Low Voltage Operation Omnipolar Type Hall Effect Switch IC

General Description

The ET3712A30CDCLG are a high sensitivity and high-accuracy Hall effect switch IC that operates at a low voltage and low current consumption. The output voltage will be pulled low when this IC detects the magnetic flux density is larger than operate point(B_{OP}) and the output voltage will recover to high until the magnetic flux density is smaller than the release point(B_{RP}). Using this IC with a magnet makes it possible to detect the open / close status in various applications.

Due to its low voltage operation and low current consumption the ET3712A30CDCLG are suitable for battery powered portable devices such as mobile phones and portable PCs etc.

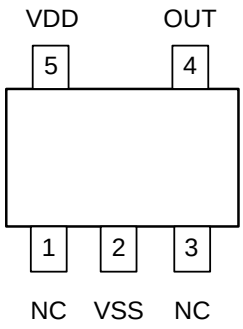
Features

- Pole detection: Omnipolar pole
- Output logic: Active "L"
- Output form: CMOS output
- Magnetic sensitivity: B_{OP} = 3.0 mT typ.
- Operating cycle (current consumption): t_{CYCLE} = 0.1 ms (I_{DD} = 1000 μA) typ.
- Power supply voltage range: V_{DD} = 1.6 V to 5.5 V
- Operation temperature range: T_A = -40°C to +85°C
- Package: SOT23-5
- Lead-free (Sn 100%), halogen-free

Application

- Open/Close detection for flip mobile phones
- Smart cover for smart phones
- Smart cover for portable PCs, tablet PCs
- Digital video cameras and portable game consoles
- Home appliance

Pin Configuration

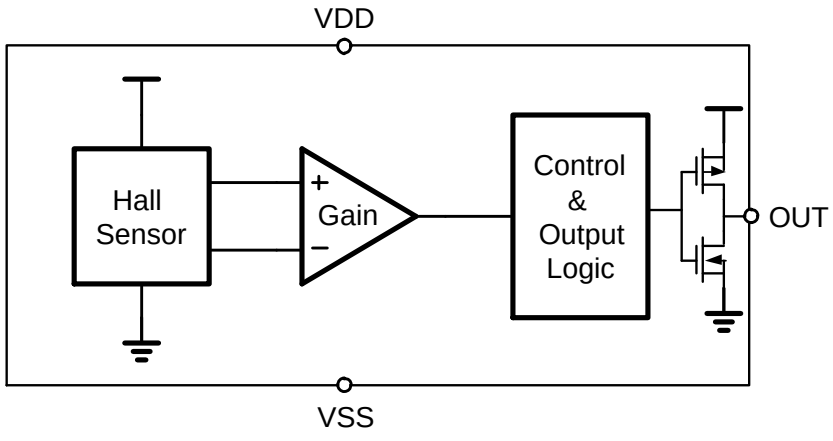


TOP VIEW

Pin Function

Pin No.	Pin Name	Pin Function
1	NC	No Connect
2	VSS	GND Pin
3	NC	No Connect
4	OUT	Output pin
5	VDD	Power supply pin

Block Diagram



Functional Description

Applied magnetic flux

The magnetic flux applied to ET3712A30CDCLG should on the vertical direction on marking surface. If not, the horizontal component has no effect to detection. ET3712A30CDCLG is omnipolar type detector, the output voltage (V_{OUT}) is inverted when the S or N type magnetic flux is applied to IC.

Below shows the direction in which magnetic flux should be applied.

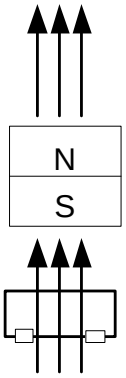


Figure1. Magnetic flux direction

Hall sensor Position

The Hall sensor embedded in ET3712A30CDCLG is at the center of IC using SOT23-5 package. As show below, the position of this Hall sensor is located in the area indicated by a circle.

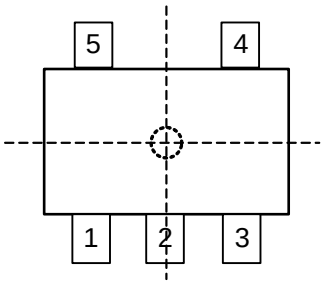


Figure2. Hall sensor position

Detecting Operation

ET3712A30CDCLG detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point (B_{OPN} or B_{OPS}) such as the S or N pole of a magnet is moved closer to IC, V_{OUT} changes from "H" to "L". On the contrary, if magnetic flux is lower than the release point (B_{RPN} or B_{RPS}), V_{OUT} changes from "L" to "H".

The relationship between the magnetic flux density and V_{OUT} is shown below.

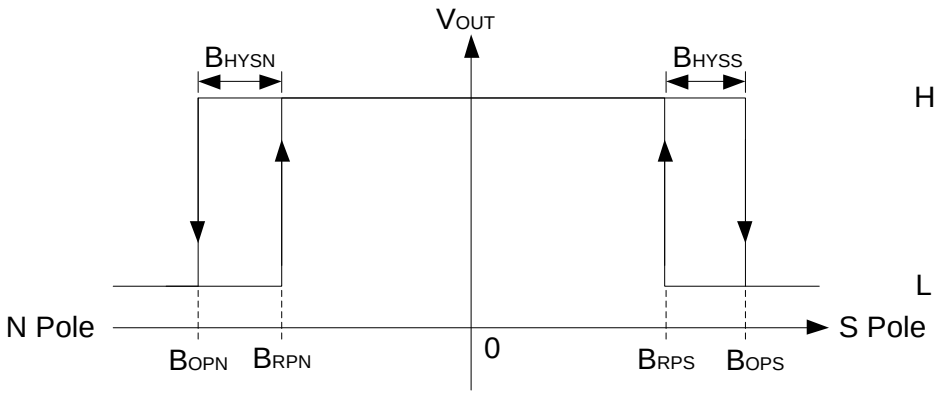


Figure3. Magnetic flux density vs V_{OUT}

Operating Current

ET3712A30CDCLG performs the continuous operation, therefore no sleep period exists and current consumption is about 1000uA typically continuously.**Timing Diagram**

The operation timing of this IC is shown below.

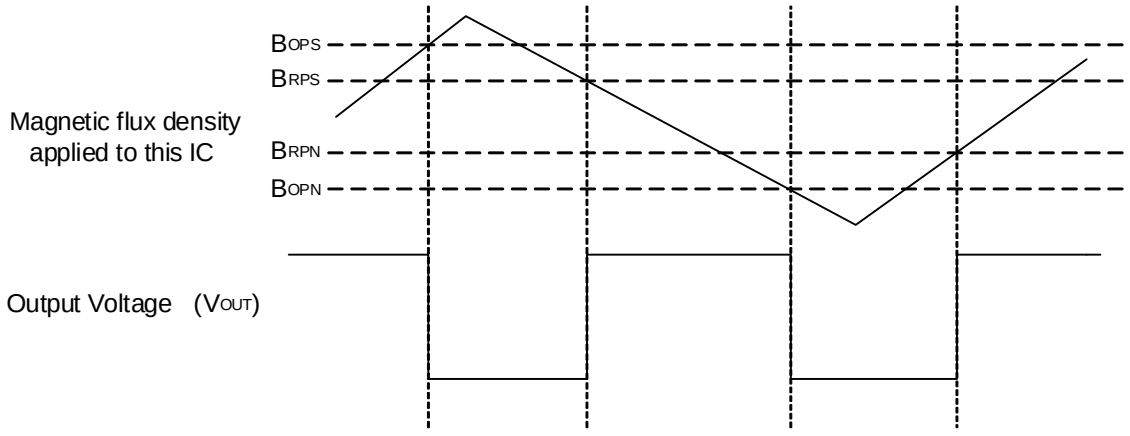


Figure4. Timing Diagram

Absolute Maximum Ratings

(TA = +25°C unless otherwise specified)

Symbol	Parameters		Rating	Unit
V_{DD}	Power supply voltage		V_{SS}−0.3 ~ V_{SS}+7.0	V
I_{OUT}	Output current		±1.0	mA
V_{OUT}	CMOS output product		V_{SS}−0.3 ~ V_{DD}+0.3	
T_A	Operation ambient temperature		−40 ~ +85	°C
T_{STG}	Storage temperature		−40 ~ +125	°C
θ_{JA}	Junction-to-ambient thermal resistance		300	°C/W
V_{ESD}	HBM	ESDA/JEDEC JS-001-2017	±4000	V
	CDM	ESDA/JEDEC JS-002-2014	±1500	V
	MM	JESD22-A115C	±300	V

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

Electrical Characteristics

(T_A = +25°C, V_{DD} = 1.85 V, V_{SS} = 0 V, unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.60	1.85	5.50	V
I_{DD}	Current consumption	Average value			1000	1800	μA
V_{OUT}	Output voltage	CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
t_{CYCLE}	Operating cycle	-			0.10	0.20	ms

Magnetic Characteristics

(TA = +25°C, VDD = 1.85 V, VSS = 0 V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point[1]	S pole	B_{OPS}		1.4	3.0	4.0	mT[4]
	N pole	B_{OPN}		-4.0	-3.0	-1.4	mT
Release point[2]	S pole	B_{RPS}		1.1	2.2	3.7	mT
	N pole	B_{RPN}		-3.7	-2.2	-1.1	mT
Hysteresis width[3]	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		0.8		mT
	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		0.8		mT

Notes:

(1) Operating points (B_{OPN}, B_{OPS}): B_{OPN} and B_{OPS} are the values of magnetic flux density triggers the output voltage (V_{OUT}) to low by increasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is larger than B_{OPN} or B_{OPS}, V_{OUT} status is held.

(2) Release points (B_{RPN}, B_{RPS}): B_{RPN} and B_{RPS} are the values of magnetic flux density makes the output voltage (V_{OUT}) recover to high by decreasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is lower than B_{RPN} or B_{RPS}, V_{OUT} status is held.

(3) Hysteresis widths (B_{HYSN}, B_{HYSS}): B_{HYSN} and B_{HYSS} are the difference between B_{OPN} and B_{RPN}, and B_{OPS} and B_{RPS}, respectively.

(4) The unit of magnetic density mT can be converted by using the formula 1 mT = 10 Gauss

Application Circuit

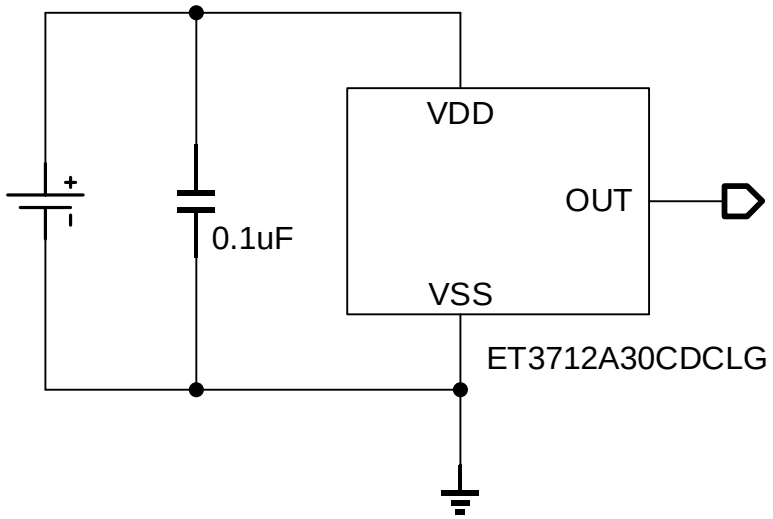
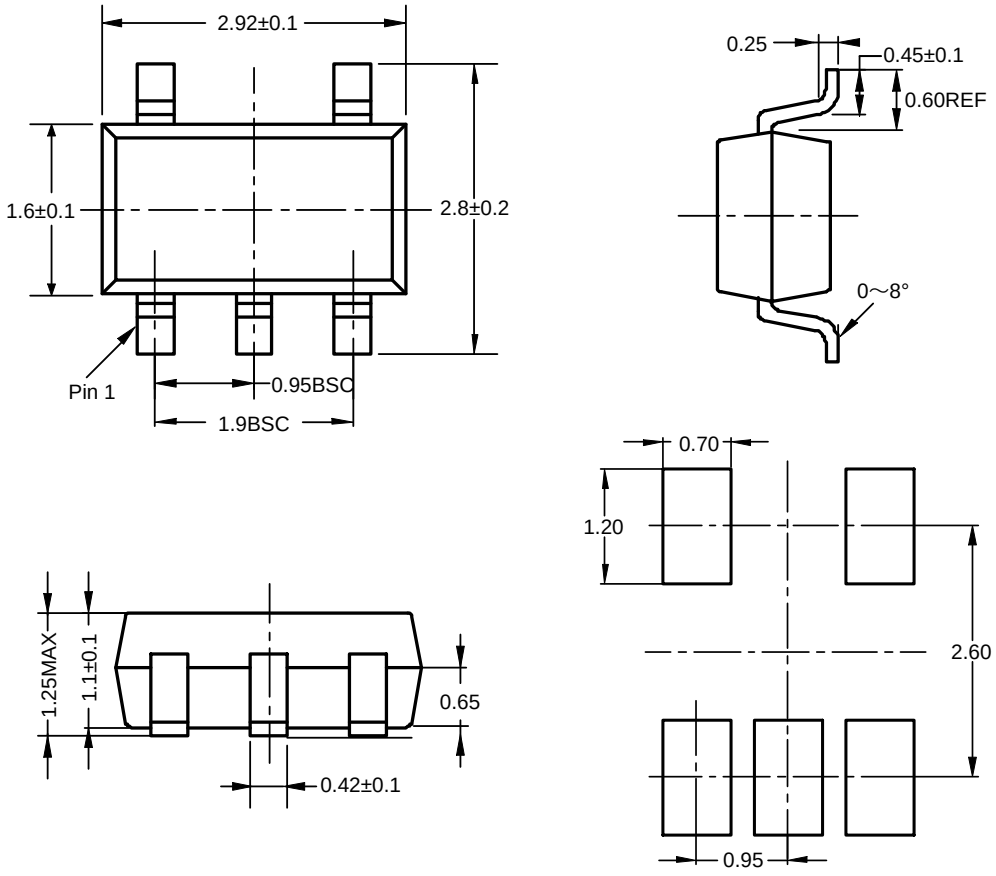


Figure5. Reference Application Circuit

Package Dimension

SOT23-5



Recommended Land Pattern

Unit:mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2024.9.12	Original Version	Zhangy	Wanggp	Liujy