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SHARP

INTEGRATED CIRCUITS GROUP
SHARP CORPORATION

SPECIFICATION

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REPRESENTATIVE DEPARTMENT

DEVICE SPECIFICATION FOR

16K CMOS STATIC RAM (2,048 X 8bit)
MODEL No.

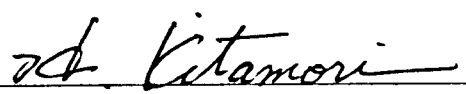
LH5116NA-10

CUSTOMERS APPROVAL

DATE

BY

PRESENTED
BY



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1. General Description

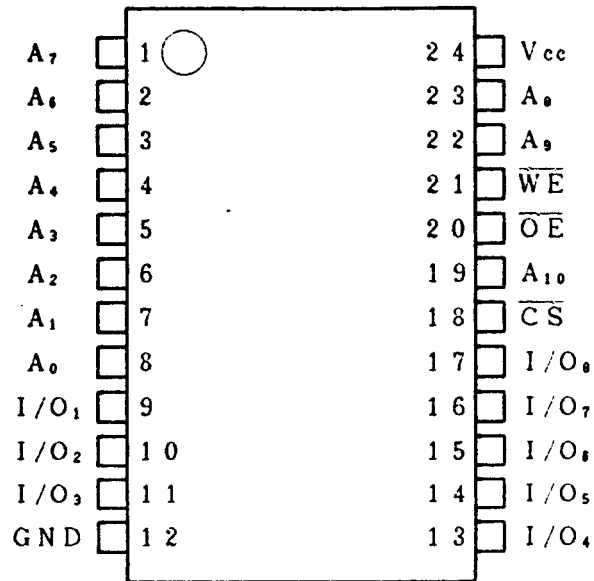
The LH5116NA-10 is a static RAM organized as 16,384(2,048 word x 8bit) fabricated with a CMOS silicon gate process.

It's main features include:

Features

- Access time (MAX.) and dissipation current (MAX.)
100 ns / 40 mA
- Single 5 V power supply ($5 V \pm 10\%$)
- Full static operation requiring no clock and refresh cycle
- All input and output TTL compatible
- Three state output
- Pin configuration is compatible with industry standard
16K EPROM/MASK ROM
- Standard 24-pin Small-Outline Package (SOP)

2. Pin Configuration

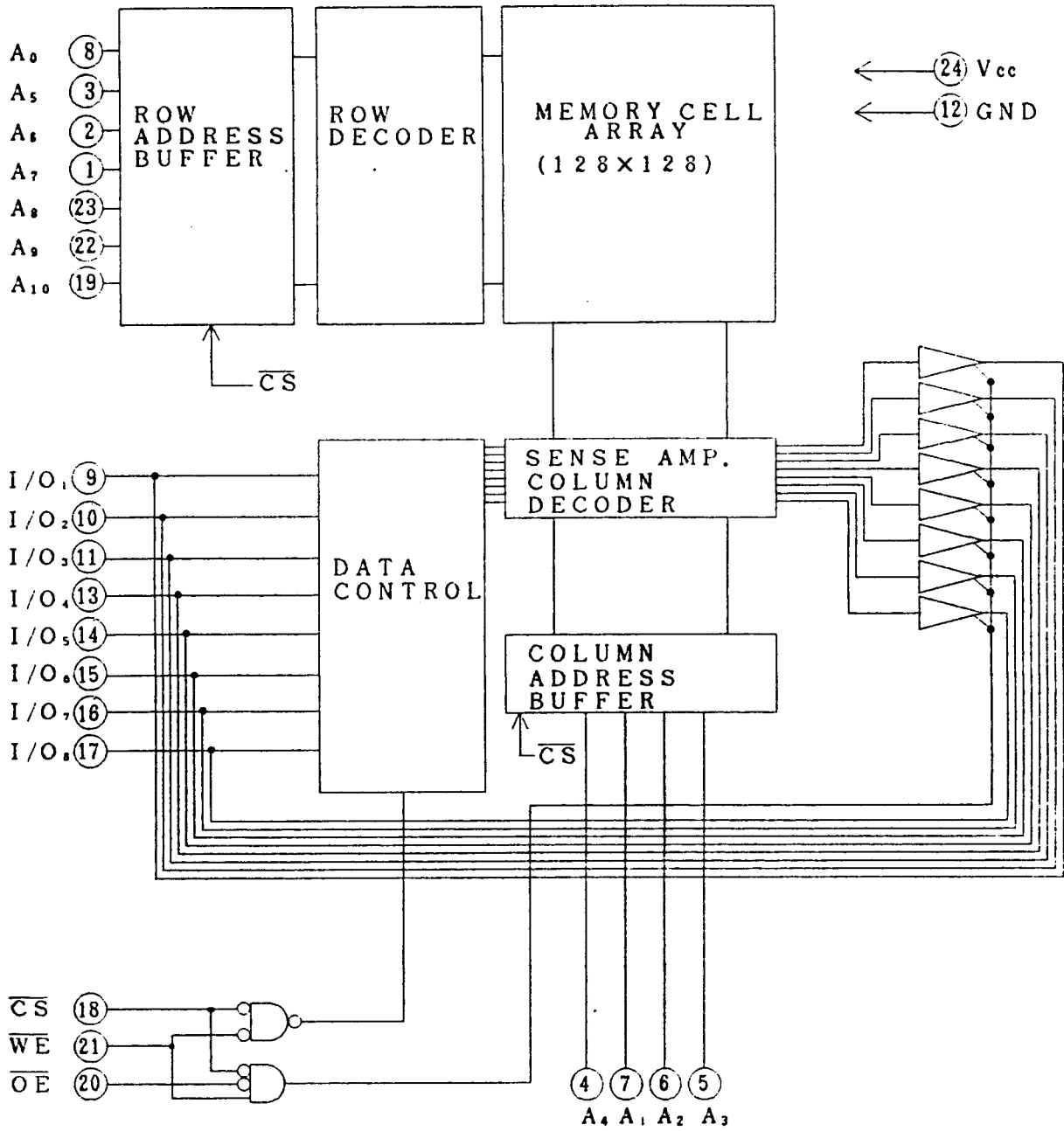


Pin name	Signal
A ₀ ~ A ₁₀	Address input
\overline{CS}	Chip select
\overline{OE}	Output enable
\overline{WE}	Write enable
I/O ₁ ~ I/O ₈	Data input/output
V _{CC}	Power supply
GND	Ground

3. Operating Mode

\overline{CS}	\overline{WE}	\overline{OE}	Mode	I/O ₁ ~ I/O ₈	Supply current
H	X	X	Deselect	High impedance	Standby (I _{CC} L)
L	L	X	Write	Data input	Operating(I _{CC})
L	H	L	Read	Data output	Operating(I _{CC})
L	X	H	Output disable	High impedance	Operating(I _{CC})

4. Block Diagram



5. Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V _{CC}	-0.3~+7.0	V
Input voltage	V _{IN}	-0.3~V _{CC} +0.3	V
Operating temperature	T _{opr}	0~+70	°C
Storage temperature	T _{str}	-55~+150	°C

6. DC Electrical Characteristics

V_{CC}=5V±10%, T_a=0~+70°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input "LOW" voltage	V _{IL}		-0.3		0.8	V
Input "HIGH" voltage	V _{IH}		2.2		V _{CC} +0.3	V
Output "LOW" voltage	V _{OL}	I _{OL} =2.1mA			0.4	V
Output "HIGH" voltage	V _{OH}	I _{OH} =-1.0mA	2.4			V
Input leakage current	I _{LI}	V _{IN} =0~V _{CC}			1.0	μA
Output leakage current	I _{LO}	$\overline{CS} = V_{IH}, V_{I/O} = 0V \sim V_{CC}$			1.0	μA
Dissipation current 1	I _{CC1}	$\overline{CS} = 0V$, other input is 0V~V _{CC} , I _{I/O} =0mA, ($\overline{OE} = V_{CC}$)		2.5	3.0	mA
Dissipation current 2	I _{CC2}	$\overline{CS} = V_{IL}$, other input is V _{IL} ~V _{IH} , I _{I/O} =0mA, ($\overline{OE} = V_{IH}$)		3.0	4.0	mA
Standby Dissipation current	I _{CCL}	$\overline{CS} \geq V_{CC} - 0.2V$ other input is 0V~V _{CC}			1.0	μA
					0.2*	μA

Note)* T_a=25°C

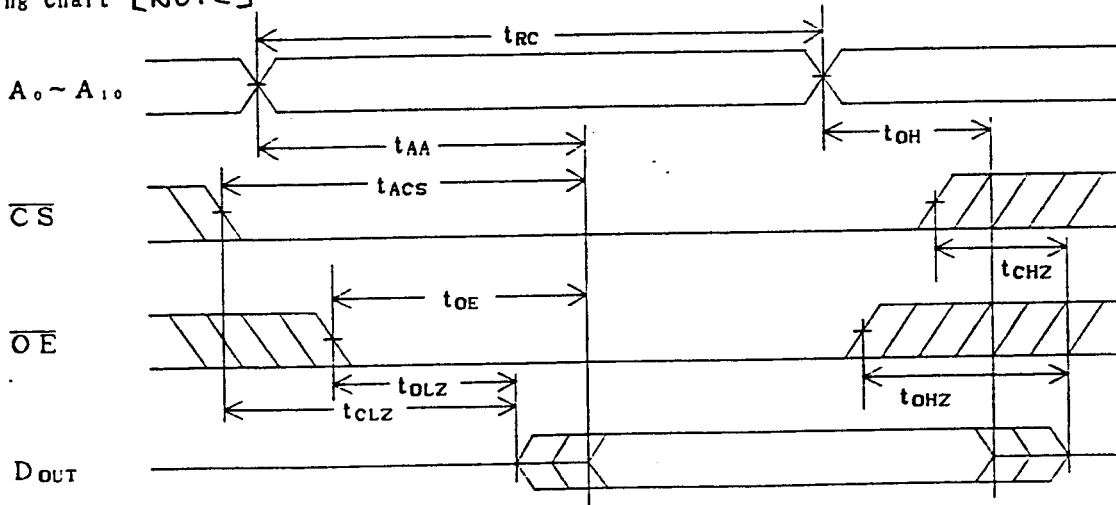
7. AC Characteristics

Read cycle

$V_{CC} = 5V \pm 10\%$, $T_a = 0 \sim +70^\circ C$

Parameter	Symbol	MIN	MAX	Unit
Read cycle time	t_{RC}	100		ns
Address access time	t_{AA}		100	ns
Chip enable access time	t_{ACS}		100	ns
Output floating hold time with respect to chip select	t_{CLZ}	10		ns
Output enable access time	t_{OE}		40	ns
Output floating hold time with respect to output enable	t_{OLZ}	10		ns
Output floating time with respect to chip select	t_{CHZ}	0	40	ns
Output floating time with respect to output enable	t_{OHZ}	0	40	ns
Previous read data valid with respect to address change	t_{OH}	10		ns

Timing Chart [NOTE]



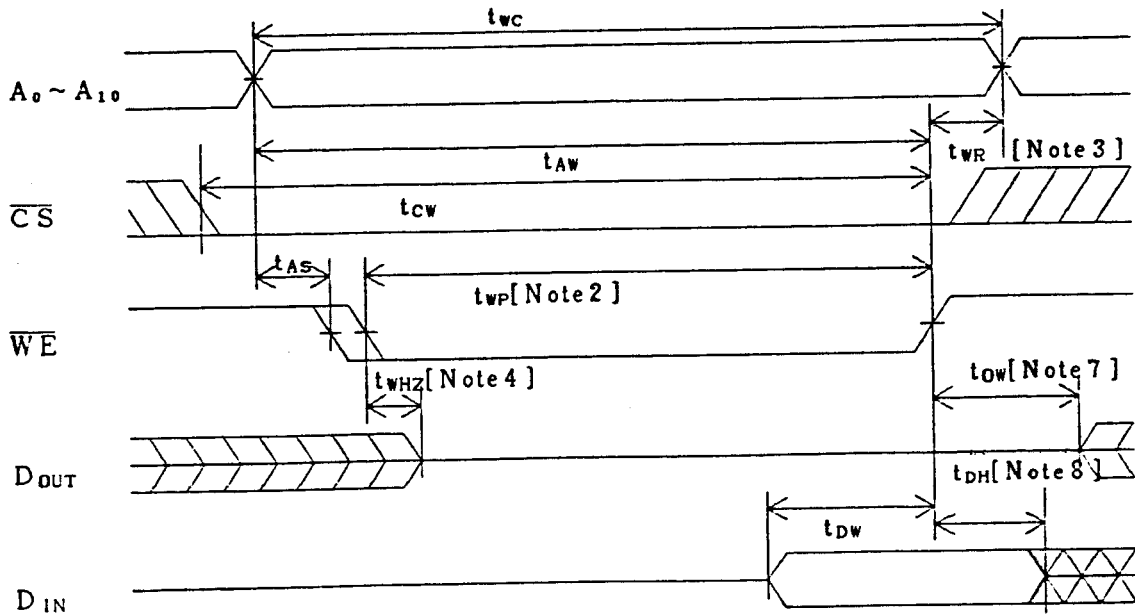
Note) \overline{WE} is "High" level during the read cycle

Write Cycle

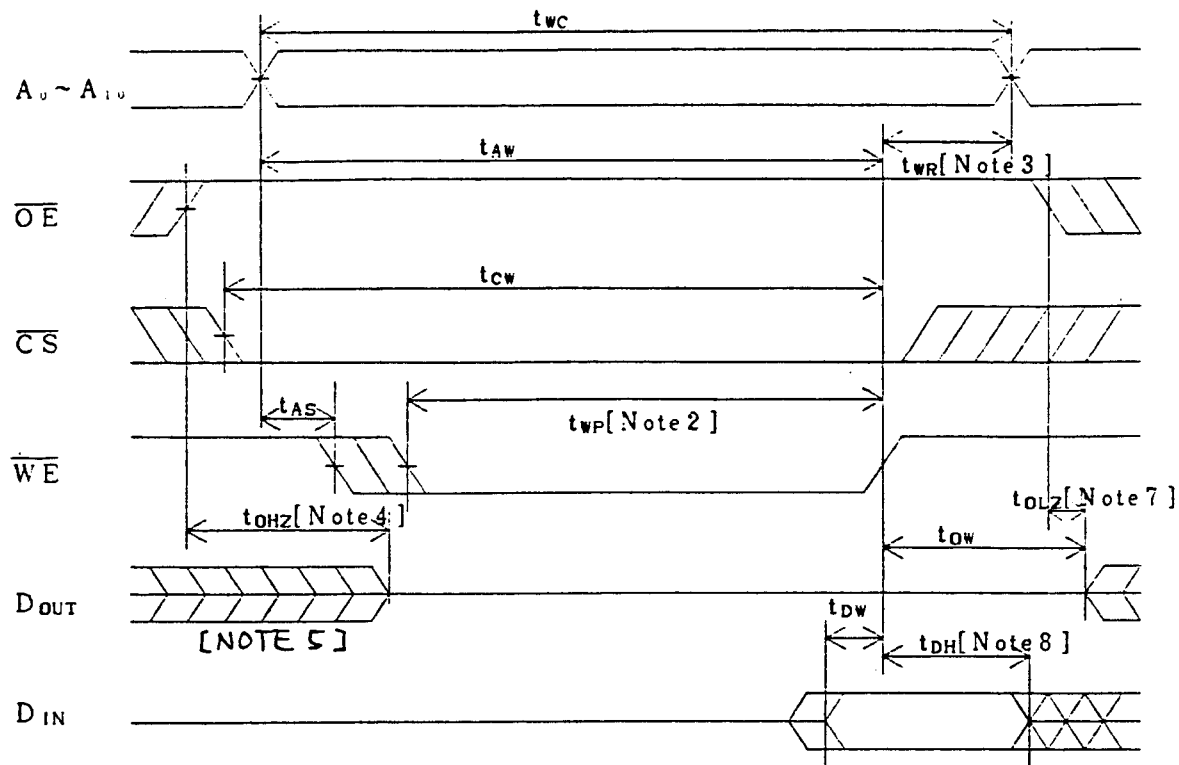
$V_{CC} = 5V \pm 10\%$, $T_a = 0 \sim +70^\circ C$

Parameter	Symbol	MIN	MAX	Unit
Write cycle	t _{wc}	100		ns
Chip enable to write	t _{cw}	80		ns
Write delay	t _{AW}	80		ns
Address setup time	t _{AS}	0		ns
Write pulse width	t _{wP}	60		ns
Write recovery	t _{wR}	10		ns
Output floating time with respect to write pulse	t _{WHZ}		30	ns
Data setup time	t _{DW}	30		ns
Data hold time	t _{DH}	10		ns
Output floating time with respect to write	t _{OW}	10		ns
Output hold time with respect to output enable	t _{OHZ}		40	ns

Timing Chart(No.1)[Note1,6]



Timing Chart (No.2) [Note 1]



[NOTE]

- \overline{WE} must be High when $A_0 \sim A_{10}$ switch between high and low.
- Write cycle occurs during a overlapping period of $\overline{CS} = \text{Low}$ and $\overline{WE} = \text{Low}(t_{wp})$.
- t_{wr} represents the time interval between the earliest rising edge of \overline{CS} or \overline{WE} and the end of write cycle.
- Since during this period, I/O pins assume output state, no input signal 180° out of phase with an output signal is admitted.
- If the rising edge of \overline{CS} occurs simultaneously with or after the falling edge of \overline{WE} the output buffer assume high impedance state.
- \overline{OE} must be kept Low level.
- D_{OUT} generates data in phase with input data for the write cycle.
- If both \overline{CS} remain Low during this period, I/O pins assume output state. At this point, no data input signal 180° out of phase with an output signal.

1. Package Outline Specification

A

Refer to drawing No. A A 9 4 1 - 0 0 1

2. Markings**2-1. Marking contents**

(1) Product name : LH5116NA-10

(2) Company name : SHARP

(3) Date code

(Example) 88 29 xxx-- Indicates the product was manufactured
in the 29th week of 1988.

| | | L--> Denotes the production ref.code (1~3)

| | | L-----> Denotes the production week.
(01,02,03, 52,53)| | | L-----> Denotes the production year.
(Lower two digit of the year.)

(4) The marking of " JAPAN " indicates the country of origin.

2-2. Marking position

Refer drawing No. A A 9 4 1 - 0 0 1

2-3. Marking color

Silver

3. Packing Specification**3-1. Packing materials**

Material Name	Material Specification	Purpose
Magazine	Anti-static treated plastic (30devices /magazine)	Packing of device
Stopper	Plastic or rubber	Fixing of device
Label	Paper	Indication of product name,quantity and date of manufacture.
Inner case	Cardboard (1200devices/case)	Fixing of magazine
Outer case	Cardboard	Outer packing of magazine

3-2. External Appearance of Packing

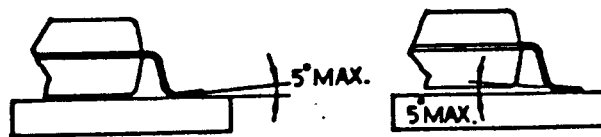
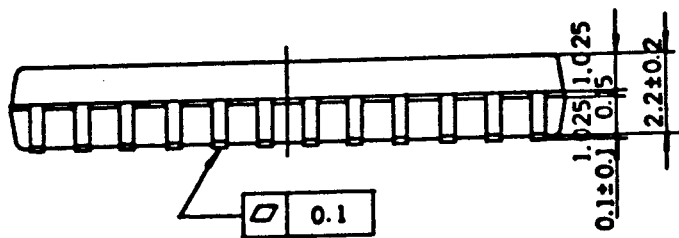
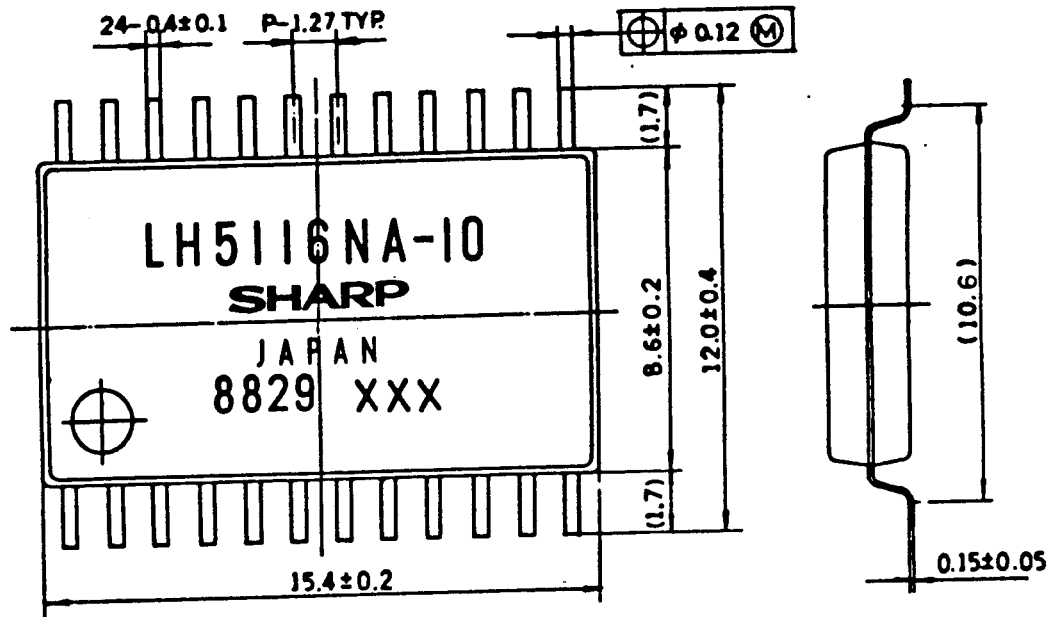
Refer to drawing No. B J 2 0 0 - 0 1 1

4. Precaution For Unpacking(1) Unpacking should be done on the stand as well as human body treated with
anti-ESD .

(2) Anti-ESD treatment is given to a magazine.

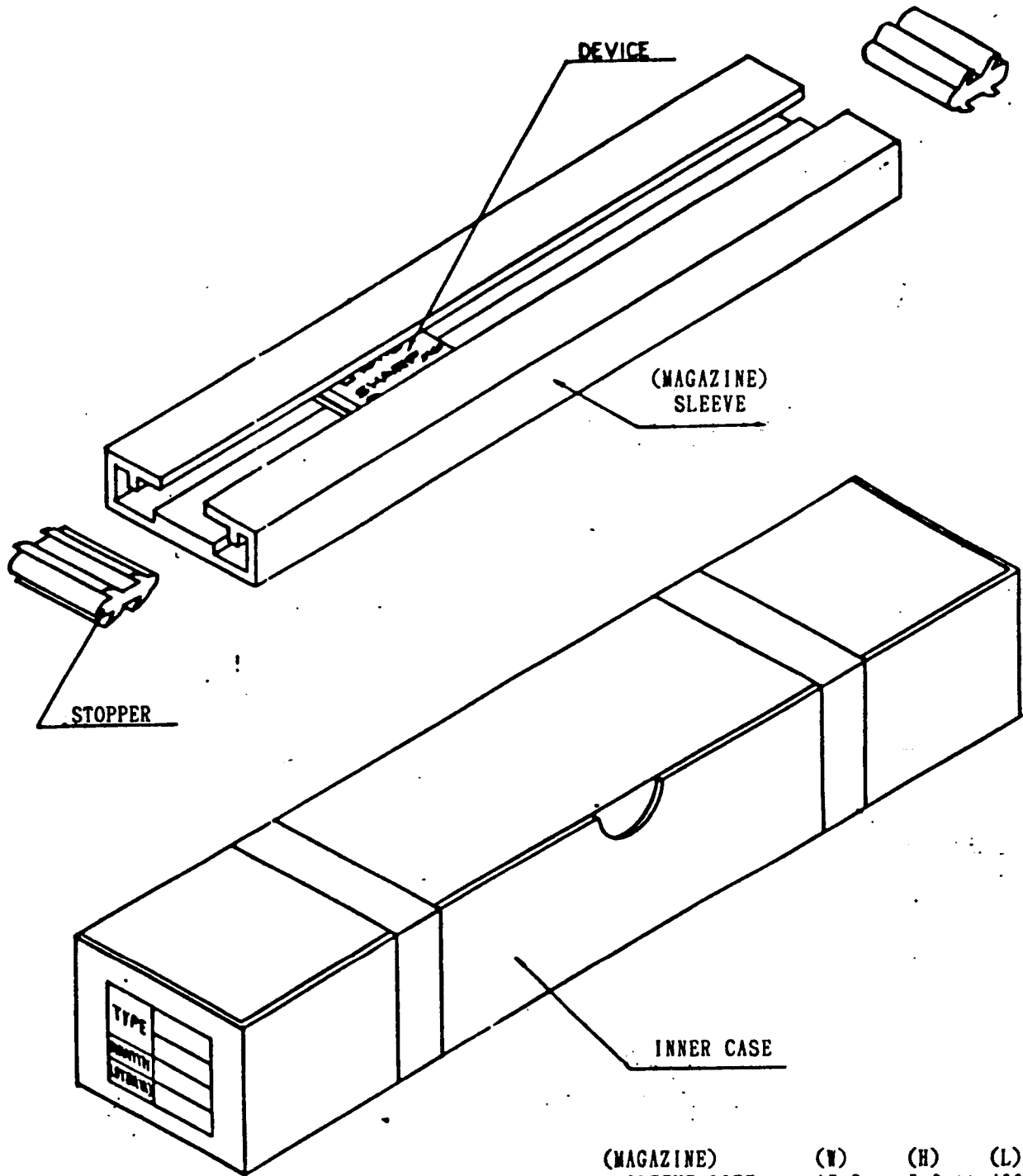
Use the equivalent magazine , if it is changed to another one.

(3) Be sure to fix two stoppers to both ends of a magazine when storage to
prevent the devices from slipping.



Plastic body dimensions do not include burr of resin.

適用機種 APPLICABLE MODEL		LH5116NA		尺度 SCALE	5 / 1	單位 UNIT	1 = 1 / 1mm	△			
板厚 THICKNESS		数量 PIECES		材質 MATERIAL		仕上 FINISH		名称 NAME			
						TIN PLATING		SOT24BP			
日付 DATE		'88. 7. 12		設計 DESIGN		製図 DRAW		工程 TRACE		検査 CHECK	
				SHARP CORPORATION		IC		コード CODE			
				SHARP CORPORATION				図番 DRAWING No.		AA941-001	



(MAGAZINE) SLEEVE SIZE : (W) 17.5 (H) 5.6 (L) 490
 CASE SIZE : (W) 80 (H) 62 (L) 510

適用機種 APPLICABLE MODEL		尺規 SCALE		單位 UNIT		△			
LH5116NA		/		1 = 1/1 mm		△			
板厚 THICKNESS		枚数 PIECES		材質 MATERIAL		仕上 FINISH		名称 NAME	
								28SOP, 24SOP EXTERNAL APPEARANCE OF PACKING	
日付 DATE		'88. 7 . 12		設計者 DESIGNER		I.C. 番号 NO.		コード CODE	
設計 DESIGN		描圖 DRAW		校核 CHECK		承認 APPROVE			
SHARP CORPORATION								図番 DRAWING NO.	
								BJ 2 0 : 0 - 0 1 1 1	

AC Characteristics Test Conditions

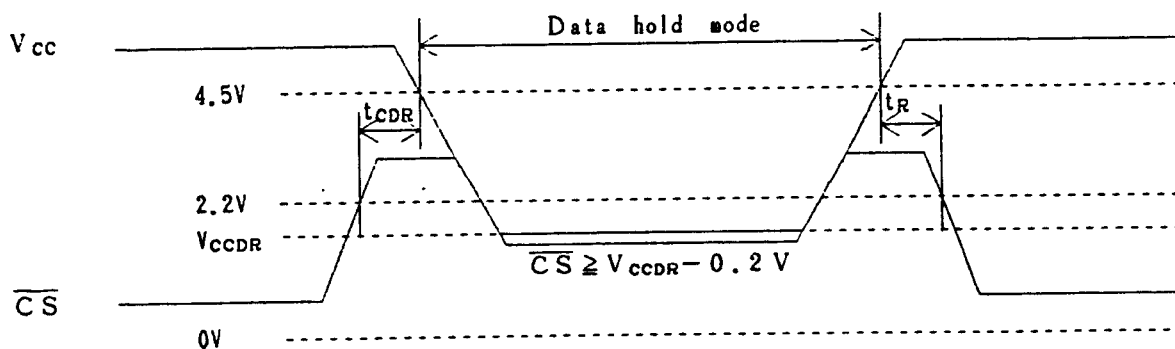
項目	条件
Input pulse level	$V_{IN} = 2.2V, V_{IL} = 0.8V$
Input rise and fall time	10 ns
I/O timing reference level	1.5 V
Output load	100 pF + 1 TTL

8. Data Hold Characteristics at Low Supply voltage

$T_a = 0 \sim +70^\circ\text{C}$

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Data hold supply voltage	V_{CCDR}	$\overline{CS} \geq V_{CCDR} - 0.2V$	2.0			V
Data hold supply current	I_{CCDR}	$\overline{CS} \geq V_{CCDR} - 0.2V$ $V_{CCDR} = 2V$			1.0 0.2**	μA μA
Chip Select Setup time	t_{CDR}		0			ns
Chip Select Hold time	t_R		t_{RC}^*			ns

Note *Read cycle time **at $T_a = 25^\circ\text{C}$



9. Pin Capacitances

$T_a = 25^\circ\text{C}, f = 1\text{MHz}$

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
Input capacitance	C_I	$V_I = 0V$			7	pF
I/O capacitance	$C_{I/O}$	$V_{I/O} = 0V$			10	pF

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