

# AS38-H39E-B13S

## 39 Bits Multi-Turn Absolute House Encoder with BiSS-C Mode Output

### Data Sheet



### Description

This AS38 absolute encoder is available with a high-resolution option of 39-bits (16-bits multi-turn and 23-bits single-turn). Structure wise, the single-turn absolute encoder contains the detector Opto-ASIC that is accompanied by a high-precision amplifier circuitry and coupled with a special multi-track code disk that rotates between the emitter and the detector.

On the multi-turn side, the power is harvested using the 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 the revolution tracking circuitry. Therefore, no miscounts occur even in the absence of an external power supply.

The encoder has a built-in BiSS-C communication protocol with provided CRC and alarm status bits. The BiSS-C protocol is supported by a full-duplex line transmissions drive (RS-485), offering good noise immunity for more robust transmission of data up to 10 Mbps in harsh industrial application. 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.

### Features

- 39-bits resolution: 16-bits energy-harvesting multi-turn and 23-bits optical single-turn
- With CRC and alarm status bits
- Built in with BiSS-C mode communication protocol
- Overall encoder outer diameter  $\varnothing 38$  mm, and maximum height of 40 mm
- Supporting 8-mm diameter of the blind hollow shaft

### Benefits

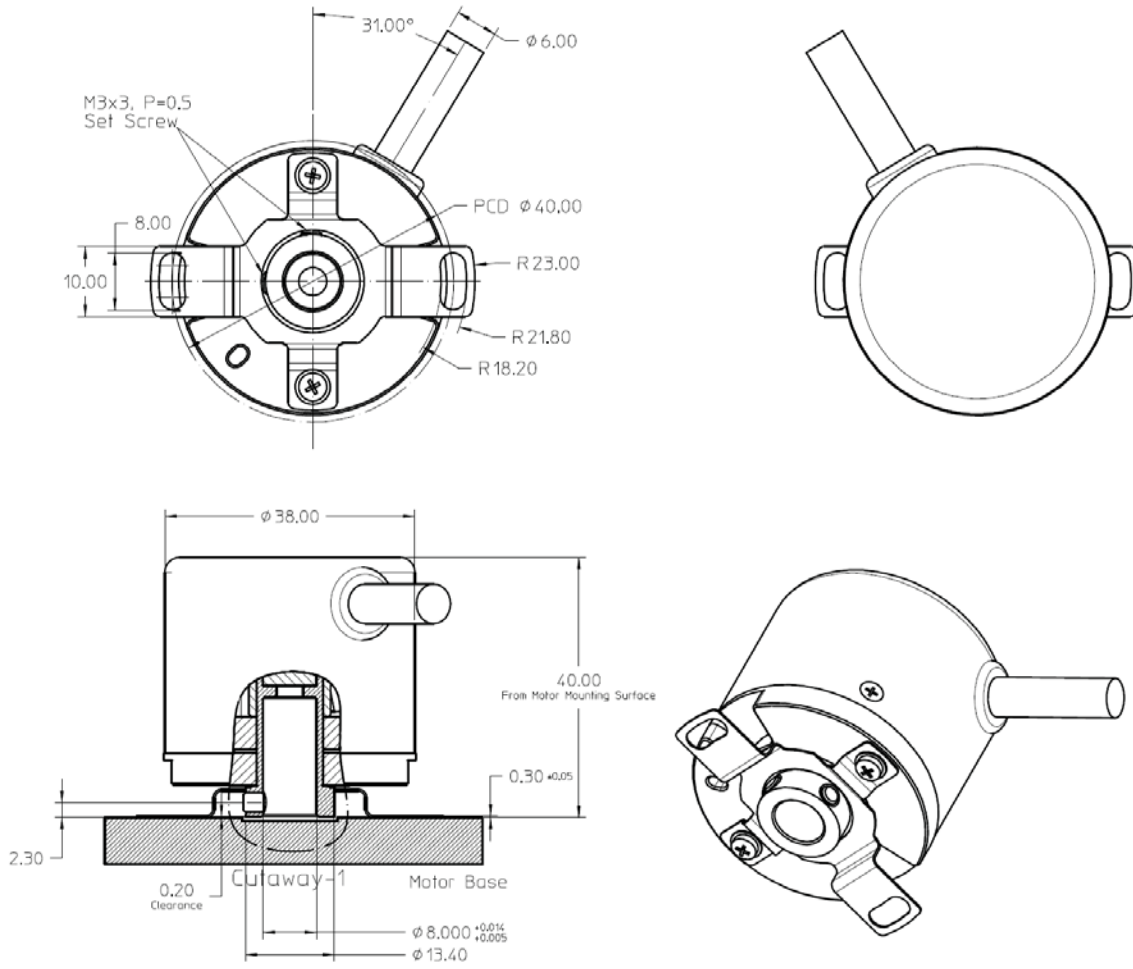
- No battery or capacitor is required for position detection during power failure
- Immediate position detection on power up

### Applications

- Robot and robotic engineering
- Factory automation
- Angular and linear positioning system
- CNC machine tool

**NOTE** Avago encoders are not recommended for use in safety-critical applications; for example, ABS braking systems, power steering, life support systems, and critical care medical equipment. Please contact a sales representative if more clarification is needed.

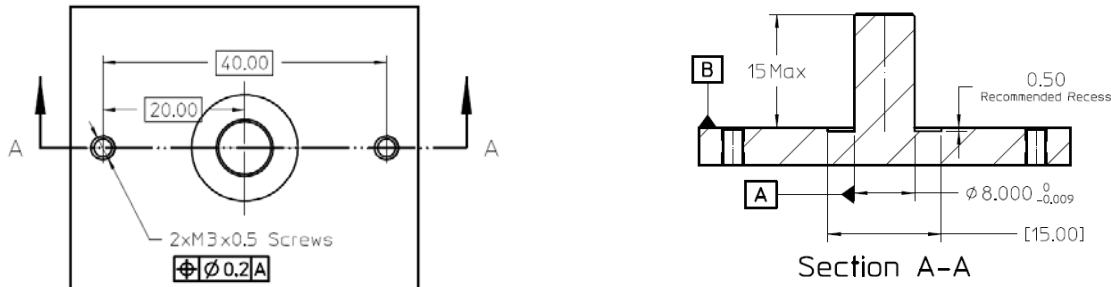
## Package Dimensions



### NOTE

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

## Recommended Shaft and Mounting Holes Requirement



### NOTE

1. Dimensions are in millimeters.
2. Third angle projection.
3. Unless otherwise specified, all tolerances are within  $\pm 0.5$  mm.
4. Recommended to have a recess on motor mounting surface to prevent encoder shaft interference 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) <sup>a</sup>	-20 °C~105 °C	BiSS-C	Binary	5.0 V $\pm$ 10%

a. ST: Single-turn; MT : Multi-turn.

## Electrical Specifications

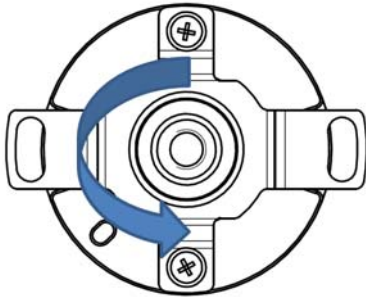
Parameter	Unit	Limits	Remark
Single-turn Resolution	Count	8,388,607 (23 bits)	
Multi-turn Resolution	Count	65,535 (16 bits)	
Fault Status	Bit	8 bits	
CRC	Bit	8 bits	
Main Supply Current	mA	Typical $\leq$ 120mA	Without load
Electrically Permissible Speed	rpm	$\leq$ 6,000min <sup>-1</sup>	

## Mechanical Specifications

Parameter	Unit	Limits	Remark
Mechanical Permissible Speed	rpm	$\leq$ 6,000min <sup>-1</sup>	
Vibration		G level: 10G; 10~2000Hz	Per IEC 60068-2-6
Shock		6ms; Half Sine; 200G	Per IEC 60068-2-27
Protection		IP50	

## Other Specifications

Parameter	Unit	Limits	Remark
System Accuracy	arc-sec	±80	With electrical correction in room temperature
Counting Direction		Increase with counter-clockwise shaft rotation	View from coupling side
Position Calculation Time	ns	Refer to BiSS C T <sub>busy time</sub>	
Initialization Time	ms	500	
Output Connection		Pig tail cable	Approximate 200mm (AWG28)
Relative Air Humidity (Non-Condensing)	RH%	90	At 40 °C
Shaft Radial Play	mm	±0.05	
Shaft Axial Play	mm	±0.1	
Storage Temperature	°C	-20 to 105	



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

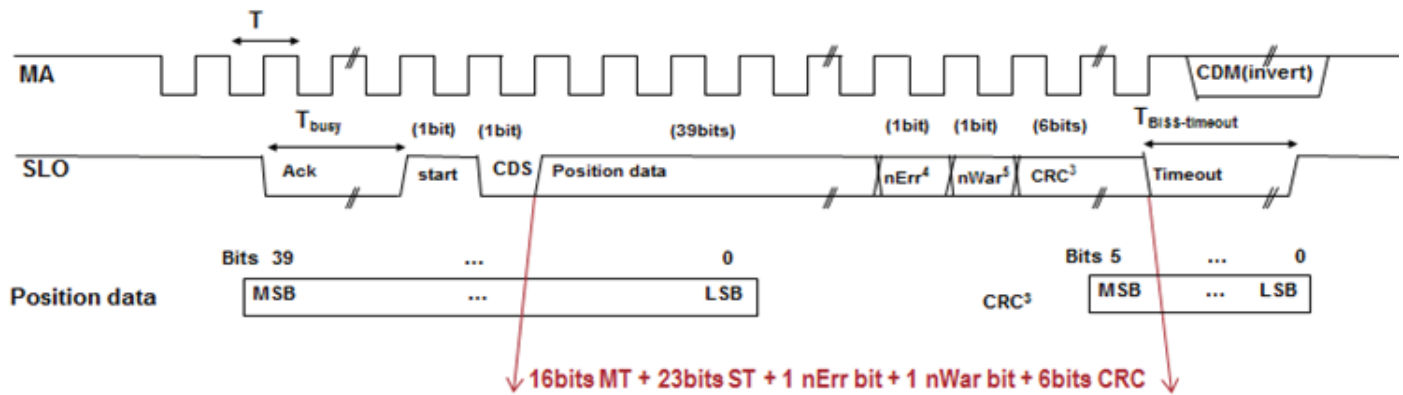
## BiSS-C Interface - Data Communication

Interface	Circuit
Serial Clock (MA)	Line Driver and Receiver Pairs (P/N: SN65LBC179Q)
Serial Data (SLO)	Line Driver and Receiver Pairs (P/N: SN65LBC179Q)

## BiSS-C Timing Diagram

Parameter	Symbol	Condition	Value			Unit	Note
			Min	Typ	Max		
MA Frequency	$f_{MA}$	—	0.08	—	10	MHz	1
Busy	$T_{busy}$	—	$2/f_{MA} + 3.35 \mu s$	—	$2.5/f_{MA} + 3.75 \mu s$	$\mu s$	2
Timeout	$t_{BiSS-timeout}$	—	$1.5/f_{MA}$	—	$1.5/f_{MA} + 90 ns$	ns	2
Encoder Initialization Time	—	—	—	500	—	ms	—

Figure 1 Timing Characteristics of MA and SLO



### NOTE

1. MA low-time =  $0.50/f_{MA}$ ; high-time =  $0.50/f_{MA}$ .
2. Refer to [Figure 1](#) for timing description.
3. CRC Polynomial = Invert of  $(X^6 + X^1 + X^0)$ .
4.  $nErr$  bit is active low. (Combine all the Error Status and reflect in  $nERR$  bit.)
5.  $nWar$  bit is active low. (Combine all the Warning Status and reflect in  $nERR$  bit.)

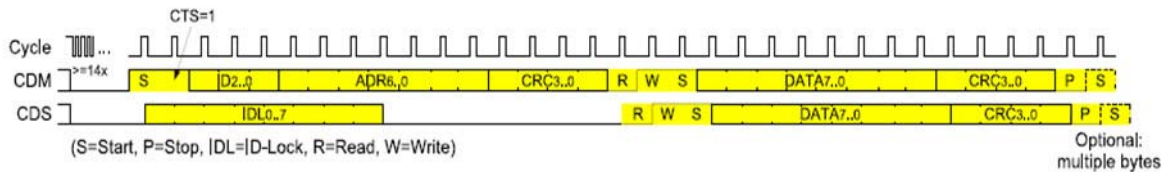
## BiSS-C Interface – Register Communication

### Description

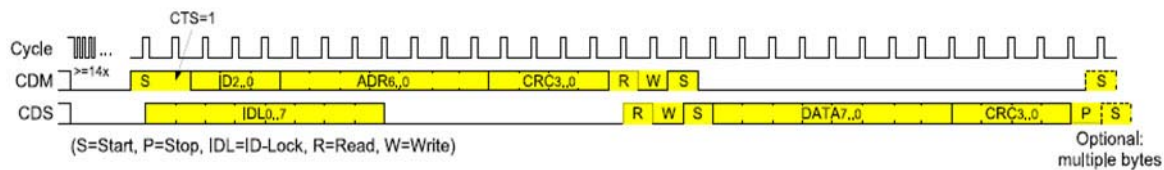
Refer to BiSS-C Interface Protocol Description Rev C5 document for detailed information of BiSS-C Register Communication.

[http://biss-interface.com/files/Bissinterface\\_c5es.pdf](http://biss-interface.com/files/Bissinterface_c5es.pdf)

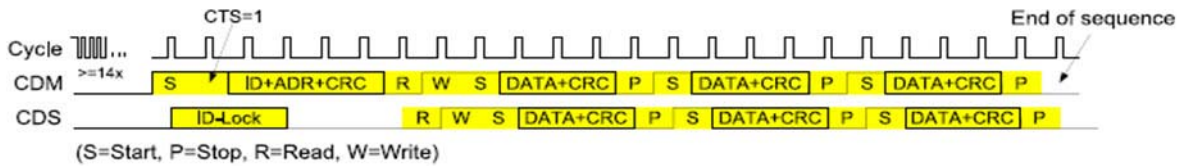
**Figure 2 Register Write Access**



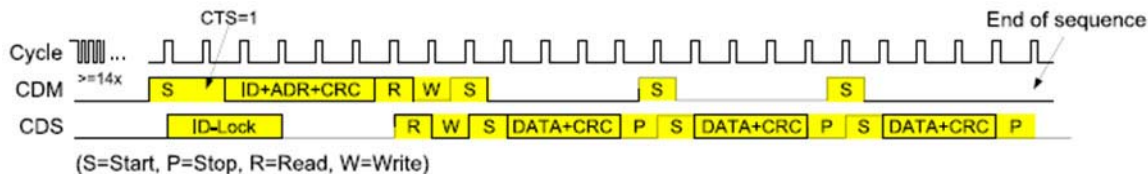
**Figure 3 Register Read Access**



**Figure 4 Writing Several Registers**



**Figure 5 Reading Several Register**



## BiSS-C Interface – Register Assignment

### Description

Refer to BiSS-C Interface Protocol Description Rev C5 document for detail information of BiSS-C Register Assignment.  
[http://biss-interface.com/files/Bissinterface\\_c5es.pdf](http://biss-interface.com/files/Bissinterface_c5es.pdf)

There are a total of 10 register banks user areas (register bank 0 to register bank 9) that are accessible by users.

The memory data is kept in nonvolatile memory.

**Table 1 Register Assignments**

Address (Decimal)	Address (Hexadecimal)	Name	Size	Memo
0 ... 63	0x00 ... 0x3F	Register bank	64 bytes	
64	0x40	Bank selection	0 ... 8 bits (1 byte)	a, b
65	0x41	EDS-Bank	0 ... 8 bits (1 byte)	a, c
66 ... 67	0x42 ... 0x43	Profile ID	16 bits (2 bytes)	c, d
68 ... 71	0x44 ... 0x47	Serial number	32 bits (4 bytes)	c, d
72 ... 119	0x48 ... 0x77	Slave register	48 bytes	
120 ... 125	0x78 ... 0x7D	Device ID	48 bits (6 bytes)	c, d
126 ... 127	0x7E ... 0x7F	Manufacturer ID	16 bits (2 bytes)	c, d

- a. If no blank switchover is used, the register should not be implemented.
- b. Unused register contents must therefore be filled with "0."
- c. Register is protected against accidental writing.
- d. The value is saved as a big endian; i.e., with the highest value byte at the lowest value address.

**Table 2 Memory Map (Nonvolatile Memory)**

EEPROM Address	BiSS C		Remarks
	Page	Address	
000h ~ 27Fh	0	00h~ 3Fh	User Area
	1	00h~ 3Fh	
	2	00h~ 3Fh	
	3	00h~ 3Fh	
	4	00h~ 3Fh	
	5	00h~ 3Fh	
	6	00h~ 3Fh	
	7	00h~ 3Fh	
	8	00h~ 3Fh	
	9	00h~ 3Fh	
280h ~ 2FFh	10	00h~ 3Fh	Avago Reservation Area
	11	00h~ 3Fh	
300h ~ 37Fh	12	00h~ 3Fh	
	13	00h~ 3Fh	
380h ~ 3BFh	14	00h~ 3Fh	
3C0h ~ 3FFh	—	40h	Bank Selection
		41h	EDS-Bank (User prohibited write) – Not Available
		42h ~ 43h	Profile ID (User prohibited write)
		44h ~ 47h	Serial Number (User prohibited write)
		48h ~ 77h	Slave Register (Refer to the Slave Register Description – user area)
		78h ~ 7Dh	Device ID (User prohibited write)
		7Eh ~ 7Fh	Manufacturer ID (User prohibited write)

Note: EDS-Bank is not available.



## Slave Register Descriptions

Address 72(0x48) – Error Status [7:0]

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
N/A			MLSErr Error	Multi-turnErr Error	STErr Error	MemoryErr Error	XCErr Error

Address 73(0x49) – Warning Status [7:0]

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
N/A						Lis_Err Warning	LED_Err Warning

Address 74(0x4A) – Encoder Clear Command

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
N/A	N/A	N/A	N/A	Warning clear command <sup>a</sup>	Error clear command <sup>a</sup>	ST clear command <sup>a</sup>	MT clear command <sup>a</sup>

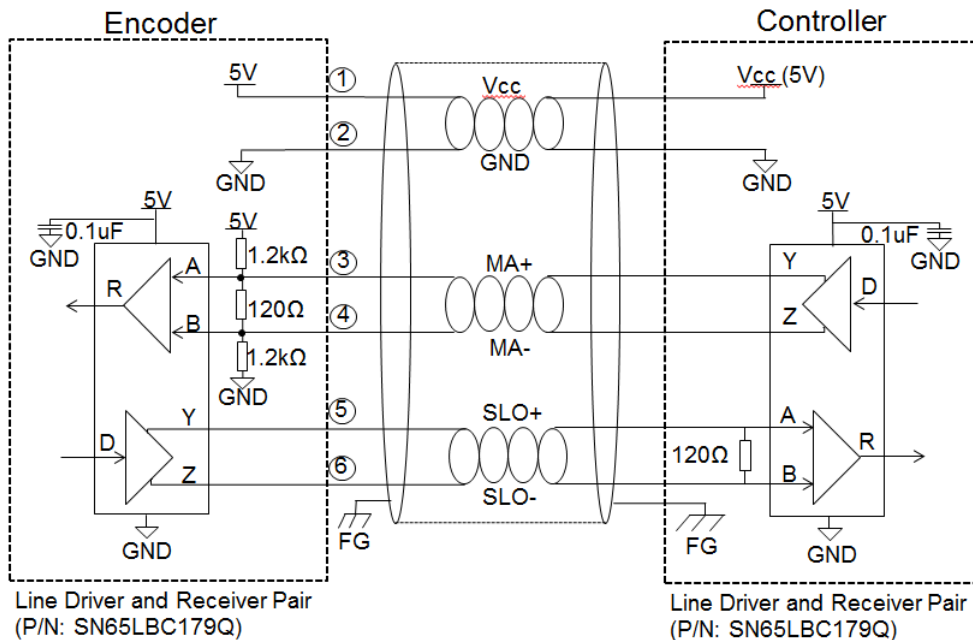
- a. Encoder Clear Command operation.  
 a. Write 1 to execute one time clear command.  
 b. Only one command should be accessed for each time.

## Other Slave Registers

- Avago Reservation Area – The user should consult Avago before accessing this area.

## Circuit Diagram of Transceiver

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



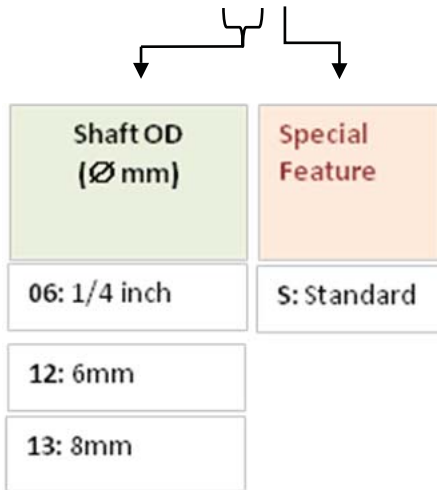
---

## Pigtail Cable Information

No	Color	Description
1	RED	VCC, Positive Supply
2	BLACK	GND, Ground
3	BROWN	MA+
4	WHITE	MA-
5	ORANGE	SLO+
6	BLUE	SLO-

## Ordering Information

### AS38-H39E- B XXX



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

---

For product information and a complete list of distributors, please go to our web site:

[www.avagotech.com](http://www.avagotech.com)

Avago Technologies and the A logo are trademarks of Avago Technologies in the United States and other countries. All other brand and product names may be trademarks of their respective companies.

Data subject to change. Copyright © 2016 Avago Technologies. All Rights Reserved.

pub-005503 – May 13, 2016

