



Integrated Device Technology, Inc.

# FAST CMOS 1-TO-10 CLOCK DRIVER

IDT54/74FCT807BT/CT

## FEATURES:

- 0.5 MICRON CMOS Technology
- Guaranteed low skew < 250ps (max.)
- Very low duty cycle distortion < 350ps (max.)
- High speed: propagation delay < 2.5ns (max.)
- 100MHz operation
- TTL compatible inputs and outputs
- TTL level output voltage swings
- 1:10 fanout
- Output rise and fall time < 1.5ns (max.)
- Low input capacitance: 4.5pF typical
- High Drive: -32mA IOH, 48mA IOL
- ESD > 2000V per MIL STD-883, Method 3015;

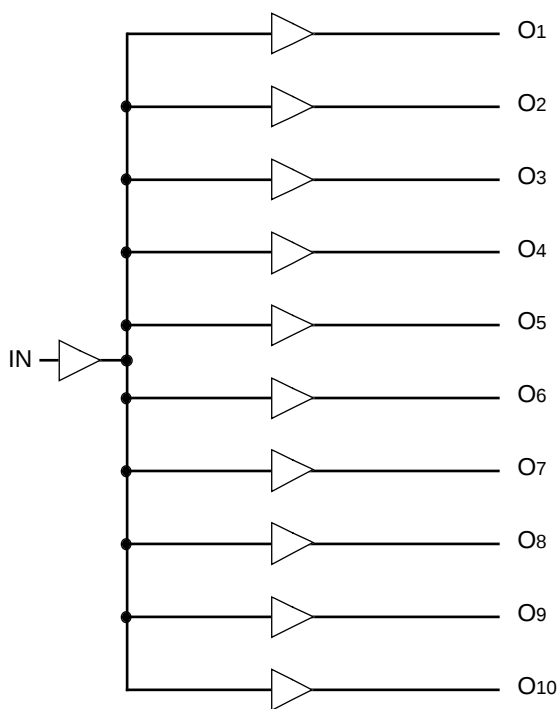
> 200V using machine model (C = 200pF, R = 0)

- Available in DIP, SOIC, SSOP, QSOP, Cerpack and LCC packages
- Military product compliant to MIL-STD-883, Class B

## DESCRIPTION:

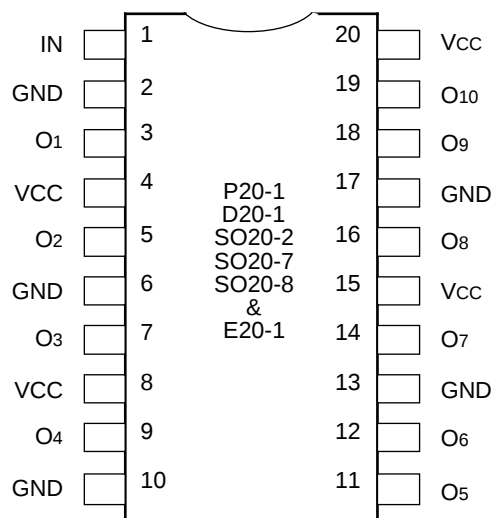
The IDT54/74FCT807BT/CT clock driver is built using advanced dual metal CMOS technology. This low skew clock driver features 1:10 fanout, providing minimal loading on the preceding drivers. The IDT54/74FCT807BT/CT offers low capacitance inputs with hysteresis for improved noise margins. TTL level outputs and multiple power and grounds reduce noise. The device also features -32/48mA drive capability for driving low impedance traces.

## FUNCTIONAL BLOCK DIAGRAM



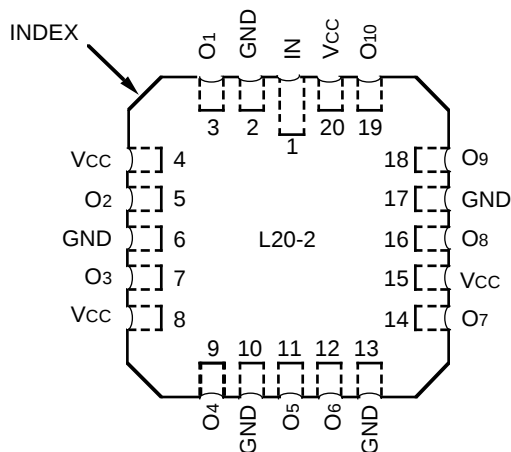
3017 drw 01

## PIN CONFIGURATIONS



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## DIP/SOIC/SSOP/QSOP/CERPACK TOP VIEW



## LCC TOP VIEW

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MILITARY AND COMMERCIAL TEMPERATURE RANGES

OCTOBER 1995

## PIN DESCRIPTION

| Pin Names | Description |
|-----------|-------------|
| IN        | Input       |
| Ox        | Outputs     |

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## CAPACITANCE ( $T_A = +25^\circ\text{C}$ , $f = 1.0\text{MHz}$ )

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 4.5  | 6.0  | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 5.5  | 8.0  | pF   |

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### NOTE:

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

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

| Symbol                           | Rating                               | Commercial                   | Military                     | Unit |
|----------------------------------|--------------------------------------|------------------------------|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | −0.5 to +7.0                 | −0.5 to +7.0                 | V    |
| V <sub>TERM</sub> <sup>(3)</sup> | Terminal Voltage with Respect to GND | −0.5 to V <sub>CC</sub> +0.5 | −0.5 to V <sub>CC</sub> +0.5 | V    |
| T <sub>A</sub>                   | Operating Temperature                | 0 to +70                     | −55 to +125                  | °C   |
| T <sub>BIAS</sub>                | Temperature Under Bias               | −55 to +125                  | −65 to +135                  | °C   |
| T <sub>STG</sub>                 | Storage Temperature                  | −55 to +125                  | −65 to +150                  | °C   |
| I <sub>OUT</sub>                 | DC Output Current                    | −60 to +120                  | −60 to +120                  | mA   |

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### 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. No terminal voltage may exceed V<sub>CC</sub> by +0.5V unless otherwise noted.
2. Input and V<sub>CC</sub> terminals.
3. Output and I/O terminals.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified

Commercial:  $T_A = 0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$ ; Military:  $T_A = -55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol                              | Parameter                                                             | Test Conditions <sup>(1)</sup>                             |                                                                               | Min. | Typ. <sup>(2)</sup> | Max.    | Unit          |
|-------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------|------|---------------------|---------|---------------|
| $V_{IH}$                            | Input HIGH Level                                                      | Guaranteed Logic HIGH Level                                |                                                                               | 2.0  | —                   | —       | V             |
| $V_{IL}$                            | Input LOW Level                                                       | Guaranteed Logic LOW Level                                 |                                                                               | —    | —                   | 0.8     | V             |
| $I_{IH}$                            | Input HIGH Current <sup>(5)</sup>                                     | $V_{CC} = \text{Max.}$                                     | $V_I = 2.7\text{V}$                                                           | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{IL}$                            | Input LOW Current <sup>(5)</sup>                                      | $V_{CC} = \text{Max.}$                                     | $V_I = 0.5\text{V}$                                                           | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZH}$                           | High Impedance Output Current<br>(3-State Output pins) <sup>(5)</sup> | $V_{CC} = \text{Max.}$                                     | $V_O = 2.7\text{V}$                                                           | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZL}$                           |                                                                       |                                                            | $V_O = 0.5\text{V}$                                                           | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_I$                               | Input HIGH Current <sup>(5)</sup>                                     | $V_{CC} = \text{Max.}$ , $V_I = V_{CC} (\text{Max.})$      |                                                                               | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $V_{IK}$                            | Clamp Diode Voltage                                                   | $V_{CC} = \text{Min.}$ , $I_{IN} = -18\text{mA}$           |                                                                               | —    | -0.7                | -1.2    | V             |
| $I_{OS}$                            | Short Circuit Current                                                 | $V_{CC} = \text{Max.}$ <sup>(3)</sup> , $V_O = \text{GND}$ |                                                                               | -60  | -120                | -225    | mA            |
| $V_{OH}$                            | Output HIGH Voltage                                                   | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH}$ or $V_{IL}$    | $I_{OH} = -12\text{mA MIL.}$<br>$I_{OH} = -15\text{mA COM'L.}$                | 2.4  | 3.3                 | —       | V             |
|                                     |                                                                       |                                                            | $I_{OH} = -24\text{mA MIL.}$<br>$I_{OH} = -32\text{mA COM'L.}$ <sup>(4)</sup> | 2.0  | 3.0                 | —       |               |
| $V_{OL}$                            | Output LOW Voltage                                                    | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH}$ or $V_{IL}$    | $I_{OL} = 32\text{mA MIL.}$<br>$I_{OL} = 48\text{mA COM'L.}$                  | —    | 0.3                 | 0.55    | V             |
| $I_{OFF}$                           | Input/Output Power Off Leakage <sup>(5)</sup>                         | $V_{CC} = 0\text{V}$ , $V_{IN}$ or $V_O \leq 4.5\text{V}$  |                                                                               | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $V_H$                               | Input Hysteresis for all inputs                                       | —                                                          |                                                                               | —    | 150                 | —       | mV            |
| $I_{CCL}$<br>$I_{CCH}$<br>$I_{CCZ}$ | Quiescent Power Supply Current                                        | $V_{CC} = \text{Max.}$ , $V_{IN} = \text{GND}$ or $V_{CC}$ |                                                                               | —    | 5                   | 500     | $\mu\text{A}$ |

### NOTES:

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- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.
- Not more than one output should be tested at one time. Duration of the test should not exceed one second.
- Duration of the condition can not exceed one second.
- The test limit for this parameter is  $\pm 5\mu\text{A}$  at  $T_A = -55^{\circ}\text{C}$ .

## POWER SUPPLY CHARACTERISTICS

| Symbol          | Parameter                                         | Test Conditions <sup>(1)</sup>                                                                     |                                                 | Min. | Typ. <sup>(2)</sup> | Max.                | Unit       |
|-----------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------|------|---------------------|---------------------|------------|
| $\Delta I_{CC}$ | Quiescent Power Supply Current<br>TTL Inputs HIGH | $V_{CC} = \text{Max.}$<br>$V_{IN} = 3.4\text{V}$                                                   |                                                 | —    | 0.5                 | 2.0                 | mA         |
| $I_{CCD}$       | Dynamic Power Supply Current <sup>(3)</sup>       | $V_{CC} = \text{Max.}$<br>Input toggling<br>50% Duty Cycle<br>Outputs Open                         | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$      | —    | 0.4                 | 0.6                 | mA/<br>MHz |
| $I_C$           | Total Power Supply Current <sup>(5)</sup>         | $V_{CC} = \text{Max.}$<br>Input toggling<br>50% Duty Cycle<br>Outputs Open<br>$f_i = 50\text{MHz}$ | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$      | —    | 20.0                | 30.5 <sup>(4)</sup> | mA         |
|                 |                                                   |                                                                                                    | $V_{IN} = 3.4\text{V}$<br>$V_{IN} = \text{GND}$ | —    | 20.3                | 31.3 <sup>(4)</sup> |            |

### NOTES:

3017 tbl 05

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.
- Per TTL driven input; ( $V_{IN} = 3.4\text{V}$ ); all other inputs at  $V_{CC}$  or  $\text{GND}$ .
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_i)$   
 $I_{CC} = \text{Quiescent Current } (I_{CCL}, I_{CCH} \text{ and } I_{CCZ})$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4\text{V})$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_i = \text{Input Frequency}$   
All currents are in milliamps and all frequencies are in megahertz.

# SWITCHING CHARACTERISTICS OVER OPERATING RANGE<sup>(3,4)</sup>

| Symbol                               | Parameter                                                                                                                        | Conditions <sup>(1)</sup>                                                                                                       | IDT54/74FCT807BT    |      |                     |      | IDT54/74FCT807CT    |      |                     |      | Unit |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|                                      |                                                                                                                                  |                                                                                                                                 | Com'l.              |      | Mil.                |      | Com'l.              |      | Mil.                |      |      |
|                                      |                                                                                                                                  |                                                                                                                                 | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay                                                                                                                | 50Ω to V <sub>CC</sub> /2,<br>C <sub>L</sub> = 10pF<br>(See figure 1)<br><br>or 50Ω ac<br>termination,<br>C <sub>L</sub> = 10pF | 1.3                 | 2.7  |                     |      | 1.3                 | 2.5  |                     |      | ns   |
| t <sub>R</sub>                       | Output Rise Time                                                                                                                 |                                                                                                                                 | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| t <sub>F</sub>                       | Output Fall Time                                                                                                                 |                                                                                                                                 | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| tsk(o)                               | Output skew: skew between outputs of same package (same transition)                                                              | termination,<br>C <sub>L</sub> = 10pF                                                                                           | —                   | 0.5  | —                   |      | —                   | 0.25 | —                   |      | ns   |
| tsk(p)                               | Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> – t <sub>PLH</sub>  )                            | (See figure 2)<br>f ≤ 100MHz                                                                                                    | —                   | 0.5  | —                   |      | —                   | 0.35 | —                   |      | ns   |
| tsk(t)                               | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade | Outputs<br>connected in<br>groups of two                                                                                        | —                   | 0.9  | —                   |      | —                   | 0.65 | —                   |      | ns   |

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| Symbol       | Parameter                                                                                                                        | Conditions <sup>(1)</sup>                    | IDT54/74FCT807BT    |      |                     |      | IDT54/74FCT807CT    |      |                     |      | Unit |
|--------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|              |                                                                                                                                  |                                              | Com'l.              |      | Mil.                |      | Com'l.              |      | Mil.                |      |      |
|              |                                                                                                                                  |                                              | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| tPLH<br>tPHL | Propagation Delay                                                                                                                | CL = 30pF<br>f ≤ 67MHz<br><br>(See figure 3) | 1.5                 | 3.8  |                     |      | 1.5                 | 3.5  |                     |      | ns   |
| tR           | Output Rise Time                                                                                                                 |                                              | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| tF           | Output Fall Time                                                                                                                 |                                              | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| tsk(o)       | Output skew: skew between outputs of same package (same transition)                                                              |                                              | —                   | 0.5  | —                   |      | —                   | 0.25 | —                   |      | ns   |
| tsk(p)       | Pulse skew: skew between opposite transitions of same output ( tPHL – tPLH )                                                     |                                              | —                   | 0.5  | —                   |      | —                   | 0.35 | —                   |      | ns   |
| tsk(t)       | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade |                                              | —                   | 0.9  | —                   |      | —                   | 0.75 | —                   |      | ns   |

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| Symbol                               | Parameter                                                                                                                        | Conditions <sup>(1)</sup>                | IDT54/74FCT807BT    |      |                     |      | IDT54/74FCT807CT    |      |                     |      | Unit |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|                                      |                                                                                                                                  |                                          | Com'l.              |      | Mil.                |      | Com'l.              |      | Mil.                |      |      |
|                                      |                                                                                                                                  |                                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay                                                                                                                | CL = 50pF<br>f ≤ 40MHz<br>(See figure 4) | 1.5                 | 3.8  |                     |      | 1.5                 | 3.5  |                     |      | ns   |
| t <sub>R</sub>                       | Output Rise Time                                                                                                                 |                                          | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| t <sub>F</sub>                       | Output Fall Time                                                                                                                 |                                          | —                   | 1.5  | —                   |      | —                   | 1.5  | —                   |      | ns   |
| tsk(o)                               | Output skew: skew between outputs of same package (same transition)                                                              |                                          | —                   | 0.5  | —                   |      | —                   | 0.35 | —                   |      | ns   |
| tsk(p)                               | Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> – t <sub>PLH</sub>  )                            |                                          | —                   | 0.60 | —                   |      | —                   | 0.45 | —                   |      | ns   |
| tsk(t)                               | Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade |                                          | —                   | 1.0  | —                   |      | —                   | 0.75 | —                   |      | ns   |

## NOTES:

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- See test circuits and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- t<sub>PLH</sub>, t<sub>PHL</sub>, tsk(t) are production tested. All other parameters guaranteed but not production tested.
- Propagation delay range indicated by Min. and Max. limit is due to V<sub>CC</sub>, operating temperature and process parameters. These propagation delay limits do not imply skew.

TEST CIRCUITS

50Ω TO Vcc/2, CL = 10pF

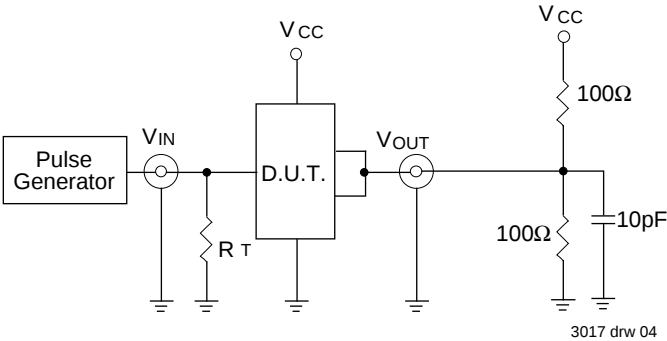
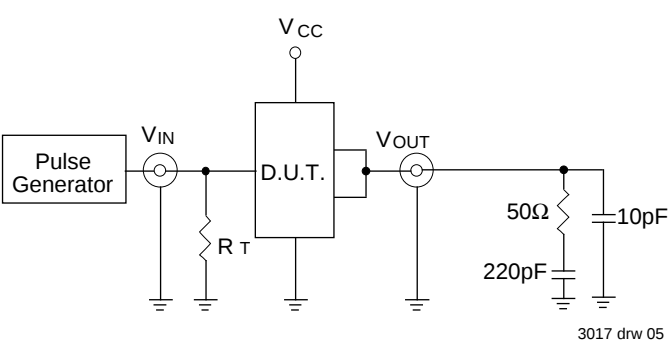


Figure 1.

50Ω AC TERMINATION, CL = 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 2.

CL = 30pF CIRCUIT

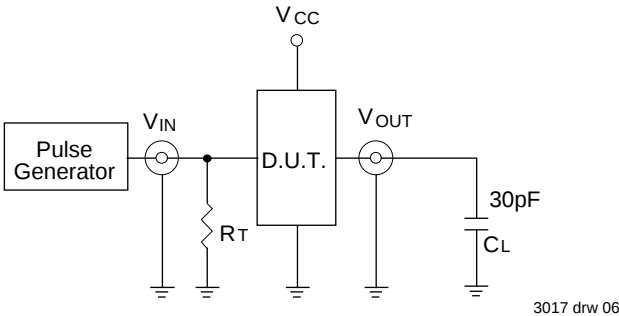


Figure 3.

CL = 50pF CIRCUIT

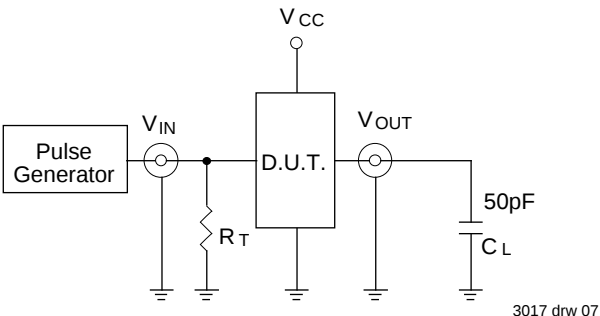


Figure 4.

ENABLE AND DISABLE TIME CIRCUIT

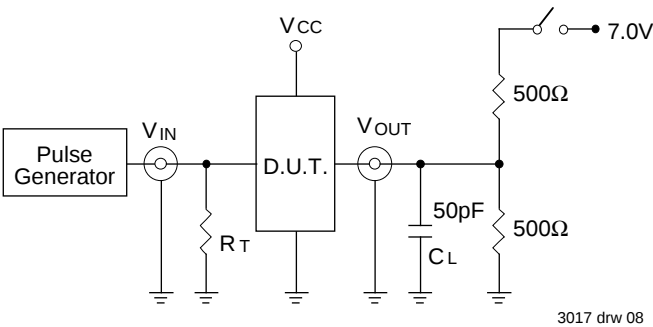


Figure 5.

ENABLE AND DISABLE TIME SWITCH POSITION

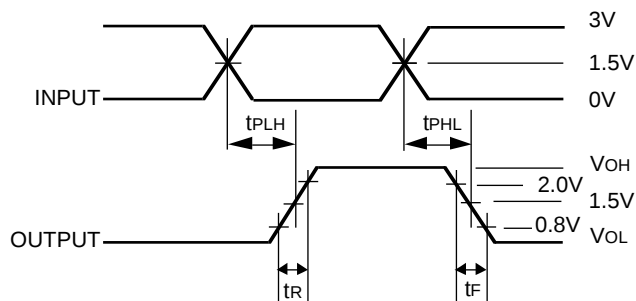
| Test                        | Switch |
|-----------------------------|--------|
| Disable LOW<br>Enable LOW   | Closed |
| Disable HIGH<br>Enable HIGH | Open   |

**DEFINITIONS:**  
CL= Load capacitance: includes jig and probe capacitance.  
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

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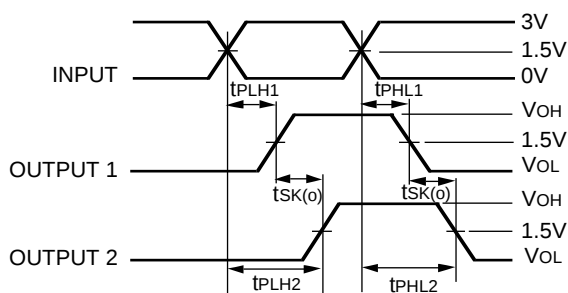
## TEST WAVEFORMS

### PACKAGE DELAY



3017 drw 09

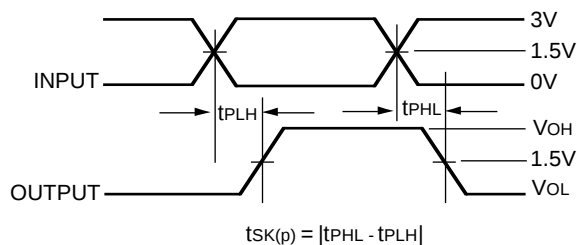
### OUTPUT SKEW- $t_{SK(o)}$



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

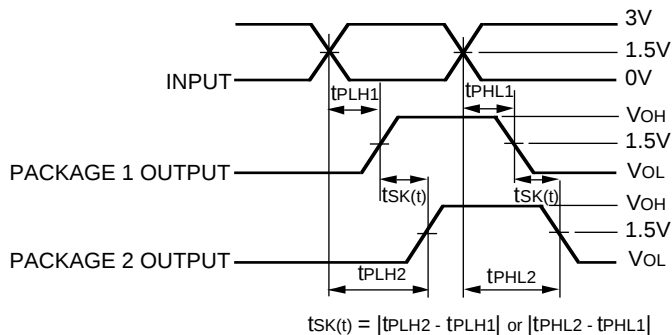
3017 drw 10

### PULSE SKEW - $t_{SK(p)}$



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### PACKAGE SKEW - $t_{SK(t)}$

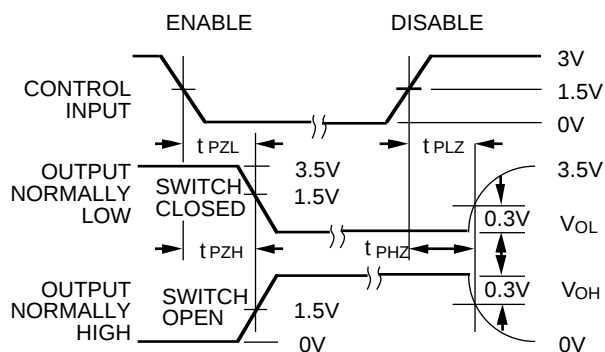


$$t_{SK(t)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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

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### ENABLE AND DISABLE TIMES

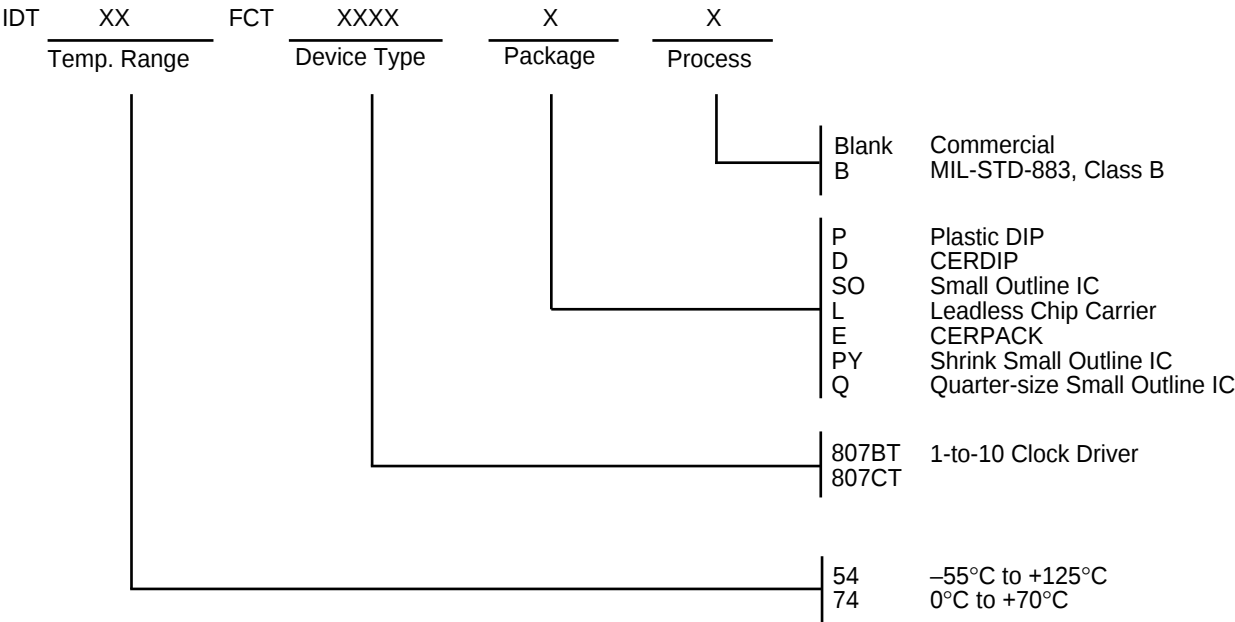


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#### NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
2. Pulse Generator for All Pulses:  $f \leq 1.0\text{MHz}$ ;  $t_f \leq 2.5\text{ns}$ ;  $t_r \leq 2.5\text{ns}$

ORDERING INFORMATION



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