

54F/74F534 Octal D-Type Flip-Flop with TRI-STATE® Outputs

General Description

The 'F534 is a high speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and TRI-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ($\overline{OE}$) are common to all flip-flops. The 'F534 is the same as the 'F374 except that the outputs are inverted.

Features

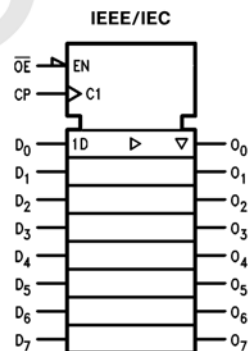
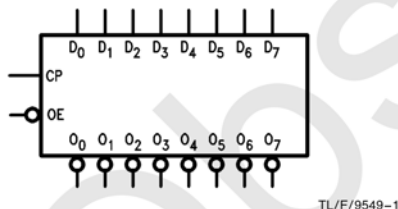
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- TRI-STATE outputs for bus-oriented applications
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F534PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F534DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F534SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F534SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F534FM (Note 2)	W20A	20-Lead Cerpack
	54F534LM (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

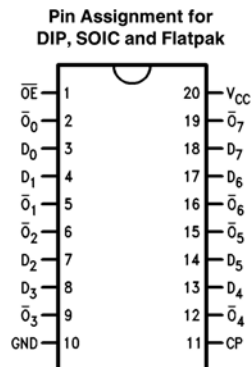


Unit Loading/Fan Out

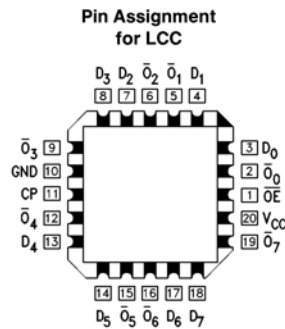
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D_0-D_7	Data Inputs	1.0/1.0	20 μ A/ -0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 μ A/ -0.6 mA
$\overline{OE}$	TRI-STATE Output Enable Input (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
$\overline{Q}_0-\overline{Q}_7$	Complementary TRI-STATE Outputs	150/40(33.3)	-3 mA/24 mA (20 mA)

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Connection Diagrams



TL/F/9549-2



TL/F/9549-3

Functional Description

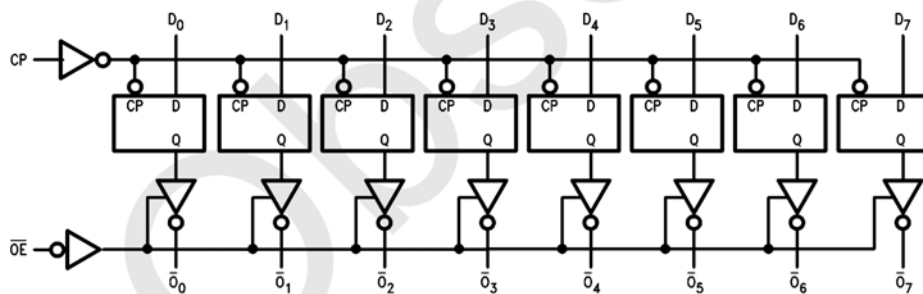
The 'F534 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE complementary outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold times requirements on the LOW-to-HIGH clock (CP) transition. With the Output Enable ($\overline{OE}$) LOW, the contents of the eight flip-flops are available at the outputs. When the $\overline{OE}$ is HIGH, the outputs go to the high impedance state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

Function Table

Inputs			Output
CP	OE	D	$\overline{O}$
	L	H	L
	L	L	H
L	L	X	$\overline{O}_0$
X	H	X	Z

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 = LOW-to-HIGH Clock Transition
 Z = High Impedance
 $\overline{O}_0$ = Value stored from previous clock cycle

Logic Diagram



TL/F/9549-4

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)	−0.5V to V _{CC}
Standard Output 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	−55°C to +125°C
Military	0°C to +70°C
Commercial	
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter	54F/74F			Units	V _{CC}	Conditions
		Min	Typ	Max			
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} 54F 10% V _{CC} 74F 10% V _{CC} 74F 10% V _{CC} 74F 5% V _{CC} 74F 5% V _{CC}	2.5 2.4 2.5 2.4 2.7 2.7		V	Min	I _{OH} = −1 mA I _{OH} = −3 mA I _{OH} = −1 mA I _{OH} = −3 mA I _{OH} = −1 mA I _{OH} = −3 mA
V _{OL}	Output LOW Voltage	54F 10% V _{CC} 74F 10% V _{CC}		0.5 0.5	V	Min	I _{OL} = 20 mA I _{OL} = 24 mA
I _{IH}	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V _{IN} = 7.0V
I _{CEX}	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V _{OUT} = V _{CC}
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} = 1.50 μA 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 _{CCZ}	Power Supply Current		55	86	mA	Max	V _O = HIGH Z

AC Electrical Characteristics

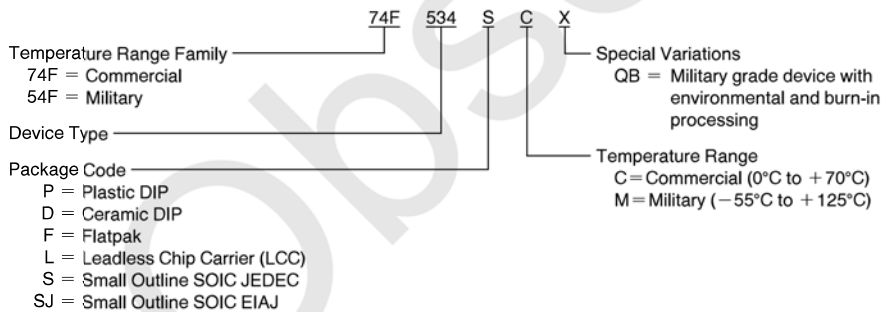
Symbol	Parameter	74F			54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{Mil}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$		
		Min	Typ	Max	Min	Max	Min	Max	
f_{max}	Maximum Clock Frequency	100			60		70		MHz
t_{PLH}	Propagation Delay	4.0	6.5	8.5	4.0	10.5	4.0	10.0	ns
t_{PHL}	CP to $\overline{O}_n$	4.0	6.5	8.5	4.0	11.0	4.0	10.0	
t_{pZH}	Output Enable Time	2.0	9.0	11.5	2.0	14.0	2.0	12.5	ns
t_{pZL}		2.0	5.8	7.5	2.0	10.0	2.0	8.5	
t_{PHZ}	Output Disable Time	1.5	5.3	7.0	1.5	8.0	1.5	8.0	
t_{PLZ}		1.5	4.3	5.5	1.5	7.5	1.5	6.5	

AC Operating Requirements

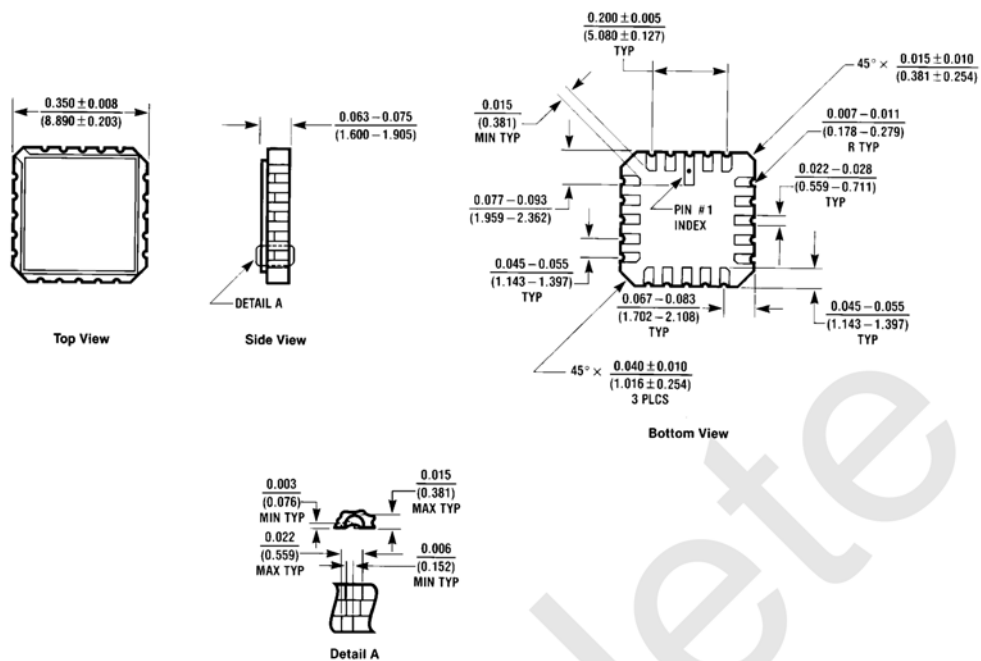
Symbol	Parameter	74F		54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$		
		Min	Max	Min	Max	Min	Max	
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW D_n to CP	2.0 2.0		2.0 2.5		2.0 2.0		ns
$t_h(\text{H})$ $t_h(\text{L})$	Hold Time, HIGH or LOW D_n to CP	2.0 2.0		2.0 2.5		2.0 2.0		
$t_w(\text{H})$ $t_w(\text{L})$	CP Pulse Width HIGH or LOW	7.0 6.0		7.0 6.0		7.0 6.0		ns

Ordering Information

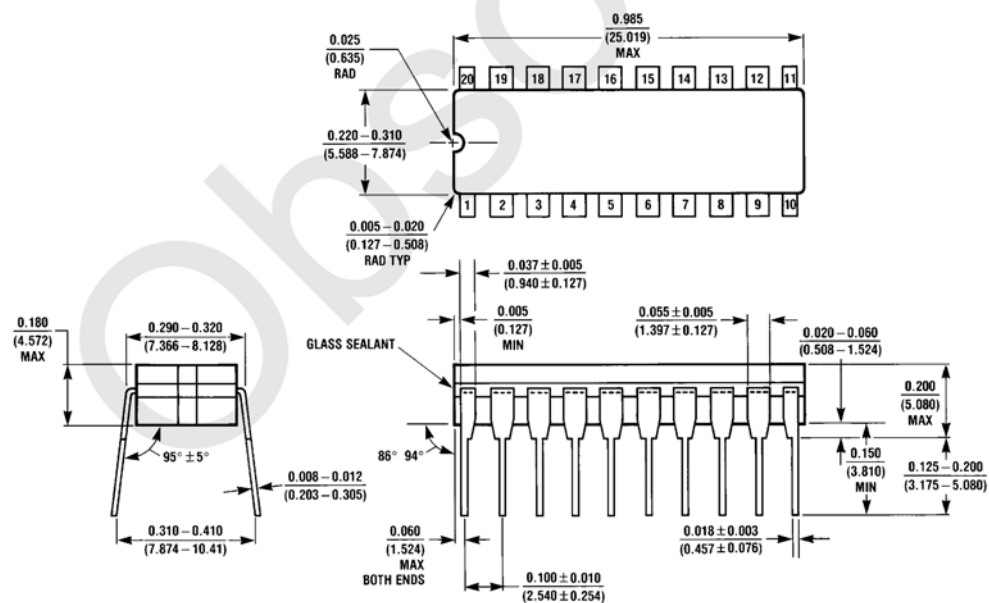
The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



Physical Dimensions inches (millimeters)

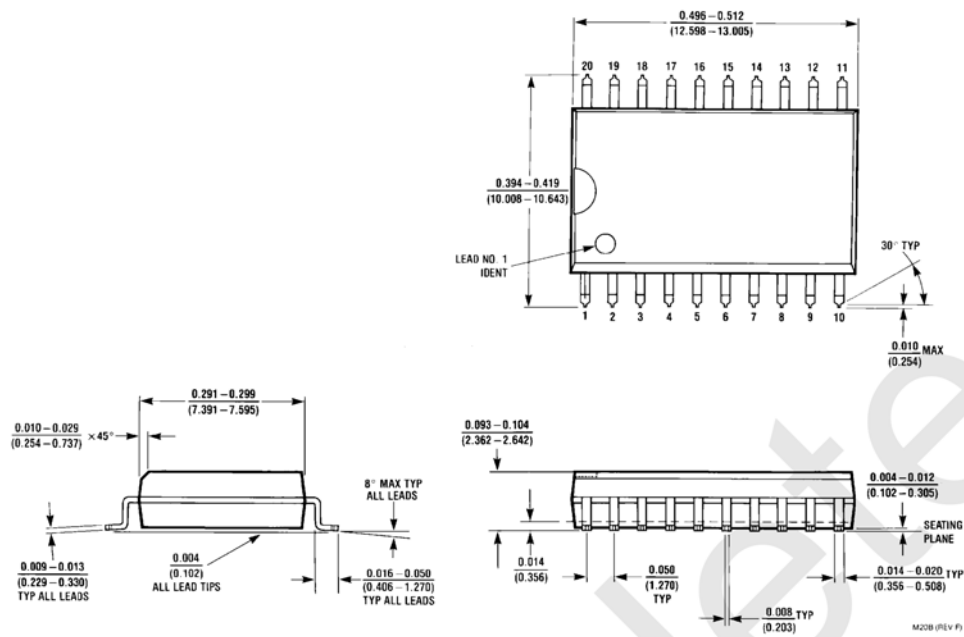


**20-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E20A**



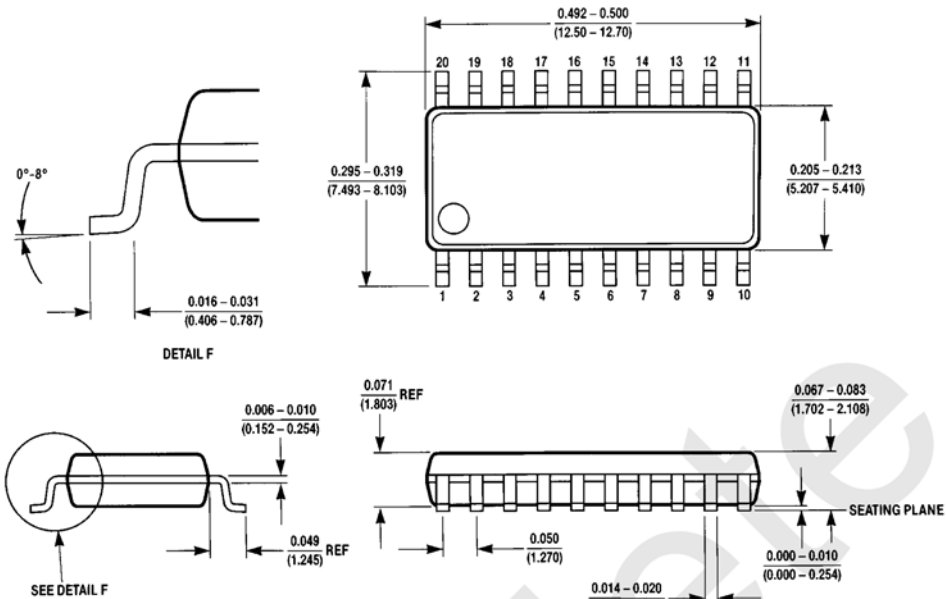
20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A

Physical Dimensions inches (millimeters) (Continued)

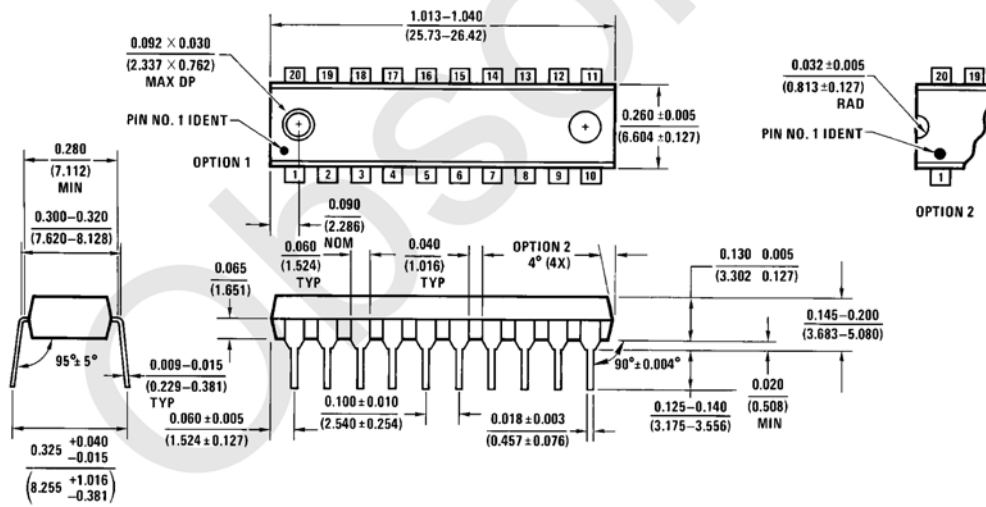


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC
NS Package Number M20B**

Physical Dimensions inches (millimeters) (Continued)



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



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