

## High Sensitivity Micropower Unipolar Hall-effect Switch

### Features

- High sensitive unipolar operation
- Micropower operation Typ 0.8 $\mu$ A  
(average :  $V_{DD}=1.8V$ )
- Ultra small package:  
WBDFN 1.0mm $\times$ 1.0mm-4L
- On board voltage regulator for 1.6V to 5.5V range
- Wide operating temperature range:  
-40 $^{\circ}$ C to 85 $^{\circ}$ C

### Applications

- Smartphone.
- Notebook computer.
- Handheld gaming consoles.
- Bluetooth headset.
- DV.
- Contact-less switch, Level, proximity and position switches in consumer products.

### General Description

AW86513EDCCDNR is a high-sensitivity micropower unipolar Hall effect switch IC with internal pull up and pull down capability. AW86513EDCCDNR uses a hibernating clocking system to reduce power consumption, which the total power consumption in normal operation is typically 0.8 $\mu$ A with a 1.8V power source. Mainly designed for portable devices such as laptop computer, smartphone and bluetooth headset etc. The supply range of AW86513EDCCDNR is 1.6V to 5.5V to support portable equipment.

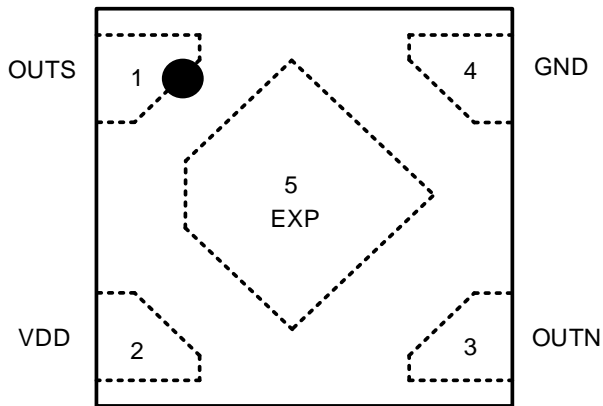
The OUTN is activity with a north pole of sufficient magnetic field strength. When the magnetic flux density perpendicular to the package is large than operate point(BopN) , the output will be turned on (pulled low) and held until B is lower than release point (BrpN). The OUTS is activity with a south pole of sufficient magnetic field strength. When the magnetic flux density perpendicular to the package is large than operate point(BopS) , the output will be turned on (pulled low) and held until B is lower than release point (BrpS).

### Typical Application Circuit

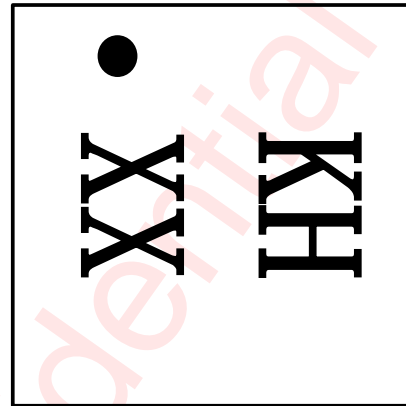


## Pin Configuration And Top Mark

AW86513EDCCDNR  
(Top View)



AW86513EDCCDNR Marking  
(Top View)

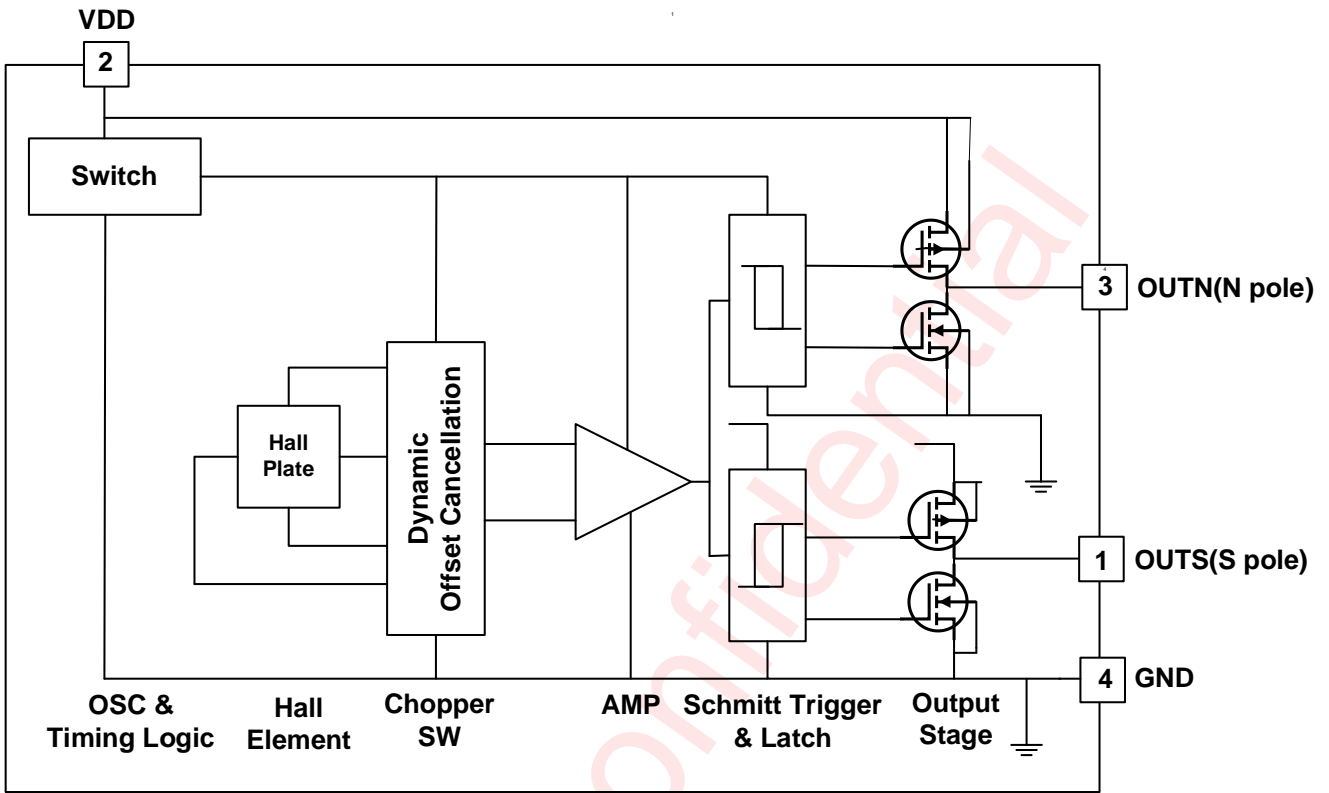


KH – AW86513EDCCDNR  
XX – Production Tracing Code

## Pin Definition

NO.	Name	Description
1	OUTS	S pole detection output
2	VDD	Power Supply
3	OUTN	N pole detection output
4	GND	Ground
5	EXP	Not Connect

### Functional Block Diagram



### Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW86513EDCCDNR	-40°C~85°C	WBDFN 1.0mm×1.0mm-4L	KH	MSL1	RoHS+HF	4500 units/ Tape and Reel

**Absolute Maximum Ratings** (NOTE1)

PARAMETERS	RANGE
Supply Voltage	-0.3V to 6V
Supply Current	4mA
Output Voltage	-0.4V to $V_{DD}+0.4V$
Output Current	4mA
Operating Ambient Temperature $T_A$	-40°C to 85°C
Storage Temperature $T_{STG}$	-65°C to 150°C
Junction temperature $T_J$	-50°C to 165°C
Magnetic Flux	No limit
Lead temperature (soldering 10 seconds)	260°C
ESD Rating(NOTE2 3)	
Human Body Model (HMB) ESD capability	±6kV
Charged-device model (CDM) ESD capability	±1.5kV
Latch-up	
Test Condition: JESD78E	+IT: 200mA
	-IT: 200mA

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: The human body model test method: ESDA/JEDEC JS -001-2017.

NOTE3: Charge Device Model test method: ESDA/JEDEC JS-002-2018.

## Electrical Characteristics

VDD = 3.3V, T<sub>A</sub> = -40°C to 85°C for typical values (unless otherwise noted)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V <sub>DD</sub>	Supply Voltage	Operating, T <sub>J</sub> < 165°C	1.6	-	5.5	V
I <sub>DD</sub> (awake) <sup>(Note1)</sup>	Supply Current	During awake period, T <sub>A</sub> = 25°C, VDD=3.3V	-	0.95	2.5	mA
I <sub>DD</sub> (sleep)		During sleep period, T <sub>A</sub> = 25°C, VDD=3.3V	-	0.43	2.4	μA
I <sub>DD</sub> (avg) <sup>(Note1)</sup>	Average supply current	T <sub>A</sub> = 25°C, VDD=1.8V, f <sub>S</sub> =20Hz	-	0.8	-	μA
		T <sub>A</sub> = 25°C, VDD=3.3V, f <sub>S</sub> =20Hz	-	-	4.2	μA
V <sub>OL</sub>	Output low voltage(on)	I <sub>O</sub> UT = 1 mA	-	0.1	0.2	V
V <sub>OH</sub>	Output high voltage(off)	I <sub>O</sub> UT = -1mA	VDD-0.2	VDD-0.1	-	V
T <sub>awake</sub> <sup>(Note1)</sup>	Awake time	(Note)	-	40	60	μs
T <sub>period</sub>	Period	f <sub>S</sub> =20Hz(sampling rate)	-	50	75	ms
D.C.	Duty cycle	-	-	0.08	-	%
f <sub>C</sub>	Chopping Frequency	-	-	500	-	kHz
I <sub>OFF</sub> <sup>(Note1)</sup>	Output Leakage Current	V <sub>OUT</sub> = 5.5 V; Switch state=off	-	-	0.1	μA

Note: Maximum and minimum parameters values over operating temperature range are not tested in production. They are guaranteed by design, characterization and process control. The magnetic field strength (Gauss) required to cause the switch to change state (operate and release) will be as specified in the magnetic characteristics. To test the switch against the specified magnetic characteristics, the switch must be placed in a uniform magnetic field.

Note1: Minimum and/or maximum limit is guaranteed by design and by statistical analysis of device characterization data. The specification is not guaranteed by production testing.

## Magnetic Characteristics

$T_A=25^{\circ}\text{C}$ ,  $V_{DD}=3.3\text{V}$  for typical values (unless otherwise noted)

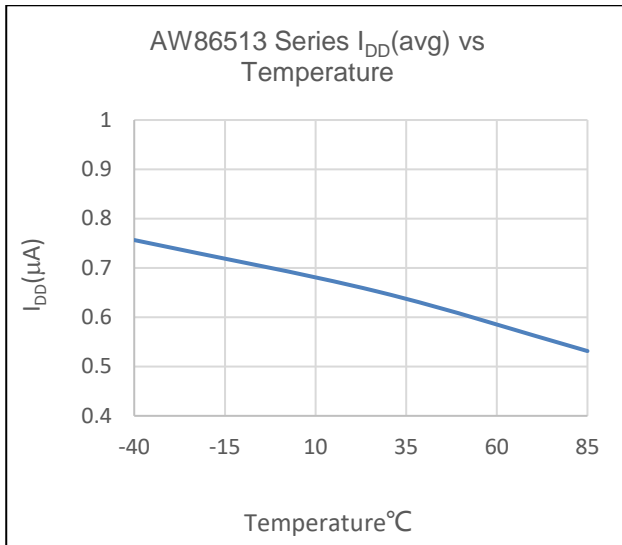
(1mT = 10Gauss)

Symbol	Characteristics	Test condition	Min	Typ	Max	Unit
Bops (south pole to part marking side)	Operation Point	$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	25	37	47	Gauss
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	23	37	50	
Bopn (north pole to part marking side)		$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	-47	-37	-25	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-50	-37	-23	
Brps (south pole to part marking side)	Release Point	$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	17	27	37	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	15	27	39	
Brpn (north pole to part marking side)		$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	-37	-27	-17	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-39	-27	-15	
Bhy ( Bopx - Brpx )	Hysteresis	$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-	10	-	

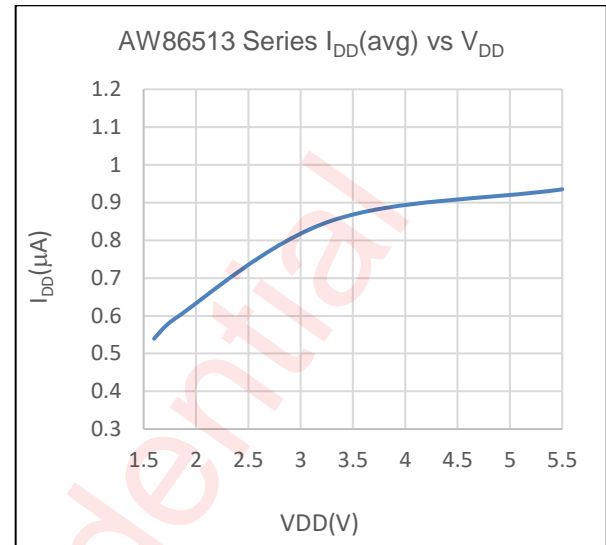
Notes: Typical data is at  $T_A=25^{\circ}\text{C}$ ,  $V_{DD}=3.3\text{V}$ .

Maximum and minimum parameters values over operating temperature range are not tested in production. They are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

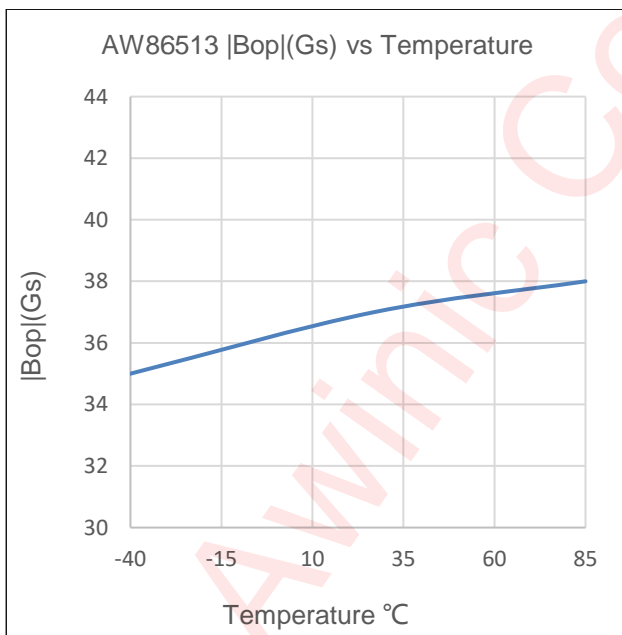
## Typical Characteristics



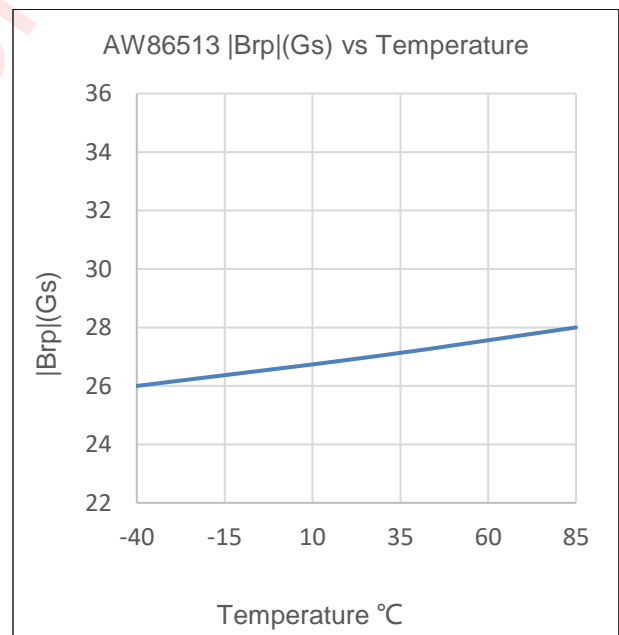
Ambient Temperature  $T_a$ [°C]  $I_{DD}$  vs.  $T_a$   
 $V_{DD}=1.8\text{V}$



Average Supply Current vs. Supply Voltage  
 $T_a=25^\circ\text{C}$



Ambient Temperature  $T_a$ [°C]  $|Bop|$  vs.  $T_a$   
 $V_{DD}=3.3\text{V}$

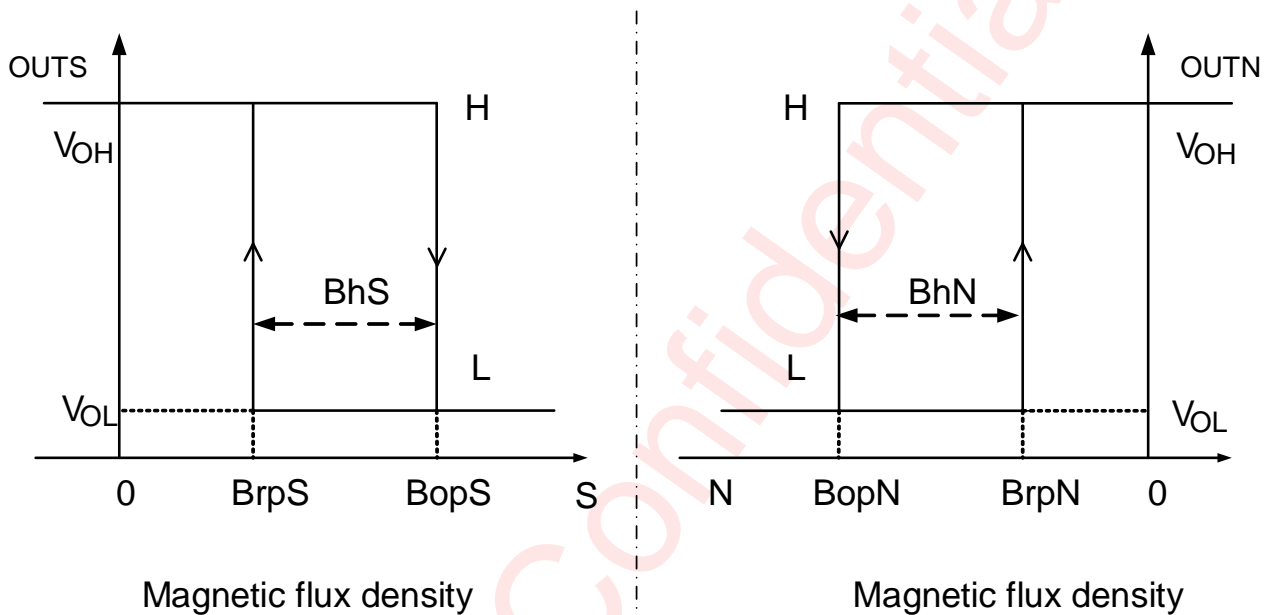


Ambient Temperature  $T_a$ [°C]  $|Brp|$  vs.  $T_a$   
 $V_{DD}=3.3\text{V}$

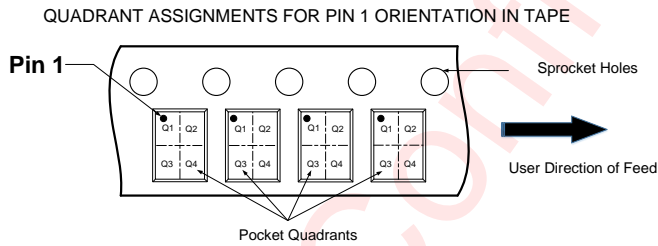
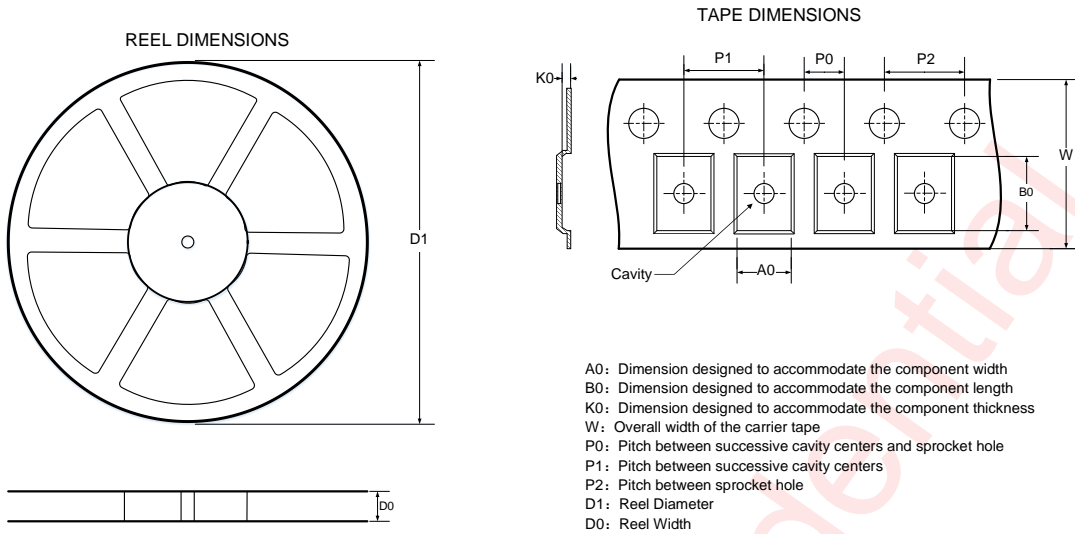
## Detailed Functional Description

### Magnetic Response

The OUTN is activity with a north pole of sufficient magnetic field strength. When the magnetic flux density perpendicular to the package is larger than operate point ( $B_{opN}$ ), the output will be turned on (pulled low) and held until  $B$  is lower than release point ( $B_{rpN}$ ). The OUTS is activity with a south pole of sufficient magnetic field strength. When the magnetic flux density perpendicular to the package is larger than operate point ( $B_{opS}$ ), the output will be turned on (pulled low) and held until  $B$  is lower than release point ( $B_{rpS}$ ).



## Tape And Reel Information



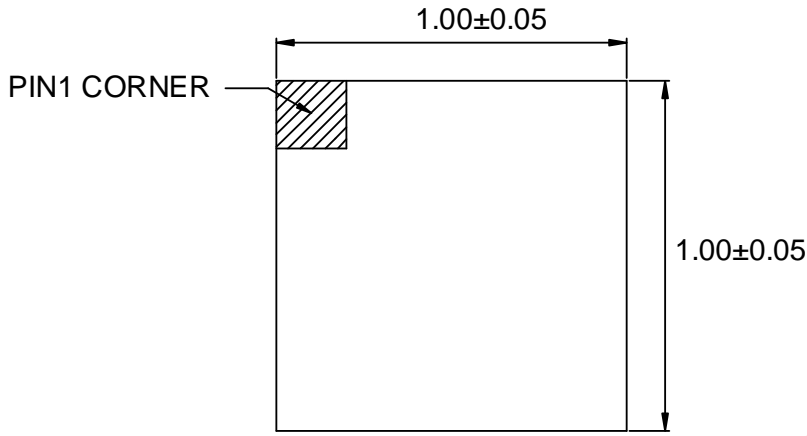
Note: The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

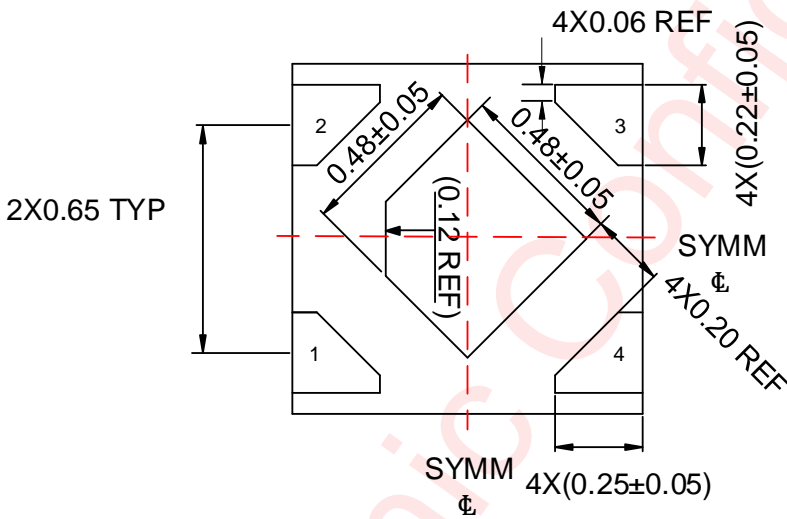
D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	1.14	1.17	0.56	2	4	4	8	Q1

All dimensions are nominal

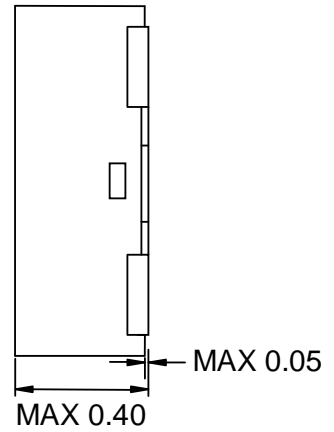
Package Description



Top View



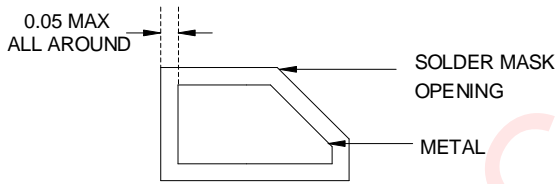
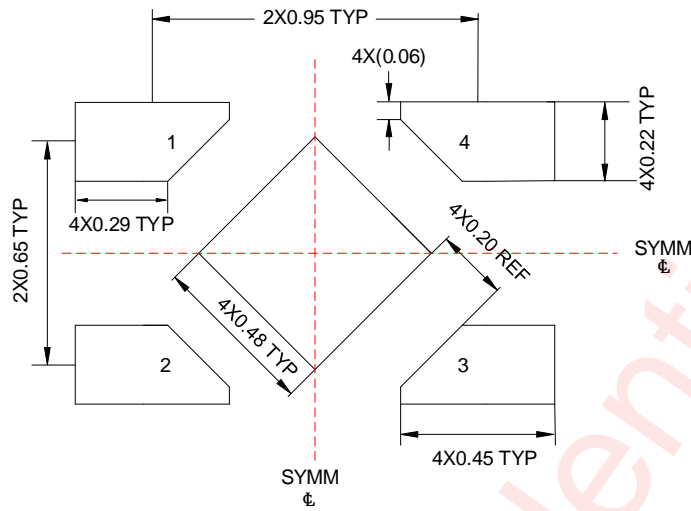
Bottom View



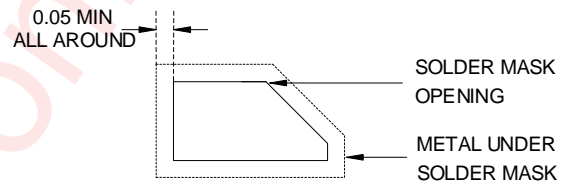
Side View

Unit:mm

Land Pattern Data



NON SOLDER MASK DEFINED



SOLDER MASK DEFINED

UNIT : mm

## Revision History

Version	Date	Change Record
V1.0	Oct. 2024	Officially released

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