

High Sensitivity Micropower Unipolar Hall-effect Switch

Features

- High sensitive unipolar operation
- Micropower operation Typ 0.8 μ A
(average : $V_{DD}=1.8V$)
- Ultra small package:
WBDFN 1.4mm \times 1.1mm-4L
- On board voltage regulator for 1.6V to 5.5V range
- Wide operating temperature range:
-40 $^{\circ}$ C to 85 $^{\circ}$ C

Applications

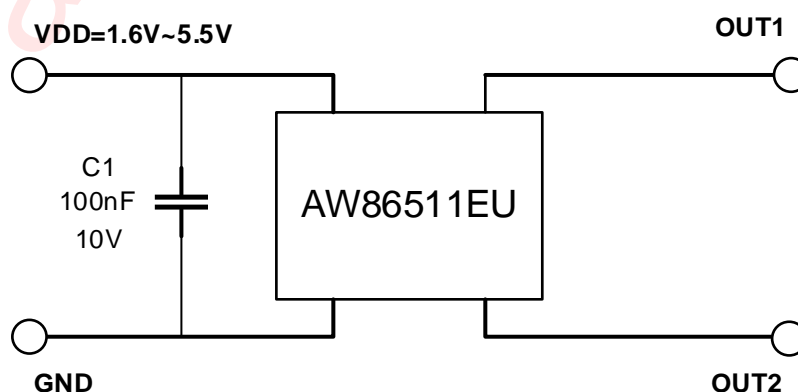
- Smartphone.
- Notebook computer.
- Handheld gaming consoles.
- Bluetooth headset.
- DV.
- Contact-less switch, Level, proximity and position switches in consumer products.

General Description

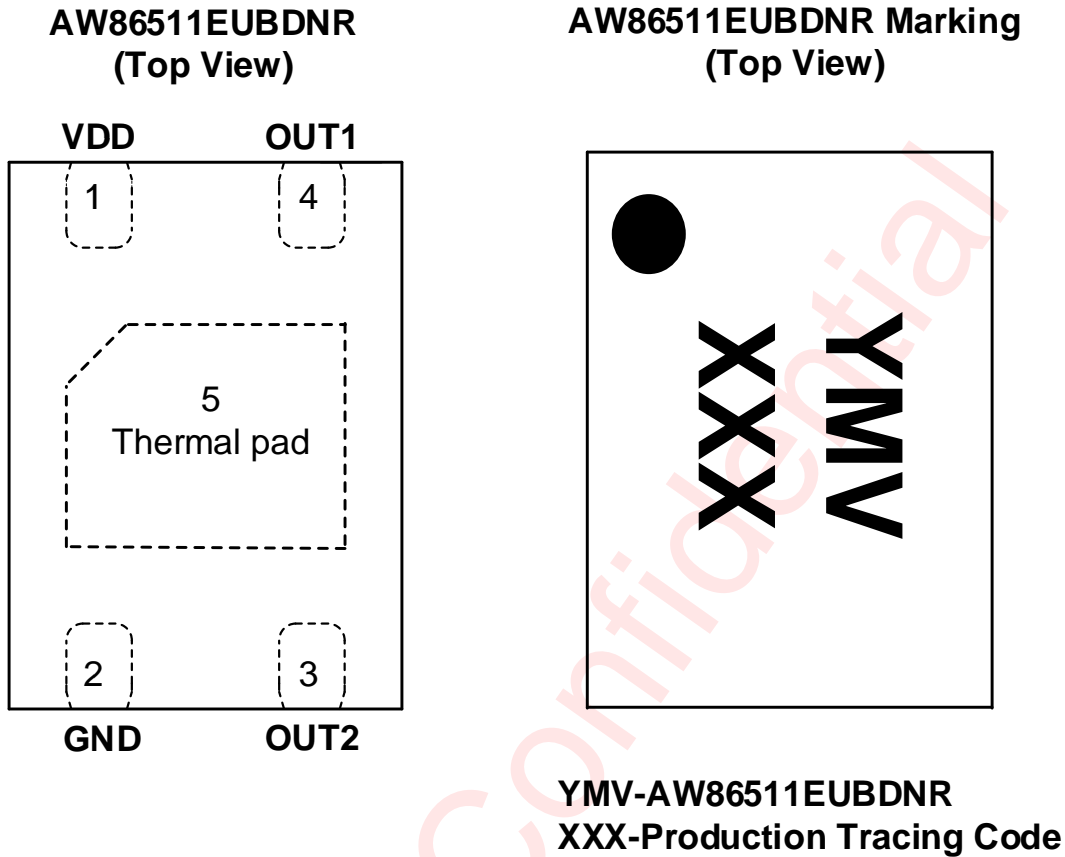
AW86511EUBDNR is a high-sensitivity micropower unipolar Hall effect switch IC with internal pull up and pull down capability. AW86511EUBDNR uses a hibernating clocking system to reduce power consumption, which the total power consumption in normal operation is typically 0.8 μ A with a 1.8V power source. Mainly designed for portable devices such as laptop computer, smartphone and bluetooth headset etc. The supply range of AW86511EUBDNR is 1.6V to 5.5V to support portable equipment.

The OUT1 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 down) and hold until B is lower than release point (BrpN). The OUT2 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



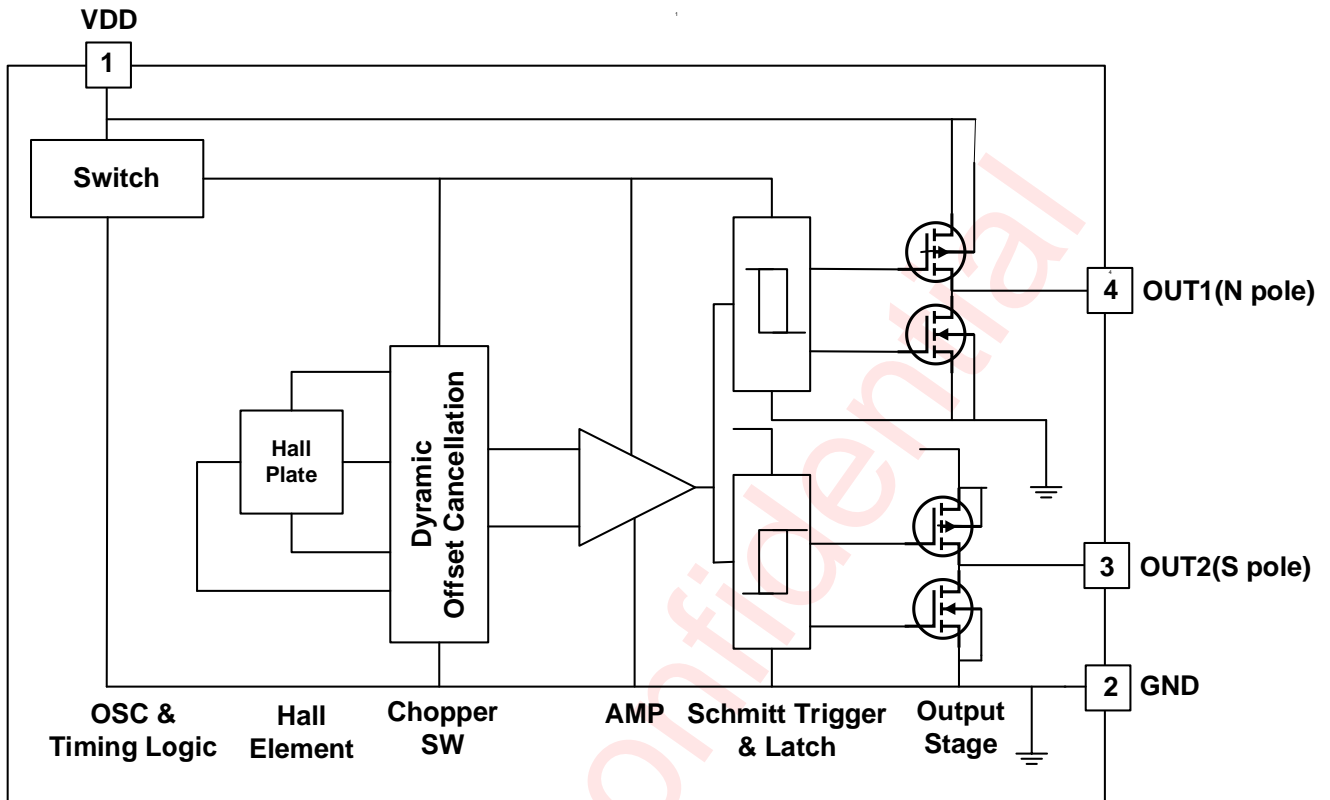
Pin Configuration And Top Mark



Pin Definition

NO.	Name	Description
1	VDD	Power Supply
2	GND	Ground
3	OUT2	S pole detection output
4	OUT1	N pole detection output
5	Thermal pad	Not Connect

Functional Block Diagram



Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW86511EUBDNR	-40°C~85°C	WBDFN 1.4mm×1.1mm -4L	YMV	MSL1	ROHS+HF	4500 units/ Tape and Reel

Absolute Maximum Ratings (NOTE1)

PARAMETERS	RANGE
Supply Voltage	6V
V _{DD} Reverse Voltage V _{DD}	-0.3V
Supply Current	3mA
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_A = -40°C to 85°C for typical values (unless otherwise noted)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{DD}	Supply Voltage	Operating, T _J < 165°C	1.6	-	5.5	V
I _{DD} (awake)	Supply Current	During awake period, T _A = 25°C, VDD=3.3V	-	0.95	1.3	mA
I _{DD} (sleep)		During sleep period, T _A = 25°C, VDD=3.3V	-	0.43	0.7	μA
I _{DD} (avg)	Average supply current	T _A = 25°C, VDD=1.8V, f _S =20Hz	-	0.8	-	μA
		T _A = 25°C, VDD=3.3V, f _S =20Hz	-	-	1.7	μA
V _{OL}	Output low voltage(on)	I _O UT = 1 mA	-	0.1	0.2	V
V _{OH}	Output high voltage(off)	I _O UT = -1mA	VDD-0.2	VDD-0.1	-	V
T _{ON}	Power on time (see Figure 1)			50	100	μs
T _{awake}	Awake time (see Figure 1)	(Note)	-	40	60	μs
T _{period}	Period (see Figure 1)	f _S =20Hz(sampling rate)		50	75	ms
D.C.	Duty cycle	-	-	0.08	-	%
f _C	Chopping Frequency	-	-	500	-	kHz
I _{OFF}	Output Leakage Current	V _{OUT} = 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.

Magnetic Characteristics

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

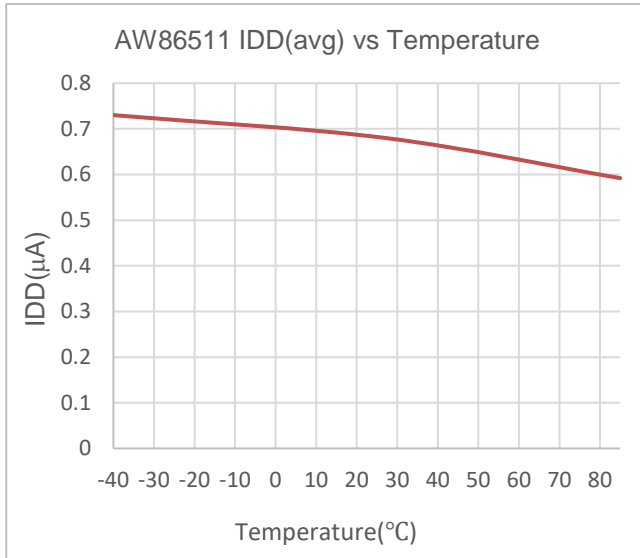
(1mT = 10Gauss)

Symbol	Characteristics	Test condition	Min	Typ	Max	Unit
Bops (south pole to part marking side)	Operation Point	$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	14	25	32	Gauss
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	13	25	39	
Bopn (north pole to part marking side)		$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	-32	-25	-14	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-39	-25	-13	
Brps (south pole to part marking side)	Release Point	$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	12	18	30	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	9	18	35	
Brpn (north pole to part marking side)		$T_A = 25^{\circ}\text{C}, V_{DD}=3.3\text{V}$	-30	-18	-12	
		$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-35	-18	-9	
Bhy ($ B_{opx} - B_{rpx} $)	Hysteresis	$T_A = -40^{\circ}\text{C to } 85^{\circ}\text{C}$ $V_{DD} = 1.6\text{V}\sim 5.5\text{V}$	-	7	-	

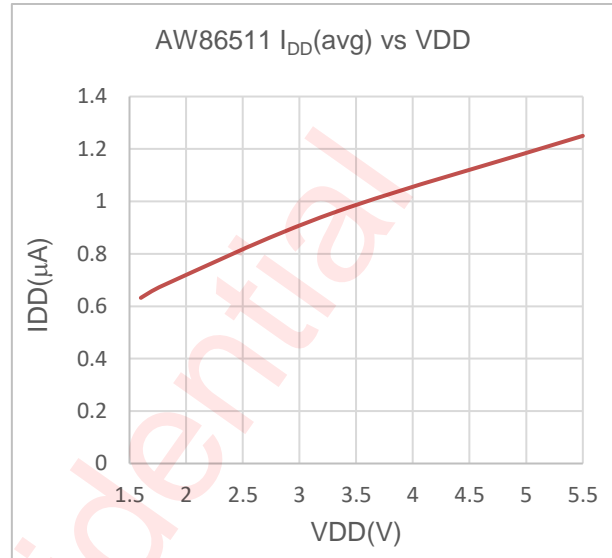
Notes: Typical data is at $T_A=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$.

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.

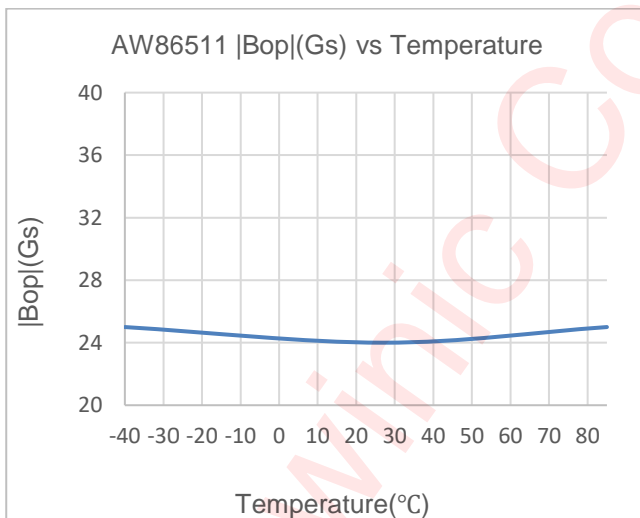
Typical Characteristics



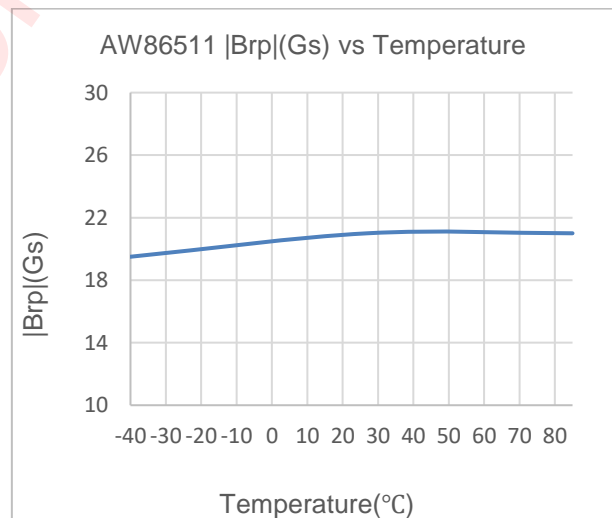
Ambient Temperature T_a [°C] I_{DD} vs. T_a
VDD=1.8V



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



Ambient Temperature T_a [°C] $|B_{op}|$ vs. T_a
VDD=3.3V

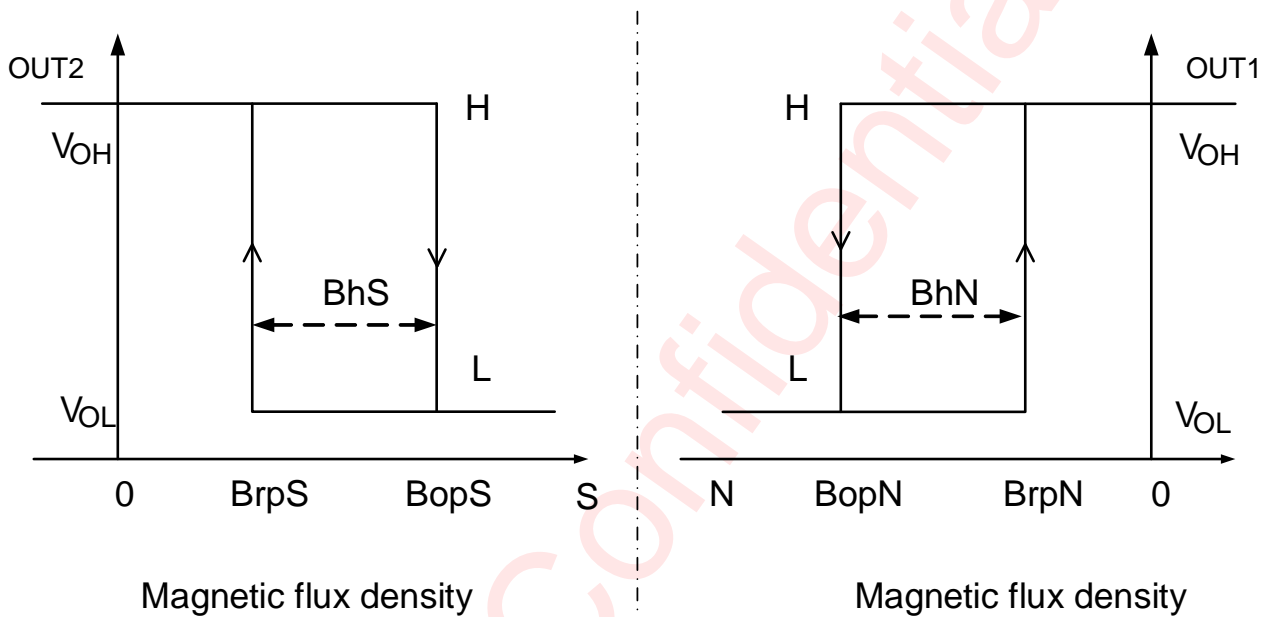


Ambient Temperature T_a [°C] $|B_{rp}|$ vs. T_a
VDD=3.3V

Detailed Functional Description

Magnetic Response

The output1 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 output2 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}).



Sampling Rate

When the AW86511EUBDNR device powers up, it measures the first magnetic sample and sets the output within the t_{ON} time. The output is latched, and the device enters an ultra-low-power sleep state. After each t_{SLEEP} time, the device measures a new sample and updates the output, if necessary. If the magnetic field does not change between periods, the output does not change.

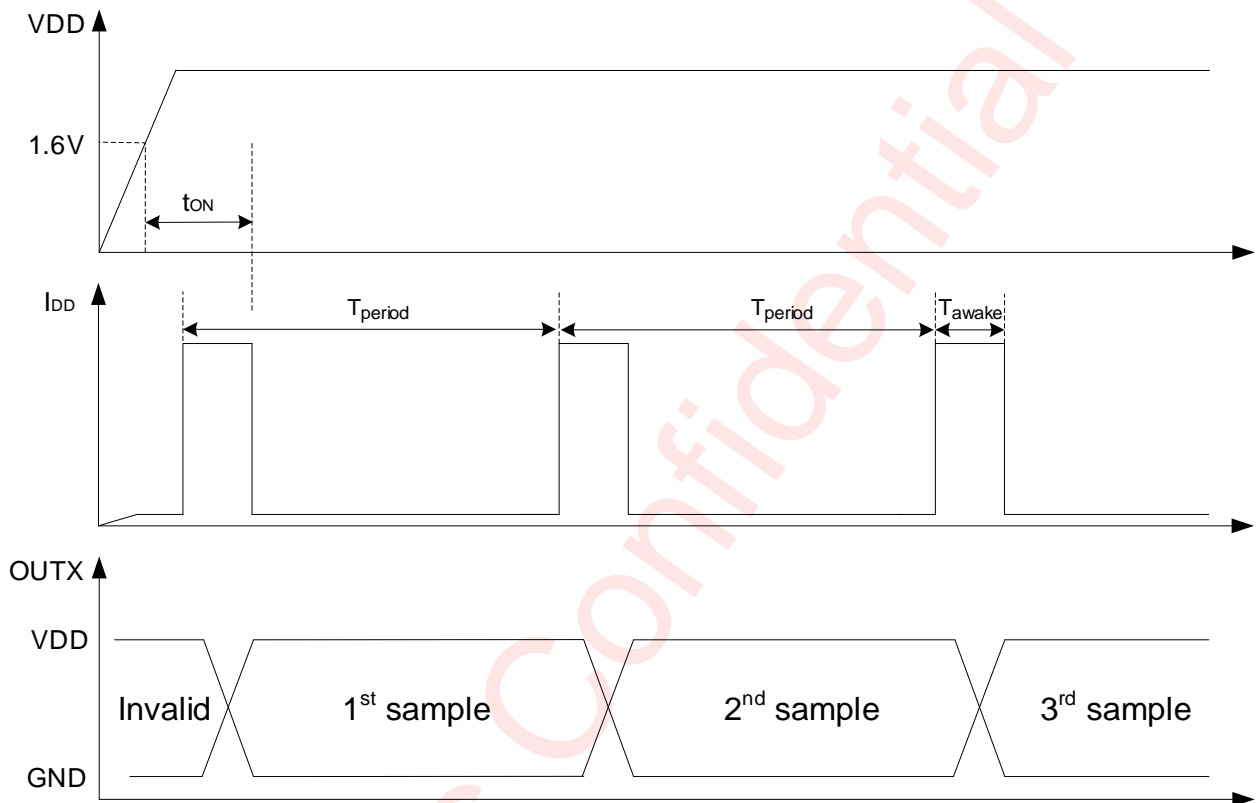
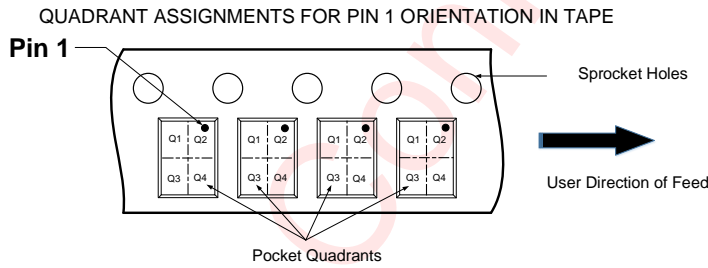
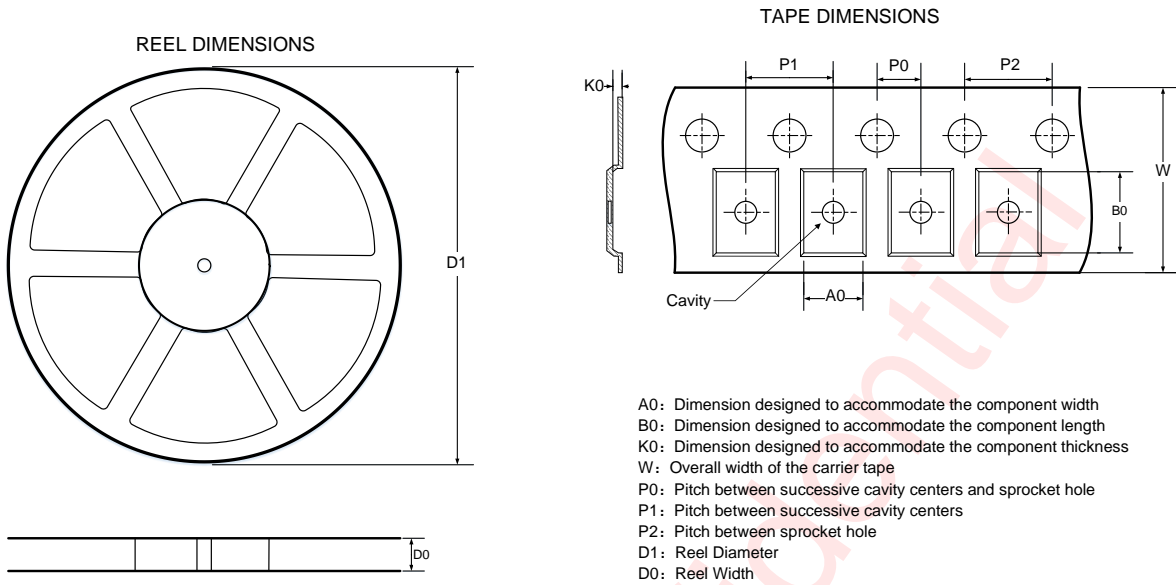


Figure 1 Timing Diagram

Tape And Reel Information



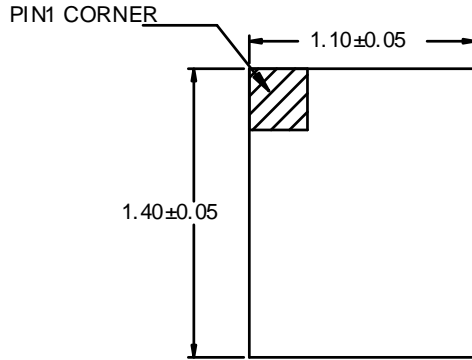
Note: The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

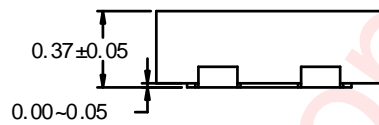
D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	1.6	1.3	0.5	2	4	4	8	Q2

All dimensions are nominal

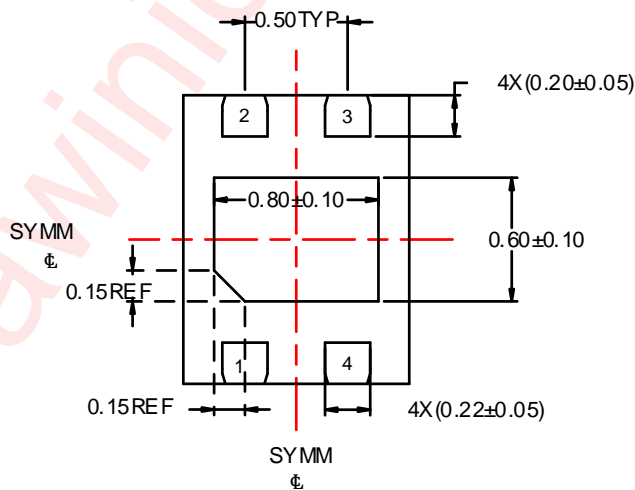
Package Description



Top View



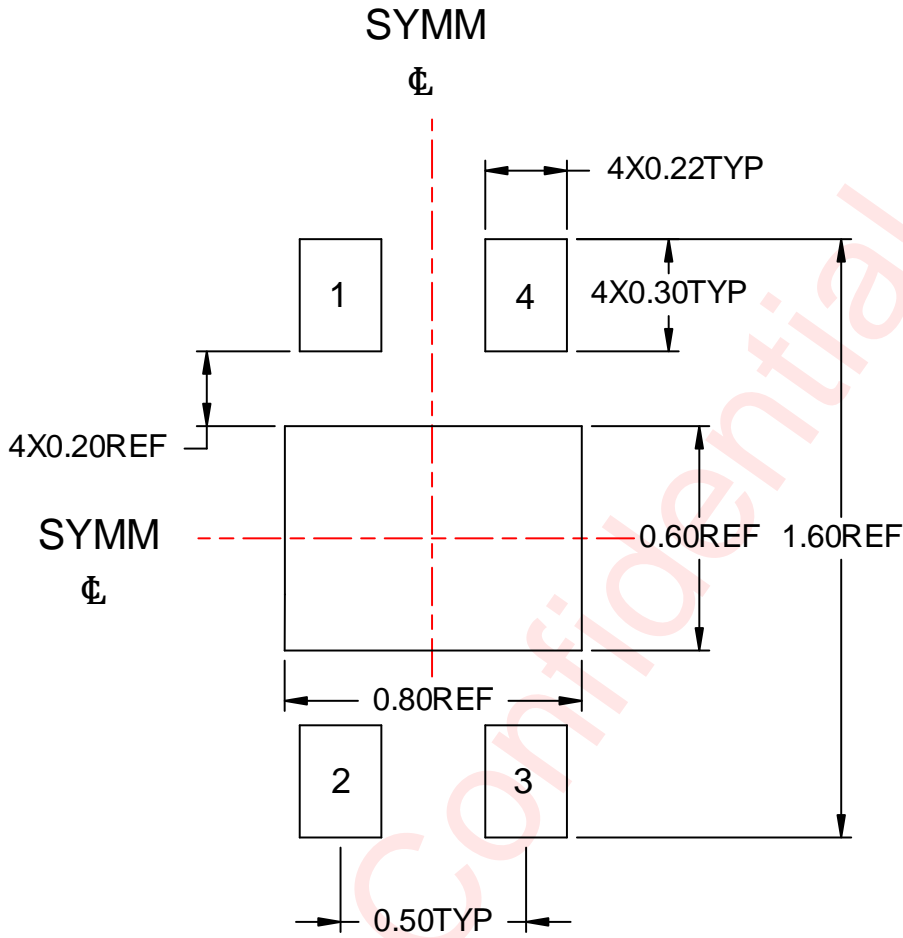
Side View



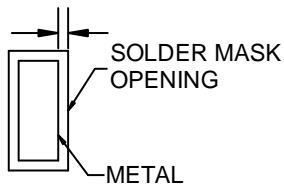
Bottom View

Unit: mm

Land Pattern Data

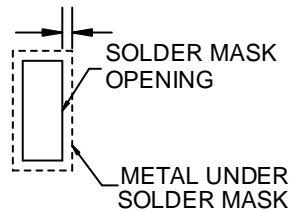


0.05 MAX
All AROUND



NON SOLDER MASK DEFINED

0.05 MIN
All AROUND



SOLDER MASK DEFINED

Unit: mm

Revision History

Version	Date	Change Record
V1.0	Jul. 2023	Officially released
V1.1	Feb. 2024	Add T _{ON} and Sampling Rate

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