High Sensitivity Micropower Omnipolar Hall-effect Switch

Features

- High sensitive omnipolar operation.
- Micropower operation.
  Typ 0.8μA (average: V_{DD}=1.8V).
- Ultra small package: SOT23-3L.
- On board voltage regulator for 1.6V to 5.5V range.
- Wide operating temperature range: -40℃ to 85℃.
- ESD (HBM) > 6KV.

Applications

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

General Description

AW86502STR is a high-sensitivity micropower Omnipolar Hall effect switch IC. It has open-drain outputs that can become high impedance or drive ground, and an external pullup resistor must be used. AW86502STR uses a hibernating clocking system to reduce power consumption, which the total power consumption in normal operation is typically 0.8μA with a 1.8V power source. Mainly designed for portable devices such as laptop computer, smartphone and bluetooth headset etc. The supply range of AW86502STR is 1.6V to 5.5V to support portable equipment. To minimize PCB space, the AW86502STR has ultra small package: SOT23-3L .

When the magnetic field strength is greater than Bop, then the device output is pulled low; When the magnetic field strength is less than Brp, then the device output is pulled high; When the magnetic field strength is between Bop and Brp, then the device output remains in the previous state.

Typical Application Circuit

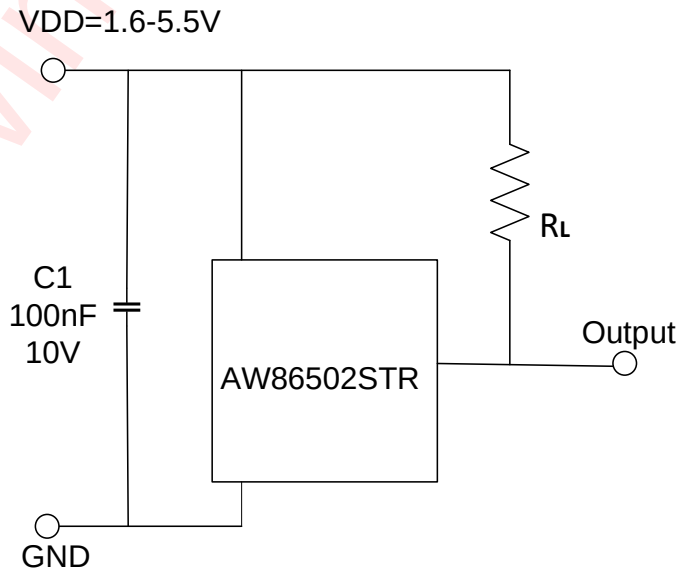


Figure 1 Typical Application Circuit of AW86502STR

Pin Configuration And Top Mark

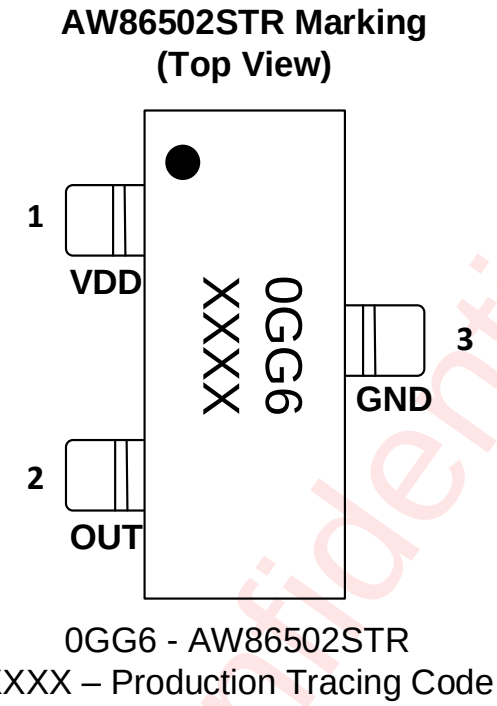


Figure 2 Pin Configuration and Top Mark

Pin Definition

NO	NAME	DESCRIPTION
1	VDD	Power Supply
2	OUT	Output pin
3	GND	Ground

Functional Block Diagram

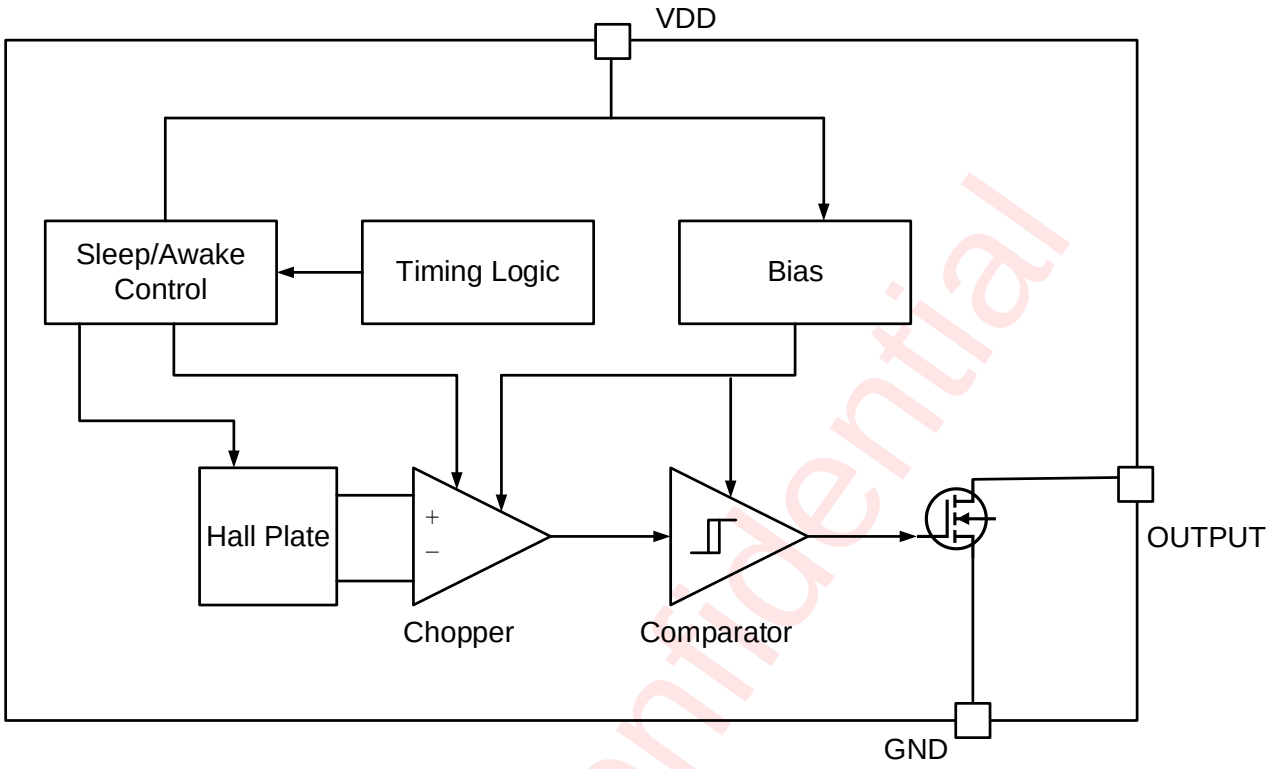


Figure 3 Functional Block Diagram

Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW86502STR	-40℃～85℃	SOT23-3L	0GG6	MSL1	ROHS+HF	3000 units/ Tape and Reel

Detailed Functional Description

When the magnetic field strength is greater than Bop, then the device output is pulled low; When the magnetic field strength is less than Brp, then the device output is pulled high; When the magnetic field strength is between Bop and Brp, then the device output remains in the previous state.

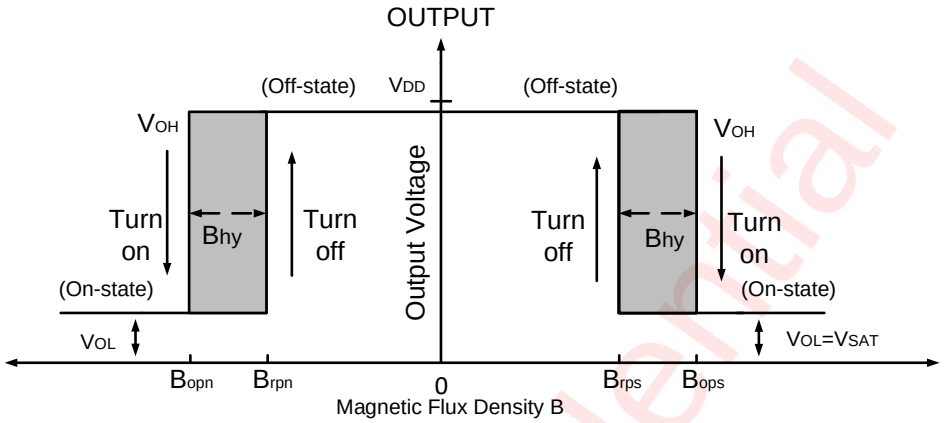


Figure 4 The Working Process of AW86502STR

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℃ to 85℃
Storage Temperature T_{STG}	-65℃ to 150℃
Junction temperature T_J	-50℃ to 165℃
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= -40 ºC 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℃，V_{DD}=3.3V	-	0.95	1.3	mA
I_{DD}(sleep)		During sleep period, T_A = 25℃，V_{DD}=3.3V	-	0.43	-	μA
I_{DD}(avg)	Average supply current	T_A = 25°C, V_{DD} = 1.8V		0.8		μA
		T_A = 25°C, V_{DD} = 3.3V		1.13		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)	-	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.*

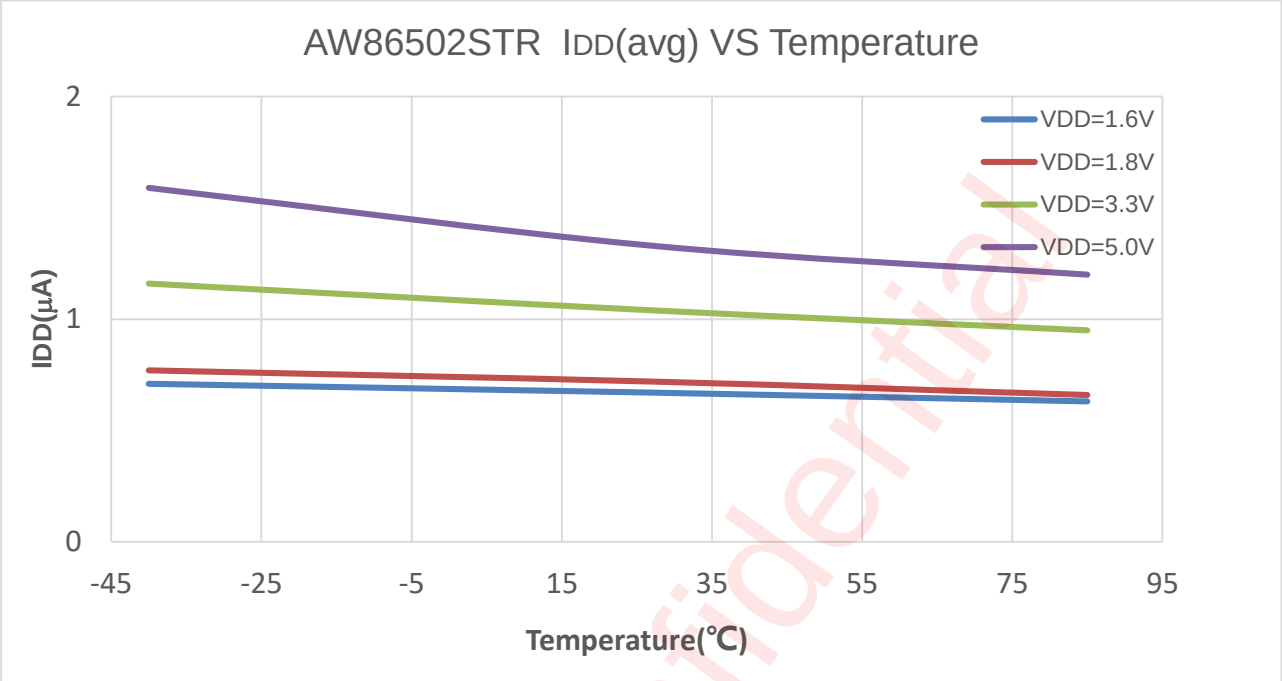
Magnetic Characteristics

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

Notes: Tyoical data is at T_A=+25℃, V_{DD}=3.3V.

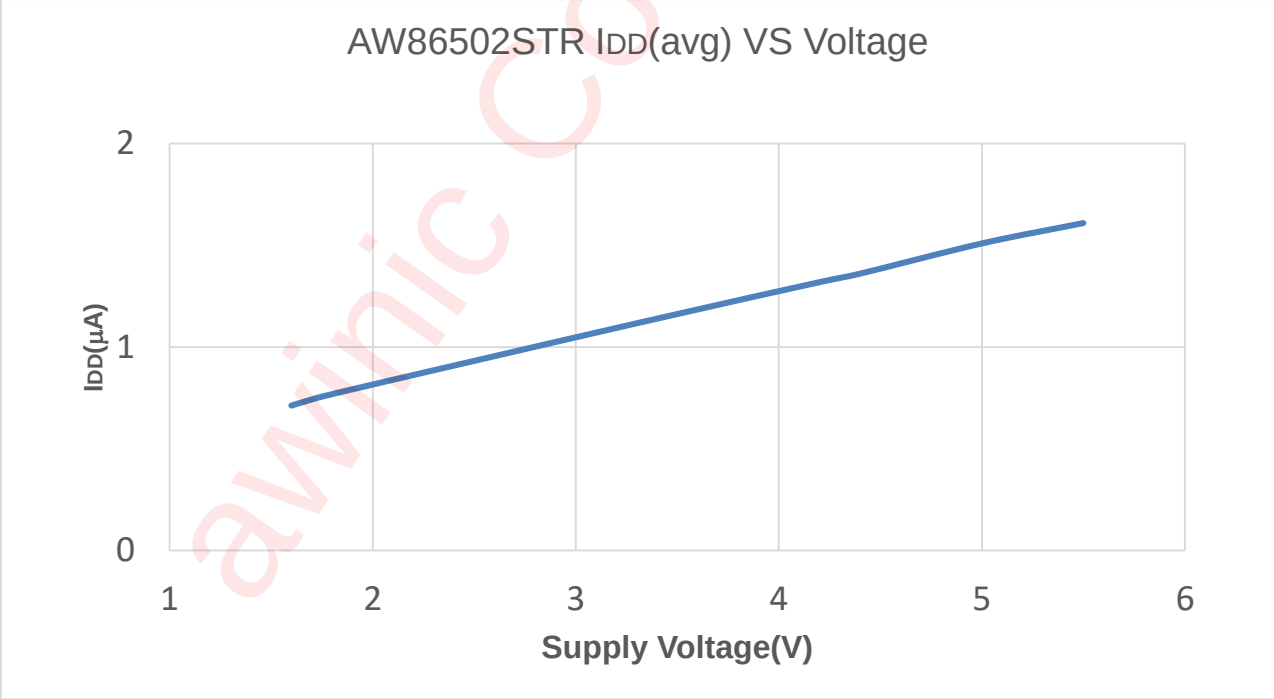
Maximum and minimum parameters values over operating temperature range are not tested in production. They are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

Typical Characteristics

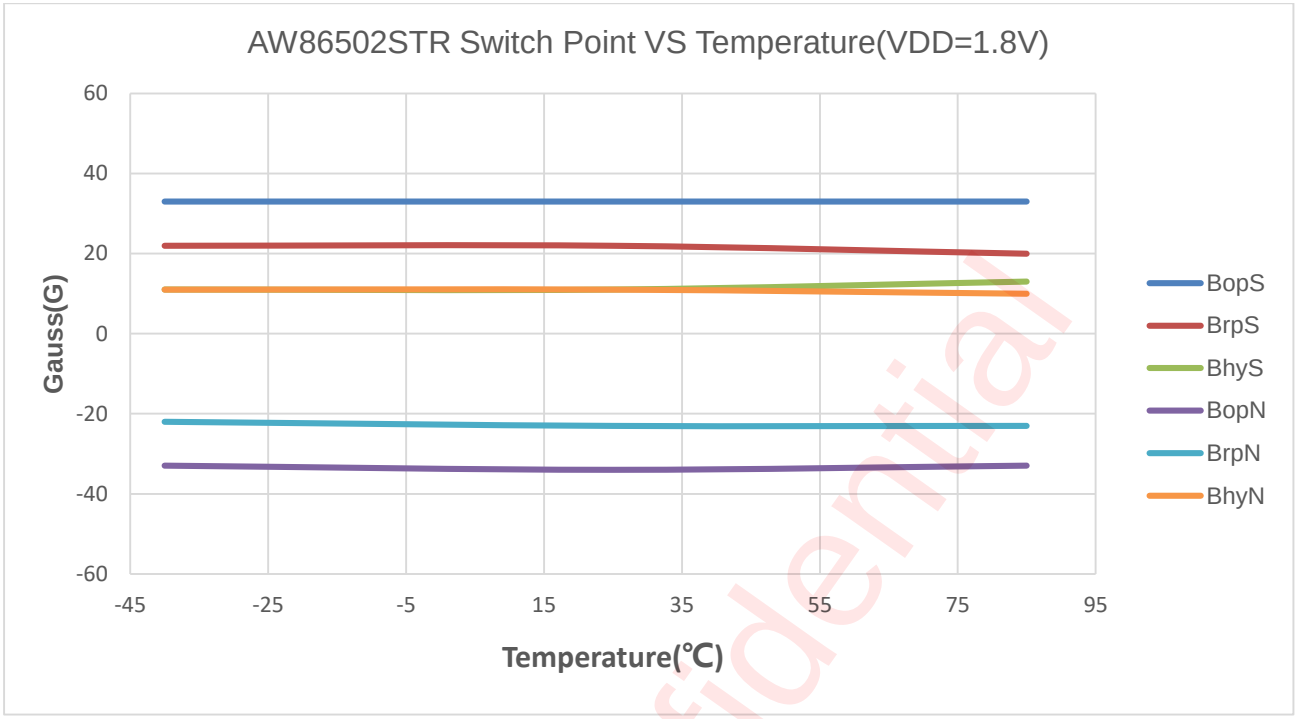


Ambient Temperature Ta[℃]

I_{DD} vs. Ta

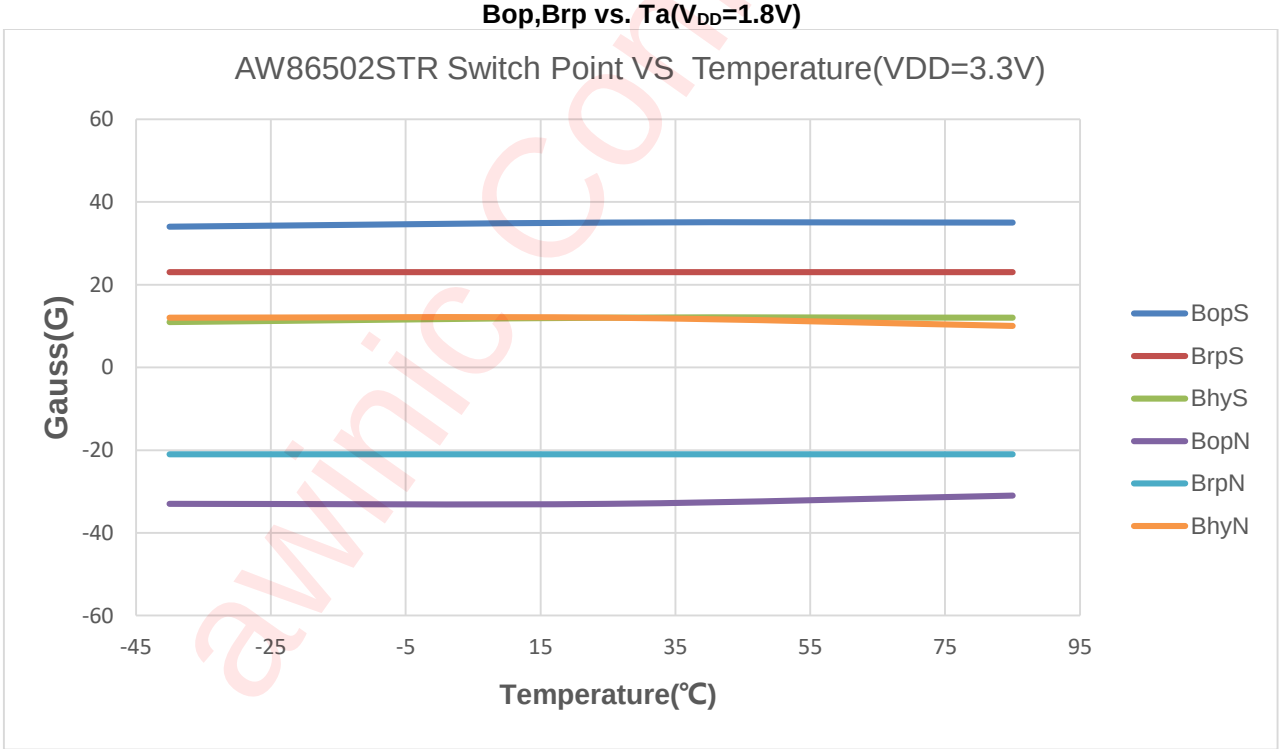


Average Supply Current vs. Supply Voltage(Ta=35℃)



Ambient Temperature Ta[℃]

Bop,Brp vs. Ta(V_{DD}=1.8V)



Ambient Temperature Ta[℃]

Bop,Brp vs. Ta(V_{DD}=3.3V)

Figure 5 The Typical Characteristics of AW86502STR

Application Information

It is recommended to connect an external capacitor of 0.1uF to VDD and GND. The noise of the injection device can be reduced. R_L is pull-up resister and the recommended value is 100KΩ.

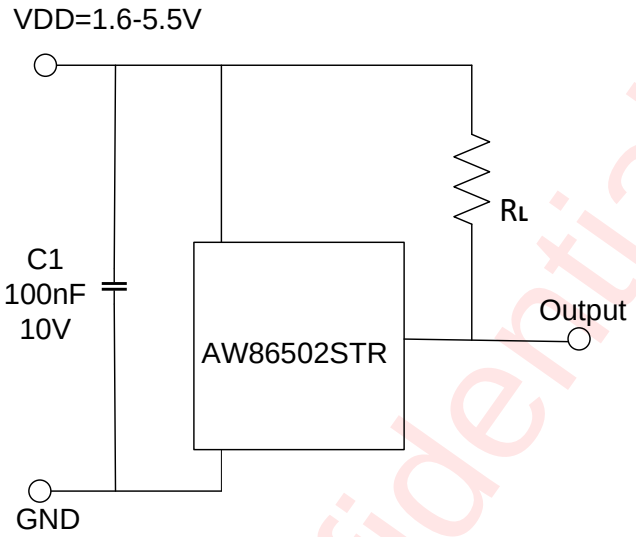
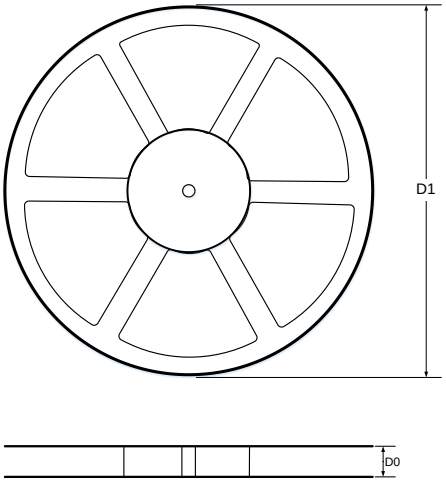


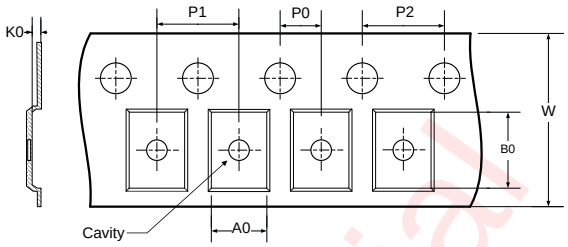
Figure 6 The Application Circuit of AW86502STR

Tape And Reel Information

REEL DIMENSIONS

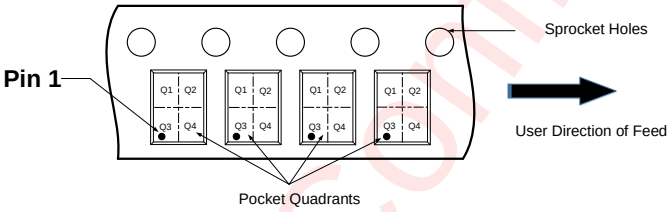


TAPE DIMENSIONS



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



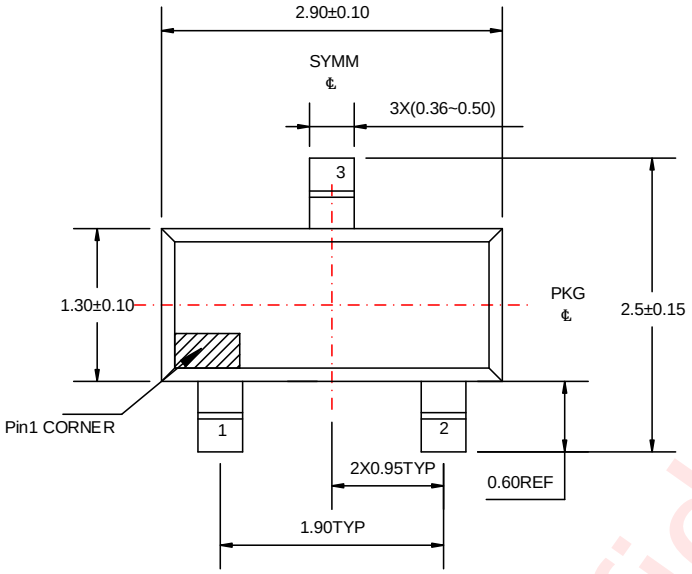
Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

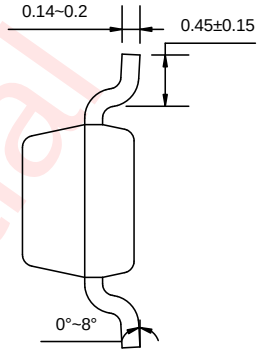
D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	3.15	2.77	1.22	2	4	4	8	Q3

All dimensions are nominal

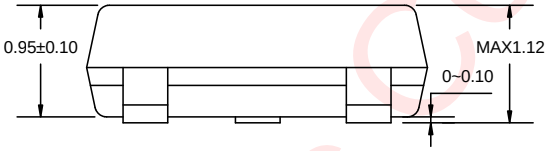
Package Description



TOP VIEW



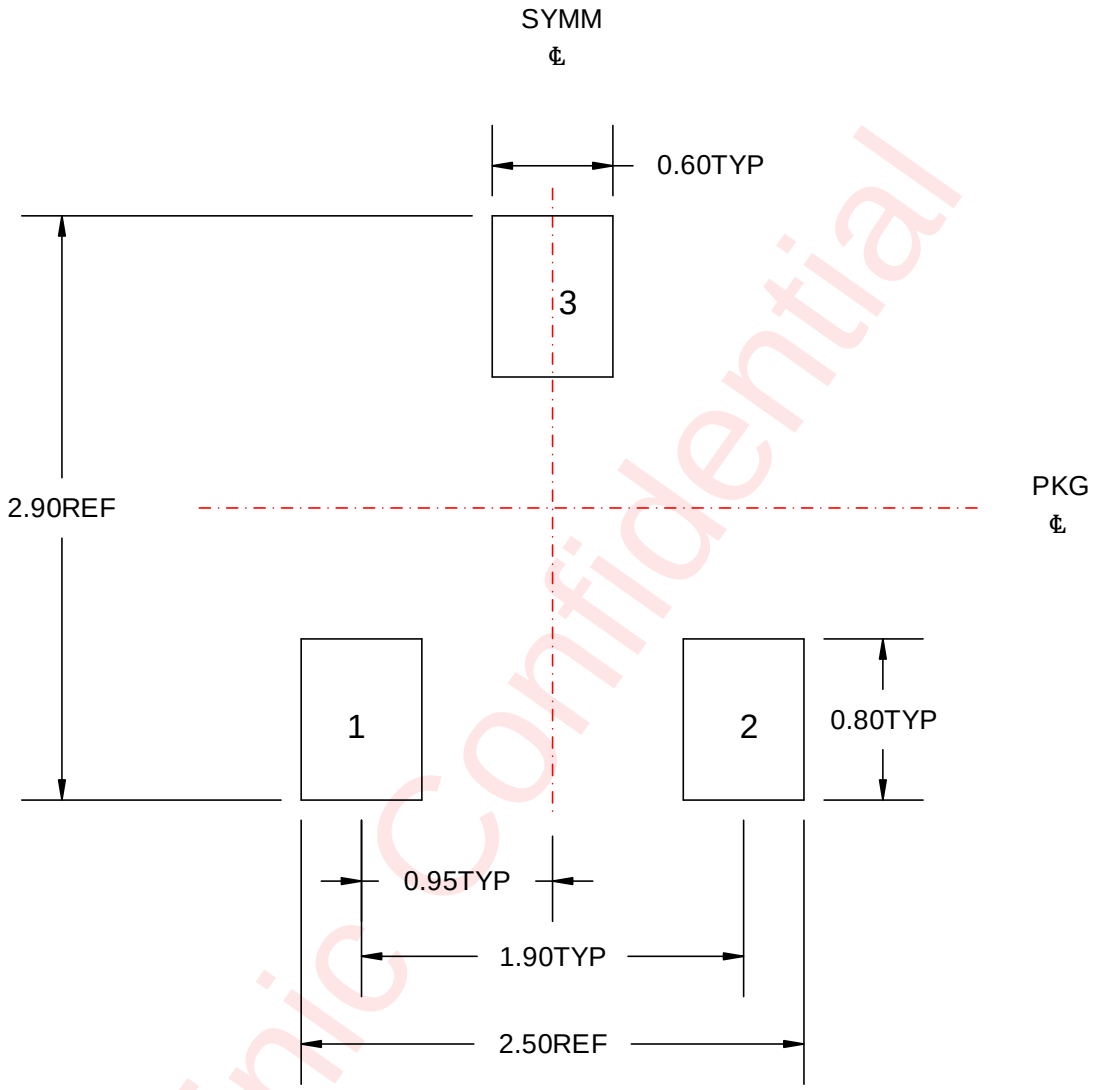
SIDE VIEW

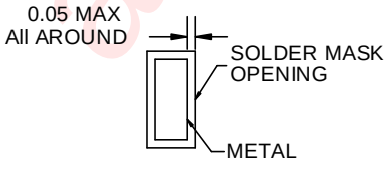


BOTTOM VIEW

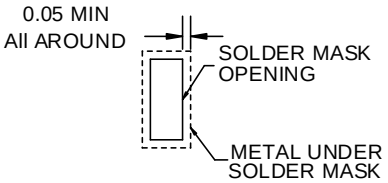
Unit：mm

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	Sep.2021	Revise current value from 0.85μA to 0.8μA When V_{DD}=1.8V
V1.2	Apr. 2022	Revise the description of the output form in the General Description
V1.3	July. 2022	Chart temperature changed from -20℃ to -40℃

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