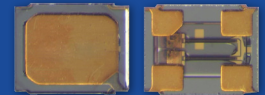


# 32.768kHz IoT Optimized SMD Crystal



## ABS04W SERIES



**1.20 x 1.00 x 0.35mm**  
**RoHS/RoHS II Compliant**  
**MSL = N/A: Not Applicable**

### FEATURES

- Industry's smallest Tuning Fork Crystal (1.20 x 1.00 x 0.35 mm package)
- Ideally suited for space constraint IoT, Wearables & Wireless applications
- Simultaneously optimized for low plating load & ESR over extended temperature range
- Enhanced performance for start-up time and power savings with Low Energy SoC's
- Low profile - ideal for height constraint designs
- Available with  $\pm 20$  ppm set-tolerance

### APPLICATIONS

- Wearables
- Wireless Modules
- Internet of Things (IoT)
- Bluetooth / Bluetooth Low Energy (BLE)
- Machine-to-Machine (M2M) Connectivity
- Ultra-Low Power MCU's, SoC's, Transceivers
- Near Field Communication
- ISM Band Applications

### Electrical Specifications

Parameters	Min.	Typ.	Max.	Units	Note
Frequency	32.768			kHz	
Operation Mode	Flexural Mode (Tuning Fork)				
Operating Temperature	-40		+85	°C	See Options
Storage Temperature	-55		+125	°C	
Frequency Tolerance @ +25°C	-20		+20	ppm	Refer to Note #1 See options
Shift through standard RoHS Reflow, (2) reflow cycles maximum	-5.00	$\pm 2.00$	+5.00	ppm	260°C peak maximum reflow temperature, relative to stand-alone set-tolerance frequency
Temperature Coefficient:	-0.04	-0.03	-0.02	ppm/T <sup>2</sup>	
Turn-over temperature:	+20	+25	+30	°C	
Frequency Stability Over Operating Temperature, relative to in-circuit measured frequency post reflow	-200		1	ppm	Over -40°C to +85°C
Load capacitance (CL)	4.0			pF	Refer to Note #2 See Options
Equivalent Series Resistance (ESR)		<75	80	k $\Omega$	@ +25 $\pm$ 3°C
		<75	130	k $\Omega$	Over -40°C to +85°C
Shunt Capacitance (C0)		1.5	2.0	pF	Combined Electrode & Package Capacitance
Motional Capacitance (C1)		6.50		fF	C1 also referred as Cm
Motional Inductance (L1)		3,800,000		mH	L1 also referred as Lm
Drive Level		0.1	0.5	$\mu$ W	
Crystal sensitivity to closed-loop oscillator loading (Ts)	45	55	65	ppm/pF	Refer to Note #3
Q value	8,000	10,000			Quality Factor
Aging @ +25°C $\pm$ 3°C [First Year]	-3		+3	ppm	Relative to post reflow measured frequency
Aging @ +25°C $\pm$ 3°C [Over 10-years]	-15		+15	ppm	Relative to post reflow measured frequency
Insulation Resistance	500			M $\Omega$	@ 100Vdc $\pm$ 15V

\*Refer to Note #1, #2, & #3 on the following page

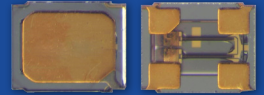


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1.20 x 1.00 x 0.35mm  
 RoHS/RoHS II Complaint  
 MSL = N/A: Not Applicable

Note #1: With an effective loop capacitance of 4.0pF, the oscillator circuit will be within set-tolerance specification; less any frequency shift due to the reflow process.

Note #2: The oscillator loop needs to present an effective loop capacitance of 4.0 pF to track the stand-alone crystal frequency. This loop capacitance is essential to ensure highest possible Closed-Loop Safety Factor for the entire population of crystals.

Note #3:  $T_s = - (C1) / [ 2*(C0 + CL)^2 ]$  ..... Where CL = 4pF

## Options and Part Identification

ABS04W-32.768 kHz - [ ] - [ ] [ ] - [ ]

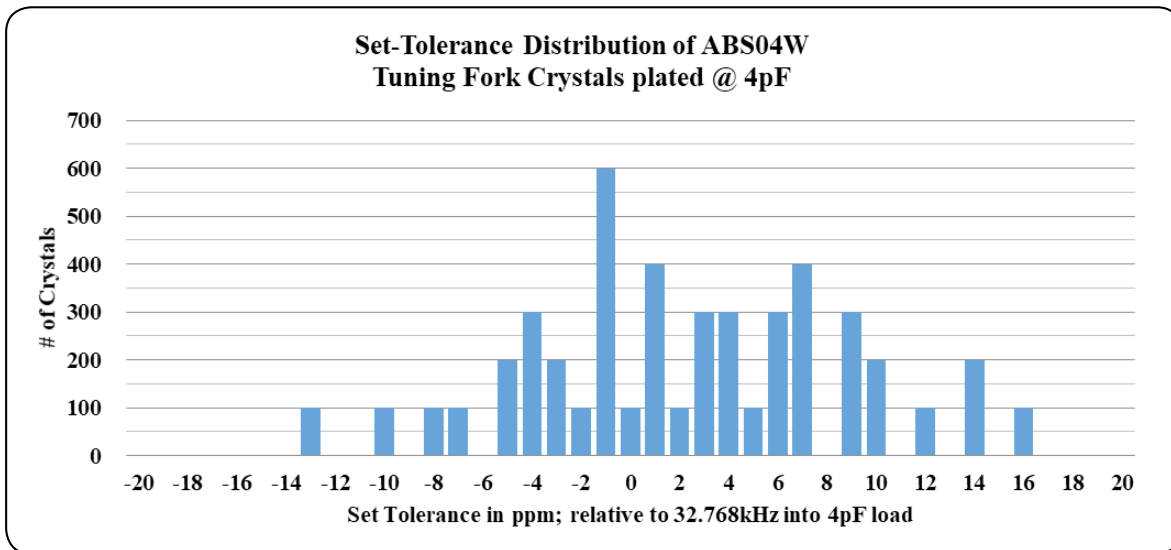
Load Capacitance (pF)
V: 12.5pF
9: 9pF
7: 7pF
6: 6pF
5: 5pF
4: 4pF

Operating Temp. Range
B: -20°C ~ +70°C
D: -40°C ~ +85°C
J: -40°C ~ +105°C

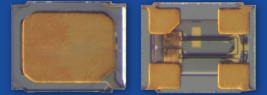
Freq. Tolerance
2: ±20ppm
3: ±30ppm
5: ±50ppm

Packaging
Blank: Bulk
T5: Tape & Reel (5000pcs/reel)

## Typical Frequency Tolerance Distribution (at 25°C ± 3°C):



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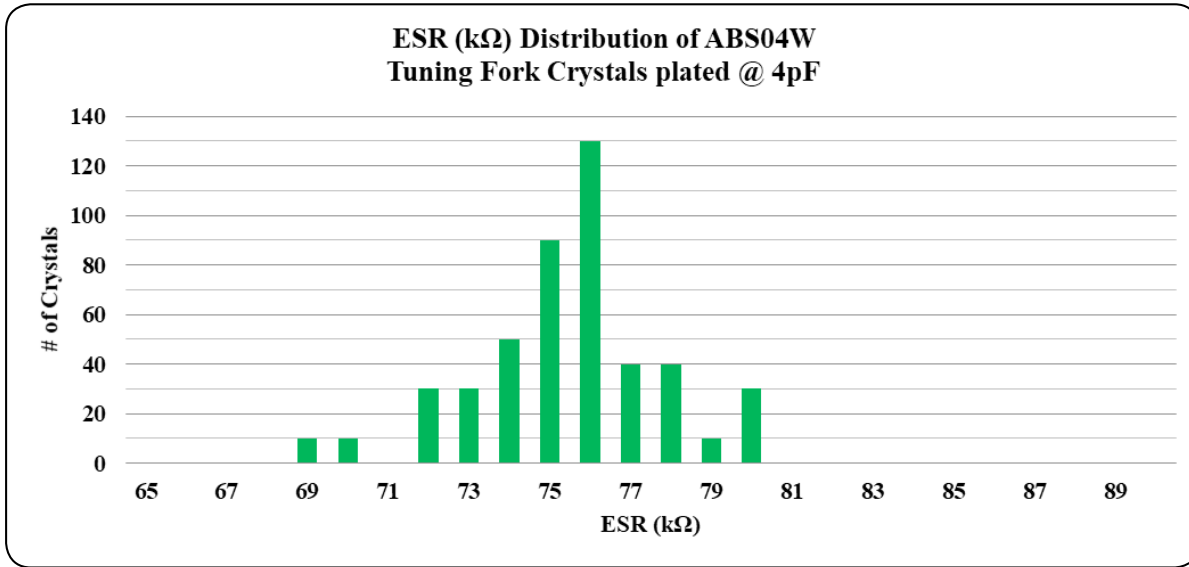


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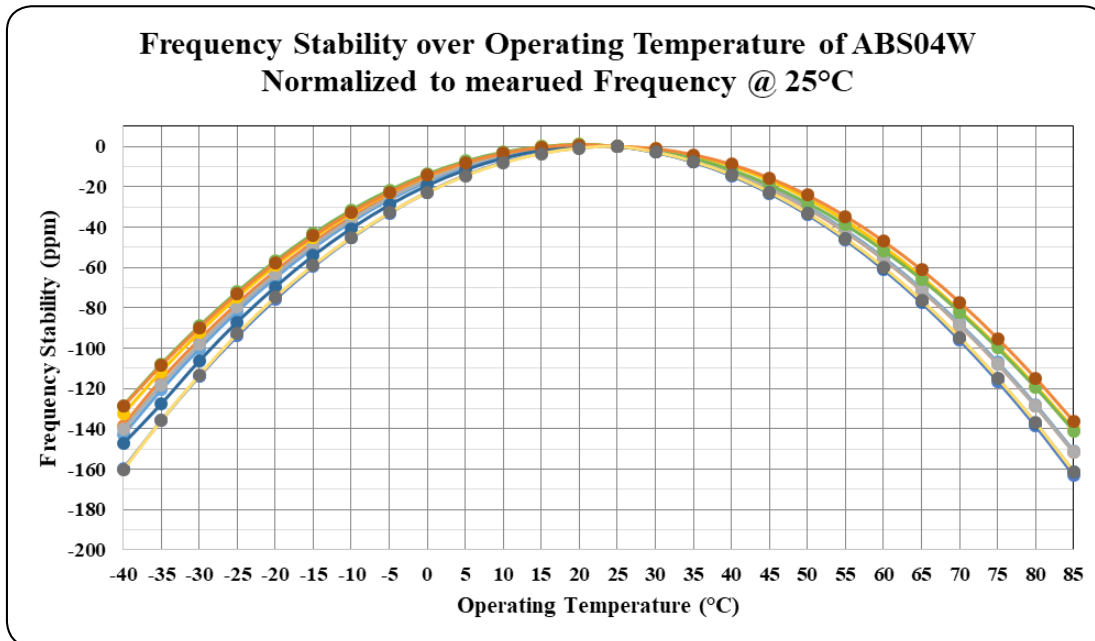
1.20 x 1.00 x 0.35mm  
RoHS/RoHS II Complaint  
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## Typical ESR Distribution (at 25°C ± 3°C):



The data above reflects typical distribution, lot-to-lot variation applies

## Typical Frequency vs. Temperature Characteristics:

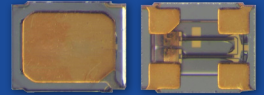


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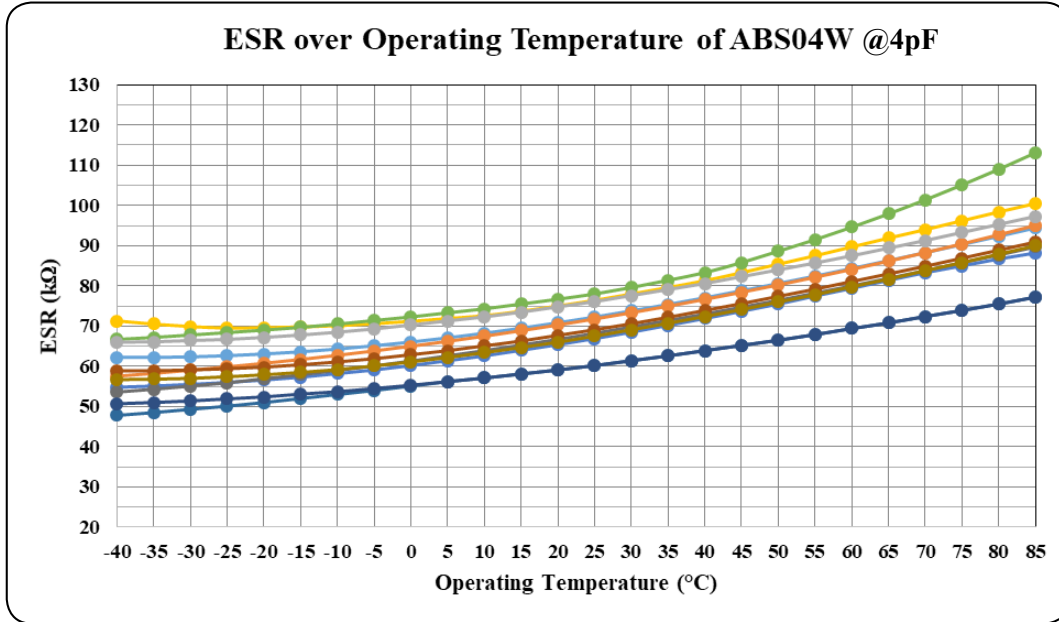


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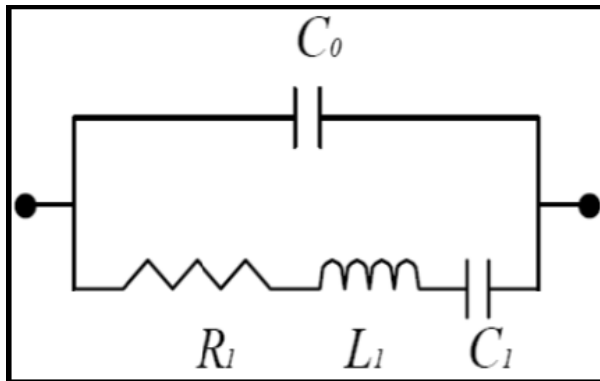
1.20 x 1.00 x 0.35mm  
 RoHS/RoHS II Complaint  
 MSL = N/A: Not Applicable

## Typical ESR (Equivalent Series Resistance) vs. Temperature Characteristics:



## SPICE Model (based on typical values at 25°C ± 3°C):

### Quartz Crystal Equivalent Circuit



#### Plating Load (CL) = 4pF

C0	=	1.54	pF
R1	=	72,895	Ω
L1	=	3,702,326	mH
C1	=	6.47	fF

#### Plating Load (CL) = 6pF

C0	=	1.50	pF
R1	=	72,615	Ω
L1	=	3,750,717	mH
C1	=	6.38	fF

#### Plating Load (CL) = 12.5pF

C0	=	1.48	pF
R1	=	75,455	Ω
L1	=	3,660,470	mH
C1	=	6.55	fF

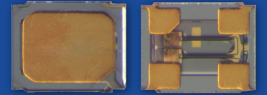


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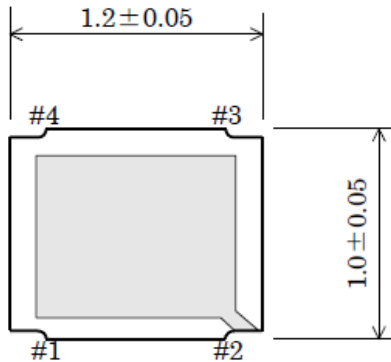
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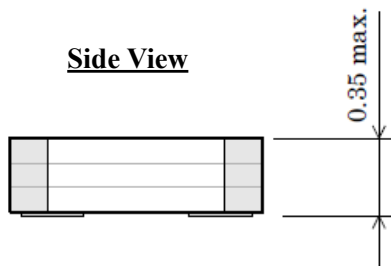
1.20 x 1.00 x 0.35mm  
RoHS/RoHS II Complaint  
MSL = N/A: Not Applicable

## Mechanical Dimensions

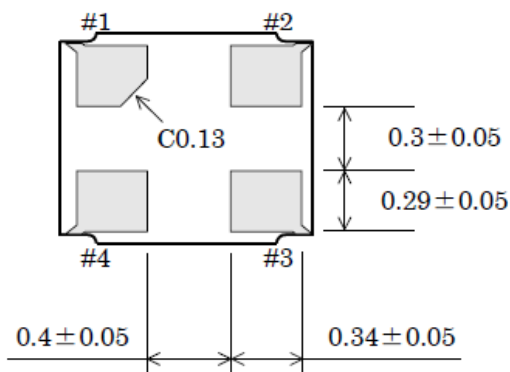
### Top View



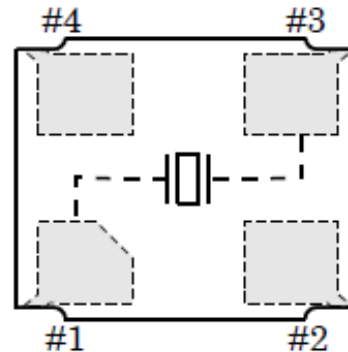
### Side View



### Bottom View



### Crystal Internal Connections

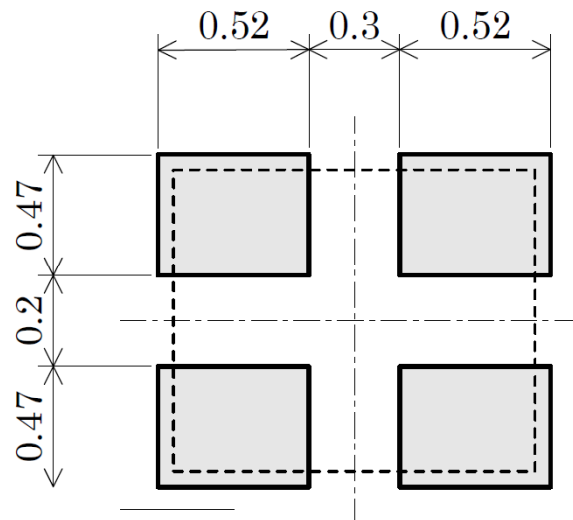


Pin #2: GND\*

Pin #4: NC

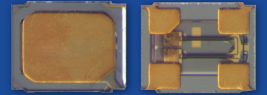
\*Pin #2 is connected to lid of the crystal package.

### Recommended Land Pattern



Dimensions: mm

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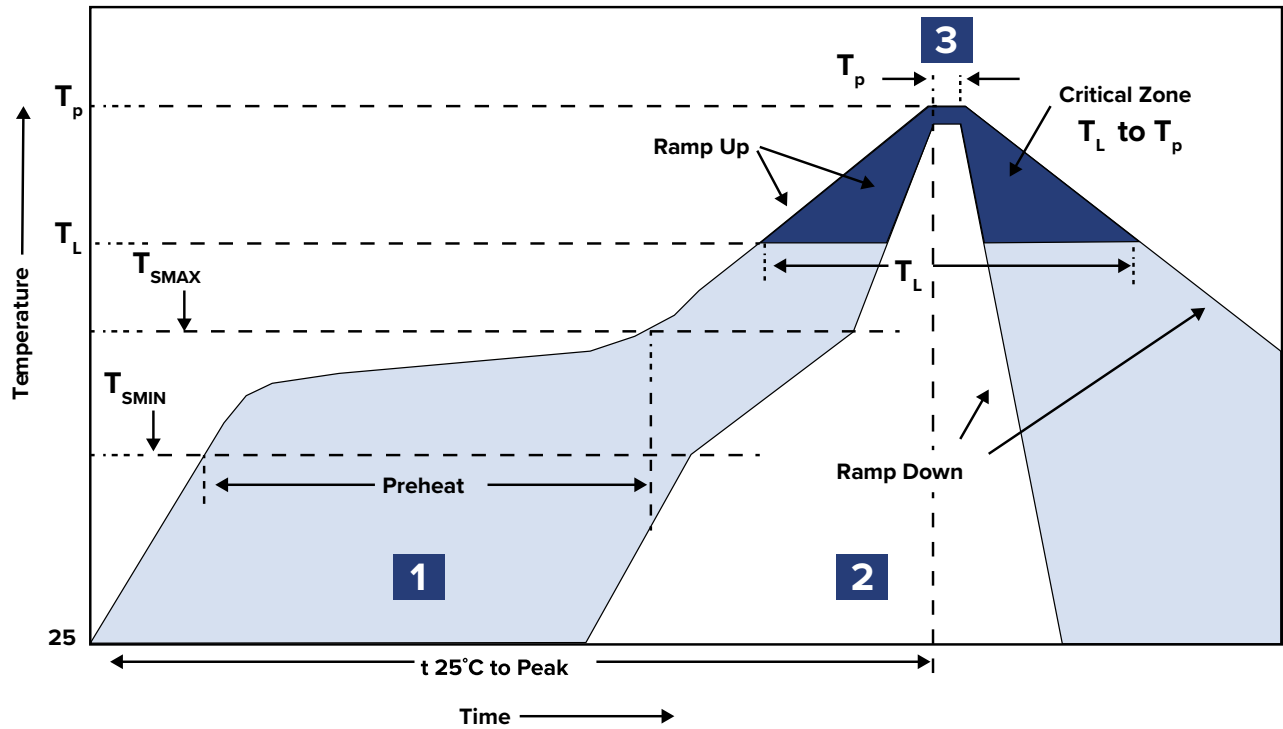


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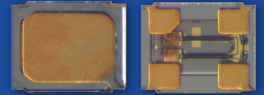
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## Recommended Reflow Profile



Zone	Description	Temperature	Time
1	Preheat / Soak	$T_{SMIN} \sim T_{SMAX}$ 150~170°C	80 ~ 100 sec.
2	Reflow	$T_L$ 220°C	50 ~ 70 sec.
3	Peak heat	$T_P$ 260±5°C	5 sec. MAX.

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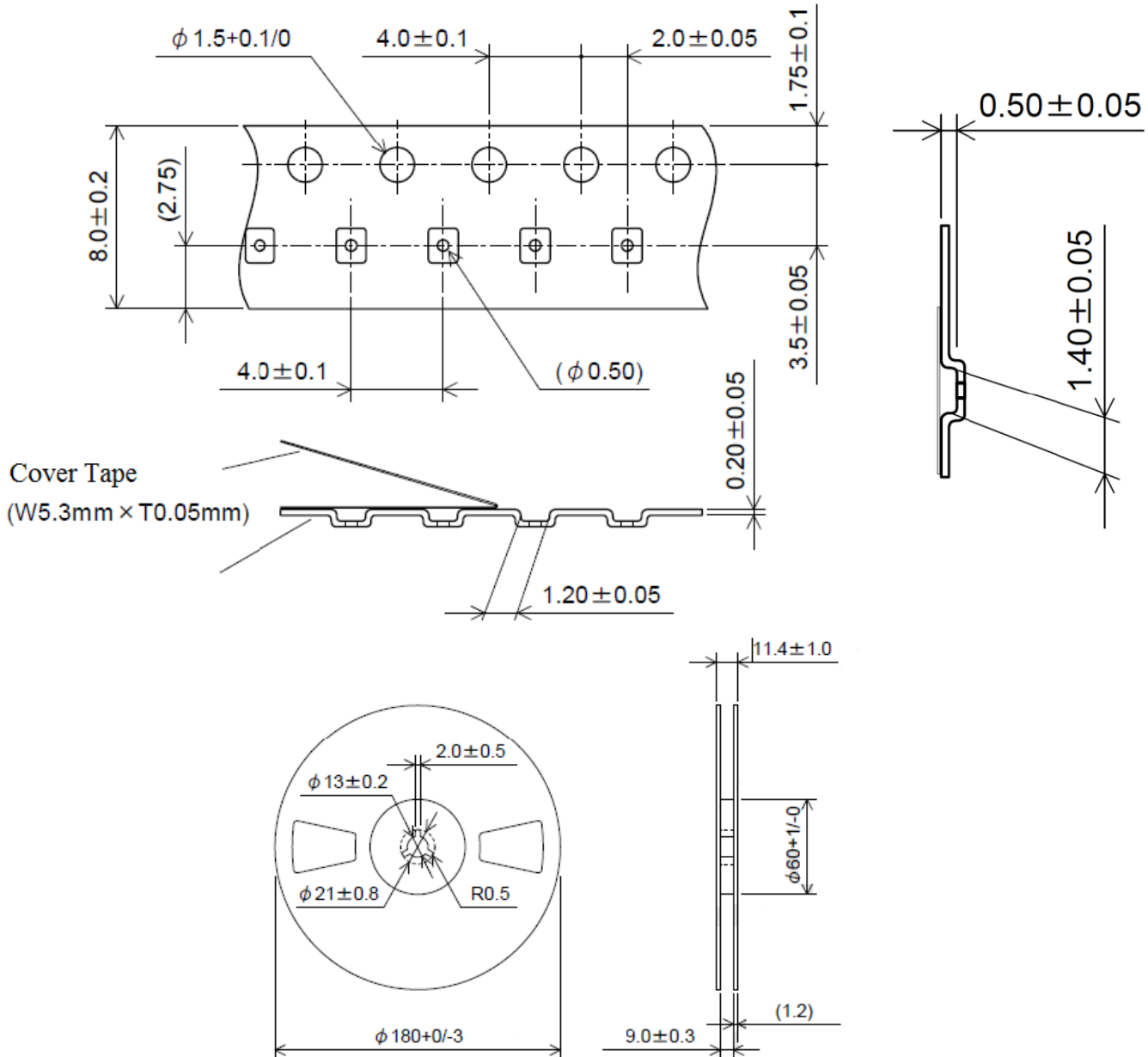
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1.20 x 1.00 x 0.35mm  
 RoHS/RoHS II Complaint  
 MSL = N/A: Not Applicable

## Packaging:

T5: Tape and reel (5,000pcs/reel)



## Dimensions: mm

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