Low-Power Single Inverter with Open-Drain Outputs

Features

- Wide Supply Voltage Range: 0.8V to 3.6V
- Low Static Power Consumption(I_{CC}= 0.1μA)
- Low Input Capacitance (C_i= 2pF)
- I_{off} Supports Partial Power-Down-Mode Operation
- t_{pd}= 3.6ns at 3.3 V
- 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operations
- Suitable for Point-to-Point Applications
- Latch-Up Performance Exceeds ±200 mA Per JEDEC78E
- ESD Performance Tested Per ESDA/JEDEC
  - ±2kV Human-Body Model (ESDA/JEDEC JS-001-2017)
  - ±1.5kV Charged-Device Model (ESDA/JEDEC JS -002-2018)
- WBSOT353 2.07mmX1.26mmX1.1mm-5L

Applications

Desktop PCs and Notebooks
CD/DVD ROM
HDTV
DVR
Solid State Drive (SSD): Enterprise
Mobile Internet Devices
Wearable Devices

General Description

AWS74AUP1G06 is an inverter with open-drain output. The device accepts any supply voltage from 0.8V to 3.6V and the maximum sink current is 24mA.

The AWS74AUP1G06 can be connected to other open-drain outputs to implement active-low wired-OR or active-high wired-AND functions.

The AWS74AUP1G06 is fully specified for partial power-down applications using off output current (I_{OFF}). The output for this device enter a high-impedance state when the device is powered down, preventing any damaging backflow current through the device.

Typical Application Circuit

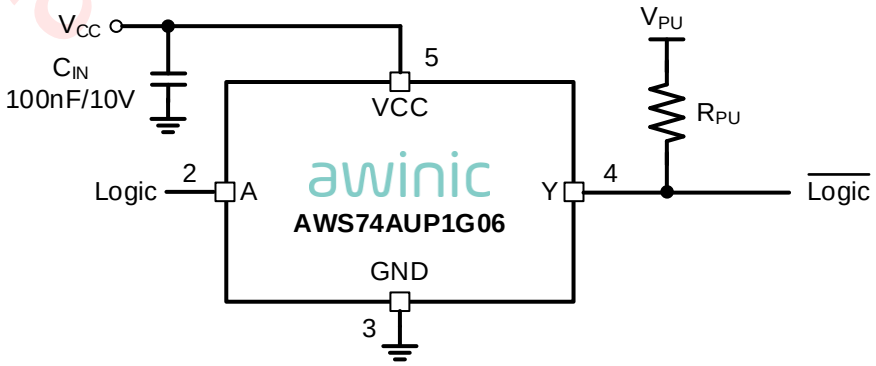
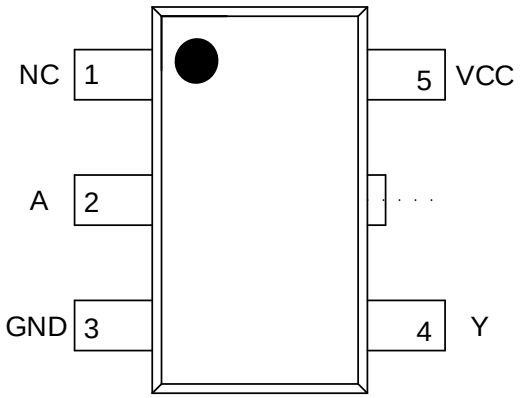


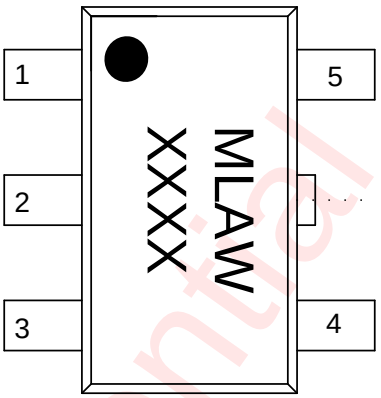
Figure 1 Inverter Function Application

Pin Configuration And Top Mark

AWS74AUP1G06STR
（Top View）



AWS74AUP1G06STR Marking
（Top View）



MLAW - AWS74AUP1G06STR
XXXX - Production Tracing Code

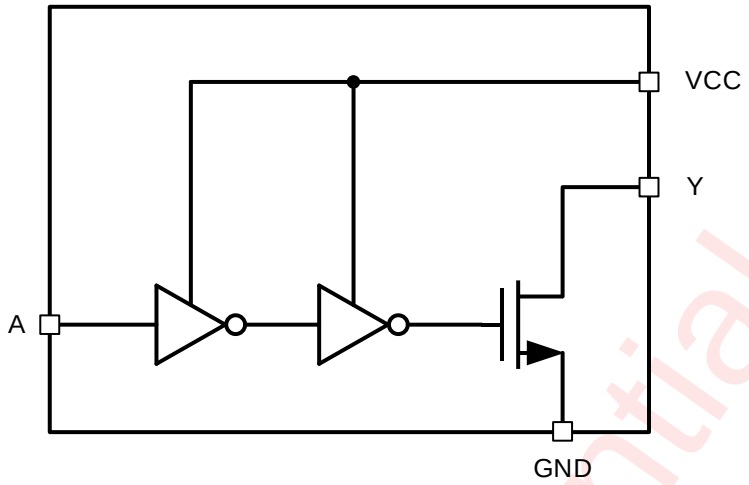
Pin Definition

No.	NAME	DESCRIPTION
1	NC	Not connect.
2	A	Data input.
3	GND	Ground.
4	Y	Data output.
5	VCC	Supply voltage.

Pin Functions

Input A	Output Y
H	L
L	High-Z

Functional Block Diagram



Typical Application Circuits

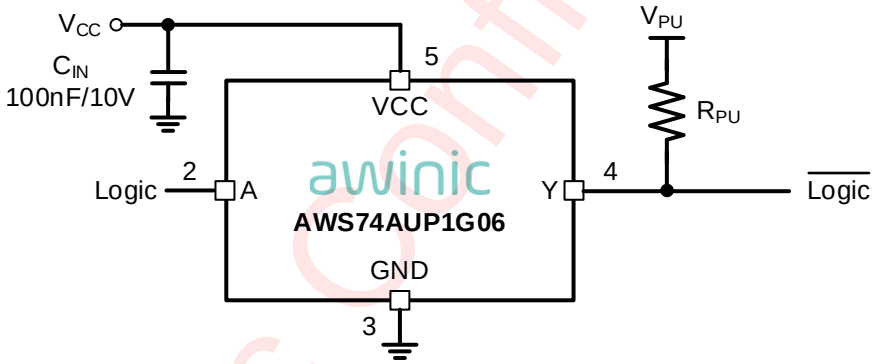


Figure 4 AWS74AUP1G06 Application circuit

Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AWS74AUP1G06STR	-40℃～125℃	WBSOT353 2.07mmX1.26mmX 1.1mm-5L	MLAW	MSL1	ROHS+HF	3000 units/ Tape and Reel

Absolute Maximum Ratings(NOTE1)

Parameters		Range
Supply voltage range, V_{CC}		-0.3V to 4.6V
Input voltage range		-0.3V to 4.6V
Output voltage range		-0.3V to 4.6V
Input clamp current, I_{Ik}	V_I <0	±50mA
Output clamp current, I_{OK}	V_O <0	±50mA
Output current, I_O	V_O =0V to 4.6V	50mA
Maximum operating junction temperature T_{JMAX}		150°C
Storage temperature T_{STG}		-65°C to 150°C
Lead temperature (soldering 10 seconds)		260°C
ESD		
HBM (All pins, per ESDA/JEDEC JS-001-2017) (NOTE 2)		±2kV
CDM (All pins, per ESDA/JEDEC JS -002-2018)		±1.5kV
Latch-Up		
Test condition: JEDEC78E		+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 is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin.

Recommended Operating Conditions

PARAMETERS		CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supply voltage		0.8	3.6	V
V_I	Input voltage(NOTE1)		0	3.6	V
V_O	Output voltage		0	3.6	V
Δt/ΔV	Input transition rise or fall rate	V_{CCI} =0.8V to 2.7V		20	ns/V
		V_{CCI} =3.3V		10	ns/V
T_A	Operating free-air temperature T_A		-40	125	°C

NOTE1: All unused data inputs of the device must be held at VCC or GND to ensure proper device operation.

Electrical Characteristics

T_A=25°C for typical values (unless otherwise noted)

PARAMETER		TEST CONDITION		MIN	TYP	MAX	UNIT
DC ELECTRICAL CHARACTERISTICS							
I_{CC}	VCC supply current	V_I=0V or 3.6V, I_O=0A; V_{CC}=0.8V to 3.6V			0.1		μA
ΔI_{CC}	Additional supply current	V_I= V_{CC} – 0.3V, I_O=0A; V_{CC}=0.8V to 3.6V			0.5		μA
I_I	Input leakage current	V_I=0V or 3.6V; V_{CC}=0.8V to 3.6V			0.1		μA
I_{OZ}	OFF-state output current	V_I=V_{IH} or V_{IL}; V_O=V_{CC} or GND; V_{CC}=3.6V			±0.02		μA
I_{OFF}	Power off leakage current	V_I or V_O=3.6V; V_{CC}=0V			±0.02		μA
V_{IH}	High-level input voltage	V_{CC}=0.8V		0.7*V_{CC}			
		V_{CC}=1.1V to 1.95V		0.65*V_{CC}			V
		V_{CC}=2.3V to 2.7V		1.6			
		V_{CC}=3.0V to 3.6V		2			
V_{IL}	Low-level input voltage	V_{CC}=0.8V				0.3*V_{CC}	
		V_{CC}=1.1V to 1.95V				0.35*V_{CC}	V
		V_{CC}=2.3V to 2.7V				0.7	
		V_{CC}=3.0V to 3.6V				0.9	
V_{OL}	Low-level output voltage	V_I=V_{IL}	I_O= 100μA; V_{CC}=0.8V to 3.6V			0.1	V
			I_O= 2mA; V_{CC} =1.1V			0.2	
			I_O= 2mA; V_{CC} =1.4V			0.25	
			I_O= 4mA; V_{CC} =1.65V			0.45	
			I_O= 8mA; V_{CC} =2.3V			0.3	
			I_O= 16mA; V_{CC} =3.0V			0.4	
			I_O= 24mA; V_{CC} =3.0V			0.55	
C_I(1)	Input capacitance	V_I=0V or 3.3V, V_{CC}=3.3V			2.0		pF

PARAMETER		TEST CONDITION		MIN	TYP	MAX	UNIT
SWITICHING CHARACTERISTICS							
t_{pd}(2)	Propagation delay	C_L=5pF	V_{CC}=0.8V		23.3		ns
			V_{CC}=1.1V to 1.3V		9.8		
			V_{CC}=1.4V to 1.6V		6.9		
			V_{CC}=1.65V to 1.95V		5.6		
			V_{CC}=2.3V to 2.7V		4.3		
			V_{CC}=3V to 3.6V		3.6		
		C_L=10pF	V_{CC}=0.8V		23.8		
			V_{CC}=1.1V to 1.3V		9.8		
			V_{CC}=1.4V to 1.6V		7.1		
			V_{CC}=1.65V to 1.95V		5.7		
			V_{CC}=2.3V to 2.7V		4.3		
			V_{CC}=3V to 3.6V		3.7		
		C_L=15pF	V_{CC}=0.8V		24.5		
			V_{CC}=1.1V to 1.3V		9.9		
			V_{CC}=1.4V to 1.6V		7.2		
			V_{CC}=1.65V to 1.95V		5.9		
			V_{CC}=2.3V to 2.7V		4.4		
			V_{CC}=3V to 3.6V		3.8		
		C_L=30pF	V_{CC}=0.8V		26.4		
			V_{CC}=1.1V to 1.3V		10.4		
			V_{CC}=1.4V to 1.6V		7.6		
			V_{CC}=1.65V to 1.95V		6.1		
			V_{CC}=2.3V to 2.7V		4.6		
			V_{CC}=3V to 3.6V		4		

(1) Typical value set by simulation only.

(2) Typical values are measured at V_{CC}=0.8V, 1.2V, 1.5V, 1.8V, 2.5V and 3.3V respectively.

Typical Characteristics

Test Information

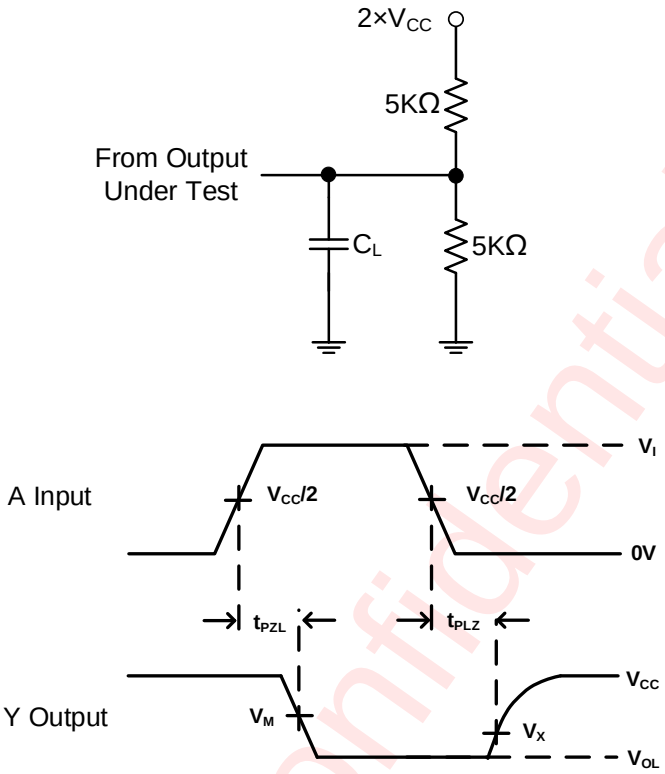


Figure 5 Load Circuit and Propagation Delay Measurement

1. The following table gives the test condition under different supply voltage：

V_{CC}	V_I	V_M	V_X	C_L
0.8V	V_{CC}	$V_{CC}/2$	V_{OL}+0.1V	30pF
1.1V to 1.3V	V_{CC}	$V_{CC}/2$	V_{OL}+0.1V	30pF
1.4V to 1.6V	V_{CC}	$V_{CC}/2$	V_{OL}+0.1V	30pF
1.65V to 1.95V	V_{CC}	$V_{CC}/2$	V_{OL}+0.15V	30pF
2.3V to 2.7V	V_{CC}	$V_{CC}/2$	V_{OL}+0.15V	30pF
3.0V to 3.6V	V_{CC}	$V_{CC}/2$	V_{OL}+0.3V	30pF

2. Load capacitance including probe and jig capacitance.

3. t_{PZL} is measured at V_M.

4. t_{PLZ} is measured at V_X.

5. For the open drain device t_{PZL} and t_{PLZ} are same as t_{pd}.

Detailed Functional Description

AWS74AUP1G06 is an inverter with open-drain output. The device accepts any supply voltage from 0.8V to 3.6V and the maximum sink current is 24mA.

The AWS74AUP1G06 can be connected to other open-drain outputs to implement active-low wired-OR or active-high wired-AND functions. The device is fully specified for partial power-down applications using off output current (I_{OFF}).The outputs for this device enter a high-impedance state when the device is powered down, preventing any damaging backflow current through the device.

Functional Modes

Input A	Output Y
H	L
L	High-Z

Application Information

Pull-up Resistor Selection Guideline

AWS74AUP1G06 has an open-drain output, which means a pull-up resistor must be added to the output for an open-drain device to have a high output. Pull-up resistor selection according to the maximum current during low output I_{OL}, and the pull-up voltage V_{PU}:

$$R \geq \frac{V_{PU}}{I_{OL(max)}} \quad (1)$$

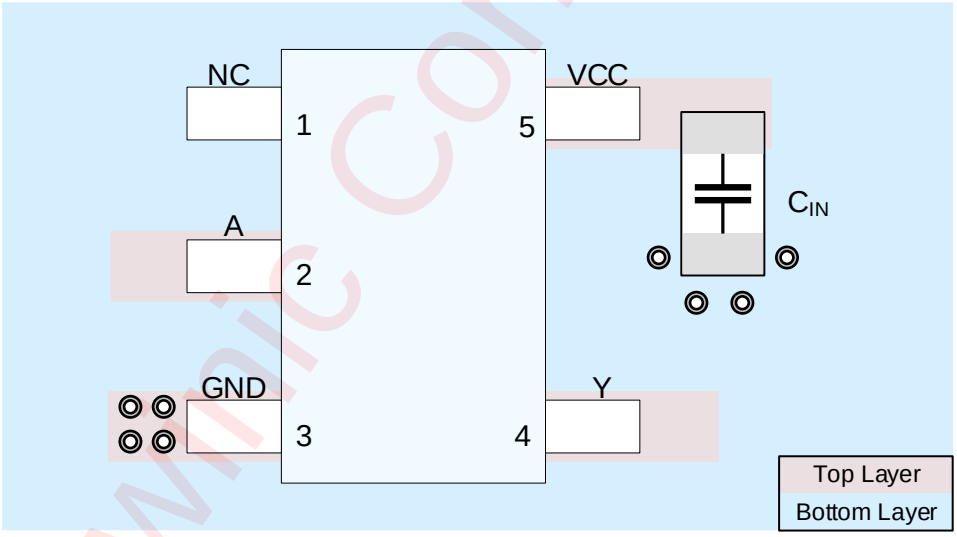
Another constraint on the Pull-up resistor is the pull-down resistance that may exist at the input port of the subsequent circuit. Ensure that the voltage level after voltage division can meet the VIH of the subsequent circuit.

The Pull-up resistor will also affect the transmission rate of the signal. A larger resistance will bring a slower transmission rate.

PCB Layout Consideration

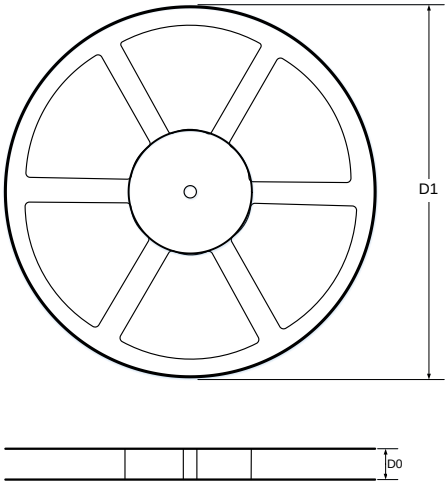
To obtain the optimal performance of AWS74AUP1G06, PCB layout should be considered carefully. Here are some guidelines:

1. We recommend adding a 0.1μF bypass capacitor to prevent power disturbance. The C_{IN} should be placed as close to the VCC pin as possible.

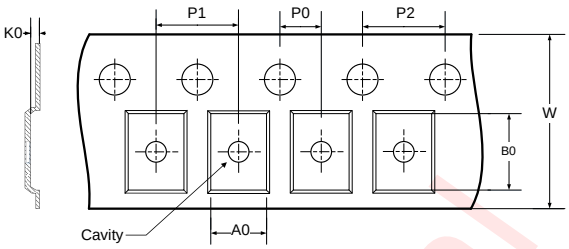


Tape And Reel Information

REEL DIMENSIONS

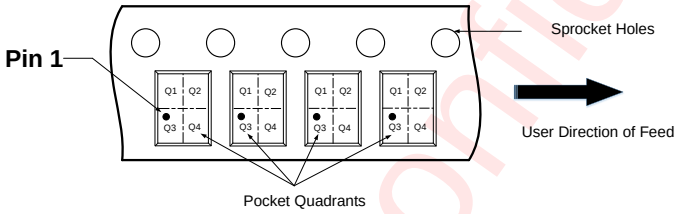


TAPE DIMENSIONS



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



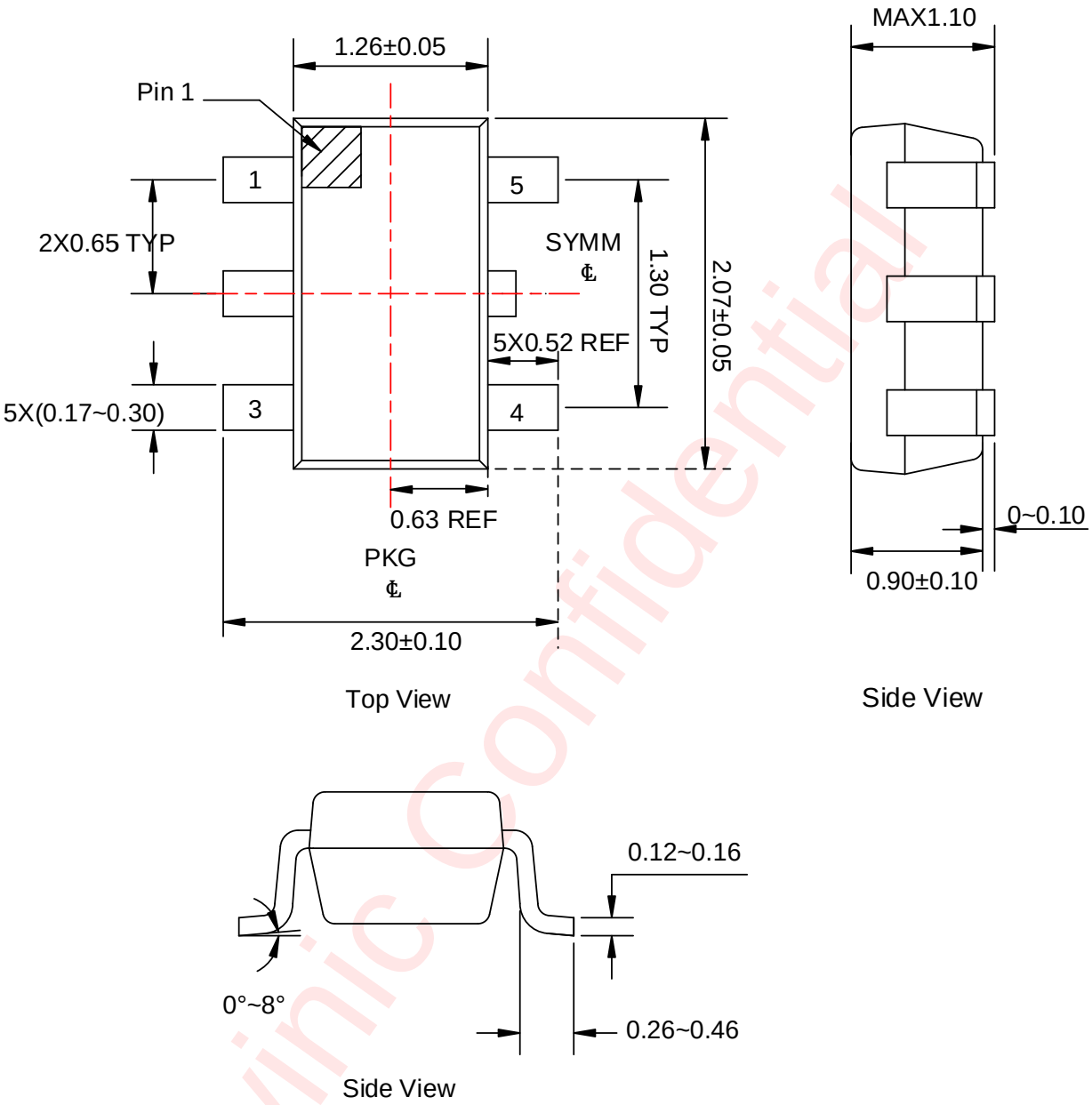
Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178.0	8.40	2.40	2.55	1.20	2.00	4.00	4.00	8.00	Q3

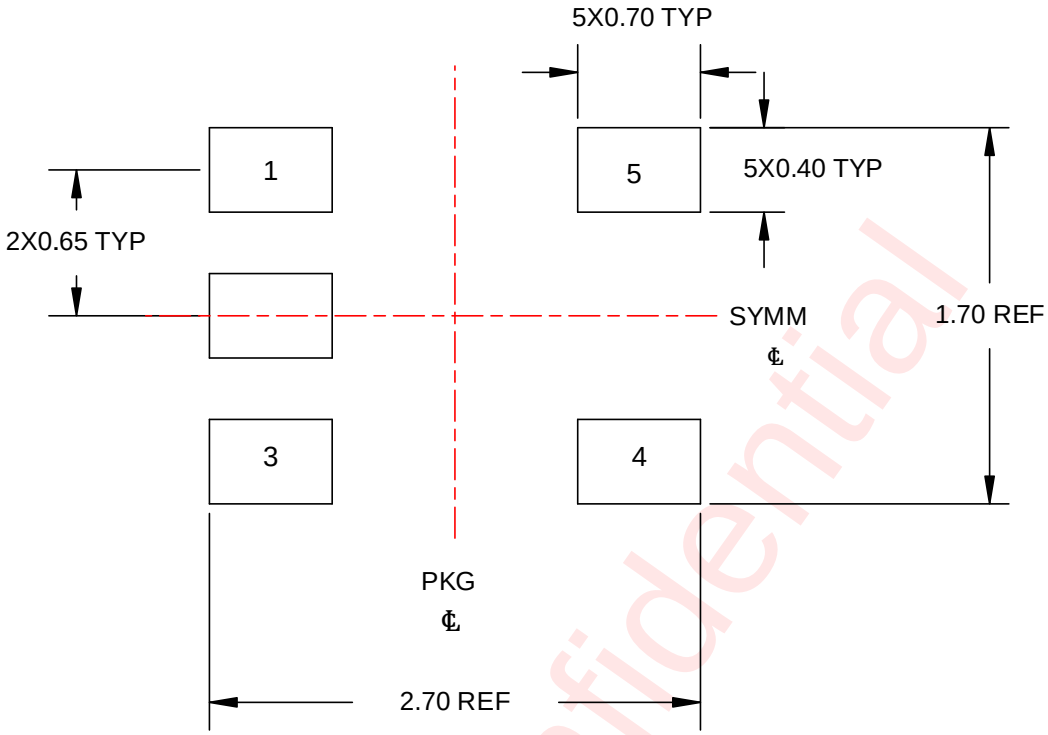
All dimensions are nominal

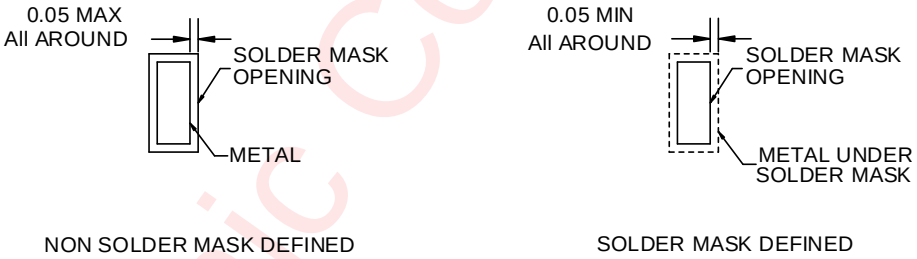
Package Description



Unit: mm

Land Pattern Data





NON SOLDER MASK DEFINED

SOLDER MASK DEFINED

Unit: mm

Revision History

Version	Date	Change Record
V1.0	Jun. 2023	Officially released
V1.1	Jul. 2023	Modify GND symbol (Page1, 3) Modify the title “Application Information” (Page9)

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