

# CD4066B CMOS Quad Bilateral Switch

## 1 Features

- 15V digital or  $\pm 7.5V$  peak-to-peak switching
- 125 $\Omega$  typical on-state resistance for 15V operation
- Switch on-state resistance matched to within 5 $\Omega$  over 15V signal-input range
- On-state resistance flat over full peak-to-peak signal range
- High on or off output-voltage ratio: 80dB typical at  $f_{is} = 10\text{kHz}$ ,  $R_L = 1\text{k}\Omega$
- High degree of linearity: <0.5% distortion typical at  $f_{is} = 1\text{kHz}$ ,  $V_{is} = 5V_{p-p}$ ,  $V_{DD} - V_{SS} \geq 10V$ ,  $R_L = 10\text{k}\Omega$
- Extremely low off-state switch leakage, resulting in very low offset current and high effective off-state resistance: 10 pA typical at  $V_{DD} - V_{SS} = 10V$ ,  $T_A = 25^\circ\text{C}$
- Extremely high control input impedance (control circuit isolated from signal circuit): 10<sup>12</sup> $\Omega$  typical
- Low crosstalk between switches: -50dB typical at  $f_{is} = 8\text{MHz}$ ,  $R_L = 1\text{k}\Omega$
- Matched control-input to signal-output capacitance: reduces output signal transients
- Frequency response, switch On = 40MHz typical
- 100% tested for quiescent current at 20V, 5V, 10V, and 15V parametric ratings

## 2 Applications

- Analog signal switching and multiplexing: signal gating, modulators, squelch controls, demodulators, choppers, commutating switches
- Digital signal switching and multiplexing
- Analog-to-digital and digital-to-analog conversions
- Digital control of frequency, impedance, phase, and analog-signal gain
- [Building automation](#)

## 3 Description

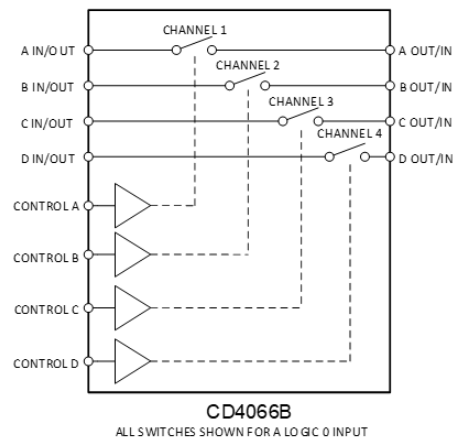
The CD4066B device is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals. It is pin-for-pin compatible with the CD4016B device, but exhibits a much lower on-state resistance. In addition, the on-state resistance is relatively constant over the full signal-input range.

The CD4066B device consists of four bilateral switches, each with independent controls. Wide operating supply of 3V to 18V allows for use in a broad array of applications. The advantages over single-channel switches include peak input-signal voltage swings equal to the full supply voltage and more constant on-state impedance over the input-signal range. However, for sample-and-hold applications, the CD4016B device is recommended.

### Package Information

| PART NUMBER | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(2)</sup> |
|-------------|------------------------|-----------------------------|
| CD4066B     | N (PDIP, 14)           | 19.3mm × 9.4mm              |
|             | D (SOIC, 14)           | 8.65mm × 6mm                |
|             | NS (SOP, 14)           | 10.2mm × 7.8mm              |
|             | PW (TSSOP, 14)         | 5mm × 6.4mm                 |

- (1) For more information, see [Section 11](#)
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.

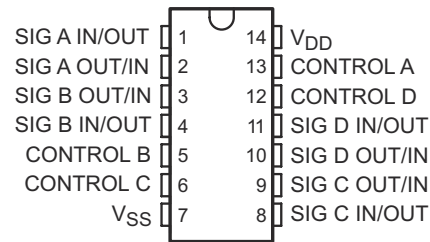


### Bidirectional Signal Transmission Through Digital Control Logic

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## 4 Pin Configuration and Functions



**Figure 4-1. N, J, D, NS, or PW Packages 14-Pin PDIP, CDIP, SOIC, SOP, or TSSOP (Top View)**

**Table 4-1. Pin Functions**

| PIN             |     | TYPE <sup>(1)</sup> | DESCRIPTION               |
|-----------------|-----|---------------------|---------------------------|
| NAME            | NO. |                     |                           |
| SIG A IN/OUT    | 1   | I/O                 | Input/Output for Switch A |
| SIG A OUT/IN    | 2   | I/O                 | Output/Input for Switch A |
| SIG B OUT/IN    | 3   | I/O                 | Output/Input for Switch B |
| SIG B IN/OUT    | 4   | I/O                 | Input/Output for Switch B |
| CONTROL B       | 5   | I                   | Control pin for Switch B  |
| CONTROL C       | 6   | I                   | Control pin for Switch C  |
| V <sub>SS</sub> | 7   | —                   | Low Voltage Power Pin     |
| SIG C IN/OUT    | 8   | I/O                 | Input/Output for Switch C |
| SIG C OUT/IN    | 9   | I/O                 | Output/Input for Switch C |
| SIG D OUT/IN    | 10  | I/O                 | Output/Input for Switch D |
| SIG D IN/OUT    | 11  | I/O                 | Input/Output for Switch D |
| CONTROL D       | 12  | I                   | Control Pin for D         |
| CONTROL A       | 13  | I                   | Control Pin for A         |
| V <sub>DD</sub> | 14  | —                   | Power Pin                 |

(1) I = input, O = output

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup> <sup>(2)</sup>

|                       |                                                               | MIN          | MAX          | UNIT |
|-----------------------|---------------------------------------------------------------|--------------|--------------|------|
| $V_{DD} - V_{SS}$     | Supply voltage                                                |              | 20           | V    |
| $V_{DD}$              |                                                               | -0.5         | 20           | V    |
| $V_{SS}$              |                                                               | -20          | 0.5          | V    |
| $I_{SEL}$ or $I_{EN}$ | Logic control input pin current ( $\overline{EN}$ , Ax, SELx) | -30          | 30           | mA   |
| $V_S$ or $V_D$        | Source or drain voltage (Sx, D)                               | $V_{SS}-0.5$ | $V_{DD}+0.5$ | V    |
| $I_S$ or $I_D$ (CONT) | Source or drain continuous current (Sx, D)                    | -20          | 20           | mA   |
| $T_J$                 | Junction temperature                                          |              | 150          | °C   |
| $T_{stg}$             | Storage temperature                                           | -65          | 150          | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltages are with respect to ground, unless otherwise specified.

### 5.2 ESD Ratings

|             |                         | VALUE                                                                                    | UNIT  |
|-------------|-------------------------|------------------------------------------------------------------------------------------|-------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | ±500  |
|             |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | ±1500 |

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

### 5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

|                                  |                                                                | MIN      | NOM | MAX      | UNIT |
|----------------------------------|----------------------------------------------------------------|----------|-----|----------|------|
| $V_{DD} - V_{SS}$ <sup>(1)</sup> | Power supply voltage differential                              | 3        |     | 18       | V    |
| $V_{DD}$                         | Positive power supply voltage                                  | 3        |     | 18       | V    |
| $V_S$ or $V_D$                   | Signal path input/output voltage (source or drain pin) (Sx, D) | $V_{SS}$ |     | $V_{DD}$ | V    |
| $V_{SEL}$ or $V_{EN}$            | Address or enable pin voltage                                  | 0        |     | $V_{DD}$ | V    |
| $I_S$ or $I_D$ (CONT)            | Source or drain continuous current (Sx, D)                     | -10      |     | 10       | mA   |
| $T_A$                            | Ambient temperature                                            | -55      |     | 125      | °C   |

- (1)  $V_{DD}$  and  $V_{SS}$  can be any value as long as  $3V \leq (V_{DD} - V_{SS}) \leq 24V$ , and the minimum  $V_{DD}$  is met.

## 5.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | CD406x   |          |         |            | UNIT |
|-------------------------------|----------------------------------------------|----------|----------|---------|------------|------|
|                               |                                              | N (PDIP) | D (SOIC) | NS (SO) | PW (TSSOP) |      |
|                               |                                              | 14 PINS  | 14 PINS  | 14 PINS | 14 PINS    |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 93.7     | 109.7    | 112.4   | 101.8      | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 72.5     | 69.4     | 70.4    | 44.3       | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 68.0     | 67.9     | 76.4    | 68.2       | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 50.3     | 25.8     | 28.9    | 3.2        | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 67.3     | 67.1     | 75.4    | 67.6       | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 5.5 Electrical Characteristics

Over operating free-air temperature range, V<sub>SUPPLY</sub> = ±5V, and R<sub>L</sub> = 100 Ω, (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                                          |                                                         | TEST CONDITIONS                                         |                                                                                                                                                                                                                            | MIN                   | TYP | MAX  | UNIT |
|--------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----|------|------|
| <b>SIGNAL INPUTS (V<sub>IS</sub>) AND OUTPUTS (V<sub>OS</sub>)</b> |                                                         |                                                         |                                                                                                                                                                                                                            |                       |     |      |      |
| V <sub>OS</sub>                                                    | Switch output voltage                                   | V <sub>DD</sub> = 5V<br>V <sub>IS</sub> = 0V            |                                                                                                                                                                                                                            |                       |     | 0.4  | V    |
|                                                                    |                                                         | V <sub>DD</sub> = 5V<br>V <sub>IS</sub> = 5V            |                                                                                                                                                                                                                            |                       |     | 4.6  | V    |
|                                                                    |                                                         | V <sub>DD</sub> = 10V<br>V <sub>IS</sub> = 0V           |                                                                                                                                                                                                                            |                       |     | 0.5  | V    |
|                                                                    |                                                         | V <sub>DD</sub> = 10V<br>V <sub>IS</sub> = 10V          |                                                                                                                                                                                                                            |                       |     | 9.5  | V    |
|                                                                    |                                                         | V <sub>DD</sub> = 15V<br>V <sub>IS</sub> = 0V           |                                                                                                                                                                                                                            |                       |     | 1.5  | V    |
|                                                                    |                                                         | V <sub>DD</sub> = 15V<br>V <sub>IS</sub> = 15V          |                                                                                                                                                                                                                            |                       |     | 13.5 | V    |
| Δ<br>R <sub>ON</sub>                                               | On-state resistance difference between any two switches |                                                         | R <sub>L</sub> = 10kΩ, V <sub>C</sub> = V <sub>DD</sub>                                                                                                                                                                    | V <sub>DD</sub> = 5V  |     | 15   | Ω    |
|                                                                    | On-state resistance difference between any two switches | On-state resistance difference between any two switches |                                                                                                                                                                                                                            | V <sub>DD</sub> = 10V |     | 10   |      |
|                                                                    | On-state resistance difference between any two switches | On-state resistance difference between any two switches |                                                                                                                                                                                                                            | V <sub>DD</sub> = 15V |     | 5    |      |
| V <sub>IHC</sub>                                                   | Control input, high voltage                             |                                                         | See Figure 7                                                                                                                                                                                                               | V <sub>DD</sub> = 5V  |     | 3.5  | V    |
|                                                                    |                                                         |                                                         |                                                                                                                                                                                                                            | V <sub>DD</sub> = 10V |     | 7    | V    |
|                                                                    |                                                         |                                                         |                                                                                                                                                                                                                            | V <sub>DD</sub> = 15V |     | 11   | V    |
|                                                                    | Maximum control input repetition rate                   |                                                         | V <sub>IN</sub> = V <sub>DD</sub> , C <sub>L</sub> = 50pF, R <sub>L</sub> = 1kΩ<br>V <sub>C</sub> = 10V (square wave centered on 5V), t <sub>r</sub> , t <sub>f</sub> = 20ns, V <sub>os</sub> = 1/2V <sub>os</sub> at 1kHz | V <sub>DD</sub> = 5V  |     | 6    | MHz  |
|                                                                    |                                                         |                                                         |                                                                                                                                                                                                                            | V <sub>DD</sub> = 10V |     | 9    |      |
|                                                                    |                                                         |                                                         |                                                                                                                                                                                                                            | V <sub>DD</sub> = 15V |     | 9.5  |      |

## 5.5 Electrical Characteristics (continued)

Over operating free-air temperature range,  $V_{\text{SUPPLY}} = \pm 5\text{V}$ , and  $R_L = 100\ \Omega$ , (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                                    |                           | TEST CONDITIONS                                              |                           |      | MIN | TYP   | MAX  | UNI<br>T |    |
|--------------------------------------------------------------|---------------------------|--------------------------------------------------------------|---------------------------|------|-----|-------|------|----------|----|
| $C_{\text{IN}}$                                              | Input Capacitance         |                                                              |                           |      | 5   | 7.5   |      | pF       |    |
| $I_{\text{IS}}$                                              | Switch input current      | $V_{\text{DD}} = 5\text{V}$<br>$V_{\text{IS}} = 0\text{V}$   | $T_A = -55^\circ\text{C}$ |      |     |       | 0.64 | mA       |    |
|                                                              |                           |                                                              | $T_A = -40^\circ\text{C}$ |      |     |       | 0.61 |          |    |
|                                                              |                           |                                                              | $T_A = 25^\circ\text{C}$  |      |     | 0.51  |      |          |    |
|                                                              |                           |                                                              | $T_A = 85^\circ\text{C}$  |      |     |       | 0.42 |          |    |
|                                                              |                           |                                                              | $T_A = 125^\circ\text{C}$ |      |     |       | 0.36 |          |    |
|                                                              |                           | $V_{\text{DD}} = 5\text{V}$<br>$V_{\text{IS}} = 5\text{V}$   | $T_A = -55^\circ\text{C}$ |      |     |       |      | -0.64    | mA |
|                                                              |                           |                                                              | $T_A = -40^\circ\text{C}$ |      |     |       |      | -0.61    |    |
|                                                              |                           |                                                              | $T_A = 25^\circ\text{C}$  |      |     | -0.51 |      |          |    |
|                                                              |                           |                                                              | $T_A = 85^\circ\text{C}$  |      |     |       |      | -0.42    |    |
|                                                              |                           |                                                              | $T_A = 125^\circ\text{C}$ |      |     |       |      | -0.36    |    |
|                                                              |                           | $V_{\text{DD}} = 10\text{V}$<br>$V_{\text{IS}} = 0\text{V}$  | $T_A = -55^\circ\text{C}$ |      |     |       |      | 1.6      | mA |
|                                                              |                           |                                                              | $T_A = -40^\circ\text{C}$ |      |     |       |      | 1.5      |    |
|                                                              |                           |                                                              | $T_A = 25^\circ\text{C}$  |      |     | 1.3   |      |          |    |
|                                                              |                           |                                                              | $T_A = 85^\circ\text{C}$  |      |     |       |      | 1.1      |    |
|                                                              |                           |                                                              | $T_A = 125^\circ\text{C}$ |      |     |       |      | 0.9      |    |
|                                                              |                           | $V_{\text{DD}} = 10\text{V}$<br>$V_{\text{IS}} = 10\text{V}$ | $T_A = -55^\circ\text{C}$ |      |     |       |      | -1.6     | mA |
|                                                              |                           |                                                              | $T_A = -40^\circ\text{C}$ |      |     |       |      | -1.5     |    |
|                                                              |                           |                                                              | $T_A = 25^\circ\text{C}$  |      |     | -1.3  |      |          |    |
|                                                              |                           |                                                              | $T_A = 85^\circ\text{C}$  |      |     |       |      | -1.1     |    |
|                                                              |                           |                                                              | $T_A = 125^\circ\text{C}$ |      |     |       |      | -0.9     |    |
|                                                              |                           | $V_{\text{DD}} = 15\text{V}$<br>$V_{\text{IS}} = 0\text{V}$  | $T_A = -55^\circ\text{C}$ |      |     |       |      | 4.2      | mA |
|                                                              |                           |                                                              | $T_A = -40^\circ\text{C}$ |      |     |       |      | 4        |    |
|                                                              |                           |                                                              | $T_A = 25^\circ\text{C}$  |      |     | 3.4   |      |          |    |
|                                                              |                           |                                                              | $T_A = 85^\circ\text{C}$  |      |     |       |      | 2.8      |    |
| $T_A = 125^\circ\text{C}$                                    |                           |                                                              |                           |      |     | 2.4   |      |          |    |
| $V_{\text{DD}} = 15\text{V}$<br>$V_{\text{IS}} = 15\text{V}$ | $T_A = -55^\circ\text{C}$ |                                                              |                           |      |     | -4.2  | mA   |          |    |
|                                                              | $T_A = -40^\circ\text{C}$ |                                                              |                           |      |     | -4    |      |          |    |
|                                                              | $T_A = 25^\circ\text{C}$  |                                                              |                           | -3.4 |     |       |      |          |    |
|                                                              | $T_A = 85^\circ\text{C}$  |                                                              |                           |      |     | -2.8  |      |          |    |
|                                                              | $T_A = 125^\circ\text{C}$ |                                                              |                           |      |     | -2.4  |      |          |    |

### 5.5 Electrical Characteristics (continued)

Over operating free-air temperature range,  $V_{SUPPLY} = \pm 5V$ , and  $R_L = 100 \Omega$ , (unless otherwise noted)<sup>(1)</sup>

| PARAMETER |                                              | TEST CONDITIONS                                                                                                  |                     |                     | MIN | TYP | MAX  | UNI<br>T |     |
|-----------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-----|-----|------|----------|-----|
| $I_{DD}$  | Quiescent Device Current<br>All switches OFF | $V_{is} = 0$ to 5V<br>$V_{DD} = 5V$                                                                              | $T_A = -55^\circ C$ |                     |     |     | 5    | $\mu A$  |     |
|           |                                              |                                                                                                                  | $T_A = -40^\circ C$ |                     |     |     | 5    |          |     |
|           |                                              |                                                                                                                  | $T_A = 25^\circ C$  |                     |     | 4   | 6    |          |     |
|           |                                              |                                                                                                                  | $T_A = 85^\circ C$  |                     |     |     | 7    |          |     |
|           |                                              |                                                                                                                  | $T_A = 125^\circ C$ |                     |     |     | 7.5  |          |     |
|           |                                              | $V_{is} = 0$ to 10V<br>$V_{DD} = 10V$                                                                            | $T_A = -55^\circ C$ |                     |     |     |      |          | 6   |
|           |                                              |                                                                                                                  | $T_A = -40^\circ C$ |                     |     |     |      |          | 6   |
|           |                                              |                                                                                                                  | $T_A = 25^\circ C$  |                     |     | 5   | 7    |          |     |
|           |                                              |                                                                                                                  | $T_A = 85^\circ C$  |                     |     |     | 8    |          |     |
|           |                                              |                                                                                                                  | $T_A = 125^\circ C$ |                     |     |     | 9    |          |     |
|           |                                              | $V_{is} = 0$ to 15V<br>$V_{DD} = 15V$                                                                            | $T_A = -55^\circ C$ |                     |     |     |      |          | 7   |
|           |                                              |                                                                                                                  | $T_A = -40^\circ C$ |                     |     |     |      |          | 7.5 |
|           |                                              |                                                                                                                  | $T_A = 25^\circ C$  |                     |     | 5.5 | 8    |          |     |
|           |                                              |                                                                                                                  | $T_A = 85^\circ C$  |                     |     |     | 9    |          |     |
|           |                                              |                                                                                                                  | $T_A = 125^\circ C$ |                     |     |     | 10   |          |     |
|           |                                              | $V_{is} = 0$ to 20V<br>$V_{DD} = 20V$                                                                            | $T_A = -55^\circ C$ |                     |     |     |      |          | 8.5 |
|           |                                              |                                                                                                                  | $T_A = -40^\circ C$ |                     |     |     |      |          | 8.5 |
|           |                                              |                                                                                                                  | $T_A = 25^\circ C$  |                     |     | 6.5 | 9    |          |     |
|           |                                              |                                                                                                                  | $T_A = 85^\circ C$  |                     |     |     | 10   |          |     |
|           |                                              |                                                                                                                  | $T_A = 125^\circ C$ |                     |     |     | 11   |          |     |
| $r_{ON}$  | ON Resistance $r_{ON}$ Max                   | to<br>$(V_{DD}+V_{SS})/2$ , $V_C$<br>$= V_{DD}$ , $R_L = 10k\Omega$<br>returned $V_{is} = V_{SS}$<br>to $V_{DD}$ | $V_{DD} = 5V$       | $T_A = -55^\circ C$ |     |     | 800  | $\Omega$ |     |
|           |                                              |                                                                                                                  |                     | $T_A = -40^\circ C$ |     |     | 850  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 25^\circ C$  |     | 470 | 1050 |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 85^\circ C$  |     |     | 1200 |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 125^\circ C$ |     |     | 1300 |          |     |
|           |                                              |                                                                                                                  | $V_{DD} = 10V$      | $T_A = -55^\circ C$ |     |     | 310  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = -40^\circ C$ |     |     | 330  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 25^\circ C$  |     | 180 | 400  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 85^\circ C$  |     |     | 500  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 125^\circ C$ |     |     | 500  |          |     |
|           |                                              |                                                                                                                  | $V_{DD} = 15V$      | $T_A = -55^\circ C$ |     |     | 200  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = -40^\circ C$ |     |     | 210  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 25^\circ C$  |     | 125 | 240  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 85^\circ C$  |     |     | 300  |          |     |
|           |                                              |                                                                                                                  |                     | $T_A = 125^\circ C$ |     |     | 320  |          |     |

### 5.5 Electrical Characteristics (continued)

Over operating free-air temperature range,  $V_{SUPPLY} = \pm 5V$ , and  $R_L = 100 \Omega$ , (unless otherwise noted)<sup>(1)</sup>

| PARAMETER |                                  | TEST CONDITIONS                                                                                           |                     |                     | MIN  | TYP   | MAX       | UNIT    |      |
|-----------|----------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------|---------------------|------|-------|-----------|---------|------|
| $V_{ILC}$ | Control input, low voltage (max) | $ I_{is}  < 10 \mu A$ , $V_{is} = V_{SS}$ , $V_{OS} = V_{DD}$ , and $V_{is} = V_{DD}$ , $V_{OS} = V_{SS}$ | $V_{DD} = 5V$       | $T_A = -55^\circ C$ |      |       | 1         | V       |      |
|           |                                  |                                                                                                           |                     | $T_A = -40^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 25^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 85^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 125^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           | $V_{DD} = 10V$      | $T_A = -55^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = -40^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 25^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 85^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 125^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           | $V_{DD} = 15V$      | $T_A = -55^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = -40^\circ C$ |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 25^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 85^\circ C$  |      |       | 1         |         |      |
|           |                                  |                                                                                                           |                     | $T_A = 125^\circ C$ |      |       | 1         |         |      |
| $I_{IN}$  | Input current (max)              | $V_{is} \leq V_{DD}$ , $V_{DD} - V_{SS} = 18V$ , $V_{CC} \leq V_{DD} - V_{SS}$ , $V_{DD} = 18V$           | $T_A = -55^\circ C$ |                     | -0.8 |       | 0.8       | $\mu A$ |      |
|           |                                  |                                                                                                           | $T_A = -40^\circ C$ |                     | -0.8 |       | 0.8       |         |      |
|           | Input current (max)              |                                                                                                           | Input current (max) | $T_A = 25^\circ C$  |      | -0.7  | $\pm 0.2$ |         | 0.7  |
|           |                                  |                                                                                                           |                     | $T_A = 85^\circ C$  |      | -0.6  |           |         | 0.6  |
|           | Input current (max)              |                                                                                                           | Input current (max) | $T_A = 125^\circ C$ |      | -0.55 |           |         | 0.55 |

(1) Peak-to-Peak voltage symmetrical about  $(V_{DD} - V_{EE}) / 2$ .

### 5.6 Switching Characteristics

$T_A = 25^\circ C$

| PARAMETER | FROM         | TO            | TEST CONDITIONS                                                         | $V_{CC}$ | MIN | TYP | MAX | UNIT |
|-----------|--------------|---------------|-------------------------------------------------------------------------|----------|-----|-----|-----|------|
| $t_{pd}$  | Signal input | Signal output | $V_{IN} = V_{DD}$ , $t_r, t_f = 20ns$ , $C_L = 50pF$ , $R_L = 1k\Omega$ | 5V       |     | 20  | 40  | ns   |
|           |              |               |                                                                         | 10V      |     | 10  | 20  |      |
|           |              |               |                                                                         | 15V      |     | 7   | 15  |      |
| $t_{ph}$  | Signal input | Signal output | $V_{IN} = V_{DD}$ , $t_r, t_f = 20ns$ , $C_L = 50pF$ , $R_L = 1k\Omega$ | 5V       |     | 35  | 70  | ns   |
|           |              |               |                                                                         | 10V      |     | 20  | 40  |      |
|           |              |               |                                                                         | 15V      |     | 15  | 30  |      |
| $t_{phi}$ | Signal input | Signal output | $V_{IN} = V_{DD}$ , $t_r, t_f = 20ns$ , $C_L = 50pF$ , $R_L = 1k\Omega$ | 5V       |     | 35  | 70  | ns   |
|           |              |               |                                                                         | 10V      |     | 20  | 40  |      |
|           |              |               |                                                                         | 15V      |     | 15  | 30  |      |



### 5.7 Typical Characteristics

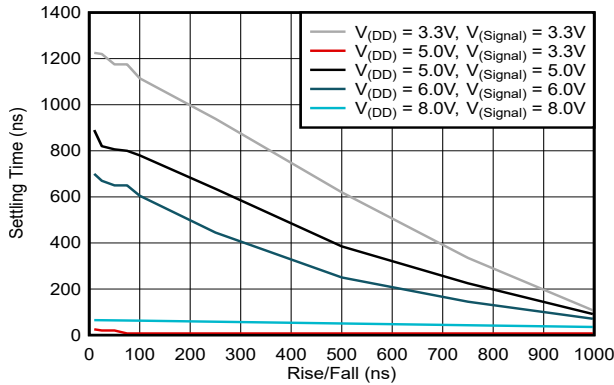


Figure 5-1. System Settling Time vs Signal Rise/Fall Time

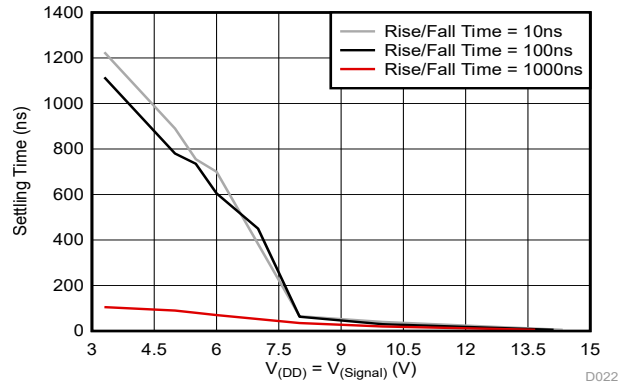


Figure 5-2. System Settling Time vs Signal Voltage

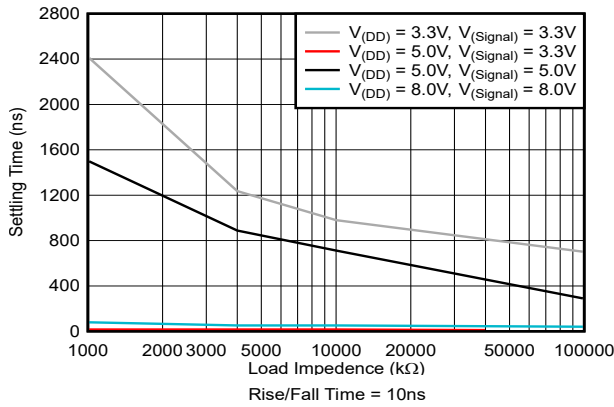


Figure 5-3. System Settling Time vs Signal Voltage

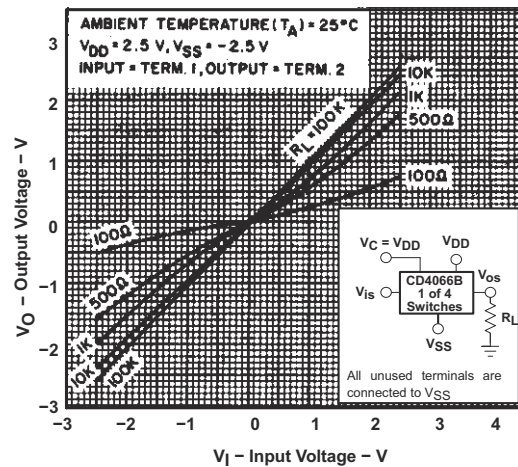


Figure 5-4. Typical ON Characteristics for 1 of 4 Channels

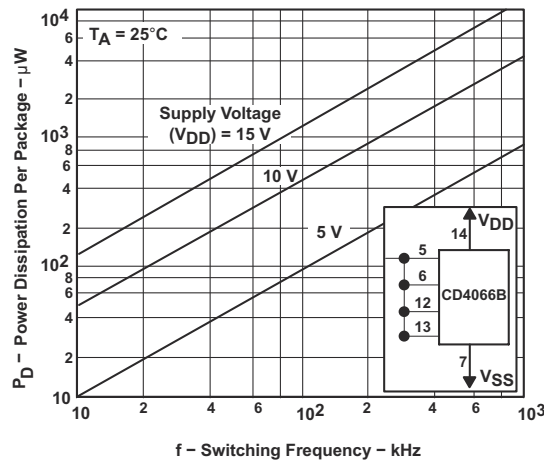
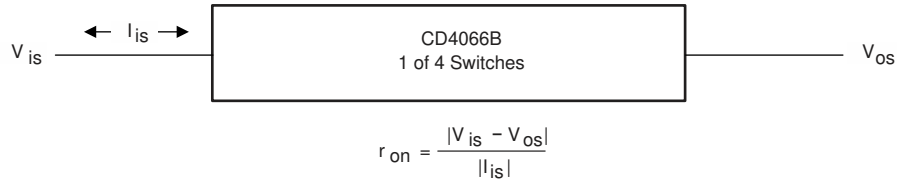


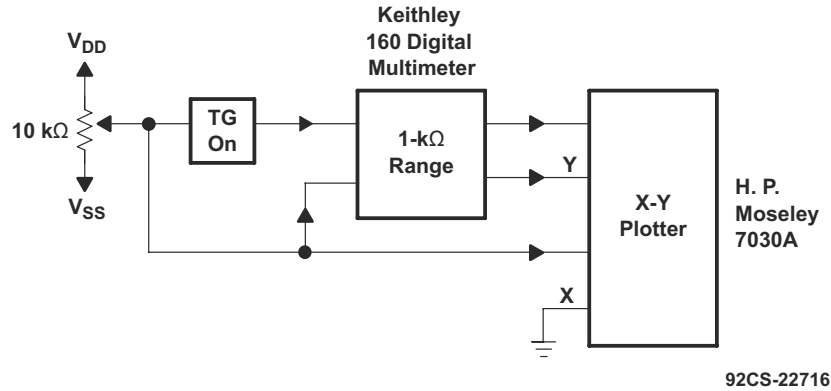
Figure 5-5. Power Dissipation per Package vs Switching Frequency

## 6 Parameter Measurement Information

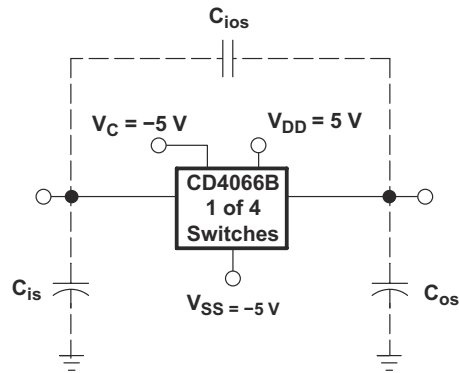


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**Figure 6-1. Determination of  $r_{on}$  as a Test Condition for Control-Input High-Voltage ( $V_{IHC}$ ) Specification**



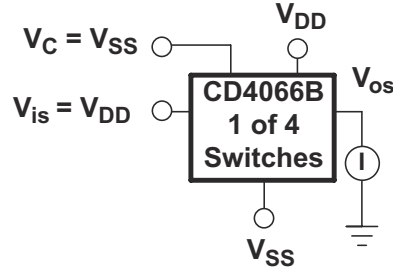
**Figure 6-2. Channel On-State Resistance Measurement Circuit**



92CS-30921

Measured on Boonton capacitance bridge, model 75a (1 MHz);  
test-fixture capacitance nulled out.

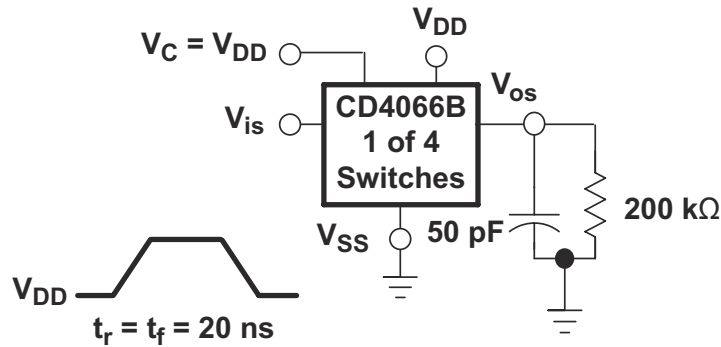
**Figure 6-3. Typical On Characteristics for One of Four Channels**



92CS-30922

All unused terminals are connected to  $V_{SS}$ .

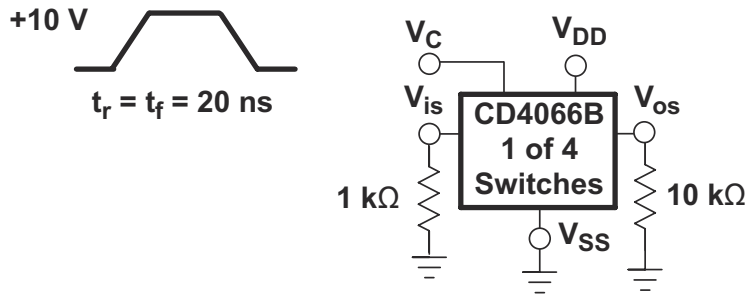
**Figure 6-4. Off-Switch Input or Output Leakage**



92CS-30923

All unused terminals are connected to  $V_{SS}$ .

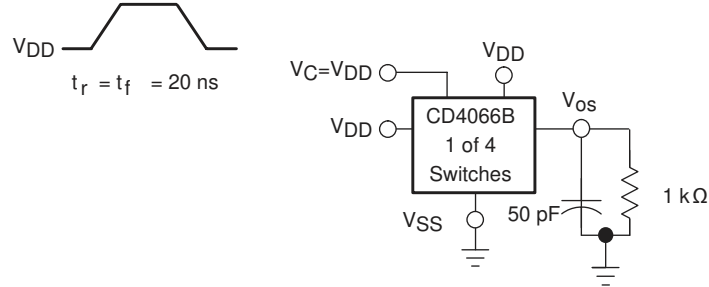
**Figure 6-5. Propagation Delay Time Signal Input ( $V_{is}$ ) to Signal Output ( $V_{os}$ )**



92CS-30924

All unused terminals are connected to  $V_{SS}$ .

**Figure 6-6. Crosstalk-Control Input to Signal Output**

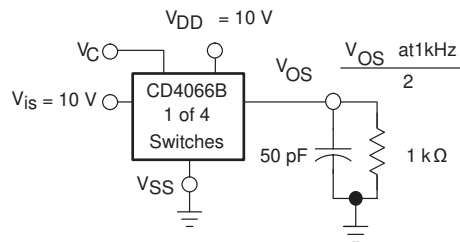
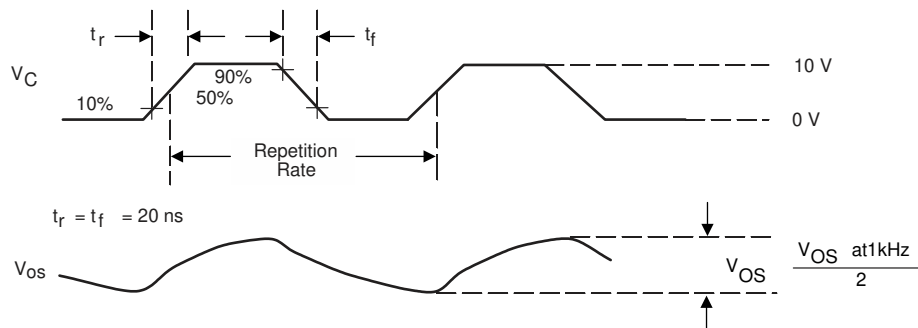


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All unused pins are connected to V<sub>SS</sub>.

Delay is measured at V<sub>OS</sub> level of +10% from ground (turn-on) or on-state output level (turn-off).

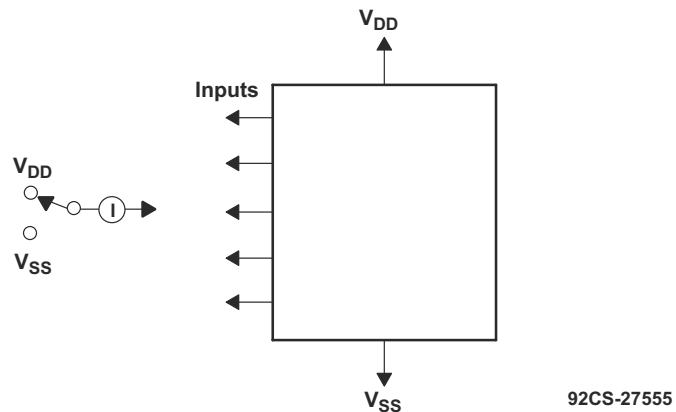
**Figure 6-7. Propagation Delay, t<sub>PLH</sub>, t<sub>PHL</sub> Control-Signal Output**



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All unused pins are connected to V<sub>SS</sub>.

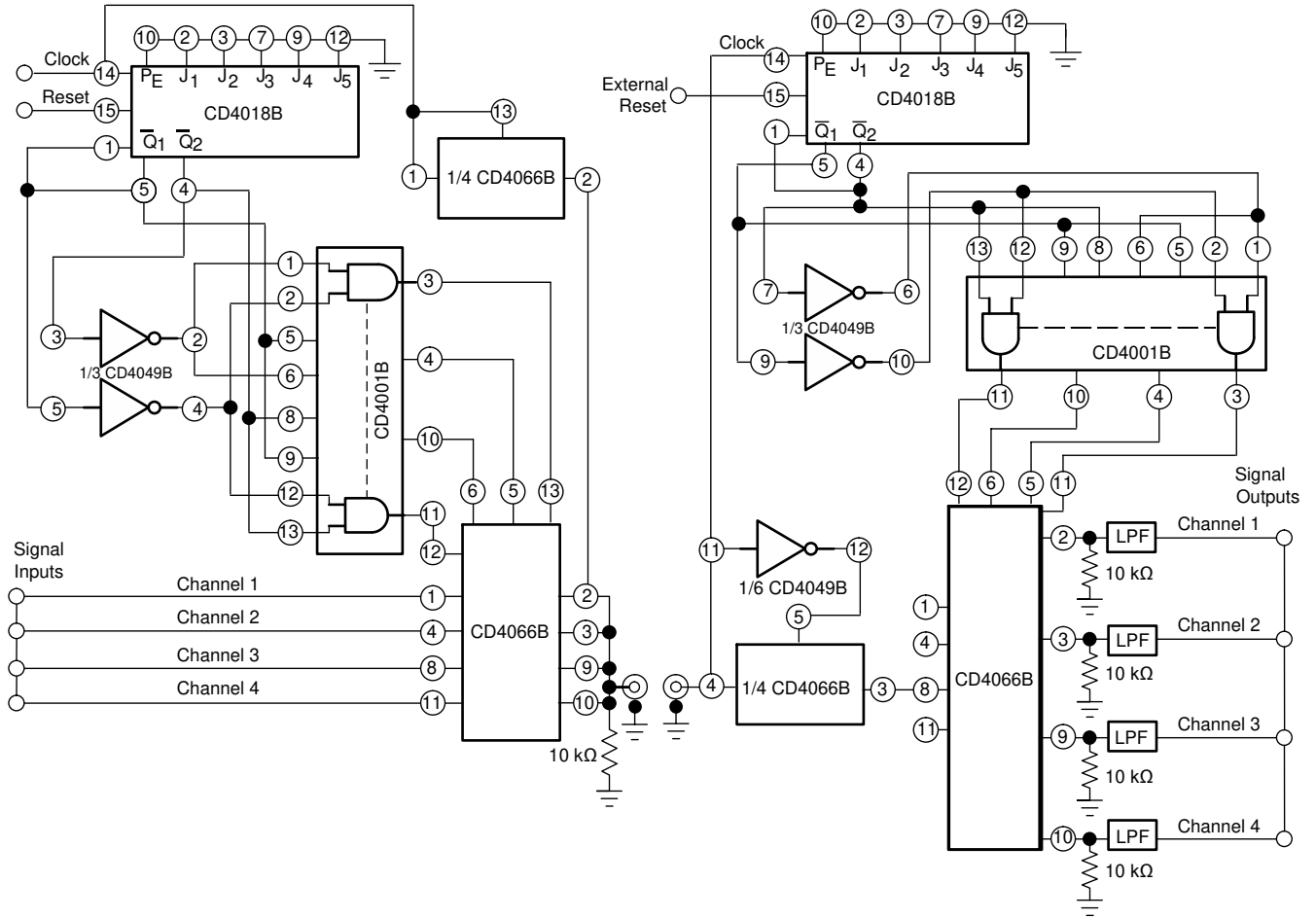
**Figure 6-8. Maximum Allowable Control-Input Repetition Rate**



92CS-27555

Measure inputs sequentially to both V<sub>DD</sub> and V<sub>SS</sub>. Connect all unused inputs to either V<sub>DD</sub> or V<sub>SS</sub>. Measure control inputs only.

**Figure 6-9. Input Leakage-Current Test Circuit**



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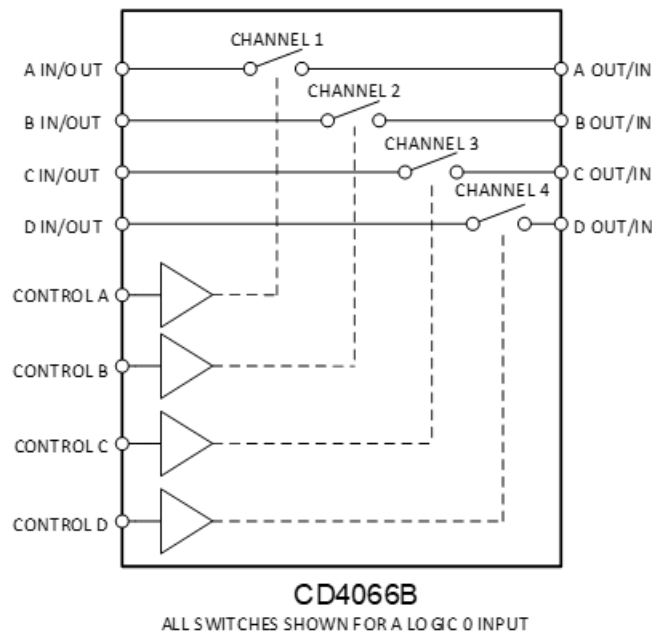
**Figure 6-10. Four-Channel PAM Multiplex System Diagram**

## 7 Detailed Description

### 7.1 Overview

CD4066B has four independent digitally controlled analog switches with a bias voltage of  $V_{SS}$  to allow for different voltage levels to be used for low output. Both the p and n devices in a given switch are biased on or off simultaneously by the control signal. As shown in Figure 7-1, the well of the n-channel device on each switch is tied to either the input (when the switch is on) or to  $V_{SS}$  (when the switch is off). Thus, when the control of the device is low, the output of the switch goes to  $V_{SS}$  and when the control is high the output of the device goes to  $V_{DD}$ .

### 7.2 Functional Block Diagram



- A. All control inputs are protected by the CMOS protection network.
- B. All p substrates are connected to  $V_{DD}$ .
- C. Normal operation control-line biasing: switch on (logic 1),  $V_C = V_{DD}$ ; switch off (logic 0),  $V_C = V_{SS}$ .
- D. Signal-level range:  $V_{SS} \leq V_{is} \leq V_{DD}$ .

**Figure 7-1. Schematic Diagram of One-of-Four Identical Switches and Associated Control Circuitry**

### 7.3 Feature Description

Each switch has different control pins, which allows for more options for the outputs. Bias Voltage allows the device to output a voltage other than 0V when the device control is low. The CD4066B has a large absolute maximum voltage for  $V_{DD}$  of 20V.

## 7.4 Device Functional Modes

Table 7-1 lists the functions of this device.

**Table 7-1. Function Table**

| INPUTS     |         | OUTPUT     |
|------------|---------|------------|
| SIG IN/OUT | CONTROL | SIG OUT/IN |
| H          | H       | H          |
| L          | H       | L          |
| X          | L       | Hi-Z       |

## 8 Application and Implementation

### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

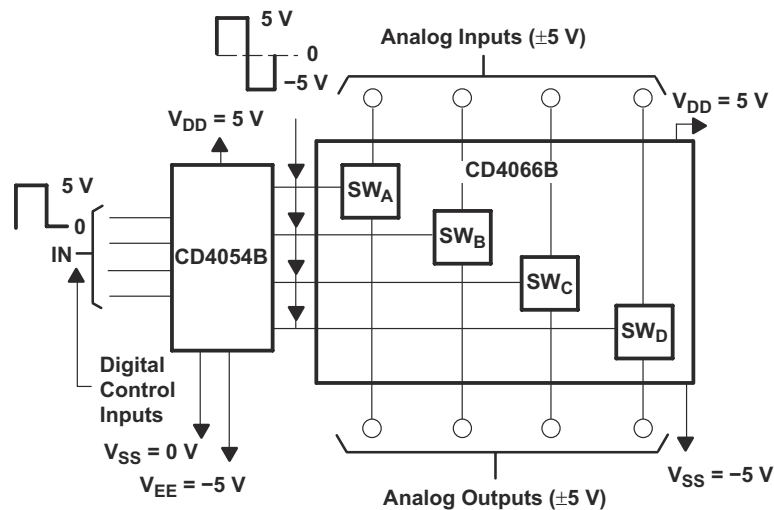
### 8.1 Application Information

In applications that employ separate power sources to drive  $V_{DD}$  and the signal inputs, the  $V_{DD}$  current capability should exceed  $V_{DD}/R_L$  ( $R_L$  = effective external load of the four CD4066B device bilateral switches). This provision avoids any permanent current flow or clamp action on the  $V_{DD}$  supply when power is applied or removed from the CD4066B device.

In certain applications, the external load-resistor current can include both  $V_{DD}$  and signal-line components. To avoid drawing  $V_{DD}$  current when switch current flows into pins 1, 4, 8, or 11, the voltage drop across the bidirectional switch must not exceed 0.8V (calculated from  $r_{on}$  values shown).

No  $V_{DD}$  current flows through  $R_L$  if the switch current flows into pins 2, 3, 9, or 10.

### 8.2 Typical Application



92CS-30927

Figure 8-1. Bidirectional Signal Transmission Through Digital Control Logic

#### 8.2.1 Design Requirements

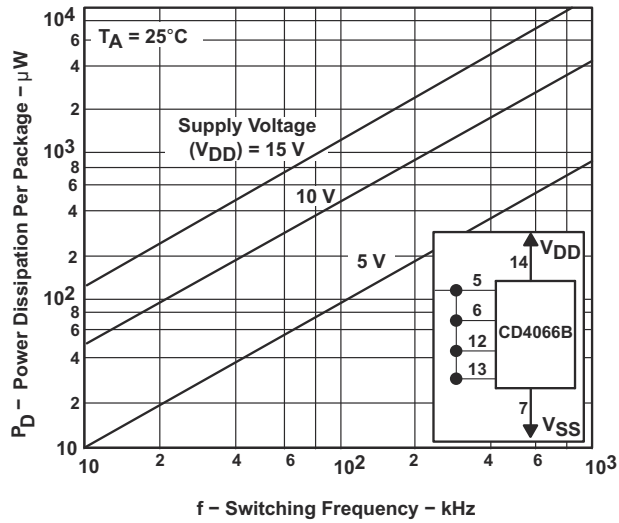
This device uses CMOS technology and has balanced output drive. Avoid bus contention because it can drive currents in excess of maximum limits. The high drive also creates fast edges into light loads, so consider routing and load conditions to prevent ringing.

#### 8.2.2 Detailed Design Procedure

- Recommended input conditions:
  - For rise time and fall time specifications, see  $\Delta t/\Delta v$  in [Recommended Operating Conditions](#).
  - For specified high and low levels, see  $V_{IH}$  and  $V_{IL}$  in [Recommended Operating Conditions](#).
- Recommended output conditions:
  - Load currents should not exceed  $\pm 10\text{mA}$ .



### 8.2.3 Application Curve



**Figure 8-2. Power Dissipation vs. Switching Frequency**

### 8.3 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in [Recommended Operating Conditions](#).

Each VCC pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply,  $0.1\mu\text{F}$  is recommended; if there are multiple VCC pins, then  $0.01\mu\text{F}$  or  $0.022\mu\text{F}$  is recommended for each power pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. A  $0.1\mu\text{F}$  and a  $1\mu\text{F}$  are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

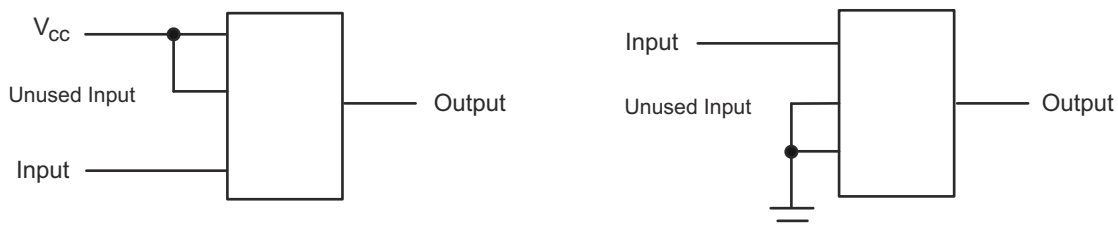
### 8.4 Layout

#### 8.4.1 Layout Guidelines

When using multiple bit logic devices inputs must never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input *and* gate are used or only 3 of the 4 buffer gates are used. Such input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or VCC, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it disables the output section of the part when asserted. This does not disable the input section of the I/Os, so they cannot float when disabled.

#### 8.4.2 Layout Example



**Figure 8-3. Diagram for Unused Inputs**

## 9 Device and Documentation Support

### 9.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 9.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 9.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 9.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

### Changes from Revision I (May 2024) to Revision J (August 2024) Page

- Added Settling Time plots.....9

### Changes from Revision H (January 2020) to Revision I (May 2024) Page

- Changed *Package Information* table to include package leads..... 1
- Changed the numbering format for tables, figures, and cross-references throughout the document..... 1
- Deleted the *J (CDIP, 14)* package from the data sheet..... 1
- Changed max and typ IDD for lower supply voltages.....5
- Changed VIL from 2V to 1V across supply..... 5

### Changes from Revision G (June 2017) to Revision H (January 2020) Page

- Added Junction Temperature details to the *Absolute Maximum Ratings* table.....4

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4066BE         | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | -55 to 125   | CD4066BE                | <a href="#">Samples</a> |
| CD4066BEE4       | ACTIVE        | PDIP         | N               | 14   | 25          | RoHS & Non-Green | NIPDAU                               | N / A for Pkg Type   | -55 to 125   | CD4066BE                | <a href="#">Samples</a> |
| CD4066BF         | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | CD4066BF                | <a href="#">Samples</a> |
| CD4066BF3A       | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | CD4066BF3A              | <a href="#">Samples</a> |
| CD4066BM         | OBSOLETE      | SOIC         | D               | 14   |             | TBD              | Call TI                              | Call TI              | -55 to 125   | CD4066BM                |                         |
| CD4066BM96       | ACTIVE        | SOIC         | D               | 14   | 2500        | RoHS & Green     | NIPDAU   SN                          | Level-1-260C-UNLIM   | -55 to 125   | CD4066BM                | <a href="#">Samples</a> |
| CD4066BM96G4     | OBSOLETE      | SOIC         | D               | 14   |             | TBD              | Call TI                              | Call TI              | -55 to 125   | CD4066BM                |                         |
| CD4066BMT        | OBSOLETE      | SOIC         | D               | 14   |             | TBD              | Call TI                              | Call TI              | -55 to 125   | CD4066BM                |                         |
| CD4066BNS        | OBSOLETE      | SO           | NS              | 14   |             | TBD              | Call TI                              | Call TI              |              | CD4066B                 |                         |
| CD4066BNSR       | ACTIVE        | SO           | NS              | 14   | 2000        | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4066B                 | <a href="#">Samples</a> |
| CD4066BPW        | OBSOLETE      | TSSOP        | PW              | 14   |             | TBD              | Call TI                              | Call TI              | -55 to 125   | CM066B                  |                         |
| CD4066BPWR       | ACTIVE        | TSSOP        | PW              | 14   | 2000        | RoHS & Green     | NIPDAU   SN                          | Level-1-260C-UNLIM   | -55 to 125   | CM066B                  | <a href="#">Samples</a> |
| CD4066BPWRG4     | OBSOLETE      | TSSOP        | PW              | 14   |             | TBD              | Call TI                              | Call TI              | -55 to 125   | CM066B                  |                         |
| JM38510/05852BCA | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>05852BCA    | <a href="#">Samples</a> |
| M38510/05852BCA  | ACTIVE        | CDIP         | J               | 14   | 25          | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510/<br>05852BCA    | <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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF CD4066B, CD4066B-MIL :**

- Catalog : [CD4066B](#)
- Automotive : [CD4066B-Q1](#), [CD4066B-Q1](#)
- Military : [CD4066B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

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