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## Description

The FX-702 is a low jitter precision frequency translator used to translate input frequencies such as 19.44, 38.88, 77.76 MHz, etc. to a binary multiple frequency as high as 850 MHz. The FX-702's superior jitter performance is achieved through the PLL's integrated VCISO. The FX-702 is housed in a hermetically sealed leadless surface mount package offered on tape and reel.

## Features

- 5 x 7.5 x 2.5 mm Package
- Frequency Translation up to 850 MHz
- VCISO based PLL for Ultra-Low Jitter
- CMOS / LVDS / LVPECL Inputs compatible
- Differential LVPECL or LVDS Output
- CMOS Lock Detect
- External Divider for Input Frequencies < 19 MHz
- 0°/70°C or -40°/+85°C Temperature Range
- Fully Compatible for Lead Free Assembly 

## Applications

- SONET/SDH
- 10GbE./10.3GbE
- Frequency Translation
- Clock Smoothing, Clock Switching
- FEC Scaling

## Block Diagram

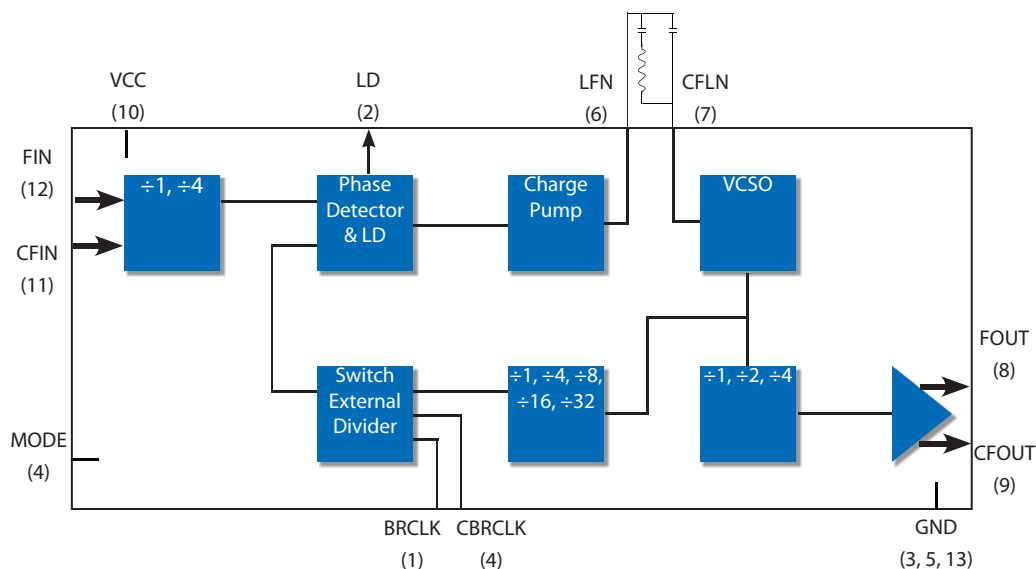


Figure 1. Functional block diagram

# Performance Specifications

Table 1. Electrical Performance					
Parameter	Symbol	Min	Typical	Maximum	Units
Frequency <sup>1,2,3</sup>					
Input Frequency	$F_{IN}$	19.44		850	MHz
Output Frequency	$F_{OUT}$	125		850	MHz
Capture Range (ordering option) <sup>1,2,3</sup>	APR	±32, ±50, or ±100			ppm
Supply					
Voltage <sup>2,3</sup>	$V_{CC}$	2.97	3.3	3.63	V
Current (No Load) <sup>3</sup>	$I_{CC}$			100	mA
LVC MOS Input <sup>2,3</sup>					
Input High Voltage	$V_{IH}$	2.0		$V_{CC}$	V
Input Low Voltage	$V_{IL}$	0		0.8	V
LVPECL Input					
Peal-Peak Amplitude Swing <sup>6,7</sup>		0.20		3.00	V
Lock Detect Output					
Output High Voltage	$V_{OH}$	$0.9 * V_{CC}$			V
Logic Low Voltage	$V_{OL}$			$0.1 * V_{CC}$	V
Outputs					
Mid Level - LVPECL <sup>2,3</sup>		$V_{CC} - 1.4$	$V_{CC} - 1.25$	$V_{CC} - 1.0$	V
Swing - LVPECL <sup>2,3</sup>		450	600	950	mV-pp
Mid Level - LVDS <sup>2,3</sup>			$V_{CC} - 1.2$		V
Swing - LVDS <sup>2,3</sup>		250	450		mV-pp
Current <sup>5</sup>	$I_{OUT}$			20	mA
Rise Time <sup>4,5</sup>	$t_R$			400	ps
Fall Time <sup>4,5</sup>	$t_F$			400	ps
Symmetry <sup>2,3</sup>	SYM	45	50	55	%
Jitter Generation - 622.08MHz output (12kHz-20MHz BW) <sup>5</sup>	$\Phi_J$		0.21	0.5	ps-rms
(50kHz - 80MHz BW) <sup>5</sup>	$\Phi_J$		0.12	0.4	ps-rms
Operating Temp (ordering option) <sup>1,3</sup>	$T_{OP}$	0/70, -40/85			°C

1. See Standard Frequencies and Ordering Information.
2. Parameters are tested with production test circuit below (Fig 1).
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 2).
5. Not tested in production, guaranteed by design, verified at qualification.
6. Minimum Input Low Voltage not to exceed 2.125 V. Minimum Input High Voltage not to go below 1.49 V.
7. AC coupling is recommended. There is an internal pull-up and pull-down resistor on all clock inputs (Fin, BRCLK).

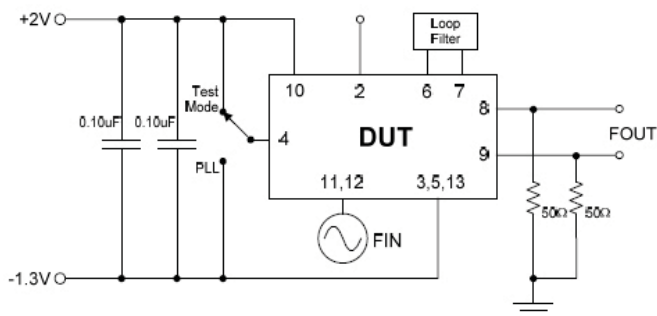


Figure 1. LVPECL Test Circuit

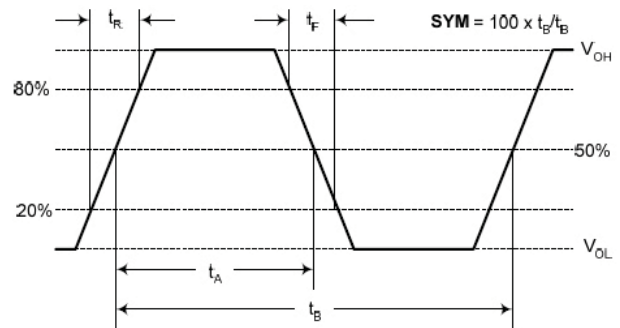


Figure 2. 10K LVPECL Waveform

## Absolute Maximum Ratings

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.

**Table 2. Absolute Maximum Ratings**

Parameter	Symbol	Ratings	Unit
Power Supply	$V_{CC}$	0 to 6	V
Input Current	$I_{IN}$	100	mA
Output Current	$I_{OUT}$	25	mA
Storage Temperature	$T_{STR}$	-55 to 125	°C
Soldering Temperature/Duration	$T_{PEAK}/t_P$	260 / 40	°C/sec

## Reliability

The FX-702 is capable of meeting the following qualification tests:

**Table 3. 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
Moisture Sensitivity Level Rating	MSL 1

## Handling Precautions

Although ESD protection circuitry has been designed into the the FX-702, 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 thresholds are dependent on the circuit parameters used to define the model.

**Table 4. Predicted ESD R\$atings**

Model	Class	Minimum	Conditions
Human Body Model	2	2000 V	MIL-STD 883, Method 3015
Charged Device Model	C5	1000 V	JEDEC, JESD22-C101
Machine Model	M3	200 V	ESD STM5.2-1999

**Table 5. 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 device has been 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-702 device is hermetically sealed so an aqueous wash is not an issue.

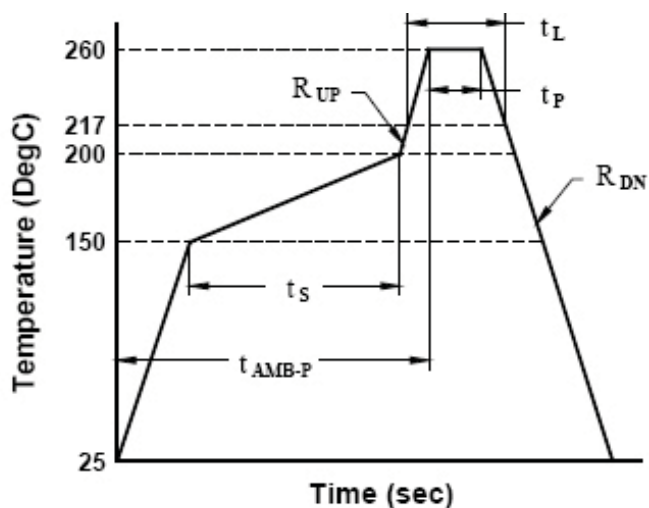


Figure 3. Suggested IR Profile

**Table 6. Tape and Reel Information**

Tape Dimensions (mm)					Reel Dimensions (mm)							
W	F	Do	Po	P1	A	B	C	D	N	W1	W2	#/Reel
16	7.5	1.5	4	8	178	1.5	13	20.2	50	16.4	22.4	200

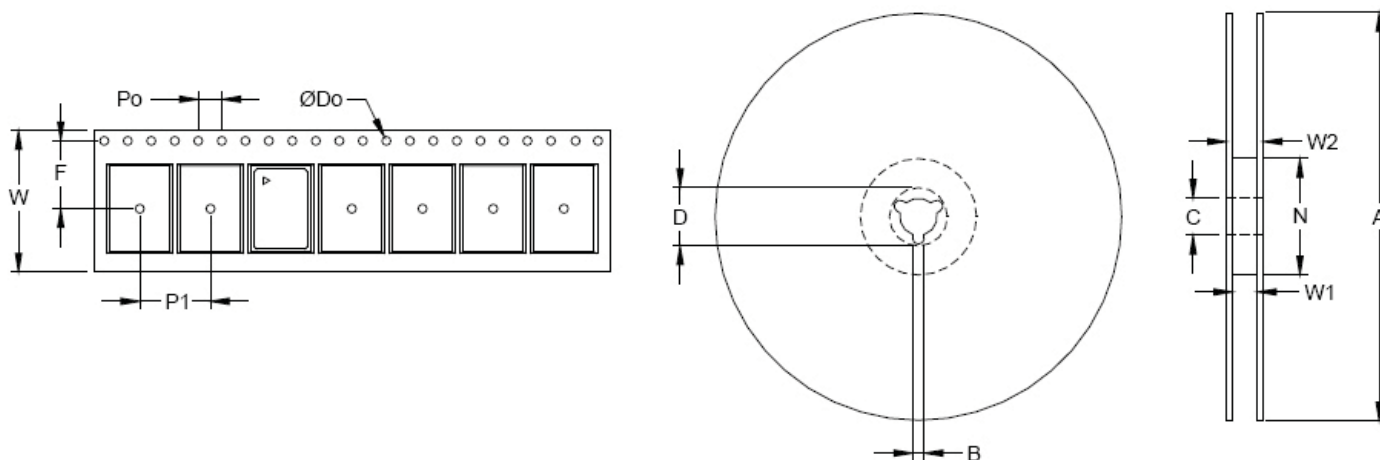


Figure 4. Tape and Reel

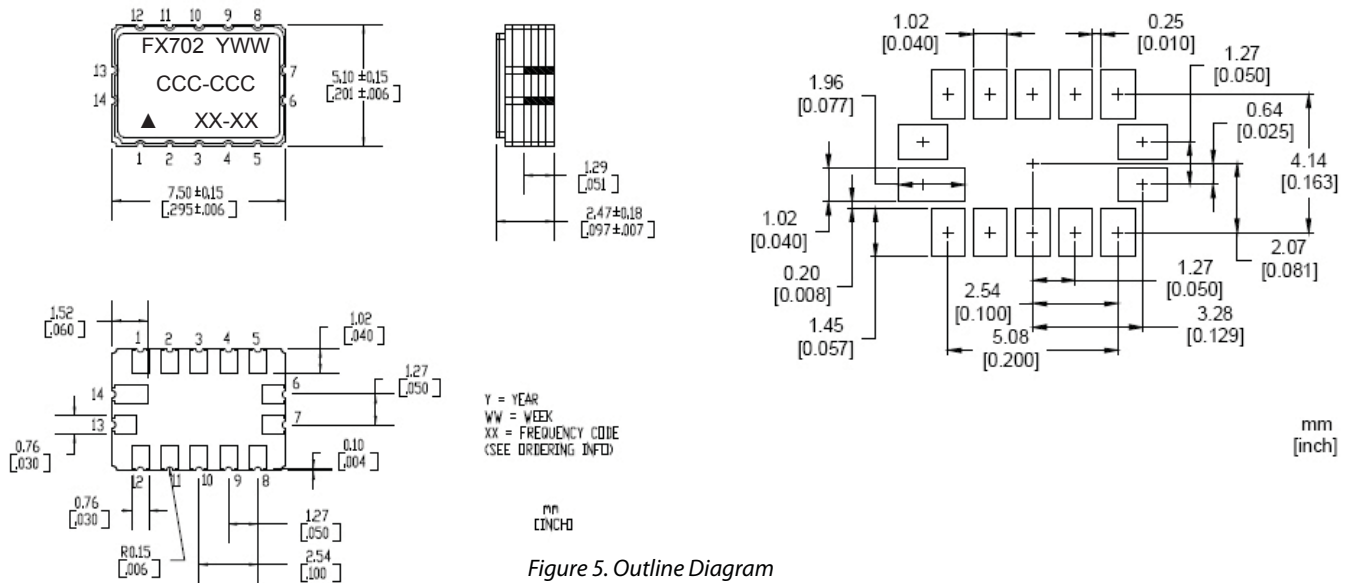


Figure 5. Outline Diagram

Table 7. Pin Functions				
Pad #	Symbol	I/O	Level	Function
1	BRCLK	I	NC or LVPE-CL, LVDS	NC or For External divider application = PD Feedback Frequency
2	LD <sup>1</sup>	O	CMOS	Lock Detect Logic 0 = FX Locked Logic 1 - No Input Output transitioning = Out of Lock
3	GND	GND	Supply	Case and electrical ground
4	MODE <sup>2</sup>	I	CMOS	FX Operating Mode Logic 0 = Standard PLL (Normal Setting) Logic 1 = FIN coupled to FOUT
5	GND	GND	Supply	Case and electrical ground
6	LFN		Analog	Loop Filter Node
7	CLFN		Analog	Complementary Loop Filter Node
8	FOUT	O	LVPECL or LVDS	Frequency Output
9	CFOUT	O	LVPECL or LVDS	Complementary Frequency Output
10	VCC	I	Supply	Power Supply Voltage (+3.3V ±5%)
11	CFIN	I	LVPECL	Complementary Input Frequency For CMOS inputs, AC-couple unused input to ground or negative supply
12	FIN	I	CMOS or LVPECL	Input Frequency
13	GND	GND	Supply	Case and electrical ground
14	CBRCLK	I	NC or LVPE-CL, LVDS	NC or For External divider applications = Comp. PD Feedback Frequency

1. It is recommended that a buffer driver is used for best noise isolation.
2. Do not leave the MODE pin floating, it should be set to logic 0 or ground for normal operation.
3. BRCLK and CBRCLK should be left floating if not used.
4. FIN, CFIN, BRCLK, and CBRCLK have internal pull-up/pull-down resistors and it is recommended to AC couple these inputs.

**Table 8. Standard Frequencies (MHz)**

18.750000	EE	39.062500	HH	73.728000	K8	173.437500	NP	624.693800	PD	796.875000	TB
19.200000	DD	39.321600	HD	74.125000	K1	176.838175	NA	624.704800	P6	800.000000	TK
19.392658	DX	39.843750	HJ	74.175800	KA	182.016000	N8	625.000000	P3	805.664100	TA
19.440000	D6	40.000000	JF	74.250000	K7	182.857142	NM	627.329600	P7	809.063500	TE
19.531250	DZ	40.283063	KK	75.000000	KH	184.000000	NG	629.987800	PA	819.200000	TH
19.660800	DB	40.960000	J1	76.800000	K4	184.320000	NH	637.500000	PG	821.777300	TF
19.698968	DK	41.088870	KM	77.760000	K2	187.500000	N5	640.000000	PN	850.000000	TJ
19.719000	DH	41.657144	KP	78.000000	LH	195.000000	N7	644.531250	P4	983.400000	TU
19.921875	ED	41.660000	LM	78.125000	K3	200.000000	NE	645.120000	RJ	1,000.0000	TM
20.000000	E2	41.832913	KT	78.643200	K5	200.192000	N6	647.239400	PE		
20.141600	E3	42.000000	JB	79.687500	KG	201.416020	N1	647.250800	PK		
20.480000	E4	42.010169	KV	80.000000	K9	212.500000	NF	649.970300	PF		
20.544434	EF	42.500000	JC	80.566413	KJ	219.429571	NL	657.421875	PB		
20.713500	E1	42.660000	JZ	82.177738	KL	240.000000	NR	665.625600	PC		
20.828572	EG	44.209544	KX	82.944000	K6	243.000000	NC	666.514286	P5		
20.828600	EB	44.434300	LF	83.314288	KN	245.760000	N9	669.128100	R2		
20.916546	EH	44.621800	JW	83.665825	KR	250.000000	NT	669.326582	R3		
21.005084	EJ	44.736000	J3	84.020338	KU	252.571428	NJ	669.642900	R1		
22.000000	E9	44.928000	JE	86.685374	LJ	256.000000	NK	670.838600	R7		
22.104772	EK	45.158400	JG	88.419088	KW	262.144000	NB	672.000000	RT		
22.217100	E5	45.824000	JM	95.700000	LK	292.571429	NN	672.156250	TX		
22.579200	E8	46.037946	LG	97.500000	KE	300.000000	PT	672.162712	R5		
24.000000	EC	46.720000	JK	100.000000	L8	307.200000	RX	673.456600	RA		
24.576000	E6	46.875000	JY	105.000000	L6	311.040000	P1	684.255400	R9		
24.704000	E7	48.000000	JV	106.250000	L9	312.500000	PU	687.700000	TV		
25.000000	F7	49.152000	J7	108.000000	LA	318.750000	PV	690.569196	R4		
25.165800	F8	49.408000	J2	110.000000	L1	320.000000	PP	693.468750	RV		
25.600000	F6	50.000000	JD	112.000000	L2	322.265650	PW	693.482991	R6		
25.920000	F2	50.048000	KD	114.000000	L3	328.710950	PX	693.750000	R8		
26.000000	F3	51.200000	LL	120.000000	LC	333.257150	PY	696.390625	RW		
27.000000	F4	51.840000	J4	122.880000	LB	334.663300	RB	696.421478	V1		
27.648000	FB	52.000000	JP	124.416000	L7	336.081350	RC	696.421875	TY		
28.704000	F1	53.330000	JU	125.000000	L4	353.676350	RD	704.380600	TG		
29.491200	F5	54.746000	JL	130.000000	LD	368.640000	RY	707.352700	TC		
29.500000	F9	55.000000	JX	139.264000	L5	375.000000	RF	707.500000	V2		
30.000000	HE	60.000000	JR	150.000000	M8	382.800000	RU	710.948600	T2		
30.720000	H1	61.380000	KY	150.144000	M6	400.000000	RR	712.520000	TW		
30.880000	HF	61.440000	J5	153.600000	MA	409.600000	RE	716.573200	T1		
31.250000	H8	62.208000	J8	155.520000	M2	491.520000	PM	718.750000	T5		
32.000000	H2	62.500000	J9	156.250000	M3	500.000000	RK	719.734400	T3		
32.768000	H3	62.914500	LE	159.375000	M7	505.000000	V3	737.280000	TL		
33.000000	H7	63.360000	JJ	160.000000	M1	531.000000	PH	739.200000	TT		
33.333000	HC	63.897600	JN	161.132813	M4	531.250000	P8	742.500000	V4		
34.368000	H6	64.000000	JT	164.355475	M9	568.928600	PJ	748.070900	T6		
34.560000	HB	64.152000	JH	166.628572	M5	569.196400	P9	750.000000	T7		
36.864000	HG	65.536000	J6	167.331646	N2	588.000000	RH	768.000000	TN		
37.056000	H4	66.000000	JA	168.040678	N3	595.056000	PL	777.600000	T4		
37.125000	H9	70.000000	KB	170.000000	N4	600.000000	PR	779.568600	T8		
37.500000	HK	70.656000	KC	172.500000	NU	614.400000	RG	780.881000	TD		
38.880000	H5	71.610000	KF	173.370748	ND	622.080000	P2	781.250000	T9		

## Ordering Information

# FX-702 - E C E - H J K A - XX - XX

### Product Family

FX: Frequency Translator

### Package

702: 5.0 x 7.5 x 2.0mm

### Input

E: 3.3 Vdc  $\pm$ 10%

### Output

C: LVPECL  
D: LVDS

### Operating Temperature

E: -40 to 85 °C  
T: 0 to 70 °C

### Absolute Pull Range

H:  $\pm$  32 ppm  
K:  $\pm$  50 ppm  
S:  $\pm$  100 ppm

### Output Frequency (See Above)

### Input Frequency (See Above)

### Prescaler

A: 1  
C: 4  
M: Factory Set

### Output 2 Divider

M: Factory Set

### Feedback Divider

L: Disable  
M: Factory Set

1, Not all combinations are possible. Please consult with your Vectron representative for application assistance. Other frequencies available upon request  
2, When ordering the FX-702 with the external divider option, the prescaler must be specified (i.e, 1 or 4). The "XX" place holder should be used for the input frequency.

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