

General Description

The CD4069 is a general purpose hex unbuffered inverter. Each inverter has a single stage. It operates over a recommended VDD power supply range of 3V to 15V referenced to VSS (usually ground). Unused inputs must be connected to VDD, VSS, or another input.

Features

- Wide supply voltage range from 3V to 15V
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40°C to +85°C
- Packaging information: DIP14/SOP14/TSSOP14

Order Information

| Product Model | Package Type | Marking | Packing | Packing Qty |
|---------------|--------------|----------|---------|-------------|
| CD4069BE | DIP-14 | CD4069BE | Tube | 1000/Box |
| CD4069BDTR | SOP-14 | CD4069B | Tape | 2500/Reel |
| CD4069BDTR | TSSOP-14 | CD4069B | Tape | 3000/Reel |
| | | | | |
| | | | | |

Block Diagram And Pin Description

Block Diagram

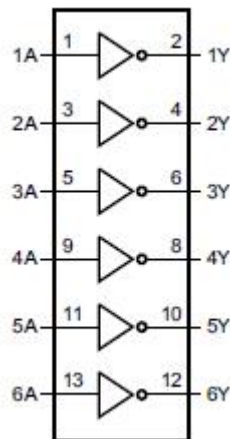


Figure 1. Logic diagram

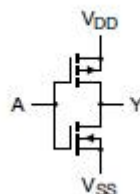
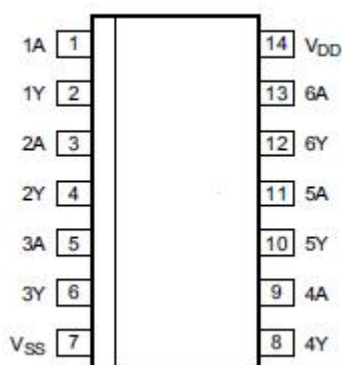


Figure 2. Schematic diagram (one inverter)

Pin Configurations



Pin Description

| Pin No. | Pin Name | Description |
|---------|-----------------|----------------|
| 1 | 1A | data input |
| 2 | 1Y | data output |
| 3 | 2A | data input |
| 4 | 2Y | data output |
| 5 | 3A | data input |
| 6 | 3Y | data output |
| 7 | V _{SS} | ground (0 V) |
| 8 | 4Y | data output |
| 9 | 4A | data input |
| 10 | 5Y | data output |
| 11 | 5A | data input |
| 12 | 6Y | data output |
| 13 | 6A | data input |
| 14 | V _{DD} | supply voltage |

Function Table

| Input | Output |
|-------|--------|
| nA | nY |
| L | H |
| H | L |

Note: H=HIGH voltage level; L=LOW voltage level.

Electrical Parameter

3.1 Absolute Maximum Ratings

(Voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

| Parameter | Symbol | Conditions | Min. | Max. | Unit |
|-------------------------|-----------|-----------------------|------|--------------|------|
| supply voltage | V_{DD} | - | -0.5 | +18 | V |
| DC input current | I_{IK} | any one input | - | ±10 | mA |
| input voltage | V_I | all inputs | -0.5 | $V_{DD}+0.5$ | V |
| storage temperature | T_{stg} | - | -65 | +150 | °C |
| total power dissipation | P_{tot} | - | - | 500 | mW |
| device dissipation | P | per output transistor | - | 100 | mW |
| Soldering temperature | T_L | 10s | DIP | 245 | °C |
| | | | SOP | 250 | |

Note:

[1] For DIP14 packages: above 70°C the value of P_{tot} derates linearly with 12mW/K.

[2] For SOP14 packages: above 70°C the value of P_{tot} derates linearly with 8mW/K.

[3] For (T)SSOP14 packages: above 60°C the value of P_{tot} derates linearly with 5.5mW/K.

3.2 Recommended Operating Conditions

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------|-------------|------|------|------|------|
| supply voltage | V_{DD} | - | 3 | - | 15 | V |
| ambient temperature | T_{amb} | in free air | -40 | - | +85 | °C |

3.3 、Electrical Characteristics

3.3.1 、DC Characteristics 1

($T_{amb}=25^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0 V), unless otherwise specified.)

| Parameter | Symbol | Conditions (V) | | | $T_{amb}=25^{\circ}\text{C}$ | | | Unit |
|---------------------------|----------|----------------|----------|----------|------------------------------|---------------|-----------|------|
| | | V_O | V_{IN} | V_{DD} | Min. | Typ. | Max. | |
| supply current | I_{DD} | - | 0, 5 | 5 | - | 0.01 | 0.25 | uA |
| | | - | 0, 10 | 10 | - | 0.01 | 0.5 | uA |
| | | - | 0, 15 | 15 | - | 0.01 | 1 | uA |
| LOW-level output current | I_{OL} | 0.4 | 0, 5 | 5 | 0.51 | 1 | - | mA |
| | | 0.5 | 0, 10 | 10 | 1.3 | 2.6 | - | mA |
| | | 1.5 | 0, 15 | 15 | 3.4 | 6.8 | - | mA |
| HIGH-level output current | I_{OH} | 4.6 | 0, 5 | 5 | -0.51 | -1 | - | mA |
| | | 2.5 | 0, 5 | 5 | -1.6 | -3.2 | - | mA |
| | | 9.5 | 0, 10 | 10 | -1.3 | -2.6 | - | mA |
| | | 13.5 | 0, 15 | 15 | -3.4 | -6.8 | - | mA |
| LOW-level output voltage | V_{OL} | - | 0, 5 | 5 | - | 0 | 0.05 | V |
| | | - | 0, 10 | 10 | - | 0 | 0.05 | V |
| | | - | 0, 15 | 15 | - | 0 | 0.05 | V |
| HIGH-level output voltage | V_{OH} | - | 0, 5 | 5 | 4.95 | 5 | - | V |
| | | - | 0, 10 | 10 | 9.95 | 10 | - | V |
| | | - | 0, 15 | 15 | 14.95 | 15 | - | V |
| LOW-level input voltage | V_{IL} | 0.5, 4.5 | - | 5 | - | - | 1 | V |
| | | 1, 9 | - | 10 | - | - | 2 | V |
| | | 1.5, 13.5 | - | 15 | - | - | 2.5 | V |
| HIGH-level input voltage | V_{IH} | 0.5 | - | 5 | 4 | - | - | V |
| | | 1 | - | 10 | 8 | - | - | V |
| | | 1.5 | - | 15 | 12.5 | - | - | V |
| input leakage current | I_I | - | 0, 15 | 15 | - | $\pm 10^{-5}$ | ± 0.1 | uA |

3.3.2、DC Characteristics 2

($T_{amb}=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

| Parameter | Symbol | Conditions (V) | | | $T_{amb}=-40^{\circ}\text{C}$ | | $T_{amb}=+85^{\circ}\text{C}$ | | Unit |
|---------------------------|----------|----------------|----------|----------|-------------------------------|-----------|-------------------------------|---------|---------------|
| | | V_O | V_{IN} | V_{DD} | Min. | Max. | Min. | Max. | |
| supply current | I_{DD} | - | 0, 5 | 5 | - | 0.25 | - | 7.5 | μA |
| | | - | 0, 10 | 10 | - | 0.5 | - | 15 | μA |
| | | - | 0, 15 | 15 | - | 1 | - | 30 | μA |
| LOW-level output current | I_{OL} | 0.4 | 0, 5 | 5 | 0.61 | - | 0.42 | - | mA |
| | | 0.5 | 0, 10 | 10 | 1.5 | - | 1.1 | - | mA |
| | | 1.5 | 0, 15 | 15 | 4 | - | 2.8 | - | mA |
| HIGH-level output current | I_{OH} | 4.6 | 0, 5 | 5 | -0.61 | - | -0.42 | - | mA |
| | | 2.5 | 0, 5 | 5 | -1.8 | - | -1.3 | - | mA |
| | | 9.5 | 0, 10 | 10 | -1.5 | - | -1.1 | - | mA |
| | | 13.5 | 0, 15 | 15 | -4 | - | -2.8 | - | mA |
| LOW-level output voltage | V_{OL} | - | 0, 5 | 5 | - | 0.05 | - | 0.05 | V |
| | | - | 0, 10 | 10 | - | 0.05 | - | 0.05 | V |
| | | - | 0, 15 | 15 | - | 0.05 | - | 0.05 | V |
| HIGH-level output voltage | V_{OH} | - | 0, 5 | 5 | 4.95 | - | 4.95 | - | V |
| | | - | 0, 10 | 10 | 9.95 | - | 9.95 | - | V |
| | | - | 0, 15 | 15 | 14.95 | - | 14.95 | - | V |
| LOW-level input voltage | V_{IL} | 0.5, 4.5 | - | 5 | - | 1 | - | 1 | V |
| | | 1, 9 | - | 10 | - | 2 | - | 2 | V |
| | | 1.5, 13.5 | - | 15 | - | 2.5 | - | 2.5 | V |
| HIGH-level input voltage | V_{IH} | 0.5 | - | 5 | 4 | - | 4 | - | V |
| | | 1 | - | 10 | 8 | - | 8 | - | V |
| | | 1.5 | - | 15 | 12.5 | - | 12.5 | - | V |
| input leakage current | I_I | - | 0, 15 | 15 | - | ± 0.1 | - | ± 1 | μA |

3.3.3、AC Characteristics 1

($T_{amb}=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, $t_r, t_f=20\text{ns}$, $C_L=50\text{pF}$, $R_L=200\text{k}\Omega$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit | |
|------------------------|--------------------|--------------|---------------------|------|------|------|----|
| propagation delay time | t_{PHL}, t_{PLH} | see Figure 4 | $V_{DD}=5\text{V}$ | - | 55 | 110 | ns |
| | | | $V_{DD}=10\text{V}$ | - | 30 | 60 | ns |
| | | | $V_{DD}=15\text{V}$ | - | 25 | 50 | ns |
| transition time | t_{THL}, t_{TLH} | see Figure 4 | $V_{DD}=5\text{V}$ | - | 100 | 200 | ns |
| | | | $V_{DD}=10\text{V}$ | - | 50 | 100 | ns |
| | | | $V_{DD}=15\text{V}$ | - | 40 | 80 | ns |
| input capacitance | C_I | any input | - | 10 | 15 | pF | |

Testing Circuit

AC Testing Circuit

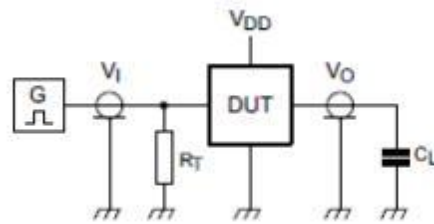


Figure 3. Test circuit for switching times

Definitions for test circuit:

DUT=Device Under Test.

C_L =Load capacitance including jig and probe capacitance.

R_T =Termination resistance should be equal to the output impedance Z_o of the pulse generator.

4.2 、 AC Testing Waveforms

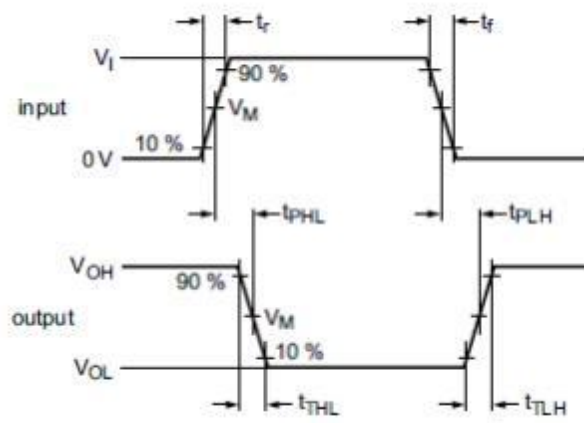


Figure 4. Propagation delay, output transition time

4.3 、 Measurement Points

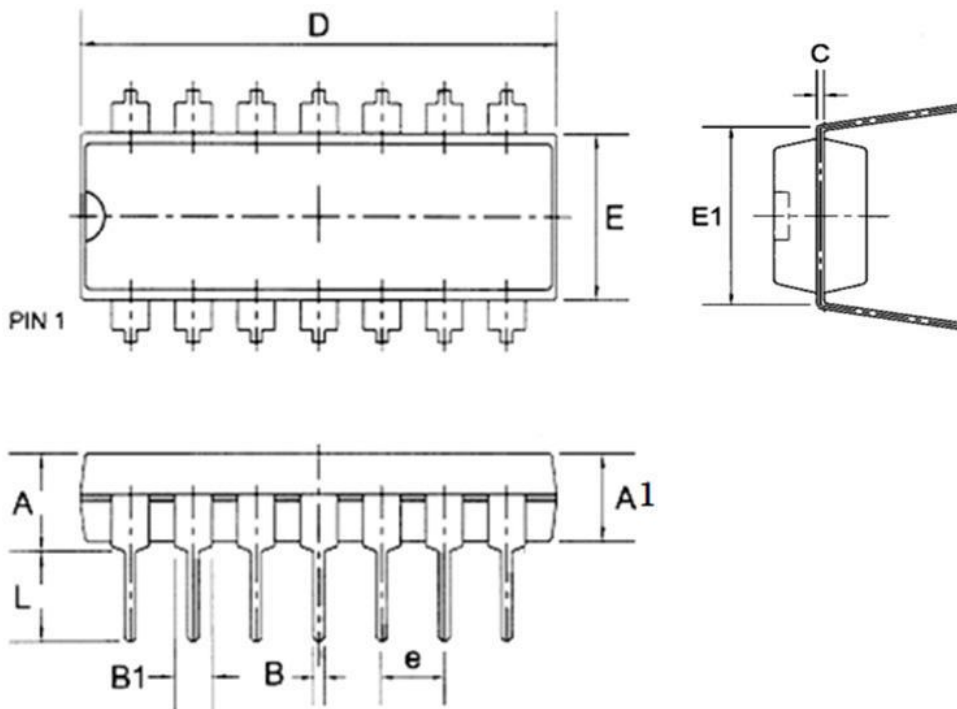
| Supply voltage | Input | Output |
|----------------|---------------------|---------------------|
| V_{DD} | V_M | V_M |
| 5V to 15V | $0.5 \times V_{DD}$ | $0.5 \times V_{DD}$ |

4.4 、 Test Data

| Supply voltage | Input | | Load |
|----------------|----------------------|--------------------|-------|
| V_{DD} | V_I | t_r, t_f | C_L |
| 5V to 15V | V_{SS} or V_{DD} | $\leq 20\text{ns}$ | 50pF |

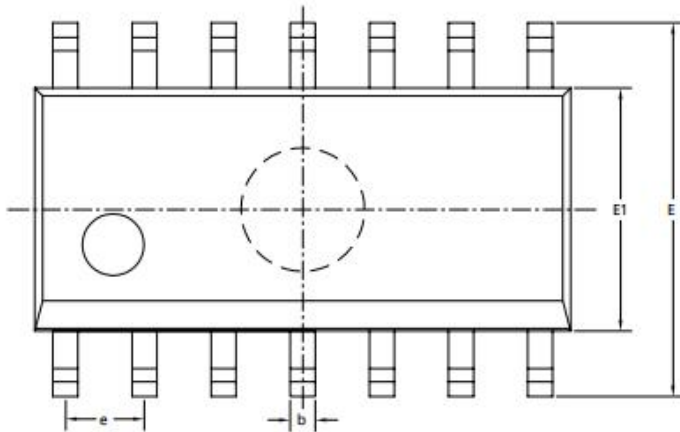
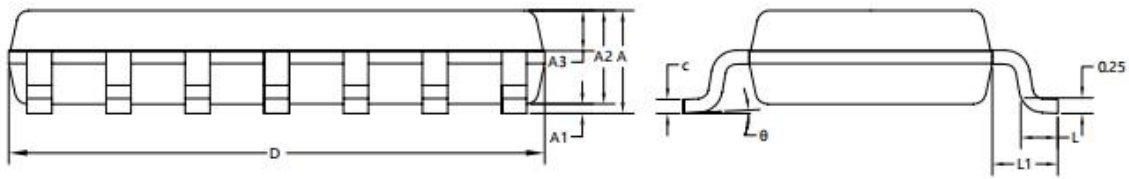
Package Information

DIP14



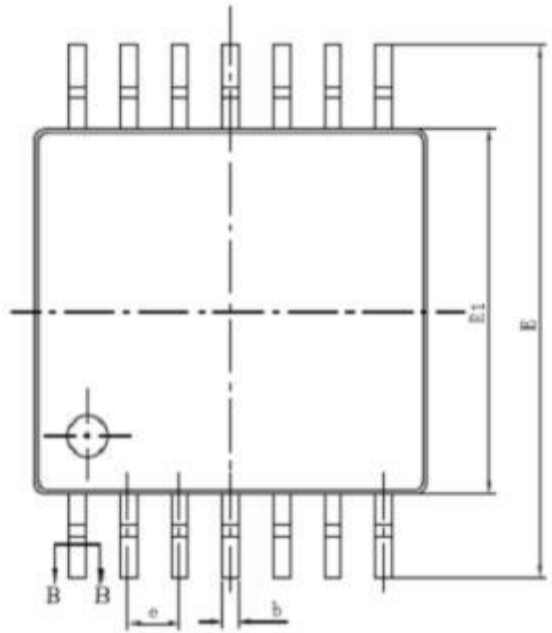
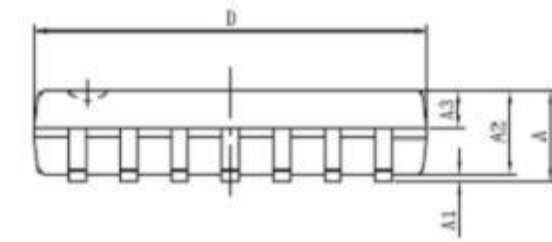
| Symbol | Dimensions in Millimeters | | |
|--------|---------------------------|-------|-------|
| | Min | Nom | Max |
| A | -- | -- | 4.31 |
| A1 | 3.15 | 3.30 | 3.65 |
| B | -- | 0.46 | -- |
| B1 | -- | 1.60 | -- |
| C | -- | 0.25 | -- |
| D | 19.00 | 19.30 | 19.60 |
| E | 6.20 | 6.40 | 6.60 |
| E1 | -- | 7.60 | -- |
| e | -- | 2.54 | -- |
| L | 3.00 | 3.35 | 3.60 |

SOP14

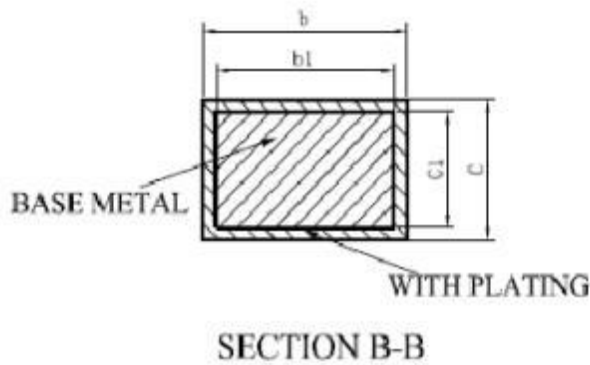
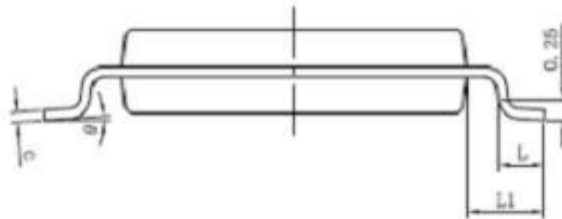


| SYMBOL | MILLIMETER | | |
|----------|------------|------|------|
| | MIN | NOM | MAX |
| A | 1.50 | 1.60 | 1.70 |
| A1 | 0.10 | 0.15 | 0.25 |
| A2 | 1.40 | 1.45 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.35 | 0.40 | 0.45 |
| c | 0.15 | 0.20 | 0.25 |
| D | 8.50 | 8.60 | 8.70 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.85 | 3.90 | 3.95 |
| e | 1.27BSC | | |
| L | 0.50 | 0.60 | 0.70 |
| L1 | 1.05REF | | |
| θ | 0° | 4° | 8° |

TSSOP14



| SYMBOL | MILLIMETER | |
|--------|------------|------|
| | MIN | MAX |
| A | — | 1.20 |
| A1 | 0.05 | 0.15 |
| A2 | 0.90 | 1.05 |
| A3 | 0.39 | 0.49 |
| b | 0.20 | 0.30 |
| b1 | 0.19 | 0.25 |
| c | 0.13 | 0.19 |
| c1 | 0.12 | 0.14 |
| D | 4.86 | 5.06 |
| E1 | 4.30 | 4.50 |
| E | 6.20 | 6.60 |
| e | 0.65BSC | |
| L | 0.45 | 0.75 |
| L1 | 1.00BSC | |
| θ | 0 | 8° |



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