Integrated Device Technology, Inc.

# 3.3V CMOS 10-BIT BUFFERS

**IDT54/74FCT3827A/B**

## FEATURES:

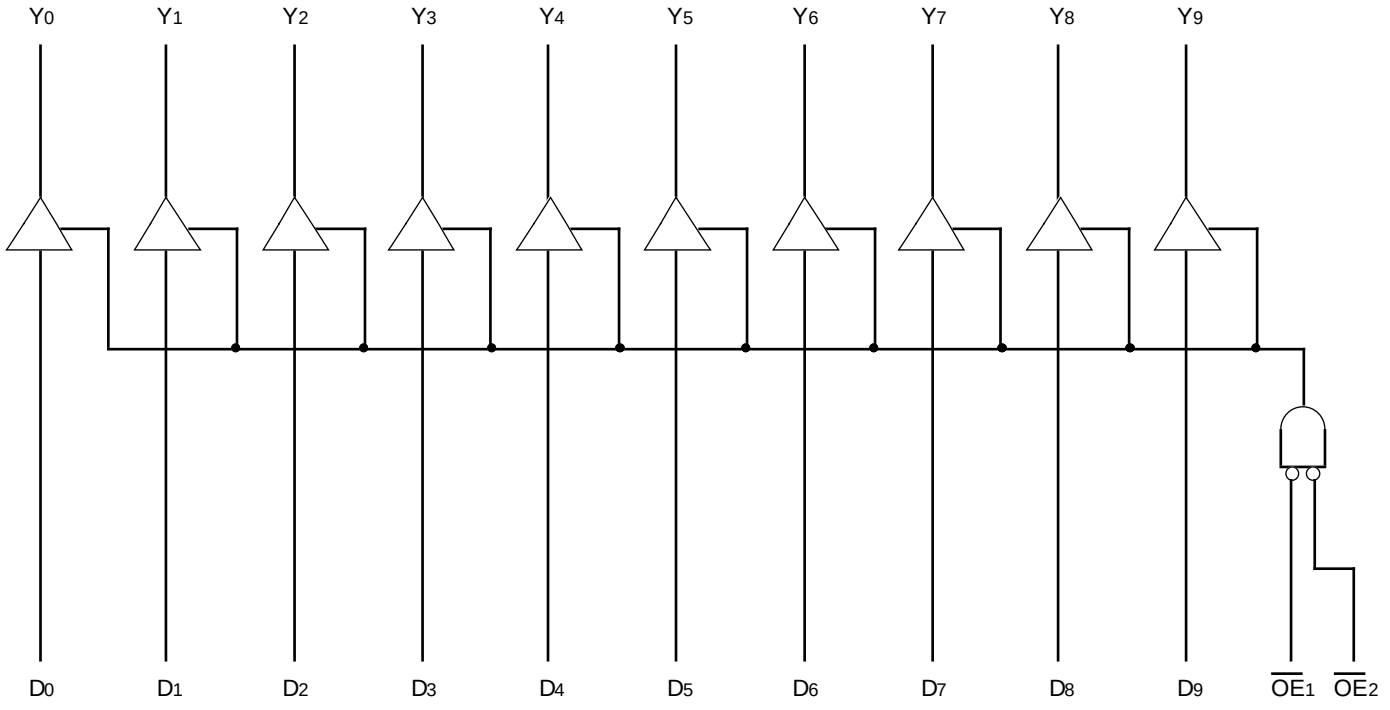
- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 25 mil Center SSOP Packages
- Extended commercial range of -40°C to +85°C
- $V_{CC}$ = 3.3V ±0.3V, Normal Range or $V_{CC}$ = 2.7V to 3.6V, Extended Range
- CMOS power levels (0.4µW typ. static)
- Rail-to-Rail output swing for increased noise margin
- Military product compliant to MIL-STD-883, Class B

## DESCRIPTION:

The FCT3827A/B 10-bit bus drivers are built using an advanced dual metal CMOS technology. These high speed, low power buffers are ideal for high-performance bus interface buffering for wide data/address paths or buses carrying parity. The 10-bit buffers have NAND-ed output enables for maximum control flexibility.

All of the FCT3827 high performance interface components are designed for high-capacitance load drive capability, while providing low-capacitance bus loading at both inputs and outputs.

## FUNCTIONAL BLOCK DIAGRAM

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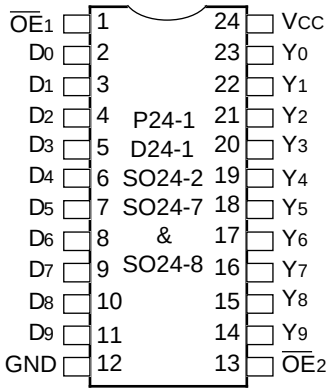
## PIN CONFIGURATIONS

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**DIP/SOIC/SSOP/QSOP**
**TOP VIEW**

## PIN DESCRIPTION

| Names | I/O | Description |
|---|---|---|
| $\overline{OE}_I$ | I | When both are LOW the outputs are enabled. When either one or both are HIGH the outputs are High Z. |
| $D_I$ | I | 10-bit data input. |
| $Y_I$ | O | 10-bit data output. |

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## FUNCTION TABLE(1)

| Inputs | | | Output | |
|---|---|---|---|---|
| $\overline{OE}_1$ | $\overline{OE}_2$ | $D_I$ | $Y_I$ | Function |
| L | L | L | L | Transparent |
| L | L | H | H | |
| H | X | X | Z | Three-State |
| X | H | X | Z | |

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**NOTE:**
1. H = HIGH Voltage Level
   X = Don't Care
   L = LOW Voltage Level
   Z = High Impedance

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Rating | Commercial | Military | Unit |
|---|---|---|---|---|
| $V_{TERM}$(2) | Terminal Voltage with Respect to GND | –0.5 to +4.6 | –0.5 to +4.6 | V |
| $V_{TERM}$(3) | Terminal Voltage with Respect to GND | –0.5 to +7.0 | –0.5 to +7.0 | V |
| $V_{TERM}$(4) | Terminal Voltage with Respect to GND | –0.5 to $V_{CC}$ + 0.5 | –0.5 to $V_{CC}$ + 0.5 | V |
| $T_A$ | Operating Temperature | –40 to +85 | –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 | 1.0 | 1.0 | W |
| $I_{OUT}$ | DC Output Current | –60 to +60 | –60 to +60 | 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.
2. Vcc terminals.
3. Input terminals.
4. Output 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 | 3.5 | 6.0 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = 0V | 4.0 | 8.0 | pF |

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

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Commercial: $T_A$ = –40°C to +85°C, $V_{CC}$ = 2.7V to 3.6V; Military: $T_A$ = –55°C to +125°C, $V_{CC}$ = 2.7V to 3.6V

| Symbol | Parameter | Test Conditions[1] | | Min. | Typ.[2] | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Level (Input pins) | Guaranteed Logic HIGH Level | | 2.0 | — | 5.5 | V |
| | Input HIGH Level (I/O pins) | | | 2.0 | — | $V_{CC}$+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)[6] | $V_{CC}$ = Max. | $V_I$ = 5.5V | — | — | ±1 | µA |
| | Input HIGH Current (I/O pins)[6] | | $V_I$ = $V_{CC}$ | — | — | ±1 | |
| $I_{IL}$ | Input LOW Current (Input pins)[6] | | $V_I$ = GND | — | — | ±1 | |
| | Input LOW Current (I/O pins)[6] | | $V_I$ = GND | — | — | ±1 | |
| $I_{OZH}$ | High Impedance Output Current | $V_{CC}$ = Max. | $V_O$ = $V_{CC}$ | — | — | ±1 | µA |
| $I_{OZL}$ | (3-State Output pins)[6] | | $V_O$ = 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 $V_{IL}$ | $I_{OH}$ = –3mA | 2.4 | 3.0 | — | |
| | | $V_{CC}$ = 3.0V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –6mA MIL. $I_{OH}$ = –8mA COM'L. | 2.4[5] | 3.0 | — | |
| $V_{OL}$ | 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 | 0.55 | |
| | | $V_{CC}$ = 3.0V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 24mA | — | 0.3 | 0.50 | |
| $I_{OS}$ | Short Circuit Current[4] | $V_{CC}$ = Max., $V_O$ = GND[3] | | –60 | –135 | –240 | mA |
| $V_H$ | Input Hysteresis | — | | — | 150 | — | mV |
| $I_{CCL}$ $I_{CCH}$ | Quiescent Power Supply Current | $V_{CC}$ = Max., $V_{IN}$ = GND or $V_{CC}$ | COM'L. | — | 0.1 | 10 | µA |
| $I_{CCZ}$ | | | MIL. | — | 0.1 | 100 | |

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**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 tested at one time. Duration of the test should not exceed one second.
4. This parameter is guaranteed but not tested.
5. $V_{OH}$ = $V_{CC}$ –0.6V at rated current.
6. The test limits for this parameter is ± 5µA at $T_A$ = –55°C.

## POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions[1] | | Min. | Typ.[2] | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $\Delta I_{CC}$ | Quiescent Power Supply Current | $V_{CC}$ = Max. | $V_{IN} = V_{CC} - 0.6V$[3] | — | 2.0 | 30 | µA |
| $I_{CCD}$ | Dynamic Power Supply Current[4] | $V_{CC}$ = Max.<br>Outputs Open<br>$\overline{OE}_1 = \overline{OE}_2$ = GND<br>One Input Toggling<br>50% Duty Cycle | $V_{IN} = V_{CC}$<br>$V_{IN}$ = GND | — | 60 | 85 | µA/<br>MHz |
| $I_C$ | Total Power Supply Current[6] | $V_{CC}$ = Max.<br>Outputs Open<br>fi = 10MHz<br>50% Duty Cycle<br>$\overline{OE}_1 = \overline{OE}_2$ = GND<br>One Bit Toggling | $V_{IN} = V_{CC}$<br>$V_{IN}$ = GND | — | 0.6 | 0.9 | mA |
| | | | $V_{IN} = V_{CC} - 0.6V$<br>$V_{IN}$ = GND | — | 0.6 | 0.9 | |
| | | $V_{CC}$ = Max.<br>Outputs Open<br>fi = 2.5MHz<br>50% Duty Cycle<br>$\overline{OE}_1 = \overline{OE}_2$ = GND<br>Ten Bits Toggling | $V_{IN} = V_{CC}$<br>$V_{IN}$ = GND | — | 1.5 | 2.1[5] | |
| | | | $V_{IN} = V_{CC} - 0.6V$<br>$V_{IN}$ = GND | — | 1.5 | 2.3[5] | |

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**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; 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. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP}/2 + f_i N_i)$
   $I_{CC}$ = Quiescent Current ($I_{CCL}$, $I_{CCH}$ and $I_{CCZ}$)
   $\Delta I_{CC}$ = Power Supply Current for a TTL High Input
   $D_H$ = 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)
   $N_{CP}$ = Number of Clock Inputs at $f_{CP}$
   $f_i$ = Input Frequency
   $N_i$ = Number of Inputs at fi

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE[3]

| | | | FCT3827A | | | | FCT3827B | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
| Symbol | Parameter | Condition[1] | Min.[2] | Max. | Min.[2] | Max. | Min.[2] | Max. | Min.[2] | Max. | Unit |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$D_I$ to $Y_I$ | $C_L$ = 50pF<br>$R_L$ = 500Ω | 1.5 | 8.0 | 1.5 | 9.0 | 1.5 | 5.0 | 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>$\overline{OE}_I$ to $Y_I$ | $C_L$ = 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 | 23.0 | 1.5 | 25.0 | 1.5 | 15.0 | 1.5 | 16.0 | |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time<br>$\overline{OE}_I$ to $Y_I$ | $C_L$ = 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 | |

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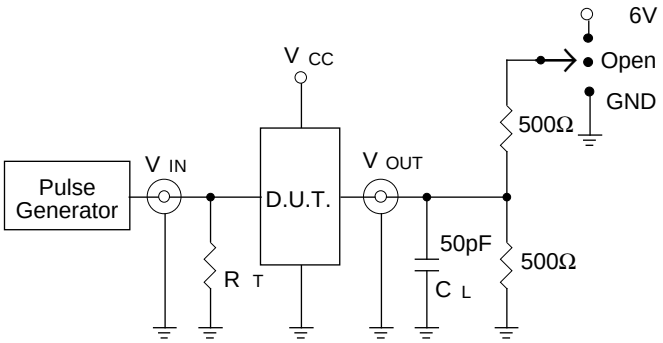
**NOTES:**
1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Propagation Delays and Enable/Disable times are with $V_{CC}$ = 3.3V ±0.3V, Normal Range. For $V_{CC}$ = 2.7V to 3.6V, Extended Range, all Propagation Delays and Enable/Disable times should be degraded by 20%.

# TEST CIRCUITS AND WAVEFORMS

## TEST CIRCUITS FOR ALL OUTPUTS

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## SWITCH POSITION

| Test | Switch |
|---|---|
| Open Drain<br>Disable Low<br>Enable Low | 6V |
| Disable High<br>Enable High | GND |
| All Other tests | Open |

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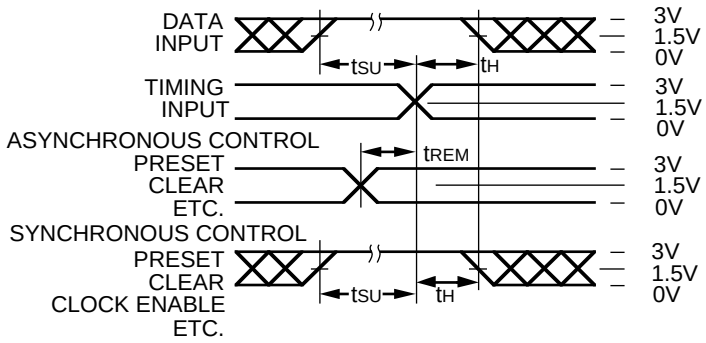
**DEFINITIONS:**

$C_L$= 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

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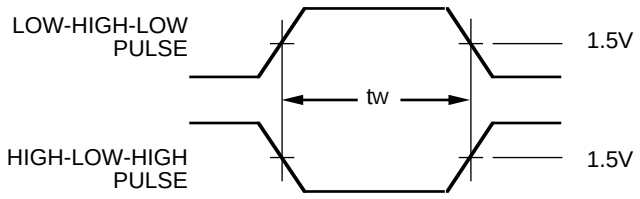
## PULSE WIDTH

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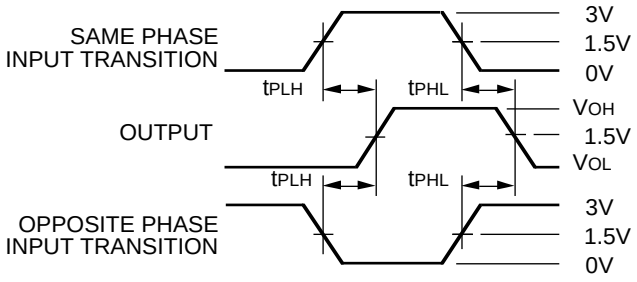
## PROPAGATION DELAY

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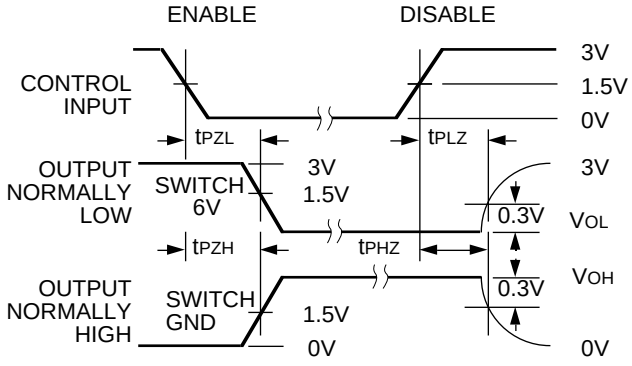
## ENABLE AND DISABLE TIMES

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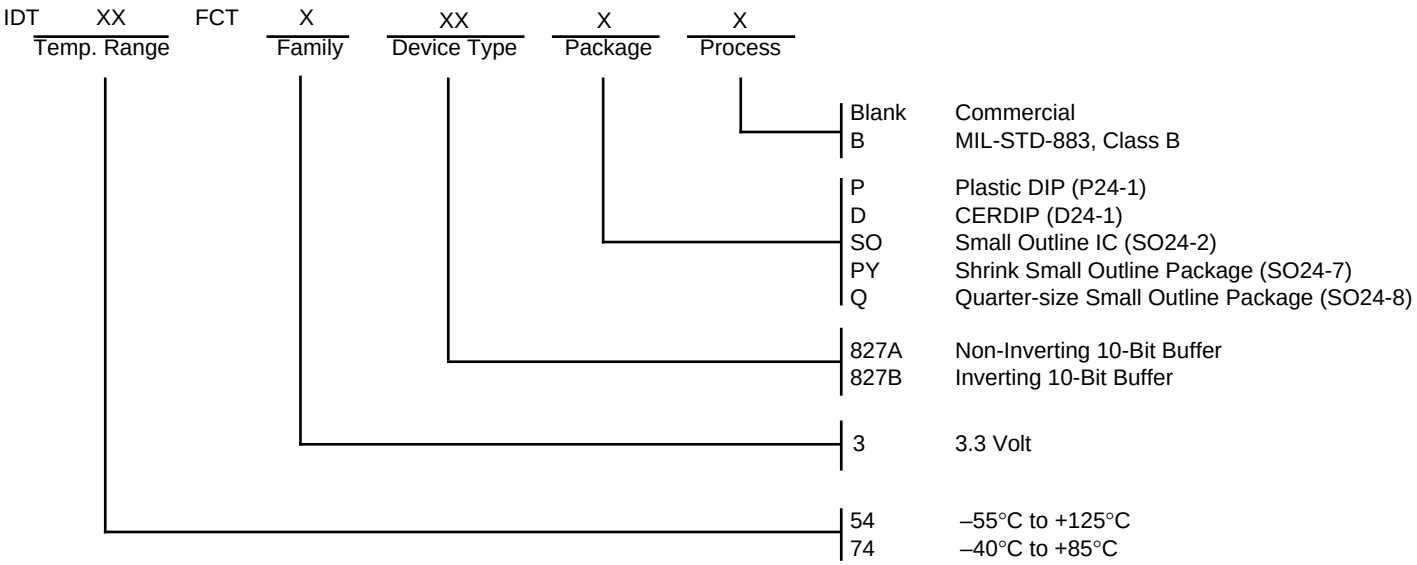
**NOTES:**

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; $t_F$ ≤ 2.5ns; $t_R$ ≤ 2.5ns.
3. If $V_{CC}$ is below 3V, input voltage swings should be adjusted not to exceed $V_{CC}$.

## ORDERING INFORMATION

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