# DUAL 4-BIT LATCH

The MMC 4508 dual 4-bit latch contains two identical 4-bit latches with separate STROBE, RESET and OUTPUT DISABLE controls. With the STROBE line in high state, the data on the "D" inputs appear at the corresponding "Q" outputs provided the DISABLE line is in the low state. Changing the STROBE line to the low state locks the data into the latch. A high on the RESET line forces the outputs to a low level regardless of the state of the STROBE input. The outputs are forced to the high-impedance state for bus line application by a high level on the DISABLE input.
The MMC 4508 E/F/G/H types are supplied in the 24-lead dual-in-line ceramic or plastic packages.

## FEATURES

- Two independent 4-bit latches
- Individual master reset for each 4-bit latch
- 3-state outputs with high-impedance state for bus line applications
- Medium-speed operation: $t_{PLH} = t_{PHL} = 70$ ns (typ.) at $V_{DD} = 10$ V and $C_L = 50$ pF

## APPLICATIONS

- Buffer storage
- Holding register
- Data storage and multiplexing

## ABSOLUTE MAXIMUM RATINGS

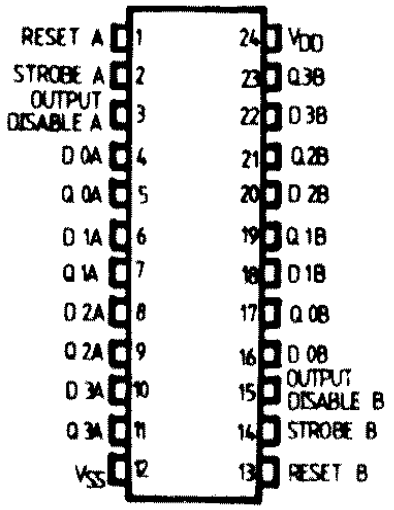
| | | | | | |
|---|---|---|---|---|---|
| $V_{DD}$* | Supply voltage: | G and H types | -0.5 to | 20 | V |
| | | E and F types | -0.5 to | 18 | V |
| $V_I$ | Input voltage | | -0.5 to | $V_{DD}$+0.5 | V |
| $I_I$ | DC input current (any one input) | | | ±10 | mA |
| $P_{tot}$ | Total power dissipation (per package) | | | 200 | mW |
| | Dissipation per output transistor for $T_A$ = full package-temperature range | | | 100 | mW |
| $T_A$ | Operating temperature : | G and H types | -55 to | 125 | °C |
| | | E and F types | -40 to | 85 | °C |
| $T_{stg}$ | Storage temperature | | -65 to | 150 | °C |

* All voltage values are referred to $V_{SS}$ pin voltage

## RECOMMENDED OPERATING CONDITIONS

| | | | | | |
|---|---|---|---|---|---|
| $V_{DD}$* | Supply voltage: | G and H types | 3 to | 18 | V |
| | | E and F types | 3 to | 15 | V |
| $V_I$ | Input voltage | | 0 to | $V_{DD}$ | V |
| $T_A$ | Operating temperature : | G and H types | -55 to | 125 | °C |
| | | E and F types | -40 to | 85 | °C |

## CONNECTION DIAGRAM



## STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

| PARAMETER | | TEST CONDITIONS | | | | VALUES | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_I$ (V) | $V_O$ (V) | $\|I_O\|$ (μA) | $V_{DD}$ (V) | $T^*_{LOW}$ | | 25°C | | | $T^*_{HIGH}$ | | |
| | | | | | | min. | max. | min. | typ | max. | min. | max. | |
| $I_L$ Quiescent current | G, H types | 0/ 5 | | | 5 | | 5 | | 0.04 | 5 | | 150 | μA |
| | | 0/10 | | | 10 | | 10 | | 0.04 | 10 | | 300 | |
| | | 0/15 | | | 15 | | 20 | | 0.04 | 20 | | 600 | |
| | | 0/20 | | | 20 | | 100 | | 0.08 | 100 | | 3000 | |
| | E, F types | 0/ 5 | | | 5 | | 20 | | 0.04 | 20 | | 150 | |
| | | 0/10 | | | 10 | | 40 | | 0.04 | 40 | | 300 | |
| | | 0/15 | | | 15 | | 80 | | 0.04 | 80 | | 600 | |
| $V_{OH}$ Output high voltage | | 0/ 5 | | < 1 | 5 | 4.95 | | 4.95 | | | 4.95 | | V |
| | | 0/10 | | < 1 | 10 | 9.95 | | 9.95 | | | 9.95 | | |
| | | 0/15 | | < 1 | 15 | 14.95 | | 14.95 | | | 14.95 | | |
| $V_{OL}$ Output low voltage | | 5 /0 | | < 1 | 5 | | 0.05 | | | 0.05 | | 0.05 | V |
| | | 10/0 | | < 1 | 10 | | 0.05 | | | 0.05 | | 0.05 | |
| | | 15/0 | | < 1 | 15 | | 0.05 | | | 0.05 | | 0.05 | |
| $V_{IH}$ Input high voltage | | | 0.5/4.5 | < 1 | 5 | 3.5 | | 3.5 | | | 3.5 | | V |
| | | | 1/9 | < 1 | 10 | 7 | | 7 | | | 7 | | |
| | | | 1.5/13.5 | < 1 | 15 | 11 | | 11 | | | 11 | | |
| $V_{IL}$ Input low voltage | | | 4.5/0.5 | < 1 | 5 | | 1.5 | | | 1.5 | | 1.5 | V |
| | | | 9/1 | < 1 | 10 | | 3 | | | 3 | | 3 | |
| | | | 13.5/1.5 | < 1 | 15 | | 4 | | | 4 | | 4 | |
| $I_{OH}$ Output drive current | G, H types | 0/ 5 | 2.5 | | 5 | −2 | | −1.6 | −3.2 | | −1.15 | | mA |
| | | 0/ 5 | 4.6 | | 5 | −0.64 | | −0.51 | −1 | | −0.36 | | |
| | | 0/10 | 9.5 | | 10 | −1.6 | | −1.3 | −2.6 | | −0.9 | | |
| | | 0/15 | 13.5 | | 15 | −4.2 | | −3.4 | −6.8 | | −2.4 | | |
| | E, F types | 0/ 5 | 2.5 | | 5 | −1.53 | | −1.36 | −3.2 | | −1.1 | | |
| | | 0/ 5 | 4.6 | | 5 | −0.52 | | −0.44 | −1 | | −0.36 | | |
| | | 0/10 | 9.5 | | 10 | −1.3 | | −1.1 | −2.6 | | −0.9 | | |
| | | 0/15 | 13.5 | | 15 | −3.6 | | −3.0 | −6.8 | | −2.4 | | |
| $I_{OL}$ Output sink current | G, H types | 0/ 5 | 0.4 | | 5 | 0.64 | | 0.51 | 1 | | 0.36 | | mA |
| | | 0/10 | 0.5 | | 10 | 1.6 | | 1.3 | 2.6 | | 0.9 | | |
| | | 0/15 | 1.5 | | 15 | 4.2 | | 3.4 | 6.8 | | 2.4 | | |
| | E, F types | 0/ 5 | 0.4 | | 5 | 0.52 | | 0.44 | 1 | | 0.36 | | |
| | | 0/10 | 0.5 | | 10 | 1.3 | | 1.1 | 2.6 | | 0.9 | | |
| | | 0/15 | 1.5 | | 15 | 3.6 | | 3.0 | 6.8 | | 2.4 | | |
| $I_{IH}$, $I_{IL}$ Input leakage current | G, H types | 0/18 | Any input | | 18 | | ±0.1 | | $±10^{-5}$ | ±0.1 | | ±1 | μA |
| | E, F types | 0/15 | | | 15 | | ±0.3 | | $±10^{-5}$ | ±0.3 | | ±1 | |
| $I_{OH}$ 3—state output | G, H types | 0/18 | 0/18 | | 18 | | ±0.4 | | ±10 | ±0.4 | | ±12 | μA |
| | E, F types | 0/15 | 0/15 | | 15 | | ±1.0 | | ±10 | ±1.0 | | ±7.5 | |

| PARAMETER | TEST CONDITIONS | | | | VALUES | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_I$ (V) | $V_O$ (V) | $I_O$ ($\mu$A) | $V_{DD}$ (V) | $T^*_{LOW}$ min. | $T^*_{LOW}$ max. | 25°C min. | 25°C typ | 25°C max. | $T^*_{HIGH}$ min. | $T^*_{HIGH}$ max. | |
| $C_I$ —Input capacitance | | Any input | | | | | | 5 | 7.5 | | | pF |

* $T_{LOW}$ = −55°C for G, H devices; −40°C for E, F devices.
* $T_{HIGH}$ = +125°C for G, H devices; +85°C for E, F devices.
The Noise Margin for both "1" and "0" level is:
1 V min. with $V_{DD}$ = 5 V
2 V min. with $V_{DD}$ = 10 V
2.5 V min. with $V_{DD}$ = 15 V

## DYNAMIC ELECTRICAL CHARACTERISTICS

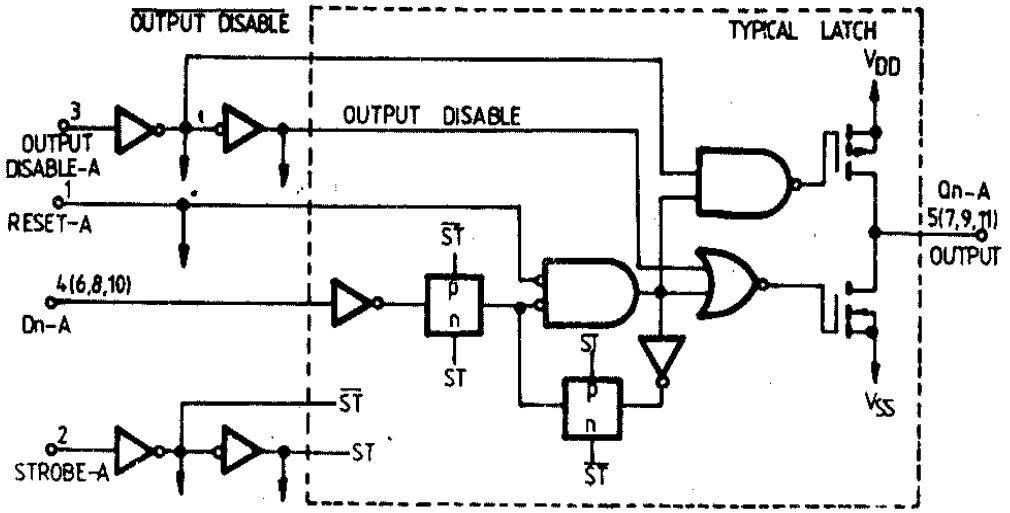
($T_A$ = 25°C, input $t_r$, $t_f$ = 20 ns, $C_L$ = 50 pF, $R_L$ = 200 kΩ, unless otherwise specified)

| PARAMETER | | TEST CONDITIONS $V_{DD}$ (V) | VALUES min. | VALUES typ. | VALUES max. | UNIT |
|---|---|---|---|---|---|---|
| $t_{THL}$, $t_{TLH}$ Transition time | | 5 | | 100 | 200 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 40 | 80 | |
| $t_W$(R) Reset pulse width | | 5 | 200 | 100 | | ns |
| | | 10 | 140 | 70 | | |
| | | 15 | 100 | 50 | | |
| $t_W$(st) Strobe pulse width | | 5 | 140 | 70 | | ns |
| | | 10 | 80 | 40 | | |
| | | 15 | 70 | 35 | | |
| $t_{setup}$ Setup time | | 5 | 50 | 25 | | ns |
| | | 10 | 30 | 15 | | |
| | | 15 | 20 | 10 | | |
| $t_H$ Hold time | | 5 | 0 | 0 | | ns |
| | | 10 | 0 | 0 | | |
| | | 15 | 0 | 0 | | |
| $t_{PHL}$, $t_{PLH}$ Propagation delay times | Strobe to data out | 5 | | 130 | 260 | ns |
| | | 10 | | 70 | 140 | |
| | | 15 | | 50 | 100 | |
| | Data in to data out | 5 | | 105 | 210 | ns |
| | | 10 | | 60 | 120 | |
| | | 15 | | 45 | 90 | |
| | Reset to data out | 5 | | 90 | 180 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 40 | 80 | |
| $t_{PHZ}$, $t_{PLZ}$ 3-state propagation delay times: output high to high impedance | | 5 | | 90 | 180 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 35 | 70 | |
| $t_{PZH}$, $t_{PZL}$ High impedance to output high | | 5 | | 90 | 180 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 35 | 70 | |
| $t_{PZ}$, $t_{PZ}$ Output low to high impedance | | 5 | | 90 | 180 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 35 | 70 | |

| PARAMETER | | TEST CONDITIONS | VALUES | | | UNIT |
|---|---|---|---|---|---|---|
| | | $V_{DD}$ (V) | min. | typ. | max. | |
| $t_{PZL}$ | High impedance to output low | 5 | | 90 | 180 | ns |
| | | 10 | | 50 | 100 | |
| | | 15 | | 35 | 70 | |

## LOGIC DIAGRAM (A Section)

1 of 4 identifical latches with common output disable, reset and strobe



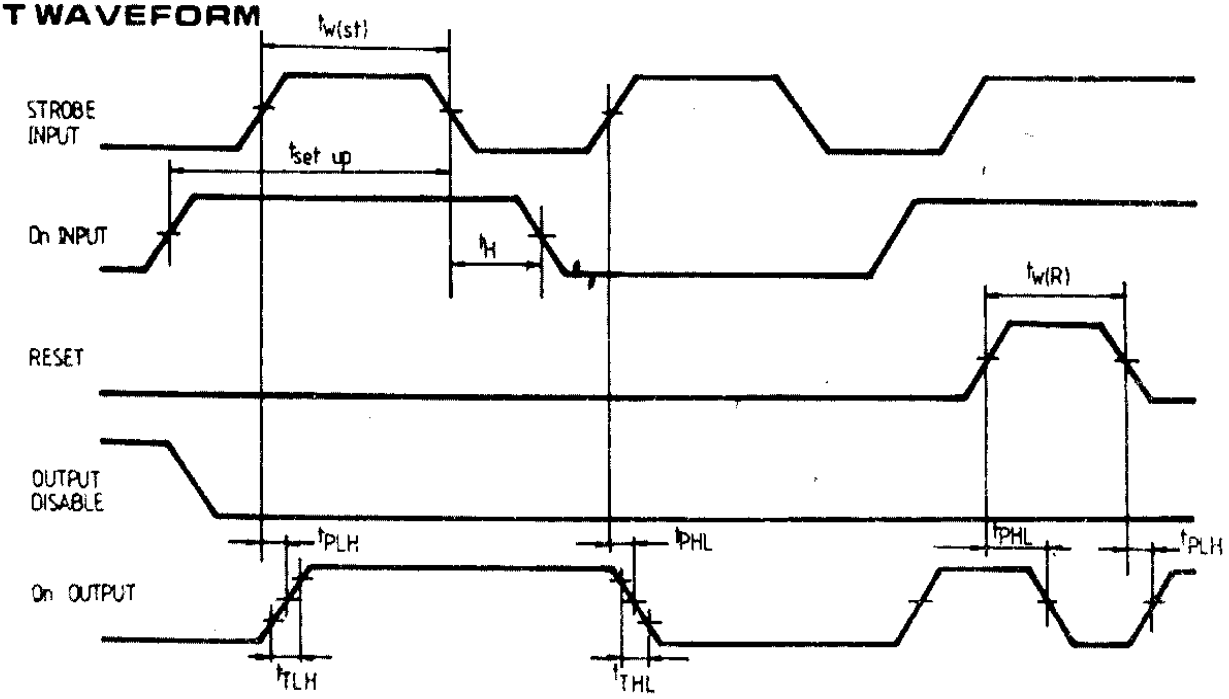

## TRUTH TABLE

| RESET | DISAB | STROBE | D INPUT | Q INPUT |
|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | X | Latched |
| 1 | 0 | X | X | 0 |
| X | 1 | X | X | Z |

1 = High level
0 = Low level

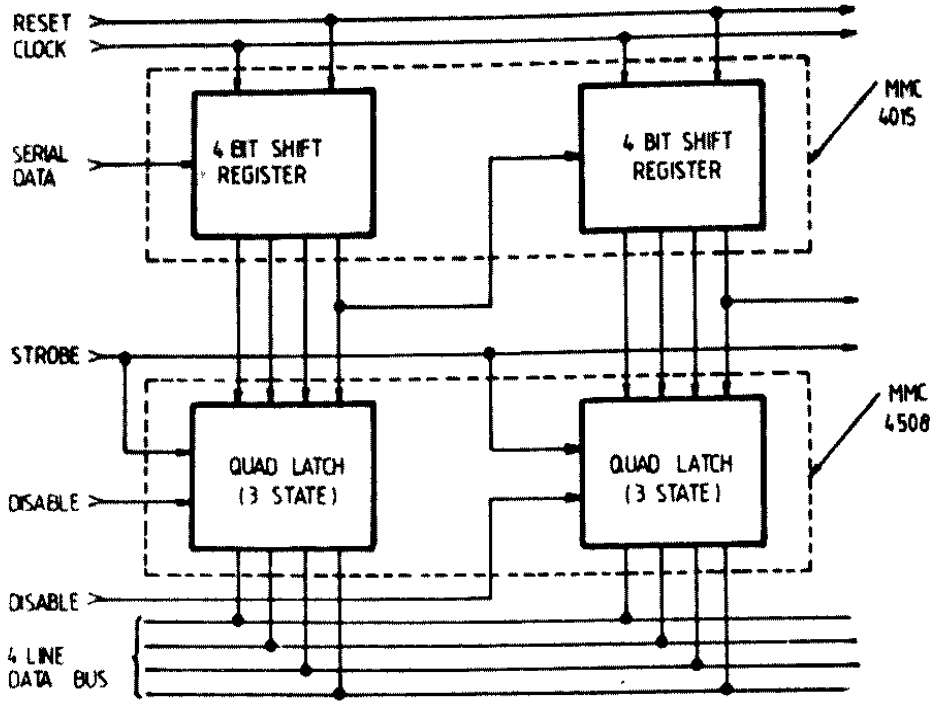
X = Don't care
Z = High impedance

## TEST WAVEFORM



## TYPICAL APPLICATIONS

Bus register




Dual multiplexed bus register with function select