EM3242
Angle Sensor IC

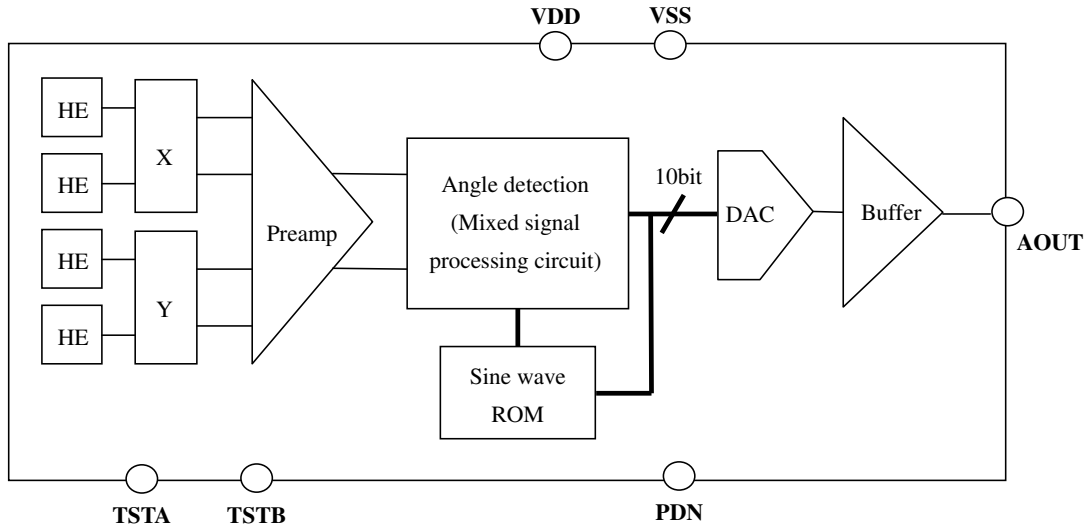
Applications

- ☐ Small absolute rotary encoder
- ☐ Small input device (mode selector, volume control, and soon)
- ☐ Potentiometer
- ☐ Rotary switch

Features

- ☐ Si monolithic rotary position sensor IC with embedded Hall devices
- ☐ Contactless rotary position sensor is easily implemented with magnetic disc (radial magnetic) and sensor IC.
- ☐ Analog ratiometric output (10%VDD～90%VDD)
- ☐ 10 bit Angular Resolution
- ☐ 3V single power supply
- ☐ Extremely small temperature drift (typ. +/-1.0 degree)
- ☐ Ambient operating temperature range: Ta=-40 to 150ºC
- ☐ Package: SOP6 body size 3.6×3.0×0.95mm

Block Diagram



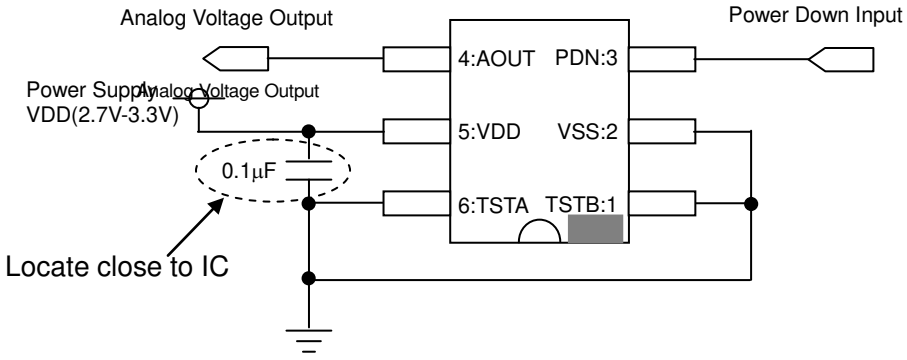
Functional Blocks

Block name	Function
HE	Hall Elements. These detect X/Y-compositions of flux which is parallel to the IC package surface by using magnetic concentrator.
PreAmp	This is able to amplify signals from Hall elements.
Angle Detection & Sine Wave ROM	Angle Detection makes digital angle data from signals from Hall Elements using Sine Wave ROM.
DAC	Digital to analog converter for angle output.

PIN Description

No.	Symbol	I/O	Type	Function
1	TSTB	I/O	Analog/Digital	TEST dedicated PIN, which should be connected to the GND in use.
2	VSS	-	Power	Ground PIN.
3	PDN	I	Analog	Power down PIN. IC is active in the case that PDN is High. IC is power down in the case that PDN is Low.
4	AOUT	O	Analog	Analog output PIN for angle data. CL: max.200pF（pull-down）
5	VDD	-	Power	Power Supply PIN. 0.1uF Ceramic Capacitor is required between Vss for stabilization. If Capacitor has magnetism, separate it around 10mm from IC.
6	TSTA	I/O	Analog	TEST dedicated PIN, which should be connected to the GND in use.

Application Circuit



*Bypass capacitor must be inserted between VDD and VSS.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	備考
Supply Voltage	V_{DD}	-0.3	6.5	V	
Input Voltage	V_{IN}	-	V_{DD}+0.3	V	PDN terminal
Storage Temperature Range	Tstg	-50	+125	℃	

Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	Vdd	2.7	3.0	3.3	V	
Operating Temperature Range	Ta	-30	-	+85	℃	

Electrical & Magnetic Specifications

Condition is; Ta=25℃, VDD=3.3V if particular notes are not defined.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Magnetic Flux Density Range	B_{RANGE}	20	30	40	mT	@-30～85℃ *2
Angle Detection Range	A_{RANGE}			360	Deg.	
Angle Resolution	A_{RES}		0.36		Deg.	10Bit
Angle error	A_{PREC}	-3.0		3.0	Deg.	@25℃ *5 *8
Linearity	INL	-0.84		0.84	%FS	FS=360° *5
Angle temperature drift	A_{TD}		+/-1.0		Deg.	@-30～85℃ (Reference)*1*6
Angle output cycle	T_p		40		μs	A/D Conversion Cycle *2
Signal delay time	T_d		140	180	μs	*2
Minimum Output Voltage	V_{OUT}(min)	$0.095V_{DD}$	$0.1V_{DD}$	$0.105V_{DD}$	V	@Angle 0° Ratiometric Load Condition *3
Maximum Output Voltage	V_{OUT}(max)	$0.895V_{DD}$	$0.9V_{DD}$	$0.905V_{DD}$	V	@Angle 359.64° Ratiometric Load Condition *4
Consumption Current While driving Sensor	I_{SUP}		8	12	mA	PDN:H *7
Consumption Current While Power Down	I_{PD}			1	μA	PDN:L *7
Startup time	T_{PD}		680	850	μs	PDN:L→H *2
Output Current	I_{OUT}	-0.3		0.3	mA	*2

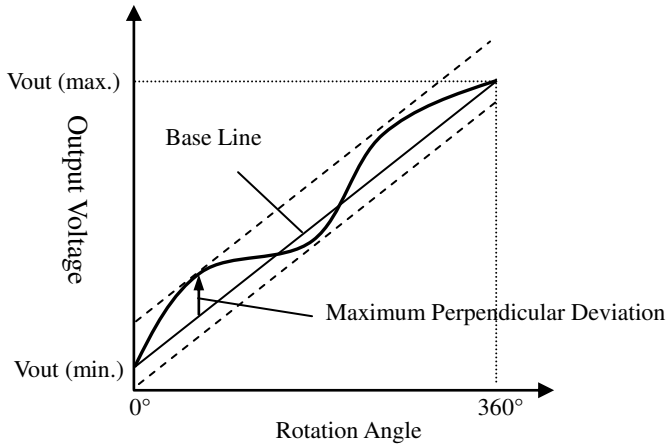
*1) Based on Ambient Temperature = 25°C

*2) This is a design assurance parameter. And this parameter will not be inspected in mass production.

*3) AOUT Maximum Load Condition is CL=200pF (pull-down), AOUT Load Condition in Vout (min.) test: RL=9kΩ (pull-up), CL＝200pF (pull-down)

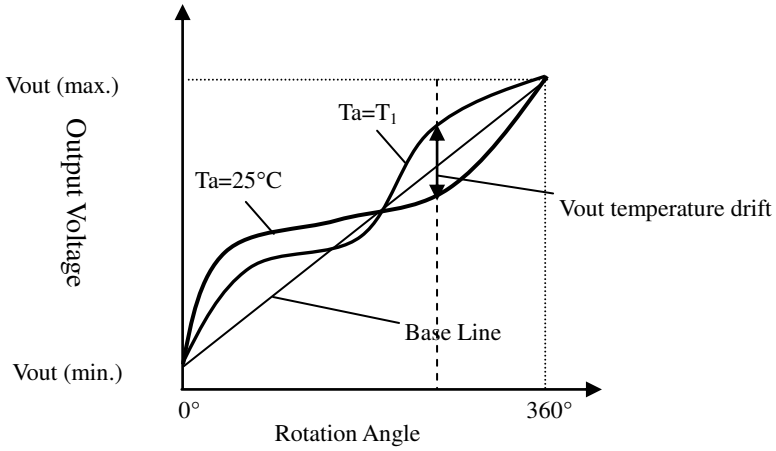
*4) AOUT Maximum Load Condition is CL=200pF (pull-down), AOUT Load Condition in Vout (max.) test: RL=9kΩ (pull-down), CL＝200pF (pull-down)

*5) Angle error
Angle Error is defined as below formula.
Angle Error [°]＝360°×Maximum Perpendicular Deviation/(Vout (max)- Vout (min))
Linearity is defined as below formula.
Linearity [%FS.]＝Maximum Perpendicular Deviation /(Vout (max)- Vout (min)) ×100 [%FS.]



*6) Angle temperature drift

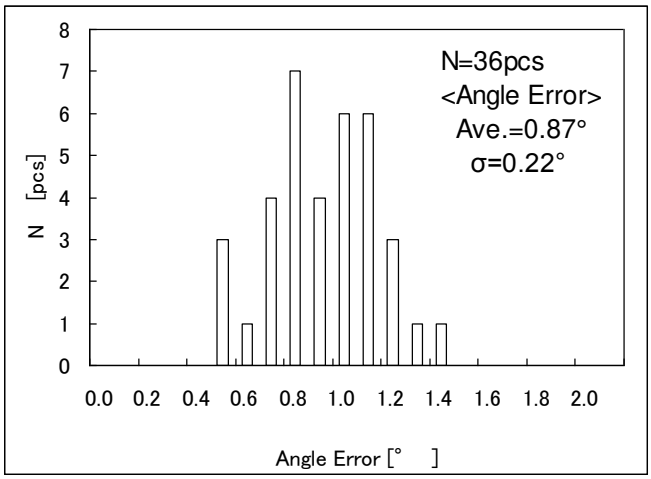
Vout temperature drift means temperature drift of output voltage at the same rotation angle.
Angle temperature drift is defined as below formula.
Angle temperature drift [°]＝360° ×Vout temperature drift/(Vout (max)- Vout (min))



*7) No Load

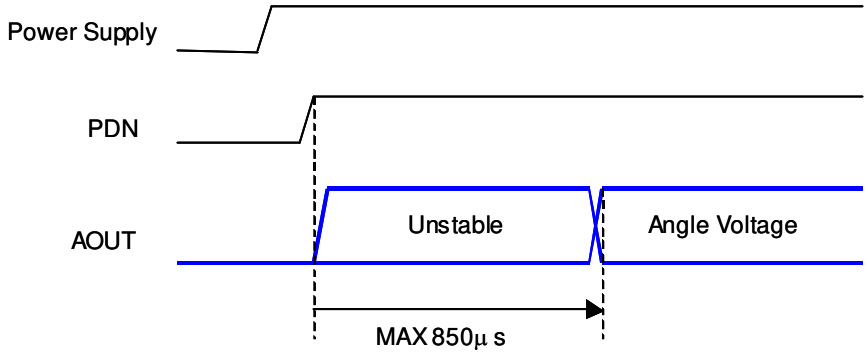
*8) Reference (Angle Error)

<Measurement conditions>
1. Magnet: φ7.0×t2.0mm (Neodymium magnet: Br=1250mT)
2. Distance between the magnet and the package: Gap=4.0mm
   (This Gap is the distance where the magnetic flux density at the sensor becomes 30mT)
3. Rotation angle of magnet: 0 to 360° (step: 1deg.)
4. Power Supply: Vdd=3.3V
5. Bypass Capacitor: C=0.1 μF（Distance from IC to Bypass Capacitor: d=15mm）



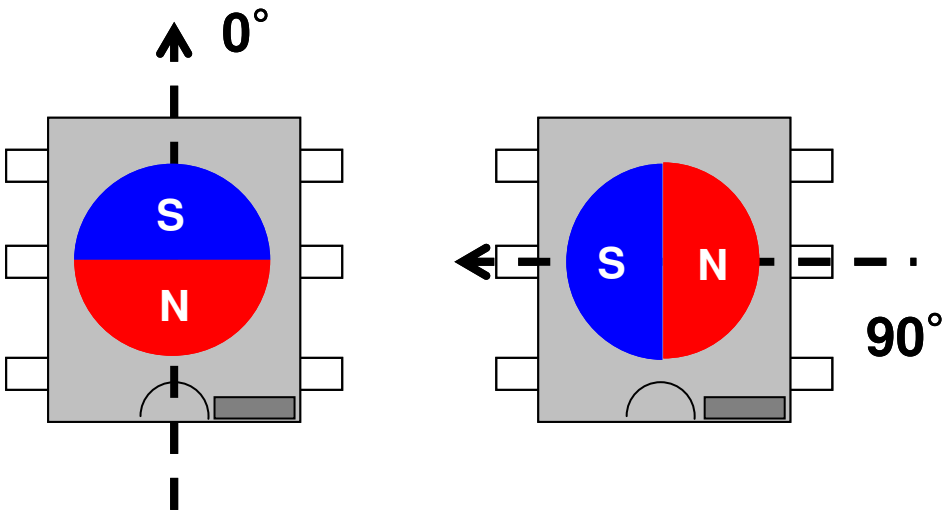
In this measurement conditions, Maximum of Angle Error (Ave.+5 σ) is smaller than +/-2°

Startup time

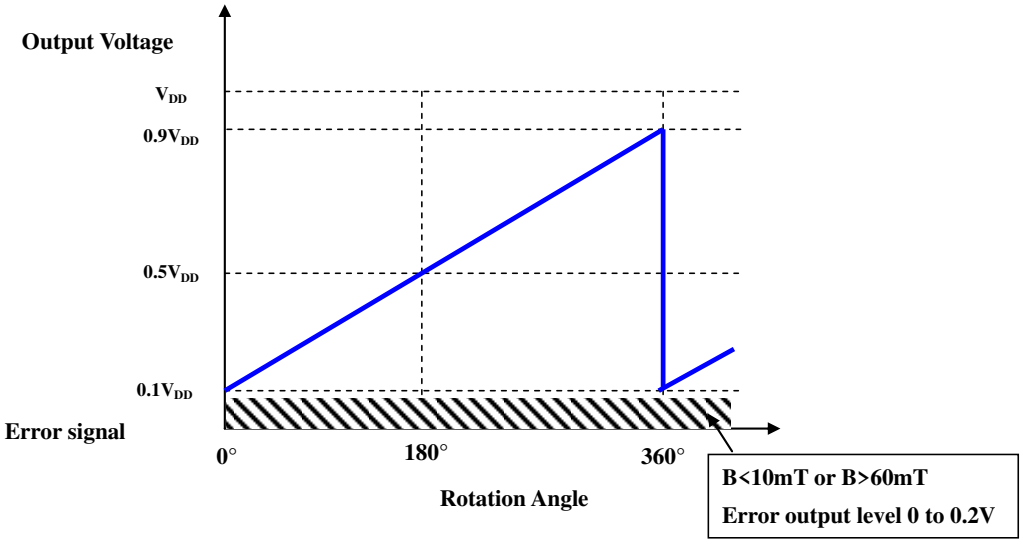


1) Please be noted that there is a certain period that the angle output voltage is unstable when EM-3242 goes to the operation from power down (PDN) mode, as shown above.
2) “Power Up Voltage” should be applied to PDN pin after applying “Power Supply Voltage” to VDD pin.

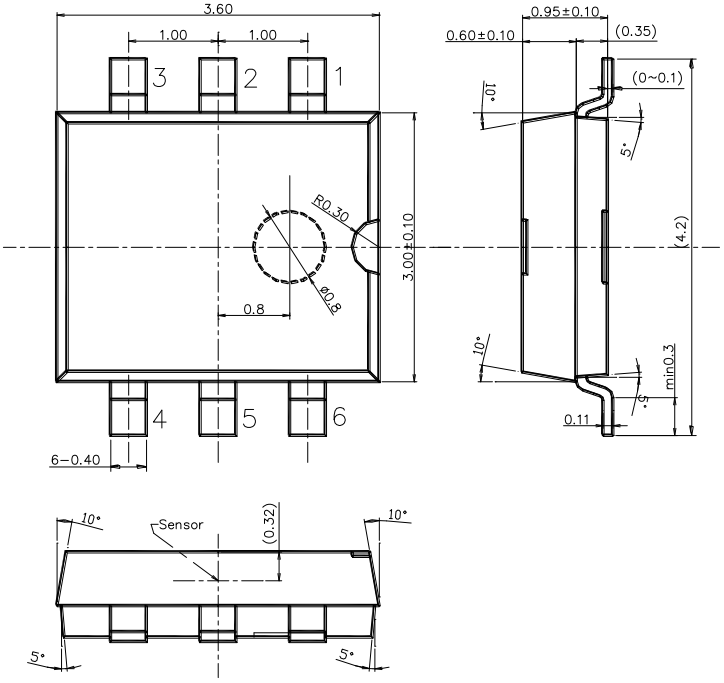
Magnet Direction and Output Voltage



Marking side defines the N polar as 0°, the Output Voltage (AOUT) increases as the magnet rotates counterclockwise. In other words, it decreases as the magnet rotates clockwise.



Package and Terminals



Material of the terminals; Cu
Material of the plating; Sn
Thickness of the plating; 10μm (Typ.)
Weight; 24.3mg
*This product is a Pb-Free Product.

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