

## FX-101 Frequency Translator

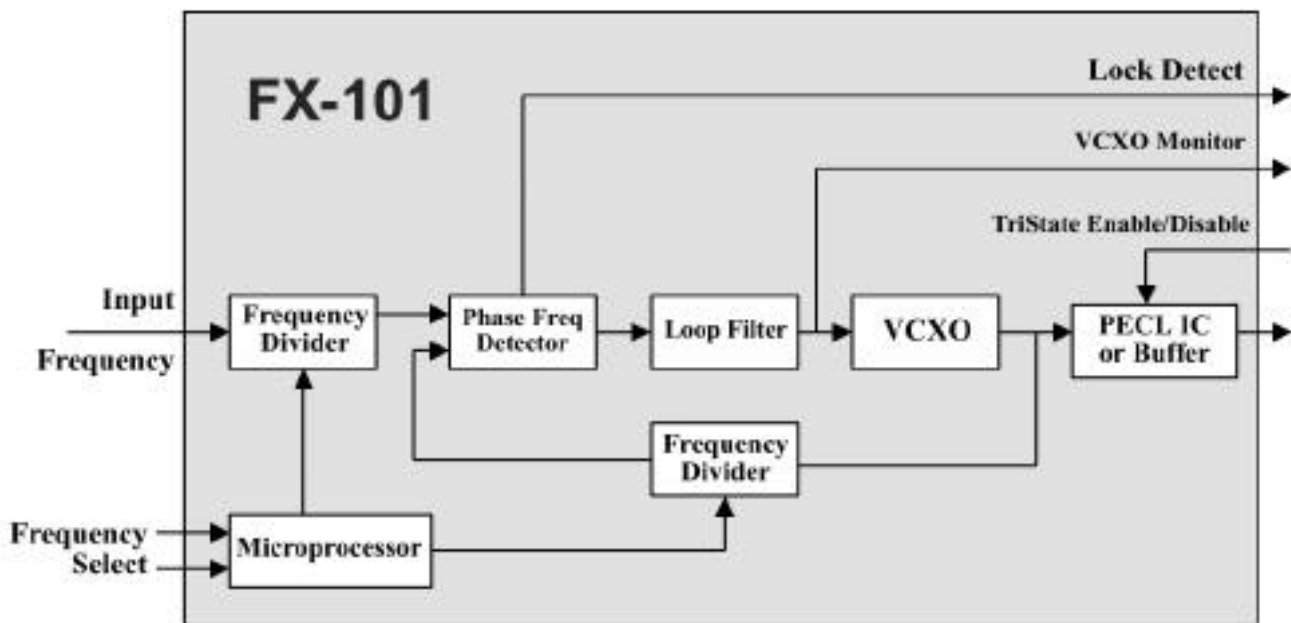


### Features

- Output frequencies up to 77.760 MHz
- Jitter Generation OC-192 compliant
- Jitter transfer per GR-253-CORE
- Single 5.0 or 3.3 Vdc supply
- Locked to specified Input frequency, e.g. 8 kHz
- 1" X 0.8" X 0.2", Surface Mount (FR4base)
- Optional CMOS or PECL Output

### Applications

- SONET / SDH / ATM
- DWDM / FDM
- DSL-PON Interconnects
- FEC (Forward Error Correction)



# FX-101 Frequency Translator

## Description

Vectron's FX-101 is a crystal based frequency translator which is used to translate any input frequency such as 8 kHz, 1.544 MHz, 2.048 MHz, 19.440 MHz etc. to any specific frequency less than or equal to 77.76 MHz. The input frequency does not have to be a 50/50% duty cycle and as an example can be an 8 kHz signal with a logic high "on time" of only 1us, such as a BITS clock. The FX-101 also has the ability to translate any of 1 to 4 different input frequencies to one common output frequency, such as input frequencies of 8 kHz and 1.544 MHz and 19.44 MHz and any other frequency between 8 kHz and 170 MHz translating them to an output frequency up to 77.76 MHz.

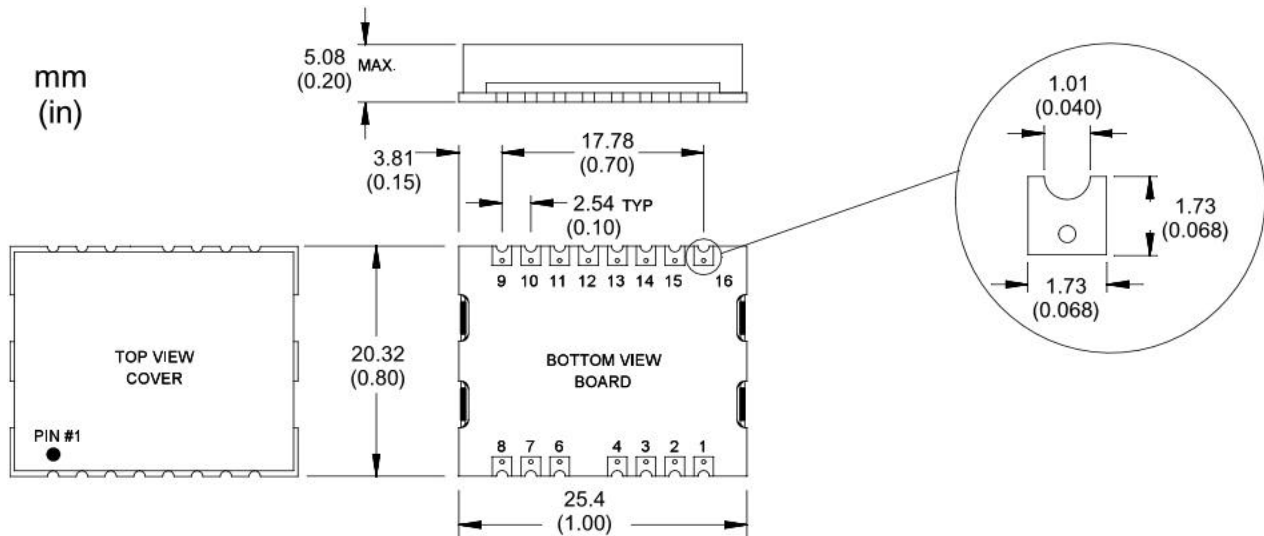
The "Input Frequency tracking capability" is the total amount of input frequency deviation in which the FX-101 is guaranteed to track or translate. As an example, a typical input clock would be 8 kHz  $\pm 20$  ppm. The FX-101 is guaranteed to track at least  $\pm 50$  ppm of error over temperature/aging/power supply and is more than twice what most applications require. The PLL control voltage is brought out through a 470K ohm resistor. This would allow for the use of external circuitry (analog comparators or an A/D converter plus a processor) to detect when the control voltage is getting close to the limits of the pull range.

## Performance Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
Output Frequencies		1.544		77.76	MHz
Supply Voltage, <b>C</b> = 5 Vdc <b>D</b> = 3.3 Vdc	V <sub>CC</sub> V <sub>CC</sub>	4.75 3.15	5.00 3.30	5.25 3.45	Vdc Vdc
Supply Current	I <sub>CC</sub>		45	70	mA
Input Signal, "0" <b>A</b> = HCMOS	CLKIN	0		0.2 (V <sub>CC</sub> )	Vdc
Input Signal, "1" <b>A</b> = HCMOS	CLKIN	0.7 (V <sub>CC</sub> )		5.5	Vdc
OUTPUT, <b>F</b> = Comp PECL	--	--	PECL	--	--
V <sub>OH</sub>	V <sub>OH</sub>	V <sub>CC</sub> -1.025		V <sub>CC</sub> -0.880	Vdc
V <sub>OL</sub>	V <sub>OL</sub>	V <sub>CC</sub> -1.810		V <sub>CC</sub> -1.620	Vdc
Rise / Fall Time (77.76 MHz)	t <sub>R</sub> /t <sub>F</sub>		0.5	2	ns
OUTPUT, <b>A</b> = HCMOS	--	--	HCMOS	--	--
V <sub>OH</sub> , I <sub>OL</sub> = 50 uA	V <sub>OH</sub>	V <sub>CC</sub> -0.3			Vdc
V <sub>OL</sub> , I <sub>OL</sub> = 50 uA	V <sub>OL</sub>			0.1	Vdc
Rise / Fall Time (77.76 MHz/20% to 80%)	t <sub>R</sub> /t <sub>F</sub>		1.4	2.5	ns
Output Symmetry, Freq >62.208MHz and 3.3V	Sym Sym	45 40		55 60	% %
Jitter @ 77.76 MHz (rms 12 kHz to 20 MHz)			0.5	1	ps
Jitter @ 77.76 MHz (cycle to cycle method)			3	5	ps
Jitter Transfer, GR-253-CORE sec 5.6.2.1.2				0.1	dB
Input Frequency Tracking Capability (Can translate Stratum 1,2,3,3E,4 or SONET Min)	APR	$\pm 50$			ppm
Operating Temperature	Temp Range <b>C</b> = 0°C to +70°C Temp Range <b>F</b> = -40°C to +85°C				
Size	25.4 x 20.32 x 5.08 (1.0" x 0.8" x 0.20")				

# FX-101 Frequency Translator

## Outline Drawing

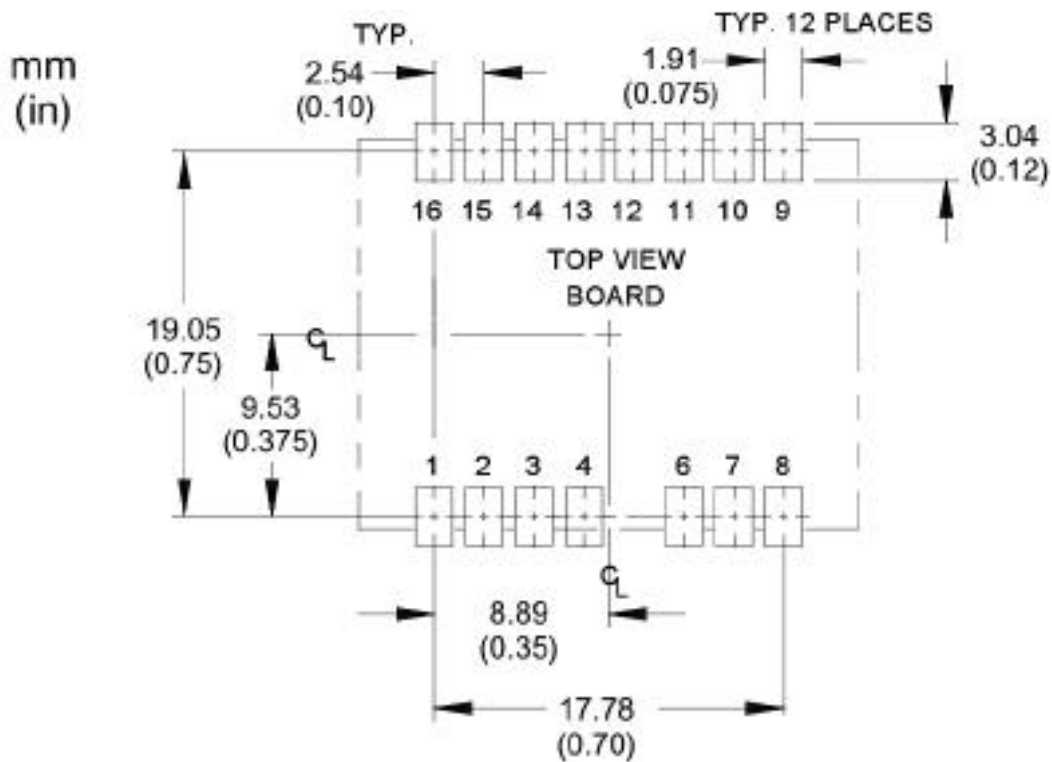


## Pin Out

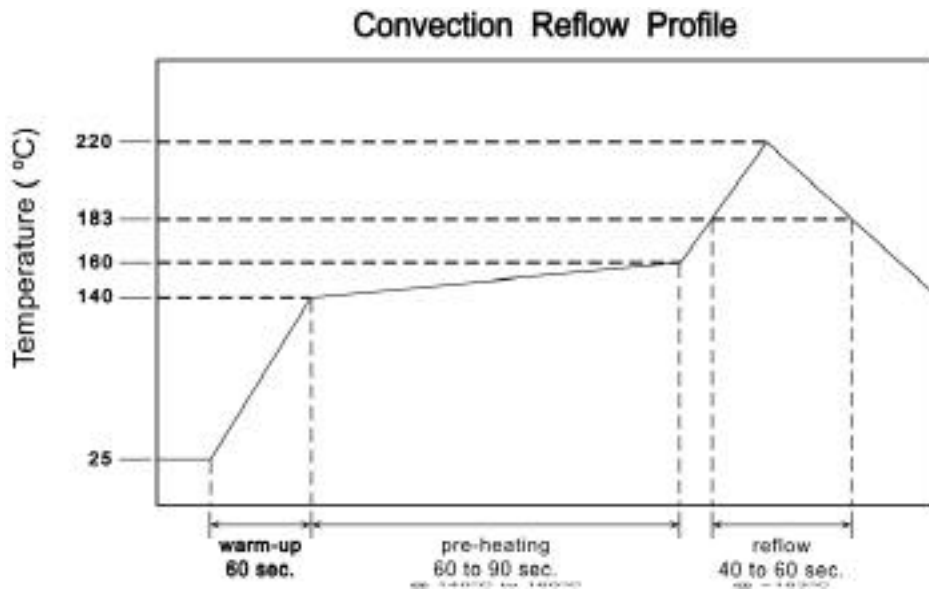
Pin	Symbol	Function
1	CLKIN	<b>Input Frequency</b> - The FX-101 series AC couples the input, this means the unit is capable of handling HCMOS, LvHCMOS, PECL and LvPECL input signals. (For Input Frequencies below 1 MHz only HCMOS and LvHCMOS are supported.)
2	GND	Ground
3	LD (output)	Lock Detect Logic "1" indicates a locked condition Logic "0" indicates that no input signal is present or the input signal has moved out of the lock range.
4	Monitor (Output)	PLL/ VCXO control voltage Under locked conditions, should be >0.3V and <3.0V for the 3.3 volt option or >0.5V and <4.5V for the 5 volt option. Input frequency may be out of range if voltage exceeds these limits.
5	---	Missing
6	NC	No Connection
7	GND	Ground
8	Tri-state & Enable Disable	HCMOS Logic "1" (or no connect) = Output enabled Logic "0" = Output in high impedance  PECL Logic "1" = Output disabled Logic "0" (or no connect) = Output enabled
9	Out	Output (PECL) or HCMOS
10	COut	Complementary Output (PECL) or GND for HCMOS output option
11	NC	No Connection
12	Select A	Do not Exceed Vcc
13	Select B	Do not Exceed Vcc
14	NC	No Connection
15	GND	Ground
16	V <sub>cc</sub>	Power Supply Voltage (5 Vdc or 3.3Vdc)

# FX-101 Frequency Translator

## Pad Layout



## Recommended Reflow Profile



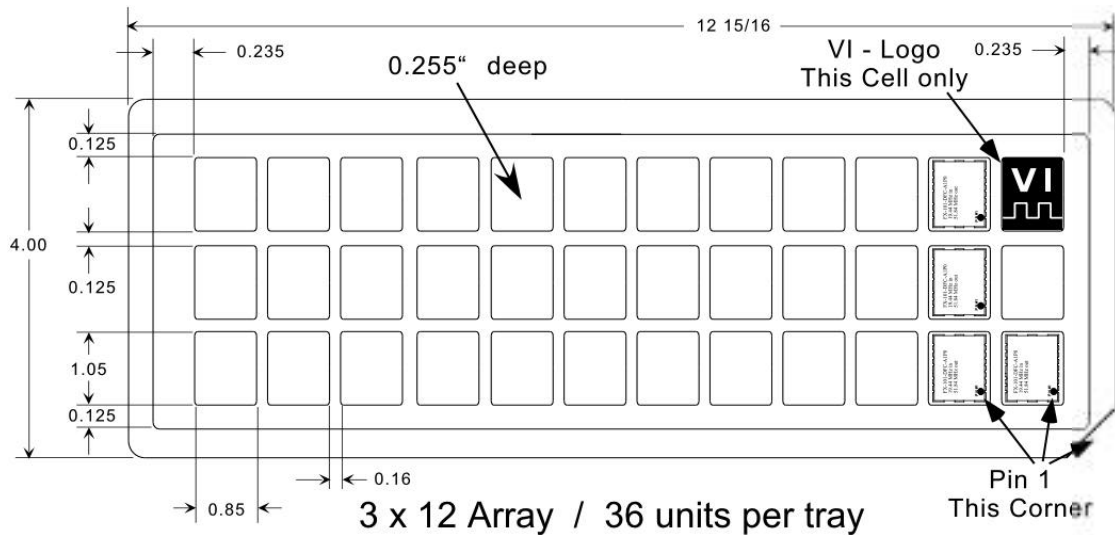
**NOTE:** The FX-100 series should not be subjected to a wash process that will immerse it in solvents. NO CLEAN is the recommended procedure. The FX-100 series has been designed for pick and place reflow soldering. The suggested reflow profile is shown above. The FX-100 series may be reflowed once, and should not be reflowed in the inverted position.

# FX-101 Frequency Translator

## Standard Shipping Method

The Standard ship method for volume production of the FX-100 series is in a matrix tray. These trays are 100% recyclable. The trays also offer the added feature that

they can be continuously feed into a pick-n-place machine eliminating the down time required with tape-n-reel.



## Handling Precautions

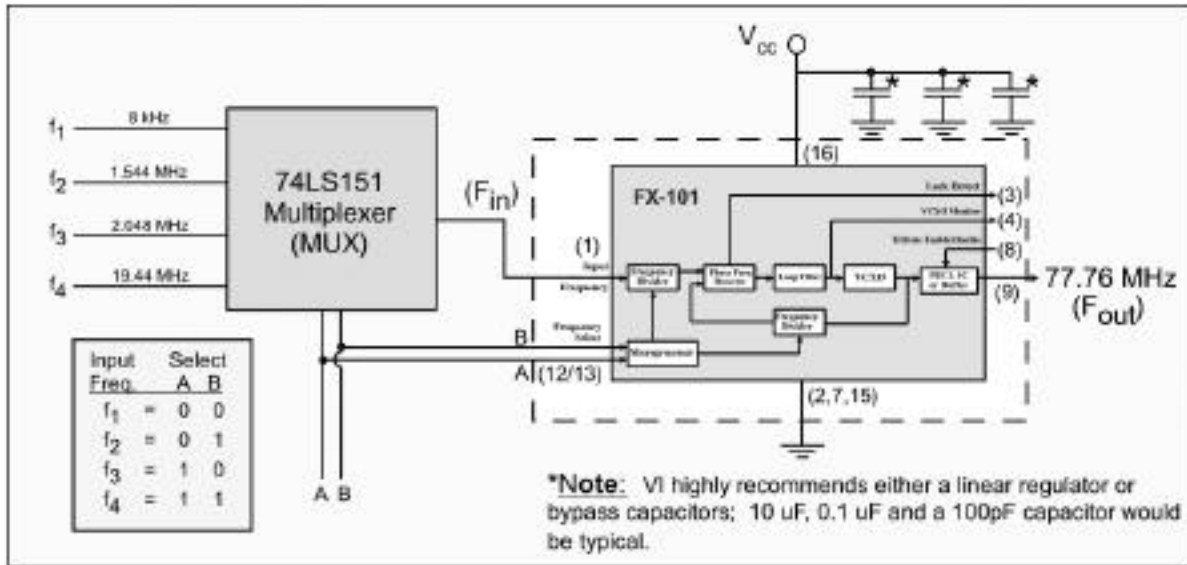
Although protection circuitry has been designed into this device, proper precautions should be taken to avoid exposure to electrostatic discharge (ESD) during handling and mounting. VI employs a human-body model (HBM) for ESD-susceptibility testing and protection design evaluation.

ESD voltage thresholds are dependent on the circuit parameters used to define the mode. The HBM ESD threshold presented here was obtained by using parameters where resistance = 1500 ohms, capacitance = 100pf

ESD Threshold Voltage		
Model	Threshold	Unit
Human Body (HBM)	500	V min

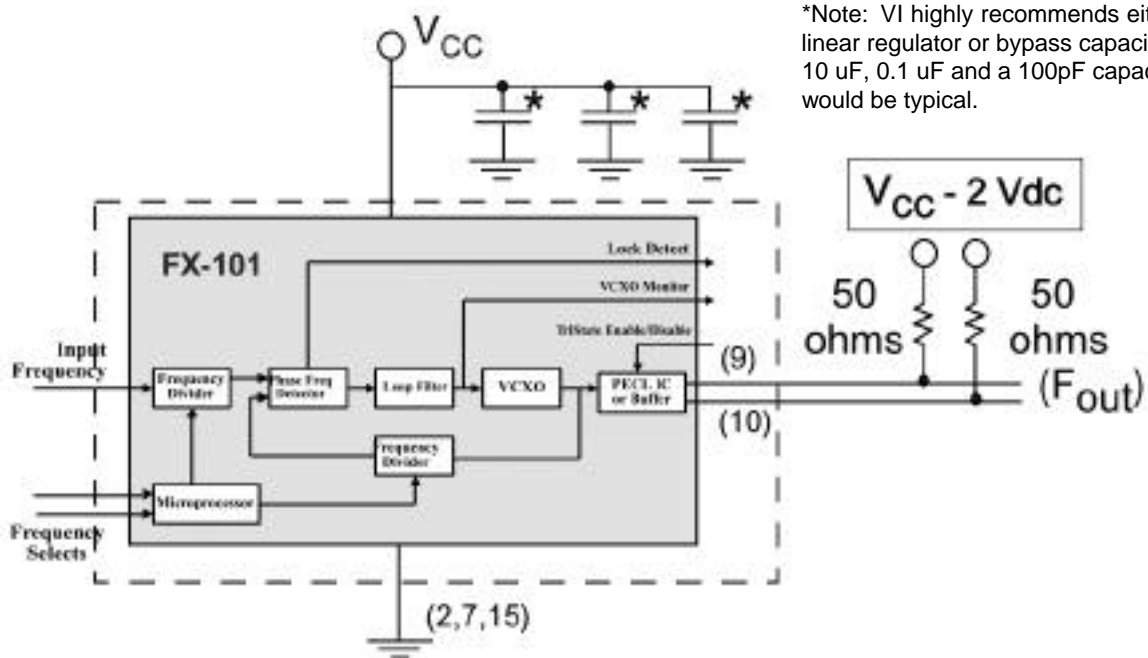
# FX-101 Frequency Translator

## Typical Application



All components outside the dotted line box are user supplied components. This is just one possible configuration of the FX-101. For additional information about your specific needs, please contact our factory.

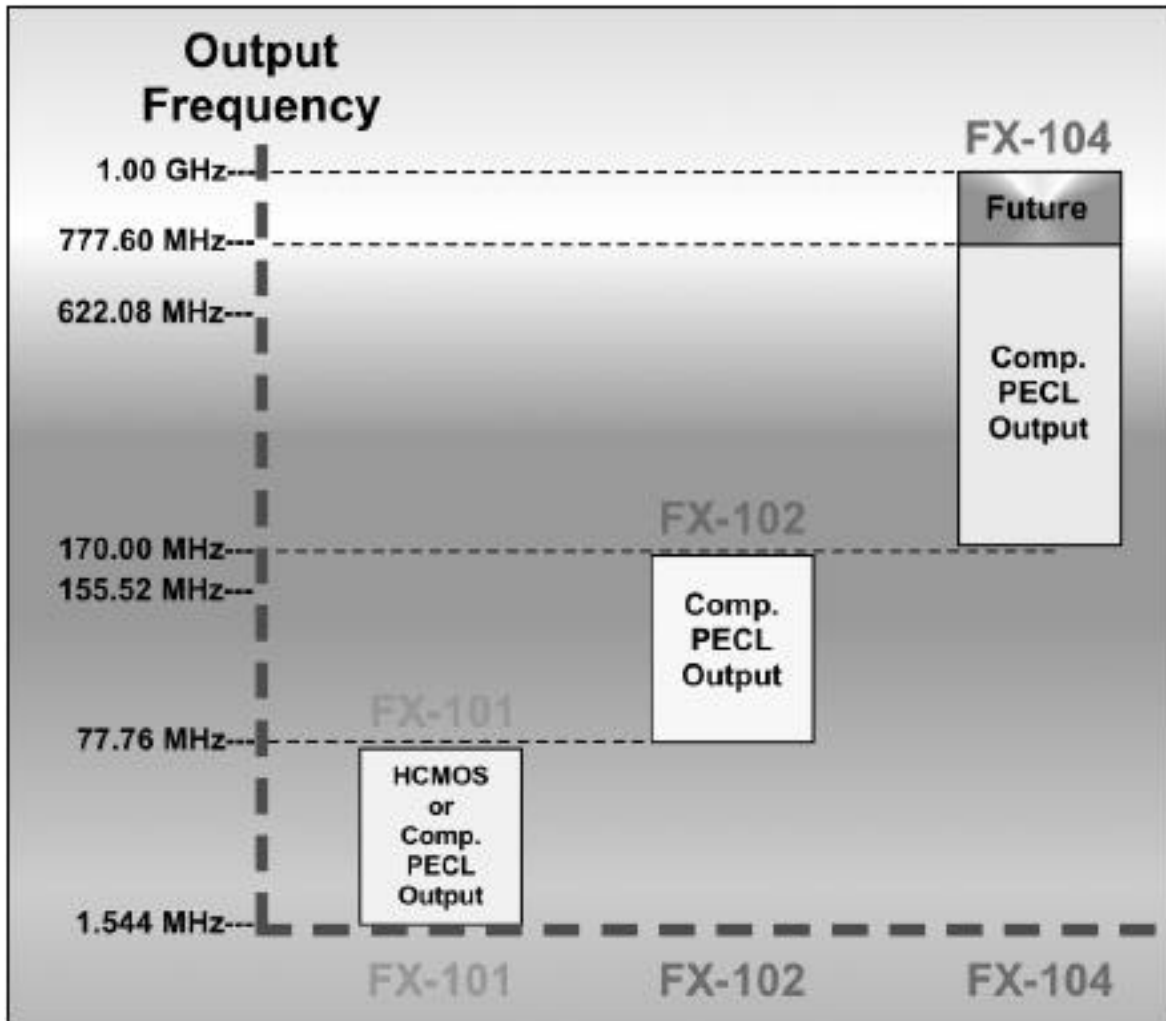
## Output Load Configuration



All components outside the dotted line box are user supplied components and/or connections. This is just one possible configuration of the FX-101. For additional information about your specific needs please contact our Factory.

# FX-101 Frequency Translator

## FX-100 Series Selection Guide



## FITS / MTBF Calculations

Per Bellcore TR-NWT-000332, GF @ +50°C.

Typical - FX-101-DFC-A1P2

FITs = 291.38

MTBF (Hours) = 3,432, 000

# FX-101 Frequency Translator

## FAQ's

Q: What are the different input frequencies that are available?

**A: The FX-100 series is able to handle any input frequency between 8 kHz and 170 MHz.  
(A list of standard frequencies is available on pages 9 and 10.)**

Q: How many different input frequencies can a specific FX-101 accept?

**A: Each FX-101 can be programmed to accept up to 4 different frequencies.**

Q: If there is only one input pin, how can your unit accept 4 different frequencies?

**A: The user is required to supply a multiplexer which would switch between the different input frequencies. The multiplexers' select pins would need to be sync'd to the select pins of the FX-101.  
(See The Typical Application illustrated on page 6.)**

Q: Can a single FX-101 handle an application for 4 input frequencies of 8 kHz, 19.44, 38.88 and 77.76 MHz all being translated to 77.76 MHz, with the 77.76 MHz input being LvPECL and the others HCMOS?

**A: Yes; since the FX-101 AC couples the input signal, this combination can be supported.**

Q: What is the lock time for the FX-101?

**A: The exact lock time will depend on the specific input frequency. It should be noted that in all cases the lock time will be significantly less than 1 second.**

Q: I asked for a FX-101-DFC-A2S2 with 19.44 and 155.52 MHz for the input frequencies and was given a Source Control Drawing (SCD) number of FX-101-DFC-S5999 Why was a new number assigned?

**A: Whenever there are multiple input frequencies, we need to assign a SCD for the unit so that we can include a table indicating what the logic levels need to be on pins 12 and 13 to control the unit per the correct input frequency.**

Q: What are the exact jitter transfer specs that the FX-101 series meets?

**A: The FX-101 meets the stringent jitter transfer specs in GR-253 for Category II jitter (Section 5.6.2.1.2) for all OC-n levels.**

Q: Does the output frequency need to be 77.76 MHz?

**A: No, the output frequency can be any frequency between 1.544 MHz and 77.76 MHz.  
(A list of standard frequencies is available on pages 9 and 10.)**

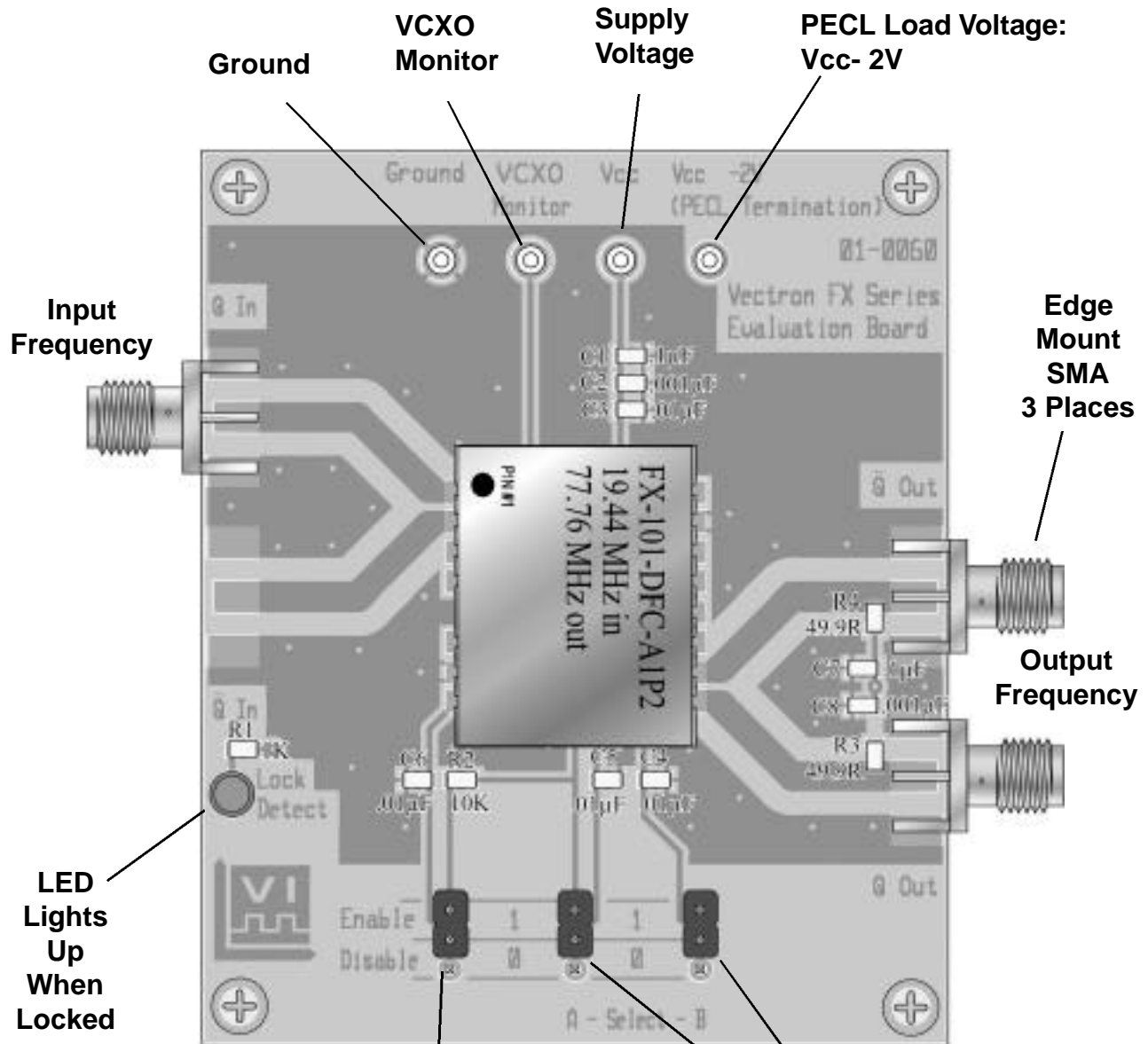
Q: What type of noise on the supply line can the FX-101 suppress?

**A: The FX-101 is designed to clean up noise on the Input Clock Signal, it is not designed to clean up noisy power supplies. If excessive noise is present on the supply line it may degrade the output jitter performance. Additional external filtering may be required. Please consult with your power supply vendor on the best way to filter noise on your supply line.**



# FX-101 Frequency Translator

## Evaluation Board



LED Lights Up When Locked

For FX-101 with PECL output Place Connector in the "0" position for Enable "1" position Disable (In disable position as shown)

Input Freq.		Select	
		A	B
f <sub>1</sub>	=	0	0
f <sub>2</sub>	=	0	1
f <sub>3</sub>	=	1	0
f <sub>4</sub>	=	1	1

Evaluation boards are available upon request.

# FX-101 Frequency Translator

## Other Standard Input / Output Combinations

Input 1	Input 2	Input 3	Input 4	Output
8 kHz	19.44 MHz	----	----	1.544 MHz
8 kHz	----	----	----	37.056 MHz
1.544 MHz	2.048 MHz	----	----	51.84 MHz
19.44 MHz	77.76 MHz	----	----	51.84 MHz
8 kHz	----	----	----	65.536 MHz
65.536	----	----	----	65.536 MHz
2.048 MHz	19.44 MHz	----	----	77.76 MHz
8 kHz	1.544 MHz	2.048 MHz	19.44 MHz	77.76 MHz
19.44 MHz	20.8286 MHz	77.76 MHz	83.3143 MHz	77.76 MHz

The combinations above are just a small sample of what is possible with the FX-101 series.

This series is capable of translating up and down in frequency. Virtually all input frequencies between 8 kHz and 170 MHz can be supported.

The FX-101 uses Vectron International's V-type VCXO and as such can support any output frequency that is available with the V-Type. A list of available output frequencies for the V-Type is provided below.

## V-type Available Frequencies (MHz)

	1.544	2.000	2.048	3.088	3.580
3.686	4.000	4.032	4.096	4.434	5.000
6.144	6.176	6.312	6.400	8.000	8.192
8.448	10.000	12.000	12.288	12.352	13.000
14.318	15.360	15.440	16.000	16.384	18.432
19.44	20.000	20.480	24.000	24.576	24.704
27.000	30.000	32.000	32.768	34.368	35.328
38.880	40.000	40.960	44.736	50.000	51.840
52.000	65.536	77.760			

# FX-101 Frequency Translator

## Standard Frequencies

8 kHz	<b>C</b>	16.384 MHz	<b>N</b>	77.76 MHz	<b>2</b>
16 kHz	<b>D</b>	19.44 MHz	<b>P</b>	82.944 MHz	<b>3</b> In only
64 kHz	<b>E</b>	20.48 MHz	<b>R</b>	112 MHz	<b>4</b> In only
1.024 MHz	<b>F</b>	26.00 MHz	<b>T</b>	139.264 MHz	<b>5</b> In only
1.544 MHz	<b>H</b>	27.00 MHz	<b>W</b>	155.52 MHz	<b>6</b> In only
2.048 MHz	<b>J</b>	38.88 MHz	<b>X</b>	166.6286 MHz	<b>7</b> In only
4.096 MHz	<b>K</b>	44.736 MHz	<b>Y</b>		
8.192 MHz	<b>L</b>	51.84 MHz	<b>0</b>		
13.00 MHz	<b>M</b>	61.44 MHz	<b>1</b>	Special SCD	<b>S</b>

## How to Order

**FX-101 -** D F C - A 1 P 2

### Supply Voltage

**C** = 5 Vdc ±5%  
**D** = 3.3 Vdc ±5%

### Output Type

**A** = HCMOS  
**F** = Comp. PECL

### Temperature Range

**C** = 0°C to +70°C  
**F** = -40°C to +85°C

### Output Frequency (H to 2)

See Frequency Chart Above

\*If not listed enter **S** in this block and then list the output frequencies after the part number.

### Input Frequency (C to 7)

See Frequency Chart Above

\*If not listed or more than one frequency enter **S** in this block and then list all the input frequencies after the part number.

### Number of Input Frequencies

**1** = 1 Input Frequency  
**2** = 2 Input Frequencies  
**3** = 3 Input Frequencies  
**4** = 4 Input Frequencies

### Input Logic

**A** = HCMOS

\*If not listed or more than one input frequency a special SCD number will be assigned at point of order.

### Part Number Examples:

\*FX-101-DFC-A1P2

\*FX-101-DFC-A4S2, S = 8 kHz, 1.544 MHz, 2.048 MHz, 19.44 MHz

\*FX-101-CFC-A1CS, S = 65.536 MHz

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