Cover Sheet and Revision Status

版別 (Rev.)	DCC No	生效日 (Eff. Date)	變更說明 (Change Description)	發行人 (Originator)
1.0	-	Aug. 17, 2016	New issue	Hank Lin
2.0	20200019	Dec. 29, 2020	Revise ICC (operating current) 45ns- 30mA, 55ns- 30mA, 70ns- 20mA	Hank Lin

PRODUCT DESCRIPTION

The CS16LV82933 is a high performance, high speed, low power CMOS Static Random Access Memory organized as 524,288 words by 16 bits and operates from a wide range of 2.7 to 3.6V supply voltage. Advanced 90 nm CMOS technology and circuit techniques provide both high speed and low power features with a Typical CMOS standby current of 4uA and maximum access time of 45/55/70ns in 3V operation. Easy memory expansion is provided by an active LOW chip enable1 (/CE1), active HIGH chip enable2 (CE2) for BGA product and active LOW output enable (/OE) and three-state output drivers.
The CS16LV82933 has an automatic power down feature, reducing the power consumption significantly when chip is deselected. The CS16LV82933 is available in JEDEC standard 48Ball TFBGA 6x8mm package.

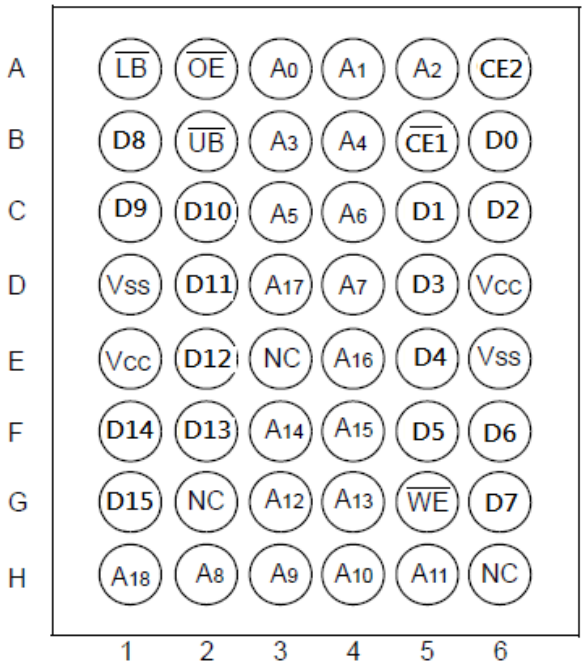
FEATURES

- Low operation voltage: 2.7 ~ 3.6V
- Ultra low power consumption :
  - operating current: 30mA (Max.) @t_{AA}=45ns
  - standby current : 4uA (Typ.)
- Fast access time: 45/55/70ns (Max.)
- Automatic power down when chip is deselected.
- Three state outputs and TTL compatible, fully static operation
- Data retention supply voltage as low as 1.5V.

PRODUCT FAMILY

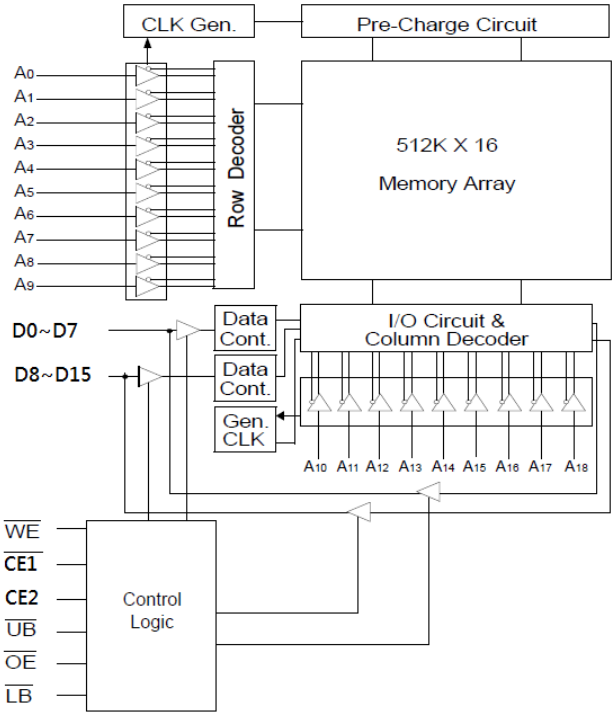
Product Family	Operating Temp	V_{CC}. Range (V)	Speed (ns)	Standby Current (Typ.)	Package Type
CS16LV82933	0 ~ 70°C	2.7 ~ 3.6	45/55/70	4 uA (V_{CC} = 3.0V)	48 TFBGA
	-40 ~ 85°C				

PIN CONFIGURATIONS



48 TFBGA- Top View

FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTIONS

Name	Type	Function
A0 ~ A18	Input	19 address inputs for selecting one of the 524,288 x 16 bit words in the RAM
/CE1 & CE2	Input	/CE1 is active LOW and CE2 is active high. Chip enable must be active when data read from or write to the device. If chip enable is not active, the device is deselected and in a standby power mode. The DQ pins will be in high impedance state when the device is deselected.
/WE	Input	The Write enable input is active LOW. It controls read and write operations. With the chip selected, when /WE is HIGH and /OE is LOW, output data will be present on the DQ pins, when /WE is LOW, the data present on the DQ pins will be written into the selected memory location.
/OE	Input	The output enable input is active LOW. If the output enable is active while the chip is selected and the write enable is inactive, data will be present on the DQ pins and they will be enabled. The DQ pins will be in the high impedance state when /OE is inactive.
/LB and /UB	Input	Lower byte and upper byte data input/output control pins.
DQ0~DQ15	I/O	These 16 bi-directional ports are used to read data from or write data into the RAM.
V_{CC}	Power	Power Supply
V_{SS}	Power	Ground

TRUTH TABLE

MODE	/CE1	CE2	/WE	/OE	/LB	/UB	DQ0~7	DQ8~15	Vcc Current
Fully Standby	H	X	X	X	X	X	High Z	High Z	I_{CCSB}, I_{CCSB1}
	X	L	X	X	X	X	High Z	High Z	I_{CCSB}, I_{CCSB1}
Output Disabled	L	H	H	H	X	X	High Z	High Z	I_{CC}
Read	L	H	H	L	L	L	D_{OUT}	D_{OUT}	I_{CC}
					H	L	High Z	D_{OUT}	I_{CC}
					L	H	D_{OUT}	High Z	I_{CC}
Write	L	H	L	X	L	L	D_{IN}	D_{IN}	I_{CC}
					H	L	High Z	D_{IN}	I_{CC}
					L	H	D_{IN}	High-Z	I_{CC}

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Parameter	Rating	Unit
V_{IN} , V_{OUT}	Voltage on Any Pin Relative to V_{SS}	-0.5 to Vcc+0.5V	V
V_{CC}	Voltage on V_{CC} supply Relative to V_{SS}	-0.5 to 4.6	V
T_A	Operating Temperature	-40 to +85	^{O}C
P_D	Power Dissipation	1.0	W

1. 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 at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC ELECTRICAL CHARACTERISTICS (TA = 0~+70℃ / -40℃~+85℃, VCC = 3.0V)

Parameter Name	Parameter	Test Conduction		MIN	TYP (1)	MAX	Unit
V_{IL}	Guaranteed Input Low Voltage (2)	V_{CC}=3V		-0.3(2)		0.8	V
V_{IH}	Guaranteed Input High Voltage (2)	V_{CC}=3V		2.2		V_{CC}+ 0.3(2)	V
I_{IL}	Input Leakage Current	V_{CC}=MAX, V_{IN}=0 to V_{CC}		-1		1	uA
I_{OL}	Output Leakage Current	/CE1=V_{IH} or CE2=V_{IL} or /OE=V_{IH} or /WE=V_{IL}		-1		1	uA
V_{OL}	Output Low Voltage	V_{CC}=MAX, I_{OL} = 2 mA				0.4	V
V_{OH}	Output High Voltage	V_{CC}=MIN, I_{OH} = -1mA		2.4			V
I_{CC}	Operating Power Supply Current	/CE1=V_{IL}, I_{DQ}=0mA, F=F_{MAX}(3)	45ns			30	mA
			55ns			30	
			70ns			20	
I_{CCSB}	Standby Supply -TTL	/CE1=V_{IH}, I_{DQ}=0mA,				0.5	mA
I_{CCSB1}	Standby Current-CMOS	/CE1≧V_{CC}-0.2V, V_{IN}≧V_{CC}-0.2V or V_{IN}≦0.2V			4	20	uA

1. *Typical characteristics are at T_A = 25℃*
2. *Overshoot: Vcc+2.0V in case of pulse width≦20ns,*

   Undershoot:-2.0V in case of pulse width≦20ns

   Overshoot and undershoot are sampled, not 100% tested.
3. *Fmax = 1/t_{RC}*

OPERATING RANGE

Range	Ambient Temperature	V_{CC}
Commercial	0~70°C	2.7V ~ 3.6V
Industrial	-40~85°C	2.7V ~ 3.6V

CAPACITANCE (1) (TA = 25℃, f =1.0 MHz)

Symbol	Parameter	Conditions	MAX.	Unit
C_{IN}	Input Capacitance	V_{IN}=0V	6	pF
C_{DQ}	Input/output Capacitance	$V_{I/O}$=0V	8	pF

1. This parameter is guaranteed and not 100% tested.

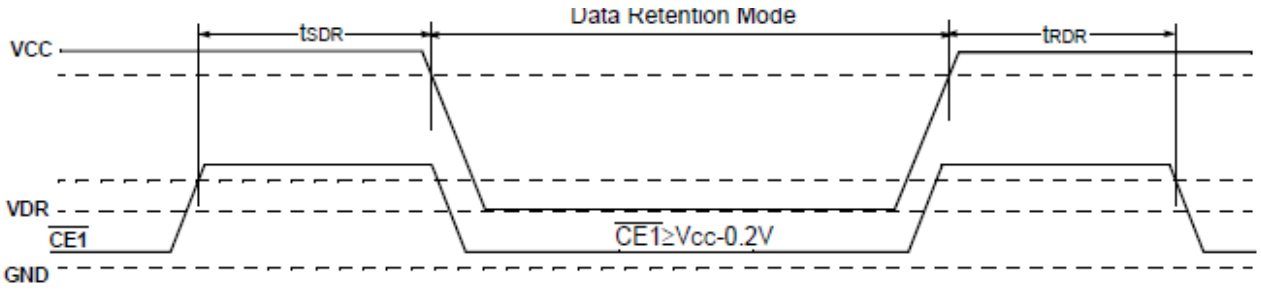
DATA RETENTION CHARACTERISTICS (TA = 0~70℃ / -40℃~85℃)

Parameter Name	Parameter	Test Conduction	MIN	TYP (1)	MAX	Unit
V_{DR}	V_{CC} for Data Retention	/CE1≧V_{CC}-0.2V, V_{IN}≧ V_{CC}-0.2V or V_{IN}≦0.2V	1.5			V
I_{CCDR}	Data Retention Current	V_{CC}=1.5V,V_{IN}≧V_{CC}-0.2V or V_{IN}≦0.2V 1) CE2≦0.2V, or 2) CE2≧V_{CC}-0.2V, /CE1≧ V_{CC}-0.2V, or 3) CE2≧V_{CC}-0.2V, /CE1≦ 0.2V, /UB=/LB≧V_{CC}-0.2V		4	20	uA
t_{SDR}	Chip Deselect to Data Retention Time	See Retention Waveform	0			ns
t_{RDR}	Operation Recovery Time		t_{RC} (2)			ns

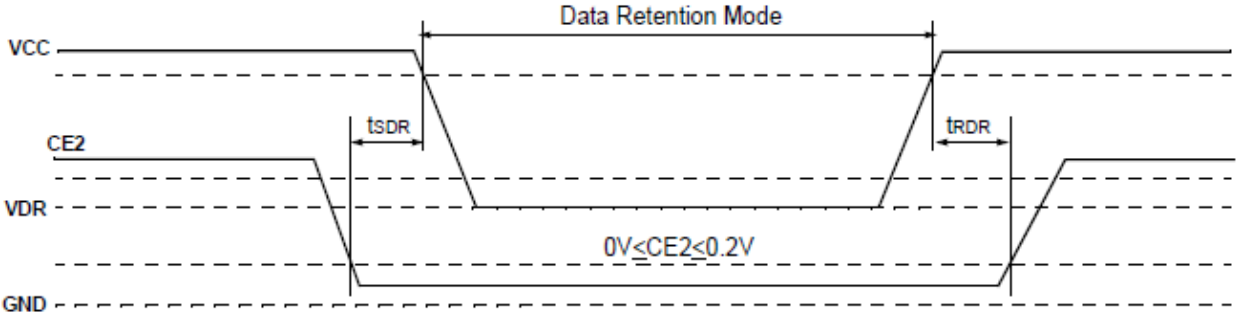
1. V_{CC}= 3.0V, T_A = +25℃

2. t_{RC} (2) = Read Cycle Time.

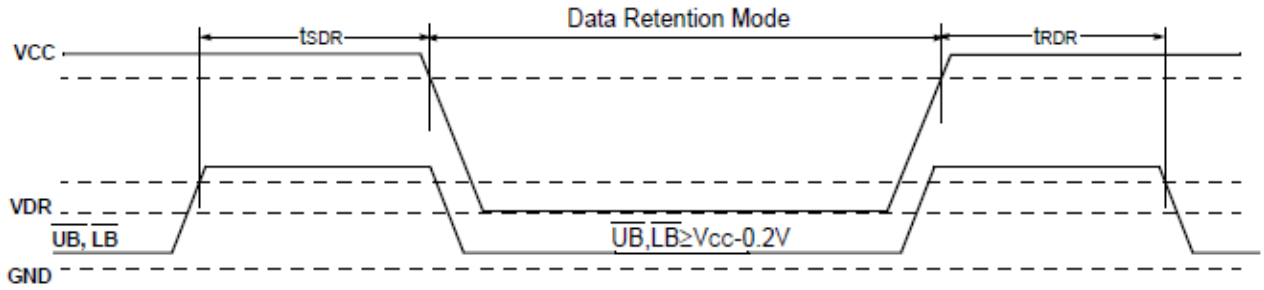
LOW V_{CC} DATA RETENTION WAVEFORM (1) (/CE1 Controlled)



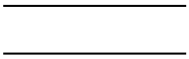
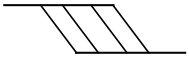
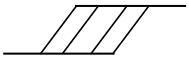
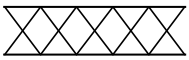
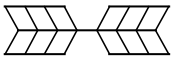
LOW V_{CC} DATA RETENTION WAVEFORM (2) (CE2 Controlled)



LOW V_{CC} DATA RETENTION WAVEFORM (3) (/UB, /LB Controlled)



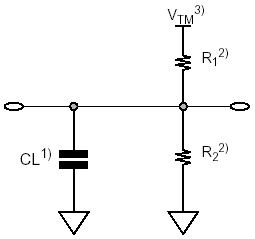
KEY TO SWITCHING WAVEFORMS

WAVEFORMS	INPUTS	OUTPUTS
	MUST BE STEADY	MUST BE STEADY
	MAY CHANGE FROM H TO L	WILL BE CHANGE FROM H TO L
	MAY CHANGE FROM L TO H	WILL BE CHANGE FROM L TO H
	DON'T CARE ANY CHANGE PERMITTED	CHANGE STATE UNKNOWN
	DOES NOT APPLY	CENTER LINE IS HIGH IMPEDANCE OFF STATE

AC TEST LOADS

Input Pulse Level : 0.4 to 2.4V
Input Rise and Fall Time : 5ns
Input and Output reference Voltage : 1.5V
Output Load (See right) : CL = 100pF+ 1 TTL
$CL^{1)}$ = 30pF + 1 TTL

1. Including scope and Jig capacitance
2. R_1=3070 ohm, R_2=3150 ohm
3. V_{TM}=2.8V



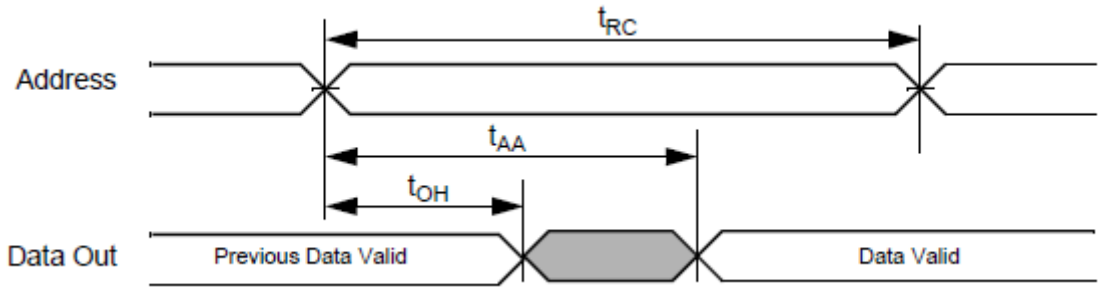
AC ELECTRICAL CHARACTERISTICS (TA = 0~70℃ / -40℃~85℃, VCC = 3.0V)

< READ CYCLE >

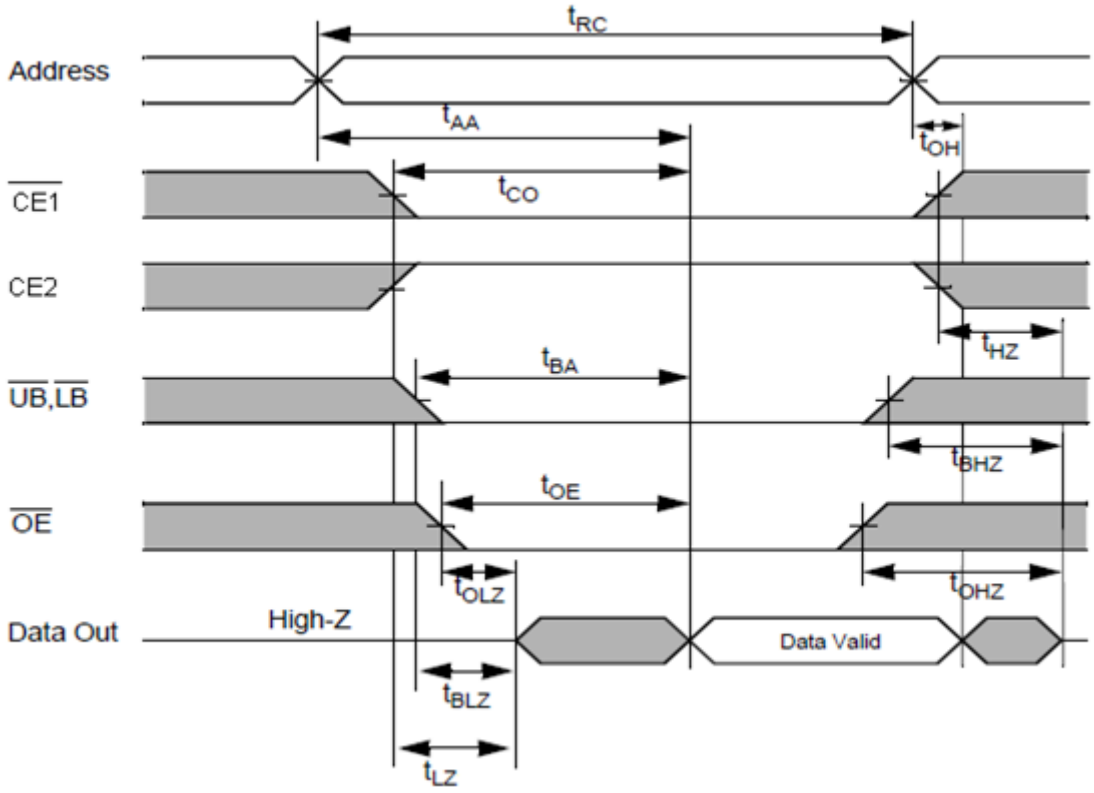
JEDEC Name	Parameter Name	Description	45ns		55ns		70ns		Unit
			Min	Max	Min	Max	Min	Max	
t_{ax}	t_{RC}	Read Cycle Time	45		55		70		ns
t_{AVQV}	t_{AA}	Address Access Time		45		55		70	ns
t_{ELQV}	t_{CO}	Chip Select Access Time (/CE1)	45			55		70	ns
t_{BA}	t_{BA}	Data Byte Control Access Time (/LB, /UB)		45		55		70	ns
t_{GLQV}	t_{OE}	Output Enable to Output Valid		22		25		35	ns
t_{ELQX}	t_{LZ}	Chip Select to Output Low Z (/CE1)	10		10		10		ns
t_{BE}	t_{BLZ}	Data Byte Control to Output Low Z (/LB, /UB)	5		5		5		ns
t_{GLQX}	t_{OLZ}	Output Enable to Output in Low Z	5		5		5		ns
t_{EHQZ}	t_{HZ}	Chip Deselect to Output in High Z (/CE1)		18		20		25	ns
t_{BDO}	t_{BHZ}	Data Byte Control to Output High Z (/LB, /UB)		18		20		25	ns
t_{GHQZ}	t_{OHZ}	Output Disable to Output in High Z		18		20		25	ns
t_{AXOX}	t_{OH}	Out Disable to Address Change	10		10		10		ns

SWITCHING WAVEFORMS (READ CYCLE)

READ CYCLE 1. (Address Controlled, /CE1=/OE=VIL, CE2=/WE=VIH)



READ CYCLE 2. (/WE=VIH)



1. t_{HZ} and t_{OHZ} are defined as the outputs achieve the open circuit conditions and are not referenced to output voltage levels.

2. At any given temperature and voltage condition, t_{HZ} (Max.) is less than t_{LZ} (Min.) both for a given device and from device to device interconnection.

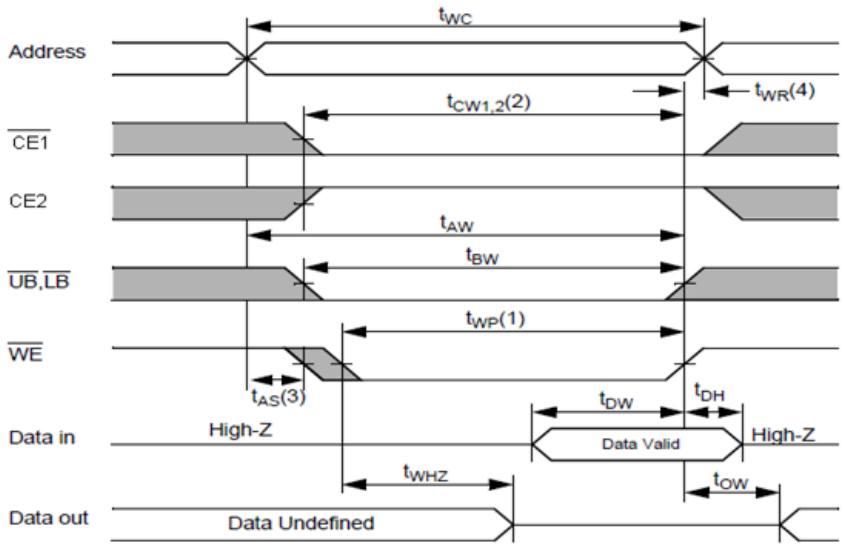
AC ELECTRICAL CHARACTERISTICS (TA = 0~70℃ / -40℃~+85℃, VCC = 3.0V)

< WRITE CYCLE >

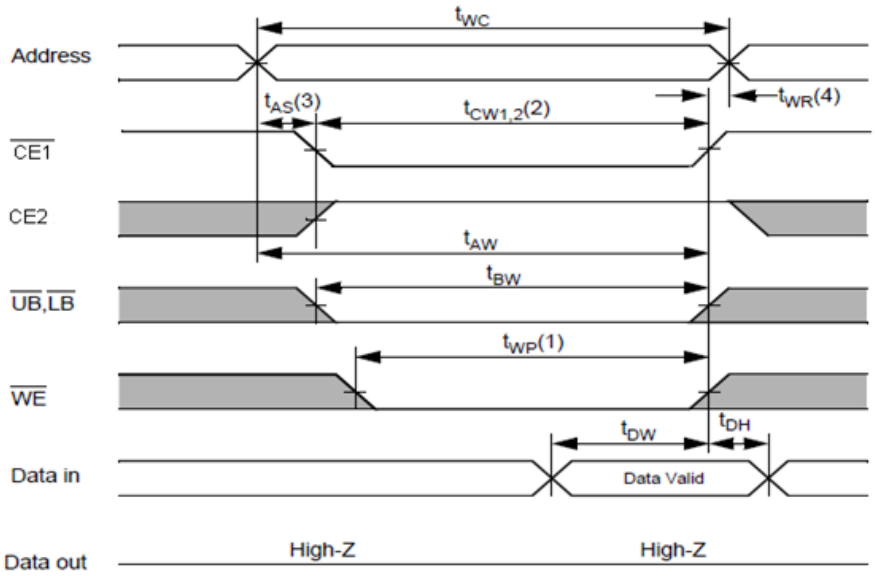
JEDEC Name	Parameter Name	Description	45ns		55ns		70ns		Unit
			Min	Max	Min	Max	Min	Max	
t_{AVAX}	t_{WC}	Write Cycle Time	45		55		70		ns
t_{E1LWH}	t_{CW}	Chip Select to End of Write	35		45		60		ns
t_{AVWL}	t_{AS}	Address Setup Time	0		0		0		ns
t_{AVWH}	t_{AW}	Address Valid to End of Write	35		45		60		ns
t_{WLWH}	t_{WP}	Write Pulse Width	35		45		55		ns
t_{WHAX}	t_{WR}	Write Recovery Time (/CE1, /WE)	0		0		0		ns
t_{BW}	t_{BW}	Data Byte Control to End of Write(/LB, /UB)	35		45		60		ns
t_{WLQZ}	t_{WHZ}	Write to Output in High Z		18		20		25	ns
t_{DVWH}	t_{DW}	Data to Write Time Overlap	25		25		30		ns
t_{WHDX}	t_{DH}	Data Hold from Write Time	0		0		0		ns
t_{WHOX}	t_{OW}	End of Write to Output Active	5		5		5		ns

SWITCHING WAVEFORMS (WRITE CYCLE)

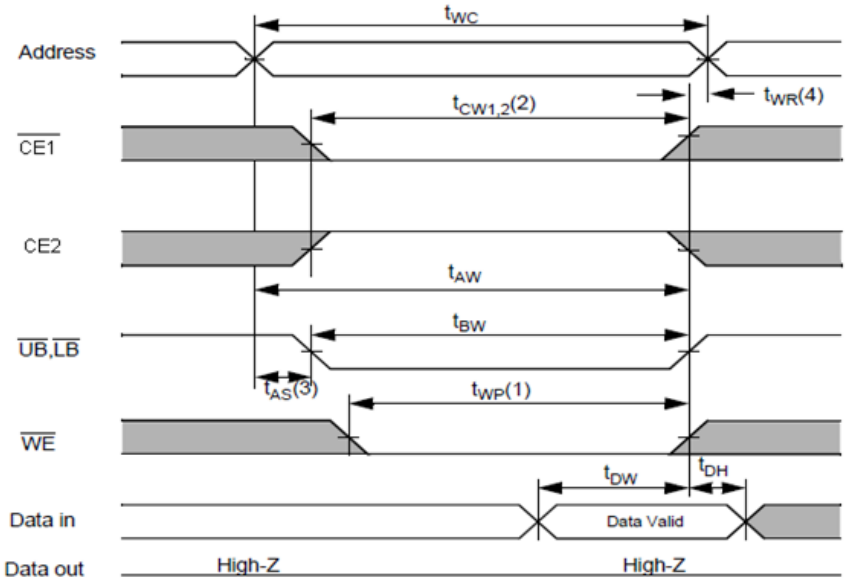
WRITE CYCLE 1. (/WE Controlled)



WRITE CYCLE 2. (/CE1 Controlled)

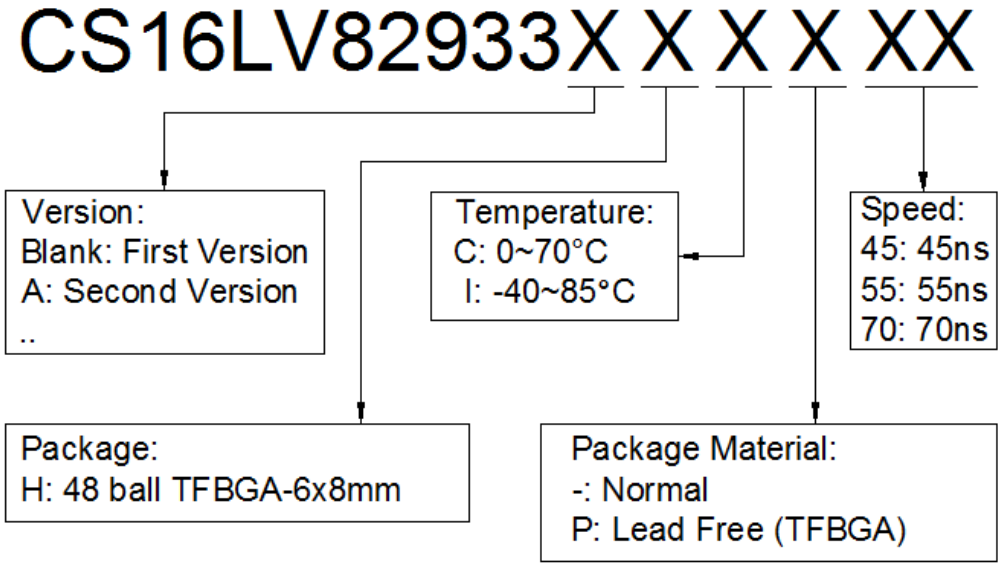


WRITE CYCLE 3. (/UB, /LB Controlled)



1. *A write occurs during the overlap (t_{WP}) of low /CE1, high CE2and low /WE. A write begins when /CE1 goes low, CE2 goes high and /WE goes low with asserting /UB and /LB for double byte operation. A write ends at the earliest transition when /CE1 goes high, CE2 goes low and /WE goes high. The t_{WP} is measured from the beginning of the write to the end of write.*
2. *t_{CW} is measured from the /CE1 going low or CE2 going high to end of write.*
3. *t_{AS} is measured from the address valid to the beginning of write.*
4. *t_{WR} is measured from the end or write to the address change. TWR applied in case a write ends as /CE1 going high, CE2 going low or /WE going high.*

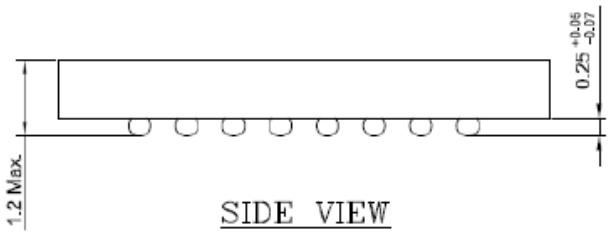
ORDER INFORMATION



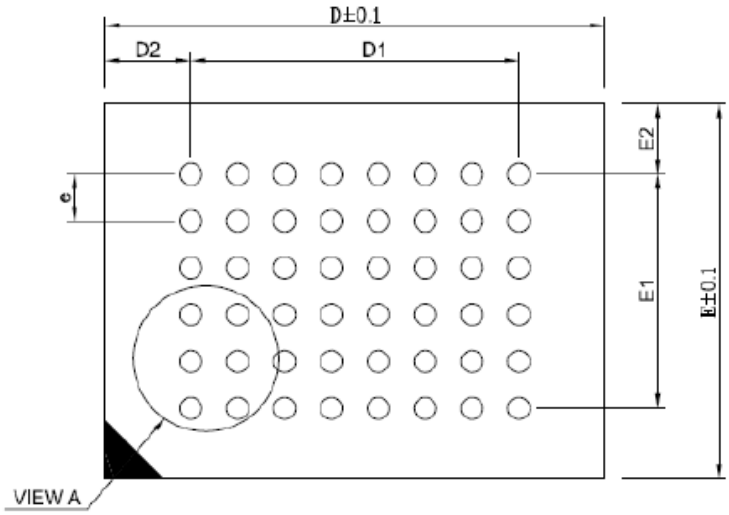
Package material code "P" & "R" comply with RoHS.

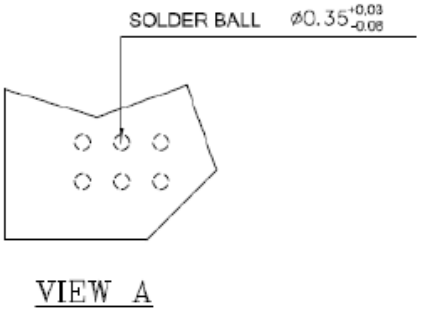
PACKAGE OUTLINE

48 ball TFBGA-6x8mm



BALL PITCH e = 0.75						
D	E	N	D1	E1	D2	E2
8.0	6.0	48	5.25	3.75	1.375	1.125





NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS.
2. PIN#1 DOT MARKING BY LASER OR PAD PRINT.
3. SYMBOL "N" IS THE NUMBER OF SOLDER BALLS.
4. TOLERANCES:
   LINEAR : X.X = ±0.1
   X.XX = ± 0.05
   X.XXX = ± 0.025