# Interlink Electronics FSR® Force Sensing Resistors®

## VersaPad® USB Integration Guide

*Document Part Number 94-00012 Rev. F*

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# 1.0 Introduction

VersaPad is a versatile touchpad module indented 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. The module's tough, moisture and grime resistant surface can be used with a finger or stylus, even in wet or dirty environments. Plus, 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™ into products such as:

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

This USB VersaPad guide is relevant to two products:

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

Part numbers and kit contents are detailed in section 9.

# 3.0 Theory of Operation

The touchpad sensor is a four-wire resistive type. 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 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.

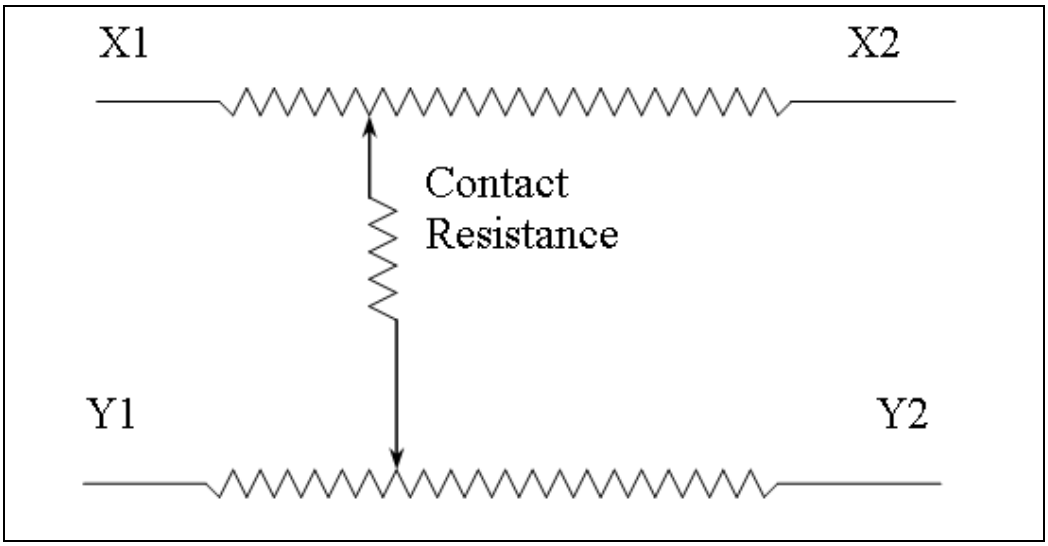


**Figure 1: VersaPad Equivalent Electrical Circuit**

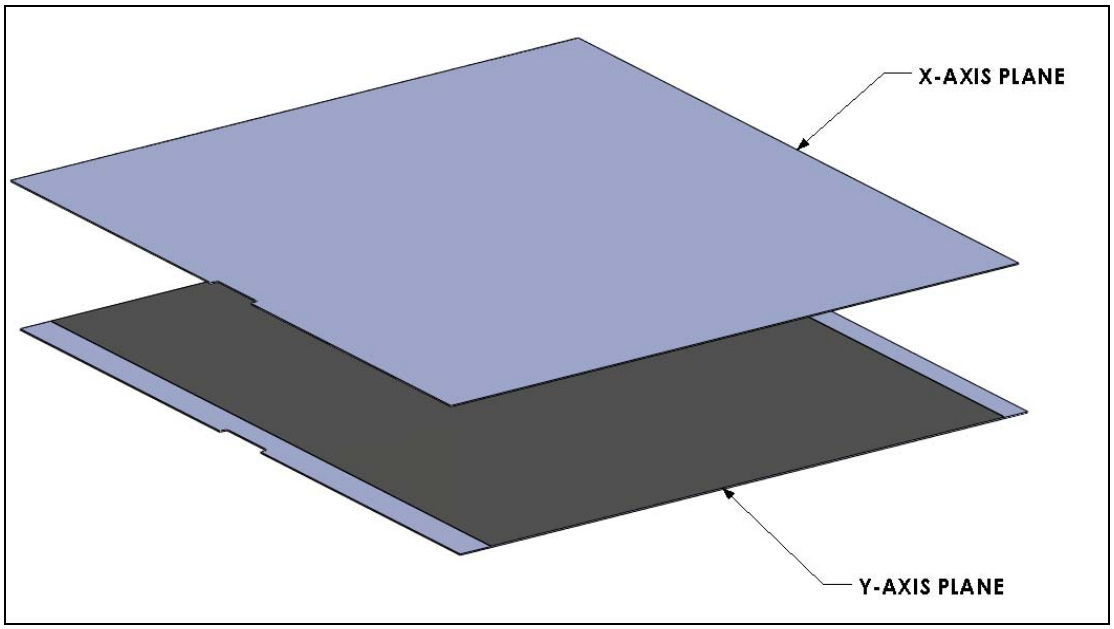


**Figure 2: Simplified Exploded View VersaPad Sensor**

# 4.0 Features and Operation

The detailed features of VersaPad are given below.

## 4.1 USB

The module is fully USB 2.0 compliant and enumerates utilizing native O/S drivers as a HID mouse with Left, Right, and Center-Click capability. The mouse can also be suspended by the host, but the mouse cannot wake the host from suspend mode. No features of the mouse are settable by the host via USB.

## 4.2 Software Driver

The USB VersaPad enumerates as a standard three-button HID-compliant mouse and requires no additional driver. In the future, Interlink may provide a driver that adds additional functionality and customization possibilities to the Windows standard mouse behavior.

## 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 Features

### 4.4.1 Tap for 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.

### 4.4.2 Double Tap

A double tap gesture will be interpreted as a double mouse left click at the position of the cursor. Double-tap is enabled by default on the base design. Custom versions can have tap features disabled.

### 4.4.3 Tap and Drag

Double-tapping and maintaining contact with the touchpad on the second tap initiates tap (left-click) and drag. Tap-and-drag is enabled by default on the base design. Custom versions can have tap features disabled.

### 4.4.4 Drag Edge Lock

If a Tap and Drag is released near any edge of the touchpad, the drag will not be released for three seconds. This allows the drag to be resumed without requiring another double-tap. Drag edge lock is enabled by default on the base design. Custom versions can have drag edge lock disabled.

### 4.4.5 Drag Edge Lock Use Entire Pad

If a Tap and Drag is released anywhere on the touchpad, the drag will not be released for three seconds. This allows the drag to be resumed without requiring another double-tap. Drag edge lock use entire pad is disabled by default on the base design and set to edge only. Custom versions can have drag edge lock use entire pad enabled.

### 4.4.6 Right-Click in Upper Right Corner

Tapping the touchpad in its upper right corner is interpreted as a right-click. Corner Right-Click is enabled by default on the base design. Custom versions can have this feature disabled.

### 4.4.7 Right Edge Border Scrolling

Initiating a touch on the right border edge of the touchpad will set the mouse into scrolling mode. The finger or stylus can then be moved up and down along the right edge to scroll. This feature does not activate when the border region is entered during a mouse cursor movement gesture and the border region is used for mousing only. Right edge border scrolling is enabled by default on the base design. Custom versions can have this feature disabled.

### 4.4.8 External Buttons

External Right, Left, and Center-Click button are available via 4-pin FFC (J3) or Molex header connector (J7).

### 4.4.9 Customization

Interlink Electronics prides itself on its ability to adapt to our customers' needs. For appropriate opportunities a customizable list includes the following:

- Color and Texture of Graphic Layer
- Multicolor graphic artwork, text, and logos
- Orientation
- Removal of features

# 5.0 Mounting

A general bezel mounting method as shown in figure 3 is one possible way to mount the VersaPad Module. Mechanical installation of the VersaPad 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 4 as the dashed line. Parts used to capture the VersaPad module must not make contact with the sensor inside the electrically active area. A general 3D CAD model of Interlink's suggested mounting method and geometry can be found on our website at www.interlinkelectronics.com/Support.

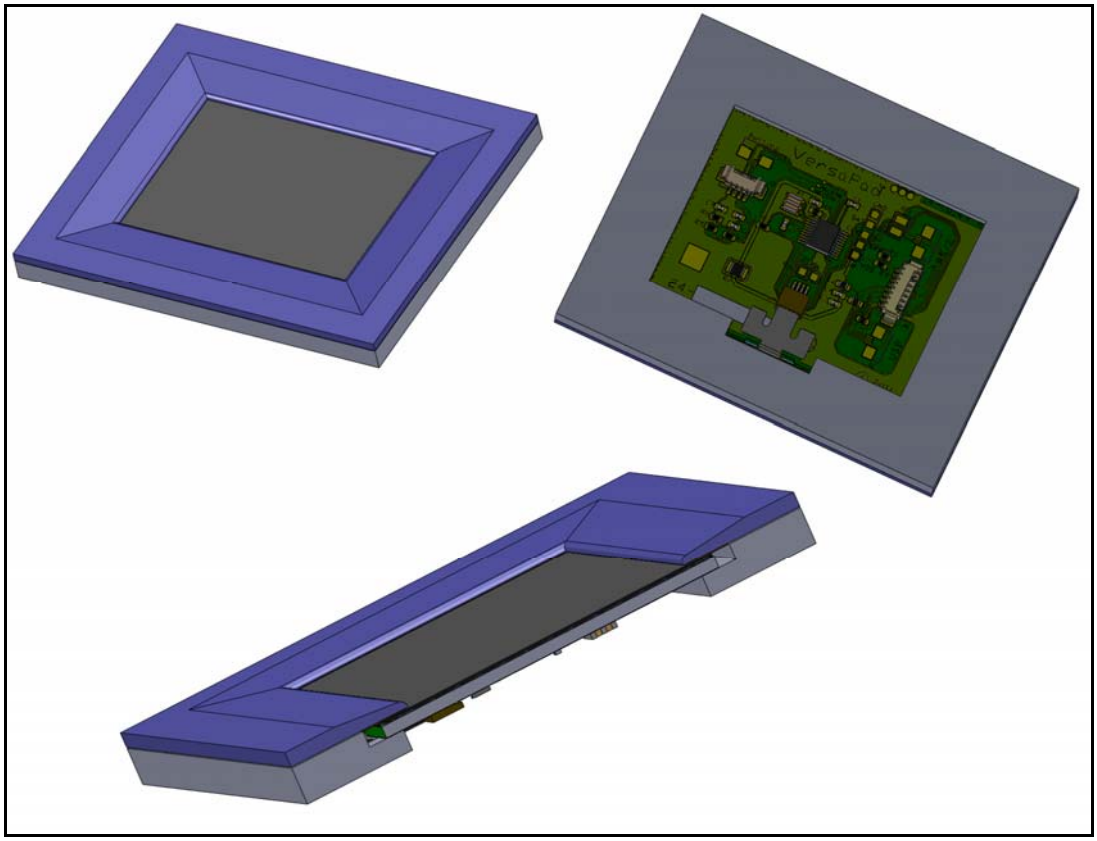

**Figure 3: VersaPad Module Bezel Mounting Concept**

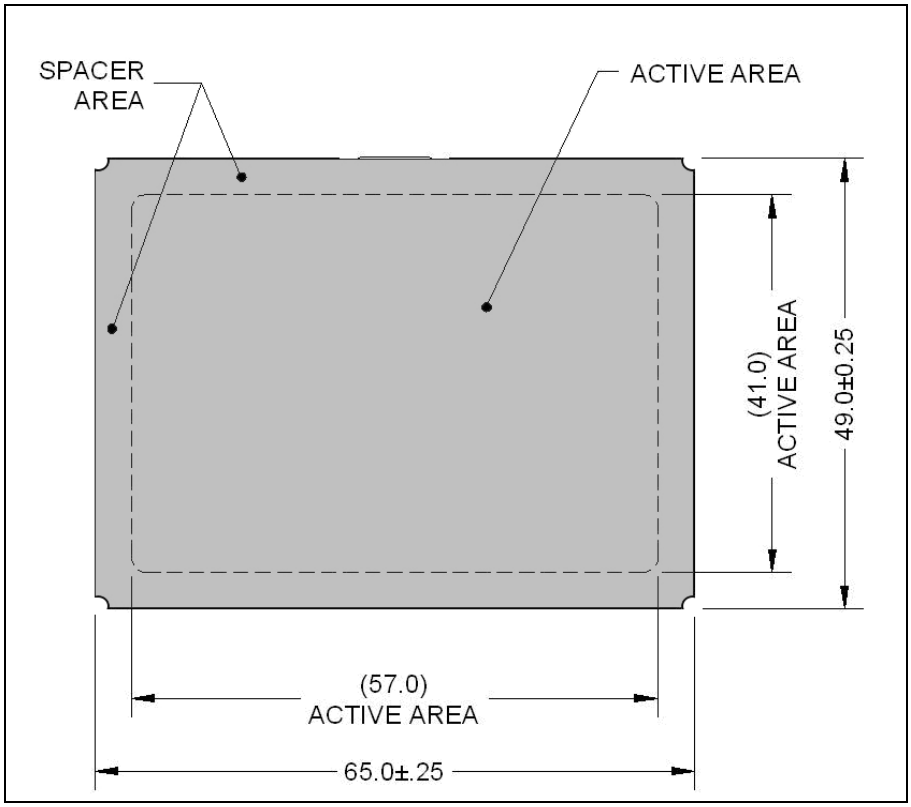


**Figure 4: Top View of VersaPad sensor showing hidden spacer geometry. Dimensions are in mm.**

## 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 module can follow either a top or bottom installation method. Pressure sensitive gaskets or adhesives may be used to support and protect the VersaPad. 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.

### 5.1.3 Contamination

Moisture and debris contamination can jeopardize the performance of the VersaPad. 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 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

The figure below shows the critical dimensions in positioning of the bezel or top case, gasket, VersaPad, 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.

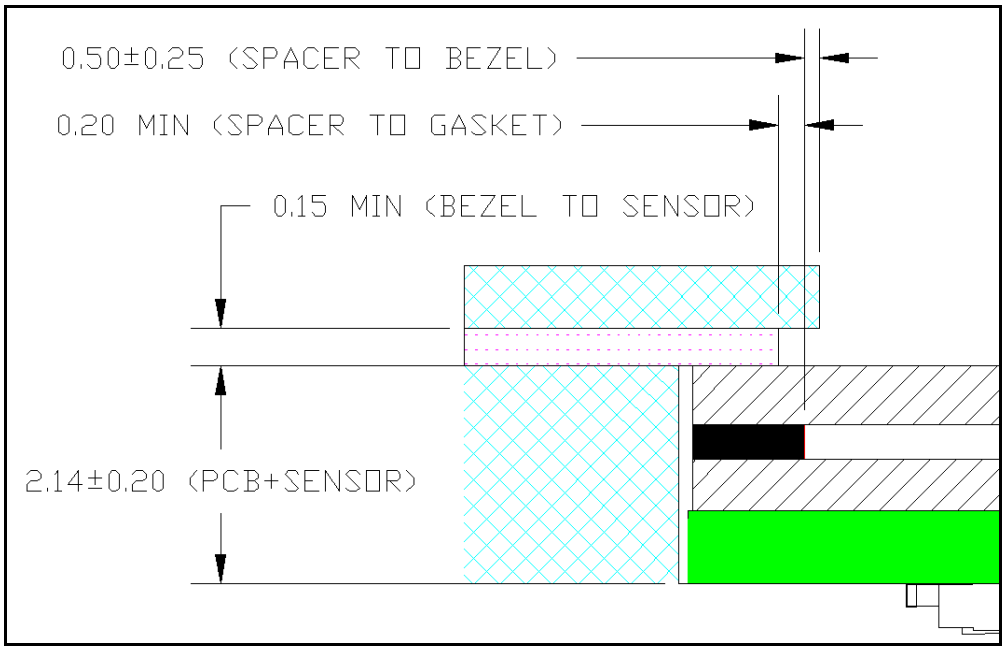


**Figure 5: Critical capture dimensions. Drawing is not to scale.**

## 5.2 Bottom Side Mounting

In bottom side integration, 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.

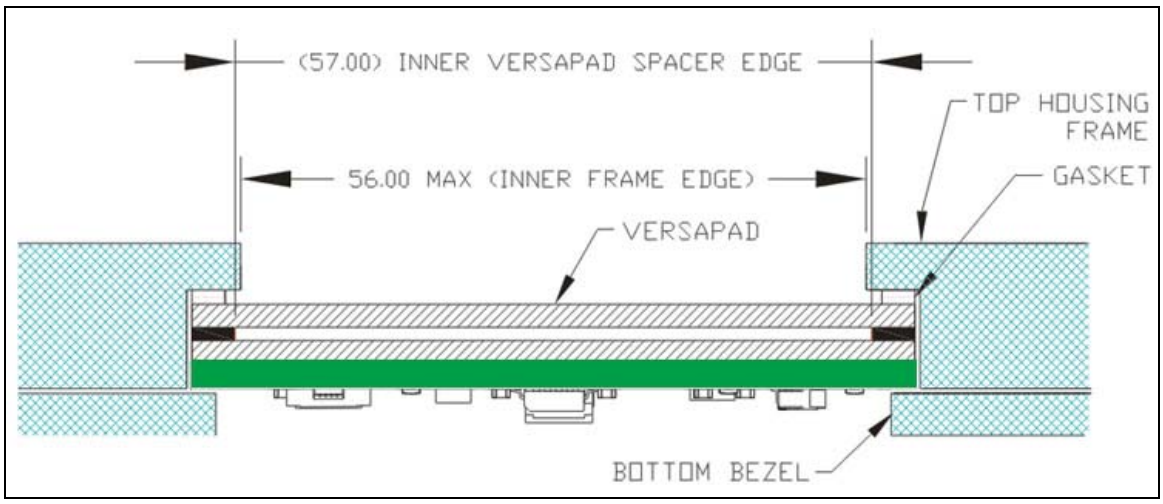


**Figure 6: Side view of bottom side mounting. Drawing is not to scale**

## 5.3 Top Side Mounting

In top side installation 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, but could extend to be a larger piece of the top case with a cutout.

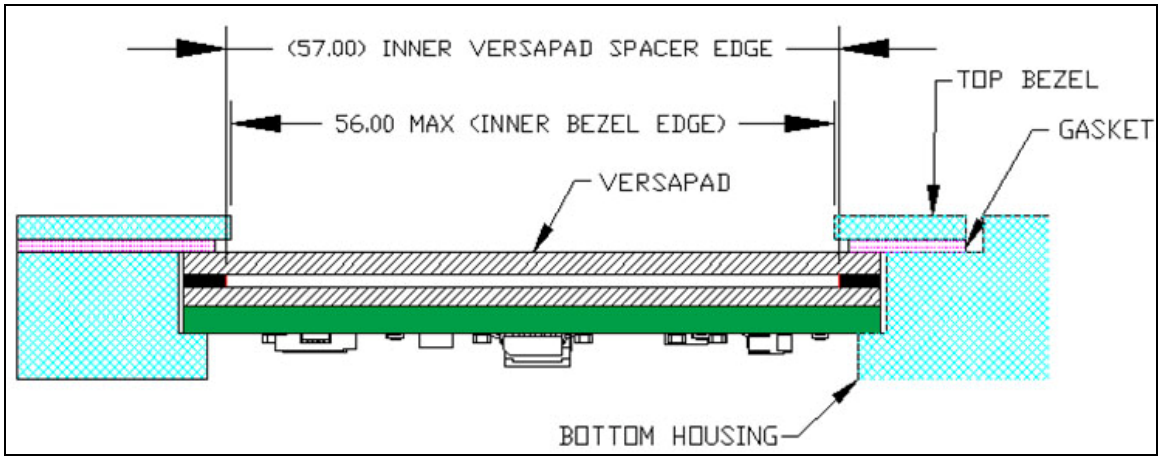


**Figure 7: Side view of top side mounting. Drawing is not to scale**

## 5.4 PCB Keep Out Area

The illustration below 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. The 3D CAD model on our website is a useful tool for packaging the VersaPad into your application.

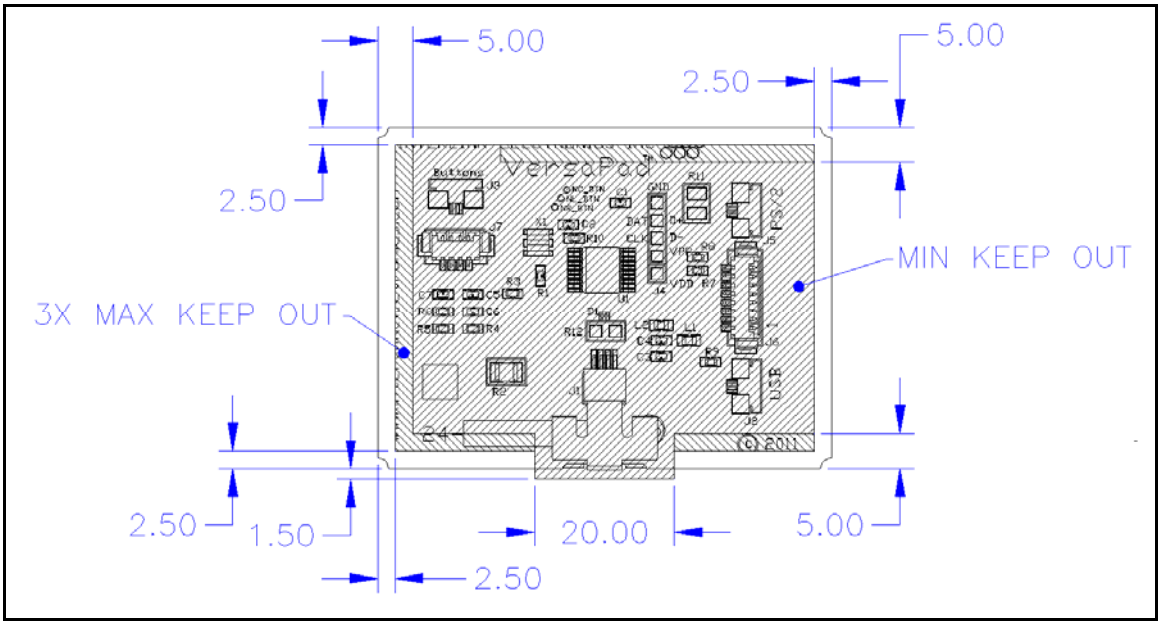


**Figure 8: Mounting Bracket & Keep out Area. Drawing is not to scale**

# 6.0 Connection

The USB VersaPad 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 is to use wire to board header connectors. The J7 header (Molex #53261-0471) is used for connecting external mouse buttons to the VersaPad PCBA. The J6 header (Molex #53261-0871) is the VersaPad 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 J6 and J7 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 is also available in a FFC connector option for the USB and external button connections. Refer to specification for FCI **SFV4R-1STE1LF** 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 **050R04-76B**. 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

The following figure and table shows the pin-out for Molex header connections to the J6 and J7 headers.

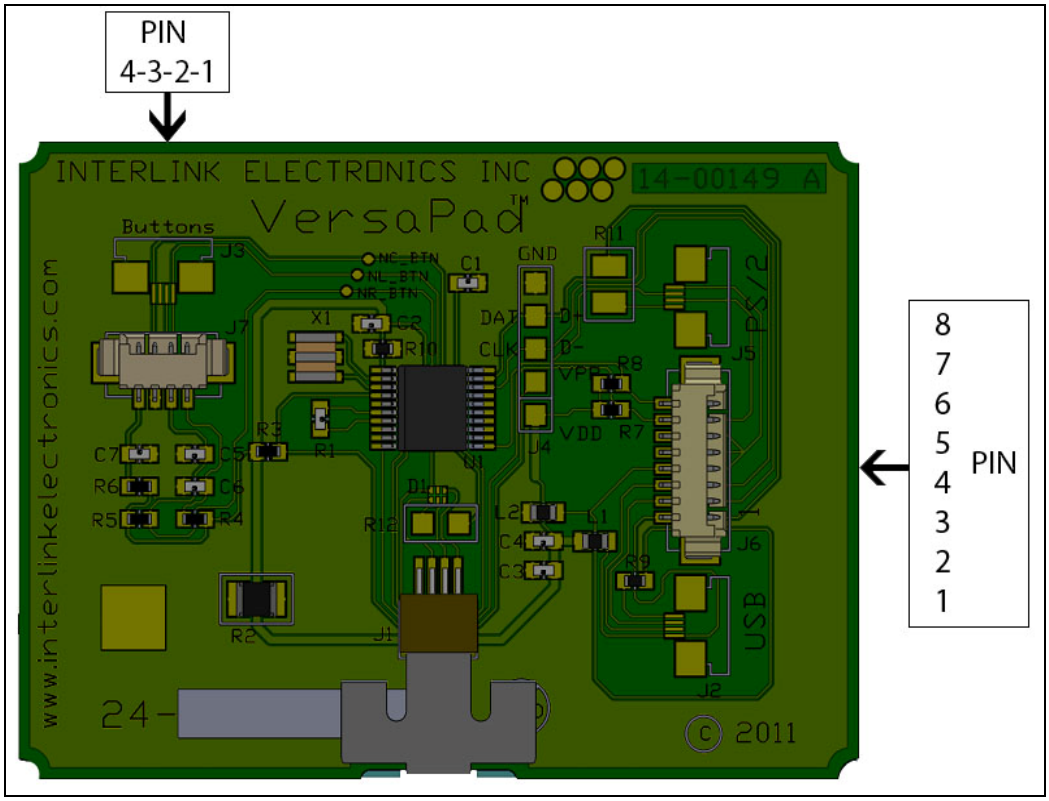


**Figure 9: Molex Header Pin-Outs**

| J6 Pin | Signal | Signal Description |
|---|---|---|
| 1 | VCC | +5v |
| 2 | D+ | D+ |
| 3 | D- | D- |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | GND | Ground |
| 7 | NC | -- |
| 8 | NC | -- |

| J7 Pin | Signal |
|---|---|
| 1 | Left Button |
| 2 | Right Button |
| 3 | Ground |
| 4 | Center Button |

**Table 1: J6 & J7 Molex Header Pin-Outs**

## 6.6 FFC Connector Pin-out

The following figure and table shows the pin-out for Molex header connections to the J2 and J3 components.

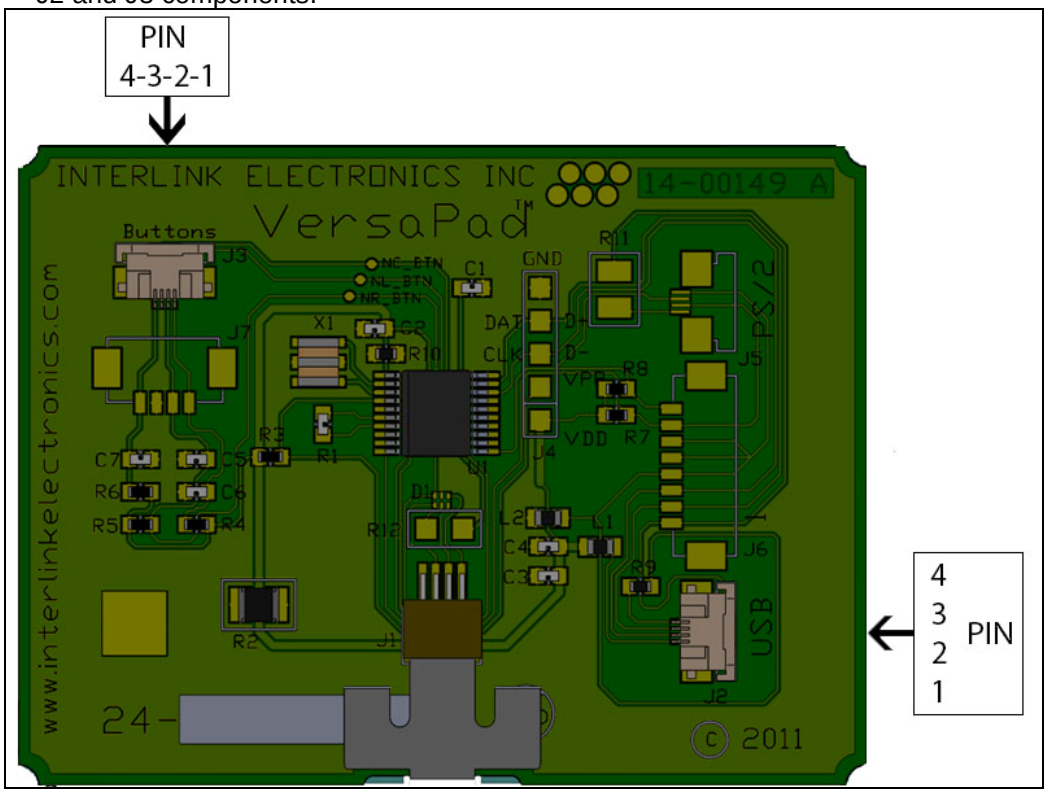


**Figure 10: FFC Connector Pin-Outs**

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

| J3 Pin | Signal |
|---|---|
| 1 | Left Button |
| 2 | Right Button |
| 3 | Ground |
| 4 | Center Button |

**Table 2: J2 & J3 FFC Connector Pin-Outs**

## 6.7 Cable Options

The following illustrations show the standard Interlink cable options.

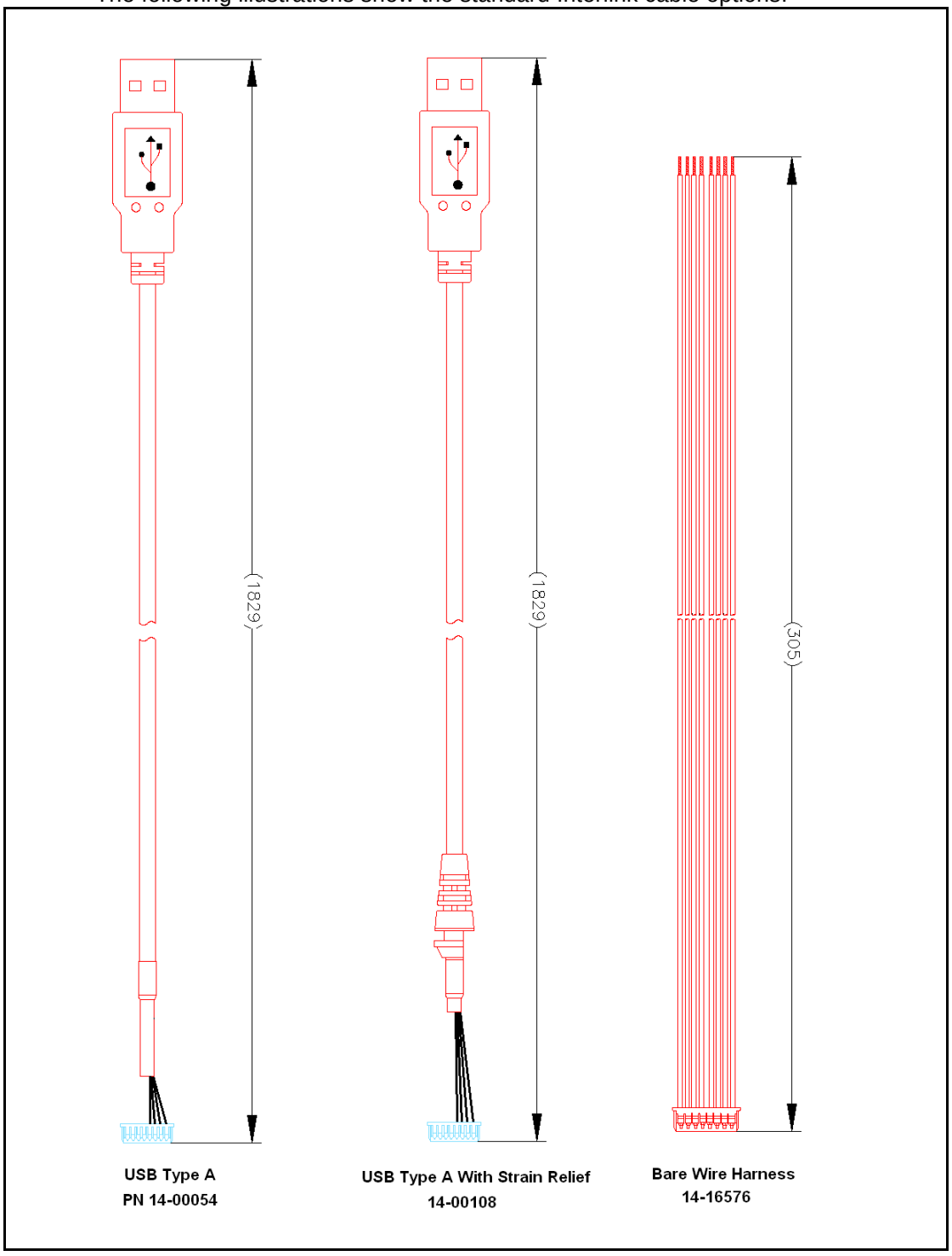


**Figure 11: USB VersaPad Standard Cable Options**

# 7.0 USB Information

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

- Uses the low speed USB standard
- Is compatible with any USB 1.1 or 2.0 host
- 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): 0x0001
- Interlink Electronics' Vendor ID (VID): 0x214A

## 7.2 Data Packet

The data packet from the chip is organized as.

- Byte 0
  - Bit 0 is the Left Button status
  - Bit 1 is the Right Button status
  - Bit 2 is the Middle button status

- Byte 1 reports the X direction. The values range from -127 to +127 counts.
- Byte 2 reports the Y direction. The values range from -127 to +127 counts.

## 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.

## 7.4 Operating Voltage and Current

The USB VersaPad is bus powered; therefore, it operates at 5V. Under normal operation, the device draws approximately 15mA. During suspend mode the chip enters a low current mode. In this mode the chip will draw no more than 25nA.

# 8.0 Drawings and Dimensions

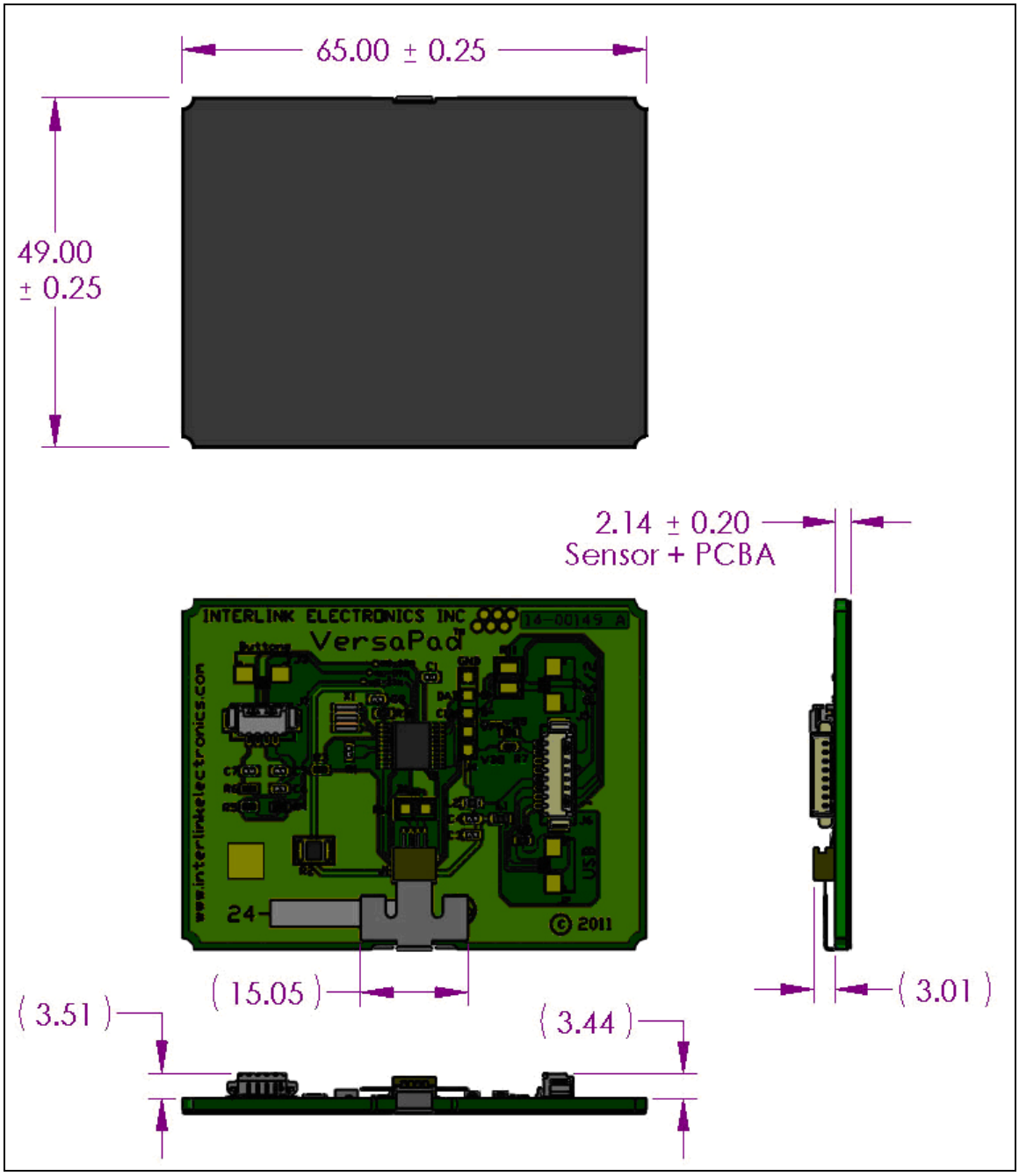


**Figure 12: Overall dimensions of VersaPad. All dimensions are in mm.**

Note: A detailed 3D CAD model of Interlink's VersaPad geometry can be found on our website at www.interlinkelectronics.com/Support.

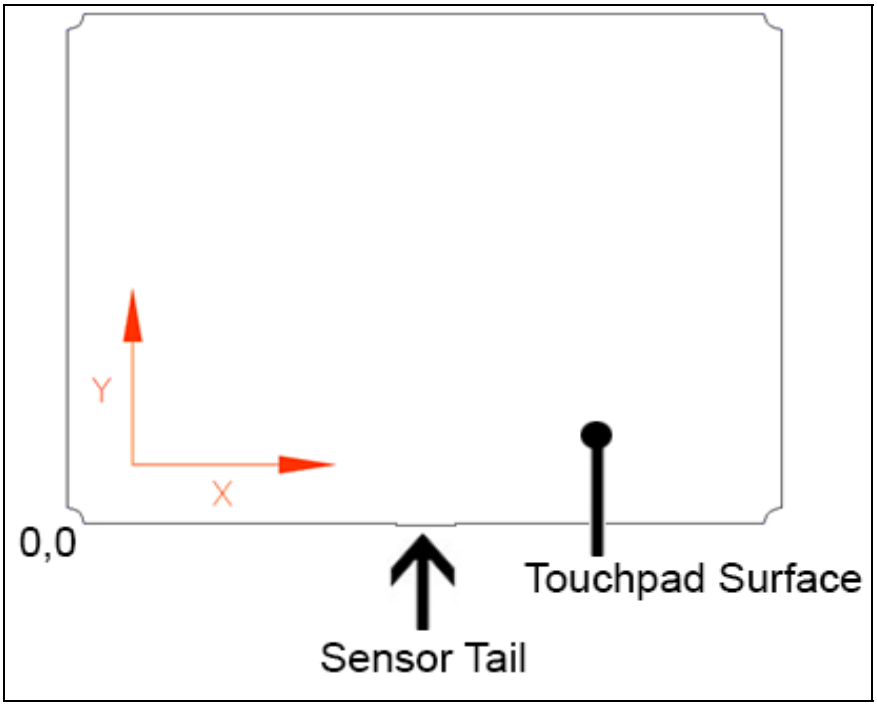


**Figure 13: VersaPad default orientation**

# 9.0 Orderable Part Numbers

- **Hardware Development Kit, 54-00007**
  - VersaPad USB Module with FFC Connectors
  - VersaPad USB Module with Molex board to Wire Connectors
  - VersaPad USB Demo with Cable
  - Demo Model Graphic Overlay
  - 12 inch Wire Cable Harness
  - 2 FFC Cables
  - 3 FFC Connectors
  - 1 USB Flash Drive with Product Literature
    - VersaPad USB Datasheet
    - VersaPad USB Integration Guide
- **VersaPad USB Module with FFC Connectors (54-00030)**
- **VersaPad USB Module with Molex Board to Wire Connectors (54-00031)**
- **VersaPad USB Module with FFC All features Disabled (54-00061)**
- **VersaPad USB Module with Molex All features Disabled (54-00063)**
- **12 inch Wire Cable Harness (14-16576)**
- **USB Cable Assembly (14-00054)**
- **USB Cable Assembly with Strain Relief (14-00108)**

# 10.0 Intellectual Property & Other Legal Matters

Interlink Electronics holds several domestic and international patents for its Force Sensing Resistor technology. FSR, Force Sensing Resistor, and VersaPad are company trademarks. All other trademarks are the property of their respective owners.

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