TC58257AP/AF-17LV, TC58257AP/AF-20LV
TC58257AP/AF-25LV

TC58257AP/AF 32,768 WORD x 8 BIT ELECTRICALLY CHIP ERASABLE AND PROGRAMMABLE READ ONLY MEMORY

PRELIMINARY

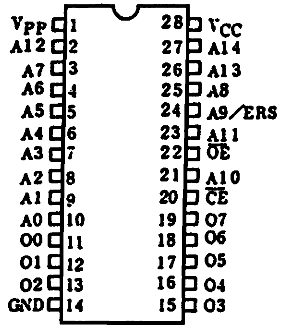
DESCRIPTION

TC58257AP/AF is a 32,768 word × 8 bit electrically chip erasable and programmable read only memory, and molded in a 28 pin plastic package. The TC58257AP/AF's access time is 170ns/200ns/250ns, and has low power standby mode which reduces the power dissipation without increasing access time. The electrical characteristics are the same as U.V.EPROM TC57256AD's. For program operation, the programming is achieved by using the high speed programming mode. The TC58257AP/AF has an electrically chip erasing mode which can erase whole bits at the same time.

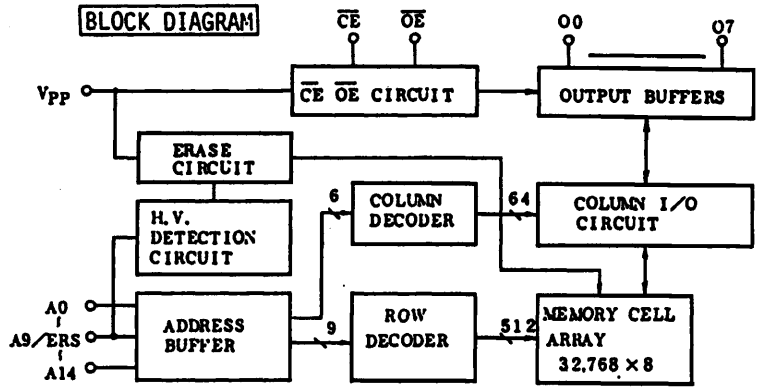
FEATURES

- Peripheral circuit: CMOS
  Memory cell : NMOS
- Fast access time: TC58257AP/AF-17LV 170ns
  TC58257AP/AF-20LV 200ns
  TC58257AP/AF-25LV 250ns
- Low power dissipation
  Active : 30mA/5.9MHz
  Standby: 100μA
- Full static operation
- High speed programming mode
- Electrically chip erasing mode
- Inputs and outputs TTL compatibility
- Pin compatible with MASK ROM TC53257P, TMM23256P, EPROM TMM27256D/AD, and TC57256D/AD, one time PROM TMM24256P/AP/AF and TC54256P/AP/AF
- Standard 28 pin DIP plastic package : TC58257AP
- Plastic Flat package: TC58257AF

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



PIN NAMES

A0∿A14	Address Inputs
O0∿O7	Output (Input)
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
A9/ERS	Address And Erase Control Input
VPP	Program And Erase Power Supply Voltage
VCC	VCC Power Supply Voltage
GND	Ground

MODE SELECTION

Mode \ Pin	$\overline{CE}$	$\overline{OE}$	A9	VPP	VCC	A0∿A8 (10∿14)	O0∿O7	Power
Read	L	L	*	5V	5V	*	Data Output	Active
Output Deselect	*	H	*			*	High Impedance	
Standby	H	*	*			*	High Impedance	Standby
Program	L	H	*	12V	5V	*	Data Input	Active
Program Inhibit	H	*	*			*	High Impedance	
Program Verify	L	L	*			*	Data Out	
Chip Erase	L	H	12V	12V	5V	*	Don't Care	Active
Chip Erase Inhibit	H	*				*	High Impedance	

*: V_{IH} or V_{IL}

MAXIMUM RATINGS

SYMBOL	ITEM	RATING	UNIT
V_{CC}	V_{CC} Power Supply Voltage	-0.6 ∿ 7.0	V
V_{PP}	Program Supply Voltage	-0.6 ∿ 14.0	V
V_{IN}	Input Voltage	-0.6 ∿ 7.0	V
$V_{I/O}$	Input/Output Voltage	-0.6 ∿ V_{CC}+0.5	V
P_D	Power Dissipation	1.5	W
T_{SOLDER}	Soldering Temperature • Time	260 • 10	°C • sec
T_{STG}	Storage Temperature	-65 ∿ 125	°C
T_{OPR}	Operating Temperature	-10 ∿ 70	°C
N_{EW}	Erase Write Endurance	100	Cycles

READ OPERATION

DC RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{IH}	Input High Voltage	2.2	-	V_{CC}+0.3	V
V_{IL}	Input Low Voltage	-0.3	-	0.8	V
V_{CC}	V_{CC} Power Supply Voltage	4.50	5.00	5.50	V
V_{PP}	V_{PP} Power Supply Voltage	V_{CC}-0.6	V_{CC}	V_{CC}+0.6	V

DC AND OPERATING CHARACTERISTICS (Ta=-10 ∿ 70°C, V_{CC}=5V±10%)

SYMBOL	PARAMETER	CONDITION		MIN.	TYP.	MAX.	UNIT
I_{LI}	Input Current	V_{IN}=0 ∿ V_{CC}		-	-	±10	μA
I_{CCO1}	Operating Current	$\overline{CE}$=0V	f=5.9MHz	-	-	30	mA
I_{CCO2}			f=1MHz	-	-	10	
I_{CCS1}	Standby Current	$\overline{CE}$=V_{IH}		-	-	1	mA
I_{CCS2}		$\overline{CE}$=V_{CC}-0.2V		-	-	100	μA
V_{OH}	Output High Voltage	I_{OH}=-400μA		2.4	-	-	V
V_{OL}	Output Low Voltage	I_{OL}=2.1mA		-	-	0.4	V
I_{PP1}	V_{PP} Current	V_{PP}=V_{CC}-0.6∿V_{CC}+0.6		-	-	±10	μA
I_{LO}	Output Leakage Current	V_{OUT}=0.4 ∿ V_{CC}		-	-	±10	μA

AC CHARACTERISTICS (Ta=-10 ∿ 70°C, V_{CC}=5V±10%, V_{PP}=V_{CC}±0.6V)

SYMBOL	PARAMETER	TEST CONDITION	-17		-20		-25		UNIT
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{ACC}	Address Access Time	$\overline{CE}$=$\overline{OE}$=V_{IL}	-	170	-	200	-	250	ns
t_{CE}	$\overline{CE}$ to Output Valid	$\overline{OE}$=V_{IL}	-	170	-	200	-	250	ns
t_{OE}	$\overline{OE}$ to Output Valid	$\overline{CE}$=V_{IL}	-	70	-	70	-	100	ns
t_{DF1}	$\overline{CE}$ to Output in High-Z	$\overline{OE}$=V_{IL}	0	60	0	60	0	90	ns
t_{DF2}	$\overline{OE}$ to Output in High-Z	$\overline{CE}$=V_{IL}	0	60	0	60	0	90	ns
t_{OH}	Output Data Hold Time	$\overline{CE}$=$\overline{OE}$=V_{IL}	0	-	0	-	0	-	ns

AC TEST CONDITIONS

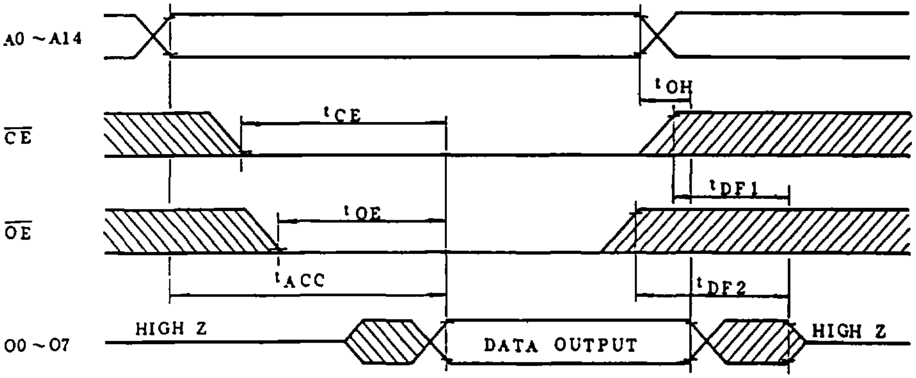
- Output Load : 1 TTL Gate and C_L=100pF
- Input Pulse Rise and Fall Times : 10ns Max.
- Input Pulse Levels : 0.45V ∿ 2.4V
- Timing Measurement Reference Level: Inputs 0.8V and 2.2V, Outputs 0.8V and 2.0V

CAPACITANCE *(Ta=25°C, f=1MHz)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
C_{IN}	Input Capacitance	V_{IN}=0V	-	4	6	pF
C_{OUT}	Output Capacitance	V_{OUT}=0V	-	8	12	pF

* This parameter is periodically sampled and is not 100% tested.

TIMING WAVEFORMS (READ)



PROGRAM OPERATION

DC RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{IH}	Input High Voltage	2.2	-	$V_{CC}+1.0$	V
V_{IL}	Input Low Voltage	-0.3	-	0.8	V
V_{CC}	V_{CC} Power Supply Voltage	4.5	5.0	5.5	V
V_{PP}	V_{PP} Power Supply Voltage	11.5	12.0	12.5	V

DC AND OPERATING CHARACTERISTICS (Ta=-10 ∿ 70°C, V_{CC}=5.0V±10%, V_{PP}=12.0V±0.5V)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
I_{LI}	Input Current	$V_{IN}=0 \sim V_{CC}$	-	-	10	μA
V_{OH}	Output High Voltage	$I_{OH}=-400\mu A$	2.4	-	-	V
V_{OL}	Output Low Voltage	$I_{OL}=2.1mA$	-	-	0.4	V
I_{CC}	V_{CC} Supply Current	-	-	-	40	mA
I_{PP2}	V_{PP} Supply Current	$V_{PP}=13.0V$	-	-	50	mA

AC PROGRAMMING CHARACTERISTICS (Ta=-10 ∿ 70°C, V_{CC}=5.0V±10%, V_{PP}=12.0V±0.5V)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
t_{AS}	Address Setup Time	-	2	-	-	μs
t_{AH}	Address Hold Time	-	2	-	-	μs
t_{CES}	$\overline{CE}$ Setup Time	-	2	-	-	μs
t_{CEH}	$\overline{CE}$ Hold Time	-	2	-	-	μs
t_{OES}	$\overline{OE}$ Setup Time	-	2	-	-	μs
t_{OEH}	$\overline{OE}$ Hold Time	-	2	-	-	μs
t_{DS}	Data Setup Time	-	2	-	-	μs
t_{DH}	Data Hold Time	-	2	-	-	μs
t_{VS}	V_{PP} Setup Time	-	2	-	-	μs
t_{PW}	Initial Program Pulse Width	$\overline{CE}=V_{IL}$, $\overline{OE}=V_{IH}$	0.95	1.0	1.05	ms
t_{OPW}	Overprogram Pulse Width	Note 1	2.85	3	78.75	ms
t_{DV}	$\overline{CE}$ to Output Valid	$\overline{OE}=V_{IL}$	-	-	1	μs
t_{DF1}	$\overline{CE}$ to Output in High-Z	$\overline{OE}=V_{IL}$	-	-	150	ns

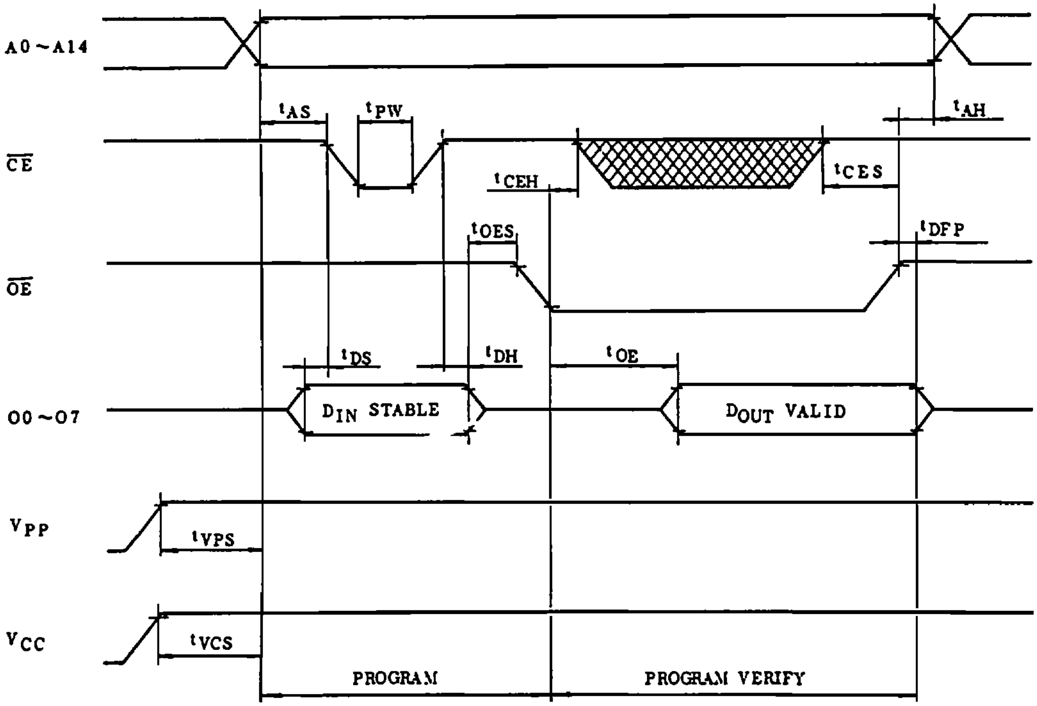
AC TEST CONDITIONS

- Output Load : 1 TTL Gate and C_L (100pF)
- Input Pulse Rise and Fall Times : 10ns Max.
- Input Pulse Levels : 0.45V ∿ 2.4V
- Timing Measurement Reference Level: Input 0.8V and 2.2V, Output 0.8V and 2.0V

Note 1: The length of the overprogram pulse may vary as a function of the counter value X.

TIMING WAVEFORMS (PROGRAM)

(V_{CC}=5.0V±10%, V_{PP}=12.0V±0.5V)



Note 1. V_{CC} must be applied simultaneously or before V_{PP} and cut off simultaneously or after V_{PP}.

2. Removing the device from socket and setting the device in socket with V_{PP}=12.0V may cause permanent damage to the device.

3. The V_{PP} supply voltage is permitted up to 14V for program operation. So the voltage over 14V should not be applied to the V_{PP} terminal. When the switching pulse voltage is applied to the V_{PP} terminal, the overshoot voltage of its pulse should not exceed 14V.

ERASE OPERATION

DC RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{IH}	Input High Voltage	2.2	-	V_{CC}+1.0	V
V_{IL}	Input Low Voltage	-0.3	-	0.8	V
V_{CC}	V_{CC} Power Supply Voltage	4.5	5.0	5.5	V
V_{PP}	V_{PP} Power Supply Voltage	11.5	12.0	12.5	V
V_{IHH}	Input High Voltage	11.5	12.0	12.5	V

DC AND OPERATING CHARACTERISTICS (Ta=-10∿70°C, V_{CC}=5V±10%)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
I_{LI}	Input Current	V_{IN}=0∿V_{CC}	-	-	±10	μA
I_{LIE}	A9/ERS Input Current	A9/ERS=0∿V_{IHH}	-	-	±100	μA
I_{CC}	V_{CC} Supply Current	-	-	-	40	mA
I_{PP2}	V_{PP} Supply Current	V_{PP}=12.5V	-	-	50	mA

AC ERASING CHARACTERISTICS (Ta=-10∿70°C, V_{CC}=5V±10%, V_{PP}=12.0V±0.5V)

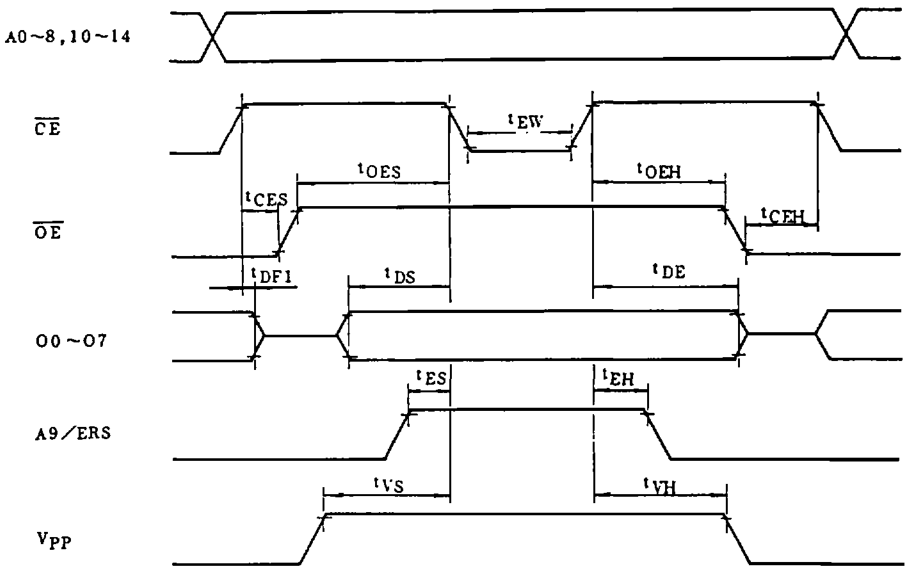
SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
t_{CES}	$\overline{CE}$ Setup Time	-	2	-	-	μs
t_{CEH}	$\overline{CE}$ Hold Time	-	2	-	-	μs
t_{OES}	$\overline{OE}$ Setup Time	-	2	-	-	μs
t_{OEH}	$\overline{OE}$ Hold Time	-	500	-	-	μs
t_{DS}	Data Setup Time	-	2	-	-	μs
t_{DH}	Data Hold Time	-	500	-	-	μs
t_{VS}	V_{PP} Setup Time	-	2	-	-	μs
t_{VH}	V_{PP} Hold Time	-	500	-	-	μs
t_{ES}	A9/ERS Setup Time	-	2	-	-	μs
t_{EH}	A9/ERS Hold Time	-	2	-	-	μs
t_{EW}	Erase Pulse Width	$\overline{CE}$=V_{IL},$\overline{OE}$=V_{IH},A9=V_{IHH}	1950	2000	2050	ms
t_{DF1}	$\overline{CE}$ to Output in High-Z	$\overline{OE}$=V_{IL}	-	-	150	ns

Input Pulse Rise and Fall Time: 10ns Max.

Input Pulse Levels : 0.45V∿2.4V

TIMING WAVEFORMS (ERASE)

(V_{CC}=5V±10%, V_{PP}=12.0V±0.5V)



Note 1. V_{CC} must be applied simultaneously or before V_{PP} and cut off simultaneously or after V_{PP}.

2. Removing the device from socket and setting the device in socket with V_{PP}=12.0V may cause permanent damage to the device.

3. The V_{PP} supply voltage is permitted up to 14V for erase operation. So the voltage over 14V should not be applied to the V_{PP} terminal. When the switching pulse voltage is applied to the V_{PP} terminal, the overshoot voltage of its pulse should not exceed 14V.

Pin Read		$\overline{CE}$	$\overline{OE}$	A9	V_{PP}	V_{CC}	O0∿O7	Power
Read Operation	Read	L	L	*	5V	5V	Data Out	Active
	Output Deselect	*	H	*			High Impedance	
	Standby	H	*	*			High Impedance	Standby
Program Operation	Program	L	H	*	12V	5V	Data In	Active
	Program Inhibit	H	*	*			High Impedance	
	Program Verify	L	L	*			Data Out	
Erase Operation	Erase	L	H	12V	12V	5V	Don't Care	Active
	Erase Inhibit	H	*				High Impedance	

Note: H; V_{IH}, L; V_{IL}, *; V_{IH} or V_{IL}

READ MODE

The TC58257AP/AF has two control functions. The chip enable ($\overline{CE}$) controls the operat power and should be used for device selection. The output enable ($\overline{OE}$) controls the output buffers, independent of device selection. Assuming that $\overline{CE}$=$\overline{OE}$=V_{IL}, the output data is valid at the outputs after address access time from stabilizing of all addresses. The $\overline{CE}$ to output valid (t_{CE}) is equal to the address access time (t_{ACC}). Assuming that $\overline{CE}$=V_{IL} and all addresses are valid, the output data is valid at the outputs after t_{OE} from the falling edge of $\overline{OE}$.

OUTPUT DESELECT MODE

Assuming that $\overline{CE}$=V_{IH} or $\overline{OE}$=V_{IH}, the outputs will be in a high impedance state. So two or more TC58257AP/AF's can be connected together on a common bus line. When $\overline{CE}$ is decoded for device selection, all deselected devices are in low power standby mode.

STANDBY MODE

The TC58257AP/AF has a low power standby mode controlled by the $\overline{CE}$ signal. By applying a high level to the $\overline{CE}$ input, the TC58257AP/AF is placed in the standby mode which reduce the operating current to 100µA by applying MOS-high level (V_{CC}) and then the outputs are in a high impedance state, independent of the $\overline{OE}$ inputs.

PROGRAM MODE

Initially, when received by customers, all bits of the TC58257AP/AF are in the "1" state which is erased state. Therefore the program operation is to introduce "0's" data into the desired bit locations by electrically programming. The TC58257AP/AF is in the programming mode when the Vpp input is at 12V and $\overline{CE}$ is at TTL-Low under $\overline{OE}=V_{IH}$. The TC58257AP/AF can be programmed any location at any time either individually, sequentially, or at random.

PROGRAM VERIFY MODE

The verify mode is to check if desired data is correctly programmed on the programmed bits. The verify is accomplished with $\overline{OE}$ at V_{IL}.

PROGRAM INHIBIT MODE

Under the condition that the program voltage (+12.0V) is applied to V_{PP} terminal, a high level $\overline{CE}$ input inhibits the TC58257AP/AF from being programmed. Programming of two or more TC58257AP/AF's in parallel with different data is easily accomplished. That is, all inputs except for $\overline{CE}$ may be commonly connected, and a TTL low level program pulse is applied to the $\overline{CE}$ of the desired device only and TTL high level signal is applied to the other devices.

HIGH SPEED PROGRAMMING MODE

The program time can be greatly decreased by using this high speed programming mode. The device is set up in the high speed programming mode when the programming voltage (+12.0V) is applied to the Vpp terminal with $V_{CC}=5.0V$. The programming is achieved by applying a single TTL low level 100μs pulse to the $\overline{CE}$ input after addresses and data are stable. Then the programmed data is verified by using Program Verify Mode. If the programmed data is not correct, another program pulse of 100μs is applied and then the programmed data is verified. The should be repeated until the program operates correctly (max. 25 times).

When programming has been completed, the data in all addresses should be verified with $V_{CC}=V_{PP}=5V$.

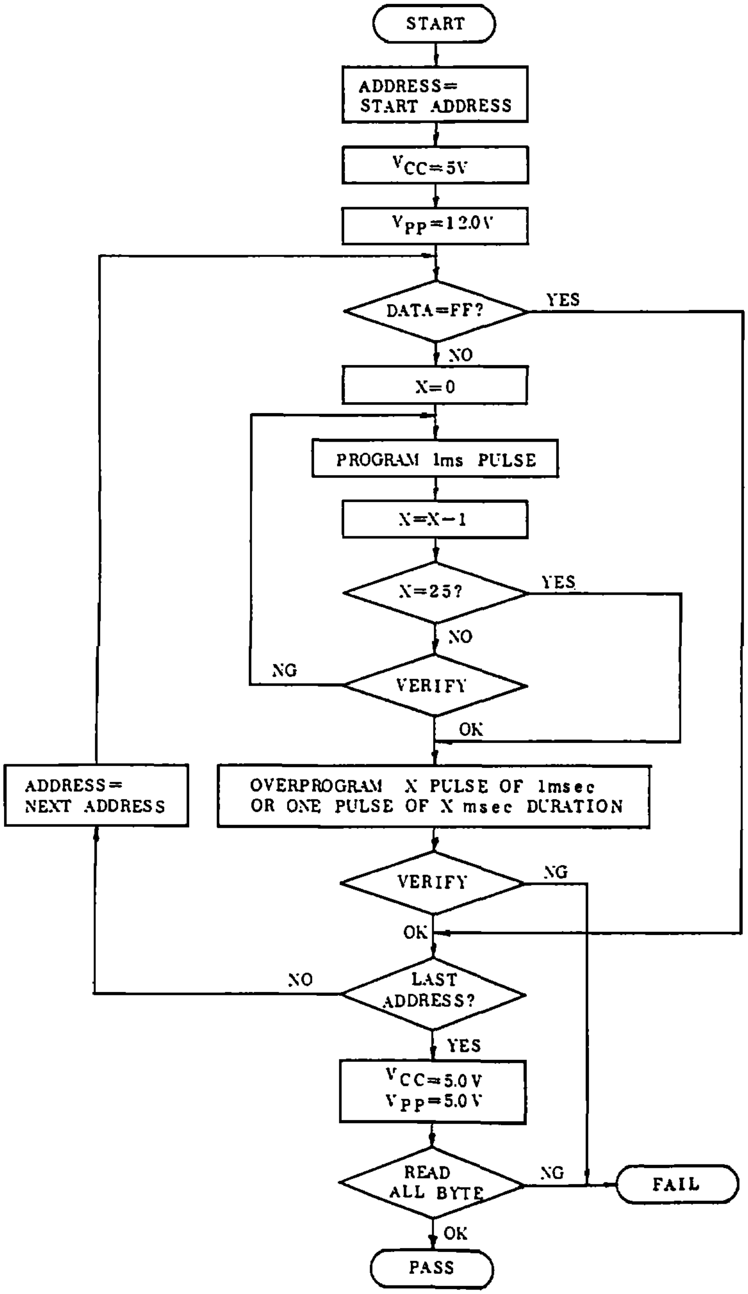
CHIP ERASE MODE

The TC58257AP/AF is in chip erase mode when the V_{PP} input is 12.0V and $\overline{CE}$ is at TTL-Low level under the condition of A9=12V, $\overline{OE}=V_{IH}$. The chip erase pulse width is only 1 sec. Once chip is erased, all bits of the device are in "1" state.

ERASE INHIBIT

Under the condition that the erase voltage (12.0V) is applied to V_{PP} terminal and 12V is to A9 input, TTL-High level $\overline{CE}$ input inhibits the TC58257AP/AF from being erased.

HIGH SPEED PROGRAM MODE FLOW CHART



ELECTRIC SIGNATURE MODE

Electric signature mode allows a code to be read from the TC58257AP/AF which identifies its manufacture and device type.

The programming equipment may read out manufacturer code and device code from TC58257AP/AF by using this mode before program operation and automatically set program voltage (V_{PP}) and algorithm.

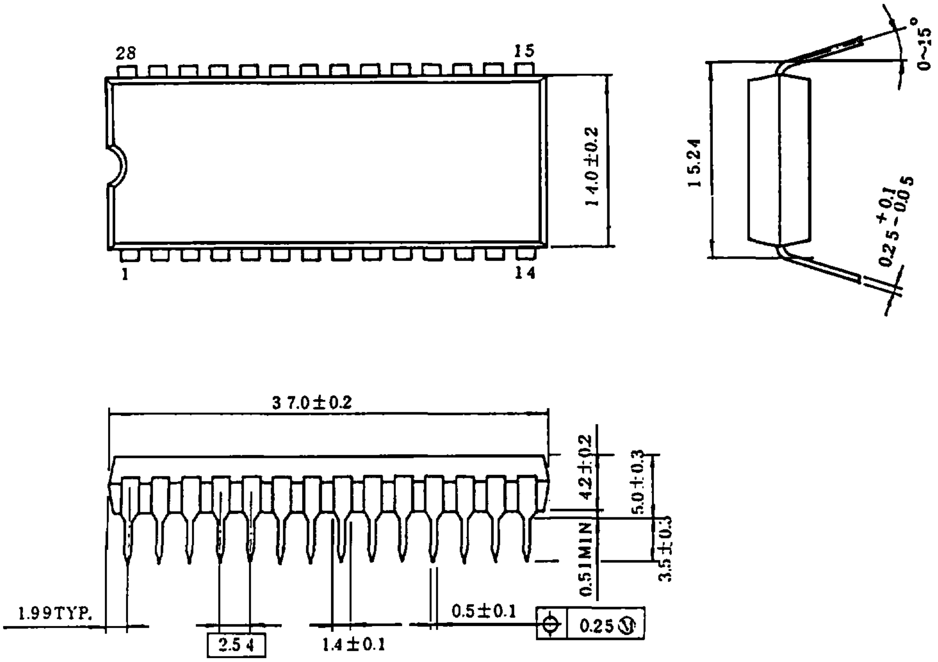
Electric Signature mode is set up when 12V is applied to address line A9 and the rest of address lines is set to V_{IL} in read operation. Data output in this condition is the manufacturer code. Device code is identified when address A0 is set to V_{IH}. These two codes possess an odd parity with the parity bit of MSB (O7). The following table shows the electric signature of TC58257AP/AF.

PINS / SIGNATURE	A0 (10)	O7 (19)	O6 (18)	O5 (17)	O4 (16)	O3 (15)	O2 (13)	O1 (12)	O0 (11)	HEX. DATA
Manufacture Code	V_{IL}	1	0	0	1	1	0	0	0	98
Device Code	V_{IH}	0	0	1	0	0	1	0	1	25

Notes: A9=12V±0.5V
A1∿A8, A10∿A14, $\overline{CE}$, $\overline{OE}$=V_{IL}

OUTLINE DRAWINGS (TC58257AP)

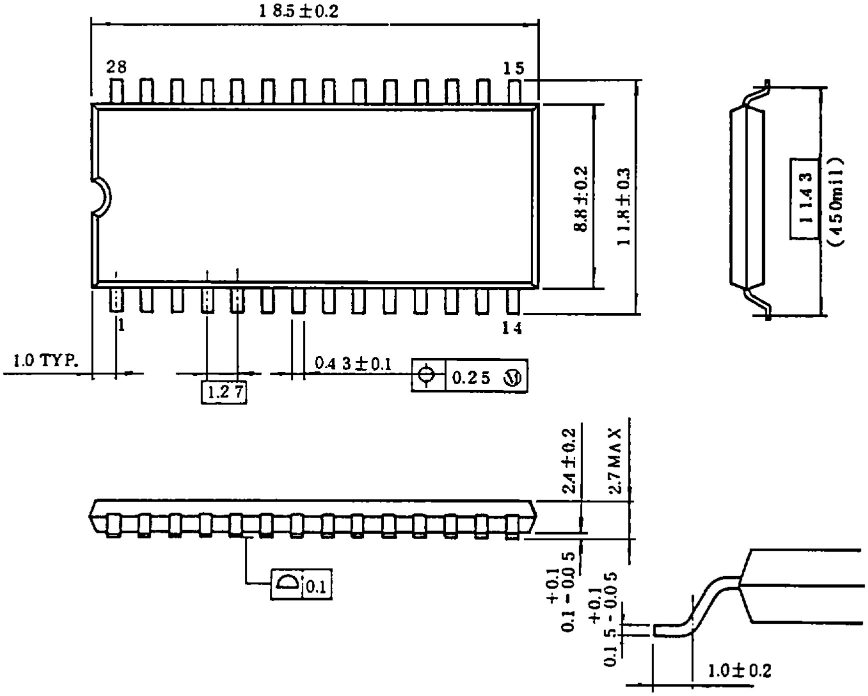
Unit in mm



Note: Package width and length do not include mold protrusion, allowable mold protrusion is 0.15mm.

OUTLINE DRAWINGS (TC58257AF)

Unit in mm



Note: Package width and length do not include mold protrusion, allowable mold protrusion is 0.15mm.