

AX3



ESD Sensitive



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

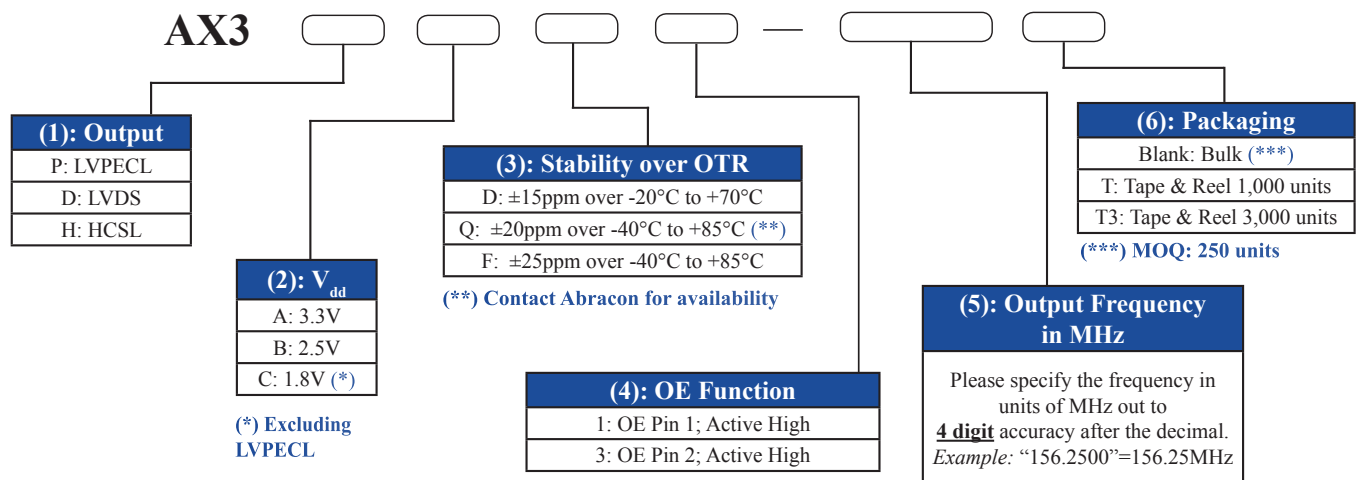
## Features

- Exceptionally Low RMS Jitter: < 80fs Typ (150fs Max @ 156.25MHz)
- Available in industry standard frequencies between 100MHz and 200MHz
- Lowest power consumption in its class (16mA Typ LVDS @ 156.25MHz)
- $\pm 25$ ppm 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]



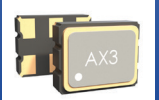
### Part Number Example:

**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.



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 MSL = 1

## Electrical Characteristics

| Parameters                                                                                                 |        | Min.                                                       | Typ. | Max. | Unit | Notes                                                      |
|------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------|------|------|------|------------------------------------------------------------|
| Frequency Range                                                                                            |        | 100                                                        |      | 200  | MHz  |                                                            |
| Standard Available Frequencies                                                                             |        | 100, 114.285, 122.88, 125, 148.5, 150, 155.52, 156.25, 200 |      |      | MHz  | Contact Abracon for availability of frequencies not listed |
| Supply Voltage (V <sub>dd</sub> ) <sup>[Note 2]</sup>                                                      |        | 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 <sub>dd</sub> )                                                                          | LVPECL |                                                            | 30   | 50   | mA   | @ 200MHz; @ V <sub>dd</sub> = 3.3V                         |
|                                                                                                            | LVDS   |                                                            | 16   | 27   |      | @ 200MHz; @ V <sub>dd</sub> = 3.3V                         |
|                                                                                                            | HCSL   |                                                            | 17   | 30   |      | @ 200MHz; @ V <sub>dd</sub> = 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) <sup>[Note 3]</sup><br>at time of shipment (Pre-Reflow) @ +25°C |        | -10                                                        | < ±5 | +10  | ppm  | Relative to carrier frequency                              |
| Frequency Stability over <sup>[Note 4]</sup><br>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 <sup>[Note 5]</sup>                                                        |        | -15                                                        |      | +15  | ppm  |                                                            |
| All-Inclusive Frequency Accuracy (Total Stability)<br>over 20 Year Product Life <sup>[Note 5, 6]</sup>     |        | -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<br>20% to 80% V <sub>peak to peak</sub>                                         | LVPECL |                                                            | 0.2  | 0.4  | ns   | @ V <sub>dd</sub> =3.3V, R <sub>L</sub> =50Ω               |
|                                                                                                            |        |                                                            | 0.3  | 0.6  |      | @ V <sub>dd</sub> =2.5V, R <sub>L</sub> =50Ω               |
|                                                                                                            | LVDS   |                                                            | 0.15 | 0.4  |      | @ V <sub>dd</sub> =3.3V, R <sub>L</sub> =100Ω              |
|                                                                                                            |        |                                                            | 0.15 | 0.4  |      | @ V <sub>dd</sub> =2.5V, R <sub>L</sub> =100Ω              |
|                                                                                                            |        |                                                            | 0.3  | 0.5  |      | @ V <sub>dd</sub> =1.8V, R <sub>L</sub> =100Ω              |
|                                                                                                            | HCSL   |                                                            | 0.3  | 0.5  |      | @ V <sub>dd</sub> =3.3V, R <sub>L</sub> =50Ω to GND        |
|                                                                                                            |        |                                                            | 0.3  | 0.5  |      | @ V <sub>dd</sub> =2.5V, R <sub>L</sub> =50Ω to GND        |
|                                                                                                            |        |                                                            | 0.3  | 0.6  |      | @ V <sub>dd</sub> =1.8V, R <sub>L</sub> =50Ω to GND        |
|                                                                                                            |        |                                                            | 0.3  | 0.6  |      | @ V <sub>dd</sub> =1.8V, R <sub>L</sub> =50Ω to GND        |
| Duty Cycle                                                                                                 |        | 45                                                         |      | 55   | %    |                                                            |
| Start-up Time <sup>[Note 3]</sup>                                                                          |        |                                                            | < 2  | 5.0  | ms   |                                                            |

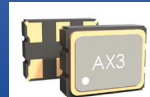
Note 2: Supply Voltage ( $V_{dd}$ ) = 1.8V option not available with LVPECL output

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



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 MSL = 1

## Electrical Characteristics Cont.

| Parameters                                                                                      |        |                 | Min.                   | Typ. | Max.                   | Unit | Notes                                        |
|-------------------------------------------------------------------------------------------------|--------|-----------------|------------------------|------|------------------------|------|----------------------------------------------|
| Differential<br>Output High Voltage (V <sub>OH</sub> )<br>Output Low Voltage (V <sub>OL</sub> ) | LVPECL | V <sub>OH</sub> | V <sub>dd</sub> -1.03  |      | V <sub>dd</sub> -0.88  | V    | R <sub>L</sub> =50Ω to V <sub>dd</sub> -2.0V |
|                                                                                                 |        | V <sub>OL</sub> | V <sub>dd</sub> -1.85  |      | V <sub>dd</sub> -1.60  |      |                                              |
|                                                                                                 | LVDS   | V <sub>OH</sub> |                        | 1.40 | 1.60                   |      | R <sub>L</sub> =100Ω between both outputs    |
|                                                                                                 |        | V <sub>OL</sub> | 0.90                   | 1.10 |                        |      |                                              |
|                                                                                                 | HCSL   | V <sub>OH</sub> | 0.40                   | 0.74 | 0.85                   |      | R <sub>L</sub> =50Ω to ground on each output |
|                                                                                                 |        | V <sub>OL</sub> | -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 <sub>dd</sub> ) |      |                        | V    | Output Enable; or No Connect                 |
|                                                                                                 |        |                 |                        |      | 0.3*(V <sub>dd</sub> ) |      | Output Disable; High Impedance               |
| Output Enable Time                                                                              |        |                 |                        | < 1  | 5.0                    | ms   |                                              |
| Output Disable Time                                                                             |        |                 |                        |      | 0.2                    | μs   |                                              |
| Output Disable Current Consumption                                                              |        |                 |                        |      | < 10                   | μA   | OE ≤ 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      |

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



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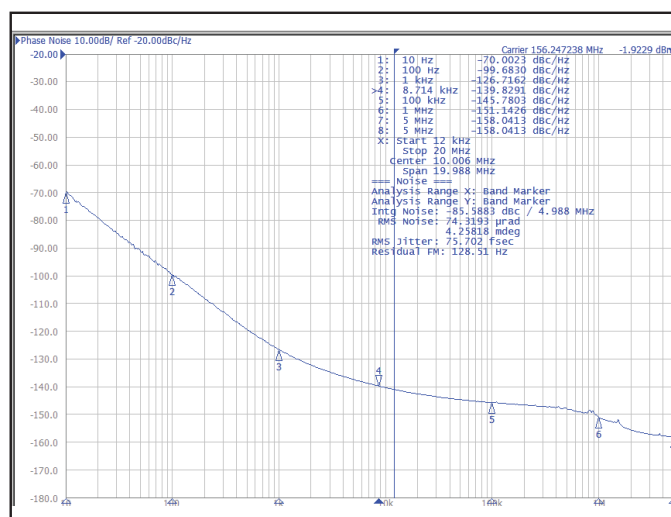


3.2 x 2.5 x 1.0 mm  
RoHS/RoHS II Compliant  
MSL = 1

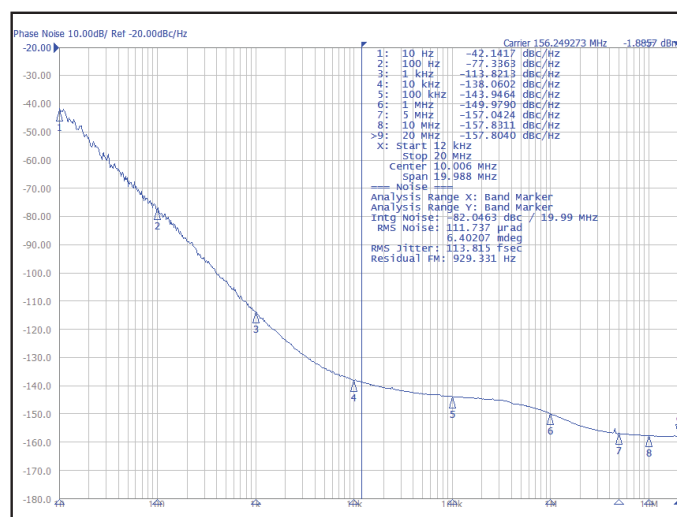
## Phase Noise Test Setup <sup>[Note 10]</sup>

- 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

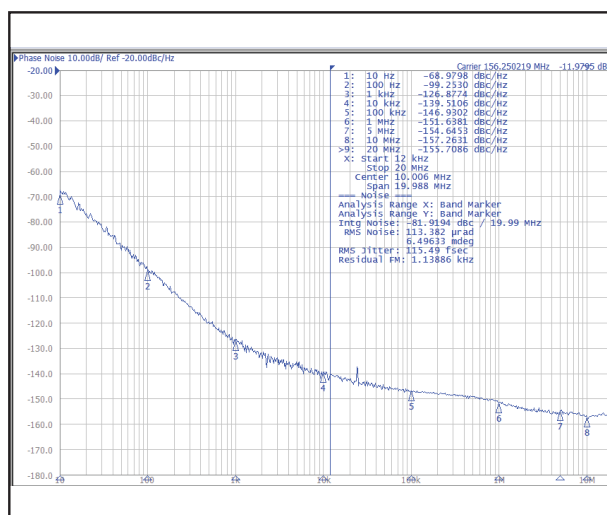
**F=156.2500MHz | V<sub>dd</sub>=3.3V | LVPECL**  
**RMS Phase Jitter = 75 fs**



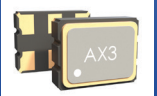
**F=156.2500MHz | V<sub>dd</sub>=3.3V | HCSL**  
**RMS Phase Jitter = 113 fs**



**F= 156.2500MHz | V<sub>dd</sub>=3.3V | LVDS**  
**RMS Phase Jitter = 115 fs**



Note 10: Contact Abracon for phase noise plots at any desired combination of V<sub>dd</sub>, differential output format, and carrier frequency within the available range



AX3



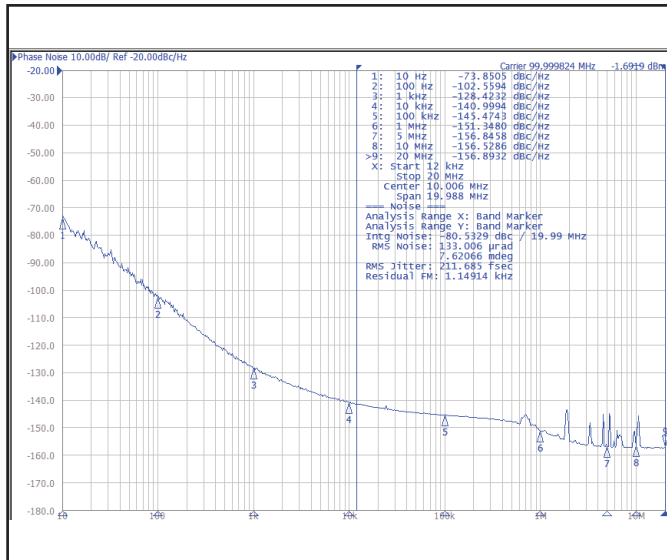
ESD Sensitive



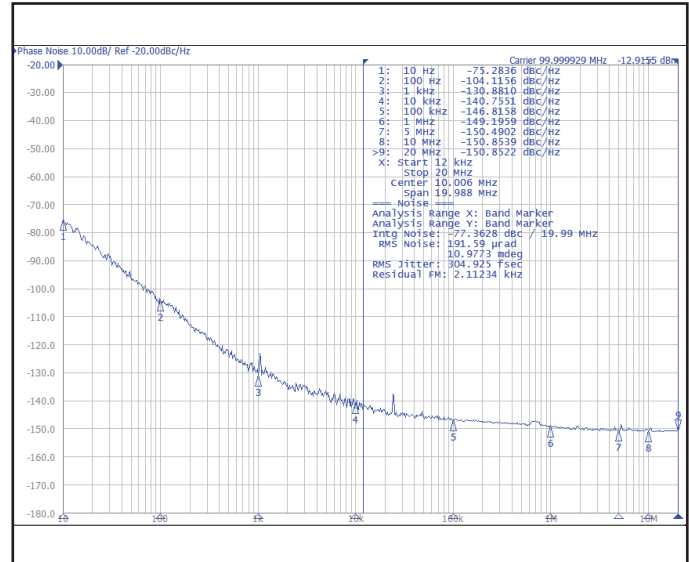
3.2 x 2.5 x 1.0 mm  
RoHS/RoHS II Compliant  
MSL = 1

## Representative Phase Noise Plots Cont. [Note 10]

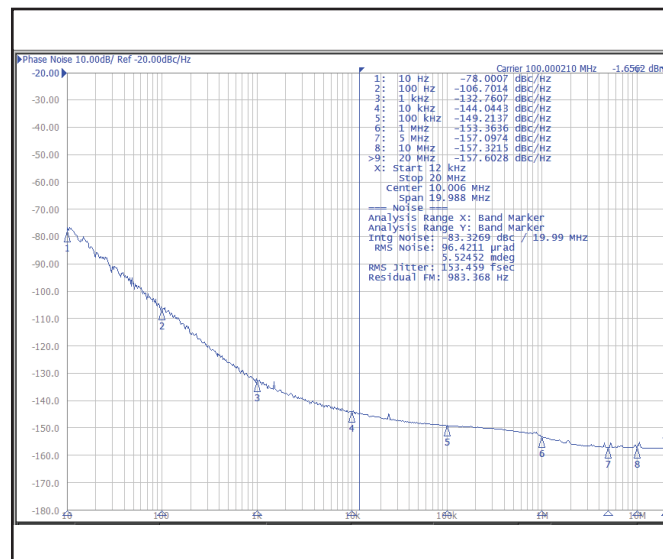
F=100.0000MHz | V<sub>dd</sub>=3.3V | LVPECL  
RMS Phase Jitter = 211 fs



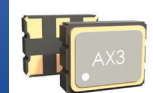
F= 100.0000MHz | V<sub>dd</sub>=3.3V | LVDS  
RMS Phase Jitter = 304 fs



F= 100.0000MHz | V<sub>dd</sub>=3.3V | HCSL  
RMS Phase Jitter = 153 fs



Note 10: Contact Abracon for phase noise plots at any desired combination of V<sub>dd</sub>, differential output format, and carrier frequency within the available range



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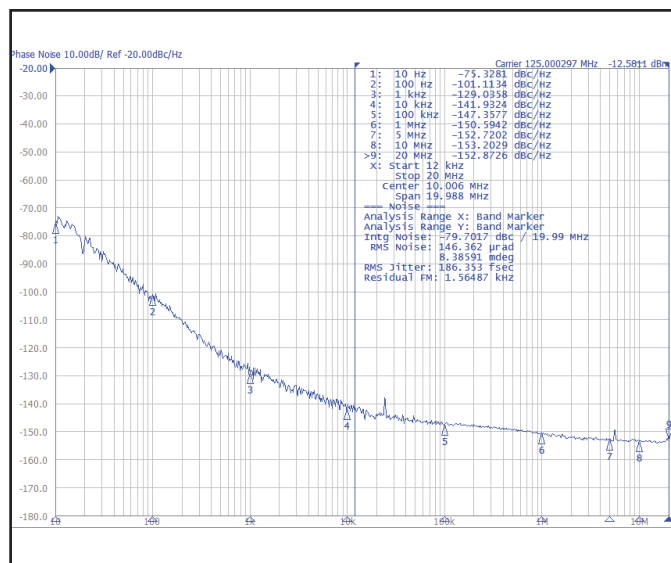
ESD Sensitive



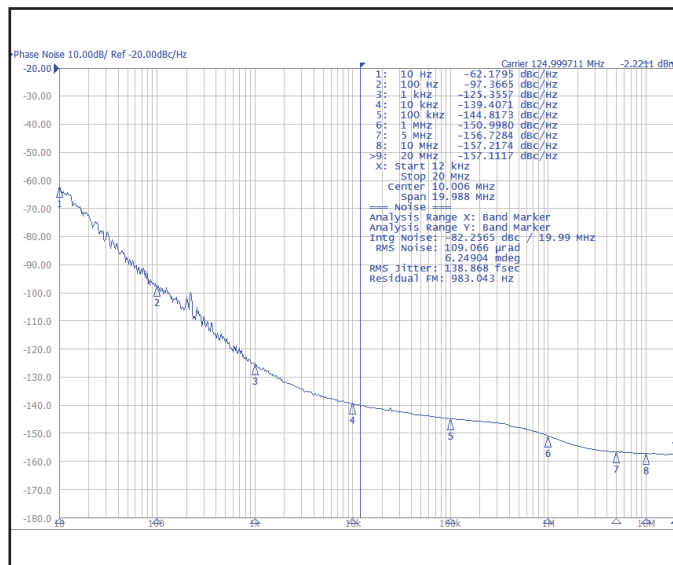
3.2 x 2.5 x 1.0 mm  
RoHS/RoHS II Compliant  
MSL = 1

## Representative Phase Noise Plots Cont. [Note 10]

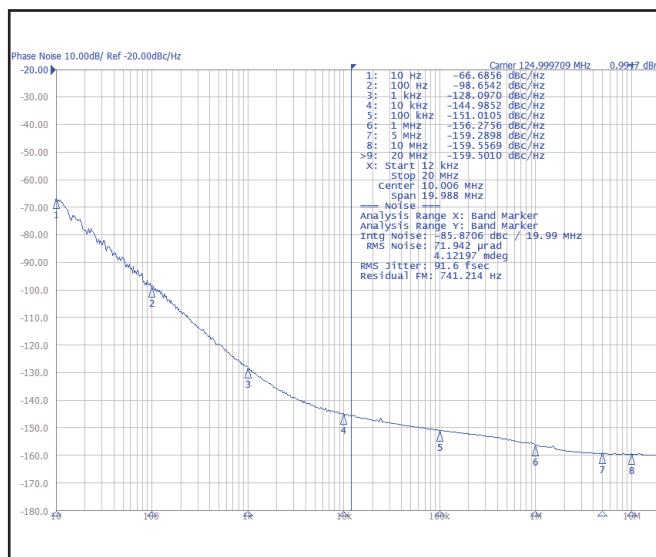
F=125.0000MHz | V<sub>dd</sub>=3.3V | LVDS  
RMS Phase Jitter = 186 fs



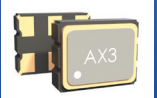
F= 125.0000MHz | V<sub>dd</sub>=3.3V | HCSL  
RMS Phase Jitter = 138 fs



F= 125.0000MHz | V<sub>dd</sub>=3.3V | LVPECL  
RMS Phase Jitter = 91 fs



Note 10: Contact Abracon for phase noise plots at any desired combination of V<sub>dd</sub>, differential output format, and carrier frequency within the available range



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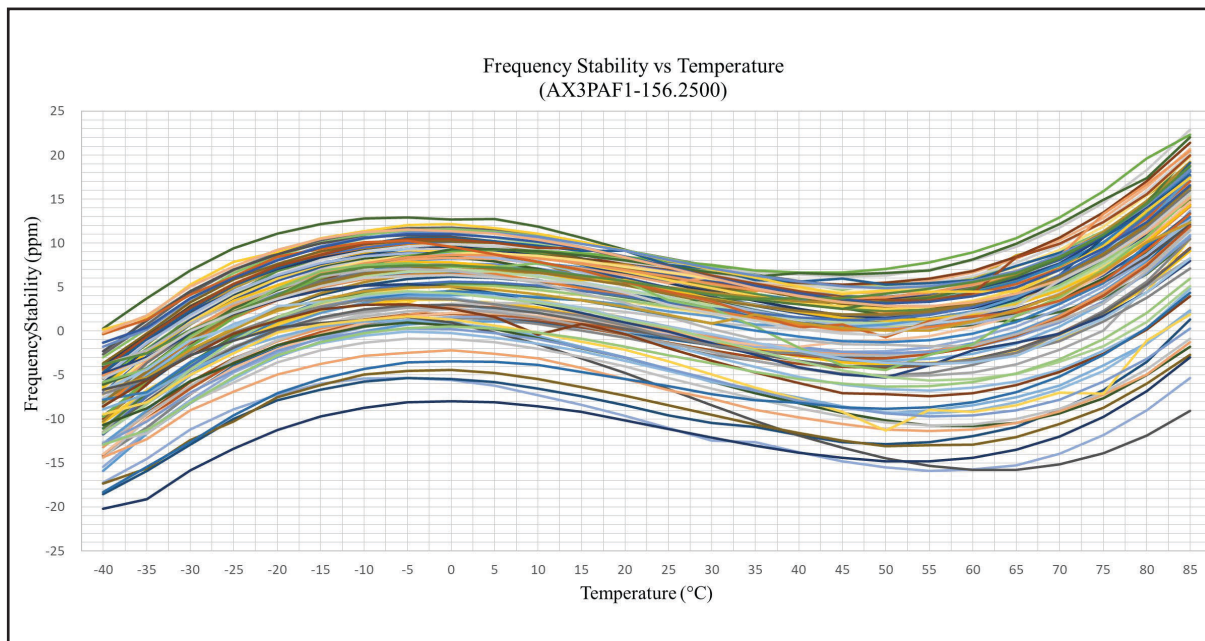
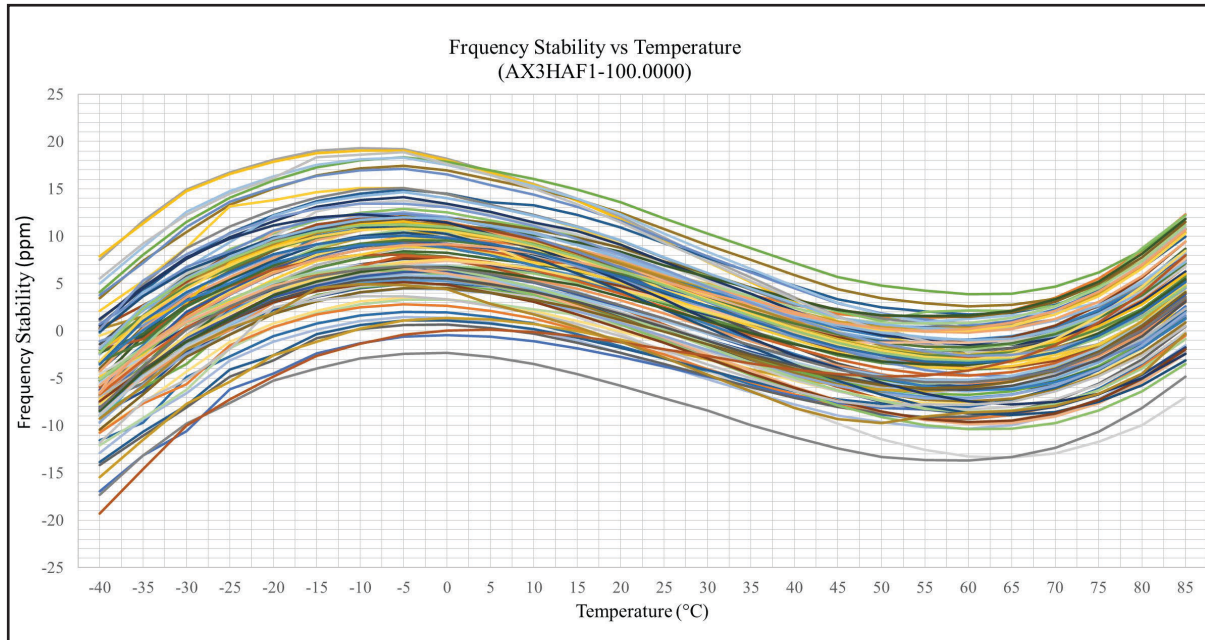


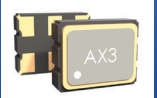
ESD Sensitive



3.2 x 2.5 x 1.0 mm  
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MSL = 1

## Typical Frequency vs. Temperature Characteristics





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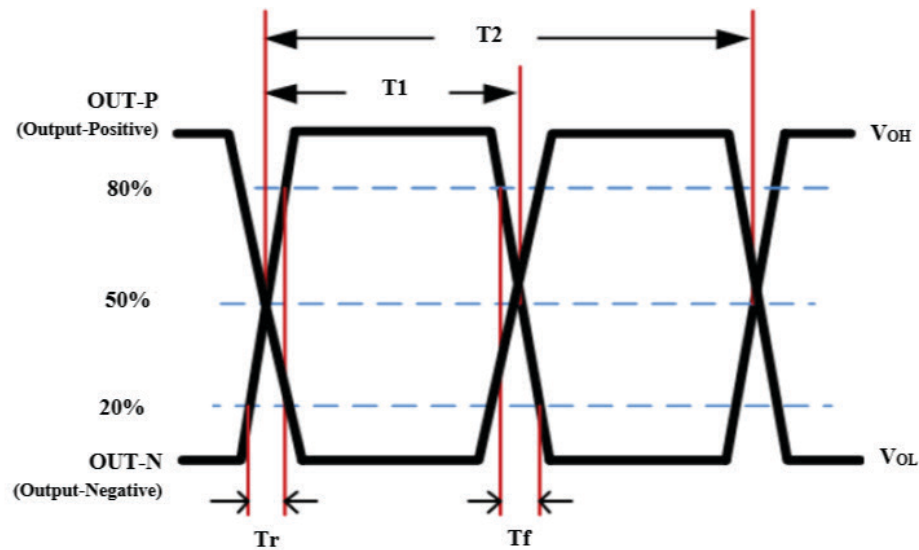


ESD Sensitive

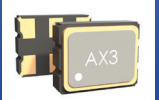


3.2 x 2.5 x 1.0 mm  
RoHS/RoHS II Compliant  
MSL = 1

## Differential Output Waveform



$$\text{Duty Cycle} = \left( \frac{T_1}{T_2} \right) * 100\%$$



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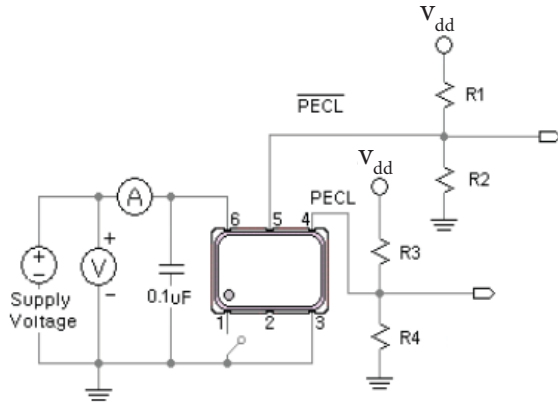
ESD Sensitive



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

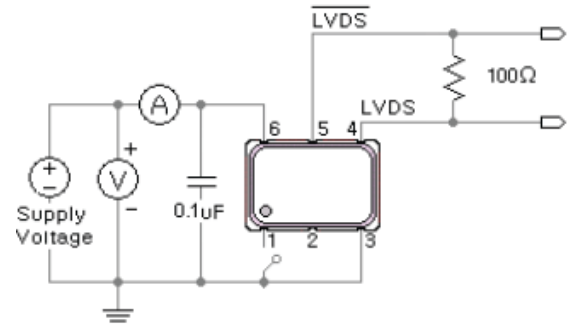
## Recommended Test Circuit [Note 11]

### LVPECL

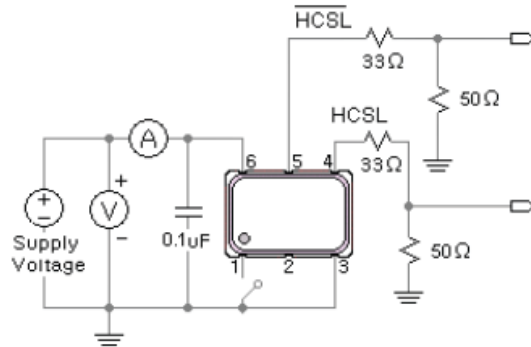


V<sub>dd</sub>=3.3V: R1=R3=127Ω; R2=R4=82.5 Ω  
V<sub>dd</sub>=2.5V: R1=R3=250Ω; R2=R4=62.5 Ω

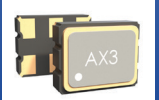
### LVDS @ V<sub>dd</sub> = 3.3V & 2.5V



### 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

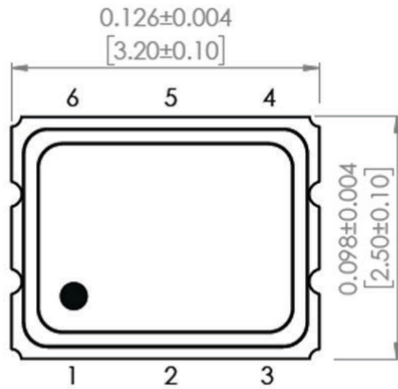


ESD Sensitive

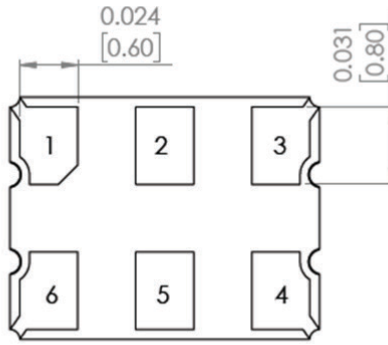


3.2 x 2.5 x 1.0 mm  
RoHS/RoHS II Compliant  
MSL = 1

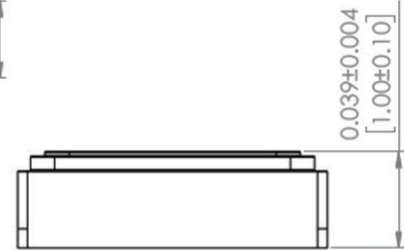
## Mechanical Dimensions



TOP VIEW

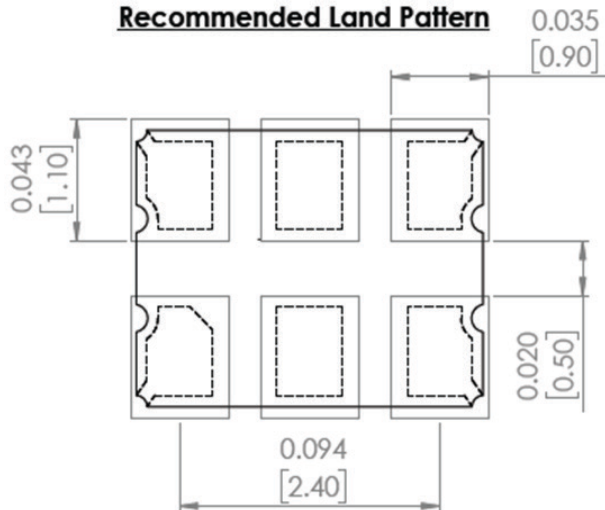


BOTTOM VIEW



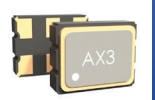
SIDE VIEW

## Recommended Land Pattern



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

Dimensions: mm



AX3

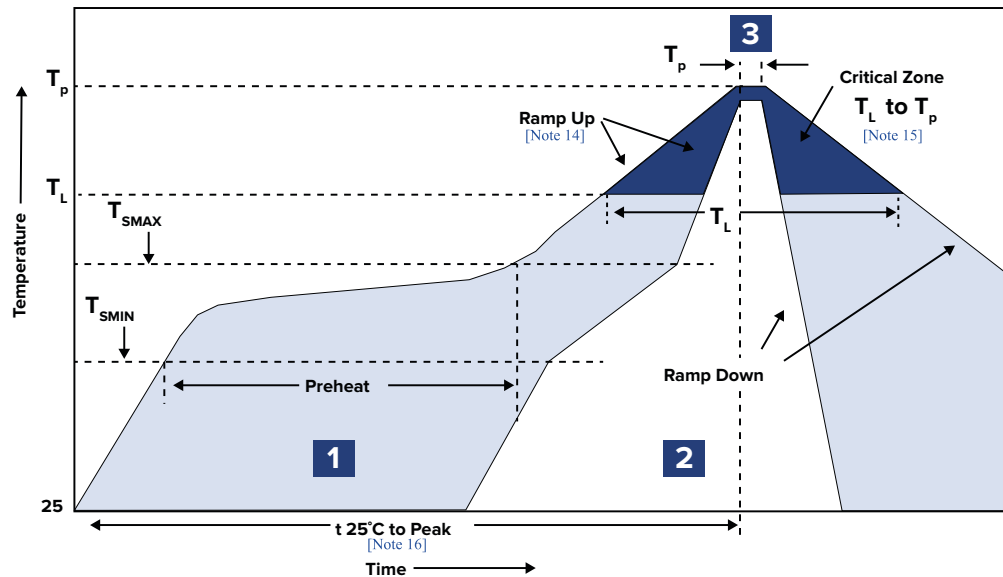


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## Recommended Reflow Profile [Note 17]



| Zone | Description    | Temperature                                                                | Time          |
|------|----------------|----------------------------------------------------------------------------|---------------|
| 1    | Preheat / Soak | $T_{SMIN} \sim T_{SMAX}$<br>$150^{\circ}\text{C} \sim 200^{\circ}\text{C}$ | 60 ~ 180 sec. |
| 2    | Reflow         | $T_L$<br>$217^{\circ}\text{C}$                                             | 60 ~ 150 sec. |
| 3    | Peak heat      | $T_P$<br>$260^{\circ}\text{C} \pm 5^{\circ}\text{C}$                       | 20 ~ 40 sec.  |

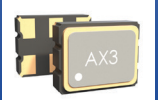
Note 14: Ramp Up Rate ( $T_L \rightarrow T_P$ ) =  $3^{\circ}\text{C} / \text{sec. MAX}$

Note 15: Ramp Down Rate ( $T_P \rightarrow T_L$ ) =  $6^{\circ}\text{C} / \text{sec. MAX}$

Note 16: Time 25°C to Peak Temperature ( $25^{\circ}\text{C} \rightarrow T_P$ ) = 8 minutes MAX

Note 17: Can withstand: 2 reflows

All temperatures refer to topside of the package, measured on the package body surface below.



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## Packaging

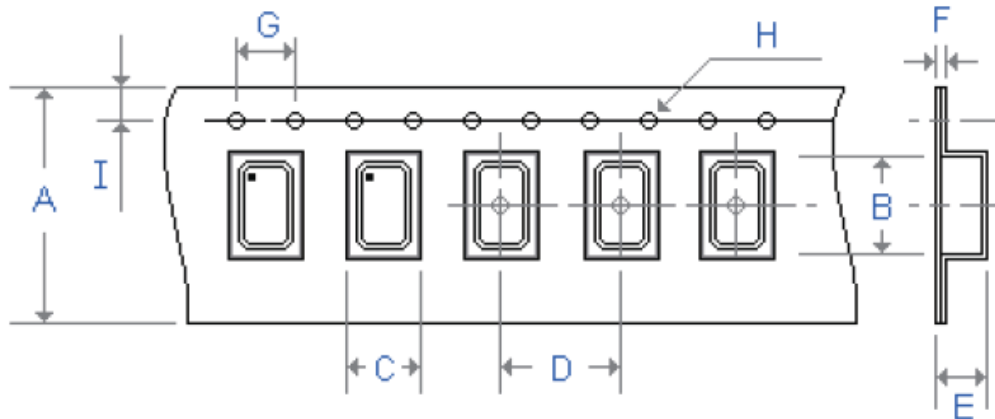
Blank = Bulk\*

T = Tape & Reel 1,000 units/reel

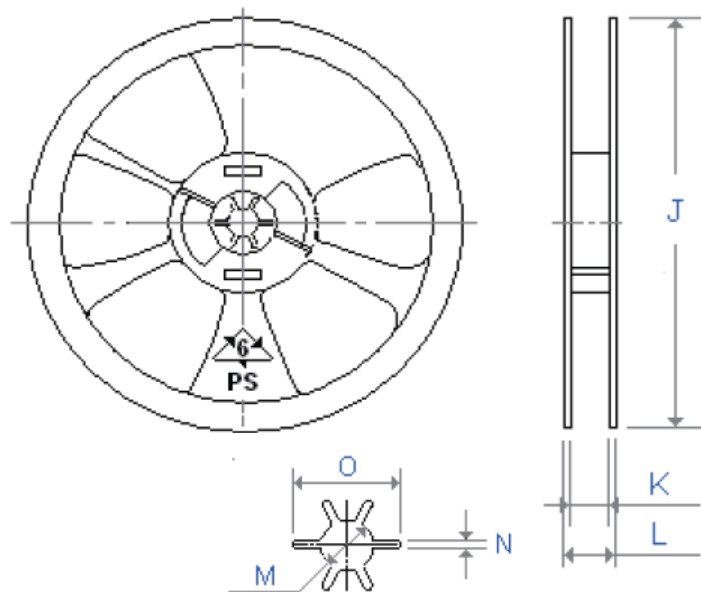
T3 = Tape & Reel 3,000 units/reel

(\* MOQ: 250 units)

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

**ATTENTION:** Abracon LLC's products are COTS – Commercial-Off-The-Shelf products; suitable for Commercial, Industrial and, where designated, Automotive Applications. Abracon's products are not specifically designed for Military, Aviation, Aerospace, Life-dependent Medical applications or any application requiring high reliability where component failure could result in loss of life and/or property. For applications requiring high reliability and/or presenting an extreme operating environment, written consent and authorization from Abracon LLC is required. Please contact Abracon LLC for more information.



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CERTIFIED



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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