# TOSHIBA MOS MEMORY PRODUCTS

1024 WORD x 4 BIT STATIC RAM

N CHANNEL SILICON GATE DEPLETION LOAD

**TMM314AP TMM314APL**
**TMM314AP-1 TMM314APL-1**
**TMM314AP-3 TMM314APL-3**

## DESCRIPTION

TMM314AP family is 1024 word x 4 bit high speed read write memories operated with 5 V single power supply. The memories with 6 Tr. cells are static in operation and require no clocks or refresh period and suitable for use in microprocessor application systems where high performance, low cost, simple interfacing are important design objectives.

TMM314AP family is able to be connected to TTL directly and to drive 1 STTL or 5 LSTTLS.

TMM314AP family is fabricated with N channel silicon gate depletion load type MOS technology by ion implantation for fast speed, stable performance and reliability.

The chip is moulded in the standard 18 pin plastic package of 0.3 inch width for low cost and high density assembly.

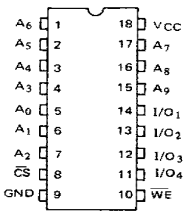
## FEATURES

- Fully decoded 1024 word x 4 bit organization
- Static operation — No clocks or refresh period
- Single 5V supply voltage — $V_{CC}$ = 5V ± 10%
- Easy memory expansion — $\overline{CS}$ input
- Three state output — Wired OR tie capability
- Inputs and outputs directly TTL compatible
- Data input/output terminal is common
- Input protected — All inputs have protection against static charge
- 2114 Type Pin compatible
- Low Power dissipation and Access time

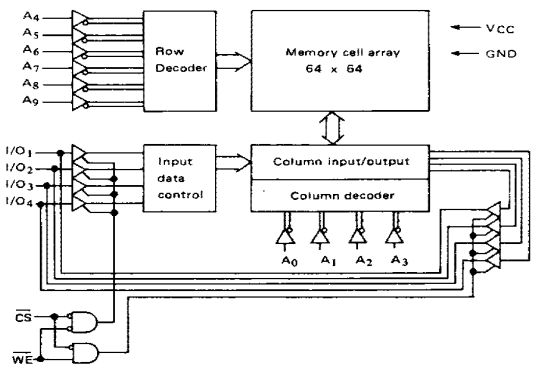
Power and Access time (maximum value)

| | Access time | Power |
|---|---|---|
| TMM314AP-1 | 200 ns | 550 mW |
| TMM314AP-3 | 300 ns | 550 mW |
| TMM314AP | 450 ns | 550 mW |
| TMM314APL-1 | 200 ns | 385 mW |
| TMM314APL-3 | 300 ns | 385 mW |
| TMM314APL | 450 ns | 385 mW |

## PIN CONNECTION (TOP VIEW)




## BLOCK DIAGRAM




## PIN NAMES

| | |
|---|---|
| $A_0 \sim A_3$ | Column Address Inputs |
| $A_4 \sim A_9$ | Row Address Inputs |
| $I/O_1 \sim I/O_4$ | Data Input/Output |
| $\overline{CS}$ | Chip Select Input |
| $\overline{WE}$ | Write Enable Input |
| $V_{CC}$ | Supply Voltage |
| GND | Ground |

## MAXIMUM RATINGS

| SYMBOL | ITEM | RATING | UNIT |
|---|---|---|---|
| $V_{CC}$ | Supply Voltage | −0.5 ~ 7.0 | V |
| $V_{I/O}$ | Input/Output Voltage | −0.5 ~ 7.0 | V |
| $T_{OPR}$ | Operating Temperature | 0 ~ 70 | °C |
| $T_{STG}$ | Storage Temperature | −55 ~ 150 | °C |
| $T_{SOLDER}$ | Soldering Temperature · Time | 260 · 10 | °C · sec |
| $P_D$ | Power dissipation (Ta = 70°C) | 850 | mW |

## DC RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Input High Voltage | – | 2.0 | – | $V_{CC}$ | V |
| $V_{IL}$ | Input Low Voltage | – | −0.5 | – | 0.8 | V |
| $V_{CC}$ | Supply Voltage | – | 4.5 | 5 | 5.5 | V |

## DC CHARACTERISTICS (Ta = 0 ~ 70°C)

| SYMBOL | PARAMETER | CONDITIONS | | MIN. | TYP.* | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| $I_{IH}$ | Input High Current | $V_{IN}$ = 5.50 V | | – | – | 10 | μA |
| $I_{IL}$ | Input Low Current | $V_{IN}$ = 0 V | | – | – | −10 | μA |
| $V_{OH}$ | Output High Voltage | $I_{SOURCE}$ = −1.0 mA | | 2.4 | 2.8 | – | V |
| $V_{OL}$ | Output Low Voltage | $I_{SINK}$ = 2.1 mA | | – | 0.15 | 0.4 | V |
| $I_{OH}$ | Output High Current | $V_{OUT}$ = 2.4 V | | −1.0 | −5.5 | – | mA |
| $I_{OL}$ | Output Low Current | $V_{OUT}$ = 0.4 V | | 2.1 | 6.5 | – | mA |
| $I_{LO}$ | Output Leakage Current | $\overline{CE}$ = $V_{IH}$ or $\overline{WE}$ = $V_{IL}$<br>$V_{OUT}$ = 0.4 V ~ $V_{CC}$ | | – | – | ±10 | μA |
| $I_{CC1}$ | Supply Current | TMM314A PL/PL-1/PL-3<br>$I_{OUT}$ = 0 mA | 25°C | – | 50 | 64 | mA |
| | | | 0°C | – | – | 70 | |
| $I_{CC2}$ | Supply Current | TMM314A P/P-1/P-3<br>$I_{OUT}$ = 0 mA | 25°C | – | 70 | 90 | mA |
| | | | 0°C | – | – | 100 | |

* Ta = 25°C, $V_{CC}$ = 5V

## AC CHARACTERISTICS ($T_a$ = 0 ~ 70°C, $V_{CC}$ = 5V ± 10%, $C_L$ = 100pF, $t_r$, $t_f$ ≦ 10 ns)

### READ CYCLE

| SYMBOL | PARAMETER | TMM314AP-1/APL-1 | | TMM314AP-3/APL-3 | | TMM314AP/APL | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| $t_{RC}$ | Read Cycle Time | 200 | – | 300 | – | 450 | – | ns |
| $t_{ACC}$ | Access Time | – | 200 | – | 300 | – | 450 | ns |
| $t_{CO}$ | Chip Select Time | – | 70 | – | 100 | – | 100 | ns |
| $t_{CX}$ | Output Active from $\overline{CS}$ | 20 | – | 20 | – | 20 | – | ns |
| $t_{OD}$ | Chip Deselect Time | 0 | 40 | 0 | 80 | 0 | 100 | ns |
| $t_{OH}$ | Output Hold from Address Change | 20 | – | 20 | – | 20 | – | ns |

### WRITE CYCLE

| SYMBOL | PARAMETER | TMM314AP-1/APL-1 | | TMM314AP-3/APL-3 | | TMM314AP/APL | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| $t_{WC}$ | Write Cycle Time | 200 | – | 300 | – | 450 | – | ns |
| $t_{WP}$ | Write Pulse Width | 120 | – | 150 | – | 200 | – | ns |
| $t_{WR}$ | Write Recovery Time | 0 | – | 0 | – | 0 | – | ns |
| $t_{ODW}$ | Output High Z from $\overline{WE}$ | 0 | 40 | 0 | 80 | 0 | 100 | ns |
| $t_{DS}$ | Data Setup Time | 120 | – | 150 | – | 200 | – | ns |
| $t_{DH}$ | Data Hold Tome | 0 | – | 0 | – | 0 | – | ns |
| $t_{AW}$ | Address to Write Setup Time | 30 | – | 30 | – | 30 | – | ns |

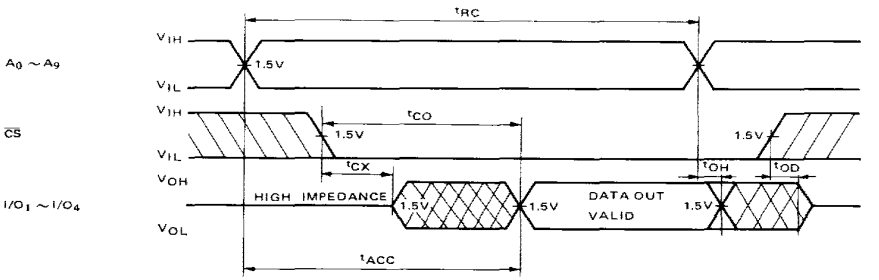
## CAPACITANCE ($T_a$ = 25°C, f = 1 MHz)

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = AC Ground | – | – | 5 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = AC Ground | – | – | 5 | pF |

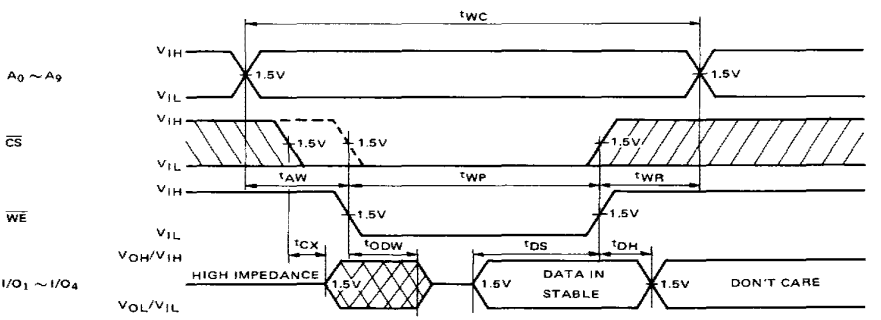
Note: This parameter is periodically sampled and not 100% tested.

## TIMING WAVEFORMS

### READ CYCLE



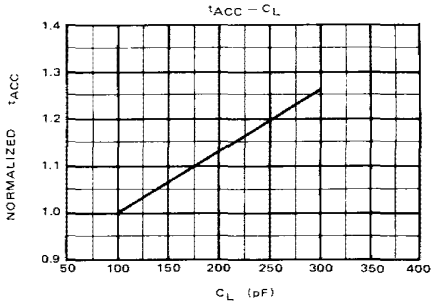

### WRITE CYCLE

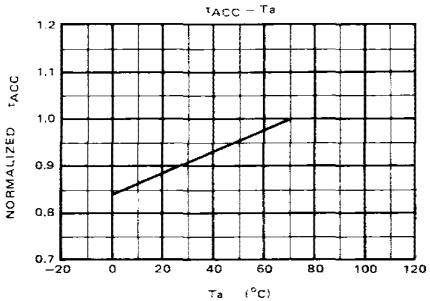


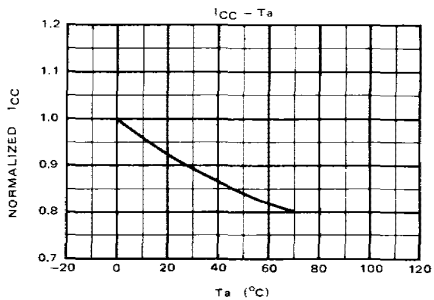

Note 1 : $\overline{WE}$ is high for a READ CYCLE.

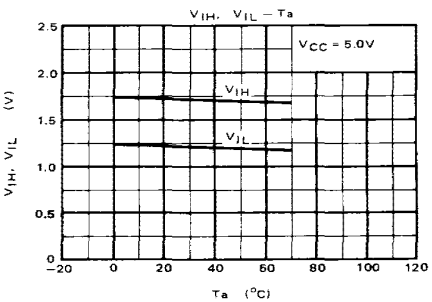
2 : $t_{WP}$ is measured from the latter of $\overline{CS}$ or $\overline{WE}$ going low to the earlier of $\overline{CS}$ or $\overline{WE}$ going high.

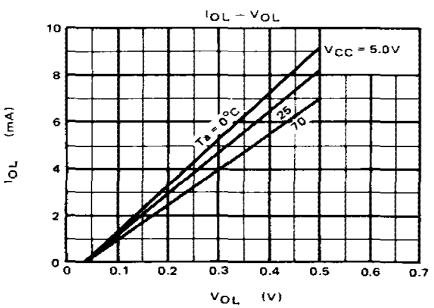
## TYPICAL CHARACTERISTICS

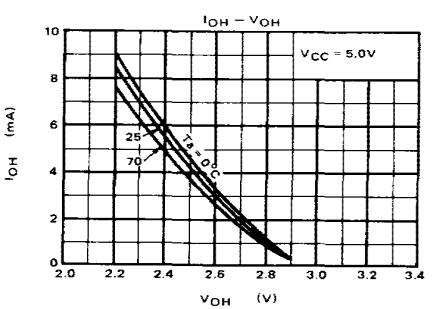


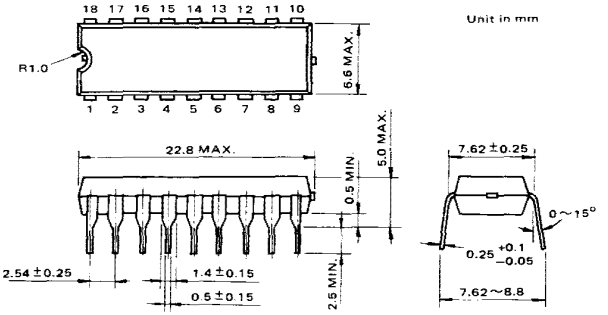



## OUTLINE DRAWINGS




Notes: Each lead pitch is 2.54 mm. All leads are located within 0.25 mm of their true longitudinal position with respect to No. 1 and No. 18 leads.