TOSHIBA MOS MEMORY PRODUCTS

TC55256PL-10/PL-12/PL-15
TC55256FL-10/FL-12/FL-15

DESCRIPTION

The TC55256PL/FL is 262,144 bit static random access memory organized as 32,768 words by 8 bits using CMOS technology, and operated from a single 5V supply. Advanced circuit techniques provide both high speed and low power features with a operating current of 5mA/MHz(TYP.) and minimum cycle time of 100ns. When $\overline{CE}$ is a logical high, the device is placed in low power standby mode in which standby current is 0.01μA typically. The TC55256PL/FL has two control inputs. Chip enable ($\overline{CE}$) allow for device selection and data retention control, and an output enable input ($\overline{OE}$) provides fast memory access. Thus the TC55256PL/FL is suitable for use in various microprocessor application systems where high speed, low power, and battery back up are required. Ultra low standby power allow not only battery but capacitance backup. The TC55256PL/FL is offered in both a standard dual-in-line 28 pin plastic package (0.6 inch width) and small-out-line plastic flat package.

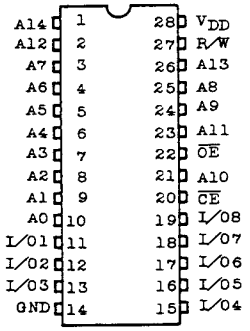
FEATURES

- Low Power Dissipation
  27.5mW/MHz(TYP.) Operating
- Standby Current
  0.2μA(MAX.) at Ta=25°C
  1.0μA(MAX.) at Ta=60°C
  10.0μA(MAX.) at Ta=85°C
- 5V Single Power Supply
- Fully Static Operation
- Data Retention Supply Voltage: 2.0∿5.5V
- Access Time

	TC55256PL -10/FL-10	TC55256PL -12/FL-12	TC55256PL -15/FL-15
Access Time (Max.)	100ns	120ns	150ns
Chip Enable Access Time (Max.)	100ns	120ns	150ns
Output Enable Time(Max.)	50ns	60ns	70ns

- Directly TTL Compatible: All Inputs and Outputs
- Plastic DIP and Plastic Flat Package
- Wide Temperature Operation: -40∿85°C

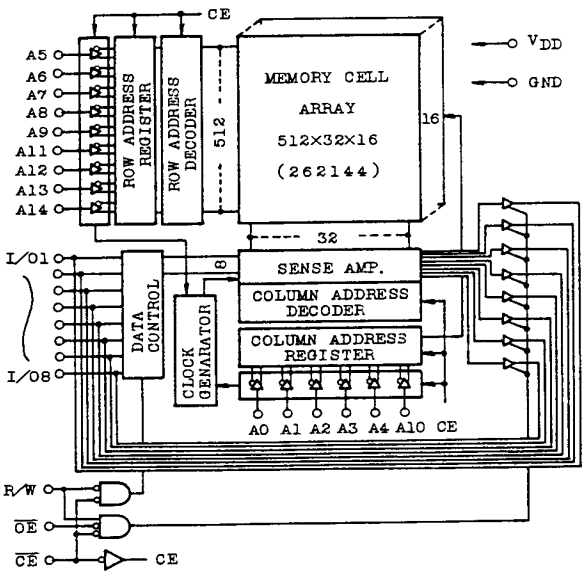
PIN CONNECTION (TOP VIEW)



PIN NAMES

A0∿A14	Address Inputs
R/W	Read/Write Control Input
$\overline{OE}$	Output Enable Input
$\overline{CE}$	Chip Enable Input
I/O1∿I/O8	Data Input/Output
V_{DD}	Power (+5V)
GND	Ground

BLOCK DIAGRAM



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OPERATION MODE

OPERATION MODE	$\overline{CE}$	$\overline{OE}$	R/W	I/O1 ∿ I/O8	POWER
Read	L	L	H	D_{OUT}	I_{DDO}
Write	L	*	L	D_{IN}	I_{DDO}
Output Deselect	L	H	H	High-Z	I_{DDO}
Standby	H	*	*	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	1.0 (0.6)**	W
T_{solder}	Soldering Temperature	260 · 10	°C·sec
T_{strg}	Storage Temperature	-55 ∿ 150	°C
T_{opr}	Operaring Temperature	-40 ∿ 85	°C

*) -3.0V at pulse width 50ns
**) SOP

D.C. RECOMMENDED OPERATING CONDITIONS (Ta=-40 ∿ 85°C)

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

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D.C. and OPERATING CHARACTERISTICS (Ta=-40 ∿ 85°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
V_{OH}	Output High Voltage	I_{OH}=-20μA		V_{DD} -0.1	-	-	V
V_{OL}	Output Low Voltage	I_{OL}=20μA		-	-	0.1	V
I_{LO}	Output Leakage Current	$\overline{CE}$=V_{IH} or R/W=V_{IL} or $\overline{OE}$=V_{IH} V_{OUT}=0 ∿ V_{DD}		-	-	±1.0	μA
I_{DDO1}	Operating Current (Read Cycle)*	V_{DD}=5.5V, $\overline{CE}$=V_{IL}, R/W=V_{IH} Other Input= V_{IH}/V_{IL}, I_{OUT}=0mA	t_{cycle}=1μs	-	10	-	mA
			t_{cycle}= Min. cycle	-	-	70	
I_{DDO2}		V_{DD}=5.5V, $\overline{CE}$=0.2V, R/W=V_{DD}-0.2V Other Input= V_{DD}-0.2V/0.2V I_{OUT}=0mA	t_{cycle}=1μs	-	5	-	mA
			t_{cycle}= Min. cycle	-	-	60	
I_{DDS1}	Standby Current	$\overline{CE}$=V_{IH}		-	-	3	mA
I_{DDS2}	Standby Current	$\overline{CE}$=V_{DD}-0.2V V_{DD}=2.0 ∿ 5.5V	Ta=25°C	-	0.01	0.2	μA
			Ta=60°C	-	-	1.0	
			Ta=85°C	-	-	10.0	

* Assuming that R/W is Low for Write Cycle, the current consumption is twice as much as that when R/W is high for Write Cycle.

CAPACITANCE (Ta=25°C, f=1MHz)

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

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

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A.C. CHARACTERISTICS

(Ta=−40 ∿ 85°C, V_{DD}=5V±10%)

READ CYCLE

SYMBOL	PARAMETER	TC55256PL -10/FL-10		TC55256PL -12/FL-12		TC55256PL -15/FL-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	
t_{CO}	$\overline{CE}$ Access Time	–	100	–	120	–	150	
t_{OE}	Output Enable to Output in Valid	–	50	–	60	–	70	
t_{COE}	Chip Enable ($\overline{CE}$) to Output in Low-Z	5	–	5	–	5	–	
t_{OEE}	Output Enable to Output in Low-Z	0	–	0	–	0	–	
t_{OD}	Chip Enable ($\overline{CE}$) to Output in High-Z	–	50	–	60	–	70	
t_{ODO}	Output Enable to Output in High-Z	–	40	–	50	–	60	
t_{OH}	Output Data Hold Time	10	–	10	–	15	–	

WRITE CYCLE

SYMBOL	PARAMETER	TC55256PL -10/FL-10		TC55256PL -12/FL-12		TC55256PL -15/FL-15		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{WC}	Write Cycle Time	100	–	120	–	150	–	ns
t_{WP}	Write Pulse Width	70	–	80	–	100	–	
t_{CW}	Chip Selection to End of Write	90	–	100	–	120	–	
t_{AS}	Address Set Up Time	0	–	0	–	0	–	
t_{WR}	Write Recovery Time	0	–	0	–	0	–	
t_{ODW}	R/W to Output High-Z	–	50	–	60	–	70	
t_{OEW}	R/W to Output Low-Z	5	–	5	–	5	–	
t_{DS}	Data Set Up Time	40	–	50	–	60	–	
t_{DH}	Data Hold Time	0	–	0	–	0	–	

AC TEST CONDITION

- Input Pulse Levels : 2.4V/0.6V
- Timing Measurement Reference Levels: 2.2V/0.8V
- Output Reference Levels : 2.2V/0.8V
- Input Pulse Rise and Fall Time : 5ns
- Output Load : 100pF + 1TTL Gate

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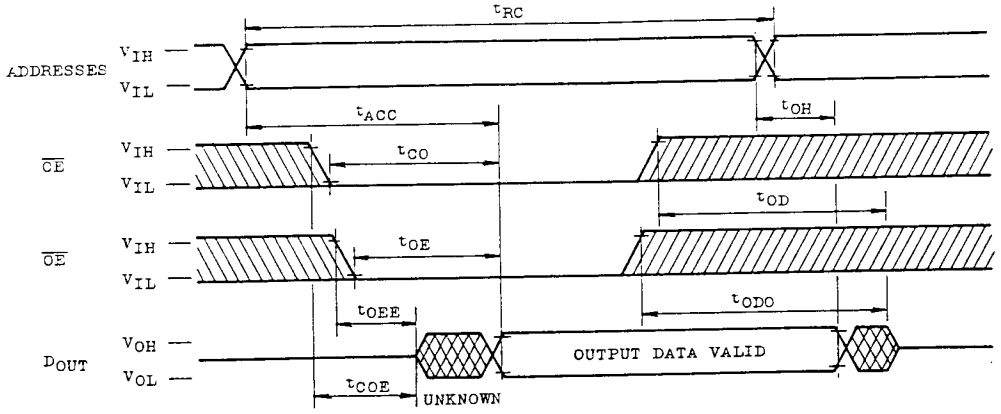
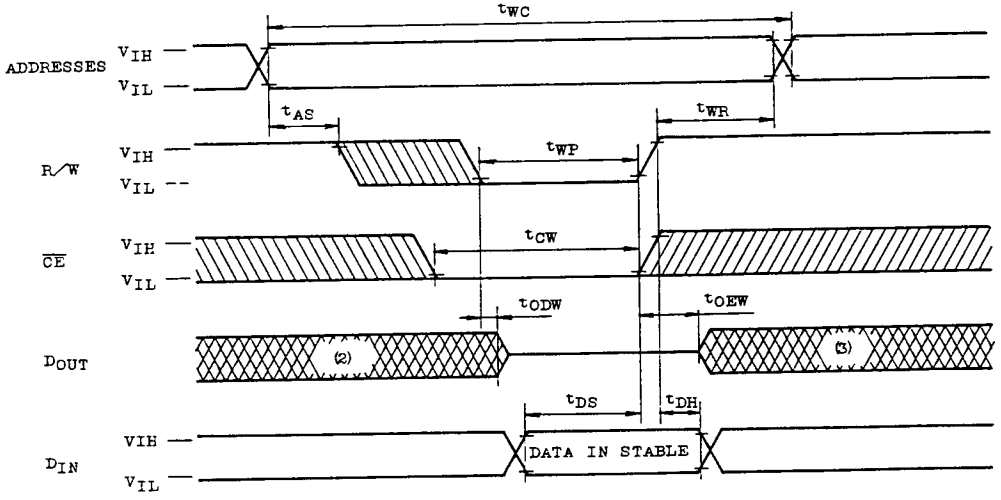
TIMING WAVEFORMS

READ CYCLE (1)



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



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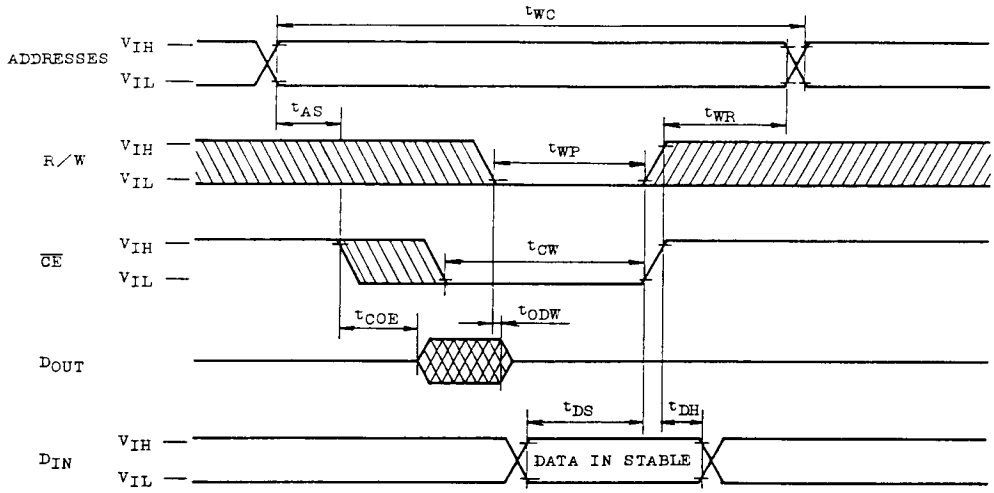
WRITE CYCLE 2 (4) ($\overline{CE}$ Controlled Write)



Note: 1. R/W is High for Read Cycle.

2. Assuming that $\overline{CE}$ low transition occurs coincident with or after R/W Low transition, Outputs remain in a high impedance state.

3. Assuming that $\overline{CE}$ High 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.

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3V OPERATE SPECIFICATION

D.C. RECOMMENDED OPERATING CONDITIONS (Ta=-10 ∿ 60°C)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DD}	Power Supply Voltage	2.7	3.0	3.3	V
V_{IH}	Input High Voltage	V_{DD}-0.2	-	V_{DD}	V
V_{IL}	Input Low Voltage	0	-	0.2	V

D.C. and OPERATING CHARACTERISTICS (Ta=-10 ∿ 60°C)

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
I_{IN}	Input Leakage Current	V_{IN}=0 ∿ V_{DD}		-	-	±1.0	μA
I_{LO}	Output Leakage Current	$\overline{CE}$=V_{IH} or R/W=V_{IL} or $\overline{OE}$=V_{IH}, V_{OUT}=0 ∿ V_{DD}		-	-	±1.0	μA
I_{OH}	Output High Current	V_{OH}=V_{DD}-0.2V		-100	-	-	μA
I_{OL}	Output Low Current	V_{OL}=0.2V		100	-	-	μA
V_{OH}	Output High Voltage	I_{OH}=-20μA		V_{DD}-0.1	-	-	V
V_{OL}	Output Low Voltage	I_{OL}=20μA		-	-	0.1	V
I_{DDO}*	Operating Current	$\overline{CE}$=V_{IL} Other input= V_{DD}-0.2V/0.2V I_{OUT}=0mA, duty 100%	t_{cycle} =1μs	-	3.0	5.0	mA
I_{DDS}	Standby Current	$\overline{CE}$=V_{IH}	Ta=25°C	-	0.01	0.2	μA
			Ta=60°C	-	-	1.0	

All voltage is measured from GND.

* I_{DDO} is slightly depending on input pulse t_r, t_f. If long t_r, t_f pulse is applied, there are some transient current at input stage. These specification is guaranteed with t_r, $t_f \leqq$ 20ns.

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3V OPERATE SPECIFICATION

A.C. CHARACTERISTICS (Ta=-10 ∿ 60°C, V_{DD}=3V±10%)

READ CYCLE

SYMBOL	PARAMETER	MIN.	TYP.*	MAX.	UNIT
t_{RC}	Read Cycle Time	1000	-	-	ns
t_{ACC}	Address Access Time	-	300	1000	
t_{CO}	CE Access Time	-	300	1000	
t_{OE}	Output Enable to Output Valid	-	150	500	
t_{OH}	Output Data Hold Time	20	-	-	
t_{COE}	Chip Enable to Output in Low Z	10	-	-	
t_{OEE}	Output Enable to Output in Low Z	5	-	-	
t_{OD}	Chip Enable to Output in High Z	-	-	200	
t_{ODO}	Output Enable to Output in High Z	-	-	150	

WRITE CYCLE

SYMBOL	PARAMETER	MIN.	TYP.*	MAX.	UNIT
t_{WC}	Write Cycle Time	1000	-	-	ns
t_{WP}	Write Pulse Width	500	-	-	
t_{CW}	Chip Selection to End of Write	800	-	-	
t_{AS}	Address Set Up Time	100	-	-	
t_{WR}	Write Recovery Time	100	-	-	
t_{DS}	Data Set Up Time	400	-	-	
t_{DH}	Data Hold Time	50	-	-	
t_{ODW}	R/W to Output High Z	-	-	200	
t_{OEW}	R/W to Output Low Z	10	-	-	

* Type. condition is Ta=25°C, V_{DD}=3V

A.C. TEST CONDITIONS

- V_{IN}=V_{DD}-0.2V/0.2V
- Output Reference Level : 1.5V/1.5V
- Timing Measurement Level : 1.5V/1.5V
- Input Pulse Rise and Fall Time: ≦20ns
- Output Load : 100pF (Include Jig)

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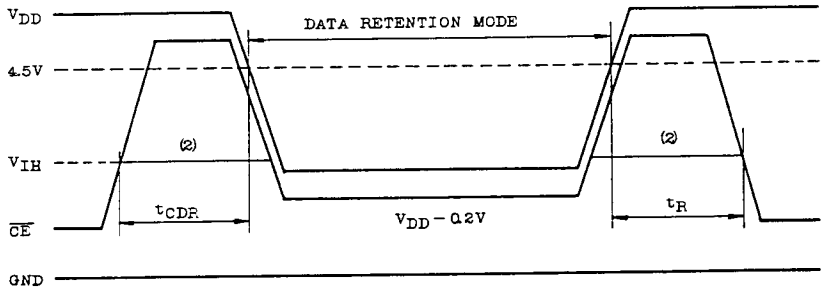
DATA RETENTION CHARACTERISTICS (Ta=-40 ~ 85°C)

SYMBOL	PARAMETER		MIN.	TYP.	MAX.	UNIT
V_{DH}	Data Retention Supply Voltage		2.0	-	5.5	V
I_{DDS2}	Standby Supply Current	Ta=25°C	-	0.01	0.2	μA
		Ta=60°C	-	-	1.0	
		Ta=85°C	-	-	10.0	
t_{CDR}	Chip Deselection to Data Retention Mode		0	-	-	μS
t_R	Recovery Time		t_{RC}(1)	-	-	

Note: (1) Read cycle time.

(2) If the V_{IH} of $\overline{CE}$ is 2.2V in operation, I_{DDS1} current flows during the period that the V_{DD} voltage is going down from 4.5V to 2.4V.

$\overline{CE}$ Controlled Data Retention Mode



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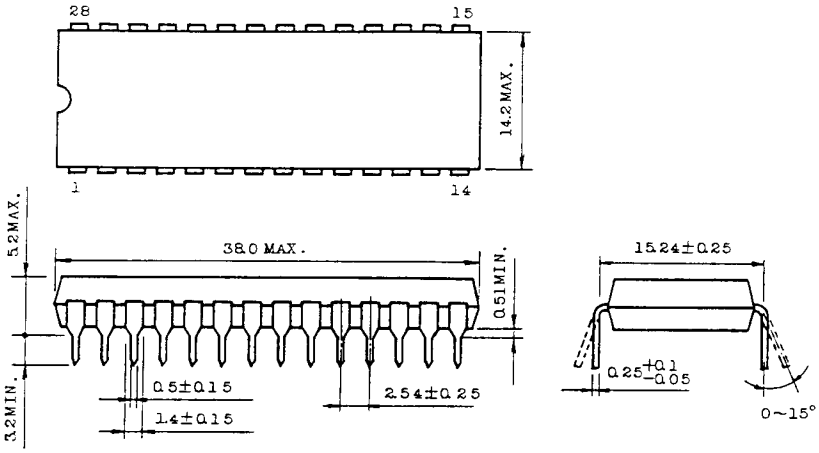
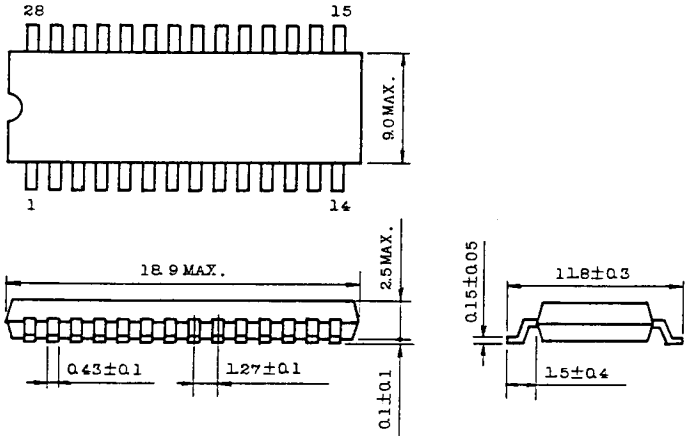
DIP 28 PIN OUTLINE DRAWING (DIP28-P-600)

Unit in mm



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.

SOP 28 PIN OUTLINE DRAWING (SOP28-P-450)



Note: Lead pitch is 1.27 and tolerance is ±0.12 against theoretical center of each lead that is obtained on the basis of No.1 and No.28 leads.

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