

Document Title**512K x8 bit 3.0V Low Power CMOS slow SRAM**Revision History

<u>Revision No</u>	<u>History</u>	<u>Draft Date</u>	<u>Remark</u>
04	Revision History Insert Revised - Insert 70ns Part - Improved standby current I <sub>sb1</sub> : 30uA ; 20uA	Jul.26.2000	Final
05	Revised - Change I <sub>ccdr</sub> Value : 15uA => 20uA	Aug.04.2000	Final
06	Marking Information Add Revised - E.T (-25~85°C), I.T (-40~85°C) Part Insert - AC Test Condition Add : 5pF Test Load - t <sub>CLZ</sub> Value Change : 15ns/20ns - > 10ns - V <sub>IH</sub> max : V <sub>cc</sub> + 0.2V => V <sub>cc</sub> + 0.3V - V <sub>IL</sub> min : - 0.2V => - 0.3V	Dec.04.2000	Final
07	Changed Logo - HYUNDAI -> hynix - Marking Information Change	Apr.30.2001	Final

## DESCRIPTION

The HY62U8400A is a high-speed, low power and 4M bits CMOS SRAM organized as 512K words by 8 bits. The HY62U8400A uses Hynix's high performance twin tub CMOS process technology and was designed for high-speed and low power circuit technology. It is particularly well suited for use in high-density and low power system applications. This device has a data retention mode that guarantees data to remain valid at the minimum power supply voltage of 2.0V.

## FEATURES

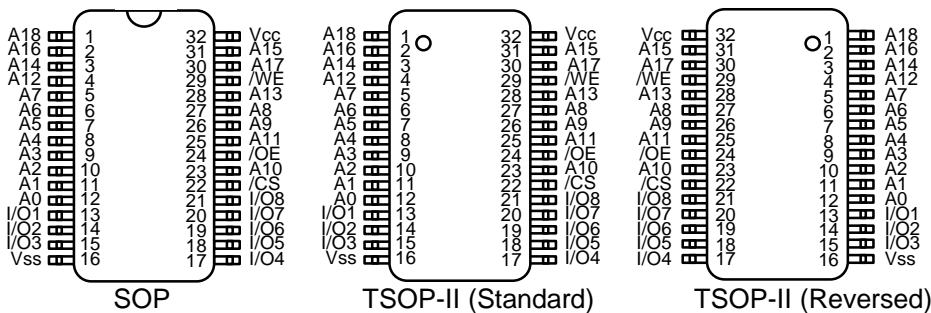
- Fully static operation and Tri-state outputs
- TTL compatible inputs and outputs
- Low power consumption
- Battery backup(LL-part)
  - 2.0V(min) data retention
- Standard pin configuration
  - 32pin 525mil SOP
  - 32pin 400mil TSOP-II (Standard and Reversed)

Product No.	Voltage (V)	Speed (ns)	Operation Current/Icc(mA)	Standby Current(μA)		Temperature (°C)
				LL		
HY62U8400A	2.7~3.3	70*/85/100	5	20		0~70
HY62U8400A-E	2.7~3.3	70*/85/100	5	30		-25~85
HY62U8400A-I	2.7~3.3	70*/85/100	5	30		-40~85

Note 1. Current value is max.

\* 70ns is available with 30pF test load

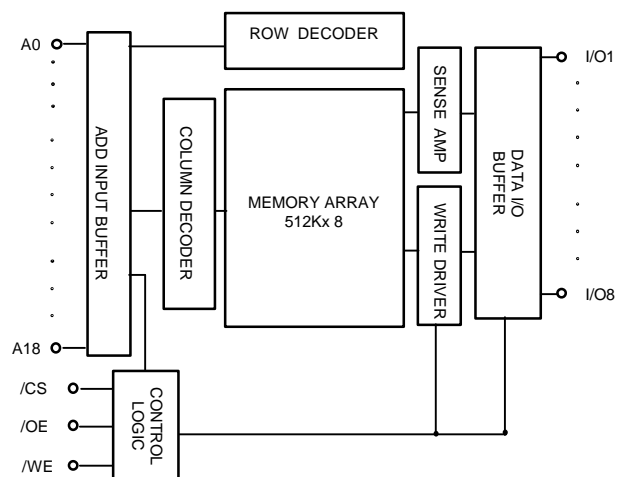
## PIN CONNECTION



## PIN DESCRIPTION

Pin Name	Pin Function
/CS	Chip Select
/WE	Write Enable
/OE	Output Enable
A0 ~ A18	Address Input
I/O1 ~ I/O8	Data Input/Output
Vcc	Power(2.7~3.3V)
Vss	Ground

## BLOCK DIAGRAM



**ORDERING INFORMATION**

Part No.	Speed	Power	Temp	Package
HY62U8400ALLG	70*/85/100	LL-part	0~70 °C	SOP
HY62U8400ALLG-E	70*/85/100	LL-part	-25~85 °C	SOP
HY62U8400ALLG-I	70*/85/100	LL-part	-40~85 °C	SOP
HY62U8400ALLT2	70*/85/100	LL-part	0~70 °C	TSOP-II (Standard)
HY62U8400ALLT2-E	70*/85/100	LL-part	-25~85 °C	TSOP-II (Standard)
HY62U8400ALLT2-I	70*/85/100	LL-part	-40~85 °C	TSOP-II (Standard)
HY62U8400ALLR2	70*/85/100	LL-part	0~70 °C	TSOP-II (Reversed)
HY62U8400ALLR2-E	70*/85/100	LL-part	-25~85 °C	TSOP-II (Reversed)
HY62U8400ALLR2-I	70*/85/100	LL-part	-40~85 °C	TSOP-II (Reversed)

\* 70ns is available with 30pF test load

**ABSOLUTE MAXIMUM RATING (1)**

Symbol	Parameter	Rating	Unit
V <sub>CC</sub> , V <sub>IN</sub> , V <sub>OUT</sub>	Power Supply, Input/Output Voltage	-0.5 to 4.0	V
T <sub>A</sub>	Operating Temperature	HY62U8400A	0 to 70
		HY62U8400A-E	-25 to 85
		HY62U8400A-I	-40 to 85
T <sub>STG</sub>	Storage Temperature	-65 to 150	°C
P <sub>D</sub>	Power Dissipation	1.0	W
I <sub>OUT</sub>	Data Output Current	50	MA
T <sub>SOLDER</sub>	Lead Soldering Temperature & Time	260 •10	°C•sec

**Note**

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is stress rating only and the functional operation of the device under these or any other conditions above those indicated in the operation of this specification is not implied. Exposure to the absolute maximum rating conditions for extended period may affect reliability.

**TRUTH TABLE**

/CS	/WE	/OE	MODE	I/O OPERATION	Power
H	X	X	Deselected	High-Z	Standby
L	H	H	Output Disabled	High-Z	Active
L	H	L	Read	Data Out	Active
L	L	X	Write	Data In	Active

**Note :**

- H=V<sub>IH</sub>, L=V<sub>IL</sub>, X=don't care (V<sub>IH</sub> or V<sub>IL</sub>)

## RECOMMENDED DC OPERATING CONDITION

TA = 0; f to 70; (Normal)/-25°C to 85°C (Extended) /-40°C to 85°C (Industrial), unless otherwise specified.

Symbol	Parameter	Min.	Typ.	Max.	Unit
Vcc	Supply Voltage	2.7	3.0	3.3	V
Vss	Ground	0	0	0	V
VIH	Input High Voltage	2.2	-	Vcc+0.3	V
VIL	Input Low Voltage	-0.3(1)	-	0.4	V

Note :

1. VIL = -1.5V for pulse width less than 30ns and not 100% tested.

## DC ELECTRICAL CHARACTERISTICS

TA = 0; f to 70; (Normal)/-25°C to 85°C (Extended) /-40°C to 85°C (Industrial), unless otherwise specified.

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit	
ILI	Input Leakage Current	Vss ≤ VIN ≤ Vcc	-1	-	1	uA	
ILO	Output Leakage Current	Vss ≤ VOUT ≤ Vcc, /CS = VIH or /OE = VIH or /WE = VIL	-1	-	1	uA	
Icc	Operating Power Supply Current	/CS = VIL, VIN = VIH or VIL, Ii/O = 0mA	-	-	5	mA	
ICC1	Average Operating Current	/CS = VIL, Min Duty Cycle = 100%, VIN = VIH or VIL, Ii/O = 0mA	-	-	35	mA	
ISB	TTL Standby Current (TTL Input)	/CS = VIH, VIN = VIH or VIL	-	-	0.5	mA	
ISB1	Standby Current (CMOS Input)	/CS ≥ Vcc - 0.2V, VIN ≥ Vcc - 0.2V or VIN ≤ Vss + 0.2V	LL	-	-	20	uA
			LL-E/I	-	-	30	uA
VOL	Output Low Voltage	IOL = 2.1mA	-	-	0.4	V	
VOH	Output High Voltage	IOH = -1mA	2.2	-	-	V	

Note : Typical values are at Vcc = 3.0V, TA = 25°C

## CAPACITANCE

Temp = 25°C, f = 1.0MHz

Symbol	Parameter	Condition	Max.	Unit
CIN	Input Capacitance	VIN = 0V	6	pF
COU	Output Capacitance	Vi/O = 0V	8	pF

Note : This parameter is sampled and not 100% tested

**AC CHARACTERISTICS**

TA = 0; fto 70; f(Normal)/-25°C to 85°C (Extended) /-40°C to 85°C (Industrial), unless otherwise specified.

#	Symbol	Parameter	-70*		-85		-10		Unit
			Min.	Max.	Min.	Max.	Min	Max.	
READ CYCLE									
1	tRC	Read Cycle Time	70	-	85	-	100	-	ns
2	tAA	Address Access Time	-	70	-	85	-	100	ns
3	tACS	Chip Select Access Time	-	70	-	85	-	100	ns
4	tOE	Output Enable to Output Valid	-	40	-	45	-	50	ns
5	tCLZ	Chip Select to Output in Low Z	10	-	10	-	10	-	ns
6	tOLZ	Output Enable to Output in Low Z	5	-	5	-	5	-	ns
7	tCHZ	Chip Deselection to Output in High Z	0	30	0	30	0	30	ns
8	tOHZ	Out Disable to Output in High Z	0	30	0	30	0	30	ns
9	tOH	Output Hold from Address Change	10	-	10	-	15	-	ns
WRITE CYCLE									
10	tWC	Write Cycle Time	70	-	85	-	100	-	ns
11	tCW	Chip Selection to End of Write	60	-	70	-	80	-	ns
12	tAW	Address Valid to End of Write	60	-	70	-	80	-	ns
13	tAS	Address Set-up Time	0	-	0	-	0	-	ns
14	tWP	Write Pulse Width	50	-	60	-	70	-	ns
15	tWR	Write Recovery Time	0	-	0	-	0	-	ns
16	tWHZ	Write to Output in High Z	0	25	0	30	0	35	ns
17	tDW	Data to Write Time Overlap	30	-	40	-	45	-	ns
18	tDH	Data Hold from Write Time	0	-	0	-	0	-	ns
19	tOW	Output Active from End of Write	5	-	5	-	10	-	ns

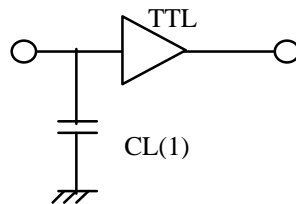
Note \* 70ns is available with 30pF test load

**AC TEST CONDITIONS**

TA = 0; fto 70; f(Normal)/-25°C to 85°C (Extended) /-40°C to 85°C (Industrial), unless otherwise specified.

Parameter	Value
Input Pulse Level	0.4V to 2.2V
Input Rise and Fall Time	5ns
Input and Output Timing Reference Level	1.5V
Output Load	tCLZ,tOLZ,tCHZ,tOHZ,tWHZ,tOW
	CL = 5pF + 1TTL Load
	CL = 100pF + 1TTL Load
Others	CL = 30pF + 1TTL Load

**AC TEST LOADS**

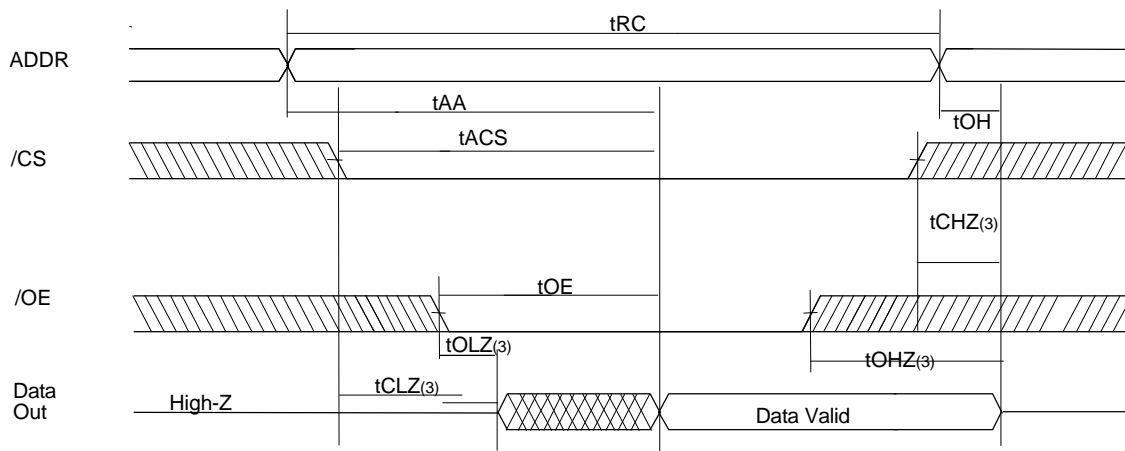


Note

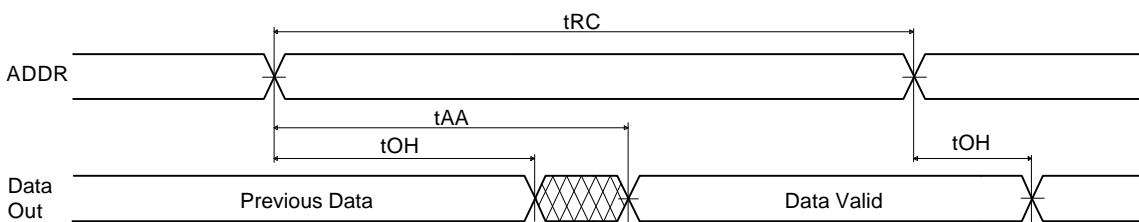
- 1. Including jig and scope capacitance

**TIMING DIAGRAM**

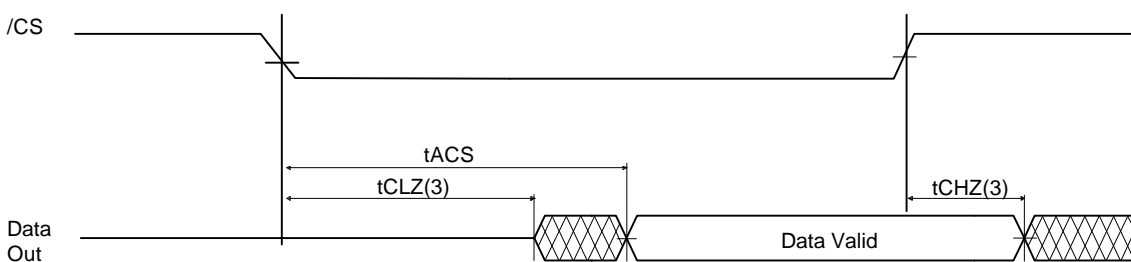
READ CYCLE 1 (Note 1,4)



READ CYCLE 2 (Note 1,2,4)



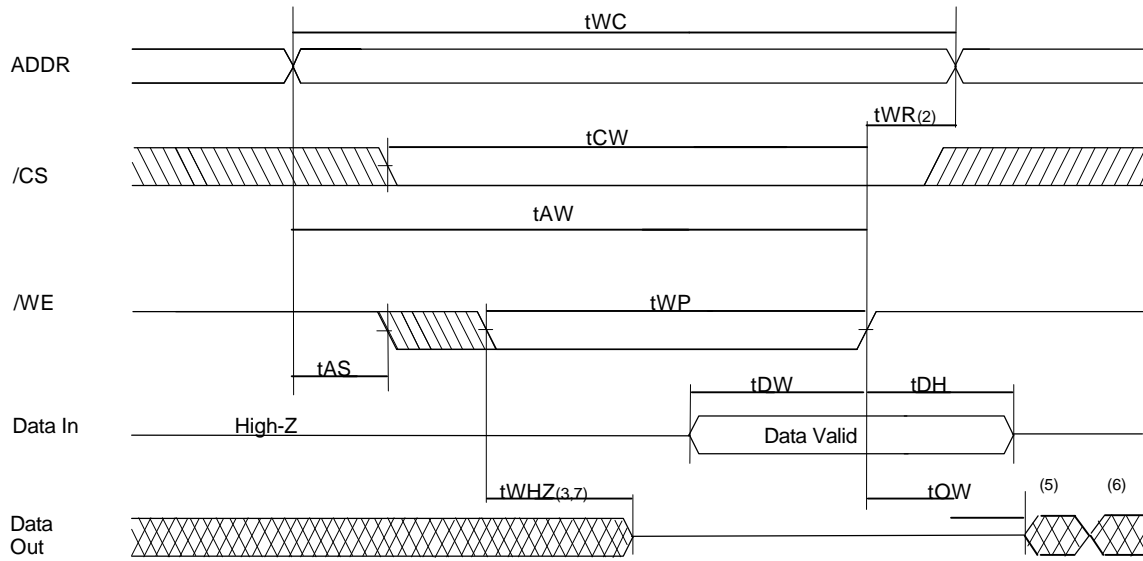
READ CYCLE 3 (Note 1,2,4)



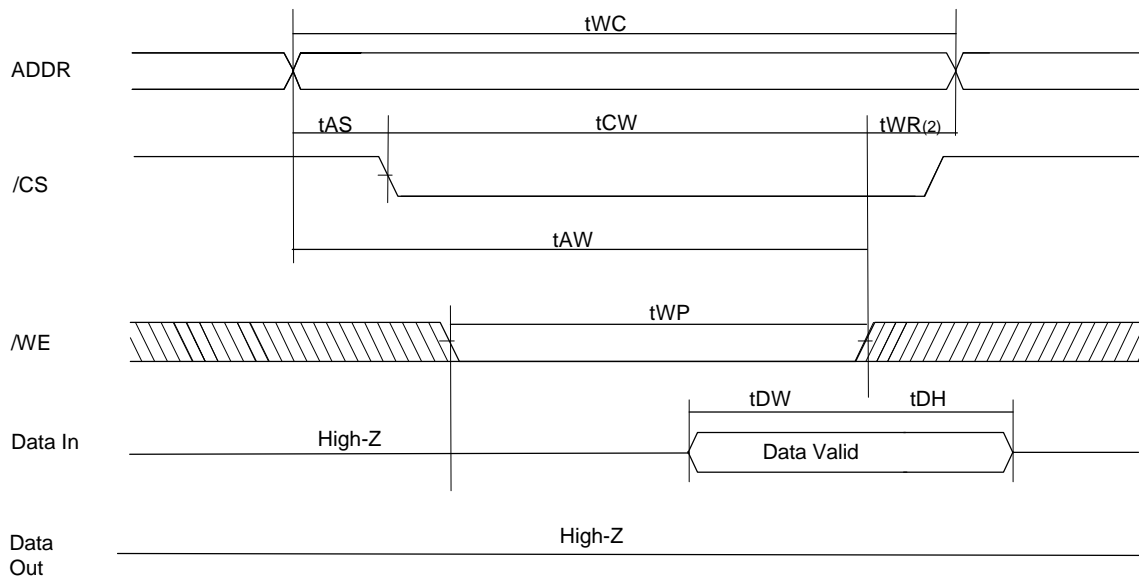
Notes:

1. A read occurs during the overlap of a low /OE, a high /WE and a low /CS.
2. /OE =  $V_{IL}$
3. Transition is measured  $\pm 200mV$  from steady state voltage.  
This parameter is sampled and not 100% tested.
4. /CS in high for the standby, low for active

WRITE CYCLE 1(1,4,5,8) (/WE Controlled)



WRITE CYCLE 2 (Note 1,4,5,8) (/CS Controlled)



Notes:

1. A write occurs during the overlap of a low /WE and a low /CS.
2. tWR is measured from the earlier of /CS or /WE going high to the end of write cycle.
3. During this period, I/O pins are in the output state so that the input signals of opposite phase to the output must not be applied.
4. If the /CS low transition occur simultaneously with the /WE low transition or after the /WE transition, outputs remain in a high impedance state.
5. Q(data out) is the same phase with the write data of this write cycle.
6. Q(data out) is the read data of the next address.
7. Transition is measured + 200mV from steady state.  
This parameter is sampled and not 100% tested.
8. /CS in high for the standby, low for active

**DATA RETENTION ELECTRIC CHARACTERISTIC**

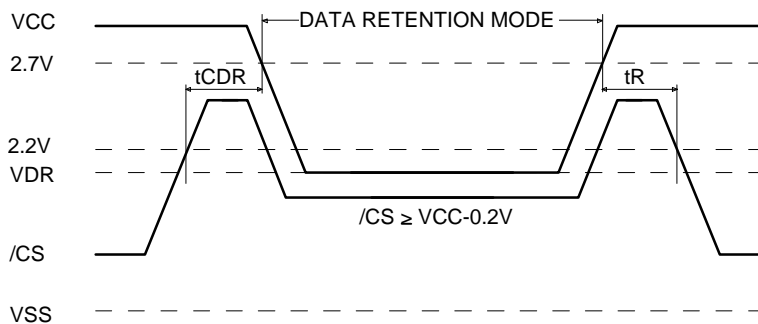
TA = 0; Ito 70; (Normal)/-25°C to 85°C (Extended) /-40°C to 85°C (Industrial), unless otherwise specified.

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit	
VDR	Vcc for Data Retention	/CS ≥ Vcc-0.2V, VIN ≥ Vcc-0.2V or VIN ≤ 0.2V	2.0	-	-	V	
ICCDR	Data Retention Current	Vcc = 3.0V, /CS ≥ Vcc-0.2V, VIN ≥ Vcc-0.2V or VIN ≤ 0.2V	LL	-	-	20	uA
			LL-E	-	-	30	uA
			LL-I	-	-	30	uA
tCDR	Chip Deselect to Data Retention Time		0	-	-	ns	
tR	Operating Recovery Time		tRC(2)	-	-	ns	

Notes:

1. Typical values are at the condition of TA = 25°C.
2. tRC is read cycle time.

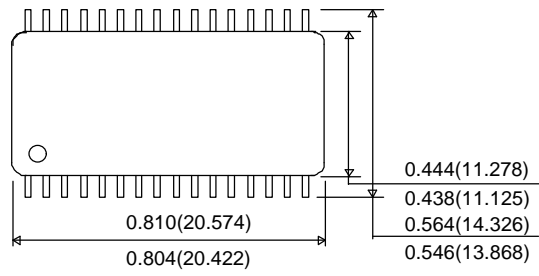
**DATA RETENTION TIMING DIAGRAM**



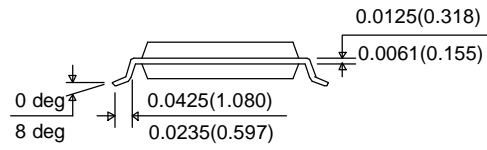
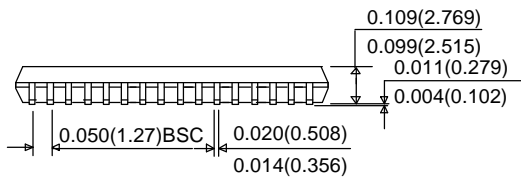




32pin 525mil Small Outline Package(G)



UNIT : INCH(mm)



**MARKING INFORMATION**

Package	Marking Example																																																
SOP	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; text-align: center;">h</td><td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">n</td><td style="border: 1px solid black; text-align: center;">i</td><td style="border: 1px solid black; text-align: center;">x</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;">K</td><td style="border: 1px solid black; text-align: center;">O</td><td style="border: 1px solid black; text-align: center;">R</td><td style="border: 1px solid black; text-align: center;">E</td><td style="border: 1px solid black; text-align: center;">A</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">H</td><td style="border: 1px solid black; text-align: center;">Y</td><td style="border: 1px solid black; text-align: center;">6</td><td style="border: 1px solid black; text-align: center;">2</td><td style="border: 1px solid black; text-align: center;">U</td><td style="border: 1px solid black; text-align: center;">8</td><td style="border: 1px solid black; text-align: center;">4</td><td style="border: 1px solid black; text-align: center;">0</td><td style="border: 1px solid black; text-align: center;">0</td><td style="border: 1px solid black; text-align: center;">A</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">w</td><td style="border: 1px solid black; text-align: center;">w</td><td style="border: 1px solid black; text-align: center;">p</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;">c</td><td style="border: 1px solid black; text-align: center;">c</td><td style="border: 1px solid black; text-align: center;">G</td><td style="border: 1px solid black; text-align: center;">-</td><td style="border: 1px solid black; text-align: center;">s</td><td style="border: 1px solid black; text-align: center;">s</td><td style="border: 1px solid black; text-align: center;">t</td> </tr> </table> </div>	h	y	n	i	x						K	O	R	E	A	H	Y	6	2	U	8	4	0	0	A						y	y	w	w	p						c	c	G	-	s	s	t	
h	y	n	i	x						K	O	R	E	A																																			
H	Y	6	2	U	8	4	0	0	A																																								
y	y	w	w	p						c	c	G	-	s	s	t																																	
TSOP-II	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; text-align: center;">h</td><td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">n</td><td style="border: 1px solid black; text-align: center;">i</td><td style="border: 1px solid black; text-align: center;">x</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;">K</td><td style="border: 1px solid black; text-align: center;">O</td><td style="border: 1px solid black; text-align: center;">R</td><td style="border: 1px solid black; text-align: center;">E</td><td style="border: 1px solid black; text-align: center;">A</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">H</td><td style="border: 1px solid black; text-align: center;">Y</td><td style="border: 1px solid black; text-align: center;">6</td><td style="border: 1px solid black; text-align: center;">2</td><td style="border: 1px solid black; text-align: center;">U</td><td style="border: 1px solid black; text-align: center;">8</td><td style="border: 1px solid black; text-align: center;">4</td><td style="border: 1px solid black; text-align: center;">0</td><td style="border: 1px solid black; text-align: center;">0</td><td style="border: 1px solid black; text-align: center;">A</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">y</td><td style="border: 1px solid black; text-align: center;">w</td><td style="border: 1px solid black; text-align: center;">w</td><td style="border: 1px solid black; text-align: center;">p</td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;"> </td><td style="border: 1px solid black; text-align: center;">c</td><td style="border: 1px solid black; text-align: center;">c</td><td style="border: 1px solid black; text-align: center;">T</td><td style="border: 1px solid black; text-align: center;">2</td><td style="border: 1px solid black; text-align: center;">-</td><td style="border: 1px solid black; text-align: center;">s</td><td style="border: 1px solid black; text-align: center;">s</td><td style="border: 1px solid black; text-align: center;">t</td> </tr> </table> </div>	h	y	n	i	x						K	O	R	E	A	H	Y	6	2	U	8	4	0	0	A						y	y	w	w	p						c	c	T	2	-	s	s	t
h	y	n	i	x						K	O	R	E	A																																			
H	Y	6	2	U	8	4	0	0	A																																								
y	y	w	w	p						c	c	T	2	-	s	s	t																																

Index	
<ul style="list-style-type: none"> <li>• hynix</li> <li>• KOREA</li> <li>• HY62U8400A</li> <li>• yy</li> <li>• ww</li> <li>• p</li> <li>• cc</li> </ul>	<ul style="list-style-type: none"> <li>: hynix Logo</li> <li>: Origin Country</li> <li>: Part Name</li> <li>: Year ( ex : 00 = year 2000, 01 = year 2001 )</li> <li>: Work Week ( ex : 12 = ww12 )</li> <li>: Process Code</li> <li>: Power Consumption</li> </ul>
<ul style="list-style-type: none"> <li>- L</li> <li>- LL</li> </ul>	<ul style="list-style-type: none"> <li>: Low Power</li> <li>: Low Low Power</li> </ul>
<ul style="list-style-type: none"> <li>• G / T2</li> </ul>	<ul style="list-style-type: none"> <li>: Package Type</li> <li>- G : SOP</li> <li>- T2 : TSOP-II</li> </ul>
<ul style="list-style-type: none"> <li>• ss</li> </ul>	<ul style="list-style-type: none"> <li>: Speed</li> <li>- 85 : 85ns</li> <li>- 10 : 100ns</li> </ul>
<ul style="list-style-type: none"> <li>• t</li> </ul>	<ul style="list-style-type: none"> <li>: Temperature</li> <li>- Blank : Commercial ( 0 ~ 70 °C )</li> <li>- E : Extended ( -25 ~ 85 °C )</li> <li>- I : Industrial ( -40 ~ 85 °C )</li> </ul>
<p><b>Note</b></p> <ul style="list-style-type: none"> <li>- Capital Letter</li> <li>- Small Letter</li> </ul>	<ul style="list-style-type: none"> <li>: Fixed Item</li> <li>: Non-fixed Item (Except hynix)</li> </ul>