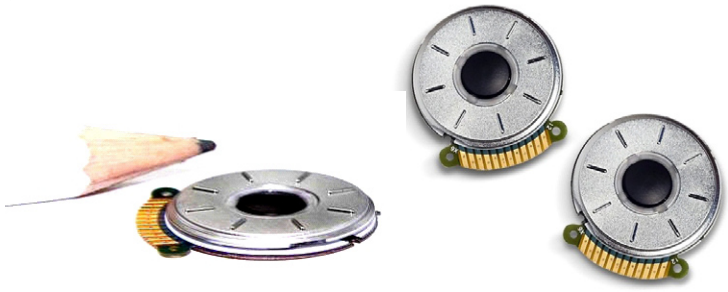
AMRX-1500-1BWA

Ultra-slim Scrollwheel with 5-way Switch

Data Sheet



Description

Avago Technologies' AMRX-1500 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-1500 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 scrollwheel is customizable to different colors and design features. Please refer to factory for further details.

Applications

- Handheld electronic devices
- Mobile phones
- 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
- Typically at 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 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 flexible PCB
- Customizable aesthetic design
- RoHS compliant

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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 [1, 2]

Part Number	Resolution (CPR)	Operating Temperature (°C)	Output Communication	Exterior Options	DC Supply Voltage (V)
AMRX-1500-1BWA	45	-25 to +80	CH A & B	Dial: Chrome-plated ; Push Button: Black; LED : White	+2.4 to +3.3

Notes:
1. Exterior color, material and illumination color are customizable.
2. For different product options, customized products and technical documents, please contact factory at mido.trsc@avagotech.com

Table 1. Absolute Maximum Ratings [1, 2]

Parameter	Symbol	Limits	Units/Standard
DC Supply Voltage	V_{CC}	1.8 to + 4.5	V
Output Voltage	Vo	1.5 to +4.0	V
PDN Input Voltage	V_{PDN}	+1.2 to +V_{CC}	V
Operating temperature [3]	Top	-25 to 80	°C
Storage Temperature	Tstg	-40 to 85	°C
ESD rating (Air Discharge) [4,5]		1.5kV	IEC-61000-4-2

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.
4. ESD Contact Discharge <1kV for InGaN LED. Other components have higher ESD rating.
5. Options with higher ESD rating will be available soon. Please contact factory for further details.

Table 2. Recommended Operating Condition

			Values				
Parameter	Symbol	Condition	Min	Typ.	Max	Units	Notes
Ambient Temperature	T_{amb}		-20	25	70	°C	
DC Supply Voltage	V_{CC}		+2.4		+3.3	V	1
PDN Minimum Voltage for logic HIGH	V_{PDN_IH} (min)		+1.2		V_{CC}	V	2
PDN Maximum Voltage for logic LOW	V_{PDN_IL} (max)				0.4	V	2
Count Frequency				112.5	8k	Hz	(Velocity (rpm) x N)/60, 3
Rotary Dial Speed	S_{RPM}				150	rpm	3

Notes:
1. LED forward voltage, V_F=2.8V typical.
2. Set logic LOW to PDN pin to power down the device.
3. Typical value is referred to mechanically permissible speed, while maximum value is referred to electrically permissible speed.

Table 3. Electrical Characteristics

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

			Values				
Parameter	**Symbol**	**Condition**	**Min**	**Typ.**	**Max**	**Units**	**Notes**
V_{CC} Supply Current	I_{CC}			7	10	mA	1
				30		mA	2
Power Down Current Consumption	I_{PDN}				4	µA	
Power Down State Output Leakage Current	I_{OZ}			<0.01		µA	
Output High Voltage	V_{OH}	I_{OH} = -230µA	1.5		2.9	V	
Output Low Voltage	V_{OL}	I_{OL} = 2.4mA			0.2	V	
		I_{OL} = 8mA			0.4	V	
PDN Turn On Delay	$t_{D_PDN_ON}$				1500	ns	
PDN Turn Off Delay	$t_{D_PDN_OFF}$				150	ns	
Quadrature Outputs Rise Time	t_r			500		ns	3
Quadrature Outputs Fall Time	t_f			250		ns	3
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	mA	No spark; No Trip Current
		AC500V for 1 sec between Rotary Dial and terminals			10	mA	No spark; No Trip Current
		AC500V for 1 sec between terminals			10	mA	No spark; No Trip Current

Notes:
1. Without illumination LED.
2. With illumination LED.
3. At CL = 33 pF .

Table 4. Mechanical Characteristics

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

			Values			
Parameter	**Symbol**	**Condition**	**Min**	**Typ.**	**Max**	**Units**
Rotational Life [1]	R_{LIFE}	Rotational Speed= 100RPM		$2x10^5$		cycles
Switch Click Life [1]	C_{LIFE}	Push Location = on cover top, at switch location Push Force = 200gf		$5 x10^5$		times
Permissible Rotational Angle	θ_A			360		°m
5-way switch button						
-Stroke				0.19		mm
-Operation force				200		gf
Overall Mass	M_{OVR}			0.002		Kg

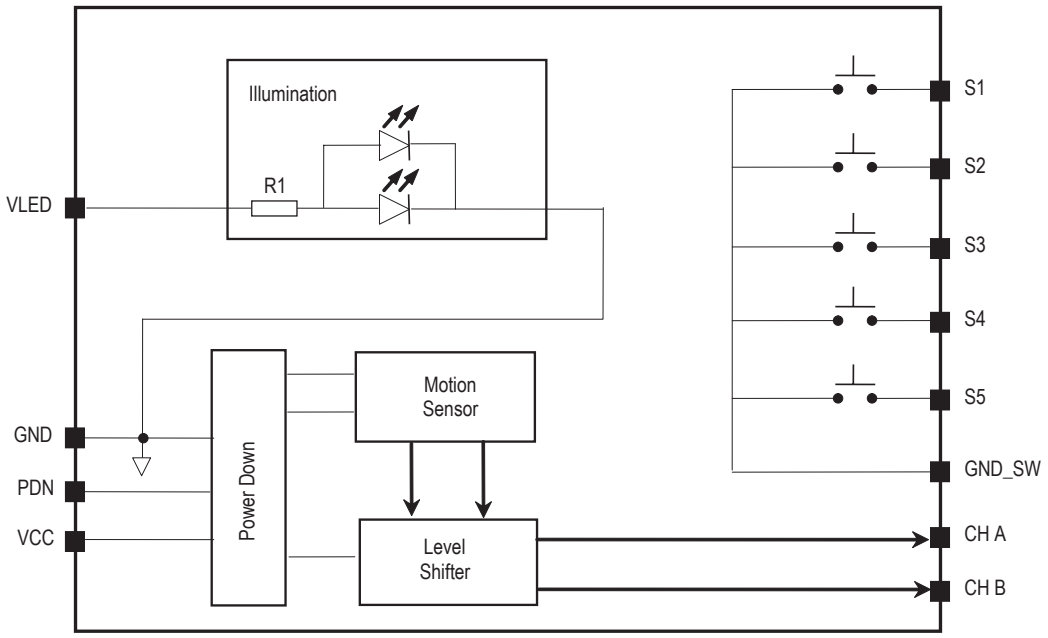
Notes:
1. Options with higher rotational life and switch click life are available, please refer to factory.

Table 5. Encoding Characteristics

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

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

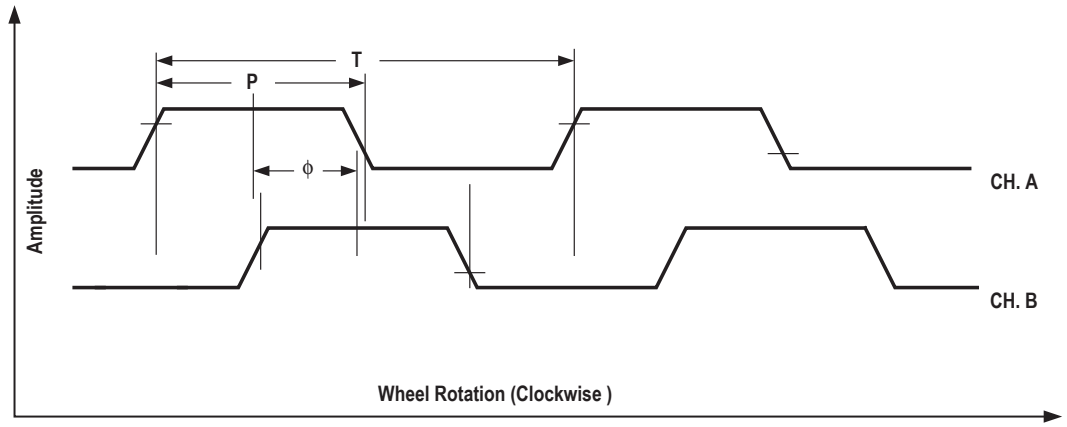
Functional Block Diagram



Notes:
1. R1 is current-limiting resistor for LEDs.

Figure 1. Functional Block Diagram

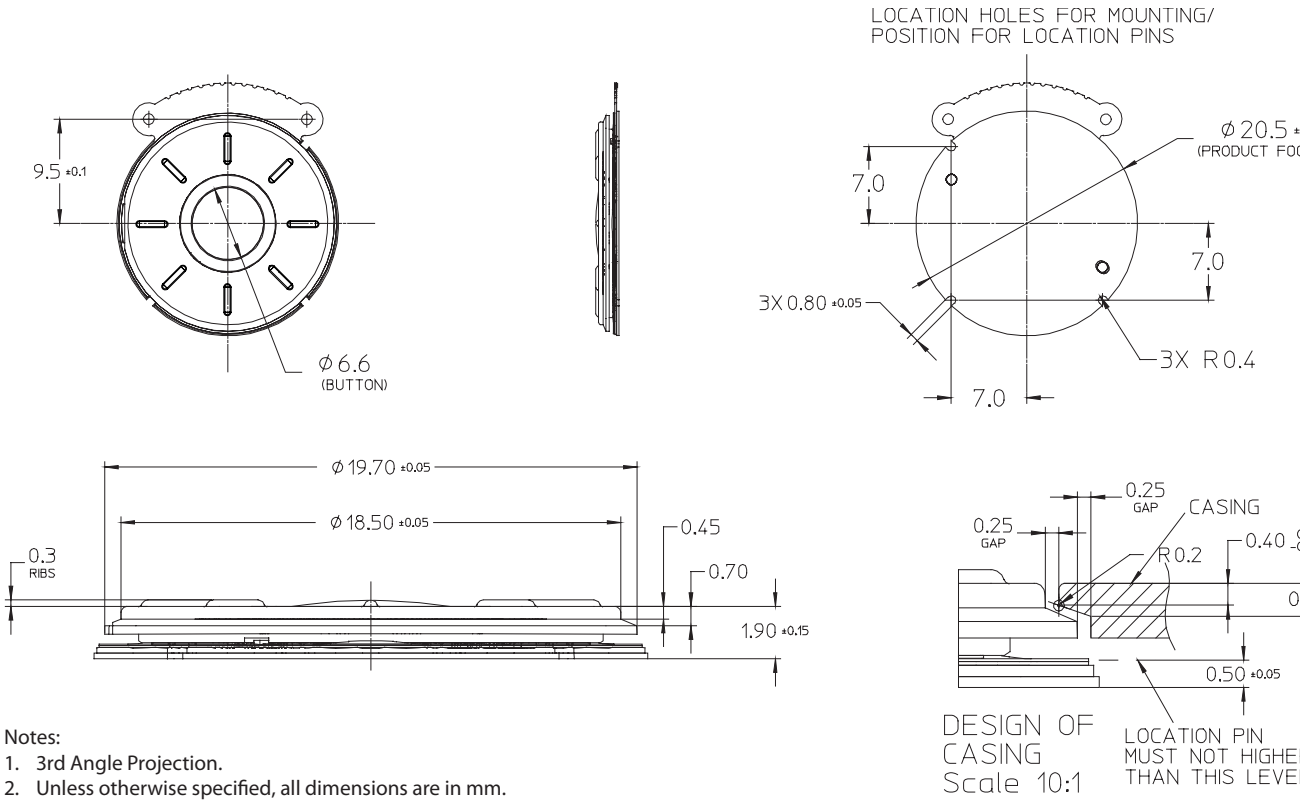
Scrollwheel Output Waveform



Notes:
2. CH A = Channel A; CH B = Channel B ; T = electrical cycle ; P = pulse width ; ϕ = phase.

Figure 2. Output Waveform

Package Dimensions



Notes:
1. 3rd Angle Projection.
2. Unless otherwise specified, all dimensions are in mm.
3. Other mounting options available upon request.

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_{CC}	Supply Voltage
11	CH A	Channel A
12	CH B	Channel B

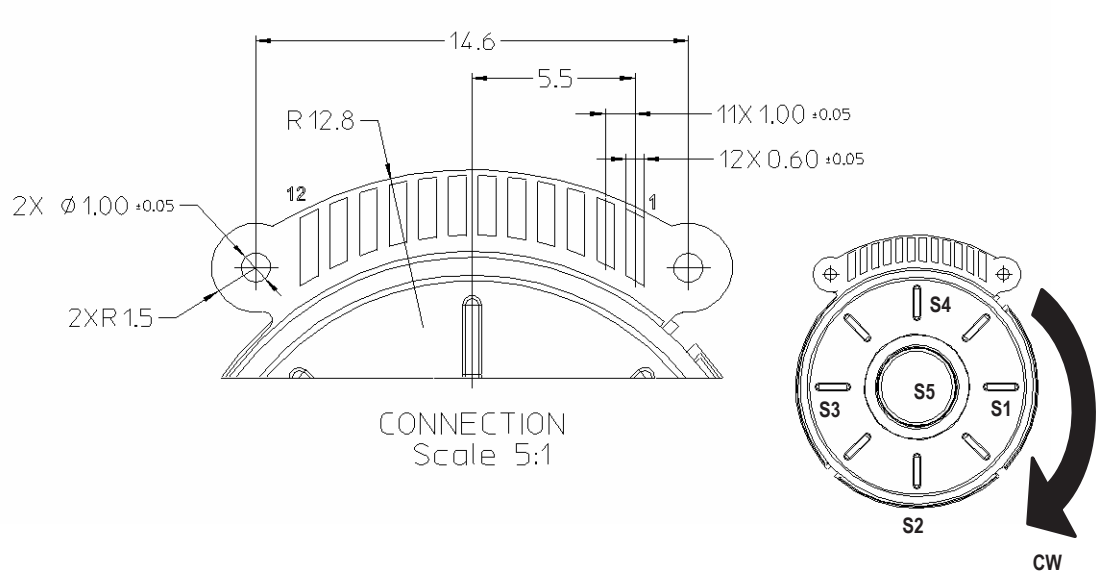


Figure 4. Electrical Connections

Ordering Information

A M R X - 1 5 0 0 - 1 B W A

Form Factor:
1 - 18.5mm Diameter, 1.9mm Height

Dome Switches:
5 - Four directional switches, one center switch.

Mounting +Connectivity Option:
0 - Direct Solder, 1mm pitch

Scroll Resolution:
0 - 45 Cycles Per Revolution (CPR)

I/O Voltage:
1 - 1.8V

Center Button:
B - Black colored

Illumination Color / LED Color:
W - White

Dial Color/Finishing:
A - Chrome Finish (Matt)

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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AV02-0369EN - April 26, 2007