



## FAST CMOS OCTAL BUFFER/LINE DRIVER

**IDT54/74FCT541/A/C**

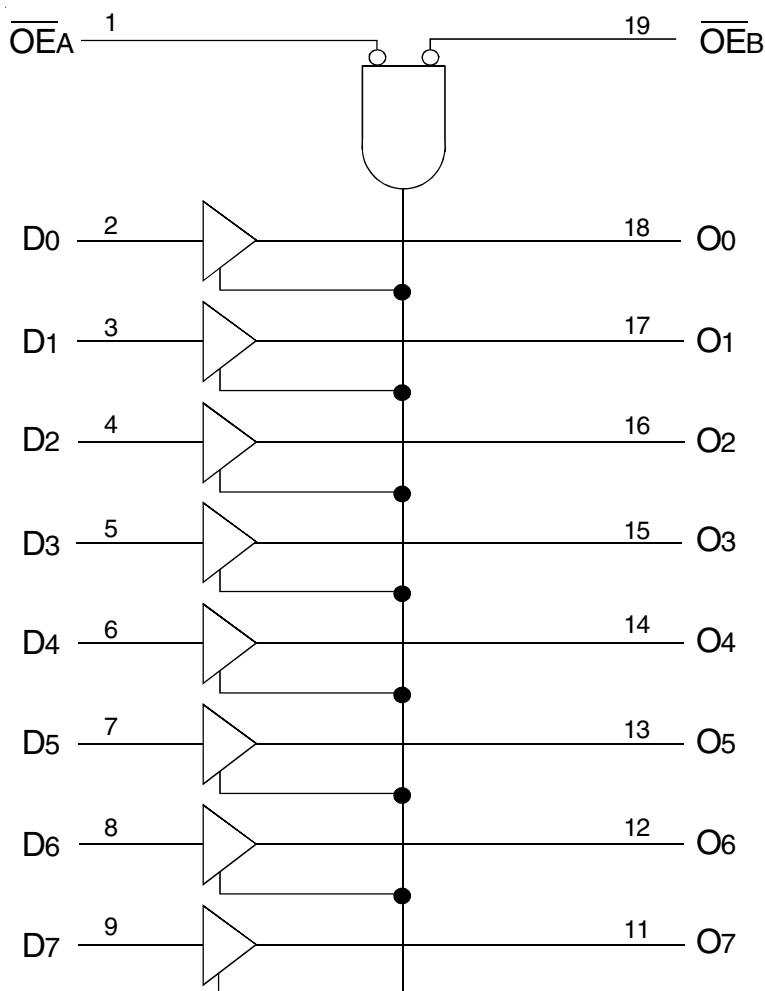
### FEATURES:

- IDT54FCT541 equivalent to FAST™ speed and drive
- IDT54/74FCT541A up to 25% faster than FAST
- IDT74FCT541C up to 55% faster than FAST
- $I_{OL} = 64\text{mA}$  (commercial) and  $48\text{mA}$  (military)
- CMOS power levels ( $1\text{mW}$  typ. static)
- Military product compliant to MIL-STD-883, Class B
- Meets or exceeds JEDEC Standard 18 specifications
- Available in the following packages:
  - Commercial: SOIC
  - Military: CERDIP, LCC

### DESCRIPTION:

The IDT octal buffer/line drivers are built using an advanced dual metal CMOS technology. The FCT541 is designed to be employed as a memory and address driver, clock driver and bus-oriented transmitter/receiver which provides improved board density. The FCT541 is similar in function to the FCT244, 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

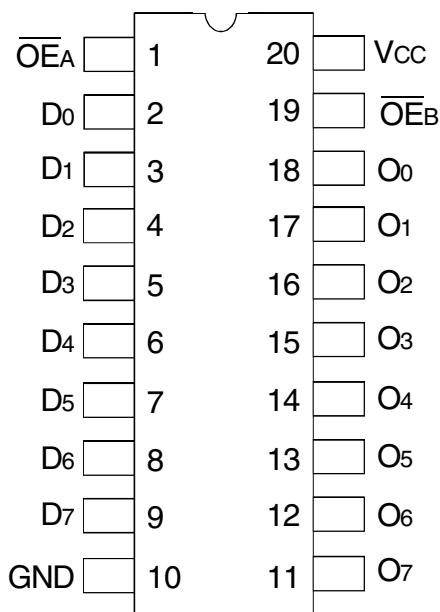


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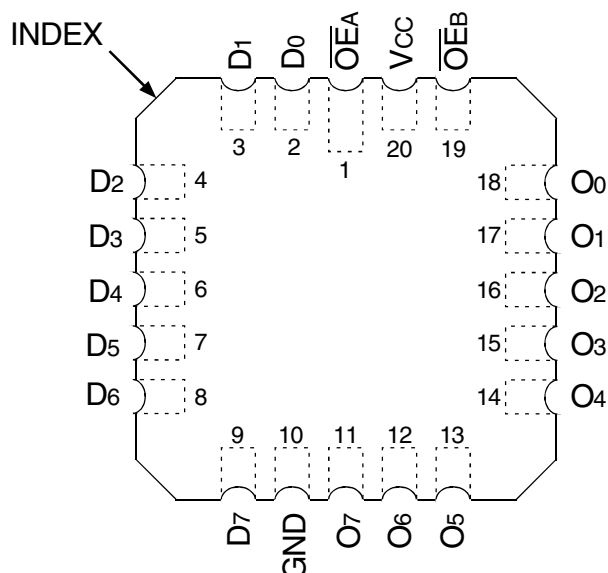
**MILITARY AND COMMERCIAL TEMPERATURE RANGES**

**JUNE 2002**

## PIN CONFIGURATION



CERDIP/ SOIC  
TOP VIEW



LCC  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol                           | Rating                               | Commercial              | Military                | Unit |
|----------------------------------|--------------------------------------|-------------------------|-------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | -0.5 to +7              | -0.5 to +7              | V    |
| V <sub>TERM</sub> <sup>(3)</sup> | Terminal Voltage with Respect to GND | -0.5 to V <sub>CC</sub> | -0.5 to V <sub>CC</sub> | V    |
| T <sub>A</sub>                   | Operating Temperature                | 0 to +70                | -55 to +125             | °C   |
| T <sub>BIAS</sub>                | Temperature under BIAS               | -55 to +125             | -65 to +135             | °C   |
| T <sub>STG</sub>                 | Storage Temperature                  | -55 to +125             | -65 to +150             | °C   |
| P <sub>T</sub>                   | Power Dissipation                    | 0.5                     | 0.5                     | W    |
| I <sub>OUT</sub>                 | DC Output Current                    | 120                     | 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<sub>CC</sub> by +0.5V unless otherwise noted.
- Input and V<sub>CC</sub> terminals only.
- Output and I/O terminals only.

## CAPACITANCE (T<sub>A</sub> = +25°C, F = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 6    | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 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) |
| Dx                                    | Inputs                                    |
| Ox                                    | Outputs                                   |

## FUNCTION TABLE<sup>(1)</sup>

| Inputs            |                   |    | Output |
|-------------------|-------------------|----|--------|
| $\overline{OE}_A$ | $\overline{OE}_B$ | Dx | Ox     |
| 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:  $V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

Commercial:  $T_A = 0^{\circ}C$  to  $+70^{\circ}C$ ,  $V_{CC} = 5.0V \pm 5\%$ , Military:  $T_A = -55^{\circ}C$  to  $+125^{\circ}C$ ,  $V_{CC} = 5.0V \pm 10\%$

| Symbol           | Parameter                                    | Test Conditions <sup>(1)</sup>                                                                       |                                  | Min.            | Typ. <sup>(2)</sup> | Max.                           | Unit |
|------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------|-----------------|---------------------|--------------------------------|------|
| V <sub>IH</sub>  | Input HIGH Level                             | Guaranteed Logic HIGH Level                                                                          |                                  | 2               | —                   | —                              | V    |
| V <sub>IL</sub>  | Input LOW Level                              | Guaranteed Logic LOW Level                                                                           |                                  | —               | —                   | 0.8                            | V    |
| I <sub>IH</sub>  | Input HIGH Current                           | V <sub>CC</sub> = Max.                                                                               | V <sub>I</sub> = V <sub>CC</sub> | —               | —                   | 5                              | μA   |
| I <sub>IL</sub>  | Input LOW Current                            |                                                                                                      | V <sub>I</sub> = 2.7V            | —               | —                   | 5 <sup>(4)</sup>               |      |
|                  |                                              |                                                                                                      | V <sub>I</sub> = 0.5V            | —               | —                   | −5 <sup>(4)</sup>              |      |
|                  |                                              |                                                                                                      | V <sub>I</sub> = GND             | —               | —                   | −5                             |      |
| I <sub>OZH</sub> | Off State (High Impedance)<br>Output Current | V <sub>CC</sub> = Max.                                                                               | V <sub>O</sub> = V <sub>CC</sub> | —               | —                   | 10                             | μA   |
| I <sub>OZL</sub> |                                              |                                                                                                      | V <sub>O</sub> = 2.7V            | —               | —                   | 10 <sup>(4)</sup>              |      |
|                  |                                              |                                                                                                      | V <sub>O</sub> = 0.5V            | —               | —                   | −10 <sup>(4)</sup>             |      |
|                  |                                              |                                                                                                      | V <sub>O</sub> = GND             | —               | —                   | −10                            |      |
| V <sub>IK</sub>  | Clamp Diode Voltage                          | V <sub>CC</sub> = Min., I <sub>IN</sub> = −18mA                                                      |                                  | —               | −0.7                | −1.2                           | V    |
| I <sub>OS</sub>  | Short Circuit Current                        | V <sub>CC</sub> = Max., V <sub>O</sub> = GND <sup>(3)</sup>                                          |                                  | −60             | −120                | —                              | mA   |
| V <sub>OH</sub>  | Output HIGH Voltage                          | V <sub>CC</sub> = 3V, V <sub>IN</sub> = V <sub>LC</sub> or V <sub>HC</sub> , I <sub>OH</sub> = −32μA |                                  | V <sub>HC</sub> | V <sub>CC</sub>     | —                              | V    |
|                  |                                              | V <sub>CC</sub> = Min<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                        | I <sub>OH</sub> = −300μA         | V <sub>HC</sub> | V <sub>CC</sub>     | —                              |      |
|                  |                                              |                                                                                                      | I <sub>OH</sub> = −12mA MIL      | 2.4             | 4.3                 | —                              |      |
|                  |                                              |                                                                                                      | I <sub>OH</sub> = −15mA COM'L    | 2.4             | 4.3                 | —                              |      |
| V <sub>OL</sub>  | Output LOW Voltage                           | V <sub>CC</sub> = 3V, V <sub>IN</sub> = V <sub>LC</sub> or V <sub>HC</sub> , I <sub>OL</sub> = 300μA |                                  | —               | GND                 | V <sub>LC</sub>                | V    |
|                  |                                              | V <sub>CC</sub> = Min<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                        | I <sub>OL</sub> = 300μA          | —               | GND                 | V <sub>LC</sub> <sup>(4)</sup> |      |
|                  |                                              |                                                                                                      | I <sub>OL</sub> = 48mA MIL       | —               | 0.3                 | 0.55                           |      |
|                  |                                              |                                                                                                      | I <sub>OL</sub> = 64mA COM'L     | —               | 0.3                 | 0.55                           |      |

### NOTES:

1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at  $V_{CC} = 5.0V$ ,  $+25^{\circ}C$  ambient and maximum loading.
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.

## POWER SUPPLY CHARACTERISTICS

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

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

### NOTES:

- For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
  - Typical values are at  $V_{CC} = 5.0V$ ,  $+25^\circ\text{C}$  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  $\Delta I_{CC}$  formula. These limits are guaranteed but not tested.
  - $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $f_i = \text{Output Frequency}$   
 $N_i = \text{Number of Outputs at } f_i$
- All currents are in milliamps and all frequencies are in megahertz.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL

| Symbol                               | Parameter                     | Condition <sup>(1)</sup> | 74FCT541A           |      | 74FCT541C           |      | Unit |
|--------------------------------------|-------------------------------|--------------------------|---------------------|------|---------------------|------|------|
|                                      |                               |                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Dx to Ox | CL = 50pF<br>RL = 500Ω   | 1.5                 | 4.8  | 1.5                 | 4.1  | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time            |                          | 1.5                 | 6.2  | 1.5                 | 5.8  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time           |                          | 1.5                 | 5.6  | 1.5                 | 5.2  | ns   |

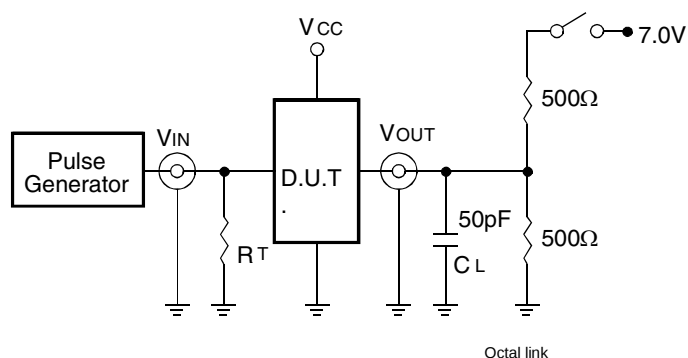
## SWITCHING CHARACTERISTICS OVER OPERATING RANGE - MILITARY

| Symbol                               | Parameter                     | Condition <sup>(1)</sup> | 54FCT541            |      | 54FCT541A           |      | Unit |
|--------------------------------------|-------------------------------|--------------------------|---------------------|------|---------------------|------|------|
|                                      |                               |                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Dx to Ox | CL = 50pF<br>RL = 500Ω   | 1.5                 | 9    | 1.5                 | 5.1  | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time            |                          | 1.5                 | 10.5 | 1.5                 | 6.5  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time           |                          | 1.5                 | 10   | 1.5                 | 5.9  | ns   |

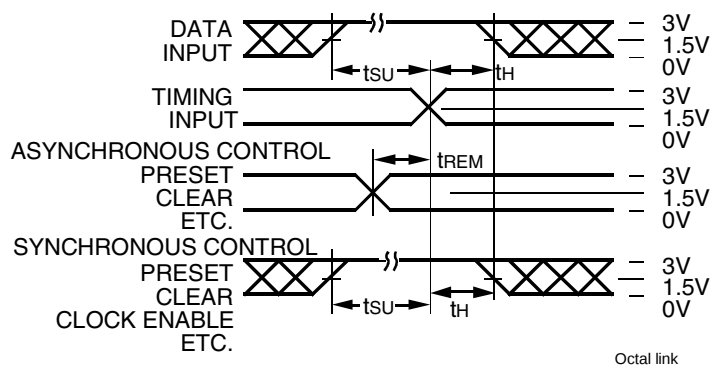
### NOTES:

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

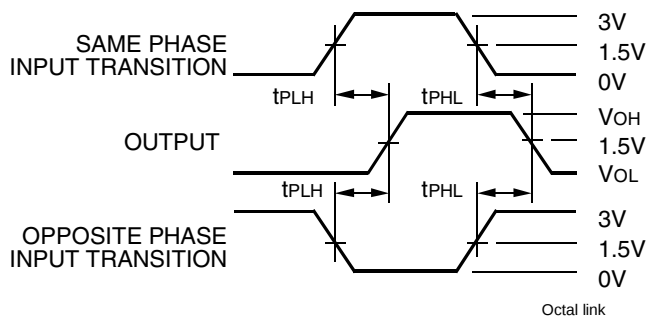
## TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-Up, Hold, and Release Times



Propagation Delay

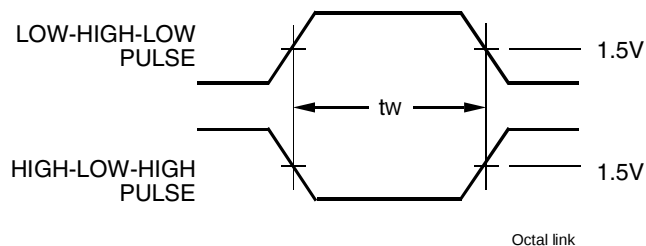
## SWITCH POSITION

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

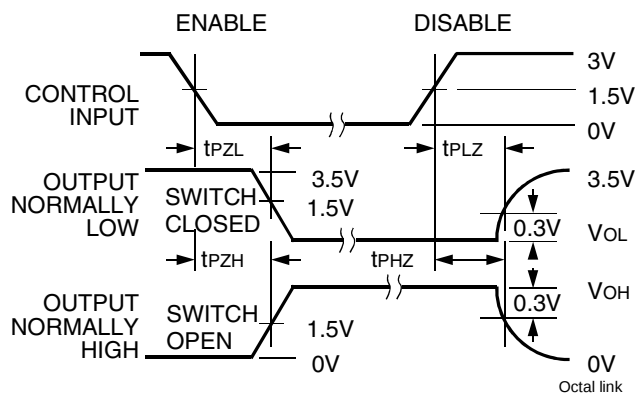
### DEFINITIONS:

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  $\leq 1.0\text{MHz}$ ;  $Z_o \leq 50\Omega$ ;  $t_r \leq 2.5\text{ns}$ ;  $t_f \leq 2.5\text{ns}$ .

## ORDERING INFORMATION

| IDT         | XX          | FCT     | XXXX    | XX | X                   |                                                            |  |
|-------------|-------------|---------|---------|----|---------------------|------------------------------------------------------------|--|
| Temp. Range | Device Type | Package | Process |    |                     |                                                            |  |
|             |             |         |         |    | Blank<br>B          | Commercial<br>MIL-STD-883, Class B                         |  |
|             |             |         |         |    | SO                  | <u>Commercial Options</u><br>Small Outline IC              |  |
|             |             |         |         |    | D<br>L              | <u>Military Options</u><br>CERDIP<br>Leadless Chip Carrier |  |
|             |             |         |         |    | 541<br>541A<br>541C | Fast CMOS Octal Buffer/Line Driver                         |  |
|             |             |         |         |    | 54<br>74            | – 55°C to +125°C<br>0°C to +70°C                           |  |



### CORPORATE HEADQUARTERS

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