

## CD40x7B CMOS Analog Multiplexers or Demultiplexers

### 1 Features

- High-voltage types (20V rating)
  - CD4067B – single 16-channel multiplexer or demultiplexer
- Low ON resistance: 125Ω (typ) over 15V<sub>p-p</sub> signal-input range for V<sub>DD</sub>–V<sub>SS</sub> = 15V
- High OFF resistance: channel leakage of ±10pA (typ) at V<sub>DD</sub> – V<sub>SS</sub> = 10V
- Matched switch characteristics: R<sub>ON</sub> = 5Ω (typ) for V<sub>DD</sub> – V<sub>SS</sub> = 15V
- Very low quiescent power dissipation under all digital-control input and supply conditions: 0.2μW (typ) at V<sub>DD</sub> – V<sub>SS</sub> = 10V
- Binary address decoding on chip
- 5V, 10V, and 15V parametric ratings
- 100% tested for quiescent current at 20V
- Standardized symmetrical output characteristics
- Maximum input current of 1μA at 18V over full package temperature range: 100nA at 18V and 25°C
- Meets all requirements of JEDEC tentative standard No. 13-B, *Standard Specifications for Description of "B" Series CMOS Devices*

### 2 Applications

- Analog signal and digital multiplexing
- Transmission-gate logic implementation
- A/DI and D/A conversion
- Signal gating

### 3 Description

CD40x7B CMOS analog multiplexers or demultiplexers are digitally controlled analog switches having low ON impedance, low OFF leakage current, and internal address decoding. When these devices are used as demultiplexers, the channel in or out terminals are the outputs and the common out or in terminals are the inputs. In addition, the ON resistance is relatively constant over the full input-signal range.

The CD4067B is a 16-channel multiplexer with four binary control inputs, A, B, C, D, and an inhibit input, arranged so that any combination of the inputs selects one switch.

A logic "1" present at the inhibit input turns all channels off.

The CD40x7B types are supplied in 24-lead hermetic dual-in-line ceramic packages (F3A suffix), 24-lead dual-in-line plastic packages (E suffix), 24-lead small-outline packages (M, M96, and NSR suffixes), and 24-lead thin shrink small-outline packages (P and PWR suffixes).

#### Device Information

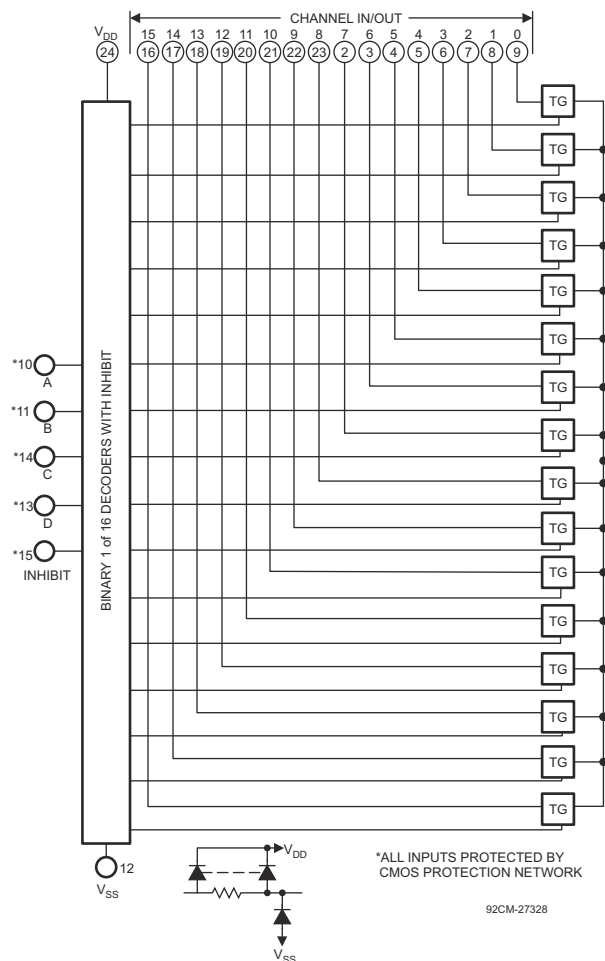
| PART NUMBER | CHANNEL                                      | PACKAGE <sup>(1)</sup> |
|-------------|----------------------------------------------|------------------------|
| CD4067B     | 2 channel<br>8:1 differential<br>multiplexer | PW (TSSOP, 24)         |
|             |                                              | DW (SOIC, 24)          |

(1) For more information, see [Section 11](#).

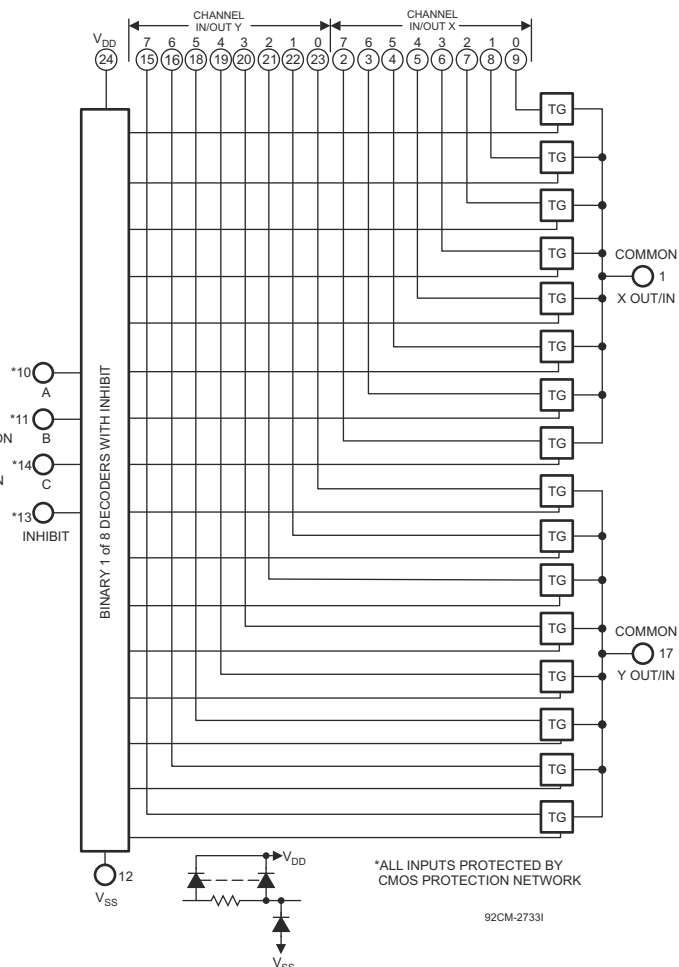


# CD4067B, CD4097B

SCHS052D – JUNE 2003 – REVISED AUGUST 2024



**CD4067 Logic Diagram**



**CD4097 Logic Diagram**

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## 4 Pin Configuration and Functions

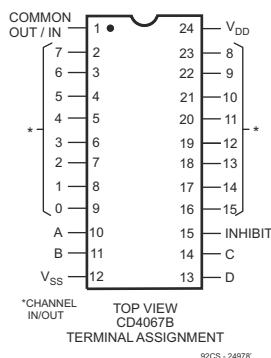


Figure 4-1. CD4067B 24 Pins (Top View)

Table 4-1. Function Table

| CD4067 TRUTH TABLE |   |   |   |     |                  |
|--------------------|---|---|---|-----|------------------|
| A                  | B | C | D | inh | Selected Channel |
| X                  | X | X | X | 1   | None             |
| 0                  | 0 | 0 | 0 | 0   | 0                |
| 1                  | 0 | 0 | 0 | 0   | 1                |
| 0                  | 1 | 0 | 0 | 0   | 2                |
| 1                  | 1 | 0 | 0 | 0   | 3                |
| 0                  | 0 | 1 | 0 | 0   | 4                |
| 1                  | 0 | 1 | 0 | 0   | 5                |
| 0                  | 1 | 1 | 0 | 0   | 6                |
| 1                  | 1 | 1 | 0 | 0   | 7                |
| 0                  | 0 | 0 | 1 | 0   | 8                |
| 1                  | 0 | 0 | 1 | 0   | 9                |
| 0                  | 1 | 0 | 1 | 0   | 10               |
| 1                  | 1 | 0 | 1 | 0   | 11               |
| 0                  | 0 | 1 | 1 | 0   | 12               |
| 1                  | 0 | 1 | 1 | 0   | 13               |
| 0                  | 1 | 1 | 1 | 0   | 14               |
| 1                  | 1 | 1 | 1 | 0   | 15               |

Table 4-2. Function Table

| CD4097 TRUTH TABLE |   |   |     |                  |
|--------------------|---|---|-----|------------------|
| A                  | B | C | inh | Selected Channel |
| X                  | X | X | 1   | None             |
| 0                  | 0 | 0 | 0   | 0X, 0Y           |
| 1                  | 0 | 0 | 0   | 1X, 1Y           |
| 0                  | 1 | 0 | 0   | 2X, 2Y           |
| 1                  | 1 | 0 | 0   | 3X, 3Y           |
| 0                  | 0 | 1 | 0   | 4X, 4Y           |
| 1                  | 0 | 1 | 0   | 5X, 5Y           |
| 0                  | 1 | 1 | 0   | 6X, 6Y           |
| 1                  | 1 | 1 | 0   | 7X, 7Y           |

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1) (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>              | ±2000 | V    |
|             |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | ±200  |      |

- (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   | CD406x     | UNIT |
|-------------------------------|----------------------------------------------|----------|------------|------|
|                               |                                              | D (SOIC) | PW (TSSOP) |      |
|                               |                                              | 14 PINS  | 14 PINS    |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 109.7    | 101.8      | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 69.4     | 44.3       | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 67.9     | 68.2       | °C/W |
| $\Psi_{JT}$                   | Junction-to-top characterization parameter   | 25.8     | 3.2        | °C/W |
| $\Psi_{JB}$                   | Junction-to-board characterization parameter | 67.1     | 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,  $V_{SUPPLY} = \pm 5V$ , and  $R_L = 100\Omega$ , (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                           | TEST CONDITIONS            | TEST CONDITIONS                                                                                                | TEST CONDITIONS     | TEST CONDITIONS     | MIN | TYP | MAX  | UNIT     |
|-----------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-----|-----|------|----------|
| SIGNAL INPUTS ( $V_{IS}$ ) AND OUTPUTS ( $V_{OS}$ ) |                            |                                                                                                                |                     |                     |     |     |      |          |
| $I_{DD}$                                            | Quiescent Device Current   | $V_{IS} = 0$ to 5V<br>$V_{DD} = 5V$                                                                            | $T_A = -55^\circ C$ |                     |     |     | 13   | $\mu A$  |
|                                                     |                            |                                                                                                                | $T_A = -40^\circ C$ |                     |     |     | 13   |          |
|                                                     |                            |                                                                                                                | $T_A = 25^\circ C$  |                     |     | 5   | 14.5 |          |
|                                                     |                            |                                                                                                                | $T_A = 85^\circ C$  |                     |     |     | 150  |          |
|                                                     |                            |                                                                                                                | $T_A = 125^\circ C$ |                     |     |     | 150  |          |
|                                                     |                            | $V_{IS} = 0$ to 5V<br>$V_{DD} = 10V$                                                                           | $T_A = -55^\circ C$ |                     |     |     | 14   |          |
|                                                     |                            |                                                                                                                | $T_A = -40^\circ C$ |                     |     |     | 14   |          |
|                                                     |                            |                                                                                                                | $T_A = 25^\circ C$  |                     |     | 6   | 15.5 |          |
|                                                     |                            |                                                                                                                | $T_A = 85^\circ C$  |                     |     |     | 300  |          |
|                                                     |                            |                                                                                                                | $T_A = 125^\circ C$ |                     |     |     | 300  |          |
|                                                     |                            | $V_{IS} = 0$ to 5V<br>$V_{DD} = 15V$                                                                           | $T_A = -55^\circ C$ |                     |     |     | 20   |          |
|                                                     |                            |                                                                                                                | $T_A = -40^\circ C$ |                     |     |     | 20   |          |
|                                                     |                            |                                                                                                                | $T_A = 25^\circ C$  |                     |     | 6   | 20   |          |
|                                                     |                            |                                                                                                                | $T_A = 85^\circ C$  |                     |     |     | 600  |          |
|                                                     |                            |                                                                                                                | $T_A = 125^\circ C$ |                     |     |     | 600  |          |
|                                                     |                            | $V_{IS} = 0$ to 5V<br>$V_{DD} = 20V$                                                                           | $T_A = -55^\circ C$ |                     |     |     | 100  |          |
|                                                     |                            |                                                                                                                | $T_A = -40^\circ C$ |                     |     |     | 100  |          |
|                                                     |                            |                                                                                                                | $T_A = 25^\circ C$  |                     |     | 7   | 100  |          |
|                                                     |                            |                                                                                                                | $T_A = 85^\circ C$  |                     |     |     | 3000 |          |
|                                                     |                            |                                                                                                                | $T_A = 125^\circ C$ |                     |     |     | 3000 |          |
| $r_{ON}$                                            | ON Resistance $r_{ON}$ Max | to $(V_{DD}-V_{SS})/2$ ,<br>$V_C = V_{DD}$ ,<br>$R_L = 10k\Omega$<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  |          |
|                                                     |                            |                                                                                                                |                     | $T_A = 85^\circ C$  |     |     | 520  |          |
|                                                     |                            |                                                                                                                |                     | $T_A = 125^\circ C$ |     |     | 550  |          |
|                                                     |                            |                                                                                                                | $V_{DD} = 15V$      | $T_A = -55^\circ C$ |     |     | 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,  $V_{\text{SUPPLY}} = \pm 5\text{V}$ , and  $R_L = 100\Omega$ , (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                                                                    |                                                         |                                                         | TEST CONDITIONS                                                                                                                                                                                     | TEST CONDITIONS                                                  | TEST CONDITIONS                                                  | TEST CONDITIONS                                                  | MIN                     | TYP | MAX           | UNIT     |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|-------------------------|-----|---------------|----------|
| $\Delta R_{\text{ON}}$                                                                       | On-state resistance difference between any two switches |                                                         | $R_L = 10\text{k}\Omega$ , $V_C = V_{\text{DD}}$                                                                                                                                                    | $V_{\text{DD}} = 5\text{V}$                                      |                                                                  |                                                                  | 15                      |     |               | $\Omega$ |
|                                                                                              | On-state resistance difference between any two switches | On-state resistance difference between any two switches |                                                                                                                                                                                                     | $V_{\text{DD}} = 10\text{V}$                                     |                                                                  |                                                                  | 10                      |     |               |          |
|                                                                                              | On-state resistance difference between any two switches | On-state resistance difference between any two switches |                                                                                                                                                                                                     | $V_{\text{DD}} = 15\text{V}$                                     |                                                                  |                                                                  | 5                       |     |               |          |
| OFF Channel Leakage Current: Any Channel OFF (Max) or ALL Channels OFF (COMMON OUT/IN) (Max) |                                                         |                                                         |                                                                                                                                                                                                     | $V_{\text{DD}} - V_{\text{SS}} = 18\text{V}$                     | $T_A = -55^\circ\text{C}$                                        |                                                                  | $\pm 100$               |     |               | nA       |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     |                                                                  | $T_A = -40^\circ\text{C}$                                        |                                                                  | $\pm 100$               |     |               |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     |                                                                  | $T_A = 25^\circ\text{C}$                                         |                                                                  | $\pm 0.1 \pm 100^{(2)}$ |     |               |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     |                                                                  | $T_A = 85^\circ\text{C}$                                         |                                                                  | $\pm 1000^{(2)}$        |     |               |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     |                                                                  | $T_A = 125^\circ\text{C}$                                        |                                                                  | $\pm 1000^{(2)}$        |     |               |          |
| $C_{\text{IS}}$                                                                              | Input capacitance                                       | $V_S = 0\text{V}$<br>$f = 1\text{MHz}$<br>CD4067        | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$                                                                                                                                    | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | 5                       |     | pF            |          |
| $C_{\text{OS}}$                                                                              | Output capacitance                                      | $V_S = 0\text{V}$<br>$f = 1\text{MHz}$<br>CD4067        | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$                                                                                                                                    | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | 55                      |     | pF            |          |
| $C_{\text{OS}}$                                                                              | Output capacitance                                      | $V_S = 0\text{V}$<br>$f = 1\text{MHz}$<br>CD4097        | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$                                                                                                                                    | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | 35                      |     | pF            |          |
| $C_{\text{IOS}}$                                                                             | Feed through                                            | $V_S = 0\text{V}$<br>$f = 1\text{MHz}$                  | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$                                                                                                                                    | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | $V_{\text{DD}} = 5\text{V}$ , $V_C = V_{\text{SS}} = -5\text{V}$ | 0.2                     |     | pF            |          |
| $V_{\text{IHC}}$                                                                             | Control input, high voltage                             |                                                         | See Figure 6-1                                                                                                                                                                                      | $V_{\text{DD}} = 5\text{V}$                                      |                                                                  |                                                                  | 3.5                     |     | V             |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     | $V_{\text{DD}} = 10\text{V}$                                     |                                                                  |                                                                  | 7                       |     | V             |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     | $V_{\text{DD}} = 15\text{V}$                                     |                                                                  |                                                                  | 11                      |     | V             |          |
| $V_{\text{ILC}}$                                                                             | Control input, low voltage (max)                        |                                                         | $V_{\text{DD}} = 5\text{V}$                                                                                                                                                                         |                                                                  |                                                                  | 1                                                                | V                       |     |               |          |
|                                                                                              |                                                         |                                                         | $V_{\text{DD}} = 10\text{V}$                                                                                                                                                                        |                                                                  |                                                                  | 1                                                                | V                       |     |               |          |
|                                                                                              |                                                         |                                                         | $V_{\text{DD}} = 15\text{V}$                                                                                                                                                                        |                                                                  |                                                                  | 1                                                                | V                       |     |               |          |
| $I_{\text{IN}}$                                                                              | Input current (max)                                     |                                                         | $V_{\text{IS}} \leq V_{\text{DD}}$ , $V_{\text{DD}} - V_{\text{SS}} = 18\text{V}$ , $V_{\text{CC}} \leq V_{\text{DD}} - V_{\text{SS}}$ , $V_{\text{DD}} = 18\text{V}$                               | $T_A = -55^\circ\text{C}$                                        |                                                                  | -0.1                                                             | 1                       |     | $\mu\text{A}$ |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     | $T_A = -40^\circ\text{C}$                                        |                                                                  | -0.1                                                             | 1                       |     |               |          |
|                                                                                              |                                                         |                                                         |                                                                                                                                                                                                     | $T_A = 25^\circ\text{C}$                                         |                                                                  | -0.1                                                             | 0.0001                  | 1   |               |          |
|                                                                                              | Input current (max)                                     | Input current (max)                                     |                                                                                                                                                                                                     | $T_A = 85^\circ\text{C}$                                         |                                                                  | -1                                                               | 1                       |     |               |          |
|                                                                                              | Input current (max)                                     | Input current (max)                                     |                                                                                                                                                                                                     | $T_A = 125^\circ\text{C}$                                        |                                                                  | -1                                                               | 1                       |     |               |          |
| $C_{\text{IN}}$                                                                              | Input Capacitance                                       |                                                         |                                                                                                                                                                                                     |                                                                  |                                                                  |                                                                  | 5                       | 7.5 | pF            |          |
| BW                                                                                           | -3dB cutoff frequency (switch on)                       | CD4067                                                  | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = -5\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 1\text{k}\Omega$ Common Out/In                               |                                                                  |                                                                  |                                                                  | 14                      | MHz |               |          |
|                                                                                              |                                                         | CD4097                                                  |                                                                                                                                                                                                     |                                                                  |                                                                  |                                                                  | 20                      |     |               |          |
|                                                                                              | -3dB cutoff frequency (switch on)                       |                                                         | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = -5\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 1\text{k}\Omega$ Any channel                                 |                                                                  |                                                                  |                                                                  | 60                      |     |               |          |
| THD                                                                                          | Total Harmonic Distortion                               | Total Harmonic Distortion                               | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = 0\text{V}$ , $V_{\text{IS(p-p)}} = 2\text{V}$ (sine wave centered on 0V), $R_L = 10\text{k}\Omega$ , $f_{\text{IS}} = 1\text{-kHz}$ sine wave  |                                                                  |                                                                  |                                                                  | 0.3                     | %   |               |          |
|                                                                                              |                                                         |                                                         | $V_C = V_{\text{DD}} = 10\text{V}$ , $V_{\text{SS}} = 0\text{V}$ , $V_{\text{IS(p-p)}} = 3\text{V}$ (sine wave centered on 0V), $R_L = 10\text{k}\Omega$ , $f_{\text{IS}} = 1\text{-kHz}$ sine wave |                                                                  |                                                                  |                                                                  | 0.2                     |     |               |          |
|                                                                                              |                                                         |                                                         | $V_C = V_{\text{DD}} = 15\text{V}$ , $V_{\text{SS}} = 0\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 10\text{k}\Omega$ , $f_{\text{IS}} = 1\text{-kHz}$ sine wave |                                                                  |                                                                  |                                                                  | 0.12                    |     |               |          |
| OISO                                                                                         | -40dB feed through frequency (switch off)               | CD4067                                                  | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = -5\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 1\text{k}\Omega$ Common Out/In                               |                                                                  |                                                                  |                                                                  | 20                      | MHz |               |          |
|                                                                                              |                                                         | CD4097                                                  |                                                                                                                                                                                                     |                                                                  |                                                                  |                                                                  | 12                      |     |               |          |
|                                                                                              | -40dB feed through frequency (switch off)               |                                                         | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = -5\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 1\text{k}\Omega$ Any channel                                 |                                                                  |                                                                  |                                                                  | 8                       |     |               |          |
| XTALK                                                                                        | -40dB crosstalk frequency                               | Any 2 Channels                                          | $V_C = V_{\text{DD}} = 5\text{V}$ , $V_{\text{SS}} = -5\text{V}$ , $V_{\text{IS(p-p)}} = 5\text{V}$ (sine wave centered on 0V), $R_L = 1\text{k}\Omega$                                             |                                                                  |                                                                  |                                                                  | 1                       | MHz |               |          |
|                                                                                              |                                                         | CD4097 on Common                                        |                                                                                                                                                                                                     |                                                                  |                                                                  |                                                                  | 10                      |     |               |          |
|                                                                                              |                                                         | CD4097 on Any                                           |                                                                                                                                                                                                     |                                                                  |                                                                  |                                                                  | 18                      |     |               |          |

## 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                                                                    | TEST CONDITIONS | TEST CONDITIONS | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------------------|------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----|-----|-----|------|
| Crosstalk (control input to signal output) | $V_C = 10\text{V}$ (square wave), $R_L = 10\text{k}\Omega$ , $V_{DD} = 10\text{V}$ |                 |                 |                 |     | 75  |     | mV   |

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

(2) Determined by minimum feasible leakage measurement for automatic testing.

## 5.6 AC Performance Characteristics

$V_{DD} = +15\text{V}$ ,  $V_{SS} = V_{EE} = 0\text{V}$ ,

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

| PARAMETER | FROM         | TO            | TEST CONDITIONS                                                     | $V_{CC}$ | MIN | TYP | MAX | UNIT |
|-----------|--------------|---------------|---------------------------------------------------------------------|----------|-----|-----|-----|------|
| $t_{pd}$  | Signal Input | Signal Output | $V_{IN} = V_{DD}$ , $C_L = 50\text{ pF}$ , $R_L = 1\text{ k}\Omega$ | 5V       |     | 30  | 60  | ns   |
|           |              |               |                                                                     | 10V      |     | 15  | 30  |      |
|           |              |               |                                                                     | 15V      |     | 7   | 20  |      |
| $t_{plh}$ | Signal Input | Signal Output | $V_{IN} = V_{DD}$ , $C_L = 50\text{ pF}$ , $R_L = 1\text{ k}\Omega$ | 5V       |     | 325 | 650 | ns   |
|           |              |               |                                                                     | 10V      |     | 135 | 270 |      |
|           |              |               |                                                                     | 15V      |     | 95  | 190 |      |
| $t_{phi}$ | Signal Input | Signal Output | $V_{IN} = V_{DD}$ , $C_L = 50\text{ pF}$ , $R_L = 1\text{ k}\Omega$ | 5V       |     | 220 | 440 | ns   |
|           |              |               |                                                                     | 10V      |     | 90  | 180 |      |
|           |              |               |                                                                     | 15V      |     | 65  | 130 |      |

## 5.7 Typical Characteristics

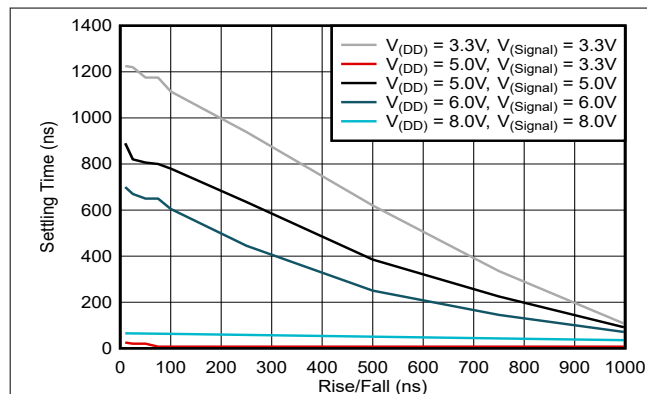


Figure 5-1. System Settling Time vs Signal Rise/Fall Time

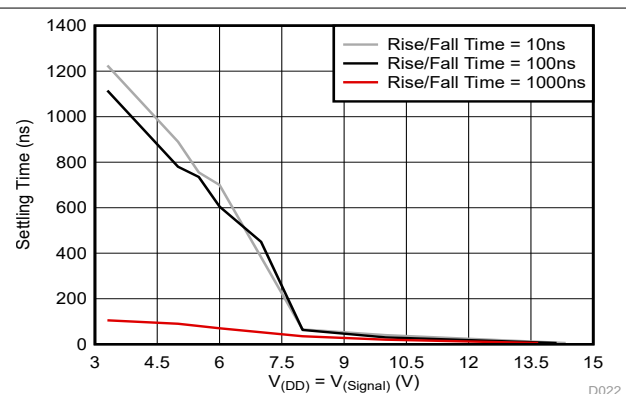


Figure 5-2. System Settling Time vs Signal Voltage

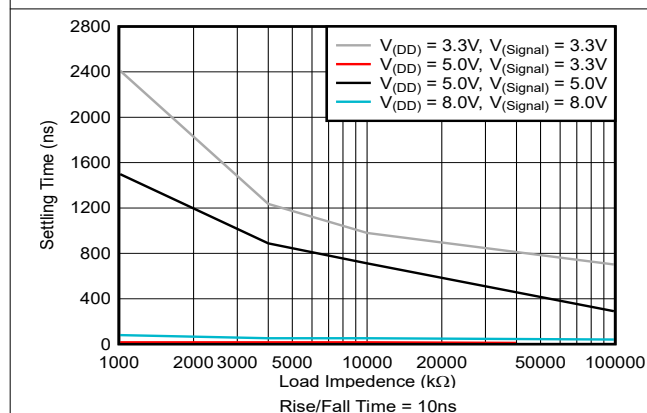


Figure 5-3. System Settling Time vs Signal Voltage

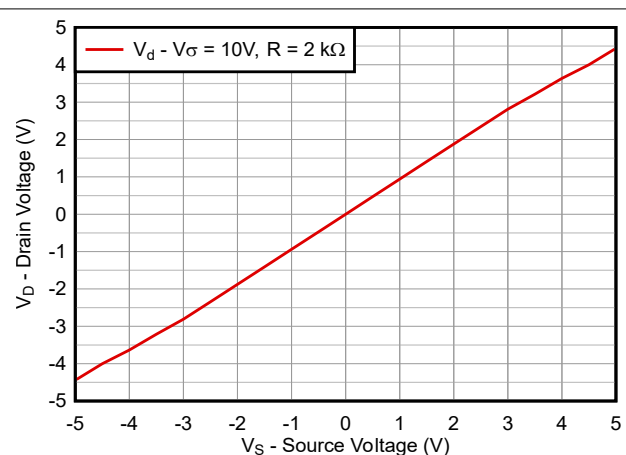
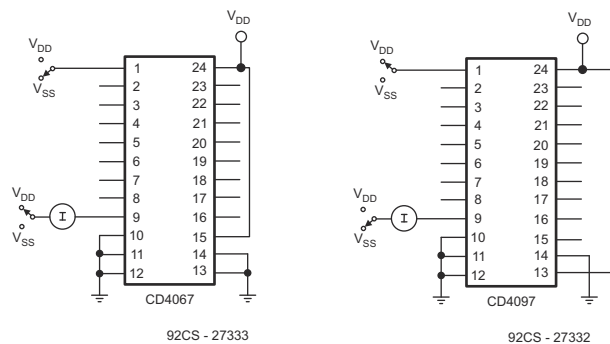


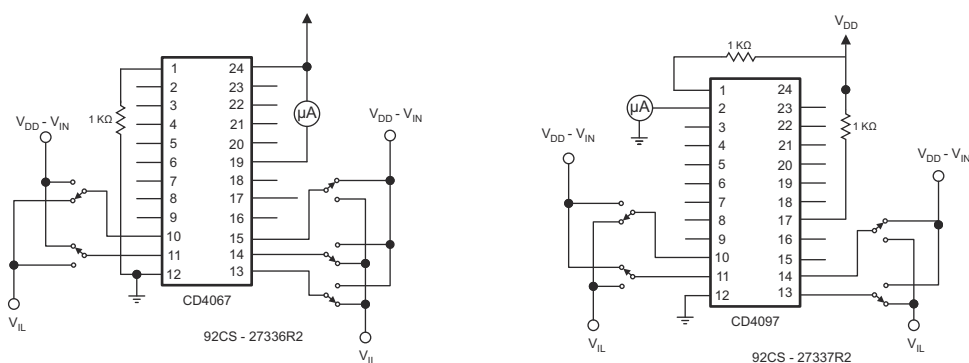
Figure 5-4. Source Voltage Input vs Drain Voltage Output

## 6 Parameter Measurement Information

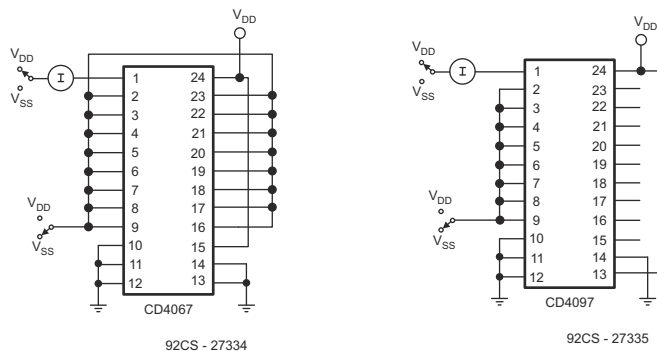
### 6.1 Test Circuits



**Figure 6-1. OFF Channel Leakage Current – Any Channel OFF**



**Figure 6-2. Input Voltage –Measure <2μA on all OFF Channels (For Example, Channel 12)**



**Figure 6-3. OFF Channel Leakage Current – All Channels OFF**

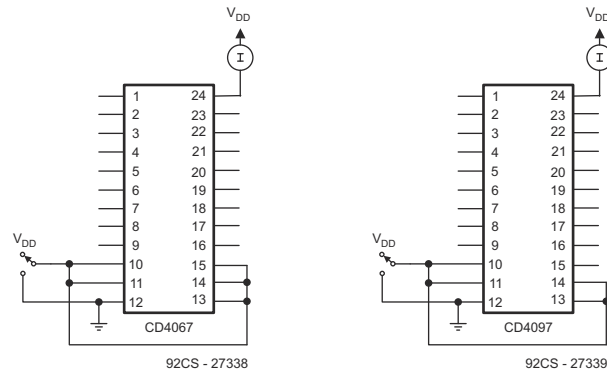


Figure 6-4. Quiescent Device Current

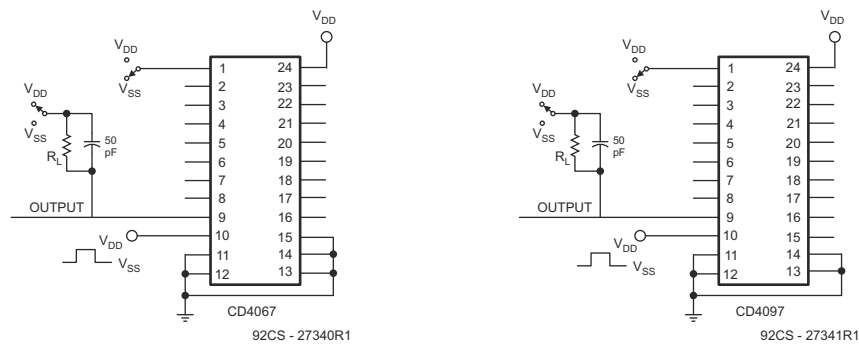


Figure 6-5. Turn-on and Turn-off Propagation Delay – Address Select Input to Signal Output (For Example,, Measured on Channel 0)

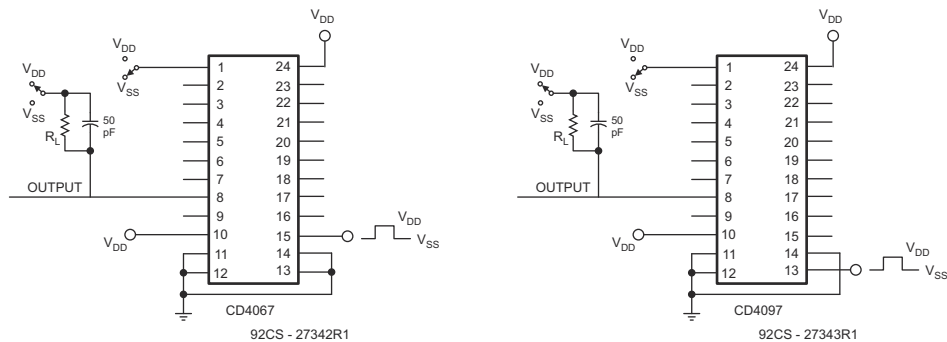


Figure 6-6. Turn-on and Turn-off Propagation Delay – Inhibit Input to Signal Output (For Example,, Measured on Channel 1)

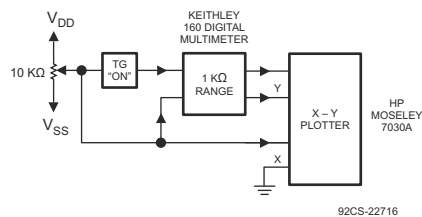


Figure 6-7. Channel ON Resistance Measurement Circuit

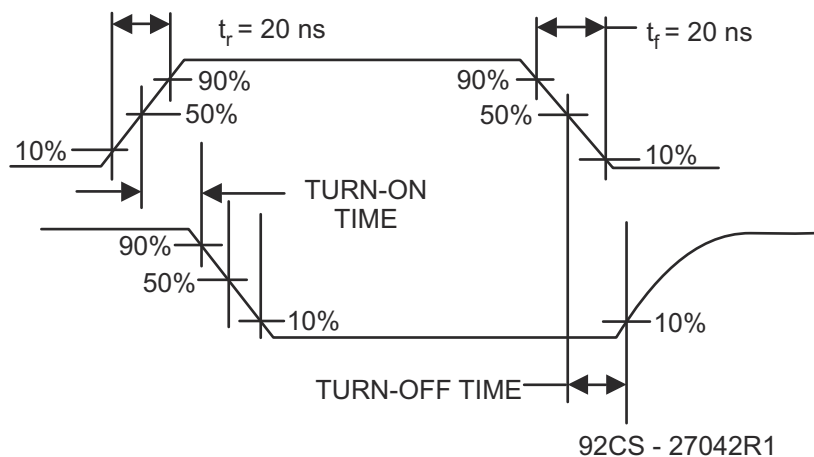


Figure 6-8. Propagation Delay Waveform Channel Being turned ON ( $R_L = 10k\Omega$ ,  $C_L = 50$  pF)

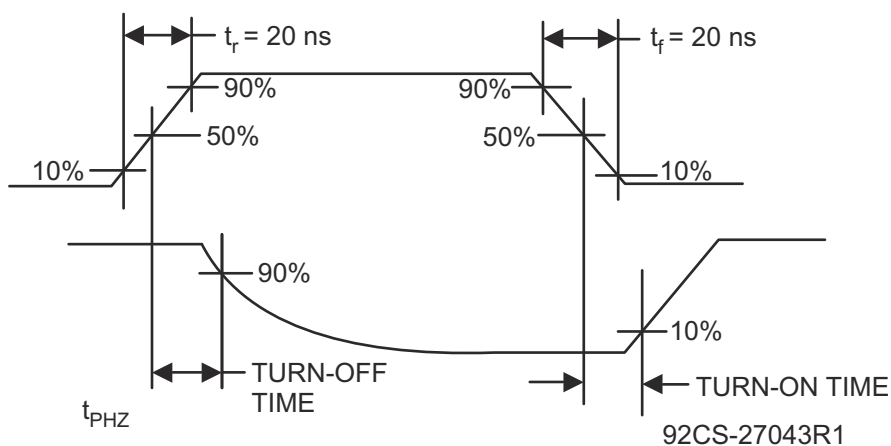


Figure 6-9. Propagation Delay Waveform Channel Being turned OFF ( $R_L = 300\Omega$ ,  $C_L = 50$  pF)

## 7 Detailed Description

### 7.1 Functional Block Diagram

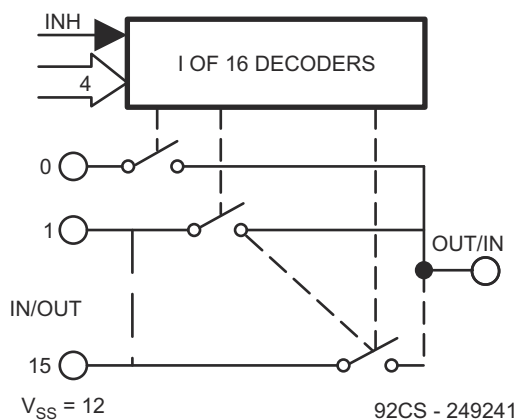


Figure 7-1. CD4067

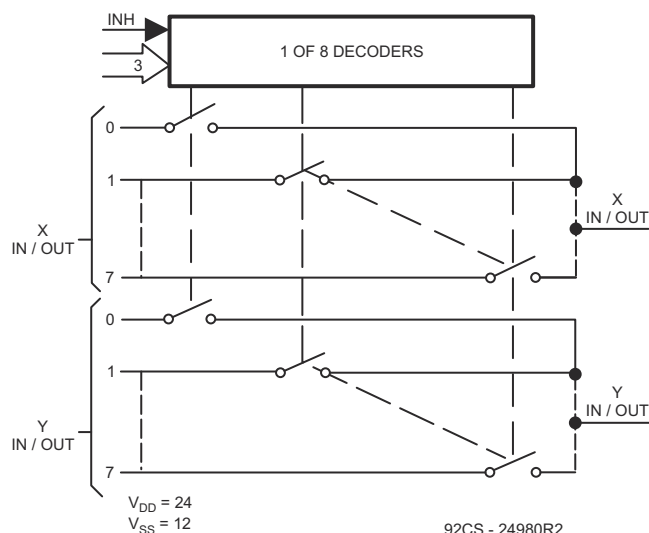


Figure 7-2. CD4097

### 7.2 Device Functional Modes

Table 7-1. Function Table

| CD4067 TRUTH TABLE |   |   |   |     |                  |
|--------------------|---|---|---|-----|------------------|
| A                  | B | C | D | inh | Selected Channel |
| X                  | X | X | X | 1   | None             |
| 0                  | 0 | 0 | 0 | 0   | 0                |
| 1                  | 0 | 0 | 0 | 0   | 1                |
| 0                  | 1 | 0 | 0 | 0   | 2                |
| 1                  | 1 | 0 | 0 | 0   | 3                |
| 0                  | 0 | 1 | 0 | 0   | 4                |
| 1                  | 0 | 1 | 0 | 0   | 5                |
| 0                  | 1 | 1 | 0 | 0   | 6                |
| 1                  | 1 | 1 | 0 | 0   | 7                |
| 0                  | 0 | 0 | 1 | 0   | 8                |
| 1                  | 0 | 0 | 1 | 0   | 9                |
| 0                  | 1 | 0 | 1 | 0   | 10               |
| 1                  | 1 | 0 | 1 | 0   | 11               |
| 0                  | 0 | 1 | 1 | 0   | 12               |
| 1                  | 0 | 1 | 1 | 0   | 13               |
| 0                  | 1 | 1 | 1 | 0   | 14               |
| 1                  | 1 | 1 | 1 | 0   | 15               |

**Table 7-2. Function Table**

| CD4097 TRUTH TABLE |   |   |     |                  |
|--------------------|---|---|-----|------------------|
| A                  | B | C | inh | Selected Channel |
| X                  | X | X | 1   | None             |
| 0                  | 0 | 0 | 0   | 0X, 0Y           |
| 1                  | 0 | 0 | 0   | 1X, 1Y           |
| 0                  | 1 | 0 | 0   | 2X, 2Y           |
| 1                  | 1 | 0 | 0   | 3X, 3Y           |
| 0                  | 0 | 1 | 0   | 4X, 4Y           |
| 1                  | 0 | 1 | 0   | 5X, 5Y           |
| 0                  | 1 | 1 | 0   | 6X, 6Y           |
| 1                  | 1 | 1 | 0   | 7X, 7Y           |

## 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

#### 8.1.1 Special Considerations

In applications where separate power sources are used to drive  $V_{DD}$  and the signal inputs, the  $V_{DD}$  current capability should exceed  $V_{DD}/R_L$  ( $R_L$  = effective external load). This provision avoids permanent current flow or clamp action on the  $V_{DD}$  supply when power is applied or removed from the CD40x7B.

When switching from one address to another, some of the ON periods of the channels of the multiplexers will overlap momentarily, which may be objectionable in certain applications. Also, when a channel is turned on or off by an address input, there is a momentary conductive path from the channel to  $V_{SS}$ , which will dump some charge from any capacitor connected to the input or output of the channel. The inhibit input turning on a channel will similarly dump some charge to  $V_{SS}$ .

The amount of charge dumped is mostly a function of the signal level above  $V_{SS}$ . Typically, at  $V_{DD}-V_{SS} = 10V$ , a 100pF capacitor connected to the input or output of the channel will lose 3-4% of its voltage at the moment the channel turns on or off. This loss of voltage is essentially independent of the address or inhibit signal transition time, if the transition time is less than 1-2 $\mu s$ . When the inhibit signal turns a channel off, there is no charge dumping to  $V_{SS}$ . Rather, there is a slight rise in the channel voltage level (65mV typical) due to capacitive coupling from inhibit input to channel input or output. Address inputs also couple some voltage steps onto the channel signal levels.

In certain applications, the external load-resistor current may include both  $V_{DD}$  and signal-line components. To avoid drawing  $V_{DD}$  current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.8V (calculated from  $R_{TON}$  values shown in *Electrical Characteristics* tables). No  $V_{DD}$  current will flow through  $R_L$  if the switch current flows into terminal 1 on the CD4067B, terminals 1 and 17 on the CD4097B.

### 8.2 Typical Application

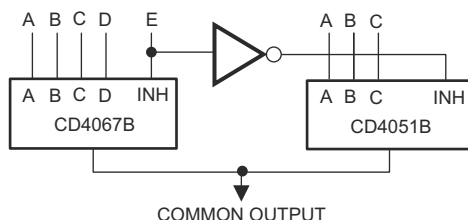


Figure 8-1. 18-24-to-1 MUX Addressing

## 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](https://www.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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### 9.3 Trademarks

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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.

| <b>Changes from Revision C (July 2024) to Revision D (August 2024)</b> | <b>Page</b>       |
|------------------------------------------------------------------------|-------------------|
| • Added Settling Time plots.....                                       | <a href="#">8</a> |

| <b>Changes from Revision B (June 2003) to Revision C (July 2024)</b>                                  | <b>Page</b>       |
|-------------------------------------------------------------------------------------------------------|-------------------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document..... | <a href="#">1</a> |
| • Changed max and typ IDD for lower supply voltages.....                                              | <a href="#">6</a> |
| • Changed max IIN at low temperature.....                                                             | <a href="#">6</a> |

## 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<br>Drawing | Pins | Package<br>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                 |
|------------------|---------------|--------------|--------------------|------|----------------|-------------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4067BF         | ACTIVE        | CDIP         | J                  | 24   | 15             | Non-RoHS &<br>Non-Green | Call TI                              | N / A for Pkg Type   | -55 to 125   | CD4067BF                | <a href="#">Samples</a> |
| CD4067BF3A       | ACTIVE        | CDIP         | J                  | 24   | 15             | Non-RoHS &<br>Non-Green | Call TI                              | N / A for Pkg Type   | -55 to 125   | CD4067BF3A              | <a href="#">Samples</a> |
| CD4067BM96       | ACTIVE        | SOIC         | DW                 | 24   | 2000           | RoHS & Green            | NIPDAU   SN                          | Level-1-260C-UNLIM   | -55 to 125   | CD4067BM                | <a href="#">Samples</a> |
| CD4067BPWR       | ACTIVE        | TSSOP        | PW                 | 24   | 2000           | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CM067B                  | <a href="#">Samples</a> |
| CD4097BF         | ACTIVE        | CDIP         | J                  | 24   | 15             | Non-RoHS &<br>Non-Green | Call TI                              | N / A for Pkg Type   | -55 to 125   | CD4097BF                | <a href="#">Samples</a> |
| CD4097BM         | NRND          | SOIC         | DW                 | 24   | 25             | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4097BM                |                         |
| CD4097BME4       | NRND          | SOIC         | DW                 | 24   | 25             | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4097BM                |                         |
| CD4097BMG4       | NRND          | SOIC         | DW                 | 24   | 25             | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4097BM                |                         |
| CD4097BPW        | NRND          | TSSOP        | PW                 | 24   | 60             | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CM097B                  |                         |
| CD4097BPWR       | NRND          | TSSOP        | PW                 | 24   | 2000           | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CM097B                  |                         |
| CD4097BPWRE4     | NRND          | TSSOP        | PW                 | 24   | 2000           | RoHS & Green            | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CM097B                  |                         |

(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.

<sup>(5)</sup> 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.

<sup>(6)</sup> 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 CD4067B, CD4067B-MIL, CD4097B, CD4097B-MIL :**

- Catalog : [CD4067B](#), [CD4097B](#)
- Military : [CD4067B-MIL](#), [CD4097B-MIL](#)

**NOTE: Qualified Version Definitions:**

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- Military - QML certified for Military and Defense Applications

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