

# CONTINUOUS VOLTAGE SMD CRYSTAL OSCILLATOR

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3.2 x 2.5 x 1.2mm  
RoHS/RoHS II Compliant  
MSL Level = 1

## Features

- Continuous Vdd operation from 1.6 V ~ 3.63 V
- Optimized for low current consumption
- Output Enable/Start & Disable/Stop function
- Output waveform CMOS/HCMOS/LVCMOS compatible
- Hermetically seam-sealed ceramic package

## Applications

- Portable & wearable electronics
- Internet of Things (IoT)
- Consumer electronics
- Industrial control & automation
- Mobile communication

## Electrical Specifications

| Parameters                                                                            |                     | Min.                                                                              | Typ. | Max.    | Units | Notes                   |
|---------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------|------|---------|-------|-------------------------|
| Frequency Range                                                                       |                     | 1                                                                                 |      | 160     | MHz   |                         |
| Operating Temperature Range                                                           |                     | -40                                                                               |      | +85     | °C    | See options             |
| Storage Temperature Range                                                             |                     | -55                                                                               |      | +125    | °C    |                         |
| Overall Frequency Stability [Note 1]                                                  |                     | -25                                                                               |      | +25     | ppm   | See options             |
| Supply Voltage (Vdd)                                                                  |                     | 1.6                                                                               |      | 3.63    | V     |                         |
| Tri-state function                                                                    |                     | “1” (VIH≥0.7*Vdd) or Open: Oscillation;<br>“0” (VIL<0.3*Vdd): No Oscillation/Hi Z |      |         | V     |                         |
| Output Load                                                                           |                     |                                                                                   |      | 15      | pF    | CMOS                    |
| Output Voltage                                                                        | VOH                 | 0.9*Vdd                                                                           |      |         | V     |                         |
|                                                                                       | VOL                 |                                                                                   |      | 0.1*Vdd | V     |                         |
| Aging 1 year @25°C±3°C                                                                |                     | -3.0                                                                              |      | +3.0    | ppm   |                         |
| Aging 5 years @25°C±3°C                                                               |                     | -5.0                                                                              |      | +5.0    | ppm   |                         |
| Symmetry @ ½ Vdd                                                                      |                     | 45                                                                                | 50   | 55      | %     |                         |
| Start-up Time                                                                         |                     |                                                                                   |      | 5.0     | ms    |                         |
| Rise and Fall Time (Tr/Tf)<br>@10%Vdd-90%Vdd, 15pF load                               | Vdd = 1.8V to 3.63V |                                                                                   |      | 8.0     | ns    | 1MHz ≤ F ≤ 19.999MHz    |
|                                                                                       |                     |                                                                                   |      | 6.0     |       | 20MHz ≤ F ≤ 39.999MHz   |
|                                                                                       |                     |                                                                                   |      | 5.0     |       | 40MHz ≤ F ≤ 69.999MHz   |
|                                                                                       |                     |                                                                                   |      | 5.0     |       | 70MHz ≤ F ≤ 99.999MHz   |
|                                                                                       |                     |                                                                                   |      | 4.0     |       | 100MHz ≤ F ≤ 129.999MHz |
|                                                                                       |                     |                                                                                   |      | 3.0     |       | 130MHz ≤ F ≤ 160MHz     |
|                                                                                       | Vdd = 1.6V          |                                                                                   |      | 10.0    |       | 1MHz ≤ F ≤ 19.999MHz    |
|                                                                                       |                     |                                                                                   |      | 8.0     |       | 20MHz ≤ F ≤ 39.999MHz   |
|                                                                                       |                     |                                                                                   |      | 6.0     |       | 40MHz ≤ F ≤ 69.999MHz   |
|                                                                                       |                     |                                                                                   |      | 6.0     |       | 70MHz ≤ F ≤ 99.999MHz   |
|                                                                                       |                     |                                                                                   |      | 5.0     |       | 100MHz ≤ F ≤ 129.999MHz |
|                                                                                       |                     |                                                                                   |      | 5.0     |       | 130MHz ≤ F ≤ 160MHz     |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
|                                                                                       |                     |                                                                                   |      | 5.0     |       |                         |
| RMS Period Jitter @25°C±3°C                                                           | Vdd = 3.0V to 3.63V |                                                                                   |      | 5.0     | ps    |                         |
|                                                                                       | Vdd = 1.6V to 2.5V  |                                                                                   |      | 7.0     |       |                         |
| RMS Phase Jitter @25°C±3°C<br>(10 - 39MHz: 12kHz to 5MHz)<br>(>39MHz: 12kHz to 20MHz) |                     |                                                                                   |      | 1.0     | ps    |                         |
| Disable Current                                                                       |                     |                                                                                   |      | 10.0    | μA    |                         |

\*Note 1: Overall frequency stability includes initial frequency tolerance @25°C±3°C and stability over the operating temperature range.



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RoHS/RoHS II Compliant  
MSL Level = 1

## Electrical Specifications *continued*

| Parameters                                                                             | Min. | Typ. | Max. | Units | Notes                   |
|----------------------------------------------------------------------------------------|------|------|------|-------|-------------------------|
| Supply Current (I <sub>dd</sub> ) into 15pF Load @25°C± 3°C<br>@ V <sub>dd</sub> =3.3V |      |      | 2.0  | mA    | 1MHz ≤ F < 5.999MHz     |
|                                                                                        |      |      | 2.0  |       | 6MHz ≤ F < 9.999MHz     |
|                                                                                        |      |      | 3.0  |       | 10MHz ≤ F < 19.999MHz   |
|                                                                                        |      |      | 4.0  |       | 20MHz ≤ F < 29.999MHz   |
|                                                                                        |      |      | 5.0  |       | 30MHz ≤ F < 39.999MHz   |
|                                                                                        |      |      | 5.0  |       | 40MHz ≤ F < 45.999MHz   |
|                                                                                        |      |      | 5.0  |       | 46MHz ≤ F < 48.999MHz   |
|                                                                                        |      |      | 6.0  |       | 49MHz ≤ F < 50.999MHz   |
|                                                                                        |      |      | 8.0  |       | 51MHz ≤ F < 54.999MHz   |
|                                                                                        |      |      | 8.0  |       | 55MHz ≤ F < 60.999MHz   |
|                                                                                        |      |      | 12.5 |       | 61MHz ≤ F < 75.999MHz   |
|                                                                                        |      |      | 14.5 |       | 76MHz ≤ F < 80.999MHz   |
|                                                                                        |      |      | 14.5 |       | 81MHz ≤ F < 105.999MHz  |
|                                                                                        |      |      | 15.5 |       | 106MHz ≤ F < 119.999MHz |
|                                                                                        |      |      | 15.5 |       | 120MHz ≤ F < 130.999MHz |
|                                                                                        |      |      | 18.0 |       | 131MHz ≤ F < 139.999MHz |
|                                                                                        |      |      | 18.0 |       | 140MHz ≤ F < 149.999MHz |
|                                                                                        |      |      | 18.0 |       | 150MHz ≤ F < 156.999MHz |
| Supply Current (I <sub>dd</sub> ) into 15pF Load @25°C± 3°C<br>@ V <sub>dd</sub> =2.5V |      |      | 1.3  | mA    | 1MHz ≤ F < 5.999MHz     |
|                                                                                        |      |      | 1.3  |       | 6MHz ≤ F < 9.999MHz     |
|                                                                                        |      |      | 2.0  |       | 10MHz ≤ F < 19.999MHz   |
|                                                                                        |      |      | 3.0  |       | 20MHz ≤ F < 29.999MHz   |
|                                                                                        |      |      | 3.5  |       | 30MHz ≤ F < 39.999MHz   |
|                                                                                        |      |      | 4.5  |       | 40MHz ≤ F < 45.999MHz   |
|                                                                                        |      |      | 4.5  |       | 46MHz ≤ F < 48.999MHz   |
|                                                                                        |      |      | 5.0  |       | 49MHz ≤ F < 50.999MHz   |
|                                                                                        |      |      | 6.5  |       | 51MHz ≤ F < 54.999MHz   |
|                                                                                        |      |      | 7.0  |       | 55MHz ≤ F < 60.999MHz   |
|                                                                                        |      |      | 10.0 |       | 61MHz ≤ F < 75.999MHz   |
|                                                                                        |      |      | 11.5 |       | 76MHz ≤ F < 80.999MHz   |
|                                                                                        |      |      | 11.5 |       | 81MHz ≤ F < 105.999MHz  |
|                                                                                        |      |      | 12.5 |       | 106MHz ≤ F < 119.999MHz |
|                                                                                        |      |      | 12.5 |       | 120MHz ≤ F < 130.999MHz |
|                                                                                        |      |      | 14.0 |       | 131MHz ≤ F < 139.999MHz |
|                                                                                        |      |      | 14.0 |       | 140MHz ≤ F < 149.999MHz |
|                                                                                        |      |      | 14.0 |       | 150MHz ≤ F < 156.999MHz |
| Supply Current (I <sub>dd</sub> ) into 15pF Load @25°C± 3°C<br>@ V <sub>dd</sub> =1.8V |      |      | 1.0  | mA    | 1MHz ≤ F < 5.999MHz     |
|                                                                                        |      |      | 1.0  |       | 6MHz ≤ F < 9.999MHz     |
|                                                                                        |      |      | 1.6  |       | 10MHz ≤ F < 19.999MHz   |
|                                                                                        |      |      | 2.2  |       | 20MHz ≤ F < 29.999MHz   |
|                                                                                        |      |      | 2.5  |       | 30MHz ≤ F < 39.999MHz   |
|                                                                                        |      |      | 3.0  |       | 40MHz ≤ F < 45.999MHz   |
|                                                                                        |      |      | 3.5  |       | 46MHz ≤ F < 48.999MHz   |
|                                                                                        |      |      | 3.5  |       | 49MHz ≤ F < 50.999MHz   |
|                                                                                        |      |      | 3.5  |       | 51MHz ≤ F < 54.999MHz   |
|                                                                                        |      |      | 4.0  |       | 55MHz ≤ F < 60.999MHz   |
|                                                                                        |      |      | 9.0  |       | 61MHz ≤ F < 75.999MHz   |
|                                                                                        |      |      | 9.0  |       | 76MHz ≤ F < 80.999MHz   |
|                                                                                        |      |      | 10.0 |       | 81MHz ≤ F < 105.999MHz  |
|                                                                                        |      |      | 10.0 |       | 106MHz ≤ F < 119.999MHz |
|                                                                                        |      |      | 10.5 |       | 120MHz ≤ F < 130.999MHz |
|                                                                                        |      |      | 10.5 |       | 131MHz ≤ F < 139.999MHz |
|                                                                                        |      |      | 11.5 |       | 140MHz ≤ F < 149.999MHz |
|                                                                                        |      |      | 11.5 |       | 150MHz ≤ F < 156.999MHz |
|                                                                                        |      |      | 11.5 |       | 157MHz ≤ F < 160MHz     |



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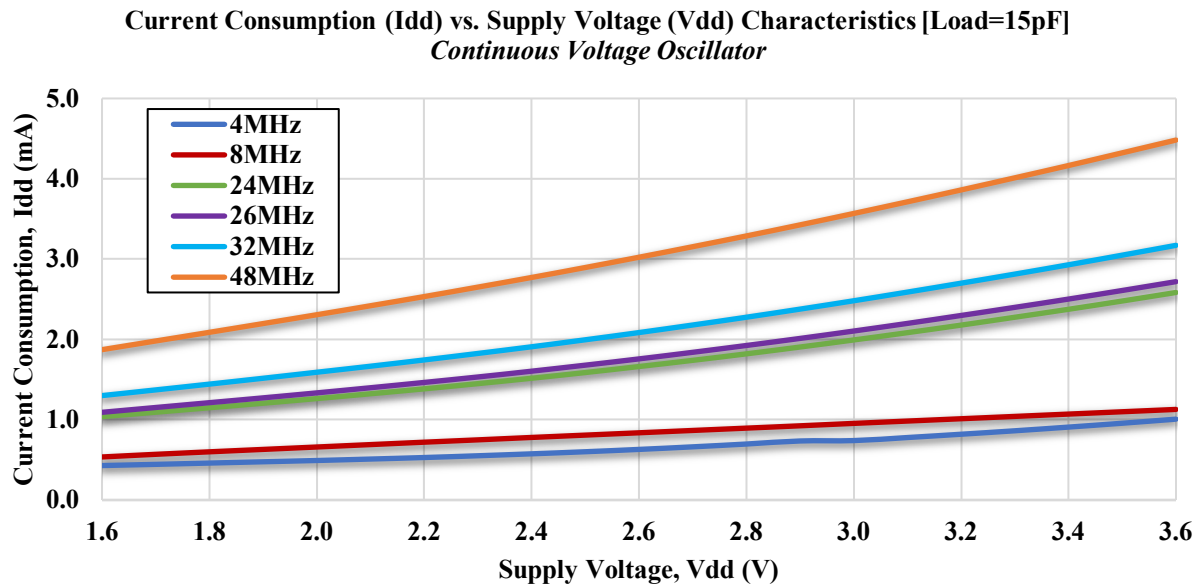


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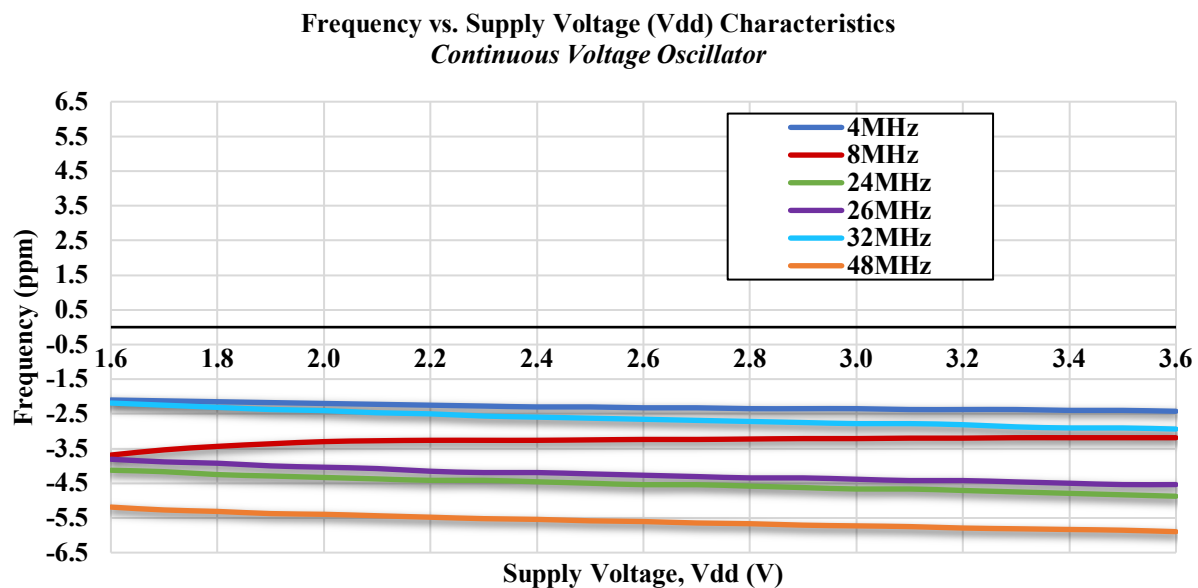


3.2 x 2.5 x 1.2mm  
RoHS/RoHS II Compliant  
MSL Level = 1

## Typical Current Consumption (Idd) vs. Supply Voltage (Vdd) Characteristics @25°C± 3°C [Load = 15pF]



## Typical Frequency vs. Supply Voltage (Vdd) Characteristics @ 25°C± 3°C



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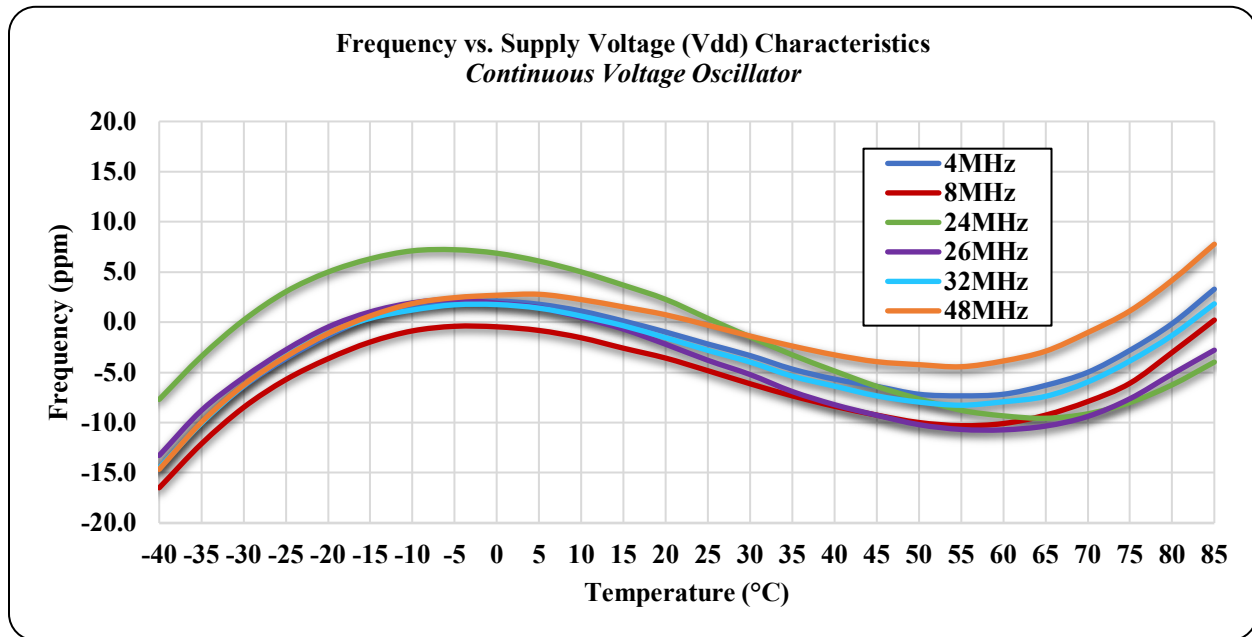


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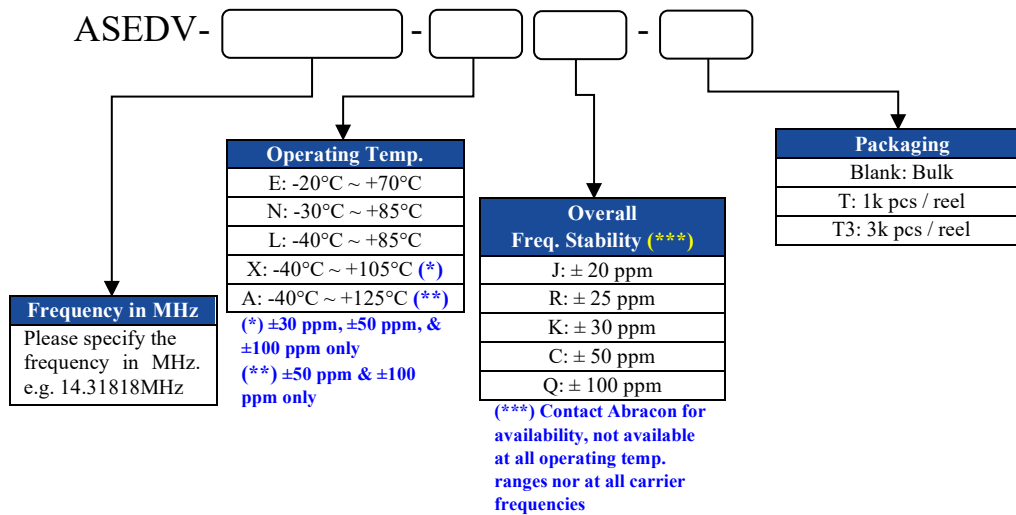


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## Typical Frequency vs. Temperature Characteristics



## Part Identification



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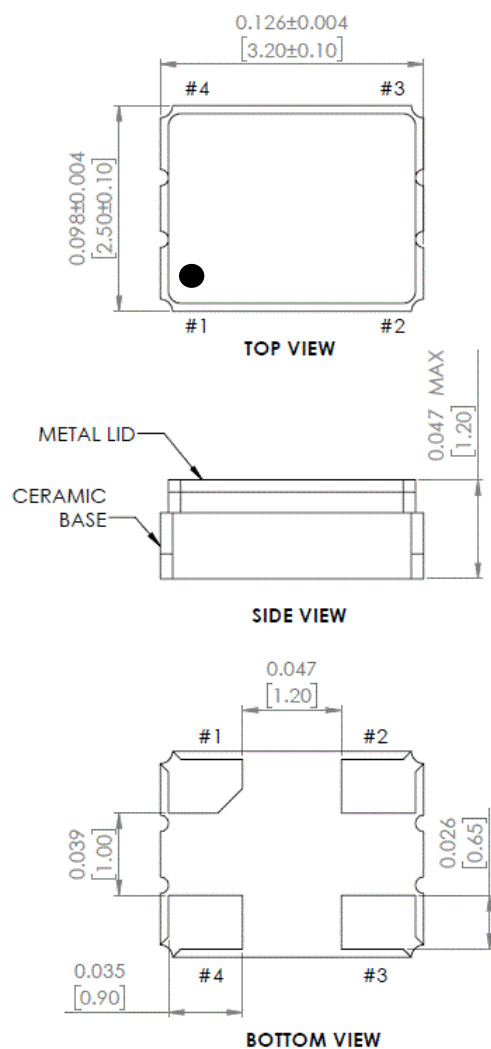


3.2 x 2.5 x 1.2mm

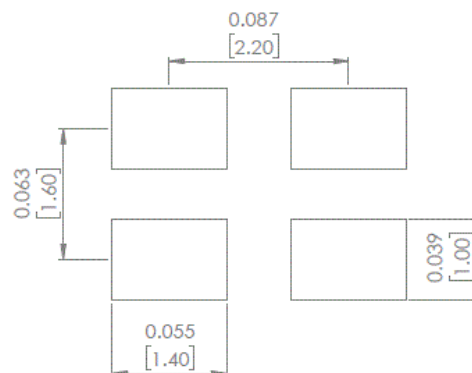
RoHS/RoHS II Compliant

MSL Level = 1

## Mechanical Dimensions



### Recommended Land Pattern



| Pin # | Function  |
|-------|-----------|
| 1     | Tri-State |
| 2     | GND       |
| 3     | Output    |
| 4     | Vdd       |

Note: Recommended to use approximately 0.01µF bypass capacitor between PIN 2 and PIN 4

Dimensions: inches (mm)



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## Reflow Profile [JEDEC J-STD-020]

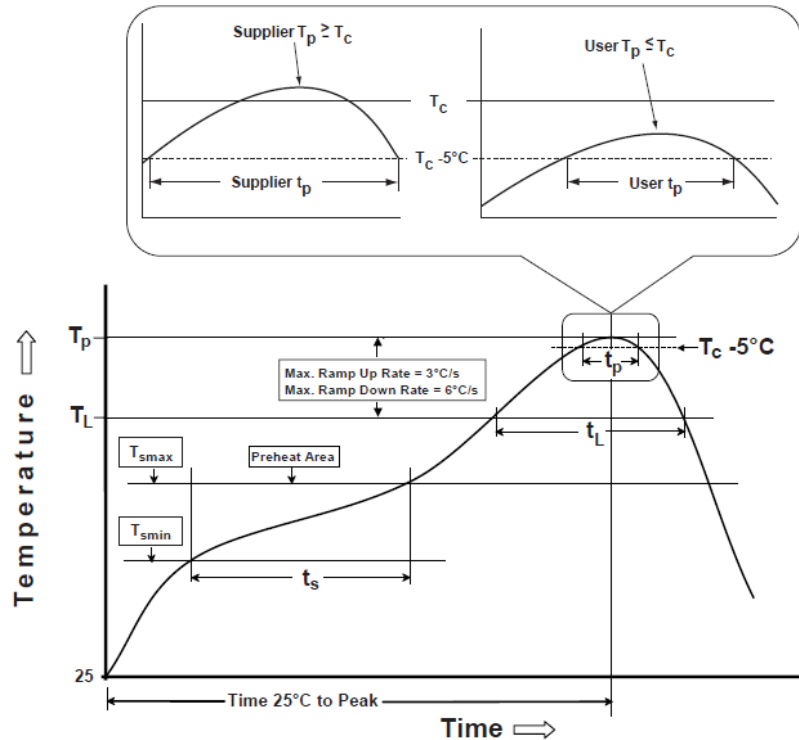


Table 1

### SnPb Eutectic Process

#### Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

Table 2

### Pb-Free Process

#### Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350-2000 | Volume mm <sup>3</sup> >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 supplier minimum and a user maximum.



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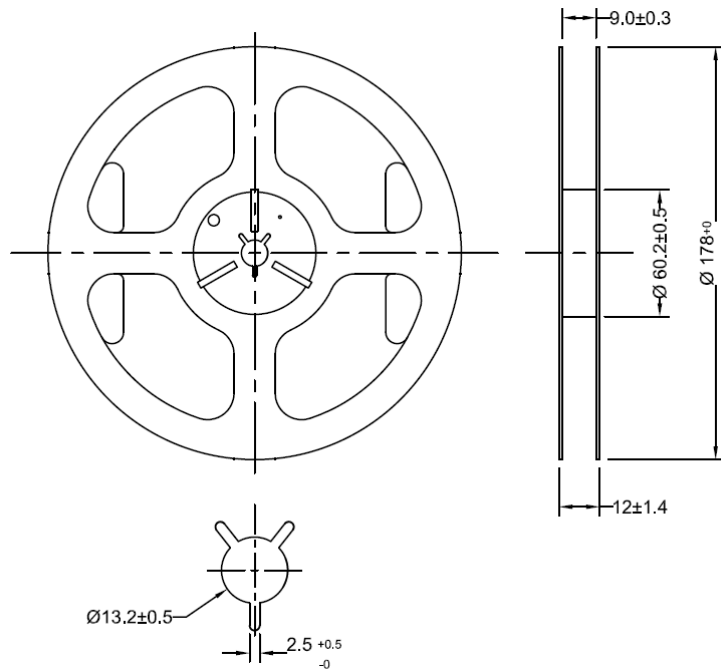
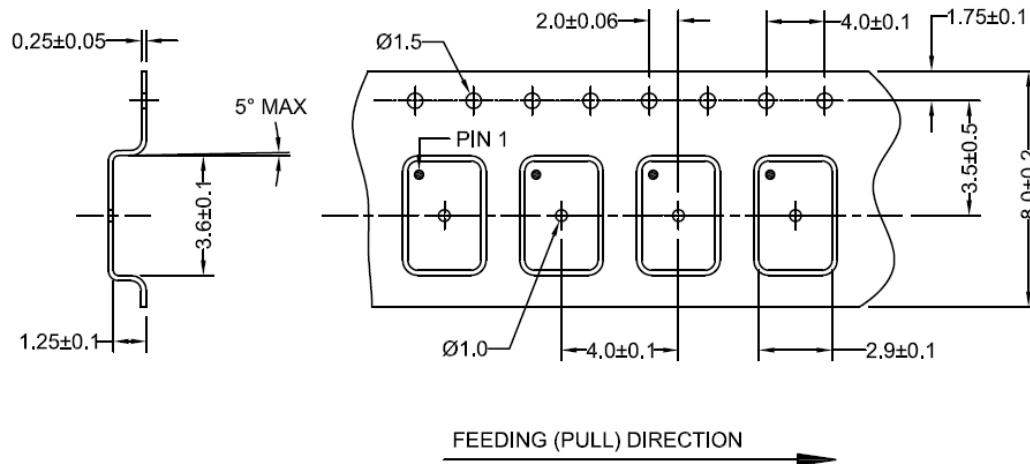
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RoHS/RoHS II Compliant  
MSL Level = 1

## Packaging

T: 1,000pcs/reel (500021, 500240)  
T3: 3,000pcs/reel (500021, 500240, 500603)



Dimensions: inches (mm)

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