



# High-Current, 10Ω, SPST, CMOS Analog Switches

## General Description

Maxim's MAX4655–MAX4658 are medium-voltage CMOS analog switches with low on-resistance of 10Ω max, specifically designed to handle large switch currents. With a switch capability of up to 400mA peak current and 300mA continuous current (MAX4655/MAX4656), and up to 300mA peak current and 150mA continuous current (MAX4657/MAX4658), these parts can switch loads as low as 25Ω. They can replace reed relays with a million times the speed and virtually unlimited number of lifetime cycles. Normal power consumption is only 3mW, whether the switch is on or off. These parts are TTL/CMOS compatible and will switch any voltage within its power-supply range.

These are SPST (single-pole/single-throw) switches. The MAX4655/MAX4657 are normally closed (NC), while the MAX4656/MAX4658 are normally open (NO). The difference between the MAX4655/MAX4656 and the MAX4657/MAX4658 is in the power dissipation of their packages. Refer to the *Absolute Maximum Ratings* and the *Electrical Characteristics*.

The MAX4655–MAX4658 power-supply range is from ±4.5V to ±20V for dual-supply operation and +9V to +40V for single-supply operation. These switches can operate from any combination of supplies, within a 40V V+ to V- range. They conduct equally well in either direction and can handle rail-to-rail analog signals. The off-leakage current is only 1nA max at T<sub>A</sub> = +25°C. They are available in 8-pin μMAX®, TDFN, and SO packages, with exposed paddle options for high-power applications.

## Applications

Relay Replacement  
Test Equipment  
Communication Systems  
xDSL Modems  
PBX, PABX Systems  
Audio Signal Routing  
Audio Systems  
PC Multimedia Boards  
Redundant/Backup Systems

## Features

- ◆ High Continuous Current Handling  
300mA (MAX4655/MAX4656)  
150mA (MAX4657/MAX4658)
- ◆ High Peak Current Handling  
400mA (MAX4655/MAX4656)  
300mA (MAX4657/MAX4658)
- ◆ 10Ω (max) On-Resistance (±15V supplies)
- ◆ V<sub>L</sub> Not Required
- ◆ 1Ω (max) R<sub>ON</sub> Flatness over Specified Signal Range
- ◆ Rail-to-Rail Signal Handling
- ◆ +12V Single Supply or ±15V Dual Supply Operation
- ◆ Pin Compatible with DG417, DG418

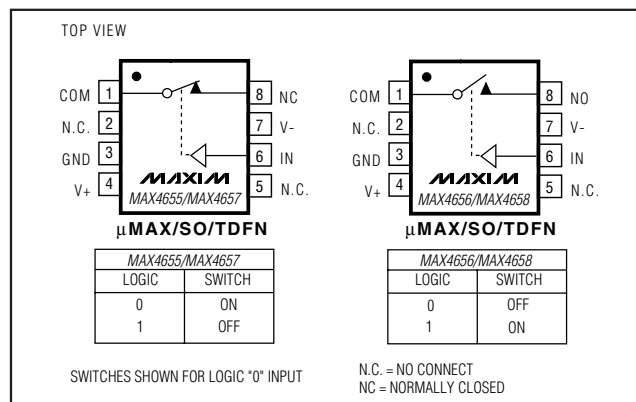
## Ordering Information

| PART       | TEMP RANGE     | PIN-PACKAGE | TOP MARK |
|------------|----------------|-------------|----------|
| MAX4655ETA | -40°C to +85°C | 8 TDFN-EP*  | AKT      |
| MAX4655EUA | -40°C to +85°C | 8 μMAX      | AAAL     |
| MAX4655ESA | -40°C to +85°C | 8 SO        | —        |
| MAX4656ETA | -40°C to +85°C | 8 TDFN-EP*  | AKU      |
| MAX4656EUA | -40°C to +85°C | 8 μMAX      | AAAM     |
| MAX4656ESA | -40°C to +85°C | 8 SO        | —        |
| MAX4657EUA | -40°C to +85°C | 8 μMAX      | —        |
| MAX4657ESA | -40°C to +85°C | 8 SO        | —        |
| MAX4658EUA | -40°C to +85°C | 8 μMAX      | —        |
| MAX4658ESA | -40°C to +85°C | 8 SO        | —        |

\*EP = Exposed paddle.

## Pin Configurations/

## Functional Diagrams/Truth Tables



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MAX4655–MAX4658

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## ABSOLUTE MAXIMUM RATINGS

|                                                              |                        |
|--------------------------------------------------------------|------------------------|
| V+ to GND .....                                              | -0.3V to +44V          |
| V- to GND .....                                              | -44V to +0.3V          |
| V+ to V- .....                                               | -0.3V to +44V          |
| All Other Pins to GND (Note 1) .....                         | V- - 0.3V to V+ + 0.3V |
| Continuous Current, COM, NO, NC<br>(MAX4655/MAX4656) .....   | $\pm 300\text{mA}$     |
| Continuous Current, COM, NO, NC<br>(MAX4657/MAX4658) .....   | $\pm 150\text{mA}$     |
| Continuous Current, IN .....                                 | $\pm 30\text{mA}$      |
| Peak Current, COM, NO, NC<br>(pulsed at 1ms, 10% duty cycle) |                        |
| MAX4655/MAX4656 .....                                        | $\pm 400\text{mA}$     |
| MAX4657/MAX4658 .....                                        | $\pm 300\text{mA}$     |

|                                                                                             |                                             |
|---------------------------------------------------------------------------------------------|---------------------------------------------|
| Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )                                  |                                             |
| 8-Pin TDFN (derate 24.4mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ ) .....               | 1951mW                                      |
| 8-Pin $\mu\text{MAX-EP}$ (derate 10.3mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ ) ..... | MAX4655/MAX4656 825mW                       |
| 8-Pin $\mu\text{MAX}$ (derate 4.50mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ ) .....    | MAX4657/MAX4658 362mW                       |
| 8-Pin SO-EP (derate 18.9mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ ) .....              | MAX4655/MAX4656 1509mW                      |
| 8-Pin SO (derate 5.88mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ ) .....                 | MAX4657/MAX4658 471mW                       |
| Operating Temperature Ranges                                                                |                                             |
| MAX4655-MAX4658 .....                                                                       | $-40^\circ\text{C}$ to $+85^\circ\text{C}$  |
| Junction Temperature .....                                                                  | $+150^\circ\text{C}$                        |
| Storage Temperature Range .....                                                             | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |
| Lead Temperature (soldering, 10s) .....                                                     | $+300^\circ\text{C}$                        |

**Note 1:** Signals on NC, NO, COM, or IN exceeding V+ or V- will be 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—Dual Supplies

(V+ = +15V, V- = -15V,  $V_{IH} = 2.4\text{V}$ ,  $V_{IL} = 0.8\text{V}$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ\text{C}$ .)  
(Notes 2, 7, 8)

| PARAMETER                                | SYMBOL                                                   | CONDITIONS                                                                                                                                                   | T <sub>A</sub>                       | MIN | TYP  | MAX | UNITS |
|------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----|------|-----|-------|
| ANALOG SWITCH                            |                                                          |                                                                                                                                                              |                                      |     |      |     |       |
| Analog Signal Range                      | V <sub>NO</sub> , V <sub>VNC</sub> ,<br>V <sub>COM</sub> |                                                                                                                                                              |                                      | V-  |      | V+  | V     |
| On-Resistance                            | R <sub>ON</sub>                                          | I <sub>COM</sub> = 100mA;<br>V <sub>NO</sub> or V <sub>VNC</sub> = ±10V                                                                                      | +25°C                                |     | 7    | 10  | Ω     |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> |     |      | 15  |       |
| On-Resistance Flatness<br>(Note 3)       | R <sub>FLAT</sub> (ON)                                   | I <sub>COM</sub> = 100mA;<br>V <sub>NO</sub> or V <sub>VNC</sub> = -5V, 0, +5V                                                                               | +25°C                                |     | 0.3  | 1   | Ω     |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> |     |      | 1.5 |       |
| NO or NC Off-Leakage<br>Current (Note 4) | I <sub>NO</sub> (OFF) or<br>I <sub>VNC</sub> (OFF)       | V <sub>COM</sub> = +14.5V, -14.5V;<br>V <sub>NO</sub> or V <sub>VNC</sub> = -14.5V, +14.5V                                                                   | +25°C                                | -1  | 0.01 | +1  | nA    |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> | -10 |      | 10  |       |
| COM Off-Leakage<br>Current (Note 4)      | I <sub>COM</sub> (OFF)                                   | V <sub>COM</sub> = +14.5V, -14.5V;<br>V <sub>NO</sub> or V <sub>VNC</sub> = -14.5V, +14.5V                                                                   | +25°C                                | -1  | 0.01 | +1  | nA    |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> | -10 |      | +10 |       |
| COM On-Leakage<br>Current (Note 4)       | I <sub>COM</sub> (ON)                                    | V <sub>COM</sub> = +14.5V, -14.5V;<br>V <sub>NO</sub> or V <sub>VNC</sub> = +14.5V,<br>-14.5V, or floating                                                   | +25°C                                | -2  |      | +2  | nA    |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> | -20 |      | +20 |       |
| DYNAMIC CHARACTERISTICS                  |                                                          |                                                                                                                                                              |                                      |     |      |     |       |
| Turn-On Time                             | t <sub>ON</sub>                                          | V <sub>NO</sub> or V <sub>VNC</sub> = 10V;<br>R <sub>L</sub> = 50Ω; MAX4655/4656,<br>R <sub>L</sub> = 100Ω; MAX4657/4658,<br>C <sub>L</sub> = 35pF; Figure 3 | +25°C                                |     | 110  | 200 | ns    |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> |     |      | 300 |       |
| Turn-Off Time                            | t <sub>OFF</sub>                                         | V <sub>NO</sub> or V <sub>VNC</sub> = 10V;<br>R <sub>L</sub> = 50Ω; MAX4655/4656,<br>R <sub>L</sub> = 100Ω; MAX4657/4658,<br>C <sub>L</sub> = 35pF; Figure 3 | +25°C                                |     | 75   | 100 | ns    |
|                                          |                                                          |                                                                                                                                                              | T <sub>MIN</sub> to T <sub>MAX</sub> |     |      | 150 |       |

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MAX4655-MAX4658

## ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V<sub>+</sub> = +15V, V<sub>-</sub> = -15V, V<sub>IH</sub> = 2.4V, V<sub>IL</sub> = 0.8V, 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.) (Notes 2, 7, 8)

| PARAMETER                 | SYMBOL                                         | CONDITIONS                                                                                                                                        | T <sub>A</sub>                       | MIN       | TYP   | MAX      | UNITS   |
|---------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|-------|----------|---------|
| Charge Injection          | Q                                              | V <sub>GEN</sub> = 0; R <sub>GEN</sub> = 0;<br>C <sub>L</sub> = 1nF; Figure 4                                                                     | +25°C                                |           | 23    |          | pC      |
| -3dB Bandwidth            | BW                                             |                                                                                                                                                   | +25°C                                |           | 210   |          | MHz     |
| Off-Isolation (Note 5)    | V <sub>ISO</sub>                               | f = 1MHz; R <sub>L</sub> = 50 $\Omega$ ;<br>Figure 5                                                                                              | +25°C                                |           | -77   |          | dB      |
| Total Harmonic Distortion | THD                                            | f = 20Hz to 20kHz,<br>V <sub>NL</sub> = 5V <sub>p-p</sub> ; R <sub>L</sub> = 600 $\Omega$                                                         | +25°C                                |           | 0.007 |          | %       |
| NO or NC Off-Capacitance  | C <sub>NO(OFF)</sub> ,<br>C <sub>NC(OFF)</sub> | f = 1MHz; Figure 6                                                                                                                                | +25°C                                |           | 25    |          | pF      |
| COM Off-Capacitance       | C <sub>COM(OFF)</sub>                          | f = 1MHz; Figure 6                                                                                                                                | +25°C                                |           | 25    |          | pF      |
| COM On-Capacitance        | C <sub>COM(ON)</sub>                           | f = 1MHz; Figure 7                                                                                                                                | +25°C                                |           | 67    |          | pF      |
| <b>DIGITAL I/O</b>        |                                                |                                                                                                                                                   |                                      |           |       |          |         |
| Input Logic High          | V <sub>IH</sub>                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> | 2.4       |       |          | V       |
| Input Logic Low           | V <sub>IL</sub>                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |           |       | 0.8      | V       |
| Input Leakage Current     | I <sub>IN</sub>                                | V <sub>IN</sub> = 0.8V or 2.4V                                                                                                                    | T <sub>MIN</sub> to T <sub>MAX</sub> | -1        |       | +1       | $\mu$ A |
| <b>POWER SUPPLY</b>       |                                                |                                                                                                                                                   |                                      |           |       |          |         |
| Power-Supply Range        |                                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> | $\pm$ 4.5 |       | $\pm$ 20 | V       |
| Positive Supply Current   | I <sub>+</sub>                                 | V <sub>IN</sub> = 0 or 5V, V <sub>NL</sub> = 3V;<br>I <sub>SWITCH</sub> = 200mA,<br>MAX4655/4656;<br>I <sub>SWITCH</sub> = 100mA,<br>MAX4657/4658 | +25°C                                |           | 90    | 150      | $\mu$ A |
|                           |                                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |           |       | 300      |         |
| Negative Supply Current   | I <sub>-</sub>                                 | V <sub>IN</sub> = 0 or 5V, V <sub>NL</sub> = 3V;<br>I <sub>SWITCH</sub> = 200mA,<br>MAX4655/4656;<br>I <sub>SWITCH</sub> = 100mA,<br>MAX4657/4658 | +25°C                                |           | 10    | 50       | $\mu$ A |
|                           |                                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |           |       | 100      |         |
| Ground Current            | I <sub>GND</sub>                               | V <sub>IN</sub> = 0 or 5V, V <sub>NL</sub> = 3V;<br>I <sub>SWITCH</sub> = 200mA,<br>MAX4655/4656;<br>I <sub>SWITCH</sub> = 100mA,<br>MAX4657/4658 | +25°C                                |           | 80    | 130      | $\mu$ A |
|                           |                                                |                                                                                                                                                   | T <sub>MIN</sub> to T <sub>MAX</sub> |           |       | 260      |         |

# High-Current, 10 $\Omega$ , SPST, CMOS Analog Switches

## ELECTRICAL CHARACTERISTICS—Single Supply

(V+ = +12V, V- = 0, VIH = 2.4V, VIL = 0.8V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at TA = +25°C.) (Note 2)

| PARAMETER                           | SYMBOL                 | CONDITIONS                                                                                                                                                 | T <sub>A</sub>                       | MIN | TYP | MAX | UNITS |
|-------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----|-----|-----|-------|
| ANALOG SWITCH                       |                        |                                                                                                                                                            |                                      |     |     |     |       |
| Analog Signal Range                 | V <sub>IN</sub>        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> | 0   |     | V+  | V     |
| On-Resistance                       | R <sub>ON</sub>        | I <sub>COM</sub> = 50mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 10V                                                                                       | +25°C                                |     | 15  | 22  | Ω     |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 33  |       |
| On-Resistance Flatness<br>(Note 3)  | R <sub>FLAT</sub> (ON) | I <sub>COM</sub> = 50mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 2V, 6V, 10V                                                                               | +25°C                                |     | 2.2 | 4   | Ω     |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 5   |       |
| DYNAMIC CHARACTERISTICS             |                        |                                                                                                                                                            |                                      |     |     |     |       |
| Turn-On Time                        | t <sub>ON</sub>        | V <sub>NO</sub> or V <sub>NC</sub> = 10V;<br>R <sub>L</sub> = 100Ω MAX4655/4656,<br>R <sub>L</sub> = 200Ω MAX4657/4658,<br>C <sub>L</sub> = 35pF; Figure 3 | +25°C                                |     | 140 | 200 | ns    |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 300 |       |
| Turn-Off Time                       | t <sub>OFF</sub>       | V <sub>NO</sub> or V <sub>NC</sub> = 10V;<br>R <sub>L</sub> = 100Ω MAX4655/4656,<br>R <sub>L</sub> = 200Ω MAX4657/4658,<br>C <sub>L</sub> = 35pF; Figure 3 | +25°C                                |     | 65  | 125 | ns    |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 200 |       |
| Charge Injection                    | Q                      | V <sub>GEN</sub> = 0; R <sub>GEN</sub> = 0;<br>C <sub>L</sub> = 1nF; Figure 4                                                                              | +25°C                                |     | 1   |     | pC    |
| POWER SUPPLY                        |                        |                                                                                                                                                            |                                      |     |     |     |       |
| Power-Supply Range                  | V+                     |                                                                                                                                                            |                                      | 9   |     | 40  | V     |
| Positive Supply Current<br>(Note 6) | I+                     | V <sub>IN</sub> = 0 or 12V,<br>I <sub>SWITCH</sub> = 100mA,<br>MAX4655/4656;<br>I <sub>SWITCH</sub> = 50mA,<br>MAX4657/4658                                | +25°C                                |     | 25  | 100 | μA    |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 200 |       |
|                                     |                        | V <sub>IN</sub> = 0 or 5V,<br>I <sub>SWITCH</sub> = 100mA,<br>MAX4655/4656;<br>I <sub>SWITCH</sub> = 50mA,<br>MAX4657/4658                                 | +25°C                                |     | 46  | 125 |       |
|                                     |                        |                                                                                                                                                            | T <sub>MIN</sub> to T <sub>MAX</sub> |     |     | 200 |       |

**Note 2:** The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

**Note 3:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal range.

**Note 4:** Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at TA = +25°C.

**Note 5:** Off-isolation = 20log10 [VCOM / (VNC or VNO)], VCOM = output, VNC or VNO = input to off switch.

**Note 6:** Guaranteed by testing with dual supplies.

**Note 7:** -40°C specifications are guaranteed by design.

**Note 8:** TDFN parts are tested at +25°C and guaranteed by design over the entire temperature range.

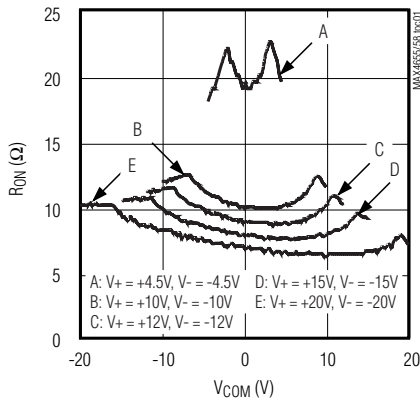
# High-Current, $10\Omega$ , SPST, CMOS Analog Switches

## Typical Operating Characteristics

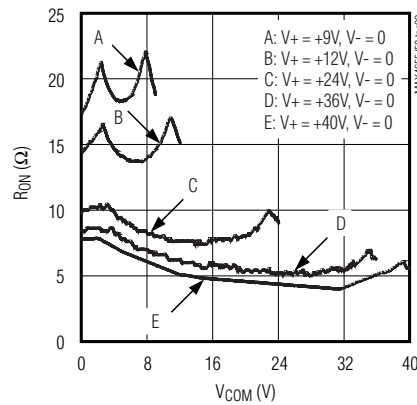
( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

MAX4655-MAX4658

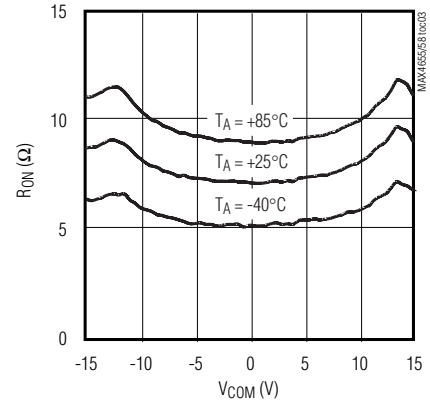
**ON-RESISTANCE vs.  $V_{\text{COM}}$   
(DUAL SUPPLIES)**



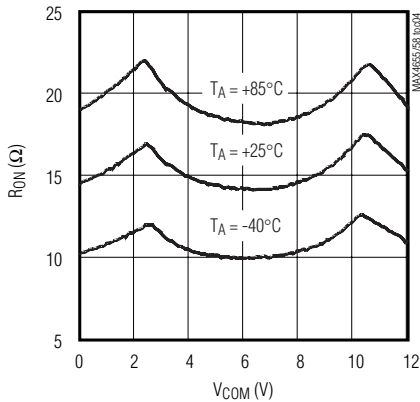
**ON-RESISTANCE vs.  $V_{\text{COM}}$   
(SINGLE SUPPLY)**



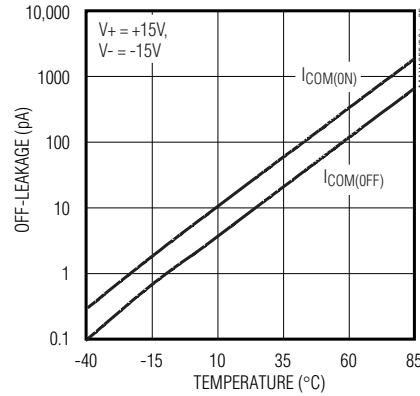
**ON-RESISTANCE vs.  $V_{\text{COM}}$   
AND TEMPERATURE (DUAL SUPPLIES)**



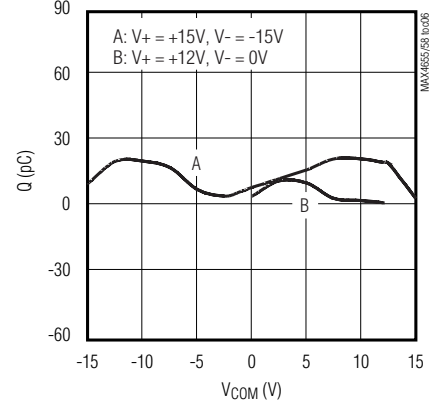
**ON-RESISTANCE vs.  $V_{\text{COM}}$   
AND TEMPERATURE (SINGLE SUPPLY)**



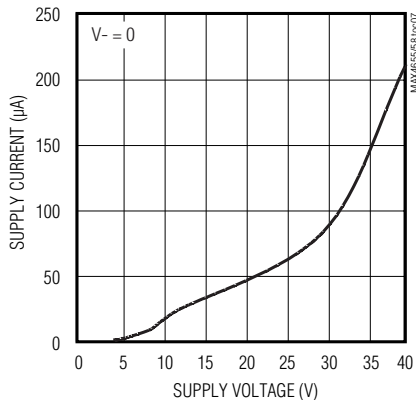
**LEAKAGE CURRENT  
vs. TEMPERATURE**



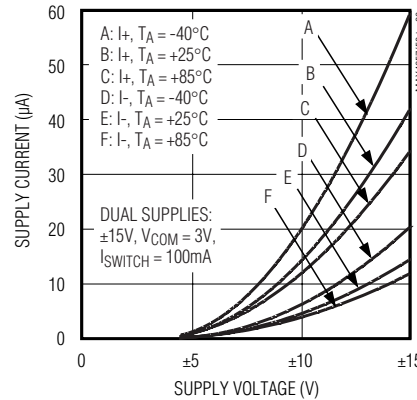
**CHARGE INJECTION  
vs.  $V_{\text{COM}}$**



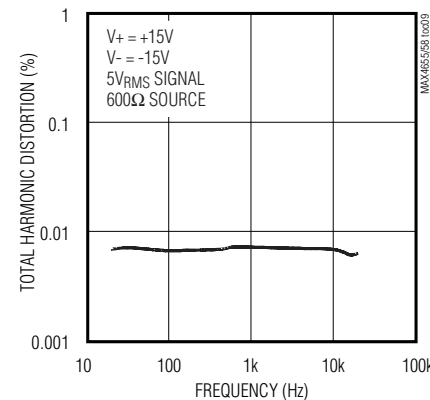
**SUPPLY CURRENT vs. SUPPLY VOLTAGE  
(SINGLE SUPPLY)**



**SUPPLY CURRENT  
vs. SUPPLY VOLTAGE AND TEMPERATURE**



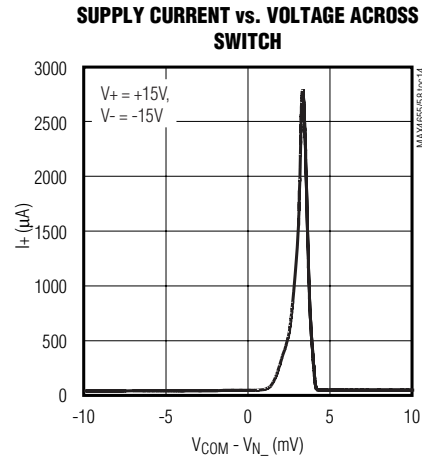
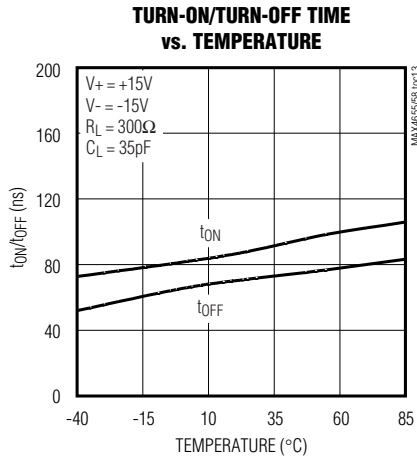
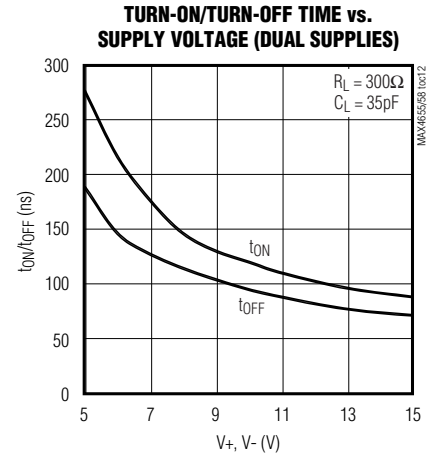
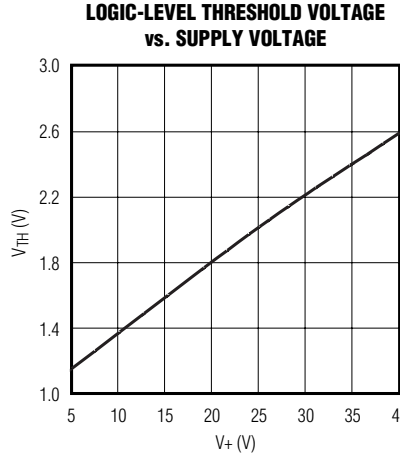
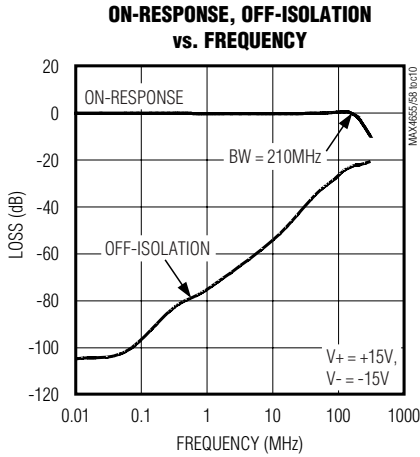
**TOTAL HARMONIC DISTORTION  
vs. FREQUENCY**



# High-Current, $10\Omega$ , SPST, CMOS Analog Switches

## Typical Operating Characteristics (continued)

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



## Pin Description

| PIN                 |                     | NAME  | FUNCTION                              |
|---------------------|---------------------|-------|---------------------------------------|
| MAX4655/<br>MAX4657 | MAX4656/<br>MAX4658 |       |                                       |
| 1                   | 1                   | COM   | Analog Switch Common                  |
| 2, 5                | 2, 5                | N.C.  | No Internal Connection                |
| 3                   | 3                   | GND   | Ground                                |
| 4                   | 4                   | $V_+$ | Positive Supply Voltage Input         |
| 6                   | 6                   | IN    | Digital Control Input                 |
| 7                   | 7                   | $V_-$ | Negative Supply Voltage Input         |
| —                   | 8                   | NO    | Analog Switch Normally Open           |
| 8                   | —                   | NC    | Analog Switch Normally Closed         |
| EP                  | —                   | EP    | Exposed Paddle. Connect EP to $V_+$ . |

# High-Current, 10 $\Omega$ , SPST, CMOS Analog Switches

## Detailed Description

The MAX4655-MAX4658 are single SPST CMOS analog switches. The CMOS switch construction provides rail-to-rail signal handling while consuming very little power. The switch is controlled by a TTL/CMOS level compatible digital input. The MAX4655/MAX4657 are normally closed switches, and the MAX4656/MAX4658 are normally open switches.

These devices can be operated with either single power supplies or dual power supplies. Operation at up to  $\pm 20\text{V}$  supplies allows users a wide switching dynamic range. Additionally, asymmetrical operation is possible to tailor performance to a particular application.

These switches have been specifically designed to handle high switch currents, up to 400mA peak current and 300mA continuous currents. In order to do this, a new technique is used to drive the body of the output N-channel device. (Note: the basic switch between the input NC/NO terminal, and the output common terminal consists of an N-channel MOSFET and a P-channel MOSFET in parallel.) The standard method limits operation to approximately a 600mV drop across the switch. More than 600mV causes an increase in  $I_{\text{DON}}$  leakage current (due to the turn-on of on-chip parasitic diodes) and an increase in  $V_+$  supply current. With the new sensing method, there is no limitation to the voltage drop across the switch. Current and voltage are limited only by the power dissipation rating of the package and the absolute maximum ratings of the switch.

When the analog input to output voltage drop is approximately 7mV there is an increase in power supply current from typically 90 $\mu\text{A}$  to 2mA within a 1mV to 7mV range, caused by the new sensing/driving circuitry.

## Applications Information

### Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the devices. First, connect GND, followed by  $V_+$ ,  $V_-$ , and the remaining pins. If power-supply sequencing is not possible, add two small signal diodes (D1, D2) in series with supply pins (Figure 1). Adding diodes reduces the analog signal range to one diode drop below  $V_+$  and one diode drop above  $V_-$ , but does not affect the devices' low switch resistance and low leakage characteristics. Device operation is unchanged, and the difference between  $V_+$  and  $V_-$  should not exceed 44V. The protection diode for the negative supply is not required when  $V_-$  is connected to GND.

### Off-Isolation at High Frequencies

In 50 $\Omega$  systems, the high-frequency on-response of these parts extends from DC to above 100MHz, with a typical loss of -2dB. When the switch is turned off, however, it behaves like a capacitor, and off-isolation decreases with increasing frequency. This effect is more pronounced with higher source and load impedances. Above 5MHz, circuit board layout becomes critical. The graphs shown in the *Typical Operating Characteristics* were taken using a 50 $\Omega$  source and load connected with BNC connectors.

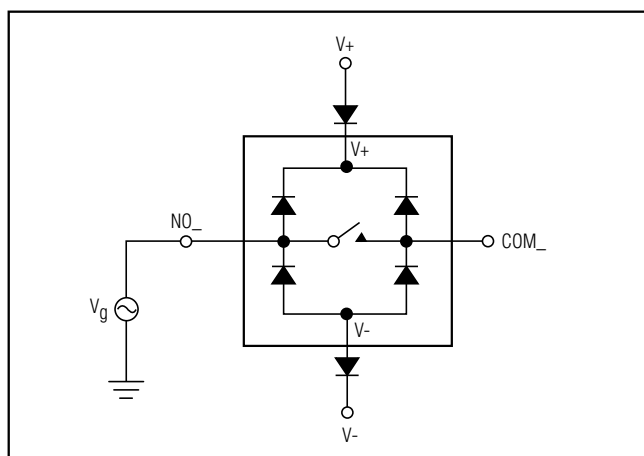


Figure 1. Overvoltage Protection Using Blocking Diodes

# High-Current, $10\Omega$ , SPST, CMOS Analog Switches

## Test Circuits/Timing Diagrams

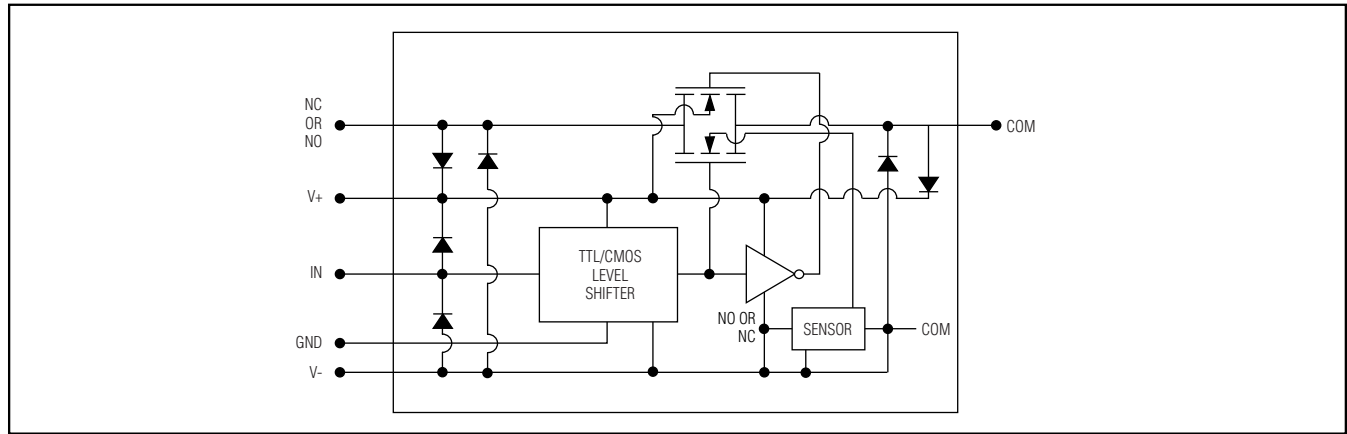


Figure 2. Block Diagram

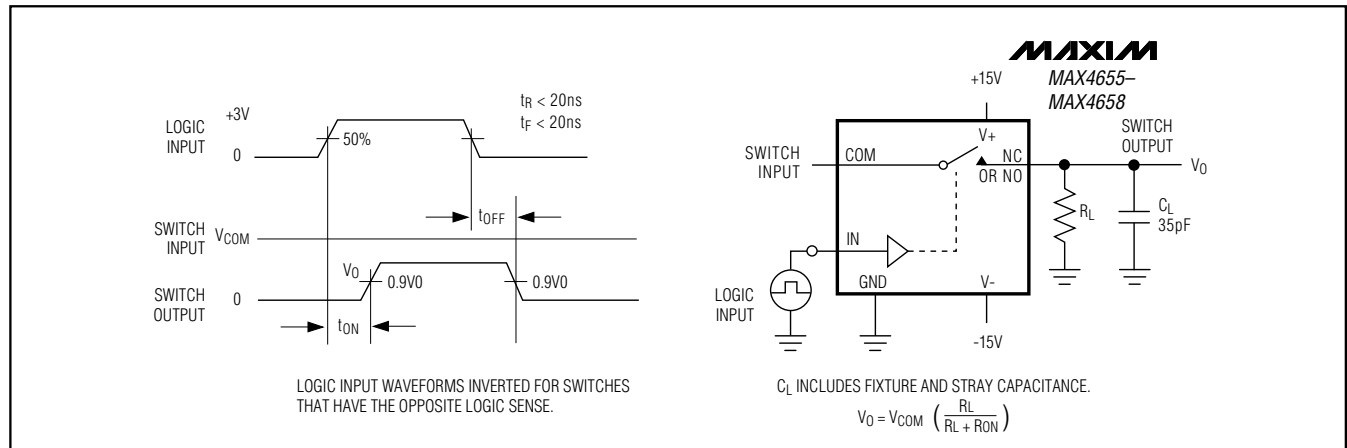


Figure 3. Switching Time

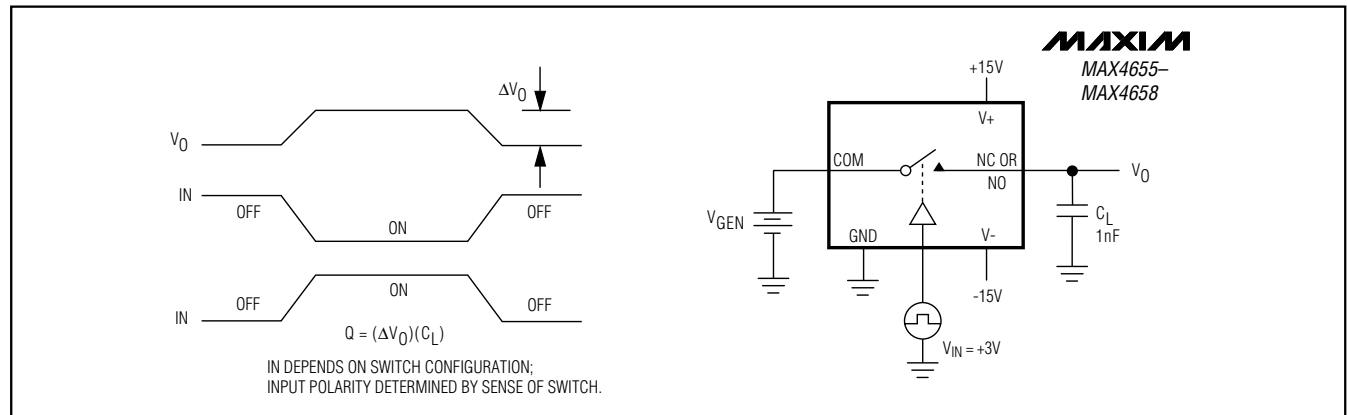


Figure 4. Charge Injection



# High-Current, $10\Omega$ , SPST, CMOS Analog Switches

## Test Circuits/Timing Diagrams (continued)

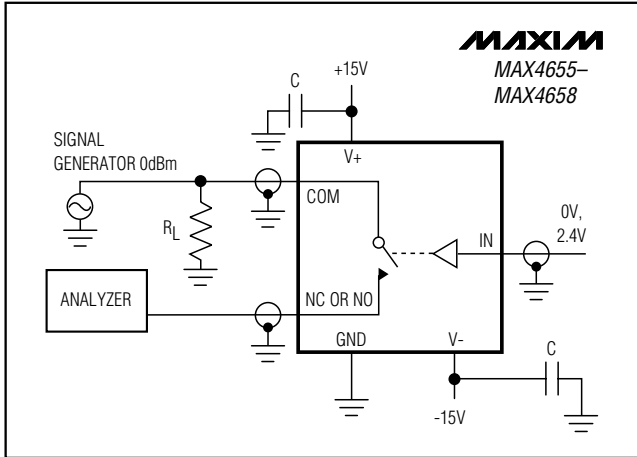


Figure 5. Off-Isolation

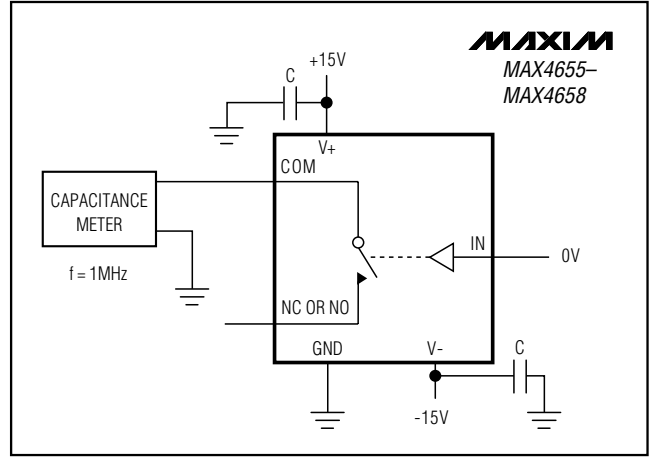


Figure 7. Channel On-Capacitance

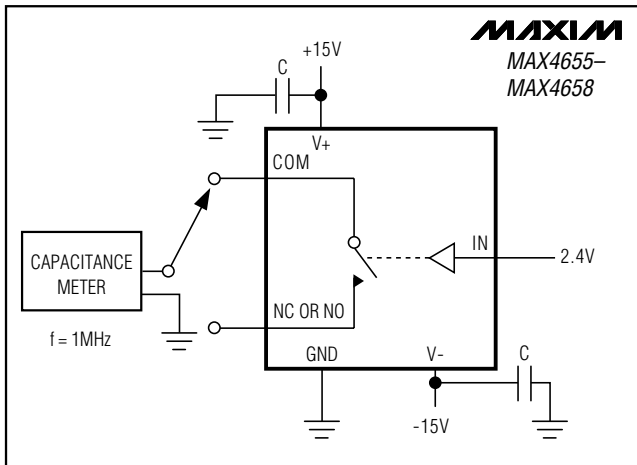


Figure 6. Channel Off-Capacitance

## Chip Information

TRANSISTOR COUNT: 45

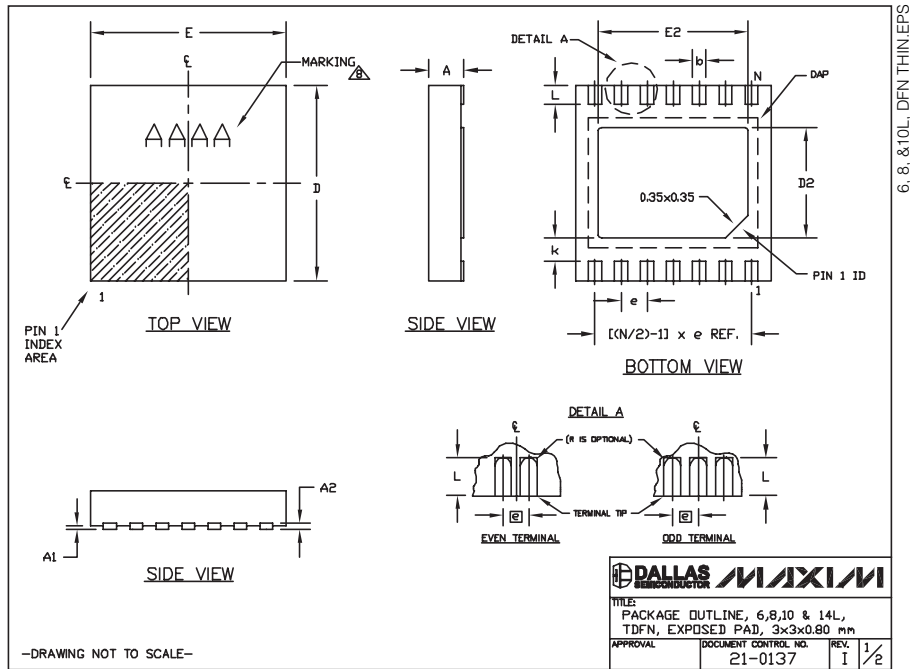
PROCESS: CMOS

MAX4655-MAX4658

# High Current, $10\Omega$ , SPST, 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).)



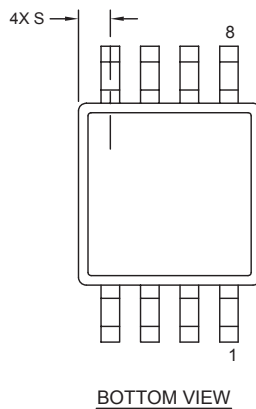
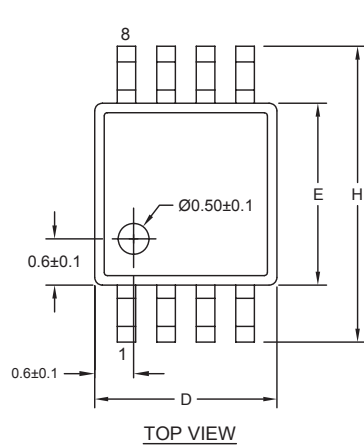
# High Current, 10Ω, SPST, CMOS Analog Switches

## Package Information (continued)

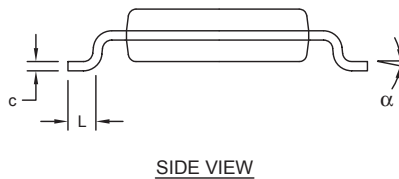
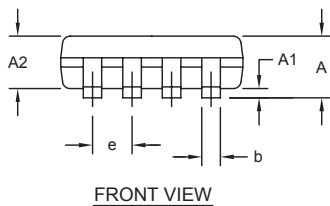
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

MAX4655-MAX4658

8LUMAXD.EPS



| DIM | INCHES     |       | MILLIMETERS |      |
|-----|------------|-------|-------------|------|
|     | MIN        | MAX   | MIN         | MAX  |
| A   | -          | 0.043 | -           | 1.10 |
| A1  | 0.002      | 0.006 | 0.05        | 0.15 |
| A2  | 0.030      | 0.037 | 0.75        | 0.95 |
| b   | 0.010      | 0.014 | 0.25        | 0.36 |
| c   | 0.005      | 0.007 | 0.13        | 0.18 |
| D   | 0.116      | 0.120 | 2.95        | 3.05 |
| e   | 0.0256 BSC |       | 0.65 BSC    |      |
| E   | 0.116      | 0.120 | 2.95        | 3.05 |
| H   | 0.188      | 0.198 | 4.78        | 5.03 |
| L   | 0.016      | 0.026 | 0.41        | 0.66 |
| α   | 0°         | 6°    | 0°          | 6°   |
| S   | 0.0207 BSC |       | 0.5250 BSC  |      |



### NOTES:

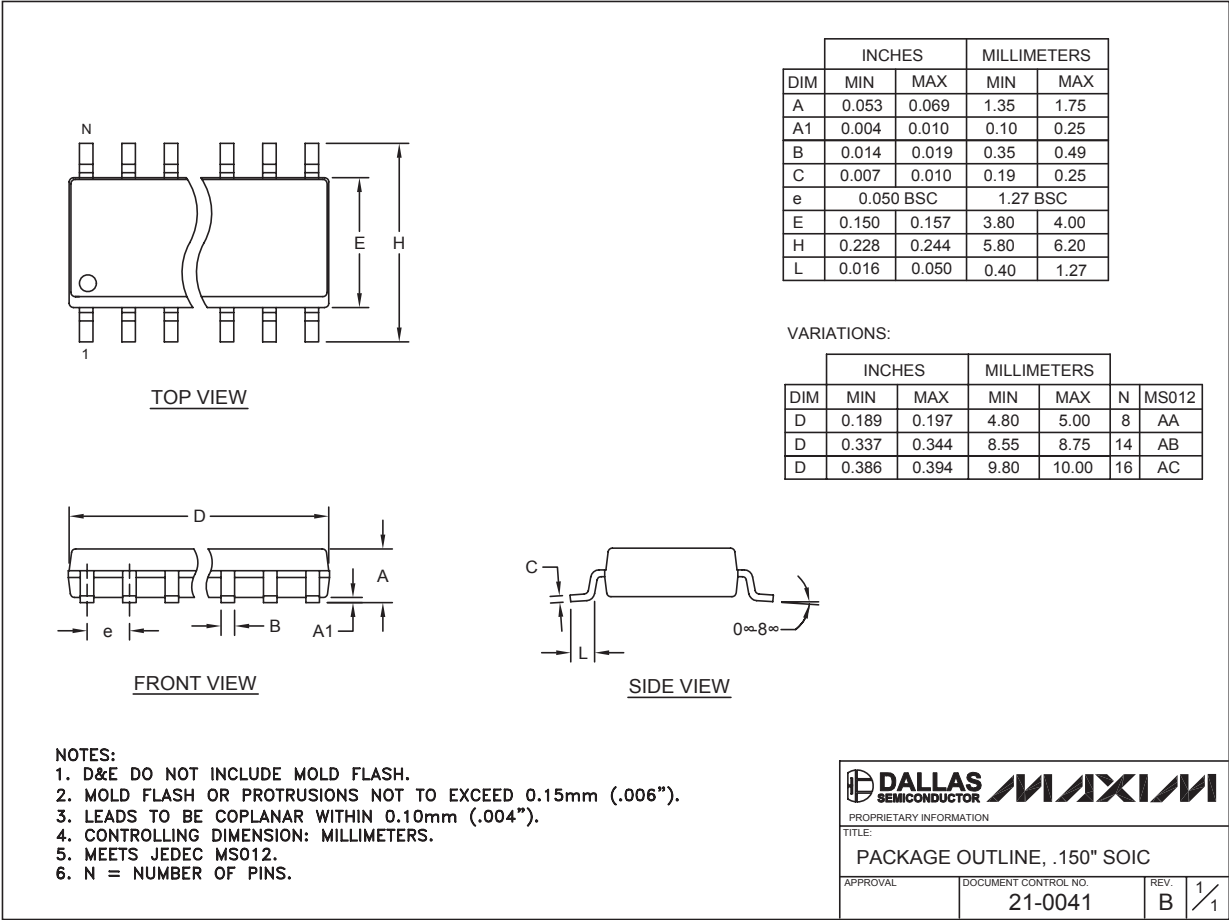
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15MM (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187C-AA.

|                                                               |                                                       |
|---------------------------------------------------------------|-------------------------------------------------------|
|                                                               |                                                       |
| <small>PROPRIETARY INFORMATION</small>                        |                                                       |
| <small>TITLE:</small><br><b>PACKAGE OUTLINE, 8L uMAX/uSOP</b> |                                                       |
| <small>APPROVAL</small>                                       | <small>DOCUMENT CONTROL NO.</small><br><b>21-0036</b> |
| <small>REV.</small><br><b>J</b>                               | <small>1/1</small>                                    |

# High Current, 10Ω, SPST, CMOS Analog Switches

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



SOICN.EPS

## Revision History

Pages changed at Rev 4: 1, 2, 3, 6, 12

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