CY4631 Wired Mouse Reference Design Kit Guide

Spec. # 001-47345 Rev. *C

Cypress Semiconductor
198 Champion Court
San Jose, CA 95134-1709
Phone (USA): 800.858.1810
Phone (Intnl): 408.943.2600
http://www.cypress.com

Downloaded from Datasheet.su

Copyrights

© Cypress Semiconductor Corporation, 2008-2009. The information contained herein is subject to change without notice. Cypress Semiconductor Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in a Cypress product. Nor does it convey or imply any license under patent or other rights. Cypress products are not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with Cypress. Furthermore, Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress products in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Any Source Code (software and/or firmware) is owned by Cypress Semiconductor Corporation (Cypress) and is protected by and subject to worldwide patent protection (United States and foreign), United States copyright laws and international treaty provisions. Cypress hereby grants to licensee a personal, non-exclusive, non-transferable license to copy, use, modify, create derivative works of, and compile the Cypress Source Code and derivative works for the sole purpose of creating custom software and or firmware in support of licensee product to be used only in conjunction with a Cypress integrated circuit as specified in the applicable agreement. Any reproduction, modification, translation, compilation, or representation of this Source Code except as specified above is prohibited without the express written permission of Cypress.

Disclaimer: CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Cypress reserves the right to make changes without further notice to the materials described herein. Cypress does not assume any liability arising out of the application or use of any product or circuit described herein. Cypress does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Cypress' product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Cypress against all charges.

Use may be limited by and subject to the applicable Cypress software license agreement.

PSoC Designer™, and Programmable System-on-Chip™ are trademarks and PSoC® is a registered trademark of Cypress Semiconductor Corp. All other trademarks or registered trademarks referenced herein are property of the respective corporations.

Flash Code Protection

Cypress products meet the specifications contained in their particular Cypress PSoC Data Sheets. Cypress believes that its family of PSoC products is one of the most secure families of its kind on the market today, regardless of how they are used. There may be methods, unknown to Cypress, that can breach the code protection features. Any of these methods, to our knowledge, would be dishonest and possibly illegal. Neither Cypress nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Cypress is willing to work with the customer who is concerned about the integrity of their code. Code protection is constantly evolving. We at Cypress are committed to continuously improving the code protection features of our products.

Downloaded from Datasheet.su [+] Feedback

Contents

Downloaded from Datasheet.su

[+] Feedback

Downloaded from Datasheet.su [+] Feedback

1. Introduction

1.1 Included in This Kit

- Full-speed gaming mouse based on the CYONS2100-LBXC Laser Navigation System on Chip
- Cypress MiniProg programmer with USB cable
- PDC-9241 Adapter for programming
- Kit CD, including
  - Hardware Design Files - Schematic, Bill of materials, PCB layout files
  - Firmware - Full source and object code
  - Documentation - Kit Guide, Release Notes, Errata and so on
  - Development Tools - PSoC Designer 5.0™ Service Pack 4.5 and PSoC Programmer

1.2 Overview

1.2.1 Description

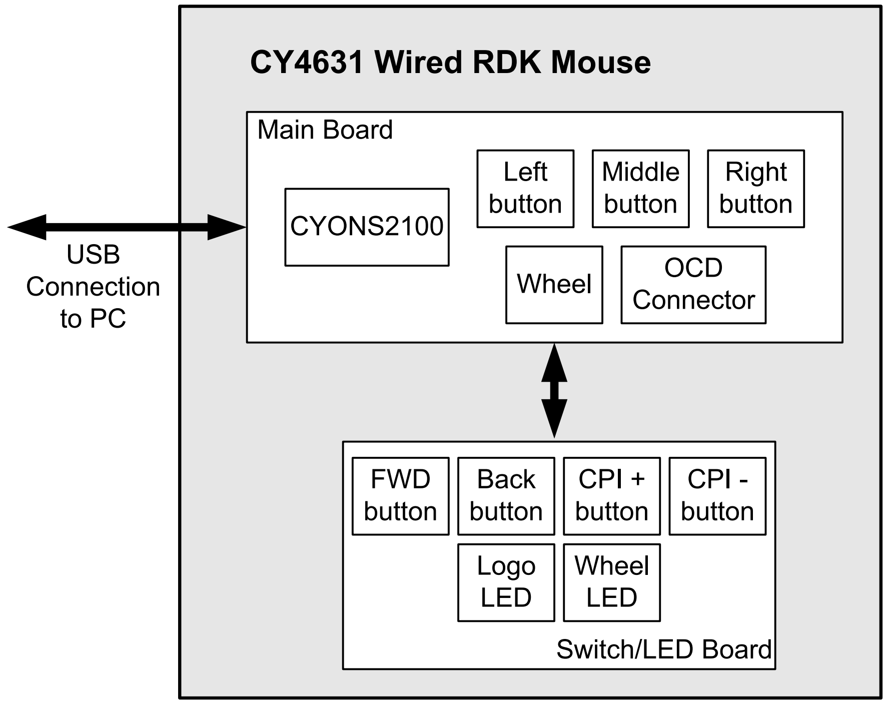
The OvationONS II Laser Navigation System on Chip is Cypress Semiconductor's second generation laser product. It combines the powerful Harvard architecture MCU found in Cypress' PSoC devices, with a high-speed, high-precision OptiCheck™ sensor. Full-speed USB capabilities are also included in the package.

The CY4631 OvationONS II wired mouse RDK provides a turnkey reference design suitable for PC mouse manufacturers. The kit incorporates the CYONS2100 OvationONS II Laser Navigation System on Chip in a wired mouse design, complete with PCB and mouse skins. This mouse is a multi-function device, featuring 7 buttons, one single-color logo LED, and on tri-color indicator LED. The system includes a total of 2 printed circuit boards: a main board and a daughter card. The main board contains the OvationONS II SoC, left, right, and center (scroll wheel) buttons along with the USB interface. The daughter card includes the front/back buttons, the DPI adjust buttons, the logo LED, and the tri-color LED. In addition, a MiniProg and USB adapter are included in the kit for programming.

Downloaded from Datasheet.su [+] Feedback

1.2.2 Block Diagram

Figure 1-1. Block Diagram of the System



The description of the block diagram in Figure 1-1 is quite simple. A total of two boards make up the system. The mouse uses a USB cable to interface with the host PC. On the mouse main PCB, there are three buttons: left, right, and center (scroll wheel). The main board also holds the OvationONS II SoC. Attached to the main board is a daughter card holding four additional buttons, a logo LED, and a multi-color LED that indicates the level of resolution the sensor is set to.

1.2.3 Theory of Operation

The mouse incorporates the CYONS2100 42-pin QFN device for controlling buttons, scroll wheel, LED(s), and full speed USB activity.

Power for the mouse is provided via standard USB 5V bus power.

The mouse has a total of seven buttons. The two top buttons control left and right button mouse functionality. There is a center button as well, which is activated by pressing down on the scroll wheel. Other buttons include two buttons for navigating forward and backward between web pages in a browser. Two more buttons, located on the top side of the mouse, control the DPI resolution of the sensor - one to increase resolution, one to decrease resolution. Finally, a scroll wheel is implemented to scroll up and down within software applications.

The mouse is a human interface device (HID) and interfaces with a PC via a five wire full speed capable USB cable.

The CYONS2100 device has 32k of flash storage for programming. 2k bytes of SRAM for data storage are also available on-chip. The main PCB includes a 5-pin USB connector, which can be used for both programming the MCU, and interfacing with the host PC. A MiniProg-to-USB adapter, board number PDC-9241, is needed for programming the OvationONS II device. This is a separate board included in the kit.

A snap-fit lens for the sensor is attached to the main board.

Downloaded from Datasheet.su

1.3 Document Revision History

Table 1-1. Revision History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	11/24/2008	FJZ	New Guide
*A	04/24/2009	FJZ	KIt Updates
*B	04/29/2009	FJZ	Updated Service Pack version and Changed compiler to ImageCraft
*C	06/12/2009	FJZ	RTM Release

1.4 Documentation Conventions

Table 1-2. Document Conventions for Guides

Convention	Usage
`Courier New`	Displays file locations, user entered text, and source code: `C:\...cd\icc\`
Italics	Displays file names and reference documentation: Read about the *sourcefile.hex* file in the *PSoC Designer User Guide*.
[**Bracketed, Bold**]	Displays keyboard commands in procedures: [**Enter**] or [**Ctrl**] [**C**]
File > Open	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: $2 + 2 = 4$
Text in gray boxes	Describes Cautions or unique functionality of the product.

Downloaded from Datasheet.su

[+] Feedback

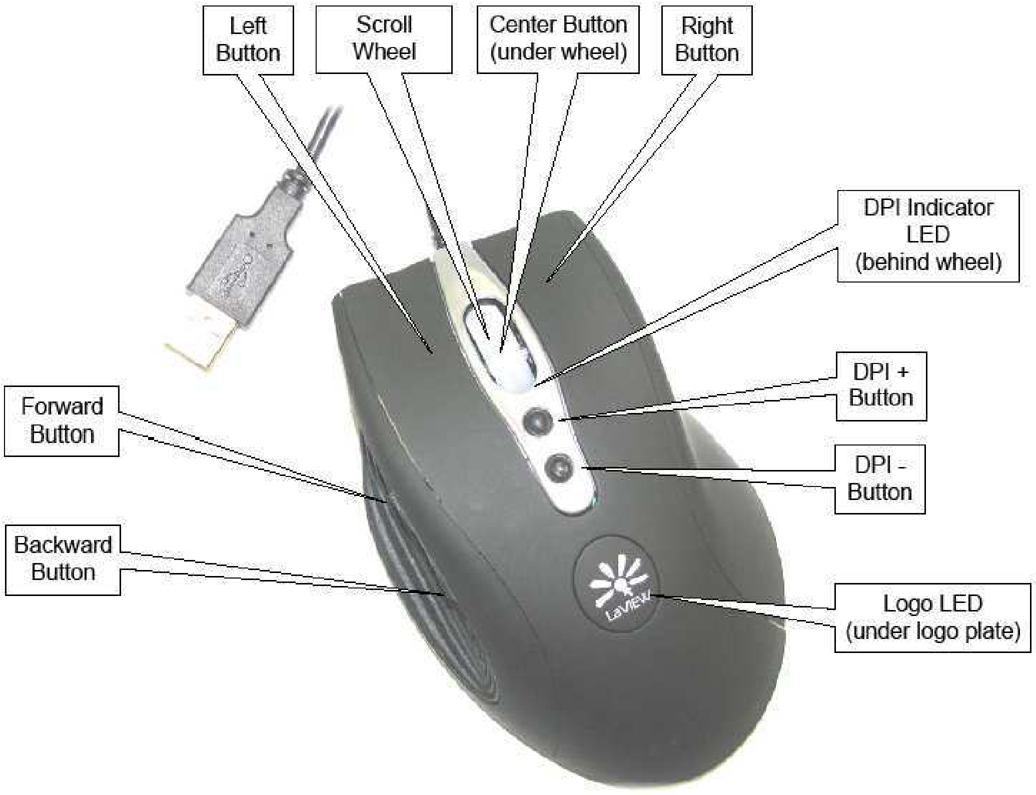
Downloaded from Datasheet.su

[+] Feedback

2. Hardware

2.1 Mouse Overview

The following image shows the major components of the mouse.



2.2 Major Components

Major components include the CYONS2100 SoC, push button switches, scroll wheel, bulk, and bypass capacitors, LED(s), and resistors.

2.3 Additional Electrical Feature

The board includes test pads for all OvationONS II pins. This allows the designer to access the other GPIO's and features supported by the device, without developing a separate board. In this sense, the CY4631 kit can also be used as a development kit for the CYONS2100-LBXC part.

The board also includes a connector for debugging. Using this connector and the Cypress CY3250-FLEXCABLE, a Cypress **ICE Cube** debugger can be used to perform on-chip debugging. With the

Downloaded from Datasheet.su [+] Feedback

ICE, the developer can step through code, set breakpoints, and monitor variable and register settings during operation.

The ICE cube is available for purchase as part of the CY3215 DVK development kit. This kit, and the CY3250-FLEXCABLE, are available for purchase from www.cypress.com.

2.4 Mechanical

The main board design includes the OvationONS II sensor, a 5-pin connector used for programming and PC-to-mouse USB interface, three push buttons and a mechanical scroll wheel encoder. The main board has two copper layers.

The daughter card contains four push buttons, a logo illumination LED, a resolution indicator LED, and a connector for interfacing to the main board.

Mechanical design is an important consideration. If the designer is developing his own PCB based on this RDK, care should be taken to meet the mechanical requirements of the OvationONS II SoC. These requirements are described in detail in the application note AN48995, "Mechanical Design Considerations for the CYONS2xxx Laser Navigation SoC". The note is included in the kit CD.

2.5 HW Documentation

The following documents are includes as part of the kit.

- Bill of Materials
- Schematics in PDF and Orcad source format
- PCB layout in PDF, gerber, and Allegro/PADs format

2.6 Manufacturing Considerations

As a guide to assist in production of mice, Cypress has published application note AN49035, “Manufacturing Considerations for the OvationONS™ II Laser Navigation System-on-Chip“. The note is included in the kit CD.

Downloaded from Datasheet.su [+] Feedback

3. Firmware

3.1 Introduction

This document covers the design goals, architecture, configuration options, and firmware source code modules for the CY4631 OvationONS II USB Mouse RDK. This document assumes the reader is familiar with the PSoC Designer™ Integrated Development Environment (IDE) software, in addition to the general operation of USB HID devices interface.

An introduction to the PSoC Designer tools is available at the Cypress website www.cypress.com/psocdesigner. The site has a link to a training page which includes Webinars, OnDemand Training, and workshops.

3.2 Development Environment

The following tools were used to develop the RDK mouse firmware and can be purchased from Cypress Semiconductor through www.cypress.com

- PSoC Designer™ IDE Software version 5.0, Service Pack 4.5 (included in kit)
- PSoC ICE-CUBE™
- ImageCraft Compiler

3.3 Design Goals

3.3.1 Mouse Application

The RDK firmware design includes configuration options to

- Target firmware builds to adjust for sensor orientation and CPI adjustment. (See *global.h* and *SVCE_Cpi()* service function)
- Support different features for all OvationONS II Optical Sensors
- Support for left, middle, right, scroll wheel, forward, back, CPI up, and CPI down buttons
- Support for USB remote wakeup on any button press, scroll wheel movement, or mouse movement
- Debounce all button presses
- Support 1ms USB report rate

3.3.2 USB Functionality

The RDK firmware uses the full-speed USB (FSUSB) User Module in PSoC Designer.

- The USB User Module provides the USB functionality required for the RDK.
- The RDK is designed to be attached to any USB host interface.
- The USB User Module is designed to handle Chapter 9 requirements of the USB 2.0 specification.

Downloaded from Datasheet.su [+] Feedback

- The RDK firmware includes additional code to support USB suspend, resume, and remote wakeup.
- The USB User Module is designed to handle USB HID device class definition v1.11.
- The USB User Module allows customization of both the standard USB Descriptors and USB HID Report Descriptors.

3.3.3 Bootloader Functionality

The bootloader enables end-user upgrades of the mouse's operating firmware. A typical upgrade operation requires the following steps:

- Preparation of a download file that contains the new firmware. Typically this is provided by the mouse manufacturer, and offered as an upgrade to end users on the manufacturer's website.
- Preparation of the mouse to accept the download file. This is referred to as "invoking the bootloader". In this step, the user performs a prescribed action on the mouse, which
  - Suspends normal operation of the mouse
  - Breaks the USB connection between the host PC and the mouse
  - Restarts the mouse as a bootloader-compatible USB device
- Launch of a PC-based application that takes the upgrade download, and sends the new firmware to the mouse over the bootloader USB interface.
- Restart of the mouse with upgraded firmware.

The CY4631 RDK's firmware invokes the bootloader when it detects simultaneous presses of the left, right, middle, CPI increase, and CPI decrease buttons. Upon this key sequence, the device stops operating as a mouse, and restarts as a bootloader compatible device. At this time, it is ready to accept a download file from the bootloader host application.

3.4 Architecture

The firmware architecture consists of PSoC Designer User Modules plus application code.

3.4.1 User Modules

3.4.1.1 Full-Speed USB Bootloader User Module

The bootloader user module (UM) provides firmware updates and client-driven replacement of firmware when the user invokes the bootloader. It also provides USB interface between the host and the RDK application. The functionality provided by the bootloader UM includes:

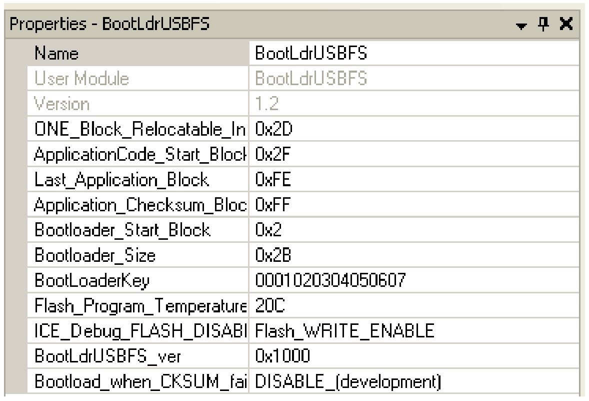
- USB device interface driver
- USB Chapter 9 compliance
- Mouse HID class support
- Setup wizard for USB descriptor generation and modification
- Standard APIs for programmatic control of the USB UM

Bootloader User Module Parameters

Parameters must be set so that there is sufficient EEPROM space and no EEPROM space conflicts between application firmware, bootloader firmware, checksum block, and any EEPROM UM blocks. If the designer adds new code to the project, it may be necessary to increase the side of the bootloader block. Refer to the user module datasheet in PSoC Designer for more information.

Downloaded from Datasheet.su [+] Feedback

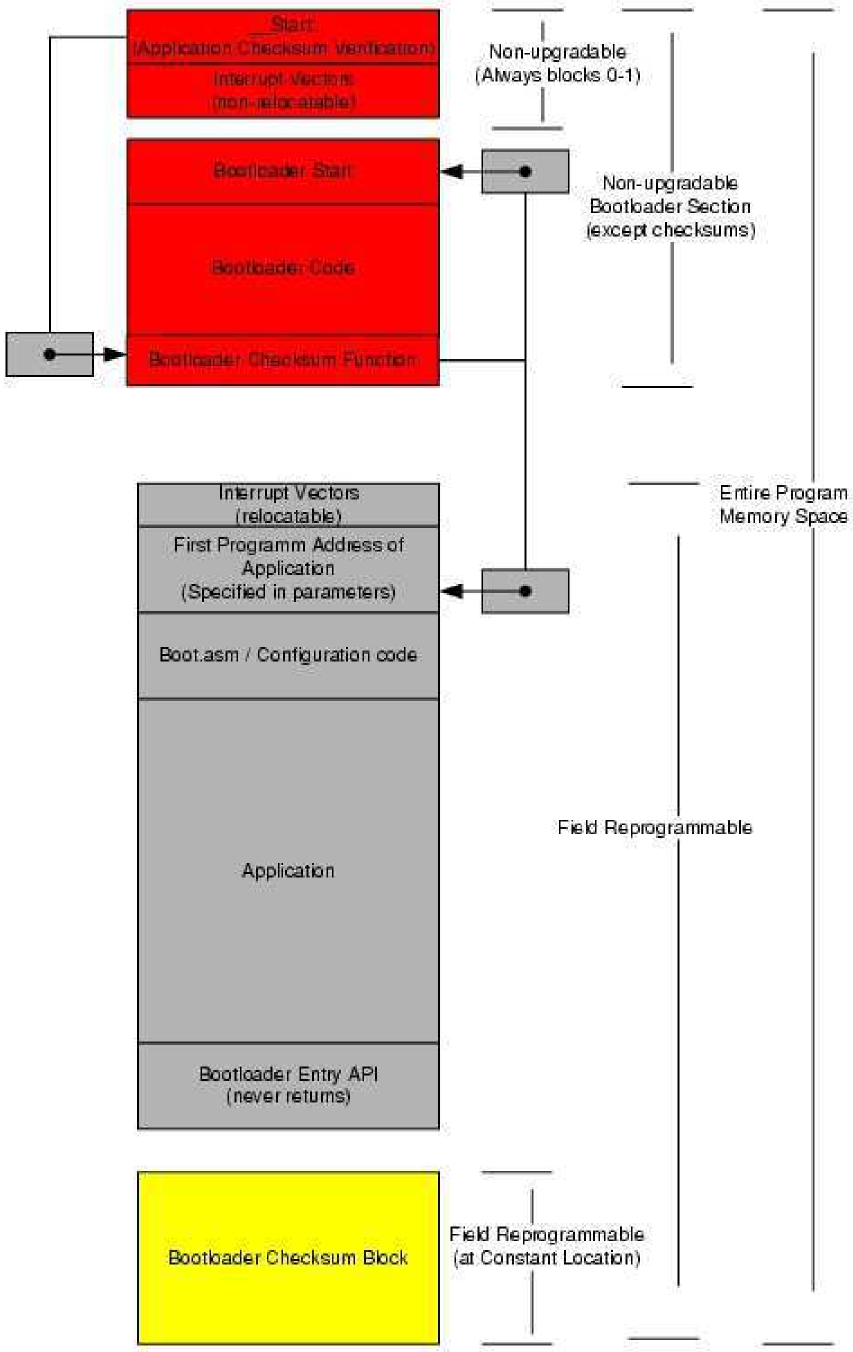
The bootloader host application checks the bootloader key which is user defined to any value.



Properties - BootLdrUSBFS

Name	BootLdrUSBFS
User Module	BootLdrUSBFS
Version	1.2
ONE_Block_Relocatable_In	0x2D
ApplicationCode_Start_Block	0x2F
Last_Application_Block	0xFE
Application_Checksum_Bloc	0xFF
Bootloader_Start_Block	0x2
Bootloader_Size	0x2B
BootLoaderKey	0001020304050607
Flash_Program_Temperature	20C
ICE_Debug_FLASH_DISABl	Flash_WRITE_ENABLE
BootLdrUSBFS_ver	0x1000
Bootload_when_CKSUM_fai	DISABLE_(development)

Downloaded from Datasheet.su [+] Feedback



For detailed information on setting up the bootloader UM parameters, open the **Protocols** folder in the User Module Catalog, then right-click on the **BootLdrFSUSB** folder, and select **Datasheet**.

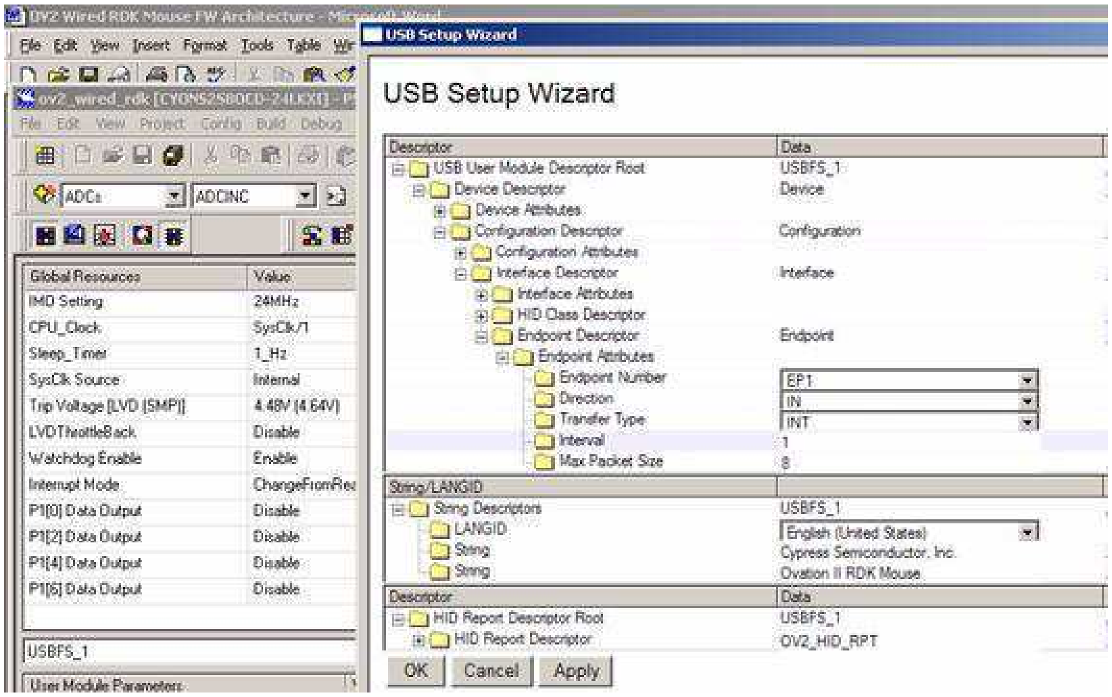
Downloaded from Datasheet.su

Full Speed USB Bootloader Setup

The bootloader user module can be configured by using the setup wizard in PSoC Designer 5.0. The bootloader user module consists of two USB interfaces: the normal mouse application, and the bootloader application. Only one interface is active at any time.

Both interfaces can be changed by running the setup wizard. Typical changes include changing the USB polling interval and modifying the USB VID/PID.

To change the USB polling interval, change the HID report rate by updating the Interval descriptor for EP1. Go to device editor in PSoC Designer, right-click the USB user module, and select the Device: Application USB Setup Wizard. Change the interval to 1 to let the USB host know to poll every 1ms for a USB report. This results in the highest report rate possible.



Global Resources	Value
IMO Setting	24MHz
CPU_Clock	SysClk/1
Sleep_Timer	1_Hz
SysClk Source	Internal
Trip Voltage [LVD (SMP)]	4.48V (4.64V)
LVDThrottleBack	Disable
Watchdog Enable	Enable
Interrupt Mode	ChangeFromRe
P1[0] Data Output	Disable
P1[2] Data Output	Disable
P1[4] Data Output	Disable
P1[6] Data Output	Disable

USB Setup Wizard

Descriptor	Data
USB User Module Descriptor Root	USBFS_1
Device Descriptor	Device
Device Attributes	
Configuration Descriptor	Configuration
Configuration Attributes	
Interface Descriptor	Interface
Interface Attributes	
HID Class Descriptor	
Endpoint Descriptor	Endpoint
Endpoint Attributes	
Endpoint Number	EP1
Direction	IN
Transfer Type	INT
Interval	1
Max Packet Size	8

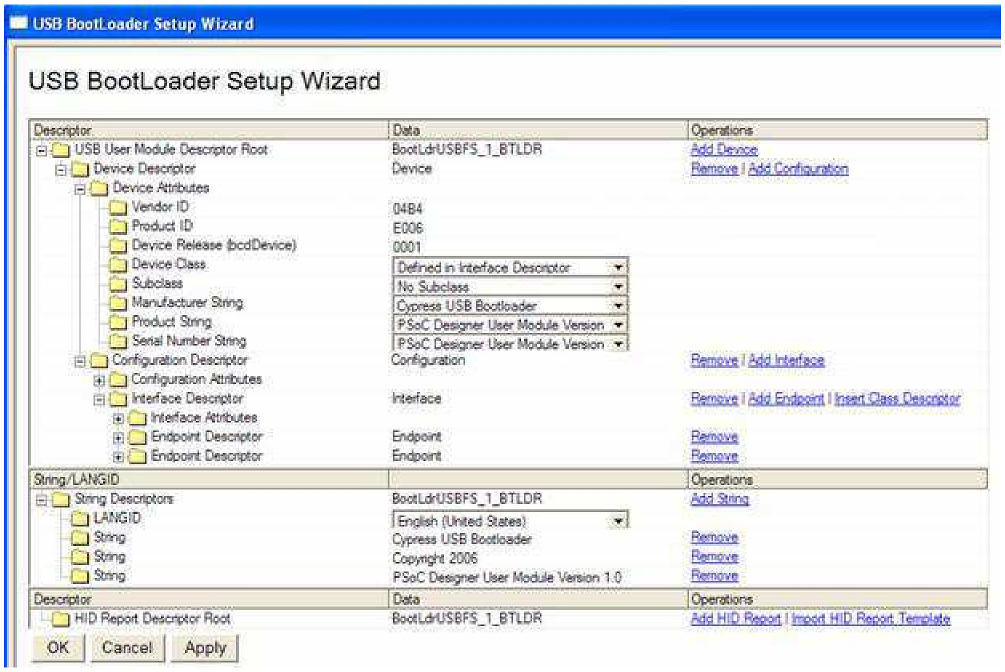
String/LANGID	
String Descriptors	USBFS_1
LANGID	English (United States)
String	Cypress Semiconductor, Inc.
String	Ovation II RDK Mouse

Descriptor	Data
HID Report Descriptor Root	USBFS_1
HID Report Descriptor	OV2_HID_RPT

The device has two USB interfaces. Typically, boot.asm presents the application firmware interface when there is no need to execute the bootloader function. If the bootloader is invoked, then bootloader code presents the bootloader USB interface to the USB host PC. To set your device's PID/VID for both interfaces, enter your PID/VID by selecting Device: Bootloader USB Setup Wizard and Device: Application USB Setup Wizard.

Downloaded from Datasheet.su
[+] Feedback

Figure 3-1. USB BootLoader Setup Wizard



USB BootLoader Setup Wizard

USB BootLoader Setup Wizard

Descriptor	Data	Operations
USB User Module Descriptor Root	BootLdrUSBFS_1_BTLDR	Add Device
Device Descriptor	Device	Remove | Add Configuration
Device Attributes		
Vendor ID	04B4	
Product ID	E006	
Device Release (bcdDevice)	0001	
Device Class	Defined in Interface Descriptor	
Subclass	No Subclass	
Manufacturer String	Cypress USB Bootloader	
Product String	PSoC Designer User Module Version	
Serial Number String	PSoC Designer User Module Version	
Configuration Descriptor	Configuration	Remove | Add Interface
Configuration Attributes		
Interface Descriptor	Interface	Remove | Add Endpoint | Insert Class Descriptor
Interface Attributes		
Endpoint Descriptor	Endpoint	Remove
Endpoint Descriptor	Endpoint	Remove
String/LANGID		**Operations**
String Descriptors	BootLdrUSBFS_1_BTLDR	Add String
LANGID	English (United States)	
String	Cypress USB Bootloader	Remove
String	Copyright 2006	Remove
String	PSoC Designer User Module Version 1.0	Remove
Descriptor	**Data**	**Operations**
HID Report Descriptor Root	BootLdrUSBFS_1_BTLDR	Add HID Report | Import HID Report Template

3.4.1.2 *EEPROM User Module*

The EEPROM UM provides memory of user CPI settings and Logo LED on/off setting. EEPROM UM uses the following device editor settings:

- Module name = E2PROMx128
- 1st Block = 1
- Length = 128

The first block is the starting block in which the EEPROM device resides for the specific device. Valid start block locations range from 0 to 511 for 32K devices, 255 for 16K devices, 127 for 8K devices, 63 for 4K devices, and 31 for 2K devices.

3.4.1.3 *NAV User Module*

The NAV UM provides OvationONS II device initialization and tracking support:

- Initializes the sensor, based on the device ID in which is factory-programmed into the Ovation device.
- Sets individual sensor settings based on calibration data stored in the device.
- Starts or stops laser and tracking in OvationONS II.
- Reads tracking count changes in X and Y directions.
- Sets CPI resolution.

NAV UM uses the following device editor settings: (Note that lift detection support is not yet available in firmware.)

- User Module Name = NAV_UM
- Navigation Sleep Modes = Enable

Downloaded from Datasheet.su

3.4.1.4 *Timer16 User Module*

The Timer UM provides a one-millisecond timer ISR routine. The application uses this timer and several counters to time-out the USB connection and allow continuous pressing of the CPI buttons to adjust CPI.

The Timer16 UM uses the following device editor settings:

- User Module Name = TickTimer
- Period = 32
- Mode = Continuous
- Clock Select = 32 kHz

These settings produce a continuous, 1 ms timer interrupt.

3.4.2 Application Code

The CY4631 OvationONS II USB Mouse RDK application, besides being the code that ties the User Modules together, handles the following tasks:

- Initialization and configuration of all blocks in the design
- Execution of the polling loop in main.c
- Control of USB idle state
- Control of the display LEDs
- Polling of buttons, scroll wheel, and optical sensor
- Debounce support for button presses
- Control of USB suspend, resume and remote wakeup
- Generation and USB transfer of the mouse reports to the host

This section describes the application code in detail, covering each global data structure and firmware source code file in the reference design.

3.4.2.1 *Global Data Structures*

Persistent Parameters Table

This structure is implemented over FLASH "EEPROM," read into RAM on system initialization, and contains user defaults that must survive power off/on cycles.

```
typedef struct STRUCT_PERSISTENT_PARAMETERS
{
  UINT16  wCheckWord;

// User-Selected Defaults Section
  UINT16  uCPI;
  BOOL    fLogoOn;
}
```

Downloaded from Datasheet.su [+] Feedback

HID Report Structure

This structure contains the Human Interface Device (HID) data report sent by USB packet to the USB host. Sub-structures BUTTON_REPORT and WHEEL REPORT contain right button, middle button, left button, and wheel states. OPTICAL_REPORT contains 32 bits of X and Y changes read from the OvationONS II device.

```
typedef struct MOUSE_HID_REPORT
{

    BUTTON_REPORT   SButtons;
    OPTICAL_REPORT  SxyData;
    WHEEL_REPORT    SWheel;
} MOUSE_HID_REPORT, *pMOUSE_HID_REPORT;
```

Wheel Report Structure

This one-byte structure contains the encoder state to sense and report changes in wheel motion.

```
typedef struct
{
    INT8 cz;

} WHEEL_REPORT;
```

Optical Report Structure

The x/y data is held in a structure consisting of two bytes each for x and y.

```
typedef struct OPTICAL_REPORT
{
  UINT8 bXLow;
  UINT8 bXHigh;

  UINT8 bYLow;
  UINT8 bYHigh;

} OPTICAL_REPORT;
```

Button Report Structure

The button data is held in a single byte, with each bit corresponding to one of the mouse buttons. The upper three bits are undefined, and the remaining five bits (in MSB to LSB order) are FWD button, BACK button, MIDDLE button, RIGHT button, and LEFT button.

```
typedef struct
{
    UINT8 bfHidMask;

} BUTTON_REPORT;
```

Downloaded from Datasheet.su

3.4.2.2 *Source Code Files*

This section covers key source code files. Other source code files are covered in the function descriptions that follow.

boot.tpl

The *boot.tpl* file contains user-defined constraints for PSoC Designer when it generates the boot.asm file for your project. In the CY4631 firmware project, there are five customizations to *boot.tpl*. All changes are to interrupt processing, so that the correct interrupt service routine is called.

boot.tpl lines 300 - 303:

```
;;INT_VEC5: equ  RELOC_INT_VECTORS + 14h                ;GPIO Interrupt Vector
    org INT_VEC5
    ljmp _GPIO_ButtonWheelIsr
    reti
```

Lines 407 - 412:

```
;;INT_VEC22: equ  RELOC_INT_VECTORS + 58h               ;USB_Wakeup
    org INT_VEC22
export USB_WAKEUP_USER_ISR_VECTOR
USB_WAKEUP_USER_ISR_VECTOR:
    ljmp _USB_WakeUpIsr
    reti
```

Lines 419 - 422:

```
INT_VEC24: equ  RELOC_INT_VECTORS + 60h                 ;;Sleep Ovation2
    org INT_VEC24
    ljmp _NAV_SleepIsr
    reti
```

Lines 424 - 427

```
INT_VEC25: equ  RELOC_INT_VECTORS + 64h                 ;Wakeup Ovation2
    org INT_VEC25
ljmp _NAV_WakeIsr
    reti
```

Lines 430 - 434

```
GENERIC_VEC26: equ  (RELOC_INT_VECTORS + 68h)          ;Ovation2 Global Interrupt
    org INT_VEC26
;`@INTERRUPT_26`
    ljmp _NAV_GlobalIsr
    reti
```

Downloaded from Datasheet.su

flashsecurity.txt

The flash security file allows EEPROM read and write for storing persistent data, such as user CPI settings, and bootloader FW updates. The flash security file is configured to allow write access to block 4 of flash, so that persistent data can be modified by the user. *Flashsecurity.txt* marks all EEPROM locations with a "u" for "unprotect" to allow firmware read/write access.

```
; 0 80 100 180 200 280 300 380 (+) Base Address
  u  u  u   u   u   u   u   u ;     Base Address 0
```

3.4.2.3 *Source Code Functions*

This section describes the various functions in the application code.

Main Function

`void main(void)`

The main c function. It calls the initialization functions for the various blocks, and then runs a loop checking for mouse activity or the need to enter USB suspend mode.

Initialization Functions

`void SYSINI_Button(void)`

Clears button states to "Not Down" in HID report, disables button interrupts until use in waking up mouse, and turns on the pull-up drive for button pins.

`void SYSINI_Eeprom(void)`

Reads persistent parameters from EEPROM. Sets up default parameters if no previous EEPROM data found.

`void SYSINI_Nav(void)`

Starts DSP, laser, and sets default tracking CPI. It primarily calls OvationONS II NAV User Modules.

`void SYSINI_Led(void)`

Calls SVCE_LED. Sets initial LED settings for lighting the scroll wheel to indicate CPI level.

`void SYSINI_Timer(void)`

Starts the Timer16 User Module.

`void SYSINI_UsbHidReport(void)`

Activates USB by User Module, waits until configuration is complete, establish data toggle, and disable USB wake-up ISR.

Downloaded from Datasheet.su [+] Feedback

`void SYSINI_ZWheel(void)`

Initialize wheel states (all 0), temporarily mask wheel interrupts, turn wheel pull-ups on.

Service Functions

`void SVCE_Buttons(void)`

Reads and debounces all buttons.

`void SVCE_Cpi(void)`

Adjust CPI up or down depending on fCpiUp and fCpiDown flags. Flags are set by `TASK_ButtonsIsr()`.

`void SVCE_Eeprom(void)`

Provides write of persistent parameters to EEPROM. In this case, user CPI adjustments.

`void SVCE_HidReport(void)`

Polls for XY tracking counts, wheel, and button state changes. Packages and posts a HID report over USB protocol, if necessary.

`void SVCE_Led(void)`

Sets initial LED settings for lighting the scroll wheel to indicate CPI level.

`void SVCE_UsbResume(void)`

Resume USB from suspend state. If no remote wakeup, then turn on track init and start laser.

`void SVCE_UsbSuspend(void)`

Suspend USB with or without remote wakeup.

`void SVCE_WheelDetect(void)`

Reads and updates the state of the zWheel.

ISR Functions

`void GPIO_ButtonWheelIsr(void)`

When buttons are pressed, this ISR sets fHaveButtonInt to TRUE allowing firmware to exit sleep and send wake-up signals to a host PC. Host PC should have remote wake-up enabled.

Downloaded from Datasheet.su [+] Feedback

`void NAV_SleepIsr(void)`

Sets the fNAVSleepInt to TRUE. Detecting the TRUE condition instructs firmware to enter or reenter sleep mode.

`void USB_WakeUpIsr(void)`

Sets the fUSBWakeInt to TRUE. The RDK mouse firmware uses this flag to detect USB wake-up and exits suspend mode.

Other Functions

void DelayMsecs(UINT16 bDelayMsecs)

A general purpose timing function that delays for the indicated number of milliseconds.

`void ButtonPortDriveOn(void)`

Sets the drive mode for the GPIOs connected to the button switches.

`void ButtonPortDriveOff(void)`

Sets the button GPIO's to a low state.

`void LogoLedPortDriveOn(void)`

Turns on the logo LED.

`void LogoLedPortDriveOff(void)`

Turns off the log LED.

`void ColorLedPortDriveOn(UINT8 bfColorLedBits)`

Turns on the LED that indicates the CPI setting. The implementation supports tri-color LED in either a common-anode or common-cathode configuration.

`void ColorLedPortDriveOff(void)`

Turns off the LED that indicates the CPI setting. The implementation supports tri-color LED in either a common-anode or common-cathode configuration.

`void PreResetWarningLedLoop(void)`

An LED blinking loop used during resets.

`void FatalLogoLedLoop(void)`

An LED blinking loop to be used to indicate failures. This function never exits.

Downloaded from Datasheet.su

[+] Feedback

3.5 Example Project Build

This section provides step-by-step instructions for building a project using the CY4631 RDK Mouse with PSoC Designer 5.0. This shows the basic use of the PSoC Designer and PSoC Programmer tools, and how to make basic changes to the firmware and operation of the mouse.

3.5.1 Project Change

For this example, assume that the designer wishes to change the behavior of the logo LED. In normal operation, the logo LED is illuminated when the mouse is in motion. In this example, the firmware is changed so that the logo LED is on at all times.

3.5.2 Step-By-Step Changes

3.5.2.1 Step 1 - Launch PSoC Designer

The first step is to open the project in PSoC Designer by double-clicking the *OvationONSII_Wired_RDK.app* file in the project's directory. After PSoC Designer is launched, the main screen can be seen.

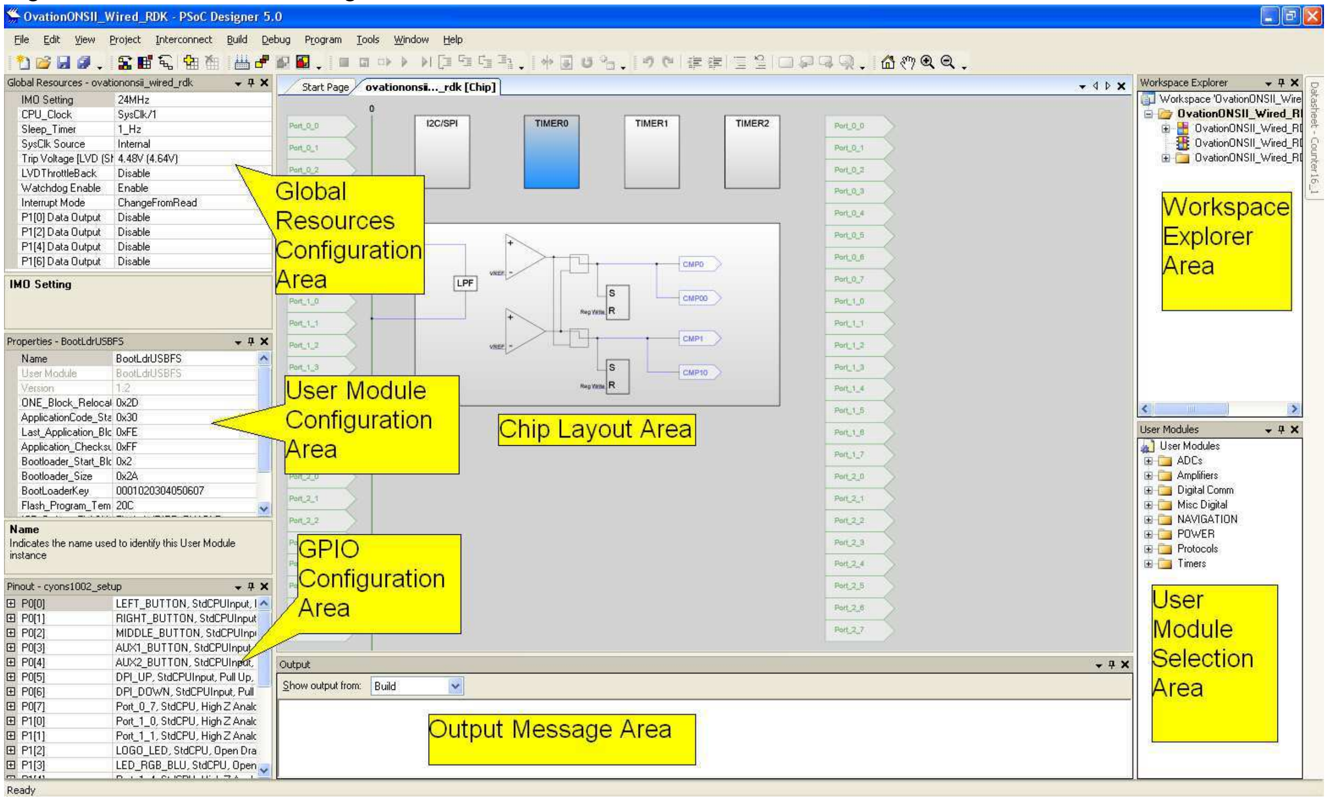
The areas of the PSoC Designer screen as follows:

- Global Resource Configuration Area - This area allows selections of global parameters of the device, such as clock speed,
- User Module Configuration Area - This area allows changes to the configuration settings of each user module. The active user module in this window is selected in the User Module Selection Area.
- GPIO Configuration Area - This area is used to configure the GPIO's, including the GPIO name, drive mode, and interrupt enable/disable.
- Chip Layout Area - This area shows the layout of the chip, showing the hardware-based interconnection among the GPIO's, mux buses, and user module blocks.
- Workspace Explorer Area - This area allows the user to navigate to all the files in the solution workspace, including source files, library files, output files, and user module documentation.
- User Module Selection Area - This area allows User Modules to be selected, named, and placed in the design.
- Output Message Area - This text area gives results of any actions taken by the user, such as error messages that may result from a project build.

Downloaded from Datasheet.su

[+] Feedback

Figure 3-2. Main PSoC Designer Screen



Global Resources - ovationonsii_wired_rdk

IMO Setting	24MHz
CPU_Clock	SysClk/1
Sleep_Timer	1_Hz
SysClk Source	Internal
Trip Voltage [LVD (SM	4.48V (4.64V)
LVDThrottleBack	Disable
Watchdog Enable	Enable
Interrupt Mode	ChangeFromRead
P1[0] Data Output	Disable
P1[2] Data Output	Disable
P1[4] Data Output	Disable
P1[6] Data Output	Disable

IMO Setting

Properties - BootLdrUSBFS

Name	BootLdrUSBFS
User Module	BootLdrUSBFS
Version	1.2
ONE_Block_Relocat	0x2D
ApplicationCode_Sta	0x30
Last_Application_Blc	0xFE
Application_Checksu	0xFF
Bootloader_Start_Blc	0x2
Bootloader_Size	0x2A
BootLoaderKey	0001020304050607
Flash_Program_Tem	20C

Name
Indicates the name used to identify this User Module instance

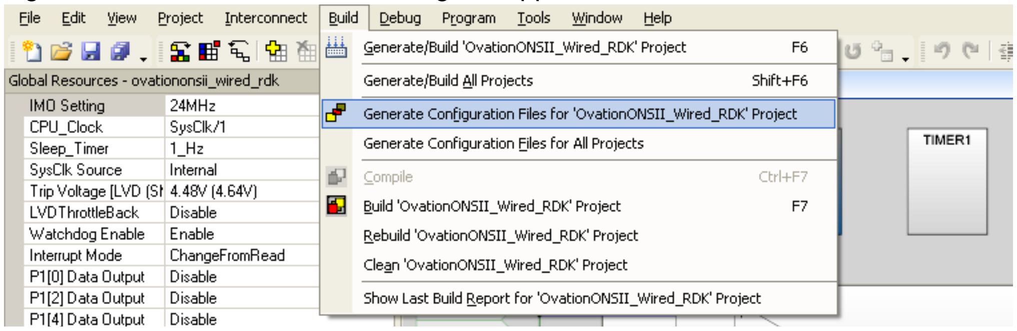
Pinout - cyons1002_setup

P0[0]	LEFT_BUTTON, StdCPUInput, I
P0[1]	RIGHT_BUTTON, StdCPUInput
P0[2]	MIDDLE_BUTTON, StdCPUInpu
P0[3]	AUX1_BUTTON, StdCPUInput
P0[4]	AUX2_BUTTON, StdCPUInput,
P0[5]	DPI_UP, StdCPUInput, Pull Up,
P0[6]	DPI_DOWN, StdCPUInput, Pull
P0[7]	Port_0_7, StdCPU, High Z Analc
P1[0]	Port_1_0, StdCPU, High Z Analc
P1[1]	Port_1_1, StdCPU, High Z Analc
P1[2]	LOGO_LED, StdCPU, Open Dra
P1[3]	LED_RGB_BLU, StdCPU, Open

3.5.2.2 *Step 2 - Generate the Application*

The next step is to generate the application, by selecting **Generate Configuration Files** under the **Build** menu item, or by clicking on the **Generate Configuration Files** icon. This creates the required library source files based on the configuration settings and user module selections.

Figure 3-3. Menu Item for Generating the Application


File Edit View Project Interconnect Build Debug Program Tools Window Help
Generate/Build 'OvationONSII_Wired_RDK' Project F6
Generate/Build All Projects Shift+F6
Generate Configuration Files for 'OvationONSII_Wired_RDK' Project
Generate Configuration Files for All Projects
Compile Ctrl+F7
Build 'OvationONSII_Wired_RDK' Project F7
Rebuild 'OvationONSII_Wired_RDK' Project
Clean 'OvationONSII_Wired_RDK' Project
Show Last Build Report for 'OvationONSII_Wired_RDK' Project
TIMER1

Global Resources - ovationonsii_wired_rdk

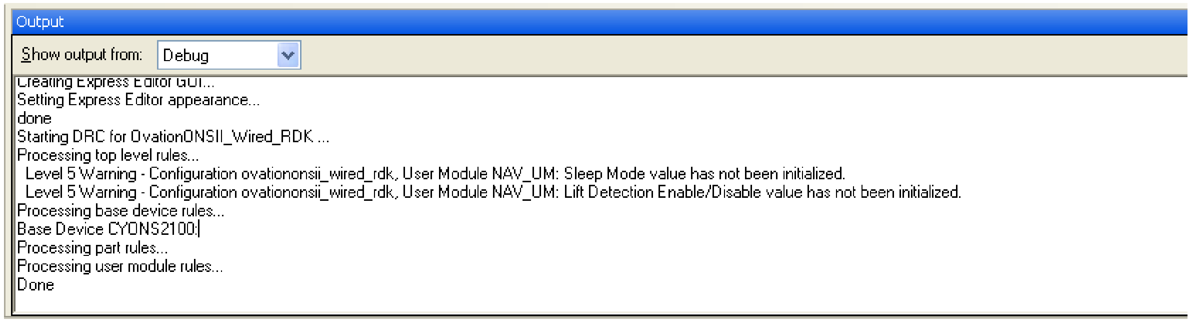
IMO Setting	24MHz
CPU_Clock	SysClk/1
Sleep_Timer	1_Hz
SysClk Source	Internal
Trip Voltage [LVD (SM	4.48V (4.64V)
LVDThrottleBack	Disable
Watchdog Enable	Enable
Interrupt Mode	ChangeFromRead
P1[0] Data Output	Disable
P1[2] Data Output	Disable
P1[4] Data Output	Disable

3.5.2.3 *Step 3 - Check for Errors*

Next, check the Output Message Area to confirm that there were no errors resulting from the previous step.

Downloaded from Datasheet.su [+] Feedback

Figure 3-4. Checking the Output Window for Errors

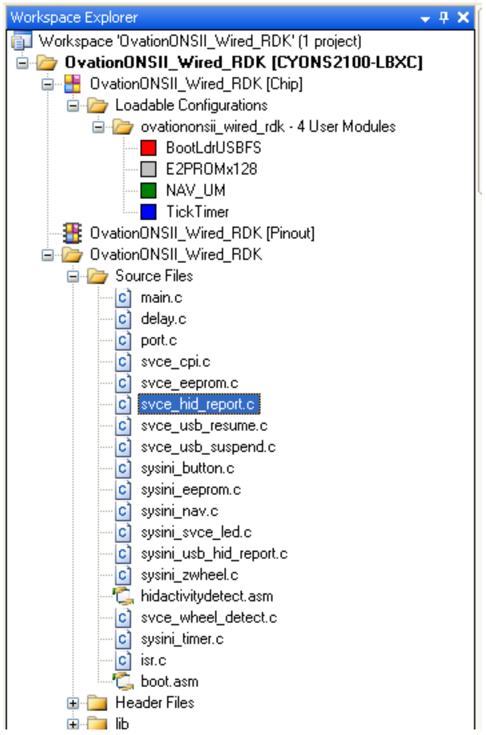


```
Creating Express Editor GUI...
Setting Express Editor appearance...
done
Starting DRC for OvationONSII_Wired_RDK ...
Processing top level rules...
  Level 5 Warning - Configuration ovationonsii_wired_rdk, User Module NAV_UM: Sleep Mode value has not been initialized.
  Level 5 Warning - Configuration ovationonsii_wired_rdk, User Module NAV_UM: Lift Detection Enable/Disable value has not been initialized.
Processing base device rules...
Base Device CYONS2100:
Processing part rules...
Processing user module rules...
Done
```

3.5.2.4 Step 4 - Open the Appropriate Source File

The next step is to make the desired firmware change. This is accomplished by opening the source file *svce_hid_report.c*, by double-clicking the file name in the expanded Workspace Explorer Area.

Figure 3-5. Opening *svce_hid_report.c*



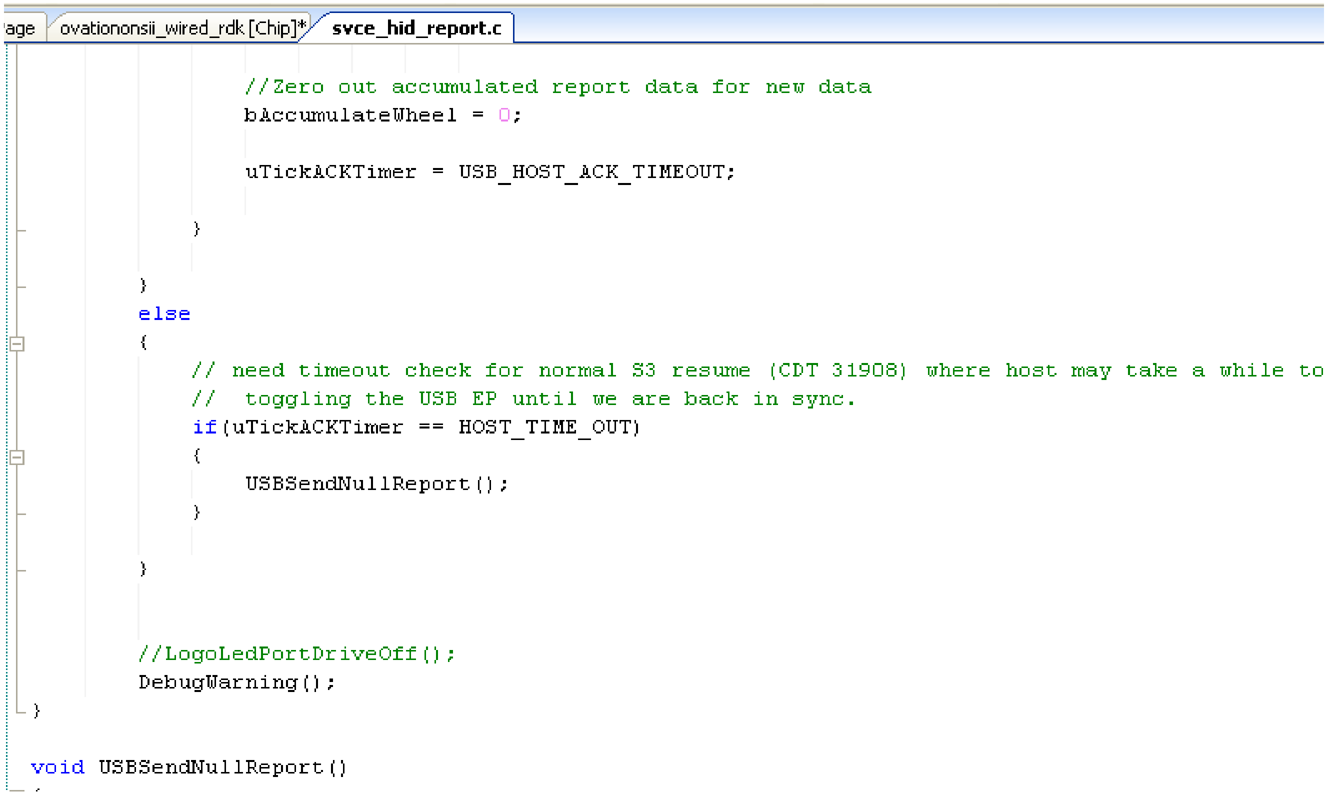
```
Workspace 'OvationONSII_Wired_RDK' (1 project)
  OvationONSII_Wired_RDK [CYONS2100-LBXC]
    OvationONSII_Wired_RDK [Chip]
      Loadable Configurations
        ovationonsii_wired_rdk - 4 User Modules
          BootLdrUSBFS
          E2PROMx128
          NAV_UM
          TickTimer
    OvationONSII_Wired_RDK [Pinout]
    OvationONSII_Wired_RDK
      Source Files
        main.c
        delay.c
        port.c
        svce_cpi.c
        svce_eeprom.c
        svce_hid_report.c
        svce_usb_resume.c
        svce_usb_suspend.c
        sysini_button.c
        sysini_eeprom.c
        sysini_nav.c
        sysini_svce_led.c
        sysini_usb_hid_report.c
        sysini_zwheel.c
        hidactivitydetect.asm
        svce_wheel_detect.c
        sysini_timer.c
        isr.c
        boot.asm
      Header Files
      lib
```

3.5.2.5 Step 5 - Edit the Source File

To make the change to the logo LED, just comment out the line of code that turns it off. In the version below, this is accomplished by commenting out line 147.

Downloaded from Datasheet.su [+] Feedback

Comment out line 147to leave the logo LED on

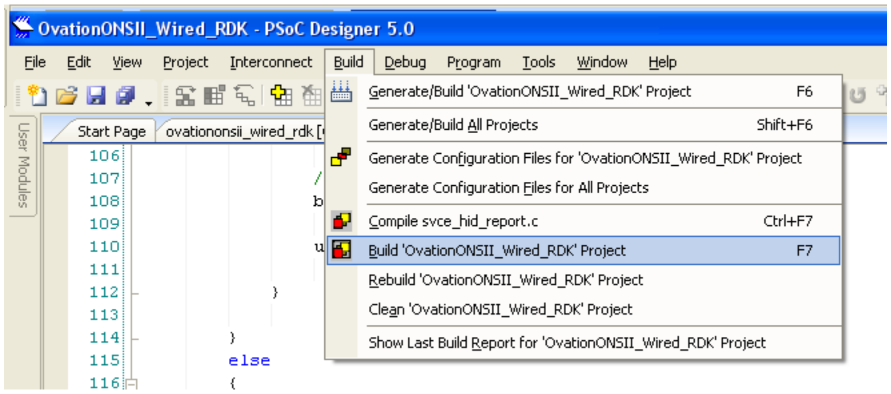


```
age | ovationonsii_wired_rdk [Chip]* | svce_hid_report.c

                    //Zero out accumulated report data for new data
                    bAccumulateWheel = 0;

                    uTickACKTimer = USB_HOST_ACK_TIMEOUT;

                }

            }
            else
            {
                // need timeout check for normal S3 resume (CDT 31908) where host may take a while to
                //  toggling the USB EP until we are back in sync.
                if(uTickACKTimer == HOST_TIME_OUT)
                {
                    USBSendNullReport();
                }

            }


            //LogoLedPortDriveOff();
            DebugWarning();
}

void USBSendNullReport()
```

3.5.2.6 Step 6 - Build the Solution

Next, build the solution by selecting **Build** from the **Build** menu, or by directly clicking the Build icon. As before, check the Output Message Area for any errors.

Figure 3-6. Build the Solution



OvationONSII_Wired_RDK - PSoC Designer 5.0

```
Generate/Build 'OvationONSII_Wired_RDK' Project                 F6
Generate/Build All Projects                                     Shift+F6
Generate Configuration Files for 'OvationONSII_Wired_RDK' Project
Generate Configuration Files for All Projects
Compile svce_hid_report.c                                       Ctrl+F7
Build 'OvationONSII_Wired_RDK' Project                          F7
Rebuild 'OvationONSII_Wired_RDK' Project
Clean 'OvationONSII_Wired_RDK' Project
Show Last Build Report for 'OvationONSII_Wired_RDK' Project
```

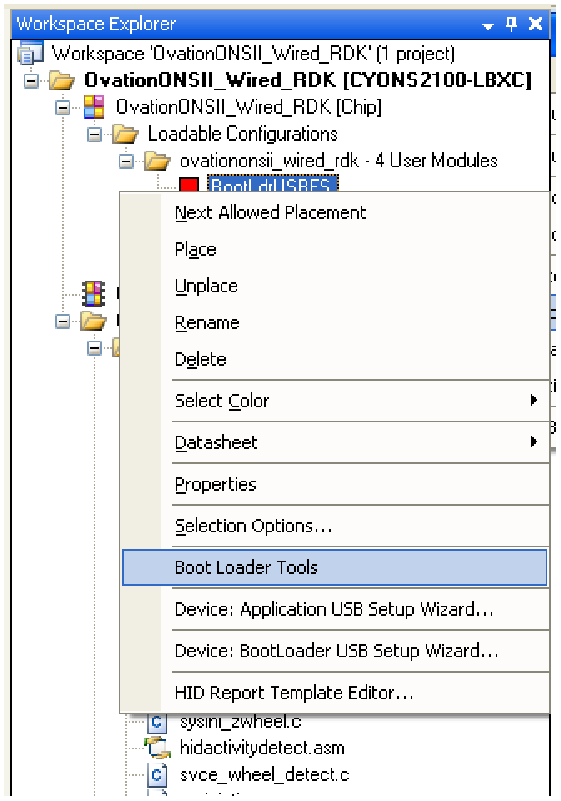
3.5.2.7 Step 7 - Launch Bootloader Tools

One complication of the bootloader function is that two checksums must be recorded. The first is the overall checksum of the entire firmware image. The second is the checksum of the application portion of the firmware. Because the overall checksum is affected by the application checksum, the project must be built twice. In the second build, the application checksum is known, and used to generate the overall checksum.

Downloaded from Datasheet.su [+] Feedback

Tools for the second build are available as **Boot Loader Tools**, which is accessible from the Workspace Explorer Area. Right-click the bootloader user module, and select **Boot Loader Tools** to open the bootloader tools window.

Figure 3-7. Launching the Bootloader Tools

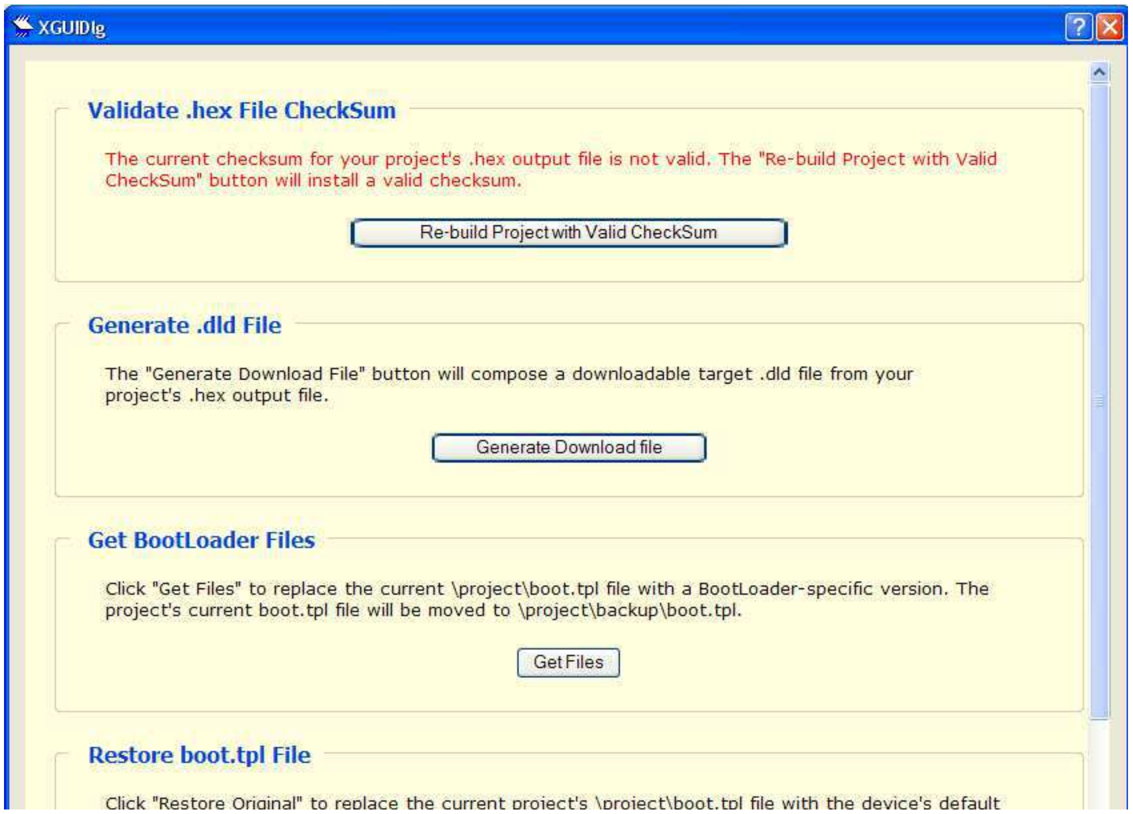

Workspace Explorer
Workspace 'OvationONSII_Wired_RDK' (1 project)
OvationONSII_Wired_RDK [CYONS2100-LBXC]
OvationONSII_Wired_RDK [Chip]
Loadable Configurations
ovationonsii_wired_rdk - 4 User Modules
BootLdrUSBFS
Next Allowed Placement
Place
Unplace
Rename
Delete
Select Color
Datasheet
Properties
Selection Options...
Boot Loader Tools
Device: Application USB Setup Wizard...
Device: BootLoader USB Setup Wizard...
HID Report Template Editor...
sysint_zwheel.c
hidactivitydetect.asm
svce_wheel_detect.c

3.5.2.8 *Step 8 - Rebuild Project with Valid Checksum*

Click on the **Rebuild Project with Valid Check Sum** button to perform the second build. When complete, there should be a green message indicating success.

Downloaded from Datasheet.su
[+] Feedback

Figure 3-8. Rebuilding with Valid Checksum



XGUIDlg

Validate .hex File CheckSum

The current checksum for your project's .hex output file is not valid. The "Re-build Project with Valid CheckSum" button will install a valid checksum.

Generate .dld File

The "Generate Download File" button will compose a downloadable target .dld file from your project's .hex output file.

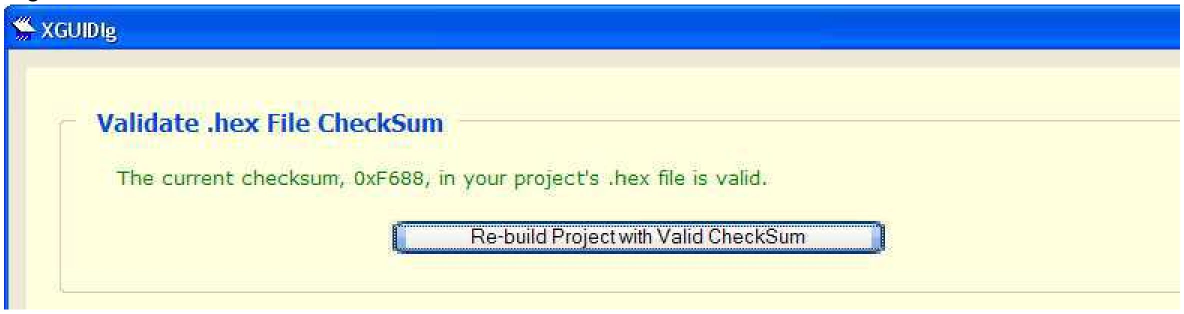
Get BootLoader Files

Click "Get Files" to replace the current \project\boot.tpl file with a BootLoader-specific version. The project's current boot.tpl file will be moved to \project\backup\boot.tpl.

Restore boot.tpl File

Click "Restore Original" to replace the current project's \project\boot.tpl file with the device's default

Figure 3-9. Successful Re-build



XGUIDlg

Validate .hex File CheckSum

The current checksum, 0xF688, in your project's .hex file is valid.

3.5.2.9 *Step 9 - Prepare to Program the Device*

The next step is to download the new code into the CYONS2100 device. First, set up the programming hardware:

- Plug the Cypress MiniProg into a USB port
- Plug the CY3655-PLG adapter board into the MiniProg. Make sure that the -PLG’s jumpers are set to the “E3” (Full-Speed USB) position, by connecting J3 pin 1 to pin 2, and pin 3 to pin 4.
- Plug the CY4631 RDK Mouse into the other side of the CY3655-PLG

Next, launch PSoC Programmer by selecting **PSoC Programmer** from the **Program** menu item.

Downloaded from Datasheet.su

Figure 3-10. Launching PSoC Programmer

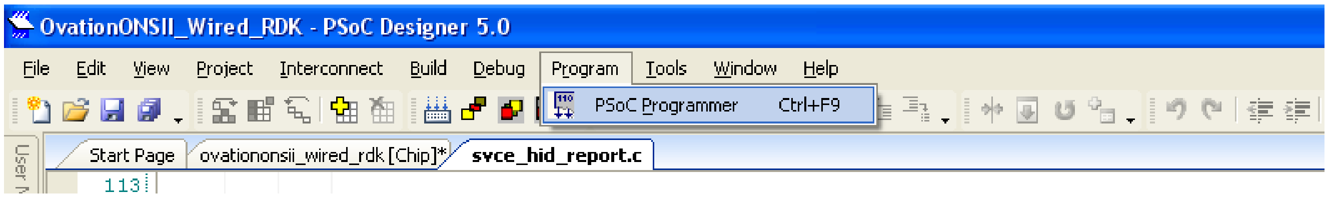
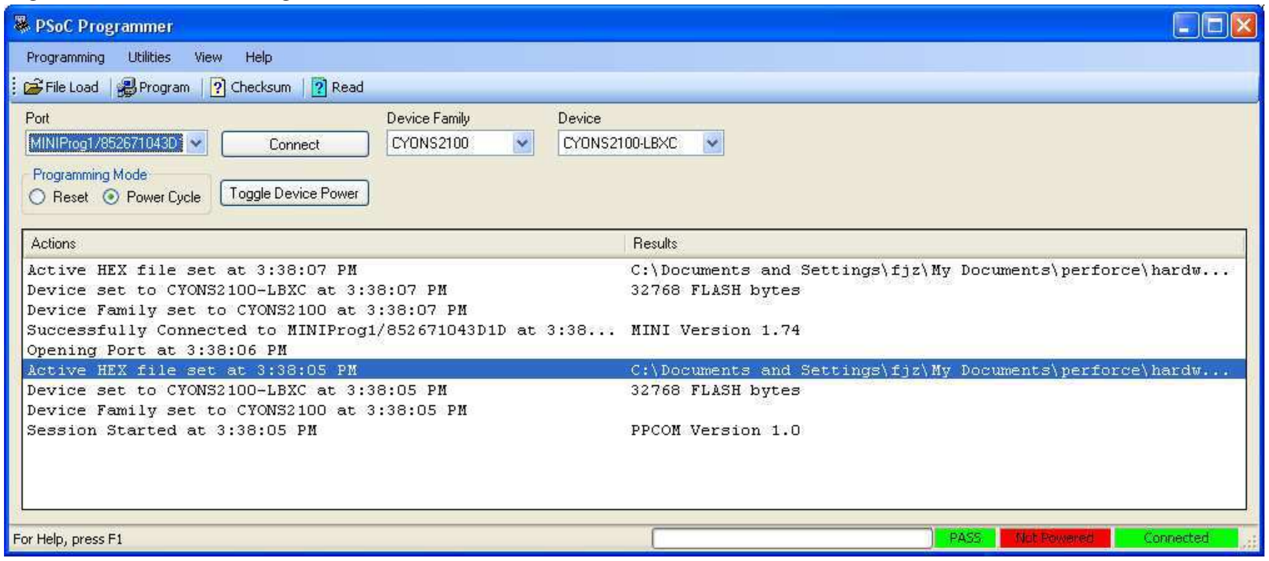


Figure 3-11. PSoC Programmer

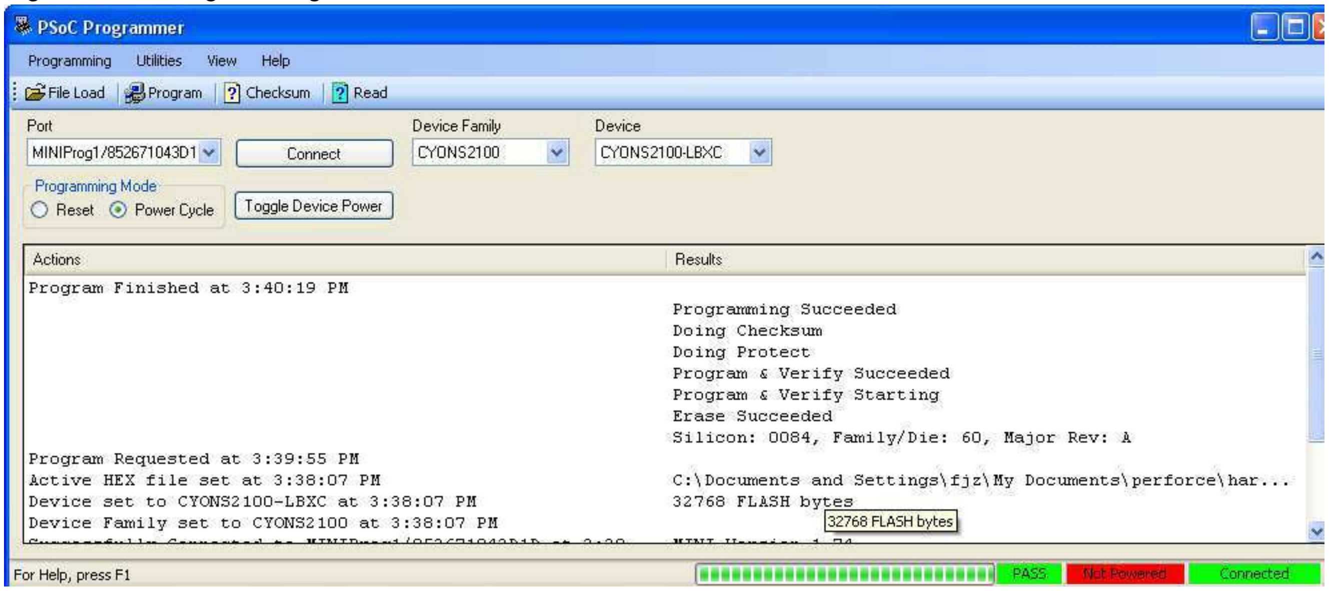


```
Actions                                                    Results
Active HEX file set at 3:38:07 PM                          C:\Documents and Settings\fjz\My Documents\perforce\hardw...
Device set to CYONS2100-LBXC at 3:38:07 PM                 32768 FLASH bytes
Device Family set to CYONS2100 at 3:38:07 PM
Successfully Connected to MINIProg1/852671043D1D at 3:38...  MINI Version 1.74
Opening Port at 3:38:06 PM
Active HEX file set at 3:38:05 PM                          C:\Documents and Settings\fjz\My Documents\perforce\hardw...
Device set to CYONS2100-LBXC at 3:38:05 PM                 32768 FLASH bytes
Device Family set to CYONS2100 at 3:38:05 PM
Session Started at 3:38:05 PM                              PPCOM Version 1.0
```

3.5.2.10 *Step 10 - Program the Device*

Before programming the device, make sure the firmware version of the MiniProg is 1.74 or later. If needed, upgrade the MiniProg firmware by selecting **Utilities**, then **Upgrade Firmware**. When complete, click the **Program** button, and wait for programming, and verify that the programming succeeds.

Figure 3-12. Programming the Device



```
Actions                                         Results
Program Finished at 3:40:19 PM
                                                Programming Succeeded
                                                Doing Checksum
                                                Doing Protect
                                                Program & Verify Succeeded
                                                Program & Verify Starting
                                                Erase Succeeded
                                                Silicon: 0084, Family/Die: 60, Major Rev: A
Program Requested at 3:39:55 PM
Active HEX file set at 3:38:07 PM               C:\Documents and Settings\fjz\My Documents\perforce\har...
Device set to CYONS2100-LBXC at 3:38:07 PM      32768 FLASH bytes
Device Family set to CYONS2100 at 3:38:07 PM
```

Downloaded from Datasheet.su

3.5.2.11 Step 11 - Test

Remove the RDK Mouse from the CY3655-PLG and plug it into the PC. The logo LED should stay lit at all times. At this point, you have successfully modified the RDK mouse firmware.

Downloaded from Datasheet.su

[+] Feedback

4. Regulatory Tests

4.1 Introduction

The CY4631 Wired Mouse Reference Design has been successfully tested for compliance with several regulatory and standards body requirements. This section lists the tests and results of those tests.

4.2 USB

The CY4631 was successfully tested as a full-speed device against the following USB specifications.

- USB 2.0, Chapter 7
- USB 2.0, Chapter 8
- USB 2.0, Chapter 9
- HID Class Specification version 1.1

4.3 FCC

The CY4631 was successfully for radiated and conducted emissions against the requirements of FCC Part 15, Subclass B, for a class B digital device.

4.4 ESD

The CY4631 was successfully for ESD immunity using standard EN55024, up to a level of 8 kV.

4.5 WLK

The CY4631 successfully passed Windows Logo Kit testing on SMSC and Cypress based hubs. Other hubs exhibited failures with full-speed mice. If you are experiencing failures during WLK testing, do contact Cypress Applications, and reference “CDT32379”.

Downloaded from Datasheet.su

Downloaded from Datasheet.su

[+] Feedback