# High Temperature, Programmable SMD MEMS Oscillator

2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm; 3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm; 7.0 x 5.0 x 0.9mm

ASTMHT

ESD Sensitive

RoHS/RoHS II compliant

**Moisture Sensitivity Level (MSL) – 1**

## FEATURES:

- Industry standard package sizes: 2.0 x 1.6 x 0.75mm, 2.5 x 2.0 x 0.75mm, 3.2 x 2.5 x 0.75mm, 5 x 3.2 x 0.75mm, 7.0 x 5.0 x 0.9mm
- Output frequency between 1MHz and 137MHz
- Supply voltage options: 3.3V, 3.0V, 2.8V, 2.5V, 1.8V, 2.25V ~ 3.63V
- Low current consumption: 3.5mA typ. (@20MHz, 1.8V, no load); 4.9mA typ. (@125MHz, 1.8V, no load)
- Wide operating temperature range options: -40 ~ +105°C; -40 ~+125°C; -55 ~ +125°C
- Frequency stability options: ±20ppm, ±25ppm, ±30ppm, ±50ppm
- Factory programmable drive strength for improved jitter, reduced EMI or higher capacitive output load

## APPLICATIONS:

- High temperature applications for Industrial, medical, non-automotive and avionics
- Harsh environment (vibration, shock-prone and humid)

## STANDARD SPECIFICATIONS:

*All electrical specifications are specified with 15pF output load and for all Vdd(s) unless otherwise stated. The typical value of any parameter in the table is specified for the nominal value of the highest voltage option for that parameter and at 25°C temperature.*

| Parameters | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Output Frequency Range (F) | 1.000000 | | 110.000000 | MHz | Available with operation temp. range option “X”, “A” and “Z” |
| | 115.194001 | | 119.342000 | | Available with operation temp. range option “X” and “A” |
| | 119.342001 | | 137.000000 | | Available with operation temp. range option “X”, “A” and “Z” |
| Standard Frequencies | See Section 1.1 for Standard Frequencies | | | MHz | |
| Frequency Stability ($F_{stab}$) | -20 | | +20 | ppm | Inclusive of initial tolerance at 25°C, 1st year aging at 25°C, and variations over operating temperature, rated power supply voltage and load (15pF±10%) |
| | -25 | | +25 | | |
| | -30 | | +30 | | |
| | -50 | | +50 | | |
| Operating Temperature Range ($T_{use}$) | -40 | | +105 | °C | Option “X” |
| | -40 | | +125 | | Option “A” |
| | -55 | | +125 | | Option “Z” |
| Supply Voltage ($V_{dd}$) | 1.62 | 1.8 | 1.98 | V | Option “18” |
| | 2.25 | 2.5 | 2.75 | | Option “25” |
| | 2.52 | 2.8 | 3.08 | | Option “28” |
| | 2.7 | 3.0 | 3.3 | | Option “30” |
| | 2.97 | 3.3 | 3.63 | | Option “33” |
| | 2.25 | | 3.63 | | Option “Blank” (default) |
| Current Consumption ( $I_{dd}$ ) | | 3.8 | 4.7 | mA | No load, F=20MHz, $V_{dd}$=2.8V,3.0V,3.3V |
| | | 3.6 | 4.5 | | No load, F=20MHz, $V_{dd}$=2.5V |
| | | 3.5 | 4.5 | | No load, F=20MHz, $V_{dd}$=1.8V |
| | | 6.2 | 8 | | No load, F=125MHz, $V_{dd}$=2.8V,3.0V,3.3V |
| | | 5.4 | 7 | | No load, F=125MHz, $V_{dd}$=2.5V |
| | | 4.9 | 6 | | No load, F=125MHz, $V_{dd}$=1.8V |
| OE Disable Current ($I_{OD}$) | | | 4.5 | mA | F=1MHz~110MHz, $V_{dd}$=2.5V-3.3V, OE=Low, output is in High-Z state |
| | | | 4.3 | | F=1MHz~110MHz, $V_{dd}$=1.8V, OE=Low, output is in High-Z state |
| | | | 4.7 | | F=115.194001MHz~110MHz, $V_{dd}$=2.5V-3.3V, OE=Low, output is in High-Z state |
| | | | 4.5 | | F=115.194001MHz~110MHz, $V_{dd}$=1.8V, OE=Low, output is in High-Z state |

2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm; 3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm; 7.0 x 5.0 x 0.9mm

**(Continued)**

| Parameters | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Standby Current ($I_{std}$) | | 2.6 | 8.5 | µA | $\overline{ST}$=Low, $V_{dd}$=2.8V-3.3V, output is weakly pulled down |
| | | 1.4 | 5.5 | | $\overline{ST}$=Low, $V_{dd}$=2.5V, output is weakly pulled down |
| | | 0.6 | 4.0 | | $\overline{ST}$=Low, $V_{dd}$=1.8V, output is weakly pulled down |
| Output Type | LVCMOS | | | | |
| Duty Cycle | 45 | | 55 | % | All $V_{dd}$ options |
| Rise/Fall Time ( $T_r$ /$T_f$) | | 1 | 2 | ns | $V_{dd}$=2.5V, 2.8V, 3.0V or 3.3V, 20%-80% |
| | | 1.3 | 2.5 | | $V_{dd}$=1.8V, 20%-80% |
| | | 1 | 3 | | $V_{dd}$=2.25V-3.63V, 20%-80% |
| Output High Voltage ($V_{OH}$) | 90%*$V_{dd}$ | | | V | $I_{OH}$=-4mA ($V_{dd}$=3.0V or 3.3V) |
| | | | | | $I_{OH}$=-3mA ($V_{dd}$=2.8V or 2.5V) |
| | | | | | $I_{OH}$=-2mA ($V_{dd}$=1.8V) |
| Output Low Voltage ($V_{OL}$) | | | 10%*$V_{dd}$ | V | $I_{OL}$=4mA ($V_{dd}$=3.0V or 3.3V) |
| | | | | | $I_{OL}$=3mA ($V_{dd}$=2.8V or 2.5V) |
| | | | | | $I_{OL}$=2mA ($V_{dd}$=1.8V) |
| Input High Voltage($V_{IH}$) | 70%*$V_{dd}$ | | | V | Pin 1 |
| Input Low Voltage($V_{IL}$) | | | 30%*$V_{dd}$ | V | Pin 1 |
| Input Pull-up Impedance ( $Z_{in}$) | 50 | 87 | 150 | kΩ | Pin 1, OE logic high or logic low, $\overline{ST}$ logic high |
| | 2 | | | MΩ | Pin 1, $\overline{ST}$ logic low |
| Startup Time ($T_{start}$) | | | 5 | ms | Measured from the time $V_{dd}$ reaches 90% of its final value |
| Enable/Disable Time ($T_{oe}$) | | | 130 | ns | F=110MHz, 115.194001MHz, 119.342001MHz. For other frequencies, $T_{oe}$=100ns+3*cycles |
| Resume Time ( $T_{resume}$) | | | 5 | ms | Measured from the time $\overline{ST}$ pin crosses 50% threshold |
| RMS Period Jitter ( $T_{jitt}$) | | 1.6 | 2.5 | ps | F=75MHz, 125MHz, $V_{dd}$=2.5V, 2.8V, 3.0V or 3.3V |
| | | 1.9 | 3 | | F=75MHz, 125MHz, $V_{dd}$=1.8V |
| Peak-to-peak Period Jitter ($T_{pk}$) | | 12 | 20 | ps | F=75MHz, 125MHz, $V_{dd}$=2.5V, 2.8V, 3.0V or 3.3V |
| | | 14 | 25 | | F=75MHz, 125MHz, $V_{dd}$=1.8V |
| RMS Phase Jitter (random) ( $T_{phj}$) | | 0.5 | 0.8 | ps | F=75MHz,125MHz integration bandwidth=900kHz to 7.5MHz |
| | | 1.3 | 2 | | F=75MHz, 125MHz integration bandwidth=12kHz to 20MHz |




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## Standard Frequency (MHz)

| Standard Frequency (MHz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7.3728 | 8 | 8.192 | 9.8304 | 9.84375 | 11.0592 | 12 | 12.288 | 13 |
| 13.225625 | 13.52127 | 14.31818 | 14.7456 | 15 | 16 | 16.384 | 18.432 | 19.6608 |
| 20 | 22.1184 | 24 | 24.56 | 24.576 | 25 | 26 | 27 | 29.4912 |
| 30 | 32 | 33 | 36 | 40 | 48 | | | |

## Absolute Maximum Ratings

Attempted operation outside the absolute maximum ratings may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

| Parameters | Min. | Max. | Unit |
|---|---|---|---|
| Storage Temperature | -65 | 150 | ℃ |
| $V_{DD}$ | -0.5 | 4 | V |
| Electrostatic Discharge (HBM) | | 2000 | V |
| Soldering Temperature (follow standard Pb free soldering guidelines) | | 260 | ℃ |
| Junction Temperature [1] | | 150 | ℃ |

Note: 1. Exceeding this temperature for extended period of time may damage the device

## Thermal Consideration

| Package | θJA, 4 Layer Board (℃/W) | θJA, 2 Layer Board (℃/W) | θJC, Bottom (℃/W) |
|---|---|---|---|
| 7.0 x 5.0mm | 142 | 273 | 30 |
| 5.0 x 3.2mm | 97 | 199 | 24 |
| 3.2 x 2.5mm | 109 | 212 | 27 |
| 2.5 x 2.0mm | 117 | 222 | 26 |
| 2.0 x 1.6mm | 152 | 252 | 36 |

## Maximum Operating Junction Temperature [2]

| Max. Operating Temperature (ambient) | Max. Operating Junction Temperature |
|---|---|
| 105°C | 115°C |
| 125°C | 135°C |

Note: 2. Datasheet specifications are not guaranteed if junction temperature exceeds the maximum operating junction temperature




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RoHS/RoHS II compliant

## PART IDENTIFICATION:

ASTMHT □-□-□ MHz-□□-□□-□

| Package Size |
|---|
| A: 2.0x1.6mm |
| D: 2.5x2.0mm |
| E: 3.2x2.5mm |
| FL: 5.0x3.2mm |
| V: 7.0x5.0mm |

| Output Frequency in MHz |
|---|
| e.g. 7.3728, 125.000 |

| Operating Temp. |
|---|
| X: -40°C ~ +105°C |
| A: -40°C ~ +125°C |
| Z: -55°C ~ +125°C |

| Pin 1 Function |
|---|
| E: Output Enable |
| S: Standby |
| N: No Connect |

| Packaging |
|---|
| Blank: Bulk |
| T: Tape & Reel (1kpcs / reel) |
| T3: Tape & Reel (3kpcs / reel) |

| Supply Voltage |
|---|
| Blank: 2.25V~3.63V |
| 18: 1.8V±10% |
| 25: 2.5V±10% |
| 28: 2.8V±10% |
| 30: 3.0V±10% |
| 33: 3.3V±10% |

| Freq. Stability |
|---|
| J: ±20ppm |
| R: ±25 ppm |
| K: ±30ppm |
| C: ±50 ppm |

| Output Drive Strength* |
|---|
| Blank: Default |
| L** |
| A** |
| R |
| B |
| T |
| E |
| U |
| F |

* See Table 1 to 5 for the Rise/Fall times at different drive strength and available options
** Only available for F=1MHz~110MHz

| List of Supported Frequency Ranges (MHz) | | | |
|---|---|---|---|
| -40°C~+105°C/-40°C~+125°C | | -55°C~+125°C | |
| Min | Max | Min | Max |
| 1.000000 | 61.222999 | 1.000000 | 61.222999 |
| 61.974001 | 69.795999 | 61.674001 | 69.239999 |
| 70.485001 | 79.062999 | 70.827001 | 78.714999 |
| 79.162001 | 81.427999 | 79.561001 | 80.159999 |
| 82.232001 | 91.833999 | 80.174001 | 80.779999 |
| 92.155001 | 94.248999 | 82.632001 | 91.833999 |
| 94.430001 | 94.874999 | 95.474001 | 96.191999 |
| 94.994001 | 97.713999 | 96.209001 | 96.935999 |
| 98.679001 | 110.000000 | 99.158001 | 110.000000 |
| 115.194001 | 117.810999 | 119.342001 | 120.238999 |
| 118.038001 | 118.593999 | 120.262001 | 121.169999 |
| 118.743001 | 122.141999 | 121.243001 | 121.600999 |
| 122.705001 | 123.021999 | 123.948001 | 137.000000 |
| 123.348001 | 137.000000 | | |

2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm; 3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm; 7.0 x 5.0 x 0.9mm

## Table 1: $V_{dd}$=1.8V Rise/Fall Times for Specific $C_{LOAD}$

**(a) Output Frequency: 1MHz – 110MHz**

| Rise/Fall Time Typ. (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | | | |
| | 5pF | 15pF | 30pF | 45pF | 60pF |
| L | 6.16 | 11.61 | 22.00 | 31.27 | 39.91 |
| A | 3.19 | 6.35 | 11.00 | 16.01 | 21.52 |
| R | 2.11 | 4.31 | 7.65 | 10.77 | 14.47 |
| B | 1.65 | 3.23 | 5.79 | 8.18 | 11.08 |
| T | 0.93 | 1.91 | 3.32 | 4.66 | 6.48 |
| E | 0.78 | 1.66 | 2.94 | 4.09 | 5.74 |
| U | 0.70 | 1.48 | 2.64 | 3.68 | 5.09 |
| F or Blank (default) | 0.65 | 1.30 | 2.40 | 3.35 | 4.56 |

**(b) Output Frequency: 115.194001MHz – 137MHz**

| Rise/Fall Time Typ. (ns) | | |
|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | |
| | 5pF | 15pF |
| T | 0.93 | N/A |
| E | 0.78 | N/A |
| U | 0.70 | 1.48 |
| F or Blank (default) | 0.65 | 1.30 |

## Table 2: $V_{dd}$=2.5V Rise/Fall Times for Specific $C_{LOAD}$

**(a) Output Frequency: 1MHz – 110MHz**

| Rise/Fall Time Typ. (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | | | |
| | 5pF | 15pF | 30pF | 45pF | 60pF |
| L | 4.13 | 8.25 | 12.82 | 21.45 | 27.79 |
| A | 2.11 | 4.27 | 7.64 | 11.20 | 14.49 |
| R | 1.45 | 2.81 | 5.16 | 7.65 | 9.88 |
| B | 1.09 | 2.20 | 3.88 | 5.86 | 7.57 |
| T | 0.62 | 1.28 | 2.27 | 3.51 | 4.45 |
| E or Blank (default) | 0.54 | 1.00 | 2.01 | 3.10 | 4.01 |
| U | 0.43 | 0.96 | 1.81 | 2.79 | 3.65 |
| F | 0.34 | 0.88 | 1.64 | 2.54 | 3.32 |

**(b) Output Frequency: 115.194001MHz – 137MHz**

| Rise/Fall Time Typ. (ns) | | |
|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | |
| | 5pF | 15pF |
| R | 1.45 | N/A |
| B | 1.09 | N/A |
| T | 0.62 | 1.28 |
| E or Blank (default) | 0.54 | 1.00 |
| U | 0.43 | 0.96 |
| F | 0.34 | 0.88 |

## Table 3: $V_{dd}$=2.8V Rise/Fall Times for Specific $C_{LOAD}$

**(a) Output Frequency: 1MHz – 110MHz**

| Rise/Fall Time Typ. (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | | | |
| | 5pF | 15pF | 30pF | 45pF | 60pF |
| L | 3.77 | 7.54 | 12.28 | 19.57 | 25.27 |
| A | 1.94 | 3.90 | 7.03 | 10.24 | 13.34 |
| R | 1.29 | 2.57 | 4.72 | 7.01 | 9.06 |
| B | 0.97 | 2.00 | 3.54 | 5.43 | 6.93 |
| T | 0.55 | 1.12 | 2.08 | 3.22 | 4.08 |
| E or Blank (default) | 0.44 | 1.00 | 1.83 | 2.82 | 3.67 |
| U | 0.34 | 0.88 | 1.64 | 2.52 | 3.30 |
| F | 0.29 | 0.81 | 1.48 | 2.29 | 2.99 |

**(b) Output Frequency: 115.194001MHz – 137MHz**

| Rise/Fall Time Typ. (ns) | | | |
|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | |
| | 5pF | 15pF | 30pF |
| R | 1.29 | N/A | N/A |
| B | 0.97 | N/A | N/A |
| T | 0.55 | 1.12 | N/A |
| E or Blank (default) | 0.44 | 1.00 | N/A |
| U | 0.34 | 0.88 | N/A |
| F | 0.29 | 0.81 | 1.48 |




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2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm; 3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm; 7.0 x 5.0 x 0.9mm

## TYPICAL PERFORMANCE DATA

### Table 4: $V_{dd}$=3.0V Rise/Fall Times for Specific $C_{LOAD}$

(a) Output Frequency: 1MHz – 110MHz

| Rise/Fall Time Typ. (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | | | |
| | 5pF | 15pF | 30pF | 45pF | 60pF |
| L | 3.60 | 7.21 | 11.97 | 18.74 | 24.30 |
| A | 1.84 | 3.71 | 6.72 | 9.86 | 12.68 |
| R | 1.22 | 2.46 | 4.54 | 6.76 | 8.62 |
| B | 0.89 | 1.92 | 3.39 | 5.20 | 6.64 |
| T or Blank (default) | 0.51 | 1.00 | 1.97 | 3.07 | 3.90 |
| E | 0.38 | 0.92 | 1.72 | 2.71 | 3.51 |
| U | 0.30 | 0.83 | 1.55 | 2.40 | 3.13 |
| F | 0.27 | 0.76 | 1.39 | 2.16 | 2.85 |

(b) Output Frequency: 115.194001MHz – 137MHz

| Rise/Fall Time Typ. (ns) | | | |
|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | |
| | 5pF | 15pF | 30pF |
| R | 1.22 | N/A | N/A |
| B | 0.89 | N/A | N/A |
| T or Blank (default) | 0.51 | 1.00 | N/A |
| E | 0.38 | 0.92 | N/A |
| U | 0.30 | 0.83 | N/A |
| F | 0.27 | 0.76 | 1.39 |

### Table 5: $V_{dd}$=3.3V Rise/Fall Times for Specific $C_{LOAD}$

(a) Output Frequency: 1MHz – 110MHz

| Rise/Fall Time Typ. (ns) | | | | | |
|---|---|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | | | |
| | 5pF | 15pF | 30pF | 45pF | 60pF |
| L | 3.39 | 6.88 | 11.63 | 17.56 | 23.59 |
| A | 1.74 | 3.50 | 6.38 | 8.98 | 12.19 |
| R | 1.16 | 2.33 | 4.29 | 6.04 | 8.34 |
| B | 0.81 | 1.82 | 3.22 | 4.52 | 6.33 |
| T or Blank (default) | 0.46 | 1.00 | 1.86 | 2.60 | 3.84 |
| E | 0.33 | 0.87 | 1.64 | 2.30 | 3.35 |
| U | 0.28 | 0.79 | 1.46 | 2.05 | 2.93 |
| F | 0.25 | 0.72 | 1.31 | 1.83 | 2.61 |

(b) Output Frequency: 115.194001MHz – 137MHz

| Rise/Fall Time Typ. (ns) | | | |
|---|---|---|---|
| Drive Strength Options | $C_{LOAD}$ | | |
| | 5pF | 15pF | 30pF |
| R | 1.16 | N/A | N/A |
| B | 0.81 | N/A | N/A |
| T or Blank (default) | 0.46 | 1.00 | N/A |
| E | 0.33 | 0.87 | N/A |
| U | 0.28 | 0.79 | 1.46 |
| F | 0.25 | 0.72 | 1.31 |

### Calculating Maximum Frequency

Based on the rise and fall time data given in Table 1 through 5, the maximum frequency the oscillator can operate with a guaranteed full swing of the output voltage over temperature is calculated as follows:

$$Max.Frequency = \frac{1}{5 \times T_{r/f}}$$

Example:
Calculate $F_{max}$ of a 1MHz ~ 110MHz device with the following condition:

- $V_{dd}$ = 1.8V (Table 1)
- Capacitive Load = 30pF
- Desired $T_{r/f}$ Time: = 3ns (rise/fall time option code "E")

The $F_{max}$ is 66.66666MHz.




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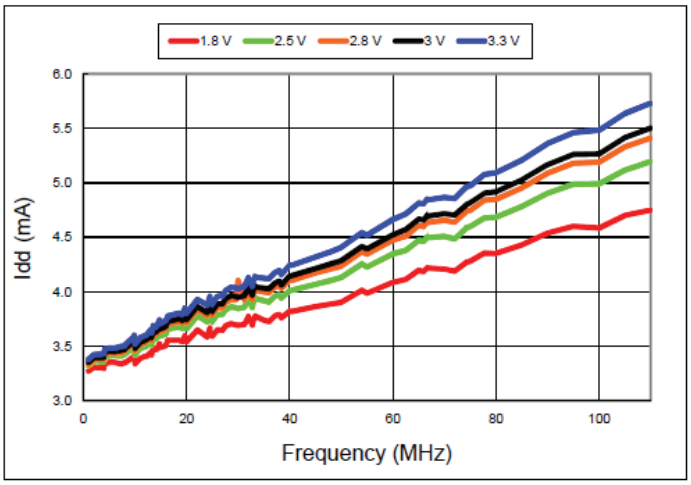
RoHS/RoHS II compliant

## TYPICAL PERFORMANCE DATA

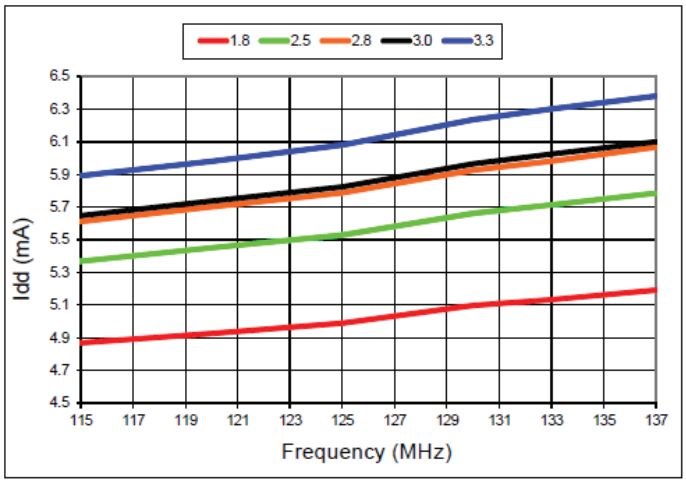
*All plots are measured with 15pF load at room temperature, unless otherwise stated.*

### $I_{DD}$ vs. Frequency

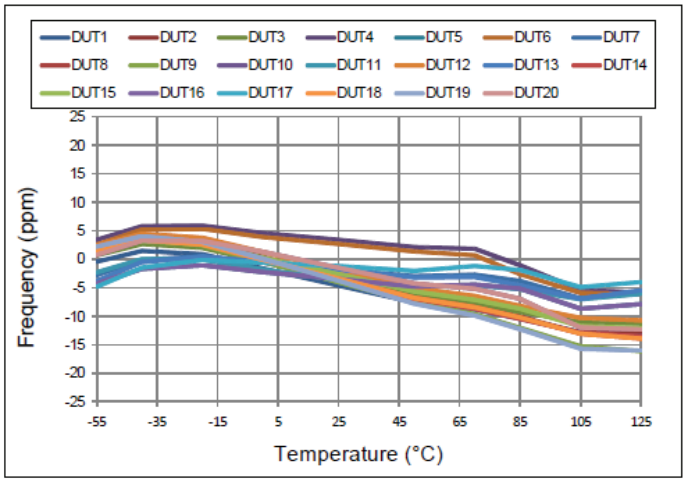
**1MHz-110MHz Devices**

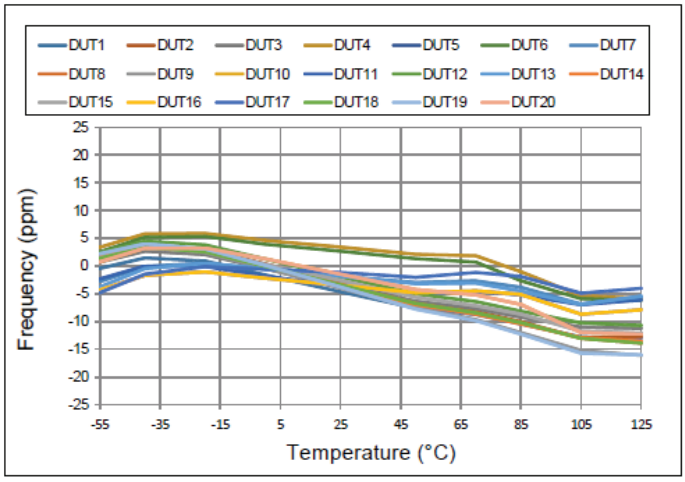



**115.194001MHz -137MHz Devices**




### Frequency vs. Temperature



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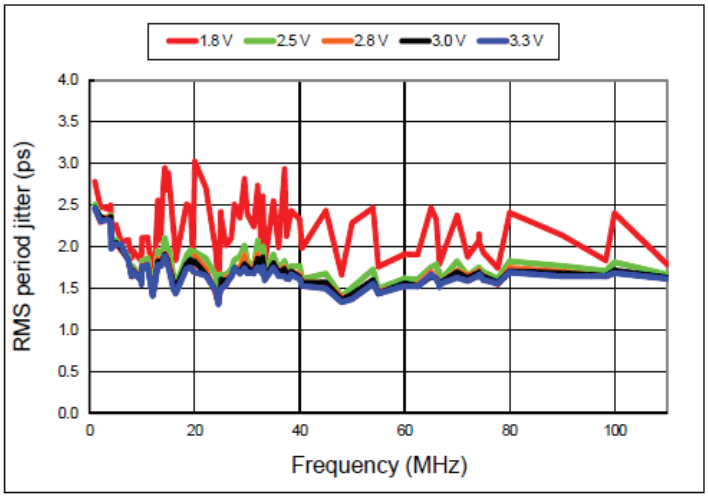
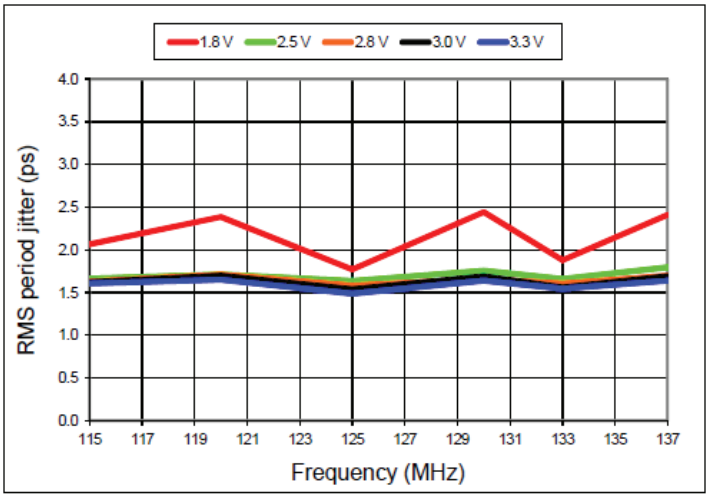
## TYPICAL PERFORMANCE DATA

### RMS Period Jitter vs. Frequency

**1MHz-110MHz Devices**

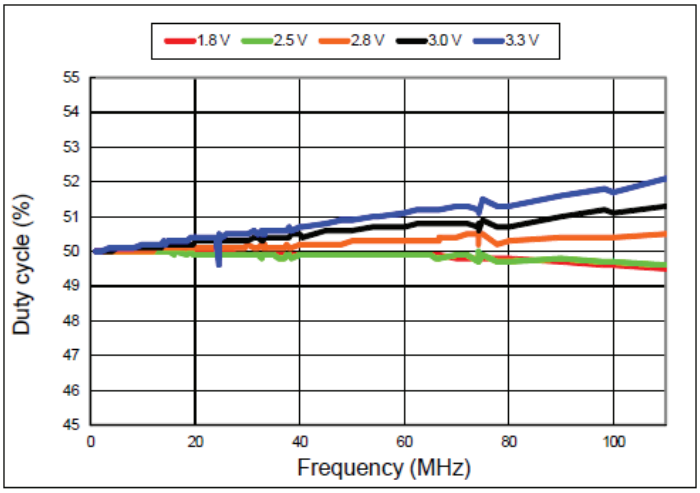



**115.194001MHz -137MHz Devices**

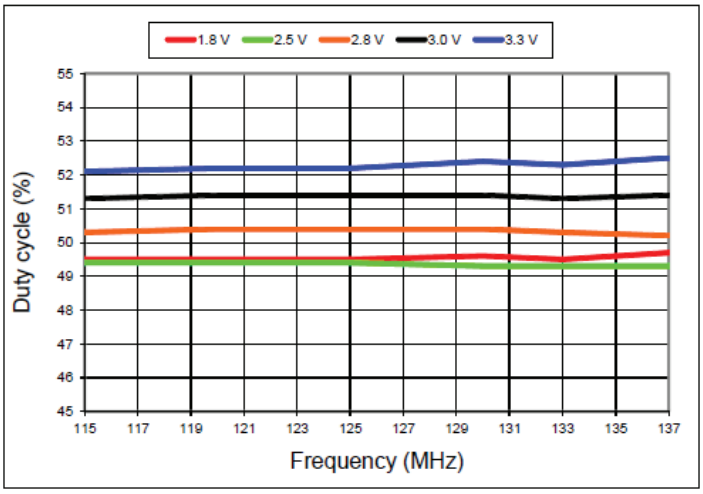



### Duty Cycle vs. Frequency

**1MHz-110MHz Devices**




**115.194001MHz -137MHz Devices**







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Revised: 06.17.2016

# High Temperature, Programmable SMD MEMS Oscillator

ASTMHT

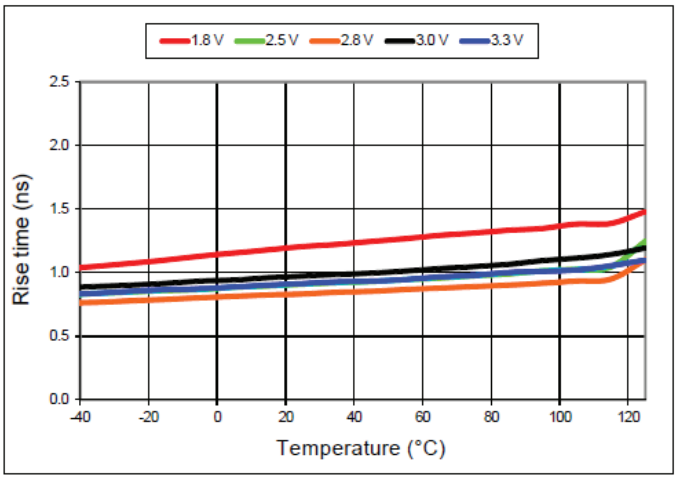
RoHS/RoHS II compliant

2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm; 3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm; 7.0 x 5.0 x 0.9mm

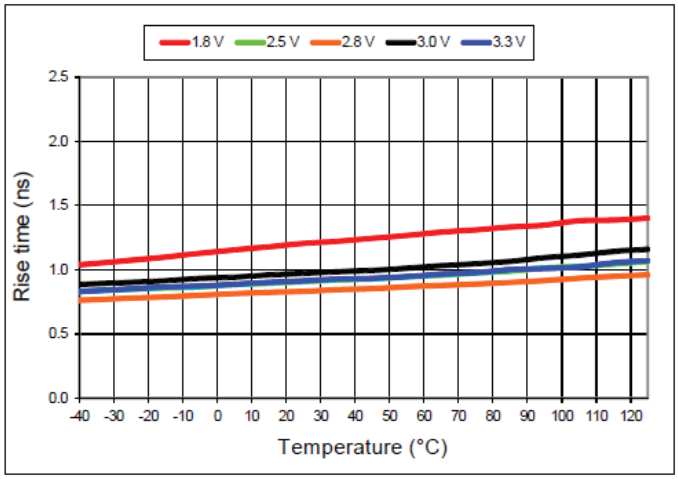
## TYPICAL PERFORMANCE DATA

### 20% - 80% Rise Time vs. Temperature

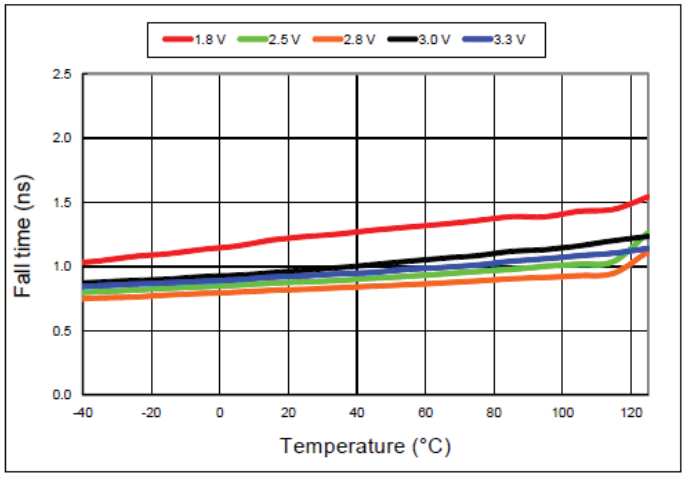
**1MHz-110MHz Devices**

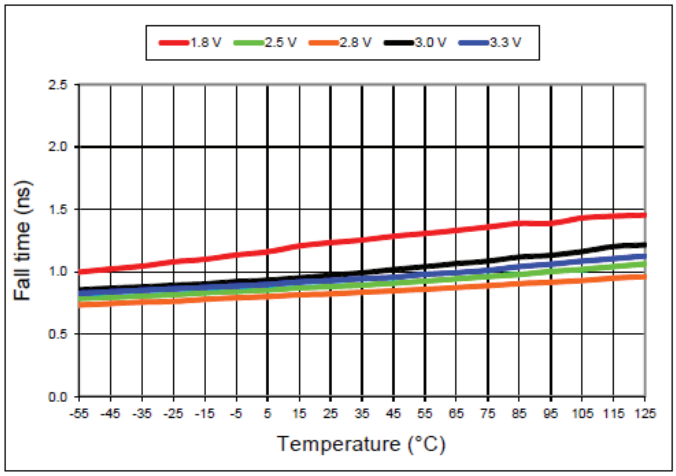



**115.194001MHz -137MHz Devices**




### 20% - 80% Fall Time vs. Temperature

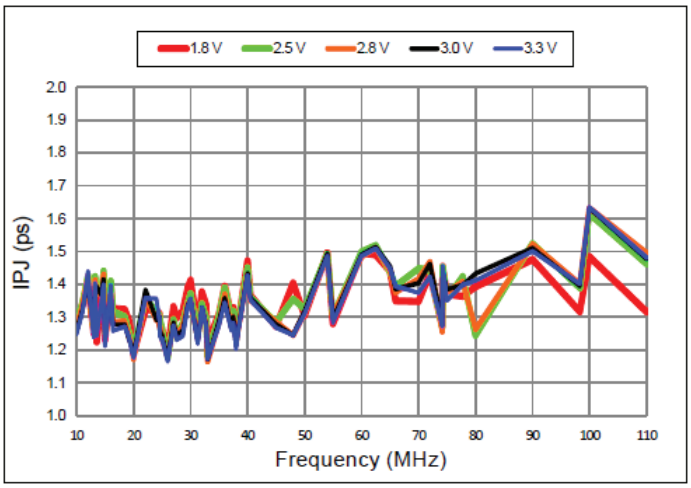


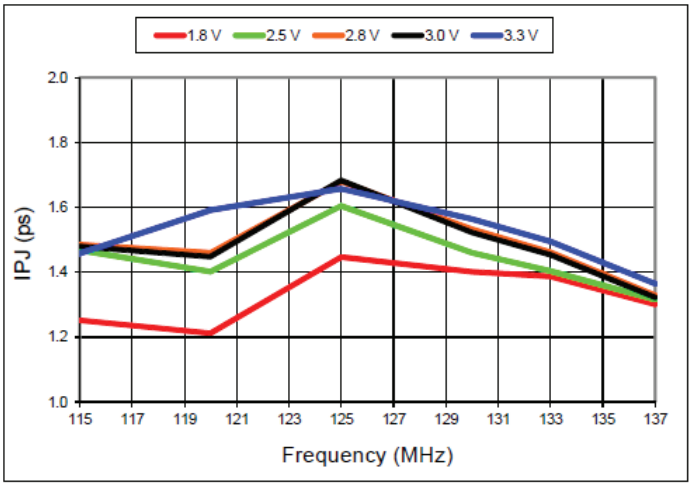
## TYPICAL PERFORMANCE DATA

### RMS Integrated Phase Jitter Random (12kHz to 20MHz) vs Frequency [3]

**1MHz-110MHz Devices**

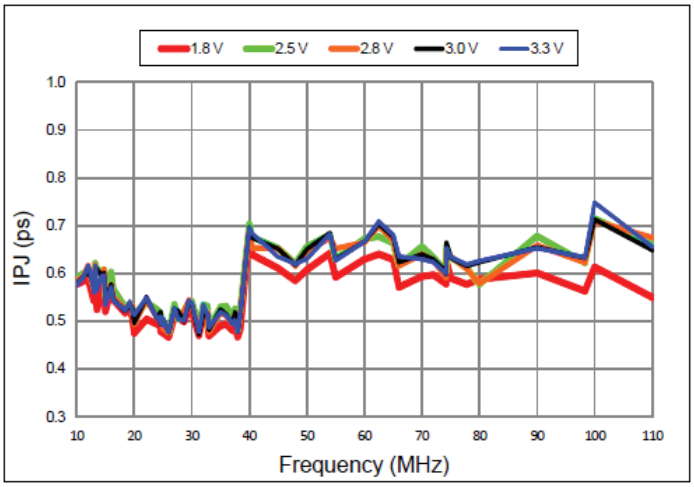



**115.194001MHz -137MHz Devices**

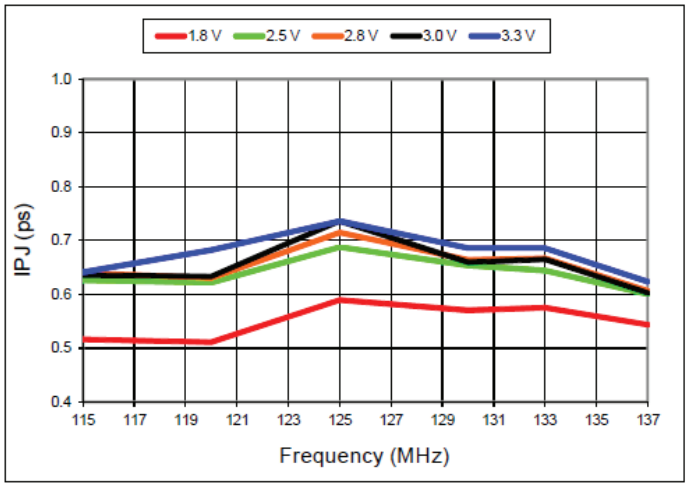



### RMS Integrated Phase Jitter Random (900kHz to 7.5MHz) vs Frequency [3]

**1MHz-110MHz Devices**




**115.194001MHz -137MHz Devices**




Notes: 3. Phase noise plots are measured with Agilent E5052B signal source analyzer. Integration range is 12kHz to 5MHz for carrier frequencies up to 40MHz.

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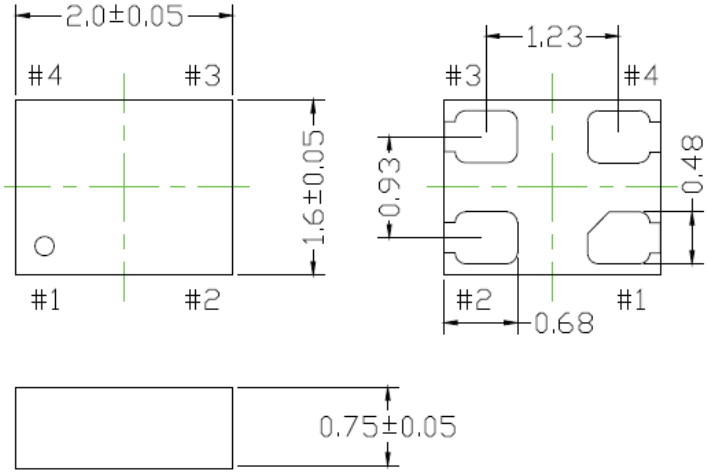
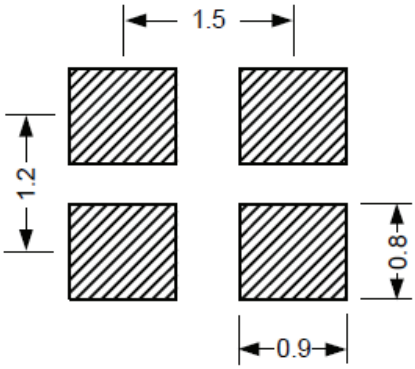
RoHS/RoHS II compliant

## OUTLINE DIMENSION:

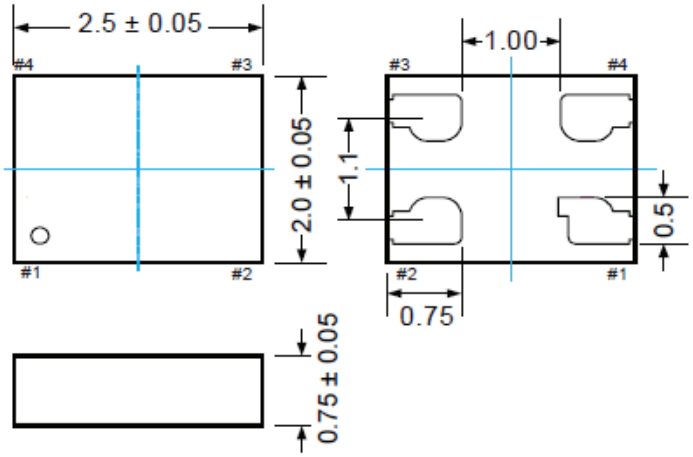
2.0 x 1.6mm Package (Option "A")



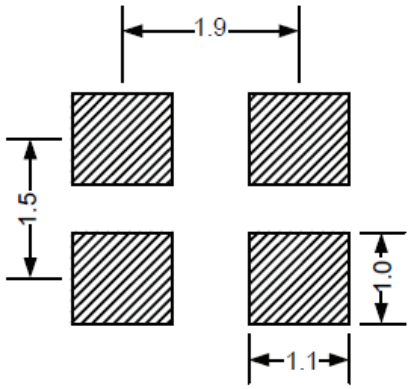

Recommended Land Pattern



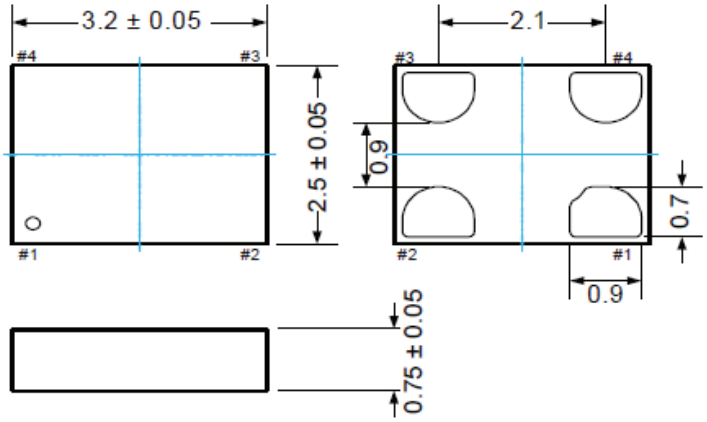

2.5 x 2.0mm Package (Option "D")



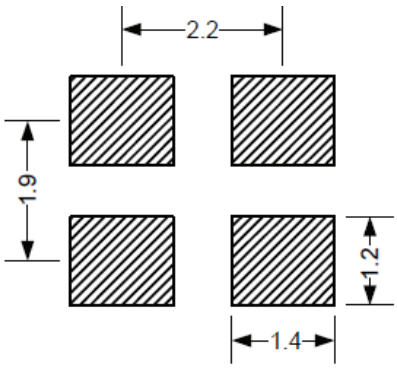

Recommended Land Pattern




3.2 x 2.5mm Package (Option "E")




Recommended Land Pattern



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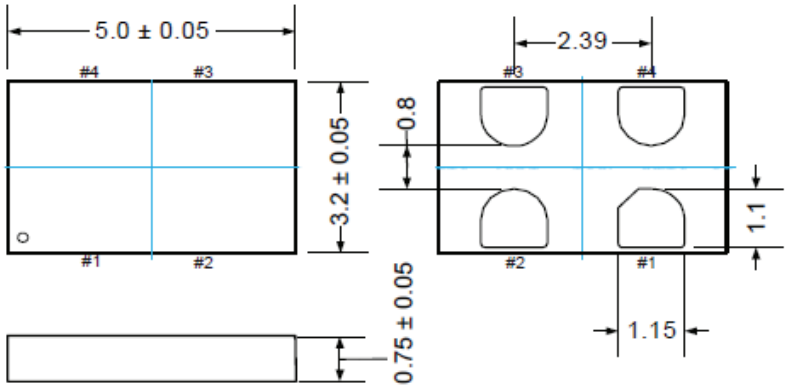
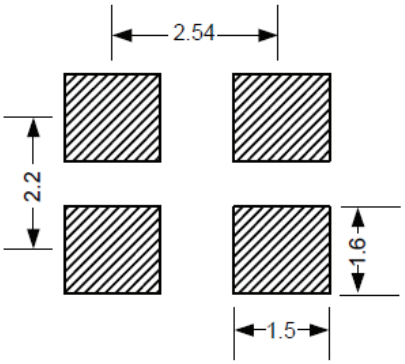
## OUTLINE DIMENSION:

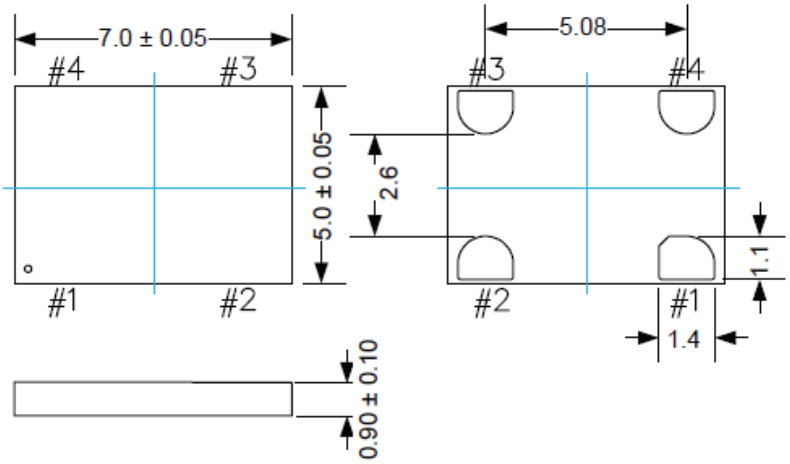
5.0 x 3.2mm Package (Option "FL")



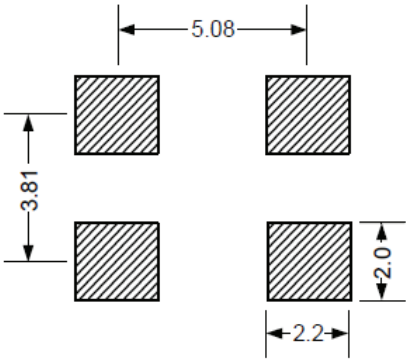

Recommended Land Pattern




7.0 x 5.0mm Package (Option "V")




Recommended Land Pattern




| Pin | Name | | Functionality |
|---|---|---|---|
| 1 | OE/$\overline{ST}$ | Output Enable | H or Open [4]: specified frequency output<br>L: output is high impedance. Only output driver is disabled |
| | | Standby | H or Open [4]: specified frequency output<br>L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to $I_{std}$. |
| | | No Connect | Any voltage between 0 and $V_{dd}$ or Open [4]: specified frequency output. Pin 1 has no function. |
| 2 | GND | Power | Electrical ground [5] |
| 3 | Out | Output | Oscillator clock output |
| 4 | $V_{dd}$ | Power | Power supply voltage [5] |

Notes: 4. In OE or $\overline{ST}$ mode, a pull-up resistor of 10kΩ or less between OE/$\overline{ST}$ pin and $V_{dd}$ is recommended if pin 1 is not externally driven. If pin 1 needs to be left floating, use the NC option.
5. A capacitor value of 0.1µF or higher between $V_{dd}$ and GND is required.

**Dimensions: mm**

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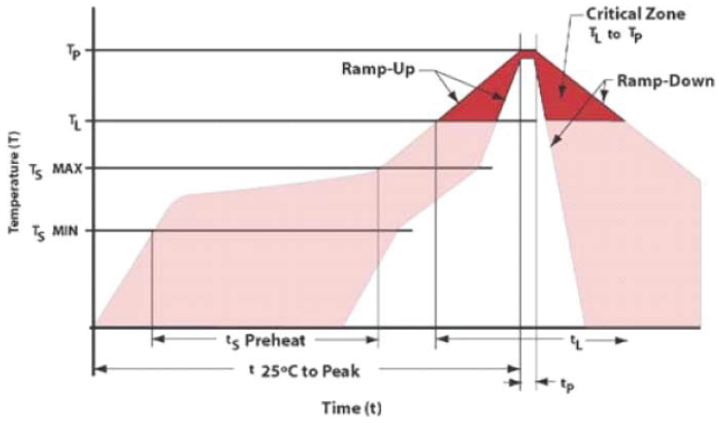
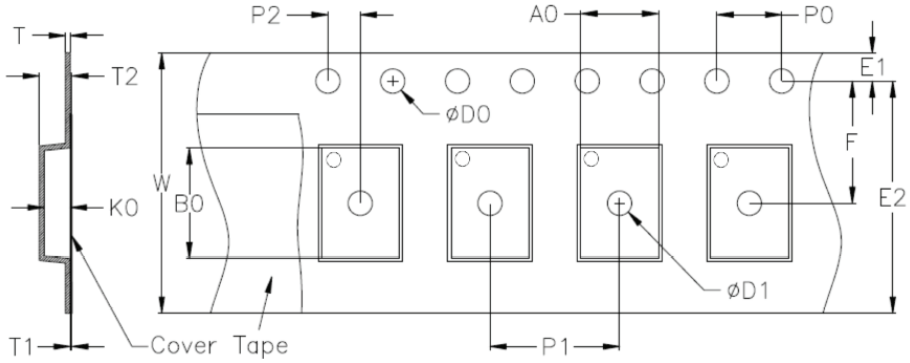
RoHS/RoHS II compliant

## REFLOW PROFILE:




| Item | Conditions |
|---|---|
| $T_S$ MAX to $T_L$ (Ramp-up Rate) | 3°C/second max |
| Preheat | |
| Temperature Minimum ($T_S$ MIN) | 150°C |
| Temperature Typical ($T_S$ TYP) | 175°C |
| Temperature Maximum ($T_S$ MAX) | 200°C |
| Time ($t_S$) | 60 – 180 seconds |
| Ramp-up Rate ($T_L$ to $T_P$) | 3°C/second max |
| Time Maintained Above | |
| Temperature ($T_L$) | 217°C |
| Time ($t_L$) | 60 – 150 seconds |
| Peak Temperature ($T_P$) | 260°C max |
| Target Peak Temperature ($T_P$ Target) | 255°C |
| Time within 5°C of actual peak ($t_P$) | 20 – 40 seconds |
| Max. Number of Reflow Cycles | 3 |
| Ramp-down Rate | 6°C/second max |
| Time 25°C to Peak Temperature (t) | 8 minutes max |

## TAPE & REEL:




Unit: mm

| Device Size | D0 | D1 min. | E1 | E2 min. | F | P0 | P1 | P2 |
|---|---|---|---|---|---|---|---|---|
| 2016 | 1.55±0.05 | 0.9 | 1.75±0.1 | 6.05 | 3.5±0.05 | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 |
| 2520 | 1.55±0.05 | 1.0 | 1.75±0.1 | 5.85 | 3.5±0.05 | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 |
| 3225 | 1.5+0.1/-0.0 | 1.0 | 1.75±0.1 | 5.95 | 3.5±0.05 | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 |
| 5032 | 1.5+0.1/-0.0 | 1.5 | 1.75±0.1 | 10.25 | 5.5±0.05 | 4.0±0.1 | 8.0±0.1 | 2.0±0.05 |
| 7050 | 1.5+0.1/-0.0 | 1.5 | 1.75±0.1 | 14.25 | 7.5±0.1 | 4.0±0.1 | 8.0±0.1 | 2.0±0.1 |

Unit: mm

| Device Size | T | T1 max. | T2 max. | W max. | A0 | B0 | K0 |
|---|---|---|---|---|---|---|---|
| 2016 | 0.3±0.05 | 0.1 | 1.55 | 8.3 | 1.9±0.05 | 2.3±0.05 | 1.00±0.10 |
| 2520 | 0.3±0.05 | 0.1 | 1.65 | 8.3 | 2.25±0.05 | 2.8±0.05 | 1.10±0.10 |
| 3225 | 0.2±0.05 | 0.1 | 1.6 | 8.2 | 2.7±0.10 | 3.4±0.10 | 1.15±0.10 |
| 5032 | 0.6 | 0.1 | 1.65 | 12.3 | 3.5±0.10 | 5.3±0.10 | 1.10±0.10 |
| 7050 | 0.6 | 0.1 | 1.80 | 16.3 | 5.4±0.10 | 7.4±0.10 | 1.3±0.10 |

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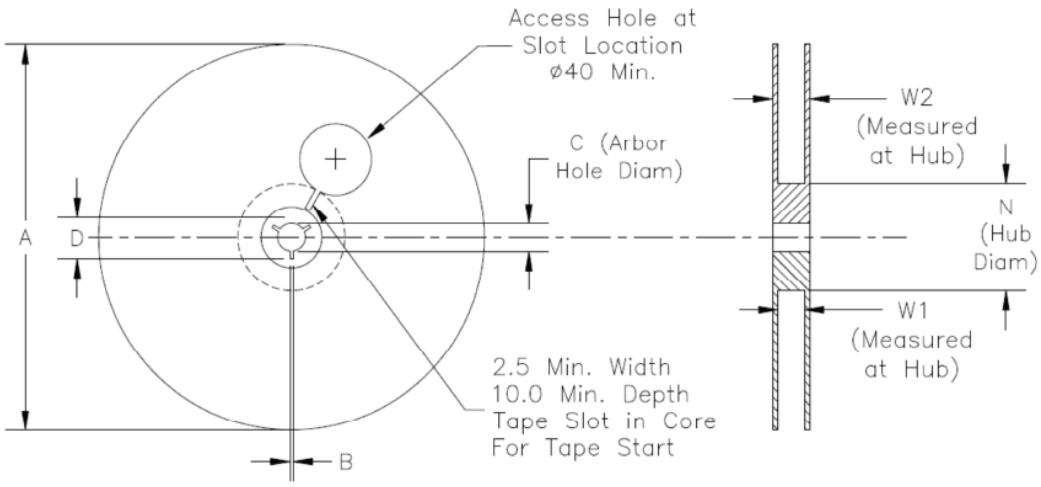
RoHS/RoHS II compliant

## TAPE & REEL:




Unit: mm

| Tape Size | A max. | B min. | C | D min. | N | W1 | W2 max. |
|---|---|---|---|---|---|---|---|
| 8mm | 180 | 1.5 | 13.0+0.6/-0.2 | 20.2 | 60±0.5 | 8.4+1.5/-0 | 14.4 |
| 12mm | 180 | 1.5 | 13.0±0.2 | 20.2 | 60±0.5 | 12.4+2.0/-0 | 18.4 |
| | 330 | 1.5 | 13.0±0.2 | 20.2 | 100±0.5 | 12.4+2.0/-0 | 18.4 |
| 16mm | 180 | 1.5 | 13.0±0.2 | 20.2 | 60±0.5 | 16.4+2.0/-0 | 22.4 |
| | 330 | 1.5 | 13.0±0.2 | 20.2 | 100±0.5 | 16.4+2.0/-0 | 22.4 |

| Device Size | "T" (1k/reel) | | "T3" (3k/reel) | |
|---|---|---|---|---|
| 2016 | 8mm Tape | 7" Reel | 8mm Tape | 7" Reel |
| 2520 | 8mm Tape | 7" Reel | 8mm Tape | 7" Reel |
| 3225 | 8mm Tape | 7" Reel | 8mm Tape | 7" Reel |
| 5032 | 12mm Tape | 7" Reel | 12mm Tape | 13" Reel |
| 7050 | 16mm Tape | 7" Reel | 16mm Tape | 13" Reel |

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Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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**Офис по работе с юридическими лицами:**

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