TOSHIBA MOS MEMORY PRODUCT

8,192 WORD × 8 BIT CMOS STATIC RAM
SILICON GATE CMOS

TC5563APL-10, TC5563APL-12
TC5563APL-15

PRELIMINARY

DESCRIPTION

The TC5563APL is 65,536 bit static random access memory organized as 8,192 words by 8 bits using CMOS technology, and operates from a single 5V supply. Advanced circuit techniques provide both high speed and low power features with a maximum operating current of 5mA/MHz and maximum access time of 100ns/120ns/150ns.

When CE_2 is a logical low or $\overline{CE_1}$ is a logical high, the device is placed in low power standby mode in which standby current is 2μA typically. The TC5563APL has three control inputs. Two chip enables ($\overline{CE_1}$, CE_2) allow for device selection and data retention control, and an output enable input ($\overline{OE}$) provides fast memory access. Thus the TC5563APL is suitable for use in various microprocessor application systems where high speed, low power, and battery back up are required.

The TC5563APL also features pin compatibility with the 64k bit EPROM (TMM2764D). RAM and EPROM are then interchangeable in the same socket, resulting in flexibility in the definition of the quantity of RAM versus EPROM in microprocessor application systems.

The TC5563APL is offered in a dual-in-line 28 pin 0.3 inch width plastic package.

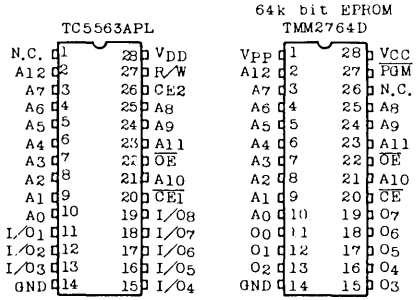
FEATURES

- Low Power Dissipation
  27.5mW/MHz (MAx.) Operating
- Standby Current : 100μA (Max.) Ta=70°C
- Access Time
  TC5563APL-10 : 100ns (Max.)
  TC5563APL-12 : 120ns (Max.)
  TC5563APL-15 : 150ns (Max.)
- 5V Single Power Supply
- Power Down Features : CE2, $\overline{CE1}$
- Fully Static Operation
- Data Retention Supply Voltage : 2.0~5.5V
- Directly TTL Compatible
  : All Inputs and Outputs
- Pin Compatible with 2764 type EPROM
- TC5565APL Family (Package Type)

Package Type	Device Name
600 mil DIP	*TC5565APL
300 mil DIP (Slim Package)	TC5563APL
Flat Package(SOP)	*TC5565AFL

*) See TC5565APL Technical Date.

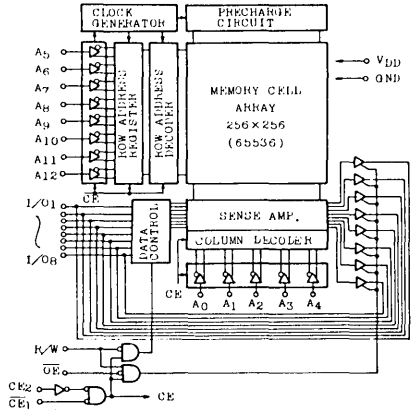
PIN CONNECTION (TOP VIEW)



PIN NAMES

A_0~A_{12}	Address Inputs
R/W	Read/Write Control Input
$\overline{OE}$	Output Enable Input
$\overline{CE_1}$, CE_2	Chip Enable Inputs
I/O_1~I/O_8	Data Input/Output
V_{DD}	Power (+5V)
GND	Ground
N. C.	No Connection

BLOCK DIAGRAM



TC5563APL-10, TC5563APL-12
TC5563APL-15

OPERATION MODE

OPERATION MODE	$\overline{CE_1}$	CE_2	$\overline{OE}$	R/W	$I/O_1 \sim I/O_8$	POWER
Read	L	H	L	H	D_{OUT}	I_{DDO}
Write	L	H	*	L	D_{IN}	I_{DDO}
Output Deselect	L	H	H	H	High-Z	I_{DDO}
Standby	H	*	*	*	High-Z	I_{DDS}
	*	L	*	*	High-Z	I_{DDS}

* : H or L

MAXIMUM RATINGS

SYMBOL	ITEM	RATING	UNIT
V_{DD}	Power Supply Voltage	−0.3~7.0	V
V_{IN}	Input Voltage	−0.3*~7.0	V
$V_{I/O}$	Input and Output Voltage	−0.5~V_{DD}+0.5	V
P_D	Power Dissipation	0.8	W
T_{SOLDER}	Soldering Temperature	260·10	°C·Sec
T_{STG}	Storage Temperature	−55~150	°C
T_{OPR}	Operating Temperature	0~70	°C

* : −3.0V at Pulse width 50ns

D. C RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP	MAX.	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.2	—	V_{DD}+0.3	V
V_{IL}	Input Low Voltage	−0.3*	—	0.8	V
V_{DH}	Data Retention Supply Voltage	2.0	—	5.5	V

* : −3.0V at Pulse width 50ns

D. C and OPERATING CHARACTERISTICS (Ta=0~70°C, V_{DD}=5V±10%)

SYMBOL	PARAMETER	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
I_{IL}	Input Leakage Current	V_{IN}=0~V_{DD}		—	—	±1.0	μA
I_{OH}	Output High Current	V_{OH}=2.4V		−1.0	—	—	mA
I_{OL}	Output Low Current	V_{OL}=0.4V		4.0	—	—	mA
I_{LO}	Output Leakage Current	$\overline{CE_1}$=V_{IH} or CE_2=V_{IL} or R/W=V_{IL} or $\overline{OE}$=V_{IH} V_{OUT}=0~V_{DD}		—	—	±1.0	μA
I_{DDO1}	Operating Current	V_{DD}=5.5V Iout=0mA $\overline{CE_1}$=V_{IL} CE_2=V_{IH} Other Input =V_{IH}/V_{IL}	t_{CYCLE}=1μs	—	—	10	mA
			t_{CYCLE}= Min. cycle	—	—	45	mA
I_{DDO2}	Operating Current	V_{DD}=5.5V $\overline{CE_1}$=0.2V CE_2=V_{DD}−0.2V Other Input Iout=0mA =V_{DD}−0.2V/0.2V	t_{CYCLE}=1μs	—	—	5	mA
			t_{CYCLE}= Min. cycle	—	—	40	mA
I_{DDS1}	Standby Current	$\overline{CE_1}$=V_{IH} or CE_2=V_{IL}		—	—	3	mA
*I_{DDS2}	Standby Current	$\overline{CE_1}$=V_{DD}−0.2V or CE_2=0.2V V_{DD}=2.0~5.5V		—	2	100	μA

* : In standby mode with $\overline{CE_1} \geqq V_{DD}-0.2V$, these specification limits are guaranteed under the condition of $CE_2 \geqq V_{DD}-0.2V$ or $CE_2 \leqq 0.2V$.

CAPACITANCE (Ta = 25°C)

SYMBOL	PARAMETER	TEST CONDITION	MAX.	UNIT
C_{IN}	Input Capacitance	V_{IN} = GND	10	pF
C_{OUT}	Output Capacitance	V_{OUT} = GND	10	pF

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

A. C. CHARACTERISTICS (Ta = 0 ~ 70°C, V_{DD} = 5V ± 10%)

Read Cycle

SYMBOL	PARAMETER	TC5563APL-10		TC5563APL-12		TC5563APL-15		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{RC}	Read Cycle Time	100	—	120	—	150	—	ns
t_{ACC}	Address Access Time	—	100	—	120	—	150	ns
t_{CO1}	$\overline{CE1}$ Access Time	—	100	—	120	—	150	ns
t_{CO2}	CE2 Access Time	—	100	—	120	—	150	ns
t_{OE}	Output Enable to Output Valid	—	50	—	60	—	70	ns
t_{COE}	Chip Enable ($\overline{CE1}$, CE2) to Output in Low-Z	10	—	10	—	15	—	ns
t_{OEE}	Output Enable to Output in Low-Z	5	—	5	—	5	—	ns
t_{OD}	Chip Enable ($\overline{CE1}$, CE2) to Output in High-Z	—	35	—	40	—	50	ns
t_{ODO}	Output Enable to Output in High-Z	—	35	—	40	—	50	ns
t_{OH}	Output Data Hold Time	20	—	20	—	20	—	ns

Write Cycle

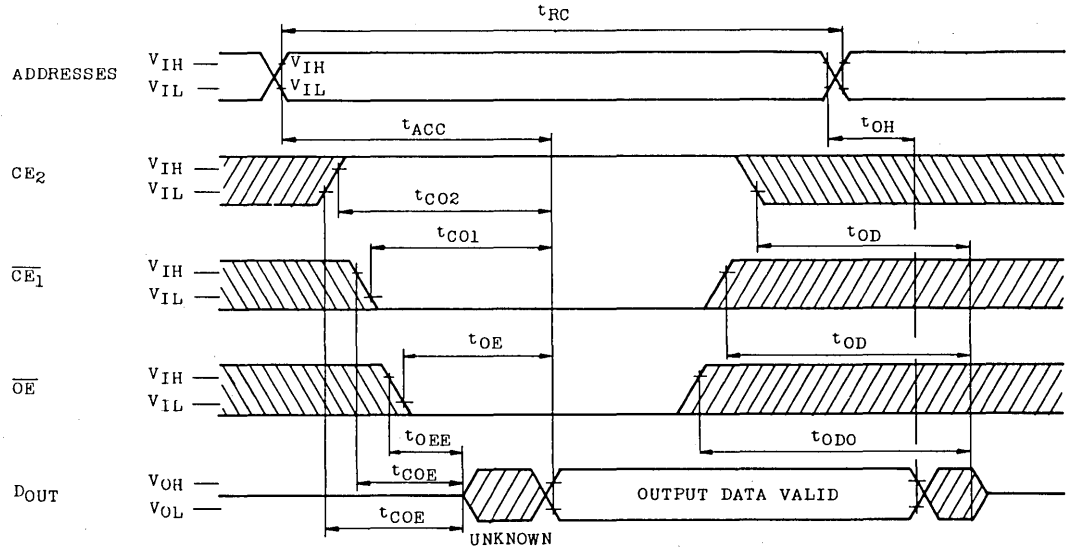
SYMBOL	PARAMETER	TC5563APL-10		TC5563APL-12		TC5563APL-15		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{WC}	Write Cycle Time	100	—	120	—	150	—	ns
t_{WP}	Write Pulse Width	60	—	70	—	90	—	ns
t_{CW}	Chip Selection to End of Write	80	—	85	—	100	—	ns
t_{AS}	Address Set up Time	0	—	0	—	0	—	ns
t_{WR}	Write Recovery Time	0	—	0	—	0	—	ns
t_{ODW}	R/W to Output in High-Z	—	35	—	40	—	50	ns
t_{OEW}	R/W to Output in Low-Z	5	—	5	—	10	—	ns
t_{DS}	Data Set Up Time	40	—	50	—	60	—	ns
t_{DH}	Data Hold Time	0	—	0	—	0	—	ns

A. C. TEST CONDITIONS

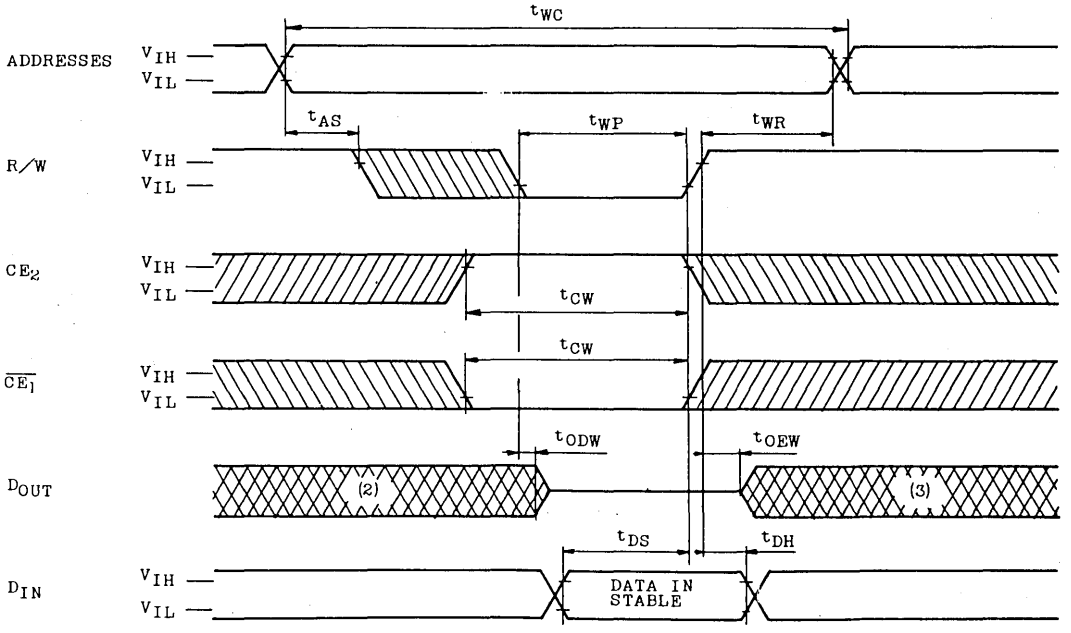
Output Load		: 100pF + 1 TTL Gate
Input Pulse Level		: 0.6V, 2.4V
Timing Measurement	V_{IN}	: 0.8V, 2.2V
Reference Level	V_{OUT}	: 0.8V, 2.2V
		: 5ns

TIMING WAVEFORMS

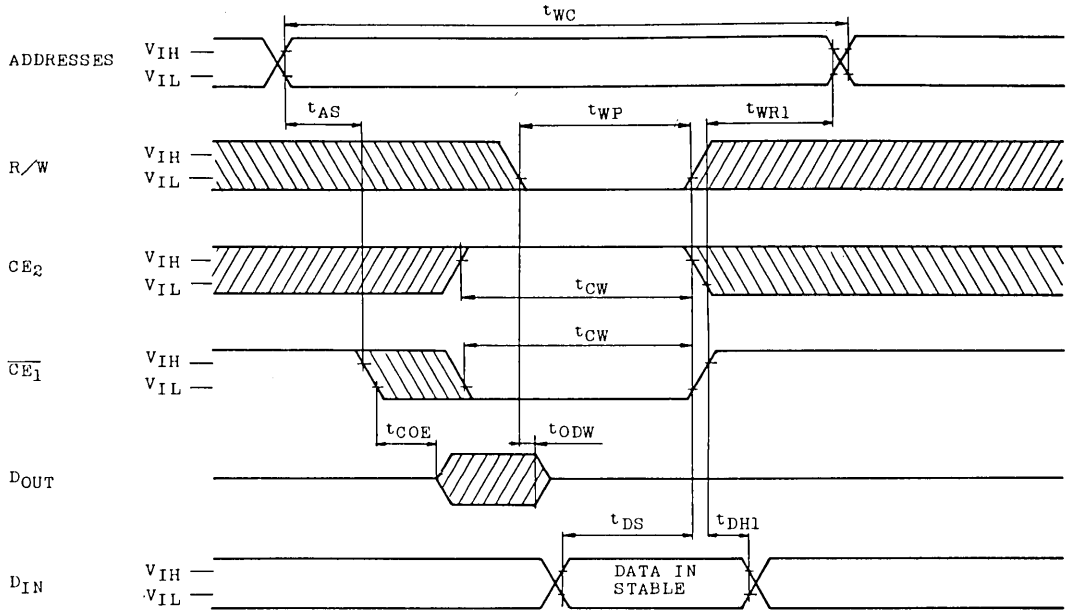
- READ CYCLE (1)



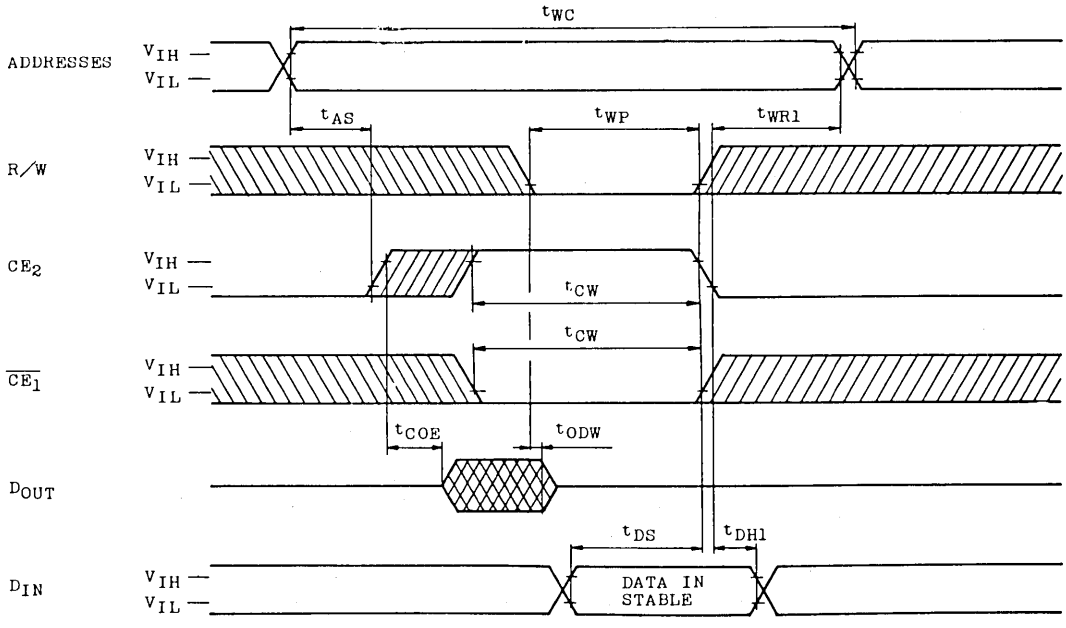
- WRITE CYCLE 1 (4) (R/W Controlled Write)



- WRITE CYCLE 2 (4) ($\overline{CE1}$ Controlled Write)



- WRITE CYCLE 3 (4) (CE2 Controlled Write)



Note :

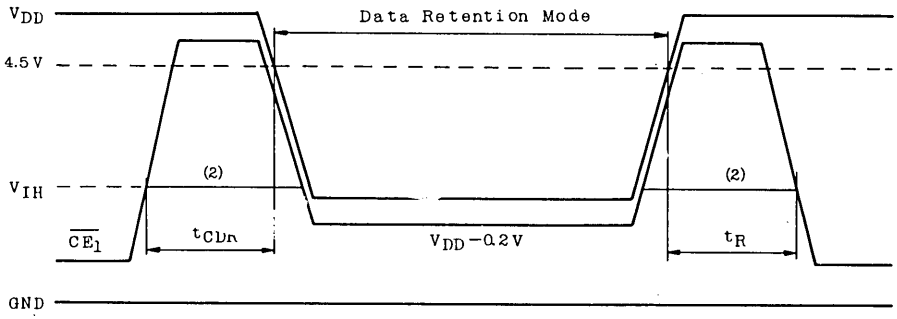
1. R/W is High for Read cycle,
2. Assuming that $\overline{CE_1}$ low transition of CE_2 High transition occurs coincident with or after R/W Low transition, Outputs remain in a high impedance state.
3. Assuming that $\overline{CE_1}$ High transition or CE_2 Low transition occurs coincident with or prior to R/W High transition Outputs remain in a high impedance state.
4. Assuming that $\overline{OE}$ is High for Write Cycle, Outputs are in high impedance state during this period

DATA RETENTION CHARACTERISTICS (Ta=0~70°C)

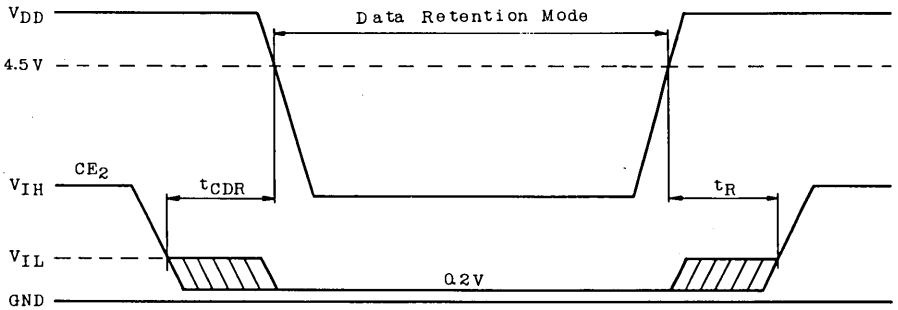
SYMBOL	PARAMETER		MIN.	TYP.	MAX.	UNIT
V_{DH}	Data Retention Supply Voltage		2.0	—	5.5	V
I_{DDS2}	Standby Supply Current	V_{DD}=3.0V	—	—	50	μA
		V_{DD}=5.5V	—	—	100	μA
t_{CDR}	Chip Deselection to Data Retntion Mode		0	—	—	μs
t_R	Recovery Time		t_{RC}*	—	—	ns

* : Read cycle time.

● $\overline{CE1}$ Controlled Data Retention Mode (1)



● CE2 Controlled Data Retention Mode (3)



Note :

1. In $\overline{CE_1}$ controlled data retention mode, minimum standby current mode is achieved under the condition of $CE_2 \leqq 0.2V$ or $CE_2 \geqq V_{DD} - 0.2V$.
2. If the V_{IH} of $\overline{CE_1}$ is 2.2V in operation, I_{DDS_1} current flows during the period that the V_{DD} voltage is going down from 4.5V to 2.4V.
3. In CE_2 controlled data retention mode, minimum standby current mode is achieved under the condition of $CE_2 \leqq 0.2V$.

DEVICE INFORMATION

The TC5563APL is an asynchronous RAM using address activated circuit technology, thus the internal operation is synchronous. Then once row address change occur, the precharge operation is executed by internal pulse generated from row address transient. Therefore the peak current flows only after row address change, as shown in the following figure.

This peak current may induce the noise on V_{DD}/GND lines. Thus the use of about 0.1μF. decoupling capacitor for every device is recommended to eliminate such noise.

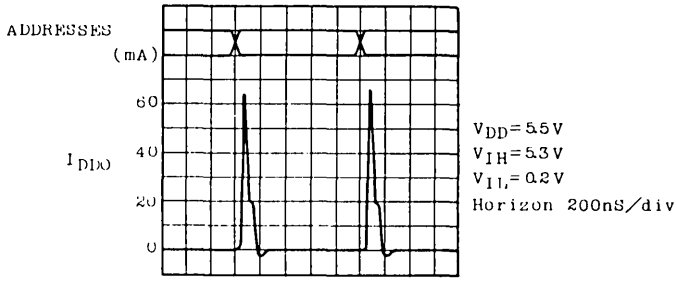
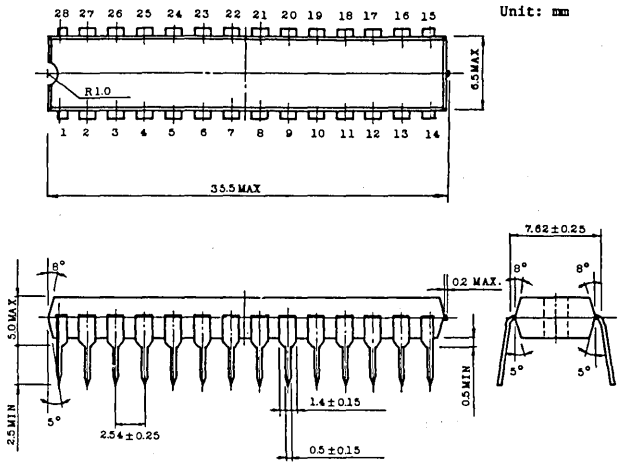


Fig. TYPICAL CURRENT WAVEFORMS

OUTLINE DRAWINGS

- DIP 28 PIN OUTLINE DRAWING (6D28A-P)



Note : Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.1 and No.28 leads.