GreenPAK Designer Legacy User Guide

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Contents

1. Introduction

This document describes the installation and usage of Dialog GreenPAK® Designer Legacy software. This software can be used as a stand-alone application for the firmware development and for GreenPAK chips programming. If the information in this guide is not sufficient to resolve issues experienced with GreenPAK Designer Legacy, refer to the resources listed under the Support section.

Features that are common for GreenPAK 1 Designer, GreenPAK 2 Designer are described in chapters with a GreenPAK Designer general name. The differences are described in separate chapters.

1.1 Application Overview

GreenPAK Designer Legacy (GreenPAK 1 Designer, GreenPAK 2 Designer) is a full-featured integrated development environment (IDE) that allows you to specify exactly how you want the device to be configured. This provides you direct access to GreenPAK device features and complete control over the routing and configuration options. GreenPAK Designer will be used as a general name for GreenPAK 1-2 Designer.

GreenPAK Designer has an integrated programming tool that allows you to program configured design into your GreenPAK chip. With this tool you can also read an already programmed chip and export its data to the Designer. Designer will generate a project, which has the same configuration as chip.

To start working with GreenPAK Designer please take the following steps:

- Download and install GreenPAK Designer software;
- Select what components you need;
- Interconnect and configure components;
- Specify the pinout;
- Test your design with the Emulation Tool;
- Use appropriate GreenPAK development platform to program your project into GreenPAK chip. You can find your kit on Dialog's webstore.

1.2 System requirements

PC System Configuration
Minimum System Requirements for Dialog GreenPAK Designer Legacy:
CPU: 1800MHz
System Memory (RAM): 512MB
Graphics Card: 128MB
Free Hard Disk Space: 200MB
Operating System: Windows 7/8.1/10, MAC OS X (v10.8 or higher), Ubuntu 16.04/18.04 (32, 64-bit), Debian 10 (32, 64-bit).

1.3 Support

Free support for GreenPAK is available online at http://www.dialog-semiconductor.com
Also click Help- > Social in GreenPAK Designer and get access to Facebook, Twitter, LinkedIn and Dialog TV.

For software updates, please go to the Software page on our website.
You can find all these resources in the **Help** menu of GreenPAK Designer.

1.4 Acronyms

These are the acronyms used in the User Guide.

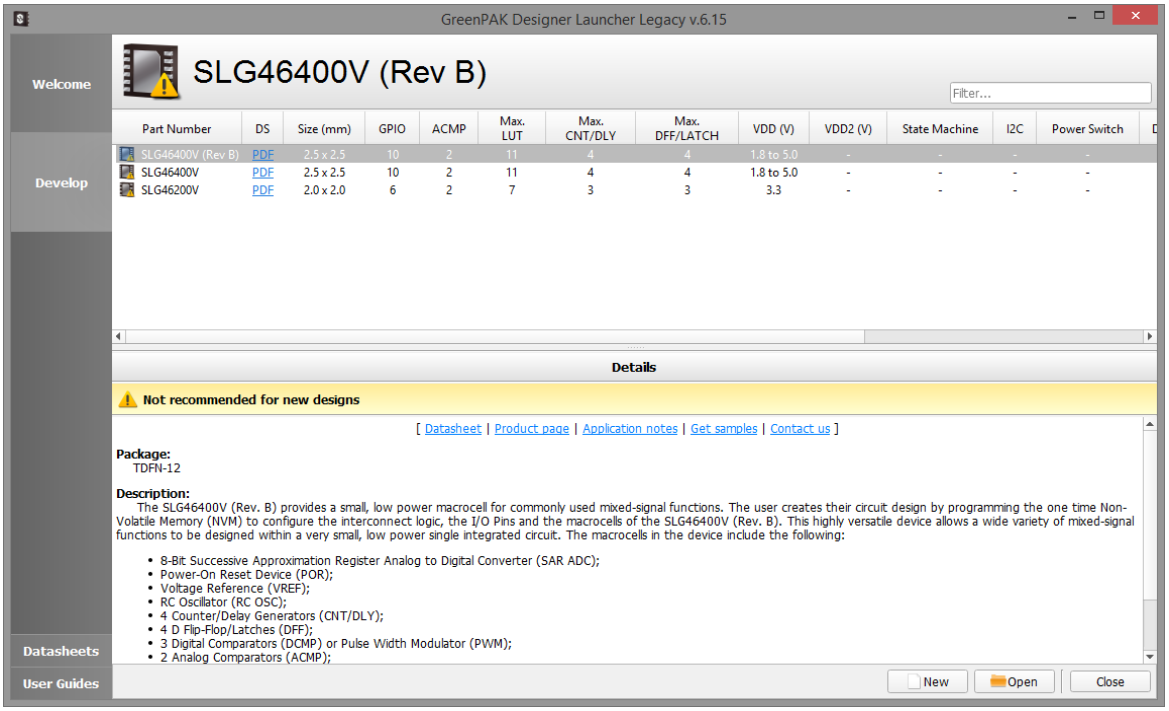
Table 1-1. Acronyms

Acronym	Description
GPD	GreenPAK Designer
GPP	GreenPAK Programmer
IDE	Integrated Development Environment
I/O	Input/Output
IC	Integrated Circuit
OE	Output Enable
USB	Universal Serial Bus
GPIO	General Purpose Input / Output
GPI	General Purpose Input
GPO	General Purpose Output
NMOS	N-channel MOSFET (metal-oxide-semiconductor field-effect transistor)
PMOS	P-channel MOSFET (metal-oxide-semiconductor field-effect transistor)

2. GreenPAK Designer Launcher Legacy

This section describes GreenPAK Designer Launcher Legacy application and its features.

Figure 2-1. GreenPAK Designer Launcher Legacy User Interface



GreenPAK Designer Launcher Legacy:

- Welcome – welcome page with short information and tips for new users.
- Develop – on this page user can select chip revision to start new project for required revision: SLG46200V, SLG46400V, SLG46400V Rev B.
- Recovery Files – page with restored files after crash or freeze. Files was saved with Autosave feature in predetermined time intervals.

New Project – starts new project for selected chip revision (or double-click with left mouse button on selected chip revision icon);
Open Project – opens existing project, automatically selects chip revision;
Close – close GreenPAK Designer Launcher Legacy.

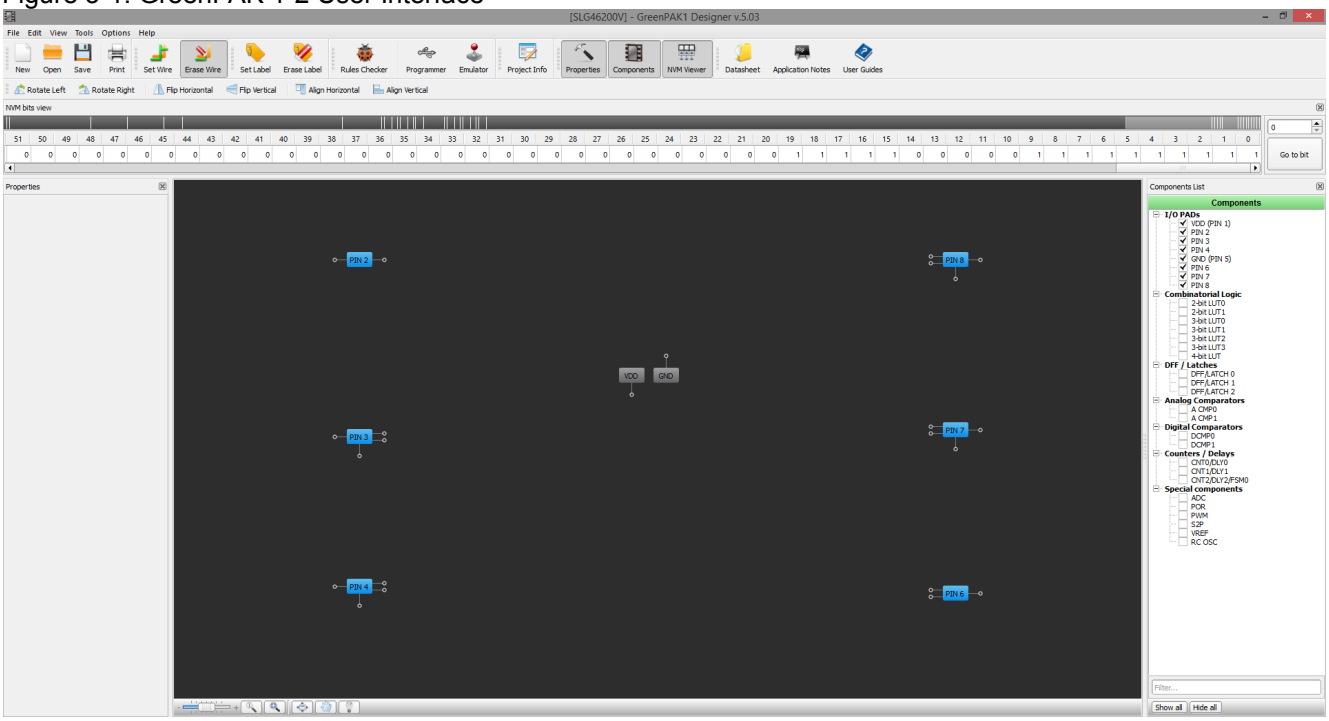
3. GreenPAK Designer

This section describes GreenPAK Designer application and its features.

3.1 GreenPAK Designer Interface Overview

GreenPAK Designer consists of: main menu, toolbar, main work area, output window, properties panel and components list (see Figure 3-1).

Figure 3-1. GreenPAK 1-2 User Interface



3.1.1. Main Menu

Main menu contains controls described below:

- **File**
  - New – start new or open existing project from GPAK Launcher;
  - Open – open existing project in GP Designer;
  - Clear – clear project and select revision for specified chip;
  - Open in current – open existing project for specified chip;
  - Save – save current project;
  - Save as – save current project in specified location;
  - Export NVM bits – save configuration bits to text file;
  - Print – simple print feature without detailed block information;
  - Print Editor (obsolete) – starts Print Editor;
  - Project Information;
  - Application Notes – opens examples web page;
  - Exit program – close GPD;
- **Edit**
  - Rotate Left – rotate a selected block counterclockwise;
  - Rotate Right – rotate a selected block clockwise;
  - Flip Horizontal – horizontal reflection of a selected block
  - Flip Vertical – vertical reflection of a selected block
  - Align Horizontal – horizontal alignment of selected blocks
  - Align Vertical – vertical alignment of selected blocks
  - Set Label – creating a text label for selected blocks
  - Erase Label – erasing text labels near selected blocks
  - Set Wire – enable wire creating mode;
  - Erase Wire – enable wire erase mode;
- **View**
  - Zoom in – increase the work area scale;
  - Zoom out – decrease the work area scale;
  - Fit work area – tune scale to show all blocks visible in project;
  - Zoom 1:1 – set default scale;
  - Full-screen mode – switch to full-screen mode
  - Pan mode – enable/disable scene move in pan mode;
  - Show hints – enable/disable hints for blocks on the scene;
  - Properties – show/hide Properties panel;
  - Components – show/hide Green PAK blocks list;
  - NVM Viewer – show/hide NVM bits viewer;
  - Rules Checker Output;
- **Tools (in GreenPAK 1 Designer)**
  - Emulator – this tool is included for convenient project testing;

- Programmer – start GreenPAK Programmer with the current project exported;
- Rules Checker – checks current design for correct settings;
- Comparison – compares bits of two projects;

- **Tools (in GreenPAK 2 Designer)**
  - Emulator – this tool is included for convenient project testing;
  - Mini-Emulator – this tool is included for convenient project testing;
  - Rules Checker – checks current design for correct settings;
  - Comparison – compares bits of two projects;
- **Options**
  - Settings – default projects folder, autosave, toolbars position, recovery, shortcuts and update options;
- **Help**
  - Help – show help window;
  - User Guides – open User guides web page;
  - Legend box – show the color legend box;
  - Dialog web site – open Dialog official web site;
  - Software and documentation – open Software & Dock web page;
  - Dialog web store – open Dialog chip store;
  - Design support – web page with training courses and videos;
  - Contact Us – web form with request;
  - Social – Dialog Semiconductor in social networks;
  - Application Notes – open examples web page;
  - Datasheet – open documentation web page;
  - Updater – open GreenPAK update tool;
  - About GreenPAK Designer – show information about GPD versions modification.

3.1.2. Tool-bars

Toolbar provides a quick access to frequently used functions. There are 8 tool-bars:

- **File**
  - New;
  - Open;
  - Save;
  - Print;
- **Undo**
  - Undo;
  - Redo;
- **Wire**
  - Set wire;
  - Erase Wire;
- **Label**
  - Set Label;
  - Erase Label;

- **Item editor**
  - Rotate Left;
  - Rotate Right;
  - Flip Horizontal;
  - Flip Vertical;
  - Align Horizontal;
  - Align Vertical;
- **Tools (in GreenPAK 1 Designer)**
  - Rules Checker;
  - Programmer;
  - Emulator;
- **Tools (in GreenPAK 2 Designer)**
  - Rules Checker;
  - Mini-Emulator;
  - Emulator;
  - Lock NVM;
- **Panel switcher**
  - Properties;
  - Components;
  - NVM Viewer;
- **Navigation**
  - Zoom slider – adjust scale;
  - Zoom 1:1;
  - Fit work area;
  - Full screen mode;
  - Pan mode;
  - Show item hint;

3.1.3. Work Area

Three types of components connection:
- Connectivity matrix connections (green) – user can connect any output to any input through wiring tool;
- Settings defined connections (orange) – these connections are predefined and depend on block settings;
- Buses (wide orange line) – buses also depend on block settings. All buses are 8-bit wide.

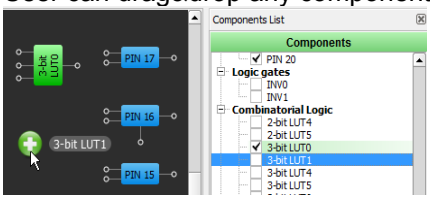
All blocks can be moved using mouse or keyboard (Ctrl+Arrow Keys or Alt+Arrow Keys) and rotated. You can move a few blocks at the same time by using multiple select option. Rotation, flipping and alignment is also available for more than one block at a time.

3.1.4. Properties Panel

Properties panel contains all settings available for selected chip component. The panel is divided in two partitions: **Properties** and **Connections**. Properties division contains settings and parameters that could be specified for a selected block. Connection division contains settings which control the predefined connections to the selected block. Last division could not be present in some blocks. Some parameters and settings are common for a few blocks. There are 2 types of controlling elements **Edit Box** and **Drop List.** To change settings in Drop List you can click and select action or place the mouse pointer over selected list and scroll by mouse wheel. To enter value into the Edit Box you can use keyboard, mouse scroll or buttons at the right. After finishing all configurations press **Apply** button to confirm changes. If you want to discard changes you can press **Reset** button with options: reset settings to default or reset connections to default.

3.1.5. Components List

The Components list is an instrument that contains all blocks available in chip. It provides user with the possibility to show/hide unused blocks. You cannot hide blocks that are connected by any type of lines. In the GreenPAK chip there are connections which are beyond the connectivity matrix. They are controlled by settings of proper components and cannot be fully disconnected. That's why there are some blocks that cannot be hidden. Hidden blocks retain their configuration. For this reason, be sure to configure hidden components properly. You can show/hide selected blocks by using the check/un-check feature on the list. In order to show a group of blocks, double-click on the check box of the desired group. In order to hide a group use a single click.
There are two buttons at the bottom of the components list – Show all (shows all blocks) and Hide all (hides all blocks which are not connected to a circuit). Also user can use filter to find required components.
User can drag&drop any component from Component List to the workarea to the right place:



3.1.6 Color Scheme

Components:

Mode		Description
Normal	Selected	
		Turned on
		Turned off
		I/O PAD

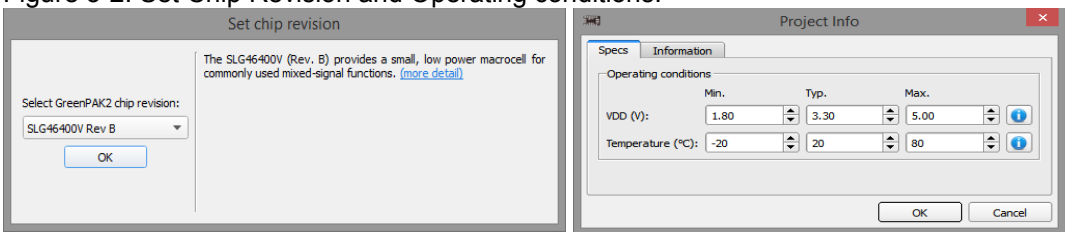
Components Pin Tips:

Color	Value
	User can connect wire to this pin
	Pin has already been connected (and there cannot be any other connections to this pin)
	User can connect wire to this pin only after changing component option
	Inner connection, user cannot connect wire to this pin
	External I/O Pin (I/O from chip)

3.2 Creating a Project

To create a new GreenPAK Designer project start GPD Launcher Legacy or go to **File->New** or click the "New" icon on the toolbar. While creating new project in GreenPAK Designer please choose chip revision for current project and specify operating conditions – VDD and Temperature.

Figure 3-2. Set Chip Revision and Operating conditions.



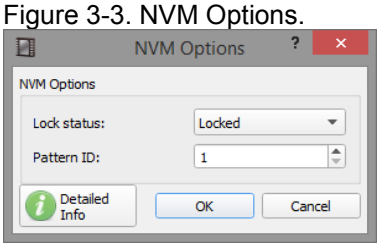
A new project will be created in current window and all unsaved changes will be lost. Also you can start a new GreenPAK Designer copy and it will be loaded with the blank project. By default the project is configured for minimal power consumption and some components are disabled. All disabled components are darker and colored in red after selection. GreenPAK 1 project uses [.gpp/gp1] file extension, GreenPAK 2 project use [.gp2] file extension. It contains information about position, rotation/flipping and configuration of chip blocks, all wire connections, and bit file sequence settings of test mode, etc. Interface settings will not be saved in the Project file.

3.2.1 Updating Existing Projects

If you load an existing project created by a previous version of GreenPAK Designer and want to save changes, it will be saved in the updated file format.

3.2.2 Lock NVM Window

Figure 3-3. NVM Options.

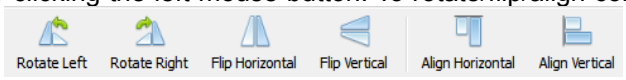


Lock status – blocks NVM reading. A programmed project becomes unavailable for chip reading. Though chip is still applicable for the emulation.

Pattern ID – gives an ID (1-255) to the project. The ID will be put in the chip after programming, and also will be read back during "chip reading" operation.

3.3 Configuring Chip Components

3.3.1 Placing Components

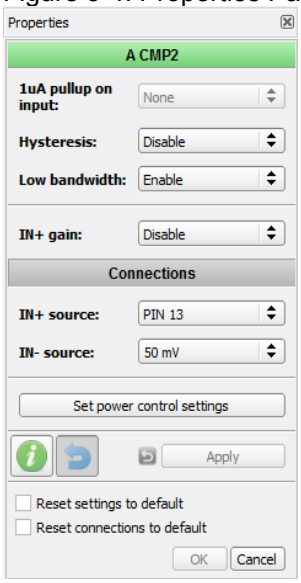
When you open GreenPAK Designer it will start with a blank project. A blank project contains pins and blocks which cannot be hidden. Components can be moved, rotated, flipped and aligned. In order to move a component, simply drag it where you want by clicking the left mouse button. To rotate/flip/align component select it and press the "Rotate/Flip/Align" buttons 

on the toolbar or select Rotate/Flip/Align in the main menu.

3.3.2 Setting Chip Components Parameters

Each chip component has different parameters. Some components have parameters that are shared with other components. Changes in one block cause changes in other blocks. Component settings are available at component **Properties** panel (Figure 3-4) which appears after double-clicking on the component. **Properties** panel consists of three parts: Properties, Connections, and Information. Properties section contains all settings of a selected component. Connections section allows you to configure connections that couldn't be made using wiring tool. Information section contains short information about parameters of selected component. After making changes in **Properties** panel click the **"Apply"** button to save changes. If you do not click the **"Apply"** button and select another block, a save changes message box will appear.

Figure 3-4. Properties Panel



Reset connections and/or settings to default: this option allows to reset NVM bits, components properties, wire connections from/to component.

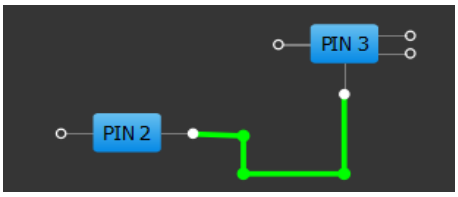
3.4 Specifying Interconnections

You can interconnect chip components to achieve the necessary functionality. To make a connection please select **Set wire** on the **Wire** toolbar or from the main menu. Next, click the first and second pins that you want to connect. After selecting the first pin, GPD highlights allowed connections in green. If you click the first pin and then decide to exit line creating mode press **Esc** or the right mouse button.

Figure 3-5.

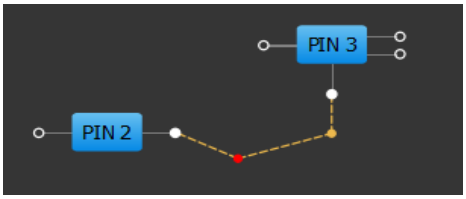
Also you can manually correct the created wires.
You can move horizontal lines up and down, vertical lines left and right (Figure 3-6).

Figure 3-6.



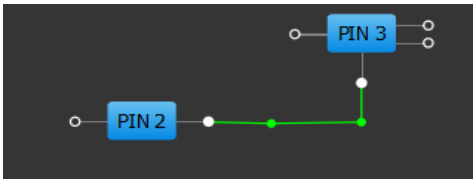
You can move points on the wire (Figure 3-7).

Figure 3-7.



In order to create additional points on the line use the double click (Figure 3-8).

Figure 3-8.



Only the green color pins can be connected Using Wire Creating tool. Some components have pins that are not allowed to be connected using wiring tool. Connections between such pins (orange dotted line and violet pin color) and buses can be made only by changing settings in **Connections** section of the **Properties** panel of

proper components. In this case violet pins can change color to green and user can connect them using wiring tool. Orange wires will be automatically generated. Orange wires also can be modified by user. Input pins without connections are considered to be tied to ground.

In order to delete wire please select **Erase wire**  at the **Wire** tool-bar and click on the selected wire. Only green wires can be deleted.

Additional controls for add/remove wires:

Hold button to force wire mode:

- Shift: for Set Wire;
- Alt: for Erase Wire;

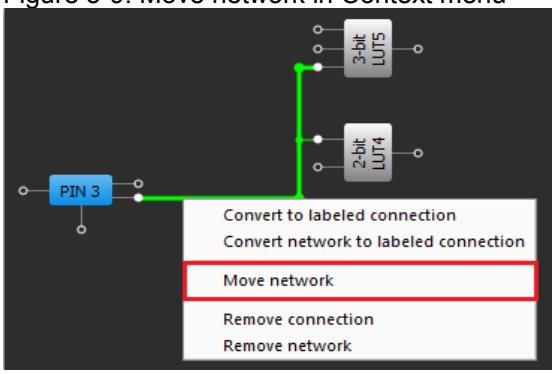
Action with multiple wires:

- Hold Ctrl+Shift and click on pin: add multiple wires from the same source pin;
- Hold Ctrl+Alt and click on wire: remove all wires from source pin;
- Hold Ctrl: works as Ctrl+Shift or Ctrl+Alt based on current wire mode;

Move network

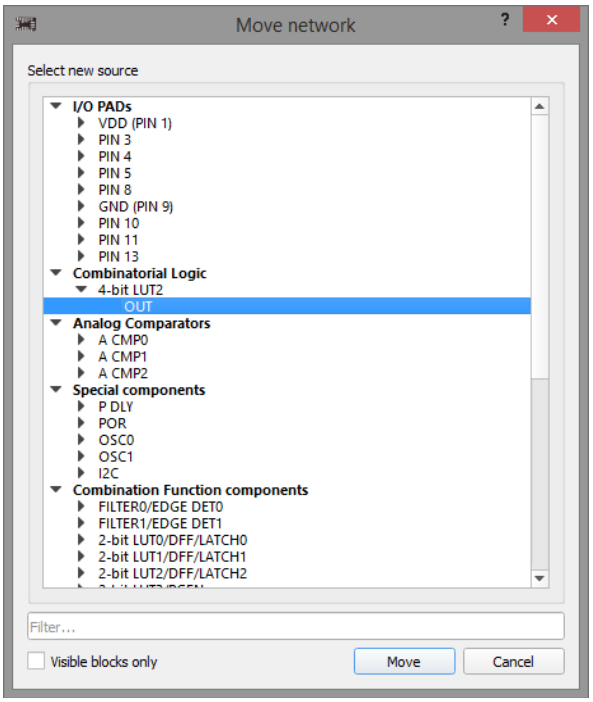
Move network feature provides the fastest way to reconnect all matrix wires from any pin to another. Simply click on wire with right mouse button and select Move network in Context menu

Figure 3-9. Move network in Context menu



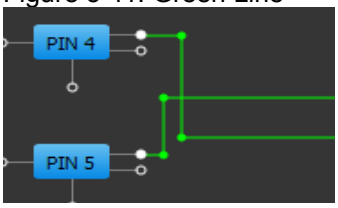
Select new source from list in Move network window. User can select new source only from list of visible blocks or from list of all blocks.

Figure 3-10. Move network window



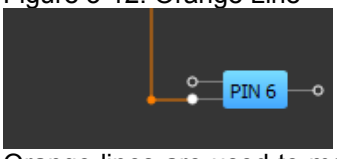
3.4.1 Wire Types

Figure 3-11. Green Line



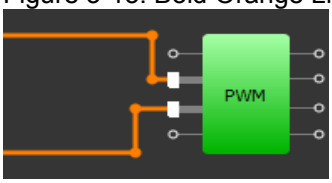
Green lines in GreenPAK Designer software tools are used to mark manual wires. Using them you can manually connect necessary blocks to operate in the desired way. You can connect block output to multiple inputs, but wiring of different outputs to one input is impossible.

Figure 3-12. Orange Line



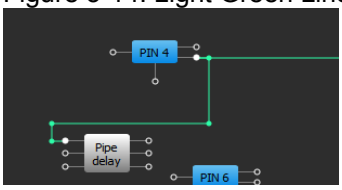
Orange lines are used to mark the internal functional bounds of the chip blocks. They do not have the impact on chip operation until the proper function is used. These lines can't be erased.

Figure 3-13. Bold Orange Line



Bold orange lines (like the orange lines) mark the internal bounds. The difference is that the bold orange lines mark 8-bit parallel data buses. These lines also cannot be erased. They do not have an impact on chip operation until the proper function is used and the proper option is set.

Figure 3-14. Light Green Line

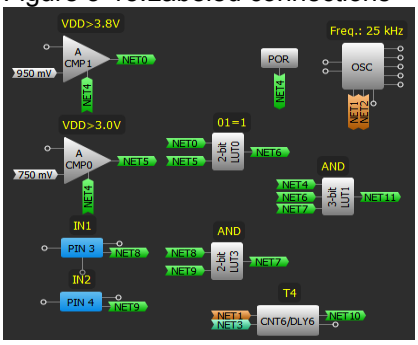


Light green lines are used to mark the shared connections. Their behavior is the same as the green lines.

Replacing wires by labels

This option converts wired connection to 2 labels (for output and input pins) and back (Figure 3-15). Name of the label will be generated automatically: NETx, where x – random number. If output was connected to few inputs all of them should have the same name. For changing the connection type use the context menu of the block, line or label(NET).

Figure 3-15.Labeled connections



Available options for wire (context menu):

- Convert to labeled connection;

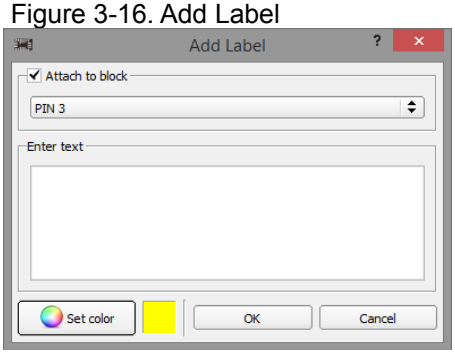
Available options for label (context menu):

- Convert to wired connection;
- Rename network;
- Remove connection.

3.4.2 Set/Erase Label

Using Set/Erase Label the user can add/delete text label. The Set Label tool adds a text label to the selected component or without connecting them to the specific component. The user can Attach label to component or Detach label(s) from component(s). If no component is selected, then the user can select a component from the list offered by the Set Label tool. The user can also choose text color. If the selected component already has a label, Set Label tool can edit label text. If the user selects more than one component, it is possible to change the text color without changing text in all components at once. If the user changes the text while more than one component is selected, it will be changed on all selected components at once as well. Erase Label deletes text label.

Figure 3-16. Add Label



3.5 Specifying the Pinout

3.5.1 Port Connections

Pin blocks can be connected just like any other blocks using the Wiring Tool.

3.5.2 Port Drive Modes

GreenPAK 1 chip has five GPIO (PIN3,4,6,7,8) and one GPI (PIN2) pin components. These components can be configured to work in the following modes:

- Digital in with Schmitt trigger;
- Digital in without Schmitt trigger;
- Low voltage digital in;
- Analog I/O;
- 1x push pull;
- 2x push pull;
- 1x open drain;
- 2x open drain;

GreenPAK 2 chip has nine GPIO (PIN3,4,5,6,8,9,10,11,12) and one GPI (PIN2) pin components. These components can be configured to work in the following modes:

- Digital in with Schmitt trigger;
- Digital in without Schmitt trigger;
- Low voltage digital in;
- Analog I/O;
- 1x push pull;
- 2x push pull;
- 1x open drain;
- 2x open drain;
- Analog in and open drain out;

Also, Pull-Up/Pull-Down resistors are configurable. To configure the pin component, open its parameters to set a desired mode and pull-up/pull-down resistor. I/O pin components have **input (IN)**, **output (OUT)** and **output enable (OE)** pins. These pins are one-way directed, so you need to configure the pin component and connect the proper pin. OUT pin is an output signal from the pin component. It corresponds to the signal from the input buffer. IN pin is an input to the pin component. It accepts a signal from internal components. Output Enable (OE) signal defines the Push-pull buffer state. Low OE signal switches buffer to Hi-Z state. High OE signal enables Push-pull buffer regardless of selected component operating mode. It could be used for applications where bidirectional pins are needed.

3.6 Navigation

To navigate through project workspace use the **View** menu or toolbar. Use **Zoom In**, **Zoom Out** buttons or slider to zoom workspace. If you want to see all project components click on **Fit work area** or **Zoom 1:1**. To navigate through work area you can use **Pan mode**. Pan mode also activates by using middle mouse button.

To enable block's hint, press **Show item hints** button. A hint box pops up next to the item when the mouse moves over the block.

3.7 Keyboard commands

To navigate through GreenPAK Designer use specific keyboard commands or shortcuts. List of commands specified in the table:

Table 3-1. Keyboard commands

Keyboard command	***Action***
Block moving on the scene	
Alt+Arrow Keys	Moves selected block on 1 pixel
Ctrl+Arrow Keys	Moves selected block on 10 pixels
Connecting/Erasing wires	
Hold *Shift*	Forces Set wire while using Erase Wire
Hold *Alt*	Forces Erase wire while using Set Wire
Hold *Ctrl+mouse cursor*	Adds multiple wires from the same source
Hold *Ctrl+Shift+mouse cursor*	Forces add of multiple wires from the same source while using Erase Wire
Hold *Ctrl+Alt+mouse cursor*	Forces remove of all wires from the network while using Set Wire
Standard hotkeys	
Ctrl+Z	Undo
Ctrl+Y	Redo
Ctrl+N	New project
Ctrl+O	Open project
Ctrl+S	Save project
Ctrl+P	Print Editor
Ctrl+Q	Exit program
Ctrl+L	Rotate component Left
Ctrl+R	Rotate component Right

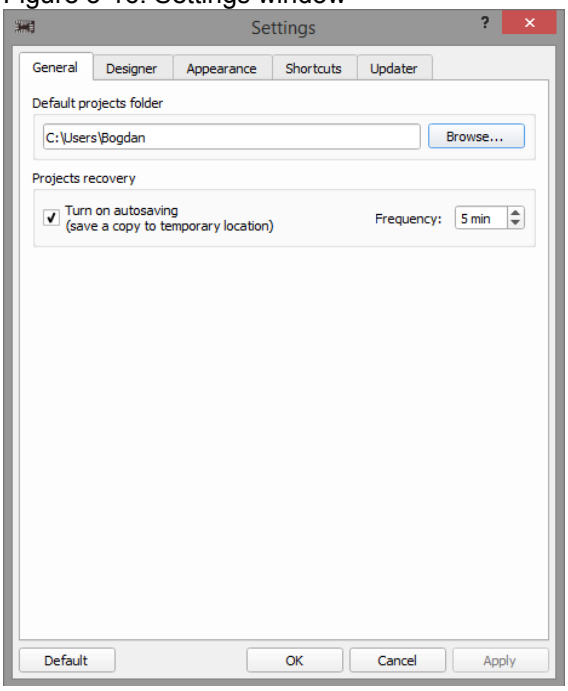
Ctrl+H	Flip component Horizontal
Ctrl+V	Flip component Vertical
Ctrl+W	Set Wire
Ctrl+E	Erase Wire
Ctrl+F	Filter on Components List
H	Hide component
+	Zoom in
-	Zoom out
F1	Help
F2	NVM Viewer
F3	Properties of component
F4	Components List
F5	Rules Checker
F9	Debug
F11	Fullscreen Mode
Emulator hotkeys	
Ctrl+E	Emulation
Ctrl+I	Info
Ctrl+L	Log
Ctrl+N	NVM Data
Ctrl+P	Program
Ctrl+R	Read
Ctrl+S	Save Settings
Ctrl+T	Test Mode

All other Designer main window actions can be configured by entering specific key sequence in Settings window on Shortcuts tab.

3.8 GreenPAK Designer Settings

GreenPAK Designer settings configure all basic options of program in several tabs (Figure 3-16). To open settings select Options-> Settings in main menu.

Figure 3-16. Settings window

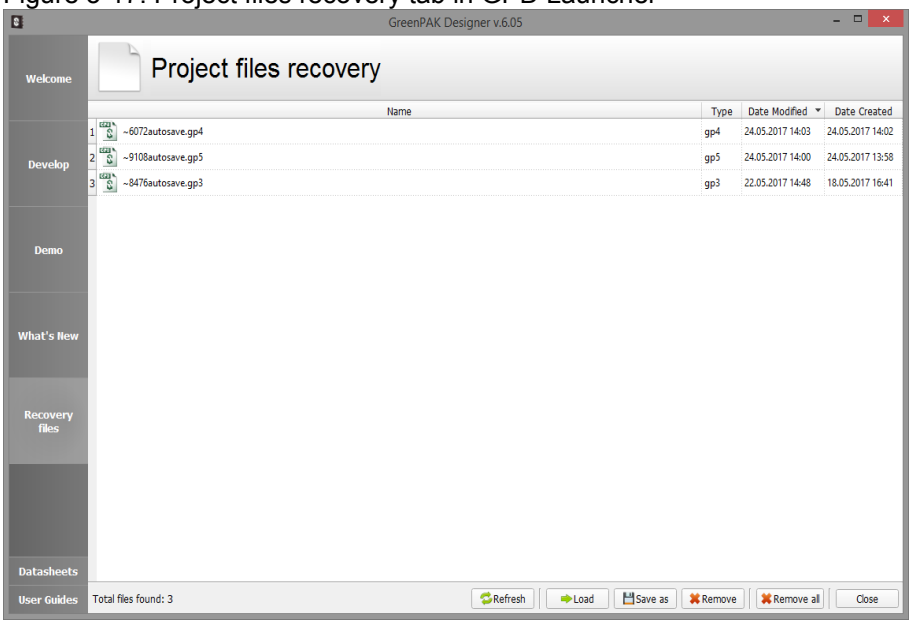


GreenPAK Designer settings window contains of tabs:

General:

- Default projects folder – defines path to users GPD project files;
- Projects recovery – activates autosave function, which allows to reduce the risk or impact of data loss in case of a crash or freeze. Autosave function in predetermined time intervals will save your files and after a critical problem will offer to restore these files in GreenPAK Designer Launcher on Projects files recovery tab (Figure 3-17);

Figure 3-17. Project files recovery tab in GPD Launcher



Designer:

- Pin hints – shows pin hints while block is selected or properties panel of component is visible:

- Look-Up Table (LUT) – allow usage of regular shape by default. For example, regular shape of NXOR:

Appearance:

- Window appearance – saves positions of toolbars/dock widgets and window geometry of GP Designer work area;
- High DPI displays – enables GP Designer scalling on high DPI displays;

Shortcuts:

- On Shortcuts tab all GP Designer actions can be configured by entering specific key sequence;

Updater:

- Scheduler – determines check for updates time: after Designer starts or Once per 1-7 days;
- Path – defines server for update and destination to download updates;
- Proxy – allow user to configure proxy for updates;
- Check configuration button – checks connection to server.

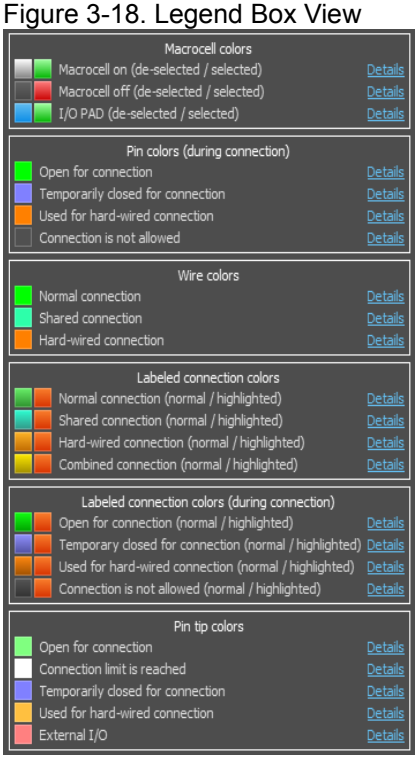
Default button:

- Resets settings to default parameters by categories or all at once.

3.9 Legend Box

Legend box shows the color scheme of GreenPAK designer.
The user can open this window by clicking 'Legend box' button in 'Help' menu.

Figure 3-18. Legend Box View

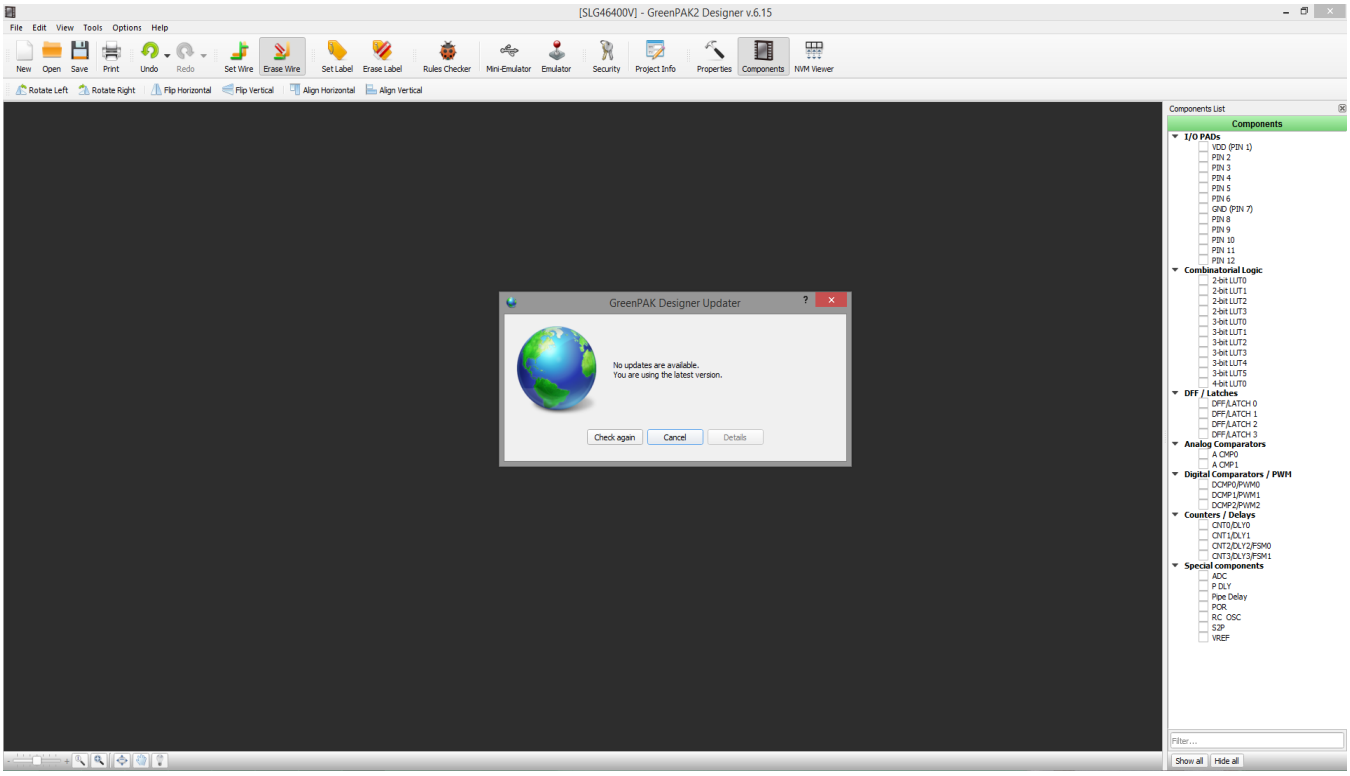


3.10. Updating GreenPAK Designer

There are two ways of updating the GreenPAK Designer:

- When updates are available – this information will be displayed. The user will get a chance to either download a new version using the “Update”, or the “Not now” to delay the renewal until the next program start. After the download is finished, an opened folder with installer will appear.

Figure 3-19. Updating GreenPAK Designer



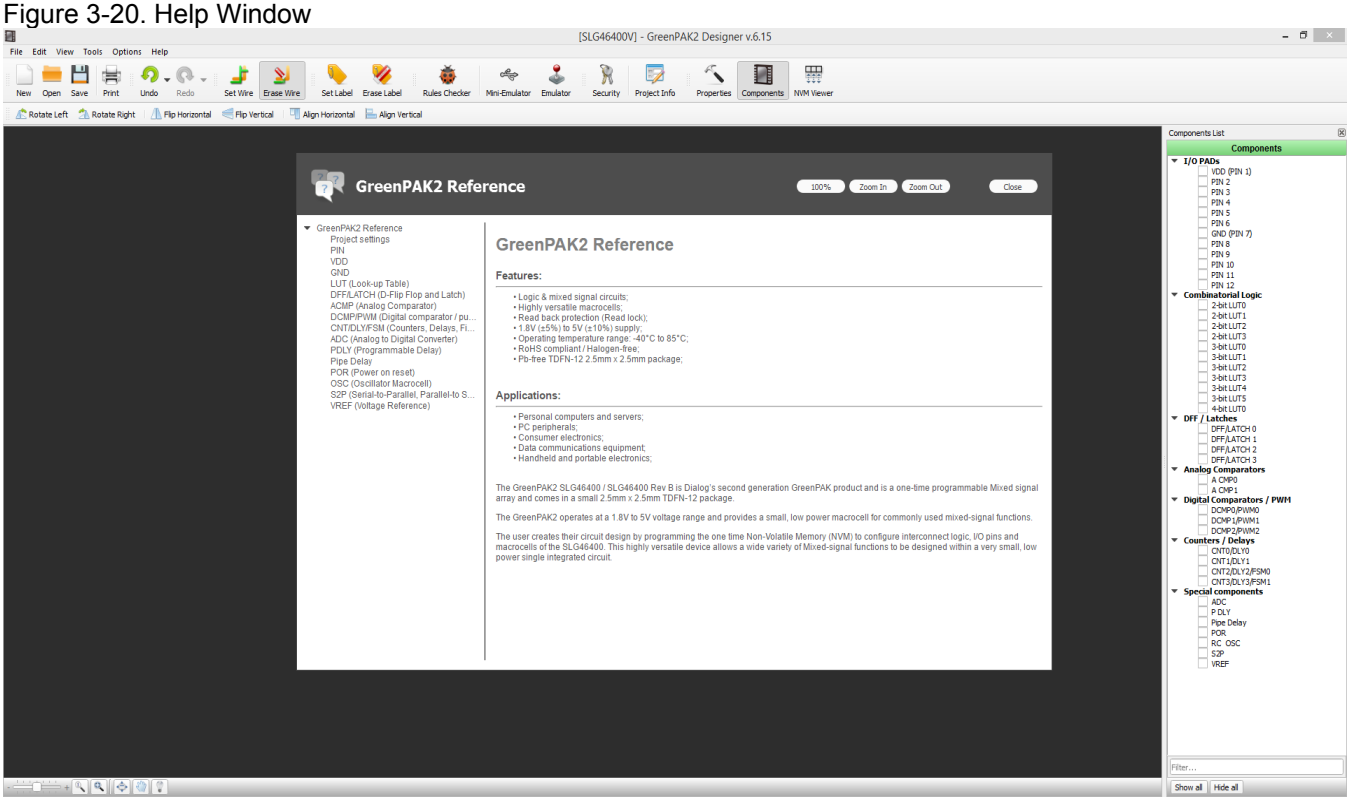
- You can also find the latest GPD version at Software page of Dialog web site. For the best user experience, keep your GreenPAK Designer up to date. Feel free to email suggested updates to the developer to improve this program (Please refer to **“About GreenPAK ”** section of **Help** menu).

Configure Updater options on Updater tab in Designer Settings window (see Section 3.8 GreenPAK Designer Settings)

3.11 Help Window

To view information about a specific block, select the block and click 'Help' from the Help menu or press the 'F1' button. A window will list the information about each block ('short info'). Press the 'detailed info' button for more detailed information (Figure 3-20). If you don't select any block, you will be shown the information about all the blocks. The 'Help' button on the property panel of each block provides the same information about the current block.

Figure 3-20. Help Window

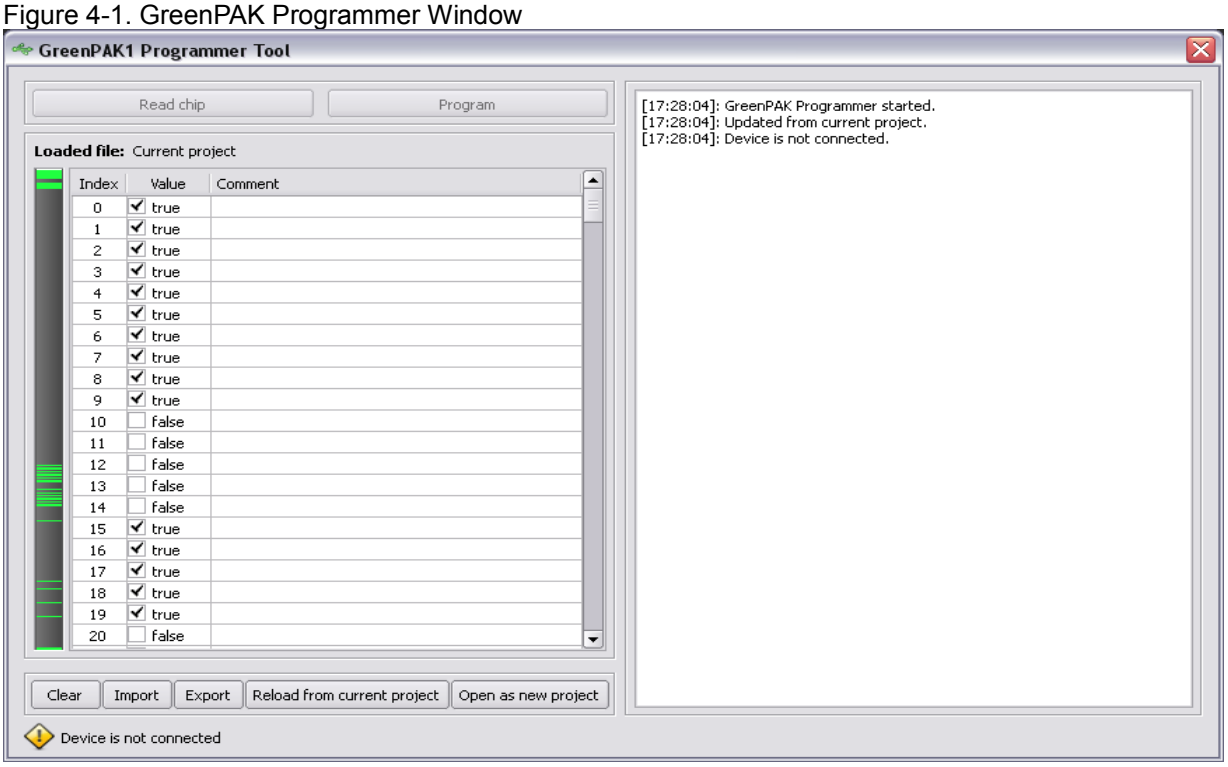


4. GreenPAK Programmer

4.1. GreenPAK Programmer Overview

GreenPAK Programmer provides user with a possibility to program a configured design to PAK chip quickly. It can be started from Designer software or from the Windows main menu. To start Programmer from GreenPAK Designer, use the Tool-bar main menu button or press **F10** on the keyboard. Programmer starts with an advanced interface shown on Figure 4-1.

Figure 4-1. GreenPAK Programmer Window



4.2. Selecting Sequence File

When you start GPP from the GPD tool-bar or the main menu, it automatically imports a bit sequence from the current project, so you can easily program the chip. Also, you can select another file sequence by pressing the **“Import”** button.

4.3. Programming Chip

To program da evice please follow the next steps:

- Insert PAK chip into the socket.
- Connect programmer hardware to USB. If you insert it for the first time please wait until programmer installation is complete. Next you will see the message, “Device is connected” in the status bar.
- Start GreenPAK Programmer
- Select file sequence if required.
- Press **Program** button.

- After programming is complete you will see a “Programming successful” message. If you see another message please refer to one of resources from the **Support** section.

4.4. Read Chip

For chip reading press the **Read chip** button. Alternatively, you can create a new file sequence manually.

4.5. Exporting Data to GPD

Using the GPP tool you can read an already programmed chip and export the data to GreenPAK Designer. Designer generates a project which has the same configuration as the chip. Components will be connected and configured but their placement will be the same as in a blank project. The exported project will be created in the new window. To export chip data to the GPD, press **Read chip** to read data and press **Open as new project** afterward.

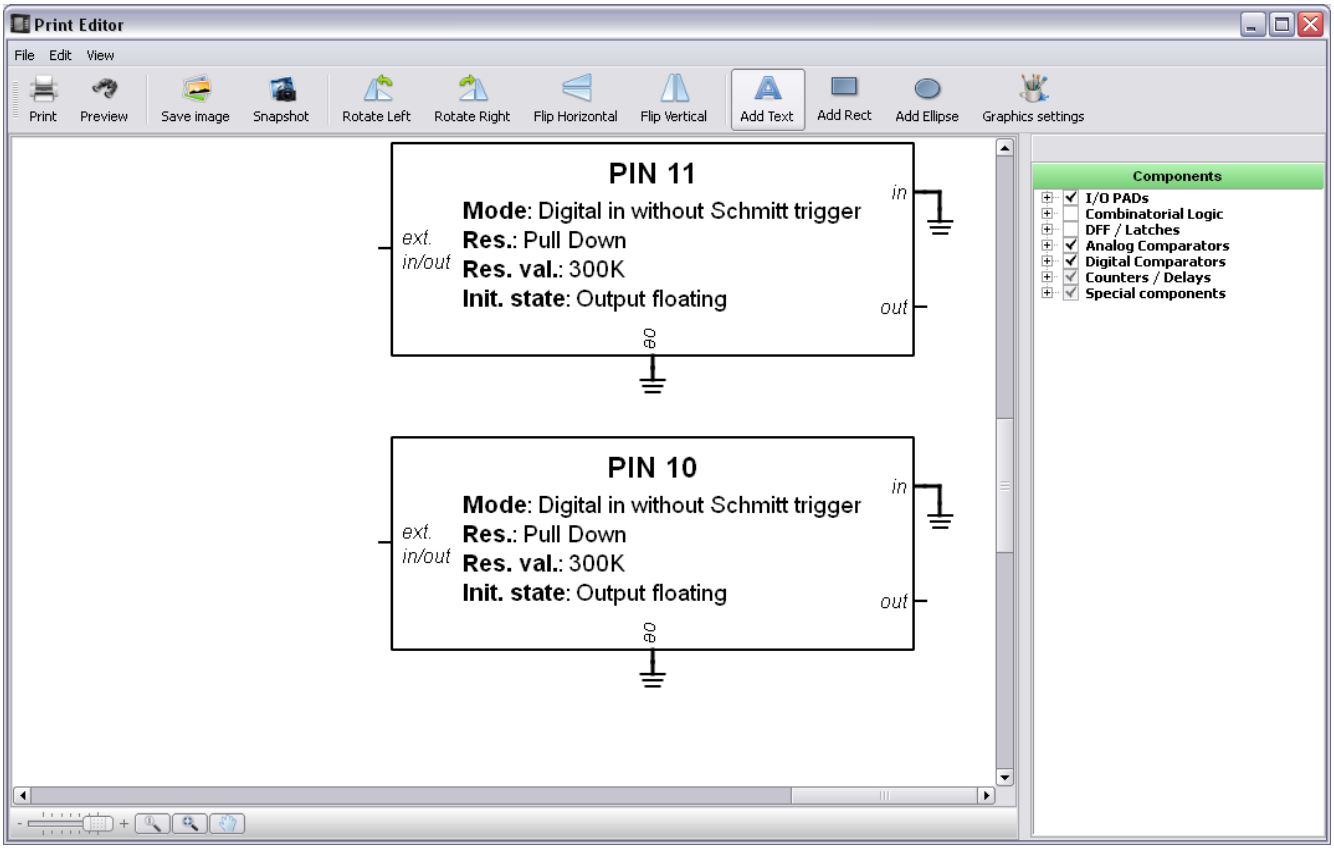
5. Print Function

Print Function component consists of two main parts:

- Editable working area, where the user can customize positions, view of components, and lines connecting them.
- Preview window where the user can set up the print preferences.

Editable working area shows all components which where used in the design.

Figure 5-1. Print Editor



The Main Actions:

- User can hide or display any component using the Components list on the right.
- Each component in the work area is selectable and movable.
- Any component can be rotated or flipped.

Note: print editor settings will be saved before print editor's window is closed. It allows the user to repair previous state during next opening.

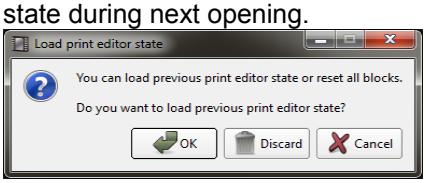


Figure 5-2. Preview Window

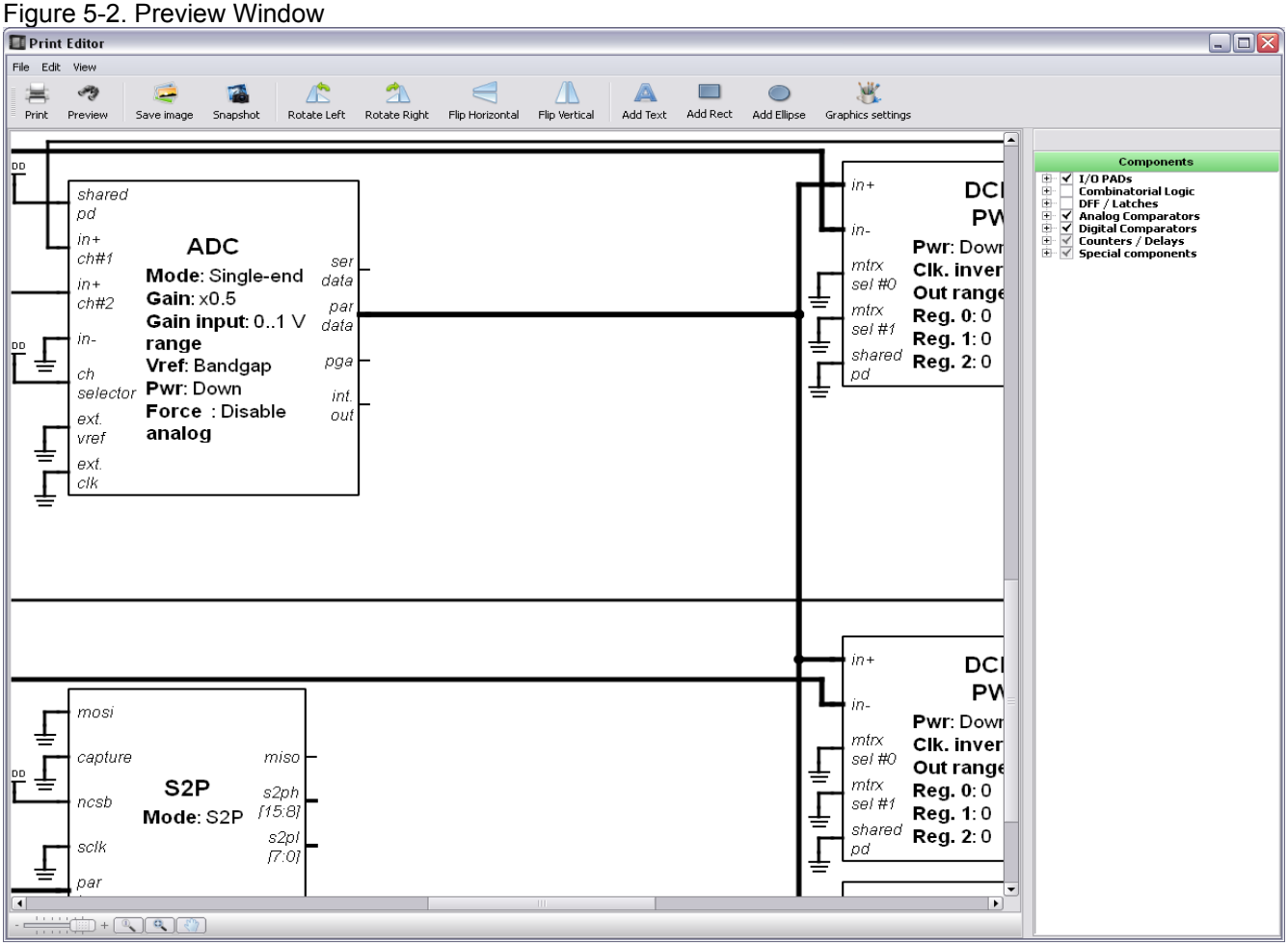
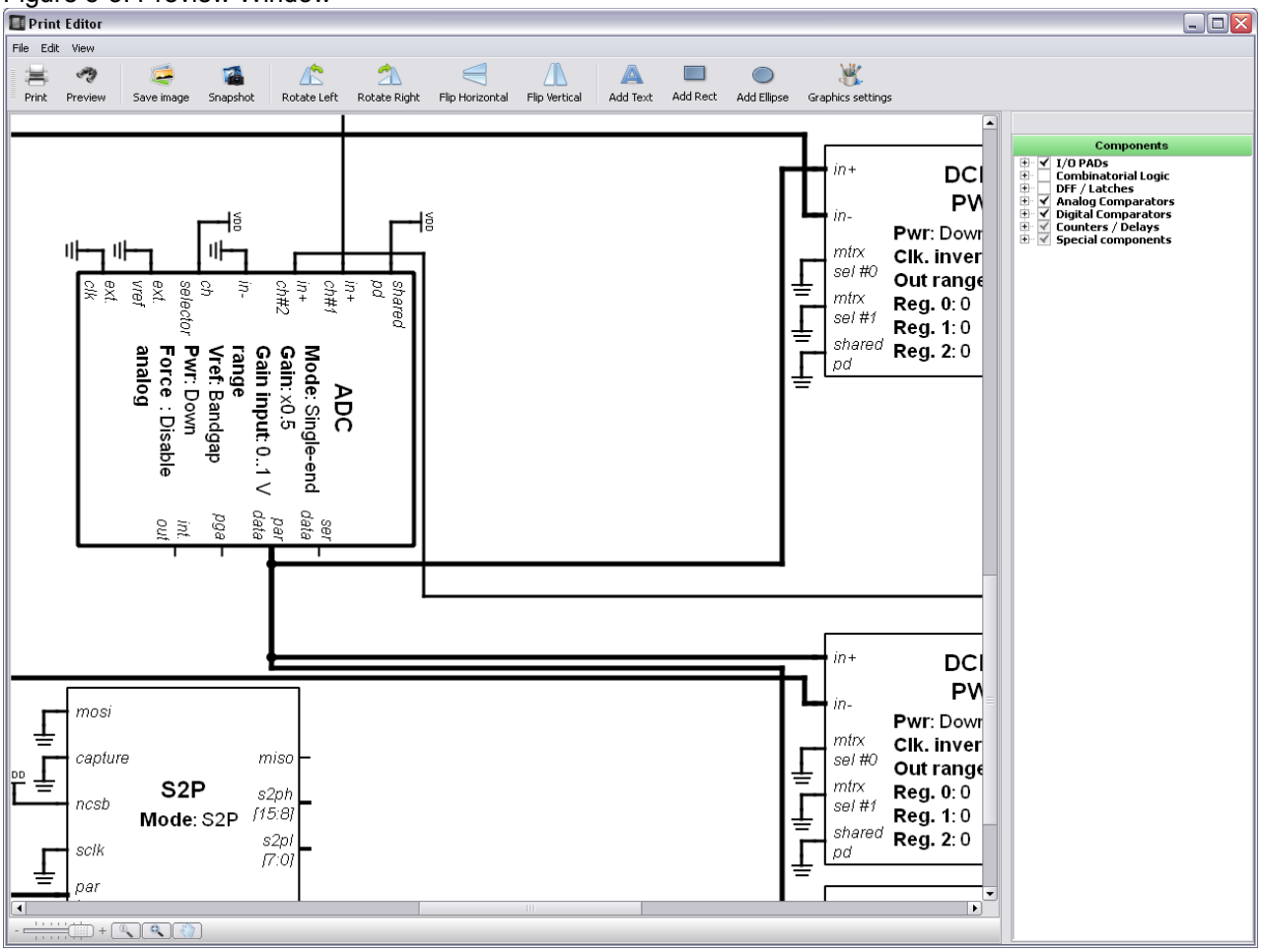
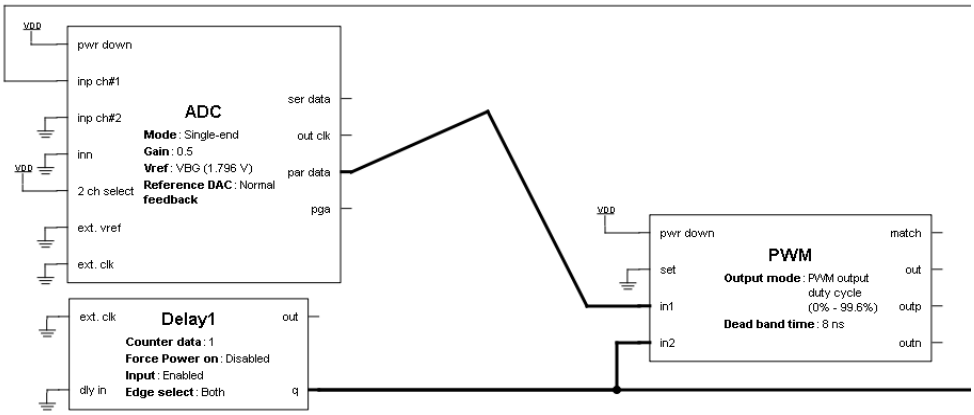


Figure 5-3. Preview Window



User can move lines and points to correct odd angled appearance.

Figure 5-4. Work sheet.



5.1. Working Area

Working area can be zoomed in or zoomed out.

User can add a text label to the schematics using the text tool.

Figure 5-5. Text Label

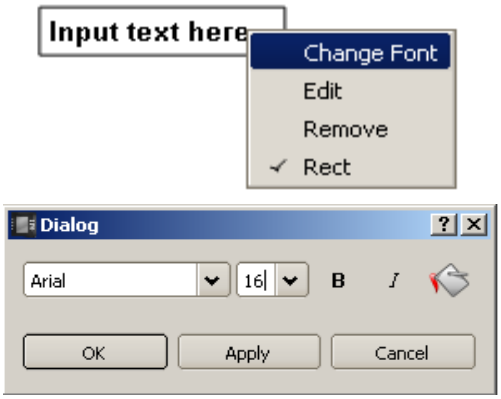
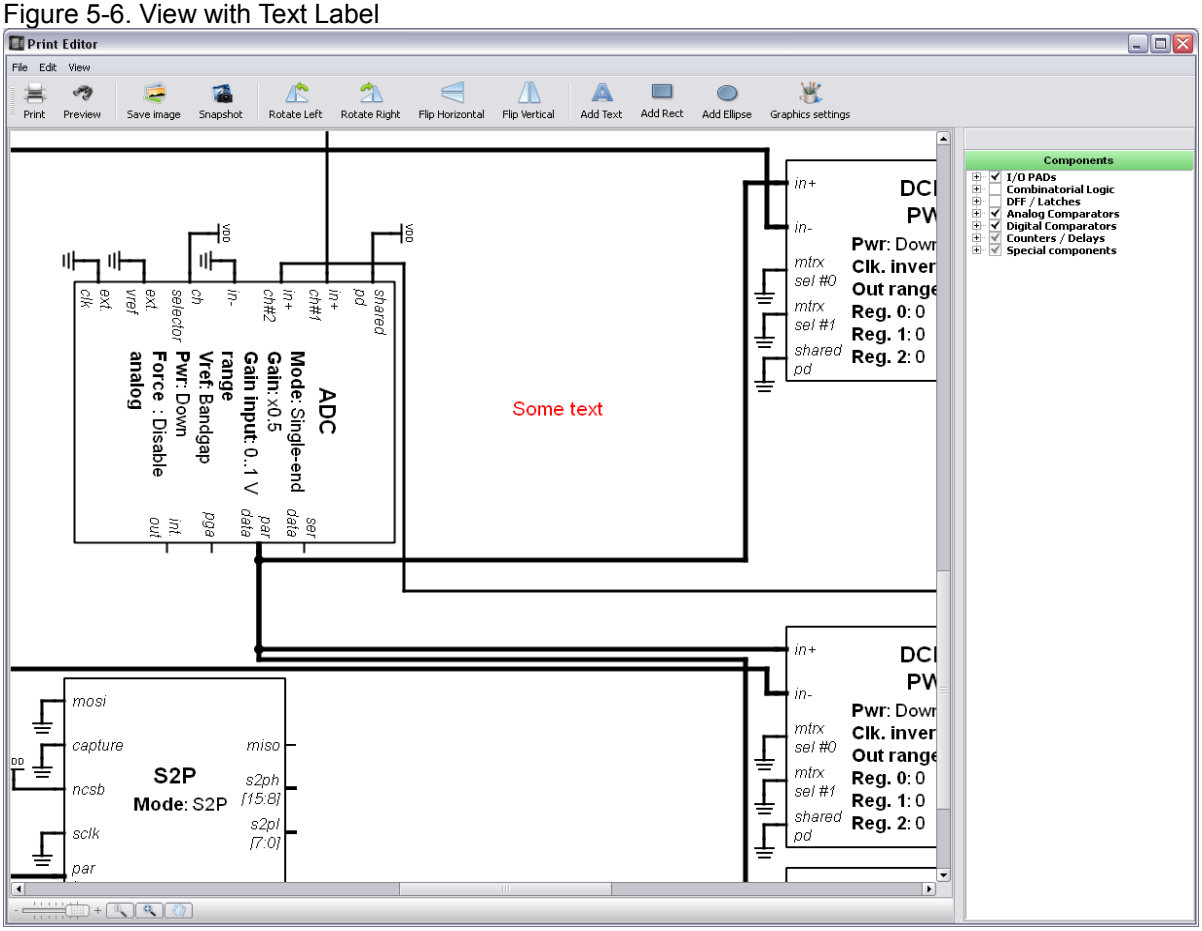
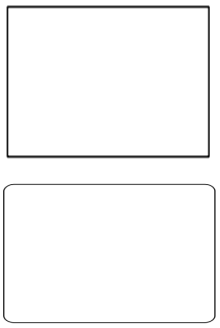


Figure 5-6. View with Text Label



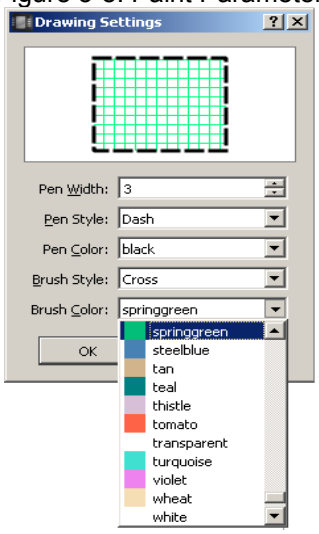
The user can add to the working area the custom figures including rectangle, rounded rectangle, ellipse etc.

Figure 5-7. Custom Figure



The user can also customize the main paint parameters.

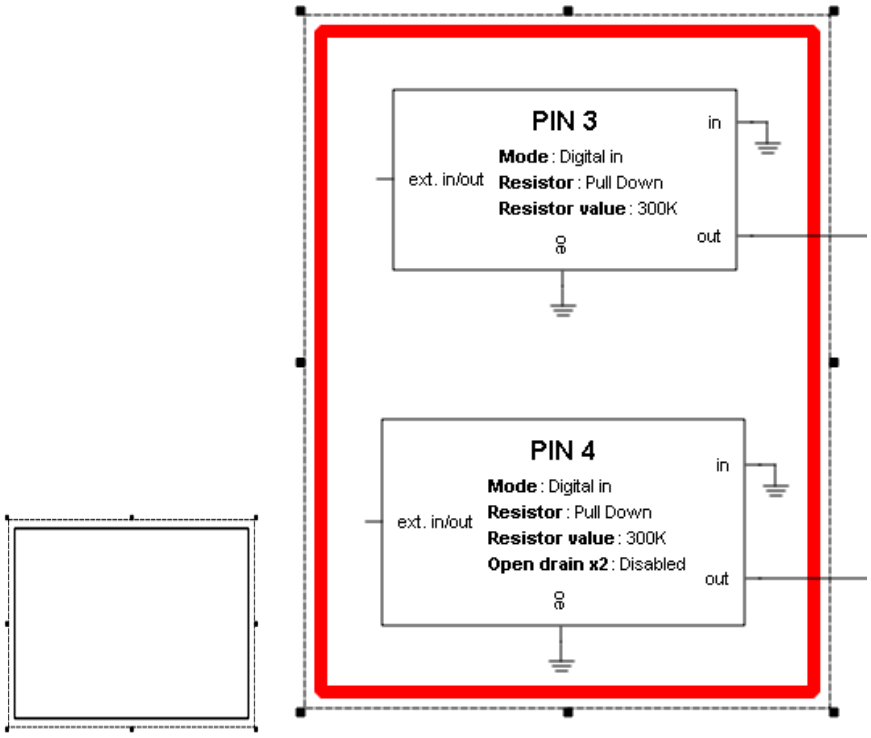
Figure 5-8. Paint Parameters



You can see a small preview window which includes a painted rectangle with user-parameters.

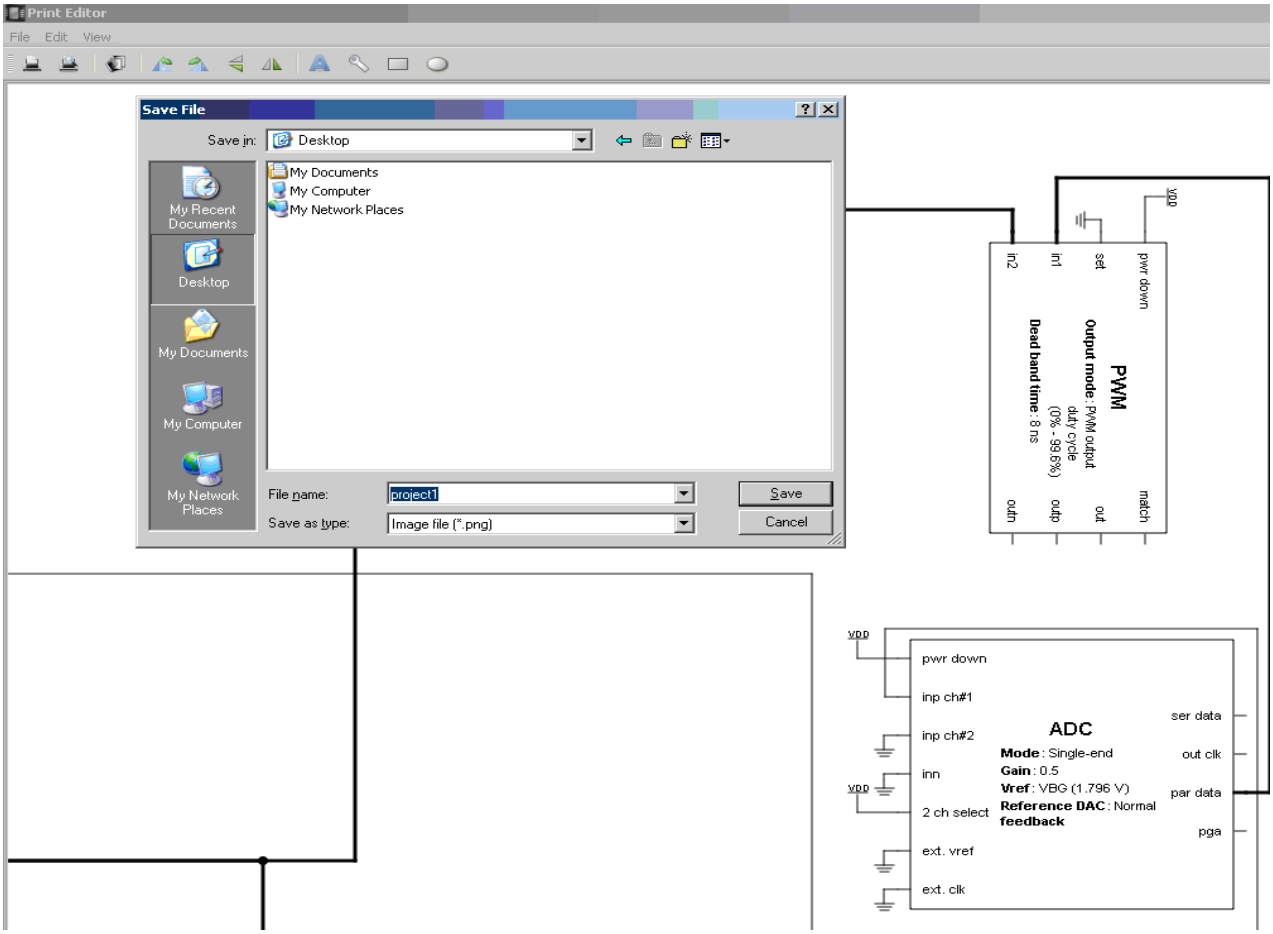
When the user adds a figure to the working area, one can customize the figure size by dragging black points on the corners and sides. The user can view it only by moving the mouse pointer up to the figure.

Figure 5-9. Work Area



The user can save a composed diagram into a graphics file or directly send it to the printer.

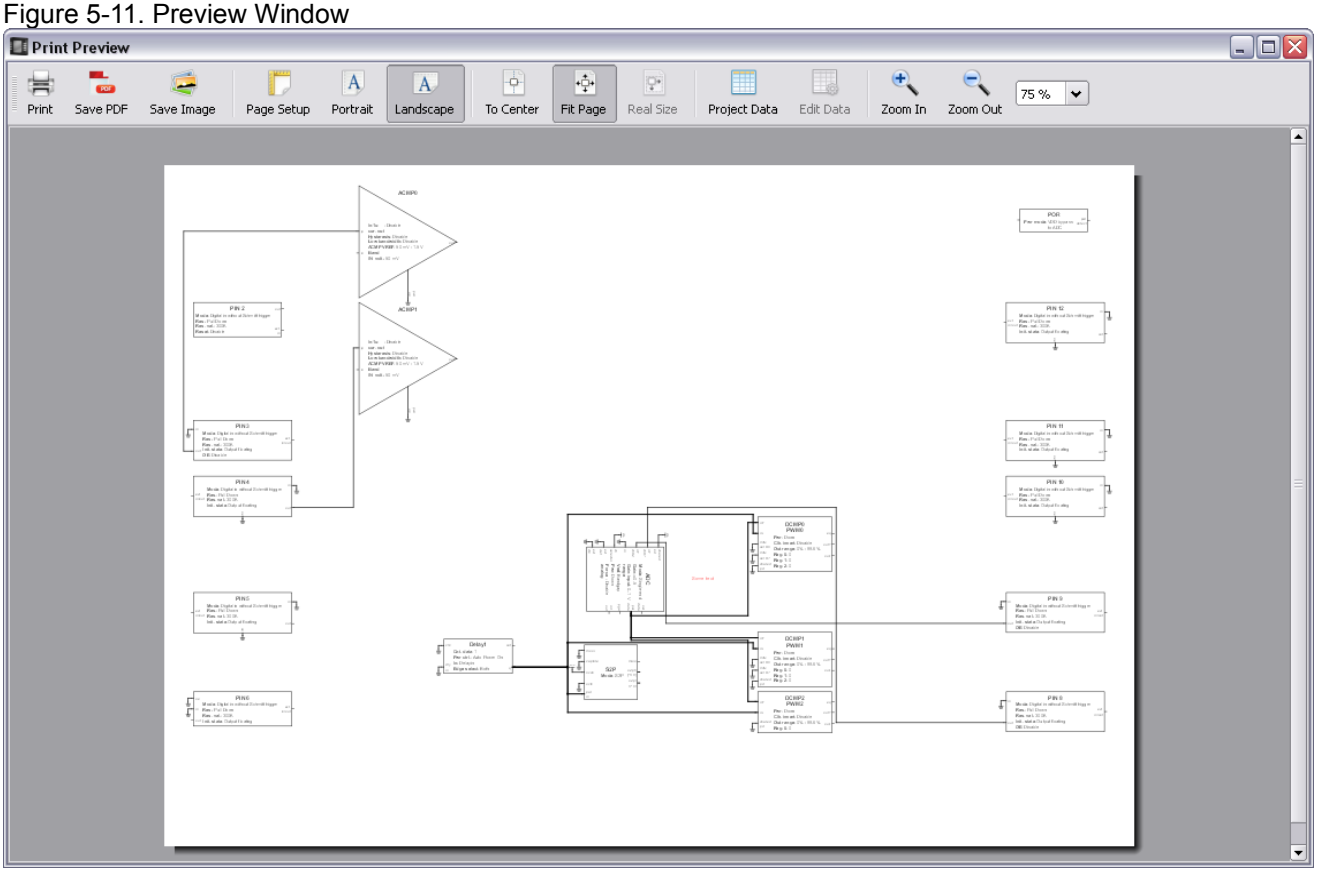
Figure 5-10. Save diagram



5.2. Preview Window

Preview window shows the composed and ready-to-print diagram. In this window, the user cannot change the position of the components or the other elements in the diagram. The user can only choose the advanced settings for printing or saving to the file.

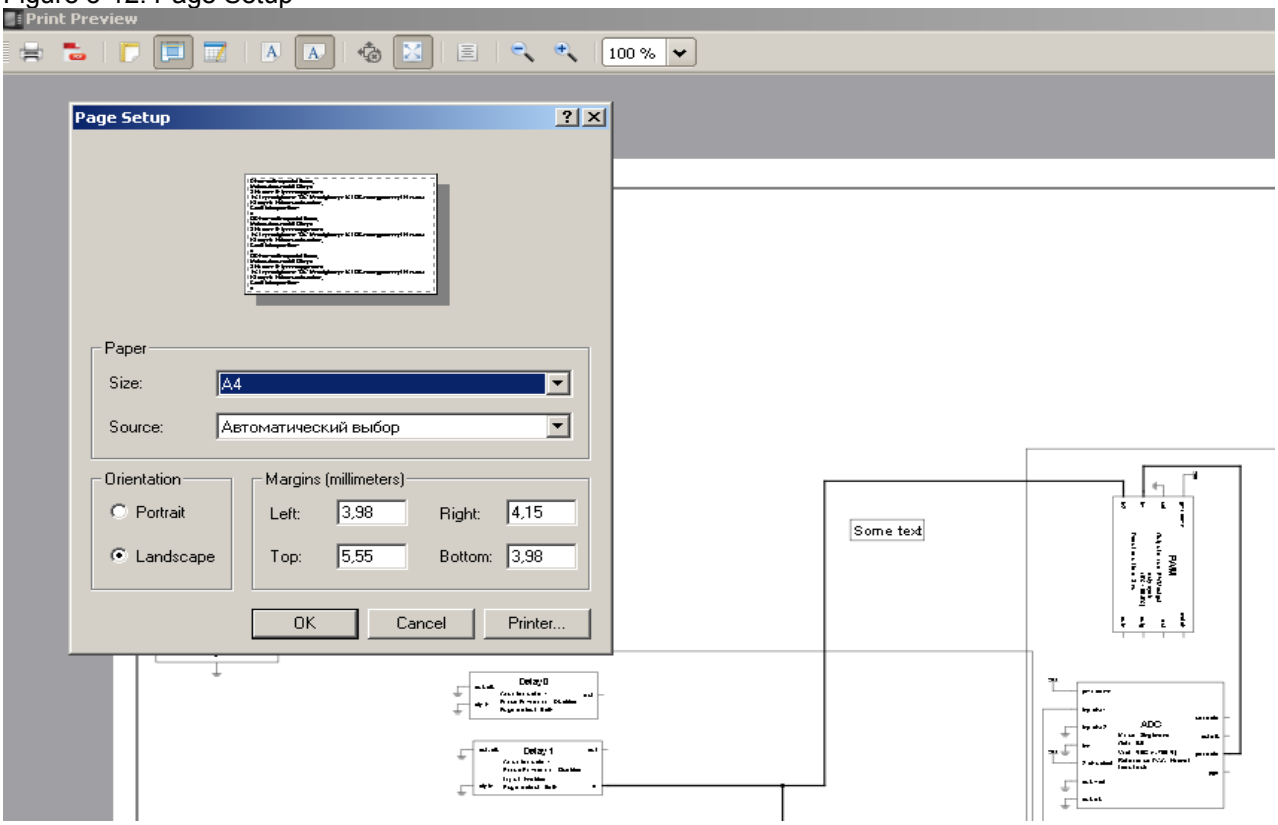
Figure 5-11. Preview Window



Main Actions
The user can:

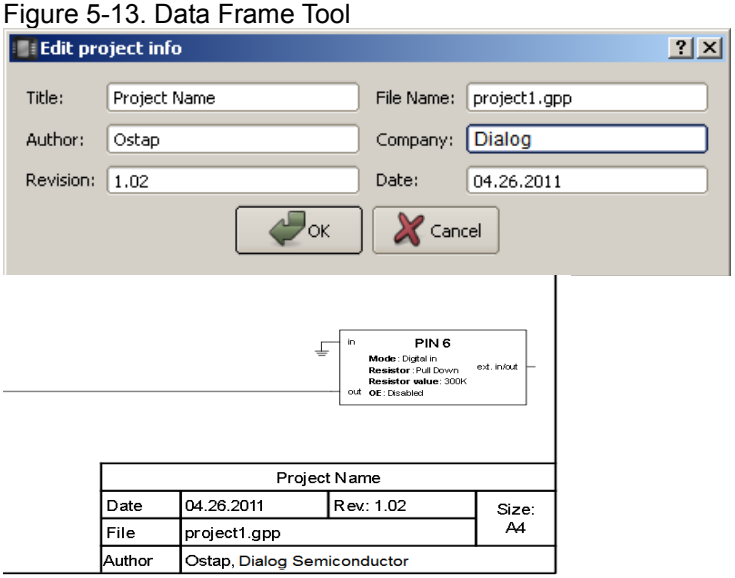
- Choose orientation of the diagram on a paper (landscape or portrait)
- Fit the diagram to a page or keep the real size
- Fit to center
- Zoom in or zoom out
- Choose the size or type of paper

Figure 5-12. Page Setup



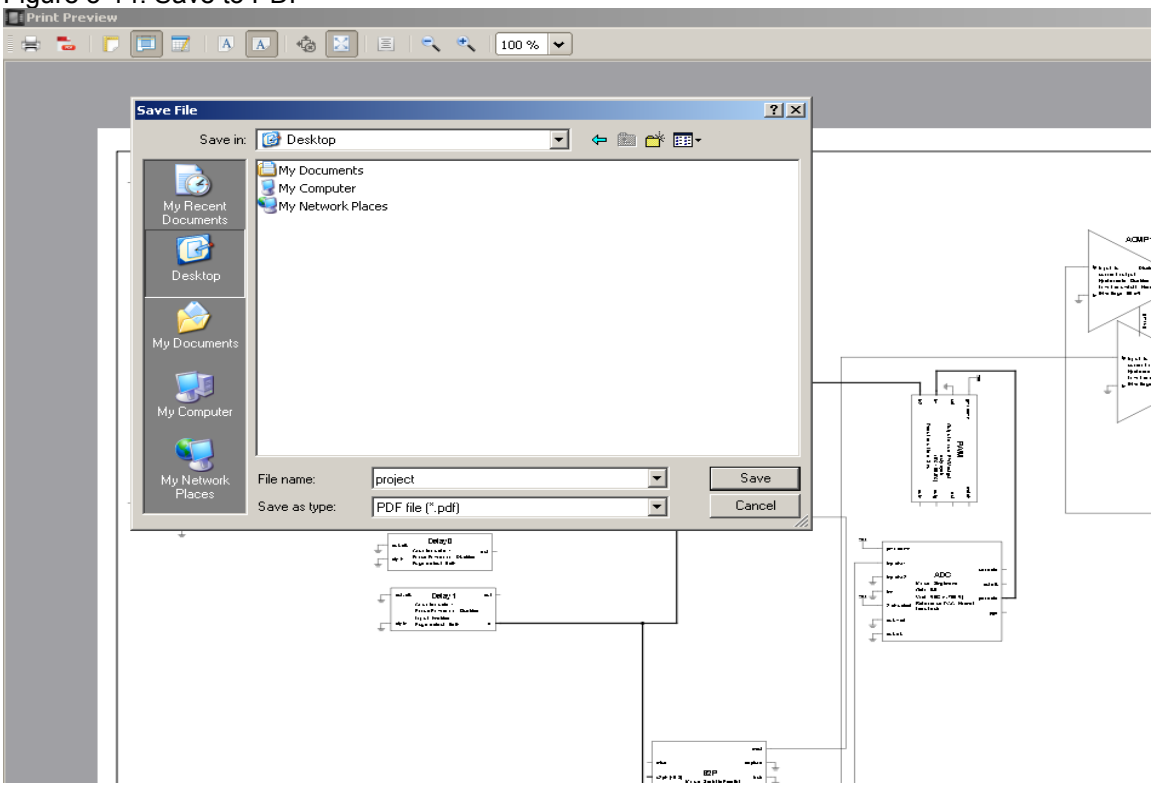
The user can add an editable data frame using the data frame tool.

Figure 5-13. Data Frame Tool



The user can save the finished diagram into a PDF file or print it out.

Figure 5-14. Save to PDF



6. Rules Checker

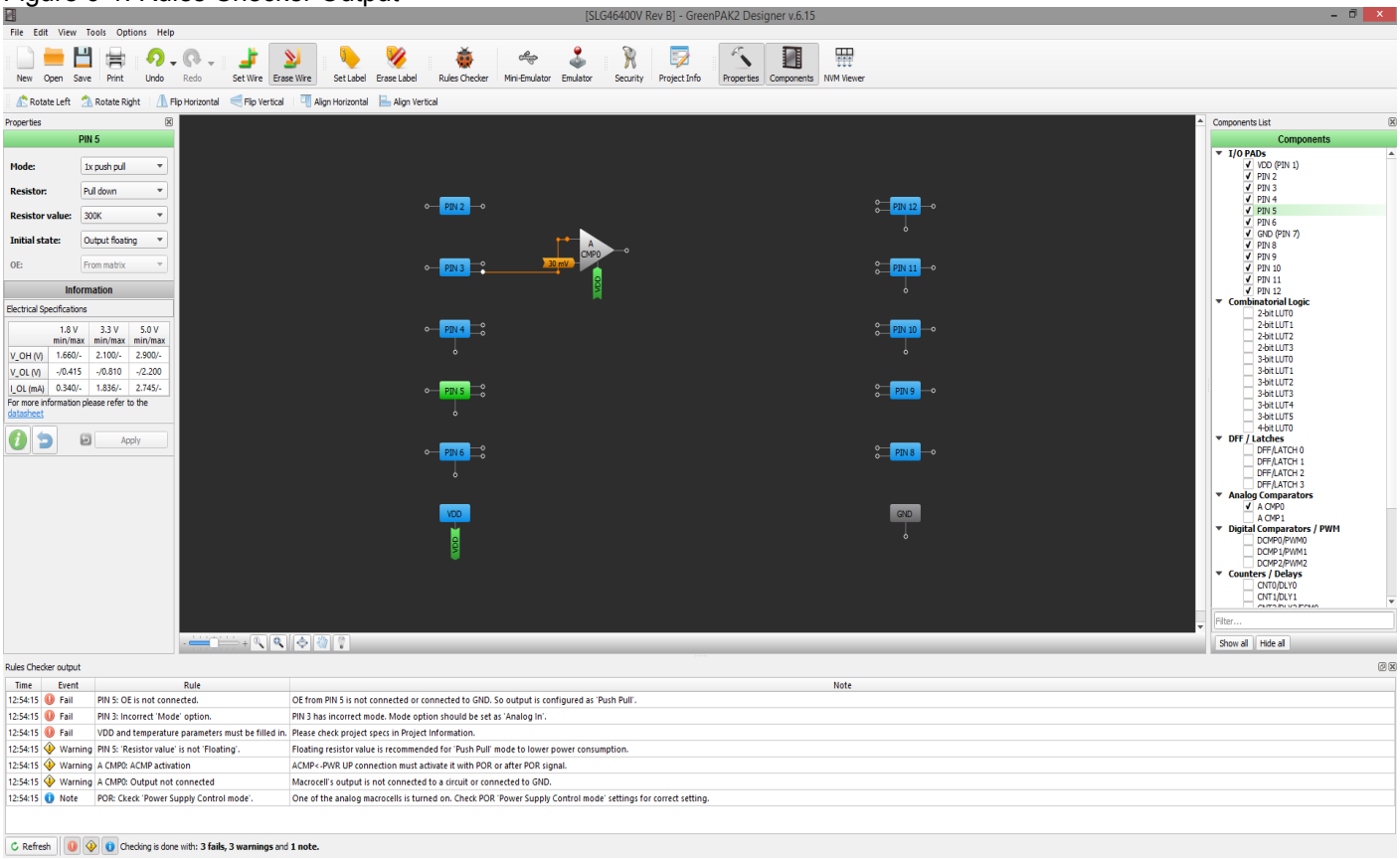
This tool allows checking current project errors, for example, incorrect block connections or settings. Rules Checker has three types of messages:

Fail - this message is generated when there is a significant error in design that will not work under any conditions.

Warning - this message is generated when one or more blocks may contain incorrect connections or settings in the design. This does not mean that there is an error. It only notifies the user to check the connections or settings of the blocks.

Note - this message is generated to remind the user to check for correct settings.

Figure 6-1. Rules Checker Output



In order to check the design, click the Rules Checker button on the tool bar in Tools menu.
Rules Checker Window can be called by clicking Rules checker output in View menu.
Rules checker output consists of three parts:

1. Event – shows message type (Fail, Warning, Note).
2. Rule – information about the message.
3. Note – recommendations on how to correct the error or error explanation.

7. GreenPAK 1 Emulation Board

Figure 7-1. The Main Screen

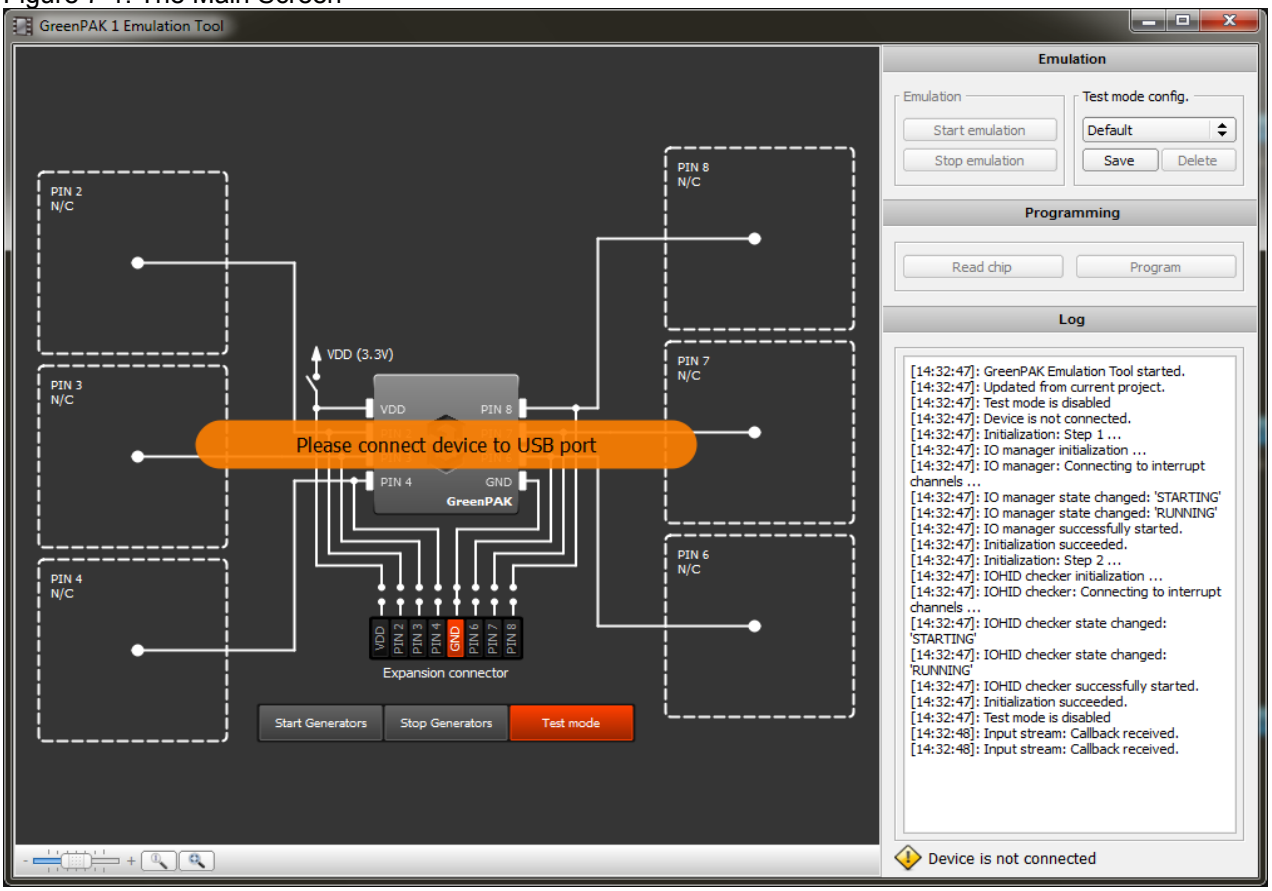
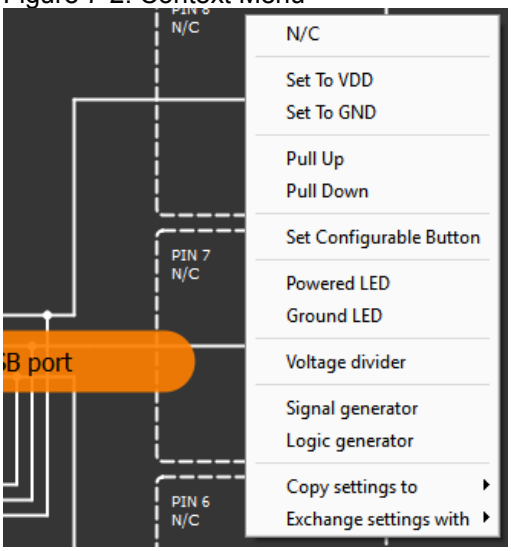


Figure 7-1 displays the GreenPAK IC with 6 dotted areas and expansion connectors which are connected to pins.

Dotted areas are used to configure input connections. Use the context menu to manage them.

Figure 7-2. Context Menu



7.1. Types of Areas

Non-Configurable Inputs (Figure 7-3 – 7-9):

Figure 7-3. N/C (not connected)

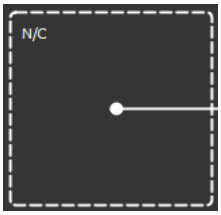


Figure 7-4. Set to VDD

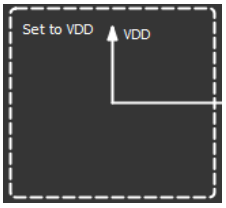


Figure 7-5. Set to GND

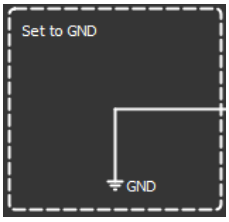


Figure 7-6. Pull Up

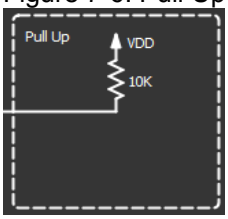


Figure 7-7. Pull Down

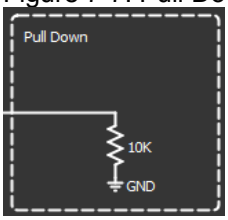


Figure 7-8. PWR LED

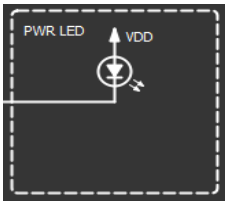
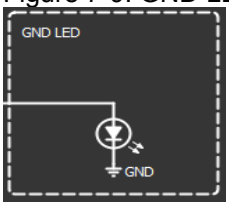
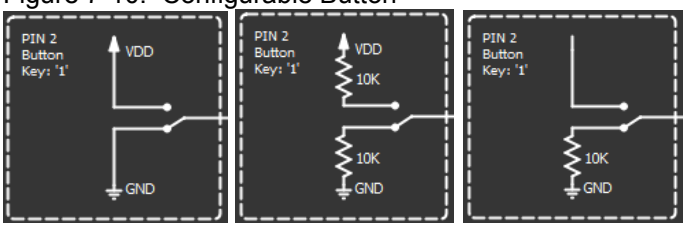


Figure 7-9. GND LED



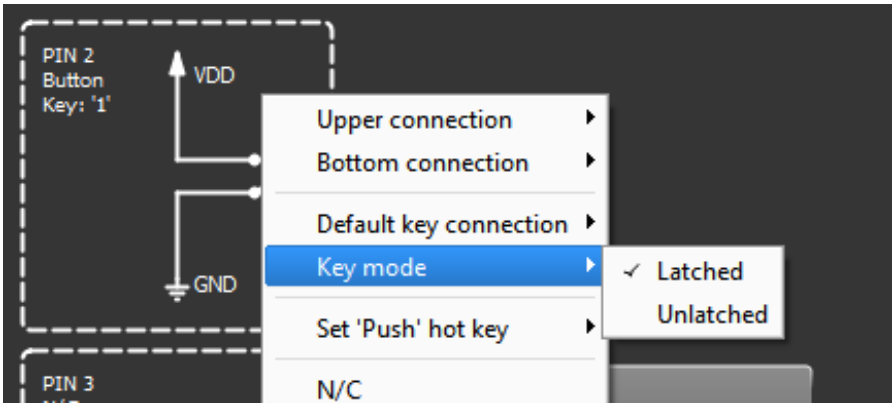
Configurable Inputs:

Figure 7-10. Configurable Button



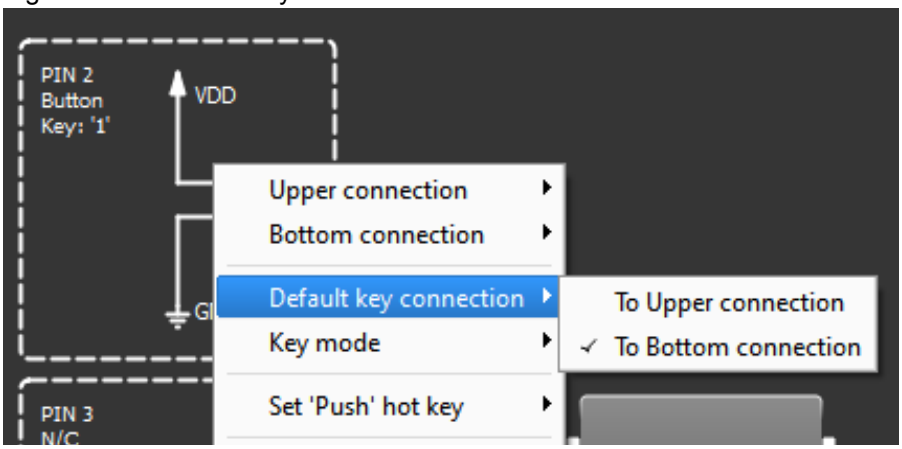
In the above mode you can switch between VDD and GND. Click your mouse over the key to change the value. The switch has 2 modes: Latched, Unlatched (default), which can be configured from the context menu:

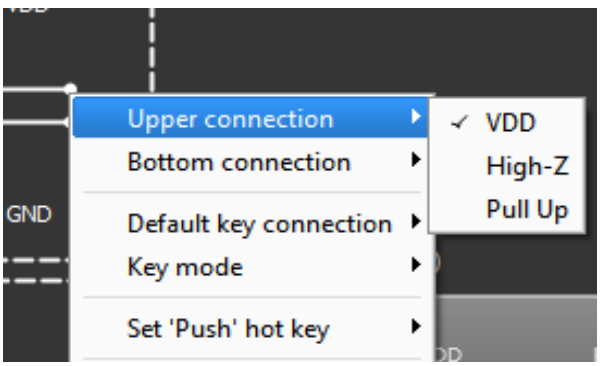
Figure 7-11. Key Mode

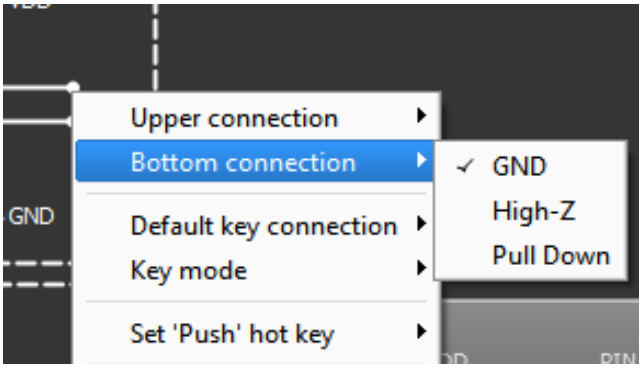


The default connection can be set to either Upper connection or Bottom connection.

Figure 7-12. Default Key Connection





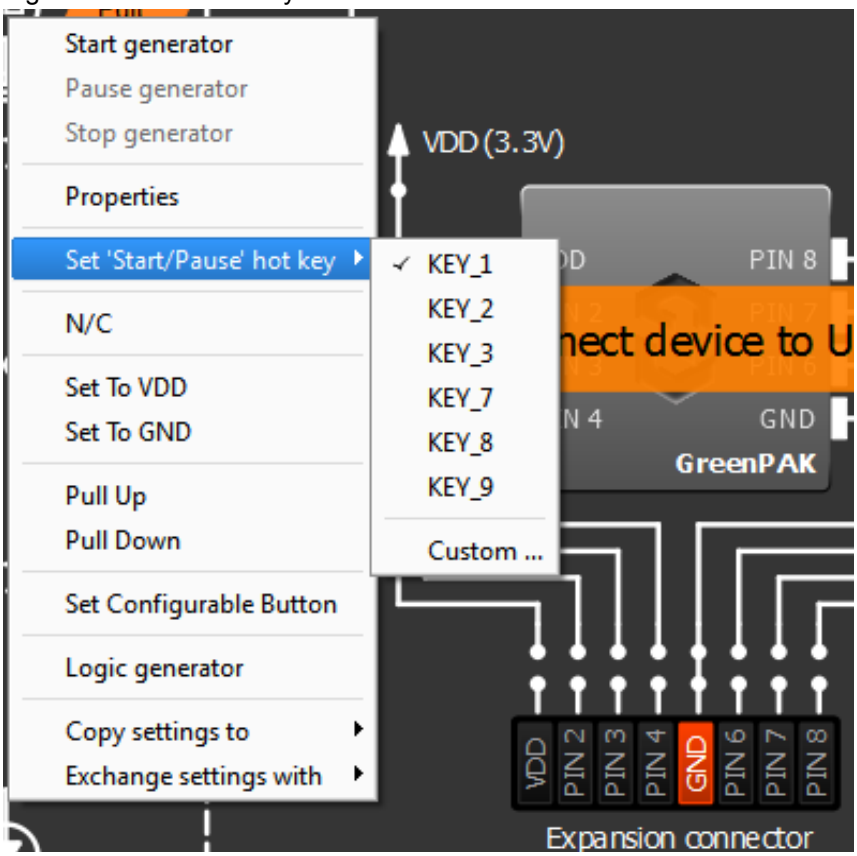


User can configure each connection. VDD/GND, High-Z or Pull Up/Down are available.

User can assign Hot Key for 'Push' action. The assigned key will simulate mouse click over the key.

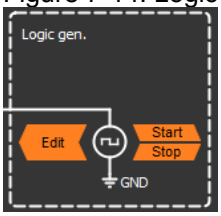
User can assign the same hot key to other Switches which will allow changing the key values of all the Switches with the same hot key at once (Figure 7-13).

Figure 7-13. Set Hot Keys



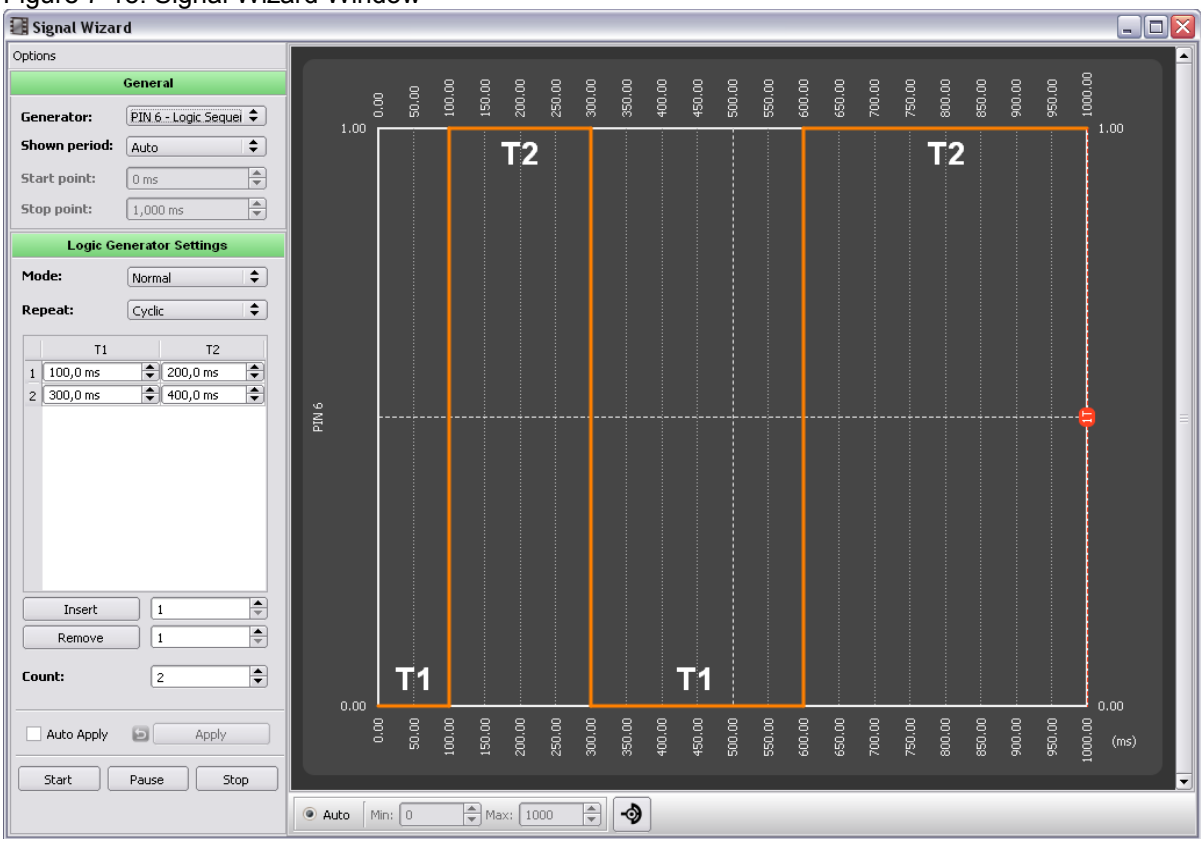
7.2. Generators
7.2.1. Logic Generator

Figure 7-14. Logic Generator



Logic generator is used for generating the logic pulses. 'Edit' button allows the user to configure the signal:

Figure 7-15. Signal Wizard Window

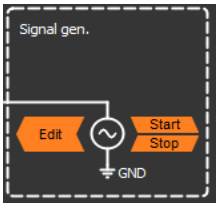


Configuration Options:

Mode:	Normal/Invert	- signal mode;
Repeat:	One shot/Cyclic	- repeat option;
T1/T2 Values Table:		- sets of pulses (T1 – low duration, T2 – high duration of one pulse)
Insert:		- insert pulse to the entered position;
Remove:		- remove pulse from the entered position;
Count:		- pulses count;

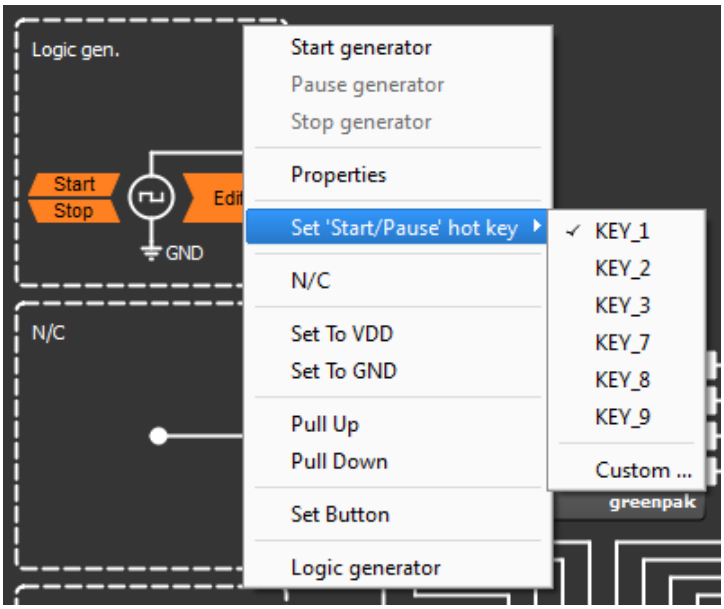
7.2.2. Signal (Analog) Generator

Figure 7-16. Signal Generator



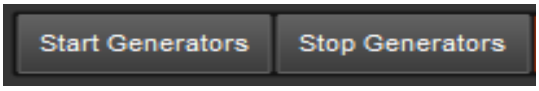
Signal generator is used to generate analog signals: Constant Voltage level, Saw, Triangle, Trapeze (Trapezoid), Sine, User defined.
Logic and signal generators can be started/paused/stopped using orange buttons or through the context menu. The user can also assign hot keys for start/pause.
Several generators can use the same hot key to start/pause at once. This is the right way to start more than one generator at the same time.

Figure 7-17. Start/Pause Hot Key



The ‘Start Generators’ and ‘Stop Generators’ buttons can also be used in this way:

Figure 7-18. ‘Start Generators’ and ‘Stop Generators’



Signal Generator settings:

Type: Const voltage level/Trapeze/Sine/User Defined - type of waveform;

Constant value:

U: - voltage level;

Figure 7-19. Generators Settings

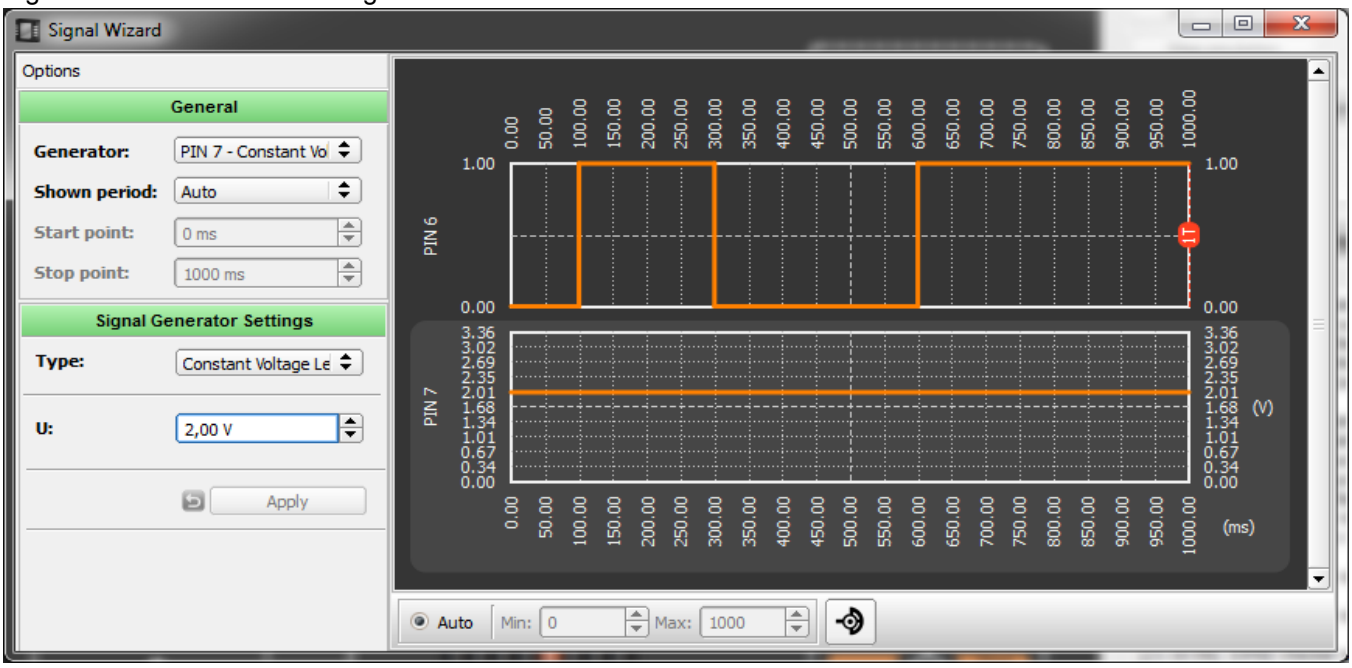
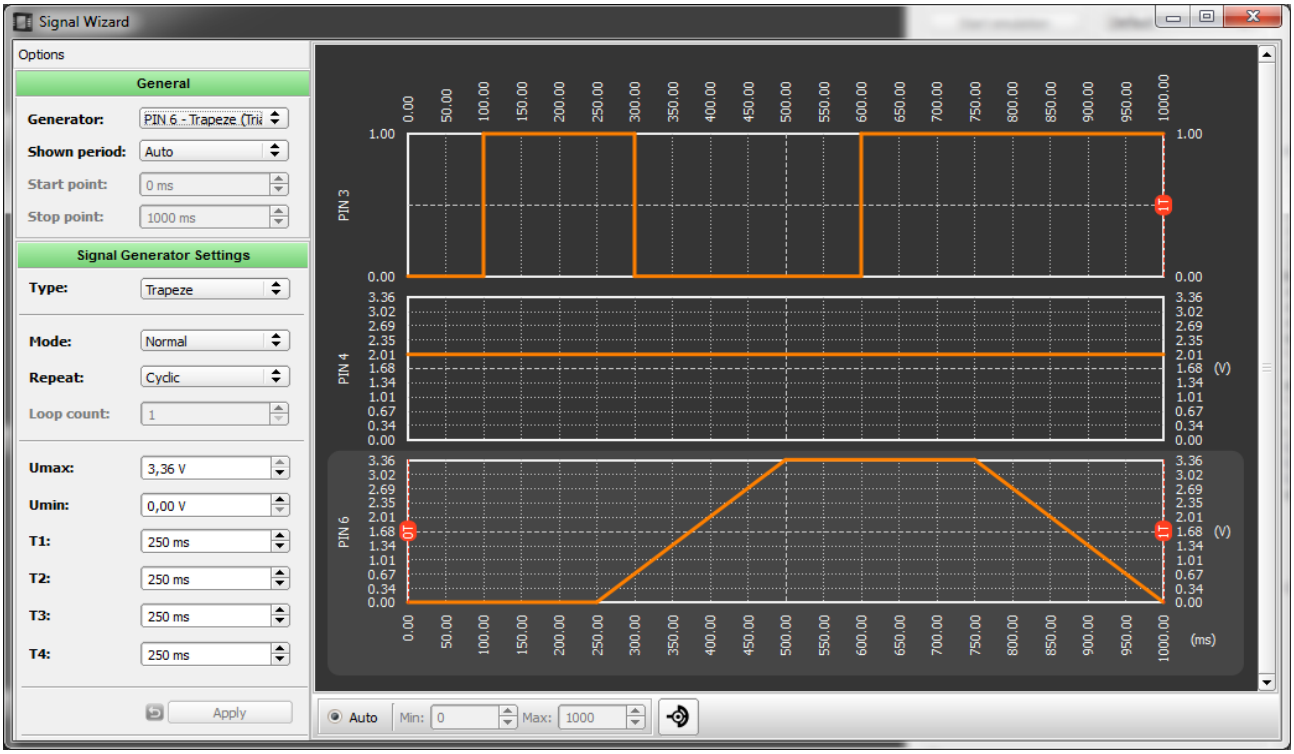


Figure. 7-20. Trapeze (Trapezoid)



Trapeze settings:

Mode:	Normal/Invert	- signal mode
Repeat:	One shot/Cyclic	- repeat option;
Umax/Umin		- max/min voltage level
T1, T2, T3, T4		- duration of trapeze

Figure 7-21. Duration of Trapeze (Trapezoid)

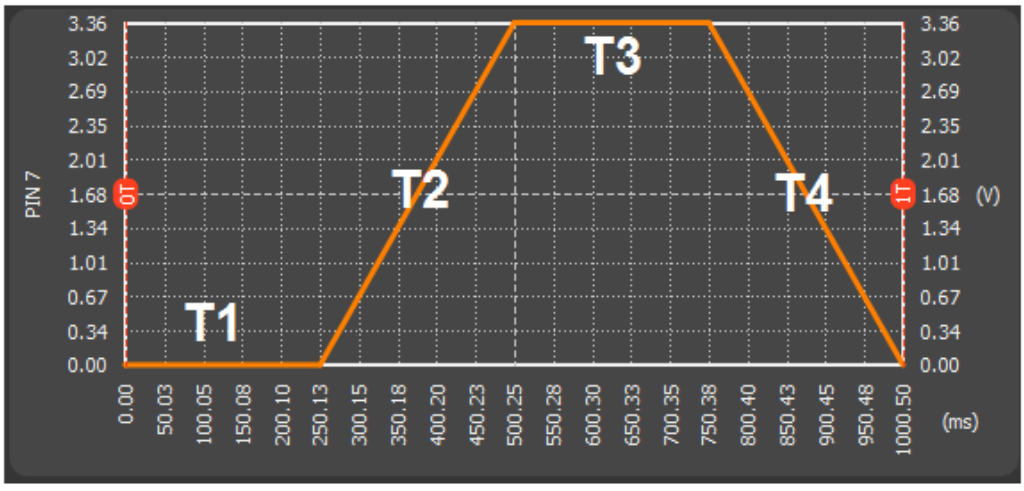


Figure 7-22. If T3 = 1: Signal is a Triangle

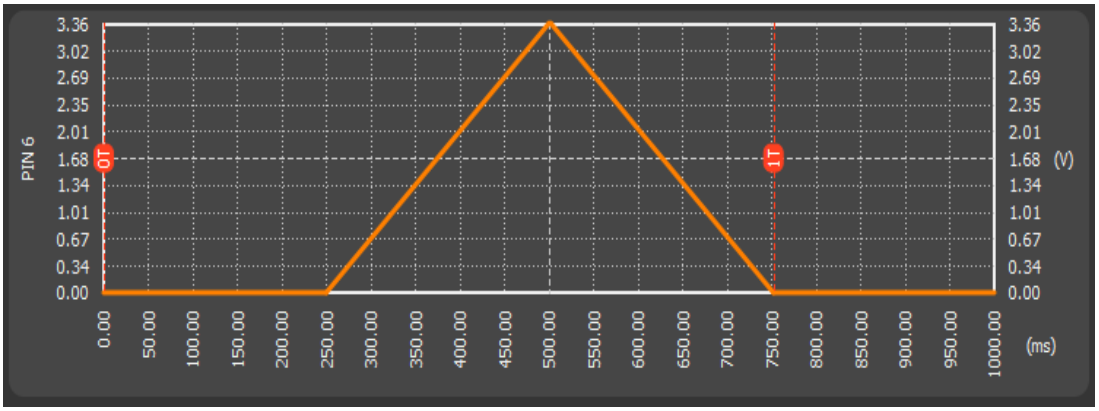


Figure 7-23. If T3 = 1 and (T2 = 2 or T4 = 2): Signal is a Sawtooth

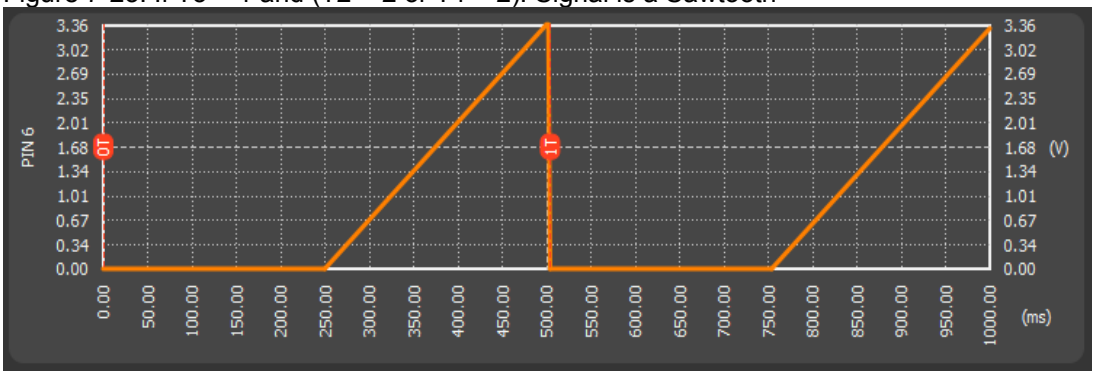
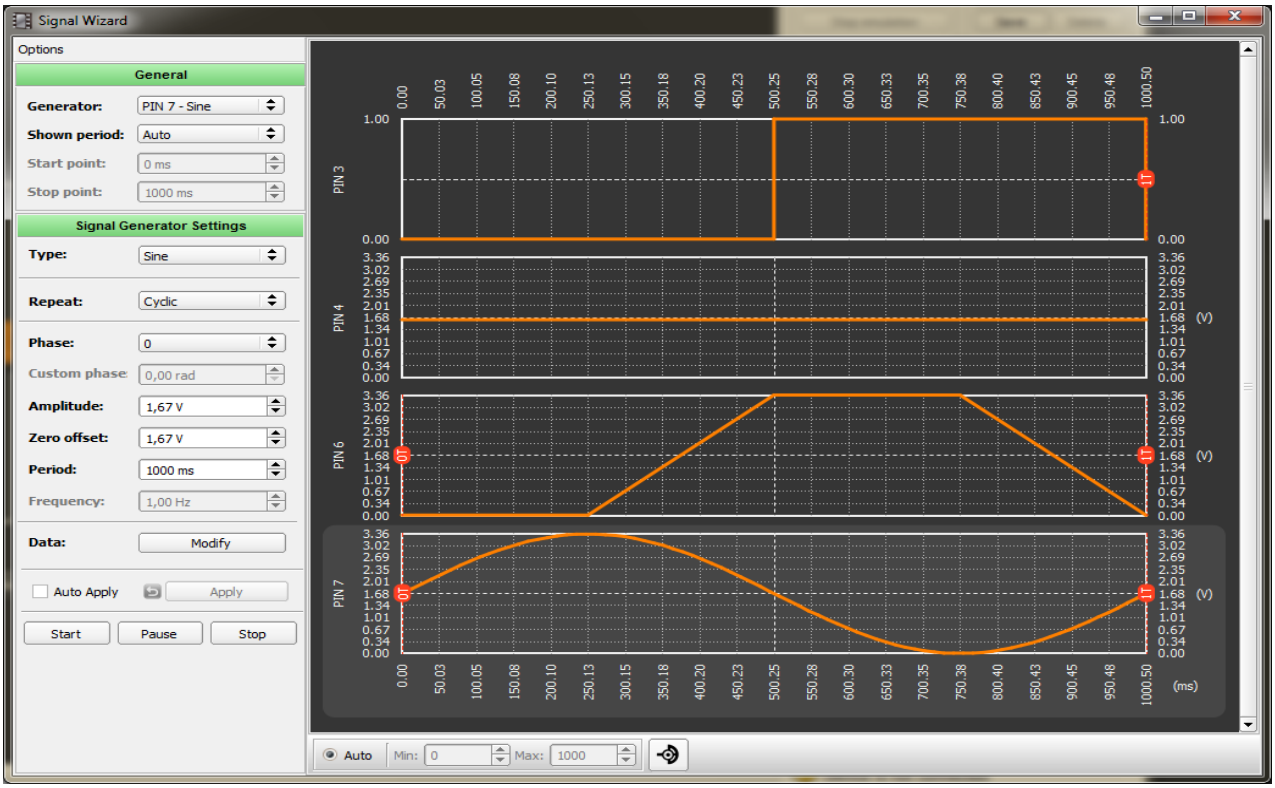


Figure 7-24. Sine

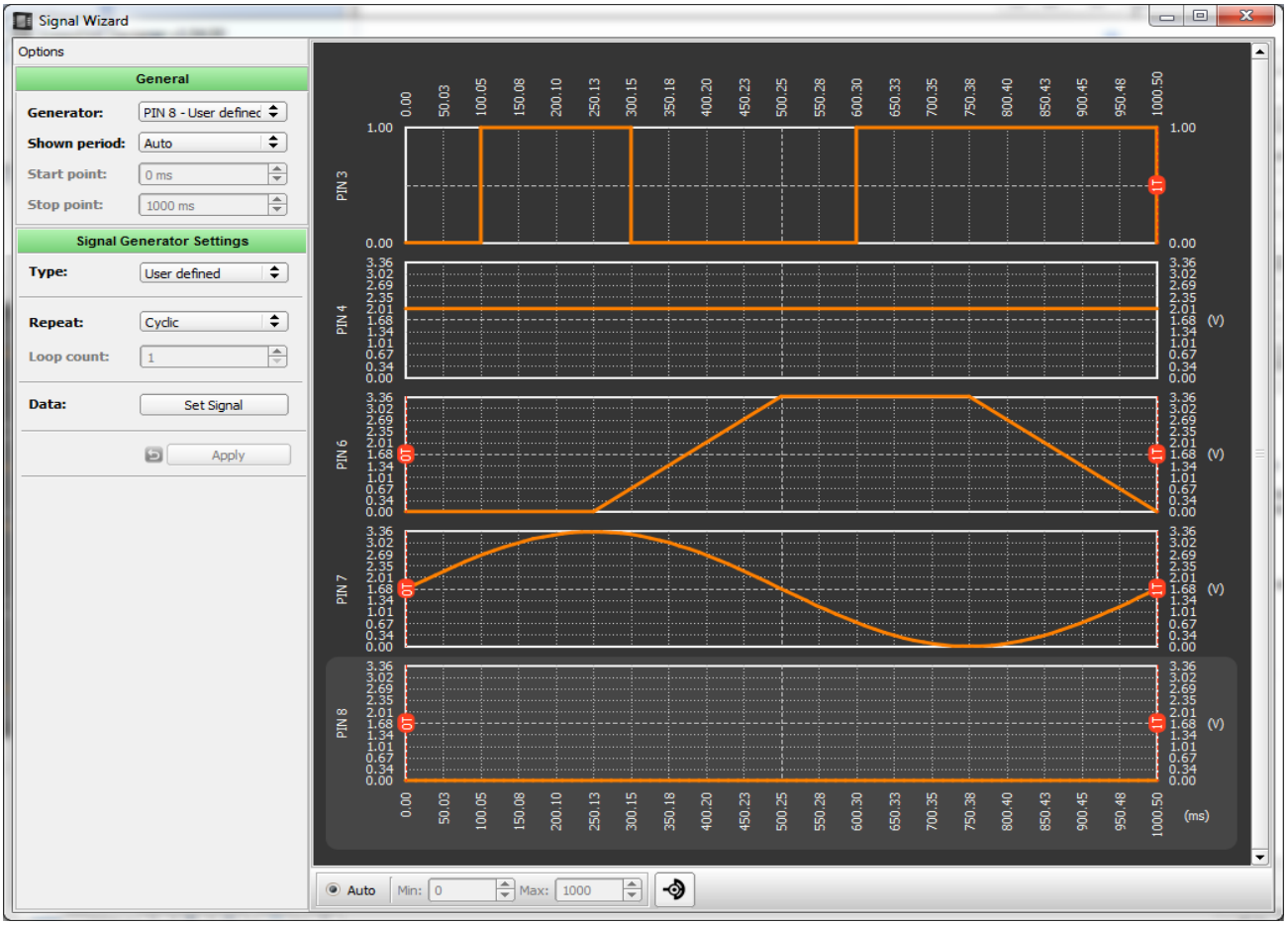


Sine settings:

Repeat:	One shot/Cyclic	- repeat option
Phase:	Custom/0/Pi:2/Pi/3Pi:2	- φ0
Amplitude:		- amplitude
Zero offset:		- zero offset
Period:		- period
Data:		- change signal using Custom Signal Wizard
Custom phase:		- show phase in radian
Frequency:		- show frequency

7.2.3. User-Defined Generator

Figure 7-25. User-Defined Waveform

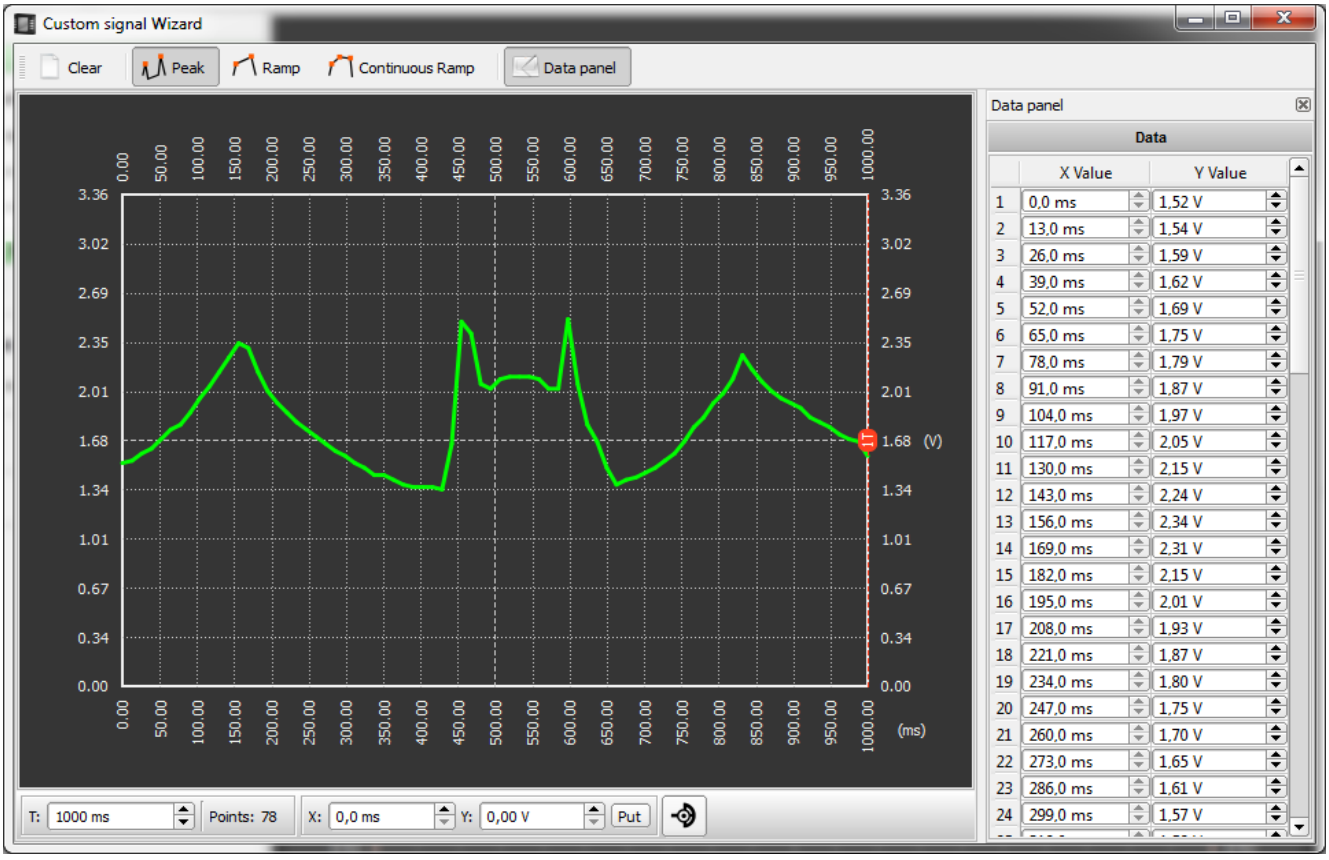


User-Defined Waveform Settings:

Repeat: One shot/Cyclic - repeat option;

Data: - change signal using Custom Signal Wizard

Figure 7-26. Custom Signal Wizard (Arbitrary waveform)



Toolbar:

Clear	- clear data
Peak/Ramp/Continuous Ramp	- draw modes
Data panel	- turn on/off the data table

Figure 7-27. Peak

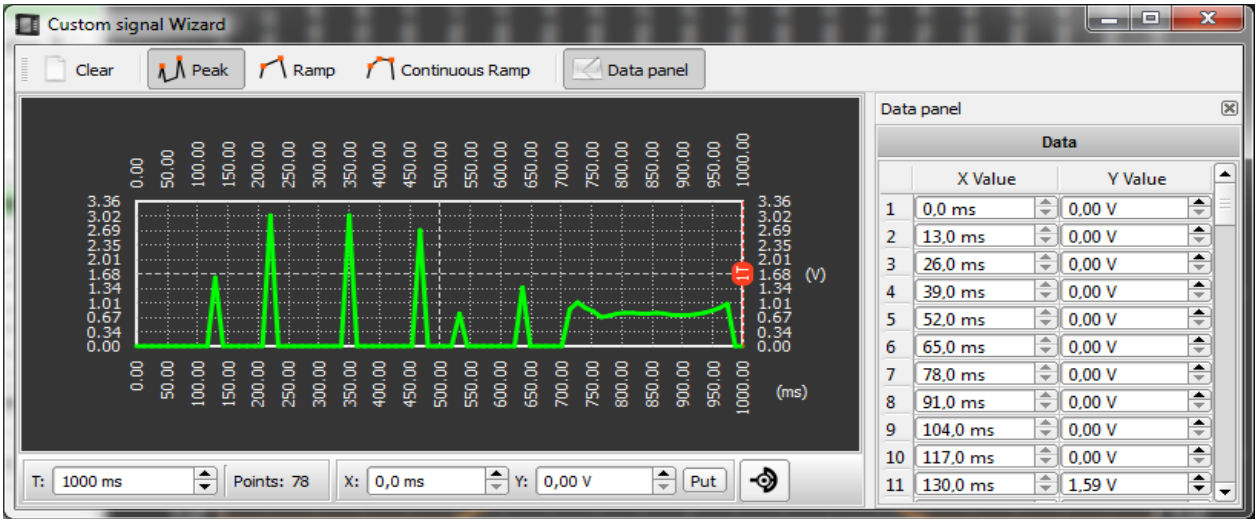


Figure 7-28. Ramp

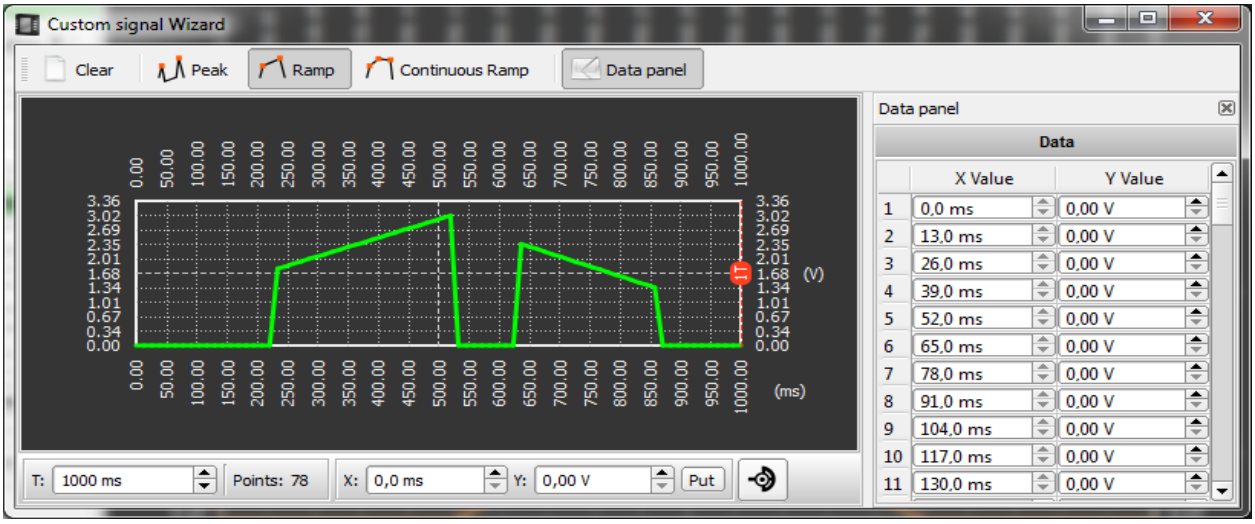


Figure 7-29. Continuous Ramp

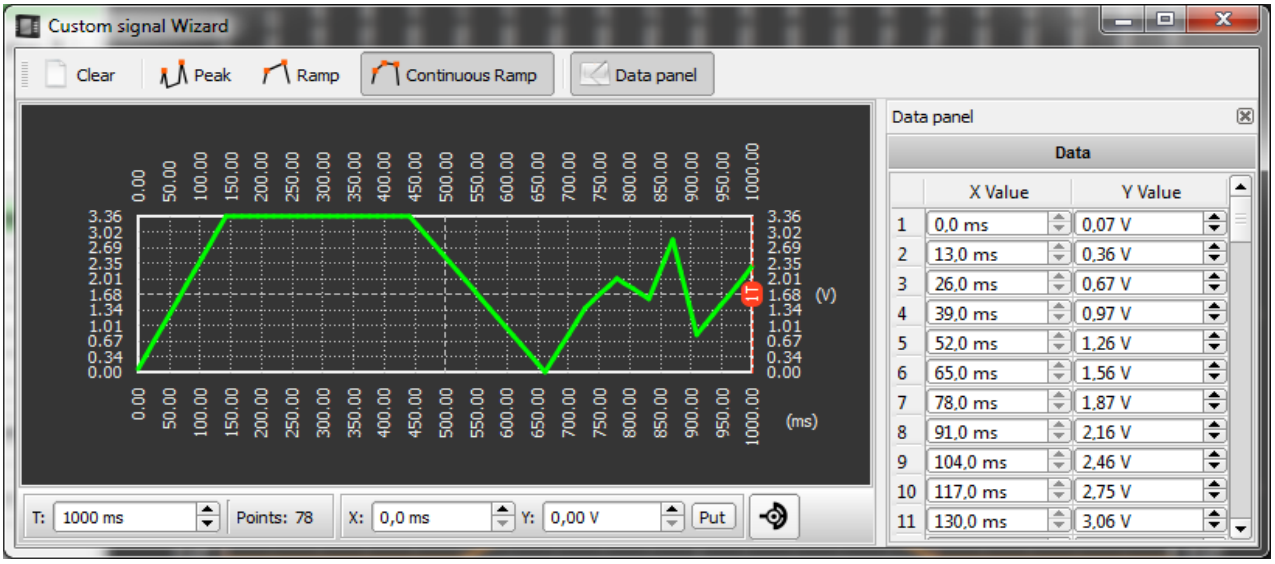


Figure 7-30. Data Panel

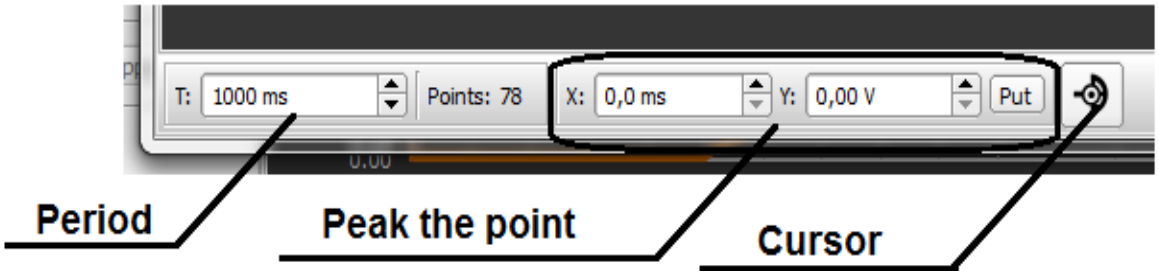
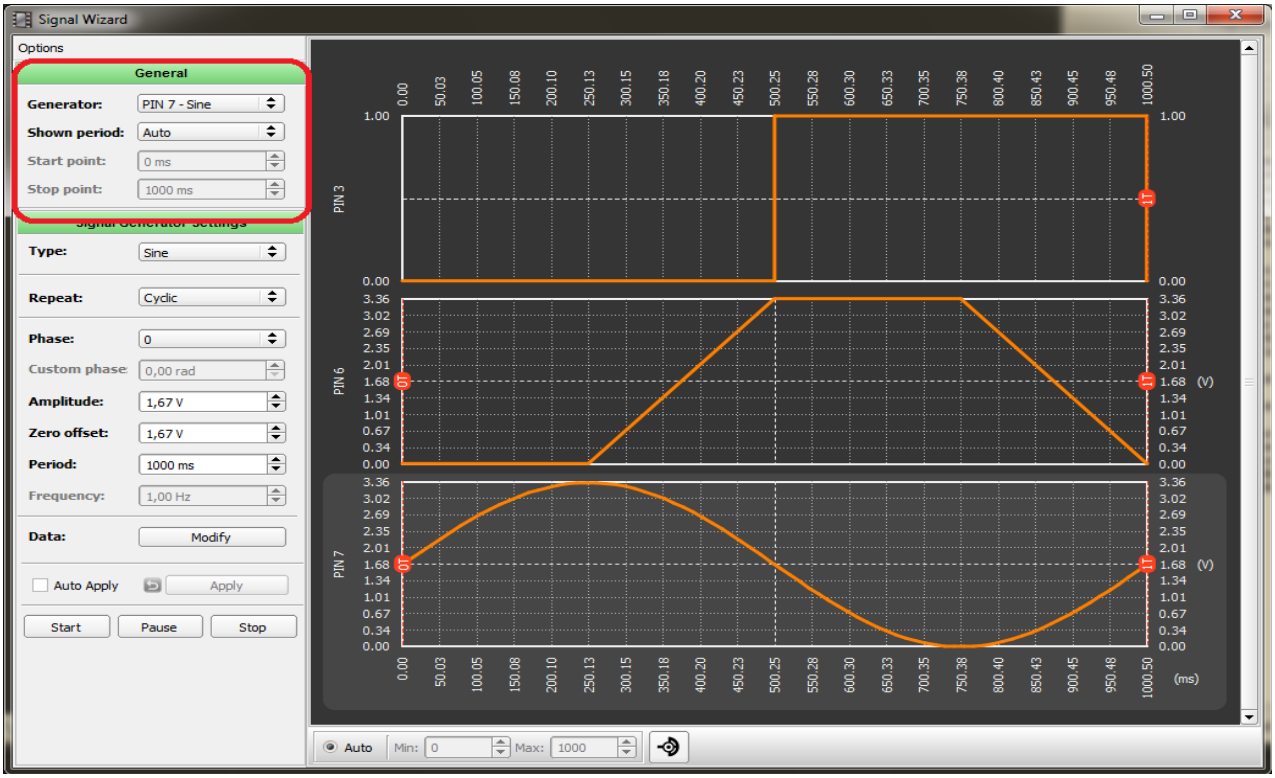


Figure 7-31. Cursor

7.3. General Options in a Signal Wizard Mode

Figure 7-32.General Options



General Settings:

Generator: - generator selector

Shown period: Auto/Custom/1T/2T/3T/4T - set the period of a current generator to be displayed

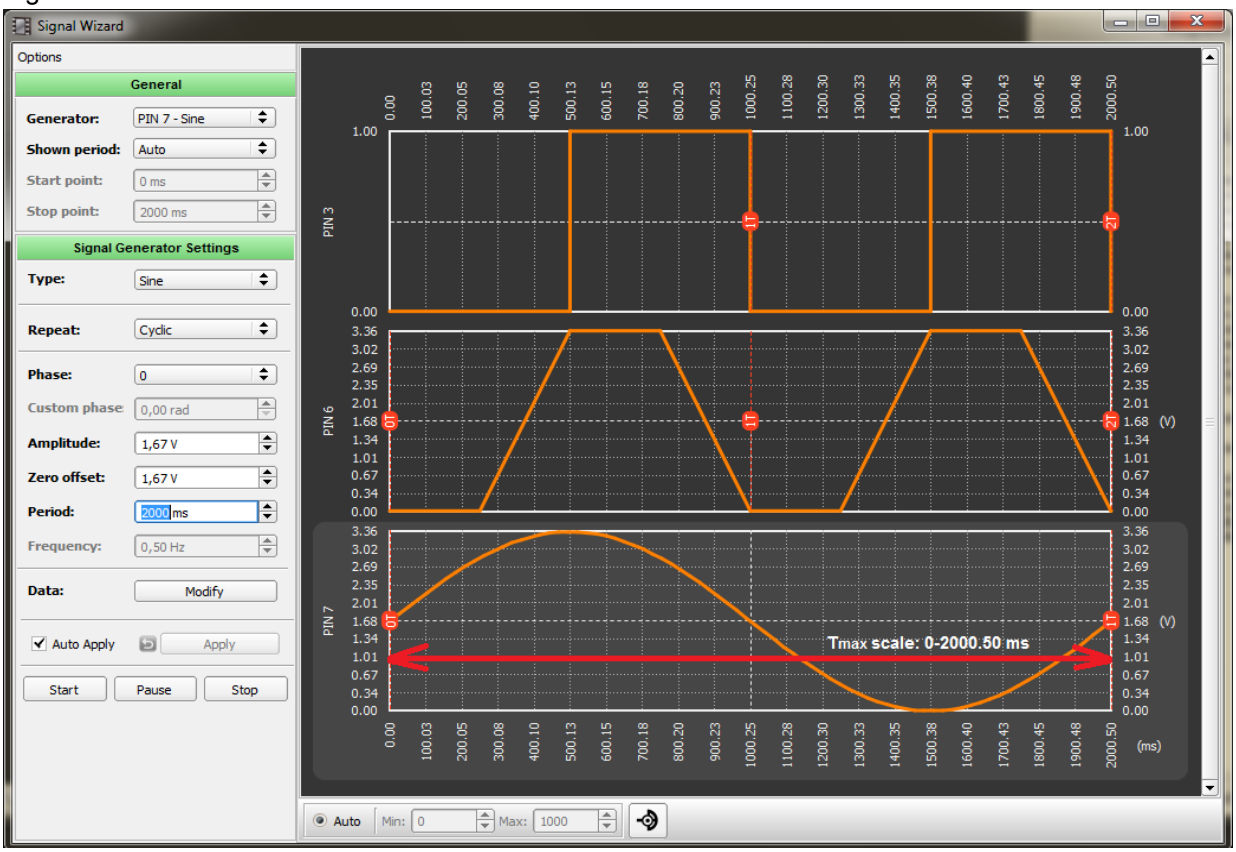
Start point: - start point generating signal

Stop point: -stop point generating signal

7.4. Period Modes
AUTO Mode

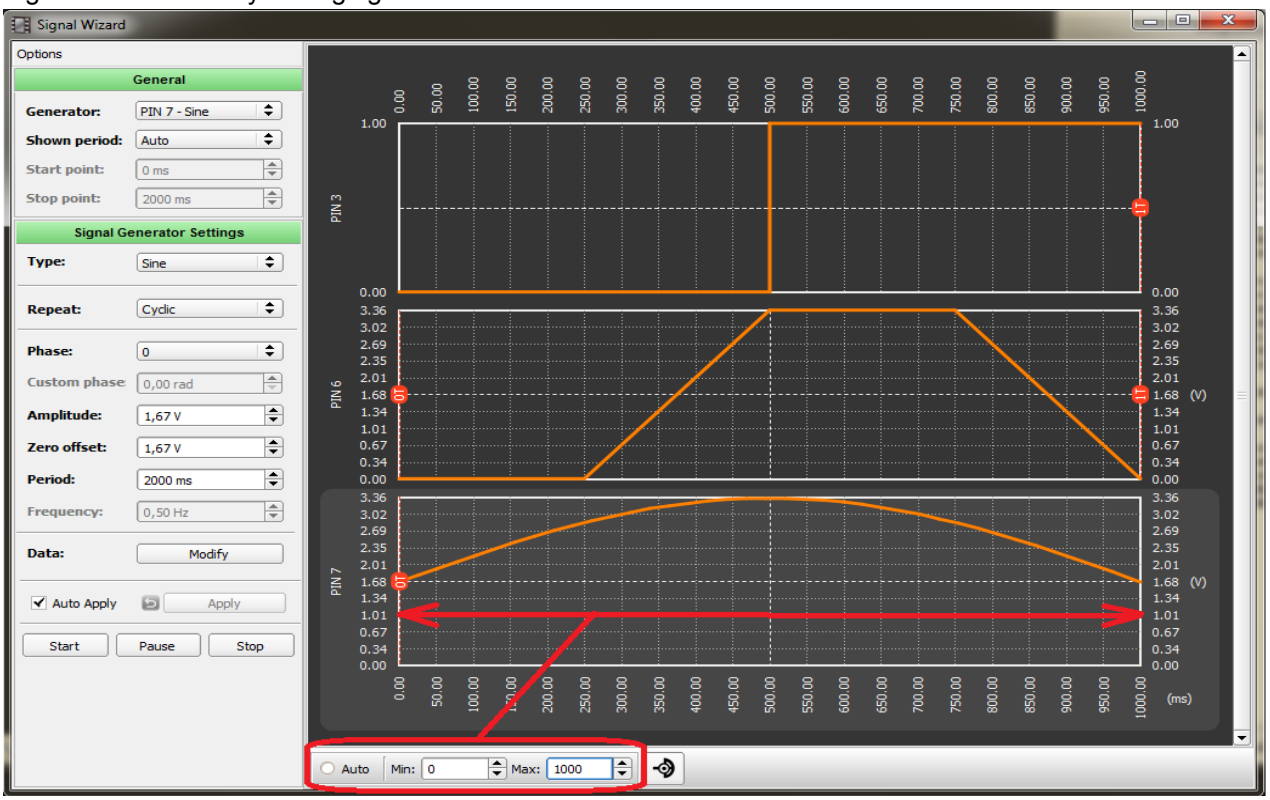
All generators with 'AUTO' option have one scale; this scale = MAX period of all generators with 'AUTO' option.

Figure 7-33. Auto Mode



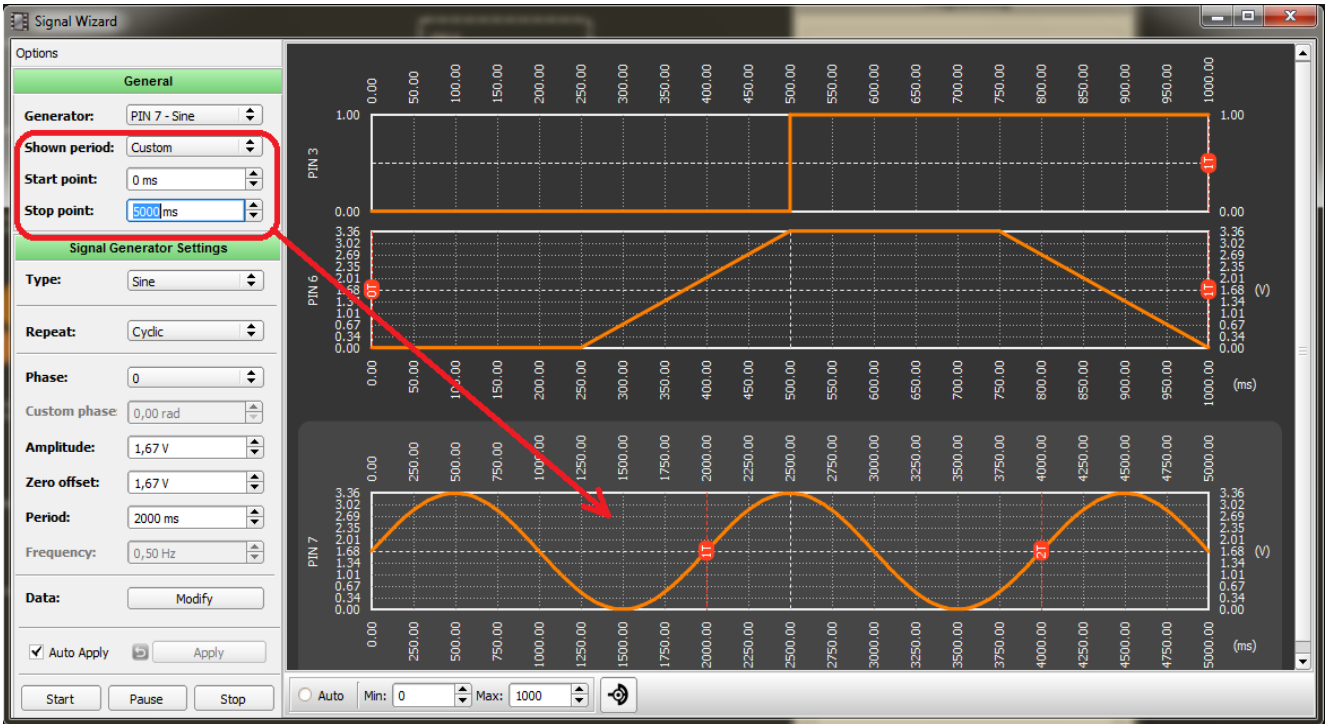
The user can manually change the scale.

Figure 7-34. Manually Changing Scale



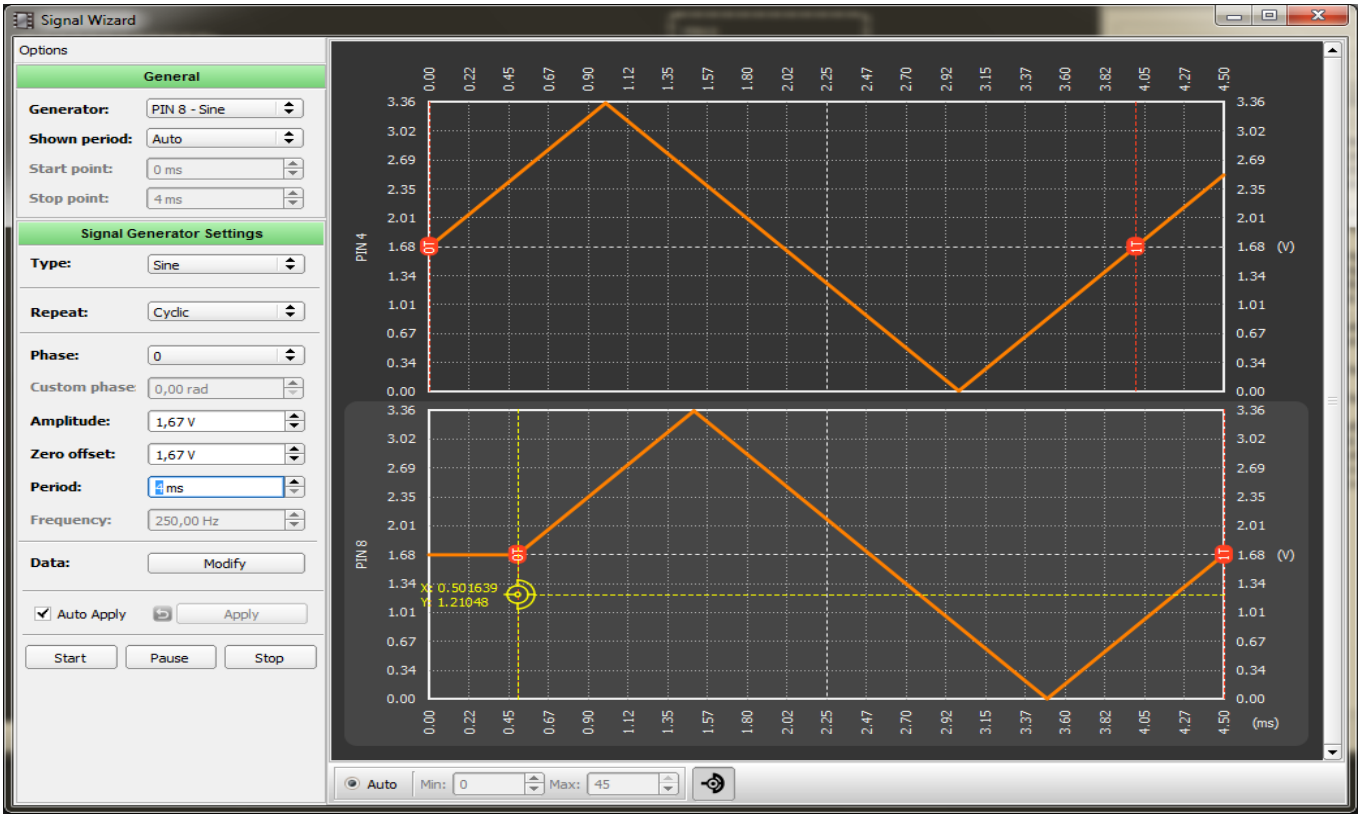
CUSTOM Mode.

Figure 7-35. Set Custom Period



The user can set a custom period to be displayed for any generator.
Note: Analog generators connected to PIN7 and PIN8 start generation 0.5ms later than those connected to PIN4 and PIN6. This delay is displayed on the graphs in a Signal Wizard when the AUTO mode is ON.

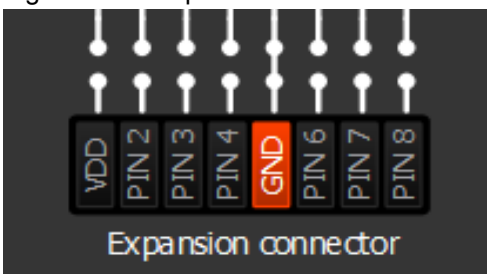
Figure 7-36. The Delay of Analog Generator



7.5. Expansion Connector

User can connect/disconnect I/O pads of GreenPAK with the expansion connector on the board.

Figure 7-37. Expansion Connector



7.6. Control Panel

Emulation:

Start emulation – load project to the chip and start the emulation;
Stop emulation – stop the emulation;

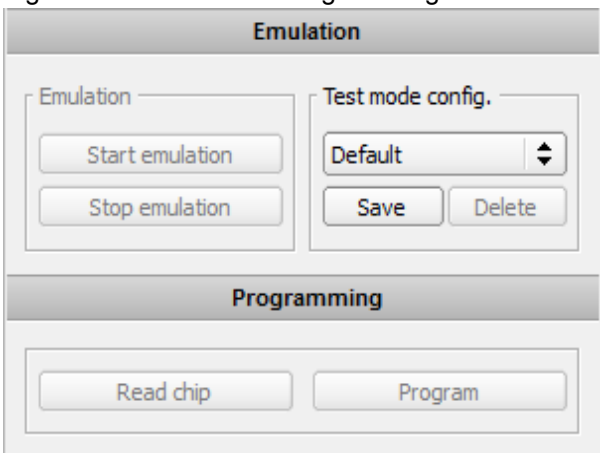
Test Mode Configuration:

The user can save current configuration of a test mode to the project file;

Programming:

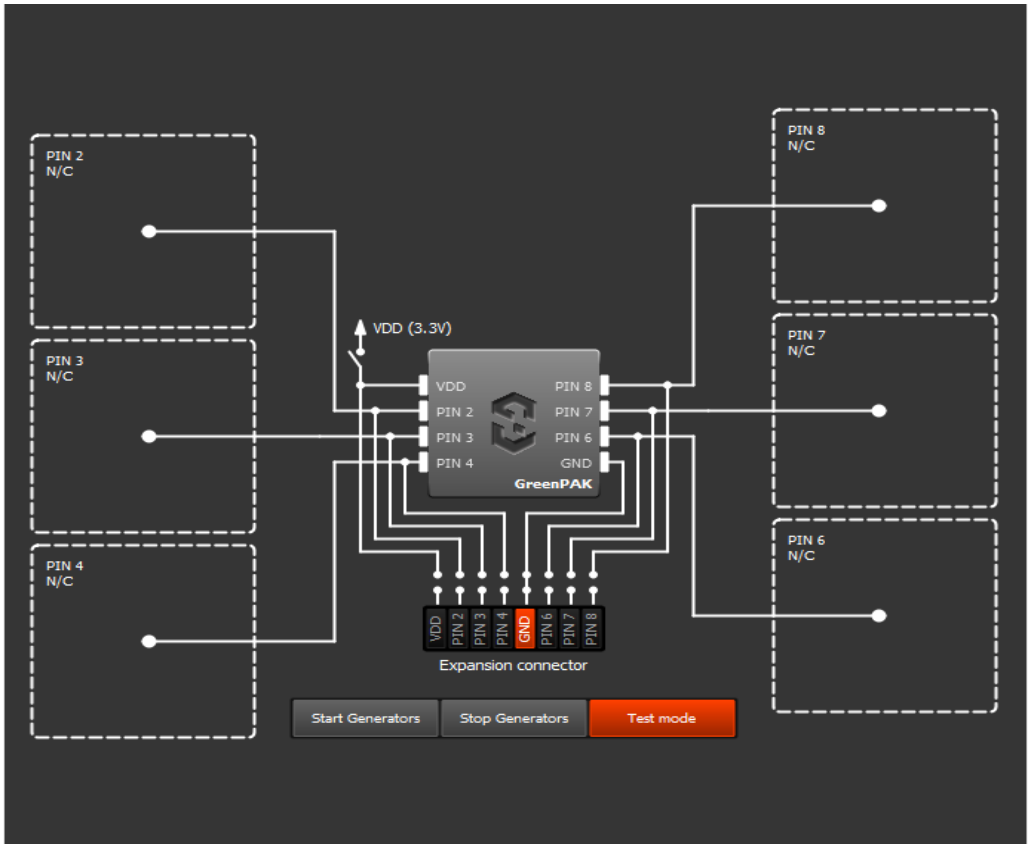
Read/Program chip with the current project using the emulation board;

Figure 7-38. Emulation/Programming



7.7. Test Mode and Emulation Process

Figure 7-39. Test Mode

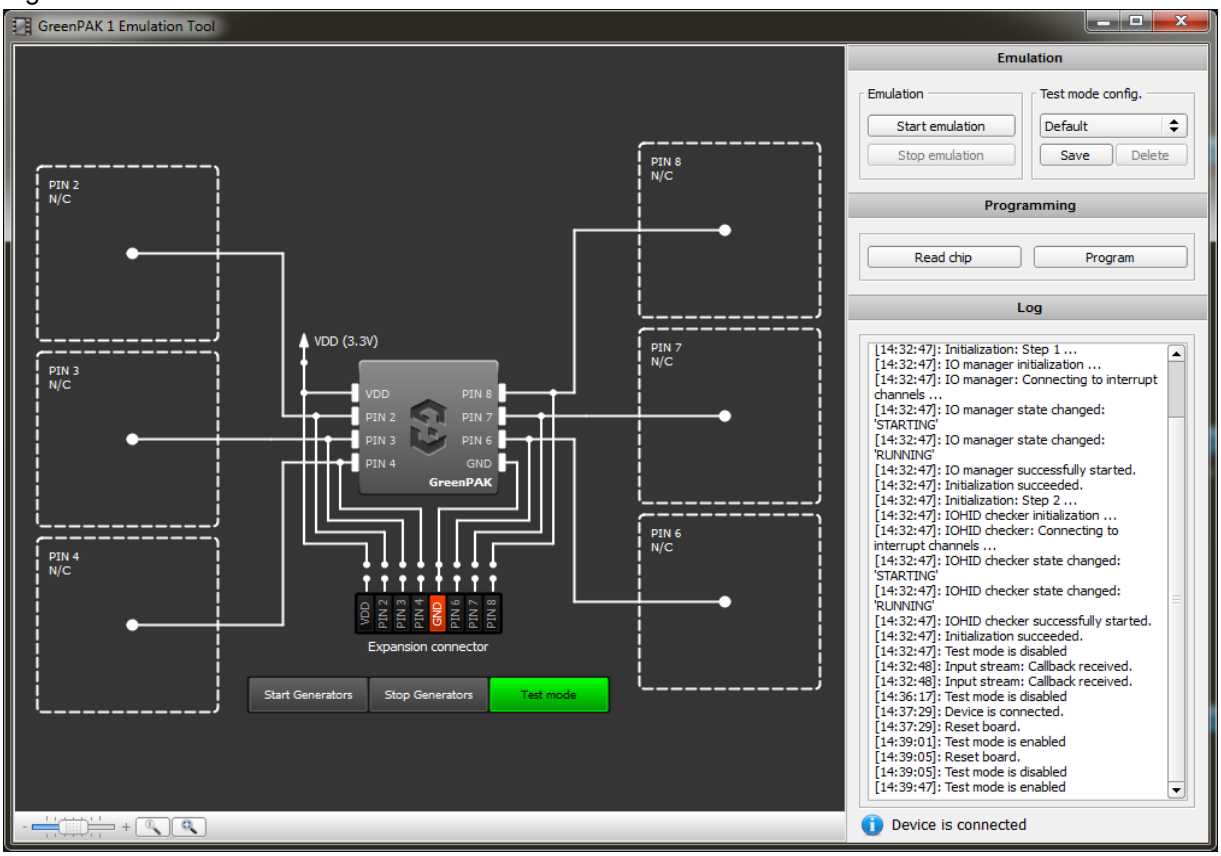


'Test mode' button is used for turning on/off the test mode.

Figure 7-40. 'Test mode' Button

Test mode can be used for connecting or disconnecting a chip's I/O pads to stimulus areas, configured by the user. The representation of test mode is illustrated below.
Emulation process can be started with the "Start emulation" button and will be indicated with the white logo in GreenPAK.

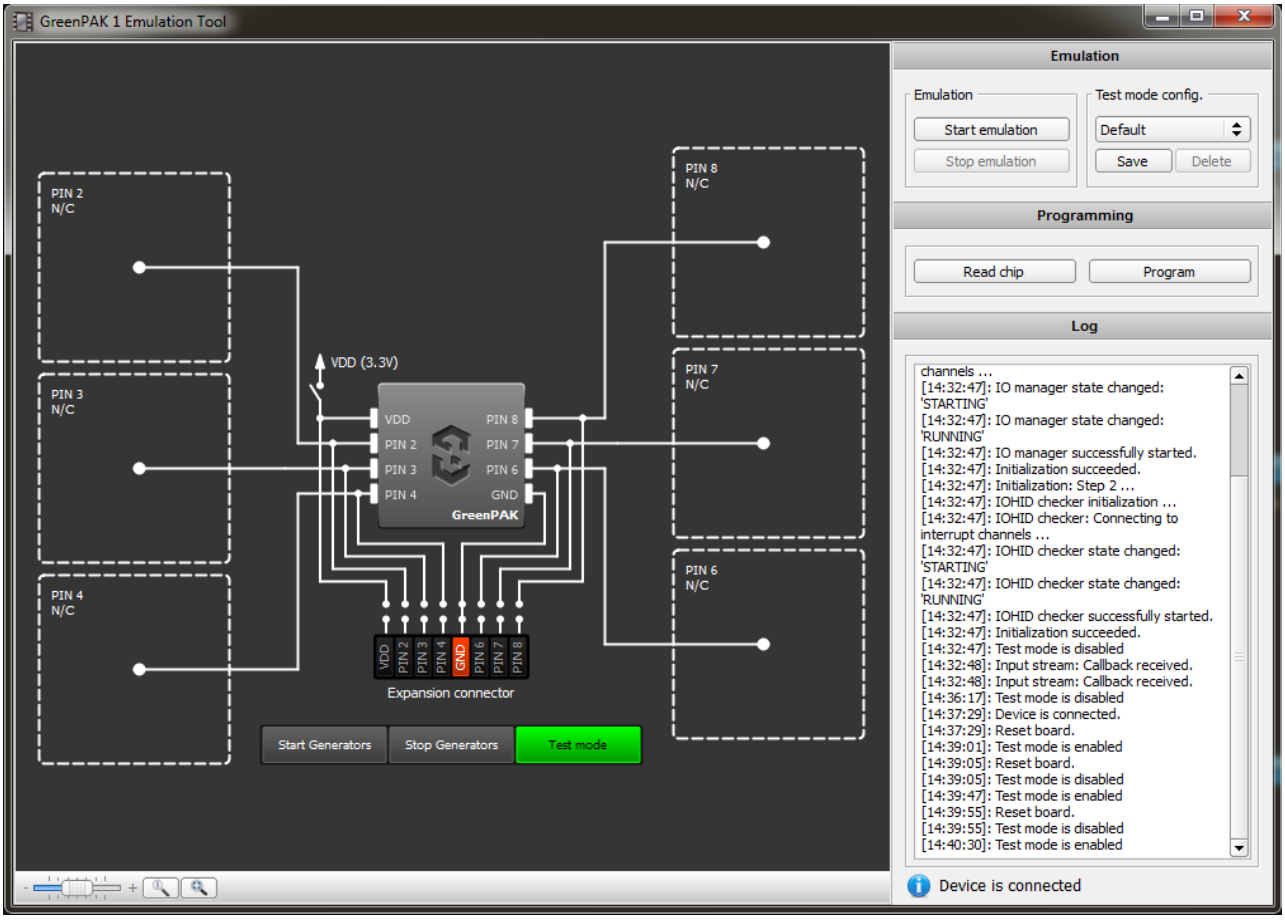
Figure 7-41. Start Emulation



In the emulation mode, the test mode will be automatically turned on. The current project will be loaded (but not programmed) to the chip, and will be ready for test on the emulation board. The user can change any configuration during the emulation process.
Note: Power turns on when Emulation goes on. The Power key must be turned on in emulation mode to send power to the chip, otherwise the emulation will not work. Power turns off when Emulation goes off.

The user can check the programmed chip using the test mode without emulation. In order to do this, turn on the test mode and the Power key. The test mode can work without power on the chip. The user will control the Power key manually.

Figure 7-42. Using Test Mode Without Emulation



8. GreenPAK 2 Emulation Board

Figure 8-1. The Main Screen

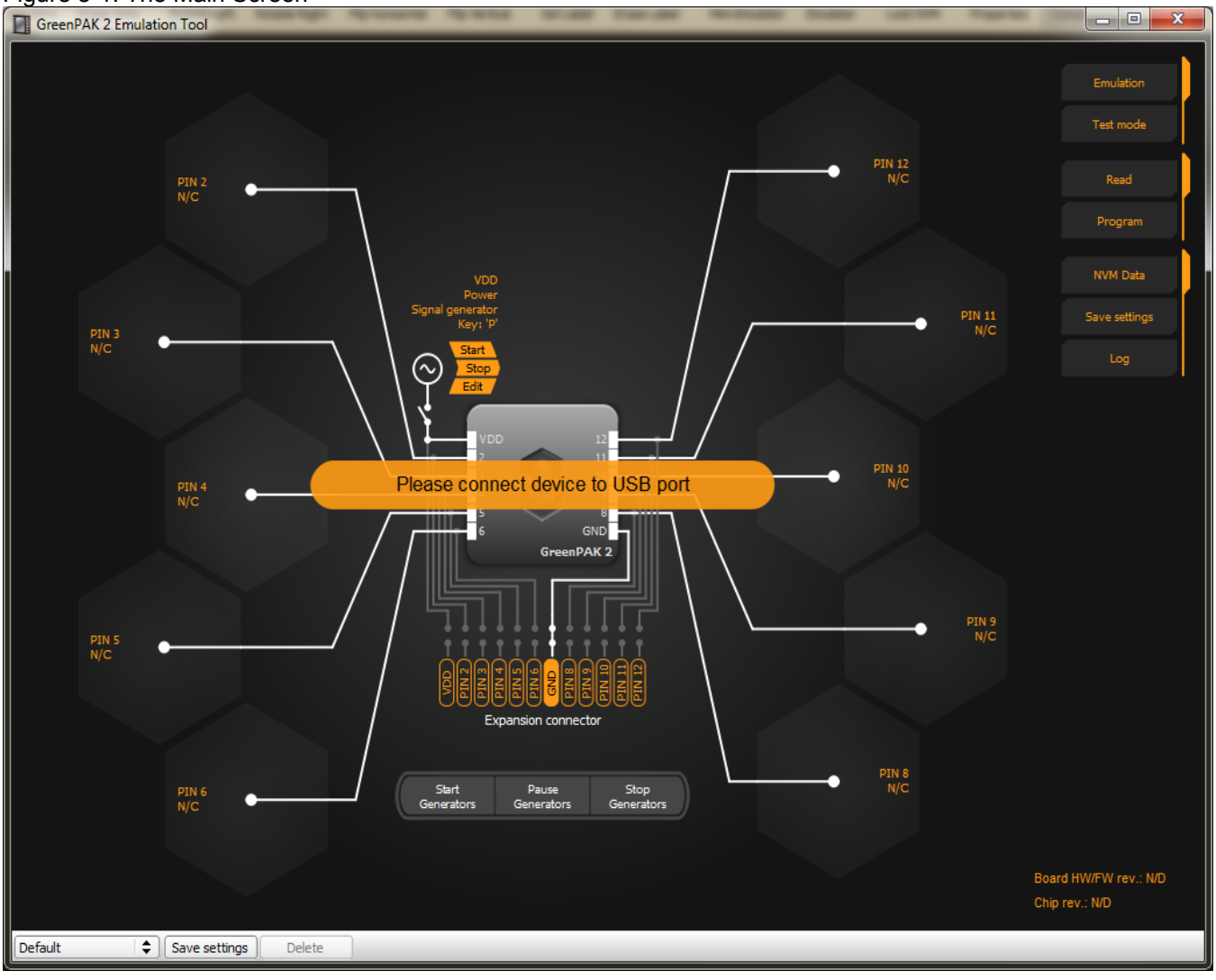
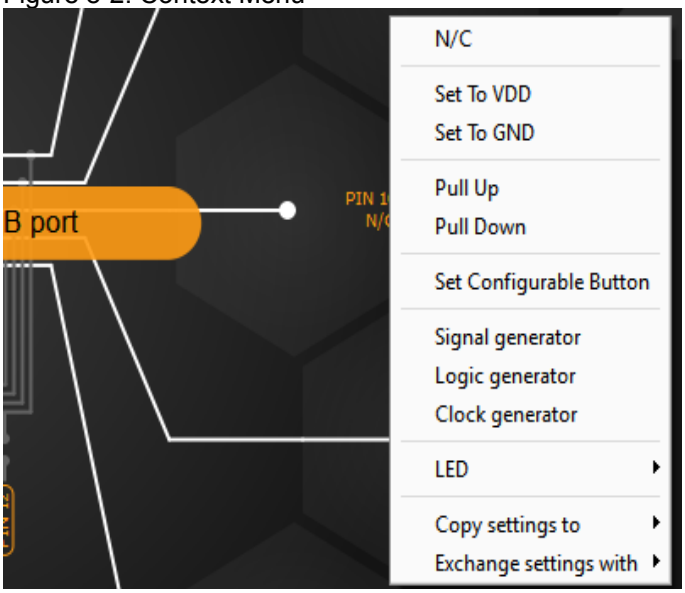


Figure 8-1 displays the GreenPAK IC with dotted areas, and expansion connectors which are connected to pins. The right bottom corner displays revision information.

Dotted areas are used to configure input connections. Use the context menu to manage them.

Figure 8-2. Context Menu



Copy settings to... – allows the copy settings from the current area to another connection.
Exchange settings with... – exchange settings of the current area with another connection.

8.1. Types of Areas

Fixed Inputs(figure 8-3 – 8-7)

Figure 8-3. N/C (not connected)

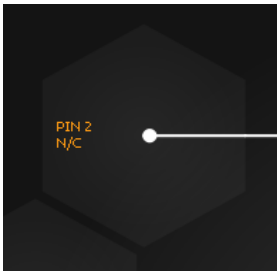


Figure 8-4. Set to VDD

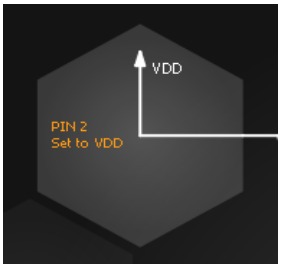


Figure 8-5. Set to GND

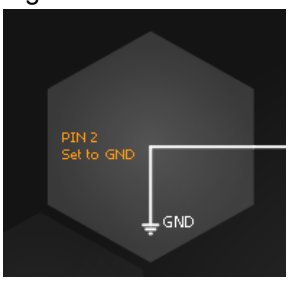


Figure 8-6. Pull Up

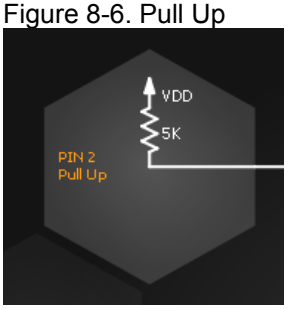
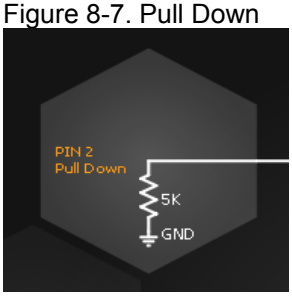


Figure 8-7. Pull Down



LED's(Figure 8-8, 8-9)

Figure 8-8. Inverted Buffered LED, Inverted Buffered LED+Pull Up, Inverted Buffered LED+Pull Down

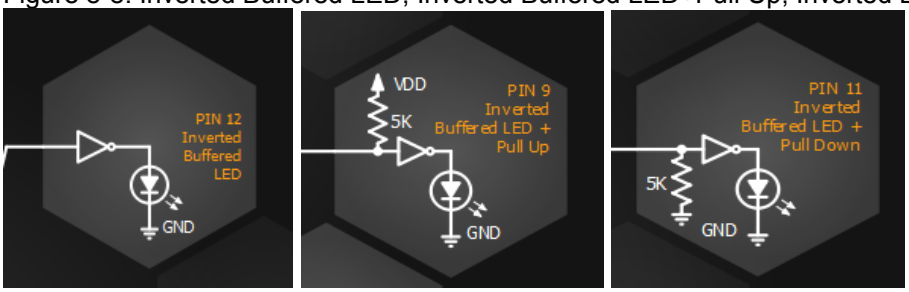
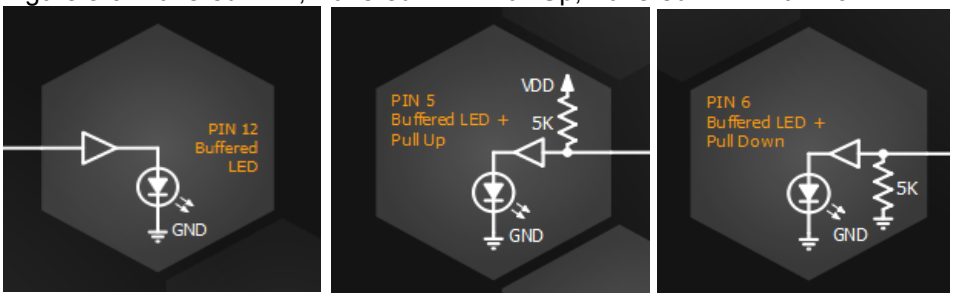
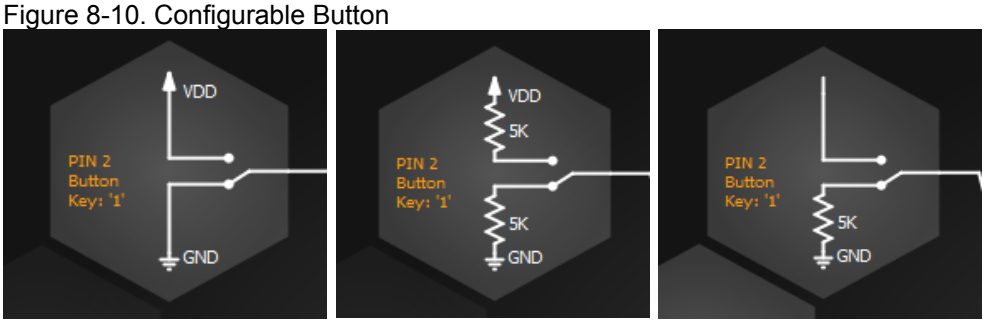


Figure 8-9. Buffered LED, Buffered LED+Pull Up, Buffered LED+Pull Down



Configurable Input (Figure 8-10)

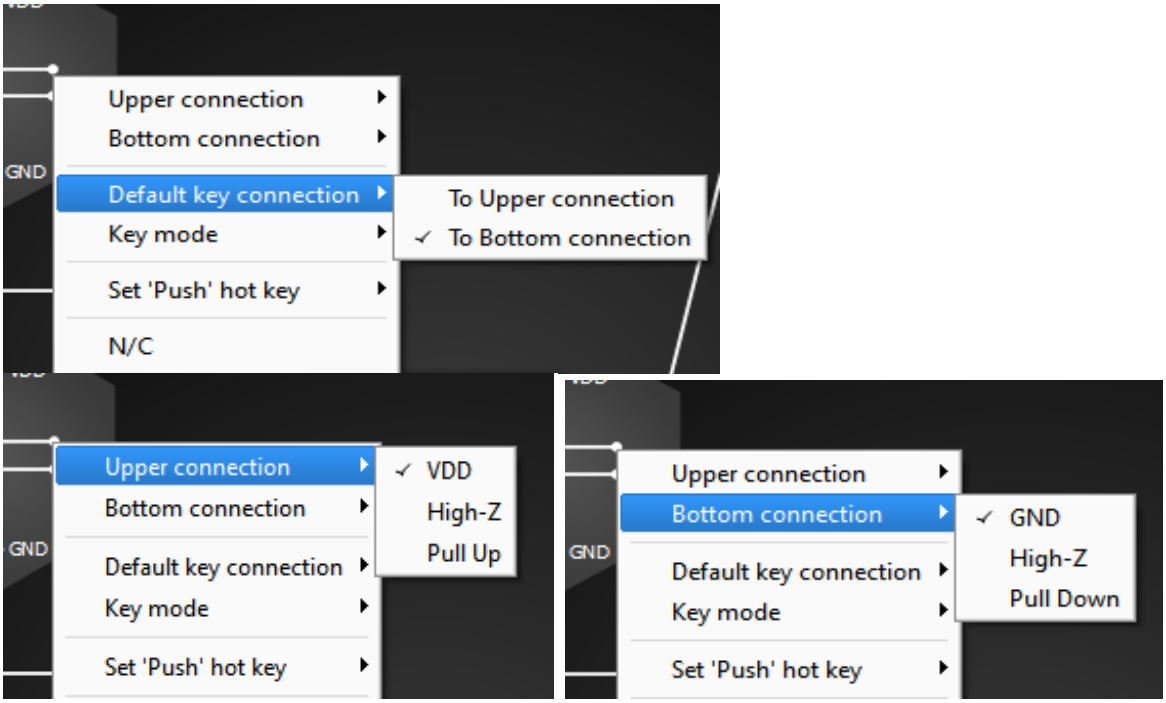
Figure 8-10. Configurable Button



The default connection can be set to either Upper connection or Bottom connection. Click your mouse over the key to change the value.

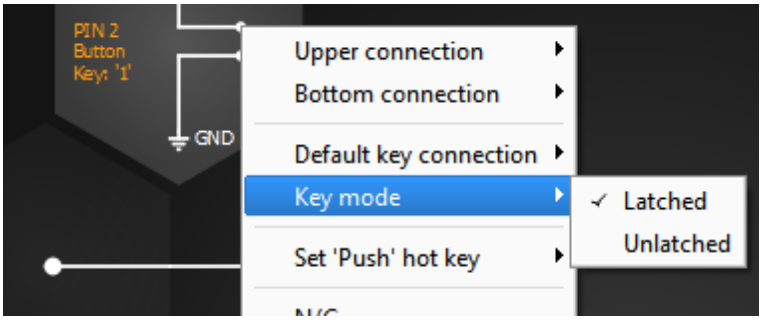
User can configure each connection to VDD/GND, High-Z or Pull Up/Down.

Figure 8-11. Default Key Connection.



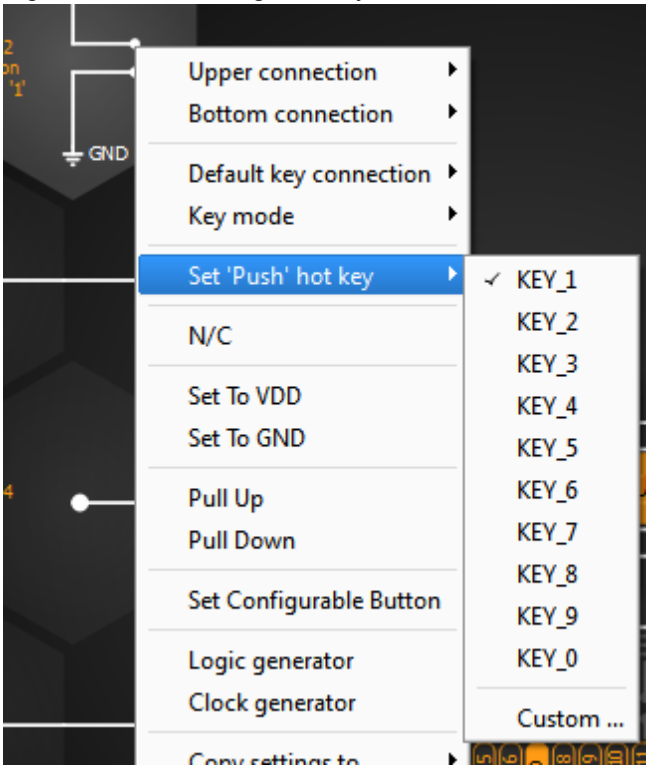
The switch has 2 modes: Latched or Unlatched, which can be configured from the context menu:

Figure 8-12. Key Mode



User can assign Hot Key for 'Push' action. The assigned key will simulate mouse click over the key:

Figure 8-13. Choosing Hot Key

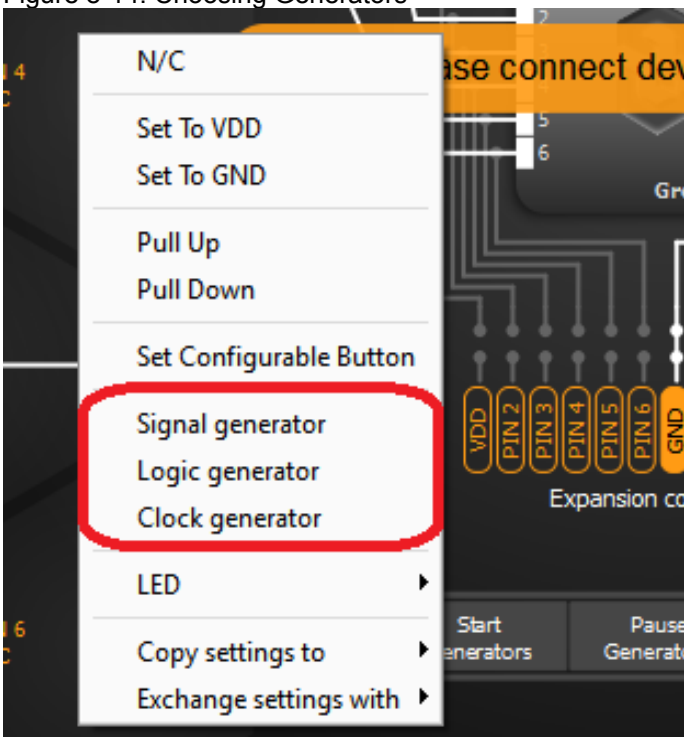


The user can assign the same hot key to multiple Switches, allowing a single hot key the ability to change the key values of all the Switches at once.

8.2. Generators

To each chip there can be connected 3 types of generators: Signal generator, Logic generator, and Clock generator.

Figure 8-14. Choosing Generators



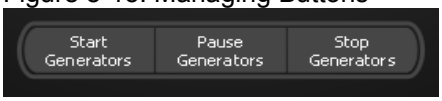
Each generator has its own settings. For the settings window to appear press the Edit button. 

On the left, the options table is divided into 2 groups:

1. General – applied to all types of generators, and
2. Special for each generator.

To start the generators, use the buttons below the Emulator.

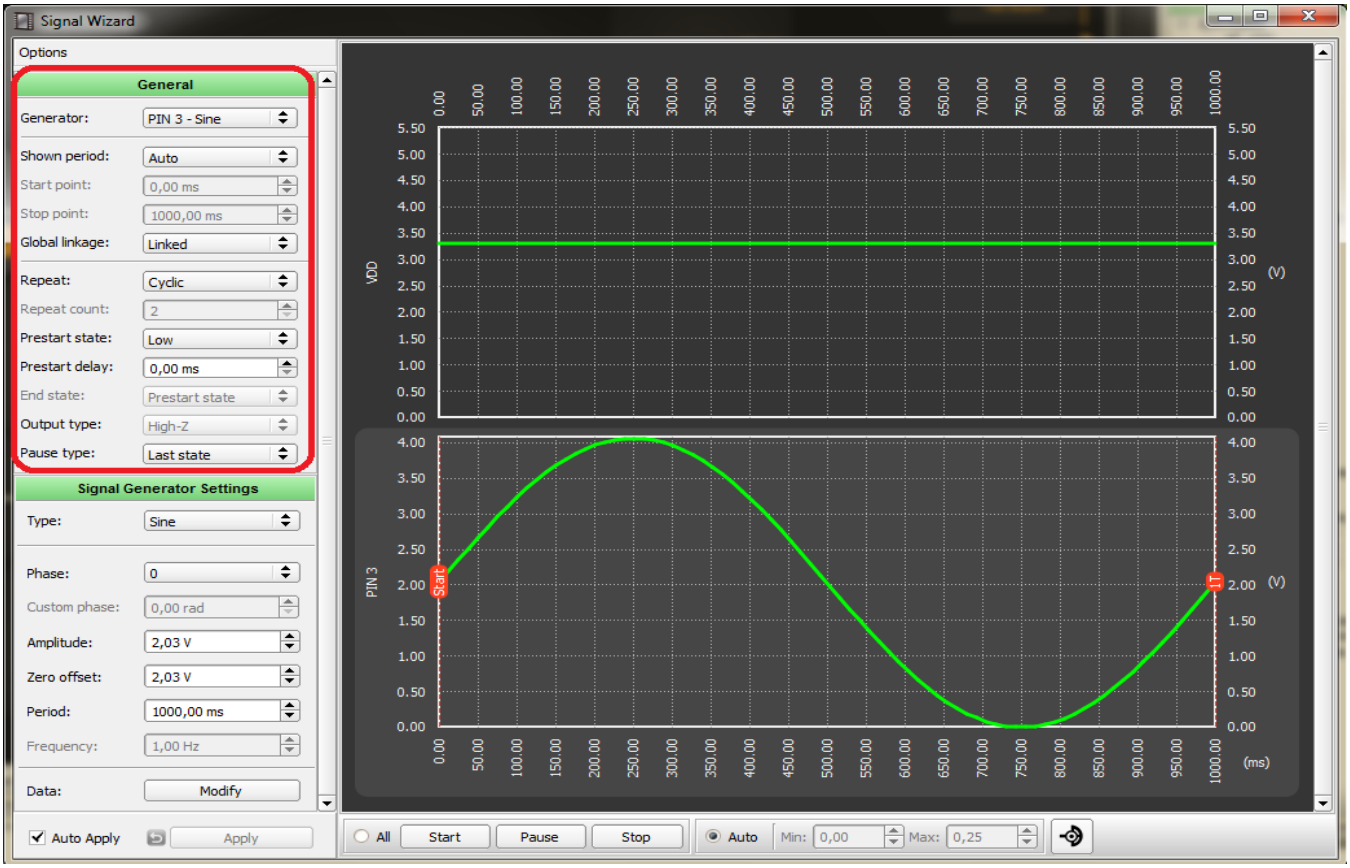
Figure 8-15. Managing Buttons



Note: These buttons can only be controlled by generators with an installed Global Linkage flag.

8.2.1. General Options in a Signal Wizard Mode

Figure 8-16. General Option



Generator:		- generator selector
Shown period:	Auto/Custom/1T/2T/3T/4T	- set the period of a current generator to be displayed
Global linkage	Linked/Unlinked	-if generator is linked, it will be controlled by buttons “Start”, “Stop” and “Pause” on the Emulator
Repeat	One shot/Cyclic/Custom	- repeat option
Prestart state	Low/Start point(V0)/High-Z	-state before start
Prestart delay		-delay before start
End state	Keep last state/Prestart state	-pin state after generation
Output type	High-Z/Strong Drive/Open Drain, Drives High/ Open Drain, Drives Low/Resistive Pull Up/ Resistive Pull Down/ Resistive Pull Up/Down	- type of output
Pause type	Last state/Low/High/High-Z	-hold state when it is paused

8.2.2. Period Modes

AUTO Mode

All generators with 'AUTO' option have one scale; this scale = MAX period of all generators with 'AUTO' option.

Figure 8-17. One Scale for All Generators

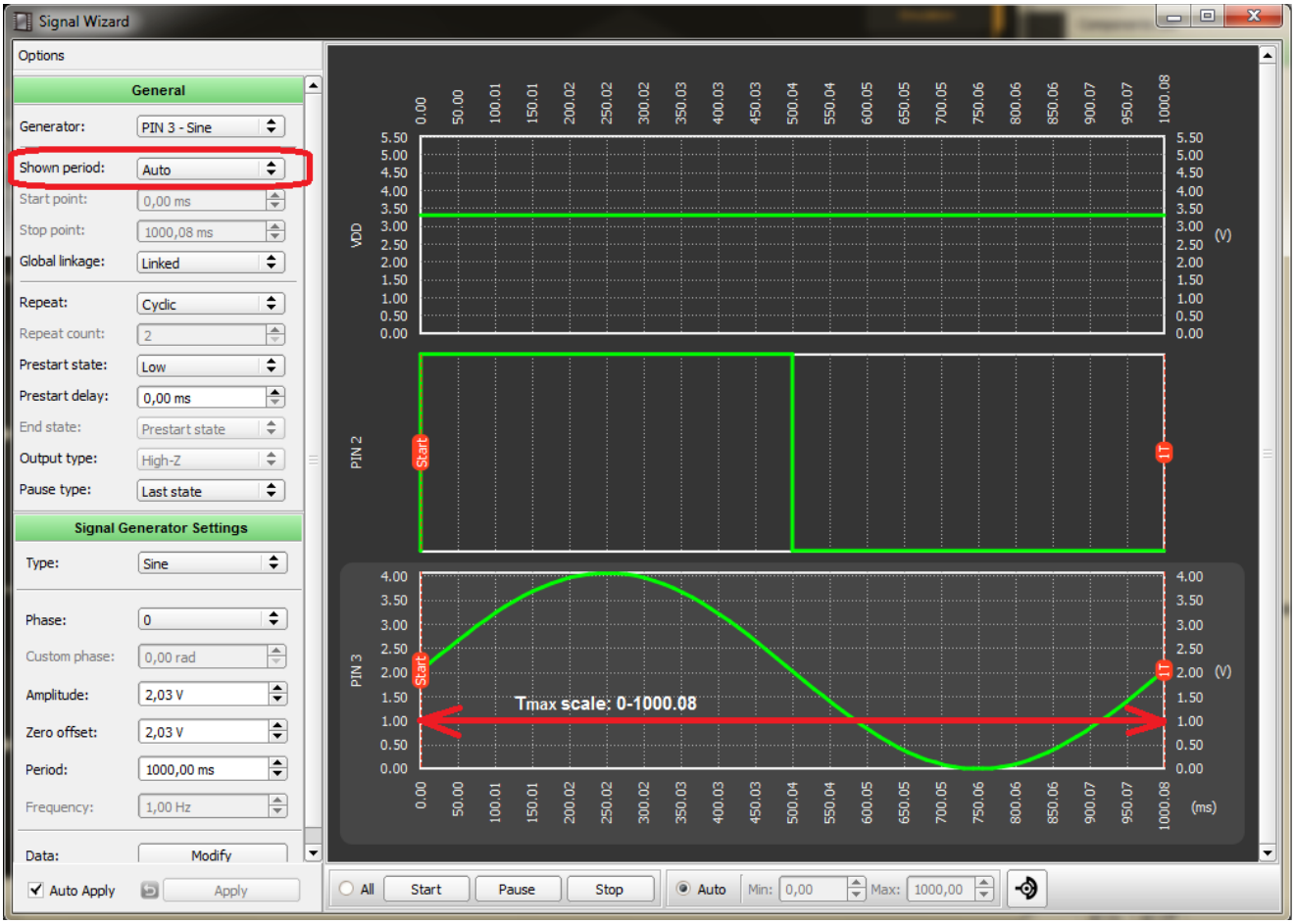
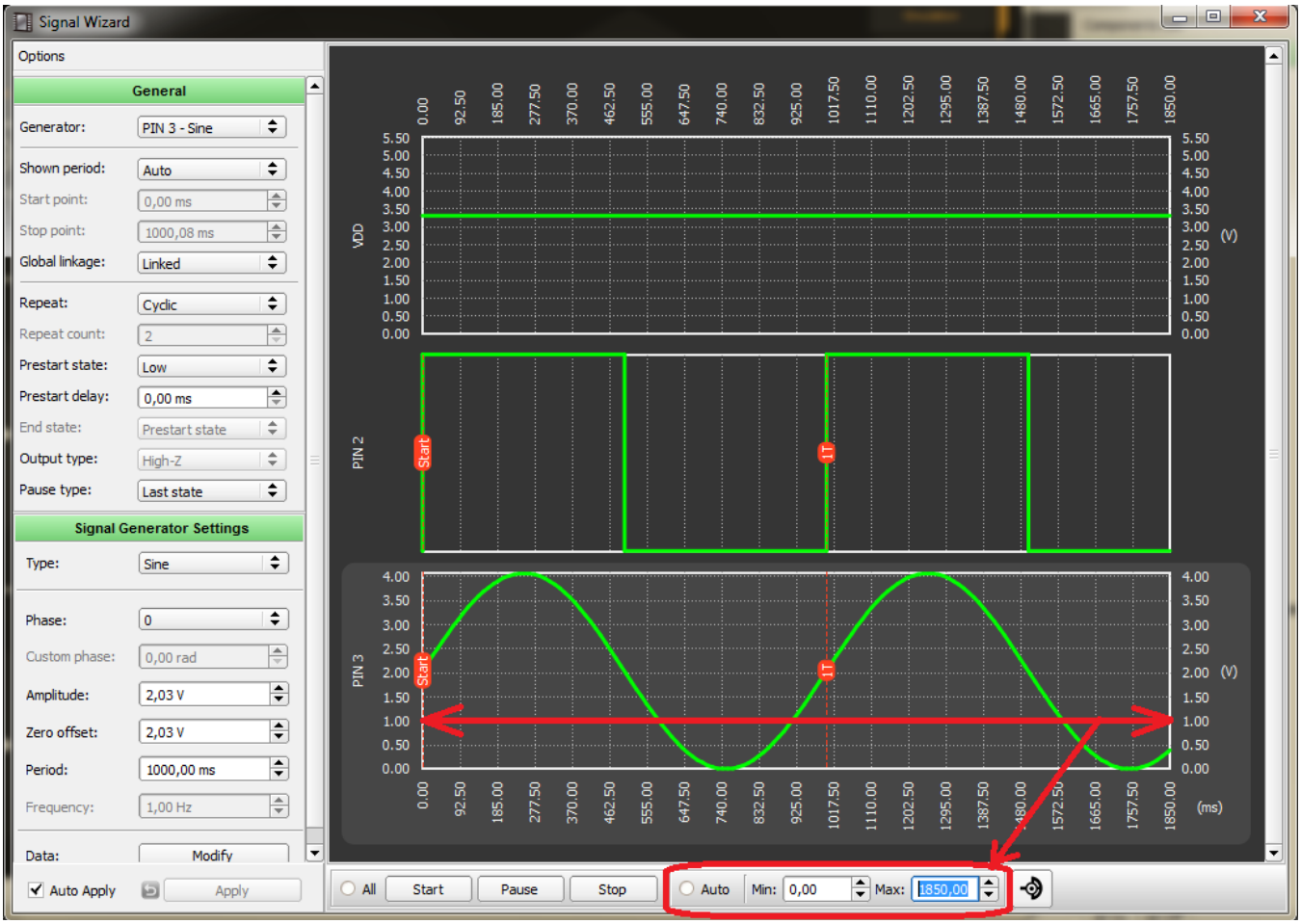


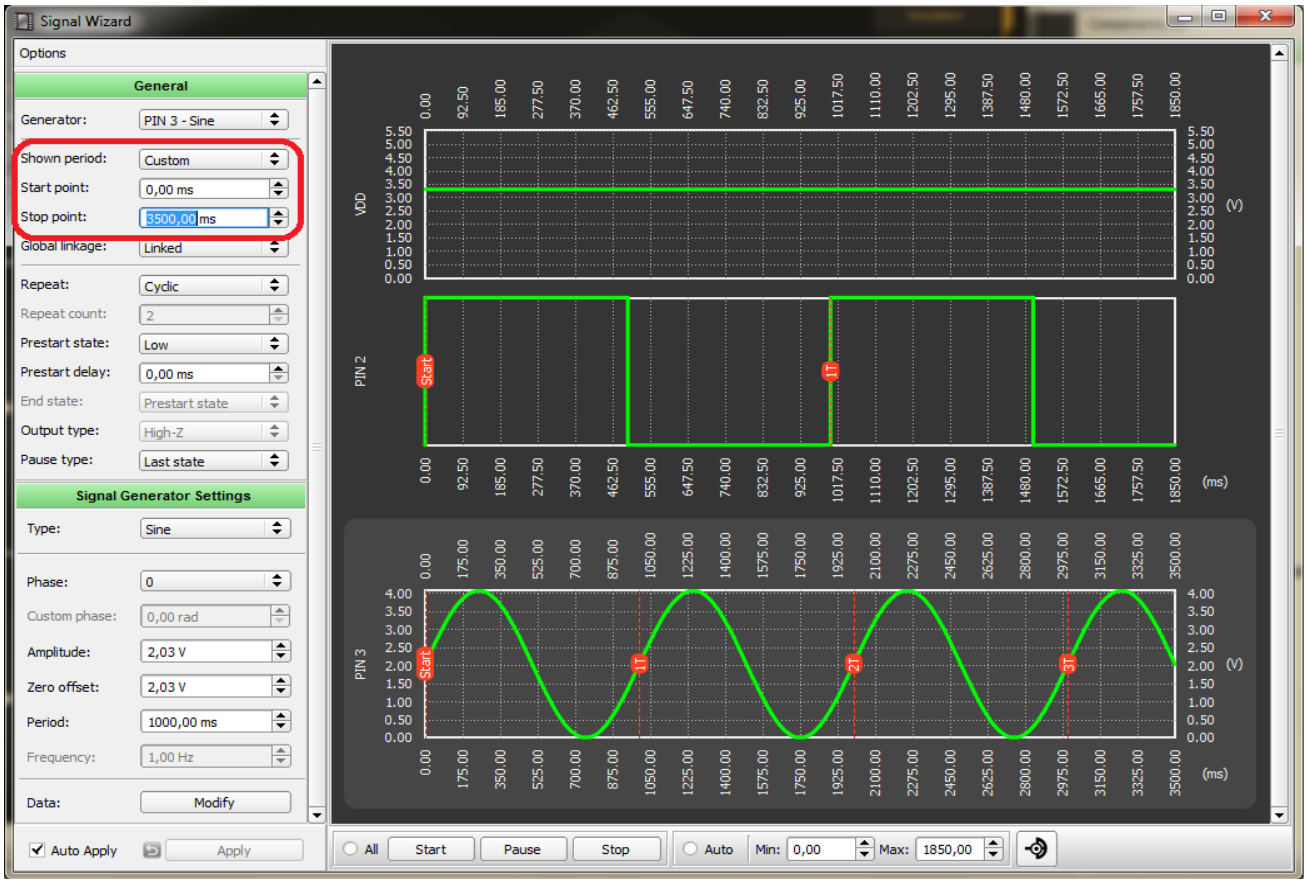
Figure 8-18. User Can Change the Scale Manually



button turns on/off the mouse coordinates on the timing diagrams.

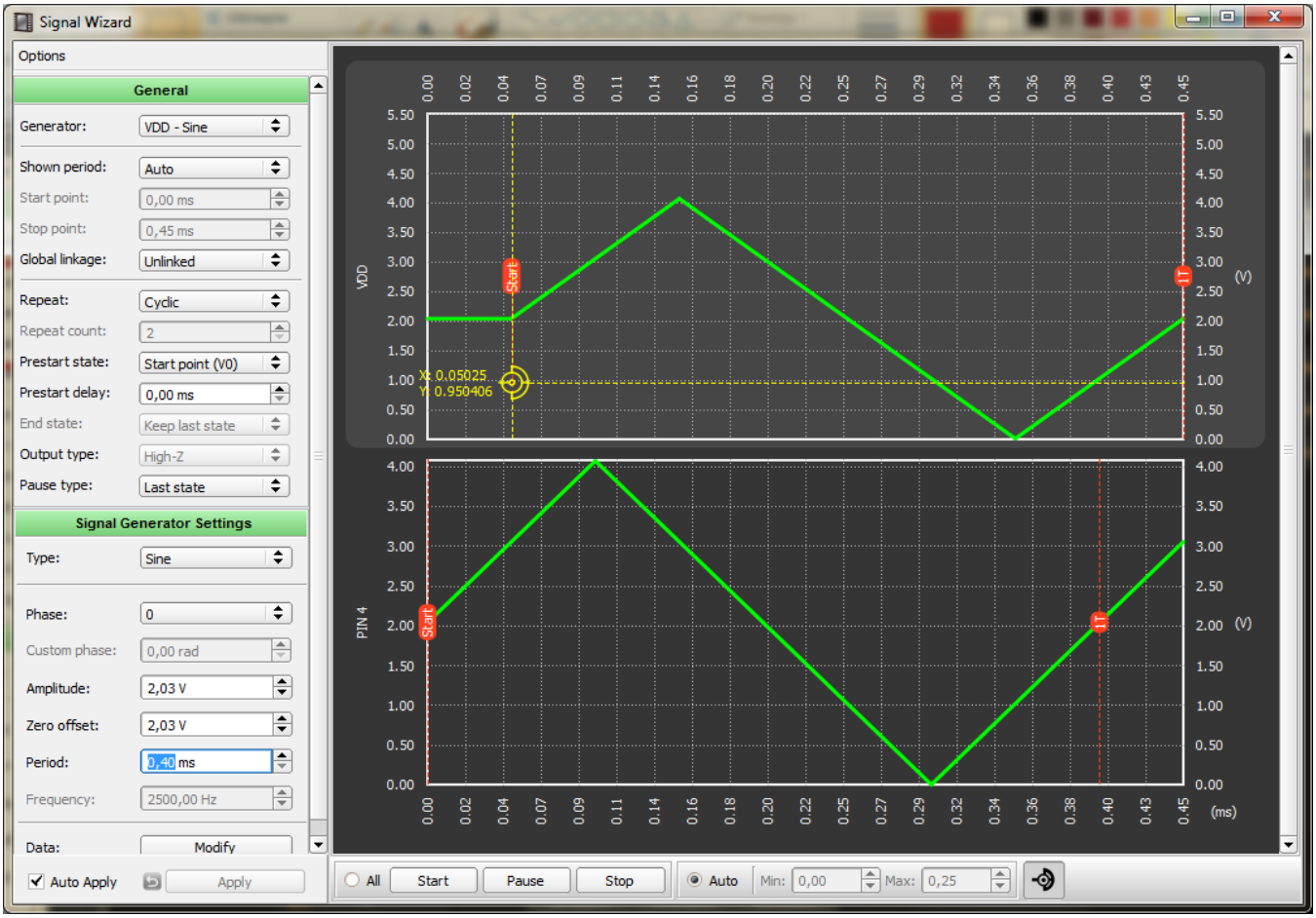
CUSTOM Mode

Figure 8-19. Choosing Period Options



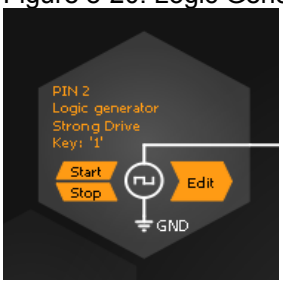
User can set a custom period to be displayed for any generator.
Note: Logic and clock generators have a 75 mks delay before start. The signal generator connected to PIN 8 or 9 has delay 25 mks before start. In case it is connected to PIN 1(VDD) or 11 the delay is 50 mks before start. This delay is displayed on the graphs in Signal Wizard when the AUTO mode is ON.

Figure 8-20. Start Delay



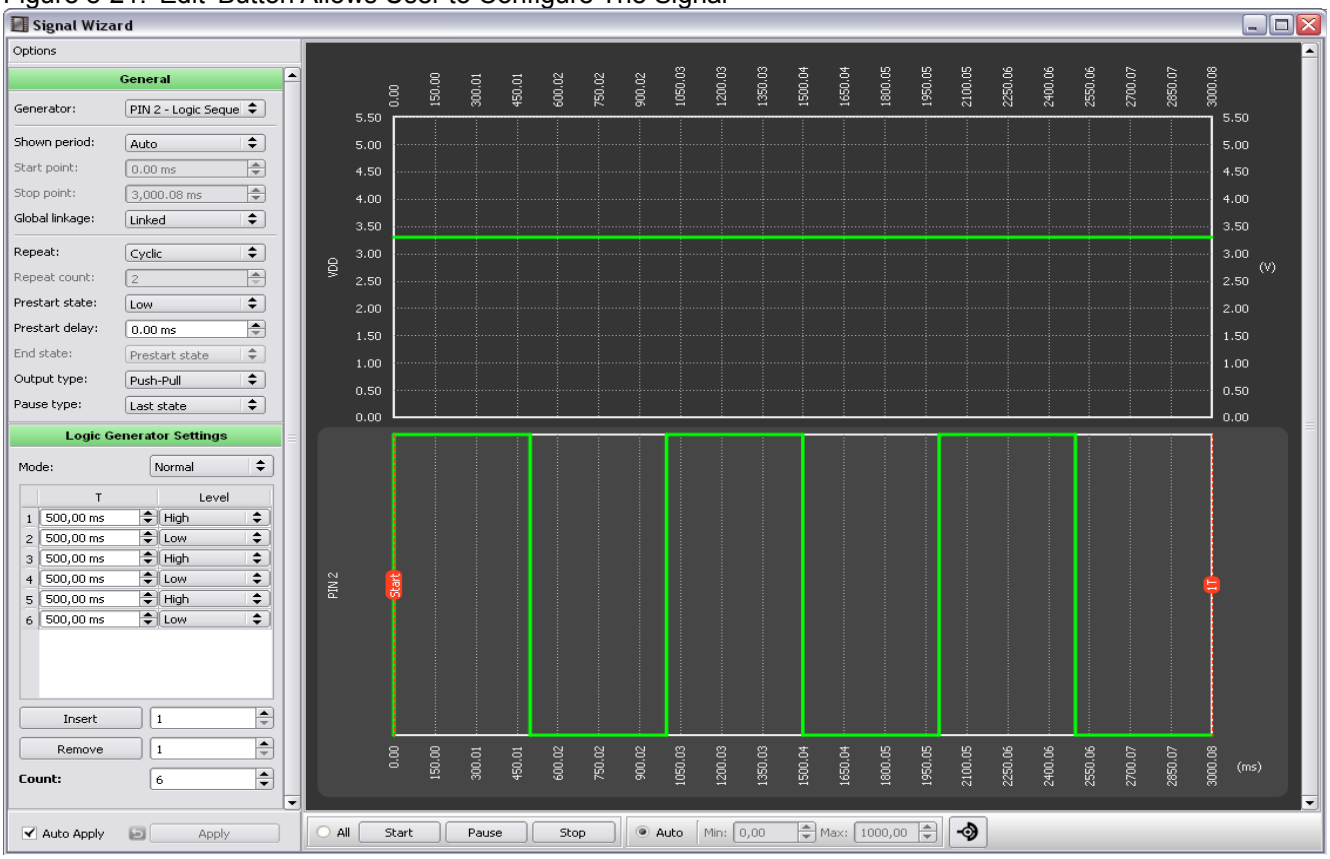
8.2.3. Logic Generator

Figure 8-20. Logic Generator



Logic generator is used for generating the logic pulses.

Figure 8-21. 'Edit' Button Allows User to Configure The Signal

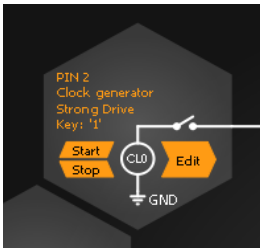


Configuration options:

Mode:	Normal/Invert	- signal mode
Repeat:	One shot/Cyclic/Custom	- repeat option
T/Level:		- sets duration of level
Insert:		- insert pulse to the entered position;
Remove:		- remove pulse from the entered position;
Count:		- pulses count

8.2.4. Clock Generator

Figure 8-22. Clock Generator

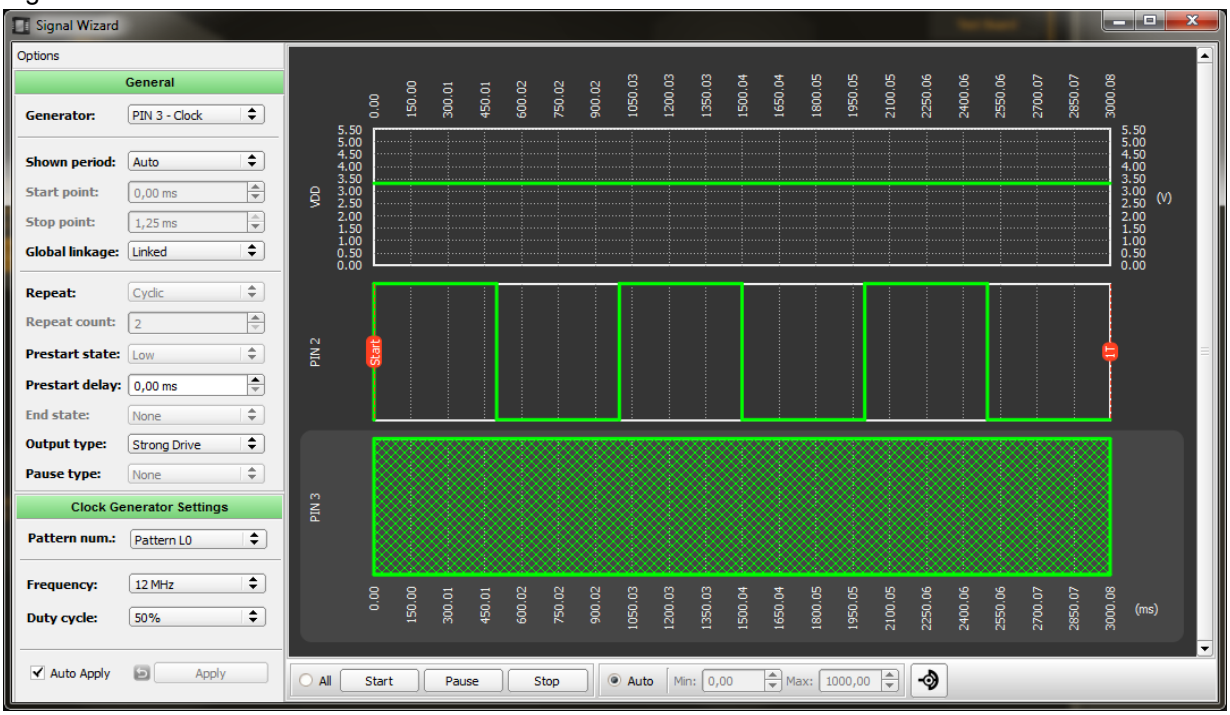


A high-frequency logic generator, which generates a 12 MHz frequency signal can be connected to any pin. Each Clock generator should be connected to its pattern (collection of generators' settings). There are 6 total patterns: L0/L1/L2 – for the left side of pins (PIN 2, 3, 4, 5, 6) and R0/R1/R2 - for the right side (PIN 8, 9, 10, 11, 12). All the patterns have inter-independent settings and can be used by a random quantity of Clock generators connected up to the pins on the corresponding side. Connections configuration is indicated in the generator's name, connected to pin. For instance, a Clock generator which is connected to pin 2 and L0 pattern will have a CL0 index (Clock, Left, Pattern number 0).

Configuration Options:

Pattern number:	Pattern L0/L1/L2/R0/R1/R2	- connect to pattern
Frequency:		- generator frequency
Duty cycle:	In percent	- duration of high signal in percentage

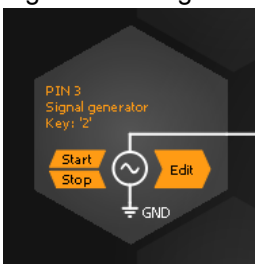
Figure 8-23. Clock Generator View



'Start' and 'Stop' buttons can be used to start and stop a current generator. A 'Pause' button used for generator pause/start at the same time makes the Clock generator key connect/disconnect. If 'All' flag is enabled, the buttons do the same as buttons in the emulator.

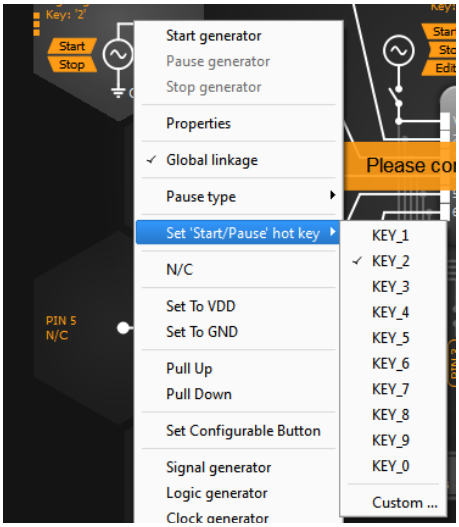
8.2.5. Signal (Analog) Generator

Figure 8-24. Signal Generator



Signal generator is used to generate analog signals: Constant Voltage level, Sine, Trapeze(Trapezoid), User defined.
Logic, signal and clock generators can be started/paused/stopped using orange buttons or through the context menu. The user can also assign the hot keys for start/pause.
Several generators can use the same hot button to start/pause at once. This is how to start more than one generator at the same time.

Figure 8-25. Sets Start/Pause Hot Key



Signal Generator Settings

Type: Const voltage level/Sine/User Defined - type of waveform;

Constant Value:

U: - voltage level;

Figure 8-26. Constant Value

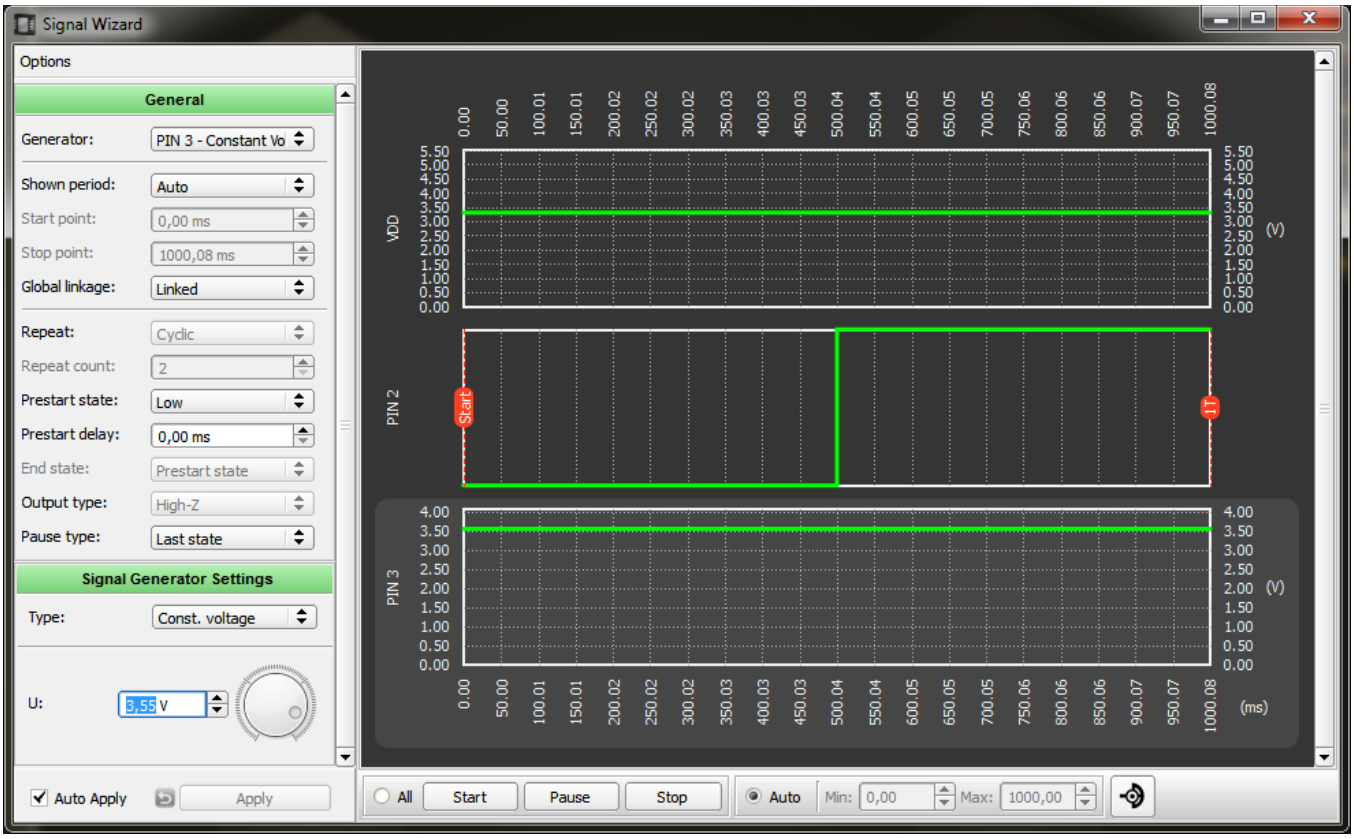
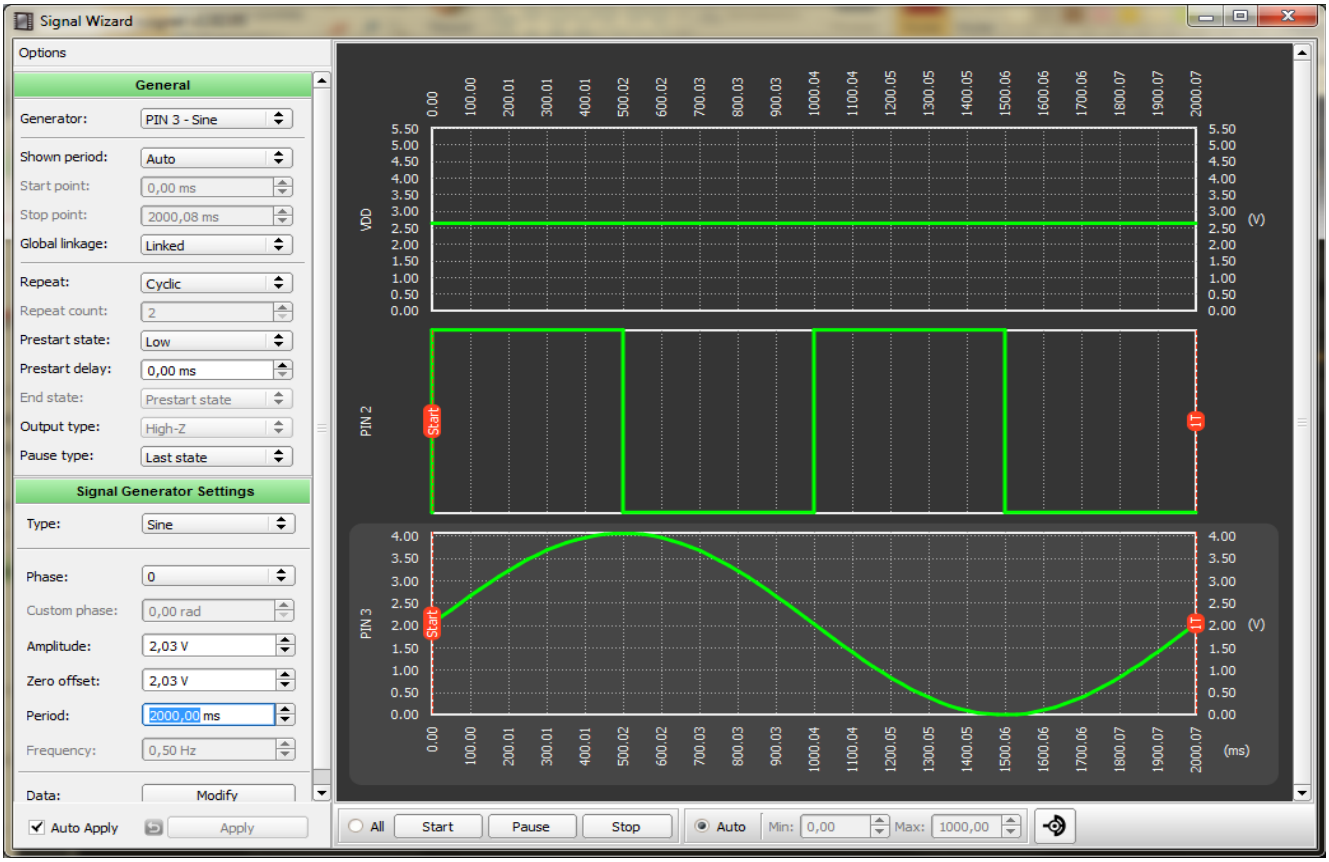


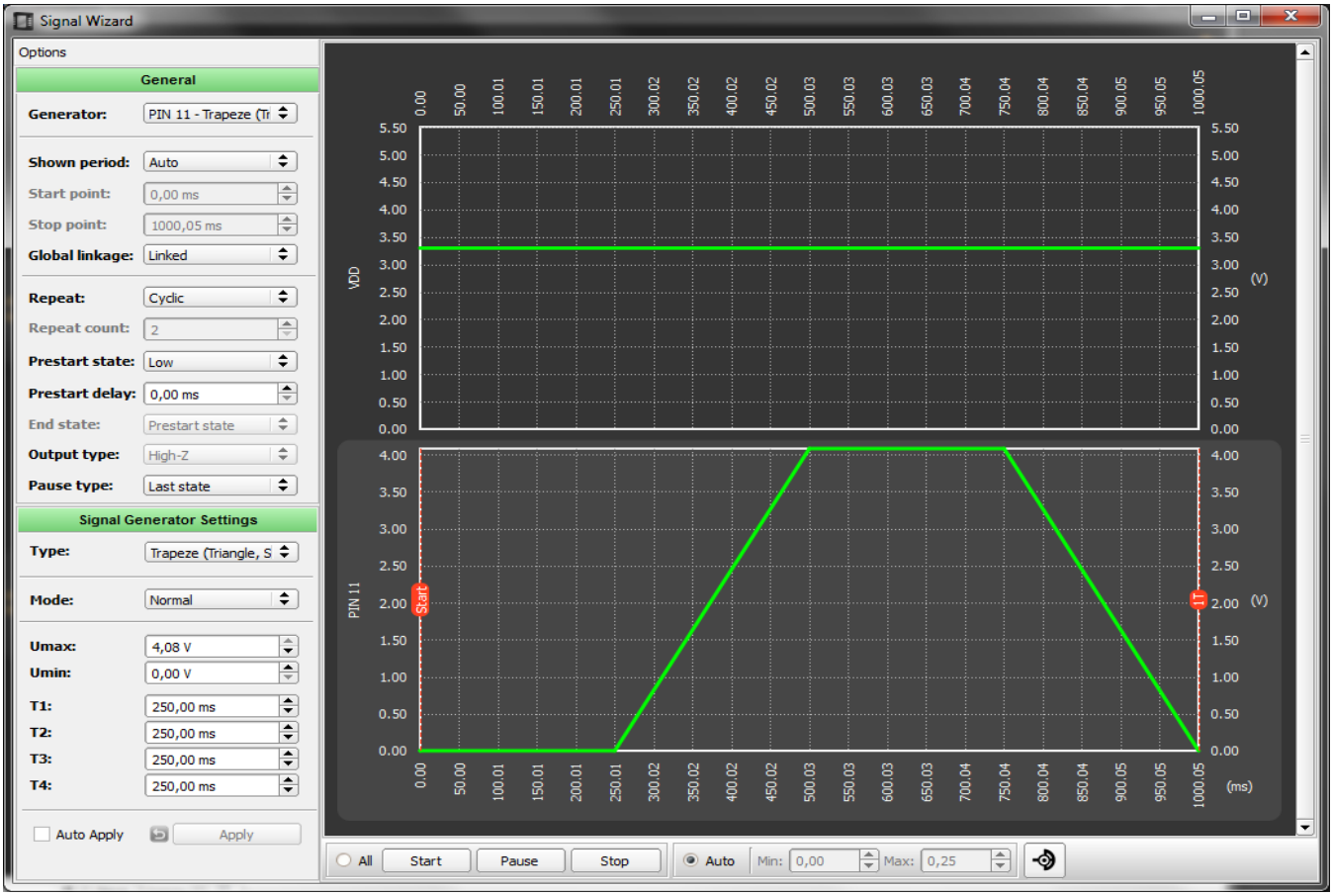
Figure 8-27. Sine



Sine Settings:

Repeat:	One shot/Cyclic/Custom	- repeat option
Phase:	Custom/0/Pi:2/Pi/3Pi:2	- φ0
Custom phase:		- show phase in a radian
Amplitude:		- amplitude
Zero offset:		- zero offset
Period:		- period
Frequency:		- shows frequency
Data:		- change signal using Custom Signal Wizard

Figure 8-28. Trapezoid (Triangle, Saw)



Trapeze Settings:

Mode:	Normal/Invert	-signal mode
Umax/Umin		-max/min voltage level
T1, T2, T3, T4		-duration of trapeze

If T_3 = 1 signal is a triangle.
If T_3 = 1, T_2 = 2 or T_4 = 2 signal is a sawtooth.

Figure 8-29. Duration of Trapeze (Trapezoid)

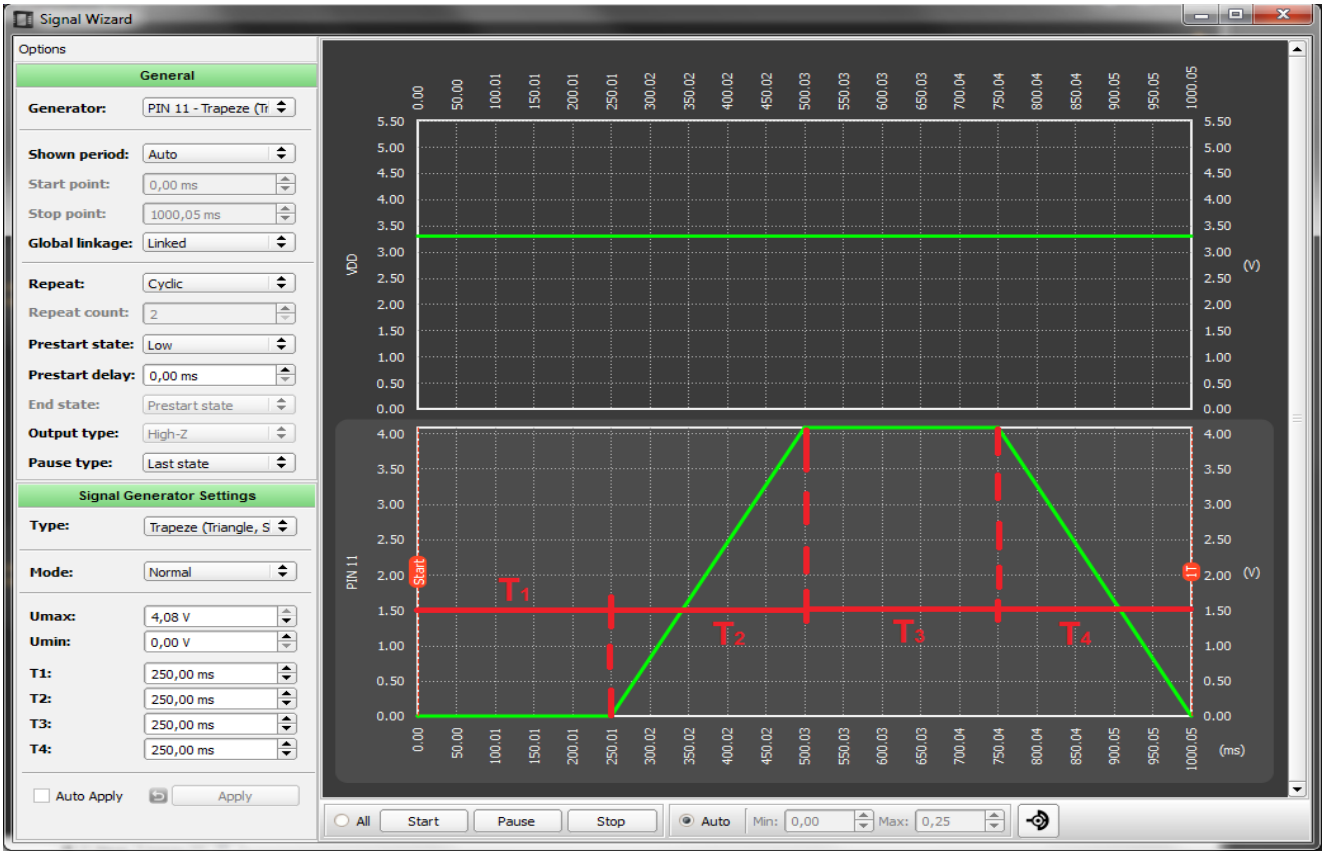
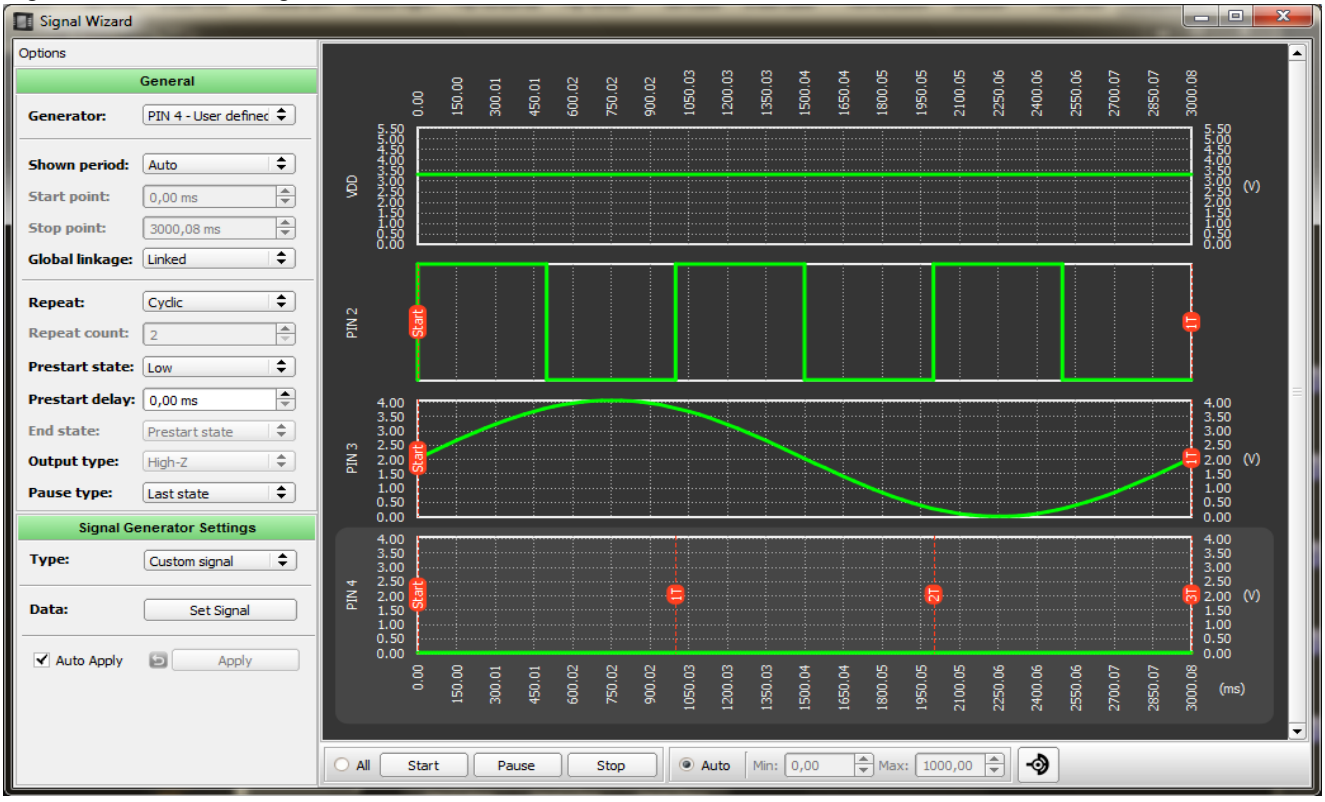


Figure 8-30. Custom Signal

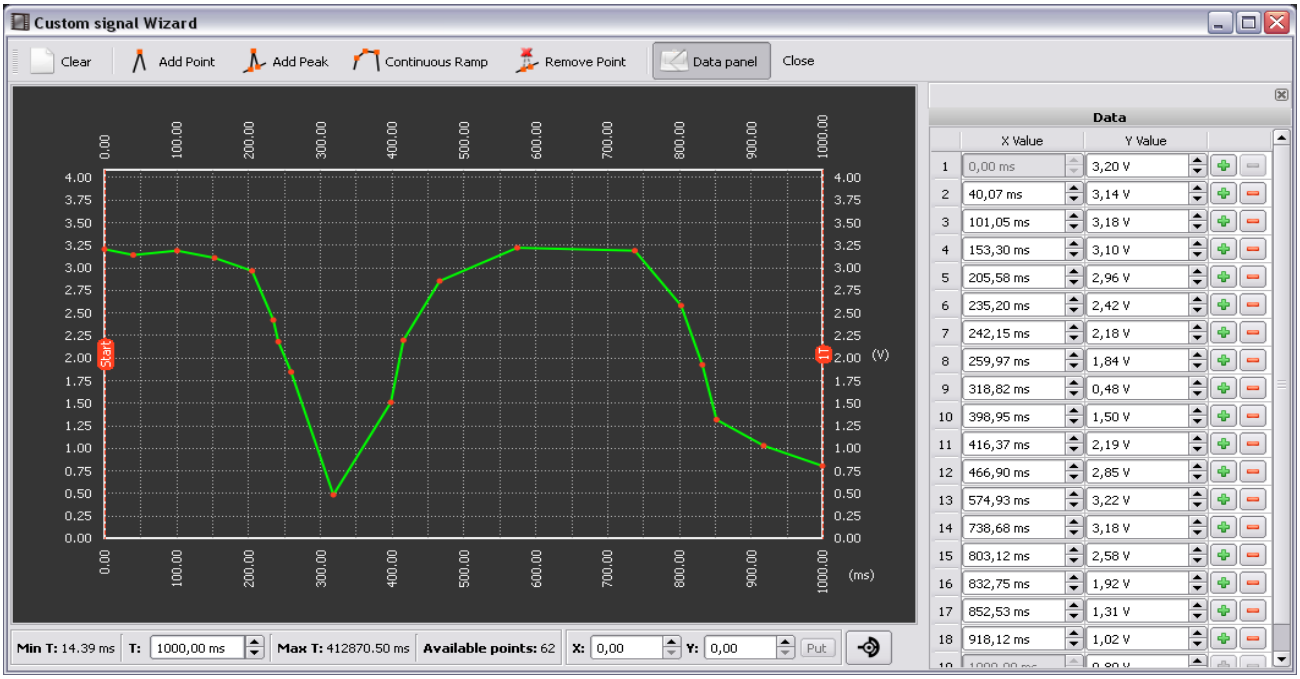


Custom Signal Settings:

Repeat:	One shot/Cyclic/Custom	- repeat option;
Data:	Set Signal	- change signal using Custom Signal Wizard

8.2.6. Custom Signal Wizard

Figure 8-31. Drawing Signal (Arbitrary waveform)



Toolbar:	Clear	- clear data
	Add Point/Add Peak/Continuous Ramp/Remove Point	- draw mode
	Data panel	- turn on/off the data table
	Close	- close window with current signal

Figure 8-32. Peak

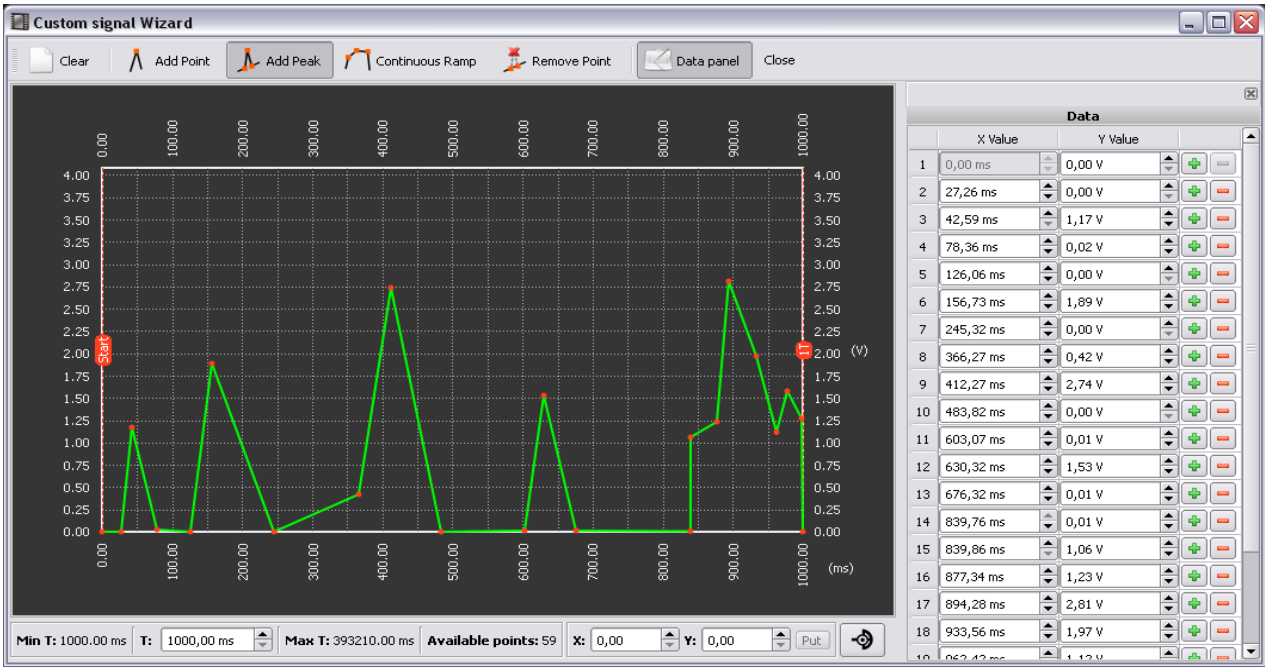
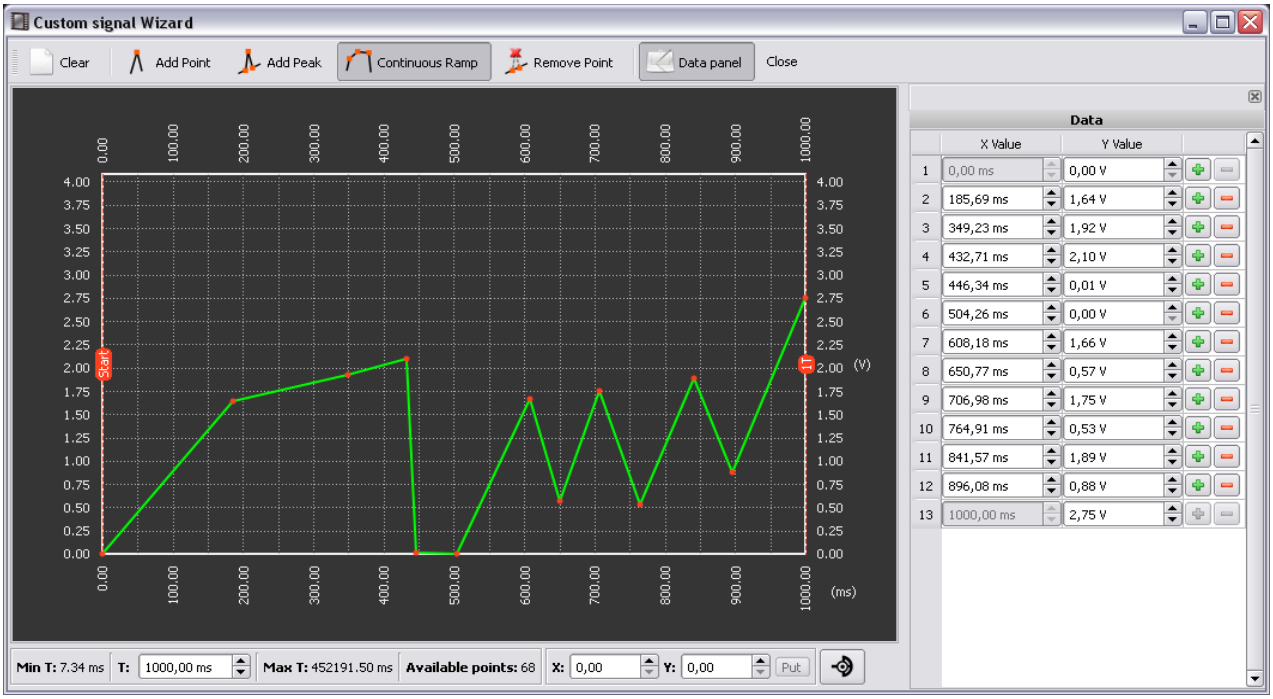


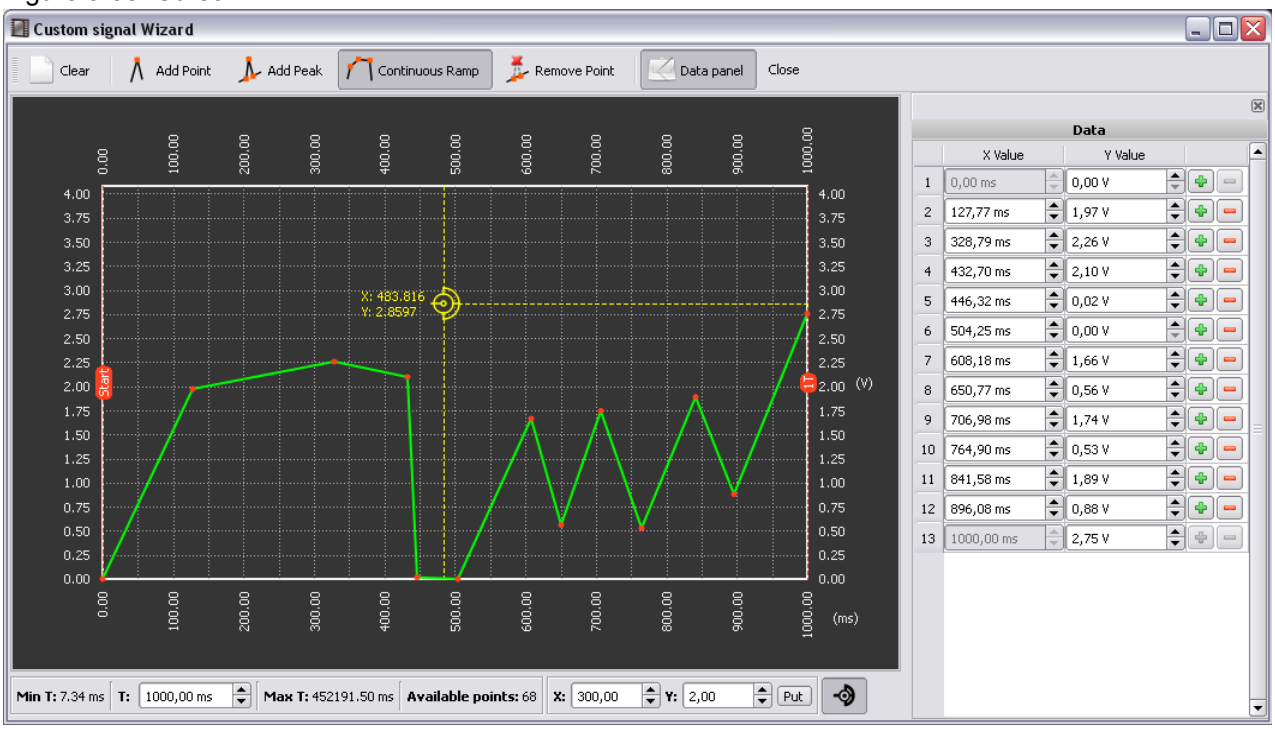
Figure 8-33. Continuous Ramp



Remove Point: Removes selected point. Double clicking on the point can also remove it.

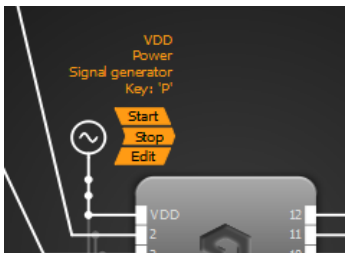
Figure 8-34. Data Panel

Figure 8-35. Cursor



8.2.7. VDD Power Signal Generator

Figure 8-36. VDD Power Signal Generator

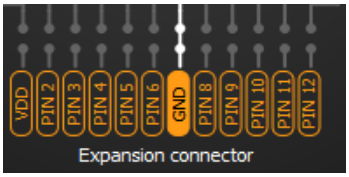


Simple signal generator for VDD with its own options.

8.3. Expansion Connector

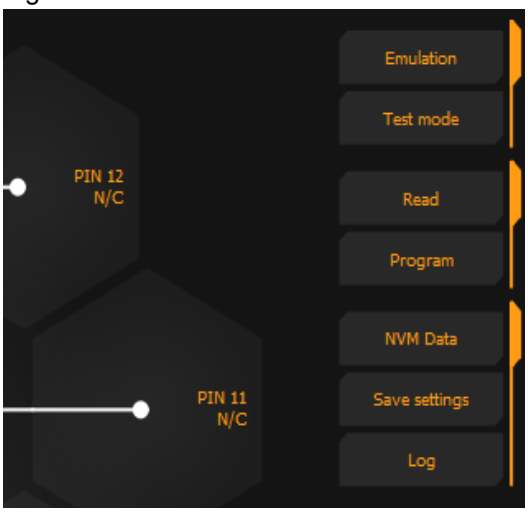
User can connect/disconnect I/O pads of GreenPAK with the expansion connector on the board.

Figure 8-37. Expansion Connector



8.4. Control Panel

Figure 8-38. Control Panel

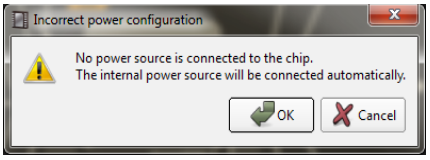


Emulation:

The current project will be loaded to the chip (but not programmed), and will be ready for the test on the emulation board. The user can also change any configuration during the emulation process.

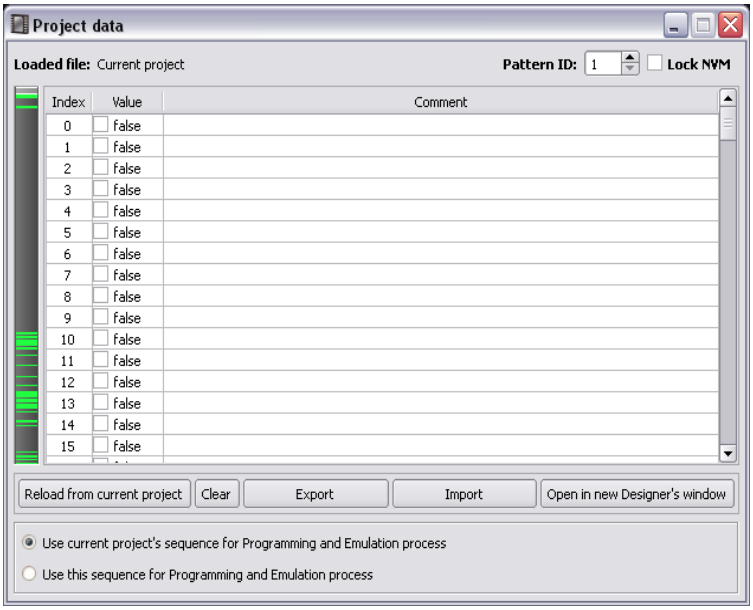
In case when Power key and VDD key on the Expansion connector are turned off there will pop up a warning message (figure 8-39).

Figure 8-39. Incorrect Power Configuration



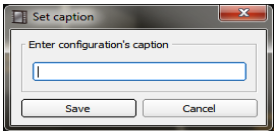
Test Mode:
The test mode is used to connect or disconnect chip's I/O pads to stimulus areas, configured by the user.
The user can also check the programmed chip using the test mode without emulation. In order to do this one only needs to turn on the test mode and power key. The test mode can work without power on the chip. User will control the Power key manually.
Read:
Read chip using emulation board.
Program:
Program chip with the current project.
NVM Data:
The table of bits.
Pattern ID – gives an ID (1-255) to the project. The ID will be put into the chip after programming, and also will be read during "chip reading" operation.
Lock NVM – blocks NVM reading. A programmed project becomes unavailable for chip reading. However, the chip is still available for emulation.

Use current project's sequence for Programming end Emulation process – user can choose to use current project's sequence for programing and emulation process.
Use this sequence for Programming end Emulation process – user can choose current sequence for programming and emulation process.
Reload from current project – user can load bit sequence from current project.
Clear – sets all bits in false.
Export – save data to text file.
Import – load data from text file.
Open in new Designer's window – open current bit sequence in new Designer's window.
Figure 8-40. NVM Data



Save Settings:
Save current configuration of a test mode to the project file.

Figure 8-41. Save Project



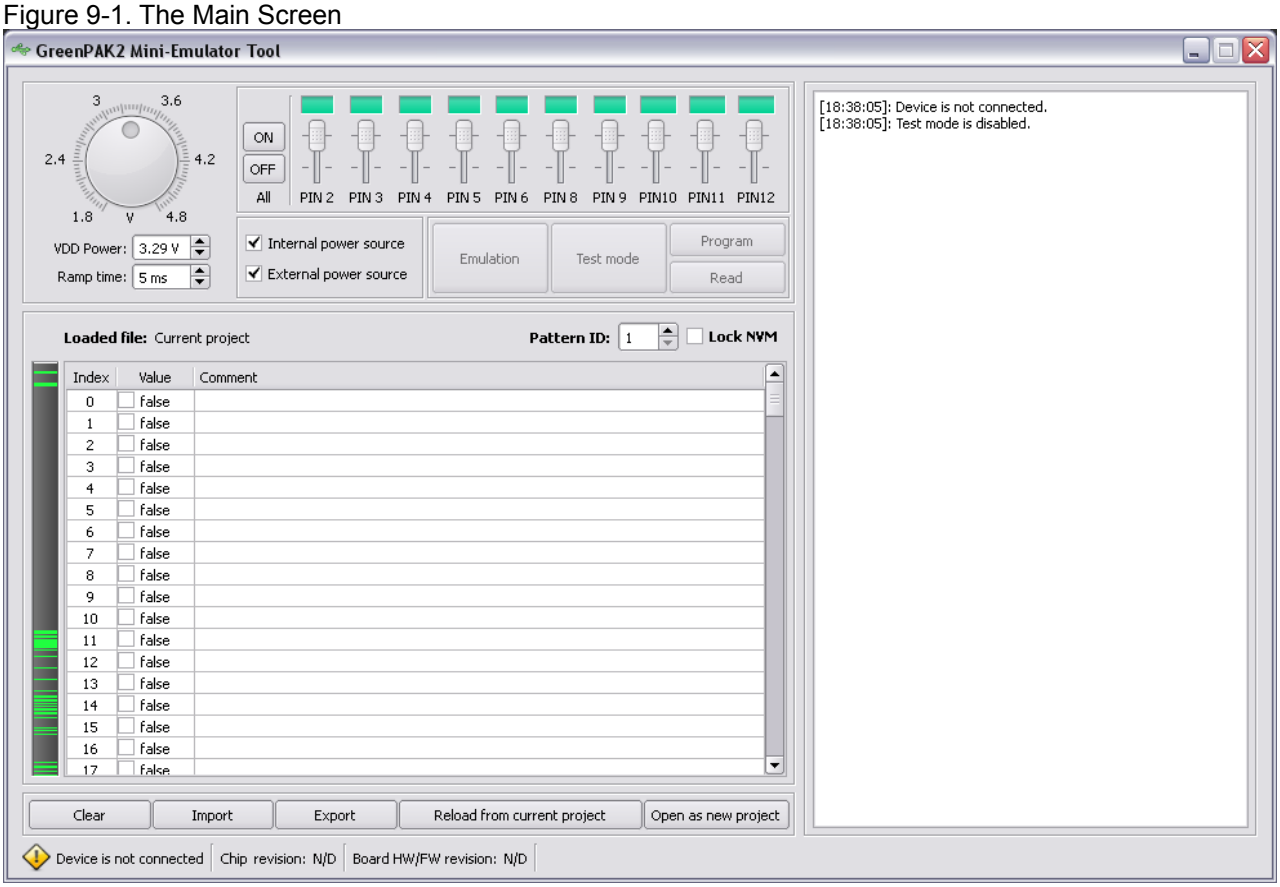
Log:
Show log.

Figure 8-42. Test Mode Configuration

User can save current configuration of a test mode to the project file (Figure 8-42).

9. GreenPAK 2 Mini-Emulation Board

Figure 9-1. The Main Screen



VDD Power – defines the voltage level, set on the GreenPAK (Internal power source) when the 'Test mode' is ON.

Ramp time – time of voltage increases from 0 V to the level specified in the VDD Power while turning the 'Test mode' ON.

Pattern ID – gives an ID (1-255) to the project. The ID will be put in the chip after programming, and also will be read while chip reading.

Lock NVM – blocks NVM reading. A programmed project becomes unavailable for chip reading. The chip is still available for emulation.

User can connect/disconnect I/O pads of GreenPAK 2 with the expansion connector on the board using PIN2, PIN3, PIN4, …latches.

The ‘Test mode’ button is used for turning on/off the test mode.

The 'Emulation' button turns on/off the Emulation mode.
In Emulation mode, the Test mode will be automatically turned on. Thus the current project will be loaded to the chip (but not programmed), and will be ready for test on the emulation board. The user can change any configuration during the emulation process.
The user can also check the programmed chip using test mode without emulation. In order to do this one only needs to turn on the test mode and power key.

A 'Program' button is used for writing NVM to chip.

A 'Read' button is used for reading NVM from chip.

A 'Clear' button resets all values to “false”.

'Export'/'Import' buttons are used for saving/opening NVM in *.txt format.

'Reload from current project' – updates NVM from current project.

'Open as a new project' – creates a new project in GreenPAK Designer with current NVM configuration.

Below the mini-emulator window, there is the information about device, chip revision, and board hardware/freeware revision.

A. Example projects.

In the GreenPAK Designer **Help** menu, you can find a link to the **Application Notes** web page for selected chip revision. There you can find fully configured examples which can help get your projects completed more quickly. Each example has documentation that contains diagrams and descriptions.