MM74HC175 Quad D-Type Flip-Flop With Clear

General Description
The MM74HC175 high speed D-type flip-flop with complementary outputs utilizes advanced silicon-gate CMOS technology to achieve the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

Information at the D inputs of the MM74HC175 is transferred to the Q and Q' outputs on the positive going edge of the clock pulse. Both true and complement outputs from each flip flop are externally available. All four flip-flops are controlled by a common clock and a common CLEAR. Clearing is accomplished by a negative pulse at the CLEAR input. All four Q outputs are cleared to a logical “0” and all four Q’ outputs to a logical “1.”

The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to VCC and ground.

Features
- Typical propagation delay: 15 ns
- Wide operating supply voltage range: 2–6V
- Low input current: 1 μA maximum
- Low quiescent supply current: 80 μA maximum (74HC)
- High output drive current: 4 mA minimum (74HC)

Ordering Code:

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Package Number</th>
<th>Package Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM74HC175M</td>
<td>M16A</td>
<td>16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150” Narrow</td>
</tr>
<tr>
<td>MM74HC175SJ</td>
<td>M16D</td>
<td>16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide</td>
</tr>
<tr>
<td>MM74HC175MTC</td>
<td>MTC16</td>
<td>16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide</td>
</tr>
<tr>
<td>MM74HC175N</td>
<td>N16E</td>
<td>16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300” Wide</td>
</tr>
</tbody>
</table>

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

Connection Diagram

Truth Table

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>Clock</td>
</tr>
<tr>
<td>L</td>
<td>X</td>
</tr>
<tr>
<td>H</td>
<td>↑</td>
</tr>
<tr>
<td>H</td>
<td>↑</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
</tr>
</tbody>
</table>

H = HIGH Level (steady state)
L = LOW Level (steady state)
X = Irrelevant
↑ = Transition from LOW-to-HIGH level
Q0 = The level of Q before the indicated steady-state input conditions were established
### Absolute Maximum Ratings (Note 1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (V&lt;sub&gt;CC&lt;/sub&gt;)</td>
<td></td>
<td>2</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>DC Input Voltage (V&lt;sub&gt;IN&lt;/sub&gt;)</td>
<td></td>
<td>0</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>V</td>
</tr>
<tr>
<td>DC Output Voltage (V&lt;sub&gt;OUT&lt;/sub&gt;)</td>
<td></td>
<td>0</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>V</td>
</tr>
<tr>
<td>Clamp Diode Current (I&lt;sub&gt;IK&lt;/sub&gt;, I&lt;sub&gt;OK&lt;/sub&gt;)</td>
<td>≤20 mA</td>
<td>≤25 mA</td>
<td>≤50 mA</td>
<td>mA</td>
</tr>
<tr>
<td>DC Output Current, per pin (I&lt;sub&gt;OUT&lt;/sub&gt;)</td>
<td>≤250 mA</td>
<td>≤85 mA</td>
<td>≤150 mA</td>
<td>mA</td>
</tr>
<tr>
<td>DC V&lt;sub&gt;CC&lt;/sub&gt; or GND Current, per pin (I&lt;sub&gt;G&lt;/sub&gt;)</td>
<td>≤250 mA</td>
<td>≤85 mA</td>
<td>≤150 mA</td>
<td>mA</td>
</tr>
<tr>
<td>Storage Temperature Range (T&lt;sub&gt;STG&lt;/sub&gt;)</td>
<td>−65°C to +150°C</td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Power Dissipation (P&lt;sub&gt;D&lt;/sub&gt;)</td>
<td>(Note 3) 600 mW</td>
<td></td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>S.O. Package only</td>
<td>500 mW</td>
<td></td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Lead Temperature (T&lt;sub&gt;L&lt;/sub&gt;)</td>
<td>(Soldering 10 seconds) 260°C</td>
<td></td>
<td></td>
<td>°C</td>
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</table>

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Typ</th>
<th>Guaranteed Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (V&lt;sub&gt;CC&lt;/sub&gt;)</td>
<td></td>
<td>2</td>
<td>600 mW</td>
</tr>
<tr>
<td>DC Input or Output Voltage</td>
<td></td>
<td>0</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Operating Temperature Range (T&lt;sub&gt;A&lt;/sub&gt;)</td>
<td>−40 to +85 °C</td>
<td></td>
<td></td>
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<tr>
<td>Input Rise or Fall Times</td>
<td>(t&lt;sub&gt;r&lt;/sub&gt;, t&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; = 2.0V 1000 ns</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; = 4.5V 500 ns</td>
</tr>
</tbody>
</table>

### DC Electrical Characteristics (Note 4)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>V&lt;sub&gt;CC&lt;/sub&gt;</th>
<th>T&lt;sub&gt;A&lt;/sub&gt; = 25°C</th>
<th>T&lt;sub&gt;A&lt;/sub&gt; = −40 to 85°C</th>
<th>T&lt;sub&gt;A&lt;/sub&gt; = −55 to 125°C</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;H&lt;/sub&gt;</td>
<td>Minimum HIGH Level Input Voltage</td>
<td>2.0V</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td>4.5V</td>
<td>3.15</td>
<td>3.15</td>
<td>3.15</td>
<td></td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td>6.0V</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>V&lt;sub&gt;L&lt;/sub&gt;</td>
<td>Maximum LOW Level Input Voltage</td>
<td>2.0V</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.5V</td>
<td>1.35</td>
<td>1.35</td>
<td>1.35</td>
<td></td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td>6.0V</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td></td>
<td>V</td>
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<tr>
<td>V&lt;sub&gt;OH&lt;/sub&gt;</td>
<td>Minimum HIGH Level Output Voltage</td>
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<tr>
<td></td>
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<td>V&lt;sub&gt;IN&lt;/sub&gt; = V&lt;sub&gt;H&lt;/sub&gt; or V&lt;sub&gt;L&lt;/sub&gt;</td>
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<tr>
<td>V&lt;sub&gt;OL&lt;/sub&gt;</td>
<td>Maximum LOW Level Output Voltage</td>
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<td>V&lt;sub&gt;IN&lt;/sub&gt; = V&lt;sub&gt;H&lt;/sub&gt; or V&lt;sub&gt;L&lt;/sub&gt;</td>
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<tr>
<td>I&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Maximum Input Current</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;IN&lt;/sub&gt; = V&lt;sub&gt;CC&lt;/sub&gt; or GND</td>
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<tr>
<td>I&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>Maximum Quiescent Supply Current</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;IN&lt;/sub&gt; = V&lt;sub&gt;CC&lt;/sub&gt; or GND</td>
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</table>

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.

Note 4: For a power supply of 5V ±10% the worst case output voltages (V<sub>OH</sub> and V<sub>OL</sub>) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IN</sub> and V<sub>CC</sub> occur at V<sub>CC</sub> = 5.5V and 4.0V respectively. (The V<sub>IN</sub> value at 5.5V is 3.85V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0V values should be used.
## AC Electrical Characteristics

V\(_{\text{CC}}\) = 5V, \(T_A = 25^\circ\text{C}\), \(C_L = 15\ pF\), \(t_r = t_f = 6\ ns\)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Typ</th>
<th>Guaranteed Limit</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(f_{\text{MAX}})</td>
<td>Maximum Operating Frequency</td>
<td></td>
<td>60</td>
<td>35</td>
<td>MHz</td>
</tr>
<tr>
<td>(t_{\text{PHL}}, t_{\text{PLH}})</td>
<td>Maximum Propagation Delay, Clock to (Q) or (\overline{Q})</td>
<td>2.0V</td>
<td>15</td>
<td>25</td>
<td>ns</td>
</tr>
<tr>
<td>(t_{\text{PHL}}, t_{\text{PLH}})</td>
<td>Maximum Propagation Delay, Reset to (Q) or (\overline{Q})</td>
<td>4.5V</td>
<td>13</td>
<td>21</td>
<td>ns</td>
</tr>
<tr>
<td>(t_{\text{REM}})</td>
<td>Minimum Removal Time, Clear to Clock</td>
<td>4.5V</td>
<td>100</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>(t_s)</td>
<td>Minimum Setup Time, Data to Clock</td>
<td>4.5V</td>
<td>100</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>(t_h)</td>
<td>Minimum Hold Time, Data from Clock</td>
<td>2.0V</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(t_w)</td>
<td>Minimum Pulse Width, Clock or Clear</td>
<td>2.0V</td>
<td>30</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>(t_RLH, t_{\text{THL}})</td>
<td>Maximum Output Rise and Fall Time</td>
<td>4.5V</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>(C_{\text{PD}})</td>
<td>Power Dissipation Capacitance (Note 5)</td>
<td>per package</td>
<td>(per package)</td>
<td>150</td>
<td>pF</td>
</tr>
<tr>
<td>(C_{\text{IN}})</td>
<td>Maximum Input Capacitance</td>
<td></td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

### Note 5:
- \(C_{\text{PD}}\) determines the no load dynamic power consumption, \(P_{\text{D}} = C_{\text{PD}} \cdot V_{\text{CC}}^2 \cdot t_r \cdot t_f\), and the no load dynamic current consumption, \(I_{\text{D}} = C_{\text{PD}} \cdot V_{\text{CC}} \cdot t_r \cdot t_f\).
Physical Dimensions  inches (millimeters) unless otherwise noted

16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150° Narrow
Package Number M16A

16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

![Diagrams showing physical dimensions](image)

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