

## 0.5 pC Charge Injection, 100 pA Leakage, Dual SPDT Analog Switch

### DESCRIPTION

The DG636 is an analog CMOS, dual SPDT switch, designed to operate from a + 2.7 V to + 12 V single supply or from  $\pm 2.7$  V to  $\pm 5.0$  V, dual supplies. The DG636 is fully specified at + 3 V, + 5 V and  $\pm 5$  V. All control logic inputs have guaranteed 2 V logic high limits when operating from + 5 V or  $\pm 5$  V supplies and 1.4 V when operating from a 3 V supply. The DG636 switches conduct equally well in both directions and offer rail to rail analog signal handling. < 1 pC low charge injection, coupled with very low switch capacitance and leakage current makes this product ideal for use in precision instrumentation applications. Operating temperature range is specified from - 40 °C to + 125 °C. The DG636 is available in 14 lead TSSOP and the space saving 1.8 mm x 2.6 mm miniQFN package.

### FEATURES

- Ultra low charge injection ( $\pm 0.5$  pC, typ. over the full analog signal range)
- Leakage current < 0.5 nA max. at 85 °C (for DG636EQ-T1-E3)
- Low switch capacitance ( $C_{\text{soff}}$ , 2 pF typ.)
- Low  $R_{\text{DS(on)}}$  - 115  $\Omega$  max.
- Fully specified with single supply operation at 3.0 V, 5.0 V and dual supplies at  $\pm 5.0$  V
- Low voltage, 2.5 V CMOS/TTL compatible
- 600 MHz, - 3 dB bandwidth
- Excellent isolation and crosstalk performance (typ. > - 60 dB at 10 MHz)
- Fully specified from - 40 °C to 85 °C and - 40 °C to + 125 °C
- 14 pin TSSOP and 16 pin miniQFN package (1.8 mm x 2.6 mm)
- Compliant to RoHS directive 2002/95/EC

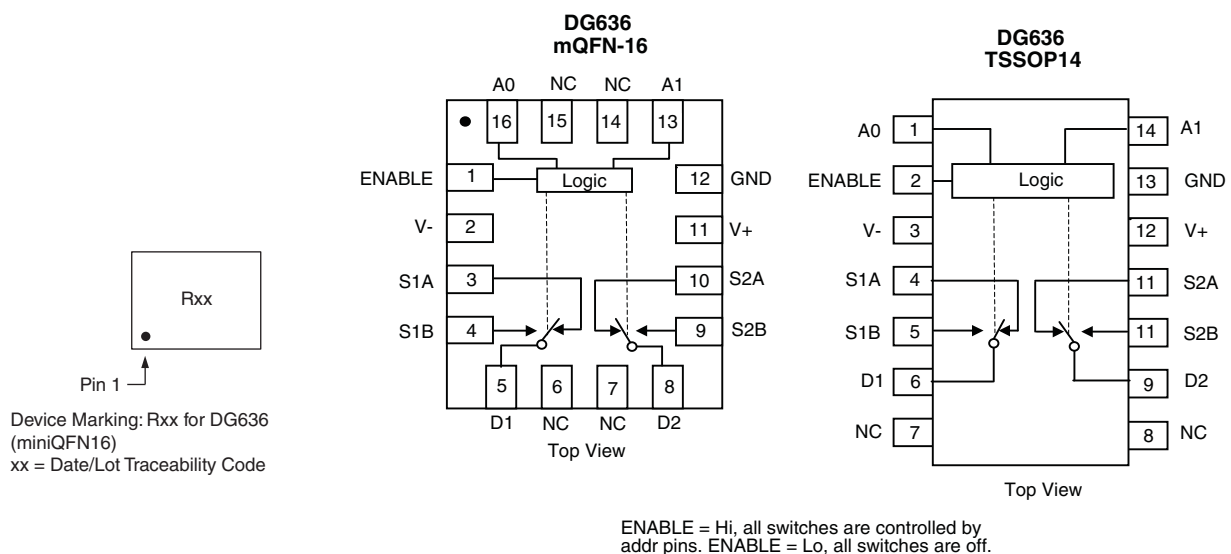


**RoHS**  
COMPLIANT

### APPLICATIONS

- High-end data acquisition
- Medical instruments
- Precision instruments
- High speed communications applications
- Automated test equipment
- Sample and hold applications

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



**TRUTH TABLE**

| Enable Input | Selected Input |    | On Switches          |
|--------------|----------------|----|----------------------|
|              | A1             | A0 | DG636                |
| L            | X              | X  | All Switches Open    |
| H            | L              | L  | D1 to S1A, D2 to S2A |
| H            | L              | H  | D1 to S1B, D2 to S2A |
| H            | H              | L  | D1 to S1A, D2 to S2B |
| H            | H              | H  | D1 to S1B, D2 to S2B |

**ORDERING INFORMATION**

| Temp. Range                    | Package        | Part Number   |
|--------------------------------|----------------|---------------|
| - 40 °C to 125 °C <sup>a</sup> | 14 pin TSSOP   | DG636EQ-T1-E3 |
|                                | 16 pin miniQFN | DG636EN-T1-E4 |

Notes:

a. - 40 °C to 85 °C datasheet limits apply.

**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25\text{ °C}$ , unless otherwise noted)

| Parameter                                                     | Limit                                                        | Unit |
|---------------------------------------------------------------|--------------------------------------------------------------|------|
| V+ to V-                                                      | 14                                                           | V    |
| GND to V-                                                     | 7                                                            |      |
| Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub> | (V-) - 0.3 to (V+) + 0.3<br>or 30 mA, whichever occurs first |      |
| Continuous Current (Any Terminal)                             | 30                                                           | mA   |
| Peak Current, S or D (Pulsed 1 ms, 10 % Duty Cycle)           | 100                                                          |      |
| Storage Temperature                                           | - 65 to 150                                                  | °C   |
| Power Dissipation (Package) <sup>b</sup>                      | 14 pin TSSOP <sup>c</sup>                                    | mW   |
|                                                               | 16 pin miniQFN <sup>d, e</sup>                               |      |
| Thermal Resistance (Package) <sup>b</sup>                     | 14 pin TSSOP                                                 | °C/W |
|                                                               | 16 pin miniQFN                                               |      |

Notes:

a. Signals on SX, DX, or INX exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

b. All leads welded or soldered to PC board.

c. Derate 5.6 mW/°C above 70 °C.

d. Derate 6.6 mW/°C above 70 °C.

e. Manual soldering with iron is not recommended for leadless components. The miniQFN-16 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

**SPECIFICATIONS FOR DUAL SUPPLIES**

| Parameter                        | Symbol                | Test Conditions<br>Unless Otherwise Specified<br>V <sub>+</sub> = 5 V, V <sub>-</sub> = - 5 V<br>V <sub>IN</sub> A0, A1 and ENABLE = 2.0 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|----------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                  |                       |                                                                                                                                                                |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Analog Switch                    |                       |                                                                                                                                                                |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup> | V <sub>ANALOG</sub>   |                                                                                                                                                                | Full               |                   | - 5               | 5                 | - 5               | 5                 | V    |
| On-Resistance                    | R <sub>DS(on)</sub>   | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                                                                      | Room Full          | 70                |                   | 115<br>160        |                   | 115<br>140        | Ω    |
| On-Resistance Match              | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V                                                                                                                  | Room Full          | 1                 |                   | 5<br>6.5          |                   | 5<br>6.5          |      |
| On-Resistance Flatness           | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                                                                      | Room Full          | 10                |                   | 20<br>33          |                   | 20<br>22          |      |

| SPECIFICATIONS FOR DUAL SUPPLIES                   |                       |                                                                                                                            |                    |                   |                   |                   |                   |                   |      |
|----------------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                                    |                       | Test Conditions<br>Unless Otherwise Specified<br>V+ = 5 V, V- = - 5 V<br>VIN A0, A1 and ENABLE = 2.0 V, 0.8 V <sup>a</sup> |                    |                   | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   |      |
| Parameter                                          | Symbol                |                                                                                                                            | Temp. <sup>b</sup> | Typ. <sup>c</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> | Unit |
| Analog Switch                                      |                       |                                                                                                                            |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>                   | V <sub>ANALOG</sub>   |                                                                                                                            | Full               |                   | - 5               | 5                 | - 5               | 5                 | V    |
| On-Resistance                                      | R <sub>DS(on)</sub>   | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                                  | Room Full          | 70                |                   | 115<br>160        |                   | 115<br>140        | Ω    |
| On-Resistance Match                                | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V                                                                              | Room Full          | 1                 |                   | 5<br>6.5          |                   | 5<br>6.5          |      |
| On-Resistance Flatness                             | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = - 3 V, 0 V, + 3 V                                                                  | Room Full          | 10                |                   | 20<br>33          |                   | 20<br>22          |      |
| Switch Off Leakage Current<br>(for 14 pin TSSOP)   | I <sub>S(off)</sub>   | V+ = 5.5 V, V- = - 5.5 V<br>V <sub>D</sub> = ± 4.5 V, V <sub>S</sub> = ∓ 4.5 V                                             | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        | nA   |
|                                                    | I <sub>D(off)</sub>   |                                                                                                                            | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        |      |
| Channel On Leakage Current<br>(for 14 pin TSSOP)   | I <sub>D(on)</sub>    | V+ = 5.5 V, V- = - 5.5 V,<br>V <sub>S</sub> = V <sub>D</sub> = ± 4.5 V                                                     | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        |      |
| Switch Off Leakage Current<br>(for 16 pin miniQFN) | I <sub>S(off)</sub>   | V+ = 5.5 V, V- = - 5.5 V<br>V <sub>D</sub> = ± 4.5 V, V <sub>S</sub> = ∓ 4.5 V                                             | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
|                                                    | I <sub>D(off)</sub>   |                                                                                                                            | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
| Channel On Leakage Current<br>(for 16 pin miniQFN) | I <sub>D(on)</sub>    | V+ = 5.5 V, V- = - 5.5 V,<br>V <sub>S</sub> = V <sub>D</sub> = ± 4.5 V                                                     | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
| Digital Control                                    |                       |                                                                                                                            |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low                 | I <sub>IL</sub>       | V <sub>IN</sub> A0, A1 and ENABLE<br>Under Test = 0.8 V                                                                    | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               | μA   |
| Input Current, V <sub>IN</sub> High                | I <sub>IH</sub>       | V <sub>IN</sub> A0, A1 and ENABLE<br>Under Test = 2.0 V                                                                    | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               |      |
| Input Capacitance <sup>e</sup>                     | C <sub>IN</sub>       | f = 1 MHz                                                                                                                  | Room               | 3.4               |                   |                   |                   |                   | pF   |
| Dynamic Characteristics                            |                       |                                                                                                                            |                    |                   |                   |                   |                   |                   |      |
| Transition Time                                    | t <sub>TRANS</sub>    | V <sub>S(CLOSE)</sub> = 3 V, V <sub>S(OPEN)</sub> = 0.0 V,<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF               | Room Full          | 20                |                   | 70<br>105         |                   | 70<br>80          | ns   |
| Turn-On Time                                       | t <sub>ON</sub>       | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>S</sub> = ± 3 V                                                   | Room Full          | 16                |                   | 60<br>90          |                   | 60<br>65          |      |
| Turn-Off Time                                      | t <sub>OFF</sub>      |                                                                                                                            | Room Full          | 15                |                   | 52<br>76          |                   | 52<br>56          |      |
| Break-Before-Make Time Delay                       | t <sub>D</sub>        | V <sub>S</sub> = 3 V<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                                                     | Room Full          | 15                | 5                 |                   | 5                 |                   |      |
| Charge Injection <sup>e</sup>                      | Q                     | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF                                                          | Room               | 0.1               |                   |                   |                   |                   | pC   |
| Off Isolation <sup>e</sup>                         | OIRR                  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz                                                                   | Room               | - 58              |                   |                   |                   |                   | dB   |
| Bandwidth <sup>e</sup>                             | BW                    | R <sub>L</sub> = 50 Ω                                                                                                      | Room               | 610               |                   |                   |                   |                   | MHz  |
| Channel-to-Channel Crosstalk <sup>e</sup>          | X <sub>TALK</sub>     | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz                                                                   | Room               | - 88              |                   |                   |                   |                   | dB   |
| Source Off Capacitance <sup>e</sup>                | C <sub>S(off)</sub>   | f = 1 MHz                                                                                                                  | Room               | 2.1               |                   |                   |                   |                   | pF   |
| Drain Off Capacitance <sup>e</sup>                 | C <sub>D(off)</sub>   |                                                                                                                            | Room               | 4.2               |                   |                   |                   |                   |      |
| Channel On Capacitance <sup>e</sup>                | C <sub>D(on)</sub>    |                                                                                                                            | Room               | 11.3              |                   |                   |                   |                   |      |
| Total Harmonic Distortion <sup>e</sup>             | THD                   | Signal = 1 V <sub>RMS</sub> , 20 Hz to 20 kHz,<br>R <sub>L</sub> = 600 Ω                                                   | Room               | 0.01              |                   |                   |                   |                   | %    |

**SPECIFICATIONS FOR DUAL SUPPLIES**

| Parameter               | Symbol | Test Conditions<br>Unless Otherwise Specified<br>V+ = 5 V, V- = - 5 V<br>VIN A0, A1 and ENABLE = 2.0 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|-------------------------|--------|----------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                         |        |                                                                                                                            |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Power Supplies          |        |                                                                                                                            |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current    | I+     | VIN = 0 V, or V+                                                                                                           | Room Full          | 0.001             |                   | 0.5<br>1          |                   | 0.5<br>1          | µA   |
| Negative Supply Current | I-     |                                                                                                                            | Room Full          | - 0.001           | - 0.5<br>- 1      |                   | - 0.5<br>- 1      |                   |      |
| Ground Current          | IGND   |                                                                                                                            | Room Full          | - 0.001           | - 0.5<br>- 1      |                   | - 0.5<br>- 1      |                   |      |

**SPECIFICATIONS FOR SINGLE SUPPLY**

| Parameter                                          | Symbol               | Test Conditions<br>Unless Otherwise Specified<br>V <sub>+</sub> = 5 V, V <sub>-</sub> = 0 V<br>V <sub>IN</sub> A0, A1 and ENABLE = 2.0 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|----------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                                    |                      |                                                                                                                                                              |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Analog Switch                                      |                      |                                                                                                                                                              |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>                   | V <sub>ANALOG</sub>  |                                                                                                                                                              | Full               |                   |                   | 5                 |                   | 5                 | V    |
| On-Resistance                                      | R <sub>DS(on)</sub>  | I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 3.5 V                                                                                                              | Room Full          | 120               |                   | 170<br>250        |                   | 170<br>200        | Ω    |
| On-Resistance Match                                | ΔR <sub>ON</sub>     | I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 3.5 V                                                                                                              | Room Full          | 3                 |                   | 5<br>12           |                   | 5<br>10           |      |
| Switch Off Leakage Current<br>(for 14 pin TSSOP)   | I <sub>S(off)</sub>  | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/4.5 V, V <sub>S</sub> = 4.5 V/1 V                                                       | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        | nA   |
|                                                    | I <sub>D(off)</sub>  |                                                                                                                                                              | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        |      |
| Channel On Leakage Current<br>(for 14 pin TSSOP)   | I <sub>D(on)</sub>   | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V<br>V <sub>S</sub> = V <sub>D</sub> = 1 V/4.5 V                                                                  | Room Full          | ± 0.01            | - 0.1<br>- 18     | 0.1<br>18         | - 0.1<br>- 0.5    | 0.1<br>0.5        |      |
| Switch Off Leakage Current<br>(for 16 pin miniQFN) | I <sub>S(off)</sub>  | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/4.5 V, V <sub>S</sub> = 4.5 V/1 V                                                       | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
|                                                    | I <sub>D(off)</sub>  |                                                                                                                                                              | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
| Channel On Leakage Current<br>(for 16 pin miniQFN) | I <sub>D(on)</sub>   | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V,<br>V <sub>S</sub> = V <sub>D</sub> = 1 V/4.5 V                                                                 | Room Full          | ± 0.01            | - 1<br>- 18       | 1<br>18           | - 1<br>- 2        | 1<br>2            |      |
| Digital Control                                    |                      |                                                                                                                                                              |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low                 | I <sub>L</sub>       | V <sub>IN</sub> A0, A1 and ENABLE Under Test = 0.8 V                                                                                                         | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               | μA   |
| Input Current, V <sub>IN</sub> High                | I <sub>H</sub>       | V <sub>IN</sub> A0, A1 and ENABLE Under Test = 2.0 V                                                                                                         | Full               | 0.005             | - 0.1             | 0.1               | - 0.1             | 0.1               |      |
| Input Capacitance                                  | C <sub>IN</sub>      | f = 1 MHz                                                                                                                                                    | Room               | 4.3               |                   |                   |                   |                   | pF   |
| Dynamic Characteristics                            |                      |                                                                                                                                                              |                    |                   |                   |                   |                   |                   |      |
| Transition Time                                    | t <sub>TRANS</sub>   | V <sub>S(CLOSE)</sub> = 3 V, V <sub>S(OPEN)</sub> = 0.0 V,<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                                                 | Room Full          | 36                |                   | 75<br>120         |                   | 75<br>95          | ns   |
| Enable Turn-On Time                                | t <sub>ON(EN)</sub>  |                                                                                                                                                              | Room Full          | 30                |                   | 70<br>102         |                   | 70<br>80          |      |
| Enable Turn-Off Time                               | t <sub>OFF(EN)</sub> |                                                                                                                                                              | Room Full          | 17                |                   | 47<br>88          |                   | 47<br>63          |      |
| Break-Before-Make-Time                             | t <sub>BMM</sub>     |                                                                                                                                                              | Room Full          | 23                | 5                 |                   | 5                 |                   |      |
| Charge Injection                                   | Q                    | C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V                                                                                        | Full               | 0.1               |                   |                   |                   |                   | pC   |
| Off-Isolation <sup>e</sup>                         | OIRR                 | f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF                                                                                                     | Room               | - 58              |                   |                   |                   |                   | dB   |
| Crosstalk <sup>e</sup>                             | X <sub>TALK</sub>    |                                                                                                                                                              | Room               | - 81              |                   |                   |                   |                   |      |
| Bandwidth <sup>e</sup>                             | BW                   | R <sub>L</sub> = 50 Ω                                                                                                                                        | Room               | 520               |                   |                   |                   |                   | MHz  |

**SPECIFICATIONS FOR SINGLE SUPPLY**

| Parameter                           | Symbol  | Test Conditions<br>Unless Otherwise Specified<br>V+ = 5 V, V- = 0 V<br>VIN A0, A1 and ENABLE = 2.0 V, 0.8 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to 125 °C |                   | - 40 °C to 85 °C  |                   | Unit |
|-------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
|                                     |         |                                                                                                                          |                    |                   | Min. <sup>d</sup> | Max. <sup>d</sup> | Min. <sup>d</sup> | Max. <sup>d</sup> |      |
| Dynamic Characteristics             |         |                                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Total Harmonic Distortion           | THD     | Signal = 1 VRMS, 20 Hz to 20 kHz,<br>RL = 600 Ω                                                                          | Room               | 0.009             |                   |                   |                   |                   | %    |
| Source Off Capacitance <sup>e</sup> | CS(off) | f = 1 MHz                                                                                                                | Room               | 2.5               |                   |                   |                   |                   | pF   |
| Drain Off Capacitance <sup>e</sup>  | CD(off) |                                                                                                                          |                    | 6.4               |                   |                   |                   |                   |      |
| Channel On Capacitance <sup>e</sup> | CD(on)  |                                                                                                                          |                    | 11.3              |                   |                   |                   |                   |      |
| Power Supplies                      |         |                                                                                                                          |                    |                   |                   |                   |                   |                   |      |
| Power Supply Current                | I+      | VIN = 0 V, or V+                                                                                                         | Room Full          | 0.001             |                   | 0.5<br>1          |                   | 0.5<br>1          | μA   |
| Negative Supply Current             | I-      |                                                                                                                          | Room Full          | - 0.001           | - 0.5<br>- 1      |                   | - 0.5<br>- 1      |                   |      |
| Ground Current                      | IGND    |                                                                                                                          | Room Full          | - 0.001           | - 0.5<br>- 1      |                   | - 0.5<br>- 1      |                   |      |

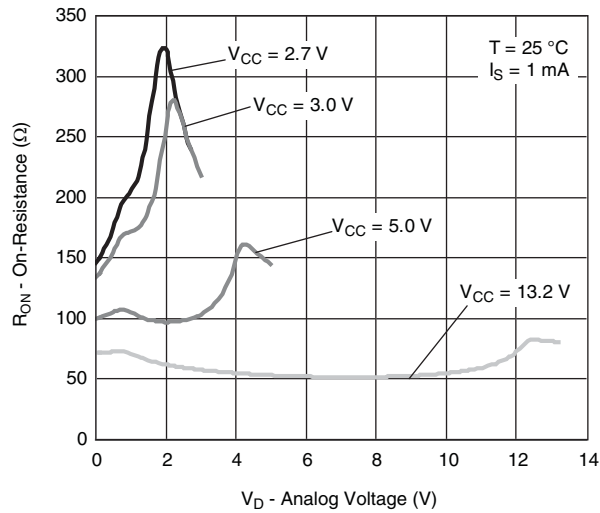
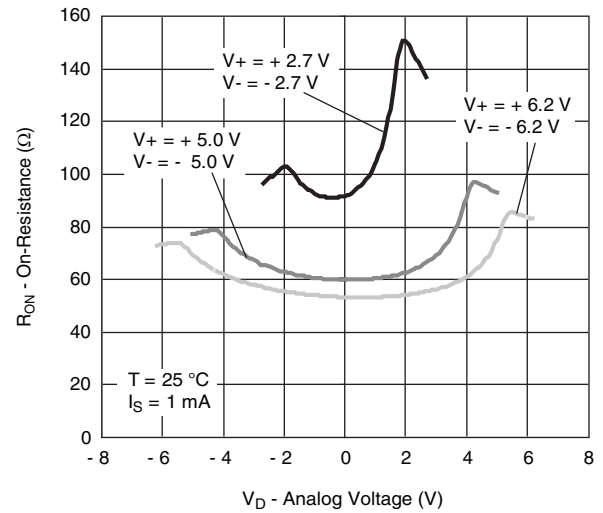
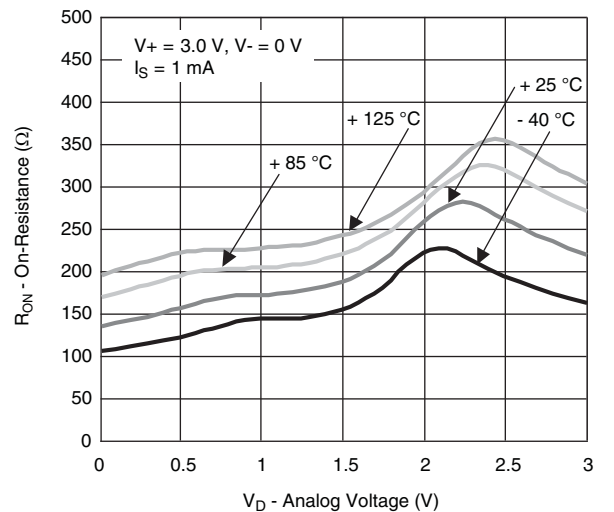
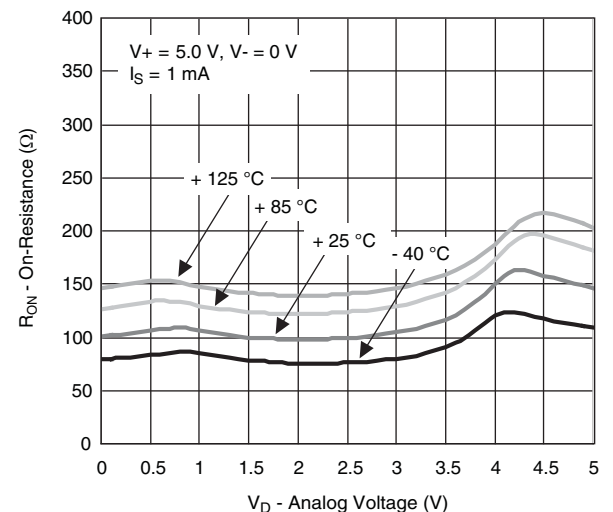
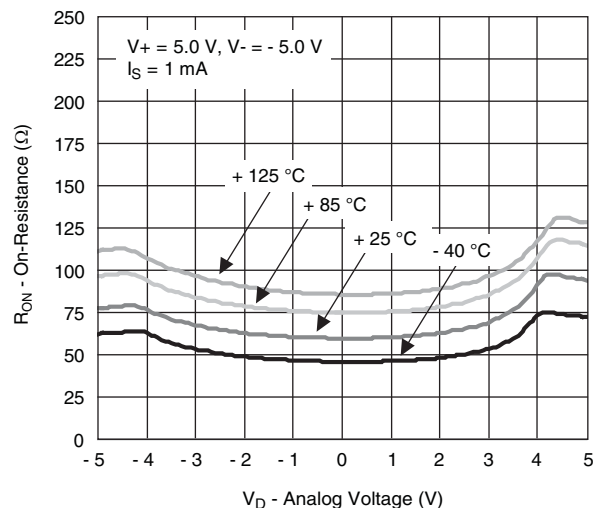
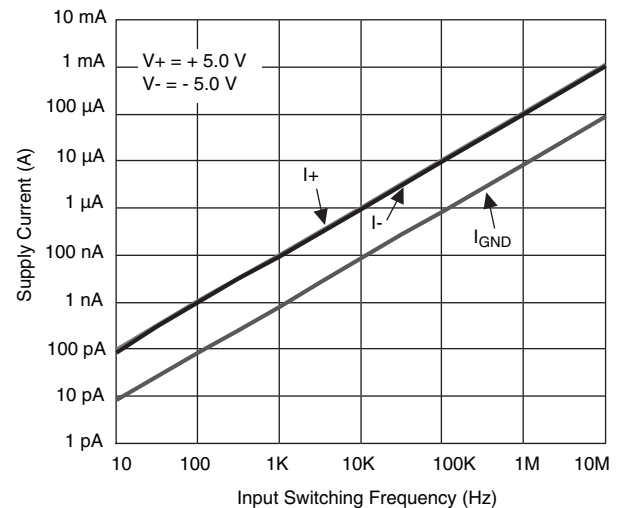
**SPECIFICATIONS FOR SINGLE SUPPLY**

| Parameter                                          | Symbol              | Test Conditions<br>Unless Otherwise Specified<br>V <sub>+</sub> = 3 V, V <sub>-</sub> = 0 V<br>V <sub>IN</sub> A0, A1 and ENABLE = 1.4 V, 0.6 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to + 125 °C |                   | - 40 °C to + 85 °C |                   | Unit |
|----------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|---------------------|-------------------|--------------------|-------------------|------|
|                                                    |                     |                                                                                                                                                              |                    |                   | Min. <sup>d</sup>   | Max. <sup>d</sup> | Min. <sup>d</sup>  | Max. <sup>d</sup> |      |
| Analog Switch                                      |                     |                                                                                                                                                              |                    |                   |                     |                   |                    |                   |      |
| Analog Signal Range <sup>e</sup>                   | V <sub>ANALOG</sub> |                                                                                                                                                              | Full               |                   |                     | 3                 |                    | 3                 | V    |
| On-Resistance                                      | R <sub>DS(ON)</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 1.5 V                                                                                                              | Room Full          | 200               |                     | 245<br>325        |                    | 245<br>290        | Ω    |
| On-Resistance Match                                | ΔR <sub>ON</sub>    | I <sub>S</sub> = 1 mA, V <sub>D</sub> = + 1.5 V                                                                                                              | Room Full          | 5                 |                     | 6<br>13           |                    | 11<br>6           |      |
| Switch Off Leakage Current<br>(for 14 pin TSSOP)   | I <sub>S(off)</sub> | V <sub>+</sub> = 3 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/3 V, V <sub>S</sub> = 3 V/1 V                                                             | Room Full          | ± 0.01            | - 0.1<br>- 18       | 0.1<br>18         | - 0.1<br>- 0.5     | 0.1<br>0.5        | nA   |
|                                                    | I <sub>D(off)</sub> |                                                                                                                                                              | Room Full          | ± 0.01            | - 0.1<br>- 18       | 0.1<br>18         | - 0.1<br>- 0.5     | 0.1<br>0.5        |      |
| Channel On Leakage Current<br>(for 14 pin TSSOP)   | I <sub>D(on)</sub>  | V <sub>+</sub> = 3 V, V <sub>-</sub> = 0 V<br>V <sub>S</sub> = V <sub>D</sub> = 1 V/3 V                                                                      | Room Full          | ± 0.01            | - 0.1<br>- 18       | 0.1<br>18         | - 0.1<br>- 0.5     | 0.1<br>0.5        |      |
| Switch Off Leakage Current<br>(for 16 pin miniQFN) | I <sub>S(off)</sub> | V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 1 V/3 V, V <sub>S</sub> = 3 V/1 V                                                           | Room Full          | ± 0.01            | - 1<br>- 18         | 1<br>18           | - 1<br>- 2         | 1<br>2            |      |
|                                                    | I <sub>D(off)</sub> |                                                                                                                                                              | Room Full          | ± 0.01            | - 1<br>- 18         | 1<br>18           | - 1<br>- 2         | 1<br>2            |      |
| Channel On Leakage Current<br>(for 16 pin miniQFN) | I <sub>D(on)</sub>  | V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V,<br>V <sub>S</sub> = V <sub>D</sub> = 1 V/3 V                                                                   | Room Full          | ± 0.01            | - 1<br>- 18         | 1<br>18           | - 1<br>- 2         | 1<br>2            |      |
| Digital Control                                    |                     |                                                                                                                                                              |                    |                   |                     |                   |                    |                   |      |
| Input Current, V <sub>IN</sub> Low                 | I <sub>L</sub>      | V <sub>IN</sub> A0, A1 and ENABLE<br>Under Test = 0.6 V                                                                                                      | Full               | 0.005             | - 1                 | 1                 | - 1                | 1                 | μA   |
| Input Current, V <sub>IN</sub> High                | I <sub>H</sub>      | V <sub>IN</sub> A0, A1 and ENABLE<br>Under Test = 1.4 V                                                                                                      | Full               | 0.005             | - 1                 | 1                 | - 1                | 1                 |      |
| Input Capacitance                                  | C <sub>IN</sub>     | f = 1 MHz                                                                                                                                                    | Room               | 4.3               |                     |                   |                    |                   | pF   |

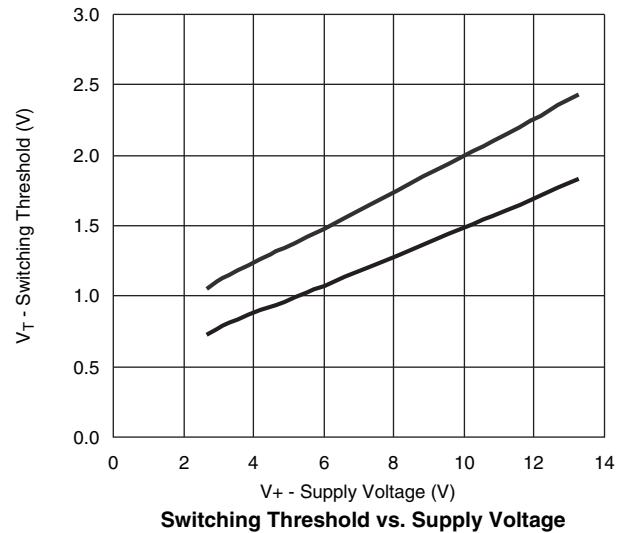
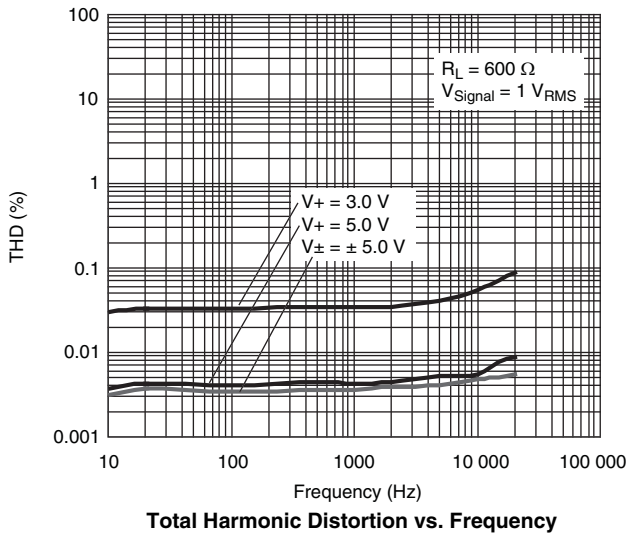
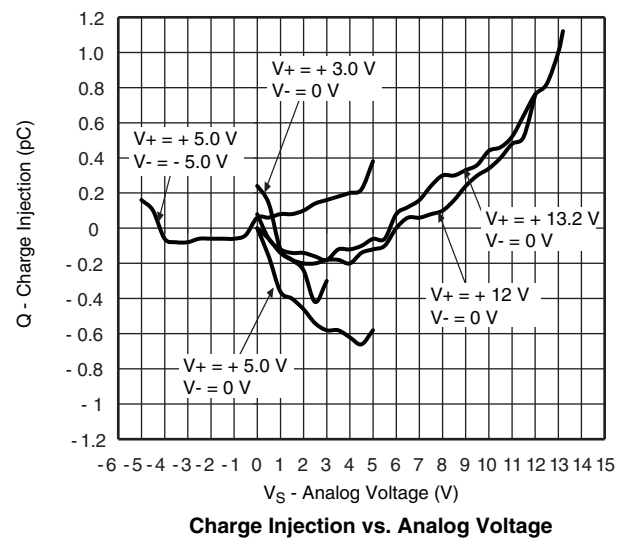
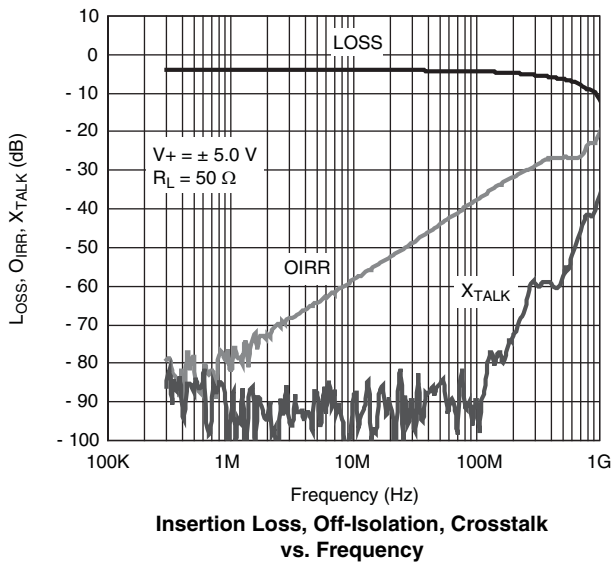
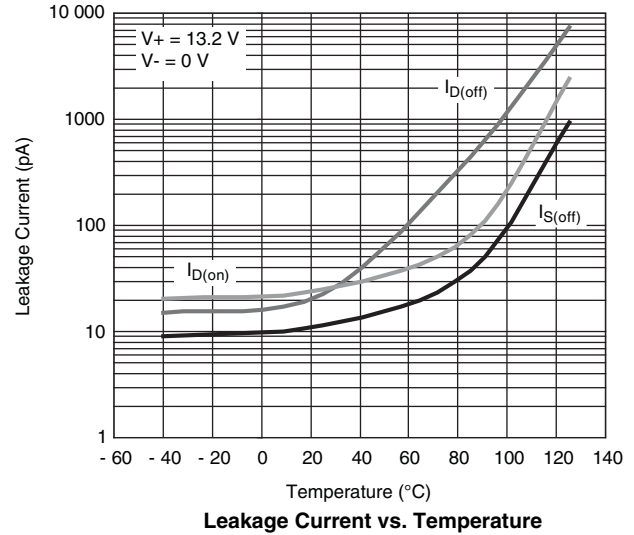
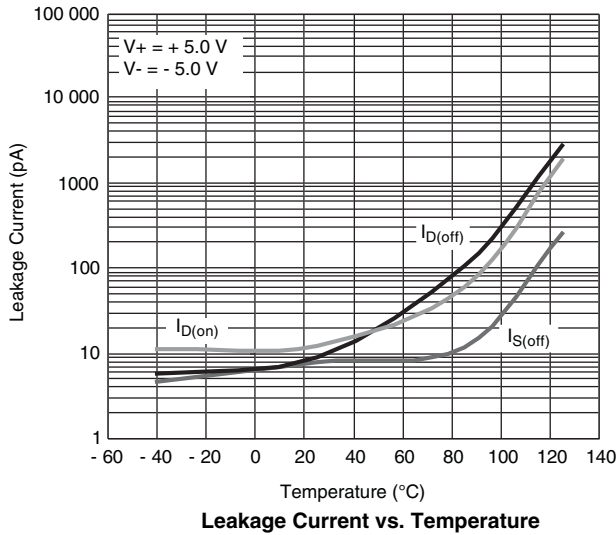
**SPECIFICATIONS FOR SINGLE SUPPLY**

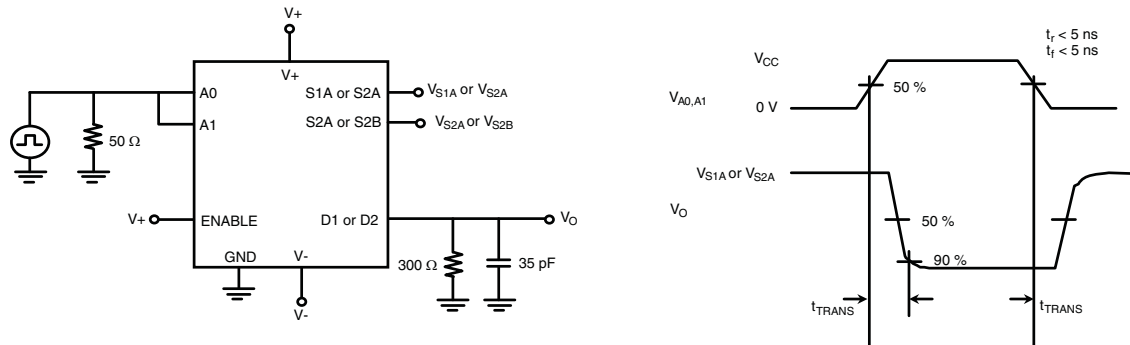
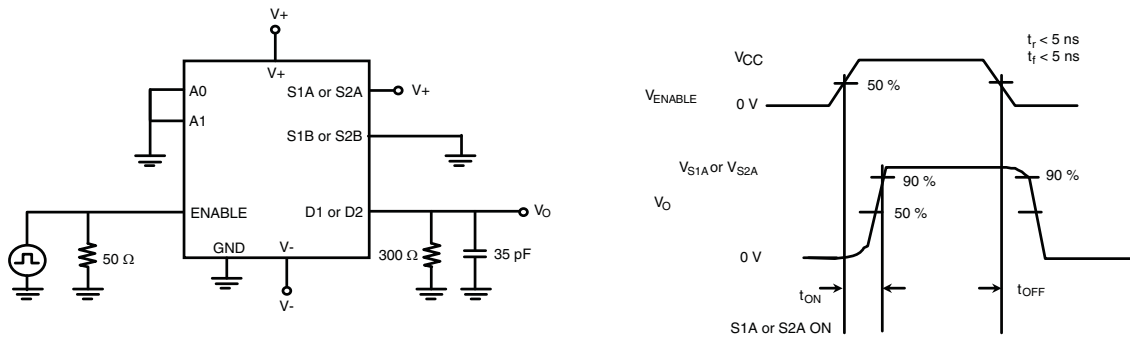
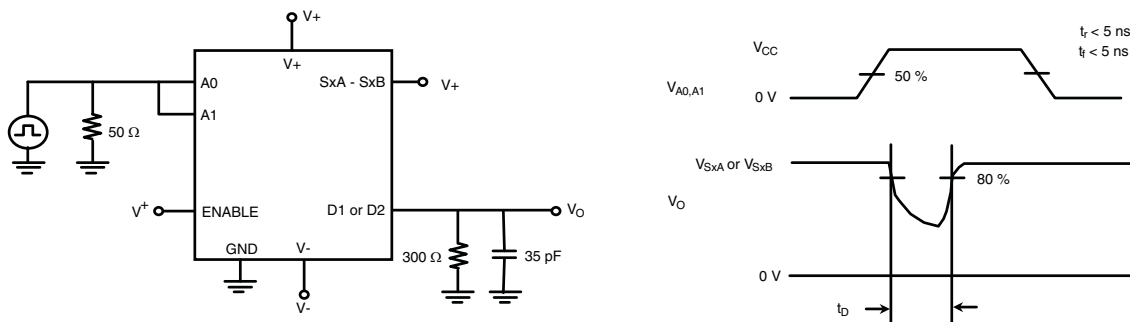
| Parameter                           | Symbol               | Test Conditions<br>Unless Otherwise Specified<br>V+ = 3 V, V- = 0 V<br>VIN A0, A1 and ENABLE = 1.4 V, 0.6 V <sup>a</sup> | Temp. <sup>b</sup> | Typ. <sup>c</sup> | - 40 °C to + 125 °C |                   | - 40 °C to + 85 °C |                   | Unit |
|-------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|---------------------|-------------------|--------------------|-------------------|------|
|                                     |                      |                                                                                                                          |                    |                   | Min. <sup>d</sup>   | Max. <sup>d</sup> | Min. <sup>d</sup>  | Max. <sup>d</sup> |      |
| Dynamic Characteristics             |                      |                                                                                                                          |                    |                   |                     |                   |                    |                   |      |
| Transition Time                     | t <sub>TRANS</sub>   | V <sub>S(CLOSE)</sub> = 3.0 V, V <sub>S(OPEN)</sub> = 0.0 V,<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF           | Room Full          | 95                |                     | 130<br>190        |                    | 130<br>160        | ns   |
| Enable Turn-On Time                 | t <sub>ON(EN)</sub>  |                                                                                                                          | Room Full          | 77                |                     | 108<br>161        |                    | 108<br>131        |      |
| Enable Turn-Off Time                | t <sub>OFF(EN)</sub> |                                                                                                                          | Room Full          | 35                |                     | 76<br>112         |                    | 76<br>88          |      |
| Break-Before-Make-Time              | t <sub>BMM</sub>     |                                                                                                                          | Room Full          | 45                | 5                   |                   | 5                  |                   |      |
| Charge Injection                    | Q                    | C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V                                                    | Full               | 0.24              |                     |                   |                    |                   | pC   |
| Off-Isolation <sup>e</sup>          | OIRR                 | f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF                                                                 | Room               | - 57              |                     |                   |                    |                   | dB   |
| Crosstalk <sup>e</sup>              | X <sub>TALK</sub>    |                                                                                                                          | Room               | - 93              |                     |                   |                    |                   |      |
| Bandwidth <sup>e</sup>              | BW                   | R <sub>L</sub> = 50 Ω                                                                                                    | Room               | 442               |                     |                   |                    |                   | MHz  |
| Total Harmonic Distortion           | THD                  | Signal = 1 V <sub>RMS</sub> , 20 Hz to 20 kHz,<br>R <sub>L</sub> = 600 Ω                                                 | Room               | 0.09              |                     |                   |                    |                   | %    |
| Source Off Capacitance <sup>e</sup> | C <sub>S(off)</sub>  | f = 1 MHz                                                                                                                | Room               | 2.5               |                     |                   |                    |                   | pF   |
| Drain Off Capacitance <sup>e</sup>  | C <sub>D(off)</sub>  |                                                                                                                          |                    | 6.4               |                     |                   |                    |                   |      |
| Channel On Capacitance <sup>e</sup> | C <sub>D(on)</sub>   |                                                                                                                          |                    | 11.7              |                     |                   |                    |                   |      |
| Power Supplies                      |                      |                                                                                                                          |                    |                   |                     |                   |                    |                   |      |
| Power Supply Current                | I+                   | V <sub>IN</sub> = 0 V, or V+                                                                                             | Room Full          | 0.001             |                     | 0.5<br>1          |                    | 0.5<br>1          | μA   |
| Negative Supply Current             | I-                   |                                                                                                                          | Room Full          | - 0.001           | - 0.5<br>- 1        |                   | - 0.5<br>- 1       |                   |      |
| Ground Current                      | I <sub>GND</sub>     |                                                                                                                          | Room Full          | - 0.001           | - 0.5<br>- 1        |                   | - 0.5<br>- 1       |                   |      |

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.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**On-Resistance vs.  $V_D$  (Single Supply Voltage)**

**On-Resistance vs.  $V_D$  (Dual Supply Voltage)**

**On-Resistance vs. Analog Voltage and Temperature**

**On-Resistance vs. Analog Voltage and Temperature**

**On-Resistance vs. Analog Voltage and Temperature**

**Supply Current vs. Input Switching Frequency**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**TEST CIRCUITS**

**Figure 1. Transition Time**

**Figure 2. Enable Switching Time**

**Figure 3. Break-Before-Make**

TEST CIRCUITS

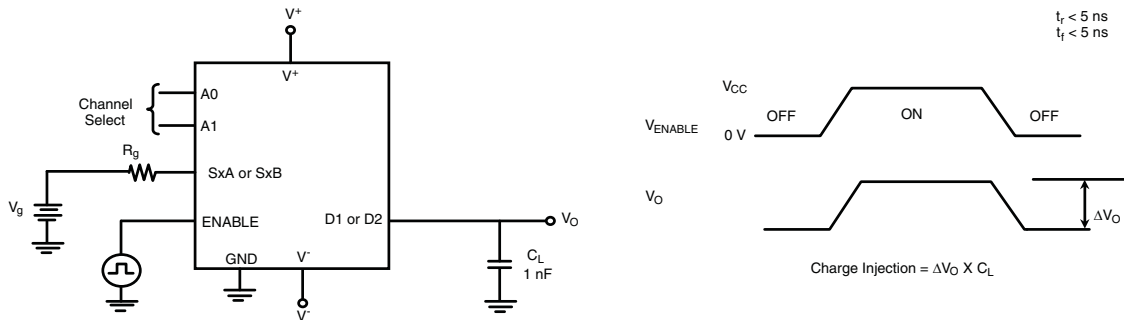


Figure 4. Charge Injection

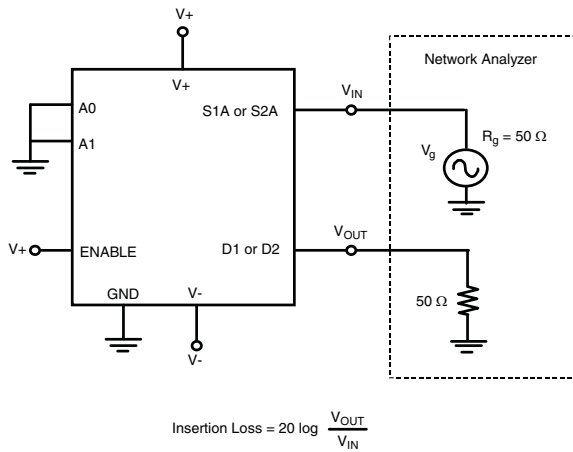


Figure 5. Insertion Loss

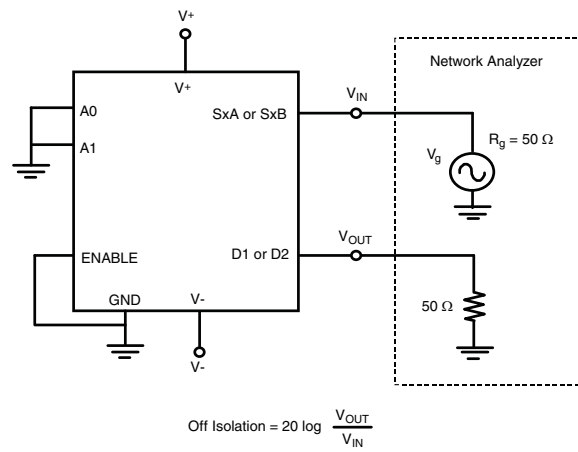


Figure 6. Off-Isolation

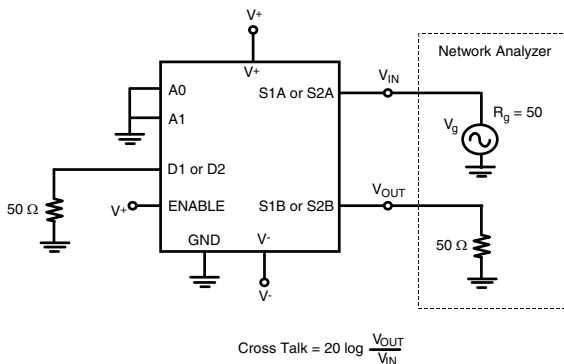


Figure 7. Crosstalk

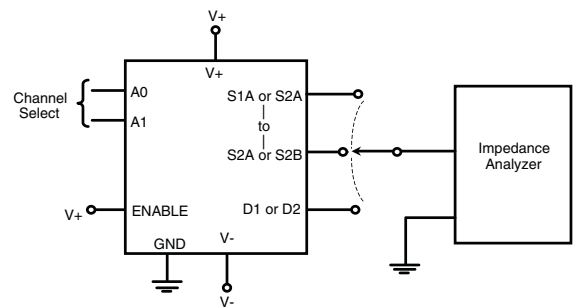
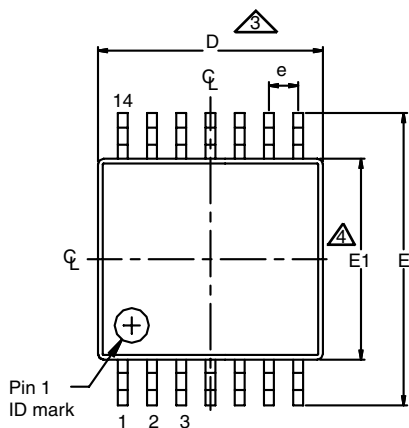


Figure 8. Source/Drain Capacitance

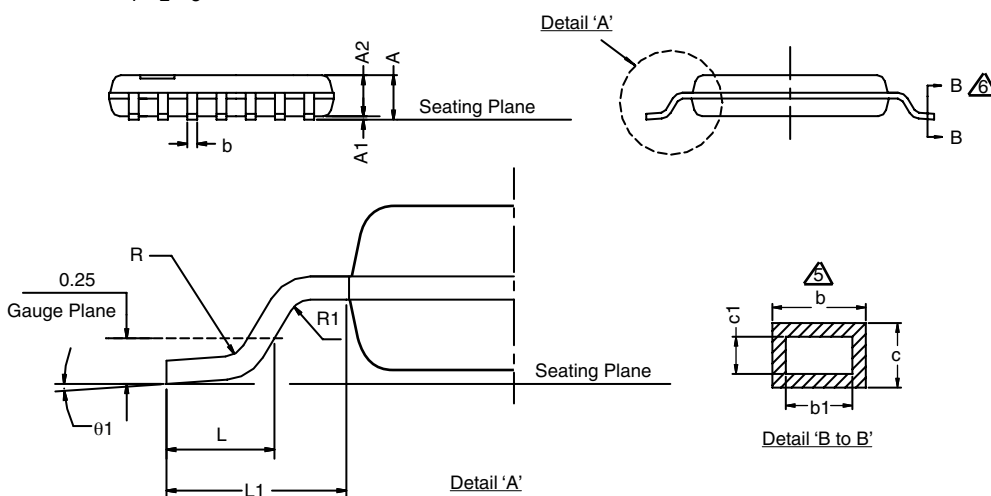
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg269901](http://www.vishay.com/ppg269901).

## 14L TSSOP



### Notes:

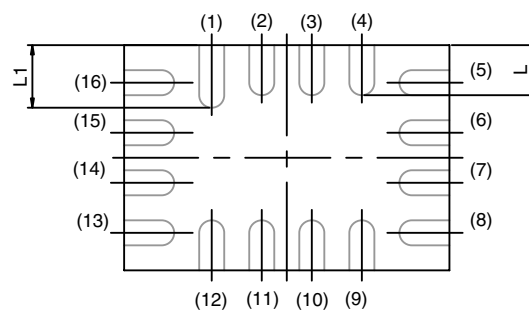
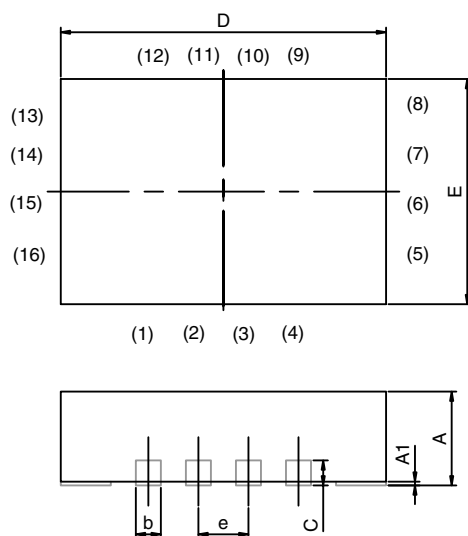
1. All dimensions are in millimeters (angles in degrees)
2. Dimensioning and tolerancing per ANSI Y14.5M-1982
3. Dimension 'D' does not include mold flash, protrusions or gate burrs
4. Dimension 'E1' does not include internal flash or protrusion
5. Dimension 'b' does not include dambar protrusion
6. Cross section B to B to be determined at 0.10 mm to 0.25 mm from the lead tip



| SYMBOL | MINIMUM | NOMINAL  | MAXIMUM |
|--------|---------|----------|---------|
| A      | -       | -        | 1.20    |
| A1     | 0.05    | -        | 0.15    |
| A2     | 0.80    | 0.90     | 1.05    |
| D      | 4.9     | 5.0      | 5.1     |
| E1     | 4.3     | 4.4      | 4.5     |
| E      | 6.2     | 6.4      | 6.6     |
| L      | 0.45    | 0.60     | 0.75    |
| R      | 0.09    | -        | -       |
| R1     | 0.09    | -        | -       |
| b      | 0.19    | -        | 0.30    |
| b1     | 0.19    | 0.22     | 0.25    |
| c      | 0.09    | -        | 0.20    |
| c1     | 0.09    | -        | 0.16    |
| θ1     | 0°      | -        | 8°      |
| L1     |         | 1.0 ref. |         |
| e      |         | 0.65 BSC |         |

ECN: T-07766-Rev. A, 14-Jan-08  
DWG: 5962

## MINI QFN-16L

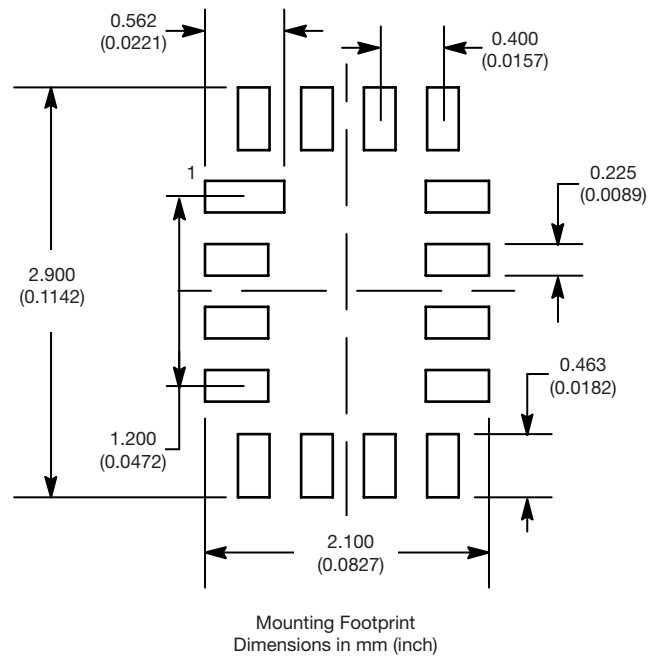


BACK SIDE VIEW

| DIM | MILLIMETERS |      |      | INCHES     |        |        |
|-----|-------------|------|------|------------|--------|--------|
|     | MIN.        | NAM  | MAX. | MIN.       | NAM    | MAX.   |
| A   | 0.70        | 0.75 | 0.80 | 0.0275     | 0.0295 | 0.0315 |
| A1  | 0           | -    | 0.05 | 0          | -      | 0.002  |
| b   | 0.15        | 0.20 | 0.25 | 0.0059     | 0.0078 | 0.0098 |
| C   | 0.15        | 0.20 | 0.25 | 0.0059     | 0.0078 | 0.0098 |
| D   | 2.60 BSC    |      |      | 0.1023 BSC |        |        |
| E   | 1.80 BSC    |      |      | 0.0708 BSC |        |        |
| e   | 0.40 BSC    |      |      | 0.0157 BSC |        |        |
| L   | 0.35        | 0.40 | 0.45 | 0.0137     | 0.0157 | 0.0177 |
| L1  | 0.45        | 0.50 | 0.55 | 0.0177     | 0.0196 | 0.0216 |

ECN T-06380-Rev. A, 14-Aug-06  
DWG: 5954

## RECOMMENDED MINIMUM PADS FOR MINI QFN 16L





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**