

## Low Voltage Omnipolar Detection Type Hall Effect Switch IC

### General Description

The ET3712A45BDCLS is a high sensitivity and high-accuracy Omnipolar detection 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( $B_{OPN}/B_{OPS}$ ) and the output voltage will recover to high until the magnetic flux density is smaller than the release point( $B_{RPN}/B_{RPS}$ ). 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 ET3712A45BDCLS is 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, no external pull-up resistor required
- Magnetic sensitivity:  $B_{OP} = 4.5 \text{ mT typ.}$
- Operating cycle (current consumption):  $t_{CYCLE} = 50.5 \text{ ms (I}_{DD} = 2.5 \mu\text{A) typ.}$
- Power supply voltage range:  $V_{DD} = 1.6 \text{ V to } 5.5 \text{ V}$
- Operation temperature range:  $T_a = -40^\circ\text{C to } +85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free
- Package:

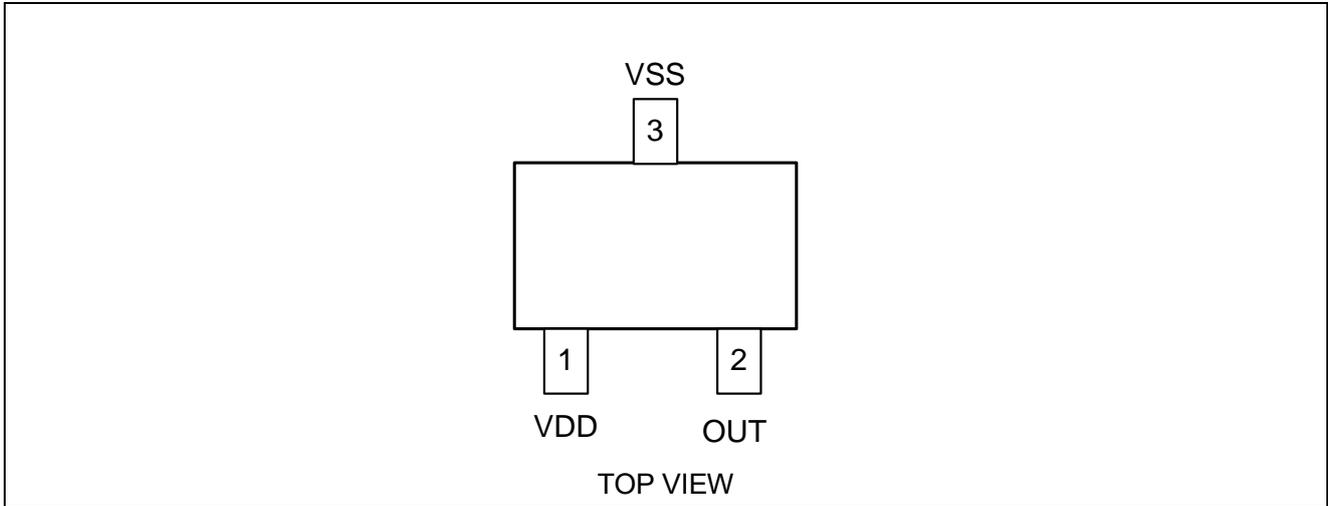
Part No.	Package	MSL
ET3712A45BDCLS	SOT23-3	Level 3

### 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 appliances

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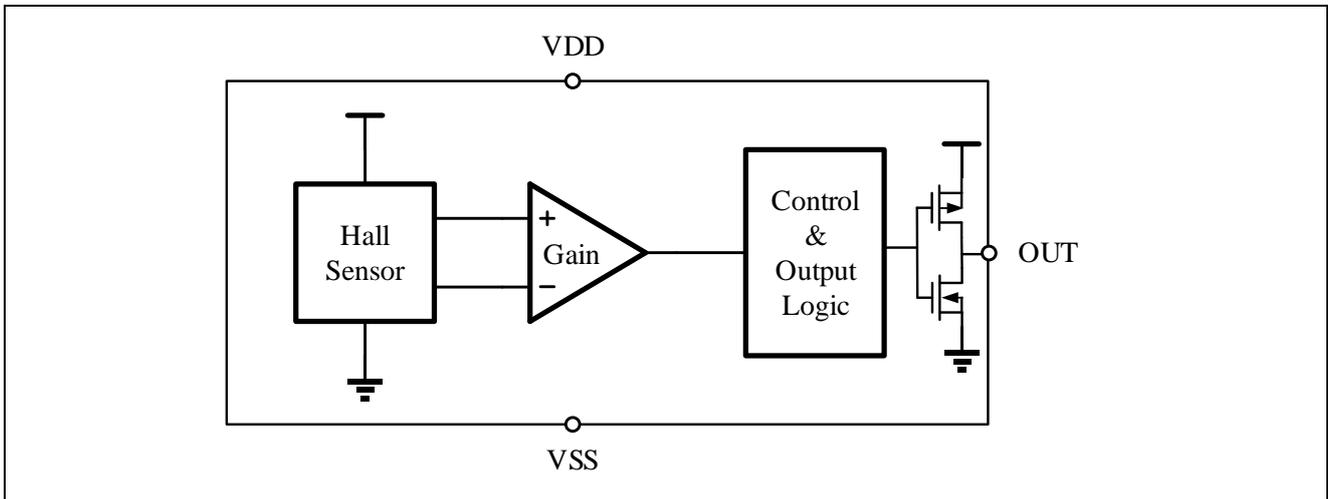
## Pin Configuration



## Pin Function

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

## Block Diagram



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## Absolute Maximum Ratings

(Ta = +25°C unless otherwise specified)

Parameters	Symbol	Rating	Unit
Power supply voltage	V <sub>DD</sub>	V <sub>SS</sub> -0.3~V <sub>SS</sub> +7.0	V
Output current	I <sub>OUT</sub>	±1.0	mA
Output voltage	V <sub>OUT</sub>	V <sub>SS</sub> - 0.3 ~ V <sub>DD</sub> + 0.3	V
Operation ambient temperature	T <sub>A</sub>	-40 ~ +85	°C
Storage temperature	T <sub>STG</sub>	-40 ~ +125	°C
Junction-to-ambient thermal resistance	θ <sub>JA</sub>	300	°C/W

**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

(Ta = +25°C, V<sub>DD</sub> = 1.85 V, V<sub>SS</sub> = 0 V unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Power supply voltage	V <sub>DD</sub>	-	1.60	1.85	5.50	V
Current consumption	I <sub>DD</sub>	Average value		2.5	5.0	uA
Output voltage	V <sub>OUT</sub>	Output transistor Nch, I <sub>OUT</sub> = 0.5 mA			0.4	V
		Output transistor Pch, I <sub>OUT</sub> = -0.5 mA	V <sub>DD</sub> -0.4			V
Awake mode time	t <sub>AW</sub>			0.05		ms
Sleep mode time	t <sub>SL</sub>			50.4		ms
Operating cycle	t <sub>CYCLE</sub>	t <sub>AW</sub> + t <sub>SL</sub>		50.5	100.00	ms

## Magnetic Characteristics

(Ta = +25°C, V<sub>DD</sub> = 1.85 V, V<sub>SS</sub> = 0 V unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Operation point <sup>(1)</sup>	S pole	B <sub>OPS</sub>	2.5	4.5	6.0	mT <sup>(4)</sup>
	N pole	B <sub>OPN</sub>	-6.0	-4.5	-2.5	mT
Release point <sup>(2)</sup>	S pole	B <sub>RPS</sub>	2.0	3.5	5.5	mT
	N pole	B <sub>RPN</sub>	-5.5	-3.5	-2.0	mT
Hysteresis width <sup>(3)</sup>	S pole	B <sub>HYSS</sub>	B <sub>HYSS</sub> = B <sub>OPS</sub> - B <sub>RPS</sub>		1.0	mT
	N pole	B <sub>HYSN</sub>	B <sub>HYSN</sub> =   B <sub>OPN</sub> - B <sub>RPN</sub>		1.0	mT

### Notes:

\*1. Operating points (B<sub>OPN</sub>, B<sub>OPS</sub>):

B<sub>OPN</sub> and B<sub>OPS</sub> are the values of magnetic flux density triggers the output voltage (V<sub>OUT</sub>) 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<sub>OPN</sub> or B<sub>OPS</sub>, V<sub>OUT</sub> status is held.

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## \*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.

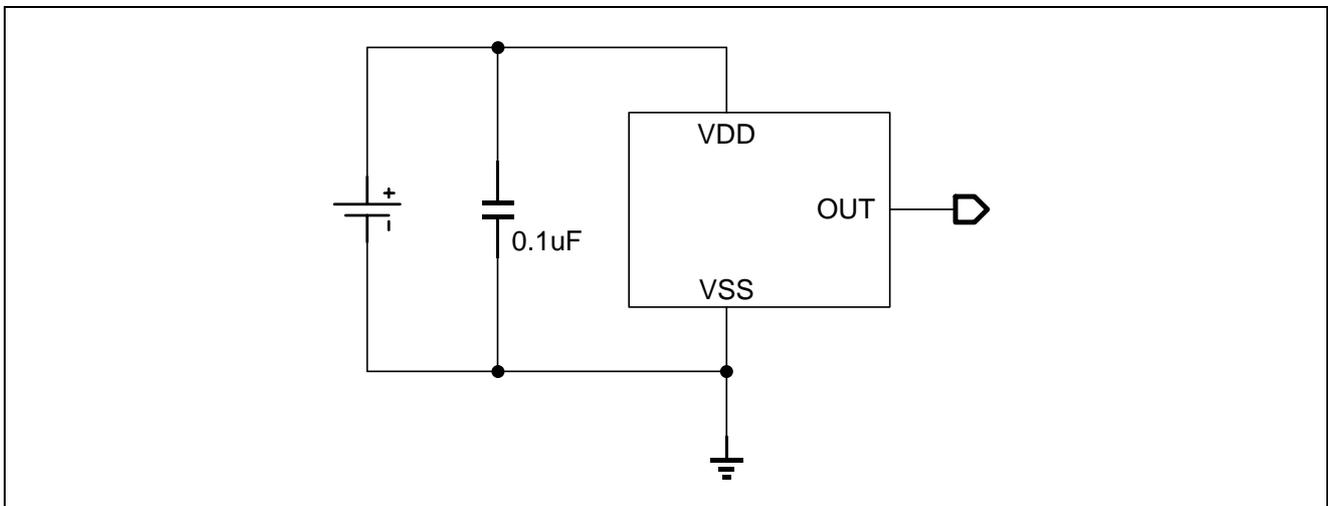
Even when the magnetic flux density is lower than  $B_{RPN}$  or  $B_{RPS}$ ,  $V_{OUT}$  status is held.

## \*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 $1 \text{ mT} = 10 \text{ Gauss}$ .

## Typical Application Circuit

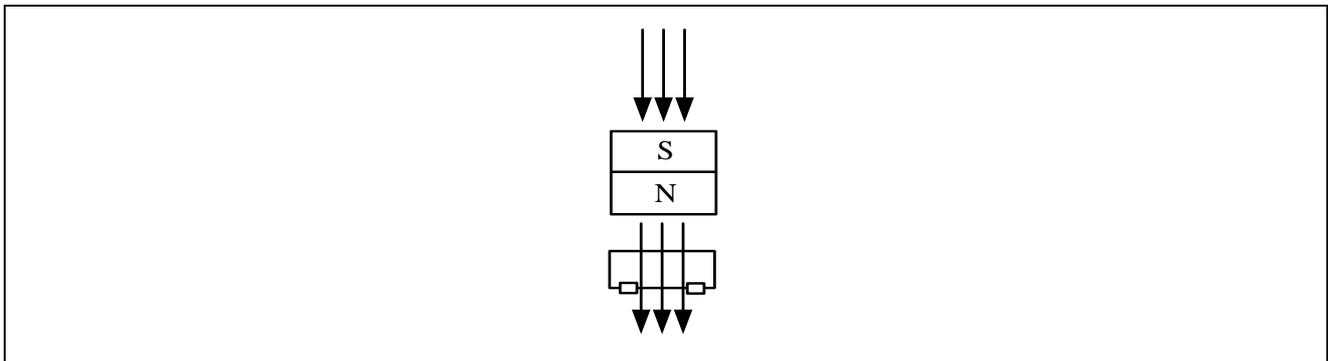


## Operation

### 1. Applied magnetic flux

The magnetic flux applied to ET3712A45BDCLS should on the vertical direction on marking surface. If not, the horizontal component has no effect to detection.

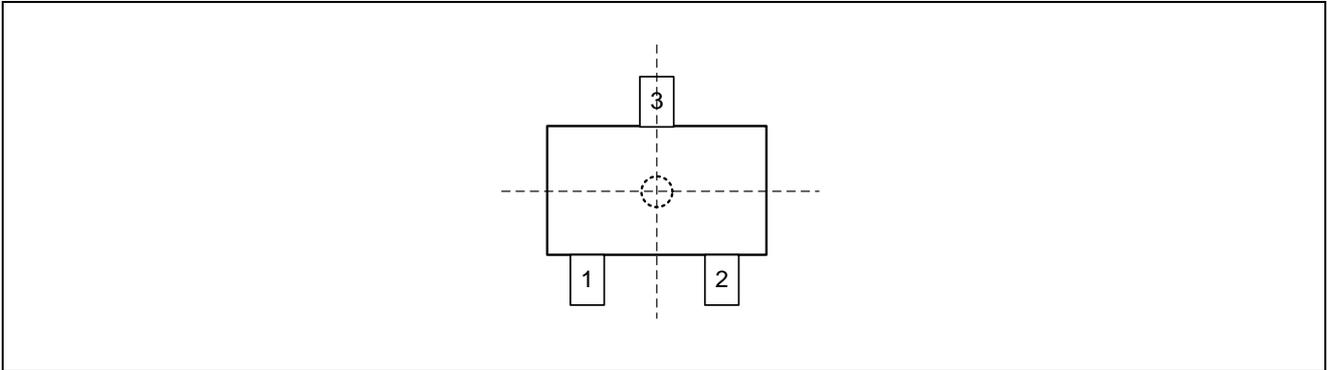
This product is omnipolar type detector, the output voltage ( $V_{OUT}$ ) is inverted when the magnetic flux is applied to IC. Below shows the direction in which magnetic flux should be applied.



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## 2. Hall sensor Position

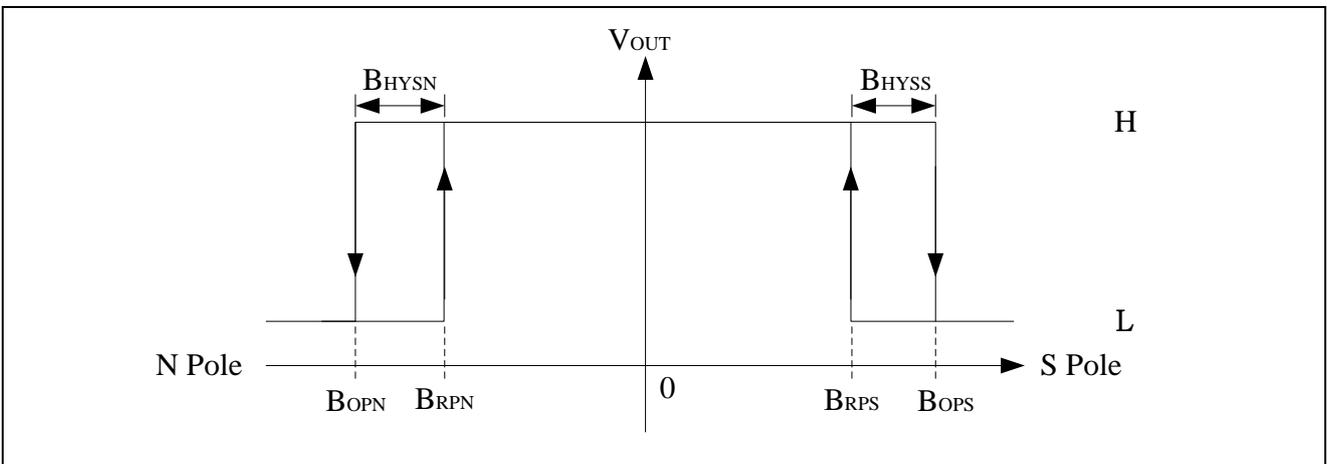
The Hall sensor embedded in ET3712A45BDCLS is at the center of IC using SOT23-3 package. As show below, the position of this Hall sensor is located in the area indicated by a circle.



## 3. Detecting Operation

ET3712A45BDCLS detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point ( $B_{OPN}/B_{OPS}$ ) such as the S/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 ( $B_{RPN}/B_{RPS}$ ),  $V_{OUT}$  changes from "L" to "H".

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

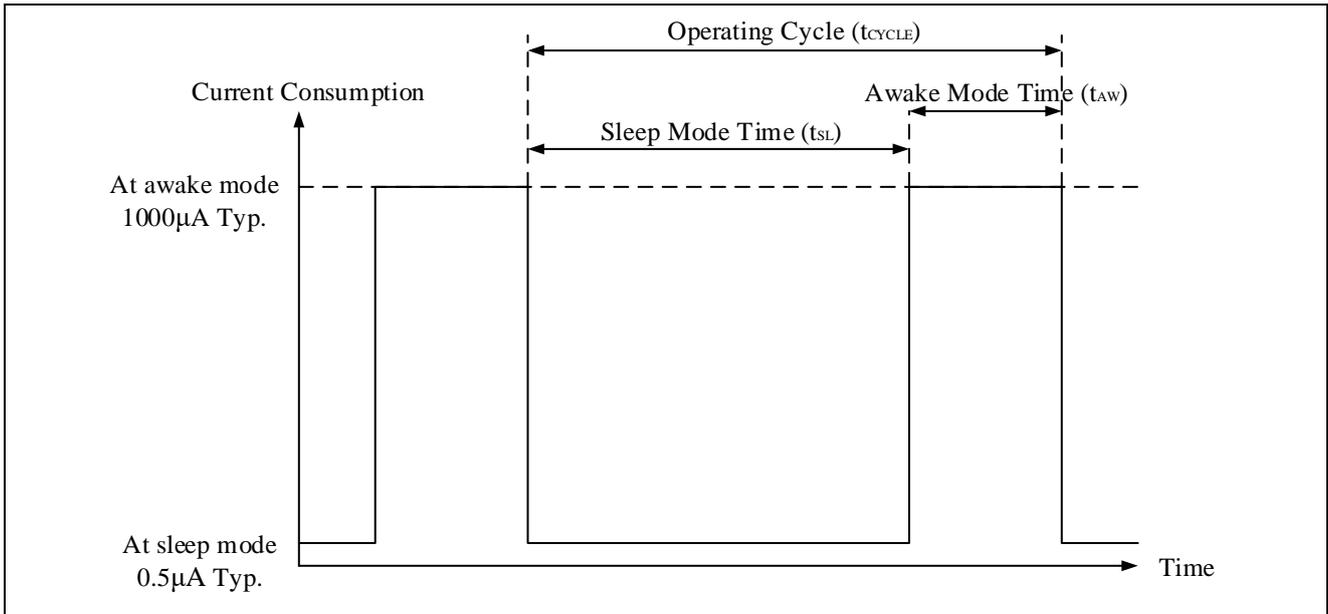


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## 4. Operating Current

ET3712A45BDCLS perform the intermittent operation, therefore the average current consumption depends on the current in active mode, the active period ( $t_{AW}$ ), the current in sleep mode, and sleep period ( $t_{SL}$ ). The active current is about 1000uA typically, and 0.5uA at sleep mode. Please refer to electrical characteristic table for detail.

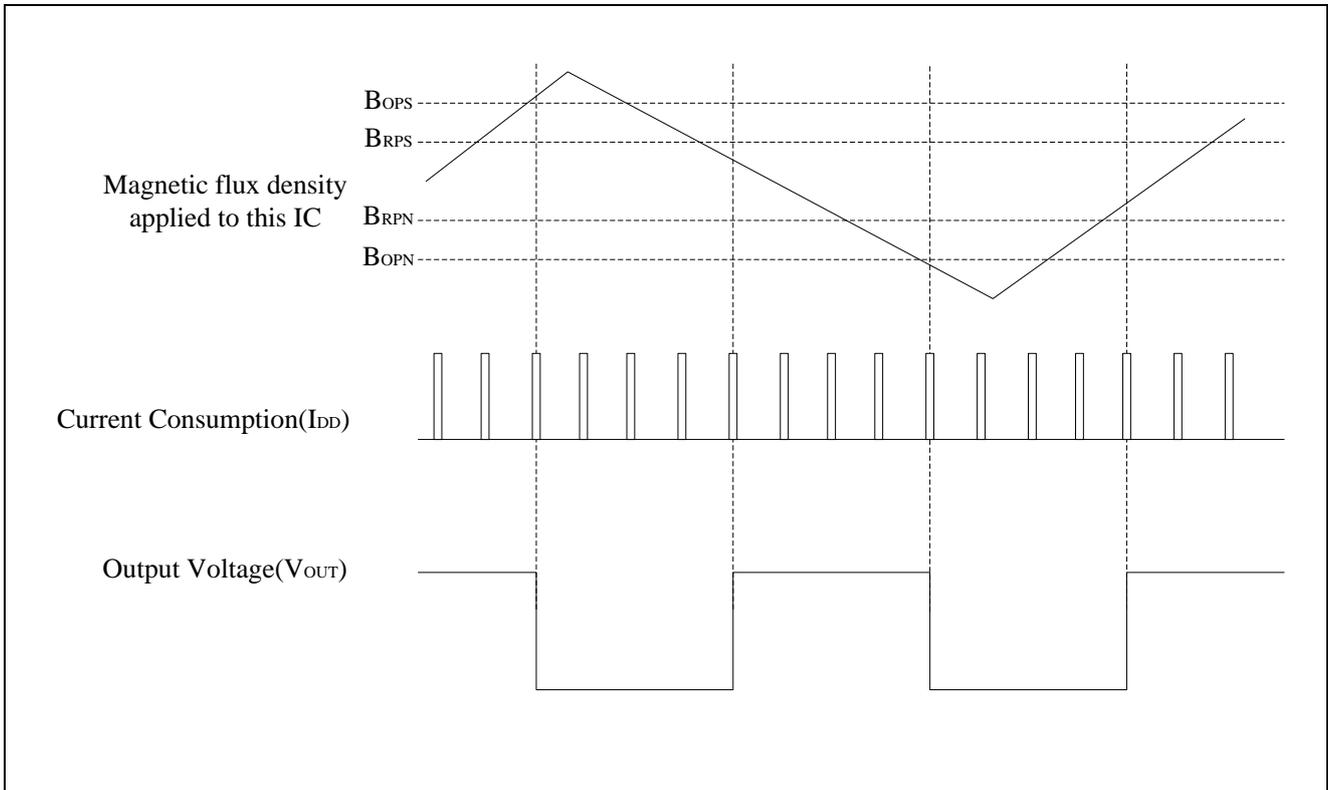
The time dependency of the current consumption is shown below.



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## 5. Timing Diagram

The operation timing of this IC is shown below.



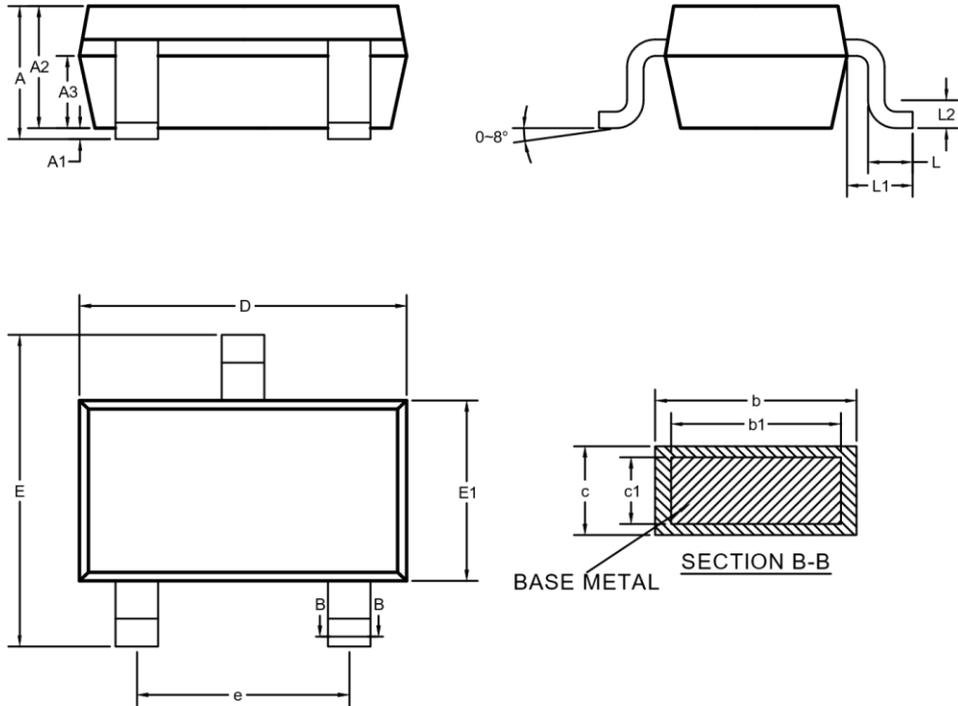
## Precautions

1. The power supply for this IC should have low impedance, the IC may malfunction due to a supply voltage drop caused by feed through current.
2. Power supply voltage rapidly changing may cause IC malfunction.
3. Large stress on this IC may affect the magnetic characteristics. Avoid large stress applied to the IC on a board.

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## Package Dimension

SOT23-3

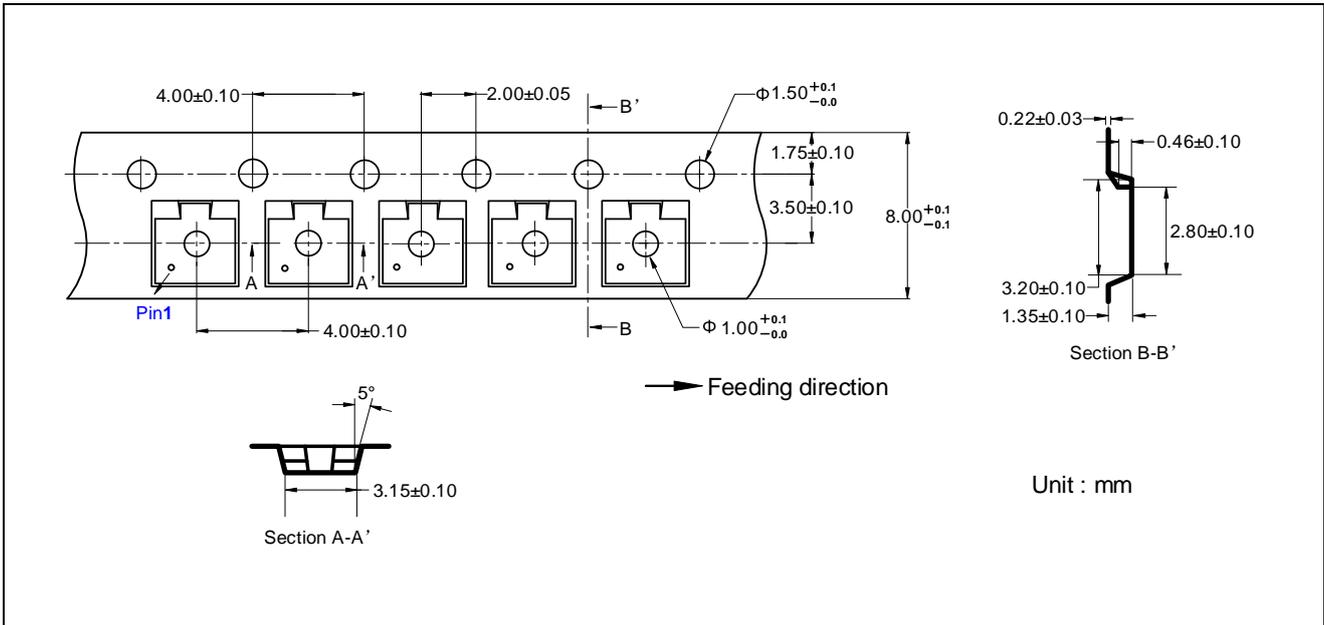


COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

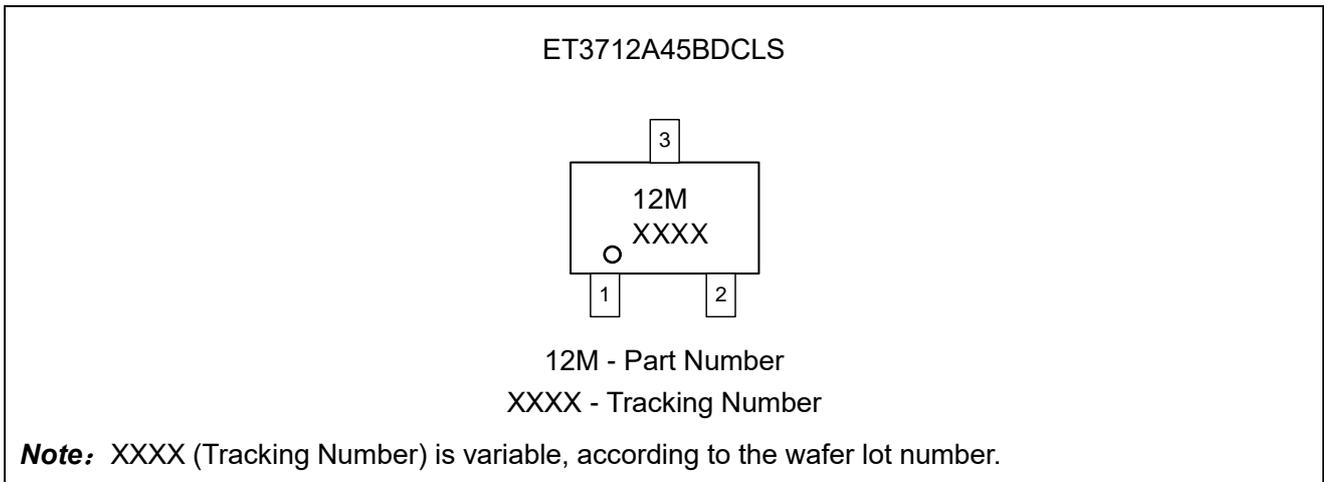
SYMBOL	MIN	NOM	MAX
A	-	-	1.25
A1	0.03	0.08	0.15
A2	1.05	1.10	1.15
A3	0.60	0.65	0.70
b	0.27	-	0.35
b1	0.26	0.285	0.31
c	0.135	-	0.23
c1	0.127	0.152	0.178
D	2.82	2.92	3.02
E	2.60	2.90	3.00
E1	1.60 BSC		
e	1.90 BSC		
L	0.35	0.45	0.55
L1	0.49	0.64	0.79
L2	0.25 BSC		

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## Tape Information



## Marking



## Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2020.9.23	Preliminary Version	Chenh	Wanggp	Zhuji
1.1	2023.1.4	Data Sheet Update	Shibo	Wanggp	Zhuji
1.2	2026.1.8	Add Tape&Marking information	Zhangy	Wanggp	Liuji