



# Silicon Oscillator with Reset Output

MAX7382

## General Description

The MAX7382 silicon oscillator replaces ceramic resonators, crystals, and crystal-oscillator modules as the clock source for microcontrollers in 3V, 3.3V, and 5V applications. The MAX7382 features a factory-programmed oscillator and a microprocessor ( $\mu$ P) power-on-reset (POR) supervisor.

Unlike typical crystal and ceramic-resonator oscillator circuits, the MAX7382 is resistant to vibration and EMI. The high-output-drive current and absence of high-impedance nodes makes the oscillator less susceptible to dirty or humid operating conditions. With a wide operating temperature range as standard, the MAX7382 is a good choice for demanding home appliance and automotive environments.

The MAX7382 is available with factory-programmed frequencies ranging from 10MHz to 32MHz. See Table 2 for standard frequencies and contact the factory for custom frequencies. Refer to the MAX7376 data sheet for frequencies less than 10MHz.

The MAX7382 is available in a 5-pin SOT23 package. The MAX7382 standard operating temperature range is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . See the *Applications Information* section for extended operating temperature range.

## Applications

White Goods  
Automotive  
Consumer Products  
Appliances and Controls  
Handheld Products  
Portable Equipment  
Microcontroller Systems

## Features

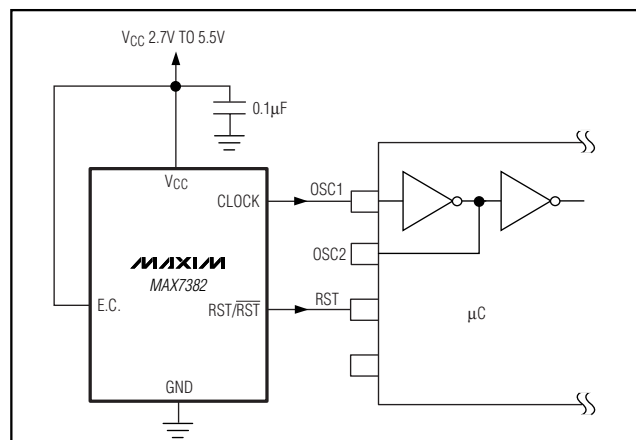
- ◆ 2.7V to 5.5V Operation
- ◆ 10MHz to 32MHz Oscillator
- ◆ Integrated POR
- ◆  $\pm 10\text{mA}$  Clock Output Drive Capability
- ◆ 2.5% Initial Accuracy
- ◆  $\pm 50\text{ppm}/^{\circ}\text{C}$  Frequency Drift
- ◆ 50% Duty Cycle
- ◆ 5ns Output Rise and Fall Time
- ◆ Low Jitter: 80psp-p at 16MHz
- ◆ 4mA Operating Current at 16MHz
- ◆  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  Temperature Range
- ◆ Small 5-Pin SOT23 Package

## Ordering Information

| PART*               | TEMP RANGE                                                                   | PIN-PACKAGE      | RESET OUTPUT          |
|---------------------|------------------------------------------------------------------------------|------------------|-----------------------|
| MAX7382A__-T        | $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$                              | 5 SOT23-5        | Active-high push-pull |
| MAX7382B__-T        | $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$                              | 5 SOT23-5        | Active-low push-pull  |
| <b>MAX7382C__-T</b> | <b><math>-40^{\circ}\text{C}</math> to <math>+125^{\circ}\text{C}</math></b> | <b>5 SOT23-5</b> | <b>Open drain</b>     |

\*Standard version is shown in bold. The first letter after the part number designates the reset output option. Insert the letter corresponding to the desired reset threshold level from Table 1 in the next position. Insert the two-letter code from Table 2 in the remaining two positions for the desired frequency range. Table 1 and Table 2 are located at the end of the data sheet.

## Typical Operating Circuit



Pin Configuration appears at end of data sheet.



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# Silicon Oscillator with Reset Output

## ABSOLUTE MAXIMUM RATINGS

V<sub>CC</sub> to GND .....-0.3V to +6.0V  
 All Other Pins to GND .....-0.3V to (V<sub>+</sub> + 0.3V)  
 CLOCK, RST Current .....±50mA  
 Continuous Power Dissipation (T<sub>A</sub> = +70°C)  
     5-Pin SOT23 (derate 7.1mW/°C above +70°C) ....571mW (U5-2)

Operating Temperature Range .....-55°C to +135°C  
 Junction Temperature .....+150°C  
 Storage Temperature Range .....-65°C to +150°C  
 Lead Temperature (soldering, 10s) .....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

(Typical Operating Circuit, V<sub>CC</sub> = 2.7V to 5.5V, V<sub>L</sub> = V<sub>CC</sub>, T<sub>A</sub> = -40°C to +125°C. Typical values are at V<sub>CC</sub> = 5.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Note 1)

| PARAMETER                     | SYMBOL             | CONDITIONS                                                                                | MIN                  | TYP | MAX  | UNITS  |
|-------------------------------|--------------------|-------------------------------------------------------------------------------------------|----------------------|-----|------|--------|
| Operating Supply Voltage      | V <sub>CC</sub>    |                                                                                           | 2.7                  |     | 5.5  | V      |
| Operating Supply Current      | I <sub>CC</sub>    | f <sub>CLOCK</sub> = 16MHz, T <sub>A</sub> = -40°C to +125°C, no load                     |                      |     | 8.7  | mA     |
|                               |                    | f <sub>CLOCK</sub> = 14.7456MHz, T <sub>A</sub> = -40°C to +125°C, no load                |                      |     | 8.0  |        |
|                               |                    | f <sub>CLOCK</sub> = 12MHz, T <sub>A</sub> = -40°C to +125°C, no load                     |                      |     | 6.5  |        |
|                               |                    | f <sub>CLOCK</sub> = 11.0592MHz, T <sub>A</sub> = -40°C to +125°C, no load                |                      |     | 6.0  |        |
|                               |                    | f <sub>CLOCK</sub> = 10MHz, T <sub>A</sub> = -40°C to +125°C, no load                     |                      |     | 5.4  |        |
| CLOCK OUTPUT                  |                    |                                                                                           |                      |     |      |        |
| Output High Voltage           | V <sub>OH</sub>    | V <sub>L</sub> = 4.5V, I <sub>SOURCE</sub> = 7.0mA                                        | V <sub>L</sub> - 0.4 |     |      | V      |
|                               |                    | V <sub>L</sub> = 2.7V, I <sub>SOURCE</sub> = 2.0mA                                        |                      |     |      |        |
| Output Low Voltage            | V <sub>OL</sub>    | V <sub>L</sub> = 4.5V, I <sub>SINK</sub> = 20mA                                           |                      |     | 0.4  | V      |
|                               |                    | V <sub>L</sub> = 2.7V, I <sub>SINK</sub> = 10mA                                           |                      |     |      |        |
| Clock Frequency Accuracy      | f <sub>CLOCK</sub> | V <sub>CC</sub> = 5V, T <sub>A</sub> = +25°C, deviation from selected frequency           | -2.5                 |     | +2.5 | %      |
|                               |                    | V <sub>CC</sub> = 2.7V to 5.5V, T <sub>A</sub> = +25°C, deviation from selected frequency | -5.0                 |     | +3.5 |        |
| Clock Temperature Coefficient |                    | T <sub>A</sub> = -40°C to +125°C                                                          |                      | ±50 | ±350 | ppm/°C |
| Duty Cycle                    |                    | (Note 2)                                                                                  | 40                   | 50  | 60   | %      |

# Silicon Oscillator with Reset Output

## ELECTRICAL CHARACTERISTICS (continued)

(Typical Operating Circuit,  $V_{CC} = 2.7V$  to  $5.5V$ ,  $V_L = V_{CC}$ ,  $T_A = -40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $V_{CC} = 5.0V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.) (Note 1)

| PARAMETER                       | SYMBOL             | CONDITIONS                                                  | MIN                                     | TYP | MAX | UNITS   |
|---------------------------------|--------------------|-------------------------------------------------------------|-----------------------------------------|-----|-----|---------|
| Output Jitter                   |                    | Observation of 16MHz for 20s using a 12GHz oscilloscope     |                                         | 80  |     | psp-P   |
| Output Rise Time                | $t_R$              | 10% to 90%                                                  |                                         | 5   |     | ns      |
| Output Fall Time                | $t_F$              | 90% to 10%                                                  |                                         | 5   |     | ns      |
| Power-On-Reset Threshold        | $V_{TH}$           | $V_{CC}$ rising, deviation from nominal threshold           | $T_A = +25^{\circ}C$                    | -2  | +2  | %       |
|                                 |                    |                                                             | $T_A = -40^{\circ}C$ to $+125^{\circ}C$ | -5  | +5  |         |
| Reset Hysteresis                | HYST               | Difference between rising and falling thresholds            |                                         | 1   |     | %       |
| Power-On-Reset Delay            | POR <sub>DLY</sub> | $V_{CC}$ rising from 0 to 5V in 1 $\mu$ s at $+25^{\circ}C$ |                                         | 122 |     | $\mu$ s |
| <b>RESET OUTPUT</b>             |                    |                                                             |                                         |     |     |         |
| Output High Voltage<br>(Note 3) | $V_{OH}$           | $V_L = 4.5V$ , $I_{SOURCE} = 7.0mA$                         | $V_{CC} - 0.4$                          |     |     | V       |
|                                 |                    | $V_L = 2.7V$ , $I_{SOURCE} = 2.0mA$                         | $V_{CC} - 0.4$                          |     |     |         |
| Output Low Voltage              | $V_{OL}$           | $V_L = 4.5V$ , $I_{SINK} = 20mA$                            |                                         |     | 0.4 | V       |
|                                 |                    | $V_L = 2.7V$ , $I_{SOURCE} = 10mA$                          |                                         |     | 0.4 |         |

**Note 1:** All parameters tested at  $T_A = +25^{\circ}C$ . Specifications over temperature are guaranteed by design.

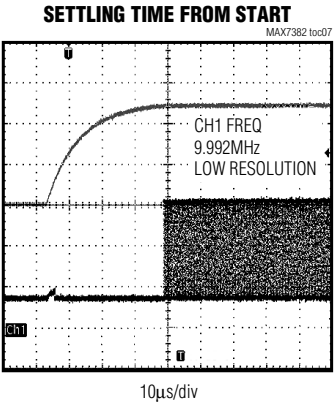
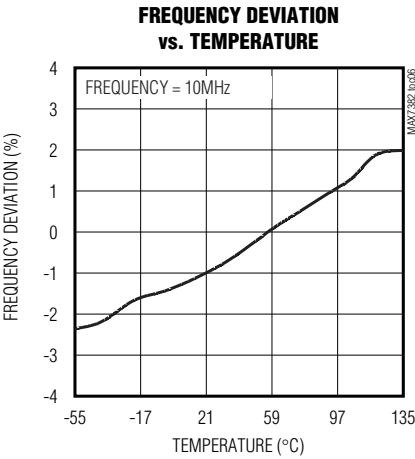
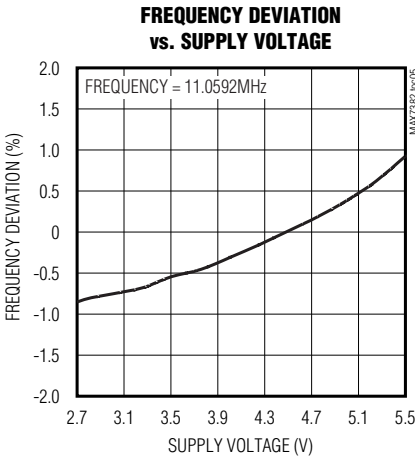
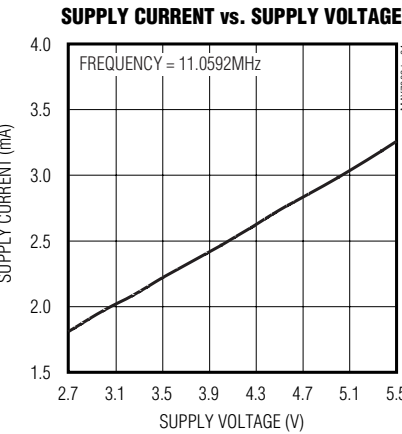
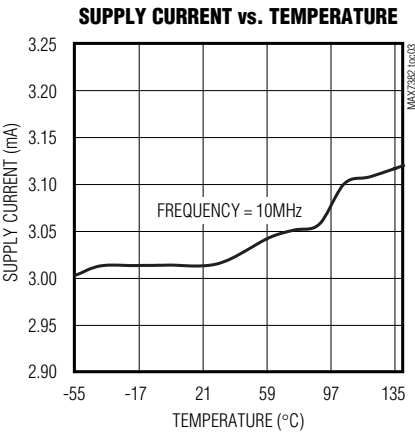
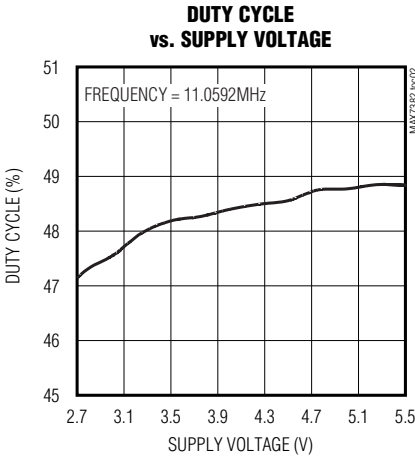
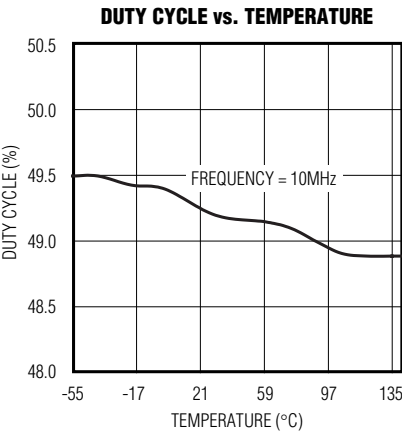
**Note 2:** Guaranteed by design. Not production tested.

**Note 3:** For push-pull output only.

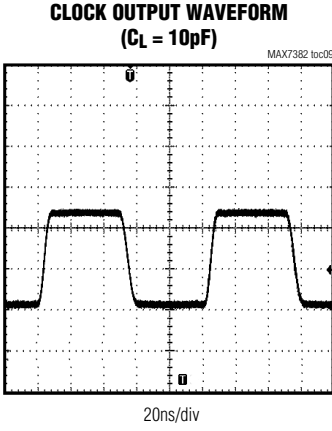
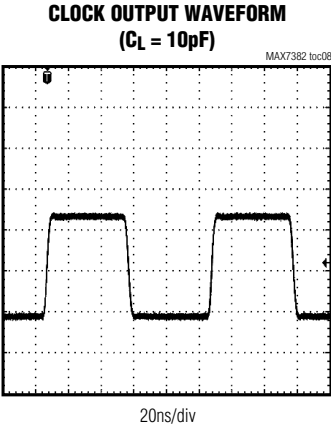
# Silicon Oscillator with Reset Output

## Typical Operating Characteristics

( $V_{CC} = V_L = 5V$ ,  $T_A = +25^\circ C$ , frequency = 10MHz, unless otherwise noted.)



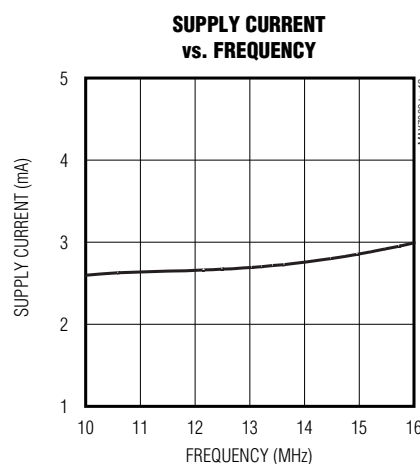
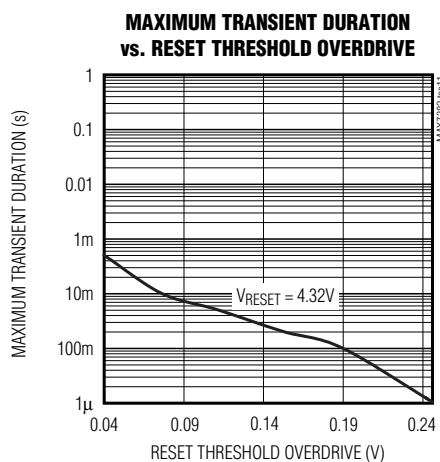
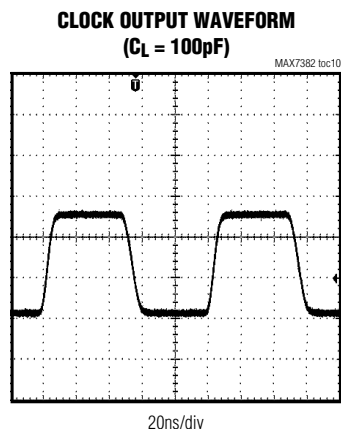
CHANNEL 1 = CLOCK, CHANNEL 2 =  $V_{CC}$



# Silicon Oscillator with Reset Output

## Typical Operating Characteristics (continued)

( $V_{CC} = V_L = 5V$ ,  $T_A = +25^\circ C$ , frequency = 10MHz, unless otherwise noted.)



## Pin Description

| PIN | NAME     | FUNCTION                                                                            |
|-----|----------|-------------------------------------------------------------------------------------|
| 1   | CLOCK    | Push-Pull Clock Output                                                              |
| 2   | GND      | Ground                                                                              |
| 3   | RST      | Reset Output. Open-drain or push-pull output. See the <i>Ordering Information</i> . |
| 4   | $V_{CC}$ | Positive Supply Voltage. Bypass with a 0.1 $\mu F$ capacitor to GND.                |
| 5   | E.C.     | Externally Connected. Connect to $V_{CC}$ .                                         |

## Detailed Description

The MAX7382 is a clock generator with integrated reset for microcontrollers ( $\mu C$ s) and UARTs in 3V, 3.3V, and 5V applications. The MAX7382 is a replacement for crystal-oscillator modules, crystals, or ceramic resonators, and a system reset IC. The clock frequency and reset threshold voltage are factory trimmed to specific values. A variety of popular standard frequencies are available; see Table 2. No external components are required for setting or adjusting the frequency.

## Oscillator

The push-pull clock output drives a load to within 400mV of either supply rail. The clock output remains stable over the full operating voltage range and does not generate short output cycles during either power-on or changing of the frequency. A typical oscillating start-up is shown in the *Typical Operating Characteristics*.

# Silicon Oscillator with Reset Output

## Applications Information

### Interfacing to a Microcontroller Clock Input

The MAX7382 clock output is a push-pull, CMOS, logic output that directly drives a  $\mu\text{P}$  or  $\mu\text{C}$  clock input. There are no impedance-matching issues when using the MAX7382. Refer to the microcontroller data sheet for clock input compatibility with external clock signals. The MAX7382 requires no biasing components or load capacitance. When using the MAX7382 to retrofit a crystal oscillator, remove all biasing components from the oscillator input.

### Reset Output

The MAX7382 is available with three reset output stage options: push-pull active-low, push-pull active-high, and open-drain active-low. RST is asserted when the monitored input ( $V_{\text{CC}}$ ) drops below the internal  $V_{\text{TH-}}$  threshold and remains asserted for 120 $\mu\text{s}$  after the monitored input exceeds the internal  $V_{\text{TH+}}$  threshold. The open-drain RST output requires an external pullup resistor.

### Output Jitter

The MAX7382's jitter performance is given in the *Electrical Characteristics* table as a peak-to-peak value obtained by observing the output of the MAX7382 for 20s with a 12GHz oscilloscope. Jitter measurements are approximately proportional to the period of the output of the device. Thus, a 10MHz device has approximately twice the jitter value of a 20MHz device. The jitter performance of all clock sources degrades in the presence of mechanical and electrical interference.

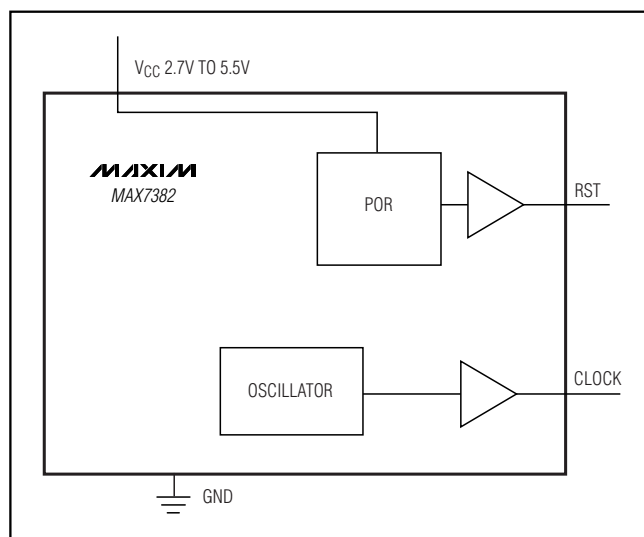


Figure 1. Functional Diagram

Table 1. Standard Reset Threshold Levels

| SUFFIX | RESET THRESHOLD (V) |
|--------|---------------------|
| X      | 2.50                |
| V      | 2.71                |
| R      | 2.89 standard value |
| Q      | 3.13                |
| P      | 3.34                |
| N      | 3.44                |
| J      | 3.96                |
| M      | 4.38 standard value |

Contact factory for nonstandard reset threshold options.

Table 2. Standard Frequencies

| SUFFIX | STANDARD FREQUENCY (MHz) |
|--------|--------------------------|
| UK     | 10                       |
| UT     | 11.0592                  |
| VB     | 12                       |
| VT     | 14.7456                  |
| WB     | 16                       |
| YN     | 32                       |

For all other frequency options, contact factory.

Table 3. Standard Part Numbers

| PART         | RESET THRESHOLD (V) | FREQUENCY (MHz) | TOP MARK |
|--------------|---------------------|-----------------|----------|
| MAX7382CRUK  | 2.89                | 10              | AEVU     |
| MAX7382CRUT* | 2.89                | 11.0592         | —        |
| MAX7382CRVB  | 2.89                | 12              | AEVM     |
| MAX7382CRVT* | 2.89                | 14.7456         | —        |
| MAX7382CRWB  | 2.89                | 16              | AEVK     |
| MAX7382CRYN* | 2.89                | 32              | AEVL     |
| MAX7382CMUK* | 4.38                | 10              | —        |
| MAX7382CMUT* | 4.38                | 11.0592         | —        |
| MAX7382CMVB  | 4.38                | 12              | AEVJ     |
| MAX7382CMVT* | 4.38                | 14.7456         | —        |
| MAX7382CMWB  | 4.38                | 16              | AEVH     |
| MAX7382CMYN* | 4.38                | 32              | AEVI     |

\*Contact factory for availability.

The MAX7382 is relatively immune to vibration, shock, and EMI influences and thus provides a considerably more robust clock source than crystal or ceramic resonator-based oscillator circuits.

# Silicon Oscillator with Reset Output

## Initial Power-Up and Operation

An internal power-up reset holds the clock output low until the supply voltage has risen above the power-on-reset threshold ( $V_{TH+}$ ).

RST holds the microcontroller in a reset condition until 120 $\mu$ s after the clock has started up. This reset delay ensures that the clock output and the microcontroller's internal clock circuits have stabilized before the system is allowed to start. Typical microcontroller reset delay ranges from 1ms to 250ms to allow a slow crystal oscillator circuit to start up. The MAX7382 has a fast startup, eliminating the need for such a long reset delay.

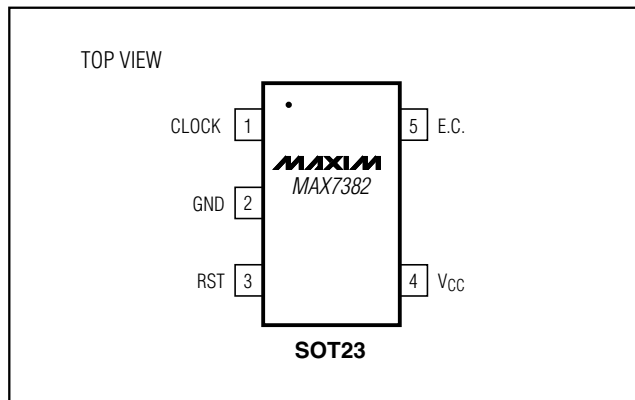
## Extended Temperature Operation

The MAX7382 was tested to +135°C during product characterization and shown to function normally at this temperature (see the *Typical Operating Characteristics*). However, production test and qualification is only performed from -40°C to +125°C at this time. Contact the factory if operation outside this range is required.

## Power-Supply Considerations

The MAX7382 operates with a 2.7V and 5.5V power-supply voltage. Good power-supply decoupling is needed to maintain the power-supply rejection performance of the MAX7382. Bypass  $V_{CC}$  to GND with a 0.1 $\mu$ F surface-mount ceramic capacitor. Mount the bypassing capacitor as close to the device as possible. If possible, mount the MAX7382 close to the microcontroller's decoupling capacitor so that additional decoupling is not required. Use a larger value of bypass capacitor recommended if the MAX7382 is to operate with a large capacitive load. Use a bypass capacitor value of at least 1000 times that of the output load capacitance.

## Pin Configuration



## Chip Information

TRANSISTOR COUNT: 2937

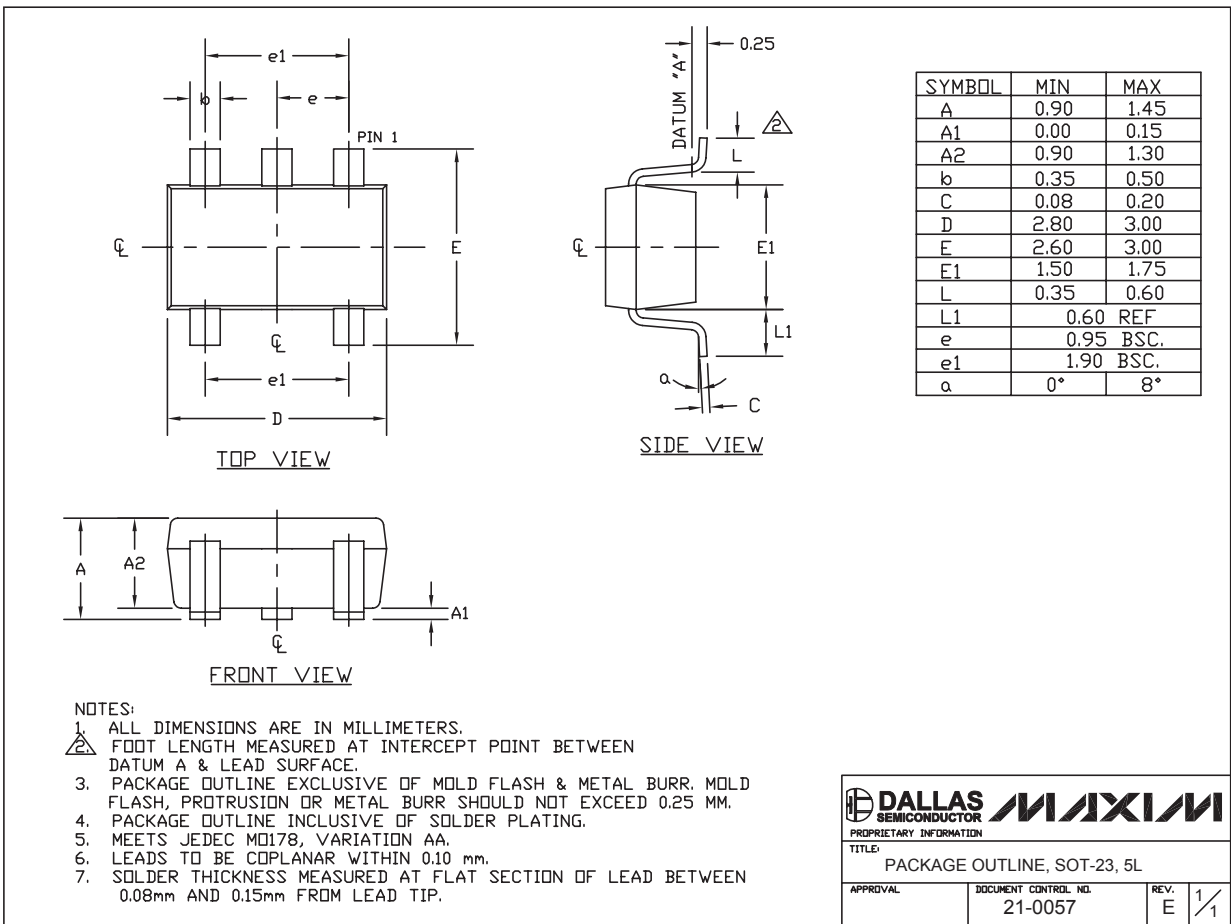
PROCESS: BiCMOS

MAX7382

# Silicon Oscillator with Reset Output

## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-integrated.com/packages](http://www.maxim-integrated.com/packages).)



SOT-23 5L .EPS

MAX7382

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