CMOS 256K-BIT STATIC RAM

• Industrial Temperature Range

■ DESCRIPTION

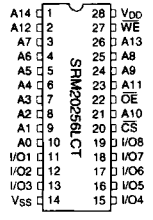
The SRM20256LT10/12 is a 32,768 word x 8 bits asynchronous, static, random access memory fabricated using an advanced CMOS technology. Its very low standby power feature makes it ideal for applications requiring non-volatile storage with back-up batteries. And - 40 to 85°C operating temperature range makes it ideal for industrial use. The asynchronous and static nature of the memory requires no external clock or refresh circuit. Input and output ports are TTL compatible and the three-state output allows easy expansion of memory capacity.

■ FEATURES

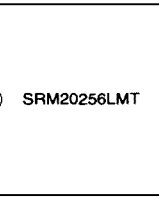
Industrial temperature range ..... - 40 to 85°C
Fast access time ..... SRM20256LT10 100ns (Max)
..... SRM20256LT12 120ns (Max)
Low supply current ..... Standby : 2µA (Typ)
Operation: 13mA/1MHz (Typ)
Completely static ..... No clock required
Single power supply .... 5V ± 10%
TTL compatible inputs and outputs
3-state output
Battery back-up operation
Package .... SRM20256LCT10/12 28-pin DIP (plastic)
SRM20256LMT10/12 28-pin TSOP (plastic)
SRM20256LTMT10/12 28-pin TSOP (plastic)
SRM20256LRMT10/12 28-pin RTSOP (plastic)

■ PIN CONFIGURATION

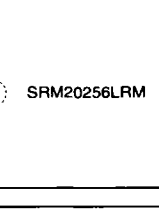
(DIP)



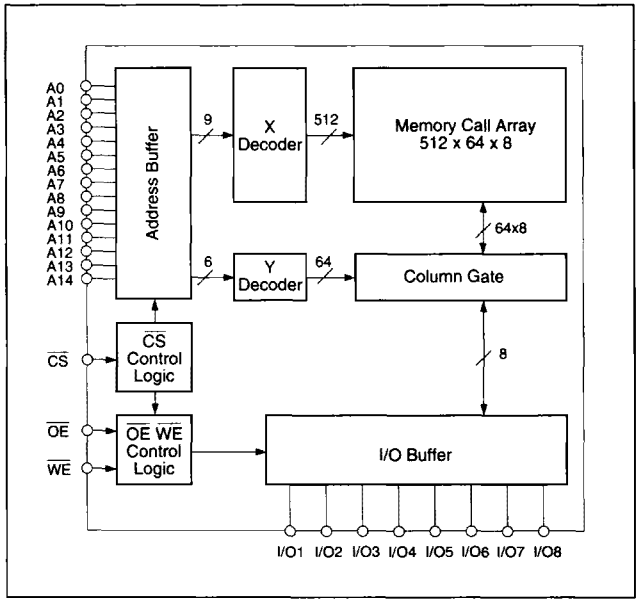
(TSOP)*



(TSOP-R1)* (Reverse lead configuration)



■ BLOCK DIAGRAM



■ PIN DESCRIPTION

A0 to A14	Address Input
$\overline{WE}$	Write enable
$\overline{OE}$	Output Enable
$\overline{CS}$	Chip Select
I/O1 to 8	Data I/O
VDD	Power Supply (+5V)
VSS	Power Supply (0V)

■ ABSOLUTE MAXIMUM RATINGS

(Vss=0V)

Parameter	Symbol	Ratings	Unit
Supply voltage	V_{DD}	-0.5 to 7.0	V
Input voltage *	V_I	-0.5 to 7.0	V
Input/Output voltage*	$V_{I/O}$	-0.5* to V_{DD}+0.3	V
Power dissipation	P_D	1.0	W
Operating temperature	T_{opr}	-40 to 85	°C
Storage temperature	T_{stg}	-65 to 150	°C
Soldering temperature and time	T_{sol}	260°C, 10s (at lead)	—

* V_I, $V_{I/O\ (Min)}$ = −1.0V when pulse width is less than or equal to 50 ns

■ RECOMMENDED DC OPERATING CONDITIONS

(V_{SS}=0V, Ta = -40 to 85°C)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	4.5	5.0	5.5	V
	V_{SS}	0	0	0	V
Input Voltage	V_{IH}	2.2	3.5	V_{DD} + 0.3	V
	V_{IL}	-0.3 *	—	0.8	V

* V_{IL} (Min) = −1.0V when pulse width is less than or equal to 50ns

■ ELECTRICAL CHARACTERISTICS

● DC Electrical Characteristics

(V_{DD} = 5V ± 10%, V_{SS} = 0V, Ta = -40 to 85°C)

Parameter	Symbol	Conditions	SRM20256LT10			SRM20256LT12			Unit
			Min	Typ*	Max	Min	Typ*	Max	
Input leakage current	I_{LI}	V_I = 0 to V_{DD}	-1	—	1	-1	—	1	uA
Standby supply current	I_{DDS}	$\overline{CS}$ = V_{IH}	—	1.5	3.0	—	1.5	3.0	mA
	I_{DDS1}	$\overline{CS}$ ≥ V_{DD} −0.2V	—	2	200	—	2	200	μA
Average operating current	I_{DDA}	V_I=V_{IL}, V_{IH}, $I_{I/O}$ = 0mA, tcyc=Min	—	40	70	—	37	70	mA
	I_{DDA1}	V_I=V_{IL}, V_{IH}, $I_{I/O}$ = 0mA, tcyc=1μs	—	13	—	—	13	—	mA
Operating supply current	I_{DDO}	V_I=V_{IL}, V_{IH}, $I_{I/O}$ = 0mA	—	35	65	—	35	65	mA
Output leakage current	I_{LO}	$\overline{CS}$ = V_{IH}, or $\overline{WE}$ = V_{IL}, or $\overline{OE}$ = V_{IH}, $V_{I/O}$ = 0 to V_{DD}	-1	—	1	-1	—	1	μA
High level output voltage	V_{OH}	I_{OH}=-1.0mA	2.4	V_{DD}-0.1	—	2.4	V_{DD}-0.1	—	V
Low level output voltage	V_{OL}	I_{OL}=2.1mA	—	0.2	0.4	—	0.2	0.4	V

● Terminal Capacitance

(f = 1MHz, Ta = 25°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Address capacitance	C_{ADD}	V_{ADD} = 0V	—	—	10	pF
Input capacitance	C_I	V_I = 0V	—	—	10	pF
I/O capacitance	$C_{I/O}$	$V_{I/O}$ = 0V	—	—	10	pF

● AC Electrical Characteristics

O Read Cycle

(V_{DD} = 5V ± 10%, V_{SS} = 0V, Ta = -40 to 85°C)

Parameter	Symbol	Conditions	SRM2264L10		SRM2264L12		Unit
			Min	Max	Min	Max	
Read cycle time	t_{RC}	*1	100	—	120	—	ns
Address access time	t_{ACC}		—	100	—	120	ns
$\overline{CS}$ access time	t_{ACS}		—	100	—	120	ns
$\overline{OE}$ access time	t_{OE}		—	50	—	60	ns
$\overline{CS}$ output set time	t_{CLZ}	*2	10	—	10	—	ns
$\overline{CS}$ output floating time	t_{CHZ}		—	35	—	40	ns
$\overline{OE}$ output set time	t_{OLZ}		5	—	5	—	ns
$\overline{OE}$ output floating time	t_{OHZ}		—	35	—	40	ns
Output hold time	t_{OH}	*1	10	—	10	—	ns

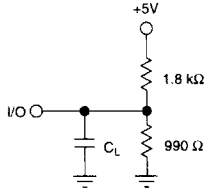
O Write Cycle

(V_{DD} = 5V ± 10%, V_{SS} = 0V, Ta = -40 to 85°C)

Parameter	Symbol	Conditions	SRM20256LC10		SRM20256LC12		Unit
			Min	Max	Min	Max	
Write cycle time	t_{WC}	*1	100	—	120	—	ns
Chip select time	t_{CW}		80	—	85	—	ns
Address valid to end of write	t_{AW}		80	—	85	—	ns
Address setup time	t_{AS}		0	—	0	—	ns
Write pulse width	t_{WP}		75	—	80	—	ns
Address hold time	t_{WR}		5	—	5	—	ns
Input data set time	t_{DW}		45	—	50	—	ns
Input data hold time	t_{DH}		0	—	0	—	ns
Write to output floating	t_{WHZ}	*2	—	35	—	40	ns
Output active from end of write	t_{OW}		5	—	5	—	ns

***1 Test conditions**

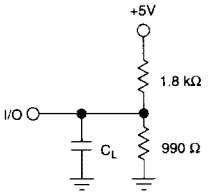
1. Input pulse level: 0.6V to 2.4V
2. tr = tf = 5ns
3. Input and output timing reference levels: 1.5V
4. Output load CL = 100pF



C_L = 100pF (Includes Jig Capacitance)

***2 Test conditions**

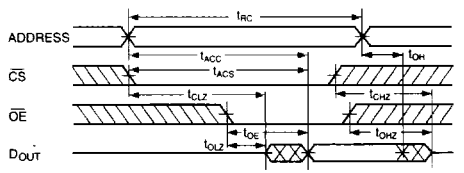
1. Input pulse level : 0.6V to 2.4V
2. tr = tf = 5ns
3. Input timing reference levels: 1.5V
4. Output timing reference levels: ±200mV (the level displaced from stable output voltage level)
5. Output load CL = 5pF



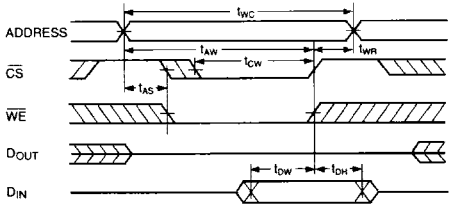
C_L = 5pF (Includes Jig Capacitance)

● Timing Chart

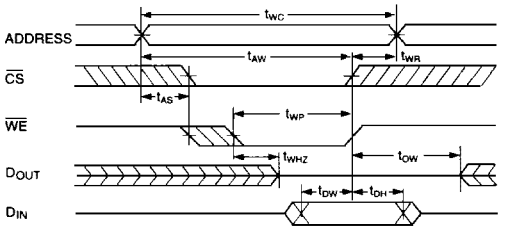
Read Cycle



Write Cycle (1) ($\overline{CS}$ Control)



Write Cycle (2) ($\overline{WE}$ Control)



Note:

1. During read cycle time, $\overline{WE}$ is to be "H" level.
2. Write cycle time is controlled by $\overline{CS}$. Output Buffer is in high impedance state, whether $\overline{OE}$ is "H" or "L".
3. Write cycle time that is controlled by $\overline{WE}$, Output Buffer is in high impedance state.

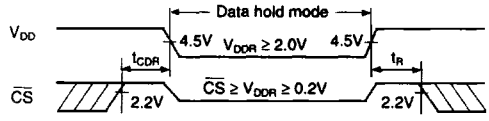
■ DATA RETENTION CHARACTERISTICS WITH LOW VOLTAGE POWER SUPPLY

(V_{SS} = 0V, Ta = -40 to 85°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Data retention supply voltage	V_{DDR}		2.0	—	5.5	V
Data retention supply current	I_{DDR}	V_{DD} = 3V, $\overline{CS} \geq V_{DDR}$ -0.2V	—	1	100	µA
Chip select data hold time	t_{CDR}		0	—	—	ns
Operation recovery time	t_R		t_{RC}*	—	—	ns

* tRC = Read cycle time

Data retention timing



■ FUNCTIONS

● Truth Table

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	A0 to A14	DATA I/O	MODE	I_{DD}
H	—	—	—	Hi-Z	Standby	I_{DDS}, I_{DDS1}
L	X	L	Stable	D_{IN}	Write	I_{DDA}, I_{DDA1}
L	L	H	Stable	D_{OUT}	Read	I_{DDA}, I_{DDA1}
L	H	H	Stable	Hi-Z	Output disable	I_{DDA}, I_{DDA1}

X : "H" or "L"

● Reading Data

Data can be read out if an address is set while $\overline{CS}$ = "L", $\overline{OE}$ = "L", and $\overline{WE}$ = "H". When $\overline{OE}$ = "H", Data I/O terminals are in high impedance state; that makes it easy fo circuit design and bus control.

● Writing Data

There are the following three ways of writing data into the memory.

(1) Hold $\overline{CS}$ low, set the address, and apply a low pulse to $\overline{WE}$.

(2) Hold R/$\overline{W}$ low, set the address, and apply a low pulse to $\overline{WE}$.

(3) Set the address, then apply low pulses to both $\overline{CS}$ and $\overline{WE}$.

In each case, data from the DATA I/O terminal is latched into the SRM20256LT10/12 when $\overline{CS}$ or $\overline{WE}$ is positive. Since DATA I/O terminals are in high impedance state when $\overline{CS}$ or $\overline{OE}$ = "H", the contention on the data bus can be avoided.

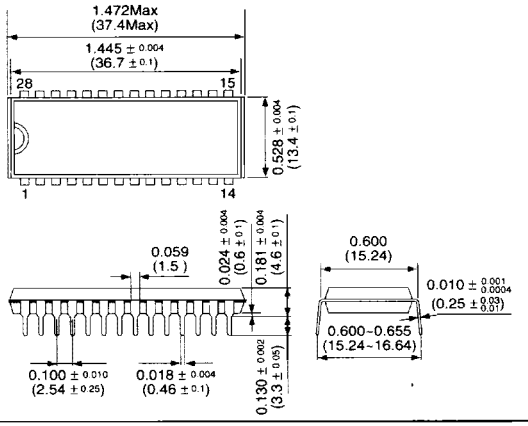
● Standby Mode

When $\overline{CS}$ is high, SRM20256LT10/12 is in the stand-by mode. In this case Data I/O terminals are in Hi-Z, so that all inputs of addresses, $\overline{WE}$ and data can be any "H" or "L". When $\overline{CS}$ is over V_{DD} - 0.2V, the SRM20256LT10/12 is in the data retention battery back-up mode. In this mode, there is a small current in the SRM20256LT10/12 which flows through the high resistances of the memory cells.

■ PACKAGE DIMENSIONS

C28

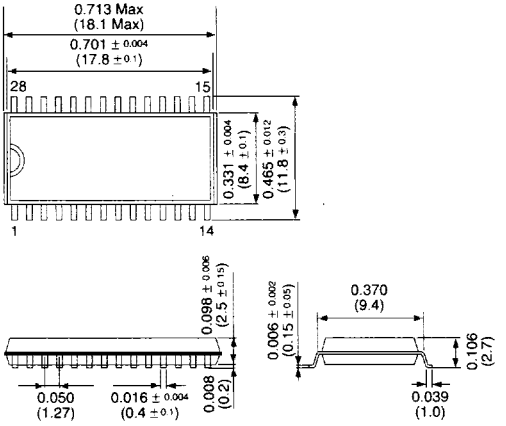
28-pin DIP



unit : inch (mm)

M28-2

28-pin SOP

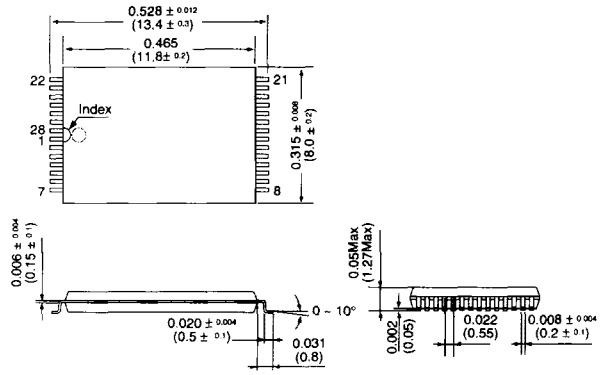


unit : inch (mm)

* SRM20256LMT10/12 has the same electrical characteristics as SRM20256LCT10/12.

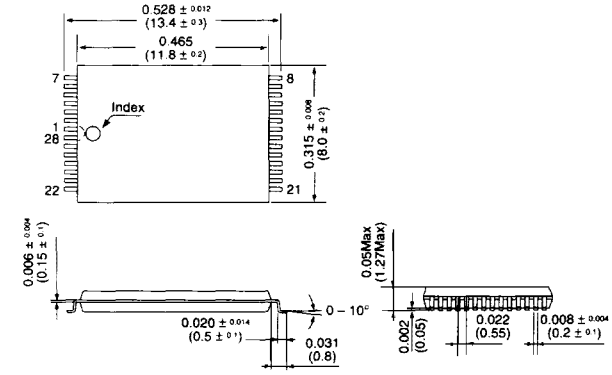
■ PACKAGE DIMENSIONS

Plastic TSOP (I) 28-pin *1



unit : inch (mm)

Plastic TSOP (I) 28-pinR1 (Reverse lead configuration) *2



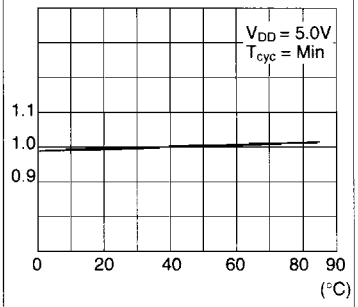
unit : inch (mm)

* 1 SRM20256LTM10/12 has the same electrical characteristics as SRM20256LC10/12.

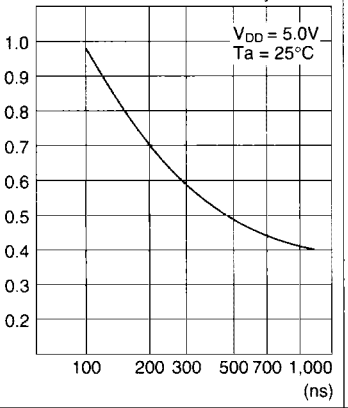
* 2 SRM20256LRM10/12 has the same electrical characteristics as SRM20256LC10/12.

■ CHARACTERISTICS CURVES

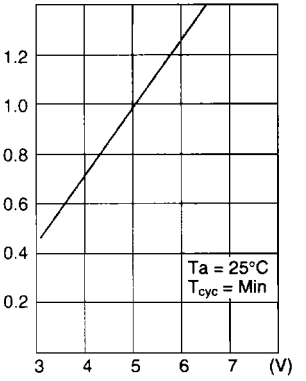
Normalized I_{DDA}—Ta



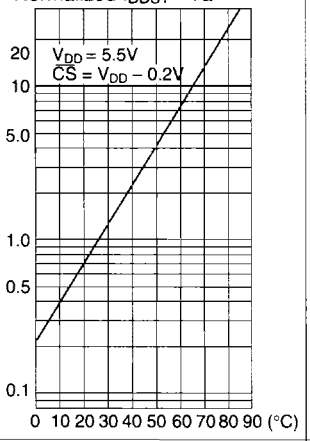
Normalized I_{DDA}—t_{cycle}



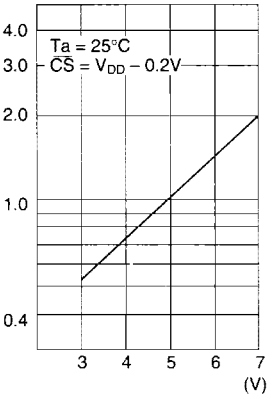
Normalized I_{DDA}—V_{DD}



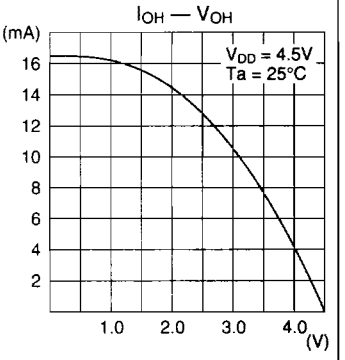
Normalized I_{DDS1}—Ta



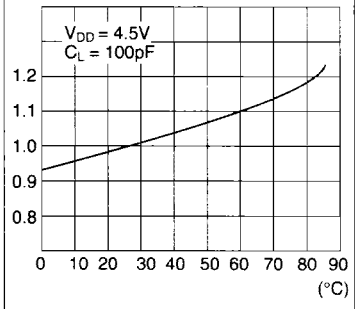
Normalized I_{DDS1}—V_{DD}



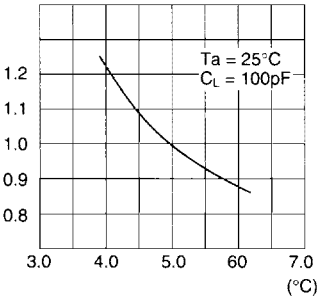
I_{OH} — V_{OH}



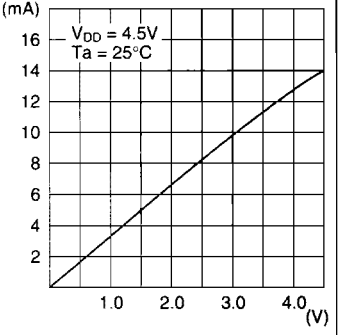
Normalized t_{ACC}·t_{ACS}—Ta



Normalized t_{ACC}·t_{ACS}—V_{DD}



I_{OL} — V_{OL}



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