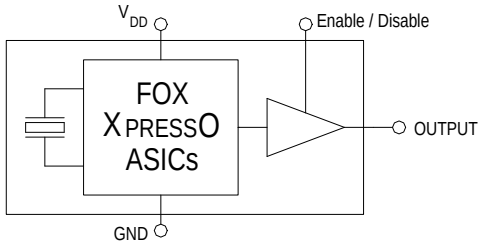
Model: FXU-LC53 SERIES

LVDS 5 x 3.2mm 3.3V Oscillator Freq: 0.016 MHz to 1.5GHz

Rev. 07/08/2015

Features

- ULTRA Low Jitter
- Low Cost
- XPRESS Delivery
- Frequency Resolution to six decimal places
- Stabilities to ± 20 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 compliant
- Gold over Nickel Termination Finish
- Serial ID with Comprehensive Traceability



For more information -- Click on the drawing

Applications

- ANY application requiring a high performance LVDS oscillator
- SONET
- Ethernet
- Storage Area Network
- Broadband Access
- Microprocessors / DSP / FPGA
- Industrial Controllers
- Test and Measurement Equipment

Description

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

The 4th order Delta Sigma Modulator reduces noise to the levels that are comparable to traditional Bulk Quartz and SAW oscillators. The ASICs family has the ability to select the output type and supply voltage.

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

Finished XPRESSO-ULTRA parts are 100% final tested.

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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

FXU – L C 5 3 5 R – 6 2 2.0 8 **Frequency (in MHz)**

Resolutions to 6 places past the decimal point

- L = **LVDS**
- M = **LVDS** ***(pin 2 E/D)***
- C = **Ceramic**
- 5 = **5 x 3.2mm**
- 3 = **3.3 V**
- 0 = **± 100 PPM**
- 5 = **± 50 PPM**
- **6 = ±25 PPM**
- **8 = ±20 PPM (-20°C to +70°C)**
- *blank* = **-20°C to +70°C**
- R = **-40°C to +85°C**

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)

854 – 622.08 – 3

The 1st Field
Product Code #
854 = FXU–LC5
854C = FXU-MC5

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, FXU-LC535R-622.08 = LVDS Output, Ceramic, 5 x 3.2mm Package, 3.3V, ±50 PPM Stability, -40 to +85°C Temperature Range, at 622.08 MHz

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Electrical Characteristics

Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Frequency Range	F_O		0.016 MHz to 1.5 GHz
Frequency Stability [1]		0.016 MHz to 1.5 GHz	100, 50, 25, 20[2] PPM
Temperature Range	T_O	Standard operating 0.016 MHz to 1.5 GHz	-20°C to +70°C
		Optional operating 0.016 MHz to 1.5 GHz	*-40°C to +85°C*
	T_{STG}	Storage	-55°C to +125°C
Supply Voltage	V_{DD}	Standard	3.3 V ± 5%
Input Current (@ Standard Load)	I_{DD}	0.016 MHz to 400 MHz 400.000+ MHz to 1.5 GHz	97 mA 122 mA
Output Load		Standard	100 Ohms Typical
Start-Up Time	T_S		10 mS
Output Enable / Disable Time			100 nS
Moisture Sensitivity Level	MSL	*JEDEC J-STD-020*	1
Termination Finish			Au

Note 1 – Stability is inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, 1 year aging at 25°C, shock and vibration.

2 – ±20 PPM stability -20°C to +70°C only.

Absolute Maximum Ratings *(Useful life may be impaired. For user guidelines only, not tested)*

Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Input Voltage	V_{DD}		–0.5V to +5.0V
Operating Temperature	T_{AMAX}		–55°C to +85°C
Storage Temperature	T_{STG}		–55°C to +125°C
Junction Temperature			125°C
ESD Sensitivity	HBM	Human Body Model	1 kV

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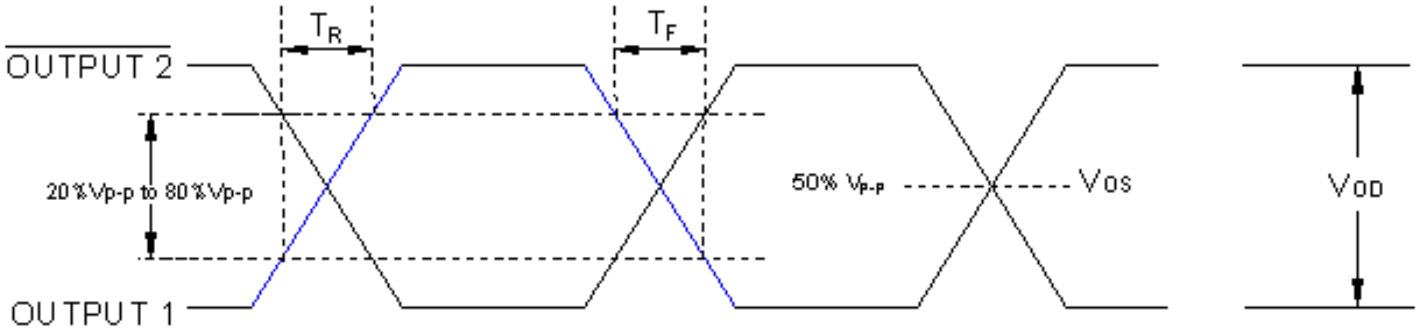
Output Wave Characteristics

Parameters	Symbol	Condition	Maximum Value (unless otherwise noted)
Differential Output Voltage	V_{OD}	0.016 MHz to 1.5 GHz	0.25V to 0.6V
Output Offset Voltage	V_{OS}	0.016 MHz to 1.5 GHz	1.0V to 1.375V
Output Symmetry		0.016 MHz to 1.5 GHz 50% V_{P-P}	45% ~ 55%
Output Enable Note1 (PIN # 1) Voltage	V_{IH}		≥ 70% V_{DD}
Output Disable Note1 (PIN # 1) Voltage	V_{IL}		≤ 30% V_{DD}
Cycle Rise Time	T_R	0.016 MHz to 1.5 GHz 20%~80%V_{P-P}	380 pS
Cycle Fall Time	T_F	0.016 MHz to 1.5 GHz 80%~20%V_{P-P}	380 pS

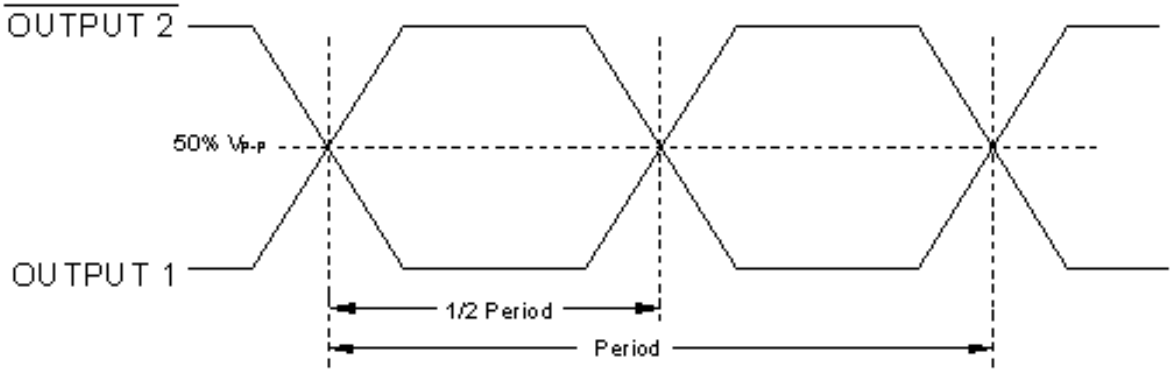
Note1 *An optional PIN # 2 as Enable / Disable is available – see Model Selection Guide (page 2)*

Output Levels / 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



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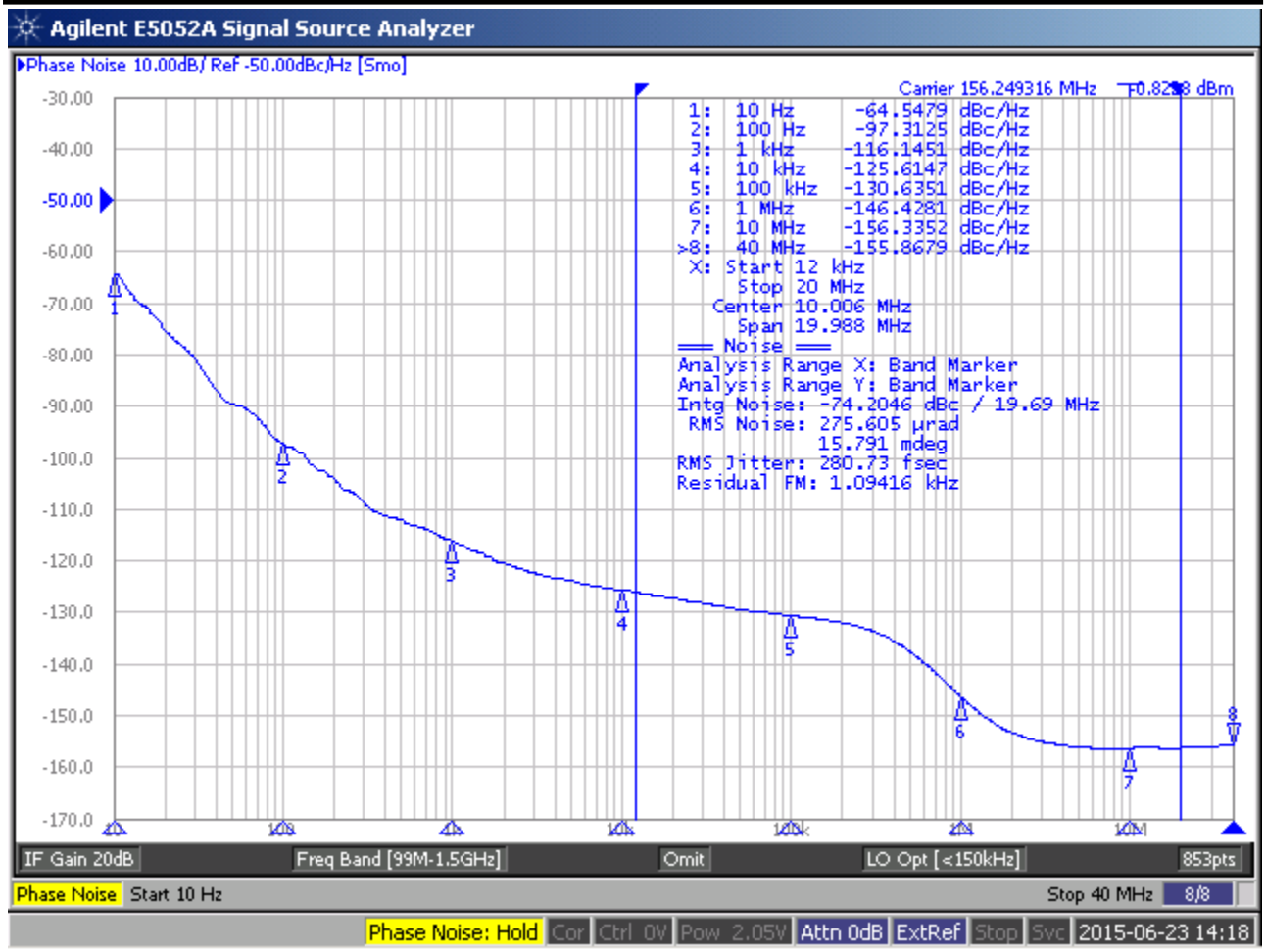
Phase Noise (typical measurement at 156.25 MHz)



Jitter is frequency dependent. Below are typical measured values for 156.25 MHz.
(Consult Fox Tech Support for other frequencies.)

LVDS Phase Jitter & Time Interval Error (TIE)

Frequency	Phase Jitter (pS) (12kHz to 20MHz)	TIE (pS) (sigma of jitter distribution)
156.25 MHz	0.28	2.5

Phase Jitter is integrated from Agilent 5052A Signal Noise Analyzer; measured directly into 50 ohm input; V_{DD} = 3.3V.
TIE was measured on LeCroy LC684 Digital Storage Scope, directly into 50 ohm input, with Amherst M1 software; V_{DD} = 3.3V.
*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) (pS - (14 x Rj) + Dj)
156.25 MHz	1.0	6.1	20

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)*

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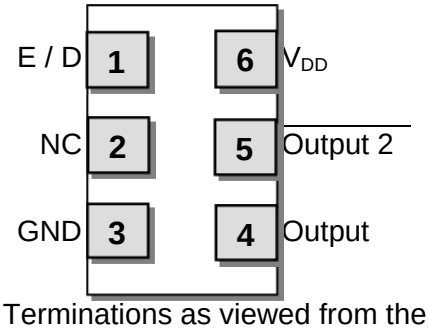
Pin Description and Recommended Circuit

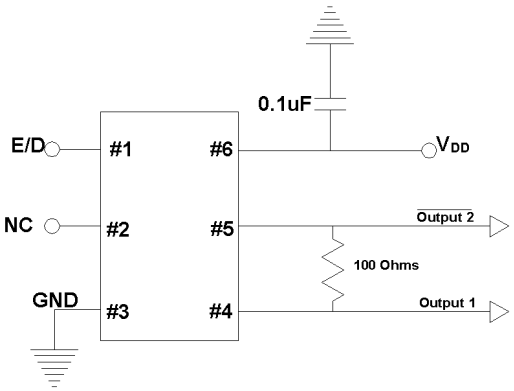
Pin #	Name	Type	Function
1	E / D [1]	Logic	Enable / Disable Control of Output (0 = Disabled)
2	NC [2]		*No Connection – Leave OPEN*
3	GND	Ground	Electrical Ground for V_{DD}
4	Output	Output	LVDS Oscillator Output
5	Output 2	Output	Differential LVDS Output
6	V_{DD} [3]	Power	Power Supply Source Voltage

NOTES:

[1] Includes pull-up resistor to V_{DD} to provide output when the pin (1) is No Connect. (Also see note 2)
[2] An optional pin # 2 Enable / Disable is available.
[3] Installation should include a 0.1µF bypass capacitor placed between V_{DD} (Pin 6) and GND (Pin 3) to minimize power supply line noise.



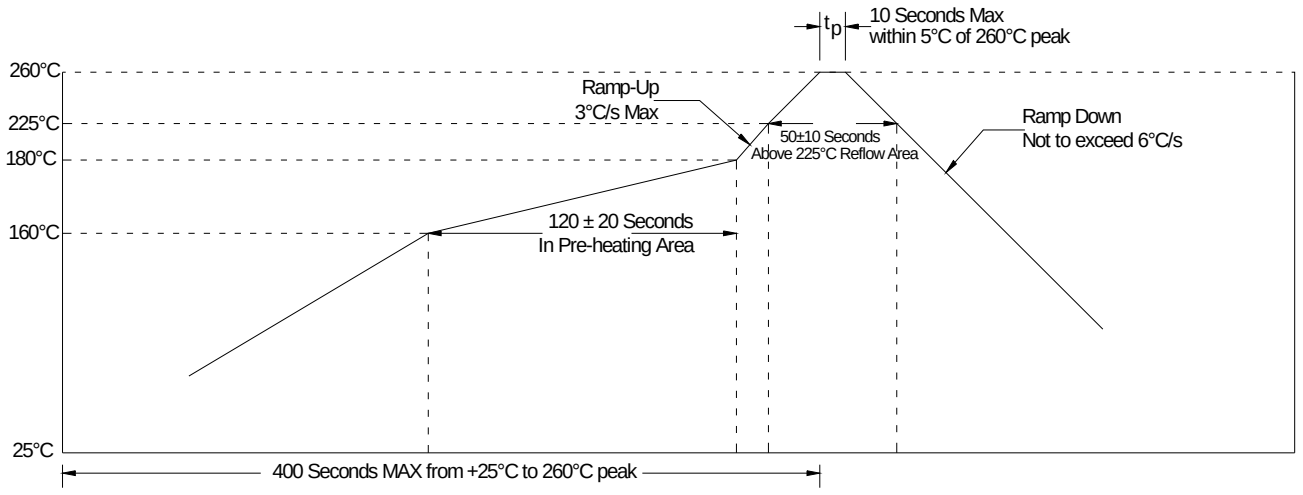
Terminations as viewed from the Top



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)



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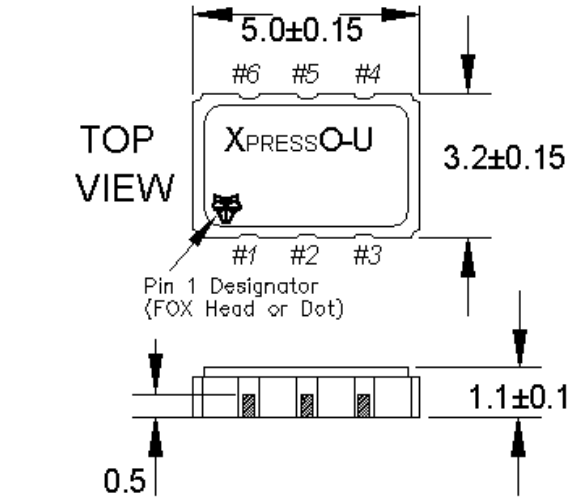
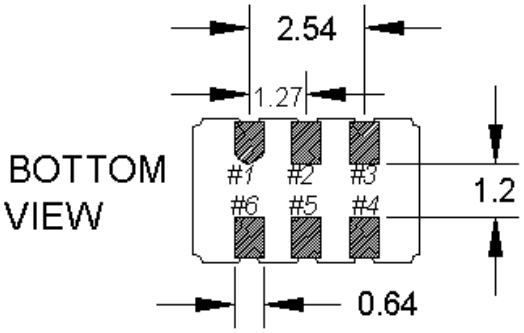
Mechanical Dimensional Drawing & Pad Layout

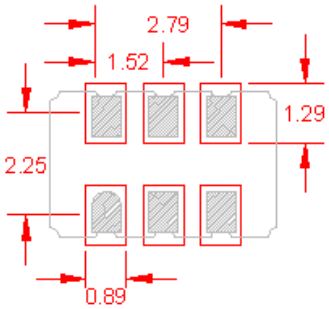


Actual part marking is depicted.

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



Recommended Solder Pad Layout



Pin Connections

#1) E/D*	#4) Output
#2) *NC**	#5) Output 2
#3) GND	#6) V_{DD}

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

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

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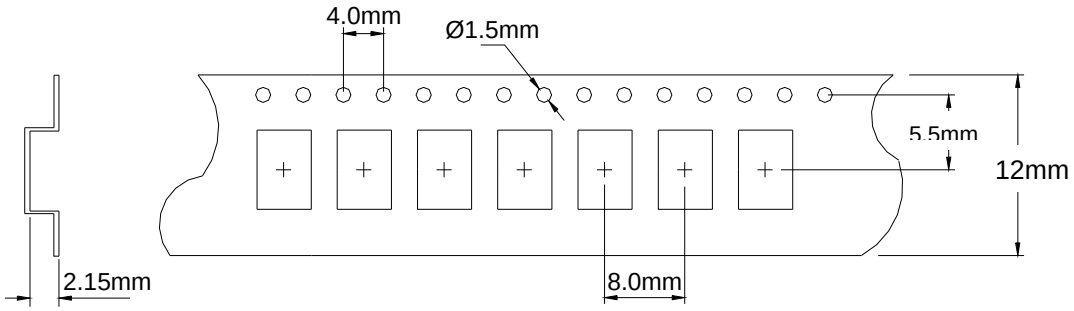
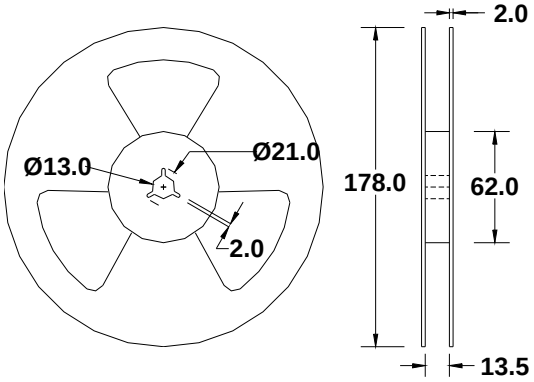
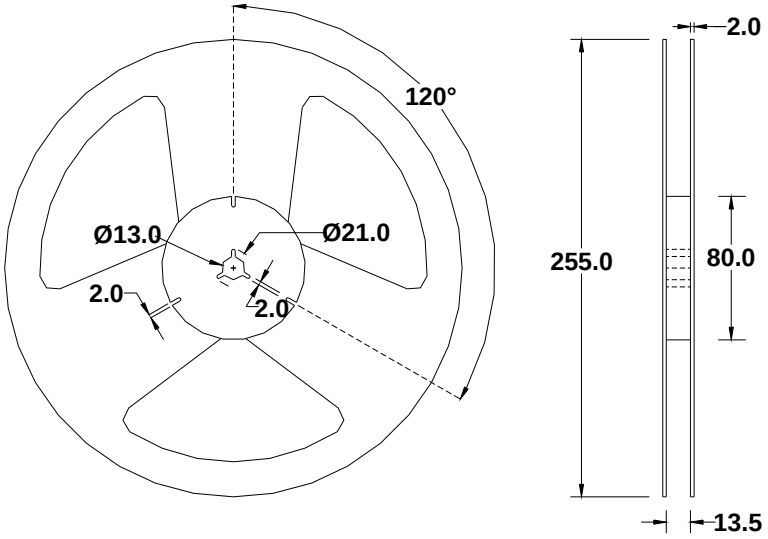
Tape and Reel Dimensions



1k Reel Dimensions in mm

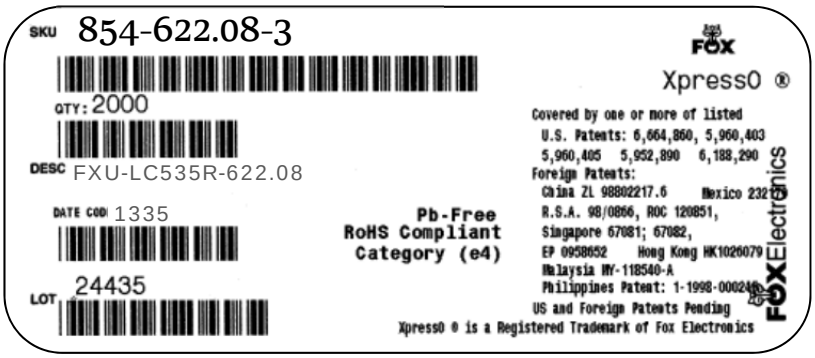


2k Reel Dimensions in mm



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

- **Fox Part Number: 854-622.08-3**
- **Quantity**: **2000 pieces**
- **Description:** **FXU-LC535R-622.08**
- **Date Code** **1335** (YYWW 2013 35th wk)
- **LOT #** **24435**



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Traceability – LOT Number & Serial Identification

LOT Number

The LOT Number has direct ties to the customer purchase order. The LOT Number is stored internally in non-volatile memory. XPRESSO-ULTRA parts are packaged in Cut Tape or Tape and Reel and placed in an ESD bag. The package label containing the Lot number is affixed to the ESD bag, and in the case of Tape and Reel it is attached to the reel as well.

It is recommended that the XPRESSO-ULTRA 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-ULTRA 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-ULTRA part. The Serial ID is unique for each and every XPRESSO-ULTRA part, and can be read by special Fox equipment.

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

- Equipment that the XPRESSO-ULTRA part was configured on
- Raw material used to configure the XPRESSO-ULTRA 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-ULTRA part produced and can then obtain the information from above within 24 hours

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Mechanical and Environmental Testing

Parameter	Test Method
Mechanical Shock	MIL-STD-202 Method 213 Condition C
Mechanical Vibration	MIL-STD-202 Method 204 5g's for 20 minutes 12 cycles of each 3 orientations: X, Y, Z
High Temperature Operating Life (HTOL)	Under Power @ 125°C for 1000 Hours
Hermetic Seal	MIL-STD-202F: Method 112D Test condition C He pressure: 4 ±1 kgf / cm^2 2 Hour soak

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XpressO-ULTRA Home

XpressO-ULTRA XOs

XpressO Brochure

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
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The above specifications, having been carefully prepared and checked, is believed to be accurate at the time of publication; however, no responsibility is assumed by Fox Electronics for inaccuracies.

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