CIRQUE®

Application Note: GP-AN-070409

Designing a Dual PS/2 Touch Stick/Touchpad Controller

This application note provides the electronic design required to integrate a combination touch stick/touchpad PS/2 controller into products with a single PS/2 port. The implementation allows the touch stick and touchpad to operate independently or simultaneously.

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Revision History

Date	Previous Revision	Current Revision	Description

Introduction

Touchpads and touch sticks together are widely used in many laptop computer applications. This application note provides a design that utilizes a microcontroller to combine the touch stick and touchpad data streams into a single PS/2 data stream. The design incorporates Cirque's expertise combining touchpad with touch sticks and has been tested to pass all Microsoft WHQL tests and is suitable for commercial applications.

Reference Design Characteristics

Benefits

- Proven PS/2 interface design
- Turnkey Solution (reduces integration and development time)
- Microsoft WHQL approved
- Interfaces to any standard PS/2 touch stick
- Generic touch stick and Cirque touchpad with standard Windows® drivers
- Plug & Play operation

Available Design Aids

- Reference Design
- PS/2 microcontroller firmware

Touchpad Support

- Cirque TSM series OEM touchpads
- Standard touchpad features:
  - Left/Right buttons
  - Vertical Scroll
  - Taps
  - Taps & Drag
- Advanced Touchpad features:
  - Independent Touch stick/Touchpad enable/disable

Overview

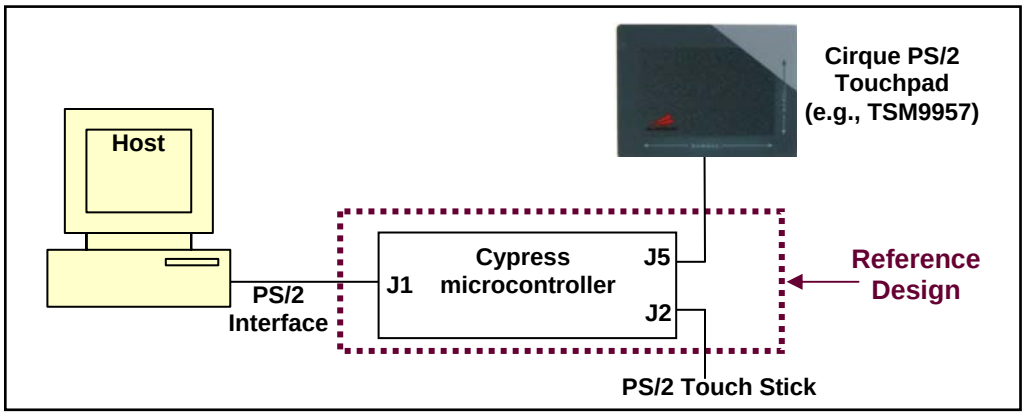

Figure 1: Block diagram of PS/2 touch stick and touchpad

The Reference Design provided uses microcontroller firmware to process mouse data protocol from a Cirque touchpad and merge it with the mouse data protocol of a PS/2 touch stick. The firmware handles all the PS/2 commands to initialize and configure both the touch stick and the touchpad.

The major elements of the Reference Design (see Figure 1) include:

1. A Cirque TSM series touchpad –
   Recommended modules include the TSM9910, TSM9915, and TSM9957. Refer to the desired module specification for dimensions, pin-outs, and connectors for a particular Cirque touchpad module. Specifications can be requested from www.cirque.com.
2. A touch stick –
   The reference design is intended for use with PS/2 touch sticks. This reference design specifically incorporated a Minebea, LP Assy (134000-001). Due to possible unforeseen varieties of touch sticks, Cirque cannot guarantee functionality with all touch sticks.
3. A Cypress Encore II Microcontroller (CY7C63803) with *DUAL1-2_20070409.HEX* firmware –
   The firmware file, *DUAL1-2_20070409.HEX*, is available upon request from www.cirque.com.

Connection to Host Computer

The Host provides power to the reference design and transmits PS/2 commands to the touch stick and touchpad through the microcontroller. Table 1 shows the Host Connector signals.

Table 1: Host Connector Pinout

4	3	2	1
VDD (5V)	DATA	CLOCK	GND

Connection to Touch Stick

PS/2 signals and power to the touch stick are routed as shown in **Table 2**.

Table 2: Touch Stick Connector

4	3	2	1
VDD (5 Volts)	GND	CLK	DATA

Connection to Touchpad

The Cirque touchpad requires power, and PS/2 data and clock signals. Depending on the touchpad module selected, it may have inputs available for up to three (3) separate buttons (see Table 3).

Table 3: Touchpad Connector (pin-outs and button options vary for each module)

7	6	5	4	3	2	1
VDD (5 Volts)	GND	Primary Switch (LEFT)	Secondary Switch (RIGHT)	Auxiliary Switch (MIDDLE)	DATA	CLK

Microcontroller Pinout and Connections

The specific signals provided on the Cypress microcontroller are shown in Table 4. Connections between the controller, the host, the touchpad, and the touch stick are shown in Table 5. The signals pertaining to PS/2 device 1 (in this case, the touch stick) are prefaced with PS2_1. The device 2 (touchpad) signals are prefaced with PS2_2.

Table 4: Cypress Encore II Microcontroller (CY7C63803) Pinout

Pin	Signal Name	Function	Configured As	Input/Output
1	TIO1 / P0.6	General-purpose digital I/O pin Alt: Timer capture inputs or Timer output TIO1		
2	TIO0 / P0.5	General-purpose digital I/O pin Alt: Timer capture inputs or Timer output TIO0		
3	INT2 / P0.4	General-purpose digital I/O pin Alt: Optional rising edge interrupt	PS2_2_ENABLE	Input enable=0, disable=1
4	INT1 / P0.3	General-purpose digital I/O pin Alt: Optional rising edge interrupt		
5	INT0 / P0.2	General-purpose digital I/O pin Alt: Optional rising edge interrupt		
6	P0.1	General-purpose digital I/O pin Alt: Can be configured as clock out		
7	P0.0	General-purpose digital I/O pin Alt: Can be configured as external clock in	PS2_1_ENABLE	Input enable=0, disable=1
8	VSS	Ground Reference		
9	P1.0/D+	General-purpose digital I/O pin (If pin is used as an output, it will draw current.) Alt: USB D+		
10	P1.1/D-	General-purpose digital I/O pin (If pin is used as an output, it will draw current.) Alt: USB D-		
11	VCC	Supply Voltage		
12	P1.2 / VREG	General-purpose digital I/O pin Alt: Voltage Regulator (3.3V if Vreg. A 1-µFmin, 2-µF max capacitor is required on Vreg output.)	VReg (3VDD)	
13	P1.3 / SSEL	General-purpose digital I/O pin Alt: SSEL on SPI bus	PS2_1_SCLK	Output
14	P1.4 / SCLK	General-purpose digital I/O pin Alt: SCLK on SPI bus	PS2_1_SDATA	Input/Output
15	P1.5 / SMOSI	General-purpose digital I/O pin Alt: SMOSI on SPI bus	PS2_2_SCLK	Output
16	P1.6 / SMISO	General-purpose digital I/O pin Alt: SMISO on SPI bus	PS2_2_SDATA	Input/Output

Table 5: Component Connections to Microcontroller

Pin	Controller	System	Host	Touchpad	Touch Stick
1	P0.6				
2	P0.5				
3	P0.4	PS2_2_ENABLE (Input enable=0, disable=1)			
4	P0.3				
5	P0.2				
6	P0.1				
7	P0.0	PS2_1_ENABLE (Input enable=0, disable=1)			
8	VSS	Ground Reference			
9	P1.0		Clock		
10	P1.1		Data		
11	VCC		VDD		
12	P1.2 / VREG	Vreg			
13	P1.3 / SSEL				PS2_1_SCLK
14	P1.4 / SCLK				PS2_1_SDATA
15	P1.5 / SMOSI			PS2_2_SCLK	
16	P1.6 / SMISO			PS2_2_SDATA	

Reference Design Schematic

An overview schematic of the provided reference design is shown in Figure 2. Only the microcontroller pin numbers are labeled as the component pinouts will vary based on the touchpad module and touch stick selected.

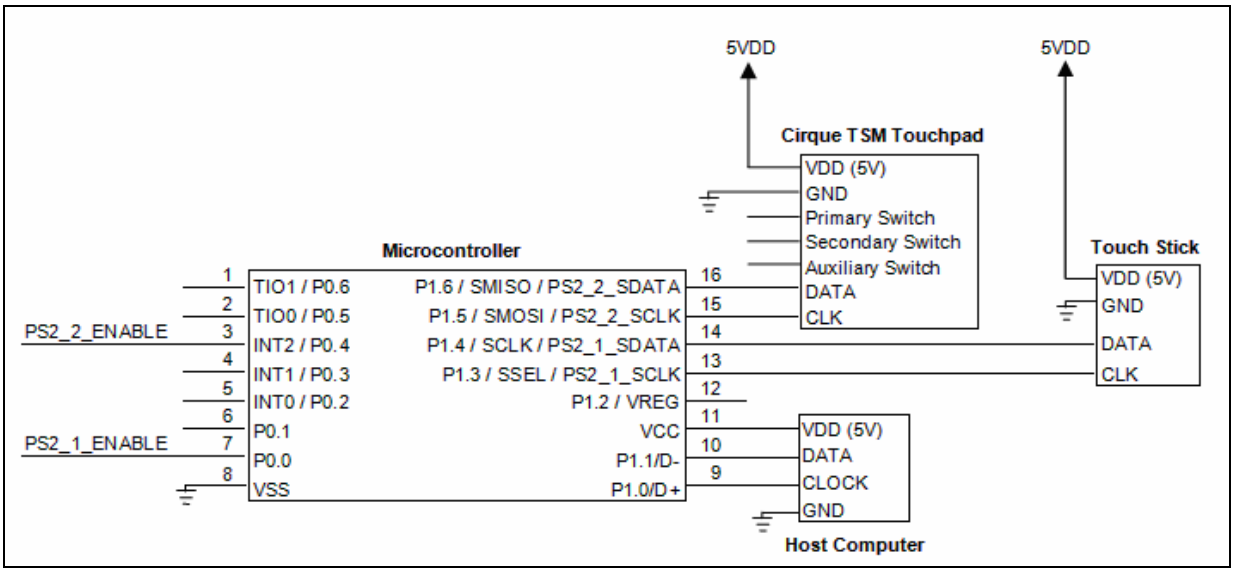

Figure 2: Dual PS/2 Touch Stick/Touchpad Controller Board Schematic

Operation

The core of the system is the microcontroller, which interfaces to the host through PS/2 client protocol and interfaces to the touch stick and touchpad on two independent PS/2 host protocol ports. The firmware implements a single standard mouse or pointing device in either standard "boot protocol" or wheel mouse "Intellimouse" mode. On the Cirque touchpad, Intellimouse mode is configured by a Hardware Configurable Option (HCO) on the Touchpad module. (See the desired Cirque touchpad module specification for further details.).

Microcontroller to Host

At power-on, the microcontroller initializes the touchpad and touch stick and queries each for Intellimouse capability. If Intellimouse capability is found, the associated device is configured for Intellimouse mode. The microcontroller responds to the Host PS/2 power-on command sequence and reports if the devices are Intellimouse capable.

Microcontroller to Touchpad/Touch Stick

Communication between the microcontroller and the touch stick and touchpad is also through PS/2 protocol. With a generic mouse driver, this interface operates with a minimal "boot protocol" (3 byte packet: set resolution to 8, set sample rate to 100, enable) or a wheel mode startup sequence to allow vertical scrolling (4 byte packet: minimal startup sequence plus wheel enable). (See the desired Cirque touchpad module specification for further details).

The touchpad and touch stick can be enabled and disabled independently or simultaneously at any time using the PS2_2_ENABLE and PS2_1_ENABLE pins. The host enables the desired device by setting the corresponding enable pin low (0) and disables it by setting the pin high(1).

Data from each device is merged into one PS/2 data stream. The Cirque touchpads (depending on the TSM module selected) have button inputs (up to three possible). Button status is passed to the host in the PS2 data stream. If the touch stick also has buttons, the button status of the two devices are combined using the OR operand to allow button clicks from either device the user chooses.

Programming the Microcontroller

The Cypress microcontroller can be programmed with the reference design firmware using a Cypress PSoC MiniProg through a USB connector prior to being incorporated into the reference design. The Cypress PSoC MiniProg is available directly from Cypress. The necessary firmware file, *DUAL1-2_20070409.HEX*, is available upon request from www.cirque.com.

Design Guidelines

Some additional design factors to consider include:

- Cirque touchpads support a special touch region (a strip on the right edge for vertical scrolling). Scrolling can be disabled through Hardware Configurable Options on the touchpad (see the desired Cirque touchpad module specification for further details).
- Cirque "Extended Mode" is not supported in this reference design. Therefore, Cirque drivers will not be required, and additional features provided with the driver will not be available.
- Care must be taken to properly mount the touchpad module as described in the specification for the desired module.

For further assistance, contact Cirque Corporation Customer Support (*www.cirque.com*).

Cirque Information

Order TSM modules, download product sheets, or contact a Cirque sales representative for a complete list of Cirque's OEM products.

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