REVISION HISTORY

Revision	Description	Issue Date
Rev. 1.0	Initial Issued	Jan.09. 2012
Rev. 1.1	Add 48 pin BGA package type.	Mar.12. 2012
Rev. 1.2	1."CE# ≧ V_{CC} - 0.2V" revised as "CE# ≦ 0.2" for **TEST CONDITION** of Average Operating Power supply Current Icc1 on page3 2.Revised **ORDERING INFORMATION** Page11	Jul.19. 2012
Rev. 1.3	1. Revise "**TEST CONDITION**" for V_{OH}, V_{OL} on page 3 I_{OH} = -8mA revised as -4mA I_{OL} =4mA revised as 8mA 2. Revise V_{IH}(max) & V_{IL}(min) note on page 3 V_{IH}(max) = V_{CC} + 2.0V for pulse width less than 6ns. V_{IL}(min) = V_{SS} - 2.0V for pulse width less than 6ns.	Jun. 04. 2013
Rev.1.4	Revised the address pin sequence of pin configuration of 48 pin TSOP I on page 2 in order to be compatible with industry convention. (No function specifications and applications have been changed and all the characteristics are kept all the same as Rev 1.3)	Oct. 30. 2013
Rev. 1.5	Add V_{CC}=1.8V specifications	Oct.20.2014
Rev. 1.6	Revised **PIN DESCRIPTION** in page 1 Revised I_{CC1}(min) in **DC ELECTRICAL CHARACTERISTICS** Deleted **WRITE CYCLE** Notes : 1. WE#,CE#, LB#, UB# must be high during all address transitions. in page 10	Mar.22.2017

LY61L102416A

Rev. 1.6

1024K X 16 BIT HIGH SPEED CMOS SRAM

FEATURES

- Fast access time : 10/12ns (V_{CC}=3.3V)
  15ns (V_{CC}=1.8V)
- **low power consumption:**
  Operating current:
  90/80mA (3.3V TYP.)
  70mA (1.8V TYP.)
  Standby current:
  4mA (TYP.)
- Power supply: 1.8 or 3.3V
- All inputs and outputs TTL compatible
- Fully static operation
- Tri-state output
- Data byte control : LB# (DQ0 ~ DQ7)
  UB# (DQ8 ~ DQ15)
- Data retention voltage : 1.5V (MIN.)
- **Green package available**
- Package : 48-pin 12mm x 20mm TSOP I
  48-ball 6mm x 8mm TFBGA

GENERAL DESCRIPTION

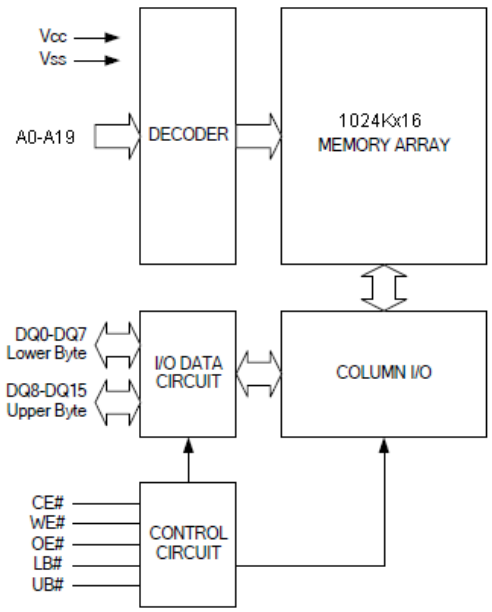
The LY61L102416A is a 16M-bit high speed CMOS static random access memory organized as 1024K words by 16 bits. It is fabricated using very high performance, high reliability CMOS technology. Its standby current is stable within the range of operating temperature.

The LY61L102416A operates with power supply either 1.8V or 3.3V, and all inputs and outputs are fully TTL compatible

PRODUCT FAMILY

Product Family	Operating Temperature	Speed		Power Dissipation			
				Standby (I_{SB1}, TYP.)		Operating (I_{CC1}, TYP.)	
		V_{CC}=1.65~2.4V	V_{CC}=2.7 ~3.6V	V_{CC}=1.65~2.4V	V_{CC}=2.7 ~3.6V	V_{CC}=1.65~2.4V	V_{CC}=2.7 ~3.6V
LY61L102416A	0 ~ 70℃	15ns	10/12ns	4mA	4mA	70mA	90/80mA
LY61L102416A(I)	-40 ~ 85℃	15ns	10/12ns	4mA	4mA	70mA	90/80mA

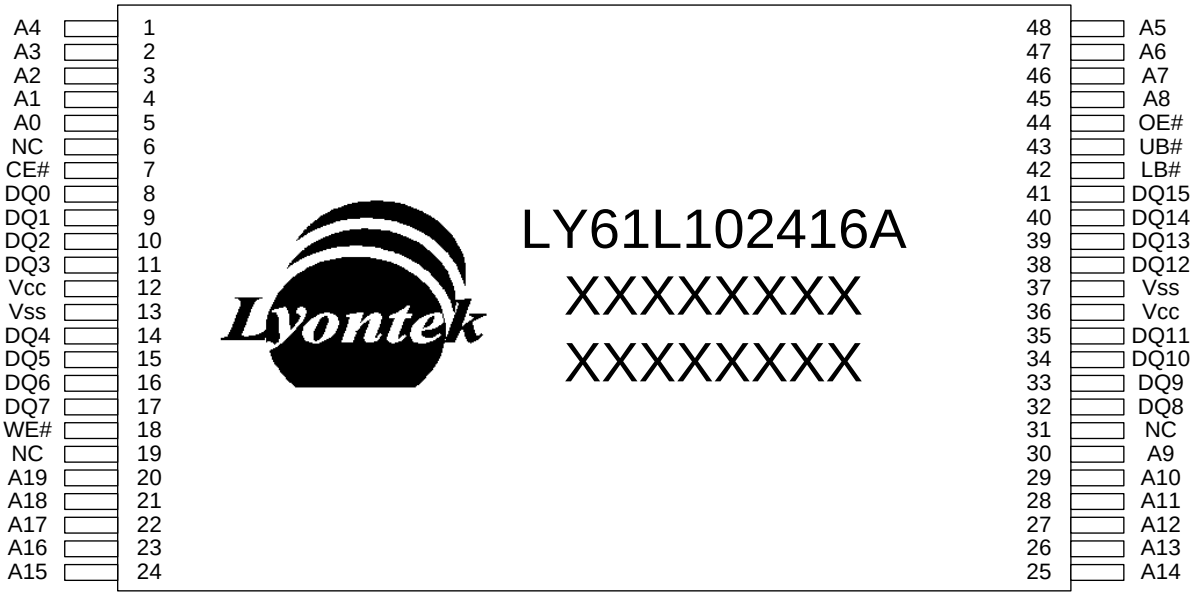
FUNCTIONAL BLOCK DIAGRAM



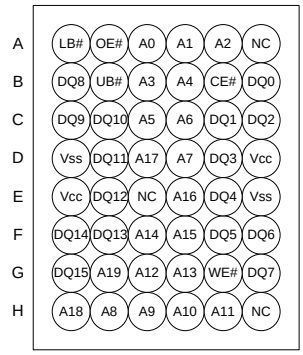
PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0 - A19	Address Inputs
DQ0 - DQ15	Data Inputs/Outputs
CE#	Chip Enable Input
WE#	Write Enable Input
OE#	Output Enable Input
LB#	Lower Byte Control
UB#	Upper Byte Control
V_{CC}	Power Supply
V_{SS}	Ground
NC	No Connection

PIN CONFIGURATION



TSOP I



TFBGA (See through with Top View)

TFBGA (Top View)

ABSOLUTE MAXIMUN RATINGS*

PARAMETER	SYMBOL	RATING	UNIT
Voltage on V_{cc} relative to V_{SS}	V_{T1}	-0.5 to 4.6	V
Voltage on any other pin relative to V_{SS}	V_{T2}	-0.5 to V_{CC}+0.5	V
Operating Temperature	T_A	0 to 70(C grade) -40 to 85(I grade)	℃
Storage Temperature	T_{STG}	-65 to 150	℃
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#	OE#	WE#	LB#	UB#	I/O OPERATION		SUPPLY CURRENT
						DQ0 - DQ7	DQ8 - DQ15	
Standby	H	X	X	X	X	High-Z	High-Z	I_{SB},I_{SB1}
Output Disable	L	H	H	X	X	High-Z	High-Z	I_{CC},I_{CC1}
	L	X	X	H	H	High-Z	High-Z	
Read	L	L	H	L	H	D_{OUT}	High-Z	I_{CC},I_{CC1}
	L	L	H	H	L	High-Z	D_{OUT}	
	L	L	H	L	L	D_{OUT}	D_{OUT}	
Write	L	X	L	L	H	D_{IN}	High-Z	I_{CC},I_{CC1}
	L	X	L	H	L	High-Z	D_{IN}	
	L	X	L	L	L	D_{IN}	D_{IN}	

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

DC ELECTRICAL CHARACTERISTICS (V_{CC}=2.7V~3.6V)

PARAMETER	SYMBOL	TEST CONDITION		MIN.	TYP. *4	MAX.	UNIT
Supply Voltage	V_{CC}			2.7	3.3	3.6	V
Input High Voltage	V_{IH} *1			2.2	-	V_{CC}+0.3	V
Input Low Voltage	V_{IL} *2			- 0.3	-	0.8	V
Input Leakage Current	I_{LI}	$V_{CC} \geqq V_{IN} \geqq V_{SS}$		- 1	-	1	µA
Output Leakage Current	I_{LO}	$V_{CC} \geqq V_{OUT} \geqq V_{SS}$, Output Disabled		- 1	-	1	µA
Output High Voltage	V_{OH}	I_{OH} = -4mA		2.4	-	-	V
Output Low Voltage	V_{OL}	I_{OL} =8mA		-	-	0.4	V
Average Operating Power supply Current	I_{CC}	CE# = V_{IL} , $I_{I/O}$ = 0mA ; f=MAX.	-10	-	110	160	mA
			-12	-	100	140	mA
	I_{CC1}	CE# $\leqq$ 0.2, Other pin is at 0.2V or V_{CC}-0.2V $I_{I/O}$ = 0mA ; f=MAX.	-10	-	90	120	mA
			-12	-	80	110	mA
Standby Power Supply Current	I_{SB}	CE# $\geqq V_{IH}$ Other pin is at V_{IL} or V_{IH}		-	-	80	mA
Standby Power Supply Current	I_{SB1}	CE# $\geqq V_{CC}$ - 0.2V; Other pin is at 0.2V or V_{CC}-0.2V		-	4	40	mA

Notes:
1. V_{IH}(max) = V_{CC} + 2.0V for pulse width less than 6ns..
2. V_{IL}(min) = V_{SS} - 2.0V for pulse width less than 6ns.
3. Over/Undershoot specifications are characterized on engineering evaluation stage, not for mass production test.
4. Typical values are included for reference only and are not guaranteed or tested.
   Typical valued are measured at V_{CC} = $V_{CC(TYP.)}$ and T_A = 25℃

DC ELECTRICAL CHARACTERISTICS (V_{CC}=1.65V~2.4V)

PARAMETER	SYMBOL	TEST CONDITION		MIN.	TYP. *4	MAX.	UNIT
Supply Voltage	V_{CC}			1.65	1.8	2.4	V
Input High Voltage	V_{IH} *1			1.4	-	V_{CC}+0.3	V
Input Low Voltage	V_{IL} *2			- 0.3	-	0.4	V
Input Leakage Current	I_{LI}	$V_{CC} \geqq V_{IN} \geqq V_{SS}$		- 1	-	1	µA
Output Leakage Current	I_{LO}	$V_{CC} \geqq V_{OUT} \geqq V_{SS}$, Output Disabled		- 1	-	1	µA
Output High Voltage	V_{OH}	I_{OH} = -0.5mA		1.4	-	-	V
Output Low Voltage	V_{OL}	I_{OL} =1mA		-	-	0.4	V
Average Operating Power supply Current	I_{CC}	CE# = V_{IL} , $I_{I/O}$ = 0mA ; f=MAX.	-15	-	90	130	mA
	I_{CC1}	CE# $\leqq$ 0.2, Other pin is at 0.2V or V_{CC}-0.2V $I_{I/O}$ = 0mA; f=MAX.	-15	-	70	90	mA
Standby Power Supply Current	I_{SB}	CE# $\geqq$ V_{IH} Other pin is at V_{IL} or V_{IH}		-	-	80	mA
Standby Power Supply Current	I_{SB1}	CE# $\geqq$ V_{CC} - 0.2V; Other pin is at 0.2V or V_{CC}-0.2V		-	4	40	mA

Notes:
1. V_{IH}(max) = V_{CC} + 2.0V for pulse width less than 6ns.
2. V_{IL}(min) = V_{SS} - 2.0V for pulse width less than 6ns.
3. Over/Undershoot specifications are characterized on engineering evaluation stage, not for mass production test.
4. Typical values are included for reference only and are not guaranteed or tested.
   Typical valued are measured at V_{CC} = $V_{CC(TYP.)}$ and T_A = 25℃

CAPACITANCE (T_A = 25℃, f = 1.0MHz)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Input Capacitance	C_{IN}	-	8	pF
Input/Output Capacitance	$C_{I/O}$	-	10	pF

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

AC TEST CONDITIONS

Speed	10/12ns(V_{CC}=3.3V), 15ns(V_{CC}=1.8V)
Input Pulse Levels	0.2V to V_{CC}-0.2V
Input Rise and Fall Times	3ns
Input and Output Timing Reference Levels	V_{CC}/2
Output Load	C_L = 30pF + 1TTL, I_{OH}/I_{OL} = -4mA/8mA(V_{CC}=3.3V) I_{OH}/I_{OL} = -0.5mA/1mA(V_{CC}=1.8V)

AC ELECTRICAL CHARACTERISTICS (V_{CC}=2.7V~3.6V)

(1) READ CYCLE

PARAMETER	SYM.	LY61L102416A-10		LY61L102416A-12		UNIT
		MIN.	MAX.	MIN.	MAX.	
Read Cycle Time	t_{RC}	10	-	12	-	ns
Address Access Time	t_{AA}	-	10	-	12	ns
Chip Enable Access Time	t_{ACE}	-	10	-	12	ns
Output Enable Access Time	t_{OE}	-	4.5	-	5	ns
Chip Enable to Output in Low-Z	t_{CLZ}*	2	-	3	-	ns
Output Enable to Output in Low-Z	t_{OLZ}*	0	-	0	-	ns
Chip Disable to Output in High-Z	t_{CHZ}*	-	4	-	5	ns
Output Disable to Output in High-Z	t_{OHZ}*	-	4	-	5	ns
Output Hold from Address Change	t_{OH}	2	-	2	-	ns
LB#, UB# Access Time	t_{BA}	-	4.5	-	5	ns
LB#, UB# to High-Z Output	t_{BHZ}*	-	4	-	5	ns
LB#, UB# to Low-Z Output	t_{BLZ}*	0	-	0	-	ns

(2) WRITE CYCLE

PARAMETER	SYM.	LY61L102416A-10		LY61L102416A-12		UNIT
		MIN.	MAX.	MIN.	MAX.	
Write Cycle Time	t_{WC}	10	-	12	-	ns
Address Valid to End of Write	t_{AW}	8	-	10	-	ns
Chip Enable to End of Write	t_{CW}	8	-	10	-	ns
Address Set-up Time	t_{AS}	0	-	0	-	ns
Write Pulse Width	t_{WP}	8	-	10	-	ns
Write Recovery Time	t_{WR}	0	-	0	-	ns
Data to Write Time Overlap	t_{DW}	6	-	7	-	ns
Data Hold from End of Write Time	t_{DH}	0	-	0	-	ns
Output Active from End of Write	t_{OW}*	2	-	2	-	ns
Write to Output in High-Z	t_{WHZ}*	-	4	-	5	ns
LB#, UB# Valid to End of Write	t_{BW}	8	-	10	-	ns

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

AC ELECTRICAL CHARACTERISTICS (V_{CC}=1.65V~2.4V)

(1) READ CYCLE

PARAMETER	SYM.	LY61L102416A-10		UNIT
		MIN.	MAX.	
Read Cycle Time	t_{RC}	15	-	ns
Address Access Time	t_{AA}	-	15	ns
Chip Enable Access Time	t_{ACE}	-	15	ns
Output Enable Access Time	t_{OE}	-	8	ns
Chip Enable to Output in Low-Z	t_{CLZ}*	3	-	ns
Output Enable to Output in Low-Z	t_{OLZ}*	0	-	ns
Chip Disable to Output in High-Z	t_{CHZ}*	-	5	ns
Output Disable to Output in High-Z	t_{OHZ}*	-	5	ns
Output Hold from Address Change	t_{OH}	2	-	ns
LB#, UB# Access Time	t_{BA}	-	8	ns
LB#, UB# to High-Z Output	t_{BHZ}*	-	5	ns
LB#, UB# to Low-Z Output	t_{BLZ}*	0	-	ns

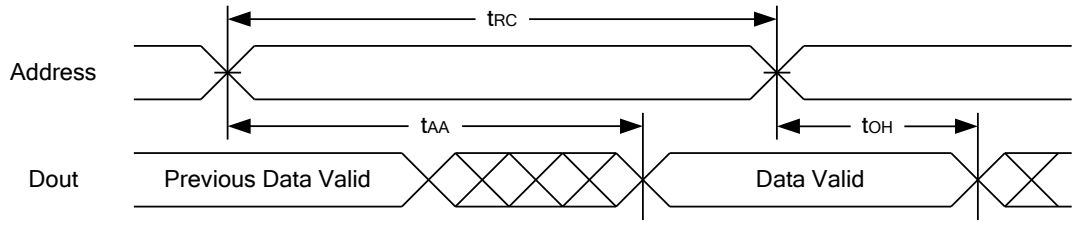
(2) WRITE CYCLE

PARAMETER	SYM.	LY61L102416A-10		UNIT
		MIN.	MAX.	
Write Cycle Time	t_{WC}	15	-	ns
Address Valid to End of Write	t_{AW}	12	-	ns
Chip Enable to End of Write	t_{CW}	12	-	ns
Address Set-up Time	t_{AS}	0	-	ns
Write Pulse Width	t_{WP}	12	-	ns
Write Recovery Time	t_{WR}	0	-	ns
Data to Write Time Overlap	t_{DW}	9	-	ns
Data Hold from End of Write Time	t_{DH}	0	-	ns
Output Active from End of Write	t_{OW}*	2	-	ns
Write to Output in High-Z	t_{WHZ}*	-	9	ns
LB#, UB# Valid to End of Write	t_{BW}	12	-	ns

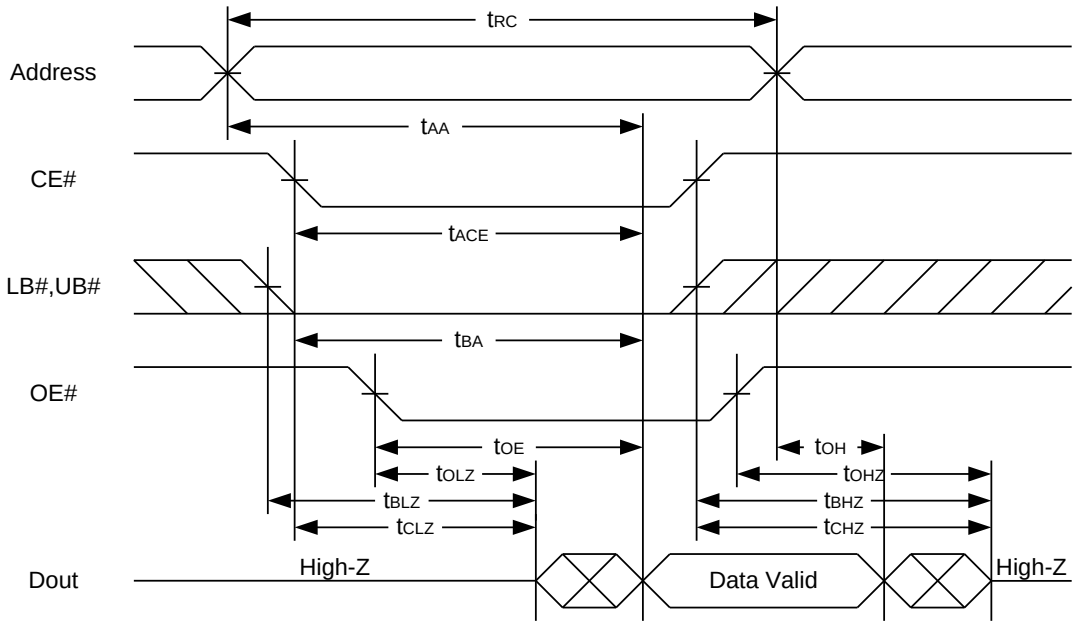
*These parameters are guaranteed by device characterization, but not production tested.

TIMING WAVEFORMS

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

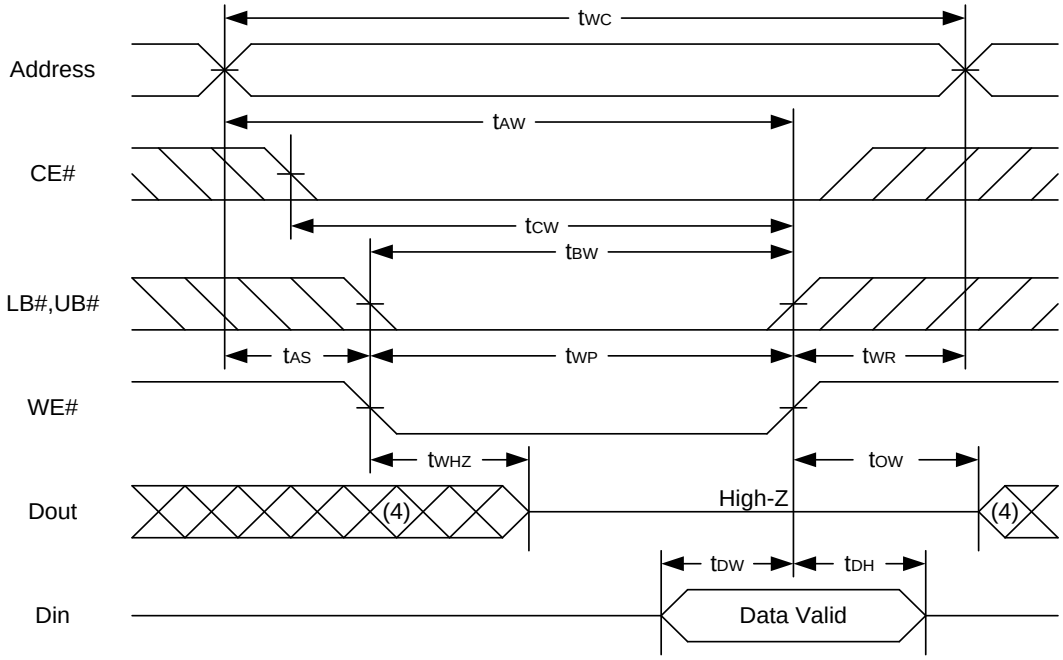


READ CYCLE 2 (CE# and OE# Controlled) (1,3,4,5)

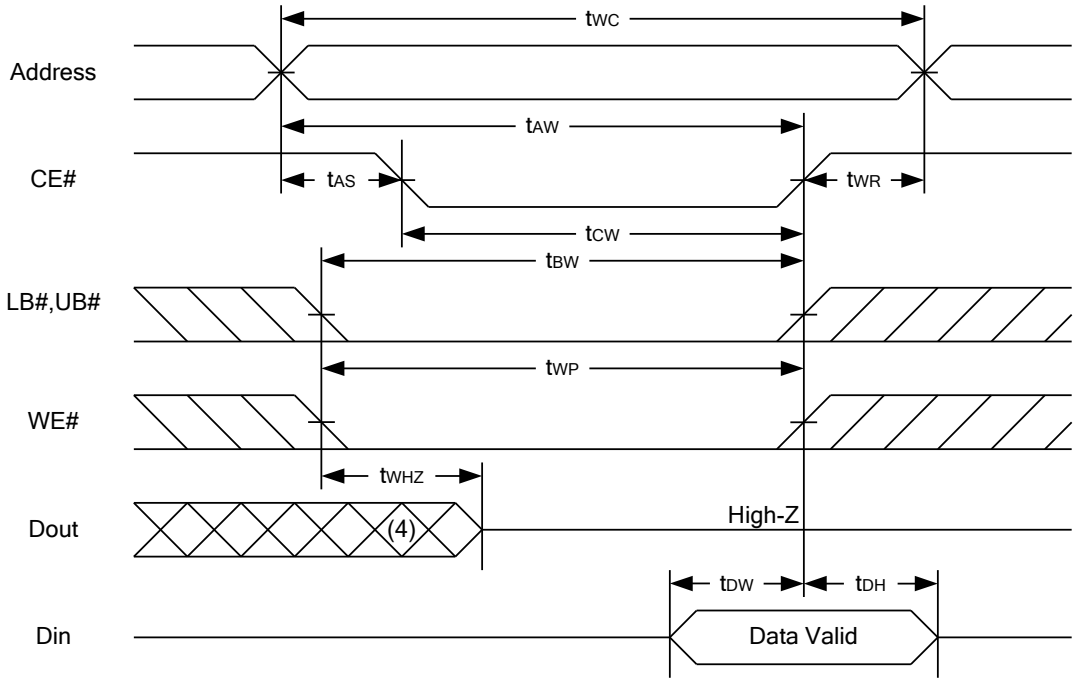


Notes :
1.WE# is high for read cycle.
2.Device is continuously selected OE# = low, CE# = low, LB# or UB# = low.
3.Address must be valid prior to or coincident with CE# = low, LB# or UB# = low transition; otherwise t_{AA} is the limiting parameter.
4.t_{CLZ}, t_{BLZ}, t_{OLZ}, t_{CHZ}, t_{BHZ} and t_{OHZ}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

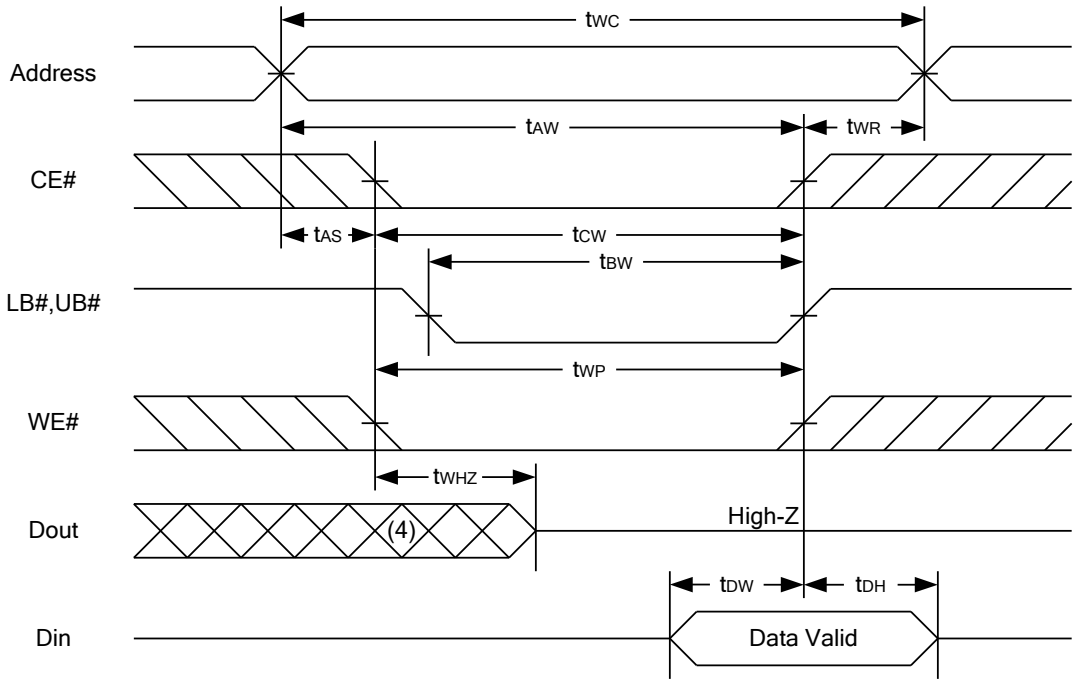
WRITE CYCLE 1 (WE# Controlled) (1,2,4,5)



WRITE CYCLE 2 (CE# Controlled) (1,4,5)



WRITE CYCLE 3 (LB#,UB# Controlled) (1,4,5)



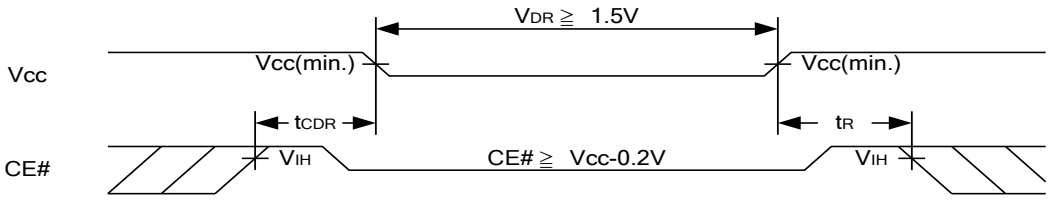
Notes :
1.A write occurs during the overlap of a low CE#, low WE#, LB# or UB# = low.
2.During a WE# controlled write cycle with OE# low, t_{WP} must be greater than $t_{WHZ} + t_{DW}$ to allow the drivers to turn off and data to be placed on the bus.
3.During this period, I/O pins are in the output state, and input signals must not be applied.
4.If the CE#, LB#, UB# low transition occurs simultaneously with or after WE# low transition, the outputs remain in a high impedance state.
5.t_{OW} and t_{WHZ} are specified with C_L = 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	1.5	-	3.6	V
Data Retention Current	I_{DR}	V_{CC} = 1.5V, CE# ≧ V_{CC} - 0.2V; Other pin is at 0.2V or V_{CC} - 0.2V	-	4	40	mA
Chip Disable to Data Retention Time	t_{CDR}	See Data Retention Waveforms (below)	0	-	-	ns
Recovery Time	t_R		t_{RC*}	-	-	ns

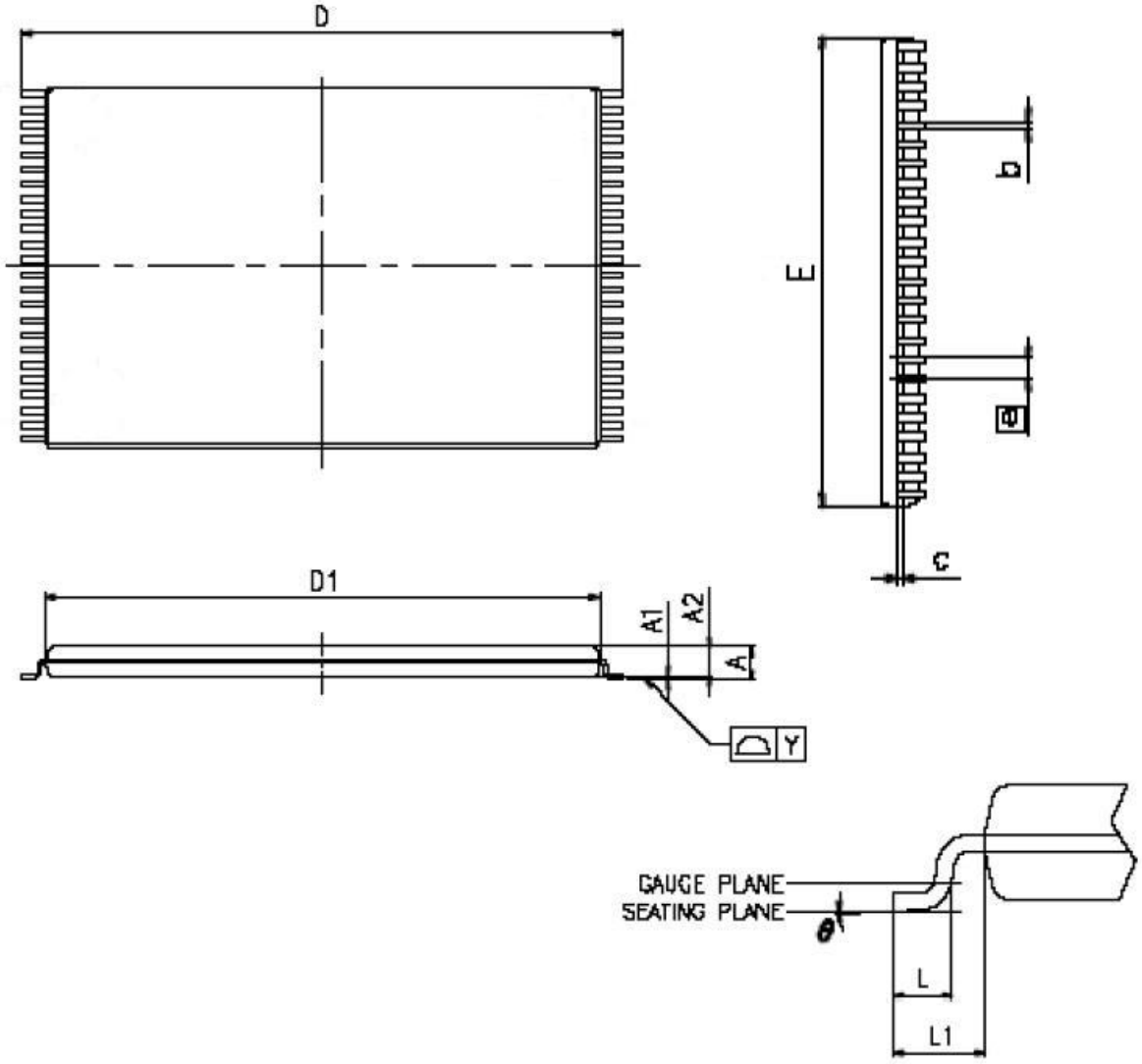
t_{RC*} = Read Cycle Time

DATA RETENTION WAVEFORM



PACKAGE OUTLINE DIMENSION

48-pin 12mm x 20mm TSOP I Package Outline Dimension

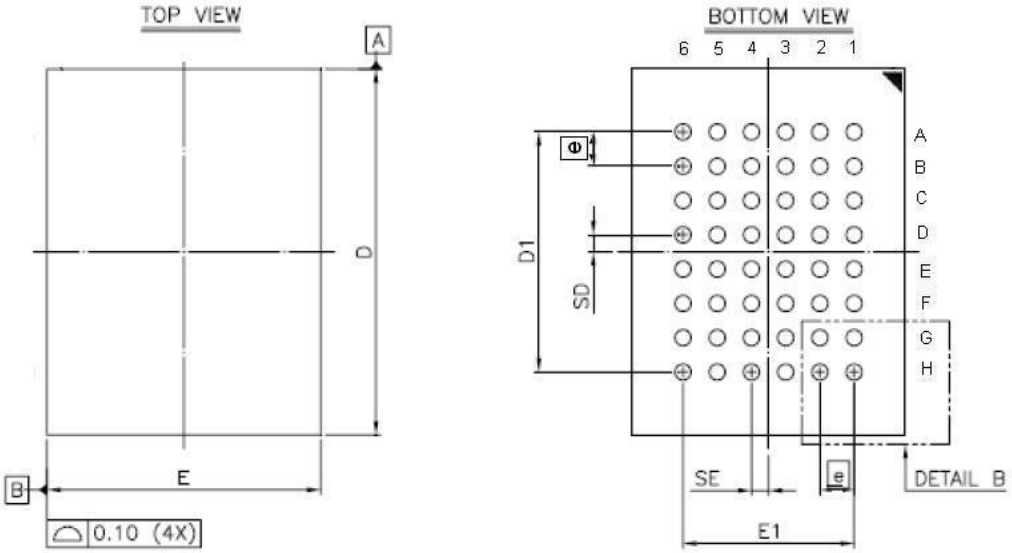


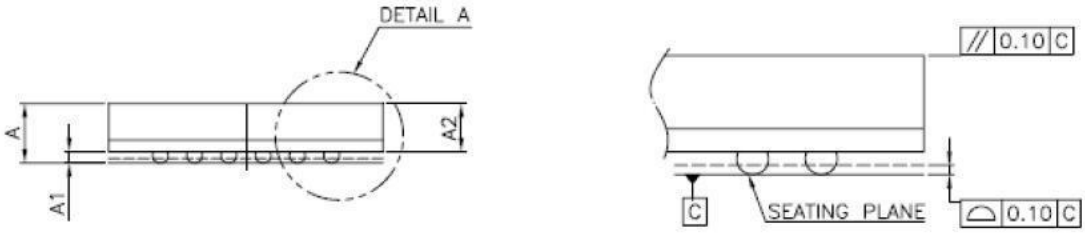
VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

	SYMBOLS	MIN.	NOM.	MAX
	A	–	–	1.20
	A1	0.05	–	0.15
	A2	0.95	1.00	1.05
	b	0.17	0.22	0.27
	c	0.10	–	0.21
⚠	D	19.80	20.00	20.20
⚠	D1	18.30	18.40	18.50
⚠	E	11.90	12.00	12.10
	e	0.50 BASIC		
	L	0.50	0.60	0.70
⚠	L1	–	0.80	–
⚠	Y	–	–	0.10
⚠	θ	0°	–	5°

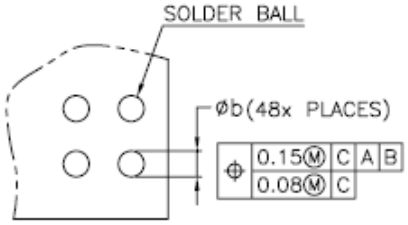
NOTES:
1 JEDEC OUTLINE : MO-142 DD
2.PROFILE TOLERANCE ZONES FOR D1 AND E DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION ON E IS 0.15mm PER SIDE AND ON D1 IS 0.25mm PER SIDE.
3.DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUN MATERIAL CONDITION DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT.

48-ball 6mm × 8mm TFBGA Package Outline Dimension





SYM.	DIMENSION (mm)			DIMENSION (inch)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	—	—	1.40	—	—	0.055
A1	0.20	0.25	0.30	0.008	0.010	0.012
A2	—	—	1.05	—	—	0.041
b	0.30	0.35	0.40	0.012	0.014	0.016
D	7.95	8.00	8.05	0.313	0.315	0.317
D1	5.25 BSC			0.207 BSC		
E	5.95	6.00	6.05	0.234	0.236	0.238
E1	3.75 BSC			0.148 BSC		
SE	0.375 TYP			0.015 TYP		
SD	0.375 TYP			0.015 TYP		
e	0.75 BSC			0.030 BSC		



NOTE:
1. CONTROLLING DIMENSION : MILLIMETER.
2. REFERENCE DOCUMENT : JEDEC MO-207.

ORDERING INFORMATION

Package Type	Access Time (Speed)(ns)	Temperature Range(℃)	Packing Type	Lyontek Item No.
48-pin (12mm x 20mm) TSOP I	10	0℃~70℃	Tray	LY61L102416ALL-10
			Tape Reel	LY61L102416ALL-10T
		-40℃~85℃	Tray	LY61L102416ALL-10I
			Tape Reel	LY61L102416ALL-10IT
	12	0℃~70℃	Tray	LY61L102416ALL-12
			Tape Reel	LY61L102416ALL-12T
		-40℃~85℃	Tray	LY61L102416ALL-12I
			Tape Reel	LY61L102416ALL-12IT

ORDERING INFORMATION

Package Type	Access Time (Speed)(ns)	Temperature Range(℃)	Packing Type	Lyontek Item No.
48-ball (6mm x 8mm) TFBGA	10	0℃~70℃	Tray	LY61L102416AGL-10
			Tape Reel	LY61L102416AGL-10T
		-40℃~85℃	Tray	LY61L102416AGL-10I
			Tape Reel	LY61L102416AGL-10IT
	12	0℃~70℃	Tray	LY61L102416AGL-12
			Tape Reel	LY61L102416AGL-12T
		-40℃~85℃	Tray	LY61L102416AGL-12I
			Tape Reel	LY61L102416AGL-12IT

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