



High Speed CMOS 16-Bit Transparent Latches

QS74FCT16373T
QS74FCT162373T

FEATURES/BENEFITS

- Pin and function compatible with T.I. Widebus™ and IDT Double-Density™ families
- CMOS power levels: <math><1 \mu\text{W}</math> typical standby
- SSOP (PV) and TSSOP (PA) packages
- Low output skew: 0.5 ns $t_{SK(O)}$
- Flow-through pinout for easy layout
- Power off disable allows hot plugging
- Extended commercial temperature: -40°C to $+85^{\circ}\text{C}$
- Input hysteresis for noise immunity
- Multiple power and ground pins for low noise
- Std., A, and C speed grades: 4.2 ns t_{PD} for C

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- High drive standard FCT-T outputs: $I_{OL} = +64 \text{ mA}$, $I_{OH} = -32 \text{ mA}$
- Incident switching for driving buses and large loads

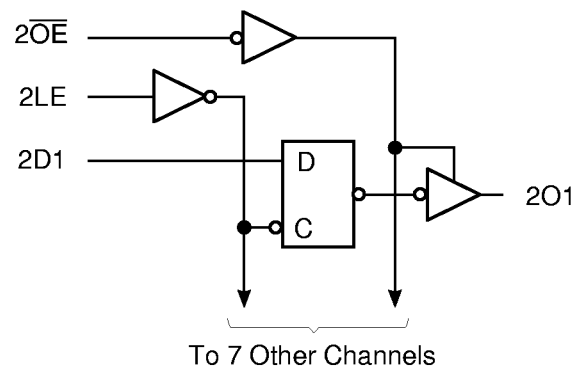
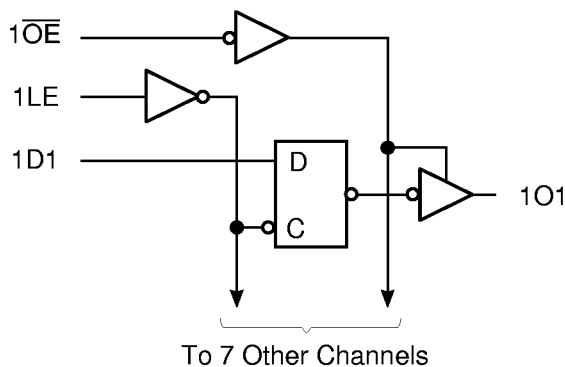
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- Balanced output drivers: $\pm 24 \text{ mA}$
- Reduced switching noise for point to point signals

DESCRIPTION

The FCT16373 family of products are 16-bit buffered latches with three-state outputs that are ideal for driving address and data buses. The output enable and latch enable controls are organized to operate each device as two 8-bit latches, or one 16-bit latch. Easy board layout is facilitated by the use of flow-through pinouts and byte enable controls provide architectural flexibility for systems designers. All outputs have ground bounce suppression circuitry (see QSI Application Note AN-01) and many power and ground pins provide low ground bounce. To accommodate hot-plug or live insertion applications, both versions of this product were designed not to load an active bus when V_{CC} is removed. In applications where bus signals are point-to-point or driving light capacitance loads, the balanced drive FCT162373 is recommended.

FUNCTIONAL BLOCK DIAGRAM



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PIN CONFIGURATION (All Pins Top View)

SSOP, TSSOP

1 \overline{OE}	1	48	1LE
1O1	2	47	1D1
1O2	3	46	1D2
GND	4	45	GND
1O3	5	44	1D3
1O4	6	43	1D4
VCC	7	42	VCC
1O5	8	41	1D5
1O6	9	40	1D6
GND	10	39	GND
1O7	11	38	1D7
1O8	12	37	1D8
2O1	13	36	2D1
2O2	14	35	2D2
GND	15	34	GND
2O3	16	33	2D3
2O4	17	32	2D4
VCC	18	31	VCC
2O5	19	30	2D5
2O6	20	29	2D6
GND	21	28	GND
2O7	22	27	2D7
2O8	23	26	2D8
2 \overline{OE}	24	25	2LE

PIN DESCRIPTION

Name	I/O	Description
xDx	I	Data Inputs
xOx	O	Data Outputs
xLE	I	Latch Enable
x \overline{OE}	I	Output Enable

FUNCTION TABLE

\overline{xOE}	Inputs xLE	xDx	Internal Q Value	Outputs xOx	Function
H	X	X	X	Hi-Z	Disable Outputs
L	L	X	H	H	Enable Outputs
L	L	X	L	L	
L	H	L	L	L	Pass Inputs
L	H	H	H	H	
L	L	X	Q	Q	Hold Prior Data

CAPACITANCE

$T_A = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{IN} = 0\text{V}$, $V_{OUT} = 0\text{V}$

Pins	Typ	Max	Unit
All	6.0	9.0	pF

Note: Capacitance is characterized but not tested.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage to Ground	-0.5V to +7.0V
DC Output Voltage V_{OUT}	-0.5V to +7.0V
DC Input Voltage V_{IN}	-0.5V to +7.0V
AC Input Voltage (for a pulse width ≤ 20 ns)	-3.0V
DC Input Diode Current with $V_{IN} < 0$	-20 mA
DC Output Diode Current with $V_{OUT} < 0$	-50 mA
DC Output Current Max. Sink Current/Pin	120 mA
Maximum Power Dissipation	1.0 watts
T_{STG} Storage Temperature	-65° to +150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	4.5	5.5	V
V_{IN}	Input Voltage	-0.5	5.5	V
V_{OUT}	Voltage Applied to Output or I/O	0	V_{CC}	V
$\Delta t/\Delta v$	Input Transition Slew Rate	—	10	ns/V
T_A	Operating Free Air Temperature	-40	+85	°C

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Recommended Operating Ranges apply unless otherwise noted.

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit
V_{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
V_{IL}	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
ΔV_T	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs ⁽⁴⁾	—	100	—	mV
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$	—	—	1	μA
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}, 0 \leq V_{OUT} \leq V_{CC}$	—	—	1	μA
I_{OS}	Short Circuit Current	$V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(3,4)}$	-80	-140	-225	mA
V_{IK}	Input Clamp Voltage	$V_{CC} = \text{Min.}, I_{IN} = -18 \text{ mA}$	-	-0.7	-1.2	V

Notes:

1. For conditions shown as Max or Min use appropriate value specified under Recommended Operating Conditions for the applicable device type.
2. Typical values indicate $V_{CC} = 5.0\text{V}$ and $T_A = 25^\circ\text{C}$.
3. Not more than one output should be tested at one time. Duration of test should not exceed one second.
4. These parameters are guaranteed by design but not tested.

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OUTPUT DRIVE CHARACTERISTICS FOR FCT16373T

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit	
I _O	Output Drive Current	V _{CC} = Max, V _{OUT} = 2.5V ⁽³⁾	-50	—	-180	mA	
V _{OH}	Output HIGH Voltage	V _{CC} = Min.	I _{OH} = -3 mA	2.5	—	—	V
		V _{IN} = V _{IH} or V _{IL}	I _{OH} = -15 mA	2.4	—	—	V
			I _{OH} = -32 mA ⁽⁴⁾	2.0	—	—	V
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OL} = 64 mA	—	0.2	0.55	V
I _{OFF}	Input/Output Power Off Leakage	V _{CC} = 0V, V _{IN} or V _{OUT} ≤ 4.5V	—	—	±1.0	μA	

OUTPUT DRIVE CHARACTERISTICS FOR FCT162373T

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit	
I _{ODL}	Output LOW Current	V _{CC} = 5V, V _{IN} = V _{IH} or V _{IL} V _{OUT} = 1.5V ⁽³⁾	60	115	150	mA	
I _{ODH}	Output HIGH Current	V _{CC} = 5V, V _{IN} = V _{IH} or V _{IL} V _{OUT} = 1.5V ⁽³⁾	-60	-115	-150	mA	
V _{OH}	Output HIGH Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OH} = -24 mA	2.4	3.3	—	V
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OL} = 24 mA	—	0.3	0.55	V

Notes:

1. For conditions shown as Max or Min use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
3. Not more than one output should be shorted and the duration is ≤1 second.
4. Duration of the condition should not exceed one second.

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POWER SUPPLY CHARACTERISTICS - FCT16373T, FCT162373T

Symbol	Parameter	Test Conditions ⁽¹⁾	Typ ⁽²⁾	Max	Unit	
I _{CCQ}	Quiescent Power Supply Current	V _{CC} = Max., Freq = 0 V _{IN} = GND or V _{CC}	5	500	μA	
ΔI _{CC}	Supply Current per Input @ TTL HIGH	V _{CC} = Max., V _{IN} = 3.4V ⁽³⁾	0.5	1.5	mA	
Q _{CCD}	Supply Current per Input per MHz ⁽⁴⁾	V _{CC} = Max., Outputs Open One Bit Toggling @ 50% Duty Cycle x \overline{OE} = GND	60	100	μA/ MHz	
I _C	Total Power Supply Current ⁽⁶⁾	V _{CC} = Max., Outputs Open One Bit Toggling @ 50% Duty Cycle x \overline{OE} = GND, f _i = 10 MHz	V _{IN} = V _{CC} V _{IN} = GND	0.6	1.5	mA
			V _{IN} = 3.4V V _{IN} = GND	0.9	2.3	mA
		V _{CC} = Max., Outputs Open Sixteen Bits Toggling @ 50% Duty Cycle x \overline{OE} = GND, f _i = 2.5 MHz	V _{IN} = V _{CC} V _{IN} = GND	2.4	4.5 ⁽⁵⁾	mA
			V _{IN} = 3.4V V _{IN} = GND	6.4	16.5 ⁽⁵⁾	mA

Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under Recommended Operating Conditions for applicable device type.
- Typical values are at V_{CC} = 5.0V, +25°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 the I_{CC} formula. These limits are guaranteed by design but not tested.
- I_C = I_{QUIESCENT} + I_{INPUTS} = I_{DYNAMIC}.
 $I_C = I_{CCQ} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$.
 I_{CCQ} = Quiescent Current (I_{CC1}, I_{CC2}, and I_{CC3}).
 ΔI_{CC} = Power Supply Current for a TTL-High Input (V_{IN} = 3.4V).
 D_H = Duty Cycle for TTL High Inputs.
 N_T = Number of TTL High Inputs.
 I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL).
 f_{CP} = Clock Frequency for Register devices (Zero for Non-Register Devices).
 N_{CP} = Number of Clock Inputs at f_{CP}.
 f_i = Input Frequency.
 N_i = Number of Inputs at f_i.

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SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Recommended Operating Ranges apply unless otherwise specified.

C_{LOAD} = 50 pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Description ⁽¹⁾	FCT16373T FCT162373T		FCT16373AT FCT162373AT		FCT16373CT FCT162373CT		Unit
		Min	Max	Min	Max	Min	Max	
t _{PHL} t _{PLH}	Propagation Delay Data to xOx	1.5	8.0	1.5	5.2	1.5	4.2	ns
t _{PHL} t _{PLH}	Propagation Delay xLE to xOx	2.0	13.0	2.0	8.5	2.0	5.5	ns
t _{PZH} t _{PZL}	Output Enable Time x \overline{OE} to xDx	1.5	12.0	1.5	6.5	1.5	5.5	ns
t _{PHZ} t _{PLZ}	Output Disable Time ⁽²⁾ x \overline{OE} to xDx	1.5	7.5	1.5	5.5	1.5	5.0	ns
t _s	Data Setup Time xDx to xLE HIGH to LOW	2.0	—	2.0	—	2.0	—	ns
t _h	Data Hold Time xDx to xLE HIGH to LOW	1.5	—	1.5	—	1.5	—	ns
t _w	LE Pulse Width HIGH	6.0	—	5.0	—	5.0	—	ns
t _{sk(o)}	Output Skew ⁽³⁾	—	0.5	—	0.5	—	0.5	ns

Notes:

1. Minimums guaranteed but not tested on propagation delays. See Test Circuit and Waveforms.
2. Guaranteed by design, but not tested.
3. Skew between any two outputs of the same package switching in the same direction.
This parameter is guaranteed by design but not tested.