

# 16-bit inverting buffer/line driver (3-State)

# MB2240

## FEATURES

- 16-bit bus interface
- Multiple V<sub>CC</sub> and GND pins minimize switching noise
- 3-State buffers
- Live insertion/extraction permitted
- Output capability: +64 mA/−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
- Power-up 3-State

## DESCRIPTION

The MB2240 high-performance BiCMOS device combines low static and

dynamic power dissipation with high speed and high output drive.

The MB2240 device is an inverting 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables (1 $\overline{O}E$ , 2 $\overline{O}E$ , 3 $\overline{O}E$ , 4 $\overline{O}E$ ), each controlling four of the 3-State outputs.

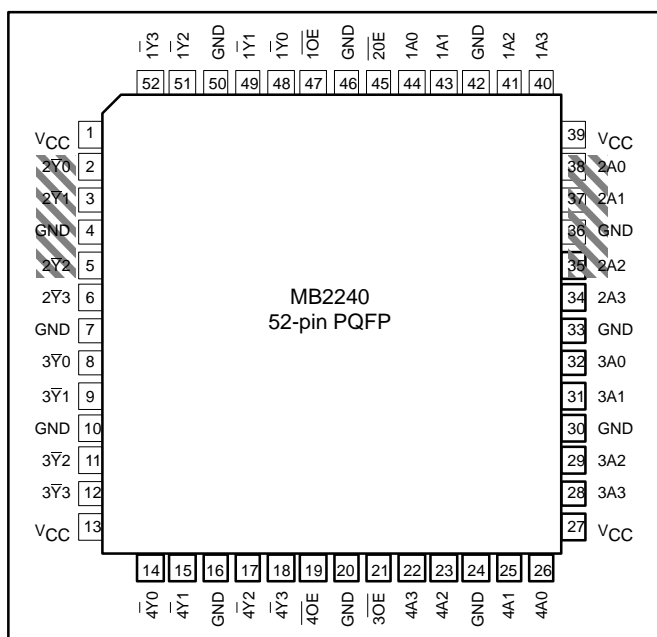
## QUICK REFERENCE DATA

| SYMBOL                               | PARAMETER                       | CONDITIONS<br>T <sub>amb</sub> = 25°C; GND = 0V | TYPICAL | UNIT |
|--------------------------------------|---------------------------------|---|---------|------|
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>nAx to nYx | C <sub>L</sub> = 50pF; V <sub>CC</sub> = 5V     | 3.2     | ns   |
| C <sub>IN</sub>                      | Input capacitance               | V <sub>I</sub> = 0V or V <sub>CC</sub>          | 4       | pF   |
| C <sub>OUT</sub>                     | Output capacitance              | V <sub>O</sub> = 0V or V <sub>CC</sub> 3-State  | 7       | pF   |
| I <sub>CCZ</sub>                     | Total supply current            | Outputs disabled; V <sub>CC</sub> = 5.5V        | 65      | μA   |

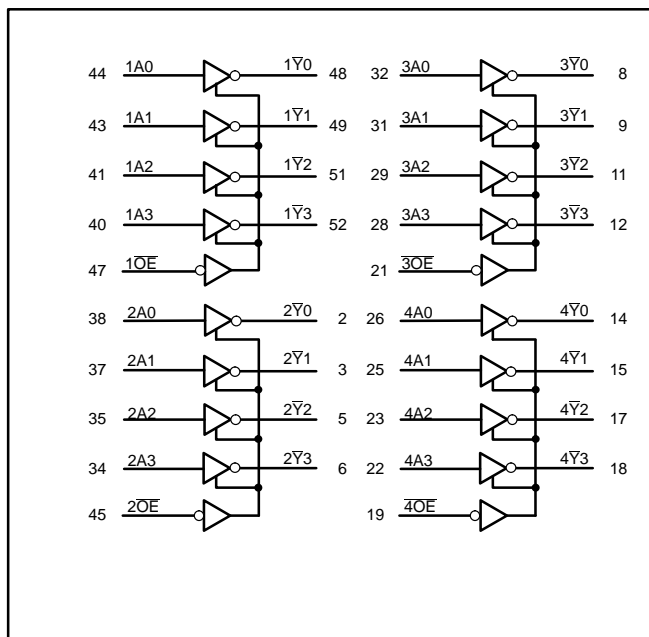
## ORDERING INFORMATION

| PACKAGES           | TEMPERATURE RANGE | ORDER CODE | DRAWING NUMBER |
|--------------------|-------------------|------------|----------------|
| 52-pin plastic QFP | −40°C to +85°C    | MB2240BB   | 1418B          |

## PIN CONFIGURATION



## LOGIC SYMBOL



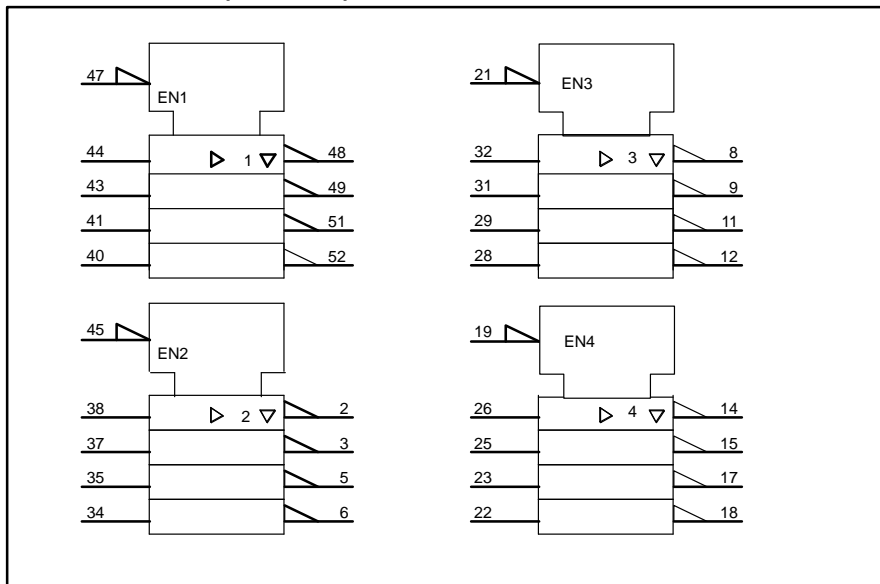
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## FUNCTION TABLE

| INPUTS |     | OUTPUTS |
|--------|-----|---------|
| nOE    | nAx | nYx     |
| L      | L   | H       |
| L      | H   | L       |
| H      | X   | Z       |

## LOGIC SYMBOL (IEEE/IEC)



## PIN DESCRIPTION

| PIN NUMBER  | SYMBOL  | NAME AND FUNCTION       |
|---|---|-------------------------|
| 44, 43, 41, 40,<br>38, 37, 35, 34,<br>32, 31, 29, 28,<br>26, 25, 23, 22 | 1A0 – 1A3,<br>2A0 – 2A3,<br>3A0 – 3A3,<br>4A0 – 4A3 | Data inputs             |
| 14, 15, 17, 18,<br>8, 9, 11, 12,<br>2, 3, 5, 6,<br>48, 49, 51, 52       | 4Y0 – 4Y3,<br>3Y0 – 3Y3,<br>2Y0 – 2Y3,<br>1Y0 – 1Y3 | Data outputs            |
| 47, 45, 21, 19  | 1OE, 2OE,<br>3OE, 4OE                               | Output enables          |
| 4, 7, 10, 16,<br>20, 24, 30, 33,<br>36, 42, 46, 50                      | GND   | Ground (0V)             |
| 1, 13, 27, 39   | V <sub>CC</sub>                                     | Positive supply voltage |

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**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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## 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    |
| 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</sub> /I <sub>PD</sub> | Power-up/down 3-state output current <sup>3</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>   |                          | 65    | 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>  |                          | 48    | 60   |                                   | 60   | mA   |
| I <sub>CCZ</sub>                 |  | V <sub>CC</sub> = 5.5V; Outputs 3-State; V <sub>I</sub> = GND or V <sub>CC</sub>                                      |                          | 65    | 250  |                                   | 250  | µA   |
| ΔI <sub>CC</sub>                 | Additional supply current per input pin <sup>2</sup> | Outputs enabled, one input at 3.4V, other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5V                    |                          | 0.5   | 1.5  |                                   | 1.5  | mA   |

**NOTES:**

- Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
- This is the increase in supply current for each input at 3.4V.
- This parameter is valid for any V<sub>CC</sub> between 0V and 2.1V with a transition time of up to 10µsec from V<sub>CC</sub> = 2.1V to V<sub>CC</sub> = 5V ± 10% a transition time of up to 100µsec is permitted.

## AC CHARACTERISTICS

GND = 0V; t<sub>R</sub> = t<sub>F</sub> = 2.5ns; C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω

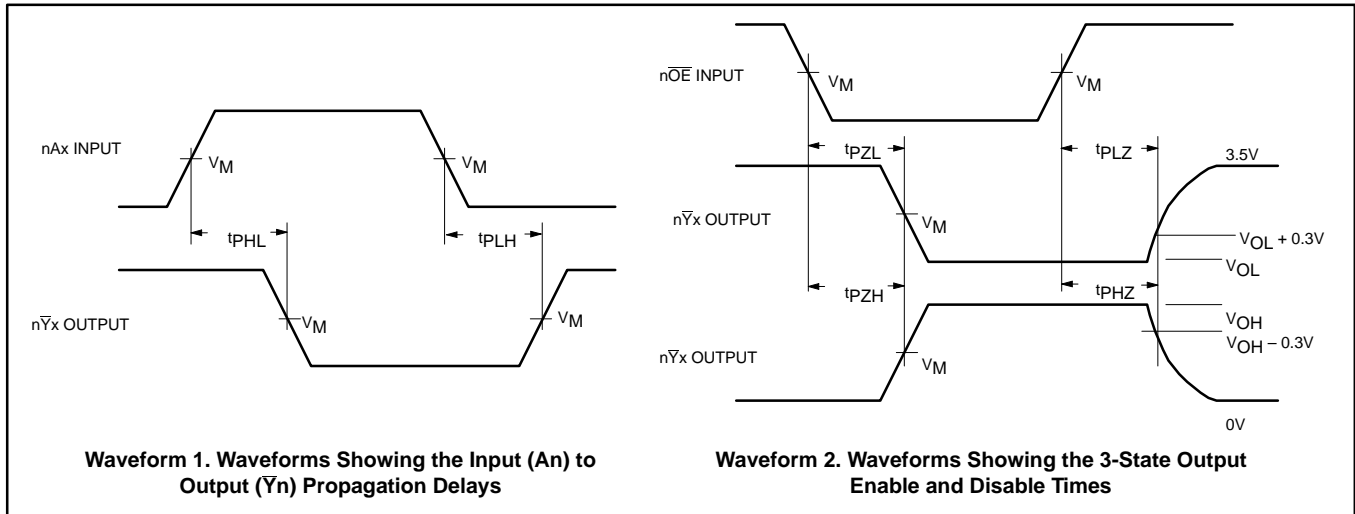
| SYMBOL                               | PARAMETER                                      | WAVEFORM | LIMITS  |            |            |  |            | UNIT |
|--------------------------------------|--|----------|---|------------|------------|--|------------|------|
|                                      |  |          | T <sub>amb</sub> = +25°C<br>V <sub>CC</sub> = +5.0V |            |            | T <sub>amb</sub> = -40°C to +85°C<br>V <sub>CC</sub> = +5.0V ±0.5V |            |      |
|                                      |  |          | Min   | Typ        | Max        | Min  | Max        |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>nAx to nYx                | 1        | 1.0<br>1.4  | 3.1<br>3.5 | 4.5<br>4.5 | 1.0<br>1.4   | 5.1<br>5.1 | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output enable time<br>to High and Low level    | 2        | 1.1<br>1.4  | 3.2<br>4.1 | 4.3<br>5.2 | 1.1<br>1.4   | 5.2<br>6.0 | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output disable time<br>from High and Low level | 2        | 1.2<br>1.3  | 4.0<br>3.6 | 5.1<br>4.8 | 1.2<br>1.3   | 5.8<br>5.5 | ns   |

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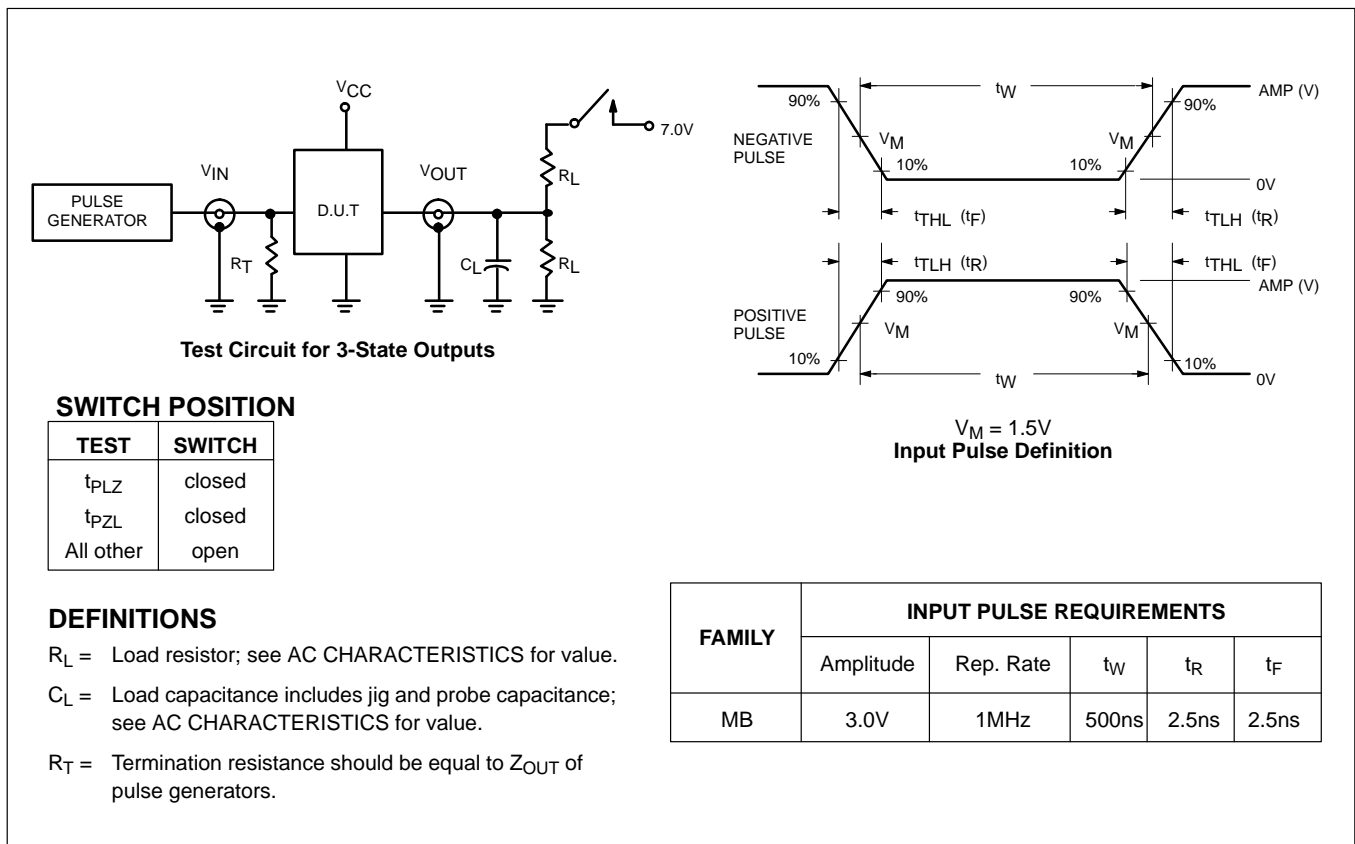
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## AC WAVEFORMS

$V_M = 1.5V$ ,  $V_{IN} = GND$  to  $3.0V$

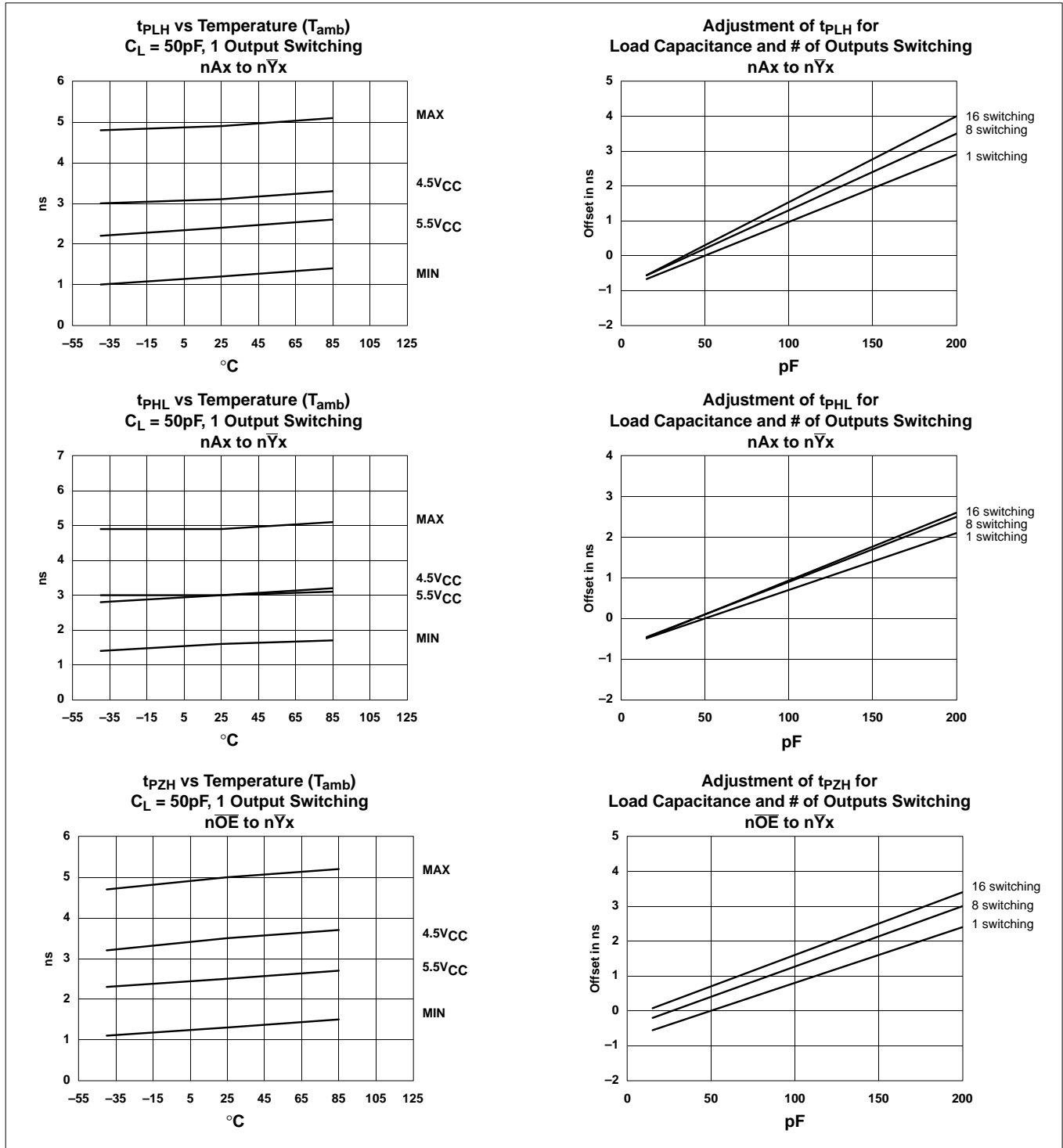


## TEST CIRCUIT AND WAVEFORMS



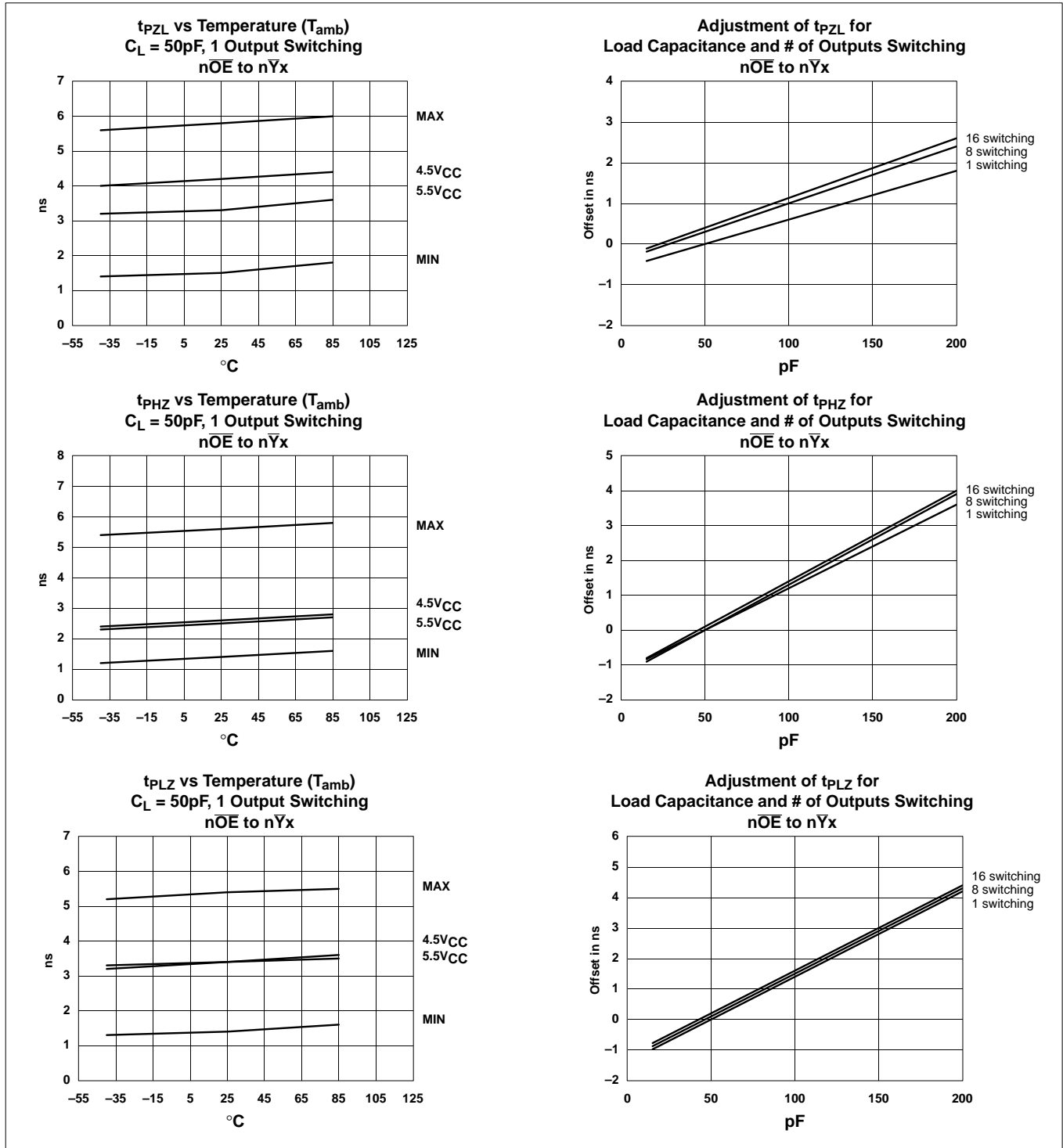
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