

# **CP2112-EK**

# **CP2112 EVALUATION KIT USER'S GUIDE**

### 1. Kit Contents

The CP2112 Evaluation Kit contains the following items:

- CP2112 Evaluation Board
- USB Cable
- Quick Start Guide

### 2. Relevant Documentation

Application notes can be found on the Interface Application Notes page for all fixed-function devices: www.silabs.com/interface-appnotes.

- AN721: USBXpress<sup>™</sup> Device Configuration and Programming Guide Customize the VID, PID, serial number, and other parameters stored in the CP2112 one-time programmable ROM.
- AN496: HID USB-to-SMBus API Specification Provides function descriptions and examples for all of the PC software functions that control the CP2112.
- AN495: CP2112 Interface Specification Describes the HID report format for CP2112 devices.

### 3. Software Setup

The Software Development Kit (SDK) packages and documentation for the CP2112 kit can be found on the device page (https://www.silabs.com/interface/usb-bridges/classic/device.cp2112.html) and contains the following:

- USBXpress Host SDK (Software & Tools Tab)
- Documentation: (Tech Docs tab)
  - CP2112 data sheets
  - CP2112 EK quick-start guide
  - CP2112 EK user's guide (this document)
- **Note:** Follow the instruction to install the SDK to the system. The CP2112 is an HID device, so a driver does not need to be installed on most operating systems.

# 4. CP2112 Hardware Interface

- 1. Connect the CP2112 evaluation board to a PC as shown in Figure 1.
- 2. Connect one end of the USB cable to a USB Port on the PC.
- 3. Connect the other end of the USB cable to the USB connector on the CP2112 evaluation board.
- 4. Connect the SDA, SCL, and Ground pins on the CP2112 to an SMBus device. External pull-up resistors are not needed if the pull-up resistors on the CP2112 evaluation board are used.



Figure 1. Hardware Setup



# 5. CP2112 Software Interface

The CP2112 is an HID device that uses the standard HID functions available in the operating system. To facilitate this process in Windows, Silicon Labs packaged the standard HID functions into the SLABHIDDevice DLL in the CP2112 software package. The HID report structure for the CP2112 is customized for the device and is not compatible with other HID report structures, like a mouse or keyboard. AN495, "CP2112 Interface Specification" describes the custom HID report structure for the CP2112, and AN496, "HID USB-to-SMBus API Specification" describes the API software functions that can be used to read or write data and control the CP2112 from the PC. The software application described in "6. CP2112 Windows Application" provides an example of how to use these functions.

The CP2112 appears as an HID device in Device Manager as shown in Figure 2.



Figure 2. CP2112 in Device Manager



# 6. CP2112 Windows Application

The HID SMBus Example application uses the Windows CP2112 HID-to-SMBus DLL to transmit and receive data with the CP2112. The application also has access to the CP2112's GPIO pins. Figure 3 shows a screenshot of the Windows Application. The following steps describe how to start the application and use some of its features.

- 1. Ensure that the hardware is connected to a Windows PC as shown in Figure 1. If the device is properly connected, the red SUSPEND LED on the CP2112 evaluation board will turn on.
- 2. Launch the Hid SMBus Example application, which is found by clicking Start→All Programs→Silicon Laboratories→CP2112 Evaluation Kit→HidSmbus Example.
- 3. In this application, you can configure the SMBus settings and GPIO pins, customize the device descriptors, and read/write data over the SMBus interface.
- 4. Select the appropriate device in the Connection drop down box and click Connect.
- 5. The Configuration tab enables setting and getting the SMBus configuration parameters. To set a parameter, modify the value that is in the corresponding text box or check/uncheck a box and click Set SMBus Config. To verify that the settings took effect, click Get SMBus Config. These configuration parameters reset to their default values when the CP2112 is reset.

🛫 HidSmbus Exa	mple						
Connection							
000A2E82				*	Disco	nnect	<u>R</u> eset
Device Informati	on						4
Vendor ID:	10C4 Releas	e Number:	0.00				
Product ID:	EA90 Pa	rt Number:	12	Version	1		
Path:	\\?\hid#vid_10c4&pid_ea90#6&1f0fefc3&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000030}						
Manufacturer:	Silicon Laboratories						
Product:	CP2112 HID USB-to-	SMBus Bridg	e				
Serial:	000A2E82						
Confouration		<b>6</b>					
Corniguration	Data Transfer   Pin Co	nfiguration	Customization	n			
SMBus Setting	gs		_				
	Bit Rate:	100000	Hz		Get SMBus	s Config	Set SMBus Config
Master's Slav	e Address (Ack Only):	02	(Hex)			X	
Automatically	y send read respons :			_ (	5		
w	rite Transfer Timeout:	U	ms				
R	ead Transfer Timeout:	100	ms				
	SCL Low Timeout:						
	Transfer Retries:	0					
Timeouts							
	Response Timeout:	1000	ms		Get Tim	eouts	Set Timeouts
000A2E82	HidSmbus_Open(	): HID_SMB	US_SUCCESS				

Figure 3. Configuring the SMBus Interface using the Example Application



- 6. To read data from an SMBus device (non-addressed mode):
  - a. Click the **Data Transfer** tab.
  - a. Enter the slave address and the number of bytes to read in the **Read Request** box.
  - b. Click the Read Request button.
  - c. To see the number of bytes that were read back, click **Get Read/Write Transfer Status** and verify the number of bytes read at the bottom of the application.
  - d. Next, click **Force Read Response** and then **Get Read Response** until the application reads back the total number of bytes. The bytes will be shown in the **Received Data** field. The status of the CP2112 will be shown at the bottom of the application.

0A2E82					Disconnect	<u>R</u> eset
vice Informat	ion					
Vendor ID:	10C4	Release Number:	0.00			
Product ID:	EA90	Part Number:	12	/ersion: 1	1	
Path:	\\?\hid#vid	d_10c4&pid_ea90#68	1f0fefc3&0&000	#{4d1e55b	2-f16f-11cf-88cb-	001111000030}
anufacturer:	Silicon Labo	oratories				
Product:	CP2112 HI	D USB-to-SMBus Brid	ge			
	000A2E82					
6a	COUNTERE					
nfis UCI	ata Transfe	er Pin Configuration	Customization			
Read Reques	+	Add	round Dood Doorus	t		
Slave Addre	ED	Aud	Slave Address	F0	(How)	
Slave Addre	iss: 10	(nex) Gh	Slave Address:		(nex)	
Bytes to Re	ad: 1		arget Address:	2	bytes	
			Target Address:	0000		
	Read Reques	st	Bytes to Read:	1	Addres	s Read Request
kead Respon	ise					
Received Da	ata: A5			—(	6e	
Putos to Do	ad: 1		Force Read Re	esponse	Get R	ead Response
bytes to Re						
Write Reque	st					
Write Reques	st ite: A5					
Write Reque Data to Wr	ite: A5					
Write Reques Data to Wr Slave Addre	st ite: A5 ess: F0	(Hex)			Wr	ite Request
Write Reques Data to Wr Slave Addre Transfer Sta	st ite: A5 ess: F0 tus	(Hex)			Wr	ite Request

Figure 4. Performing a Non-Addressed Read using the Example Application



- 7. To read data from an EEPROM or similar device (addressed mode):
  - a. Click the **Data Transfer** tab.
  - e. Enter the slave address, the number of address bytes in the target address, the target address of the SMBus device being read (in hex), and the number of bytes to read in the **Addressed Read Request** box.
  - f. Click the Address Read Request button.
  - g. To see the number of bytes that were read back, click **Get Read/Write Transfer Status** and verify the number of bytes read at the bottom of the application.
  - h. Click **Force Read Response** and then **Get Read Response** until the application reads back the total number of bytes. The bytes will be shown in the **Received Data** field. The status bar of the application displays the current status of the CP2112.

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00A2E82					Disconnect	<u>R</u> eset	
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Path:	\\?\hid#vid_10c4&pid_ea90#6&1f0fefc3&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000030}						
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Product:	CP2112 HIL	) USB-to-SMBu	s Bridge				
	000A2E82						
<b>7</b> a							
onfig	ata Transfe	Pin Configu	ration Customi	zation			
-Read Reques	t		Addressed Rea	d Request		·····	
Slave Addre	ss: F0	(Hex)	Slave A	Address: F0	0 ( O )		
Bytes to Rea	ad: 1		Size of Target A	Address: 2	bytes		
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F	lead Reques	t	Bytes t	to Read: 1	Address R	ead Request	
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Read Respon							
Read Respon Received Da	ta: A5						
Read Respon Received Da Bytes to Rea	ta: A5 ad: 1		Force	Read Response	Get Rea	Response	
<ul> <li>Read Respon</li> <li>Received Da</li> <li>Bytes to Rea</li> <li>Write Reques</li> </ul>	ta: A5 ad: 1 t		Force	Read Response	Get Rea	1 Response	
<ul> <li>Read Respon</li> <li>Received Da</li> <li>Bytes to Rea</li> <li>Write Reques</li> <li>Data to Write</li> </ul>	ta: A5 ad: 1 t te: A5		Force	Read Response	Get Rea	Response	
Read Respon Received Da Bytes to Rea Write Reques Data to Wri Slave Addre	ta: A5 ad: 1 t te: A5 ss: F0	(Hex)	Force	Read Response	Get Rea	d Response	
<ul> <li>Read Respon</li> <li>Received Da</li> <li>Bytes to Rea</li> <li>Write Reques</li> <li>Data to Wri</li> <li>Slave Addre</li> <li>Transfer State</li> </ul>	ta: A5 ad: 1 t te: A5 ss: F0 us	(Hex)	Force	Read Response	Get Read	d Response	

Figure 5. Performing an Addressed Read using the Example Application



- 8. To write data over the SMBus interface:
  - a. Click the **Data Transfer** tab.
  - i. Enter the Slave address and data (in hex) in the Write Request box.
  - j. Click the Write Request button.
  - k. Click **Get Read/Write Transfer Status** and verify that the transfer completed using the status bar at the bottom of the application.

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evice Informati	on									
Vendor ID:	10C4	Release N	umber:	0.00						
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Path:	\\?\hid#vid_10c4&pid_ea90#6&1f0fefc3&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000030}									
Manufacturer:	Silicon Labor	atories								
Product:	CP2112 HID	USB-to-SMB	us Bridg	e						
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<b>8</b> a										
onfig	ata Transfer	Pin Config	uration	Customizatio	on					
-Read Reques	t	_	Addre	essed Read Re	eques	t				
Slave Addre	ss: F0	(Hex)		Slave Addr	ess:	F0		(Hex)		
Bytes to Rea	ad: 1		Size o	f Target Addr	ess:	2		bytes		
				Target Addr	ess:	0000				
F	Read Request			Bytes to Re	ead:	1		Address R	ead Request	
Read Respon	se									
Received Da	ta: A5									
Bytes to Rea	ad: 1			Force Rea	d Res	oonse		Get Rea	l Response	
Write Reques	t									
Data to Wri	te: A5									
Slave Addre	ss: F0 ·		8	0				Write	Request	
Transfer Stat	us									
				Cancel Read/	Write	Transf	er	Get Read/Writ	e Transfer Stati	IS

Figure 6. Performing a Write using the Example Application



9. The **Pin Configuration** tab enables configuration of the GPIO and special functions (TX Toggle, RX Toggle, and Clock Output).

a. Click the Pin Configuration tab.

- I. GPIO pins toggle between Input/Ouput and Open-Drain/Push-Pull by clicking the corresponding GPIO boxes in the **GPIO Configuration** area. Check the boxes for **TX Toggle**, **RX Toggle**, and **Clock Output** to enable the special functionality on these pins. Click the **Set GPIO Config** button to update the device settings.
- m. The **Latch Values** section enables writing or reading the GPIO latches. Clicking the box next the GPIO pins listed will scroll through 1, 0, and X for a don't care. Click the **Write Latch** button to change the state of the GPIO latch.

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Path:	\??\hid#vid_10c4&pid_ea90#6&1f0fefc3&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000030}						
Manufacturer:	Silicon Lab	oratories					
Product:	CP2112 H	ID USB-to-SMBus Bridge	e				
Serial:	0004						
	9	a	1				
Configuration   [	Data 1	in Configuration	Customization	1			
-GPIO Configu	iration			Latch Values			
	Get GPI	O Config Set GPIO	Config	Read Latch	Write Latch		
GPIO.0:	Output	) Push-Pull 🛛 🕅	Toggle	PTO 0: 1	6		
				10.0.			
GPIO.1:	Input	Open-Drain	x loonie	GPIO.1: 1			
GPIO.1:	Input Output	Open-Drain	k logaje	GPIO.1: 1 GPIO.2: 1			
GPIO. 1: GPIO. 2: GPIO. 3:	Input Output Output	Open-Drain Da	x loogle	GPIO.1: 1 GPIO.2: 1 GPIO.3: X 1-Logic	gh		
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GPIO.1: GPIO.2: GPIO.3: GPIO.4: GPIO.5: GPIO.6: GPIO.7: Clock Output I	Input Output Output Input Input Input Divider: 0	Open-Drain Push-Pull Open-Drain Open-Drain Open-Drain Open-Drain Open-Drain Copen-Drain Open-Drain Open-Drain Open-Drain Open-Drain	lock Output 48000000 Hz	GPIO.1: 1 GPIO.2: 1 GPIO.3: X GPIO.3: X GPIO.4: 1 GPIO.4: 1 GPIO.5: 0 GPIO.5: 1 GPIO.7: 1	igh .ow t modify		

Figure 7. Configuring the CP2112 Pins using the Example Application



- 10. The Customization tab allows for programming the One-Time-Programmable (OTP) parameters of the device. These parameters can only be programmed once and cannot be changed back to their default values after being programmed. This tab has the same functionality as the CP2112SetIDs application provided with the CP2112 software package. In order for these parameters to be successfully programmed, a 4.7 μF capacitor must be connected between the VPP pin and ground. This capacitor is populated by default on the CP2112 Evaluation Kit board has this capacitor. See "8. Schematic" on page 12 for more information.
  - a. The USB Customization section sets the USB parameters. Click Get to retrieve the current settings. Change the settings by modifying the text boxes and checking the box next to the parameter being modified. Click the Set button to program the device with the modified settings. The parameter will not be changed without checking the corresponding box. Perform a Get after changing any parameters to ensure that the settings updated correctly.
  - n. The **String Descriptors** section enables modification of the serial strings in the CP2112. Type a string into the corresponding text box and click the **Set** button to modify the strings. Perform a **Get** after changing any parameters to ensure that the settings updated correctly.
  - o. The Lock Byte section displays which fields have been programmed and can lock fields to prevent future modification. Any field that has been programmed will not be checked. To prevent a field from being programmed, uncheck the corresponding box and click the Set button. Perform a Get after changing any parameters to ensure that the settings updated correctly.

だ HidSmbus Exa	mple						
Connection							
000A2E82				-	Disconne	ect	<u>R</u> eset
Device Informati	ion						
Vendor ID:	10C4	Release Number:	0.00				
Product ID:	EA90	Part Number:	12	Version:	1		
Path:	\\?\hid#vid_10c4&pid_ea90#6&1f0fefc3&0&0000#{4d1e55b2-f16f-11cf-88cb-001111000030}						
Manufacturer:	Silicon Laboratories						
Product:	CP2112 HI	D USB-to-SMBus Bridg	e				
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VSB Customiz Vend Produ P Power M Release Ve	ation or ID:	10C4     tHex)       A917     (Hex)       100     mA     (0 -       Image: Self Powered, Volta     Self Powered, Volta       *The device will not op     1     0	- 500) age Regulator age Regulator berate unless (0 - 25	Get S Disabled* Enabled powered by V 55)	a Prog	grammable Fi Vendor ID Product ID Power Nower Mod Release Ver Manufactur Product Serial	Get Set elds: 10c e rsion er
- String Descrip	tora						
Mar	nufacturer:	Company					Get Set
	Product:	Bridge Product					Get Set
	Serial:	000A2E82					Get Set
*Each field can	be program	med one time if unlock	ed. Once lock	ed, a field car	nnot be progr	ammed or un	locked.
00A2E82	HidSmbr	us Open(): HID_SMB	US SUCCES	5			

Figure 8. Customizing a CP2112 Device using the Example Application



# 7. Target Board

The CP2112 Evaluation Kit includes an evaluation board with a CP2112 device pre-installed for evaluation and preliminary software development. Numerous input/output (I/O) connections are provided to facilitate prototyping using the evaluation board. Refer to Figure 9 for the locations of the various I/O connectors. Refer to Figure 10, "CP2112 Evaluation Board Schematic" for information regarding the SMBus pull-up resistors that are located on the target board.

P1	USB connector for USB interface
H1	Access Connector for SMBus interface (SDA, SCL, GND, Pull-Up Voltage)
J1, J2, J3, J4	GPIO access connectors
J6	Power connector
J7	SMBus pull-up voltage connector
J8	Red SUSPEND LED connector
DS0–DS7	Green GPIO LEDs
DS8	Red SUSPEND LED
TB1	SMBus interface terminal block



Figure 9. CP2112 Evaluation Board with Default Shorting Blocks Installed

### 7.1. LED Headers (J1, J2, J3, J4)

Connectors J1, J2, J3, and J4 are provided to allow access to the GPIO pins on the CP2112. Place shorting blocks on J1, J2, J3, and J4 to connect the GPIO pins to the eight green LEDs, DS0–DS7. These LEDs can be used to indicate active communications through the CP2112. Table 1 lists the LED corresponding to each header position.

LED	Pins
DS0	J1[3:4]
DS1	J1[1:2]
DS2	J2[3:4]
DS3	J2[1:2]
DS4	J3[3:4]
DS5	J3[1:2]
DS6	J4[3:4]
DS7	J4[1:2]

### Table 1. J2 and J3 LED Locations



### 7.2. Universal Serial Bus (USB) Interface (P1)

A Universal Serial Bus (USB) connector (P1) is provided to facilitate connections to the USB interface on the CP2112. See Table 2 for the USB pin definitions.

Pin #	Description
1	VBUS
2	D-
3	D+
4	GND (Ground)

### **Table 2. USB Connector Pin Descriptions**

### 7.3. SMBus Signals (TB1, H1)

The SMBus interface terminal block and access headers are included to easily interace SMBus devices to the evaluation board. The terminal block can be used to connect wires to the board, and the access connectors can be used to connect scope probes to the SMBus interface for debugging. The signals that are accessible through these two connectors are SDA, SCL, GND, and the external pull-up voltage signal.

### 7.4. VDD and VIO Power Connector (J6)

This header (J6) is included on the evaluation board to provide several power options. The following describes the function of each pin:

- Pins 1–2: Connect CP2112 VIO input (pin 5) to CP2112 VDD (Pin 6). Remove the shorting block to power VIO from an external source.
- Pins 3–4: Connects the main +3 V net to the CP2112 VDD (Pin 6). The main +3 V net powers the other components (eight green LEDs) on the board.

### 7.5. SMBus Pull-Up Voltage Connector (J7)

This header (J7) is included on the evaluation board to provide power options for SMBus pull-up voltage. The following describes the function of each pin:

- J7[1:2]: Connects CP2112 VIO pin (Pin 5) to the 4.7 kΩ pull-up resistors located on the evaluation board.
- J7[2:3]: Connects the External Pull-Up signal from TB1 (Pin 4) to the 4.7 kΩ pull-up resistors on the evaluation board.

### 7.6. SUSPEND LED Connector (J8)

The J8 header is used to connect the CP2112 SUSPEND pin (Pin 17) to the DS8 red LED. When the LED is on, the device has enumerated with the PC operating normally. When the LED is off, the device has not yet enumerated or is in the USB Suspend state.



# 8. Schematic



# Figure 10. CP2112 Evaluation Board Schematic



# **DOCUMENT CHANGE LIST**

### **Revision 0.1 to Revision 0.2**

- Updated Figure 1.
- Updated "6. CP2112 Windows Application" on page 4.
  - Instructions and figures from updated PC application.
- Updated Figure 10 on page 12.

### Revision 0.2 to Revision 0.3

- Updated "1. Kit Contents" to change CD-ROM to DVD.
- Added "2. Relevant Documentation" and "5. CP2112 Software Interface".
- Updated "3. Software Setup" to point to the drivers on the website.
- Updated Figure 1.
- Updated the instructions and figures in "6. CP2112 Windows Application".

### Revision 0.3 to Revision 0.4

- Updated "1. Kit Contents" to remove DVD.
- Updated "2. Relevant Documentation".
- Updated "3. Software Setup".
- Updated "5. CP2112 Software Interface".

