

FX-424 Low Jitter Frequency Translator



Features

- Quartz-based PLL for Ultra-Low Jitter
- Frequency Translation up to 850 MHz
- Accepts up to 4 externally-muxed clock inputs
- CMOS / LVDS / LVPECL Inputs compatible
- Differential LVPECL or LVCMOS Output
- Lock Detect / Loss of Signal Alarms
- Output Disable
- 20.3 x 13.7 x 5.1 mm surface mount package

Description

The FX-424 is a precision quartz-based frequency translator used to translate an input frequency such as 8 kHz, 1.544 MHz, 2.048 MHz, 19.44 MHz etc. to any specific frequency from 1.544 MHz to 850 MHz. The FX-424 can perform either up or down frequency conversion. The FX-424's superior jitter performance is achieved through the use of a precision VCXO or VCSO. With the use of an external multiplexer, up to 4 different input clocks can be translated to a common output frequency.

Applications

Description	Standard
• 1-2-4 Gigabit FC	INCITS 352-2002
• 10 Gigabit FC	INCITS 364-2003
• 10GbE LAN / WAN	IEEE 802.3ae
• OC-192	ITU-T G.709
• SONET / SDH	GR-253-CORE Issue 3
• FEC (Forward Error Correction) Scaling	

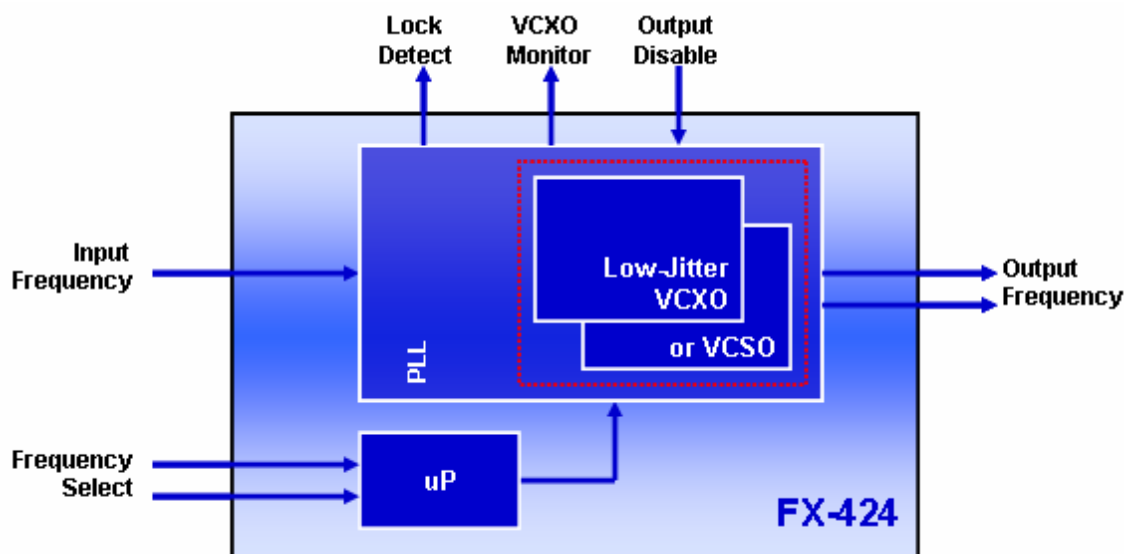


Figure 1. Functional Block Diagram

FX-424 Low Jitter Frequency Translator

Table 1. Electrical Performance

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Frequency						
Input Frequency	F_{IN}	0.008		170	MHz	1,2,3
Capture Range	APR	± 40			ppm	1,2,3
Output Frequency	F_{OUT}	1.544		850	MHz	1,2,3
Supply						
Voltage	V_{CC}	3.13	3.3	3.46	V	2,3
Current (No Load)	I_{CC}		45	60	mA	3
LVCMOS Input						
Input High Voltage	V_{IH}	2		V_{CC}	V	2,3
Input Low Voltage	V_{IL}	-0.3		0.8	V	
LVPECL Input						
Input High Voltage	V_{IH}	1.49		2.72	V	6
Input Low Voltage	V_{IL}	0.86		2.125	V	6
LVCMOS Output (Option A)			LVCMOS			2,3
Differential Output (Option F)						
Common Mode Output Voltage	V_{OCM}	$V_{CC}-1.5$	$V_{CC}-1.3$	$V_{CC}-1.1$	V	2,3
Output High Voltage	V_{OH}	$V_{CC}-1.025$	$V_{CC}-0.950$	$V_{CC}-0.880$	V	2,3
Output Low Voltage	V_{OL}	$V_{CC}-1.810$	$V_{CC}-1.700$	$V_{CC}-1.620$	V	2,3
Peak-to-Peak Output Voltage	V_{P-P}		700		mV-pp	2,3
Rise Time	t_R		0.5		ns	4,5
Fall Time	t_F		0.5		ns	4,5
Symmetry	SYM	45	50	55	%	2,3
SSB Phase Noise, $F_{OUT} = 155.52/622.08$						
@ 10 Hz Offset	Φ_n		-64/-27		dBc/Hz	5
@ 100 Hz Offset	Φ_n		-95/-55		dBc/Hz	
@ 1 kHz Offset	Φ_n		-123/-85		dBc/Hz	
@ 10 kHz Offset	Φ_n		-143/-110		dBc/Hz	
@ 100 kHz Offset	Φ_n		-146/-130		dBc/Hz	
@ 1 MHz Offset	Φ_n		-146/-146		dBc/Hz	
@ 10 MHz Offset	Φ_n		-146/-146		dBc/Hz	
Operating Temperature	T_{OP}	-40		85	°C	1,3

1. See Standard Frequencies and Ordering Information.
2. Parameters are tested with production test circuit below (Fig 2).
3. Parameters are tested at ambient temperature with test limits guardbanded for specified operating temperature.
4. Measured from 20% to 80% of a full output swing (Fig 3).
5. Not tested in production, guaranteed by design, verified at qualification.

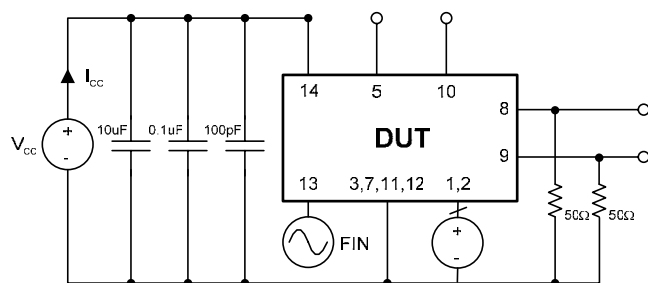


Figure 2. Test Circuit

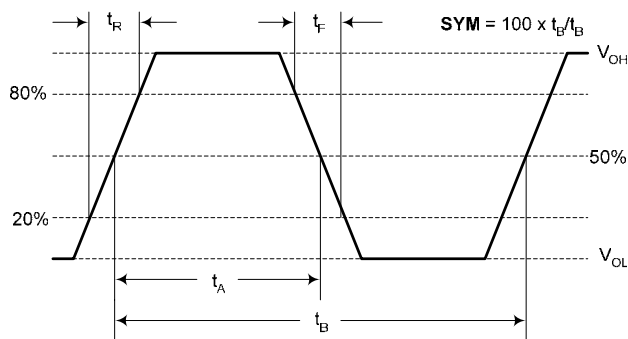


Figure 3. LVPECL Waveform

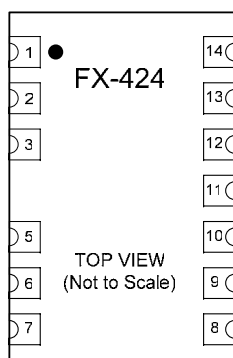


Figure 4. Pin Configuration

Table 2. Pin Out

Pin #	Symbol	I/O	Level	Function
1	SEL0	I	LVTTL	Input Frequency Select*
2	SEL1	I	LVTTL	Input Frequency Select*
3	GND	GND	Supply	Case and Electrical Ground
4				Not present
5	VMON	O	Analog	VCXO Control Voltage Monitor Under locked conditions VMON should be > 0.3V and <3.0V. The input frequency may be out of range if the voltage exceeds these levels.
6	OD	I	LVC MOS	Output Disable Disabled = Logic "1" Enabled = Logic "0" or no connect
7	GND	GND	Supply	Case and Electrical Ground
8	FOUT	O	LVPECL or LVC MOS	Frequency Output
9	CFOUT	O or GND	LVPECL or LVC MOS	Complementary Frequency Output – Note for LVC MOS option this pad will be tied to GND.
10	LD	O	LVC MOS	Lock Detect Locked = Logic "1" Loss of Signal = Logic "0"
11	GND	GND	Supply	Case and Electrical Ground
12	GND	GND	Supply	Case and Electrical Ground
13	FIN	I	LVC MOS or LVPECL	Input Frequency. The FX-424 series AC couples the input for handling of either LVC MOS or LVPECL input signals.
14	VCC	VCC	Supply	Power Supply Voltage (3.3 V $\pm$ 5%)

* For applications requiring two to four input frequencies, Vectron will assign a unique part number and the Input Frequency versus SEL[1:0] settings will be provided in a Specification Control Drawing. For single input configurations it is recommended that SEL0 and SEL1 are tied to ground.

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Outline Diagram

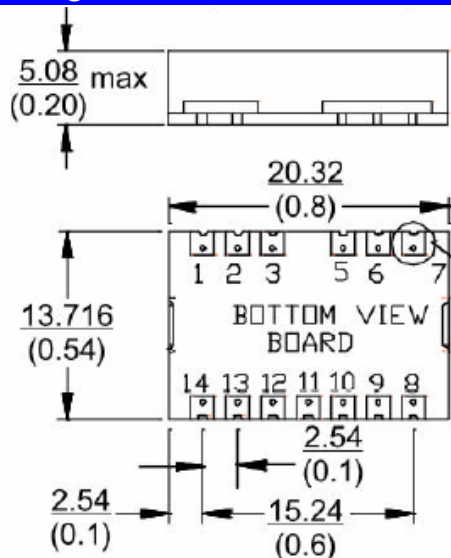


Figure 5.

Suggested Pad Layout

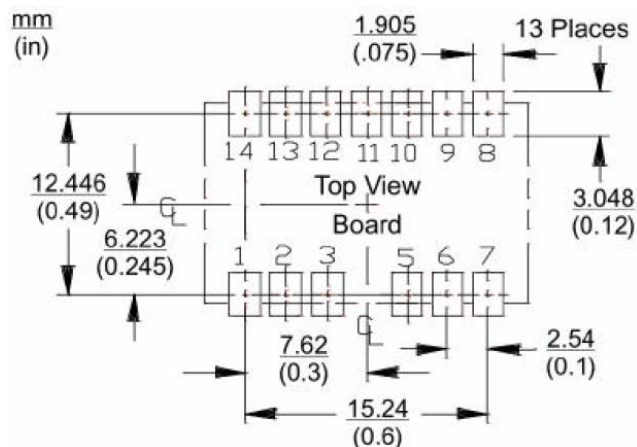


Figure 6.

Table 3. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Power Supply	V_{CC}	0 to 6	V
Output Current	I_{OUT}		mA
Storage Temperature	T_S	-55 to 125	°C
Soldering Temp/Time	T_{LS}	220/10	°C/sec

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in excess of conditions represented in the operational sections of this data sheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability.

Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The FX-424 family is undergoing the following qualification tests:

Environmental Compliance

Parameter	Conditions
Mechanical Shock	MIL-STD-883, Method 2002
Mechanical Vibration	MIL-STD-883, Method 2007
Solderability	MIL-STD-883, Method 2003
Gross and Fine Leak	MIL-STD-883, Method 1014
Resistance to Solvents	MIL-STD-883, Method 2016

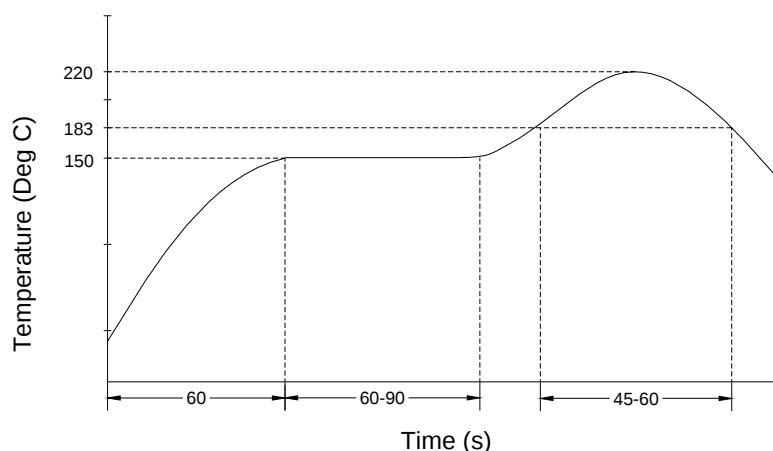
Handling Precautions

Although ESD protection circuitry has been designed into the FX-424 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged-device model (CDM) for ESD susceptibility testing and design protection evaluation

ESD Ratings

Model	Minimum	Conditions
Human Body Model	500 V	MIL-STD 883, Method 3015
Charged Device Model	500 V	JEDEC, JESD22-C101

Recommended Solder Reflow Profile



NOTE: The FX-424 should not be subjected to a wash process that will immerse it in solvents. NO CLEAN is the recommended procedure. The FX-424 has been designed for pick and place reflow soldering. The suggested reflow profile is shown above. The FX-422/3 series may be reflowed once and should not be reflowed in the inverted position.

This profile shows a ramp up condition to prevent thermal shock, a preheat period in which the flux is activated, a ramp up to 183°C which is the reflow temperature of Sn/Pb eutectic, and a gradual cool down. The time above 183°C should not exceed 60 seconds and the peak temperature should be no more than 220°C for 10 seconds. The FX-424 should not be exposed to an aqueous wash.

Application Circuits

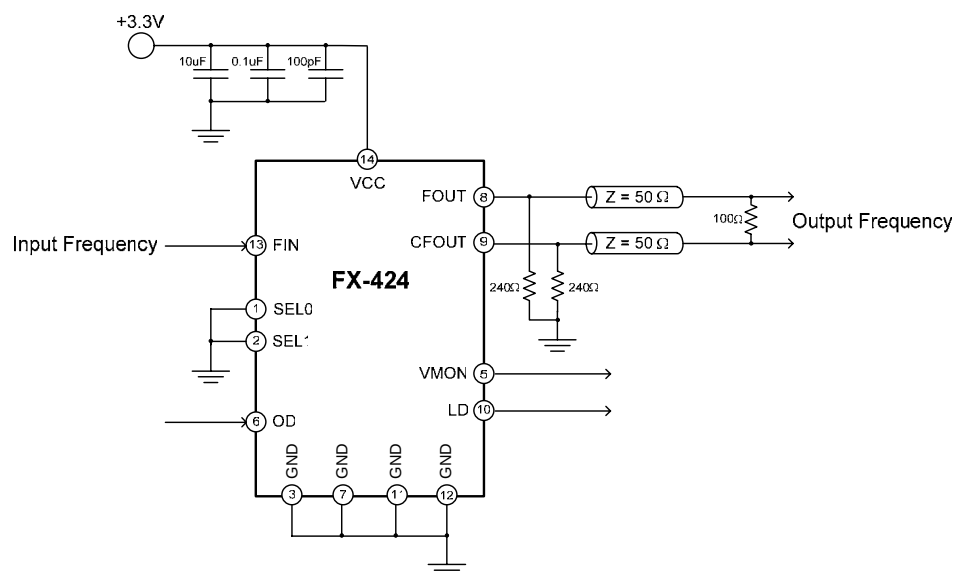


Figure 7. Single Input Frequency Translation

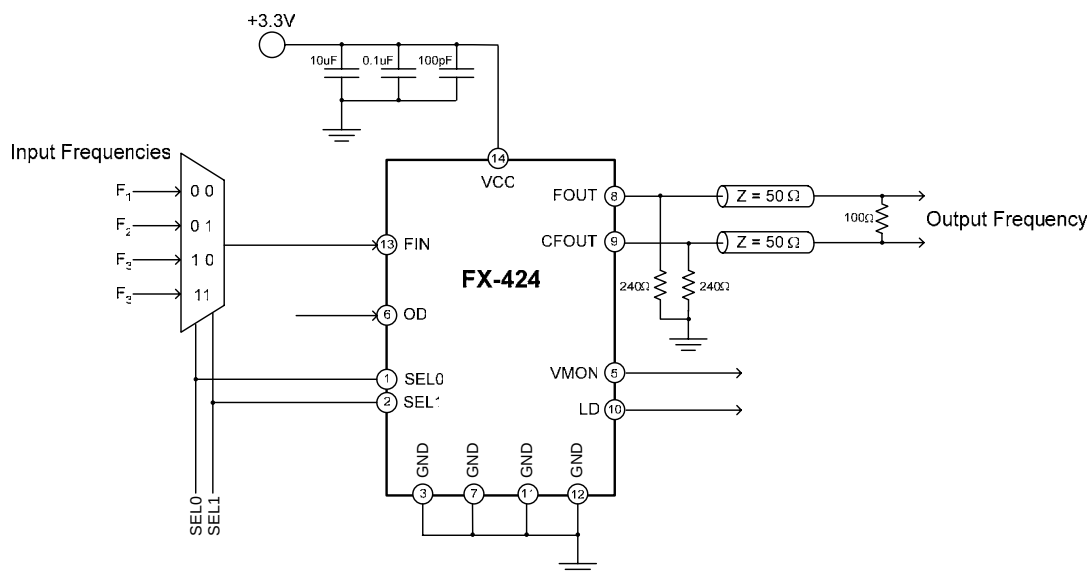
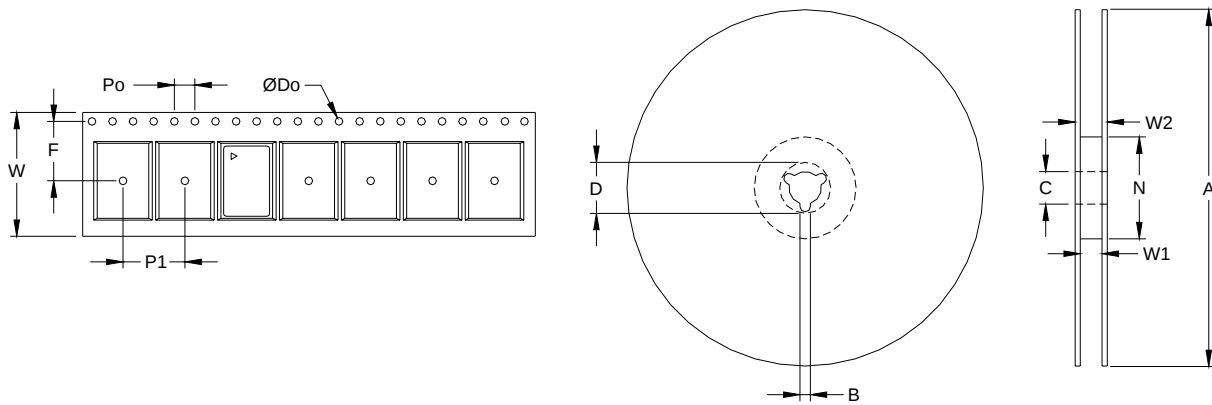


Figure 8. Four Input Frequencies Translated to Common Output Frequency

Tape and Reel (EIA-481-2-A)



Tape Dimensions (mm)						Reel Dimensions (mm)							# Per Reel
Dimension	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	
Tolerance	Typ	Typ	Typ	Typ	Typ	Typ	Min	Typ	Min	Min	Typ	Max	
FX-424	44	20.2	1.5	4	20	330	1.5	13	20.2	100	44.4	50.4	

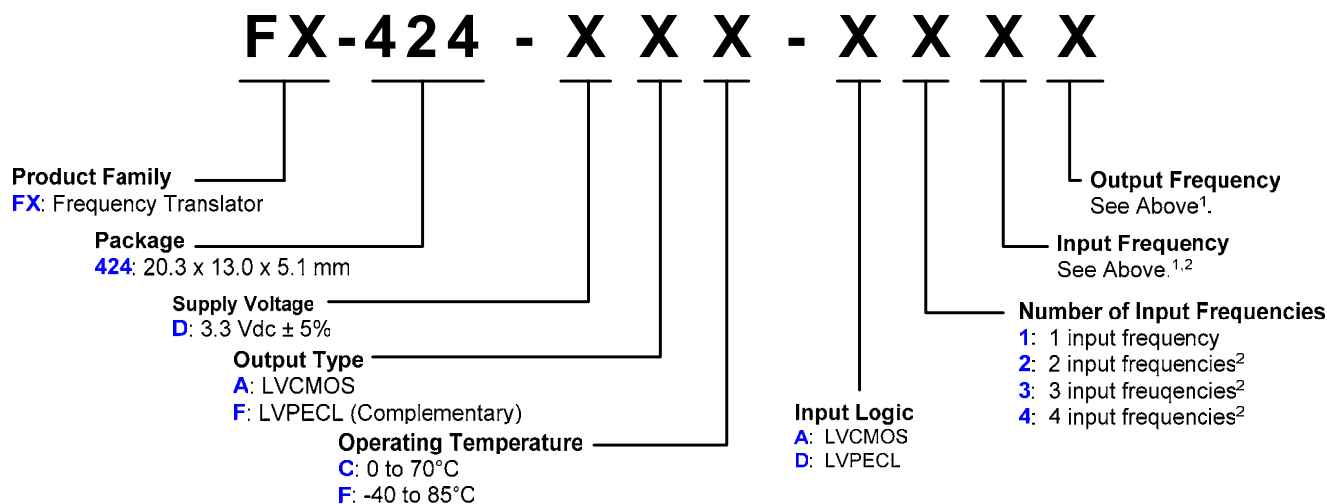
Vectron plans to offer both tape-n-reel and matrix trays as packaging options for the FX-424. The standard shipping container for volume production is a matrix tray. The trays are 100% recyclable and offer the added feature that they can be continuously fed into a pick-n-place machine. (Matrix tray drawing not currently available)

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Standard Frequencies					
8 kHz	C	26.00 MHz	T	622.08 MHz	8
16 kHz	D	27.00 MHz	W	666.5143 MHz	9
64 kHz	E	38.88 MHz	X		
1.024 MHz	F	44.736 MHz	Y		
1.544 MHz	H	51.84 MHz	0		
2.048 MHz	J	61.44 MHz	1		
4.096 MHz	K	77.76 MHz	2		
8.192 MHz	L	82.944 MHz	3		
13.000 MHz	M	112.000 MHz	4		
16.384 MHz	N	139.264 MHz	5		
19.440 MHz	P	155.520 MHz	6		
20.480 MHz	R	166.6286 MHz	7	Special SCD	S

Not all combinations are possible.

Ordering Information



- For non-listed frequencies and/or multiple input frequencies a unique part number will be assigned with the following format FX-424-XXX-SNNNN. "SNNNN" is the SCD number.
- To request *initial samples* for an FX-424 with more than one input frequency, please use the following format FX-424-XXX-XNSX followed by the input frequencies. For example, to request samples for a translator with and operating temperature of -40 to +85°C, input frequencies of 8 kHz, 1.544 MHz, 19.44 MHz, 77.76 MHz and an output frequency of 622.08 MHz, the part number would be FX-424-DFF-A4S8, S = 8 kHz, 1.544 MHz, 19.44 MHz, 77.76 MHz.

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