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## CP210X/CP211X DEVICE CUSTOMIZATION GUIDE

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### Relevant Devices

This application note applies to the following devices:

CP2101, CP2102, CP2103, CP2104, CP2105, CP2108, CP2110, CP2112, CP2114

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## 1. Introduction

This document explains the steps required to customize a fixed function USB device. It is intended for developers creating products based on the CP210x/CP211x USB Bridge Controllers. It contains information about obtaining a Vendor ID (VID) and Product ID (PID) for a CP210x/CP211x product and describes the steps necessary for customizing the device descriptors. Refer to [www.silabs.com/interface](http://www.silabs.com/interface) for the latest revisions of this document and other application notes related to the CP210x/CP211x device families.

### 1.1. USB Logos and Certification Testing

USB is a widely used peripheral. The USB Implementers Forum, Inc. has introduced trademark-protected logos for use with qualified USB products. To use the logo, USB products are required to meet the standards of the USB Implementers Forum. For a product to have compliance and/or certification implies that the USB product has been tested by the USB-IF to meet the specification. Each type of USB product requires specific testing to be listed on the Integrators List. This is important not only to OEMs but to consumers because products tested and certified by the USB-IF are assured to work together. Compliance testing exists to help manufacturers measure how well their products match the respective USB specification. If a product has passed USB-IF compliance testing, the company can use the USB logo on the products.

### 1.2. USB Vendor IDs and Product IDs

Each device on a USB bus must have a unique Vendor ID (VID), Product ID (PID), and serial number combination. This ID system uniquely identifies the different devices on the bus to avoid conflicts. The PC uses the VID/PID to find the drivers (if any) to be used for the USB device. The VID/PID must be unique in that each USB device with the same VID/PID will use the same driver, and it is strongly recommended to make the PID unique to a particular design. The USB devices of a given VID/PID combination can be serialized, which allows the operating system to track not only a particular model, but also a specific board of that model.

Vendor IDs are owned by the vendor company and assigned by the USB Implementers Forum (USB-IF) only. Details about obtaining a unique VID can be found at [www.usb.org/developers/vendor](http://www.usb.org/developers/vendor).

To obtain the right to license the USB-IF logo, register the product's VID and PID with USB-IF and submit the product to the USB-IF Compliance Program. USB-IF Compliance Program details are available at [www.usb.org/developers/compliance](http://www.usb.org/developers/compliance). Once the product is certified, it can be added to the USB-IF Integrators List, and the "Certified USB" logo can be used on the product. The default Silicon Labs VID is 0x10C4 and the default Silicon Labs PID is dependent on the device. To obtain a unique PID for your CP210x/CP211x-based product, visit <http://www.silabs.com/RequestPID>. Note that customization of the USB strings is optional, but is strongly recommended. A unique VID/PID combination will prevent the driver from conflicting with any other USB driver.

## 2. Basic Device Customization

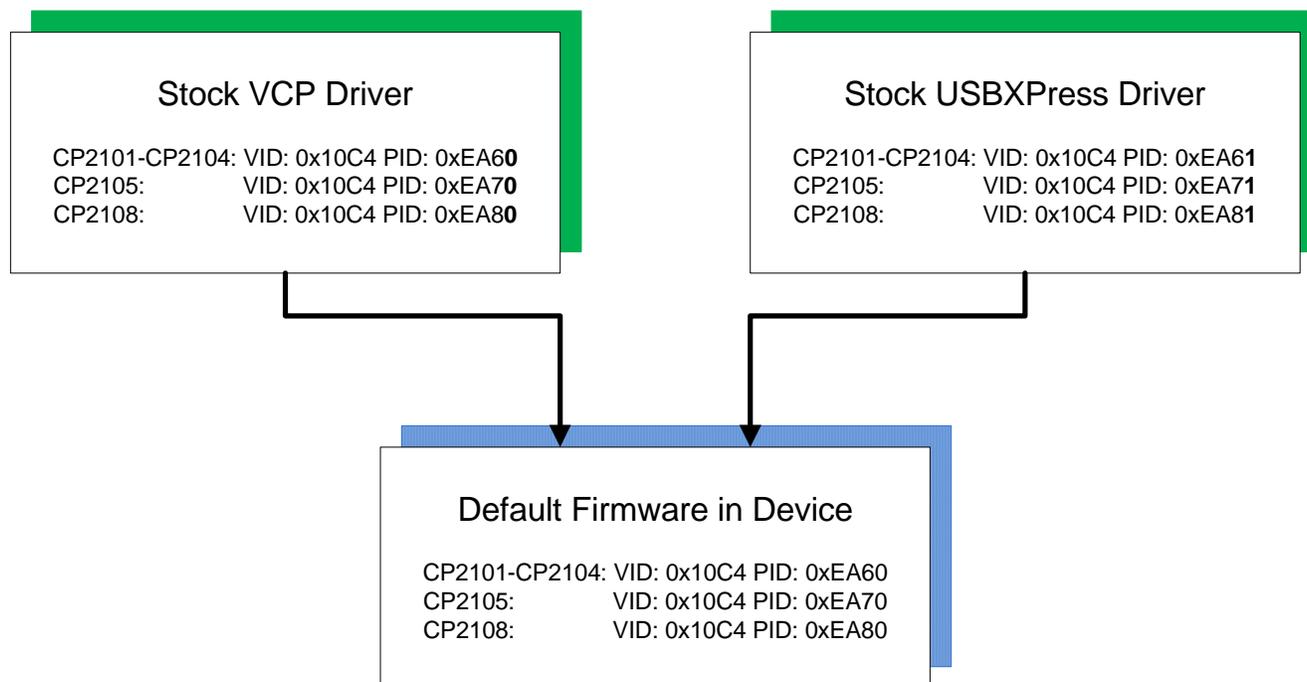
The steps to customize the CP210x family of devices is slightly different than customizing the CP211x devices. The CP210x devices require a driver, but the CP211x devices do not because they are of the HID class, which is natively supported by most operating systems. The next two sections describe the recommended steps for customizing the device based on the family, either the CP210x or the CP211x.

### 2.1. Summary of Steps for Customizing the CP210x Non-HID USB Devices

The CP210x family of devices provides communication from USB to UART. This requires a driver to interface to the device. There are two types of drivers provided. One is the Virtual COM port (VCP) driver which allows the device to appear to the PC's application software as a COM port. This driver is always used first to connect to the Device Customization Software program to change the PID since by default this driver has the same VID and PID as what is programmed in the default devices. After the Device Customization Software program is used to change the PID, the driver must match the new values that have been loaded in the device from the Device Customization Software. If the user wants to communicate to the device via a high level application program, a USBXpress driver can be used which provides this functionality. This driver must be downloaded and installed after using the Device Customization Software. Then the USBXpress driver or VCP driver (which ever one will be used) should be updated to make sure the driver matches the VID and PID in the device. A PC cannot have both the VCP and USBXpress drivers loaded with the same VID and PID, as this would cause USB device identification conflicts. In the end, only one driver can be used, either the VCP or the USBXpress.

There are VCP and USBXpress drivers for various operating systems, which are all listed on the website at <http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx> for the VCP driver and at [www.silabs.com/usbexpress](http://www.silabs.com/usbexpress) for the USBXpress driver. The process described below must be followed each time a new operating system must be supported. If the driver has been certified for Windows 7 32-bit and then it is necessary to support Windows 7 64-bit, then the driver must be recertified. The Microsoft certification process must be initiated again, and the reseller fee must be paid to Microsoft for the 64-bit version of the driver. Microsoft requires this certification process which involves Windows hardware quality labs testing (WHQL). It certifies that the hardware or software has been tested by Microsoft to ensure compatibility. Device drivers that pass the WHQL tests are given a digitally signed certification file, which prevents Windows from displaying a warning message that the driver has not been certified by Microsoft.

Figure 1 shows the default VID and PID values for the device and drivers. To establish communication with the driver, the VID and PID of the device must match the driver. Notice that the default CP210x device VID and PID match the default VCP driver VID and PID numbers.



**Figure 1. Default VID and PID Values for Driver vs Firmware**

The steps to customize the CP210x USB devices are as follows:

1. Request a unique PID from Silicon Labs for your new product design: <http://www.silabs.com/RequestPID>, or obtain a VID/PID from usb.org.
2. Download the VCP driver appropriate for your operating system here: <http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpcdrivers.aspx>. The stock VCP driver from the website should match the default VID and PID in the CP210x. The VCP driver must be installed with matching VID and PID to communicate to the device.
3. Run the Device Customization Software program described in the next sections to change the descriptors in the device.
4. **(USBXpress Users Only):** If the desired driver is USBXpress, it can be download here: [www.silabs.com/usbpress](http://www.silabs.com/usbpress). This driver allows direct access using Silicon Labs API commands to control the device. When this driver is initially downloaded it will not have the matching VID/PID of the CP210x devices. See Figure 1 for the default driver and device VID/PID.
5. Use the USB Driver Customization Wizard and instructions in AN220SW and AN220 “USB Driver Customization” <https://www.silabs.com/Support%20Documents/TechnicalDocs/an220.pdf> to update the driver for the new PID and any other descriptors that have been changed from Step 3. Be certain to use the version of AN220 software which corresponds to the correct driver when generating the modified drivers. Take care to verify that these customized drivers are completely correct, as none of the files in the driver package can change in any way once the driver has been certified. If you do not have the correct version of the AN220 software, please contact our support team [www.silabs.com/contactsupport](http://www.silabs.com/contactsupport). Update either the VCP driver (COM port) or USBXpress driver (API commands) to match the device. The USB Driver Customization Wizard customizes the driver by changing the hardware installation files (.inf) in the driver package. The strings contained in the .inf files affect what is displayed in the “Found New Hardware Wizard” dialogs, Device Manager and the Registry. Any changes to the Windows® installation .inf files will require new Windows Hardware Quality Labs (WHQL) tests.
6. **(Microsoft Windows Only):** The customized driver is eligible for WHQL re-seller submissions to certify the driver. These submissions do not have the high cost and testing requirements of an original driver

submission. To certify a customized VCP or USBXpress driver, register at the WinQual site <https://sysdev.microsoft.com> to obtain a WinQual account with your company. Internet Explorer is the only web browser that can be used with the WHQL website. A Verisign ID is needed to register an account (instructions for obtaining one are available at Microsoft's website:

<http://msdn.microsoft.com/en-us/library/windows/hardware/hh801887?ppud=4>. The correct Verisign ID is the CodeSigner Standard <http://www.verisign.com/code-signing/microsoft-authenticode/index.html?sl=header>.

7. **(Microsoft Windows Only):** After obtaining a WinQual account, notify the Silicon Labs support team [www.silabs.com/contactsupport](http://www.silabs.com/contactsupport) to be added as a registered Reseller. Provide the driver type (VCP or USBXpress) and version (e.g., v6.5) when requesting Reseller status.
8. **(Microsoft Windows Only):** Silicon Labs will add your company as a registered reseller. Your company must complete the provided directions to finish the recertification process.

**Note:** For further detailed instructions on Microsoft's submission process for recertification for a customized driver please view the document attached to the KnowledgeBase article called "How to Recertify a Customized Driver Package.pdf" located here: <http://cp-siliconlabs.kb.net/article.aspx?article=89180&p=4120>.

## 2.2. Summary of Steps for Customizing the CP211x HID USB Devices

The CP211x family does not require a driver because it is automatically recognized as part of the HID class, which simplifies the process. Most operating systems include native drivers. The CP211x will not fit a standard HID device type such as a keyboard or mouse. Any CP211x PC application will need to use the specific CP211x HID specification to communicate with it. This low-level HID specification is documented and provided by Silicon Labs in the form of a DLL.

The following are the steps to follow to customize the CP211x HID USB devices to ensure a unique VID/PID combination:

1. Request a unique PID from Silicon Labs for a new design: <http://www.silabs.com/RequestPID>.
2. Use the Device Customization Software program described in Section 3 below to change the descriptors in the firmware of the device.

### 3. Device Customization Software

The descriptors and other configurable options of the devices in the CP210x/CP211x families are modifiable using the Windows program CP21xx Device Customization Software.exe (Figure 2). The software program automatically recognizes the device that is plugged into the PC. When the Device Customization Software.exe is launched, the program searches the Windows registry for any CP21xx devices attached to the PC. The full path information for all of the devices found is inserted into the “Select Device” drop-down list, and the first device is selected automatically. This CP21xxDevice Customization Software.exe program is included in the software zip file in this application note. The descriptions of how to use the program is described in more detail in the following sections for the different families of devices. Be aware that one time programmable (OTP) devices can only be changed once. The program can access the fields but will not be able to program them more than once.

The CP21xx Device Customization Software uses the Windows Host API functions implemented by all the DLL files for the different families of devices mentioned. The Host API functions give read/write access to the descriptors contained in programmable areas of a connected device. Another option is implementing a custom application using the host API with the DLL suited to the individual needs of a particular production environment.

The descriptors can also be set in the factory at production time for large orders. Contact your Silicon Laboratories sales representative for details.

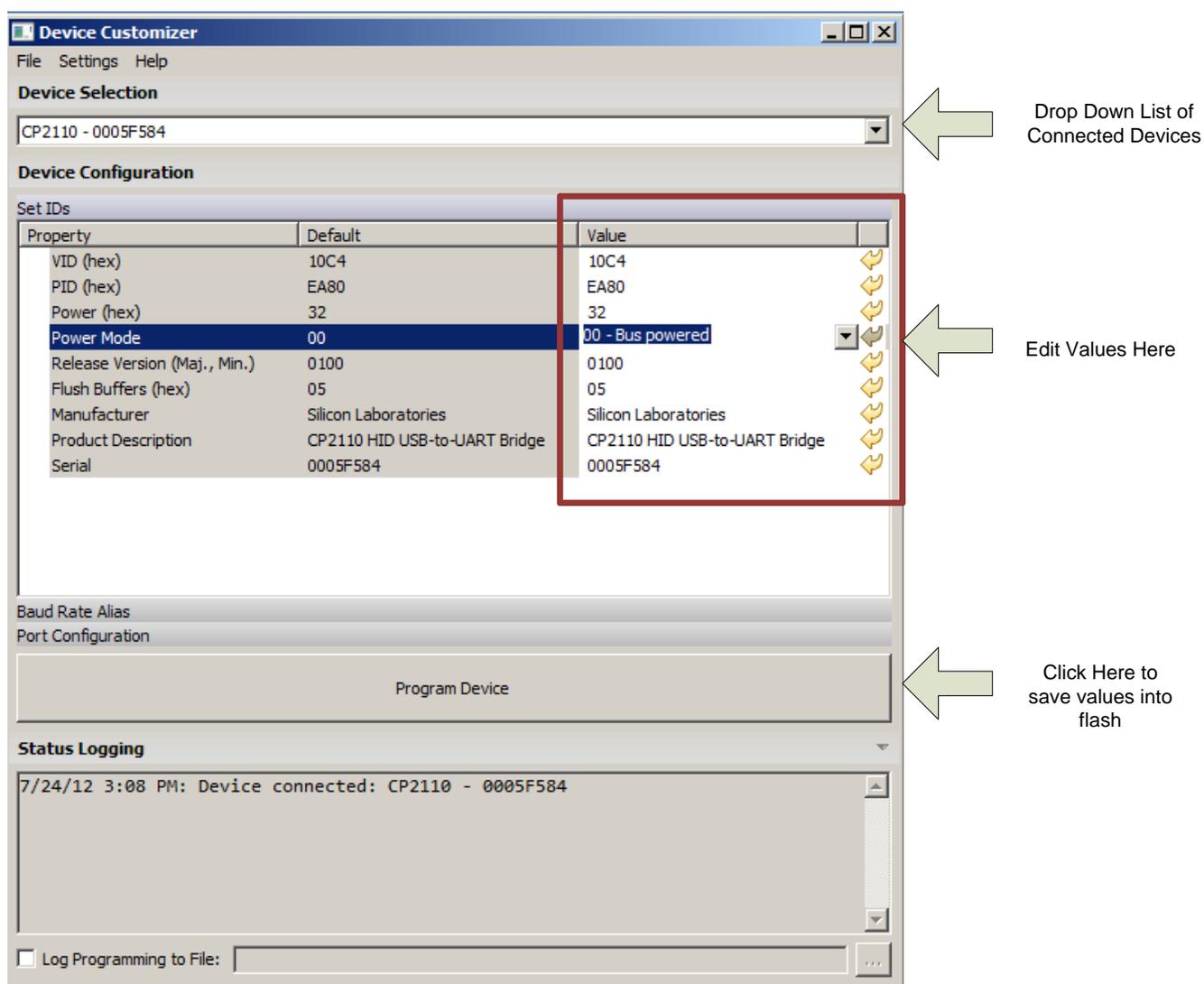


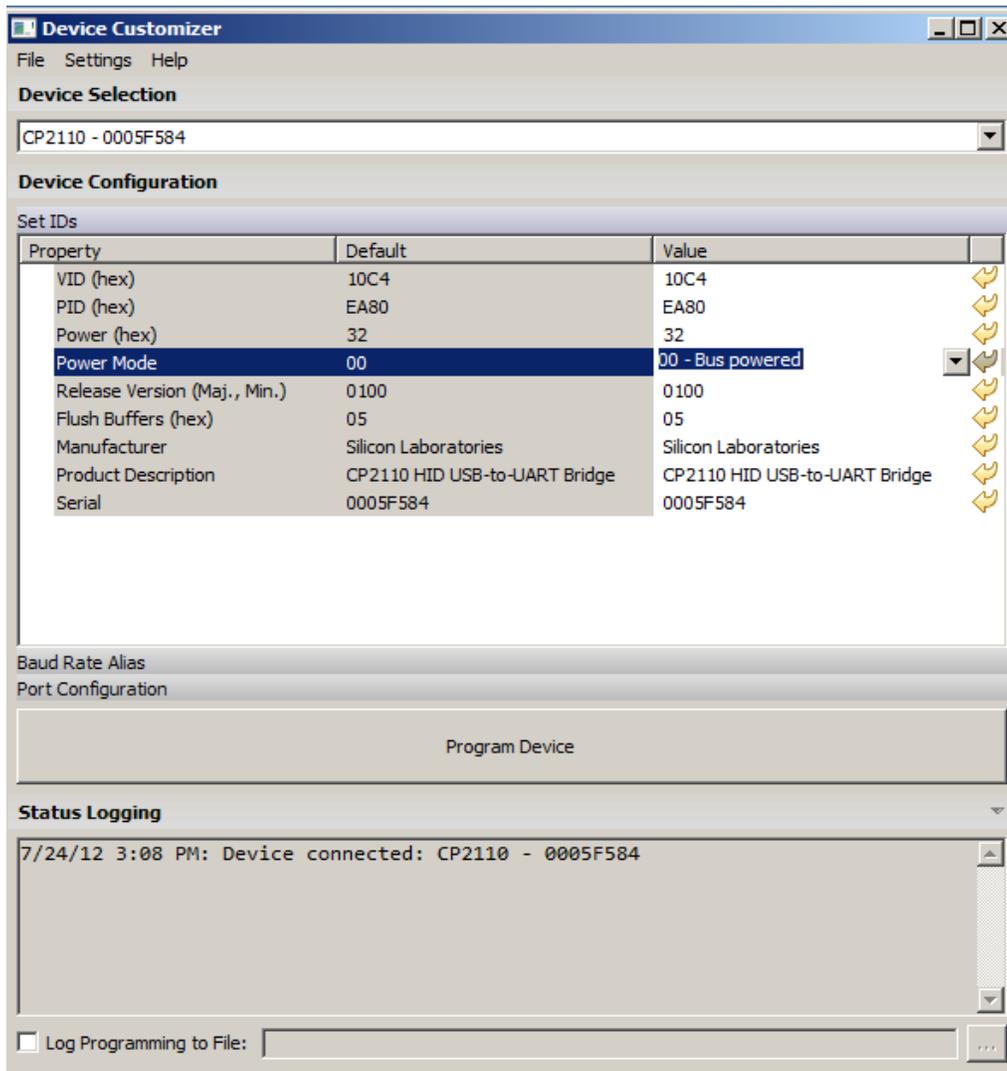
Figure 2. Device Customization Software General Overview

# AN721

The above program is an example of the CP2110 device, but the program is similar for all devices. There are three main sections that can be edited. The first one is the Set IDs section as shown. Below that is the Baud Rate Alias section and then below that is the Port Configuration settings. Changes can be made in each of these sections and saved by clicking on the "Program Device" button. This will save the values into flash. If any of these three main sections are blank it is because there is no configuration for the Baud Rate Alias or Port Configuration. All devices will have the SETID Configuration.

## 4. Changing Device Settings CP2110, CP2114

The CP2110 and CP2114 are both one time programmable devices. The various customizable fields of the CP2110/CP2114 devices are only programmable one time using the program. Be careful to change all settings under every tab before clicking the "Program Device" button.



**Figure 3. CP2110, CP2114 Device Customization Software Set IDs Window**

When the Device Customization Software is launched, the program searches for any CP2110/CP2114 devices attached to the PC. The full path information for all of the devices found is inserted into the "Device Selection" drop-down list, and the first device is selected automatically.

#### 4.1. Modifiable Properties under the Set IDs Tab CP2110, CP2114 Devices

1. **VID**—The Vendor ID is a four hexadecimal digit number such as 10C4.
2. **PID**—The Product ID is a four hexadecimal digit number such as EA60.
3. **Power**—This is a two hexadecimal digit number such as 10 with a maximum setting of 250. Note this number corresponds to units of current in 2 mA increments. Therefore a value of 10 corresponds to 32 mA.
4. **Power Mode**—There are three different power mode options. Click the field to see the options. 00 corresponds to Bus Powered, 01 is Self Powered with Voltage Regulator Disabled, 02 is Self Powered with Voltage Regulator Enabled.
5. **Release Version**—The release version is a numerical identifier of the device release version. Each field is a decimal number value 0–99. The first two digits are the major version number and the last two are the minor digits. 0100 corresponds to Major Version 01, Minor Version 00.

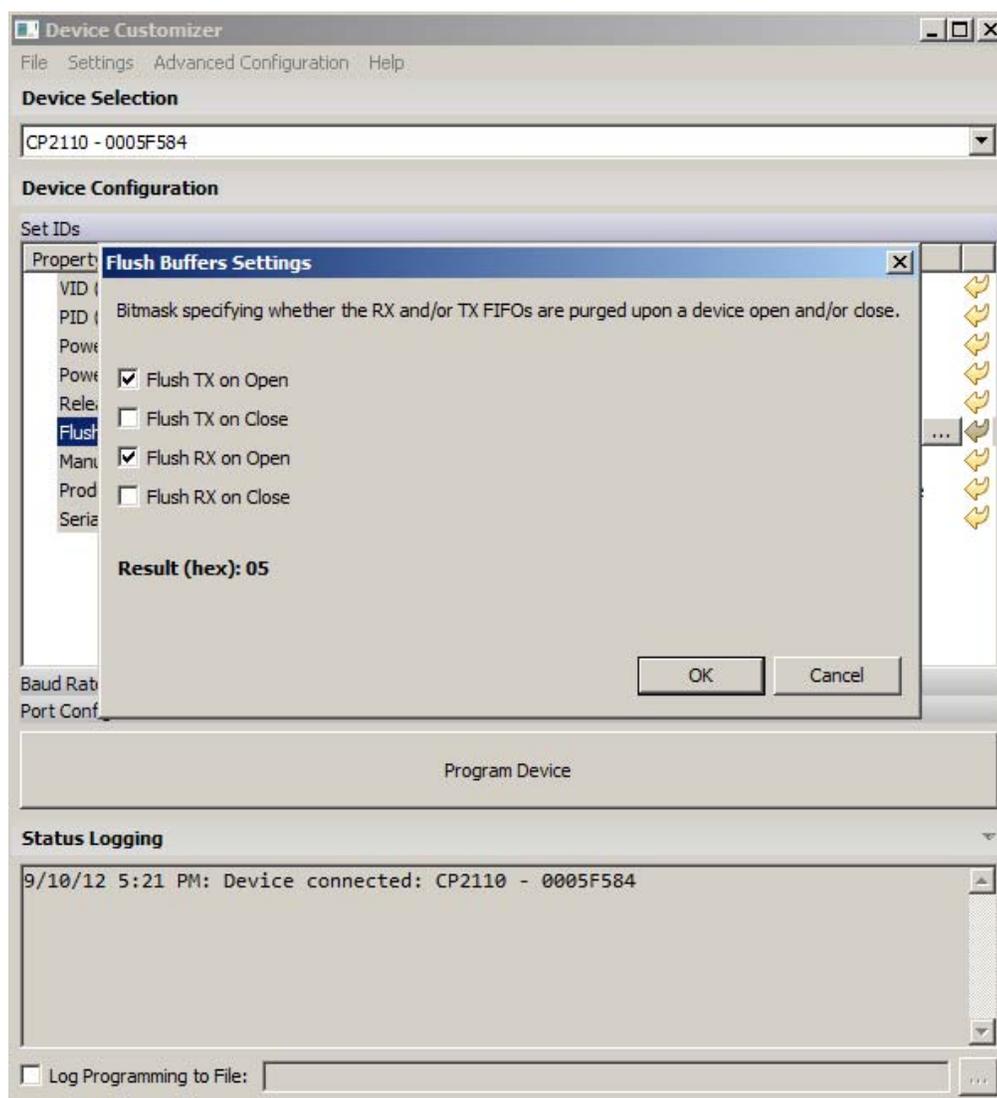


Figure 4. CP2110/CP2114 Flush Buffers Options

6. **Flush Buffers**—The flush buffers options shown above in Figure 4 allows open and close options on the RX and TX. Check the options required for the application.
7. **Manufacturer**—This is the name of the company manufacturing the product.

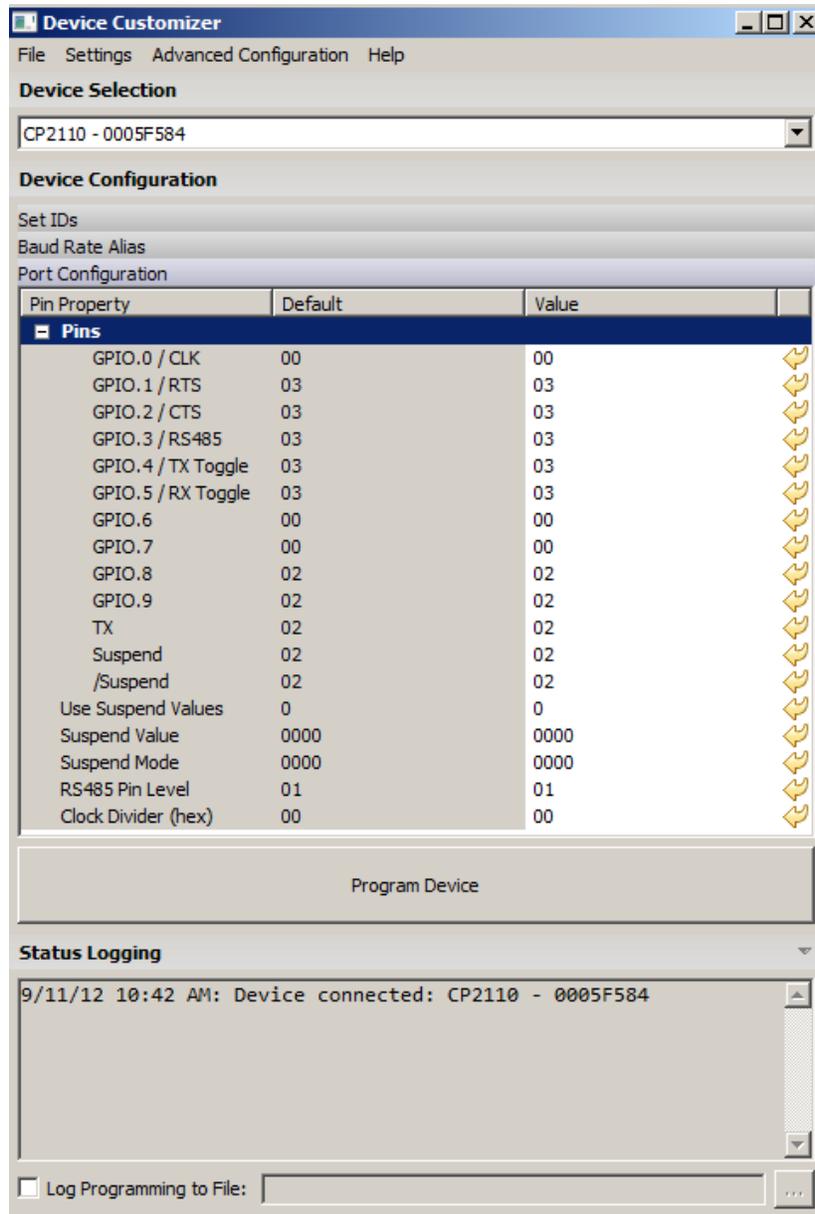
# AN721

8. **Product Description**—The Product Description can be any sequence of up to 126 characters. Usually this is text which provides a description of the device, such as CP2103 USB to UART Bridge Controller.

9. **Serial Number**—The Serial Number can be any sequence of up to 63 characters.

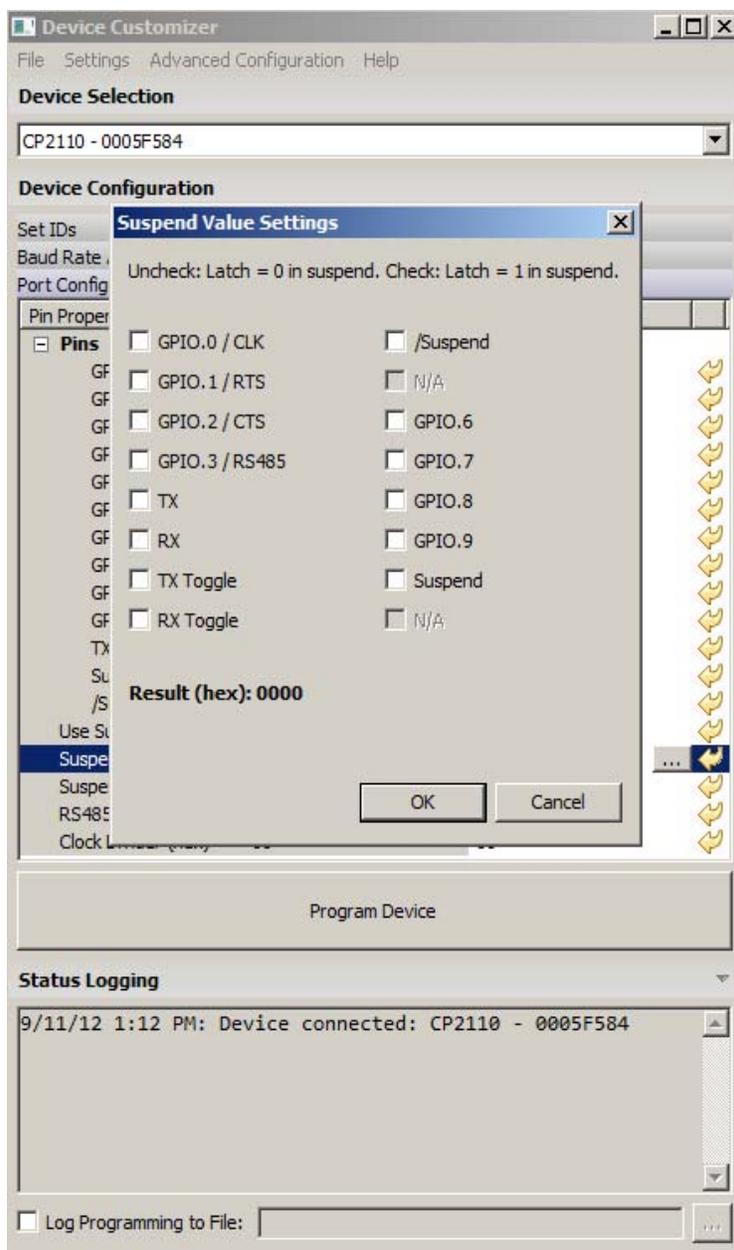
## 4.2. Port Configuration Settings CP2110/CP2114

The Port Configuration settings are available by clicking on the “Port Configuration” Tab. Click on the number in the value box to access a drop down menu of options for each pin configuration. Refer to the data sheet for further explanation of the different options available. After a value has been changed it will be highlighted in yellow. Click the Program Device button when complete.



**Figure 5. Cp2110/CP2114 Port Configuration Settings**

The GPIO pin settings can be modified to set the pins for input, Output Push-Pull, or Output Open Drain. The different options are selectable from the drop down menu when clicking on the value. The Suspend Value setting allows the option for the latch to be enabled on any of the selected pins shown in Figure 6. A similar menu is available for the Suspend Mode allowing a selection between open-drain and push-pull for the different pins in suspend mode.



**Figure 6. CP2110/CP2114 Suspend Value Settings**

See “AN434: CP2110 Interface Specification” for a full description of each of the customizable parameters.

If using the CP2110Device Customization Software to program multiple devices, the customized values can be saved to a text file using the File → Save and File → Save As commands. When connecting a new device, use the File → Open command to retrieve the saved settings, which are then directly programmable to the new device.

**Notes:**

1. Avoid connecting more than one device containing the same VID, PID, and serial number combination.
2. GPIO.0/CLK must be configured as a “CLK Output -Push Pull” before configuring the “CLK Output Divider” setting.
3. The Manufacturer String, Product String, and Serial Number are automatically converted to Unicode strings before programming.

## 5. DAC Configuration Application (AN721SW)

The DAC Configuration utility is an application within the AN721SW that allows audio configuration strings to be sent to the CP2114s one-time programmable memory or RAM. The audio string is used by the CP2114 to configure the DAC/CODEC. To access the DAC Configuration utility, run the AN721SW and connect to the CP2114 device.

After connecting to the device, select *Advanced Configuration*, then *DAC Configuration*. After this, the DAC Configuration utility shown in Figure 7 will appear. This DAC configuration applications is available in the AN721SW package available at [www.silabs.com/interface](http://www.silabs.com/interface).

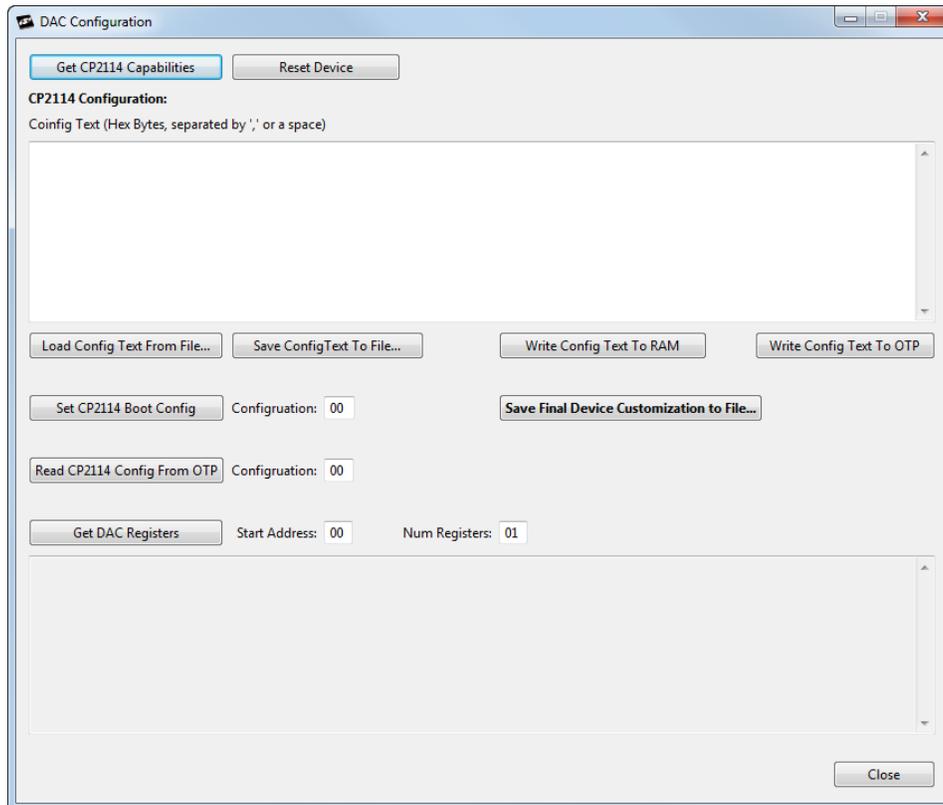


Figure 7. AN721: DAC Configuration

### 5.1. Application Command Descriptions

#### 5.1.1. Get CP2114 Capabilities

This button will report the current configuration of the one-time programmable memory. With the default pin configuration and no jumpers installed on GPIO.5, GPIO.6, GPIO.7, or GPIO.8, the utility will display the following:

```
* CP2114 Caps
AvailableBootIndices: 0x20
AvailableOtpConfigs: 0x1D
CurrentBootConfig: 0xFF
AvailableOtpConfigSpace: 0x1532
```

The **AvailableBootIndices: 0x20** parameter indicates that all 32 boot index slots are available for programming.

The **AvailableOtpConfigs: 0x1D** parameter indicates that there are 29 CP2114 configurations available in the one-time programmable memory.

The CP2114 EVB ships with three default configurations in OTP at the following indices:

Index 0: Audio out and audio in streams both set to Asynchronous with CS42L55 DAC settings.

Index 1: Audio out and audio in streams both set to Asynchronous with WM8523 DAC settings.

Index 2: Audio out and audio in streams both set to Asynchronous with PCM1774 DAC settings.

The **CurrentBootConfig** parameter with a value of 0xFF indicates the CP2114 will not configure any DAC devices on a reset or boot. This occurs when

- DAC select input feature is turned on and no jumpers are installed on GPIO.5, GPIO.6, GPIO.7, and GPIO.8.
- DAC select input feature is turned on and the GPIO value is set to “Use OTP Boot Config” while no valid boot config entry is found in the one-time programmable memory.
- DAC select input feature is turned off and there is no valid Boot Config entry in the one-time programmable memory.

The CP2114 has 32 programmable boot configuration entries by default. (The CP2114 boot configuration can be changed up to a total of 32 times.)

The final parameter, **AvailableOtPConfigSpace: 0x1532** indicates there are 0x1532 (5426) bytes of programmable memory available to support new configurations.

### 5.1.2. Reset Device

This button forces a CP2114 reset.

### 5.1.3. Load Config Text from File

Loads configuration text from a file into the **Config Text** window.

### 5.1.4. Save Config Text to File

Saves the text in the **Config Text** window to a file.

### 5.1.5. Write Config Text to RAM

Writes the configuration displayed in the **Config Text** window into the CP2114 RAM. The DAC configurations are also written to the DAC. This operation will cause the CP2114 to disconnect and reconnect on the USB bus. This configuration is not retained on device reset.

### 5.1.6. Write Config Text to OTP

Writes the configuration in the **Config Text** window to the one-time programmable memory. The configuration does not become the active configuration in RAM unless it's specified in CP2114 Boot Config or via DAC select GPIO pins followed by power cycling or resetting the device.

### 5.1.7. Read CP2114 Config from OTP

After specifying the configuration number in the text box to the right of the button and clicking the button, the utility will display the one-time programmable memory configuration in the output window.

### 5.1.8. Set CP2114 Boot Config

After specifying the configuration number in the text box to the right of the button and clicking the button, the boot configuration index is programmed into the one-time programmable memory space.

**Note:** The CP2114 boot configuration index can be changed up to 32 times.

### 5.1.9. Get DAC Registers

Displays one or more DAC registers in the output window. To display a contiguous range of DAC registers enter the starting register address in the **Start Address** field and the number of registers to read in the **Num Registers** field. Click **Get DAC Registers** and the register values will be displayed in the status window as hex comma-separated values.

### 5.1.10. Save Final Device Customization to File

Save the final 5.5 kB of customized data into a file for one-time programming in production.

## 5.2. Using the Application

Use the following steps to program the CP2114 using the DAC configuration utility:

1. Click **Get CP2114 Capabilities** and note the boot index, available OTP boot index slots, and available OTP config space.
2. Click **Load Config Text from File** if there is one available; otherwise write the config text into the Config Text window directly.
3. Click **Write Config Text to RAM**. This will cause CP2114 to re-enumerate over USB. Once CP2114 device is seen by the Host again, verify the device's audio functionalities including volume control and mute control. Adjust the value in **Config Text** if necessary and repeat **Write Config Text to RAM** until desired result is achieved.
4. Verify the DAC registers have the desired setting by entering the **Start Address** and **Num Registers** and clicking **Get DAC Registers**.
5. Click **Save Config Text to File** to save a copy of the text in the **Config Text** window.
6. Click **Write Config Text to OTP** after all functionalities have been completely verified in RAM. The new config will consume one Boot Config index slot and some one-time programmable config space. The index of this new config should be the next available index. For example, if **Get CP2114 Capabilities** returned AvailableOtpConfigs of 0x1D, this Configuration index will be 3.
7. Enter the index of the new config and click **Read CP2114 Config from OTP**. Verify the data returned is as expected.
8. Click **Get CP2114 Capabilities** and verify the available OTP config space is (2+Config Data bytes) less than the previous value. The firmware inserts 2-byte length before the Config Data when writing to OTP. Available OTP Configs should be 1 less than the previous value.
9. Enter the Configuration index of the new Config and click **Set CP2114 Boot Config** to make CP2114 to boot from the new Config.
10. Reset the CP2114.
11. Verify CP2114 boots up properly with DAC functioning properly. Verify volume and mute integration with the Host. Click **Save Final Device Configuration to File** for OTP programming in production.

NOTES:

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