National Semiconductor

August 1995

54F/74F573
Octal D-Type Latch with TRI-STATE® Outputs

General Description

The ’F573 is a high speed octal latch with buffered common Latch Enable (LE) and buffered common Output Enable ($\overline{OE}$) inputs.

This device is functionally identical to the ’F373 but has different pinouts.

Features

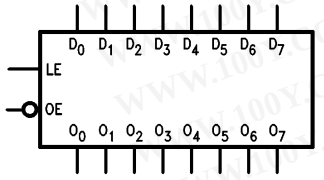
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to ’F373
- TRI-STATE outputs for bus interfacing
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F573PC		N20A	20-Lead (0.300″ Wide) Molded Dual-In-Line
	54F573DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F573SC (Note 1)		M20B	20-Lead (0.300″ Wide) Molded Small Outline, JEDEC
74F573SJ (Note 1)		M20D	20-Lead (0.300″ Wide) Molded Small Outline, EIAJ
	54F573FM (Note 2)	W20A	20-Lead Cerpak
	54F573LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13″ reel. Use suffix = SCX and SJX.

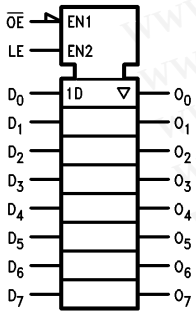
Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

Logic Symbols



TL/F/9566–1

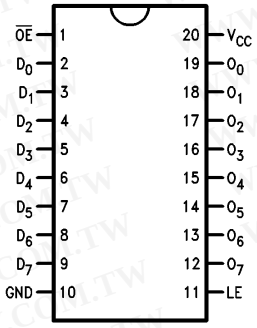
IEEE/IEC



TL/F/9566–4

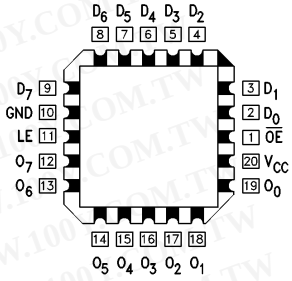
Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



TL/F/9566–2

Pin Assignment for LCC



TL/F/9566–3

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D_0–D_7	Data Inputs	1.0/1.0	20 μA/−0.6 mA
LE	Latch Enable Input (Active HIGH)	1.0/1.0	20 μA/−0.6 mA
$\overline{OE}$	TRI-STATE Output Enable Input (Active LOW)	1.0/1.0	20 μA/−0.6 mA
O_0–O_7	TRI-STATE Latch Outputs	150/40(33.3)	−3 mA/24 mA (20 mA)

Functional Description

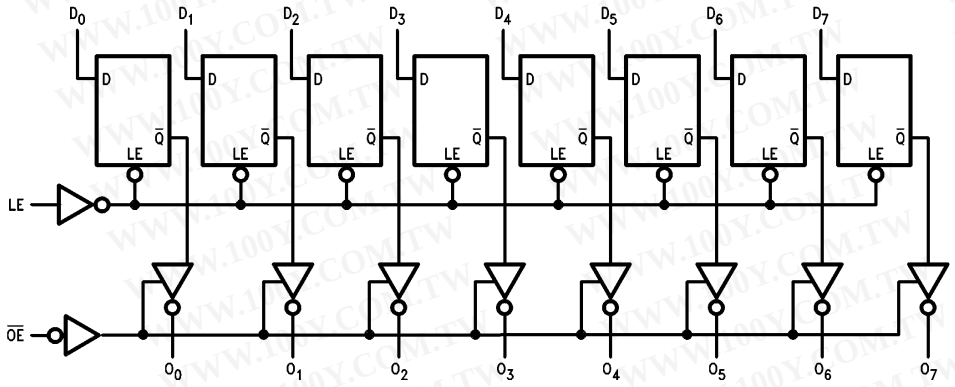
The ’F573 contains eight D-type latches with 3-state output buffers. When the Latch Enable (LE) input is HIGH, data on the D_n inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW transition of LE. The 3-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 interfer 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



TL/F/9566–5

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)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +175°C
Plastic	−55°C to +150°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 Output in HIGH State (with V_{CC} = 0V)	
Standard Output	−0.5V to V_{CC}
TRI-STATE Output	−0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I_{OL} (mA)
ESD Last Passing Voltage (Min)	4000V

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.

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55°C to +125°C
Commercial	0°C to +70°C
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter		54F/74F Min	54F/74F Typ	54F/74F Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized as a HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized as a LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54F 10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
		54F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 10% V_{CC}	2.5					I_{OH} = −1 mA
		74F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 5% V_{CC}	2.7					I_{OH} = −1 mA
		74F 5% V_{CC}	2.7					I_{OH} = −3 mA
V_{OL}	Output LOW Voltage	54F 10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
		74F 10% V_{CC}			0.5			I_{OL} = 24 mA
I_{IH}	Input HIGH Current	54F			20.0	μA	Max	V_{IN} = 2.7V
		74F			5.0			
I_{BVI}	Input HIGH Current Breakdown Test	54F			100	μA	Max	V_{IN} = 7.0V
		74F			7.0			
I_{CEX}	Output HIGH Leakage Current	54F			250	μA	Max	V_{OUT} = V_{CC}
		74F			50			
V_{ID}	Input Leakage Test	74F	4.75			V	0.0	I_{ID} = 1.9 μA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current	74F			3.75	μA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{IL}	Input LOW Current				−0.6	mA	Max	V_{IN} = 0.5V
I_{OZH}	Output Leakage Current				50	μA	Max	V_{OUT} = 2.7V
I_{OZL}	Output Leakage Current				−50	μA	Max	V_{OUT} = 0.5V
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{ZZ}	Bus Drainage Test				500	μA	0.0V	V_{OUT} = 5.25V
I_{CCL}	Power Supply Current			35	55	mA	Max	V_O = LOW
I_{CCZ}	Power Supply Current			35	55	mA	Max	V_O = HIGH Z

AC Electrical Characteristics

Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			54F T_A, V_{CC} = Mil, $C_L = 50$ pF		74F T_A, V_{CC} = Com, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay D_n to O_n	3.0 2.0	5.3 3.7	7.0 6.0	3.0 2.0	9.0 7.0	3.0 2.0	8.0 6.5	ns
t_{PLH} t_{PHL}	Propagation Delay LE to O_n	5.0 3.0	9.0 5.2	11.0 7.0	5.0 3.0	13.5 7.5	5.0 3.0	12.0 7.0	ns
t_{PZH} t_{PZL}	Output Enable Time	2.0 2.0	5.0 5.6	8.0 8.5	2.0 2.0	10.0 10.0	2.0 2.0	9.0 9.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time	1.5 1.5	4.5 3.8	5.5 5.5	1.5 1.5	7.0 5.5	1.5 1.5	6.5 5.5	

AC Operating Requirements

Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$		54F T_A, V_{CC} = Mil		74F T_A, V_{CC} = Com		Units
		Min	Max	Min	Max	Min	Max	
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW D_n to LE	2.0 2.0		2.0 2.0		2.0 2.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW D_n to LE	3.0 3.5		3.0 4.0		3.0 3.5		ns
$t_w(H)$	LE Pulse Width, HIGH	4.0		4.0		4.0		ns

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

74F 573 S C X

Temperature Range Family
74F = Commercial
54F = Military

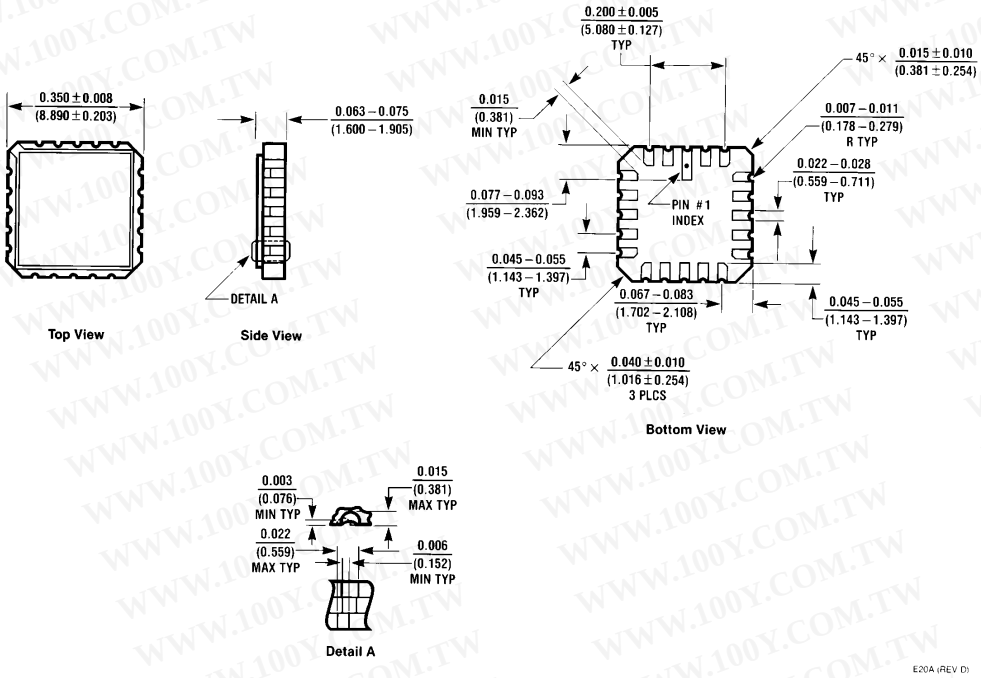
Device Type

Package Code
P = Plastic DIP
D = Ceramic DIP
F = Flatpak
L = Leadless Chip Carrier (LCC)
S = Small Outline SOIC JEDEC
SJ = Small Outline SOIC EIAJ

Temperature Range
C = Commercial (0°C to +70°C)
M = Military (−55°C to +125°C)

Special Variations
QB = Military grade device with environmental and burn-in processing
X = Devices shipped in 13″ reels

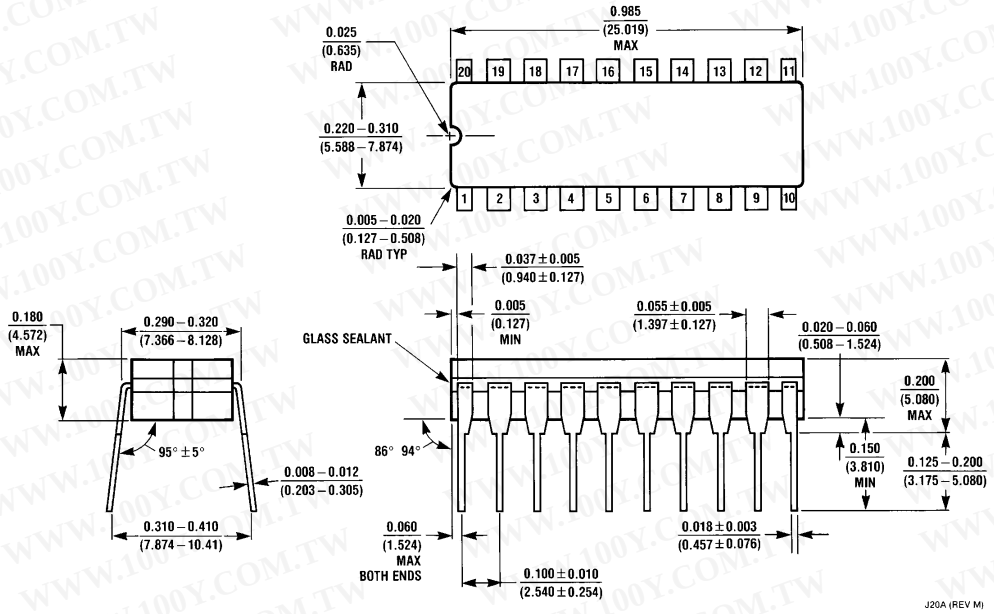
Physical Dimensions inches (millimeters)



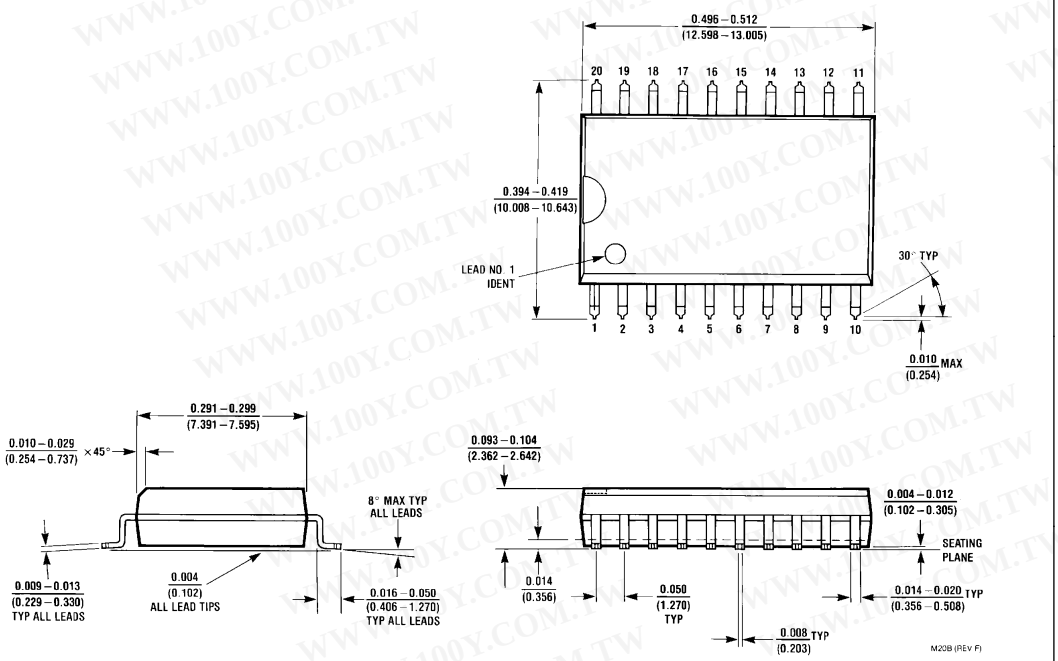
E20A (REV D)

20-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

Physical Dimensions inches (millimeters) (Continued)

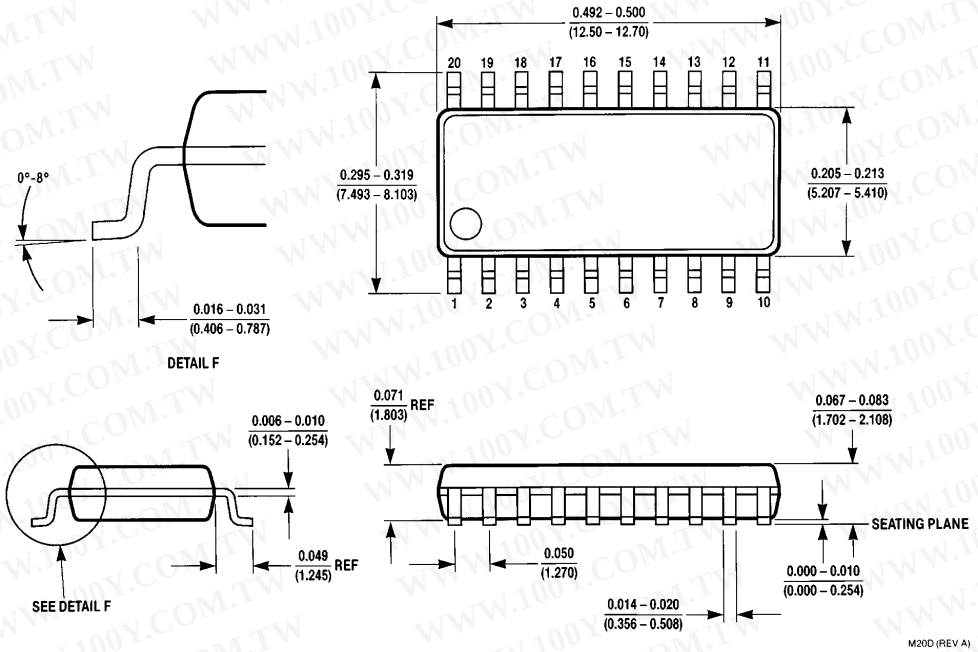


20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A

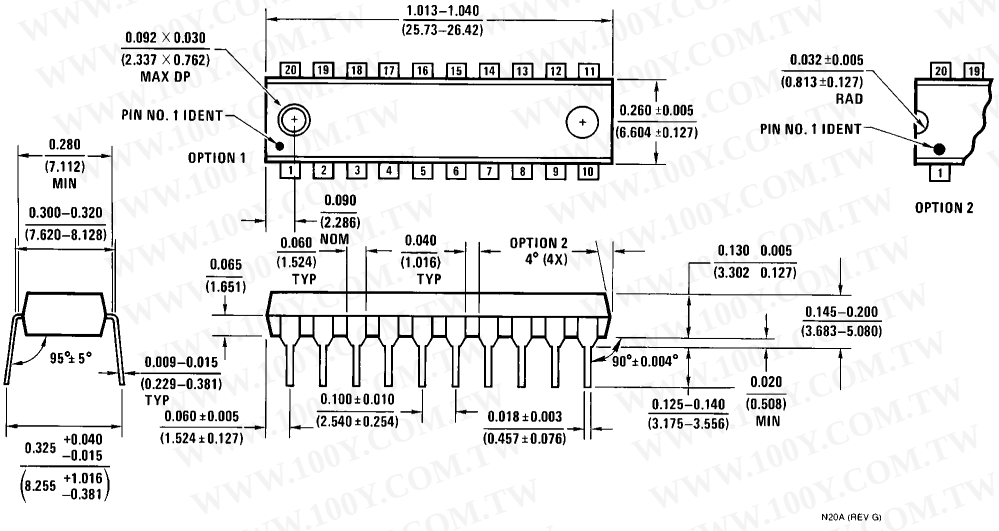


20-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B

Physical Dimensions inches (millimeters) (Continued)

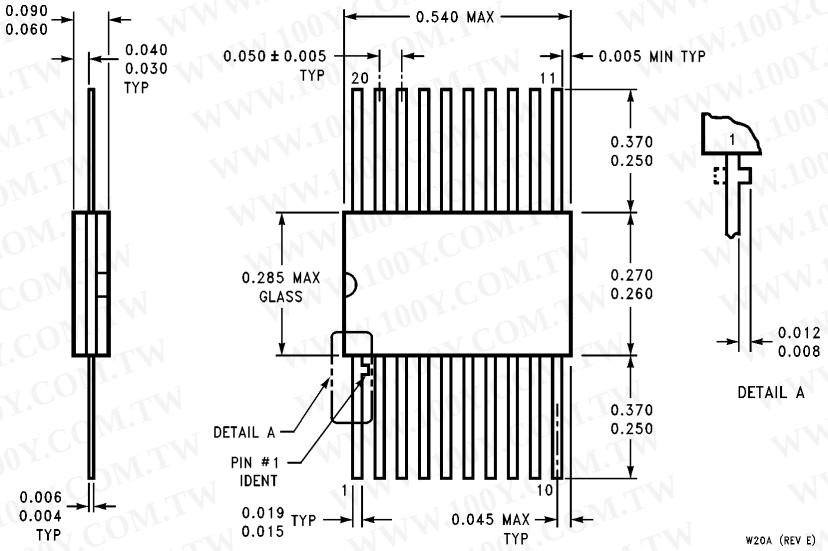


20-Lead (0.300″ Wide) Small Outline Package, EIAJ (SJ)
NS Package Number M20D



20-Lead (0.300″ Wide) Molded Dual-In-Line Package (P)
NS Package Number N20A

Physical Dimensions inches (millimeters) (Continued)



20 Lead Ceramic Flatpak (F)
NS Package Number W20A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.