19-1338; Rev 2; 4/99

MAXIM

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers



## General Description

The MAX4200–MAX4205 are ultra-high-speed, open-loop buffers featuring high slew rate, high output current, low noise, and excellent capacitive-load-driving capability. The MAX4200/MAX4201/MAX4202 are single buffers, while the MAX4203/MAX4204/MAX4205 are dual buffers. The MAX4201/MAX4204 have integrated 50Ω termination resistors, making them ideal for driving 50Ω transmission lines. The MAX4202/MAX4205 include 75Ω back-termination resistors for driving 75Ω transmission lines. The MAX4200/MAX4203 have no internal termination resistors.

The MAX4200–MAX4205 use a proprietary architecture to achieve up to 780MHz -3dB bandwidth, 280MHz 0.1dB gain flatness, 4200V/µs slew rate, and ±90mA output current drive capability. They operate from ±5V supplies and draw only 2.2mA of quiescent current. These features, along with low-noise performance, make these buffers suitable for driving high-speed analog-to-digital converter (ADC) inputs or for data-communications applications.

## Applications

High-Speed DAC Buffers

Wireless LANs

Digital-Transmission Line Drivers

High-Speed ADC Input Buffers

IF/Communications Systems

## Selector Guide

| PART | NO. OF BUFFERS | INTERNAL OUTPUT TERMINATION (Ω) | PIN-PACKAGE |
|---|---|---|---|
| MAX4200 | 1 | — | 8 SO, 5 SOT23 |
| MAX4201 | 1 | 50 | 8 SO, 5 SOT23 |
| MAX4202 | 1 | 75 | 8 SO, 5 SOT23 |
| MAX4203 | 2 | — | 8 SO/µMAX |
| MAX4204 | 2 | 50 | 8 SO/µMAX |
| MAX4205 | 2 | 75 | 8 SO/µMAX |

*Pin Configurations appear at end of data sheet.*

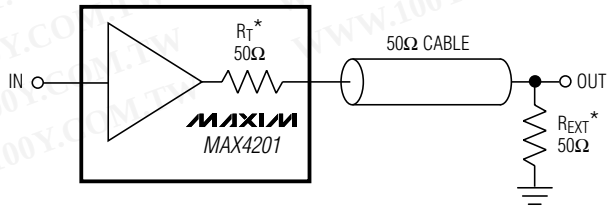
## Features

- **2.2mA Supply Current**
- **High Speed**
  **780MHz -3dB Bandwidth (MAX4201/MAX4202)**
  **280MHz 0.1dB Gain Flatness (MAX4201/MAX4202)**
  **4200V/µs Slew Rate**
- **Low 2.1nV/√Hz Voltage-Noise Density**
- **Low 0.8pA/√Hz Current-Noise Density**
- **High ±90mA Output Drive (MAX4200/MAX4203)**
- **Excellent Capacitive-Load-Driving Capability**
- **Available in Space-Saving SOT23 or µMAX Packages**

## Ordering Information

| PART | TEMP. RANGE | PIN-PACKAGE | TOP MARK |
|---|---|---|---|
| **MAX4200**ESA | -40°C to +85°C | 8 SO | — |
| MAX4200EUK-T | -40°C to +85°C | 5 SOT23-5 | AABZ |
| **MAX4201**ESA | -40°C to +85°C | 8 SO | — |
| MAX4201EUK-T | -40°C to +85°C | 5 SOT23-5 | ABAA |
| **MAX4202**ESA | -40°C to +85°C | 8 SO | — |
| MAX4202EUK-T | -40°C to +85°C | 5 SOT23-5 | ABAB |
| **MAX4203**ESA | -40°C to +85°C | 8 SO | — |
| MAX4203EUA | -40°C to +85°C | 8 µMAX | — |
| **MAX4204**ESA | -40°C to +85°C | 8 SO | — |
| MAX4204EUA | -40°C to +85°C | 8 µMAX | — |
| **MAX4205**ESA | -40°C to +85°C | 8 SO | — |
| MAX4205EUA | -40°C to +85°C | 8 µMAX | — |

## Typical Application Circuit




COAXIAL CABLE DRIVER

*$R_L = R_T + R_{EXT}$

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ($V_{CC}$ to $V_{EE}$).....+12V
Voltage on Any Pin to GND.....($V_{EE}$ - 0.3V) to ($V_{CC}$ + 0.3V)
Output Short-Circuit Duration to GND.....Continuous
Continuous Power Dissipation ($T_A$ = +70°C)
5-Pin SOT23 (derate 7.1mW/°C above +70°C).....571mW
8-Pin µMAX (derate 4.1mW/°C above +70°C).....330mW
8-Pin SO (derate 5.9mW/°C above +70°C).....471mW

Operating Temperature Range .....-40°C to +85°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10sec) .....+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.*

## DC ELECTRICAL CHARACTERISTICS

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = ∞, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Supply Voltage | $V_S$ | Guaranteed by PSR test | | ±4 | | ±5.5 | V |
| Quiescent Supply Current | $I_S$ | Per buffer, $V_{IN}$ = 0V | | | 2.2 | 4 | mA |
| Input Offset Voltage | $V_{OS}$ | $V_{IN}$ = 0V | | | 1 | 15 | mV |
| Input Offset Voltage Drift | $TCV_{OS}$ | $V_{IN}$ = 0V | | | 20 | | µV/°C |
| Input Offset Voltage Matching | | MAX4203/MAX4204/MAX4205 | | | 0.4 | | mV |
| Input Bias Current | $I_B$ | | | | 0.8 | 10 | µA |
| Input Resistance | $R_{IN}$ | | | | 500 | | kΩ |
| Voltage Gain | $A_V$ | -3.0V ≤ $V_{OUT}$ ≤ 3.0V | MAX4200/MAX4203, $R_{EXT}$ = 150Ω | 0.9 | 0.96 | 1.1 | V/V |
| | | | MAX4201/MAX4204, $R_{EXT}$ = 50Ω | 0.42 | 0.50 | 0.58 | |
| | | | MAX4202/MAX4205, $R_{EXT}$ = 75Ω | 0.41 | 0.50 | 0.59 | |
| Power-Supply Rejection | PSR | $V_S$ = ±4V to ±5.5V | | 55 | 72 | | dB |
| Output Resistance | $R_{OUT}$ | f = DC | MAX4200/MAX4203 | | 8 | | Ω |
| | | | MAX4201/MAX4204 | | 50 | | |
| | | | MAX4202/MAX4205 | | 75 | | |
| Output Current | $I_{OUT}$ | $R_L$ = 30Ω | MAX4200/MAX4203 | | ±90 | | mA |
| | | | MAX4201/MAX4204 | | ±52 | | |
| | | | MAX4202/MAX4205 | | ±44 | | |
| Short-Circuit Output Current | $I_{SC}$ | Sinking or sourcing | MAX4200/MAX4203 | | 150 | | mA |
| | | | MAX4201/MAX4204 | | 90 | | |
| | | | MAX4202/MAX4205 | | 75 | | |
| Output Voltage Swing | $V_{OUT}$ | MAX4200/MAX4203 | $R_L$ = 150Ω | ±3.3 | ±3.8 | | V |
| | | | $R_L$ = 100Ω | ±3.2 | ±3.7 | | |
| | | | $R_L$ = 37.5Ω | | ±3.3 | | |
| | | MAX4201/MAX4204 | $R_L$ = 50Ω | ±1.9 | ±2.1 | | |
| | | MAX4202/MAX4205 | $R_L$ = 75Ω | ±2.0 | ±2.3 | | |

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

## AC ELECTRICAL CHARACTERISTICS

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = 100Ω for MAX4200/MAX4201/MAX4203/MAX4204, $R_L$ = 150Ω for MAX4202/MAX4205, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.)

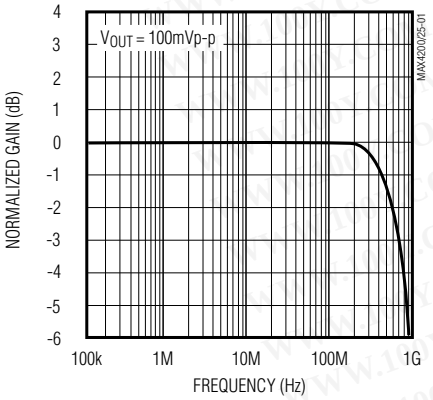
| PARAMETER | SYMBOL | CONDITIONS | | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| -3dB Bandwidth | $BW_{(-3dB)}$ | $V_{OUT}$ ≤ 100m$V_{RMS}$ | MAX4200 | | | 660 | | MHz |
| | | | MAX4201/MAX4202 | | | 780 | | |
| | | | MAX4203 | | | 530 | | |
| | | | MAX4204/MAX4205 | | | 720 | | |
| 0.1dB Bandwidth | $BW_{(0.1dB)}$ | $V_{OUT}$ ≤ 100m$V_{RMS}$ | MAX4200 | | | 220 | | MHz |
| | | | MAX4201/MAX4202 | | | 280 | | |
| | | | MAX4203 | | | 130 | | |
| | | | MAX4204/MAX4205 | | | 230 | | |
| Full-Power Bandwidth | FPBW | $V_{OUT}$ ≤ 2Vp-p | MAX4200/MAX4201/MAX4202 | | | 490 | | MHz |
| | | | MAX4203/MAX4204/MAX4205 | | | 310 | | |
| Slew Rate | SR | $V_{OUT}$ = 2V step | | | | 4200 | | V/µs |
| Group Delay Time | | | | | | 405 | | ps |
| Settling Time to 0.1% | $t_S$ | $V_{OUT}$ = 2V step | | | | 12 | | ns |
| Spurious-Free Dynamic Range | SFDR | $V_{OUT}$ = 2Vp-p | MAX4200/MAX4201/MAX4202 | f = 5MHz | | -48 | | dBc |
| | | | | f = 20MHz | | -45 | | |
| | | | | f = 100MHz | | -34 | | |
| | | | MAX4203/MAX4204/MAX4205 | f = 5MHz | | -47 | | |
| | | | | f = 20MHz | | -44 | | |
| | | | | f = 100MHz | | -32 | | |
| Harmonic Distortion | HD | MAX4200/MAX4201/MAX4202, f = 500kHz, $V_{OUT}$ = 2Vp-p | | Second harmonic | | -72 | | dBc |
| | | | | Third harmonic | | -48 | | |
| | | | | Total harmonic | | -48 | | |
| | | MAX4203/MAX4204/l MAX4205, f = 500kHz, $V_{OUT}$ = 2Vp-p | | Second harmonic | | -83 | | |
| | | | | Third harmonic | | -47 | | |
| | | | | Total harmonic | | -47 | | |
| Differential Gain Error | DG | NTSC, $R_L$ = 150Ω | | | | 1.3 | | % |
| Differential Phase Error | DP | NTSC, $R_L$ = 150Ω | | | | 0.15 | | degrees |
| Input Voltage Noise Density | $e_n$ | f = 1MHz | | | | 2.1 | | nV/√Hz |
| Input Current Noise Density | $i_n$ | f = 1MHz | | | | 0.8 | | pA/√Hz |
| Input Capacitance | $C_{IN}$ | | | | | 2 | | pF |
| Output Impedance | $Z_{OUT}$ | f = 10MHz | | | | 6 | | Ω |
| Amplifier Crosstalk | $X_{TALK}$ | $V_{OUT}$ = 2Vp-p | | f = 10MHz | | -87 | | dB |
| | | | | f = 100MHz | | -65 | | |

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

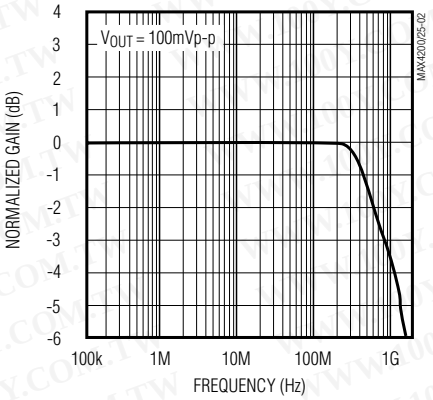
## Typical Operating Characteristics

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = 100Ω for MAX4200/MAX4201/MAX4203/MAX4204, $R_L$ = 150Ω for MAX4202/MAX4205, unless otherwise noted.)

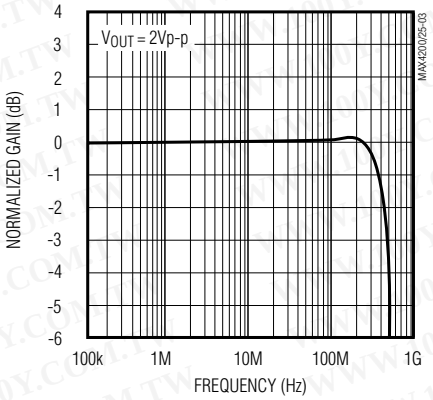
**MAX4200**
**SMALL-SIGNAL GAIN vs. FREQUENCY**



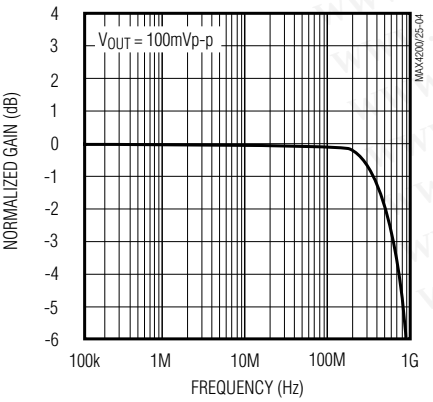

**MAX4201/MAX4202**
**SMALL-SIGNAL GAIN vs. FREQUENCY**



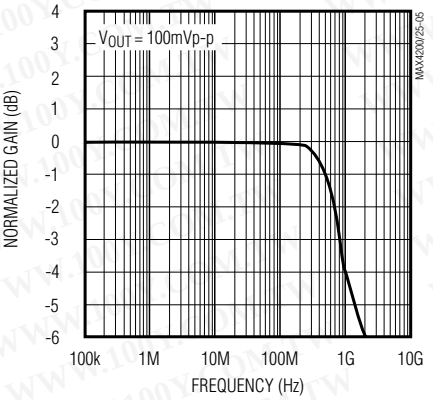

**MAX4200/MAX4201/MAX4202**
**LARGE-SIGNAL GAIN vs. FREQUENCY**



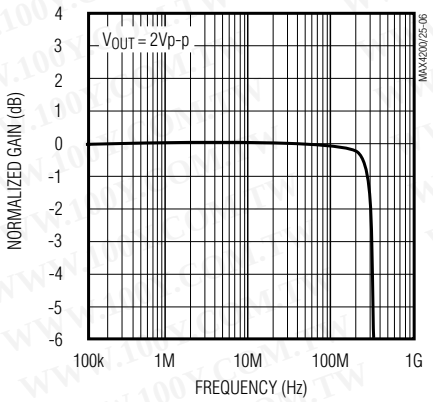

**MAX4203**
**SMALL-SIGNAL GAIN vs. FREQUENCY**



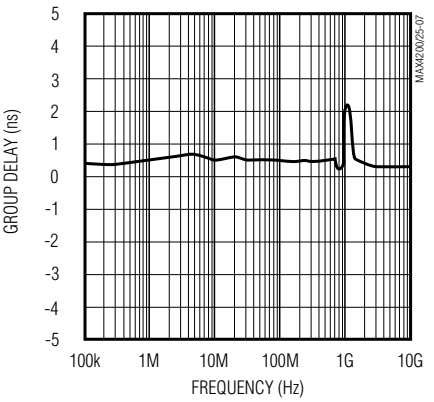

**MAX4204/MAX4205**
**SMALL-SIGNAL GAIN vs. FREQUENCY**



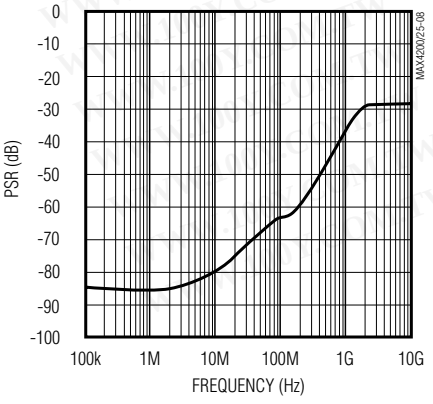

**MAX4203/MAX4204/MAX4205**
**LARGE-SIGNAL GAIN vs. FREQUENCY**



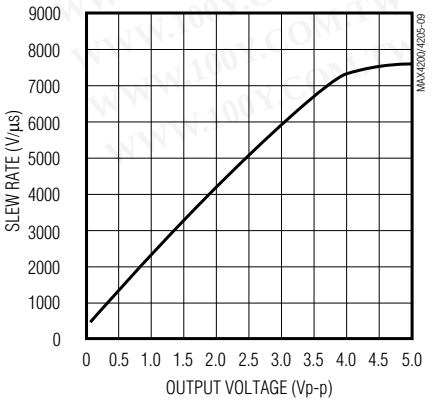

**GROUP DELAY vs. FREQUENCY**




**POWER-SUPPLY REJECTION vs. FREQUENCY**




**SLEW RATE vs. OUTPUT VOLTAGE**

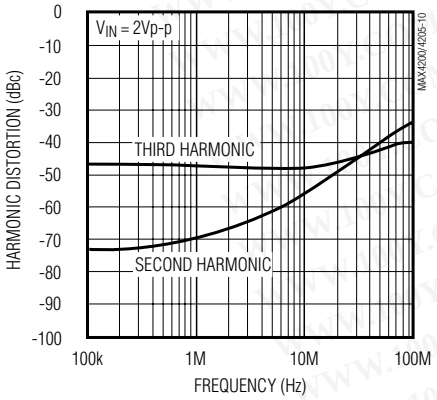


# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

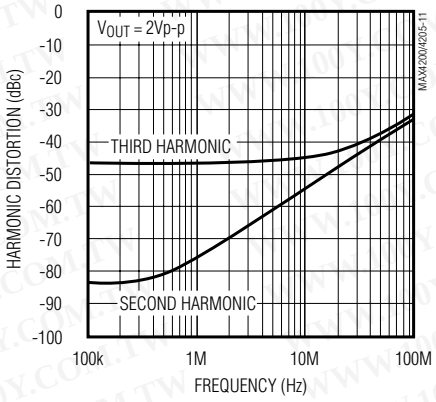
## Typical Operating Characteristics (continued)

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = 100Ω for MAX4200/MAX4201/MAX4203/MAX4204, $R_L$ = 150Ω for MAX4202/MAX4205, unless otherwise noted.)

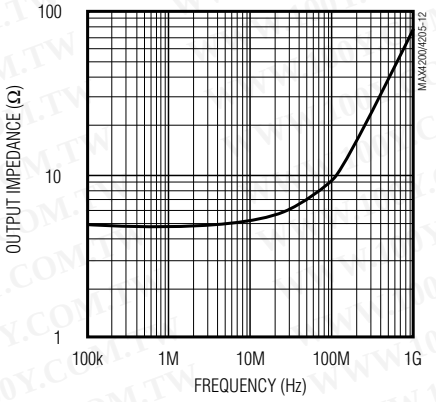
**MAX4200/MAX4201/MAX4202 HARMONIC DISTORTION vs. FREQUENCY**



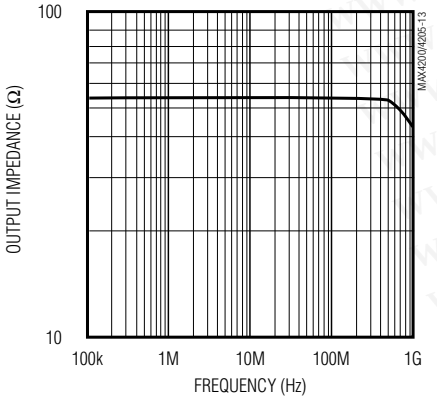

**MAX4203/MAX4204/MAX4205 HARMONIC DISTORTION vs. FREQUENCY**



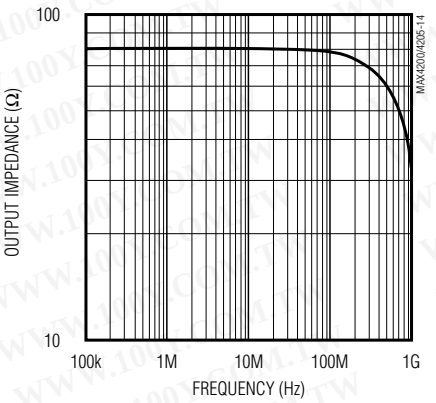

**MAX4200/MAX4203 OUTPUT IMPEDANCE vs. FREQUENCY**



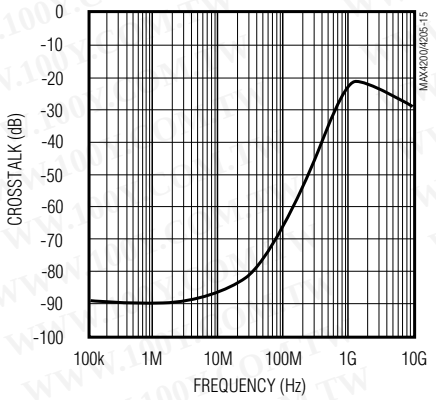

**MAX4201/MAX4204 OUTPUT IMPEDANCE vs. FREQUENCY**



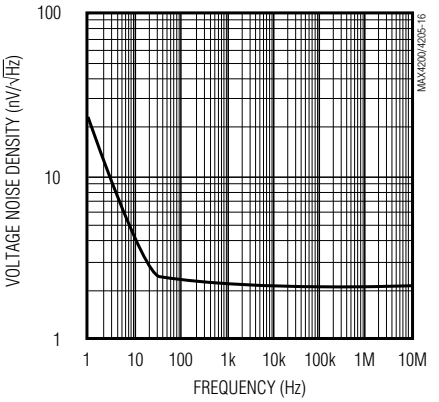

**MAX4202/MAX4205 OUTPUT IMPEDANCE vs. FREQUENCY**



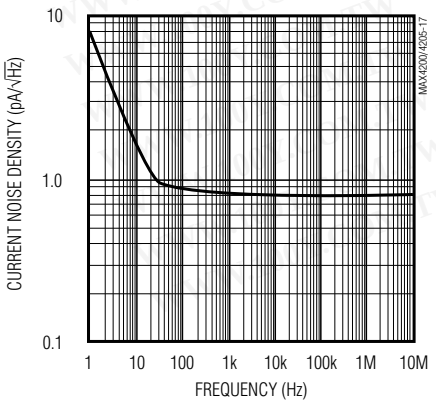

**MAX4203/MAX4204/MAX4205 CROSSTALK vs. FREQUENCY**



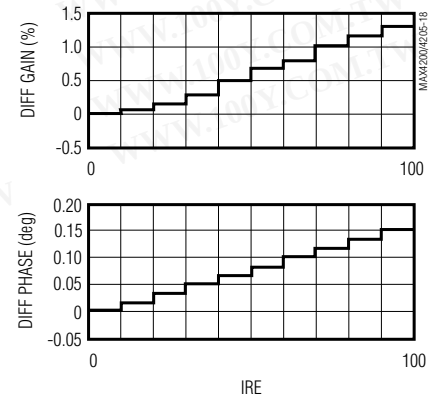

**INPUT VOLTAGE NOISE DENSITY vs. FREQUENCY**




**INPUT CURRENT NOISE DENSITY vs. FREQUENCY**




**DIFFERENTIAL GAIN AND PHASE ($R_L$ = 150Ω)**

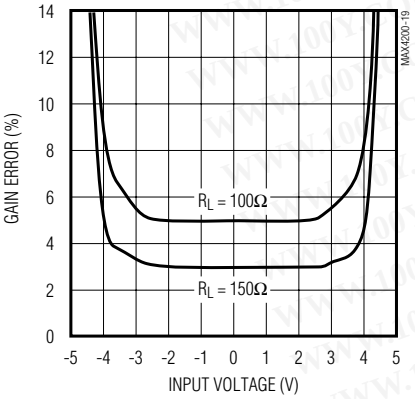


# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

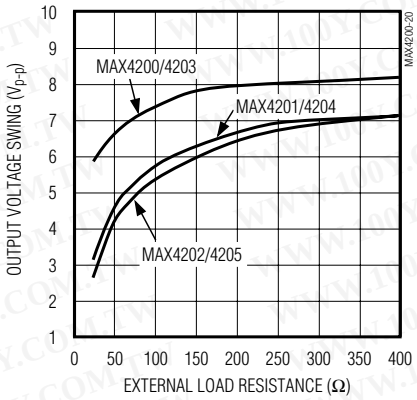
## Typical Operating Characteristics (continued)

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = 100Ω for MAX4200/MAX4201/MAX4203/MAX4204, $R_L$ = 150Ω for MAX4202/MAX4205, unless otherwise noted.)

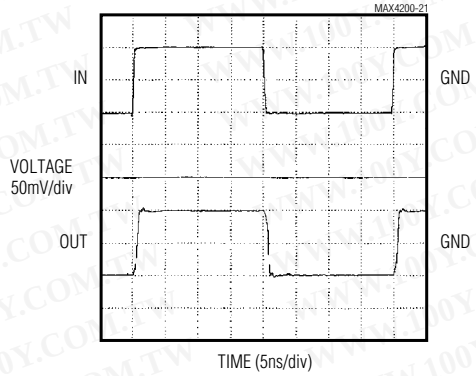
**GAIN ERROR vs. INPUT VOLTAGE**



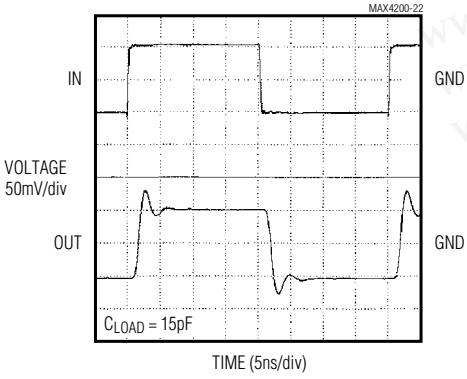

**OUTPUT VOLTAGE SWING vs. EXTERNAL LOAD RESISTANCE**



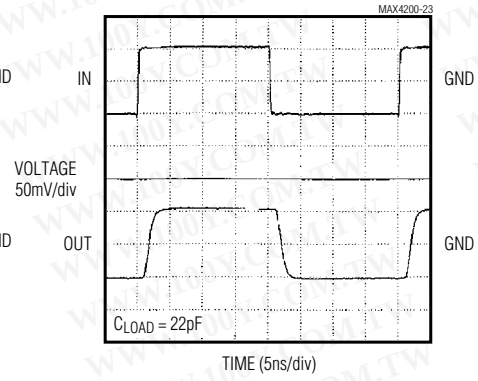

**SMALL-SIGNAL PULSE RESPONSE**



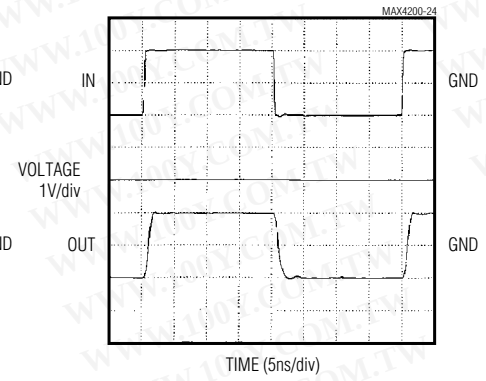

**MAX4200/MAX4203 SMALL-SIGNAL PULSE RESPONSE**




**MAX4201/MAX4202/MAX4204/MAX4205 SMALL-SIGNAL PULSE RESPONSE**




**LARGE-SIGNAL PULSE RESPONSE**

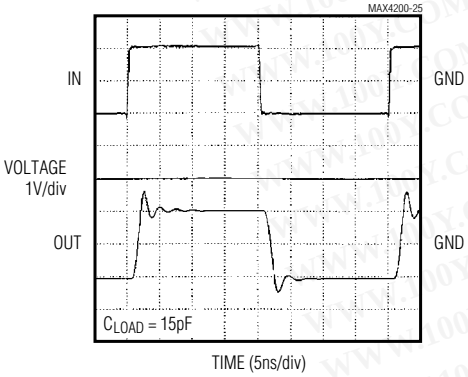


# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

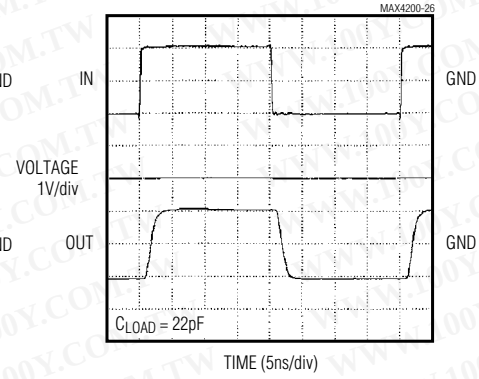
## Typical Operating Characteristics (continued)

($V_{CC}$ = +5V, $V_{EE}$ = -5V, $R_L$ = 100Ω for MAX4200/MAX4201/MAX4203/MAX4204, $R_L$ = 150Ω for MAX4202/MAX4205, unless otherwise noted.)

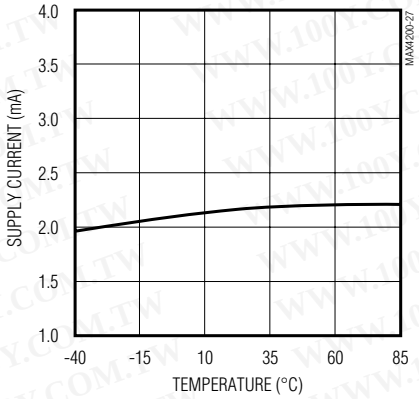
**MAX4200/MAX4203 LARGE-SIGNAL PULSE RESPONSE**



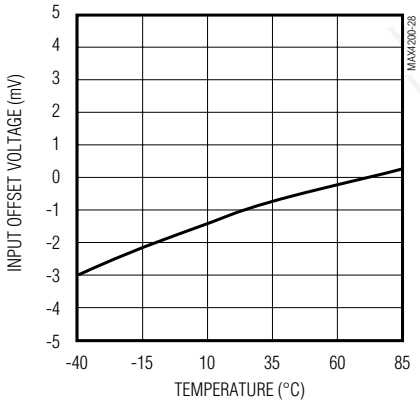

**MAX4201/MAX4202/MAX4204/MAX4205 LARGE-SIGNAL PULSE RESPONSE**



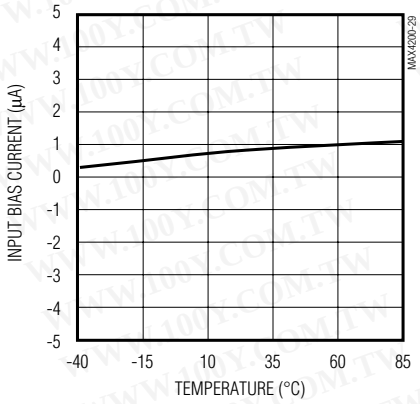

**SUPPLY CURRENT (PER BUFFER) vs. TEMPERATURE**



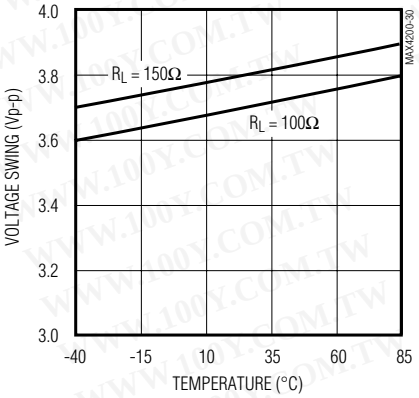

**INPUT OFFSET VOLTAGE vs. TEMPERATURE**




**INPUT BIAS CURRENT vs. TEMPERATURE**




**MAX4200/MAX4203 OUTPUT VOLTAGE SWING vs. TEMPERATURE**



# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

## Pin Description

| PIN | | | NAME | FUNCTION |
|---|---|---|---|---|
| MAX4200/MAX4201/MAX4202 | | MAX4203 MAX4204 MAX4205 | | |
| SOT23-5 | SO | SO/µMAX | | |
| 1 | 1, 2, 5, 8 | — | N.C. | Not Internally Connected |
| 3 | 3 | — | IN | Buffer Input |
| — | — | 1 | IN1 | Buffer 1 Input |
| — | — | 2 | OUT1 | Buffer 1 Output |
| 2 | 4 | — | $V_{EE}$ | Negative Power Supply |
| — | — | 3 | $V_{EE1}$ | Negative Power Supply for Buffer 1 |
| — | — | 4 | $V_{EE2}$ | Negative Power Supply for Buffer 2 |
| — | — | 5 | IN2 | Buffer 2 Input |
| — | — | 6 | OUT2 | Buffer 2 Output |
| 5 | 6 | — | OUT | Buffer Output |
| 4 | 7 | — | $V_{CC}$ | Positive Power Supply |
| — | — | 7 | $V_{CC2}$ | Positive Power Supply for Buffer 2 |
| — | — | 8 | $V_{CC1}$ | Positive Power Supply for Buffer 1 |

## Detailed Description

The MAX4200–MAX4205 wide-band, open-loop buffers feature high slew rates, high output current, low 2.1nV/√Hz voltage-noise density, and excellent capacitive-load-driving capability. The MAX4200/MAX4203 are single/dual buffers with up to 660MHz bandwidth, 230MHz 0.1dB gain flatness, and a 4200V/µs slew rate. The MAX4201/MAX4204 single/dual buffers with integrated 50Ω output termination resistors, up to 780MHz bandwidth, 280MHz gain flatness, and a 4200V/µs slew rate, are ideally suited for driving high-speed signals over 50Ω cables. The MAX4202/MAX4205 provide bandwidths up to 720MHz, 230MHz gain flatness, 4200V/µs slew rate, and integrated 75Ω output termination resistors for driving 75Ω cables.

With an open-loop gain that is slightly less than +1V/V, these devices do not have to be compensated with the internal dominant pole (and its associated phase shift) that is present in voltage-feedback devices. This feature allows the MAX4200–MAX4205 to achieve a nearly constant group delay time of 405ps over their full frequency range, making them well suited for a variety of RF and IF signal-processing applications.

These buffers operate with ±5V supplies and consume only 2.2mA of quiescent supply current per buffer while providing up to ±90mA of output current drive capability.

## Applications Information

### Power Supplies

The MAX4200–MAX4205 operate with dual supplies from ±4V to ±5.5V. Both $V_{CC}$ and $V_{EE}$ should be bypassed to the ground plane with a 0.1µF capacitor located as close to the device pin as possible.

### Layout Techniques

Maxim recommends using microstrip and stripline techniques to obtain full bandwidth. To ensure that the PC board does not degrade the amplifier's performance, design it for a frequency greater than 6GHz. Pay careful attention to inputs and outputs to avoid large parasitic capacitance. Whether or not you use a constant-impedance board, observe the following guidelines when designing the board:

- Do not use wire-wrap boards, because they are too inductive.
- Do not use IC sockets, because they increase parasitic capacitance and inductance.

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

- Use surface-mount instead of through-hole components for better high-frequency performance.
- Use a PC board with at least two layers; it should be as free from voids as possible.
- Keep signal lines as short and as straight as possible. Do not make 90° turns; round all corners.

### Input Impedance

The MAX4200–MAX4205 input impedance looks like a 500kΩ resistor in parallel with a 2pF capacitor. Since these devices operate without negative feedback, there is no loop gain to transform the input impedance upward, as in closed-loop buffers. Inductive input sources (such as an unterminated cable) may react with the input capacitance and produce some peaking in the buffer's frequency response. This effect can usually be minimized by using a properly terminated transmission line at the buffer input, as shown in Figure 1.

### Output Current and Gain Sensitivity

The absence of negative feedback means that open-loop buffers have no loop gain to reduce their effective output impedance. As a result, open-loop devices usually suffer from decreasing gain as the output current is decreased. The MAX4200–MAX4205 include local feedback around the buffer's class-AB output stage to ensure low output impedance and reduce gain sensitivity to load variations. This feedback also produces demand-driven current bias to the output transistors for ±90mA (MAX4200/MAX4203) drive capability that is relatively independent of the output voltage (see *Typical Operating Characteristics*).

### Output Capacitive Loading and Stability

The MAX4200–MAX4205 provide maximum AC performance with no load capacitance. This is the case when the load is a properly terminated transmission line. However, these devices are designed to drive any load capacitance without oscillating, but with reduced AC performance.

Since the MAX4200–MAX4205 operate in an open-loop configuration, there is no negative feedback to be transformed into positive feedback through phase shift introduced by a capacitive load. Therefore, these devices will not oscillate with capacitive loading, unlike similar buffers operating in a closed-loop configuration. However, a capacitive load reacting with the buffer's output impedance can still affect circuit performance. A capacitive load will form a lowpass filter with the buffer's output resistance, thereby limiting system bandwidth. With higher capacitive loads, bandwidth is dominated by the RC network formed by $R_T$ and $C_L$; the bandwidth of the buffer itself is much higher. Also note that the isolation resistor forms a divider that decreases the voltage delivered to the load.

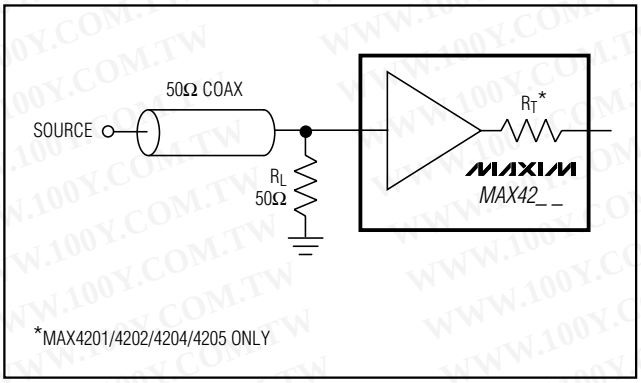



*Figure 1. Using a Properly Terminated Input Source*

Another concern when driving capacitive loads results from the amplifier's output impedance, which looks inductive at high frequency. This inductance forms an L-C resonant circuit with the capacitive load and causes peaking in the buffer's frequency response.

Figure 2 shows the frequency response of the MAX4200/MAX4203 under different capacitive loads. To settle out some of the peaking, the output requires an isolation resistor like the one shown in Figure 3. Figure 4 is a plot of the MAX4200/MAX4203 frequency response with capacitive loading and a 10Ω isolation resistor. In many applications, the output termination resistors included in the MAX4201/MAX4202/MAX4204/MAX4205 will serve this purpose, reducing component count and board space. Figure 5 shows the MAX4201/MAX4202/MAX4204/MAX4205 frequency response with capacitive loads of 47pF, 68pF, and 120pF.

### Coaxial Cable Drivers

Coaxial cable and other transmission lines are easily driven when properly terminated at both ends with their characteristic impedance. Driving back-terminated transmission lines essentially eliminates the line's capacitance. The MAX4201/MAX4204, with their integrated 50Ω output termination resistors, are ideal for driving 50Ω cables. The MAX4202/MAX4205 include integrated 75Ω termination resistors for driving 75Ω cables. Note that the output termination resistor forms a voltage divider with the load resistance, thereby decreasing the amplitude of the signal at the receiving end of the cable by one half (see the *Typical Application Circuit).*

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

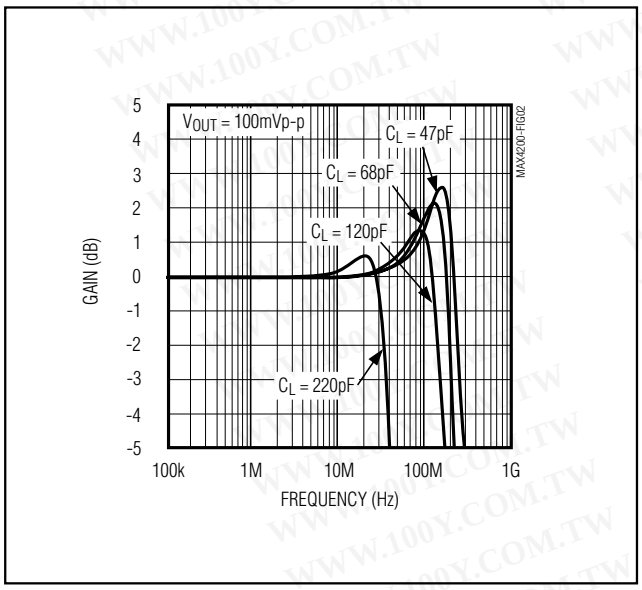



Figure 2. MAX4200/MAX4203 Small-Signal Gain vs. Frequency with Load Capacitance and No Isolation Resistor

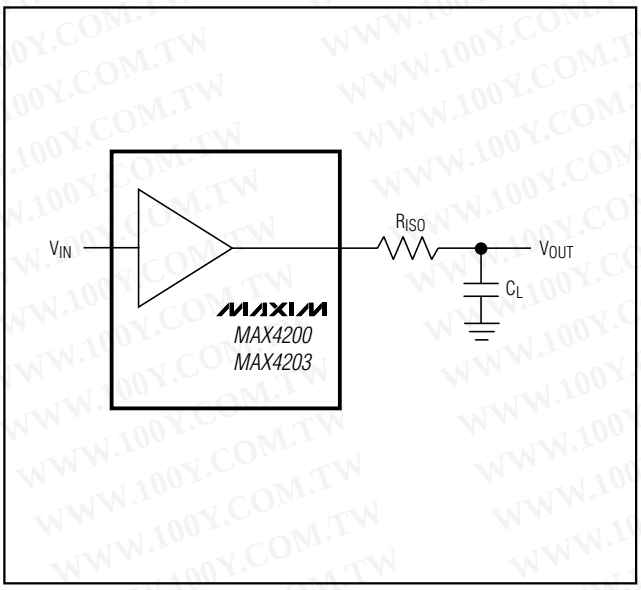



Figure 3. Driving a Capacitive Load Through an Isolation Resistor

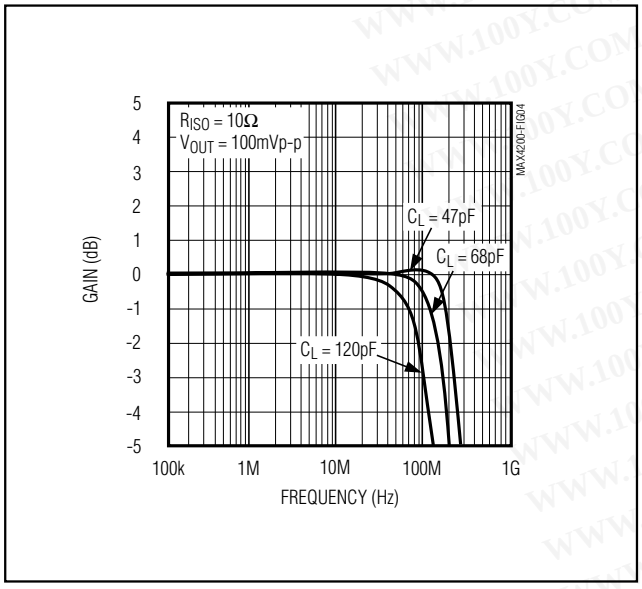



Figure 4. MAX4200/MAX4203 Small-Signal Gain vs. Frequency with Load Capacitance and 10Ω Isolation Resistor

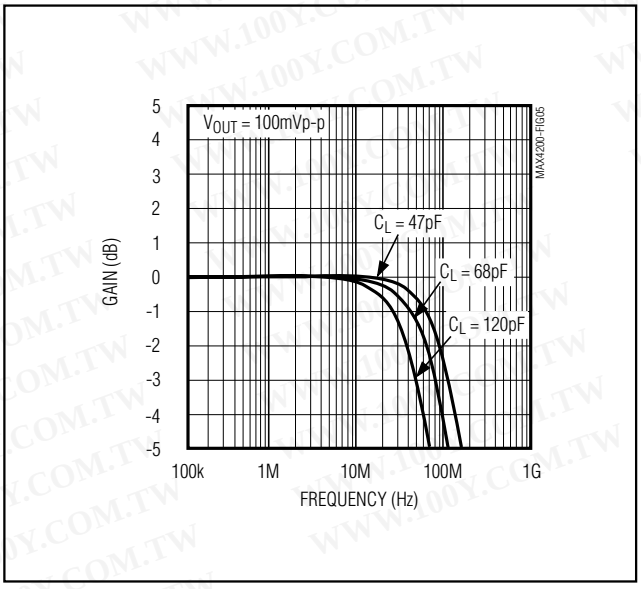
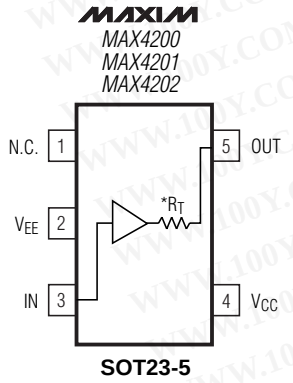



Figure 5. MAX4201/MAX4202/MAX4204/MAX4205 Small-Signal Gain vs. Frequency with Capacitive Load and No External Isolation Resistor

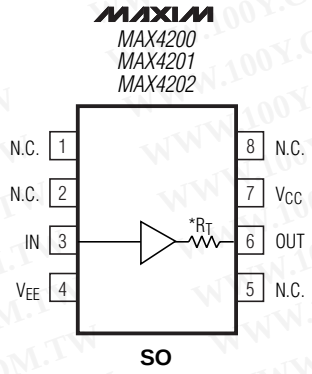
# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

## Pin Configurations

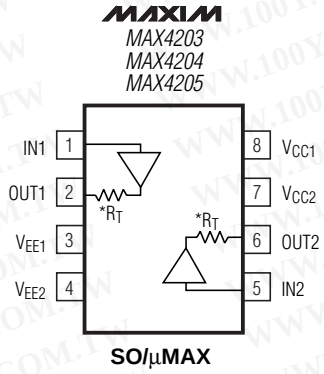
TOP VIEW




SOT23-5




SO




SO/μMAX

N.C. = NOT INTERNALLY CONNECTED

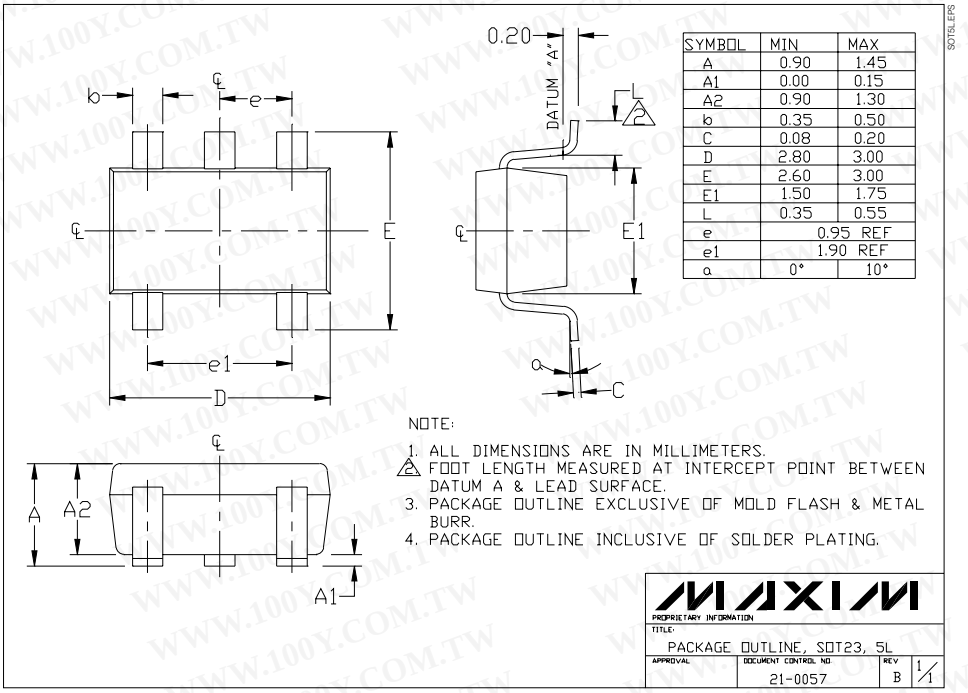
* $R_T = 0\Omega$ (MAX4200/MAX4203)
$R_T = 50\Omega$ (MAX4201/MAX4204)
$R_T = 75\Omega$ (MAX4202/MAX4205)

## Chip Information

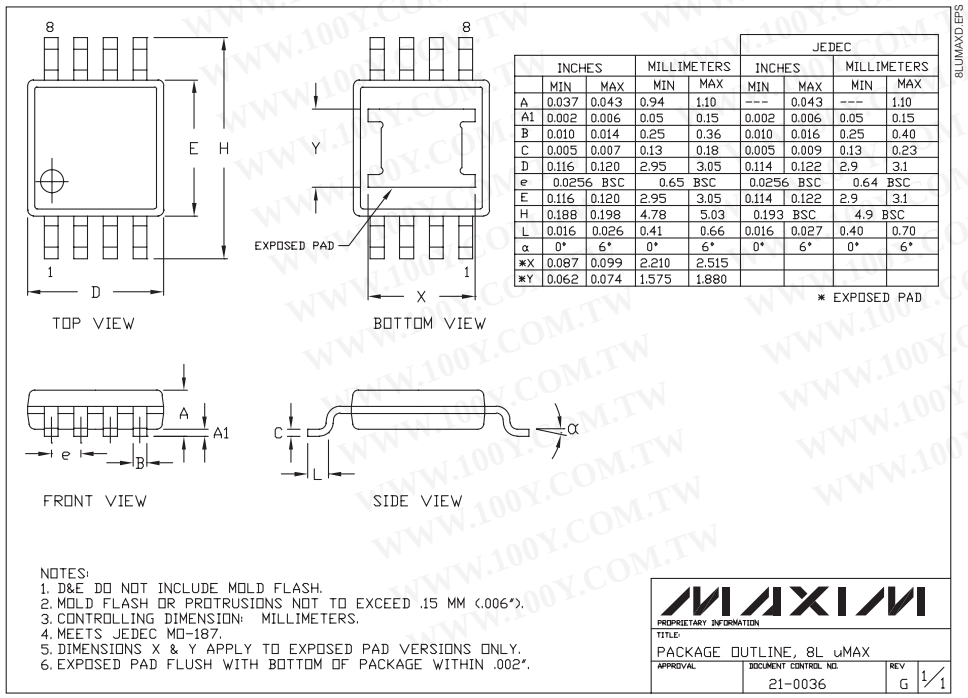
TRANSISTOR COUNTS:
MAX4200/MAX4201/MAX4202: 33
MAX4203/MAX4204/MAX4205: 67
SUBSTRATE CONNECTED TO $V_{EE}$

# Ultra-High-Speed, Low-Noise, Low-Power, SOT23 Open-Loop Buffers

## Package Information




| 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 | 0.55 |
| e | 0.95 REF | |
| e1 | 1.90 REF | |
| α | 0° | 10° |




| | INCHES | | MILLIMETERS | | JEDEC INCHES | | JEDEC MILLIMETERS | |
|---|---|---|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| A | 0.037 | 0.043 | 0.94 | 1.10 | --- | 0.043 | --- | 1.10 |
| A1 | 0.002 | 0.006 | 0.05 | 0.15 | 0.002 | 0.006 | 0.05 | 0.15 |
| B | 0.010 | 0.014 | 0.25 | 0.36 | 0.010 | 0.016 | 0.25 | 0.40 |
| C | 0.005 | 0.007 | 0.13 | 0.18 | 0.005 | 0.009 | 0.13 | 0.23 |
| D | 0.116 | 0.120 | 2.95 | 3.05 | 0.114 | 0.122 | 2.9 | 3.1 |
| e | 0.0256 BSC | | 0.65 BSC | | 0.0256 BSC | | 0.64 BSC | |
| E | 0.116 | 0.120 | 2.95 | 3.05 | 0.114 | 0.122 | 2.9 | 3.1 |
| H | 0.188 | 0.198 | 4.78 | 5.03 | 0.193 BSC | | 4.9 BSC | |
| L | 0.016 | 0.026 | 0.41 | 0.66 | 0.016 | 0.027 | 0.40 | 0.70 |
| α | 0° | 6° | 0° | 6° | 0° | 6° | 0° | 6° |
| *X | 0.087 | 0.099 | 2.210 | 2.515 | | | | |
| *Y | 0.062 | 0.074 | 1.575 | 1.880 | | | | |

* EXPOSED PAD