

54F/74F398 • 54F/74F399 Quad 2-Port Register

General Description

The 'F398 and 'F399 are the logical equivalents of a quad 2-input multiplexer feeding into four edge-triggered flip-flops. A common Select input determines which of the two 4-bit words is accepted. The selected data enters the flip-flops on the rising edge of the clock. The 'F399 is the 16-pin version of the 'F398, with only the Q outputs of the flip-flops available.

Features

- Select inputs from two data sources
- Fully positive edge-triggered operation
- Both true and complement outputs—'F398
- Guaranteed 4000V minimum ESD protection—'F399

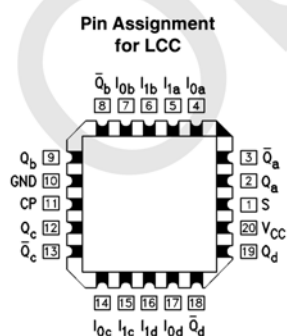
Commercial	Military	Package Number	Package Description
74F398PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F398DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F398SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
	54F398FM (Note 2)	W20A	20-Lead Cerpack
	54F398LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C
74F399PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F399DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F399SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F399SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F399FM (Note 2)	W20A	20-Lead Cerpack
	54F399LM (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.

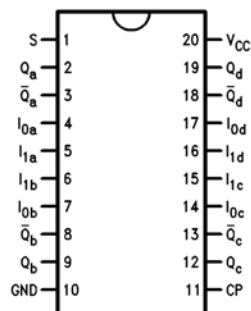
Connection Diagrams

'F398



TL/F/9533-5

Pin Assignment for DIP, SOIC and Flatpak

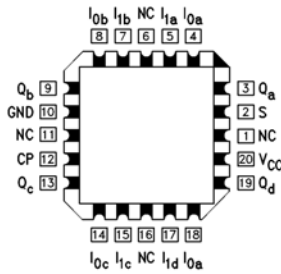


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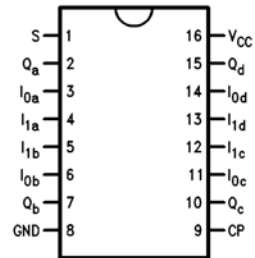
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Connection Diagrams (Continued)

'F399

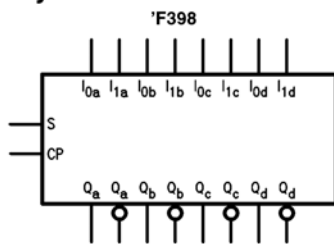


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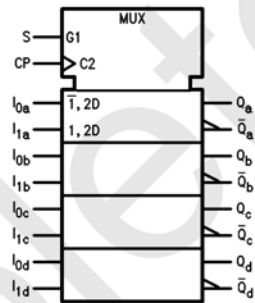
TL/F/9533-8

Logic Symbols

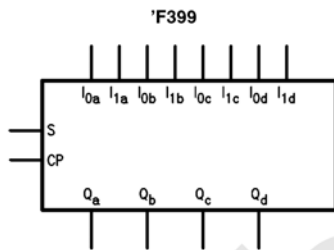


TL/F/9533-2

IEEE/IEC
'F398

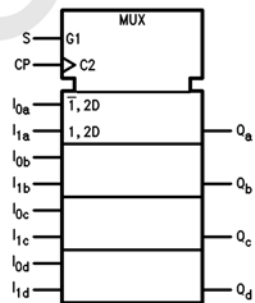


TL/F/9533-1



TL/F/9533-4

'F399



TL/F/9533-3

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
S	Common Select Input	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
$I_{0a}-I_{0d}$	Data Inputs from Source 0	1.0/1.0	20 μ A/ -0.6 mA
$I_{1a}-I_{1d}$	Data Inputs from Source 1	1.0/1.0	20 μ A/ -0.6 mA
Q_a-Q_d	Register True Outputs	50/33.3	-1 mA/20 mA
$\bar{Q}_a-\bar{Q}_d$	Register Complementary Outputs ('F398)	50/33.3	-1 mA/20 mA

Functional Description

The 'F398 and 'F399 are high-speed quad 2-port registers. They select four bits of data from either of two sources (Ports) under control of a common Select input (S). The selected data is transferred to a 4-bit output register synchronous with the LOW-to-HIGH transition of the Clock input (CP). The 4-bit D-type output register is fully edge-triggered. The Data inputs (I_{0x} , I_{1x}) and Select input (S) must be stable only a setup time prior to and hold time after the LOW-to-HIGH transition of the Clock input for predictable operation. The 'F398 has both Q and $\bar{Q}$ outputs.

Function Table

Inputs			Outputs	
S	I_0	I_1	Q	$\bar{Q}^*$
l	l	X	L	H
l	h	X	H	L
h	X	l	L	H
h	X	h	H	L

H = HIGH Voltage Level

L = LOW Voltage Level

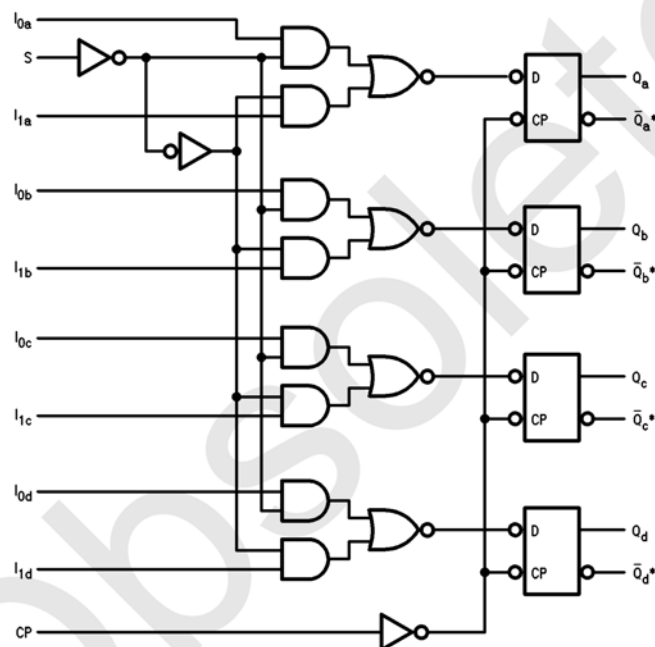
h = HIGH Voltage Level one setup time prior to the LOW-to-HIGH clock transition

l = LOW Voltage Level one setup time prior to the LOW-to-HIGH clock transition

X = Immaterial

*'F398 only

Logic Diagram



*'F398 Only

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

TL/F/9533-9

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
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Input Voltage (Note 2)	−0.5V to +7.0V
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Input Current (Note 2)	−30 mA to +5.0 mA
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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)
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ESD Last Passing Voltage (Min)—F399	4000V
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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			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} 74F 10% V _{CC} 74F 5% V _{CC}	2.5 2.5 2.7		V	Min	I _{OH} = −1 mA I _{OH} = −1 mA I _{OH} = −1 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} = 20 mA
I _{IH}	Input HIGH Current	54F 74F	20.0 5.0		μA	Max	V _{IN} = 2.7V
I _{BI}	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} = 150 mV All Other Pins Grounded
I _{IL}	Input LOW Current			−0.6	mA	Max	V _{IN} = 0.5V
I _{OS}	Output Short-Circuit Current		−60	−150	mA	Max	V _{OUT} = 0V
I _{OCH}	Power Supply Current ('F398)		25	38	mA	Max	V _O = HIGH
I _{OCL}	Power Supply Current ('F398)		25	38	mA	Max	V _O = LOW
I _{OCH}	Power Supply Current ('F399)		22	34	mA	Max	V _O = HIGH
I _{OCL}	Power Supply Current ('F399)		22	34	mA	Max	V _O = LOW

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}	Input Clock Frequency	100	140		80		100		MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q or $\overline{\text{Q}}$	3.0*	5.7	7.5	3.0	9.5	3.0	8.5	ns
		3.0	6.8	9.0	3.0	11.5	3.0	10.0	

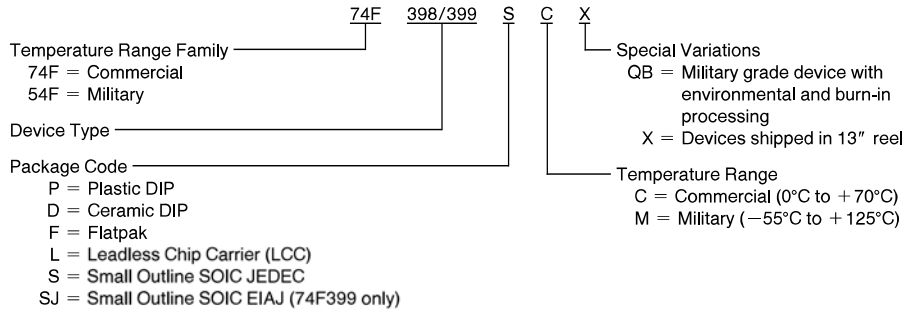
*F398 3.3 ns

AC Operating Requirements

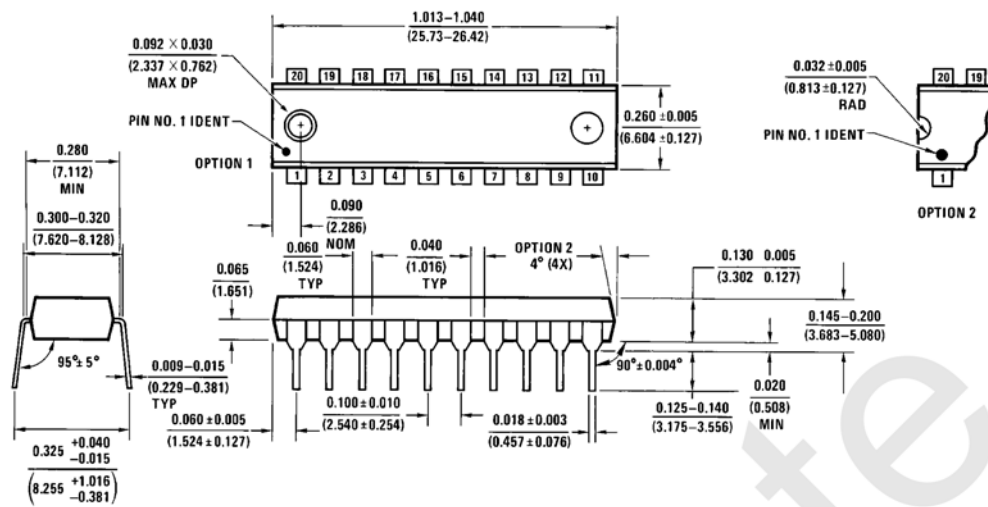
Symbol	Parameter	74F		54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$		
		Min	Max	Min	Max	Min	Max	
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW I_n to CP	3.0		4.5		3.0		ns
		3.0		4.5		3.0		
$t_h(\text{H})$ $t_h(\text{L})$	Hold Time, HIGH or LOW I_n to CP	1.0		1.5		1.0		ns
		1.0		1.5		1.0		
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW S to CP ('F398)	7.5		10.5		8.5		ns
		7.5		10.5		8.5		
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW S to CP ('F399)	7.5		9.5		8.5		
		7.5		9.5		8.5		
$t_h(\text{H})$ $t_h(\text{L})$	Hold Time, HIGH or LOW S to CP	0		0		0		ns
		0		0		0		
$t_w(\text{H})$ $t_w(\text{L})$	CP Pulse Width HIGH or LOW	4.0		4.0		4.0		ns
		5.0		7.0		5.0		

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) (Continued)



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