

Dual 9-bit D-type flip-flop with  
reset and enable (3-State)

MB2823

FEATURES

- Two sets of high speed parallel registers with positive edge-triggered D-type flip-flops
- Ideal where high speed, light loading, or increased fan-in are required with MOS microprocessors
- Live insertion/extraction permitted
- Power-up 3-State
- Power-up Reset

- Output capability: +64mA/−32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

provide extra data width for wider data/address paths of buses carrying parity.

The MB2823 has two 9-bit wide buffered registers with Clock Enable (nCE) and Master Reset (nMR) which are ideal for parity bus interfacing in high microprogrammed systems.

DESCRIPTION

The MB2823 dual bus interface register is designed to eliminate the extra packages required to buffer existing registers and

The registers are fully edge-triggered. The state of each D input, one set-up time before the Low-to-High clock transition is transferred to the corresponding flip-flop's Q output.

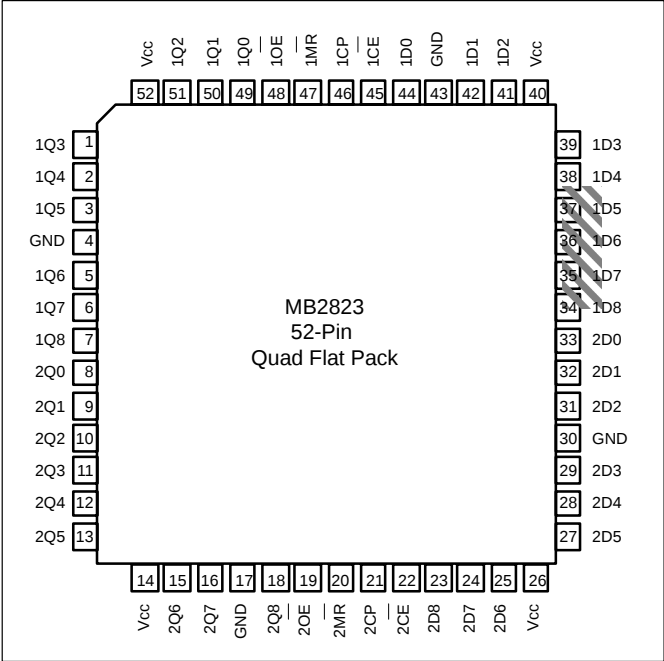
QUICK REFERENCE DATA

| SYMBOL                 | PARAMETER                       | CONDITIONS<br>$T_{amb} = 25^{\circ}\text{C}; \text{GND} = 0\text{V}$ | TYPICAL | UNIT |
|------------------------|---------------------------------|----------------------------------------------------------------------|---------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>nCP to nQx | $C_L = 50\text{pF}; V_{CC} = 5\text{V}$                              | 4.6     | ns   |
| $C_{IN}$               | Input capacitance               | $V_I = 0\text{V}$ or $V_{CC}$                                        | 4       | pF   |
| $C_{OUT}$              | Output capacitance              | $V_O = 0\text{V}$ or $V_{CC}$ ; 3-state                              | 7       | pF   |
| $I_{CCZ}$              | Total supply current            | Outputs disabled; $V_{CC} = 5.5\text{V}$                             | 500     | nA   |

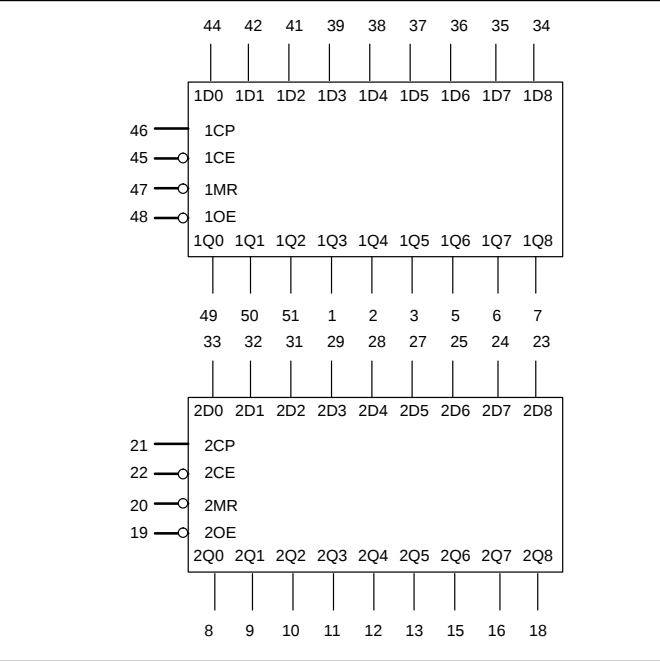
ORDERING INFORMATION

| PACKAGES                      | TEMPERATURE RANGE | ORDER CODE | DRAWING NUMBER |
|-------------------------------|-------------------|------------|----------------|
| 52-Pin Plastic Quad Flat Pack | −40°C to +85°C    | MB2823BB   | 1418B          |

PIN CONFIGURATION



LOGIC SYMBOL



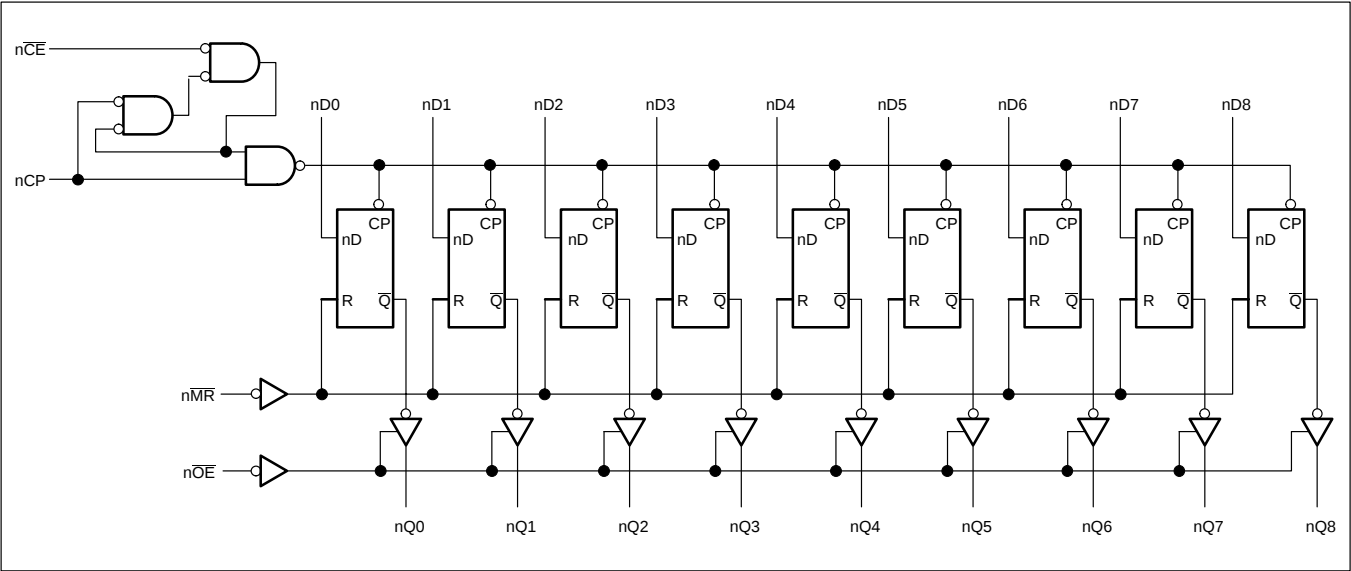
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MB2823

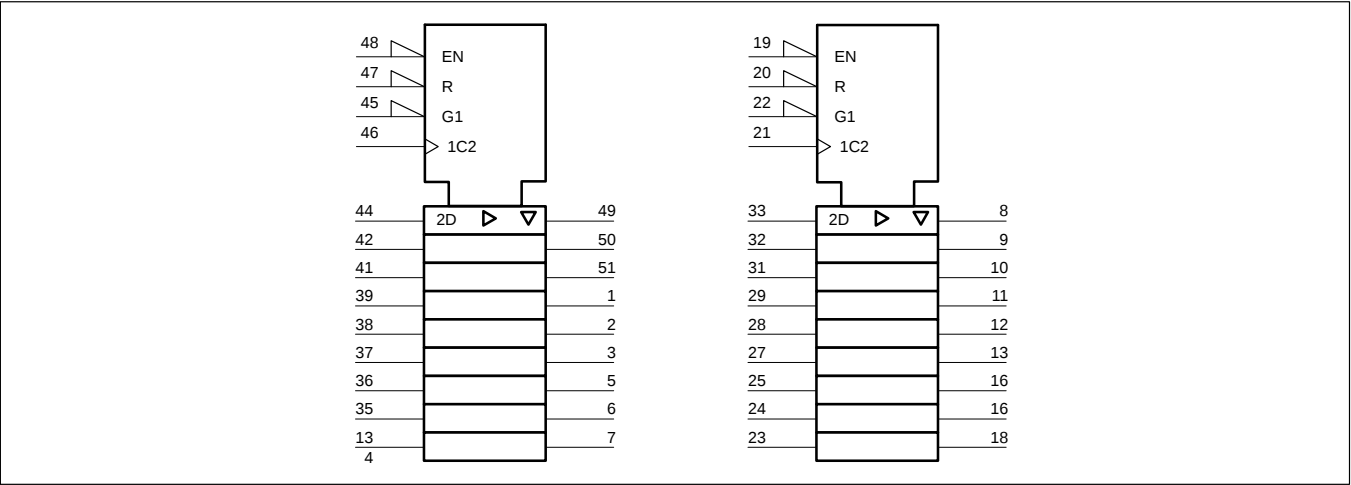
PIN DESCRIPTION

| PIN NUMBER                                                                | SYMBOL             | FUNCTION                               |
|---------------------------------------------------------------------------|--------------------|----------------------------------------|
| 48, 19                                                                    | 1OE, 2OE           | Output enable input (active-Low)       |
| 44, 42, 41, 39, 38, 37, 36, 35, 34,<br>33, 32, 31, 29, 28, 27, 25, 24, 23 | 1D0-1D8<br>2D0-2D8 | Data inputs                            |
| 49, 50, 51, 1, 2, 3, 5, 6, 7,<br>8, 9, 10, 11, 12, 13, 15, 16, 18         | 1Q0-1Q8<br>2Q0-2Q8 | Data outputs                           |
| 46, 21                                                                    | 1CP, 2CP           | Clock pulse input (active rising edge) |
| 45, 22                                                                    | 1CE, 2CE           | Clock enable input (active-Low)        |
| 47, 20                                                                    | 1MR, 2MR           | Master reset input (active-Low)        |
| 4, 17, 30, 43                                                             | GND                | Ground (0V)                            |
| 14, 26, 40, 52                                                            | VCC                | Positive supply voltage                |

LOGIC DIAGRAM



LOGIC SYMBOL (IEEE/IEC)



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MB2823

## FUNCTION TABLE

| INPUTS |     |     |     |     | OUTPUTS   | OPERATING MODE     |
|--------|-----|-----|-----|-----|-----------|--------------------|
| nOE    | nMR | nCE | nCP | nDx | nQ0 – nQ8 |                    |
| L      | L   | X   | X   | X   | L         | Clear              |
| L      | H   | L   | ↑   | h   | H         | Load and read data |
| L      | H   | L   | ↑   | l   | L         |                    |
| L      | H   | H   | ↑   | X   | NC        | Hold               |
| H      | X   | X   | X   | X   | Z         | High impedance     |

H = High voltage level

h = High voltage level one set-up time prior to the Low-to-High clock transition

L = Low voltage level

l = Low voltage level one set-up time prior to the Low-to-High clock transition

NC = No change

X = Don't care

Z = High impedance "off" state

↑ = Low to High clock transition

↑ = Not a Low-to-High clock transition

## ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

| SYMBOL           | PARAMETER                      | CONDITIONS                  | RATING       | UNIT |
|------------------|--------------------------------|-----------------------------|--------------|------|
| V <sub>CC</sub>  | DC supply voltage              |                             | –0.5 to +7.0 | V    |
| I <sub>IK</sub>  | DC input diode current         | V <sub>I</sub> < 0          | –18          | mA   |
| V <sub>I</sub>   | DC input voltage <sup>3</sup>  |                             | –1.2 to +7.0 | V    |
| I <sub>OK</sub>  | DC output diode current        | V <sub>O</sub> < 0          | –50          | mA   |
| V <sub>OUT</sub> | DC output voltage <sup>3</sup> | output in Off or High state | –0.5 to +5.5 | V    |
| I <sub>OUT</sub> | DC output current              | output in Low state         | 128          | mA   |
| T <sub>stg</sub> | Storage temperature range      |                             | –65 to 150   | °C   |

### NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL           | PARAMETER                            | LIMITS |                 | UNIT |
|------------------|--------------------------------------|--------|-----------------|------|
|                  |                                      | MIN    | MAX             |      |
| V <sub>CC</sub>  | DC supply voltage                    | 4.5    | 5.5             | V    |
| V <sub>I</sub>   | Input voltage                        | 0      | V <sub>CC</sub> | V    |
| V <sub>IH</sub>  | High-level input voltage             | 2.0    |                 | V    |
| V <sub>IL</sub>  | Low-level input voltage              |        | 0.8             | V    |
| I <sub>OH</sub>  | High-level output current            |        | –32             | mA   |
| I <sub>OL</sub>  | Low-level output current             |        | 64              | mA   |
| Δt/Δv            | Input transition rise or fall rate   | 0      | 10              | ns/V |
| T <sub>amb</sub> | Operating free-air temperature range | –40    | +85             | °C   |

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MB2823

## DC ELECTRICAL CHARACTERISTICS

| SYMBOL             | PARAMETER                                            | TEST CONDITIONS                                                                                                       | LIMITS                   |       |      |                                   |      | UNIT |
|--------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------|-------|------|-----------------------------------|------|------|
|                    |                                                      |                                                                                                                       | T <sub>amb</sub> = +25°C |       |      | T <sub>amb</sub> = −40°C to +85°C |      |      |
|                    |                                                      |                                                                                                                       | MIN                      | TYP   | MAX  | MIN                               | MAX  |      |
| V <sub>IK</sub>    | Input clamp voltage                                  | V <sub>CC</sub> = 4.5V; I <sub>IK</sub> = −18mA                                                                       |                          | −0.9  | −1.2 |                                   | −1.2 | V    |
| V <sub>OH</sub>    | High-level output voltage                            | V <sub>CC</sub> = 4.5V; I <sub>OH</sub> = −3mA; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                   | 2.5                      | 2.9   |      | 2.5                               |      | V    |
|                    |                                                      | V <sub>CC</sub> = 5.0V; I <sub>OH</sub> = −3mA; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                   | 3.0                      | 3.4   |      | 3.0                               |      | V    |
|                    |                                                      | V <sub>CC</sub> = 4.5V; I <sub>OH</sub> = −32mA; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                  | 2.0                      | 2.4   |      | 2.0                               |      | V    |
| V <sub>OL</sub>    | Low-level output voltage                             | V <sub>CC</sub> = 4.5V; I <sub>OL</sub> = 64mA; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                   |                          | 0.42  | 0.55 |                                   | 0.55 | V    |
| V <sub>RST</sub>   | Power-up output low voltage <sup>3</sup>             | V <sub>CC</sub> = 5.5V; I <sub>OL</sub> = 1mA; V <sub>I</sub> = GND or V <sub>CC</sub>                                |                          | 0.13  | 0.55 |                                   | 0.55 | V    |
| I <sub>I</sub>     | Input leakage current                                | V <sub>CC</sub> = 5.5V; V <sub>I</sub> = GND or 5.5V                                                                  |                          | ±0.01 | ±1.0 |                                   | ±1.0 | μA   |
| I <sub>OFF</sub>   | Power-off leakage current                            | V <sub>CC</sub> = 0.0V; V <sub>O</sub> or V <sub>I</sub> ≤ 4.5V                                                       |                          | ±5.0  | ±100 |                                   | ±100 | μA   |
| I <sub>PU/PD</sub> | Power-up/down 3-State output current <sup>4</sup>    | V <sub>CC</sub> = 2.1V; V <sub>O</sub> = 0.5V; V <sub>I</sub> = GND or V <sub>CC</sub> , V <sub>OE</sub> = Don't care |                          | ±5.0  | ±50  |                                   | ±50  | μA   |
| I <sub>OZH</sub>   | 3-State output High current                          | V <sub>CC</sub> = 5.5V; V <sub>O</sub> = 2.7V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                    |                          | 5.0   | 50   |                                   | 50   | μA   |
| I <sub>OZL</sub>   | 3-State output Low current                           | V <sub>CC</sub> = 5.5V; V <sub>O</sub> = 0.5V; V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>                    |                          | −5.0  | −50  |                                   | −50  | μA   |
| I <sub>CEX</sub>   | Output High leakage current                          | V <sub>CC</sub> = 5.5V; V <sub>O</sub> = 5.5V; V <sub>I</sub> = GND or V <sub>CC</sub>                                |                          | 5.0   | 50   |                                   | 50   | μA   |
| I <sub>O</sub>     | Output current <sup>1</sup>                          | V <sub>CC</sub> = 5.5V; V <sub>O</sub> = 2.5V                                                                         | −50                      | −70   | −180 | −50                               | −180 | mA   |
| I <sub>CCH</sub>   | Quiescent supply current                             | V <sub>CC</sub> = 5.5V; Outputs High, V <sub>I</sub> = GND or V <sub>CC</sub>                                         |                          | 120   | 250  |                                   | 250  | μA   |
| I <sub>CCL</sub>   |                                                      | V <sub>CC</sub> = 5.5V; Outputs Low, V <sub>I</sub> = GND or V <sub>CC</sub>                                          |                          | 45    | 68   |                                   | 68   | mA   |
| I <sub>CCZ</sub>   |                                                      | V <sub>CC</sub> = 5.5V; Outputs 3-State; V <sub>I</sub> = GND or V <sub>CC</sub>                                      |                          | 120   | 250  |                                   | 250  | μA   |
| ΔI <sub>CC</sub>   | Additional supply current per input pin <sup>2</sup> | V <sub>CC</sub> = 5.5V; one input at 3.4V, other inputs at V <sub>CC</sub> or GND                                     |                          | 0.5   | 1.5  |                                   | 1.5  | mA   |

## NOTES:

1. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
2. This is the increase in supply current for each input at  $3.4\text{V}$ .
3. For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.
4. This parameter is valid for any  $V_{CC}$  between  $0\text{V}$  and  $2.1\text{V}$  with a transition time of up to  $10\text{msec}$ . From  $V_{CC} = 2.1\text{V}$  to  $V_{CC} = 5\text{V} \pm 10\%$  a transition time of up to  $100\mu\text{sec}$  is permitted.

## AC CHARACTERISTICS

GND = 0V,  $t_R = t_F = 2.5\text{ns}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 500\Omega$ 

| SYMBOL                               | PARAMETER                                      | WAVEFORM | LIMITS                                              |            |            |                                                                  |            | UNIT |
|--------------------------------------|------------------------------------------------|----------|-----------------------------------------------------|------------|------------|------------------------------------------------------------------|------------|------|
|                                      |                                                |          | T <sub>amb</sub> = +25°C<br>V <sub>CC</sub> = +5.0V |            |            | T <sub>amb</sub> = -40 to +85°C<br>V <sub>CC</sub> = +5.0V ±0.5V |            |      |
|                                      |                                                |          | MIN                                                 | TYP        | MAX        | MIN                                                              | MAX        |      |
| f <sub>MAX</sub>                     | Maximum clock frequency                        | 1        | 140                                                 | 190        |            | 140                                                              |            | MHz  |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>nCP to nQx                | 1        | 2.0<br>2.5                                          | 3.8<br>4.2 | 5.1<br>5.6 | 2.0<br>2.5                                                       | 5.7<br>6.1 | ns   |
| t <sub>PHL</sub>                     | Propagation delay<br>nMR to nQx                | 2        | 3.2                                                 | 5.3        | 6.6        | 3.2                                                              | 7.5        | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output enable time<br>to High and Low level    | 4<br>5   | 1.3<br>2.2                                          | 3.2<br>4.0 | 4.4<br>5.3 | 1.3<br>2.2                                                       | 5.1<br>5.9 | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output disable time<br>from High and Low level | 4<br>5   | 1.3<br>1.5                                          | 3.3<br>3.1 | 4.6<br>4.4 | 1.3<br>1.5                                                       | 5.1<br>5.9 | ns   |

# Dual 9-bit D-type flip-flop with reset and enable (3-State)

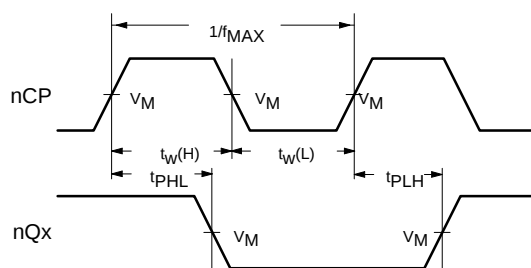
MB2823

## AC SETUP REQUIREMENTS

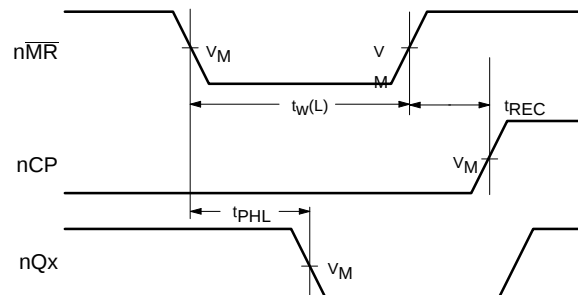
GND = 0V,  $t_R = t_F = 2.5\text{ns}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 500\Omega$ 

| SYMBOL                             | PARAMETER                             | WAVEFORM | LIMITS                                                                 |              |                                                                                                        | UNIT |
|------------------------------------|---------------------------------------|----------|------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------|------|
|                                    |                                       |          | $T_{\text{amb}} = +25^\circ\text{C}$<br>$V_{\text{CC}} = +5.0\text{V}$ |              | $T_{\text{amb}} = -40 \text{ to } +85^\circ\text{C}$<br>$V_{\text{CC}} = +5.0\text{V} \pm 0.5\text{V}$ |      |
|                                    |                                       |          | MIN                                                                    | TYP          | MIN                                                                                                    |      |
| $t_s(\text{H})$<br>$t_s(\text{L})$ | Setup time, High or Low<br>nDx to nCP | 3        | 2.0<br>1.5                                                             | 0.6<br>0.2   | 2.0<br>1.5                                                                                             | ns   |
| $t_h(\text{H})$<br>$t_h(\text{L})$ | Hold time, High or Low<br>nDx to nCP  | 3        | 1.5<br>1.5                                                             | -0.2<br>-0.5 | 1.5<br>1.5                                                                                             |      |
| $t_w(\text{H})$<br>$t_w(\text{L})$ | nCP pulse width<br>High or Low        | 1        | 3.0<br>3.5                                                             | 1.0<br>2.3   | 3.0<br>3.5                                                                                             | ns   |
| $t_s(\text{H})$<br>$t_s(\text{L})$ | Setup time, High or Low<br>nCE to nCP | 3        | 1.5<br>2.0                                                             | -0.2<br>1.0  | 1.5<br>2.0                                                                                             | ns   |
| $t_h(\text{H})$<br>$t_h(\text{L})$ | Hold time, High or Low<br>nCE to nCP  | 3        | 1.5<br>1.5                                                             | -1.2<br>0.3  | 1.5<br>1.5                                                                                             | ns   |
| $t_w(\text{L})$                    | nMR pulse width, Low                  | 2        | 3.0                                                                    | 1.6          | 3.0                                                                                                    | ns   |
| $t_{\text{rec}}$                   | Recovery time<br>nMR to nCP           | 2        | 2.5                                                                    | 0.6          | 2.5                                                                                                    | ns   |

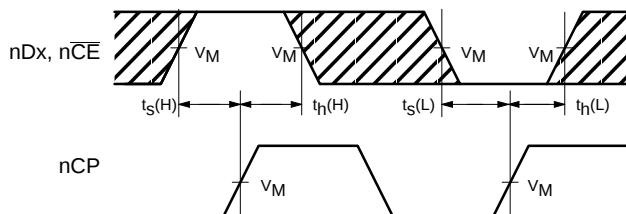
## AC WAVEFORMS



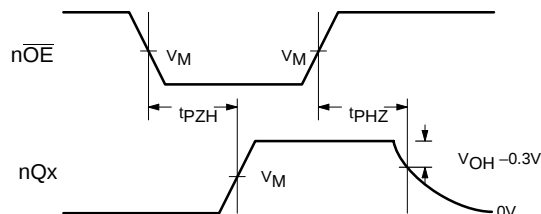
Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency



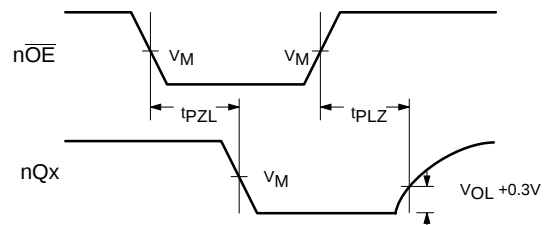
Waveform 2. Master Reset Pulse Width, Master Reset to Output Delay and Master Reset to Clock Recovery Time



Waveform 3. Data Setup and Hold Times



Waveform 4. 3-State Output Enable Time to High Level and Output Disable Time from High Level



Waveform 5. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

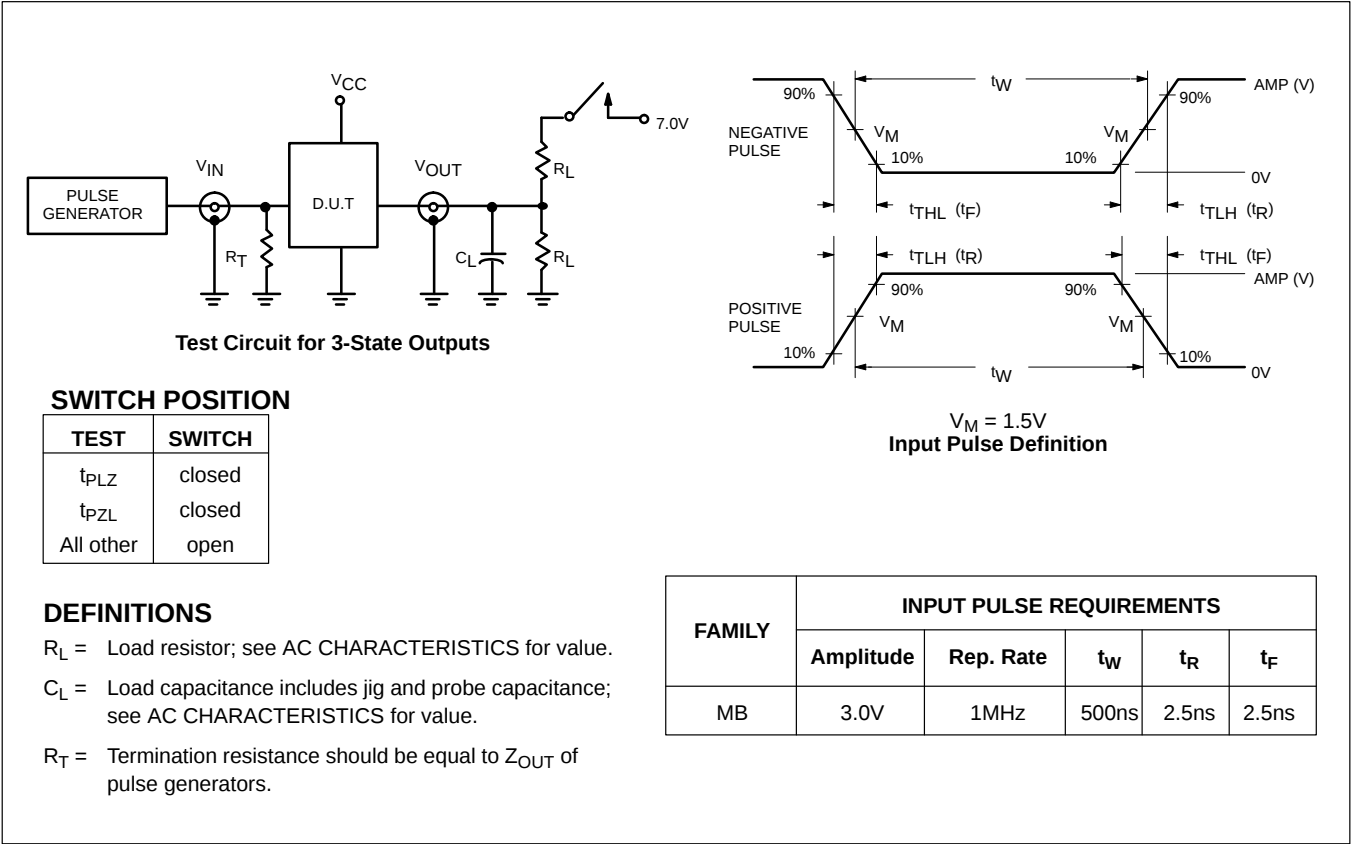
NOTE: For all waveforms,  $V_M = 1.5\text{V}$ .

The shaded areas indicate when the input is permitted to change for predictable output performance.

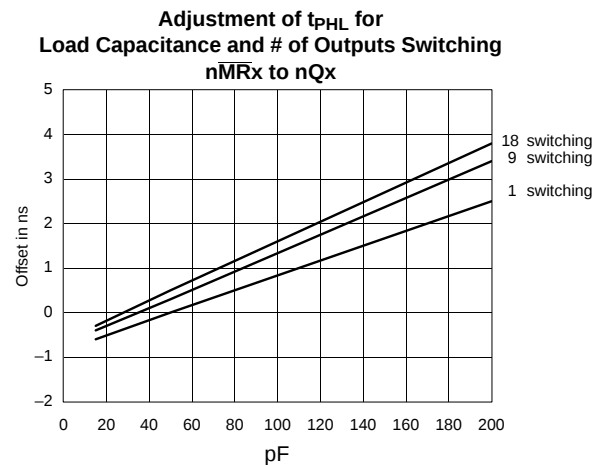
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MB2823

TEST CIRCUIT AND WAVEFORM

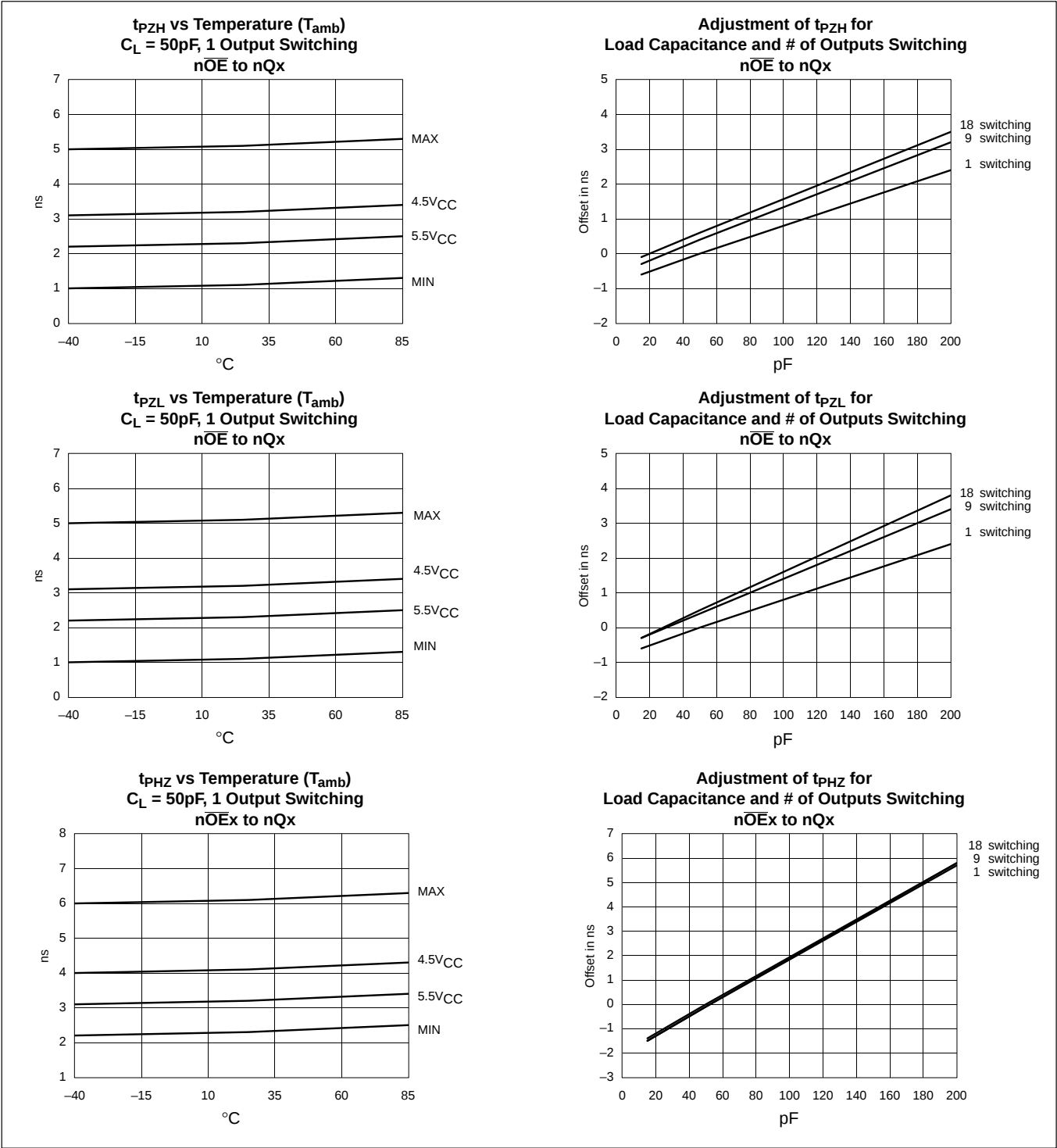


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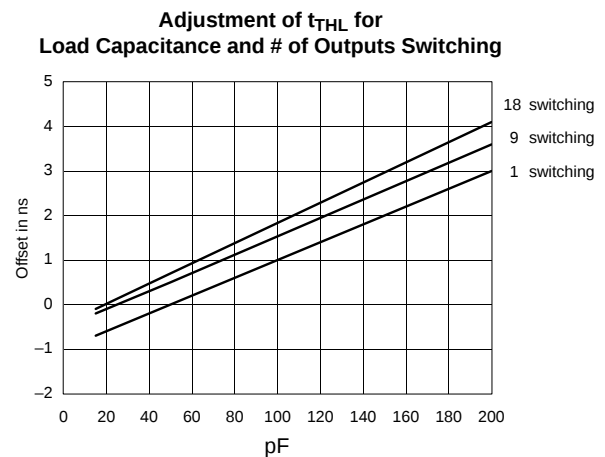


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