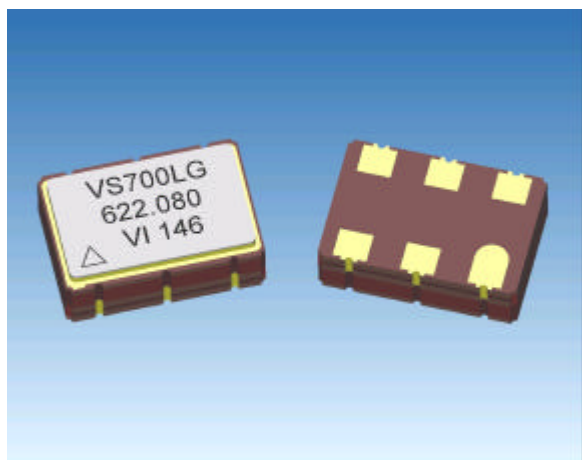




## VS-700

### Voltage Controlled SAW Oscillator



#### Features

- Industry Standard Package, 5.0 x 7.5 x 2.5 mm
- Output Frequencies from 500 MHz to 850 MHz
- 3.3 V Operation
- Low Jitter < 0.20 ps-rms across 50 kHz to 80 MHz
- LV-PECL Configuration with Fast Transition Times
- Complementary Outputs
- Output Disable Feature
- Fully Compatible for Lead Free Assembly

#### Applications

PLL circuits for Clock Smoothing and Frequency Translation

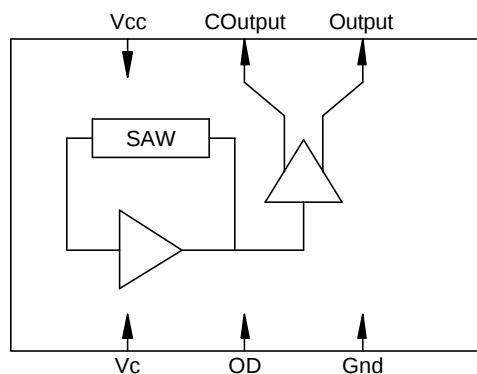
##### Description

##### Standard

- |                               |                    |
|-------------------------------|--------------------|
| • 1-2-4 Gigabit Fibre Channel | INCITS 352-2002    |
| • 10 Gigabit 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-700 is a SAW based voltage controlled oscillator that operates at the fundamental frequency of the internal SAW filter. The SAW filter is a high-Q quartz device that enables the circuit to achieve low phase jitter performance over a wide operating temperature range. The oscillator is housed in a hermetically sealed leadless surface mount package offered on tape and reel. It has an output disable to facilitate on-board testing.

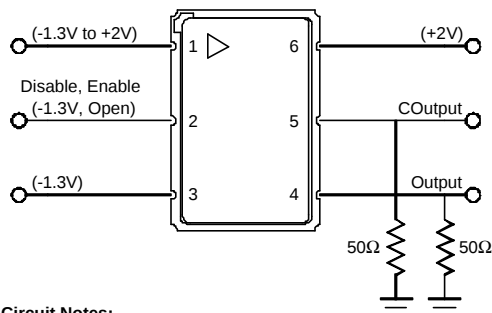


# VS-700 Voltage Controlled SAW Oscillator

## 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        | $\pm 50$        |              |              | ppm                | 1,2,3,8 |
| Linearity                    | Lin        |                 | $\pm 5$      |              | %                  | 2,4,8   |
| Gain Transfer (See Pg 5)     | $K_V$      |                 | +390         |              | ppm/V              | 2,8     |
| Temperature Stability        | $f_{STAB}$ |                 | $\pm 100$    |              | ppm                | 1,6     |
| <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                    |            | $V_{CC}-1.5$    | $V_{CC}-1.3$ | $V_{CC}-1.1$ | V                  | 2,3     |
| Swing                        |            | 500             | 650          | 800          | 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)            | $\phi_J$   |                 | 0.120        |              | ps-rms             | 6,7     |
| <b>Control Voltage</b>       |            |                 |              |              |                    |         |
| Input Impedance              | $Z_c$      |                 | 100          |              | k $\Omega$         | 6       |
| Modulation Bandwidth         | BW         |                 | 500          |              | kHz                | 6       |
| <b>Operating Temperature</b> | $T_{OP}$   | -40             |              | 85           | $^{\circ}\text{C}$ | 1,3     |
| <b>Package Size</b>          |            | 5.0 x 7.5 x 2.5 |              |              | 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  $V_c = 0.3\text{V}$  to  $3.0\text{V}$ .



### Test Circuit Notes:

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

Figure 1. Test Circuit

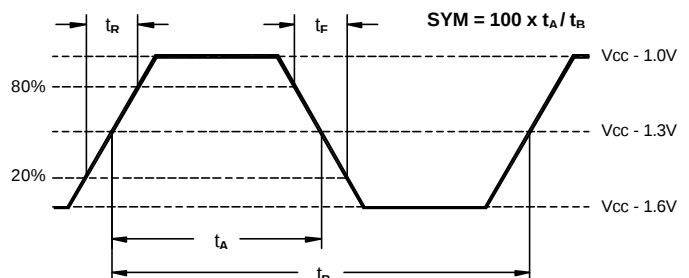
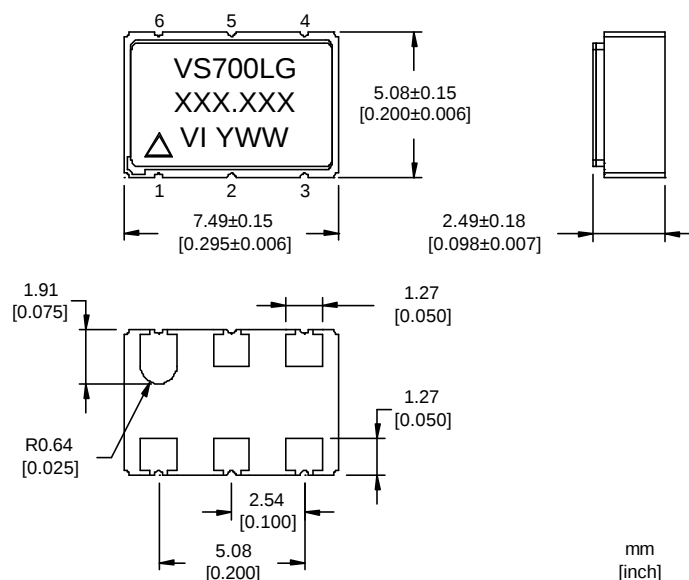


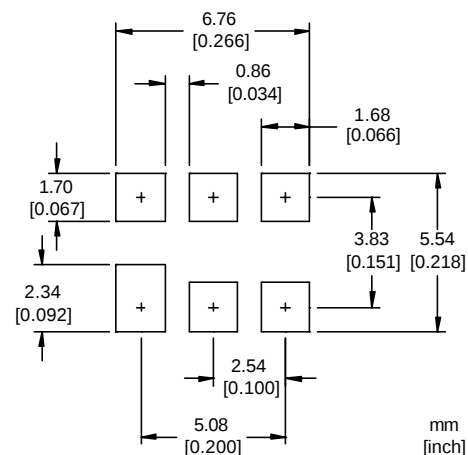
Figure 2. 10K LV-PECL Waveform

# VS-700 Voltage Controlled SAW Oscillator

## Outline Diagram



## Suggested Pad Layout



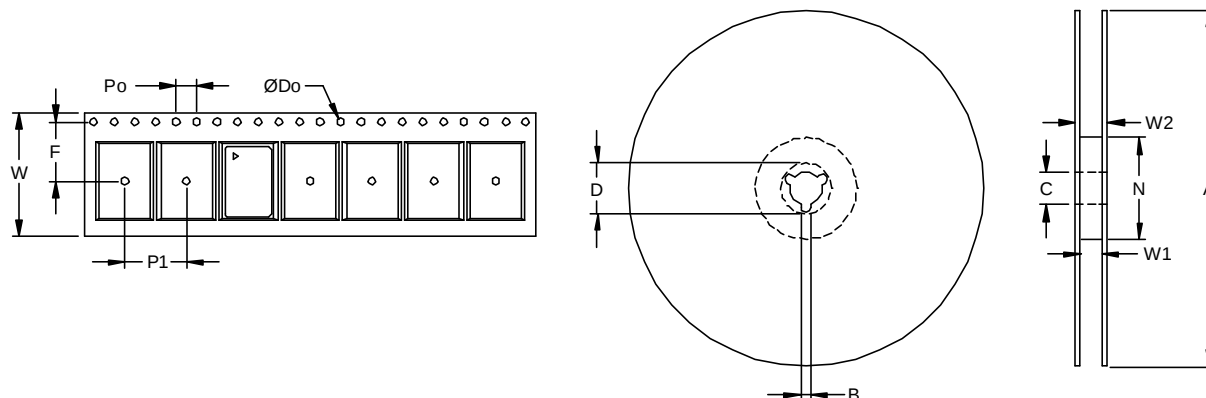
## Pin Out

| Pin | Symbol          | Function                                                                                     |
|-----|-----------------|----------------------------------------------------------------------------------------------|
| 1   | V <sub>C</sub>  | VCSO Control Voltage                                                                         |
| 2   | OD              | Output Disable<br>Disabled = LV-CMOS Logic 0 (or Gnd)<br>Enabled = LV-CMOS Logic 1 (or Open) |
| 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%)                                                            |

## Marking Key

| Position 6 | Position 7 |
|------------|------------|
| L = LFF    | G = GNN    |
|            | H = HNN    |

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



## Tape Dimensions (mm)

## Reel Dimensions (mm)

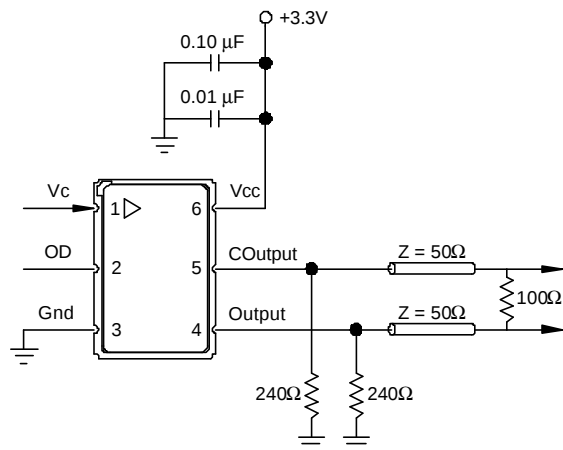
| Dimension | W   | F   | Do  | Po  | P1  | A   | B   | C   | D    | N   | W1   | W2   | # Per Reel |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|------|------|------------|
| Tolerance | Typ | Typ | Typ | Typ | Typ | Typ | Min | Typ | Min  | Min | Typ  | Max  |            |
| VS-700    | 16  | 7.5 | 1.5 | 4   | 8   | 178 | 1.5 | 13  | 20.2 | 50  | 16.4 | 22.4 | 200        |

# VS-700 Voltage Controlled SAW Oscillator

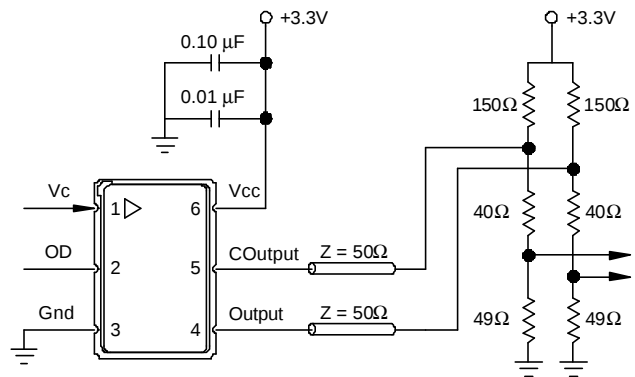
| Absolute Maximum Ratings |           |               |        |
|--------------------------|-----------|---------------|--------|
| Parameter                | Symbol    | Ratings       | Unit   |
| Power Supply             | $V_{CC}$  | 0 to 6        | V      |
| Output Current           | $I_{out}$ | 25            | mA     |
| Voltage Control Range    | $V_C$     | 0 to $V_{CC}$ | V      |
| Storage Temperature      | TS        | -55 to 125    | °C     |
| Soldering Temp/Time      | $T_{Ls}$  | 220/10        | °C/sec |

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 datasheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability. Permanent damage is also possible if OD or  $V_C$  is applied before  $V_{CC}$ .

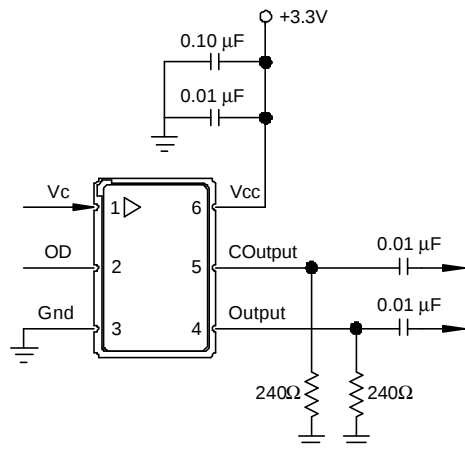
## Suggested Output Load Configurations



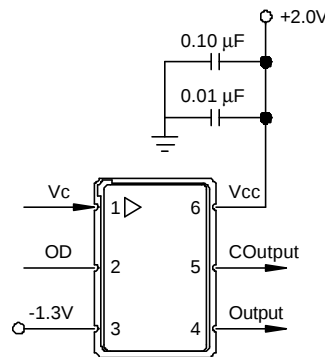
**LV-PECL to LV-PECL:** For short transmission lengths, the power consumption could be reduced by removing the 100Ω resistor and doubling the value of the pull down resistors.



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



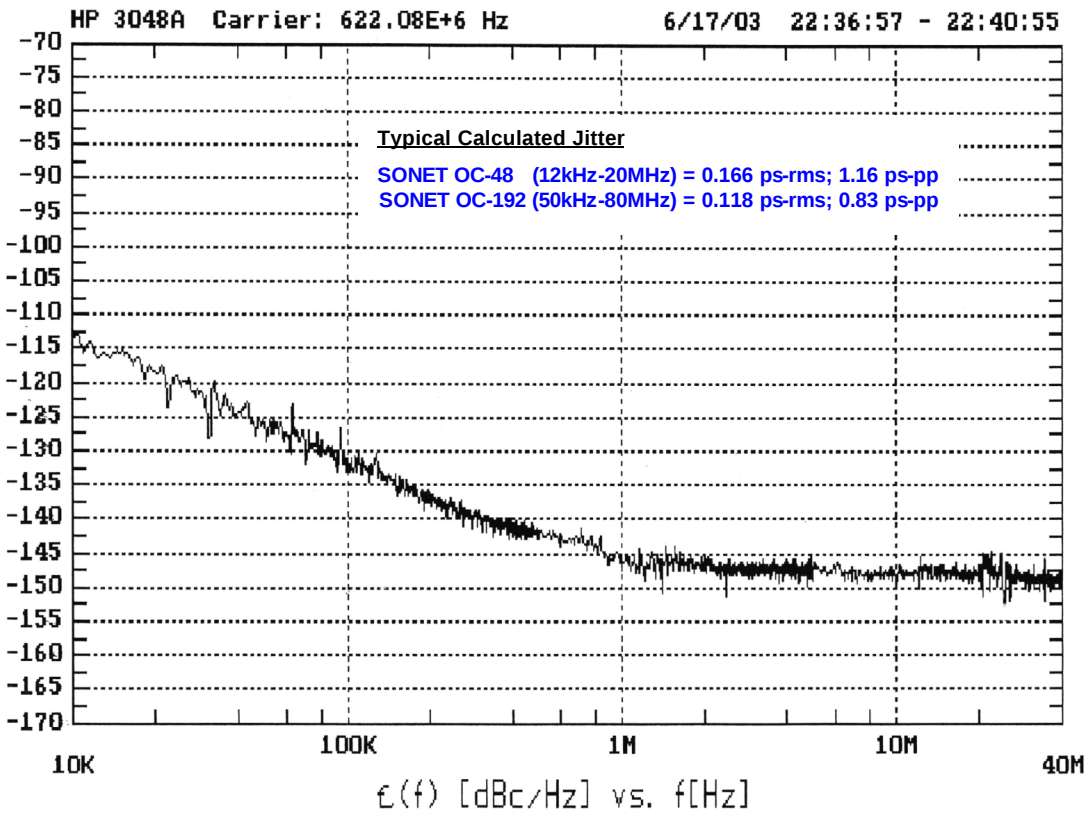
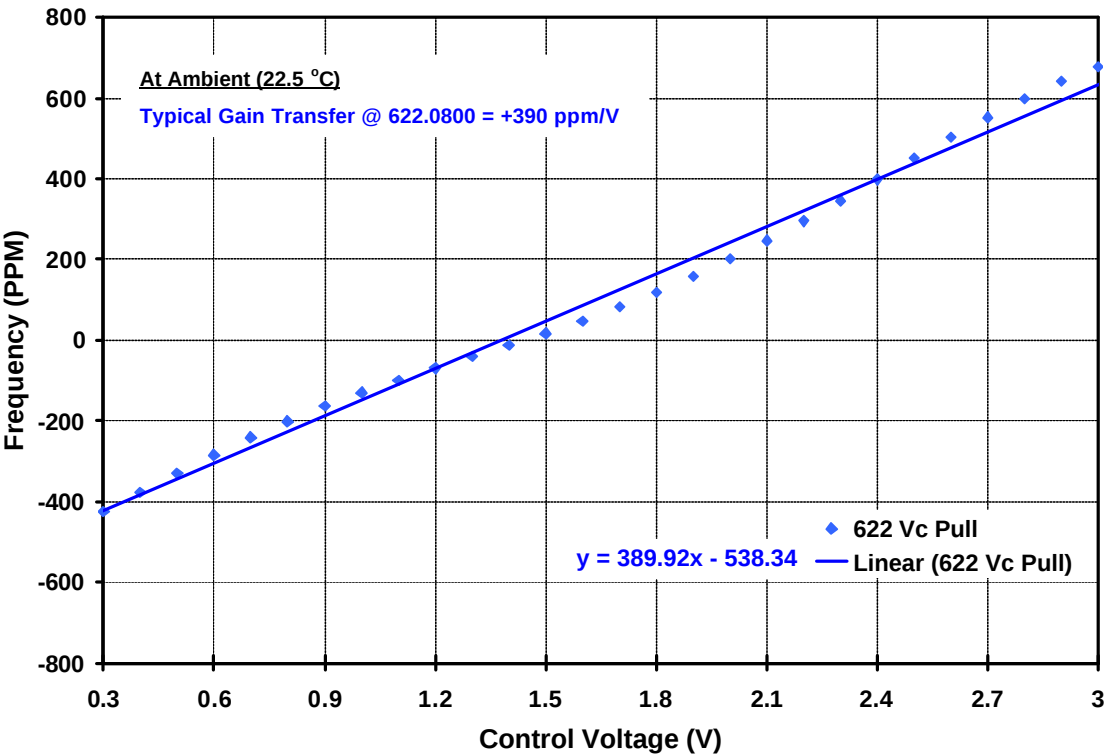
**Functional Test:** Allows standard power supply configuration. Since AC coupled, the LV-PECL levels cannot be measured.



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

# VS-700 Voltage Controlled SAW Oscillator

## Typical Characteristics



# VS-700 Voltage Controlled SAW Oscillator

## Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VS-700 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-700 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.

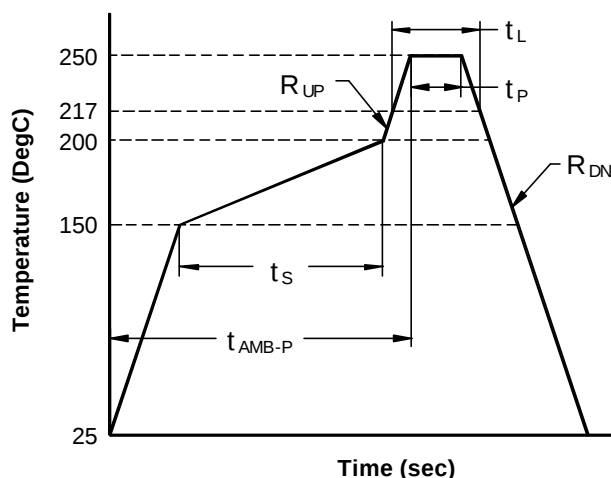
## ESD Ratings

| 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-020B)

| 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 250 °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 VS-700 device is hermetically sealed so an aqueous wash is not an issue.



# VS-700 Voltage Controlled SAW Oscillator

## Standard Frequencies (MHz)

|          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 531.2500 | 569.1964 | 622.0800 | 624.7048 | 625.0000 | 627.3296 | 629.9878 | 637.5000 |
| 644.5313 | 657.4219 | 666.5143 | 669.3266 | 669.6429 | 670.8386 | 672.1627 | 673.4566 |
| 690.5692 | 693.4830 | 693.7500 | 707.3527 | 716.5732 | 718.7500 | 719.7344 | 748.0709 |
| 750.0000 | 777.6000 | 779.5686 | 780.8810 | 781.2500 | 796.8750 | 805.6641 | 809.0635 |
|          |          |          |          |          |          |          |          |

Other frequencies available upon request

## Ordering Information

**VS - 700 - L F F - G N N - xxx.xxx**

**Product Family**

VS: VCSO

**Package**

700: 5.0 x 7.5 x 2.5 mm

**Input**

L: 3.3 V

**Output**

F: LV-PECL

**Frequency (See Above)**

500 - 850 MHz

**Other (Future Use)**

N: N/A

**Other (Future Use)**

N: N/A

**Absolute Pull Range**

G: +/- 50 ppm

H: +/- 100 ppm

**Operating Temperature**

F: -40 to 85 °C

## For Additional Information, Please Contact:



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