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MM74HC374 3-STATE Octal D-Type Flip-Flop

General Description

The MM74HC374 high speed Octal D-Type Flip-Flops utilize advanced silicon-gate CMOS technology. They possess the high noise immunity and low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LS-TTL loads. Due to the large output drive capability and the 3-STATE feature, these devices are ideally suited for interfacing with bus lines in a bus organized system.

These devices are positive edge triggered flip-flops. Data at the D inputs, meeting the setup and hold time requirements, are transferred to the Q outputs on positive going transitions of the CLOCK (CK) input. When a high logic level is applied to the OUTPUT CONTROL (OC) 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.

The 74HC logic family is speed, function, and pinout compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

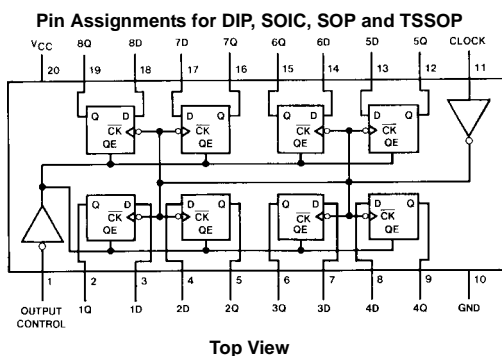
- Typical propagation delay: 20 ns
- Wide operating voltage range: 2–6V
- Low input current: 1 μ A maximum
- Low quiescent current: 80 μ A maximum
- Compatible with bus-oriented systems
- Output drive capability: 15 LS-TTL loads

Ordering Code:

| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| MM74HC374WM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| MM74HC374SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HC374MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HC374N | N20A | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Truth Table

| Output Control | Clock | Data | Output |
|----------------|-------|------|--------|
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | L | X | Q_0 |
| H | X | X | Z |

H = HIGH Level
L = LOW Level
X = Don't Care
↑ = Transition from LOW-to-HIGH
Z = High Impedance State
 Q_0 = The level of the output before steady state input conditions were established

Absolute Maximum Ratings(Note 1)

(Note 2)

| | |
|--|-------------------------|
| Supply Voltage (V_{CC}) | -0.5 to +7.0V |
| DC Input Voltage (V_{IN}) | -1.5 to $V_{CC} + 1.5V$ |
| DC Output Voltage (V_{OUT}) | -0.5 to $V_{CC} + 0.5V$ |
| Clamp Diode Current (I_{IK}, I_{OK}) | ± 20 mA |
| DC Output Current, per pin (I_{OUT}) | ± 35 mA |
| DC V_{CC} or GND Current, per pin (I_{CC}) | ± 70 mA |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |
| Power Dissipation (P_D) | |
| (Note 3) | 600 mW |
| S.O. Package only | 500 mW |
| Lead Temperature (T_L) | |
| (Soldering 10 seconds) | 260°C |

Recommended Operating Conditions

| | Min | Max | Units |
|--|-----|----------|-------|
| Supply Voltage (V_{CC}) | 2 | 6 | V |
| DC Input or Output Voltage (V_{IN}, V_{OUT}) | 0 | V_{CC} | V |
| Operating Temperature Range (T_A) | -40 | +85 | °C |
| Input Rise or Fall Times (t_r, t_f) | | | |
| $V_{CC} = 2.0V$ | | 1000 | ns |
| $V_{CC} = 4.5V$ | | 500 | ns |
| $V_{CC} = 6.0V$ | | 400 | ns |

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C.

DC Electrical Characteristics

| Symbol | Parameter | Conditions | V_{CC} | $T_A = 25^\circ\text{C}$ | | | Units | |
|----------|--|---|----------|--------------------------|-------------------|-----------|-----------|---------------|
| | | | | Typ | Guaranteed Limits | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | | 2.0V | | 1.5 | 1.5 | 1.5 | V |
| | | | 4.5V | | 3.15 | 3.15 | 3.15 | V |
| | | | 6.0V | | 4.2 | 4.2 | 4.2 | V |
| V_{IL} | Maximum LOW Level Input Voltage | | 2.0V | | 0.5 | 0.5 | 0.5 | V |
| | | | 4.5V | | 1.35 | 1.35 | 1.35 | V |
| | | | 6.0V | | 1.8 | 1.8 | 1.8 | V |
| V_{OH} | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu\text{A}$ | 2.0V | 2.0 | 1.9 | 1.9 | 1.9 | V |
| | | | 4.5V | 4.5 | 4.4 | 4.4 | 4.4 | V |
| | | | 6.0V | 6.0 | 5.9 | 5.9 | 5.9 | V |
| | | $V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 6.0 \text{ mA}$ $ I_{OUT} \leq 7.8 \text{ mA}$ | 4.5V | 4.2 | 3.98 | 3.84 | 3.7 | V |
| | | | 6.0V | 5.7 | 5.48 | 5.34 | 5.2 | V |
| | | | | | | | | |
| V_{OL} | Maximum LOW Level Output Voltage | $V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu\text{A}$ | 2.0V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | | 4.5V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | | 6.0V | 0 | 0.1 | 0.1 | 0.1 | V |
| | | $V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 6.0 \text{ mA}$ $ I_{OUT} \leq 7.8 \text{ mA}$ | 4.5V | 0.2 | 0.26 | 0.33 | 0.4 | V |
| | | | 6.0V | 0.2 | 0.26 | 0.33 | 0.4 | V |
| | | | | | | | | |
| I_{IN} | Maximum Input Current | $V_{IN} = V_{CC}$ or GND | 6.0V | | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| I_{OZ} | Maximum 3-STATE Output Leakage Current | $V_{IN} = V_{IH}$, $OC = V_{IH}$ $V_{OUT} = V_{CC}$ or GND | 6.0V | | ± 0.5 | ± 5 | ± 10 | μA |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu\text{A}$ | 6.0V | | 8.0 | 80 | 160 | μA |

Note 4: For a power supply of 5V $\pm 10\%$ the worst case output voltages (V_{OH} and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics $V_{CC} = 5V, T_A = 25^\circ C, t_r = t_f = 6 \text{ ns}$

| Symbol | Parameter | Conditions | Typ | Guaranteed Limit | Units |
|--------------------|--------------------------------------|--|-----|------------------|-------|
| f_{MAX} | Maximum Operating Frequency | | 50 | 35 | MHz |
| t_{PHL}, t_{PLH} | Maximum Propagation Delay Clock to Q | $C_L = 45 \text{ pF}$ | 20 | 32 | ns |
| t_{PZH}, t_{PZL} | Maximum Output Enable Time | $R_L = k\Omega$ $C_L = 45 \text{ pF}$ | 19 | 28 | ns |
| t_{PHZ}, t_{PLZ} | Maximum Output Disable Time | $R_L = k\Omega$ $C_L = 5 \text{ pF}$ | 17 | 25 | ns |
| t_S | Minimum Setup Time | | | 20 | ns |
| t_H | Minimum Hold Time | | | 5 | ns |
| t_W | Minimum Pulse Width | | 9 | 16 | ns |

AC Electrical Characteristics

$V_{CC} = 2.0\text{--}6.0\text{V}$, $C_L = 50\text{ pF}$, $t_r = t_f = 6\text{ ns}$ (unless otherwise specified)

| Symbol | Parameter | Conditions | V_{CC} | $T_A = 25^\circ\text{C}$ | | | Units | |
|-----------------------|---|---------------------------|----------|--------------------------|-------------------|------|-------|----------|
| | | | | Typ | Guaranteed Limits | | | |
| f_{MAX} | Maximum Operating Frequency | $C_L = 50\text{ pF}$ | 2.0V | | 6 | 5 | 4 | MHz |
| | | | 4.5V | | 30 | 24 | 20 | MHz |
| | | | 6.0V | | 35 | 28 | 23 | MHz |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay, Clock to Q | $C_L = 50\text{ pF}$ | 2.0V | 68 | 180 | 225 | 270 | ns |
| | | $C_L = 150\text{ pF}$ | 2.0V | 110 | 230 | 288 | 345 | ns |
| | | $C_L = 50\text{ pF}$ | 4.5V | 22 | 36 | 45 | 48 | ns |
| | | $C_L = 150\text{ pF}$ | 4.5V | 30 | 46 | 57 | 69 | ns |
| | | $C_L = 50\text{ pF}$ | 6.0V | 20 | 31 | 39 | 46 | ns |
| t_{PZH} , t_{PZL} | Maximum Output Enable Time | $R_L = 1\text{ k}\Omega$ | | | | | | |
| | | $C_L = 50\text{ pF}$ | 2.0V | 50 | 150 | 189 | 225 | ns |
| | | $C_L = 150\text{ pF}$ | 2.0V | 80 | 200 | 250 | 300 | ns |
| | | $C_L = 50\text{ pF}$ | 4.5V | 21 | 30 | 37 | 45 | ns |
| | | $C_L = 150\text{ pF}$ | 4.5V | 30 | 40 | 50 | 60 | ns |
| t_{PHZ} , t_{PLZ} | Maximum Output Disable Time | $R_L = 1\text{ k}\Omega$ | 2.0V | 50 | 150 | 189 | 225 | ns |
| | | $C_L = 50\text{ pF}$ | 4.5V | 21 | 30 | 37 | 45 | ns |
| | | $C_L = 50\text{ pF}$ | 6.0V | 19 | 26 | 31 | 39 | ns |
| t_S | Minimum Setup Time | | 2.0V | | 50 | 60 | 75 | ns |
| | | | 4.5V | | 9 | 13 | 15 | ns |
| | | | 6.0V | | 9 | 11 | 13 | ns |
| t_H | Minimum Hold Time | | 2.0V | | 5 | 30 | 5 | ns |
| | | | 4.5V | | 5 | 5 | 5 | ns |
| | | | 6.0V | | 5 | 5 | 5 | ns |
| t_W | Minimum Pulse Width | | 2.0V | 30 | 80 | 100 | 120 | ns |
| | | | 4.5V | 9 | 16 | 20 | 24 | ns |
| | | | 6.0V | 8 | 14 | 18 | 20 | ns |
| t_{THL} , t_{TLH} | Maximum Output Rise and Fall Time | $C_L = 50\text{ pF}$ | 2.0V | 25 | 60 | 75 | 90 | ns |
| | | | 4.5V | 7 | 12 | 15 | 18 | ns |
| | | | 6.0V | 6 | 10 | 13 | 15 | ns |
| t_r , t_f | Maximum Input Rise and Fall Time, Clock | | 2.0V | | 1000 | 1000 | 1000 | ns |
| | | | 4.5V | | 500 | 500 | 500 | ns |
| | | | 6.0V | | 400 | 400 | 400 | ns |
| C_{PD} | Power Dissipation Capacitance (Note 5) | (per flip-flop) | | | | | | |
| | | OC = V_{CC} OC = GND | | 30 50 | | | | pF pF |
| C_{IN} | Maximum Input Capacitance | | | 5 | 10 | 10 | 10 | pF |

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B**

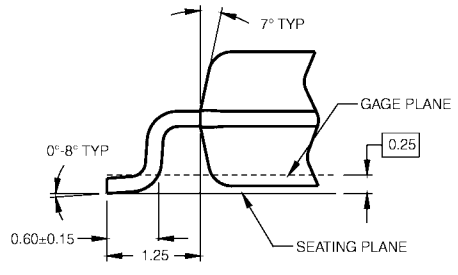
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



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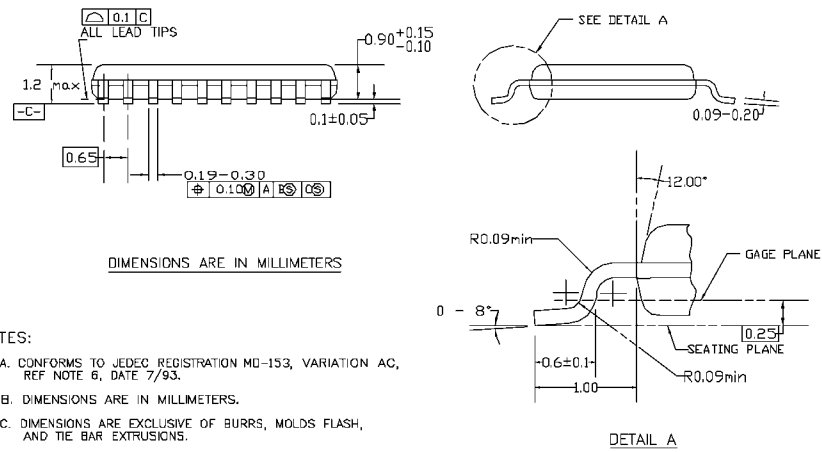
DETAIL A

- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DRevB1

20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M20D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



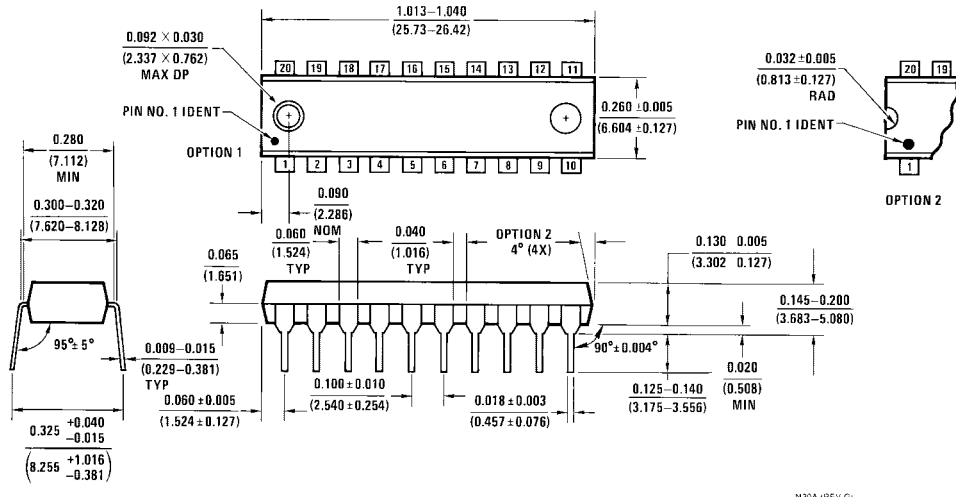
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- NOTES:
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 - B. DIMENSIONS ARE IN MILLIMETERS.
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 - D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20REVD1

20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC20

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N20A

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