



## FAST CMOS 8-BIT IDENTITY COMPARATOR

IDT54/74FCT521T/AT/BT/CT

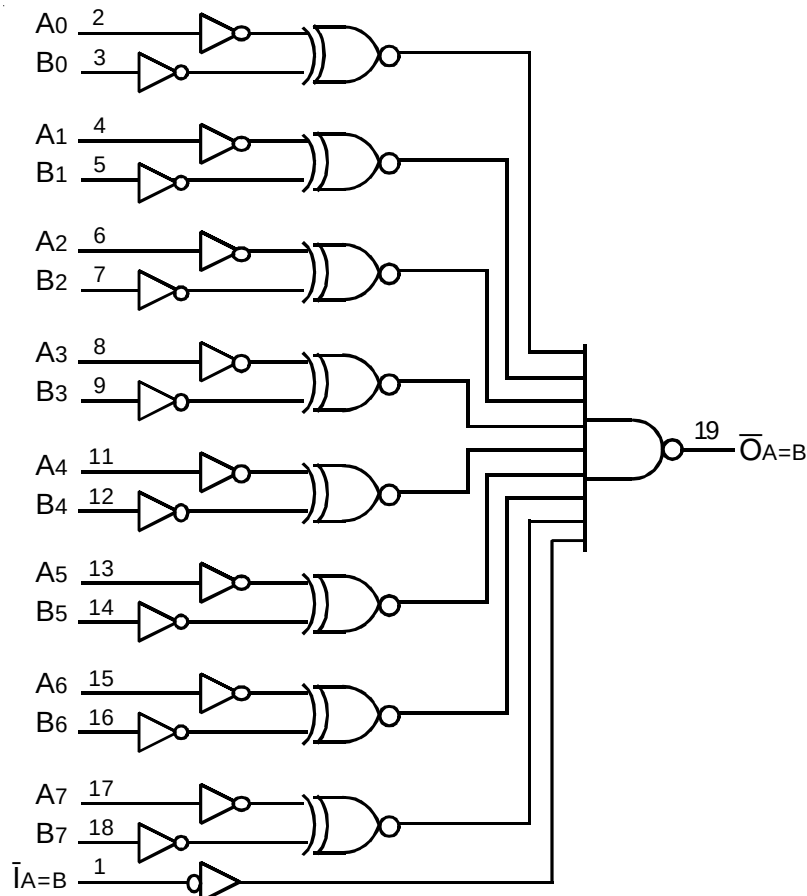
### FEATURES:

- Std., A, B, 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  $I_{OH}$ , 48mA  $I_{OL}$ )
- 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
  - Military: CERDIP, LCC

### DESCRIPTION:

The IDT54/74FCT521T is an 8-bit identity comparator built using an advanced dual metal CMOS technology. These devices compare two words of up to eight bits each and provide a low output when the two words match bit for bit. The expansion input  $\bar{I}A = B$  also serves as an active low enable input.

### FUNCTIONAL BLOCK DIAGRAM

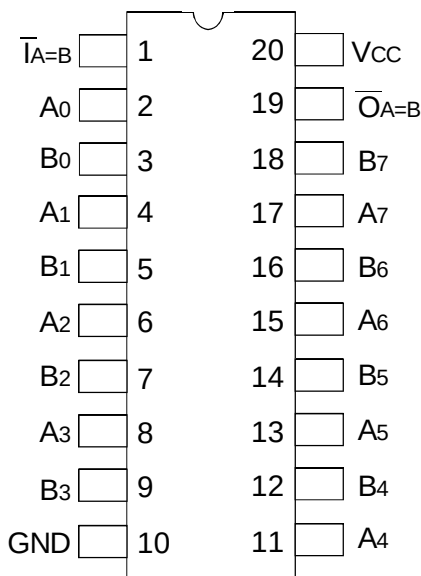


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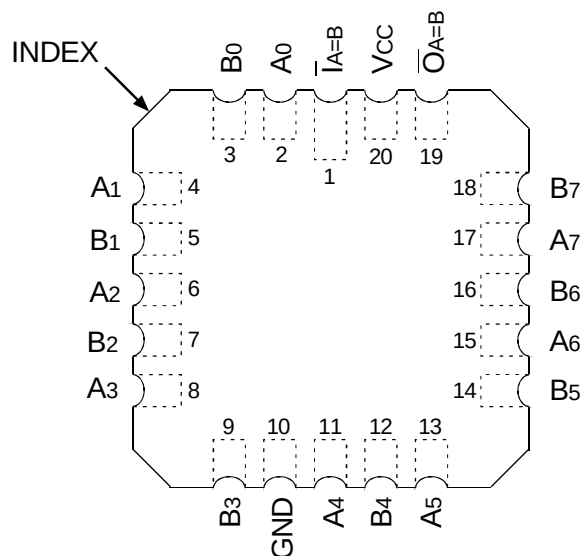
MILITARY AND INDUSTRIAL TEMPERATURE RANGES

JUNE 2002

## PIN CONFIGURATION



CERDIP/ SOIC/ SSOP/ QSOP  
TOP VIEW



LCC  
TOP VIEW

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

| Symbol                           | Description                          | Max                          | Unit |
|----------------------------------|--------------------------------------|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | −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 | V    |
| T <sub>STG</sub>                 | Storage Temperature                  | −65 to +150                  | °C   |
| I <sub>OUT</sub>                 | 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<sub>CC</sub> by +0.5V unless otherwise noted.
- Inputs 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                            |
|---------------------------------|----------------------------------------|
| A <sub>0</sub> - A <sub>7</sub> | Word A Inputs                          |
| B <sub>0</sub> - B <sub>7</sub> | Word B Inputs                          |
| I <sub>A</sub> = B              | Expansion or Enable Input (Active LOW) |
| O <sub>A</sub> = B              | Identity Output (Active LOW)           |

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

| Inputs             |        | Output             |
|--------------------|--------|--------------------|
| I <sub>A</sub> = B | A, B   | O <sub>A</sub> = B |
| L                  | A = B* | L                  |
| L                  | A ≠ B  | H                  |
| H                  | A = B* | H                  |
| H                  | A ≠ B  | H                  |

### NOTE:

- H = HIGH Voltage Level

L = LOW Voltage Level

\*A<sub>0</sub> = B<sub>0</sub>, A<sub>1</sub> = B<sub>1</sub>, A<sub>2</sub> = B<sub>2</sub>, etc.

## 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 <sup>(1)</sup>                                |                                                            | Min. | Typ. <sup>(2)</sup> | 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 <sup>(4)</sup> | $V_{CC} = \text{Max.}$                                        | $V_I = 2.7\text{V}$                                        | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current <sup>(4)</sup>  | $V_{CC} = \text{Max.}$                                        | $V_I = 0.5\text{V}$                                        | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_I$    | Input HIGH Current <sup>(4)</sup> | $V_{CC} = \text{Max.}, V_I = V_{CC} (\text{Max.})$            |                                                            | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $V_{IK}$ | Clamp Diode Voltage               | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$                 |                                                            | —    | -0.7                | -1.2    | V             |
| $I_{OS}$ | Short Circuit Current             | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$                |                                                            | -60  | -120                | -225    | mA            |
| $V_{OH}$ | Output HIGH Voltage               | $V_{CC} = \text{Min}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -6\text{mA MIL}$<br>$I_{OH} = -8\text{mA IND}$   | 2.4  | 3.3                 | —       | V             |
|          |                                   |                                                               | $I_{OH} = -12\text{mA MIL}$<br>$I_{OH} = -15\text{mA IND}$ | 2    | 3                   | —       |               |
|          |                                   |                                                               |                                                            |      |                     |         |               |
| $V_{OL}$ | Output LOW Voltage                | $V_{CC} = \text{Min}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OL} = 32\text{mA MIL}$<br>$I_{OL} = 48\text{mA IND}$   | —    | 0.3                 | 0.5     | V             |
| $V_H$    | Input Hysteresis                  | —                                                             |                                                            | —    | 200                 | —       | mV            |
| $I_{CC}$ | Quiescent Power Supply Current    | $V_{CC} = \text{Max.}$<br>$V_{IN} = \text{GND or } V_{CC}$    |                                                            | —    | 0.01                | 1       | 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 <sup>(1)</sup>                                                                       |                                     | Min. | Typ. <sup>(2)</sup> | Max. | Unit       |
|-----------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------|------|---------------------|------|------------|
| $\Delta I_{CC}$ | 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>One Input Toggling<br>50% Duty Cycle                       | $V_{IN} = V_{CC}$<br>$V_{IN} = GND$ | —    | 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>One Bit Toggling<br>50% Duty Cycle | $V_{IN} = V_{CC}$<br>$V_{IN} = GND$ | —    | 1.5                 | 3.5  | mA         |
|                 |                                                   |                                                                                                      | $V_{IN} = 3.4V$<br>$V_{IN} = GND$   | —    | 1.8                 | 4.5  |            |

### 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  $V_{CC} = 5.0V$ ,  $+25^\circ\text{C}$  ambient.

3. Per TTL driven input; ( $V_{IN} = 3.4V$ ). 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  $\Delta I_{CC}$  formula. These limits are guaranteed but not tested.

6.  $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$

$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$

$I_{CC} = \text{Quiescent Current}$

$\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$

$D_H = \text{Duty Cycle for TTL Inputs High}$

$N_T = \text{Number of TTL Inputs at } D_H$

$I_{CCD} = \text{Dynamic Current caused by an Input Transition Pair (HLH or LHL)}$

$f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$

$f_i = \text{Output Frequency}$

$N_i = \text{Number of Outputs at } f_i$

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

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL

| Symbol    | Parameter                          | Condition <sup>(1)</sup>                 | FCT521AT            |      | FCT521CT            |      | Unit |
|-----------|------------------------------------|------------------------------------------|---------------------|------|---------------------|------|------|
|           |                                    |                                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| $t_{PLH}$ | Propagation Delay                  | $C_L = 50\text{pF}$<br>$R_L = 500\Omega$ | 1.5                 | 7.2  | 1.5                 | 4.5  | ns   |
| $t_{PHL}$ | Ax or Bx to $\bar{O}_A = B$        |                                          |                     |      |                     |      |      |
| $t_{PLH}$ | Propagation Delay                  | $\bar{I}_A = B$ to $\bar{O}_A = B$       | 1.5                 | 6    | 1.5                 | 4.1  | ns   |
| $t_{PHL}$ | $\bar{I}_A = B$ to $\bar{O}_A = B$ |                                          |                     |      |                     |      |      |

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE - MILITARY

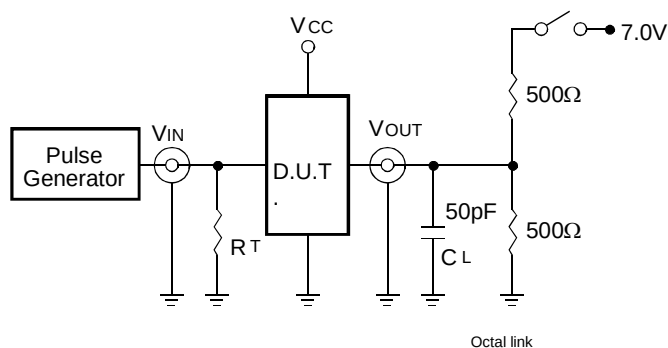
| Symbol    | Parameter                          | Condition <sup>(1)</sup>                 | 54FCT521T           |      | 54FCT521AT          |      | 54FCT521BT          |      | 54FCT521CT          |      | Unit |
|-----------|------------------------------------|------------------------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|           |                                    |                                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| $t_{PLH}$ | Propagation Delay                  | $C_L = 50\text{pF}$<br>$R_L = 500\Omega$ | 1.5                 | 15   | 1.5                 | 9.5  | 1.5                 | 7.3  | 1.5                 | 5.1  | ns   |
| $t_{PHL}$ | Ax or Bx to $\bar{O}_A = B$        |                                          |                     |      |                     |      |                     |      |                     |      |      |
| $t_{PLH}$ | Propagation Delay                  | $\bar{I}_A = B$ to $\bar{O}_A = B$       | 1.5                 | 9    | 1.5                 | 7.8  | 1.5                 | 6    | 1.5                 | 4.5  | ns   |
| $t_{PHL}$ | $\bar{I}_A = B$ to $\bar{O}_A = B$ |                                          |                     |      |                     |      |                     |      |                     |      |      |

### NOTES:

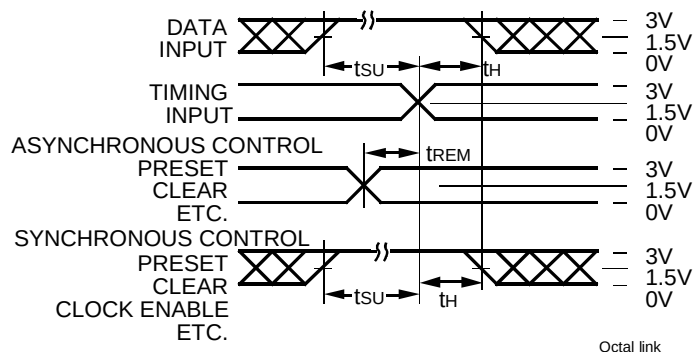
1. See test circuit and waveforms.

2. Minimum limits are guaranteed but not tested on Propagation Delays.

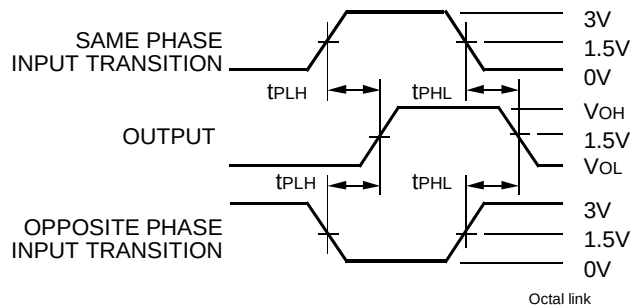
## TEST CIRCUITS AND WAVEFORMS



**Test Circuits for All Outputs**



**Set-Up, Hold, and Release Times**



**Propagation Delay**

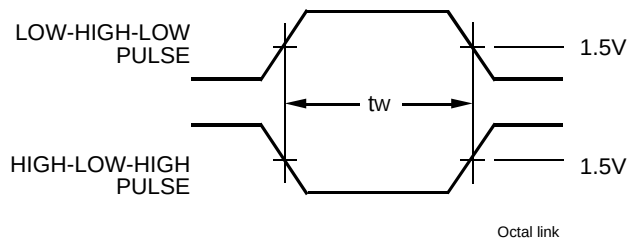
## SWITCH POSITION

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

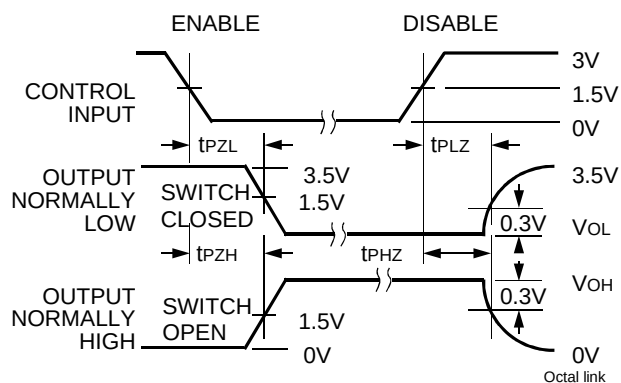
### DEFINITIONS:

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

## ORDERING INFORMATION

| IDT         | XX | FCT         | XXXX | XX      | X       |                                     |  |
|-------------|----|-------------|------|---------|---------|-------------------------------------|--|
| Temp. Range |    | Device Type |      | Package | Process |                                     |  |
|             |    |             |      |         | Blank   | Industrial                          |  |
|             |    |             |      |         | B       | MIL-STD-883, Class B                |  |
|             |    |             |      |         |         | <u>Industrial Options</u>           |  |
|             |    |             |      |         | SO      | Small Outline IC                    |  |
|             |    |             |      |         | PY      | Shrink Small Outline Package        |  |
|             |    |             |      |         | Q       | Quarter-size Small Outline Package  |  |
|             |    |             |      |         |         | <u>Military Options</u>             |  |
|             |    |             |      |         | D       | CERDIP                              |  |
|             |    |             |      |         | L       | Leadless Chip Carrier               |  |
|             |    |             |      |         | 521T    | Fast CMOS 8-Bit Identity Comparator |  |
|             |    |             |      |         | 521AT   |                                     |  |
|             |    |             |      |         | 521BT   |                                     |  |
|             |    |             |      |         | 521CT   |                                     |  |
|             |    |             |      |         | 54      | – 55°C to +125°C                    |  |
|             |    |             |      |         | 74      | – 40°C to +85°C                     |  |



### CORPORATE HEADQUARTERS

2975 Stender Way  
Santa Clara, CA 95054

### for SALES:

800-345-7015 or 408-727-6116  
fax: 408-492-8674  
www.idt.com

### for Tech Support:

logichelp@idt.com  
(408) 654-6459