

## CMOS Quad Bilateral Switch

For Transmission or Multiplexing  
of Analog or Digital Signals

High-Voltage Types (20-Volt Rating)

■ CD4016B Series types are quad bilateral switches intended for the transmission or multiplexing of analog or digital signals. Each of the four independent bilateral switches has a single control signal input which simultaneously biases both the p and n device in a given switch on or off.

The CD4016 "B" Series types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

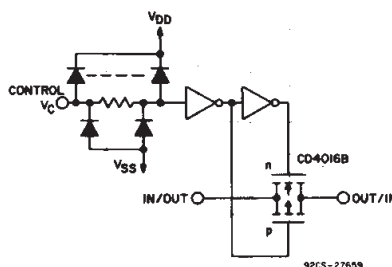
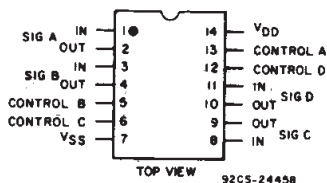
### Features:

- 20-V digital or  $\pm 10$ -V peak-to-peak switching
- 280- $\Omega$  typical on-state resistance for 15-V operation
- Switch on-state resistance matched to within 10  $\Omega$  typ. over 15-V signal-input range
- High on/off output-voltage ratio: 65 dB typ. @  $f_{is} = 10$  kHz,  $R_L = 10$  k $\Omega$
- High degree of linearity: <0.5% distortion typ. @  $f_{is} = 1$  kHz,  $V_{is} = 5$  V<sub>p-p</sub>,  $V_{DD} - V_{SS} \geq 10$  V,  $R_L = 10$  k $\Omega$
- Extremely low off-state switch leakage resulting in very low offset current and high effective off-state resistance: 100 pA typ. @  $V_{DD} - V_{SS} = 18$  V,  $T_A = 25^\circ\text{C}$
- Extremely high control input impedance (control circuit isolated from signal circuit: 1012  $\Omega$  typ.)
- Low crosstalk between switches: -50 dB typ. @  $f_{is} = 0.9$  MHz,  $R_L = 1$  k $\Omega$
- Matched control-input to signal-output capacitance: Reduces output signal transients
- Frequency response, switch on = 40 MHz (typ.)
- 100% tested for quiescent current at 20 V
- Maximum control input current of 1  $\mu\text{A}$  at 18 V over full package temperature range; 100 nA at 18 V at  $25^\circ\text{C}$
- 5-V, 10-V, and 15-V parametric ratings

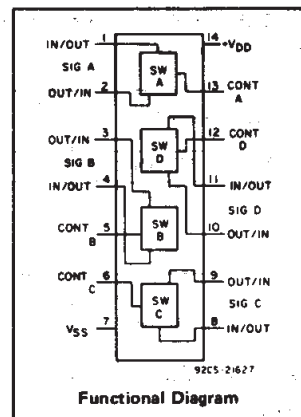
### Applications:

- Analog signal switching/multiplexing
  - Signal gating
  - Squelch control
  - Chopper
  - Modulator
  - Demodulator
  - Commutating switch
- Digital signal switching/multiplexing
- CMOS logic implementation
- Analog-to-digital & digital-to-analog conversion
- Digital control of frequency, impedance, phase, and analog-signal gain

### Terminal Assignment



Schematic diagram - 1 of 4 identical sections.



Functional Diagram

### RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following range:

| CHARACTERISTIC  | LIMITS |      | UNITS |
|---|--------|------|-------|
|   | Min.   | Max. |       |
| Supply Voltage Range (For $T_A$ = Full Package Temperature Range) | 3      | 18   | V     |

### MAXIMUM RATINGS, Absolute-Maximum Values:

|   |   |
|---|---|
| DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )                                       | -0.5V to +20V   |
| Voltages referenced to $V_{SS}$ Terminal)                                   |   |
| INPUT VOLTAGE RANGE, ALL INPUTS   | -0.5V to $V_{DD} + 0.5$ V                             |
| DC INPUT CURRENT, ANY ONE INPUT   | $\pm 10$ mA   |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):                                    |   |
| For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$                       | 500 mW  |
| For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$                      | Derate Linearity at 12 mW/ $^\circ\text{C}$ to 200 mW |
| DEVICE DISSIPATION PER OUTPUT TRANSISTOR                                    |   |
| FOR $T_A$ = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)              | 100 mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ )                                       | $-55^\circ\text{C}$ to $+125^\circ\text{C}$           |
| STORAGE TEMPERATURE RANGE ( $T_{stg}$ )                                     | $-65^\circ\text{C}$ to $+150^\circ\text{C}$           |
| LEAD TEMPERATURE (DURING SOLDERING):  |   |
| At distance 1/16 $\pm$ 1/32 inch (1.59 $\pm$ 0.79 mm) from case for 10s max | $+265^\circ\text{C}$                                  |

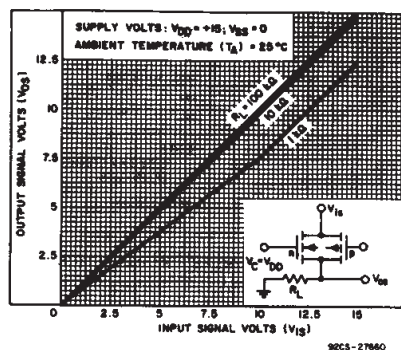


Fig. 1—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +15$  V,  $V_{SS} = 0$  V.

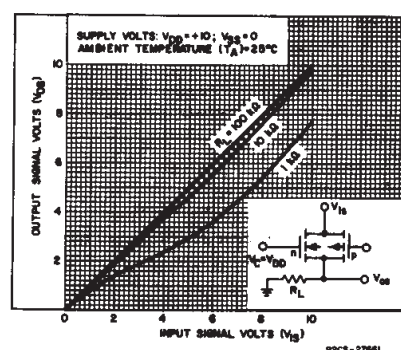


Fig. 2—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +10$  V,  $V_{SS} = 0$  V.

# CD4016B Types

## ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC  | TEST CONDITIONS  | LIMITS AT INDICATED TEMPERATURES (°C)               |                        |      |      |      |                  |      |      | UNITS |
|---|--|---|------------------------|------|------|------|------------------|------|------|-------|
|   |  | V <sub>IN</sub><br>(V)                              | V <sub>DD</sub><br>(V) |      |      |      |                  | +25  |      |       |
|   |  |   |                        | -55  | -40  | +85  | +125             | Typ. | Max. |       |
| Quiescent Device Current, I <sub>DD</sub>   |  | 0,5   | 5                      | 0.25 | 0.25 | 7.5  | 7.5              | 0.01 | 0.25 | μA    |
|   |  | 0,10  | 10                     | 0.5  | 0.5  | 15   | 15               | 0.01 | 0.5  |       |
|   |  | 0,15  | 15                     | 1    | 1    | 30   | 30               | 0.01 | 1    |       |
|   |  | 0,20  | 20                     | 5    | 5    | 150  | 150              | 0.02 | 5    |       |
| Signal Inputs (V <sub>is</sub> ) and Output (V <sub>os</sub> )                                  |  |   |                        |      |      |      |                  |      |      |       |
| On-State Resistance, r <sub>on</sub> Max.   | V <sub>C</sub> = V <sub>DD</sub><br>R <sub>L</sub> = 10kΩ<br>Returned to<br>V <sub>DD</sub> -V <sub>SS</sub><br>2  | V <sub>is</sub> =V <sub>DD</sub> or V <sub>SS</sub> | 10                     | 600  | 610  | 840  | 960              | —    | 660  | Ω     |
|   |  | V <sub>is</sub> =4.75 to 5.75 V                     | 10                     | 1870 | 1900 | 2380 | 2600             | —    | 2000 |       |
|   |  | V <sub>is</sub> =V <sub>DD</sub> or V <sub>SS</sub> | 15                     | 360  | 370  | 520  | 600              | —    | 400  |       |
|   |  | V <sub>is</sub> =7.25 to 7.75 V                     | 15                     | 775  | 790  | 1080 | 1230             | —    | 850  |       |
| ΔOn-State Resistance Between Any 2 Switches, Δr <sub>on</sub>                                   | R <sub>L</sub> = 10kΩ, V <sub>C</sub> = V <sub>DD</sub>  |   | 5                      | —    | —    | —    | —                | 15   | —    | Ω     |
|   |  |   | 10                     | —    | —    | —    | —                | 10   | —    |       |
|   |  |   | 15                     | —    | —    | —    | —                | 5    | —    |       |
| Total Harmonic Distortion, THD  | V <sub>C</sub> =V <sub>DD</sub> = 5 V, V <sub>SS</sub> = -5 V, V <sub>is</sub> (p-p) = 5 V (Sine wave centered on 0 V)<br>R <sub>L</sub> =10 kΩ, f <sub>is</sub> =1 kHz sine wave                            |   | —                      | —    | —    | —    | 0.4              | —    | %    |       |
| -3dB Cutoff Frequency (Switch on)   | V <sub>C</sub> =V <sub>DD</sub> =5 V, V <sub>SS</sub> = -5 V, V <sub>is</sub> (p-p) = 5 V (Sine wave centered on 0 V) R <sub>L</sub> = 1 kΩ,   |   | —                      | —    | —    | —    | 40               | —    | MHz  |       |
| -50dB Feed-through Frequency (Switch off)   | V <sub>C</sub> =V <sub>SS</sub> = -5 V, V <sub>is</sub> (p-p)=5 V (Sine wave centered on 0 V) R <sub>L</sub> = 1 kΩ  |   | —                      | —    | —    | —    | 1.25             | —    | MHz  |       |
| Input/Output Leakage Current (Switch off) I <sub>is</sub> Max.                                  | V <sub>C</sub> = 0 V<br>V <sub>is</sub> = 18 V, V <sub>os</sub> = 0 V;<br>V <sub>is</sub> = 0 V, V <sub>os</sub> = 18 V  | 18  | ±0.1                   | ±0.1 | ±1   | ±1   | 10 <sup>-4</sup> | ±0.1 | μA   |       |
| -50 dB Crosstalk Frequency  | V <sub>C</sub> (A) = V <sub>DD</sub> = +5 V, V <sub>C</sub> (B) = V <sub>SS</sub> = -5 V, V <sub>is</sub> (A) = 5 V p-p, 50 Ω source R <sub>L</sub> = 1 kΩ   |   | —                      | —    | —    | —    | 0.9              | —    | MHz  |       |
| Propagation Delay (Signal Input to Signal Output) t <sub>pd</sub>                               | R <sub>L</sub> = 200 kΩ<br>V <sub>C</sub> = V <sub>DD</sub> , V <sub>SS</sub> = GND, C <sub>L</sub> = 50 pF<br>V <sub>is</sub> = Square Wave 0 to V <sub>DD</sub><br>t <sub>r</sub> , t <sub>f</sub> = 20 ns | 5   | —                      | —    | —    | —    | 40               | 100  | ns   |       |
|   |  | 10  | —                      | —    | —    | —    | 20               | 40   |      |       |
|   |  | 15  | —                      | —    | —    | —    | 15               | 30   |      |       |
| Capacitance: Input, C <sub>is</sub><br>Output, C <sub>os</sub><br>Feedthrough, C <sub>ios</sub> | V <sub>DD</sub> = +5 V<br>V <sub>C</sub> = V <sub>SS</sub> = -5 V  |   | —                      | —    | —    | —    | 4                | —    | pF   |       |
|   |  |   | —                      | —    | —    | —    | 4                | —    |      |       |
|   |  |   | —                      | —    | —    | —    | 0.2              | —    |      |       |

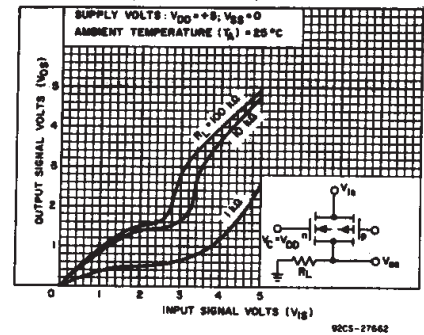


Fig. 3—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +5$  V,  $V_{SS} = 0$  V.

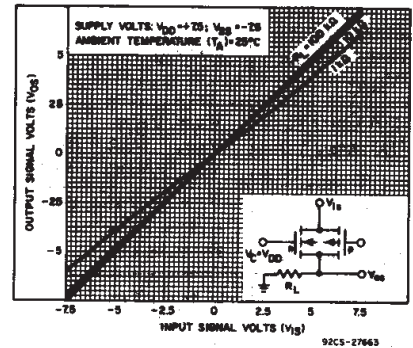


Fig. 4—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +7.5$  V,  $V_{SS} = -7.5$  V.

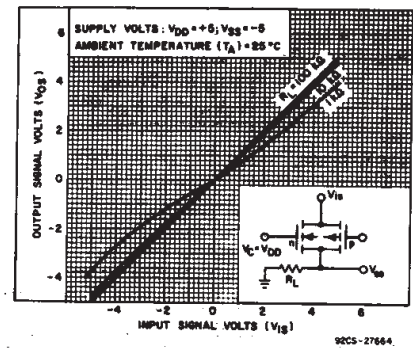


Fig. 5—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +5$  V,  $V_{SS} = -5$  V.

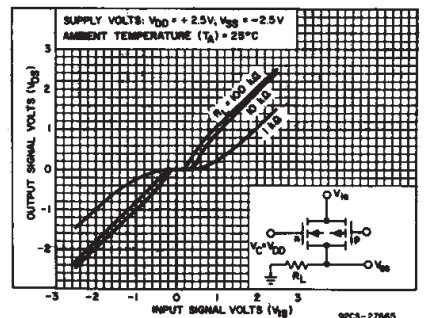


Fig. 6—Typ. on-state characteristics for 1 of 4 switches with  $V_{DD} = +2.5$  V,  $V_{SS} = -2.5$  V.

# CD4016B Types

## ELECTRICAL CHARACTERISTICS (cont'd)

| CHARACTERISTIC                                     | TEST CONDITIONS  | LIMITS AT INDICATED TEMPERATURES (°C) |                                     |             |             |             |                   |                | UNITS |
|--|--|---------------------------------------|-------------------------------------|-------------|-------------|-------------|-------------------|----------------|-------|
|  |  | V <sub>DD</sub><br>(V)                | -55                                 | -40         | +85         | +125        | +25               |                |       |
|  |  |                                       |                                     |             |             |             | Typ.              | Max.           |       |
| Control (V <sub>C</sub> )                          |  |                                       |                                     |             |             |             |                   |                |       |
| Control Input Low Voltage, V <sub>ILC</sub> (Max.) | $ I_{is}  < 10 \mu A$<br>$V_{is} = V_{SS}, V_{OS} = V_{DD}$<br>and<br>$V_{is} = V_{DD}, V_{OS} = V_{SS}$   | 5,10,15                               | 0.9                                 | 0.9         | 0.4         | 0.4         | —                 | 0.7            | V     |
| Control Input High Voltage, V <sub>IHC</sub>       | See Fig. 10  | 5<br>10<br>15                         | 3.5 (Min.)<br>7 (Min.)<br>11 (Min.) |             |             |             |                   |                | V     |
| Input Current, I <sub>IN</sub> (Max.)              | $V_{is} \leq V_{DD}$<br>$V_{DD} - V_{SS} = 18 V$<br>$V_{CC} \leq V_{DD} - V_{SS}$  | 18                                    | ±0.1                                | ±0.1        | ±1          | ±1          | ±10 <sup>-5</sup> | ±0.1           | μA    |
| Crosstalk (Control Input to Signal Output)         | V <sub>C</sub> = 10 V (Sq. Wave)<br>t <sub>r</sub> , t <sub>f</sub> = 20 ns<br>R <sub>L</sub> = 10 kΩ  | 10                                    | —                                   | —           | —           | —           | 50                | —              | mV    |
| Turn-On Propagation Delay                          | t <sub>r</sub> , t <sub>f</sub> = 20 ns<br>C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 1 kΩ   | 5<br>10<br>15                         | —<br>—<br>—                         | —<br>—<br>— | —<br>—<br>— | —<br>—<br>— | 35<br>20<br>15    | 70<br>40<br>30 | ns    |
| Maximum Control Input Repetition Rate              | V <sub>is</sub> = V <sub>DD</sub> , V <sub>SS</sub> = GND,<br>R <sub>L</sub> = 1 kΩ to gnd,<br>C <sub>L</sub> = 50 pF,<br>V <sub>C</sub> = 10 V (Square wave centered on 5 V)<br>t <sub>r</sub> , t <sub>f</sub> = 20 ns,<br>V <sub>os</sub> = ½ V <sub>os</sub> @ 1 kHz | 10                                    | —                                   | —           | —           | —           | 10                | —              | MHz   |
| Input Capacitance, C <sub>IN</sub>                 |  |                                       | —                                   | —           | —           | —           | 5                 | 7.5            | μF    |

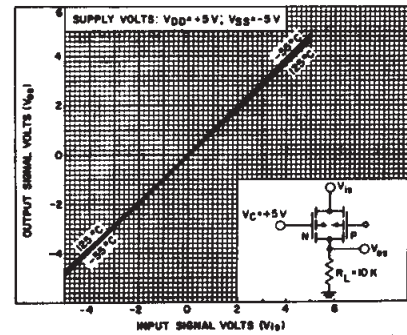


Fig. 7—Typ. on-state characteristics as a function of temp. for 1 of 4 switches with V<sub>DD</sub> = +5 V, V<sub>SS</sub> = -5 V.

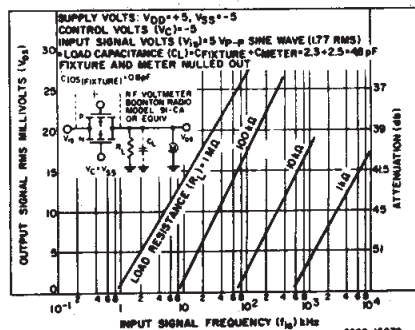


Fig. 8—Typ. feedthru vs. frequency - switch off.

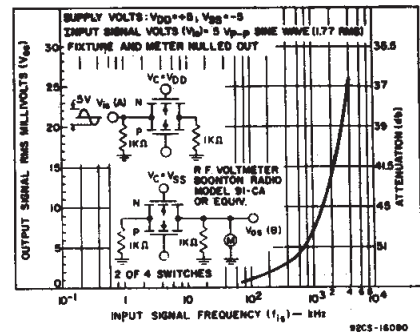


Fig. 9—Typical crosstalk between switch circuits in the same package.

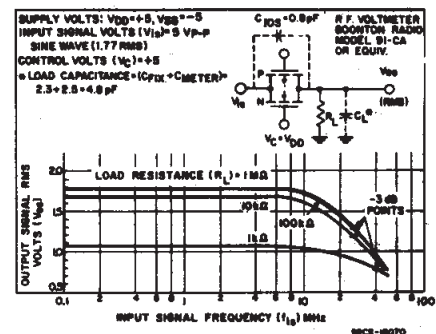


Fig. 11—Typical frequency response - switch on.

| V <sub>DD</sub> (V) | V <sub>is</sub> (V) | Switch Input<br>I <sub>is</sub> (mA) |       |       |       |       |        | Switch Output<br>V <sub>os</sub> (V) |      |
|---------------------|---------------------|--------------------------------------|-------|-------|-------|-------|--------|--------------------------------------|------|
|                     |                     | -55°C                                | -40°C | 25°C* | 25°C▲ | +85°C | +125°C | Min.                                 | Max. |
| 5                   | 0                   | 0.25                                 | 0.2   | 0.2   | 0.16  | 0.12  | 0.14   | —                                    | 0.4  |
| 5                   | 5                   | -0.25                                | -0.2  | -0.2  | -0.16 | -0.12 | -0.14  | 4.6                                  | —    |
| 10                  | 0                   | 0.62                                 | 0.5   | 0.5   | 0.4   | 0.3   | 0.35   | —                                    | 0.5  |
| 10                  | 10                  | -0.62                                | -0.5  | -0.5  | -0.4  | -0.3  | -0.35  | 9.5                                  | —    |
| 15                  | 0                   | 1.8                                  | 1.4   | 1.5   | 1.2   | 1     | 1.1    | —                                    | 1.5  |
| 15                  | 15                  | -1.8                                 | -1.4  | -1.5  | -1.2  | -1    | -1.1   | 13.5                                 | —    |

\* Plastic package

▲ Ceramic package

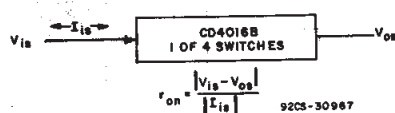


Fig. 10—Determination of  $r_{on}$  as a test condition for control input high voltage (V<sub>IHC</sub>) specification.

## COMMERCIAL CMOS HIGH VOLTAGE ICs

| CHARACTERISTIC* | SUPPLY CONDITIONS |                 | LOAD CONDITIONS       |                 |                       |                 |                       |                 |
|-----------------|-------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|
|                 |                   |                 | $R_L = 1k\Omega$      |                 | $R_L = 10k\Omega$     |                 | $R_L = 100k\Omega$    |                 |
|                 | $V_{DD}$<br>(V)   | $V_{SS}$<br>(V) | VALUE<br>( $\Omega$ ) | $V_{is}$<br>(V) | VALUE<br>( $\Omega$ ) | $V_{is}$<br>(V) | VALUE<br>( $\Omega$ ) | $V_{is}$<br>(V) |
| $r_{on}$        | +15               | 0               | 200                   | +15             | 200                   | +15             | 180                   | +15             |
|                 |                   |                 | 200                   | 0               | 200                   | 0               | 200                   | 0               |
| $r_{on} (max.)$ | +15               | 0               | 300                   | +11             | 300                   | +9.3            | 320                   | +9.2            |
| $r_{on}$        | +10               | 0               | 290                   | +10             | 250                   | +10             | 240                   | +10             |
|                 |                   |                 | 290                   | 0               | 250                   | 0               | 300                   | 0               |
| $r_{on} (max.)$ | +10               | 0               | 500                   | +7.4            | 560                   | +5.6            | 610                   | +5.5            |
| $r_{on}$        | +5                | 0               | 860                   | +5              | 470                   | +5              | 450                   | +5              |
|                 |                   |                 | 600                   | 0               | 580                   | 0               | 800                   | 0               |
| $r_{on} (max.)$ | +5                | 0               | 1.7k                  | +4.2            | 7k                    | +2.9            | 33k                   | +2.7            |
| $r_{on}$        | +7.5              | -7.5            | 200                   | +7.5            | 200                   | +7.5            | 180                   | +7.5            |
|                 |                   |                 | 200                   | -7.5            | 200                   | -7.5            | 180                   | -7.5            |
| $r_{on} (max.)$ | +7.5              | -7.5            | 290                   | $\pm 0.25$      | 280                   | $\pm 25$        | 400                   | $\pm 0.25$      |
| $r_{on}$        | +5                | -5              | 260                   | +5              | 250                   | +5              | 240                   | +5              |
|                 |                   |                 | 310                   | -5              | 250                   | -5              | 240                   | -5              |
| $r_{on} (max.)$ | +5                | -5              | 600                   | $\pm 0.25$      | 580                   | $\pm 0.25$      | 760                   | $\pm 0.25$      |
| $r_{on}$        | +2.5              | -2.5            | 590                   | +2.5            | 450                   | +2.5            | 490                   | +2.5            |
|                 |                   |                 | 720                   | -2.5            | 520                   | -2.5            | 520                   | -2.5            |
| $r_{on} (max.)$ | +2.5              | -2.5            | 232k                  | $\pm 0.25$      | 300k                  | $\pm 0.25$      | 870k                  | $\pm 0.25$      |

**ALL UNUSED TERMINALS ARE CONNECTED TO VSS**

92C5-27464

**92CS-27612**

92CS-27613

**92CS - 27614**

**92CS-27615**



92CS-27616

Figure 1 illustrates the experimental setup. A subject is seated at a table, looking at a video screen. A video camera is positioned above the screen. A horizontal line is drawn on the screen, representing the horizontal plane. A vertical line is drawn on the screen, representing the vertical plane. The subject's hand is positioned near the intersection of these lines. The diagram is labeled with 'Subject', 'Video Screen', 'Video Camera', 'Horizontal Plane', and 'Vertical Plane'.

92CS-27617

3-49

## CD4016B Types

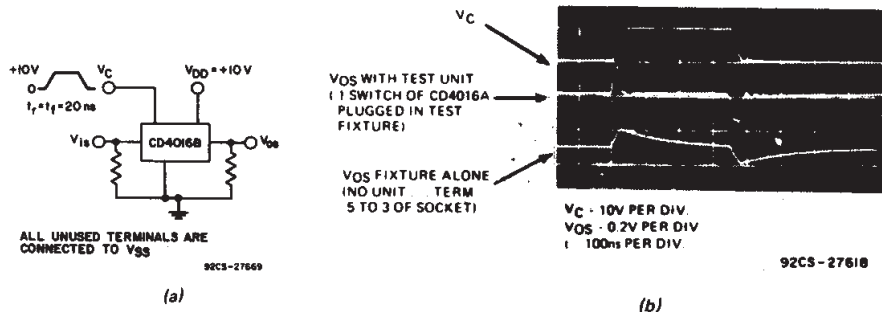


Fig. 20 - Crosstalk-control input to signal output.

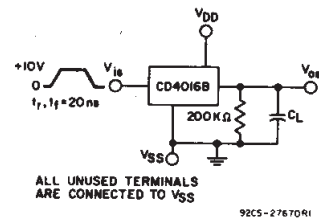


Fig. 21 - Propagation delay time signal input ( $V_{Is}$ ) to signal output ( $V_{Os}$ ).

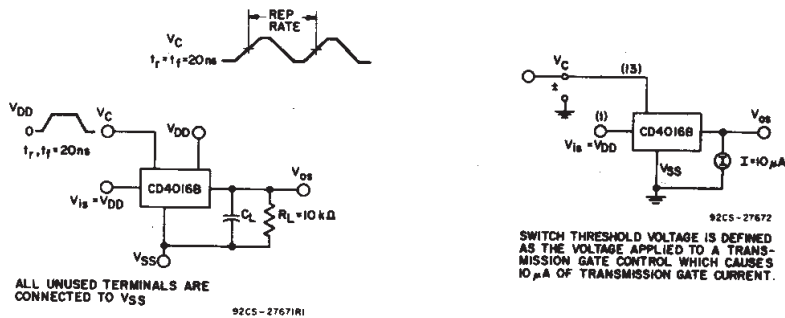


Fig. 22 - Max. control-input repetition rate.

Fig. 23 - Switch threshold voltage.

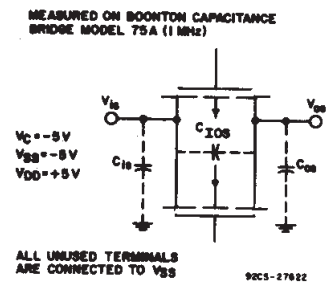


Fig. 24 - Capacitance  $C_{IOs}$  and  $C_{Os}$ .

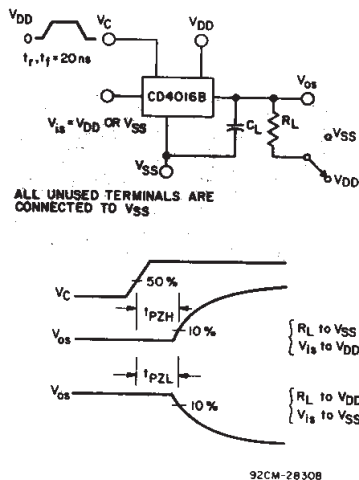
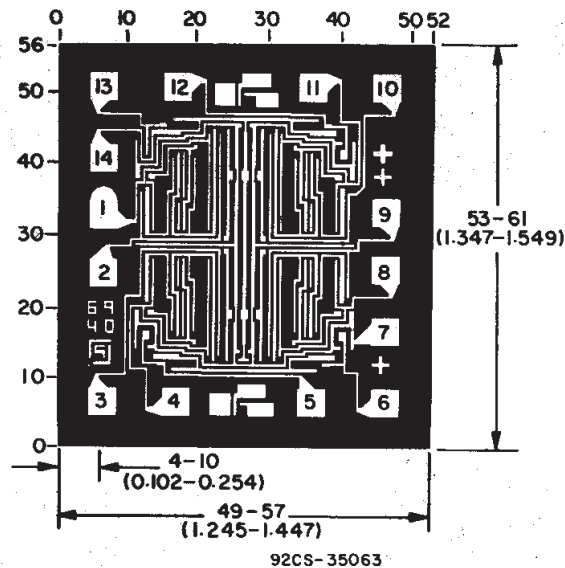


Fig. 25 - Turn-On propagation delay-control input.

### Dimensions and pad layout for CD4016BH



Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ( $10^{-3}$  inch).



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)      | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|------------------------------|-------------------------|
| 5962-9064001CA   | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | 5962-9064001CA<br>CD4016BF3A | <a href="#">Samples</a> |
| CD4016BE         | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | -55 to 125   | CD4016BE                     | <a href="#">Samples</a> |
| CD4016BEE4       | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | -55 to 125   | CD4016BE                     | <a href="#">Samples</a> |
| CD4016BF         | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | CD4016BF                     | <a href="#">Samples</a> |
| CD4016BF3A       | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | 5962-9064001CA<br>CD4016BF3A | <a href="#">Samples</a> |
| CD4016BM         | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BM96       | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BM96E4     | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BM96G4     | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BME4       | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BMG4       | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BMT        | ACTIVE        | SOIC         | D                  | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BMTE4      | ACTIVE        | SOIC         | D                  | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BMTG4      | ACTIVE        | SOIC         | D                  | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016BM                     | <a href="#">Samples</a> |
| CD4016BNSR       | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016B                      | <a href="#">Samples</a> |
| CD4016BNSRE4     | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016B                      | <a href="#">Samples</a> |
| CD4016BNSRG4     | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CD4016B                      | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4016BPW        | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |
| CD4016BPWE4      | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |
| CD4016BPWG4      | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |
| CD4016BPWR       | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |
| CD4016BPWRE4     | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |
| CD4016BPWRG4     | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -55 to 125   | CM016B                  | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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**OTHER QUALIFIED VERSIONS OF CD4016B, CD4016B-MIL :**

- Catalog: [CD4016B](#)
- Military: [CD4016B-MIL](#)

**NOTE: Qualified Version Definitions:**

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications



**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


|    |   |
|----|---|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

**TAPE AND REEL INFORMATION**

\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4016BM96 | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| CD4016BMT  | SOIC         | D               | 14   | 250  | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| CD4016BNSR | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| CD4016BPWR | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4016BM96 | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| CD4016BMT  | SOIC         | D               | 14   | 250  | 367.0       | 367.0      | 38.0        |
| CD4016BNSR | SO           | NS              | 14   | 2000 | 367.0       | 367.0      | 38.0        |
| CD4016BPWR | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/F 12/12

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

4040062/C 03/03

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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