

# ADNS-7630

## One-Chip Bluetooth® SoC LaserStream™ Navigation Sensor



### Data Sheet



#### Description

ADNS-7630 is the world's first one-chip Bluetooth (BT) 2.1 System-on-Chip (SoC) LaserStream navigation sensor chip for laser-illuminated navigation system. Driven by Avago's LaserStream navigation technology and proprietary optimized cum efficient RF transceiver architecture, it provides a fully integrated and feature-rich navigation system for wireless mouse applications and other integrated input devices. This compact, laser navigation sensor engine from Avago, integrates a BT transceiver, stand-alone baseband processor and VCSEL illumination into a single chip package to provide a complete SoC solution that provides fast and secure connectivity, and easy integration into mouse designs.

ADNS-7630 complies with Bluetooth specification version 2.1 and HID profile version 1.0. The built-in radio provides low-power, low-cost and robust communications for applications operating in the 2.4-GHz unlicensed ISM band. Additionally, this new laser sensor has several features that can be configured via an external EEPROM to simplify mouse and provide flexibility for product customization.

This chip is available in 58-pin custom designed QFN package and designed to be used with the ADNS-7100-001 laser mouse lens to achieve the optimum performance featured in this document. These parts provide a complete and compact navigation system with no moving parts and precise optical alignment to facilitate high volume assembly. Avago has pre-calibrated the laser power prior shipment to meet IEC/EN 60825-1 Class 1 Eye Safety Standard, thus no laser power calibration is required at manufacturer site, therefore reducing assembly time and associated cost.

#### Applications

- Bluetooth cordless laser mice
- Integrated input devices

#### Features

- One-chip Bluetooth SoC LaserStream navigation sensor optimized for laser mouse performance
- Bluetooth HID profile version 1.0 compliant.
- Bluetooth specification version 2.1 compatible.
- Compliance to IEC/EN 60825-1 Class 1 Eye Safety
- Fast data transmission through synchronized timing between sensor and Bluetooth system
- Extended battery life with low power architecture and LaserStream navigation technology
  - Extended inquiry response to enable fast discovery of device and to reduce latency
  - Sniff Sub Rating to reduce power consumption for HID.
  - Secure Simple Pairing, which supports “Just Works” and to enhance ease of use user experience.
  - Encryption Pause Resume where better protection through encryption key refreshed during long connection period of use.
- Excellent receiver sensitivity
- Optimized Adaptive Frequency Hopping (AFH) to minimize interference disturbance
- Programmable output power control meets Bluetooth Power Class 2 or Class 3 requirements
- On-chip Power On Reset (POR)
- High speed motion detection at 30 inches per second (ips) & acceleration up to 8g
- Support up to 10 I/O pins for flexible configuration
  - 3-key or 5-key mouse
  - LED indicators
  - Media buttons for audio control
  - KeyMap (KM) for keyboard shortcut key (supported in Bluetooth version 2.0 only)

(continued on next page)

## Features (continued)

- Mechanical and optical Z-Wheel interface for vertical scroll
- Tilt-Wheel function for horizontal scroll
- 12-bit Bluetooth HID motion data reporting
- Customizable SDP Service Name, Service Description, Provider Name, VID, PID, & Bluetooth Address
- 4-axis sensor rotations: 0°, 90°, 180° or 270°
- Resolution:
  - Programmable from 250-3000 counts per inch (cpi) with 250cpi incremental step
  - Up to 10 selections of On-the-Fly (OTF) resolution mode setting

Disclaimer: All designers and manufacturers of final product with tilt wheel enabled must assure that they have all necessary intellectual property rights.

## Theory of Operation

ADNS-7630 is based on LaserStream navigation technology that measures changes in position by optically acquiring sequential surface images (per frames) and mathematically determining the direction and magnitude of motion. It contains an Image Acquisition System (IAS), a Digital Signal Processor (DSP) and Bluetooth HID stream output. Images acquired by the IAS are processed by the DSP to determine the direction and distance of motion. The DSP generates the  $\Delta x$  and  $\Delta y$  relative displacement values which are converted to Bluetooth HID data. The motion data and buttons input status are then transmitted in wireless mode to the Bluetooth.

## Ordering Information

| Part Number  | Packaging Type | Minimum Order Quantity |
|--------------|----------------|------------------------|
| ADNS-7630    | Tube           | 1000 units per tube    |
| ADNS-7630-TR | Tape and Reel  | 4000 units per roll    |

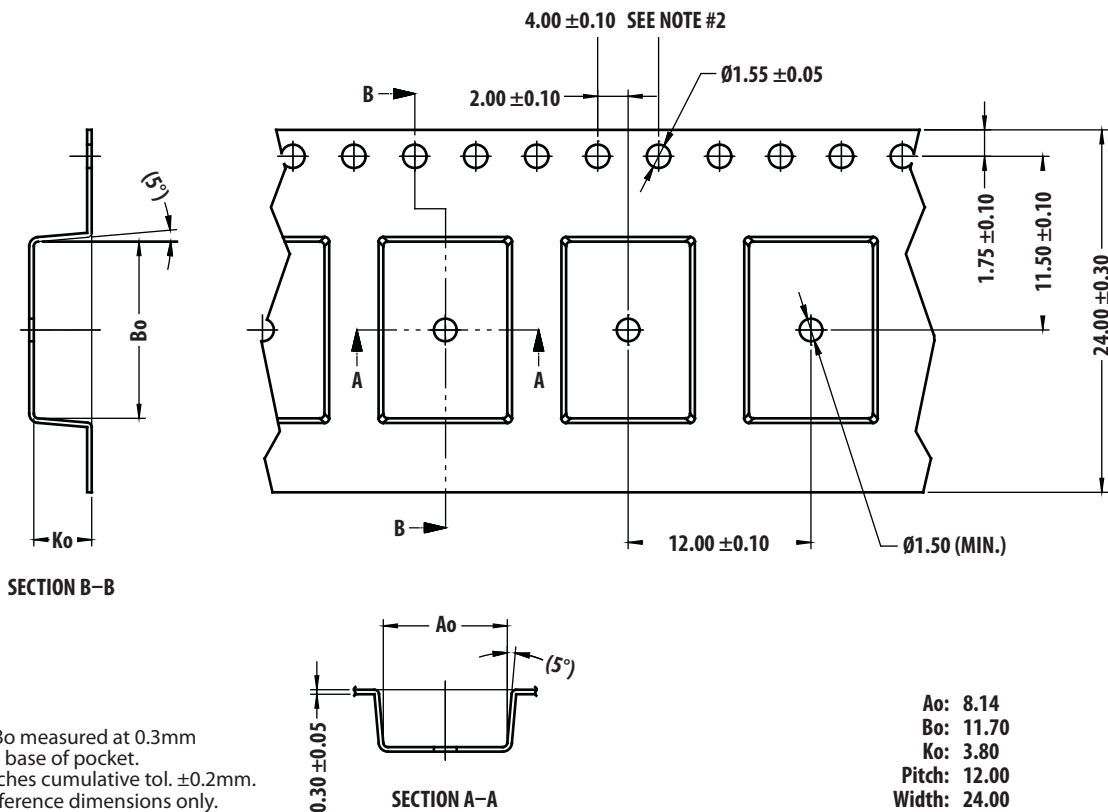
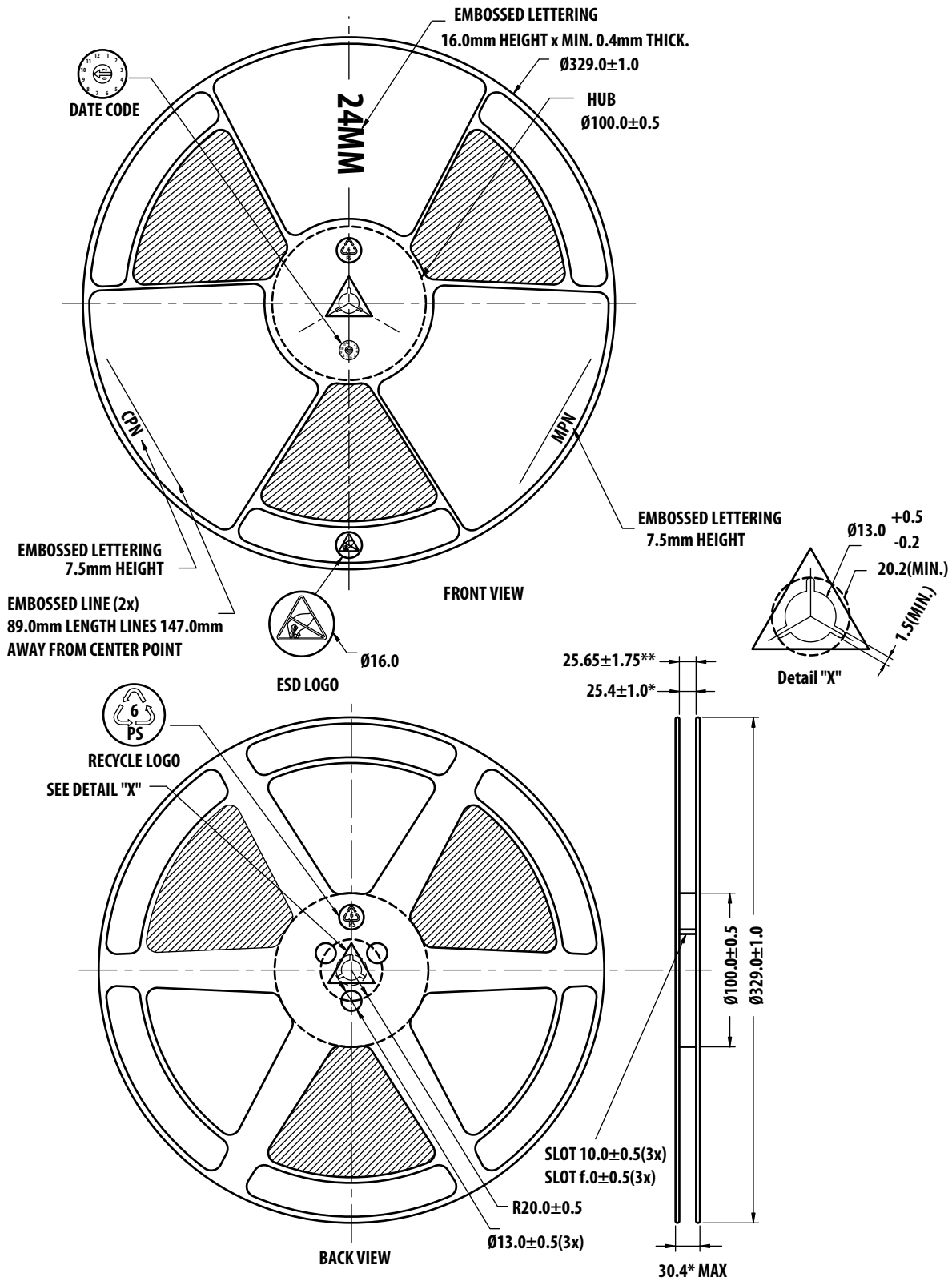


Figure 1a. ADNS-7630-TR Tape and Reel Packaging Dimension



Notes:

1. Unless otherwise specified. Dimensions are in millimeters.
2. \* - Measured at hub area.
3. \*\* - Measured at outer edge.
4. Flange and hub ultrasonic welded.

Figure 1b. ADNS-7630-TR Reel Packaging Dimension

## Package Pinout

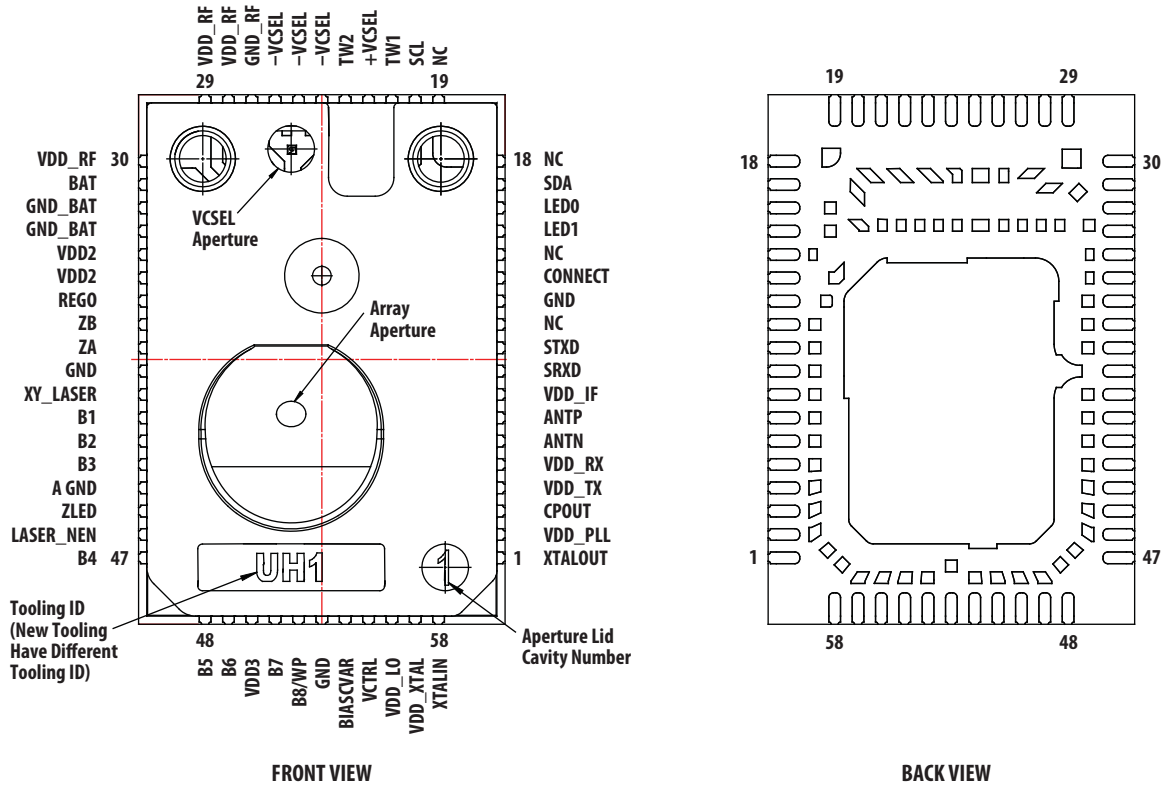


Figure 2. ADNS-7630 QFN Package Pinout

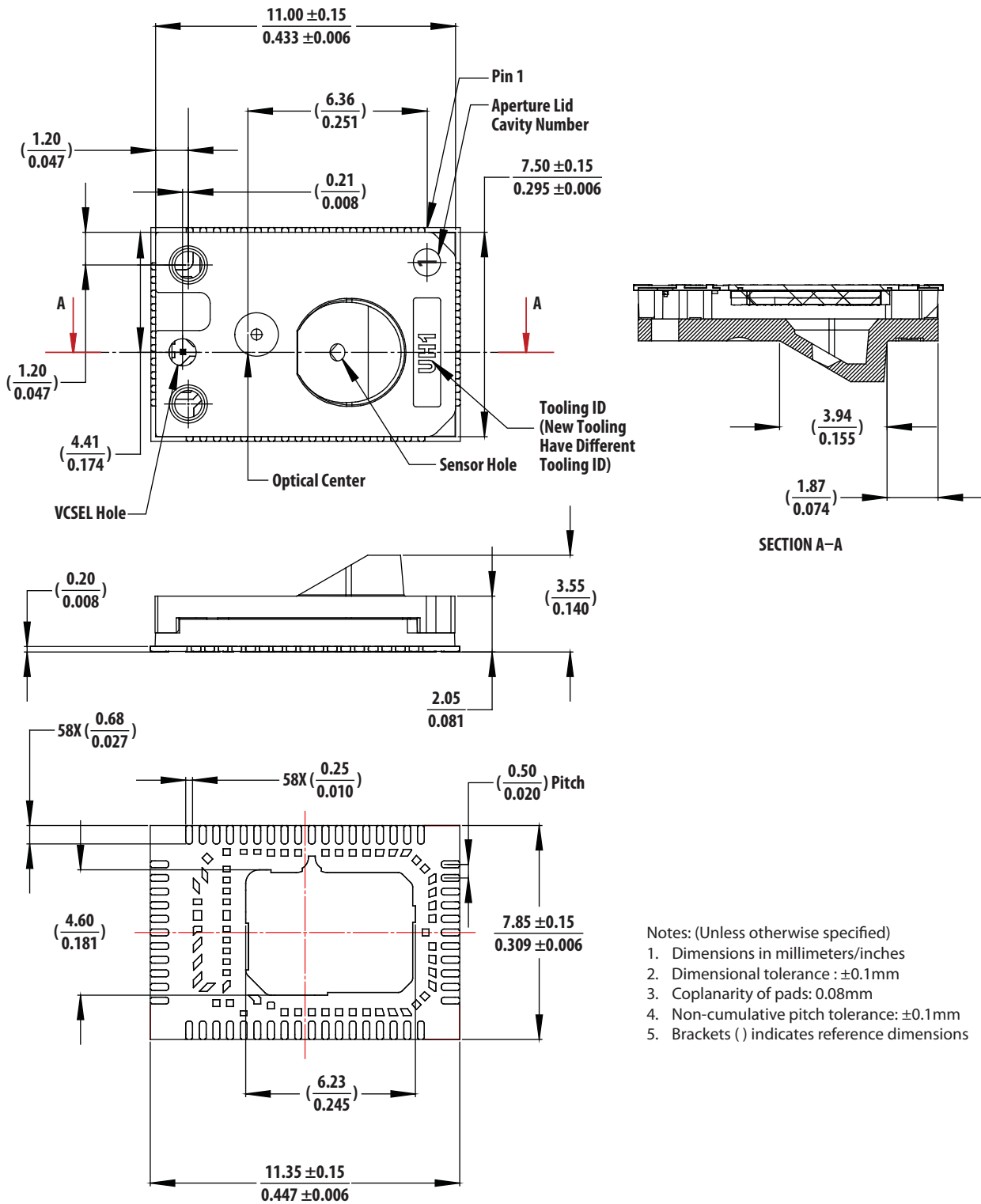
Table 1. ADNS-7630 Pinout Device Configuration

| Pin | Name         | Description                                      | Type  |
|-----|--------------|--|-------|
| 1   | XTAL_OUT     | Crystal output                                   | I/O   |
| 2   | VDD_PLL      | Power supply for frequency synthesizer           | Power |
| 3   | CPOUT        | Charge pump output pin for digital clock PLL     | I/O   |
| 4   | VDD_TX       | Power supply for RF transmitter                  | Power |
| 5   | VDD_RX       | Power supply for RF receiver                     | Power |
| 6   | ANTN         | Negative port for antenna                        | I/O   |
| 7   | ANTP         | Positive port for antenna                        | I/O   |
| 8   | VDD_IF       | Power supply for IF                              | Power |
| 9   | SRXD         | Serial Port transfer out to Host                 | I/O   |
| 10  | STXD         | Serial Port receive in from Host                 | I/O   |
| 11  | NC           | No Connect                                       | -     |
| 12  | GND          | Ground   | GND   |
| 13  | CONNECT      | Bluetooth Connect button                         | I/O   |
| 14  | NC           | No Connect                                       | -     |
| 15  | LED1 (GPIO6) | Bluetooth Connect Status / Battery LED Indicator | I/O   |
| 16  | LED0 (GPIO5) | Bluetooth Connect Status / Battery LED Indicator | I/O   |
| 17  | SDA          | Serial Control Data to/from EEPROM               | I/O   |
| 18  | NC           | No Connect                                       | -     |
| 19  | NC           | No Connect                                       | -     |
| 20  | SCL          | Serial Control Clock to/from EEPROM              | I/O   |
| 21  | TW1 (GPIO3)  | Left Tilt Wheel / Programmable LED indicator     | I/O   |
| 22  | +VCSEL       | Positive Terminal of VCSEL                       | Power |
| 23  | TW2 (GPIO4)  | Right Tilt Wheel / Programmable LED indicator    | I/O   |
| 24  | -VCSEL       | Negative Terminal of VCSEL                       | Power |
| 25  | -VCSEL       | Negative Terminal of VCSEL                       | Power |

**Table 1. ADNS-7630 Pinout Device Configuration** (continued)

| <b>Pin</b> | <b>Name</b>    | <b>Description</b>                                       | <b>Type</b> |
|------------|----------------|--|-------------|
| 26         | -VCSEL         | Negative Terminal of VCSEL                               | Power       |
| 27         | GND_RF         | RF regulator GND   | GND         |
| 28         | VDD_RF         | 1.8V supply voltage to RF block                          | Power       |
| 29         | VDD_RF         | 1.8V supply voltage to RF block                          | Power       |
| 30         | VDD_RF         | 1.8V supply voltage to RF block                          | Power       |
| 31         | BAT            | Battery Voltage Monitor                                  | I/O         |
| 32         | GND_BAT        | Battery Ground   | GND         |
| 33         | GND_BAT        | Battery Ground   | GND         |
| 34         | VDD2           | Power 2.1V input   | Power       |
| 35         | VDD2           | Power 2.1V input   | Power       |
| 36         | REGO           | Regulator Output   | Power       |
| 37         | ZB             | Z-Wheel quadrature input                                 | I/O         |
| 38         | ZA             | Z-Wheel quadrature input                                 | I/O         |
| 39         | GND            | Ground   | GND         |
| 40         | XY_LASER       | VCSEL current source                                     | I/O         |
| 41         | B1             | Button 1 input (Left Button)                             | I/O         |
| 42         | B2             | Button 2 input (Middle Button)                           | I/O         |
| 43         | B3             | Button 3 input (Right Button)                            | I/O         |
| 44         | AGND           | Analog GND   | GND         |
| 45         | ZLED           | Optical Z-Wheel IR LED input                             | I/O         |
| 46         | LASER_NEN      | Laser Enable (active low)                                | I/O         |
| 47         | B4 (GPIO11)    | Programmable Button 4 / LED input                        | I/O         |
| 48         | B5 (GPIO12)    | Programmable Button 5 / LED input                        | I/O         |
| 49         | B6 (GPIO13)    | Programmable Button 6 / LED input                        | I/O         |
| 50         | VDD3           | Power 3V input   | Power       |
| 51         | B7 (GPIO14)    | Programmable Button 7 / LED input                        | I/O         |
| 52         | B8/WP (GPIO15) | Programmable Button 8 / LED input / EEPROM Write Protect | I/O         |
| 53         | GND            | Ground   | GND         |
| 54         | BIASCVAR       | Filter capacitor pin for VCO                             | I/O         |
| 55         | VCTRL          | VCO control signal                                       | I/O         |
| 56         | VDD_LO         | Power supply for local oscillator                        | Power       |
| 57         | VDD_XTAL       | Power supply for crystal oscillator                      | Power       |
| 58         | XTAL_IN        | Crystal input  | I/O         |

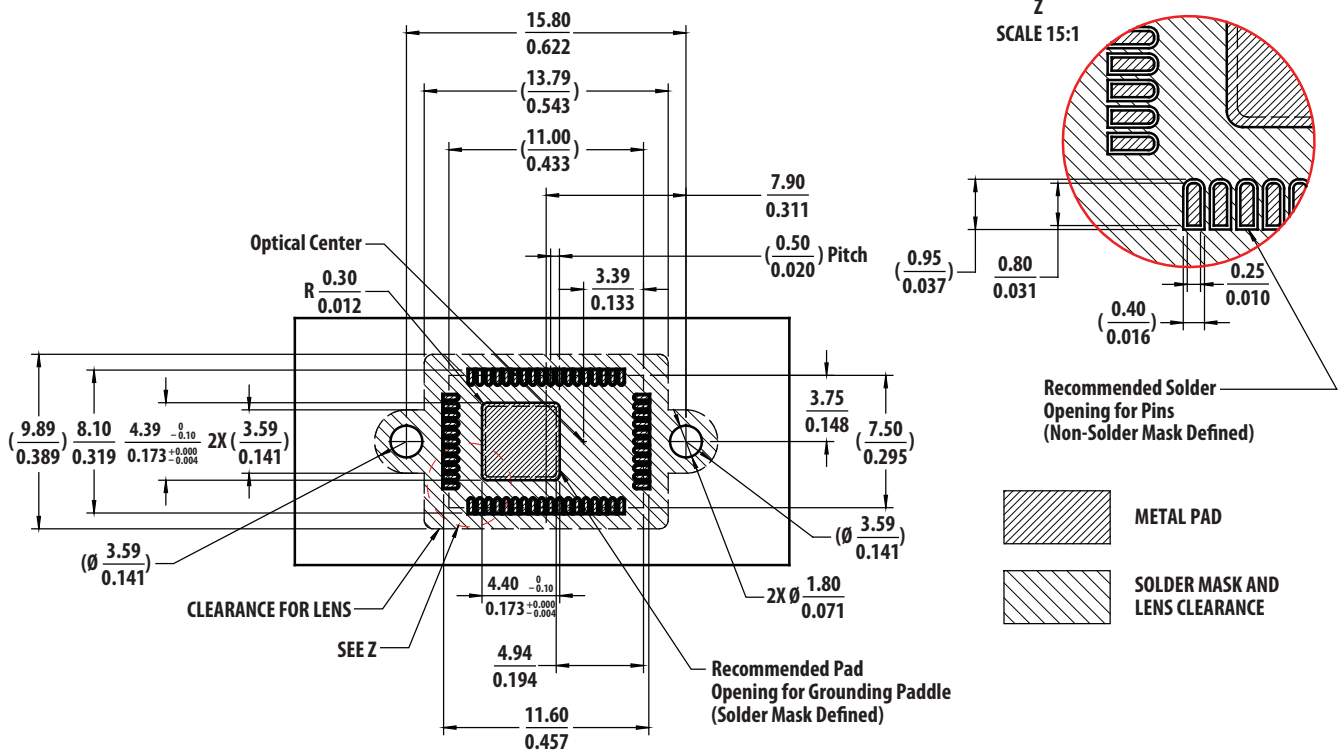
Disclaimer: All designers and manufacturers of this design must assure that they have all necessary intellectual property rights.



- Notes: (Unless otherwise specified)
1. Dimensions in millimeters/inches
  2. Dimensional tolerance :  $\pm 0.1$ mm
  3. Coplanarity of pads: 0.08mm
  4. Non-cumulative pitch tolerance:  $\pm 0.1$ mm
  5. Brackets ( ) indicates reference dimensions

Figure 3. Package outline drawing

**CAUTION:** It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.



Note:

1. Dimensions in millimeters/inches

Figure 4. Recommended PCB mechanical cutouts and spacing (Top view)

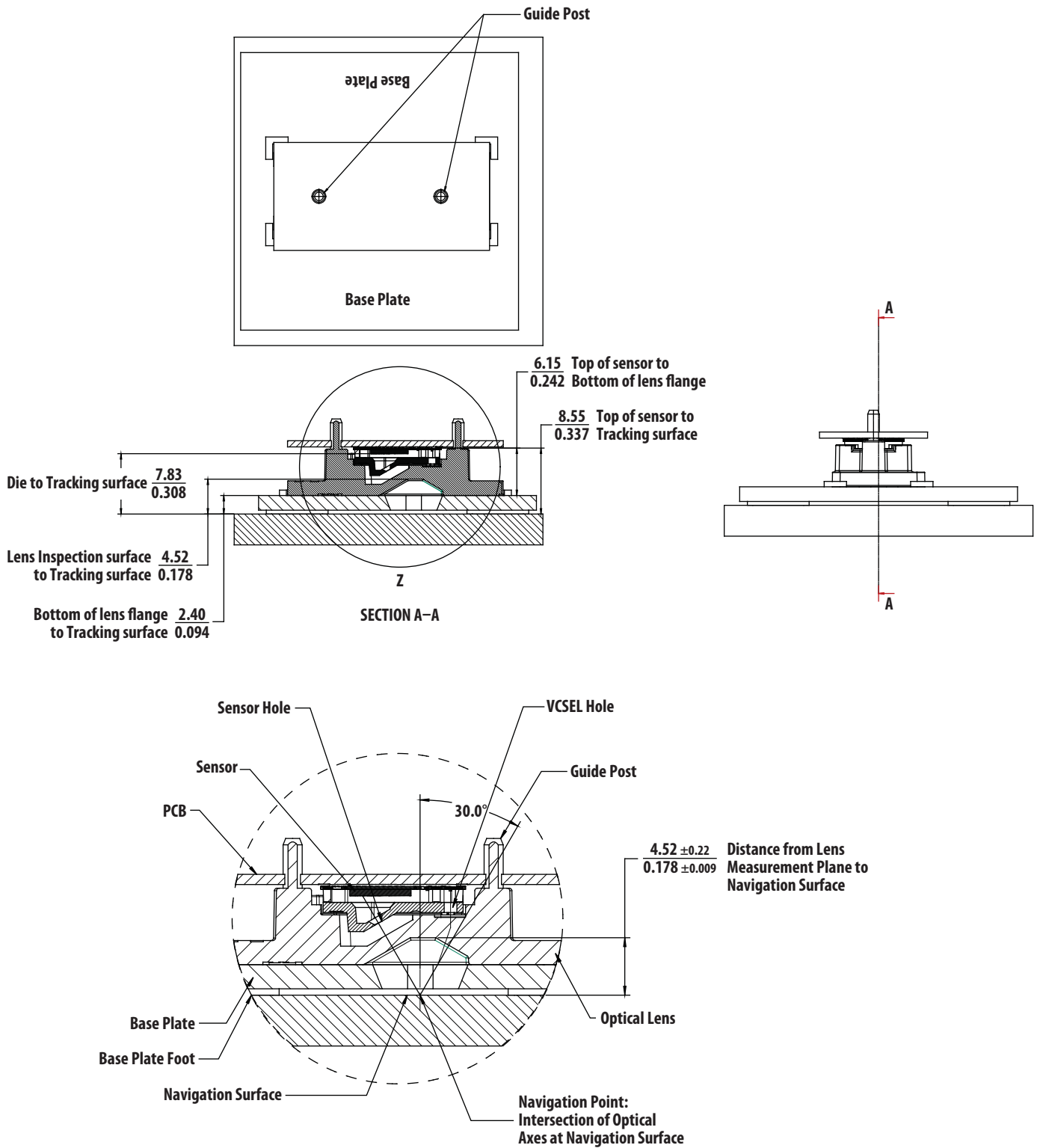


Figure 5. 2D assembly drawing of ADNS-7630 sensor coupled with ADNS-7100-001 lens, PCB & base plate



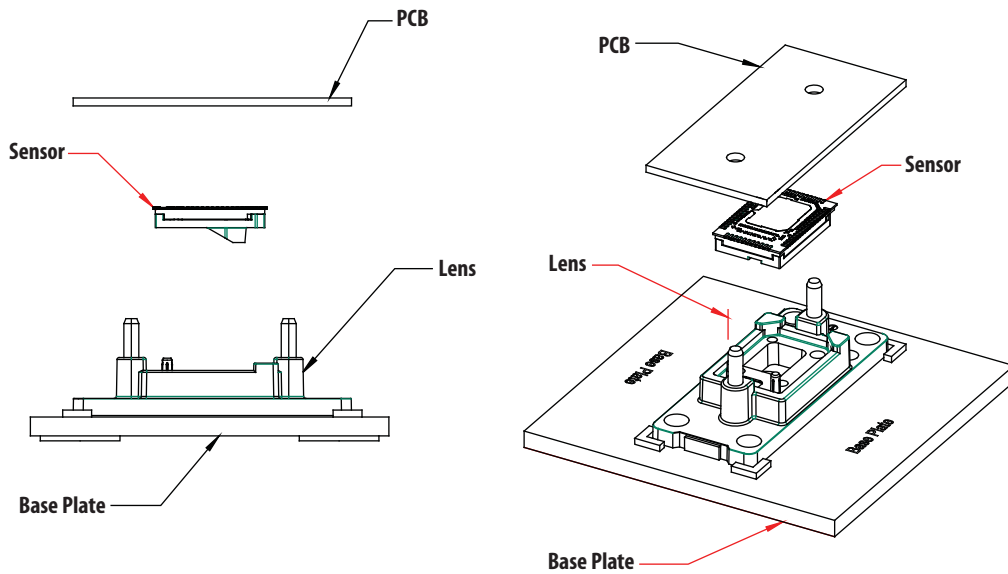


Figure 6. Exploded view drawing of ADNS-7630 sensor coupled with ADNS-7100-001 lens, PCB & base plate (front view and top side view)

As shown above, the components self align as they are mounted onto defined features on the base plate. There should be guide holes on the PCB to align the ADNS-7100-001 lens to the ADNS-7630 sensor's aperture stop. The ADNS-7630 sensor is designed for mounting on the bottom side of a PCB, looking down.

The integrated VCSEL is used for the illumination, provides a laser diode with a single longitudinal and a single transverse mode. Together with the VCSEL contained in the sensor package, the ADNS-7100-001 lens provides directed illumination and optical imaging necessary for the operation of the sensor. The lens is a precision molded optical component and should be handled with care to avoid scratching and contamination on the optical surfaces.

3D drawing files in STEP or IGES format for the sensor, lens and base plate describing the components and base plate molding features for the lens and PCB alignment is available.

### Design considerations for improving ESD Performance

The table below shows typical values assuming base plate construction per the Avago Technologies supplied IGES file for ADNS-7100-001 lens. Note that the lens material is polycarbonate and therefore, cyanoacrylate based adhesives should not be used as they will cause lens material deformation.

| Typical Distance | Millimeters (mm) |
|------------------|------------------|
| Creepage         | 11.87            |
| Clearance        | 10.05            |

### PCB Assembly Considerations and Soldering Profile

1. Prior to PCB assembly, handling precaution must be taken for ADNS-7630 sensor that is classified as MSL-3. (For more information, please refer to IPC/JEDEC J-STD-033B.1: Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices)
2. Surface-mount the sensor package and all other electrical components onto PCB.
3. Reflow the entire assembly with a no-wash solder flux process (refer to Figure 7 below).
4. Remove the protective kapton tapes from both optical apertures on the ADNS-7630 sensor by using flat-headed tweezers. Care must be taken to keep contaminants from entering the aperture. Recommend not to place the PCB facing up during the entire assembly process. Recommend to hold the PCB vertically for the kapton tapes removal process.
5. Place the PCB over the lens onto base plate. The sensor package should be self-aligned to the lens. The optical center reference for the PCB is set by base plate and lens. Note that the PCB movement due to button presses must be minimized to maintain good optical alignment.
6. Recommended: The lens can be permanently located by heat-staking or ultrasonic-staking the lens' guide posts over the PCB board.
7. Then, install the mouse top case. There MUST be feature in the top case (or other area) to press down onto the PCB assembly to ensure the sensor and lens are interlocked to correct vertical height.

Refer to Figure 7 and Table 2 for the recommended solder reflow profile for PCB using Pb-free solder paste LF310.

**Table 2. Recommended Solder Reflow Profile**

| Description  | Specification  |
|--|----------------|
| Max Ramp-Up Rate,  | 3°C/sec        |
| Max Ramp-Down Rate,  | 6°C /sec       |
| Preheat temperature minimum, $T_{smin}$  | 150°C          |
| Preheat temperature maximum, $T_{smax}$  | 200°C          |
| Preheat Duration( $T_{smin}$ to $T_{smax}$ ), $t_s$  | 60-120 sec     |
| Liquidus Temperature, $T_L$  | 220°C          |
| Time Above Reflow ( $T_L=220^\circ\text{C}$ ), $t$   | 30-90 sec      |
| Peak Temperature, $T_p$  | 250°C          |
| Time within 5°C of the specified classification temperature ( $T_c=250^\circ\text{C}$ ), $t_p$ | 10 sec         |
| Time 25°C to peak temperature  | 8 mins maximum |

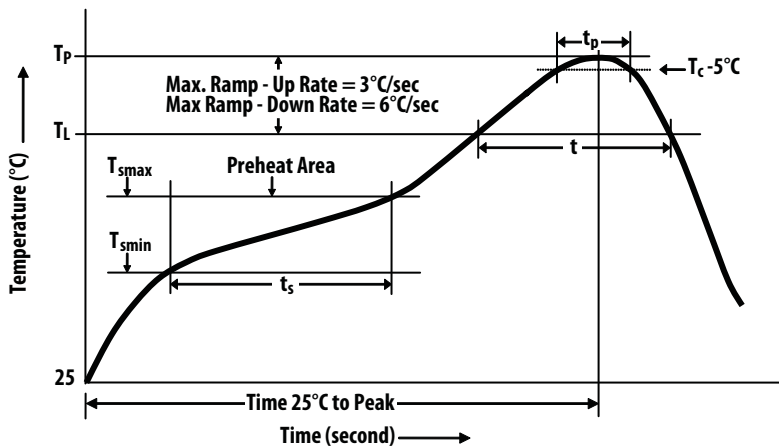


Figure 7. Solder Reflow Profile for PCB

### Critical and Non-critical Areas of QFN Soldering

As ADNS-7630 is a QFN package, it is designed to be a contact-down package. Refer to Figure 7 and 8 on the critical and non-critical areas for QFN soldering. The critical area for soldering ADNS-7630 is on the terminal undersides, while the terminal sides are deemed as non-critical area, and thus not intended to be wettable. The non-wetting

of the terminal sides are due to exposed copper on the package side (which is expected and accepted), occurred after the singulation step, which is a standard process in QFN assembly. This is inline with the Industry Standard (for more information, please refer to IPC-A-610D: Acceptability of Electronics Assemblies).

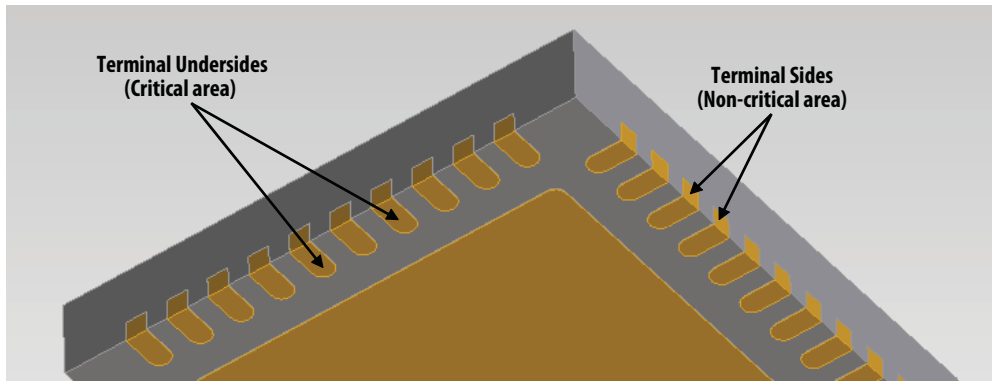


Figure 8. Critical and Non-critical areas (Bottom view)

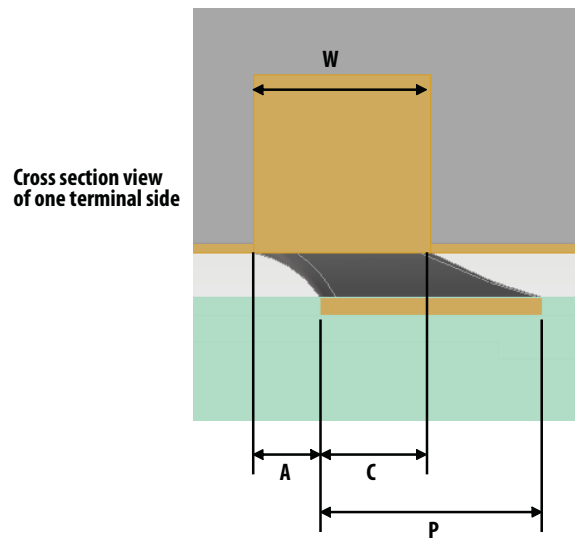
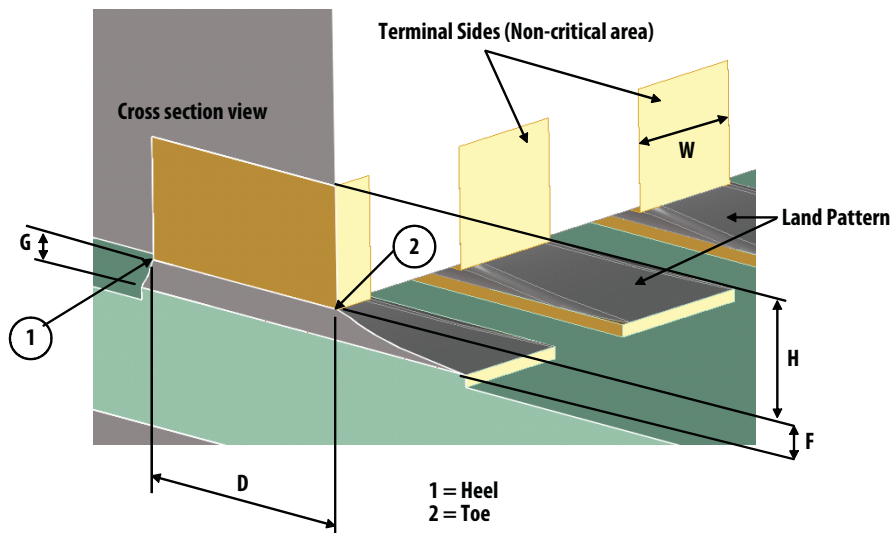


Figure 9. Critical and Non-critical areas (Cross sectional views)

Table 3. Dimensional Criteria

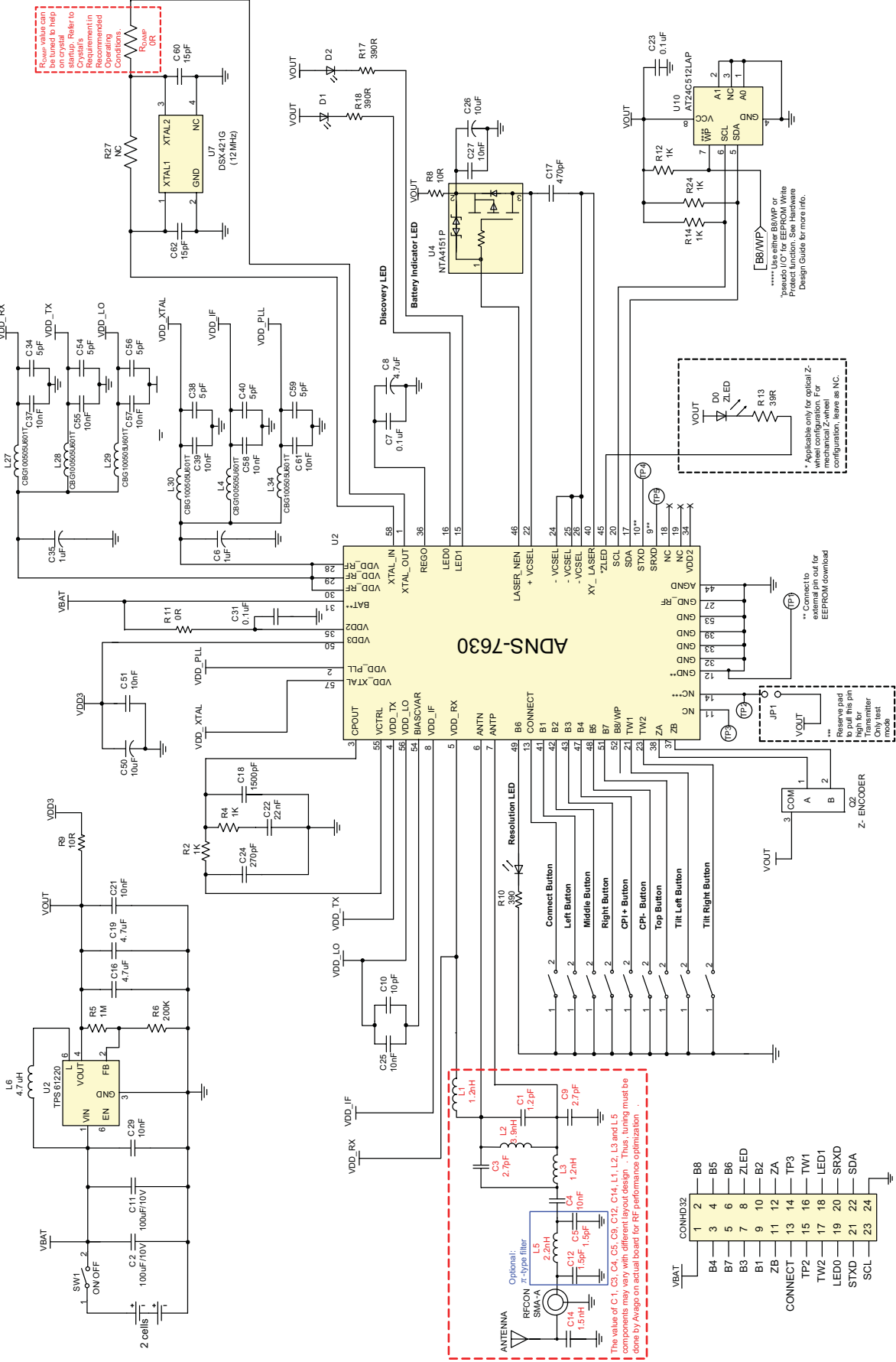
| Feature                   | Dimension | Class 1       | Class 2       | Class 3       |
|---------------------------|-----------|---------------|---------------|---------------|
| Maximum Side Overhang     | A         | 50% W, Note 1 | 25% W, Note 1 | 25% W, Note 1 |
| Minimum End Joint Width   | C         | 50% W         | 75% W         | 75% W         |
| Minimum Side Joint Length | D         | Note 4        | Note 4        | Note 4        |
| Minimum Fillet Height     | F         | Notes 2, 5    | Notes 2, 5    | Notes 2, 5    |
| Solder Fillet Thickness   | G         | Note 3        | Note 3        | Note 3        |
| Termination Height        | H         | Note 5        | Note 5        | Note 5        |

Notes:

1. Should not violate minimum electrical clearance.
2. Unspecified parameter. Variable in size as determined by design.
3. Good wetting is evident.
4. Is not a visual attribute for inspection.
5. Terminal sides are not required to be solderable. Toe fillets are not required.

All data and information is provided to and as a reference in the application of Avago Technologies' product, but the responsibility for proper design of printed circuit SMT process design still lies with the SMT assembly company. Avago Technologies has no liability for customer's design.

# Application Schematic



Note: Due to complexity of RF board design, technical assistance on the PCB layout design and RF performance buy off is provided. Please contact Avago Technologies' sales representative during design stage.

Figure 10. ADNS-7630 Application Schematic

## PCB Layout Requirements:

1. Recommended to use 4-layer PCB board, with second layer as GND plane and third layer as power plane.
2. Cut the copper beneath the antenna pattern on the GND plane, power layer and the bottom layer; no signal line is allowed beneath the antenna pattern at all of the layers. Antenna pattern is highly recommended to be located at one of the board edges, furthest away from palm coverage.
3. Keeping any metallic objects (eg. Battery terminal plates) at least 15mm away from the antenna as this is the distance of the near field for electromagnetic field.
4. Power lines should be thick and short. Big via holes are recommended whenever needed.
5. C37 and C34, C55 and C54, C57 and C56, should be placed as near as possible to pin 5, pin 4 and pin 56 respectively for effective decoupling.
6. C39 and C38, C61 and C59, C58 and C40, should be placed as near as possible to pin 57, pin 2 and pin 8 respectively for effective decoupling.
7. The ground pad beneath the centre of the ADNS-7630 QFN package should have sufficient via holes down to the same ground plane (2nd layer of the PCB). Use solder mask to prevent any unwanted short circuit. Prepare necessary area of solder pads only.
8. Components connected to CPOUT (pin 3) and VCTRL (pin 55) must as close as possible to ADNS-7630 IC. It is recommended to complete the loop within the same PCB layer.
9. Keep sufficient clearance between RF Trace class\_1 (from pin ANTEN to Antenna) and Ground copper (if applicable) on the top side 3 times larger than h (height of top layer to GND layer); the same requirement is needed for RF Trace class\_2 (from pin ANTP to Antenna) and Ground copper (if applicable). Keep a clearance between VDD\_RX (pin 5) and ANTEN (pin 6) traces, as well as between ANTP (pin 7) and VDD\_IF (pin 8) traces.
10. Keep ANTEN and ANTP traces (from IC to antenna) parallel, short and as straight as possible without many curves. Recommended to have differential impedance between ANTEN and ANTP to be 100Ω, and unbalanced trace (from C4 to ANTENNA) impedance controlled to 50Ω.
11. Keep a clearance between antenna and ground.
12. Ensure large grounding plane and more via holes at GND (pin 27, pin 32 and pin 33) down to the ground plane (2nd layer of the PCB).
13. Components connected to the pins below MUST complete the loop within the same PCB layer (no usage via holes allowed).
  - a. BIASVAR (pin 54)
  - b. REGO (pin 36)
  - c. VDD3 (pin 31, 35, 50)
14. C17 must be as close as possible to the ADNS-7630 IC.
15. All separate AGND, GND\_RF and GND paths MUST be via down to the same ground plane (2nd layer of the PCB). Ensure large grounding plane on the PCB layout for better performance on ESD and EFTB.
16. All caps MUST be as close to the power pins as possible, with the smaller capacitors nearer to the ADNS-7630 IC.
17. Frequency tolerance of crystal oscillator should follow the specification of +/- 20PPM. Recommended to use TST TZ0683B 12MHz crystal. Crystal should be placed less than 10mm (must not be more than 15mm) from ADNS-7630 XTALIN and XTALOUT pins.
18. Ceramic non-polarity caps and tantalum polarity capacitors are recommended.
19. Capacitors connected to VDD3 MUST have less than 0.2Ω ESR.
20. It is optional but highly recommended for customers to route some signals to a 2mm pin header (only to be soldered when troubleshooting is needed) on the mouse board to ease Avago's technical support in future. Refer to Design Guide – Hardware for more information.
21. Ensure that no component is placed at the lens clearance area as shown in Figure 4 so that the lens is interlocked to the PCB at the correct vertical height.
22. Add an optional  $\pi$ -type filter at antenna circuit to suppress 4.8G/7.2GHz harmonics.

## Block Diagram

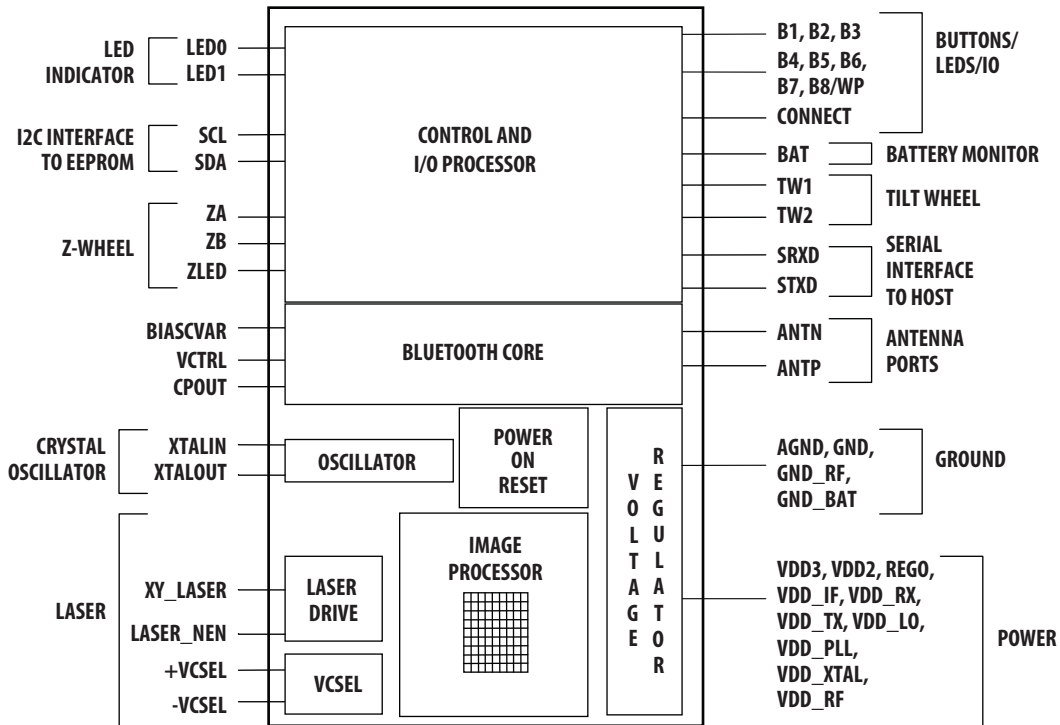


Figure 11. ADNS-7630 Block Diagram

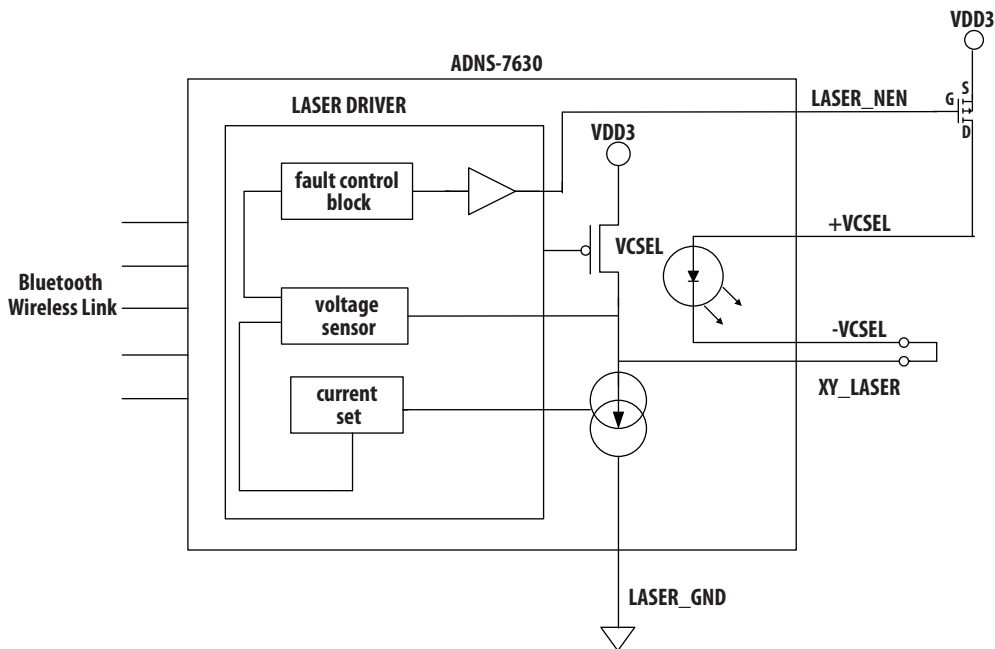


Figure 12. Single Fault Detection and Eye Safety Feature

## Eye Safety

ADNS-7630 SoC sensor and the associated components in the schematic of Figure 9 are intended to comply with Class 1 Eye Safety requirements of IEC/EN 60825-1. Avago Technologies pre-calibrate sensor laser output power (LOP) to Class 1 eye safety level prior shipping out, thus no laser output power calibration is required at mouse manufacturer site.

ADNS-7630 SoC sensor is designed to maintain the laser output power using ADNS-7100-001 lens within Class 1 requirements over components manufacturing tolerances under the recommended operating conditions and application circuit of Figure 9 as specified in this document. Under normal operating conditions, the sensor generates the drive current for the VCSEL. For more information, please refer to Eye Safety Application Note.

## Single Fault Detection

ADNS-7630 SoC sensor is able to detect a short circuit or fault condition at the -VCSEL pin, which could lead to excessive laser power output. A path to ground on this pin will trigger the fault detection circuit, which will turn off the laser drive current source and set the LASER\_NEN output high. The system will prevent excess laser power

for a resistive path to ground at -VCSEL by shutting off the laser. In addition to the ground path fault detection described above, the fault detection circuit is continuously checking for proper operation by internally generating a path to ground with the laser turned off via LASER\_NEN. If the -VCSEL pin is shorted internally to VDD3, this test will fail and will be reported as a fault.

## Regulatory Requirements

- Passes FCC C and worldwide analogous emission limits when assembled into a mouse and following Avago Technologies recommendations.
- Passes IEC-61000-4-2 Electrostatic Discharge Immunity Test (ESD) and provides sufficient ESD creepage/clearance distance to withstand up to 15 kV discharge when assembled into a mouse with ADNS-7100-001 trim lens.
- Passes IEC/EN 60825-1 Class 1 Eye Safety when ADNS-7630 is driving the laser using ADNS-7100-001 lens with the laser output power pre-calibrated by Avago Technologies under recommended operating conditions.

## Absolute Maximum Ratings

| Parameter                             | Symbol             | Minimum | Maximum                 | Units | Notes  |
|---------------------------------------|--------------------|---------|-------------------------|-------|--|
| Storage Temperature                   | T <sub>S</sub>     | -40     | 85                      | °C    | MSL 3 level  |
| Lead Solder Temperature               | T <sub>p</sub>     |         | 260                     | °C    | MSL 3 level refer to Solder Reflow Profile in Figure 7 |
| Power Supply Voltage                  | V <sub>DD21</sub>  | -0.5    | 3.7                     | V     |  |
|                                       | V <sub>DD3</sub>   | -0.5    | 3.7                     | V     |  |
|                                       | V <sub>DD_RF</sub> | -0.5    | 2.1                     | V     |  |
| ESD (Human body model) <sup>1,2</sup> |                    |         | 2                       | kV    | All Pins.  |
| Input Voltage                         | V <sub>IN</sub>    | -0.5    | V <sub>DDIO</sub> + 0.5 | V     | All I/O Pins   |
| Latch-up Current                      | I <sub>OUT</sub>   |         | 20                      | mA    | All Pins   |
| Laser Output Power                    | LOP <sub>max</sub> |         | 716                     | μW    | Class 1 Eye Safety Limit                               |

Notes:

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are the stress ratings only and functional operation of the device at these or any other condition beyond those indicated for extended period of time may affect device reliability.
2. The inherent design of this component causes it to be sensitive to electrostatic discharge. The ESD threshold is listed above. To prevent ESD-induced damage, take adequate ESD precautions when handling this product

## Recommended Operating Conditions

| Parameter                                     | Symbol       | Minimum | Typical | Maximum | Units             | Notes   |
|---|--------------|---------|---------|---------|-------------------|---|
| Operating Temperature                         | $T_A$        | 0       |         | 40      | °C                |   |
| Power Supply Voltage                          | $V_{DD21}$   | 2.1     | 2.8     | 3.6     | V                 | For digital core. Including noise.  |
|   | $V_{DD3}$    | 2.7     | 2.8     | 3.6     | V                 | For sensor core. Including noise.   |
| RF Regulator Output Voltage                   | $V_{DD\_RF}$ | 1.7     | 1.8     | 1.9     | V                 | For RF Core. Output from REG0 & $V_{DD\_RF}$  |
| Power Supply Rise Time                        | $V_{RT}$     | 2       |         | 100     | ms                | $V_{DD21}$ is tied to $V_{DD3}$ and ramp from 0 to 2.8V   |
| Latch-Up Current                              |              |         | 10      |         | mA                | All pins  |
| Supply Noise (Sinusoidal)                     | $V_{NA}$     |         |         | 80      | mV <sub>p-p</sub> | With RC filter (10Ω+10uF) for 10kHz~50MHz Except 25kHz~35kHz that max is 35mVp-p<br>Without RC filter will degrade Carrier Drift  |
| Distance From Lens Reference Plane To Surface | Z            | 2.18    | 2.40    | 2.62    | mm                | Results in +/- 0.22 mm minimum DOF. See Figure 13   |
| Speed   | S            |         |         | 30      | in/sec            |   |
| Acceleration                                  | A            |         |         | 8       | g                 |   |
| Vcsel Peak Wavelength                         | $\lambda$    | 832     |         | 865     | nm                |   |
| Laser Output Power                            | LOP          |         |         | 506     | μW                | Under operating temperature, 25°C± 5°C. Class 1 eye safety level when ADNS-7630 is driving the laser using ADNS-7100-001 lens based on application circuit in Figure 10 |

| Crystal's Requirement            | Symbol         | Minimum | Typical | Maximum | Units | Notes   |
|----------------------------------|----------------|---------|---------|---------|-------|---|
| Nominal Frequency                | $F_{CLK}$      |         | 12      |         | MHz   | ±20ppm  |
| Equivalent Series Resistor (ESR) | $X_{RES}$      |         |         | 100     | Ω     |   |
| Shunt Capacitance                | $C_O$          |         | 3       | 7       | pF    |   |
| Load Capacitance                 | CL             |         |         | 12      | pF    |   |
| Drive Level                      | $P_{DL}$       | 10      |         | 50      | μW    |   |
| Damping Resistor                 | $R_{DAMP}$     | 0       |         | 18      | Ω     | See Figure 10 on $R_{DAMP}$ connection and Figure 14 to fine tune the $R_{DAMP}$ value to match with the drive level of crystal used. |
| Clock Ready Time                 | $T_{XAL\_RDY}$ |         |         | 2       | ms    | See Figure 14   |

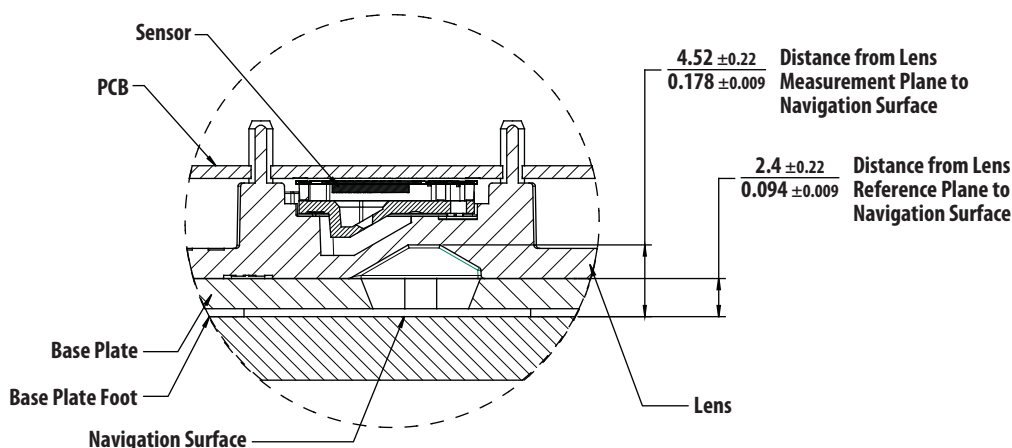


Figure 13. Distance from lens reference plane to object surface, Z



## AC Electrical Specifications

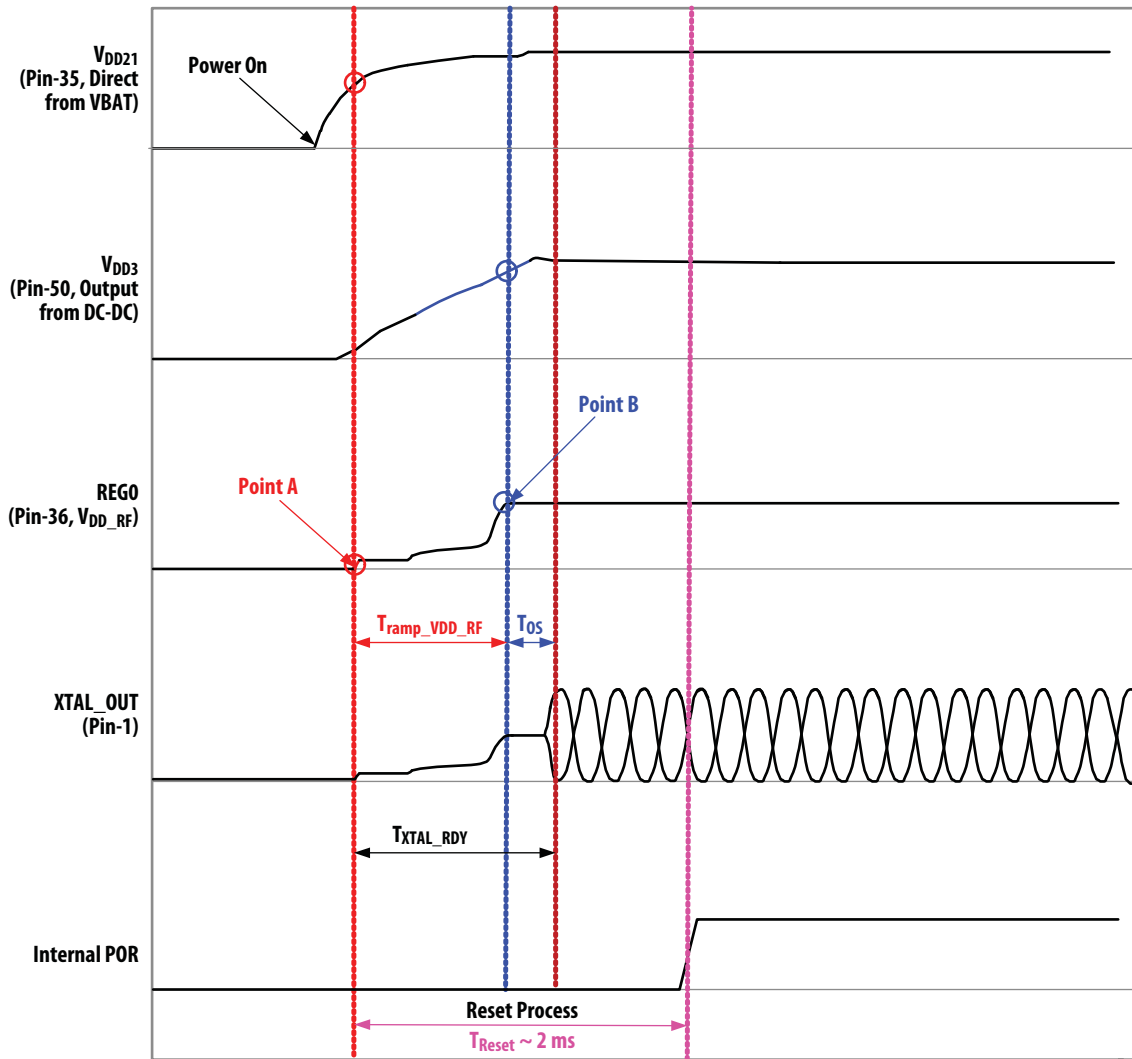
Electrical Characteristics over recommended operating conditions. Typical values at 25 °C,  $V_{DD21} = 2.8V$ ,  $V_{DD3} = 2.8V$

| Parameter                       | Symbol    | Minimum | Typical | Maximum | Units | Notes   |
|---------------------------------|-----------|---------|---------|---------|-------|---|
| Debounce delay on button inputs | $t_{DBB}$ |         | 6       | 7.9     | ms    |   |
| Scroll wheel sampling period    | $t_{SW}$  | 1.9     | 2.0     | 2.8     | ms    | ZA & ZB Pins.   |
| Transient Supply Current        | $I_{DDT}$ |         |         | 100     | mA    | $V_{DD21}$ is tied to $V_{DD3}$ . Max supply current during a ramp from 0 to 2.8V |

## DC Electrical Specifications

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C,  $V_{DD21} = 2.8V$ ,  $V_{DD3} = 2.8V$

| Parameter                      | Symbol               | Minimum         | Typical | Maximum         | Units   | Notes  |
|--------------------------------|----------------------|-----------------|---------|-----------------|---------|--|
| Tx Current                     | $I_{Tx}$             |                 | 53      | 57.5            | mA      | Transmitter and baseband are fully ON, navigation core is OFF. Buttons and I/Os are floating, LED pins pull to low |
| Rx Current                     | $I_{Rx}$             |                 | 47      | 51              | mA      | Receiver and baseband are fully ON, navigation core is OFF. Buttons and I/Os are floating, LED pins pull to low    |
| DM1 Tx mode Current            | $I_{DM1\_Tx}$        |                 | 24.7    |                 | mA      | RF sends a longest DM1 packet every 1.25ms   |
| DM1 Rx mode Current            | $I_{DM1\_Rx}$        |                 | 24.2    |                 | mA      | RF receives a longest DM1 packet every 1.25ms  |
| Sniff mode 11.25ms Current     | $I_{sniff\_11.25ms}$ |                 | 10      | 12              | mA      | System average current includes VCSEL current. Sniff_TimeOut = 0, Sniff_Attempt = 1                                |
| Sniff mode 67.5ms Current      | $I_{sniff\_67.5ms}$  |                 | 1.4     | 2               | mA      | System average current includes VCSEL current.   |
| Sniff mode 300ms Current       | $I_{sniff\_300ms}$   |                 | 0.335   | 0.785           | mA      | System average current includes VCSEL current.   |
| Deep Sleep Current             | $I_{DSleep}$         |                 | 110     | 280             | $\mu A$ | Disconnected, wake on sensor motion. State preserved.  |
|                                |                      |                 | 80      | 250             | $\mu A$ | Disconnected, wake on button clicked. State preserved.   |
| Input Hysteresis               | $V_{HYST}$           |                 | 285     |                 | mV      | Pins: B1-B8, TW1, TW2  |
| Button Pull-up Current         | $I_{PULLUP}$         | 100             | 300     | 500             | $\mu A$ | Pins: B1-B8, TW1, TW2  |
| Input Low Voltage              | $V_{IL}$             |                 |         | $0.2 * V_{DD3}$ | V       | Pins: B1-B8, TW1, TW2, ZA, ZB  |
| Input High Voltage             | $V_{IH}$             | $0.8 * V_{DD3}$ |         |                 | V       | Pins: B1-B8, TW1, TW2, ZA, ZB  |
| Input Leakage Current          | $I_{leak}$           |                 | $\pm 1$ | $\pm 10$        | $\mu A$ | $V_{in} = 0.7 * V_{DD3}$   |
| Output Low Voltage, LASER_NEN  | $V_{OL}$             |                 |         | $0.2 * V_{DD3}$ | V       | Iout= 1mA, LASER_NEN   |
| Output High Voltage, LASER_NEN | $V_{OH}$             | $0.8 * V_{DD3}$ |         |                 | V       | Iout= -0.5mA, LASER_NEN  |
| Input Capacitance              | $C_{in}$             |                 |         | 10              | pF      |  |



Notes:

1. Point A = Ramp start point of REG0/VDD<sub>RF</sub> that triggers internal reset process.
2. Point B = Stable point of REG0/VDD<sub>RF</sub> that crystal will start its oscillation.
3.  $T_{ramp\_VDD\_RF}$  = Ramp up time of REG0/VDD<sub>RF</sub>.
4.  $T_{OS}$  = Crystal startup time. Depends on crystal's drive level and load capacitance.
5.  $T_{Reset}$  = ADNS-7630's internal Power On Reset (POR) process duration.
6.  $T_{XTAL\_RDY} < T_{Reset}$ .

Figure 14. Power-Up Timing Diagram

## Receiver RF Specifications

Electrical Characteristics over recommended operating conditions based on Avago Technologies' ADNK-7633 reference design mouse. Typical values at 25 °C, V<sub>DD21</sub> = 2.8V, V<sub>DD3</sub> = 2.8V

| Parameter                                    | Minimum | Typical | Maximum | Units | Mode and Conditions   |
|--|---------|---------|---------|-------|-----------------------|
| <b>Receiver Section</b>                      |         |         |         |       |                       |
| RX sensitivity                               | -90     | -85     | -80     | dBm   | GFSK, 0.1%BER, 1 Mbps |
| Maximum input power                          | -20     | -10     |         | dBm   |                       |
| <b>Interference Performance</b>              |         |         |         |       |                       |
| C/I co-channel                               |         | 7.5     | 11      | dB    | GFSK, 0.1%BER         |
| C/I 1MHz adjacent channel                    |         | -3.5    | 0       | dB    | GFSK, 0.1%BER         |
| C/I 2MHz adjacent channel                    |         | -31     | -30     | dB    | GFSK, 0.1%BER         |
| C/I ≥ 3MHz adjacent channel                  |         | -41     | -40     | dB    | GFSK, 0.1%BER         |
| C/I Image channel                            |         | -39     | -9      | dB    | GFSK, 0.1%BER         |
| C/I 1MHz adjacent to image channel           |         | -37     | -20     | dB    | GFSK, 0.1%BER         |
| <b>Out-of-Band Blocking Performance (CW)</b> |         |         |         |       |                       |
| 30 MHz to 2000 MHz                           | -10     |         |         | dBm   | 0.1% BER              |
| 2000 MHz to 2400 MHz                         | -27     |         |         | dBm   | 0.1% BER              |
| 2500 MHz to 3000 MHz                         | -27     |         |         | dBm   | 0.1% BER              |
| 3000 MHz to 12.75 GHz                        | -10     |         |         | dBm   | 0.1% BER              |
| <b>Intermodulation Performance</b>           |         |         |         |       |                       |
| BT, Delta F = 3MHz                           | -39     | -36     |         | dBm   |                       |
| <b>Spurious Emission</b>                     |         |         |         |       |                       |
| 30 MHz to 1 GHz                              |         | -77     | -57     | dBm   |                       |
| 1 GHz to 12.75 GHz                           |         | -64     | -47     | dBm   |                       |

## Transmitter RF Specifications

Electrical Characteristics over recommended operating conditions based on Avago Technologies' ADNK-7633 reference design mouse. Typical values at 25 °C,  $V_{DD21} = 2.8V$ ,  $V_{DD3} = 2.8V$

| Parameter   | Minimum | Typical  | Maximum  | Units          | Notes |
|---|---------|----------|----------|----------------|-------|
| <b>Transmitter Section</b>                                  |         |          |          |                |       |
| Spectrum frequency range                                    | 2400    |          | 2483.5   | MHz            |       |
| Output power  | -6      | 0        | 4        | dBm            |       |
| <b>In-Band Spurious Emission</b>                            |         |          |          |                |       |
| +/-500 kHz  |         |          | -20      | dBc            |       |
| <b>Out-of-Band Spurious Emission</b>                        |         |          |          |                |       |
| 30 MHz to 1 GHz   |         | -60      | -36      | dBm            |       |
| 1 GHz to 12.75 GHz  |         |          | -30      | dBm            |       |
| 1.8 GHz to 1.9 GHz  |         | -80      | -47      | dBm            |       |
| 5.15 GHz to 5.3 GHz   |         | -90      | -47      | dBm            |       |
| <b>Lo Performance</b>                                       |         |          |          |                |       |
| Lock time   |         | 130      | 180      | $\mu$ s        |       |
| Initial carrier frequency tolerance                         |         | $\pm 25$ | $\pm 75$ | kHz            |       |
| <b>Frequency Drift</b>                                      |         |          |          |                |       |
| DM1 packet  |         | $\pm 20$ | $\pm 25$ | kHz            |       |
| DH1 packet  |         | $\pm 20$ | $\pm 25$ | kHz            |       |
| Drift rate  |         | 10       | 20       | kHz/50 $\mu$ s |       |
| <b>Frequency Deviation</b>                                  |         |          |          |                |       |
| Average deviation in payload<br>(sequence used is 00001111) | 140     | 168      | 175      | kHz            |       |
| Maximum deviation in payload<br>(sequence used is 10101010) | 115     |          |          | kHz            |       |
| Channel spacing   |         | 1        |          | MHz            |       |

## Z-Wheel

ADNS-7630 can support both mechanical and optical Z-wheel design. Selection of Mechanical or Optical Z-Wheel interface can be set from EEPROM Z\_Selection register (0x0137). The Z-Wheel reporting format which determines the vertical scroll resolution can be configured to Z/2 or Z/4 format when using different sensitivity optical Z-Wheel via EEPROM Z\_Configuration register (0x0138). For mechanical Z-Wheel, Z/2 format is widely used as most of the commonly available mechanical Z-Wheel encoders come with low sensitivity. Optical Z-Wheel can utilize either the Z/2 or Z/4 format according to the desired sensitivity. Z\_Negate (0x0139) enables correct Z-Wheel orientation in case ZA and ZB are swapped.

For mechanical Z-Wheel design, only ZA and ZB pins are connected to the physical mechanical encoder. ZLED pins should be floated (No Connect). For optical Z-Wheel design, connect all ZA, ZB and ZLED pins appropriately to the physical optical encoder system.

The direction of the Z-Wheel (positive or negative) based upon the Z-Wheel's quadrature output is shown in the state diagram below. State is shown in the form ZB ZA. Z-Wheel counts are reported only for transitions with + or - signs.

## Tilt-Wheel

ADNS-7630 can support Tilt Wheel function via TW1 and TW2 pins by activating it through EEPROM register Tilt\_Wheel\_Enabled (0x0114). For applications without Tilt-Wheel, TW1 (GPIO3) and TW2 (GPIO4) pins can be configured as LED GPIO via the same register above.

Disclaimer: All designers and manufacturers of final product with tilt wheel enabled must assure that they have all necessary intellectual property rights.

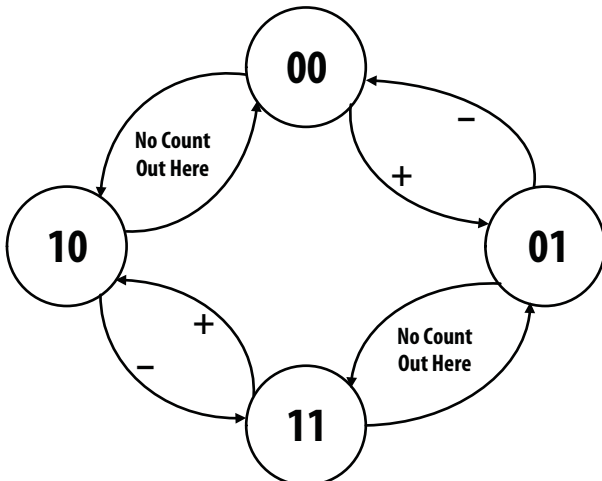


Figure 15. State Diagram for Z-Wheel

## Connect Button

It is a must to have a "Connect" button in a Bluetooth mouse design to enable end users to initiate pairing/unpairing with any Bluetooth host. Connect\_Button\_Press\_Duration register (0x00a4-0x00a5) allows mouse manufacturers to define duration needed for the "Connect" button to be held for a valid button pressed.

Connect "Connect" button to CONNECT pin (pin 13) for this feature.

## Discover LED Indicator

It is highly recommended for mouse manufacturers to include a discover LED indicator in a Bluetooth mouse design as it enables end users to know if the mouse has entered discoverable mode successfully. See registers 0x0115-0x0119 to enable/disable discover LED support, to assign GPIO pin to be used, to define GPIO state to turn on the discover LED as well as the LED's duty cycle.

Connect the physical discover LED to LED0 (GPIO5) pin or LED1 (GPIO6) pin for this feature.

## Battery LED Indicator

It is highly recommended for mouse manufacturers to include a battery LED indicator in a Bluetooth mouse design as it alerts end users when the battery power is running low, and also to remind end users to change the batteries. See registers 0x011a-0x011e, 0x0238-0x023d and 0x248 for the following configuration:

- enable/disable battery LED support
- assign GPIO pin to be used
- define GPIO state to turn on the battery LED, the LED's duty cycle, the blink/rest duration, active sniff modes and total duration
- define whether the LED is disabled before connection is established.

Connect the physical battery LED to LED0 (GPIO5) pin or LED1 (GPIO6) pin for this feature.

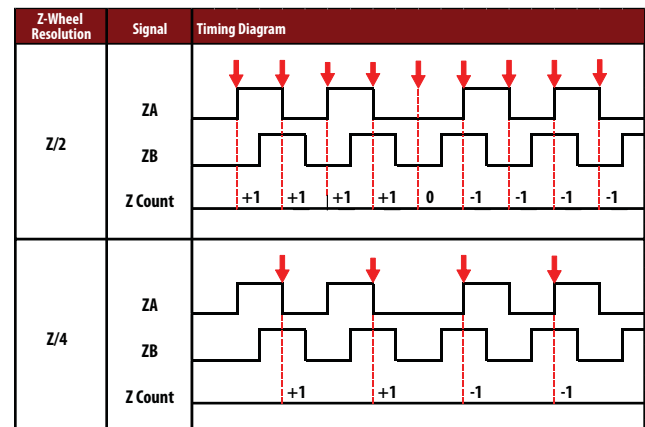


Figure 16. Timing Diagram for Z/2 and Z/4 settings

## Basic Buttons & Programmable Buttons

There are a total of 3 basic buttons supported by ADNS-7630, namely B1 (left button), B2 (middle button) and B3 (right button). B4 (GPIO11) through B8/WP (GPIO15) are General Purpose Input/Output pins programmable to be buttons, LED indicator, or EEPROM write protect enabler. Access EEPROM register, Programmable\_Buttons\_Total (0x00d1) to define the total number of programmable buttons to be used in the mouse design. For all available programmable buttons, manufacturer can assign each button to a GPIO pin, as well as its function when the button is clicked once, double clicked or pressed for a specified duration.

Buttons, B1 through B8, TW1 and TW2 are connected to a Schmidt trigger input with 100 $\mu$ A current sources pulling up to +3V during run and rest modes. When used as buttons, the minimum time between button presses is  $T_{DBB}$ .  $T_{DBB}$  is programmable via the EEPROM (0x021e). The buttons are sampled every 4ms (default), typically. Five consecutive low values create a button press event. Five consecutive high values create a button release event. This is applicable to all single button click function.

ADNS-7630 also support double-click and button long-press features. The double click interval and long-press duration of each programmable button is configurable via EEPROM registers. However, button double click is functional only if SPP is disabled. Long-press duration should be programmed significantly longer than the single click duration so that end users will not be confused between single click and long press functions.

To define explicit functions single click, double click and long press functions for each programmable buttons, manufacturers can either assign the On-the-Fly (OTF) Resolution Mode or KeyMap (KM) feature through Keyboard Code A and Keyboard Code B. Refer to next section on detail description on KeyMap and On-the-Fly (OTF) Resolution Mode implementation.

## On-the-Fly (OTF) Resolution Mode

The ADNS-7630 sensor is enhanced with programmable On-the-Fly (OTF) resolution mode, in which user is able to switch resolution setting anytime with OTF button single click, double click or long press. Any two available GPIOs between GPIO11-GPIO15 can be used to configure as the OTF resolution buttons. There are two types of OTF resolution mode:

- a. Step by step increment or decrement using CPI+ and CPI- buttons:

This method requires two GPIOs namely CPI+ and CPI- programmable buttons to increase or decrease the resolution setting step by step. There is a maximum of 10 resolution settings which can be enabled through EEPROM. If the current resolution setting is either in maximum or minimum level, any new button press will remain at the respective maximum or minimum level.

- b. Rotational state change using CPI rotation button:

This method requires only one GPIO to be programmed as CPI rotation button for incremental state change of resolution settings as configured in EEPROM. There is a maximum of 10 resolutions which can be enabled through EEPROM.

This OTF Resolution Mode can be enabled or disabled through EEPROM register Resolution\_Selection\_Method (0x0141). The OTF resolution mode types, step by step increment or decrement or rotational state change can be configured through SingleClick, LongPress or DoubleClick function in Button Configuration.

Mouse manufacturers can limit the total possible resolution settings to maximum of ten via EEPROM Resolution\_Selection\_Total register (0x0142). To define all resolution settings, access registers 0x0144-0x014d. The values must be valid resolution range from 250cpi to 3000cpi.

The OTF current resolution state can be displayed with LED indication via any available GPIO between GPIO3-GPIO6 and GPIO11-GPIO15. These GPIOs can be configured to be active high output and the blinking duty cycle can also be determined via EEPROM.

Mouse manufacturers can use up to 4 GPIO to support resolution LED indicators. Refer to registers 0x011f-0x0123 for total GPIO to be used and each GPIO assignment. As there is a maximum of ten possible resolution settings, there is also a maximum of ten possible resolution LED indicator settings via registers 0x0124-0x012d. Duration for resolution LEDs to be lighted up can also be programmed via Resolution\_LED\_Duration (0x012e). For optimized power saving purposes, it is recommended that the LEDs are lighted up for a short moment once there is a change in the resolution setting. To define GPIO state to turn on the resolution LED indicator as well as the LED's duty cycle, access EEPROM registers 0x012f-0x0131.

## KeyMap (KM)

The KeyMap is only supported in Bluetooth version 2.0 firmware. KM enables any available GPIO between GPIO11-GPIO15 to be assigned as keyboard shortcut key. User\_Defined\_Function\_n\_A/B/C registers (where, n=1, 2, 3, 4 or 5) allow configuration of User\_Defined\_Function\_n\_A/B/C registers (where, n=1, 2, 3, 4 or 5). Thus, the sensor can be customized to implement standard Microsoft keyboard shortcut keys or special shortcut keys used in different applications, e.g. Office, CAD, PC Games, etc.

The respective first and second byte of keyboard code A, B and C can be assigned to programmable button n (where, n=1, 2, 3, 4 or 5) in the MConfig software program. The first byte usually consists of any combinations for keys located on the either side (left or right only) of a standard keyboard as listed:

- Windows Logo Key ("LWIN", "RWIN")
- CTRL ("LCTRL", "RCTRL")
- SHIFT ("LSHIFT", "RSHIFT")
- ALT ("LALT", "RALT")

The second byte can be referred to any single keyboard key scan code available from Windows Platform Design Notes on Keyboard Scan Code Specification, which can be downloaded from:

<http://www.microsoft.com/whdc/archive/scancode.msp>

Some examples of possible key combinations for programmable buttons below:

If keyboard code A of programmable button 1 is shortcut key of "Windows Logo Key",

Keyboard code A byte1 = "LWin" (or "RWin")

Keyboard code A byte2 = Not Support

User\_Defined\_Function\_1\_A = a1 01 08 00 03 00 00 00 00 00

If keyboard code A of programmable button 2 is shortcut key of "Enter",

Keyboard code A byte1 = "Not Support"

Keyboard code A byte2 = "ENTER"

User\_Defined\_Function\_2\_A = a1 01 00 00 28 00 00 00 00 00

If keyboard code B for programmable button 5 is shortcut key of "Ctrl+Alt+Delete",

Keyboard code B byte1 = "LAlt+LCtrl" (or "RAlt+RCtrl")

Keyboard code B byte2 = "Delete"

User\_Defined\_Function\_5\_B = a1 01 05 00 4c 00 00 00 00 00

Note: "LCtrl+RAlt" and "RCtrl+LAlt" are not supported.

## EEPROM Write Protect Feature

Notice that B8/WP can either be used as a programmable button or LED indicator, or even as an I/O pin for EEPROM Write Protect function. In the event where all I/Os above are used up in a Bluetooth Mouse with tilt wheel, schematic below can be used to generate a 'pseudo I/O' for EEPROM Write Protect function. However, if all I/Os are used up in a Bluetooth Mouse without tilt wheel, there will be no EEPROM Write Protect function in the mouse. Though the possibility of EEPROM being overwritten through normal

mouse operation is low, Avago Technologies highly recommends mouse makers to use either B8/WP or the "pseudo I/O" method for EEPROM Write Protect function.

## Media Buttons

The Media button featuring audio control is supported in both Bluetooth version 2.0 and 2.1 firmwares. The ADNS-7630 is the first one-chip mouse sensor to support Consumer Control usages as defined in the **Consumer Page** (page 0x0C) in the *Universal Serial Bus HID Usage Tables Version 1.0 specification*. For more information, please visit <http://www.usb.org/developers/hidpage/>.

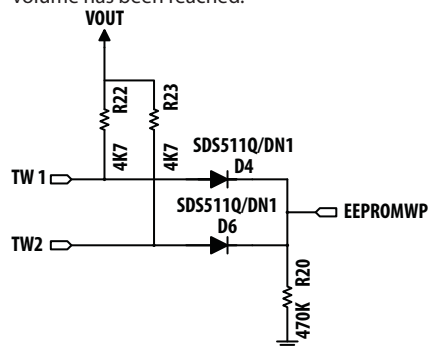
This feature is related to User-Defined HID Programmable Buttons listed in EEPROM registers. For example, in order to define one function of consumer page, the value should be set in the format of "a1 07 xx yy 00 00 00 00 00 00", where xx yy should be replaced by the usage ID of the target function in byte-inverted sequence, eg. "cd 00" for ID = cd and "25 02" for ID = 225. When manually setting this media button function in MConfig software program, both first and second bytes of corresponding Keyboard Code A, B or C must be set to "Not Support". The User Defined Function C for each programmable button will cease to be effective when SSP is enabled in Bluetooth-Version-2.1's firmware.

**Table 15. Example of Consumer Page audio controls supported in Windows 2000.**

| Usage | Name              | Type                     |
|-------|-------------------|--------------------------|
| 0xE0  | Volume*           | Linear Control (LC)      |
| 0xE2  | Mute*             | On/Off Control (OOC)     |
| 0xE3  | Bass              | Linear Control (LC)      |
| 0xE4  | Treble            | Linear Control (LC)      |
| 0xE5  | Bass Boost*       | On/Off Control (OOC)     |
| 0xE7  | Loudness          | On/Off Control (OOC)     |
| 0xE9  | Volume Increment* | Re-trigger Control (RTC) |
| 0xEA  | Volume Decrement* | Re-trigger Control (RTC) |

\* These controls are supported in Windows 98 (original release and Service Pack 1 release).

Note: Programmable buttons with RTC usage type controls should be assigned to single click function only. If the button is pressed continuously and not released, the event will be retriggered. Thus, there should not be any long press function assigned to these buttons. For example, if user keeps pressing the Volume Increment button, ADNS-7630 will perform the actual re-triggering of events that will lead to continuous increments of the volume until the button has been released or until the maximum volume has been reached.



**Figure 17. "Pseudo I/O" for EEPROM Write Protect Function**

## Typical Performance Characteristics

The following graphs are the typical performance of the ADNS-7630 sensor, assembled as shown in the 2D assembly drawing with the ADNS-7100-001 lens.

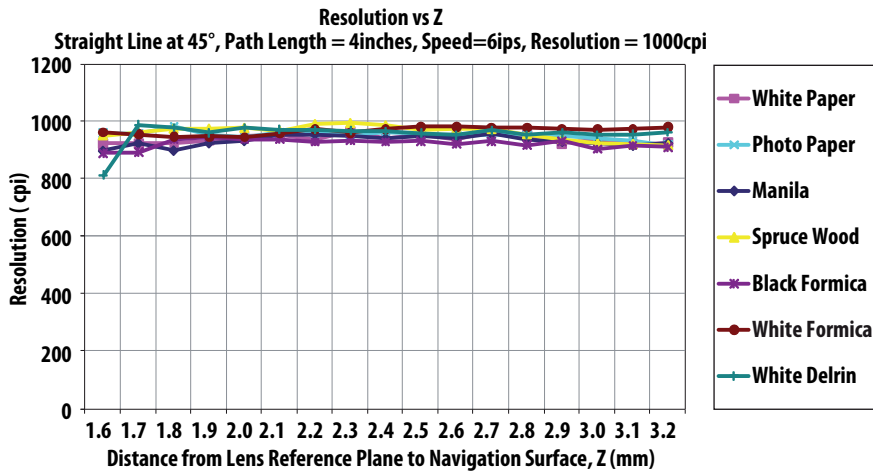


Figure 18. Mean Resolution vs. Z at 1000cpi

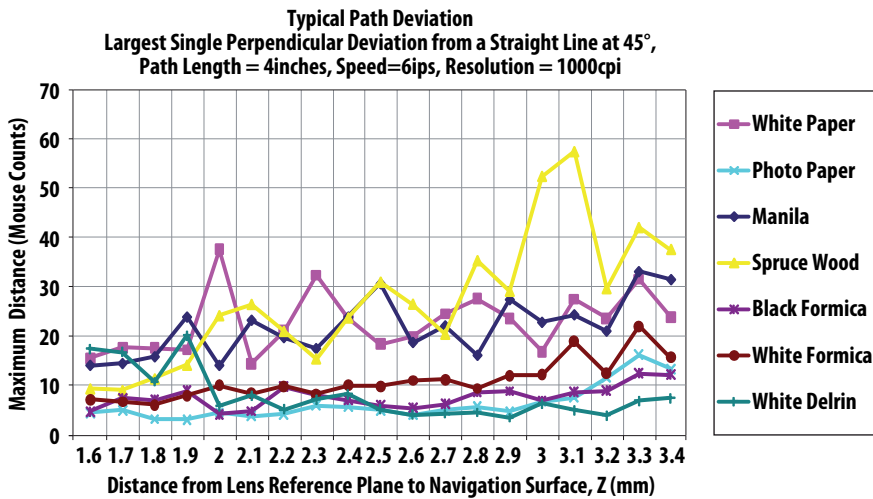


Figure 19. Average Error vs. Distance at 1000cpi (mm)

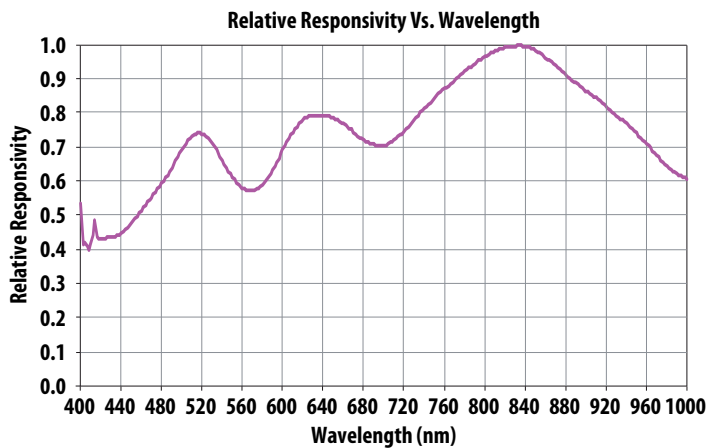


Figure 20. Wavelength Responsivity



## Configuration after Power Up (Data Values)

| Signal Function | Powered or Default Address or Configured | Suspended from any other states |
|-----------------|--|---------------------------------|
| B1              | Pullup active for button use             | Pullup active for button use    |
| B2              | Pullup active for button use             | Pullup active for button use    |
| B3              | Pullup active for button use             | Pullup active for button use    |
| B4              | Pullup active for button use             | Pullup active for button use    |
| B5              | Pullup active for button use             | Pullup active for button use    |
| B6              | Pullup active for button use             | Pullup active for button use    |
| B7              | Pullup active for button use             | Pullup active for button use    |
| B8              | Pullup active for button use             | Pullup active for button use    |
| TW1             | Pullup active for button use             | Pullup active for button use    |
| TW2             | Pullup active for button use             | Pullup active for button use    |
| -VCSEL          | Pulsing                                  | Pulled high (off)               |
| ZA              | Hi-Z input                               | Hi-Z input                      |
| ZB              | Hi-Z input                               | Hi-Z input                      |

## Bluetooth HID Data Packet Format for 12-Bit Motion Format, 3/5 Buttons, Z-Wheel and Tilt-Wheel Mouse

|               | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Byte 1</b> | 0     | 0     | 0     | FB*   | BB*   | MB    | RB    | LB    |
| <b>Byte 2</b> | X[7]  | X[6]  | X[5]  | X[4]  | X[3]  | X[2]  | X[1]  | X[0]  |
| <b>Byte 3</b> | Y[3]  | Y[2]  | Y[1]  | Y[0]  | X[11] | X[10] | X[9]  | X[8]  |
| <b>Byte 4</b> | Y[11] | Y[10] | Y[9]  | Y[8]  | Y[7]  | Y[6]  | Y[5]  | Y[4]  |
| <b>Byte 5</b> | Z[7]  | Z[6]  | Z[5]  | Z[4]  | Z[3]  | Z[2]  | Z[1]  | Z[0]  |
| <b>Byte 6</b> | TW[7] | TW[6] | TW[5] | TW[4] | TW[3] | TW[2] | TW[1] | TW[0] |

\* For 3 buttons mouse, FB = BB = 0.

## Bluetooth HID Data Packet Format for 12-Bit Motion Format, 3/5 Buttons, Z-Wheel, Non Tilt-Wheel Mouse

|               | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Byte 1</b> | 0     | 0     | 0     | FB*   | BB*   | MB    | RB    | LB    |
| <b>Byte 2</b> | X[7]  | X[6]  | X[5]  | X[4]  | X[3]  | X[2]  | X[1]  | X[0]  |
| <b>Byte 3</b> | Y[3]  | Y[2]  | Y[1]  | Y[0]  | X[11] | X[10] | X[9]  | X[8]  |
| <b>Byte 4</b> | Y[11] | Y[10] | Y[9]  | Y[8]  | Y[7]  | Y[6]  | Y[5]  | Y[4]  |
| <b>Byte 5</b> | Z[7]  | Z[6]  | Z[5]  | Z[4]  | Z[3]  | Z[2]  | Z[1]  | Z[0]  |

\* For 3 buttons mouse, FB = BB = 0.

## Registers

The ADNS-7630 can be programmed or customized through an external EEPROM. Below is the list showing the EEPROM register mapping. Programmable configurations include basic mouse information, connection settings, mouse generic configuration, sensor configuration, and Bluetooth SDP configuration. Any changes on the register default value will effect the specifications and characteristics of ADNS-7630 as stated in this data sheet.

| Domain                          | Register Name                  | Register Address |                  | Byte Size | Default Value    |                   |
|---------------------------------|--------------------------------|------------------|------------------|-----------|------------------|-------------------|
|                                 |                                | Bluetooth Ver2.0 | Bluetooth Ver2.1 |           | Bluetooth Ver2.0 | Bluetooth Ver2.1  |
| <b>Basic Information</b>        |                                |                  |                  |           |                  |                   |
| Firmware Version                | Firmware_Version               | 0x0304-0x0305    |                  | 2         |                  | 1.0               |
| Bluetooth Address               | Bluetooth_BDAddress            | 0x0008-0x000b    |                  | 6         |                  | 00:19:4d:11:22:33 |
| Pin Code                        | Pin_Length                     | 0x000e           |                  | 1         |                  | 4                 |
|                                 | Pin_Code                       | 0x000f-0x0012    |                  | 4         |                  | 0000              |
| Device                          | Device_Name_Length             | 0x0013           |                  | 1         |                  | 11                |
|                                 | Device_Name                    | 0x0014-0x0053    |                  | 64        |                  | Avago Mouse       |
| Bluetooth 2.1 Function          | Bluetooth_2.1_Function_Support | 0x00d3           |                  | 1         | 0x00             | 0x0f              |
|                                 | Secure Simple Pairing          | Bit-0            |                  | 1 bit     | False            | True              |
|                                 | Encryption Pause Resume        | Bit-1            |                  | 1 bit     | False            | True              |
|                                 | Extended Inquiry Response      | Bit-2            |                  | 1 bit     | False            | True              |
|                                 | Sniff Sub Rating               | Bit-3            |                  | 1 bit     | False            | True              |
| <b>Connection Configuration</b> |                                |                  |                  |           |                  |                   |
| Power On Configuration          | Mouse_Power_Up_Mode            | 0x0234           |                  | 1         |                  | Discoverable Mode |
|                                 | Auto_Reconnect_Enabled         | 0x0249           |                  | 1         |                  | True              |
| LMP Supervision Timeout         | LMP_Supervision_TimeOut        | 0x0094-0x00a5    |                  | 2         |                  | 8000              |
| Inquiry and Page Parameters     | Page_Scan_Window               | 0x0096-0x0097    |                  | 2         |                  | 768               |
|                                 | Page_Scan_Interval             | 0x0098-0x0099    |                  | 2         |                  | 1024              |
|                                 | Inquiry_Scan_Window            | 0x009a-0x009b    |                  | 2         |                  | 768               |
|                                 | Inquiry_Scan_Interval          | 0x009c-0x009d    |                  | 2         |                  | 1024              |
|                                 | Inquiry_Scan_TimeOut           | 0x009e-0x009f    |                  | 2         |                  | 2250              |
|                                 | Page_TimeOut                   | 0x00a0-0x00a1    |                  | 2         |                  | 0                 |
| Pairing and Authentication Mode | Pairing_Mode                   | 0x00a2           |                  | 1         |                  | True              |
|                                 | Authentication_Mode            | 0x00a3           |                  | 1         |                  | False             |
| Connect Button Configuration    | Connect_Button_Press_Duration  | 0x00a4-0x00a5    |                  | 2         |                  | 12                |
|                                 | VC_Unplug_Enable               | 0x00a6           |                  | 1         |                  | True              |
| Low Power Configuration         | Max_Sniff_Modes                | 0x00a7           |                  | 1         |                  | 3                 |
|                                 | Sleep_Mode_Enabled             | 0x00a8           |                  | 1         |                  | True              |
|                                 | Wake_Up_Method                 | 0x00a9           |                  | 1         |                  | All event         |
|                                 | Sniff_Retry_Count              | 0x00aa           |                  | 1         |                  | 3                 |
|                                 | Sniff_Retry_Interval           | 0x00ab-0x00ac    |                  | 2         |                  | 1600              |
|                                 | Sniff_Timeout                  | 0x00ad-0x00ae    |                  | 2         |                  | 1                 |
|                                 | Sniff_Attempt                  | 0x00af-0x00b0    |                  | 2         |                  | 2                 |
|                                 | Sniff_Mode_Interval0           | 0x00b1-0x00b2    |                  | 2         |                  | 18                |
|                                 | Sniff_Mode_Interval1           | 0x00b3-0x00b4    |                  | 2         |                  | 108               |
|                                 | Sniff_Mode_Interval2           | 0x00b5-0x00b6    |                  | 2         |                  | 468               |
|                                 | Sniff_Mode_Interval3           | 0x00b7-0x00b8    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Interval4           | 0x00b9-0x00ba    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Interval5           | 0x00bb-0x00bc    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Interval6           | 0x00bd-0x00be    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Interval7           | 0x00bf-0x00c0    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Duration0           | 0x00c1-0x00c2    |                  | 2         |                  | 178               |
|                                 | Sniff_Mode_Duration1           | 0x00c3-0x00c4    |                  | 2         |                  | 900               |
|                                 | Sniff_Mode_Duration2           | 0x00c5-0x00c6    |                  | 2         |                  | 2050              |
|                                 | Sniff_Mode_Duration3           | 0x00c7-0x00c8    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Duration4           | 0x00c9-0x00ca    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Duration5           | 0x00cb-0x00cc    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Duration6           | 0x00cd-0x00ce    |                  | 2         |                  | 0                 |
|                                 | Sniff_Mode_Duration7           | 0x00cf-0x00d0    |                  | 2         |                  | 0                 |

## Registers (continued)

| Domain                             | Register Name                  | Register Address |                  |           | Default Value                 |                  |
|------------------------------------|--------------------------------|------------------|------------------|-----------|-------------------------------|------------------|
|                                    |                                | Bluetooth Ver2.0 | Bluetooth Ver2.1 | Byte Size | Bluetooth Ver2.0              | Bluetooth Ver2.1 |
| <b>Mouse Generic Configuration</b> |                                |                  |                  |           |                               |                  |
| <b>Button Configuration</b>        |                                |                  |                  |           |                               |                  |
| Button Configuration               | Programmable_Buttons_Total     | 0x00d1           |                  | 1         | 0                             |                  |
|                                    | Programmable_Buttons_Low_Power | 0x00d2           |                  | 1         | 1                             |                  |
|                                    | Debouncing_Time                | 0x021e           |                  | 1         | 4                             |                  |
| Programmable Button 1              | GPIO_Pin_Selection1            | 0x00d4           |                  | 1         | 0                             |                  |
|                                    | Single_Click_Function1         | 0x00d5           |                  | 1         | Not Support                   |                  |
|                                    | Single_Click_Repeat_Delay1     | 0x00d6           | N/A              | 1         | 0                             |                  |
|                                    | Long_Press_Function1           | 0x00d7           | 0x00d6           | 1         | Not Support                   |                  |
|                                    | Long_Press_Duration1           | 0x00d8           | 0x00d7           | 1         | 25                            |                  |
|                                    | Double_Click_Function1         | 0x00d9           | N/A              | 1         | Not Support                   |                  |
|                                    | Double_Click_Interval1         | 0x00da           | N/A              | 1         | 6                             |                  |
|                                    | User_Defined_Function_1_A      | 0x025b-0x0264    | 0x0287-0x0290    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_1_B      | 0x0266-0x026f    | 0x0292-0x029b    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_1_C      | 0x0271-0x027a    | N/A              | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
| Programmable Button 2              | GPIO_Pin_Selection2            | 0x00db           | 0x00e0           | 1         | 0                             |                  |
|                                    | Single_Click_Function2         | 0x00dc           | 0x00e1           | 1         | Not Support                   |                  |
|                                    | Single_Click_Repeat_Delay2     | 0x00dd           | N/A              | 1         | 0                             |                  |
|                                    | Long_Press_Function2           | 0x00de           | 0x00e2           | 1         | Not Support                   |                  |
|                                    | Long_Press_Duration2           | 0x00df           | 0x00e3           | 1         | 25                            |                  |
|                                    | Double_Click_Function2         | 0x00e0           | N/A              | 1         | Not Support                   |                  |
|                                    | Double_Click_Interval2         | 0x00e1           | N/A              | 1         | 6                             |                  |
|                                    | User_Defined_Function_2_A      | 0x027c-0x0285    | 0x029d-0x02a6    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_2_B      | 0x0287-0x0290    | 0x02a8-0x02b1    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_2_C      | 0x0292-0x029b    | N/A              | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
| Programmable Button 3              | GPIO_Pin_Selection3            | 0x00e2           | 0x00ec           | 1         | 0                             |                  |
|                                    | Single_Click_Function3         | 0x00e3           | 0x00ed           | 1         | Not Support                   |                  |
|                                    | Single_Click_Repeat_Delay3     | 0x00e4           | N/A              | 1         | 0                             |                  |
|                                    | Long_Press_Function3           | 0x00e5           | 0x00ee           | 1         | Not Support                   |                  |
|                                    | Long_Press_Duration3           | 0x00e6           | 0x00ef           | 1         | 25                            |                  |
|                                    | Double_Click_Function3         | 0x00e7           | N/A              | 1         | Not Support                   |                  |
|                                    | Double_Click_Interval3         | 0x00e8           | N/A              | 1         | 6                             |                  |
|                                    | User_Defined_Function_3_A      | 0x029d-0x02a6    | 0x02b3-0x02bc    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_3_B      | 0x02a8-0x02b1    | 0x02be-0x02c7    | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                    | User_Defined_Function_3_C      | 0x02b3-0x02bc    | N/A              | 10        | a1 00 00 00 03 00 00 00 00 00 |                  |

## Registers (continued)

| Domain                               | Register Name                      | Register Address |                  |                               | Default Value                 |                  |
|--------------------------------------|------------------------------------|------------------|------------------|-------------------------------|-------------------------------|------------------|
|                                      |                                    | Bluetooth Ver2.0 | Bluetooth Ver2.1 | Byte Size                     | Bluetooth Ver2.0              | Bluetooth Ver2.1 |
| Programmable Button 4                | GPIO_Pin_Selection4                | 0x00e9           | 0x00f8           | 1                             | 0                             |                  |
|                                      | Single_Click_Function4             | 0x00ea           | 0x00f9           | 1                             | Not Support                   |                  |
|                                      | Single_Click_Repeat_Delay4         | 0x00eb           | N/A              | 1                             | 0                             |                  |
|                                      | Long_Press_Function4               | 0x00ec           | 0x00fa           | 1                             | Not Support                   |                  |
|                                      | Long_Press_Duration4               | 0x00ed           | 0x00fb           | 1                             | 25                            |                  |
|                                      | Double_Click_Function4             | 0x00ee           | N/A              | 1                             | Not Support                   |                  |
|                                      | Double_Click_Interval4             | 0x00ef           | N/A              | 1                             | 6                             |                  |
|                                      | User_Defined_Function_4_A          | 0x02be-0x02c7    | 0x02c9-0x02d2    | 10                            | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                      | User_Defined_Function_4_B          | 0x02c9-0x02d2    | 0x02d4-0x02dd    | 10                            | a1 00 00 00 03 00 00 00 00 00 |                  |
| User_Defined_Function_4_C            | 0x02d4-0x02dd                      | N/A              | 10               | a1 00 00 00 03 00 00 00 00 00 |                               |                  |
| Programmable Button 5                | GPIO_Pin_Selection5                | 0x00f0           | 0x0108           | 1                             | 0                             |                  |
|                                      | Single_Click_Function5             | 0x00f1           | 0x0109           | 1                             | Not Support                   |                  |
|                                      | Single_Click_Repeat_Delay5         | 0x00f2           | N/A              | 1                             | 0                             |                  |
|                                      | Long_Press_Function5               | 0x00f3           | 0x010a           | 1                             | Not Support                   |                  |
|                                      | Long_Press_Duration5               | 0x00f4           | 0x010b           | 1                             | 25                            |                  |
|                                      | Double_Click_Function5             | 0x00f5           | N/A              | 1                             | Not Support                   |                  |
|                                      | Double_Click_Interval5             | 0x00f6           | N/A              | 1                             | 6                             |                  |
|                                      | User_Defined_Function_5_A          | 0x02df-0x02e8    |                  | 10                            | a1 00 00 00 03 00 00 00 00 00 |                  |
|                                      | User_Defined_Function_5_B          | 0x02ea-0x02f3    |                  | 10                            | a1 00 00 00 03 00 00 00 00 00 |                  |
| User_Defined_Function_5_C            | 0x02f5-0x02fe                      | N/A              | 10               | a1 00 00 00 03 00 00 00 00 00 |                               |                  |
| <b>Twheel PIN Function Selection</b> |                                    |                  |                  |                               |                               |                  |
| Tilt Wheel                           | Tilt_Wheel_Enabled                 |                  | 0x0114           | 1                             | Support Twheel Function       |                  |
| <b>LED Configuration</b>             |                                    |                  |                  |                               |                               |                  |
| Power-On LED Configuration           | Power_On_LED_Enabled               |                  | 0x22c            | 1                             | False                         |                  |
|                                      | Power_On_LED_PIN                   |                  | 0x22d            | 1                             | 0                             |                  |
|                                      | Power_On_LED_GPIO_State            |                  | 0x22e            | 1                             | 0                             |                  |
|                                      | Power_On_LED_On_Duration           |                  | 0x22f            | 1                             | 37                            |                  |
|                                      | Reconnect_Power_On_LED_Enabled     |                  | 0x244            | 1                             | False                         |                  |
|                                      | Reconnect_Power_On_LED_PIN         |                  | 0x245            | 1                             | 0                             |                  |
|                                      | Reconnect_Power_On_LED_GPIO_State  |                  | 0x246            | 1                             | 0                             |                  |
|                                      | Reconnect_Power_On_LED_On_Duration |                  | 0x247            | 1                             | 37                            |                  |
| Discovery LED Configuration          | Discover_LED_Enabled               |                  | 0x0115           | 1                             | True                          |                  |
|                                      | Discover_LED_PIN                   |                  | 0x0116           | 1                             | 6                             |                  |
|                                      | Discover_LED_GPIO_State            |                  | 0x0117           | 1                             | 0                             |                  |
|                                      | Discover_LED_On_Period             |                  | 0x0118           | 1                             | 5                             |                  |
|                                      | Discover_LED_Off_Period            |                  | 0x0119           | 1                             | 9                             |                  |

## Registers (continued)

| Domain                      | Register Name                          | Register Address |                  |           | Default Value    |                  |
|-----------------------------|--|------------------|------------------|-----------|------------------|------------------|
|                             |  | Bluetooth Ver2.0 | Bluetooth Ver2.1 | Byte Size | Bluetooth Ver2.0 | Bluetooth Ver2.1 |
| Reconnect LED Configuration | Reconnect_LED_Enabled                  | 0x0230           |                  | 1         | False            |                  |
|                             | Reconnect_LED_PIN                      | 0x0231           |                  | 1         | 0                |                  |
|                             | Reconnect_LED_GPIO_State               | 0x0232           |                  | 1         | 0                |                  |
|                             | Reconnect_LED_On_Duration              | 0x0233           |                  | 1         | 3                |                  |
| Battery LED Configuration   | Battery_LED_Enabled                    | 0x011a           |                  | 1         | True             |                  |
|                             | Battery_LED_PIN                        | 0x011b           |                  | 1         | 5                |                  |
|                             | Battery_LED_GPIO_State                 | 0x011c           |                  | 1         | 0                |                  |
|                             | Battery_LED_On_Period                  | 0x011d           |                  | 1         | 4                |                  |
|                             | Battery_LED_Off_Period                 | 0x011e           |                  | 1         | 9                |                  |
|                             | Battery_LED_Blink_Duration             | 0x0238-0x0239    |                  | 2         | 30               |                  |
|                             | Battery_LED_Rest_Duration              | 0x023a-0x023b    |                  | 2         | 0                |                  |
|                             | Battery_LED_Active_Sniff_Mode          | 0x023c           |                  | 1         | 0x06             |                  |
|                             | Battery_LED_Total_Duration             | 0x023d           |                  | 1         | 30               |                  |
|                             | Battery_LED_Disabled_Before_Connection | 0x0248           |                  | 1         | True             |                  |
| CPI Selection Indicator     | Resolution_LED_GPIO_Total              | 0x011f           |                  | 1         | 0                |                  |
|                             | Resolution_LED_GPIO_Selection1         | 0x0120           |                  | 1         | 0                |                  |
|                             | Resolution_LED_GPIO_Selection2         | 0x0121           |                  | 1         | 0                |                  |
|                             | Resolution_LED_GPIO_Selection3         | 0x0122           |                  | 1         | 0                |                  |
|                             | Resolution_LED_GPIO_Selection4         | 0x0123           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting1                | 0x0124           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting2                | 0x0125           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting3                | 0x0126           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting4                | 0x0127           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting5                | 0x0128           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting6                | 0x0129           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting7                | 0x012a           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting8                | 0x012b           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting9                | 0x012c           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Setting10               | 0x012d           |                  | 1         | 0000             |                  |
|                             | Resolution_LED_Duration                | 0x012e           |                  | 1         | 0                |                  |
|                             | GPIO_state_On_Resolution_LED           | 0x012f           |                  | 1         | 0                |                  |
|                             | Resolution_LED_On_Period               | 0x0130           |                  | 1         | 0                |                  |
|                             | Resolution_LED_Off_Period              | 0x0131           |                  | 1         | 0                |                  |
|                             | Resolution_LED_Blink_On_Connection     | 0x024a           |                  | 1         | False            |                  |
| <b>Motion Configuration</b> |  |                  |                  |           |                  |                  |
| Motion Configuration        | Report_Protocol                        | 0x0132           |                  | 1         | Report Mode      |                  |
|                             | Motion_Report_Size                     | 0x0133           |                  | 1         | 12               |                  |
|                             | XY_Swap                                | 0x0134           |                  | 1         | True             |                  |
|                             | X_Flip                                 | 0x0135           |                  | 1         | False            |                  |
|                             | Y_Flip                                 | 0x0136           |                  | 1         | False            |                  |
|                             | Z_Selection                            | 0x0137           |                  | 1         | Mechanical       |                  |
|                             | Z_Configuration                        | 0x0138           |                  | 1         | Z/2              |                  |
|                             | Z_Negate                               | 0x0139           |                  | 1         | False            |                  |
|                             | X_Scale                                | 0x013a           |                  | 1         | 0                |                  |
|                             | Y_Scale                                | 0x013b           |                  | 1         | 0                |                  |

## Registers (continued)

| Domain                         | Register Name                  | Register Address |                  |           | Default Value         |                  |
|--------------------------------|--------------------------------|------------------|------------------|-----------|-----------------------|------------------|
|                                |                                | Bluetooth Ver2.0 | Bluetooth Ver2.1 | Byte Size | Bluetooth Ver2.0      | Bluetooth Ver2.1 |
| <b>Battery Configuration</b>   |                                |                  |                  |           |                       |                  |
| Battery Configuration          | Battery_Alarm_Power            | 0x01c0           |                  | 1         | 2.2V                  |                  |
|                                | Battery_Alarm_Time             | 0x01c1           |                  | 4         | 125                   |                  |
|                                | Battery_Sleep_Power            | 0x0203           |                  | 1         | 2.0V                  |                  |
| <b>Sensor Configuration</b>    |                                |                  |                  |           |                       |                  |
| Resolution                     | Max_Resolution                 | 0x013d           |                  | 1         | 3000                  |                  |
|                                | Default_Resolution             | 0x013e           |                  | 1         | 1250                  |                  |
| CPI Selection                  | Resolution_Selection_Method    | 0x0141           |                  | 1         | Not Support           |                  |
|                                | Resolution_Selection_Total     | 0x0142           |                  | 1         | 0                     |                  |
|                                | Current_Resolution_Selection   | 0x0143           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting1            | 0x0144           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting2            | 0x0145           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting3            | 0x0146           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting4            | 0x0147           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting5            | 0x0148           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting6            | 0x0149           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting7            | 0x014a           |                  | 1         | 0                     |                  |
|                                | Resolution_Setting8            | 0x014b           |                  | 1         | 0                     |                  |
| Resolution_Setting9            | 0x014c                         |                  | 1                | 0         |                       |                  |
| Resolution_Setting10           | 0x014d                         |                  | 1                | 0         |                       |                  |
| <b>SDP Configuration</b>       |                                |                  |                  |           |                       |                  |
| Vendor Information             | SDP_Service_Name               | 0x014e-0x018d    |                  | 64        | Avago Bluetooth Mouse |                  |
|                                | SDP_Service_Name_Length        | 0x018e           |                  | 1         | 21                    |                  |
|                                | SDP_Service_Description        | 0x018f-0x019e    |                  | 16        | A Mouse               |                  |
|                                | SDP_Service_Description_Length | 0x019f           |                  | 1         | 7                     |                  |
|                                | SDP_Provider_Name              | 0x01a0-0x01af    |                  | 16        | Avago                 |                  |
|                                | SDP_Provider_Name_Length       | 0x01b0           |                  | 1         | 5                     |                  |
|                                | SDP_Vendor_ID                  | 0x01b1-0x01b2    |                  | 2         | abcd                  |                  |
|                                | SDP_Product_ID                 | 0x01b3-0x01b4    |                  | 2         | 1234                  |                  |
| SDP_Product_Version            | 0x01b5-0x01b6                  |                  | 2                | 100       |                       |                  |
| BQB-Specific SDP Configuration | HID_Attribute_Length           | 0x01ff           |                  | 1         | 0x9f                  |                  |
|                                | HID_Attribute_Offset           | 0x0201           |                  | 1         | 0xeb                  |                  |
| <b>EEPROM Configuration</b>    |                                |                  |                  |           |                       |                  |
| EEPROM Write Protection        | EEPROM_WP_Flag                 | 0x021f           |                  | 1         | GPIO                  |                  |

## Basic Information

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### Firmware\_Version

Size: 2 byte                      Default Value: **1.0**

USAGE: This register contains the firmware version. Value 2 means version 2.0. This register value is fixed and not programmable.

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### Bluetooth\_BDAddress

Size: 6 byte                      Default Value: **00:19:4d:11:22:33**

USAGE: This register contains the Bluetooth address in hexadecimal. The format should be 00:11:22:33:44:55, where "00:11" are NAP (Non- Significant Address Part), "22" is UAP (Upper Address Part) and "33:44:55" are LAP (Lower Address Part).

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### Pin\_Length

Size: 1 byte                      Default Value: **4**

USAGE: This register contains the fixed PIN code length. Value 4 means the length of the PIN code is 4 bits.

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### Pin\_Code

Size: 4 byte                      Default Value: **0000**

USAGE: This register contains the PIN code in format of 4-byte alphanumeric string and special characters. Value 0000 means the PIN code is "0000".

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### Device\_Name\_Length

Size: 1 byte                      Default Value: **11**

USAGE: This register contains the length of the mouse Device Name.

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### Device\_Name

Size: up to 64 bytes              Default Value: **Avago Mouse**

USAGE: This register contains the mouse Device Name.

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### Bluetooth\_2.1\_Function\_Support

Size: 1 byte                      Default Value: **0x00**

USAGE: This register defines which Bluetooth V2.1 feature(s) is supported.

- bit 0: Secure Simple Pairing (SSP)
- bit 1: Encryption Pause and Resume (EPR)
- bit 2: Extended Inquiry Response (EIR)
- bit 3: Sniff Sub Rating (SSR)
- bit 4~7: Reserved

**Secure simple pairing** – Set whether to support secure simple pairing which supports "Just Works" and to enhance ease of use user experience.

**Encryption pause resume** – Set whether to support encryption pause and resume where better protection through encryption key refreshed during long connection period of use.

**Extended inquiry response** – Set whether to support extended inquiry response to enable fast discovery of device and to reduce latency.

**Sniff sub-rating** – Set whether to support sniff sub-rating which reduces power consumption for HID.

For example, 5 (i.e. 0x05) means SSP and EIR are supported, and the other 2 features are not supported. Set to 0 to disable support for all four Bluetooth V2.1 features.

## Connection Configuration

---

### Mouse\_Power\_Up\_Mode

Size: 1 byte                      Default Value: **Discoverable mode**

USAGE: This register defines which mode the mouse will enter after power-up, if reconnection is unnecessary.

Set to "Sleep mode" to make mouse enter sleep mode;

Set to "Discoverable mode" to enter discoverable mode.

---

### Auto\_Reconnect\_Enabled

Size: 1 byte                      Default Value: **True**

USAGE: This register defines the status of auto reconnection to host after power on

---

### LMP\_Supervision\_TimeOut

Size: 2 byte                      Default Value: **8000**

USAGE: This register defines the LMP supervision timeout in slots of 625us each. For example, 4096 means  $4096 * 625\text{us} = 2.56$  seconds.

---

### Page\_Scan\_Window

Size: 2 byte                      Default Value: **768**

USAGE: This register defines the page scan window in slots of 625us each. For example, 768 means  $768 * 625\text{us} = 480\text{ms}$ .

---

### Page\_Scan\_Interval

Size: 2 byte                      Default Value: **1024**

USAGE: This register defines the page scan interval in slots of 625us each. For example, 1024 means  $1024 * 625\text{us} = 640\text{ms}$ .

---

### Inquiry\_Scan\_Window

Size: 2 byte                      Default Value: **768**

USAGE: This register defines the inquiry scan window in slots of 625us each. For example, 768 means  $768 * 625\text{us} = 480\text{ms}$ .

---

### Inquiry\_Scan\_Interval

Size: 2 byte                      Default Value: **1024**

USAGE: This register defines the inquiry scan interval in slots of 625us each. For example, 1024 means  $1024 * 625\text{us} = 640\text{ms}$ .

---

### Inquiry\_Scan\_TimeOut

Size: 2 byte                      Default Value: **2250**

USAGE: This register defines the inquiry scan timeout (multiples of 80ms). For example, 750 means  $750 * 80\text{ms} = 60$  seconds.

---

### Page\_TimeOut

Size: 2 byte                      Default Value: **0**

USAGE: This register defines the page timeout (multiples of 80ms). For example, 30 means  $30 * 80\text{ms} = 2.4$  seconds. Set to 0 to disable page timeout.

---



---

### Pairing\_Mode

Size: 1 byte                      Default Value: **True**

USAGE: This register defines whether auto pairing or normal pairing mode is used. Data type is Boolean.  
Set to "True" for auto pairing which support authentication  
Set to "False" for normal pairing which reject authentication

---

### Authentication\_Mode

Size: 1 byte                      Default Value: **False**

USAGE: This register defines whether the host or the device starts authentication. Data type is Boolean.  
Set to "True" to allow mouse to initiate authentication;  
Set to "False" to allow host to initiate authentication.

---

### Connect\_Button\_Press\_Duration

Size: 2 byte                      Default Value: **12**

USAGE: This register defines duration (multiples of 80ms) needed for the connect button to be held before events are generated. 10 means  $10 * 80\text{ms} = 0.8$  second.

---

### VC\_Unplug\_Enable

Size: 1 byte                      Default Value: **True**

USAGE: This register controls whether a Virtual Cable unplug is generated on a connect button press. Data type is Boolean.  
Set to "True" to enable Virtual Cable unplug when connection button is pressed;  
Set to "False" to disable Virtual Cable unplug when connection button is pressed.

---

## Low Power Configuration

---

### Max\_Sniff\_Modes

Size: 1 byte                      Default Value: **3**

USAGE: This register defines the maximal number (less than or equal to 8) of sniff modes, for example, 3 means there are 3 sniff modes at most.

---

### Sleep\_Mode\_Enabled

Size: 1 byte                      Default Value: **True**

USAGE: This register defines whether to enter sleep mode when last sniff mode timeout. Data type is Boolean.  
Set to "True" to allow mouse enter sleep mode when last sniff mode timeout;  
Set to "False" to disallow mouse enter sleep mode when last sniff mode timeout.

---

### Wake\_Up\_Method

Size: 1 byte                      Default Value: **All event**

USAGE: This register defines through which way the mouse will be awakened.  
Set to "All event" to allow a button event or motion to wake up the mouse;  
Set to "Button event" to allow a button event to wake up the mouse;  
Set to "Motion" to allow motion to wake up the mouse.

---

---

### Sniff\_Retry\_Count

Size: 1 byte                      Default Value: **3**

USAGE: This register defines how many times of sniff will be requested by device if the master rejects the sniff request. For example, 3 means sniff will retry 3 times. Set to 0 to retry forever.

---

### Sniff\_Retry\_Interval

Size: 2 byte                      Default Value: **1600**

USAGE: This register defines how many slots (1slot = 625us) the device should wait before resending the sniff request. For example, 1600 means  $1600 * 625us = 1$  second.

---

### Sniff\_Timeout

Size: 2 byte                      Default Value: **1**

USAGE: This register defines timeout (in slots) of the sniff request to master in the current state. For example, 10 means 10 transmission slots. For the HID device to work well while multiple Bluetooth devices are connected to the host, non-zeros value is recommended.

Notes: If the slave has received a packet with a matching LT\_ADDR that contains ACL data (DM, DH, DV, or AUX1 packets) in the preceding Nsniff\_timeout master-to-slave transmission slots, then it shall continue listening.

If the slave has transmitted a packet containing ACL data (DM, DH, DV, or AUX1 packets) in the preceding Nsniff\_timeout slave-to-master transmission slots, then it shall continue listening.

If the slave has received any packet with a matching LT\_ADDR in the preceding Nsniff\_timeout master-to-slave transmission slots, then it may continue listening.

---

### Sniff\_Attempt

Size: 2 byte                      Default Value: **2**

USAGE: This register defines sniff attempt (in slots) of the sniff request to master in the current state. For example, 4 means 4 transmission slot.

Notes: If fewer than Nsniff\_attempt master-to-slave transmission slots have elapsed since the sniff anchor point, then the slave shall continue listening.

---

### Sniff\_Mode\_Interval0

Size: 2 byte                      Default Value: **18**

USAGE: This register defines sniff interval (in slot) for sniff mode 0. For example, 18 means  $18 * 625us = 11.25ms$ .

Note: Only 10, 12, 14, 16, 18 and 20 are valid.

---

### Sniff\_Mode\_Interval1

Size: 2 byte                      Default Value: **108**

USAGE: This register defines sniff interval (in slot) for sniff mode 1. For example, 108 means  $108 * 625us = 67.5ms$ .

---

### Sniff\_Mode\_Interval2

Size: 2 byte                      Default Value: **468**

USAGE: This register defines sniff interval (in slot) for sniff mode 2. For example, 480 means  $480 * 625us = 300ms$ .

---

### Sniff\_Mode\_Interval3

Size: 2 byte                      Default Value: **0**

USAGE: This register defines sniff interval (in slot) for sniff mode 3. For example, 300 means  $300 * 625us = 187.5ms$ .

---

---

#### **Sniff\_Mode\_Interval4**

Size: 2 byte                      Default Value: **0**

USAGE: This register defines sniff interval (in slot) for sniff mode 4. For example, 400 means  $400 * 625\mu s = 250ms$ .

---

#### **Sniff\_Mode\_Interval5**

Size: 2 byte                      Default Value: **0**

USAGE: This register defines sniff interval (in slot) for sniff mode 5. For example, 500 means  $500 * 625\mu s = 312.5ms$ .

---

#### **Sniff\_Mode\_Interval6**

Size: 2 byte                      Default Value: **0**

USAGE: This register defines sniff interval (in slot) for sniff mode 6. For example, 600 means  $600 * 625\mu s = 375ms$ .

---

#### **Sniff\_Mode\_Interval7**

Size: 2 byte                      Default Value: **0**

USAGE: This register defines sniff interval (in slot) for sniff mode 7. For example, 700 means  $700 * 625\mu s = 437.5ms$ .

---

#### **Sniff\_Mode\_Duration0**

Size: 2 byte                      Default Value: **178**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 178 means 178 times of the corresponding sniff mode interval (Sniff\_Mode\_Interval0 in this case). Therefore the default Sniff\_Mode\_Duration0 means  $178 * 11.25ms = 2002.5ms$ .

---

#### **Sniff\_Mode\_Duration1**

Size: 2 byte                      Default Value: **900**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 370 means 370 times of the corresponding sniff mode interval (Sniff\_Mode\_Interval1 in this case). Therefore the default Sniff\_Mode\_Duration1 means  $370 * 67.5ms = 24.975sec$ .

---

#### **Sniff\_Mode\_Duration2**

Size: 2 byte                      Default Value: **2050**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 6000 means 6000 times of the corresponding sniff mode interval (Sniff\_Mode\_Interval2 in this case). Therefore the default Sniff\_Mode\_Duration2 means  $6000 * 300ms = 1800sec$  (30min).

---

#### **Sniff\_Mode\_Duration3**

Size: 2 byte                      Default Value: **0**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 50 means 50 times of the corresponding sniff mode interval.

---

#### **Sniff\_Mode\_Duration4**

Size: 2 byte                      Default Value: **0**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 50 means 50 times of the corresponding sniff mode interval.

---

### **Sniff\_Mode\_Duration5**

Size: 2 byte                      Default Value: **0**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 50 means 50 times of the corresponding sniff mode interval.

---

### **Sniff\_Mode\_Duration6**

Size: 2 byte                      Default Value: **0**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 50 means 50 times of the corresponding sniff mode interval.

---

### **Sniff\_Mode\_Duration7**

Size: 2 byte                      Default Value: **0**

USAGE: The register defines sniff mode duration (must be a positive multiple of corresponding sniff mode interval) for the sniff mode. For examples, 50 means 50 times of the corresponding sniff mode interval.

---

## **Mouse Generic Configuration**

---

### **Programmable\_Buttons\_Total**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the number of programmable buttons. For example, 5 means there are 5 programmable buttons.

---

### **Programmable\_Buttons\_Low\_Power**

Size: 1 byte                      Default Value: **1**

USAGE: This register defines the maximal number of button events to be saved during low power mode period, for example, 1 means 1 button event will be saved at most. For current IC version, this register value is fixed to "1".

---

### **Debouncing\_Time**

Size: 1 byte                      Default Value: **4**

USAGE: Define the shortest period of time (in ms) for effective button state of an operation. An integer between 1 and 30 is valid. For example, 30 means a button press/release state will be ignored if this state lasts less than 30 ms.

---

### **GPIO\_Pin\_Selection1, GPIO\_Pin\_Selection2, GPIO\_Pin\_Selection3, GPIO\_Pin\_Selection4, GPIO\_Pin\_Selection5**

Size: 1 byte                      Default Value: **0**

USAGE: This register selects which pin the programmable button is connected to. An integer between 11 and 15 is valid. For example, 11 means the programmable button is connected to GPIO11.

---

### **Single\_Click\_Function1, Single\_Click\_Function2, Single\_Click\_Function3, Single\_Click\_Function4, Single\_Click\_Function5**

Size: 1 byte                      Default Value: **Not Supported**

USAGE: This register defines an explicit function of each single-click function of programmable button.

- Set to "Not support" to disable single click function;
- Set to "Function A" to choose Function A for single click function;
- Set to "Function B" to choose Function B for single click function;
- Set to "Function C" to choose Function C for single click function;
- Set to "Increase CPI" to choose Increase CPI for single click function;
- Set to "Decrease CPI" to choose Decrease CPI for single click function;
- Set to "CPI Rotation" to choose CPI Rotation for single click function.

---

**Single\_Click\_Repeat\_Delay1, Single\_Click\_Repeat\_Delay2, Single\_Click\_Repeat\_Delay3, Single\_Click\_Repeat\_Delay4, Single\_Click\_Repeat\_Delay5**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the duration (multiples of 80ms) of each single-click function of programmable button. An integer less than or equal to 255 is valid. Set to 0 to disable single click repeat delay. For example, 20 means the single click duration is 1.6 seconds. If Secure Simple Pairing is enabled, this feature will cease to be effective.

---

**Long\_Press\_Function1, Long\_Press\_Function2, Long\_Press\_Function3, Long\_Press\_Function4, Long\_Press\_Function5**

Size: 1 byte                      Default Value: **Not Supported**

USAGE: This register defines an explicit function of each long-press function of programmable button.

- Set to "Not support" to disable long press function;
  - Set to "Function A" to choose Function A for long press function;
  - Set to "Function B" to choose Function B for long press function;
  - Set to "Function C" to choose Function C for long press function;
  - Set to "Increase CPI" to choose Increase CPI for long press function;
  - Set to "Decrease CPI" to choose Decrease CPI for long press function;
  - Set to "CPI Rotation" to choose CPI Rotation for long press function.
- 

**Long\_Press\_Duration1, Long\_Press\_Duration2, Long\_Press\_Duration3, Long\_Press\_Duration4, Long\_Press\_Duration5**

Size: 1 byte                      Default Value: **25**

USAGE: This register defines the long press duration (in multiples of 80ms) of programmable button. To set the threshold, input an integer between 1 and 255. For example, 20 means the long press duration is 20\*80ms = 1.6 seconds.

---

**Double\_Click\_Function1, Double\_Click\_Function2, Double\_Click\_Function3, Double\_Click\_Function4, Double\_Click\_Function5**

Size: 1 byte                      Default Value: **Not Supported**

USAGE: This register defines an explicit function of each double-click function of programmable button.

- Set to "Not support" to disable double click function;
  - Set to "Function A" to choose Function A for double click function;
  - Set to "Function B" to choose Function B for double click function;
  - Set to "Function C" to choose Function C for double click function;
  - Set to "Increase CPI" to choose Increase CPI for double click function;
  - Set to "Decrease CPI" to choose Decrease CPI for double click function;
  - Set to "CPI Rotation" to choose CPI Rotation for double click function.
- If Secure Simple Pairing is enabled, this feature will cease to be effective.
- 

**Double\_Click\_Interval1, Double\_Click\_Interval2, Double\_Click\_Interval3, Double\_Click\_Interval4, Double\_Click\_Interval5**

Size: 1 byte                      Default Value: **6**

USAGE: This register defines the interval (multiples of 80ms) of each double-click function of programmable button. A positive integer less than or equal to 255 is valid. For example, 20 means the double click duration is 1.6 seconds. If Secure Simple Pairing is enabled, this feature will cease to be effective.

---

**User\_Defined\_Function\_1\_A, User\_Defined\_Function\_2\_A, User\_Defined\_Function\_3\_A, User\_Defined\_Function\_4\_A, User\_Defined\_Function\_5\_A**

Size: 10 byte                      Default Value: **a1 00 00 00 03 00 00 00 00 00**

USAGE: Define the user-defined HID report for function A of programmable button 1 to 5. For example, in order to define one function of consumer page, the value should be set in the format of "a1 07 xx yy 00 00 00 00 00 00", where xx yy should be replaced by the usage ID of the target function in byte-inverted sequence, e.g. "cd 00" for ID = cd and "25 02" for ID = 225. When manually setting this item, keyboard code A must be set to "Not support" in both bytes.

---

**User\_Defined\_Function\_1\_B, User\_Defined\_Function\_2\_B, User\_Defined\_Function\_3\_B, User\_Defined\_Function\_4\_B, User\_Defined\_Function\_5\_B**

Size: 10 byte                      Default Value: **a1 00 00 00 03 00 00 00 00 00**

USAGE: Define the user-defined HID report for function B of programmable button 1 to 5. For example, in order to define one function of consumer page, the value should be set in the format of "a1 07 xx yy 00 00 00 00 00", where xx yy should be replaced by the usage ID of the target function in byte-inverted sequence, e.g. "cd 00" for ID = cd and "25 02" for ID = 225. When manually setting this item, keyboard code B must be set to "Not support" in both bytes.

---

**User\_Defined\_Function\_1\_C, User\_Defined\_Function\_2\_C, User\_Defined\_Function\_3\_C, User\_Defined\_Function\_4\_C, User\_Defined\_Function\_5\_C**

Size: 10 byte                      Default Value: **a1 00 00 00 03 00 00 00 00 00**

USAGE: Define the user-defined HID report for function C of programmable button 1 to 5. For example, in order to define one function of consumer page, the value should be set in the format of "a1 07 xx yy 00 00 00 00 00 00", where xx yy should be replaced by the usage ID of the target function in byte-inverted sequence, e.g. "cd 00" for ID = cd and "25 02" for ID = 225. When manually setting this item, keyboard code B must be set to "Not support" in both bytes. If Secure Simple Pairing is enabled, this feature will cease to be effective.

---

**Tilt\_Wheel\_Enabled**

Size: 1 byte                      Default Value: **Not Supported**

USAGE: This register enables or disables the tilt wheel function (via TW+ and TW- pins). Data type is Boolean.  
Set to "Not Supported" to disable tilt wheel function;  
Set to "Support TWheel Function" to activate the TW+ and TW- for tilt wheel function;  
Set to "Support LED Function" to activate the TW+ and TW- as LED GPIO.

---

**Power\_On\_LED\_Enabled**

Size: 1 byte                      Default Value: **False**

USAGE: This register enables or disables power-on LED indicator function. Data type is Boolean.  
Set to "True" to enable power-on LED support;  
Set to "False" to disable power-on LED support.

---

**Power\_On\_LED\_PIN**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines which GPIO pin the power-on LED is connected to. GPIO3-GPIO6 and GPIO11-GPIO15 are valid options. For example, 6 means the power-on LED is connected to GPIO6.

---

**Power\_On\_LED\_GPIO\_State**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the power-on LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes power-on LED to turn on, and GPIO value "0" causes power-on LED to turn off.

---

**Power\_On\_LED\_On\_Duration**

Size: 1 byte                      Default Value: **37**

USAGE: This register defines power-on LED on period (multiples of 80ms). The range is 0 to 255. For example, 10 means 10\*80ms = 0.8 second.

---

### **Reconnect\_Power\_On\_LED\_Enabled**

Size: 1 byte                      Default Value: **False**

USAGE: This register enables or disables reconnect power-on LED indicator function. Data type is Boolean.

Set to "True" to enable reconnect power-on LED support;  
Set to "False" to disable reconnect power-on LED support.

---

### **Reconnect\_Power\_On\_LED\_PIN**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines which GPIO pin the reconnect power-on LED is connected to. GPIO3-GPIO6 and GPIO11-GPIO15 are valid options. For example, 6 means the reconnect power-on LED is connected to GPIO6.

---

### **Reconnect\_Power\_On\_LED\_GPIO\_State**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the reconnect power-on LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes reconnect power-on LED to turn on, and GPIO value "0" causes reconnect power-on LED to turn off.

---

### **Reconnect\_Power\_On\_LED\_On\_Duration**

Size: 1 byte                      Default Value: **37**

USAGE: This register defines reconnect power-on LED on period (multiples of 80ms). The range is 0 to 255. For example, 10 means  $10 \times 80\text{ms} = 0.8$  second.

---

### **Discover\_LED\_Enabled**

Size: 1 byte                      Default Value: **True**

USAGE: This register enable or disable discover LED indicator function. Data type is Boolean.

Set to "True" to enable discover LED support;  
Set to "False" to disable discover LED support.

---

### **Discover\_LED\_PIN**

Size: 1 byte                      Default Value: **6**

USAGE: This register defines which GPIO pin the discover LED is connected to. Only GPIO5 and GPIO6 are valid options. For example, 6 means the discover LED is connected to GPIO6.

---

### **Discover\_LED\_GPIO\_State**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the discover LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes discover LED to turn on, and GPIO value "0" causes discover LED to turn off.

---

### **Discover\_LED\_On\_Period**

Size: 1 byte                      Default Value: **10**

USAGE: This register defines discover LED on period (multiples of 80ms). The range is 0 to 255. For example, 10 means  $10 \times 80\text{ms} = 0.8$  second.

---

---

### **Discover\_LED\_Off\_Period**

Size: 1 byte                      Default Value: **10**

USAGE: This register defines discover LED off period (multiples of 80ms). The range is 0 to 255. For example, 10 means 10\*80ms = 0.8 second.

---

### **Reconnect\_LED\_Enabled**

Size: 1 byte                      Default Value: **False**

USAGE: This register enables or disables reconnect LED indicator function. Data type is Boolean.

Set to "True" to enable reconnect LED support;

Set to "False" to disable reconnect LED support.

---

### **Reconnect\_LED\_PIN**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines which GPIO pin the reconnect LED is connected to. GPIO3-GPIO6 and GPIO11-GPIO15 are valid options. For example, 6 means the reconnect LED is connected to GPIO6.

---

### **Reconnect\_LED\_GPIO\_State**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the reconnect LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes reconnect LED to turn on, and GPIO value "0" causes reconnect LED to turn off.

---

### **Reconnect\_LED\_On\_Duration**

Size: 1 byte                      Default Value: **37**

USAGE: This register defines reconnect LED on period (multiples of 80ms). The range is 0 to 255. For example, 10 means 10\*80ms = 0.8 second.

---

### **Battery\_LED\_Enabled**

Size: 1 byte                      Default Value: **True**

USAGE: This register enable or disable battery LED indicator function. Data type is Boolean.

Set to "True" to enable battery LED support;

Set to "False" to disable battery LED support.

---

### **Battery\_LED\_PIN**

Size: 1 byte                      Default Value: **5**

USAGE: This register defines which GPIO pin the battery LED is connected to. Only GPIO5 and GPIO6 are valid options. For example, 5 means the discover LED is connected to GPIO5.

---

### **Battery\_LED\_GPIO\_State**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the battery LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes battery LED to turn on, and GPIO value "0" causes battery LED to turn off.

---



---

### **Battery\_LED\_On\_Period**

Size: 1 byte                      Default Value: **5**

USAGE: This register defines battery LED on period (multiples of 80ms). The range is 0 to 255. For example, 10 means 10\*80ms = 0.8 second.

---

### **Battery\_LED\_Off\_Period**

Size: 1 byte                      Default Value: **9**

USAGE: This register defines battery LED off period (multiples of 80ms). The range is 0 to 255. For example, 10 means 10\*80ms = 0.8 second.

---

### **Battery\_LED\_Blink\_Duration**

Size: 2 byte                      Default Value: **30**

USAGE: This register defines battery LED blink duration (in 1sec). The range is 0 to 5242. For example, 30 means 30 seconds.

---

### **Battery\_LED\_Rest\_Duration**

Size: 2 byte                      Default Value: **0**

USAGE: This register defines battery LED rest duration (in 1sec). The range is 0 to 5242. For example, 0 means 0 second.

---

### **Battery\_LED\_Active\_Sniff\_Mode**

Size: 1 byte                      Default Value: **0x06**

USAGE: This register defines the active sniff mode(s) of battery LED. The range is 0x0 to 0xf. For example, 0x6 means battery LED is active in sniff mode 1 and 2.

---

### **Battery\_LED\_Total\_Duration**

Size: 1 byte                      Default Value: **30**

USAGE: This register defines battery LED total duration (in 1sec). The range is 0 to 255. For example, 30 means 30 seconds. Set to 0 to instruct battery LED to work when mouse is in the activated sniff modes.

---

### **Battery\_LED\_Disabled\_Before\_Connection**

Size: 1 byte                      Default Value: **True**

USAGE: Define whether or not to disable the battery LED before connection is established.

Set to "True" to disable the battery LED before connection;

Set to "False" to disable the battery LED after connection.

---

### **Resolution\_LED\_GPIO\_Total**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the number of GPIO pins to be used to support resolution LED indicators. An integer between 0 and 4 is valid. Set to 0 to disable this function. For example, 4 means 4 GPIO pins will be used to support CPI selection indicator.

---

### **Resolution\_LED\_GPIO\_Selection1, Resolution\_LED\_GPIO\_Selection2, Resolution\_LED\_GPIO\_Selection3, Resolution\_LED\_GPIO\_Selection4**

Size: 1 byte                      Default Value: **None**

USAGE: This register defines which GPIO pin to be used for LED indicator of each resolution. The options will be limited in the range of 3-6, 11-15, and each of them will be omitted if a programmable button or the battery/discovery LED has asserted this GPIO. Select "None" to disable this indicator.

---

---

### **Resolution\_LED\_Setting1**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_1, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_1. For example, "0101" means that the two GPIO pins which are asserted for LED\_GPIO\_Selection1 and LED\_GPIO\_Selection3 will output high, while the two GPIO pins which are asserted for LED\_GPIO\_Selection2 and LED\_GPIO\_Selection4 will output low.

---

### **Resolution\_LED\_Setting2**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_2, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_2.

---

### **Resolution\_LED\_Setting3**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_3, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_3.

---

### **Resolution\_LED\_Setting4**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_4, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_4.

---

### **Resolution\_LED\_Setting5**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_5, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_5.

---

### **Resolution\_LED\_Setting6**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_6, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_6.

---

### **Resolution\_LED\_Setting7**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_7, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_7.

---

### **Resolution\_LED\_Setting8**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_8, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_8.

---

---

### **Resolution\_LED\_Setting9**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_9, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_9.

---

### **Resolution\_LED\_Setting10**

Size: 1 byte                      Default Value: **0000**

USAGE: This register defines which resolution LED indicators light up when mouse is set to Resolution\_Selection\_10, in 4-bit big-endian binary. Set to "0000" to disable LED indication for Resolution\_Selection\_10.

---

### **Resolution\_LED\_Duration**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the duration in which the resolution LED indicators work, in 80ms. The range is from 0 to 255. Set to 0 to disable the LED indicator. For example, 30 means the LEDs will be on for 2.4 seconds.

---

### **GPIO\_state\_ON\_Resolution\_LED**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines the GPIO value which causes the LED to turn on. The opposite value is used automatically to turn it off. Only 0 and 1 are valid. For example, 1 means GPIO value "1" causes LED to turn on, and GPIO value "0" causes LED to turn off.

---

### **Resolution\_LED\_ON\_Period**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines LED on period (in 80ms). The range is 0 to 255. The LED on period must not be greater than the LED duration. For example, 10 means 0.8 second.

---

### **Resolution\_LED\_OFF\_Period**

Size: 1 byte                      Default Value: **0**

USAGE: This register defines LED off period (in 80ms). The range is 0 to 255. The LED on period must not be greater than the LED duration. For example, 10 means 0.8 second.

---

### **Resolution\_LED\_Blink\_On\_Connection**

Size: 1 byte                      Default Value: **False**

USAGE: This register defines whether to blink resolution LED after connection is established.  
Set to "True" to allow corresponding resolution LED to blink;  
Set to "False" to disallow corresponding resolution LED to blink.

## Motion Configuration

---

### Report\_Protocol

Size: 1 byte                      Default Value: **Report Mode**

USAGE: This register defines the protocol used upon (re)establishment of connection. Set to "Report mode" or "Boot mode".

---

### Motion\_Report\_Size

Size: 1 byte                      Default Value: **12**

USAGE: This register defines the size (bit) of the motion reports sent in report mode (must match SDP record). For example, 12 means the size of motion reports is 12 bit.

---

### XY\_Swap

Size: 1 byte                      Default Value: **False**

USAGE: This register causes the firmware to swap the X/Y readings to accommodate various mounting configurations. Note that X/Y swapping is done prior to X/Y flip. Data type is Boolean.  
Set to "True" to enable X/Y swap;  
Set to "False" to disable X/Y swap.

---

### X\_Flip

Size: 1 byte                      Default Value: **False**

USAGE: This register causes the firmware flip the X value read from the sensor. Note that flip is done after X/Y swap. Combined with X/Y swap accommodates various physical sensor orientation. Data type is Boolean.  
Set to "True" to enable X flip;  
Set to "False" to disable X flip.

---

### Y\_Flip

Size: 1 byte                      Default Value: **False**

USAGE: This register causes the firmware flip the Y value read from the sensor. Note that flip is done after X/Y swap. Combined with X/Y swap accommodates various physical sensor orientation. Data type is Boolean.  
Set to "True" to enable Y flip;  
Set to "False" to disable Y flip.

---

### Z\_Selection

Size: 1 byte                      Default Value: **Mechanical**

USAGE: This register defines which type of scroll is used. For example, mechanical, or optical.

---

### Z\_Configuration

Size: 1 byte                      Default Value: **Z/2**

USAGE: This register defines the step of Z-wheel. For example, Z/2 (for mechanical z-wheel) or Z/4 (for optical z-wheel).

---

### Z\_Negate

Size: 1 byte                      Default Value: **False**

USAGE: This register instructs the firmware to negate the scroll value read from the scroll wheel. Data type is Boolean.  
Set to "True" to enable negating scroll;  
Set to "False" to disable negating scroll.

---

### X\_Scale

Size: 1 byte                      Default Value: **0**

USAGE: This register scales down the X motion reported by the sensor. Choose one from the options as below:  
"0" means to disable scaling;  
"1" means to scale down to 1/2;  
"2" means to scale down to 1/4;  
"3" means to scale down to 1/8;  
"4" means to scale down to 1/16.

---

### Y\_Scale

Size: 1 byte                      Default Value: **0**

USAGE: This register scales down the Y motion reported by the sensor. Choose one from the options as below:  
"0" means to disable scaling;  
"1" means to scale down to 1/2;  
"2" means to scale down to 1/4;  
"3" means to scale down to 1/8;  
"4" means to scale down to 1/16.

---

## Battery Configuration

---

### Battery\_Alarm\_Power

Size: 1 byte                      Default Value: **2.2V**

USAGE: Define at which voltage the battery LED will be turned on, in order to indicate low battery-level. The range is 1.8V to 2.5V at step of 0.1V.

---

### Battery\_Alarm\_Time

Size: 4 bytes                      Default Value: **125**

USAGE: Define the interval (in 80mS) of mouse detects battery level. The range is 1 to 4,294,967,295. For example, 125 means the interval is 125\*80ms = 10 seconds.

---

### Battery\_Sleep\_Power

Size: 1 byte                      Default Value: **2.0V**

USAGE: Define at which voltage the battery LED will be shut down. This time, mouse will also be shut down. The range is 1.8V to 2.5V at step of 0.1V.

---

## Sensor Configuration

---

### Max\_Resolution

Size: 1 byte                      Default Value: **3000**

USAGE: This register sets the maximum sensor resolution in count per inch (cpi). For example, 3000 means the maximum sensor resolution is 3000cpi. This register value is fixed and not programmable.

---

### Default\_Resolution

Size: 1 byte                      Default Value: **1250**

USAGE: This register sets the default sensor resolution in count per inch (cpi). The value must be an integral multiple of 250, and be less than or equal to "Max resolution". For example, 750 means the default sensor resolution is 750cpi.

---

### Resolution\_Selection\_Method

Size: 1 byte                      Default Value: **Not Support**

USAGE: This register defines the way to input resolution selection.

Set to "Not Support" to disable this feature;

Set to "Hotkey" to select CPI by hotkey.

---

### Resolution\_Selection\_Total

Size: 1 byte                      Default Value: **0**

USAGE: This register sets the number of resolution setting stages to be saved, for example, 10 means 10 resolution setting stages will be saved.

---

### Current\_Resolution\_Selection

Size: 1 byte                      Default Value: **0**

USAGE: This register sets current mouse resolution from the list of Resolution\_Setting index. Set to 0 to implicitly choose the value of "Default resolution". The mouse will save the latest used resolution selection of the user, if applicable, as this index. For example, 1 means the current selection is Resolution\_Setting1.

---

### Resolution\_Setting1, Resolution\_Setting2, Resolution\_Setting3, Resolution\_Setting4, Resolution\_Setting5 Resolution\_Setting6, Resolution\_Setting7, Resolution\_Setting8, Resolution\_Setting9, Resolution\_Setting10

Size: 1 byte                      Default Value: **0**

USAGE: This register sets the resolution of each selection (from 1 to 10). The value must be an integral multiple of 250, and be less than or equal to "Max resolution" in Resolution page. Set to 0 to disable this selection. For example, 750 means CPI selection 1 is "750".

## SDP Programmable Features

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### SDP\_Service\_Name

Size: 64 byte                      Default Value: **Avago Bluetooth Mouse**

USAGE: This register defines the service name in SDP.

---

### SDP\_Service\_Name\_Length

Size: 1 byte                      Default Value: **21**

USAGE: This register defines the length of the service name in SDP.

---

### SDP\_Service\_Description

Size: 16 byte                      Default Value: **A Mouse**

USAGE: This register defines the service description in SDP.

---

### SDP\_Service\_Description\_Length

Size: 1 byte                      Default Value: **7**

USAGE: This register defines the length of service description in SDP.

---

### SDP\_Provider\_Name

Size: 16 byte                      Default Value: **Avago**

USAGE: This register defines the provider name in SDP.

---

### SDP\_Provider\_Name\_Length

Size: 1 byte                      Default Value: **5**

USAGE: This register defines the length of provider name in SDP.

---

### SDP\_Vendor\_ID

Size: 2 byte                      Default Value: **0**

USAGE: This register defines the vendor ID in SDP, specific for manufacturer.

---

### SDP\_Product\_ID

Size: 2 byte                      Default Value: **0**

USAGE: This register defines the product ID in SDP, specific for manufacturer.

---

### SDP\_Product\_Version

Size: 2 byte                      Default Value: **0**

USAGE: This register defines the product version in SDP in hexadecimal, with higher byte representing the major version number, and lower byte representing the minor version number. For example 0x0100 means version 1.0, 0x1011 means version 16.17.

## BQB-Specific SDP Configuration

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### HID\_Attribute\_Length

Size: 1 byte                      Default Value: **0x9f**

USAGE: Define the HID descriptor list length. For example, HID descriptor list is 09 02 06 35 02 35 00 ..., so the length is 7. This control byte is just for the BQB HID test.

---

### HID\_Attribute\_Offset

Size: 1 byte                      Default Value: **0xeb**

USAGE: Define the offset of HID descriptor list. For example, HID descriptor list is 09 02 06 35 02 35 00 ..., so the offset is length from the beginning of SDP information to 09. This control byte is just for the BQB HID test.

---

## EEPROM Configuration

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### EEPROM\_WP\_Flag

Size: 1 byte                      Default Value: **GPIO**

USAGE: Define the way to support EEPROM write protection. If activated, the function will prevent all accidental write operations to EEPROM.

Set to "Not support" to disable EEPROM write protection;

Set to "GPIO" to support EEPROM write protection via GPIO15 (B8/WP);

Set to "TWheel" to support EEPROM write protection via T-wheel pins.

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)