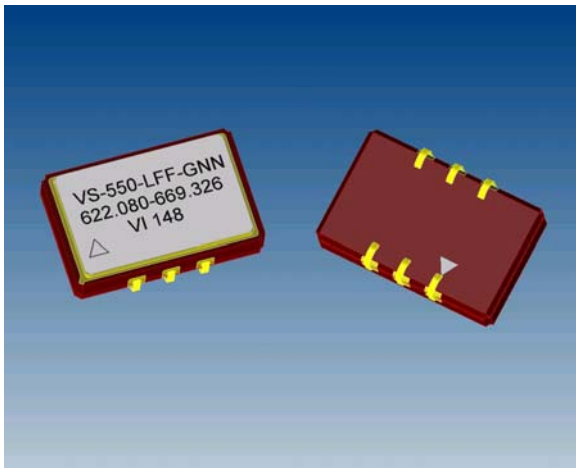


## VS-550 Dual Frequency VCSO



### Features

- 9 x 14 x 3.5 mm Package
- Output Frequencies from 500 MHz to 850 MHz
- 3.3 V Operation
- Low Jitter < 0.25 ps-rms across 50 kHz to 80 MHz
- LV-PECL Configuration with Fast Transition Times
- Complementary Outputs
- Frequency Select Feature

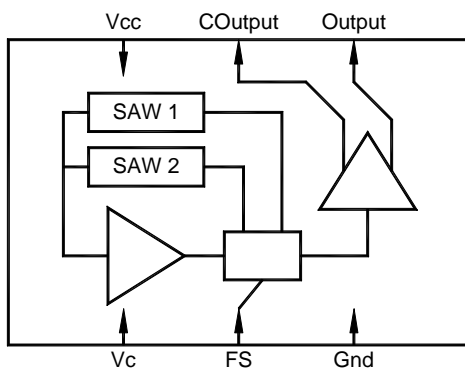


Product is free of lead and compliant to EC RoHS Directive

### Applications

PLL circuits for Clock Smoothing and Frequency Translation

<u>Description</u>	<u>Standard</u>
• 10G Fibre Channel	INCITS 364-2003
• 10GbE LAN / WAN	IEEE 802.3ae
• OC-192	ITU-T G.709
• SONET / SDH	GR-253-CORE Issue3



### Description

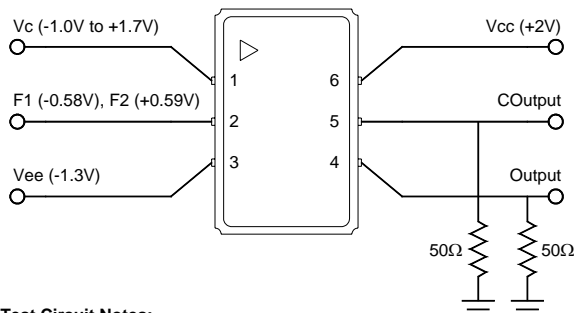
The VS-550 is a SAW based voltage controlled oscillator that operates at the fundamental frequencies of the internal SAW filters. These SAW filters are high-Q quartz devices that enable the circuit to achieve low phase jitter performance over a wide operating temperature range. The dual oscillator is housed in a hermetically sealed J-lead surface mount package offered on tape and reel. It has a frequency select function that enables either "Frequency 1" or "Frequency 2."

# VS-550 Voltage Controlled SAW Oscillator

## Electrical Performance

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
<b>Frequency</b>						
Nominal Frequency	$f_N$		500 - 850		MHz	1,2,3
Absolute Pull Range	APR	±50			ppm	1,2,3,8
Linearity	$L_{in}$		±5		%	2,4,8
Gain Transfer (See Pg 5)	$K_V$		+385		ppm/V	2,8
Temperature Stability	$f_{STAB}$		±100		ppm	1,6
Transition Time			4		µsec	6
<b>Supply</b>						
Voltage	$V_{CC}$	2.97	3.3	3.63	V	2,3
Current (No Load)	$I_{CC}$		55	70	mA	3
<b>Outputs</b>						
Mid Level		$V_{CC}-1.4$	$V_{CC}-1.3$	$V_{CC}-1.2$	V	2,3
Swing		550	650	950	mV-pp	2,3
Current	$I_{OUT}$			20	mA	6
Rise Time	$t_R$		250	400	ps	5,6
Fall Time	$t_F$		250	400	ps	5,6
Symmetry	SYM	45	50	55	%	2,3
Spurious Suppression		50	60		dBc	6
Jitter (See Pg 5)	$\phi_J$		0.135	0.250	ps-rms	6,7
<b>Control Voltage</b>						
Input Impedance	$Z_c$		100		kΩ	6
Modulation Bandwidth	BW		500		kHz	6
<b>Operating Temperature</b>						
	$T_{OP}$	-40		85	°C	1,3
<b>Package Size</b>						
		9.0 x 14.0 x 3.5			mm	

1. See Standard Frequencies and Ordering Information (Pg 7).
2. Parameters are tested with production test circuit below (Fig 1).
3. Parameters are tested at ambient temperature with test limits guardbanded for specified operating temperature.
4. Measured as the maximum deviation from the best straight-line fit, per MIL-0-55310.
5. Measured from 20% to 80% of a full output swing (Fig 2).
6. Not tested in production, guaranteed by design, verified at qualification.
7. Integrated across 50 kHz to 80 MHz, per GR-253-CORE Issue3.
8. Tested with  $V_c = 0.3V$  to  $3.0V$ .



### Test Circuit Notes:

- 1) To Permit 50Ω Measurement of Outputs, all DC Inputs are Biased Down 1.3V.
- 2) All Voltage Sources Contain Bypass Capacitors to Minimize Supply Noise.
- 3) 50Ω Terminations are Within Test Equipment.

Figure 1. Test Circuit

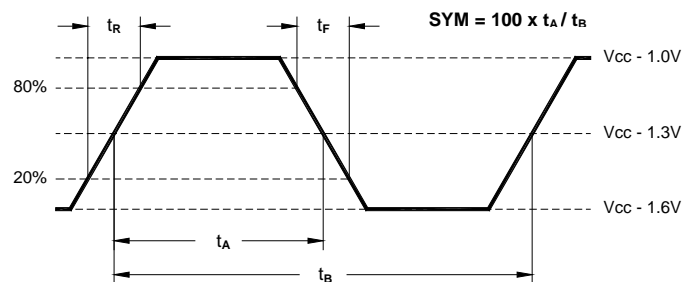
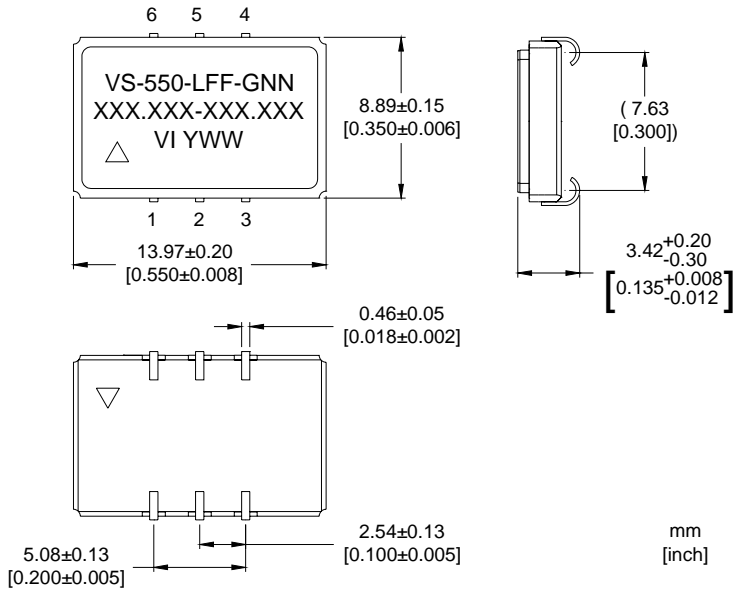


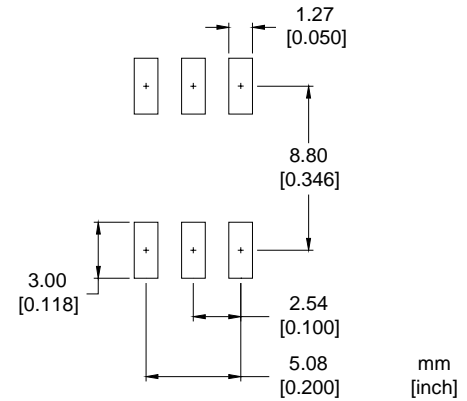
Figure 2. 10K LV-PECL Waveform

# VS-550 Voltage Controlled SAW Oscillator

## Outline Diagram



## Pad Layout



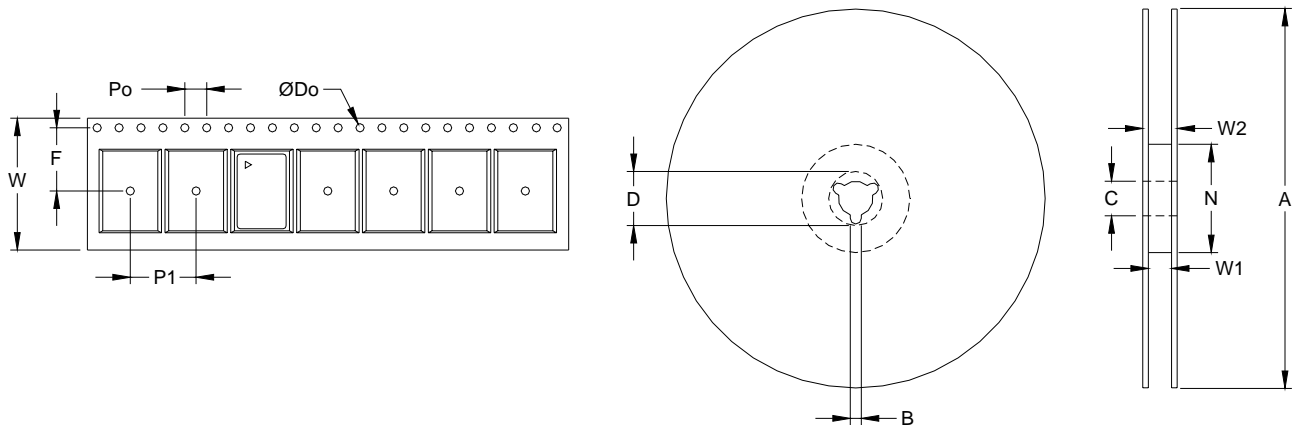
## Pin Out

Pin	Symbol	Function
1	V <sub>c</sub>	VCSO Control Voltage
2	FS	Frequency Select (See Control Logic)
3	GND	Case and Electrical Ground
4	Output	VCSO Output
5	COutput	VCSO Complementary Output
6	V <sub>cc</sub>	Power Supply Voltage (3.3 V ±10%)

## Control Logic (LV-CMOS)

FS	Operation
0	F1
1	F2

## Tape and Reel (EIA-481-2-A)



## Tape Dimensions (mm) | Reel Dimensions (mm)

Dimension	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	# Per Reel
Tolerance	Typ	Typ	Typ	Typ	Typ	Typ	Min	Typ	Min	Min	Typ	Max	
VS-550	24	11.5	1.5	4	12	330	1.5	13	20.2	100	24.4	30.4	200

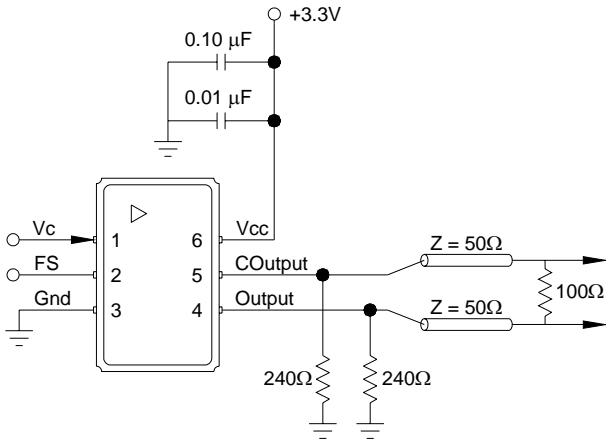
# VS-550 Voltage Controlled SAW Oscillator

## Absolute Maximum Ratings

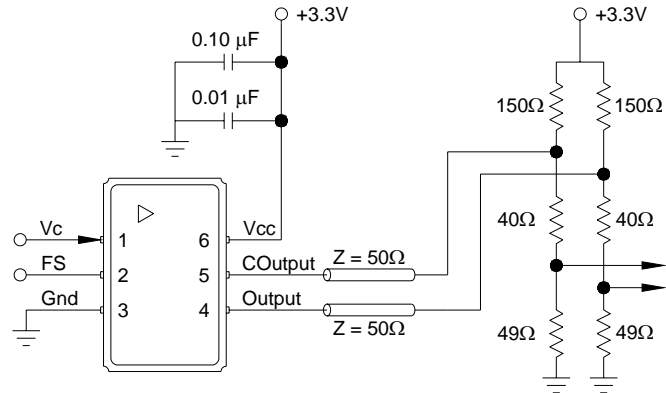
Parameter	Symbol	Ratings	Unit
Power Supply	$V_{CC}$	0 to 6	V
Input Current	$I_{IN}$	100	mA
Output Current	$I_{OUT}$	25	mA
Voltage Control Range	$V_C$	0 to $V_{CC}$	V
Storage Temperature	$T_{STR}$	-55 to 125	°C
Solder Temperature / Duration	$T_{PEAK} / t_p$	260 / 40	°C / sec

Stresses in excess of the absolute maximum ratings can permanently damage the device. Also, exposure to these absolute maximum ratings for extended periods may adversely affect device reliability. Functional operation is not implied at these or any other conditions in excess of those represented in the operational sections of this datasheet. Permanent damage is also possible if any device input ( $V_C$  or  $FS$ ) draws greater than 100mA.

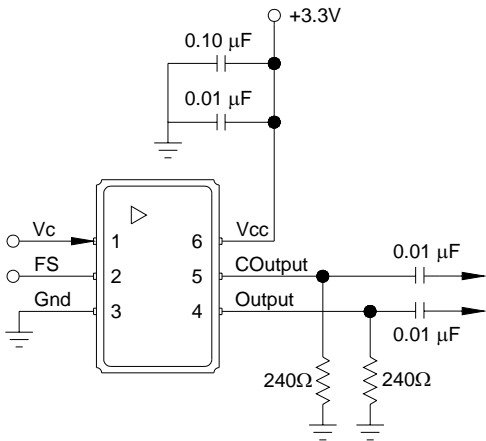
## Suggested Output Load Configurations



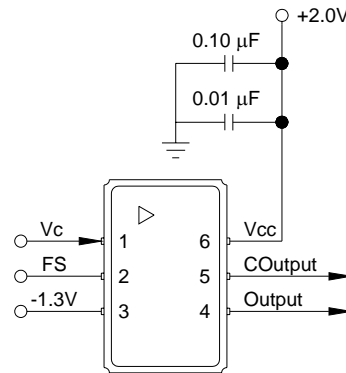
**LV-PECL to LV-PECL:** For short transmission lengths, the power consumption could be reduced by removing the 100Ω resistor and doubling the value of the pull down resistors.



**LV-PECL to LVDS:** Restricted for short transmission lengths. Configuration may require modification depending on LVDS receiver.



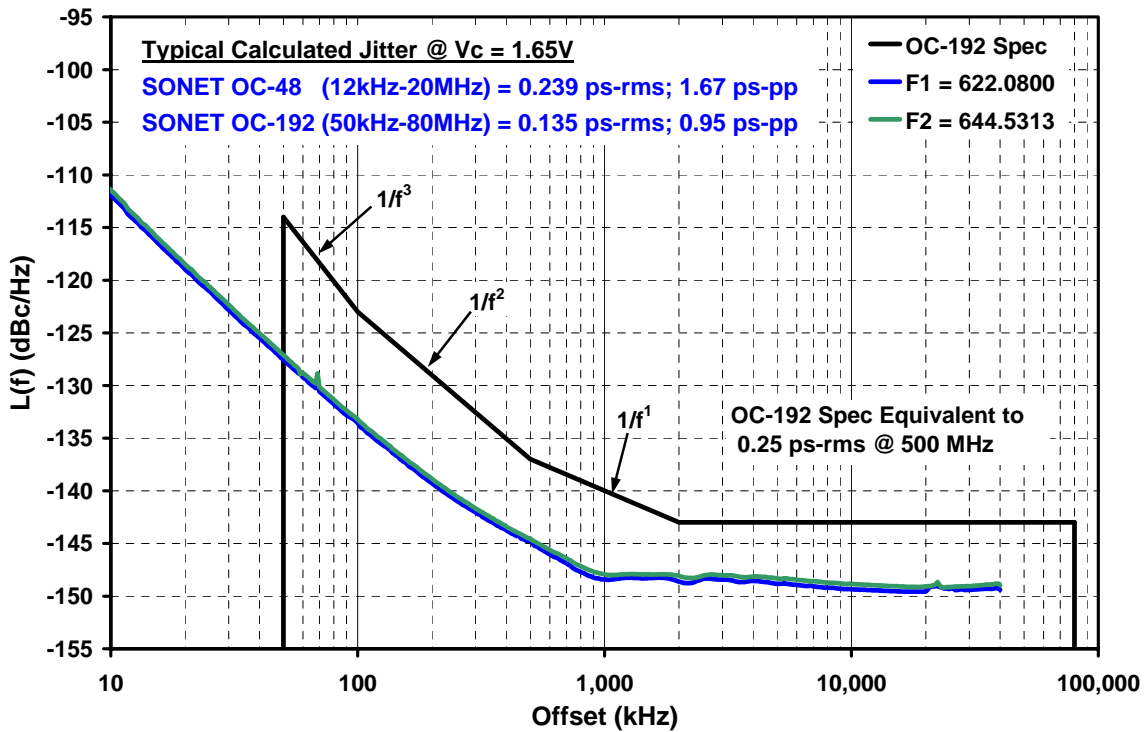
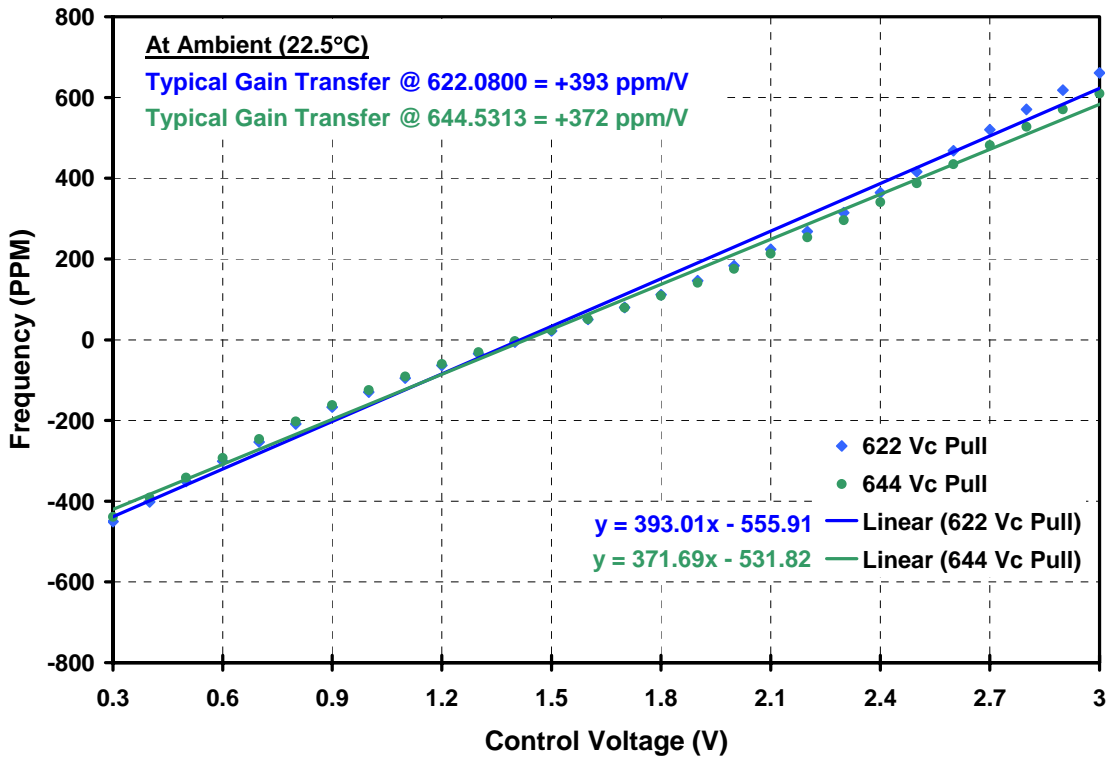
**Functional Test:** Allows standard power supply configuration. Since AC coupled, the LV-PECL levels cannot be measured.



**Production Test:** Allows direct DC coupling into 50Ω measurement equipment. Must bias the power supplies as shown. Similar to Figure 1.

# VS-550 Voltage Controlled SAW Oscillator

## Typical Characteristics



# VS-550 Voltage Controlled SAW Oscillator

## Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VS-550 family is capable of meeting 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 VS-550 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.

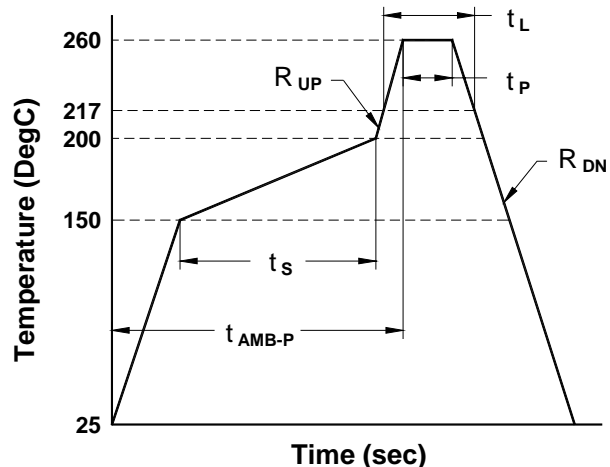
### ESD Ratings

Model	Minimum	Conditions
Human Body Model	1500 V	MIL-STD 883, Method 3015
Charged Device Model	1000 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 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 VS-550 device is hermetically sealed so an aqueous wash is not an issue.



# VS-550 Voltage Controlled SAW Oscillator



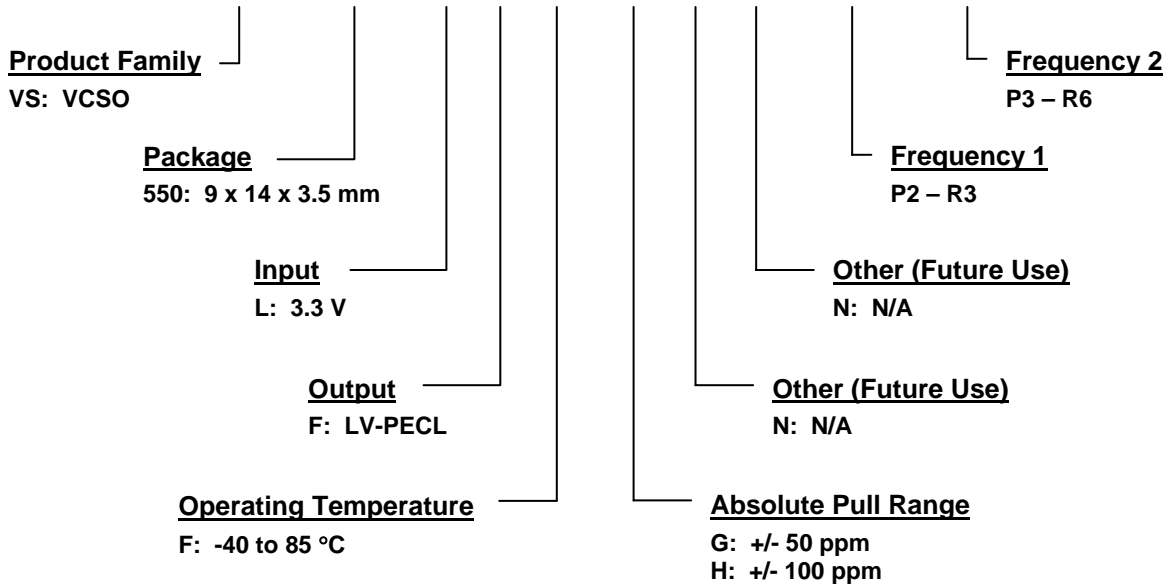
## Standard Frequencies (MHz)

622.0800 P2	625.0000 P3	644.5313 P4	657.4219 PB	666.5143 P5	669.3266 R3
672.1627 R5	690.5692 R4	693.4830 R6			

1. For other frequencies, we recommend the VS-751, please contact VI for details.
2. Frequency 1 must be lower than Frequency 2. Not all combinations are available.

## Ordering Information

### VS - 550 - L F F - H N N - P2 - P4



## For Additional Information, Please Contact:



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