# P54/74FCT540T/AT/CT-P54/74FCT541T/AT/CT OCTAL BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

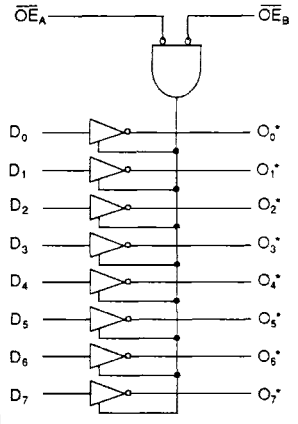
## FEATURES

- Function, Pinout and Drive Compatible with the FCT and F Logic
- FCT-C speed at 4.3ns max. (Com'l)
  FCT-A speed at 4.8ns max. (Com'l)
- Reduced $V_{OH}$ (typically = 3.3V) versions of Equivalent FCT functions
- Edge-rate Control Circuitry for Significantly Improved Noise Characteristics
- ESD protection exceeds 2000V
- Power-off disable feature
- Matched Rise and Fall times
- Fully Compatible with TTL Input and Output Logic Levels
- 64 mA Sink Current (Com'l), 32 mA (Mil)
  15 mA Source Current (Com'l), 12 mA (Mil)
- 3-State Outputs
- Manufactured in 0.7 micron PACE Technology™

## DESCRIPTION

The 'FCT540T and the 'FCT541T are octal buffers and line drivers designed to be employed as memory address drivers, clock drivers and bus-oriented transmitters/receivers. The devices provide speed and drive capabilities equivalent to their fastest bipolar logic counterparts while reducing power dissipation. The input and output voltage levels allow direct interface with TTL, NMOS and CMOS devices without external components.

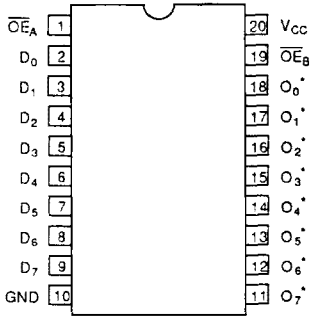
## FUNCTIONAL BLOCK DIAGRAM



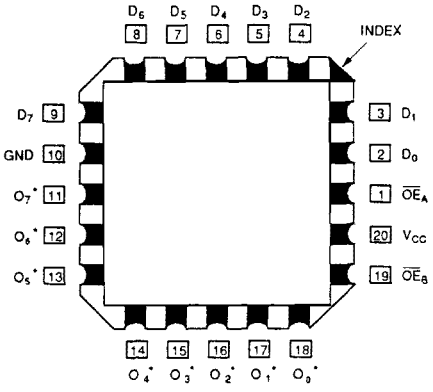

'FCT540T/541T

*$\overline{O}_n$ for 'FCT540T

## PIN CONFIGURATIONS




DIP (D2,P2),
SOIC (S2)




LCC (L2)

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## ABSOLUTE MAXIMUM RATINGS[1,2]

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $T_{STG}$ | Storage Temperature | –65 to +150 | °C |
| $T_A$ | Ambient Temperature Under Bias | –65 to +135 | °C |
| $V_{CC}$ | $V_{CC}$ Potential to Ground | –0.5 to +7.0 | V |
| $P_T$ | Power Dissipation | 0.5 | W |

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| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{OUTPUT}$ | Current Applied to Output | 120 | mA |
| $V_{IN}$ | Input Voltage | –0.5 to +7.0 | V |
| $V_{OUT}$ | Voltage Applied to Output | –0.5 to +7.0 | V |

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**Notes:**

1. Operation beyond the limits set forth in the above table may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
2. Unused inputs must always be connected to an appropriate logic voltage level, preferably either $V_{CC}$ or ground.

## RECOMMENDED OPERATING CONDITIONS

| Free Air Ambient Temperature | Min | Max |
|---|---|---|
| Military | –55°C | +125°C |
| Commercial | 0°C | +70°C |

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| Supply Voltage ($V_{CC}$) | Min | Max |
|---|---|---|
| Military | +4.5V | +5.5V |
| Commercial | +4.75V | +5.25V |

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## DC ELECTRICAL CHARACTERISTICS (Over recommended operating conditions)

| Symbol | Parameter | | Min | Typ[1] | Max | Units | $V_{CC}$ | Conditions |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | | |
| $V_{IL}$ | Input LOW Voltage | | | | 0.8 | V | | |
| $V_H$ | Hysteresis | | | 0.2 | | V | | All inputs |
| $V_{IK}$ | Input Clamp Diode Voltage | | | –0.7 | –1.2 | V | MIN | $I_{IN}$ = –18mA |
| $V_{OH}$ | Output HIGH Voltage | Military | 2.4 | 3.3 | | V | MIN | $I_{OH}$ = –12mA |
| | | Commercial | 2.4 | 3.3 | | V | MIN | $I_{OH}$ = –15mA |
| $V_{OL}$ | Output LOW Voltage | Military | | 0.3 | 0.55 | V | MIN | $I_{OL}$ = 32mA |
| | | Commercial | | 0.3 | 0.55 | V | MIN | $I_{OL}$ = 48mA |
| | | Commercial | | 0.3 | 0.55 | V | MIN | $I_{OL}$ = 64mA |
| $I_I$ | Input HIGH Current | | | | 20 | µA | MAX | $V_{IN}$ = $V_{CC}$ |
| $I_{IH}$ | Input HIGH Current | | | | 5 | µA | MAX | $V_{IN}$ = 2.7V |
| $I_{IL}$ | Input LOW Current | | | | –5 | µA | MAX | $V_{IN}$ = 0.5V |
| $I_{OZH}$ | Off State $I_{OUT}$ HIGH-Level Output Current | | | | 10 | µA | MAX | $V_{OUT}$ = 2.7V |
| $I_{OZL}$ | Off State $I_{OUT}$ LOW-Level Output Current | | | | –10 | µA | MAX | $V_{OUT}$ = 0.5V |
| $I_{OS}$ | Output Short Circuit Current[2] | | –60 | –120 | –225 | mA | MAX | $V_{OUT}$ = 0.0V |
| $I_{OFF}$ | Power-off Disable | | | | 100 | µA | 0V | $V_{OUT}$ = 4.5V |
| $C_{IN}$ | Input Capacitance[3] | | | 5 | 10 | pF | MAX | All inputs |
| $C_{OUT}$ | Output Capacitance[3] | | | 9 | 12 | pF | MAX | All outputs |
| $I_{CC}$ | Quiescent Power Supply Current | | | 0.2 | 1.5 | mA | MAX | $V_{IN} \leq 0.2V$, $V_{IN} \geq V_{CC}-0.2V$ |

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**Notes:**

1. Typical limits are at $V_{CC}$ = 5.0V, $T_A$ = +25°C ambient.
2. Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip heating and more accurately reflect operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, $I_{OS}$ tests should be performed last.
3. This parameter is guaranteed but not tested.

## DC CHARACTERISTICS (Over recommended operating conditions unless otherwise specified.)

| Symbol | Parameter | Typ[1] | Max | Units | Conditions |
|---|---|---|---|---|---|
| $\Delta I_{CC}$ | Quiescent Power Supply Current (TTL inputs) | 0.5 | 2.0 | mA | $V_{CC}$ = MAX, $V_{IN}$ = 3.4V[2], $f_1$ = 0, Outputs Open |
| $I_{CCD}$ | Dynamic Power Supply Current[3] | 0.15 | 0.25 | mA/ mHz | $V_{CC}$ = MAX, One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, or $\overline{OE}_A$ = GND, $OE_B$ = $V_{CC}$ $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$ |
| $I_C$ | Total Power Supply Current[5] | 1.7 | 4.0 | mA | $V_{CC}$ = MAX, 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1$ = 10MHz, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, or $\overline{OE}_A$ = GND, $OE_B$ = $V_{CC}$ $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$ |
| | | 2.0 | 5.0 | mA | $V_{CC}$ = MAX, 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1$ = 10MHz, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, or $\overline{OE}_A$ = GND, $OE_B$ = $V_{CC}$ $V_{IN}$ = 3.4V or $V_{IN}$ = GND |
| | | 3.2 | 6.5[4] | mA | $V_{CC}$ = MAX, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1$ = 2.5MHz, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, or $\overline{OE}_A$ = GND, $OE_B$ = $V_{CC}$ $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$ |
| | | 5.2 | 14.5[4] | mA | $V_{CC}$ = MAX, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1$ = 2.5MHz, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, or $\overline{OE}_A$ = GND, $OE_B$ = $V_{CC}$ $V_{IN}$ = 3.4V or $V_{IN}$ = GND |

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**Notes:**

1. Typical values are at $V_{CC}$ = 5.0V, +25°C ambient.
2. Per TTL driven input ($V_{IN}$ = 3.4V); all other inputs at $V_{CC}$ or GND.
3. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
4. Values for these conditions are examples of the $I_{CC}$ formula. These limits are guaranteed but not tested.
5. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}(f_0/2 + f_1 N_1)$
   $I_{CC}$ = Quiescent Current with CMOS input levels
   $\Delta I_{CC}$ = 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)
   $f_0$ = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   $f_1$ = Input Frequency
   $N_1$ = Number of Inputs at $f_1$

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

## TRUTH TABLES

**'FCT540T**

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

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**'FCT541T**

| Inputs | | | Output |
|---|---|---|---|
| $\overline{OE}_A$ | $OE_B$ | D | |
| L | L | L | L |
| L | L | H | H |
| H | H | X | Z |

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

## AC CHARACTERISTICS

| Symbol | Parameter | 'FCT540T 'FCT541T | | | | 'FCT540AT 'FCT541AT | | | | 'FCT540CT 'FCT541CT | | | | Units | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIL | | COM'L | | MIL | | COM'L | | MIL | | COM'L | | | |
| | | Min.[1] | Max. | Min.[1] | Max. | Min.[1] | Max. | Min.[1] | Max. | Min.[1] | Max. | Min.[1] | Max. | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Data to Output(540) | 1.5 | 9.5 | 1.5 | 8.5 | 1.5 | 5.1 | 1.5 | 4.8 | 1.5 | 4.7 | 1.5 | 4.3 | ns | 1, 2 |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Data to Output(541) | 1.5 | 9.0 | 1.5 | 8.0 | 1.5 | 5.1 | 1.5 | 4.8 | 1.5 | 4.6 | 1.5 | 4.1 | ns | 1, 2 |
| $t_{PZH}$ $t_{PZL}$ | Output Enable Time | 1.5 | 10.5 | 1.5 | 10.0 | 1.5 | 6.5 | 1.5 | 6.2 | 1.5 | 6.5 | 1.5 | 5.8 | ns | 1 7 |
| $t_{PHZ}$ $t_{PLZ}$ | Output Disable Time | 1.5 | 10.0 | 1.5 | 9.5 | 1.5 | 5.9 | 1.5 | 5.6 | 1.5 | 5.7 | 1.5 | 5.2 | ns | 8 |

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## ORDERING INFORMATION

PxxFCT (Temp. Class) / xxxx (Device type) / x (Package) / x (Processing)

| | |
|---|---|
| **Processing** | |
| Blank | Commercial |
| M | Military Temperature |
| B | MIL-STD-883, Class B |
| **Package** | |
| P | Plastic DIP |
| D | CERDIP |
| SO | Small Outline IC |
| L | Leadless Chip Carrier |
| **Device type** | |
| 540T | Inverting Octal Buffer/Line Driver |
| 541T | Octal Buffer/Line Driver |
| 540AT | Fast Inverting Octal Buffer/Line Driver |
| 541AT | Fast Octal Buffer/Line Driver |
| 540CT | Ultra Fast Inverting Octal Buffer/Line Driver |
| 541CT | Ultra Octal Buffer/Line Driver |
| **Temp. Class** | |
| 74 | Commercial |
| 54 | Military |

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