

## FEATURES

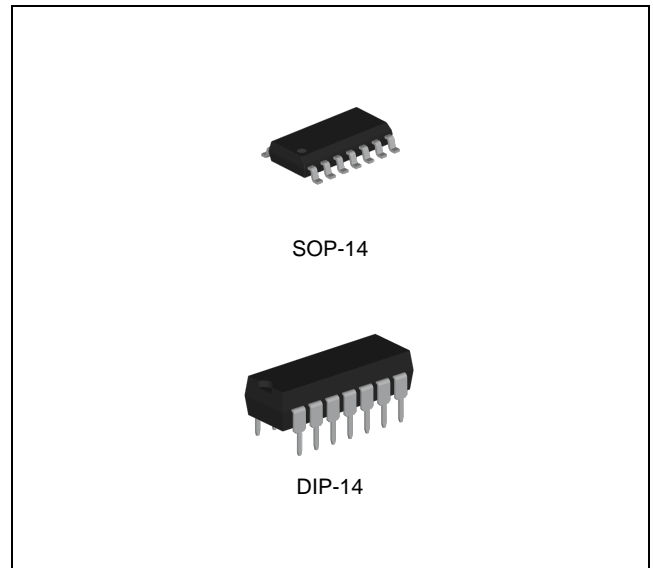
- Wide Operating Voltage Range of 3.0V to 18.0V
- Maximum Input Current of 1 $\mu$ A at 18V over Full Package-Temperature range, 100nA at 18V and 25°C
- Independent Schmitt-Trigger at each Input

## APPLICATIONS

- Wave and Pulse Shapers
- High-Noise-Environment Systems
- Monostable Multivibrators
- Astable Multivibrators
- NAND Logic

## DESCRIPTION

The CD4093B consist of four Schmitt-trigger circuits. Each circuit functions as a two-input NAND gate with Schmitt-trigger action on both inputs. The gate switches at different points for positive- and negative-going signals. The difference between the positive voltage ( $V_{TP}$ ) and the negative voltage ( $V_{TN}$ ) is defined as hysteresis voltage ( $V_H$ ).



## ORDERING INFORMATION

Device	Package
CD4093BD	SOP-14
CD4093BN	DIP-14

## ABSOLUTE MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
DC Supply Voltage (Referenced to $V_{SS}$ )	$V_{DD}$	-0.5	20	V
DC Input Voltage (Referenced to $V_{SS}$ )	$V_{IN}$	-0.5	$V_{DD} + 0.5$	V
DC Input Current	$I_{IN}$	-	$\pm 10$	mA
Maximum Junction Temperature	$T_J$	-	150	°C
Storage Temperature	$T_{STG}$	-65	150	°C

Note1. Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

**RECOMMENDED OPERATING CONDITIONS** (Note 2)

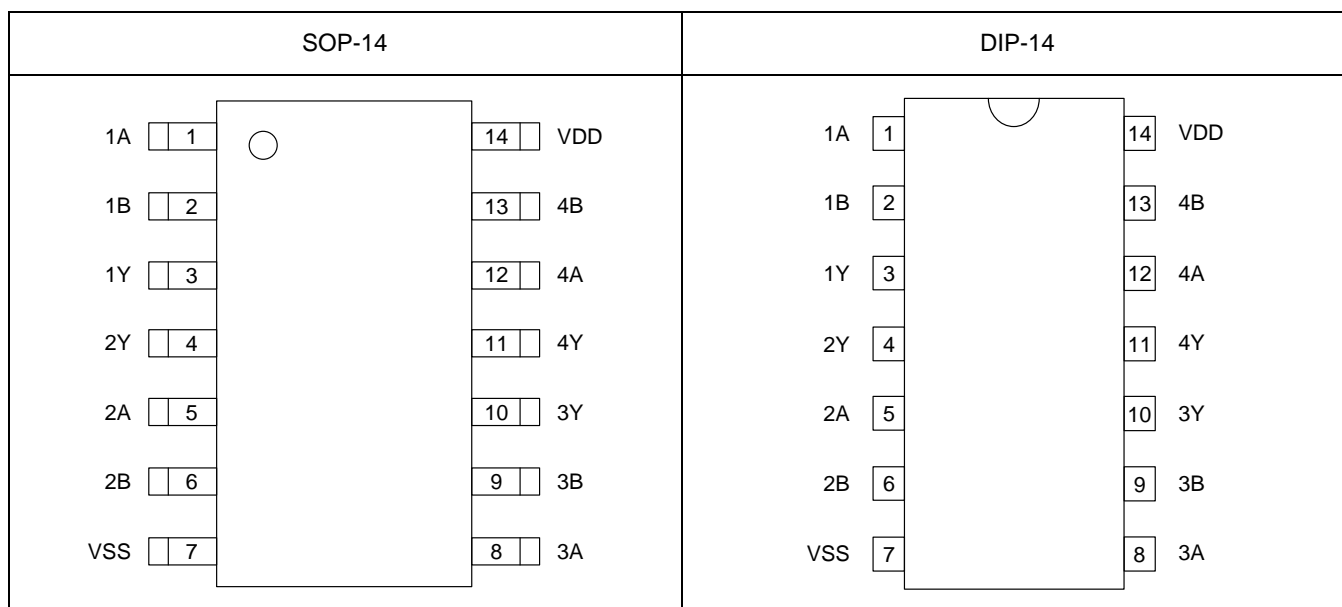
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	$V_{DD}$	3	18	V
DC Input Voltage	$V_{IN}$	0	$V_{DD}$	V
DC Output Voltage	$V_{OUT}$	0	$V_{DD}$	V
Operating Free-Air Temperature Range	$T_A$	-55	125	°C

Note 2. The device is not guaranteed to function outside its operating ratings.

**ORDERING INFORMATION**

Package	Order No.	Description	Supplied As	Status
SOP-14	CD4093BD	Quad 2-Input NAND Schmitt Triggers	Tape & Reel	Active
DIP-14	CD4093BN	Quad 2-Input NAND Schmitt Triggers	Tube	Active

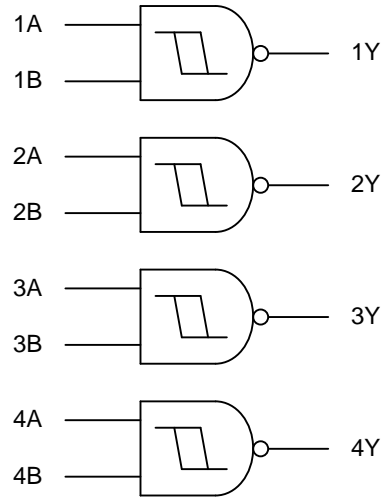
## PIN CONFIGURATION



## PIN DESCRIPTION

Pin No.		Pin Name	Pin Function
SOP-14	DIP-14		
1	1	1A	Input 1A
2	2	1B	Input 1B
3	3	1Y	Output 1
4	4	2Y	Output 2
5	5	2A	Input 2A
6	6	2B	Input 2B
7	7	VSS	Ground
8	8	3A	Input 3A
9	9	3B	Input 3B
10	10	3Y	Output 3
11	11	4Y	Output 4
12	12	4A	Input 4A
13	13	4B	Input 4B
14	14	VDD	Power Supply

## BLOCK DIAGRAM



## DC ELECTRICAL CHARACTERISTICS

Voltages referenced to  $V_{SS}$ .

SYMBOL	PARAMETER	TEST CONDITION	$V_{DD}$	Limit			UNIT
				-55°C	25°C	125°C	
$V_{TP.min}$	Minimum Positive-Going Input Threshold Voltage	Input on Terminal A or B; Other Inputs to $V_{DD}$	5 V	2.2	2.2	2.2	V
			10 V	4.6	4.6	4.6	
			15 V	6.8	6.8	6.8	
		Input on Terminal A and B; Other Inputs to $V_{DD}$	5 V	2.6	2.6	2.6	
			10 V	5.6	5.6	5.6	
			15 V	6.3	6.3	6.3	
$V_{TP.max}$	Maximum Positive-Going Input Threshold Voltage	Input on Terminal A or B; Other Inputs to $V_{DD}$	5 V	3.6	3.6	3.6	V
			10 V	7.1	7.1	7.1	
			15 V	10.8	10.8	10.8	
		Input on Terminal A and B; Other Inputs to $V_{DD}$	5 V	4.0	4.0	4.0	
			10 V	8.2	8.2	8.2	
			15 V	12.7	12.7	12.7	
$V_{TN.min}$	Minimum Negative-Going Input Threshold Voltage	Input on Terminal A or B; Other Inputs to $V_{DD}$	5 V	0.9	0.9	0.9	V
			10 V	2.5	2.5	2.5	
			15 V	4.0	4.0	4.0	
		Input on Terminal A and B; Other Inputs to $V_{DD}$	5 V	1.4	1.4	1.4	
			10 V	3.4	3.4	3.4	
			15 V	4.8	4.8	4.8	
$V_{TN.max}$	Maximum Negative-Going Input Threshold Voltage	Input on Terminal A or B; Other Inputs to $V_{DD}$	5 V	2.8	2.8	2.8	V
			10 V	5.2	5.2	5.2	
			15 V	7.4	7.4	7.4	
		Input on Terminal A and B; Other Inputs to $V_{DD}$	5 V	3.2	3.2	3.2	
			10 V	6.6	6.6	6.6	
			15 V	9.6	9.6	9.6	
$V_{H.min}$	Minimum Hysteresis Voltage	Input on Terminal A and/or B; Other Inputs to $V_{DD}$	5 V	0.3	0.3	0.3	V
			10 V	1.2	1.2	1.2	
			15 V	1.6	1.6	1.6	
$V_{H.max}$	Maximum Hysteresis Voltage	Input on Terminals A and/or B; Other Inputs to $V_{DD}$	5 V	1.6	1.6	1.6	V
			10 V	3.4	3.4	3.4	
			15 V	5.0	5.0	5.0	

## DC ELECTRICAL CHARACTERISTICS (continued)

Voltages referenced to  $V_{SS}$ .

SYMBOL	PARAMETER	TEST CONDITION	$V_{DD}$	Limit			UNIT	
				-55°C	25°C	125°C		
$V_{OH}$	Minimum High-Level Output Voltage	$V_{IN} = V_{DD}$ or $V_{SS}$	5 V	4.95	4.95	4.95	V	
			10 V	9.95	9.95	9.95		
			15 V	14.95	14.95	14.95		
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{IN} = V_{DD}$	5 V	0.05	0.05	0.05	V	
			10 V	0.05	0.05	0.05		
			15 V	0.05	0.05	0.05		
$I_{IN}$	Maximum Input Leakage Current	$V_{IN} = V_{DD}$ or $V_{SS}$	18 V	±0.1	±0.1	±1.0	µA	
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{DD}$ or $V_{SS}$	5 V	1	1	30	µA	
			10 V	2	2	60		
			15 V	4	4	120		
			20 V	20	20	600		
$I_{OL}$	Minimum Output Low (Sink) Current	$V_{IN} = V_{DD}$ or $V_{SS}$	$V_{OL} = 0.4V$	5 V	0.64	0.51	0.36	mA
			$V_{OL} = 0.5V$	10 V	1.6	1.3	0.9	
			$V_{OL} = 1.5V$	15 V	4.2	3.4	2.4	
$I_{OH}$	Minimum Output High (Source) Current	$V_{IN} = V_{DD}$ or $V_{SS}$	$V_{OH} = 2.5V$	5 V	-2.0	-1.6	-1.15	mA
			$V_{OH} = 4.6V$	5 V	-0.64	-0.51	-0.36	
			$V_{OH} = 9.5V$	10 V	-1.6	-1.3	-0.9	
			$V_{OH} = 13.5V$	15 V	-4.2	-3.4	-2.4	

## AC ELECTRICAL CHARACTERISTICS

$C_L = 50$  pF,  $R_L = 200k\Omega$ , Input  $t_r = t_f = 20$  ns

SYMBOL	PARAMETER	$V_{DD}$	Limit			UNIT
			-55°C	25°C	125°C	
$t_{PLH}$ , $t_{PHL}$	Maximum Propagation Delay, Input A or Input B to Output Y (Figure 4)	5 V	380	380	760	ns
		10 V	180	180	360	
		15 V	130	130	260	
$t_{TLH}$ , $t_{THL}$	Maximum Output Transition Time, Any Output (Figure 4)	5 V	200	200	400	ns
		10 V	100	100	200	
		15 V	80	80	160	
$C_{IN}$	Maximum Input Capacitance	–		7.5		pF

## FUNCTION TABLE

Input (A)	Input (B)	Output (Y)
L	L	H
L	H	H
H	L	H
H	H	L

## SWITCHING CHARACTERISTICS

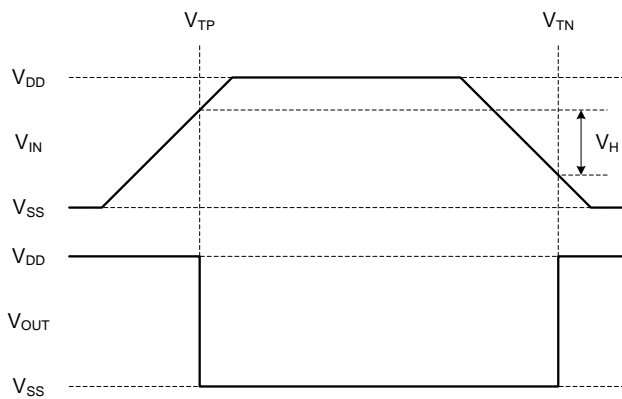


Fig. 1. Hysteresis Definition

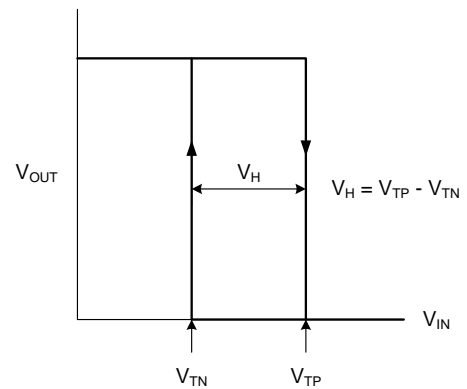


Fig. 2. Hysteresis Characteristic

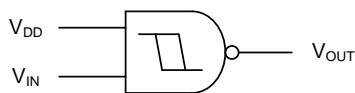


Fig. 3. Test Circuit

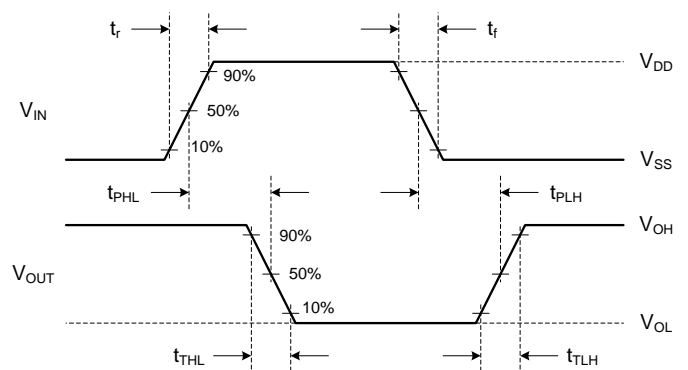


Fig. 4. Switching Time Waveforms

**TYPICAL OPERATING CHARACTERISTICS**

T.B.D.



## REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.

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