HID USB TO IR REFERENCE DESIGN USER'S GUIDE

1. Kit Contents

The HID USB to IR Reference Design contains the following items:

- HID USB to IR Bridge Board
- Retractable USB cable

2. Software Download

The software for this kit must be downloaded from the web at the following address:

http://www.silabs.com/HID-USB-to-IR-Bridge

After downloading the installer, run *PuzzleSwipe.exe*. In order to use this board, the board must be plugged into a computer running the PuzzleSwipe PC application. The instructions in this document assume that a Windows PC is being used.

3. HID USB to IR Reference Design Hardware Interface

The HID USB to IR Bridge board contains a USB connector on the printed circuit board (PCB) and can be connected to a USB port in one of two ways:

1. Plug the PCB USB connector into a USB port on the PC.
2. Plug one end of the retractable USB cable into the PCB USB connector and plug the other end of the retractable USB cable into a USB port on the PC.

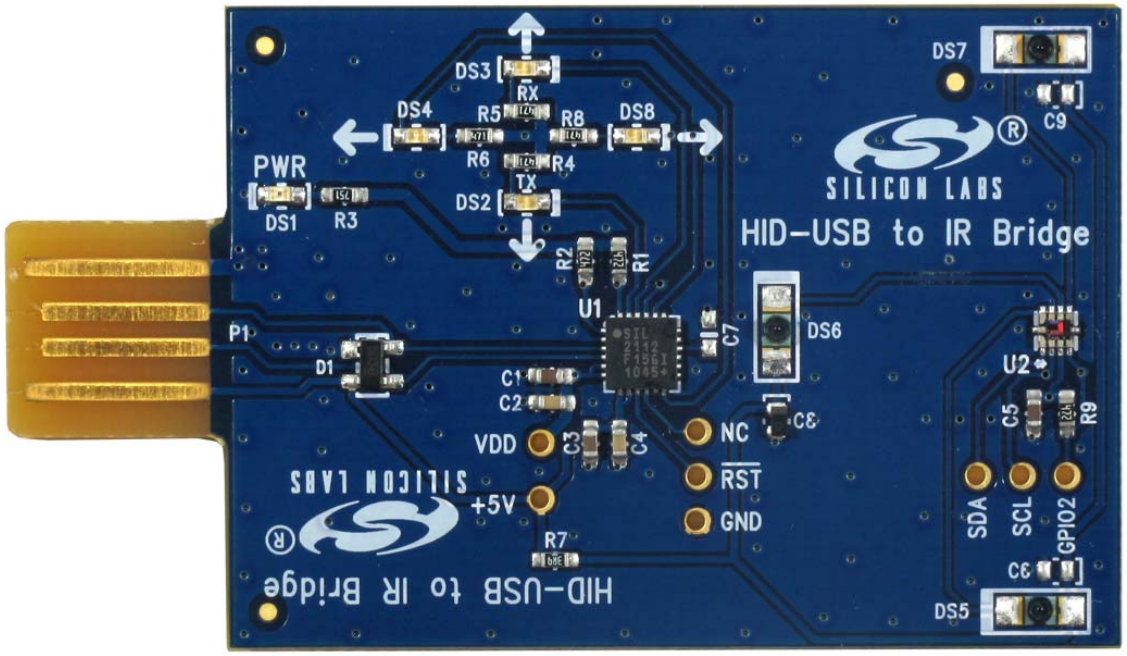


Figure 1. HID USB to IR Bridge

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4. PuzzleSwipe Windows Application

The PuzzleSwipe application is an example application that 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 to control LEDs and communicate with the Si1143 infrared proximity sensor's INT line. The PuzzleSwipe application can be installed from the link in "2. Software Download". Figure 2 shows a screen shot 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 green Power LED on the board will turn on.
2. Launch the PuzzleSwipe application, which is found by clicking:
   Start→All Programs→Silicon Laboratories→PuzzleSwipe.
3. Select the correct device in the "Device" menu, and click "Connect".
4. Select the correct board orientation by clicking *Settings→Board Orientation*. Figure 3 shows a screen shot of the board orientation menu. Click the arrows until the orientation matches the way you are using the board and click "OK".
5. Hand gestures can now move tiles into the area occupied by the blank tile (gray box labeled 16). As you make gestures, the blue LEDs will indicate which direction your gesture was motioning towards and the grey box will move in that direction.
6. To start a new puzzle, click "New Game". Figure 4 shows an example of a new PuzzleSwipe game. Move the gray box around until the puzzle is in the correct sequence.
7. For additional instructions and helpful hand gesture tips, see the PuzzleSwipe directions in *Help→About*.



Figure 2. PuzzleSwipe PC Application



Figure 3. Board Orientation Selection



Figure 4. PuzzleSwipe New Game

5. HID USB to IR Bridge Board

The HID USB to IR Reference Design includes the HID USB to IR Bridge board, which contains a CP2112 HID USB to SMBus Bridge device and an Si1143 Proximity and ALS device. Three IR LEDs (DS5, DS6, and DS7) are included to allow for improved gesture detection. Visible LEDs (DS2, DS3, DS4, and DS8) are included to provide feedback to the user. The red-dashed lines in Figure 5 indicate the “Active Area” for gesture detection by the Si1143. Refer to Figure 5 for the locations of the various board components. Refer to Figure 6, “HID USB to IR Reference Design Board Schematic,” for the reference design board schematic.

U1	CP2112 HID USB to SMBus Bridge
U2	Si1143 Proximity and ALS device
P1	USB connector for USB interface
DS1	Power Green LED
DS2	TX/Down Blue LED
DS3	RX/Up Blue LED
DS4	Left Blue LED
DS5–DS7	IR LEDs
DS8	Right Blue LED

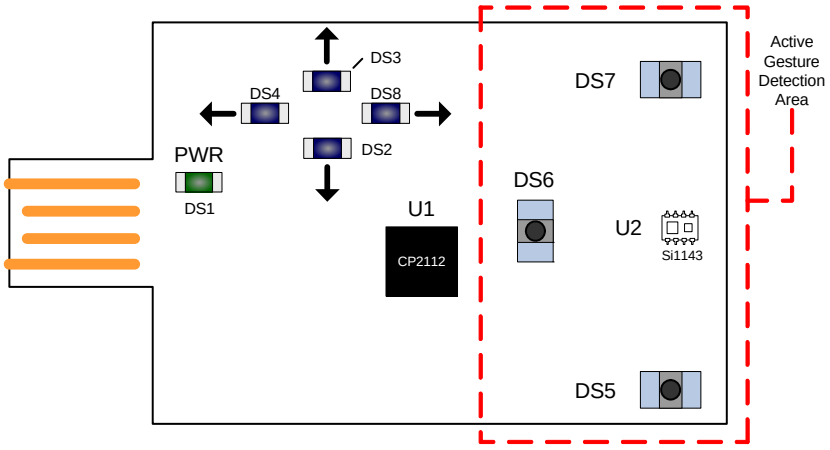


Figure 5. HID USB to IR Reference Design Evaluation Board

5.1. Blue LEDs (DS2, DS3, DS4, DS8)

The blue LEDs on the board are used to provide feedback to the user (these are not the IR LEDs that are used for gesture detection). Table 1 shows the connections between the CP2112 GPIO pins and the Blue LEDs.

Table 1. CP2112 GPIO Pin Connections to Blue LEDs

LED	Pins
DS2	GPIO0 (pin 23)
DS3	GPIO1 (pin 22)
DS4	GPIO7 (pin 12)
DS8	GPIO3 (pin 20)

5.2. IR LEDs (DS5, DS6, DS7)

The three IR LEDs are used for gesture detection and are connected to the Si1143's three LED pins. Table 2 shows the connections between the Si1143 LED pins and the IR LEDs.

Table 2. Si1143 LED Pin Connections to IR LEDs

LED	Si1143 Pins
DS5	LED1 (pin 9)
DS6	LED3 (pin 7)
DS7	LED2 (pin 6)

5.3. Si1143 INT pin

The Si1143 INT pin is connected to the CP2112 GPIO2 pin. The Si1143 pulls the INT line low when new samples are available. When the CP2112 recognizes the drop on GPIO2, it reads new data from the Si1143 over the SMBus interface. For gesture detection, the use of the INT pin of the Si1143 is optional. For position detection, the INT pin of the Si1143 must be used. For more information on the INT line, see the "Host Interface" section of the Si114x data sheet.

5.4. 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 3 for the USB pin definitions.

Table 3. USB Connector Pin Descriptions

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

5.5. Board Power

The HID USB to IR Bridge board is powered through the VBUS line on the USB connector. The 5 V signal is fed into the VREGIN pin of the CP2112. A 3.45 V signal is output from the VDD pin on the CP2112 and is used to power the Si1143. The Blue LEDs and Power LED are powered by the VDD output of the CP2112. The IR LEDs are powered by the 5 V VBUS signal on the USB connector.

6. Relevant Application Notes

The following application notes cover the CP2112:

- AN495: CP2112 Interface Specification
- AN496: CP2112 HID USB-to-SMBus API Specification

The following application notes cover the Si1143:

- AN498: Si114x Designer's Guide
- AN521: IR-LED Selection Guide for Si114x Proximity Applications
- AN523: Overlay Considerations for the Si114x
- AN580: Infrared Gesture Sensing

7. Schematic

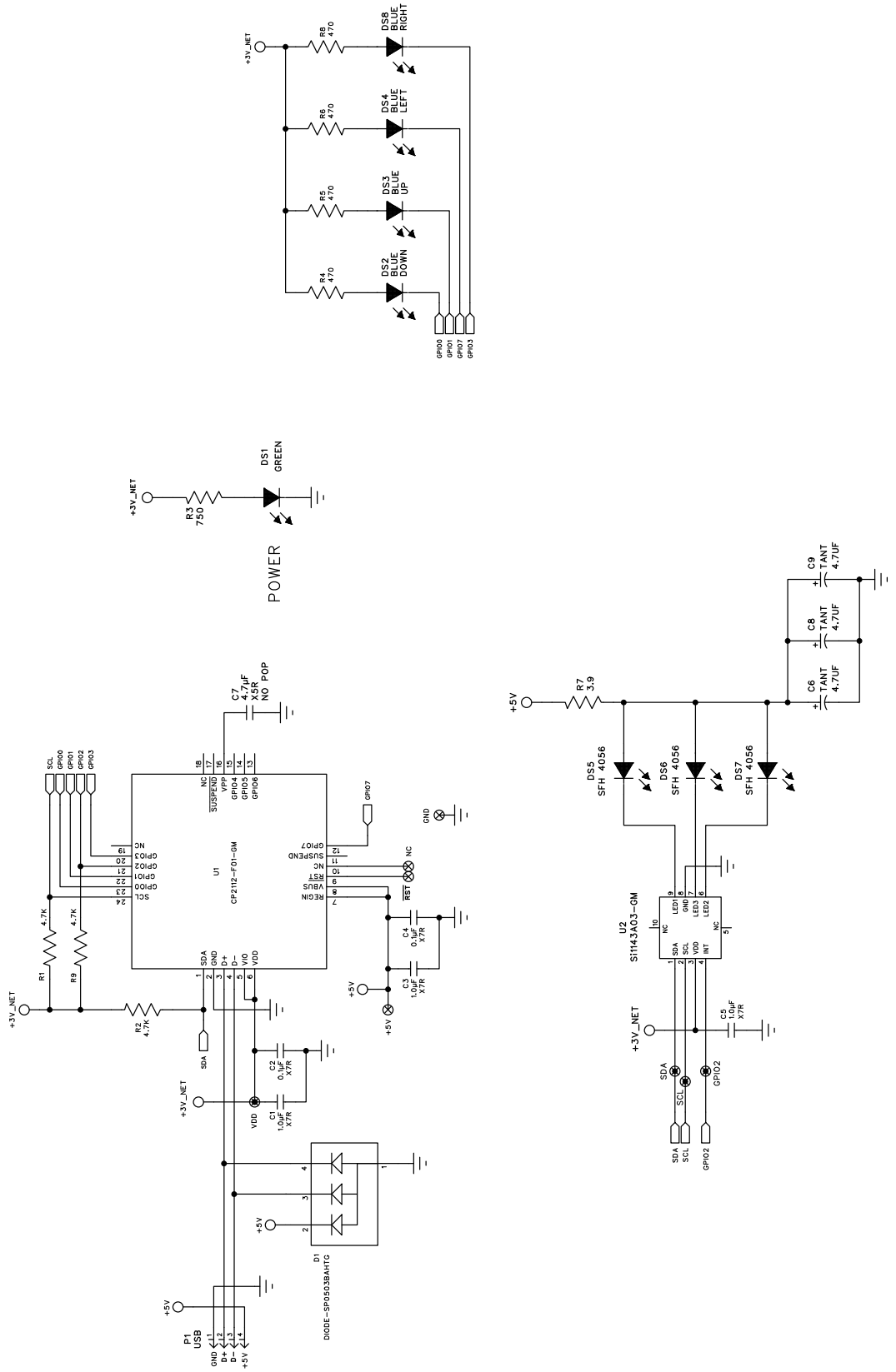


Figure 6. HID USB to IR Reference Design Board Schematic

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