

# 54F/74F821 10-Bit D-Type Flip-Flop

## General Description

The 'F821 is a 10-bit D-type flip-flop with TRI-STATE® true outputs arranged in a broadside pinout. The 'F821 is functionally and pin compatible with the AMD's Am29821.

## Features

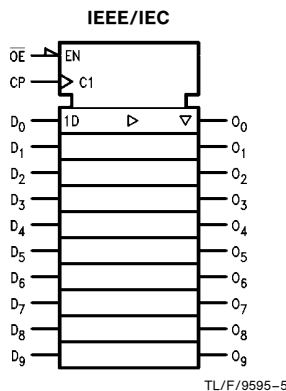
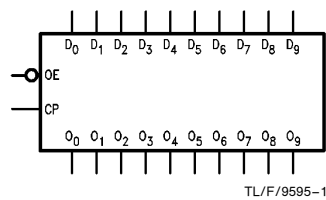
- TRI-STATE Outputs
- Direct replacement for AMD's Am29821

Commercial	Military	Package Number	Package Description
74F821SPC		N24C	24-Lead (0.300" Wide) Molded Dual-In-Line
	54F821SDM (Note 2)	J24F	24-Lead (0.300" Wide) Ceramic Dual-In-Line
74F821SC (Note 1)		M24B	24-Lead (0.300" Wide) Molded Small Outline, JEDEC
	54F821FM (Note 2)	W24C	24-Lead Cerpack
	54F821LM (Note 2)	E28A	24-Lead Ceramic Leadless Chip Carrier, Type C

**Note 1:** Devices also available in 13" reel. Use suffix = SCX.

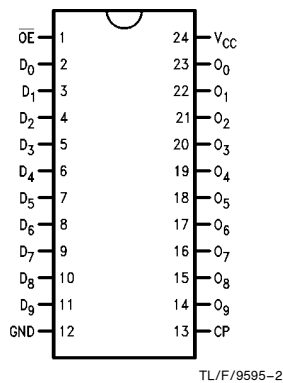
**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = SDM QB, FM QB and LM QB.

## Logic Symbols

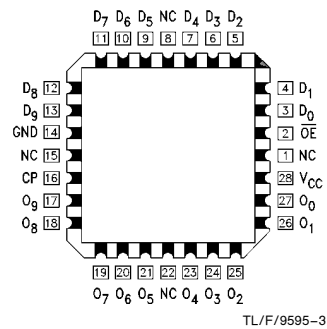


## Connection Diagrams

Pin Assignment  
for DIP, SOIC and Flatpak



Pin Assignment  
for LCC



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## Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
$D_0$ – $D_9$	Data Inputs	1.0/1.0	20 $\mu$ A/ –0.6 mA
$\overline{OE}$	Output Enable	1.0/1.0	20 $\mu$ A/ –0.6 mA
	TRI-STATE Input	1.0/1.0	20 $\mu$ A/ –0.6 mA
CP	Clock Input	1.0/1.0	20 $\mu$ A/ –0.6 mA
$O_0$ – $O_9$	TRI-STATE Outputs	150/40 (33.3)	–3.0 mA/24 mA (20 mA)

## Functional Description

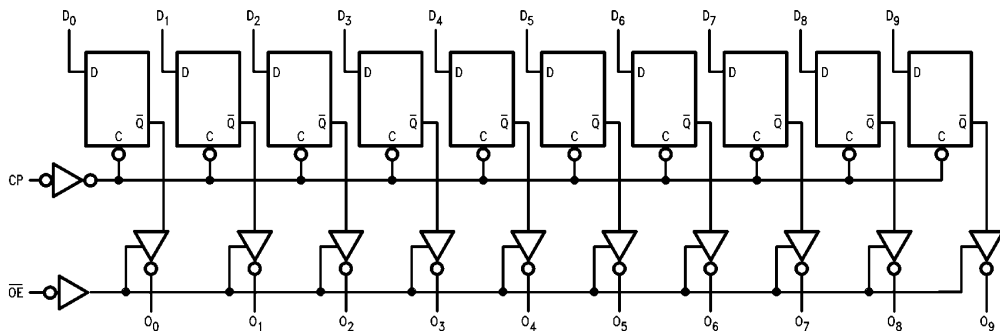
The 'F821 consists of ten D-type edge-triggered flip-flops. This device has TRI-STATE true outputs for bus systems organized in a broadside pinning. The buffered Clock (CP) and buffered Output Enable ( $\overline{OE}$ ) are common to all flip-flops. The flip-flops will store the state of their individual D inputs that meet the setup and hold times requirements on the LOW-to-HIGH CP transition. With the  $\overline{OE}$  LOW the content of the 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			Internal	Output	Function
$\overline{OE}$	CP	D	$\overline{Q}$	O	
H	H	X	NC	Z	Hold
H	L	X	NC	Z	Hold
H	$\nearrow$	L	H	Z	Load
H	$\nearrow$	H	L	Z	Load
L	$\nearrow$	L	H	L	Data Available
L	$\nearrow$	H	L	H	Data Available
L	H	X	NC	NC	No Change in Data
L	L	X	NC	NC	No Change in Data

L = LOW Voltage Level  
H = HIGH Voltage Level  
X = Immaterial  
Z = High Impedance  
 $\nearrow$  = LOW-to-HIGH Transition  
NC = No Change

## Logic Diagram



TL/F/9595-4

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 <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
Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V)	
Standard Output	-0.5V to V <sub>CC</sub>
TRI-STATE Output	-0.5V to +5.5V

Current Applied to Output in LOW State (Max) twice the rated I<sub>OL</sub> (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.

## 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 <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	54F 10% V <sub>CC</sub> 54F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub> 74F 5% V <sub>CC</sub> 74F 5% V <sub>CC</sub>	2.5 2.4 2.5 2.4 2.7 2.7			V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA
V <sub>OL</sub>	Output LOW Voltage	54F 10% V <sub>CC</sub> 74F 10% V <sub>CC</sub>	0.5 0.5			V	Min	I <sub>OL</sub> = 20 mA I <sub>OL</sub> = 24 mA
I <sub>IH</sub>	Input HIGH Current	54F 74F	20.0 5.0			μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	54F 74F	100 7.0			μA	Max	V <sub>IN</sub> = 7.0V
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>IL</sub>	Input LOW Current		-0.6			mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OZH</sub>	Output Leakage Current		50			μA	Max	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Output Leakage Current		-50			μA	Max	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current		-60	-150		mA	Max	V <sub>OUT</sub> = 0V
I <sub>CCZ</sub>	Power Supply Current		78	100		mA	Max	V <sub>O</sub> = HIGH Z

## AC Electrical Characteristics

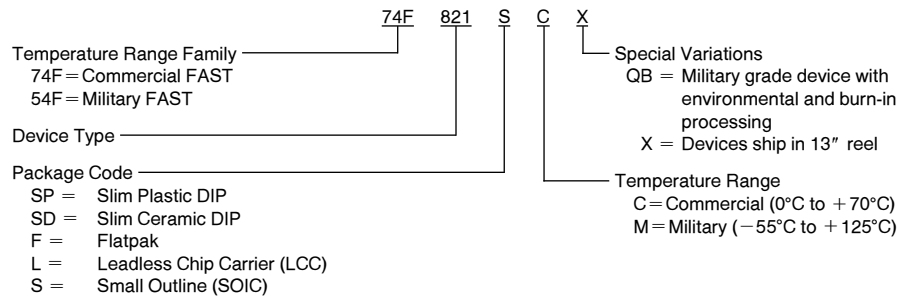
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	100	150		60		70		MHz
t <sub>PLH</sub>	Propagation Delay	2.0	6.4	9.5	2.0	10.5	2.0	10.5	ns
t <sub>PHL</sub>	CP to O <sub>n</sub>	2.0	6.2	9.5	2.0	10.5	2.0	10.5	
t <sub>PZH</sub>	Output Enable Time	2.0	5.8	10.5	2.0	13.0	2.0	11.5	ns
t <sub>PZL</sub>	$\overline{OE}$ to O <sub>n</sub>	2.0	6.3	10.5	2.0	13.0	2.0	11.5	
t <sub>PHZ</sub>	Output Disable Time	1.5	3.4	7.0	1.0	7.5	1.5	7.5	ns
t <sub>PLZ</sub>	$\overline{OE}$ to O <sub>n</sub>	1.5	3.5	7.0	1.0	7.5	1.5	7.5	

## AC Operating Requirements

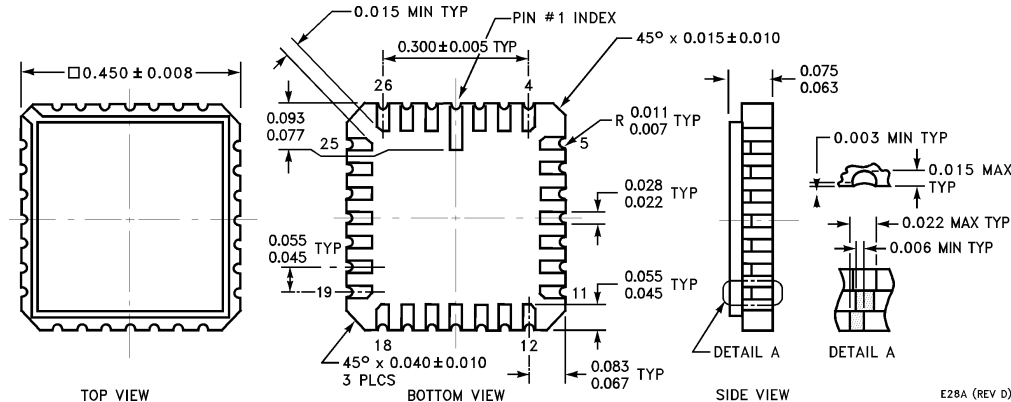
Symbol	Parameter	74F		54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> , V <sub>CC</sub> = Mil		T <sub>A</sub> , V <sub>CC</sub> = Com		
		Min	Max	Min	Max	Min	Max	
t <sub>s</sub> (H)	Setup Time, HIGH or LOW	2.5		4.0		3.0		ns
t <sub>s</sub> (L)	D <sub>n</sub> to CP	2.5		4.0		3.0		
t <sub>h</sub> (H)	Hold Time, HIGH or LOW	2.5		2.5		2.5		ns
t <sub>h</sub> (L)	D <sub>n</sub> to CP	2.5		2.5		2.5		
t <sub>w</sub> (H)	CP Pulse Width	5.0		6.0		6.0		ns
t <sub>w</sub> (L)	HIGH or LOW	5.0		6.0		6.0		

## 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:

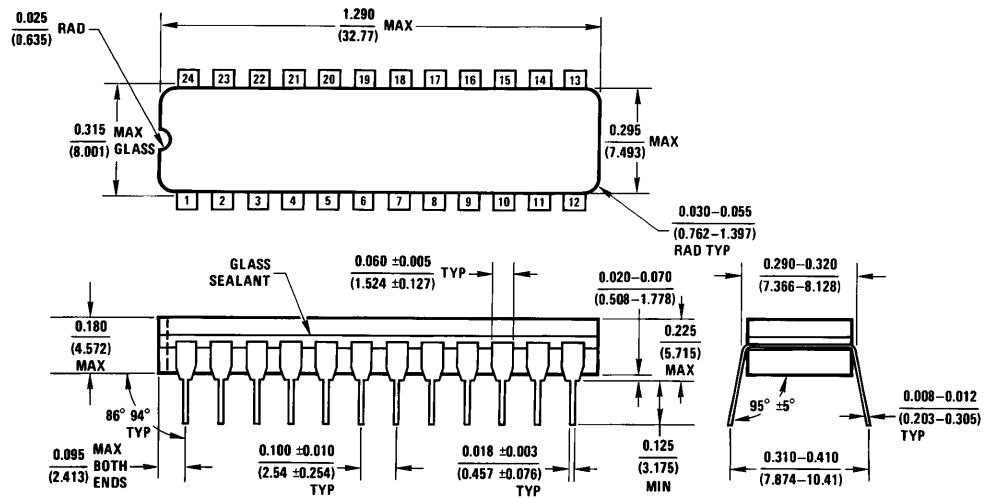


**Physical Dimensions** inches (millimeters)



**28-Lead Ceramic Leadless Chip Carrier (L)  
NS Package Number E28A**

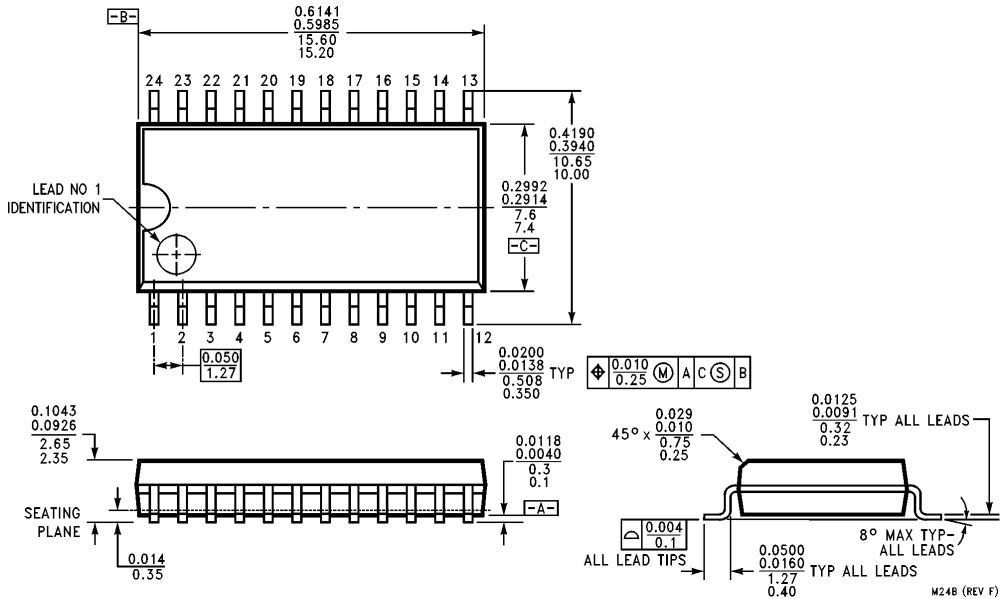
E28A (REV D)



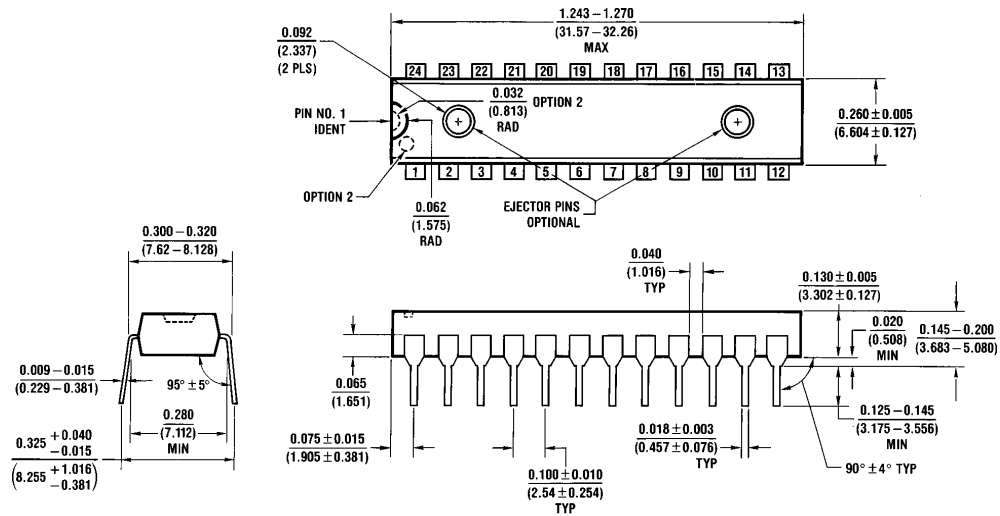
**24-Lead (0.300" Wide) Ceramic Dual-In-Line Package (SD)  
NS Package Number J24F**

J24F (REV G)

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

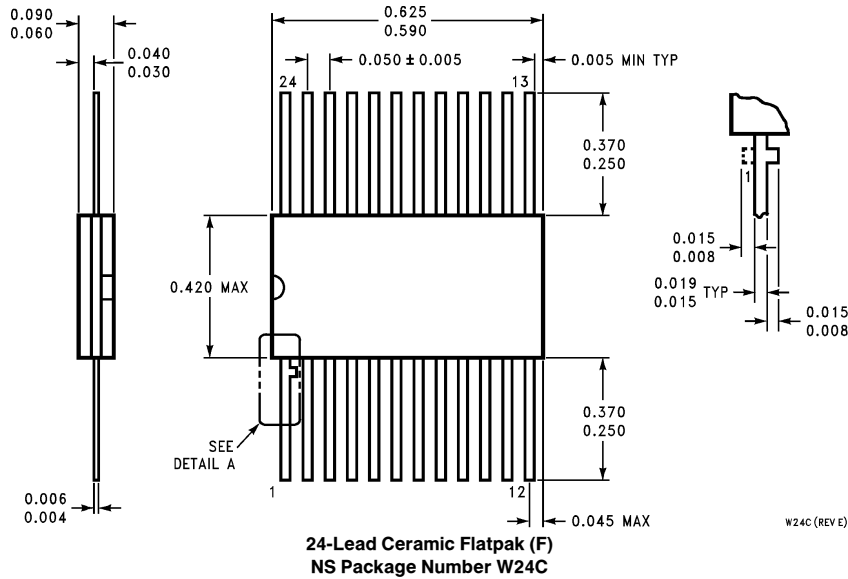


**24-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M24B**



**24-Lead (0.300" Wide) Molded Dual-In-Line Package (SP)  
NS Package Number N24C**

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



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