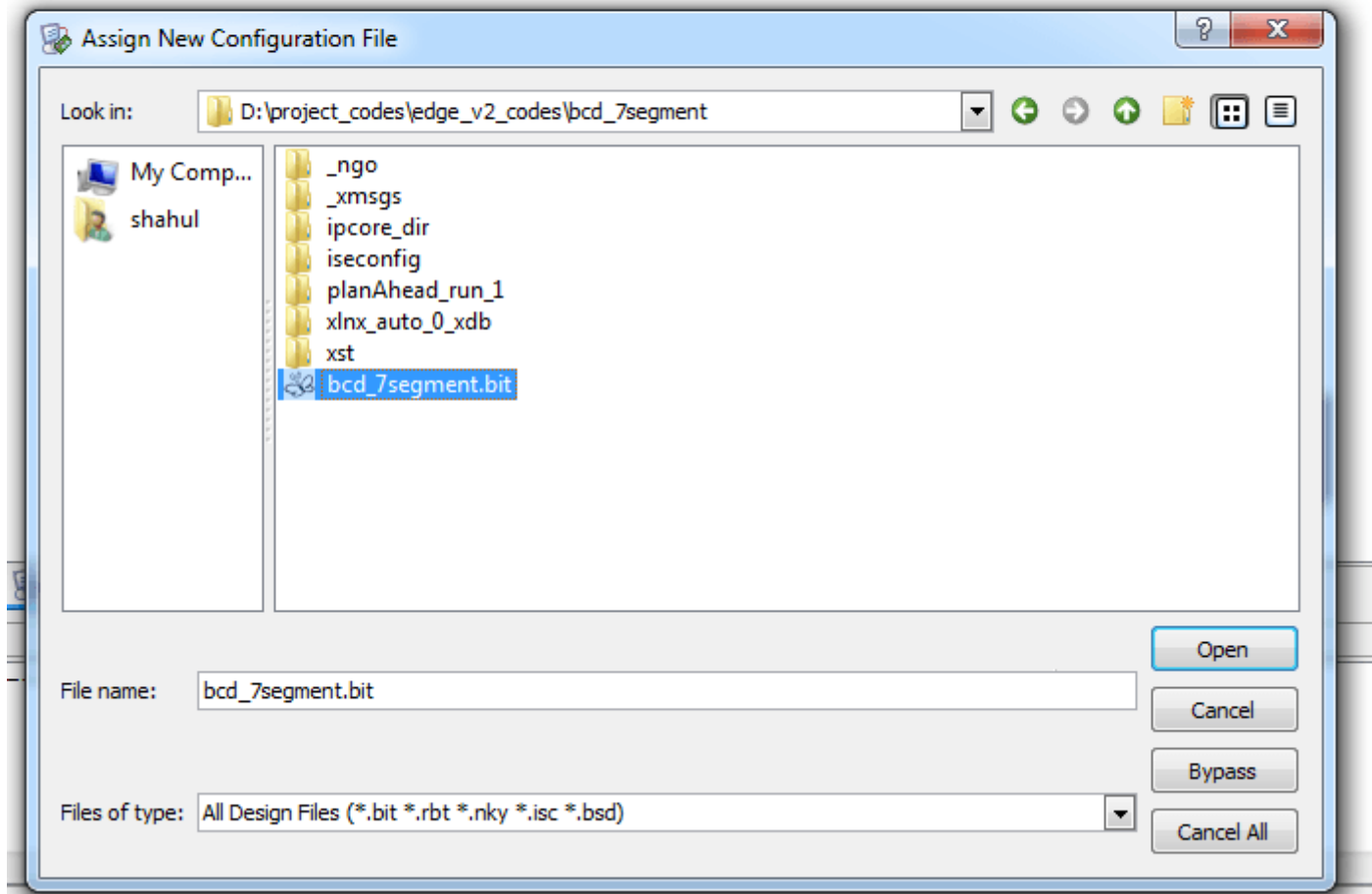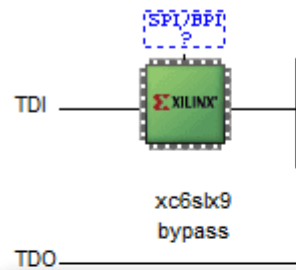
it ask for PROM device. Skip it by selecting No.

right click on Spartan6 FPGA and click program.
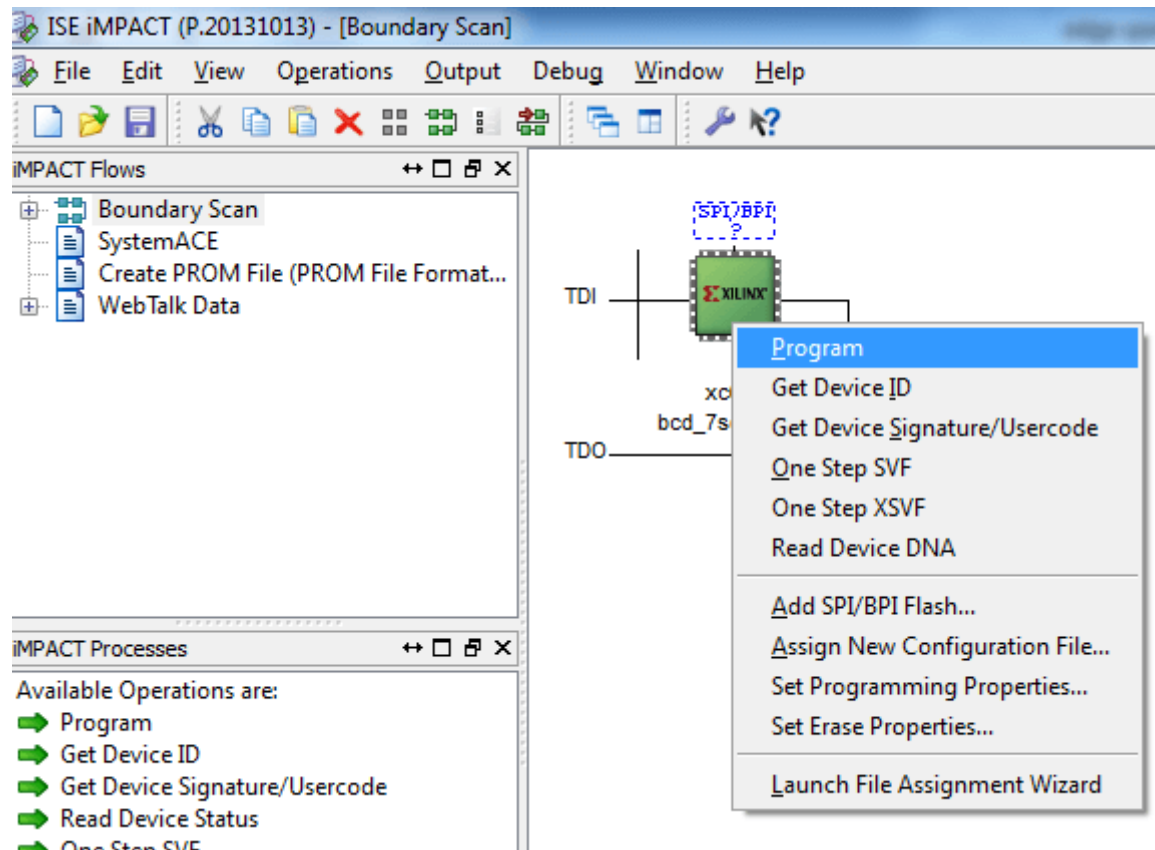
It displays Program Succeeded message and Done LED glow on EDGE Board for the indication of Programming completed.
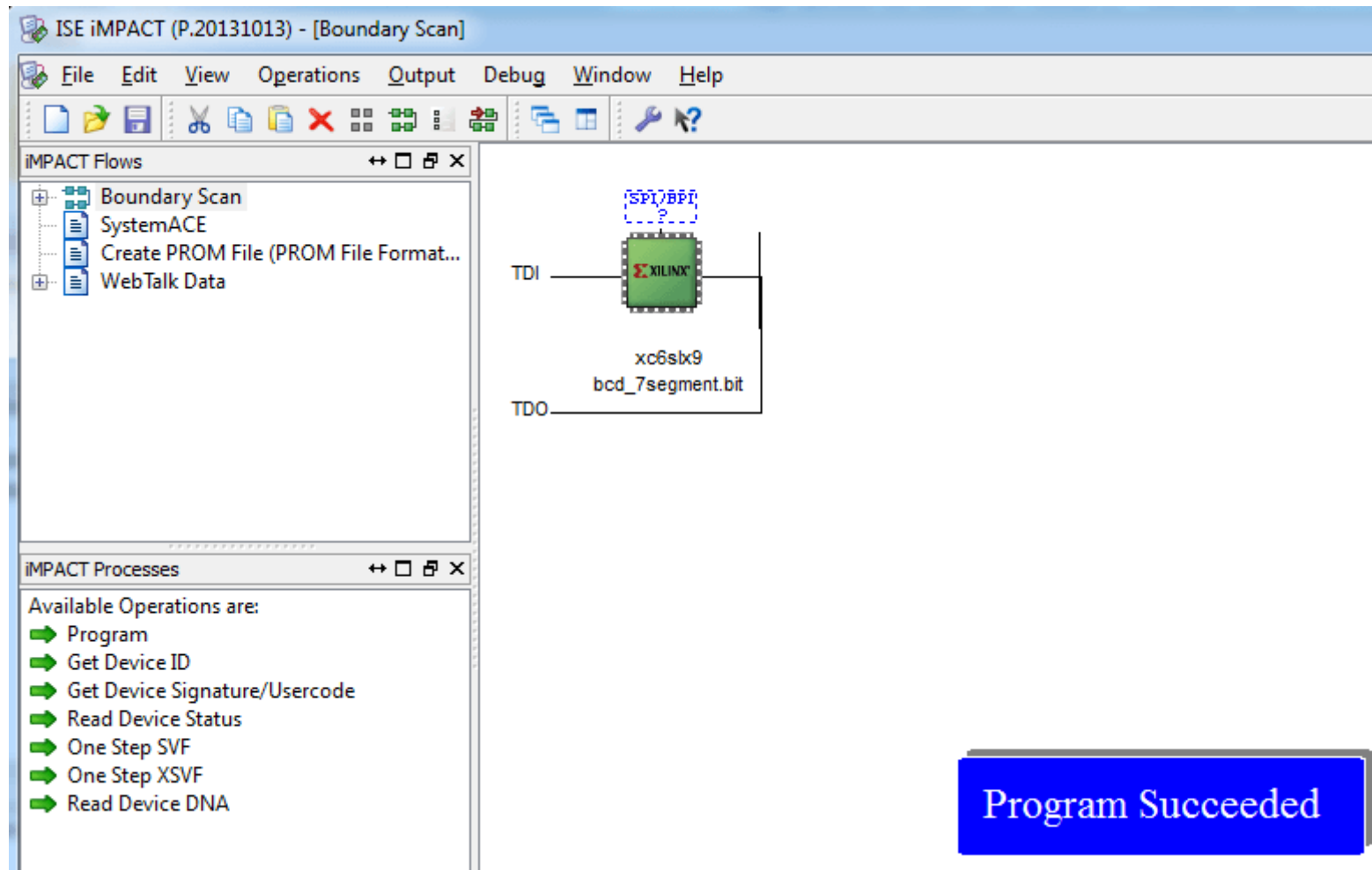
Programming SPI FLASH Memory using Xilinx iMPACT

To Program SPI Flash, Set the following operating system environment variable

IMPACT_SKIPIDCODECHECK=1

The procedure for setting an environment variable varies by operating system. The following sequence shows how to add an environment variable within the Microsoft Windows 7 Professional operating system:

a) Click the Windows Start Button and open the "Control Panel."

b) Within the "Control Panel" click "System and Security" followed by "System," which will open the "Basic Information" window.

c) Click "Advanced system settings" to open the "System Properties" window
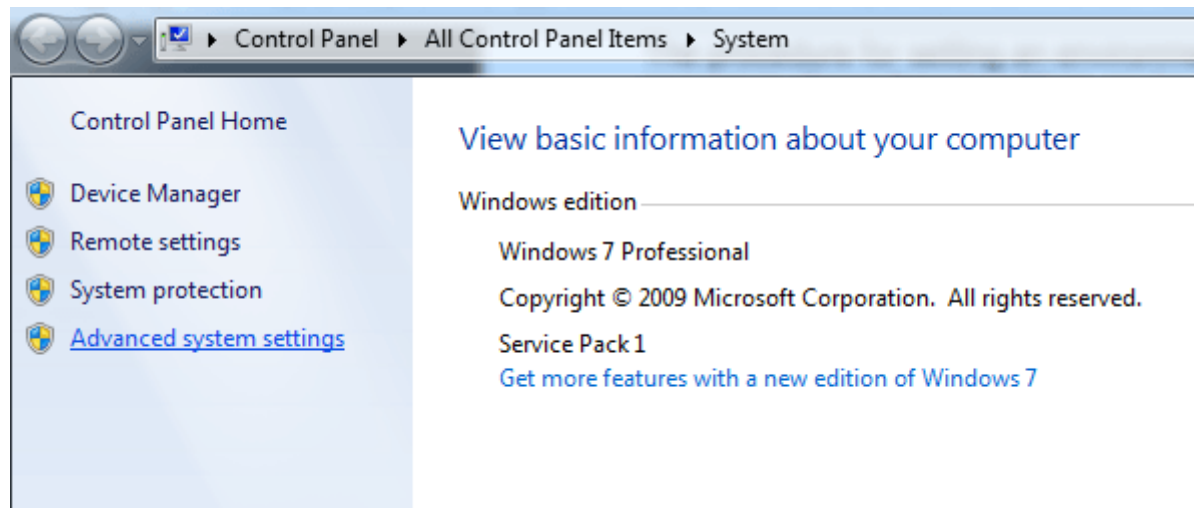
d) In the "System Properties" window, select the "Advanced" tab and then click the "Environment Variables" button which will open an "Environment Variables" window
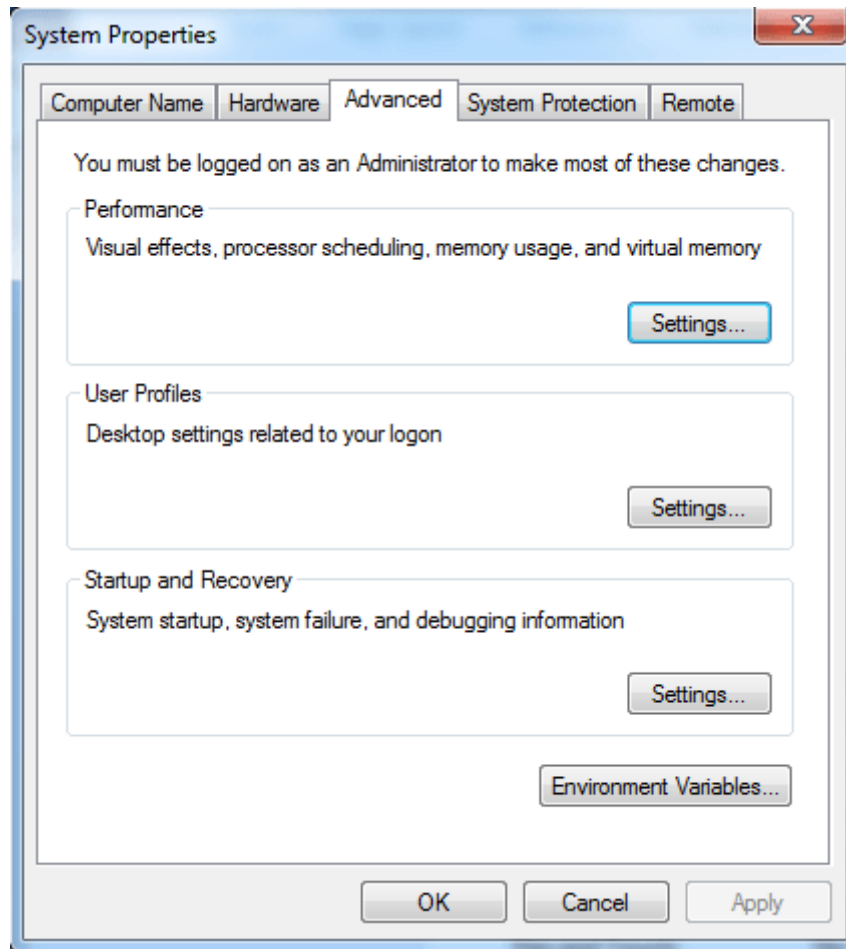
e) In the "Environment Variables" window click one of the two "New…" buttons to create either a User variable or a System variable. In Figure below, a new User variable is being created.

f) In the "New User Variable" window, enter "XIL_IMPACT_SKIPIDCODECHECK" for the Variable name and "1" for the Variable value. Click the "OK" button to add the environment variable.
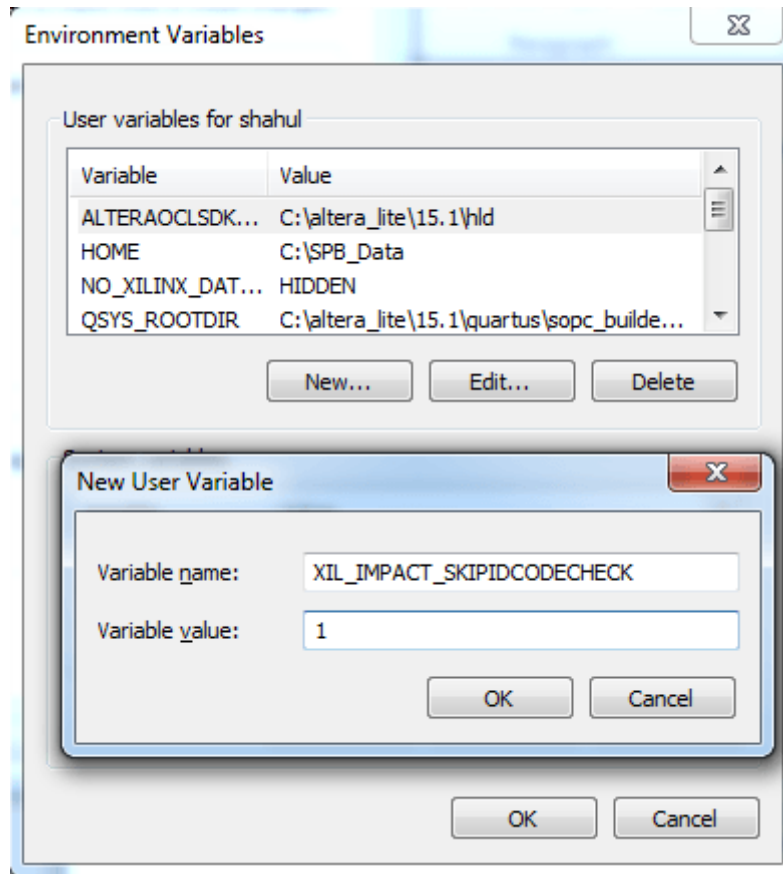
After Setting environment variable open Xilinx iMPACT Tool.
Select Create PROM file in the iMPACT window
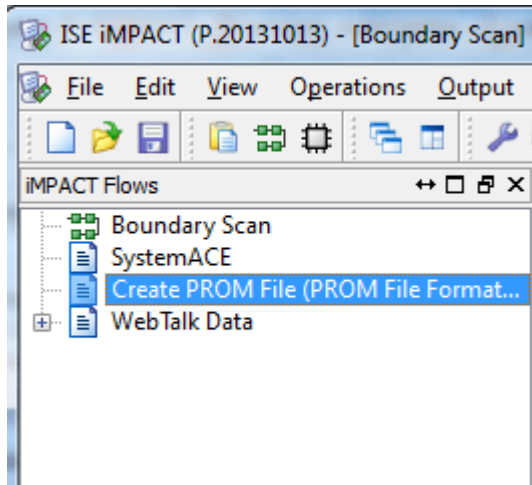
PROM File Formatter dialog box opens.

Now select configure single FPGA under SPI FLASH in step1.

Then Select Storage Device to 64M and click Add Storage Device in step2.

Then Select output file location and specify output file name in step 3

After completing 3 steps click ok.

Now the following window opens and click ok in the add device dialog box.
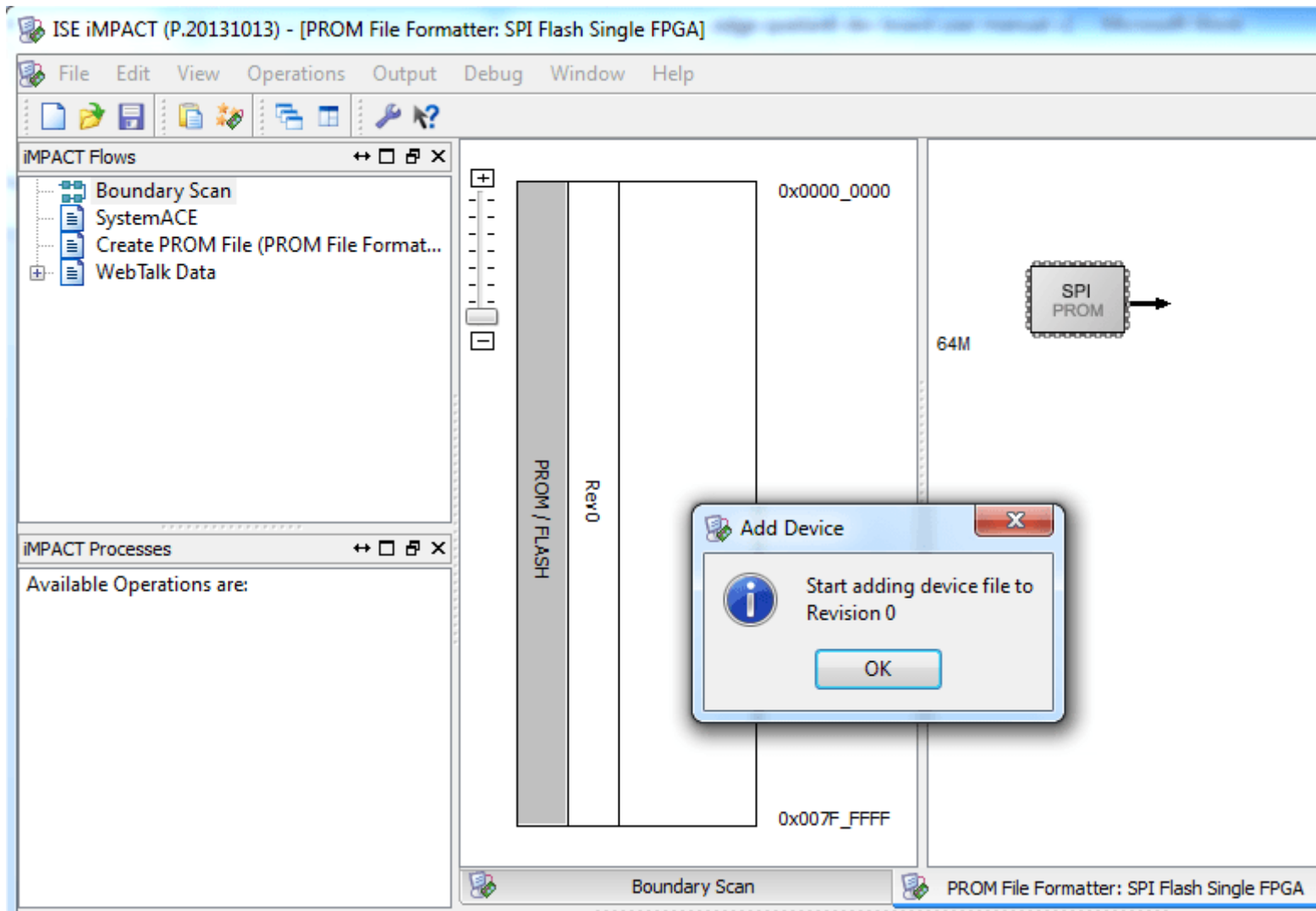
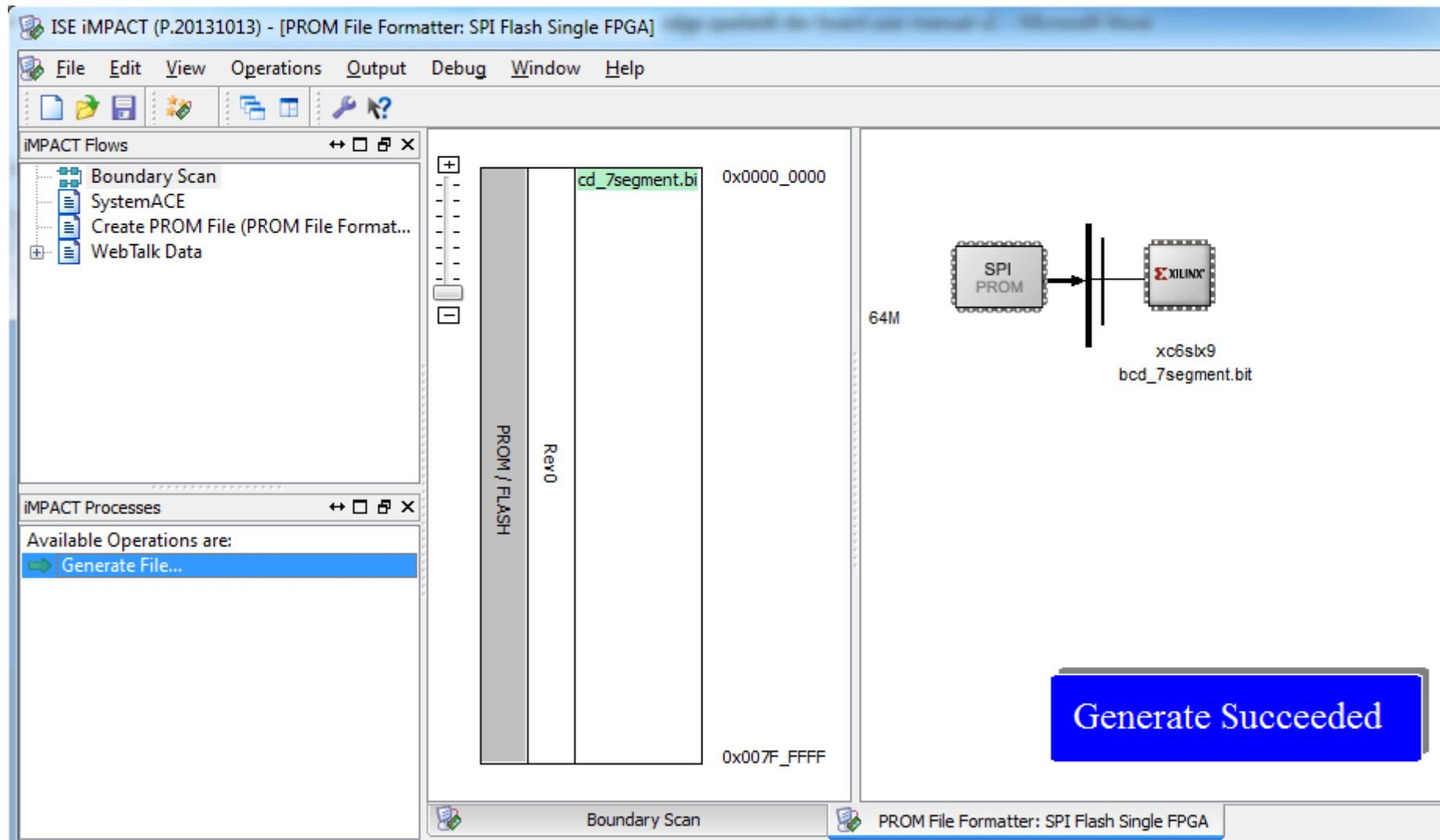Now select bit. It will ask for adding new device. Click NO

cd_7segment.bi   0x0000_0000

SPI
PROM

ΣXILINX

64M

xc6slx9
bcd_7segment.bit

PROM / FLASH

Rev0

Add Device

?   Would you like to add another device file to
Revision: 0 ?

Yes   No

0x007F_FFFF

Boundary Scan   PROM File Formatter: SPI Flash Single FPGA
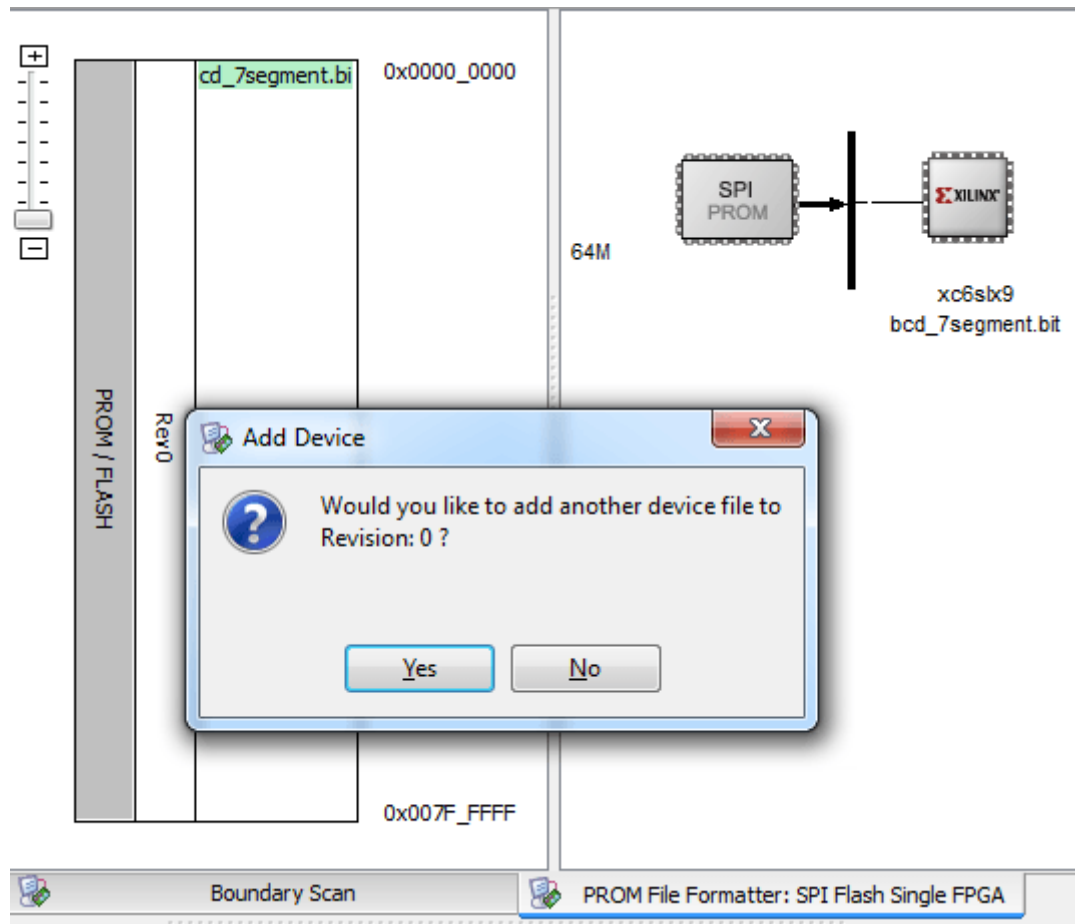
Now Click generate file option under iMPACT Process to generate MCS file.

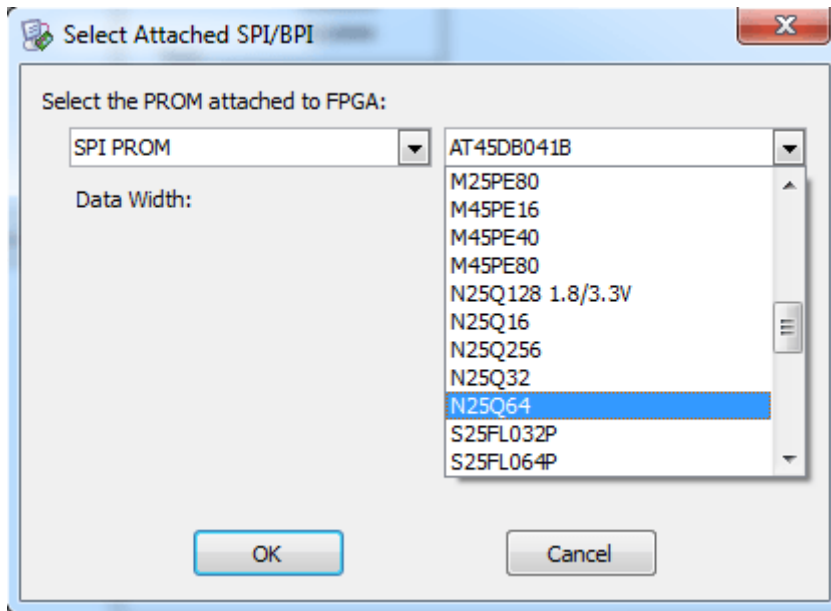Now double click boundary scan option and do initialize chain to detect Spartan 6 FPGA.
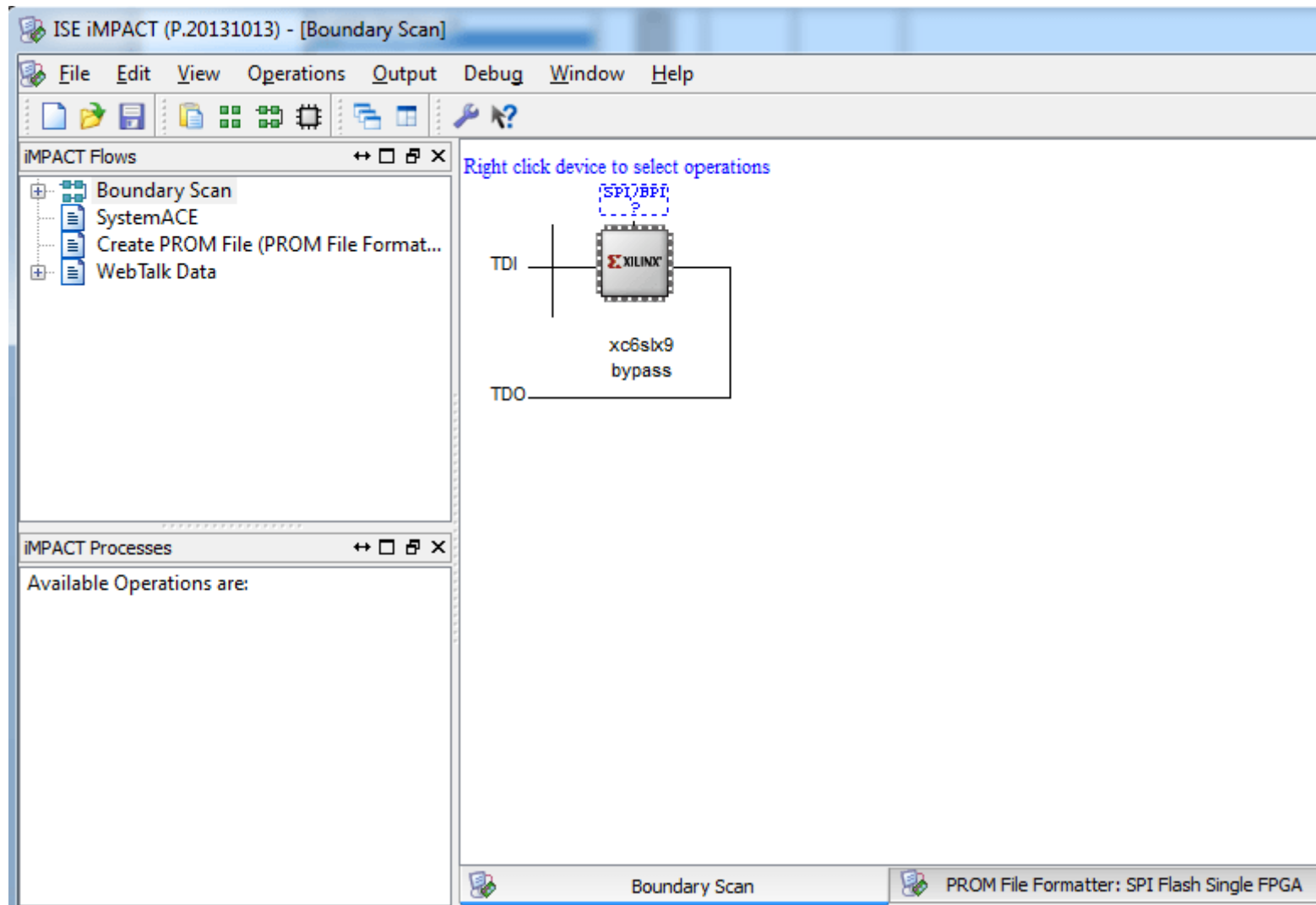
Now click double click SPI/BPI option at the top FPGA IC to select MCS file for SPI FLASH Memory.
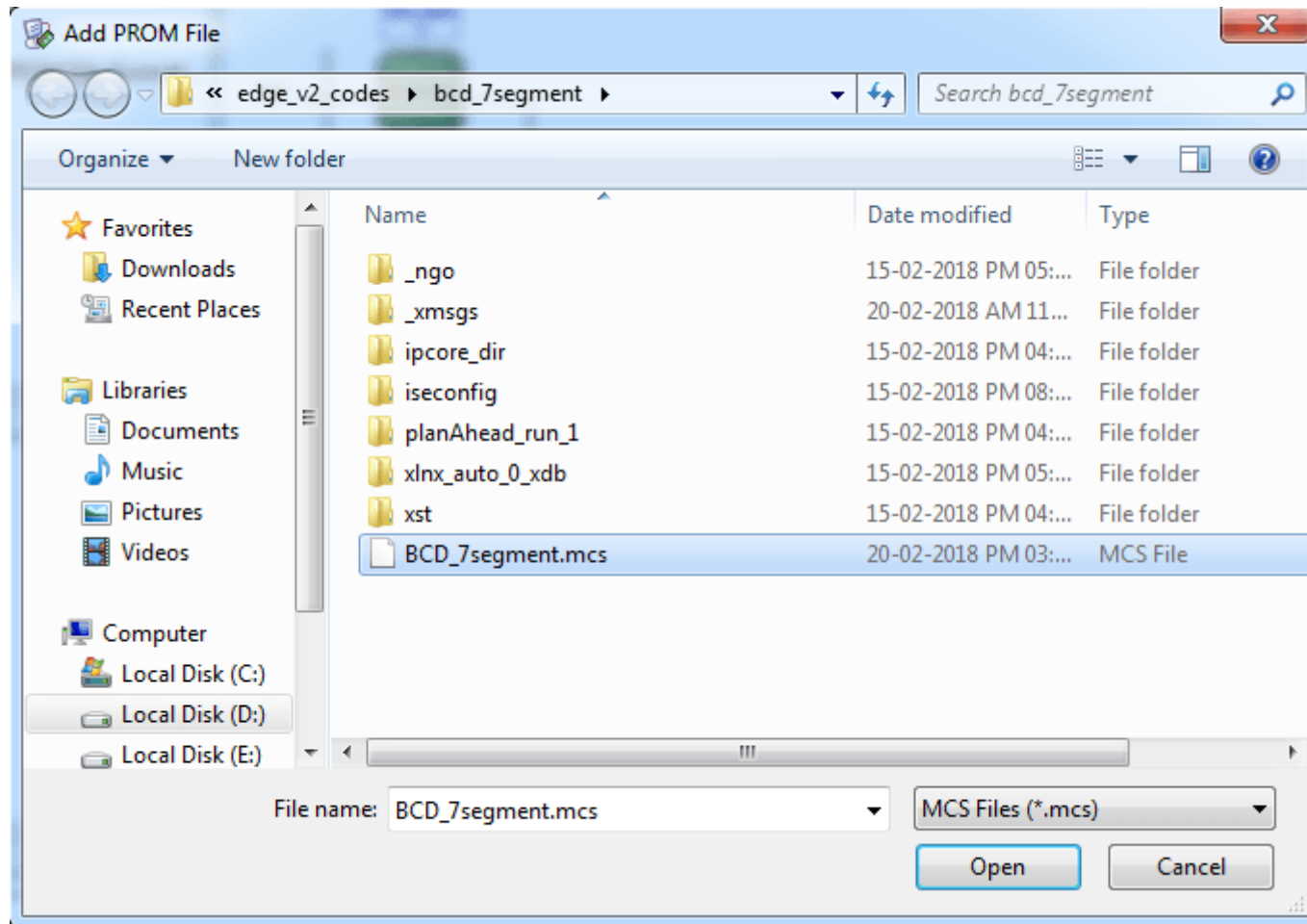
Now Select N25Q64 in the SPI PROM Dialog box.

Now FLASH Added at the top of FPGA. Right click PROM and select Program option.

Right click device to select operations

FLASH

TDI ——— Σ XILINX

xc6slx9
bypass

TDO ———

Program Succeeded

📄 Boundary Scan   📄 PROM File Formatter: SPI Flash Single FPGA

Console

```
  LCK cycle: NoWait
ⓘINFO:iMPACT - '1': Checking done pin....done.
 '1': Programmed successfully.
 PROGRESS_END - End Operation.
 Elapsed time =    17 sec.
```

Now Program Succeeded and done LED is glowing on the EDGE Board.

ase the PROM file, right click FLASH symbol at the top and select Erase option to successfully erase the SPI FLASH Data.

EDGE Spartan 6 FPGA Development Board

₹ 7,750

★★★★★

Select Options

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