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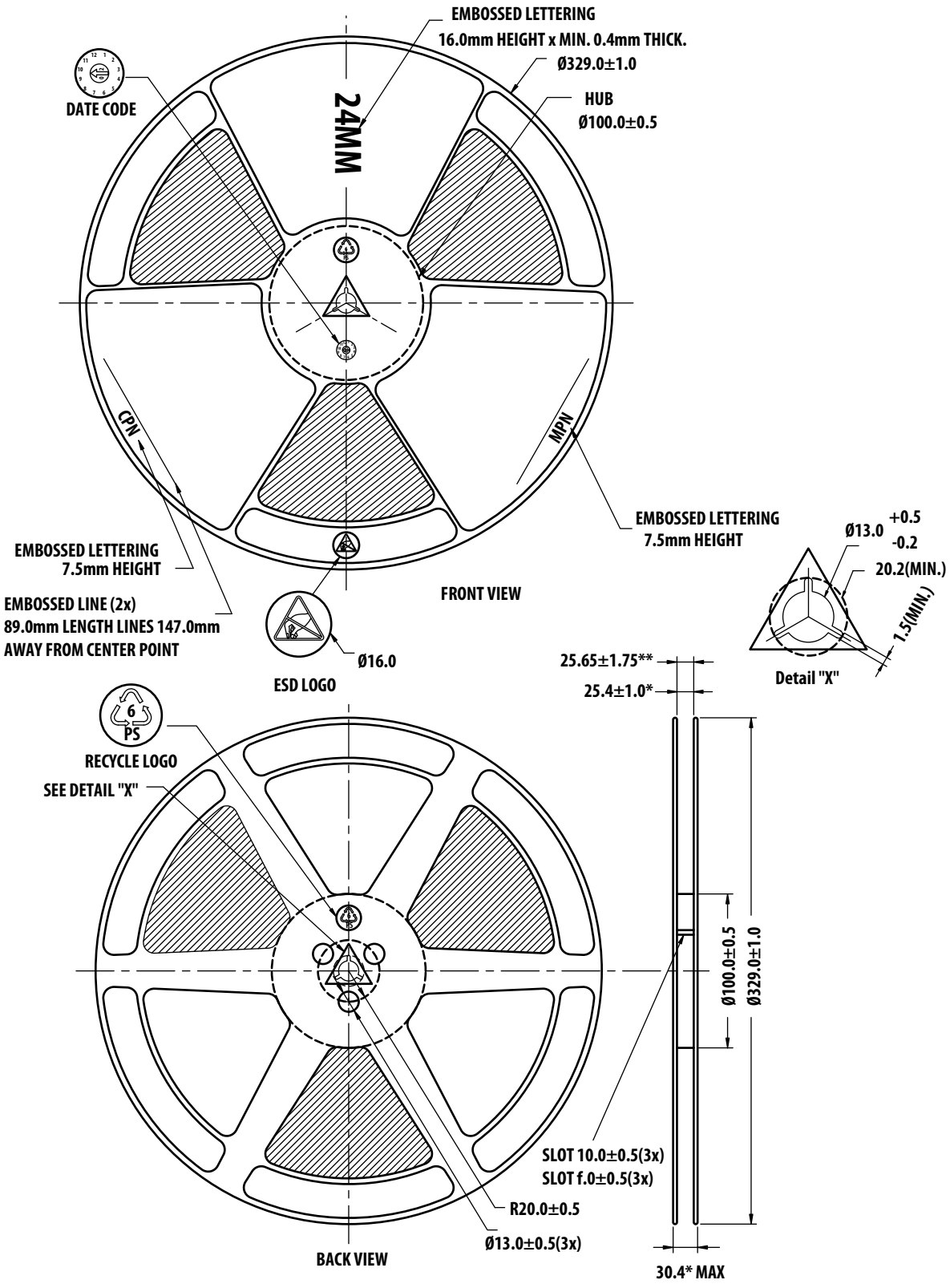
What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	PIC
Core Size	8-Bit
Speed	20MHz
Connectivity	-
Peripherals	POR, WDT
Number of I/O	11
Program Memory Size	1.5KB (1K x 12)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	72 x 8
Voltage - Supply (Vcc/Vdd)	2V ~ 5.5V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	14-SOIC (0.154", 3.90mm Width)
Supplier Device Package	14-SOIC
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16f505-i-sl



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

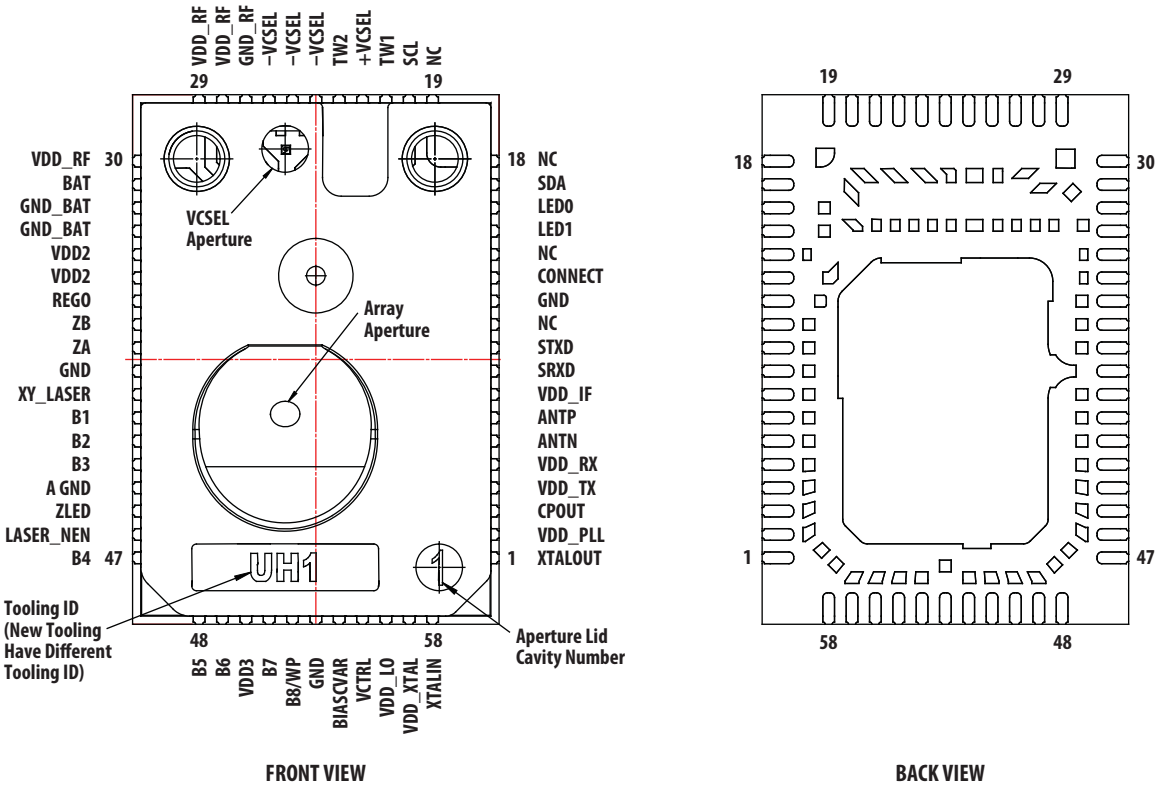
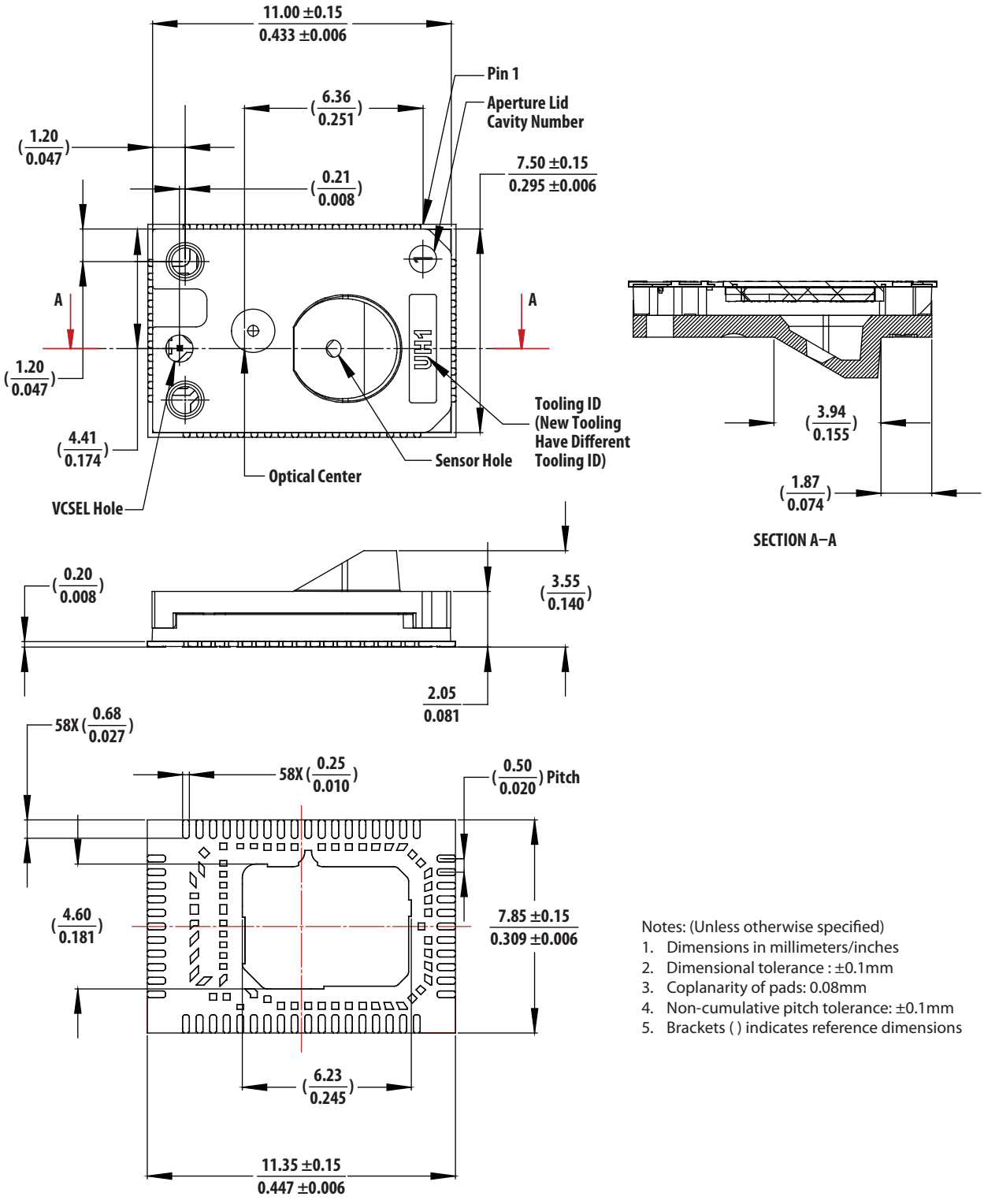


Figure 2. ADNS-7630 QFN Package Pinout

Table 1. ADNS-7630 Pinout Device Configuration

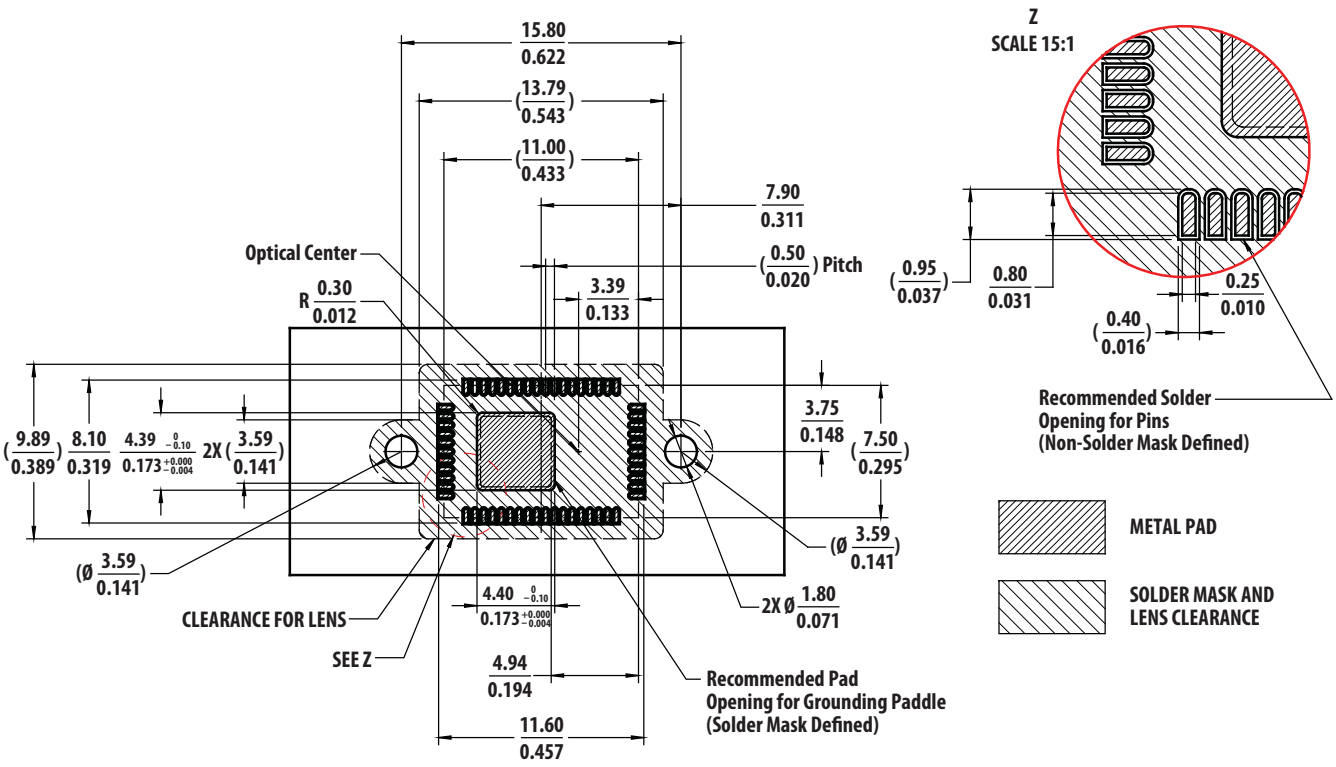
Pin	Name	Description	Type
1	XTAL_OUT	Crystal output	I/O
2	VDD_PLL	Power supply for frequency synthesizer	Power
3	CPOUT	Charge pump output pin for digital clock PLL	I/O
4	VDD_TX	Power supply for RF transmitter	Power
5	VDD_RX	Power supply for RF receiver	Power
6	ANTN	Negative port for antenna	I/O
7	ANTP	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



Notes: (Unless otherwise specified)
1. Dimensions in millimeters/inches
2. Dimensional tolerance : ±0.1mm
3. Coplanarity of pads: 0.08mm
4. Non-cumulative pitch tolerance: ±0.1mm
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)

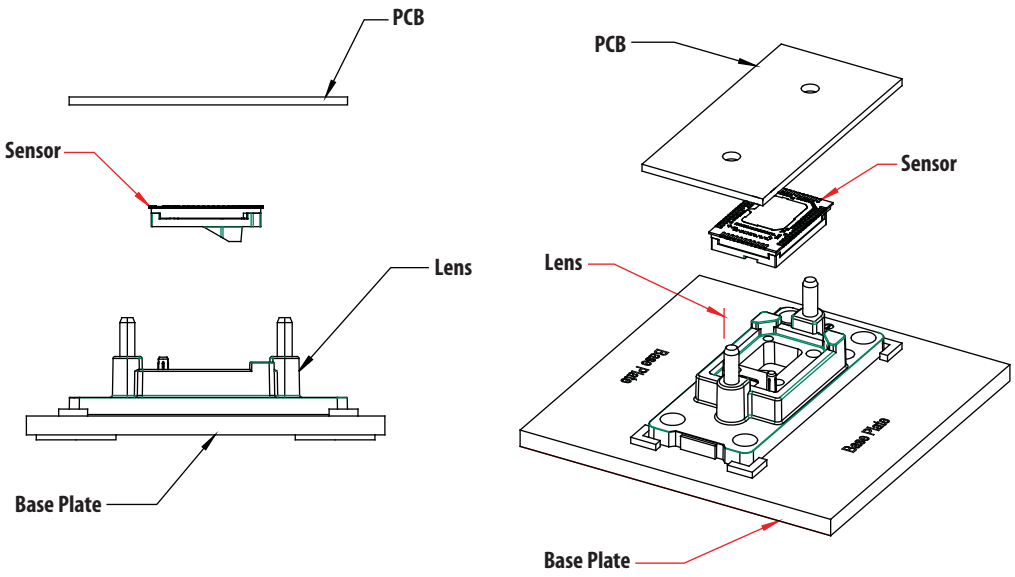


Figure 6. Exploded view drawing of ADNS-7630 sensor coupled with ADNS-7100-001 lens, PCB & base plate (front view and top side view)

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 tweezer. 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, Tsmin	150°C
Preheat temperature maximum, Tsmax	200°C
Preheat Duration(Tsmin to Tsmax), t_s	60-120 sec
Liquidus Temperature, T_L	220°C
Time Above Reflow (T_L=220°C), t	30-90 sec
Peak Temperature, Tp	250°C
Time within 5°C of the specified classification temperature (Tc=250°C), tp	10 sec
Time 25°C to peak temperature	8 mins maximum

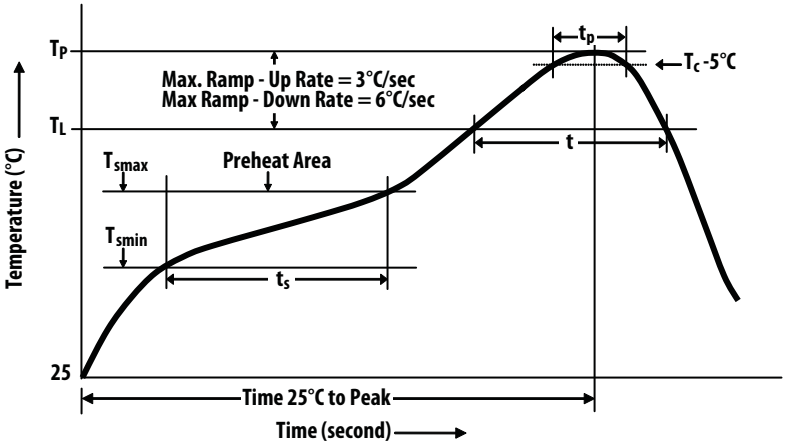


Figure 7. Solder Reflow Profile for PCB

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).

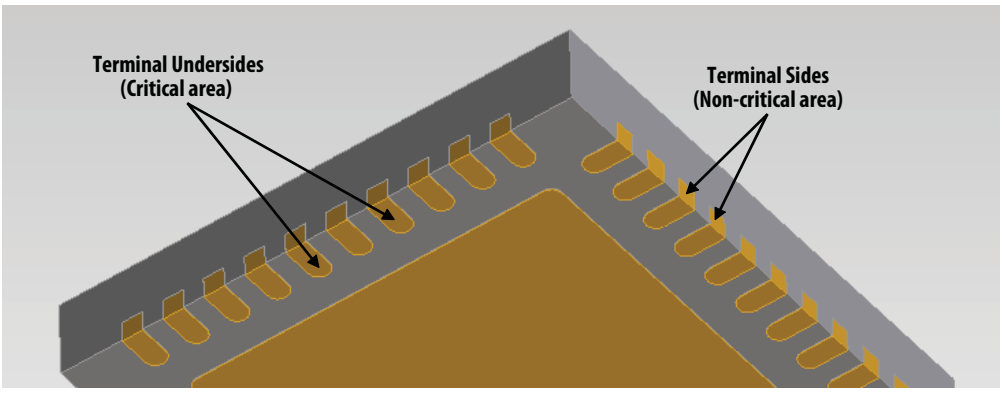


Figure 8. Critical and Non-critical areas (Bottom view)

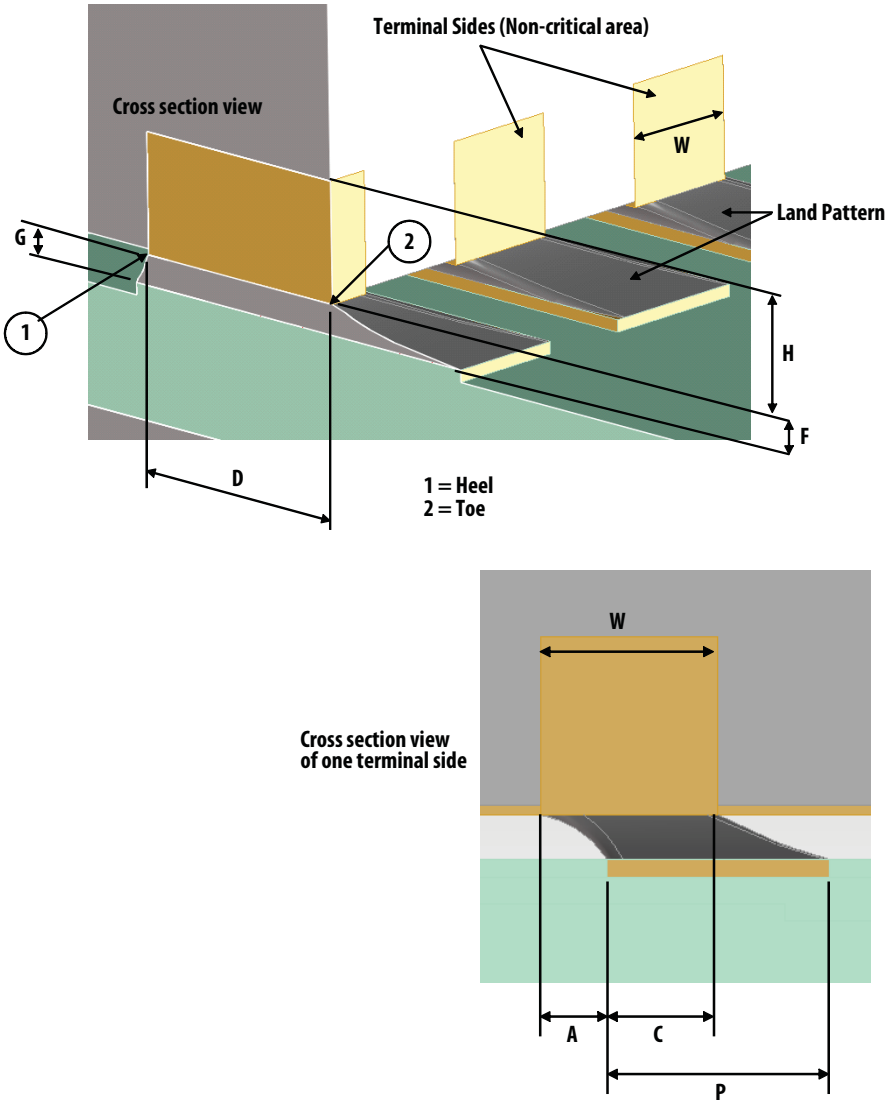


Figure 9. Critical and Non-critical areas (Cross sectional views)

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.

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 ANTN 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 ANTN (pin 6) traces, as well as between ANTP (pin 7) and VDD_IF (pin 8) traces.
10. Keep ANTN and ANTP traces (from IC to antenna) parallel, short and as straight as possible without many curves. Recommended to have differential impedance between ANTN 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 π-type filter at antenna circuit to suppress 4.8G/7.2GHz harmonics.

Block Diagram

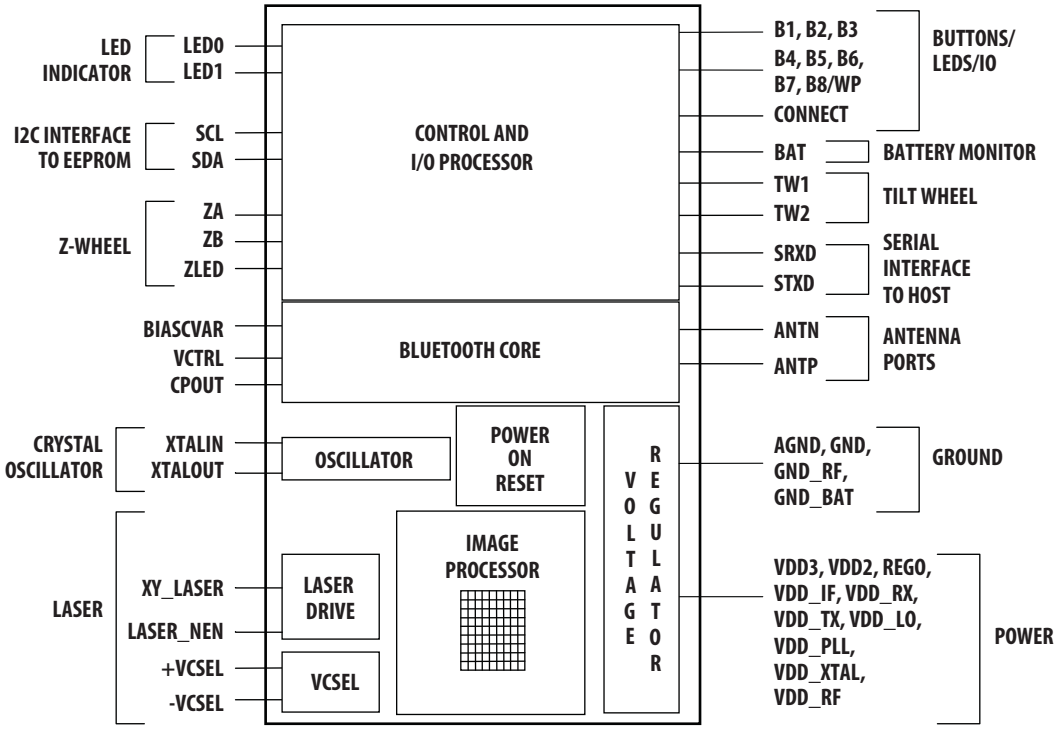


Figure 11. ADNS-7630 Block Diagram

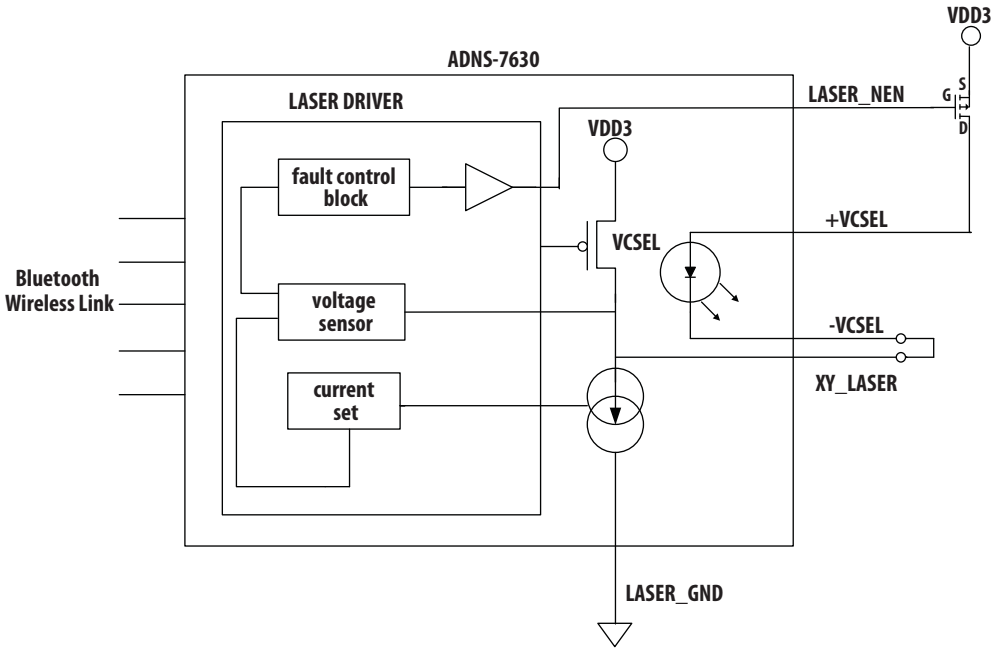


Figure 12. Single Fault Detection and Eye Safety Feature

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	µA	Disconnected, wake on sensor motion. State preserved.
			80	250	µA	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	µA	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}		±1	±10	µA	Vin = 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	

Receiver 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	Mode and Conditions
Receiver Section					
RX sensitivity	-90	-85	-80	dBm	GFSK, 0.1%BER, 1 Mbps
Maximum input power	-20	-10		dBm	
Interference Performance					
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
Out-of-Band Blocking Performance (CW)					
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
Intermodulation Performance					
BT, Delta F = 3MHz	-39	–36		dBm	
Spurious Emission					
30 MHz to 1 GHz		-77	-57	dBm	
1 GHz to 12.75 GHz		-64	-47	dBm	

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 100µA 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.

Registers (continued)

Domain	Register Name	Register Address		Byte Size	Default Value	
		Bluetooth Ver2.0	Bluetooth Ver2.1		Bluetooth Ver2.0	Bluetooth Ver2.1
Mouse Generic Configuration						
Button Configuration						
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		Byte Size	Default Value	
		Bluetooth Ver2.0	Bluetooth Ver2.1		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	
Twheel PIN Function Selection						
Tilt Wheel	Tilt_Wheel_Enabled	0x0114		1	Support Twheel Function	
LED Configuration						
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		Byte Size	Default Value	
		Bluetooth Ver2.0	Bluetooth Ver2.1		Bluetooth Ver2.0	Bluetooth Ver2.1
Battery Configuration						
Battery Configuration	Battery_Alarm_Power	0x01c0		1	2.2V	
	Battery_Alarm_Time	0x01c1		4	125	
	Battery_Sleep_Power	0x0203		1	2.0V	
Sensor Configuration						
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	
SDP Configuration						
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	
EEPROM Configuration						
EEPROM Write Protection	EEPROM_WP_Flag	0x021f		1	GPIO	

Basic Information

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.

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).

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.

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".

Device_Name_Length

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

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

Device_Name

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

USAGE: This register contains the mouse Device Name.

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.

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 paring 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*80ms = 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.

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.

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.

BQB-Specific SDP Configuration

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

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.

AV02-2504EN - July 22, 2010