



# Low Capacitance, Low Charge Injection, 4- / 8-Channel, Triple SPDT, ± 5 V / 12 V / 5 V / 3 V Analog Multiplexers

## DESCRIPTION

The DG4051E, DG4052E, and DG4053E are high precision CMOS analog multiplexers. The DG4051E is an 8-channel multiplexer, the DG4052E is a dual 4-channel multiplexer, and the DG4053E is a triple 2-channel multiplexer or triple SPDT.

The DG4051E, DG4052E, and DG4053E feature low leakage, parasitic capacitance, and low charge injection of 0.3 pC over the full voltage range. These devices are ideal for high precision signal switching and multiplexing.

Designed to operate from a 3 V to 16 V single supply or from a ± 3 V to ± 8 V dual supplies, the DG4051E, DG4052E, and DG4053E are fully specified at 3 V, 5 V, 12 V and ± 5 V. All control logic inputs have guaranteed 2 V logic high limit when operating from 5 V or ± 5 V supplies and 1.4 V when operating from a 3 V supply.

All switches conduct equally well in both directions, offering rail to rail analog signal switching and can be used both as multiplexers as well as de-multiplexers.

The DG4051E, DG4052E, and DG4053E operating temperature is specified from -40 °C to +125 °C and are available in 16 pin TSSOP and the ultra compact 1.8 mm x 2.6 mm miniQFN16 packages.

## BENEFITS

- Wide operation voltage range
- Low charge injection
- Low parasitic capacitance
- Compact package option

## FEATURES

- 3 V to 16 V single supply or ± 3 to ± 8 V dual supply operation
- Low parasitic capacitance:
  - $C_{D(ON)}$ : 8.5 pF / typ. (DG4053E)
  - $C_{S(OFF)}$ : 2.0 pF / typ. (DG4053E)
- Less than 0.3 pC charge injection over the full signal swing range
- Low leakage: < 50 pA, typ.
- Fast switching  $t_{ON}$ : 35 ns, typ.
- 3 V logic compatible for control
- Bi-directional rail to rail signal switching
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

## APPLICATIONS

- Automatic test equipment
- Process control and automation
- Data acquisition systems
- Meters and instruments
- Medical and healthcare systems
- Communication systems
- Audio and video signal routing
- Relay replacement
- Battery powered systems

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



ENABLE = LO, all switches are controlled by addr pins.  
ENABLE = HI, all switches are off.





| ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted) |  |     |      |
|---|--|-----|------|
| PARAMETER   | LIMIT  |     | UNIT |
| V+ to V-  | -0.3 to +18  |     | V    |
| GND to V-   | -18  |     |      |
| 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 <sup>b</sup>  | 16-pin TSSOP <sup>c</sup>                                    | 450 | mW   |
|   | 16-pin miniQFN <sup>d, f</sup>                               | 525 |      |
|   | 16-pin narrow SOIC <sup>e</sup>                              | 640 |      |
| Thermal Resistance <sup>b</sup>   | 16-pin TSSOP <sup>c</sup>                                    | 178 | °C/W |
|   | 16-pin miniQFN <sup>d, f</sup>                               | 152 |      |
|   | 16-pin narrow SOIC <sup>e</sup>                              | 125 |      |
| ESD Human Body Model (HBM); per ANSI / ESDA / JEDEC <sup>®</sup> JS-001   | 2500   |     | V    |
| Latch Up Current, per JESD78D   | 400  |     | mA   |

**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. Derate 8.0 mW/°C above 70 °C.
- f. 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.

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.

| SPECIFICATIONS FOR DUAL SUPPLIES    |                       |  |                    |                   |                   |                   |                   |                   |      |
|-------------------------------------|-----------------------|--|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
| PARAMETER                           | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V+ = 5 V, V- = -5 V<br>V <sub>IN(A, B, C, and enable)</sub> = 2 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> |      |
| <b>Analog Switch</b>                |                       |  |                    |                   |                   |                   |                   |                   |      |
| Analog Signal Range <sup>e</sup>    | V <sub>ANALOG</sub>   |  | Full               | -                 | -5                | 5                 | -5                | 5                 | V    |
| On-Resistance                       | R <sub>ON</sub>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, 3 V   | Room               | 68                | -                 | 78                | -                 | 78                | Ω    |
|                                     |                       |  | Full               | -                 | -                 | 106               | -                 | 97                |      |
| On-Resistance Match                 | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V  | Room               | 0.91              | -                 | 6                 | -                 | 6                 | Ω    |
|                                     |                       |  | Full               | -                 | -                 | 6                 | -                 | 6                 |      |
| On-Resistance Flatness              | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, 3 V   | Room               | 10                | -                 | 17                | -                 | 17                | Ω    |
|                                     |                       |  | Full               | -                 | -                 | 20                | -                 | 19                |      |
| Switch Off Leakage Current          | 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               | ± 0.05            | -1                | 1                 | -1                | 1                 | nA   |
|                                     |                       |  | Full               | -                 | -50               | 50                | -5                | 5                 |      |
|                                     | Room                  |  | ± 0.05             | -1                | 1                 | -1                | 1                 |                   |      |
|                                     | Full                  |  | -                  | -50               | 50                | -5                | 5                 |                   |      |
| Channel On Leakage Current          | 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               | ± 0.05            | -1                | 1                 | -1                | 1                 | nA   |
|                                     |                       |  | Full               | -                 | -50               | 50                | -5                | 5                 |      |
| <b>Digital Control</b>              |                       |  |                    |                   |                   |                   |                   |                   |      |
| Input Current, V <sub>IN</sub> Low  | I <sub>IL</sub>       | V <sub>IN(A, B, C, and enable)</sub> under test = 0.6 V  | Full               | 0.02              | -1                | 1                 | -1                | 1                 | μA   |
| Input Current, V <sub>IN</sub> High | I <sub>IH</sub>       | V <sub>IN(A, B, C, and enable)</sub> under test = 2 V  | Full               | 0.02              | -1                | 1                 | -1                | 1                 |      |
| Input Capacitance <sup>e</sup>      | C <sub>IN</sub>       | f = 1 MHz  | Room               | 3.4               | -                 | -                 | -                 | -                 | pF   |



| SPECIFICATIONS FOR DUAL SUPPLIES          |                     |  |   |                   |                   |                   |                   |                   |      |    |     |
|---|---------------------|--|---|-------------------|-------------------|-------------------|-------------------|-------------------|------|----|-----|
| PARAMETER                                 | SYMBOL              | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V+ = 5 V, V- = -5 V<br>VIN(A, B, C, and enable) = 2 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> |      |    |     |
| <b>Dynamic Characteristics</b>            |                     |  |   |                   |                   |                   |                   |                   |      |    |     |
| Off Isolation <sup>e</sup>                | OIRR                | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF   | f = 100 kHz   | Room              | -106              | -                 | -                 | -                 | -    | dB |     |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>   |  | f = 10 MHz  | Room              | -68               | -                 | -                 | -                 | -    |    |     |
|   |                     |  | f = 100 MHz   | Room              | -49               | -                 | -                 | -                 | -    |    |     |
|   |                     | f = 100 kHz  | Room  | -105              | -                 | -                 | -                 | -                 |      |    |     |
| Bandwidth, 3 dB                           | BW                  | R <sub>L</sub> = 50 Ω  | DG4051E   | Room              | 308               | -                 | -                 | -                 | -    |    | MHz |
|   |                     |  | DG4052E   | Room              | 353               | -                 | -                 | -                 | -    |    |     |
|   |                     |  | DG4053E   | Room              | 930               | -                 | -                 | -                 | -    |    |     |
| Transition Time                           | t <sub>TRANS</sub>  | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see Fig. 1, 2, 3   | Room  | 72                | -                 | 112               | -                 | 112               | ns   |    |     |
| Enable Turn-On Time                       | t <sub>ON</sub>     |  | Full  | -                 | -                 | 139               | -                 | 131               |      |    |     |
| Enable Turn-Off Time                      | t <sub>OFF</sub>    |  | Room  | 35                | -                 | 75                | -                 | 75                |      |    |     |
|   |                     |  | Full  | -                 | -                 | 86                | -                 | 80                |      |    |     |
| Break-Before-Make Time Delay              | t <sub>D</sub>      |  | Room  | 48                | -                 | 88                | -                 | 88                |      |    |     |
|   |                     |  | Full  | -                 | -                 | 97                | -                 | 95                |      |    |     |
| 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              | 0.38              | -                 | -                 | -                 |      | -  | pC  |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub> |  | f = 1 MHz   | DG4051E           | Room              | 2.2               | -                 | -                 |      | -  | -   |
|   |                     | DG4052E  |   | Room              | 2.1               | -                 | -                 | -                 | -    |    |     |
|   |                     | DG4053E  |   | Room              | 2                 | -                 | -                 | -                 | -    |    |     |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub> | f = 1 MHz  | DG4051E   | Room              | 9.2               | -                 | -                 | -                 | -    |    |     |
|   |                     |  | DG4052E   | Room              | 4.8               | -                 | -                 | -                 | -    |    |     |
|   |                     |  | DG4053E   | Room              | 3.1               | -                 | -                 | -                 | -    |    |     |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>  | f = 1 MHz  | DG4051E   | Room              | 14.9              | -                 | -                 | -                 | -    |    |     |
|   |                     |  | DG4052E   | Room              | 10                | -                 | -                 | -                 | -    |    |     |
|   |                     |  | DG4053E   | Room              | 8.5               | -                 | -                 | -                 | -    |    |     |
| Total Harmonic Distortion <sup>e</sup>    | THD                 | Signal = 5 V <sub>RMS</sub> ,<br>20 Hz to 20 kHz, R <sub>L</sub> = 600 Ω   | Room  | 0.065             | -                 | -                 | -                 | -                 | %    |    |     |
| <b>Power Supplies</b>                     |                     |  |   |                   |                   |                   |                   |                   |      |    |     |
| Power Supply Current                      | I+                  | V+ = 5 V, V- = -5 V<br>VIN(A, B, C, and enable) = 0 V or 5 V   | Room  | 0.05              | -                 | 1                 | -                 | 1                 | μA   |    |     |
| Negative Supply Current                   | I-                  |  | Full  | -                 | -                 | 10                | -                 | 10                |      |    |     |
|   |                     |  | Room  | -0.05             | -1                | -                 | -1                | -                 |      |    |     |
| Ground Current                            | I <sub>GND</sub>    |  | Full  | -                 | -10               | -                 | -10               | -                 |      |    |     |
|   |                     |  | Room  | -0.05             | -1                | -                 | -1                | -                 |      |    |     |
|   |                     |  | Full  | -                 | -10               | -                 | -10               | -                 |      |    |     |



| SPECIFICATIONS FOR UNIPOLAR SUPPLIES      |                       |  |   |                   |                   |                   |                   |                   |      |   |    |
|---|-----------------------|--|---|-------------------|-------------------|-------------------|-------------------|-------------------|------|---|----|
| PARAMETER                                 | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V+ = 12 V, V- = 0 V<br>VIN(A, B, C, and enable) = 2 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> |      |   |    |
| <b>Analog Switch</b>                      |                       |  |   |                   |                   |                   |                   |                   |      |   |    |
| Analog Signal Range <sup>e</sup>          | V <sub>ANALOG</sub>   |  | Full  | -                 | 0                 | 12                | 0                 | 12                | V    |   |    |
| On-Resistance                             | R <sub>ON</sub>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, 11.3 V  | Room  | 85                | -                 | 103               | -                 | 103               | Ω    |   |    |
|   |                       |  | Full  | -                 | -                 | 133               | -                 | 125               |      |   |    |
| On-Resistance Match                       | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 11.3 V   | Room  | 1.24              | -                 | 8                 | -                 | 8                 | Ω    |   |    |
|   |                       |  | Full  | -                 | -                 | 8                 | -                 | 8                 |      |   |    |
| On-Resistance Flatness                    | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, 11.3 V  | Room  | 27                | -                 | 37                | -                 | 37                | Ω    |   |    |
|   |                       |  | Full  | -                 | -                 | 44                | -                 | 43                |      |   |    |
| Switch Off Leakage Current                | I <sub>S(off)</sub>   | V+ = 13.2 V, V- = 0 V<br>V <sub>D</sub> = 1 V / 12.2 V, V <sub>S</sub> = 12.2 V / 1 V                                      | Room  | ± 0.05            | -1                | 1                 | -1                | 1                 | nA   |   |    |
|   |                       |  | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
|   | I <sub>D(off)</sub>   |  | Room  | ± 0.05            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                       |  | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| Channel On Leakage Current                | I <sub>D(on)</sub>    | V+ = 13.2 V, V- = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 1 V / 12.2 V  | Room  | ± 0.05            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                       |  | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| <b>Digital Control</b>                    |                       |  |   |                   |                   |                   |                   |                   |      |   |    |
| Input Current, V <sub>IN</sub> Low        | I <sub>L</sub>        | V <sub>IN(A, B, C, and enable)</sub> under test = 0.8 V  | Full  | 0.02              | -1                | 1                 | -1                | 1                 | μA   |   |    |
| Input Current, V <sub>IN</sub> High       | I <sub>H</sub>        | V <sub>IN(A, B, C, and enable)</sub> under test = 2 V  | Full  | 0.02              | -1                | 1                 | -1                | 1                 |      |   |    |
| <b>Dynamic Characteristics</b>            |                       |  |   |                   |                   |                   |                   |                   |      |   |    |
| Transition Time                           | t <sub>TRANS</sub>    | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see Fig. 1, 2, 3   | Room  | 43                | -                 | 83                | -                 | 83                | ns   |   |    |
|   |                       |  | Full  | -                 | -                 | 95                | -                 | 90                |      |   |    |
| Enable Turn-On Time                       | t <sub>ON</sub>       |  | Room  | 22                | -                 | 62                | -                 | 62                |      |   |    |
|   |                       |  | Full  | -                 | -                 | 71                | -                 | 67                |      |   |    |
| Enable Turn-Off Time                      | t <sub>OFF</sub>      |  | Room  | 47                | -                 | 87                | -                 | 87                |      |   |    |
|   |                       |  | Full  | -                 | -                 | 94                | -                 | 93                |      |   |    |
| Break-Before-Make Time Delay              | t <sub>D</sub>        |  | Room  | 25                | 1                 | -                 | 1                 | -                 |      |   |    |
|   |                       |  | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Charge Injection <sup>e</sup>             | Q                     |  | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF | Full              | -                 | -                 | -                 | -                 |      | - | pC |
| Off Isolation <sup>e</sup>                | OIRR                  |  | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF<br>f = 100 kHz       | Room              | -                 | -                 | -                 | -                 |      | - | dB |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>     | Room   |   | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub>   | f = 1 MHz  | DG4051E   | Room              | -                 | -                 | -                 | -                 | pF   |   |    |
|   |                       |  | DG4052E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
|   |                       |  | DG4053E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub>   | f = 1 MHz  | DG4051E   | Room              | -                 | -                 | -                 | -                 | pF   |   |    |
|   |                       |  | DG4052E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
|   |                       |  | DG4053E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>    | f = 1 MHz  | DG4051E   | Room              | -                 | -                 | -                 | -                 | pF   |   |    |
|   |                       |  | DG4052E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
|   |                       |  | DG4053E   | Room              | -                 | -                 | -                 | -                 |      |   |    |
| <b>Power Supplies</b>                     |                       |  |   |                   |                   |                   |                   |                   |      |   |    |
| Power Supply Current                      | I+                    | V <sub>IN(A, B, C, and enable)</sub> = 0 V or 5 V  | Room  | 0.05              | -                 | 1                 | -                 | 1                 | μA   |   |    |
|   |                       |  | Full  | -                 | -                 | 10                | -                 | 10                |      |   |    |
| Negative Supply Current                   | I-                    |  | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                       |  | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |
| Ground Current                            | I <sub>GND</sub>      |  | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                       |  | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |



| SPECIFICATIONS FOR UNIPOLAR SUPPLIES      |                       |   |   |                   |                   |                   |                   |                   |      |   |    |
|---|-----------------------|---|---|-------------------|-------------------|-------------------|-------------------|-------------------|------|---|----|
| PARAMETER                                 | SYMBOL                | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V <sub>+</sub> = 5 V, V <sub>-</sub> = 0 V<br>V <sub>IN(A, B, C, and enable)</sub> = 2 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> |      |   |    |
| <b>Analog Switch</b>                      |                       |   |   |                   |                   |                   |                   |                   |      |   |    |
| Analog Signal Range <sup>e</sup>          | V <sub>ANALOG</sub>   |   | Full  | -                 | 0                 | 5                 | 0                 | 5                 | V    |   |    |
| On-Resistance                             | R <sub>ON</sub>       | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, 3.5 V  | Room  | 125               | -                 | 147               | -                 | 147               | Ω    |   |    |
|   |                       |   | Full  | -                 | -                 | 176               | -                 | 168               |      |   |    |
| On-Resistance Match                       | ΔR <sub>ON</sub>      | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 3.5 V   | Room  | 1.3               | -                 | 8                 | -                 | 8                 | Ω    |   |    |
|   |                       |   | Full  | -                 | -                 | 8                 | -                 | 8                 |      |   |    |
| On-Resistance Flatness                    | R <sub>FLATNESS</sub> | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, 3 V  | Room  | 21                | -                 | 31                | -                 | 31                | Ω    |   |    |
|   |                       |   | Full  | -                 | -                 | 25                | -                 | 29                |      |   |    |
| Switch Off Leakage Current                | 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  | ± 0.03            | -1                | 1                 | -1                | 1                 | nA   |   |    |
|   |                       |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
|   | I <sub>D(off)</sub>   |   | Room  | ± 0.03            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                       |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| Channel On Leakage Current                | I <sub>D(on)</sub>    | V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 1 V / 4.5 V   | Room  | ± 0.03            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                       |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| <b>Digital Control</b>                    |                       |   |   |                   |                   |                   |                   |                   |      |   |    |
| Input Current, V <sub>IN</sub> Low        | I <sub>L</sub>        | V <sub>IN(A, B, C, and enable)</sub> under test = 0.6 V   | Full  | 0.02              | -1                | 1                 | -1                | 1                 | μA   |   |    |
| Input Current, V <sub>IN</sub> High       | I <sub>H</sub>        | V <sub>IN(A, B, C, and enable)</sub> under test = 2 V   | Full  | 0.02              | -1                | 1                 | -1                | 1                 |      |   |    |
| <b>Dynamic Characteristics</b>            |                       |   |   |                   |                   |                   |                   |                   |      |   |    |
| Transition Time                           | t <sub>TRANS</sub>    | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see Fig. 1, 2, 3  | Room  | 95                | -                 | 135               | -                 | 135               | ns   |   |    |
|   |                       |   | Full  | -                 | -                 | 169               | -                 | 148               |      |   |    |
| Enable Turn-On Time                       | t <sub>ON</sub>       |   | Room  | 56                | -                 | 96                | -                 | 96                |      |   |    |
|   |                       |   | Full  | -                 | -                 | 117               | -                 | 107               |      |   |    |
| Enable Turn-Off Time                      | t <sub>OFF</sub>      |   | Room  | 55                | -                 | 95                | -                 | 95                |      |   |    |
|   |                       |   | Full  | -                 | -                 | 110               | -                 | 103               |      |   |    |
| Break-Before-Make Time Delay              | t <sub>D</sub>        |   | Room  | -                 | 12                | -                 | 12                | -                 |      |   |    |
|   |                       |   | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Charge Injection <sup>e</sup>             | Q                     |   | V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF | Full              | 0.32              | -                 | -                 | -                 |      | - | pC |
| Off Isolation <sup>e</sup>                | OIRR                  |   | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF<br>f = 100 kHz       | Room              | -86               | -                 | -                 | -                 |      | - | dB |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>     | Room  |   | -105              | -                 | -                 | -                 | -                 |      |   |    |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub>   | f = 1 MHz   | DG4051E   | Room              | 2.4               | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4052E   | Room              | 2.4               | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4053E   | Room              | 2.3               | -                 | -                 | -                 | -    |   |    |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub>   | f = 1 MHz   | DG4051E   | Room              | 10.1              | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4052E   | Room              | 5.3               | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4053E   | Room              | 3.4               | -                 | -                 | -                 | -    |   |    |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>    | f = 1 MHz   | DG4051E   | Room              | 15.9              | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4052E   | Room              | 10.6              | -                 | -                 | -                 | -    |   |    |
|   |                       |   | DG4053E   | Room              | 8.9               | -                 | -                 | -                 | -    |   |    |
| <b>Power Supplies</b>                     |                       |   |   |                   |                   |                   |                   |                   |      |   |    |
| Power Supply Current                      | I <sub>+</sub>        | V <sub>IN(A, B, C, and enable)</sub> = 0 V or 5 V   | Room  | 0.05              | -                 | 1                 | -                 | 1                 | μA   |   |    |
|   |                       |   | Full  | -                 | -                 | 10                | -                 | 10                |      |   |    |
| Negative Supply Current                   | I <sub>-</sub>        |   | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                       |   | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |
| Ground Current                            | I <sub>GND</sub>      |   | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                       |   | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |



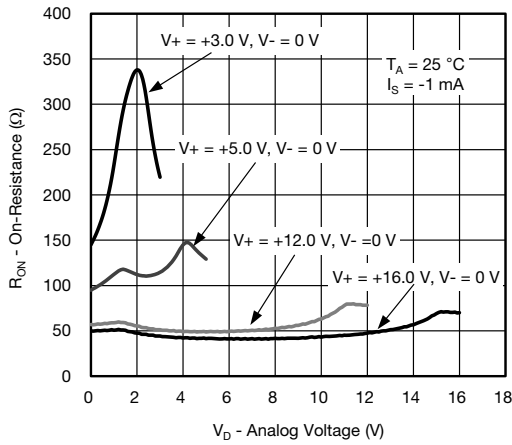
| SPECIFICATIONS FOR UNIPOLAR SUPPLIES      |                     |   |   |                   |                   |                   |                   |                   |      |   |    |
|---|---------------------|---|---|-------------------|-------------------|-------------------|-------------------|-------------------|------|---|----|
| PARAMETER                                 | SYMBOL              | TEST CONDITIONS<br>UNLESS OTHERWISE SPECIFIED<br>V <sub>+</sub> = 3 V, V <sub>-</sub> = 0 V<br>V <sub>IN(A, B, C, and enable)</sub> = 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> |      |   |    |
| <b>Analog Switch</b>                      |                     |   |   |                   |                   |                   |                   |                   |      |   |    |
| Analog Signal Range <sup>e</sup>          | V <sub>ANALOG</sub> |   | Full  | -                 | 0                 | 3                 | 0                 | 3                 | V    |   |    |
| On-Resistance                             | R <sub>ON</sub>     | I <sub>S</sub> = 1 mA, V <sub>D</sub> = 1.5 V   | Room  | 221               | -                 | -                 | -                 | -                 | Ω    |   |    |
|   |                     |   | Full  | -                 | -                 | -                 | -                 |                   |      |   |    |
| Switch Off Leakage Current                | I <sub>S(off)</sub> | V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = 0.3 V / 3 V, V <sub>S</sub> = 3 V / 0.3 V  | Room  | ± 0.02            | -1                | 1                 | -1                | 1                 | nA   |   |    |
|   |                     |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
|   | I <sub>D(off)</sub> |   | Room  | ± 0.02            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                     |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| Channel On Leakage Current                | I <sub>D(on)</sub>  | V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V<br>V <sub>D</sub> = V <sub>S</sub> = 0.3 V / 3 V   | Room  | ± 0.02            | -1                | 1                 | -1                | 1                 |      |   |    |
|   |                     |   | Full  | -                 | -50               | 50                | -5                | 5                 |      |   |    |
| <b>Digital Control</b>                    |                     |   |   |                   |                   |                   |                   |                   |      |   |    |
| Input Current, V <sub>IN</sub> Low        | I <sub>L</sub>      | V <sub>IN(A, B, C, and enable)</sub><br>under test = 0.6 V  | Full  | 0.02              | -1                | 1                 | -1                | 1                 | μA   |   |    |
| Input Current, V <sub>IN</sub> High       | I <sub>H</sub>      | V <sub>IN(A, B, C, and enable)</sub><br>under test = 1.4 V  | Full  | 0.02              | -1                | 1                 | -1                | 1                 |      |   |    |
| <b>Dynamic Characteristics</b>            |                     |   |   |                   |                   |                   |                   |                   |      |   |    |
| Transition Time                           | t <sub>TRANS</sub>  | R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>see Fig. 1, 2, 3  | Room  | 200               | -                 | -                 | -                 | -                 | ns   |   |    |
|   |                     |   | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Enable Turn-On Time                       | t <sub>ON</sub>     |   | Room  | 130               | -                 | -                 | -                 | -                 |      |   |    |
|   |                     |   | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Enable Turn-Off Time                      | t <sub>OFF</sub>    |   | Room  | 78                | -                 | -                 | -                 | -                 |      |   |    |
|   |                     |   | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| Break-Before-Make Time Delay              | t <sub>D</sub>      |   | Room  | 130               | -                 | -                 | -                 | -                 |      |   |    |
|   |                     |   | Full  | -                 | -                 | -                 | -                 | -                 |      |   |    |
| 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              | 0.34              | -                 | -                 | -                 |      | - | pC |
| Off Isolation <sup>e</sup>                | OIRR                |   | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF<br>f = 100 kHz       | Room              | -88               | -                 | -                 | -                 |      | - | dB |
| Channel-to-Channel Crosstalk <sup>e</sup> | X <sub>TALK</sub>   | Room  |   | -105              | -                 | -                 | -                 | -                 |      |   |    |
| Source Off Capacitance <sup>e</sup>       | C <sub>S(off)</sub> | f = 1 MHz   | DG4051E   | Room              | 2.6               | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4052E   | Room              | 2.6               | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4053E   | Room              | 2.5               | -                 | -                 | -                 | -    |   |    |
| Drain Off Capacitance <sup>e</sup>        | C <sub>D(off)</sub> | f = 1 MHz   | DG4051E   | Room              | 10.7              | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4052E   | Room              | 5.7               | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4053E   | Room              | 3.6               | -                 | -                 | -                 | -    |   |    |
| Channel On Capacitance <sup>e</sup>       | C <sub>D(on)</sub>  | f = 1 MHz   | DG4051E   | Room              | 16.4              | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4052E   | Room              | 10.9              | -                 | -                 | -                 | -    |   |    |
|   |                     |   | DG4053E   | Room              | 9.1               | -                 | -                 | -                 | -    |   |    |
| <b>Power Supplies</b>                     |                     |   |   |                   |                   |                   |                   |                   |      |   |    |
| Power Supply Current                      | I <sub>+</sub>      | V <sub>IN(A, B, C, and enable)</sub> = 0 V or 3 V   | Room  | 0.05              | -                 | 1                 | -                 | 1                 | μA   |   |    |
|   |                     |   | Full  | -                 | -                 | 10                | -                 | 10                |      |   |    |
| Negative Supply Current                   | I <sub>-</sub>      |   | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                     |   | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |
| Ground Current                            | I <sub>GND</sub>    |   | Room  | -0.05             | -1                | -                 | -1                | -                 |      |   |    |
|   |                     |   | Full  | -                 | -10               | -                 | -10               | -                 |      |   |    |

**Notes**

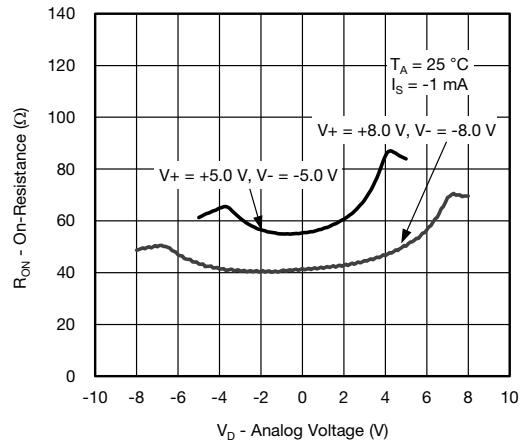
- a. V<sub>IN</sub> = input voltage to perform proper function.
- b. Room = 25 °C, full = as determined by the operating temperature suffix.
- c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- e. Guaranteed by design, not subject to production test.



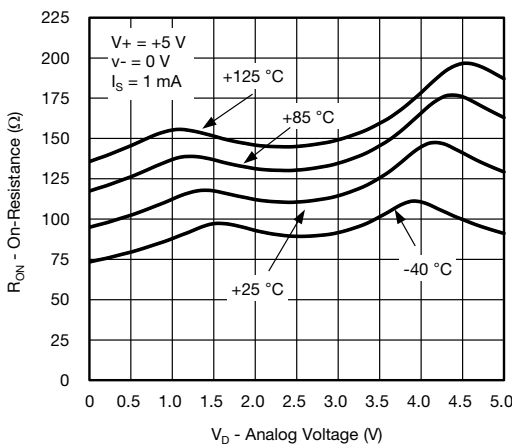
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



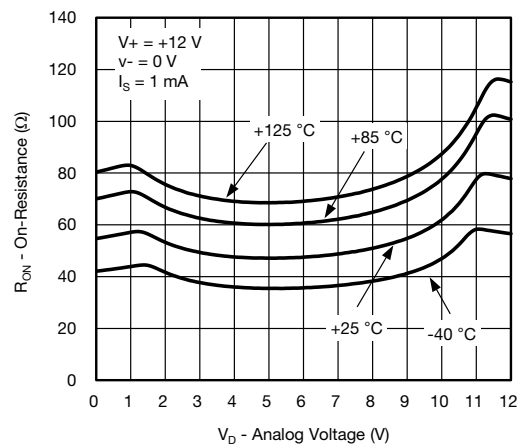
On-Resistance vs. Analog Voltage (Single Supply)



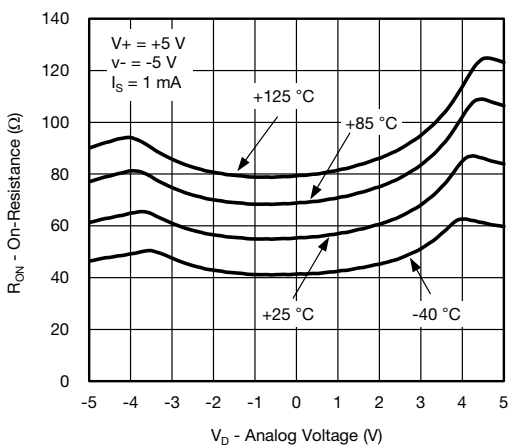
On-Resistance vs. Analog Voltage (Dual Supply)



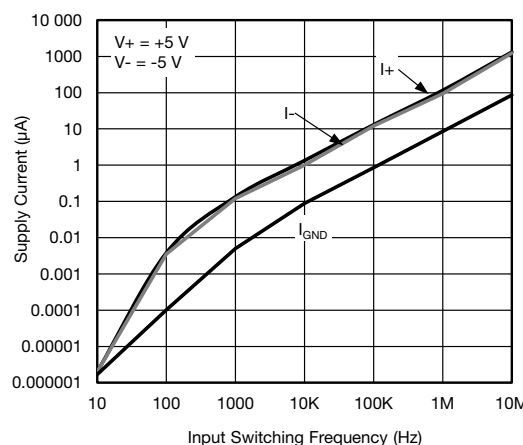
On-Resistance vs. Analog Voltage (Temperature)



On-Resistance vs. Analog Voltage (Temperature)



On-Resistance vs. Analog Voltage (Temperature)

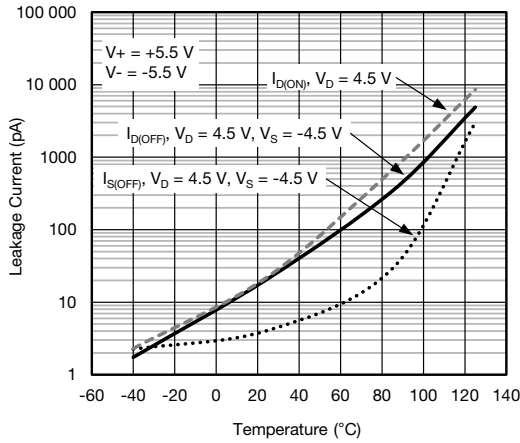


Supply Current vs. Input Switching Frequency

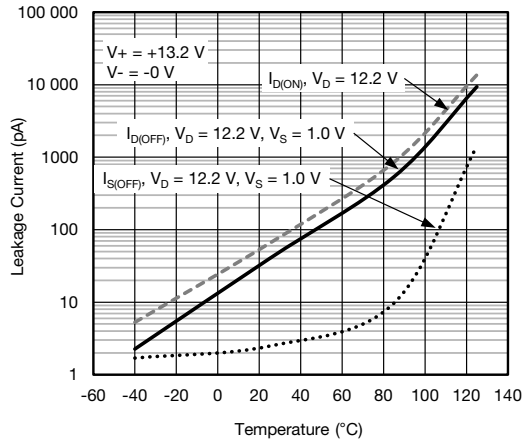




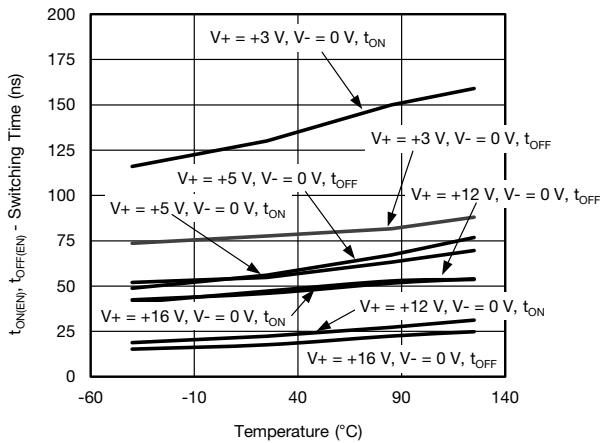
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



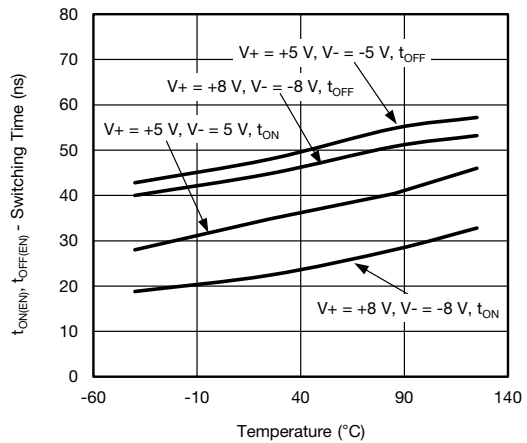
**Leakage Current vs. Temperature**



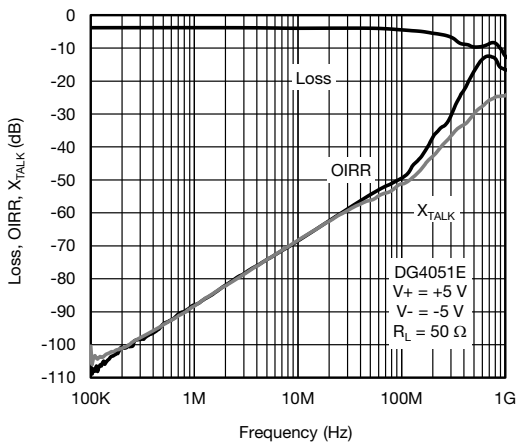
**Leakage Current vs. Temperature**



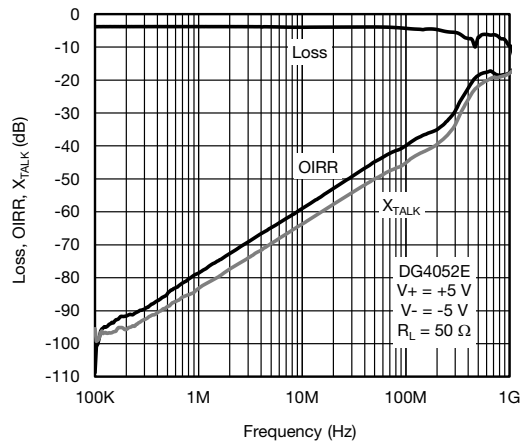
**Switching Time vs. Temperature (Single Supply)**



**Switching Time vs. Temperature (Dual Supply)**



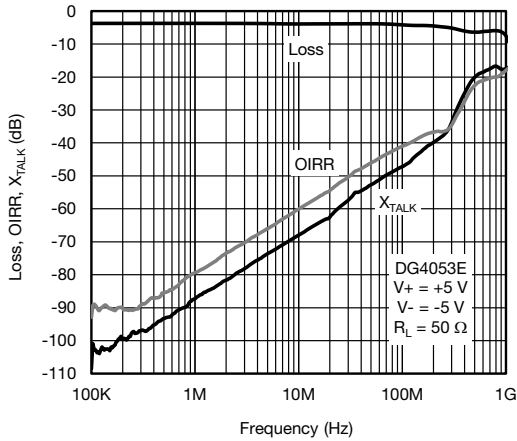
**DG4051E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency**



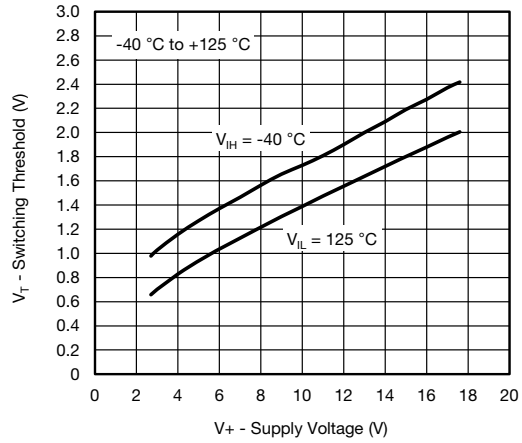
**DG4052E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency**



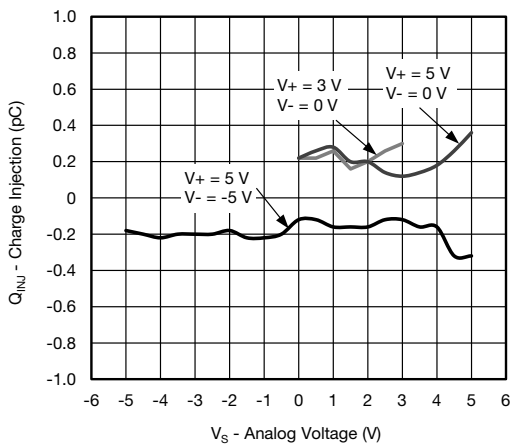
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



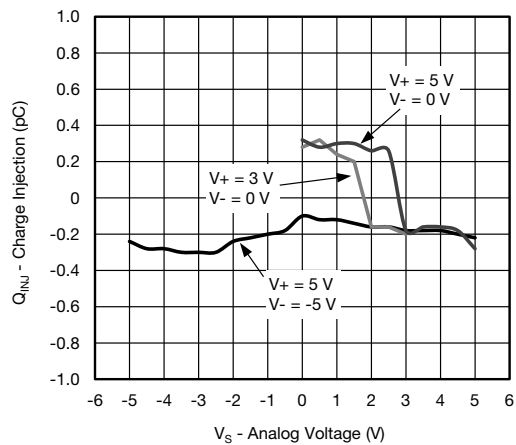
DG4053E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



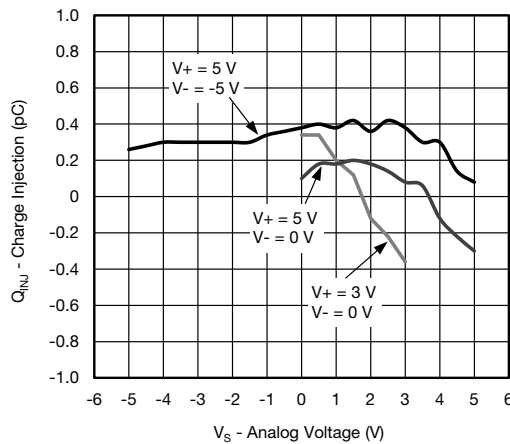
Switching Threshold vs. V+ Supply Voltage



DG4051E Charge Injection vs. Analog Voltage

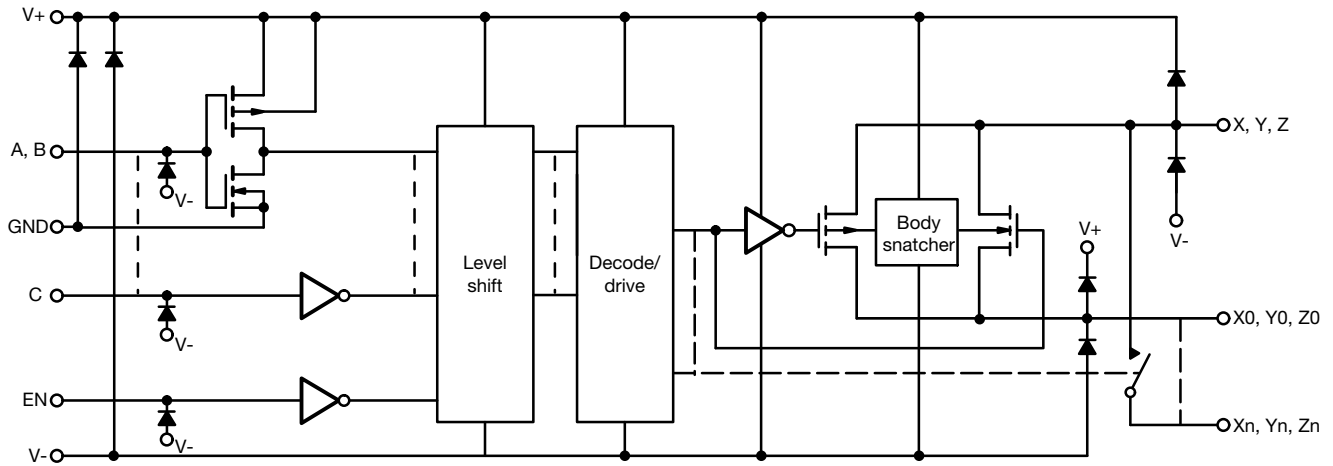


DG4053E Charge Injection vs. Analog Voltage



DG4052E Charge Injection vs. Analog Voltage

**SCHEMATIC DIAGRAM** (Typical Channel)



**TEST CIRCUITS**

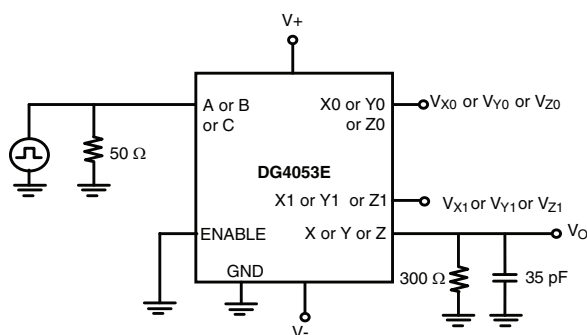
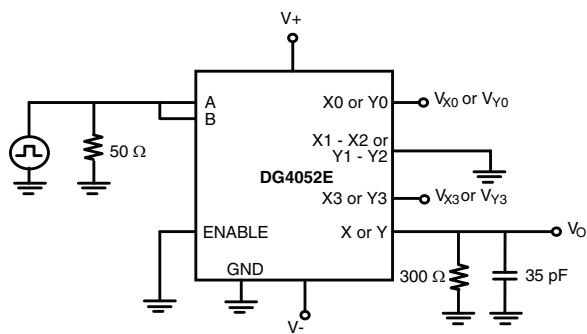
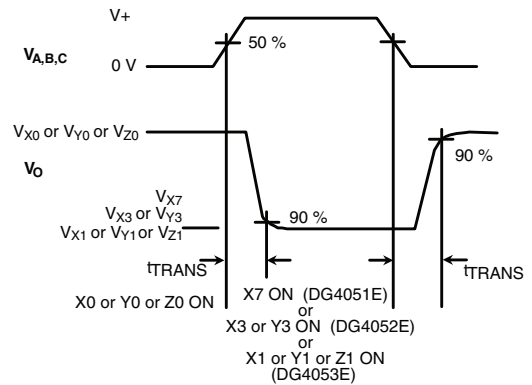
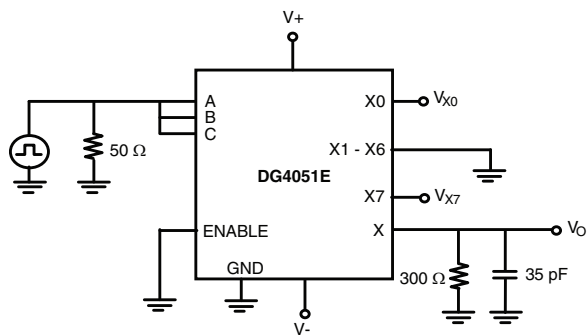
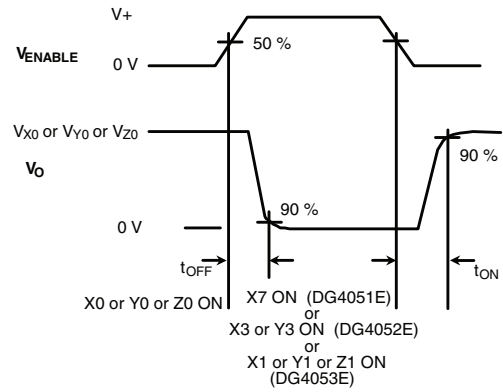
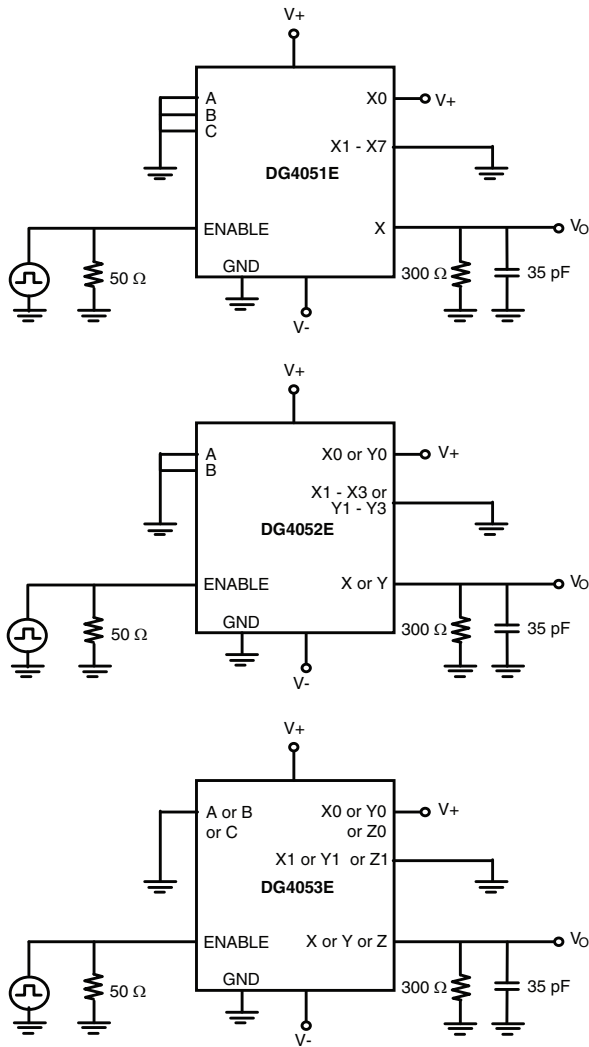
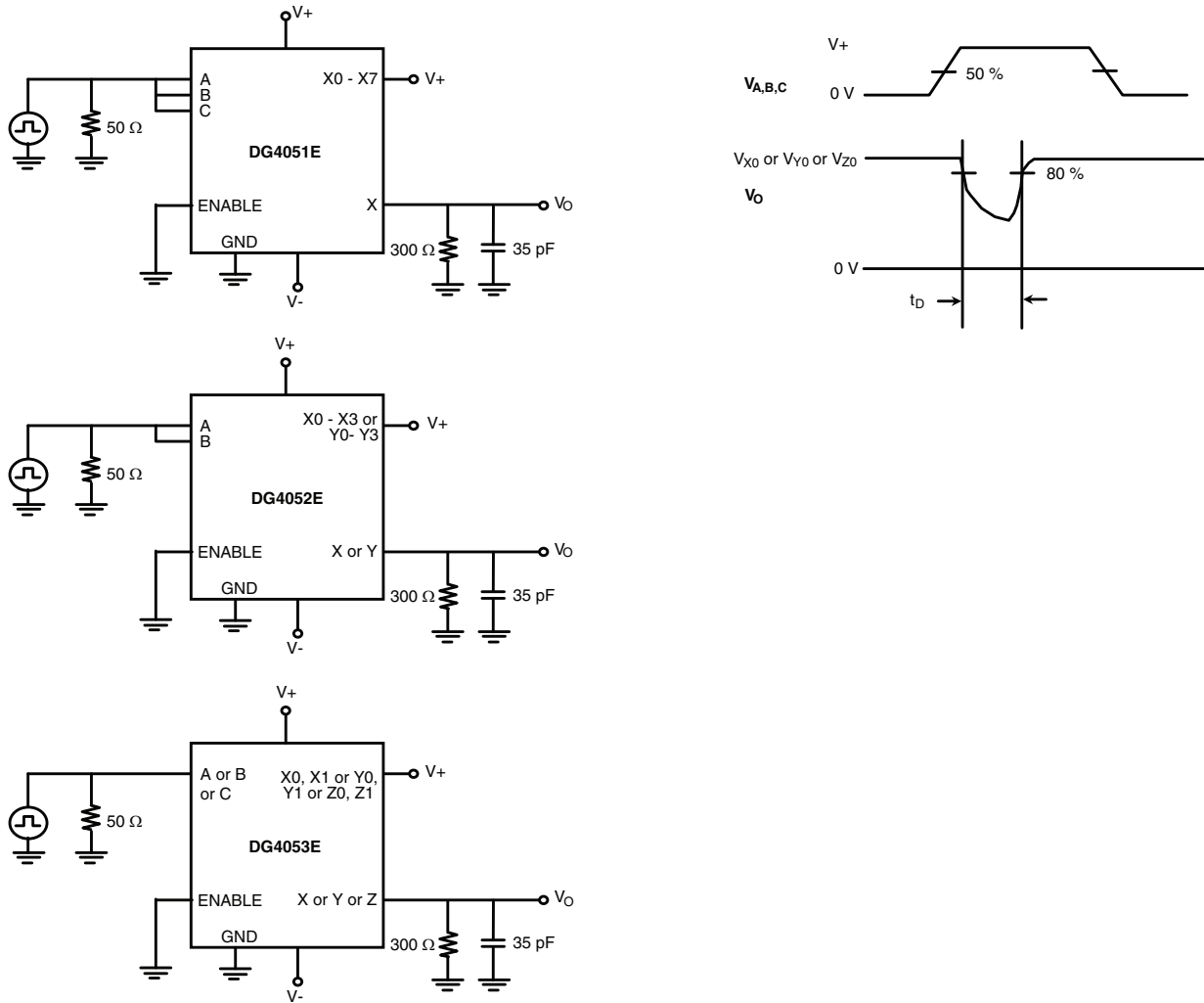
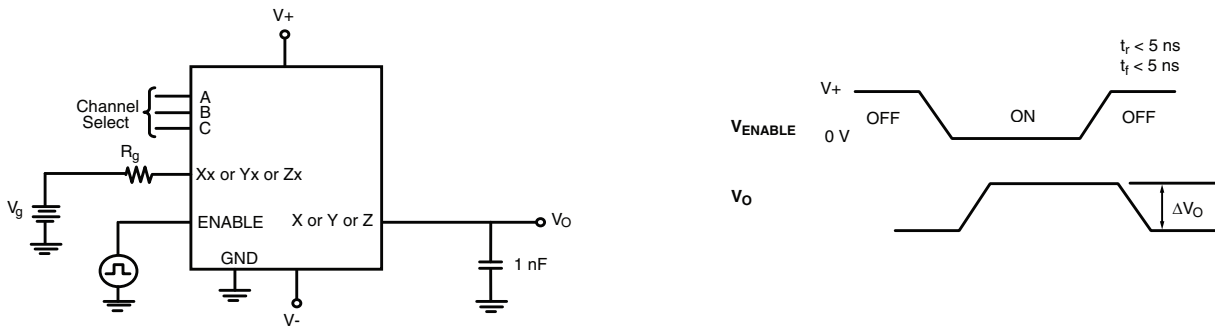


Fig. 1 - Transition Time

**TEST CIRCUITS**

**Fig. 2 - Enable Switching Time**

**TEST CIRCUITS**

**Fig. 3 - Break-Before-Make**

**Fig. 4 - Charge Injection**

TEST CIRCUITS

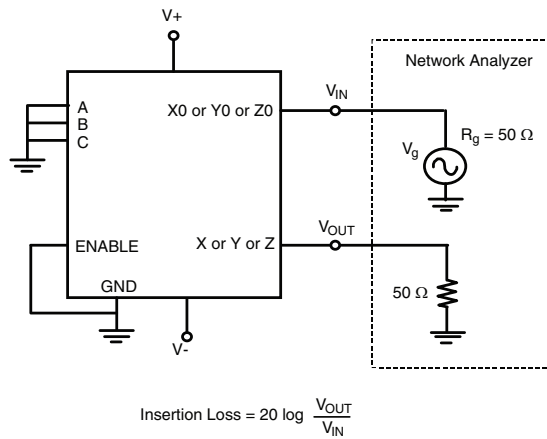


Fig. 5 - Insertion Loss

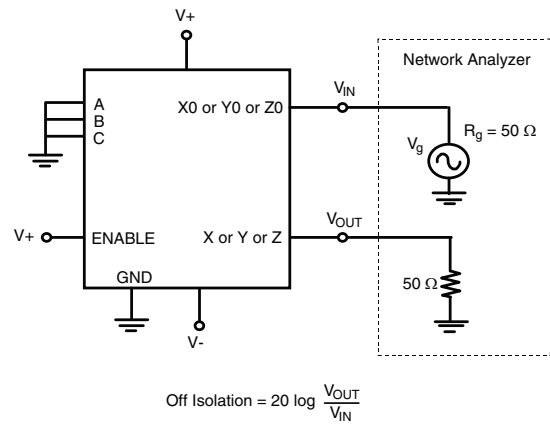


Fig. 7 - Off Isolation

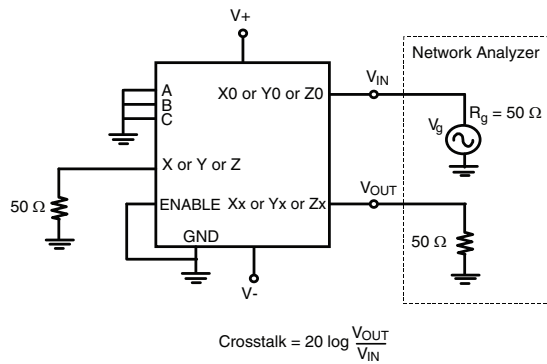


Fig. 6 - Crosstalk

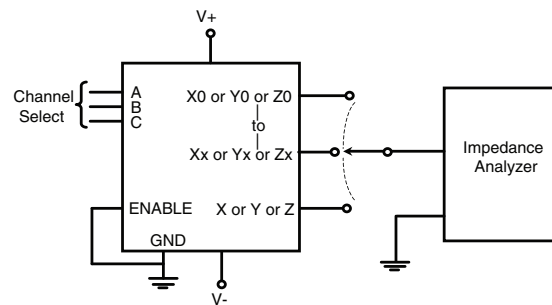
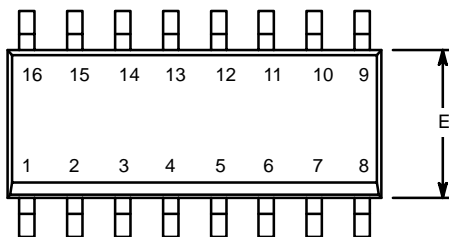


Fig. 8 - Source, Drain Capacitance

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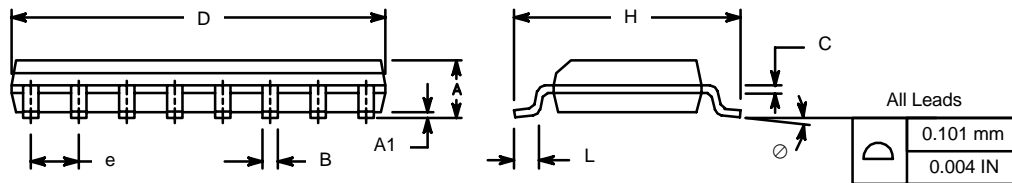


**SOIC (NARROW): 16-LEAD**  
JEDEC Part Number: MS-012



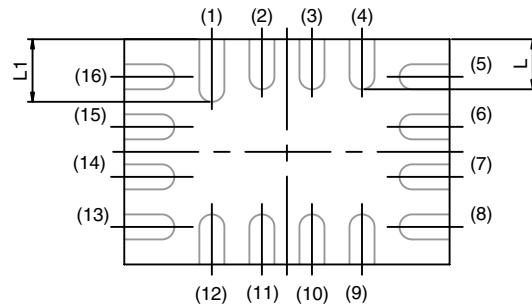
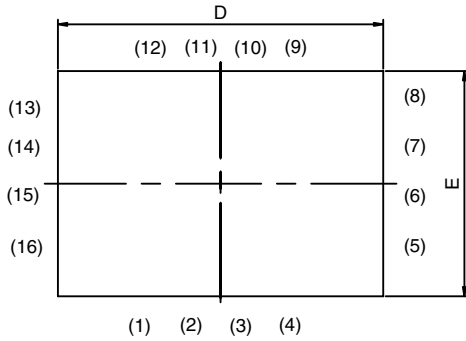
| Dim            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | Min         | Max   | Min       | Max   |
| A              | 1.35        | 1.75  | 0.053     | 0.069 |
| A <sub>1</sub> | 0.10        | 0.20  | 0.004     | 0.008 |
| B              | 0.38        | 0.51  | 0.015     | 0.020 |
| C              | 0.18        | 0.23  | 0.007     | 0.009 |
| D              | 9.80        | 10.00 | 0.385     | 0.393 |
| E              | 3.80        | 4.00  | 0.149     | 0.157 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H              | 5.80        | 6.20  | 0.228     | 0.244 |
| L              | 0.50        | 0.93  | 0.020     | 0.037 |
| ∅              | 0°          | 8°    | 0°        | 8°    |

ECN: S-03946—Rev. F, 09-Jul-01  
DWG: 5300

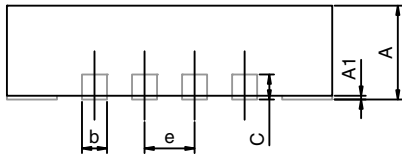




miniQFN-16L



BACK SIDE VIEW

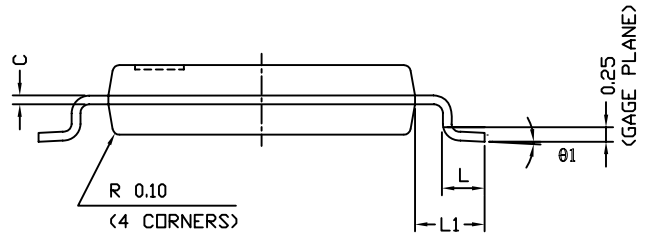
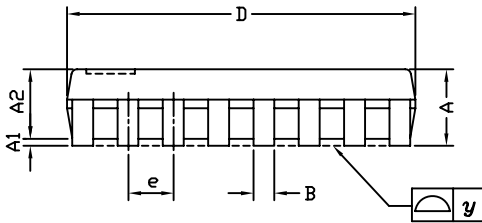
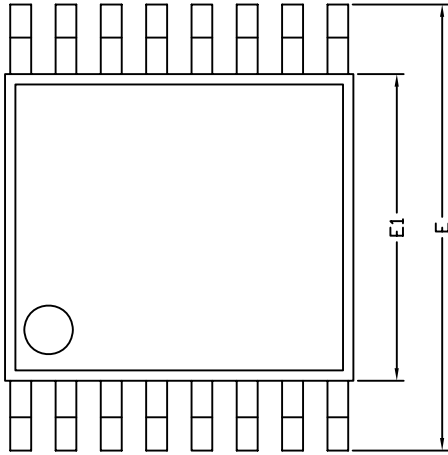


| DIM | MILLIMETERS |      |      | INCHES     |        |        |
|-----|-------------|------|------|------------|--------|--------|
|     | MIN.        | NAM  | MAX. | MIN.       | NAM    | MAX.   |
| A   | 0.70        | 0.75 | 0.80 | 0.0275     | 0.0295 | 0.0315 |
| A1  | 0           | -    | 0.05 | 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   | 2.50        | 2.60 | 2.70 | 0.0984     | 0.1023 | 0.1063 |
| E   | 1.70        | 1.80 | 1.90 | 0.0669     | 0.0708 | 0.0748 |
| 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 T16-0234-Rev. B, 09-May-16  
 DWG: 5954



## TSSOP: 16-LEAD



| Symbols | DIMENSIONS IN MILLIMETERS |       |      |
|---------|---------------------------|-------|------|
|         | Min                       | Nom   | Max  |
| A       | -                         | 1.10  | 1.20 |
| A1      | 0.05                      | 0.10  | 0.15 |
| A2      | -                         | 1.00  | 1.05 |
| B       | 0.22                      | 0.28  | 0.38 |
| C       | -                         | 0.127 | -    |
| D       | 4.90                      | 5.00  | 5.10 |
| E       | 6.10                      | 6.40  | 6.70 |
| E1      | 4.30                      | 4.40  | 4.50 |
| e       | -                         | 0.65  | -    |
| L       | 0.50                      | 0.60  | 0.70 |
| L1      | 0.90                      | 1.00  | 1.10 |
| y       | -                         | -     | 0.10 |
| theta1  | 0°                        | 3°    | 6°   |

ECN: S-61920-Rev. D, 23-Oct-06  
 DWG: 5624



## RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads  
Dimensions in inches (mm)

**RECOMMENDED MINIMUM PADS FOR MINI QFN 16L**



Mounting Footprint  
Dimensions in mm (inch)

## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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- Экспресс доставка в любую точку России;
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- Техническая поддержка проекта;
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#### Как с нами связаться

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