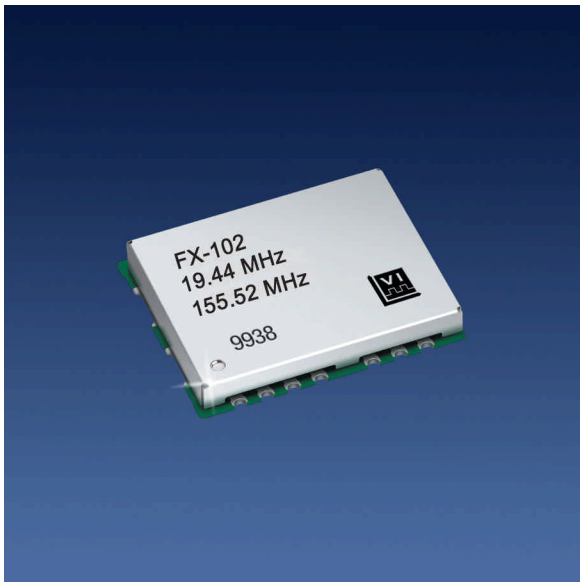
VECTRON INTERNATIONAL
A DOVER TECHNOLOGIES COMPANY

Product Data Sheet

FX-102

Frequency Translator

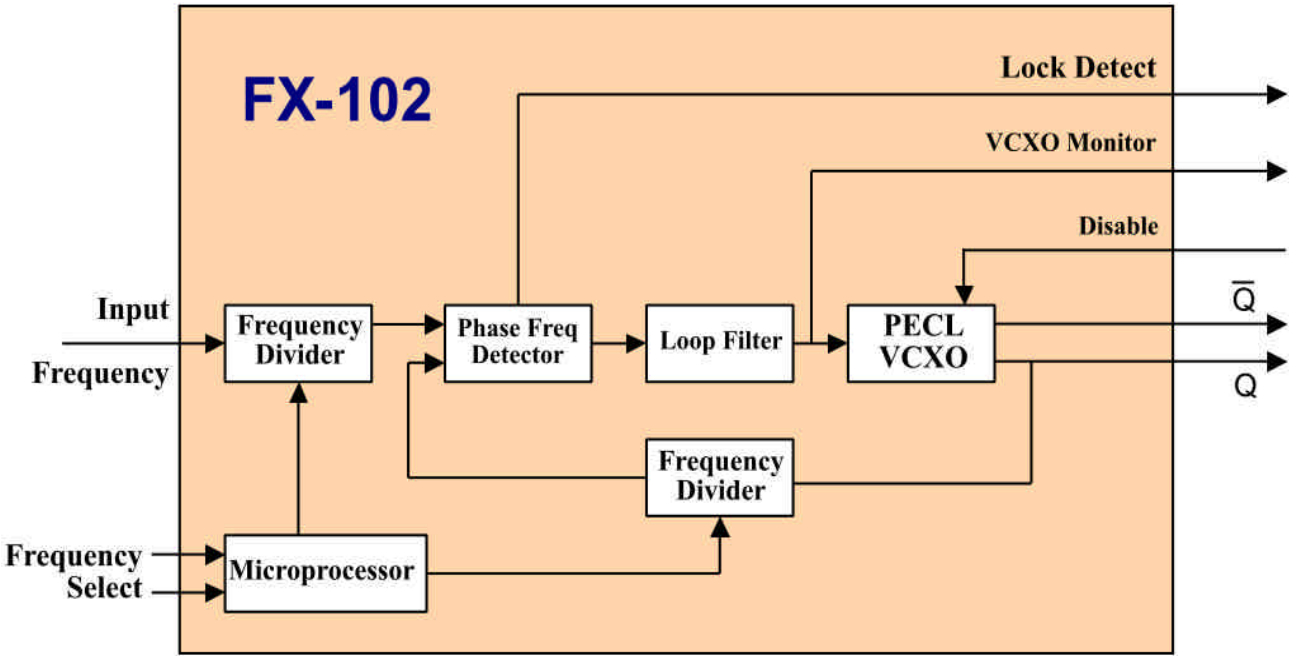


Features

- Output frequencies up to 170 MHz
- Jitter Generation OC-192 compliant
- Jitter transfer per GR-253-CORE
- Single 5 or 3.3 Vdc supply
- Locked to specified Input frequency, e.g. 8 kHz
- 1" x 0.8" x 0.25", Surface Mount (FR4 base)

Applications

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



FX-102 Frequency Translator

Description

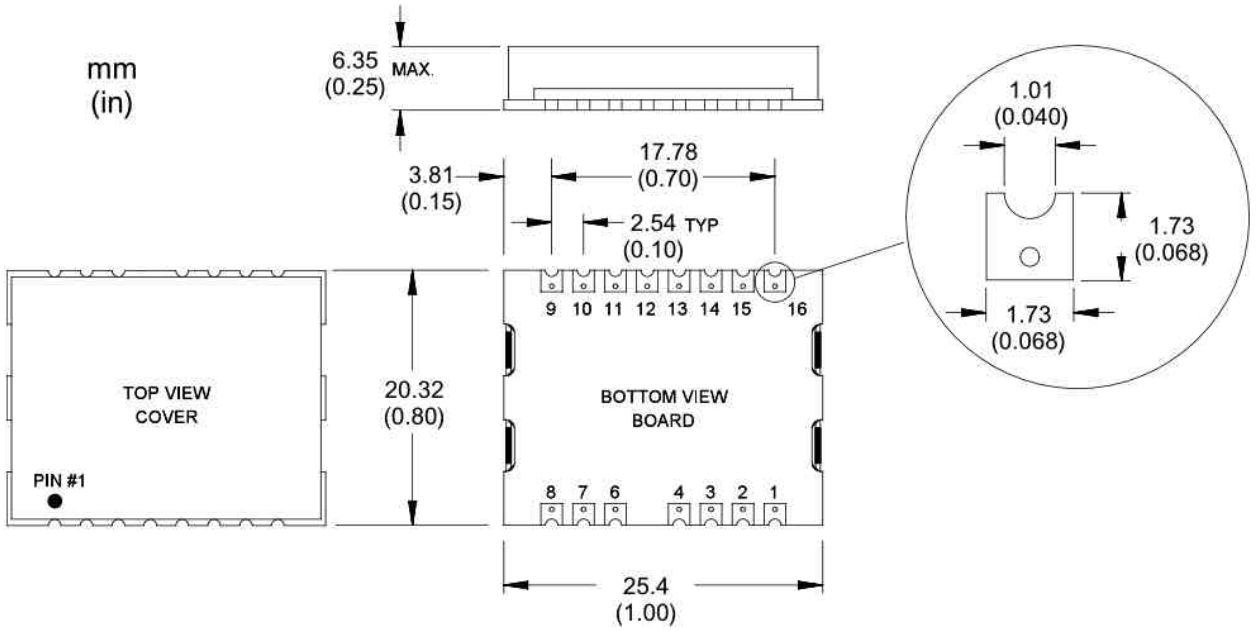
Vectron's FX-102 is a crystal based frequency translator which is used to translate any input frequency such as 8 kHz, 1.544 MHz, 2.048 MHz, 19.440 MHz etc. to any specific frequency from 77.76 to 170 MHz. The input frequency does not have to be a 50/50% duty cycle and as an example can be an 8 kHz signal with a logic high "on time" of only 1us, such as a BITS clock. The FX-102 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 any specific output frequency from 77.76 MHz to 170 MHz.

The "Input Frequency tracking capability" is the total amount of input frequency deviation in which the FX-102 is guaranteed to track or translate. As an example, a typical input clock would be 8 kHz ±20 ppm. The FX-102 is guaranteed to track at least ±40 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		77.76		170	MHz
Supply Voltage, **C** = 5 Vdc **D** = 3.3 Vdc	V_{CC} V_{CC}	4.75 3.15	5.00 3.30	5.25 3.45	Vdc Vdc
Supply Current	I_{CC}		75	100	mA
Input Signal, **A** = HCMOS **D** = PECL	CLKIN CLKIN		HCMOS PECL	--- ---	--- ---
OUTPUT, **F** = Comp PECL	---	---	PECL	---	---
V_{OH} (Temp Range **C** = 0°C to +70°C) V_{OL} (Temp Range **C** = 0°C to +70°C) V_{OH} (Temp Range **F** = -40°C to +85°C) V_{OL} (Temp Range **F** = -40°C to +85°C)	V_{OH} V_{OL} V_{OH} V_{OL}	V_{CC}-1.025 V_{CC}-1.810 V_{CC}-1.085 V_{CC}-1.830		V_{CC}-0.880 V_{CC}-1.620 V_{CC}-0.880 V_{CC}-1.555	V V V V
Rise/Fall Time	t_R/t_F		0.5	1	ns
Output Symmetry	Sym	45		55	%
Jitter Generation, rms (12 kHz to 20 MHz)			<0.5	1	ps
Jitter Generation, rms (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 a Stratum 1,2,3,3E,4 or SONET Min source)	APR	±40			ppm
Operating Temperature	Temp Range **C** = 0°C to +70°C Temp Range **F** = -40°C to +85°C				
Size	25.4 x 20.32 x 6.35 mm (1.0” x 0.8” x 0.25”)				

Outline Drawing

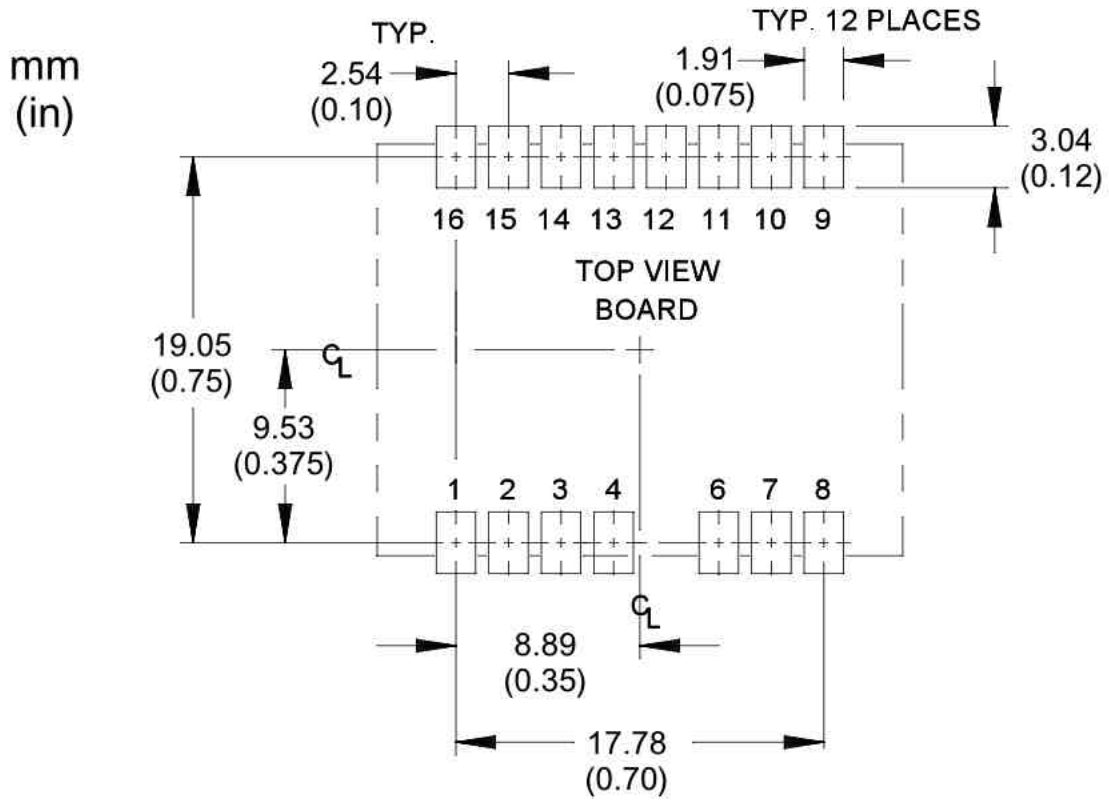


Pin Out

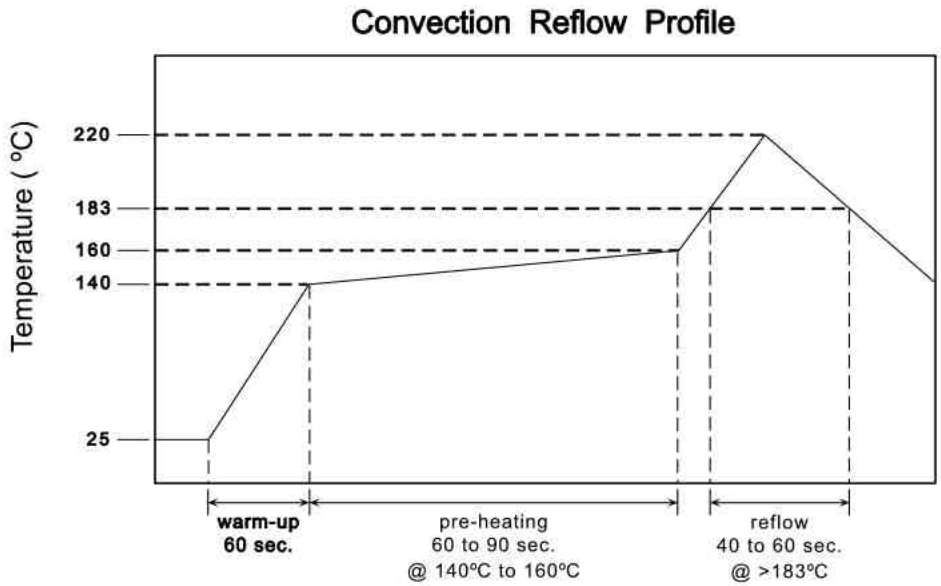
Pin	Symbol	Function
1	CLKIN	**Input Frequency** - The FX-102 series AC couples the input, this means the unit is capable of handling HCMOS, LvHCMOS, PECL and LvPECL input signals. (For Input Frequencies below1 MHz only HCMOS and LvHCMOS are supported.)
2	GND	Ground
3	LD (output)	Lock Detect Logic “1” 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	Enable / Disable	Logic "0" (or no connect) = Output Enabled Logic "1” = Output Disabled
9	Out	Output
10	COut	Complementary Output
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_{CC}	Power Supply Voltage (5 Vdc or 3.3Vdc)

FX-102 Frequency Translator

Pad Layout



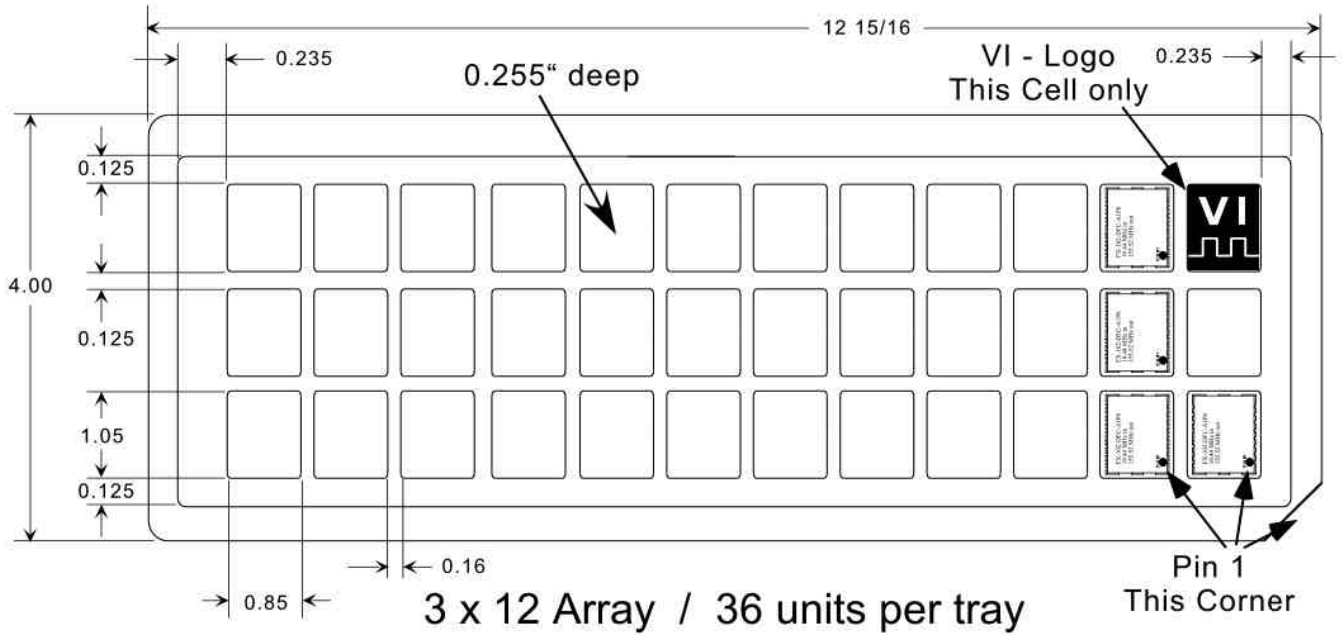
Recommended Reflow Profile



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.

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

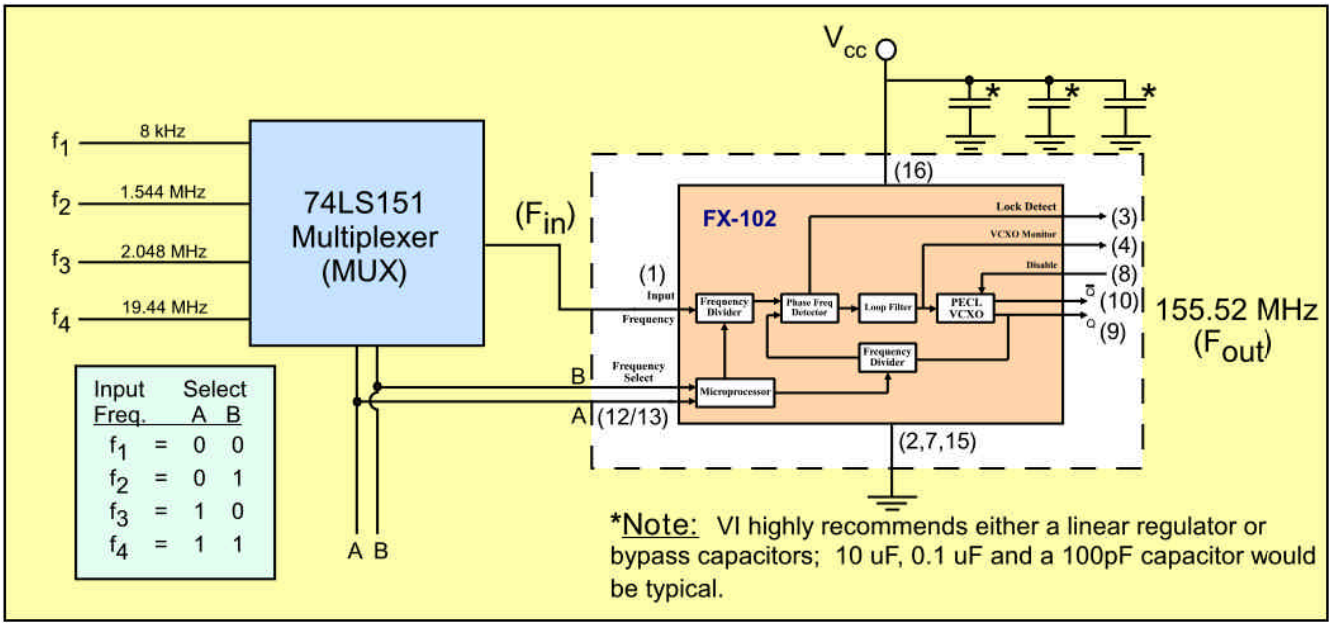
Although protection circuitry has been designed into this device, proper precautions should be taken to avoid exposure to electrostatic discharge (ESD) during handling and mounting. VI employs a human-body model (HBM) and a charged-device model (CDM) for ESD-susceptibility testing and protection design evaluation. ESD voltage thresholds are dependent on the circuit parameters used to define the mode

Although no industry-wide standard has been adopted for the CDM, a standard HBM (resistance = 1500 ohms, capacitance = 100pf) is widely used and therefore can be used for comparison purposes. The HBM ESD threshold presented here was obtained by using these circuit parameters.

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

FX-102 Frequency Translator

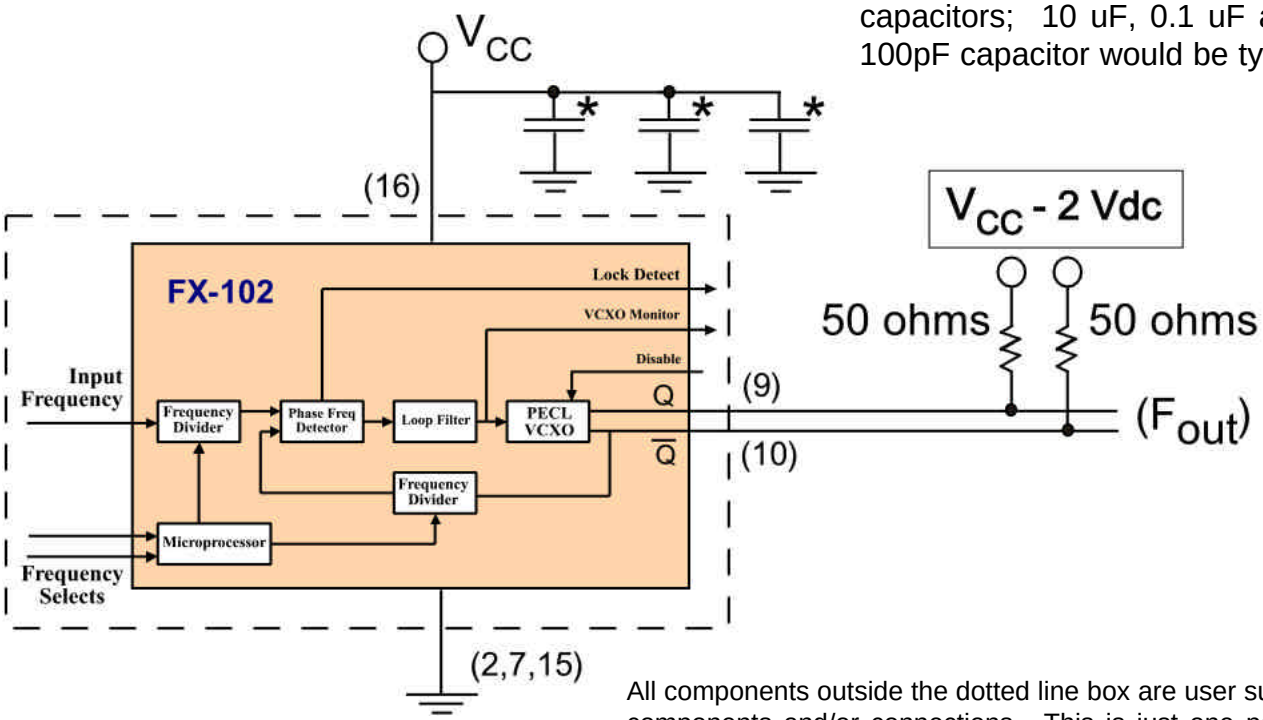
Typical Application



All components outside the dotted line box are user supplied components. This is just one possbile configuration of the FX-102. For additional information about your specific needs, please contact our factory.

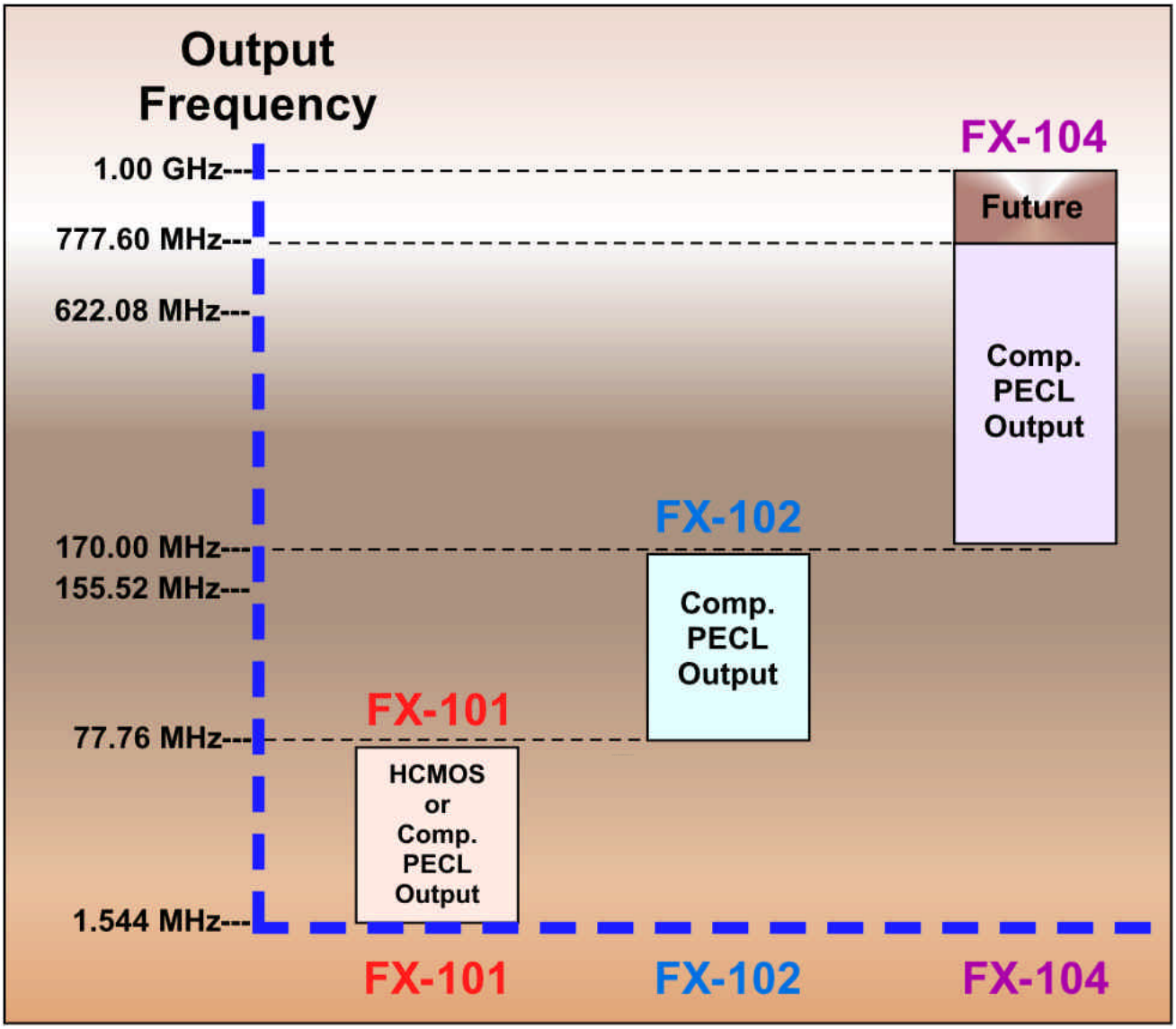
Output Load Configuration

*Note: VI highly recommends either a linear regulator or bypass capacitors; 10 uF, 0.1 uF and a 100pF capacitor would be typical.



All components outside the dotted line box are user supplied components and/or connections. This is just one possible configuration of the FX-102. For additional information about your specific needs please contact our Factory.

FX-100 Series Selection Guide



FITS / MTBF Calculations

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

Typical - FX-102-DFC-A1P6

FITs = 485.63

MTBF (Hours) = 2,059,202

FAQ's

Q1: 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 & 10.)

Q2: How many different input frequencies can a specific FX-102 accept?
A: Each FX-102 can be programmed to accept up to 4 different frequencies.

Q3: 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-102. (See The Typical Application illustrated on page 6.)

Q4: Can a single FX-102 handle an application for 4 input frequencies of 8 kHz, 19.44, 77.76 and 155.52 MHz all being translated to 155.52 MHz, with the 155.52 MHz input being LvPECL and the others HCMOS?
A: Yes; since the FX-102 AC couples the input signal, this combination can be supported.

Q5: What is the lock time for the FX-102?
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.

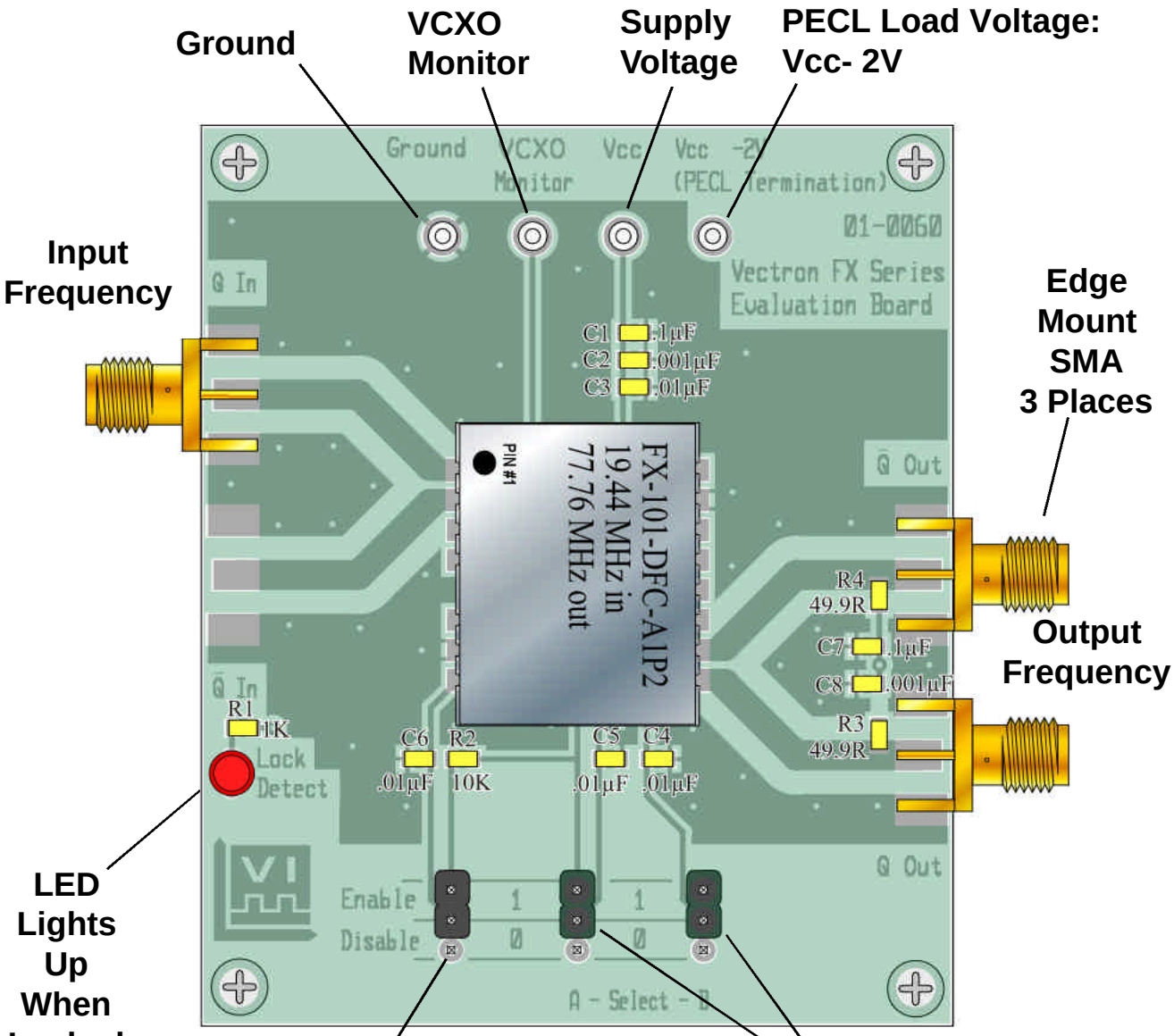
Q6: I asked for a FX-102-DFC-A2S6 with 19.44 and 155.52 MHz for the input frequencies and was given a Source Control Drawing (SCD) number of FX-102-DFC-S5999. Why was a new number assigned?
A: Whenever there are multiple input frequencies, we need to assign a SCD for the unit so that we can include a table indicating what the logic levels need to be on pins 12 and 13 to control the unit per the correct input frequency.

Q7: What are the exact jitter transfer specs that the FX-102 series meets?
A: The FX-102 meets the stringent jitter transfer specs in GR-253 for Category II jitter (Section 5.6.2.1.2) for all OC-n levels.

Q8: My circuit card is already laid out for the FX-104, Is the FX-102 footprint compatible?
A: Yes; The FX-102 package is a drop in replacement for the FX-104 package. The only difference is in the logic level for the Output Disable/Enable pin. They are opposite between the FX-102 and FX-104. However letting pin 8 float will allow both units to be enabled.

Q9: What type of noise on the supply line can the FX-102 suppress?
A: The FX-102 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.

Evaluation Board



For FX-102 with PECL output
Place Connector in the
"0" position for Enable
"1" position Disable
(In disable position as shown)

Input Freq.		Select A	Select B
f_1	=	0	0
f_2	=	0	1
f_3	=	1	0
f_4	=	1	1

Evaluation boards are available upon request.

FX-102 Frequency Translator

Other Standard Input / Output Combinations				
Input 1	**Input 2**	**Input 3**	**Input 4**	**Output**
16 kHz	----	----	----	77.76 MHz
77.76 MHz	155.52 MHz	----	----	77.76 MHz
29.4912 MHz	----	----	----	78.6432 MHz
99.84	----	----	----	99.84 MHz
55 MHz	110 MHz	----	----	110 MHz
20.48 MHz	----	----	----	112 MHz
19.44 MHz	----	----	----	114 MHz
8 kHz	16.384 MHz	----	----	125 MHz
62.5 MHz	125 MHz	----	----	125 MHz
125 MHz	----	----	----	125 MHz
8 kHz	1.544 MHz	2.048 MHz	19.44 MHz	155.52 MHz
8 kHz	19.44 MHz	77.76 MHz	155.52 MHz	155.52 MHz
6.48 MHz	19.44 MHz	32.768 MHz	51.84 MHz	155.52 MHz
19.44 MHz	38.88 MHz	77.76 MHz	155.52 MHz	155.52 MHz
166.6286 MHz	----	----	----	155.52 MHz
155.52 MHz	----	----	----	166.6286 MHz
19.44 MHz	----	----	----	168.0407 MHz

The combinations above are just a small sample of what is possible with the FX-102 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-102 uses Vectron International's J-type VCXO and as such can support any output frequency that is available with the J-Type.

Vectron International will support all FEC rates for SONET, 10 GigE and 10.3125 GigE applications. If you do not see a frequency option listed that you need please contact the factory.

When ordering FEC rates, we ask that you also include the FEC ratio (e.g. 255/237 x OC-3, 237/236 x OC-3,etc....) for both the input and output frequencies.

Standard Frequencies

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

FX-102 - [D] [**F**] [C] **-** [A] [1] [P] [6]

Supply Voltage
C = 5 Vdc ±5%
D = 3.3 Vdc ±5%

Output Type
F = Comp. PECL

Temperature Range
C = 0°C to +70°C
F = -40°C to +85°C

Output Frequency (2 to 7)
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
D = PECL

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

Part Number Examples:

FX-102-DFC-D1P6

*FX-102-DFF-A4S6, S = 8 kHz, 1.544 MHz, 2.048 MHz, 19.44 MHz

*FX-102-DFC-D16S, S = 166.6286 MHz

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For additional information please contact:

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