

39 Bits Multi-Turn Absolute House Encoder with SSI Mode Output

Data Sheet



Description

AS38-H39E series encoder is a high-resolution optical absolute encoder produced by Avago Technologies, which offers 23-bits single-turn and 16-bits multi-turn counts, hence a combined 39 bits high resolution. The AS38-H39E series encoder is a house encoder consisting of a patterned disk, a light source, and photosensitive elements to translate the mechanical motion into electrical signal. The Sxxx option encoders are preloaded with SSI communication protocol, which is supported by a full-duplex line transmissions drive (RS-485), offering good noise immunity for more robust transmission of data up to 1 Mbps in harsh industrial applications.

The key advantage of the AS38-H39E series is its multi-turn tracking that employs energy-harvesting technology by harvesting the magnetic energy as the encoder shaft rotates. It is the gearless multi-turn counting that eliminates the gear wear-out or acoustics noise issue that is encountered in conventional geared multi-turn encoders. On the other hand, when comparing to battery backed up multi-turn counting, this technology does not require periodic maintenance of the battery backup components and the down time associated with it. Because the product is intended for industrial application, ESD protection circuitry has been designed in to achieve Class 3 ESD immunity per IEC -61000-4-2 standard. The AS38-H39E series is also compliant with IP50 per IEC 60529 standard.

Operating Theory

Structure-wise, the encoder contains two main functional blocks: the single-turn optical engine block and the energy-harvesting multi-turn counter block. The single-turn engine comprises an Avago developed high-performance optical detector ASIC, which is accompanied by high-precision amplifier circuitry, coupled with a special multi-track code disk that rotates between the LED emitter and detector IC.

On the multi-turn side, the multi-turn counting is enabled utilizing energy-harvesting technology. When the shaft is rotating, the magnet mounted on the shaft moves in tandem.

The energy-harvesting coil module cuts the moving magnet field, and generates energy as a result. The beauty of the energy-harvesting effect is that the same amount of energy is generated independent of the rotation speed. The generated energy is sufficient to power up the revolution tracking circuitry. Therefore, no miscounts occur even in the absence of external power supply.

Features

- 39-bits resolution: 16-bits energy-harvesting multi-turn and 23-bits optical single-turn
- Built-in SSI Mode Communication Protocol
- Overall encoder outer diameter Ø38 mm, and maximum height of 40 mm
- Supporting 8-mm diameter of the blind hollow shaft

Benefits

- No battery or capacitor required for position detection during power failure
- Immediate position detection on power up

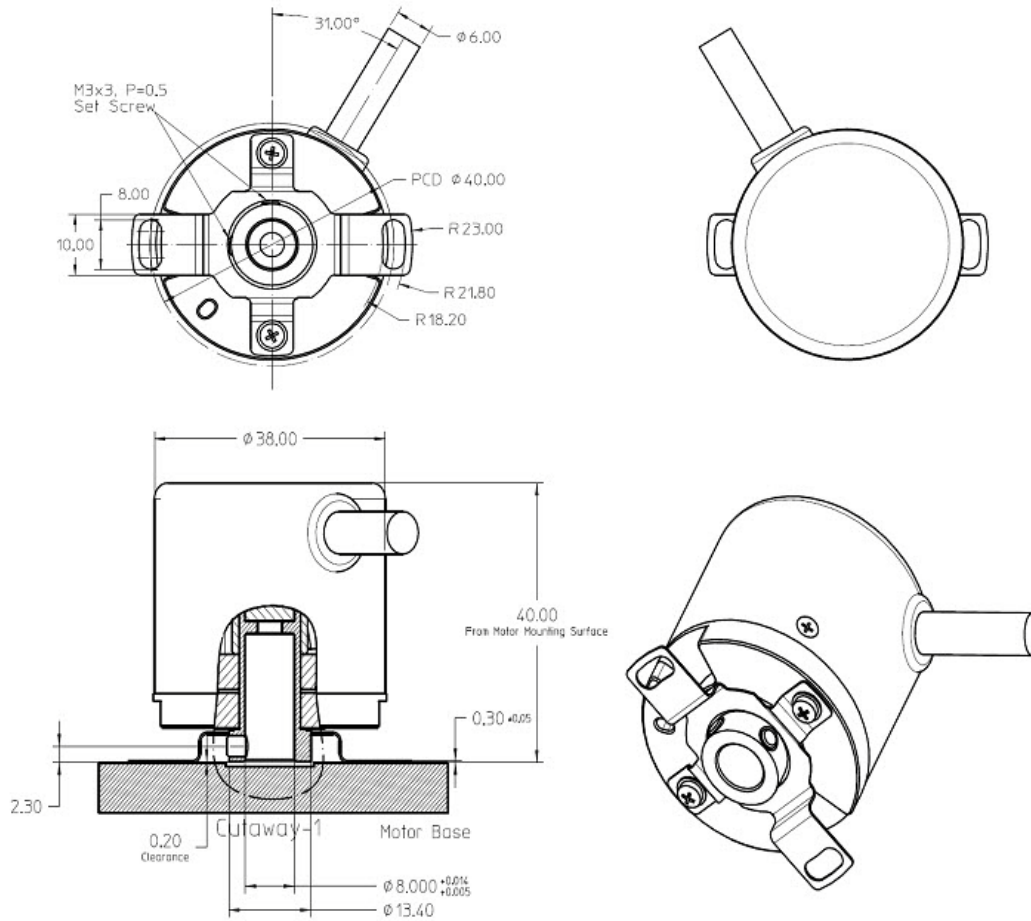
Applications

- Robotics
- Factory automation
- Linear positioning system
- CNC machine tool
- Medical and lab equipment
- Wind turbine

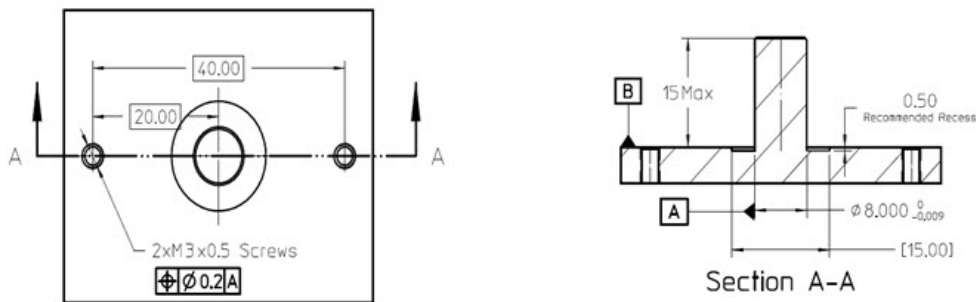
NOTE Avago Technologies encoders are not recommended for use in safety critical applications, e.g., ABS braking systems, power steering, life support systems, and critical care medical equipment. Contact a sales representative if more clarification is needed.

Mechanical Drawings

Package Dimensions



Recommended Shaft and Mounting Requirement



NOTE

1. Dimensions are in millimeters.
2. Third angle projection.
3. Unless otherwise specified, all tolerances are within ± 0.5 mm.
4. Recommended to have a recess on motor mounting surface to prevent encoder shaft interfere with motor base.

Device Selection Guide

Part Number	Resolution	Operating Temperature (°C)	Output Communication	Output Code	DC Supply Voltage (V)
AS38-H39E	39 bits (16 bits MT + 23 bits ST) ^a	-20 °C ~ 105 °C ^b	SSI	Binary	5.0 V ± 10%

- a. ST: Single-turn; MT: Multi-turn.
b. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Electrical Specifications

Parameter	Conditions	Min	Typ	Max	Unit
Current Consumption	Without load, Tamb = 25 °C	—	120	—	mA
Supply Voltage	—	4.5	5	5.5	V
Electrically Permissible Speed	—	—	—	6,000	min ⁻¹

Mechanical Specifications

Parameter	Conditions	Min	Typ	Max	Unit
System Accuracy	With electrical correction, Tamb = 25 °C	—	±80	—	Arc-sec
Mechanical Permissible Speed	—	—	—	6,000	min ⁻¹
Shaft Radial Play	—	—	—	±0.05	mm
Shaft Axial Play	—	—	—	±0.1	mm
Starting Torque	Tamb = 25 °C	—	—	9.8 x 10 ⁻³	N.m

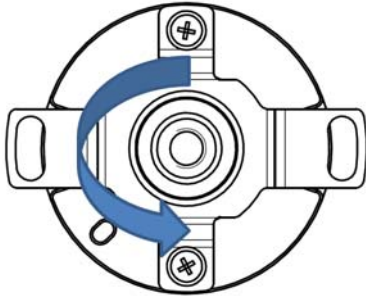
Environmental Specifications

Parameter	Conditions	Min	Typ	Max	Unit
Storage Temperature	—	-20	—	105	°C
Operating Temperature	—	-20	—	105	°C
Relative Air Humidity (Non-Condensing)	Tamb = 40 °C	—	90	—	RH%
Protection	—	—	IP50	—	—
Vibration	Per IEC 60068-2-6	—	—	10G; 10 ~ 2000 Hz	—
Shock	Per IEC 60068-2-27	—	—	6 ms; Half Sine; 200G	—

Encoder Specifications

Parameter	Remark
Resolution	ST 23 Bits (8388607 counts) and MT 16 Bits (65535 counts)
Counting Direction	Increase with counter clockwise shaft rotation, view from coupling end
Position Calculation Time	Background looping with typical 400 ns uncertainty
Initialization Time	500 ms

Figure 1 View from Coupling Side



View from coupling side, shaft rotate CCW direction when the count is increasing.

Interface Protocol - SSI

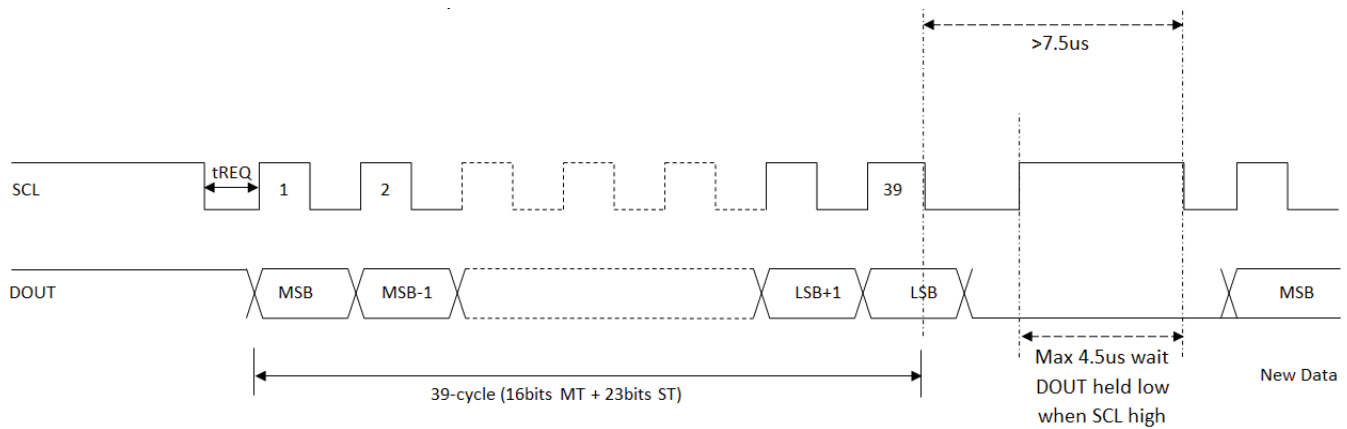
Data Communication

Interface	Circuit
SSI Serial Clock (SCL)	Line Driver and Receiver Pairs (P/N: SN65LBC179Q)
SSI Serial Data (DOUT)	Line Driver and Receiver Pairs (P/N: SN65LBC179Q)

Timing Characteristics

Parameter	Min	Typ	Max	Unit
SCL Frequency	0.133	—	1	MHz
Position Latency	3.4	3.6	3.8	μ s
Position Jitter (Data latch uncertainty)	0.38	0.4	0.42	μ s
tREQ	—	—	0.5	μ s
SSI Time Out (DOUT held low when SCL high)	—	—	4.5	μ s

Figure 2 Timing Characteristics of SCL and DOUT

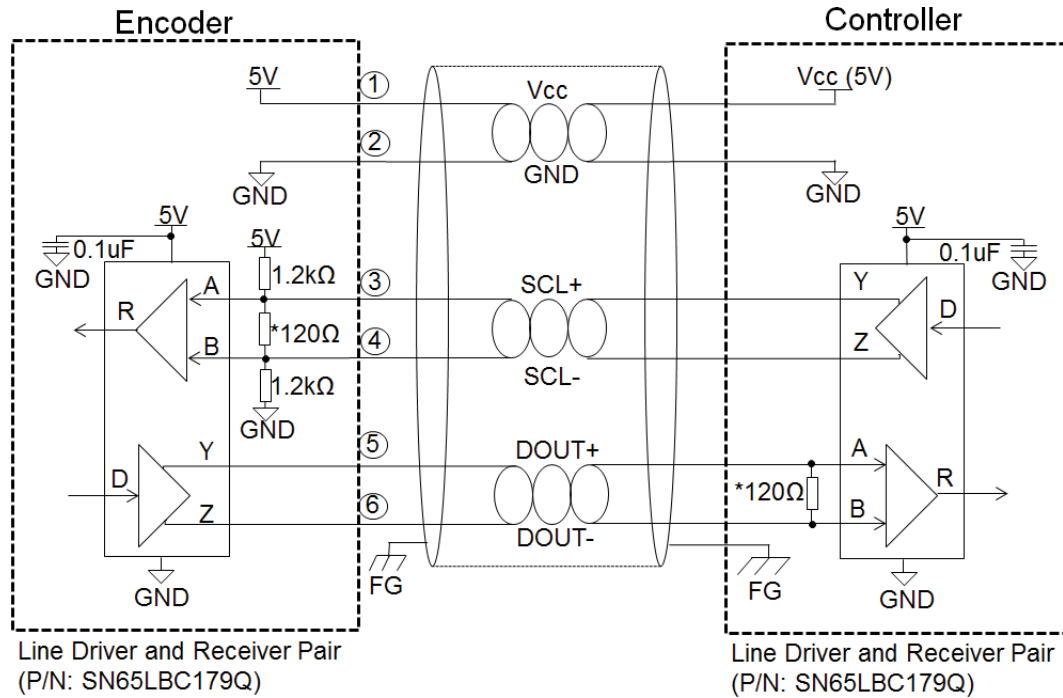


Note: The MSB is at first rising edge of SCL.

Typical Application

The following is an example of the circuit diagram of the transceiver.

Figure 3 Circuit Diagram of Transceiver



* Termination resistor, 120 Ω, is recommended but may depend on the characteristic impedance of cable used.

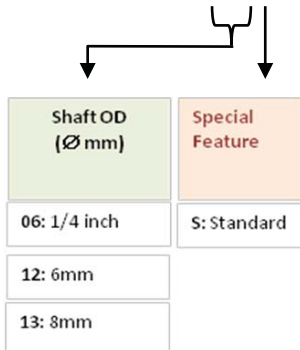
Cable Information

Pin	Color	Description
1	RED	VCC, Positive Supply
2	BLACK	GND, Ground
3	BROWN	SCL+
4	WHITE	SCL-
5	ORANGE	DOUT+
6	BLUE	DOUT-

Note: The cable provided is approximately 200 mm (including pigtail length) with AWG28.

Ordering Information

AS38-H39E-S XXX



NOTE Refer to the factory for sample order and lead time.

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