



SO-502 SAW Based Clock Oscillator



Features

- Output frequencies from 300 MHz to 1350 MHz
- Ultra low jitter < 1.0 ps-rms (12 kHz to 20 MHz)
< 1.0 ps-rms (50 kHz to 80 MHz)
- Small low profile 9.0 * 14 * 4.5 mm SMT package
- 3.3 V, 5.0 V and 12V Supply Options
- Low phase noise, -160 dBc/Hz @ 1 MHz offset (1 GHz)
- LV-PECL, PECL, or Sinewave (0 to +10 dBm into 50Ω)
- Output disable feature (For LVPECL - PECL option)

Applications

- Point to Point / Point to Multi Point Radios
- Instrumentation
- Test & Measurement
- Military & Avionics

Description

The SO-502 is a SAW based clock oscillator that operates at the fundamental frequency of the internal SAW resonator. This direct approach enables this series to achieve low phase noise and jitter performance at high output frequencies and over wide operating temperature range. The oscillator is housed in a hermetically sealed J-lead surface mount package offered on tape and reel. As an option, it has an output disable to facilitate on-board testing.

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Table 1. Electrical Performance

| Parameter | Symbol | Minimum | Typical | Maximum | Units | Notes | |
|--|------------|------------------|---------|---------------|--------------------|-------------|---|
| Frequency | | | | | | | |
| Center Frequency | F_N | 300 | | 1350 | MHz | 1,2 | |
| Frequency Stability (Referenced to F_O) | F_{STAB} | | | +50, -250 | ppm | 1,2,7 | |
| Aging (10 years) | | | | +50, -100 | ppm | 5 | |
| Supply | | | | | | | |
| Voltage (B) | V_{CC} | 11.4 | 12 | 12.6 | V | 2,3 | |
| Voltage (C) | V_{CC} | 4.75 | 5 | 5.25 | V | 2,3 | |
| Voltage (D) | V_{CC} | 3.135 | 3.3 | 3.450 | V | 2,3 | |
| Current (No Load) | I_{CC} | | 55 | 70 | mA | 2,3 | |
| Output- Sinewave Options | | | | | | | |
| Sinewave, into 50 Ω (G) | P_O | 0 | | | dBm | 2,3 | |
| Sinewave, into 50 Ω (J) | P_O | +7 | | | dBm | 2,3 | |
| Sinewave, into 50 Ω (K) | P_O | +10 | | | dBm | 2,3 | |
| Harmonics | | | | -20 | dBc | 2,3 | |
| Jitter @ 622.08 MHz (12 kHz to 20 MHz) | | | 0.28 | | ps,rms | 5,6 | |
| Jitter @ 622.08 MHz (50 kHz to 80 MHz) | | | 0.29 | | ps,rms | 5,6 | |
| Output- PECL Logic Option (F) | | | | | | | |
| Output Level Low | V_{OL} | $V_{CC}-1.95$ | | $V_{CC}-1.63$ | V | 2,3,4 | |
| Output Level High | V_{OL} | $V_{CC}-0.98$ | | $V_{CC}-0.75$ | V | 2,3,4 | |
| Rise & Fall Time | t_R, t_F | | 200 | 350 | ps | 2,3,4 | |
| Symmetry (Duty Cycle) | SYM | 45 | 49/51 | 55 | % | 2,3,4 | |
| Operating Temperature | | T_{OP} | | | See Ordering Table | $^{\circ}C$ | 1 |
| Package Size | | 9.0 x 14.0 x 4.5 | | | mm | | |

Table Notes:

1. See Standard Frequencies and Ordering Information
2. Parameters are tested with production test circuit
3. Parameters are tested at ambient temperature with test limits guard-banded for specified operating temperature.
4. Output levels are standard 100K PECL compatible and measured from 20% to 80% of a full output swing (Fig 1).
5. Not tested in production, guaranteed by design, verified at qualification.
6. Integrated across 12 kHz to 20 MHz or 50 kHz to 80 MHz per GR-253-CORE Issue3.
7. Maximum Frequency occurs at room temperature

Table 2. Typical Single Side-Band Phase Noise (dBc/Hz) for Sinewave Output

| Output Frequency | 100 Hz Offset | 1 kHz Offset | 10 kHz Offset | 100 kHz Offset | 1 MHz Offset |
|------------------|---------------|--------------|---------------|----------------|--------------|
| 622.08 MHz | -70 | -100 | -125 | -155 | -160 |
| 1000 MHz | -70 | -100 | -125 | -155 | -160 |

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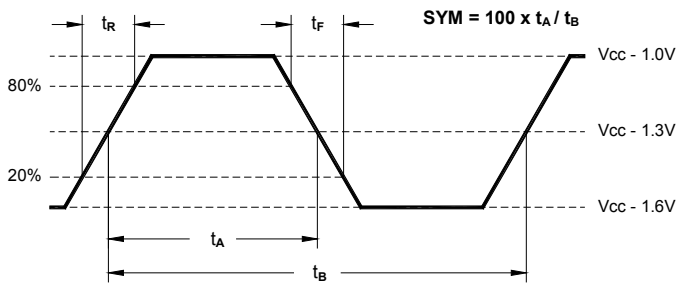
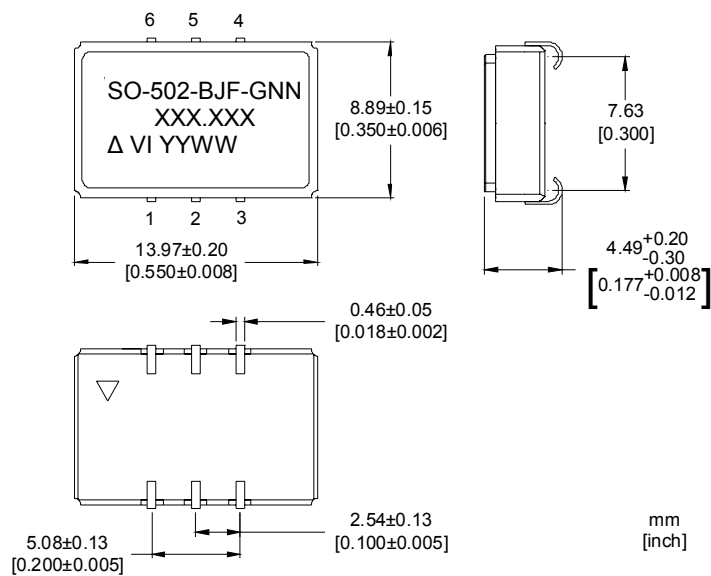


Figure 1. 100K PECL Waveform

Outline Diagram



Pad Layout

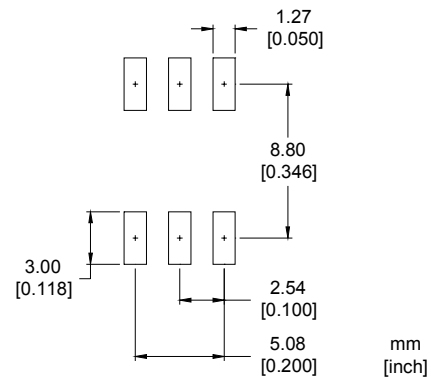


Table 3. Pin Out – PECL Option

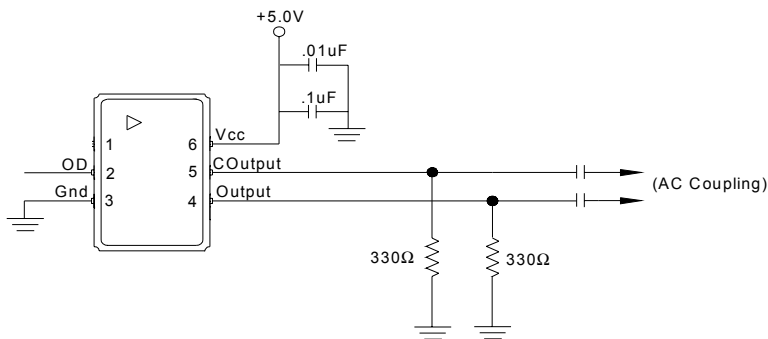
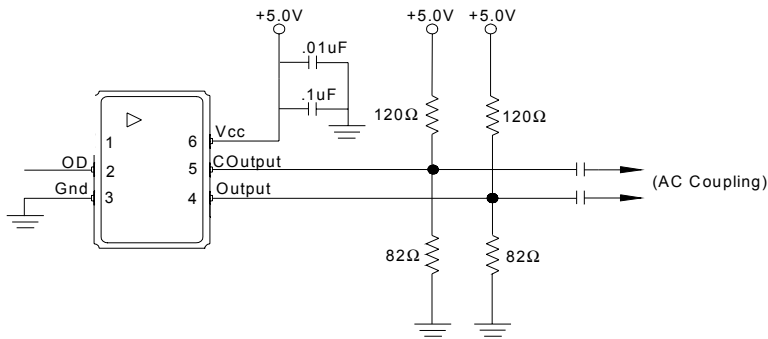
| Pin | Symbol | Function |
|-----|-----------------|------------------------------------|
| 1 | - | N/C |
| 2 | OD | N/C or Output Disable ¹ |
| 3 | GND | Case and Electrical Ground |
| 4 | Output | Output |
| 5 | COutput | Complementary Output |
| 6 | V _{CC} | Power Supply Voltage |

Table Notes:

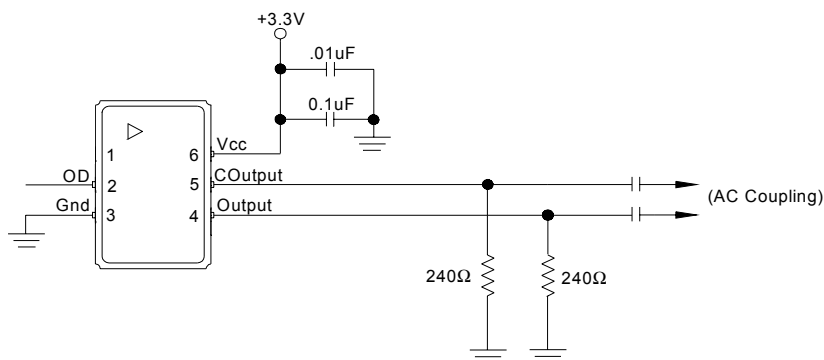
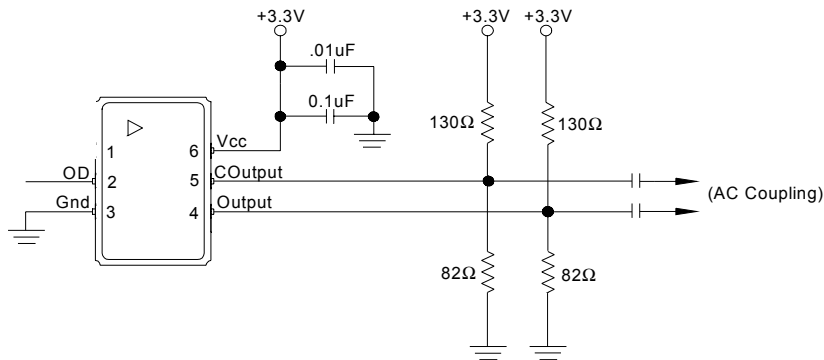
- By setting Output Disable pin low, the RF output is disabled and pin 4 is held high, pin 5 is held low. The threshold for Output Disable is 1.4V above pin 3. Output disable pin can be left floating for normal operation

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Suggested Output Load Configurations – PECL Operation



Suggested Output Load Configurations – LVPECL Operation



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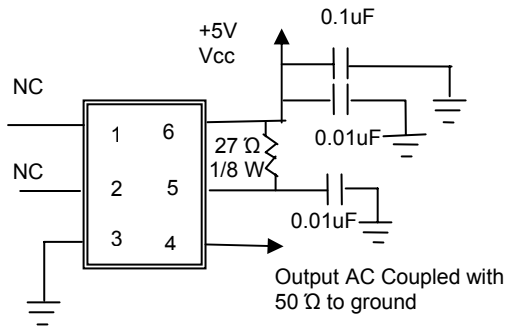
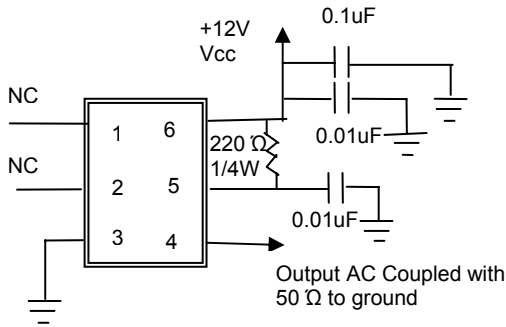
Table 4. Pin Out – Sinewave Option

| Pin | Symbol | Function |
|-----|-----------------|-------------------------------|
| 1 | V _c | N/C |
| 2 | - | N/C |
| 3 | V _{EE} | Ground |
| 4 | Output | Sinewave Output |
| 5 | V _{CC} | V _{CC2} ¹ |
| 6 | V _{CC} | V _{CC1} |

Table Notes:

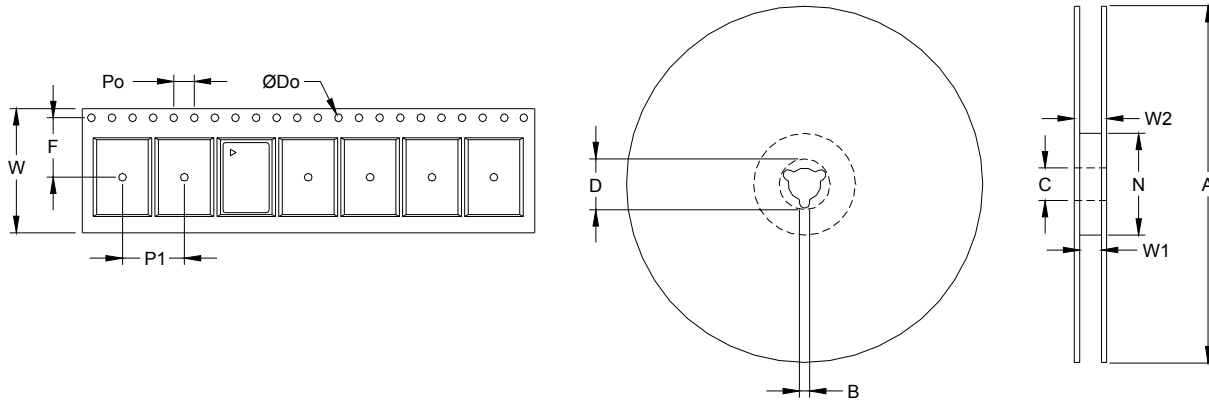
1. If V_{CC1} is +12V and a separate 5V is not applied to pin 5 then pin 5 must be connected through a 220Ω 1/4W external resistor.

Suggested Output Load Configurations – SINEWAVE Operation



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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 | |
| SO-502 | 24 | 11.5 | 1.5 | 4 | 12 | 330 | 1.5 | 13 | 20.2 | 100 | 24.4 | 30.4 | 200 |

Absolute Maximum Ratings

| Parameter | Symbol | Ratings | Unit |
|---------------------|----------|-----------------|--------|
| Power Supply | V_{CC} | $V_{CC} + 1.0V$ | V |
| Storage Temperature | T_s | -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.

Reliability

The SO-502 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 |

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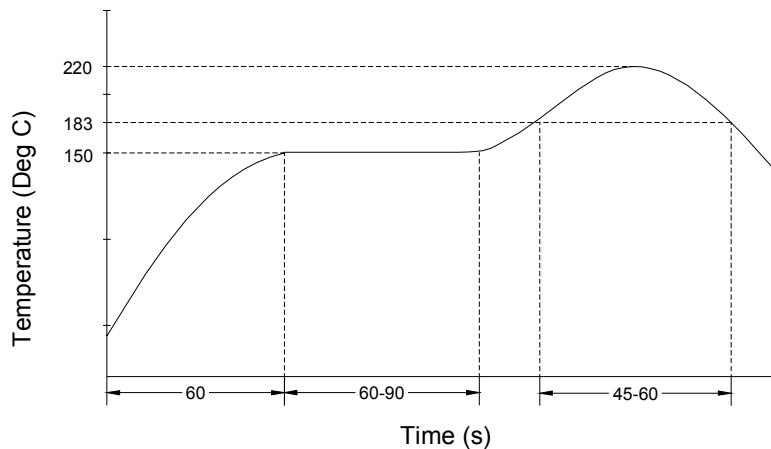
Handling Precautions

Although ESD protection circuitry has been designed into the SO-502 proper precautions should be taken when handling and mounting. VI employs a human body model 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 | JESD 22-C101 |

Recommended Solder Reflow Profile



VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The conditions a device can withstand are well understood and devices can be subjected to the profile above. This profile shows a ramp up condition to prevent thermal shock, a preheat period in which the flux is activated, a ramp up to 183°C which is the reflow temperature of Sn/Pb eutectic, and a gradual cool down. The time above 183°C should not exceed 60 seconds and the peak temperature should be no more than 220°C for 10 seconds. The SO-502's are hermetically sealed so an aqueous wash is not an issue.

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Available Standard Frequencies (MHz)

| | | | | | |
|-----|--------|------|------|------|--------|
| 480 | 622.08 | 640 | 938 | 970 | 983.04 |
| 990 | 1000 | 1090 | 1200 | 1330 | |

Other Frequencies Available Upon Request.

Ordering Information

SO – 502 - B J C - G N N – xxxx.xxxx

Product Family

SO: SAW XO

Package

502: 9 x 14 x 4.5 mm

Input

D: 3.3 V

C: 5.0 V

B: 12.0 V

Output

F: PECL

G: Sine \geq 0 dBm

H: Sine \geq 3 dBm

J: Sine \geq 7 dBm

K: Sine \geq 10 dBm

Operating Temperature

C: 0°C to +70 °C

D: -20°C to +85 °C

F: -40°C to +85 °C

Frequency (See Above)

300 – 1350 MHz

Other (Future Use)

N: N/A

Other (Future Use)

N: N/A

Frequency Stability

L: \pm 130 ppm (0°C to +70 °C only)

T: \pm 200 ppm

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