



## FAST CMOS OCTAL D REGISTER (3-STATE)

*IDT74FCT2574T/AT/CT*

### FEATURES:

- Low input and output leakage  $\leq 1\mu\text{A}$  (max.)
- Extended commercial range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- CMOS power levels
- True TTL input and output compatibility
  - $V_{OH} = 3.3\text{V}$  (typ.)
  - $V_{OL} = 0.3\text{V}$  (typ.)
- Meets or exceeds JEDEC standard 18 specifications
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Available in PDIP, SOIC, SSOP, QSOP, and TSSOP packages
- Std., A, and C speed grades
- Resistor outputs ( $-15\text{mA } I_{OH}$ ,  $12\text{mA } I_{OL}$ )
- Reduced system switching noise

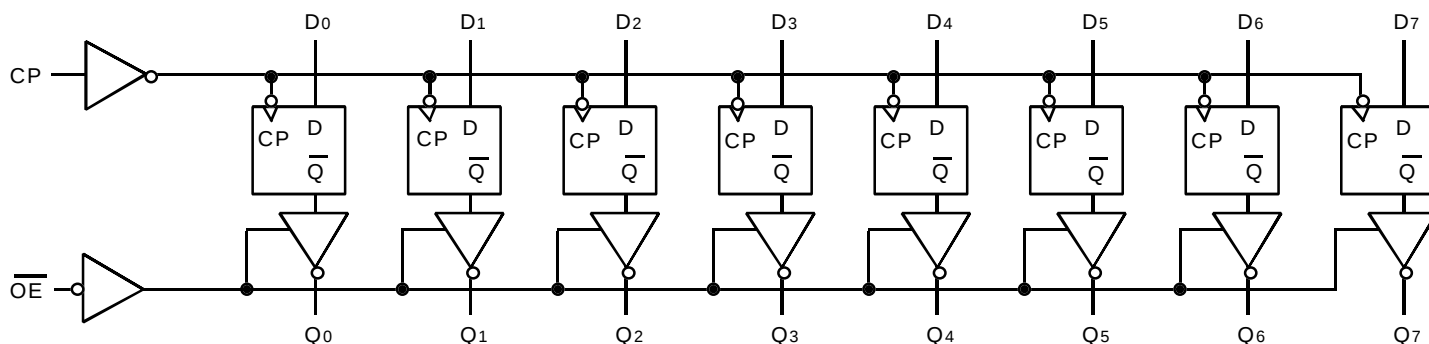
### DESCRIPTION:

The FCT2574T is an 8-bit register built using an advanced dual metal CMOS technology. These registers consist of eight D-type flip-flops with a buffered common clock and buffered 3-state output control. When the output enable ( $\overline{OE}$ ) input is low, the eight outputs are enabled. When the  $\overline{OE}$  input is high, the outputs are in the high-impedance state.

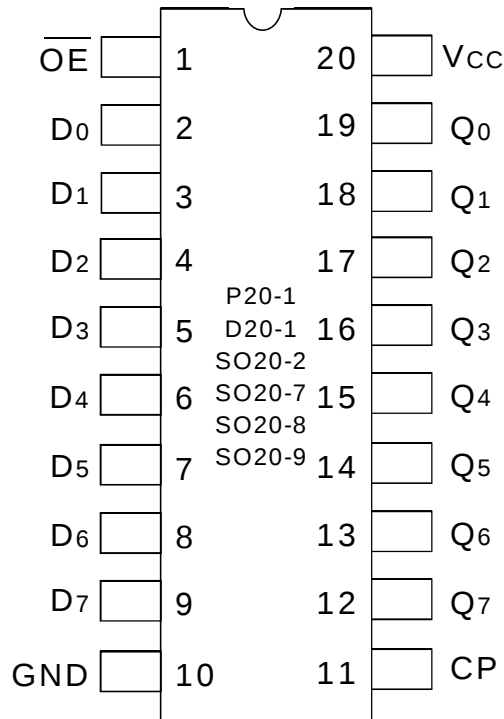
Input data meeting the set-up and hold time requirements of the D inputs is transferred to the Q outputs on the low-to-high transition of the clock input.

The FCT2574T has balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot and controlled output fall times-reducing the need for external series terminating resistors. FCT2574T parts are plug-in replacements for FCT574T parts.

### FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



PDIP/ SOIC/ SSOP/ QSOP/ TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol           | Rating                               | 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                    | -65 to +120          | mA   |

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### 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.
- Outputs and I/O terminals only.

## CAPACITANCE ( $T_A = +25^{\circ}\text{C}$ , $f = 1.0\text{MHz}$ )

| Symbol    | Parameter <sup>(1)</sup> | Conditions     | Typ. | Max. | Unit |
|-----------|--------------------------|----------------|------|------|------|
| $C_{IN}$  | Input Capacitance        | $V_{IN} = 0V$  | 6    | 10   | pF   |
| $C_{OUT}$ | Output Capacitance       | $V_{OUT} = 0V$ | 8    | 12   | pF   |

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### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

| Pin Names        | Description                                                          |
|------------------|----------------------------------------------------------------------|
| $D_N$            | D flip-flop data inputs                                              |
| CP               | Clock Pulse for the register. Enters data on LOW-to-HIGH transition. |
| $Q_N$            | 3-state outputs (TRUE)                                               |
| $\overline{Q}_N$ | 3-state outputs (INVERTED)                                           |
| $\overline{OE}$  | Active LOW 3-state Output Enable input                               |

## FUNCTION TABLE (1)

| Function      | Inputs          |    |       | Outputs | Internal         |
|---------------|-----------------|----|-------|---------|------------------|
|               | $\overline{OE}$ | CP | $D_N$ | $Q_N$   | $\overline{Q}_N$ |
| HI-Z          | H               | L  | X     | Z       | NC               |
|               | H               | H  | X     | Z       | NC               |
| LOAD REGISTER | L               | ↑  | L     | L       | H                |
|               | L               | ↑  | H     | H       | L                |
|               | H               | ↑  | L     | Z       | H                |
|               | H               | ↑  | H     | Z       | L                |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance  
NC = No Change  
↑ = LOW-to-HIGH transition

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

| 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>                                      |                                                        | $V_I = 0.5\text{V}$ | —    | —                   | $\pm 1$ |               |
| $I_{OZH}$ | High Impedance Output Current<br>(3-State Output pins) <sup>(4)</sup> | $V_{CC} = \text{Max.}$                                 | $V_O = 2.7\text{V}$ | —    | —                   | $\pm 1$ |               |
| $I_{OL}$  |                                                                       |                                                        | $V_O = 0.5\text{V}$ | —    | —                   | $\pm 1$ |               |
| $I_I$     | 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             |
| $V_H$     | 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            |

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## OUTPUT DRIVE CHARACTERISTICS

| Symbol    | Parameter           | Test Conditions <sup>(1)</sup>                                                        |                         | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|-----------|---------------------|---------------------------------------------------------------------------------------|-------------------------|------|---------------------|------|------|
| $I_{ODL}$ | Output LOW Current  | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$ |                         | 16   | 48                  | —    | mA   |
| $I_{ODH}$ | Output HIGH Current | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$ |                         | -16  | -48                 | —    | mA   |
| $V_{OH}$  | Output HIGH Voltage | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                        | $I_{OH} = -15\text{mA}$ | 2.4  | 3.3                 | —    | V    |
| $V_{OL}$  | Output LOW Voltage  | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                        | $I_{OH} = 12\text{mA}$  | —    | 0.3                 | 0.5  | V    |

### NOTES:

- For conditions shown as Max. or Min., 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 shorted at one time. Duration of the short circuit 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 Current <sup>(4)</sup>       | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$\overline{OE} = \text{GND}$<br>One Input Toggling<br>50% Duty Cycle                                                                        | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 0.06                | 0.12              | mA/<br>MHz |
| $I_C$           | Total Power Supply Current <sup>(6)</sup>         | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$f_{CP} = 10\text{MHz}$<br>50% Duty Cycle<br>$\overline{OE} = \text{GND}$<br>$f_i = 5\text{MHz}$<br>50% Duty Cycle<br>One Bit Toggling      | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 0.6                 | 2.2               | mA         |
|                 |                                                   |                                                                                                                                                                                       | $V_{IN} = 3.4$<br>$V_{IN} = \text{GND}$    | —    | 1.1                 | 4.2               |            |
|                 |                                                   | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$f_{CP} = 10\text{MHz}$<br>50% Duty Cycle<br>$\overline{OE} = \text{GND}$<br>Eight Bits Toggling<br>$f_i = 2.5\text{MHz}$<br>50% Duty Cycle | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 1.5                 | 4 <sup>(5)</sup>  |            |
|                 |                                                   |                                                                                                                                                                                       | $V_{IN} = 3.4$<br>$V_{IN} = \text{GND}$    | —    | 3.8                 | 13 <sup>(5)</sup> |            |

### NOTES:

- For conditions shown as Max. or Min., 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  $\text{GND}$ .
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_{HNT} + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$   
All currents are in milliamps and all frequencies are in megahertz.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

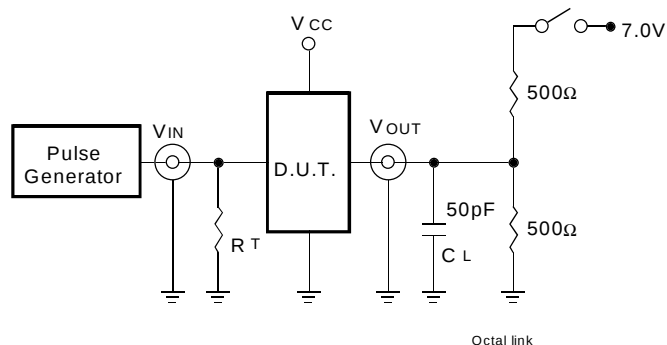
| Symbol                               | Parameter                                        | Condition <sup>(1)</sup>                       | FCT2574T            |      | FCT2574AT           |      | FCT2574CT           |      | Unit |
|--------------------------------------|--------------------------------------------------|------------------------------------------------|---------------------|------|---------------------|------|---------------------|------|------|
|                                      |                                                  |                                                | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CP to Q <sub>N</sub>        | C <sub>L</sub> = 50pF<br>R <sub>L</sub> = 500Ω | 2                   | 10   | 2                   | 6.5  | 2                   | 5.2  | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time                               |                                                | 1.5                 | 12.5 | 1.5                 | 6.5  | 1.5                 | 5.5  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time                              |                                                | 1.5                 | 8    | 1.5                 | 5.5  | 1.5                 | 5    | ns   |
| t <sub>su</sub>                      | Set-up Time HIGH<br>or LOW, D <sub>N</sub> to CP |                                                | 2                   | —    | 2                   | —    | 2                   | —    | ns   |
| t <sub>h</sub>                       | Hold Time HIGH<br>or LOW, D <sub>N</sub> to CP   |                                                | 1.5                 | —    | 1.5                 | —    | 1.5                 | —    | ns   |
| t <sub>w</sub>                       | CP Pulse Width<br>HIGH or LOW <sup>(3)</sup>     |                                                | 7                   | —    | 5                   | —    | 5                   | —    | ns   |

### NOTES:

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

## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



### SWITCH POSITION

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

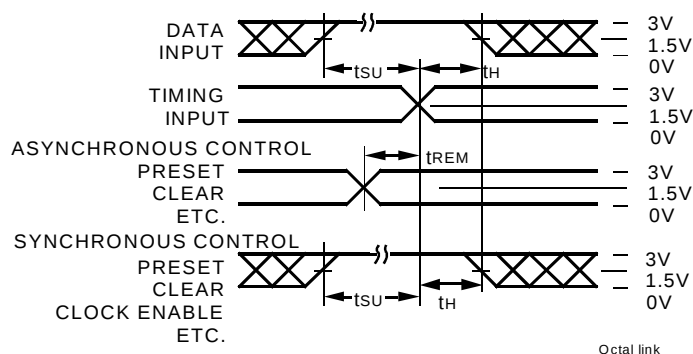
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#### DEFINITIONS:

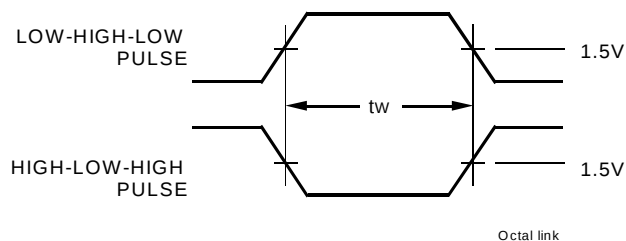
$C_L$  = Load capacitance: includes jig and probe capacitance.

$R_T$  = Termination resistance: should be equal to  $Z_{out}$  of the Pulse Generator.

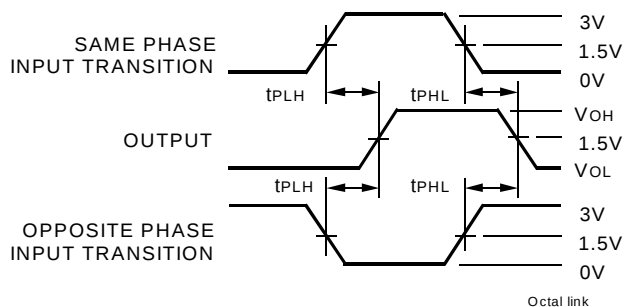
### SET-UP, HOLD, AND RELEASE TIMES



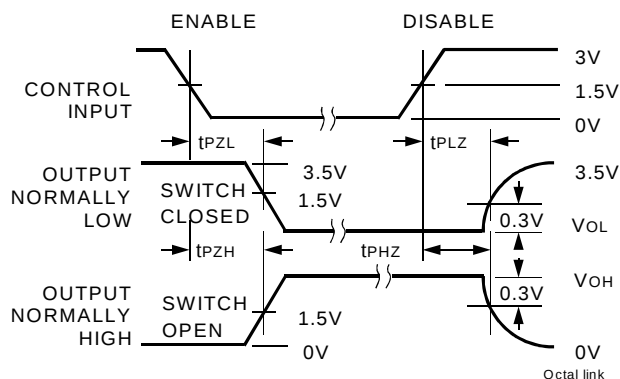
### PULSE WIDTH



### PROPAGATION DELAY



### ENABLE AND DISABLE TIMES



#### NOTES:

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

## ORDERING INFORMATION

| IDT | XX<br>Temp. Range | FCT | X<br>Family | XXXX<br>Device Type | X<br>Package | X<br>Process |                                             |
|-----|-------------------|-----|-------------|---------------------|--------------|--------------|---------------------------------------------|
|     |                   |     |             |                     |              | Blank        | Commercial                                  |
|     |                   |     |             |                     |              | P            | Plastic DIP (P20-1)                         |
|     |                   |     |             |                     |              | D            | CERDIP (D20-1)                              |
|     |                   |     |             |                     |              | SO           | Small Outline IC (SO20-2)                   |
|     |                   |     |             |                     |              | PY           | Shrink Small Outline Package (SO20-7)       |
|     |                   |     |             |                     |              | Q            | Quarter-size Small Outline Package (SO20-8) |
|     |                   |     |             |                     |              | PG           | Thin Shrink Small Outline Package (SO20-9)  |
|     |                   |     |             |                     |              | 574T         | Octal D Register                            |
|     |                   |     |             |                     |              | 574AT        |                                             |
|     |                   |     |             |                     |              | 574CT        |                                             |
|     |                   |     |             |                     |              | 2            | Balanced Drive                              |
|     |                   |     |             |                     |              | 74           | -40°C to +85°C                              |



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