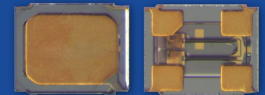




**THE DATASHEET OF
ABS04W-32.768KHZ-6-B3-T5**



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 ± 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 | ± 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 ² | |
| 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 Ω | @ +25 \pm 3°C |
| | | <75 | 130 | k Ω | 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 | μ 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 Ω | @ 100Vdc \pm 15V |

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

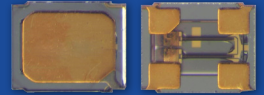


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1.20 x 1.00 x 0.35mm
 RoHS/RoHS II Complaint
 MSL = N/A: Not Applicable

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 - [] - [] [] - []

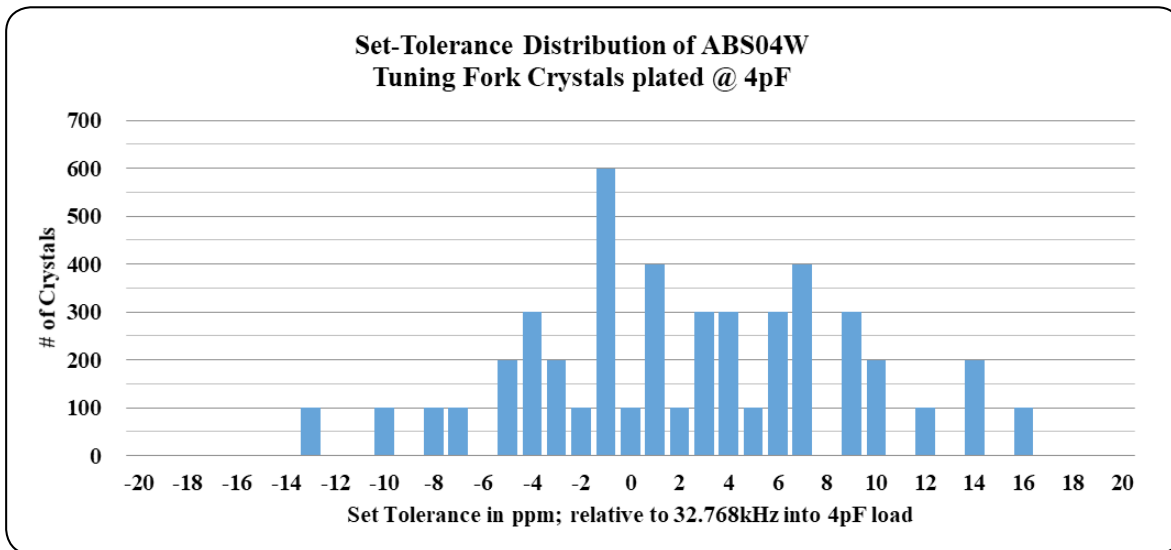
| Load Capacitance (pF) |
|-----------------------|
| V: 12.5pF |
| 9: 9pF |
| 7: 7pF |
| 6: 6pF |
| 5: 5pF |
| 4: 4pF |

| 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):

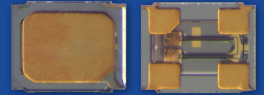


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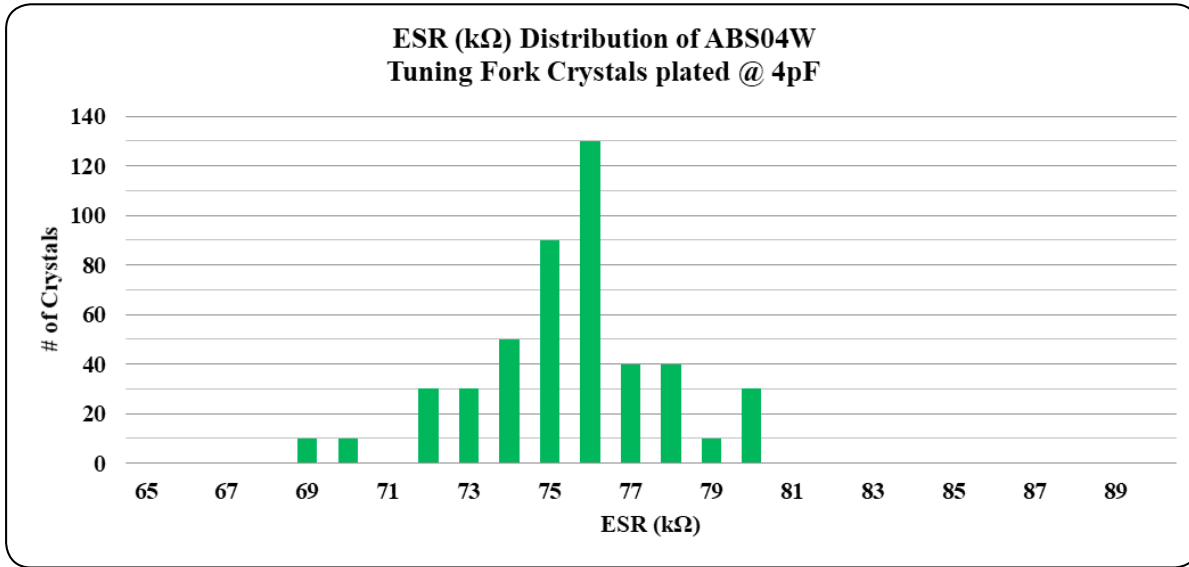


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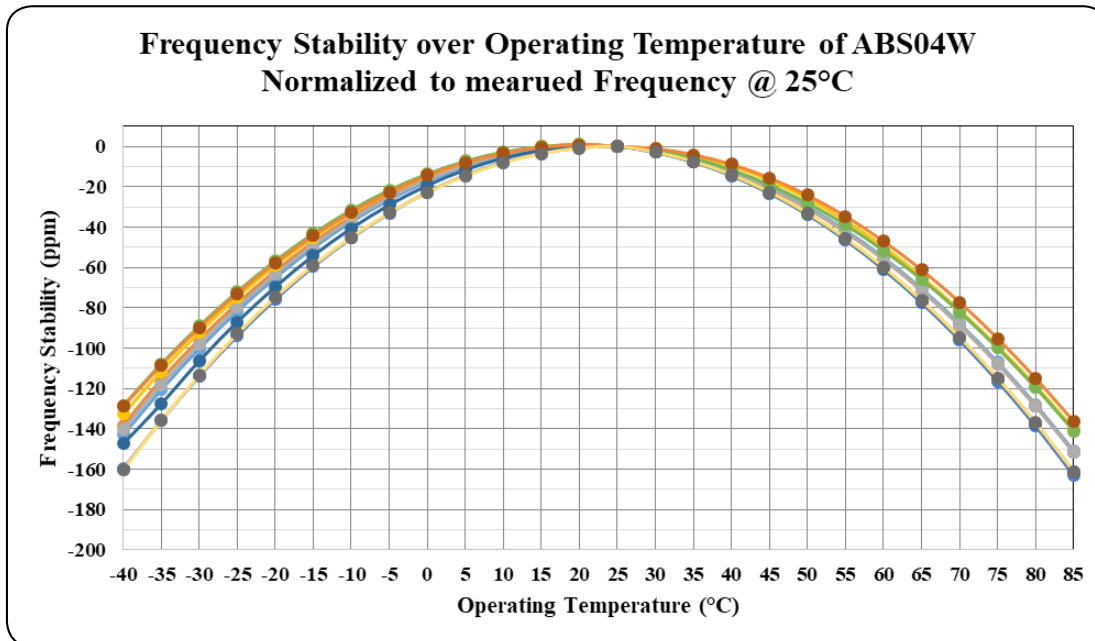
1.20 x 1.00 x 0.35mm
RoHS/RoHS II Complaint
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Typical ESR Distribution (at 25°C ± 3°C):



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

Typical Frequency vs. Temperature Characteristics:

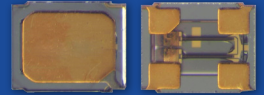


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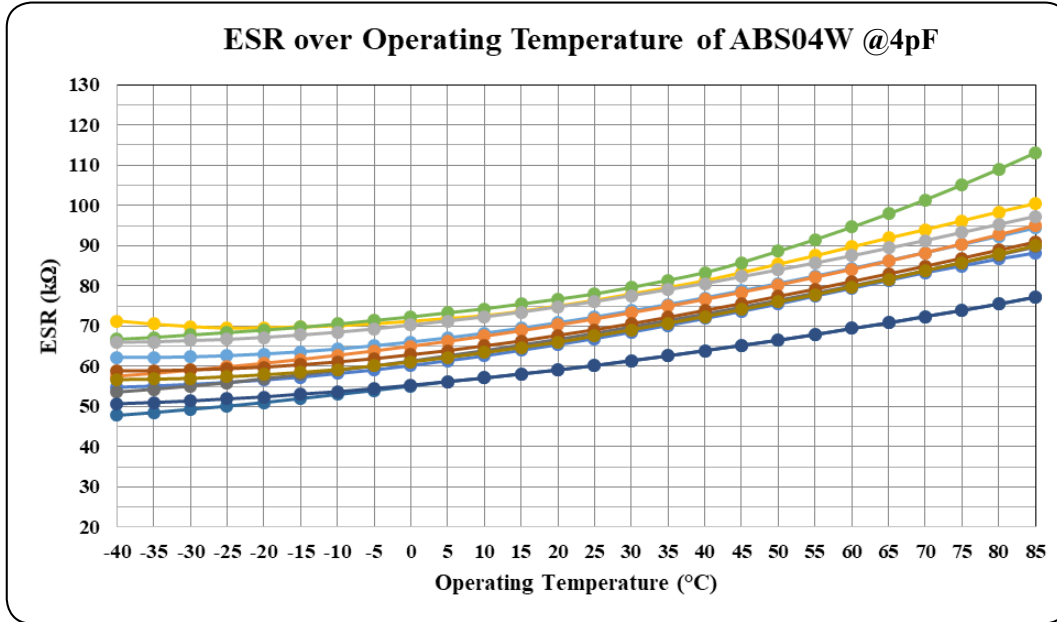


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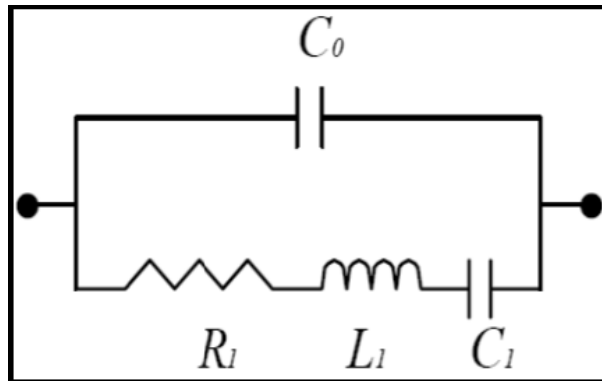
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 RoHS/RoHS II Complaint
 MSL = N/A: Not Applicable

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 |

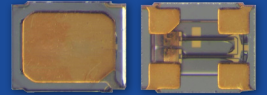
Plating Load (CL) = 6pF

| | | | |
|----|---|-----------|----|
| 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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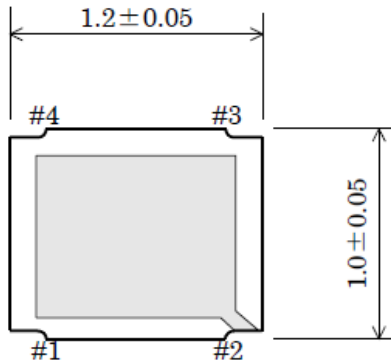
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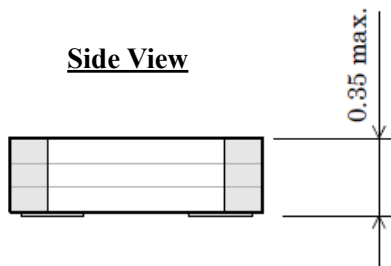
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Mechanical Dimensions

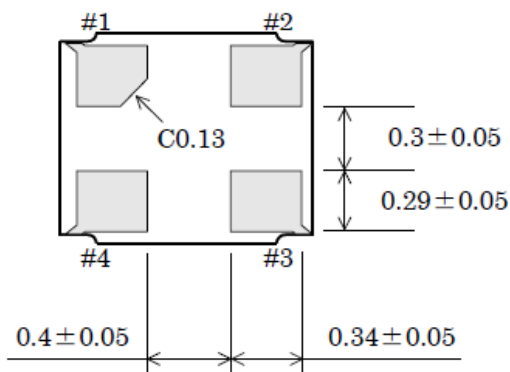
Top View



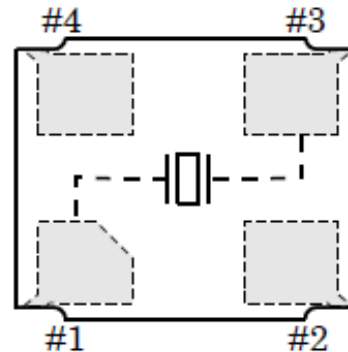
Side View



Bottom View



Crystal Internal Connections

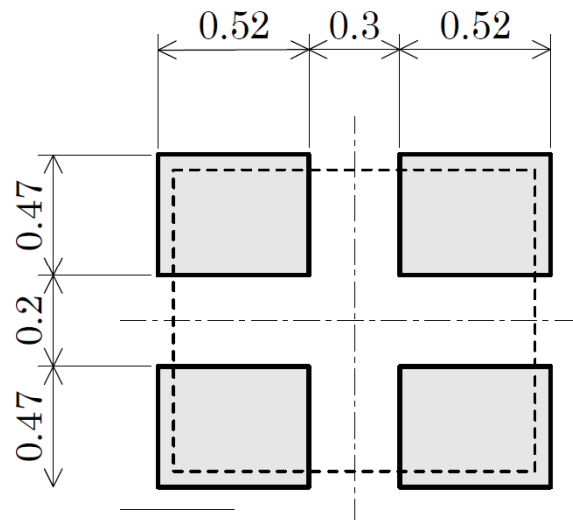


Pin #2: GND*

Pin #4: NC

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

Recommended Land Pattern



Dimensions: mm

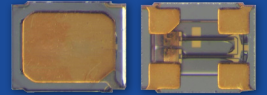


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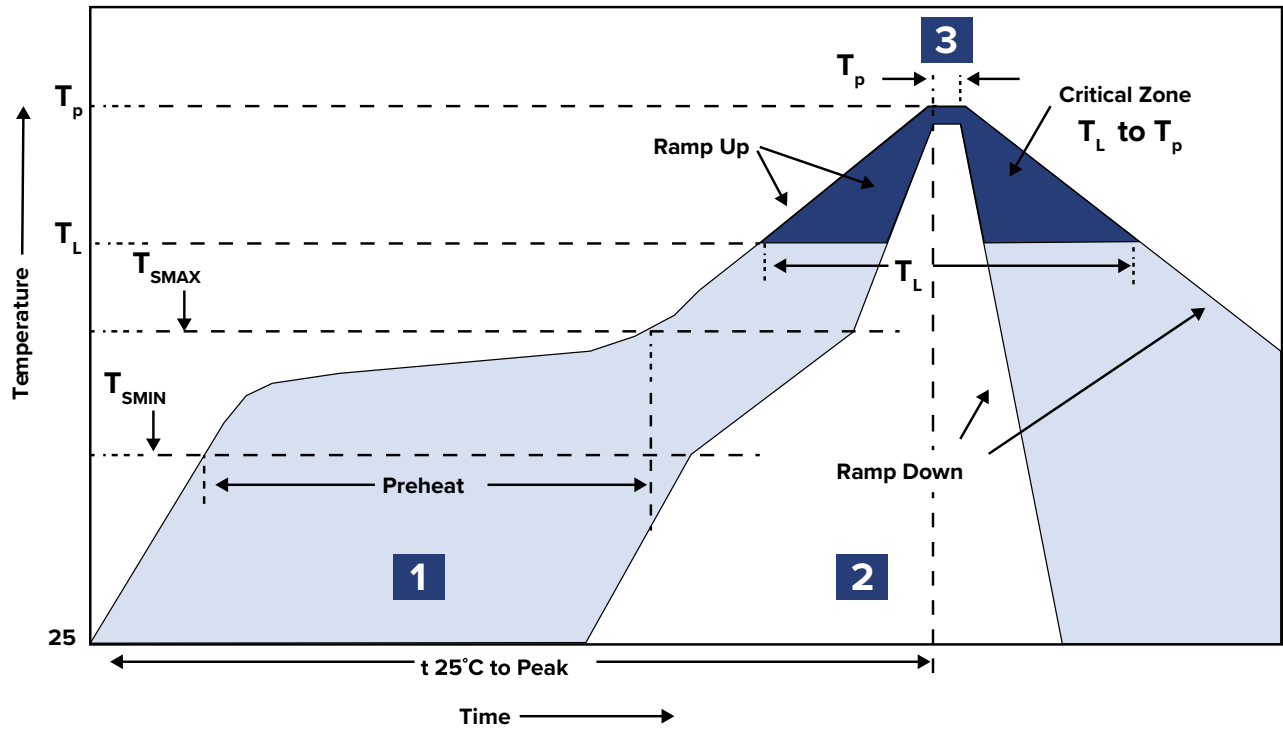


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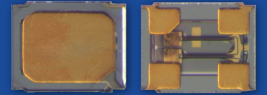
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Recommended Reflow Profile



| 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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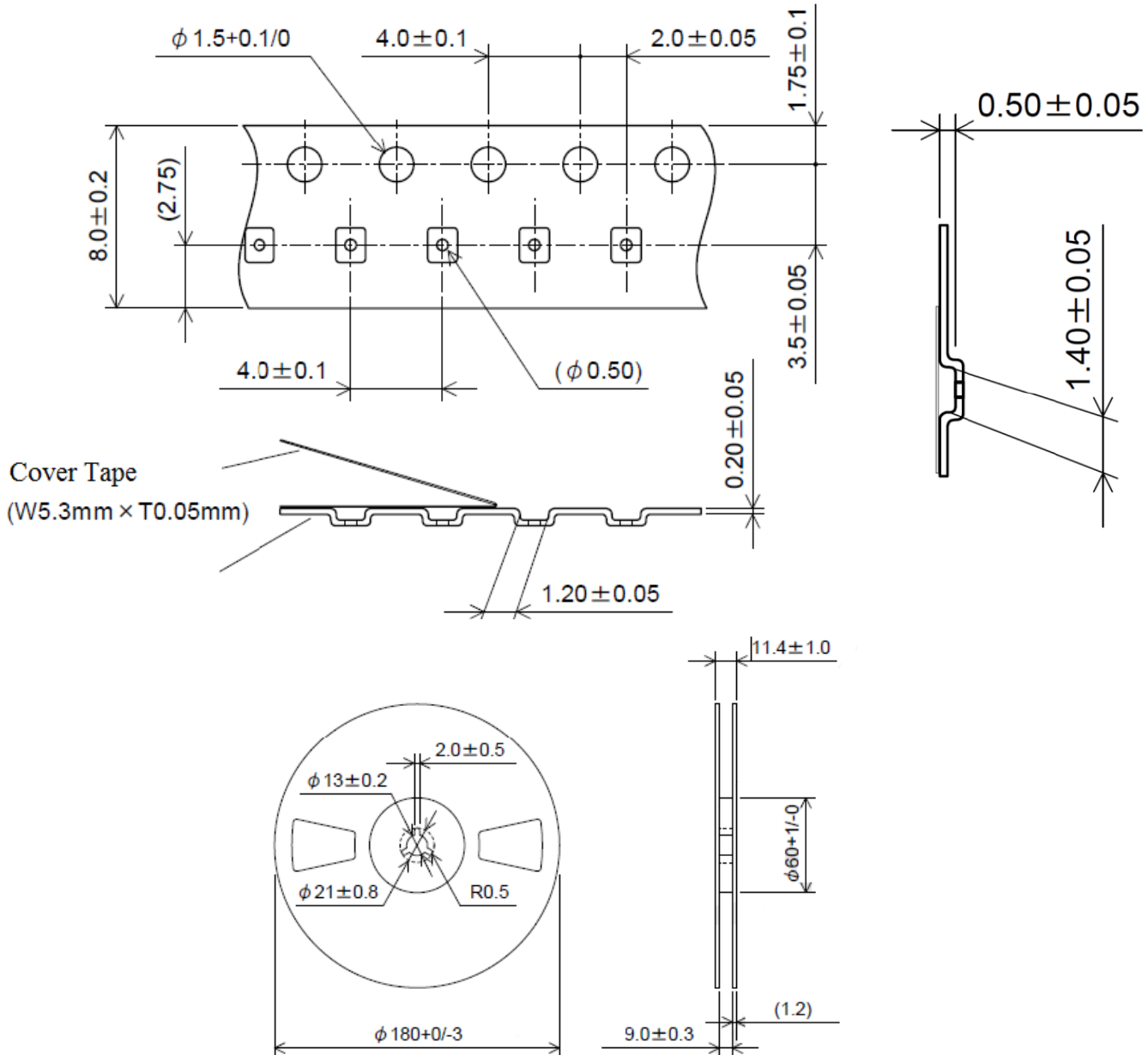
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Packaging:

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



Dimensions: mm

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