# 3.3V CMOS 1-TO-10 CLOCK DRIVER

**IDT74FCT3807/A**

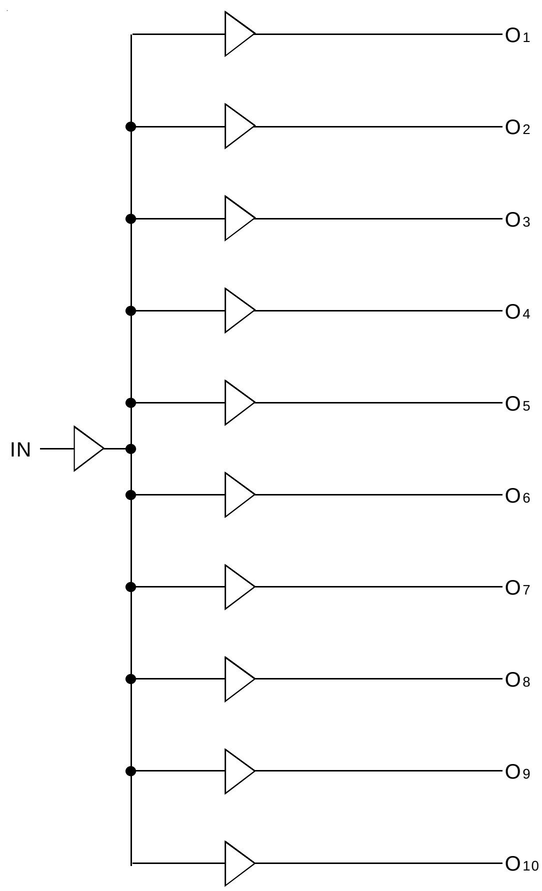
## FEATURES:

- 0.5 MICRON CMOS Technology
- Guaranteed low skew < 350ps (max.)
- Very low duty cycle distortion < 350ps (max.)
- High speed: propagation delay < 3ns (max.)
- Very low CMOS power levels
- TTL compatible inputs and outputs
- 1:10 fanout
- Maximum output rise and fall time < 1.5ns (max.)
- Maximum operating frequency of 133.33MHz
- Low input capacitance: 4.5pF typical
- $V_{CC}$ = 3.3V ± 0.3V
- Inputs can be driven from 3.3V or 5V components
- Available in SSOP, SOIC, and QSOP packages

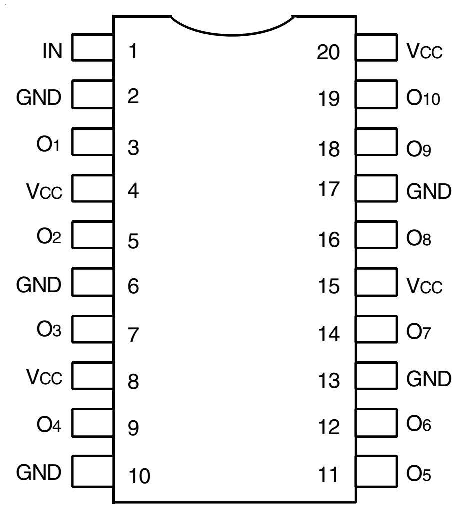
## DESCRIPTION:

The FCT3807/A 3.3V clock driver is built using advanced dual metal CMOS technology. This low skew clock driver offers 1:10 fanout. The large fanout from a single input reduces loading on the preceding driver and provides an efficient clock distribution network. The FCT3807/A offers low capacitance inputs with hysteresis for improved noise margins. Multiple power and grounds reduce noise. Typical applications are clock and signal distribution.

## FUNCTIONAL BLOCK DIAGRAM




## PIN CONFIGURATION




SOIC/ SSOP/ QSOP
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Description | Max | Unit |
|---|---|---|---|
| $V_{TERM}$(2) | Terminal Voltage with Respect to GND | –0.5 to +4.6 | V |
| $V_{TERM}$(3) | Terminal Voltage with Respect to GND | –0.5 to +7 | V |
| $V_{TERM}$(4) | Terminal Voltage with Respect to GND | –0.5 to $V_{CC}$+0.5 | V |
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |
| $I_{OUT}$ | DC Output Current | –60 to +60 | mA |

NOTES:
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.
2. $V_{CC}$ terminals.
3. Input terminals.
4. Outputs and I/O terminals.

## CAPACITANCE ($T_A$ = +25°C, f = 1.0MHz)

| Symbol | Parameter(1) | Conditions | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | 4.5 | 6 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = 0V | 5.5 | 8 | pF |

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

## PIN DESCRIPTION

| Pin Names | Description |
|---|---|
| IN | Clock Inputs |
| Ox | Clock Outputs |

## POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions(1) | | Min. | Typ.(2) | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $\Delta I_{CC}$ | Quiescent Power Supply Current<br>TTL Inputs HIGH | $V_{CC}$ = Max.<br>$V_{IN}$ = $V_{CC}$–0.6V(3) | | — | 10 | 30 | μA |
| $I_{CCD}$ | Dynamic Power Supply Current(4) | $V_{CC}$ = Max.<br>Input toggling<br>50% Duty Cycle<br>Outputs Open | $V_{IN}$ = $V_{CC}$<br>$V_{IN}$ = GND | — | 0.31 | 0.45 | mA/<br>MHz |
| $I_C$ | Total Power Supply Current(6) | $V_{CC}$ = Max.<br>Input toggling<br>50% Duty Cycle<br>Outputs Open<br>fi = 50MHz | $V_{IN}$ = $V_{CC}$<br>$V_{IN}$ = GND | — | 15.5 | 22.8 | mA |
| | | | $V_{IN}$ = $V_{CC}$–0.6V<br>$V_{IN}$ = GND | — | 15.5 | 22.8 | |

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 $V_{CC}$ = 3.3V, +25°C ambient.
3. Per TTL driven input ($V_{IN}$ = $V_{CC}$ -0.6V); all other inputs at $V_{CC}$ or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
5. Values for these conditions are examples of the $I_C$ formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}$ ($f_i$)
   $I_{CC}$ = Quiescent Current ($I_{CCL}$, $I_{CCH}$ and $I_{CCZ}$)
   $\Delta I_{CC}$ = Power Supply Current for a TTL High Input ($V_{IN}$ = $V_{CC}$ -0.6V)
   $D_H$ = Duty Cycle for TTL Inputs High
   $N_T$ = Number of TTL Inputs at $D_H$
   $I_{CCD}$ = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   $f_i$ = Input Frequency
   All currents are in milliamps and all frequencies are in megahertz.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified
Commercial: $T_A = 0°C$ to $+70°C$, Industrial: $T_A = -40°C$ to $+85°C$, $V_{CC} = 3.3V \pm 0.3V$

| Symbol | Parameter | Test Conditions(1) | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Level (Input pins) | Guaranteed Logic HIGH Level | | 2 | — | 5.5 | V |
| | Input HIGH Level (I/O pins) | | | 2 | — | $V_{CC}$ + 0.5 | |
| $V_{IL}$ | Input LOW Level (Input and I/O pins) | Guaranteed Logic LOW Level | | –0.5 | — | 0.8 | V |
| $I_{IH}$ | Input HIGH Current (Input pins) | $V_{CC}$ = Max. | $V_I$ = 5.5V | — | — | ±1 | µA |
| | Input HIGH Current (I/O pins) | | $V_I$ = $V_{CC}$ | — | — | ±1 | |
| $I_{IL}$ | Input LOW Current (Input pins) | $V_{CC}$ = Max. | $V_I$ = GND | — | — | ±1 | |
| | Input LOW Current (I/O pins) | | $V_I$ = GND | — | — | ±1 | |
| $I_{OZH}$ | High Impedence Output Current | $V_{CC}$ = Max. | $V_O$ = $V_{CC}$ | — | — | ±1 | µA |
| $I_{OZL}$ | (3-State Output Pins) | | $V_O$ = GND | — | — | ±1 | |
| $V_{IK}$ | Clamp Diode Voltage | $V_{CC}$ = Min., $I_{IN}$ = –18mA | | — | –0.7 | –1.2 | V |
| $I_{ODH}$ | Output HIGH Current | $V_{CC}$ = 3.3V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$, $V_O$ = 1.5V(3) | | –36 | –60 | –110 | mA |
| $I_{ODL}$ | Output LOW Current | $V_{CC}$ = 3.3V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$, $V_O$ = 1.5V(3) | | 50 | 90 | 200 | mA |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = Min. | $I_{OH}$ = –0.1mA | $V_{CC}$–0.2 | — | — | V |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –8mA | 2.4(5) | 3 | — | |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = Min. | $I_{OL}$ = 0.1mA | — | — | 0.2 | V |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 16mA | — | 0.2 | 0.4 | |
| | | | $I_{OL}$ = 24mA | — | 0.3 | 0.5 | |
| $I_{OFF}$ | Input Power Off Leakage | $V_{CC}$ = 0V, $V_{IN}$ = 4.5V | | — | — | ±1 | µA |
| $I_{OS}$ | Short Circuit Current(4) | $V_{CC}$ = Max., $V_O$ = GND(3) | | –60 | –135 | –240 | mA |
| $V_H$ | Input Hysteresis | — | | — | 150 | — | mV |
| $I_{CCL}$ $I_{CCH}$ $I_{CCZ}$ | Quiescent Power Supply Current | $V_{CC}$ = Max. $V_{IN}$ = GND or $V_{CC}$ | | — | 0.1 | 10 | µA |

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. 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. $V_{OH}$ = Vcc - 0.6V at rated current.

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

| Symbol | Parameter | Conditions(1) | FCT3807 Min.(2) | FCT3807 Max. | FCT3807A Min.(2) | FCT3807A Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay | 50Ω to $V_{CC}/2$ $C_L$ = 10pF | 1.5 | 3.5 | 1.5 | 3 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 1) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | or 10Ω AC | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | termination, $C_L$ = 50pF | — | 0.5 | — | 0.35 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\lvert t_{PHL} - t_{PLH} \rvert$) | (See figure 2) $f \leq$ 100MHz | — | 0.5 | — | 0.35 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | Outputs connected in groups of two | — | 0.9 | — | 0.65 | ns |

| Symbol | Parameter | Conditions(1) | FCT3807 Min.(2) | FCT3807 Max. | FCT3807A Min.(2) | FCT3807A Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay | $C_L$ = 30pF $f \leq$ 67MHz | 1.5 | 4.5 | 1.5 | 4 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 3) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | | — | 0.5 | — | 0.35 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\lvert t_{PHL} - t_{PLH} \rvert$) | | — | 0.5 | — | 0.35 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | | — | 1 | — | 0.75 | ns |

| Symbol | Parameter | Conditions(1) | FCT3807 Min.(2) | FCT3807 Max. | FCT3807A Min.(2) | FCT3807A Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay | $C_L$ = 50pF $f \leq$ 40MHz | 1.5 | 4.8 | 1.5 | 4.3 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 4) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | | — | 0.5 | — | 0.35 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\lvert t_{PHL} - t_{PLH} \rvert$) | | — | 0.5 | — | 0.35 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | | — | 1 | — | 0.75 | ns |

NOTES:
1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. $t_{PLH}$, $t_{PHL}$, $t_{SK}(t)$ 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.

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

| Symbol | Parameter | Conditions(1) | FCT3807 | | FCT3807A | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min.(2) | Max. | Min.(2) | Max. | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay | 50Ω to $V_{CC}/2$<br>$C_L$ = 10pF | 1.5 | 3.5 | 1.5 | 3 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 1) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | or 50Ω AC | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | termination,<br>$C_L$ = 10pF | — | 0.6 | — | 0.45 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$) | (See figure 2)<br>f ≤ 100MHz | — | 0.6 | — | 0.45 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | Outputs connected in groups of two | — | 0.9 | — | 0.65 | ns |

| Symbol | Parameter | Conditions(1) | FCT3807 | | FCT3807A | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min.(2) | Max. | Min.(2) | Max. | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay | $C_L$ = 30pF<br>f ≤ 67MHz | 1.5 | 4.5 | 1.5 | 4 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 3) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | | — | 0.6 | — | 0.45 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$) | | — | 0.6 | — | 0.45 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | | — | 1 | — | 0.75 | ns |

| Symbol | Parameter | Conditions(1) | FCT3807 | | FCT3807A | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min.(2) | Max. | Min.(2) | Max. | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay | $C_L$ = 50pF<br>f ≤ 40MHz | 1.5 | 4.8 | 1.5 | 4.3 | ns |
| $t_R$ | Output Rise Time (0.8 to 2V) | (See figure 4) | — | 1.5 | — | 1.5 | ns |
| $t_F$ | Output Fall Time (0.8 to 2V) | | — | 1.5 | — | 1.5 | ns |
| $t_{SK(O)}$ | Output skew: skew between outputs of same package (same transition) | | — | 0.6 | — | 0.45 | ns |
| $t_{SK(P)}$ | Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$) | | — | 0.6 | — | 0.45 | ns |
| $t_{SK(T)}$ | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | | — | 1 | — | 0.75 | ns |

NOTES:
1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. $t_{PLH}$, $t_{PHL}$, $t_{SK}(t)$ 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.

# TEST CIRCUITS

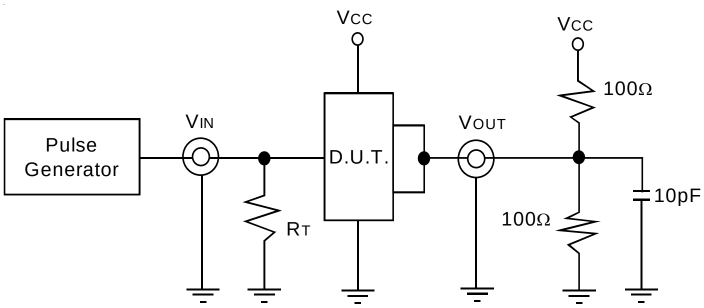



*Figure 1. $Z_O = 50\Omega$ to $V_{CC}/2$, $C_L = 10pF$*

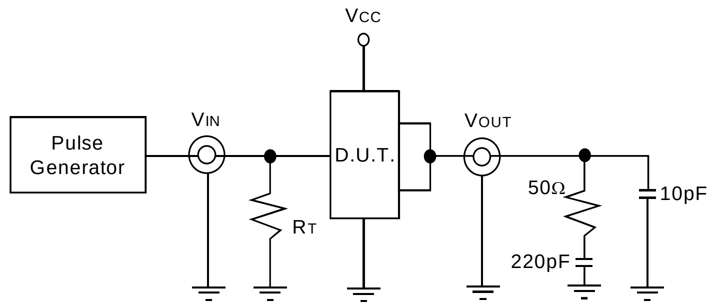



*Figure 2. $Z_O = 50\Omega$ AC Termination, $C_L = 10pF$*

The capacitor value for ac termination is determined by the operating frequency. For very low frequencies a higher capacitor value should be selected.

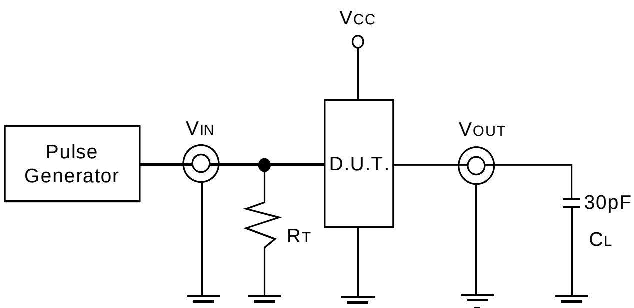



*Figure 3. $C_L = 30pF$ Circuit*

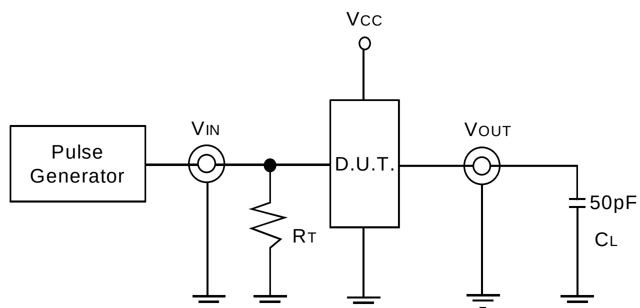



*Figure 3. $C_L = 50pF$ Circuit*

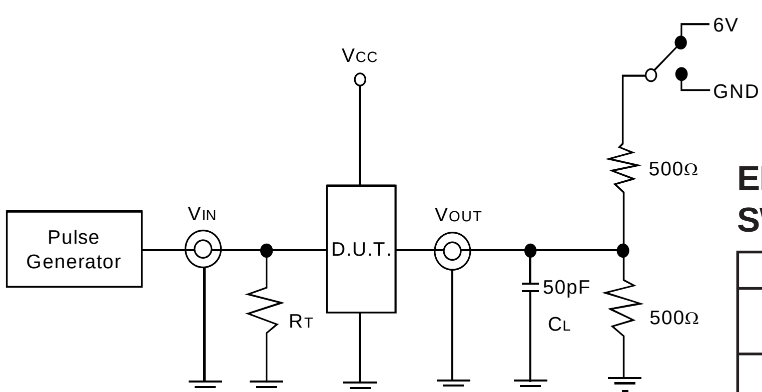


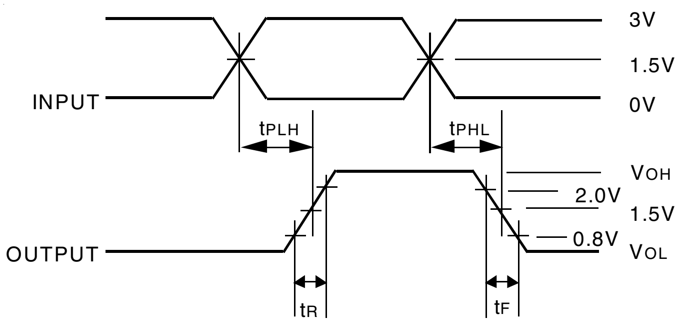

*Figure 5. Enable and Disable Time Circuit*

## ENABLE AND DISABLE TIME SWITCH POSITION

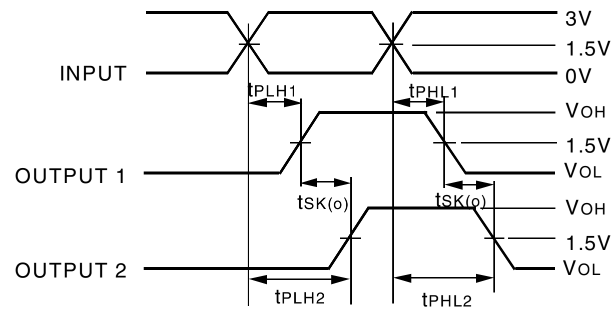
| Test | Switch |
|---|---|
| Disable LOW<br>Enable LOW | 6V |
| Disable HIGH<br>Enable HIGH | GND |

DEFINITIONS:
$C_L$ = Load capacitance: includes jig and probe capacitance.
$R_T$ = Termination resistance: should be equal to $Z_{OUT}$ of the Pulse Generator.

## TEST WAVEFORMS

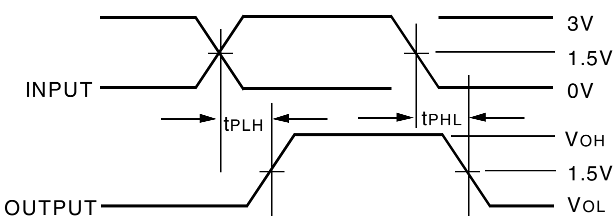



*Package Delay*



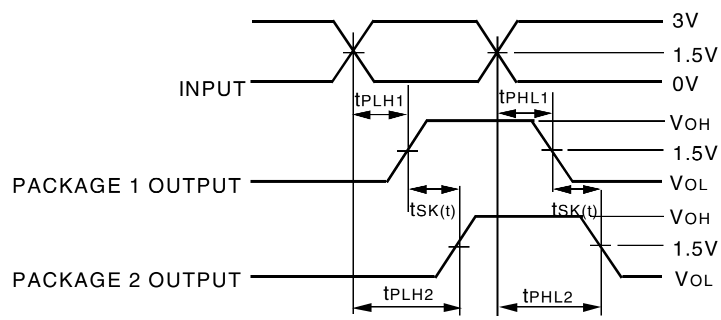

$t_{SK(o)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

*Output Skew - $t_{SK(O)}$*




$t_{SK(p)} = |t_{PHL} - t_{PLH}|$

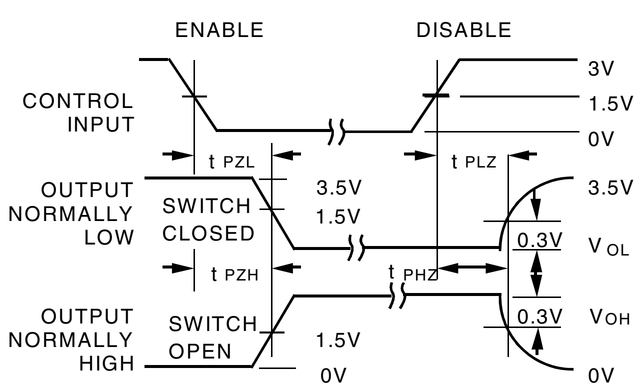
*Pulse Skew - $t_{SK(P)}$*




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

*Package Skew - $t_{SK(T)}$*

Package 1 and Package 2 are same device type and speed grade




*Enable and Disable Times*

NOTES:
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
2. Pulse Generator for All Pulses: f ≤ 1.0MHz; $t_F \leq 2.5$ns; $t_R \leq 2.5$ns

## ORDERING INFORMATION

| 74FCT | XXXXX | XX | XX | X |
|---|---|---|---|---|
| | Device Type | Package | Process/ Temp. Range | Shipping |

Shipping:

| | |
|---|---|
| Blank | Tubes |
| 8 | Tape and Reel |

Process/Temp. Range:

| | |
|---|---|
| Blank | Commercial (0ºC to +70ºC) |
| I | Industrial (-40ºC to +85ºC) |

Package:

| | |
|---|---|
| SOG | SOIC – Green |
| PYG | SSOP – Green |
| QG | QSOP – Green |

Device Type:

| | |
|---|---|
| 3807<br>3807A | 3.3V CMOS 1-to-10 Clock Driver |

## REVISION HISTORY

October 16, 2014 Updated ordering information to include Tubes/Tape and Reel

## IMPORTANT NOTICE AND DISCLAIMER



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For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
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