Interlink Electronics
FSR® Force Sensing Resistors®

VersaPad Plus™ USB Integration Guide

Document Part Number EIG-10009-B

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1.0 Introduction

VersaPad Plus™ is a versatile touchpad module intended for integration by OEMs into laptops, military and rugged computers, panel PCs, and medical devices. With smoothness and sensitivity, internally enhanced by true pressure measurement, it offers all customary mouse functions - mousing, tapping, dragging, and scrolling. In addition, two-finger functions including pinch and zoom and two-finger scrolling are supported. The module's tough, moisture and grime resistant surface can be used with a bare finger, gloved hand or a passive stylus, even in wet or dirty environments. In addition, it operates over an extended temperature range of -20ºC to +60ºC.

2.0 Scope

This Integration Guide provides the OEM integrator with all of the necessary technical information to successfully integrate VersaPad Plus™ into products such as:

- Industrial Computers
- Rugged/Military Notebook Computers
- Desktop Keyboards
- Handheld PCs

This VersaPad Plus™ USB guide is relevant to two products:

- VersaPad Plus™ USB Module with Flat Flexible Cable Connectors (FFC)
- VersaPad Plus™USB Module with Molex 8-pin board to wire header connector

3.0 Theory of Operation

The touchpad sensor is a four-wire resistive type device. The pad is composed of two resistive layers separated by an air gap. One plate is used for the X-axis and the other is used for the Y-axis. When pressure is applied, the two resistive plates make contact. A microcontroller measures position and pressure then it uses advanced, proprietary algorithms to yield smooth mouse functionality. Figure 1 shows the electrical representation of the sensor and Figure 2 shows a simplified exploded view of the sensor.

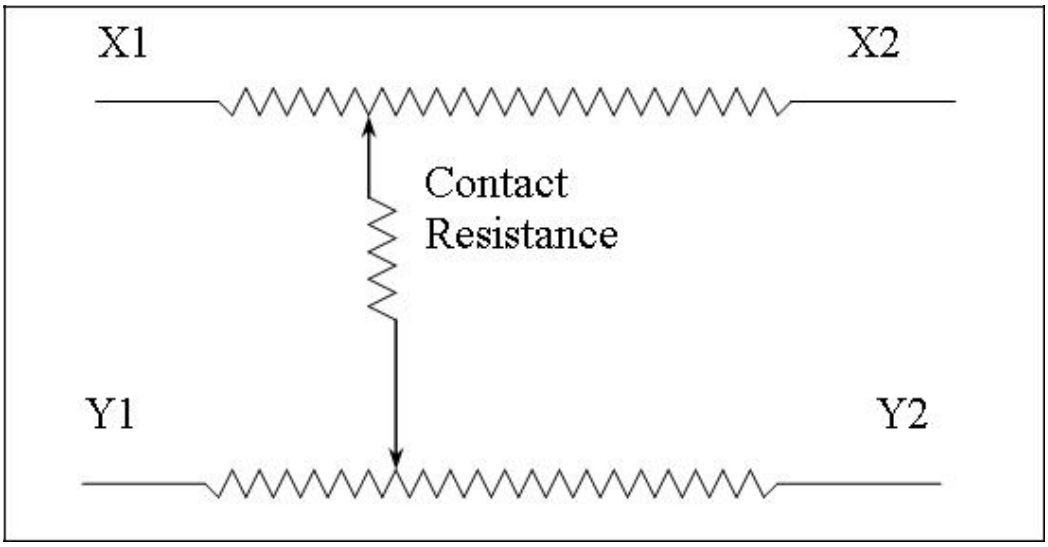

Figure 1: VersaPad Equivalent Electrical Circuit

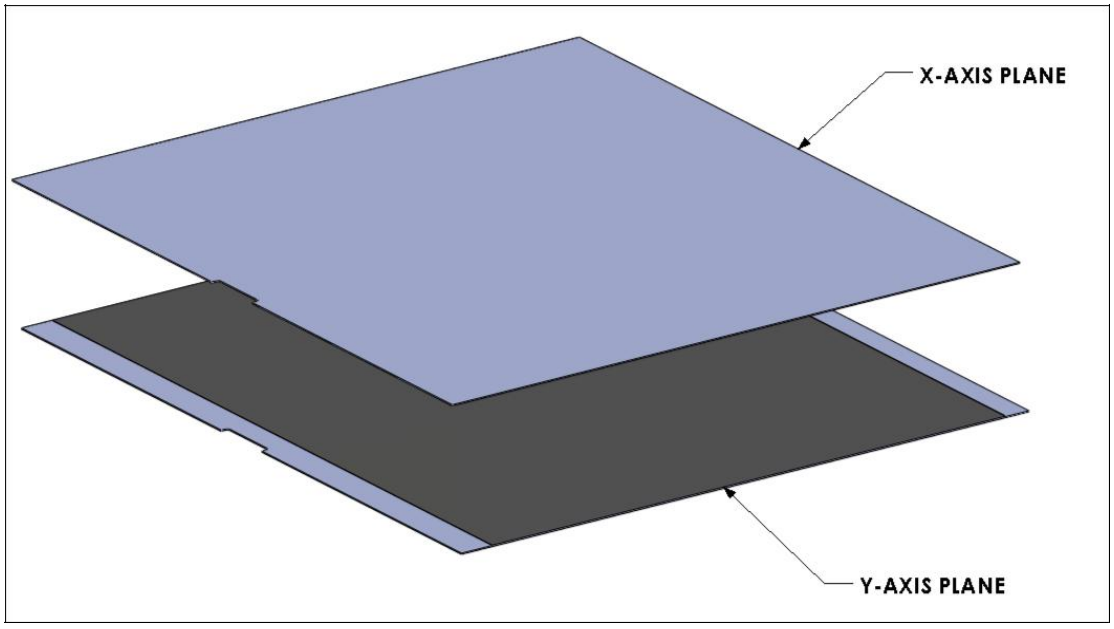

Figure 2: Simplified Exploded View VersaPad Sensor

4.0 Features and Operation

The VersaPad Plus™ is intended to be used with a desktop or laptop computer running Windows® 7, 8 or 10. The VersaPad Plus™ is a force-based resistive touchpad sensor (not a capacitive based sensor as is found on typical, non-rugged laptops), so force must be applied to achieve proper function. As a result, it may take

some practice to get used to the feel of the unit and achieve proficient use of the device. The VersaPad Plus™ supports the one and two finger gestures listed below. It does not support three or four finger gestures at this time. We also note that horizontal scrolling using two fingers is supported only in some applications (for example, two finger horizontal scrolling works in Microsoft Word). The VersaPad Plus™ is designed for use in rugged equipment and can be used with bare fingers, a gloved hand or a passive stylus.

Description of the Active Zones:

The zones of the VersaPad Plus™ sensor are shown in Figure 3.

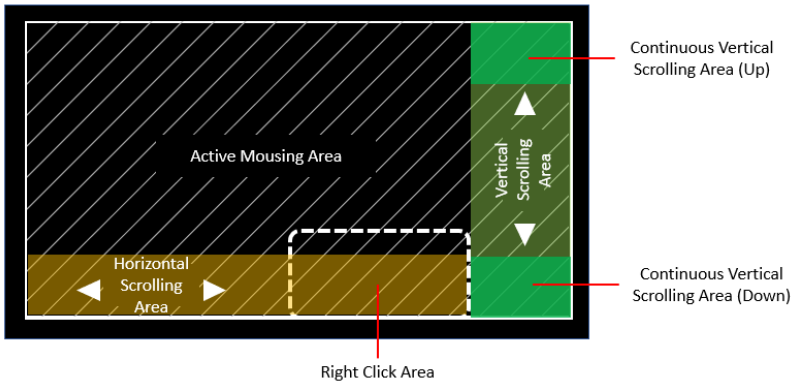

Figure 3. Sensing zone map of the VersaPad Plus™ touchpad

The Vertical Scrolling Area (green area) along the right side of the device is used for vertical scrolling. This zone is approximately 20% of the width of the sensor. Within the Vertical Scrolling area there are two additional smaller areas shown by the light green rectangle at the top and the light green rectangle at the bottom. The area inside the light green rectangle at the top of the vertical scrolling area can be used for continuous vertical scrolling in the “up” direction and the area at the bottom inside light green rectangle can be used for continuous vertical scrolling in the “down” direction.

The Horizontal Scrolling Area along the bottom edge, shown in brown, is for horizontal scrolling. This zone is approximately 20% of the height of the sensor.

A portion of the Horizontal Scrolling Area located towards the right side of the touchpad but not entering the Vertical Scrolling Area serves as the Right Click Area. This is shown by the dashed white rectangle in Figure 3.
The remaining area is for active mousing and is designated as the Active Mousing Area. A Left Click can be performed anywhere in the Active Mousing Area except in the Right Click zone.

The functionality of these zones is described in the sections below.

4.1 USB

The module is fully USB 2.0 compliant and enumerates utilizing native operating system drivers as a Human Interface Device (HID) mouse with Left and Right -Click capability. At the present time, no features of the mouse are settable by the host via USB.

4.2 Software Driver

The VersaPad Plus™ USB enumerates as a standard two-button HID compliant mouse and requires no additional driver.

4.3 Touchpad and Mouse

The module is a resistive, 4-wire X-Y touchpad measured by a microcontroller. When not touched, the touchpad appears to the microcontroller as an open switch. On a touch event, the processor detects this 'switch closure' and begins to evaluate the touchpad through a series of measurements. The processor 'oversamples' the touchpad to facilitate filtering and processing of the mouse report.

4.4 VersaPad Plus™ Features

4.4.1 Cursor Movement

A single touch and motion inside of the Active Mousing Area will move the mouse cursor in the same direction as the motion on the VersaPad Plus™ touchpad (for example, if the finger moves to the right on the touchpad the cursor moves to the right on the screen). The scrolling areas shown in Figure 1 will be deactivated and the entire VersaPad Plus™ touchpad surface will be used for cursor control until the touch is released. Initiating touch in the Vertical Scrolling Area and moving horizontally will cause mousing. Initiating touch in the Horizontal Scrolling Area and moving the finger vertically will cause mousing.

4.4.2 Left Click

A single tap gesture will be interpreted as a mouse left click at the position of the cursor. Tap for left-click is enabled by default on the base design. Custom versions can have tap features disabled. Please contact your sales representative for information on these customization options.

4.4.3 Right Click

A Right-Click function is achieved by a single tap in the Right Click Area of the VersaPad Plus™ touchpad. Right-Click is a standard feature on the base design of the VersaPad Plus™ touchpad.

4.4.4 Double Left Click

A Double-Tap gesture tap inside the Active Mousing Area will be interpreted as a double-left mouse button click, at the position of the cursor. Double-Tap is a standard feature on the base design of the VersaPad Plus™ touchpad.

4.4.5 Double Tap and Drag

A Double-Tap gesture inside the Active Mousing Area in combination with maintaining contact with the VersaPad Plus™ touchpad on the second tap initiates the Drag feature. The double-tap and drag feature can be used to select and move desktop icons and folder files, or to change the sizes of windows. It can also be used to select/highlight text without using the physical click buttons. The Double Tap and Drag feature are a standard feature on the base design of the VersaPad Plus™ touchpad

4.4.6 Drag Edge Lock

If a Double Tap and Drag is released at the edge of the VersaPad Plus™ touchpad, the drag state will be held for 3 seconds. This allows resumption of the drag in another area of the VersaPad Plus™ touchpad without initiating another Double-Tap. Drag Lock at the VersaPad Plus™ touchpad edge is a standard feature on the base design of the VersaPad Plus™ touchpad

4.4.7 One-Finger Scrolling

VersaPad Plus™ supports wheel scrolling and smooth scrolling.

Vertical scrolling using one finger is achieved by initiating VersaPad Plus™ touchpad activation on the right-side edge inside the Vertical Scrolling Area (see Figure 2) and moving along the right edge in an up or down motion.

A touch along the right edge (Vertical Scrolling Area) followed by vertical motion away from the user (up) will cause vertical scrolling in the same direction on the computer screen taking the user towards the beginning of a document. A touch along the right edge (Vertical Scrolling Area) followed by vertical motion towards the

user (down) will cause vertical scrolling in the same direction on the computer screen taking the user towards the end of a document

A touch along the right edge in the Vertical Scrolling Area followed by horizontal motion will cause mousing (cursor movement).

A touch and hold in the upper right corner (Continuous Vertical Scrolling Area - Up) will cause continuous vertical scrolling towards the beginning of a document (up). A touch and hold in the bottom right corner (Continuous Vertical Scrolling Area - Down) will cause continuous vertical scrolling towards the end of the document (down). Moving the finger from the right edge into the top right corner, then holding, will cause continuous vertical scrolling towards the beginning of a document (up) and moving the finger from the right edge into the bottom right corner, then holding, will cause continuous vertical scrolling towards the end of a document (down).

One-finger horizontal scrolling is not supported in all applications. For example, Microsoft Excel and Adobe Acrobat Reader.

Horizontal scrolling using one finger is achieved by initiating VersaPad Plus™ touchpad activation on the bottom edge in the Horizontal Scrolling Area and moving along the bottom edge in a horizontal (side-to-side) motion. Moving the finger to the left causes scrolling to the left and moving the finger to the right causes scrolling to the right.

4.4.8 Pinch and Zoom

The VersaPad Plus™ touchpad can detect the presence of two fingers vs. one finger, and whether the fingers are coming together or moving apart. To use pinch and zoom, the user must touch the Active Mousing Area with two fingers and move them closer together or further apart to activate the zoom function. For many users, the best way to achieve this is to keep one finger in a fixed position while moving the second finger. If one finger is lifted during the motion, the device will stay in pinch and zoom mode and you can continue the zoom motion.

4.4.9 Two-Finger Scrolling

To use two-finger scroll, the user must touch the touchpad with two fingers and move them together in parallel. This action can be initiated at any point on the touchpad including the Vertical Scrolling Area, Horizontal Scrolling Area, the Right Click Area and the Active Mousing Area. If the two fingers are moved in parallel vertically, vertical scroll will be active. Moving the two fingers away from the user (up) on the touchpad will cause the document to scroll down towards the end of the document. Moving the two fingers toward the user (down) will cause the document to scroll up towards the beginning of the document.

If the two fingers are moved in parallel horizontally, horizontal scroll will be active. This action can be initiated at any point on the touchpad including the Vertical Scrolling Area, Horizontal Scrolling Area, the Right Click Area and the Active Mousing Area. Moving the two fingers to the right will scroll the document to the left and moving the two fingers to the left will scroll the document to the right

4.4.10 External Buttons

External Right, and Left button are available via 4-pin FFC (J7) or Molex header connector (J8).

5.0 Mounting

A general bezel mounting method, as shown in Figure 4, is one possible way to mount the VersaPad Plus™ Module. Mechanical installation of the VersaPad Plus™ module has many critical features that must be considered for mounting. In particular, care should be taken to avoid inadvertent pressure on the top membrane of the sensor as such pressure could be confused with a user's external touch. The membrane is supported at its edge by an internal spacer, shown in figure 5 as the dashed line. Parts used to capture the VersaPad Plus™ module must not make contact with the sensor inside the electrically active area.

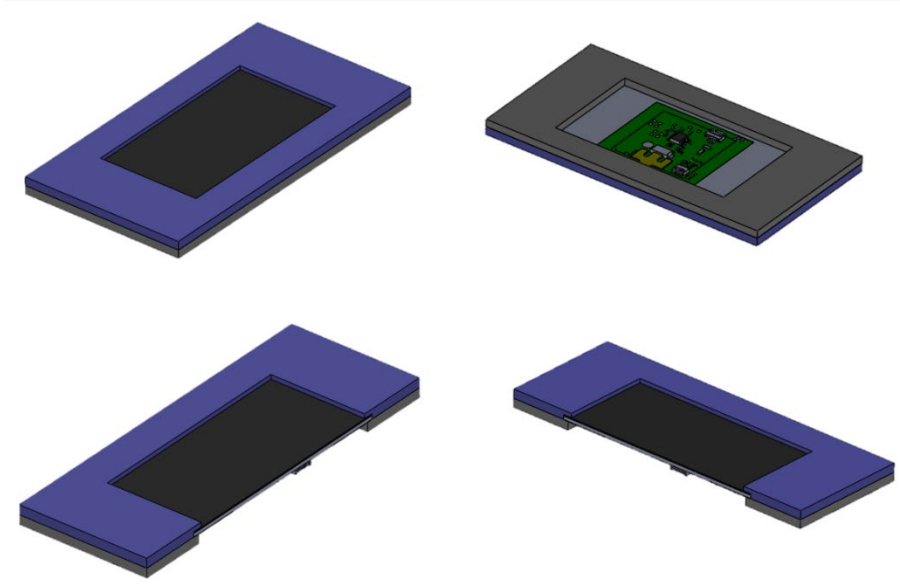

Figure 4: VersaPad Module Bezel Mounting Concept

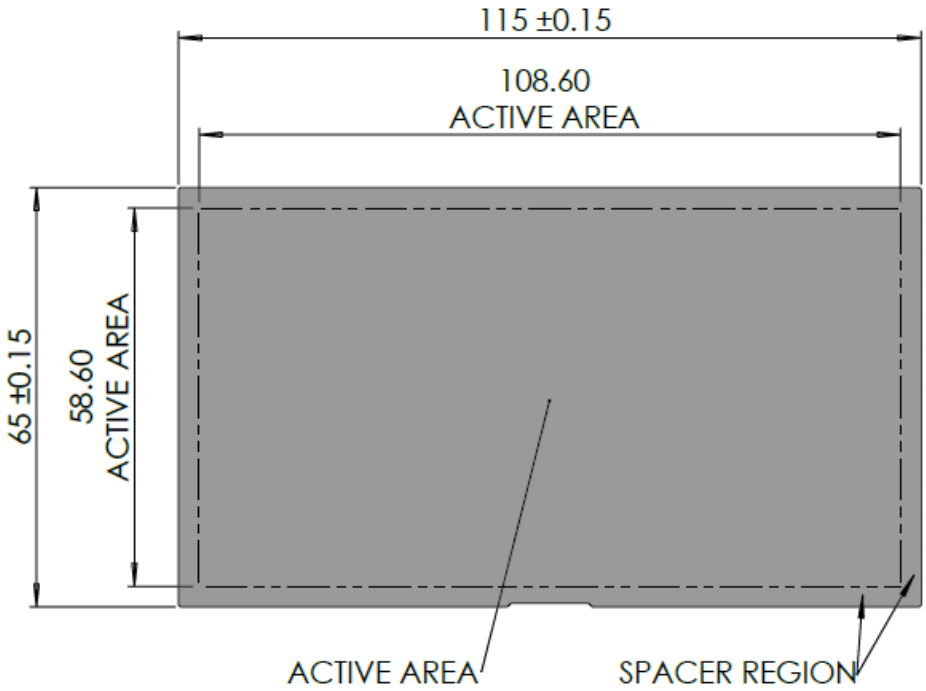

Figure 5. Top View of VersaPad Plus™ sensor showing hidden spacer geometry. Dimensions are in mm.

5.1 Mounting and Capture Guidelines

Achieving an optimal mounting design requires that consideration be given to the following guidelines.

5.1.1 Capture

Design of the enclosure used to capture the VersaPad Plus™ module can follow either a top or bottom installation method. Pressure sensitive gaskets or adhesives may be used to support and protect the VersaPad Plus™. Tolerances of gaskets, bezels, etc. should be chosen to avoid contact with the sensor active area under all conditions

5.1.2 Protection of the Spacer Edge

It is possible that long term wear can emboss the touchpad sensor near the spacer edge. To avoid this, the top case or an additional bezel should be used to overhang the spacer. A small vertical gap is necessary to avoid touching the sensor. Size and

position tolerance should be chosen to overlap the spacer under all conditions. See Figure 5 and Figure 6.

5.1.3 Contamination

Moisture and debris contamination can jeopardize the performance of the VersaPad Plus™. Hence, in instances where these factors are considerable, the designer may choose a gasket strategy to avoid ingress.

5.1.4 PCB Support

The clamping parts used to secure the PCB component side of the VersaPad Plus™ module should provide additional support wherever it is allowable.

5.1.5 Enclosure Material

Bezels and encasements can be made of conductive or non-conductive materials. Proper care should be taken to avoid creating ESD concerns.

5.1.6 Critical Capture Dimensions

Figure 6 shows the critical dimensions in positioning of the bezel or top case, gasket, VersaPad Plus™, and enclosure. These recommendations are chosen to prevent embossing near the spacer and to prevent inadvertent pressure on the top surface of the sensor. All dimensions and tolerances apply to both top and bottom mounting methods.

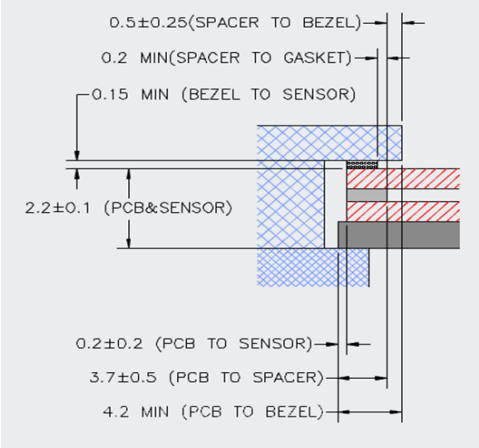

Figure 6: Critical capture dimensions. Drawing is not to scale.

5.2 Bottom Side Mounting

In bottom side integration (see Figure 7), the module is held up against an inner lip using a combination of adhesive from above and pressure from beneath. The gasket can both aid in assembly and provide sealing. Support from beneath could be from a rear bezel, from case features such as ribs or posts, or from other nearby components.

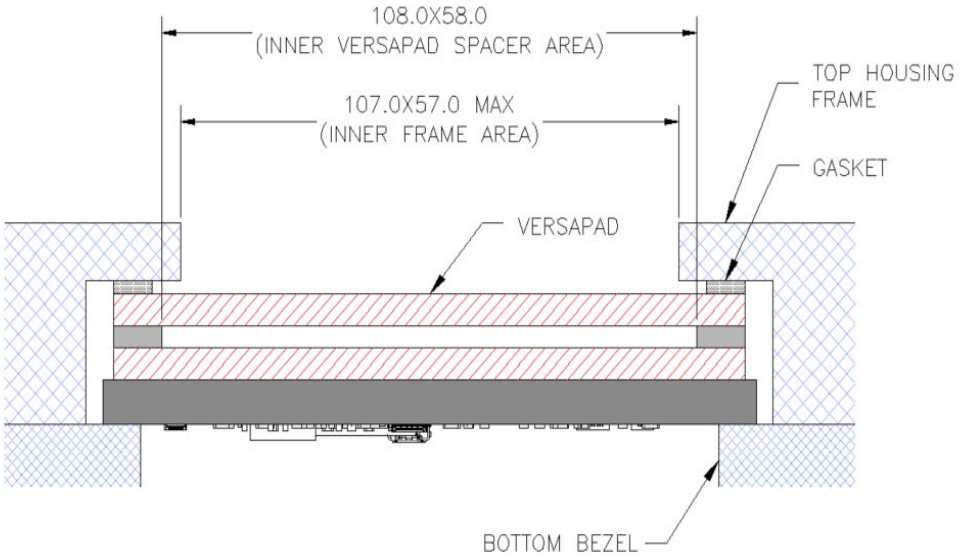

Figure 7: Side view of bottom side mounting. Drawing is not to scale

5.3 Top Side Mounting

In top side installation (see Figure 8) the module is set into a hole from above and then surrounded by a bezel. The bezel could be secured with plastic snaps and/or adhesive gasketing. The bezel need not be just a frame around the VersaPad Plus™, but could extend to be a larger piece of the top case with a cutout.

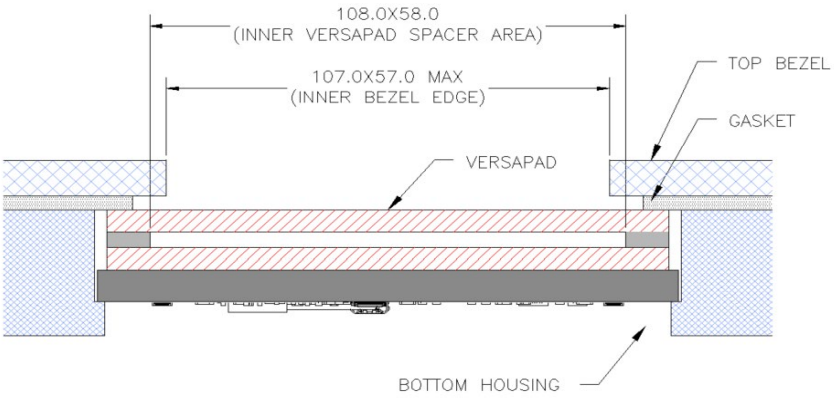

Figure 8: Side view of top side mounting. Drawing is not to scale.

5.4 PCB Keep Out Area

The illustration below (see Figure 9) highlights the recommended keep out area for the mounting bracket or other surrounding interfaces. The keep out area can be reduced as long as proper care and tolerance studies are performed to avoid interference with components and interfacing connectors. Also note that the interfacing geometry should be designed to avoid interference with the sensor tail that wraps around the PCBA. Maximum component heights can be found in the drawing in section 8.

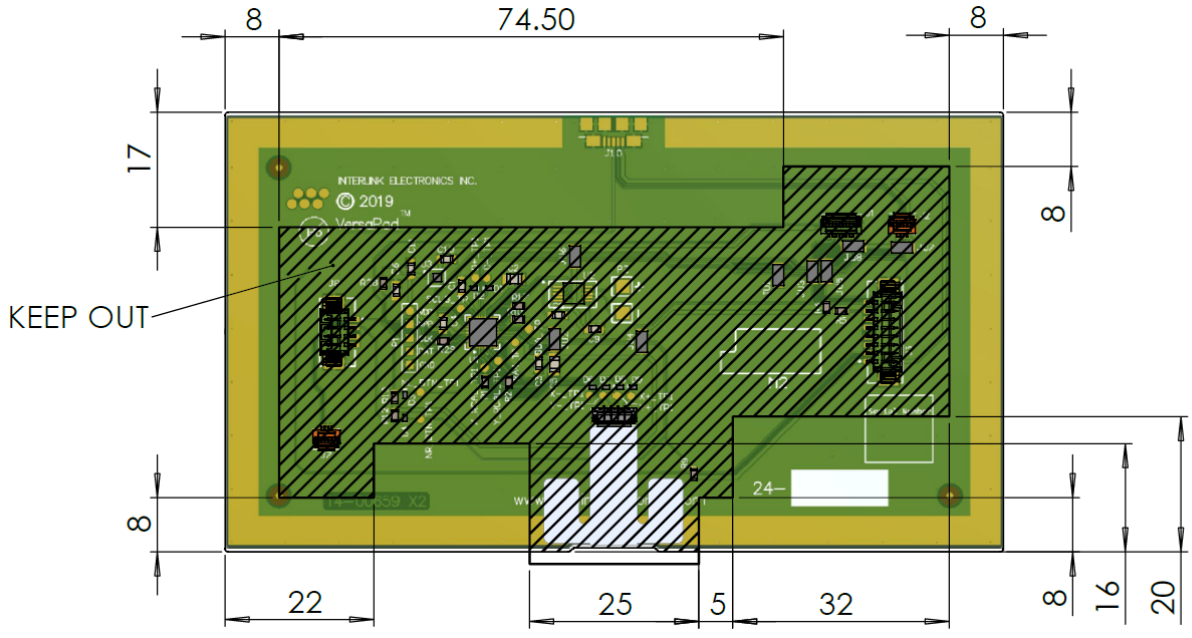

Figure 9: Mounting Bracket & Keep out Area. Drawing is not to scale.

6.0 Connections

The VersaPad Plus™ USB is available in two connection methods for both data and button connections.

- Flat Flexible Cable interface (FFC).
- Wire to Board Header Connector interface.

6.1 Molex Headers

One connector option for the VersaPad Plus™ is to use wire to board header connectors. The J8 header (Molex #53261-0471) is used for connecting external mouse buttons to the VersaPad Plus™ PCBA. The J3 header (Molex #53261-0871) is the VersaPad Plus™ USB communication header

6.2 Molex Header Cables

The mating wire harness cable to the wire to board connector is not shipped with the standard product. The Molex connector series #51021 are designed to mate with the J3 and J8 headers. The metallic contacts that slip into the #51021 housing can be either
50079- 8 or 50058-8. The 50079 contacts accept wires AWG 26-28, and the 50058 contacts accept wires AWG 28-32

6.3 Flat Flex Cable Connector (FFC)

The VersaPad Plus™ is also available in an FFC connector option for the USB and external button connections. Refer to specification for Hirose FH19C-4S-0.5SH for further details.

6.4 Flex Cable

The flexible cable, not shipped with the standard module, shall be designated for insertion into FFC connector. An example cable is Parlex **050R4-76B**. Refer to the FCI connector specification for cable geometry requirements if you are designing a custom FPC cable interface

6.5 Molex Connector Pin-out

Figure 10 and Table 1 shows the pin-out for Molex header connections to the J3 and J8 headers.

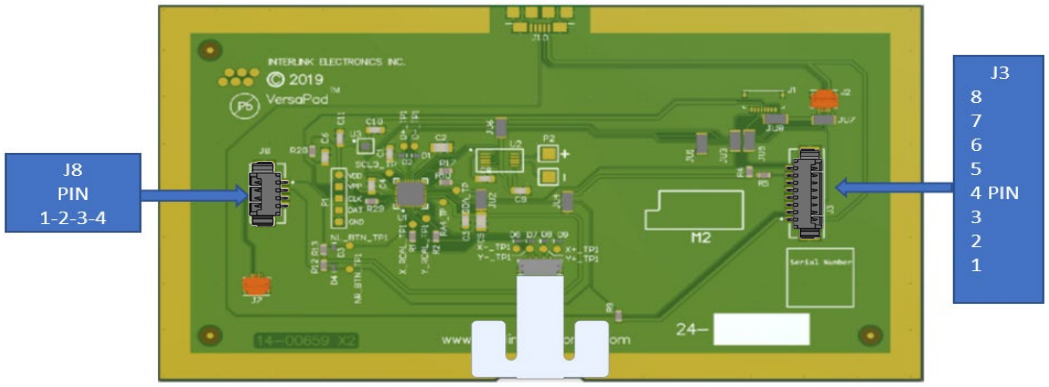

Figure 10: Molex Header Pin-Out

J3 Pin	Signal	Signal Description
1	VCC	+5V
2	D+	D+
3	D-	D-
4	GND	Ground
5	GND	Ground
6	NC	Reserved
7	NC	Reserved
8	NC	Reserved

J8 Pin	Signal
1	Left Button
2	Right Button
3	Ground
4	Reserved

Table 1. Pin-Out for Molex header

6.6 FFC Connector Pin-out

Figure 11 and Table 2 show the pin-out for FFC connections to the J2 and J7 components.

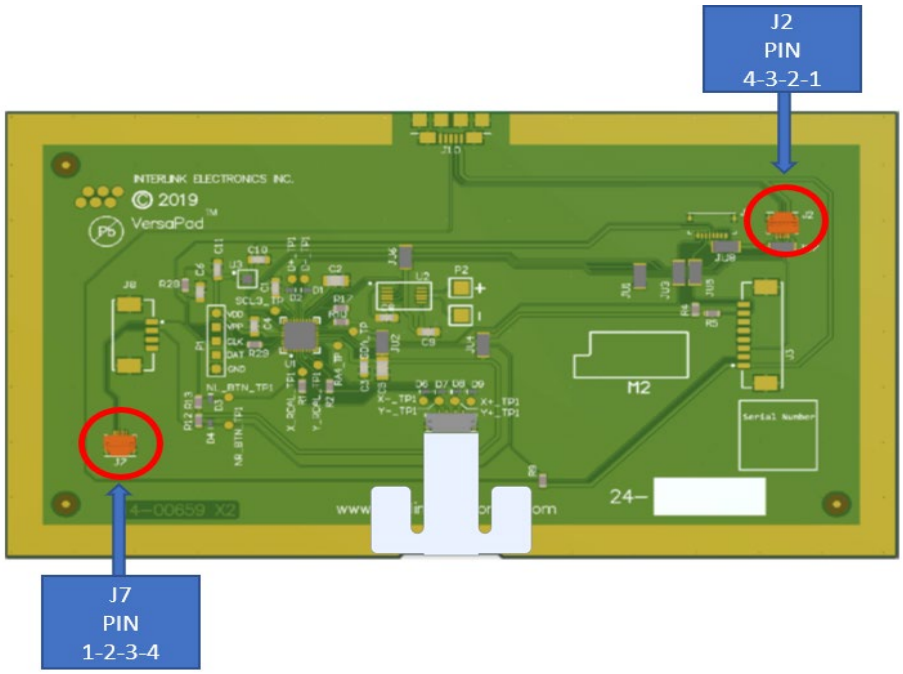

Figure 11: FFC Connector Pin-Outs

J2 Pin	Signal	Signal Description
1	VCC	+5v
2	D-	D-
3	D+	D+
4	GND	Ground

J7 Pin	Signal
1	Left Button
2	Right Button
3	Ground
4	NC

Table 2: J2 & J7 FFC Connector Pin-Outs

6.7 Cable Options

Figure 12 shows the standard Interlink cable options.

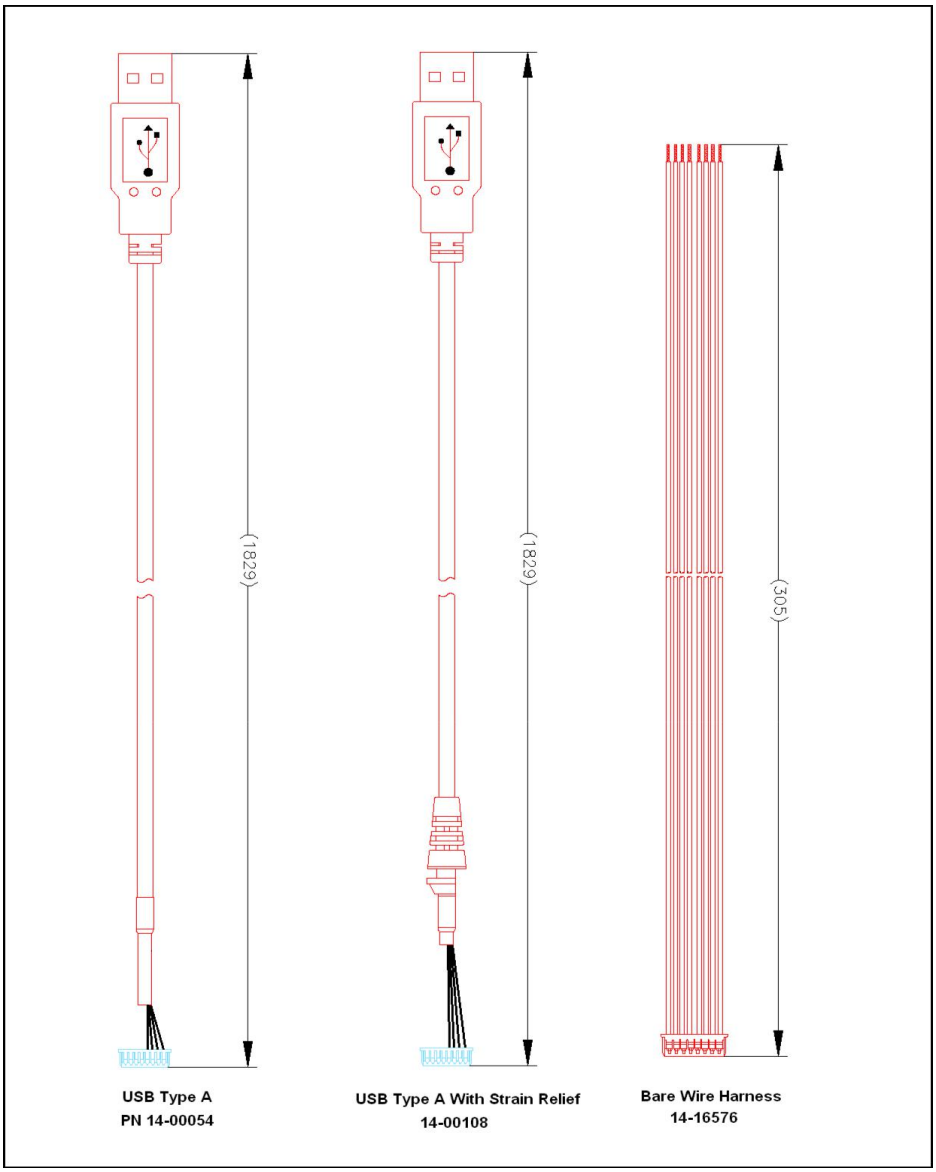

Figure 12: VersaPad Plus™ USB Standard Cable Options

7.0 USB Information

Communication from the host to the microprocessor is done via USB and:

- Uses the full-speed USB standard
- Is compatible with any USB 2.0 host and later versions (as later versions are backwards compatible.
- Enumerates as a HID device

- Uses the standard Windows mouse driver

The microprocessor reports data to the host at a rate of 50 reports/sec.

7.1 Device PID and VID

- IC's Product ID (PID): 0x0018
- Interlink Electronics' Vendor ID (VID): 0x214A

7.2 Data Packet

There are 3 HID interfaces: mouse, keyboard and custom.

7.2.1 Mouse Interface

Report Structure:

Byte 1	Buttons Data
Bit	
0	Left Button Status
1	Right Button Status
2	(Reserved for middle button)
3	Always = 0 (Reserved)
4	Always = 0 (Reserved)
5	Always = 0 (Reserved)
6	Always = 0 (Reserved)
7	Always = 0 (Reserved)

Byte 2	X Data
Bit	
0	LSB of X data
1	X data
2	X data
3	X data
4	X data
5	X data
6	X data
7	MSB of X data

Byte 3	Y Data
Bit	
0	LSB of Y data
1	Y data
2	Y data
3	Y data
4	Y data
5	Y data
6	Y data
7	MSB of Y data

Byte 4	Vertical Scroll Data
Bit	
0	LSB of vertical scroll data
1	vertical Scroll data
2	Scroll data
3	Scroll data
4	Scroll data
5	Scroll data
6	Scroll data
7	MSB of scroll data

Byte 5	Horizontal Scroll Data
Bit	
0	LSB of data
1	Scroll data
2	Scroll data
3	Scroll data
4	Scroll data
5	Scroll data
6	Scroll data
7	MSB of scroll data

7.2.2 Keyboard Interface

Report Structure:

Byte 1	Keyboard Modifier Bit
Bit	
0	Left Control
1	Always = 0 (Reserved)
2	Always = 0 (Reserved)
3	Always = 0 (Reserved)
4	Always = 0 (Reserved)
5	Always = 0 (Reserved)
6	Always = 0 (Reserved)
7	Always = 0 (Reserved)

7.2.3 Custom Interface

The custom interface is reserved for the manufacturers use.

7.3 USB Suspend Mode

The module will respond to suspend command from the host by entering 'sleep mode' until awakened by the host. While in suspend mode, the chip will go into a low current draw mode. The module also supports remote wakeup. The remote wakeup sources are:

- touchpad
- external buttons through J7 or J8.

7.4 Operating Voltage and Current

The VersaPad Plus™ USB is bus powered; therefore, it operates at 5V. Under normal operation, the device draws approximately 15mA. During USB suspend mode the chip enters a low current mode. In this mode the chip will draw no more than 2.5mA.

8.0 Drawings and Dimensions

Please see the drawings below to assist you with your integration plans.

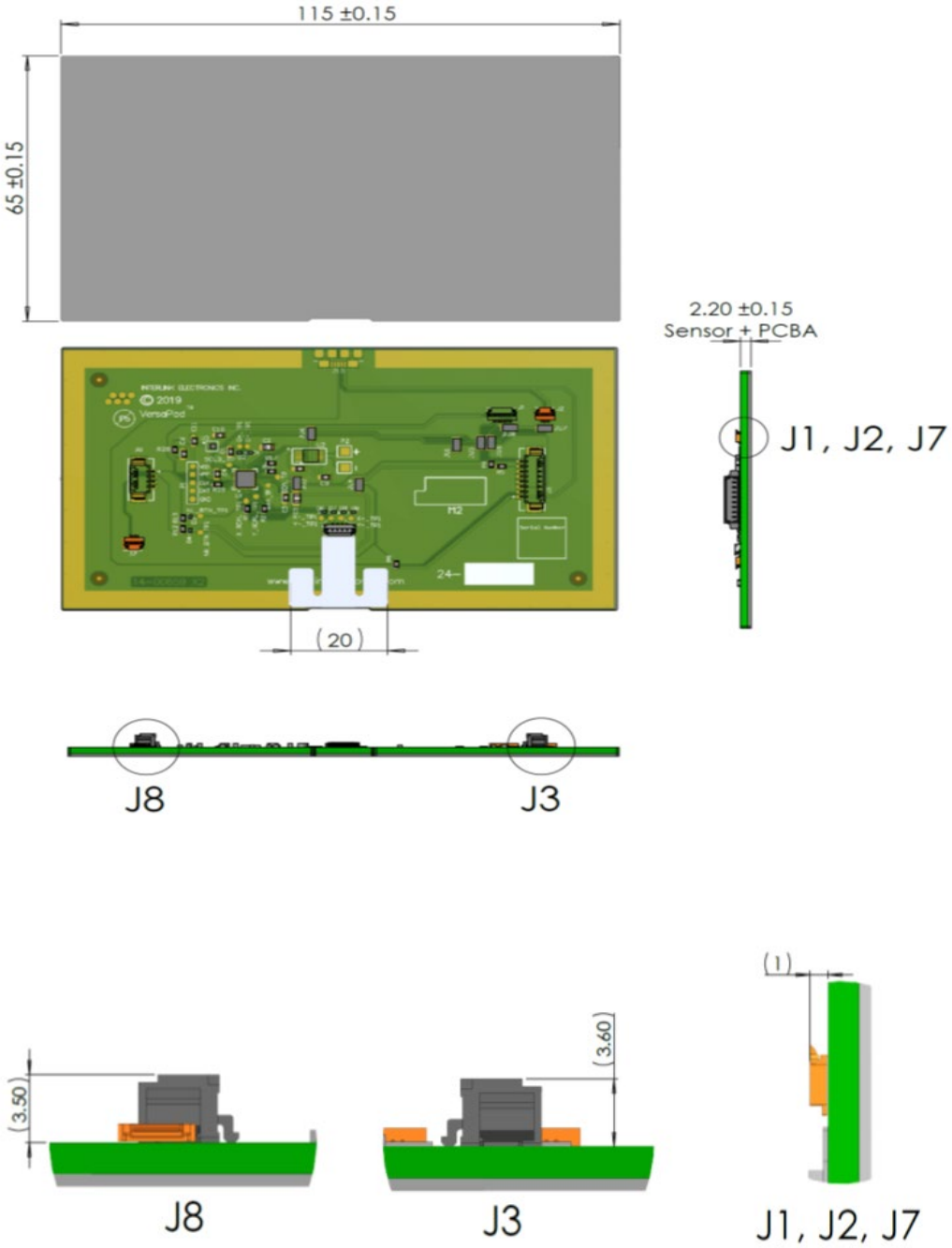

Figure 13. Overall dimensions of VersaPad Plus™. All dimensions are in mm.

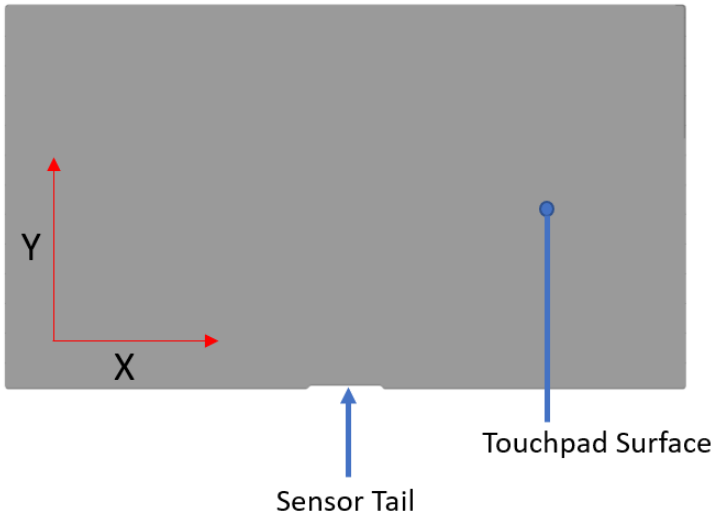

Figure 14. VersaPad Plus™ default orientation.

9.0 Orderable Part Numbers

Hardware Development Kit, 54-00162

- VersaPad Plus™ USB Module with FFC Connectors
- VersaPad Plus™ USB Demo
- 1 Micro USB Cable
- 2 FFC Cables

VersaPad Plus™ USB Module with FFC Connectors (54-00157)

VersaPad Plus™ USB Module with FFC & MicroUSB Connectors (54-00160)

VersaPad Plus™ USB Module with Molex Board to Wire Connectors (54-00163)

12-inch Wire Cable Harness (14-16576)

USB Cable Assembly (14-00054)

USB Cable Assembly with Strain Relief (14-00108)

10.0 Intellectual Property and Other Legal Matters

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11.0 Contact Interlink Electronics

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12.0 Revision History

Date Revised	Document Revision	Released under DCO #	**Change Content**	**Revised by**
2019-04-30	**A**	**DCO 0334**	New release	John Heitzinger
2019-07-02	**B**		Content update	Shawn Lee