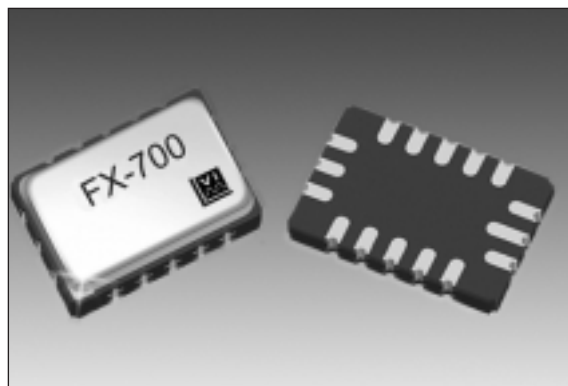


FX-700

Low Jitter Frequency Translator



Description

The FX-700 is a crystal-based frequency translator used in communications applications where low jitter is paramount.

Performance advantages include superior jitter performance, high output frequencies and small package size. Advanced custom ASIC technology results in a highly robust, reliable and predictable device. The device is packaged in a 16 pad ceramic package with a hermetic seam welded lid.

Features

- 5.0 x 7.5 mm, Hermetically sealed SMD package
- Frequency Translation to 77.760 MHz
- 3.3 Volt or 5.0 Volt Supply
- Tri-State Output allows board test
- Lock Detect
- Commercial or Industrial Temp. Range
- CMOS Output
- Absolute Pull Range Performance to ± 100 ppm
- Capable of locking to an 8 kHz pulse/BITS clock

Applications

- Frequency Translation, Clock Smoothing
- Telecom - SONET/SDH/ATM
- Datacom - DSLAM, DSLAR, Access Nodes
- Base Station - GSM, CDMA
- Cable Modem Head End

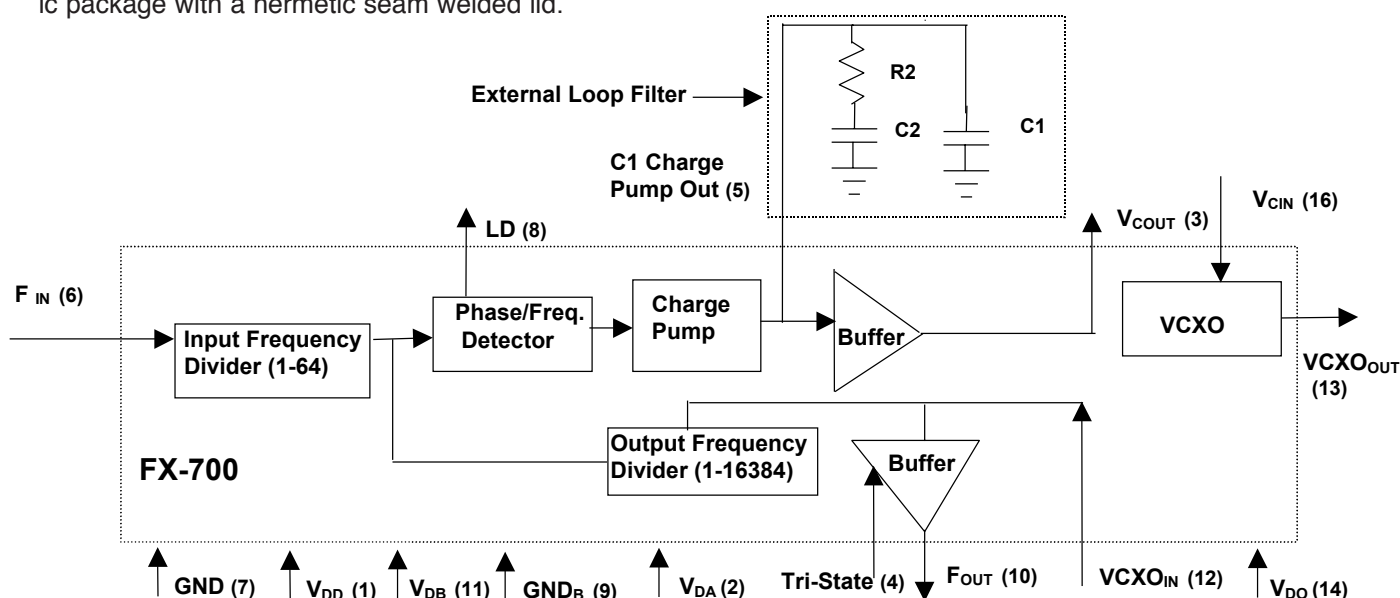


Figure 1. FX-700 Block Diagram

FX-700 Low Jitter Frequency Translator

Performance Characteristics

Electrical Performance

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Frequency ⁴					
Output (3.3 V)	f _o	0.100		77.760	MHz
Output (5.0 V)	f _o	0.100		77.760	MHz
Supply Voltage ¹ (V _{DD} , V _{DB} , V _{DA} , V _{DO})					
+5.0	V _{DD}	4.5	5.0	5.5	V
+3.3	V _{DD}	2.97	3.3	3.63	V
Supply Current ⁵ @19.440 MHz	I _{DD}		15	20	mA
49.152 MHz	I _{DD}		25	30	mA
77.760 MHz	I _{DD}		35	40	mA
Output ²					
Output High	V _{OH}	0.9*V _{dd}			V
Output Low	V _{OL}			0.1*V _{dd}	V
Transition Times ²					
Rise Time	t _R		1.8	3.0	ns
Fall Time	t _F		1.8	3.0	ns
Duty Cycle ³ <60 MHz	D	45	50	55	%
≥60 MHz	D	40	50	60	%
Absolute Pull Range	APR	See Part Numbering			ppm
Operating Temperature:		0 to 70°C or -40 to 85°C			
Test Conditions for APR (+5V option)	V _C	0.5		4.5	V
Test Conditions for APR (+3.3V option)	V _C	0.3		3.0	V
Input					
Frequency	f _{IN}	1 kHz		77.76 MHz	
Pulse Width		6.0			ns
Low Logic Level	V _{IL}			0.3* V _{dd}	V
High Logic Level	V _{IH}	0.7* V _{dd}			V
Jitter, 8kHz to 77.760 MHz ⁶					
rms			4.7		ps
peak/peak			44		ps
peak/peak			0.003		UI
Leakage Current of Input	I _C	-1		+1	uA
Size		5.0mm x 7.5mm x 2.0mm			

1. A 0.01uF high frequency ceramic capacitor in parallel with a 0.1uF low frequency tantalum bypass capacitor is recommended

2. Figure 2 defines the waveform parameters. Figure 3 illustrates the standard test conditions under which these parameters are tested and specified

3. Duty Cycle is defined as (on time/period) with V_s = V_{dd}/2 per Figure 2. Duty Cycle is measured with a 15pf load per Figure 3.

4. Other frequencies may be available, please contact factory.

5. Combined Current From V_{DD}, V_{DO}, V_{DA}, and V_{DB}

6. Typical jitter for 8 kHz to 77.760 MHz translation (no offset bandwidth).

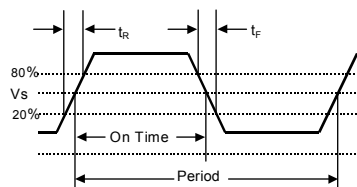


Figure 2. Output Waveform

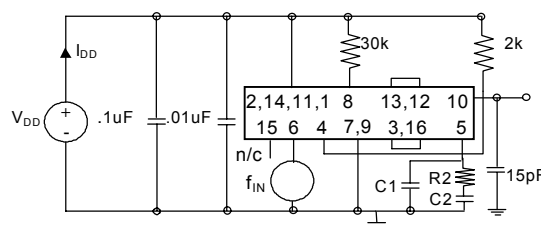
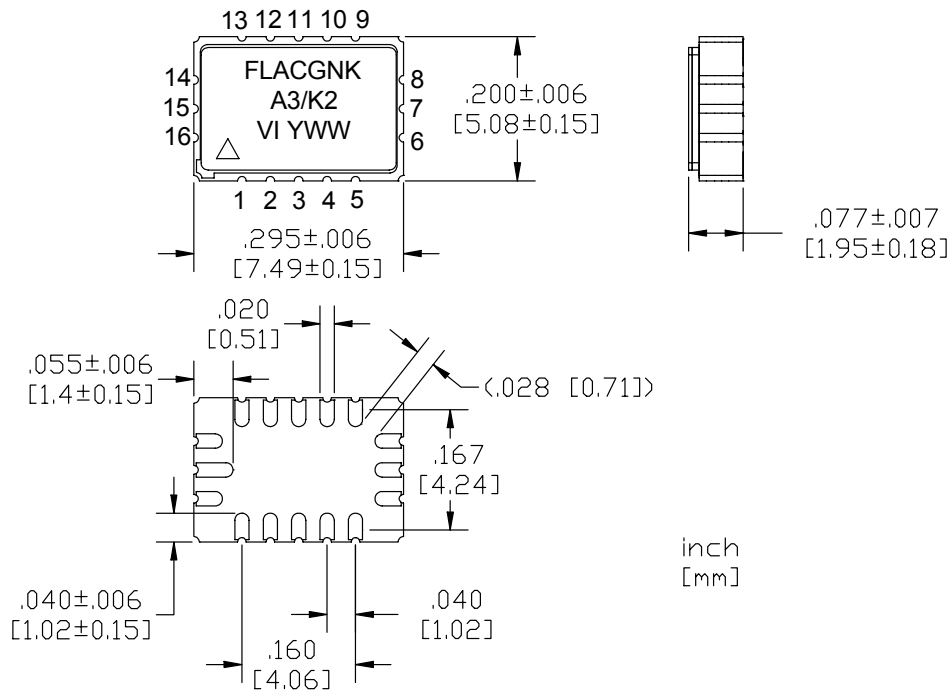


Figure 3. Output Test Conditions (25 ±5°C)

FX-700 Low Jitter Frequency Translator

Outline Diagram



Pin Out

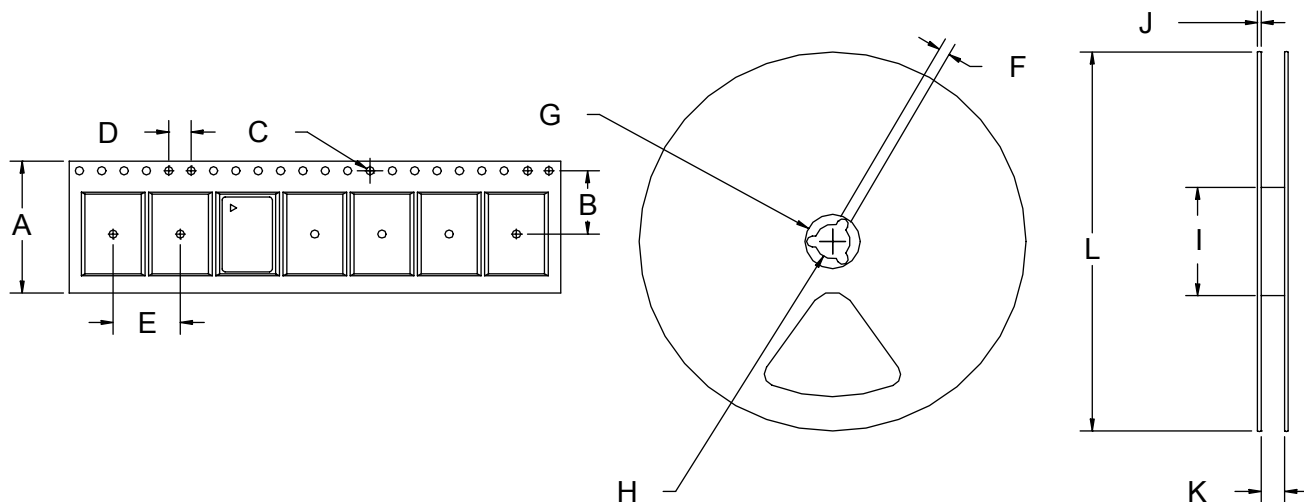
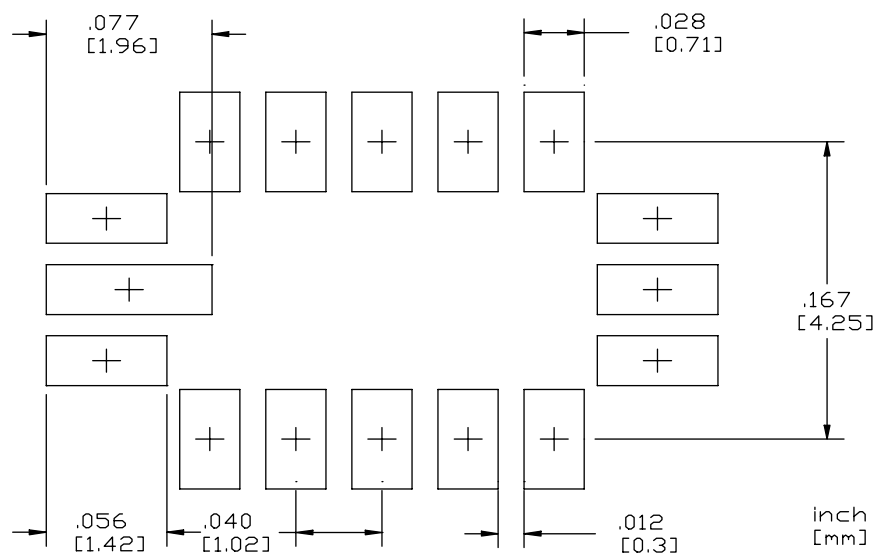
Pin #	Symbol	Function
1	V _{DD}	Digital PLL Supply (3.3 V +/- 10% or 5.0 V +/- 10%)
2	V _{DA}	Analog PLL Supply (3.3 V +/- 10% or 5.0 V +/- 10%)
3	V _{COU} T	Control Voltage
4	Tri-state ¹	Logic Low = Output Disable / Logic High = Output Enabled
5	C1	Passive Loop Filter Node
6	F _{IN}	Input Frequency
7	GND	Cover and Electrical Ground
8	LD ²	Lock Detect
9	GND _B	Output Buffer Ground
10	F _{OUT}	Output Frequency
11	V _{DB}	Output Buffer Supply (3.3V +/-10% or 5.0V +/-10%)
12	VCXO _{IN}	VCXO Input
13	VCXO _{OUT}	VCXO Output
14	V _{DO}	VCXO Supply (3.3 V +/- 10% or 5.0 V +/- 10%)
15	N.C.	No Internal Connection Made
16	VC _{IN}	VCXO Control Voltage Input

1 Tri-state must be driven to a logic high or a logic low, there is no internal pull up or pull down resistor (tie pin to VDD for PLL operation).

2 LD is an open collector output requiring a 30k ohm minimum pull-up resistor to VDD. LD output is logic high under locked condition, logic low for no input at F_{IN}, and for "out-of-lock" condition LD transitions between logic low and high at the phase detector frequency.

FX-700 Low Jitter Frequency Translator

Solder Pad Layout



Tape and Reel Dimensions (mm)

Tape Dimensions						Reel Dimensions							# Per Reel
Product	A	B	C	D	E	F	G	H	I	J	K	L	
FX-700	16	7.5	1.5	4	8	1.5	20.2	13	50	6	16.4	178	500

FX-700 Low Jitter Frequency Translator

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.

Parameter	Symbol	Ratings	Unit
Power Supply	V _{DD}	7	Vdc
Storage Temperature	T _{storage}	-55/125	°C

Reliability

Absolute Maximum Ratings

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

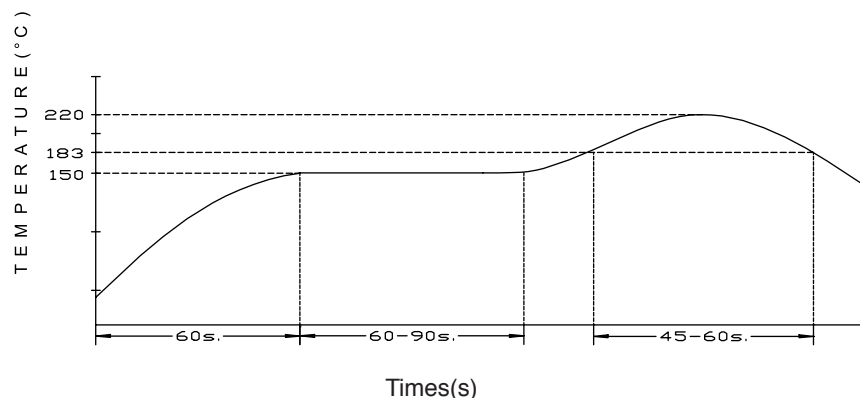
Handling Precautions

Although ESD protection circuitry has been designed into the the FX-700, proper precautions should be taken when handling and mounting. VI employs a human body model 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. Although no industry wide standard has been adopted for the CDM, a standard HBM of resistance=1.5Kohms and capacitance = 100pF is widely used and Therefore can be used for comparison purposes.

ESD Ratings

Model	Minimum	Conditions
Human Body Model	1500	MIL-STD-883, Method 3015
Charged Device Model	1000	JESD 22-C101

Recommended Solder Reflow Profile



FX-700 Low Jitter Frequency Translator

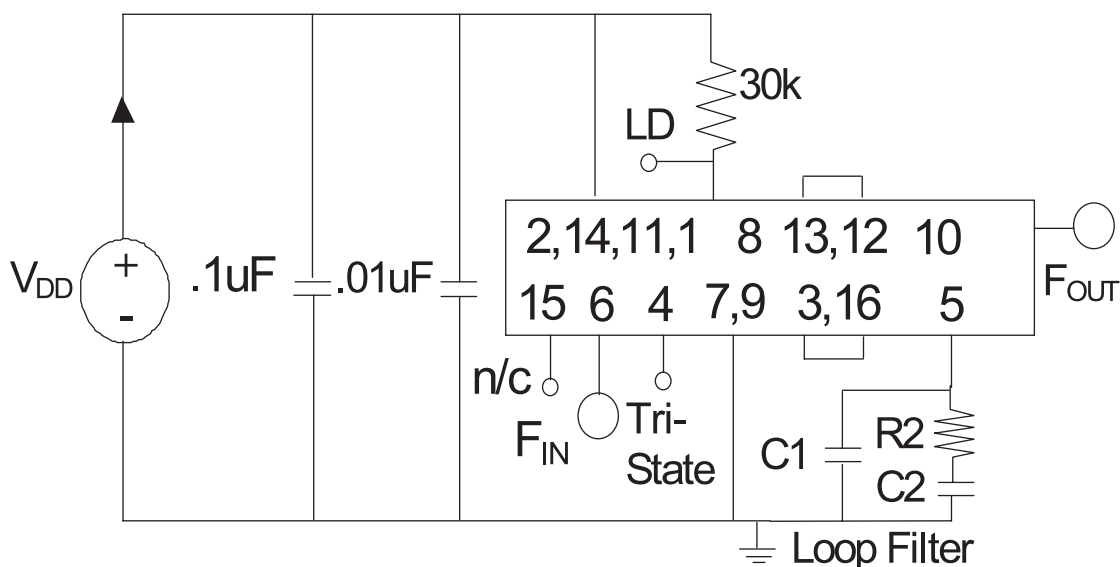
FX-700 Theory of Operation

The FX-700 includes an integrated phase detector, current mode charge pump, programmable frequency dividers and VCXO. The FX-700 will translate an input frequency such as 8 kHz, 1.544 MHz or 19.440 MHz to a specific output frequency which is an integer multiple (1-16384) of the input frequency and less than or equal to 77.760 MHz. For clock smoothing applications, the input frequency is typically internally divided down by a factor of 64 ($2N$ where $N = 6$) by the input frequency divider and this frequency becomes an input to the phase detector. The integrated frequency dividers (factory programmed) and crystal based VCXO allows for a large range of possible frequency translations and clock smoothing applications.

The FX-700's PLL is a feedback system which forces the output frequency to lock in both phase and frequency to the input frequency. While there will be some phase error, theory

states there is no frequency error. The loop filter design will dictate many key parameters such as jitter reduction, stability, lock range and acquisition time. The external second order passive loop filter is a complex impedance in parallel with the input capacitance of the VCXO. The loop filter converts the charge pump output into the VCXO's control voltage. VI's loop filter design methodology involves the calculation of the open loop gain bandwidth and corresponding phase margin to determine the optimal component values that ensure high loop stability and acceptable lock in time. As a rule of thumb, the VCXO gain is typically 100 ppm/volt and the charge pump current is typically 32 μ A.

VI's Applications Engineering staff can provide the external loop filter component values required to meet specific system requirements and application



Suggested FX-700 Circuit Configuration Drawing

FX-700 Low Jitter Frequency Translator

Standard Frequencies

1.000 KHz A1	4.000 KHz A2	8.000 KHz A3	16.000 KHz A4	64.000 KHz A5	1.024 MHz B2
1.544 MHz B3	2.048 MHz B4	3.088 MHz B6	4.096 MHz B5	6.480 MHz C2	8.192 MHz C3
10.000 MHz C4	12.352 MHz D1	13.000 MHz D3	15.000 MHz D4	16.384 MHz D5	18.432 MHz D7
19.440 MHz D6	20.000 MHz E2	20.480 MHz E4	24.576 MHz E6	24.704 MHz E7	26.000 MHz F3
27.000 MHz F4	30.720 MHz H1	32.000 MHz H2	32.768 MHz H3	34.368 MHz H6	37.056 MHz H4
38.880 MHz H5	40.960 MHz J1	44.736 MHz J3	49.152 MHz J7	51.840 MHz J4	61.440 MHz J5
62.208 MHz J8	62.500 MHz J9	65.536 MHz J6	74.152 MHz K1	74.250 MHz K7	77.760 MHz K2

Note 1: Other frequencies are available upon request, please contact VI for details

SS is code for non-standard frequencies, list the frequency after the part number.

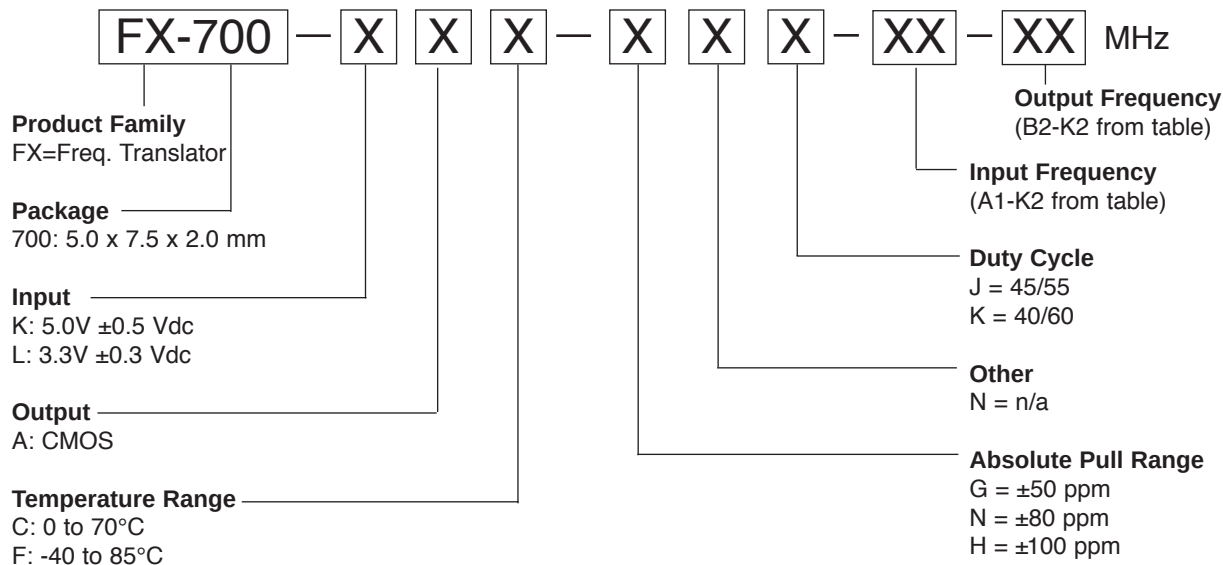
Note 2: Not all combinations are possible.

Note 3: The output frequency must be equal to or greater than the input frequency.

Note 4: The output frequency divided by the input frequency (F_{OUT}/F_{IN}) must be an integer.

Note 5: The output frequency must also be equal to or greater than 100 kHz.

Ordering Information



EXAMPLE: FX-700-LAC-GNK-A3-K2

FX-700, 3.3V, CMOS output, 0 to 70°C operating temperature,

$\pm$ 50 ppm APR, 40/60 % duty cycle with an 8kHz input and 77.760MHz output

FX-700 Low Jitter Frequency Translator



For additional information please contact:



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