

## 0.1-3GHz SP6T Diversity Switch

### FEATURES

- Broadband frequency range: 0.1 to 3.0 GHz
- Low insertion loss: 0.4dB typical @ 2.7 GHz
- High isolation: >20dB @ 2.7 GHz
- Integrated logic
- Small QFN (14-pin, 2.0mm x 2.0 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

### APPLICATIONS

- 2G/3G/4G antenna diversity
- Cellular modems , tablets and USB Devices
- Other RF front-end modules

### GENERAL DESCRIPTION

The AW13416 is a SP6T switch with low insertion loss and high Isolation. It can be used to support band switching and mode switching in antenna diversity systems for 2G/3G/4G, data cards and tablets.

The symmetrical design of internal ports makes it convenient for PCB routing and adjustment of receiving and transmitting signals. The band/mode switching is realized by the GPIO pins as referenced in the chip block diagram and the control logic.

The AW13416 is provided in a compact 2.0mm x 2.0mm, 14-pin QFN package.

### TYPICAL APPLICATION CIRCUIT

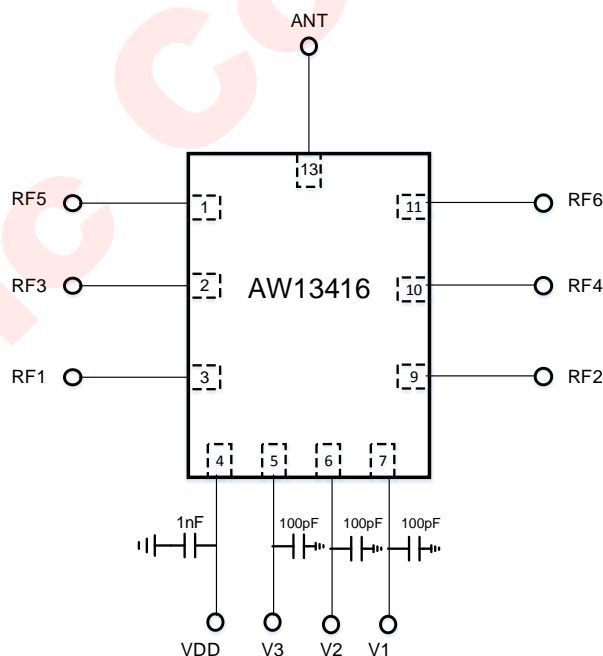


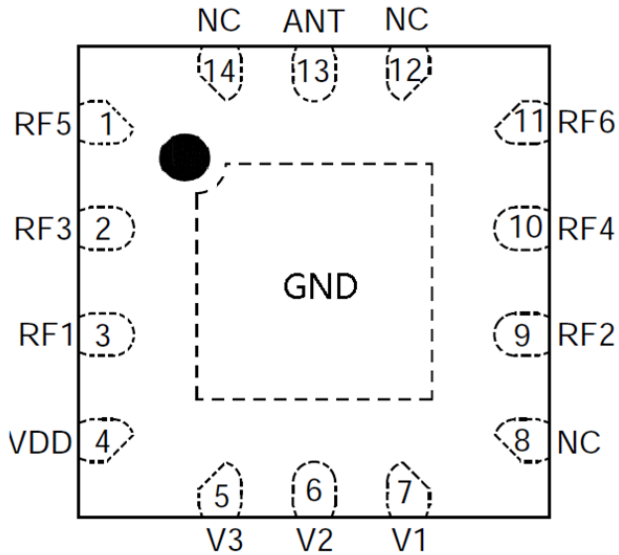
Figure 1 Typical Application Circuit of AW13416

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## PIN CONFIGURATION AND TOP MARK

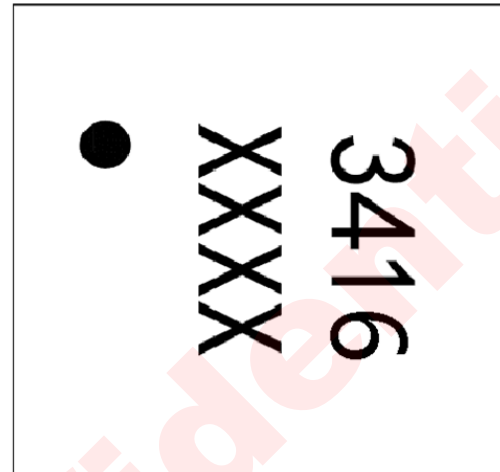
AW13416QNR PIN Configuration

(Top View)



AW13416QNR MARKING

(Top View)



3416 – AW13416QNR

XXXX – Production Tracking Code

**Figure 2** Pin Configuration and Top Mark

## PIN DEFINITION

No.	NAME	DESCRIPTION
1	RF5	RF I/O path 5
2	RF3	RF I/O path 3
3	RF1	RF I/O path 1
4	VDD	DC power supply
5	V3	DC control voltage 3
6	V2	DC control voltage 2
7	V1	DC control voltage 1
8	NC	Not connected
9	RF2	RF I/O path 2
10	RF4	RF I/O path 4
11	RF6	RF I/O path 6
12	NC	Not connected
13	ANT	Antenna port
14	NC	Not connected

**Note:** Bottom ground paddles must be connected to ground.

## FUNCTIONAL BLOCK DIAGRAM

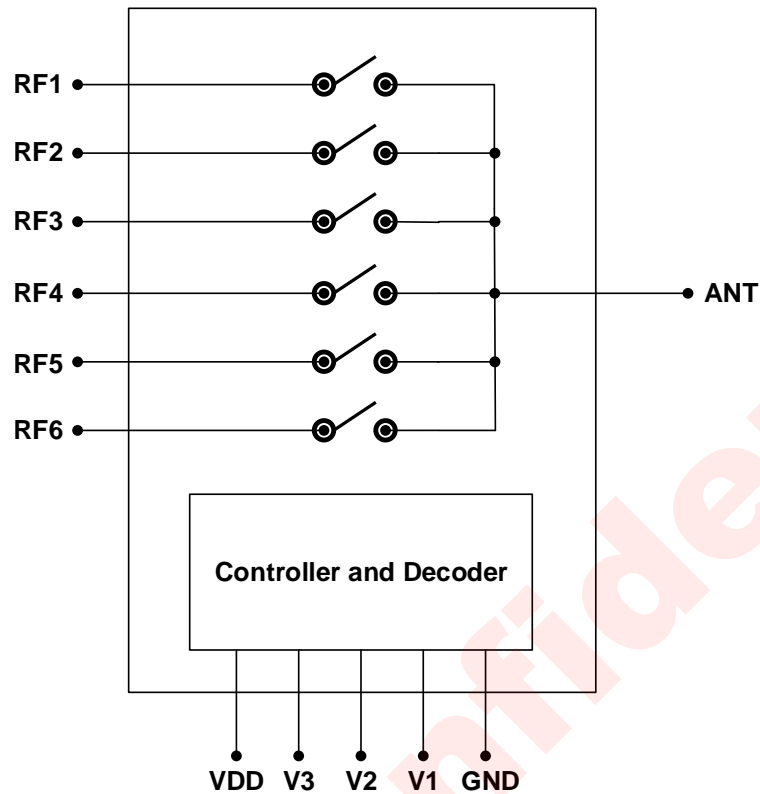


Figure 3 FUNCTIONAL BLOCK DIAGRAM

## ORDERING INFORMATION

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW13416QN R	-40°C~85°C	QFN 2X2-14L	3416	MSL1	ROHS+HF	3000 units/ Tape and Reel

AW13416□□□

Shipping  
R:Tape & Reel

Package Type  
QN:QFN

**ABSOLUTE MAXIMUM RATINGS**(NOTE1)

PARAMETERS		RANGE
Supply Voltage Range VDD		2.4V to 3.3V
Control Voltage Range	V1,V2,V3	0V to 3V
RF input power(RF1 to RF6)		31dBm
Operating Free-air Temperature Range		-40°C to 85°C
Storage Temperature T <sub>STG</sub>		-65°C to 150°C
Lead Temperature (Soldering 10 Seconds)		260°C
ESD (NOTE 2)		
HBM		±2kV
CDM		±1kV
Latch up		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. Test method: MIL-STD-883J Method 3015.9

**ELECTRICAL CHARACTERISTICS**

VDD=2.8V, V1=V2=V3=0/1.8V, PIN=0dBm, TOP=+25°C, Z<sub>0</sub>=50Ω. (unless otherwise noted)

PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT	
<b>DC Specifications</b>						
VDD	Supply Voltage	2.4	2.8	3	V	
IDD	Supply Current		45		μA	
VCTL_H VCTL_L	Control Voltage High Low	1.35 0	1.8	3 0.45	V	
ICTL	Control Current	VCTL = 1.8V		0.1	1	μA
tON	Turn-on Switching Time	50% of final control voltage to 90% of final RF power, switching between RF1/2/3/4/5/6		0.5	1	μS
<b>RF Specifications</b>						
IL	Insertion loss (ANT pin to RF1-RF6)	0.1-1.0G	0.20	0.30	dB	
		1.0-2.0G	0.30	0.40	dB	
		2.0-2.7G	0.40	0.50	dB	

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
ISO	Isolation (ANT pin to RF1-RF6)	0.1-1.0G	35	40		dB
		1.0-2.0G	25	30		dB
		2.0-2.7G	20	24		dB
RL	Input return loss (ANT pin to RF1-RF6)	0.1-1.0G	23	27		dB
		1.0-2.0G	20	22		dB
		2.0-2.7G	18	20		dB
2fo	Second harmonics (ANT pin to RF1-RF6)	PIN=+26dBm, 0.1-3GHz		90		dBc
3fo	Third harmonics (ANT pin to RF1-RF6)	PIN=+26dBm, 0.1-3GHz		80		dBc
P <sub>0.1dB</sub>	0.1dB Compression Point (ANT pin to RF1-RF6)	0.1GHz-3GHz		31		dBm
IIP3	3 <sup>rd</sup> Order Input Intercept Point	@ 2.0GHz, PIN=+26dBm, $\Delta f=1\text{MHz}$		57		dBm

## TIMING DIAGRAM (POWER ON AND OFF SEQUENCE)

It is very important that the user adheres to the correct power-on/off sequence in order to avoid damaging the device. The control signal V1, V2, V3 should be set to 0V unless VDD is set in the operating voltage range.

Power ON:

- 1) Apply voltage supply --- VDD
- 2) Set Controls---V1, V2, V3
- 3) Apply RF input

Change switch position from one RF port to another:

- 1) Remove RF input
- 2) Change control voltages V1, V2, V3 to set the switch to desired RF port
- 3) Apply RF input

Power OFF:

- 1) Remove RF input
- 2) Remove control voltages-V1, V2, V3
- 3) Remove VDD input

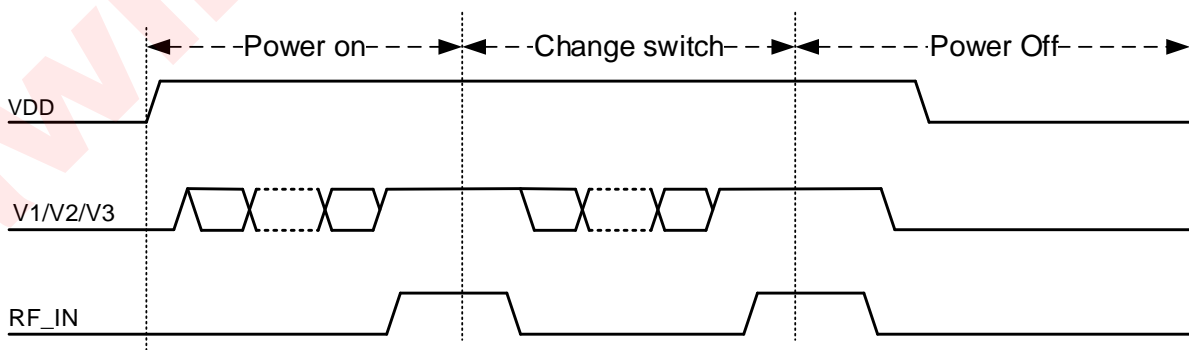


Figure 9 Power on/Change switch/Power off sequence

## AW13416 CONTROL LOGIC

Control Pins			Switch RF I/O					
V1	V2	V3	RF1	RF2	RF3	RF4	RF5	RF6
0	0	0	<b>ON</b>	Isolation	Isolation	Isolation	Isolation	Isolation
0	0	1	Isolation	<b>ON</b>	Isolation	Isolation	Isolation	Isolation
0	1	0	Isolation	Isolation	<b>ON</b>	Isolation	Isolation	Isolation
0	1	1	Isolation	Isolation	Isolation	<b>ON</b>	Isolation	Isolation
1	0	0	Isolation	Isolation	Isolation	Isolation	<b>ON</b>	Isolation
1	0	1	Isolation	Isolation	Isolation	Isolation	Isolation	<b>ON</b>
1	1	0	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation
1	1	1	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation

APPLICATION CIRCUITS

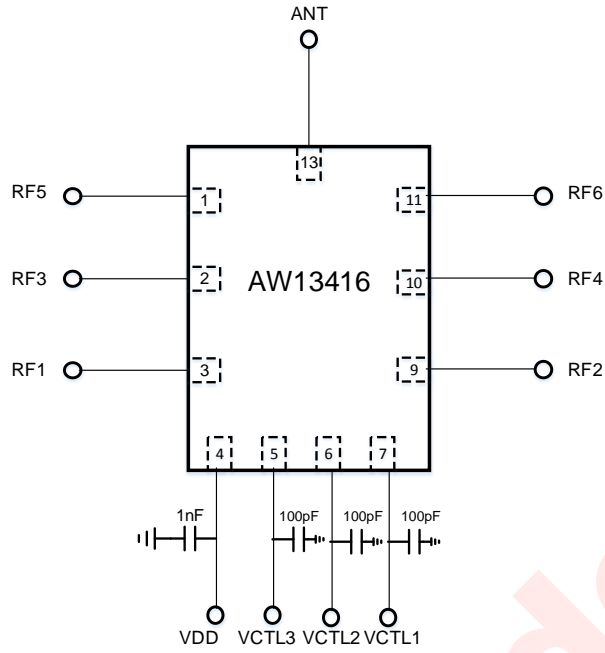


Figure 9 AW13416 EVB Schematic

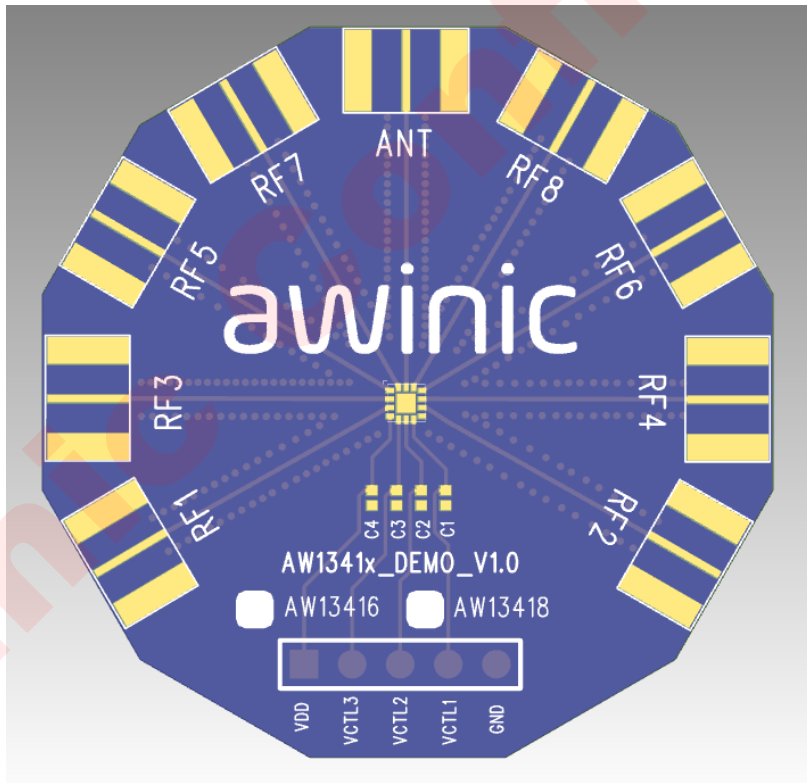


Figure 6 AW13416 EVB

## PACKAGE OUTLINE DIMENSIONS

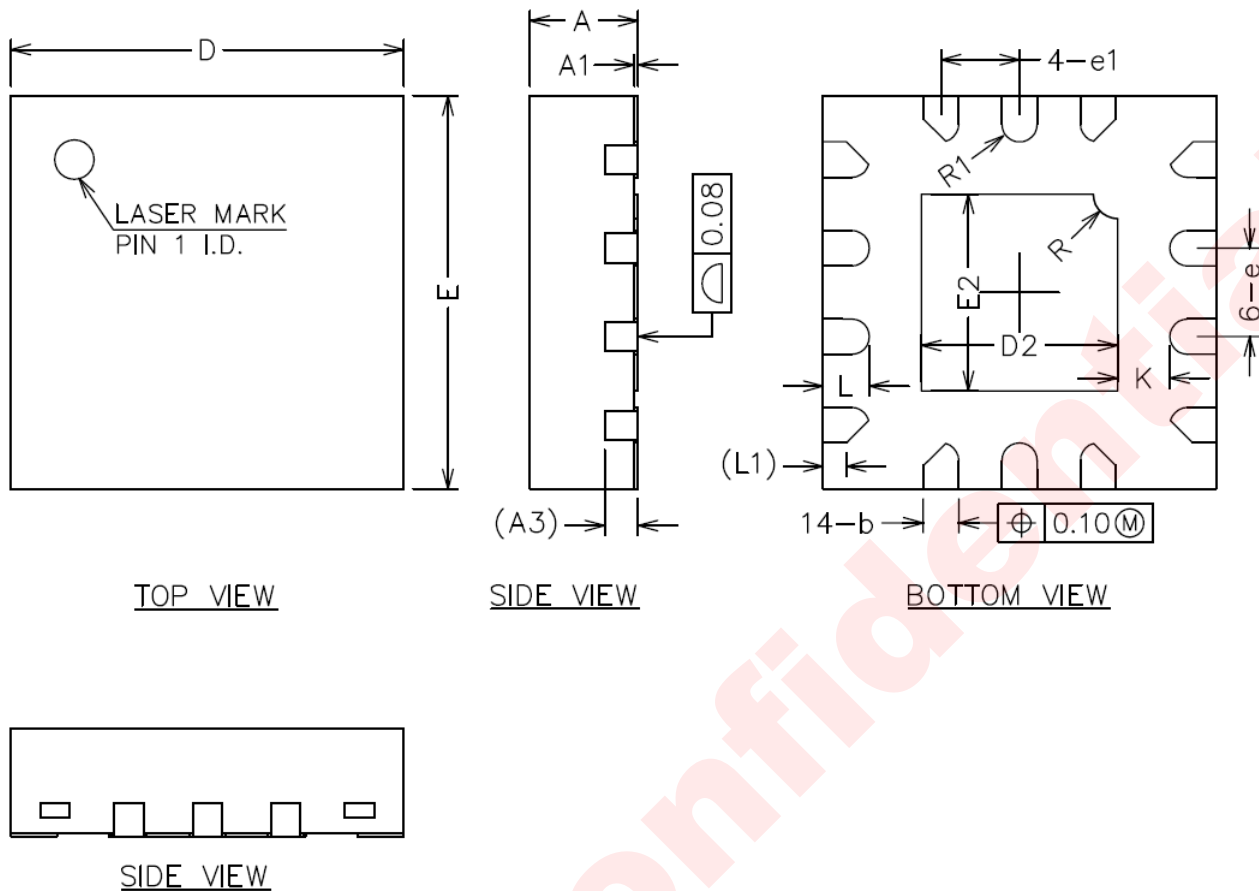


Figure 7 Package Outline

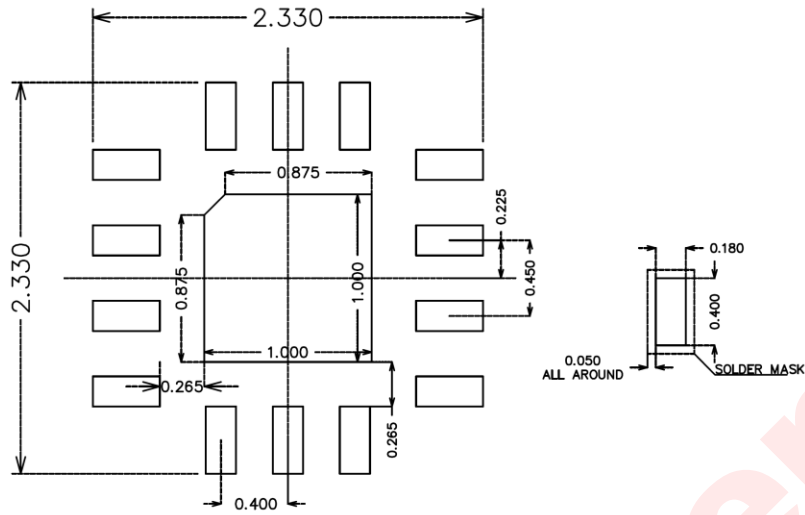
## AW13416 OUTLINE DIMENSIONS

COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.15REF		
b	0.13	0.18	0.23
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	0.90	1.00	1.10
e	0.40	0.45	0.50
e1	0.35	0.40	0.45
K	0.15	-	-
L	0.185	0.235	0.285
L1	0.118REF		
R	0.125REF		
R1	0.075	-	-

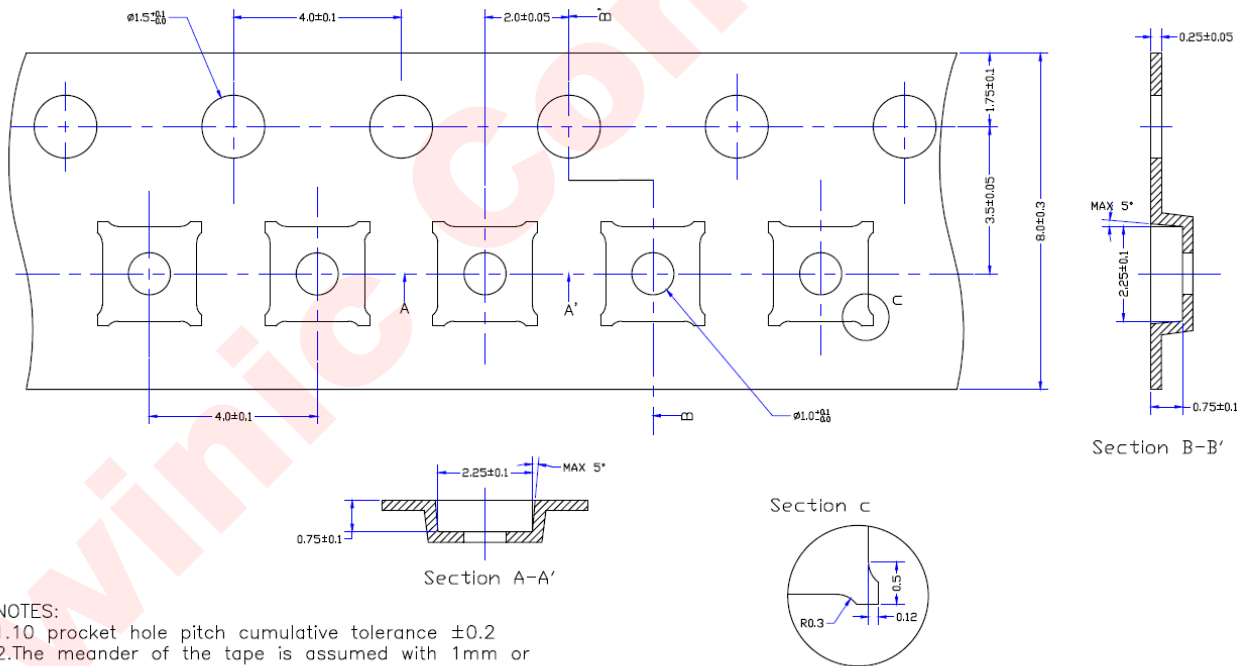


LAND PATTERN DATA

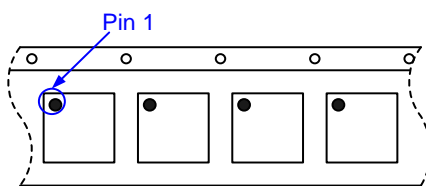


Unit: mm

TAPE AND REEL INFORMATION

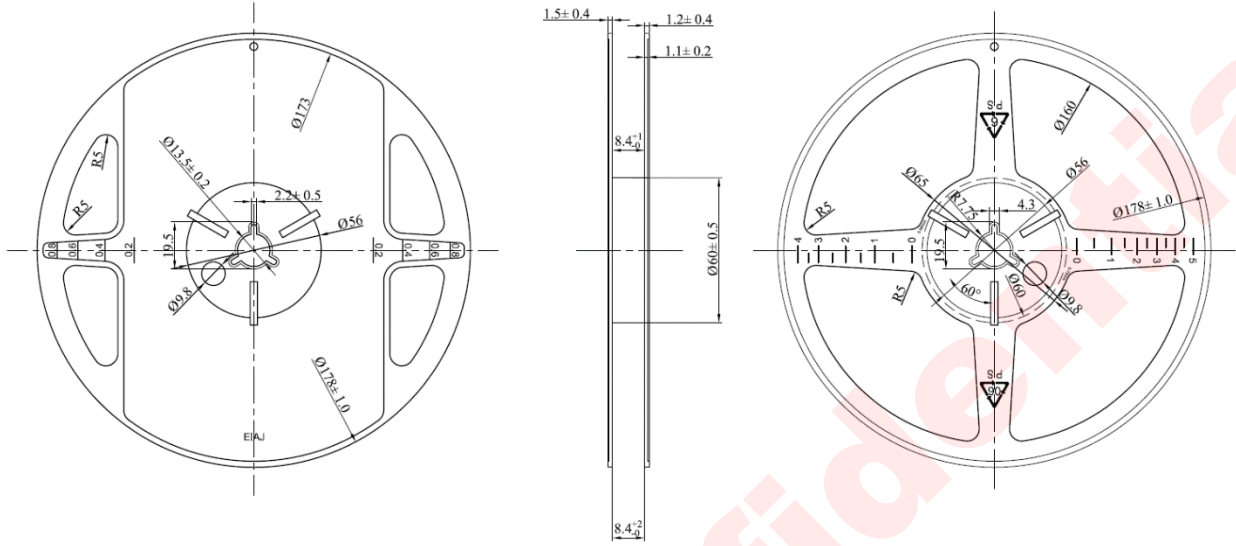


- NOTES:  
 1. 10 procket hole pitch cumulative tolerance  $\pm 0.2$   
 2. The meander of the tape is assumed with 1mm or less every 100mm between 250mm  
 3. MATERIAL: CONDUCTIVE POYSTYRENE  
 4. ALL DIMS IN MM



User Direction of Feed

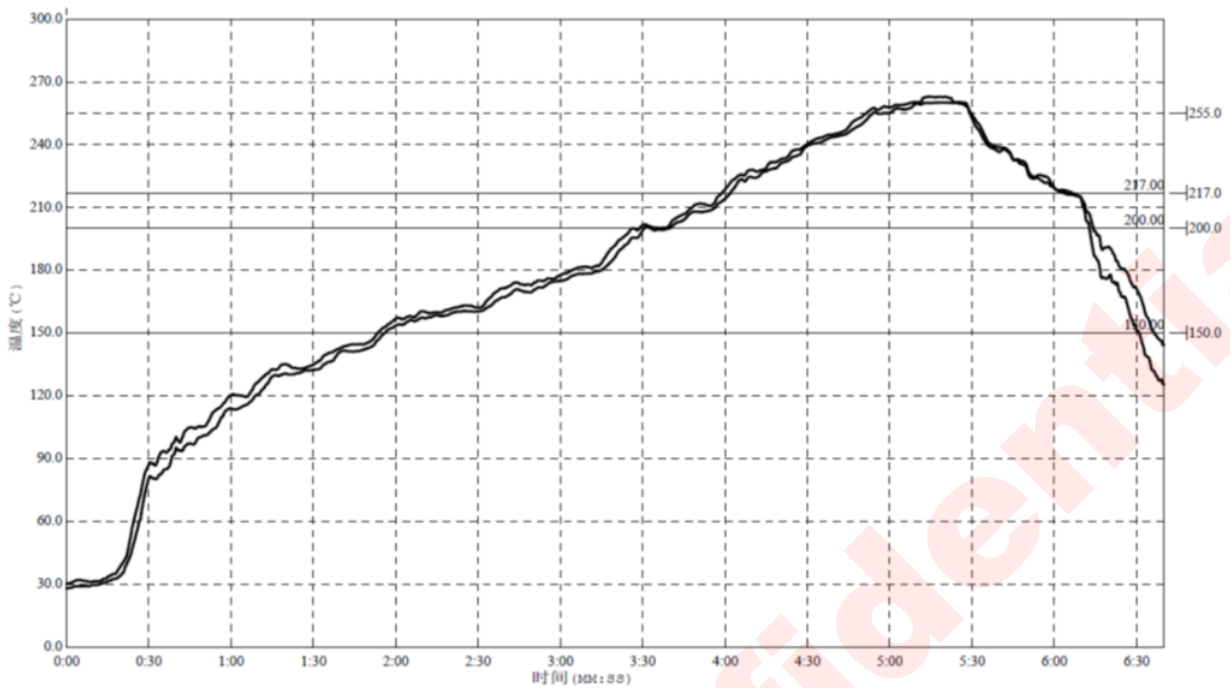
Figure 8-1 Tape and Reel



Unit: mm

Figure 8-2 Tape and Reel

## REFLOW



Reflow Note	Spec
Average ramp-up rate (217°C to peak)	Max. 3°C /sec
Time of Preheat temp. (from 150°C to 200°C)	60-120sec
Time to be maintained above 217°C	60-150sec
Peak Temperature	>260°C
Time within 5°C of actual peak temp	20-40sec
Ramp-down rate	Max. 6°C /sec
Time from 25°C to peak temp	Max. 8min

Figure 9 Package Reflow Standard Profile

NOTE 1: All data are compared with the package-top temperature, measured on the package surface;

NOTE 2: AW13416 adopted the Pb-Free assembly.

**REVISION HISTORY**

<b>Vision</b>	<b>Date</b>	<b>Change Record</b>
V1.0	Aug 2017	Officially Released.
V1.1	Nov 2017	Change datasheet template.
V1.2	Dec 2017	Update the POD.
V1.3	Oct 2018	Change 1. Tape and reel information 2. TSTG 3. Latch up
V1.4	Jun 2019	Change 1. the spec and feature of IL 2. The spec of ISO

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