Integrated Device Technology, Inc.

# HIGH-PERFORMANCE CMOS BUS TRANSCEIVERS

**IDT54/74FCT861A/B**
**IDT54/74FCT863A/B**

## FEATURES:

- Equivalent to AMD's Am29861-64 bipolar registers in pinout/function, speed and output drive over full temperature and voltage supply extremes
- IDT54/74FCT861A/863A equivalent to FAST™ speed
- **IDT54/74FCT861B/863B 25% faster than FAST**
- High-speed symmetrical bidirectional transceivers
- $I_{OL}$ = 48mA (commercial) and 32mA (military)
- Clamp diodes on all inputs for ringing suppression
- CMOS power levels (1mW typ. static)
- TTL input and output level compatible
- CMOS output level compatible
- Substantially lower input current levels than AMD's bipolar Am29800 Series (5µA max.)
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B

## DESCRIPTION:

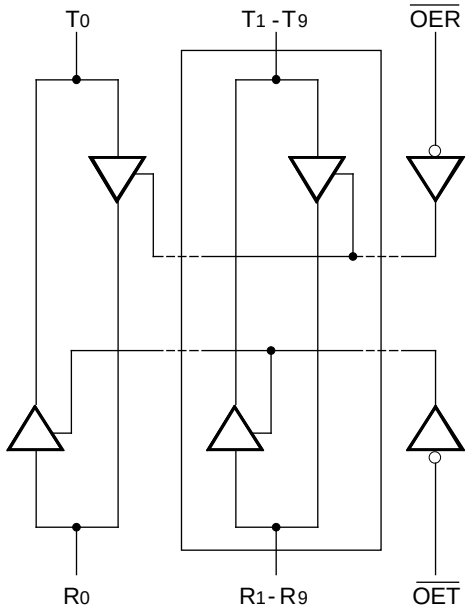
The IDT54/74FCT800 series is built using an advanced dual metal CMOS technology.

The IDT54/74FCT860 series bus transceivers provide high-performance bus interface buffering for wide data/address paths or buses carrying parity. The IDT54/74FCT863 9-bit transceivers have NAND-ed output enables for maximum control flexibility.

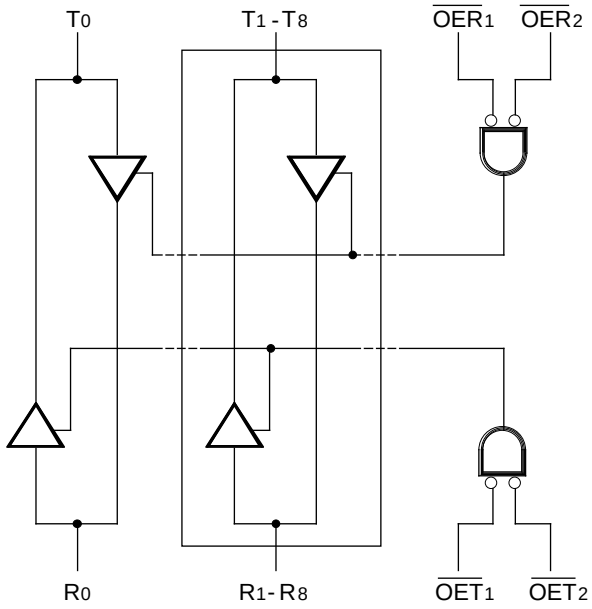
All of the IDT54/74FCT800 high-performance interface family are designed for high-capacitance load drive capability while providing low-capacitance bus loading at both inputs and outputs. All inputs have clamp diodes and all outputs are designed for low-capacitance bus loading in the high- impedance state.

## FUNCTIONAL BLOCK DIAGRAMS

**IDT54/74FCT861**




**IDT54/74FCT863**

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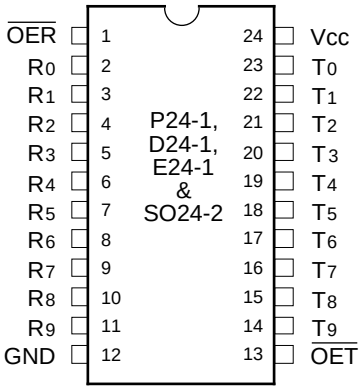
## PRODUCT SELECTOR GUIDE

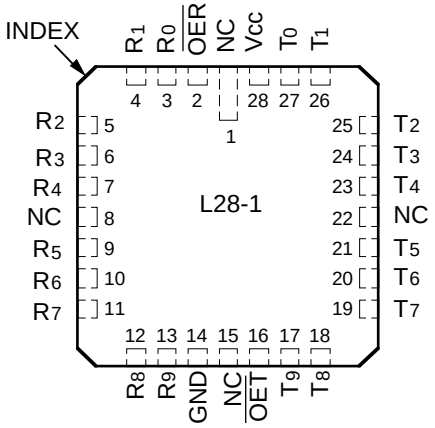
| | Device | |
|---|---|---|
| | **10-Bit** | **9-Bit** |
| Non-inverting | IDT54/74FCT861 | IDT54/74FCT863 |

## PIN CONFIGURATIONS

### IDT54/74FCT861 10-BIT TRANSCEIVERS

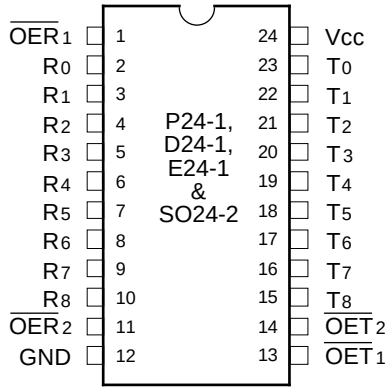



**DIP/CERPACK/SOIC**
**TOP VIEW**

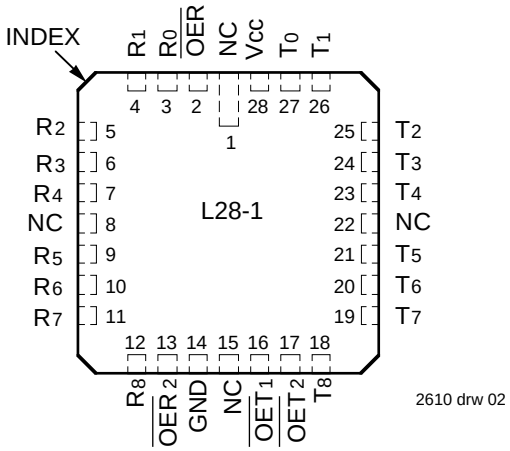



**LCC**
**TOP VIEW**

### IDT54/74FCT863 9-BIT TRANSCEIVERS



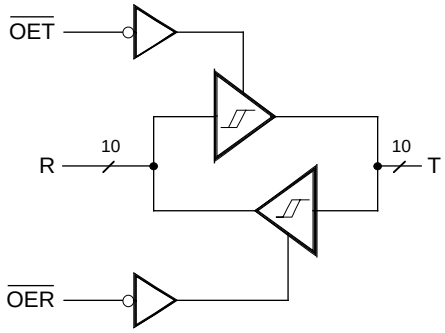

**DIP/CERPACK/SOIC**
**TOP VIEW**



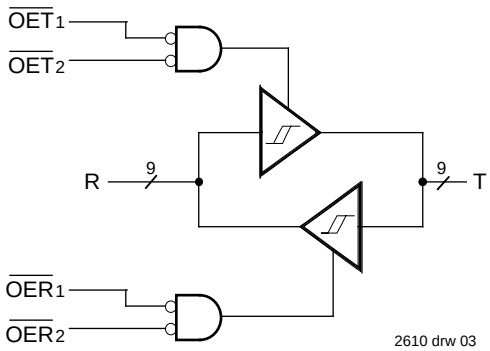

**LCC**
**TOP VIEW**

## LOGIC SYMBOLS

### IDT54/74FCT861




### IDT54/74FCT863



## PIN DESCRIPTION

| Name | I/O | Description |
|---|---|---|
| **IDT54/74FCT861** | | |
| $\overline{OER}$ | I | When LOW in conjunction with $\overline{OET}$ HIGH activates the RECEIVE mode. |
| $\overline{OET}$ | I | When LOW in conjunction with $\overline{OER}$ HIGH activates the TRANSMIT mode. |
| $R_I$ | I/O | 10-bit RECEIVE input/output. |
| $T_I$ | I/O | 10-bit TRANSMIT input/output. |
| **IDT54/74FCT863** | | |
| $\overline{OER}_I$ | I | When LOW in conjunction with $\overline{OET}_I$ HIGH activates the RECEIVE mode. |
| $\overline{OET}_I$ | I | When LOW in conjunction with $\overline{OER}_I$ HIGH activates the TRANSMIT mode. |
| $R_I$ | I/O | 9-bit RECEIVE input/output. |
| $T_I$ | I/O | 9-bit TRANSMIT input/output. |

2610 tbl 01

## FUNCTION TABLE[1]

### IDT54/74FCT861/863 (Non-inverting)

| Inputs | | | | Outputs | | |
|---|---|---|---|---|---|---|
| $\overline{OET}$ | $\overline{OER}$ | $R_I$ | $T_I$ | $R_I$ | $T_I$ | Function |
| L | H | L | N/A | N/A | L | Transmitting |
| L | H | H | N/A | N/A | H | Transmitting |
| H | L | N/A | L | L | N/A | Receiving |
| H | L | N/A | H | H | N/A | Receiving |
| H | H | X | X | Z | Z | High Z |

**NOTE:** 2610 tbl 02

1. H = HIGH, L = LOW, Z = High Impedance, X = Don't Care, N/A = Not Applicable.

## ABSOLUTE MAXIMUM RATINGS[1]

| Symbol | Rating | Commercial | Military | Unit |
|---|---|---|---|---|
| $V_{TERM}$[2] | Terminal Voltage with Respect to GND | –0.5 to +7.0 | –0.5 to +7.0 | V |
| $V_{TERM}$[3] | Terminal Voltage with Respect to GND | –0.5 to $V_{CC}$ | –0.5 to $V_{CC}$ | V |
| $T_A$ | Operating Temperature | 0 to +70 | –55 to +125 | °C |
| $T_{BIAS}$ | Temperature Under Bias | –55 to +125 | –65 to +135 | °C |
| $T_{STG}$ | Storage Temperature | –55 to +125 | –65 to +150 | °C |
| $P_T$ | Power Dissipation | 0.5 | 0.5 | W |
| $I_{OUT}$ | DC Output Current | 120 | 120 | mA |

**NOTES:** 2610 tbl 03

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 $V_{CC}$ by +0.5V unless otherwise noted.
2. Inputs and $V_{CC}$ terminals only.
3. Outputs and I/O terminals only.

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

| Symbol | Parameter[1] | Conditions | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | 6 | 10 | pF |
| $C_{I/O}$ | I/O Capacitance | $V_{OUT}$ = 0V | 8 | 12 | pF |

**NOTE:** 2610 tbl 04

1. This parameter is guaranteed by characterization but not tested.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified: $V_{LC}$ = 0.2V, $V_{HC}$ = $V_{CC}$ – 0.2V
Commercial: $T_A$ = 0°C to +70°C, $V_{CC}$ = 5.0V ± 5%; Military: $T_A$ = –55°C to +125°C, $V_{CC}$ = 5.0V ± 10%

| Symbol | Parameter | Test Conditions[1] | | Min. | Typ.[2] | 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 (Except I/O pins) | $V_{CC}$ = Max. | $V_I$ = $V_{CC}$ | — | — | 5 | µA |
| | | | $V_I$ = 2.7V | — | — | 5[4] | |
| $I_{IL}$ | Input LOW Current (Except I/O pins) | | $V_I$ = 0.5V | — | — | –5[4] | µA |
| | | | $V_I$ = GND | — | — | –5 | |
| $I_{IH}$ | Input HIGH Current (I/O pins Only) | $V_{CC}$ = Max. | $V_I$ = $V_{CC}$ | — | — | 15 | |
| | | | $V_I$ = 2.7V | — | — | 15[4] | |
| $I_{IL}$ | Input LOW Current (I/O pins Only) | | $V_I$ = 0.5V | — | — | –15[4] | |
| | | | $V_I$ = GND | — | — | –15 | |
| $V_{IK}$ | Clamp Diode Voltage | $V_{CC}$ = Min., $I_N$ = –18mA | | — | –0.7 | –1.2 | V |
| $I_{OS}$ | Short Circuit Current | $V_{CC}$ = Max.[3], $V_O$ = GND | | –75 | –120 | — | mA |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = 3V, $V_{IN}$ = $V_{LC}$ or $V_{HC}$, $I_{OH}$ = –32µA | | $V_{HC}$ | $V_{CC}$ | — | V |
| | | $V_{CC}$ = Min. $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –300µA | $V_{HC}$ | $V_{CC}$ | — | |
| | | | $I_{OH}$ = –15mA MIL. | 2.4 | 4.3 | — | |
| | | | $I_{OH}$ = –24mA COM'L. | 2.4 | 4.3 | — | |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = 3V, $V_{IN}$ = $V_{LC}$ or $V_{HC}$, $I_{OL}$ = 300µA | | — | GND | $V_{LC}$ | V |
| | | $V_{CC}$ = Min. $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 300µA | — | GND | $V_{LC}$[4] | |
| | | | $I_{OL}$ = 32mA MIL.[5] | — | 0.3 | 0.5 | |
| | | | $I_{OL}$ = 48mA COM'L.[5] | — | 0.3 | 0.5 | |

2610 tbl 05

**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 $V_{CC}$ = 5.0V, +25°C ambient and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
4. This parameter is guaranteed but not tested.
5. These are maximum $I_{OL}$ values per output, for 10 outputs turned on simultaneously. Total maximum $I_{OL}$ (all outputs) is 480mA for commercial and 320mA for military. Derate $I_{OL}$ for number of outputs exceeding 10 turned on simultaneously.

## POWER SUPPLY CHARACTERISTICS

$V_{LC}$ = 0.2V; $V_{HC}$ = $V_{CC}$ – 0.2V

| Symbol | Parameter | Test Conditions[1] | | Min. | Typ.[2] | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Quiescent Power Supply Current | $V_{CC}$ = Max.<br>$V_{IN} \geq V_{HC}$ ; $V_{IN} \leq V_{LC}$ | | — | 0.2 | 1.5 | mA |
| $\Delta I_{CC}$ | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC}$ = Max.<br>$V_{IN}$ = 3.4V[3] | | — | 0.5 | 2.0 | mA |
| $I_{CCD}$ | Dynamic Power Supply Current[4] | $V_{CC}$ = Max., Outputs Open<br>$\overline{OER}$ or $\overline{OET}$ = GND<br>One Input Toggling<br>50% Duty Cycle | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq V_{LC}$ | — | 0.15 | 0.25 | mA/ MHz |
| $I_C$ | Total Power Supply Current[6] | $V_{CC}$ = Max., Outputs Open<br>$f_i$ = 10MHz<br>50% Duty Cycle | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq V_{LC}$<br>(FCT) | — | 1.7 | 4.0 | mA |
| | | $\overline{OER}$ or $\overline{OET}$ = GND<br>One Bit Toggling | $V_{IN}$ = 3.4V<br>$V_{IN}$ = GND | — | 2.0 | 5.0 | |
| | | $V_{CC}$ = Max., Outputs Open<br>$f_i$ = 2.5MHz<br>50% Duty Cycle | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq V_{LC}$<br>(FCT) | — | 3.2 | 6.5[5] | |
| | | $\overline{OER}$ or $\overline{OET}$ = GND<br>Eight Bits Toggling | $V_{IN}$ = 3.4V<br>$V_{IN}$ = GND | — | 5.2 | 14.5[5] | |

**NOTES:** 2610 tbl 06

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 $V_{CC}$ = 5.0V, +25°C ambient.
3. Per TTL driven input ($V_{IN}$ = 3.4V); 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 $I_{CC}$ formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}(f_{CP}/2 + f_i N_i)$
   $I_{CC}$ = Quiescent Current
   $\Delta I_{CC}$ = Power Supply Current for a TTL High Input ($V_{IN}$ = 3.4V)
   $D_H$ = 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)
   $f_{CP}$ = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   $f_i$ = Input Frequency
   $N_i$ = Number of Inputs at $f_i$
   All currents are in milliamps and all frequencies are in megahertz.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol | Parameter | Condition[1] | FCT861A/863A | | | | FCT861B/863B | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
| | | | Min.[2] | Max. | Min.[2] | Max. | Min.[2] | Max. | Min.[2] | Max. | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$R_I$ to $T_I$ or $T_I$ to $R_I$<br>FCT861/863 | $C_L$ = 50pF<br>$R_L$ = 500Ω | 1.5 | 8.0 | 1.5 | 9.0 | 1.5 | 6.0 | 1.5 | 6.5 | ns |
| | | $C_L$ = 300pF[3]<br>$R_L$ = 500Ω | 1.5 | 15.0 | 1.5 | 17.0 | 1.5 | 13.0 | 1.5 | 14.0 | |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time<br>$\overline{OET}$ to $T_I$ or $\overline{OER}$ to $R_I$ | $C_L$ = 50pF<br>$R_L$ = 500Ω | 1.5 | 12.0 | 1.5 | 13.0 | 1.5 | 8.0 | 1.5 | 9.0 | ns |
| | | $C_L$ = 300pF[3]<br>$R_L$ = 500Ω | 1.5 | 20.0 | 1.5 | 22.0 | 1.5 | 15.0 | 1.5 | 16.0 | |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time<br>$\overline{OET}$ to $T_I$ or $\overline{OER}$ to $R_I$ | $C_L$ = 5pF[3]<br>$R_L$ = 500Ω | 1.5 | 9.0 | 1.5 | 9.0 | 1.5 | 6.0 | 1.5 | 7.0 | ns |
| | | $C_L$ = 50pF<br>$R_L$ = 500Ω | 1.5 | 10.0 | 1.5 | 10.0 | 1.5 | 7.0 | 1.5 | 8.0 | |

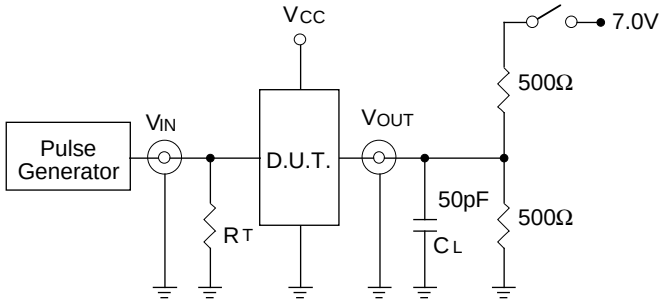
**NOTES:**

2610 tbl 07

1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. This condition guaranteed but not tested.

# TEST CIRCUITS AND WAVEFORMS

## TEST CIRCUITS FOR ALL OUTPUTS




## SWITCH POSITION

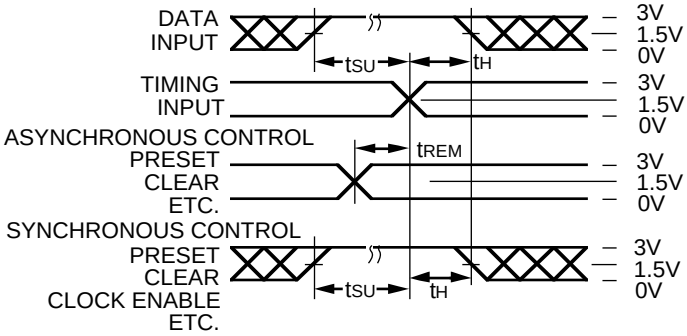
| Test | Switch |
|---|---|
| Open Drain<br>Disable Low<br>Enable Low | Closed |
| All Other Tests | Open |

2610 tbl 08

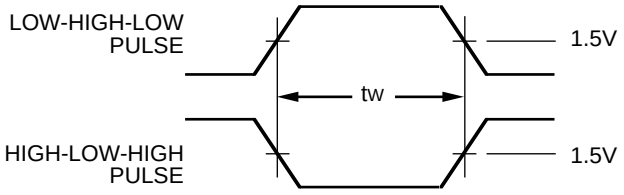
**DEFINITIONS:**

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

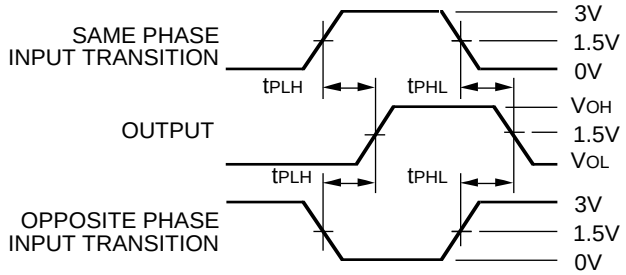
## SET-UP, HOLD AND RELEASE TIMES



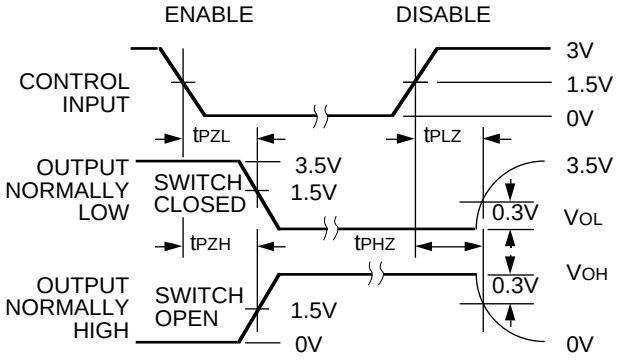

## PULSE WIDTH




## PROPAGATION DELAY




## ENABLE AND DISABLE TIMES

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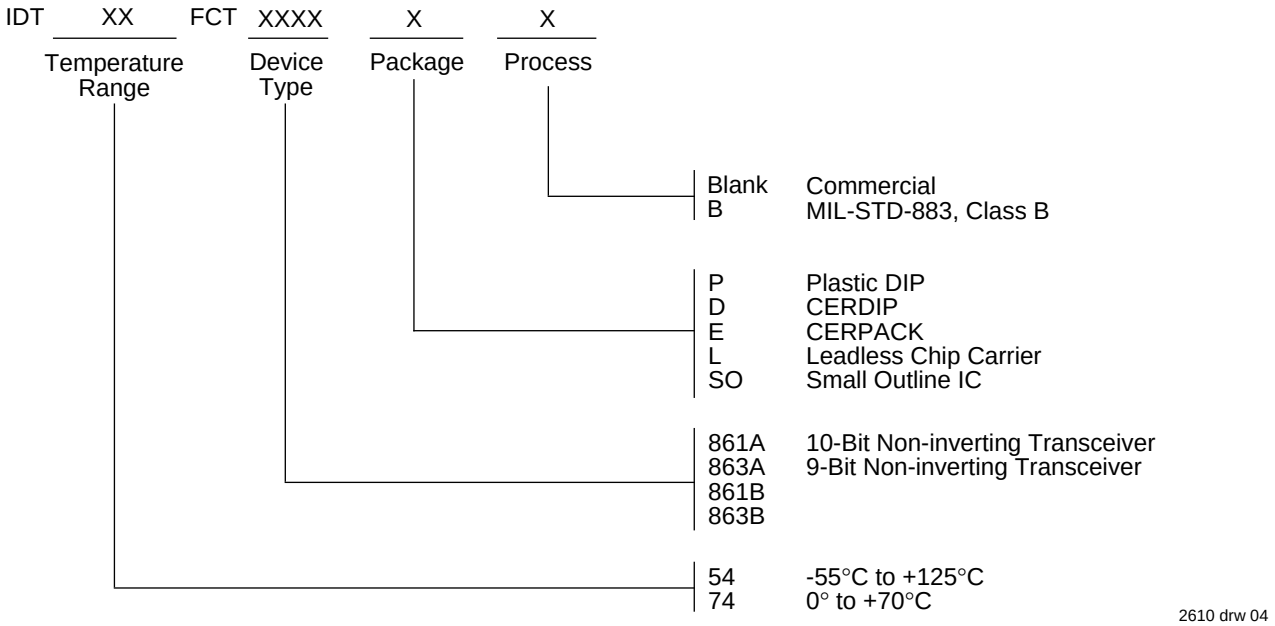
**NOTES:**

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

## ORDERING INFORMATION

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