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# HD74BC564A

Octal D Type Flip Flops With 3 State Outputs

## HITACHI

ADE-205-041 (Z)  
1st. Edition  
Feb. 1994

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### Description

The HD74BC564A provides high drivability and operation equal to or better than high speed bipolar standard logic IC by using Bi-CMOS process. The device features low power dissipation that is about 1/5 of high speed bipolar logic IC, when the frequency is 10 MHz. The device has eight edge trigger D type flip flops with three state outputs in a 20 pin package. Data at the D inputs meeting set up requirements, are transferred to the  $\bar{Q}$  outputs on positive going transitions of the clock input. When the latch enable goes low, data at the D inputs will be retained at the outputs until latch enable returns high again. When a high logic level is applied to the output control input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.



### Features

- Input/Output are at high impedance state when power supply is off.
- Built in input pull up circuit can make input pins be open, when not used.
- TTL level input
- Wide operating temperature range  
Ta = -40 to + 85°C

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## Function Table

### Inputs


Output Control	CK	D	Output $\bar{Q}$
L		H	L
L		L	H
L	L	X	$Q_0$
H	X	X	Z

H : High level

L : Low level

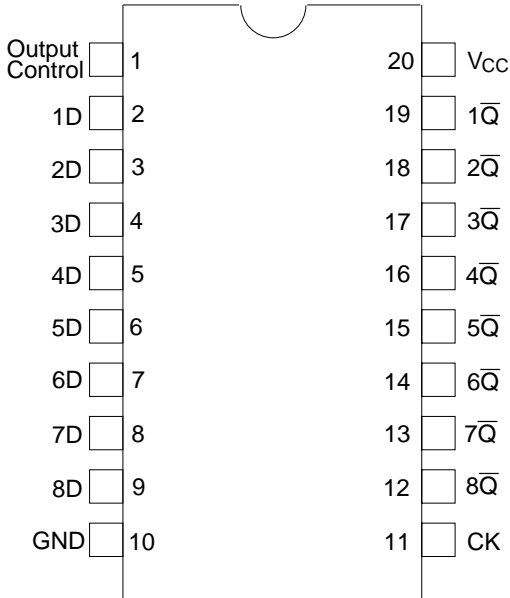
X : Immaterial

Z : High impedance

 : Low to high transition

$Q_0$  : Level of  $\bar{Q}$  before the indicated steady state input conditions were established.

## Pin Arrangement



(Top view)

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## Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to +7.0	V
Input diode current	$I_{IK}$	$\pm 30$	mA
Input voltage	$V_{IN}$	-0.5 to +7.5	V
Output voltage	$V_{OUT}$	-0.5 to +7.5	V
Off state output voltage	$V_{OUT(off)}$	-0.5 to +5.5	V
Storage temperature	$T_{stg}$	-65 to +150	$^{\circ}C$

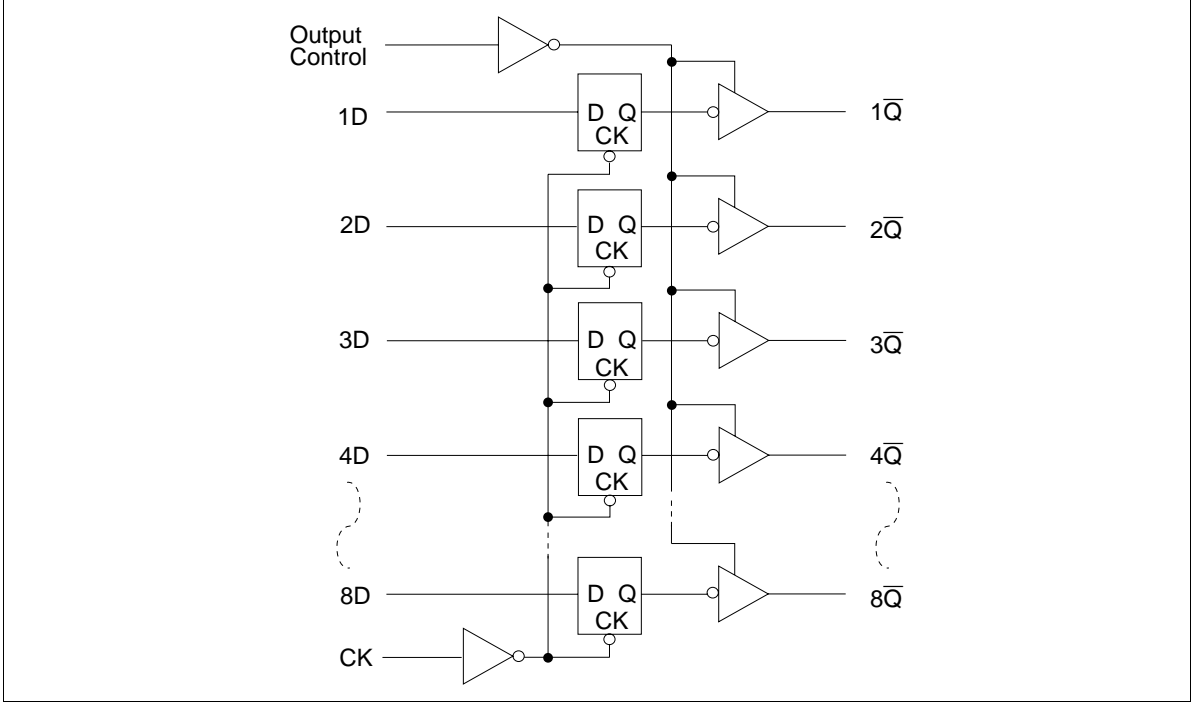
Note: 1. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

## Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	$V_{CC}$	4.5	5.0	5.5	V
Input voltage	$V_{IN}$	0	—	$V_{CC}$	V
Output voltage	$V_{OUT}$	0	—	$V_{CC}$	V
Operating temperature	$T_{opr}$	-40	—	85	$^{\circ}C$
Input rise/fall time* <sup>1</sup>	$t_r, t_f$	0	—	8	ns/V

Note: 1. This item guarantees maximum limit when one input switches.  
Waveform: Refer to test circuit of switching characteristics.

## Logic Diagram



**Electrical Characteristics** (Ta = -40°C to +85°C)

Item	Symbol	VCC(V)	Min	Max	Unit	Test Conditions
Input voltage	V <sub>IH</sub>		2.0	—	V	
	V <sub>IL</sub>		—	0.8	V	
Output voltage	V <sub>OH</sub>	4.5	2.4	—	V	I <sub>OH</sub> = -3 mA
		4.5	2.0	—	V	I <sub>OH</sub> = -15 mA
	V <sub>OL</sub>	4.5	—	0.4	V	I <sub>OL</sub> = 24 mA
		4.5	—	0.5	V	I <sub>OL</sub> = 48 mA
Input diode voltage	V <sub>IK</sub>	4.5	—	-1.2	V	I <sub>IN</sub> = -18 mA
Input current	I <sub>I</sub>	5.5	—	-250	μA	V <sub>IN</sub> = 0 V
		5.5	—	1.0	μA	V <sub>IN</sub> = 5.5 V
		5.5	—	100	μA	V <sub>IN</sub> = 7.0 V
Short circuit output current*1	I <sub>OS</sub>	5.5	-100	-225	mA	V <sub>IN</sub> = 0 or 5.5 V
Off state output current	I <sub>OZH</sub>	5.5	—	50	μA	V <sub>O</sub> = 2.7 V
	I <sub>OZL</sub>	5.5	—	-50	μA	V <sub>O</sub> = 0.5 V
Supply current	I <sub>CCL</sub>	5.5	—	29.5	mA	V <sub>IN</sub> = 0 or 5.5 V All outputs is "L"
	I <sub>CCH</sub>	5.5	—	2.5	mA	V <sub>IN</sub> = 0 or 5.5 V All outputs is "H"
	I <sub>CCZ</sub>	5.5	—	2.5	mA	V <sub>IN</sub> = 0 or 5.5 V All outputs is "Z"
	I <sub>CCT</sub> *2	5.5	—	1.5	mA	V <sub>IN</sub> = 3.4 or 0.5 V

Notes : 1. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

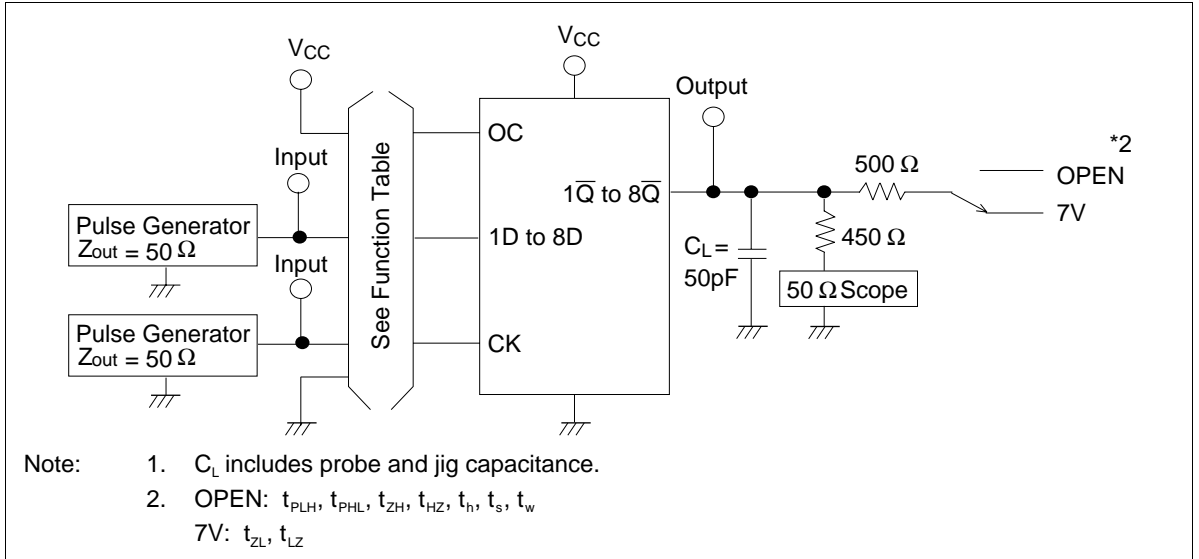
2. When input by the TTL level, it shows I<sub>CC</sub> increase at per one input pin.

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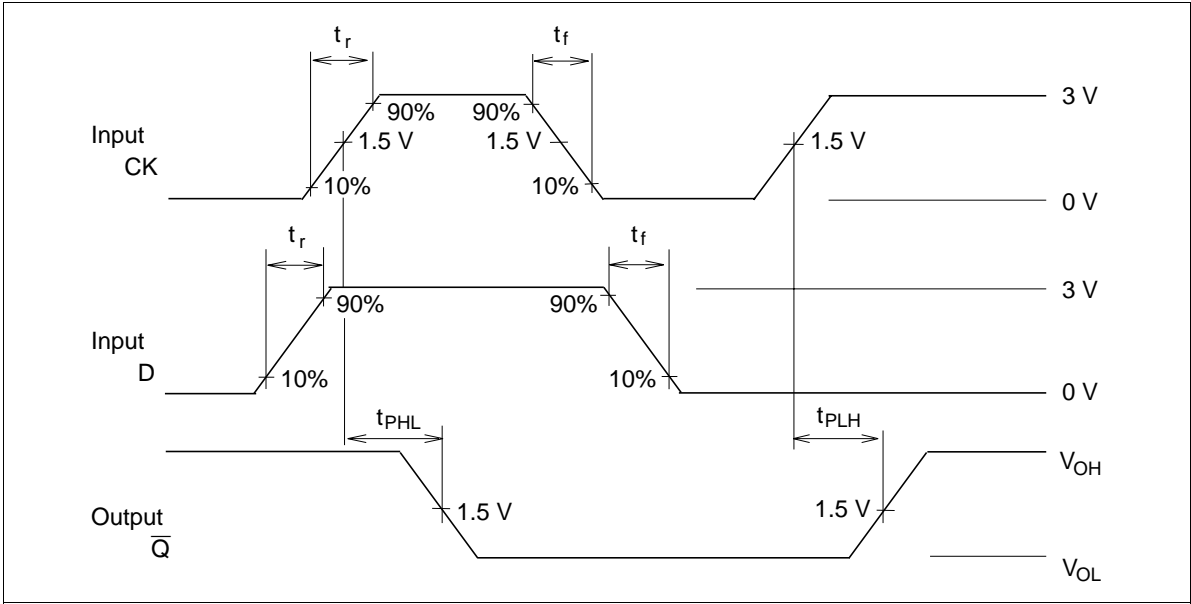
## Switching Test Method ( $C_L = 50 \text{ pF}$ )

Item	Symbol	$T_a = 25^\circ\text{C}$ $V_{CC} = 5.0 \text{ V}$		$T_a = -40 \text{ to } 85^\circ\text{C}$ $V_{CC} = 5.0\text{V} \pm 10\%$		Unit	Test Conditions
		Min	Max	Min	Max		
Propagation delay time	$\text{CK} \rightarrow \bar{Q}$ $t_{PLH}$	3.0	8.0	3.0	10.0	ns	See under figure
	$t_{PHL}$	3.0	8.0	3.0	10.0		
Output enable time	$t_{ZH}$	3.0	9.0	3.0	11.0	ns	
	$t_{ZL}$	3.0	9.0	3.0	11.0		
Output disable time	$t_{HZ}$	3.0	8.0	3.0	10.0	ns	
	$t_{LZ}$	3.0	8.0	3.0	10.0		
Setup time	$t_s(H)$	2.0	—	2.0	—	ns	
	$t_s(L)$	2.0	—	2.0	—		
Hold time	$t_h(H)$	2.0	—	2.0	—	ns	
	$t_h(L)$	2.0	—	2.0	—		
Pulse width	$t_w(H)$	6.0	—	6.0	—	ns	
	$t_w(L)$	6.0	—	6.0	—		
Input capacitance	$C_{IN}$	3.0(Typ)		—		pF	$V_{IN} = V_{CC} \text{ or GND}$
Output capacitance	$C_O$	15.0(Typ)		—		pF	$V_O = V_{CC} \text{ or GND}$

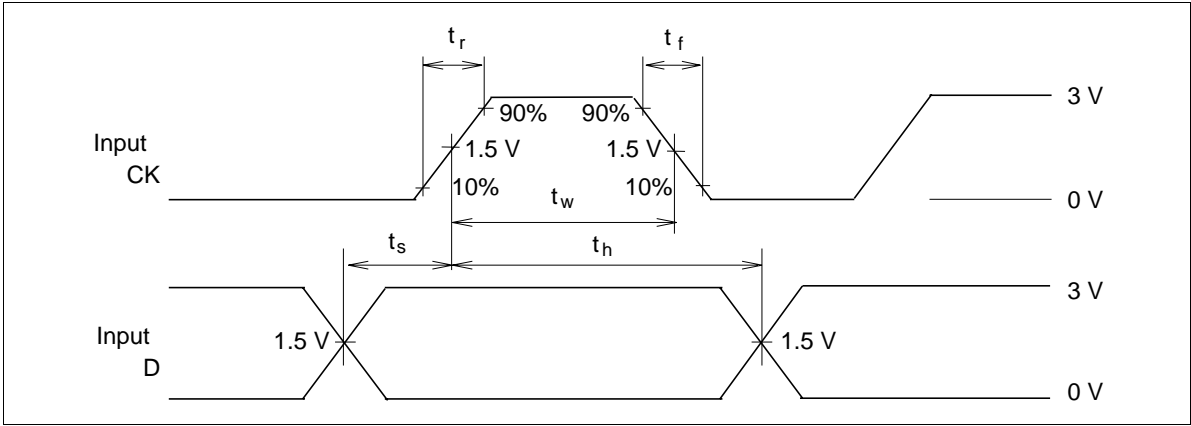
## Test Circuit



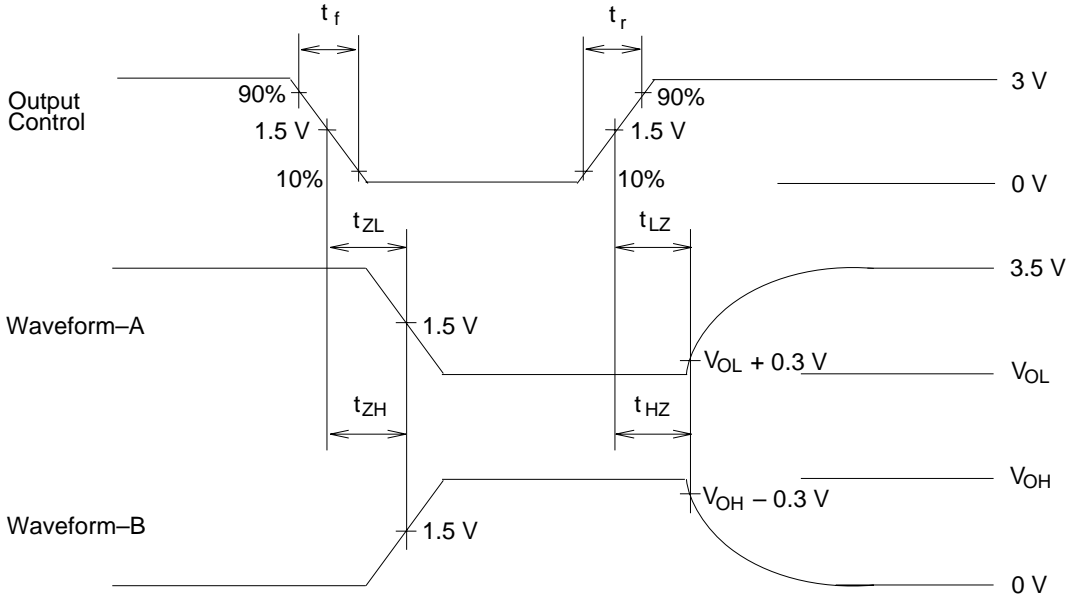
Waveforms-1



Waveforms-2



## Waveforms-3



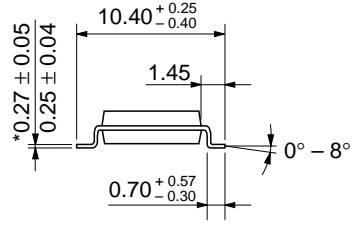
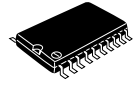
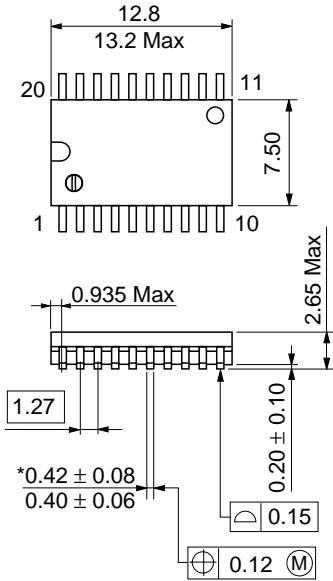
- Notes:
1.  $t_r = 2.5 \text{ ns}$ ,  $t_f = 2.5 \text{ ns}$
  2. Input waveform: PRR = 1 MHz, duty cycle 50%
  3. Waveform-A shows input conditions such that the output is "L" level when enable by the output control.
  4. Waveform-B shows input conditions such that the output is "H" level when enable by the output control.





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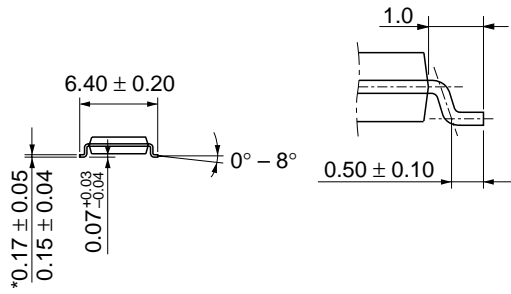
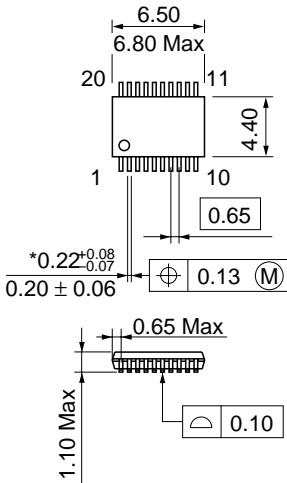
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-20DB
JEDEC	Conforms
EIAJ	—
Mass (reference value)	0.52 g

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	TTP-20DA
JEDEC	—
EIAJ	—
Mass (reference value)	0.07 g

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