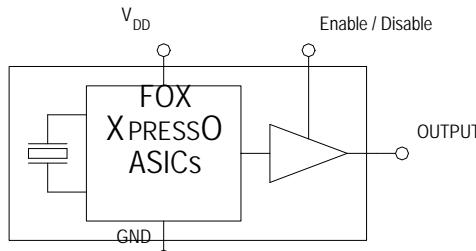


## Features

- XTREMELY Low Jitter
- Low Cost
- XPRESS Delivery
- Frequency Resolution to six decimal places
- Stabilities to  $\pm 25$  PPM
- -20 to +70°C or -40 to +85°C operating temperatures
- Tri-State Enable / Disable Feature
- Industry Standard Package, Footprint & Pin-Out
- Fully RoHS and REACH compliant
- Gold over Nickel Termination Finish
- Serial ID with Comprehensive Traceability



For more information -- Click on the drawing

## Description

The Fox XPRESSO Crystal Oscillator is a breakthrough in configurable Frequency Control Solutions. XPRESSO utilizes a family of proprietary ASICs, designed and developed by Fox, with a key focus on noise reduction technologies.

The 3<sup>rd</sup> order Delta Sigma Modulator reduces noise to the levels that are comparable to traditional Bulk Quartz and SAW oscillators. The ASICs family has ability to select the output type, input voltages, and temperature performance features.

With the XPRESS lead-time, low cost, low noise, wide frequency range, excellent ambient performance, XpressO is an excellent choice over the conventional technologies.

Finished XPRESSO parts are 100% final tested.



## Applications

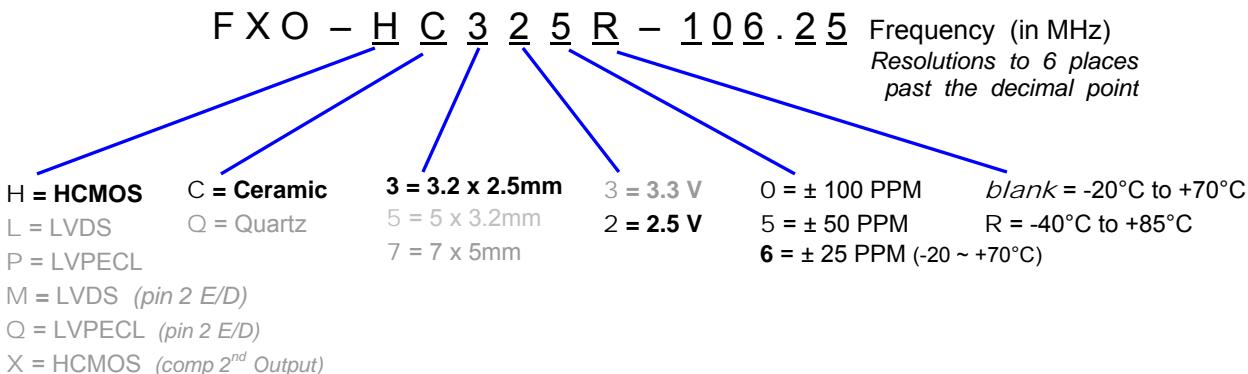
- ANY application requiring an oscillator
- SONET
- Ethernet
- Storage Area Network
- Broadband Access
- Microprocessors / DSP / FPGA
- Industrial Controllers
- Test and Measurement Equipment
- Fiber Channel

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## Model Selection Guide & Fox Part Number

**STEP #1:** Customer selects the Model Description and provides to Fox Customer Service  
**Model Description**



**STEP #2:** The Fox Customer Service team provides a customer specific Part Number for use on their Bill Of Materials (BOM).

**Fox Part Number** *(The assigned Fox Part Number must be on the BOM – not the above Model Description)  
 (This will ensure receipt of the proper part)*

The 1<sup>st</sup> Field  
 Product Code #  
**766A = FXO-HC32**  
**766 = FXO-HC33**

766A - 106.25 - 8

The 2<sup>nd</sup> Field  
 The Customer's Frequency

The 3<sup>rd</sup> Field  
 Fox Internally Generated Number  
*(If any specification changes, the last digits change)*  
*(The same specs for a different customer also changes the last digits)*

*This example, FXO-HC325R-106.25 = HCMOS Output, Ceramic 3.2 x 2.5mm Package, 2.5V, ±50 PPM Stability, -40 to +85°C Temperature Range, at 106.25 MHz*

## Electrical Characteristics

| Parameters                       | Symbol             | Condition  | Maximum Value<br>(unless otherwise noted)           |
|----------------------------------|--------------------|--|---|
| Frequency Range                  | $F_O$              |  | 0.750 to 180.000 MHz                                |
| Frequency Stability <sup>1</sup> |                    | -20 ~ +70°C<br>-40 to +85°C  | 100, 50, 25* PPM<br>100, 50 PPM                     |
| Temperature Range                | $T_O$<br>$T_{STG}$ | Standard operating<br><i>Optional operating</i><br>Storage   | -20°C to +70°C<br>-40°C to +85°C<br>-55°C to +125°C |
| Supply Voltage                   | $V_{DD}$           | Standard   | 2.5 V ± 5%  |
| Input Current (@ 15pF LOAD)      | $I_{DD}$           | 0.75 ~ 20 MHz<br>20+ ~ 50 MHz<br>50+ ~ 100 MHz<br>100+ ~ 130 MHz<br>130+ ~ 160 MHz<br>160+ ~ 180 MHz | 22 mA<br>25 mA<br>29 mA<br>32 mA<br>35 mA<br>37 mA  |
| Output Load                      | HCMOS              | Standard   | 15 pF   |
| Start-Up Time                    | $T_s$              |  | 10 mS   |
| Output Enable / Disable Time     |                    |  | 100 nS  |
| Moisture Sensitivity Level       | MSL                | <i>JEDEC J-STD-20</i>  | 1   |
| Termination Finish               |                    |  | Au  |

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

## Absolute Maximum Ratings

(Useful life may be impaired. For user guidelines only, not tested)

Operation is only guaranteed for voltage and temperature specifications in Electrical Characteristics section.)

| Parameters            | Symbol     | Condition        | Maximum Value<br>(unless otherwise noted) |
|-----------------------|------------|------------------|---|
| Input Voltage         | $V_{DD}$   |                  | -0.5V to +5.0V                            |
| Operating Temperature | $T_{AMAX}$ |                  | -55°C to +105°C                           |
| Storage Temperature   | $T_{STG}$  |                  | -55°C to +125°C                           |
| Junction Temperature  |            |                  | 150°C                                     |
| ESD Sensitivity       | HBM        | Human Body Model | > 1 kV                                    |

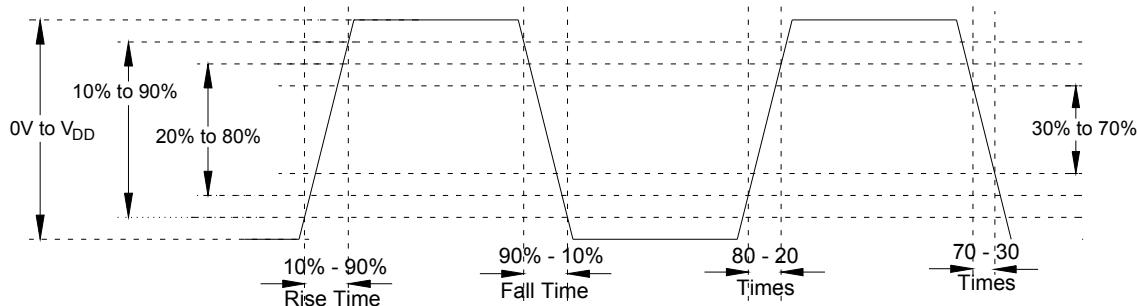
## Output Wave Characteristics

| Parameters                          | Symbol   | Condition                          | Maximum Value<br>(unless otherwise noted) |
|-------------------------------------|----------|------------------------------------|---|
| Output LOW Voltage                  | $V_{OL}$ | 0.75 to 160 MHz<br>160+ to 180 MHz | 10% $V_{DD}$<br>20% $V_{DD}$              |
| Output HIGH Voltage                 | $V_{OH}$ | 0.75 to 160 MHz<br>160+ to 180 MHz | 90% $V_{DD}$ MIN<br>80% $V_{DD}$ MIN      |
| Output Symmetry (See Drawing Below) |          | @ 50% $V_{DD}$ Level               | 45% ~ 55%                                 |
| Output Enable (PIN # 1) Voltage     | $V_{IH}$ |                                    | $\geq 70\%$ $V_{DD}$                      |
| Output Disable (PIN # 1) Voltage    | $V_{IL}$ |                                    | $\leq 30\%$ $V_{DD}$                      |
| Cycle Rise Time (See Drawing Below) | $T_R$    | 0.75 to 160 MHz<br>160+ to 180 MHz | 3.5 nS (10%~90%)<br>2.5 nS (20%~80%)      |
| Cycle Fall Time (See Drawing Below) | $T_F$    | 0.75 to 160 MHz<br>160+ to 180 MHz | 3.5 nS (90%~10%)<br>2.5 nS (80%~20%)      |

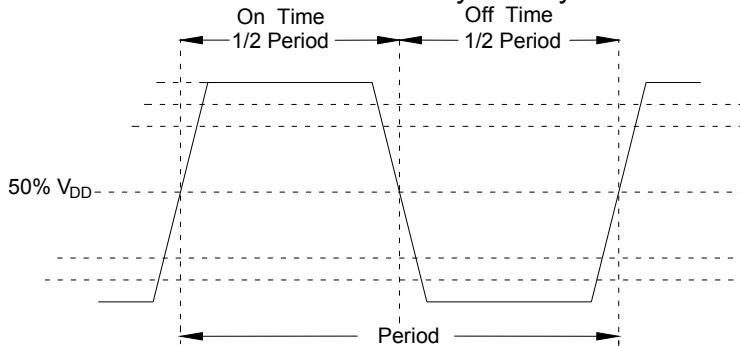
If 30% to 70% times are used, Rise and Fall times change to 2 nS from 0.75 to 180MHz

If 20% to 80% times are used, Rise and Fall times change to 2.5 nS from 0.75 to 160MHz

### Rise Time / Fall Time Measurements

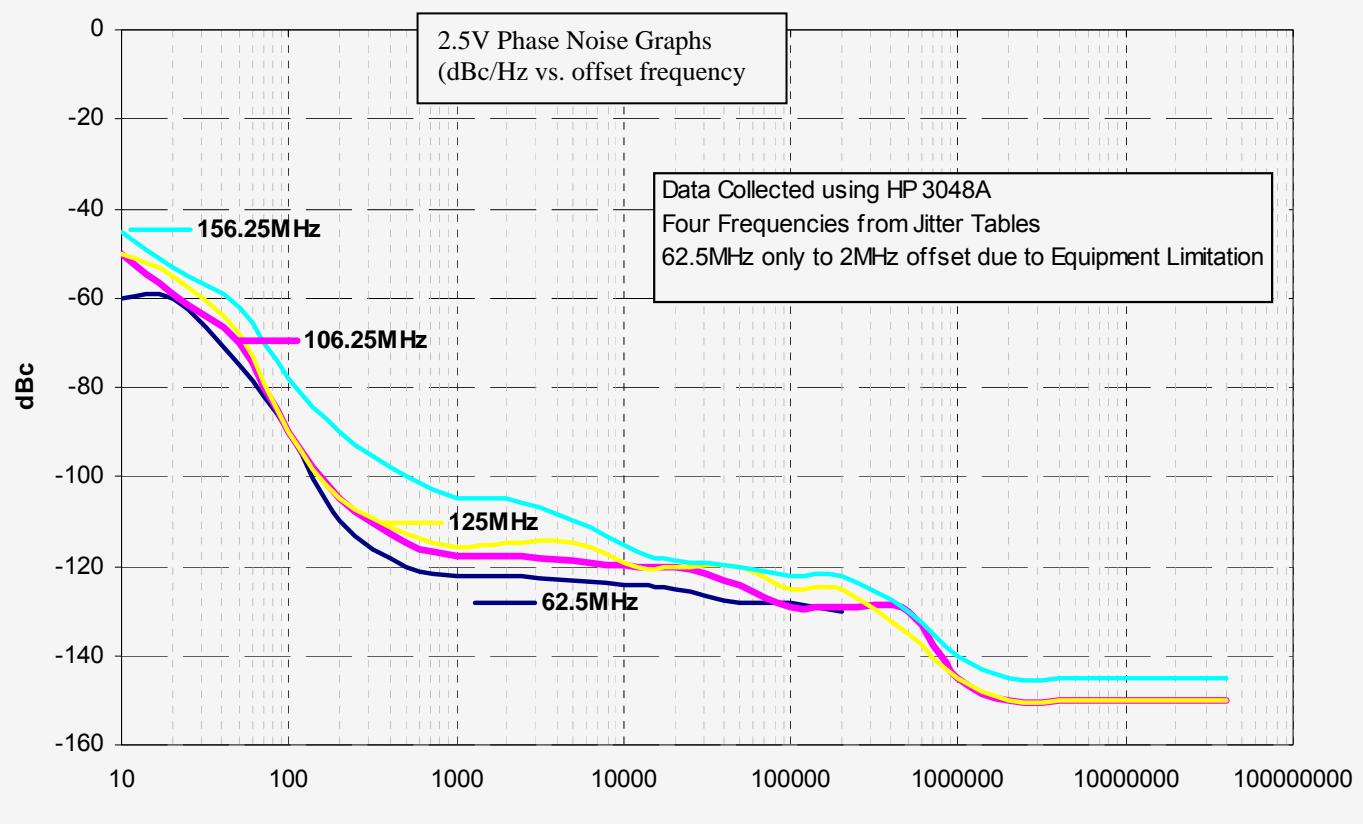


### Oscillator Symmetry



Ideally, Symmetry should be 50/50 -- Other expressions are 45/55 or 55/45

## Phase Noise



Jitter is frequency dependent. Below are typical values at select frequencies.

## Phase Jitter & Time Interval Error (TIE)

| Frequency  | Phase Jitter<br>(12KHz to 20MHz) | TIE<br>(Sigma of Jitter Distribution) | Units  |
|------------|----------------------------------|---------------------------------------|--------|
| 62.5 MHz   | 0.9                              | 2.9                                   | pS RMS |
| 106.25 MHz | 0.8                              | 3.5                                   | pS RMS |
| 125 MHz    | 0.8                              | 2.5                                   | pS RMS |
| 156.25 MHz | 0.9                              | 3.1                                   | pS RMS |

**Phase Jitter** is integrated from HP3048 Phase Noise Measurement System; measured directly into 50 ohm input;  $V_{DD} = 2.5V$ .

**TIE** was measured on LeCroy LC684 Digital Storage Scope, directly into 50 ohm input, with Amherst M1 software;  $V_{DD} = 2.5V$ .

Per **MJSQ spec** (Methodologies for Jitter and Signal Quality specifications)

## Random & Deterministic Jitter Composition

| Frequency  | Random (Rj)<br>(pS RMS) | Deterministic (Dj)<br>(pS P-P) | Total Jitter (Tj)<br>(14 x Rj) + Dj |
|------------|-------------------------|--------------------------------|-------------------------------------|
| 62.5 MHz   | 1.3                     | 9.2                            | 28.4 pS                             |
| 106.25 MHz | 1.3                     | 9.0                            | 27.2 pS                             |
| 125 MHz    | 1.3                     | 8.8                            | 27.7 pS                             |
| 156.25 MHz | 1.4                     | 10.4                           | 30.3 pS                             |

**Rj** and **Dj**, measured on LeCroy LC684 Digital Storage Scope, directly into 50 ohm input, with Amherst M1 software. Per **MJSQ spec** (Methodologies for Jitter and Signal Quality specifications)

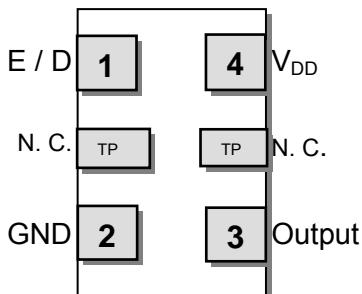
## Pin Description and Recommended Circuit

| Pin #       | Name                         | Type   | Function  |
|-------------|------------------------------|--------|---|
| 1           | E / D <sup>1</sup>           | Logic  | Enable / Disable Control of Output (0 = Disabled) |
| 2           | GND                          | Ground | Electrical Ground for V <sub>DD</sub>             |
| 3           | Output                       | Output | HCMOS Oscillator Output                           |
| 4           | V <sub>DD</sub> <sup>2</sup> | Power  | Power Supply Source Voltage                       |
| Test Points | N. C.                        | Hi Z   | No Connection (Factory Use ONLY)                  |

**NOTES:**

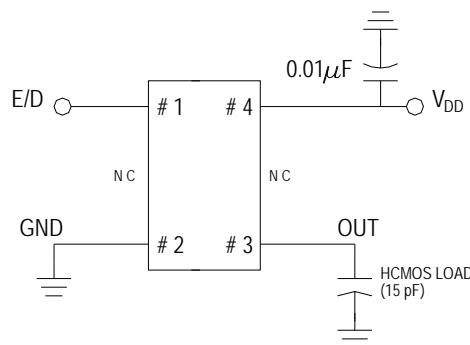
<sup>1</sup> Includes pull-up resistor to V<sub>DD</sub> to provide output when the pin (1) is No Connect.

<sup>2</sup> Installation should include a 0.01μF bypass capacitor placed between V<sub>DD</sub> (Pin 4) and GND (Pin 2) to minimize power supply line noise.



Terminations as viewed from the Top

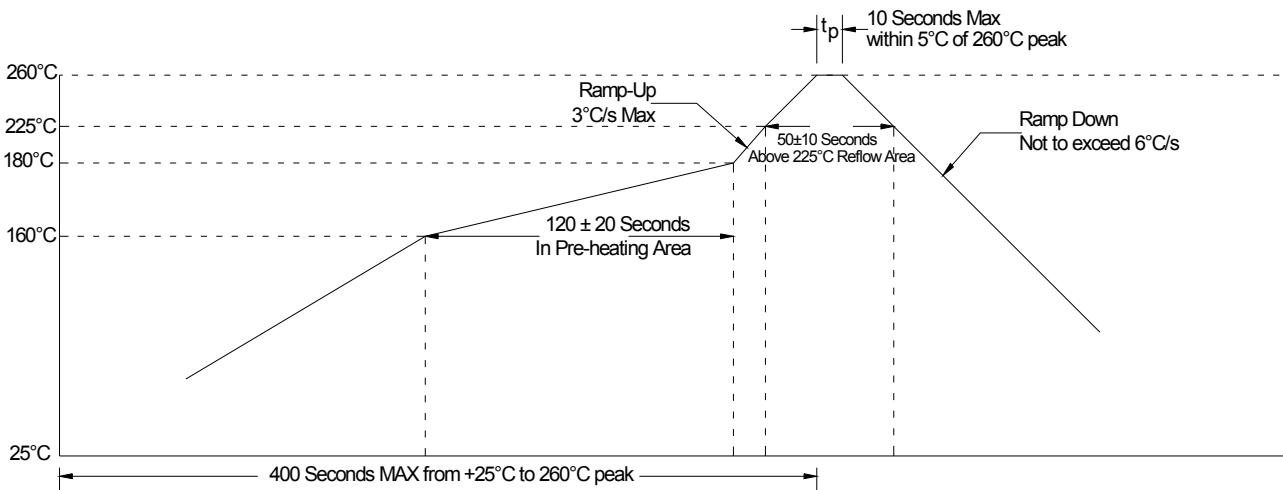
NOTE: XPRESSO HCMOS XOs are designed to fit on Industry Standard, 4 pad layouts



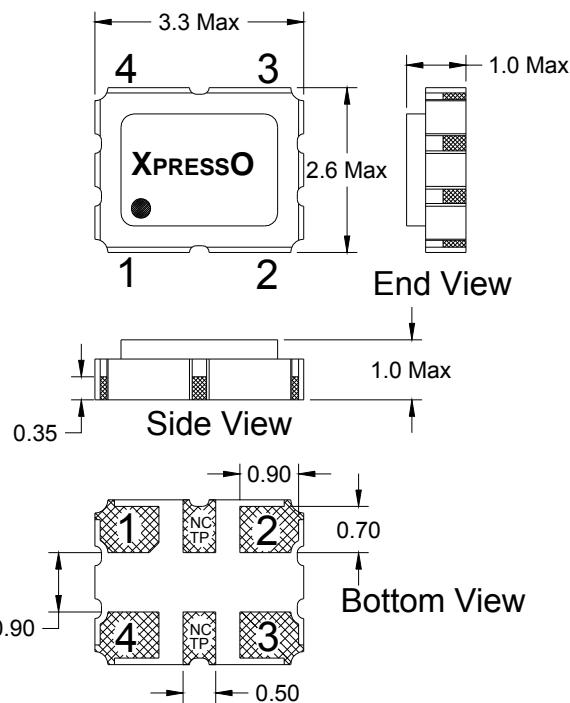
## Enable / Disable Control

| Pin # 1 (state)                     | Output (Pin # 3) |
|-------------------------------------|------------------|
| OPEN (No Connection)                | ACTIVE Output    |
| "1" Level $V_{IH} \geq 70\% V_{DD}$ | ACTIVE Output    |
| "0" Level $V_{IL} \leq 30\% V_{DD}$ | High Impedance   |

## Soldering Reflow Profile (2 times Maximum at 260°C for 10 seconds MAX)

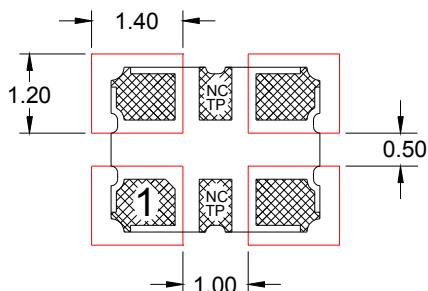


## Mechanical Dimensional Drawing &amp; Pad Layout

3.2 x 2.5 Xpresso  
HCMOS

Actual part marking  
is depicted.

See Traceability (pg. 8)  
for more information

Recommended  
Solder Pad Layout

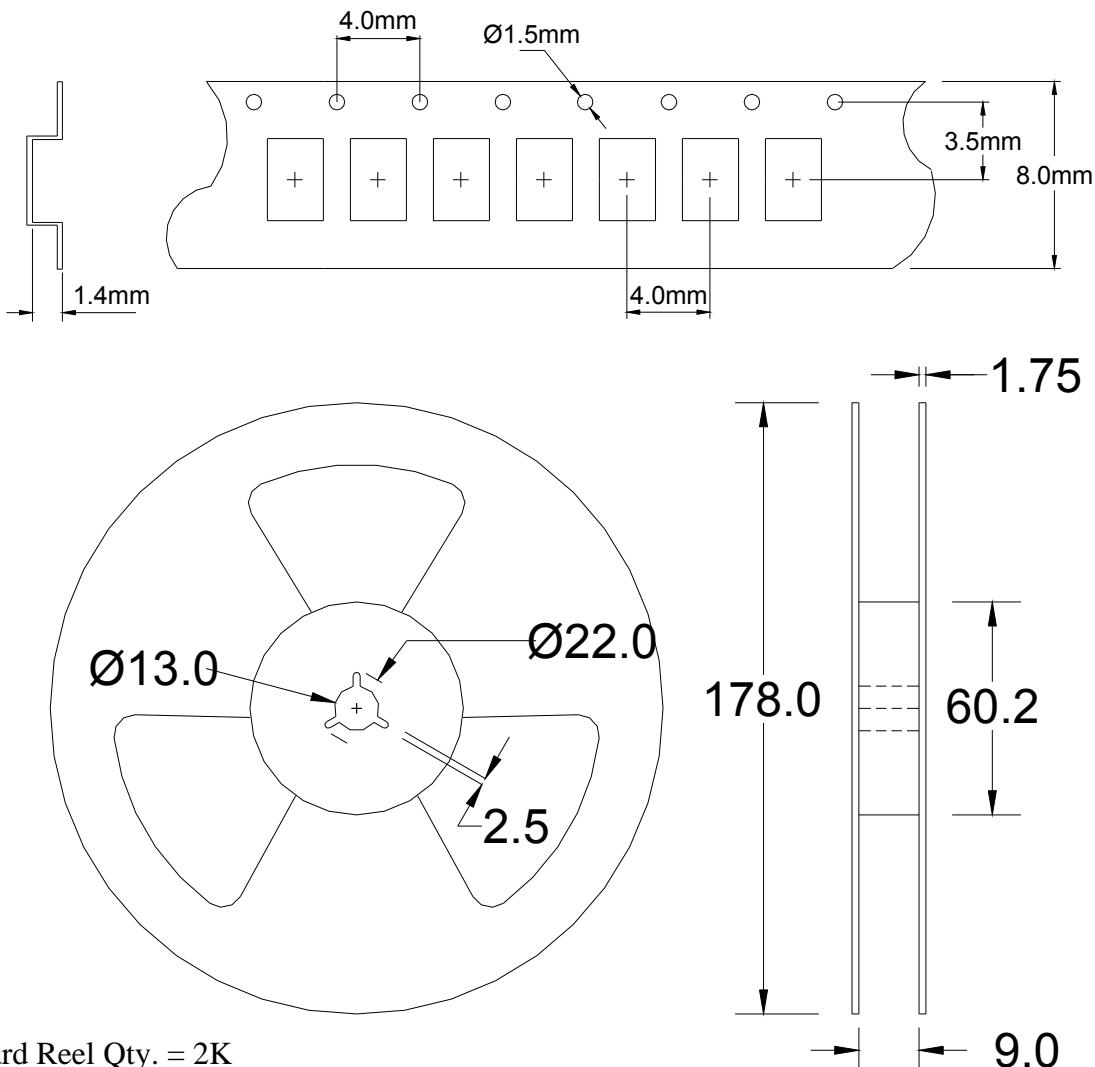
Note: Xpresso HCMOS XO's are designed  
to fit on industry standard, 4 pad layouts.

## Pin Connections

# 1 E / D      # 3 Output  
# 2 GND      # 4 V<sub>DD</sub>

Drawing is for reference to critical specifications defined by size measurements.  
Certain non-critical visual attributes, such as side castellations, reference pin shape, etc. may vary

## Tape and Reel Dimensions (mm)



## Labeling (Reels and smaller packaging are labeled with the below)

- Fox Part Number: **766A-106.25-8**
- Quantity: **2000 pieces**
- Description: **FXO-HC325R-106.25**
- Date Code **0745**  
(YYWW 2007 45<sup>th</sup> wk)
- LOT # **24435**  
*If traceability should become necessary*



An additional identification code is contained internally if tracking should ever be necessary

## Traceability – LOT Number & Serial Identification

### LOT Number

The LOT Number has direct ties to the customer purchase order. The LOT Number is marked on the "Reel" label, and also stored internally on non-volatile memory inside the XPRESSO part. XPRESSO parts that are shipped Tape and Reel, are also placed in an Electro Static Discharge (ESD) bag and will have the LOT Number labeled on the exterior of the ESD bag.

It is recommended that the XPRESSO parts remain in this ESD bag during storage for protection and identification.

If the parts become separated from the label showing the LOT Number, it can be retrieved from inside one of the parts, and the information that can be obtained is listed below:

- Customer Purchase Order Number
- Internal Fox Sales Order Number
- Dates that the XPRESSO part was shipped from the factory
- The assigned customer part number
- The specification that the part was designed for

---

### Serial Identification

The Serial ID is the individualized information about the configuration of that particular XPRESSO part. The Serial ID is unique for each and every XPRESSO part, and can be read by special Fox equipment.

With the Serial ID, the below information can be obtained about that individual, XPRESSO part:

- Equipment that the XPRESSO part was configured on
- Raw material used to configure the XPRESSO part
- Traceability of the raw material back to the foundries manufacturing lot
- Date and Time that the part was configured
- Any optimized electrical parameters based on customer specifications
- Electrical testing of the actual completed part
- Human resource that was monitoring the configuration of the part

Fox has equipment placed at key Fox locations World Wide to read the Lot Identification and Serial Number of any XPRESSO part produced and can then obtain the information from above within 24 hours.

**3<sup>rd</sup> Party (SGS) Material Report****Test Report**

No. : CE/2009/B5581 Date : 2009/11/27 Page : 1 of 4

FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA**The following sample(s) was/were submitted and identified by/on behalf of the client as:**

|                       |   |                           |
|-----------------------|---|---------------------------|
| Sample Description    | : | XPRESSO CLOCK OSCILLATORS |
| Style/Item No.        | : | SEAM SEAL CERAMIC PACKAGE |
| Buyer/Order No.       | : | 51173                     |
| Sample Receiving Date | : | 2009/11/20                |
| Testing Period        | : | 2009/11/20 TO 2009/11/27  |

---

**Test Result(s)** : Please refer to next page(s).

Chenyu Kung / Operation Manager  
Signed for and on behalf of  
SGS TAIWAN LTD.  
Chemical Laboratory – Taipei

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## Test Report

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FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USATest Result(s)

PART NAME NO.1 : OSCILLATORS

| Test Item (s):  | Unit  | Method   | MDL | Result |
|---|-------|--|-----|--------|
|   |       |  |     | NO.1   |
| Cadmium (Cd)  | mg/kg | With reference to IEC 62321: 2008 and performed by ICP-AES.                                    | 2   | n.d.   |
| Lead (Pb)   | mg/kg | With reference to IEC 62321: 2008 and performed by ICP-AES.                                    | 2   | n.d.   |
| Mercury (Hg)  | mg/kg | With reference to IEC 62321: 2008 and performed by ICP-AES.                                    | 2   | n.d.   |
| Hexavalent Chromium Cr(VI) by alkaline extraction                                     | mg/kg | With reference to IEC 62321: 2008 and performed by UV-VIS.                                     | 2   | n.d.   |
| Perfluorooctane sulfonates (PFOS)<br>PFOS – Acid<br>PFOS – Metal Salt<br>PFOS – Amide | mg/kg | With reference to US EPA 3540C: 1996 method for PFOS Content. Analysis was performed by LC/MS. | 10  | n.d.   |
| PFOA (CAS No.: 000335-67-1)   | mg/kg | With reference to US EPA 3540C: 1996 method for PFOA Content. Analysis was performed by LC/MS. | 10  | n.d.   |
| Halogen   |       |  |     |        |
| Halogen-Fluorine (F) (CAS No.: 014762-94-8)   | mg/kg | With reference to BS EN 14582:2007. Analysis was performed by IC.                              | 50  | n.d.   |
| Halogen-Chlorine (Cl) (CAS No.: 022537-15-1)  | mg/kg | With reference to BS EN 14582:2007. Analysis was performed by IC.                              | 50  | n.d.   |
| Halogen-Bromine (Br) (CAS No.: 010097-32-2)   | mg/kg | With reference to BS EN 14582:2007. Analysis was performed by IC.                              | 50  | n.d.   |
| Halogen-Iodine (I) (CAS No.: 014362-44-8)   | mg/kg | With reference to BS EN 14582:2007. Analysis was performed by IC.                              | 50  | n.d.   |

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## Test Report

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FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA

| Test Item (s):           | Unit  | Method  | MDL | Result<br>NO.1 |
|--------------------------|-------|---|-----|----------------|
| <b>Sum of PBBs</b>       |       |   | -   | n.d.           |
| Monobromobiphenyl        |       |   | 5   | n.d.           |
| Dibromobiphenyl          |       |   | 5   | n.d.           |
| Tribromobiphenyl         |       |   | 5   | n.d.           |
| Tetrabromobiphenyl       |       |   | 5   | n.d.           |
| Pentabromobiphenyl       |       |   | 5   | n.d.           |
| Hexabromobiphenyl        |       |   | 5   | n.d.           |
| Heptabromobiphenyl       |       |   | 5   | n.d.           |
| Octabromobiphenyl        |       |   | 5   | n.d.           |
| Nonabromobiphenyl        |       |   | 5   | n.d.           |
| Decabromobiphenyl        |       |   | 5   | n.d.           |
| <b>Sum of PBDEs</b>      |       | With reference to IEC 62321: 2008 and performed by GC/MS. | -   | n.d.           |
| Monobromodiphenyl ether  | mg/kg |   | 5   | n.d.           |
| Dibromodiphenyl ether    |       |   | 5   | n.d.           |
| Tribromodiphenyl ether   |       |   | 5   | n.d.           |
| Tetrabromodiphenyl ether |       |   | 5   | n.d.           |
| Pentabromodiphenyl ether |       |   | 5   | n.d.           |
| Hexabromodiphenyl ether  |       |   | 5   | n.d.           |
| Heptabromodiphenyl ether |       |   | 5   | n.d.           |
| Octabromodiphenyl ether  |       |   | 5   | n.d.           |
| Nonabromodiphenyl ether  |       |   | 5   | n.d.           |
| Decabromodiphenyl ether  |       |   | 5   | n.d.           |

## Note :

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. n.d. = Not Detected
3. MDL = Method Detection Limit
4. " - " = Not Regulated

## PFOS Reference Information : Directive 2006/122/EC

- (1) May not be placed on the market or used as a substance or constituent of preparations in a concentration equal to or higher than 0.005 % by mass.
- (2) May not be placed on the market in semi-finished products or articles, or parts thereof, if the concentration of PFOS is equal to or higher than 0.1 % by mass calculated with reference to the mass of structurally or microstructurally distinct parts that contain PFOS or, for textiles or other coated materials, if the amount of PFOS is equal to or higher than 1 $\mu$ g/m<sup>2</sup> of the coated material.

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## Test Report

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FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA

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## Test Report (SVHC)

FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA



The following sample(s) was/were submitted and identified by/on behalf of the client as :

Sample Description : XPRESSO CLOCK OSCILLATORS  
 Style/Item No. : SEAM SEAL CERAMIC PACKAGE  
 Buyer/Order No. : 51173  
 Sample Receiving Date : 2009/11/20  
 Testing Period : 2009/11/20 TO 2009/11/27

=====

**Test Requested** : Fifteen (15) Substances of Very High Concern (SVHC) screening in addition of Cyclododecane by specific client's request. SVHC candidate list based on the publication by European Chemicals Agency (ECHA) on 2008 October 28, regarding Regulation (EC) No 1907/2006 concerning the REACH.

**Test Method** : Please refer to next page(s).

**Test Result(s)** : Please refer to next page(s).

**Summary** : According to the specified scope and analytical technique, concentrations of all SVHC are <0.1% in the submitted sample(s).

Chenyu Kung / Operation Manager  
 Signed for and on behalf of  
 SGS TAIWAN LTD.  
 Chemical Laboratory – Taipei

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## Test Report (SVHC)

FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA



No. : CR/2009/B0181 Date : 2009/11/27 Page : 2 of 8

Test Sample : OSCILLATORS

Test Method : SGS In-House method-RSTS-EE-SVHC-002. Analyzed by ICP-AES, UV-VIS, GC/MS and GC/FPD.

Remark:

1. The chemical analysis of 15 SVHC is performed by means of currently available analytical techniques against the list published by ECHA on 2008 October 28. This list is under evaluation by ECHA and may subject to change in the future. Please refer to [http://echa.europa.eu/consultations/authorisation/svhc/svhc\\_cons\\_en.asp](http://echa.europa.eu/consultations/authorisation/svhc/svhc_cons_en.asp)
2. In accordance with Regulation (EC) No 1907/2006, any producer or importer of articles shall notify ECHA, in accordance with paragraph 2 of Article 7, if a substance meets the criteria in Article 57 and is identified in accordance with Article 59(1) of the Regulation, if (a) the substance is present in those articles in quantities totaling over one tonne per producer or importer per year; and (b) the substance is present in those articles above a concentration of 0.1% weight by weight (w/w).
3. Article 33 of Regulation (EC) No 1907/2006 requires supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1% weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance.
4. If a SVHC is found over the reporting limit, client is suggested to identify the component which contains the SVHC and the exact concentration of the SVHC by requesting further quantitative analysis from the laboratory.

Test Result(s)

| Substance Name   | Unit | Concentration of Article | RL    | Classification                   |
|--|------|--------------------------|-------|----------------------------------|
| Anthracene (CAS No.: 000120-12-7)  | %    | n.d.                     | 0.005 | PBT                              |
| 4,4' - Diaminodiphenylmethane (CAS No.: 000101-77-9)                       | %    | n.d.                     | 0.005 | Carcinogen Category 2            |
| DBP (Dibutyl phthalate) (CAS No.: 000084-74-2)                             | %    | n.d.                     | 0.005 | Toxic to Reproduction Category 2 |
| BBP (Benzyl butyl phthalate) (CAS No.: 000085-68-7)                        | %    | n.d.                     | 0.005 | Toxic to Reproduction Category 2 |
| DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 000117-81-7)                 | %    | n.d.                     | 0.005 | Toxic to Reproduction Category 2 |
| 5-tert-butyl-2,4,6-trinitro- m-xylene (Musk Xylene) (CAS No.: 000081-15-2) | %    | n.d.                     | 0.005 | vPvB                             |

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## Test Report (SVHC)

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| Substance Name  | Unit | Concentration of Article | RL    | Classification  |
|---|------|--------------------------|-------|---|
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ -HBCDD, $\beta$ -HBCDD, $\gamma$ -HBCDD) (CAS No.: 025637-99-4 and 003194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)) | %    | n.d.                     | 0.005 | PBT   |
| Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) (CAS No.: 085535-84-8)  | %    | n.d.                     | 0.01  | PBT   |
| Bis(tributyltin)oxide*** (CAS No.: 000056-35-9)   | %    | n.d.                     | -     | PBT   |
| Cobalt dichloride (CAS No.: 007646-79-9)  | %    | n.d.                     | 0.05  | Carcinogen Category 2   |
| Diarsenic pentaoxide*** (CAS No.: 001303-28-2)  | %    | n.d.                     | -     | Carcinogen Category 1   |
| Diarsenic trioxide*** (CAS No.: 001327-53-3)  | %    | n.d.                     | -     | Carcinogen Category 1   |
| Triethyl arsenate*** (CAS No.: 015606-95-8)   | %    | n.d.                     | -     | Carcinogen Category 1   |
| Lead hydrogen arsenate*** (CAS No.: 007784-40-9)  | %    | n.d.                     | -     | Carcinogen Category 1; Toxic to Reproduction Category 1                     |
| Sodium dichromate*** (CAS No.: 010588-01-9(**))   | %    | n.d.                     | -     | Carcinogen Category 2; Mutagen Category 2; Toxic to Reproduction Category 2 |

Additional screening by client's request outside the scope of SVHC as published by ECHA on 2008 October 28:

| Substance Name                       | Unit | Concentration of Article | RL    | Classification |
|--------------------------------------|------|--------------------------|-------|----------------|
| Cyclododecane (CAS No.: 000294-62-2) | %    | n.d.                     | 0.005 | PBT            |

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## Test Report

(SVHC)

FOX ELECTRONICS  
5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA



**Note :**

1. mg/kg = ppm; 0.1wt% = 1000ppm
2. n.d.= not detected = below Reporting Limit
3. RL = Reporting Limit
4. Definition of classification is listed in Appendix A of this report in accordance with 67/548/EEC and Regulation (EC) No 1907/2006.
5. Please refer to Appendix C to find the concentration and the weight of each tested unit.
6. " - " = Not Regulated
7. \*\*\*: The substance was calculated by the test results of Tributyl Tin or element  
(Ex. Arsenic, Lead or Cr(VI) respectively).

AX = A × F

| AX                     | A                          | F      |
|------------------------|----------------------------|--------|
| Diarsenic pentaoxide   | Arsenic                    | 1.5339 |
| Diarsenic trioxide     |                            | 1.3203 |
| Triethyl arsenate      |                            | 3.0179 |
| Lead hydrogen arsenate |                            | 4.6332 |
| Lead                   | Lead                       | 1.6753 |
| Sodium dichromate      | Hexavalent Chromium Cr(VI) | 2.5192 |
| Bis(tributyltin)oxide  | Tributyl Tin (TBT)         | 1.0276 |

Regarding lead hydrogen arsenate lead and arsenic are tested and used for the calculation of the separated concentration of lead hydrogen arsenate. The final concentration of lead hydrogen arsenate for the report uses the minimum value of above-mentioned two concentration of lead hydrogen arsenate.

The test result is given as:

| Substance Name             | Unit | Concentration of Article | RL    |
|----------------------------|------|--------------------------|-------|
| Tributyl Tin (TBT)         | %    | n.d.                     | 0.005 |
| Arsenic (As)               | %    | n.d.                     | 0.005 |
| Lead (Pb)                  | %    | n.d.                     | 0.005 |
| Hexavalent Chromium Cr(VI) | %    | n.d.                     | 0.005 |

8. (\*): conc. of Sodium dichromate dihydrate (CAS No.: 007789-12-0) = conc. of sodium dichromate × 1.1374

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## Test Report (SVHC)

FOX ELECTRONICS

5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA

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## Test Report (SVHC)

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5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA



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### 【Appendix A】

| Classification                    | Definition under 67/548/EEC and Regulation (EC) No 1907/2006  |
|-----------------------------------|---|
| Carcinogen Category 1:            | Substances known to be carcinogenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer.   |
| Carcinogen Category 2:            | Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer.<br>Generally on the basis of:<br>- appropriate long-term animal studies<br>- other relevant information.   |
| Mutagen Category 1:               | Substances known to be mutagenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage.   |
| Mutagen Category 2:               | Substances which should be regarded as if they are mutagenic to man. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of:<br>- appropriate animal studies,<br>- other relevant information.  |
| Toxic to Reproduction Category 1: | Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility.<br>Substances known to cause developmental toxicity in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent developmental toxic effects in the progeny.   |
| Toxic to Reproduction Category 2: | Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of:<br>- clear evidence in animal studies of impaired fertility in the absence of toxic effects, or, evidence of impaired fertility occurring at around the same dose levels as other toxic effects but which is not a secondary nonspecific consequence of the other toxic effects,<br>- other relevant information.<br><br>Substances which should be regarded as if they cause developmental toxicity to humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity, generally on the basis of:<br>- clear results in appropriate animal studies where effects have been observed in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects,<br>- other relevant information. |
| PBT & vPvB:                       | Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) pose a particular challenge to the chemicals safety management. For these substances a "safe" concentration in the environment cannot be established with sufficient reliability.   |

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## Test Report (SVHC)

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5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA

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### 【Appendix B】

| SVHC SURVEY FORM  |                              |             |   |
|---|------------------------------|-------------|---|
| Company Name  | FOX ELECTRONICS              |             |   |
| Product name  | EXPRESSO CLOCK OSCILLATORS   |             |   |
| Product/Sampling weight   | 0.2 g                        |             |   |
| Report No.  | CR/2009/B0181                |             |   |
| Substance identification  |                              |             |   |
| Substance name  | Concentration of Article (%) | weight (mg) | providing information about safe use according to Article 33 is necessary |
| Anthracene  | n.d.                         | N/A         | No  |
| 4,4' - Diaminodiphenylmethane   | n.d.                         | N/A         | No  |
| DBP (Dibutyl phthalate)   | n.d.                         | N/A         | No  |
| BBP (Benzyl butyl phthalate)  | n.d.                         | N/A         | No  |
| DEHP (Di- (2-ethylhexyl) phthalate)   | n.d.                         | N/A         | No  |
| 5-tert-butyl-2,4,6-trinitro- m-xylene (Musk Xylene)   | n.d.                         | N/A         | No  |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ - HBCDD, $\beta$ - HBCDD, $\gamma$ - HBCDD) | n.d.                         | N/A         | No  |
| Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)   | n.d.                         | N/A         | No  |
| Bis(tributyltin)oxide   | n.d.                         | N/A         | No  |
| Cobalt dichloride   | n.d.                         | N/A         | No  |
| Diarsenic pentoxide   | n.d.                         | N/A         | No  |
| Diarsenic trioxide  | n.d.                         | N/A         | No  |
| Triethyl arsenate   | n.d.                         | N/A         | No  |
| Lead hydrogen arsenate  | n.d.                         | N/A         | No  |
| Sodium dichromate   | n.d.                         | N/A         | No  |

Note: N/A = Non-Available

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## Test Report (SVHC)

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5570 ENTERPRISE PARKWAY FT. MYERS, FL 33905, USA



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【Appendix C】  
Tested Unit No.1 : OSCILLATORS (Weight: 0.2g)

| Substance Name  | Concentration (%) | RL    | Sample picutre |
|---|-------------------|-------|----------------|
| Anthracene  | n.d.              | 0.005 |                |
| 4,4' - Diaminodiphenylmethane   | n.d.              | 0.005 |                |
| DBP (Dibutyl phthalate)   | n.d.              | 0.005 |                |
| BBP (Benzyl butyl phthalate)  | n.d.              | 0.005 |                |
| DEHP (Di- (2-ethylhexyl) phthalate)   | n.d.              | 0.005 |                |
| 5-tert-butyl-2,4,6-trinitro- m-xylene (Musk Xylene)   | n.d.              | 0.005 |                |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ - HBCDD, $\beta$ - HBCDD, $\gamma$ - HBCDD) | n.d.              | 0.005 |                |
| Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)   | n.d.              | 0.01  |                |
| Tributyl Tin (TBT)  | n.d.              | 0.005 |                |
| Bis(tributyltin)oxide   | n.d.              | -     |                |
| Cobalt dichloride   | n.d.              | 0.05  |                |
| Arsenic (As)  | n.d.              | 0.005 |                |
| Diarsenic pentaoxide  | n.d.              | -     |                |
| Diarsenic trioxide  | n.d.              | -     |                |
| Triethyl arsenate   | n.d.              | -     |                |
| Lead (Pb)   | n.d.              | 0.005 |                |
| Lead hydrogen arsenate  | n.d.              | -     |                |
| Hexavalent Chromium Cr(VI)  | n.d.              | 0.005 |                |
| Sodium dichromate   | n.d.              | -     |                |
| Cyclododecane   | n.d.              | 0.005 |                |

### Note:

1. The average concentration of a whole article can be calculated per the following formula.

$$C_{Average\ of\ Article} = \frac{\sum_{i=1}^n (C_i * W_i)}{\sum_{i=1}^n (W_i)}$$

$C_i$  : Concentration of a SVHC item in each tested unit

$W_i$  : Weight of each tested unit

$C_{Average\ of\ Article}$  : Average concentration of a whole article

\*\* End of Report \*\*

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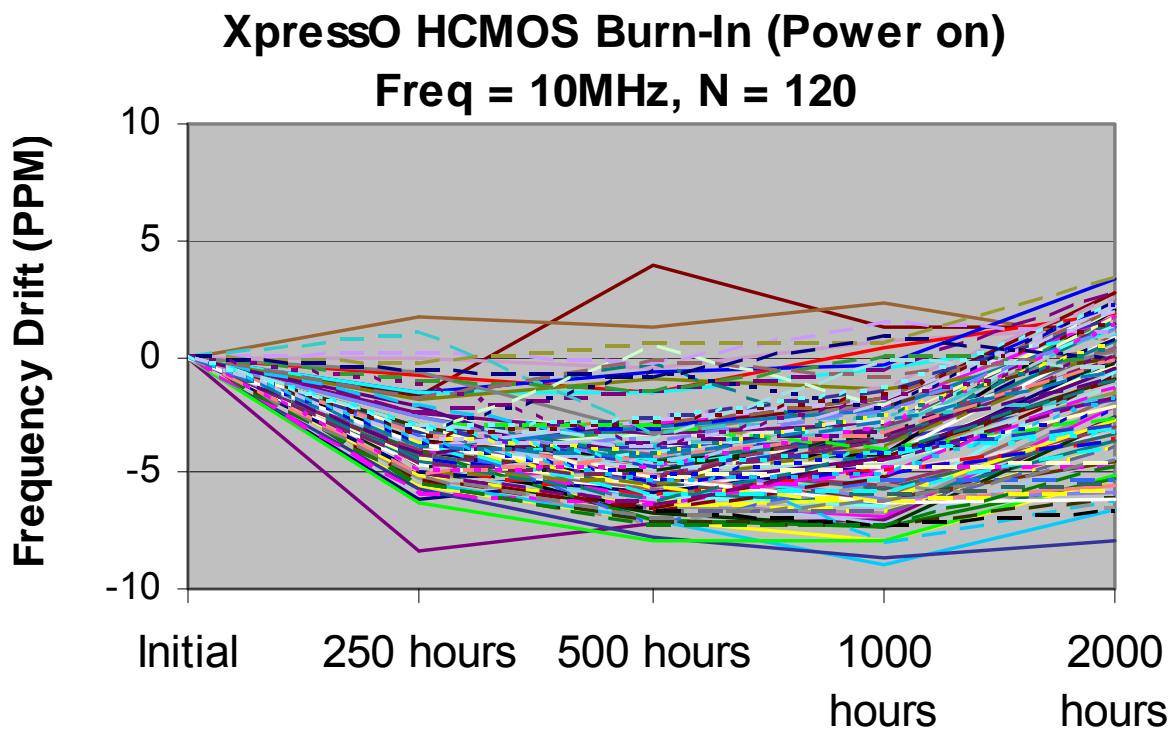
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## Mechanical Testing

| Parameter                | Test Method  |
|--------------------------|--|
| Mechanical Shock         | Drop from 75cm to hardwood surface – 3 times                                       |
| Mechanical Vibration     | 10~55Hz, 1.5mm amplitude, 1 Minute Sweep<br>2 Hours each in 3 Directions (X, Y, Z) |
| High Temperature Burn-in | Under Power @ 125°C for 2000 Hours (results below)                                 |
| Hermetic Seal            | He pressure: $4 \pm 1 \text{ kgf/cm}^2$ 2 Hour soak                                |

## 2,000 Hour Burn-In

**Burn-In Testing** – under power 2000 Hours, 125°C



## MTTF / FITS Calculations

Products are grouped together by process for MTTF calculations.  
(All XpressO output and package types are manufactured with the same process)

Number of Parts Tested: 360 (120 of each output type: HCMOS, LVDS, LVPECL)  
Number of Failures: 0  
Test Temperature: 125°C  
Number of Hours: 2000

MTTF was calculated using the following formulas:

[1.] Device Hours (*devhrs*) = (number of devices) x (hours at elevated temperature in °K)

$$[2.] \text{MTTF} = \frac{\text{devhrs} \times af \times 2}{\chi^2}$$

$$[3.] \text{FITS} = \frac{1}{\text{MTTF}} * 10^9$$

Where:

| Label          | Name                | Formula/Value   |
|----------------|---------------------|---|
| af             | Acceleration Factor | $e^{(\frac{eV}{k}) \times (\frac{1}{t_1} - \frac{1}{t_2})}$   |
| eV             | Activation Energy   | 0.40 V  |
| k              | Bolzman's Constant  | 8.62 X 10 <sup>-5</sup> eV/°K   |
| t <sub>1</sub> |                     | Operating Temperature (°K)  |
| t <sub>2</sub> |                     | Accelerated Temperature (°K)  |
| Θ              | Theta               | Confidence Level (60% industry standard)  |
| r              | Failures            | Number of failed devices  |
| χ <sup>2</sup> | Chi-Square          | statistical significance for bivariate tabular analysis [table look-up] based on assumed Θ (Theta – confidence) and number of failures (r) For zero failures (60% Confidence): χ <sup>2</sup> = 1.830 |

DEVICE-HOURS = 360 x 2000 HOURS = 720,000

$$\text{ACCELERATION FACTOR} = e^{(\frac{0.40}{8.625}) \times (\frac{1}{298} - \frac{1}{398})} = 49.91009$$

$$\text{MTTF} = \frac{720,000 \times 49.91009 \times 2}{1.833} = 39,209,238 \text{ Hours}$$

$$\text{Failure Rate} = \frac{1.833}{720,000 \times 49.91009 \times 2} = 2.55E-8$$

$$\text{FITS} = \text{Failure Rate} * 1E9 = 26$$

**Notes :****Other XPRESSO Links**[XPRESSO Brochure](#)

| <b>Crystal Oscillators</b>  |
|---|
| <a href="#"><u>HCMOS 5 x 3.2mm 3.3V XO 0.75 to 250MHz</u></a>     |
| <a href="#"><u>HCMOS 7 x 5mm 3.3V XO 0.75 to 250MHz</u></a>       |
| <a href="#"><u>LVPECL 5 x 3.2mm 3.3V XO 0.75 to 1.35GHz</u></a>   |
| <a href="#"><u>LVPECL 7 x 5mm 3.3V XO 0.75 to 1.35GHz</u></a>     |
| <a href="#"><u>LVDS 5 x 3.2mm 3.3V XO 0.75 to 1.35GHz</u></a>     |
| <a href="#"><u>LVDS 7 x 5mm 3.3V XO 0.75 to 1.35GHz</u></a>       |
| <b>Voltage Controlled Crystal Oscillators</b>                     |
| <a href="#"><u>HCMOS 5 x 3.2mm 3.3V VCXO 0.75 to 250MHz</u></a>   |
| <a href="#"><u>HCMOS 7 x 5mm 3.3V VCXO 0.75 to 250MHz</u></a>     |
| <a href="#"><u>LVPECL 5 x 3.2mm 3.3V VCXO 0.75 to 1.35GHz</u></a> |
| <a href="#"><u>LVPECL 7 x 5mm 3.3V VCXO 0.75 to 1.35GHz</u></a>   |
| <a href="#"><u>LVDS 5 x 3.2mm 3.3V VCXO 0.75 to 1.35GHz</u></a>   |
| <a href="#"><u>LVDS 7 x 5mm 3.3V VCXO 0.75 to 1.35GHz</u></a>     |

[Main Website www.foxonline.com](http://www.foxonline.com)**Patent Numbers:**

US 6,664,860, US 5,960,403, US 5,952,890; US 5,960,405; US 6,188,290;

Foreign Patents: R.S.A. 98/0866, R.O.C. 120851; Singapore 67081, 67082; EP 0958652

China ZL 98802217.6, Malaysia MY-118540-A, Philippines 1-1998-000245, Hong Kong #HK1026079, Mexico #232179

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