

# TOSHIBA MOS MEMORY PRODUCTS

256 WORD x 4 BIT CMOS RAM

TC5501P/-1  
TC5501D/-1

## DESCRIPTION

The TC5501P/D is a fully static read write memory organized as 256 words by 4 bits using CMOS technology. Because of ultra low power dissipation, the TC5501P/D can be used as battery operated portable memory system and also as a nonvolatile memory with battery back up. The TC5501P/D 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.

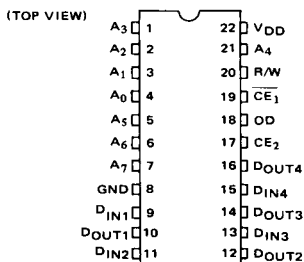
The three state outputs simplify the memory expansion making the TC5501P/D suitable for use in a microprocessor peripheral memory. Since the minimum data retention voltage is 2V, the battery back up system needs only simple circuit. By using Toshiba's original C<sup>2</sup>MOS technology, the device circuitry is not only simplified but wide operating margin and noise margin are also realized.

The TC5501P/D is offered in standard 22 pin plastic and cerdip packages, 0.4 inch in width.

## FEATURES

- Low Power Dissipation
  - 55 $\mu$ W (MAX.) STANDBY
  - 83mW (MAX.) OPERATING
- Single 5V Power Supply
- Data Retention Voltage 2V to 5.5V
- Package
  - Plastic DIP : TC5501P
  - Cerdip DIP : TC5501D
- Fully static operation
- Three State Output
- Input/output, TTL Compatible
- Access Time
  - TC5501P/D ;  $t_{ACC} \leq 450ns$  (MAX.)
  - TC5501P-1/D-1;  $t_{ACC} \leq 650ns$  (MAX.)

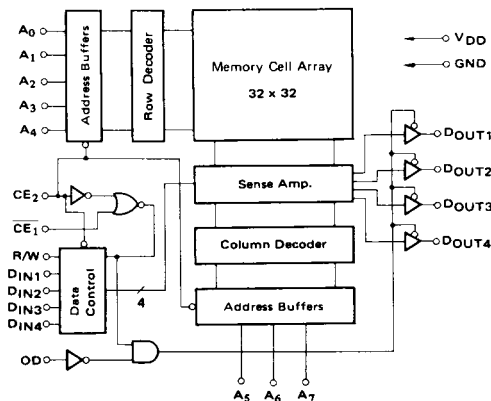
## PIN CONNECTION



## PIN NAMES

A <sub>0</sub> ~ A <sub>7</sub>	Address Inputs
R/W	Read Write Input
CE <sub>1</sub> , CE <sub>2</sub>	Chip Enable Inputs
DIN <sub>1</sub> ~ 4	Data Inputs
DOUT <sub>1</sub> ~ 4	Data Outputs
OD	Output Disable Input
V <sub>DD</sub> /GND	Power Supply Terminals

## BLOCK DIAGRAM



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**MAXIMUM RATINGS**

SYMBOL	ITEM	RATING	UNITS
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)	800	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

**DC RECOMMENDED OPERATING CONDITION**

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS
V <sub>DD</sub>	Power Supply Voltage	4.5	-	5.5	V
V <sub>IH</sub>	Input High Level Voltage	2.2	-	V <sub>DD</sub> + 0.3	V
V <sub>IL</sub>	Input Low Level Voltage	-0.3	-	0.65	V
V <sub>DH</sub>	Data Retention Voltage	2.0	-	5.5	V

**DC CHARACTERISTICS (T<sub>a</sub> = -30 ~ 85°C)**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.(1)	MAX.	UNITS
I <sub>IN</sub>	Input Current	0 ≤ V <sub>IN</sub> ≤ V <sub>DD</sub>	-	±0.05	±1.0	μA
I <sub>DDs</sub>	Standby Current	V <sub>DD</sub> = 2.0V to 5.5V CE <sub>2</sub> = 0.2V, Output open	-	0.2	10	μA
I <sub>DDO</sub>	Operating Current	V <sub>DD</sub> = 5.5V, t <sub>CYC</sub> = 1μs	-	6.2	15	mA
I <sub>LO</sub>	Output Leakage Current	0 ≤ V <sub>OUT</sub> ≤ V <sub>DD</sub>	-	±0.05	±1.0	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

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

**CAPACITANCE (2) (T<sub>a</sub> = 25°C)**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V, f = 1MHz	-	5	10	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0V, f = 1MHz	-	7	15	pF

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

**A.C. CHARACTERISTICS**● **READ CYCLE**

SYMBOL	PARAMETER	TC5501P/D		TC5501P-1/D-1		UNIT
		MIN.	MAX.	MIN.	MAX.	
t <sub>RC</sub>	Read Cycle Time	450	—	650	—	ns
t <sub>ACC</sub>	Address Access Time	—	450	—	650	ns
t <sub>ACC1</sub>	CE <sub>1</sub> Access Time	—	400	—	600	ns
t <sub>ACC2</sub>	CE <sub>2</sub> Access Time	—	500	—	700	ns
t <sub>OD0</sub>	OD Access Time	—	250	—	350	ns
t <sub>COE</sub>	Output Enable Time	0	—	0	—	ns
t <sub>DIS</sub>	Output Disable Time	0	130	0	150	ns
t <sub>OH</sub>	Output Data Hold Time	0	—	0	—	ns

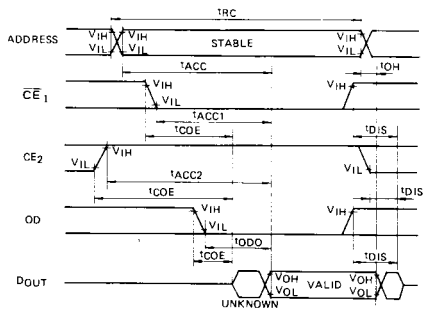
● **WRITE CYCLE**

SYMBOL	PARAMETER	TC5501P/D		TC5501P-1/D-1		UNIT
		MIN.	MAX.	MIN.	MAX.	
t <sub>WC</sub>	Write Cycle Time	450	—	650	—	ns
t <sub>AW</sub>	Address Setup Time	130	—	150	—	ns
t <sub>CW</sub>	CE <sub>2</sub> Setup Time	130	—	150	—	ns
t <sub>WP</sub>	Write Pulse Width	250	—	400	—	ns
t <sub>DS</sub>	Data Setup Time	250	—	400	—	ns
t <sub>DH</sub>	Data Hold Time	50	—	100	—	ns
t <sub>WR</sub>	Write Recovery Time	50	—	50	—	ns

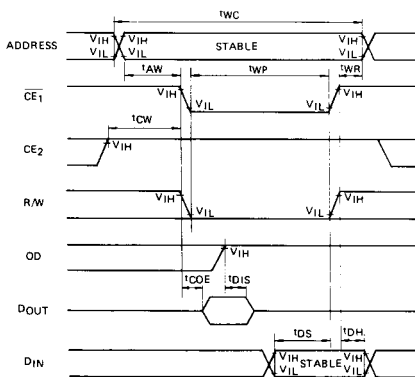
**A.C. TEST CONDITIONS**

- Output Load : 100 pF + 1 TTL Gate
- Input Pulse Levels : 0.45V, 2.4V
- Timing Measurement Reference Levels
  - Input : 0.65V, 2.2V
  - Output : 0.65V, 2.2V
- Input Pulse Rise and Fall Times : 10ns

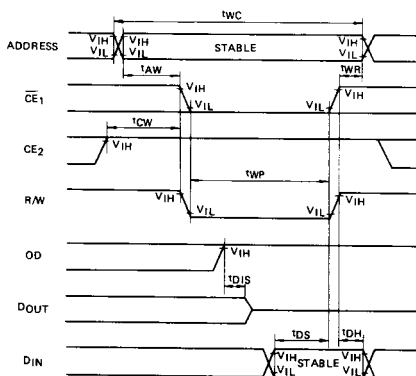
## Read Cycle



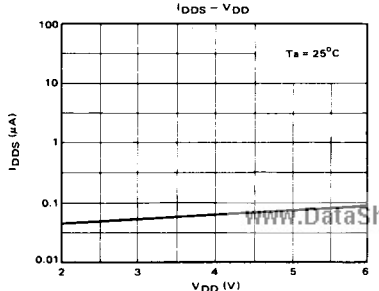
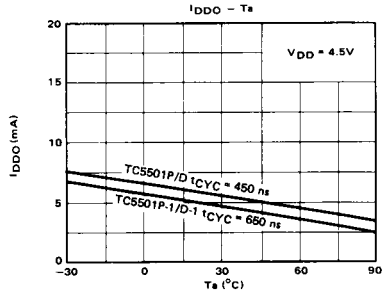
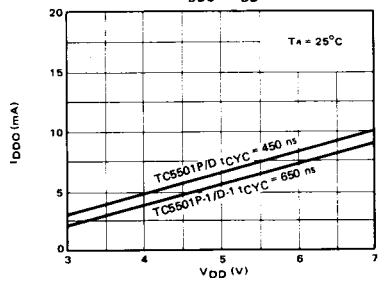
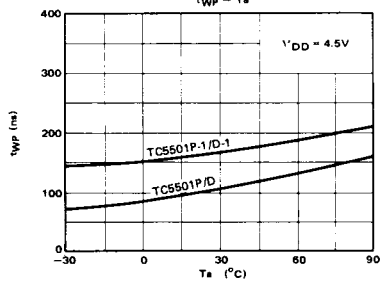
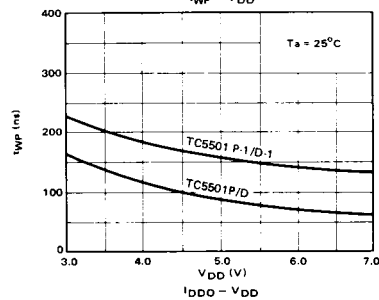
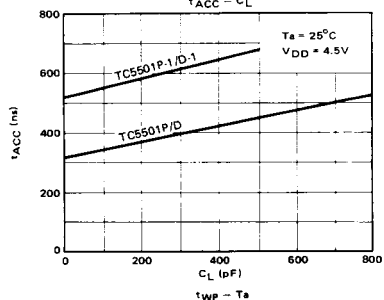
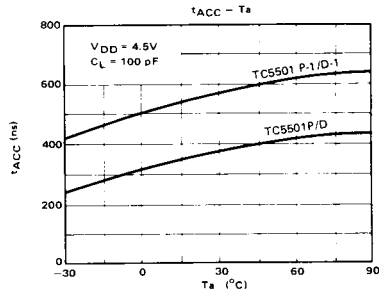
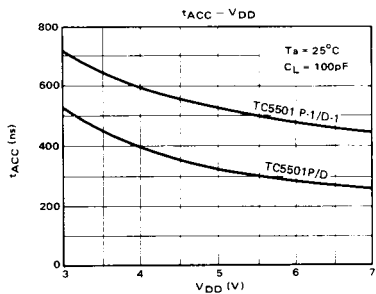
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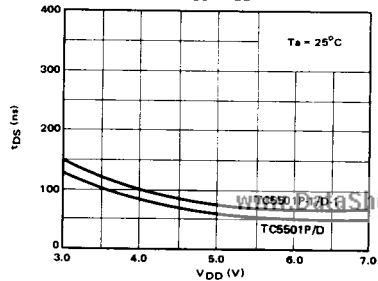
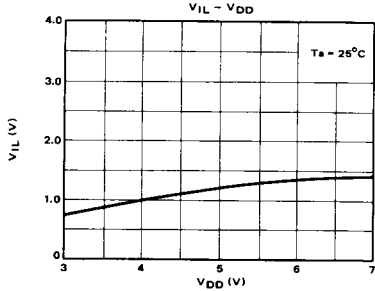
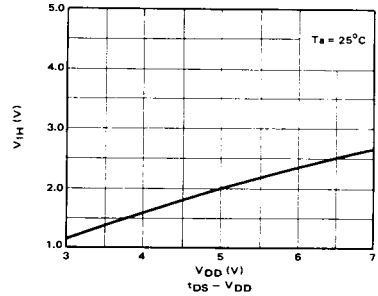
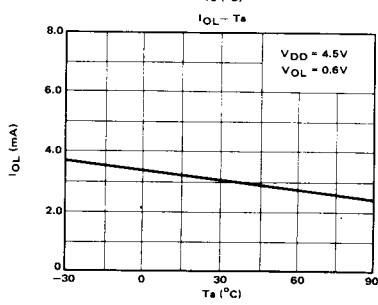
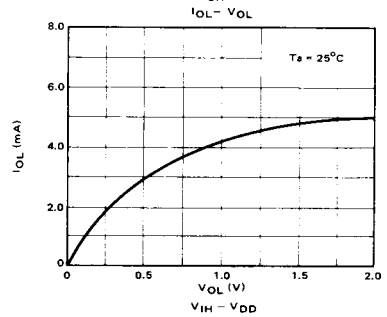
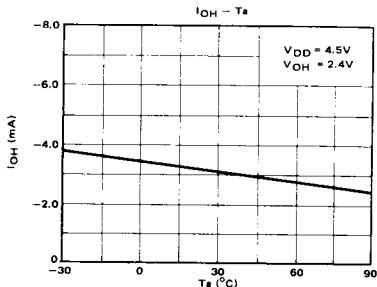
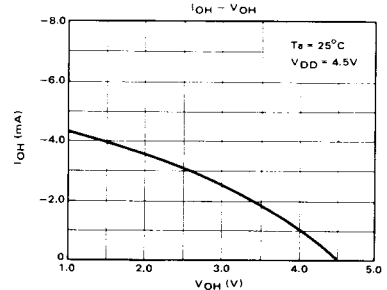
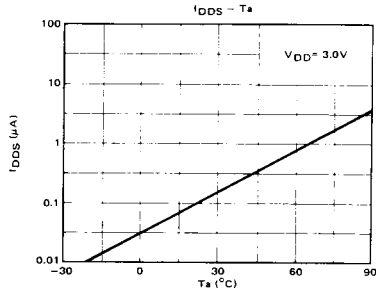


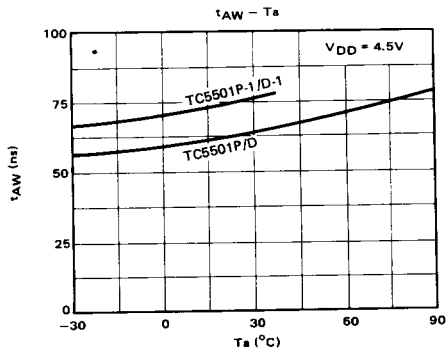
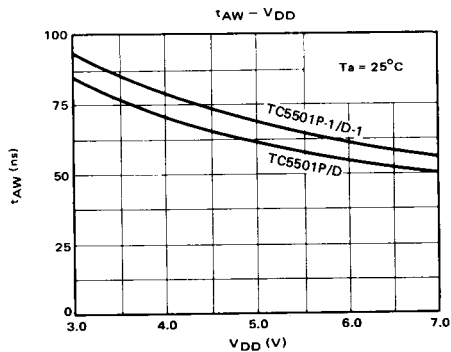
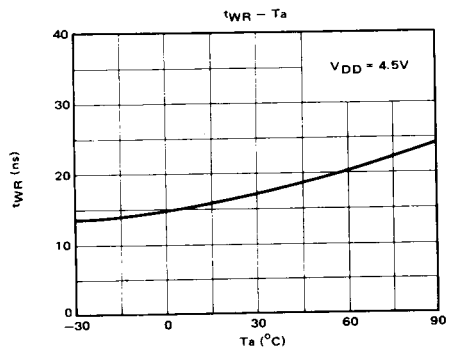
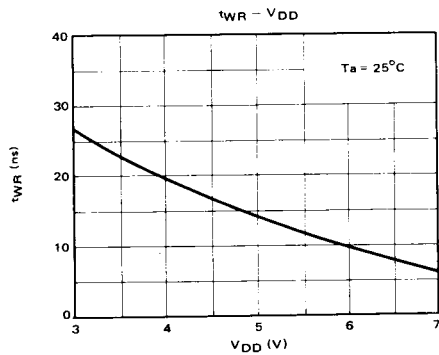
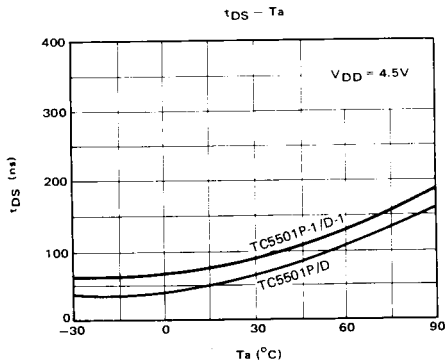
## Write Cycle 2



## TYPICAL CHARACTERISTICS

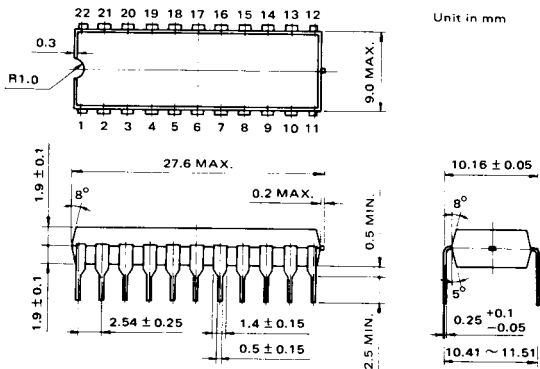




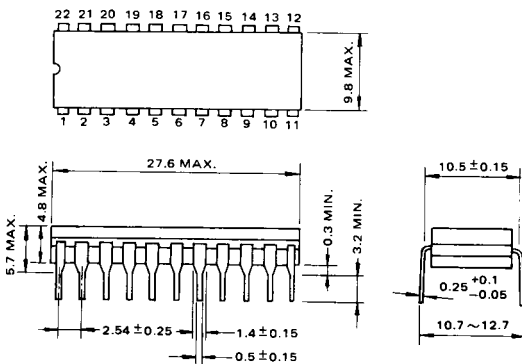


OUTLINE DRAWINGS

PLASTIC PACKAGE



CERDIP PACKAGE



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. 22 leads.

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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