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**ZL30267**  
**ZL30260-ZL30267 and ZL40250-ZL30253**  
**Evaluation Software User Manual**  
**November 2015**

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# ZL30267 Evaluation Software User Manual

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## Introduction

### Supported Devices

This document describes the software interface and tools provided with the ZL30267 Evaluation Software. This software supports the following Microsemi devices: ZL30260 to ZL30267 and ZL40250 to ZL40253.

### Related Documents

- ZLE30267 Evaluation Board Rev B Schematic
- ZLE30267 Evaluation Board Rev B Bill of Materials
- Datasheets for the ZL30267 and the other part numbers listed in the Supported Devices section

### Software Overview

The ZL30267 evaluation software package is fully supported on Windows XP and Windows 7. It may also work on other Windows versions. The software package is comprised of:

1. Device drivers for the FTDI USB interface IC on the evaluation board
2. Graphical user interface (GUI) software for easy configuration and monitoring of the device
3. Installation .EXE for the GUI and the FTDI device driver
4. Evaluation Software User Manual (this document).

The software GUI provides on-screen graphical controls for all features of the devices listed in the Supported Devices section above.

### Target Audience and Prerequisites

This document is targeted towards development engineers who will install, configure and operate the ZLE30267 evaluation board. Users should be familiar with timing and PLL-related terminology and methodology, and the features and operation of the device to be evaluated. Uses for the evaluation software include:

- Demonstration of the ZL30267 and related devices, with or without an evaluation board
- Device configuration and the creation of configuration files

This guide only discusses the on-screen controls and status displays available in the GUI. Users should refer to the appropriate device data sheet to understand the device registers and behaviors.

## Evaluation Software Installation

Before connecting the ZLE30267 evaluation board to the host PC, it is best to install both the Microsemi ZL30267 evaluation software and the device driver for the evaluation board's USB interface chip.

### Software Installation

The installation package for the GUI is typically delivered in a .ZIP file. In this .ZIP file, double click on the ZL30267\_GUI\_[version]\_Setup.exe file. The software will guide you through the installation process.

NOTE: With the GUI installed, the evaluation software can be used in an “offline” mode, that is, without any connection to an evaluation board.

NOTE: Windows regional settings may need to be set to English to correctly display frequency values.

### Device Driver Installation

At the end of GUI installation, the GUI installer gives the option to install the device driver for the evaluation board's FTDI USB interface IC. When this option is selected, the evaluation software installer runs the FTDI USB driver installer. These drivers only need to be installed if they do not already exist on the PC, or if they need to be updated. On most systems this transition from one installer to another happens automatically with no error. However, on some Windows variants, device driver installers have to be run with administrator privilege or Windows gives an error message. If such an error does occur, try these alternatives:

1. Run the device driver installer (CDM\_v2.10.00\_WHQL\_Certified.exe) from the folder where the GUI was installed. This location is “C:\Program Files (x86)\Microsemi\ZL30267” unless a different location was specified during GUI installation.
2. To force this file to be run with administrator privilege, right-click on CDM\_v2.10.00\_WHQL\_Certified.exe and select **Run as administrator**.

### Windows Settings that May Need Adjustment

In rare cases, some users have font display problems in Windows 7 when the display magnification is larger than 100%. To change this Windows property to 100%, go to the **Control Panel** → **Display** and change **Make it easier to read what's on your screen** to **Smaller – 100% (default)**.

## Launching the Evaluation Software GUI

During the software installation, access to the ZL30267 GUI will have been added to the “All Programs” list in the Windows Start menu under the **Microsemi ZL30267** program group (unless otherwise changed by the user during installation). To launch the GUI, click the **ZL30267** link in this group or the shortcut created on the Windows Desktop. Refer to the sections below for further details on all features available.

## Using the Evaluation Software GUI

### Device Selection Window

Figure 1 shows the initial Device Selection window that appears when the program is launched. Before the GUI main window is displayed, a connection must be made to a ZLE30267 board, or the Work Offline option must be selected.

The GUI software can be used with or without an evaluation board connected.

### Working Offline (No Evaluation Board Connected)

To work offline, in the **Work Offline** tab select the desired device in the **Device ID** dropdown box and click the **OK** button. The GUI then displays the main window. The main purpose of working offline is to allow the user to set up a desired configuration, then save the configuration using the **File** menu. These settings can then be loaded back into the GUI and optionally into a device at a later time.

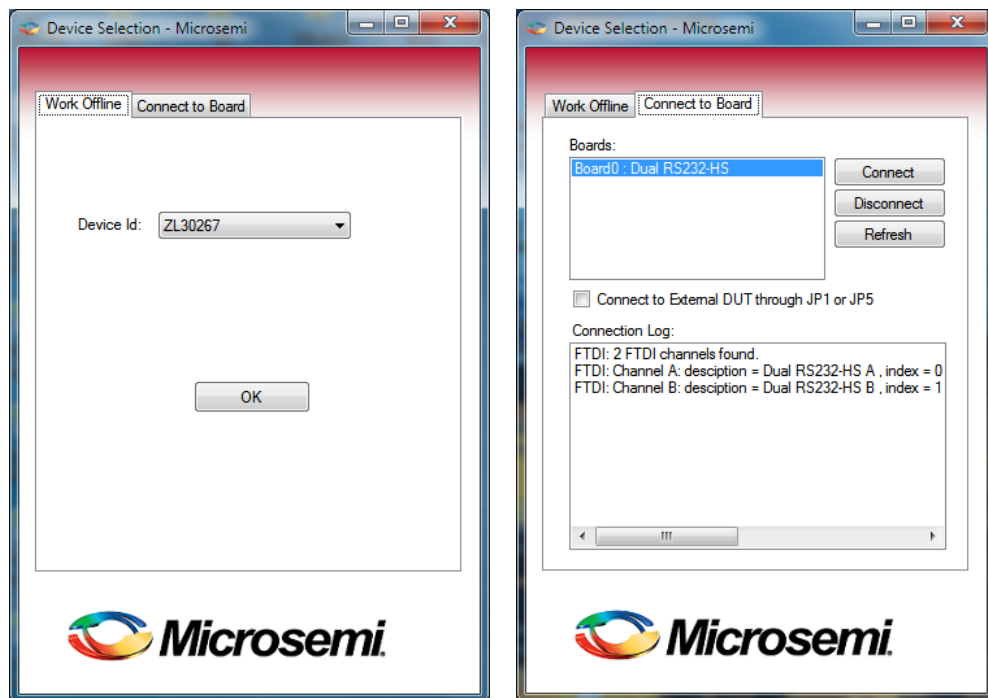


Figure 1 · Device Selection Window, Work Offline and Connect Tabs

### Connecting to a Board

The **Connect to Board** tab in the **Device Selection** window shows a list of all compatible evaluation boards attached to the PC's USB port(s). If an expected board does not appear in the list, verify the USB cable connection and power supply to the evaluation board, then click the **Refresh** button to the right of the list several times waiting about 5 seconds between clicks. It may take a few seconds after a connection or board power up for Windows to negotiate the USB connection and find the device. If the expected device is still not found, see Appendix A.

Click an entry in the **Boards** list to select it then click the **Connect** button. The GUI then displays the main window.

## On-Screen Controls and Status Displays

Device controls are grouped according to function in the main window, and follow a signal progression from the inputs on the left, through the APLL controls, to the outputs on the right. Figure 2 shows a screen shot of the GUI main window for the ZL30267 2-APLL, 10-output device.

### Connection Lines on the Main Window

The main window dynamically displays lines to show connections among blocks in the device. Examples include which input clock is the selected reference for an APLL and which of the APLL's high-speed dividers is the source for each bank of output clocks.

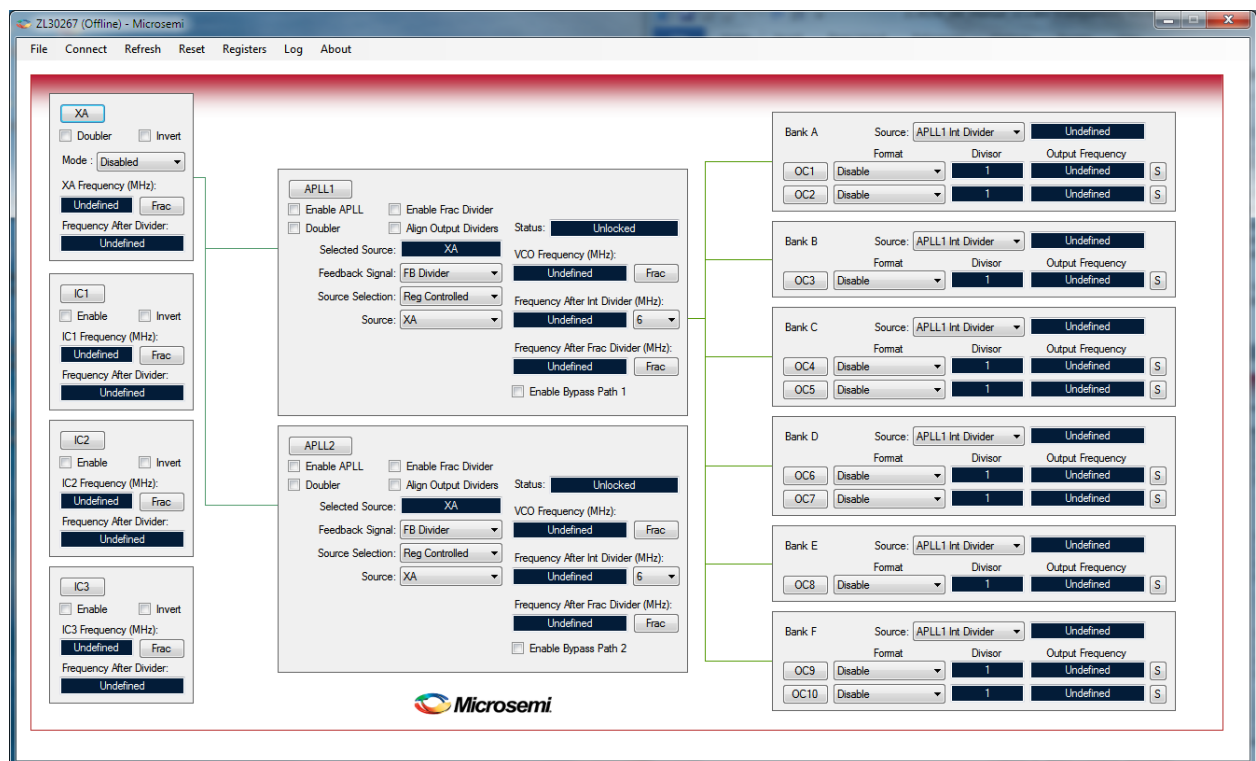


Figure 2 · Software Main Window

## Input Configuration

### Enable and Invert

The **Enable** checkbox for each IC<sub>x</sub> input enables and disables the device's receiver logic. When checked, the **Invert** checkbox adds a signal inversion in the input clock path. The XA pin is enabled using the **Mode** field in the XA box. XA can be configured for operation with an external crystal or an input clock signal.

### Frequency

Each input has a **Frequency (MHz)** box on the main window. For each input that is used in the device configuration, enter the frequency in MHz in the box.

The following constraint must be met for input clock frequencies:

- If an APLL is configured to have two possible inputs (pin-selected or monitor-selected) the frequencies of those two inputs must each be internally divided to a common APLL PFD frequency between 9.72MHz and 156.25MHz. Each ICx input clock can be divided by 1, 2, 4 or 8. The XA pin can be divided by 1 or 2.

The input divider value can be set in the **ICx Configuration** or **XA Configuration** window, which can be opened by clicking the main-window **IC1**, **IC2**, **IC3** or **XA** buttons, respectively. The divided input frequency is shown in the **Frequency After Divider** box in the main window.

#### **Help with Fractional Frequencies**

Some frequencies used in communication systems and other applications make use of clock frequencies that can only be exactly expressed as ratios of integers. For example, a common forward error correction frequency in communication systems is  $155.52\text{MHz} * 255 / 237$ . This frequency cannot be expressed exactly as a single decimal number because the digits to the right of the decimal never terminate.

When the **Frac** button to the right of each input frequency box is pressed, the software opens a window in which a frequency can be expressed as a **Base Frequency** multiplied by one or more numerator integers **N1**, **N2**, etc. and divided by one or more denominator integers **D1**, **D2**, etc.

#### **XA Configuration**

The XA input is followed by a clock doubler circuit that can be enabled by checking the **Doubler** checkbox in the XA section of the GUI main window. Note that this merely enables the doubler. Each APLL can be provided either the regular or doubled XA signal in the APLL's **Source** control field.

Note About the Doubler: The clock doubler can reduce RMS output jitter by increasing the APLL's input clock frequency but does generate high-frequency deterministic phase jitter and increased cycle-to-cycle jitter. The high-frequency jitter can often be completely filtered by downstream PLLs and therefore may not be detrimental in many system designs. See the device data sheet and application notes for guidance on the use of the clock doubler.

When the XA's **Mode** control is set to one of the **100 $\mu$ W**, **200 $\mu$ W** or **300 $\mu$ W** options, the **XA Capacitance**, **XB Capacitance** and **XOAMP** controls in the **XA Configuration** window are automatically set to appropriate values for the ZLE30267 evaluation board and the specified crystal frequency and power rating. If any of these values is changed in the **XA Configuration** window, the **Mode** field in the main window is changed to **Custom Crystal**.

#### **APLL Configuration (ZL30260-ZL30267 Only)**

The basic APLL configuration steps are as follows:

1. Check the **Enable APLL** checkbox
2. Set the **Source** field to an input that (a) is enabled and (b) has a **Frequency After Divider** value in the range 9.72MHz to 156.25MHz.
3. Enter a **VCO Frequency** number in the range 3715MHz to 4180MHz.
4. Below the label **Frequency After Int Divider** choose an appropriate divider value to get the desired integer divider output frequency.

As an example for steps 3 and 4 above, to configure the APLL so the device can output Ethernet clock frequencies, set **VCO Frequency** to 3750MHz and set the integer divider value to 6 to get a **Frequency After Int Divider** of 625MHz. This frequency can then be further divided by the output dividers to get 156.25MHz for 10G Ethernet, 125MHz for 1G Ethernet, and 25MHz for 100M Ethernet all from the same APLL integer divider.

### **APLL Fractional Output Divider Configuration**

Each APLL can produce a second, unrelated output frequency using its fractional output divider. To use this block, check the **Enable Frac Divider** checkbox and then enter the desired output frequency in the **Frequency After Frac Divider** box.

Notes about the fractional output divider:

1. The fractional output divider has a limited range, but its output frequency can be further divided by the output dividers to get lower frequencies.
2. Use the **Frac** button to open a form in which the output frequency can be expressed as a ratio. This form also indicates the range of valid values, which is a function of the APLL's VCO frequency.

### **APLL Input Selection**

The **Source Selection** field controls how the APLL's source is selected. When it is set for **Reg Controlled** (register controlled) the **Source** field specifies the APLL's input reference.

When **Source Selection** is set to **Pin Controlled** one of the device's GPIO pins can be specified as the control pin, and two of the XA and ICx inputs can be specified as the alternate inputs, one selected when GPIO=0 and the other selected when GPIO=1.

When **Source Selection** is set to **Monitor Controlled**, primary and backup inputs can be specified, and a basic activity monitor in the device monitors the primary input. When the primary input fails, the monitor automatically switches the APLL to the backup input. Each input's configuration window has configuration settings to specify the **Reference Clock** for that input's monitor and a **Monitoring Interval**. The **Reference Clock** for an input's monitor should be set to the feedback signal from the APLL to which the input is going. If the input is going to both APLLs then either feedback signal can be used.

The **Selected Source** box always displays the APLL's actual source for any of the source selection modes listed above.

### **APLL External Feedback**

By default the feedback signal to the APLL's phase-frequency detector is from the APLL's internal fractional feedback divider. For zero-delay applications the **Feedback Signal** field can be changed to specify external feedback through one of the IC1, IC2 or IC3 pins or an on-die external feedback path from OC1 (for APLL1) or OC3 (for APLL2).

### **APLL Bypass**

When the **Enable Bypass Path 1** (APLL1) or **Enable Bypass Path 2** (APLL2) checkbox is checked the signal from the APLL's fractional output divider is replaced by the APLL's input signal to accomplish APLL bypass. This bypass signal can be the **Source** for any of the output banks.

### **APLL Align Output Dividers**

When an APLL's **Align Output Dividers** checkbox is checked, the device phase-aligns all outputs with **Source** field set to that APLL and **Phase Alignment Enable** bit checked (in the **OCx Configuration** window). See the device data sheet for details on output phase alignment.

### **APLL Phase Adjustment**

After an APLL's input and VCO frequencies have been set in the GUI main window, the APLL's output phase can be incremented and decremented as needed by clicking the **APLL1** or **APLL2** button in the main window to open the **APLL Configuration** form.



### ***NCO and Spread-Spectrum Behavior***

APLL numerically controlled oscillator (NCO) behavior is demonstrated in the **APLL Configuration** form in the **Special Features** section. When **NCO+Spread Spectrum** is selected for either the APLL itself or the APLL's fractional output divider, the **Frequency Offset Step** field specifies the amount that the **Frequency Offset** value is incremented or decremented by the up and down arrow buttons on the right side of the **Frequency Offset** box. As another option an offset number can be typed into the **Frequency Offset** box.

Spread Spectrum Modulation (SSM) is a special case of NCO behavior. When SSM is enabled, the GUI configures hardware in the device to modulate the APLL's output frequency or the APLL fractional output divider's output frequency according to the **Spread Type**, **Spread %** and **Modulation Frequency** parameters. See the device data sheet for more details on SSM.

### ***APLL Frequency Increment/Decrement Behavior***

As an alternative to the NCO behavior described above, the device also supports frequency increment/decrement capability, which can be controlled by register bits or by GPIO pins. With this **Freq Inc/Dec** feature the **Frequency Offset Step** specifies the amount that the device hardware increments or decrements the APLL's output frequency per inc/dec event, and the read-only **Frequency Offset** box reports the device's current offset. See the device data sheet for more details on frequency increment/decrement.

## **Output Configuration**

In the software main window each of six output banks, A through F, has its own configuration box and **Source** control to select among the APLLs' integer (**Int**) and fractional (**Frac**) output dividers.

In the per-output **Format** controls, **Programmable Diff** is the device's programmable differential signal format. With this format, both output **Common Mode Voltage** and **Differential Voltage** can be configured in 100mV steps in the **OCx Configuration** window. The **1 CMOS-N** option enables the OCxN pin as a CMOS output while OCxP remains high-impedance. The **1 CMOS-P** option is similar, with OCxP enabled as a CMOS output and OCxN high impedance. The **2 CMOS-in phase** option enables both pins as CMOS outputs in-phase with one another. The **2 CMOS-N inverted** option enables both OCxP and OCxN as CMOS outputs with OCxN inverted.

In the **OCx Configuration** window, an optional inversion can be added to the output clock path by checking the **Invert** box. The device can be configured to automatically squelch (i.e. stop) the output clock when the APLL does not have a reference input by checking the **Auto-Squelch** box.

When an output pair is configured as **2 CMOS** and both the medium-speed divider and the low-speed divider are configured to divide by 2 or more then the OCxP and OCxN CMOS outputs can be configured as two different frequencies by setting **Drive OCxP from** to **Medium-Speed Divider** and **Drive OCxN from** to **Low-Speed Divider**.

An output's phase relative to the other outputs from the same **Source** can be set using the **Phase Alignment** controls. An output's duty cycle can optionally be set to something other than 50% nominal using the **Pulse Width** controls.

An output can also be configured to stop when a GPIO pin or a register bit changes state. Outputs can stop low or high and can optionally go high-impedance after stopping.

## Main Window Menus

### File Menu

The GUI has the following options under its **File** menu:

- Load Configuration
- Save Configuration

### Load Configuration

This menu option loads a device configuration file previously created by the **Save Configuration** menu option described below.

### Save Configuration

This menu option allows device configurations created in the GUI to be saved as *configuration files* (also known as **mfg** files because they have a “.mfg” file extension). These are human-readable text files that contain an ordered sequence of write commands and wait commands that can be followed to configure a device. These mfg files can be easily converted to a format usable in a customer’s system, and system software can execute the commands to configure the Microsemi device during system start-up. Device configuration files can also be used as input for the creation of an EEPROM image file, which can be loaded into devices with internal EEPROM. It is not necessary to understand anything about the content of these files to use them.

### Refresh Menu

The rate at which the GUI reads device registers and refreshes its windows is specified here.

### Reset Menu

In this menu the **Hard Reset** option toggles the device’s MCR1.HRST bit while the **Soft Reset** option toggles the device’s MCR1.SRST bit.

### Registers Menu

This menu item opens the GUI’s **Registers** window. This window shows the current values for every register in the device. Tabs at the top of the window group registers by type and section of the device. Most of the window provides an array where the names, addresses and values of the registers and their bits are displayed. Register bits set to 1 in the device are colored green in the array. This window can be expanded to the right make longer bit names readable.

Register bit values *in the GUI* can be toggled by double-clicking the register bit. Then the updated register value can be written to the device by clicking the **W** button. A register’s value can be read from the device by clicking the **R** button.

**Warning:** Writing registers directly from the Registers window can cause unexpected results and should be avoided. Whenever possible users should control register values through other GUI fields rather than through the Registers window.

### Log Menu

This menu item enables and disables logging of all writes to the device on the evaluation board. (In work-offline mode it logs all writes that would go to the device if the GUI were connected to an evaluation board.) These writes are in the same format as the writes in **mfg** configuration files (see Save Configuration above). This logging feature can be useful for seeing exactly what the GUI does to the device when one or more GUI controls are changed. During logging, in between changes to GUI controls, the user is free to edit and save the log file as needed, such as to indicate “; OC4 configuration writes start here” for example.

## Appendix A: FTDI Driver Removal and Reinstallation

The FTDI USB interface IC is often used on evaluation boards. As evaluation software and boards from various manufacturers are added to and removed from a PC, occasionally a driver problem will arise.

If the PC running the ZL30267 software is connected to a powered evaluation board but nothing is listed in the **Boards** box in the **Device Selection** form (or there is a listing of random characters) then the first step is to wait 5 seconds then click the **Refresh** button. Wait and click several times before going on to the other steps in this Appendix.

If multiple clicks of the **Refresh** button don't cause **Board0: Dual RS232-HS** or something similar to be listed in the **Boards** box then it is likely there is an FTDI driver problem. Follow the steps below to completely remove and reinstall the FTDI driver.

1. Disconnect the evaluation board from the PC.
2. Go to <http://www.ftdichip.com/Support/Utilities.htm>.
3. Scroll down to the heading **CDM Uninstaller 1.4**.
4. Click the **Download CDM Uninstaller** link.
5. Open the downloaded ZIP and the folder inside that.
6. Double-click **CDMuninstallerGUI.exe** to run it.
7. In the pop-up with options "Extract all" and "Run" and "Cancel" click **Run**.
8. In the **CDM Uninstaller** window change **Product ID** from 6001 to 6010.
9. Click the **Add** button.
10. VID\_0403 PID\_6010 is displayed. Click on it to highlight it.
11. Click the **Remove Devices** button at the bottom.
12. After several seconds you should get a pop-up saying "Device removed from system."
13. Close the CDM Uninstaller.
14. You may get a Windows pop-up saying "This program might not have installed correctly." If so, click **This program installed correctly**.
15. Reinstall the ZL30267 software. In the last step titled **Completing the ZL30267 GUI Setup Wizard**, check the checkbox **Install evaluation board device driver** and click **Finish**.
16. Allow the device driver installer to run, then click **Extract**.
17. Connect the ZLE30267 evaluation board to the PC using a USB cable.
18. Run the ZL30267 GUI executable.
19. In the Device Selection window you should see an item in the **Boards** box, such as **Board0: Dual RS232-HS**. If not, click the **Refresh** button every 5 seconds until you do.
20. Click the **Connect** button.

## Document Revision History

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