Octal 3-State Inverting D Flip-Flop
## High–Performance Silicon–Gate CMOS

The MC74HC564 is identical in pinout to the LS564. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This device is identical in function to the HC534A but has the flip–flop inputs on the opposite side of the package from the outputs to facilitate PC board layout.

Data meeting the setup time is clocked, in inverted form, to the outputs with the rising edge of the Clock. The Output Enable input does not affect the states of the flip–flops, but when Output Enable is high, all device outputs are forced to the high–impedance state. Thus, data may be stored even when the outputs are not enabled.

The HC564 is the inverting version of the HC574A.

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1 μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 282 FETs or 70.5 Equivalent Gates
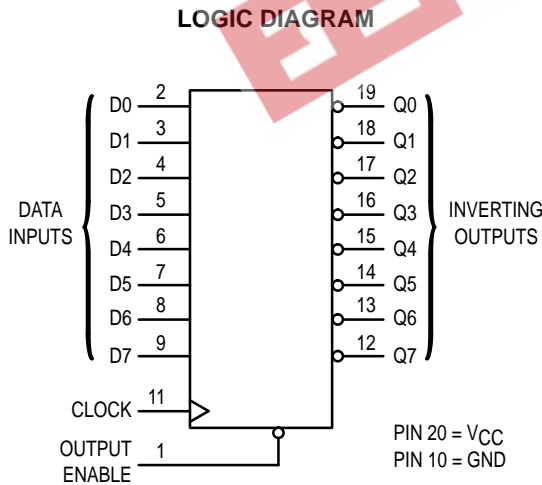
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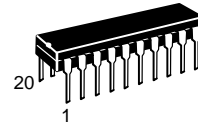
N SUFFIX
PLASTIC PACKAGE
CASE 738–03

DW SUFFIX
SOIC PACKAGE
CASE 751D–04

ORDERING INFORMATION

MC74HCXXXN   Plastic
MC74HCXXXDW   SOIC

PIN ASSIGNMENT

OUTPUT ENABLE	1	20	V_{CC}
D0	2	19	Q0
D1	3	18	Q1
D2	4	17	Q2
D3	5	16	Q3
D4	6	15	Q4
D5	7	14	Q5
D6	8	13	Q6
D7	9	12	Q7
GND	10	11	CLOCK

LOGIC DIAGRAM

DATA INPUTS: D0 (2), D1 (3), D2 (4), D3 (5), D4 (6), D5 (7), D6 (8), D7 (9)

INVERTING OUTPUTS: Q0 (19), Q1 (18), Q2 (17), Q3 (16), Q4 (15), Q5 (14), Q6 (13), Q7 (12)

CLOCK (11)

OUTPUT ENABLE (1)

PIN 20 = V_{CC}
PIN 10 = GND

FUNCTION TABLE

Inputs			Output
Output Enable	Clock	D	Q
L	↗	H	L
L	↗	L	H
L	L,H,�‾↓	X	No Change
H	X	X	Z

X = don't care
Z = high impedance

MC74HC564

MAXIMUM RATINGS*

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		− 0.5 to + 7.0	V
V_{in}	DC Input Voltage (Referenced to GND)		− 1.5 to V_{CC} + 1.5	V
V_{out}	DC Output Voltage (Referenced to GND)		− 0.5 to V_{CC} + 0.5	V
I_{in}	DC Input Current, per Pin		± 20	mA
I_{out}	DC Output Current, per Pin		± 35	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins		± 75	mA
P_D	Power Dissipation in Still Air	Plastic DIP†	750	mW
		SOIC Package†	500	
T_{stg}	Storage Temperature		− 65 to + 150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)		260	°C

* Maximum Ratings are those values beyond which damage to the device may occur.
  Functional operation should be restricted to the Recommended Operating Conditions.
† Derating — Plastic DIP: − 10 mW/°C from 65° to 125°C
              SOIC Package: − 7 mW/°C from 65° to 125°C
For high frequency or heavy load considerations, see Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature, All Package Types		− 55	+ 125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	V_{CC} = 2.0 V	0	1000	ns
		V_{CC} = 4.5 V	0	500	
		V_{CC} = 6.0 V	0	400	

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit − 55 to 25°C	≤ 85°C	≤ 125°C	Unit
V_{IH}	Minimum High–Level Input Voltage	V_{out} = 0.1 V or V_{CC} − 0.1 V $|I_{out}|$ ≤ 20 μA	2.0	1.5	1.5	1.5	V
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V_{IL}	Maximum Low–Level Input Voltage	V_{out} = 0.1 V or V_{CC} − 0.1 V $|I_{out}|$ ≤ 20 μA	2.0	0.3	0.3	0.3	V
			4.5	0.9	0.9	0.9	
			6.0	1.2	1.2	1.2	
V_{OH}	Minimum High–Level Output Voltage	V_{in} = V_{IH} or V_{IL} $|I_{out}|$ ≤ 20 μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
			6.0	5.9	5.9	5.9	
		V_{in} = V_{IH} or V_{IL} $|I_{out}|$ ≤ 6.0 mA	4.5	3.98	3.84	3.70	
		$|I_{out}|$ ≤ 7.8 mA	6.0	5.48	5.34	5.20	
V_{OL}	Maximum Low–Level Output Voltage	V_{in} = V_{IH} or V_{IL} $|I_{out}|$ ≤ 20 μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
			6.0	0.1	0.1	0.1	
		V_{in} = V_{IH} or V_{IL} $|I_{out}|$ ≤ 6.0 mA	4.5	0.26	0.33	0.40	
		$|I_{out}|$ ≤ 7.8 mA	6.0	0.26	0.33	0.40	
I_{in}	Maximum Input Leakage Current	V_{in} = V_{CC} or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I_{OZ}	Maximum Three–State Leakage Current	Output in High–Impedance State V_{in} = V_{IL} or V_{IH} V_{out} = V_{CC} or GND	6.0	± 0.5	± 5.0	± 10	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	V_{in} = V_{CC} or GND I_{out} = 0 μA	6.0	8	80	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input $t_r = t_f$ = 6 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			− 55 to 25°C	≤ 85°C	≤ 125°C	
f_{max}	Maximum Clock Frequency (50% Duty Cycle) (Figures 1 and 4)	2.0 4.5 6.0	6.0 30 35	4.8 24 28	4.0 20 24	MHz
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Clock to Q (Figures 1 and 4)	2.0 4.5 6.0	175 35 30	220 44 37	265 53 45	ns
t_{PLZ}, t_{PHZ}	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 5)	2.0 4.5 6.0	150 30 26	190 38 33	225 45 38	ns
t_{PZL}, t_{PZH}	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 5)	2.0 4.5 6.0	150 30 26	190 38 33	225 45 38	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 4)	2.0 4.5 6.0	60 12 10	75 15 13	90 18 15	ns
C_{in}	Maximum Input Capacitance	—	10	10	10	pF
C_{out}	Maximum Three–State Output Capacitance (Output in High–Impedance State)		15	15	15	pF

NOTES:
1. For propagation delays with loads other than 50 pF, see Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).
2. Information on typical parametric values can be found in Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

|		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Per Flip–Flop)*	38	pF

* Used to determine the no–load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$. For load considerations, see Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

TIMING REQUIREMENTS (Input $t_r = t_f$ = 6 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			− 55 to 25°C	≤ 85°C	≤ 125°C	
t_{su}	Minimum Setup Time, Data to Clock (Figure 3)	2.0 4.5 6.0	100 20 17	125 25 21	150 30 26	ns
t_h	Minimum Hold Time, Clock to Data (Figure 3)	2.0 4.5 6.0	5 5 5	5 5 5	5 5 5	ns
t_w	Minimum Pulse Width, Clock (Figure 1)	2.0 4.5 6.0	80 16 14	100 20 17	120 24 20	ns
t_r, t_f	Maximum Input Rise and Fall Times (Figure 1)	2.0 4.5 6.0	1000 500 400	1000 500 400	1000 500 400	ns

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

MC74HC564
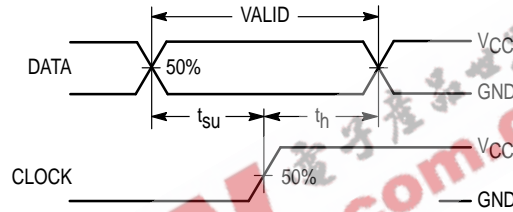
SWITCHING WAVEFORMS
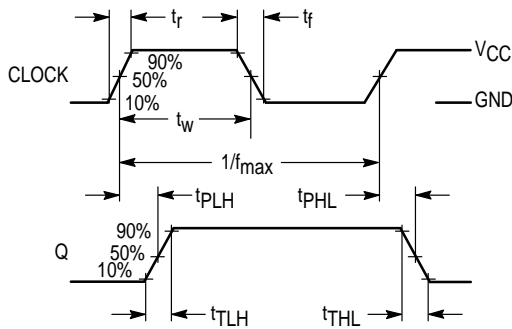
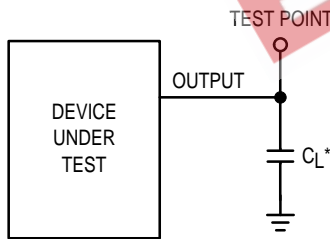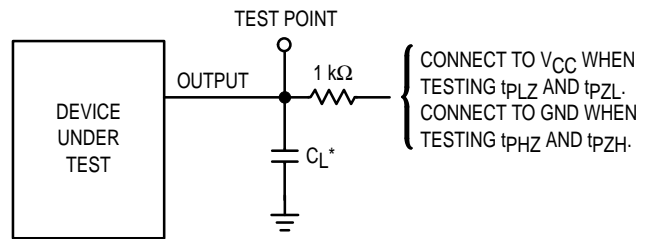**Figure 1.**
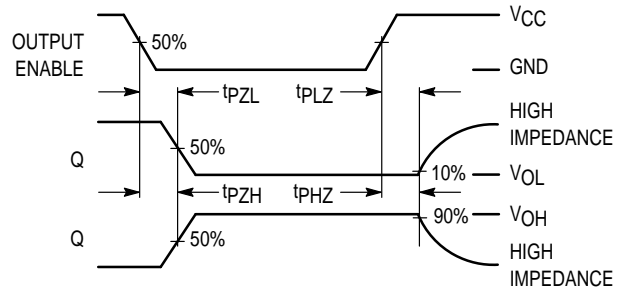
Figure 2.

Figure 3.
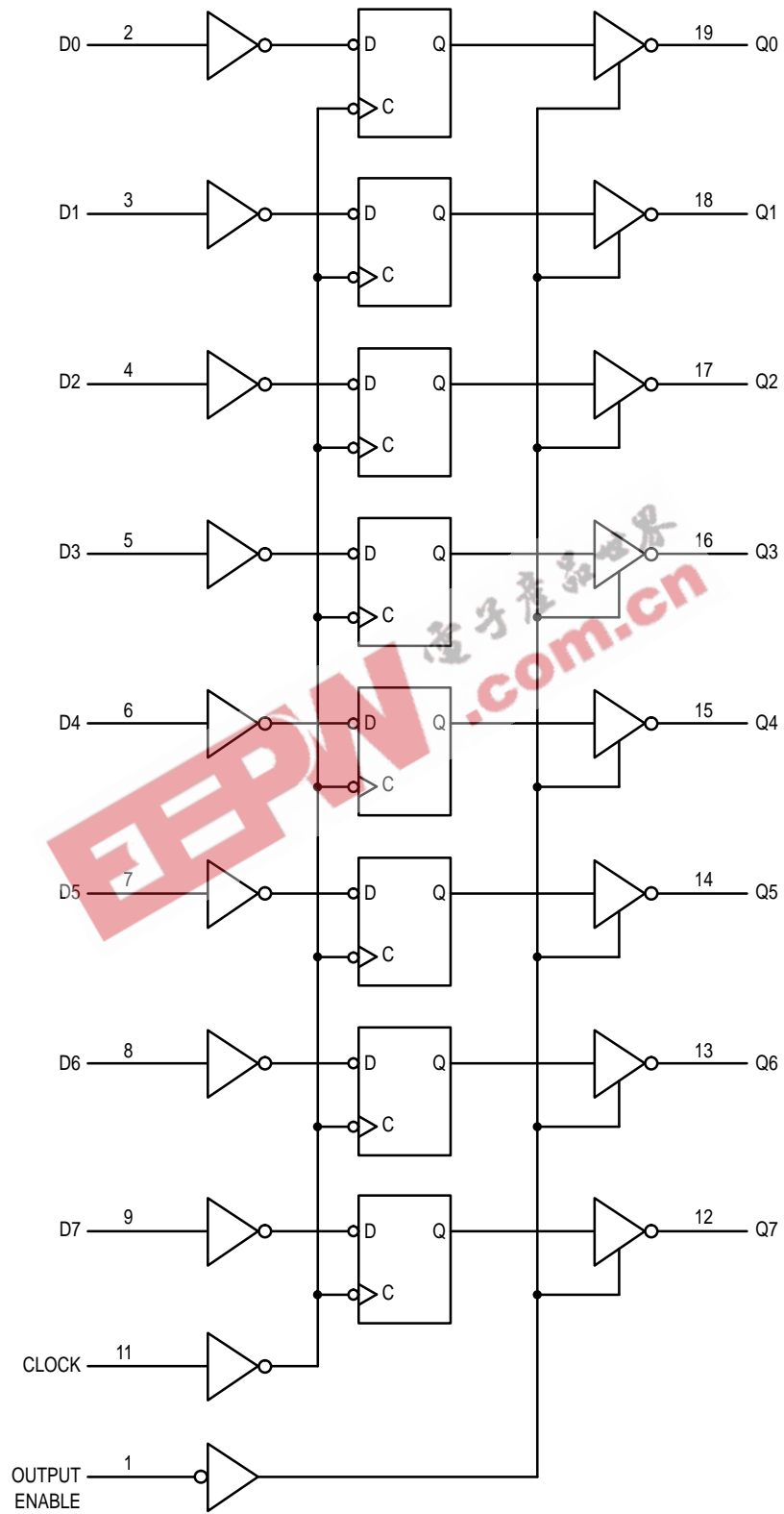
TEST CIRCUITS

* Includes all probe and jig capacitance

Figure 4.

* Includes all probe and jig capacitance

Figure 5.

EXPANDED LOGIC DIAGRAM

MC74HC564

OUTLINE DIMENSIONS

N SUFFIX
PLASTIC PACKAGE
CASE 738–03
ISSUE E

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

⊕ 0.25 (0.010) Ⓜ T A Ⓜ

⊕ 0.25 (0.010) Ⓜ T B Ⓜ

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

DW SUFFIX
PLASTIC SOIC PACKAGE
CASE 751D–04
ISSUE E

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

⊕ 0.010 (0.25) Ⓜ B Ⓜ

⊕ 0.010 (0.25) Ⓜ T A Ⓢ B Ⓢ

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	12.65	12.95	0.499	0.510
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

MOTOROLA

◊ CODELINE

MC74HC564/D