



## HIGH-SPEED CMOS DUAL 4-INPUT MULTIPLEXER

*IDTQS74FCT153AT/CT*

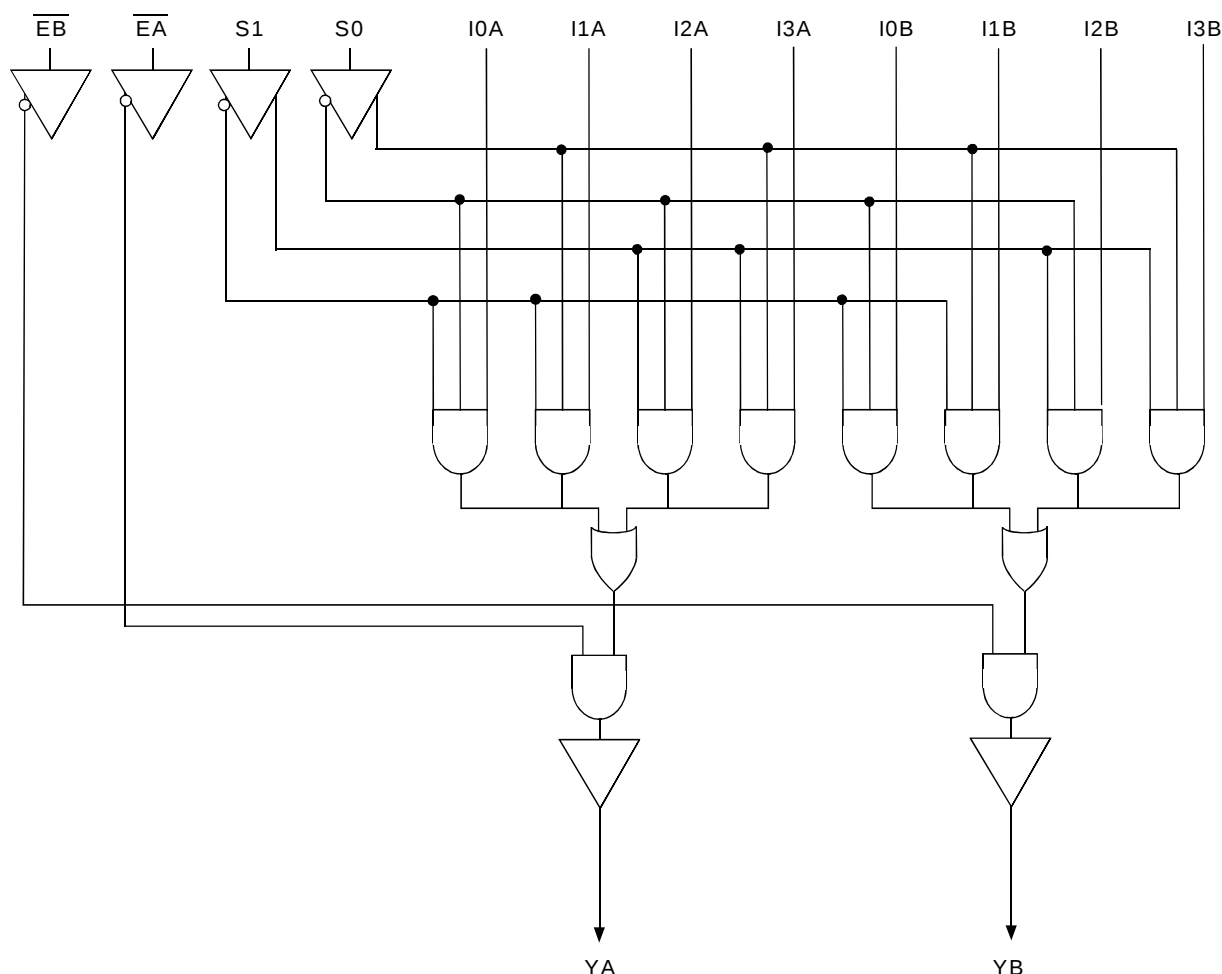
### FEATURES:

- CMOS power levels: <7.5mW static
- Undershoot clamp diodes on all inputs
- True TTL input and output compatibility
- Ground bounce controlled outputs
- Reduced output swing of 0 to 3.5V
- A and C speed grades with 4.5ns t<sub>PD</sub> for C
- I<sub>OL</sub> = 48mA
- Available in SOIC and QSOP packages

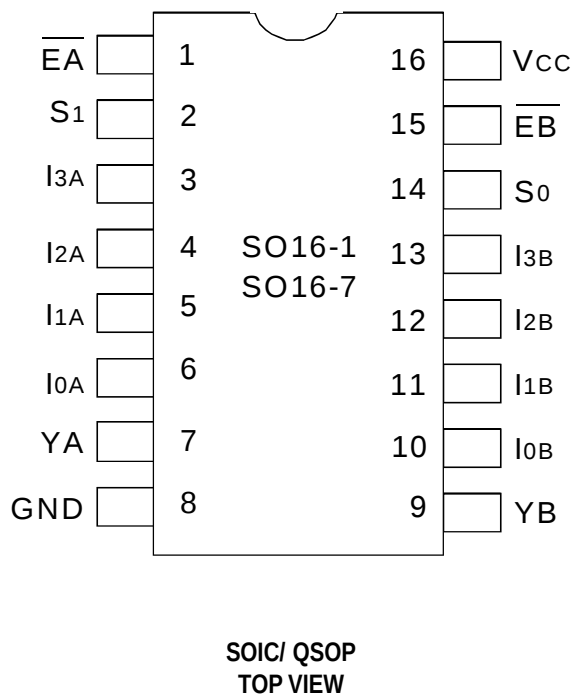
### DESCRIPTION:

The IDTQS74FCT153T is a high-speed CMOS TTL-compatible dual 4-input multiplexer. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression. Outputs will not load an active bus when V<sub>CC</sub> is removed from the device.

### FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



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

| Symbol            | Description                                | Max.         | Unit |
|-------------------|--------------------------------------------|--------------|------|
| V <sub>TERM</sub> | Terminal Voltage with Respect to GND       | – 0.5 to +7  | V    |
| T <sub>STG</sub>  | Storage Temperature                        | – 65 to +150 | °C   |
| I <sub>OUT</sub>  | DC Output Current Max Sink Current/Pin     | 120          | mA   |
| I <sub>IK</sub>   | Input Diode Current, V <sub>IN</sub> < 0   | – 20         | mA   |
| I <sub>OK</sub>   | Output Diode Current, V <sub>OUT</sub> < 0 | – 50         | mA   |

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### NOTE:

- 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.

## 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  | 4    | —    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 8    | —    | pF   |

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### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

| Pin Names                         | I/O | Description |
|-----------------------------------|-----|-------------|
| I <sub>0</sub> - I <sub>7</sub>   | I   | Data In     |
| S <sub>0</sub> - S <sub>1</sub>   | I   | Select      |
| $\overline{EA}$ , $\overline{EB}$ | I   | Enable      |
| YA, YB                            | O   | Data Out    |

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

| Enable          |                 | Select         |                | Outputs         |                 | Function               |
|-----------------|-----------------|----------------|----------------|-----------------|-----------------|------------------------|
| $\overline{EA}$ | $\overline{EB}$ | S <sub>1</sub> | S <sub>0</sub> | Y <sub>A</sub>  | Y <sub>B</sub>  |                        |
| H               | X               | X              | X              | L               | X               | Disable A              |
| X               | H               | X              | X              | X               | L               | Disable B              |
| L               | L               | L              | L              | I <sub>0A</sub> | I <sub>0B</sub> | S <sub>1</sub> - 0 = 0 |
| L               | L               | L              | H              | I <sub>1A</sub> | I <sub>1B</sub> | S <sub>1</sub> - 0 = 1 |
| L               | L               | H              | L              | I <sub>2A</sub> | I <sub>2B</sub> | S <sub>1</sub> - 0 = 2 |
| L               | L               | H              | H              | I <sub>3A</sub> | I <sub>3B</sub> | S <sub>1</sub> - 0 = 3 |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

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

| 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    |  |
| ΔV <sub>T</sub> | Input Hysteresis      | V <sub>TLH</sub> - V <sub>THL</sub> for all inputs                                     |                                       | —    | 0.2                 | —    | V    |  |
| I <sub>IH</sub> | Input HIGH Current    | V <sub>CC</sub> = Max.                                                                 | 0 ≤ V <sub>IN</sub> < V <sub>CC</sub> | —    | —                   | ±5   | μA   |  |
| I <sub>IL</sub> | Input LOW Current     |                                                                                        |                                       |      |                     |      |      |  |
| I <sub>OS</sub> | Short Circuit Current | V <sub>CC</sub> = Max., V <sub>OUT</sub> = GND <sup>(2)</sup>                          |                                       | -60  | —                   | —    | mA   |  |
| V <sub>IC</sub> | Input Clamp Voltage   | V <sub>CC</sub> = Min., I <sub>IN</sub> = −18mA, T <sub>A</sub> = 25° C <sup>(2)</sup> |                                       | —    | −0.7                | −1.2 | V    |  |
| V <sub>OH</sub> | Output HIGH Voltage   | V <sub>CC</sub> = Min.                                                                 | I <sub>OH</sub> = -15mA               | 2.4  | —                   | —    | V    |  |
| V <sub>OL</sub> | Output LOW Voltage    | V <sub>CC</sub> = Min.                                                                 | I <sub>OL</sub> = 48mA                | —    | —                   | 0.5  | V    |  |

### NOTES:

1. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $T_A = 25^{\circ}\text{C}$ .
2. This parameter is guaranteed but not tested.

## POWER SUPPLY CHARACTERISTICS

Following Conditions Apply Unless Otherwise Specified:

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

| Symbol          | Parameter                                | Test Conditions <sup>(1)</sup>                                                                                                             | Min. | Max. | Unit   |
|-----------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------|------|--------|
| $I_{CC}$        | Quiescent Power Supply Current           | $V_{CC} = \text{Max.}$<br>$\text{freq} = 0$<br>$0\text{V} \leq V_{IN} \leq 0.2\text{V}$ or<br>$V_{CC}-0.2\text{V} \leq V_{IN} \leq V_{CC}$ | —    | 1.5  | mA     |
| $\Delta I_{CC}$ | Supply Current per Input TTL Inputs HIGH | $V_{CC} = \text{Max.}$<br>$V_{IN} = 3.4\text{V}^{(2)}$<br>$\text{freq} = 0$                                                                | —    | 2    | mA     |
| $I_{CCD}$       | Supply Current per Input per MHz         | $V_{CC} = \text{Max.}$<br>Outputs Open and Enabled<br>One Bit Toggling<br>50% Duty Cycle<br>Other inputs at GND or $V_{CC}^{(3,4)}$        | —    | 0.25 | mA/MHz |

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### NOTES:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
2. Per TLL driven input ( $V_{IN} = 3.4\text{V}$ ).
3. For flip-flops,  $I_{CCD}$  is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance.
4.  $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC}$  = Quiescent Current  
 $\Delta I_{CC}$  = Power Supply Current for a TTL High Input ( $V_{IN} = 3.4\text{V}$ )  
 $D_H$  = Duty Cycle for TTL Inputs High  
 $N_T$  = Number of TTL Inputs at  $D_H$   
 $I_{CCD}$  = Dynamic Current Caused by an Output 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.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE<sup>(1)</sup>

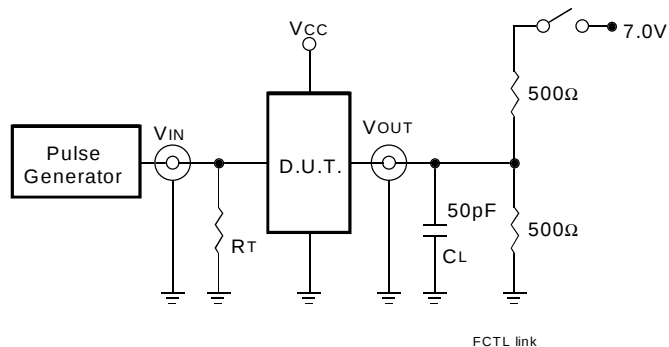
| Symbol                               | Parameter <sup>(2)</sup>             | 74FCT153AT |      | 74FCT153CT |      | Unit |
|--------------------------------------|--------------------------------------|------------|------|------------|------|------|
|                                      |                                      | Min.       | Max. | Min.       | Max. |      |
| t <sub>iy</sub>                      | Propagation Delay<br>In to Y         | 1.5        | 5.2  | 1.5        | 4.5  | ns   |
| t <sub>sy</sub>                      | Propagation Delay<br>Sn to Y         | 1.5        | 6.6  | 1.5        | 5.6  | ns   |
| t <sub>OEH</sub><br>t <sub>OEL</sub> | Output Enable Time<br>$\bar{E}$ to Y | 1.5        | 5.2  | 1.5        | 4.8  | ns   |

### NOTES:

1. C<sub>LOAD</sub> = 50pF, R<sub>LOAD</sub> = 500Ω unless otherwise noted.
2. Minimums 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   |

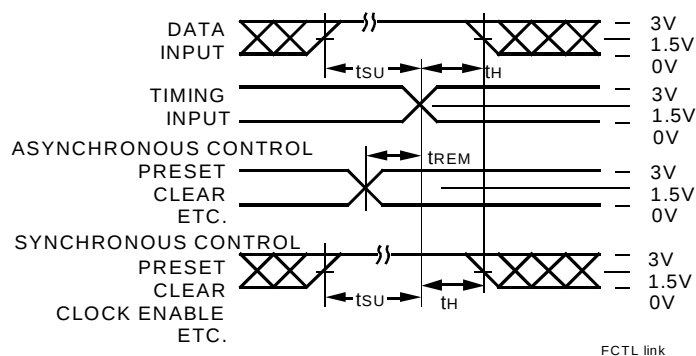
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#### DEFINITIONS:

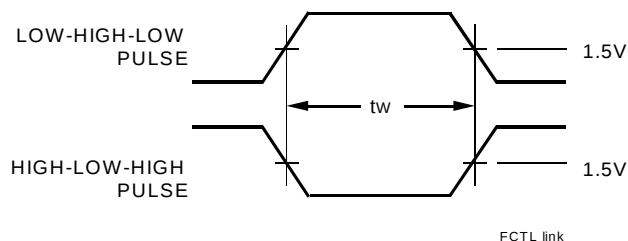
CL = Load capacitance: includes jig and probe capacitance.

RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

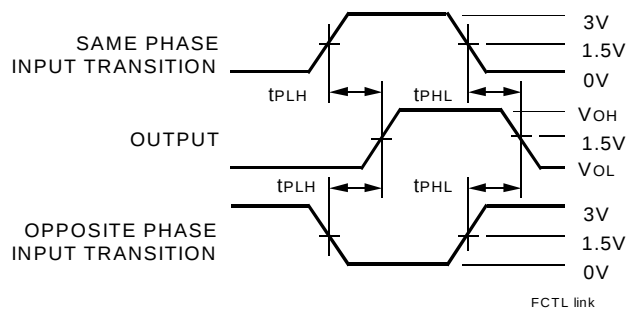
### SET-UP, HOLD, AND RELEASE TIMES



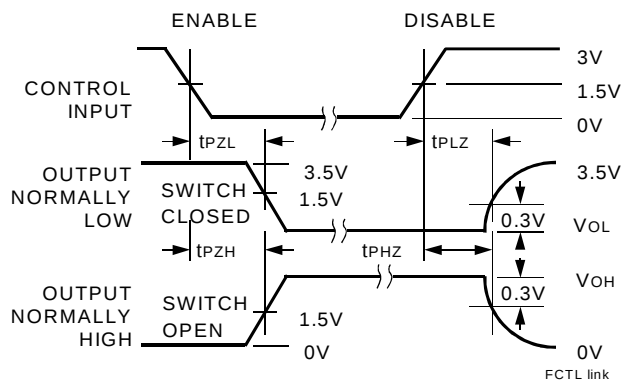
### PULSE WIDTH



### 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  $\leq 10\text{MHz}$ ;  $Z_o \leq 50\Omega$ ;  $t_r \leq 2.5\text{ns}$ ;  $t_r \leq 2.5\text{ns}$ .

## ORDERING INFORMATION

| IDTQS | XX          | FCT | XXXX        | XX      |                                             |
|-------|-------------|-----|-------------|---------|---------------------------------------------|
|       | Temp. Range |     | Device Type | Package |                                             |
|       |             |     |             | SO      | Small Outline IC (gull wing) (SO16-1)       |
|       |             |     |             | Q       | Quarter Size Small Outline Package (SO16-7) |
|       |             |     | 153AT       |         | High-Speed CMOS Dual 4-Input Multiplexer    |
|       |             |     | 153CT       |         |                                             |
|       |             |     |             | 74      | −40°C to +85°C                              |



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