

# MAXIM

## Low-Voltage, 60 $\Omega$ , 4:1 Analog Multiplexer in QFN

MAX4704

### General Description

The MAX4704 low-voltage, 4-channel analog multiplexer operates from a single +1.8V to +5.5V supply. The MAX4704 features break-before-make switching action with a  $t_{ON} = 60\text{ns}$  and  $t_{OFF} = 20\text{ns}$  at +3V.

When powered from a +2.7V supply, the device has a 60 $\Omega$  (max) on-resistance ( $R_{ON}$ ), with 3 $\Omega$  (max)  $R_{ON}$  matching and 5 $\Omega$  max  $R_{ON}$  flatness. The digital logic inputs are 1.8V-logic compatible from a +2.7V to +3.3V supply. The MAX4704 is available in both a space-saving 12-pin QFN (3mm x 3mm) package and a 10-pin  $\mu$ MAX package.

### Applications

MP3 Players  
Battery-Operated Equipment  
Relay Replacement  
Audio and Video Signal Routing  
Low-Voltage Data-Acquisition Systems  
Communications Circuits  
PCMCIA Cards  
Cellular Phones  
Modems

### Features

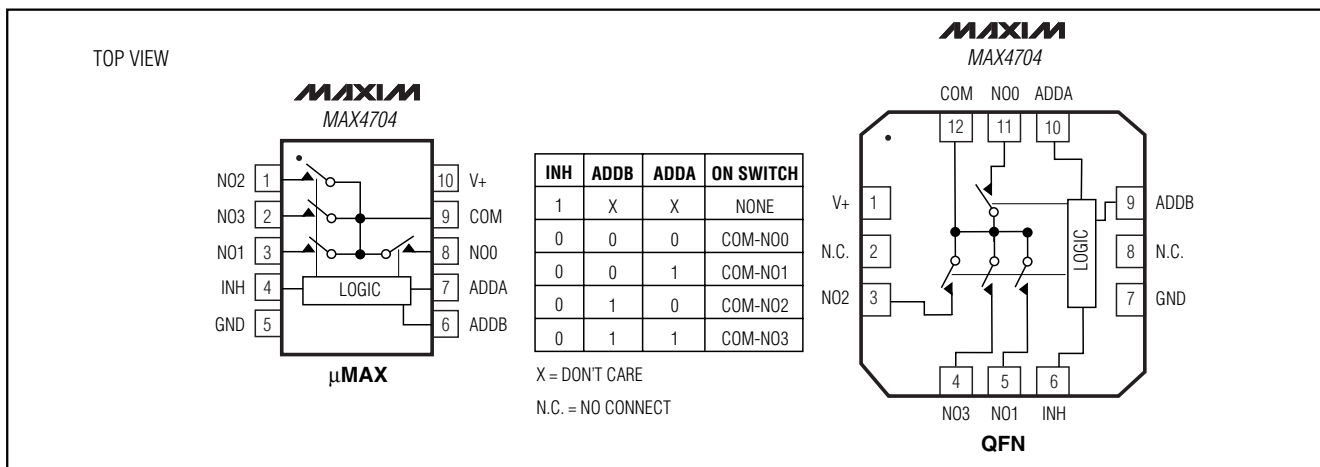
- ◆ 3mm x 3mm 12-Pin QFN Package
- ◆ Guaranteed On-Resistance:  
60 $\Omega$  (max) (+2.7V supply)  
40 $\Omega$  (max) (+5V supply)
- ◆ Guaranteed Match Between Channels: 3 $\Omega$  (max)
- ◆ Guaranteed Flatness Over Signal Range:  
5 $\Omega$  (max)
- ◆ Guaranteed Low Leakage Currents:  
100pA (max) at +25 $^{\circ}\text{C}$
- ◆ Switching Time:  $t_{ON} = 60\text{ns}$ ,  $t_{OFF} = 20\text{ns}$
- ◆ +1.8V to +5.5V Single-Supply Operation
- ◆ Rail-to-Rail<sup>®</sup> Signal Handling
- ◆ -3dB Bandwidth: >200MHz
- ◆ Low Crosstalk: -90dB (1MHz)
- ◆ High Off-Isolation: -85dB (1MHz)
- ◆ Low 3pC Charge Injection
- ◆ THD: 0.02%
- ◆ +1.8V CMOS-Logic Compatible

### Ordering Information

| PART       | TEMP. RANGE                                      | PIN-PACKAGE  |
|------------|--------------------------------------------------|--------------|
| MAX4704EGC | -40 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$ | 12 QFN       |
| MAX4704EUB | -40 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$ | 10 $\mu$ MAX |

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

### Pin Configurations



# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

## ABSOLUTE MAXIMUM RATINGS

(Voltages Referenced to GND)

|                                                             |                      |
|-------------------------------------------------------------|----------------------|
| V+ .....                                                    | -0.3V to +6V         |
| All Other Pins (Note 1) .....                               | -0.3V to (V+ + 0.3V) |
| Continuous Current COM, NO_ .....                           | ±20mA                |
| Peak Current COM, NO_ (pulsed at 1ms, 10% duty cycle) ..... | ±40mA                |
| ESD per Method 3015.7 .....                                 | >2kV                 |

Continuous Power Dissipation (T<sub>A</sub> = +70°C)

|                                                 |                 |
|-------------------------------------------------|-----------------|
| 10-Pin μMAX (derate 4.7mW/°C above +70°C) ..... | 330mW           |
| 12-Pin QFN (derate 11.9mW/°C above +70°C) ..... | 952mW           |
| Operating Temperature Range .....               | -40°C to +85°C  |
| Storage Temperature Range .....                 | -65°C to +150°C |
| Lead Temperature (soldering, 10s) .....         | +300°C          |

**Note 1:** Signals on INH, ADD\_, NO\_, and COM exceeding V+ or GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.

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—Single +3V Supply

(V+ = +2.7V to +3.3V, V<sub>IH</sub> = +1.4V, V<sub>IL</sub> = +0.5V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V+ = +3V and T<sub>A</sub> = +25°C.) (Notes 2, 3)

| PARAMETER                                        | SYMBOL                              | CONDITIONS                                                                              | T <sub>A</sub>                                | MIN        | TYP   | MAX      | UNITS |
|--------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------|------------|-------|----------|-------|
| ANALOG SWITCH                                    |                                     |                                                                                         |                                               |            |       |          |       |
| Analog Signal Range                              | V <sub>COM</sub> , V <sub>NO_</sub> |                                                                                         |                                               | 0          |       | V+       | V     |
| On-Resistance                                    | R <sub>ON</sub>                     | V+ = +2.7V, I <sub>COM</sub> = 5mA,<br>V <sub>NO_</sub> = +1.3V                         | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 50         | 60    | 70       | Ω     |
| On-Resistance Match<br>Between Channels (Note 4) | ΔR <sub>ON</sub>                    | V+ = +2.7V, I <sub>COM</sub> = 5mA,<br>V <sub>NO_</sub> = +1.3V                         | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 1          | 3     | 5        | Ω     |
| On-Resistance Flatness<br>(Note 5)               | R <sub>FLAT</sub> (ON)              | V+ = +2.7V, I <sub>COM</sub> = 5mA,<br>V <sub>NO_</sub> = +1V, +1.3V, +1.8V             | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 3          | 5     | 10       | Ω     |
| NO_ Off-Leakage<br>Current (Note 6)              | I <sub>NO_</sub> (OFF)              | V+ = +3.3V, V <sub>COM</sub> = +0.3V, +3V<br>V <sub>NO_</sub> = +3V, +0.3V              | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | -0.1<br>-1 | ±0.01 | 0.1<br>1 | nA    |
| COM On-Leakage Current<br>(Note 6)               | I <sub>COM</sub> (ON)               | V+ = +3.3V, V <sub>COM</sub> = +0.3V, +3V<br>V <sub>NO_</sub> = +0.3V, +3V, or floating | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | -0.5<br>-5 | ±0.01 | 0.5<br>5 | nA    |
| COM Off-Leakage Current<br>(Note 6)              | I <sub>COM</sub> (OFF)              | V+ = +3.3V, V <sub>COM</sub> = +0.3V, +3V<br>V <sub>NO_</sub> = +3V, +0.3V              | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | -0.5<br>-5 | ±0.01 | 0.5<br>5 | nA    |
| DYNAMIC                                          |                                     |                                                                                         |                                               |            |       |          |       |
| Address Transition Time                          | t <sub>TRANS</sub>                  | V <sub>NO_</sub> = +1.5V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 2     | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 20         | 60    | 70       | ns    |
| Inhibit Turn-On Time                             | t <sub>ON</sub>                     | V <sub>NO_</sub> = +1.5V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 3     | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 25         | 60    | 70       | ns    |
| Inhibit Turn-Off Time                            | t <sub>OFF</sub>                    | V <sub>NO_</sub> = +1.5V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 3     | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 10         | 20    | 30       | ns    |
| Break-Before-Make Time<br>(Note 7)               | t <sub>BBM</sub>                    | V <sub>NO_</sub> = +1.5V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 4     | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 20         | 2     |          | ns    |
| Charge Injection                                 | Q                                   | V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1.0nF,<br>Figure 5         |                                               |            | 2     |          | pC    |

# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

MAX4704

## ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

(V<sub>+</sub> = +2.7V to +3.3V, V<sub>IH</sub> = +1.4V, V<sub>IL</sub> = +0.5V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>+</sub> = +3V and T<sub>A</sub> = +25°C.) (Notes 2, 3)

| PARAMETER                 | SYMBOL                            | CONDITIONS                                                     | T <sub>A</sub> | MIN | TYP  | MAX | UNITS |
|---------------------------|-----------------------------------|----------------------------------------------------------------|----------------|-----|------|-----|-------|
| On-Channel -3dB Bandwidth | BW                                | Signal = 0dBm, 50Ω in and out, Figure 6                        |                |     | >200 |     | MHz   |
| Off-Isolation (Note 8)    | V <sub>ISO</sub>                  | f = 1MHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 6 |                |     | -85  |     | dB    |
| Crosstalk (Note 9)        | V <sub>CT</sub>                   | f = 1MHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 6 |                |     | -90  |     | dB    |
| NO_ Off-Capacitance       | C <sub>NO_(OFF)</sub>             | f = 1MHz, V <sub>NO_</sub> = GND, Figure 7                     |                |     | 7    |     | pF    |
| COM On-Capacitance        | C <sub>COM(ON)</sub>              | f = 1MHz, V <sub>NO_</sub> = GND, Figure 7                     |                |     | 19   |     | pF    |
| COM Off-Capacitance       | C <sub>COM(OFF)</sub>             | f = 1MHz, V <sub>NO_</sub> = GND, Figure 7                     |                |     | 15   |     | pF    |
| <b>DIGITAL I/O</b>        |                                   |                                                                |                |     |      |     |       |
| Input Logic High          | V <sub>IH</sub>                   |                                                                |                | 1.4 |      |     | V     |
| Input Logic Low           | V <sub>IL</sub>                   |                                                                |                |     |      | 0.5 | V     |
| Input Leakage Current     | I <sub>IH</sub> , I <sub>IL</sub> | ADD_, INH = 0 or V <sub>+</sub>                                |                | -1  |      | 1   | μA    |
| <b>SUPPLY</b>             |                                   |                                                                |                |     |      |     |       |
| Power-Supply Range        | V <sub>+</sub>                    |                                                                |                | 1.8 |      | 5.5 | V     |
| Power-Supply Current      | I <sub>+</sub>                    | V <sub>+</sub> = +5.5V, ADD_, INH = 0 or V <sub>+</sub>        |                |     |      | 1   | μA    |

## ELECTRICAL CHARACTERISTICS—Single +5V Supply

(V<sub>+</sub> = +4.5V to +5.5V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>+</sub> = +5V and T<sub>A</sub> = +25°C.) (Notes 2, 3)

| PARAMETER                                     | SYMBOL                              | CONDITIONS                                                                                        | T <sub>A</sub>                       | MIN  | TYP   | MAX            | UNITS |
|-----------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|------|-------|----------------|-------|
| <b>ANALOG SWITCH</b>                          |                                     |                                                                                                   |                                      |      |       |                |       |
| Analog Signal Range                           | V <sub>COM</sub> , V <sub>NO_</sub> |                                                                                                   |                                      | 0    |       | V <sub>+</sub> | V     |
| On-Resistance                                 | R <sub>ON</sub>                     | V <sub>+</sub> = +4.5V, I <sub>COM</sub> = 5mA, V <sub>NO_</sub> = +3.5V                          | +25°C                                |      | 30    | 40             | Ω     |
|                                               |                                     |                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 50             |       |
| On-Resistance Match Between Channels (Note 4) | ΔR <sub>ON</sub>                    | V <sub>+</sub> = +4.5V, I <sub>COM</sub> = 5mA, V <sub>NO_</sub> = +3.5V                          | +25°C                                |      | 1     | 2              | Ω     |
|                                               |                                     |                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 3              |       |
| On-Resistance Flatness (Note 5)               | R <sub>FLAT (ON)</sub>              | V <sub>+</sub> = +4.5V, I <sub>COM</sub> = 5mA, V <sub>NO_</sub> = +1V, +2.25V, +3.5V             | +25°C                                |      | 3     | 5              | Ω     |
|                                               |                                     |                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 10             |       |
| NO_ Off-Leakage Current (Note 6)              | I <sub>NO_(OFF)</sub>               | V <sub>+</sub> = +5.5V, V <sub>COM</sub> = +0.5V, +5V, V <sub>NO_</sub> = +5V, +0.5V              | +25°C                                | -0.1 | ±0.01 | 0.1            | nA    |
|                                               |                                     |                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> | -1   |       | 1              |       |
| COM On-Leakage Current (Note 6)               | I <sub>COM(ON)</sub>                | V <sub>+</sub> = +5.5V, V <sub>COM</sub> = +0.5V, +5V, V <sub>NO_</sub> = +0.5V, +5V, or floating | +25°C                                | -0.5 | ±0.01 | 0.5            | nA    |
|                                               |                                     |                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> | -5   |       | 5              |       |

# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

## ELECTRICAL CHARACTERISTICS—Single +5V Supply (continued)

(V<sub>+</sub> = +4.5V to +5.5V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>+</sub> = +5V and T<sub>A</sub> = +25°C.) (Notes 2, 3)

| PARAMETER                          | SYMBOL                            | CONDITIONS                                                                              | T <sub>A</sub>                       | MIN  | TYP   | MAX | UNITS |
|------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------|------|-------|-----|-------|
| COM Off-Leakage Current            | I <sub>COM(OFF)</sub>             | V <sub>+</sub> = +5.5V, V <sub>COM_</sub> = +0.5V, +5V<br>V <sub>NO_</sub> = +5V, +0.5V | +25°C                                | -0.5 | ±0.01 | 0.5 | nA    |
|                                    |                                   |                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | -5   |       | 5   |       |
| <b>DYNAMIC</b>                     |                                   |                                                                                         |                                      |      |       |     |       |
| Address Transition Time            | t <sub>TRANS</sub>                | V <sub>NO_</sub> = +3V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 2       | +25°C                                |      | 15    | 35  | ns    |
|                                    |                                   |                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 40  |       |
| Inhibit Turn-On Time               | t <sub>ON</sub>                   | V <sub>NO_</sub> = +3V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 3       | +25°C                                |      | 18    | 35  | ns    |
|                                    |                                   |                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 40  |       |
| Inhibit Turn-Off Time              | t <sub>OFF</sub>                  | V <sub>NO_</sub> = +3V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 3       | +25°C                                |      | 9     | 20  | ns    |
|                                    |                                   |                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 30  |       |
| Break-Before-Make Time<br>(Note 7) | t <sub>BBM</sub>                  | V <sub>NO_</sub> = +3V, R <sub>L</sub> = 300Ω,<br>C <sub>L</sub> = 35pF, Figure 4       | +25°C                                |      | 20    |     | ns    |
|                                    |                                   |                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | 2    |       |     |       |
| Charge Injection                   | Q                                 | V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1.0nF,<br>Figure 5         |                                      |      | 3     |     | pC    |
| On-Channel -3dB Bandwidth          | BW                                | Signal = 0dBm, 50Ω in and out,<br>Figure 6                                              |                                      |      | >200  |     | MHz   |
| Off-Isolation (Note 8)             | V <sub>ISO</sub>                  | f = 1MHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF,<br>Figure 6                       |                                      |      | -85   |     | dB    |
| Crosstalk (Note 9)                 | V <sub>CT</sub>                   | f = 1MHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF,<br>Figure 6                       |                                      |      | -90   |     | dB    |
| Total Harmonic Distortion          | THD                               | f = 20Hz to 20kHz, 1Vp-p, R <sub>L</sub> = 600Ω                                         |                                      |      | 0.02  |     | %     |
| <b>DIGITAL I/O</b>                 |                                   |                                                                                         |                                      |      |       |     |       |
| Input Logic High                   | V <sub>IH</sub>                   |                                                                                         |                                      | 2.0  |       |     | V     |
| Input Logic Low                    | V <sub>IL</sub>                   |                                                                                         |                                      |      |       | 0.8 | V     |
| Input Leakage Current              | I <sub>IH</sub> , I <sub>IL</sub> | ADD <sub>-</sub> , INH = 0 or V <sub>+</sub>                                            |                                      | -1   |       | 1   | μA    |
| <b>SUPPLY</b>                      |                                   |                                                                                         |                                      |      |       |     |       |
| Power-Supply Range                 | V <sub>+</sub>                    |                                                                                         |                                      | 1.8  |       | 5.5 | V     |
| Positive Supply Current            | I <sub>+</sub>                    | V <sub>+</sub> = +5.5V, ADD <sub>-</sub> , INH = 0 or V <sub>+</sub>                    |                                      |      |       | 1   | μA    |

**Note 2:** The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.

**Note 3:** -40°C specifications are guaranteed by design.

**Note 4:** ΔRON = RON(MAX) - RON(MIN).

**Note 5:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Note 6:** Leakage currents are 100% tested at T<sub>A</sub> = +85°C. Limits across the full temperature range are guaranteed by correlation.

**Note 7:** Guaranteed by design.

**Note 8:** Off-Isolation = 20log<sub>10</sub> (V<sub>COM</sub> / V<sub>NO\_</sub>), V<sub>COM</sub> = output, V<sub>NO\_</sub> = input to off switch.

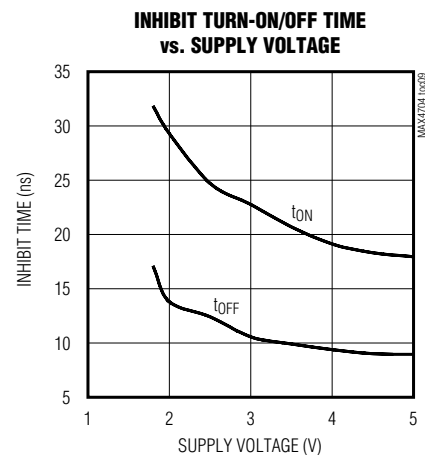
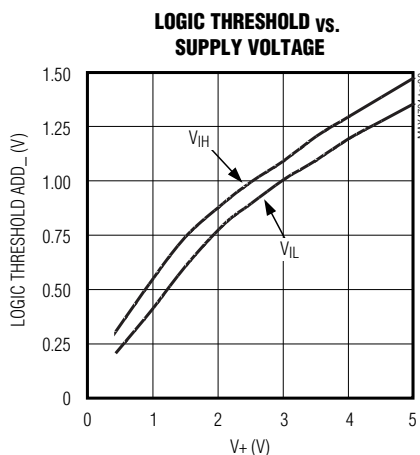
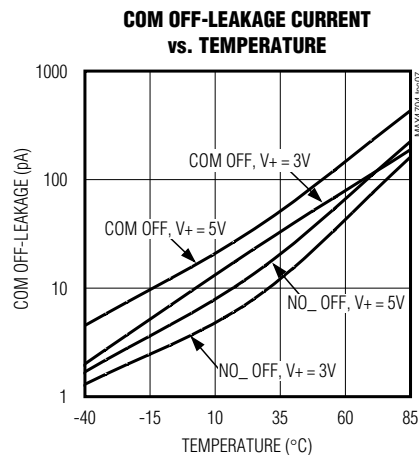
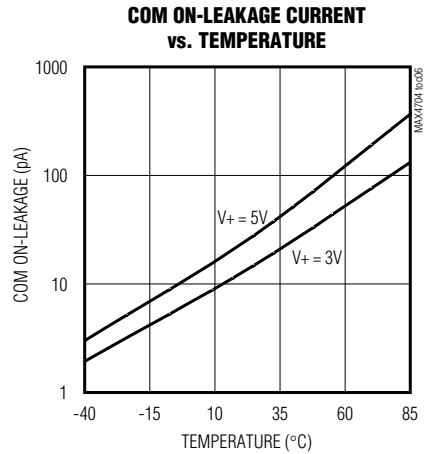
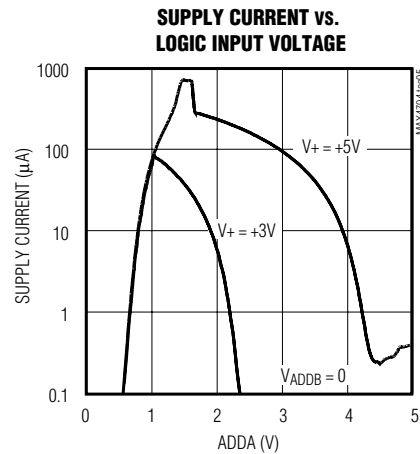
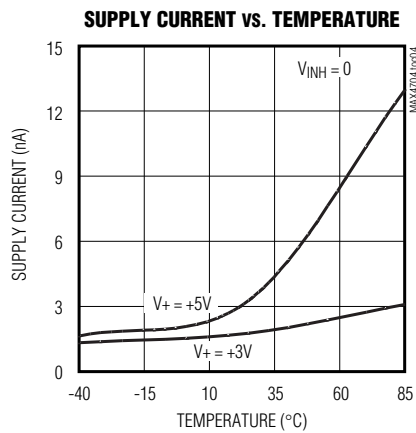
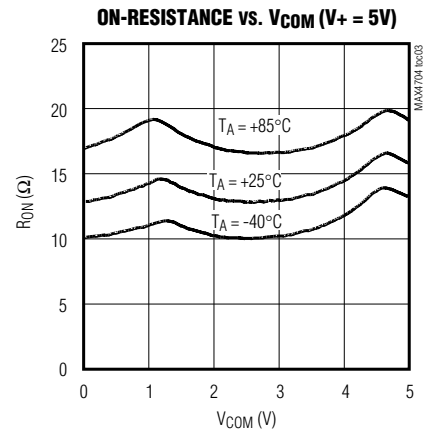
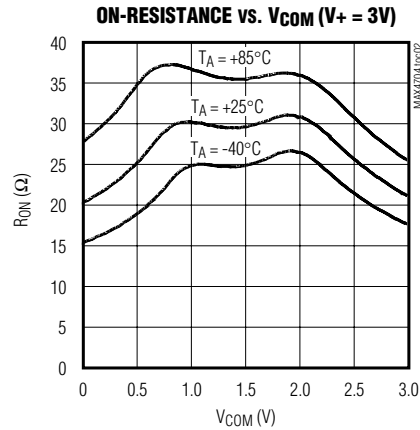
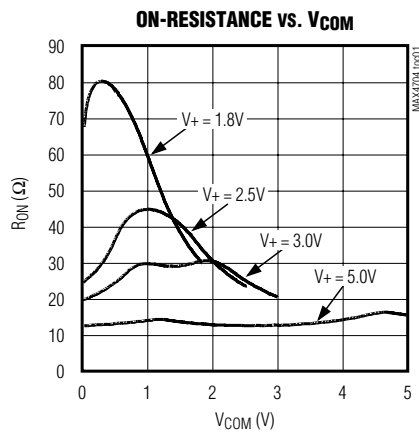
**Note 9:** Between any two switches.

# Low-Voltage, 60 $\Omega$ , 4:1 Analog Multiplexer in QFN

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

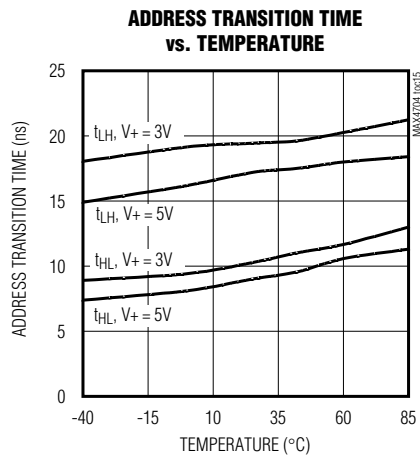
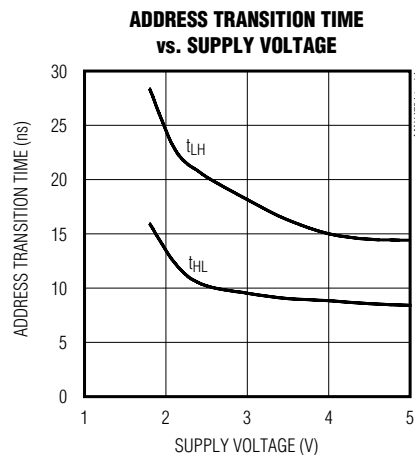
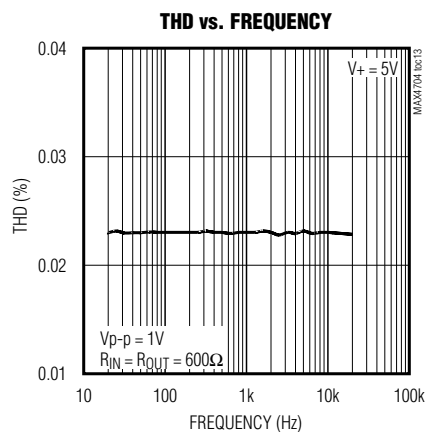
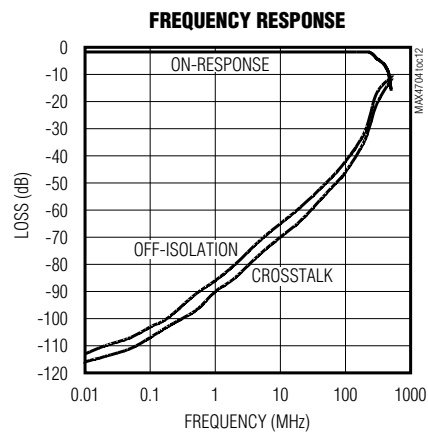
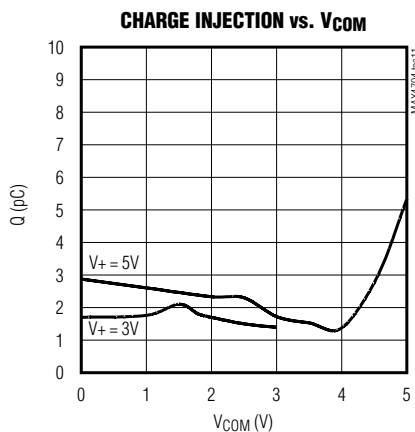
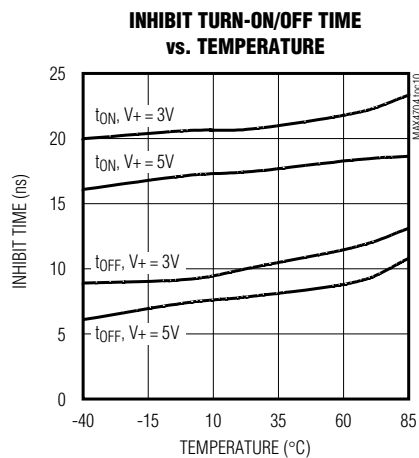
MAX4704



# Low-Voltage, 60 $\Omega$ , 4:1 Analog Multiplexer in QFN

## Typical Operating Characteristics (continued)

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



# Low-Voltage, 60 $\Omega$ , 4:1 Analog Multiplexer in QFN

MAX4704

## Pin Description

| PIN       |      | NAME | FUNCTION                                                                                            |
|-----------|------|------|-----------------------------------------------------------------------------------------------------|
| $\mu$ MAX | QFN  |      |                                                                                                     |
| 10        | 1    | V+   | Positive Supply Voltage                                                                             |
| —         | 2, 8 | N.C. | No Connection. Not internally connected.                                                            |
| 1         | 3    | NO2  | Analog Switch 2. Normally open.                                                                     |
| 2         | 4    | NO3  | Analog Switch 3. Normally open.                                                                     |
| 3         | 5    | NO1  | Analog Switch 1. Normally open.                                                                     |
| 4         | 6    | INH  | Inhibit. Connect to GND for normal operation. Connect to logic-level high to turn all switches off. |
| 5         | 7    | GND  | Ground                                                                                              |
| 6         | 9    | ADDB | Address Decoder Selection B                                                                         |
| 7         | 10   | ADDA | Address Decoder Selection A                                                                         |
| 8         | 11   | NO0  | Analog Switch 0. Normally open.                                                                     |
| 9         | 12   | COM  | Analog Switch Common Terminal                                                                       |

## Detailed Description

The MAX4704 low-voltage, 4-channel analog multiplexer operates from a single +1.8V to +5.5V supply. When powered from a +2.7V supply, the device has a 60 $\Omega$  (max) on-resistance ( $R_{ON}$ ), with 3 $\Omega$  (max)  $R_{ON}$  matching and 5 $\Omega$  (max)  $R_{ON}$  flatness. The digital logic inputs are +1.8V-logic compatible from a +2.7V to +3.3V supply.

## Applications Information

### Digital Control Inputs

The MAX4704 logic inputs are +1.8V CMOS logic compatible for 3V operation and TTL compatible for 5V operation of V+. Driving ADD\_ rail-to-rail minimizes power consumption.

### Analog Signal Levels

Analog signals that range over the entire supply voltage (V+ to GND) are passed with very little change in on-resistance (see *Typical Operating Characteristics*). The switches are bidirectional, so the NO\_ and COM pins can be either inputs or outputs.

### Power-Supply Sequencing and Overvoltage Protection

**Caution:** Do not exceed the absolute maximum ratings because stresses beyond those listed may cause permanent damage to devices.

Proper power-supply sequencing is recommended for all CMOS devices. Always apply V+ before applying analog signals, especially if the analog signal is not current limited. If this sequencing is not possible, and if the analog inputs are not current limited to <20mA, add a small-signal diode (D1) as shown in Figure 1. If the

analog signal can dip below GND, add D2. Adding protection diodes reduces the analog range to a diode drop (about 0.7V) below V+ (for D1), and a diode drop above ground (for D2). On-resistance increases slightly at low supply voltages. Maximum supply voltage (V+) must not exceed +6V.

Adding protection diode D2 causes the logic threshold to be shifted relative to GND. TTL compatibility is not guaranteed when D2 is added.

Protection diodes D1 and D2 also protect against some overvoltage situations. In the circuit in Figure 1, if the supply voltage is below the absolute maximum rating, and if a fault voltage up to the absolute maximum rating is applied to an analog signal pin, no damage will result.

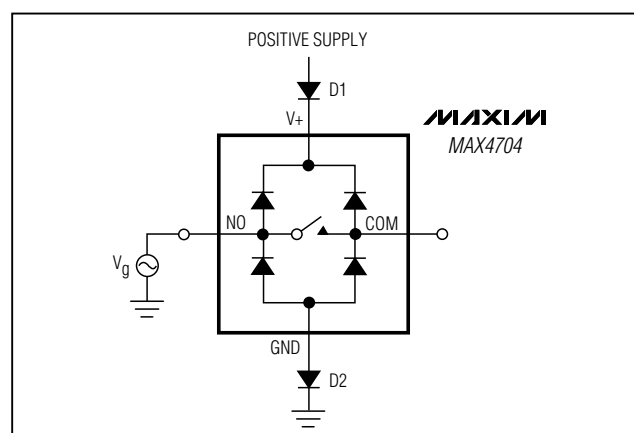


Figure 1. Overvoltage Protection Using Two External Blocking Diodes

# Low-Voltage, 60 $\Omega$ , 4:1 Analog Multiplexer in QFN

## Test Circuits/Timing Diagrams

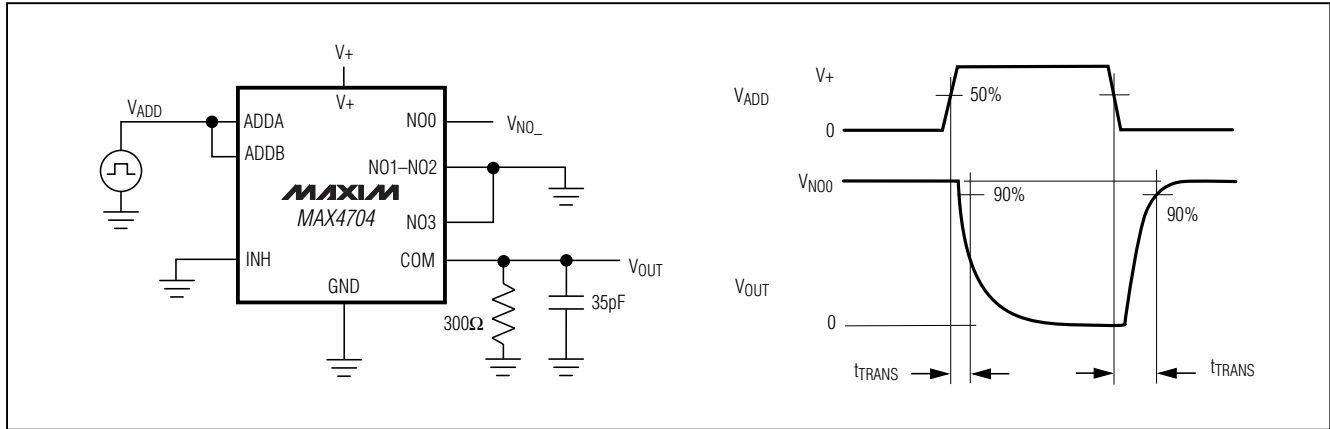


Figure 2. Address Transition Time

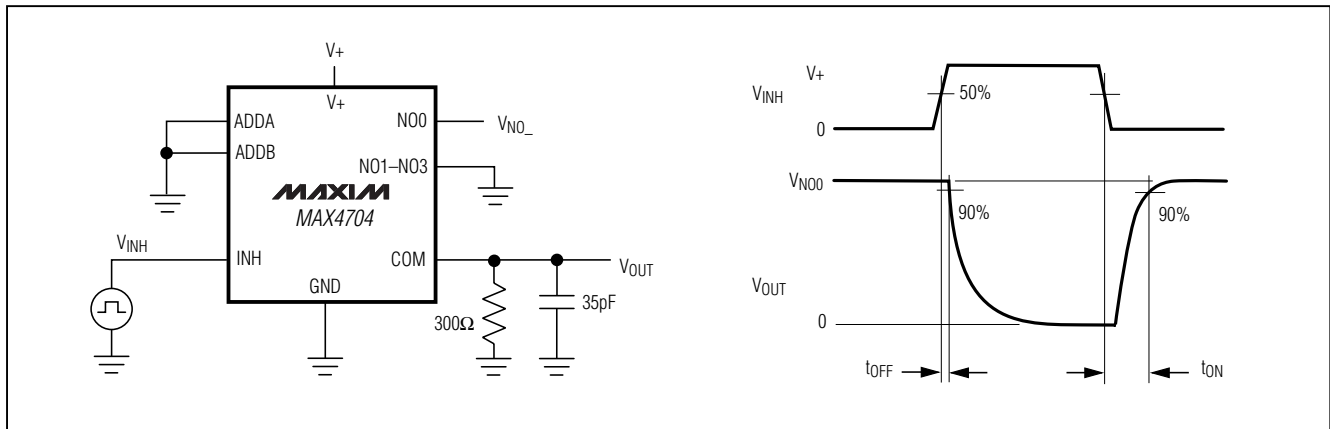


Figure 3. Inhibit Switching Times

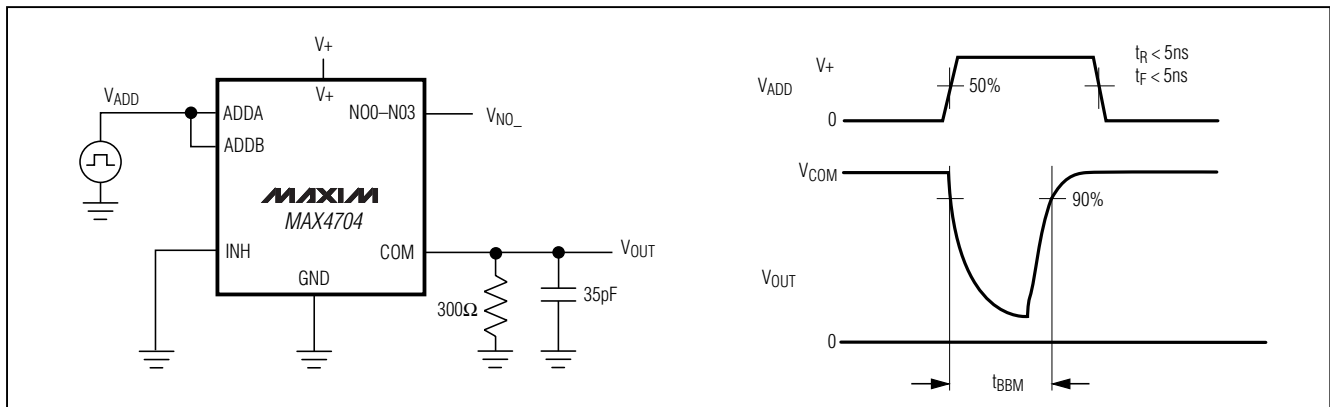


Figure 4. Break-Before-Make Interval

# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

## Test Circuits/Timing Diagrams (continued)

MAX4704

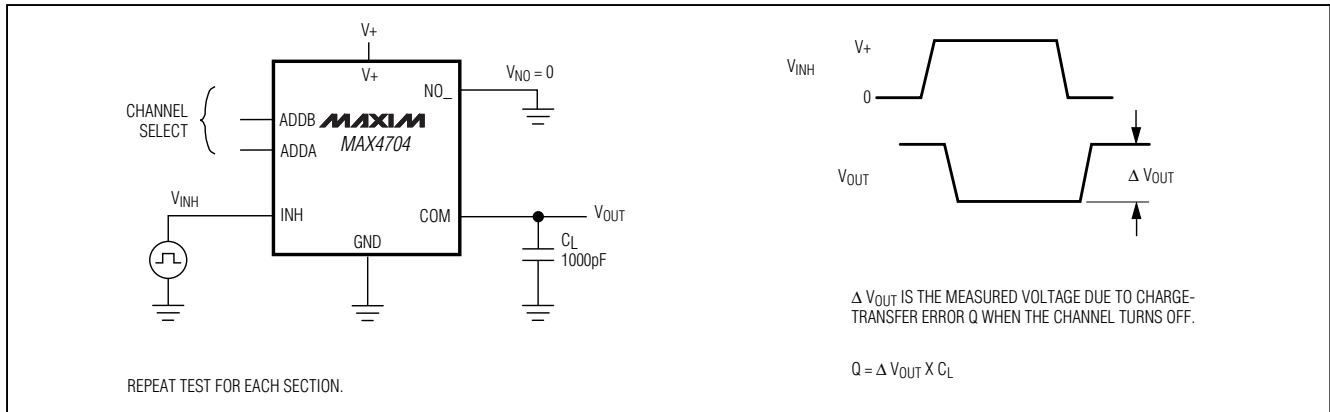


Figure 5. Charge Injection

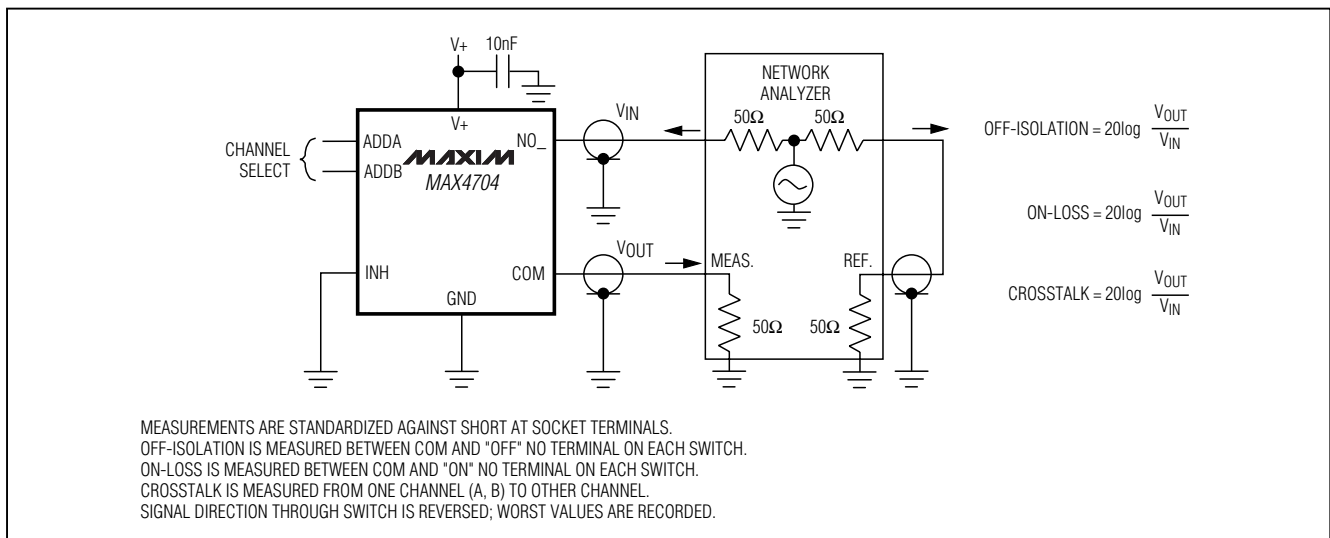


Figure 6. Off-Isolation, On-Loss, and Crosstalk

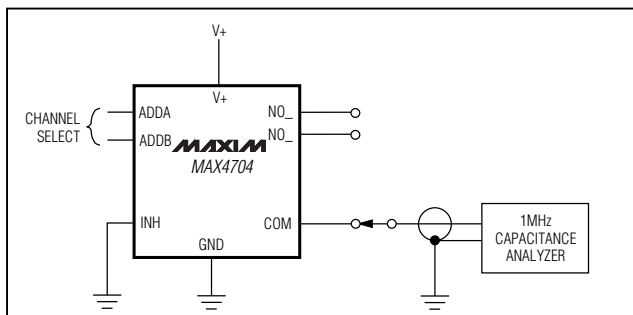


Figure 7. NO<sub>1</sub>/COM Capacitance

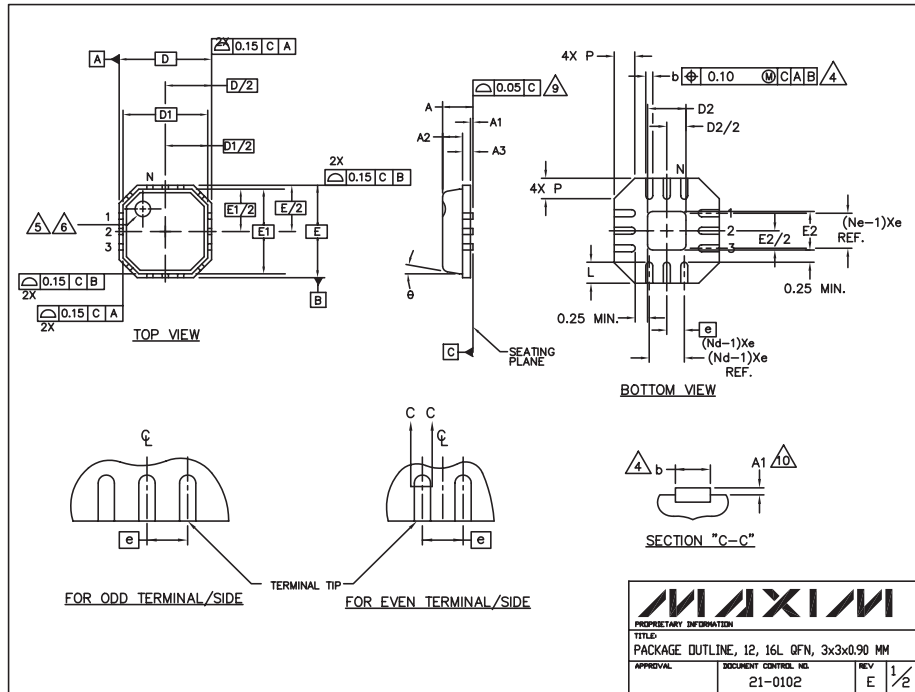
## Chip Information

TRANSISTOR COUNT: 256

PROCESS: CMOS

# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

## Package Information



32L QFN: 3x3x0.85 EPS

### NOTES:

1. DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM)
2. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. - 1994.
3. N IS THE NUMBER OF TERMINALS.  
Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION &  
Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
5. THE PIN #1 IDENTIFIER MUST EXIST ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/ LASER MARKED.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. PACKAGE WARPAGE MAX 0.05mm.
9. APPLIED FOR EXPOSED PAD AND TERMINALS.  
EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
10. MEETS JEDEC MO220.
11. THIS PACKAGE OUTLINE APPLIES TO ANVIL SINGULATION (STEPPED SIDES) AND TO SAW SINGULATION (STRAIGHT SIDES) QFN STYLES.

| S<br>V<br>G | COMMON<br>DIMENSIONS |           |      | n <sub>D</sub><br>n <sub>E</sub> |
|-------------|----------------------|-----------|------|----------------------------------|
|             | MIN.                 | NOM.      | MAX. |                                  |
| A           | 0.80                 | 0.90      | 1.00 |                                  |
| A1          | 0.00                 | 0.01      | 0.05 |                                  |
| A2          | 0.00                 | 0.65      | 1.00 |                                  |
| A3          |                      | 0.20 REF. |      |                                  |
| D           |                      | 3.00 BSC  |      |                                  |
| D1          |                      | 2.75 BSC  |      |                                  |
| E           |                      | 3.00 BSC  |      |                                  |
| E1          |                      | 2.75 BSC  |      |                                  |
| θ           | 0°                   |           | 12°  |                                  |
| P           | 0                    |           | 0.60 |                                  |
| D2          | 0.25                 |           | 1.65 |                                  |
| E2          | 0.25                 |           | 1.65 |                                  |

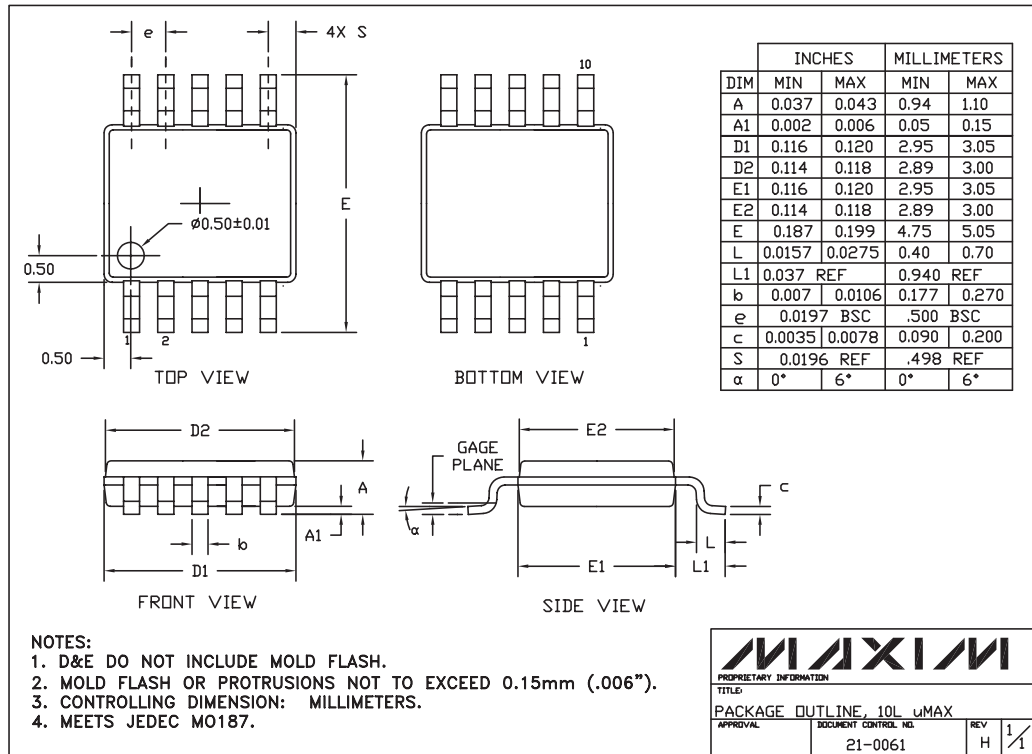
| S<br>V<br>G | PITCH VARIATION C |          |      |  | n <sub>D</sub><br>n <sub>E</sub> | S<br>V<br>G | PITCH VARIATION D |          |      |  | n <sub>D</sub><br>n <sub>E</sub> |
|-------------|-------------------|----------|------|--|----------------------------------|-------------|-------------------|----------|------|--|----------------------------------|
|             | MIN.              | NOM.     | MAX. |  |                                  |             | MIN.              | NOM.     | MAX. |  |                                  |
| ⑥           |                   | 0.50 BSC |      |  |                                  | ⑥           |                   | 0.50 BSC |      |  |                                  |
| N           |                   | 12       |      |  | 3                                | N           |                   | 16       |      |  | 3                                |
| Nd          |                   | 3        |      |  | 3                                | Nd          |                   | 4        |      |  | 3                                |
| Ne          |                   | 3        |      |  | 3                                | Ne          |                   | 4        |      |  | 3                                |
| L           | 0.35              | 0.55     | 0.75 |  | 4                                | L           | 0.30              | 0.40     | 0.50 |  | 4                                |
| b           | 0.18              | 0.23     | 0.30 |  | 4                                | b           | 0.18              | 0.23     | 0.30 |  | 4                                |

| MAXIM                                            |                                        |
|--------------------------------------------------|----------------------------------------|
| PROPRIETARY INFORMATION                          |                                        |
| TITLE: PACKAGE OUTLINE, 12, 16L QFN, 3x3x0.90 MM |                                        |
| APPROVAL:                                        | DOCUMENT CONTROL NO. 21-0102 REV E 2/2 |

# Low-Voltage, 60Ω, 4:1 Analog Multiplexer in QFN

## Package Information (continued)

MAX4704



10LUMAX.EPS

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600 11