MAXIM

Silicon Oscillator with Reset Output

MAX7376

General Description

The MAX7376 silicon oscillator with reset, is a replacement for ceramic resonators, crystals, crystal oscillator modules, and discrete reset circuits. The MAX7376 provides the primary clock source and reset function for microcontrollers in 3V, 3.3V, and 5V applications. The MAX7376 features a factory-programmed high-speed oscillator and a microprocessor (µP) power-on-reset (POR) supervisor.

Unlike typical crystal and ceramic resonator oscillator circuits, the MAX7376 is resistant to vibration and EMI. The high-output-drive current and absence of high-impedance nodes make the oscillator less susceptible to dirty or humid operating conditions. With a wide operating temperature range as standard, the MAX7376 is a good choice for demanding home appliance, industrial, and automotive environments.

The MAX7376 is available in factory-programmed frequencies from 32.768kHz to 10MHz. See Table 2 for standard frequencies and contact the factory for custom frequencies.

The MAX7376 is available in a 5-pin SOT23 package. Refer to the MAX7382 data sheet for frequencies ≥10MHz. The MAX7376 standard operating temperature range is -40°C to +125°C. See the *Applications Information* section for the extended operating temperature range.

Applications

White Goods

Automotive

Consumer Products

Appliances and Controls

Handheld Products

Portable Equipment

Microcontroller (µC) Systems

Typical Application Circuit appears at end of data sheet.

Features

♦ **2.7V to 5.5V Operation**

♦ **Accurate Oscillator: 600kHz to 10MHz or 32kHz**

♦ **Reset Output Holds the µC in Reset for 100µs After Clock Startup**

♦ **±10mA Clock Output Drive Capability**

♦ **2% Initial Accuracy**

♦ **±50ppm/°C Temperature Coefficient**

♦ **50% Duty Cycle**

♦ **5ns Output Rise and Fall Time**

♦ **Low Jitter: 160ps$_{P-P}$ at 8MHz (No PLL)**

♦ **3mA Operating Current (8MHz)**

♦ **13µA Operating Current (32kHz)**

♦ **-40°C to +125°C Temperature Range**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	RESET OUTPUT
MAX7376C___-T	-40°C to +125°C	5 SOT23-5	Open drain
MAX7376A___-T	-40°C to +125°C	5 SOT23-5	Active high push-pull
MAX7376B___-T	-40°C to +125°C	5 SOT23-5	Active low push-pull

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. See Table 3 for standard part numbers.

Pin Configuration

TOP VIEW

```
          ┌─────────┐
CLOCK  1 ─┤•        ├─ 5  E.C.
          │  MAXIM  │
          │ MAX7376 │
 GND   2 ─┤         │
          │         │
RST/RST 3 ─┤         ├─ 4  VCC
          └─────────┘
```

SOT23

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.
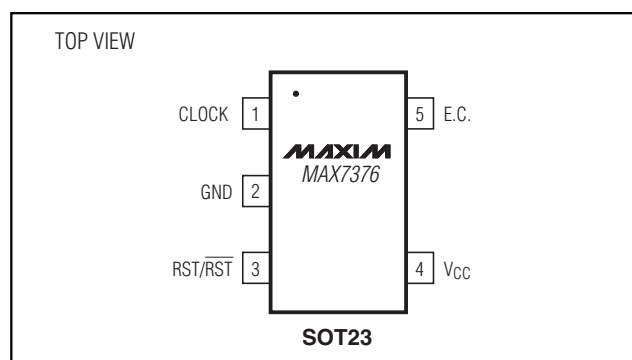
Silicon Oscillator with Reset Output

ABSOLUTE MAXIMUM RATINGS

V$_{CC}$ to GND ....-0.3V to +6V
All Other Pins to GND ....-0.3V to (V$_{CC}$ + 0.3V)
CLOCK Current ....±10mA
Continuous Power Dissipation (T$_A$ = +70°C)
  5-Pin SOT23
  (derate 7.1mW/°C above +70°C) ....571mW (U5 - 2)

Operating Temperature Range ....-40°C to +135°C
Junction Temperature ....+150°C
Storage Temperature Range.............................-60°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

(V$_{CC}$ = 2.7V to 5.5V, T$_A$ = -40°C to +125°C, unless otherwise noted. Typical values are at V$_{CC}$ = 5V and T$_A$ = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V$_{CC}$		2.7		5.5	V
Operating Supply Current	I$_{CC}$	f$_{CLOCK}$ = 8MHz, no load		3	5	mA
		f$_{CLOCK}$ = 32.768kHz, no load		13	25	µA
CLOCK OUTPUT						
Minimum Operating Voltage				1.65		V
Output High Voltage	V$_{OH}$	V$_{CC}$ = 4.5V, I$_{SOURCE}$ = 9mA	V$_{CC}$ - 0.4			V
		V$_{CC}$ = 2.7V, I$_{SOURCE}$ = 2.5mA	V$_{CC}$ - 0.4			
Output Low Voltage	V$_{OL}$	V$_{CC}$ = 4.5V, I$_{SINK}$ = 20mA			0.4	V
		V$_{CC}$ = 2.7V, I$_{SINK}$ = 10mA			0.4	
Initial Frequency Accuracy	f$_{CLOCK}$	V$_{CC}$ = 5V, T$_A$ = +25°C (Note 2)	-2		+2	%
		V$_{CC}$ = 2.7V to 5.5V, T$_A$ = +25°C	-4		+4	
Frequency Temperature Sensitivity		(Note 3)		±50	±325	ppm/°C
Initial Frequency Accuracy (32.768kHz)	f$_{CLOCK}$	V$_{CC}$ = 5V, T$_A$ = +25°C (Note 2)	32.440	32.768	33.096	kHz
		V$_{CC}$ = 2.7V to 5.5V, T$_A$ = +25°C	31.785		33.751	
Frequency Temperature Sensitivity		32.768kHz (Note 3)		±50	±325	ppm/°C
CLOCK Output Duty Cycle			43	50	57	%
CLOCK Output Jitter		Observation of 8MHz output for 20s using a 500MHz oscilloscope		160		ps$_{P-P}$
CLOCK Output Rise Time	t$_R$	10% to 90%		5		ns
CLOCK Output Fall Time	t$_F$	90% to 10%		5		ns

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MAX7376

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 2.7V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{CC} = 5V and T_A = +25°C.) (Note 1)

| PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
RST/$\overline{RST}$ OUTPUT							
Reset Threshold	V_{TH+}	V_{CC} rising	T_A = +25°C	V_{TH} - 2%		V_{TH} + 2%	V
			T_A = -40°C to +125°C	V_{TH} - 5%		V_{TH} + 5%	
Reset Hysteresis	V_{THYS}	V_{HYST} = {(V_{TH+}) - (V_{TH-})}/(V_{TH-}) x 100%			2.0		%
POR Delay		V_{CC} rising from 0V to (V_{TH} + 200mV) in 1µs			100		µs
Output High Voltage	V_{OH}	V_{CC} = 4.5V, I_{SOURCE} = 9mA		V_{CC} - 0.4			V
		V_{CC} = 2.7V, I_{SOURCE} = 2.5mA		V_{CC} - 0.4			
Output Low Voltage	V_{OL}	V_{CC} = 4.5V, I_{SINK} = 20mA				0.4	V
		V_{CC} = 2.7V, I_{SINK} = 10mA				0.4	
Leakage Current	I_{LEAK}	V_{CC} = 5.5V, V_{RST} = 5.5V, open drain				1	µA

Note 1: All parameters are tested at T_A = +25°C. Specifications over temperature are guaranteed by design.
Note 2: The frequency is determined by part number selection. See Table 3.
Note 3: Guaranteed by design. Not production tested.
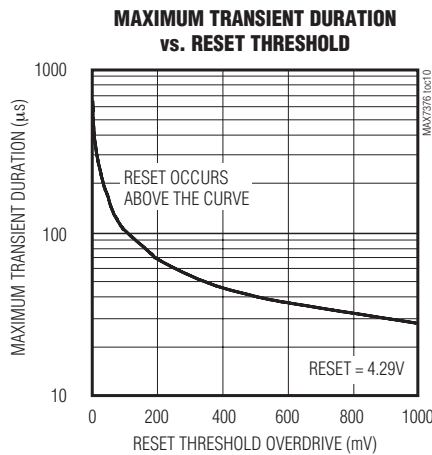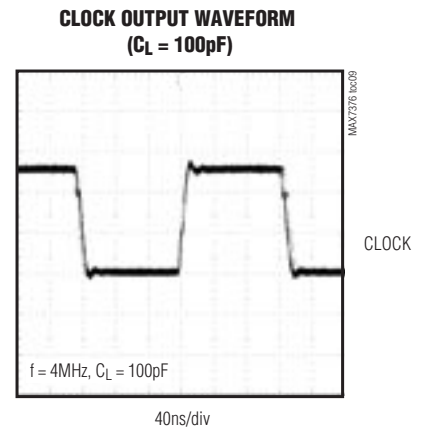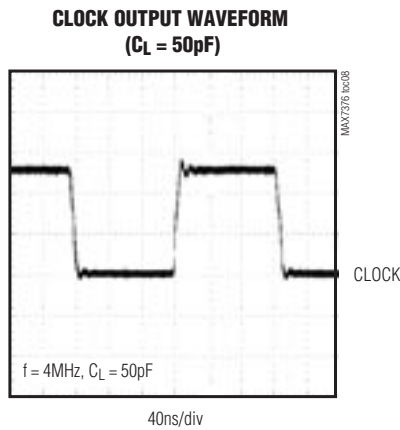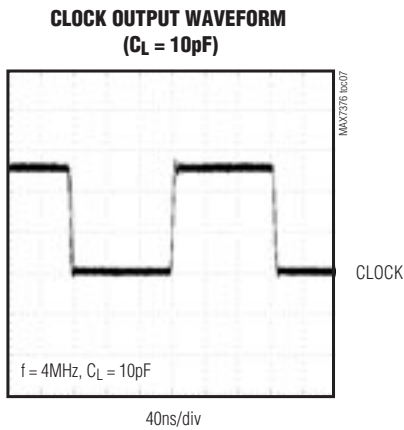
Typical Operating Characteristics

(V_{CC} = 5V, T_A = +25°C, unless otherwise noted.)

DUTY CYCLE vs. TEMPERATURE

DUTY CYCLE vs. SUPPLY VOLTAGE

SUPPLY CURRENT vs. TEMPERATURE
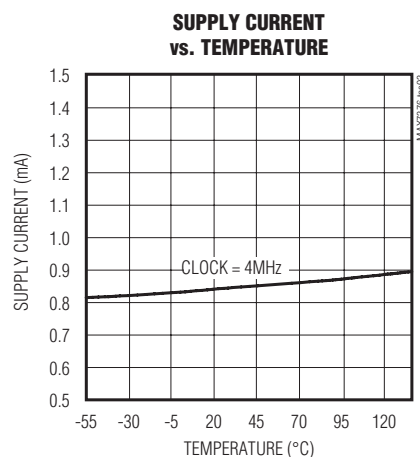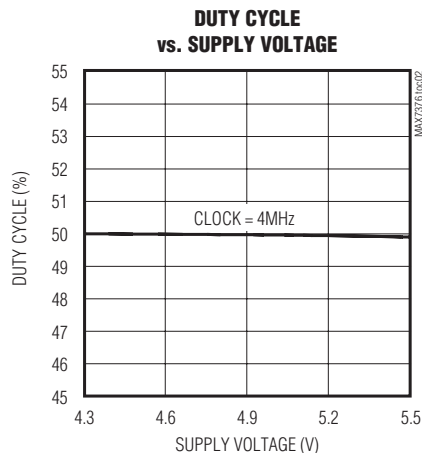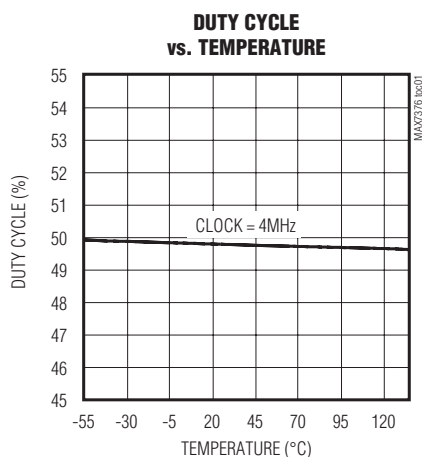
Silicon Oscillator with Reset Output

_____Typical Operating Characteristics (continued)

(V_{CC} = 5V, T_A = +25°C, unless otherwise noted.)

SUPPLY CURRENT vs. SUPPLY VOLTAGE

FREQUENCY vs. SUPPLY VOLTAGE

FREQUENCY vs. TEMPERATURE

CLOCK OUTPUT WAVEFORM (C_L = 10pF)

CLOCK OUTPUT WAVEFORM (C_L = 50pF)

CLOCK OUTPUT WAVEFORM (C_L = 100pF)

MAXIMUM TRANSIENT DURATION vs. RESET THRESHOLD

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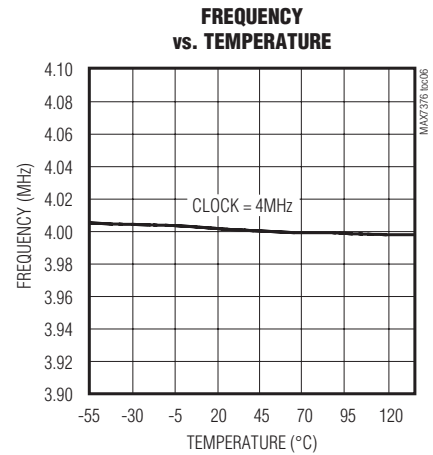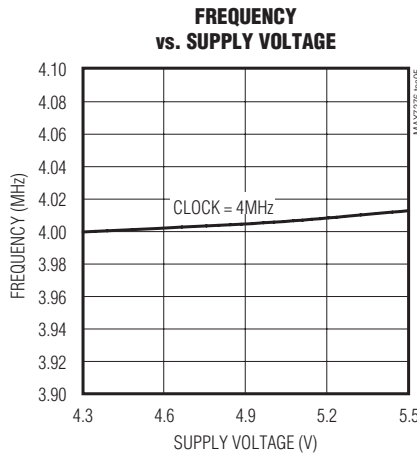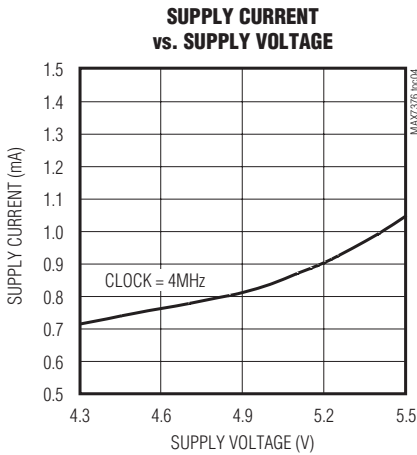
PIN	NAME	FUNCTION
1	CLOCK	Push-Pull Clock Output
2	GND	Ground
3	RST	Reset Output. See the *RST Reset Output Options* section for more details.
4	V$_{CC}$	Positive Supply Voltage. Bypass V$_{CC}$ to GND with a 0.1µF capacitor.
5	E.C.	Must Be Externally Connected to V$_{CC}$

Detailed Description

The MAX7376 is a clock generator with integrated reset for µCs and UARTs in 3V, 3.3V, and 5V applications (Figure 1). The MAX7376 is a replacement for crystal oscillator modules, crystals, or ceramic resonators and a system-reset IC. The clock frequency is factory trimmed to specific values. A variety of popular standard frequencies are available (Table 2). No external components are required for setting or adjusting the frequency.

Supply Voltage

The MAX7376 has been designed for use in systems with nominal supply voltages of 3V, 3.3V, or 5V and is specified for operation with supply voltages in the 2.7V to 5.5V range. See the *Absolute Maximum Ratings* section for limit values of power-supply and pin voltages.
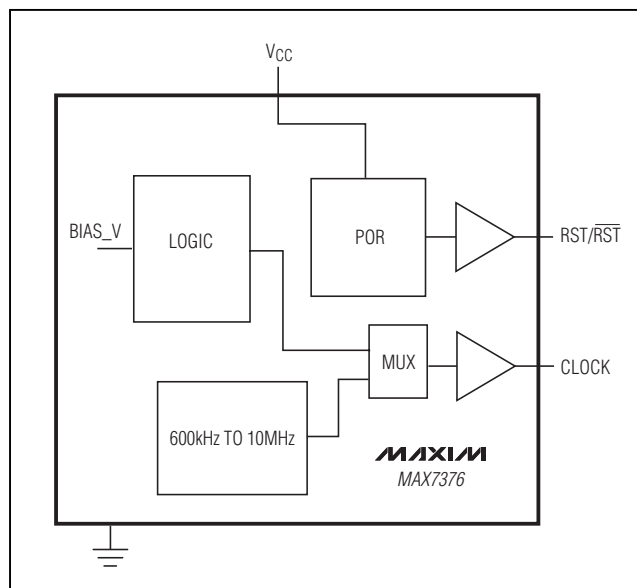

Figure 1. Functional Diagram

Oscillator

The clock output is a push-pull configuration and is capable of driving a ground-connected 500Ω or a positive-supply-connected 250Ω 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 power-off. A typical startup characteristic is shown in the *Typical Operating Characteristics*.

Applications Information

Interfacing to a µC Clock Input

The MAX7376 clock output is a push-pull, CMOS, logic output that directly drives any µP or µC clock input. There are no impedance-matching issues when using the MAX7376. The MAX7376 is not sensitive to its position on the board and it does not need to be placed right next to the µP. Refer to the µC data sheet for clock-input compatibility with external clock signals. The MAX7376 requires no biasing components or load capacitance. When using the MAX7376 to retrofit a crystal oscillator, remove all biasing components from the oscillator input.

RST Reset Output Options

The MAX7376 is available with three reset output stage options: push-pull with active-low output, push-pull with active-high output, and open drain with active-low output. The RST output is asserted when the monitored input (V$_{CC}$) drops below the internal V$_{TH-}$ threshold and remains asserted for 100µs after the monitored input exceeds the internal V$_{TH+}$ threshold. The open-drain RST output requires an external pullup resistor.

Output Jitter

The MAX7376's jitter performance is given in the *Electrical Characteristics* table as a peak-to-peak value obtained by observing the output of the MAX7376 for 20s with a 500MHz oscilloscope. Jitter values are approximately proportional to the period of the output frequency of the device. Thus, a 4MHz part has approximately twice the jitter value of an 8MHz part. The jitter performance of clock sources degrades in the presence of mechanical and electrical interference.

Silicon Oscillator with Reset Output

The MAX7376 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.

Initial Power-Up and Operation

The clock starts up within 30µs (typ) after V$_{CC}$ has risen above the reset threshold. The reset output remains asserted for 100µs after the reset threshold is reached.

Extended Temperature Operation

The MAX7376 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 MAX7376 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 MAX7376. Bypass V$_{CC}$ to GND with a 0.1µF surface-mount ceramic capacitor. Mount the bypass capacitor as close to the device as possible. If possible, mount the MAX7376 close to the µC's decoupling capacitor so that additional decoupling is not required. A larger value bypass capacitor is recommended if the MAX7376 is to operate with a large capacitive load. Use a bypass capacitor value of at least 1000 times that of the output load capacitance.

Table 1. Standard Reset Threshold Levels

SUFFIX	RESET THRESHOLD (V)
R	2.57
M	4.29

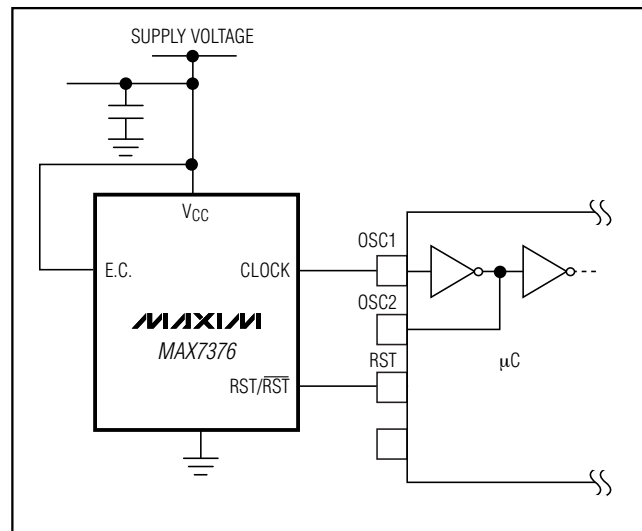*For all other reset threshold options, contact factory.*

Table 2. Standard Frequencies

SUFFIX	STANDARD FREQUENCY (MHz)
AA	32.768kHz
MG	1
OK	1.8432
QT	3.39545
QW	3.6864
RD	4
RH	4.1943
TP	8

For all other reset threshold options, contact factory.

_____Typical Application Circuit

Table 3. Standard Part Numbers

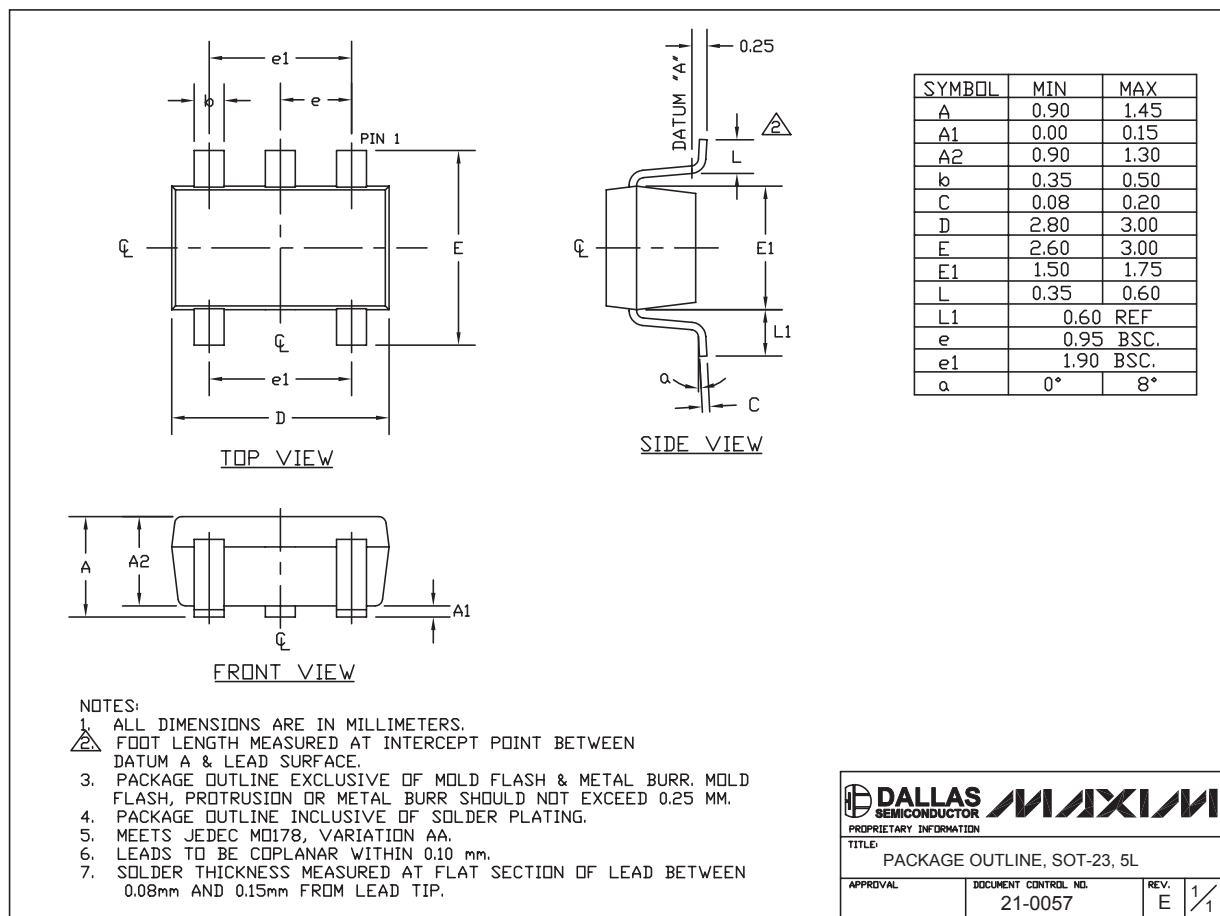| PART	PIN-PACKAGE	RESET THRESHOLD (V)	FREQUENCY (Hz)	TOP MARK
MAX7376CRAA	5 SOT23	2.57	32.768k	AEUZ
MAX7376CRMG	5 SOT23	2.57	1M	AEUN
MAX7376CROK	5 SOT23	2.57	1.8432M	AEUJ
MAX7376CRQT	5 SOT23	2.57	3.39545M	AETT
MAX7376CRQW	5 SOT23	2.57	3.6864M	AETU
MAX7376CRRD	5 SOT23	2.57	4M	AETV
MAX7376CRRH	5 SOT23	2.57	4.1943M	AETW
MAX7376CRTP	5 SOT23	2.57	8M	AESF
MAX7376CMMG	5 SOT23	4.29	1M	AEUM
MAX7376CMOK	5 SOT23	4.29	1.8432M	AEUI
MAX7376CMQT	5 SOT23	4.29	3.39545M	AESH
MAX7376CMQW	5 SOT23	4.29	3.6864M	AETP
MAX7376CMRD	5 SOT23	4.29	4M	AESJ
MAX7376CMRH	5 SOT23	4.29	4.1943M	AETR
MAX7376CMTP	5 SOT23	4.29	8M	AETS

Chip Information

TRANSISTOR COUNT: 2027
PROCESS: BiCMOS

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-ic.com/packages**.)

SYMBOL	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.35	0.50
C	0.08	0.20
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.75
L	0.35	0.60
L1	0.60	REF
e	0.95	BSC.
e1	1.90	BSC.
α	0°	8°

SOT-23 5L.EPS

TOP VIEW

SIDE VIEW

FRONT VIEW

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM A & LEAD SURFACE.
3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR. MOLD FLASH, PROTRUSION OR METAL BURR SHOULD NOT EXCEED 0.25 MM.
4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
5. MEETS JEDEC MO178, VARIATION AA.
6. LEADS TO BE COPLANAR WITHIN 0.10 mm.
7. SOLDER THICKNESS MEASURED AT FLAT SECTION OF LEAD BETWEEN 0.08mm AND 0.15mm FROM LEAD TIP.

DALLAS SEMICONDUCTOR ***MAXIM***

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, SOT-23, 5L

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0057	E	1/1