

TM080048-1 TrackPad

Specification

Document Version 2.1

DECEMBER 2015



This document describes Cirque's TM080048-1 trackpad (79.70 x 47.70 mm, 10 - pin connector, 3.0-5.5 Voltage, USB, or I2C interface).

Sample hardware and firmware are available upon request. See [page 20](#) for ordering information.

Document Version History

Date	Current Version	Description
NOVEMBER 2014	1.0	Initial documentation created.
JANUARY 2015	1.1	Added 1.3 firmware version power specification.
DECEMBER 2015	2.0	Updated for Rev B board information.
NOVEMBER 2016	2.1	Updated Sample Rate vs Tracking Speed data. Edited for readability.

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Table of Contents

TM080048-1 Trackpad Overview	4
Gen 4 Product Line Benefits	5
General Specifications	6
Physical Dimensions	8
Interface Specifications	9
Buttons	10
Interface Specifications	11
I2C HID Communication	11
USB Communication	11
User Interaction	13
Configurable Options	13
Advanced Gestures (AG)	13
GlideExtend	15
Overlay Specifications	16
Bezel Design Recommendations	17
Mounting Design Recommendations	18
ESD Protection and EMI Specification	19
EMI Specification	19
Contact Information	20
Part Ordering Information	20

TM080048-1 Trackpad Overview

The TM080048-1 trackpad is an embedded Universal Serial Bus[®] (USB) or Inter-Integrated Circuit[®] (I2C) device. The dimensions of the TM080048-1 make it ideal for notebook computer pointing devices, and a variety of products. An example of the trackpad is shown in [Figure 1](#).

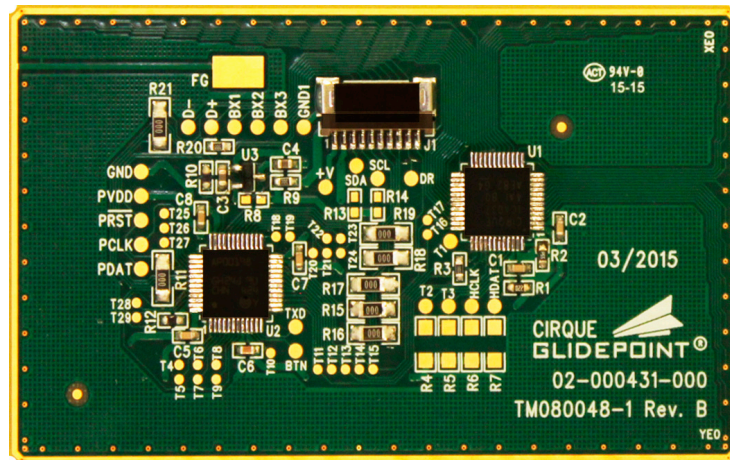


Figure 1. The Component Side of the TM080048-1 Trackpad

This document describes the mechanical and electrical specifications for the TM080048-1 trackpad solution. It also describes how an external host controller can interface with the Cirque TM080048-1 solution using the USB/I2C communication protocols. Suggested design considerations are also covered.

Benefits of the TM080048-1 Trackpad

Cirque's latest generation of trackpads define the standard for the pointing device industry. These solid-state devices are extremely durable because they have no moving parts to break down. This as well as the following benefits, makes the TM080048-1 an ideal solution for integration.

- | | |
|---|--|
| <ul style="list-style-type: none"> • Uses Cirque's Gen 4 technology. • Field upgradable. • Built-in precise positioning. • Superior navigation and high responsiveness. • Environmentally sealed design. • Adaptable and collaborative support for integrating this solution into your product. | <ul style="list-style-type: none"> • Gestures work on all supported applications. • Able to track five points and report X and Y data. • Swipe Gestures available. • Built-in palm rejection. • Highly reliable and durable. • Advanced, multi-touch gestures without requiring an additional driver installation. |
|---|--|

Gen 4 Product Line Benefits

The GlidePoint Gen 4 image sensor uses a proprietary analog front end and customized MCU with flash memory, which provides the following benefits:

- Native multi-touch gestures - no additional driver installation is required.
- Built-in palm rejection technology.
- Optimized for the I2C and USB protocol.
- Excellent processing and measurement.
- Exceptional noise immunity.
- Superior default motion.

Cirque's GlidePoint trackpads operate as a standard mouse, and provide smooth and precise cursor control with no additional software for basic functions. The trackpad accurately responds to even the smallest finger movements; simply:

- Move a finger across the trackpad to move the cursor.
- Tap the pad to click.
- Tap the pad twice to double-click.
- Tap twice and then hold to drag, draw, and highlight.

Previously, it was necessary to install a driver for advanced gestures. Gen 4 provides multi-touch, gestures (that is, advanced scroll, zoom, and other gesture capabilities) regardless of the operating system¹. For more information about Advanced Gestures, see [page 13](#).

The firmware in Gen 4 trackpads includes superior cursor ballistics that have been optimized for best performance. This ballistics optimization provides enhanced precision and cursor control. The palm rejection technology in the Gen 4 firmware detects large objects touching the trackpad. When a large object or multiple objects are on the trackpad, cursor movement is prevented.

¹ Gestures are dependent on the application. If the application supports the keystroke short cut, the gesture will occur regardless of the OS.

General Specifications

Operational Specifications

Position Detection Method:	Mutual capacitance sensing
X/Y Position Sensing Resolution:	Up to 60 counts/mm
X/Y Position Reporting:	Relative (similar to a mouse) or Absolute (via a register write)
Touch Force:	No contact pressure required
Lifetime (Cirque Plastic Overlay):	Minimum 10,000,000 strokes (500 km)
	Note These specifications are for Cirque's overlay. A custom overlay would need to be tested. See Overlay Specifications on page 16 .
Sample Rate:	Up to 100 samples/sec

Environmental Specifications

Operating Temperature: (Measured on Component Side.)	-40 to 85 °C
Operating Humidity at High Temperature:	Up to 95% relative humidity (Non-condensing)*
Storage Temperature:	-40 to 125 °C
Storage Humidity:	5% to 95% relative humidity (Non-condensing)*
ESD: (Applied to sensing surface.)	Up to ±15 kV when module is properly installed

* Only for Humidity Test, all other tests, Humidity is not controlled.

Note: For more information, see the [CT-120305 Environmental Test document](#).

Interface Specifications

Communication Protocol:	USB or I2C
Driver Requirements:	No additional driver installation required
	Note A Cirque driver is not currently available for this product.
Mechanical Buttons:	Supports up to three buttons

Note: I2C must be supported by the OS to use the I2C version of the trackpad.

Physical Specifications

Module Thickness:	4.90 mm Max (PCB + Overlay + Components) 1.90 mm \pm 0.25 (PCB + Overlay)
Module Length:	79.70 \pm 0.25 mm
Module Width:	47.70 \pm 0.25 mm
Module Weight:	< 14 Grams
Active Sensing Area:	77.20 x 45.20 \pm 0.25 mm

Note: See [Physical Dimensions on page 8](#) for detailed dimensions.

Typical Electrical Specifications

Note: Cirque uses Microsoft's power-consumption requirement formula:
(0.9 x IDLE Power Consumption in mA) + (0.1 x Active Power Consumption in mA)
This formula is described in the [Windows Precision Touchpad Implementation Guide](#), which can be downloaded from [Microsoft's web site](#)

I2C Average Voltage Range: 3.0 to 5.5 Volts

Note: All power specifications are typical values.

Average power consumption:	1.9 mA
*Shutdown	20 μ A
Idle:	0.1 mA
Active - Not Touched:	0.5mA
Active - Touched:	18 mA

* Shutdown is activated by software command from the host. The trackpad returns to the Active mode by a button press or a command can be sent to exit shutdown mode.

USB Average Voltage Range: 3.0 to 5.5 Volts

Note: All power specifications are typical values.

Suspend - not wake-enabled:	0.3 mA
Suspend - wake-enabled:	0.7 mA
Active - Touched:	19 mA
Idle	N/A*

*Idle mode is not supported by USB modules.

Physical Dimensions

The physical dimensions for the Component, Sensor, and Side Views are provided below.

Note: Unless otherwise noted,

- All dimensions shown in mechanical drawings are in millimeters and are not to scale.
- All dimensional tolerances are ± 0.15 mm.

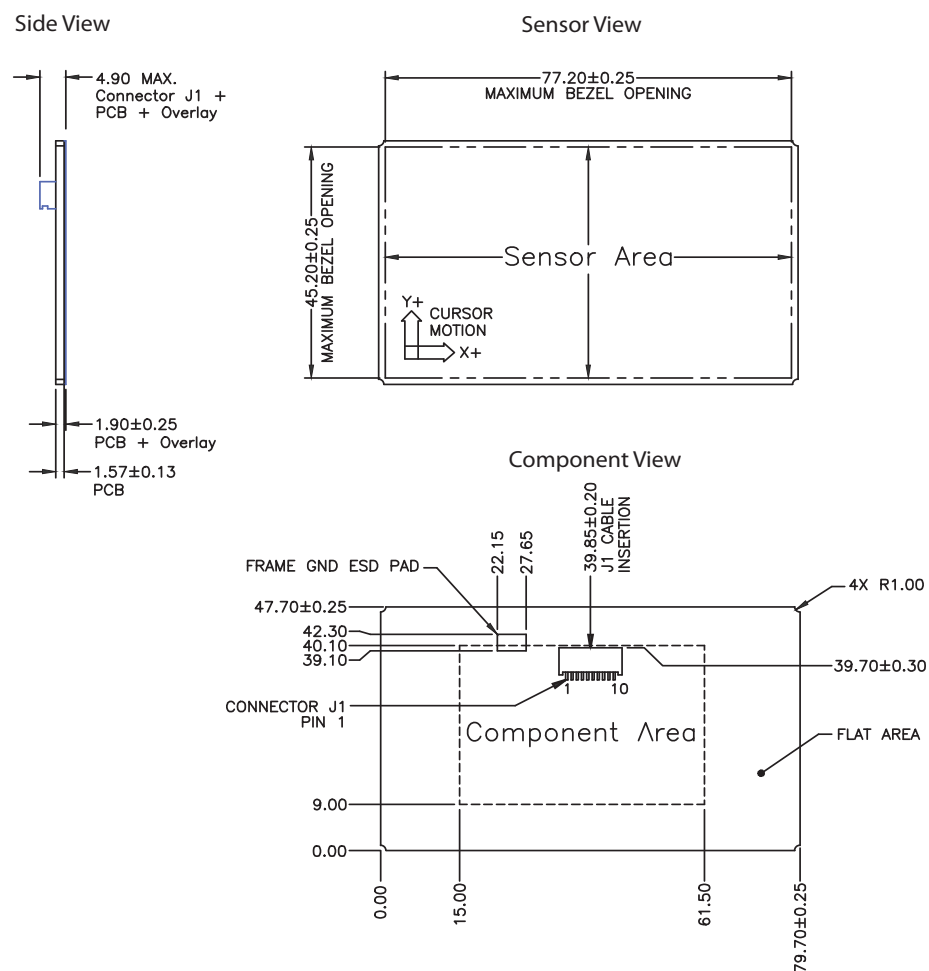


Figure 2. TM080048-1 Design Dimensions - Side, Sensor, and Component Views

Interface Specifications

This section describes how the module connects or communicates to the host.

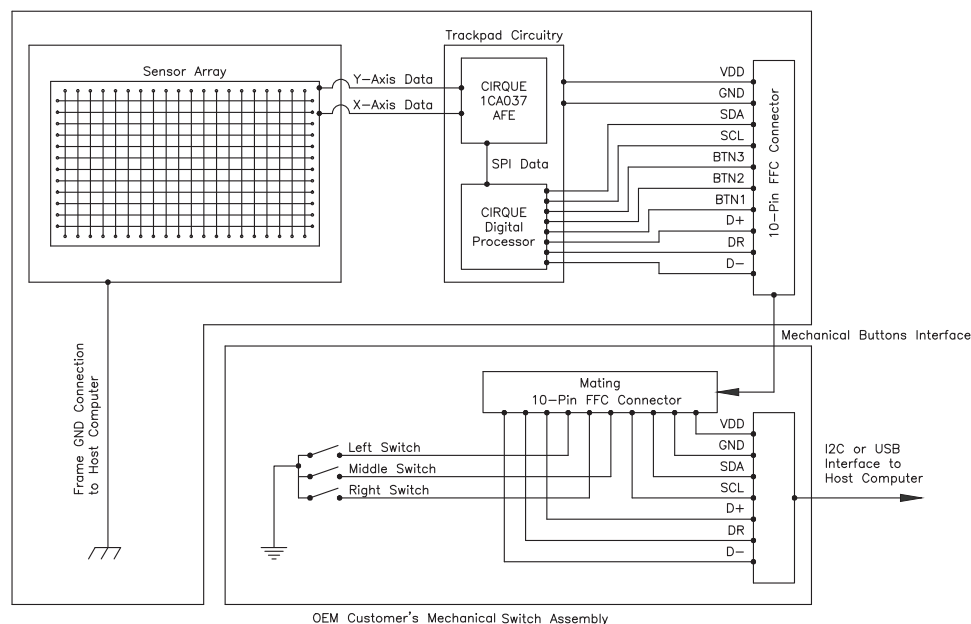


Figure 3. TM080048-1 System Interface Block Diagram

Connection to Host Computer

The 10-pin connector mounted on the trackpad module supports power supply, up to three separate button functions (primary, secondary, and auxiliary input), and I2C signals (see [Table 1](#) below).

Table 1. Pin Order for J1-10-Pin Connector

1	2	3	4	5	6	7	8	9	10
VDD	Ground	SDA	SCL	BTN3	BTN2	BTN1	D+	DR	D-

The connecting cable and mating connector are not included with the module. Both can be included as an additional option. See [Table 2](#) and [Table 3](#) on page 10 for supplier and manufacturing information.

Table 2. FFC Cable Manufacturing Sources

Manufacturer	Description	Part Number
Axon Cable, Inc. (www.axon-cable.com)	Custom length FFC cable	FFC1.00A10/XXXXE4.0-4.0-06.0-06.0FB (Replace XXXX with desired insulated length in mm)
DigiKey (http://www.digikey.com)	Flat Flex, Ribbon Jumper cable	WM100xx-ND (Replace XXX with desired length in mm)

Table 3. J1-Connector Manufacturing Sources

Manufacturer	Description	Part Number
J.S.T. Corporation (http://www.jst.com)	FFC Connector	10FMS-1.0SP-TF

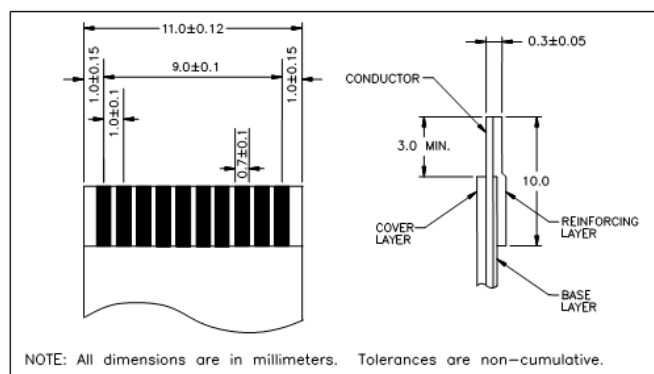


Figure 4. 10-pin, FFC/FPC Lead Section Dimensions

Buttons

The TM080048-1 can support up to three separate button inputs. OEM customers may design and manufacture their own mechanical switch assembly when integrating buttons into their own custom enclosure.

The 10-pin flexible flat cable (FFC) must route signals from the trackpad module to a mating connector on the switch assembly. (For manufacturer information, see [Table 2 on page 9](#) and [Table 3 on page 10](#).) An additional connector on the switch assembly is required in order to route power, signal ground, and data signals to the host computer (see [Figure 2 on page 8](#)).

The location and physical shape of buttons is open to the discretion of the OEM customer. For ergonomic reasons, low-profile switch caps should be located near the bottom edge of the bezel window. Cirque recommends switch cap designs that are short but wide to prevent inadvertent button actuation while using the trackpad.

Interface Specifications

The TM080048-1 can be ordered as either an I2C or a USB device. This section describes these system interfaces, connector pins, and cables for both protocols.

I2C HID Communication

The I2C protocol is a simple and cost effective standard for reading position data. Further information regarding the I2C protocol is included in the [Interfacing to Cirque's GlidePoint Gen 4 through I2C](#) document. This document can be requested through Cirque's website (<http://www.cirque.com>).

USB Communication

USB communication between the TM080048-1 and the host computer is based upon USB HID class protocols as presented in the [Universal Serial Bus Specification, version 2.0](#) and [USB Class Definition for Human Interface Devices \(HID\), version 1.11](#).

The byte number value determines if the packet information is for a mouse or keyboard (see [Table 4](#) below). The Mouse packet is shown in [Table 5](#). The Keyboard packet is shown in [Table 6](#) below. [Table 7 on page 12](#), provides the data for specific gestures.

Table 4. Gen 4 Data Format - Byte Number

Byte Number	Name	Description
0	ReportID	The unique identification assigned to each report, which is used to distinguish between mouse and keyboard data. For example, the mouse packet's report ID is 6; a keyboard packet's report ID is 8.

Table 5. Mouse Packet Format - Report ID 6

Byte Number	Name	Description
1	Buttons	The button data.
2	X Delta	The X-motion deltas, signed 8-bit value.
3	Y Delta	The Y-motion deltas, signed 8-bit value.
4	Scroll Delta	The Vertical-scroll deltas, signed 8-bit value.
5	Pan Delta	The Horizontal-scroll deltas, signed 8-bit value.

Table 6. Keyboard Packet - Report ID 8

Byte Number	Name	Description							
		Bit 7 Right GUI	Bit 6 Right Alt	Bit 5 Right Shift	Bit 4 Right Ctrl	Bit 3 Left GUI	Bit 2 Left Alt	Bit 1 Left Shift	Bit 0 Left Ctrl
1	Modifier Keys								
2	Reserved	Reserved							
3	Keycode 1	- Report ID 8							
4	Keycode 2	Not used							
5	Keycode 3	Not used							
6	Keycode 4	Not used							
7	Keycode 5	Not used							
8	Keycode 6	Not used							

Table 7. Keycode Table for Keycode 1- of Report ID 8

Value	Gesture	Key	Description
7	Minimize all	Letter "D"	Used for the Windows Logo key + D key command.
80	Back command	Left arrow	Used for the Alt + left arrow function.
79	Forward command	Right arrow	Used for the Alt + right arrow function.
6	Windows 8 Right edge	Left "C"	Used for the Windows Logo key + C key command.
43	Windows 8 Left edge	Tab	Used for the Windows Logo key + Tab key command.
29	Windows 8 Top edge	Letter "Z"	Used for the Windows Logo key + Z key command.

Relative or Absolute Mode

Regardless of the protocol, positions may be reported in either relative or absolute mode. In relative mode, touch positions are reported in a comparative manner, the instantaneous position is always a DELTA, or change, with respect to the previous position. DELTAs are expressed in two's-complement notation. In absolute mode, touch positions are reported as unmodified data.

User Interaction

This section describes how users can interact with the trackpad. For example, buttons, native multi-touch Advanced Gestures, and configurable options.

Configurable Options

Gen 4 offers two configurable gesture suites, a single finger suite and a multi-finger suite. Any gestures can be selected or disabled in either suite, allowing you to customize either gesture suite to meet your business needs. However, you cannot select gestures in both suites. These suites are customized through the USB interface. Contact Cirque for more information (see [Contact Information on page 20.](#))

Advanced Gestures (AG)

Cirque's GlidePoint TM080048-1 trackpad features single and multi-touch Advanced Gestures™, all without the need of a custom driver.

Note: *Currently, the Cirque GlidePoint driver is not available for this product. The OS must support I2C to use the I2C version of the trackpad.*

Users are able to interact in advanced ways without ever leaving the trackpad, allowing your devices to become even more useful to your customers. Gesture enabled devices offer the following:

Efficient Usability Experiences: Gestures allow users to activate programs and actions on the device. Familiar gestures that people use every day are easily made. For example, zooming in on pictures, and panning or scrolling through documents, all without having to perform multiple clicks and using menu bars. Gestures make it easier for your customers to use your devices.

Intuitive Interactions: Gestures are designed to function like everyday activities. A simple flick of your fingers, similar to turning a book page, will activate the back button on a web browser and other utilities. Dragging two fingers down the trackpad let users read a whole document without ever pushing a button. All open windows minimize by simply swiping three fingers in a downward motion.

Slides and Taps

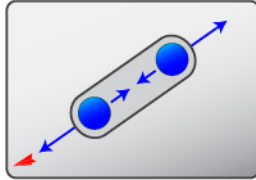
The following slides or taps are supported:

- Single-finger slide: Moves the mouse cursor.
- Tap: Primary button click.
- Double tap: Double click at the current cursor position.
- Two Finger tap: Activates right click menu.

Two-Finger Gestures

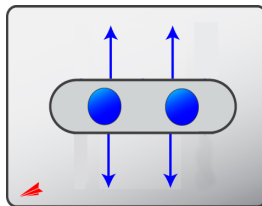
Gesture functions are defined and then assigned by the Cirque firmware. Gestures are subject to change with new releases.

Zoom



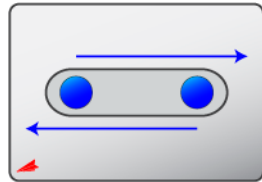
Place two fingers on the trackpad and expand the distance between the two fingers to zoom (enlarge the image view) or bring the fingers closer together to zoom out (shrink the image view).

Scroll



Move two fingers together up or down on the trackpad to scroll vertically.

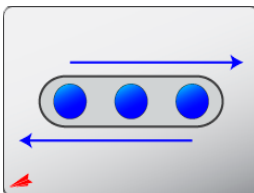
Pan



Move two fingers together left or right on the trackpad to scroll horizontally (pan).

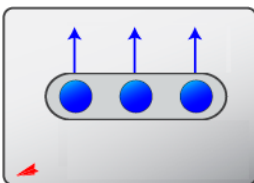
Three-Finger Gestures

Back/Forward

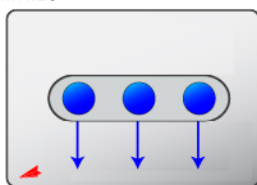


Flick three fingers quickly on the trackpad to the left to go back. Flick right to go forward.

Launch Start Menu



Flick three fingers upward on the trackpad to launch the Start Menu.

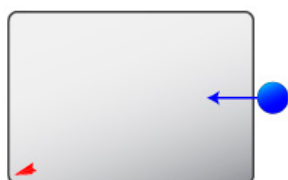
Minimize

Flick three fingers downward on the trackpad to minimize the active window.

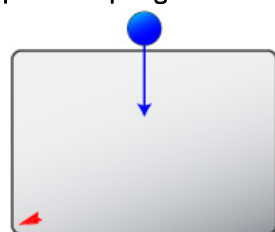
Swipe Gestures

In addition to the above gestures, the following Swipe gestures are supported.

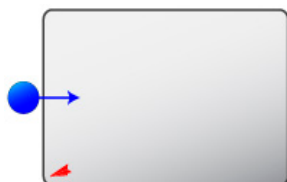
Note: Windows 8 gestures are only available to Windows 8 users.

Swipe from Right Edge

Place finger on the edge and then swipe from right edge onto the sensitive area of the trackpad. This act will toggle the charm bar.

Swipe from Top Edge

Place finger on the edge and then swipe down from top edge onto the sensitive area of the trackpad. This act will toggle the App commands.

Swipe from Left Edge

Place finger on the edge and then swipe from left edge onto the sensitive area of the trackpad. This act will cycle through previously open or used applications.

GlideExtend

The TM080048-1 includes Cirque's patented motion extender, GlideExtend[®]. GlideExtend differs from other motion extension approaches by allowing the user to retain direct control of the cursor at all times. When the user's finger encounters the edge of the trackpad during a drag, draw, or highlight operation, GlideExtend temporarily holds this function so that the user may lift and reposition their finger (similar to repositioning a mouse on a mouse pad). The user is always in control and is never required to "steer" as the cursor begins to coast in the direction of the finger.

Overlay Specifications

Cirque offers a series of laminate overlays that provide a durable surface that is resistant to environmental influences. Most of these overlays incorporate two distinct textures to define the areas on the trackpad where the GlideExtend and Right Taps features may be activated during typical user operations. The slightly coarser texture of the GlideExtend zone provides valuable tactile feedback during drag, draw, and highlight operations. The zone also signals to the consumer they may now lift and reposition their finger away from the edge of the trackpad while GlideExtend is engaged. Similarly, the slightly coarser texture of the Right Taps zone alerts the user that tapping in this area will result in a secondary button input (“right click”). The Right Taps zone is also visually defined by a change in color.

Note: *The Right Taps Zone is not active by default and must be activated before use.*

OEM customers can order a trackpad without an overlay and then purchase their own customized overlay. Custom overlays may include a logo and matching colors. Trackpad functionality is impeded by overlays that use conductive materials (gold, silver, carbon, and so forth); these materials should not be used. Contact Cirque for overlay design guidelines.

Note: *Ensure no air gaps remain when adhering an overlay to a trackpad. Air gaps between the trackpad sensing surface and the overlaying surface must be eliminated.*

Bezel Design Recommendations

Cirque offers the following bezel design recommendations as a guideline for integrating the TM080048-1 into enclosures.

Bezel Sidewall

Minimum Wall Thickness: A 1.0 mm minimum thickness is recommended to provide tactile feedback to the user, indicating that the finger has encountered a bezel edge.

Maximum Wall Thickness: An extremely thick and steep bezel sidewall may prevent a finger from accessing the outer edges of the trackpad and reduce the functional sensing and GlideExtend area of the pad.

Bezel Sidewall Geometry: A 30 to 45 degree tapered edge on the trackpad bezel is recommended to allow for optimum GlideExtend functionality. This edge also provides users with tactile feedback that they have encountered a bezel edge. Sidewall geometries outside of this 30 to 45 degree range can be used but should be verified through prototype to ensure satisfactory performance.

Bezel Window

Bezel Window Geometry: A rectangular or slightly modified rectangular window is recommended based upon the trackpad's maximum bezel opening ([Figure 2 on page 8](#)). It is important not to infringe upon the GlideExtend region of the pad as it could result in diminished GlideExtend performance. For aesthetic reasons, an equal offset with respect to the maximum bezel opening is suggested when using the OEM dual textured overlay.

Alignment in Bezel: The trackpad should be reasonably centered in the bezel opening to ensure proper functionality.

Electrical Considerations

Conductive Bezel Materials: Conductive bezel materials may be used if the bezel does not overlap the maximum bezel opening area of the module.

Mounting Design Recommendations

The thin, flat profile of the TM080048-1 makes it compatible with a variety of industry practices for mounting trackpads into enclosures. Regardless of the mounting technique employed, it is important that the trackpad be supported from the underside of the trackpad assembly. This will prevent excessive flexing of the assembly during finger tapping operations.

Alignment

The four corners of the circuit board incorporate a quarter section of a 2.00 mm diameter hole that may be used to locate the trackpad within the bezel window. These sections may be used for alignment posts or studs on the underside of the bezel.

A common method for aligning the trackpad in the bezel window involves incorporating a slightly recessed area in the underside of the bezel window. The geometry of this recessed area should closely follow the contour of the circuit board and overlay, allowing a small amount of extra room to accommodate manufacturing tolerances.

Support Features

The TM080048-1 includes a flat area on the Component Side (underside) of the trackpad module. This flat area should be used with support features, such as ribs, posts, and brackets that make contact with the underside of the assembly. Only insulated features are allowed to make contact with the flat area of the assembly.

Mounting Techniques

Clamshell Mounting: A common practice for mounting trackpads into enclosures involves clamping the assembly between two of the enclosure's components, resulting in a clamshell structure that secures the trackpad in place. The upper section of the clamshell typically includes the bezel window opening and alignment features, while the bottom section of the clamshell incorporates support features. It is recommended that a slight amount of interference exist between the clamshell structure and the trackpad to prevent it from sliding or rattling around within the bezel window.

Mounting Bracket Sub-Chassis: Mounting brackets typically employ screw bosses or stud-like features within close proximity to the bezel onto which the sub-chassis is secured. It is recommended that the trackpad be held in place between the sub-chassis and the underside of the enclosure with a slight compression fit. The sub-chassis should provide adequate support features to prevent the trackpad from flexing noticeably during heavy finger usage.

ESD Protection and EMI Specification

Cirque performs ESD tests at the module level. OEM customers should test and validate ESD performance at each system level. Cirque's ESD tests are based on the IEC61000-4-2 standard, which is a systems-level test specification.

To achieve good ESD performance (up to ± 15 kV), a low impedance path to frame ground must be present in order to dissipate inadvertent electrostatic discharges to the touch surface of the TM080048-1.

Note: *The 10-pin connector does NOT provide a path to the host computer's frame ground.*

Connecting to the Frame Ground Pad

The TM080048-1 circuit board includes a frame-ground solder pad on the Component Side of the trackpad module ([Figure 2 on page 8](#)). You must incorporate one of the following grounding techniques:

- A suitable drain wire may be soldered directly to the solder pad, which provides a low-impedance path to frame ground when properly connected to the host.
- Conductive cloth tape may be used instead of a drain wire. One end of the conductive tape must be adhered to the exposed frame ground pad on the trackpad while the other end must have continuity to the host frame ground.

EMI Specification

Cirque performs Electromagnetic interference (EMI) tests based on the International Electrotechnical Commission (IEC) international standards for radiated and conducted electromagnetic interference.

The TM080048-1 trackpad exhibits low susceptibility to electromagnetic interference in noisy environments. Contact a Cirque OEM sales representative to obtain EMI guidelines and test procedures. For more information, contact Cirque Corporation ([Contact Information on page 20](#)).

Contact Information

Contact a Cirque sales representative for a complete list of Cirque's OEM products.

In United States & Canada	(800) GLIDE-75 (454-3375)
Outside US & Canada	(801) 467-1100
Fax	(801) 467-0208
Web site	http://www.cirque.com

Part Ordering Information

When ordering parts, please contact your Cirque representative to assist you in selecting the correct size, power, configurations, and overlay that will best meet your capacitive touch needs.

Part Number

Example: TM080048-1-R04U-0500-00

Table 8. USB Part Number Explanation

Category	Horizontal Size	Vertical Size	Variance	Volt	IC	I/O	Customer Special	Customer Special	Overlay	HW Diff	SW Diff
TM	~80 mm	~48 mm	1	R= 3 - 5.5 V	04 = Rushmore	U = USB	0	50	0	0	0

Example: TM080048-1-R04I-0500-00

Table 9. I2C Part Number Explanation

Category	Horizontal Size	Vertical Size	Variance	Volt	IC	I/O	Customer Special	Customer Special	Overlay	HW Diff	SW Diff
TM	~80 mm	~48 mm	1	R= 3 - 5.5 V	04 = Rushmore	I = I2C	0	50	0	0	0

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