FX-427
Low Jitter Frequency Translator

Features

- **Quartz-based PLL for Ultra-Low Jitter**
- **Frequency Translation up to 850 MHz**
- **Accepts 4 externally-muxed clock inputs**
- **LVCMOS/LVDS/LVPECL Inputs Compatible**
- **Differential LVPECL Outputs**
- **Lock Detect**
- **Output Disable**
- **20.3 x 13.7 x 5.1 mm surface mount package**
- **Compliant to EC RoHS Directive**

Description

The FX-427 is a precision quartz-based frequency translator used to translate 1 to 4 selected input clocks as low as 8 kHz to an integer multiple as high as 850 MHz. The FX-427's superior jitter performance is achieved through the filtering action of the on-board voltage-controlled SAW oscillator (VCSO) and integrated loop filter. Two low-jitter outputs are provided. Monitoring and control functionality are also standard features.

Applications

- **Wireless Infrastructure**
- **802.16 BTS**
- **10 Gigabit FC**
- **10GbE LAN / WAN**
- **OADM and IP Routers**
- **Test Equipment**

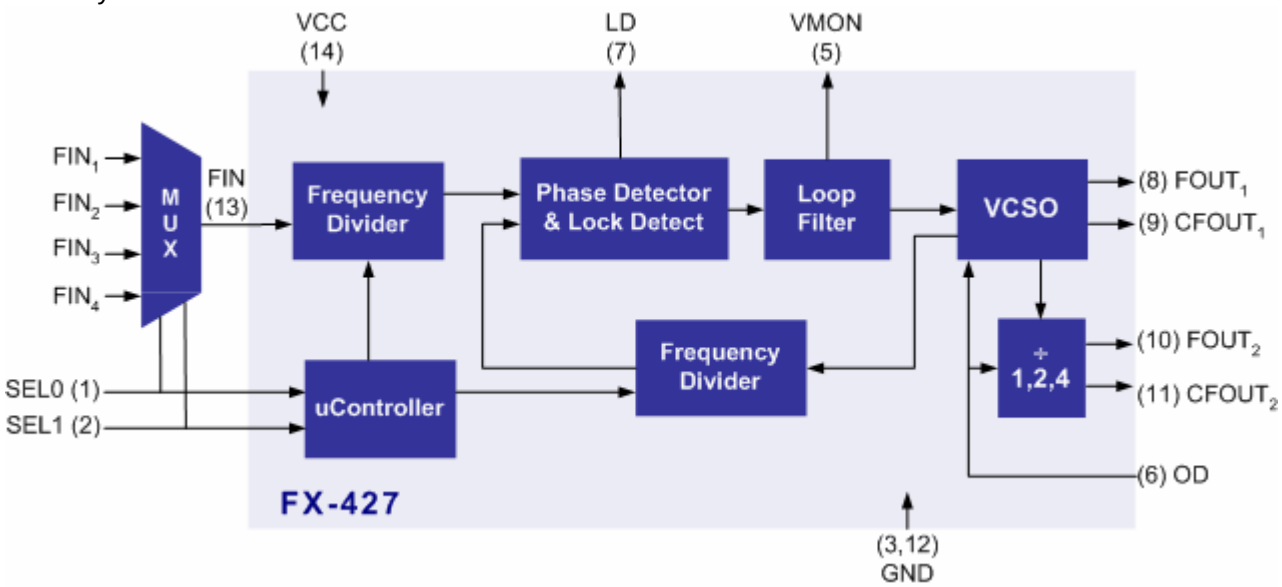


Figure 1. Functional Block Diagram

Table 1. Electrical Performance

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Frequency						
Input Frequency	F_{IN}	0.008		200	MHz	1,2,3
Capture Range	APR	±40			ppm	1,2,3
Output Frequency - Primary	F_{OUT1}	500		850	MHz	1,2,3
Output Frequency - Secondary	F_{OUT2}	125		850	MHz	1,2,3
Supply						
Voltage	V_{CC}	3.13	3.3	3.46	V	2,3
Current (No Load)	I_{CC}		140	180	mA	3
Input Signal						
CMOS	F_{IN}		CMOS			2,3
LVDS	F_{IN}		LVDS			
LVPECL	F_{IN}		LVPECL			
Differential Output (Options F and P)						
Common Mode Output Voltage	V_{OCM}	V_{CC}-1.5	V_{CC}-1.3	V_{CC}-1.1	V	3,5
DC Output High Voltage	V_{OH}	V_{CC}-1.085	V_{CC}-0.950	V_{CC}-0.880	V	3,5
DC Output Low Voltage	V_{OL}	V_{CC}-1.830	V_{CC}-1.700	V_{CC}-1.620	V	3,5
Peak-to-Peak Output Voltage	V_{P-P}		700		mV-pp	3,5
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	5,6
@ 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	
Jitter Generation						
155.52 MHz (12 kHz – 20 MHz BW)	Φ_J		0.30		ps RMS	5, 6
622.08 MHz (12 kHz – 20 MHz BW)	Φ_J		0.12		ps RMS	
Operating Temperature (Options C or F)	T_{OP}	0° to 70° or -40 to +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 guard banded 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.
6. The FX-427 phase noise and jitter performance can be optimized for specific applications. Please consult with Vectron's Application Engineers for more information.

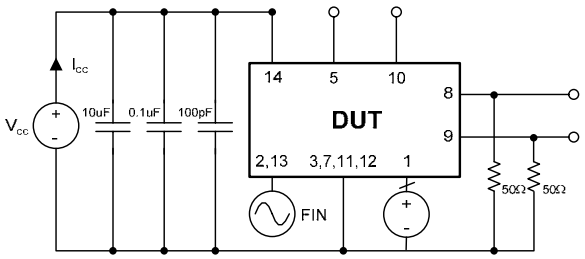


Figure 2. Test Circuit

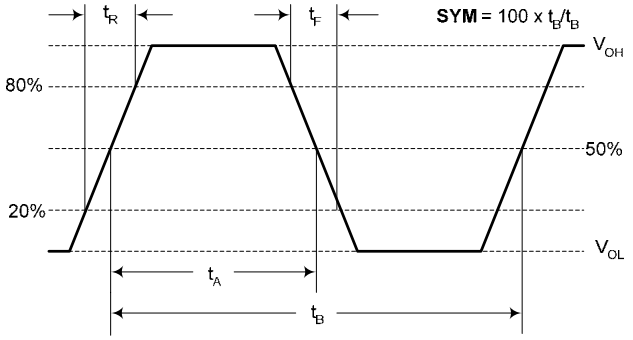


Figure 3. LVPECL Waveform

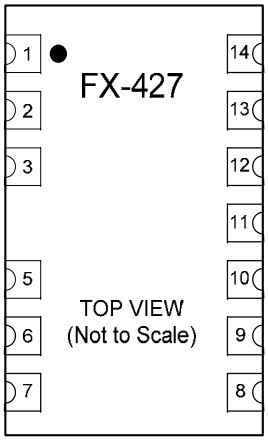


Figure 4. Pin Configuration

Table 2. Pin Out

Pin #	Symbol	I/O	Level	Function
1	SEL0	I	LVCMOS	Frequency Select - see table 3
2	SEL1	I	LVCOMS	Frequency Select – see table 3
3	GND	GND	Supply	Case and Electrical Ground
4				Not present
5	VMON	O	Analog (0 – Vcc)	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	LVCMOS	Output Disable Disabled = Logic “1” Enabled = Logic “0” or no connect
7	LD	O	LVCMOS	Lock Detect Locked = Logic “1” Loss of Lock = Logic “0”
8	FOUT1	O	LCPECL	Frequency Output – Primary
9	CFOUT1	O	LVPECL	Complimentary Frequency Output - Primary
10	FOUT2	O	LVPECL	Divided-Down VCSO/VCXO Output, or Disabled
11	CFOUT2	O	LVPECL	Complimentary Divided-Down VCSO/VCXO Output, or Disabled
12	GND	GND	Supply	Case and Electrical Ground
13	FIN	I	LVCMOS or LVPECL	Input Frequency – AC Coupled
14	VCC	VCC	Supply	Power Supply Voltage (3.3 V ±5%)

Table 3. Control Logic (LVCMOS)

SEL0	SEL1	CLOCK INPUT
0	0	FIN_1
0	1	FIN_2
1	0	FIN_3
1	1	FIN_4

Outline Diagram

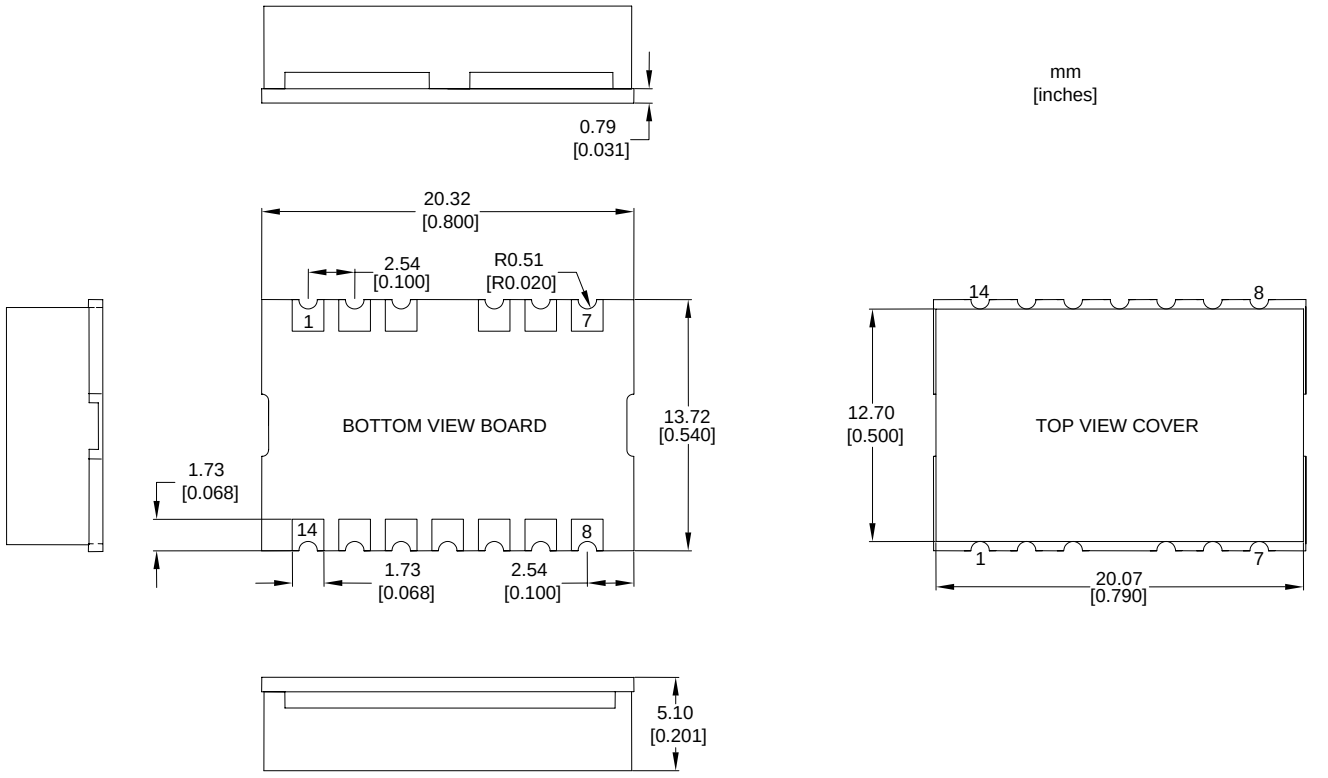


Figure 5.

Suggested Pad Layout

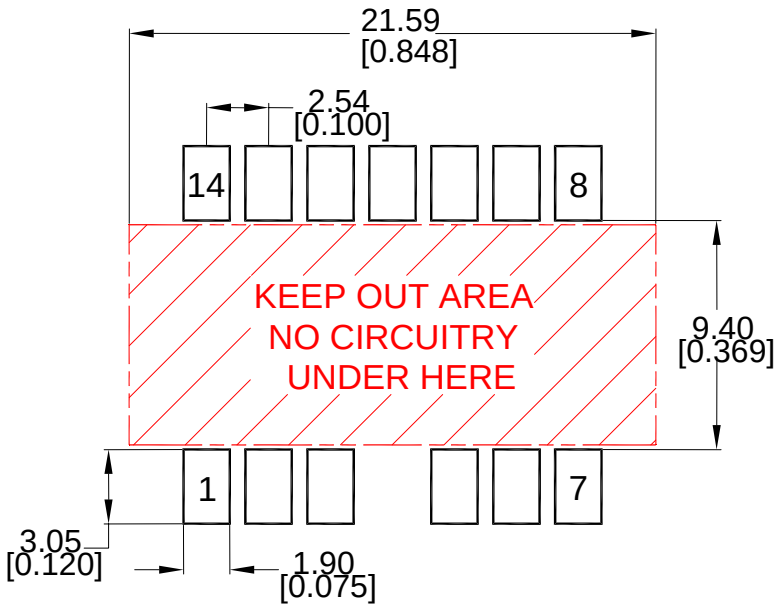


Figure 6.

Table 4. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Power Supply	V_{CC}	0 to 6	V
Storage Temperature	TS	-55 to 125	°C
Soldering Temp/Time	T_{LS}	260/40	°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-427 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-427 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

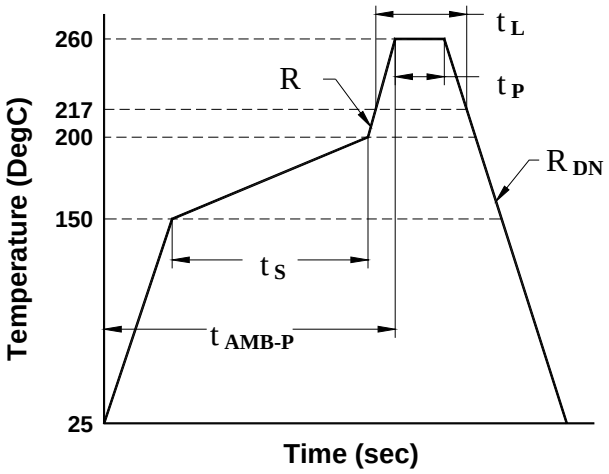
ESD Ratings

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

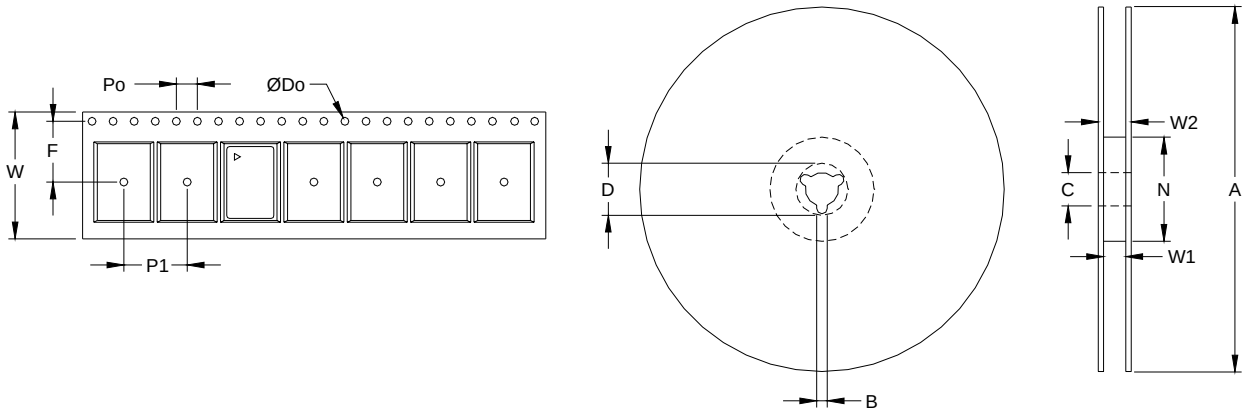
Reflow Profile (IPC/JEDEC J-STD-020C)

Parameter	Symbol	Value
PreHeat Time	t_S	60 sec Min, 180 sec Max
Ramp Up	R_{UP}	3 °C/sec Max
Time Above 217 °C	t_L	60 sec Min, 150 sec Max
Time To Peak Temperature	t_{AMB-P}	480 sec Max
Time At 260 °C	t_P	20 sec Min, 40 sec Max
Ramp Down	R_{DN}	6 °C/sec Max

The FX-427 is qualified to meet the JEDEC standard for Pb-Free assembly. The temperatures and time intervals listed are based on the Pb-Free small body requirements. The temperatures refer to the topside of the package, measured on the package body surface. The FX-427 should not be subjected to a wash process that will immerse it in solvents. NO CLEAN is the recommended procedure. The FX-427 has been designed for pick and place reflow soldering. The FX-427 may be reflowed once and should not be reflowed in the inverted position.



Tape and Reel



Tape Dimensions (mm)						Reel Dimensions (mm)							
Dimension	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	# Per
Tolerance	Typ	Typ	Typ	Typ	Typ	Typ	Min	Typ	Min	Min	Typ	Max	Reel
FX-427	32	14.2	1.5	4	20	330	1.5	13	20.2	100	44.4	50.4	200

Vectron plans to offer both tape-n-reel and matrix trays as packaging options for the FX-427. 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.

Standard Frequencies (MHz)*											
0.0080	**A3**	31.2500	**H8**	166.6286	**M5**	625.0000	**P3**	707.3527	**TC**	781.2500	**T9**
0.0160	**A4**	38.8800	**H5**	167.3316	**N2**	637.5000	**PG**	716.5732	**T1**	796.8750	**TB**
1.5440	**B3**	51.8400	**J4**	201.4160	**N1**	644.5313	**P4**	718.7500	**T5**	805.6641	**TA**
2.0480	**B4**	61.4400	**J5**	300.0000	**PT**	657.4219	**PB**	719.7344	**T3**	809.0635	**TE**
10.0000	**C4**	77.7600	**K2**	311.0400	**P1**	666.5143	**P5**	748.0709	**T6**		
12.3520	**D1**	125.0000	**L4**	491.5200	**PM**	669.3266	**R3**	750.0000	**T7**		
19.4400	**D6**	155.5200	**M2**	531.2500	**P8**	672.1627	**R5**	777.6000	**T4**		
20.0000	**E2**	156.2500	**M3**	569.1964	**P9**	690.5692	**R4**	779.5686	**T8**		
30.7200	**H1**	161.1328	**M4**	622.0800	**P2**	693.4830	**R6**	780.8810	**TD**		

Note 1: Other frequencies available upon request.
Note 2: Not all combinations are possible.
Note 3: For multiple input frequencies, replace the Input Frequency Code with “SS” and denote the input frequencies following the part number.

Ordering Information

FX-427 - X X X - XX XX X

Product Family
FX: Frequency Translator

Package
427: 20.3 x 13.0 x 5.1 mm

Supply Voltage
D: 3.3 Vdc ± 5%

Output Type
F: LVPECL (Comp.)
P: LVDS (Comp.)

Operating Temperature
C: 0° to 70°C
F: -40° to +85°C

Input Frequency
(**A3** - **N1** from table)

Output Frequency
(**PM** - **TE** from table)

Second Output
A: Divide By 1
B: Divide By 2
C: Divide By 4
K: Disabled

EXAMPLE: **FX-427-DFF-A3P2C**
FX-427, 3.3V, LVPECL output, -40° to +85°C, F_{IN1} = 8 kHz, F_{OUT1} = 622.08 MHz, F_{OUT2} = 155.52 MHz.

EXAMPLE: **FX-427-DFC-SSP2B, S = 2.048 MHz, 19.44 MHz, 77.76 MHz**
FX-427, 3.3V, LVPECL output, 0° to 70°C, F_{IN1} = 2.048 MHz, F_{IN2} = 19.44 MHz, F_{IN3} = 77.76 MHz, F_{OUT1} = 622.08 MHz, F_{OUT2} = 311.04 MHz

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