

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

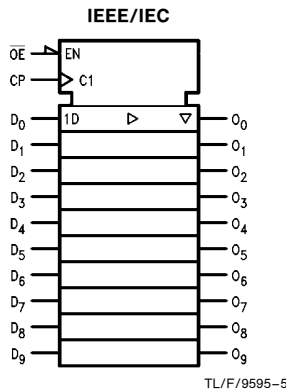
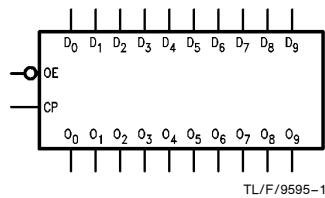
- TRI-STATE Outputs
- Direct replacement for AMD's Am29821

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.

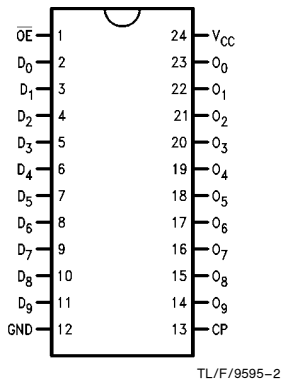
Note 2: Military grade device with environmental and burn-in processing. Use suffix = SDM QB, FM QB and LM QB.

Logic Symbols

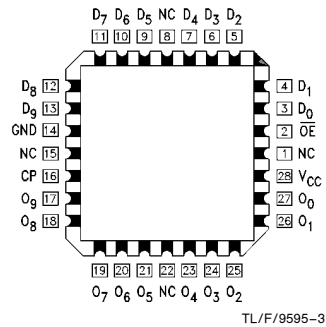


Connection Diagrams

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 μA / -0.6 mA
$\overline{OE}$	Output Enable	1.0/1.0	20 μA / -0.6 mA
CP	TRI-STATE Input	1.0/1.0	20 μA / -0.6 mA
O_0-O_9	Clock Input	1.0/1.0	20 μA / -0.6 mA
	TRI-STATE Outputs	150/40 (33.3)	-3.0 mA/24 mA (20 mA)

Functional Description

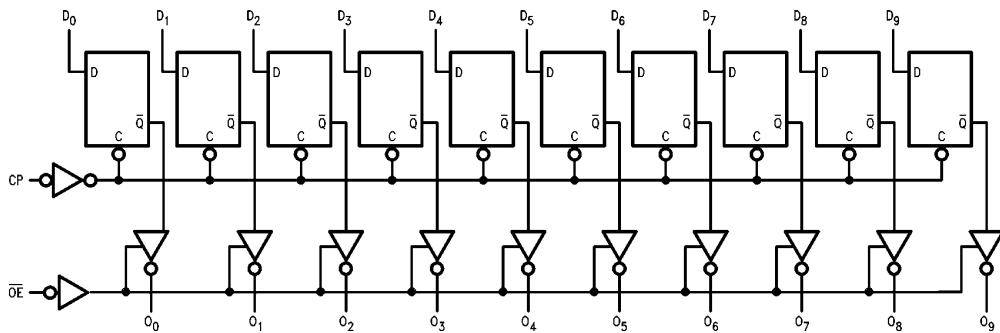
The 'F821 consists of ten D-type edge-triggered flip-flops. This device has TRI-STATE true outputs for bus systems organized in a broadside pinning. The buffered Clock (CP) and buffered Output Enable ($\overline{OE}$) are common to all flip-flops. The flip-flops will store the state of their individual 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 _{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)

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} 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} = 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 _{CCZ}	Power Supply Current		78	100	mA	Max	V _O = HIGH Z

AC Electrical Characteristics

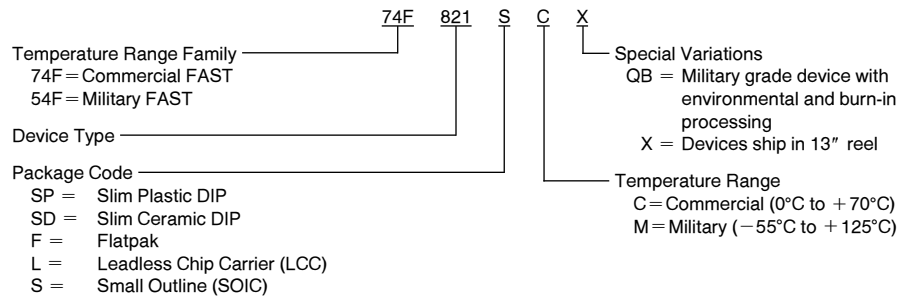
Symbol	Parameter	74F			54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{Mil}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$		
		Min	Typ	Max	Min	Max	Min	Max	
f _{max}	Maximum Clock Frequency	100	150		60		70		MHz
t _{PLH}	Propagation Delay	2.0	6.4	9.5	2.0	10.5	2.0	10.5	ns
t _{PHL}	CP to O _n	2.0	6.2	9.5	2.0	10.5	2.0	10.5	
t _{PZH}	Output Enable Time	2.0	5.8	10.5	2.0	13.0	2.0	11.5	ns
t _{PZL}	OE to O _n	2.0	6.3	10.5	2.0	13.0	2.0	11.5	
t _{PHZ}	Output Disable Time	1.5	3.4	7.0	1.0	7.5	1.5	7.5	
t _{PLZ}	OE to O _n	1.5	3.5	7.0	1.0	7.5	1.5	7.5	

AC Operating Requirements

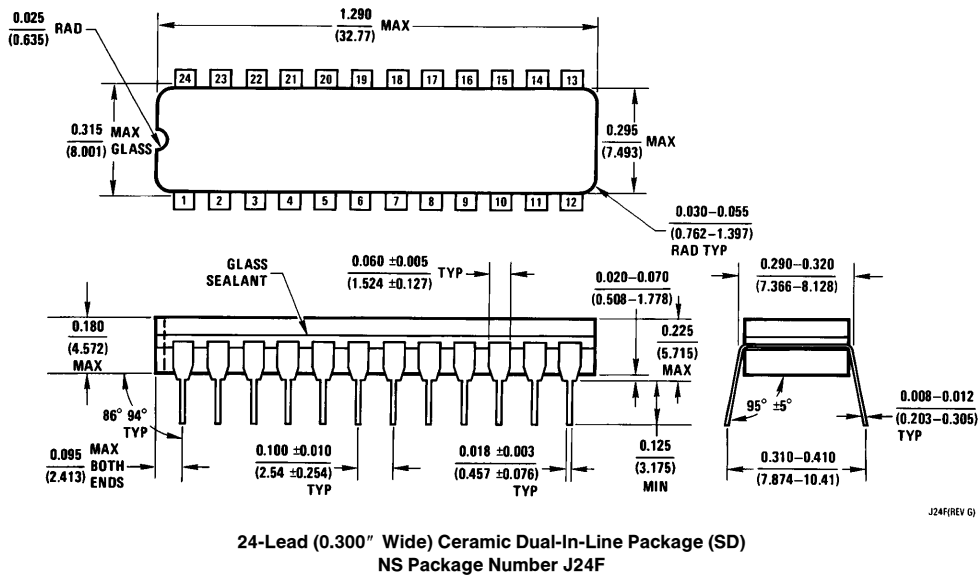
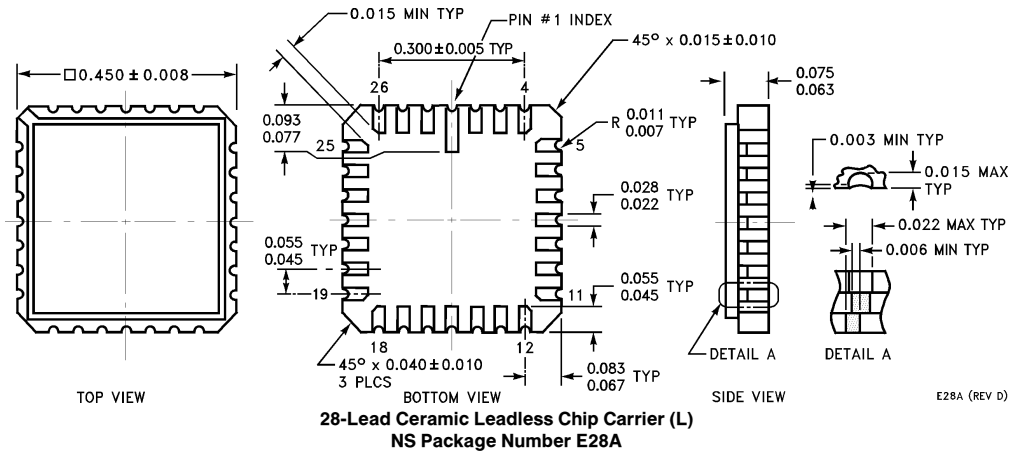
Symbol	Parameter	74F		54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$		
		Min	Max	Min	Max	Min	Max	
$t_s(\text{H})$	Setup Time, HIGH or LOW	2.5		4.0		3.0		ns
$t_s(\text{L})$	D_n to CP	2.5		4.0		3.0		
$t_h(\text{H})$	Hold Time, HIGH or LOW	2.5		2.5		2.5		ns
$t_h(\text{L})$	D_n to CP	2.5		2.5		2.5		
$t_w(\text{H})$	CP Pulse Width	5.0		6.0		6.0		ns
$t_w(\text{L})$	HIGH or LOW	5.0		6.0		6.0		

Ordering Information

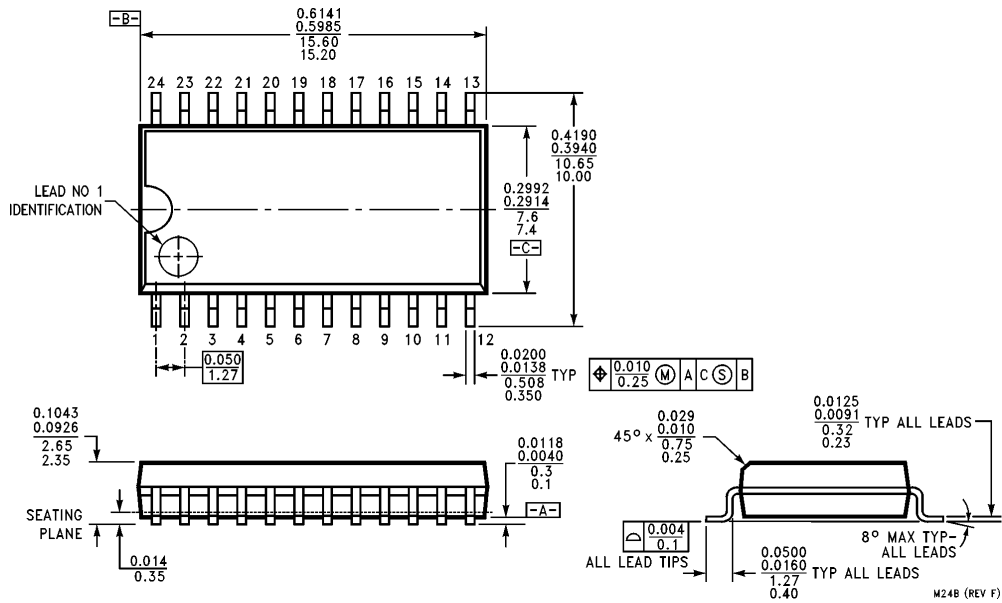
The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



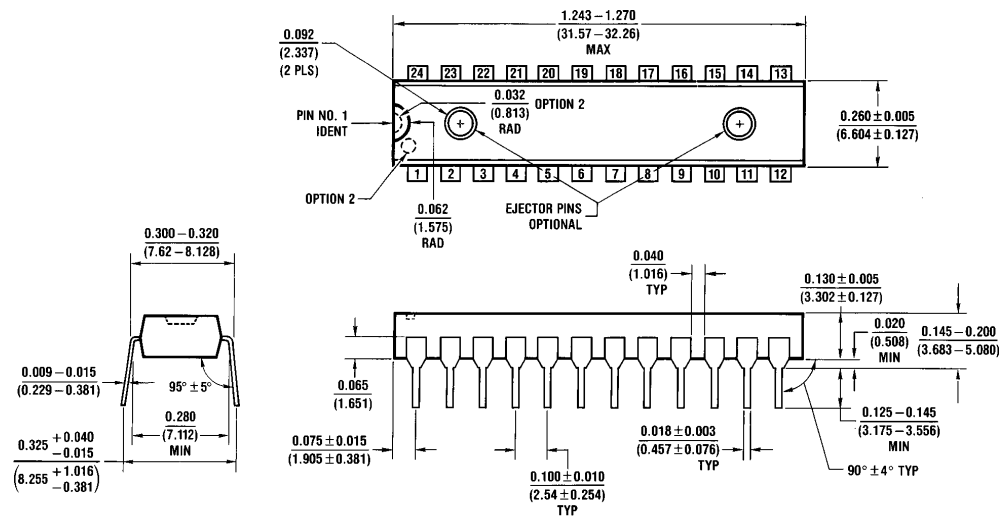
Physical Dimensions inches (millimeters)



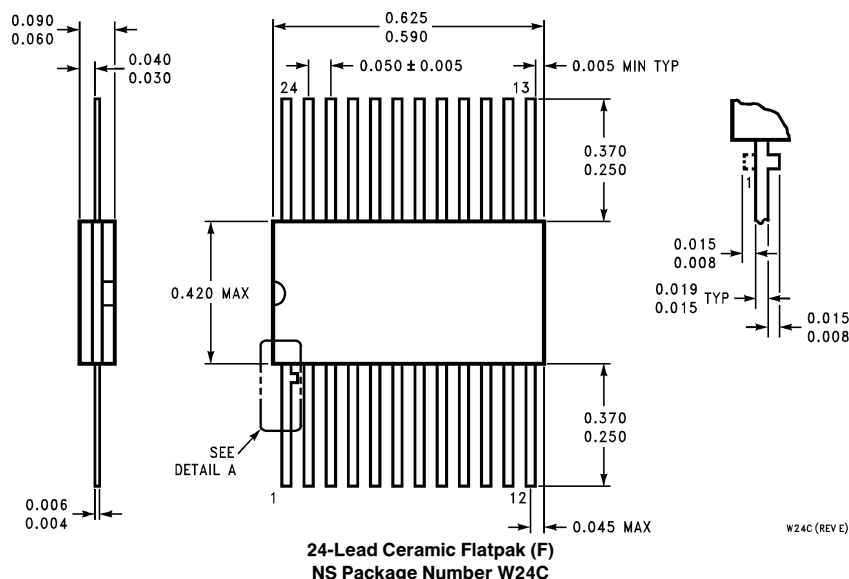
Physical Dimensions inches (millimeters) (Continued)



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)**LIFE SUPPORT POLICY**

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National Semiconductor Corporation
2900 Semiconductor Drive
P.O. Box 58090
Santa Clara, CA 95052-8090
Tel: (408) 272-9959
TWX: (910) 339-9240

National Semiconductor GmbH
Livvy-Gargan-Str. 10
D-82256 Fürstenfeldbruck
Germany
Tel: (81-41) 35-0
Telex: 527849
Fax: (81-41) 35-1

National Semiconductor Japan Ltd.
Sumitomo Chemical
Engineering Center
Bldg. 7F
1-7-1, Nakase, Mihamu-Ku
Chiba-City,
Chiba Prefecture 261
Tel: (043) 299-2300
Fax: (043) 299-2500

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semicondutores Do Brasil Ltda.
Rue Deputado Lacorda Franco
120-3A
Sao Paulo-SP
Brazil 05418-000
Tel: (55-11) 212-5066
Telex: 391-1131931 NSBR BR
Fax: (55-11) 212-1181

National Semiconductor (Australia) Pty. Ltd.
Building 16
Business Park Drive
Monash Business Park
Nottingham, Melbourne
Victoria 3168 Australia
Tel: (3) 558-9999
Fax: (3) 558-9998

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