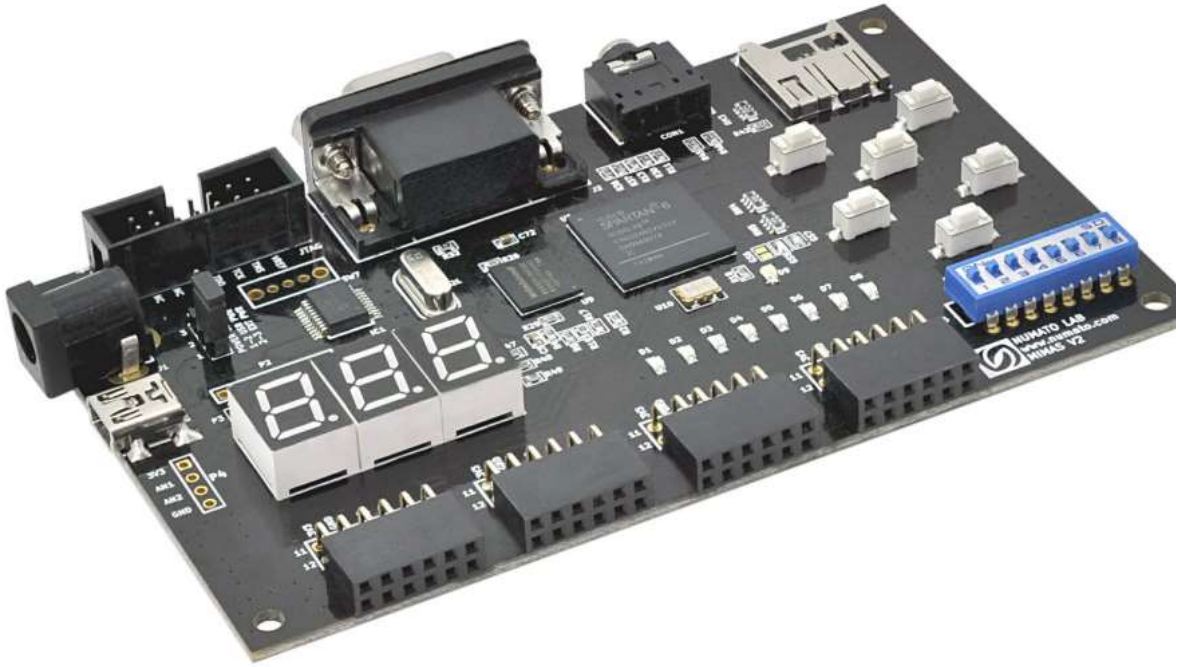
Mimas V2 Spartan 6 FPGA Development Board With DDR SDRAM

User Manual

1. Introduction



MIMAS V2 is a feature packed yet low cost FPGA Development board featuring Xilinx Spartan-6 FPGA. It is specially designed for experimenting and learning This development board features SPARTAN XC6SLX9 CSG324 FPGA with onboard 512Mb DDR SDRAM. The USB 2.0 interface provides fast and easy configura board SPI flash. No need to buy an expensive programmer or special downloader cable to download the bit stream to the board.

Applications

- Product Prototype Development
- Signal Processing
- Learning Digital Electronics
- Educational tool for schools and universities

Board features

- FPGA: Spartan XC6SLX9 in CSG324 package
- DDR: 166MHz 512Mb LPDDR (MT46H32M16LF/W949D6CBHX6E)
- Flash memory: 16 Mb SPI flash memory (M25P16)
- USB 2.0 interface for On-board flash programming
- FPGA configuration via JTAG and USB
- 8 LEDs Six Push Buttons and 8 way DIP switch for user defined purposes
- VGA Connector
- Stereo Jack
- Micro SD Card Adapter
- Three Digit Seven Segment Display.
- 32 IOs for user defined purposes
- Four 6×2 Expansion Connectors
- On-board voltage regulators for single power rail operation

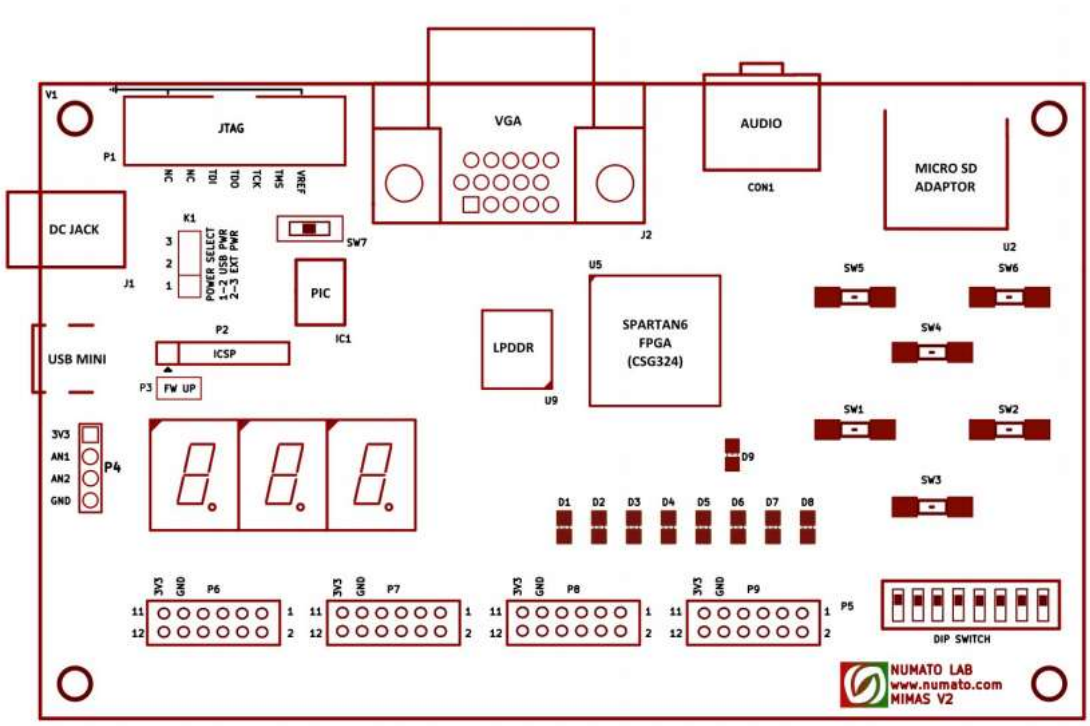
2. How to Use Mimas V2 Spartan 6 FPGA Development Board

2.1. Components/Tools Required

Along with the module, you may need the items in the list below for easy and fast installation.

1. USB A to Mini B cable.
2. DC Power supply (Optional).

2.2. Connection Diagram



This diagram should be used as a reference only. For detailed information, see MIMAS V2 schematics at the end of this documentation. Details of individual

2.3. USB Interface

The on board full speed USB controller helps a computer to communicate with this module. Use a USB A to Mini B cable to connect with a PC. By default the module is powered from USB so make sure not to overcrowd unpowered USB hubs.

2.4. DC Power Supply

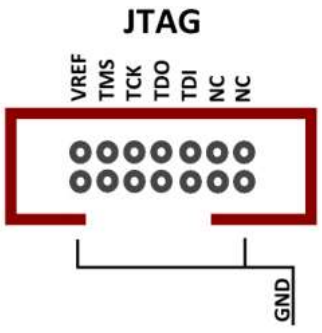
This module uses +5V power supply to function properly. **By default the board is configured to use +5V supply from USB. So an external +5V power is not required unless USB port is unable to supply enough current. In most cases USB ports are capable of providing enough current for the module. Current requirement for this board largely depends on your application. Please consult FPGA datasheet for more details on power requirements.** If for any reason, an external 5V power supply needs to be used for the module, the Power select jumper should be configured properly before connecting the power supply. Please refer to the marking on the board for more details.

2.5. Power Select

The Power Select header K1 is used to configure the power source for the board. The jumper in pin 1 and 2 is shorted to switch the power source to on boar use the external DC power.

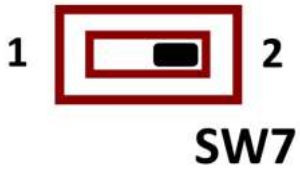
2.6. JTAG Connector

JTAG connector provides access to FPGA's JTAG pins. A XILINX platform cable can be used for JTAG programming.



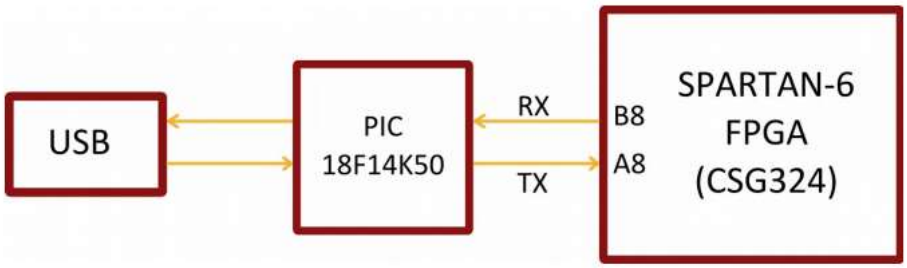
2.7. Configuration Mode Selection

Slide switch SW7 is used to switch between the USB configuration mode and UART. Slide the switch to Position 1 to download bit stream through USB config use the interface as a UART in order to communicate from your code in FPGA with the PC. By default the board is shipped with slide switch position in USB c



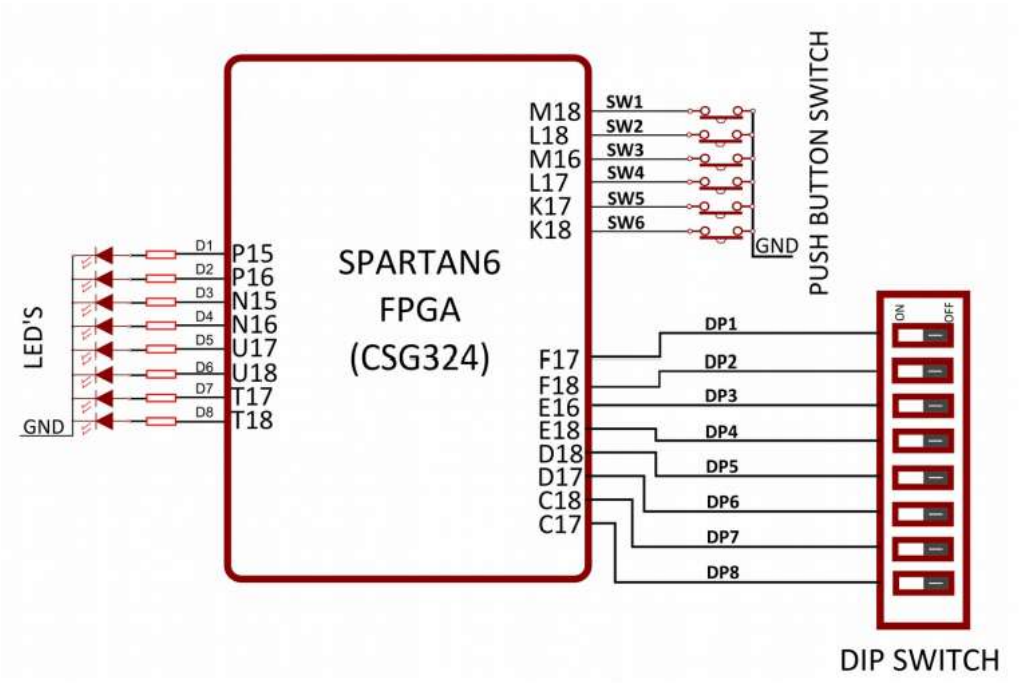
2.8. UART

The MIMAS V2 includes USB-UART, which helps to establish the communication between the code in the FPGA and any application running on the PC. Data c the FPGA by using Serial Terminal at baud rate 19200.



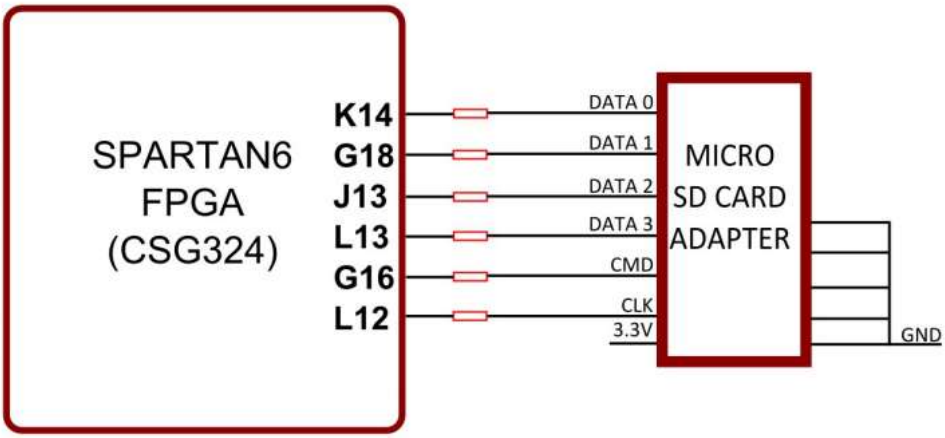
2.9. LED, Push Button and Dip Switch

MIMAS V2 has six push button switches, an eight position DIP switch and eight LEDs for human interaction. All switches are directly connected to Spartan 6 F design with minimal effort.



2.10. Micro SD

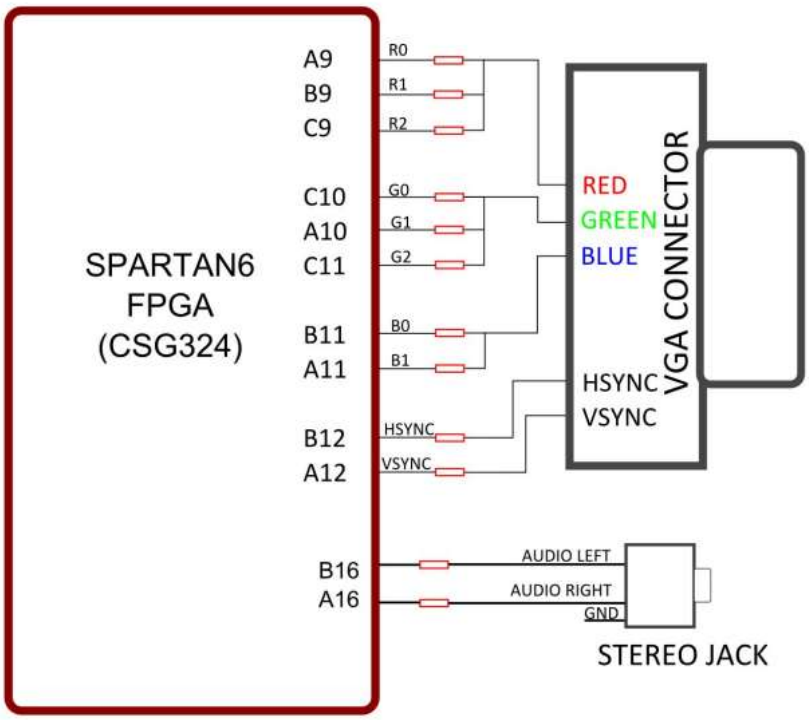
MIMAS V2 features a Micro SD adapter on-board. By installing a Micro SD card, you can add data logging, media storage and other file storage to your desigr



2.11. VGA and Audio

The VGA interface provides this board the ability to generate VGA signals from FPGA and display information any Display/monitor that supports standard VG interface uses resistor network based DAC for easy code implementation. This 8 bit VGA interface can display up to 256 colors.

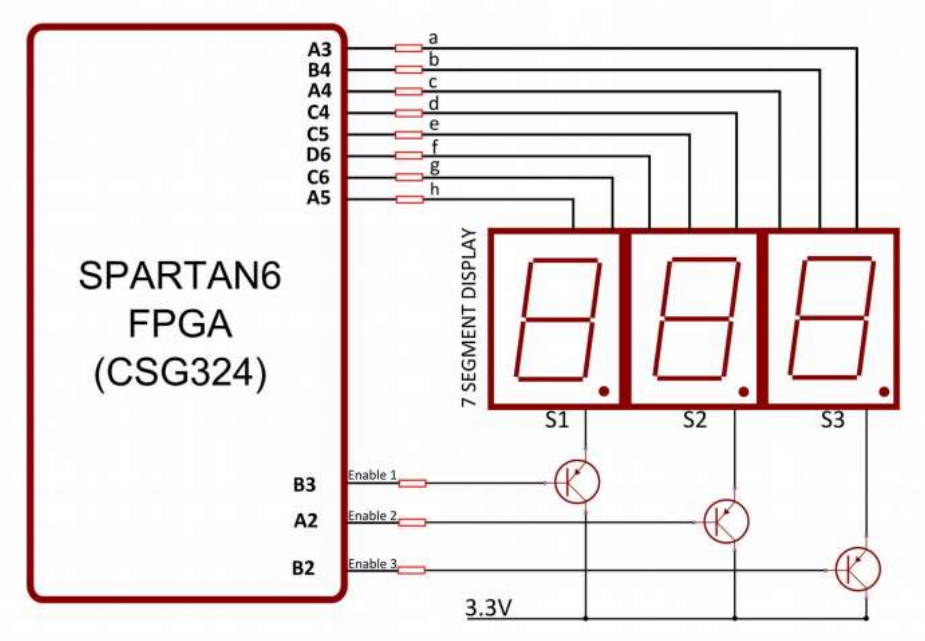
Two IOs on the FPGA are dedicated for generating two channels of audio. Different audio tones can be generated by using PWM and Frequency synthesis.



2.12. 7Segment LED Display

This board features three 7-segment LED display multiplexed for low pin count operation. Each module can be separately turned on and off with the three s

Note: All signals (*a, b, c, d, e, f, g, dot, enable 1, enable 2, enable 3*) used for controlling 7-Segment display are **active-low** signals**.** So, for example, for displa need to drive *Enable 2* to *0* as well as drive signals *a, b, c, d, e, f* to *0.* All other signals need to be driven to 1.



2.13. GPIOs

This board is equipped with 32 user IO pins that can be used for various custom applications. Pin assignments on the connectors are available in the tables l

HEADER P6

Header Pin No.	Pin description	Spartan-6 (CSG324) Pin No.
1	IO_L43P_2	U7
2	IO_L43N_2	V7
3	IO_L63P_2	T4
4	IO_L63N_2	V4
5	IO_L49P_D3_2	U5
6	IO_L49N_D4_2	V5
7	IO_L62P_D5_2	R3
8	IO_L62N_D6_2	T3
9	GND	NA
10	GND	NA
11	VCCAUX	NA
12	VCCAUX	NA

HEADER P7

Header Pin No.	Pin description	Spartan-6 (CSG324) Pin No.
1	IO_L41P_2	U8
2	IO_L41N_VREF_2	V8
3	IO_L31P_GCLK31_D14_2	R8
4	IO_L31N_GCLK30_D15_2	T8
5	IO_L48P_D7_2	R5
6	IO_L48N_RDWR_B_VREF_2	T5
7	IO_L32P_GCLK29_2	T9
8	IO_L32N_GCLK28_2	V9
9	GND	NA
10	GND	NA
11	VCCAUX	NA
12	VCCAUX	NA

HEADER P8

Header Pin No.	Pin description	Spartan-6 (CSG324) Pin No.
1	IO_L16P_2	R11
2	IO_L16N_VREF_2	T11
3	IO_L29P_GCLK3_2	R10

Header Pin No.	Pin description	Spartan-6 (CSG324) Pin No.
4	IO_L29N_GCLK2_2	T10
5	IO_L14P_D11_2	U13
6	IO_L14N_D12_2	V13
7	IO_L23P_2	U11
8	IO_L23N_2	V11
9	GND	NA
10	GND	NA
11	VCCAUX	NA
12	VCCAUX	NA

HEADER P9

Header Pin No.	Pin description	Spartan-6 (CSG324) Pin No.
1	IO_L43P_GCLK5_M1DQ4_1	H17
2	IO_L43N_GCLK4_M1DQ5_1	H18
3	IO_L44P_A3_M1DQ6_1	J16
4	IO_L44N_A2_M1DQ7_1	J18
5	IO_L41P_GCLK9_IRDY1_M1RASN_1	K15
6	IO_L41N_GCLK8_M1CASN_1	K16
7	IO_L42P_GCLK7_M1UDM_1	L15
8	IO_L42N_GCLK6_TRDY1_M1LDM_1	L16
9	GND	NA
10	GND	NA
11	VCCAUX	NA
12	VCCAUX	NA

3. Driver Installation

3.1. Installing on Windows

This product requires a driver to be installed for proper functioning when used with Windows. The driver package can be downloaded from the product pag
the contents of the downloaded driver package to a folder. Attach USB cable to the PC and when asked by Windows device installation wizard, point to the f
present. When driver installation is complete, the module should appear in Windows Device Manager as a serial port (see the picture on the right). Note dow
(COM1, COM2 etc..). This information is required while programming the module with configuration tool.

3.2. Installing on Linux

To use this product with Linux, USB CDC driver needs to be compiled in with the kernel. Fortunately, **most Linux distributions (Ubuntu, Redhat, Debian e installed**. The chances of you requiring to rebuild the kernel to include the USB CDC driver is very slim. When connected to a Linux machine, this product sh the /dev directory. Usually the name of the device will be "ttyACMx" or similar. The name may be different depending on the Linux distribution you have.

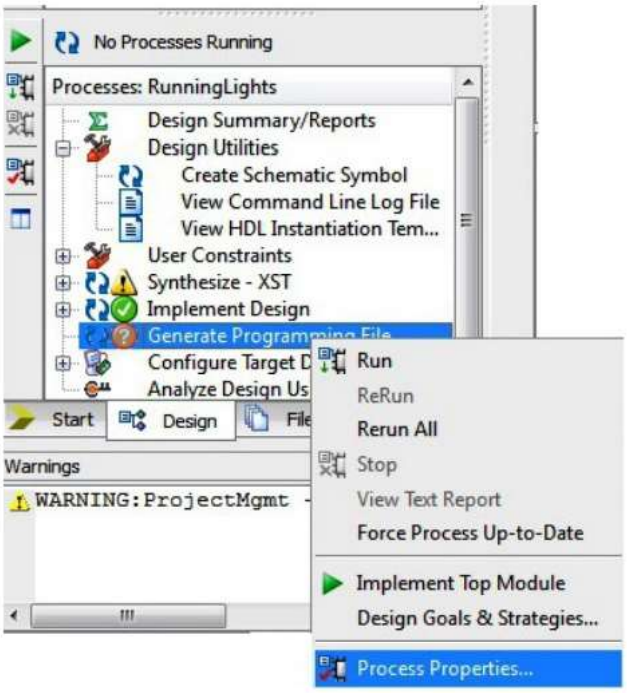
3.3. Installing on Mac

Similar to Linux, Mac operating system comes with the required drivers pre-installed. When connected to a Mac computer, the device should appear as a ser

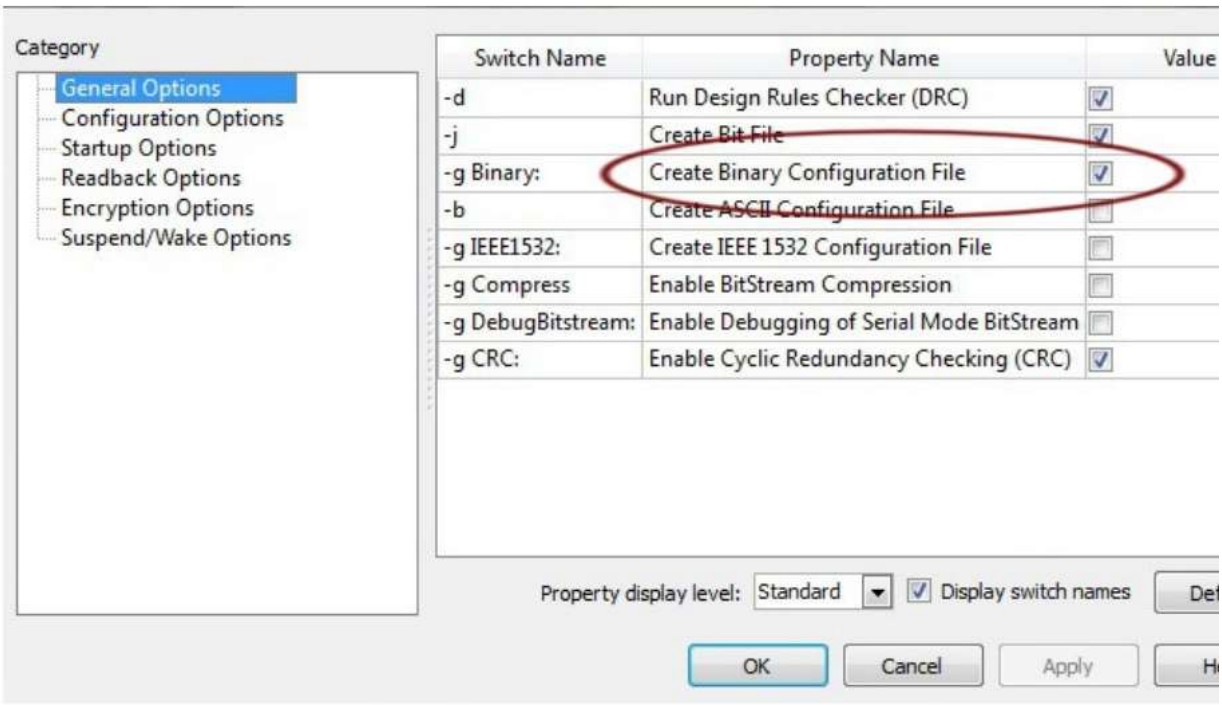
4. Generating Bit Stream for MIMAS V2

HDL design needs to be converted to bit stream before it can be programmed to FPGA. MIMAS V2 configuration tool at this time accepts only binary (.bin) bi (http://www.xilinx.com/tools/webpack.htm). Once the HDL is synthesized, it is easy to create a binary bit stream out of it. Please follow the Steps below to ge your design using ISE Web Pack.

Step 1: Right click on the "Generate Programming File" option in "Processes" window.



Step 2: Select “Process Properties” from the pop up menu. In the dialog box, check “Create Binary Configuration File” Check box and click “Apply”.



Step 3: Click “OK” to close the dialog box. Right click on “Generate Programming File” option again and select “Run”. Now you will be able to find a .bin file in file can be used for MIMAS V2 configuration.

5. Powering Up MIMAS V2

MIMAS V2 can be powered directly from USB port so make sure that you are using a USB port that can power the board properly. It is recommended to conr PC instead using a hub. It is practically very difficult to estimate the power consumption of the board, as it depends heavily on your design and the clock use estimate the power consumption. In any case if power from USB is not enough for your application, an external supply can be applied to the board. MIMAS V voltages, a 3.3V and a 1.2V supply. On-board regulators derive these voltages from the USB/Ext power supply

6. Configuring MIMAS V2

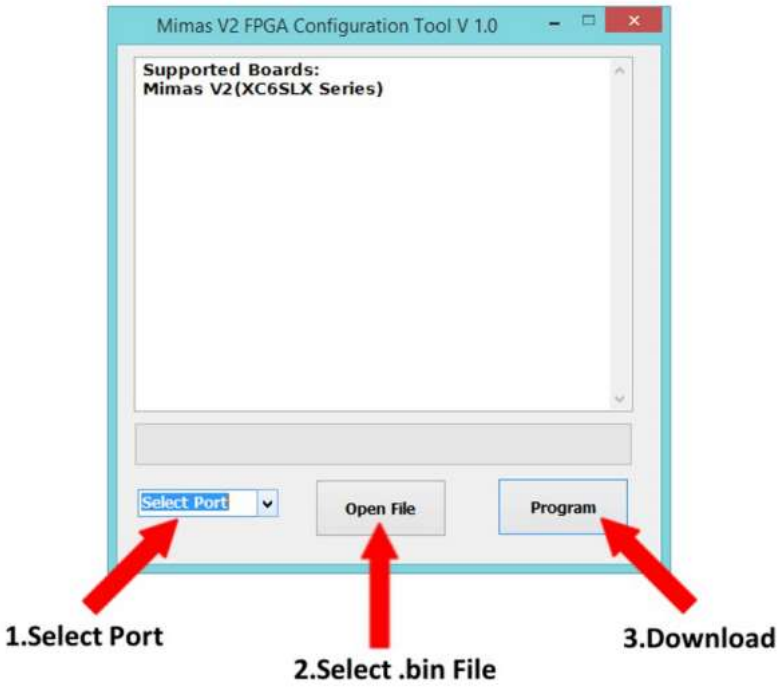
The MIMAS V2 Spartan6 module can be configured by two methods,

a) Using MIMAS V2 configuration tool through USB.
b) Using the Xilinx programming cable..

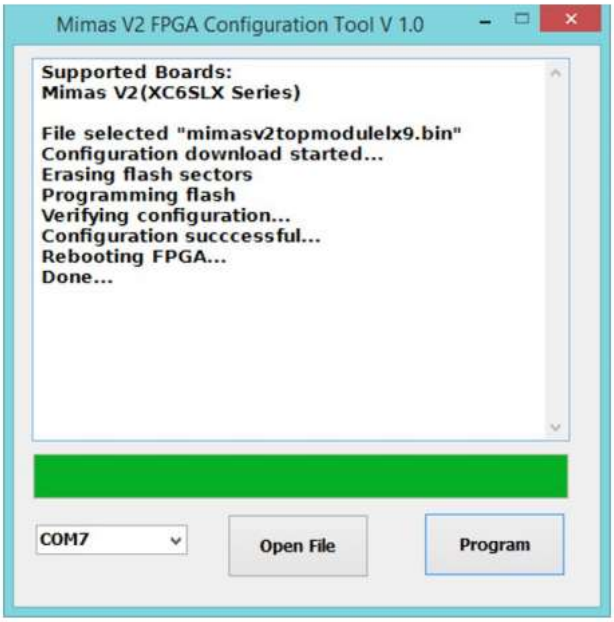
6.1. Configuring MIMAS V2 Using Configuration Tool

MIMAS V2 has an on-board micro-controller which facilitates easy reprogramming of on-board SPI flash through USB interface. The micro-controller receives application and program it in to the SPI Flash and lets the FPGA boot from the flash. The MIMAS V2 configuration application can be downloaded from www. MIMAS V2 is connected to PC, it shows up as a COM port in Device Manager. Run configuration application, select correct COM Port before downloading bit s select the bit stream file (.bin) and press "Program" button to download the bit stream. Wait till the download process is finished. Once the download proces controller will try to boot the FPGA from the SPI Flash automatically. Follow the below steps.

Step 1: Make sure you have selected USB configuration mode (Slide SW7 to position 1. Refer to the section "Configuration Mode Selection" for more informa Configuration Tool and select the correct port (Refer to section "Driver installation" for more information on finding port number). Click Open file button and



Step 2: Click on "Program" button. Wait till "Done" appears on the screen.

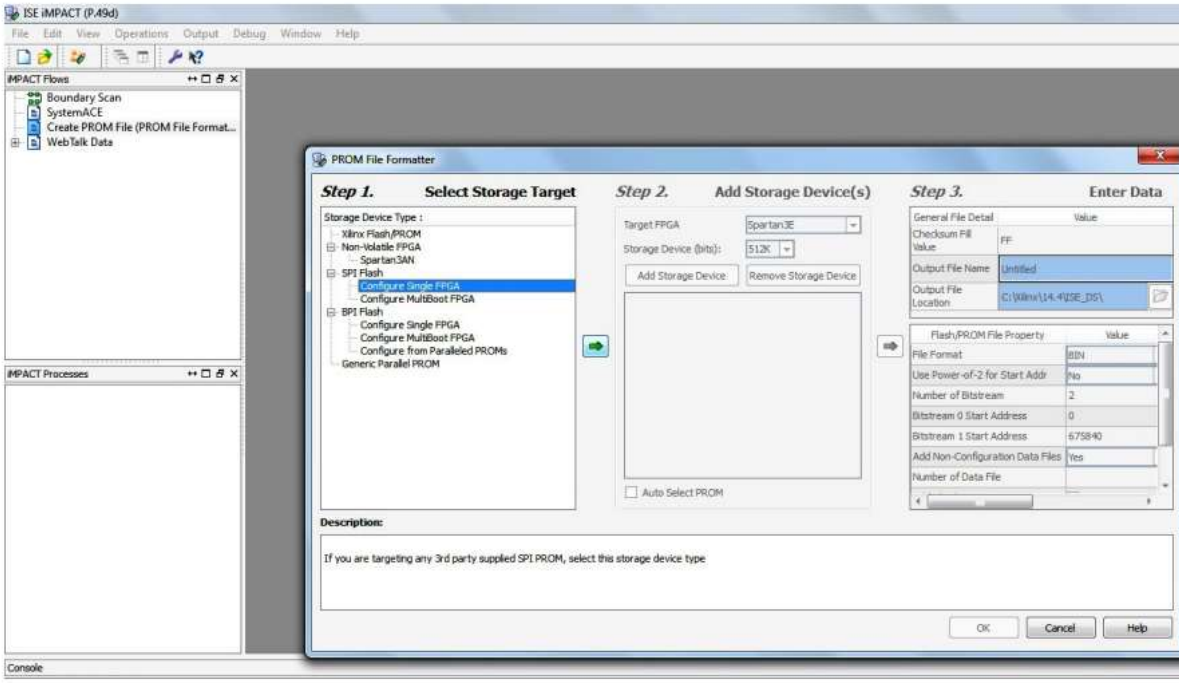


6.2. Configuring MIMAS V2 Using JTAG

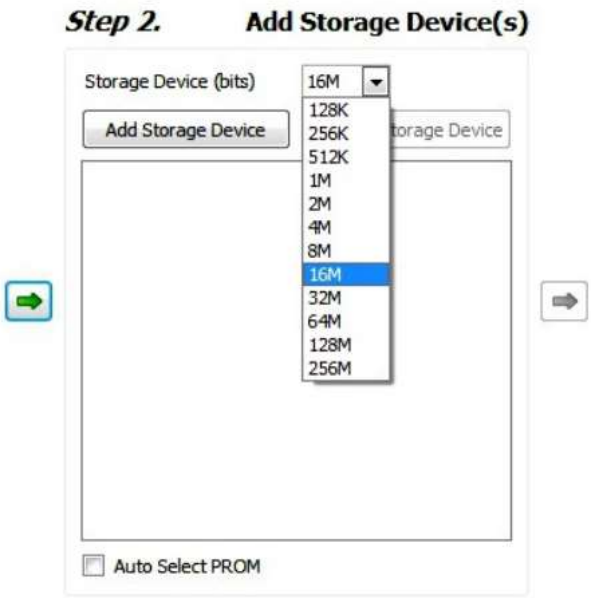
MIMAS V2 Spartan6 module features an on-board JTAG connector which facilitates easy reprogramming of SRAM and on-board SPI flash through JTAG progr cable usb". Programming MIMAS V2 using JTAG requires "XILINX ISE iMPACT" software which is bundled with XILINX ISE Design Suite. To program SPI flash we needs to be generated from the ".bit" file. Steps for generating ".mcs" file is discussed below. Programming FPGA SRAM does not require a mcs file to be gen

Generating ".mcs" file for MIMAS V2

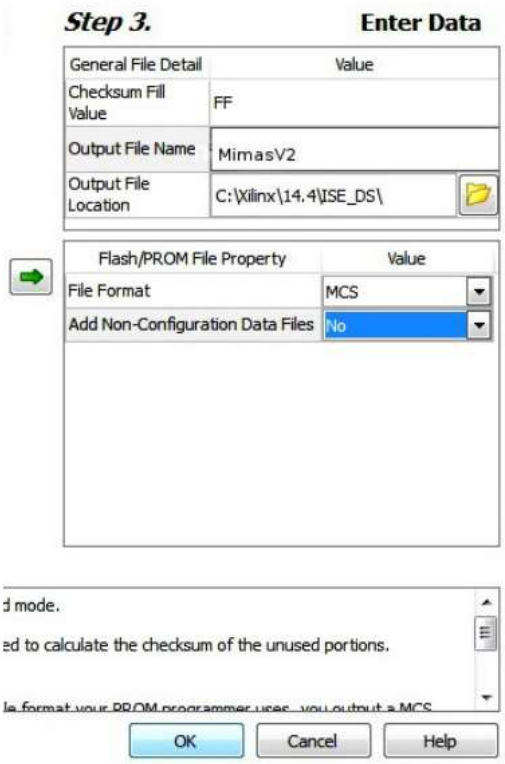
Step 1: Open ISE iMPACT. Click on "Create PROM file(PROM file formatter)".In the dialog box, select "Configure Single FPGA" in storage device type. Then click right side.



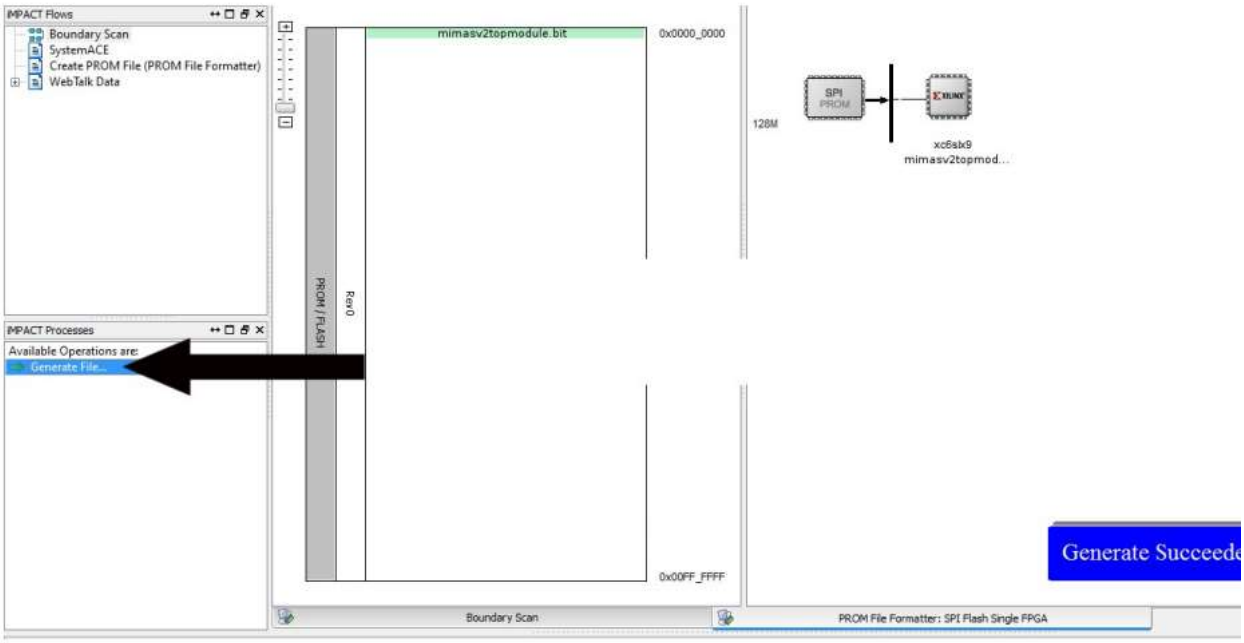
Step 2: Select 16M in Storage Device (bits) list. Now click on "Add Storage Device", then the green arrow at the right side.



Step 3: Set an output file name and an output file location (the ".mcs" file will be generated at this location which will be required later for programming the then select the ".bit" file we already generated then click Open and click NO when it prompts to add another device file.

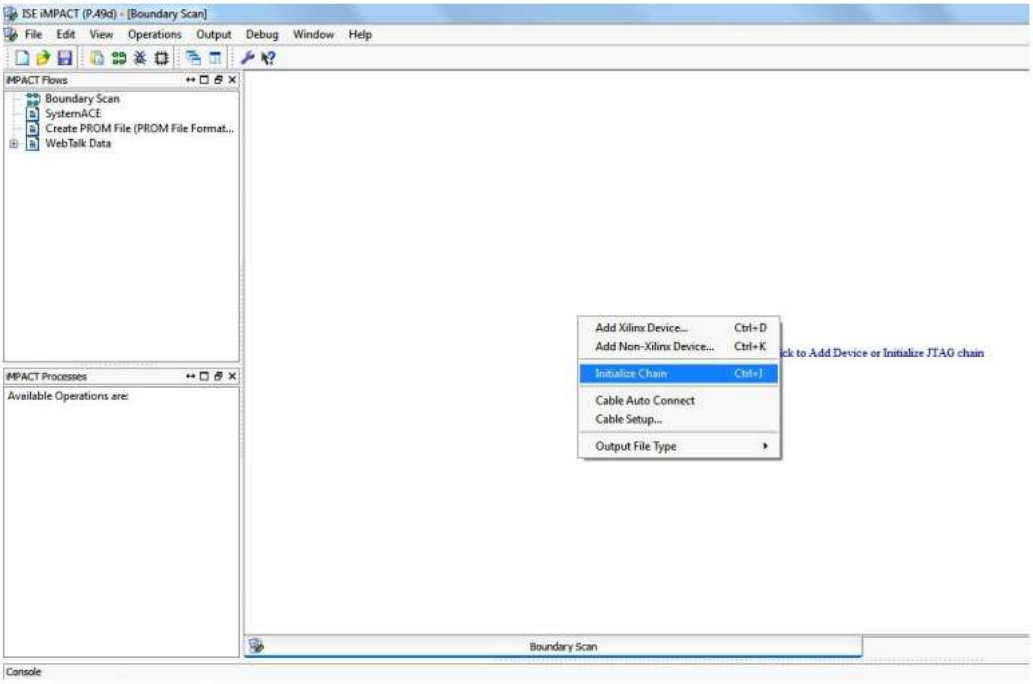


Step 4: Double click on "Generate File". A message "Generate Succeeded" will be displayed as shown in fig below if the mcs file is generated successfully.

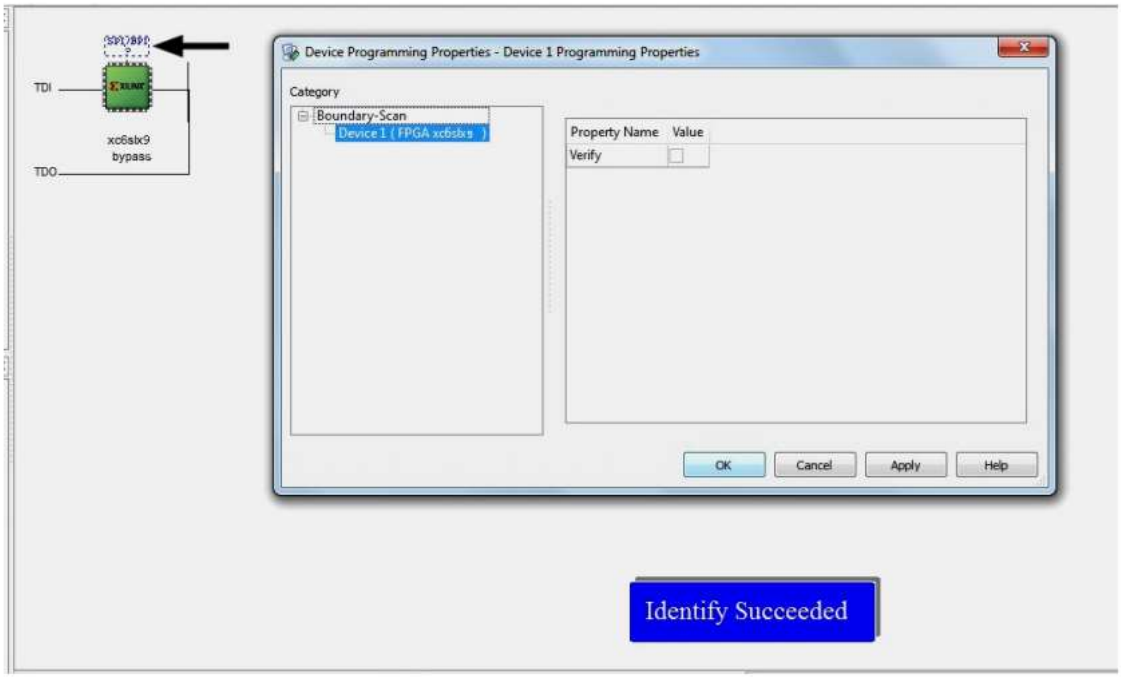


6.3. Programming Onboard SPI flash Using ISE iMPACT

Step 1: Make sure Xilinx Platform Cable USB is connected properly to the board. Open ISE iMPACT. Click on “Boundary Scan” in the iMPACT flows window in t
click on the window panel in the right side. Select “Initialize Chain”.

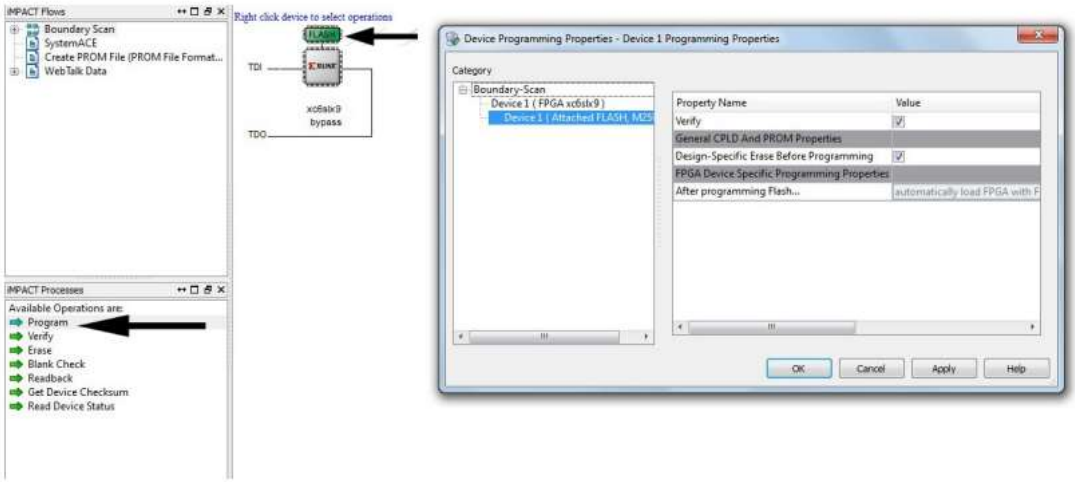


Step 2: If the device is detected properly you will get a pop up window as shown below, Click OK. Then right click on the SPI/BPI (next to the black arrow in th
SPI/BPI Flash.



Step 3: Select the ".mcs" file we already created and click OK. Now choose "M25P16" in the dialogue box appeared, then click OK.

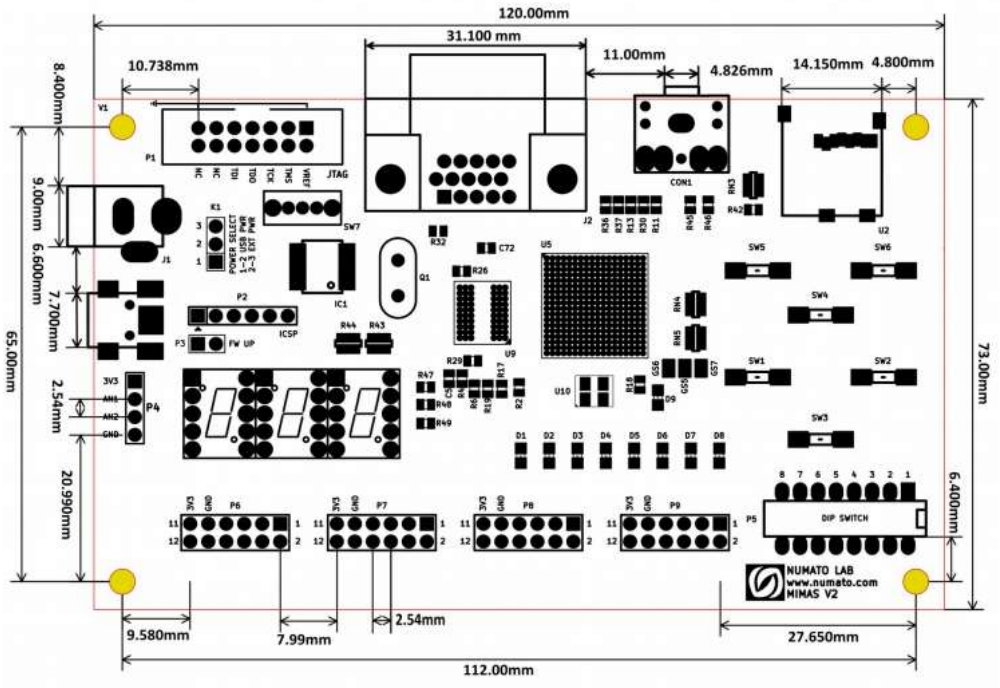
Step 4: Click on "Flash", Double Click on Program, select OK. If the programming is successful, a confirmation message will be displayed.



7. Technical Specifications

Parameter *	Value
Basic Specifications	
Number of GPIOs	32
Number of LEDs	8
Number of Push Buttons	6
SPI Flash Memory (M25P16)	16
Power supply voltage (USB or external)	5 - 7
FPGA Specifications	
Internal supply voltage relative to GND	–0.5 to 1.25
Auxiliary supply voltage relative to GND	–0.5 to 3.75
Output drivers supply voltage relative to GND	–0.5 to 3.75

8. Mechanical Dimensions



L x W x H : 120.00 mm x73.00 mm x 17 mm
Mechanical Hole Diameter : 3.2 mm

9. Schematics

Mimas V2 Schematics (https://docs.numato.com/wp-content/uploads/2016/08/MimasV2Sch.pdf)