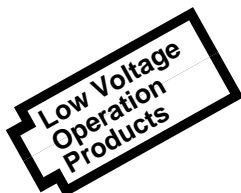


# SRM20V100LLMX7

## 1M-Bit Static RAM



- Low Supply Voltage
- Wide Temperature Range
- Low Supply Current
- Access Time 70ns (2.7V)
- 131,072 Words×8-Bit Asynchronous

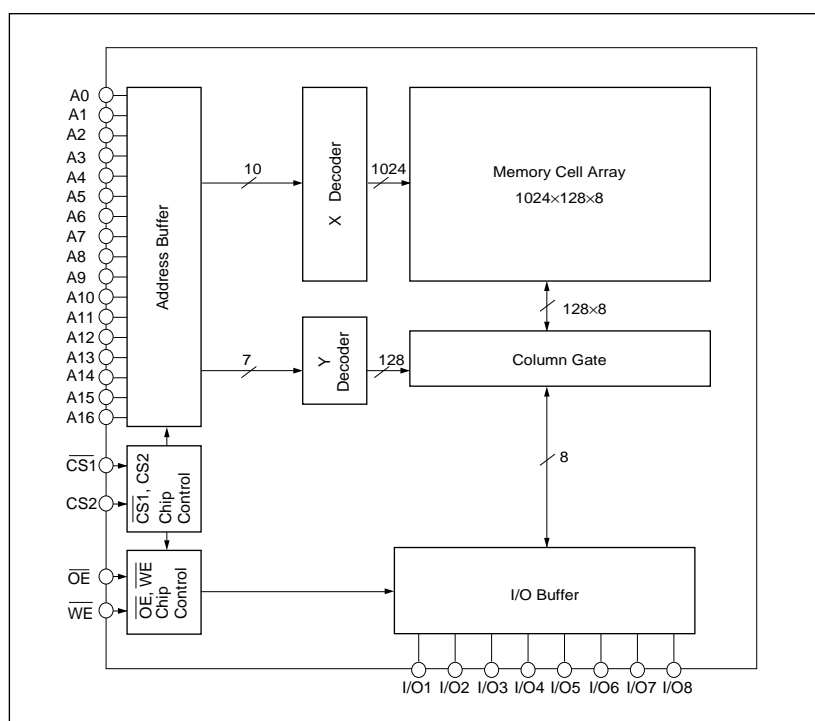
### DESCRIPTION

The SRM20V100LLMX7 is an 131,072 words×8-bit asynchronous, static, random access memory on a monolithic CMOS chip. Its very low standby power requirement makes it ideal for applications requiring non-volatile storage with back-up batteries. And —25 to 85°C operating temperature range makes it ideal for portable equipment. The asynchronous and static nature of the memory requires no external clock or refreshing circuit. Both the input and output ports are TTL compatible and 3-state output allows easy expansion of memory capacity.

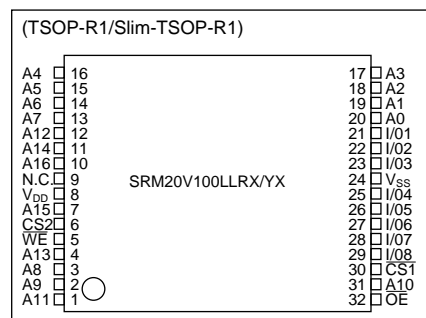
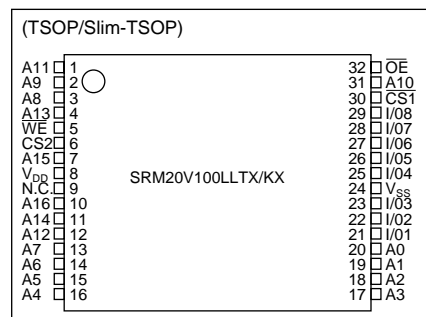
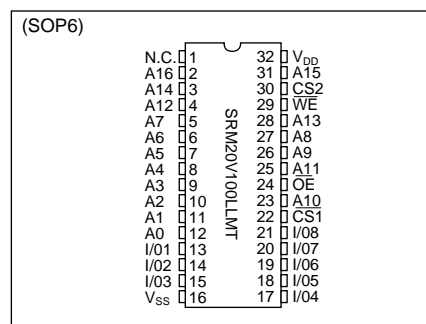
### FEATURES

- Wide temperature range ..... –25 to 85°C
- Fast Access time ..... SRM20V100LLMX7 70ns (Max.)
- Low supply current ..... standby: 0.6μA (Typ.): LL Version  
0.3μA (Typ.): SL Version  
operation: 8mA/1MHz (Typ.)
- Completely static ..... No clock required
- Supply voltage ..... 2.7V to 3.6V
- TTL compatible inputs and outputs
- 3-state output with wired-OR capability
- Non-volatile storage with back-up batteries
- Package ..... SRM20V100LLMX7 SOP6-32pin (plastic)  
SRM20V100LLTX7 TSOP ( I )-32pin (plastic)  
SRM20V100LLRX7 TSOP ( I )-32pin-R1 (plastic)  
SRM20V100LLKX7 Slim-TSOP ( I )-32pin (plastic)  
SRM20V100LLYX7 Slim-TSOP ( I )-32pin-R1 (plastic)

### BLOCK DIAGRAM



### PIN CONFIGURATION



### PIN DESCRIPTION

A0 to A16	Address Input
WE	Write Enable
OE	Output Enable
CS1, CS2	Chip Select
I/O1 to I/O8	Data I/O
VDD	Power Supply (2.7V to 3.6V)
Vss	Power Supply (0V)
N. C.	No connection

## ■ ABSOLUTE MAXIMUM RATINGS

(V<sub>SS</sub> = 0V)

Parameter	Symbol	Ratings	Unit
Supply voltage	V <sub>DD</sub>	−0.5 to 4.6	V
Input voltage	V <sub>I</sub>	−0.5 to V <sub>DD</sub> +0.3	V
Input/Output voltage	V <sub>I/O</sub>	−0.5 to V <sub>DD</sub> +0.3	V
Power dissipation	P <sub>D</sub>	0.5	W
Operating temperature	T <sub>opr</sub>	−25 to 85	°C
Storage temperature	T <sub>stg</sub>	−65 to 150	°C
Soldering temperature and time	T <sub>sol</sub>	260°C, 10s (at lead)	—

\*V<sub>I</sub>, V<sub>I/O</sub> (Min.) = −3.0V (Pulse width is 50ns)

## ■ DC RECOMMENDED OPERATING CONDITIONS

(V<sub>SS</sub> = 0V, Ta = −25 to 85°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>DD</sub>	—	2.7	3.0	3.6	V
	V <sub>SS</sub>	—	0	0	0	V
Input voltage	V <sub>IH</sub>	—	2.2	—	V <sub>DD</sub> +0.3	V
	V <sub>IL</sub>	—	−0.3*	—	0.4	V

\*If pulse width is less than 50ns, it is −3.0V

## ■ ELECTRICAL CHARACTERISTICS

### ● DC Electrical Characteristics

(V<sub>DD</sub> = 2.7 to 3.6V, V<sub>SS</sub> = 0V, Ta = −25 to 85°C)

Parameter	Symbol	Conditions	Min.	Typ.*	Max.	Unit
Input leakage	I <sub>LI</sub>	V <sub>I</sub> =0 to V <sub>DD</sub>	−1	—	1	μA
Output leakage	I <sub>LO</sub>	$\overline{CS1} = V_{IH}$ or $\overline{CS2} = V_{IL}$ or $\overline{WE} = V_{IL}$ or $OE = V_{IH}$ , V <sub>I/O</sub> = 0 to V <sub>DD</sub>	−1	—	1	μA
Standby supply current	I <sub>DDs</sub>	$\overline{CS1} = V_{IH}$ or $CS2 = V_{IL}$	—	—	1.0	mA
	I <sub>DDs1</sub>	$\overline{CS1} = CS2 \geq V_{DD} - 0.2V$ or $CS2 \leq 0.2V$	LL	0.6	60	μA
			SL	0.3	30	
Average operating current	I <sub>DDA</sub>	V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub> I <sub>I/O</sub> = 0mA, t <sub>cyc</sub> = Min.	—	20	35	mA
	I <sub>DDA1</sub>	V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub> I <sub>I/O</sub> = 0mA, t <sub>cyc</sub> = 1μs	—	8	15	mA
Operating supply current	I <sub>DDO</sub>	V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub> I <sub>I/O</sub> = 0mA	—	8	15	mA
High level output voltage	V <sub>OH</sub>	V <sub>DD</sub> ≥ 3V, I <sub>OH</sub> = −2.0mA	2.4	—	—	V
		I <sub>OH</sub> = −100μA	V <sub>DD</sub> − 0.2	—	—	
Low level output voltage	V <sub>OL</sub>	V <sub>DD</sub> ≥ 3V, I <sub>OL</sub> = −2.0mA	—	—	0.4	V
		I <sub>OL</sub> = 100μA	—	—	0.2	

\*Typical values are measured at Ta=25°C and V<sub>DD</sub>=3.0V

### ● Terminal Capacitance

(f = 1MHz, Ta = 25°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Address Capacitance	C <sub>ADD</sub>	V <sub>ADD</sub> =0V	—	—	8	pF
Input Capacitance	C <sub>I</sub>	V <sub>I</sub> =0V	—	—	8	pF
I/O Capacitance	C <sub>I/O</sub>	V <sub>I/O</sub> =0V	—	—	10	pF

# SRM20V100LLMX7

## ● AC Electrical Characteristics

### ○ Read Cycle

(VDD = 2.7V to 3.6V, VSS = 0V, Ta = -25 to 85°C)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Read cycle time	t <sub>RC</sub>	*1	70	—	ns
Address access time	t <sub>ACC</sub>		—	70	ns
Chip select1 access time	t <sub>ACS1</sub>		—	70	ns
Chip select2 access time	t <sub>ACS2</sub>		—	70	ns
Output enable access time	t <sub>OE</sub>		—	40	ns
Chip select1 output set time	t <sub>CLZ1</sub>	*2	5	—	ns
Chip select1 output floating	t <sub>CHZ1</sub>		—	30	ns
Chip select2 output set time	t <sub>CLZ2</sub>		5	—	ns
Chip select2 output floating	t <sub>CHZ2</sub>		—	30	ns
Output enable output set time	t <sub>OLZ</sub>		0	—	ns
Output enable output floating	t <sub>OHZ</sub>		—	30	ns
Output hold time	t <sub>OH</sub>	*1	10	—	ns

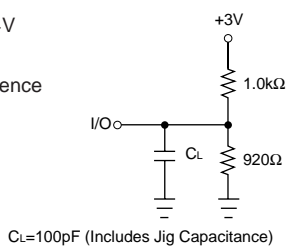
### ○ Write Cycle

(VDD = 2.7V to 3.6V, VSS = 0V, Ta = -25 to 85°C)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Write cycle time	t <sub>WC</sub>	*1	70	—	ns
Chip select time1	t <sub>CW1</sub>		60	—	ns
Chip select time2	t <sub>CW2</sub>		60	—	ns
Address enable time	t <sub>AW</sub>		60	—	ns
Address setup time	t <sub>AS</sub>		0	—	ns
Write pulse width	t <sub>WP</sub>		55	—	ns
Address hold time	t <sub>WR</sub>		0	—	ns
Input data setup time	t <sub>DW</sub>		30	—	ns
Input data hold time	t <sub>DH</sub>		0	—	ns
WE Output floating	t <sub>WHZ</sub>	*2	—	30	ns
WE Output setup time	t <sub>OW</sub>		5	—	ns

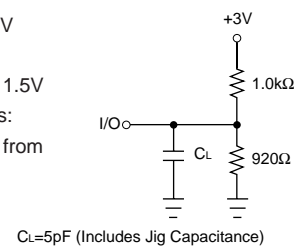
#### \*1 Test Conditions

1. Input pulse level: 0.4V to 2.4V
2. t<sub>r</sub> = t<sub>f</sub> = 5ns
3. Input and output timing reference levels : 1.5V
4. Output load C<sub>L</sub> = 100pF

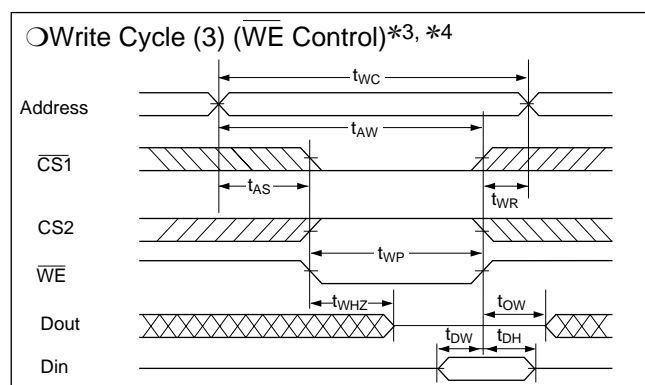
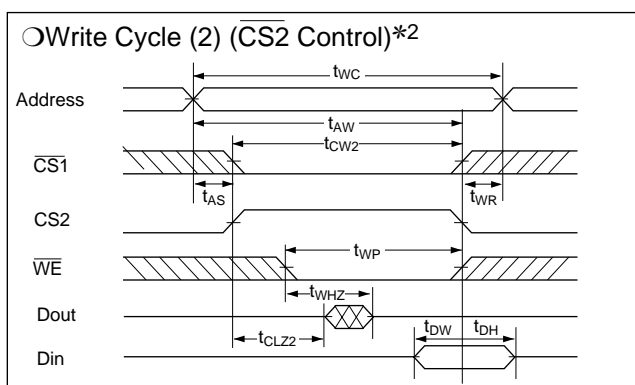
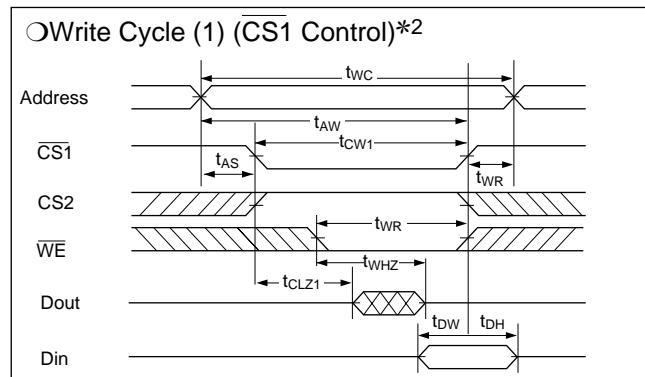
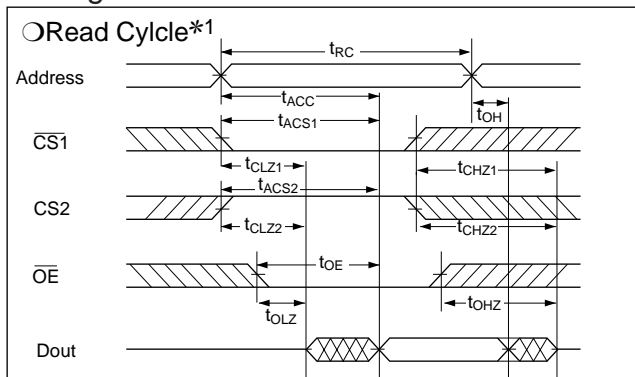


#### \*2 Test Conditions

1. Input pulse level : 0.4V to 2.4V
2. t<sub>r</sub> = t<sub>f</sub> = 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 C<sub>L</sub> = 5pF



## ● Timing chart



Note : 1. During read cycle time,  $\overline{WE}$  is to be "H" level.

2. During write cycle time that is controlled by  $\overline{CS1}$  or  $\overline{CS2}$ , Output Buffer is in high impedance state, whether  $\overline{OE}$  level is "H" or "L".

3. During write cycle time that is controlled by  $\overline{WE}$ , Output Buffer is high impedance state if  $\overline{OE}$  is "H" level.

4. When I/O terminals are output mode, be careful that do not give the opposite signals to the I/O terminals.

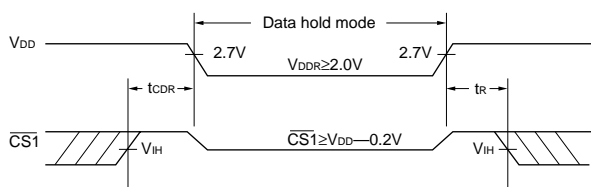
## ● DATA RETENTION CHARACTERISTIC WITH LOW VOLTAGE POWER SUPPLY

( $V_{SS} = 0V$ ,  $T_a = -25$  to  $85^\circ C$ )

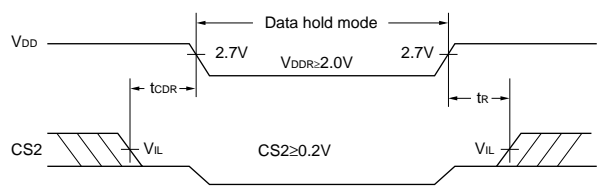
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Data retention Supply voltage	$V_{DDR}$		2.0	—	3.6	V
Data retention current	$I_{DDR}$	$V_{DD} = 2.7V$ $\overline{CS1} = \overline{CS2} \geq V_{DD} - 0.2V$ or $\overline{CS2} \leq 0.2V$	LL	—	0.5*	$\mu A$
			SL	—	0.25*	
Chip select data hold time	$t_{CDR}$		0	—	—	ns
Operation recovery time	$t_R$		5	—	—	ms

\* $T_a = 25^\circ C$

### Data retention timing (CS1 Control)



### Data retention timing (CS2 Control)



\* when retaining data in standby mode, supply voltage can be lowered with in a certain range. But read or write cycle cannot be performed while the supply voltage is low.

## ■ FUNCTIONS

### ● Truth Table

$\overline{CS1}$	CS2	$\overline{OE}$	$\overline{WE}$	DATA I/O	Mode	$I_{DD}$
H	X	X	X	Hi-Z	Unselected	$I_{DDs}, I_{DDs1}$
X	L	X	X	Hi-Z	Unselected	$I_{DDs}, I_{DDs1}$
L	H	X	L	Input data	Write	$I_{DDO}$
L	H	L	H	Output data	Read	$I_{DDO}$
L	H	H	H	Hi-Z	Output disable	$I_{DDO}$

X : "H" or "L"

### ● Reading data

Data is able to be read when the address is set while holding  $\overline{CS1} = "L"$ , CS2 = "H",  $\overline{OE} = "L"$  and  $\overline{WE} = "H"$ . Since DATA I/O terminals are in high impedance state when  $\overline{OE} = "H"$ , the data bus line can be used for any other objective, then access time apparently is able to be cut down.

### ● Writing data

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

- (1) Hold CS2 = "H",  $\overline{WE} = "L"$ , set addresses and give "L" pulse to  $\overline{CS1}$ .
- (2) Hold  $\overline{CS1} = "L"$ ,  $\overline{WE} = "L"$ , set addresses and give "H" pulse to CS2.
- (3) Hold  $\overline{CS1} = "L"$ , CS2 = "H", set addresses and give "L" pulse to  $\overline{WE}$ .
- (4) After setting addresses, give "L" pulse to  $\overline{CS1}$ ,  $\overline{WE}$  and give "H" pulse to CS2.

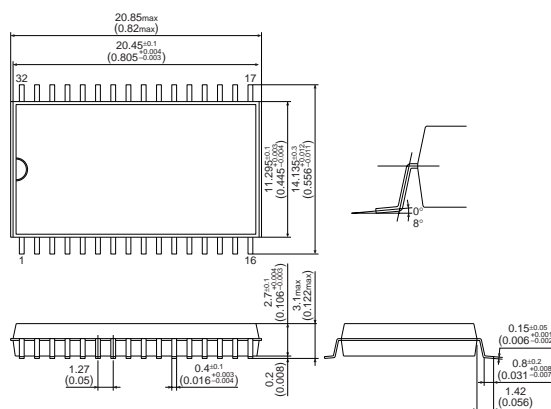
Anyway, data on the Data I/O terminals are latched up into the SRM20V100LLMX7 at the end of the period that  $\overline{CS1}$ ,  $\overline{WE}$  are "L" level, and CS2 is "H" level. As Data I/O terminals are in high impedance state when any of  $\overline{CS1}$ ,  $\overline{OE} = "H"$ , or CS2 = "L", the contention on the data bus can be avoided.

### ● Standby mode

When  $\overline{CS1}$  is "H" or CS2 is "L" level, the SRM20V100LLMX7 is in the standby mode which has retaining data operation. In this case Data I/O terminals are Hi-Z, and all inputs of addresses,  $\overline{WE}$  and data can be any "H" or "L". When CS1 and  $\overline{CS2}$  level are in the range over  $V_{DD}-0.2V$ , CS2 level is in the range under 0.2V, in the SRM20V100LLMX7 there is almost no current flow except through the high resistance parts of the memory.

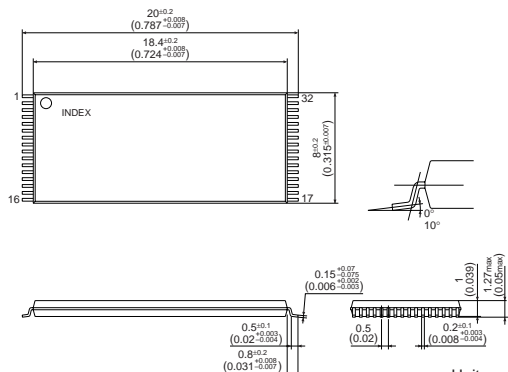
## ■ PACKAGE DIMENSIONS

Plastic SOP6-32pin



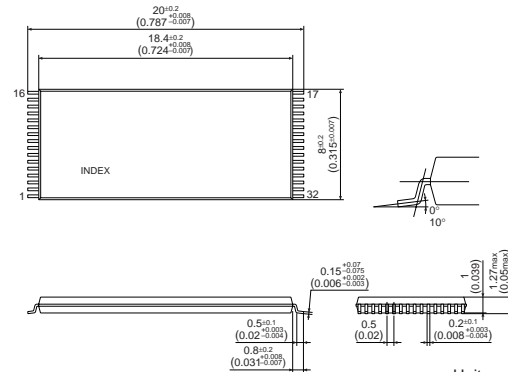
Unit : mm  
(inch)

Plastic TSOP ( I ) -32pin



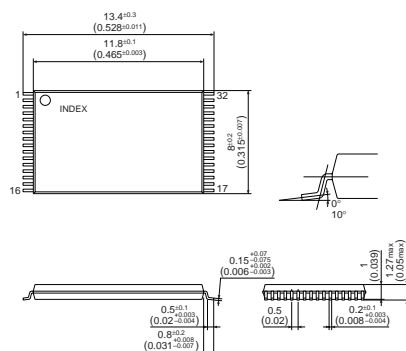
Unit : mm  
(inch)

Plastic TSOP ( I ) -32pin-R1



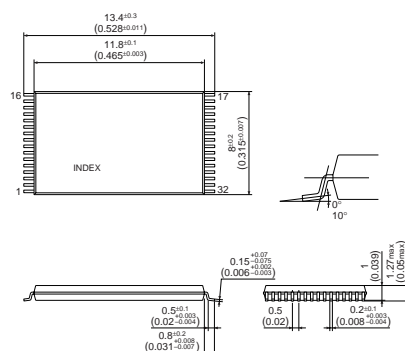
Unit : mm  
(inch)

Plastic Slim-TSOP ( I ) -32pin



Unit : mm  
(inch)

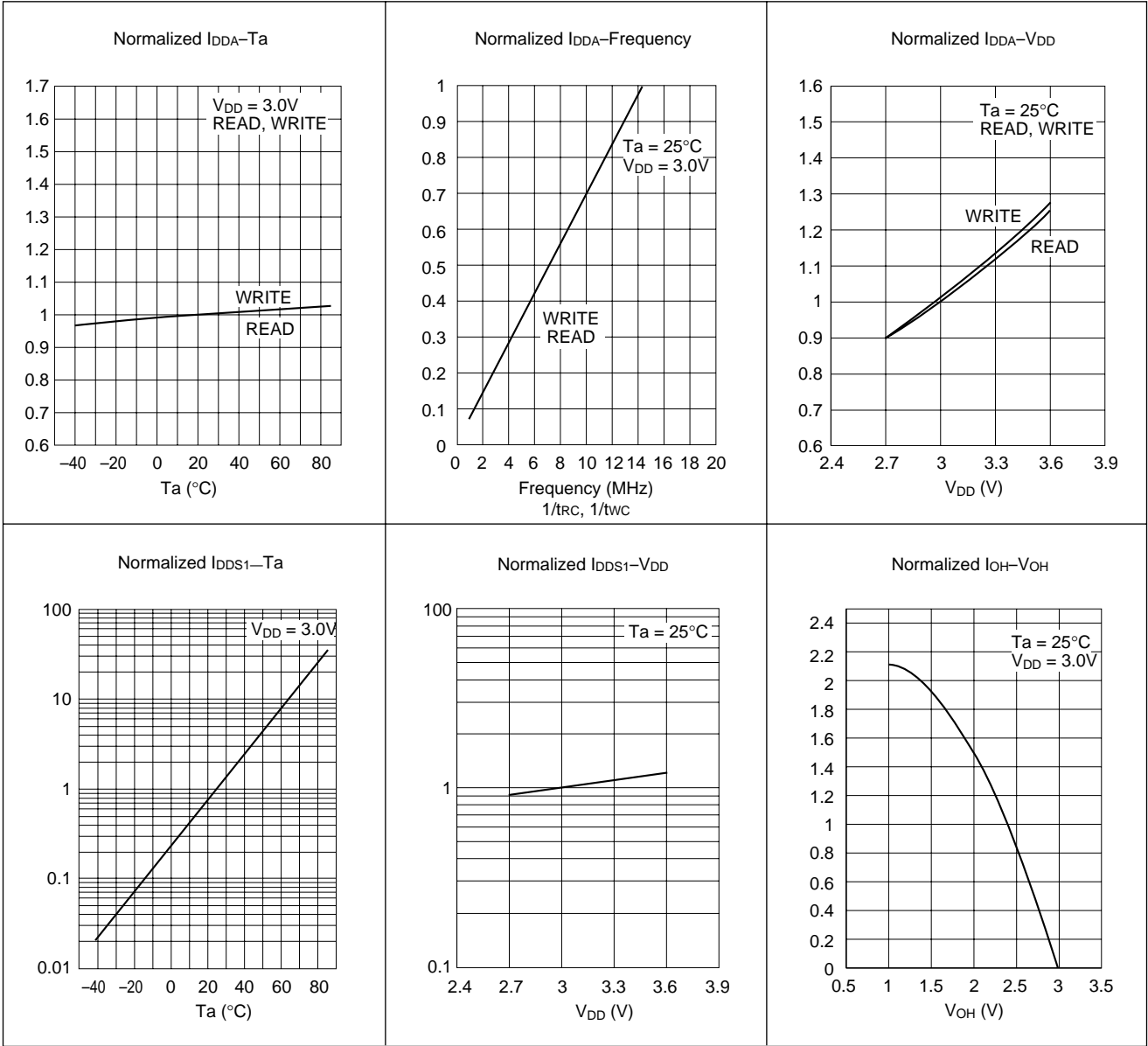
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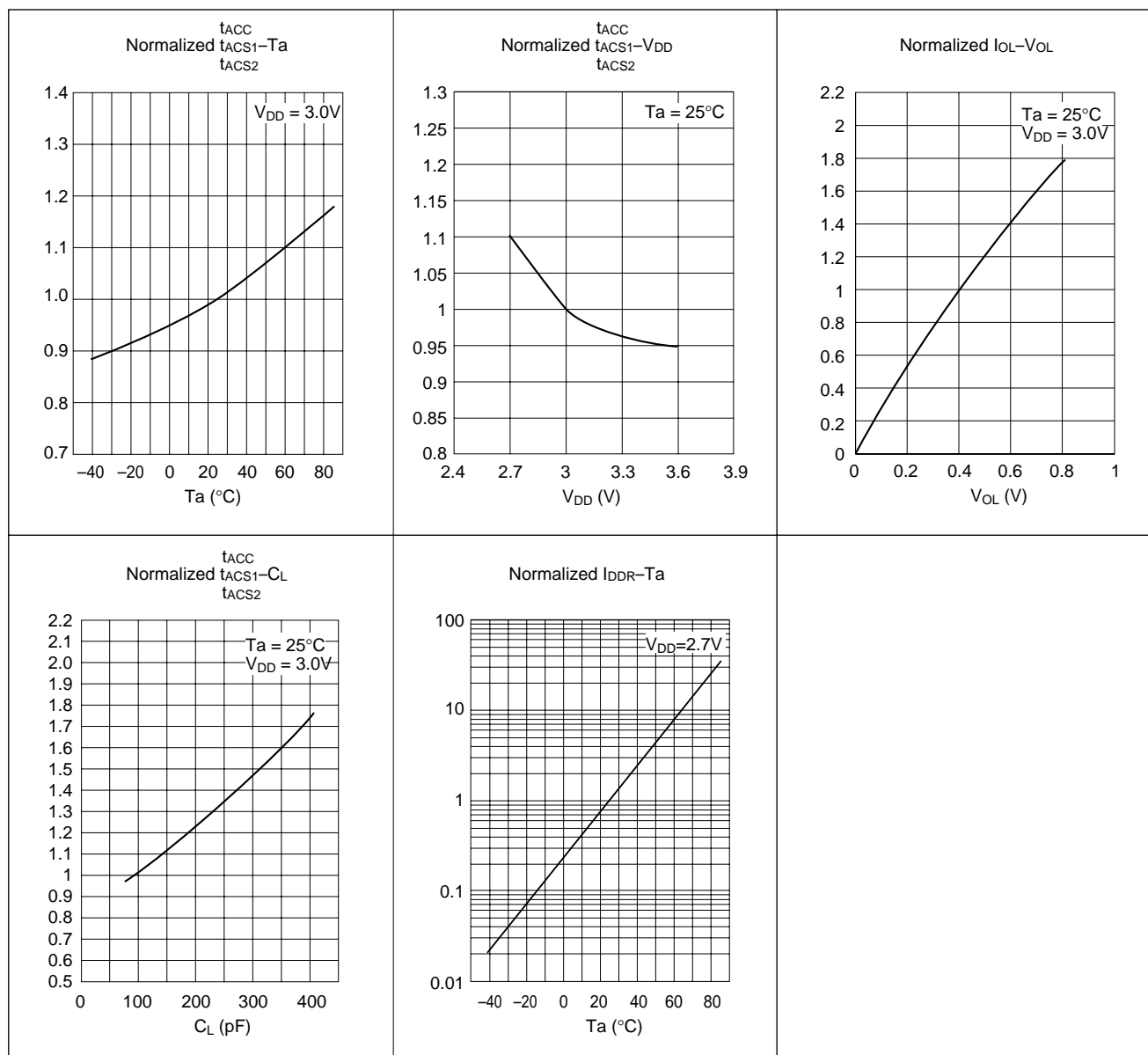


Unit : mm  
(inch)

# SRM20V100LLMX7

## CHARACTERISTICS CURVES





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