

# 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

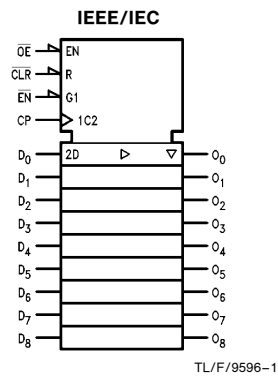
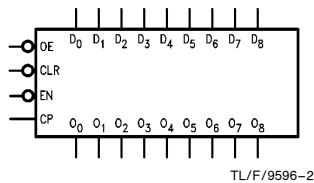
- TRI-STATE® outputs
- Clock Enable and Clear
- Direct replacement for AMD's Am29823

| 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.

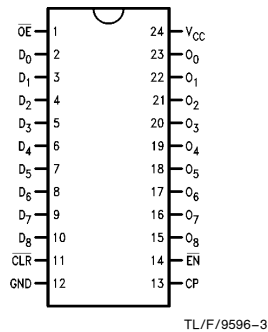
**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = SDMQB, FMQB and LMQB.

### Logic Symbols

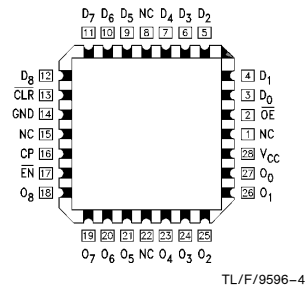


### Connection Diagrams

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.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
| $D_0-D_8$        | Data Inputs         | 1.0/1.0          | 20 $\mu A$ / -0.6 mA                            |
| $\overline{OE}$  | Output Enable Input | 1.0/1.0          | 20 $\mu A$ / -0.6 mA                            |
| $\overline{CLR}$ | Clear               | 1.0/1.0          | 20 $\mu A$ / -0.6 mA                            |
| CP               | Clock Input         | 1.0/2.0          | 20 $\mu A$ / -1.2 mA                            |
| $\overline{EN}$  | Clock Enable        | 1.0/1.0          | 20 $\mu A$ / -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.

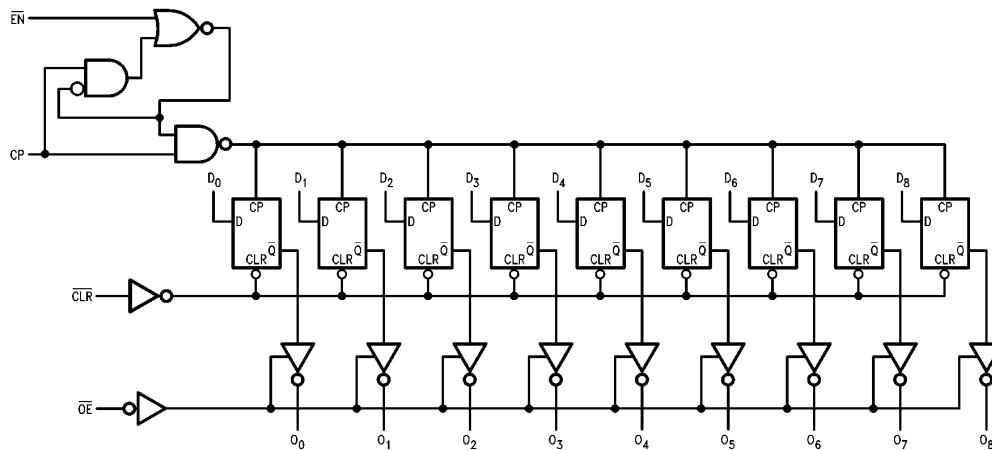
When the  $\overline{CLR}$  is LOW and the  $\overline{OE}$  is LOW, the outputs are LOW. When  $\overline{CLR}$  is HIGH, data can be entered into the flip-flops. When  $\overline{EN}$  is LOW, data on the inputs is transferred to the outputs on the LOW to HIGH clock transition. When the  $\overline{EN}$  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  
↘ = HIGH-to-LOW Transition  
NC = No Change

## Logic Diagram



TL/F/9596-5

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> | 2.5  |      | V     | Min             | I <sub>OH</sub> = –1 mA  |
|                  |                                   | 54F 10% V <sub>CC</sub> | 2.4  |      |       |                 | I <sub>OH</sub> = –3 mA  |
|                  |                                   | 74F 10% V <sub>CC</sub> | 2.5  |      |       |                 | I <sub>OH</sub> = –1 mA  |
|                  |                                   | 74F 10% V <sub>CC</sub> | 2.4  |      |       |                 | I <sub>OH</sub> = –3 mA  |
|                  |                                   | 74F 5% V <sub>CC</sub>  | 2.7  |      |       |                 | I <sub>OH</sub> = –1 mA  |
|                  |                                   | 74F 5% V <sub>CC</sub>  | 2.7  |      |       |                 | I <sub>OH</sub> = –3 mA  |
| V <sub>OL</sub>  | Output LOW Voltage                | 54F 10% V <sub>CC</sub> | 0.5  |      | V     | Min             | I <sub>OL</sub> = 20 mA  |
|                  |                                   | 74F 10% V <sub>CC</sub> | 0.5  |      |       |                 | I <sub>OL</sub> = 24 mA  |
| I <sub>IH</sub>  | Input HIGH Current                | 54F                     | 20.0 |      | μA    | Max             | V <sub>IN</sub> = 2.7V   |
|                  |                                   | 74F                     | 5.0  |      |       |                 |  |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test | 54F                     | 100  |      | μA    | Max             | V <sub>IN</sub> = 7.0V   |
|                  |                                   | 74F                     | 7.0  |      |       |                 |  |
| I <sub>CEX</sub> | Output HIGH Leakage Current       | 54F                     | 250  |      | μA    | Max             | V <sub>OUT</sub> = V <sub>CC</sub>   |
|                  |                                   | 74F                     | 50   |      |       |                 |  |
| V <sub>ID</sub>  | Input Leakage Test                | 74F                     | 4.75 |      | V     | 0.0             | I <sub>ID</sub> = 1.9 μA<br>All Other Pins Grounded  |
| I <sub>OD</sub>  | Output Leakage Circuit Current    | 74F                     | 3.75 |      | μA    | 0.0             | V <sub>IOD</sub> = 150 mV<br>All Other Pins Grounded   |
| I <sub>IL</sub>  | Input LOW Current                 |                         | –0.6 |      | mA    | Max             | V <sub>IN</sub> = 0.5V ( $\overline{OE}$ , $\overline{CLR}$ , $\overline{EN}$ )<br>V <sub>IN</sub> = 0.5V (CP) |
|                  |                                   |                         | –1.2 |      |       |                 |  |
| 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>ZZ</sub>  | Buss Drainage Test                |                         | 500  |      | μA    | 0.0V            | V <sub>OUT</sub> = 5.25V   |
| I <sub>CCZ</sub> | Power Supply Current              |                         | 75   | 100  | mA    | Max             | V <sub>O</sub> = HIGH Z  |

## AC Electrical Characteristics

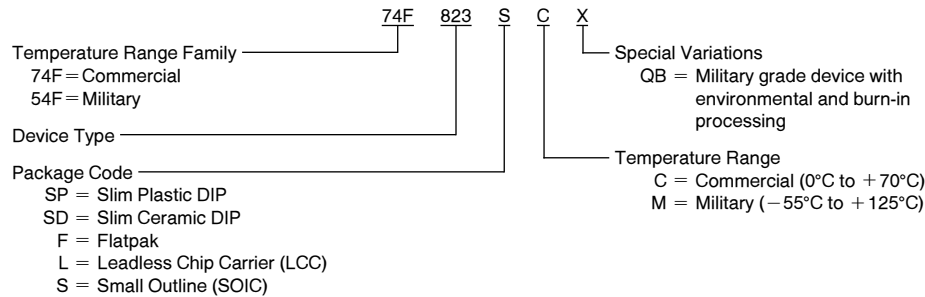
| Symbol                                | Parameter                                   | 74F   |     |      | 54F  |      | 74F  |      | Units |
|---------------------------------------|---|---|-----|------|--|------|--|------|-------|
|                                       |   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     |      | T <sub>A</sub> , V <sub>CC</sub> = Mil<br>C <sub>L</sub> = 50 pF |      | T <sub>A</sub> , V <sub>CC</sub> = Com<br>C <sub>L</sub> = 50 pF |      |       |
|                                       |   | Min   | Typ | Max  | Min  | Max  | Min  | Max  |       |
| f <sub>max</sub>                      | Maximum Clock Frequency                     | 100   | 160 |      | 60   |      | 70   |      | MHz   |
| t <sub>PLH</sub><br>t <sub>PHL</sub>  | Propagation Delay<br>CP to O <sub>n</sub>   | 2.0   | 5.6 | 9.5  | 2.0  | 10.5 | 2.0  | 10.5 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>CLR to O <sub>n</sub>  | 4.0   | 7.1 | 12.0 | 4.0  | 13.0 | 4.0  | 13.0 | ns    |
| t <sub>PZH</sub><br>t <sub>PZL</sub>  | Output Enable Time<br>OE to O <sub>n</sub>  | 2.0   | 5.8 | 10.5 | 2.0  | 13.0 | 2.0  | 11.5 | ns    |
| t <sub>PHZ</sub><br>t <sub>P LZ</sub> | Output Disable Time<br>OE to O <sub>n</sub> | 1.5   | 2.9 | 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<br>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)<br>t <sub>s</sub> (L) | Setup Time, HIGH or LOW<br>D <sub>n</sub> to CP | 2.5   |     | 4.0                                    |     | 3.0                                    |     | ns    |
| t <sub>h</sub> (H)<br>t <sub>h</sub> (L) | Hold Time, HIGH or LOW<br>D <sub>n</sub> to CP  | 2.5   |     | 2.5                                    |     | 2.5                                    |     |       |
| t <sub>s</sub> (H)<br>t <sub>s</sub> (L) | Setup Time, HIGH or LOW<br>EN to CP             | 4.5   |     | 5.0                                    |     | 5.0                                    |     | ns    |
| t <sub>h</sub> (H)<br>t <sub>h</sub> (L) | Hold Time, HIGH or LOW<br>EN to CP              | 2.0   |     | 3.0                                    |     | 2.0                                    |     |       |
| t <sub>w</sub> (H)<br>t <sub>w</sub> (L) | CP Pulse Width<br>HIGH or LOW                   | 5.0   |     | 6.0                                    |     | 6.0                                    |     | ns    |
| t <sub>w</sub> (L)                       | CLR Pulse Width, LOW                            | 5.0   |     | 5.0                                    |     | 5.0                                    |     | ns    |
| t <sub>rec</sub>                         | CLR Recovery Time                               | 5.0   |     | 5.0                                    |     | 5.0                                    |     | ns    |

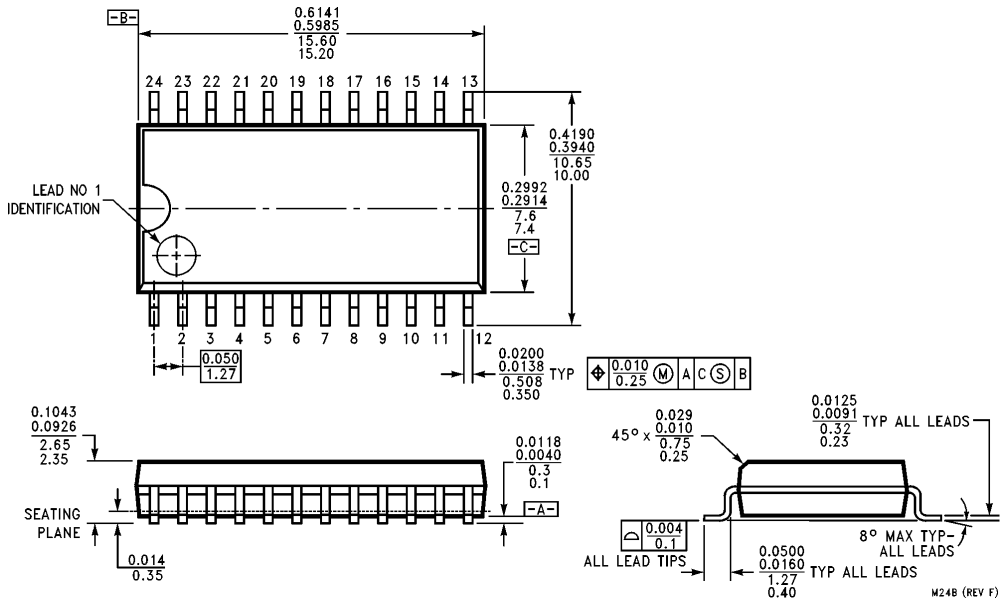
## Ordering Information

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

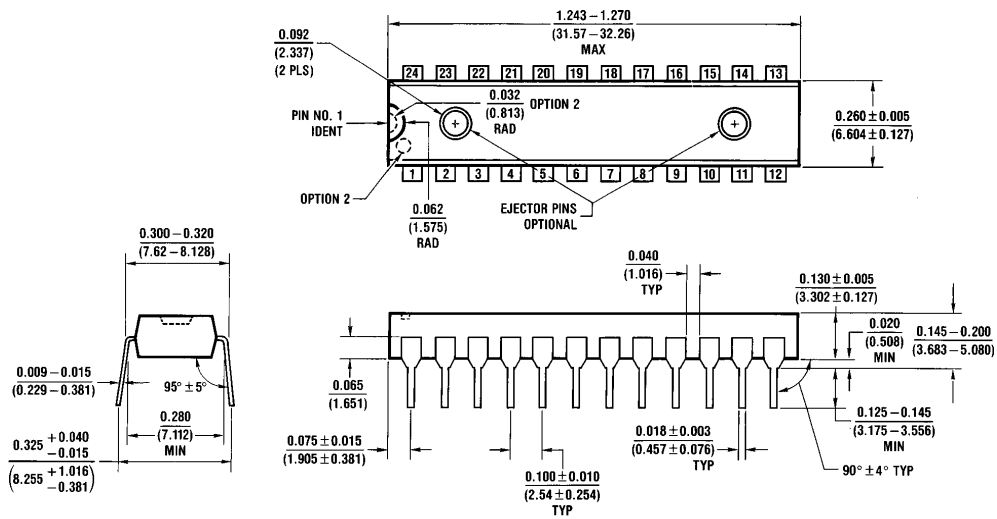




**Physical Dimensions** inches (millimeters) (Continued)

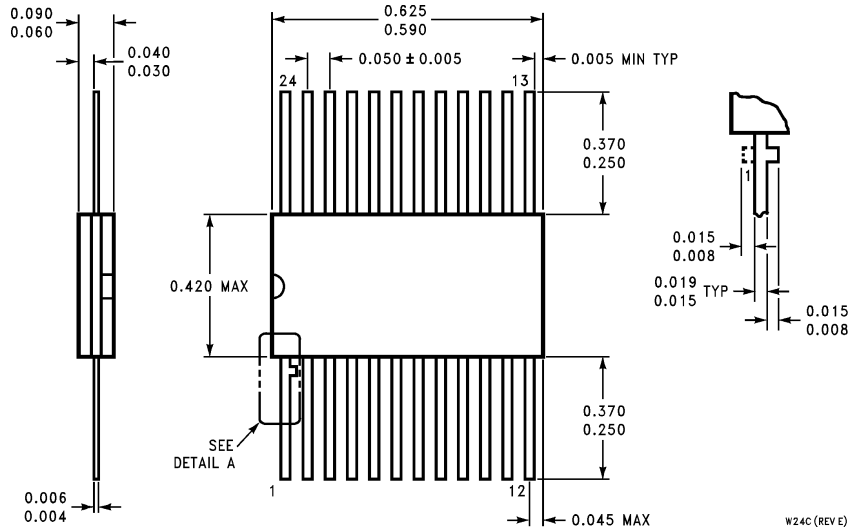


**24-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M24B**



**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**

W24C (REV E)

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