

# 54F/74F779

## 8-Bit Bidirectional Binary Counter with TRI-STATE® Outputs

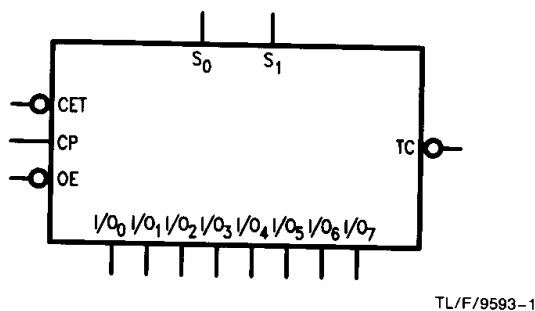
### General Description

The 'F779 is a fully synchronous 8-stage up/down counter with multiplexed TRI-STATE I/O ports for bus-oriented applications. All control functions (hold, count up, count down, synchronous load) are controlled by two mode pins ( $S_0$ ,  $S_1$ ). The device also features carry lookahead for easy cascading. All state changes are initiated by the rising edge of the clock.

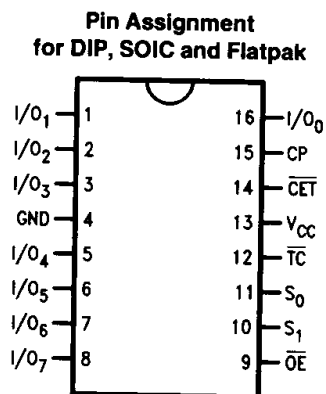
### Features

- Multiplexed TRI-STATE I/O ports
- Built-in lookahead carry capability
- Count frequency 100 MHz typ
- Supply current 80 mA typ
- Guaranteed 4000V minimum ESD protection
- Available in SOIC (300 mil only)

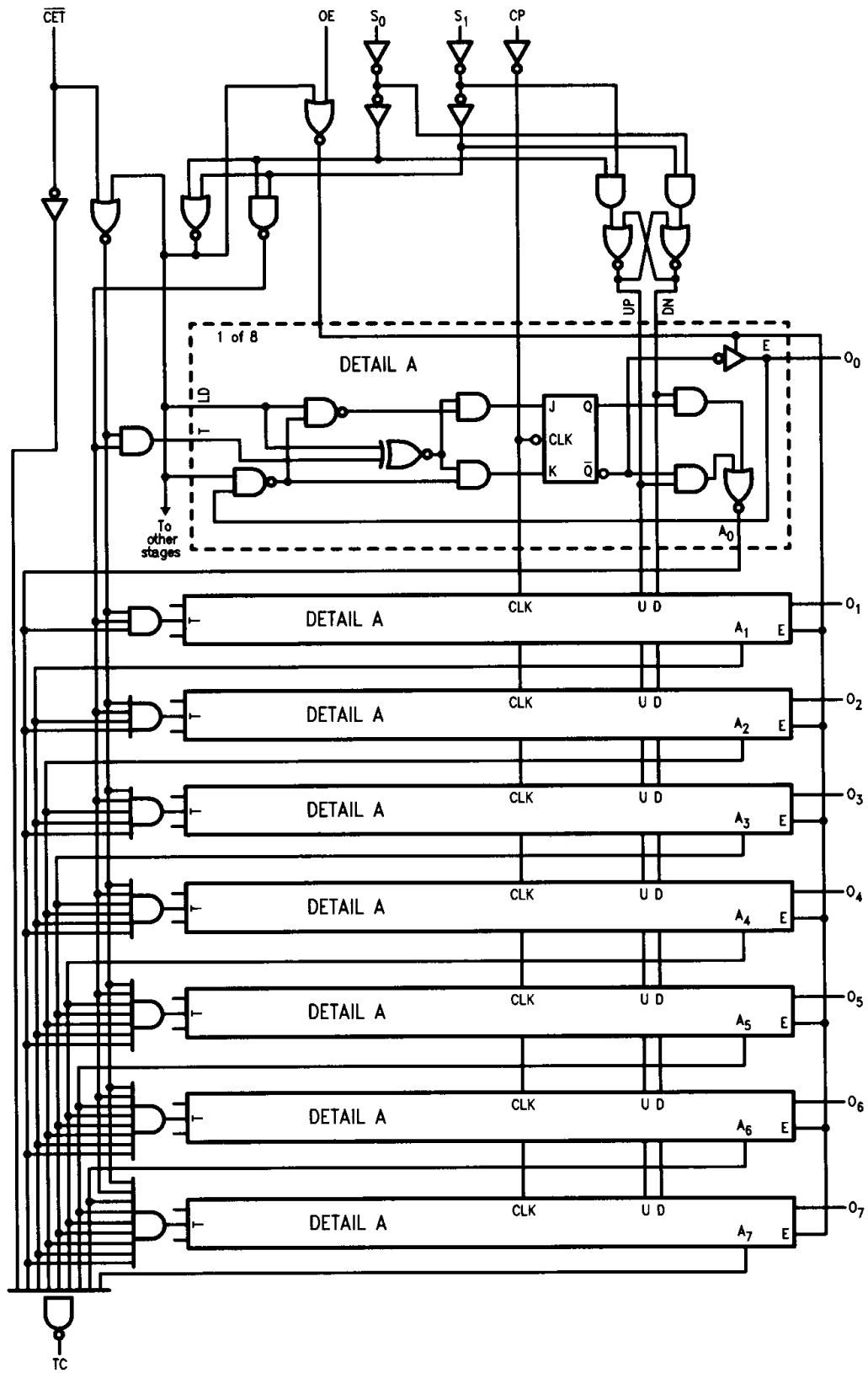
### Logic Symbols



### Connection Diagram



# Logic Diagram








TL/F/9593-4

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

## Unit Loading/Fan Out

Pin Names	Description	74F	
		U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
$I/O_0-I/O_7$	Data Inputs Data Outputs	0.25/0.33 75/15 (12.5)	$5 \mu A / -0.2 mA$ $-3 mA / 24 mA (20 mA)$
$S_0, S_1$	Select Inputs	0.25/0.33	$5 \mu A / -0.2 mA$
$\overline{OE}$	Output Enable Input (Active LOW)	0.25/0.33	$5 \mu A / -0.2 mA$
$\overline{CET}$	Count Enable Trickle Input (Active LOW)	0.25/0.33	$5 \mu A / -0.2 mA$
CP	Clock Pulse Input (Active Rising Edge)	0.25/0.33	$5 \mu A / -0.2 mA$
$\overline{TC}$	Terminal Count Output (Active LOW)	25/12.5	$-1 mA / 20 mA$

Function Table

$S_1$	$S_0$	$\overline{CET}$	$\overline{OE}$	CP	Function
X	X	X	H	X	$I/O_0$ to $I/O_7$ in High Z
X	X	X	L	X	Flip-Flop Outputs Appear on I/O Lines
L	L	X	X		Parallel Load All Flip-Flops
(Not LL)	H	X	X		Hold ( $\overline{TC}$ Held HIGH)
H	H	X	X		Hold
H	L	L	X		Count Up
L	H	L	X		Count Down

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

 = LOW-to-HIGH Clock Transition

(Not LL) means  $S_0$  and  $S_1$  should never both be LOW level at the same time.

## 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
V <sub>CC</sub> 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

**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.

Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V)	-0.5V to V <sub>CC</sub>
Standard Output TRI-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (mA)
ESD Last Passing Voltage (Min)	4000V

## Recommended Operating Conditions

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

## DC Electrical Characteristics

Symbol	Parameter	54F/74F			Units	V <sub>CC</sub>	Conditions
		Min	Typ	Max			
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	Mil 10% V <sub>CC</sub> 5% V <sub>CC</sub>	2.4 2.4 2.7		V	Min	I <sub>OH</sub> = -3 mA
V <sub>OL</sub>	Output LOW Voltage	Mil 10% V <sub>CC</sub> 5% V <sub>CC</sub>		0.5 0.5 0.5	V	Min	I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 20 mA I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V <sub>IN</sub> = 2.7V (Non-I/O Pins)
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V <sub>IN</sub> = 7.0V (Non-I/O Pins)
I <sub>BVIT</sub>	Input HIGH Current Breakdown (I/O)	54F 74F		1.0 0.5	mA	Max	V <sub>IN</sub> = 5.5V (I/O <sub>n</sub> )
I <sub>CEX</sub>	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	74F	4.75		V	0.0	I <sub>ID</sub> = 1.9 μA All other pins grounded
I <sub>OD</sub>	Output Leakage Circuit Current	74F		3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All other pins grounded
I <sub>ZZ</sub>	Bus Drainage Test			500	μA	0.0	V <sub>OUT</sub> = 5.25V
I <sub>IL</sub>	Input LOW Current			-0.2	mA	Max	V <sub>IN</sub> = 0.5V (Non I/O Pins)
I <sub>IH</sub> + I <sub>OZH</sub>	Output Leakage Current			70	μA	Max	V <sub>OUT</sub> = 2.7V (I/O <sub>n</sub> )
I <sub>IL</sub> + I <sub>OZL</sub>	Output Leakage Current			-200	μA	Max	V <sub>OUT</sub> = 0.5V (I/O <sub>n</sub> )
I <sub>OS</sub>	Output Short-Circuit Current		-60	-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CCH</sub>	Power Supply Current			90	mA	Max	V <sub>O</sub> = HIGH
I <sub>CCL</sub>	Power Supply Current			105	mA	Max	V <sub>O</sub> = LOW
I <sub>CCZ</sub>	Power Supply Current			110	mA	Max	V <sub>O</sub> = HIGH Z

## AC Electrical Characteristics

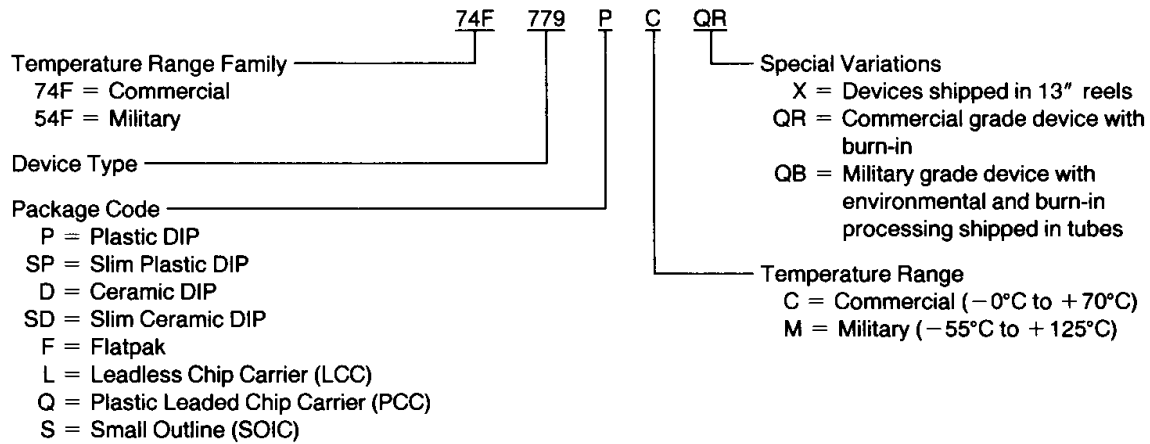
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	100	105				90		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to I/O <sub>n</sub>	3.0 5.0	5.0 7.5	8.0 11.0			3.0 5.0	8.5 11.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to $\overline{TC}$	5.0 5.0	7.5 9.3	9.0 10.5			5.0 5.0	10.0 11.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay $\overline{CET}$ to $\overline{TC}$	2.5 4.5	3.8 6.1	5.5 8.0			2.5 4.5	6.0 8.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay SN to $\overline{TC}$	3.5 3.5	6.5 7.5	12.0 12.0			3.5 3.5	12.0 12.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time $\overline{OE}$ to I/O <sub>n</sub>	3.0 5.0	5.0 8.0	7.0 10.0			3.0 5.0	7.5 10.5	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time $\overline{OE}$ to I/O <sub>n</sub>	1.0 1.0	4.0 3.7	6.5 6.5			1.0 1.0	7.0 7.0	ns

## AC Operating Requirements

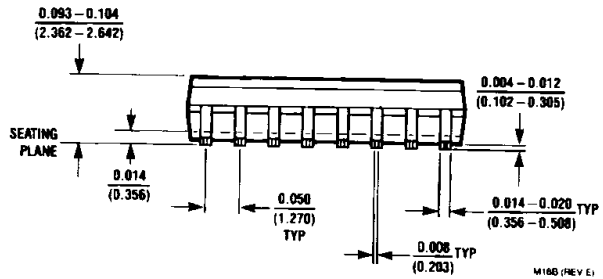
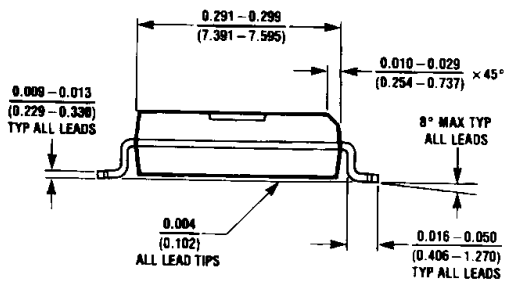
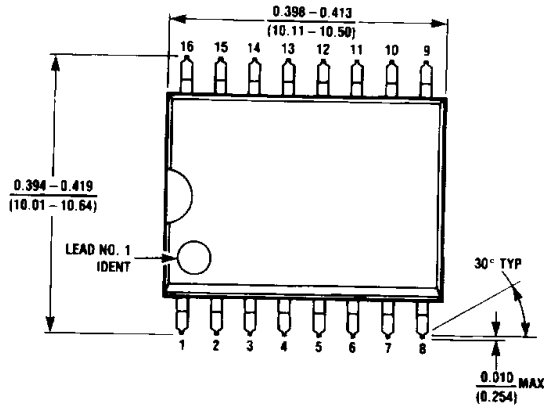
Symbol	Parameter	74F		54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> , V <sub>CC</sub> = Mil		T <sub>A</sub> , V <sub>CC</sub> = Com		
		Min	Max	Min	Max	Min	Max	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time I/O <sub>n</sub> to CP	5.0 5.0				5.0 5.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time I/O <sub>n</sub> to CP	0.0 0.0				0.0 0.0		ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time Sn to CP	9.5 9.5				10.0 10.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time Sn to CP	0.0 0.0				0.0 0.0		ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time $\overline{CET}$ to CP	7.0 7.0				7.0 7.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time $\overline{CET}$ to CP	0.0 0.0				0.0 0.0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock Pulse Width High or Low	4.0 4.0				4.0 4.0		ns

## Ordering Information

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



**Physical Dimensions** inches (millimeters)

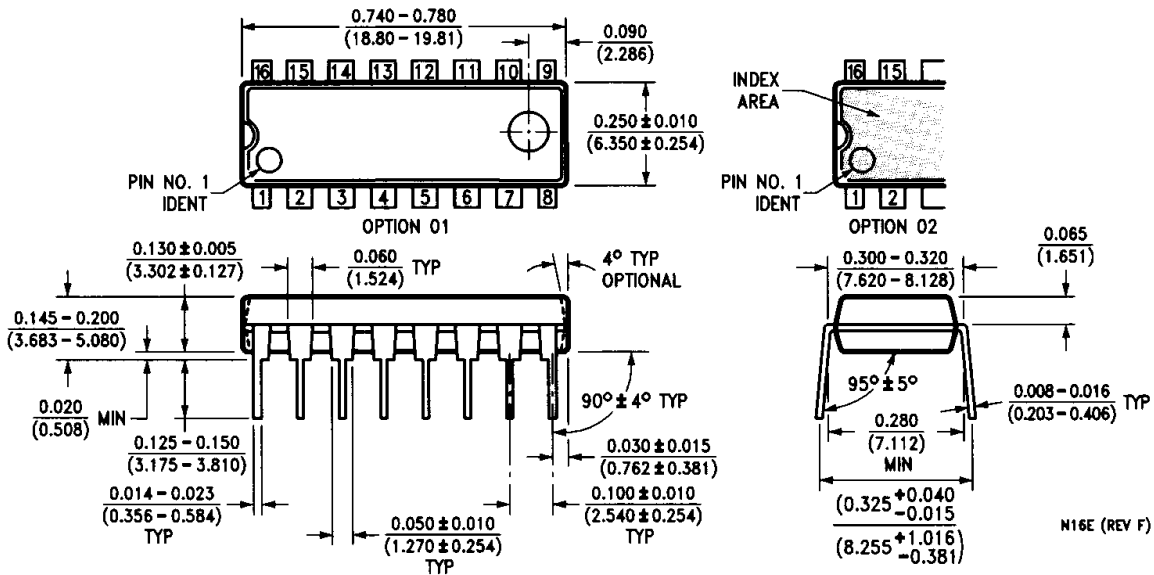


**16-Lead (0.300" Wide) Small Outline Integrated Circuit (S)  
NS Package Number M16B**

M16B (REV E)

**Physical Dimensions** inches (millimeters) (Continued)

Lit # 114653



**16-Lead Plastic Dual-In-Line Package (P)  
NS Package Number N16E**

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