



# Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

**MAX4729/MAX4730**

## General Description

The MAX4729/MAX4730 single-pole/double-throw (SPDT) switches operate from a single supply ranging from +1.8V to +5.5V. These switches provide low 3.5Ω on-resistance (RON), as well as 0.45Ω RON flatness with a +2.7V supply. These devices typically consume only 1nA of supply current, making them ideal for use in low-power, portable applications. The MAX4729/MAX4730 feature low-leakage currents over the extended temperature range, TTL/CMOS-compatible digital logic, and excellent AC characteristics.

The MAX4729/MAX4730 are available in small 6-pin SC70 and 6-pin μDFN packages. The MAX4729/MAX4730 are offered in three pinout configurations to ease design. The MAX4729/MAX4730 are specified over the extended -40°C to +85°C temperature range.

## Features

- ◆ Low 3.5Ω RON (+2.7V Supply)
- ◆ 0.45Ω RON Flatness (+2.7V Supply)
- ◆ 0.05Ω RON Match Between Channels (+2.7V Supply)
- ◆ Tiny SC70 and μDFN Packages
- ◆ -3dB Bandwidth: 300MHz
- ◆ Low On-Capacitance: 19.5pF
- ◆ 0.036% Total Harmonic Distortion
- ◆ Low Supply Current: 1nA
- ◆ +1.8V to +5.5V Single-Supply Operation

## Applications

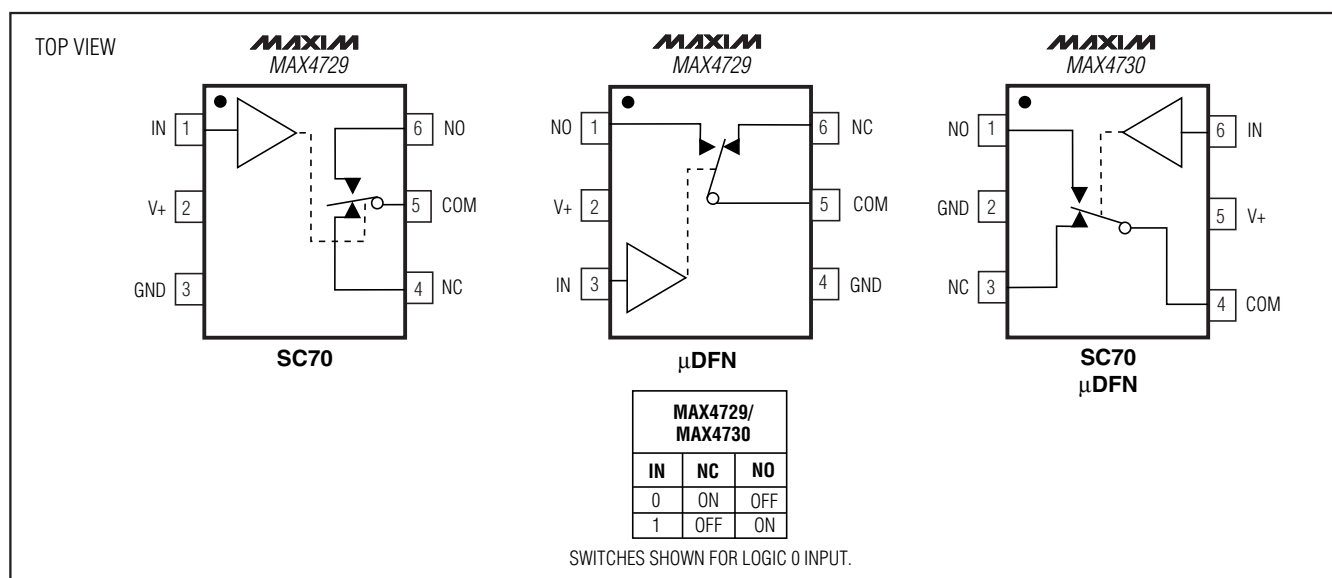
Battery-Operated Equipment  
Audio and Video-Signal Routing  
Low-Voltage Data-Acquisition Systems  
Sample-and-Hold Circuits  
Communications Circuits  
Relay Replacement

## Ordering Information

| PART          | TEMP RANGE     | PIN-PACKAGE | TOP MARK |
|---------------|----------------|-------------|----------|
| MAX4729EXT-T  | -40°C to +85°C | 6 SC70-6    | ABU      |
| MAX4729ELT-T* | -40°C to +85°C | 6 μDFN-6    | —        |
| MAX4730EXT-T  | -40°C to +85°C | 6 SC70-6    | ABV      |
| MAX4730ELT-T* | -40°C to +85°C | 6 μDFN-6    | —        |

\*Future product—contact factory for availability.

## Pin Configurations/Functional Diagrams/Truth Table



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## ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to ground)

|                                                             |                     |
|-------------------------------------------------------------|---------------------|
| V+, IN                                                      | -0.3V to +6V        |
| COM, NO, NC (Note 1)                                        | -0.3V to (V+ +0.3V) |
| Continuous Current (IN, V+, GND)                            | ±30mA               |
| Continuous Current (COM, NO, NC)                            | ±80mA               |
| Peak Current COM, NO, NC<br>(Pulsed at 1ms, 10% Duty Cycle) | ±150mA              |

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

|                                          |                 |
|------------------------------------------|-----------------|
| 6-Pin μDFN (derate 2.1mW/°C above +70°C) | 168mW           |
| 6-Pin SC70 (derate 3.1mW/°C above +70°C) | 245mW           |
| Operating Temperature Range              | -40°C to +85°C  |
| Maximum Junction Temperature             | +150°C          |
| Storage Temperature Range                | -65°C to +150°C |
| Lead Temperature (soldering, 10s)        | +300°C          |

**Note 1:** Signals on NO, NC, or COM exceeding V+ or GND are clamped by internal diodes. Signals on IN exceeding GND are clamped by an internal diode. 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

(V+ = +2.7V to +3.6V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Note 2)

| PARAMETER                                            | SYMBOL                                                  | CONDITIONS                                                                                              | T <sub>A</sub>                       | MIN | TYP    | MAX  | UNITS |
|------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------|-----|--------|------|-------|
| ANALOG SWITCH                                        |                                                         |                                                                                                         |                                      |     |        |      |       |
| Analog Signal Range                                  | V <sub>COM</sub> ,<br>V <sub>NO</sub> , V <sub>NC</sub> |                                                                                                         |                                      | 0   |        | V+   | V     |
| On-Resistance (Note 6)                               | R <sub>ON</sub>                                         | V+ = 2.7V, I <sub>COM</sub> = 10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0V to V+                    | +25°C                                |     | 3.5    | 5.5  | Ω     |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 5.7  |       |
| On-Resistance Match Between<br>Channels (Notes 3, 6) | ΔR <sub>ON</sub>                                        | V+ = 2.7V, I <sub>COM</sub> = 10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.7V, 1.2V,<br>2V (MAX4729) | +25°C                                |     | 0.05   | 0.15 | Ω     |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 0.2  |       |
|                                                      |                                                         | V+ = 2.7V, I <sub>COM</sub> = 10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.7V, 1.2V,<br>2V (MAX4730) | +25°C                                |     | 0.2    | 0.34 |       |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 0.37 |       |
| On-Resistance Flatness (Note 4)                      | R <sub>FLAT(ON)</sub>                                   | V+ = 2.7V, I <sub>COM</sub> = 10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.7V, 1.2V,<br>2V (MAX4729) | +25°C                                |     | 0.8    | 1.5  | Ω     |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 2.2  |       |
|                                                      |                                                         | V+ = 2.7V, I <sub>COM</sub> = 10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.7V, 1.2V,<br>2V (MAX4730) | +25°C                                |     | 0.45   | 0.95 |       |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 1.3  |       |
| NO, NC Off-Leakage Current                           | I <sub>NO</sub> (OFF),<br>I <sub>NC</sub> (OFF)         | V+ = 3.3V, V <sub>COM</sub> = 1V, 3V,<br>V <sub>NO</sub> or V <sub>NC</sub> = 3V, 1V                    | +25°C                                | -2  | +0.01  | +2   | nA    |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | -3  |        | +3   |       |
| COM On-Leakage Current                               | I <sub>COM</sub> (ON)                                   | V+ = 3.3V, V <sub>COM</sub> = 1V or<br>3V, V <sub>NO</sub> or V <sub>NC</sub> = 1V, 3V, or<br>float     | +25°C                                | -3  | +0.01  | +3   | nA    |
|                                                      |                                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | -4  |        | +4   |       |
| DIGITAL INPUTS                                       |                                                         |                                                                                                         |                                      |     |        |      |       |
| Input Logic High                                     | V <sub>IH</sub>                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | 2.0 |        |      | V     |
| Input Logic Low                                      | V <sub>IL</sub>                                         |                                                                                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |     |        | 0.4  | V     |
| Input Leakage Current                                | I <sub>IN</sub>                                         | V <sub>IN</sub> = 0V or 3.6V                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> | -1  | +0.005 | +1   | μA    |

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MAX4729/MAX4730

## ELECTRICAL CHARACTERISTICS (continued)

(V+ = +2.7V to +3.6V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Note 2)

| PARAMETER                  | SYMBOL                                         | CONDITIONS                                                                                                   | T <sub>A</sub>                                | MIN   | TYP | MAX | UNITS |
|----------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------|-----|-----|-------|
| <b>DYNAMIC</b>             |                                                |                                                                                                              |                                               |       |     |     |       |
| Turn-On Time (Note 5)      | t <sub>ON</sub>                                | V <sub>NO</sub> , V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 1               | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 18    | 45  | 45  | ns    |
| Turn-Off Time (Note 5)     | t <sub>OFF</sub>                               | V <sub>NO</sub> , V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 1               | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 10    | 26  | 26  | ns    |
| Break-Before-Make (Note 5) |                                                | V <sub>NO</sub> , V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 1               | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 5     | 1   |     | ns    |
| Charge Injection           | Q                                              | V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1.0nF, Figure 3                                |                                               | 3     |     |     | pC    |
| NO, NC Off-Capacitance     | C <sub>NO(OFF)</sub> ,<br>C <sub>NC(OFF)</sub> | f = 1MHz, Figure 4                                                                                           |                                               | 6.5   |     |     | pF    |
| Switch On-Capacitance      | C <sub>ON</sub>                                | f = 1MHz, Figure 4                                                                                           |                                               | 19.5  |     |     | pF    |
| Off-Isolation (Note 7)     | V <sub>ISO</sub>                               | V <sub>NO</sub> = V <sub>NC</sub> = 1V <sub>RMS</sub> , R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 2 | f = 1MHz<br>f = 10MHz                         | -67   | -45 |     | dB    |
| On-Channel Bandwidth -3dB  | BW                                             | Signal = 0dBm, 50Ω in and out, Figure 2                                                                      |                                               | 300   |     |     | MHz   |
| Crosstalk (Note 8)         | V <sub>CT</sub>                                | NO or NC = 1V <sub>RMS</sub> , C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, Figure 2                          | f = 1MHz<br>f = 10MHz                         | -67   | -52 |     | dB    |
| Total Harmonic Distortion  | THD                                            | R <sub>L</sub> = 600Ω, V <sub>NC</sub> or V <sub>NO</sub> = 2V <sub>P-P</sub> , f = 20Hz to 20kHz            | +25°C                                         | 0.035 |     |     | %     |
| <b>POWER SUPPLY</b>        |                                                |                                                                                                              |                                               |       |     |     |       |
| Power-Supply Range         | V+                                             |                                                                                                              |                                               | 1.8   |     | 5.5 | V     |
| Positive Supply Current    | I+                                             | V+ = 5.5V, V <sub>IN</sub> = 0V or 5.5V                                                                      | +25°C<br>T <sub>MIN</sub> to T <sub>MAX</sub> | 0.001 |     | 1   | μA    |

**Note 2:** SC70 and μDFN parts are 100% tested at T<sub>A</sub> = +25°C. Limits across the full-temperature range are guaranteed by design and correlation.

**Note 3:** ΔR<sub>ON</sub> = R<sub>ON(MAX)</sub> - R<sub>ON(MIN)</sub>.

**Note 4:** R<sub>ON</sub> flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Note 5:** Guaranteed by design.

**Note 6:** μDFN is guaranteed by design.

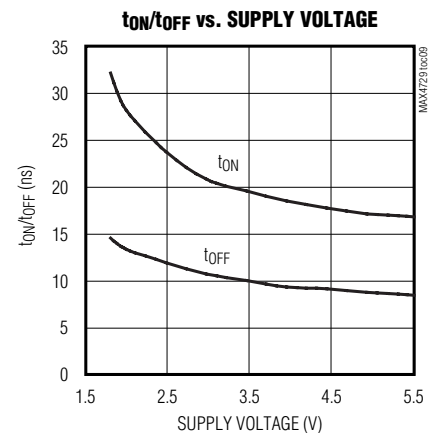
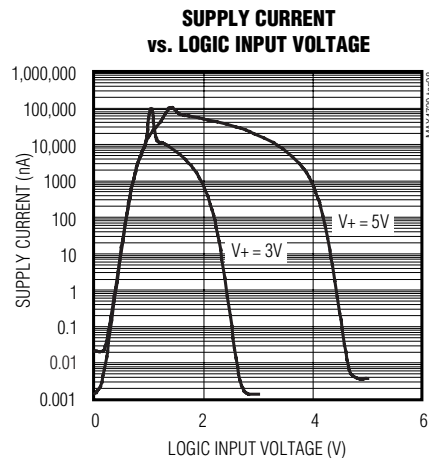
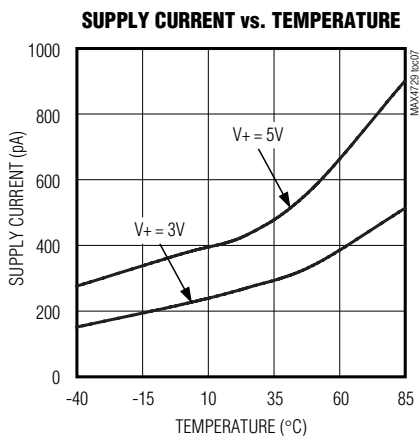
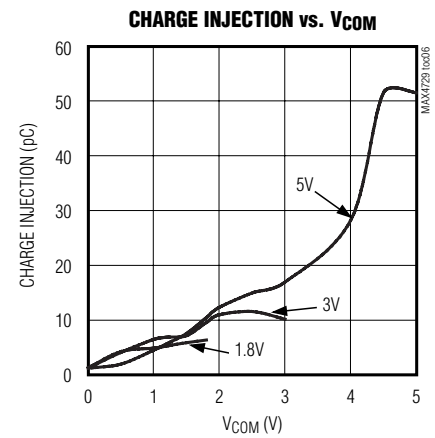
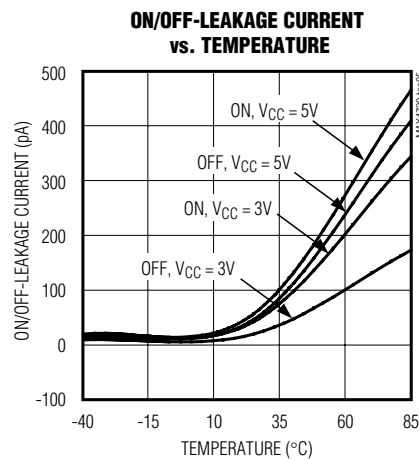
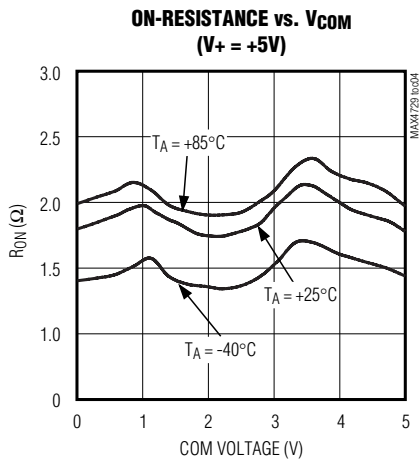
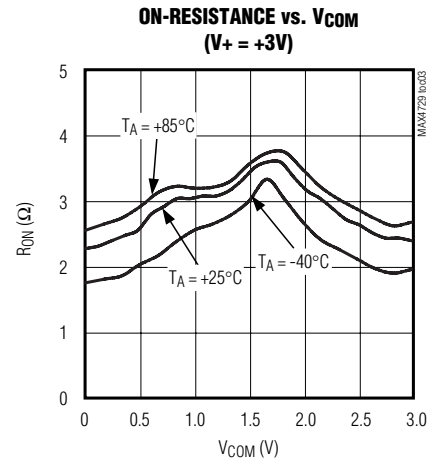
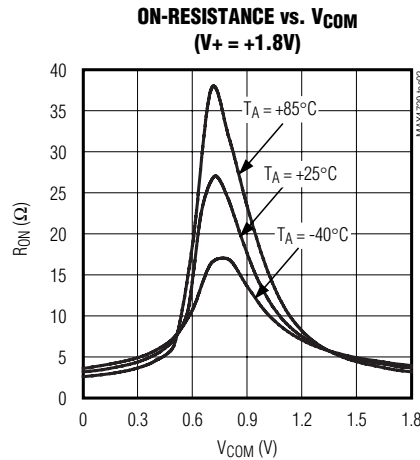
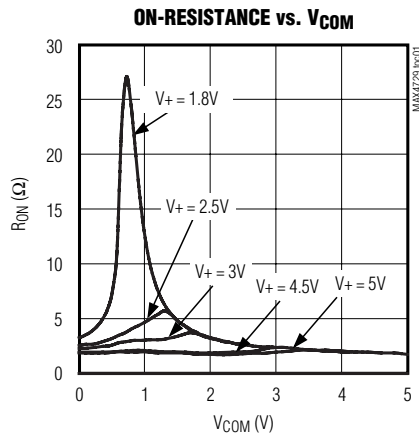
**Note 7:** Off-Isolation = 20log<sub>10</sub> (V<sub>O</sub> / V<sub>I</sub>), where V<sub>O</sub> is V<sub>COM</sub> and V<sub>I</sub> is either V<sub>NC</sub> or V<sub>NO</sub> from the network analyzer.

**Note 8:** Crosstalk is measured between the two switches.

# Low-Voltage $3.5\Omega$ , SPDT, CMOS Analog Switches

## Typical Operating Characteristics

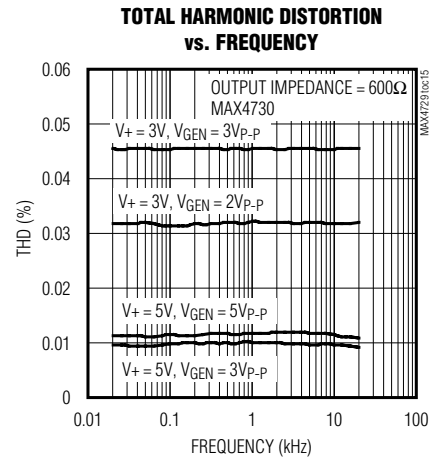
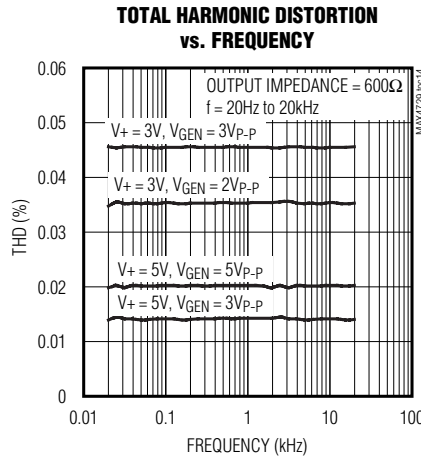
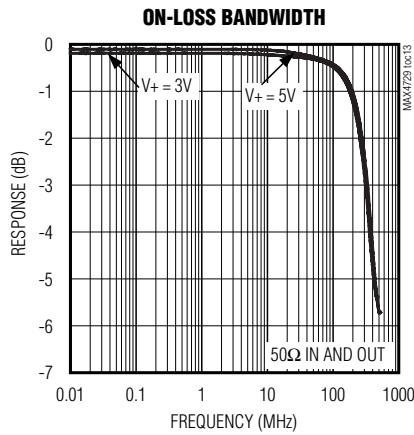
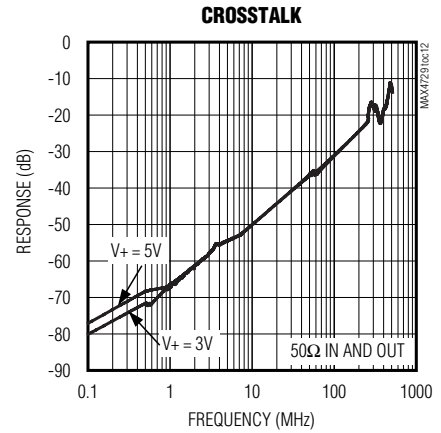
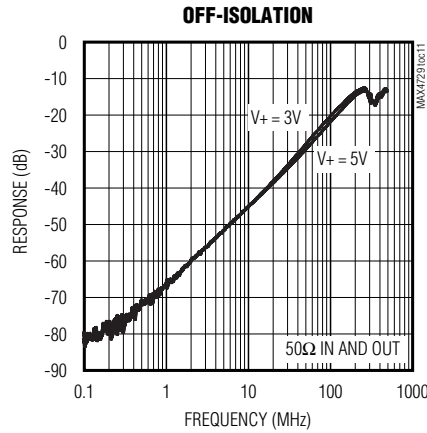
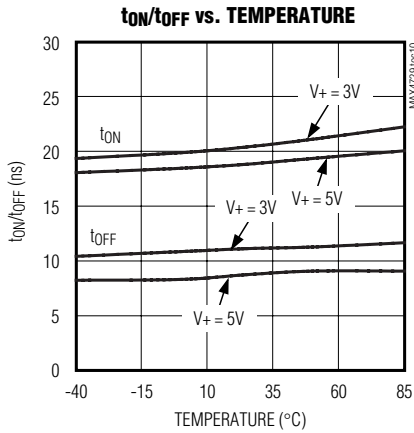
( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



# Low-Voltage 3.5 $\Omega$ , SPDT, CMOS Analog Switches

## Typical Operating Characteristics (continued)

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



## Pin Description

| PIN     |                 |                       | NAME | FUNCTION                               |
|---------|-----------------|-----------------------|------|----------------------------------------|
| MAX4729 |                 | MAX4730               |      |                                        |
| SC70    | $\mu\text{DFN}$ | SC70/ $\mu\text{DFN}$ |      |                                        |
| 1       | 3               | 6                     | IN   | Logic-Control Input                    |
| 2       | 2               | 5                     | V+   | Positive Supply Voltage                |
| 3       | 4               | 2                     | GND  | Ground                                 |
| 4       | 6               | 3                     | NC   | Analog Switch Normally Closed Terminal |
| 5       | 5               | 4                     | COM  | Analog Switch Common Terminal          |
| 6       | 1               | 1                     | NO   | Analog Switch Normally Open Terminal   |

# Low-Voltage $3.5\Omega$ , SPDT, CMOS Analog Switches

## Detailed Description

The MAX4729/MAX4730 single-pole/double-throw (SPDT) switches operate from a single supply ranging from +1.8V to +5.5V. These switches provide low  $3.5\Omega$  on-resistance ( $R_{ON}$ ), as well as  $0.45\Omega$   $R_{ON}$  flatness with a 2.7V supply. These devices typically consume only 1nA of supply current, making them suitable for use in low-power, portable applications. The MAX4729/MAX4730 feature low-leakage currents over the entire temperature range, TTL/CMOS-compatible digital logic, and excellent AC characteristics.

## Applications Information

### Digital Control Inputs

The MAX4729/MAX4730 logic inputs accept up to +5.5V, regardless of supply voltage. For example, with a +3.3V

supply, IN can be driven low to GND and high to +5.5V, allowing for mixing of logic levels in a system. With a 2.7V to 3.6V power-supply voltage range, the logic thresholds are set so  $V_{IL} = 0.4V$  (max) and  $V_{IH} = 2V$  (min).

## Power-Supply Sequencing and Overvoltage Protection

**Caution:** Do not exceed the absolute maximum ratings because stresses beyond the listed ratings can cause permanent damage to the device. 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.

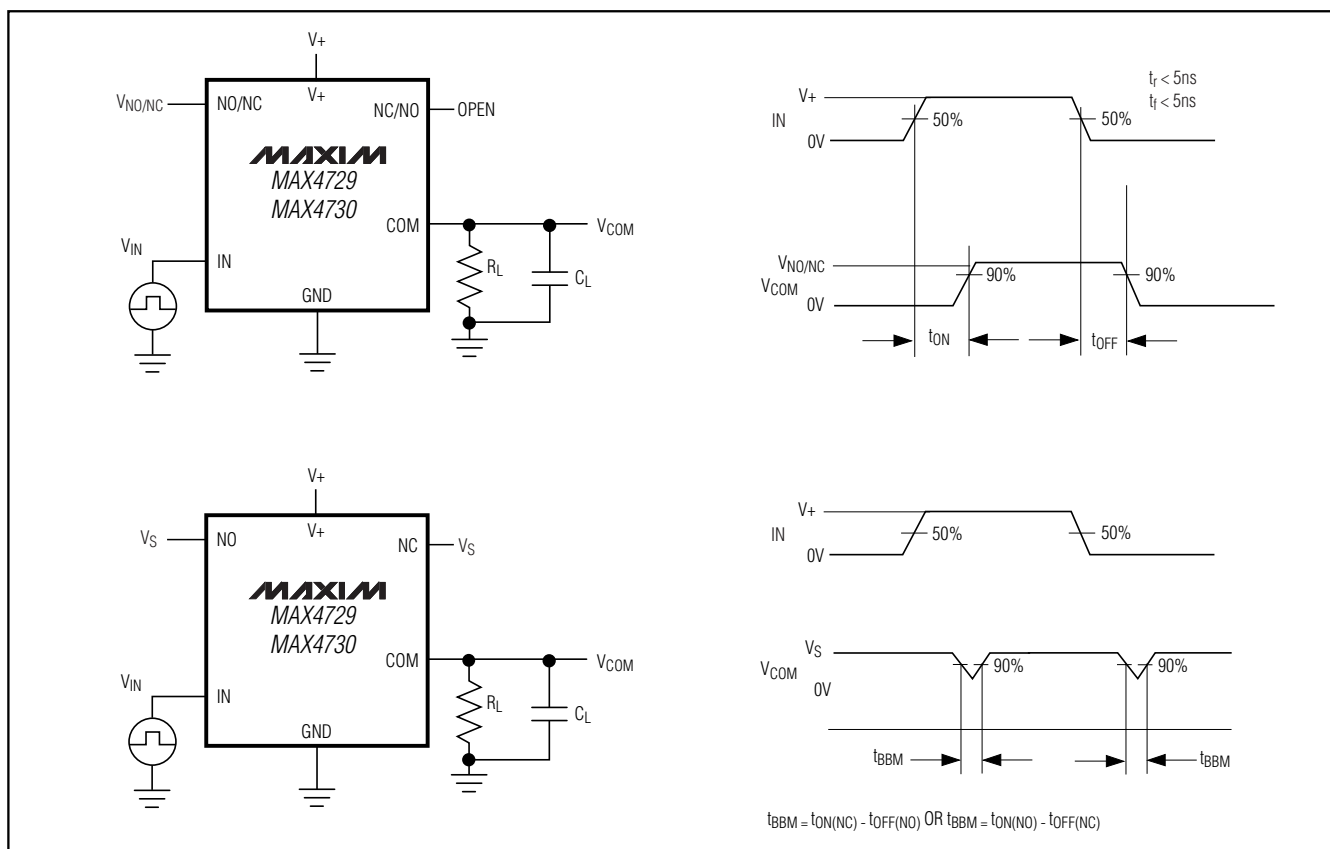


Figure 1. Switching Times

# Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

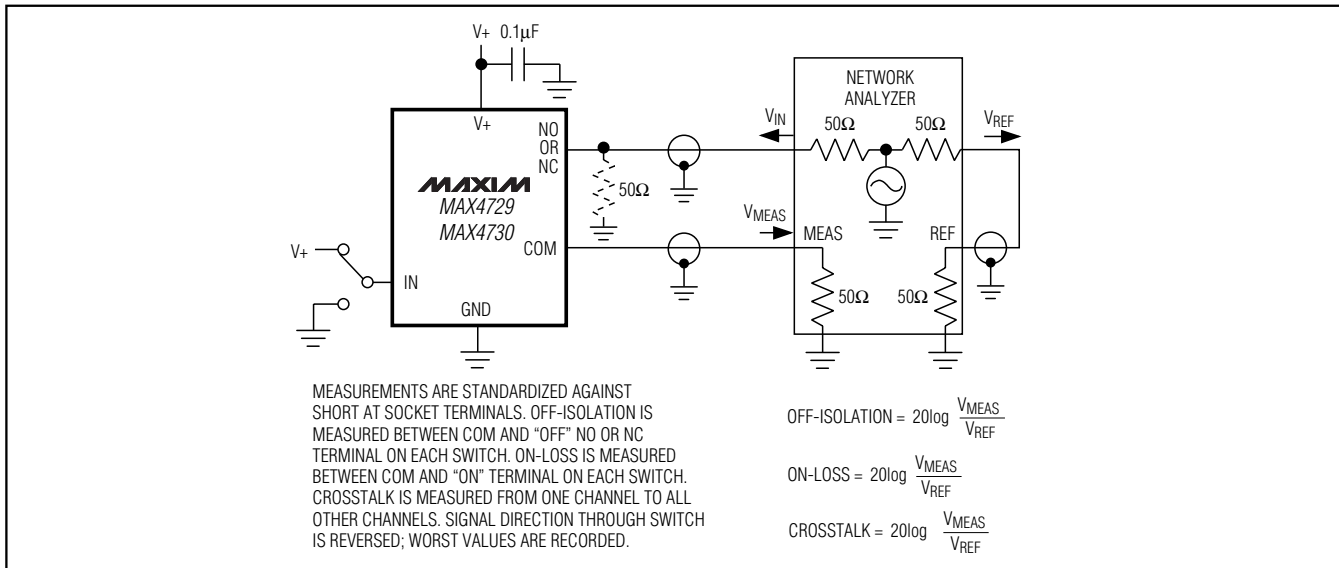


Figure 2. Off-Isolation/On-Loss Bandwidth, Crosstalk

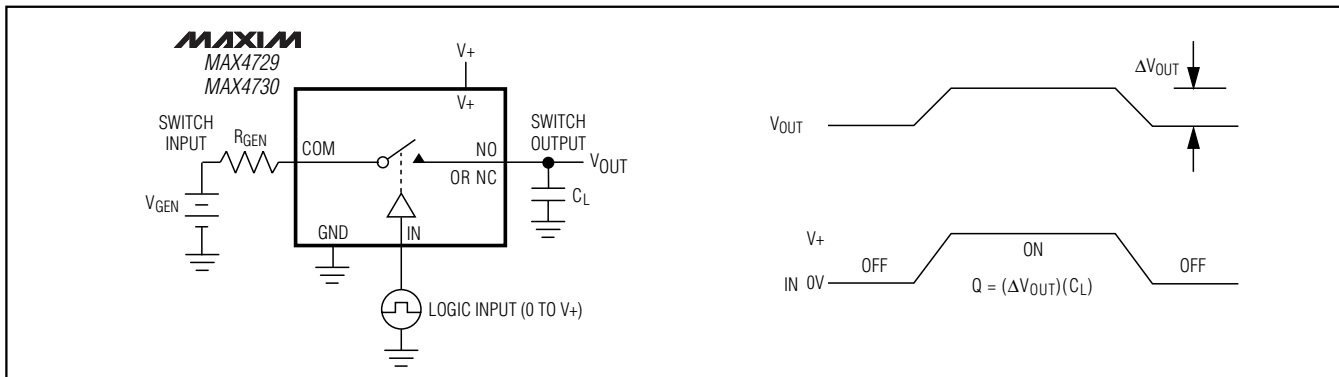


Figure 3. Charge Injection

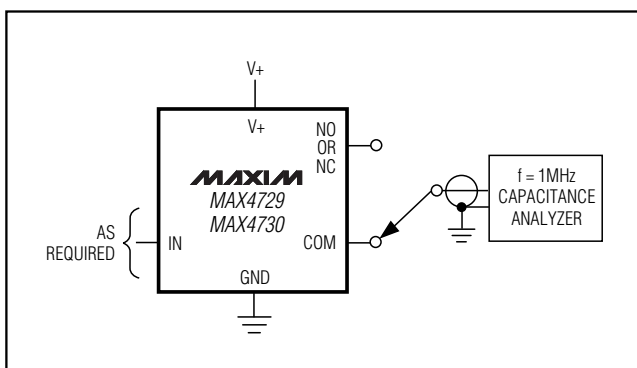


Figure 4. NO, NC, and COM Capacitance

## Chip Information

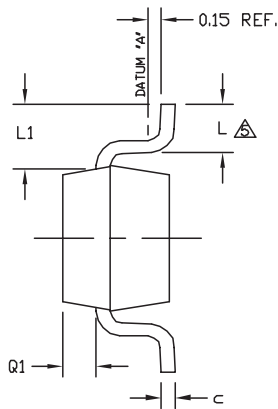
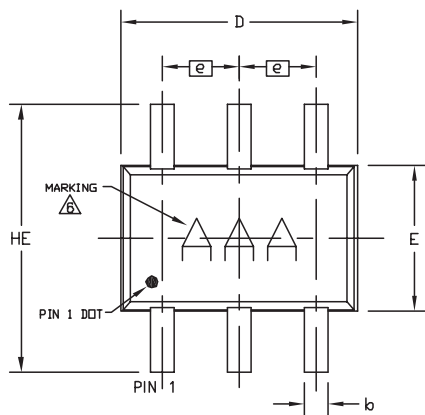
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PROCESS: CMOS

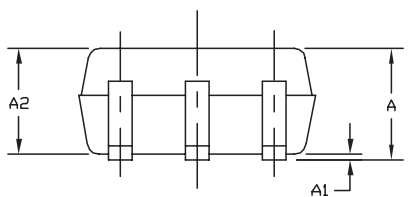
# Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

## 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](http://www.maxim-ic.com/packages).)



| COMMON DIMENSIONS |            |      |
|-------------------|------------|------|
| SYMBOL            | MIN        | MAX  |
| A                 | 0.80       | 1.10 |
| A1                | 0.00       | 0.10 |
| A2                | 0.80       | 1.00 |
| b                 | 0.15       | 0.30 |
| c                 | 0.10       | 0.18 |
| D                 | 1.80       | 2.20 |
| e                 | 0.65 BSC.  |      |
| E                 | 1.15       | 1.35 |
| HE                | 1.80       | 2.40 |
| L                 | 0.10       | 0.41 |
| L1                | 0.425 TYP. |      |
| Q1                | 0.10       | 0.40 |



- NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. DIMENSIONS ARE INCLUSIVE OF PLATING.
  3. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH & METAL BURR.
  4. COPLANARITY 4 MILS. MAX.
  5. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM "A" AND LEAD SURFACE.
  6. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
  7. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

TITLE: PACKAGE OUTLINE, 6L SC70

|          |                              |        |     |
|----------|------------------------------|--------|-----|
| APPROVAL | DOCUMENT CONTROL NO. 21-0077 | REV. C | 1/1 |
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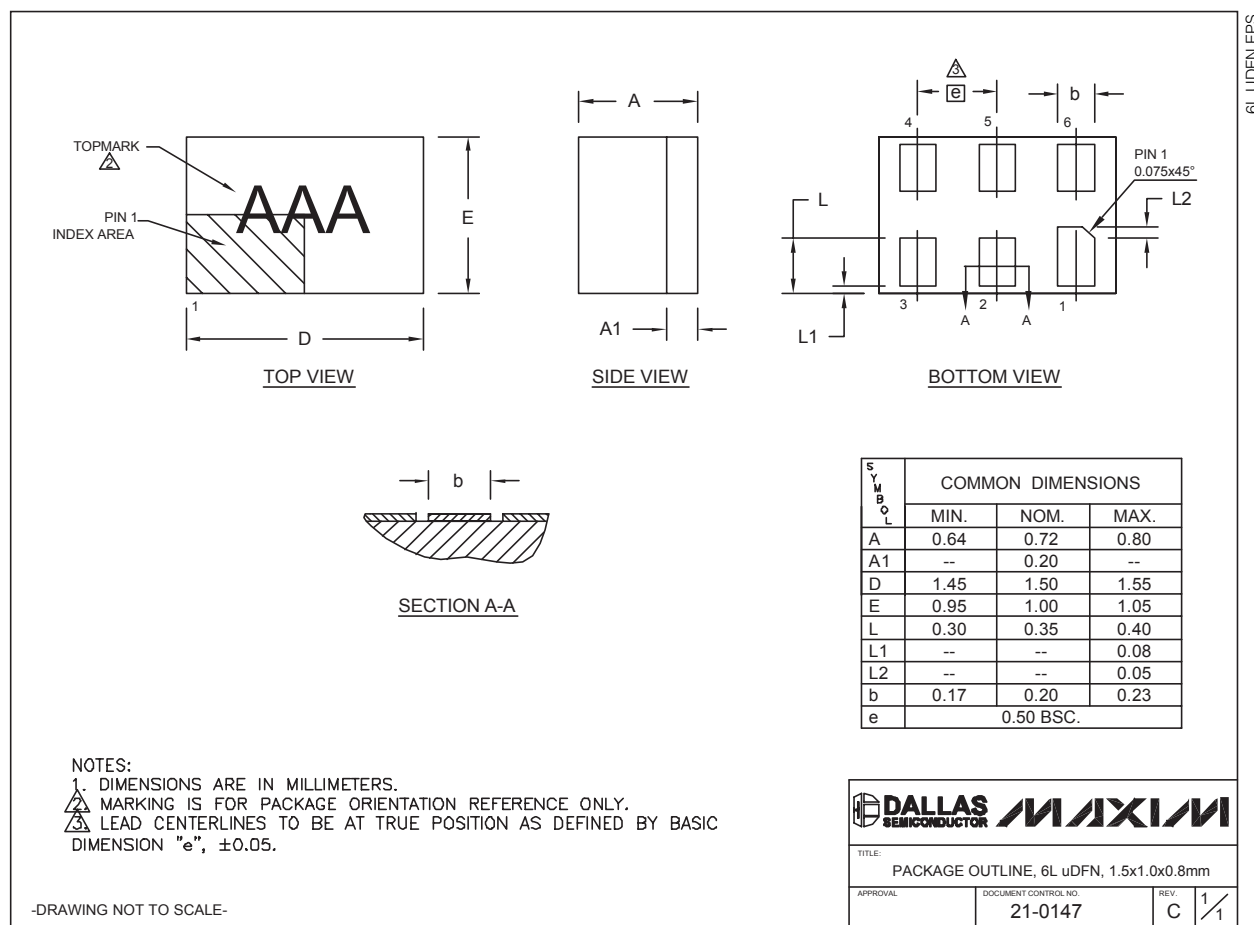
SC70, 6LEPS

-DRAWING NOT TO SCALE-

# Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

## Package Information (continued)

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MAX4729/MAX4730

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