High Sensitivity Micropower Unipolar Hall-effect Switch

Features

- High sensitive unipolar operation.
- Micropower operation.
  Typ 0.45μA (average: V_{DD}=1.8V).
- Ultra small package: SOT553-5L.
- On board voltage regulator for
  1.6V to 5.5V range.
- Wide operating temperature range:
  -40°C to 85°C.

Applications

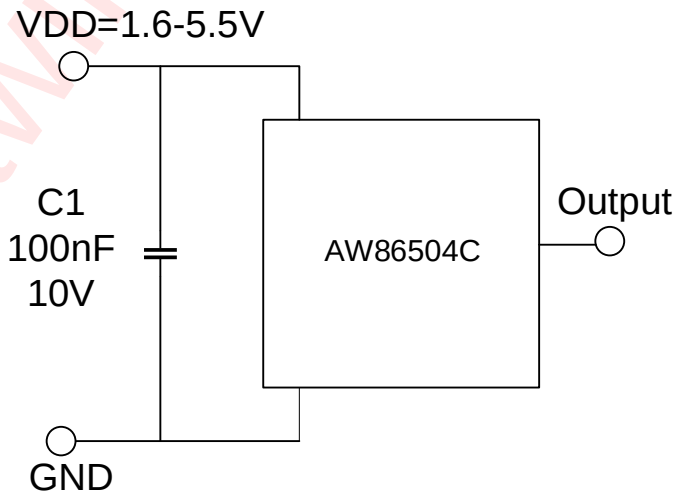
- Smartphone.
- Notebook computer.
- Handheld gaming consoles.
- Bluetooth headset.
- DV.
- Contact-less switch, Level, proximity and position switches in consumer products.

General Description

AW86504C is a high-sensitivity micropower Unipolar Hall effect switch IC with internal pull up and pull down capability. AW86504C uses a hibernating clocking system to reduce power consumption, which the total power consumption in normal operation is typically 0.45μA with a 1.8V power source. Mainly designed for portable devices such as laptop computer, smartphone and bluetooth headset etc. The supply range of AW86504C is 1.6V to 5.5V to support portable equipment. To minimize PCB space, the AW86504C has ultra small package: SOT553-5L.

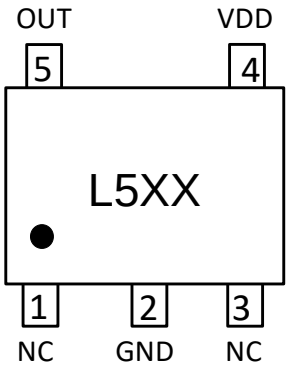
When the N pole magnetic field strength is greater than BopN, then the device output is pulled low; When the N pole magnetic field strength is less than BrpN, then the device output is pulled high; When the N pole magnetic field strength is between BopN and BrpN, then the device output remains in the previous state. The S pole magnetic field does not affect the device output.

Typical Application Circuit



Pin Configuration And Top Mark

AW86504CSTR Marking
(Top View)

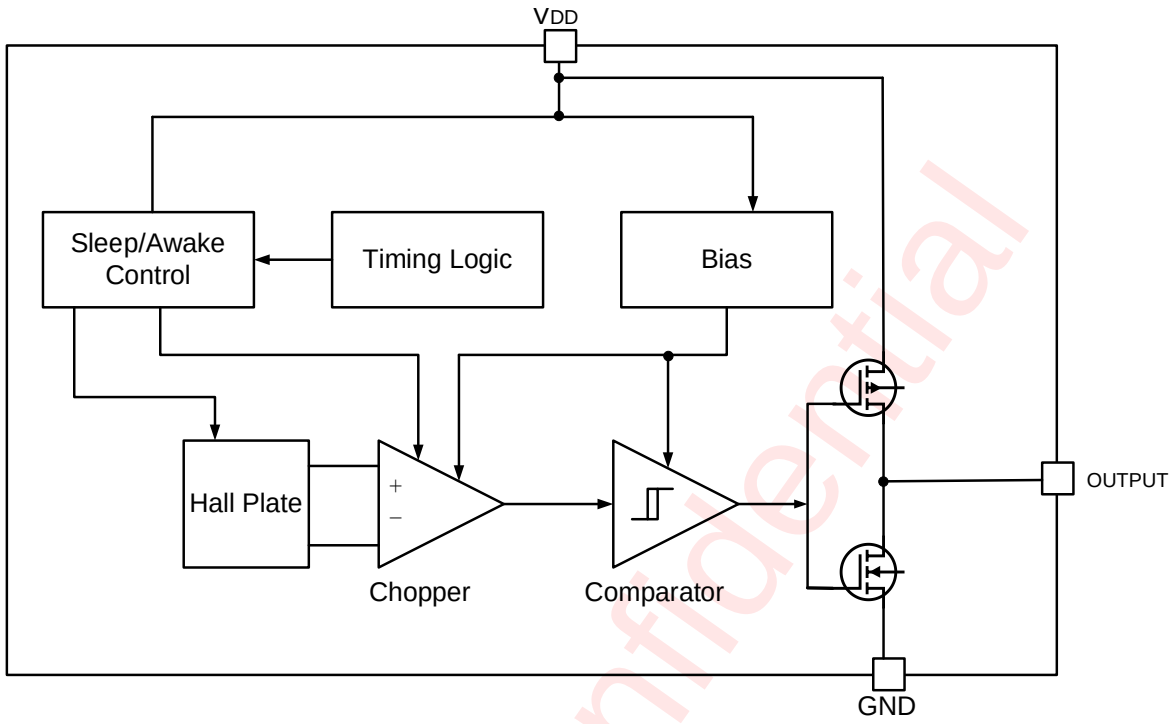


L5 – AW86504CSTR
XX – Production Tracing Code

Pin Definition

NO	Name	Description
1	NC	Not connect
2	GND	Ground
3	NC	Not connect
4	VDD	Power Supply
5	OUT	Output pin

Functional Block Diagram



Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW86504CSTR	-40°C~85°C	SOT553-5L	L5	MSL3	ROHS+HF	3000 units/ Tape and Reel

Detailed Functional Description

When the N pole magnetic field strength is greater than BopN, then the device output is pulled low; When the N pole magnetic field strength is less than BrpN, then the device output is pulled high; When the N pole magnetic field strength is between BopN and BrpN, then the device output remains in the previous state. The S pole magnetic field does not affect the device output.

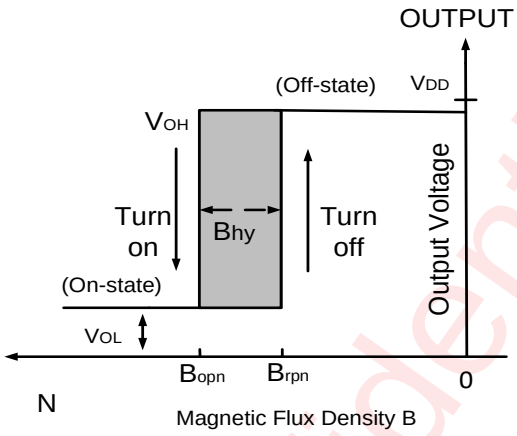


Figure 1 The Working Process of AW86504C

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

Parameters Specification (V_{DD}=3.3V supply, T_A= -40ºC to 85ºC except where otherwise specified.)						
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，V_{DD}=3.3V	-	0.95	1.3	mA
I_{DD}(sleep)	Supply Current	During sleep period, T_A = 25°C，V_{DD}=3.3V	-	0.4	-	μA
I_{DD}(avg)	Average supply current	T_A = 25°C, V_{DD} = 1.8V		0.45		μA
		T_A = 25°C, V_{DD} = 3.3V		0.7		μA
V_{OL}	Output low voltage(on)	I_{OUT} =1 mA	-	0.1	0.2	V
V_{OH}	Output high voltage(off)	I_{OUT} = -1mA	V_{DD}-0.2	V_{DD}-0.1	-	V
T_{awake}	Awake time	(note)	-	40	60	μs
T_{period}	Period	(note)	-	200	280	ms
D.C.	Duty cycle	-	-	0.02	-	%
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.*

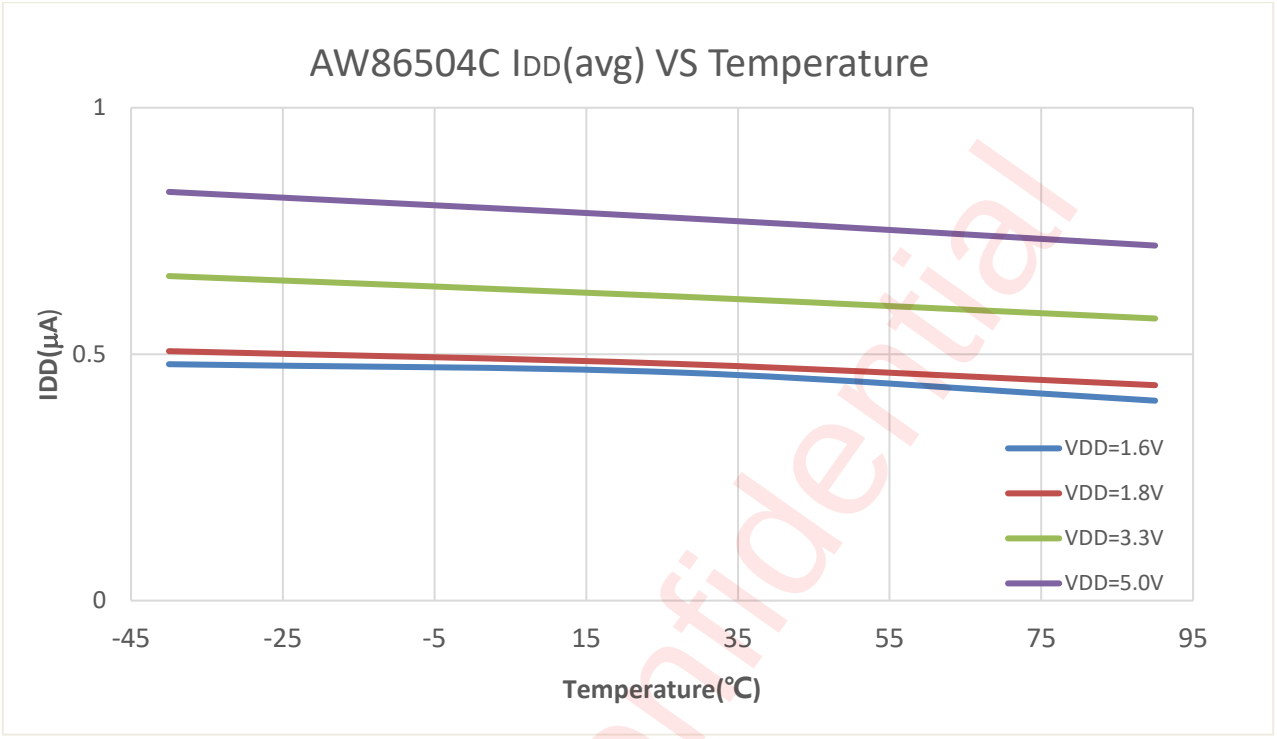
Magnetic Characteristics

Magnetic Characteristics (T_A=+25°C,V_{DD}=3.3V, unless otherwise specified 1 mT=10 Gauss)						
Symbol	Characteristics	Test condition	Min	Typ	Max	Unit
Bopn (north pole to part marking side)	Operation Point		-40	-30	-20	Gauss
		V_{DD}=1.6V to 5.5V, T_A=-40°C to +85°C	-42	-30	-18	
Brpn (north pole to part marking side)	Release Point		-30	-20	-10	
		V_{DD}=1.6V to 5.5V, T_A=-40°C to +85°C	-32	-20	-8	
Bhy (|Bopn|-|Brpn|)	Hysteresis		-	10	-	

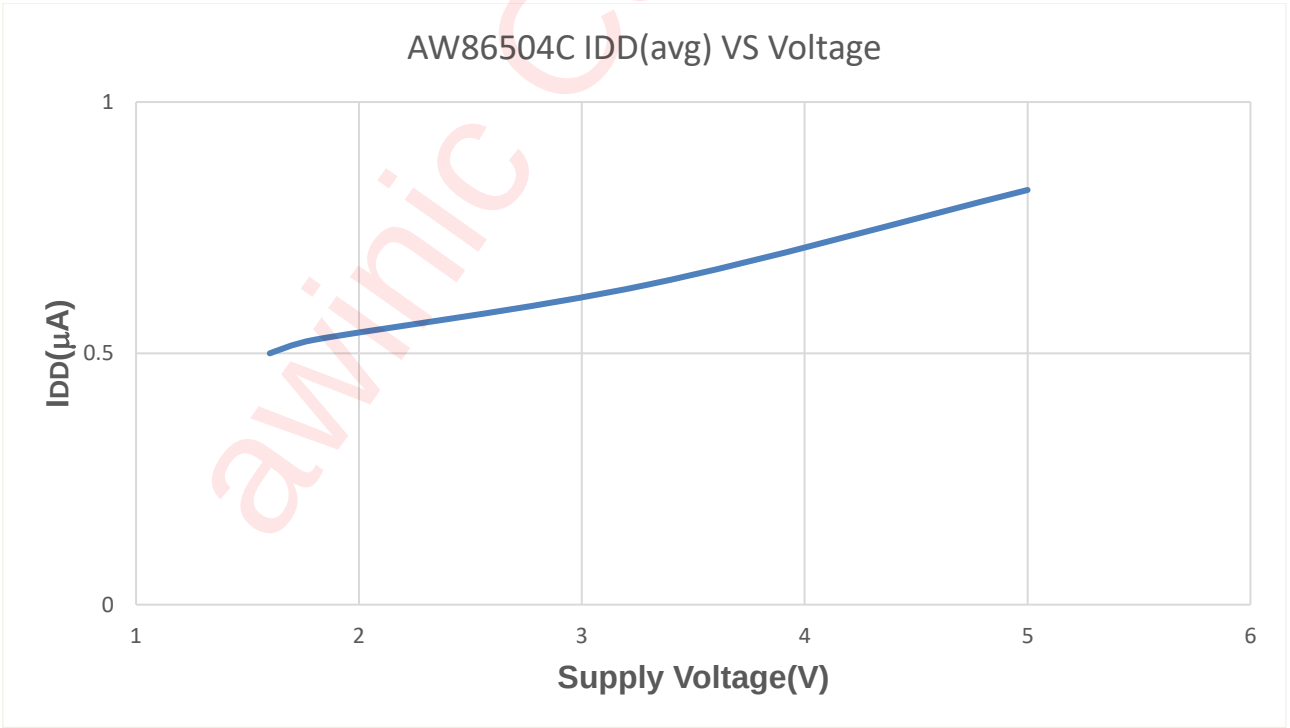
Notes: Typical data is at T_A=+25°C, V_{DD}=3.3V.

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.

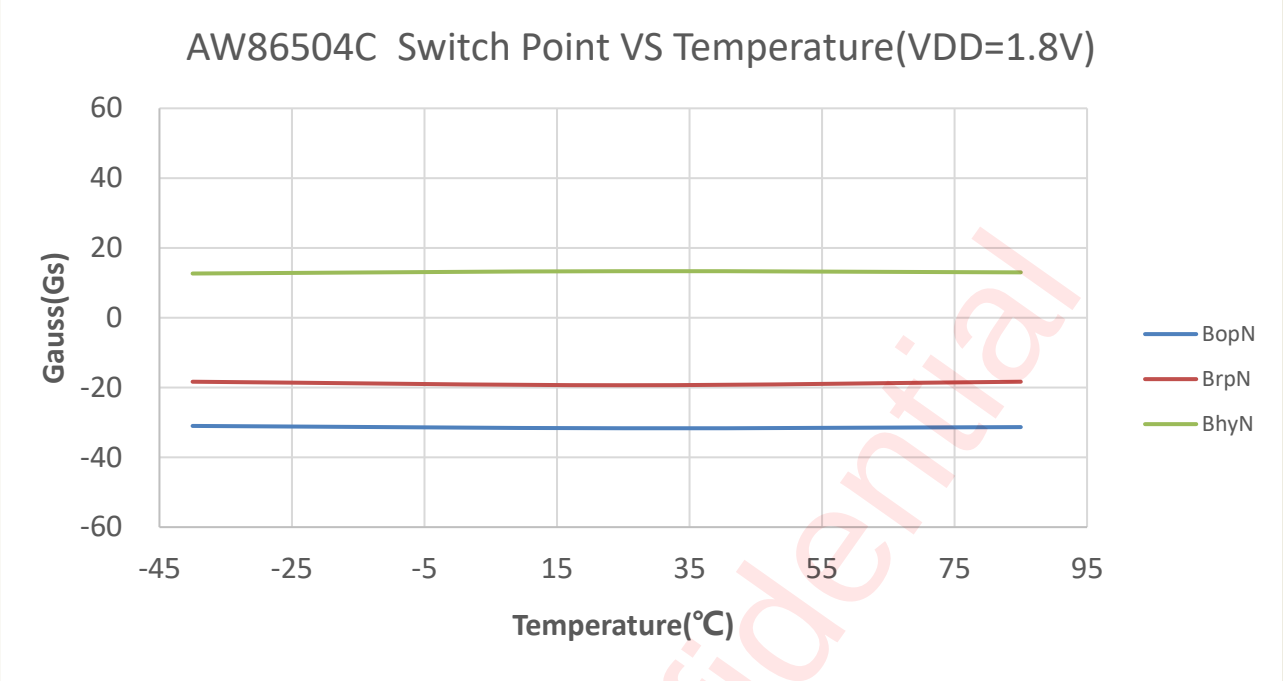
Typical Characteristics



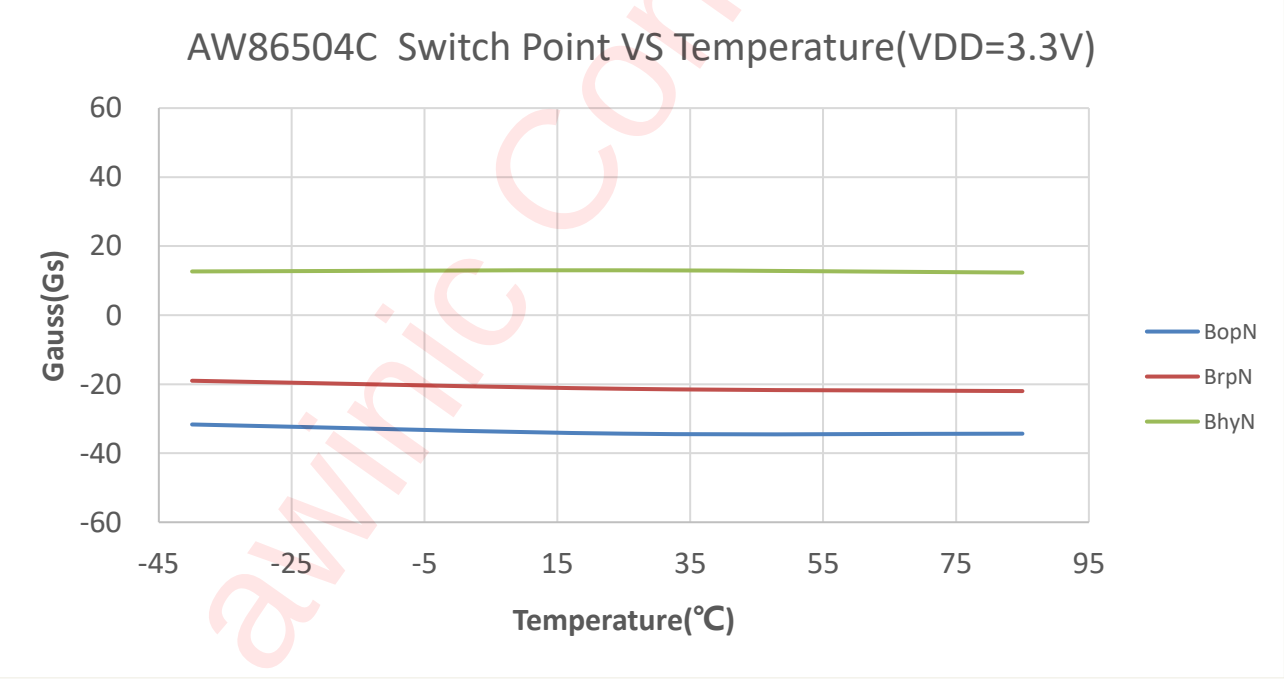
Ambient Temperature Ta[°C]
I_{DD} vs. Ta



Average Supply Current vs. Supply Voltage(Ta=35°C)



Ambient Temperature Ta[°C]
Bop,Brp vs. Ta(V_{DD}=1.8V)



Ambient Temperature Ta[°C]
Bop,Brp vs. Ta(V_{DD}=3.3V)

Figure 2 The Typical Characteristics of AW86504C

Application Information

It is recommended to connect an external capacitor of 0.1μF to V_{DD} and GND. The noise of the injection device can be reduced.

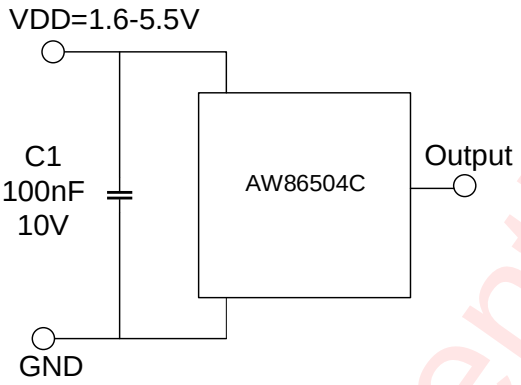
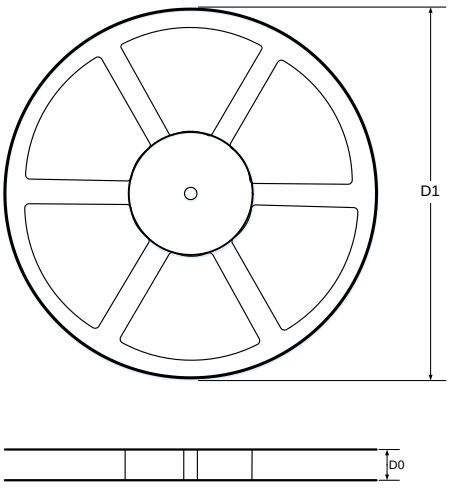


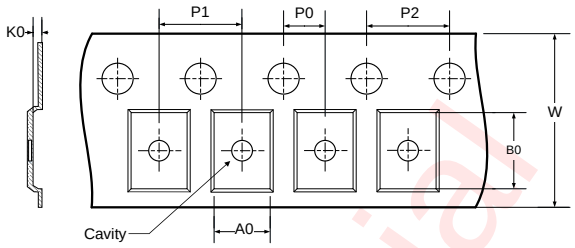
Figure 3 The Application Circuit of AW86504C

Tape And Reel Information

REEL DIMENSIONS

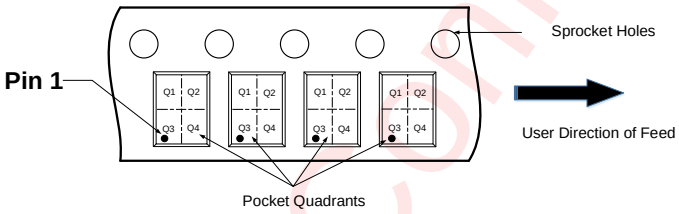


TAPE DIMENSIONS



A0：Dimension designed to accommodate the component width
B0：Dimension designed to accommodate the component length
K0：Dimension designed to accommodate the component thickness
W：Overall width of the carrier tape
P0：Pitch between successive cavity centers and sprocket hole
P1：Pitch between successive cavity centers
P2：Pitch between sprocket hole
D1：Reel Diameter
D0：Reel Width

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



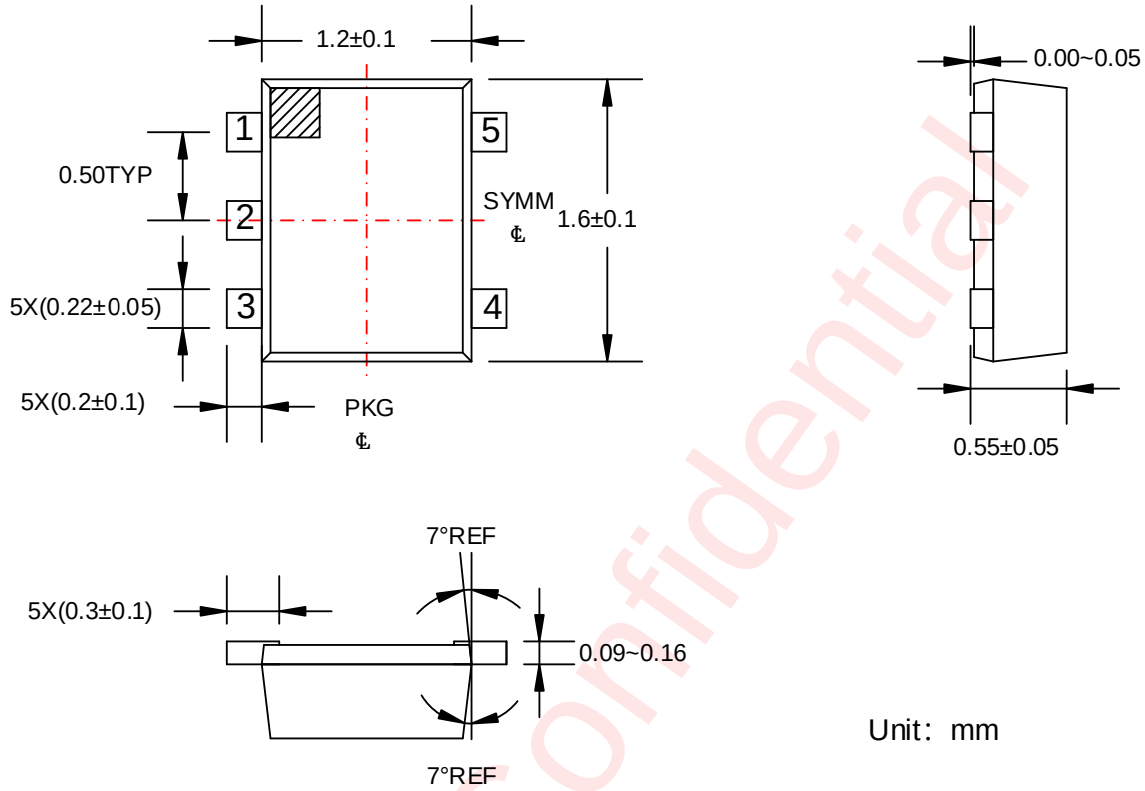
Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

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	9.5	1.78	1.78	0.69	2	4	4	8	Q3

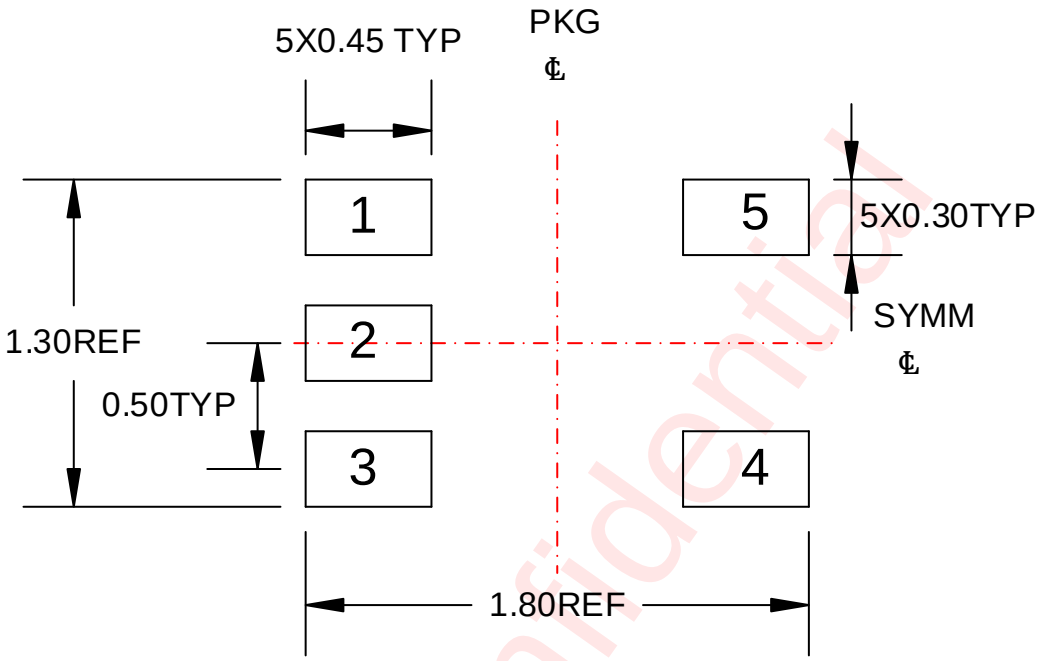
All dimensions are nominal

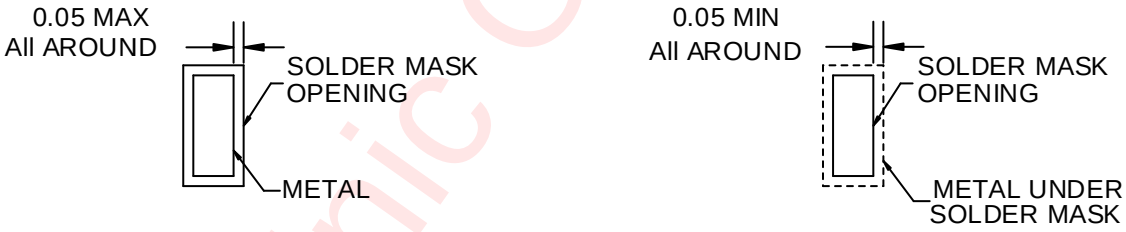
Package Description



Unit：mm

Land Pattern Data





NON SOLDER MASK DEFINED

SOLDER MASK DEFINED

Unit: mm

Revision History

Version	Date	Change Record
V1.0	Apr. 2021	Officially initial version
V1.1	Jul. 2022	The BopN and BrpN value change from positive to negative; Chart temperature changed from -20°C to -40°C
V1.2	Sep. 2023	Change Package Description; Change the ESD value 6kV and 1.5kV to ±6kV and ±1.5kV
V1.3	Oct. 2023	Change Land Pattern Data

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