



FAST CMOS OCTAL BUFFER/LINE DRIVER

IDT54/74FCT541T/AT/CT

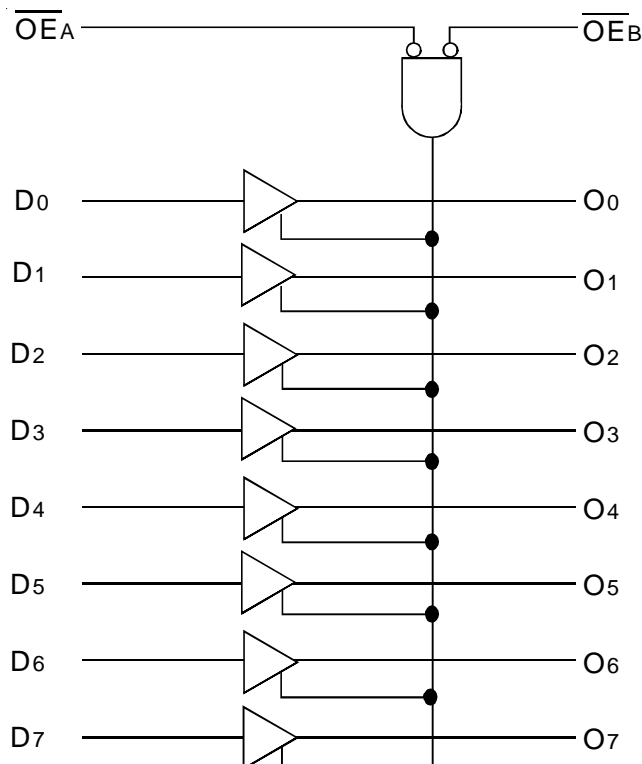
FEATURES:

- Std., A, and C grades
- Low input and output leakage $\leq 1\mu\text{A}$ (max.)
- CMOS power levels
- True TTL input and output compatibility:
 - $V_{OH} = 3.3V$ (typ.)
 - $V_{OL} = 0.3V$ (typ.)
- High Drive outputs (-15mA I_{OH} , 64mA I_{OL})
- Meets or exceeds JEDEC standard 18 specifications
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Power off disable outputs permit "live insertion"
- Available in the following packages:
 - Industrial: SOIC, SSOP, QSOP, TSSOP
 - Military: CERDIP, LCC

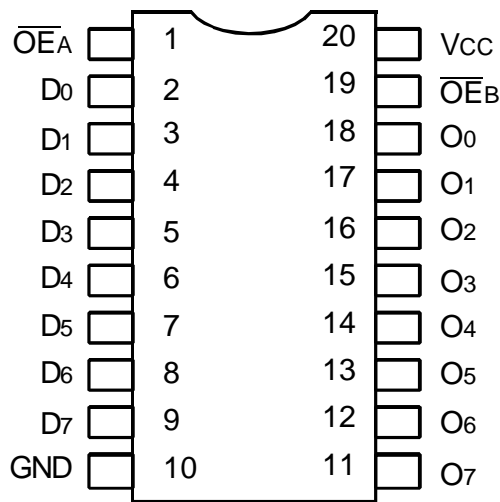
DESCRIPTION:

The IDT octal buffer/line driver is built using an advanced dual metal CMOS technology. The FCT541T is similar in function to the FCT244T, except that the inputs and outputs are on opposite sides of the package. This pinout arrangement makes these devices especially useful as output ports for microprocessors and as backplane drivers, allowing ease of layout and greater board density.

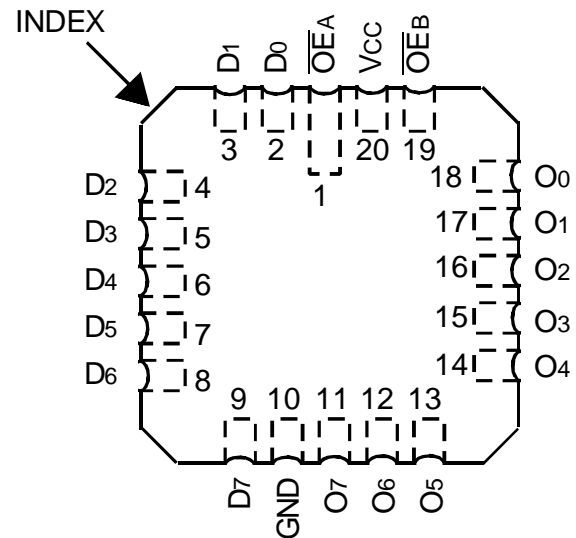
FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



CERDIP/ SOIC/ SSOP/ QSOP/ TSSOP
TOP VIEW



LCC
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Description | Max | Unit |
|----------------------------------|--------------------------------------|------------------------------|------|
| V _{TERM} ⁽²⁾ | Terminal Voltage with Respect to GND | -0.5 to +7 | V |
| V _{TERM} ⁽³⁾ | 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 +120 | 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. No terminal voltage may exceed V_{CC} by +0.5V unless otherwise noted.
- Inputs and V_{CC} terminals only.
- Output 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 _{OUT} | Output Capacitance | V _{OUT} = 0V | 8 | 12 | pF |

NOTE:

- This parameter is measured at characterization but not tested.

PIN DESCRIPTION

| Pin Names | Description |
|---------------------------------------|---|
| \overline{OE}_A , \overline{OE}_B | 3-State Output Enable Inputs (Active LOW) |
| D _x | Inputs |
| O _x | Outputs |

FUNCTION TABLE⁽¹⁾

| Inputs | | | Outputs |
|-------------------|-------------------|---|---------|
| \overline{OE}_A | \overline{OE}_B | D | |
| L | L | L | L |
| L | L | H | H |
| H | H | X | Z |

NOTE:

- H = HIGH Voltage Level
X = Don't Care
L = LOW Voltage Level
Z = High Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$; Military: $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|-----------|---|--|---------------------|------|---------------------|---------|---------------|
| V_{IH} | Input HIGH Level | Guaranteed Logic HIGH Level | | 2 | — | — | V |
| V_{IL} | Input LOW Level | Guaranteed Logic LOW Level | | — | — | 0.8 | V |
| I_{IH} | Input HIGH Current ⁽⁴⁾ | $V_{CC} = \text{Max.}$ | $V_I = 2.7\text{V}$ | — | — | ± 1 | μA |
| I_{IL} | Input LOW Current ⁽⁴⁾ | $V_{CC} = \text{Max.}$ | $V_I = 0.5\text{V}$ | — | — | ± 1 | μA |
| I_{OZH} | High Impedance Output Current (3-State output pins) ⁽⁴⁾ | $V_{CC} = \text{Max.}$ | $V_O = 2.7\text{V}$ | — | — | ± 1 | μA |
| I_{OZL} | | | $V_O = 0.5\text{V}$ | — | — | ± 1 | |
| I_I | Input HIGH Current ⁽⁴⁾ | $V_{CC} = \text{Max.}, V_I = V_{CC} (\text{Max.})$ | | — | — | ± 1 | μA |
| V_{IK} | Clamp Diode Voltage | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$ | | — | -0.7 | -1.2 | V |
| V_H | Input Hysteresis | — | | — | 200 | — | mV |
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND or } V_{CC}$ | | — | 0.01 | 1 | mA |

OUTPUT DRIVE CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|----------|-----------------------|--|--|------|---------------------|------|------|
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -6\text{mA MIL}$ $I_{OH} = -8\text{mA IND}$ | 2.4 | 3.3 | — | V |
| | | | $I_{OH} = -12\text{mA MIL}$ $I_{OH} = -15\text{mA IND}$ | 2 | 3 | — | |
| V_{OL} | Output LOW Voltage | $V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OL} = 48\text{mA MIL}$ $I_{OL} = 64\text{mA IND}$ | — | 0.3 | 0.55 | V |
| I_{OS} | Short Circuit Current | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$ | | -60 | -120 | -225 | mA |

NOTES:

- For conditions shown as Min. or Max., 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.
- 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 ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|-----------------|---|--|--|------|---------------------|-------------------|------------|
| ΔI_{CC} | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$ | | — | 0.5 | 2 | mA |
| I_{CCD} | Dynamic Power Supply Current ⁽⁴⁾ | $V_{CC} = \text{Max.}$ Outputs Open $\overline{OE}_A = \overline{OE}_B = \text{GND}$ One Input Toggling 50% Duty Cycle | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | — | 0.15 | 0.25 | mA/ MHz |
| I_C | Total Power Supply Current ⁽⁶⁾ | $V_{CC} = \text{Max.}$ Outputs Open $f_i = 10\text{MHz}$ 50% Duty Cycle $\overline{OE}_A = \overline{OE}_B = \text{GND}$ One Bit Toggling | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | — | 1.5 | 3.5 | mA |
| | | | $V_{IN} = 3.4V$ $V_{IN} = \text{GND}$ | — | 1.8 | 4.5 | |
| | | $V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{OE}_A = \overline{OE}_B = \text{GND}$ Eight Bits Toggling | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | — | 3 | 6 ⁽⁵⁾ | |
| | | | $V_{IN} = 3.4V$ $V_{IN} = \text{GND}$ | — | 5 | 14 ⁽⁵⁾ | |

NOTES:

- For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, +25°C ambient.
- Per TTL driven input; ($V_{IN} = 3.4V$). All other inputs at V_{CC} or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of ΔI_{CC} formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} \cdot D_{HNT} + I_{CCD} \cdot (f_{CP}/2 + f_i N_i)$
 I_{CC} = Quiescent Current
 ΔI_{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 = Output Frequency
 N_i = Number of Outputs at f_i

All currents are in milliamps and all frequencies are in megahertz.

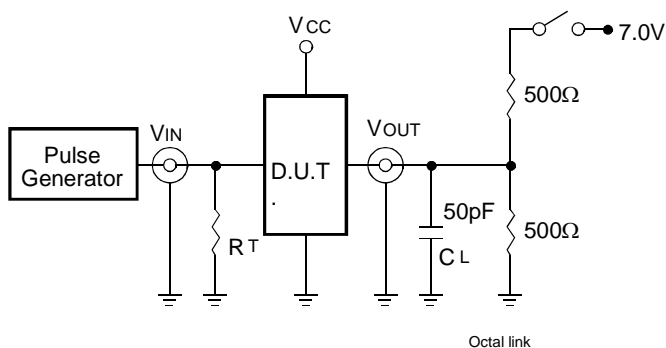
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol | Parameter | Condition ⁽¹⁾ | 54FCT541T | | 54/74FCT541AT | | | | 54/74FCT541CT | | | | Unit |
|-----------|---------------------|--|---------------------|------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
| | | | Mil. | | Ind. | | Mil. | | Ind. | | Mil. | | |
| | | | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | |
| t_{PLH} | Propagation Delay | $C_L = 50\text{pF}$ $R_L = 500\Omega$ | 1.5 | 9 | 1.5 | 4.8 | 1.5 | 5.1 | 1.5 | 4.1 | 1.5 | 4.6 | ns |
| t_{PHL} | Dx to Ox | | | | | | | | | | | | |
| t_{PZH} | Output Enable Time | | 1.5 | 10.5 | 1.5 | 6.2 | 1.5 | 6.5 | 1.5 | 5.8 | 1.5 | 6.5 | ns |
| t_{PZL} | | | | | | | | | | | | | |
| t_{PHZ} | Output Disable Time | | 1.5 | 10 | 1.5 | 5.6 | 1.5 | 5.9 | 1.5 | 5.2 | 1.5 | 5.7 | ns |
| t_{PLZ} | | | | | | | | | | | | | |

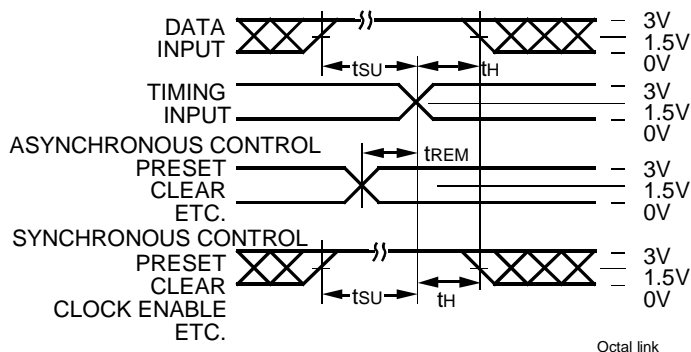
NOTES:

- See test circuit and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.

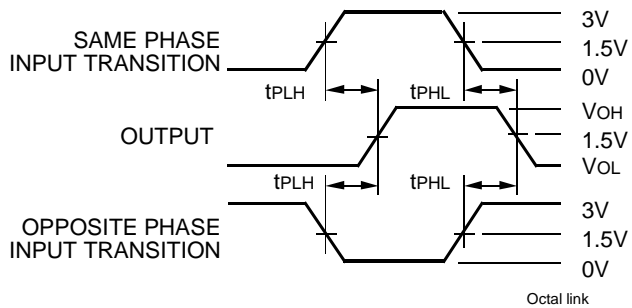
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-Up, Hold, and Release Times



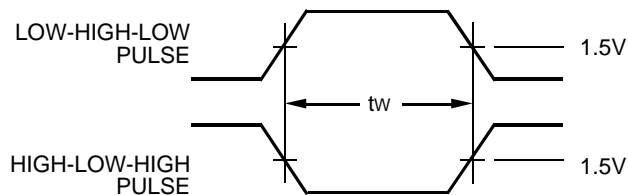
Propagation Delay

SWITCH POSITION

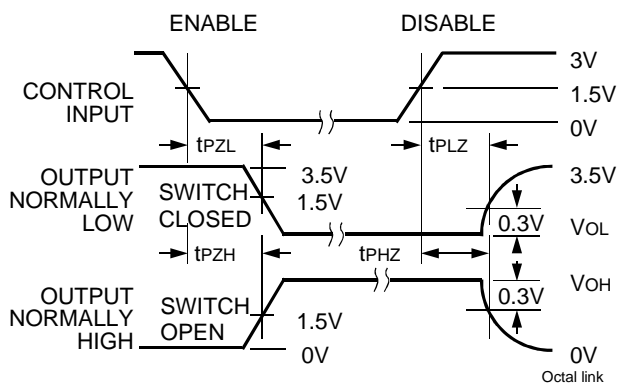
| Test | Switch |
|---|--------|
| Open Drain Disable Low Enable Low | Closed |
| All Other Tests | Open |

DEFINITIONS:

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



Pulse Width



Enable and Disable Times

NOTES:

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

ORDERING INFORMATION

| IDT | XX | FCT | XXXX | XX | X | |
|-------------|-------------|-----|---------|---------|-------|------------------------------------|
| Temp. Range | Device Type | | Package | Process | | |
| | | | | | Blank | Industrial |
| | | | | | B | MIL-STD-883, Class B |
| | | | | | SO | <u>Industrial Options</u> |
| | | | | | PY | Small Outline IC |
| | | | | | Q | Shrink Small Outline Package |
| | | | | | PG | Quarter-size Small Outline Package |
| | | | | | | Thin Shrink Small Outline Package |
| | | | | | D | <u>Military Options</u> |
| | | | | | L | CERDIP |
| | | | | | | Leadless Chip Carrier |
| | | | | | 541T | Fast CMOS Octal Buffer/Line Driver |
| | | | | | 541AT | |
| | | | | | 541CT | |
| | | | | | 54 | - 55°C to +125°C |
| | | | | | 74 | - 40°C to +85°C |



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