

## General Description

The CD4050 provides six non-inverting buffers with high current output capability suitable for driving TTL or high capacitive loads. Since input voltages in excess of the buffers' supply voltage are permitted, the buffers may also be used to convert logic levels of up to 15 V to standard TTL levels.

It operates over a recommended  $V_{DD}$  power supply range of 3V to 15V referenced to  $V_{SS}$  (usually ground). Unused inputs must be connected to  $V_{DD}$ ,  $V_{SS}$ , or another input.

## Features

- Wide supply voltage range from 3v to 15v
- Accepts input voltages in excess of the supply voltage
- 5V, 10V, and 15V parametric ratings
- Specified from -40°C to +105°C
- Packaging information: DIP16/SOP16/TSSOP16

## ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing QTY
CD4050BE	DIP-16	CD4050BE	Tube	1000/Box
CD4050BDTR	SOP-16	CD4050B	Tape	2500/Reel
CD4050BDTR	TSSOP-16	CD4050B	Tape	3000/Reel

## Block Diagram And Pin Description

**Block Diagram**

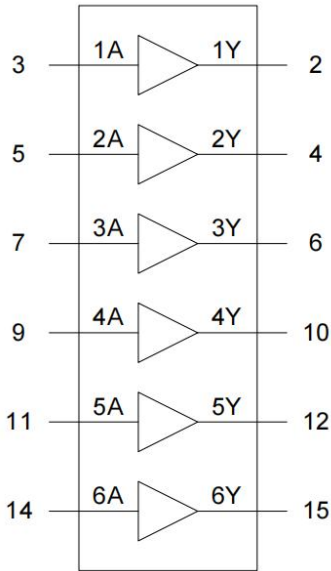


Figure 1. Functional symbol

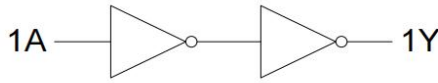


Figure 2. Logic diagram for one gate

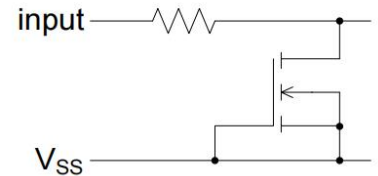
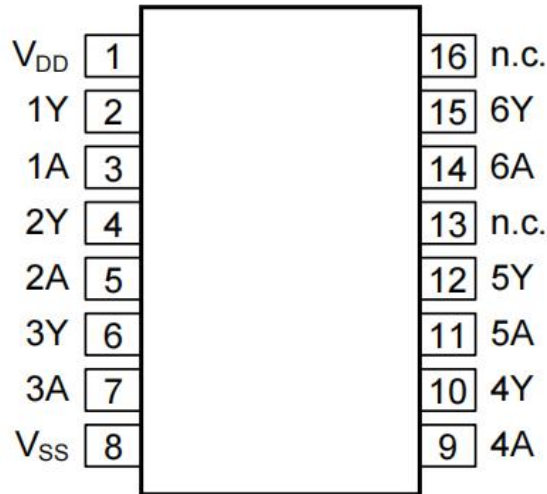


Figure 3. Input protection circuit

**Pin Configurations**



**Pin Description**

Pin No.	Pin Name	Description
1	V <sub>DD</sub>	supply voltage
2	1Y	output
3	1A	input
4	2Y	output
5	2A	input
6	3Y	output
7	3A	input
8	V <sub>SS</sub>	ground supply voltage
9	4A	input
10	4Y	output
11	5A	input
12	5Y	output
13	n.c.	not connected
14	6A	input
15	6Y	output
16	n.c.	not connected

## Electrical Parameter

Absolute Maximum Ratings (T<sub>amb</sub>=25°C, unless otherwise specified.)

Characteristic	Symbol	Conditions	Min.	Max.	Unit
supply voltage	V <sub>DD</sub>	-	-0.5	+18	V
DC input current	I <sub>IK</sub>	V <sub>I</sub> < -0.5V	-10	-	mA
input voltage	V <sub>I</sub>	-	-0.5	+18	V
output clamping current	I <sub>OK</sub>	V <sub>O</sub> < -0.5V or V <sub>O</sub> > V <sub>DD</sub> +0.5V	-	±10	mA
input/output current	I <sub>I/O</sub>	-	-	10	mA
supply current	I <sub>DD</sub>	-	-	50	mA
storage temperature	T <sub>stg</sub>	-	-65	+150	°C
soldering temperature	T <sub>L</sub>	10s	DIP	245	°C
			SOP/TSSOP	260	°C

## Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	$V_{DD}$	-	3	-	15	V
input voltage	$V_I$	-	0	-	15	V
ambient temperature	$T_{amb}$	-	-40	-	+105	°C
input transition rise and fall rate	$\Delta t/\Delta V$	$V_{DD}=5V$	-	-	3.75	$\mu s/V$
		$V_{DD}=10V$	-	-	0.5	$\mu s/V$
		$V_{DD}=15V$	-	-	0.08	$\mu s/V$

## Electrical Characteristics

DC Characteristics 1 ( $T_{amb}=25^{\circ}C$ , voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions(V)			$T_{amb}=25^{\circ}C$			Unit
		$V_O$	$V_{IN}$	$V_{DD}$	Min.	Typ.	Max.	
supply current	$I_{DD}$	-	0, 5	5	-	-	4	$\mu A$
		-	0, 10	10	-	-	8	$\mu A$
		-	0, 15	15	-	-	16	$\mu A$
LOW-level output current	$I_{OL}$	0.4	0, 5	5	2.9	-	-	mA
		0.5	0, 10	10	10	-	-	mA
		1.5	0, 15	15	20	-	-	mA
HIGH-level output current	$I_{OH}$	4.6	0, 5	5	-	-	-0.44	mA
		2.5	0, 5	5	-	-	-1.4	mA
		9.5	0, 10	10	-	-	-1.1	mA
		13.5	0, 15	15	-	-	-3	mA
LOW-level output voltage	$V_{OL}$	-	0, 5	5	-	-	0.05	V
		-	0, 10	10	-	-	0.05	V
		-	0, 15	15	-	-	0.05	V
HIGH-level output voltage	$V_{OH}$	-	0, 5	5	4.95	-	-	V
		-	0, 10	10	9.95	-	-	V
		-	0, 15	15	14.95	-	-	V
LOW-level input voltage	$V_{IL}$	0.5, 4.5	-	5	-	-	1.5	V
		1, 9	-	10	-	-	3	V
		1.5, 13.5	-	15	-	-	4	V
HIGH-level input voltage	$V_{IH}$	0.5, 4.5	-	5	3.5	-	-	V
		1, 9	-	10	7	-	-	V
		1.5, 13.5	-	15	11	-	-	V
input leakage current	$I_I$	-	0, 15	15	-	-	$\pm 0.3$	$\mu A$

### DC Characteristics 2

( $T_{amb}=-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , voltages are referenced to  $V_{SS}$  (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions(V)			$T_{amb}=-40^{\circ}\text{C}$		$T_{amb}=+105^{\circ}\text{C}$		Unit
		$V_O$	$V_{IN}$	$V_{DD}$	Min.	Max.	Min.	Max.	
supply current	$I_{DD}$	-	0, 5	5	-	4	-	30	$\mu\text{A}$
		-	0, 10	10	-	8	-	60	$\mu\text{A}$
		-	0, 15	15	-	16	-	120	$\mu\text{A}$
LOW-level output current	$I_{OL}$	0.4	0, 5	5	3.5	-	2.3	-	$\text{mA}$
		0.5	0, 10	10	12	-	8	-	$\text{mA}$
		1.5	0, 15	15	24	-	16	-	$\text{mA}$
HIGH-level output current	$I_{OH}$	4.6	0, 5	5	-	-0.52	-	-0.36	$\text{mA}$
		2.5	0, 5	5	-	-1.7	-	-1.1	$\text{mA}$
		9.5	0, 10	10	-	-1.3	-	-0.9	$\text{mA}$
		13.5	0, 15	15	-	-3.6	-	-2.4	$\text{mA}$
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	-	1.5	-	1.5	V
		1, 9	-	10	-	3	-	3	V
		1.5, 13.5	-	15	-	4	-	4	V
HIGH-level input voltage	$V_{IH}$	0.5, 4.5	-	5	3.5	-	3.5	-	V
		1, 9	-	10	7	-	7	-	V
		1.5, 13.5	-	15	11	-	11	-	V
input leakage current	$I_I$	-	0, 15	15	-	$\pm 0.3$	-	$\pm 1.0$	$\mu\text{A}$

AC Characteristics ( $T_{amb}=25^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified.)

Parameter	Symbol	Conditions	DD	Min.	Typ.	Max.	Unit
HIGH to LOW propagation delay	$t_{PHL}$	nA to nY; see Figure 5	5	-	35	70	ns
			10	-	20	35	ns
			15	-	15	30	ns
LOW to HIGH propagation delay	$t_{PLH}$	nA to nY; see Figure 5	5	-	55	110	ns
			10	-	25	55	ns
			15	-	20	40	ns
HIGH to LOW output transition time	$t_{THL}$	see Figure 5	5	-	25	50	ns
			10	-	10	20	ns
			15	-	7	14	ns
LOW to HIGH output transition time	$t_{TLH}$	see Figure 5	5	-	60	120	ns
			10	-	30	60	ns
			15	-	20	40	ns

## Testing Circuit

### AC Testing Circuit

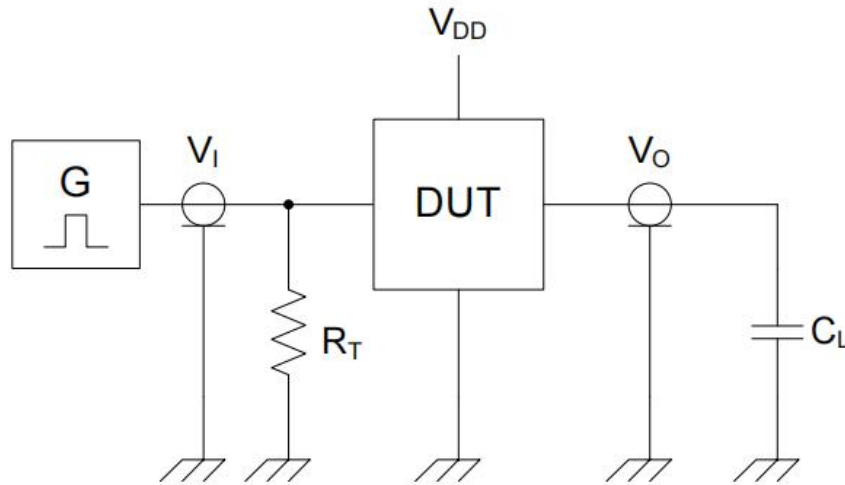


Figure 4. Test circuit for measuring switching times

Definitions for test circuit:

$C_L$ =Load capacitance including jig and probe capacitance.

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

### AC Testing Waveforms

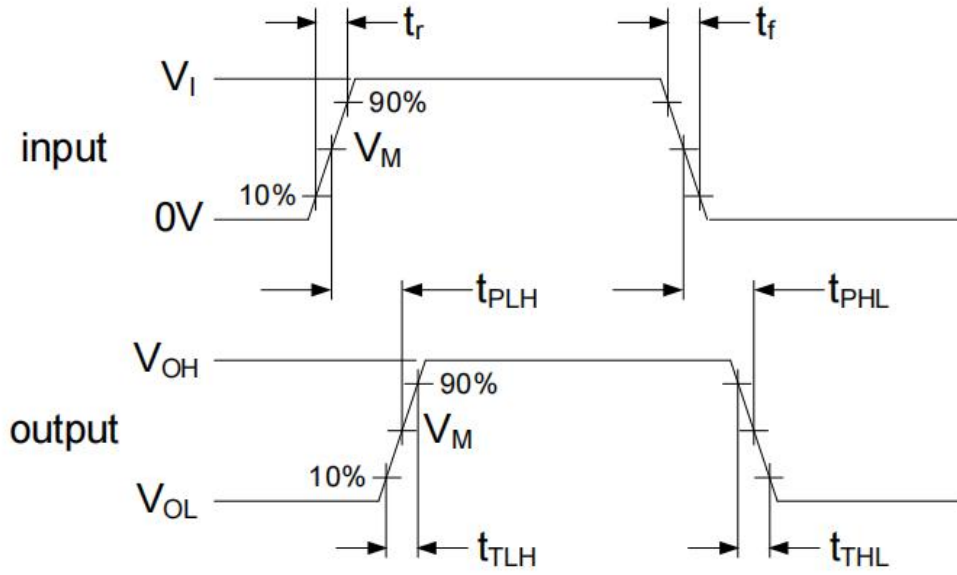


Figure 5. Input to output propagation delays

#### Measurement Points

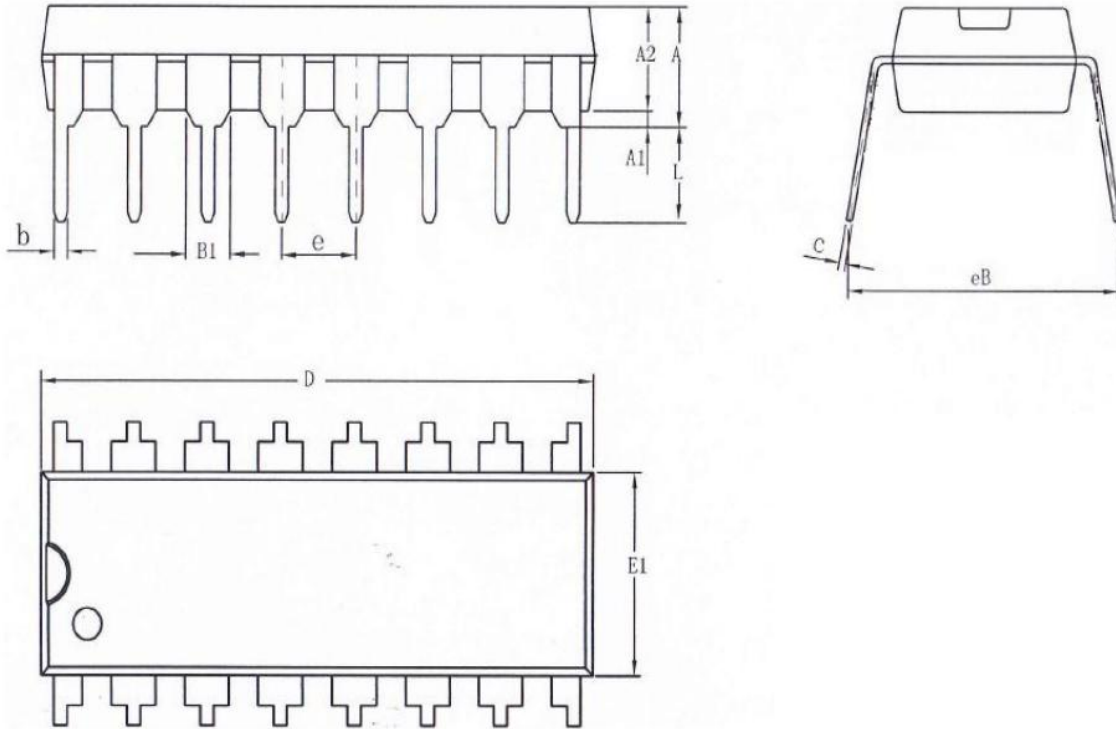
Input		Output
$V_M$	$V_I$	$V_M$
$0.5 \times V_{DD}$	$0V$ to $V_{DD}$	$0.5 \times V_{DD}$

#### Test Data

Supply voltage	Input			Load
$V_{DD}$	$V_I$	$V_M$	$t_r, t_f$	$C_L$
5V to 15V	$V_{DD}$	$0.5 \times V_I$	$\leq 20ns$	50pF

## Package Information

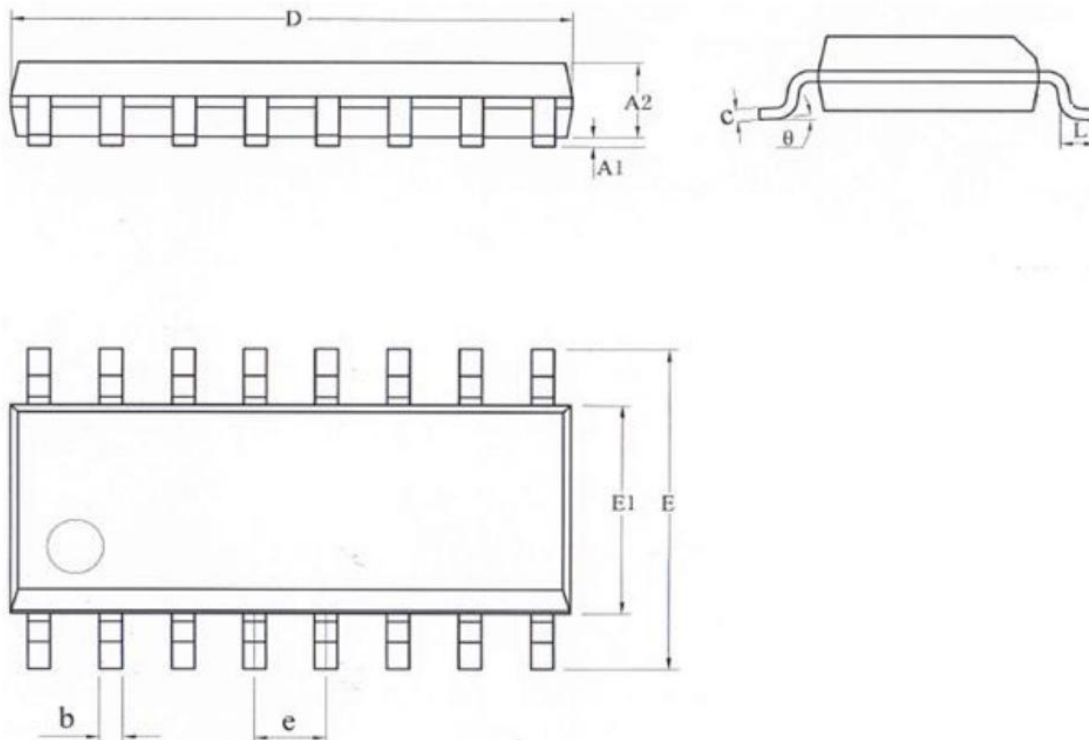
DIP16



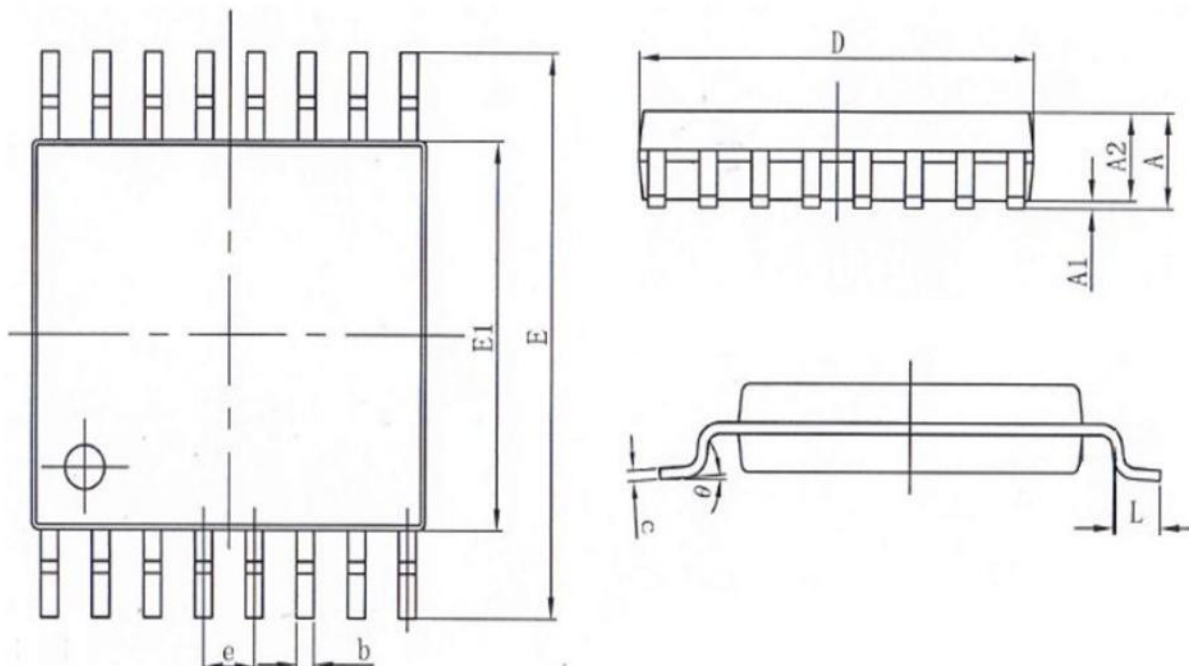
Symbol	Dimensions(mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	-
A	3.60	5.33
L	3.00	3.60
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30

SOP16





Symbol	Dimensions (mm)	
	Min.	Max.
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
θ	0°	8°



SYMBOL	MILLIMETER	
	MIN	MAX
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
EI	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
$\theta$	0°	8°

### Statements And Notes

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butyl benzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements									

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