19-3060; Rev 0; 10/03

MAXIM

3-Pin Silicon Oscillator

MAX7375

General Description

The MAX7375 is a silicon oscillator, intended as a low-cost improvement to replace ceramic resonators, crystals, and crystal oscillator modules used as the clock source for microcontrollers and UARTs in 3V, 3.3V, and 5V applications.

The MAX7375 is a fully integrated oscillator, supplied at specific factory-trimmed frequencies with a Rail-to-Rail® 50% duty cycle square-wave output. The oscillator frequency is generated directly without the use of a phase-locked loop (PLL). No additional components are used for setting or adjusting the frequency.

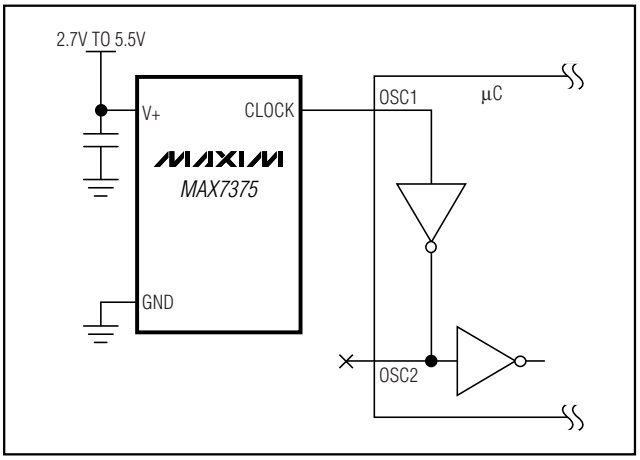
Unlike typical crystal and ceramic resonator oscillator circuits, the MAX7375 is resistant to vibration and EMI. The high output drive current and absence of high-impedance nodes make the oscillator less susceptible to dirty or humid operating conditions. With a wide operating temperature range, the oscillator is a good choice for demanding home appliance and automotive environments.

The MAX7375 is offered in space-saving 3-pin SC70 and SOT23 packages. All parts are guaranteed to operate over the -55°C to +135°C temperature range and are specified from -40°C to +125°C.

Applications

White Goods
Automotive
Appliances and Controls
Hand-Held Products
Portable Equipment
Microcontroller Systems

Typical Application Circuit



Selector Guide appears at end of data sheet.

Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd,

Features

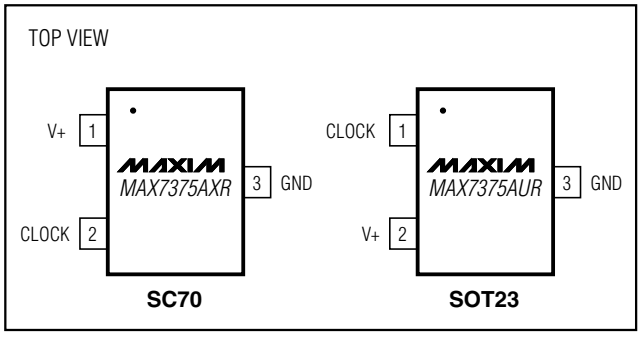
- **2.7V to 5.5V Operation**
- **Factory-Trimmed Oscillator**
- **No External Components Required**
- **±10mA Output Drive Current**
- **2% Initial Accuracy**
- **±50ppm/°C Temp Drift**
- **Fast Startup Time: 5µs**
- **45% to 55% Maximum Duty Cycle**
- **5ns Output Rise and Fall Time**
- **No PLL**
- **Low Jitter: 160ps$_{P-P}$ at 8MHz**
- **Tiny Surface-Mount Package (SC70, SOT23)**
- **-40°C to +125°C Temperature Range**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX7375AXR105-T*	-40°C to +125°C	3 SC70-3
MAX7375AXR185-T*	-40°C to +125°C	3 SC70-3
MAX7375AXR365-T	-40°C to +125°C	3 SC70-3
MAX7375AXR375-T	-40°C to +125°C	3 SC70-3
MAX7375AXR405-T	-40°C to +125°C	3 SC70-3
MAX7375AXR425-T	-40°C to +125°C	3 SC70-3
MAX7375AXR805-T	-40°C to +125°C	3 SC70-3
MAX7375AUR105-T*	-40°C to +125°C	3 SOT23-3
MAX7375AUR185-T*	-40°C to +125°C	3 SOT23-3
MAX7375AUR365-T	-40°C to +125°C	3 SOT23-3
MAX7375AUR375-T	-40°C to +125°C	3 SOT23-3
MAX7375AUR405-T	-40°C to +125°C	3 SOT23-3
MAX7375AUR425-T	-40°C to +125°C	3 SOT23-3
MAX7375AUR805-T	-40°C to +125°C	3 SOT23-3

**Future product—contact factory for availability.*

Pin Configuration



3-Pin Silicon Oscillator

ABSOLUTE MAXIMUM RATINGS

V+ to GND .....-0.3V to +6V
CLOCK to GND .....-0.3V to (V+ + 0.3V)
Continuous Power Dissipation (T_A = +70°C)
3-Pin SC70 (derate 2.9mW/°C over +70°C).....235mW
3-Pin SOT23 (derate 4mW/°C over +70°C.....320mW
Operating Temperature Range .....-40°C to +125°C
Functional 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

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

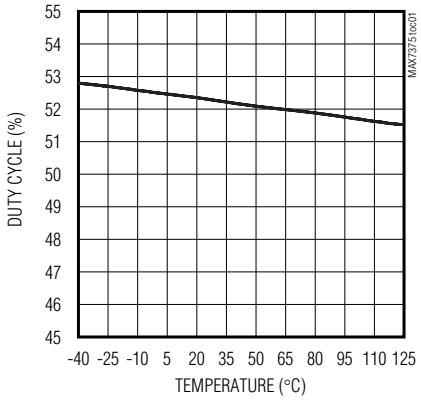
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage	V+			2.7		5.5	V
Operating Supply Current	I_+	MAX7375A_R405			2.0	4.2	V
		MAX7375A_R805			3.2	6.4	
Output High Voltage	V_{OH}	V+ ≥ 2.7V, I_{SOURCE} = 2.5mA		V+ - 0.4			V
		V+ ≥ 4.5V, I_{SOURCE} = 9mA		V+ - 0.4			
Output Low Voltage	V_{OL}	V+ ≥ 2.7, I_{SINK} = 10mA				0.4	V
		V+ ≥ 4.5V, I_{SINK} = 20mA				0.4	
Initial CLOCK Frequency	f_{CLOCK}	V+ = 3.0V, T_A = +25°C (Note 2)	MAX7375A_R___	-2%		+2%	MHz
		V+ = 2.7V to 5.5V, T_A = +25°C (Note 2)	MAX7375A_R___	-4%		+4%	
CLOCK Frequency Temperature Sensitivity		(Note 3)			±50	±325	ppm/°C
Duty Cycle		(Note 3)		45	52	57	%
Output Jitter		Observation for 20s using a 500MHz oscilloscope (MAX7375A_R805)			160		ps_{P-P}
Output Rise Time	t_R	(Note 3)			5.0		ns
Output Fall Time	t_F	(Note 3)			2.5		ns

Note 1: All parameters are tested at T_A = +25°C. Specifications over temperature are guaranteed by design and characterization.
Note 2: Typical frequencies are nominal values.
Note 3: Guaranteed by design and characterization. Not production tested.

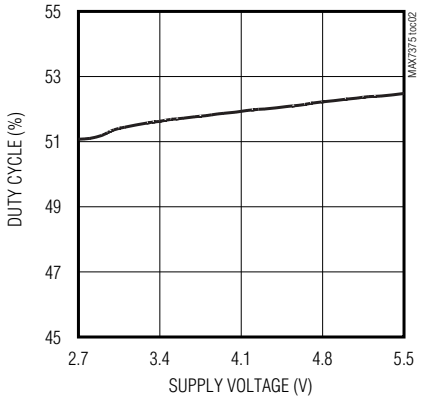
Typical Operating Characteristics

(V+ = 5V, T_A = +25°C, C_L = 10pF, 8MHz output, unless otherwise noted.)

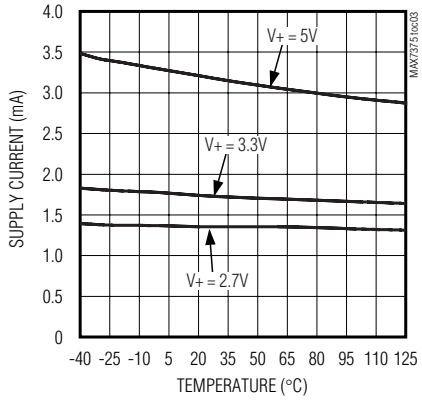
DUTY CYCLE vs. TEMPERATURE



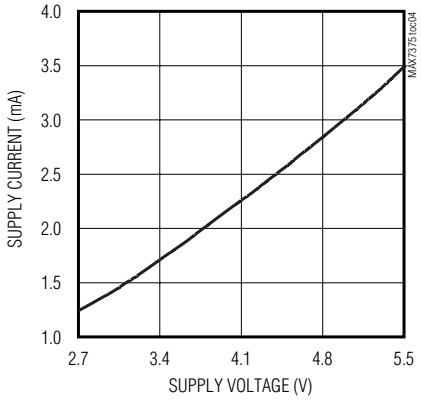
DUTY CYCLE vs. SUPPLY VOLTAGE



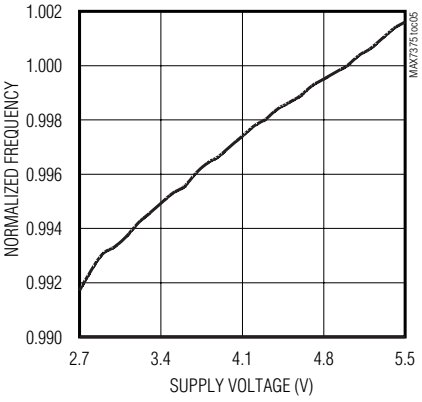
SUPPLY CURRENT vs. TEMPERATURE



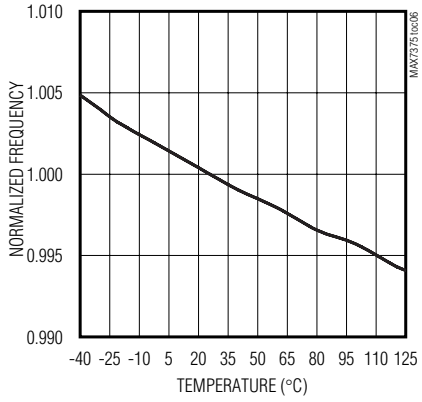
SUPPLY CURRENT vs. SUPPLY VOLTAGE



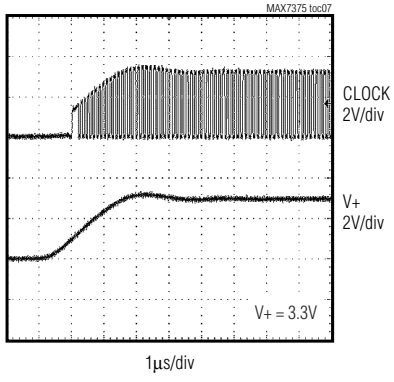
FREQUENCY vs. SUPPLY VOLTAGE



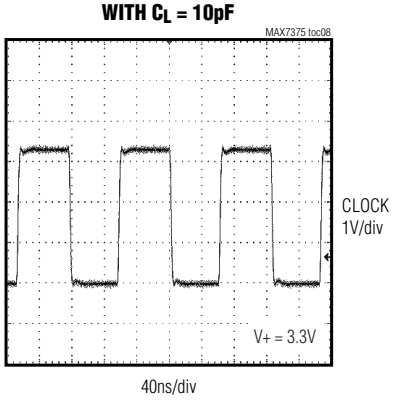
FREQUENCY vs. TEMPERATURE



SETTLING TIME FROM START



CLOCK OUTPUT WAVEFORM WITH C_L = 10pF

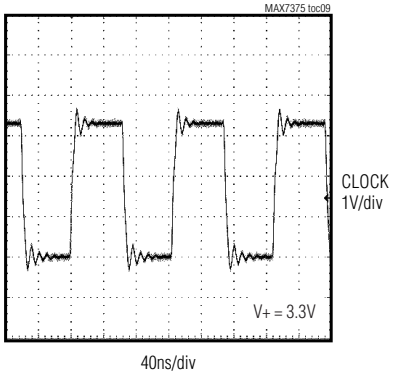


3-Pin Silicon Oscillator

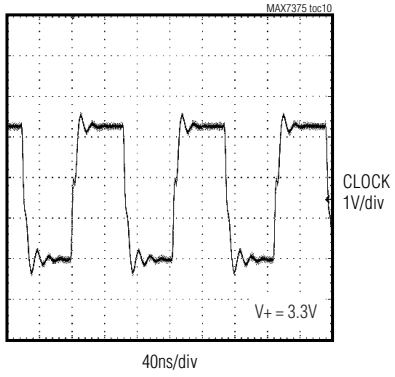
Typical Operating Characteristics (continued)

(V+ = 5V, T_A = +25°C, C_L = 10pF, 8MHz output, unless otherwise noted.)

CLOCK OUTPUT WAVEFORM WITH C_L = 50pF



CLOCK OUTPUT WAVEFORM WITH C_L = 100pF



Pin Description

PIN		NAME	FUNCTION
SC70	SOT23		
1	2	V+	Positive Supply Voltage
2	1	CLOCK	Clock output. Output is push-pull.
3	3	GND	Ground

Detailed Description

The MAX7375 is a replacement for ceramic resonators, crystals, and crystal oscillator modules as the clock source for microcontrollers and UARTs in 3V, 3.3V, and 5V applications. The MAX7375 is an integrated oscillator, supplied at specific frequencies just like crystals and resonators. A variety of popular standard frequencies are available. No external components are required for setting or adjusting the frequency.

Supply Voltages

The MAX7375 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. Operation outside this range is not guaranteed. See the *Absolute Maximum Ratings* table for limit values of power-supply and pin voltages.

Oscillator

The clock output is a push-pull configuration and is capable of driving a ground-connected 1kΩ load or a positive supply connected 500Ω load to within 300mV 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* section.

Output Jitter

The MAX7375's jitter performance is given in the *Electrical Characteristics* table as a peak-to-peak value obtained by observing the output of the MAX7375 for 20s with a 500MHz oscilloscope. Jitter measurements 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 all clock sources degrades in the presence of mechanical and electrical interference. The MAX7375 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.

Applications Information

Interfacing to a Microcontroller Clock Input

The MAX7375 clock output is a push-pull, CMOS, logic output, which directly drives any microprocessor (µP) or microcontroller (µC) clock input. There are no impedance-matching issues when using the MAX7375. Operate the MAX7375 and microcontroller (or other clock input device) from the same supply voltage level. Refer to the microcontroller data sheet for clock input compatibility with external clock signals.

The MAX7375 requires no biasing components or load capacitance. When using the MAX7375 to retrofit a crystal oscillator, remove all biasing components from the oscillator input.

Startup Performance

The MAX7375 oscillator output stabilizes within a few cycles of operation after V+ rises to a sufficient voltage to start the oscillator, typically 1.65V at +25°C. Use a reset or similar voltage-detection circuit to disable devices connected to the MAX7375 until 5µs after the voltage on V+ has risen above 2.7V.

Selector Guide

PART	FREQUENCY (MHz)	TOP MARK
MAX7375AXR105	1	AOV
MAX7375AXR185	1.8432	AOU
MAX7375AXR365	3.579545	AOT
MAX7375AXR375	3.6864	AOS
MAX7375AXR405	4	AOR
MAX7375AXR425	4.1943	AOQ
MAX7375AXR805	8	AOP
MAX7375AUR105	1	FZPZ
MAX7375AUR185	1.8432	FZPT
MAX7375AUR365	3.579545	FZPU
MAX7375AUR375	3.6864	FZPV
MAX7375AUR405	4	FZPY
MAX7375AUR425	4.1943	FZPW
MAX7375AUR805	8	FZPX

Power-Supply Considerations

The MAX7375 operates with power-supply voltages in the 2.7V to 5.5V range. Good power-supply decoupling is needed to maintain the power-supply rejection performance of the MAX7375. Use a 0.1µF surface-mount ceramic capacitor connected between V+ and GND and mounted as close to the device as possible. If possible, mount the MAX7375 close to the microcontroller's decoupling capacitor so that additional decoupling is not required.

A larger value of bypass capacitor is recommended if the MAX7375 is to operate with a large capacitive load. Use a bypass capacitor value of at least 1000 times that of the output load capacitance.

Chip Information

TRANSISTOR COUNT: 432

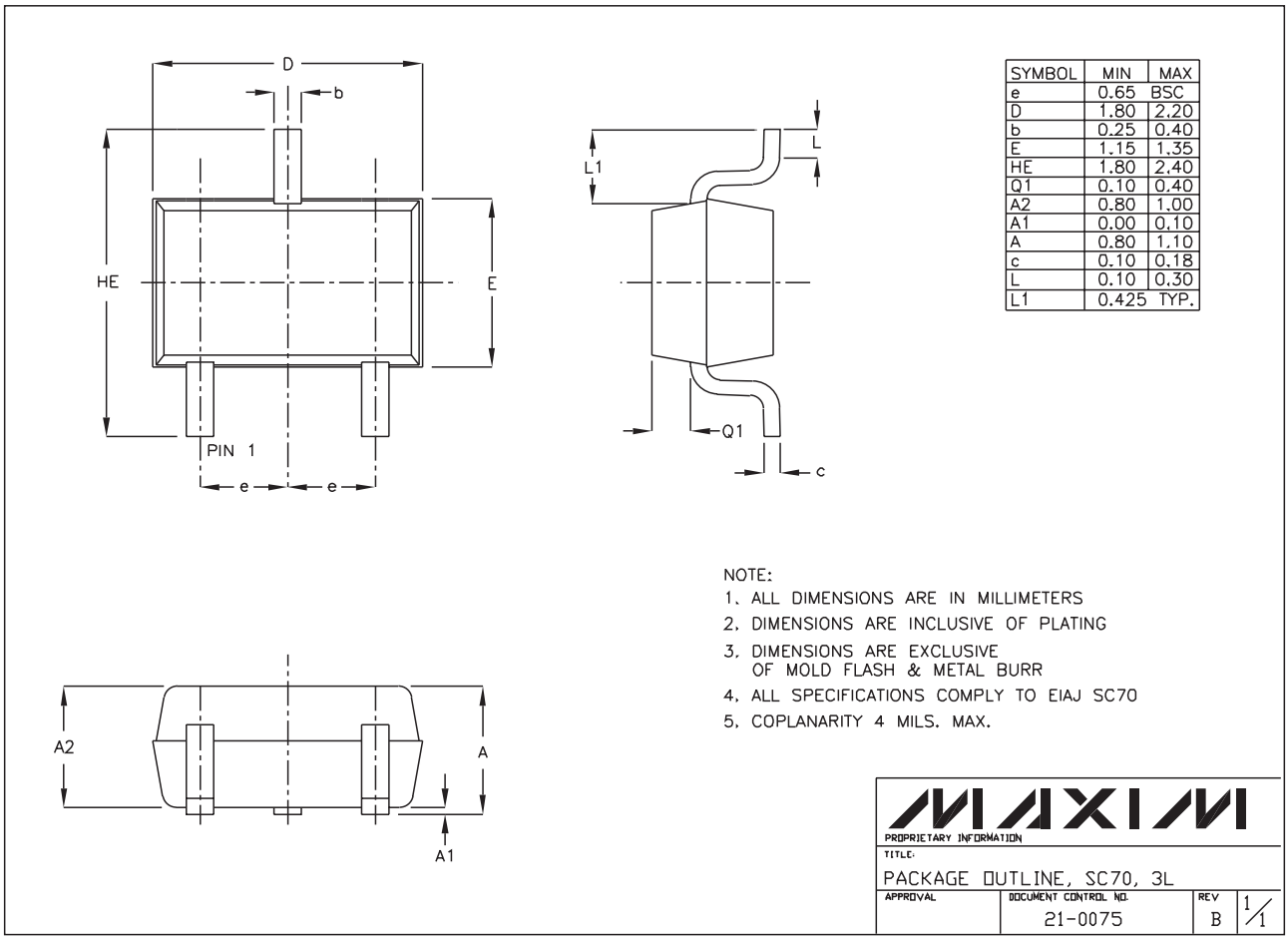
PROCESS: BiCMOS

3-Pin Silicon Oscillator

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**.)

SC70, 3L.EPS



SYMBOL	MIN	MAX
e	0.65	BSC
D	1.80	2.20
b	0.25	0.40
E	1.15	1.35
HE	1.80	2.40
Q1	0.10	0.40
A2	0.80	1.00
A1	0.00	0.10
A	0.80	1.10
c	0.10	0.18
L	0.10	0.30
L1	0.425	TYP.

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS
2. DIMENSIONS ARE INCLUSIVE OF PLATING
3. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH & METAL BURR
4. ALL SPECIFICATIONS COMPLY TO EIAJ SC70
5. COPLANARITY 4 MILS. MAX.

MAXIM
PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, SC70, 3L

APPROVAL	DOCUMENT CONTROL NO.	REV	
	21-0075	B	1/1

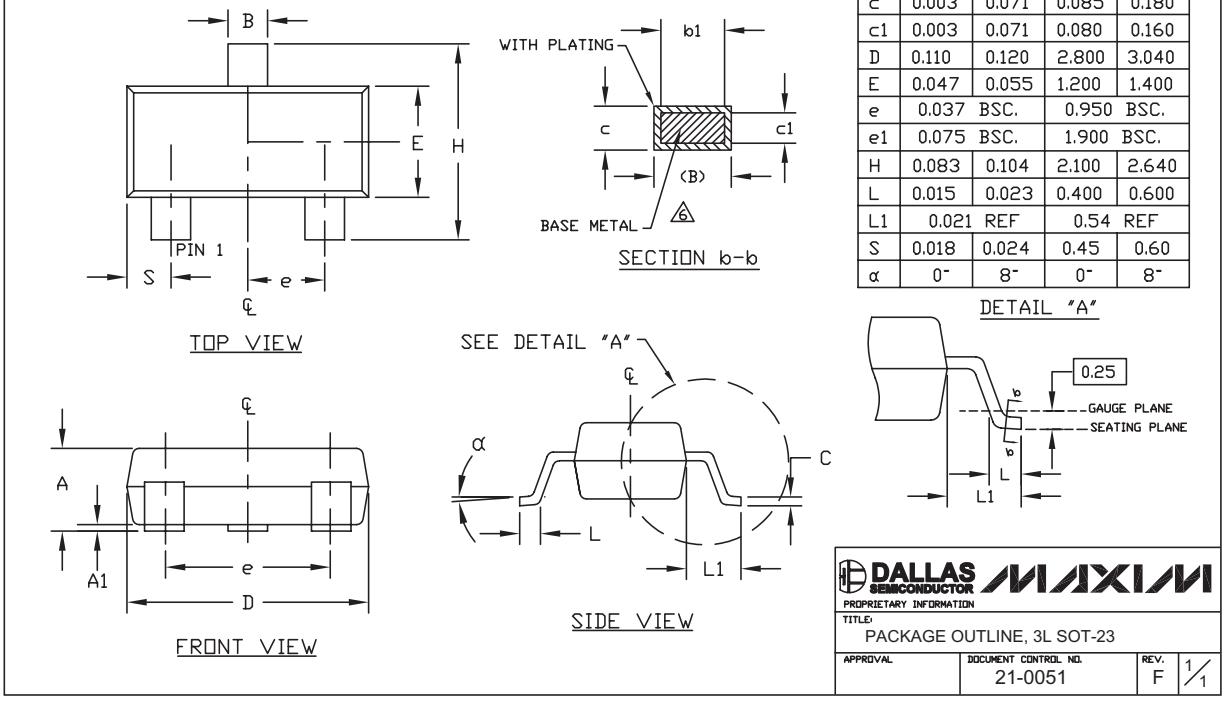
Package Information (continued)

(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**.)

SOT23 L.EPS

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. REFERENCE JEDEC TO236-VARIATION AB.
5. LEADS TO BE COPLANAR WITHIN 0.10mm.
6. DIMENSIONS MEASURED AT FLAT SECTION OF LEAD BETWEEN 0.08mm AND 0.15mm FROM LEAD TIP.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.035	0.044	0.890	1.120
A1	0.001	0.004	0.013	0.100
B	0.015	0.020	0.370	0.500
b1	0.012	0.018	0.300	0.450
c	0.003	0.071	0.085	0.180
c1	0.003	0.071	0.080	0.160
D	0.110	0.120	2.800	3.040
E	0.047	0.055	1.200	1.400
e	0.037 BSC.		0.950 BSC.	
e1	0.075 BSC.		1.900 BSC.	
H	0.083	0.104	2.100	2.640
L	0.015	0.023	0.400	0.600
L1	0.021 REF		0.54 REF	
S	0.018	0.024	0.45	0.60
α	0°	8°	0°	8°



DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 3L SOT-23

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0051	F	1/1