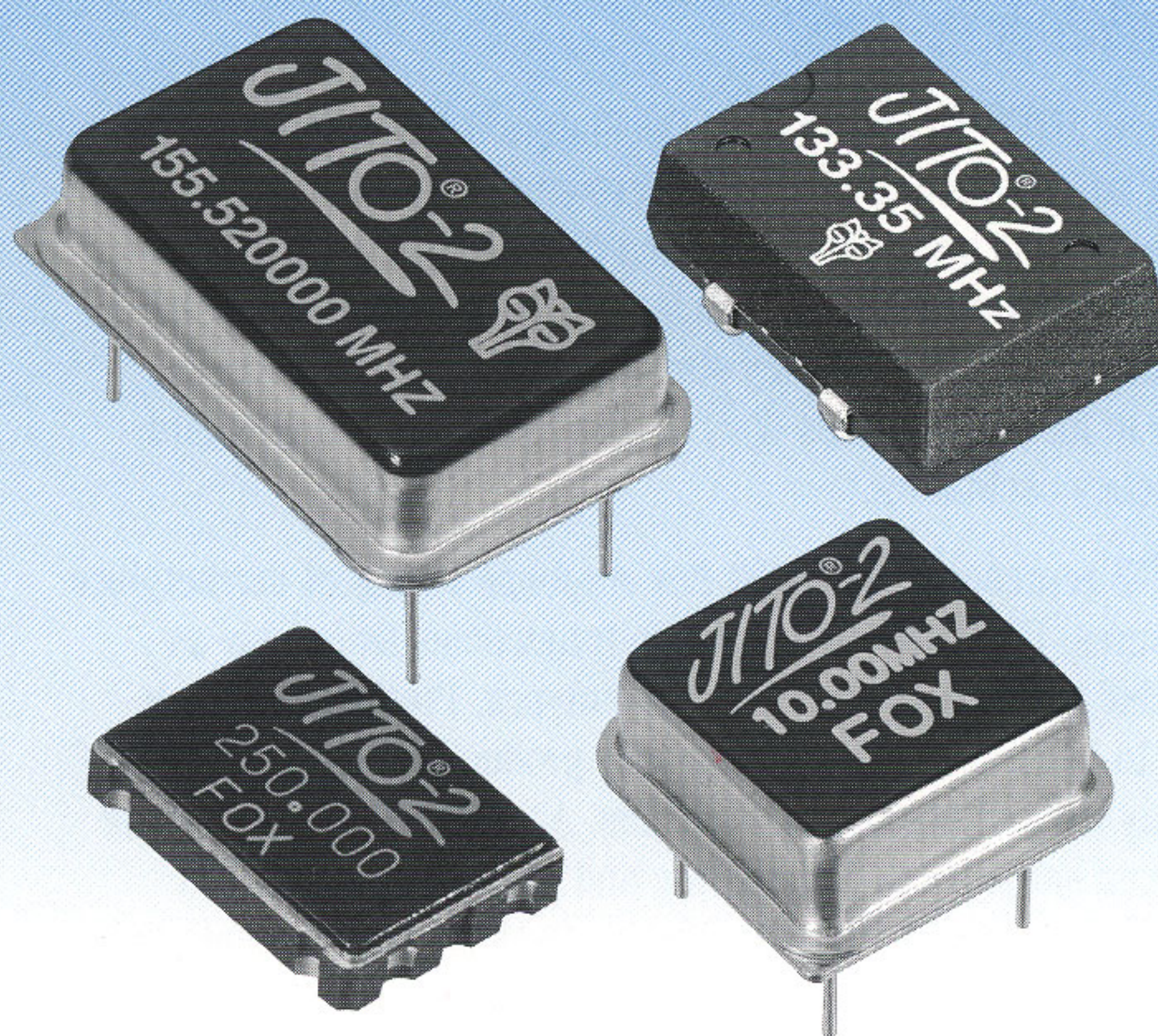
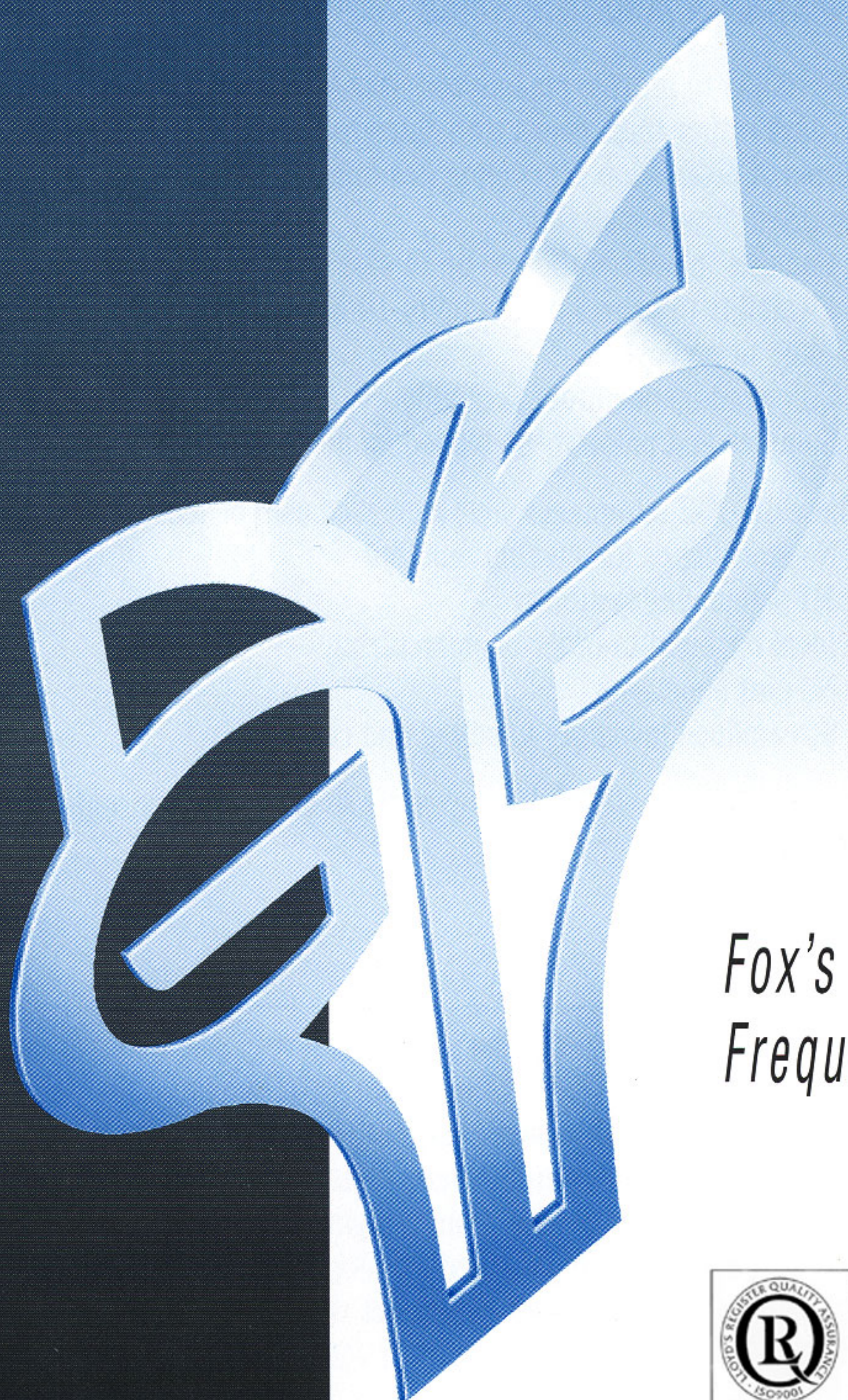


*Fox Redefines  
Oscillator Delivery.*



# J1TO<sup>®</sup>-2

## JUST-IN-TIME OSCILLATORS<sup>®</sup>



*Fox's Expanded Line of Custom and Standard  
Frequency Oscillators...in Just Days.*



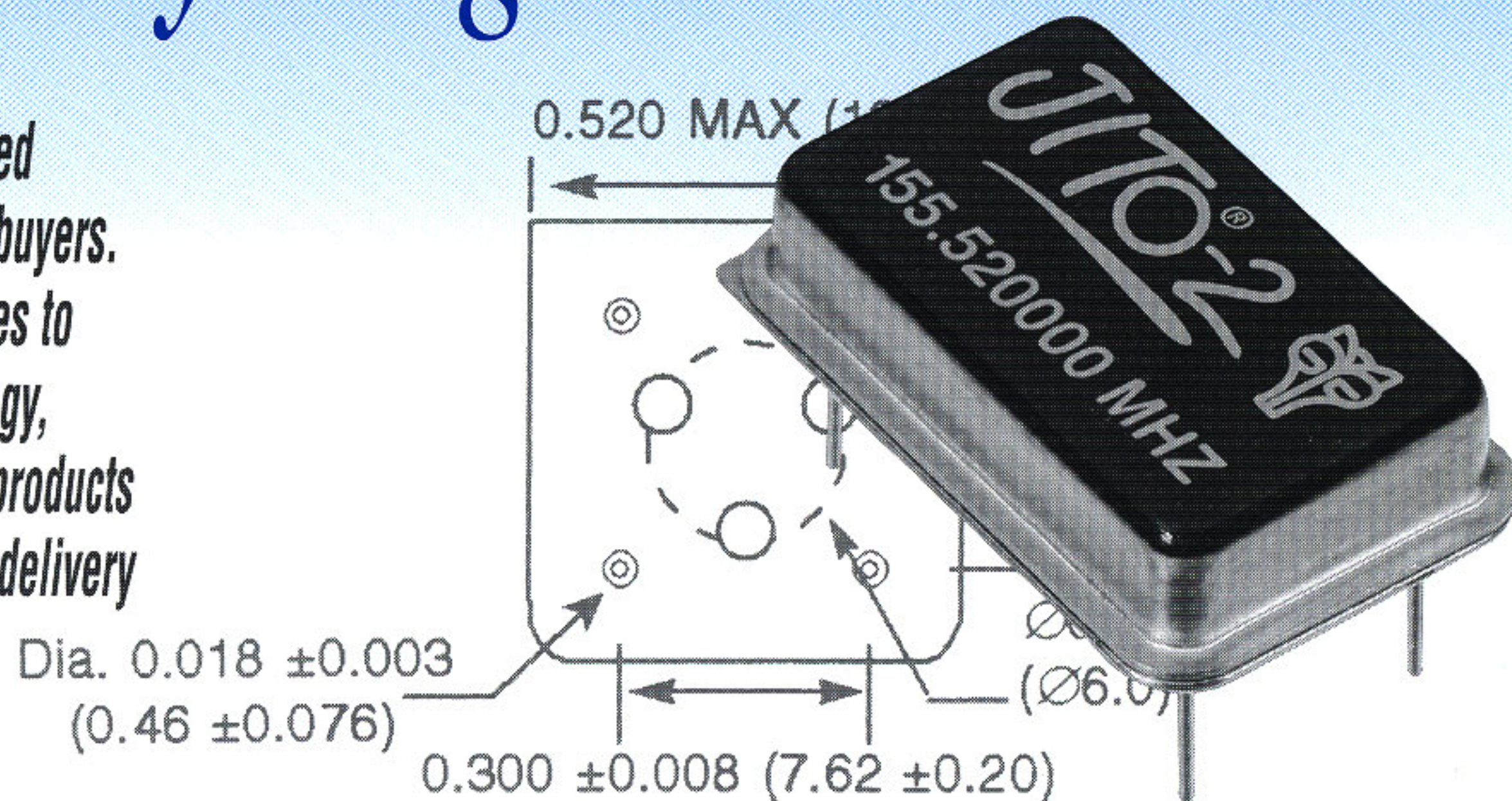
ISO9001:2000 Certified

**FOX** Electronics

# FOX...

## Redefining Oscillator Delivery... Again!

*For years, Fox has been ranked as America's preferred oscillator/crystal company...by both engineers and buyers. But we've never rested on our laurels. Fox continues to pioneer advances in crystal and oscillator technology, availability and technical support...from standard products to custom solutions. Now, Fox redefines oscillator delivery and scheduling flexibility.*



### Meeting Today's Time-to-Market Pressures with JITO®-2 ... Just-In-Time Oscillators®: Custom and Standard Frequency Oscillators in Days!

The new JITO®-2 (Just-In-Time Oscillators®) line represents Fox's latest contribution to helping buyers and engineers alike meet the increasing pressure of bringing new designs and products to market faster and more efficiently. This new line of crystal oscillators cuts the industry standard lead time of 10 weeks down to just 10 business days or less for custom or standard frequency oscillators.

JITO®-2 represents the latest Fox response to urgent marketplace pressures. Engineers need custom frequencies as quickly as possible to test and prove their prototypes. Production people need to know that custom frequency products can be accessed quickly without holding up their line. And buyers have to ensure they can satisfy both engineering and production needs. The JITO®-2 line provides a total solution to those requirements by cutting industry standard lead times by an average of 90%.

### JITO®-2 today...and tomorrow

*Fox's current JITO®-2 line is offered in the following ranges:*

- Custom and standard frequencies from 340 kHz up to 250 MHz
- 100, 50, 30, 25 and 20 PPM stability
- 3.3 or 5 volts; -20 to +70°C or -40 to +85°C operating range
- Both SMD and thru-hole packaging available
- Fox quality built-in
- Total technical support from the industry leader
- Reduced Phase Jitter - less than that of competitive programmable oscillators

### Meeting Today's Build-to-Order (BTO) Flexible Scheduling Needs

The ability to provide custom and standard frequency oscillators in days rather than weeks translates to tremendous benefits in terms of production scheduling flexibility. Only Fox's JITO®-2 program provides all this:

- Changes in orders allowed up to ship date
- Flexibility to cancel orders up to 10 days prior to ship date at no cost
- Unlimited upside order flexibility
- Samples and prototypes shipped immediately

These JITO®-2 advantages yield increased user benefits, including:

- No stocking or forecasting required
- JIT scheduling flexibility
- Ideal for build-to-order manufacturing
- No part shortages
- Streamlined inventory handling and control

In every respect, JITO®-2 lets you get to market faster and more efficiently than ever before.

JITO®-2 is Fox's answer to the phenomenal response we received from engineers and buyers to our initial JITO® program. The much-expanded and enhanced line features a wider range of frequencies, stabilities, operating temperatures and packages, plus greater flexibility in specification changing and scheduling. As JITO®-2 expands, we'll post product information on our website; [www.foxonline.com](http://www.foxonline.com). Check it, contact your local Fox representative, or call direct, 888-GET-2-FOX.

## ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = Max Load; HCMOS Option = Single Output)

| PARAMETERS                                                                                        | FREQUENCY RANGE                                                               | CONDITIONS                                      | MIN                              | MAX                                           | UNITS |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------|-----------------------------------------------|-------|
| Frequency Range (Fo)                                                                              |                                                                               |                                                 | 0.340                            | 250.000                                       | MHZ   |
| Frequency Stability                                                                               | 0.340 ~ 250.000                                                               | All Conditions <sup>1</sup>                     | -100<br>-50<br>-30<br>-25<br>-20 | +100<br>+50<br>+30<br>+25<br>+20 <sup>3</sup> | PPM   |
| Temperature Range<br>Operating (TOPR)<br>Storage (TSTG)                                           | 0.340 ~ 250.000                                                               |                                                 | -20<br>-40<br>-55                | +70<br>+85<br>+125                            | °C    |
| Supply Voltage (VDD)                                                                              | 0.340 ~ 250.000                                                               |                                                 | +4.5<br>+3.0                     | +5.5<br>+3.6                                  | V     |
| Input Current**                                                                                   | 0.340 ~ 25.000<br>25.000+ ~ 50.000<br>50.000+ ~ 150.000<br>150.000+ ~ 250.000 | VDD = 5.0V<br>Max Load (HCMOS)                  |                                  | 15<br>20<br>33<br>55                          | mA    |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | VDD = 5.0V<br>PECL                              |                                  | 55                                            |       |
|                                                                                                   | 0.340 ~ 25.000<br>25.000+ ~ 50.000<br>50.000+ ~ 150.000<br>150.000+ ~ 250.000 | VDD = 3.3V<br>Max Load (HCMOS)                  |                                  | 8<br>11<br>21<br>30                           |       |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | VDD = 3.3V<br>PECL                              |                                  | 30                                            |       |
| Output Symmetry                                                                                   | 0.340 ~ 250.000                                                               | 50% VDD Level<br>HCMOS                          | 45                               | 55                                            | %     |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | 50% Vp-p Level<br>PECL                          | 40                               | 60                                            |       |
| Rise Time                                                                                         | 0.340 ~ 250.000                                                               | 10% ~ 90% VDD Level<br>HCMOS                    |                                  | 5                                             | nS    |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | 20% ~ 80% Vp-p Level<br>PECL                    |                                  | 2                                             |       |
| Fall Time                                                                                         | 0.340 ~ 250.000                                                               | 90% ~ 10% VDD Level<br>HCMOS                    |                                  | 5                                             |       |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | 80% ~ 20% Vp-p Level<br>PECL                    |                                  | 2                                             |       |
| Output Voltage<br>HCMOS (VOL)<br>(VOH)<br>(VOL)<br>(VOH)<br>PECL (VOL)<br>(VOH)<br>(VOL)<br>(VOH) | 0.340 ~ 250.000                                                               | VDD = 5.0V±10%<br>IOL = 4mA<br>IOH = -4mA       |                                  | 10%VDD<br>90%VDD                              | V     |
|                                                                                                   |                                                                               | VDD = 3.3V±10%<br>IOL = 2mA<br>IOH = -2mA       |                                  | 10%VDD<br>90%VDD                              |       |
|                                                                                                   |                                                                               | VDD = 5.0V<br>Per recommended termination       | 3.0<br>3.9                       | 3.4<br>4.3                                    |       |
|                                                                                                   | 0.340 ~ 200.000 <sup>4</sup>                                                  | VDD = 3.3V<br>Per recommended termination       | 1.2<br>2.2                       | 1.6<br>2.6                                    | V     |
|                                                                                                   |                                                                               |                                                 |                                  |                                               |       |
|                                                                                                   |                                                                               |                                                 |                                  |                                               |       |
| Output Current<br>HCMOS (IOL)<br>(IOH)<br>(IOL)<br>(IOH)                                          | 0.340 ~ 250.000                                                               | VDD = 5.0V±10%<br>VOL = 10%VDD<br>VOH = 90% VDD |                                  | 4<br>-4                                       | mA    |
|                                                                                                   |                                                                               | VDD = 3.3V±10%<br>VOL = 10%VDD<br>VOH = 90%VDD  |                                  | 2<br>-2                                       |       |
| Output Load                                                                                       | 0.340 ~ 100.000                                                               | VDD = 5.0V±10%<br>(HCMOS)                       |                                  | 25                                            | pF    |
|                                                                                                   | 100.000+ ~ 250.000                                                            |                                                 |                                  | 10                                            |       |
|                                                                                                   | 0.340 ~ 100.000<br>100.000+ ~ 250.000                                         | VDD = 3.3V ±10%<br>(HCMOS)                      |                                  | 15<br>10                                      |       |
| Start-up Time (Ts)                                                                                | 0.340 ~ 250.000                                                               |                                                 |                                  | 10                                            | mS    |
| Enable/Disable Time <sup>2</sup><br>(JITO <sup>®</sup> -2 D)<br>(JITO <sup>®</sup> -2 P)          | 0.340 ~ 250.000                                                               |                                                 |                                  | 100                                           | nS    |
| Output Skew<br>(JITO <sup>®</sup> -2 D)<br>(PECL)                                                 | 0.340 ~ 200.000 <sup>4</sup>                                                  | 50% Vp-p                                        |                                  | 500                                           | pS    |

<sup>1</sup> Inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, aging, shock and vibration.

<sup>2</sup> Stand by current (3.3V) = 60µA (MAX) • Stand by enable time = 10mS (MAX)

<sup>3</sup> Inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, shock and vibration.

<sup>4</sup> PECL can be programmed to 250 MHz; output terminations may have to be modified for desired output levels. See Application Note "JITO-2 PECL Interface Considerations".

NOTE: A0.01µF bypass capacitor should be placed between VDD and GND to minimize power supply line noise.

### ENABLE/DISABLE FUNCTION

| PIN 1                  | Output<br>MIN-6: Pins 4&2 (PECL)<br>JITO <sup>®</sup> -2 P: Pin 3 |
|------------------------|-------------------------------------------------------------------|
| OPEN                   | ACTIVE                                                            |
| '1' Level VIH ≥ 70%VDD | ACTIVE                                                            |
| '0' Level VIL ≤ 30%VDD | High Z                                                            |

**JITO<sup>®</sup>-2**  
JUST-IN-TIME OSCILLATORS<sup>®</sup>

Covered by U.S. Patents  
5,952,890 and 5,960,405  
and 6,188,290.  
Covered by one or more listed  
Foreign Patents: R.S.A. 98/0866  
and R.O.C. 120851.

**JITO<sup>®</sup>-2 . Only from Fox Electronics. Because in this business, timing is everything.**

## FULL SIZE 14 PIN DIP

Pin Connections  
#1 N.C. #8 Output  
#7 GND #14 VDD

## HALF SIZE 8 PIN DIP

Pin Connections  
#1 N.C. #5 Output  
#4 GND #8 VDD

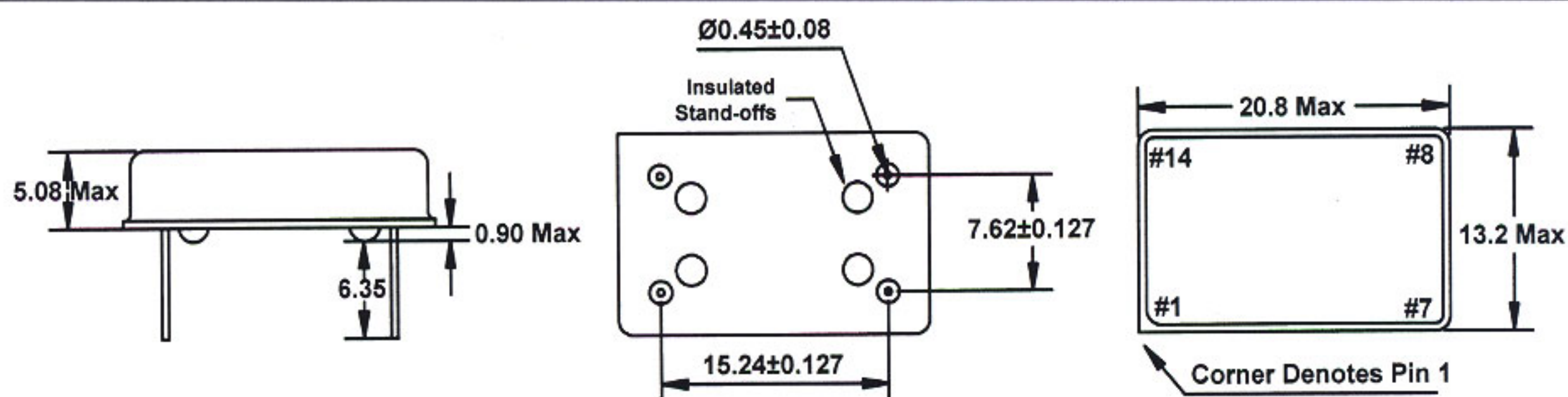
## MIN-6 SMD

Pin Connections  
#1 E/D #6 VDD  
#2 N.C. or Out2 #5 N.C.  
#3 GND #4 Output

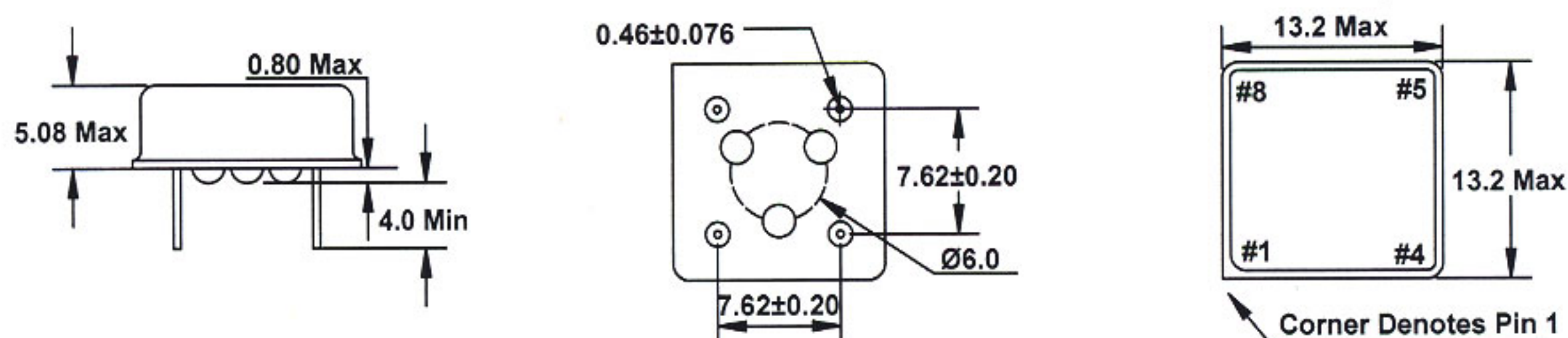
## JITO®-2P

Pin Connections  
#1 E/D #2 GND  
#3 Output #4 VDD

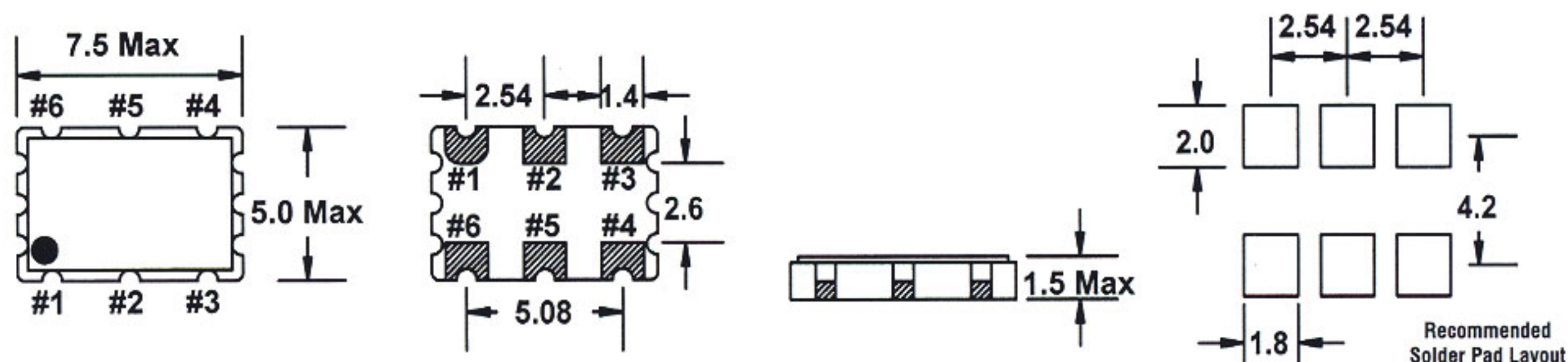
Package  
**A**



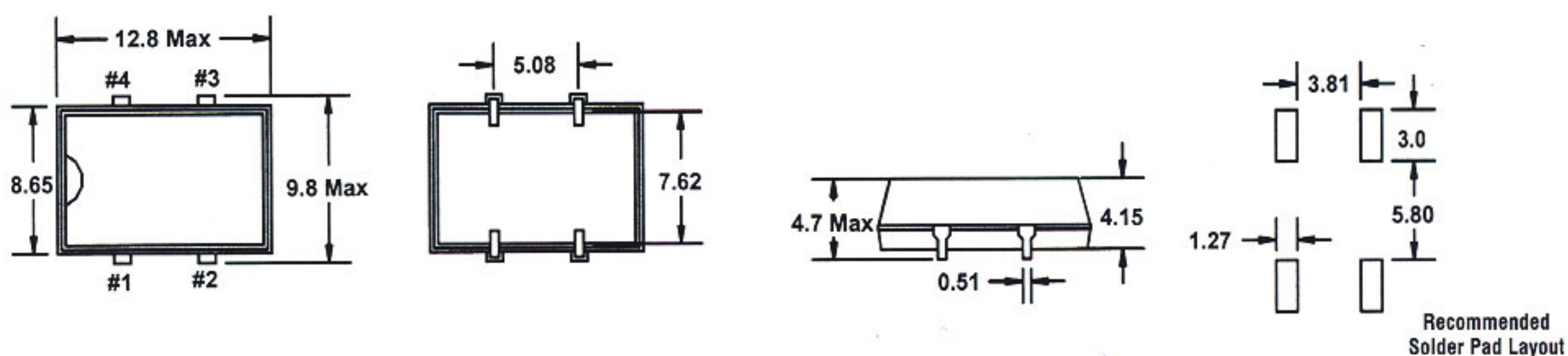
Package  
**B**



Package  
**D**



Package  
**P**



# SMD Packaging – Tape & Reel Specifications (in millimeters)

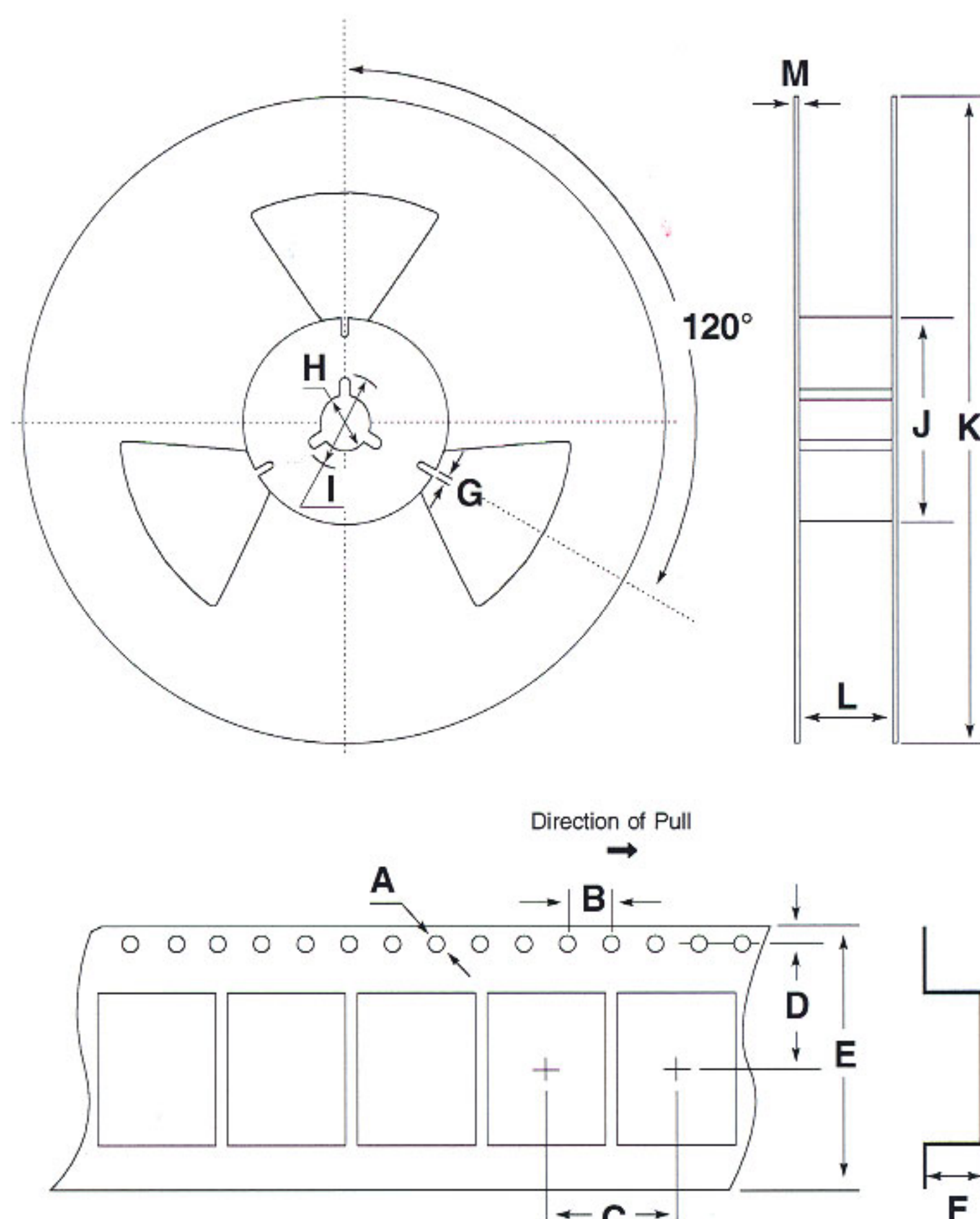
## Tape Specifications (millimeters)

| Model    | A                            | B   | C    | D    | E    | F    |
|----------|------------------------------|-----|------|------|------|------|
| JITO®-2D | Ø1.5                         | 4.0 | 8.0  | 7.5  | 16.0 | 2.15 |
| JITO®-2P | Ø1.5                         | 4.0 | 12.0 | 11.5 | 24.0 | 5.2  |
| JITO®-2A | Shipped in tubes of 25 only. |     |      |      |      |      |
| JITO®-2B | Shipped in tubes of 40 only. |     |      |      |      |      |

## Reel Specifications (millimeters)

| Model    | G                            | H   | I   | J   | K     | L    | M   |
|----------|------------------------------|-----|-----|-----|-------|------|-----|
| JITO®-2D | 2.0                          | Ø13 | Ø21 | Ø80 | Ø2.50 | 17.5 | 2.0 |
| JITO®-2P | 2.0                          | Ø13 | Ø21 | Ø80 | Ø330  | 25.5 | 2.0 |
| JITO®-2A | Shipped in tubes of 25 only. |     |     |     |       |      |     |
| JITO®-2B | Shipped in tubes of 40 only. |     |     |     |       |      |     |

JITO®-2D Standard quantity is 2,000. JITO®-2P Standard quantity is 1,000.



# The JITO<sup>®</sup>-2 PECL Advantage

The JITO<sup>®</sup>-2 PECL option is basically a method of getting high-speed differential outputs from the internal CMOS circuitry. Similar to ECL, PECL utilizes positive ECL values. This option places the complement of the  $f_{out}$  signal on the  $f_{out2}$  output while maintaining a low skew between the signal edges.

Typically these signals have very low voltage swings (around 1Vp-p), thus reducing unwanted radiation. Another big advantage is the complementary pair aids common mode noise rejection. In essence, you can filter out noise, which is common on both lines.

This interface is quickly becoming the standard for new high end disk drives (Fiber Channel) and new high speed networking such as SONET and Ethernet.

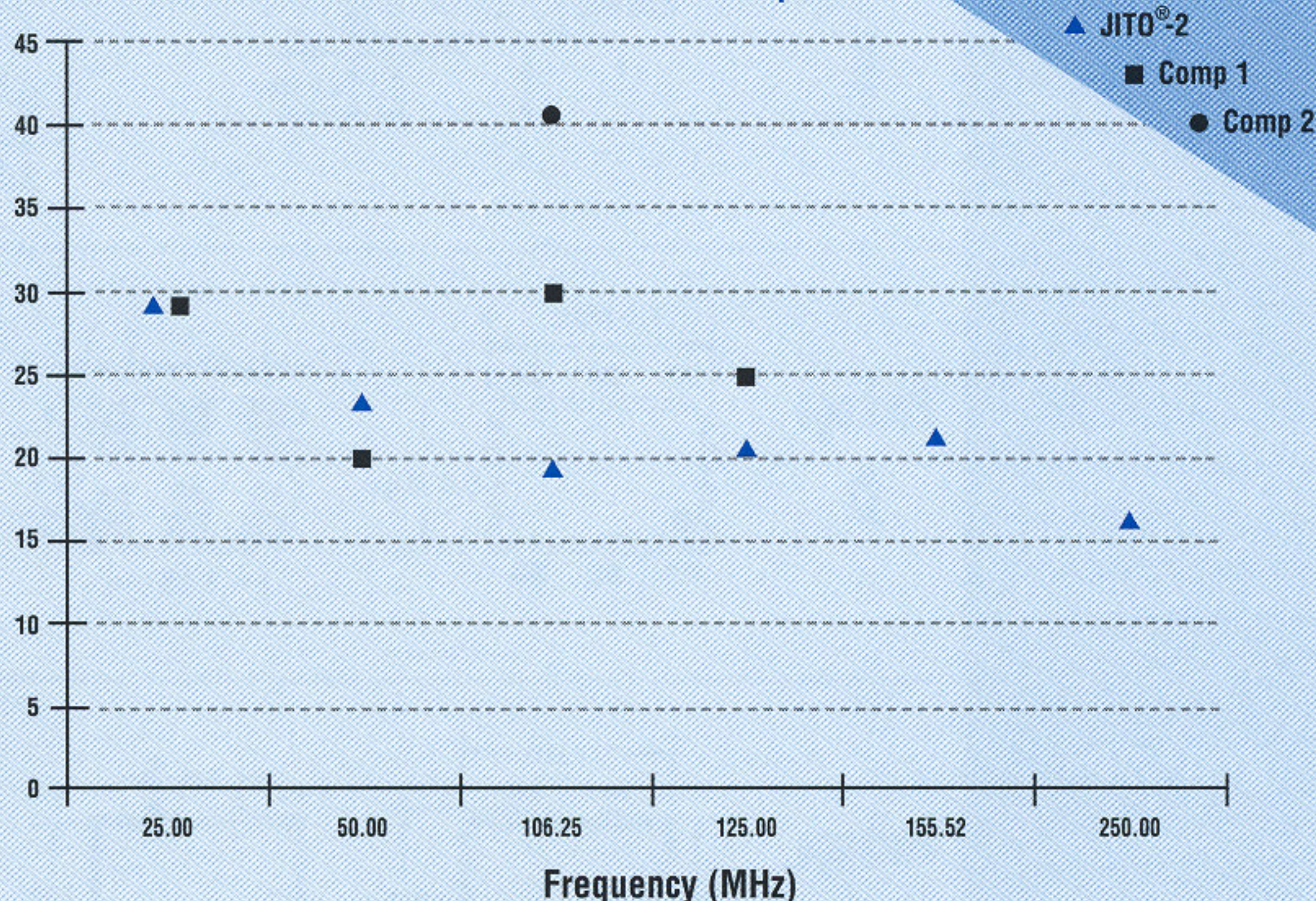
JITO<sup>®</sup>-2 3.3V PECL Test Circuit (below),  
5.0V PECL Test Circuit (middle), and  
HCMOS Test Circuit (bottom).

## Typical Period Jitter Measurements at Fox Electronics

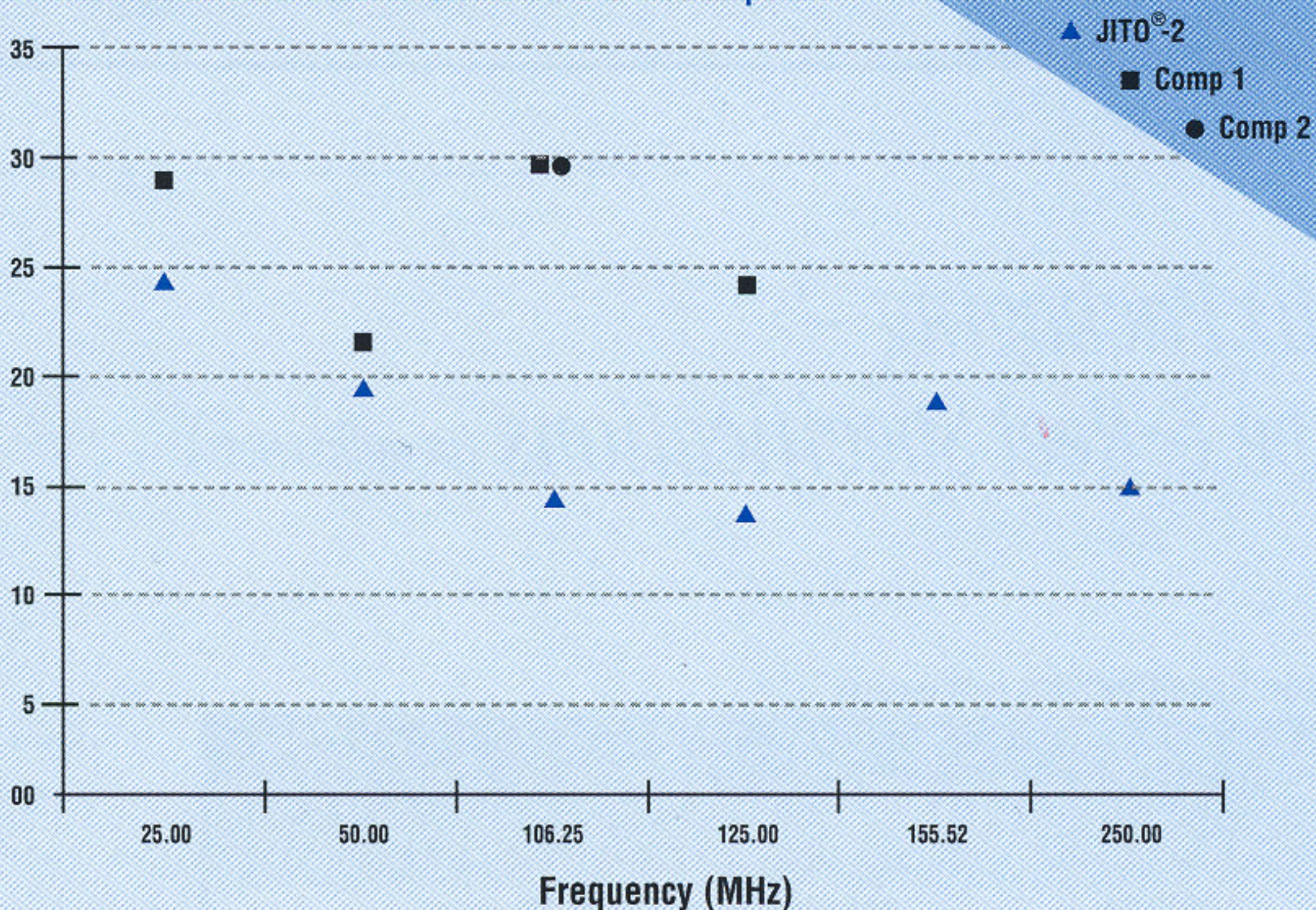
Period jitter is measured as a statistical distribution of the deviation in an oscillator's period widths. Period jitter is measured at Fox Electronics in the following manner:

A 'single-shot' acquisition of several thousand consecutive cycles is taken and each period is measured. A histogram is then constructed of the period widths from which the RMS (one sigma) and p-p (deviation from the smallest measured period to the largest measured period) is determined. For jitter that is gaussian in nature, RMS is considered the most accurate measurement of the period jitter distribution.

3.3V RMS Period Jitter Measurements: JITO-2 vs. Competition

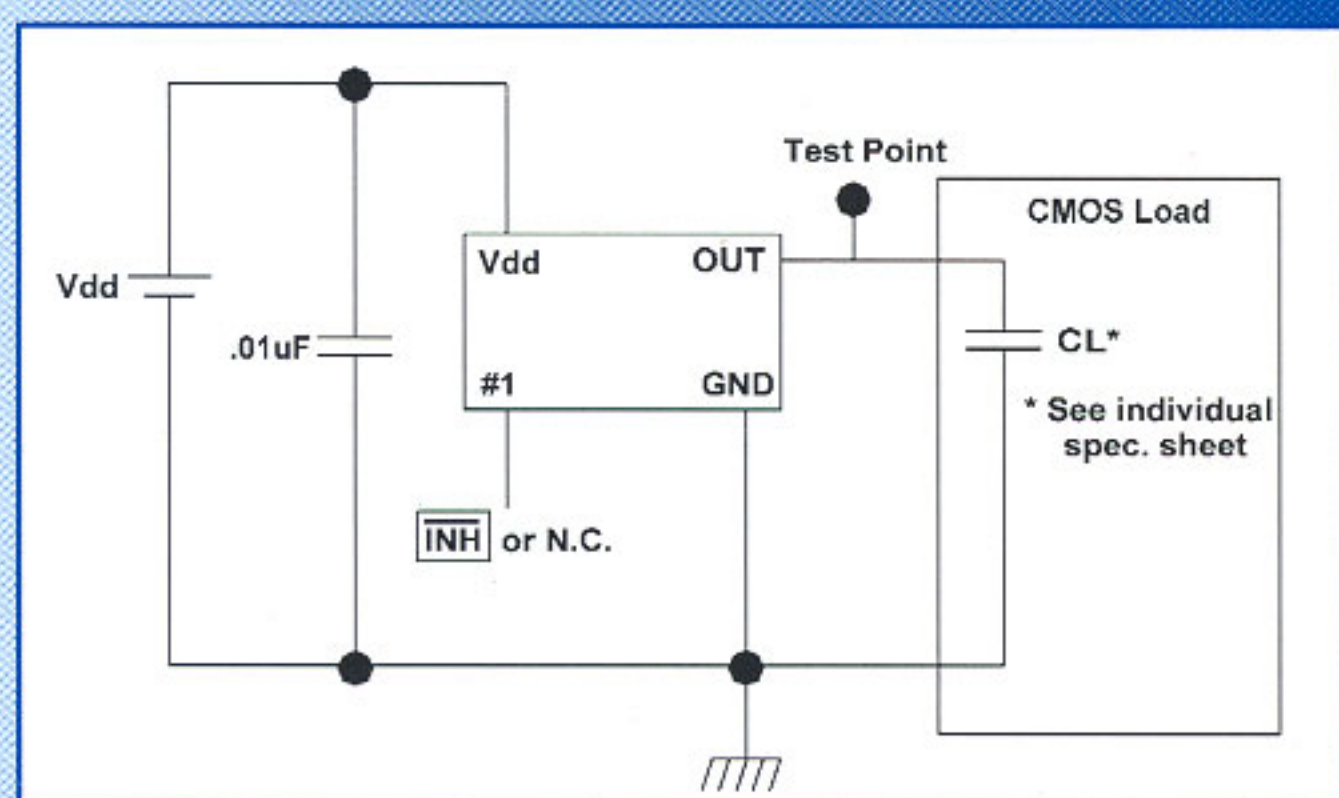
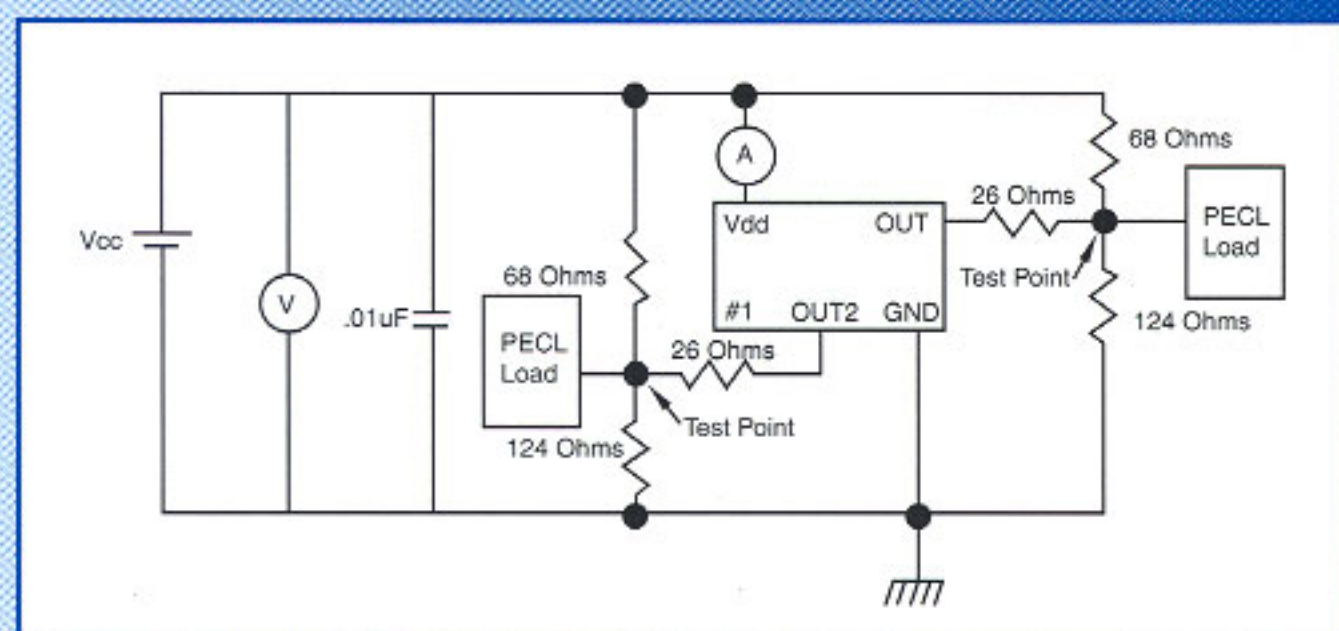
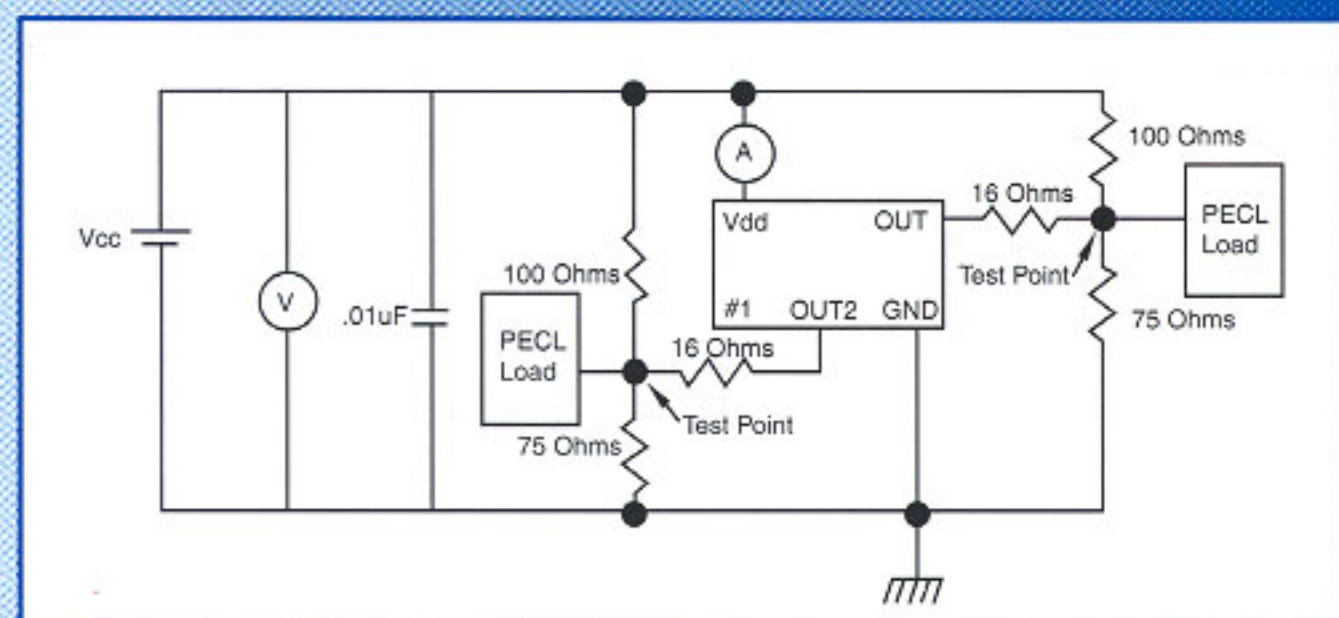


5V RMS Period Jitter Measurements: JITO-2 vs. Competition



**Application Precautions:** It is recommended that a sample be evaluated in each application before adding JITO<sup>®</sup>-2 or any other oscillator to the AVL. This JITO<sup>®</sup>-2 series of products utilize PLL technology. As a result, overall circuit jitter will often increase if applied to another PLL device. Please contact Fox technical support if you require assistance.

**Latch up Statement:** The JITO<sup>®</sup> family of oscillators are CMOS devices and are sensitive to latch up conditions characteristic of such devices. Applying power to the enable/disable connection or any other unused connections prior to applying power to the VDD pin can cause latch up. The N/C pins of the JITO<sup>®</sup> family are internally connected; connecting these pins can cause unstable operation and possibly permanent damage.





## JITO<sup>®</sup>-2 ORDERING INFORMATION

Use the part description guide below to order the JITO<sup>®</sup>-2 Oscillator you need:

### JITO<sup>®</sup>-2 PART DESCRIPTION GUIDE

**JITO<sup>®</sup>-2 - B C 3 A M C - 106.250000**

#### Package Style:

**A** = 14 Pin DIP  
**B** = 8 Pin DIP  
**D** = MIN-6 (5x7.5x1.5mm  
6 Pad SMD)  
**P** = Plastic (10x13x5mm)

#### Type:

**C** = HCMOS  
**P** = PECL  
**S** = HCMOS/Standby  
(D & P Pkg. only)  
**X** = 2<sup>nd</sup> HCMOS Output/ $\div 2$   
(D Pkg. only)  
**Y** = 2<sup>nd</sup> HCMOS Output/ $\div 4$   
(D Pkg. only)  
**Z** = 2<sup>nd</sup> HCMOS Output/ $\div 8$   
(D Pkg. only)

#### Supply Voltage:

**5** = +5.0V  
**3** = +3.3V

#### Stability:

**A** =  $\pm 100$ ppm  
**B** =  $\pm 50$ ppm  
**C** =  $\pm 30$ ppm  
**D** =  $\pm 25$ ppm  
**E** =  $\pm 20$ ppm\*\*

#### Temperature Range:

**F** = -20°C to +70°C  
**M** = -40°C to +85°C

Frequency (MHz)

**C** = Custom  
(or leave blank)

If you need assistance in selecting the proper JITO<sup>®</sup>-2 oscillator for your specific application, Fox's skilled technical support team will be glad to assist you. Just call us.

\*\* Only available in F temperature range.

**JITO<sup>®</sup>-T:** (Thru-Hole, Dual Output PECL, Tri-State) Ask your Customer Service Representative for details.

## OTHER FOX FREQUENCY CONTROL PRODUCTS

The JITO<sup>®</sup>-2 series represents just a portion of the broad spectrum of frequency control products and solutions available from Fox, including:

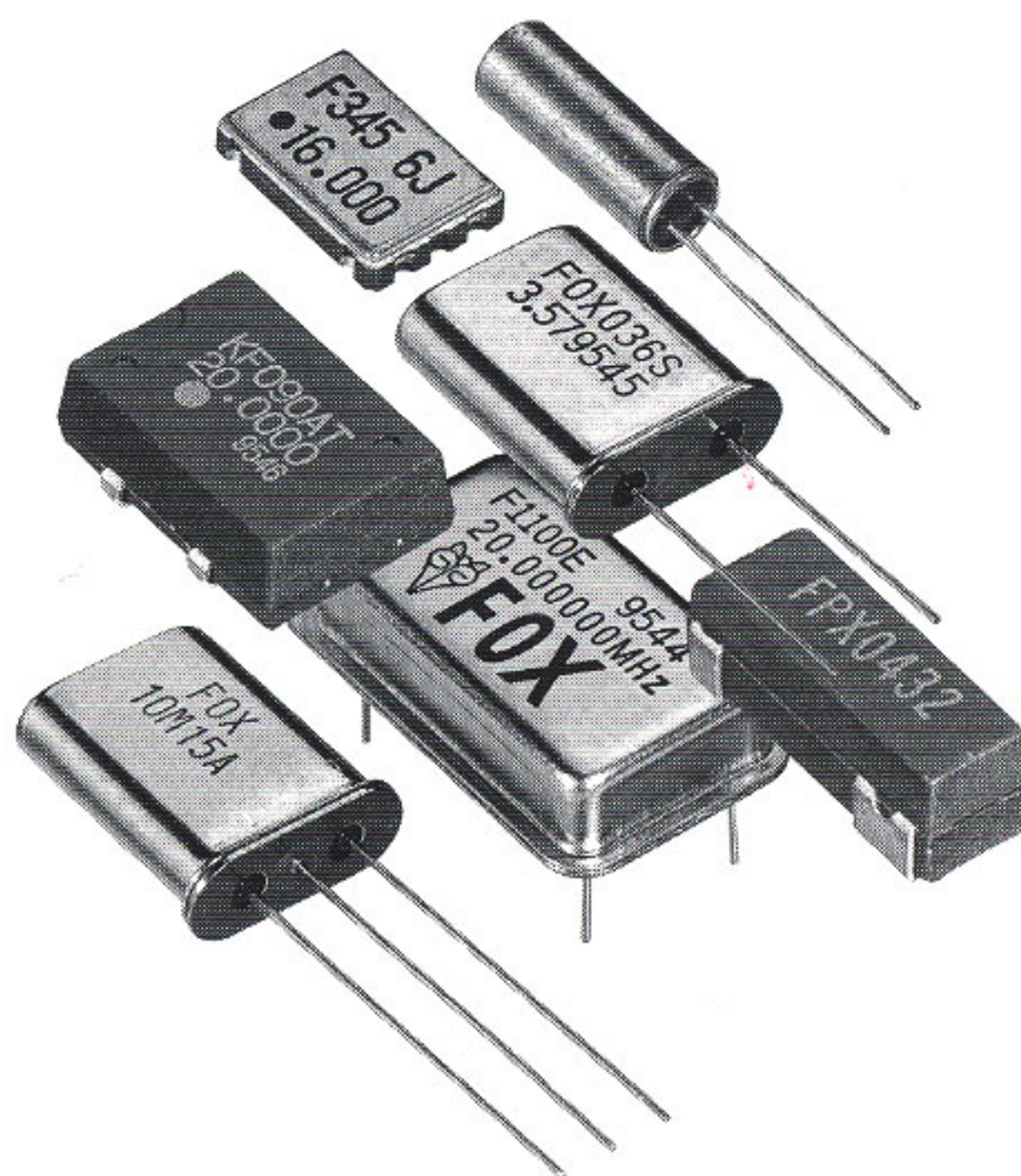
**Quartz Crystals:** Frequencies from 32.768 kHz to 200 MHz, standard and custom; stabilities to 5 PPM.

**Oscillators:** Frequencies from 340 kHz to 250 MHz, standard and custom; stabilities from 20 PPM to 100 PPM.

**TCXOs/VCXOs:** High performance temperature- and voltage-controlled oscillators; frequencies from 1 MHz to 622.080 MHz.

**Crystal Filters:** Frequencies from 10.7 MHz to 90 MHz.

All Fox frequency control products are 100% tested, offered in a variety of surface mount and thru-hole configurations, and are available directly from Fox or off the shelves of our very well stocked national distribution network.



# FOX Electronics

We're On Your Frequency.

5570 Enterprise Parkway  
Fort Myers, FL 33905  
Tel: **888-GET-2-FOX**  
Fax: 941-693-1554

When it comes to frequency control, why trust your products to anyone less than Fox? It always pays to go with the leader. Call, fax or visit us on the web today.

[www.foxonline.com](http://www.foxonline.com)

FX-3336-102-5M-FP  
Revised January 2002

# Mouser Electronics

Authorized Distributor

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[LT125](#) [JITO-2-DS5BM-LT125](#) [JITO-2-BS5BM-LT125](#) [JITO-2-AS5BM-LT125](#) [JITO-2-AS5BM-GT125](#) [JITO-2-DS5BM-](#)  
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