

LH5116NA-10F

16K SRAM

(Model Number: LH5116NC)

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To: _____

S P E C I F I C A T I O N S

Product Type _____ 16k SRAM _____

LH5116NA-10F

Model No. _____ (LH5116NC) _____

*This specifications contains 20 pages including the cover and appendix.
If you have any objections, please contact us before issuing purchasing order.

CUSTOMER ACCEPTANCE

DATE: _____

BY: _____

PRESENTED

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 - Instrumentation and measuring equipment
 - Machine tools
 - Audiovisual equipment
 - Home appliances
 - Communication equipment other than for trunk lines
 - (2) Those contemplating using the products covered herein for the following equipment which demands high reliability, should first contact a sales representative of the company and then accept responsibility for incorporating into the design fail-safe operation, redundancy, and other appropriate measures for ensuring reliability and safety of the equipment and the overall system.
 - Control and safety devices for airplanes, trains, automobiles, and other transportation equipment
 - Mainframe computers
 - Traffic control systems
 - Gas leak detectors and automatic cutoff devices
 - Rescue and security equipment
 - Other safety devices and safety equipment, etc.
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1. Description

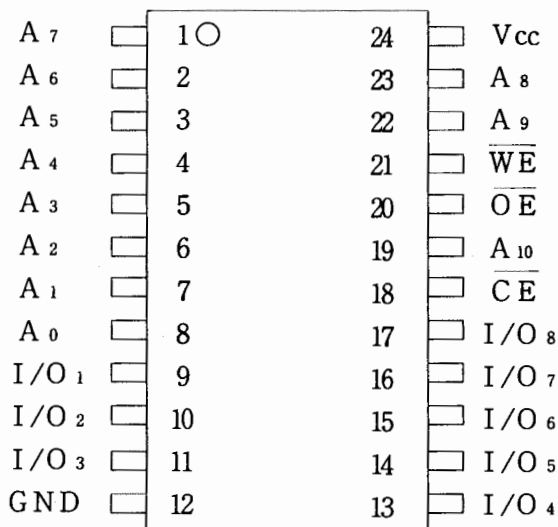
The LH5116NA-10F is a static RAM organized as 2,048 × 8 bit with provides low-power standby mode.

It is fabricated using silicon-gate CMOS process technology.

Features

- Access Time 100 ns (Max.)
- Operating current 40 mA (Max.)
- Standby current 1.0 μA (Max.)
- Data retention current 0.2 μA (Max. V_{CCDR} = 2V, T_a = 25°C)
- Wide operating voltage range 4.5 V to 5.5 V
- Operating temperature 0°C to +70°C
- Fully static operation
- Three-state output
- Not designed or rated as radiation hardened
- 24 pin SOP (SOP24-P-450) plastic package
- P-type bulk silicon

2. Pin Configuration



(Top View)

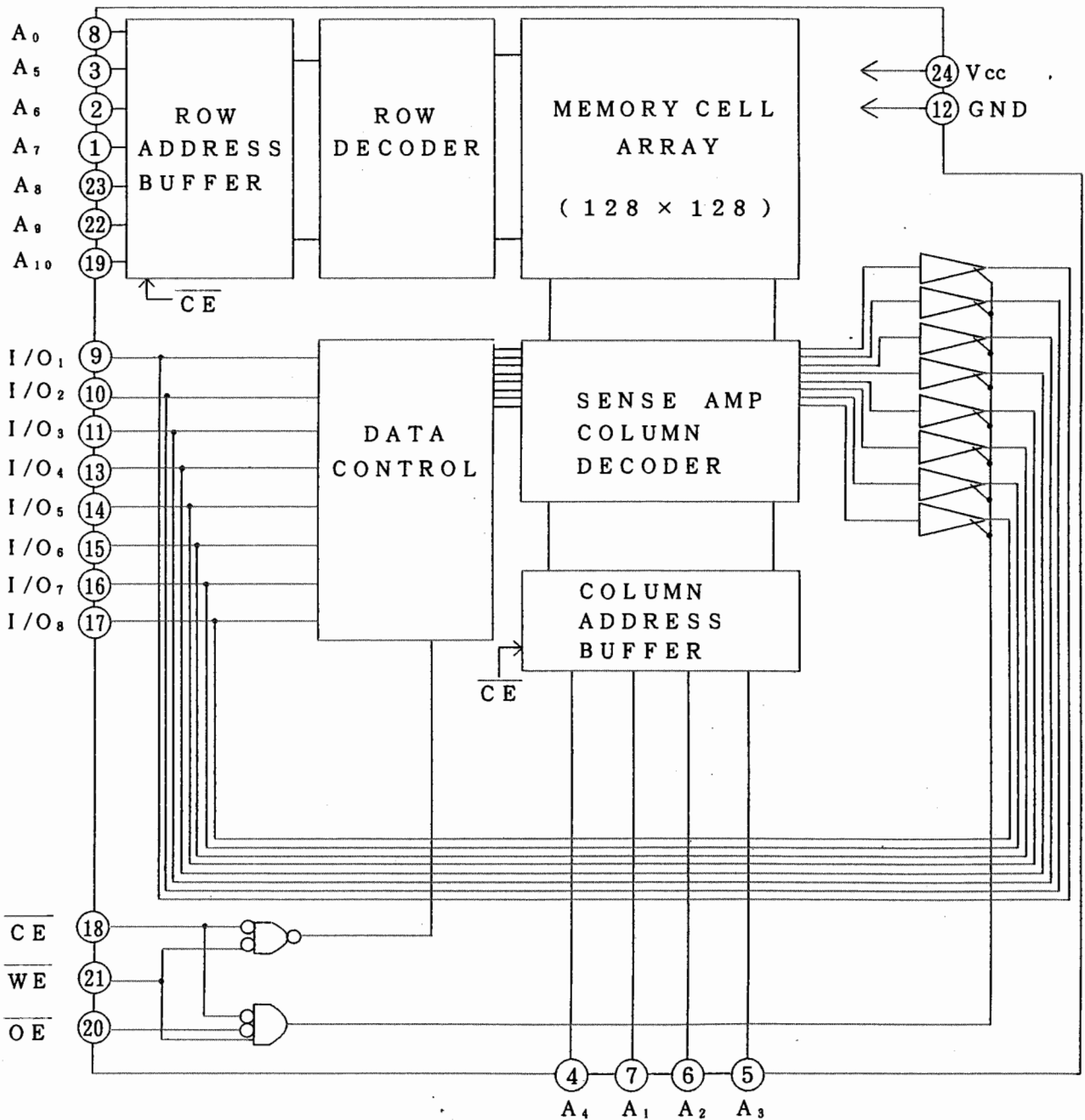
Pin Name	Function
A ₀ to A ₁₀	Address inputs
\overline{CE}	Chip enable
\overline{WE}	Write enable
\overline{OE}	Output enable
I/O ₁ to I/O ₈	Data inputs/outputs
V _{cc}	Power supply
GND	Ground

3. Truth Table

\overline{CE}	\overline{WE}	\overline{OE}	Mode	I/O ₁ to I/O ₈	Supply current
H	*	*	Standby	High impedance	Standby (I _{SB})
L	H	L	Read	Data output	Active (I _{CC})
L	*	H	Output disable	High impedance	Active (I _{CC})
L	L	*	Write	Data Input	Active (I _{CC})

(* = Don't Care, L=Low, H=High)

4. Block Diagram



5. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply voltage(*1)	V _{CC}	-0.3 to +7.0	V
Input voltage(*1)	V _{IN}	-0.3(*2) to V _{CC} +0.3	V
Operating temperature	T _{OPR}	0 to +70	°C
Storage temperature	T _{STG}	-55 to +150	°C

Note) *1. The maximum applicable voltage on any pin with respect to GND.

*2. Undershoot of -3.0V is allowed width of pulse below 50ns.

6. Recommended DC Operating Conditions

(T_a = 0°C to +70°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V _{CC}	4.5	5.0	5.5	V
Input voltage	V _{IH}	2.2		V _{CC} +0.3	V
	V _{IL}	-0.3(*3)		0.8	V

Note) *3. Undershoot of -3.0V is allowed width of pulse below 50ns.

7. DC Electrical Characteristics

(T_a = 0°C to +70°C, V_{CC} = 4.5V to 5.5V)

Parameter	Symbol	Conditions	Min.	Typ. (*4)	Max.	Unit
Input leakage current	I _{LI}	V _{IN} = 0V to V _{CC}	-1.0		1.0	μA
Output leakage current	I _{LO}	$\overline{CE} = V_{IH}$ V _{I/O} = 0V to V _{CC}	-1.0		1.0	μA
Operating supply current	I _{CC1}	$\overline{CE} = 0V$, Other input is 0V to V _{CC} I _{I/O} = 0mA, ($\overline{OE} = V_{CC}$)		25	30	mA
	I _{CC2}	$\overline{CE} = V_{IL}$, Other input is V _{IL} to V _{IH} I _{I/O} = 0mA, ($\overline{OE} = V_{IH}$)		30	40	mA
Standby current	I _{SB}	$\overline{CE} \geq V_{CC} - 0.2V$			0.2	μA
		Other input is 0V to V _{CC}			1.0	μA
Output voltage	V _{OL}	I _{OL} = 2.1mA			0.4	V
	V _{OH}	I _{OH} = -1.0mA	2.4			V

Note) *4. Typical values at V_{CC} = 5.0V, T_a = 25°C.

8. AC Electrical Characteristics

AC Test Conditions

Input pulse level	0.8 V to 2.2 V
Input rise and fall time	10 ns
Input and Output timing Ref. level	1.5 V
Output load	1 TTL + C _L (100 pF) (*5)

Note) *5. Including scope and jig capacitance.

Read cycle

(T_a = 0 °C to +70 °C, V_{cc} = 4.5 V to 5.5 V)

Parameter	Symbol	Min.	Max.	Unit	
Read cycle time	t _{RC}	100		ns	
Address access time	t _{AA}		100	ns	
CE access time	t _{ACE}		100	ns	
Output enable to output valid	t _{OE}		40	ns	
Output hold from address change	t _{OH}	10		ns	
CE Low to output active	t _{CLZ}	10		ns	*6
OE Low to output active	t _{OLZ}	10		ns	*6
CE High to output in High impedance	t _{CHZ}	0	40	ns	*6
OE High to output in High impedance	t _{OHZ}	0	40	ns	*6

Write cycle

(T_a = 0 °C to +70 °C, V_{cc} = 4.5 V to 5.5 V)

Parameter	Symbol	Min.	Max.	Unit	
Write cycle time	t _{WC}	100		ns	
CE Low to end of write	t _{CW}	80		ns	
Address valid to end of write	t _{AW}	80		ns	
Address setup time	t _{AS}	0		ns	
Write pulse width	t _{WP}	60		ns	
Write recovery time	t _{WR}	10		ns	
Input data setup time	t _{DW}	30		ns	
Input data hold time	t _{DH}	10		ns	
WE High to output active	t _{OW}	10		ns	*6
WE Low to output in High impedance	t _{WHZ}	0	30	ns	*6
OE High to output in High impedance	t _{OHZ}	0	40	ns	*6

Note) *6. Active output to High impedance and High impedance to output active tests specified for a ±200mV transition from steady state levels into the test load.

9. Data Retention Characteristics

(Ta= 0°C to +70°C)

Parameter	Symbol	Conditions	Min.	Typ. (*7)	Max.	Unit
Data Retention supply voltage	V _{CCDR}	$\overline{CE} \geq V_{CCDR} - 0.2V$	2.0		5.5	V
Data Retention supply current	I _{CCDR}	V _{CCDR} = 2.0V			0.2	μA
		$\overline{CE} \geq V_{CCDR} - 0.2V$			1.0	μA
Chip enable setup time	t _{CDR}		0			ns
Chip enable hold time	t _R		(*8) t _{RC}			ns

Note) *7. Typical values at Ta=25°C

*8. Read Cycle

10. Pin Capacitance

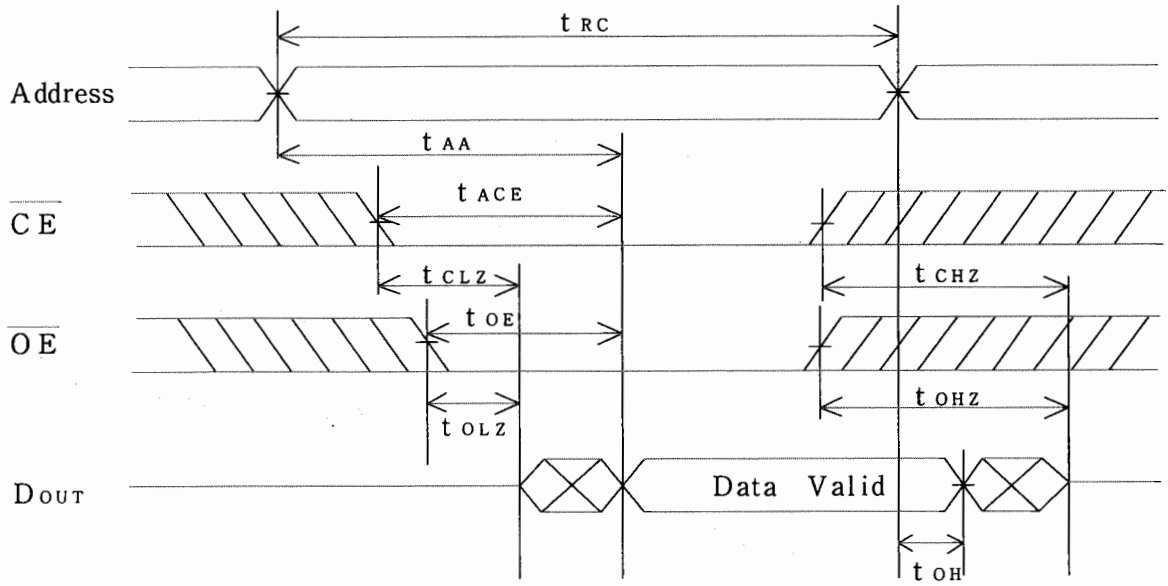
(Ta= 25°C, f = 1MHz)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input capacitance	C _{IN}	V _{IN} = 0V			7	pF *9
I/O capacitance	C _{I/O}	V _{I/O} = 0V			10	pF *9

Note) *9. This parameter is sampled and not production tested.

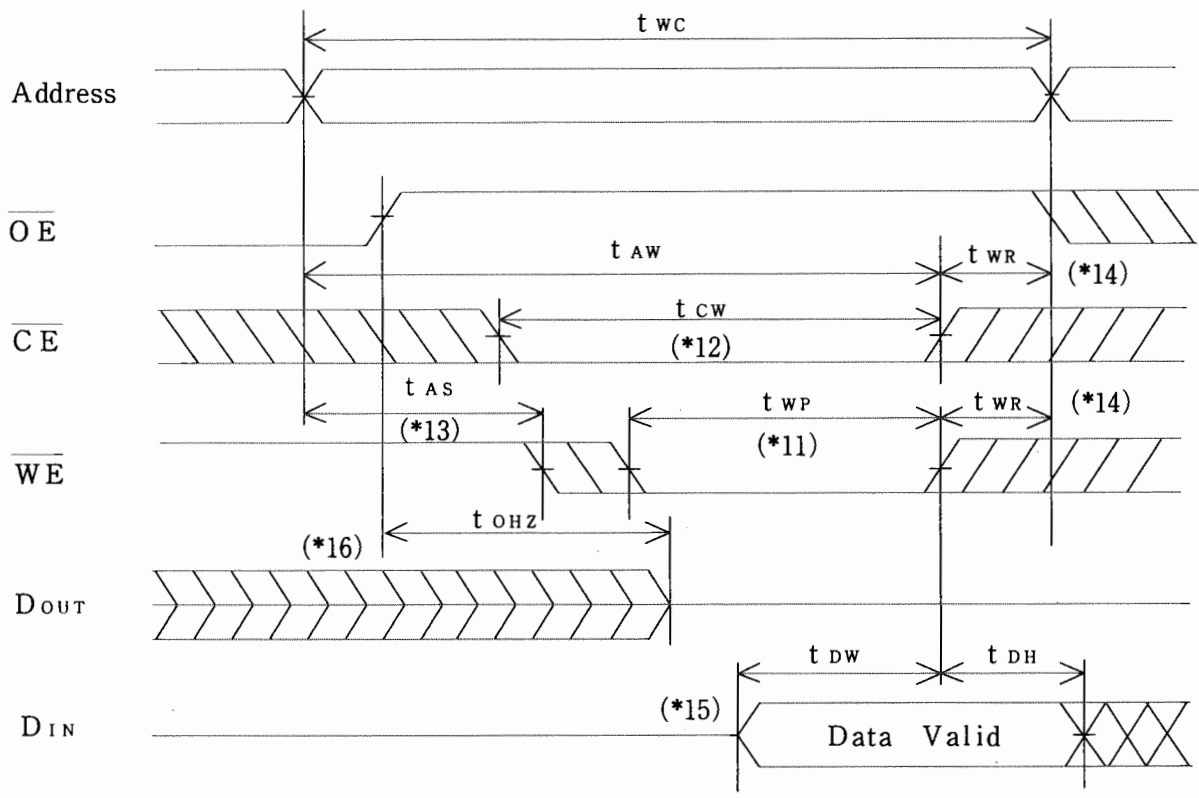
11. Timing Chart

Read cycle timing chart (*10)

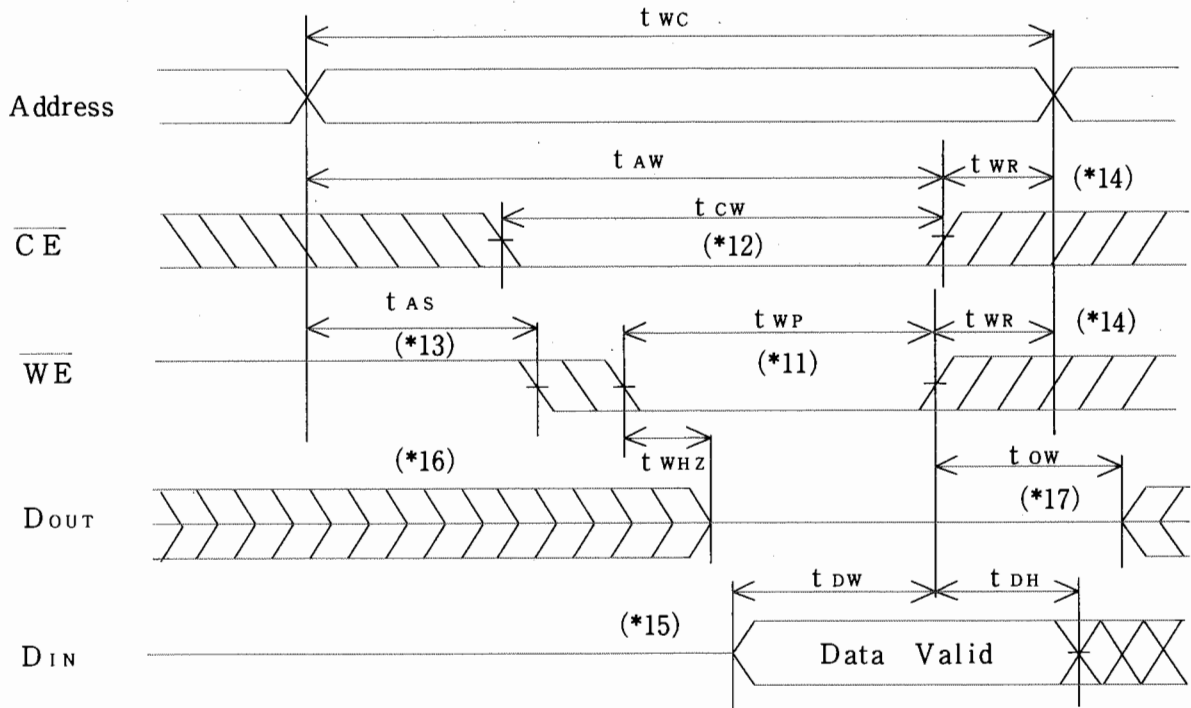


Note) *10. \overline{WE} is high for Read cycle.

Write cycle timing chart (\overline{OE} Controlled)

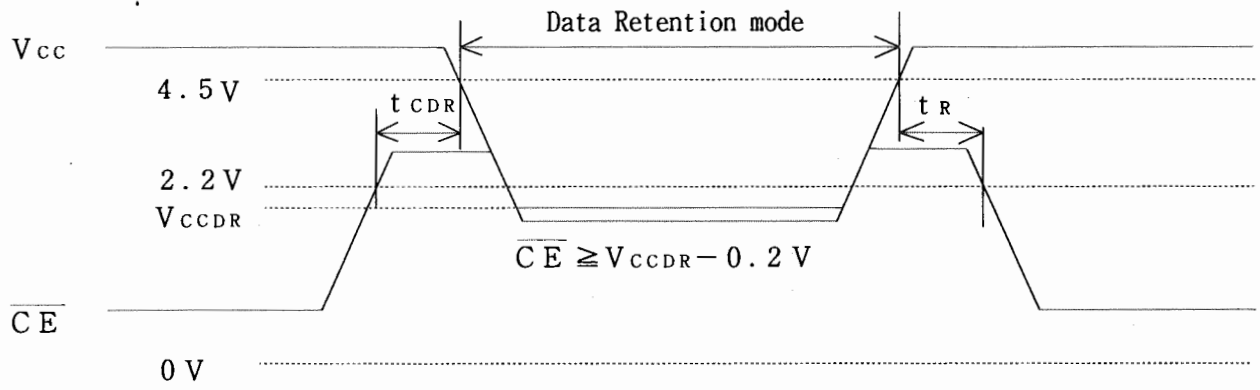


Write cycle timing chart (\overline{OE} Low fixed)



- Note) * 11. A write occurs during the overlap of a low \overline{CE} , and a low \overline{WE} .
 A write begins at the latest transition among \overline{CE} going low, and \overline{WE} going low.
 A write ends at the earliest transition among \overline{CE} going high, and \overline{WE} going high.
 t_{WP} is measured from the beginning of write to the end of write.
- * 12. t_{CW} is measured from the later of \overline{CE} going low to the end of write.
 - * 13. t_{AS} is measured from the address valid to the beginning of write.
 - * 14. t_{WR} is measured from the end of write to the address change.
 - * 15. During this period, I/O pins are in the output state, therefore the input signals of opposite phase to the outputs must not be applied.
 - * 16. If \overline{CE} goes low simultaneously with \overline{WE} going low or after \overline{WE} going low, the outputs remain in high impedance state.
 - * 17. If \overline{CE} goes high simultaneously with \overline{WE} going high or before \overline{WE} going high, the outputs remain in high impedance state.

Data Retention timing chart (\overline{CE} Controlled)



12 Package and packing specification

[Applicability]

This specification applies to IC package of the LEAD-FREE delivered as a standard specification.

1.Storage Conditions.

1-1.Storage conditions required before opening the dry packing.

- Normal temperature : 5~40°C
- Normal humidity : 80%(Relative humidity) max.
- "Humidity" means "Relative humidity"

1-2.Storage conditions required after opening the dry packing.

In order to prevent moisture absorption after opening, ensure the following storage conditions apply:

- (1) Storage conditions for one-time soldering. (Convection reflow^{*1}, IR/Convection reflow.^{*1}, or Manual soldering.)
 - Temperature : 5~25°C
 - Humidity : 60% max.
 - Period : 96 hours max. after opening.
- (2) Storage conditions for one-time soldering . (Solder dipping .)
 - Temperature : 5~25°C
 - Humidity : 60% Max.
 - Period : 96 hours max. after opening.
- (3) Storage conditions for two-time soldering. (Convection reflow^{*1}, IR/Convection reflow.^{*1})
 - a. Storage conditions following opening and prior to performing the 1st reflow.
 - Temperature : 5~25°C
 - Humidity : 60% max.
 - Period : 96 hours max. after opening.
 - b. Storage conditions following completion of the 1st reflow and prior to performing the 2nd reflow.
 - Temperature : 5~25°C
 - Humidity : 60% max.
 - Period : 96 hours max. after completion of the 1st reflow.

^{*1}:Air or nitrogen environment.

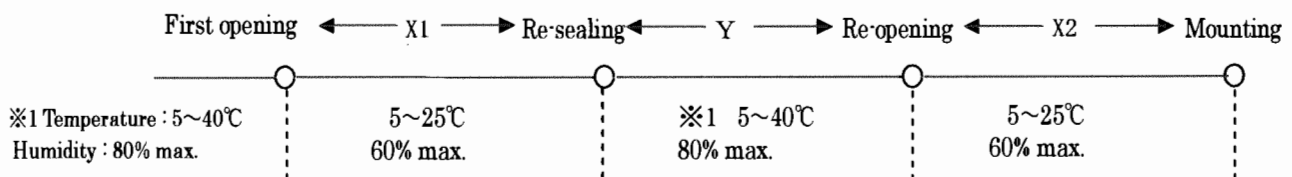
1-3.Temporary storage after opening.

To re-store the devices before soldering, do so only once and use a dry box or place desiccant (with a blue humidity indicator) with the devices and perform dry packing again using heat-sealing.

The storage period, temperature and humidity must be as follows :

(1) Storage temperature and humidity.

※1 : External atmosphere temperature and humidity of the dry packing.



(2) Storage period.

- X1 + X2 : Refer to Section 1-2(1),(2), and (3)a , depending on the mounting method.
- Y : Two weeks max.

2. Baking Condition.

(1) Situations requiring baking before mounting.

- Storage conditions exceed the limits specified in Section 1-2 or 1-3.
- Humidity indicator in the desiccant was already red (pink) when opened.
(Also for re-opening.)

(2) Recommended baking conditions.

- Baking temperature and period : 120°C for 16~24 hours or 150°C for 5~10 hours.
- The above baking conditions do not apply since the magazines are not heat-resistant . Replace the devices on heat-resistant magazine .

(3) Storage after baking.

- After baking, store the devices in the environment specified in Section 1-2 and mount immediately.

3. Surface mount conditions.

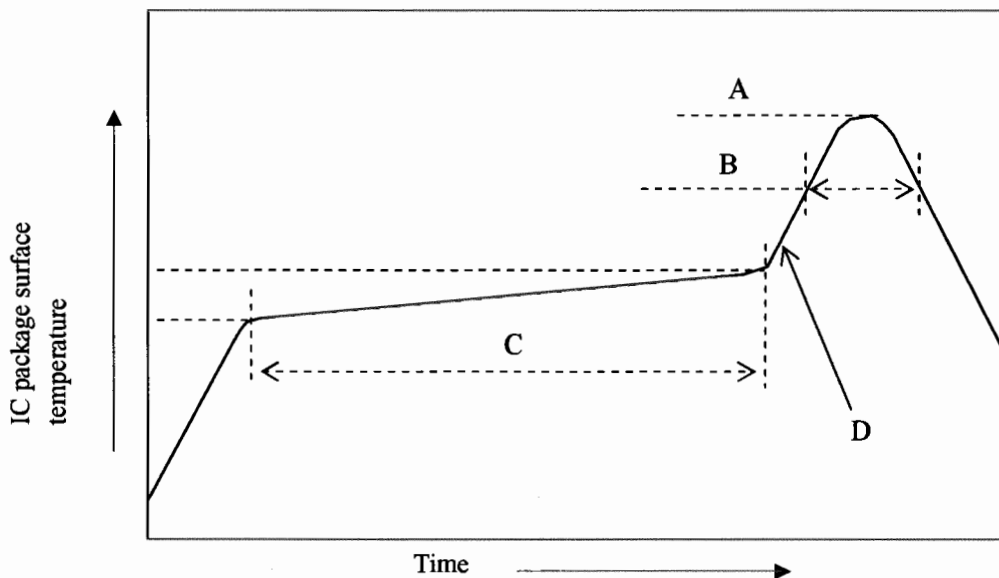
The following soldering condition are recommended to ensure device quality.

3-1.Soldering.

(1) Convection reflow or IR/Convection. (one-time soldering or two-time soldering in air or nitrogen environment)

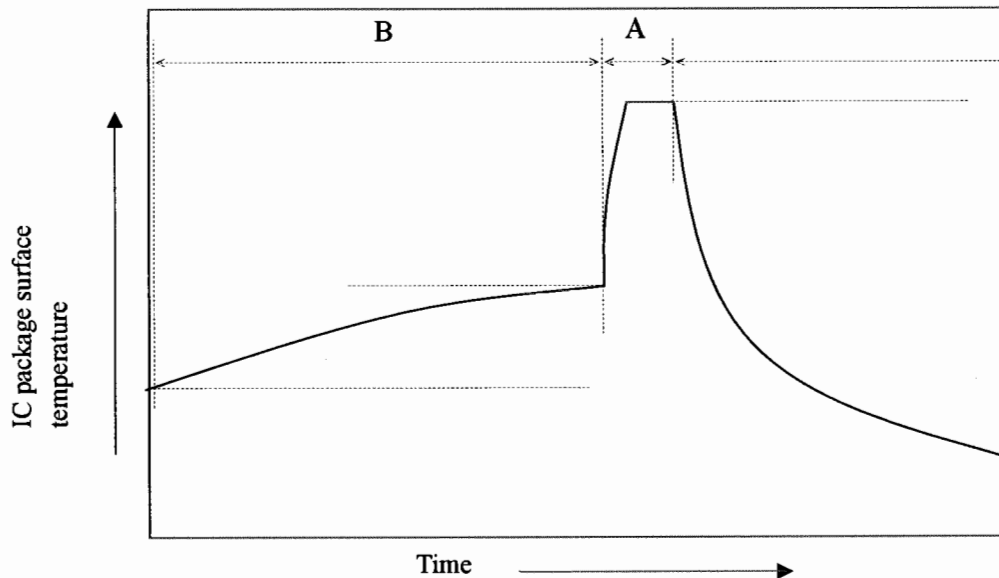
- Temperature and period :

A) Peak temperature.	250°C max.
B) Heating temperature.	40 to 60 seconds as 220°C
C) Preheat temperature.	It is 150 to 200°C, and is 120±30 seconds
D) Temperature increase rate.	It is 1 to 3°C/seconds
- Measuring point : IC package surface.
- Temperature profile :



(2) Solder dipping. (one-time dipping only)

- Temperature and period :
 - A) Peak temperature. 260°C max. for 10 seconds Max.
 - B) Preheat temperature of 120 to 150°C for 120±60 seconds
- Measuring point :
 - A) Solder bath.
 - B) IC package surface.
- Temperature profile:



(3) Manual soldering (soldering iron) (one-time soldering only)

Soldering iron should only touch the IC's outer leads.

- Temperature and period :
 - 350°C max. for 3 seconds / pin max.
 - (Soldering iron should only touch the IC's outer leads.)
- Measuring point : Soldering iron tip.

4. Condition for removal of residual flux.

- (1) Ultrasonic washing power : 25 watts / liter max.
- (2) Washing time : Total 1 minute max.
- (3) Solvent temperature : 15~40°C

5. Package outline specification.

Refer to the attached drawing.

(Plastic body dimensions do not include burr of resin.)

The contents of LEAD-FREE TYPE application of the specifications. (*2)

6. Markings.

6-1. Marking details. (The information on the package should be given as follows.)

- (1) Product name : LH5116NA-10F
- (2) Company name : SHARP
- (3) Date code : (Example) YYWW XXX
 - YY → Denotes the production year. (Last two digits of the year.)
 - WW → Denotes the production week. (01 · 02 · ~ · 52 · 53)
 - XXX → Denotes the production ref. code (1~3 digits).
- (4) "JAPAN" indicates the country of origin.

6-2. Marking layout.

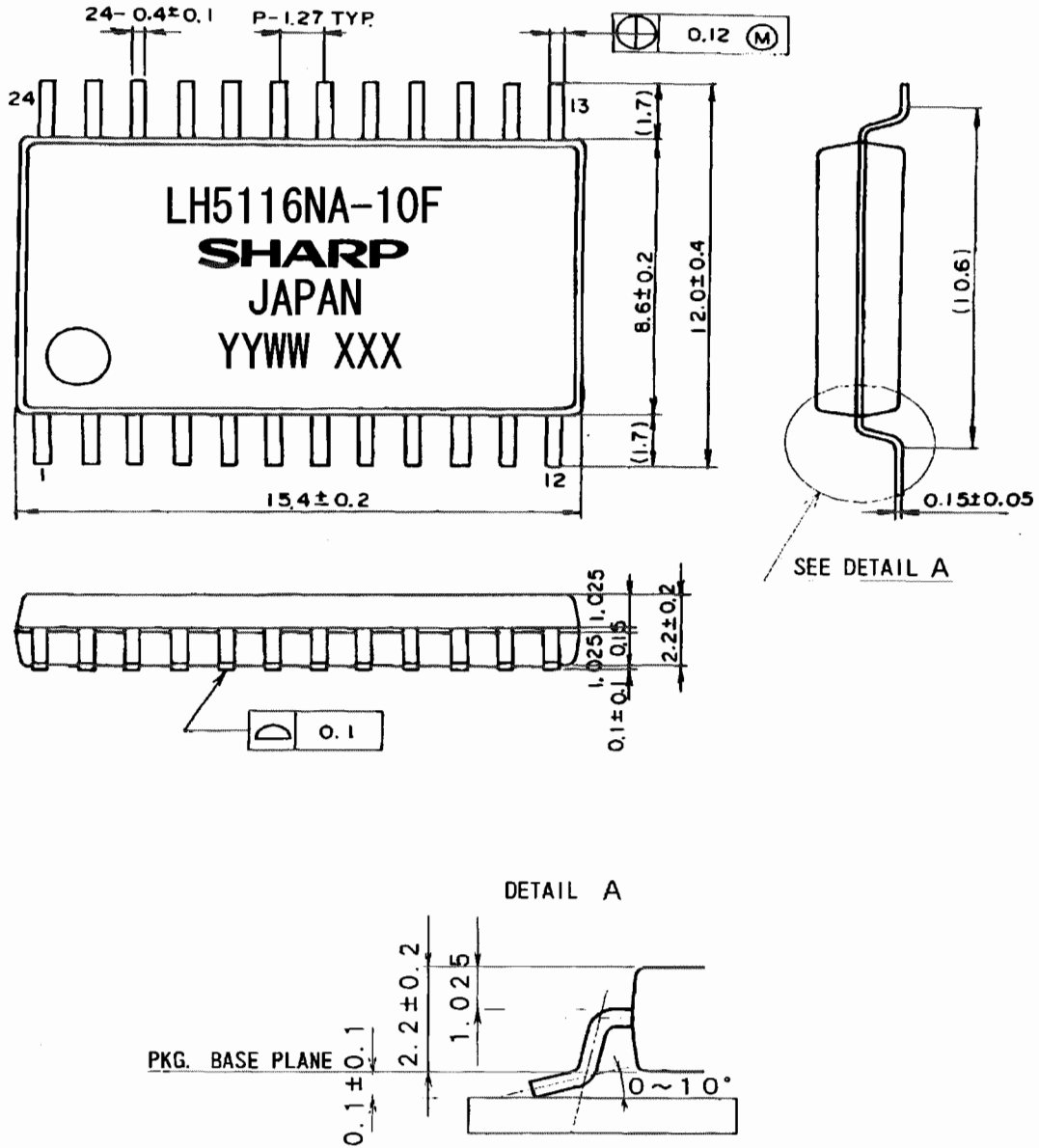
The layout is shown in the attached drawing.

(However, this layout does not specify the size of the marking character and marking position.)

*2 The contents of LEAD-FREE TYPE application of the specifications.

LEAD FINISH or BALL TYPE	LEAD-FREE TYPE (Sn-Bi)
DATE CODE	They are those with an underline.
The word of " LEAD FREE" is printed on the packing label	Printed

(Note) It is those with an underline printing in a date code because of a LEAD-FREE type.



SOP024-P-0450-AA941

LEAD TYPE	LEAD FINISH		LEAD MATERIAL
	Sn-Bi PLATING		42Alloy
NAME	SOP024-P-0450		NOTE : Plastic body dimensions do not include burr of resin.
DRAWING NO.	AA941	UNIT : mm	

7.Packing Specifications(Dry packing for surface mount packages.)

7-1.Packing materials.

Material name	Material specifications	Purpose
Inner carton	Gardboard (1200 devices / inner carton max.)	Packing the devices.
Magazine	Anti-static treated plastic (30 devices / magazine)	Securing the devices.
Stopper	Plastic or rubber	Securing the devices.
Cap	Plastic (2 caps / bag)	Securing the magazine.
Laminated aluminum bag	Aluminum polyethylene	Keeping the devices dry.
Desiccant	Silica gel	Keeping the devices dry.
Label	Paper	Indicates part number, quantity , and packed date .
Outer carton	Gardboard (4800 devices / outer carton max.)	Outer packing.

(Devices must be placed on the magazine in the same direction.)

7-2.Outline dimension of magazine.

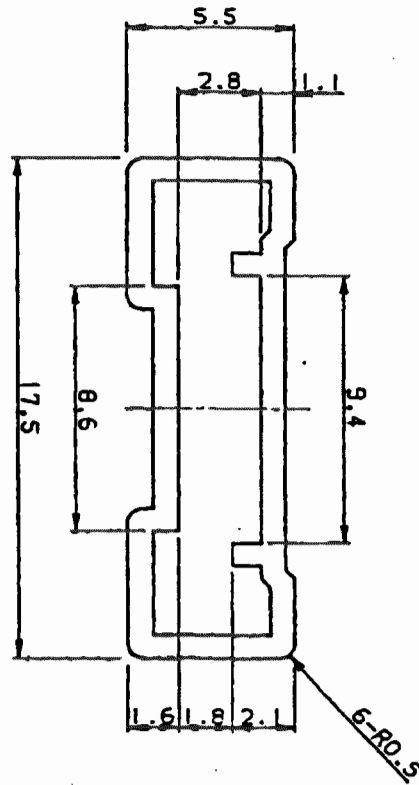
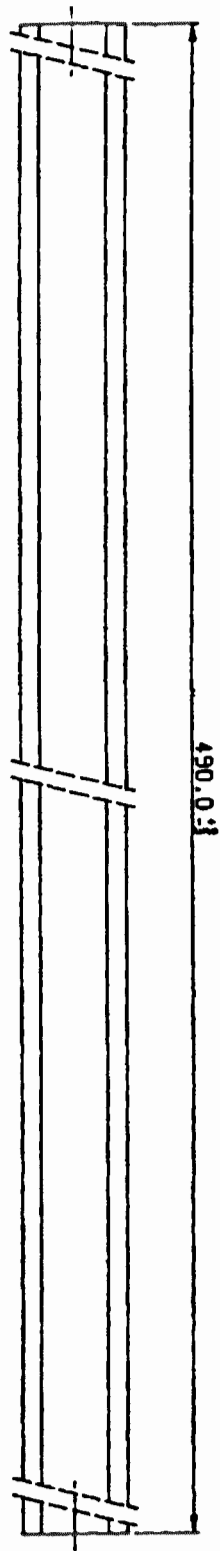
Refer to the attached drawing.

7-3.Outline dimension of carton.

Refer to the attached drawing.

8.Precautions for use.

- (1) Opening must be done on an anti-ESD treated workbench.
All workers must also have undergone anti- ESD treatment.
- (2) The magazines have undergone either conductive or anti-ESD treatment.
If another magazine is used , make sure it has also undergone conductive or anti-ESD treatment.
- (3) The devices should be mounted within one year of the date of delivery.

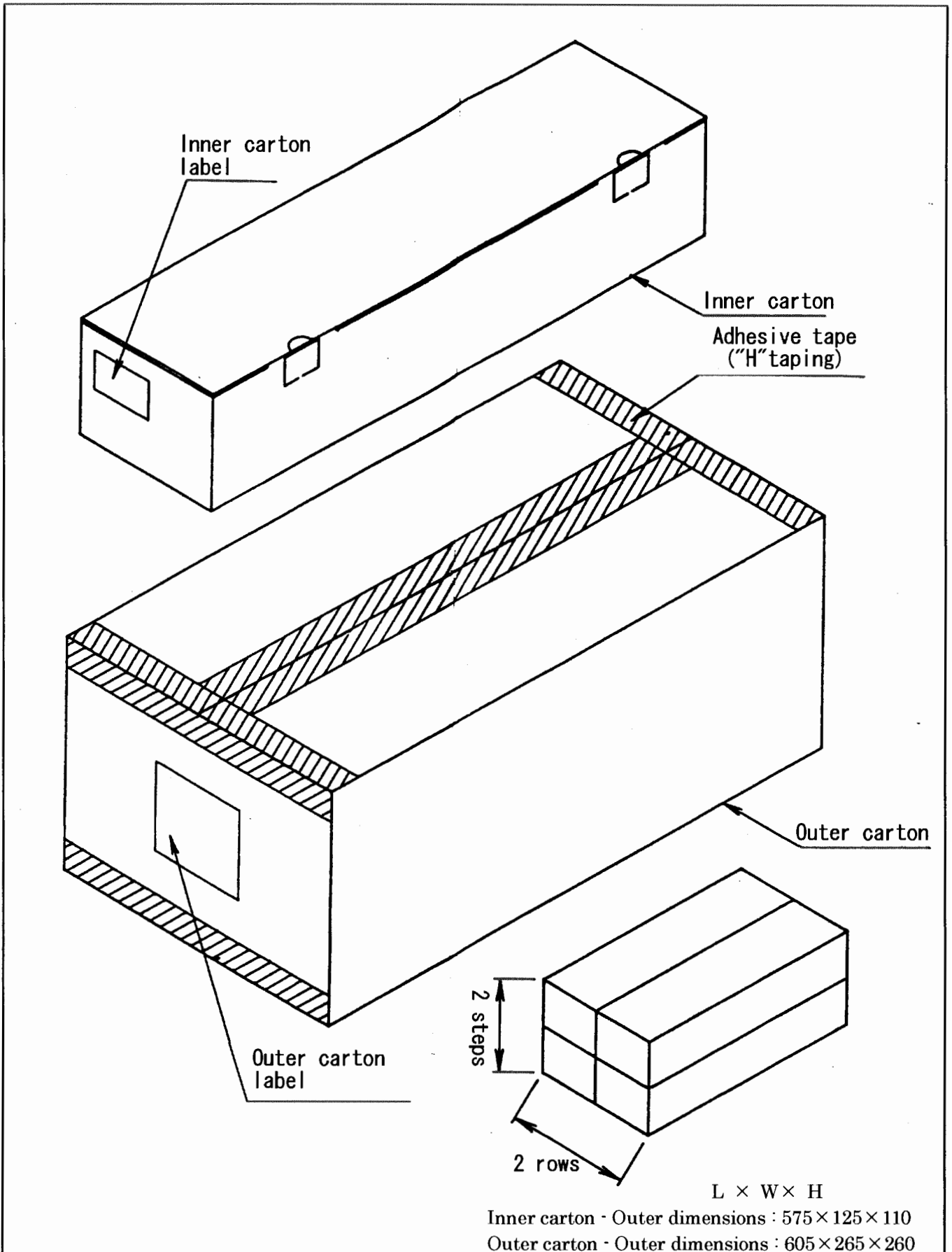


注記 : マガジン (スリーブ) 両側のストッパーは、ゴムストッパーとする。指示無き寸法公差は全て±0.4mmとする。

NOTES : Stopper which is set at the both ends of magazine (sleeve) is made of rubber.

All tolerances are ±0.4mm unless otherwise specified.

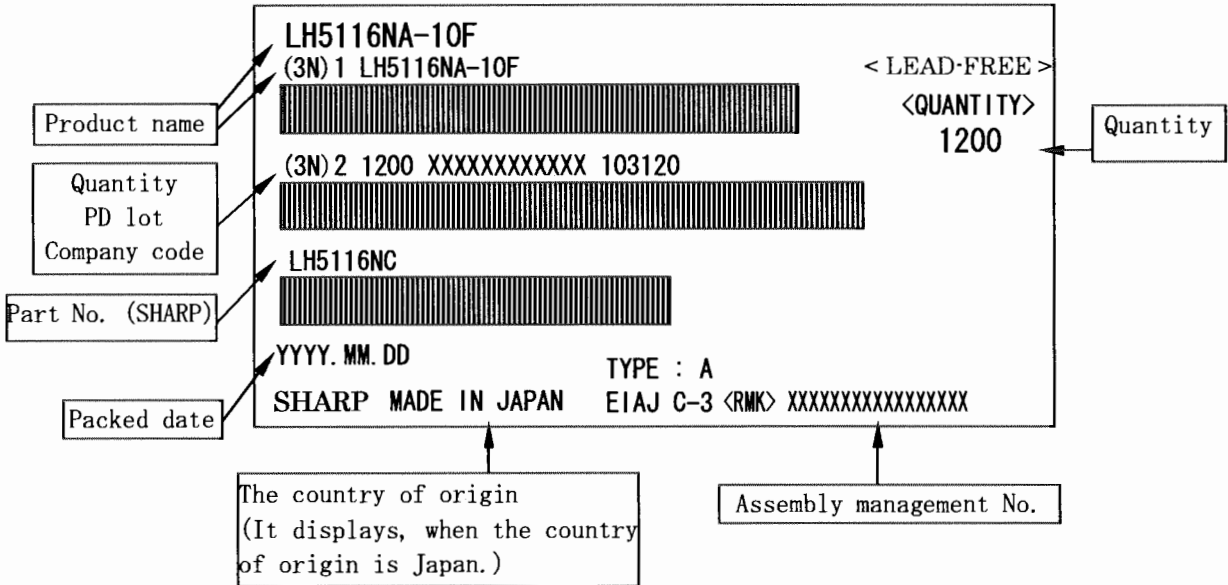
名称 Name	SOP28SPN-A2			備考 Note
Drawing no.	CV607	単位 Unit	mm	



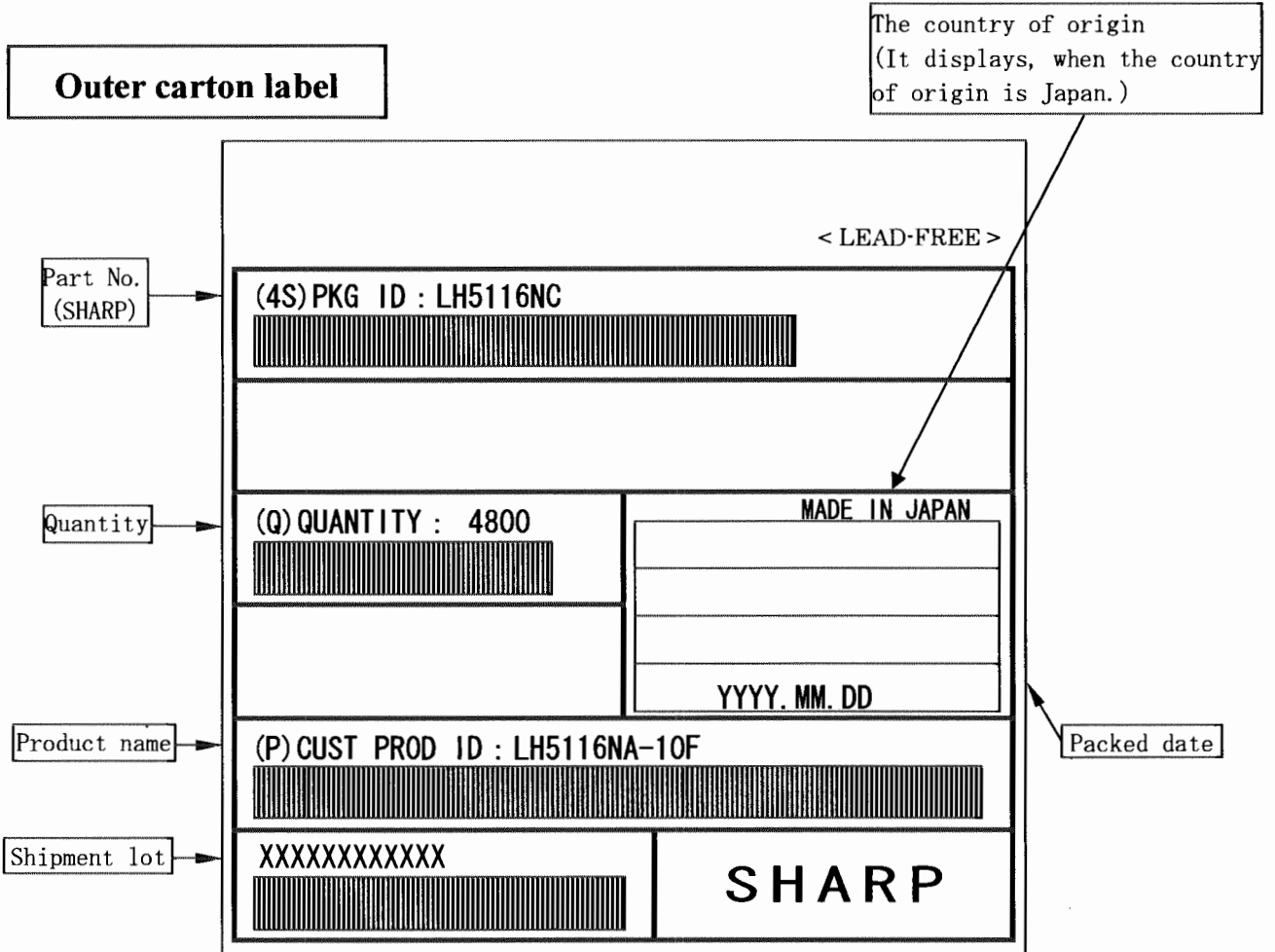
名称 NAME	Packing specifications			備考 NOTE	出荷数量が端数の場合、本仕様と異なることがあります。 There is a possibility different from this specification when the number of shipments is fractions.
DRAWING NO.	BJ535	単位 UNIT	mm		

(Note) The <LEAD-FREE> display shows a lead-free article.

Inner carton label



Outer carton label



(Former) EIAJ B Standard conforming

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