



## Quad SPST CMOS Analog Switches

## General Description

The DG202/DG212 are normally open, quad single-pole single-throw (SPST) analog switches. These CMOS switches can be continuously operated with power supplies ranging from  $\pm 4.5\text{V}$  to  $\pm 18\text{V}$ . Maxim guarantees that these switches will not latch up if the power supplies are disconnected with input signals still connected.

The DG202/DG212 are similar to the DG201/DG211 except for inverted control inputs. All devices have guaranteed break-before-make switching, as well as essentially constant on-resistance over the analog signal range. All switches conduct current in either direction and add no offset to the output signal.

Compared to the original manufacturer's products, Maxim's DG202/DG212 consume very little power, making them better suited for portable applications. Maxim has also eliminated the need for the third logic power supply ( $V_L$ ) that is required for the operation of the original manufacturer's DG212 without sacrificing compatibility.

## Applications

## Analog Multiplexers

## Programmable Gain Amplifiers

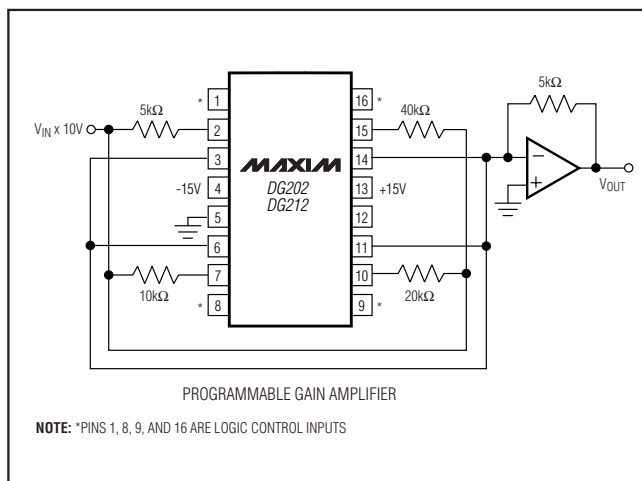
## Communications Systems

Sample/Holds

## Automatic Test Equipment

PBX, PABX

### Typical Operating Circuit



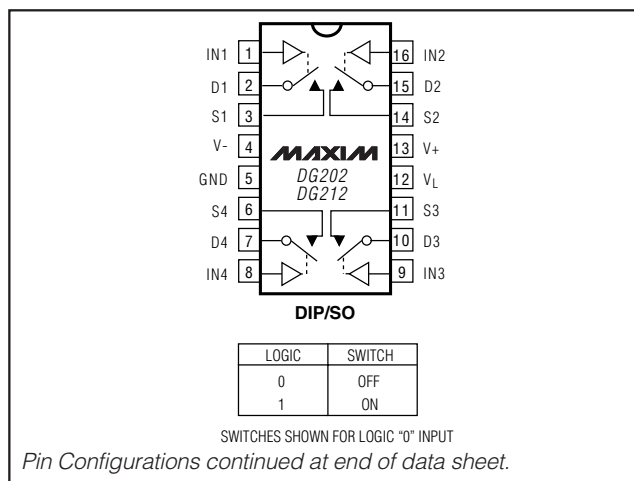
## Features

- ◆ **Guaranteed  $\pm 4.5\text{V}$  to  $\pm 18\text{V}$  Operation**
- ◆ **No  $V_L$  Supply Required**
- ◆ **Nonlatching with Supplies Turned Off and Input Signals Present**
- ◆ **CMOS and TTL Logic Compatible**
- ◆ **Monolithic, Low-Power CMOS Design**

## Ordering Information

| PART             | TEMP RANGE      | PIN-PACKAGE        |
|------------------|-----------------|--------------------|
| <b>DG202</b> CUE | 0°C to +70°C    | 16 TSSOP           |
| DG202CSE         | 0°C to +70°C    | 16 SO              |
| DG202CJ          | 0°C to +70°C    | 16 Plastic DIP     |
| DG202C/D         | 0°C to +70°C    | Dice               |
| DG202AEGE        | -40°C to +85°C  | 16 QFN (5mm x 5mm) |
| DG202AEUE        | -40°C to +85°C  | 16 TSSOP           |
| DG202ADY         | -40°C to +85°C  | 16 SO              |
| DG202ADJ         | -40°C to +85°C  | 16 Plastic DIP     |
| DG202AK          | -55°C to +125°C | 16 Cerdip          |
| <b>DG212</b> CUE | 0°C to +70°C    | 16 TSSOP           |
| DG212CSE         | 0°C to +70°C    | 16 SO              |
| DG212CJ          | 0°C to +70°C    | 16 Plastic DIP     |
| DG212C/D         | 0°C to +70°C    | Dice               |
| DG212EGE         | -40°C to +85°C  | 16 QFN (5mm x 5mm) |
| DG212EUE         | -40°C to +85°C  | 16 TSSOP           |
| DG212DY          | -40°C to +85°C  | 16 SO              |
| DG212DJ          | -40°C to +85°C  | 16 Plastic DIP     |
| DG212ETE         | -40°C to +85°C  | 16 Thin QFN        |

## Pin Configurations



# Quad SPST CMOS Analog Switches

## ABSOLUTE MAXIMUM RATINGS (DG212)

|                                                                 |                                 |
|-----------------------------------------------------------------|---------------------------------|
| V <sub>+</sub> to V <sub>-</sub> .....                          | 44V                             |
| V <sub>IN</sub> to Ground.....                                  | V <sub>-</sub> , V <sub>+</sub> |
| V <sub>L</sub> to Ground.....                                   | -0.3V, 25V                      |
| V <sub>S</sub> or V <sub>D</sub> to V <sub>+</sub> .....        | 0, -40V                         |
| V <sub>S</sub> or V <sub>D</sub> to V <sub>-</sub> .....        | 0, 40V                          |
| V <sub>+</sub> to Ground.....                                   | 25V                             |
| V <sub>-</sub> to Ground.....                                   | -25V                            |
| Current, Any Terminal Except S or D.....                        | 30mA                            |
| Continuous Current, S or D.....                                 | 20mA                            |
| Peak Current, S or D<br>(pulsed at 1ms 10% duty cycle max)..... | 70mA                            |
| Storage Temperature Range.....                                  | -65°C to +125°C                 |

|                                                               |                |
|---------------------------------------------------------------|----------------|
| Operating Temperature Range                                   |                |
| DG212C .....                                                  | 0°C to +70°C   |
| DG212D/E .....                                                | -40°C to +85°C |
| Power Dissipation (T <sub>A</sub> = +70°C) (Note 1)           |                |
| 16-Pin Plastic Dip (derate 10.5mW/°C above +70°C) ..          | 842mW          |
| 16-Pin Narrow SO (derate 8.7mW/°C above +70°C) ..             | 696mW          |
| 16-Pin TSSOP (derate 9.4mW/°C above +70°C) .....              | 755mW          |
| 16-Pin QFN (5mm x 5mm)<br>(derate 19.2mW/°C above +70°C)..... | 1538mW         |
| 16-Pin Thin QFN<br>(derate 14.7mW/°C above +70°C).....        | 1177mW         |

**Note 1:** Device mounted with all leads soldered to PC board.

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 (DG212)

(V<sub>+</sub> = +15V, V<sub>-</sub> = -15V, GND = 0, T<sub>A</sub> = +25°C, unless otherwise noted.) (For more information on TYP values see Note 2.)

| PARAMETER                             | SYMBOL                  | CONDITIONS                                                                                              |                                             | MIN  | TYP     | MAX  | UNITS |
|---------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------|------|---------|------|-------|
| SWITCH                                |                         |                                                                                                         |                                             |      |         |      |       |
| Analog Signal Range                   | V <sub>ANALOG</sub>     |                                                                                                         |                                             | -15  |         | +15  | V     |
| Drain-Source ON-Resistance            | R <sub>DS (ON)</sub>    | V <sub>D</sub> = ±10V, V <sub>IN</sub> = 2.4V, I <sub>S</sub> = 1mA                                     |                                             |      | 115     | 175  | Ω     |
| Source OFF-Leakage Current            | I <sub>S (OFF)</sub>    | V <sub>IN</sub> = 0.8V                                                                                  | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V |      | 0.01    | 5.0  | nA    |
|                                       |                         |                                                                                                         | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -5.0 | -0.02   |      |       |
| Drain OFF-Leakage Current             | I <sub>D (OFF)</sub>    | V <sub>IN</sub> = 0.8V                                                                                  | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V |      | 0.01    | 5.0  |       |
|                                       |                         |                                                                                                         | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -5.0 | -0.02   |      |       |
| Drain ON-Leakage Current (Note 3)     | I <sub>D (ON)</sub>     | V <sub>S</sub> = V <sub>D</sub> = 14V, V <sub>IN</sub> = 2.4V                                           |                                             |      | 0.1     | 5.0  |       |
|                                       |                         | V <sub>S</sub> = V <sub>D</sub> = -14V, V <sub>IN</sub> = 2.4V                                          |                                             | -5.0 | -0.15   |      |       |
| INPUT                                 |                         |                                                                                                         |                                             |      |         |      |       |
| Input Current with Input Voltage High | I <sub>INH</sub>        | V <sub>IN</sub> = 2.4V                                                                                  |                                             | -1.0 | -0.0004 |      | μA    |
|                                       |                         | V <sub>IN</sub> = 15V                                                                                   |                                             |      | 0.003   | 1.0  |       |
| Input Current with Input Voltage Low  | I <sub>INL</sub>        | V <sub>IN</sub> = 0                                                                                     |                                             | -1.0 | -0.0004 |      |       |
| DYNAMIC                               |                         |                                                                                                         |                                             |      |         |      |       |
| Turn-ON Time                          | t <sub>ON</sub>         | See Switching Time Test Circuit<br>V <sub>S</sub> = 2V, R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 35pF     |                                             |      | 460     | 1000 | ns    |
| Turn-OFF Time                         | t <sub>OFF1</sub>       |                                                                                                         |                                             |      | 360     | 500  |       |
|                                       | t <sub>OFF2</sub>       |                                                                                                         |                                             |      | 450     |      |       |
| Source OFF-Capacitance                | C <sub>S (OFF)</sub>    | V <sub>S</sub> = 0, V <sub>IN</sub> = 0, f = 1MHz                                                       |                                             |      | 5       |      | pF    |
| Drain OFF-Capacitance                 | C <sub>D (OFF)</sub>    | V <sub>D</sub> = 0, V <sub>IN</sub> = 0, f = 1MHz                                                       |                                             |      | 5       |      |       |
| Channel ON-Capacitance                | C <sub>D + S (ON)</sub> | V <sub>D</sub> = V <sub>S</sub> = 0, V <sub>IN</sub> = 5V, f = 1MHz                                     |                                             |      | 16      |      |       |
| OFF-Isolation (Note 4)                | OIRR                    | V <sub>IN</sub> = 0, R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 15pF,<br>V <sub>S</sub> = 1VRMS, f = 100kHz |                                             |      | 70      |      | dB    |
| Crosstalk (Channel to Channel)        | CCRR                    |                                                                                                         |                                             |      | 90      |      |       |

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## ELECTRICAL CHARACTERISTICS (DG212) (continued)

(V+ = +15V, V- = -15V, GND = 0, TA = +25°C, unless otherwise noted.) (For more information on TYP values see Note 2.)

| PARAMETER                                   | SYMBOL | CONDITIONS             | MIN  | TYP  | MAX   | UNITS |
|---------------------------------------------|--------|------------------------|------|------|-------|-------|
| <b>SUPPLY</b>                               |        |                        |      |      |       |       |
| Positive Supply Current                     | I+     | VIN = 0 and 2.4V (all) |      | 0.02 | 0.4   | mA    |
| Negative Supply Current                     | I-     |                        |      | 0.01 | 0.4   |       |
| Logic Supply Current                        | IL     |                        |      | 0    | 0     |       |
| Power-Supply Range for Continuous Operation | VOP    |                        | ±4.5 |      | ±18.0 | V     |

**Note 2:** Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

**Note 3:** ID(ON) is leakage from driver into "ON" switch.

**Note 4:** OFF-Isolation = 20 log VS/VD, VS = input to OFF switch, VD = output.

## ABSOLUTE MAXIMUM RATINGS (DG202)

Voltages Reference to V-

|                                                                 |                                                     |
|-----------------------------------------------------------------|-----------------------------------------------------|
| V+.....                                                         | 44V                                                 |
| GND.....                                                        | 25V                                                 |
| Digital Inputs (Note 1), VS, VD.....                            | -2V to (V+ + 2V)<br>or 20mA, whichever occurs first |
| Current, Any Terminal Except S or D.....                        | 30mA                                                |
| Continuous Current, S or D.....                                 | 20mA                                                |
| Peak Current, S or D<br>(pulsed at 1ms 10% duty cycle max)..... | 70mA                                                |

Operating Temperature Range

|                                                       |                 |
|-------------------------------------------------------|-----------------|
| DG202C .....                                          | 0°C to +70°C    |
| DG202D/E.....                                         | -40°C to +85°C  |
| DG202A .....                                          | -55°C to +125°C |
| Storage Temperature Range.....                        | -65°C to +150°C |
| Power Dissipation (Note 2)                            |                 |
| 16-Pin Plastic Dip (derate 10.5mW/°C above +70°C) ... | 842mW           |
| 16-Pin SO (derate 8.7mW/°C above +70°C) .....         | 696mW           |
| 16-Pin TSSOP (derate 9.4mW/°C above +70°C) .....      | 755mW           |
| 16-Pin QFN (5 × 5)                                    |                 |
| (derate 19.2mW/°C above +70°C).....                   | 1538mW          |
| 16-Pin CERP (derate 10.0mW/°C above +70°C).....       | 800mW           |

**Note 1:** Signals on S, D, or IN\_ exceeding V+ or V- on Maxim's DG202 will be clamped by internal diodes, and are also internally current limited to 25mA.

**Note 2:** Device mounted with all leads soldered to PC board.

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 (DG202)

(V+ = +15V, V- = -15V, GND = 0, TA = +25°C, unless otherwise noted.) (For more information on TYP values see Note 3.)

| PARAMETER                         | SYMBOL               | CONDITIONS                                                          |                                             | DG202A |       |     | DG202C, D, E |       |     | UNITS |
|-----------------------------------|----------------------|---------------------------------------------------------------------|---------------------------------------------|--------|-------|-----|--------------|-------|-----|-------|
|                                   |                      |                                                                     |                                             | MIN    | TYP   | MAX | MIN          | TYP   | MAX |       |
| SWITCH                            |                      |                                                                     |                                             |        |       |     |              |       |     |       |
| Analog Signal Range               | V <sub>ANALOG</sub>  |                                                                     |                                             | -15    |       | 15  | -15          |       | 15  | V     |
| Drain-Source ON Resistance        | R <sub>DS (ON)</sub> | V <sub>D</sub> = ±10V, V <sub>IN</sub> = 2.4V, I <sub>S</sub> = 1mA |                                             |        | 115   | 175 |              | 115   | 200 | Ω     |
| Source OFF-Leakage Current        | I <sub>S (OFF)</sub> | V <sub>IN</sub> = 0.8V                                              | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V |        | 0.01  | 1.0 |              | 0.01  | 5.0 | nA    |
|                                   |                      |                                                                     | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -1.0   | -0.02 |     | -1.0         | -0.02 |     |       |
| Drain OFF-Leakage Current         | I <sub>D (OFF)</sub> | V <sub>IN</sub> = 0.8V                                              | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V |        | 0.01  | 1.0 |              | 0.01  | 5.0 |       |
|                                   |                      |                                                                     | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -1.0   | -0.02 |     | -1.0         | -0.02 |     |       |
| Drain ON-Leakage Current (Note 4) | I <sub>D (ON)</sub>  | V <sub>IN</sub> = 2.4V                                              | V <sub>S</sub> = -14V                       |        | 0.1   | 1.0 |              | 0.1   | 1.0 |       |
|                                   |                      |                                                                     | V <sub>S</sub> = 14V                        | -1.0   |       |     | -5.0         |       |     |       |

# Quad SPST CMOS Analog Switches

## ELECTRICAL CHARACTERISTICS (DG202) (continued)

(V+ = +15V, V- = -15V, GND = 0, T<sub>A</sub> = +25°C, unless otherwise noted.) (For more information on TYP values see Note 3.)

| PARAMETER                                   | SYMBOL                                    | CONDITIONS                                                          |            | DG202A |         |       | DG202C, D, E |         |       | UNITS |     |
|---------------------------------------------|-------------------------------------------|---------------------------------------------------------------------|------------|--------|---------|-------|--------------|---------|-------|-------|-----|
|                                             |                                           |                                                                     |            | MIN    | TYP     | MAX   | MIN          | TYP     | MAX   |       |     |
| INPUT                                       |                                           |                                                                     |            |        |         |       |              |         |       |       |     |
| Input Current with Input Voltage High       | I <sub>INH</sub>                          | V <sub>IN</sub> = 2.4V                                              |            | -1.0   | -0.0004 |       | -1.0         | -0.0004 |       | μA    |     |
|                                             |                                           | V <sub>IN</sub> = 15V                                               |            | 0.003  |         | 1.0   |              | 0.003   |       |       | 1.0 |
| Input Current with Input Voltage Low        | I <sub>INL</sub>                          | V <sub>IN</sub> = 0                                                 |            | -1.0   | -0.0004 |       | -1.0         | -0.0004 |       |       |     |
| DYNAMIC                                     |                                           |                                                                     |            |        |         |       |              |         |       |       |     |
| Turn-ON Time                                | t <sub>ON</sub>                           | See Figure 1 Switching Time Test Circuit                            |            |        | 480     | 600   |              | 480     | 600   |       | ns  |
| Turn-OFF Time                               | t <sub>OFF1</sub>                         |                                                                     |            |        | 370     | 450   |              | 370     | 450   |       |     |
| Charge Injection                            | Q                                         | C <sub>L</sub> = 1000pF, V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0 |            |        | 20      |       | 20           |         | pC    |       |     |
| Source OFF-Capacitance                      | C <sub>S (OFF)</sub>                      | V <sub>S</sub> = 0,                                                 | f = 140kHz |        |         | 5     |              | 5       |       | pF    |     |
| Drain OFF-Capacitance                       | C <sub>D (OFF)</sub>                      | V <sub>IN</sub> = 0                                                 |            |        |         | 5     |              | 5       |       |       |     |
| Channel ON-Capacitance                      | C <sub>D (ON)</sub> + C <sub>S (ON)</sub> | V <sub>D</sub> = V <sub>S</sub> = 0, V <sub>IN</sub> = 5V           |            |        |         | 16    |              | 16      |       |       |     |
| OFF-Isolation                               |                                           | V <sub>IN</sub> = 0, Z <sub>L</sub> = 75Ω                           |            |        | 70      |       | 70           |         | dB    |       |     |
| Crosstalk (Channel to Channel)              |                                           | V <sub>S</sub> = 2.0V, f = 100kHz                                   |            |        | 90      |       | 90           |         |       |       |     |
| SUPPLY                                      |                                           |                                                                     |            |        |         |       |              |         |       |       |     |
| Positive Supply Current                     | I+                                        | All channels ON or OFF                                              |            |        | 0.02    | 0.1   |              | 0.02    | 0.1   |       | mA  |
| Negative Supply Current                     | I-                                        | All channels ON or OFF                                              |            |        | -0.1    | -0.01 |              | -0.1    | -0.01 |       |     |
| Power-Supply Range for Continuous Operation | V <sub>OP</sub>                           |                                                                     |            |        | ±4.5    | ±18   |              | ±4.5    | ±18.0 |       | V   |

**Note 3:** Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

**Note 4:** I<sub>D (ON)</sub> is leakage from driver into "ON" switch.

# Quad SPST CMOS Analog Switches

## ELECTRICAL CHARACTERISTICS (DG202)

(V+ = +15V, V- = -15V, GND = 0, T<sub>A</sub> = full operating temperature range, unless otherwise noted.) (For more information on TYP values see Note 3.)

| PARAMETER                             | SYMBOL               | CONDITIONS                                                          |                                             | DG202A |     |     | DG202C, D, E |     |     | UNITS |
|---------------------------------------|----------------------|---------------------------------------------------------------------|---------------------------------------------|--------|-----|-----|--------------|-----|-----|-------|
|                                       |                      |                                                                     |                                             | MIN    | TYP | MAX | MIN          | TYP | MAX |       |
| SWITCH                                |                      |                                                                     |                                             |        |     |     |              |     |     |       |
| Analog Signal Range                   | V <sub>ANALOG</sub>  |                                                                     |                                             | -15    |     | +15 | -15          |     | +15 | V     |
| Drain-Source ON Resistance (Note 5)   | R <sub>DS (ON)</sub> | V <sub>D</sub> = ±10V, V <sub>IN</sub> = 2.4V, I <sub>S</sub> = 1mA |                                             | 250    |     |     | 250          |     |     | Ω     |
| Source OFF-Leakage Current            | I <sub>S (OFF)</sub> | V <sub>IN</sub> = 0.8V                                              | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V | 100    |     |     | 100          |     |     | nA    |
|                                       |                      |                                                                     | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -100   |     |     | -100         |     |     |       |
| Drain OFF-Leakage Current             | I <sub>D (OFF)</sub> | V <sub>IN</sub> = 0.8V                                              | V <sub>S</sub> = 14V, V <sub>D</sub> = -14V | 100    |     |     | 100          |     |     |       |
|                                       |                      |                                                                     | V <sub>S</sub> = -14V, V <sub>D</sub> = 14V | -100   |     |     | -100         |     |     |       |
| Drain ON-Leakage Current (Note 6)     | I <sub>D (ON)</sub>  | V <sub>IN</sub> = 2.4V                                              | V <sub>S</sub> = -14V                       | 200    |     |     | 200          |     |     |       |
|                                       |                      |                                                                     | V <sub>D</sub> = 14V                        | -200   |     |     | -200         |     |     |       |
| INPUT                                 |                      |                                                                     |                                             |        |     |     |              |     |     |       |
| Input Current with Input Voltage High | I <sub>INH</sub>     | V <sub>IN</sub> = 2.4V                                              |                                             | -1.0   |     |     | -1.0         |     |     | μA    |
|                                       |                      | V <sub>IN</sub> = 15V                                               |                                             | 1.0    |     |     | 1.0          |     |     |       |
| Input Current with Input Voltage Low  | I <sub>INL</sub>     | V <sub>IN</sub> = 0                                                 |                                             | -1.0   |     |     | -1.0         |     |     |       |

**Note 5:** Electrical characteristics, such as On-Resistance, will change when power supplies other than ±15V, are used.

**Note 6:** I<sub>D (ON)</sub> is leakage from driver into "ON" switch.

## Pin Description

| PIN          |              | NAME    | FUNCTION                                                        |
|--------------|--------------|---------|-----------------------------------------------------------------|
| DIP/SO/TSSOP | QFN/TQFN     |         |                                                                 |
| 1, 16, 9, 8  | 15, 14, 7, 6 | IN1–IN4 | Input                                                           |
| 2, 15, 10, 7 | 16, 13, 8, 5 | D1–D4   | Analog Switch Drain Terminal                                    |
| 3, 14, 11, 6 | 1, 12, 9, 4  | S1–S4   | Analog Switch Source Terminal                                   |
| 4            | 2            | V-      | Negative-Supply Voltage Input                                   |
| 5            | 3            | GND     | Ground                                                          |
| 12           | 10           | N.C.    | No Connection                                                   |
| 13           | 11           | V+      | Positive-Supply Voltage Input—Connected to Substrate            |
| —            | EP           | EP      | Exposed Pad. Connect exposed pad to V+ or leave EP unconnected. |

## Switching Time Test Circuit

Switch output waveform shown for V<sub>S</sub> = constant with logic input waveform as shown. Note that V<sub>S</sub> may be +ve or -ve as per switching times test circuit. V<sub>O</sub> is the steady state output with switch on. Feedthrough via gate capacitance may result in spikes at leading and trailing edge of output waveform.

## Protecting Against Fault Conditions

Fault conditions occur when power supplies are turned off when input signals are still present, or when over-voltages occur at the inputs during normal operation. In either case, source-to-body diodes can be forward biased and conduct current from the signal source. If

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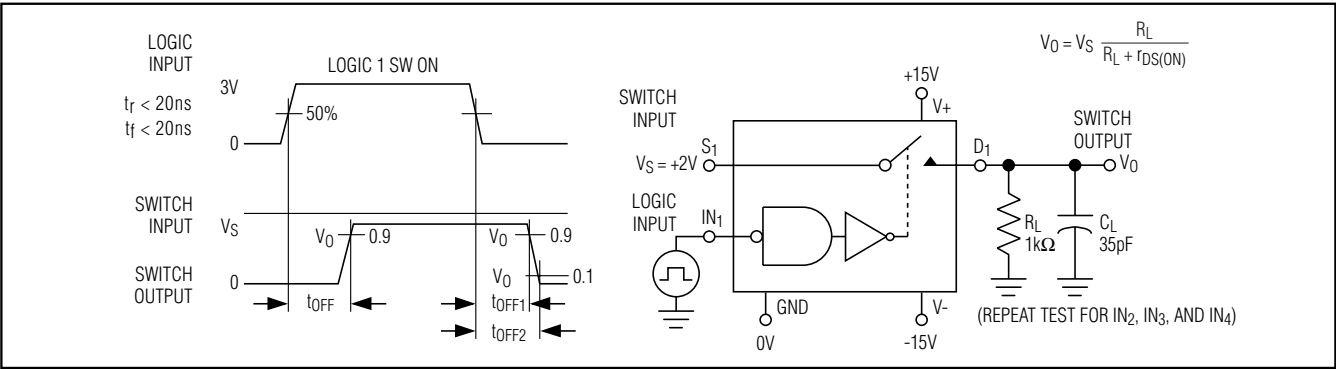


Figure 1. Switching Time

## Typical RDS(ON) vs. Power Supplies for Maxim's DG202, and DG212

| POWER SUPPLIES   | RDS(ON) AT ANALOG SIGNAL LEVEL |              |              |              |              |              |
|------------------|--------------------------------|--------------|--------------|--------------|--------------|--------------|
|                  | -5V                            | +5V          | -10V         | +10V         | -15V         | +15V         |
| $\pm 5\text{V}$  | 350 $\Omega$                   | 380 $\Omega$ | —            | —            | —            | —            |
| $\pm 10\text{V}$ | —                              | —            | 165 $\Omega$ | 250 $\Omega$ | —            | —            |
| $\pm 15\text{V}$ | —                              | —            | 125 $\Omega$ | 160 $\Omega$ | 135 $\Omega$ | 155 $\Omega$ |

this current is required to be kept to low ( $\mu\text{A}$ ) levels then the addition of external protection diodes is recommended.

To provide protection for overvoltages up to 20V above the supplies, a 1N4001 or 1N914 type diode should be placed in series with the positive and negative supplies as shown in Figure 2. The addition of these diodes will reduce the analog signal range to 1V below the positive supply and 1V above the negative supply.

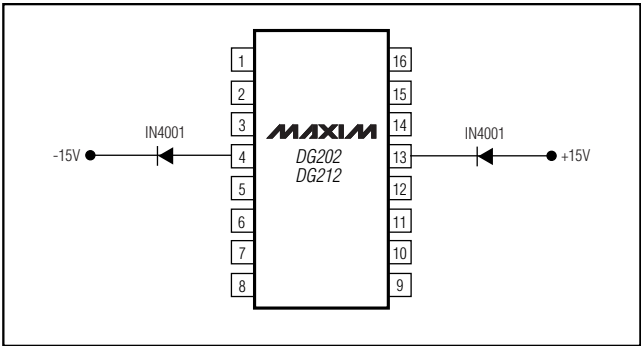
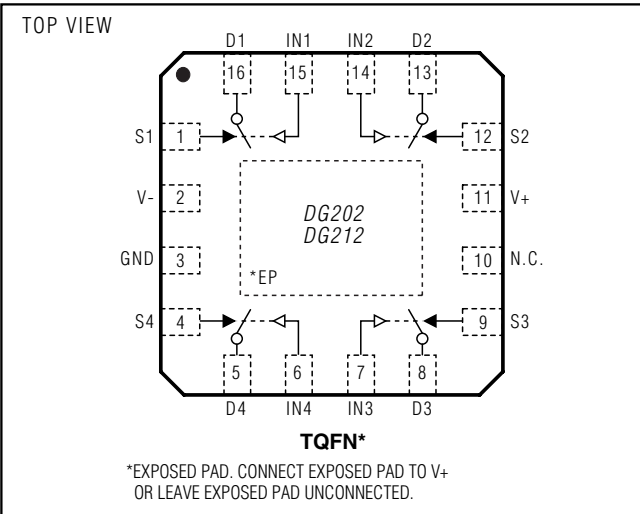


Figure 2. Protection against Fault Conditions

## Pin Configurations (continued)



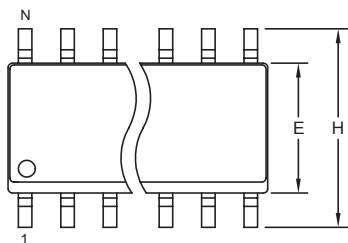
# Quad SPST CMOS Analog Switches

## Package Information

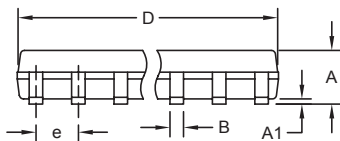
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

DG202/DG212

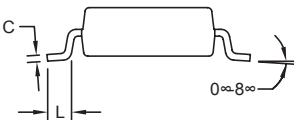
SOICN EPSS



TOP VIEW



FRONT VIEW



SIDE VIEW

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.053     | 0.069 | 1.35        | 1.75 |
| A1  | 0.004     | 0.010 | 0.10        | 0.25 |
| B   | 0.014     | 0.019 | 0.35        | 0.49 |
| C   | 0.007     | 0.010 | 0.19        | 0.25 |
| e   | 0.050 BSC |       | 1.27 BSC    |      |
| E   | 0.150     | 0.157 | 3.80        | 4.00 |
| H   | 0.228     | 0.244 | 5.80        | 6.20 |
| L   | 0.016     | 0.050 | 0.40        | 1.27 |

### VARIATIONS:

| DIM | INCHES |       | MILLIMETERS |       | N  | MS012 |
|-----|--------|-------|-------------|-------|----|-------|
|     | MIN    | MAX   | MIN         | MAX   |    |       |
| D   | 0.189  | 0.197 | 4.80        | 5.00  | 8  | AA    |
| D   | 0.337  | 0.344 | 8.55        | 8.75  | 14 | AB    |
| D   | 0.386  | 0.394 | 9.80        | 10.00 | 16 | AC    |

### NOTES:

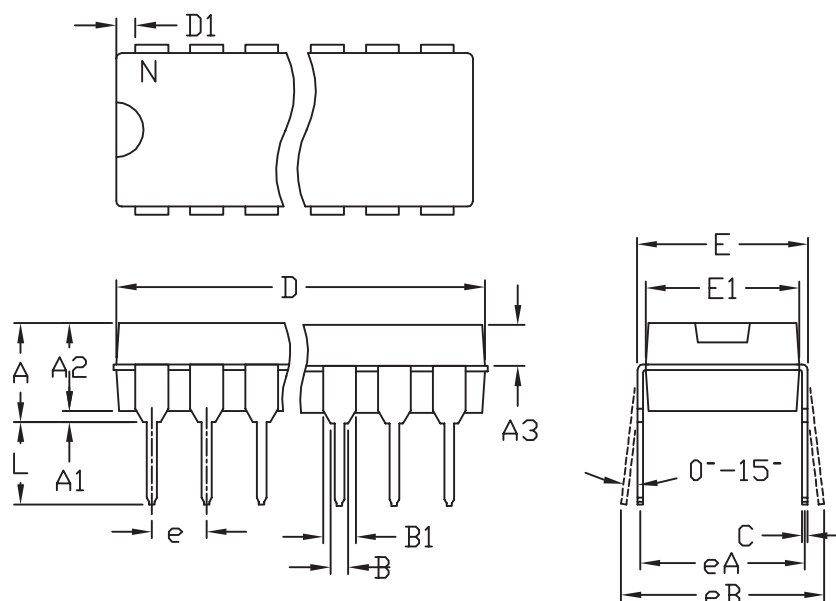
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

|                                       |                                 |
|---------------------------------------|---------------------------------|
|                                       |                                 |
| PROPRIETARY INFORMATION               |                                 |
| TITLE:<br>PACKAGE OUTLINE, .150" SOIC |                                 |
| APPROVAL                              | DOCUMENT CONTROL NO.<br>21-0041 |
| REV.<br>B                             | 1/1                             |

# Quad 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).)



PDIP/EP

|    | INCHES |       | MILLIMETERS |       |
|----|--------|-------|-------------|-------|
|    | MIN    | MAX   | MIN         | MAX   |
| A  | ---    | 0.180 | ---         | 4.572 |
| A1 | 0.015  | ---   | 0.38        | ---   |
| A2 | 0.125  | 0.175 | 3.18        | 4.45  |
| A3 | 0.055  | 0.080 | 1.40        | 2.03  |
| B  | 0.015  | 0.022 | 0.381       | 0.56  |
| B1 | 0.045  | 0.065 | 1.14        | 1.65  |
| C  | 0.008  | 0.014 | 0.2         | 0.355 |
| D1 | 0.005  | 0.080 | 0.13        | 2.03  |
| E  | 0.300  | 0.325 | 7.62        | 8.26  |
| E1 | 0.240  | 0.310 | 6.10        | 7.87  |
| e  | 0.100  | BSC.  | 2.54        | BSC.  |
| eA | 0.300  | BSC.  | 7.62        | BSC.  |
| eB | 0.400  | BSC.  | 10.16       | BSC.  |
| L  | 0.115  | 0.150 | 2.921       | 3.81  |

|   | INCHES |       | MILLIMETERS |       |    |       |
|---|--------|-------|-------------|-------|----|-------|
|   | MIN    | MAX   | MIN         | MAX   | N  | MS001 |
| D | 0.348  | 0.390 | 8.84        | 9.91  | 8  | AB    |
| D | 0.735  | 0.765 | 18.67       | 19.43 | 14 | AC    |
| D | 0.745  | 0.765 | 18.92       | 19.43 | 16 | AA    |
| D | 0.885  | 0.915 | 22.48       | 23.24 | 18 | AD    |
| D | 1.015  | 1.045 | 25.78       | 26.54 | 20 | AE    |
| D | 1.14   | 1.265 | 28.96       | 32.13 | 24 | AF    |
| D | 1.360  | 1.380 | 34.54       | 35.05 | 28 | *5    |

### NOTES:

1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC MS001-XX AS SHOWN IN ABOVE TABLE
5. SIMILAR TO JEDEC MO-058AB
6. N = NUMBER OF PINS



PACKAGE FAMILY OUTLINE: PDIP .300"

1/1

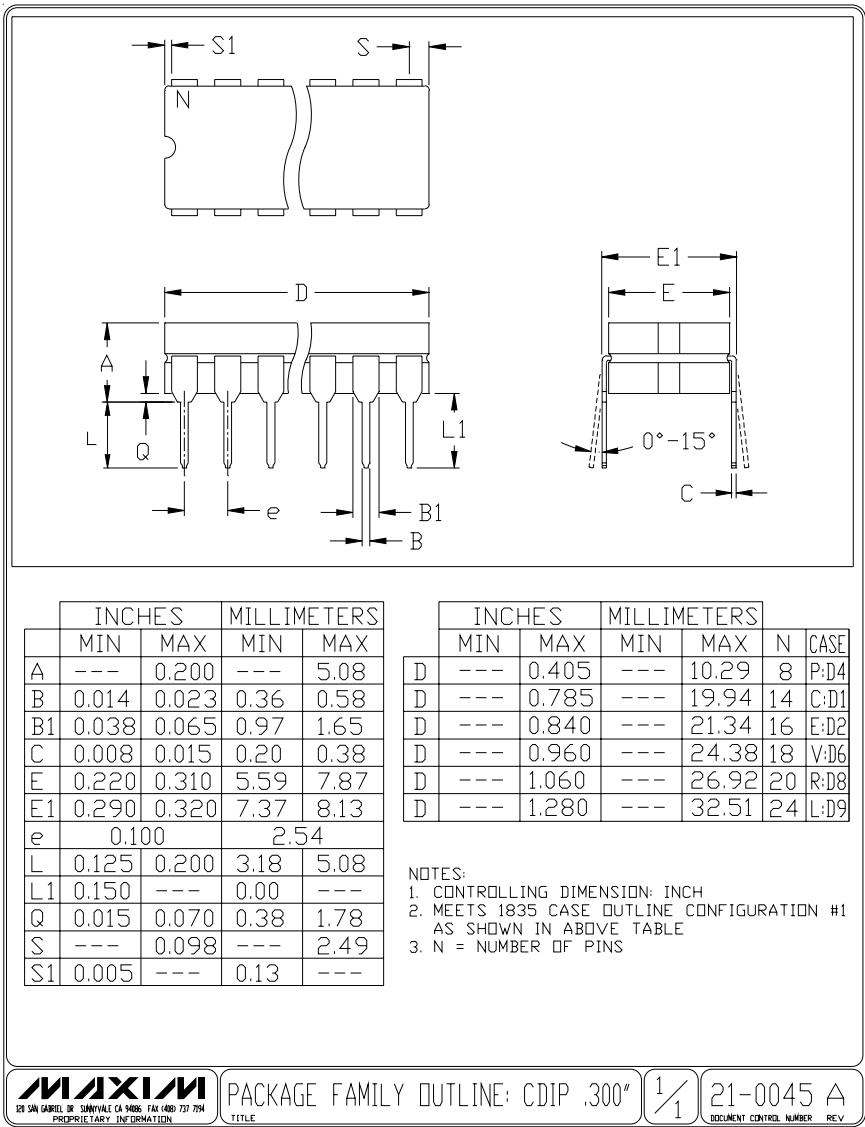
21-0043 D  
DOCUMENT CONTROL NUMBER REV

# Quad 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).)

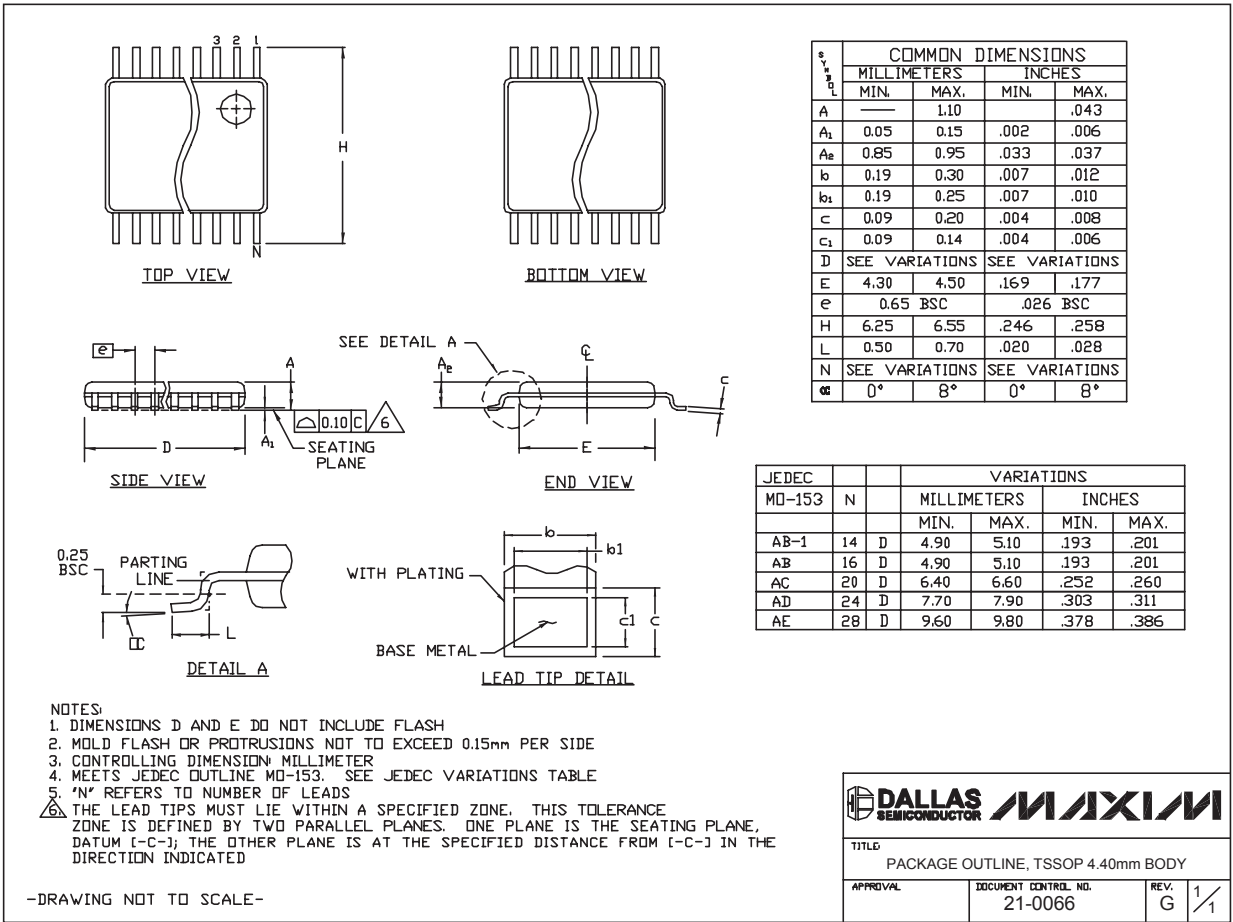
DG202/DG212



# Quad 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).)



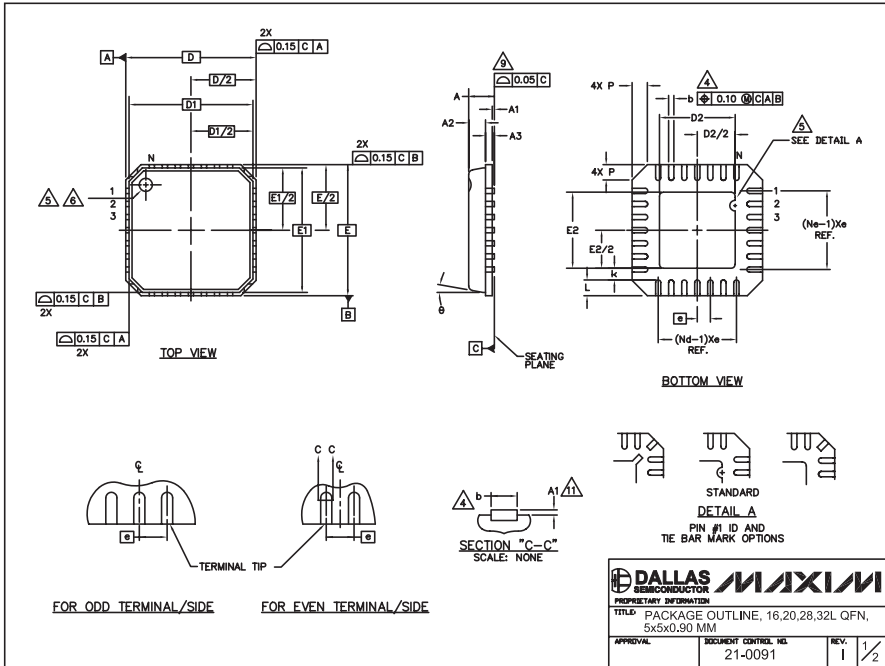
TSSOP4, 40mm, EPS

# Quad 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).)

DG202/DG212



| COMMON DIMENSIONS |          |      |      |          |      |      |          |      |      |          |      |      |
|-------------------|----------|------|------|----------|------|------|----------|------|------|----------|------|------|
| PKG               | 16L 5x5  |      |      | 20L 5x5  |      |      | 28L 5x5  |      |      | 32L 5x5  |      |      |
| SYMBOL            | MIN.     | NOM. | MAX. | MIN.     | NOM. | MAX. | MIN.     | NOM. | MAX. | MIN.     | NOM. | MAX. |
| A                 | 0.80     | 0.90 | 1.00 | 0.80     | 0.90 | 1.00 | 0.80     | 0.90 | 1.00 | 0.80     | 0.90 | 1.00 |
| A1                | 0.00     | 0.01 | 0.05 | 0.00     | 0.01 | 0.05 | 0.00     | 0.01 | 0.05 | 0.00     | 0.01 | 0.05 |
| A2                | 0.00     | 0.65 | 1.00 | 0.00     | 0.65 | 1.00 | 0.00     | 0.65 | 1.00 | 0.00     | 0.65 | 1.00 |
| A3                | 0.20 REF |      |      | 0.20 REF |      |      | 0.20 REF |      |      | 0.20 REF |      |      |
| b                 | 0.28     | 0.33 | 0.40 | 0.23     | 0.28 | 0.35 | 0.18     | 0.23 | 0.30 | 0.18     | 0.23 | 0.30 |
| D                 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 |
| D1                | 4.75 BSC |      |      | 4.75 BSC |      |      | 4.75 BSC |      |      | 4.75 BSC |      |      |
| E                 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 | 4.90     | 5.00 | 5.10 |
| E1                | 4.75 BSC |      |      | 4.75 BSC |      |      | 4.75 BSC |      |      | 4.75 BSC |      |      |
| e                 | 0.80 BSC |      |      | 0.65 BSC |      |      | 0.50 BSC |      |      | 0.50 BSC |      |      |
| k                 | 0.25     | —    | —    | 0.25     | —    | —    | 0.25     | —    | —    | 0.25     | —    | —    |
| L                 | 0.35     | 0.55 | 0.75 | 0.35     | 0.55 | 0.75 | 0.35     | 0.55 | 0.75 | 0.30     | 0.40 | 0.50 |
| N                 | 16       |      |      | 20       |      |      | 28       |      |      | 32       |      |      |
| ND                | 4        |      |      | 5        |      |      | 7        |      |      | 8        |      |      |
| NE                | 4        |      |      | 5        |      |      | 7        |      |      | 8        |      |      |
| P                 | 0.00     | 0.42 | 0.60 | 0.00     | 0.42 | 0.60 | 0.00     | 0.42 | 0.60 | 0.00     | 0.42 | 0.60 |
| θ                 | 0°       | 12°  | 0°   | 12°      | 0°   | 12°  | 0°       | 12°  | 0°   | 12°      | 0°   | 12°  |

| EXPOSED PAD VARIATIONS |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|
| PKG CODES              | D2   |      |      | E2   |      |      |
|                        | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| G1655-3                | 2.95 | 3.10 | 3.25 | 2.95 | 3.10 | 3.25 |
| G2055-1                | 2.55 | 2.70 | 2.85 | 2.55 | 2.70 | 2.85 |
| G2055-2                | 2.95 | 3.10 | 3.25 | 2.95 | 3.10 | 3.25 |
| G2855-1                | 2.55 | 2.70 | 2.85 | 2.55 | 2.70 | 2.85 |
| G2855-2                | 2.95 | 3.10 | 3.25 | 2.95 | 3.10 | 3.25 |
| G3255-1                | 2.95 | 3.10 | 3.25 | 2.95 | 3.10 | 3.25 |

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.
4. ND IS THE NUMBER OF TERMINALS IN X-DIRECTION & Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
5. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
6. THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN ZONE INDICATED.
7. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
8. ALL DIMENSIONS ARE IN MILLIMETERS.
9. PACKAGE WARPAGE MAX 0.05mm.
10. APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDED PART OF EXPOSED PAD FROM MEASURING.
11. MEETS JEDEC MO220; EXCEPT DIMENSION "b".
12. APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
13. THIS PACKAGE OUTLINE APPLIES TO ANVIL SINGULATION (STEPPED SIDES).

DALLAS MAXIM SEMICONDUCTOR

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 16,20,28,32L QFN, 5x5x0.90 MM

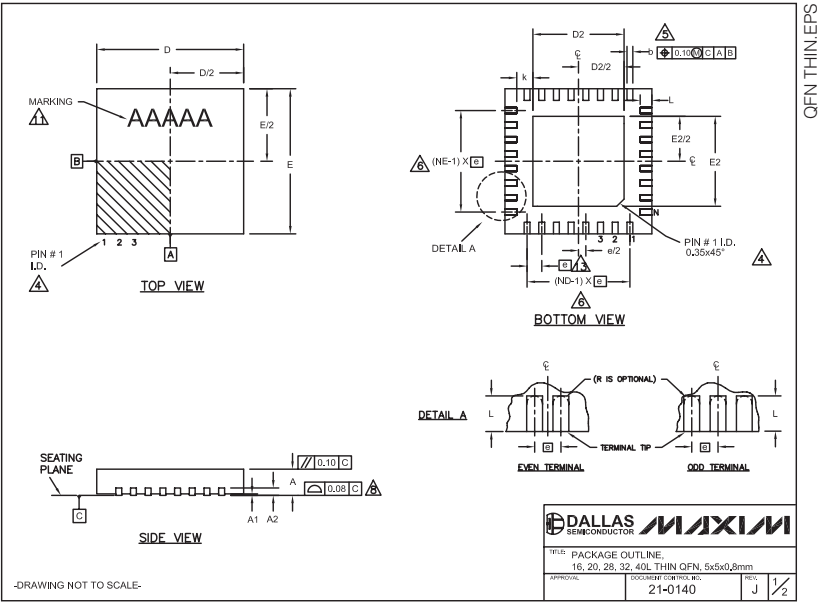
APPROVAL: 21-0091

REV: 1 1/2

Quad 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).)



| COMMON DIMENSIONS |           |      |      |           |      |      |           |      |      |           |      |      |
|-------------------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|------|------|
| PKG.              | 16L 5x5   |      |      | 20L 5x5   |      |      | 28L 5x5   |      |      | 32L 5x5   |      |      |
| SYMBOL            | MIN.      | NOM. | MAX. | MIN.      | NOM. | MAX. | MIN.      | NOM. | MAX. | MIN.      | NOM. | MAX. |
| A                 | 0.70      | 0.75 | 0.80 | 0.70      | 0.75 | 0.80 | 0.70      | 0.75 | 0.80 | 0.70      | 0.75 | 0.80 |
| A1                | 0         | 0.02 | 0.05 | 0         | 0.02 | 0.05 | 0         | 0.02 | 0.05 | 0         | 0.02 | 0.05 |
| A2                | 0.20 REF. |      |      | 0.20 REF. |      |      | 0.20 REF. |      |      | 0.20 REF. |      |      |
| b                 | 0.25      | 0.30 | 0.35 | 0.25      | 0.30 | 0.35 | 0.25      | 0.30 | 0.35 | 0.25      | 0.30 | 0.35 |
| D                 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 |
| E                 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 | 4.90      | 5.00 | 5.10 |
| e                 | 0.80 BSC. |      |      | 0.80 BSC. |      |      | 0.80 BSC. |      |      | 0.80 BSC. |      |      |
| k                 | 0.25      | -    | -    | 0.25      | -    | -    | 0.25      | -    | -    | 0.25      | -    | -    |
| L                 | 0.30      | 0.40 | 0.50 | 0.45      | 0.55 | 0.65 | 0.30      | 0.40 | 0.50 | 0.30      | 0.40 | 0.50 |
| N                 | 16        |      |      | 20        |      |      | 28        |      |      | 32        |      |      |
| ND                | 4         |      |      | 5         |      |      | 7         |      |      | 8         |      |      |
| NE                | 4         |      |      | 5         |      |      | 7         |      |      | 8         |      |      |
| JEDEC             | WHHB      |      |      | WHHC      |      |      | WHHD-1    |      |      | WHHD-2    |      |      |

| EXPOSED PAD VARIATIONS |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| PKG. CODES             | D2   |      |      | E2   |      |      |      |      |      |      |      |      |
| MIN.                   | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. |
| T1655-2                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T1655-3                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T1655N-1               | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T2055-3                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T2055-4                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T2055-5                | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 |      |      |      |      |      |      |
| T2855-3                | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 |      |      |      |      |      |      |
| T2855-4                | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 |      |      |      |      |      |      |
| T2855-5                | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 |      |      |      |      |      |      |
| T2855-6                | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 |      |      |      |      |      |      |
| T2855-7                | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 |      |      |      |      |      |      |
| T2855-8                | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 |      |      |      |      |      |      |
| T2855N-1               | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 |      |      |      |      |      |      |
| T3255-3                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T3255-4                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T3255-5                | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T3255N-1               | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 |      |      |      |      |      |      |
| T4055-1                | 3.40 | 3.50 | 3.60 | 3.40 | 3.50 | 3.60 |      |      |      |      |      |      |
| T4055-2                | 3.40 | 3.50 | 3.60 | 3.40 | 3.50 | 3.60 |      |      |      |      |      |      |

NOTES:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEDEC 95-1 SPR-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. DRAWING CONFORMS TO JEDEC MO220, EXCEPT EXPOSED PAD DIMENSION FOR T2855-3 AND T2855-6.
10. WARPAGE SHALL NOT EXCEED 0.10 mm.
11. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
12. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
13. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "w", ±0.05.

-DRAWING NOT TO SCALE-

MAXIM  
SEMICONDUCTOR

PACKAGE OUTLINE  
16, 20, 28, 32, 40L THIN QFN, 5x5x0.8mm

21-0140

J 2/2

Revision History

Pages changed at Rev3: 1-6, 11

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