

## FEATURES:

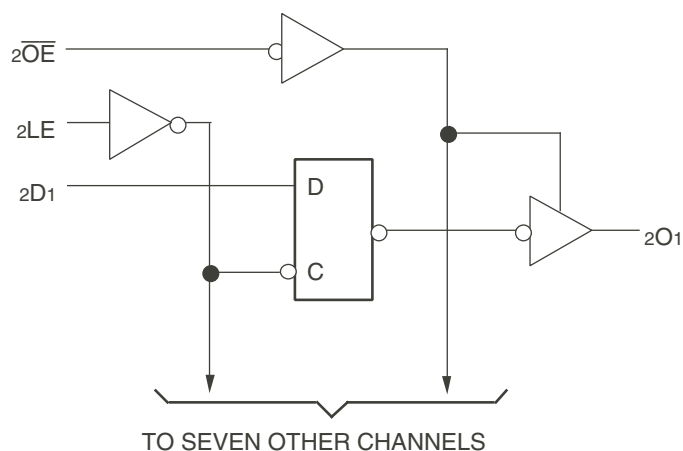
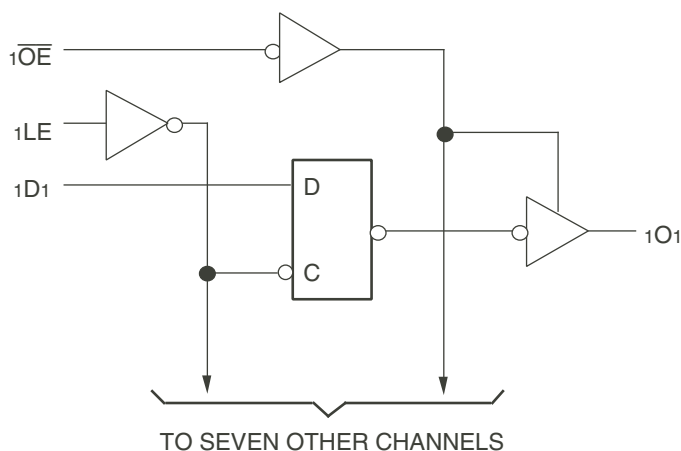
- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical  $t_{sk(o)}$  (Output Skew) < 250ps
- Low input and output leakage  $\leq 1\mu A$  (max.)
- $V_{CC} = 5V \pm 10\%$
- Balanced Output Drivers:  $\pm 24mA$
- Reduced system switching noise
- Typical VOLP (Output Ground Bounce) < 0.6V at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$
- Available in SSOP and TSSOP packages

## DESCRIPTION:

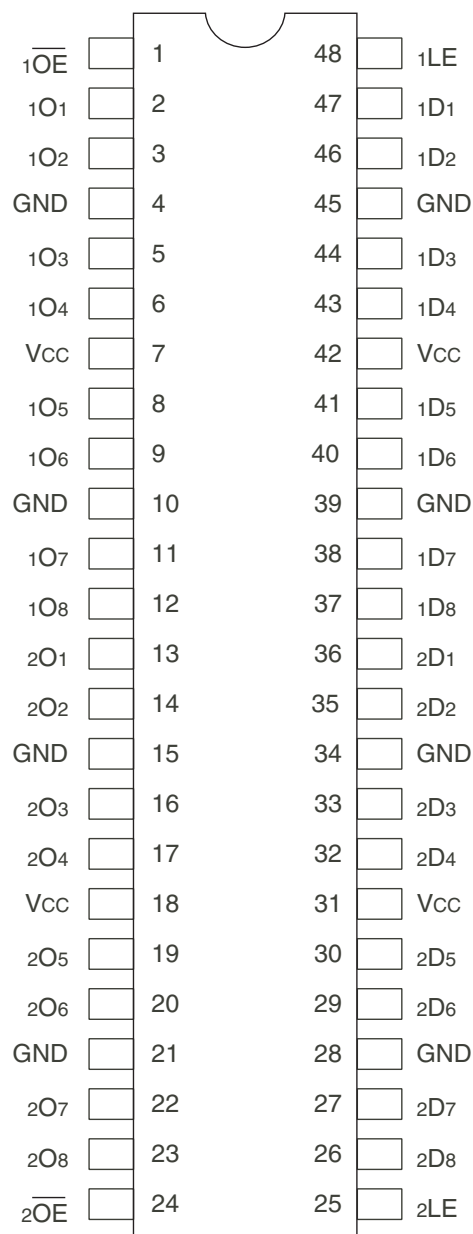
The FCT162373T 16-bit transparent D-type latch is built using advanced dual metal CMOS technology. This high-speed, low-power latch is ideal for temporary storage of data. It can be used for implementing memory address latches, I/O ports, and bus drivers. The Output Enable and Latch Enable controls are organized to operate each device as two 8-bit latches, or one 16-bit latch. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The FCT162373T 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. The FCT162373T is a plug-in replacement for the FCT16373T and ABT16373 for on-board interface applications.

## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



SSOP/ TSSOP  
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.
- All device terminals except FCT162XXX Output and I/O terminals.
- Output and I/O terminals terminals for FCT162XXX.

## 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  | 3.5  | 6    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 3.5  | 8    | pF   |

### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

| Pin Names         | Description                       |
|-------------------|-----------------------------------|
| xDx               | Data Inputs                       |
| xLE               | Latch Enable Input (Active HIGH)  |
| x $\overline{OE}$ | Outputs Enable Input (Active LOW) |
| xOx               | 3-State Outputs                   |

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

| Inputs |     |                   | Outputs |
|--------|-----|-------------------|---------|
| xDx    | xLE | x $\overline{OE}$ | xOx     |
| H      | H   | L                 | H       |
| L      | H   | L                 | L       |
| X      | X   | H                 | 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:

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

| 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 (Input pins) <sup>(5)</sup>                        | $V_{CC} = \text{Max.}$                                     | $V_I = V_{CC}$      | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
|                                     | Input HIGH Current (I/O pins) <sup>(5)</sup>                          |                                                            |                     | —    | —                   | $\pm 1$ |               |
| $I_{IL}$                            | Input LOW Current (Input pins) <sup>(5)</sup>                         | $V_{CC} = \text{Max.}$                                     | $V_I = \text{GND}$  | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
|                                     | Input LOW Current (I/O pins) <sup>(5)</sup>                           |                                                            |                     | —    | —                   | $\pm 1$ |               |
| $I_{OZH}$                           | High Impedance Output Current<br>(3-State Output pins) <sup>(5)</sup> | $V_{CC} = \text{Max.}$                                     | $V_O = 2.7\text{V}$ | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZL}$                           |                                                                       |                                                            | $V_O = 0.5\text{V}$ | —    | —                   | $\pm 1$ |               |
| $V_{IK}$                            | Clamp Diode Voltage                                                   | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$              |                     | —    | -0.7                | -1.2    | V             |
| $I_{OS}$                            | Short Circuit Current                                                 | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$             |                     | -80  | -140                | -250    | mA            |
| $V_H$                               | Input Hysteresis                                                      | —                                                          |                     | —    | 100                 | —       | mV            |
| $I_{CCL}$<br>$I_{CCH}$<br>$I_{CCZ}$ | Quiescent Power Supply Current                                        | $V_{CC} = \text{Max.}$<br>$V_{IN} = \text{GND or } V_{CC}$ |                     | —    | 5                   | 500     | $\mu\text{A}$ |

## OUTPUT DRIVE CHARACTERISTICS

| Symbol    | Parameter           | Test Conditions <sup>(1)</sup>                                                    |                         | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|-----------|---------------------|-----------------------------------------------------------------------------------|-------------------------|------|---------------------|------|------|
| $I_{ODL}$ | Output LOW Current  | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_O = 1.5\text{V}^{(3)}$ |                         | 60   | 115                 | 200  | mA   |
| $I_{ODH}$ | Output HIGH Current | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_O = 1.5\text{V}^{(3)}$ |                         | -60  | -115                | -200 | mA   |
| $V_{OH}$  | Output HIGH Voltage | $V_{CC} = \text{Min}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                     | $I_{OH} = -24\text{mA}$ | 2.4  | 3.3                 | —    | V    |
| $V_{OL}$  | Output LOW Voltage  | $V_{CC} = \text{Min}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                     | $I_{OL} = 24\text{mA}$  | —    | 0.3                 | 0.55 | V    |

### 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.
- Duration of the condition can 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                 | 1.5                 | mA               |
| $I_{CCD}$       | Dynamic Power Supply<br>Current <sup>(4)</sup>    | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$\overline{xOE} = \text{GND}$<br>One Input Toggling<br>50% Duty Cycle                                               | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 60                  | 100                 | $\mu A /$<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>$\overline{xOE} = \text{GND}$<br>$xLE = V_{CC}$<br>One Bit Toggling       | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 0.6                 | 1.5                 | mA               |
|                 |                                                   |                                                                                                                                                               | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | —    | 0.9                 | 2.3                 |                  |
|                 |                                                   | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$f_i = 2.5\text{MHz}$<br>50% Duty Cycle<br>$\overline{xOE} = \text{GND}$<br>$xLE = V_{CC}$<br>Sixteen Bits Toggling | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 2.4                 | 4.5 <sup>(5)</sup>  |                  |
|                 |                                                   |                                                                                                                                                               | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | —    | 6.4                 | 16.5 <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  $\text{GND}$ .
- 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.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_{HNT} + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V \text{)}$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$

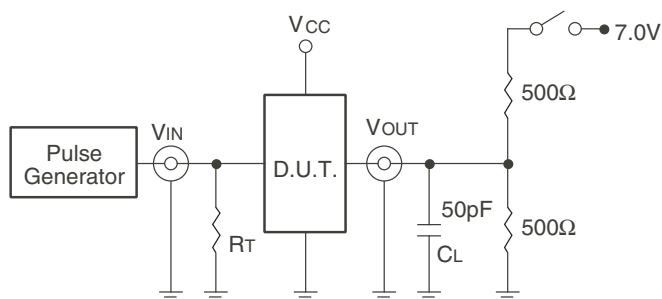
## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol                               | Parameter                           | Condition <sup>(1)</sup> | 74FCT162373AT       |      | 74FCT162373CT       |      | 74FCT162373ET       |      | 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>xDx to xOx     | CL = 50pF<br>RL = 500Ω   | 1.5                 | 5.2  | 1.5                 | 4.2  | 1.5                 | 3.4  | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>xLE to xOx     |                          | 2                   | 8.5  | 2                   | 5.5  | 1.5                 | 3.7  | ns   |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Output Enable Time                  |                          | 1.5                 | 6.5  | 1.5                 | 5.5  | 1.5                 | 4.4  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time                 |                          | 1.5                 | 5.5  | 1.5                 | 5    | 1.5                 | 3.6  | ns   |
| t <sub>SU</sub>                      | Set-up Time HIGH or LOW, xDx to xLE |                          | 2                   | —    | 2                   | —    | 1                   | —    | ns   |
| t <sub>H</sub>                       | Hold Time HIGH or LOW, xDx to xLE   |                          | 1.5                 | —    | 1.5                 | —    | 1                   | —    | ns   |
| t <sub>W</sub>                       | xLE Pulse Width HIGH                |                          | 5                   | —    | 5                   | —    | 3 <sup>(4)</sup>    | —    | ns   |
| t <sub>SK(o)</sub>                   | Output Skew <sup>(3)</sup>          |                          | —                   | 0.5  | —                   | 0.5  | —                   | 0.5  | ns   |

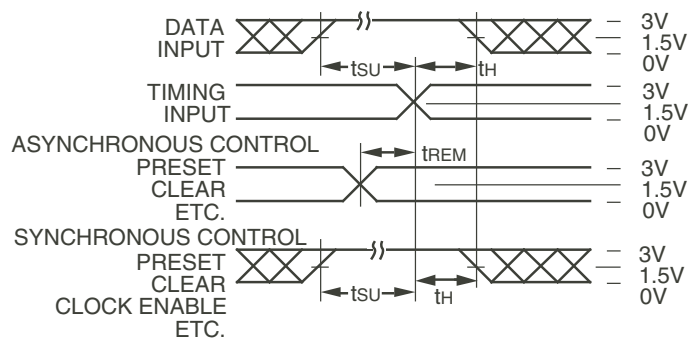
### NOTES:

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
4. This limit is guaranteed but not tested.

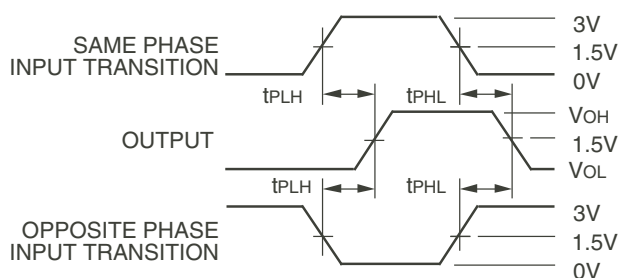
## TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-up, Hold, and Release Times



Propagation Delay

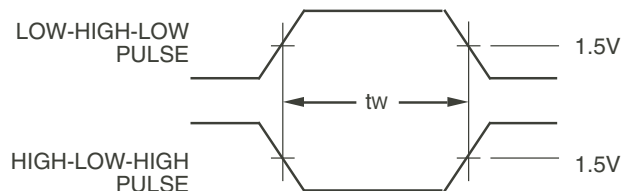
## SWITCH POSITION

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

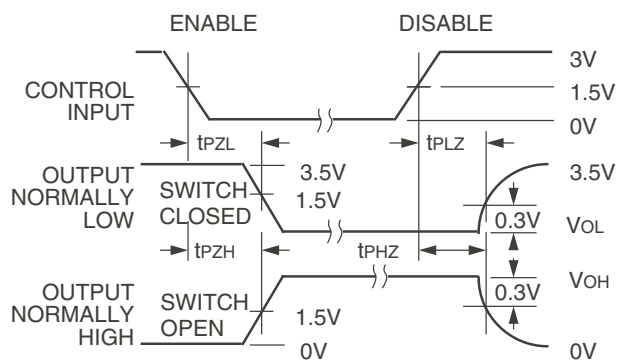
### DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

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



Pulse Width

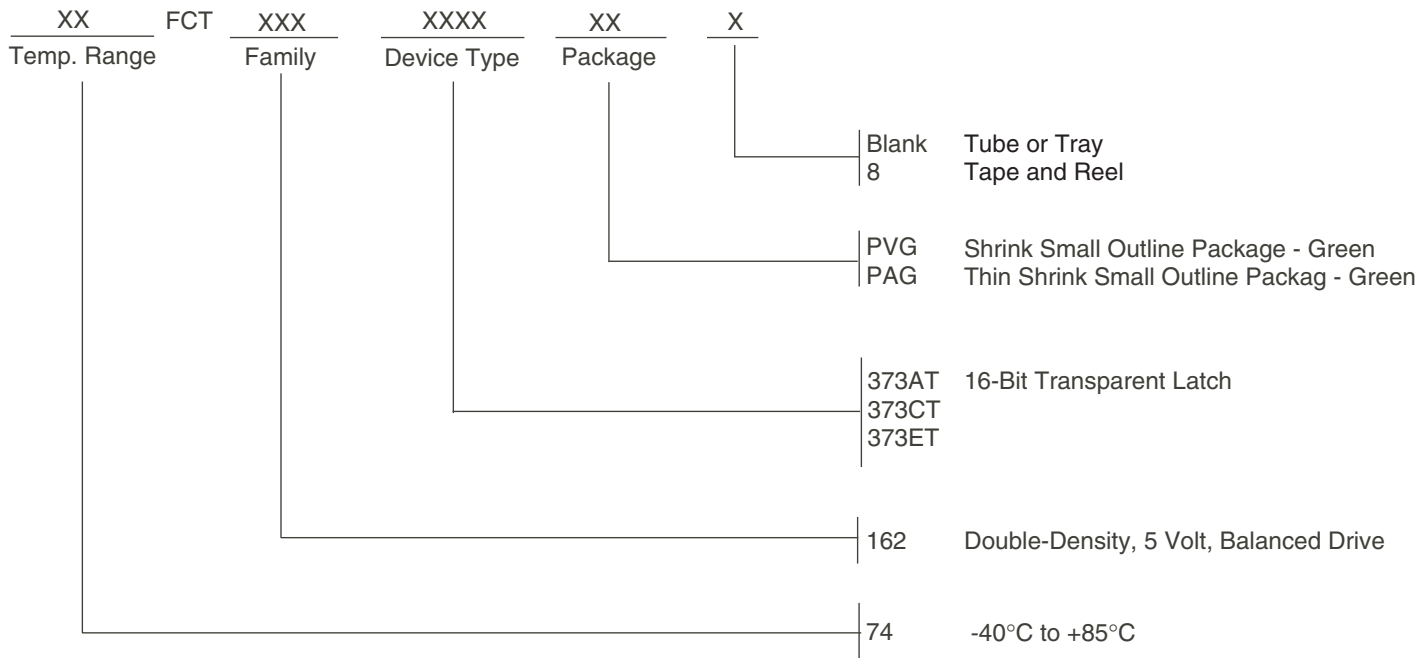


Enable and Disable Times

### NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. 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



## Datasheet Document History

|            |       |                                                                                    |
|------------|-------|------------------------------------------------------------------------------------|
| 09/06/2009 | Pg. 7 | Updated the ordering information by removing the "IDT" notation and non RoHS part. |
| 03/19/2015 | Pg. 7 | Added Tape & Reel to the ordering information.                                     |

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES ("RENESAS") PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.