

## AMRX-1510

### Ultra-slim Scroll Wheel with 5-way Switch

**AVAGO**  
TECHNOLOGIES

## Data Sheet



### Description

Avago Technologies' AMRX-1510 provides an integrated solution for scrolling, directional navigation and push button selection in a compact and ultra-slim package. With ease of use in mind, AMRX-1510 is ideal for scrolling of menus in new handheld electronic devices, such as in mobile phones, music players, cameras, and entertainment consoles. Based on Avago Technologies' reflective optical technology, the motion sensor is non-contact and ensures reliable operations. The five tactile switches provide directional navigation and center selection from a list of menu. The aesthetic design of the scroll wheel is customizable to different colors and design features. Please refer to factory for further details.

### Applications

- Handheld electronic devices
- Mobile devices
- Digital cameras and camcorders
- Entertainment consoles
- Handheld GPS or navigation devices
- Portable audio and video players
- Photo printers

### Features

- Ultra-slim package
- Less than 2 mm height profile
- Typical 18.5 mm diameter
- Integrated with four directional switches and a center push button
- Integrated with scroll wheel for scrolling operation
- Built-in illumination ring
- Two-Channel Quadrature Output
- 45 Cycles Per Revolution (CPR)
- 1.8V / 3.3V TTL/CMOS Logic Compatible Single-ended Output
- Single 2.4V to 3.3V supply
- Simple Power Down feature
- Easy assembly, no signal adjustment required
- Connectivity through 15-way 0.5 mm pitch FPC
- Customizable aesthetic design
- RoHS compliant

**WARNING:** These devices are Electrostatic Discharge (ESD) sensitive. The following precautions are strongly recommended. Ensure that an ESD approved carrier is used when units are transported from one destination to another. Personal grounding is to be worn at all times when handling these devices. Failure to observe proper ESD handling precautions will void all warranties. Refer to Avago Application Note A004R: Electrostatic Discharge Damage and Control.



## Device Selection Guide <sup>1,2</sup>

Part Number	Resolution (CPR)	Operating Temperature (°C)	Output Communication	Exterior Options	DC Supply Voltage (V)
AMRX-1510-1BWA	45	-25 to +85	1.8V CH A & B	Dial: VM Chrome Finish; Push Button: Matt Black; LED : White; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-1AWB	45	-15 to +70	1.8V CH A & B	Dial: Black SF Rubber; Push Button: High Gloss Black; LED : White; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-1AWC	45	-25 to +85	1.8V CH A & B	Dial: High Gloss Black; Push Button: High Gloss Black; LED : White; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-1BBA	45	-25 to +85	1.8V CH A & B	Dial: VM Chrome Finish; Push Button: Matt Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-1ABB	45	-15 to +70	1.8V CH A & B	Dial: Black SF Rubber; Push Button: High Gloss Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-1ABC	45	-25 to +85	1.8V CH A & B	Dial: High Gloss Black; Push Button: High Gloss Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2BWA	45	-25 to +85	3.3 V CH A & B	Dial: VM Chrome Finish; Push Button: Matt Black; LED : White Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2AWB	45	-15 to +70	3.3 V CH A & B	Dial: Black SF Rubber; Push Button: High Gloss Black; LED : White; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2AWC	45	-25 to +85	3.3 V CH A & B	Dial: High Gloss Black; Push Button: High Gloss Black; LED : White; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2BBA	45	-25 to +85	3.3 V CH A & B	Dial: VM Chrome Finish; Push Button: Matt Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2ABB	45	-15 to +70	3.3 V CH A & B	Dial: Black SF Rubber; Push Button: High Gloss Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3
AMRX-1510-2ABC	45	-25 to +85	3.3 V CH A & B	Dial: High Gloss Black; Push Button: High Gloss Black; LED : Blue; Connectivity: FPC 15-way 0.5 mm pitch	+2.4 to +3.3

### Notes:

1. For different product options, customized products and technical documents, please contact factory at [mido.trsc@avagotech.com](mailto:mido.trsc@avagotech.com)
2. FPC connection is compatible with bottom contact type FPC ZIF connector:
3. Recommended ZIF connector : MOLEX 52893-1595 (2mm height), KYOCERA 6239-015 (1.5mm height), 6238-015 (1.1mm height) & etc
4. The ESD rating is subjected to the dial finishing option (refer to Table 2).

**Table 1. Absolute Maximum Ratings**<sup>[1, 2]</sup>

Parameter	Symbol	Limits	Units/Standard
DC Supply Voltage	V <sub>CC</sub>	1.8 to + 4.5	V
Output Voltage	V <sub>o</sub>	1.5 to +4.0	V
PDN Input Voltage	V <sub>PUP</sub>	+1.2 to +V <sub>CC</sub>	V
Operating temperature <sup>[3]</sup>	T <sub>op</sub>	-25 to 85	°C
Storage Temperature	T <sub>stg</sub>	-40 to 85	°C

Notes:

1. Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is stress rating only, and functional operation of the device at these or at any other conditions above than those indicated in the operational sections of this specification is not implied.
2. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
3. Operating temperature range is subjected to customized finishing or coating.

**Table 2. ESD Ratings**<sup>[1]</sup>

	Dial Finishing	
	Option A (VM Chrome)	Option B (Black SF Rubber) & C (High Gloss Black)
Air Discharge	2kV	5kV
Contact Discharge	2kV	4kV

Note:

1. Based on IEC-61000-4-2.

**Table 3. Recommended Operating Condition**

Parameter	Symbol	Condition	Values			Units	Notes
			Min	Typ.	Max		
Ambient Temperature	T <sub>amb</sub>		-25	25	85	°C	1
DC Supply Voltage	V <sub>CC</sub>		+2.4		+3.3	V	2
PDN Minimum Voltage for Logic HIGH	V <sub>PDN_IH(min)</sub>		+1.2		V <sub>CC</sub>	V	3
PDN Maximum Voltage for Logic LOW	V <sub>PDN_IL(max)</sub>				0.4	V	3
Count Frequency				112.5	8k	Hz	(Velocity (rpm) x N)/60, 4
Rotary Dial Speed	S <sub>RPM</sub>				150	rpm	4

Notes:

1. Except for Black SF Rubber coating options.
2. LED forward voltage, V<sub>F</sub>=2.8V typical.
3. Set PDN input pin to logic HIGH for normal operation and logic LOW to power down the device.
4. Typical value is referred to mechanically permissible speed, while maximum value is referred to electrically permissible speed.

**Table 4. Electrical Characteristics**

Electrical Characteristics over Recommended Operating Range, typical at 25 °C

Parameter	Symbol	Condition	Values			Units	Notes
			Min	Typ.	Max		
VCC Supply Current	I <sub>CC</sub>			7	10	mA	1
				30			
Power Down Current Consumption	I <sub>PDN</sub>				4	μA	
Power Down State Output Leakage Current	I <sub>OZ</sub>			<0.01		μA	
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -230μA	1.5		2.9	V	3
			2.4		3.3		
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.4mA			0.2	V	
		I <sub>OL</sub> = 8mA			0.4		
PDN Turn On Delay	t <sub>D_PDN_ON</sub>				1500	ns	
PDN Turn Off Delay	t <sub>D_PDN_OFF</sub>				150	ns	
Quadrature Outputs Rise Time	t <sub>r</sub>			500		ns	5
Quadrature Outputs Fall Time	t <sub>f</sub>			250		ns	5
5-way Switch Contact Resistance		At 3VDC, 1mA			300	mΩ	
Insulation Resistance for 5-way Switch and Rotary Dial		DC100V 1 min between terminals	110			MΩ	
		DC100V 1 min between Rotary Dial and terminals	110			MΩ	
		DC 500V 1 min between terminals	550			MΩ	
		DC 500V 1 min between Rotary Dial and terminals	550			MΩ	
Withstand Voltage for 5-way Switch and Rotary Dial		AC120V for 1 sec between Rotary Dial and terminals			1	mA	No spark; No Trip Current
		AC120V for 1 sec between terminals			1		
		AC500V for 1 sec between Rotary Dial and terminals			10	mA	No spark; No Trip Current
		AC500V for 1 sec between terminals			10		

## Notes:

1. Without illumination LED.
2. With illumination LED.
3. Refer to I/O Voltage Option 1 (on page 7).
4. Refer to I/O Voltage Option 2 (on page 7).
3. At C<sub>L</sub> = 33 pF.

**Table 5. Mechanical Characteristics**

Mechanical Characteristics over Recommended Operating Range, typical at 25 °C

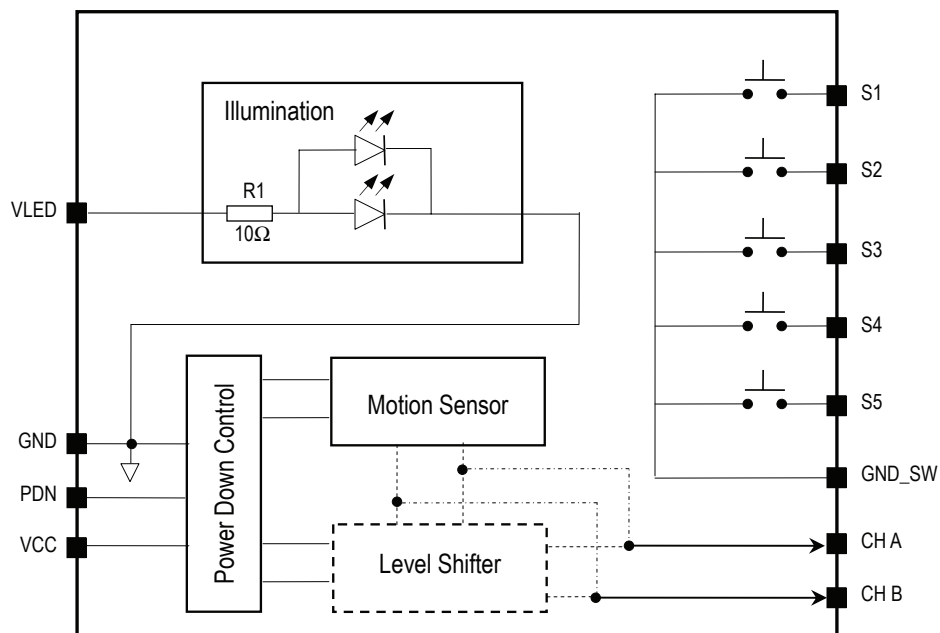
Parameter	Symbol	Condition	Values			Units
			Min	Typ.	Max	
Rotational Life	R <sub>LIFE</sub>	Rotational Speed= 100RPM		2x10 <sup>5</sup>		cycles
Switch Click Life	C <sub>LIFE</sub>	Push Location = on cover top, at switch location Push Force = 200gf		5 x10 <sup>5</sup>		times
Permissible Rotational Angle	θA			360		m°
5-way switch button						
-Stroke				0.19		mm
-Operation force				200		gf
Overall Mass	M <sub>OV</sub> R			0.002		kg

**Table 6. Encoding Characteristics**

Encoding Characteristics over Recommended Operating Range, typical at 25°C. The typical values are average over the full rotation.

Parameter	Symbol	Condition	Values			Units
			Min	Typ.	Max	
Output Resolution	N			45		CPR
Pulse width Error	ΔP				±50	°e
Logic State Width Error	ΔS				±50	°e
Phase Error	Δω				±15	°e

**Functional Block Diagram**

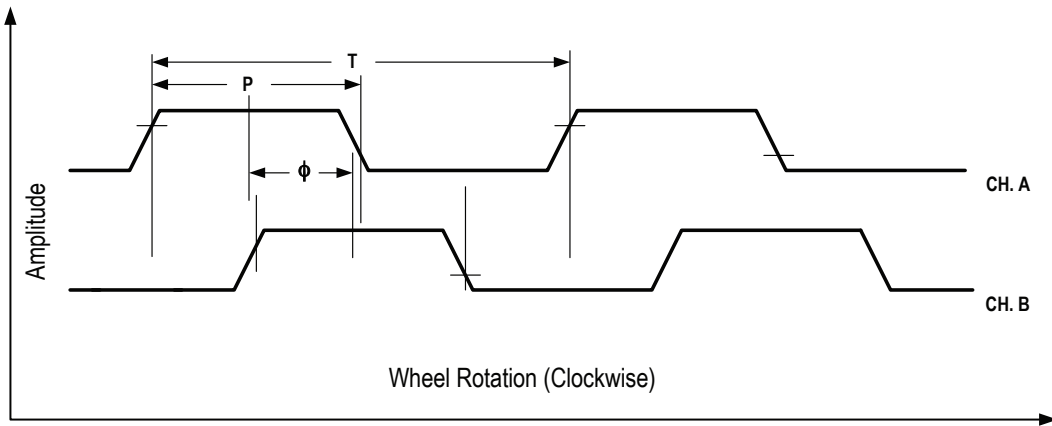


Notes:

1. R1 is the current-limiting resistor for LEDs.

**Figure 1. Functional Block Diagram**

## Scroll Wheel Output Waveform

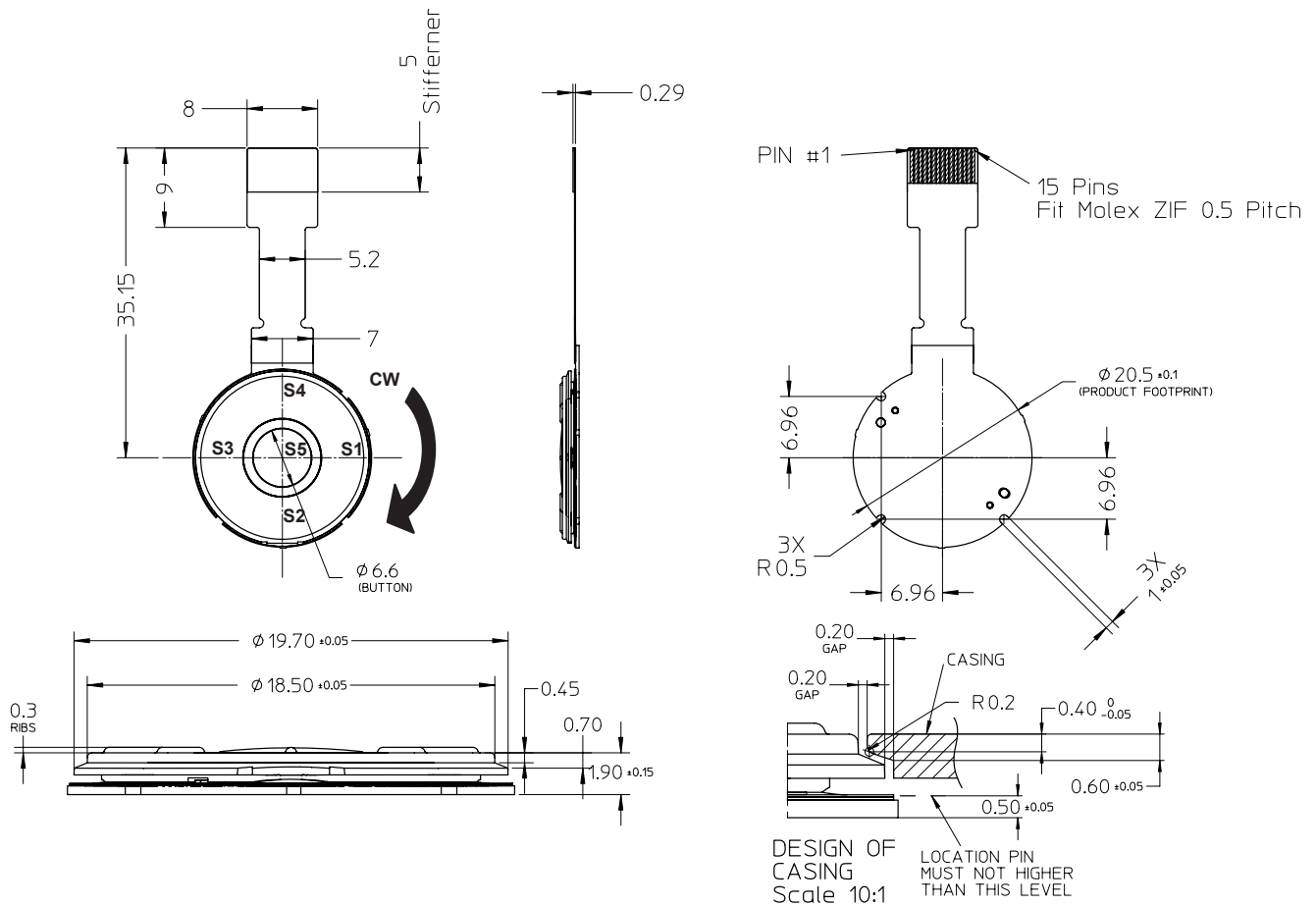


Notes:

1. CH A = Channel A; CH B = Channel; T = electrical cycle; P = pulse width ;  $\phi$  = phase.

**Figure 2. Output Waveform**

## Package Dimensions



Notes:

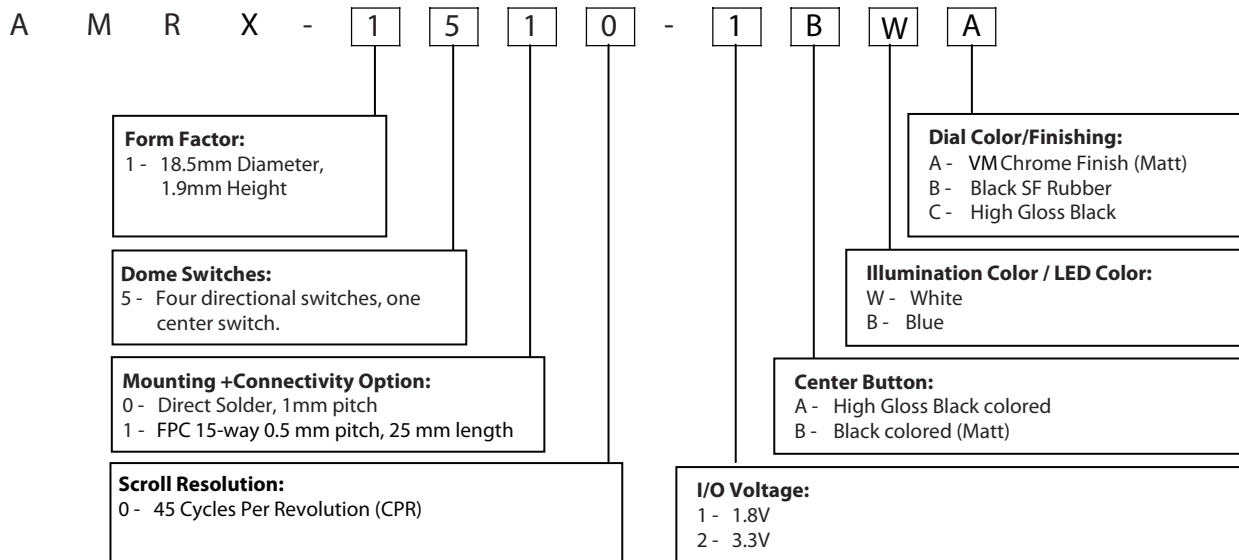
1. 3rd Angle Projection.
2. Unless otherwise specified, all dimensions are in mm.
3. Compatible with SMT ZIF bottom contact type FFC/FPC connectors for connectivity.

**Figure 3. Package Dimensions**

## Electrical Connections

Pin	Symbol	Description
1	VLED	LED Anode
2	PDN	Power Down Control. LOW: Activate Power Down
3	S1	Connect to Switch 1 (S1)
4	S2	Connect to Switch 2 (S2)
5	S5	Connect to Switch 5 (S5)
6	GND_SW	Common Ground for S1,S2,S3,S4,S5
7	S4	Connect to Switch 4 (S4)
8	S3	Connect to Switch 3 (S3)
9	GND	Supply Ground
10	V <sub>CC</sub>	Supply Voltage
11	CH A	Channel A
12	CH B	Channel B
13	NC	Not Connected
14	NC	Not Connected
15	NC	Not Connected

## Ordering Information



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