



## 2.5V CMOS 1-TO-10 CLOCK DRIVER

**IDT74FCT20807**

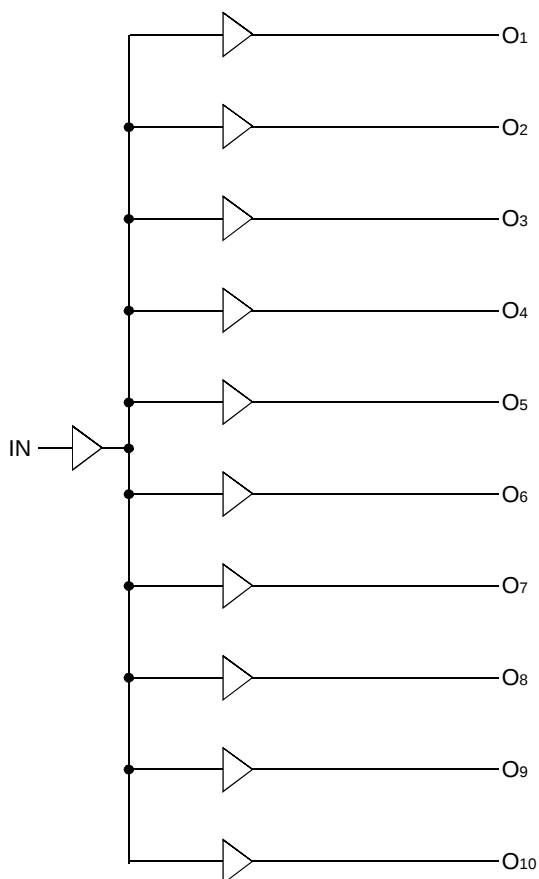
### FEATURES:

- High frequency > 150MHz
- Guaranteed low skew < 150ps (max.) between any two outputs
- Very low duty cycle distortion < 300ps
- High speed: propagation delay < 3ns
- Very low CMOS power levels
- TTL compatible inputs and outputs
- 1:10 fanout
- Maximum output rise and fall time < 1.25ns (max.)
- Low input capacitance: 3pF typical
- 2.5V supply voltage
- Available in SSOP and QSOP packages

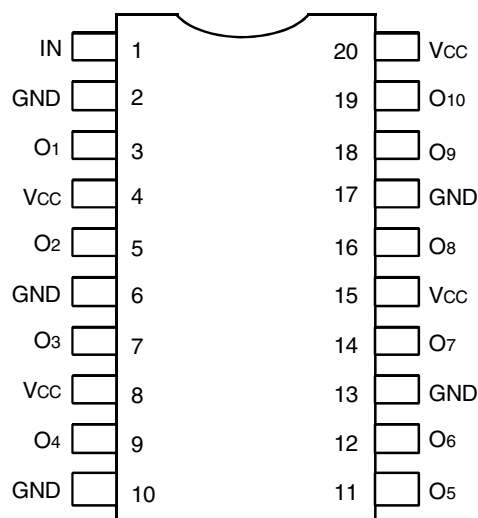
### DESCRIPTION:

The FCT20807 is a 2.5V compatible, high speed, low noise, 1:10 fanout, non-inverting clock buffer. The large fanout from a single input reduces loading on the preceding driver and provides an efficient clock distribution network. Providing output to output skew as low as 150ps, the FCT20807 is an ideal clock distribution device for synchronous systems. Multiple power and grounds reduce noise. Typical applications are clock and signal distribution.

### FUNCTIONAL BLOCK DIAGRAM



### PIN CONFIGURATION



SSOP/ QSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol                           | Description                          | Max                          | Unit |
|----------------------------------|--------------------------------------|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | −0.5 to +4.6                 | V    |
| V <sub>TERM</sub> <sup>(3)</sup> | Terminal Voltage with Respect to GND | −0.5 to +5.5                 | V    |
| V <sub>TERM</sub> <sup>(4)</sup> | Terminal Voltage with Respect to GND | −0.5 to V <sub>CC</sub> +0.5 | V    |
| T <sub>STG</sub>                 | Storage Temperature                  | −65 to +150                  | °C   |
| I <sub>OUT</sub>                 | DC Output Current                    | −60 to +60                   | mA   |

### NOTES:

- 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.
- V<sub>CC</sub> terminals.
- Input terminals.
- Outputs and I/O terminals.

## CAPACITANCE (T<sub>A</sub> = +25°C, f = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 3    | 4    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | —    | 6    | pF   |

### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

| Pin Names | Description   |
|-----------|---------------|
| IN        | Clock Inputs  |
| O x       | Clock Outputs |

## POWER SUPPLY CHARACTERISTICS

| Symbol            | Parameter                                              | Test Conditions <sup>(1)</sup>                                                                     |                                                                   | Min. | Typ. <sup>(2)</sup> | Max. | Unit    |
|-------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------|---------------------|------|---------|
| I <sub>CC</sub>   | Quiescent Power Supply Current                         | V <sub>CC</sub> = Max.                                                                             |                                                                   | —    | 0.1                 | 20   | μA      |
| I <sub>CC</sub> H | TTL Inputs HIGH                                        | V <sub>IN</sub> = GND or V <sub>CC</sub>                                                           |                                                                   | —    | —                   | —    | —       |
| ΔI <sub>CC</sub>  | Power Supply Current per Input HIGH                    | V <sub>CC</sub> = Max.<br>V <sub>IN</sub> = V <sub>CC</sub> − 0.6V                                 |                                                                   | —    | 45                  | 300  | μA      |
| I <sub>CC</sub> D | Dynamic Power Supply Current per Output <sup>(3)</sup> | V <sub>CC</sub> = 2.7V<br>15 pF                                                                    | 150 MHz                                                           | —    | 40                  | —    | μA /MHz |
| I <sub>C</sub>    | Total Power Supply Current <sup>(4)</sup>              | V <sub>CC</sub> = Max.<br>C <sub>L</sub> = 12pF<br>All outputs toggling<br>f <sub>i</sub> = 150MHz | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND        | —    | 65                  | 90   | mA      |
|                   |                                                        |                                                                                                    | V <sub>IN</sub> = V <sub>CC</sub> − 0.6V<br>V <sub>IN</sub> = GND | —    | 75                  | 100  |         |
|                   |                                                        |                                                                                                    |                                                                   |      |                     |      |         |

### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 2.5V, +25°C ambient.
- This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
I<sub>C</sub> = I<sub>CC</sub> + ΔI<sub>CC</sub> D<sub>H</sub>N<sub>T</sub> + I<sub>CC</sub>D (f<sub>i</sub>)  
I<sub>CC</sub> = Quiescent Current (I<sub>CC</sub>L, I<sub>CC</sub>H and I<sub>CC</sub>Z)  
ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = V<sub>CC</sub> − 0.6V)  
D<sub>H</sub> = Duty Cycle for TTL Inputs High  
N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
I<sub>CC</sub>D = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
f<sub>i</sub> = Input Frequency

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 2.5\text{V} \pm 0.2\text{V}$

| Symbol    | Parameter                            | Test Conditions <sup>(1)</sup>                                                       | Min.           | Typ. <sup>(2)</sup> | Max.    | Unit |
|-----------|--------------------------------------|--------------------------------------------------------------------------------------|----------------|---------------------|---------|------|
| $V_{IH}$  | Input HIGH Level                     |                                                                                      | 1.7            | —                   | —       | V    |
| $V_{IL}$  | Input LOW Level                      |                                                                                      | —              | —                   | 0.7     | V    |
| $I_{IH}$  | Input HIGH Current (Input pins)      | $V_{CC} = \text{Max.}, V_I = V_{CC}$                                                 | —              | —                   | $\pm 1$ | mA   |
| $I_{IL}$  | Input LOW Current (Input pins)       | $V_{CC} = \text{Max.}, V_I = \text{GND}$                                             | —              | —                   | $\pm 1$ | mA   |
| $V_{IK}$  | Clamp Diode Voltage                  | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$                                        | —              | -0.7                | -1      | V    |
| $I_{ODH}$ | Output HIGH Current                  | $V_{CC} = 2.5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_O = 1.25\text{V}^{(3)}$ | -25            | -45                 | -100    | mA   |
| $I_{ODL}$ | Output LOW Current                   | $V_{CC} = 2.5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_O = 1.25\text{V}^{(3)}$ | 20             | 55                  | 120     | mA   |
| $V_{OH}$  | Output HIGH Voltage                  | $V_{CC} = \text{Min.}, I_{OH} = -1\text{mA}$                                         | $V_{CC} - 0.2$ | —                   | —       | V    |
|           |                                      | $V_{IN} = V_{IH} \text{ or } V_{IL}, I_{OH} = -8\text{mA}$                           | $1.8^{(5)}$    | —                   | —       |      |
| $V_{OL}$  | Output LOW Voltage                   | $V_{CC} = \text{Min.}, I_{OL} = 1\text{mA}$                                          | —              | —                   | 0.4     | V    |
|           |                                      | $V_{IN} = V_{IH} \text{ or } V_{IL}, I_{OL} = 8\text{mA}$                            | —              | —                   | 0.6     |      |
| $I_{OS}$  | Short Circuit Current <sup>(4)</sup> | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$                                       | -25            | -60                 | -135    | mA   |

### 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  $V_{CC} = 2.5\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
4. This parameter is guaranteed but not tested.
5.  $V_{OH} = V_{CC} - 0.6\text{V}$  at rated current.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE<sup>(1,2)</sup>

Following Conditions Apply Unless Otherwise Specified

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 2.5\text{V} \pm 0.2\text{V}$

| Symbol                 | Parameter                                         | Conditions <sup>(3)</sup>      | Min. | Typ. | Max. | Unit |
|------------------------|---------------------------------------------------|--------------------------------|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay                                 | $C_L = 22\text{pF}$<br>100 MHz | —    | 3    | 3.5  | ns   |
| $t_R$                  | Output Rise Time                                  |                                | —    | 1    | 1.25 | ns   |
| $t_F$                  | Output Fall Time                                  |                                | —    | 1    | 1.25 | ns   |
| $t_{SK(O)}$            | Same Device Output Pin-to-Pin Skew <sup>(4)</sup> |                                | —    | 100  | 150  | ps   |
| $t_{SK(P)}$            | Pulse Skew <sup>(5)</sup>                         |                                | —    | 250  | 300  | ps   |
| $t_{SK(PP)}$           | Part-to-Part Skew <sup>(6)</sup>                  |                                | —    | 400  | 600  | ps   |

| Symbol                 | Parameter                                         | Conditions <sup>(3,7)</sup>    | Min. | Typ. | Max. | Unit |
|------------------------|---------------------------------------------------|--------------------------------|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay                                 | $C_L = 12\text{pF}$<br>150 MHz | —    | 2.4  | 2.7  | ns   |
| $t_R$                  | Output Rise Time                                  |                                | —    | 1    | 1.2  | ns   |
| $t_F$                  | Output Fall Time                                  |                                | —    | 1    | 1.2  | ns   |
| $t_{SK(O)}$            | Same Device Output Pin-to-Pin Skew <sup>(4)</sup> |                                | —    | 100  | 150  | ps   |
| $t_{SK(P)}$            | Pulse Skew <sup>(5)</sup>                         |                                | —    | 250  | 300  | ps   |
| $t_{SK(PP)}$           | Part-to-Part Skew <sup>(6)</sup>                  |                                | —    | 400  | 600  | ps   |

### NOTES:

1.  $t_{PLH}$  and  $t_{PHL}$  are production tested. All other parameters guaranteed but not production tested.

2. 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.

3. See test circuits and waveforms.

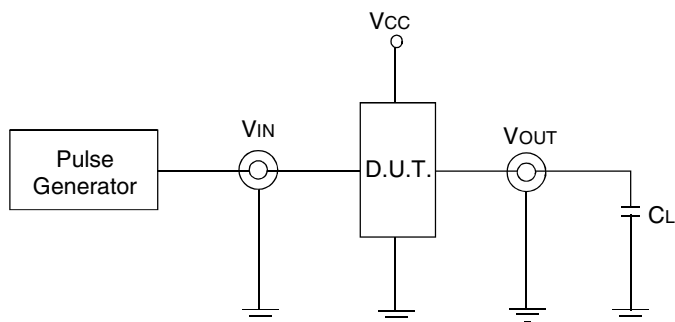
4. Skew measured between all outputs under identical transitions and load conditions.

5. Skew measured is difference between propagation delay times  $t_{PHL}$  and  $t_{PLH}$  of same output under identical load conditions.

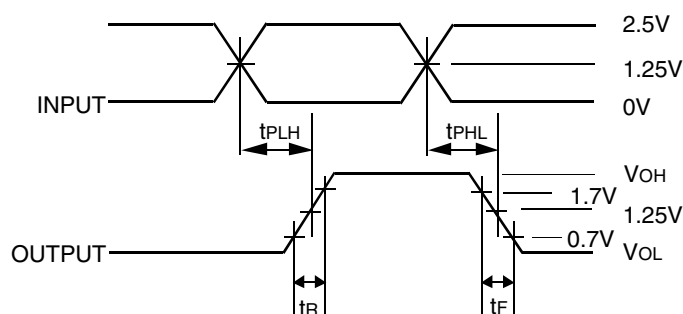
6. Part to part skew for all outputs given identical transitions and load conditions at identical  $V_{CC}$  levels and temperature.

7. Airflow of 1m/s is recommended for frequencies above 133MHz.

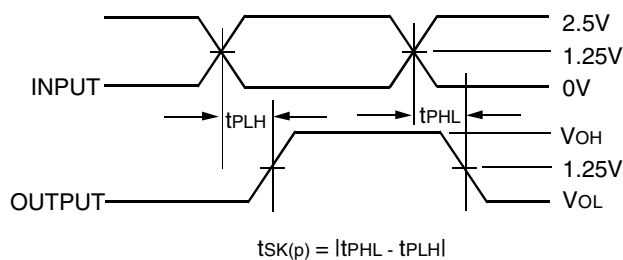
## TEST CIRCUITS AND WAVEFORMS



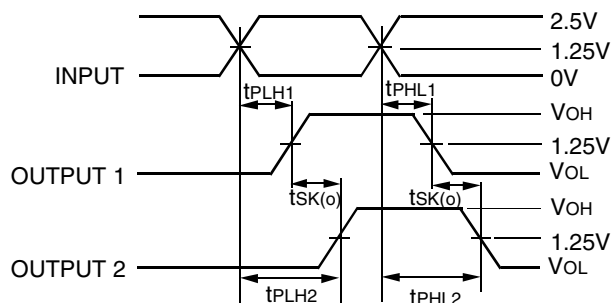
$C_L$  = Load Capacitance: Includes Jig and Probe Capacitance



Propagation Delay

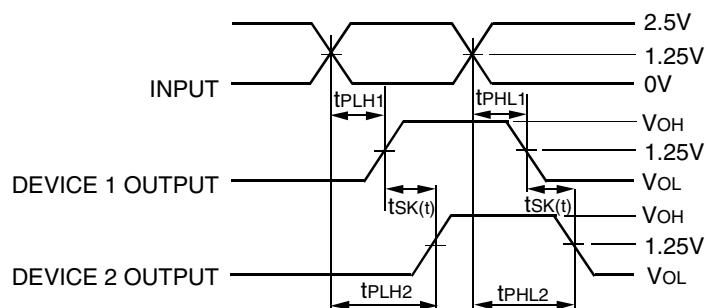


Pulse Skew -  $t_{SK(P)}$



$$t_{SK(o)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

Output Skew -  $t_{SK(o)}$



$$t_{SK(t)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

Part-to-Part Skew -  $t_{SK(PP)}$

**NOTE:** Device 1 and device 2 are same package type and speed grade.

## TEST CONDITIONS

| Symbol      | $V_{CC} = 2.5V \pm 0.2V$     | Unit     |
|-------------|------------------------------|----------|
| $C_L$       | 22 <sup>(1)</sup>            | pF       |
|             | 12 <sup>(2)</sup>            |          |
| $R_T$       | $Z_{OUT}$ of pulse generator | $\Omega$ |
| $t_R / t_F$ | 1.25 <sup>(1)</sup>          | ns       |
|             | 1.2 <sup>(2)</sup>           |          |

### DEFINITIONS:

$C_L$  = Load capacitance: includes jig and probe capacitance.  
 $R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator.  
 $t_R / t_F$  = Rise/Fall time of the input stimulus from the Pulse Generator.

### NOTES:

- Test conditions at 100MHz.
- Test conditions at 150MHz.

## ORDERING INFORMATION

| 74FCT | XXXX        | X       | X           |  |                             |
|-------|-------------|---------|-------------|--|-----------------------------|
|       | Device Type | Package | Temp. Range |  |                             |
|       |             |         | I           |  | Industrial (-40°C to +85°C) |
|       |             |         | PYG         |  | Shrink Small Outline IC     |
|       |             |         | QG          |  | QSOP - Green                |
|       |             |         | 20807       |  | 1-to-10 2.5V Clock Driver   |



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