IDT74FCT38074

3.3V CMOS
1-TO-4 CLOCK DRIVER

DESCRIPTION:
The FCT38074 is a 3.3V clock driver built using advanced CMOS technology. This low skew clock driver offers 1:4 fanout. The large fanout from a single input reduces loading on the preceding driver and provides an efficient clock distribution network. Multiple power and grounds reduce noise. Typical applications are clock and signal distribution.

FEATURES:
- Advanced CMOS Technology
- Guaranteed low skew < 100ps (max.)
- Very low duty cycle distortion< 250ps (max.)
- High speed propagation delay< 3ns (max.)
- Very low CMOS power levels
- TTL compatible inputs and outputs
- 1:4 fanout
- Maximum output rise and fall time < 1.5ns (max.)
- Low input capacitance: 3pF typical
- Vcc = 3.3V ± 0.3V
- Inputs can be driven from 3.3V or 5V components
- Operating frequency up to 166MHz
- Available in SOIC package

FUNCTIONAL BLOCK DIAGRAM

PIN CONFIGURATION

IN

O1

O2

O3

O4

Vcc 1 8 04
Vcc 2 7 03
IN 3 6 02
GND 4 5 01

SOIC
TOP VIEW

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INDUSTRIAL TEMPERATURE RANGE

MAY 2010
ABSOLUTE MAXIMUM RATINGS(1)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Max. Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>Input Power Supply Voltage</td>
<td>–0.5 to +4.6 V</td>
<td>VCC = Max. VIN = GND or VCC</td>
</tr>
<tr>
<td>VI</td>
<td>Input Voltage</td>
<td>–0.5 to +5.5 V</td>
<td>VCC = Max. VIN = VCC – 0.6 V</td>
</tr>
<tr>
<td>VO</td>
<td>Output Voltage</td>
<td>–0.5 to VCC + 0.5 V</td>
<td></td>
</tr>
<tr>
<td>TJ</td>
<td>Junction Temperature</td>
<td>150 °C</td>
<td></td>
</tr>
<tr>
<td>TSTG</td>
<td>Storage Temperature</td>
<td>–65 to +165 °C</td>
<td></td>
</tr>
</tbody>
</table>

NOTE:
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

CAPACITANCE (TA = +25°C, f = 1.0MHz)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter(1)</th>
<th>Conditions</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIN</td>
<td>Input Capacitance</td>
<td>VIN = 0V</td>
<td>3</td>
<td>4</td>
<td>pF</td>
</tr>
<tr>
<td>COUT</td>
<td>Output Capacitance</td>
<td>VOUT = 0V</td>
<td>—</td>
<td>6</td>
<td>pF</td>
</tr>
</tbody>
</table>

NOTE:
1. This parameter is measured at characterization but not tested.

PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin Names</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>Input</td>
</tr>
<tr>
<td>OX</td>
<td>Outputs</td>
</tr>
</tbody>
</table>

POWER SUPPLY CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions(1)</th>
<th>Min.</th>
<th>Typ.(2)</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icc</td>
<td>Quiescent Power Supply Current</td>
<td>VCC = Max. VIN = GND or VCC</td>
<td>—</td>
<td>0.1</td>
<td>30</td>
<td>µA</td>
</tr>
<tr>
<td>∆icc</td>
<td>Power Supply Current per Input HIGH</td>
<td>VCC = Max. VIN = VCC – 0.6 V</td>
<td>—</td>
<td>45</td>
<td>300</td>
<td>µA</td>
</tr>
<tr>
<td>I Cord</td>
<td>Dynamic Power Supply Current perOutput(3)</td>
<td>VCC = Max. CL = 15pF All Outputs Toggling VIN = VCC VIN = GND</td>
<td>—</td>
<td>80</td>
<td>120</td>
<td>µA/MHz</td>
</tr>
<tr>
<td>Ic</td>
<td>Total Power Supply Current(4)</td>
<td>VCC = Max. CL = 15pF All Outputs Toggling fi = 133MHz VIN = VCC VIN = VCC – 0.6V VIN = GND</td>
<td>80</td>
<td>110</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VCC = Max. CL = 15pF All Outputs Toggling fi = 166MHz VIN = VCC VIN = VCC – 0.6V VIN = GND</td>
<td>—</td>
<td>110</td>
<td>140</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at VCC = 3.3V, +25°C ambient.
3. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
4. IC = QUIESCENT + INPUTS + IDYNAMIC
   IC = Icc + ∆icc • Di • Nt + ICCD (fi)
   Icc = Quiescent Current
   ∆icc = Power Supply Current for a TTL High Input (VIN = Vcc -0.6V)
   Di = Duty Cycle for TTL Inputs High
   Nt = Number of TTL Inputs at Di
   ICCD = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   fi = Input Frequency
## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified

### Industrial: \( T_A = -40°C \) to +85°C, \( V_{CC} = 3.3V ± 0.3V \)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions(1)</th>
<th>Min.</th>
<th>Typ.(2)</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIH</td>
<td>Input HIGH Level</td>
<td></td>
<td>2</td>
<td>—</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>VIL</td>
<td>Input LOW Level</td>
<td></td>
<td>—0.5</td>
<td>—</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td>IIH</td>
<td>Input HIGH Current</td>
<td>( V_{CC} = \text{Max.} ), ( V_I = 5.5V )</td>
<td>—</td>
<td>—</td>
<td>±1</td>
<td>µA</td>
</tr>
<tr>
<td>IIL</td>
<td>Input LOW Current</td>
<td>( V_{CC} = \text{Max.} ), ( V_I = \text{GND} )</td>
<td>—</td>
<td>—</td>
<td>±1</td>
<td>µA</td>
</tr>
<tr>
<td>VIK</td>
<td>Clamp Diode Voltage</td>
<td>( V_{CC} = \text{Min.}, I_{IN} = -18mA )</td>
<td>—45</td>
<td>—6.7</td>
<td>—1.2</td>
<td>V</td>
</tr>
<tr>
<td>IODH</td>
<td>Output HIGH Current</td>
<td>( V_{CC} = 3.3V, V_IN = V_IH \text{ or } V_IL, V_O = 1.5V(3,4) )</td>
<td>50</td>
<td>92</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>IODL</td>
<td>Output LOW Current</td>
<td>( V_{CC} = 3.3V, V_IN = V_IH \text{ or } V_IL, V_O = 1.5V(3,4) )</td>
<td>60</td>
<td>135</td>
<td>240</td>
<td>mA</td>
</tr>
<tr>
<td>IOS</td>
<td>Short Circuit Current</td>
<td>( V_{CC} = \text{Max.}, V_O = \text{GND}(3,4) )</td>
<td>60</td>
<td>135</td>
<td>240</td>
<td>mA</td>
</tr>
<tr>
<td>VOH</td>
<td>Output HIGH Voltage</td>
<td>( V_{CC} = \text{Min.} ), ( V_IN = V_IH \text{ or } V_IL ), ( I_{OH} = -12mA )</td>
<td>2.4</td>
<td>3</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>VOL</td>
<td>Output LOW Voltage</td>
<td>( V_{CC} = \text{Min.} ), ( V_IN = V_IH \text{ or } V_IL ), ( I_{OL} = 12mA )</td>
<td>0.3</td>
<td>0.5</td>
<td>0.2</td>
<td>V</td>
</tr>
</tbody>
</table>

### NOTES:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at \( V_{CC} = 3.3, 25°C \) ambient.
3. This parameter is guaranteed but not tested.
4. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
5. \( V_{OH} = V_{CC} - 0.6V \) at rated current.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE (3,4)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions(1,8)</th>
<th>Min.(2)</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPLH</td>
<td>PropagationDelay</td>
<td>( C_L = 15pF ), ( f \leq 166\text{MHz} )</td>
<td>0.5</td>
<td>3</td>
<td>ns</td>
</tr>
<tr>
<td>tPHL</td>
<td></td>
<td></td>
<td>—</td>
<td>1.5</td>
<td>ns</td>
</tr>
<tr>
<td>tR</td>
<td>Output Rise Time (0.8V to 2V)</td>
<td></td>
<td>—</td>
<td>1.5</td>
<td>ns</td>
</tr>
<tr>
<td>tF</td>
<td>Output Fall Time (2V to 0.8V)</td>
<td></td>
<td>—</td>
<td>100</td>
<td>ps</td>
</tr>
<tr>
<td>tSK(O)</td>
<td>Same device output pin-to-pin skew(5)</td>
<td></td>
<td>—</td>
<td>100</td>
<td>ps</td>
</tr>
<tr>
<td>tSK(P)</td>
<td>Pulse skew(6)</td>
<td></td>
<td>—</td>
<td>250</td>
<td>ps</td>
</tr>
<tr>
<td>tSK(PP)</td>
<td>Part to part skew(7)</td>
<td></td>
<td>—</td>
<td>550</td>
<td>ps</td>
</tr>
<tr>
<td>fMAX</td>
<td>Input Frequency</td>
<td></td>
<td>—</td>
<td>166</td>
<td>MHz</td>
</tr>
</tbody>
</table>

### NOTES:
1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. \( t_{PLH}, t_{PHL}, t_{SK(P)}, \) and \( t_{SK(o)} \) are production tested. All other parameters guaranteed but not production tested.
4. Propagation delay range indicated by Min. and Max. limit is due to \( V_{CC}, \) operating temperature and process parameters. These propagation delay limits do not imply skew.
5. Skew measured between all outputs under identical transitions and load conditions.
6. Skew measured is difference between propagation delay times \( t_{PHL} \) and \( t_{PLH} \) of same output under identical load conditions.
7. Part to part skew for all outputs given identical transitions and load conditions at identical \( V_{CC} \) levels and temperature.
8. Airflow of 1m/s is recommended for frequencies above 133MHz.

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TEST CIRCUITS

TEST CONDITIONS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td>15 pF</td>
</tr>
<tr>
<td>RL</td>
<td>33 Ω</td>
</tr>
<tr>
<td>RT</td>
<td>Zout of pulse generator Ω</td>
</tr>
<tr>
<td>tR / tF</td>
<td>1 (0V to 3V or 3V to 0V) ns</td>
</tr>
</tbody>
</table>

DEFINITIONS:
CL = Load capacitance: includes jig and probe capacitance.
RL = Termination resistance: should be equal to Zout of the Pulse Generator.
tR / tF = Rise/Fall time of the input stimulus from the Pulse Generator.

TEST WAVEFORMS

Propagation Delay

Output Skew - tSK(o)

Part-to-Part Skew - tSK(PP)

Part-to-Part Skew is for the same package and speed grade.
ORDERING INFORMATION

- 74FCT  XXXX  X  X
  - Device Type  Package  Process

- DCG  SOIC - Green
  - -40°C to +85°C (Industrial)

- 38074  3.3V CMOS 1-to-4 Clock Driver
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