# AEAT-6010/6012 Magnetic Encoder

10 or 12 bit Angular Detection Device

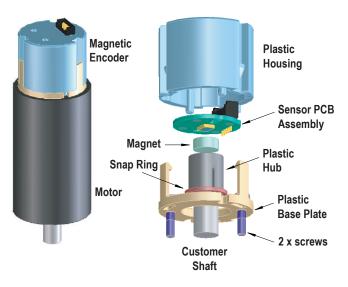


# **Data Sheet**

### Description

Avago Technologies' AEAT-60xx series of magnetic encoders provides an integrated solution for angular detection. With ease of use in mind, these magnetic encoders are ideal for angular detection within 360°. Based on magnetic technologies, the device is noncontact and ensures reliable operations. It is able to provide absolute angle detection upon power-up, with a resolution of 0.0879°(12 bits version) or 0.35°(10bits version), which is equivalent to 4096 and 1024 positions per revolution respectively. The positional data is provided in serial bit stream. There is no upper speed limit; the only restriction is that there will be fewer samples per revolution as the speed increases.

## **Exploded View**



#### **Features**

- 10 or 12 bits resolution
- Contactless sensing technologies
- Wide temperature range from -40° to 125°C
- Absolute angular position detection
- Synchronous serial interface (SSI) output for absolute position data (binary format)
- Code monotony error = ± 1 LSB
- Single 5V supply
- Easy Assembly, No Signal Adjustment required
- Direct Connectivity through PCB
- RoHS compliant

#### **Applications**

- Flow meter
- Angular detection
- Knob control
- Rotary encoder

Note: "This product is not specifically designed or manufactured for use in any specific device. Customers are solely responsible for determining the suitability of this product for its intended application and solely liable for all loss, damage, expense or liability in connection with such use."

## Device Selection Guide [1]

Part Number	Resolution (bit)	Operating Temperature (°C)	<b>Output Communication</b>	DC Supply Voltage (V), V <sub>DD</sub>
AEAT-6012	12	-40 to +125	Serial	+5.0
AEAT-6010	10	-40 to +125	Serial	+5.0

#### Notes:

## Table 1. Absolute Maximum Ratings [1, 2]

Parameter	Symbol	Limits	Units	Notes	
DC Supply Voltage at pin $V_{DD} = 5V$	$V_{DD}$	-0.3  to + 7	V		
Input Voltage	Vi	-0.3 to VDD+0.3	V		
Storage Temperature	T <sub>STG</sub>	-40 to 125	°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 any other conditions above 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.

**Table 2. Recommended Operating Condition** 

Parameter	Symbol	Values	Units	Notes	
DC Supply Voltage at pin $V_{DD} = 5V$	$V_{DD}$	+4.5 / +5.5	V		
Ambient Temperature	$T_{amb}$	-40 to +125	°C		
Maximum Read-out Frequency	f <sub>CLK</sub>	≤1	MHz	>0 MHz	

### **Table 3. DC Characteristics**

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

				Values			
Parameter	Symbol	Condition	Min	Typ.	Max	Units	Notes
VDD Supply Current	I <sub>DD</sub>			16	20	mA	
Output High Voltage D0	$V_{OH}$		V <sub>DD</sub> -0.5			V	
Output Low Voltage DO	$V_{OL}$				$V_{SS}+0.4$	V	
Output Current DO	I <sub>0</sub>				4	mA	$V_{DD}$ pin = 4.5V
Input High Voltage CLK, CSn	$V_{IH}$		0.7*V <sub>DD</sub>				1
Input Low Voltage CLK, CSn	$V_{IL}$				0.3*V <sub>DD</sub>		

#### Notes

1. CSn is internal pull-up.

<sup>1.</sup> For other options of Magnetic Encoder, please refer to factory.

## **Table 4. Timing Characteristics**

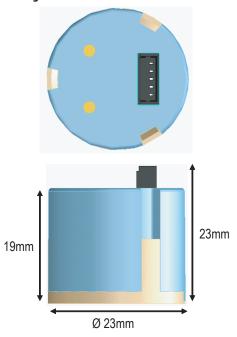
Timing Characteristics over Recommended Operating Range, typical at 25 °C

			Values			
Symbol	Condition	Min	Тур.	Max	Units	Notes
T <sub>DO active</sub>				100	ns	2
t <sub>CLK FE</sub>		500			ns	3
T <sub>CLK/2</sub>		500			ns	4
T <sub>DO valid</sub>				375	ns	5
T <sub>DO tristate</sub>				100	ns	6
T <sub>CSn</sub>		500	-		ns	7
f <sub>abs</sub>		9.9	10.42	10.94	kHz	8
	T <sub>DO active</sub> t <sub>CLKFE</sub> T <sub>CLK/2</sub> T <sub>DO valid</sub> T <sub>DO tristate</sub> T <sub>CSn</sub>	T <sub>DO active</sub> t <sub>CLKFE</sub> T <sub>CLK/2</sub> T <sub>DO valid</sub> T <sub>DO tristate</sub> T <sub>CSn</sub>	TD0 active  tCLK FE 500  TCLK/2 500  TD0 valid  TD0 tristate  TCSn 500	Symbol         Condition         Min         Typ.           TDO active         500         500           TCLK/2         500         500           TDO valid         TDO tristate         500           TCSn         500         500	Symbol         Condition         Min         Typ.         Max           TD0 active         100           tclkfe         500           Tclk/2         500           TD0 valid         375           TD0 tristate         100           Tcsn         500	Symbol         Condition         Min         Typ.         Max         Units           TDO active         100         ns           tCLKFE         500         ns           TCLK/2         500         ns           TDO valid         375         ns           TDO tristate         100         ns           TCSn         500         ns

#### Notes:

- 2. Time between falling edge of CSn and data output activated
- 3. Time between falling edge of CSn and first falling edge of CLK
- 4. Rising edge of CLK shifts out one bit a time
- 5. Time between rising edge of CLK and data output valid
- 6. After the last bit DO changes back to "tristate"
- 7. CSn=high; To initiate read-out of next angular position
- 8. Internal sampling rate.

# **Package Dimensions**



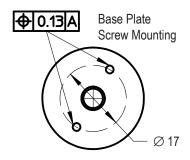


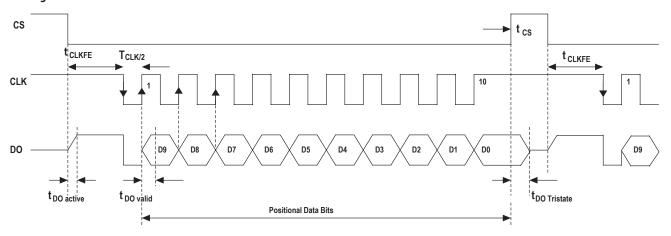
Figure 1. Package and recommended mounting dimension

### **Parameters**

No.	Parameter	Value
1	Operating Temp(°C)	- 40 to +125
2	Shaft axial play (mm)	± 0.08
3	Shaft TIR (mm)	0.05
4	Mechanical speed (rpm)	12,000
5	Shaft diameter (mm)	6+0/-0.01
6	Moment inertia (g-cm^2)	0.104
7	Shaft length — (mm)	8.5 ±1.0
8	Mounting screw size (mm)	M2 x 0.4 x 4 (socket head cap screw, head $\emptyset$ 3.8 $\pm$ 0.18 mm)
9	Recommended screw torque	0.6 lb.inch
10	Encoder base plate thickness (mm)	2
11	Bolt circle	± 0.13

<sup>\*</sup> Note:- For high temperature application, it is highly recommended that adhesive be applied at least to the screw and the base plate interface. Refer Application Note for further details.

## **Timing Characteristics**

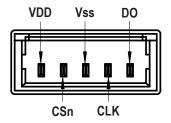


#### Notes:

- 1. Please refer to Table 4 for Timing Characteristics.
- 2. For 12 bits version; the Positional Data Bits will start with D11 instead and end at D0.

Figure 2. Timing Diagram for 10 bit Magnetic Encoder

### **Electrical Connections**



Pin	Symbol	Description
1	VDD	5V Supply Voltage
2	CSn	Chip Select — Input (See Figure 2)
3	VSS	Supply Ground
4	CLK	Serial Clock - Input (See Figure 2)
5	DO DO	Serial Data - Output. (See Figure 2)

**Figure 3. Electrical Connections** 

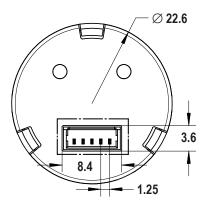


Figure 4. Basic connector dimensions

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

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