This part is no longer available from Fox, please contact IDT for this product.

Model: FXO-LC32 SERIES

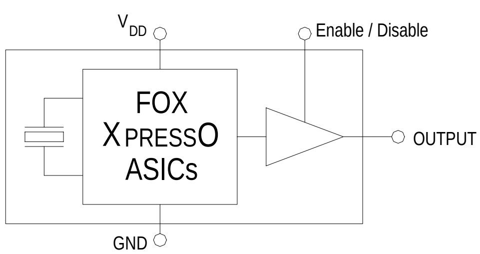
LVDS 3.2 x 2.5mm 2.5V Oscillator

Freq: 0.75 MHz to 1.0GHz

Rev.3/27/2012

Features

- XTREMELY Low Jitter
- Low Cost
- XPRESS Delivery
- Frequency Resolution to six decimal places
- Stabilities to ± 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

Applications

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

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 3rd 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.

Contents

FOXElectronics 5570 Enterprise Parkway Fort Myers, Florida 33905 USA +1.239.693.0099 FAX +1.239.693.1554 http://www.foxonline.com
EMEA Tel/Fax: +44 .1767.312632 | Asia Hong Kong Tel: +852.2854.4285 Fax +852.2854.4282
Japan Tel: +81.3.3374.2079 Fax: +81.3.3374.5221

Model Selection Guide & Fox Part Number

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

Model Description

F X O – L C 3 2 5 R – 6 2 2 . 0 8 Frequency (in MHz)
Resolutions to 6 places past the decimal point

Output	Crystal	Package	Voltage	Stability	Temperature
H = HCMOS	C = **Ceramic**	3 = **3.2 x 2.5mm**	3 = 3.3 V	0 = ± 100 PPM	*blank* = -20°C to +70°C
L = **LVDS**	Q = Quartz	5 = 5 x 3.2mm	2 = **2.5 V**	5 = ± 50 PPM	R = -40°C to +85°C
P = LVPECL		7 = 7 x 5mm		**6** = ± 25 PPM (-20 ~ +70°C)	
M = **LVDS** ***(pin 2 E/D)***					
Q = LVPECL *(pin 2 E/D)*					
X = HCMOS *(comp 2nd Output)*					

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)

769A – 6 2 2 . 0 8 – 2

The 1st Field
Product Code #
769A = FXO–LC32
769 = FXO–LC33
770B = FXO–LC52
770 = FXO–LC53
770C = FXO-MC52
770A = FXO-MC53

The 2nd Field
The Customer's Frequency

The 3rd 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-LC325R-622.08 = LVDS Output, Ceramic, 3.2 x 2.5mm Package, 2.5V, ±50 PPM Stability, -40 to +85°C Temperature Range, at 622.08 MHz

Electrical Characteristics

Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Frequency Range	F_O		0.750 MHz to 1.0 GHz
Frequency Stability [1]		0.75 ~ 630.000 MHz (-20 to +70°C) 0.75 ~ 630.000 MHz (-40 to +85°C) 630.000+ MHz ~ 1.000 GHz (-20 to +70°C) 630.000+ MHz ~ 1.000 GHz (-40 to +85°C)	100, 50, 25* PPM 100, 50 PPM 100, 50 PPM 100 PPM
Temperature Range	T_O T_{STG}	Standard operating *Optional operating* Storage	-20°C to +70°C *-40°C to +85°C* -55°C to +125°C
Supply Voltage	V_{DD}	Standard	2.5V ± 5%
Input Current (@ 100 Ohm LOAD)	I_{DD}	0.75 ~ 20.000 MHz 20.000+ ~ 220.000 MHz 220.000+ ~ 630.000 MHz 630.000+ MHz ~ 1.000 GHz	26 mA 34 mA 44 mA 65 mA
Output Load		Standard	100 Ohms Typ.
Start-Up Time	T_S		10 mS
Output Enable / Disable Time			100 nS
Moisture Sensitivity Level	MSL	*JEDEC J-STD-20*	1
Termination Finish			Au

[1]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.)

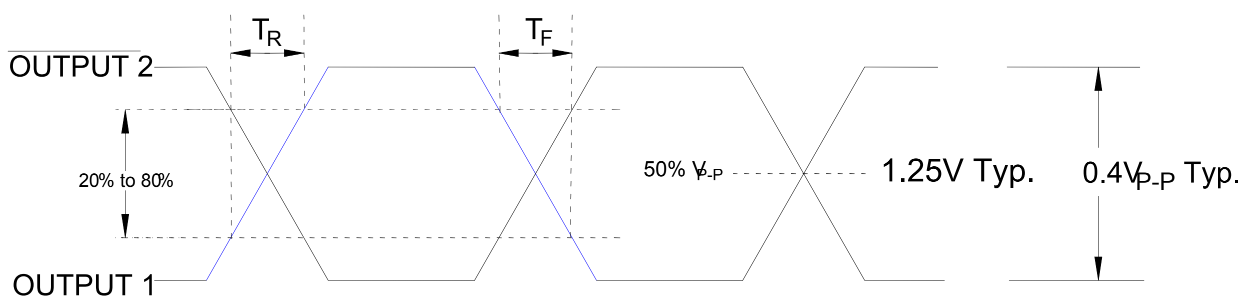
Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Input Voltage	V_{DD}		–0.5V to +5.0V
Operating Temperature	T_{AMAX}		–55°C to +105°C
Storage Temperature	T_{STG}		–55°C to +125°C
Junction Temperature			125°C
ESD Sensitivity	HBM	Human Body Model	> 1 kV

Output Wave Characteristics

Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Differential Output Voltage	V_{OD}	0.75 MHz to 1.0 GHz	0.4V Typ.
Output Offset Voltage	V_{OS}	Volts DC	1.25V Typ
Output Symmetry (See Drawing Below)		@ 50% V_{P-P} Level	45% ~ 55%
Output Enable (PIN # 1) Voltage [Note1]	V_{IH}		≥ 70% V_{DD}
Output Disable (PIN # 1) Voltage [Note1]	V_{IL}		≤ 30% V_{DD}
Cycle Rise Time (See Drawing Below)	T_R	20%~80% Vp-p	400 pS
Cycle Fall Time (See Drawing Below)	T_F	80%~20% Vp-p	400 pS

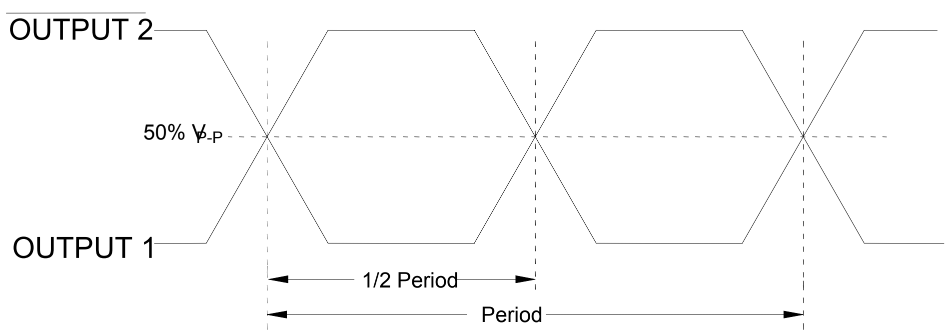
[Note1] *An optional PIN # 2 as Enable / Disable is available – see Model Selection Guide (page 2)*

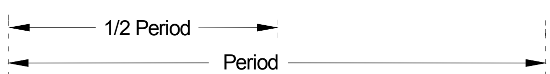
Rise Time / Fall Time Measurements



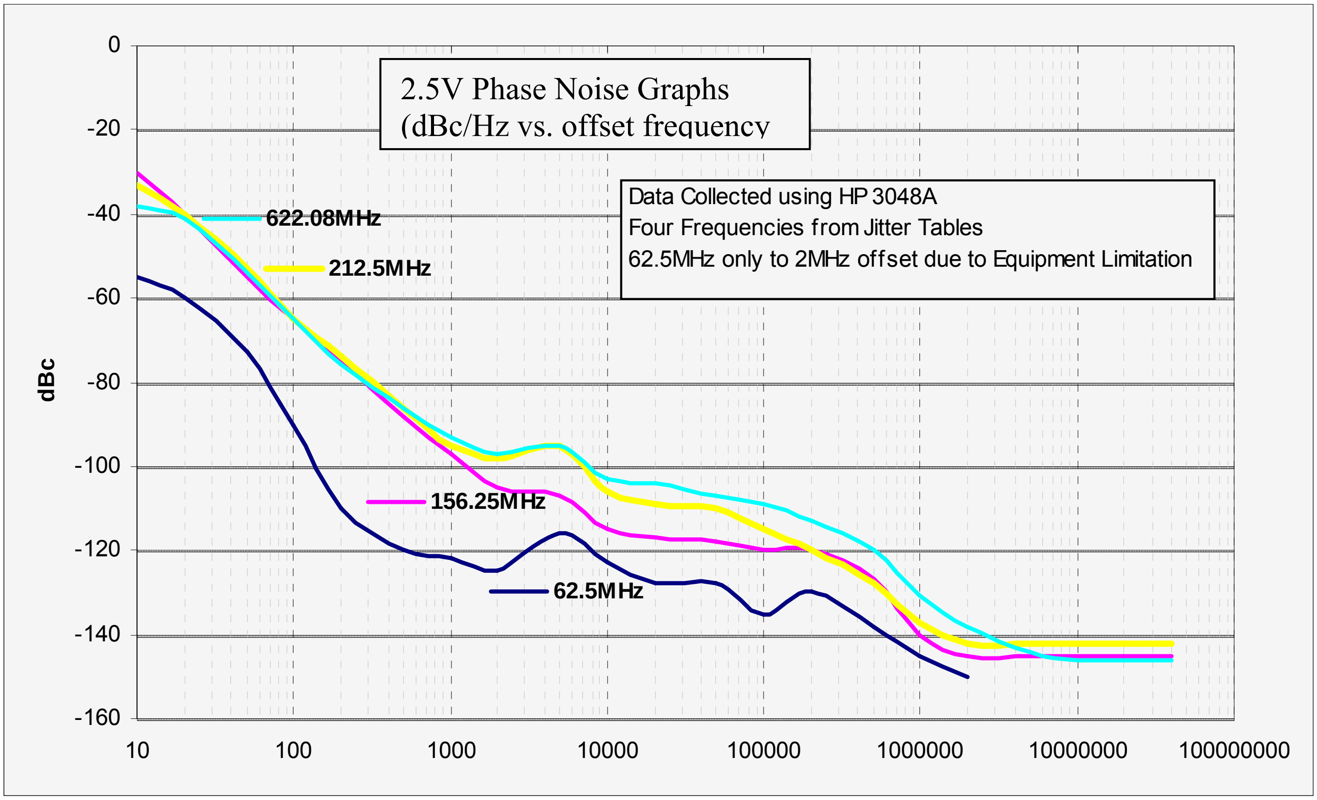
Oscillator Symmetry

Ideally, Symmetry should be 50/50 for 1/2 period -- Other expressions are 45/55 or 55/45





Phase Noise



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

LVDS Phase Jitter & Time Interval Error (TIE)

Frequency	Phase Jitter (12kHz to 20MHz)	T I E (Sigma of Jitter Distribution)	Units
62.5 MHz	0.9	2.9	pS RMS
156.25 MHz	1.1	3.5	pS RMS
212.5 MHz	1.2	3.9	pS RMS
622.08MHz	0.8	2.4	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)*

LVDS Random & Deterministic Jitter Composition

Frequency	Random (Rj) (pS RMS)	Deterministic (Dj) (pS P-P)	Total Jitter (Tj) (14 x Rj) + Dj
62.5 MHz	1.3	9.6	28.6 pS
156.25 MHz	1.4	9.8	29.4pS
212.5 MHz	1.4	11.4	30.9 pS
622.08 MHz	1.0	13.05	27.5 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)*

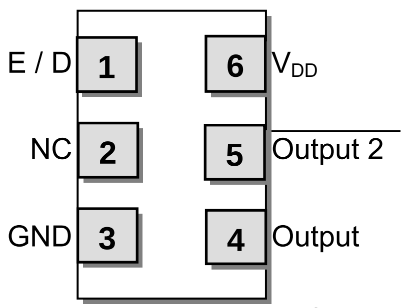
Pin Description and Recommended Circuit

Pin #	Name	Type	Function
1	E / D [1]	Logic	Enable / Disable Control of Output (0 = Disabled)
2	NC		*No Connection – Leave OPEN*
3	GND	Ground	Electrical Ground for V_{DD}
4	Output	Output	LVDS Oscillator Output
5	Output 2	Output	Complementary LVDS Output
6	V_{DD} [2]	Power	Power Supply Source Voltage

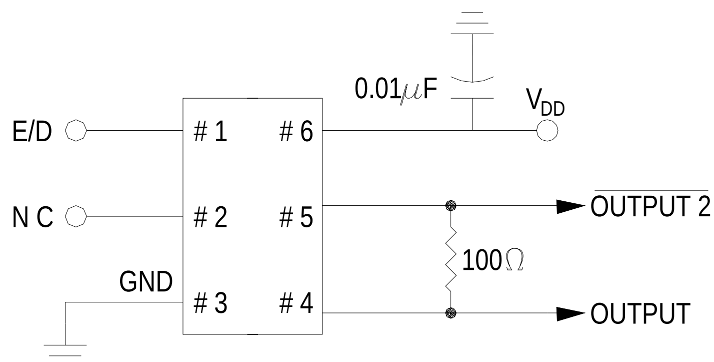
NOTES:

[1] Includes pull-up resistor to V_{DD} to provide output when the pin (1) is No Connect.

[2] Installation should include a 0.01µF bypass capacitor placed between V_{DD} (Pin 6) and GND (Pin 3) to minimize power supply line noise.



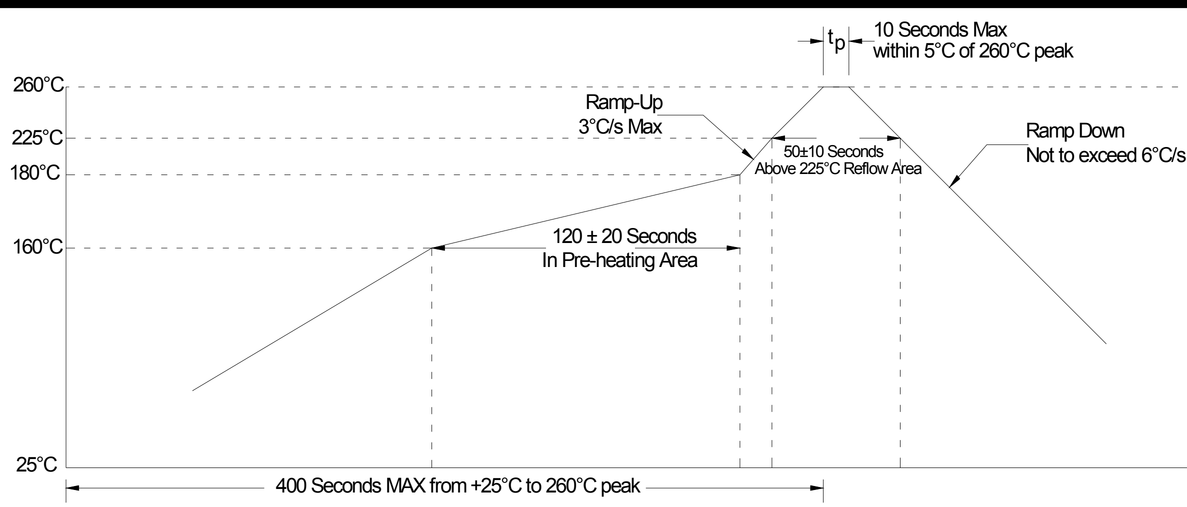
Terminations as viewed from the Top



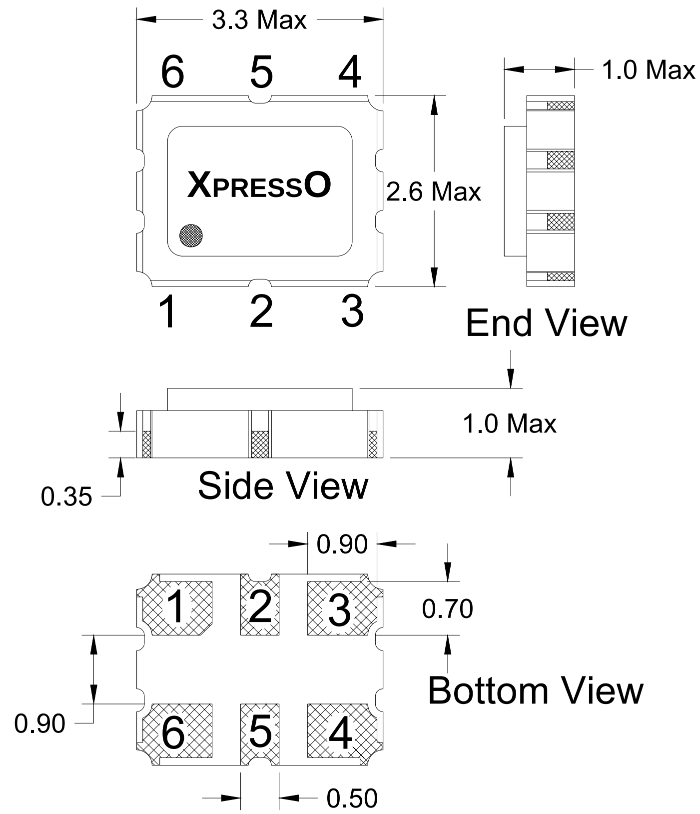
Enable / Disable Control

	Pin # 1 (state)	Output (Pin # 4, Pin # 5)
	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)



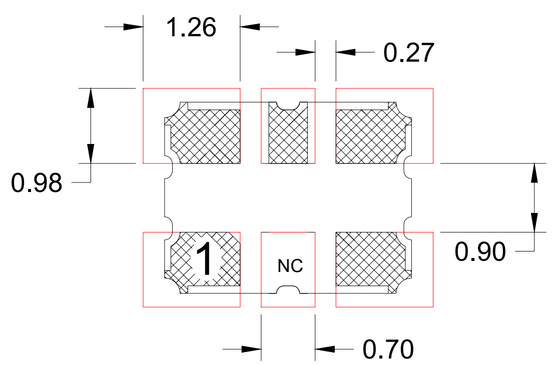
Mechanical Dimensional Drawing & Pad Layout



Actual part marking is depicted.

See **Traceability** *(pg. 9)* for more information

Recommended Solder Pad Layout

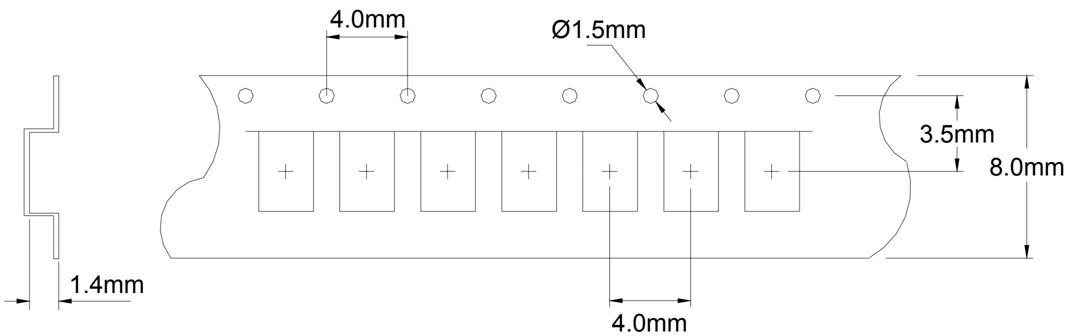


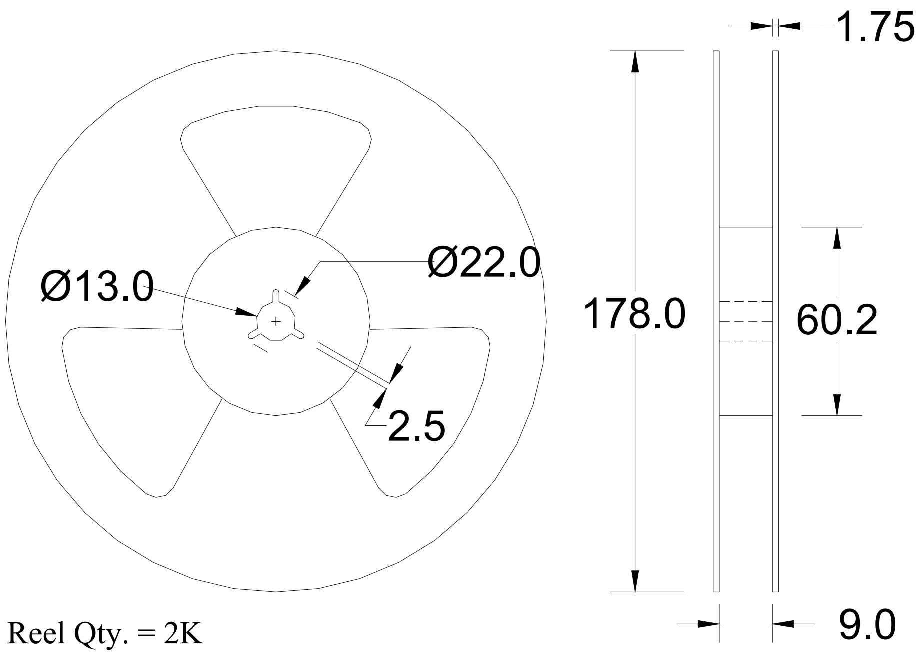
Pin Connections

# 1 E / D	# 4 $V_{OUT\ 1}$
# 2 N.C.	# 5 $V_{OUT\ 2}$
# 3 GND	# 6 V_{DD}

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

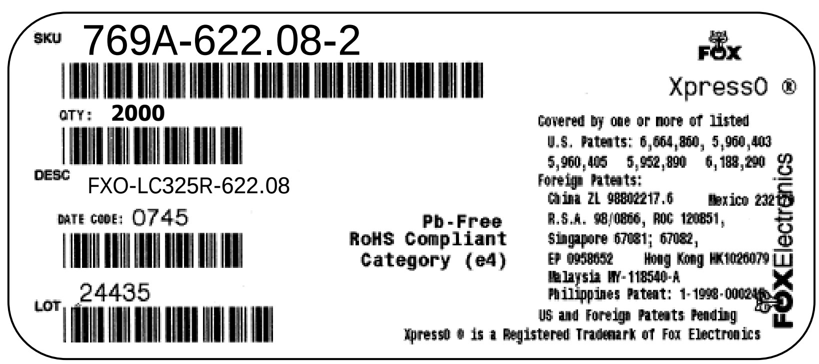




Standard Reel Qty. = 2K

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

- Fox Part Number: 769A-**622.08-2**
- Quantity: **2000** pieces
- Description: **FXO-LC325R-622.08**
- Date Code **0745**
  (YYWW 2007 45th 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

3rd Party (SGS) Material Report

SGS

Test Report

No. : CE/2008/63138 Date : 2008/06/19 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 CERAMIC OSCILLATORS
Style/Item No.	:	SEAM SEAL CLOCK OSCILLATOR
Buyer/Order No.	:	47454
Sample Receiving Date	:	2008/06/12
Testing Period	:	2008/06/12 TO 2008/06/19

==

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

SGS Taiwan Ltd.
台灣檢驗科技股份有限公司
No. 33 Wu Chyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號
t (886-2) 2299-3939 f (886-2) 2299-3237 www.tw.sgs.com
Member of the SGS Group

SGS

Test Report

No. : CE/2008/63138 Date : 2008/06/19 Page : 2 of 4

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

Test Result(s)

PART NAME NO.1 : MIXED ALL PARTS

Test Item (s):	Unit	Method	MDL	Result No.1
Cadmium (Cd)	mg/kg	With reference to IEC 62321/2nd CDV (111/95/CDV). Determination of Cadmium by ICP-AES.	2	n.d.
Lead (Pb)	mg/kg	With reference to IEC 62321/2nd CDV (111/95/CDV). Determination of Lead by ICP-AES.	2	n.d.
Mercury (Hg)	mg/kg	With reference to IEC 62321/2nd CDV (111/95/CDV). Determination of Mercury by ICP-AES.	2	n.d.
Hexavalent Chromium Cr(VI) by alkaline extraction	mg/kg	With reference to IEC 62321/2nd CDV (111/95/CDV). Determination of Hexavalent Chromium for non-metallic samples by UV/Vis Spectrometry.	2	n.d.
Halogen	---	With reference to BS EN 14582:2007. Analysis was performed by IC method for F , Cl , Br, I content.	---	---
Halogen-Fluorine (F) (CAS No.: 007782-41-4)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC method for Fluorine content.	50	n.d.
Halogen-Chlorine (Cl) (CAS No.: 007782-50-5)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC method for Chlorine content.	50	n.d.
Halogen-Bromine (Br) (CAS No.: 007726-95-6)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC method for Bromine content.	50	n.d.
Halogen-Iodine (I) (CAS No.: 007553-56-2)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC method for Iodine content.	50	n.d.

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No. 33 Wu Chyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號
t (886-2) 2299-3939 f (886-2) 2299-3237 www.tw.sgs.com
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3rd Party (SGS) Material Report (continued)

SGS

Test Report

No. : CE/2008/63138 Date : 2008/06/19 Page : 3 of 4

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

Test Item (s):	Unit	Method	MDL	Result No.1
Sum of PBBs			-	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.
Sum of PBDEs (Mono to Nona)	mg/kg	With reference to IEC 62321/2nd CDV (111/95/CDV). Determination of PBB and PBDE by GC/MS.	-	n.d.
Monobromodiphenyl ether			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.
Sum of PBDEs (Mono to Deca)			-	n.d.

Note： 1. mg/kg = ppm
2. n.d. = Not Detected
3. MDL = Method Detection Limit
4. "---" = Not Conducted
5. " - " = Not Regulated
6. The sample(s) was/were analyzed on behalf of the applicant as mixing sample in one testing. The above result(s) was/were only given as the informality value.

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t (886-2) 2299-3939 f (886-2) 2299-3237 www.tw.sgs.com
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3rd Party (SGS) Material Report (continued)

SGS

Test Report

No. : CE/2008/63138 Date : 2008/06/19 Page : 4 of 4

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

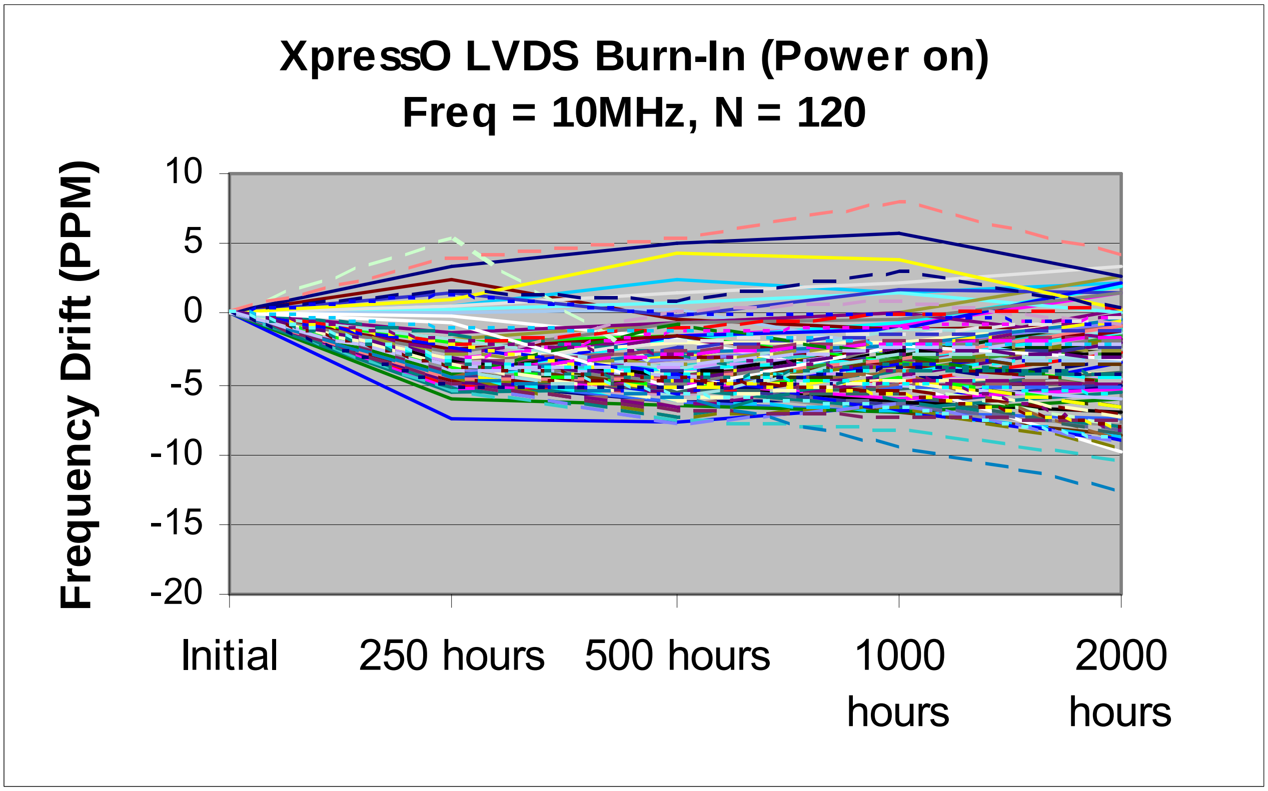
** End of Report **

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 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 ±1 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.] $$MTTF = \frac{devhrs \times af \times 2}{\chi^2}$$

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

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	8.62×10^{-5} *eV*/°K
t_1		Operating Temperature (°K)
t_2		Accelerated Temperature (°K)
Θ	Theta	Confidence Level (60% industry standard)
r	Failures	Number of failed devices
χ^2	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^2 = 1.830

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

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

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

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

FITS = Failure Rate *1E9 = 26

Notes :

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
US and Foreign Patents Pending
XpressO® Fox Electronics

Contact Information

(USA)-Worldwide Headquarters
Tel: 888-GET-2-FOX
Outside US: +1.239.693.0099,
Fax:+1.239.693.1554
Email: www.foxonline.com/email.htm

Fox Hong Kong
Tel: +852.2854.4285,
Fax:+852.2854.4282
Email: www.foxonline.com/email.htm

Fox EMEA
Tel/Fax: +44.1767.312632
Email: www.foxonline.com/email.htm

Fox Japan
Tel:+81.3.3374.2079,
Fax: +81.3.3377.5221
Email: www.foxonline.com/email.htm