

# Low power, Programmable SMD MEMS Oscillator

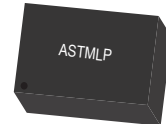
ASTMLP



ESD Sensitive



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

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
- Any 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)
- Frequency Stability options:  $\pm 20$ ppm,  $\pm 25$ ppm,  $\pm 50$ ppm over -20 to +70°C and -40 to +85°C
- Factory programmable drive strength for improved jitter, reduced EMI or higher capacitive output load

## APPLICATIONS:

- GPON, EPON
- Portable devices
- Consumer electronics
- Network switches, router, servers
- Ethernet, USB, SATA, SAS, Firewire
- Harsh environment (vibration, shock-prone and humid)

## STANDARD SPECIFICATIONS:

All Min and Max limits are specified over temperature and rated operating voltage with 15pF output load unless otherwise stated. Typical values are at 25°C and nominal supply voltage.

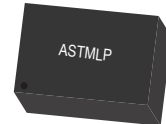
| Parameters                                | Min                                      | Typ | Max  | Unit    | Notes                                                                                                                                                                       |
|-------------------------------------------|------------------------------------------|-----|------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Frequency Range (F)                | 1                                        |     | 110  | MHz     |                                                                                                                                                                             |
|                                           | 115                                      |     | 137  |         |                                                                                                                                                                             |
| Standard Frequencies                      | See Section 1.1 for Standard Frequencies |     |      | MHz     |                                                                                                                                                                             |
| Frequency Stability ( $F_{stab}$ )        | -20                                      |     | +20  | ppm     | Inclusive of initial tolerance at 25°C, 1 <sup>st</sup> year aging at 25°C, and variations over operating temperature, rated power supply voltage and load (15pF $\pm$ 10%) |
|                                           | -25                                      |     | +25  |         |                                                                                                                                                                             |
|                                           | -50                                      |     | +50  |         |                                                                                                                                                                             |
| Operating Temperature Range ( $T_{use}$ ) | -20                                      |     | +70  | °C      | Option "E"                                                                                                                                                                  |
|                                           | -40                                      |     | +85  |         | Option "L"                                                                                                                                                                  |
| 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 | 4.5  | mA      | No load, F=20MHz, $V_{dd}$ =2.8V, 3.0V, 3.3V or 2.25V-3.63V                                                                                                                 |
|                                           |                                          | 3.7 | 4.2  |         | No load, F=20MHz, $V_{dd}$ =2.5V                                                                                                                                            |
|                                           |                                          | 3.5 | 4.1  |         | No load, F=20MHz, $V_{dd}$ =1.8V                                                                                                                                            |
|                                           |                                          | 6.2 | 7.5  |         | No load, F=125MHz, $V_{dd}$ =2.8V, 3.0V, 3.3V or 2.25V-3.63V                                                                                                                |
|                                           |                                          | 5.5 | 6.4  |         | No load, F=125MHz, $V_{dd}$ =2.5V                                                                                                                                           |
|                                           |                                          | 4.9 | 5.6  |         | No load, F=125MHz, $V_{dd}$ =1.8V                                                                                                                                           |
| OE Disable Current ( $I_{OD}$ )           |                                          |     | 4.2  | mA      | $V_{dd}$ =2.5V-3.3V, OE=GND, output is in High-Z state                                                                                                                      |
|                                           |                                          |     | 4.0  |         | $V_{dd}$ =1.8V, OE=GND, output is in High-Z state                                                                                                                           |
| Standby Current ( $I_{std}$ )             |                                          | 2.6 | 4.3  | $\mu$ A | $\overline{ST}$ =GND, $V_{dd}$ =2.8V-3.3V, output is weakly pulled down                                                                                                     |
|                                           |                                          | 1.4 | 2.5  |         | $\overline{ST}$ =GND, $V_{dd}$ =2.5V, output is weakly pulled down                                                                                                          |
|                                           |                                          | 0.6 | 1.3  |         | $\overline{ST}$ =GND, $V_{dd}$ =1.8V, output is weakly pulled down                                                                                                          |
| Startup Time ( $T_{start}$ )              |                                          |     | 5    | ms      | Measured from the time $V_{dd}$ reaches its rated minimum value                                                                                                             |
| Enable/Disable Time ( $T_{oe}$ )          |                                          |     | 130  | ns      | F=110MHz. For other frequencies, $T_{oe}$ =100ns+3*cycles                                                                                                                   |
|                                           |                                          |     | 122  |         | F=137MHz. For other frequencies, $T_{oe}$ =100ns+3*cycles                                                                                                                   |
| Resume Time ( $T_{resume}$ )              |                                          |     | 5    | ms      | Measured from the time $\overline{ST}$ pin crosses 50% threshold                                                                                                            |

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(Continued)

| Parameters                                        | Min                 | Typ | Max                 | Unit | Notes                                                         |
|---------------------------------------------------|---------------------|-----|---------------------|------|---------------------------------------------------------------|
| Output Type                                       | LVCMOS              |     |                     |      |                                                               |
| Duty Cycle                                        | 45                  |     | 55                  | %    | All V <sub>dd</sub> options                                   |
| Rise/Fall Time ( T <sub>r</sub> /T <sub>f</sub> ) |                     | 1   | 2                   | ns   | V <sub>dd</sub> =2.5V, 2.8V, 3.0V or 3.3V, 20%-80%            |
|                                                   |                     | 1.3 | 2.5                 |      | V <sub>dd</sub> =1.8V, 20%-80%                                |
|                                                   |                     |     | 2                   |      | V <sub>dd</sub> =2.25V-3.63V, 20%-80%                         |
| Output High Voltage (V <sub>OH</sub> )            | 90%*V <sub>dd</sub> |     |                     | V    | I <sub>OH</sub> =-4mA (V <sub>dd</sub> =3.0V or 3.3V)         |
|                                                   |                     |     |                     |      | I <sub>OH</sub> =-3mA (V <sub>dd</sub> =2.8V or 2.5V)         |
|                                                   |                     |     |                     |      | I <sub>OH</sub> =-2mA (V <sub>dd</sub> =1.8V)                 |
| Output Low Voltage (V <sub>OL</sub> )             |                     |     | 10%*V <sub>dd</sub> | V    | I <sub>OL</sub> =4mA (V <sub>dd</sub> =3.0V or 3.3V)          |
|                                                   |                     |     |                     |      | I <sub>OL</sub> =3mA (V <sub>dd</sub> =2.8V or 2.5V)          |
|                                                   |                     |     |                     |      | I <sub>OL</sub> =2mA (V <sub>dd</sub> =1.8V)                  |
| Input High Voltage(V <sub>IH</sub> )              | 70%*V <sub>dd</sub> |     |                     | V    | Pin 1                                                         |
| Input Low Voltage(V <sub>IL</sub> )               |                     |     | 30%*V <sub>dd</sub> | V    | Pin 1                                                         |
| Input Pull-up Impedance ( Z <sub>in</sub> )       | 50                  | 87  | 150                 | kΩ   | Pin 1, OE logic high or logic low, $\overline{ST}$ logic high |
|                                                   | 2                   |     |                     | MΩ   | Pin 1, $\overline{ST}$ logic low                              |
| RMS Period Jitter ( T <sub>jitt</sub> )           |                     | 1.8 | 3                   | ps   | F=75MHz, V <sub>dd</sub> =2.5V, 2.8V, 3.0V or 3.3V            |
|                                                   |                     | 1.8 | 3                   |      | F=75MHz, V <sub>dd</sub> =1.8V                                |
|                                                   |                     | 1.9 | 3                   |      | F=125MHz, V <sub>dd</sub> =2.5V, 2.8V, 3.0V or 3.3V           |
|                                                   |                     | 1.8 | 4                   |      | F=125MHz, V <sub>dd</sub> =1.8V                               |
| Peak-to-peak Period Jitter (T <sub>pk</sub> )     |                     | 12  | 25                  | ps   | F=75MHz, 125MHz, V <sub>dd</sub> =2.5V, 2.8V, 3.0V or 3.3V    |
|                                                   |                     | 14  | 30                  |      | F=75MHz, 125MHz, V <sub>dd</sub> =1.8V                        |
| RMS Phase Jitter (random) ( T <sub>phj</sub> )    |                     | 0.5 | 0.9                 | ps   | F=75MHz, integration bandwidth=900kHz to 7.5MHz               |
|                                                   |                     | 1.3 | 2                   |      | F=75MHz, integration bandwidth=12kHz to 20MHz                 |

## Standard Frequency (MHz)

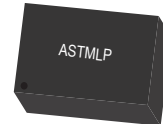
| Standard Frequency (MHz) |           |        |        |        |       |           |         |          |
|--------------------------|-----------|--------|--------|--------|-------|-----------|---------|----------|
| 3.57                     | 4         | 4.096  | 6      | 7.3728 | 8.192 | 10        | 12      | 14       |
| 18.432                   | 19.2      | 20     | 24     | 24.576 | 25    | 25.000625 | 26      | 27       |
| 28.6363                  | 30        | 31.25  | 32.768 | 33     | 33.3  | 33.33     | 33.333  | 33.3333  |
| 33.3333                  | 37.5      | 38     | 38.4   | 40     | 40.5  | 48        | 50      | 54       |
| 60                       | 62.5      | 65     | 66     | 66.66  | 66.66 | 66.666    | 66.6666 | 66.66666 |
| 72                       | 74.175824 | 74.176 | 74.25  | 75     | 77.76 |           |         |          |

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7.0 x 5.0 x 0.9mm

## 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  | °C   |
| V <sub>DD</sub>                                                         | -0.5 | 4    | V    |
| Electrostatic Discharge (HBM)                                           |      | 2000 | V    |
| Soldering Temperature<br>(follow standard Pb free soldering guidelines) |      | 260  | °C   |
| Junction Temperature <sup>(1)</sup>                                     |      | 150  | °C   |

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

## Thermal Consideration

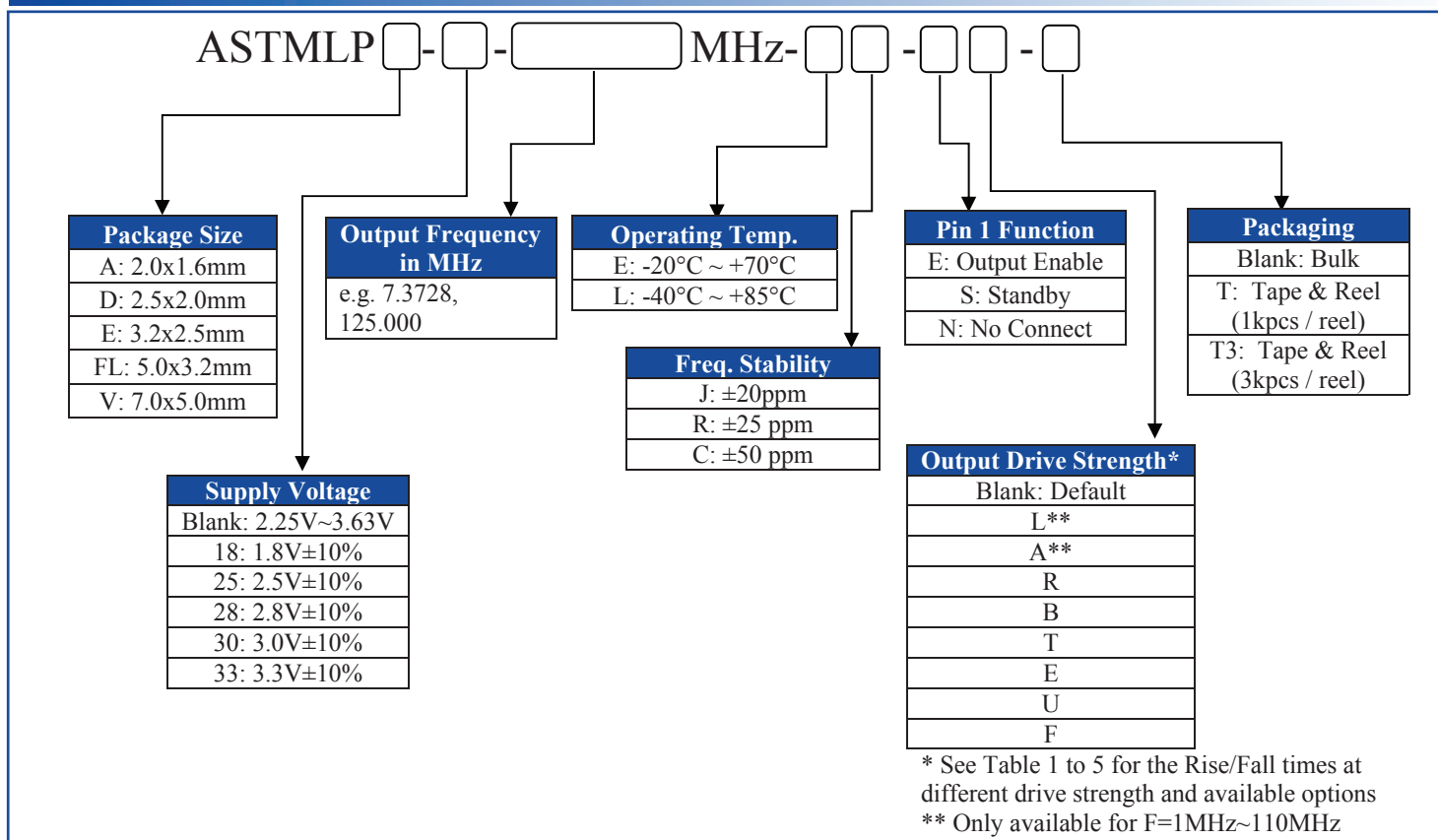
| Package     | θJA, 4 Layer Board<br>(°C/W) | θJA, 2 Layer Board<br>(°C/W) | θJC, Bottom<br>(°C/W) |
|-------------|------------------------------|------------------------------|-----------------------|
| 7.0 x 5.0mm | 142                          | 273                          | 30                    |
| 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                    |

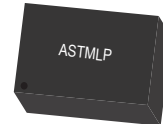
## Maximum Operating Junction Temperature <sup>(2)</sup>

| Max. Operating Temperature (ambient) | Max. Operating Junction Temperature |
|--------------------------------------|-------------------------------------|
| 70°C                                 | 80°C                                |
| 85°C                                 | 95°C                                |

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

## PART IDENTIFICATION:





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

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

| Drive Strength Options | Rise/Fall Time Typ. (ns) |       |       |       |       |
|------------------------|--------------------------|-------|-------|-------|-------|
|                        | $C_{LOAD}$               |       |       |       |       |
|                        | 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: 115MHz – 137MHz**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |
|------------------------|--------------------------|------|
|                        | $C_{LOAD}$               |      |
|                        | 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**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |       |       |       |
|------------------------|--------------------------|------|-------|-------|-------|
|                        | $C_{LOAD}$               |      |       |       |       |
|                        | 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: 115MHz – 137MHz**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |
|------------------------|--------------------------|------|
|                        | $C_{LOAD}$               |      |
|                        | 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 |

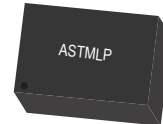
**Table 3:  $V_{dd}=2.8V$  Rise/Fall Times for Specific  $C_{LOAD}$**

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

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |       |       |       |
|------------------------|--------------------------|------|-------|-------|-------|
|                        | $C_{LOAD}$               |      |       |       |       |
|                        | 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: 115MHz – 137MHz**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |      |
|------------------------|--------------------------|------|------|
|                        | $C_{LOAD}$               |      |      |
|                        | 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 |



**Table 4: V<sub>dd</sub>=3.0V Rise/Fall Times for Specific C<sub>LOAD</sub>**

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

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |       |       |       |
|------------------------|--------------------------|------|-------|-------|-------|
|                        | C <sub>LOAD</sub>        |      |       |       |       |
|                        | 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: 115MHz – 137MHz**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |      |
|------------------------|--------------------------|------|------|
|                        | C <sub>LOAD</sub>        |      |      |
|                        | 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<sub>dd</sub>=3.3V Rise/Fall Times for Specific C<sub>LOAD</sub>**

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

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |       |       |       |
|------------------------|--------------------------|------|-------|-------|-------|
|                        | C <sub>LOAD</sub>        |      |       |       |       |
|                        | 5pF                      | 15pF | 30pF  | 45pF  | 60pF  |
| L                      | 3.39                     | 6.88 | 11.63 | 17.56 | 23.59 |
| A                      | 1.74                     | 3.50 | 6.38  | 8.89  | 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: 115MHz – 137MHz**

| Drive Strength Options | Rise/Fall Time Typ. (ns) |      |      |
|------------------------|--------------------------|------|------|
|                        | C <sub>LOAD</sub>        |      |      |
|                        | 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:

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

Example:

Calculate F<sub>max</sub> of a 1MHz ~ 110MHz device with the following condition:

- ° V<sub>dd</sub> = 1.8V (Table 1)
- ° Capacitive Load = 30pF
- ° Desired T<sub>r/f</sub> Time: = 3ns (rise/fall time option code “E”)

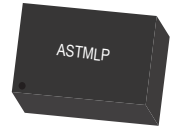
The F<sub>max</sub> is 66.66666MHz.

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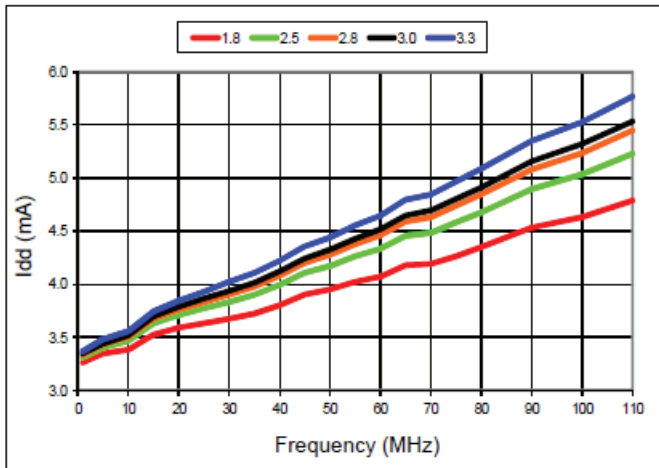
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3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm;  
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## TYPICAL PERFORMANCE DATA

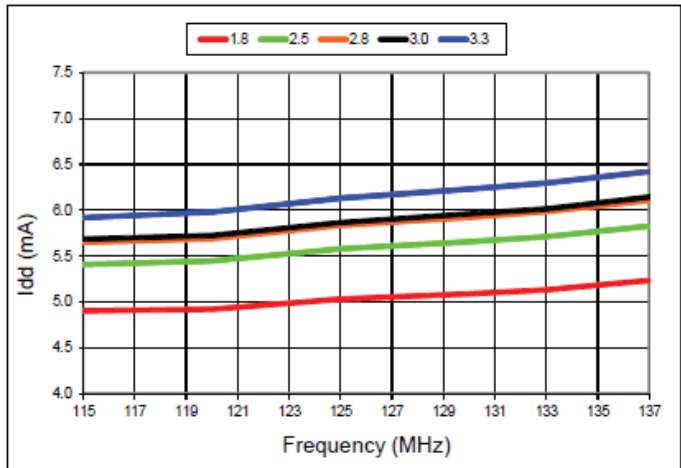
All plots are measured with 15pF load at room temperature, unless otherwise stated.

### I<sub>DD</sub> vs. Frequency

1MHz-110MHz Devices

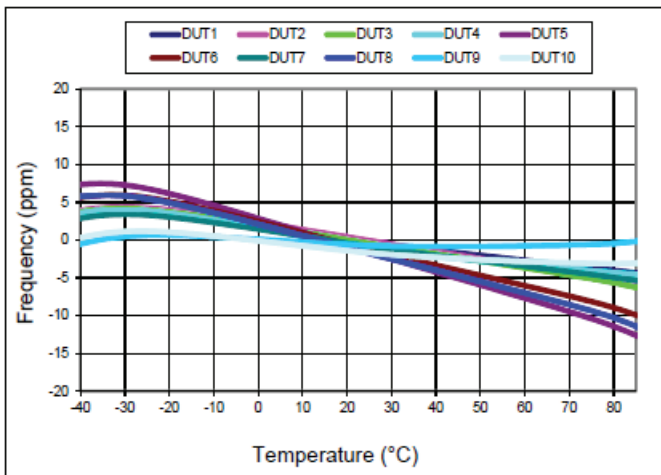


115MHz -137MHz Devices

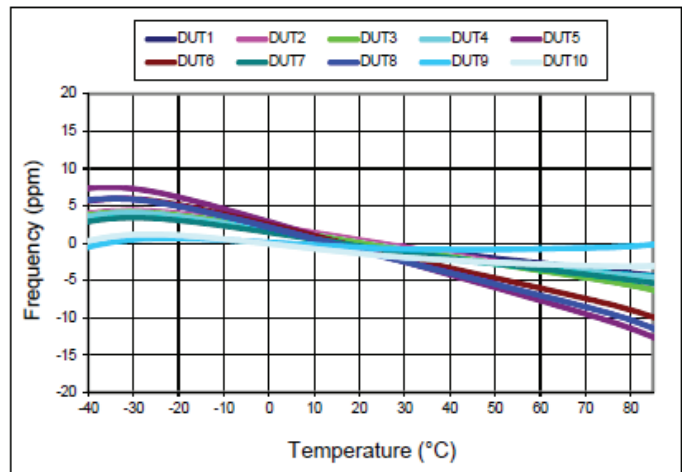


### Frequency vs. Temperature

1MHz-110MHz Devices



115MHz -137MHz Devices

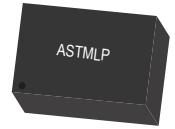


# Low power, Programmable SMD MEMS Oscillator

ASTMLP



RoHS/RoHS II compliant

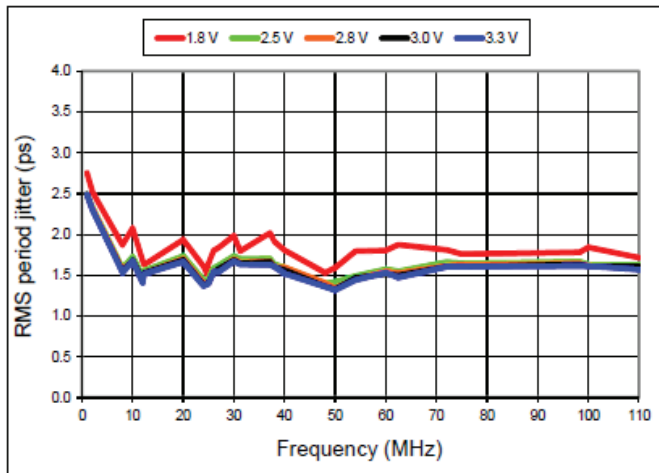


2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm;  
3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm;  
7.0 x 5.0 x 0.9mm

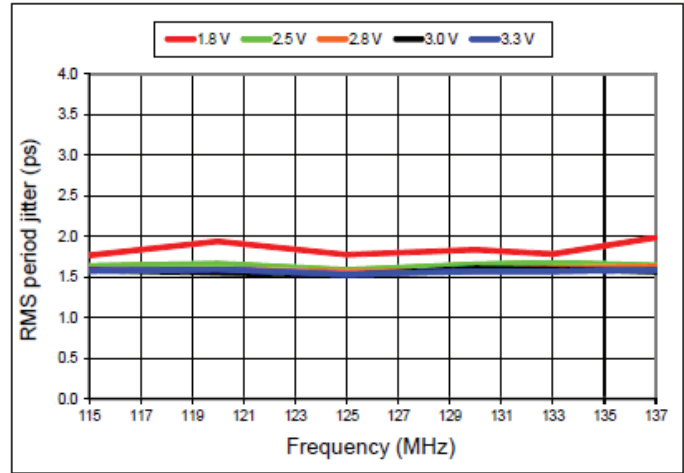
## TYPICAL PERFORMANCE DATA

### RMS Period Jitter vs. Frequency

1MHz-110MHz Devices

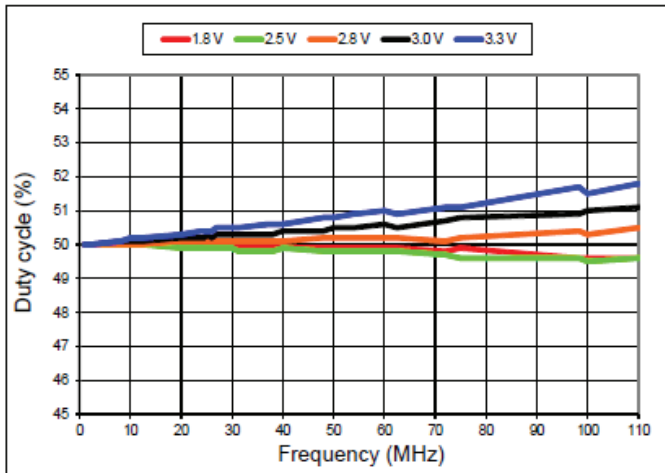


115MHz -137MHz Devices

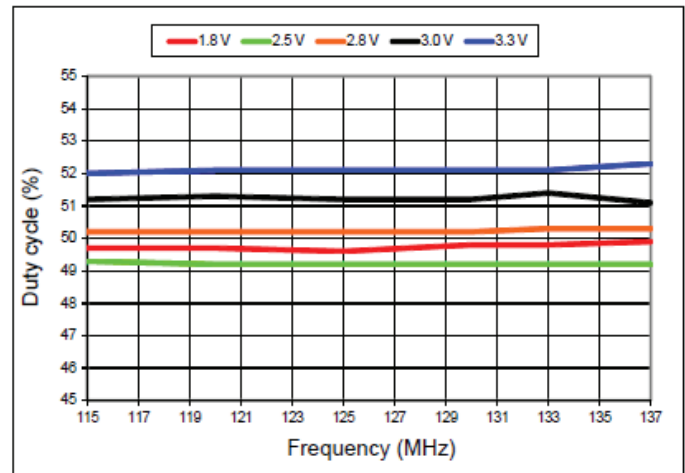


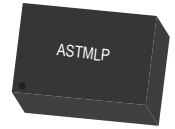
### Duty Cycle vs. Frequency

1MHz-110MHz Devices



115MHz -137MHz Devices

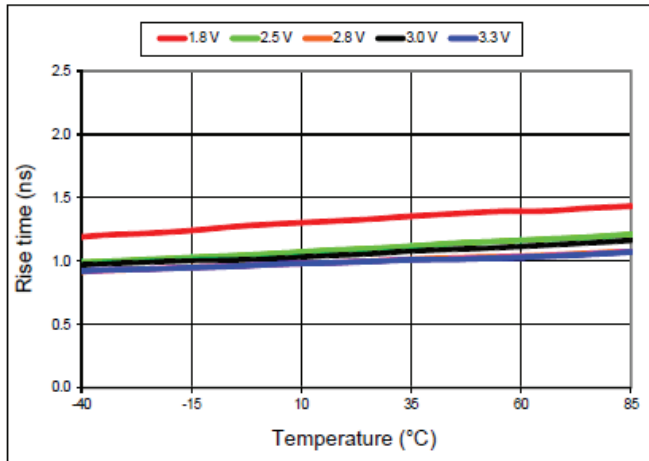




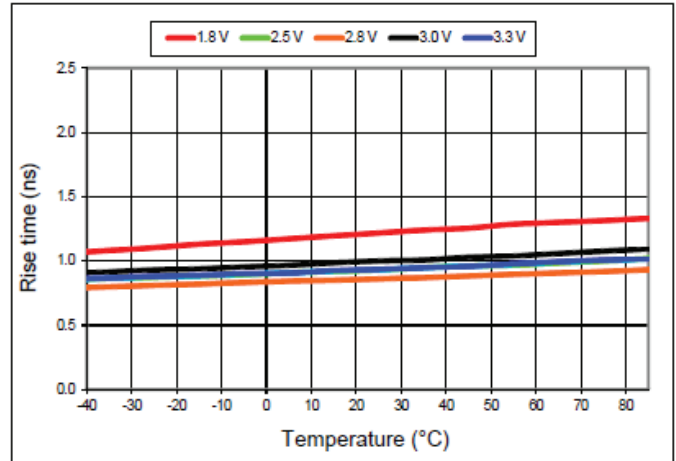
## TYPICAL PERFORMANCE DATA

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

1MHz-110MHz Devices

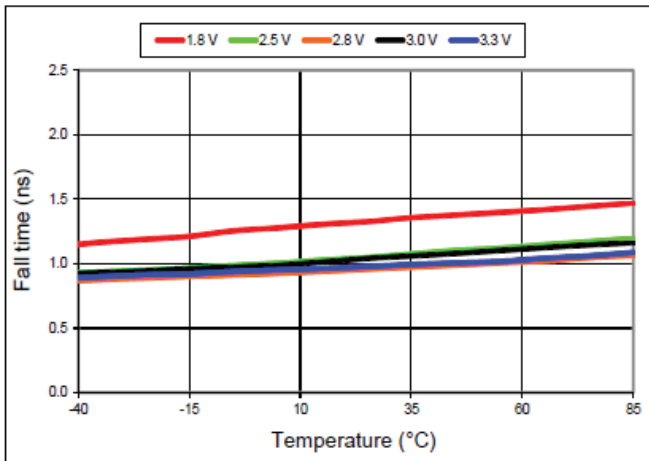


115MHz -137MHz Devices

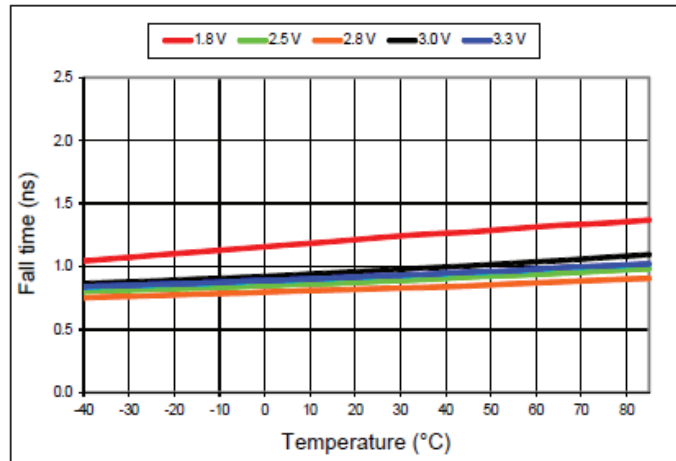


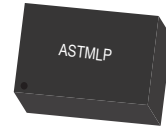
### 20% - 80% Fall Time vs. Temperature

1MHz-110MHz Devices



115MHz -137MHz Devices

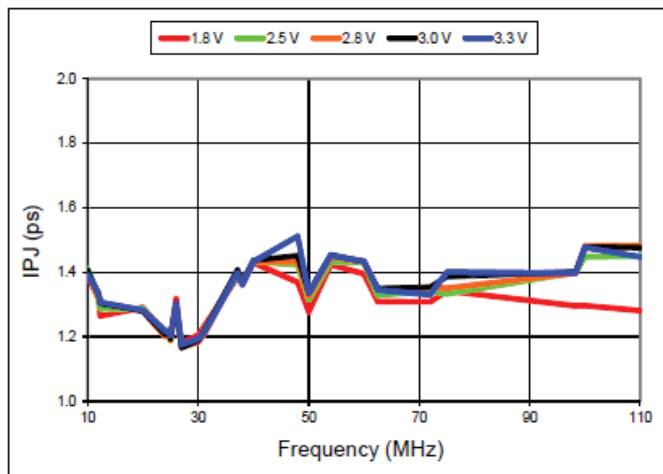




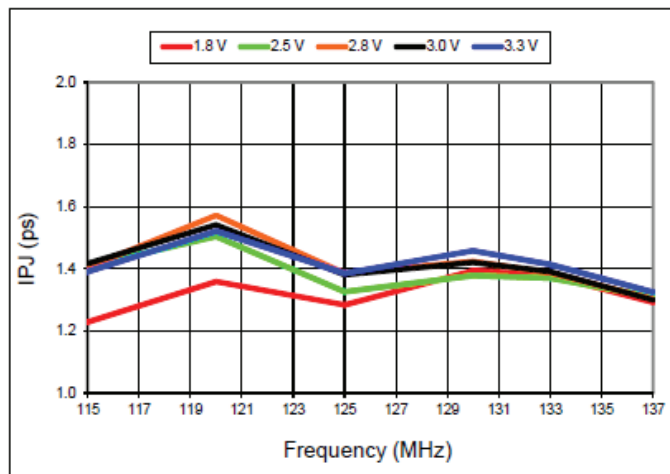
## TYPICAL PERFORMANCE DATA

### RMS Integrated Phase Jitter Random (12kHz to 20MHz) vs Frequency<sup>(3)</sup>

1MHz-110MHz Devices

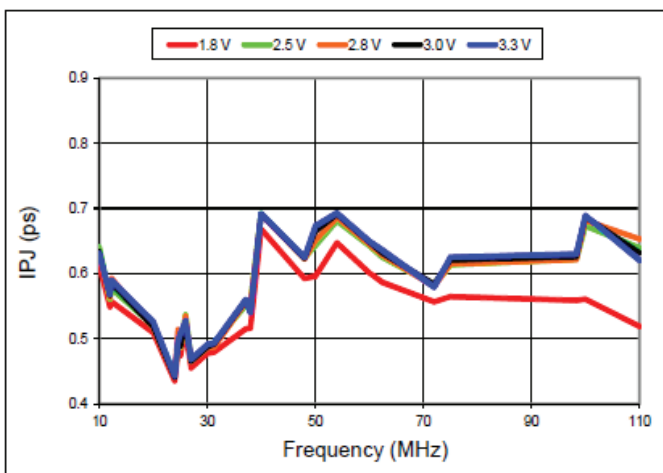


115MHz -137MHz Devices

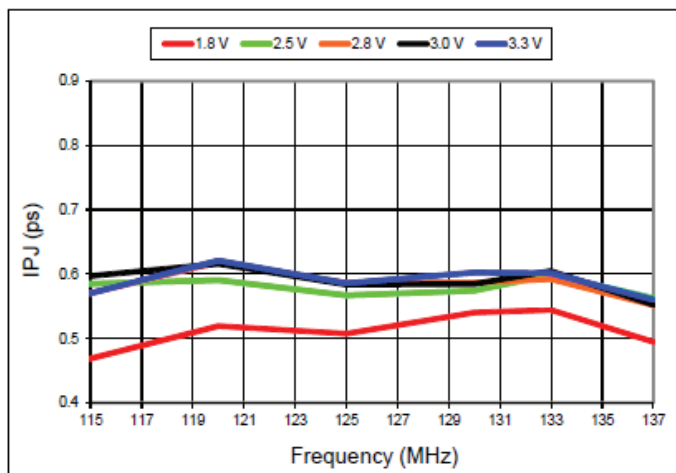


### RMS Integrated Phase Jitter Random (900kHz to 20MHz) vs Frequency<sup>(3)</sup>

1MHz-110MHz Devices



115MHz -137MHz Devices



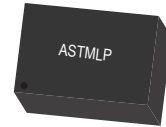
Notes: 3. Phase noise plots are measured with Agilent E5052B signal source analyzer. Integration range is up to 5MHz for carrier frequencies below 40MHz.

# Low power, Programmable SMD MEMS Oscillator

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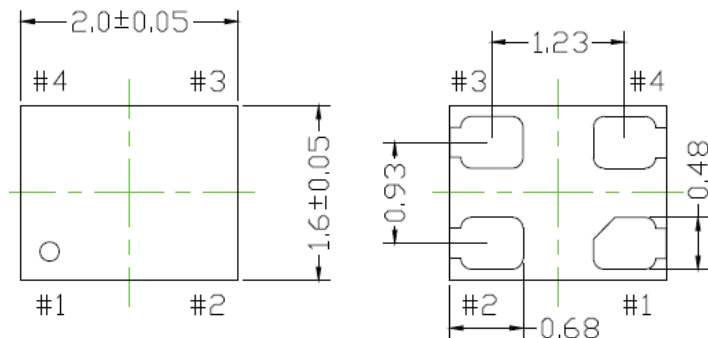
RoHS/RoHS II compliant



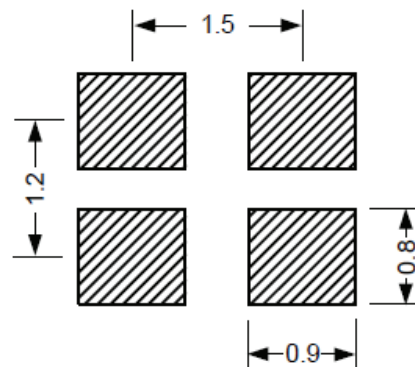
2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm;  
3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm;  
7.0 x 5.0 x 0.9mm

## OUTLINE DIMENSION:

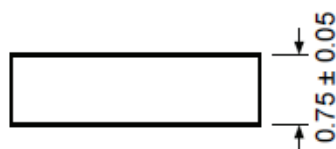
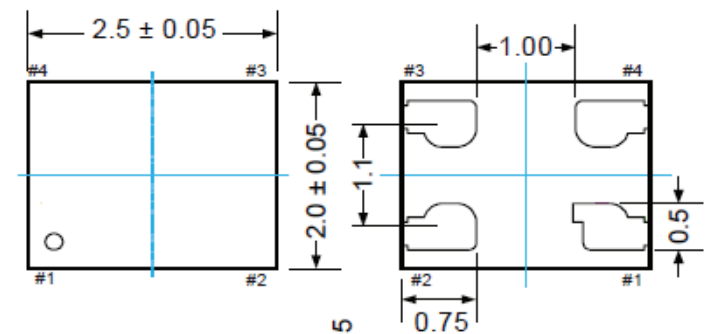
### 2.0 x 1.6mm Package (Option "A")



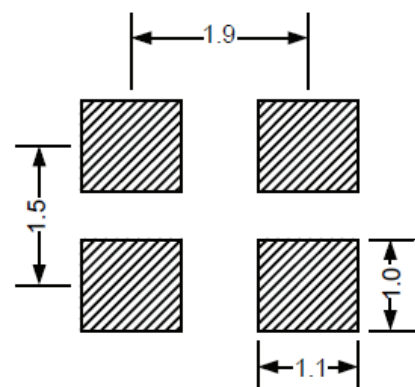
### Recommended Land Pattern



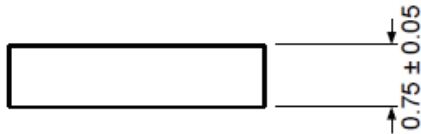
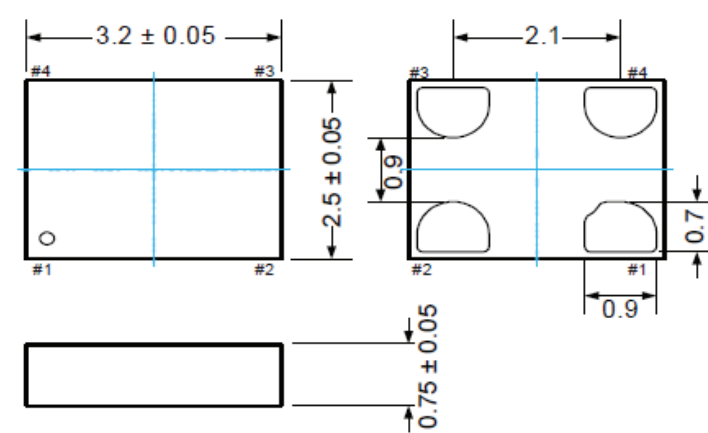
### 2.5 x 2.0mm Package (Option "D")



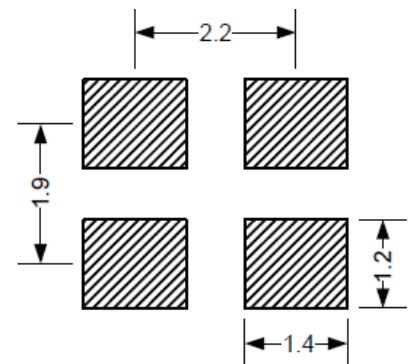
### Recommended Land Pattern



### 3.2 x 2.5mm Package (Option "E")



### Recommended Land Pattern

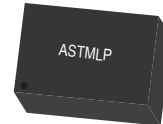


# Low power, Programmable SMD MEMS Oscillator

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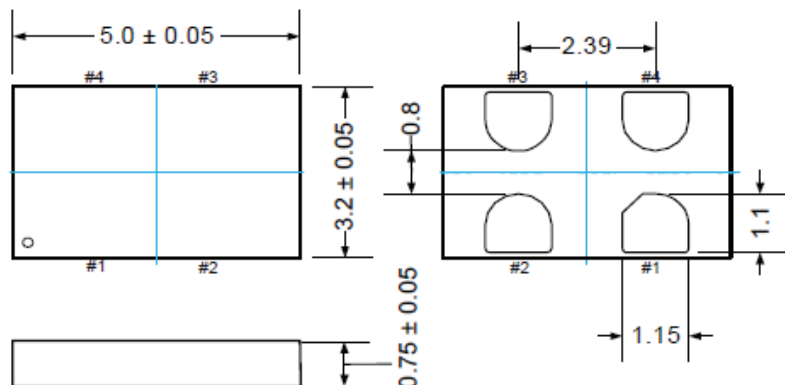
RoHS/RoHS II compliant



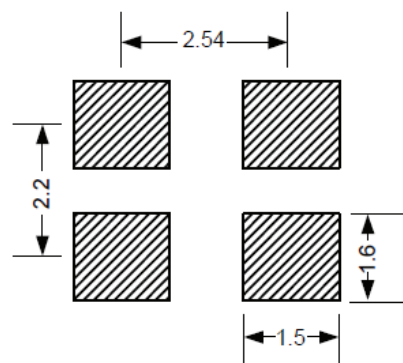
2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm;  
3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm;  
7.0 x 5.0 x 0.9mm

## OUTLINE DIMENSION:

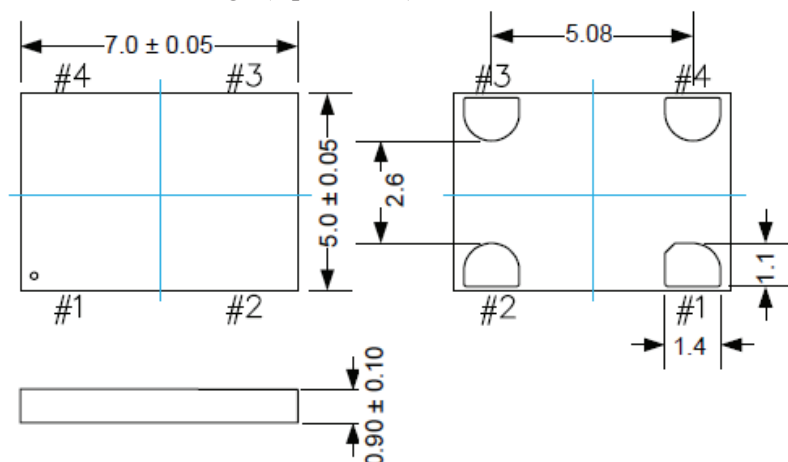
### 5.0 x 3.2mm Package (Option "FL")



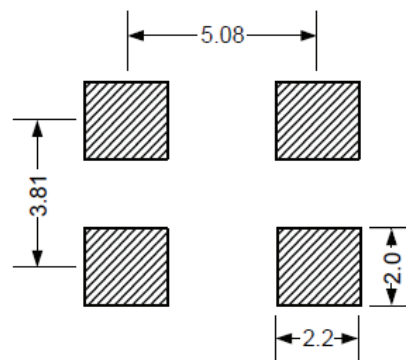
### Recommended Land Pattern



### 7.0 x 5.0mm Package (Option "V")



### Recommended Land Pattern



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

Notes: 4. In OE or  $\overline{\text{ST}}$  mode, a pull-up resistor of <10k $\Omega$  between OE/ $\overline{\text{ST}}$  pin and  $V_{\text{dd}}$  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 0.1 $\mu\text{F}$  between  $V_{\text{dd}}$  and GND is required.

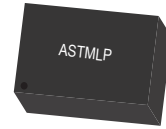
Dimensions: mm

# Low power, Programmable SMD MEMS Oscillator

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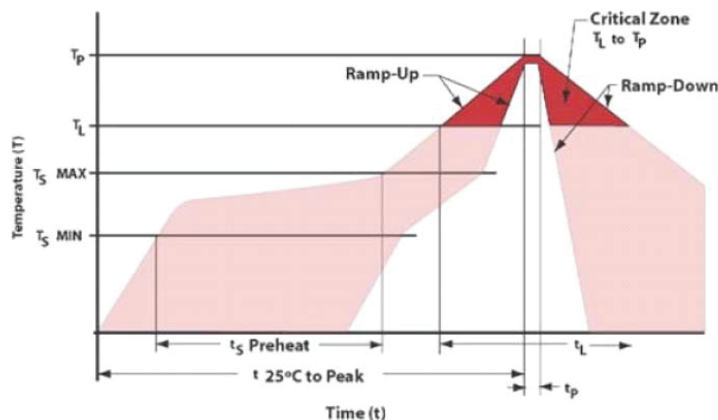


RoHS/RoHS II compliant



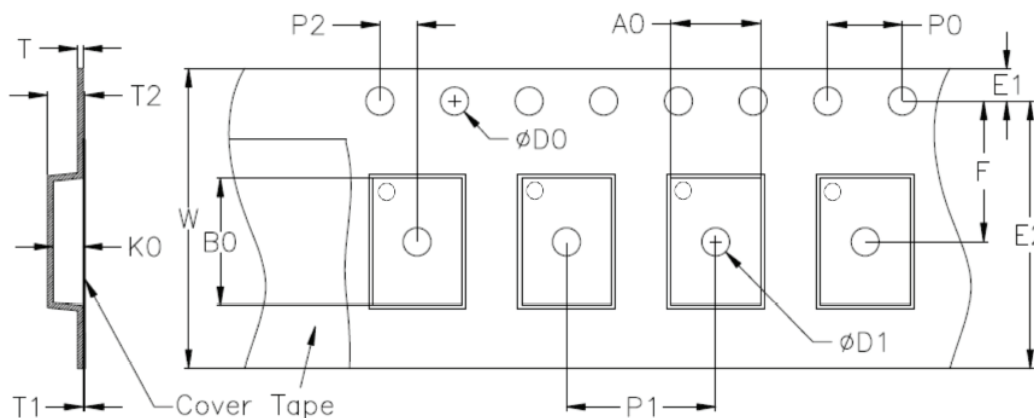
2.0 x 1.6 x 0.75mm; 2.5 x 2.0 x 0.75mm;  
3.2 x 2.5 x 0.75mm; 5.0 x 3.2 x 0.75mm;  
7.0 x 5.0 x 0.9mm

## REFLOW PROFILE:



| Item                                                | Conditions       |
|-----------------------------------------------------|------------------|
| T <sub>S</sub> MAX to T <sub>L</sub> (Ramp-up Rate) | 3°C/second max   |
| Preheat                                             |                  |
| Temperature Minimum (T <sub>S</sub> MIN)            | 150°C            |
| Temperature Typical (T <sub>S</sub> TYP)            | 175°C            |
| Temperature Maximum (T <sub>S</sub> MAX)            | 200°C            |
| Time (t <sub>S</sub> )                              | 60 – 180 seconds |
| Ramp-up Rate (T <sub>L</sub> to T <sub>P</sub> )    | 3°C/second max   |
| Time Maintained Above                               |                  |
| Temperature (T <sub>L</sub> )                       | 217°C            |
| Time (t <sub>L</sub> )                              | 60 – 150 seconds |
| Peak Temperature (T <sub>P</sub> )                  | 260°C max        |
| Target Peak Temperature (T <sub>P</sub> Target)     | 255°C            |
| Time within 5°C of actual peak (t <sub>P</sub> )    | 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:



| 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  |

| 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  |

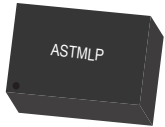
Unit: mm

# Low power, Programmable SMD MEMS Oscillator

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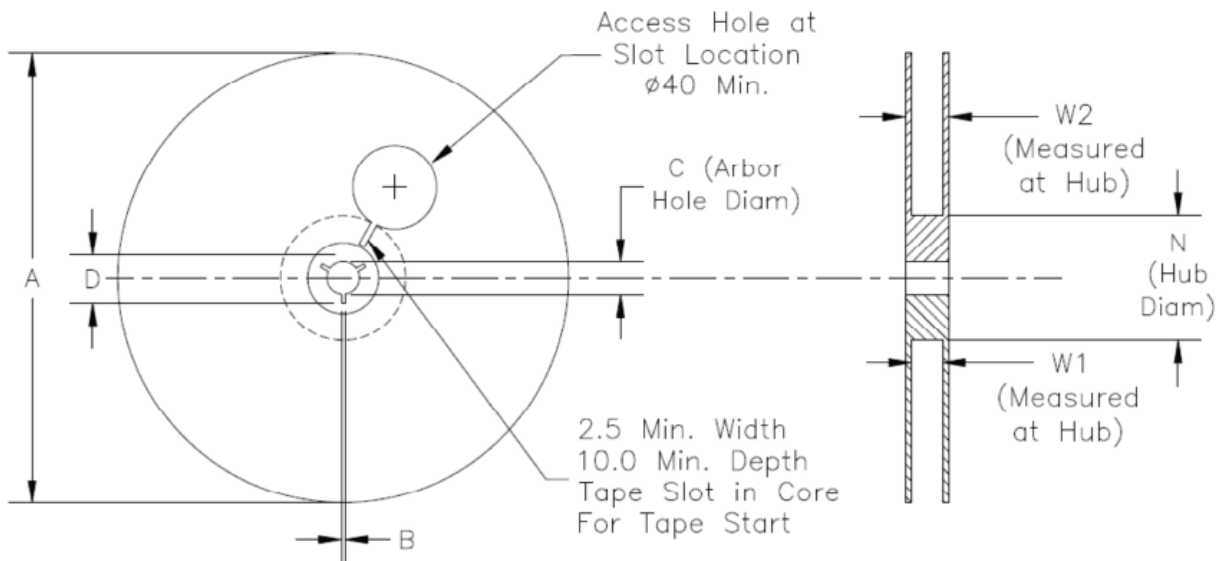


RoHS/RoHS II compliant



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

## 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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