



# TOSHIBA MOS MEMORY PRODUCTS

1024 WORD X 1 BIT CMOS RAM

SILICON GATE CMOS

TC5508P

TC5508P-4

TC5508P-1

## DESCRIPTION

The TC5508P is a static read/write memory organized as 1024 words by 1 bit using CMOS technology. Because of ultra-low power dissipation, the TC5508P can be used as battery-operated portable memory system and also as a nonvolatile memory with battery back-up. The TC5508P operates from a single 5V power supply with a static operation, so that the no refresh periods are required. This simplifies the power supply circuit design.

The three-state output simplifies the memory expansion making the TC5508P suitable for use in a microprocessor peripheral memory. Since the minimum data retention voltage is 2V, the battery back-up system needs only simple circuit. By using Toshiba's original C<sup>2</sup>MOS technology, the device circuitry is not only simplified but wide operating margin and noise margin are also realized.

The TC5508P family is moulded in a dual-in-line 16 pin plastic package, 0.3 inch in width.

## FEATURES

- Low Power Dissipation
  - 55μW (MAX.) STANDBY
  - 55mW (MAX.) OPERATING
- Single 5V Power Supply
- Data Retention Voltage; 2.0~5.5V
- 16 PIN Plastic Package
- Static Operation

- Three State Output
- Input/Output; TTL Compatible
- Latched Address Inputs
- Access Time

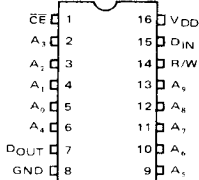
TC5508P : t<sub>ACC</sub> = 370ns (MAX.)

TC5508P-4: t<sub>ACC</sub> = 450ns (MAX.)

TC5508P-1: t<sub>ACC</sub> = 550ns (MAX.)

## PIN CONNECTION

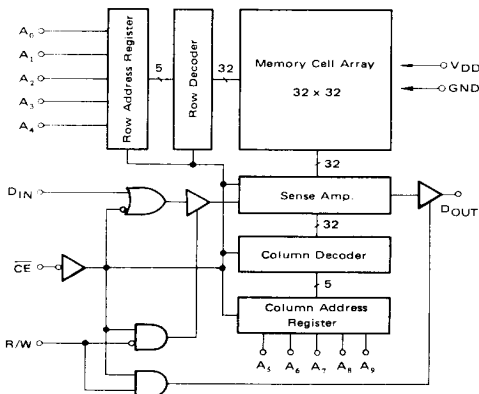
(TOP VIEW)



## PIN NAMES

A <sub>0</sub> ~ A <sub>9</sub>	Address Inputs
R/W	Read/Write Input
CE	Chip Enable Input
D <sub>IN</sub>	Data Input
D <sub>OUT</sub>	Data Output
V <sub>DD</sub> /GND	Power Supply Terminals

## BLOCK DIAGRAM



## MAXIMUM RATINGS

SYMBOL	ITEM	RATING	UNIT
V <sub>DD</sub>	Power Supply Voltage	-0.3 ~ 7.0	V
V <sub>IN</sub>	Input Voltage	-0.3 ~ V <sub>DD</sub> + 0.3	V
V <sub>OUT</sub>	Output Voltage	0 ~ V <sub>DD</sub>	V
P <sub>D</sub>	Power Dissipation (T <sub>a</sub> = 85°C)	500	mW
T <sub>SOLDER</sub>	Soldering Temperature · Time	260 · 10	°C·sec.
T <sub>STG</sub>	Storage Temperature	-55 ~ 150	°C
T <sub>OPR</sub>	Operating Temperature	-30 ~ 85	°C

## D.C. CHARACTERISTICS (T<sub>a</sub> = -30~85°C)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP. (1)	MAX.	UNIT
I <sub>IN</sub>	Input Current	0V ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>	-	±0.05	±1.0	μA
I <sub>BDS</sub>	Standby Current	V <sub>DD</sub> = 2V ~ 5.5V CE = V <sub>DD</sub> -0.2V Output open Other Inputs=0.2V or V <sub>DD</sub> -0.2V	-	0.2	10	μA
I <sub>BDO</sub>	Operating Current	V <sub>DD</sub> = 5.5V, t <sub>CYC</sub> = 1μs	-	6	10	mA
I <sub>LO</sub>	Output Leakage Current	0V ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub>	-	±0.1	±5.0	μA
I <sub>OH</sub>	Output High Current	V <sub>DD</sub> = 4.5V, V <sub>OH</sub> = 2.4V	-1.0	-2.0	-	mA
I <sub>OL</sub>	Output Low Current	V <sub>DD</sub> = 4.5V, V <sub>OL</sub> = 0.4V	2.0	3.0	-	mA
C <sub>i</sub> (2)	Input Capacitance	f = 1MHz	-	5	10	pF
C <sub>o</sub> (2)	Output Capacitance	f = 1MHz	-	7	15	pF

Note (1) T<sub>a</sub> = 25°C V<sub>DD</sub> = 5V

Note (2) This parameter is periodically sampled and is not 100% tested.

## D.C. RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V <sub>DD</sub>	Power Supply Voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	Input High Level Voltage	V <sub>DD</sub> -2.0	-	V <sub>DD</sub> +0.3	V
V <sub>IL</sub>	Input Low Level Voltage	-0.3	-	0.8	V
V <sub>DH</sub>	Data Retention Voltage	2.0	-	5.5	V

## A.C. CHARACTERISTICS (T<sub>a</sub> = -30~85°C)

### ● TC5508P

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t <sub>ACC</sub>	Access Time	V <sub>DD</sub> = 4.5 ~ 5.5V	-	-	370	ns
t <sub>COE</sub>	CE To Output Enable Time	V <sub>OH</sub> = 2.4V	0	-	-	ns
t <sub>DIS</sub>	CE To Output Disable Time	V <sub>OL</sub> = 0.8V	-	-	100	ns
t <sub>ROE</sub>	R/W To Output Enable Time	C <sub>L</sub> = 100 pF	0	-	-	ns
t <sub>ROD</sub>	R/W To Output Disable Time		-	-	100	ns

● TC5508P-4

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t <sub>ACC</sub>	Access Time	V <sub>DD</sub> = 4.5 ~ 5.5V	—	—	450	ns
t <sub>COE</sub>	CE To Output Enable Time	V <sub>OH</sub> = 2.4V	0	—	—	ns
t <sub>DIS</sub>	CE To Output Disable Time	V <sub>OL</sub> = 0.8V	—	—	130	ns
t <sub>ROE</sub>	R/W To Output Enable Time	C <sub>L</sub> = 100 pF	0	—	—	ns
t <sub>ROD</sub>	R/W To Output Disable Time		—	—	130	ns

● TC5508P-1

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t <sub>ACC</sub>	Access Time	V <sub>DD</sub> = 4.5 ~ 5.5V	—	—	550	ns
t <sub>COE</sub>	CE To Output Enable Time	V <sub>OH</sub> = 2.4V	0	—	—	ns
t <sub>DIS</sub>	CE To Output Disable Time	V <sub>OL</sub> = 0.8V	—	—	150	ns
t <sub>ROE</sub>	R/W To Output Enable Time	C <sub>L</sub> = 100 pF	0	—	—	ns
t <sub>ROD</sub>	R/W To Output Disable Time		—	—	150	ns

**A.C. RECOMMENDED OPERATING CONDITIONS**

● TC5508P

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
t <sub>AS</sub>	Address Setup Time	V <sub>DD</sub> = 4.5~5.5V C <sub>L</sub> = 100 pF V <sub>IH</sub> = V <sub>DD</sub> - 2.0V ~ V <sub>DD</sub> + 0.3V V <sub>IL</sub> = 0.8V T <sub>a</sub> = -30 ~ 85°C	20	—	ns
t <sub>AH</sub>	Address Hold Time		50	—	ns
t <sub>PC</sub>	Precharge Time		80	—	ns
t <sub>CE</sub>	CE Pulse Width		370	—	ns
t <sub>WP</sub>	Write Pulse Width		200	—	ns
t <sub>WS</sub>	Write Setup Time		0	—	ns
t <sub>WH</sub>	Write Hold Time		200	—	ns
t <sub>CEH</sub>	CE Hold Time		200	—	ns
t <sub>OW</sub>	Output Valid to R/W		0	—	ns
t <sub>DS</sub>	Data Setup Time		200	—	ns
t <sub>DH</sub>	Data Hold Time	0	—	ns	
t <sub>RS</sub>	Read Setup Time	0	—	ns	
t <sub>RH</sub>	Read Hold Time	0	—	ns	

● TC5508P-4

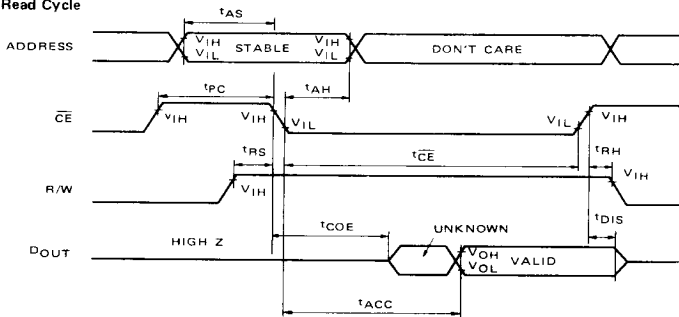
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
t <sub>AS</sub>	Address Setup Time	V <sub>DD</sub> = 4.5 ~ 5.5V C <sub>L</sub> = 100 pF V <sub>IH</sub> = V <sub>DD</sub> - 2.0V ~ V <sub>DD</sub> + 0.3V V <sub>IL</sub> = 0.8V T <sub>a</sub> = -30 ~ 85°C	20	—	ns
t <sub>AH</sub>	Address Hold Time		80	—	ns
t <sub>PC</sub>	Precharge Time		100	—	ns
t <sub>CE</sub>	CE Pulse Width		450	—	ns
t <sub>WP</sub>	Write Pulse Width		250	—	ns
t <sub>WS</sub>	Write Setup Time		0	—	ns
t <sub>WH</sub>	Write Hold Time		250	—	ns
t <sub>CEH</sub>	CE Hold Time		250	—	ns
t <sub>OW</sub>	Output Valid to R/W		0	—	ns
t <sub>DS</sub>	Data Setup Time		250	—	ns
t <sub>DH</sub>	Data Hold Time	0	—	ns	
t <sub>RS</sub>	Read Setup Time	0	—	ns	
t <sub>RH</sub>	Read Hold Time	0	—	ns	

● TC5508P-1

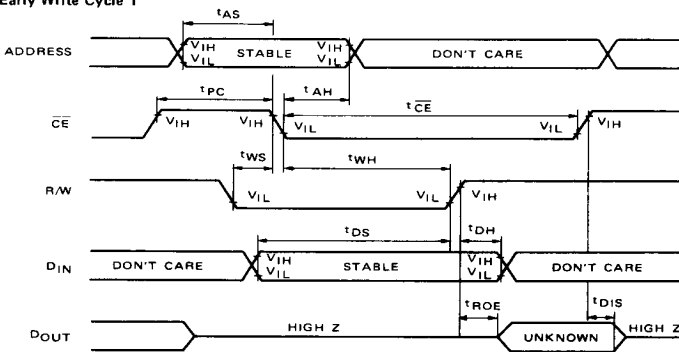
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$t_{AS}$	Address Setup Time		20	—	ns
$t_{AH}$	Address Hold Time		80	—	ns
$t_{PC}$	Precharge Time	$V_{DD} = 4.5 \sim 5.5V$	150	—	ns
$t_{CE}$	CE Pulse Width	$C_L = 100 pF$	550	—	ns
$t_{WP}$	Write Pulse Width	$V_{IH} = V_{DD} - 2.0V \sim V_{DD} + 0.3V$	300	—	ns
$t_{WS}$	Write Setup Time	$V_{IL} = 0.8V$	0	—	ns
$t_{WH}$	Write Hold Time	$T_a = -30 \sim 85^\circ C$	300	—	ns
$t_{CFH}$	CE Hold Time		300	—	ns
$t_{OV}$	Output Valid to R/W		0	—	ns
$t_{DS}$	Data Setup Time		300	—	ns
$t_{DH}$	Data Hold Time		0	—	ns
$t_{RS}$	Read Setup Time		0	—	ns
$t_{RH}$	Read Hold Time		0	—	ns

**TIMING WAVEFORMS**

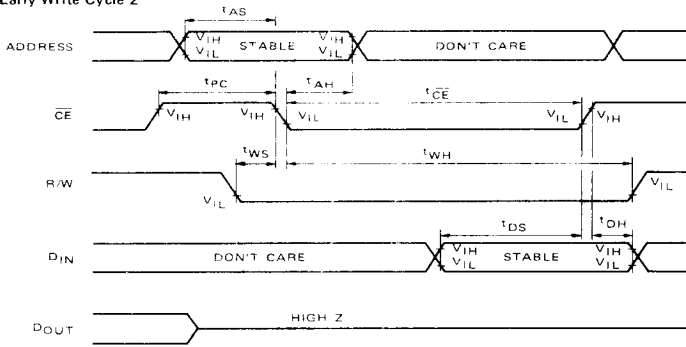
● Read Cycle



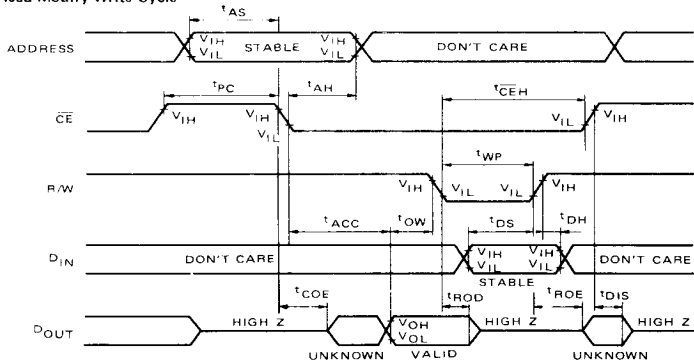
● Early Write Cycle 1



• Early Write Cycle 2

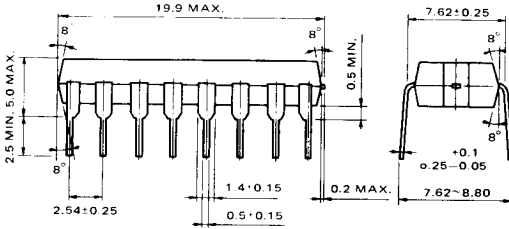
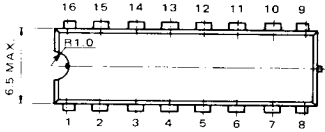


• Read Modify Write Cycle



**OUTLINE DRAWINGS**

Unit in mm



Note: Each lead pitch is 2.54mm. All leads are located within 0.25mm of their longitudinal position with respect to No. 1 and No. 16.

Note: Toshiba does not assume any responsibility for use of any circuitry described; no circuit patent licenses are implied, and Toshiba reserves the right, at any time without notice, to change said circuitry.  
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