TC5565APL/AFL-10L,-12L,-15L

8,192 WORD 8 BIT CMOS STATIC RAM

DESCRIPTION

The TC5565APL/AFL 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 0.6μA typically. The TC5565APL/AFL has three control inputs. Two chip enable ($\overline{CE}_1$, CE_2) allow for device selection and data retention control, and an output enable input ($\overline{OE}$) provides fast memory access. Thus the TC5565APL/AFL is suitable for use in various microprocessor application systems where high speed, low power, and battery back up are required.

The TC5565APL 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 TC5565APL is offered in a dual-in-line 28 pin standard plastic package. The TC5565AFL is offered in 28 pin mini Flat Package.

FEATURES

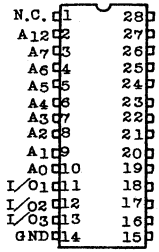
- Low Power Dissipation
  27.5mW/MHz(Max.) Operating
- Standby Current: 1μA(Max.) Ta=25°C
- Access Time
  TC5565APL/AFL-10L: 100ns(Max.)
  TC5565APL/AFL-12L: 120ns(Max.)
  TC5565APL/AFL-15L: 150ns(Max.)
- 5V Single Power Supply
- Power Down Features: CE_2, $\overline{CE}_1$
- Fully Static Operation
- 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	DIP28-P-600
300 mil DIP (Slim Package)	*TC5563APL	DIP28-P-300B
Flat Package (SOP)	TC5565AFL	SOP28-P-450

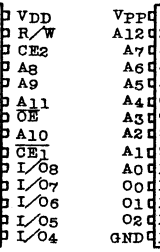
*: See TC5563APL Technical Data.

PIN CONNECTION (TOP VIEW)

TC5565APL/AFL



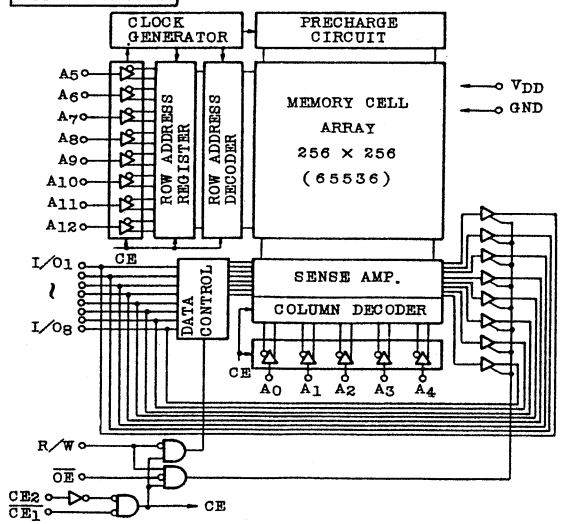
64k bit EPROM TMM2764D



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



OPERATION MODE

OPERATION MODE	$\overline{CE}_1$	CE_2	$\overline{OE}$	R/W	I/O_1-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	1.0/0.6**	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 MAX.

**: Flat package

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 MAX.

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	$\overline{CE1}$=V_{IH} or CE2=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 $\overline{CE1}$=V_{IL} CE2=V_{IH} Other input= V_{IH}/V_{IL} I_{OUT}=0mA	t_{cycle}=1.0μs		-	-	10	mA
			TC5565APL-10L TC5565AFL-10L	t_{cycle} =100ns	-	-	45	mA
			TC5565APL-12L TC5565AFL-12L	t_{cycle} =120ns	-	-	40	mA
			TC5565APL-15L TC5565AFL-15L	t_{cycle} =150ns	-	-	35	mA
I_{DDO2}		V_{DD}=5.5V $\overline{CE1}$=0.2V CE2=V_{DD}-0.2V Other input= V_{DD}-0.2V/0.2V I_{OUT}=0mA	t_{cycle}=1.0μs		-	-	5	mA
			TC5565APL-10L TC5565AFL-10L	t_{cycle} =100ns	-	-	40	mA
			TC5565APL-12L TC5565AFL-12L	t_{cycle} =120ns	-	-	35	mA
			TC5565APL-15L TC5565AFL-15L	t_{cycle} =150ns	-	-	30	mA
I_{DDS1}	Standby Current	$\overline{CE1}$=V_{IH} or CE2=V_{IL}			-	-	3	mA
* I_{DDS2}	Standby Current	$\overline{CE1}$=V_{DD}-0.2V or CE2=0.2V		Ta=25°C	-	0.6	1.0	μA
				Ta=0 ∿ 70°C	-	-	30	

*: In standby mode with $\overline{CE1} \geqq V_{DD}$-0.2V, these specification limits are guaranteed under the condition of CE2 ≧ V_{DD}-0.2V or CE2 ≦ 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	

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

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

READ CYCLE

SYMBOL	PARAMETER	TC5565APL-10L TC5565AFL-10L		TC5565APL-12L TC5565AFL-12L		TC5565APL-15L TC5565AFL-15L		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_{CO1}	$\overline{CE}_1$ Access Time	-	100	-	120	-	150	
t_{CO2}	CE_2 Access Time	-	100	-	120	-	150	
t_{OE}	Output Enable to Output Valid	-	50	-	60	-	70	
t_{COE}	Chip Enable ($\overline{CE}_1$, CE_2) to Output in Low-Z	10	-	10	-	15	-	
t_{OEE}	Output Enable to Output in Low-Z	5	-	5	-	5	-	
t_{OD}	Chip Enable ($\overline{CE}_1$, CE_2) to Output in High-Z	-	35	-	40	-	50	
t_{ODO}	Output Enable to Output in High-Z	-	35	-	40	-	50	
t_{OH}	Output Data Hold Time	20	-	20	-	20	-	

WRITE CYCLE

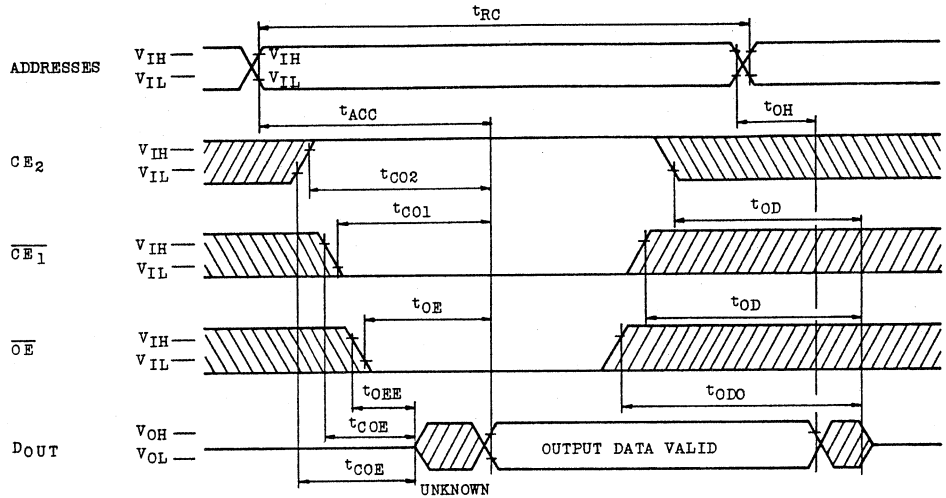
SYMBOL	PARAMETER	TC5565APL-10L TC5565AFL-10L		TC5565APL-12L TC5565AFL-12L		TC5565APL-15L TC5565AFL-15L		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{WC}	Write Cycle Time	100	-	120	-	150	-	ns
t_{WP}	Write Pulse Width	60	-	70	-	90	-	
t_{CW}	Chip Selection to End of Write	80	-	85	-	100	-	
t_{AS}	Address Set up Time	0	-	0	-	0	-	
t_{WR}	Write Recovery Time	0	-	0	-	0	-	
t_{ODW}	R/W to Output High-Z	-	35	-	40	-	50	
t_{OEW}	R/W to Output Low-Z	5	-	5	-	10	-	
t_{DS}	Data Set up Time	40	-	50	-	60	-	
t_{DH}	Data Hold Time	0	-	0	-	0	-	

A.C. TEST CONDITION

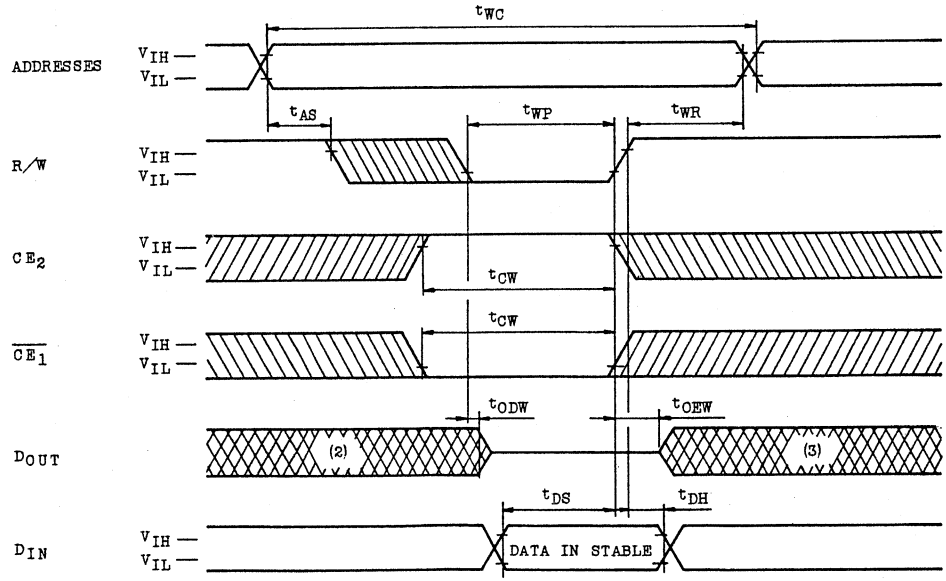
Output Load		: 100pF + 1 TTL Gate
Input Pulse Level		: 0.6V, 2.4V
Timing Measurement	V_{IN}	: 0.8V, 2.2V
Reference Level	V_{OUT}	: 0.8V, 2.2V
t_r, t_f		: 5ns

TIMING WAVEFORMS

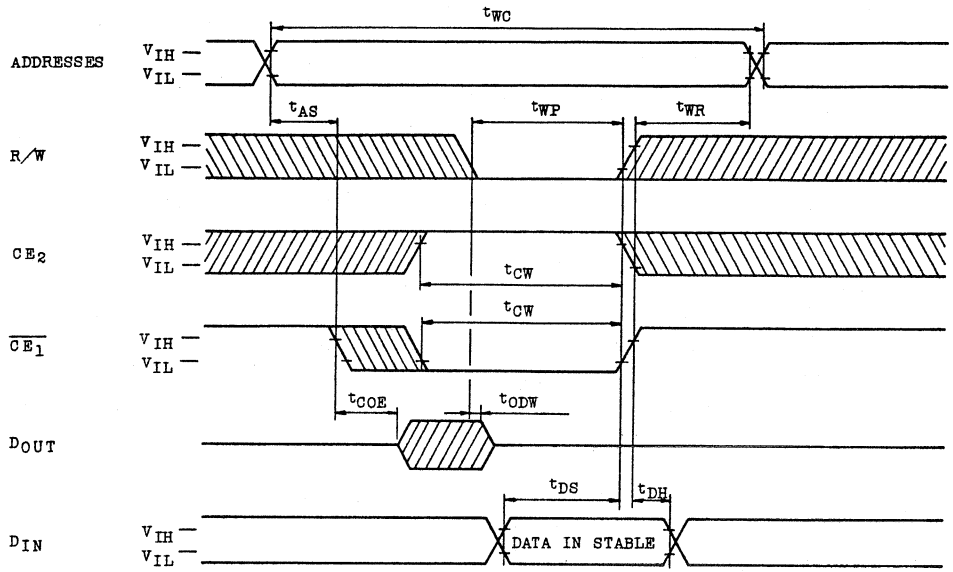
READ CYCLE (1)



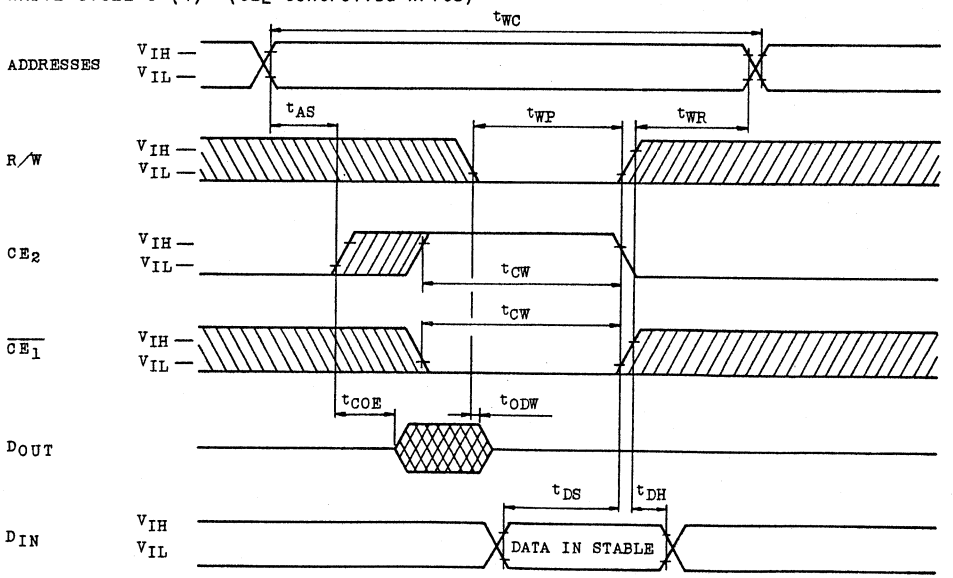
WRITE CYCLE 1 (4) (R/W Controlled Write)



WRITE CYCLE 2 (4) ($\overline{CE}_1$ Controlled Write)



WRITE CYCLE 3 (4) (CE_2 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.

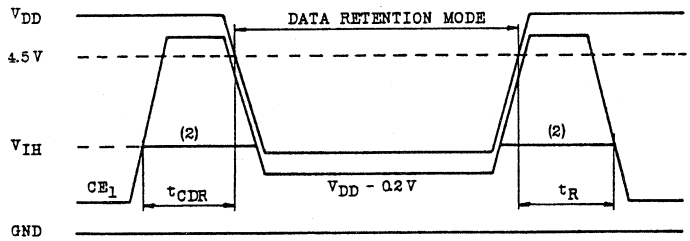
4. Assuming that $\overline{OE}$ is High for Write Cycle, Outputs are in high impedance state during this period.

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

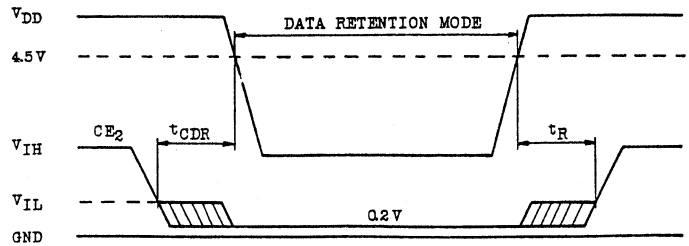
SYMBOL	PARAMETER		MIN.	TYP.	MAX.	UNIT
V_{DH}	Data Retention Supply Voltage		2.0	-	5.5	V
I_{DDS2}	Stand by Supply Current	V_{DD}=3.0V	-	-	15	µA
		V_{DD}=5.5V	-	-	30	
t_{CDR}	Chip Deselection to Data Retention Mode		0	-	-	µs
t_R	Recovery Time		t_{RC} *	-	-	µs

*: Read cycle time.

$\overline{CE}_1$ Controlled Dara Retention Mode (1)



CE_2 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 $CE_2 \leq 0.2V$ or $CE_2 \geq V_{DD}-0.2V$.

2 : If the V_{IH} of $\overline{CE}_1$ 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.

3 : In CE_2 controlled data retention mode, minimum standby current mode is achieved under the condition of $CE_2 \leq 0.2V$.

DEVICE INFORMATION

The TC5565APL/AFL is an asynchronous RAM using address activated citcuit 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.

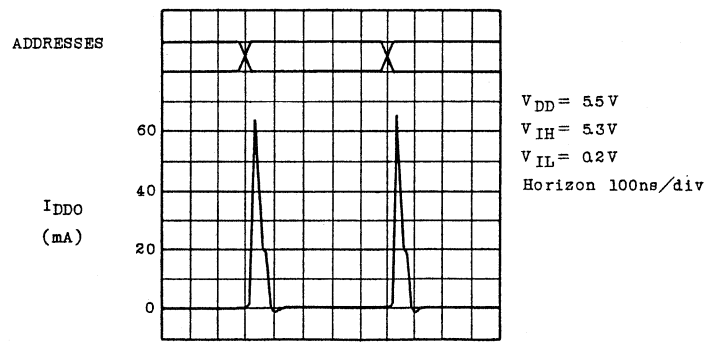


Fig.TYPICAL CURRENT WAVEFORMS

TOSHIBA

DATA BOOK

MOS MEMORY

(VRAM, SRAM)

1991

INTRODUCTION

We continually venture at the leading edge of technology so that we may develop and offer to you a diverse array of semiconductor memory products which may be used in many commercial and industrial applications. At this time, we offer three data books; "MOS-Memory Dynamic RAM and Module", "MOS-Memory Video RAM and Static RAM" and "MOS-Memory ROM".

Particularly, this data book is "MOS-Memory Video RAM and Static RAM" edition.

These data books represent our current culminations of electrical characteristics, timing waveforms and package data for our line of semiconductor memory products.

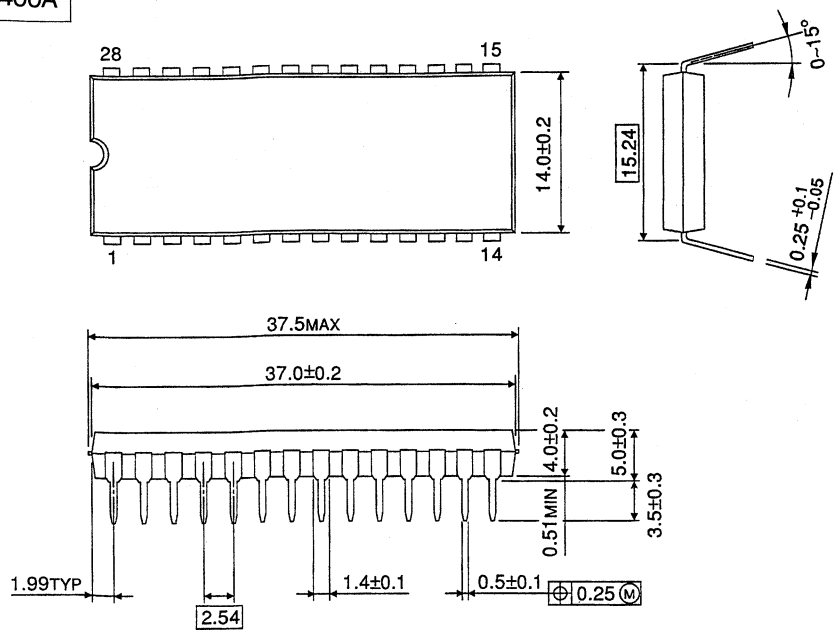
We hope this information will be very useful for you.

Nov. 1991

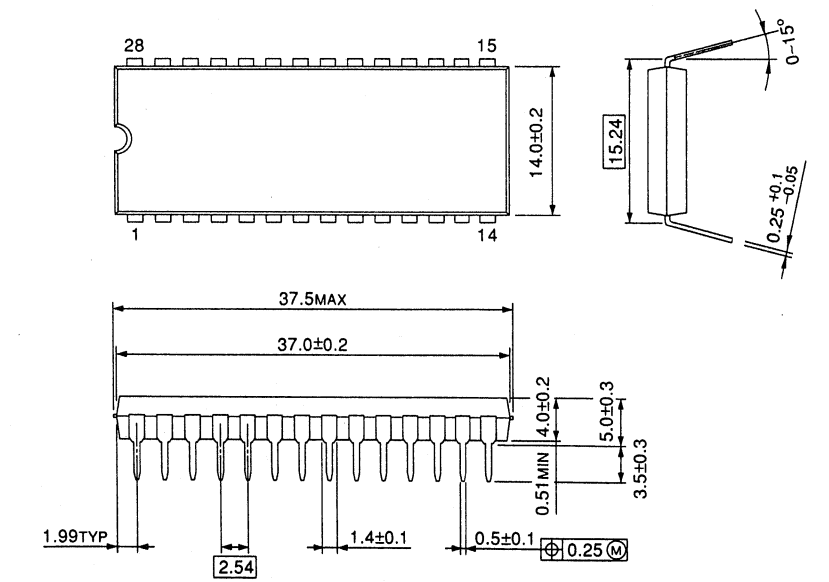
TOSHIBA CORPORATION
Semiconductor Group

Unit in mm

DIP28-P-400A

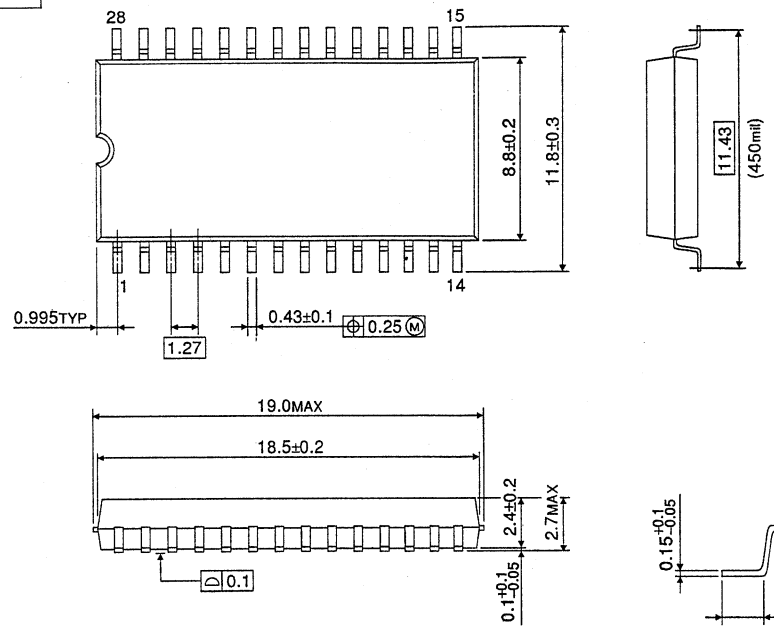


DIP28-P-600



Unit in mm

SOP28-P-450



SOP32-P-450