National Semiconductor

August 1998

54FCT573
Octal D-Type Latch with TRI-STATE® Outputs

General Description

The 'FCT573 is an octal latch with buffered common Latch Enable (LE) and buffered common Output Enable ($\overline{OE}$) inputs.

This device is functionally identical to the 'FCT373 but has different pinouts.

Features

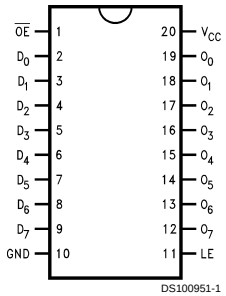
- Inputs and outputs on opposite sides of package allow easy interface with microprocessors
- Useful as input or output port for microprocessors
- TTL input and output level compatible
- CMOS power consumption
- Functionally identical to 'FCT373
- TRI-STATE outputs for bus interfacing
- Output sink capability of 32 mA, source capability of 12 mA
- Standard Microcircuit Drawing (SMD) 5962-8863901

Ordering Code

Military	Package Number	Package Description
54FCT573DMQB	J20A	20-Lead Ceramic Dual-In-Line
54FCT573FMQB	W20A	20-Lead Cerpack
54FCT573LMQB	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Connection Diagram

Pin Assignment for DIP and Cerpack



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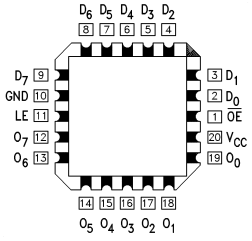
Pin Assignment for LCC



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Pin Names	Description
D_0–D_7	Data Inputs
LE	Latch Enable Input (Active HIGH)
$\overline{OE}$	TRI-STATE Output Enable Input (Active LOW)
O_0–O_7	TRI-STATE Latch Outputs

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Functional Description

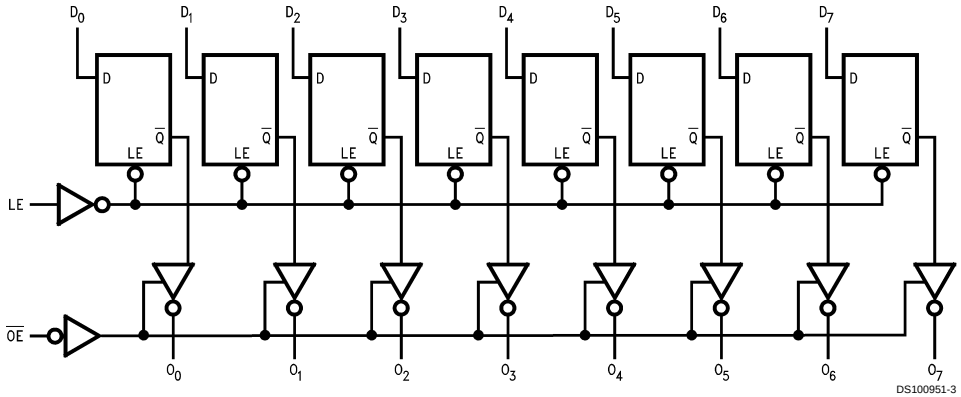
The 'FCT573 contains eight D-type latches with TRI-STATE output buffers. When the Latch Enable (LE) input is HIGH, data on the D_n inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW transition of LE. The TRI-STATE buffers are controlled by the Output Enable ($\overline{OE}$) input. When $\overline{OE}$ is LOW, the buffers are in the bi-state mode. When $\overline{OE}$ is HIGH the buffers are in the high impedance mode but this does not interfere with entering new data into the latches.

Function Table

Inputs			Outputs
$\overline{OE}$	LE	D	O
L	H	H	H
L	H	L	L
L	L	X	O_0
H	X	X	Z

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
O_0 = Value stored from previous clock cycle

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)

Storage Temperature	−65˚C to +150˚C
Ambient Temperature under Bias	−55˚C to +125˚C
Junction Temperature under Bias	
Ceramic	−55˚C to +175˚C
V_{CC} Pin Potential to	
Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Any Output	
in the Disabled or	
Power-Off State	−0.5V to +5.5V
in the HIGH State	−0.5V to V_{CC}
Current Applied to Output	
in LOW State (Max)	Twice the rated I_{OL} (mA)
DC Latchup Source Current	−500 mA
Over Voltage Latchup (I/O)	10V

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55˚C to +125˚C
Supply Voltage	
Military	+4.5V to +5.5V
Minimum Input Edge Rate	(ΔV/Δt)
Data Input	50 mV/ns
Enable Input	20 mV/ns

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

Symbol	Parameter		FCT573 Min	FCT573 Typ	FCT573 Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54FCT	4.3			V	Min	I_{OH} = −300 µA
		54FCT	2.4					I_{OH} = −12 mA
V_{OL}	Output LOW Voltage	54FCT			0.2	V	Min	I_{OL} = 300 µA
		54FCT			0.5			I_{OL} = 32 mA
I_{IH}	Input HIGH Current				5	µA	Max	V_{IN} = V_{CC}
I_{IL}	Input LOW Current				−5	µA	Max	V_{IN} = 0.0V
I_{OZH}	Output Leakage Current				50	µA	0 − 5.5V	V_{OUT} = 2.7V; $\overline{OE}$ = 2.0V
I_{OZL}	Output Leakage Current				−50	µA	0 − 5.5V	V_{OUT} = 0.5V; $\overline{OE}$ = 2.0V
I_{OS}	Output Short-Circuit Current				-60	mA	Max	V_{OUT} = 0.0V
I_{CCQ}	Quiescent Power Supply Current				1.5	mA	Max	V_{IN} < 0.2V or V_{IN} 5.3V, V_{CC} = 5.5V
ΔI_{CC}	Quiescent Power Supply Current				2.0	mA	Max	V_I = 3.4V, V_{CC} = 5.5V
I_{CCD}	Dynamic I_{CC}				0.4	mA/ MHz	Max	Outputs Open, V_{CC} = 5.5V, V_{IN} 5.3V or V_{IN} < 0.2V, One Bit Toggling, 50% Duty Cycle, $\overline{OE}$ = GND, LE = V_{CC}
I_{CC}	Total Power Supply Current				6.0	mA	Max	Outputs Open, f_{CP} = 10 MHz, V_{CC} = 5.5V, V_{IN} 5.3V or V_{IN} < 0.2V, One Bit Toggling, 50% Duty Cycle, $\overline{OE}$ = GND, LE = V_{CC}

AC Electrical Characteristics

Symbol	Parameter	54FCT T_A = −55˚C to +125˚C, V_{CC} = 4.5V to 5.5V, C_L = 50 pF Min	54FCT Max	Units	Fig. No.
t_{PLH}	Propagation Delay	1.0	8.5	ns	*Figure 4*
t_{PHL}	D_n to O_n	1.0	8.5		
t_{PLH}	Propagation Delay	1.0	15.0	ns	*Figure 4*
t_{PHL}	LE to O_n	1.0	15.0		
t_{PZH}	Output Enable Time	1.0	13.5	ns	*Figure 6*
t_{PZL}		1.0	13.5		

AC Electrical Characteristics (Continued)

Symbol	Parameter	54FCT $T_A = -55^\circ C$ to $+125^\circ C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units	Fig. No.
		Min	Max		
t_{PHZ}	Output Disable Time	1.0	10.0	ns	*Figure 6*
t_{PLZ}	Time	1.0	10.0		

AC Operating Requirements

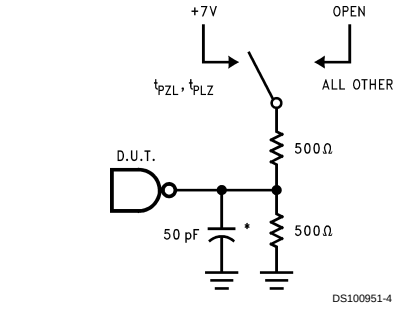
Symbol	Parameter	54FCT $T_A = -55^\circ C$ to $+125^\circ C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units	Fig. No.
		Min	Max		
$t_s(H)$	Set Time, HIGH	2.0		ns	*Figure 7*
$t_s(L)$	or LOW D_n to LE	2.0			
$t_h(H)$	Hold Time, HIGH	1.5		ns	*Figure 7*
$t_h(L)$	or LOW D_n to LE	1.5			
$t_w(H)$	Pulse Width, LE HIGH	6.0		ns	*Figure 5*

Capacitance

Symbol	Parameter	Max	Units	Conditions ($T_A = 25^\circ C$)
C_{IN}	Input Capacitance	10	pF	$V_{CC} = 0V$
C_{OUT} (Note 3)	Output Capacitance	12	pF	$V_{CC} = 5.0V$

Note 3: C_{OUT} is measured at frequency f = 1 MHz per MIL-STD-883B, Method 3012.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Test Load

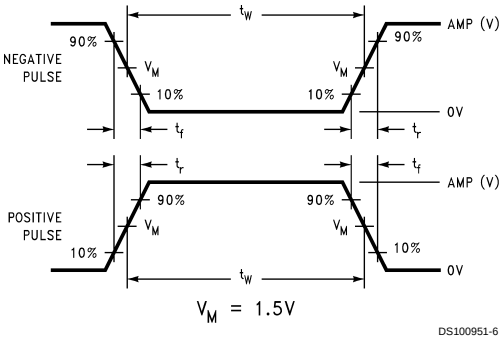


FIGURE 2. Test Input Signal Levels

Amplitude	Rep. Rate	t_w	t_r	t_f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

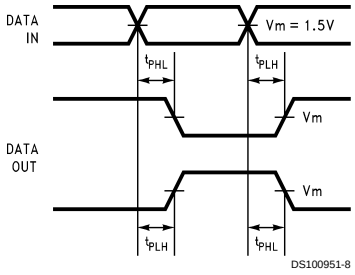


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

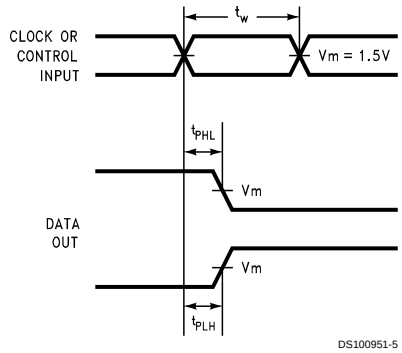


FIGURE 5. Propagation Delay, Pulse Width Waveforms

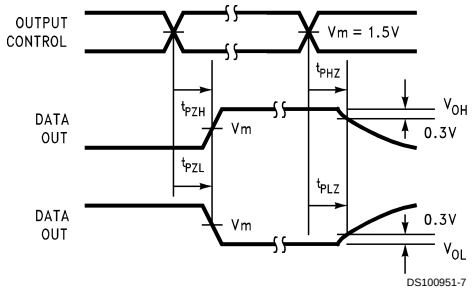


FIGURE 6. TRI-STATE Output HIGH and LOW Enable and Disable Times

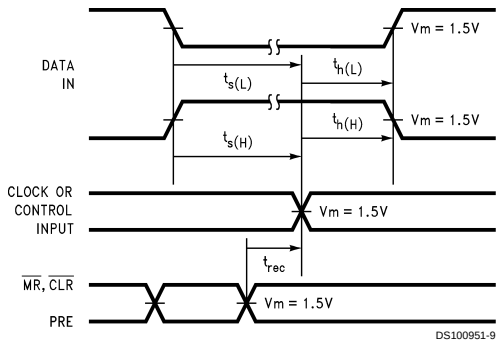
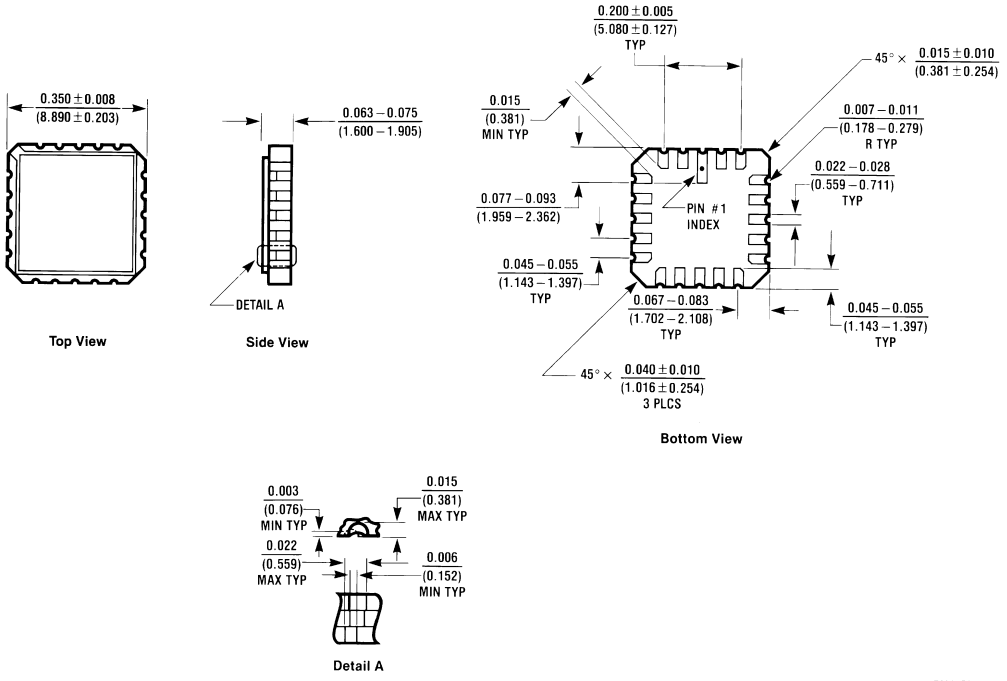
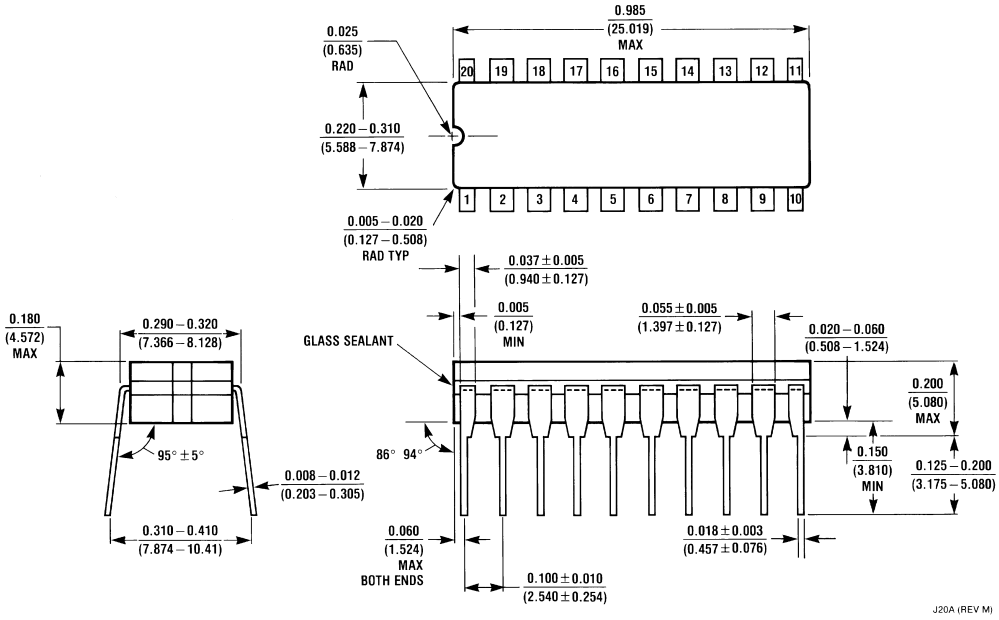


FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

Physical Dimensions inches (millimeters) unless otherwise noted

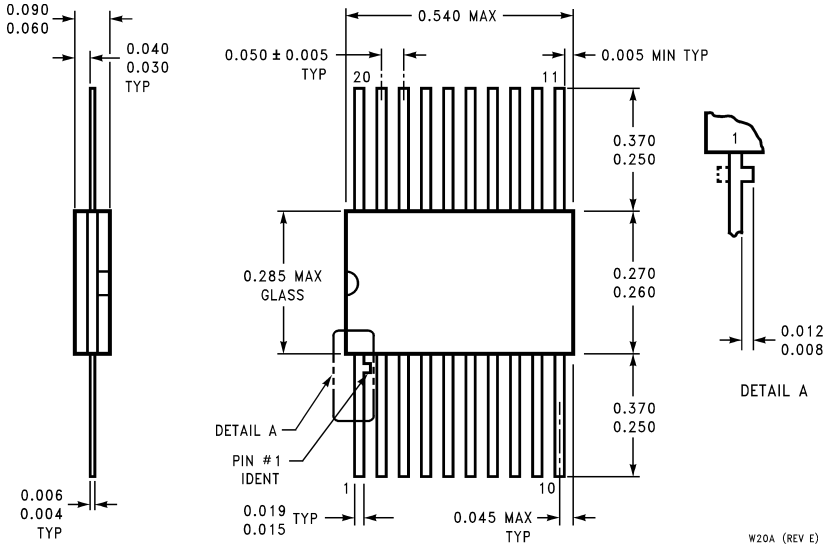


20-Lead Ceramic Leadless Chip Carrier
NS Package Number E20A



20-Lead Ceramic Dual-In-Line
NS Package Number J20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Ceramic Flatpack
NS Package Number W20A

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