

## 158-Type Voltage-Controlled SAW Oscillator (VCSO)



The 158-Type Voltage-Controlled SAW Oscillator (VCSO).

### Features

- Compatible with SONET at 622.08 MHz
- High-Q SAW-resonator based design
- Sinusoidal output voltage (into a 50  $\Omega$  load)
- ECL output, other frequencies available by 1993
- Phase noise better than  $-95$  dBc/Hz at 1 kHz from carrier
- Second and third harmonic distortion less than  $-20$  dBc
- Spurious tones less than  $-60$  dBc
- High reliability

### Description

The 158-Type Voltage-Controlled SAW Oscillator (VCSO) is a high-performance oscillator that operates at the fundamental frequency of the internal SAW resonator. The resonator is a high-stability, high-Q quartz device which enables the circuit to achieve low phase noise performance over a wide temperature range. The circuit is hermetically sealed in a 16-pin, double-width, metal DIP. The package is compact, with overall dimensions (excluding leads) of 0.80 in. x 0.97 in. x 0.28 in. (W x L x H).

The first oscillators in this family, the 158A and the 158B, are available at a nominal frequency of 622.08 MHz. They are designed for synchronization of a 622.08 Mbits/s OC-12 signal to a 51.84 Mbits/s clock rate in optical communication systems using the SONET standards. They are also suited for use in clock or data retiming applications.

## Pin Information

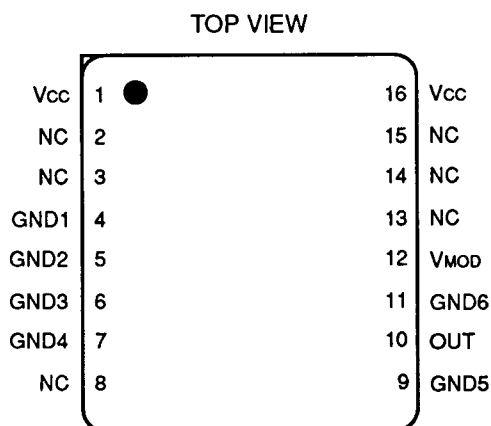


Figure 1. Pin Diagram

Table 1. Pin Descriptions

| Pin | Symbol | Description                       |
|-----|--------|-----------------------------------|
| 1   | Vcc    | Supply voltage (12.0 V $\pm$ 5%). |
| 2   | NC*    | No connect.                       |
| 3   | NC     | No connect.                       |
| 4   | GND1   | Circuit and package ground.       |
| 5   | GND2   | Circuit and package ground.       |
| 6   | GND3   | Circuit and package ground.       |
| 7   | GND4   | Circuit and package ground.       |
| 8   | NC     | No connect.                       |
| 9   | GND5   | Circuit and package ground.       |
| 10  | OUT    | Output waveform.                  |
| 11  | GND6   | Circuit and package ground.       |
| 12  | VMOD   | Modulation voltage.               |
| 13  | NC     | No connect.                       |
| 14  | NC     | No connect.                       |
| 15  | NC     | No connect.                       |
| 16  | Vcc    | Supply voltage (12.0 V $\pm$ 5%). |

\* It is recommended that NC pins be grounded.

## Electrical Specifications

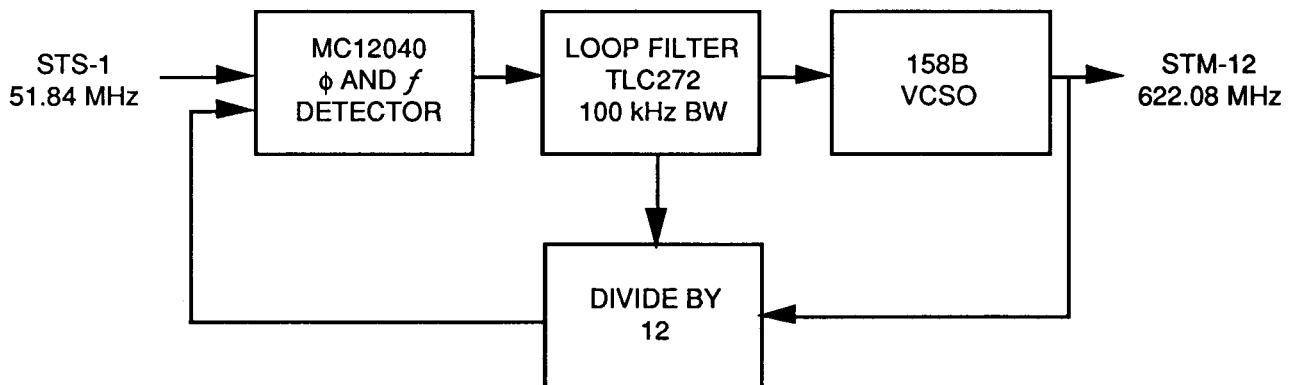
### 158A/B

**Table 2. Electrical Specifications**

**Note:** All measurements taken with a nominal load impedance of 50  $\Omega$  at a return loss of  $\geq 20$  dB.

| Parameter                                    | Value                                                                             |
|----------------------------------------------|-----------------------------------------------------------------------------------|
| Output Frequency                             | 622.08 MHz $\pm$ 20 ppm                                                           |
| Operating Temperature Range:<br>158A<br>158B | $-40$ $^{\circ}$ C to $+85$ $^{\circ}$ C<br>$0$ $^{\circ}$ C to $70$ $^{\circ}$ C |
| Power Supply Voltage                         | 12 V $\pm$ 5% at 65 mA max                                                        |
| Tuning Voltage (V <sub>MOD</sub> )           | 1 V to 10 V (0 V to 12 V max)                                                     |
| Tuning Sensitivity                           | 20 kHz/V to 100 kHz/V (V <sub>MOD</sub> = 1 V to 10 V)                            |
| Tuning Voltage Input Impedance               | 180 pF in parallel with 10 k $\Omega$ nominal                                     |
| Output Power                                 | 7.5 dBm to 12 dBm at 622.08 MHz (ac coupled)                                      |
| Second Harmonic Level                        | $\leq -20$ dBc                                                                    |
| Spurious Tone Level                          | $\leq -60$ dBc                                                                    |
| Phase Noise                                  | $\leq -95$ dBc/Hz at 1 kHz from carrier                                           |
| Modulation Bandwidth                         | 90 kHz                                                                            |

## Application



**Figure 2. SONET STS-1 to STS-12 Frequency Synthesizer**

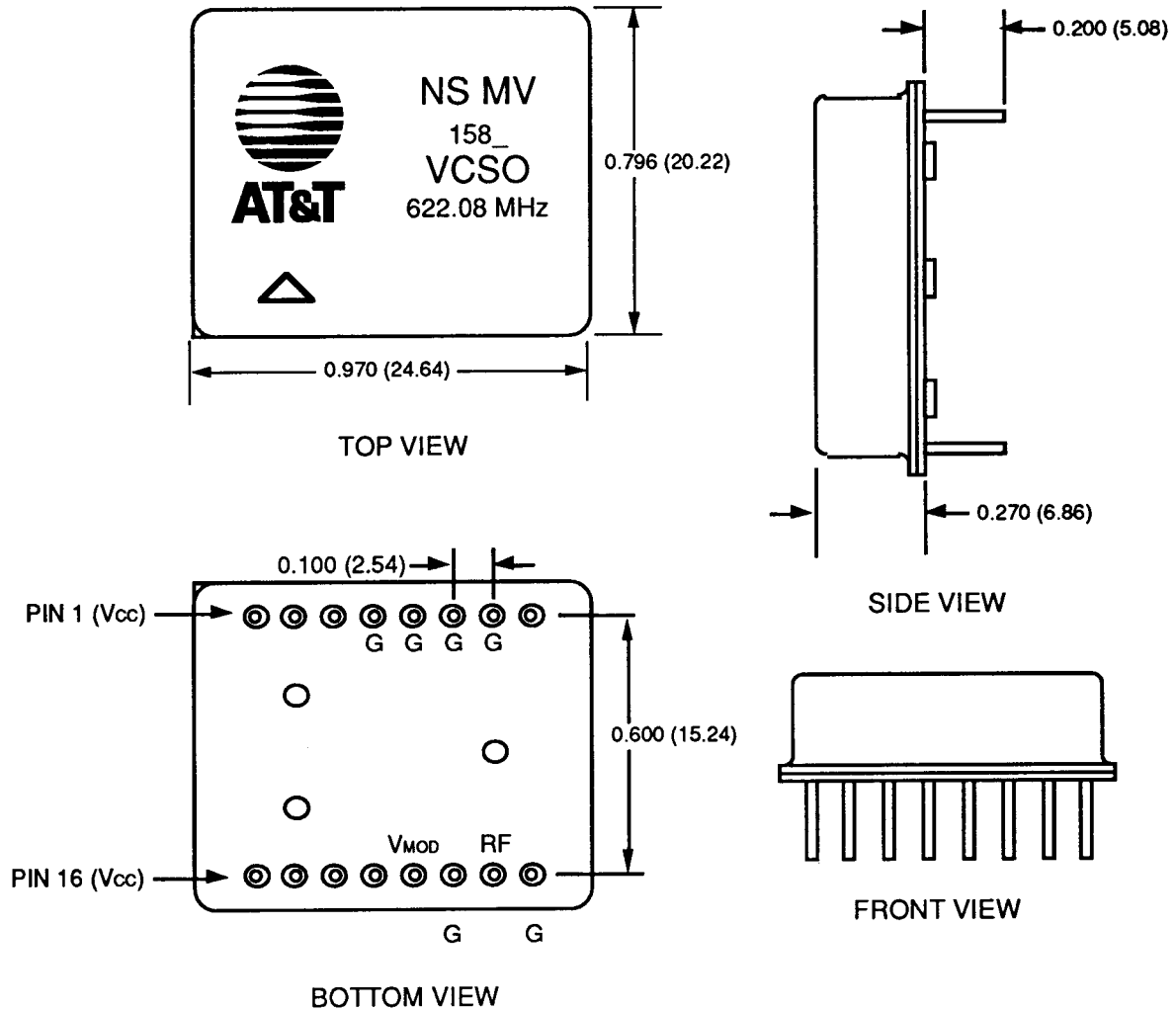
A typical application for the 158-type SAW oscillator is frequency synthesis of a base frequency to a higher frequency. In Figure 2, the STS/OC-12 rate of 622.08 MHz is being phase-locked to an STS/OC-1 SONET rate of 51.84 MHz. The phase-locked loop contains a phase frequency detector, a loop filter based upon an operational amplifier, a divider set to divide by 12, and the 158 VCSO. The noise level and the acquisition time of the phase-locked loop will be determined by the loop filter bandwidth, which for this example has been set at 100 kHz. The SONET STS/OC-12 rate can be phase-locked to any submultiple frequency by selecting the appropriate divider. A similar application based upon this type of layout might involve clock and data recovery of a SONET STS/OC-12 rate or some submultiple of that frequency.

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## Outline Diagram

### 16-Pin Double-Width Metal Can DIP

Dimensions are in inches and (millimeters).



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