

REVISION HISTORY

<u>Revision</u>	<u>Description</u>	<u>Issue Date</u>
Rev. 1.0	Initial Issue	Jul.25.2004
Rev. 1.1	Revised sym. b of 32 pin 450mil SOP package outline dimension in page 8	Jan.17.2007
Rev. 1.2	Added SL(C-grade) Spec.	Jun.14.2007
Rev. 1.3	Revised $I_{SB1}/I_{DR(MAX.)}$ Added SL(E/I-grade) Spec.	Aug.20.2008
Rev. 1.4	Deleted L Spec. Revised $I_{SB1}/I_{DR(MAX.)}$ Added I_{SB1}/I_{DR} values when $T_A = 25^\circ C$ and $T_A = 40^\circ C$ Revised <u>FEATURES & ORDERING INFORMATION</u> <u>Lead free and green package available to Green package available</u>	Mar.30.2009
Rev. 1.5	Added packing type in <u>ORDERING INFORMATION</u> Deleted T_{SOLDER} in <u>ABSOLUTE MAXIMUM RATINGS</u> Revised V_{DR}	Sep.11.2009



LY621024

Rev. 1.5

128K X 8 BIT LOW POWER CMOS SRAM

FEATURES

- Fast access time : 35/55/70ns
- Low power consumption:
Operating current : 24/17/15mA (TYP.)
Standby current : 2 μ A@5V(TYP.) LL/SL version
0.8 μ A@3V(TYP.) SL version
- Single 5V power supply
- All inputs and outputs TTL compatible
- Fully static operation
- Tri-state output
- Data retention voltage : 1.5V (MIN.)
- **Green package available**
- Package : 32-pin 450 mil SOP
32-pin 600 mil P-DIP
32-pin 8mm x 20mm TSOP-I
32-pin 8mm x 13.4mm STSOP
36-ball 6mm x 8mm TFBGA

GENERAL DESCRIPTION

The LY621024 is a 1,048,576-bit low power CMOS static random access memory organized as 131,072 words by 8 bits. It is fabricated using very high performance, high reliability CMOS technology. Its standby current is stable within the range of operating temperature.

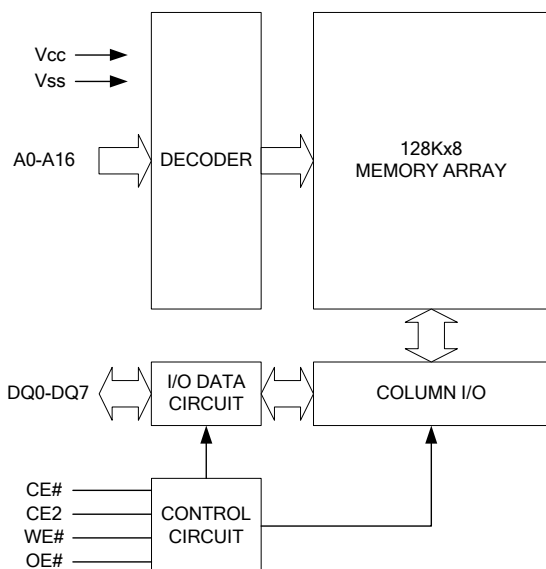
The LY621024 is well designed for very low power system applications, and particularly well suited for battery back-up nonvolatile memory application.

The LY621024 operates from a single power supply of 5V and all inputs and outputs are fully TTL compatible

PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation		
				Standby(I _{SB1} , TYP.)	Operating(I _{CC} , TYP.)	
LY621024(LL)	0 ~ 70°C	4.5 ~ 5.5V	35/55/70ns	-	2 μ A@5V	24/17/15mA
LY621024(LLE)	-20 ~ 80°C	4.5 ~ 5.5V	35/55/70ns	-	2 μ A@5V	24/17/15mA
LY621024(LLI)	-40 ~ 85°C	4.5 ~ 5.5V	35/55/70ns	-	2 μ A@5V	24/17/15mA
LY621024(SL)	0 ~ 70°C	4.5 ~ 5.5V	35/55/70ns	0.8 μ A@3V	2 μ A@5V	24/17/15mA
LY621024(SLE)	-20 ~ 80°C	4.5 ~ 5.5V	35/55/70ns	0.8 μ A@3V	2 μ A@5V	24/17/15mA
LY621024(SLI)	-40 ~ 85°C	4.5 ~ 5.5V	35/55/70ns	0.8 μ A@3V	2 μ A@5V	24/17/15mA

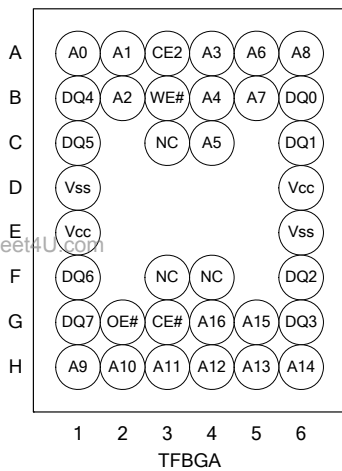
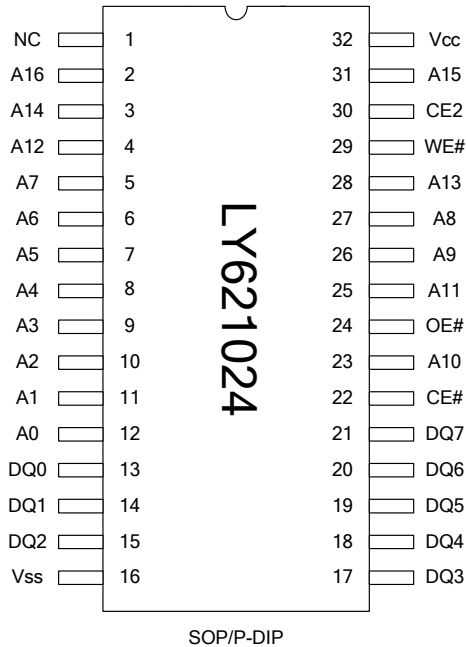
FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0 - A16	Address Inputs
DQ0 - DQ7	Data Inputs/Outputs
CE#, CE2	Chip Enable Inputs
WE#	Write Enable Input
OE#	Output Enable Input
Vcc	Power Supply
Vss	Ground
NC	No Connection

PIN CONFIGURATION



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ABSOLUTE MAXIMUM RATINGS*

PARAMETER	SYMBOL	RATING	UNIT
Voltage on Vcc relative to Vss	V _{T1}	-0.5 to 6.5	V
Voltage on any other pin relative to Vss	V _{T2}	-0.5 to Vcc+0.5	V
Operating Temperature	T _A	0 to 70(C grade)	°C
		-20 to 80(E grade)	
		-40 to 85(I grade)	
Storage Temperature	T _{STG}	-65 to 150	°C
Power Dissipation	P _D	1	W
DC Output Current	I _{OUT}	50	mA

*Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to the absolute maximum rating conditions for extended period may affect device reliability.

TRUTH TABLE

MODE	CE#	CE2	OE#	WE#	I/O OPERATION	SUPPLY CURRENT
Standby	H	X	X	X	High-Z	I _{SB1}
	X	L	X	X	High-Z	I _{SB1}
Output Disable	L	H	H	H	High-Z	I _{CC} , I _{CC1}
Read	L	H	L	H	D _{OUT}	I _{CC} , I _{CC1}
Write	L	H	X	L	D _{IN}	I _{CC} , I _{CC1}

Note: H = V_{IH}, L = V_{IL}, X = Don't care.

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP. ⁴	MAX.	UNIT	
Supply Voltage	V _{CC}		4.5	5.0	5.5	V	
Input High Voltage	V _{IH} ¹		2.4	-	V _{CC} +0.3	V	
Input Low Voltage	V _{IL} ²		-0.2	-	0.6	V	
Input Leakage Current	I _{LI}	V _{CC} ≥ V _{IN} ≥ V _{SS}	-1	-	1	μA	
Output Leakage Current	I _{LO}	V _{CC} ≥ V _{OUT} ≥ V _{SS} , Output Disabled	-1	-	1	μA	
Output High Voltage	V _{OH}	I _{OH} = -1mA	2.4	-	-	V	
Output Low Voltage	V _{OL}	I _{OL} = 2mA	-	-	0.4	V	
Average Operating Power supply Current	I _{CC}	Cycle time = Min. CE# = V _{IL} and CE2 = V _{IH} , I _{I/O} = 0mA Other pins at V _{IL} or V _{IH}	-35	24	80	mA	
			-55	17	60	mA	
			-70	15	50	mA	
	I _{CC1}	Cycle time = 1μs CE# = 0.2V and CE2 ≥ V _{CC} -0.2V, I _{I/O} = 0mA Other pins at 0.2V or V _{CC} - 0.2V	-	2	10	mA	
Standby Power Supply Current	I _{SB1}	CE# ≥ V _{CC} -0.2V or CE2 ≤ 0.2V Others at 0.2V or V _{CC} - 0.2V	LL	2	15	μA	
			LLE/LLI	2	30	μA	
			SL ^{*5}	25°C	0.8	2	μA
			SLE ^{*5}				
			SLI ^{*5}	40°C	1	2	μA
			SL			2	7
SLE/SLI		2	10	μA			

Notes:

- V_{IH}(max) = V_{CC} + 3.0V for pulse width less than 10ns.
- V_{IL}(min) = V_{SS} - 3.0V for pulse width less than 10ns.
- Over/Undershoot specifications are characterized, not 100% tested.
- Typical values are included for reference only and are not guaranteed or tested.
Typical values are measured at V_{CC} = V_{CC}(TYP.) and T_A = 25°C
- This parameter is measured at V_{CC} = 3.0V

CAPACITANCE ($T_A = 25^\circ\text{C}$, $f = 1.0\text{MHz}$)

PARAMETER	SYMBOL	MIN.	MAX	UNIT
Input Capacitance	C_{IN}	-	6	pF
Input/Output Capacitance	$C_{I/O}$	-	8	pF

Note : These parameters are guaranteed by device characterization, but not production tested.

AC TEST CONDITIONS

Input Pulse Levels	0.2V to $V_{CC} - 0.2V$
Input Rise and Fall Times	3ns
Input and Output Timing Reference Levels	1.5V
Output Load	$C_L = 50\text{pF} + 1\text{TTL}$, $I_{OH}/I_{OL} = -1\text{mA}/2\text{mA}$

AC ELECTRICAL CHARACTERISTICS**(1) READ CYCLE**

PARAMETER	SYM.	LY621024-35		LY621024-55		LY621024-70		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Read Cycle Time	t_{RC}	35	-	55	-	70	-	ns
Address Access Time	t_{AA}	-	35	-	55	-	70	ns
Chip Enable Access Time	t_{ACE}	-	35	-	55	-	70	ns
Output Enable Access Time	t_{OE}	-	25	-	30	-	35	ns
Chip Enable to Output in Low-Z	t_{CLZ}^*	10	-	10	-	10	-	ns
Output Enable to Output in Low-Z	t_{OLZ}^*	5	-	5	-	5	-	ns
Chip Disable to Output in High-Z	t_{CHZ}^*	-	15	-	20	-	25	ns
Output Disable to Output in High-Z	t_{OHZ}^*	-	15	-	20	-	25	ns
Output Hold from Address Change	t_{OH}	10	-	10	-	10	-	ns

(2) WRITE CYCLE

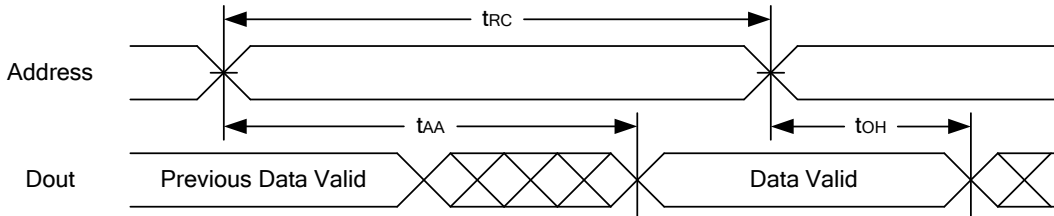
PARAMETER	SYM.	LY621024-35		LY621024-55		LY621024-70		UNIT
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Write Cycle Time	t_{WC}	35	-	55	-	70	-	ns
Address Valid to End of Write	t_{AW}	30	-	50	-	60	-	ns
Chip Enable to End of Write	t_{CW}	30	-	50	-	60	-	ns
Address Set-up Time	t_{AS}	0	-	0	-	0	-	ns
Write Pulse Width	t_{WP}	25	-	45	-	55	-	ns
Write Recovery Time	t_{WR}	0	-	0	-	0	-	ns
Data to Write Time Overlap	t_{DW}	20	-	25	-	30	-	ns
Data Hold from End of Write Time	t_{DH}	0	-	0	-	0	-	ns
Output Active from End of Write	t_{OW}^*	5	-	5	-	5	-	ns
Write to Output in High-Z	t_{WHZ}^*	-	15	-	20	-	25	ns

*These parameters are guaranteed by device characterization, but not production tested.

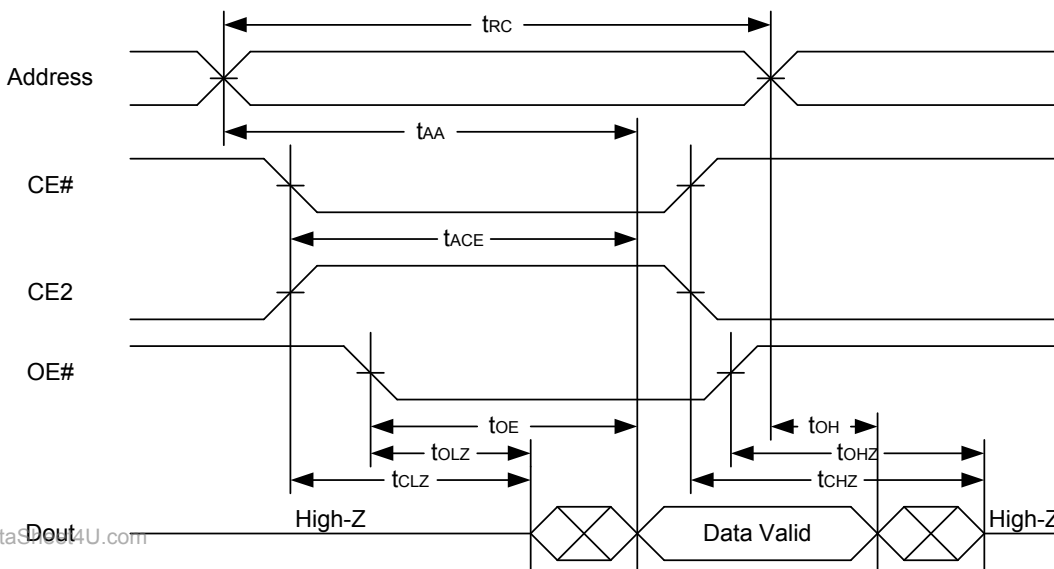


TIMING WAVEFORMS

READ CYCLE 1 (Address Controlled) (1,2)



READ CYCLE 2 (CE# and CE2 and OE# Controlled) (1,3,4,5)



Notes :

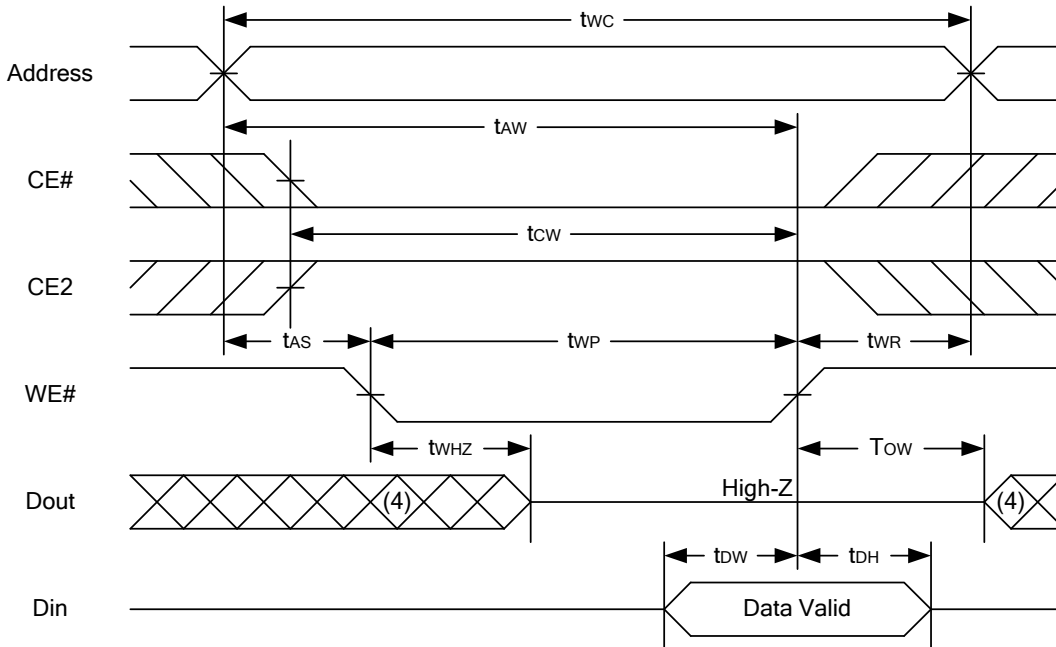
1. WE# is high for read cycle.
2. Device is continuously selected OE# = low, CE# = low, CE2 = high.
3. Address must be valid prior to or coincident with CE# = low, CE2 = high; otherwise t_{AA} is the limiting parameter.
4. t_{CLZ} , t_{OLZ} , t_{CHZ} and t_{OHZ} are specified with $C_L = 5pF$. Transition is measured $\pm 500mV$ from steady state.
5. At any given temperature and voltage condition, t_{CHZ} is less than t_{CLZ} , t_{OHZ} is less than t_{OLZ} .

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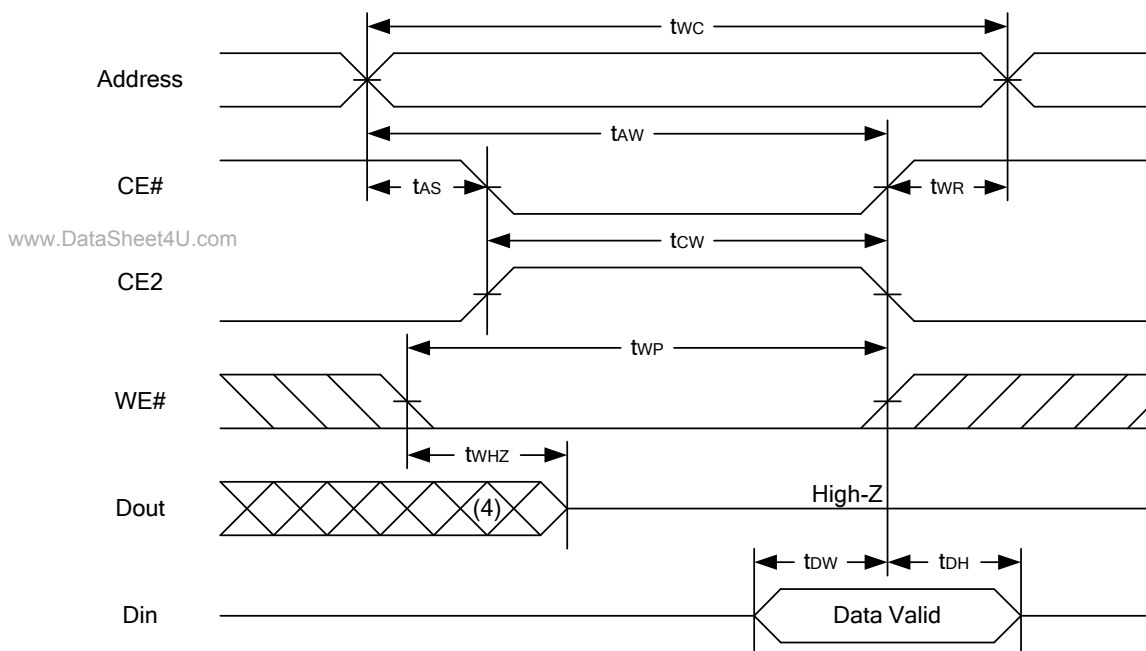
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WRITE CYCLE 1 (WE# Controlled) (1,2,3,5,6)



WRITE CYCLE 2 (CE# and CE2 Controlled) (1,2,5,6)



Notes :

1. WE#, CE# must be high or CE2 must be low during all address transitions.
2. A write occurs during the overlap of a low CE#, high CE2, low WE#.
3. During a WE#-controlled write cycle with OE# low, twp must be greater than twhz + tdw to allow the drivers to turn off and data to be placed on the bus.
4. During this period, I/O pins are in the output state, and input signals must not be applied.
5. If the CE# low transition and CE2 high transition occurs simultaneously with or after WE# low transition, the outputs remain in a high impedance state.
6. tow and twhz are specified with CL = 5pF. Transition is measured ±500mV from steady state.



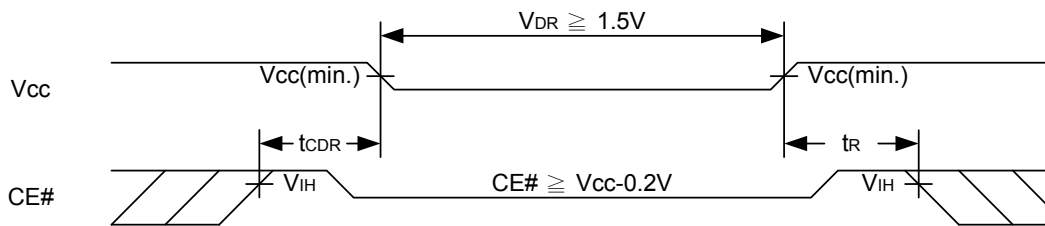
DATA RETENTION CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT		
V _{CC} for Data Retention	V _{DR}	CE# ≥ V _{CC} - 0.2V or CE2 ≤ 0.2V	1.5	-	5.5	V		
Data Retention Current	I _{DR}	V _{CC} = 1.5V CE# ≥ V _{CC} - 0.2V or CE2 ≤ 0.2V Other pins at 0.2V or V _{CC} -0.2V	LL	-	0.5	12	μA	
			LLE/LLI	-	0.5	30	μA	
			SL	25°C	-	0.4	2	μA
			SLE	40°C	-	0.5	2	μA
			SLI		-	0.4	5	μA
			SLE/SLI	-	0.4	8	μA	
Chip Disable to Data Retention Time	t _{CDR}	See Data Retention Waveforms (below)	0	-	-	ns		
Recovery Time	t _R		t _{RC} *	-	-	ns		

t_{RC}* = Read Cycle Time

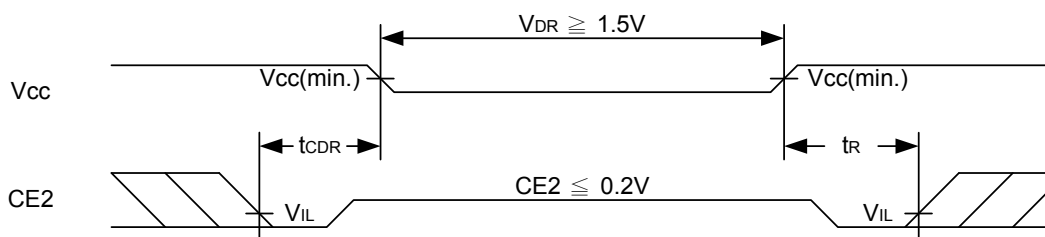
DATA RETENTION WAVEFORM

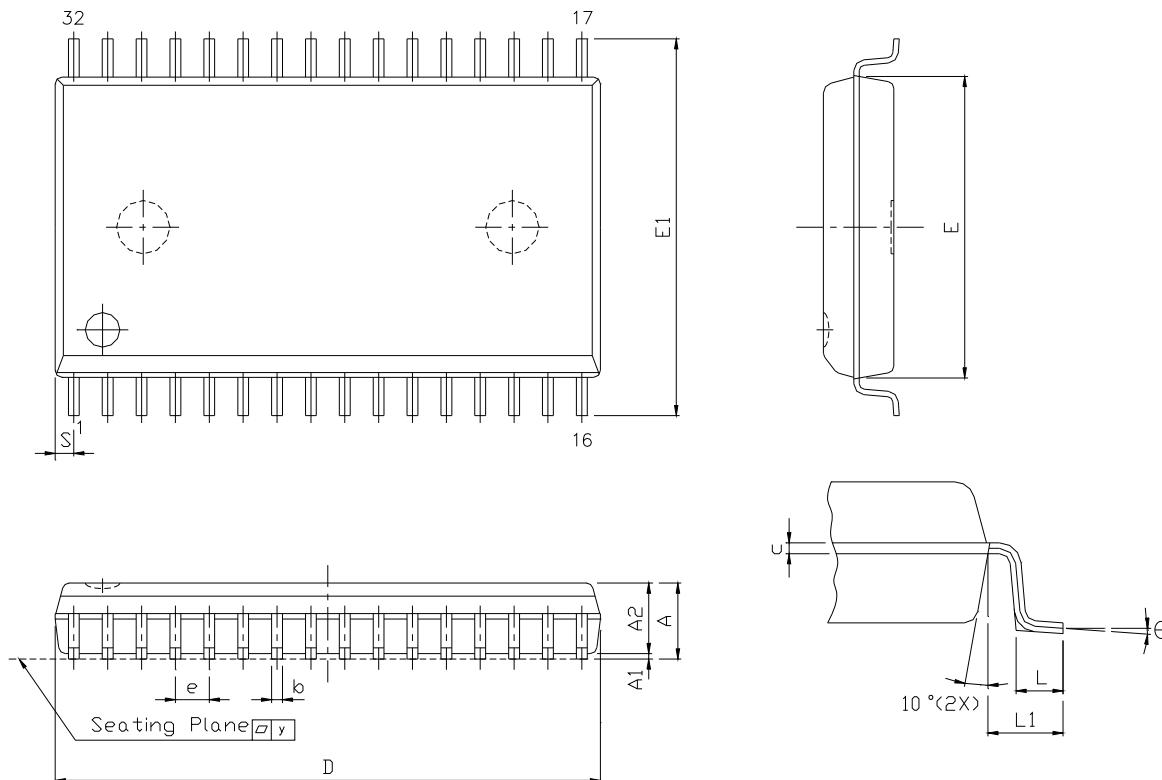
Low V_{CC} Data Retention Waveform (1) (CE# controlled)



Low V_{CC} Data Retention Waveform (2) (CE2 controlled)

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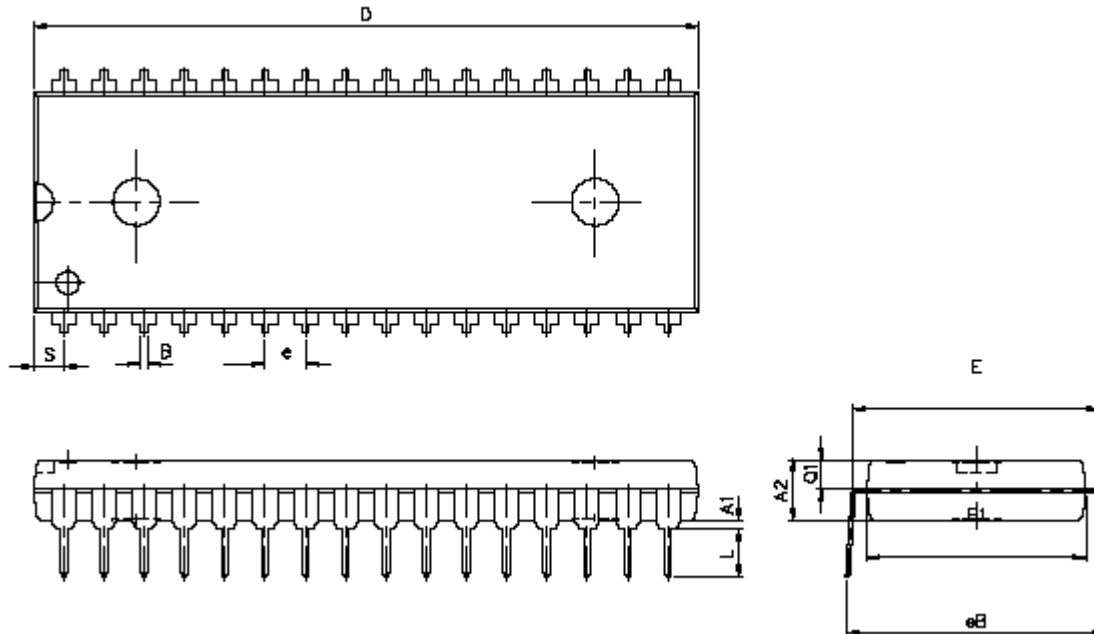


PACKAGE OUTLINE DIMENSION**32 pin 450 mil SOP Package Outline Dimension**

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SYM.	UNIT	INCH.(BASE)	MM(REF)
A		0.118 (MAX)	2.997 (MAX)
A1		0.004(MIN)	0.102(MIN)
A2		0.111(MAX)	2.82(MAX)
b		0.016 +0.004 -0.002	0.406 +0.102 -0.051
c		0.008(TYP)	0.203(TYP)
D		0.817(MAX)	20.75(MAX)
E		0.445 ±0.005	11.303 ±0.127
E1		0.555 ±0.012	14.097 ±0.305
e		0.050(TYP)	1.270(TYP)
L		0.0347 ±0.008	0.881 ±0.203
L1		0.055 ±0.008	1.397 ±0.203
S		0.026(MAX)	0.660 (MAX)
y		0.004(MAX)	0.101(MAX)
Θ		0° -10°	0° -10°

32 pin 600 mil P-DIP Package Outline Dimension



SYM.	UNIT	INCH(BASE)	MM(REF)
A1		0.001 (MIN)	0.254 (MIN)
A2		0.150 ± 0.005	3.810 ± 0.127
B		0.018 ± 0.005	0.457 ± 0.127
D		1.650 ± 0.005	41.910 ± 0.127
E		0.600 ± 0.010	15.240 ± 0.254
E1		0.544 ± 0.004	13.818 ± 0.102
e		0.100 (TYP)	2.540 (TYP)
eB		0.640 ± 0.020	16.256 ± 0.508.
L		0.130 ± 0.010	3.302 ± 0.254
S		0.075 ± 0.010	1.905 ± 0.254
Q1		0.070 ± 0.005	1.778 ± 0.127

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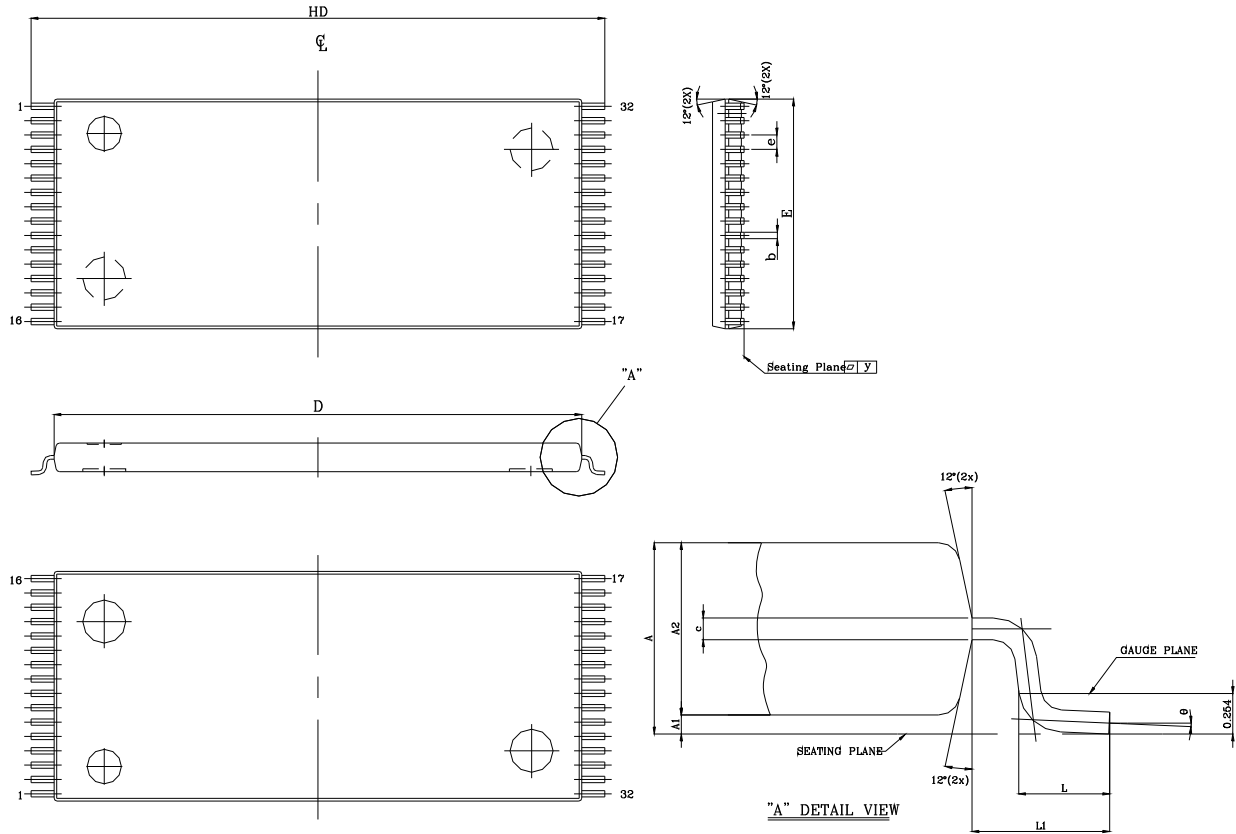
Note : D/E1/S dimension do not include mold flash.

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32 pin 8mm x 20mm TSOP-I Package Outline Dimension

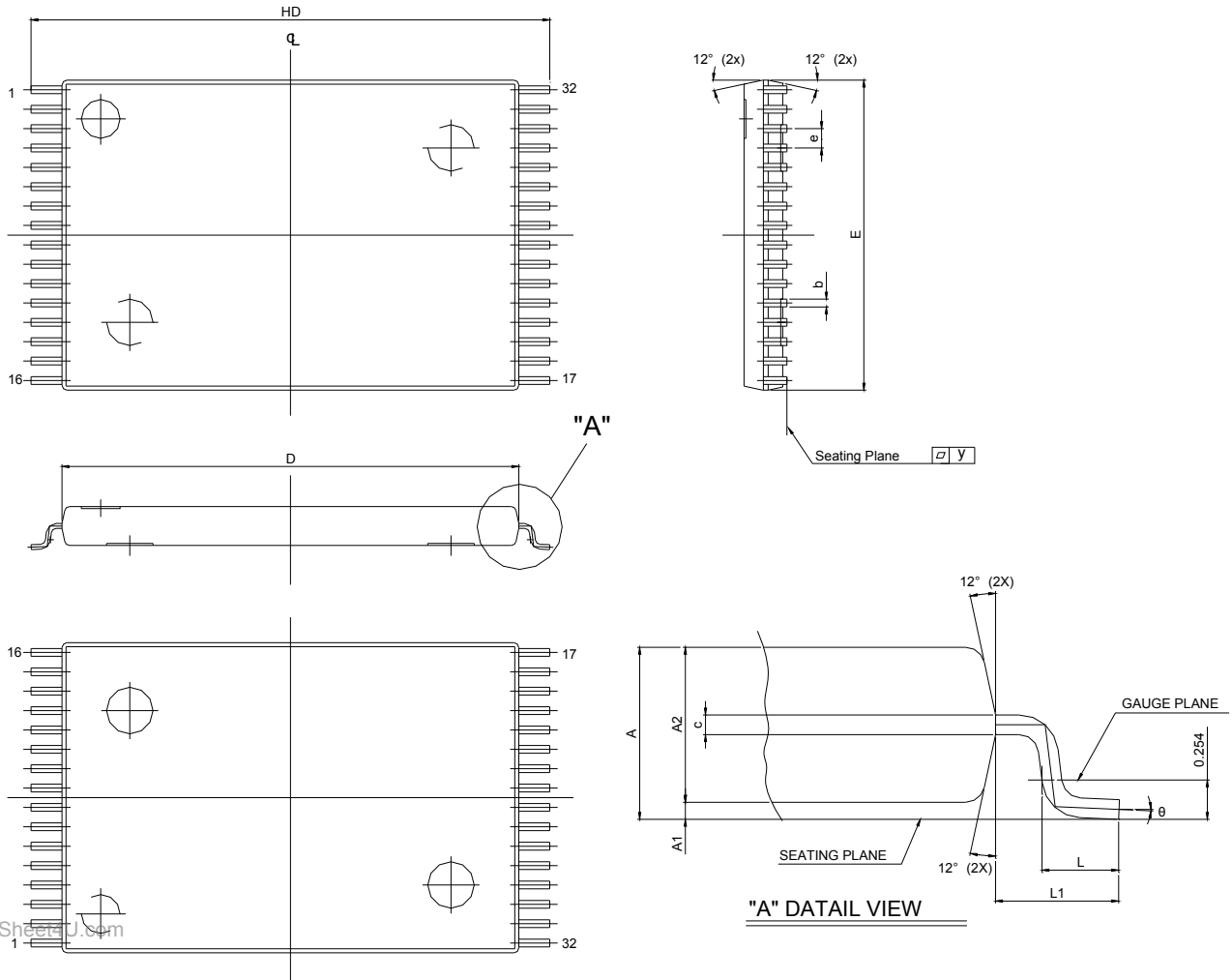


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SYM.	UNIT	INCH(BASE)	MM(REF)
A		0.047 (MAX)	1.20 (MAX)
A1		0.004 \pm 0.002	0.10 \pm 0.05
A2		0.039 \pm 0.002	1.00 \pm 0.05
b		0.008 + 0.002 - 0.001	0.20 + 0.05 - 0.03
c		0.005 (TYP)	0.127 (TYP)
D		0.724 \pm 0.004	18.40 \pm 0.10
E		0.315 \pm 0.004	8.00 \pm 0.10
e		0.020 (TYP)	0.50 (TYP)
HD		0.787 \pm 0.008	20.00 \pm 0.20
L		0.0197 \pm 0.004	0.50 \pm 0.10
L1		0.0315 \pm 0.004	0.08 \pm 0.10
y		0.003 (MAX)	0.076 (MAX)
θ		0 $^\circ$ ~ 5 $^\circ$	0 $^\circ$ ~ 5 $^\circ$



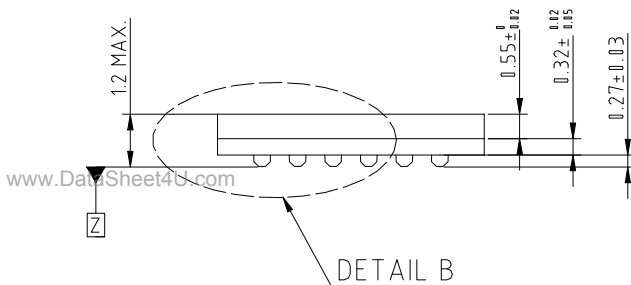
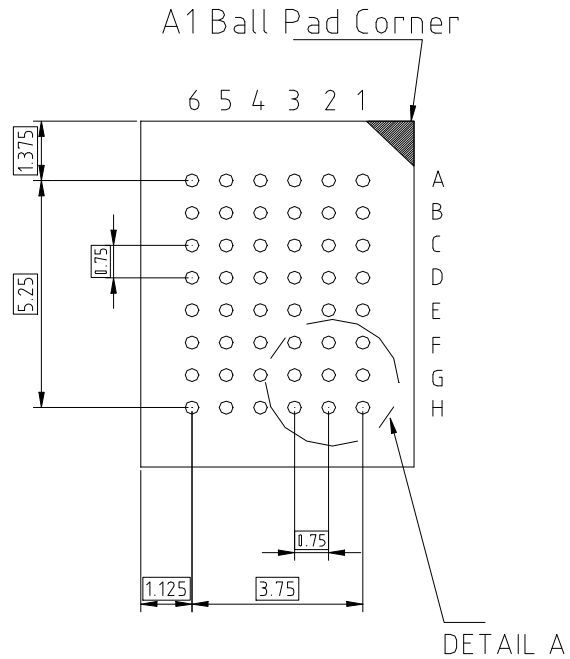
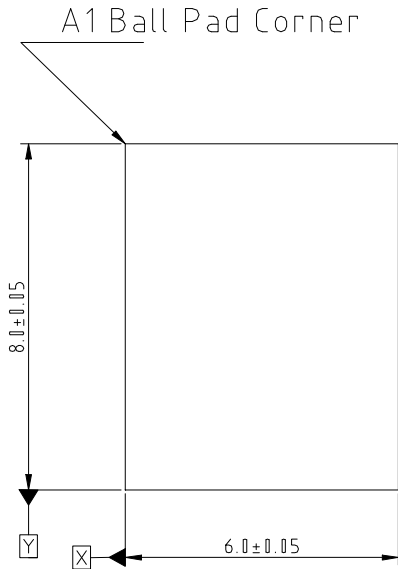
32 pin 8mm x 13.4mm STSOP Package Outline Dimension



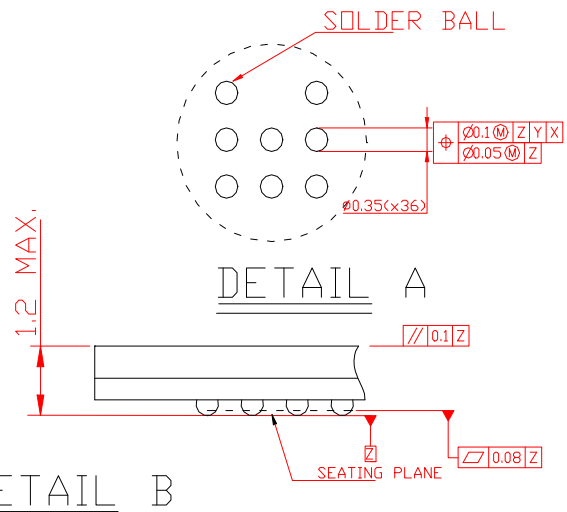
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SYM.	UNIT	INCH(BASE)	MM(REF)
A		0.049 (MAX)	1.25 (MAX)
A1		0.005 ±0.002	0.130 ±0.05
A2		0.039 ±0.002	1.00 ±0.05
b		0.008 ±0.01	0.20±0.025
c		0.005 (TYP)	0.127 (TYP)
D		0.465 ±0.004	11.80 ±0.10
E		0.315 ±0.004	8.00 ±0.10
e		0.020 (TYP)	0.50 (TYP)
HD		0.528±0.008	13.40 ±0.20.
L		0.0197 ±0.004	0.50 ±0.10
L1		0.0315 ±0.004	0.8 ±0.10
y		0.003 (MAX)	0.076 (MAX)
Θ		0°~5°	0°~5°

36 ball 6mm x 8mm TFBGA Package Outline Dimension



SIDE VIEW



DETAIL B



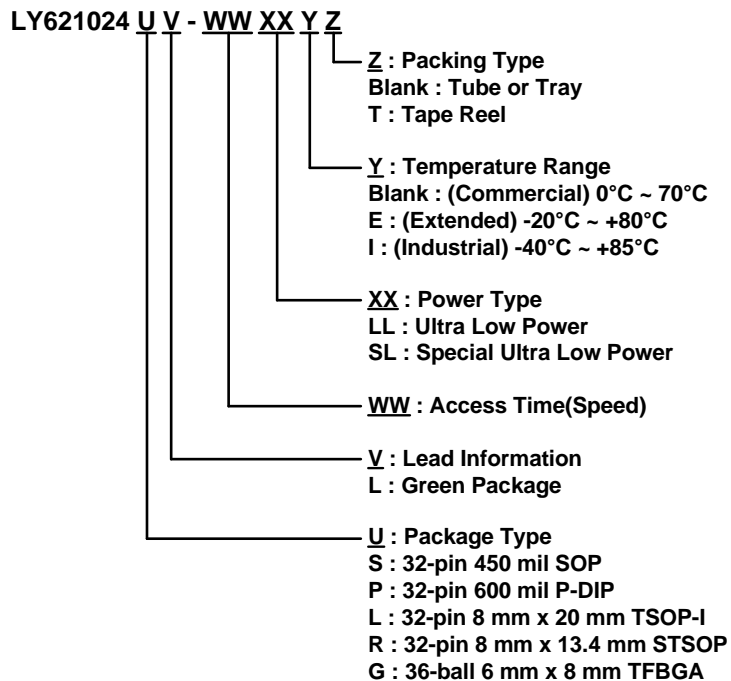
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ORDERING INFORMATION





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