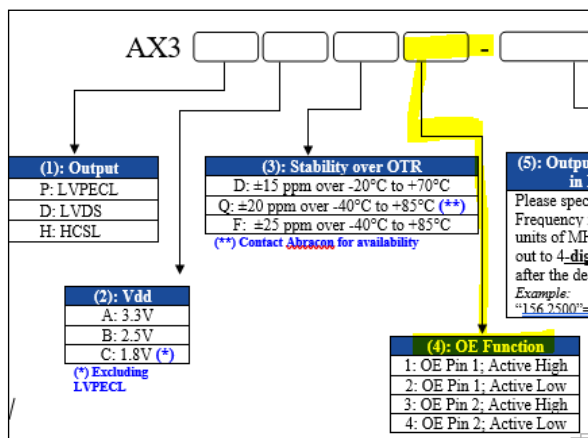


ECN/PCN No.: 3445

| For Manufacturer | | | |
|--|--|--|--|
| Product Description: Ultra-Low Jitter, Fixed-Frequency SMD Clock Oscillator | Abracon Part Number / Part Series: AX3 | <input type="checkbox"/> Documentation only <input checked="" type="checkbox"/> ECN <input type="checkbox"/> EOL | <input checked="" type="checkbox"/> Series <input type="checkbox"/> Part Number |
| Affected Revision: C | New Revision: D | Application: | <input type="checkbox"/> Safety <input checked="" type="checkbox"/> Non-Safety |

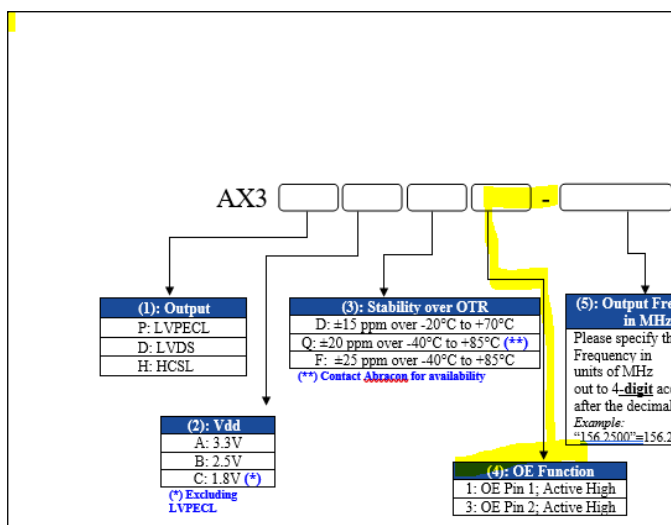
Prior to Change:

- Electrical Specifications
 - Output High Voltage (V_{OH}), LVPECL Max: **$V_{dd}-0.60\text{ V}$**
 - Output High Voltage (V_{OH}), HCSL Min: **0.66 V**
- Part Number Builder – OE Function Options
 - 1: OE Pin 1; Active High
 - 2: OE Pin 1; Active Low
 - 3: OE Pin 2; Active High
 - 4: OE Pin 2; Active Low



After Change:

- Electrical Specifications
 - Output High Voltage (V_{OH}), LVPECL Max: **$V_{dd}-0.88\text{ V}$**
 - Output High Voltage (V_{OH}), HCSL Min: **0.4 V**
- Part Number Builder – OE Function Options
 - 1: OE Pin 1; Active High
 - 3: OE Pin 2; Active High



Cause/Reason for Change:

Incorrect electrical specifications selected on datasheet and unavailable performance options, specific to the output enable/disable pin, included on datasheet. The electrical specifications have been corrected and the unavailable performance options removed.

| Change Plan | | |
|---|---|--|
| Effective Date: 5/5/2021 | Additional Remarks: N/A | |
| Change Declaration: <ul style="list-style-type: none"> This statement addresses both the electrical and mechanical changes of the product series. The electrical changes outlined in this ECN impact the electrical performance of this device. The differential output voltage boundary specifications were changed, and the device cannot be toggled active via a logic low/GND signal. The mechanical changes outlined in this ECN do not impact the mechanical performance of the device. | | |
| Issued Date: 5/5/2021 | Issued By: <i>Brooke Cushman</i> Product Engineer | Issued Department: Engineering |
| Approval: <i>Thomas Culhane</i> Engineering Director | Approval: <i>Reuben Quintanilla</i> Quality Director | Approval: <i>Ying Huang</i> Purchasing Director |
| For Abracon EOL only | | |
| Last Time Buy (if applicable): N/A | Alternate Part Number / Part Series: N/A | |
| Additional Approval: N/A | Additional Approval: N/A | Additional Approval: N/A |
| Customer Approval (If Applicable) | | |
| Qualification Status: <div style="text-align: center; margin-top: 5px;"> <input type="checkbox"/> Approved <input type="checkbox"/> Not accepted </div> <p><i>Note: It is considered approved if there is no feedback from the customer 1 month after ECN/PCN is released.</i></p> | | |
| Customer Part Number: | | Customer Project: |
| Company Name: | Company Representative: | Representative Signature: |
| Customer Remarks: | | |
| Affected Part Numbers | | |
| AX3DAF2-100.0000 AX3DAF2-100.0000T AX3DAF2-100.0000T3 AX3DAF2-114.0000 AX3DAF2-114.0000T AX3DAF2-114.0000T3 AX3DAF2-114.2850 AX3DAF2-114.2850T AX3DAF2-114.2850T3 AX3DAF2-120.0000 AX3DAF2-120.0000T AX3DAF2-120.0000T3 AX3DAF2-122.8800 AX3DAF2-122.8800T AX3DAF2-122.8800T3 AX3DAF2-125.0000 AX3DAF2-125.0000T AX3DAF2-125.0000T3 | | |

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AX3DAF2-156.2500T
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AX3HCF3-156.2500T3
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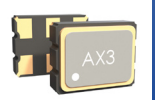
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| | | | | | |
|---------|--------------------|-----|------|---|---|
| Abracon | AX3PBF4-156.2500T | AX3 | 3445 | https://abracon.com/datasheets/AX3.pdf | https://abracon.com/downloads/ECN-PCN/ECN-PCN-3445-AX3-Series.pdf |
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AX3



ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

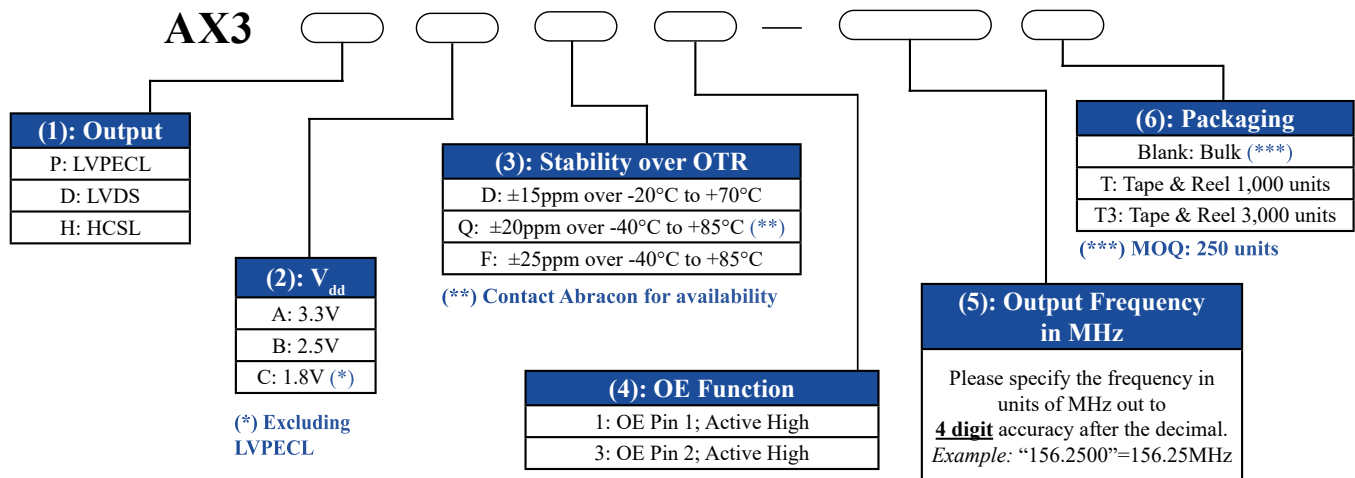
Features

- Exceptionally Low RMS Jitter: < 80fs Typ (150fs Max @ 156.25MHz)
- Available in industry standard frequencies between 100MHz and 212.5MHz
- Lowest power consumption in its class (16mA Typ LVDS @ 156.25MHz)
- ±25ppm stability over industrial operating temperature (-40 to +85°C)
- 3.3V, 2.5V, 1.8V supply voltage options
- LVPECL, LVDS, HCSL differential outputs
- Industry standard 3.2 x 2.5 x 1.0 mm footprint
- Available in Abracon's Global Distribution Network

Applications

- PCI Express
- 10G/40G/100G optical Ethernet
- Networking & communication
- RF systems, base stations (BTS)
- Data center
- Test & measurement

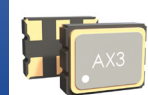
Options and Part Identification [Note 1]



Part Number Example:

AX3PAF1-156.2500
AX3PAF1-156.2500T
AX3PAF1-156.2500T3

Note 1: Contact Abracon for non-standard configurations and/or requests with carrier frequency callouts up to 5 & 6 digit accuracy after the decimal.



AX3



ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Electrical Characteristics

| Parameters | | Min. | Typ. | Max. | Unit | Notes |
|--|--------|---|------|---------|------|--|
| Frequency Range | | 100 | | 212.500 | MHz | |
| Standard Available Frequencies | | 100, 114.285, 122.88, 125, 148.5, 150, 155.52, 156.25, 200, 212.500 | | | MHz | Contact Abracon for availability of frequencies not listed |
| Supply Voltage (V_{dd}) [Note 2] | | 2.97 | 3.3 | 3.63 | V | Option "A" |
| | | 2.37 | 2.5 | 2.62 | | Option "B" |
| | | 1.71 | 1.8 | 1.89 | | Option "C" |
| Supply Current (I_{dd}) | LVPECL | | 30 | 50 | mA | @ 200MHz; @ $V_{dd} = 3.3V$ |
| | LVDS | | 16 | 27 | | @ 200MHz; @ $V_{dd} = 3.3V$ |
| | HCSL | | 17 | 30 | | @ 200MHz; @ $V_{dd} = 3.3V$ |
| Operating Temperature Range | | -20 | | +70 | °C | Option "D" |
| | | -40 | | +85 | | Option "F" or "Q" |
| Storage Temperature | | -55 | | +150 | °C | |
| Frequency Accuracy (Initial Set-Tolerance) at time of shipment (Pre-Reflow) @ +25°C | | -10 | < ±5 | +10 | ppm | Relative to carrier frequency |
| Frequency Stability over [Note 3,4] Operating Temperature Range | | -15 | | +15 | ppm | Option "D" (-20°C to +70°C) |
| | | -20 | | +20 | | Option "Q" (-40°C to +85°C) |
| | | -25 | | +25 | | Option "F" (-40°C to +85°C) |
| Aging over 20 Year Product Life [Note 5] | | -15 | | +15 | ppm | |
| All-Inclusive Frequency Accuracy (Total Stability) over 20 Year Product Life [Note 5, 6] | | -40 | | +40 | ppm | Option "D" (-20°C to +70°C) |
| | | -45 | | +45 | | Option "Q" (-40°C to +85°C) |
| | | -50 | | +50 | | Option "F" (-40°C to +85°C) |
| Rise (Tr) / Fall (Tf) Time 20% to 80% $V_{peak\ to\ peak}$ | LVPECL | | 0.2 | 0.4 | ns | @ $V_{dd} = 3.3V, R_L = 50\Omega$ |
| | | | 0.3 | 0.6 | | @ $V_{dd} = 2.5V, R_L = 50\Omega$ |
| | | | 0.15 | 0.4 | | @ $V_{dd} = 3.3V, R_L = 100\Omega$ |
| | LVDS | | 0.15 | 0.4 | | @ $V_{dd} = 2.5V, R_L = 100\Omega$ |
| | | | 0.3 | 0.5 | | @ $V_{dd} = 1.8V, R_L = 100\Omega$ |
| | | | 0.3 | 0.5 | | @ $V_{dd} = 3.3V, R_L = 50\Omega\ to\ GND$ |
| | HCSL | | 0.3 | 0.5 | | @ $V_{dd} = 2.5V, R_L = 50\Omega\ to\ GND$ |
| | | | 0.3 | 0.5 | | @ $V_{dd} = 3.3V, R_L = 50\Omega\ to\ GND$ |
| | | | 0.3 | 0.6 | | @ $V_{dd} = 1.8V, R_L = 50\Omega\ to\ GND$ |
| Duty Cycle | | 45 | | 55 | % | |
| Start-up Time [Note 3] | | | < 2 | 5.0 | ms | |

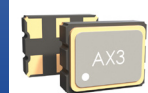
Note 2: Supply Voltage (V_{dd}) = 1.8V option not available with LVPECL output

Note 3: Relative to initial measured frequency @ +25°C

Note 4: Option Q only available in select frequencies. Please contact Abracon for availability

Note 5: Relative to post-reflow frequency

Note 6: Includes temperature stability, initial frequency accuracy, load pulling, power supply variation, and 20-year aging



AX3



ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Electrical Characteristics Cont.

| Parameters | | Min. | Typ. | Max. | Unit | Notes |
|---|--------|----------------|-----------------|----------------|-----------------|---|
| Differential Output High Voltage (V_{OH}) Output Low Voltage (V_{OL}) | LVPECL | V_{OH} | $V_{dd} - 1.03$ | | $V_{dd} - 0.88$ | $R_L = 50\Omega$ to $V_{dd} - 2.0V$ |
| | | V_{OL} | $V_{dd} - 1.85$ | | $V_{dd} - 1.60$ | |
| | LVDS | V_{OH} | | 1.40 | 1.60 | $R_L = 100\Omega$ between both outputs |
| | | V_{OL} | 0.90 | 1.10 | | |
| | HCSL | V_{OH} | 0.40 | 0.74 | 0.85 | $R_L = 50\Omega$ to ground on each output |
| | | V_{OL} | -0.15 | 0.00 | 0.15 | |
| Output Voltage Swing | | 0.595 | 0.75 | 0.93 | V | LVPECL |
| | | 0.25 | 0.35 | 0.45 | | LVDS |
| | | 0.620 | 0.70 | 0.78 | | HCSL |
| Output Enable & Disable Control | | $0.7*(V_{dd})$ | | | V | Output Enable; or No Connect |
| | | | | $0.3*(V_{dd})$ | | Output Disable; High Impedance |
| Output Enable Time | | | < 1 | 5.0 | ms | |
| Output Disable Time | | | | 0.2 | μs | |
| Output Disable Current Consumption | | | | < 10 | μA | $OE \leq 0.3V$ |

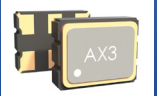
RMS Phase Jitter (12kHz -20MHz BW) | $V_{dd} = 3.3V$ [Note 7, 8, 9]

| Frequency (MHz) | Output | RMS Jitter | |
|-----------------|--------|------------|----------|
| | | Typ. (fs) | Max (fs) |
| 100 | HCSL | 153 | 200 |
| | LVPECL | 211 | 300 |
| | LVDS | 304 | 500 |
| 114.285 | LVPECL | 264 | 500 |
| | LVDS | 239 | 500 |
| 122.88 | HCSL | 122 | 200 |
| | LVPECL | 228 | 300 |
| | LVDS | 198 | 300 |
| 125 | HCSL | 138 | 200 |
| | LVPECL | 91 | 150 |
| | LVDS | 186 | 300 |
| 148.5 | LVPECL | 154 | 200 |
| | LVDS | 158 | 200 |
| 150 | LVPECL | 154 | 200 |
| | LVDS | 153 | 200 |
| 155.52 | LVPECL | 121 | 150 |
| 156.25 | HCSL | 113 | 150 |
| | LVPECL | 75 | 150 |
| | LVDS | 115 | 150 |
| 200 | LVDS | 70 | 150 |
| | LVPECL | 140 | 200 |
| | HCSL | 140 | 200 |
| 212.5 | LVDS | 60 | 150 |
| | LVPECL | 130 | 200 |
| | HCSL | 130 | 200 |

Note 7: Guaranteed by characterization; RMS Phase Jitter specifications are inclusive of any spurs

Note 8: Phase jitter measured with Keysight E5052B Signal Source Analyzer

Note 9: Refer to the next section for phase noise test setup and representative phase noise plots



AX3



ESD Sensitive



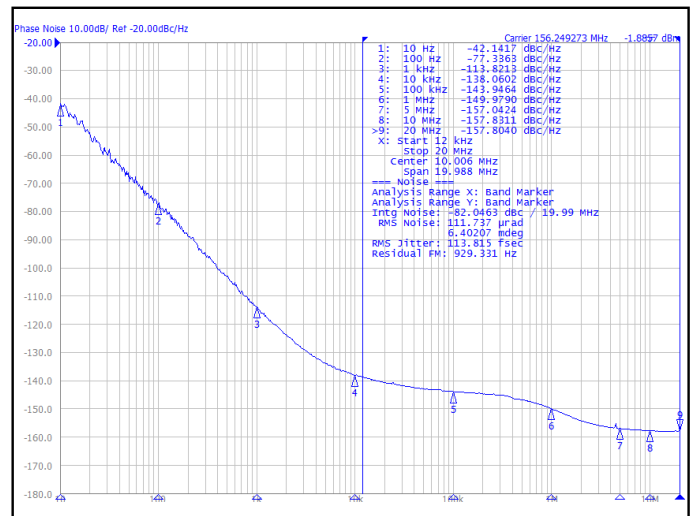
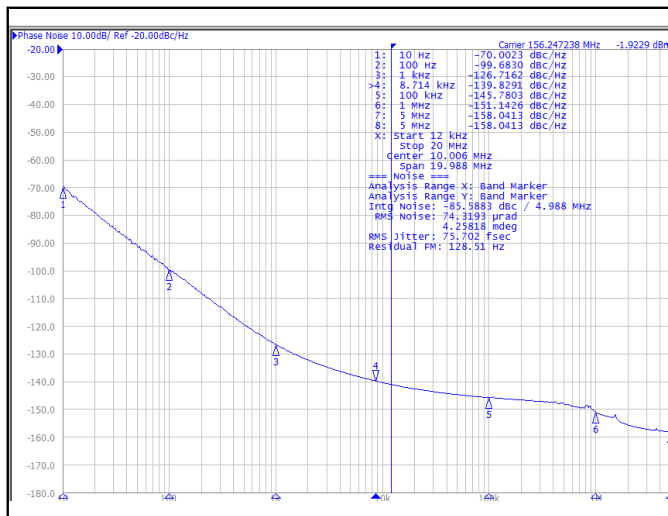
3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Phase Noise Test Setup [Note 10]

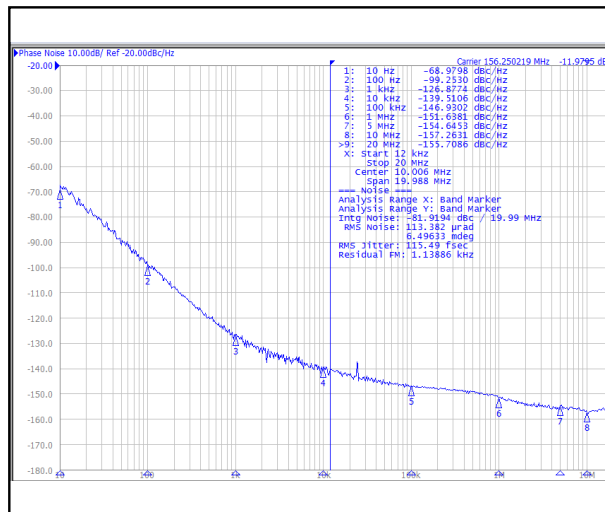
- Keysight E5052B Signal Source Analyzer
- Integration Bandwidth = 12kHz to 20MHz
- Spurious Activity (entire plot trace) = Not Omitted (Normalized in dBc/Hz)
- Specified Spur Omission Function = Not Enabled
- IF Gain = 20dB
- Correlation = 5
- Average = 3

F=156.2500MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 75 fs

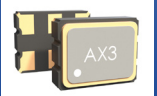
F=156.2500MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 113 fs



F= 156.2500MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 115 fs



Note 10: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range



AX3



ESD Sensitive

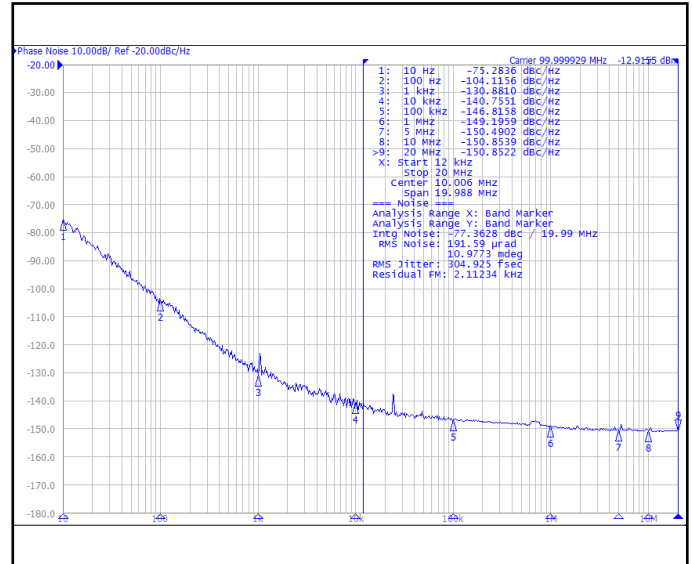
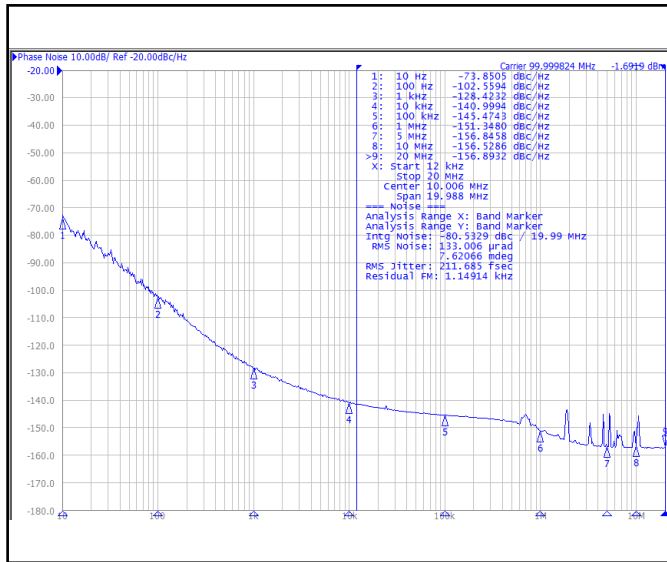


3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

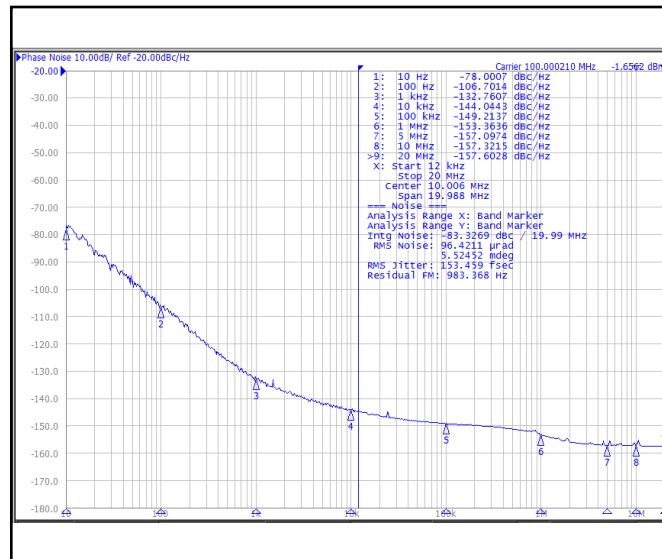
Representative Phase Noise Plots Cont. [Note 10]

F=100.0000MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 211 fs

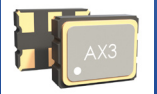
F= 100.0000MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 304 fs



F= 100.0000MHz | V_{dd}=3.3V | HCSSL
RMS Phase Jitter = 153 fs



Note 10: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range



AX3



ESD Sensitive

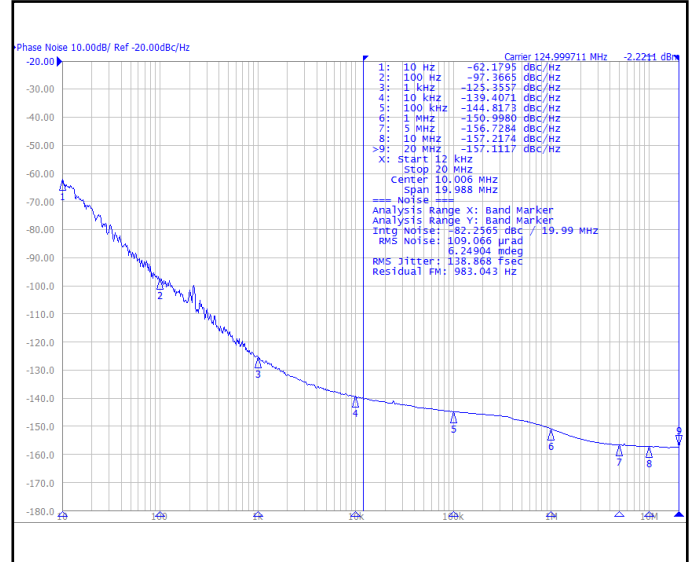
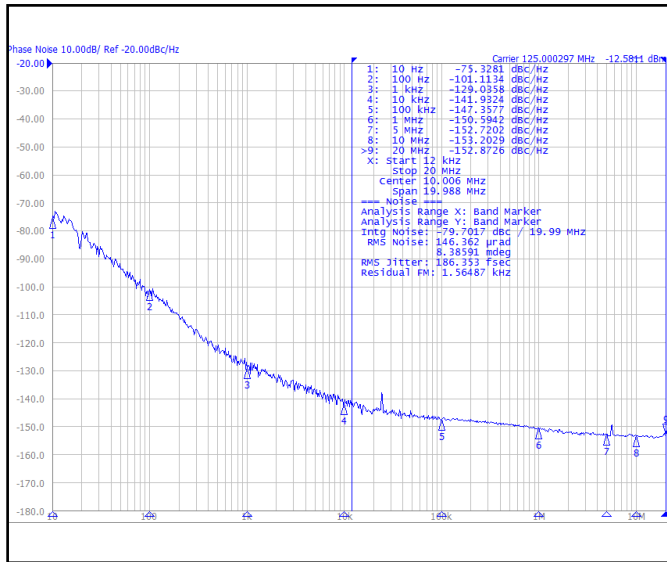


3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Representative Phase Noise Plots Cont. [Note 10]

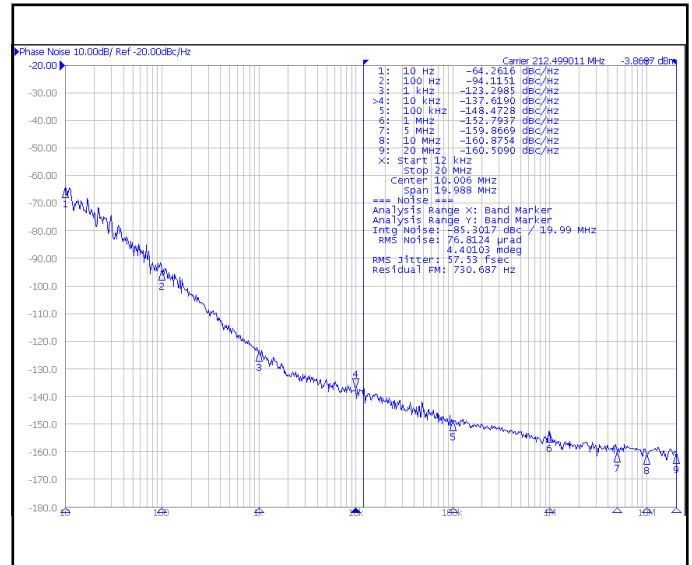
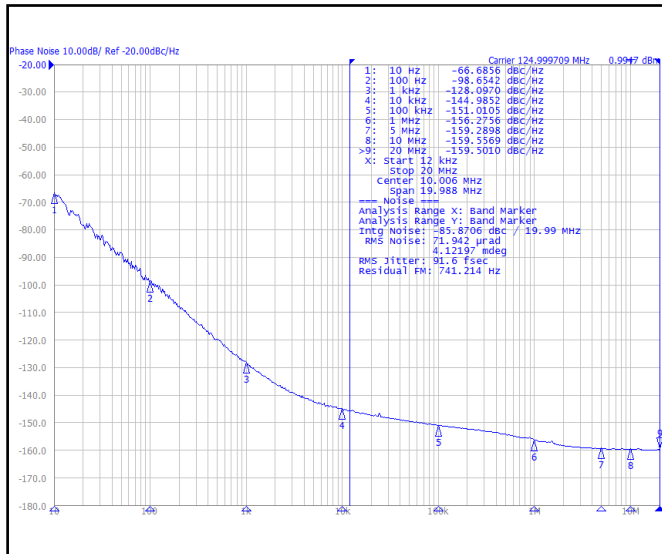
F=125.0000MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 186 fs

F= 125.0000MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 138 fs

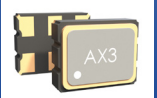


F= 125.0000MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 91 fs

F= 212.5000MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 57 fs



Note 10: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range



AX3

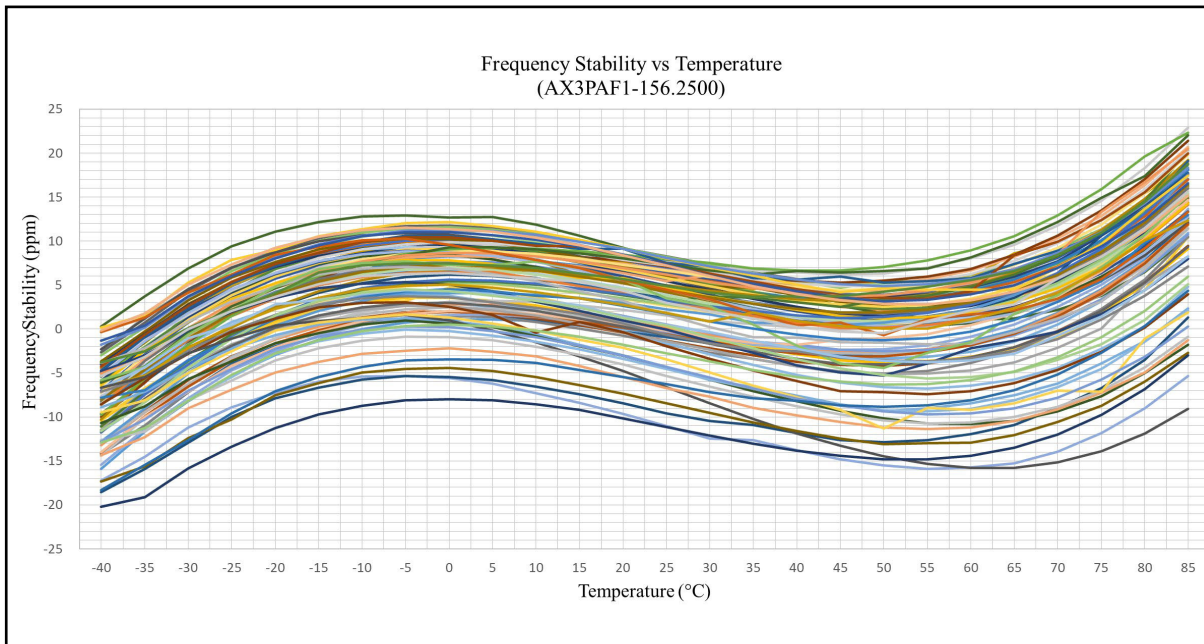
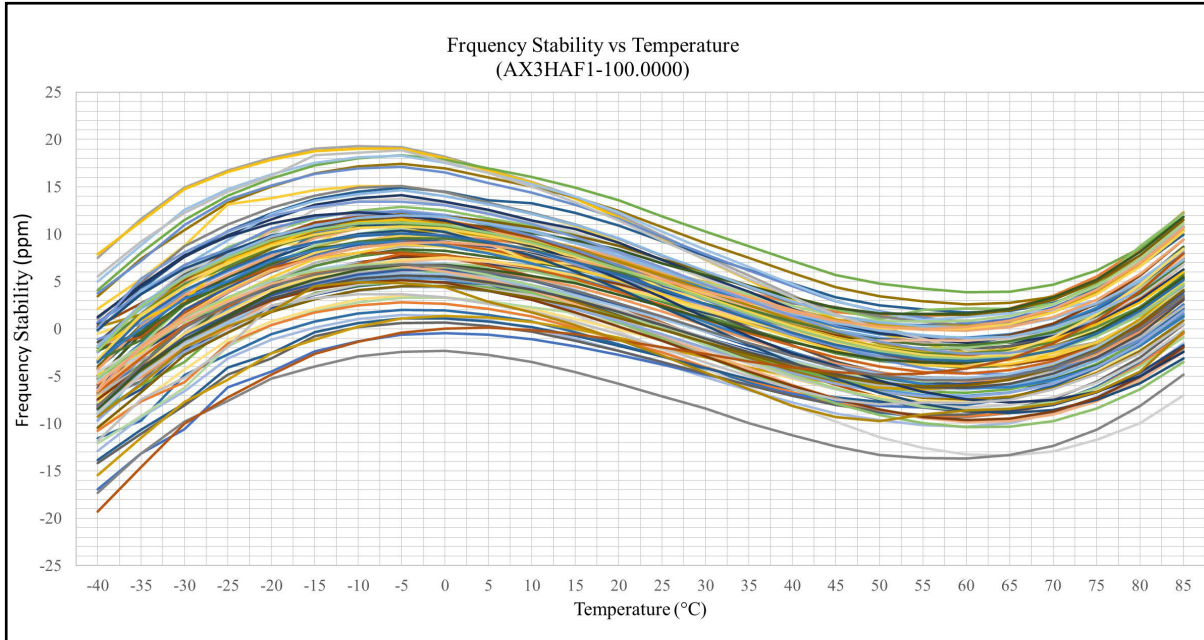


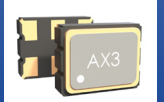
ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Typical Frequency vs. Temperature Characteristics





AX3

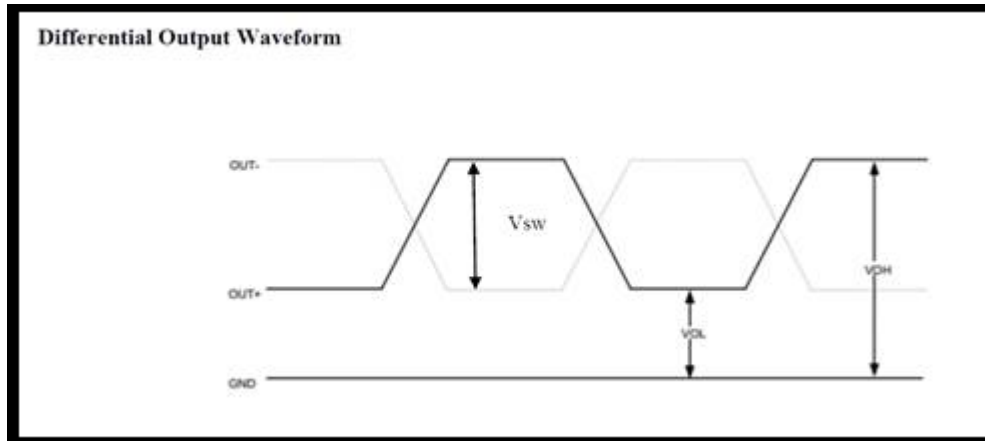


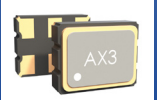
ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Differential Output Waveform





AX3

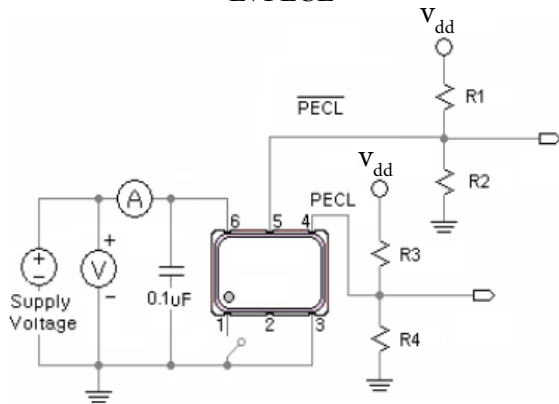


ESD Sensitive

3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

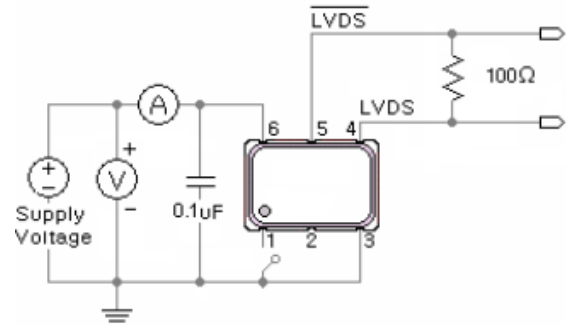
Recommended Test Circuit [Note 11]

LVPECL

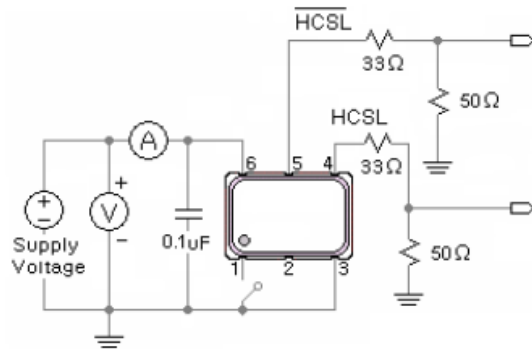


$V_{dd}=3.3V$: R1=R3=127Ω; R2=R4=82.5 Ω
 $V_{dd}=2.5V$: R1=R3=250Ω; R2=R4=62.5 Ω

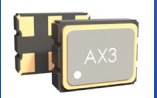
LVDS



HCSL



Note 11: Recommended test circuit images display OE Functions Option 1 & Option 2 where the OE Function is located on Pin 1
 When the OE Function is located on Pin 2, then Pin 1=No Connect & Pin 2=OE or No Connect



AX3

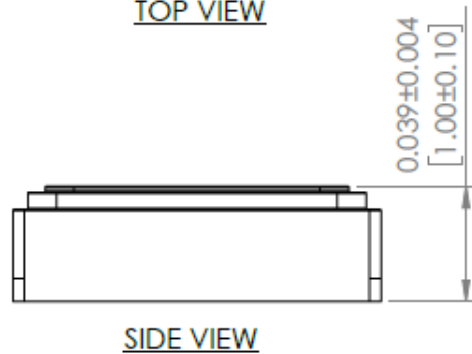
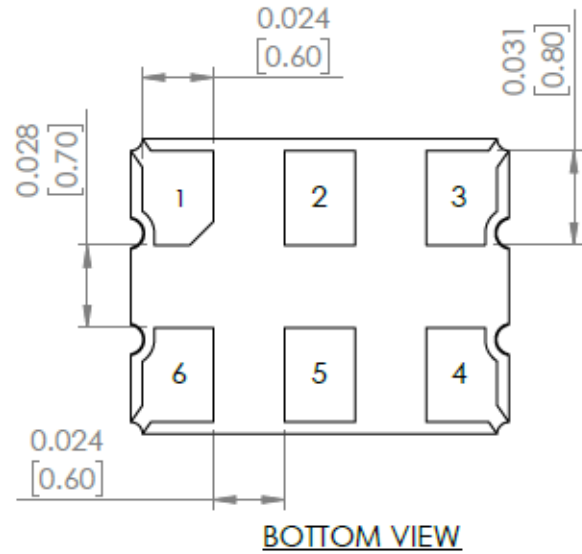
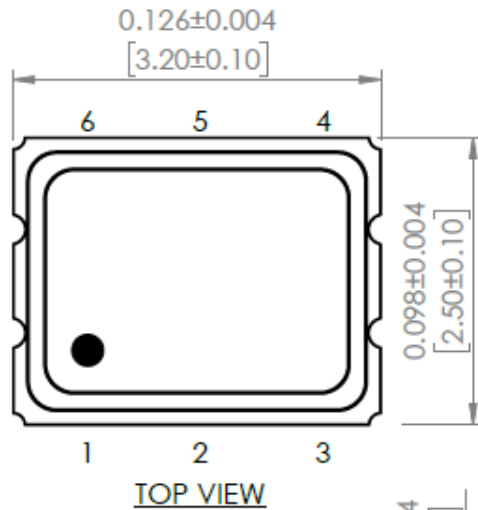


ESD Sensitive

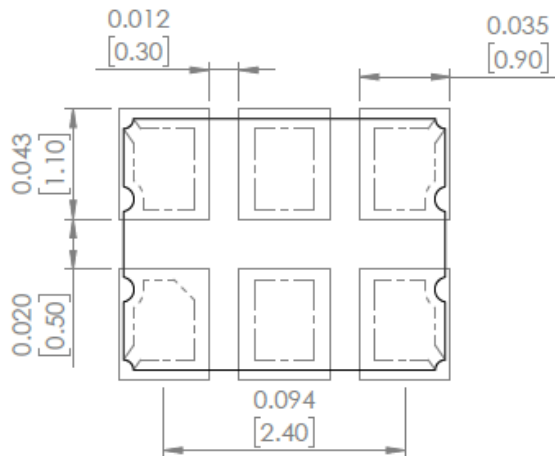


3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Mechanical Dimensions

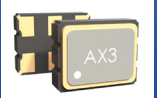


Recommended Land Pattern



| Case 1 Pin #1=Output Enable/Disable Function where OE is Active HIGH | | Case 2 Pin #2=Output Enable/Disable Function where OE is Active HIGH | |
|---|--|---|--|
| Pin | Description | Pin | Description |
| # 1 | Output Enable = Logic High, "1", V _{dd} | # 1 | No Connect |
| | Output Disable = Logic Low, "0", GND | # 2 | Output Enable = Logic High, "1", V _{dd} |
| # 2 | No Connect | | Output Disable = Logic Low, "0", GND |
| # 3 | GND | # 3 | GND |
| # 4 | Output | # 4 | Output |
| # 5 | Complementary output | # 5 | Complementary output |
| # 6 | Supply Voltage (V _{dd}) | # 6 | Supply Voltage (V _{dd}) |

Dimensions: inches [mm]



AX3



ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Recommended Reflow Profile

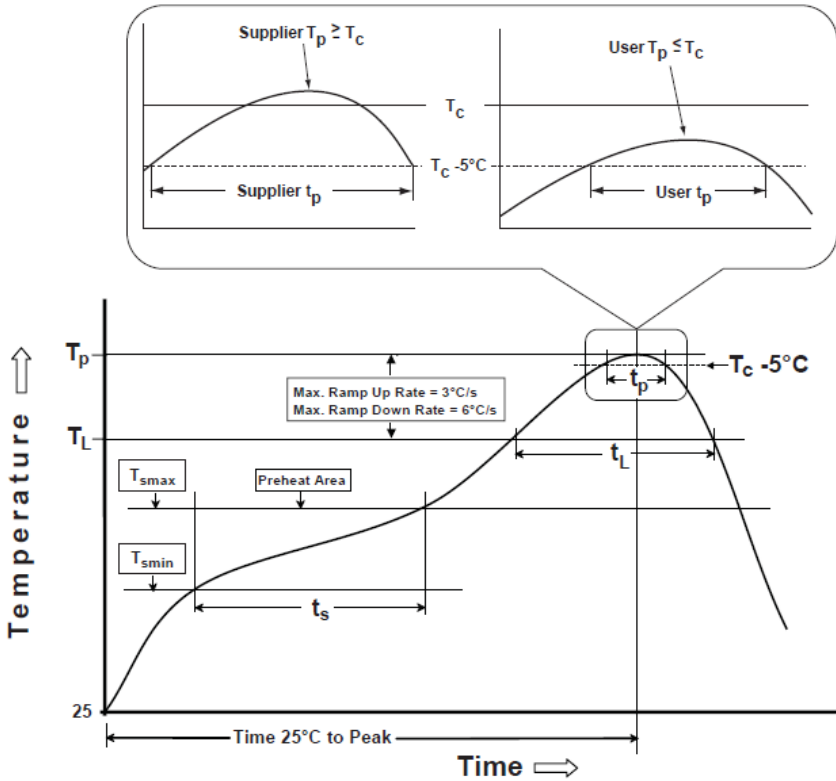


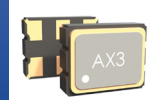
Table 1

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

Table 2

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

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



AX3



ESD Sensitive



3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

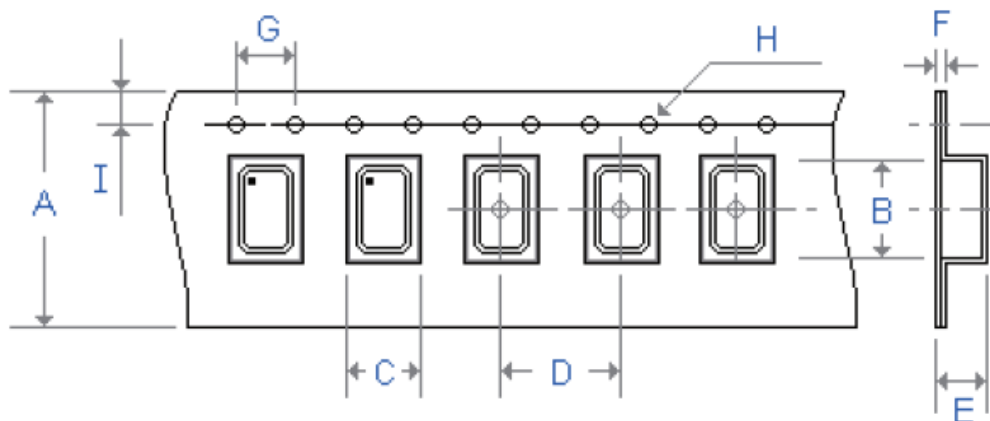
Packaging

Blank = Bulk (MOQ = 250 units)

T = Tape & Reel 1,000 units/reel

T3 = Tape & Reel 3,000 units/reel

Feeding (PULL) Direction →

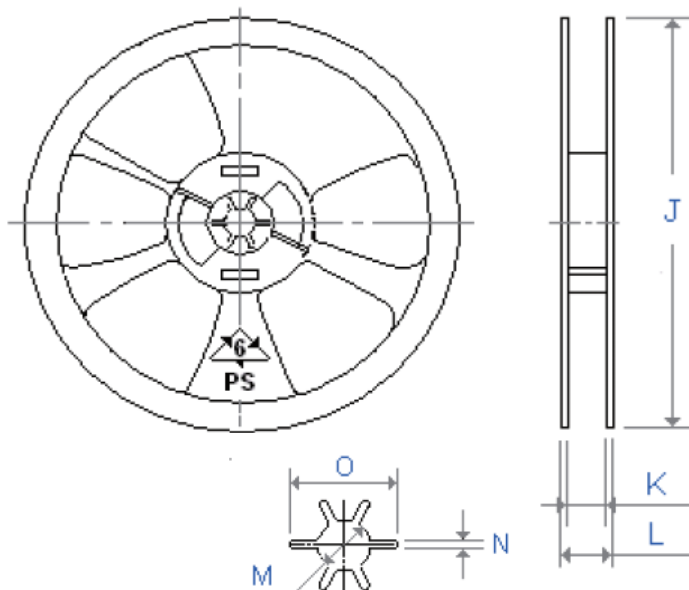


Tape Dimensions

| | |
|---|-------|
| A | 8.00 |
| B | 3.40 |
| C | 2.70 |
| D | 4.00 |
| E | 1.40 |
| F | 0.30 |
| G | 4.00 |
| H | Ø1.55 |
| I | 1.75 |

Reel Dimensions

| | |
|---|--------|
| J | 180.00 |
| K | 10.90 |
| L | 11.40 |
| M | 13.20 |
| N | 2.20 |
| O | 22.00 |



Dimensions: mm

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5101 Hidden Creek Ln Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
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