National Semiconductor

December 1994

54F/74F823
9-Bit D-Type Flip-Flop

General Description

The 'F823 is a 9-bit buffered register. It features Clock Enable and Clear which are ideal for parity bus interfacing in high performance microprogramming systems.

The 'F823 is functionally and pin compatible with AMD's Am29823.

Features

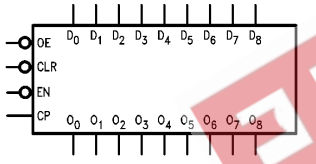
- TRI-STATE® outputs
- Clock Enable and Clear
- Direct replacement for AMD's Am29823

Commercial	Military	Package Number	Package Description
74F823SPC		N24C	24-Lead (0.300″ Wide) Molded Dual-In-Line
	54F823SDM (Note 2)	J24F	24-Lead (0.300″ Wide) Ceramic Dual-In-Line
74F823SC (Note 1)		M24B	24-Lead (0.300″ Wide) Molded Small Outline, JEDEC
	54F823FM (Note 2)	W24C	24-Lead Cerpack
	54F823LM (Note 2)	E28A	24-Lead Ceramic 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 = SDMQB, FMQB and LMQB.

Logic Symbols



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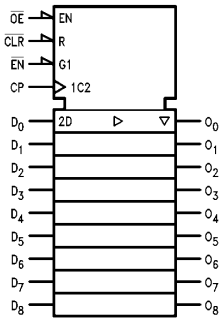
IEEE/IEC



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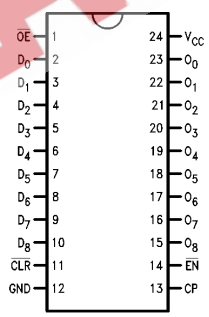
Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



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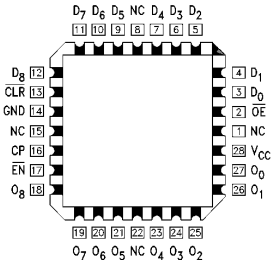
Pin Assignment for LCC



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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_8	Data Inputs	1.0/1.0	20 μA/−0.6 mA
$\overline{OE}$	Output Enable Input	1.0/1.0	20 μA/−0.6 mA
$\overline{CLR}$	Clear	1.0/1.0	20 μA/−0.6 mA
CP	Clock Input	1.0/2.0	20 μA/−1.2 mA
$\overline{EN}$	Clock Enable	1.0/1.0	20 μA/−0.6 mA
O_0–O_8	TRI-STATE Outputs	150/40 (33.3)	−3 mA/24 mA (20 mA)

Functional Description

The 'F823 device consists of nine D-type edge-triggered flip-flops. It has TRI-STATE true outputs and is organized in 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 contents 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. In addition to the Clock and Output Enable pins, the 'F823 has Clear ($\overline{CLR}$) and Clock Enable ($\overline{EN}$) pins.

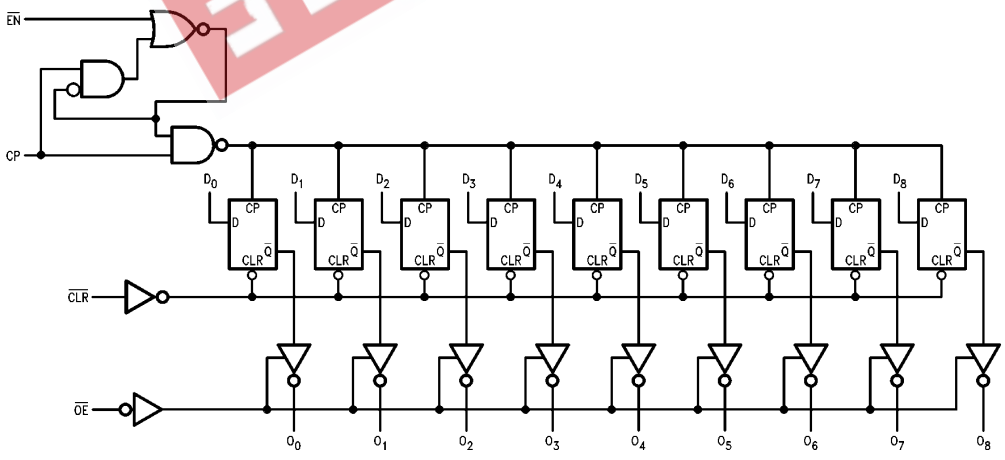
When the $\overline{CLR}$ is LOW and the $\overline{OE}$ is LOW, the outputs are LOW. When $\overline{CLR}$ is HIGH, data can be entered into the flip-flops. When $\overline{EN}$ is LOW, data on the inputs is transferred to the outputs on the LOW to HIGH clock transition. When the $\overline{EN}$ is HIGH, the outputs do not change state regardless of the data or clock inputs transitions. This device is ideal for parity bus interfacing in high performance systems.

Function Table

Inputs					Internal	Output	Function
$\overline{OE}$	$\overline{CLR}$	$\overline{EN}$	CP	D	$\overline{Q}$	O	
H	H	L	H	X	NC	Z	Hold
H	H	L	L	X	NC	Z	Hold
H	H	H	X	X	NC	Z	Hold
L	H	H	X	X	NC	NC	Hold
H	L	X	X	X	H	Z	Clear
L	L	X	X	X	H	L	Clear
H	H	L	↗	H	H	Z	Load
H	H	L	↗	H	L	Z	Load
L	H	L	↗	L	H	L	Data Available
L	H	L	↗	H	L	H	Data Available
L	H	L	H	X	NC	NC	No Change in Data
L	H	L	L	X	NC	NC	No Change in Data

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

Logic Diagram



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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 Min	54F/74F Typ	54F/74F Max	Units	V_{CC}	Conditions
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}	2.5			V	Min	I_{OH} = −1 mA
		54F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 10% V_{CC}	2.5					I_{OH} = −1 mA
		74F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 5% V_{CC}	2.7					I_{OH} = −1 mA
		74F 5% V_{CC}	2.7					I_{OH} = −3 mA
V_{OL}	Output LOW Voltage	54F 10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
		74F 10% V_{CC}			0.5			I_{OL} = 24 mA
I_{IH}	Input HIGH Current	54F			20.0	μA	Max	V_{IN} = 2.7V
		74F			5.0			
I_{BVI}	Input HIGH Current Breakdown Test	54F			100	μA	Max	V_{IN} = 7.0V
		74F			7.0			
I_{CEX}	Output HIGH Leakage Current	54F			250	μA	Max	V_{OUT} = V_{CC}
		74F			50			
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 ($\overline{OE}$, $\overline{CLR}$, $\overline{EN}$)
					−1.2	mA	Max	V_{IN} = 0.5V (CP)
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}	Buss Drainage Test				500	μA	0.0V	V_{OUT} = 5.25V
I_{CCZ}	Power Supply Current			75	100	mA	Max	V_O = HIGH Z

AC Electrical Characteristics

Symbol	Parameter	74F $T_A = +25°C$ $V_{CC} = +5.0V$ $C_L = 50$ pF			54F $T_A, V_{CC} =$ Mil $C_L = 50$ pF		74F $T_A, V_{CC} =$ Com $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
f_{max}	Maximum Clock Frequency	100	160		60		70		MHz
t_{PLH} t_{PHL}	Propagation Delay CP to O_n	2.0 2.0	5.6 5.2	9.5 9.5	2.0 2.0	10.5 10.5	2.0 2.0	10.5 10.5	ns
t_{PHL}	Propagation Delay $\overline{CLR}$ to O_n	4.0	7.1	12.0	4.0	13.0	4.0	13.0	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OE}$ to O_n	2.0 2.0	5.8 5.5	10.5 10.5	2.0 2.0	13.0 13.0	2.0 2.0	11.5 11.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OE}$ to O_n	1.5 1.5	2.9 2.7	7.0 7.0	1.0 1.0	7.5 7.5	1.5 1.5	7.5 7.5	

AC Operating Requirements

Symbol	Parameter	74F $T_A = +25°C$ $V_{CC} = +5.0V$		54F $T_A, V_{CC} =$ Mil		74F $T_A, V_{CC} =$ Com		Units
		Min	Max	Min	Max	Min	Max	
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW D_n to CP	2.5 2.5		4.0 4.0		3.0 3.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW D_n to CP	2.5 2.5		2.5 2.5		2.5 2.5		
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW $\overline{EN}$ to CP	4.5 2.5		5.0 3.0		5.0 3.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW $\overline{EN}$ to CP	2.0 0		3.0 1.0		2.0 0		
$t_w(H)$ $t_w(L)$	CP Pulse Width HIGH or LOW	5.0 5.0		6.0 6.0		6.0 6.0		ns
$t_w(L)$	$\overline{CLR}$ Pulse Width, LOW	5.0		5.0		5.0		ns
t_{rec}	$\overline{CLR}$ Recovery Time	5.0		5.0		5.0		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:

74F 823 S C X

Temperature Range Family
74F = Commercial
54F = Military

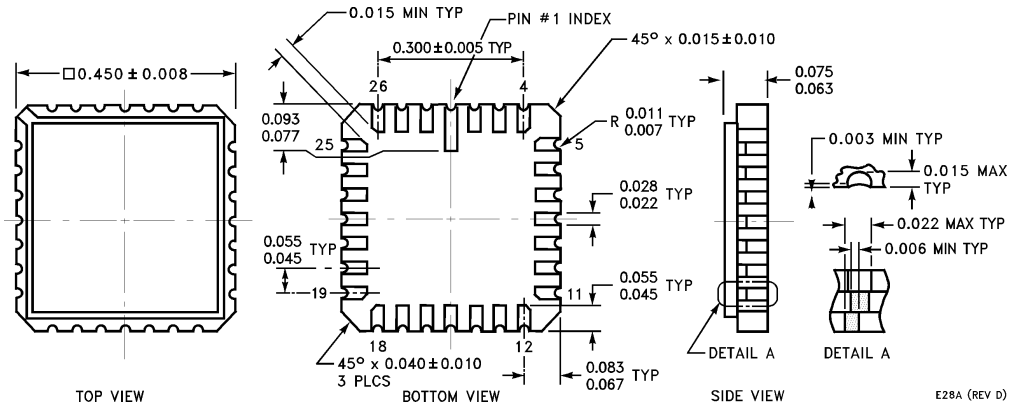
Device Type

Package Code
SP = Slim Plastic DIP
SD = Slim Ceramic DIP
F = Flatpak
L = Leadless Chip Carrier (LCC)
S = Small Outline (SOIC)

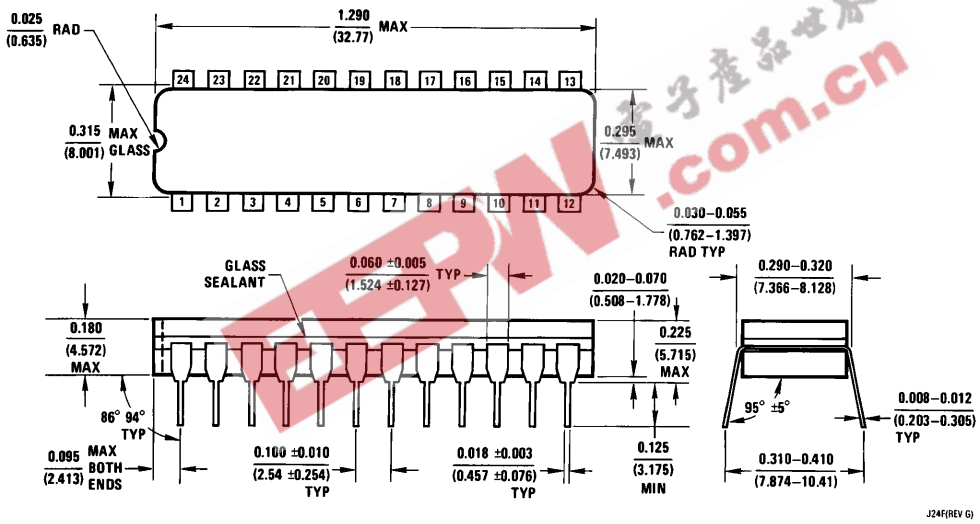
Temperature Range
C = Commercial (0°C to +70°C)
M = Military (−55°C to +125°C)

Special Variations
QB = Military grade device with environmental and burn-in processing

Physical Dimensions inches (millimeters)

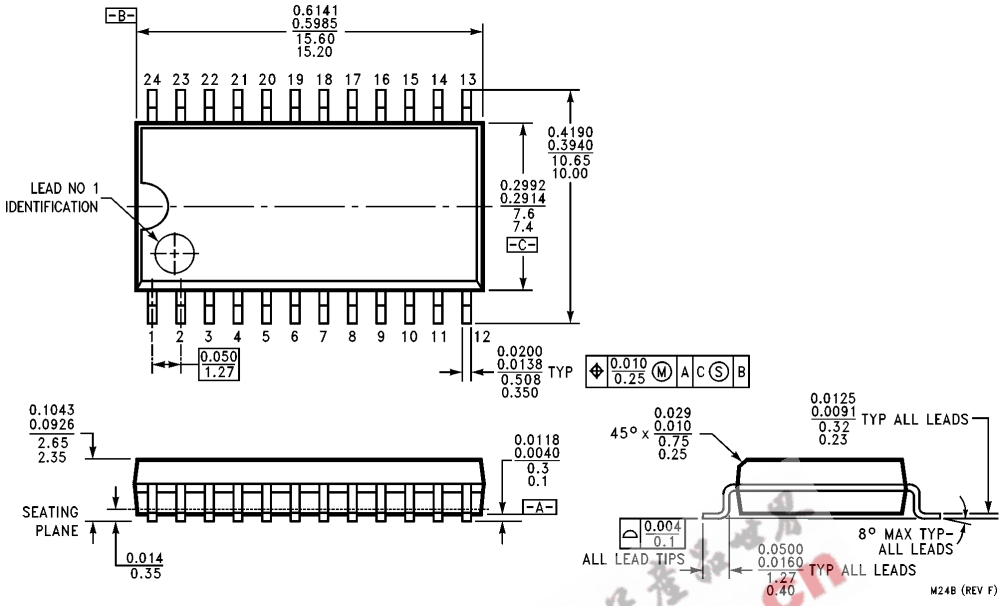


28-Lead Ceramic Leadless Chip Carrier, Type C (L)
NS Package Number E28A

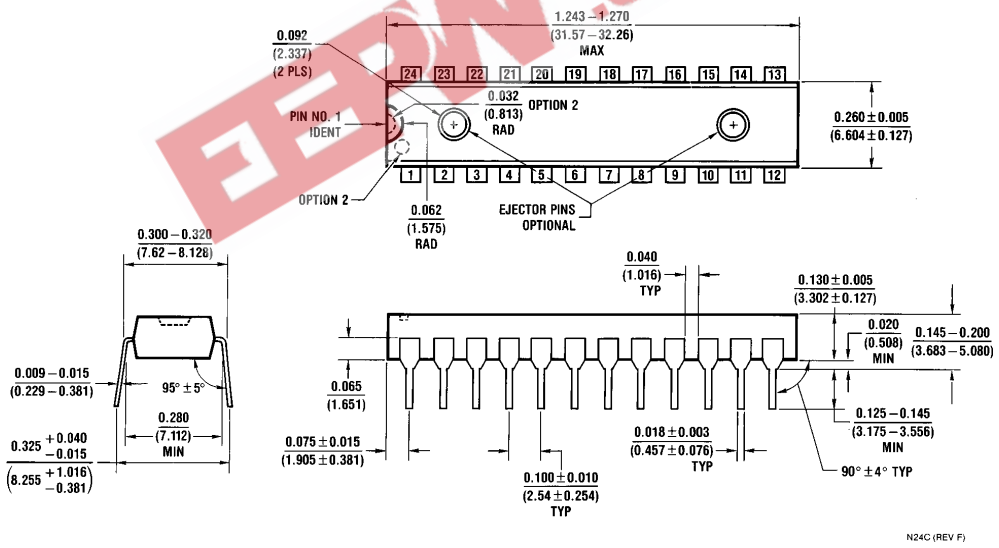


24-Lead (0.300″ Wide) Ceramic Dual-In-Line Package (SD)
NS Package Number J24F

Physical Dimensions inches (millimeters) (Continued)

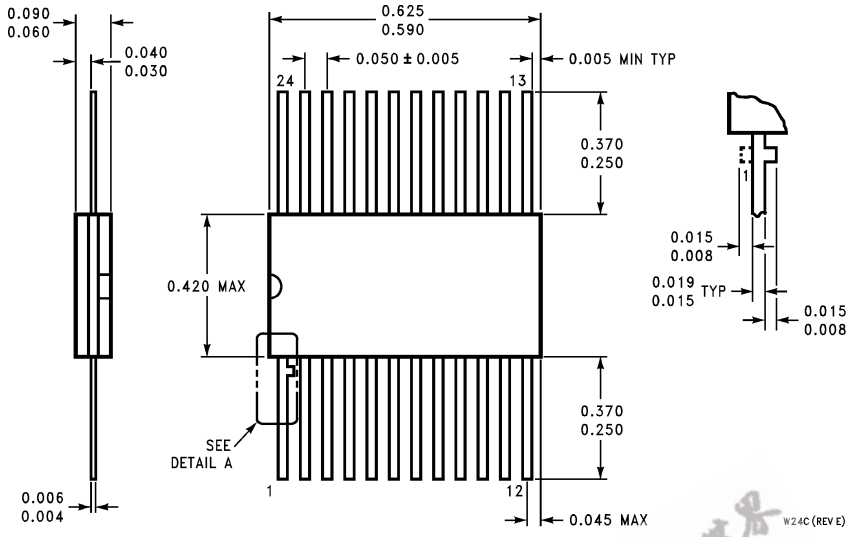


24-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M24B



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

Physical Dimensions inches (millimeters) (Continued)



24-Lead Ceramic Flatpak (F)
NS Package Number W24C

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