

# 32.768KHZ IoT OPTIMIZED SMD CRYSTAL



ABS06W

2.0 x 1.2 x 0.6 mm

RoHS/RoHS II Compliant

MSL = N/A: NOT APPLICABLE

Due to capacity constraints, this product is temporarily unavailable.  
 Recommended alternative part number: ABS04W or ABS05W  
 Contact Abracon for technical assistance: tech-support@abracon.com

## FEATURES

- Exceptionally low plating load of 3.0pF, ideal for wearables, wireless, and IoT applications
- Simultaneously optimized for ESR over extended operating temperature range
- Miniature 2.0x1.2x0.6 mm SMD package, ideally suited for space constrained designs
- Seam sealed package for long term reliability

## APPLICATIONS

- Wearables
- Wireless Modules
- Internet of Things (IoT)
- Bluetooth/Bluetooth Low Energy (BLE)
- Machine-to-Machine (M2M) Connectivity
- Ultra Low Power MCU
- Near Field Communication (NFC)
- ISM Band Applications
- Ultra low power, energy saving MCU

## STANDARD SPECIFICATIONS

| PARAMETERS  | MINIMUM                     | TYPICAL   | MAXIMUM | UNITS              | NOTES  |
|---|-----------------------------|-----------|---------|--------------------|--|
| Frequency   | 32.768                      |           |         | kHz                |  |
| Operation Mode  | Flexural Mode (Tuning Fork) |           |         |                    |  |
| Operating Temperature   | -40                         |           | +125    | °C                 | See options  |
| Storage Temperature   | -55                         |           | +125    | °C                 |  |
| Frequency Tolerance @ +25°C   | -20                         |           | +20     | ppm                | Refer to Note #1   |
| Shift through standard RoHS Reflow, (2) reflow cycles maximum   | -2.00                       |           | +2.00   | 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                        |           | -100    | ppm                | Over -40°C to +85°C  |
|   | -275                        |           | -100    | ppm                | Over -40°C to +105°C   |
|   | -450                        |           | -100    | ppm                | Over -40°C to +125°C   |
| Load capacitance (CL)   | 3                           |           |         | pF                 | Refer to Note #2   |
| Equivalent Series Resistance (ESR)  |                             | <55       | 65      | kΩ                 | @ +25±3°C  |
|   |                             | <75       | 95      | kΩ                 | Over -40°C to +85°C  |
|   |                             | <90       | 110     | kΩ                 | Over -40°C to +105°C   |
|   |                             | <100      | 120     | kΩ                 | Over -40°C to +125°C   |
| Shunt capacitance (C0)  |                             | 1.0       | 2.0     | pF                 | Combined Electrode & Package Capacitance   |
| Motional Capacitance (C1)   |                             | 5.0       |         | fF                 | C1 also referred as Cm   |
| Motional Inductance (L1)  |                             | 5,549,000 |         | mH                 | L1 also referred as Lm   |
| Drive Level   |                             | 0.1       | 0.5     | μW                 |  |
| Crystal sensitivity to closed-loop oscillator loading (Ts)  | 125                         | 140       | 165     | ppm/pF             | Refer to Note #3   |
| Q value   | 10000                       |           |         |                    | Quality Factor   |
| Aging @ +25°C±3°C [First Year]  | -3                          |           | +3      | ppm                | Relative to post reflow measured frequency   |
| Aging @ +25°C±3°C [Over 10-years]   | -10                         |           | +10     | ppm                | Relative to post reflow measured frequency   |
| Insulation Resistance   | 500                         |           |         | MΩ                 | @ 100Vdc   |

Note #1: With an effective loop capacitance of 3.0pF, 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 3.0 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 = 3pF



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REVISED: 05.26.2021

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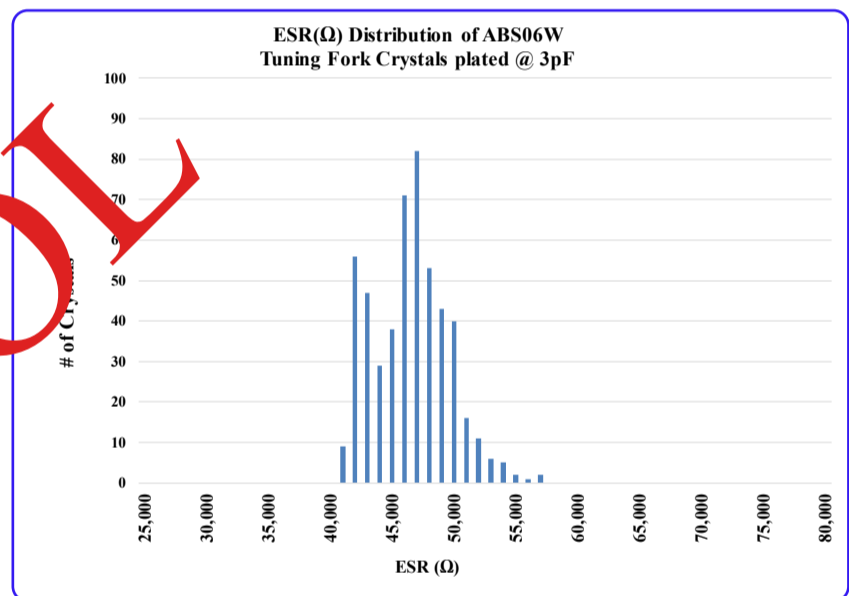
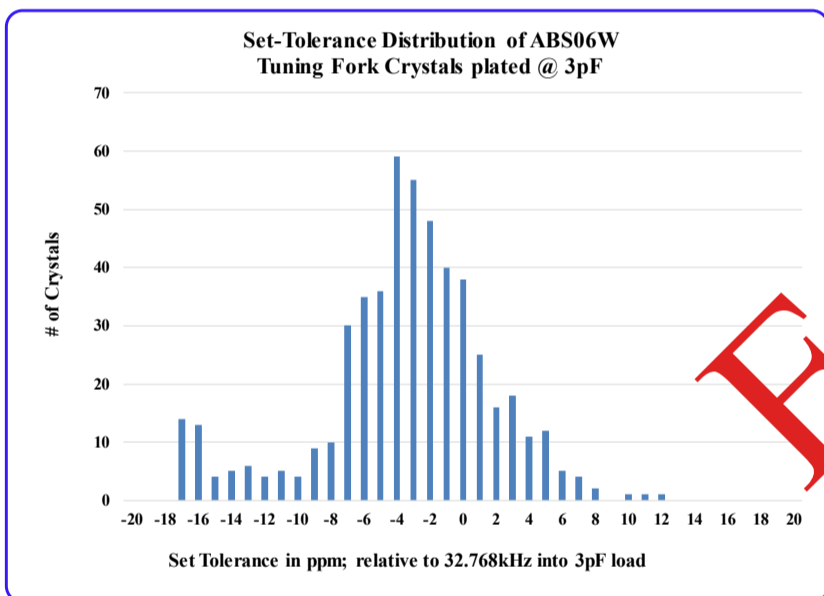
## OPTIONS AND PART IDENTIFICATION

ABS06W - 32.768kHz - ○ - ○ - ○

| OPERATING TEMP RANGE | FREQ. TOLERANCE | PACKAGING                          |
|----------------------|-----------------|------------------------------------|
| D: -40°C ~ +85°C     | 2: ±20 ppm      | Blank: Bulk                        |
| J: -40°C ~ +125°C    |                 | T: Tape & Reel<br>(3,000pcs/reel)  |
| K: -55°C ~ +125°C    |                 | T9: Tape & Reel<br>(9,000pcs/reel) |

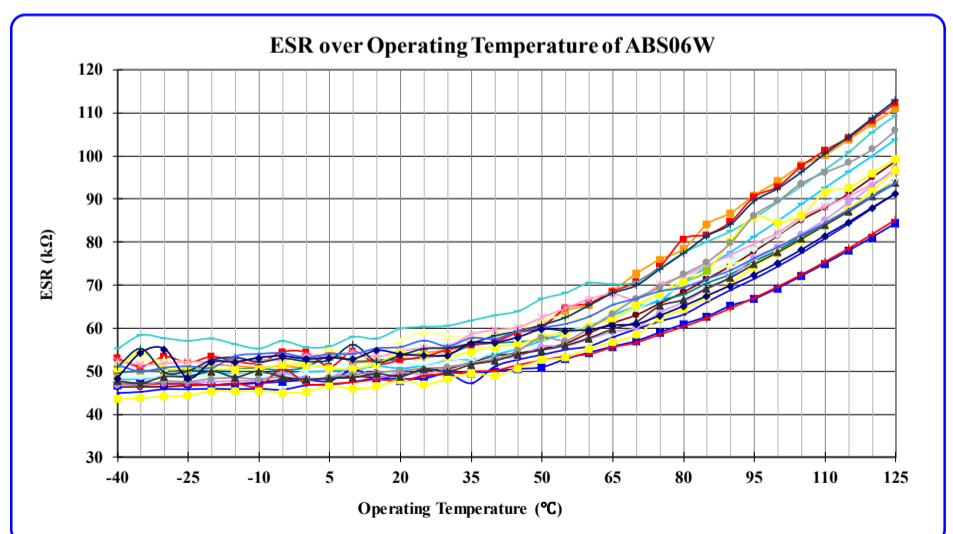
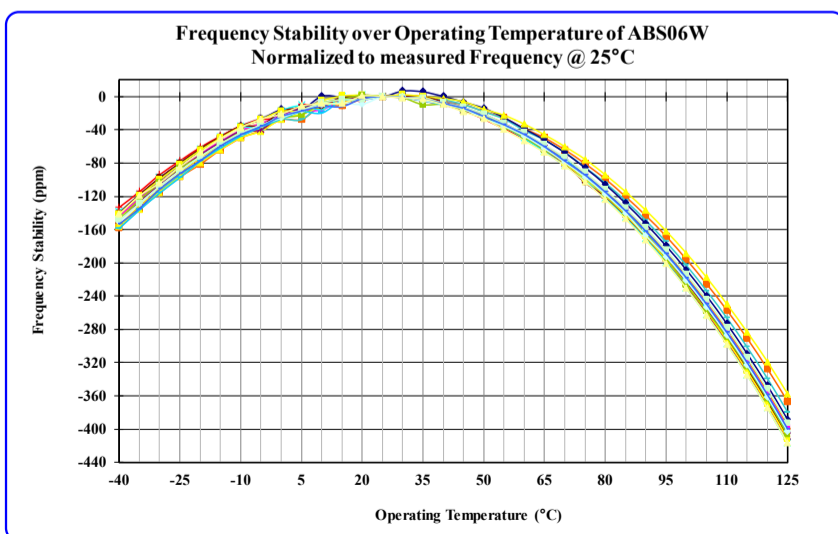
## TYPICAL FREQUENCY TOLERANCE DISTRIBUTION (AT 25°C ± 3°C)

## TYPICAL ESR DISTRIBUTION (AT 25°C ± 3°C)



## TYPICAL FREQUENCY Vs. TEMPERATURE CHARACTERISTICS

## TYPICAL ESR(EQUIVALENT SERIES RESISTANCE) Vs. TEMPERATURE CHARACTERISTICS



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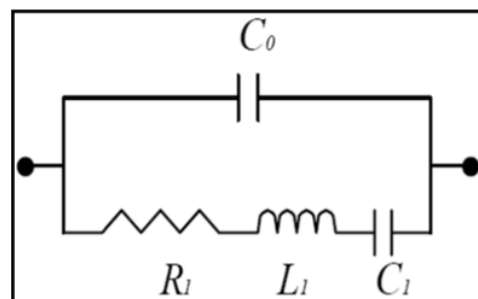
2.0 x 1.2 x 0.6 mm

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SPICE MODEL (BASED ON TYPICAL VALUES AT 25°C ± 3°C):

## Quartz Crystal Equivalent Circuit



Frequency: 32.78kHz

**Plating Load (CL) = 3pF**

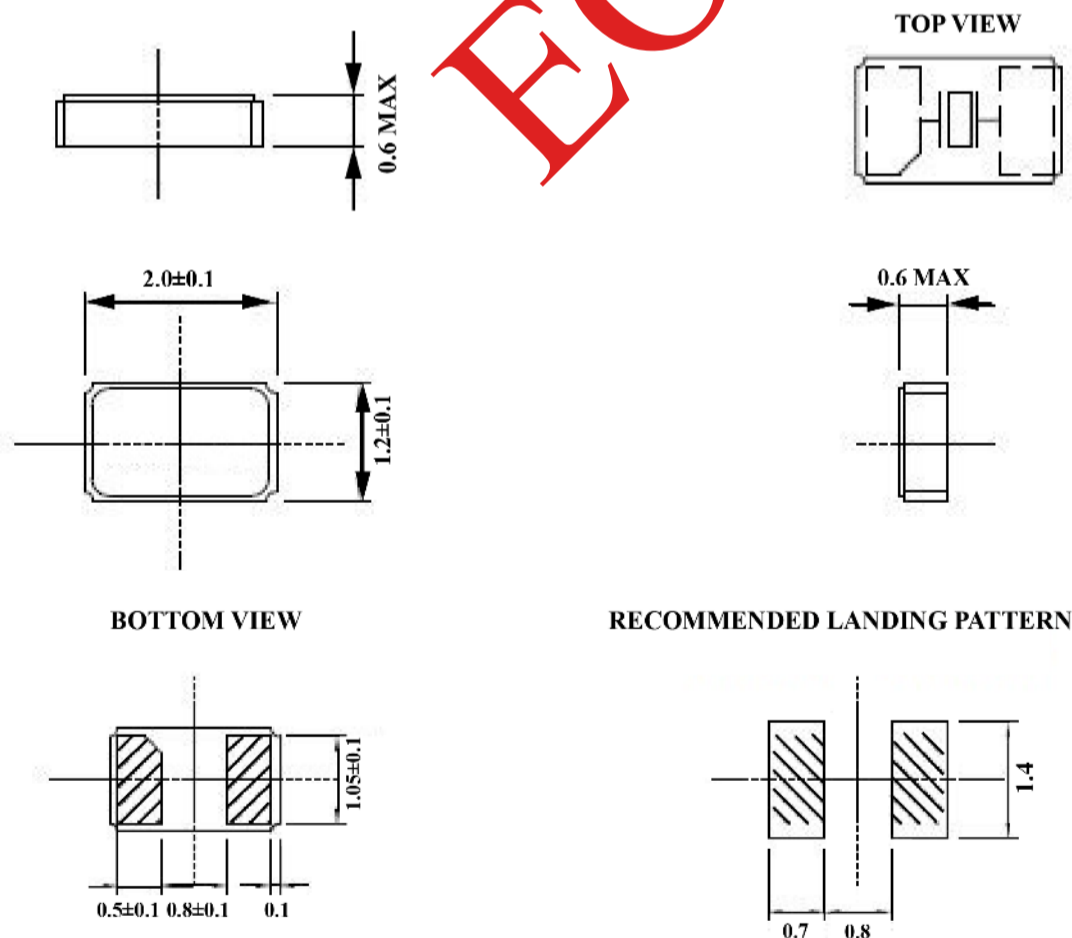
C0 = 0.90 pF

R1 = 47,594 Ω

L1 = 5,549,000 mH

C1 = 4.26 fF

## MECHANICAL DIMENSIONS



DIMENSIONS: mm



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## REFLOW PROFILE [JEDEC J-STD-020]

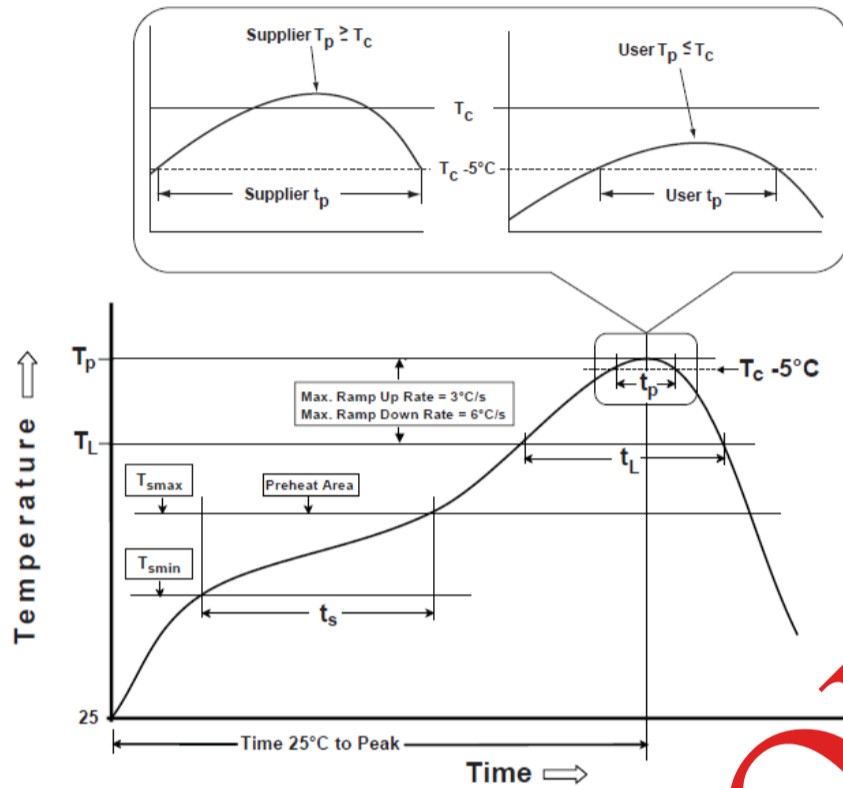


Table 1

| SnPb Eutectic Process<br>Classification Temperatures ( $T_c$ ) |                    |                    |
|--|--------------------|--------------------|
| Package Thickness  | Volume $mm^3$ <350 | Volume $mm^3$ >350 |
| <2.5 mm  | 235 °C             | 220 °C             |
| >2.5 mm  | 220 °C             | 220 °C             |

Table 2

| Pb-Free Process<br>Classification Temperatures ( $T_c$ ) |                    |                        |                     |
|--|--------------------|------------------------|---------------------|
| Package Thickness  | Volume $mm^3$ <350 | Volume $mm^3$ 350-2000 | Volume $mm^3$ >2000 |
| <1.6 mm  | 260 °C             | 260 °C                 | 260 °C              |
| 1.6 mm - 2.5 mm  | 260 °C             | 250 °C                 | 245 °C              |
| >2.5 mm  | 250 °C             | 245 °C                 | 245 °C              |

| Profile Feature   | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|-------------------------|------------------|
| Preheat / soak  |                         |                  |
| Temperature minimum ( $T_{smin}$ )  | 100°C                   | 150°C            |
| Temperature maximum ( $T_{smax}$ )  | 150°C                   | 200°C            |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                       | 60 - 120 sec.           | 60 - 120 sec.    |
| Average ramp-up rate ( $T_{smax}$ to $T_p$ )                                      | 3°C/sec. max            | 3°C/sec. max     |
| Liquidous temperature ( $T_L$ )   | 183°C                   | 217°C            |
| Time at liquidous ( $t_L$ )   | 60 - 150 sec.           | 60 - 150 sec.    |
| Peak package body temperature ( $T_p$ )*  | see Table 1             | see Table 2      |
| Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ ) | 20 sec.                 | 30 sec.          |
| Ramp-down rate ( $T_p$ to $T_{smax}$ )  | 6°C/sec. max            | 6°C/sec. max     |
| Time 25°C to peak temperature   | 6 min. max              | 8 min. max       |
| Reflow cycles   | 2 max                   | 2 max            |

\*Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

\*\*Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

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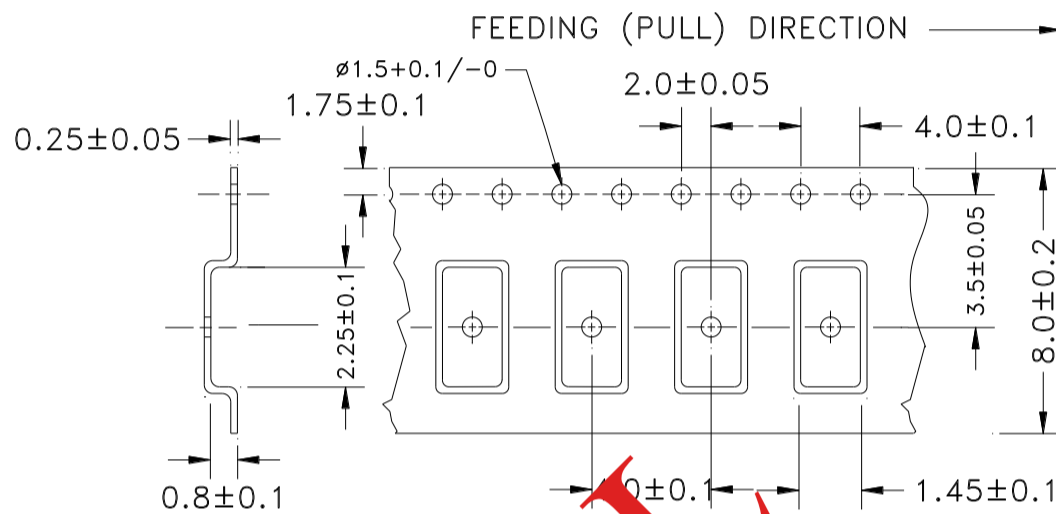
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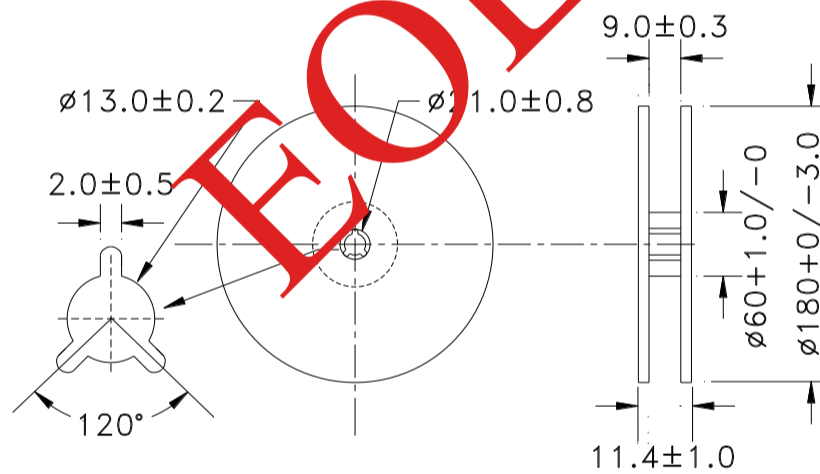
## PACKAGING

T= Tape and reel (3,000pcs/reel)

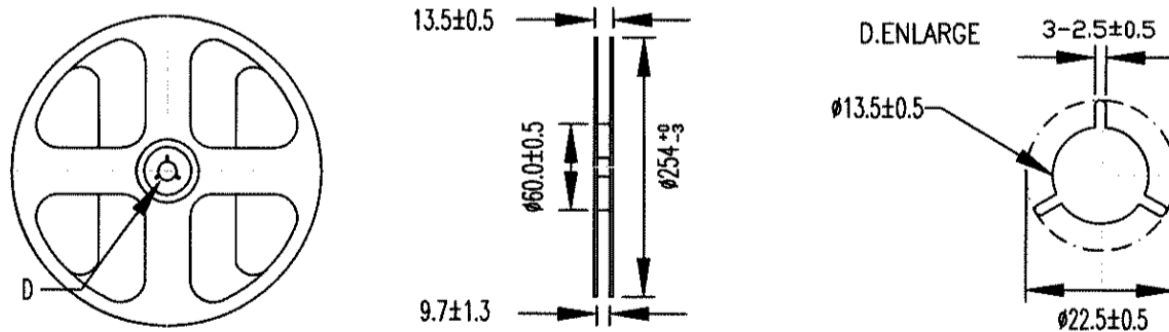
T9= Tape and reel (9,000pcs/reel)



Reel=3,000pcs



Reel=9,000pcs



Dimensions: mm



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