



## Low-Voltage, Low R<sub>ON</sub> Quad SPST Analog Switch

### DESCRIPTION

The DG2041/2042/2043 are quad single-pole/single-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, fast switching, low on-resistance ( $R_{DS(on)}$ : 1  $\Omega$  at 2.7 V) and small physical size, the DG2041/2042/2043 are ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2041/2042/2043 are built on Vishay Siliconix's new high density low voltage process. An epitaxial layer prevents latchup.

Each switch conducts equally well in both directions when on, and blocks up to the power supply level when off.

### FEATURES

- Low Voltage Operation (1.8 V to 5.5 V)
- Low On-Resistance -  $R_{DS(on)}$ : 1  $\Omega$
- Fast Switching - 14 ns  $t_{ON}$
- Low Charge Injection -  $Q_{INJ}$ : 1 pC
- Low Power Consumption
- TTL/CMOS Compatible
- TSSOP-16 and QFN-16 Packages
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



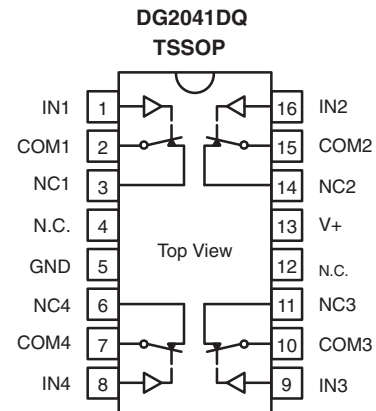
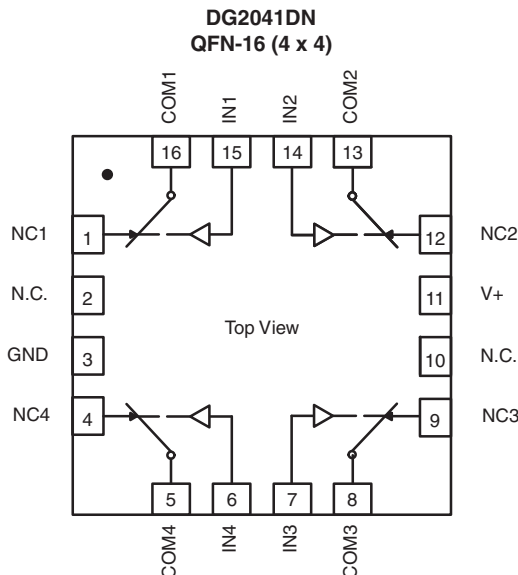
### BENEFITS

- Reduced Power Consumption
- Simple Logic Interface
- High Accuracy
- Reduce Board Space

### APPLICATIONS

- Cellular Phones
- Communication Systems
- Portable Test Equipment
- Battery Operated Systems
- Sample and Hold Circuits

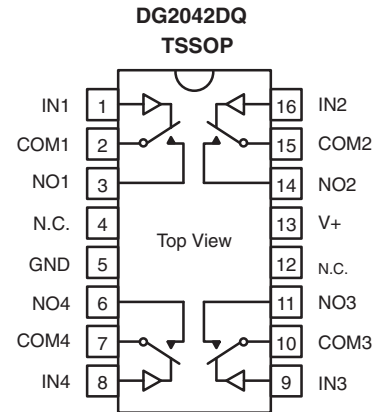
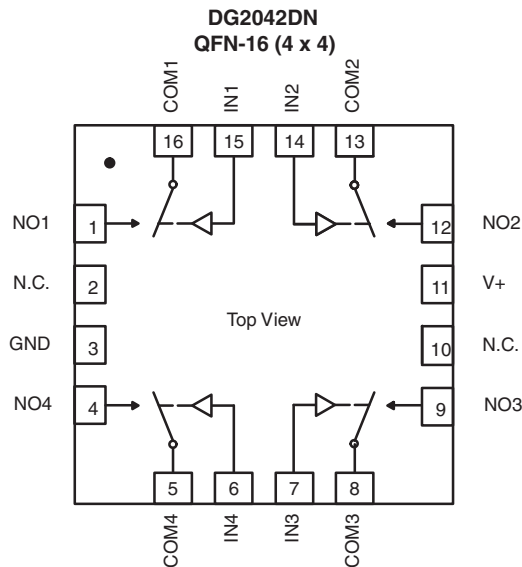
### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION - DG2041



| TRUTH TABLE - DG2041 |        |
|----------------------|--------|
| Logic                | Switch |
| 0                    | On     |
| 1                    | Off    |

Switches Shown for Logic "0" Input

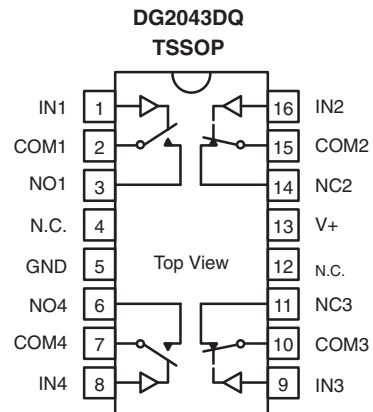
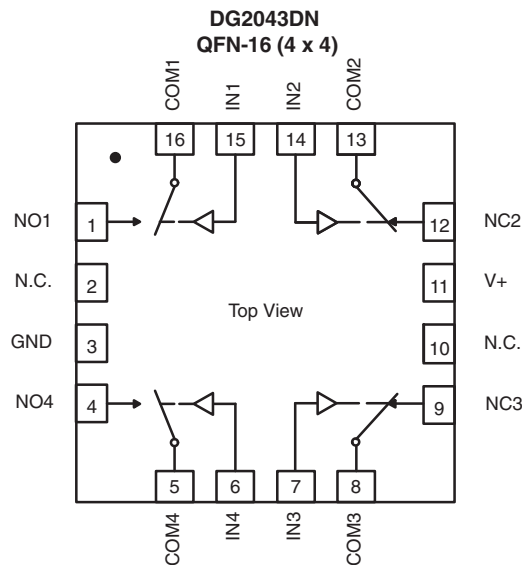
## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION - DG2042, DG2043



**TRUTH TABLE - DG2042**

| Logic | Switch |
|-------|--------|
| 0     | Off    |
| 1     | On     |

Switches Shown for Logic "0" Input



**TRUTH TABLE - DG2043**

| Logic | Switches 1, 4 | Switches 2, 3 |
|-------|---------------|---------------|
| 0     | Off           | On            |
| 1     | On            | Off           |

Switches Shown for Logic "0" Input



| ORDERING INFORMATION |                                       |                |
|----------------------|---------------------------------------|----------------|
| Temp Range           | Package                               | Part Number    |
| - 40 °C to 85 °C     | TSSOP-16                              | DG2041DQ-T1    |
|                      |                                       | DG2041DQ-T1-E3 |
|                      |                                       | DG2042DQ-T1    |
|                      |                                       | DG2042DQ-T1-E3 |
|                      |                                       | DG2043DQ-T1    |
|                      |                                       | DG2043DQ-T1-E3 |
|                      | QFN-16 (4 mm x 4 mm)<br>(Variation 1) | DG2041DN-T1-E4 |
|                      |                                       | DG2042DN-T1-E4 |
|                      |                                       | DG2043DN-T1-E4 |

| ABSOLUTE MAXIMUM RATINGS                       |                                   |                     |      |
|--|-----------------------------------|---------------------|------|
| Parameter                                      | Symbol                            | Limit               | Unit |
| Reference V+ to GND                            |                                   | - 0.3 to + 6        | V    |
| IN, COM, NC, NO <sup>a</sup>                   |                                   | - 0.3 to (V+ + 0.3) |      |
| Continuous Current (Any terminal)              |                                   | ± 50                | mA   |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) |                                   | ± 200               |      |
| Storage Temperature (D Suffix)                 |                                   | - 65 to 150         | °C   |
| Power Dissipation (Packages) <sup>b</sup>      | TSSOP-16 <sup>c</sup>             | 450                 | mW   |
|  | QFN-16 (4 mm x 4 mm) <sup>d</sup> | 1880                |      |

Notes:

- a. Signals on NC, NO, or COM or IN exceeding 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 23.5 mW/°C above 70 °C
- e. Manual soldering with soldering iron is not recommended for leadless components. The QFN 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 (V+ = 2 V)               |   |  |                           |                            |                   |                   |      |
|---|---|--|---------------------------|----------------------------|-------------------|-------------------|------|
| Parameter                               | Symbol  | Test Conditions<br>Otherwise Unless Specified<br>V+ = 2 V, V <sub>IN</sub> = 0.4 V or 1.6 V <sup>e</sup> | Temp. <sup>a</sup>        | Limits<br>- 40 °C to 85 °C |                   |                   | Unit |
|   |   |  |                           | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>Analog Switch</b>                    |   |  |                           |                            |                   |                   |      |
| Analog Signal Range <sup>d</sup>        | V <sub>NO</sub> , V <sub>NC</sub><br>V <sub>COM</sub> |  | Full                      | 0                          |                   | V+                | V    |
| On- Resistance                          | R <sub>ON</sub>                                       | V+ = 2 V, V <sub>COM</sub> = 0.2 V/1.2 V, I <sub>NO</sub> , I <sub>NC</sub> = 10 mA                      | Room<br>Full              |                            | 3                 | 6.3<br>6.3        | Ω    |
| R <sub>ON</sub> Flatness <sup>d</sup>   | R <sub>ON</sub><br>Flatness                           | V+ = 2 V, V <sub>COM</sub> = 0 V to V+, I <sub>NO</sub> , I <sub>NC</sub> = 10 mA                        | Room                      |                            |                   | 4.2               |      |
| R <sub>ON</sub> Match Between Channels  | ΔR <sub>ON</sub>                                      |  | Room                      |                            |                   | 0.4               |      |
| Switch Off Leakage Current <sup>f</sup> | I <sub>NO(off)</sub><br>I <sub>NC(off)</sub>          | V+ = 2.2 V<br>V <sub>NO</sub> , V <sub>NC</sub> = 0.2 V/2 V, V <sub>COM</sub> = 2 V/0.2 V                | Room<br>Full <sup>d</sup> | - 1<br>- 10                |                   | 1<br>10           | nA   |
|   | I <sub>COM(off)</sub>                                 |  | Room<br>Full <sup>d</sup> | - 1<br>- 10                |                   | 1<br>10           |      |
| Channel-On Leakage Current <sup>f</sup> | I <sub>COM(on)</sub>                                  | V+ = 2.2 V, V <sub>NO</sub> , V <sub>NC</sub> = V <sub>COM</sub> = 0.2 V/2 V                             | Room<br>Full <sup>d</sup> | - 1<br>- 10                |                   | 1<br>10           |      |

| SPECIFICATIONS (V+ = 2 V)           |  |   |                           |                            |                   |                   |      |
|-------------------------------------|--|---|---------------------------|----------------------------|-------------------|-------------------|------|
| Parameter                           | Symbol                                       | Test Conditions<br>Otherwise Unless Specified<br>V+ = 2 V, VIN = 0.4 V or 1.6 V <sup>e</sup>                | Temp. <sup>a</sup>        | Limits<br>- 40 °C to 85 °C |                   |                   | Unit |
|                                     |  |   |                           | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>Digital Control</b>              |  |   |                           |                            |                   |                   |      |
| Input High Voltage                  | V <sub>INH</sub>                             |   | Full                      | 1.6                        |                   |                   | V    |
| Input Low Voltage                   | V <sub>INL</sub>                             |   | Full                      |                            |                   | 0.4               |      |
| Input Capacitance <sup>d</sup>      | C <sub>in</sub>                              |   | Full                      |                            | 4                 |                   | pF   |
| Input Current                       | I <sub>INL</sub> or I <sub>INH</sub>         | V <sub>IN</sub> = 0 V or V+   | Full                      | - 1                        |                   | 1                 | μA   |
| <b>Dynamic Characteristics</b>      |  |   |                           |                            |                   |                   |      |
| Turn-On Time                        | t <sub>ON</sub>                              | V <sub>NO</sub> or V <sub>NC</sub> = 1.5 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>fig. 1 and 2  | Room<br>Full <sup>d</sup> |                            | 30                | 81<br>82          | ns   |
| Turn-Off Time                       | t <sub>OFF</sub>                             |   | Room<br>Full <sup>d</sup> |                            | 22                | 41<br>42          |      |
| Break-Before-Make Time Delay        | t <sub>D</sub>                               | V <sub>NO</sub> or V <sub>NC</sub> = 1.5 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>(DG2043 Only) | Room                      | 5                          |                   |                   |      |
| Charge Injection <sup>d</sup>       | Q <sub>INJ</sub>                             | C <sub>L</sub> = 1 nF, V <sub>GEN</sub> = 0 V, R <sub>GEN</sub> = 0 Ω, fig. 2                               | Room                      |                            | 1                 |                   | pC   |
| Off-Isolation <sup>d</sup>          | OIRR   | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 1 MHz   | Room                      |                            | - 63              |                   | dB   |
| Crosstalk <sup>d</sup>              | X <sub>TALK</sub>                            |   | Room                      |                            | - 95              |                   |      |
| NO, NC Off Capacitance <sup>d</sup> | C <sub>NO(off)</sub><br>C <sub>NC(off)</sub> | V <sub>IN</sub> = 0 V or V+, f = 1 MHz  | Room                      |                            | 24                |                   | pF   |
| Channel-On Capacitance <sup>d</sup> | C <sub>ON</sub>                              |   | Room                      |                            | 48                |                   |      |
| <b>Power Supply</b>                 |  |   |                           |                            |                   |                   |      |
| Power Supply Current <sup>d</sup>   | I+   | V <sub>IN</sub> = 0 V or V+   |                           |                            | 0.001             | 1                 | μA   |

| SPECIFICATIONS (V+ = 3 V)               |   |  |                    |                         |                   |                   |      |
|---|---|--|--------------------|-------------------------|-------------------|-------------------|------|
| Parameter                               | Symbol  | Test Conditions<br>Otherwise Unless Specified<br>V+ = 3 V, ± 10 %, V <sub>IN</sub> = 0.4 V or 2 V <sup>e</sup> | Temp. <sup>a</sup> | Limits<br>- 40 to 85 °C |                   |                   | Unit |
|   |   |  |                    | Min. <sup>b</sup>       | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>Analog Switch</b>                    |   |  |                    |                         |                   |                   |      |
| Analog Signal Range <sup>d</sup>        | V <sub>NO</sub> , V <sub>NC</sub><br>V <sub>COM</sub> |  | Full               | 0                       |                   | V+                | V    |
| On-Resistance                           | R <sub>ON</sub>                                       | V+ = 2.7 V, V <sub>COM</sub> = 0.7 V/1.5 V, I <sub>NO</sub> ,<br>I <sub>NC</sub> = 10 mA                       | Room<br>Full       |                         | 1.6               | 2.1<br>2.2        | Ω    |
| R <sub>ON</sub> Flatness <sup>d</sup>   | R <sub>ON</sub><br>Flatness                           | V+ = 2.7 V, V <sub>COM</sub> = 0 V to V+, I <sub>NO</sub> , I <sub>NC</sub> = 10 mA                            | Room               |                         |                   | 0.7               |      |
| R <sub>ON</sub> Match Between Channels  | ΔR <sub>ON</sub>                                      |  | Room               |                         |                   | 0.3               |      |
| Switch Off Leakage Current <sup>f</sup> | I <sub>NO(off)</sub><br>I <sub>NC(off)</sub>          | V+ = 3.3 V<br>V <sub>NO</sub> , V <sub>NC</sub> = 0.3 V/3 V, V <sub>COM</sub> = 3 V/0.3 V                      | Room<br>Full       | - 1<br>- 10             |                   | 1<br>10           | nA   |
|   | I <sub>COM(off)</sub>                                 |  | Room<br>Full       | - 1<br>- 10             |                   | 1<br>10           |      |
| Channel-On Leakage Current <sup>f</sup> | I <sub>COM(on)</sub>                                  | V+ = 3.3 V, V <sub>NO</sub> , V <sub>NC</sub> = V <sub>COM</sub> = 0.3 V/3 V                                   | Room<br>Full       | - 1<br>- 10             |                   | 1<br>10           |      |
| <b>Digital Control</b>                  |   |  |                    |                         |                   |                   |      |
| Input High Voltage <sup>d</sup>         | V <sub>INH</sub>                                      |  | Full               | 1.6                     |                   |                   | V    |
| Input Low Voltage                       | V <sub>INL</sub>                                      |  | Full               |                         |                   | 0.4               |      |
| Input Capacitance <sup>d</sup>          | C <sub>in</sub>                                       |  | Full               |                         | 4                 |                   | pF   |
| Input Current                           | I <sub>INL</sub> or I <sub>INH</sub>                  | V <sub>IN</sub> = 0 V or V+  | Full               | - 1                     |                   | 1                 | μA   |



| SPECIFICATIONS (V+ = 3 V)           |  |   |                    |                            |                   |                   |      |
|-------------------------------------|--|---|--------------------|----------------------------|-------------------|-------------------|------|
| Parameter                           | Symbol                                       | Test Conditions<br>Otherwise Unless Specified<br>V+ = 3 V, ± 10 %, VIN = 0.4 V or 2 V <sup>e</sup>        | Temp. <sup>a</sup> | Limits<br>- 40 °C to 85 °C |                   |                   | Unit |
|                                     |  |   |                    | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>Dynamic Characteristics</b>      |  |   |                    |                            |                   |                   |      |
| Turn-On Time <sup>d</sup>           | t <sub>ON</sub>                              | V <sub>NO</sub> or V <sub>NC</sub> = 2 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>fig. 1 and 2  | Room Full          |                            | 19                | 51<br>52          | ns   |
| Turn-Off Time <sup>d</sup>          | t <sub>OFF</sub>                             |   | Room Full          |                            | 17                | 36<br>37          |      |
| Break-Before-Make Time Delay        | t <sub>D</sub>                               | V <sub>NO</sub> or V <sub>NC</sub> = 2 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>(DG2043 Only) | Room               | 2                          |                   |                   |      |
| Charge Injection <sup>d</sup>       | Q <sub>INJ</sub>                             | C <sub>L</sub> = 1 nF, V <sub>GEN</sub> = 0 V, R <sub>GEN</sub> = 0 Ω, fig. 2                             | Room               |                            | 3                 |                   | pC   |
| Off-Isolation <sup>d</sup>          | OIRR   | R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 1 MHz   | Room               |                            | - 63              |                   | dB   |
| Crosstalk <sup>d</sup>              | X <sub>TALK</sub>                            |   | Room               |                            | - 94              |                   |      |
| NO, NC Off Capacitance <sup>d</sup> | C <sub>NO(off)</sub><br>C <sub>NC(off)</sub> | VIN = 0 V or V+, f = 1 MHz  | Room               |                            | 25                |                   | pF   |
| Channel-On Capacitance <sup>d</sup> | C <sub>ON</sub>                              |   | Room               |                            | 49                |                   |      |
| <b>Power Supply</b>                 |  |   |                    |                            |                   |                   |      |
| Power Supply Current                | I+   | VIN = 0 V or V+   |                    |                            | 0.001             | 1                 | μA   |

| SPECIFICATIONS (V+ = 5 V)              |   |  |                    |                            |                   |                   |      |
|--|---|--|--------------------|----------------------------|-------------------|-------------------|------|
| Parameter                              | Symbol  | Test Conditions<br>Otherwise Unless Specified<br>V+ = 5 V, ± 10 %, VIN = 0.8 V or 2.4 V <sup>e</sup> | Temp. <sup>a</sup> | Limits<br>- 40 °C to 85 °C |                   |                   | Unit |
|  |   |  |                    | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| <b>Analog Switch</b>                   |   |  |                    |                            |                   |                   |      |
| Analog Signal Range <sup>d</sup>       | V <sub>NO</sub> , V <sub>NC</sub><br>V <sub>COM</sub> |  | Full               | 0                          |                   | V+                | V    |
| On-Resistance                          | R <sub>ON</sub>                                       | V+ = 4.5 V, V <sub>COM</sub> = 0.7 V/2.5 V, I <sub>NO</sub> ,<br>I <sub>NC</sub> = 10 mA             | Room Full          |                            | 1                 | 1.5<br>1.6        | Ω    |
| R <sub>ON</sub> Flatness <sup>d</sup>  | R <sub>ON</sub><br>Flatness                           | V+ = 4.5 V, V <sub>COM</sub> = 0 V to V+, I <sub>NO</sub> , I <sub>NC</sub> = 10 mA                  | Room               |                            |                   | 0.7               |      |
| R <sub>ON</sub> Match Between Channels | ΔR <sub>ON</sub>                                      |  | Room               |                            |                   | 0.3               |      |
| Switch Off Leakage Current             | I <sub>NO(off)</sub><br>I <sub>NC(off)</sub>          | V+ = 5.5 V<br>V <sub>NO</sub> , V <sub>NC</sub> = 1 V/4.5 V, V <sub>COM</sub> = 4.5 V/1 V            | Room Full          | - 1<br>- 10                |                   | 1<br>10           | nA   |
|  | I <sub>COM(off)</sub>                                 |  | Room Full          | - 1<br>- 10                |                   | 1<br>10           |      |
| Channel-On Leakage Current             | I <sub>COM(on)</sub>                                  | V+ = 5.5 V, V <sub>NO</sub> , V <sub>NC</sub> = V <sub>COM</sub> = 1 V/4.5 V                         | Room Full          | - 1<br>- 10                |                   | 1<br>10           |      |
| <b>Digital Control</b>                 |   |  |                    |                            |                   |                   |      |
| Input High Voltage                     | V <sub>INH</sub>                                      |  | Full               | 2.4                        |                   |                   | V    |
| Input Low Voltage                      | V <sub>INL</sub>                                      |  | Full               |                            |                   | 0.8               |      |
| Input Capacitance                      | C <sub>in</sub>                                       |  | Full               |                            | 4                 |                   | pF   |
| Input Current                          | I <sub>INL</sub> or I <sub>INH</sub>                  | VIN = 0 V or V+  | Full               | - 1                        |                   | 1                 | μA   |



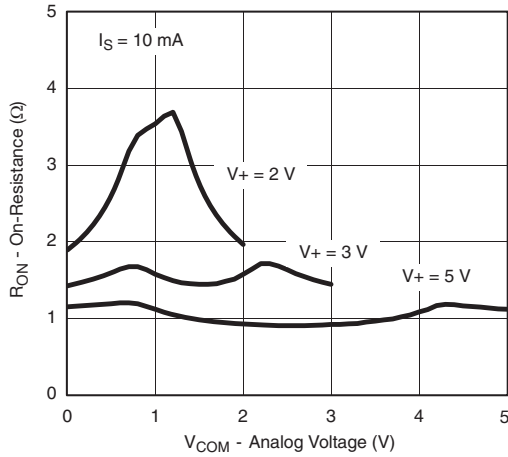
| SPECIFICATIONS ( $V_+ = 5\text{ V}$ ) |                                |   |                    |                            |                   |                   |               |
|---------------------------------------|--------------------------------|---|--------------------|----------------------------|-------------------|-------------------|---------------|
| Parameter                             | Symbol                         | Test Conditions<br>Otherwise Unless Specified<br>$V_+ = 5\text{ V}, \pm 10\%, V_{IN} = 0.8\text{ V or } 2.4\text{ V}^e$ | Temp. <sup>a</sup> | Limits<br>- 40 °C to 85 °C |                   |                   | Unit          |
|                                       |                                |   |                    | Min. <sup>b</sup>          | Typ. <sup>c</sup> | Max. <sup>b</sup> |               |
| <b>Dynamic Characteristics</b>        |                                |   |                    |                            |                   |                   |               |
| Turn-On Time <sup>d</sup>             | $t_{ON}$                       | $V_{NO}$ or $V_{NC} = 3\text{ V}, R_L = 300\ \Omega, C_L = 35\text{ pF}$<br>fig. 1 and 2                                | Room Full          |                            | 13                | 42<br>43          | ns            |
| Turn-Off Time <sup>d</sup>            | $t_{OFF}$                      |   | Room Full          |                            | 19                | 32<br>33          |               |
| Break-Before-Make Time Delay          | $t_D$                          | $V_{NO}$ or $V_{NC} = 3\text{ V}, R_L = 300\ \Omega, C_L = 35\text{ pF}$<br>(DG2043 Only)                               | Room               | 1                          |                   |                   |               |
| Charge Injection <sup>d</sup>         | $Q_{INJ}$                      | $C_L = 1\text{ nF}, V_{GEN} = 0\text{ V}, R_{GEN} = 0\ \Omega$ , fig. 2   | Room               |                            | 3                 |                   | pC            |
| Off-Isolation <sup>d</sup>            | OIRR                           | $R_L = 50\ \Omega, C_L = 5\text{ pF}, f = 1\text{ MHz}$   | Room               |                            | - 63              |                   | dB            |
| Crosstalk <sup>d</sup>                | $X_{TALK}$                     |   | Room               |                            | - 93              |                   |               |
| Source-Off Capacitance <sup>d</sup>   | $C_{NO(off)}$<br>$C_{NC(off)}$ | $V_{IN} = 0\text{ V or } V_+, f = 1\text{ MHz}$   | Room               |                            | 26                |                   | pF            |
| Channel-On Capacitance <sup>d</sup>   | $C_{ON}$                       |   | Room               |                            | 49                |                   |               |
| <b>Power Supply</b>                   |                                |   |                    |                            |                   |                   |               |
| Power Supply Current                  | I+                             | $V_{IN} = 0\text{ V or } V_+$   |                    |                            | 0.001             | 1                 | $\mu\text{A}$ |

Notes:

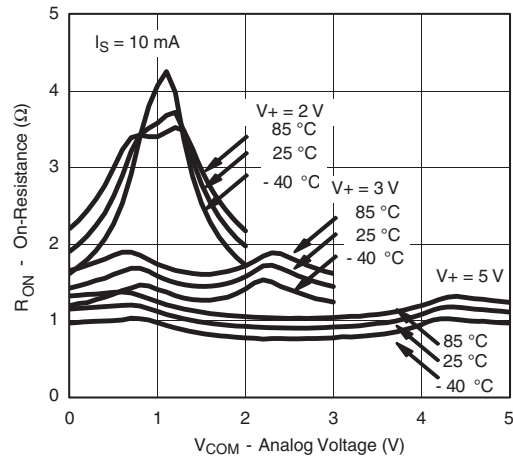
- Room = 25 °C, full = as determined by the operating suffix.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Typical values are for design aid only, not guaranteed nor subject to production testing.
- Guarantee by design, nor subjected to production test.
- $V_{IN}$  = input voltage to perform proper function.
- Guaranteed by 5 V leakage testing, not production tested.

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.

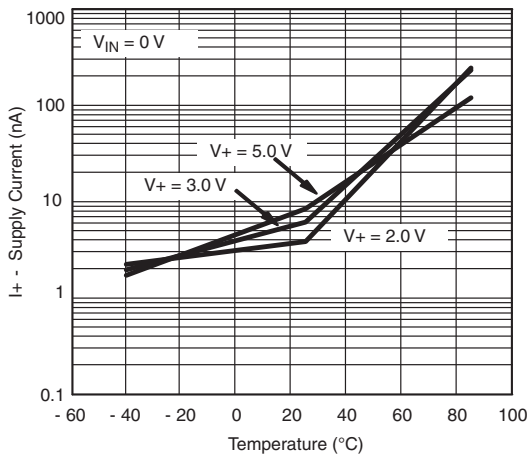
**TYPICAL CHARACTERISTICS** (25 °C unless noted)



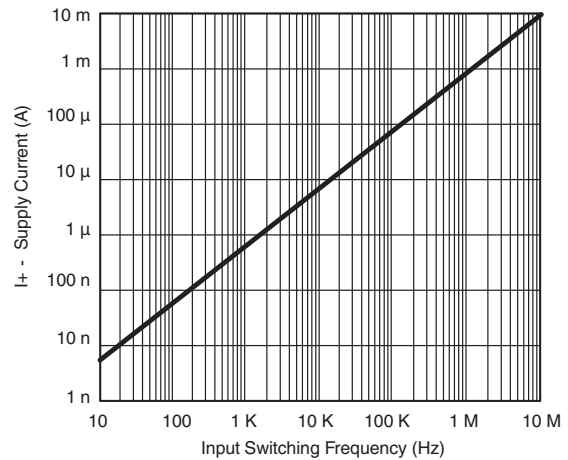
**RON vs. VCOM and Supply Voltage**



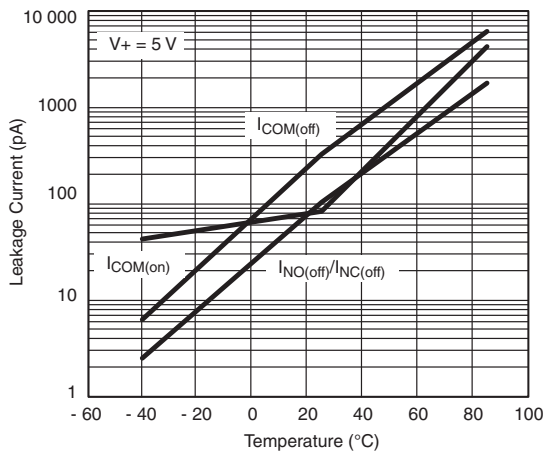
**RON vs. Analog Voltage and Temperature**



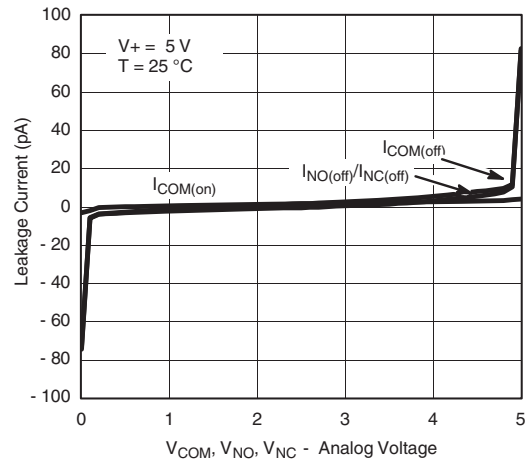
**Supply Current vs. Temperature**



**Supply Current vs. Input Switching Frequency**

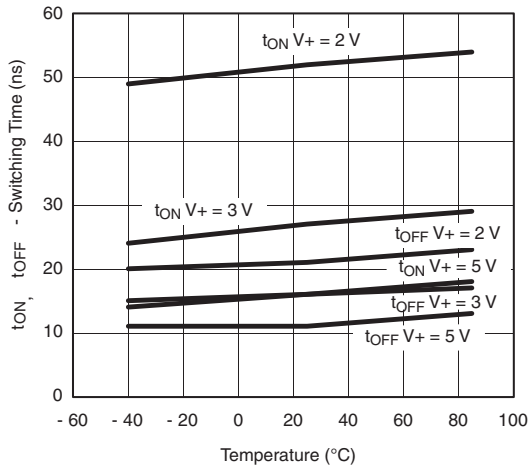


**Leakage Current vs. Temperature**

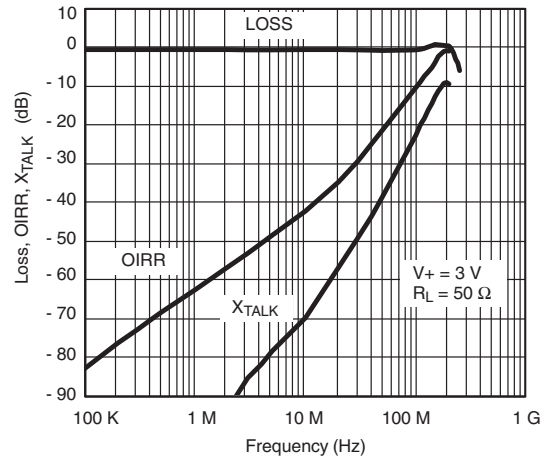


**Leakage vs. Analog Voltage**

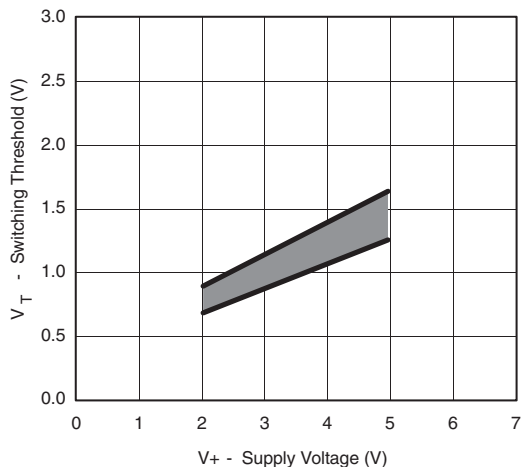
### TYPICAL CHARACTERISTICS (25 °C unless noted)



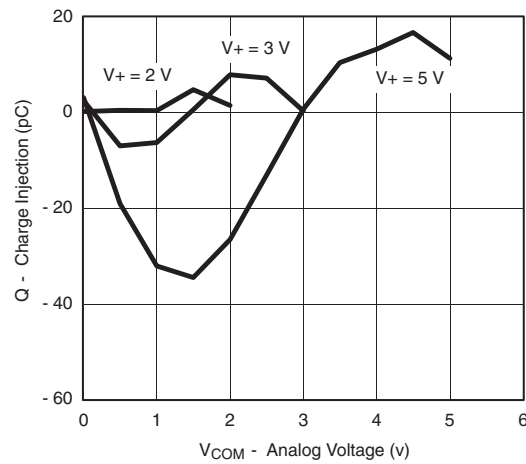
**Switching Time vs. Temperature and Supply Voltage**



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



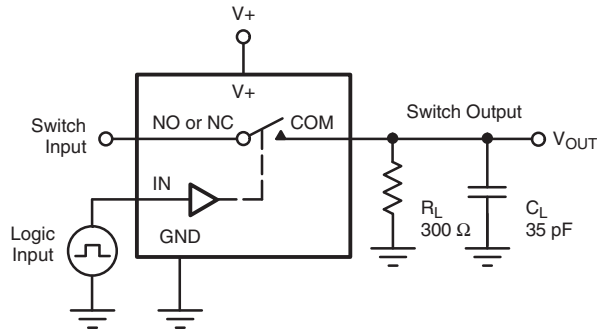
**Switching Threshold vs. Supply Voltage**



**Charge Injection vs. Analog Voltage**

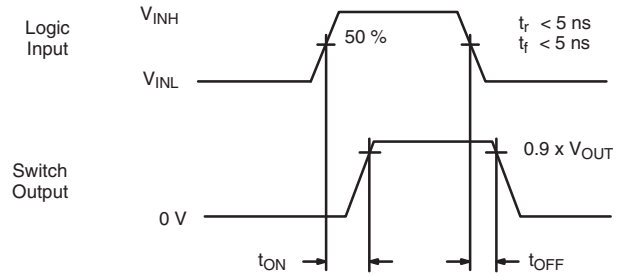


## TEST CIRCUITS



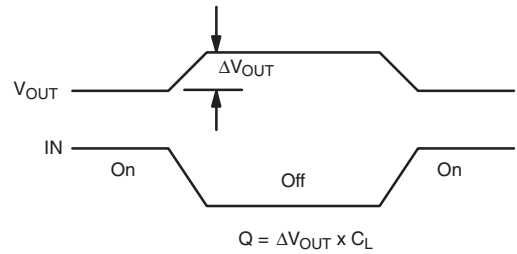
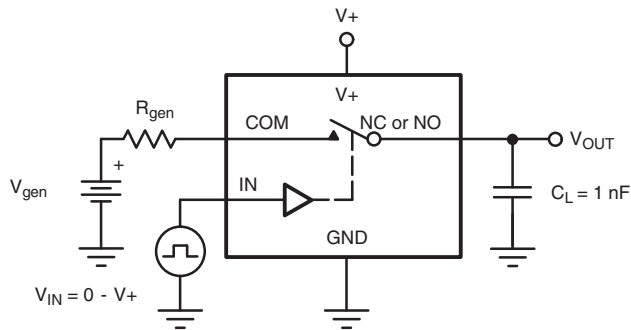
$C_L$  (includes fixture and stray capacitance)

$$V_{OUT} = V_{COM} \left( \frac{R_L}{R_L + R_{ON}} \right)$$



Logic "1" = Switch On  
Logic input waveforms inverted for switches that have the opposite logic sense.

Figure 1. Switching Time



IN depends on switch configuration: input polarity determined by sense of switch.

Figure 2. Charge Injection

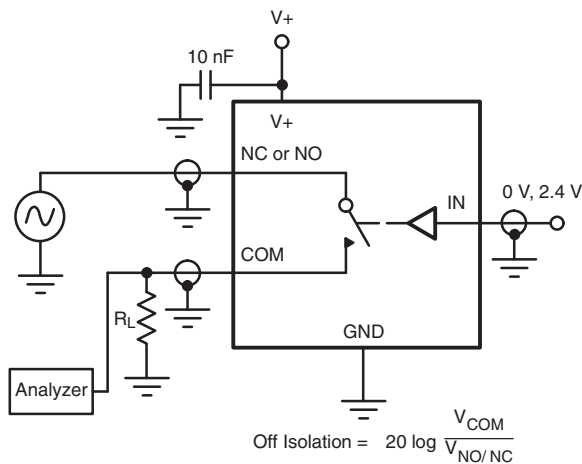


Figure 3. Off-Isolation

$$\text{Off Isolation} = 20 \log \frac{V_{COM}}{V_{NO/NC}}$$

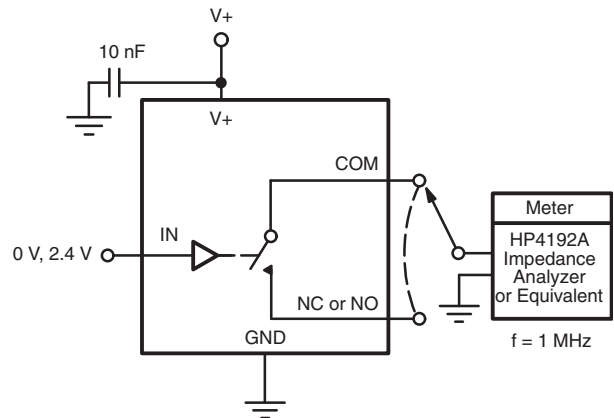
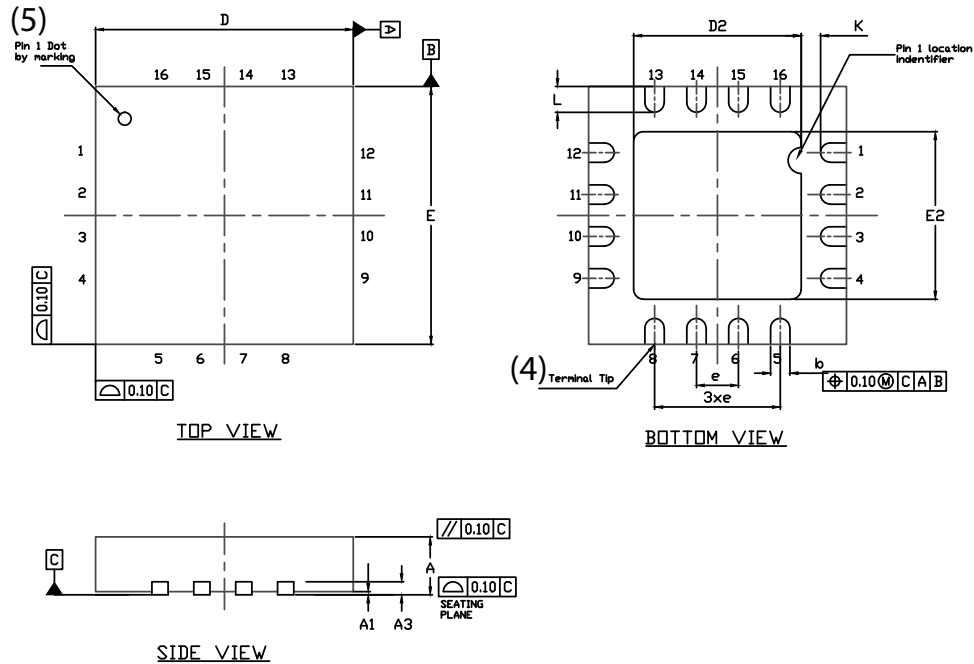


Figure 4. Channel Off/On Capacitance

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/ppg?72091](http://www.vishay.com/ppg?72091).

### QFN 4x4-16L Case Outline



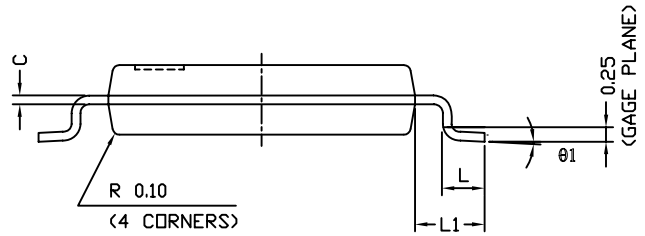
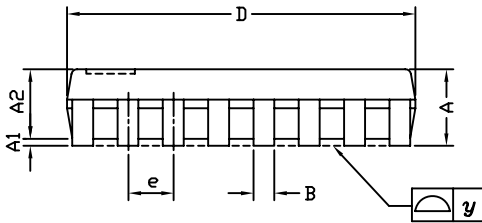
| DIM               | VARIATION 1                |      |      |            |       |       | VARIATION 2                |      |      |            |       |       |
|-------------------|----------------------------|------|------|------------|-------|-------|----------------------------|------|------|------------|-------|-------|
|                   | MILLIMETERS <sup>(1)</sup> |      |      | INCHES     |       |       | MILLIMETERS <sup>(1)</sup> |      |      | INCHES     |       |       |
|                   | MIN.                       | NOM. | MAX. | MIN.       | NOM.  | MAX.  | MIN.                       | NOM. | MAX. | MIN.       | NOM.  | MAX.  |
| A                 | 0.75                       | 0.85 | 0.95 | 0.029      | 0.033 | 0.037 | 0.75                       | 0.85 | 0.95 | 0.029      | 0.033 | 0.037 |
| A1                | 0                          | -    | 0.05 | 0          | -     | 0.002 | 0                          | -    | 0.05 | 0          | -     | 0.002 |
| A3                | 0.20 ref.                  |      |      | 0.008 ref. |       |       | 0.20 ref.                  |      |      | 0.008 ref. |       |       |
| b                 | 0.25                       | 0.30 | 0.35 | 0.010      | 0.012 | 0.014 | 0.25                       | 0.30 | 0.35 | 0.010      | 0.012 | 0.014 |
| D                 | 4.00 BSC                   |      |      | 0.157 BSC  |       |       | 4.00 BSC                   |      |      | 0.157 BSC  |       |       |
| D2                | 2.0                        | 2.1  | 2.2  | 0.079      | 0.083 | 0.087 | 2.5                        | 2.6  | 2.7  | 0.098      | 0.102 | 0.106 |
| e                 | 0.65 BSC                   |      |      | 0.026 BSC  |       |       | 0.65 BSC                   |      |      | 0.026 BSC  |       |       |
| E                 | 4.00 BSC                   |      |      | 0.157 BSC  |       |       | 4.00 BSC                   |      |      | 0.157 BSC  |       |       |
| E2                | 2.0                        | 2.1  | 2.2  | 0.079      | 0.083 | 0.087 | 2.5                        | 2.6  | 2.7  | 0.098      | 0.102 | 0.106 |
| K                 | 0.20 min.                  |      |      | 0.008 min. |       |       | 0.20 min.                  |      |      | 0.008 min. |       |       |
| L                 | 0.5                        | 0.6  | 0.7  | 0.020      | 0.024 | 0.028 | 0.3                        | 0.4  | 0.5  | 0.012      | 0.016 | 0.020 |
| N <sup>(3)</sup>  | 16                         |      |      | 16         |       |       | 16                         |      |      | 16         |       |       |
| Nd <sup>(3)</sup> | 4                          |      |      | 4          |       |       | 4                          |      |      | 4          |       |       |
| Ne <sup>(3)</sup> | 4                          |      |      | 4          |       |       | 4                          |      |      | 4          |       |       |

#### Notes

- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

ECN: S13-0893-Rev. B, 22-Apr-13  
 DWG: 5890

## 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 |
| $\theta 1$ | 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)



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