

## Improved Quad CMOS Analog Switches

### DESCRIPTION

The DG211B, DG212B analog switches are highly improved versions of the industry-standard DG211, DG212. These devices are fabricated in Vishay Siliconix' proprietary silicon gate CMOS process, resulting in lower on-resistance, lower leakage, higher speed, and lower power consumption.

These quad single-pole single-throw switches are designed for a wide variety of applications in telecommunications, instrumentation, process control, computer peripherals, etc. An improved charge injection compensation design minimizes switching transients. The DG211B and DG212B can handle up to  $\pm 22$  V, and have an improved continuous current rating of 30 mA. An epitaxial layer prevents latchup.

All devices feature true bi-directional performance in the on condition, and will block signals to the supply levels in the off condition.

The DG211B is a normally closed switch and the DG212B is a normally open switch. (see Truth Table.)

### FEATURES

- $\pm 22$  V supply voltage rating
- TTL and CMOS compatible logic
- Low on-resistance -  $R_{DS(on)}$ : 50  $\Omega$
- Low leakage -  $I_{D(on)}$ : 20 pA
- Single supply operation possible
- Extended temperature range
- Fast switching -  $t_{ON}$ : 120 ns
- Low charge injection - Q: 1 pC

### BENEFITS

- Wide analog signal range
- Simple logic interface
- Higher accuracy
- Minimum transients
- Reduced power consumption
- Superior to DG211, DG212
- Space savings (TSSOP)

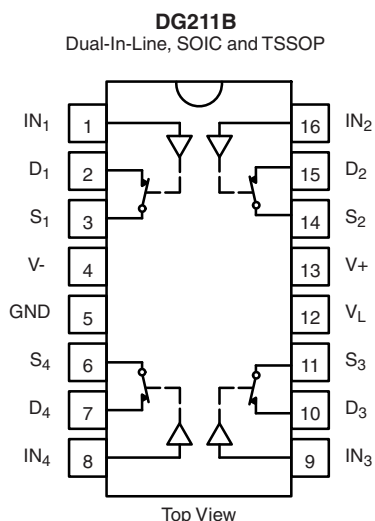
### APPLICATIONS

- Industrial instrumentation
- Test equipment
- Communications systems
- Disk drives
- Computer peripherals
- Portable instruments
- Sample-and-hold circuits



Available  
**RoHS\***  
COMPLIANT

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE |        |        |
|-------------|--------|--------|
| Logic       | DG211B | DG212B |
| 0           | ON     | OFF    |
| 1           | OFF    | ON     |

Logic "0"  $\leq 0.8$  V  
Logic "1"  $\geq 2.4$  V

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

## ORDERING INFORMATION

| Temp. Range      | Package            | Standard Part Number    | Lead (Pb)-free Part Number    |
|------------------|--------------------|-------------------------|-------------------------------|
| - 40 °C to 85 °C | 16-Pin Plastic DIP | DG211BDJ                | DG211BDJ-E3                   |
|                  |                    | DG212BDJ                | DG212BDJ-E3                   |
|                  | 16-Pin Narrow SOIC | DG211BDY<br>DG211BDY-T1 | DG211BDY-E3<br>DG211BDY-T1-E3 |
|                  |                    | DG212BDY<br>DG212BDY-T1 | DG212BDY-E3<br>DG212BDY-T1-E3 |
|                  | 16-Pin TSSOP       | DG211BDQ<br>DG211BDQ-T1 | DG211BDQ-E3<br>DG211BDQ-T1-E3 |
|                  |                    | DG212BDQ<br>DG212BDQ-T1 | DG212BDQ-E3<br>DG212BDQ-T1-E3 |

## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                                                   | Limit                                                              | Unit |
|-------------------------------------------------------------|--------------------------------------------------------------------|------|
| Voltages Referenced, $V_+$ to $V_-$                         | 44                                                                 | V    |
| GND                                                         | 25                                                                 |      |
| Digital Inputs <sup>a</sup> , $V_S$ , $V_D$                 | ( $V_-$ ) - 2 to ( $V_+$ ) + 2<br>or 30 mA, whichever occurs first |      |
| Current (Any terminal)                                      | 30                                                                 | mA   |
| Peak Current, S or D (Pulsed at 1 ms, 10 % duty cycle max.) | 100                                                                |      |
| Storage Temperature                                         | - 65 to 125                                                        | °C   |
| Power Dissipation (Package) <sup>b</sup>                    | 16-Pin Plastic DIP <sup>c</sup>                                    | mW   |
|                                                             | 16-Pin Narrow SOIC and TSSOP <sup>d</sup>                          |      |

Notes:

a. Signals on  $S_X$ ,  $D_X$ , or  $IN_X$  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 6.5 mW/°C above 75 °C.

d. Derate 7.6 mW/°C above 75 °C.

## SCHEMATIC DIAGRAM (Typical Channel)

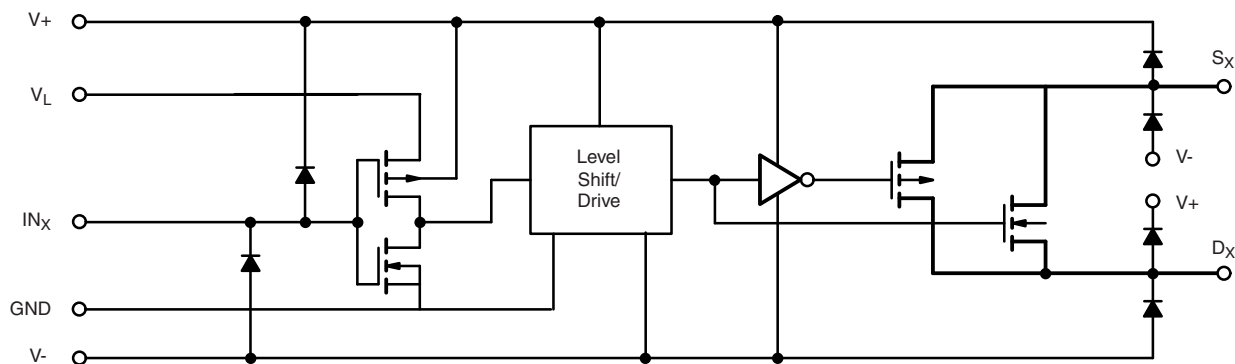


Figure 1.

**SPECIFICATIONS**

| Parameter                                   | Symbol                               | Test Conditions<br>Unless Otherwise Specified<br>V+ = 15 V, V- = - 15 V<br>VL = 5 V, VIN = 2.4 V, 0.8 V <sup>e</sup> | Temp. <sup>a</sup> | D Suffix<br>- 40 °C to 85 °C |                   |                   | Unit |
|---------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------|-------------------|-------------------|------|
|                                             |                                      |                                                                                                                      |                    | Min. <sup>b</sup>            | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| Analog Switch                               |                                      |                                                                                                                      |                    |                              |                   |                   |      |
| Analog Signal Range <sup>d</sup>            | V <sub>ANALOG</sub>                  |                                                                                                                      | Full               | - 15                         |                   | 15                | V    |
| Drain-Source On-Resistance                  | R <sub>DS(on)</sub>                  | VD = ± 10 V, IS = 1 mA                                                                                               | Room Full          |                              | 45                | 85<br>100         | Ω    |
| R <sub>DS(on)</sub> Match                   | ΔR <sub>DS(on)</sub>                 |                                                                                                                      | Room               |                              | 2                 |                   |      |
| Source Off Leakage Current                  | IS(off)                              | VS = ± 14 V, VD = ± 14 V                                                                                             | Room Full          | - 0.5<br>- 5                 | ± 0.01            | 0.5<br>5          | nA   |
| Drain Off Leakage Current                   | ID(off)                              | VD = ± 14 V, VS = ± 14 V                                                                                             | Room Full          | - 0.5<br>- 5                 | ± 0.01            | 0.5<br>5          |      |
| Drain On Leakage Current                    | ID(on)                               | VS = VD = ± 14 V                                                                                                     | Room Full          | - 0.5<br>- 10                | ± 0.02            | 0.5<br>10         |      |
| Digital Control                             |                                      |                                                                                                                      |                    |                              |                   |                   |      |
| Input Voltage High                          | V <sub>INH</sub>                     |                                                                                                                      | Full               | 2.4                          |                   |                   | V    |
| Input Voltage Low                           | V <sub>INL</sub>                     |                                                                                                                      | Full               |                              |                   | 0.8               |      |
| Input Current                               | I <sub>INH</sub> or I <sub>INL</sub> | V <sub>INH</sub> or V <sub>INL</sub>                                                                                 | Full               | - 1                          |                   | 1                 | μA   |
| Input Capacitance                           | C <sub>IN</sub>                      |                                                                                                                      | Room               |                              | 5                 |                   | pF   |
| Dynamic Characteristics                     |                                      |                                                                                                                      |                    |                              |                   |                   |      |
| Turn-On Time                                | t <sub>ON</sub>                      | VS = 10 V<br>see figure 2                                                                                            | Room               |                              |                   | 300               | ns   |
| Turn-Off Time                               | t <sub>OFF</sub>                     |                                                                                                                      | Room               |                              |                   | 200               |      |
| Charge Injection                            | Q                                    | CL = 1000 pF, V <sub>gen</sub> = 0 V, R <sub>gen</sub> = 0 Ω                                                         | Room               |                              | 1                 |                   | pC   |
| Source-Off Capacitance                      | CS(off)                              | VS = 0 V, f = 1 MHz                                                                                                  | Room               |                              | 5                 |                   | pF   |
| Drain-Off Capacitance                       | CD(off)                              |                                                                                                                      | Room               |                              | 5                 |                   |      |
| Channel-On Capacitance                      | CD(on)                               | VD = VS = 0 V, f = 1 MHz                                                                                             | Room               |                              | 16                |                   |      |
| Off Isolation                               | OIRR                                 | CL = 15 pF, RL = 50 Ω,<br>VS = 1 V <sub>RMS</sub> , f = 100 kHz                                                      | Room               |                              | 90                |                   | dB   |
| Channel-to-Channel Crosstalk                | XTALK                                |                                                                                                                      | Room               |                              | 95                |                   |      |
| Power Supply                                |                                      |                                                                                                                      |                    |                              |                   |                   |      |
| Positive Supply Current                     | I+                                   | VIN = 0 or 5 V                                                                                                       | Room Full          |                              |                   | 10<br>50          | μA   |
| Negative Supply Current                     | I-                                   |                                                                                                                      | Room Full          | - 10<br>- 50                 |                   |                   |      |
| Logic Supply Current                        | IL                                   |                                                                                                                      | Room Full          |                              |                   | 10<br>50          |      |
| Power Supply Range for Continuous Operation | VOP                                  |                                                                                                                      | Full               | ± 4.5                        |                   | ± 22              | V    |

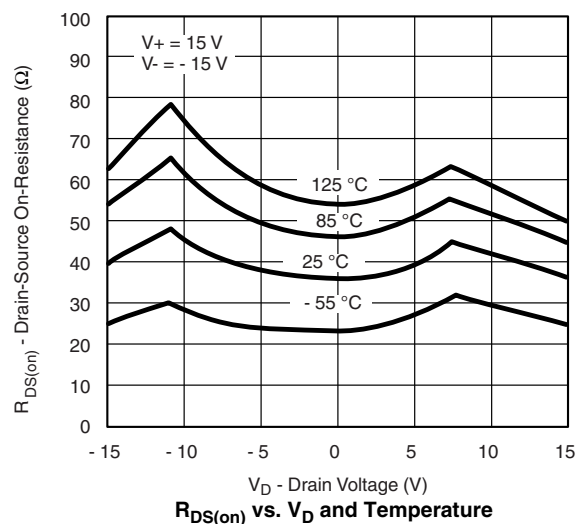
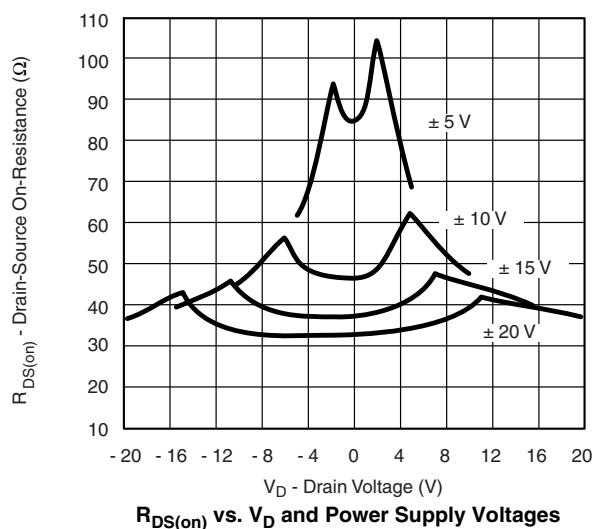
| SPECIFICATIONS (for Single Supply)          |                     |                                                                                                                                           |                    |                              |                   |                   |      |
|---------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------|-------------------|-------------------|------|
| Parameter                                   | Symbol              | Test Conditions<br>Unless Otherwise Specified<br>V+ = 12 V, V- = 0 V<br>V <sub>L</sub> = 5 V, V <sub>IN</sub> = 2.4 V, 0.8 V <sup>e</sup> | Temp. <sup>a</sup> | D Suffix<br>- 40 °C to 85 °C |                   |                   | Unit |
|                                             |                     |                                                                                                                                           |                    | Min. <sup>b</sup>            | Typ. <sup>c</sup> | Max. <sup>b</sup> |      |
| Analog Switch                               |                     |                                                                                                                                           |                    |                              |                   |                   |      |
| Analog Signal Range <sup>d</sup>            | V <sub>ANALOG</sub> |                                                                                                                                           | Full               | 0                            |                   | 12                | V    |
| Drain-Source On-Resistance                  | R <sub>DS(on)</sub> | V <sub>D</sub> = 3 V, 8 V, I <sub>S</sub> = 1 mA                                                                                          | Room Full          |                              | 90                | 160 200           | Ω    |
| Dynamic Characteristics                     |                     |                                                                                                                                           |                    |                              |                   |                   |      |
| Turn-On Time                                | t <sub>ON</sub>     | V <sub>S</sub> = 8 V<br>see figure 1                                                                                                      | Room               |                              |                   | 300               | ns   |
| Turn-Off Time                               | t <sub>OFF</sub>    |                                                                                                                                           | Room               |                              |                   | 200               |      |
| Charge Injection                            | Q                   | C <sub>L</sub> = 1 nF, V <sub>gen</sub> = 6 V, R <sub>gen</sub> = 0 Ω                                                                     | Room               |                              | 4                 |                   | pC   |
| Power Supply                                |                     |                                                                                                                                           |                    |                              |                   |                   |      |
| Positive Supply Current                     | I+                  | V <sub>IN</sub> = 0 or 5 V                                                                                                                | Room Full          |                              |                   | 10 50             | μA   |
| Negative Supply Current                     | I-                  |                                                                                                                                           | Room Full          | - 10 - 50                    |                   |                   |      |
| Logic Supply Current                        | I <sub>L</sub>      |                                                                                                                                           | Room Full          |                              |                   | 10 50             |      |
| Power Supply Range for Continuous Operation | V <sub>OP</sub>     |                                                                                                                                           | Full               | + 4.5                        |                   | + 25              | V    |

Notes:

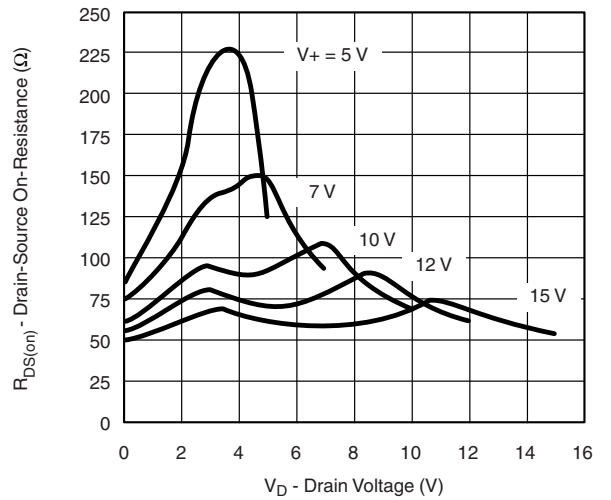
- Room = 25 °C, Full = as determined by the operating temperature suffix.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
-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

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.

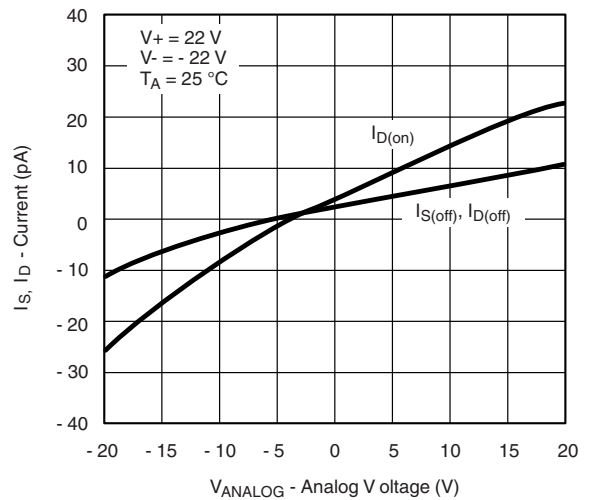
## TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



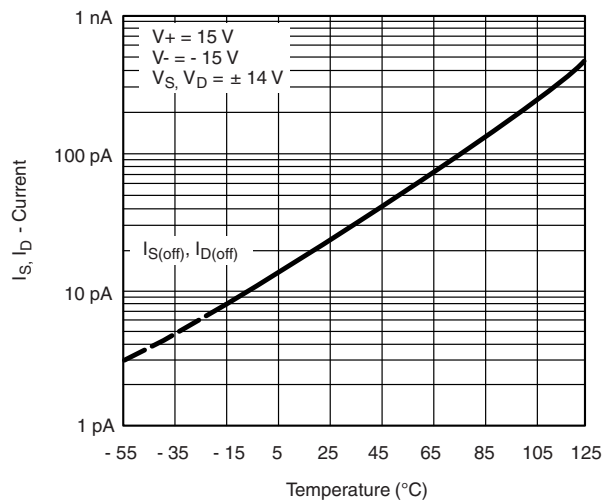
## TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)



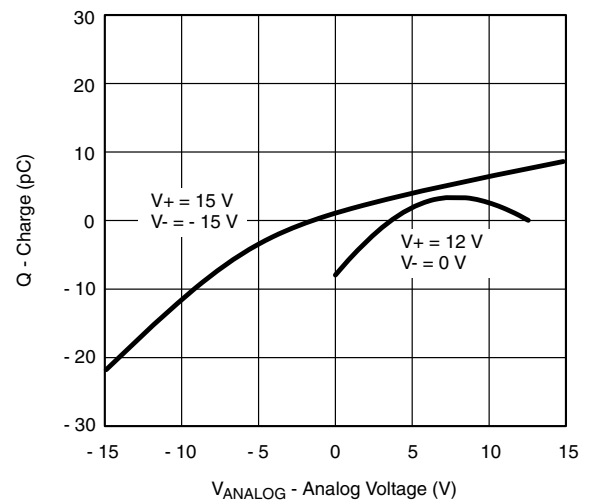
$R_{DS(on)}$  vs.  $V_D$  and Single Power Supply Voltages



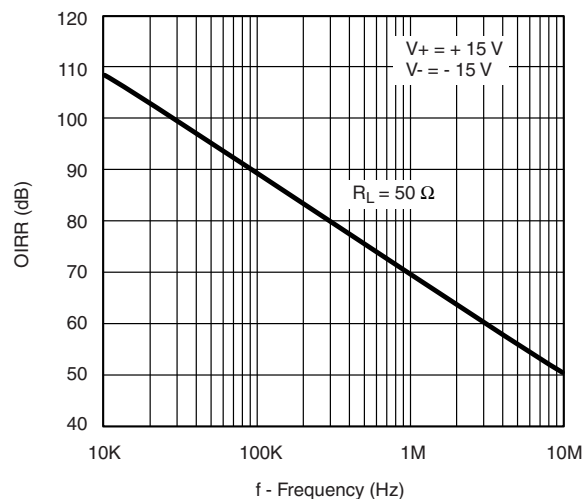
Leakage Currents vs. Analog Voltage



Leakage Current vs. Temperature



$Q_S, Q_D$  - Charge Injection vs. Analog Voltage



Off Isolation vs. Frequency

## TEST CIRCUITS

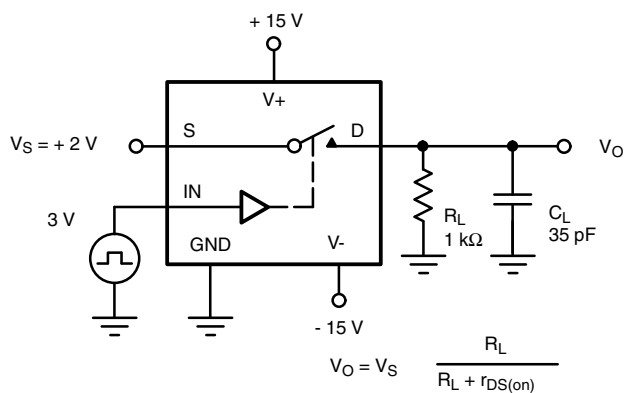


Figure 2. Switching Time

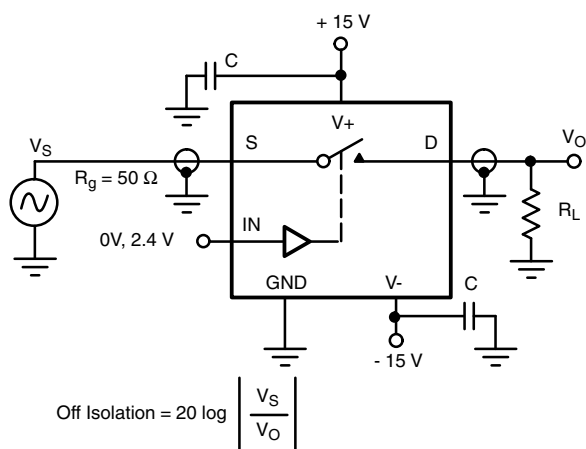
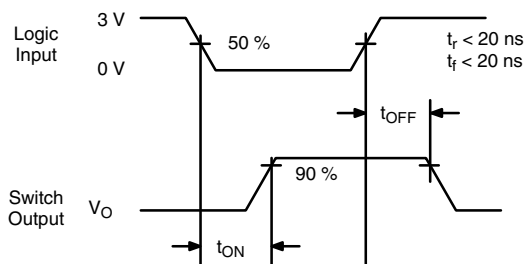


Figure 3. Off Isolation

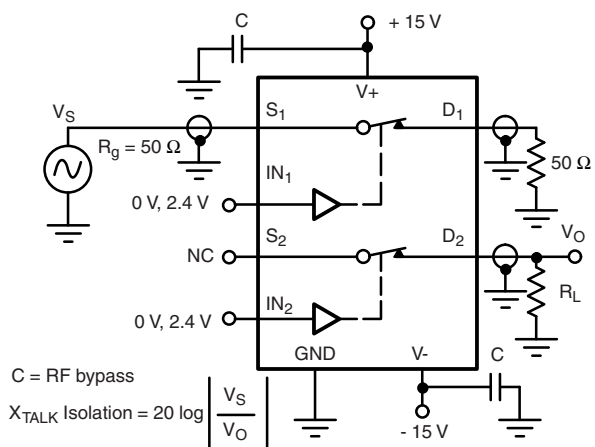


Figure 4. Channel-to-Channel Crosstalk

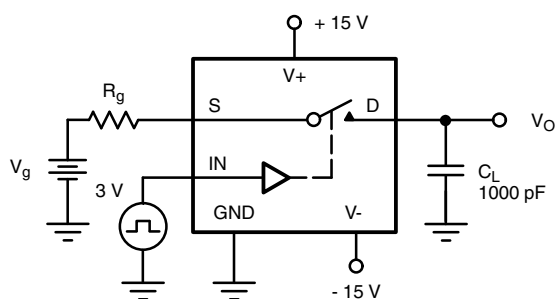
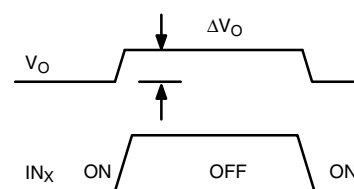


Figure 5. Charge Injection



$\Delta V_O$  = measured voltage error due to charge injection  
The charge injection in coulombs is  $Q = C_L \times \Delta V_O$

## APPLICATIONS

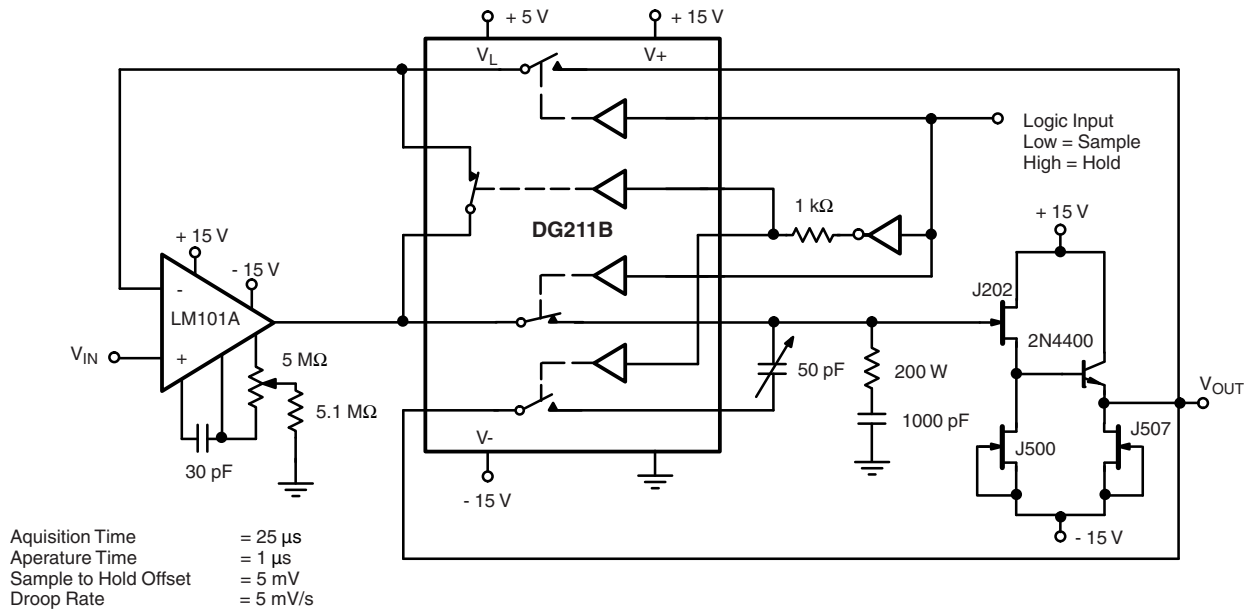
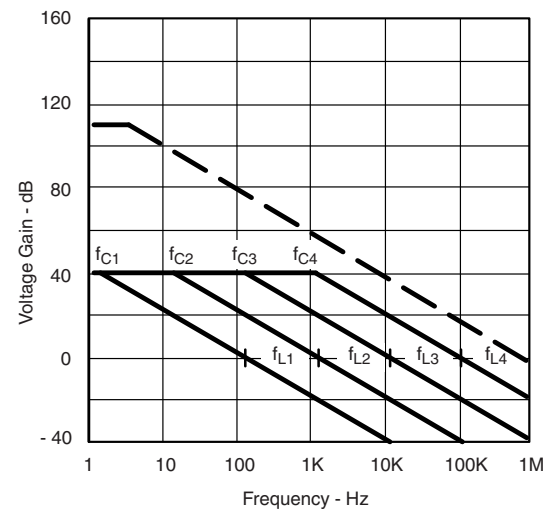
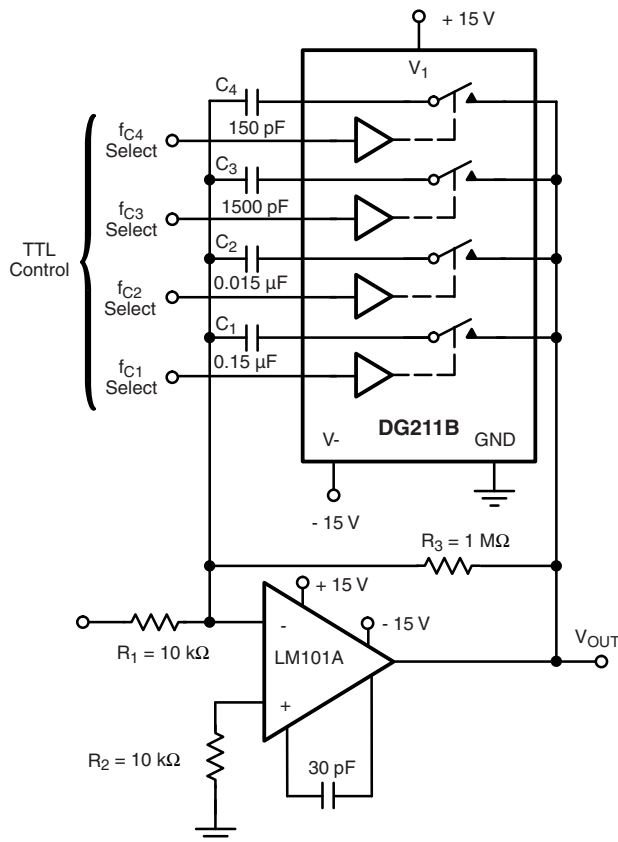


Figure 6. Sample-and-Hold



$$A_L \text{ (Voltage Gain Below Break Frequency)} = \frac{R_3}{R_1} = 100 \text{ (40 dB)}$$

$$f_C \text{ (Break Frequency)} = \frac{1}{2\pi R_3 C_X}$$

$$f_L \text{ (Unity Gain Frequency)} = \frac{1}{2\pi R_1 C_X}$$

$$\text{Max. Attenuation} = \frac{R_{DS(on)}}{10 \text{ k}\Omega} \approx -47 \text{ dB}$$

Figure 7. Active Low Pass Filter with Digitally Selected Break Frequency

## APPLICATIONS

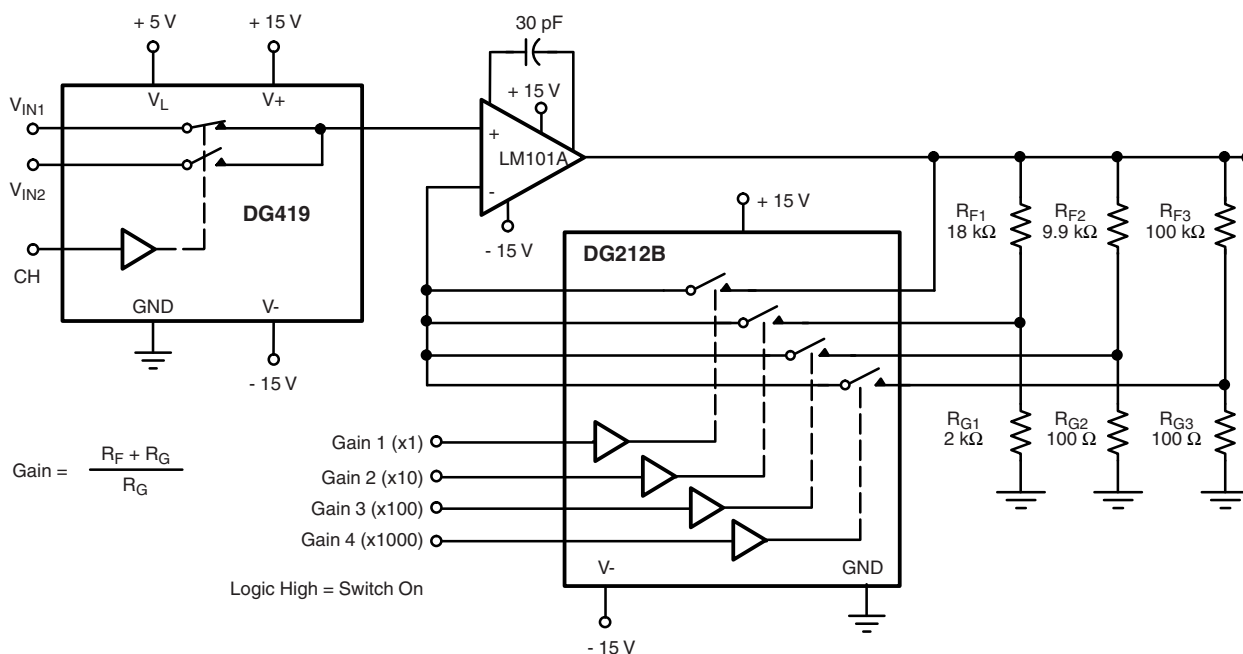


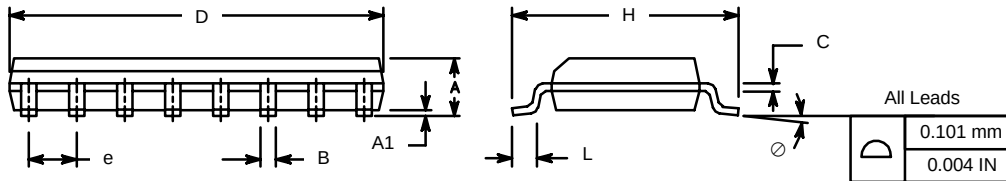
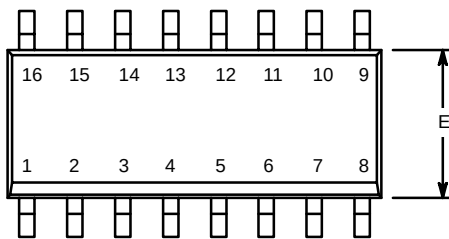
Figure 8. A Precision Amplifier with Digitally Programmable Input and Gains

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### SOIC (NARROW): 16-LEAD

JEDEC Part Number: MS-012

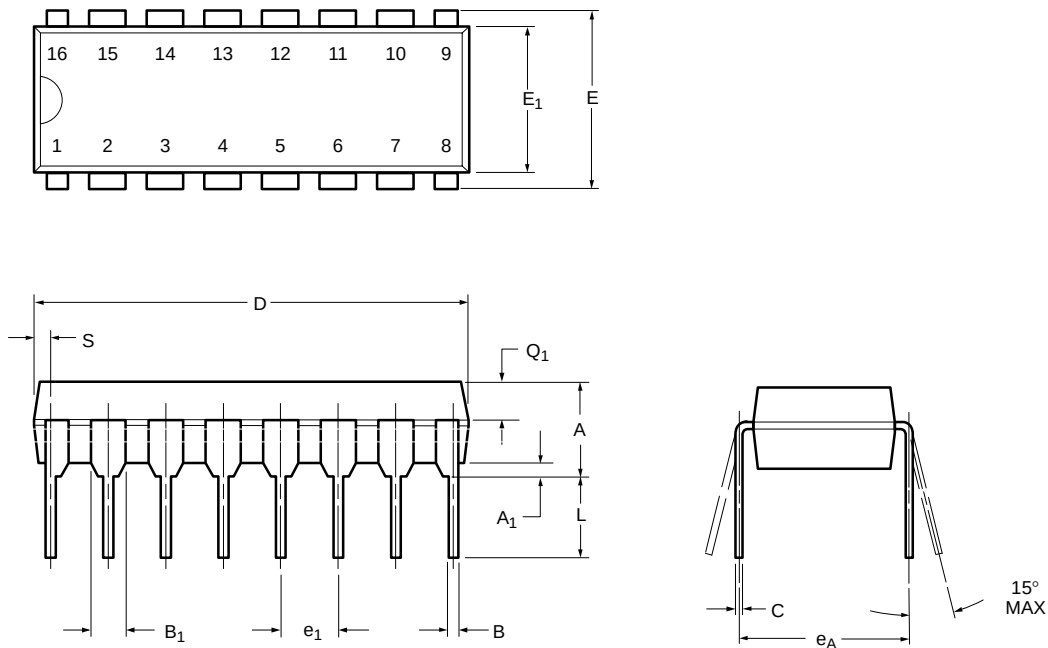


| Dim            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | Min         | Max   | Min       | Max   |
| A              | 1.35        | 1.75  | 0.053     | 0.069 |
| A <sub>1</sub> | 0.10        | 0.20  | 0.004     | 0.008 |
| 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 |
| Ø              | 0°          | 8°    | 0°        | 8°    |

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



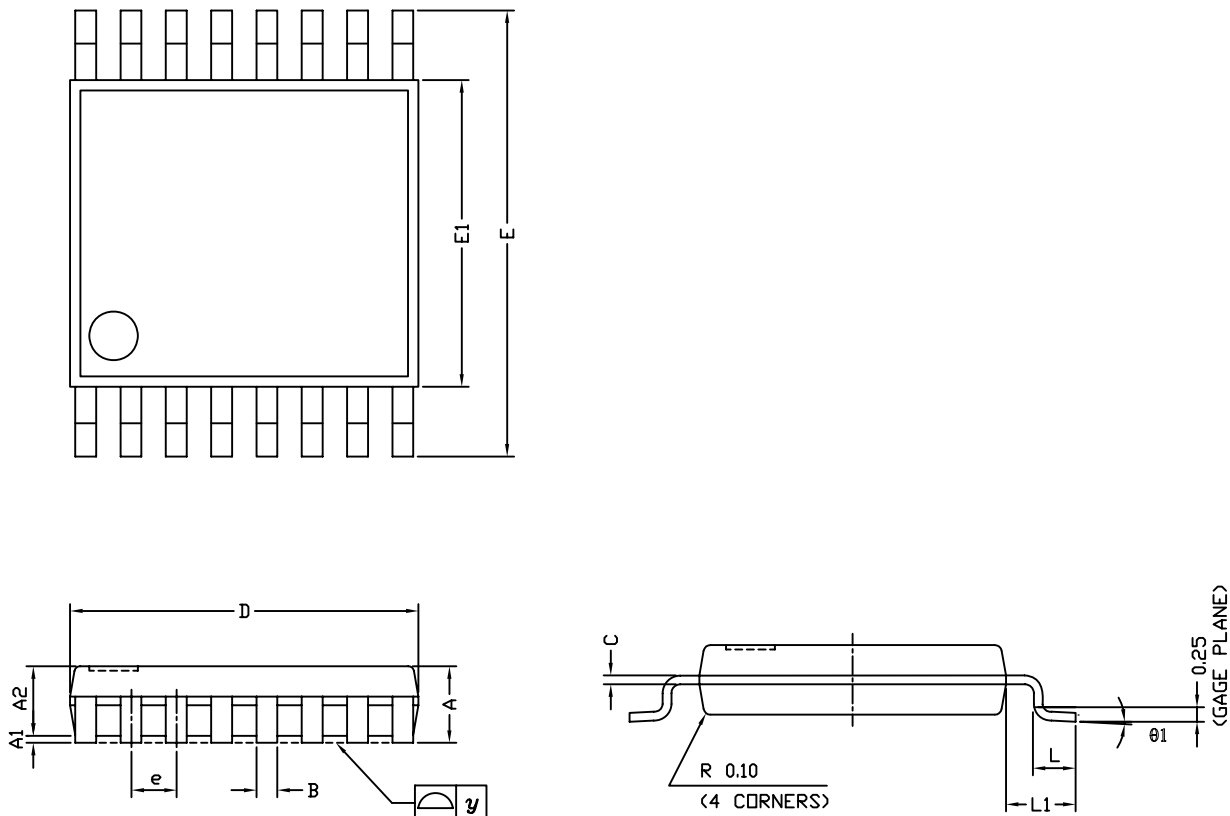
**PDIP: 16-LEAD**



| Dim            | MILLIMETERS |       | INCHES |       |
|----------------|-------------|-------|--------|-------|
|                | Min         | Max   | Min    | Max   |
| A              | 3.81        | 5.08  | 0.150  | 0.200 |
| A <sub>1</sub> | 0.38        | 1.27  | 0.015  | 0.050 |
| B              | 0.38        | 0.51  | 0.015  | 0.020 |
| B <sub>1</sub> | 0.89        | 1.65  | 0.035  | 0.065 |
| C              | 0.20        | 0.30  | 0.008  | 0.012 |
| D              | 18.93       | 21.33 | 0.745  | 0.840 |
| E              | 7.62        | 8.26  | 0.300  | 0.325 |
| E <sub>1</sub> | 5.59        | 7.11  | 0.220  | 0.280 |
| e <sub>1</sub> | 2.29        | 2.79  | 0.090  | 0.110 |
| e <sub>A</sub> | 7.37        | 7.87  | 0.290  | 0.310 |
| L              | 2.79        | 3.81  | 0.110  | 0.150 |
| Q <sub>1</sub> | 1.27        | 2.03  | 0.050  | 0.080 |
| S              | 0.38        | 1.52  | .015   | 0.060 |

ECN: S-03946—Rev. D, 09-Jul-01  
DWG: 5482

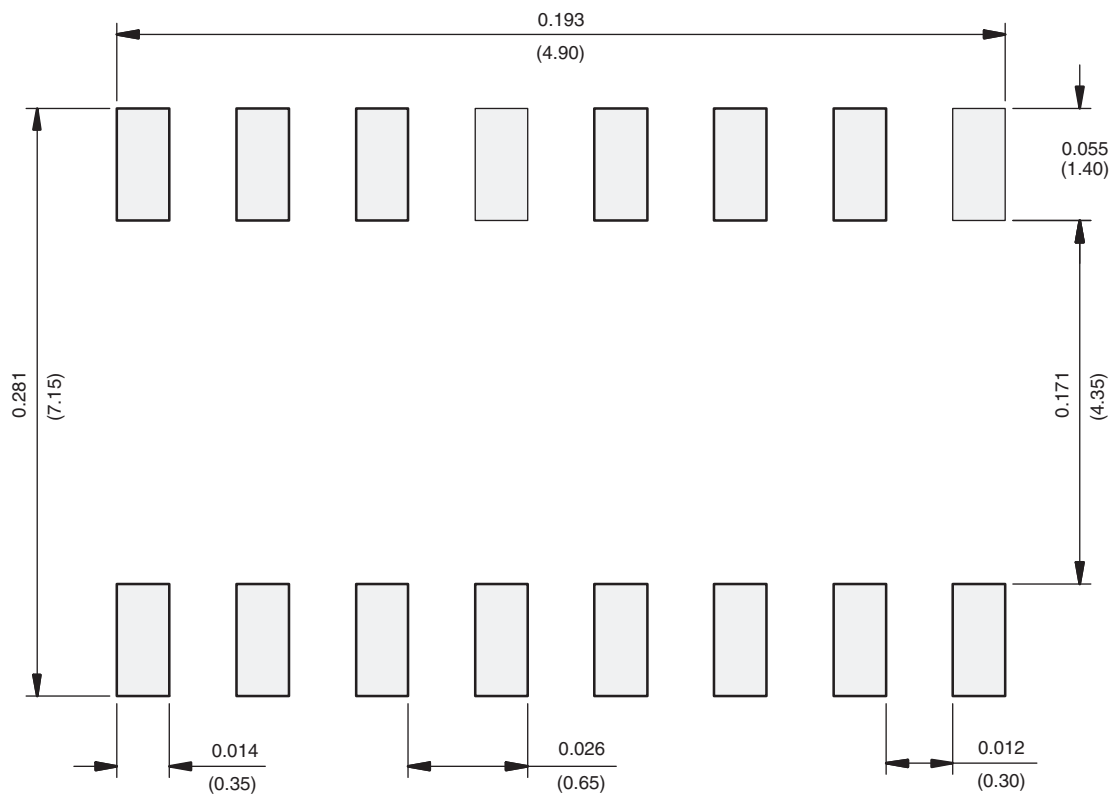
## TSSOP: 16-LEAD



| 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 |
| θ1                             | 0°                        | 3°    | 6°   |
| ECN: S-61920-Rev. D, 23-Oct-06 |                           |       |      |
| DWG: 5624                      |                           |       |      |

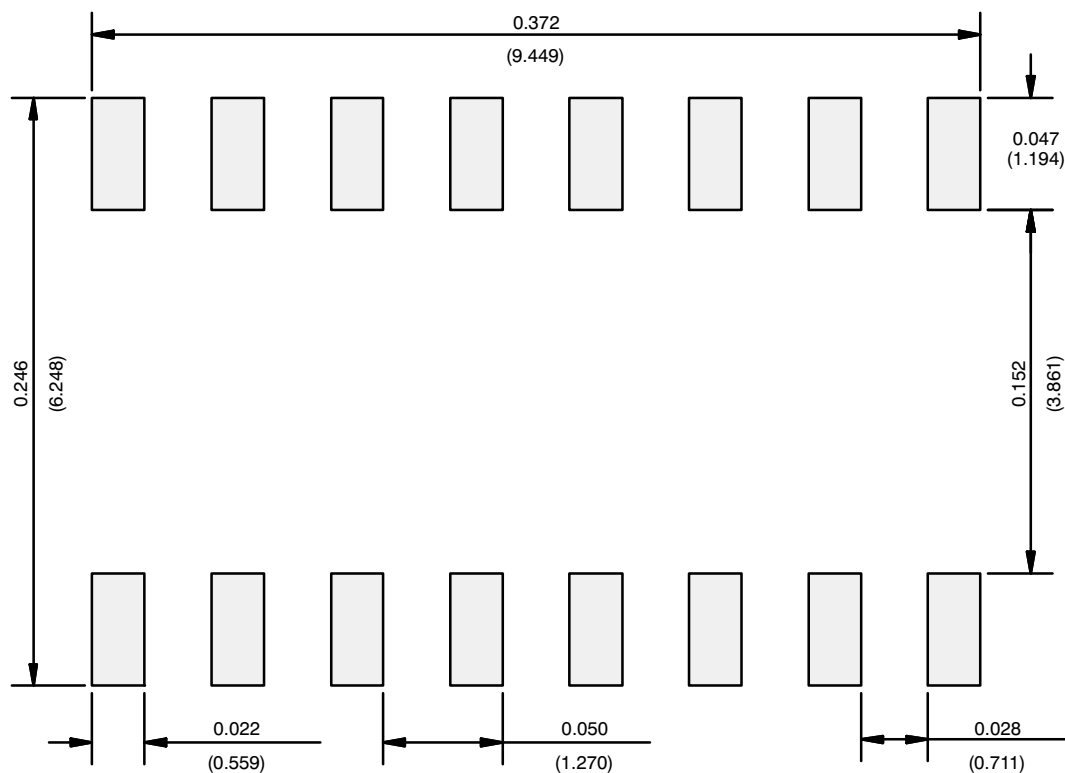


## RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads  
Dimensions in inches (mm)

## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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

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

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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