# National Semiconductor

# 54FCT/74FCT241A
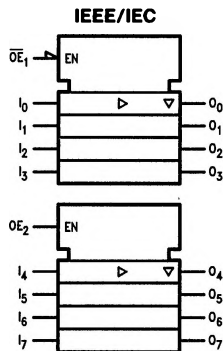# Octal Buffer/Line Driver with TRI-STATE® Outputs

## General Description

The 'FCT241A is an octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus-oriented transmitter or receiver which provides improved PC board density.

## Features

- NSC 54/74FCT241A is pin and functionally equivalent to IDT 54/74FCT241A
- Non-inverting TRI-STATE outputs drive bus lines or buffer memory address registers
- 'FCT241A has TTL-compatible inputs
- Military product compliant to MIL-STD-883C
- Inherently radiation tolerant
- $I_{OL} = 64$ mA (Comm) and 48 mA (Mil)
- TTL input and output level compatible
- High current latch up

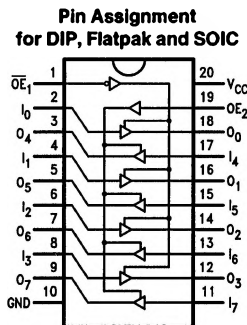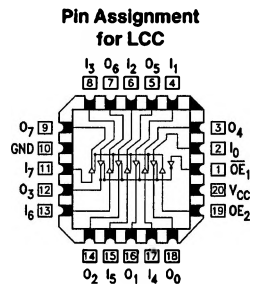## Ordering Code: See Section 8

## Logic Symbol

### IEEE/IEC



TL/F/10269-1

## Connection Diagrams

### Pin Assignment for DIP, Flatpak and SOIC



TL/F/10269-2

### Pin Assignment for LCC



TL/F/10269-3

| Pin Names | Description |
|---|---|
| $\overline{OE}_1$, | TRI-STATE Output Enable Input |
| $OE_2$ | TRI-STATE Output Enable Input (Active HIGH) |
| $I_0$–$I_7$ | Inputs |
| $O_0$–$O_7$ | Outputs |

## Truth Tables

| Inputs | | Outputs |
|---|---|---|
| $\overline{OE}_1$ | D | (Pins 12, 14, 16, 18) |
| L | L | L |
| L | H | H |
| H | X | Z |

| Inputs | | Outputs |
|---|---|---|
| $OE_2$ | D | (Pins 3, 5, 7, 9) |
| H | L | L |
| H | H | H |
| L | X | Z |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Terminal Voltage with Respect to GND ($V_{TERM}$)
| | |
|---|---|
| 74FCTA | −0.5V to 7.0V |
| 54FCTA | −0.5V to 7.0V |

Temperature under Bias ($T_{BIAS}$)
| | |
|---|---|
| 74FCTA | −55°C to +125°C |
| 54FCTA | −65°C to +135°C |

Storage Temperature ($T_{STG}$)
| | |
|---|---|
| 74FCTA | −55°C to +125°C |
| 54FCTA | −65°C to +150°C |

| | |
|---|---|
| Power Dissipation ($P_T$) | 0.5W |
| DC Output Current ($I_{OUT}$) | 120 mA |

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ FCT circuits outside databook specifications.

## Recommended Operating Conditions

Supply Voltage ($V_{CC}$)
| | |
|---|---|
| 54FCTA | 4.5V to 5.5V |
| 74FCTA | 4.75V to 5.25V |

| | |
|---|---|
| Input Voltage | 0V to $V_{CC}$ |
| Output Voltage | 0V to $V_{CC}$ |

Operating Temperature ($T_A$)
| | |
|---|---|
| 54FCTA | −55°C to +125°C |
| 74FCTA | −0°C to +70°C |

Junction Temperature ($T_J$)
| | |
|---|---|
| CDIP | 175°C |
| PDIP | 140°C |

## DC Characteristics for 'FCTA Family Devices

Typical values are at $V_{CC}$ = 5.0V, 25°C ambient and maximum loading. For test conditons shown as Max, use the value specified for the appropriate device type: Com: $V_{CC}$ = 5.0V ±5%, $T_A$ = 0°C to +70°C; Mil: $V_{CC}$ = 5.0V ±10%, $T_A$ = −55°C to +125°C, $V_{HC}$ = $V_{CC}$ − 0.2V

| Symbol | Parameter | 54FCTA/74FCTA | | | Units | Conditions | |
|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | | |
| $V_{IH}$ | Minimum High Level Input Voltage | 2.0 | | | V | | |
| $V_{IL}$ | Maximum Low Level Input Voltage | | | 0.8 | V | | |
| $I_{IH}$ | Input High Current | | | 5.0<br>5.0 | µA | $V_{CC}$ = Max | $V_I$ = $V_{CC}$<br>$V_I$ = 2.7V (Note 2) |
| $I_{IL}$ | Input Low Current | | | −5.0<br>−5.0 | µA | $V_{CC}$ = Max | $V_I$ = 0.5V (Note 2)<br>$V_I$ = GND |
| $I_{OZ}$ | Maximum TRI-STATE Current | | | 10.0<br>10.0<br>−10.0<br>−10.0 | µA | $V_{CC}$ = Max | $V_O$ = $V_{CC}$<br>$V_O$ = 2.7V (Note 2)<br>$V_O$ = 0.5V (Note 2)<br>$V_O$ = GND |
| $V_{IK}$ | Clamp Diode Voltage | | −0.7 | −1.2 | V | $V_{CC}$ = Min; $I_N$ = −18 mA | |
| $I_{OS}$ | Short Circuit Current | −60 | −120 | | mA | $V_{CC}$ = Max (Note 1); $V_O$ = GND | |
| $V_{OH}$ | Minimum High Level Output Voltage | 2.8 | 3.0 | | V | $V_{CC}$ = 3V; $V_{IN}$ = 0.2V or $V_{HC}$; $I_{OH}$ = −32 µA | |
| | | $V_{HC}$<br>2.4<br>2.4 | $V_{CC}$<br>4.3<br>4.3 | | | $V_{CC}$ = Min<br>$V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −300 µA<br>$I_{OH}$ = −12 mA (Mil)<br>$I_{OH}$ = −15 mA (Com) |
| $V_{OL}$ | Maximum Low Level Output Voltage | | GND | 0.2 | V | $V_{CC}$ = 3V; $V_{IN}$ = 0.2V or $V_{HC}$; $I_{OL}$ = 300 µA | |
| | | | GND<br>0.3<br>0.3 | 0.2<br>0.55<br>0.55 | | $V_{CC}$ = Min<br>$V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 300 µA<br>$I_{OL}$ = 48 mA (Mil)<br>$I_{OL}$ = 64 mA (Com) |
| $I_{CC}$ | Maximum Quiescent Supply Current | | 0.001 | 1.5 | mA | $V_{CC}$ = Max<br>$V_{IN}$ ≥ $V_{HC}$, $V_{IN}$ ≤ 0.2V<br>$f_I$ = 0 | |
| $\Delta I_{CC}$ | Quiescent Supply Current; TTL Inputs HIGH | | 0.5 | 2.0 | mA | $V_{CC}$ = Max<br>$V_{IN}$ = 3.4V (Note 3) | |

# DC Characteristics for 'FCTA Family Devices (Continued)

Typical values are at $V_{CC}$ = 5.0V, 25°C ambient and maximum loading. For test conditons shown as Max, use the value specified for the appropriate device type: Com: $V_{CC}$ = 5.0V ±5%, $T_A$ = 0°C to +70°C; Mil: $V_{CC}$ = 5.0V ±10%, $T_A$ = −55°C to +125°C, $V_{HC}$ = $V_{CC}$ − 0.2V

| Symbol | Parameter | 54FCTA/74FCTA | | | Units | Conditions | |
|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | | |
| $I_{CCD}$ | Dynamic Power Supply Current (Note 4) | | 0.25 | 0.40 | mA/MHz | $V_{CC}$ = Max<br>Outputs Open<br>$\overline{OE}_A$ = $\overline{OE}_B$ = GND<br>One Input Toggling<br>50% Duty Cycle | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq 0.2V$ |
| $I_C$ | Total Power Supply Current (Note 6) | | 1.5 | 4.5 | mA | $V_{CC}$ = Max<br>Outputs Open<br>$\overline{OE}_A$ = $\overline{OE}_B$ = GND | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq 0.2V$ |
| | | | 1.8 | 5.0 | | $f_I$ = 10 MHz<br>One Bit Toggling<br>50% Duty Cycle | $V_{IN}$ = 3.4V<br>$V_{IN}$ = GND |
| | | | 3.0 | 8.0 | | (Note 5)<br>$V_{CC}$ = Max<br>Outputs Open<br>$\overline{OE}_A$ = $\overline{OE}_B$ = GND | $V_{IN} \geq V_{HC}$<br>$V_{IN} \leq 0.2V$ |
| | | | 5.0 | 14.5 | | $f_I$ = 2.5 MHz<br>Eight Bits Toggling<br>50% Duty Cycle | $V_{IN}$ = 3.4V<br>$V_{IN}$ = GND |
| $V_H$ | Input Hysteresis on Clock Only | | 200 | | mV | | |

**Note 1:** Maximum test duration not to exceed one second, not more than one output shorted at one time.

**Note 2:** This parameter guaranteed but not tested.

**Note 3:** Per TTL driven input ($V_{IN}$ = 3.4V); all other inputs at $V_{CC}$ or GND.

**Note 4:** This parameter is not directly testable, but is derived for use in Total Power Supply calculations.

**Note 5:** Values for these conditions are examples of the $I_{CC}$ formula. These limits are guaranteed but not tested.

**Note 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 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.

## AC Electrical Characteristics: See Section 2 for Waveforms

| Symbol | Parameter | 54FCTA/74FCTA $T_A = +25°C$ $V_{CC} = 5.0V$ | 74FCTA $T_A, V_{CC} = Com$ $R_L = 500Ω$ $C_L = 50 pF$ | | 54FCTA $T_A, V_{CC} = Mil$ $R_L = 500Ω$ $C_L = 50 pF$ | | Units | Fig. No. |
|---|---|---|---|---|---|---|---|---|
| | | Typ | Min (Note 1) | Max | Min (Note 1) | Max | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay $D_n$ to $O_n$ | 3.0 | 1.5 | 4.8 | | | ns | 2-8 |
| $t_{PZH}$ $t_{PZL}$ | Output Enable Time | 4.0 | 1.5 | 6.2 | | | ns | 2-10 |
| $t_{PHZ}$ $t_{PLZ}$ | Output Disable Time | 3.0 | 1.5 | 5.6 | | | ns | 2-10 |

Note 1: Minimum limits are guaranteed but not tested on propagation delays.

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

| Symbol | Parameter (Note) | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 6 | 10 | pF | $V_{IN} = 0V$ |
| $C_{OUT}$ | Output Capacitance | 8 | 12 | pF | $V_{OUT} = 0V$ |

Note: This parameter is measured at characterization but not tested.