256K x 8 Static RAM

Features

- **Low voltage range:**
  - **— 2.7–3.6V**
- **Ultra-low active power**
- **Low standby power**
- **Easy memory expansion with $\overline{CS_1}$/CS_2 and $\overline{OE}$ features**
- **TTL-compatible inputs and outputs**
- **Automatic power-down when deselected**
- **CMOS for optimum speed/power**

Functional Description

The CY62138V is a high-performance CMOS static RAM organized as 256K words by 8 bits. This device features advanced circuit design to provide ultra-low active current. This is ideal for providing More Battery Life™ (MoBL®) in portable applications such as cellular telephones. The device also has an automatic power-down feature that reduces power consumption by 99% when addresses are not toggling. The device can be put into standby mode when deselected ($\overline{CS_1}$ HIGH or CS_2 LOW).

Writing to the device is accomplished by taking Chip Enable One ($\overline{CS_1}$) and Write Enable ($\overline{WE}$) inputs LOW and Chip Enable Two (CS_2) HIGH. Data on the eight I/O pins (I/O$_0$ through I/O$_7$) is then written into the location specified on the address pins (A$_0$ through A$_{17}$).

Reading from the device is accomplished by taking Chip Enable One ($\overline{CS_1}$) and Output Enable ($\overline{OE}$) LOW while forcing Write Enable ($\overline{WE}$) and Chip Enable Two (CS_2) HIGH. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

The eight input/output pins (I/O$_0$ through I/O$_7$) are placed in a high-impedance state when the device is deselected ($\overline{CS_1}$ HIGH or CS_2 LOW), the outputs are disabled ($\overline{OE}$ HIGH), or during a write operation ($\overline{CS_1}$ LOW, CS_2 HIGH, and $\overline{WE}$ LOW).

The CY62138V is available in a 36-ball FBGA.

Logic Block Diagram

Pin Configuration

FBGA
TOP View
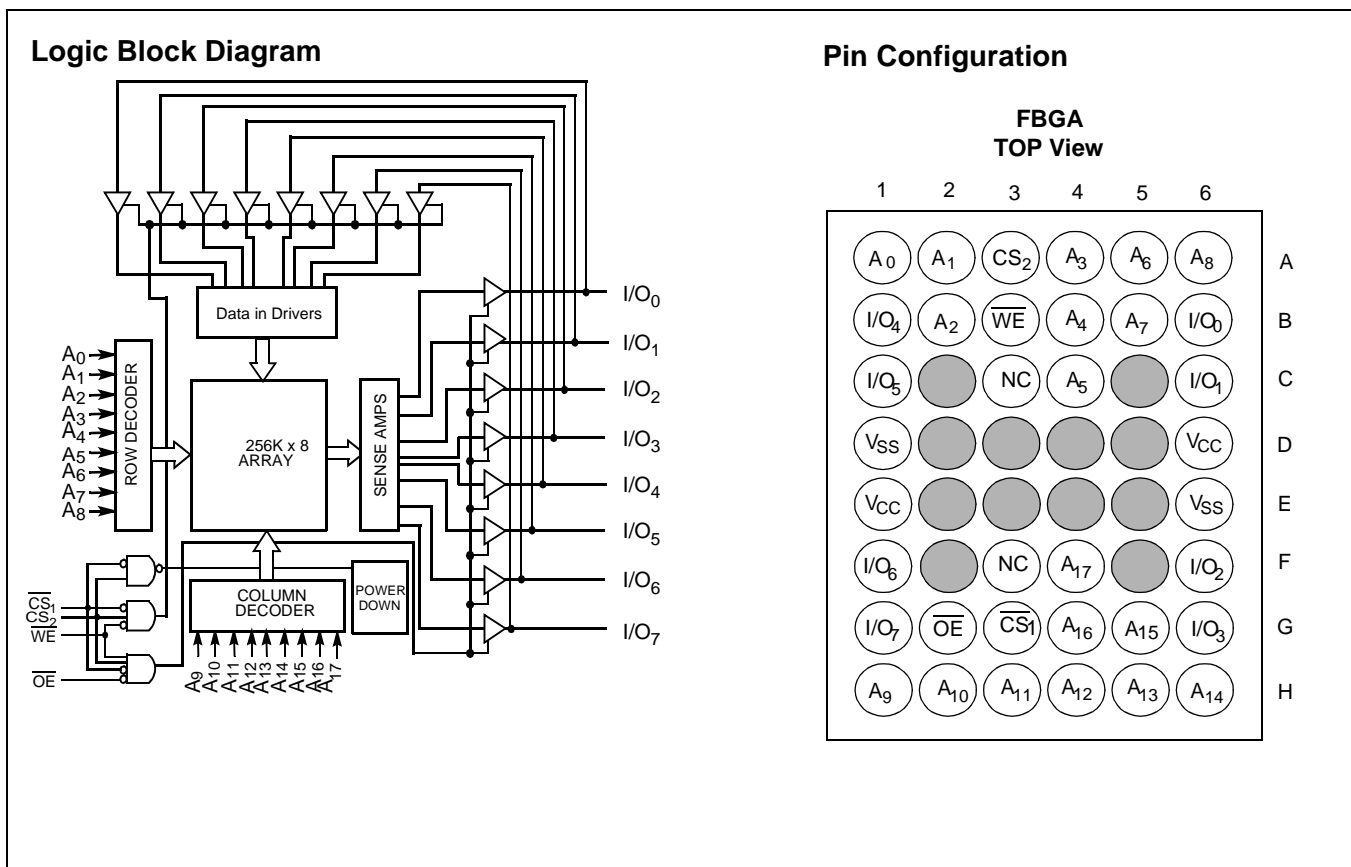
Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .... −65°C to +150°C

Ambient Temperature with
Power Applied... −55°C to +125°C

Supply Voltage to Ground Potential .... −0.5V to +4.6V

DC Voltage Applied to Outputs
in High-Z State[1] .... −0.5V to V_{CC} + 0.5V

DC Input Voltage[1] .... −0.5V to V_{CC} + 0.5V

Output Current into Outputs (LOW) .... 20 mA

Static Discharge Voltage .... > 2001V
(per MIL-STD-883, Method 3015)

Latch-up Current .... > 200 mA

Operating Range

Device	Range	Ambient Temperature	V_{CC}
CY62138V	Industrial	−40°C to +85°C	2.7V to 3.6V

Product Portfolio

Product	V_{CC} Range			Speed	Power Dissipation (Industrial)			
					Operating (I_{CC})		Standby (I_{SB2})	
	$V_{CC(min)}$	$V_{CC(typ)}$[2]	$V_{CC(max)}$		Typ.[2]	Maximum	Typ.[2]	Maximum
CY62138V	2.7V	3.0V	3.6V	70 ns	7 mA	15 mA	1 µA	15 µA

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		CY62138V			Unit
				Min.	Typ.[2]	Max.	
V_{OH}	Output HIGH Voltage	I_{OH} = −1.0 mA	V_{CC} = 2.7V	2.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 2.1 mA	V_{CC} = 2.7V			0.4	V
V_{IH}	Input HIGH Voltage		V_{CC} = 3.6V	2.2		V_{CC} + 0.5V	V
V_{IL}	Input LOW Voltage		V_{CC} = 2.7V	−0.5		0.8	V
I_{IX}	Input Load Current	GND ≤ V_I ≤ V_{CC}		−1	±1	+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_O ≤ V_{CC}, Output Disabled		−1	+1	+1	µA
I_{CC}	V_{CC} Operating Supply Current	I_{OUT} = 0 mA, f = f_{MAX} = 1/t_{RC}, CMOS Levels	V_{CC} = 3.6V		7	15	mA
		I_{OUT} = 0 mA, f = 1 MHz, CMOS Levels			1	2	mA
I_{SB1}	Automatic CE Power-down Current— CMOS Inputs	$\overline{CE}$ ≥ V_{CC} − 0.3V, V_{IN} ≥ V_{CC} − 0.3V or V_{IN} ≤ 0.3V, f = f_{MAX}				100	µA
I_{SB2}	Automatic CE Power-down Current— CMOS Inputs	$\overline{CE}$ ≥ V_{CC}−0.3V V_{IN} ≥ V_{CC}−0.3V or V_{IN} ≤ 0.3V, f = 0	V_{CC} = 3.6V LL		1	15	µA

Capacitance[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = $V_{CC(typ)}$	6	pF
C_{OUT}	Output Capacitance		8	pF

Notes:
1. V_{IL}(min) = −2.0V for pulse durations less than 20 ns.
2. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at V_{CC} = V_{CC} Typ, T_A = 25°C.
3. Tested initially and after any design or process changes that may affect these parameters.

AC Test Loads and Waveforms
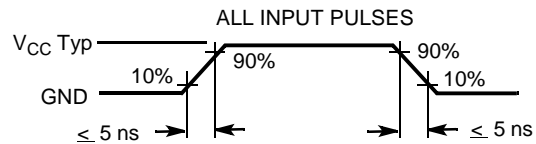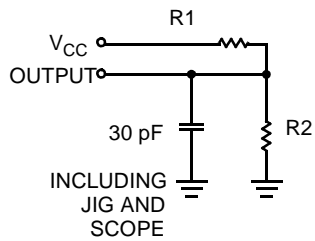
Parameters	3.0V	Unit
R1	1105	Ohms
R2	1550	Ohms
R_{TH}	645	Ohms
V_{TH}	1.75	Volts

Data Retention Characteristics (Over the Operating Range)

| Parameter	Description	Conditions[4]		Min.	Typ.[2]	Max.	Unit
V_{DR}	V_{CC} for Data Retention			1.0		3.6	V
I_{CCDR}	Data Retention Current	$V_{CC} = 1.0V$ $CE \geq V_{CC} - 0.3V$, $V_{IN} \geq V_{CC} - 0.3V$ or $V_{IN} \leq 0.3V$ No input may exceed $V_{CC}+0.3V$	LL		0.1	5	μA
t_{CDR}[3]	Chip Deselect to Data Retention Time			0			ns
t_R	Operation Recovery Time			100			μs

Data Retention Waveform[5]
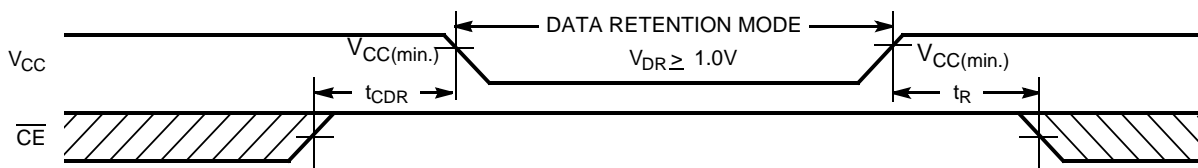
Notes:
4. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to V_{CC} typ., and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
5. $\overline{CE}$ is the combination of both $\overline{CS}_1$ and CS_2.
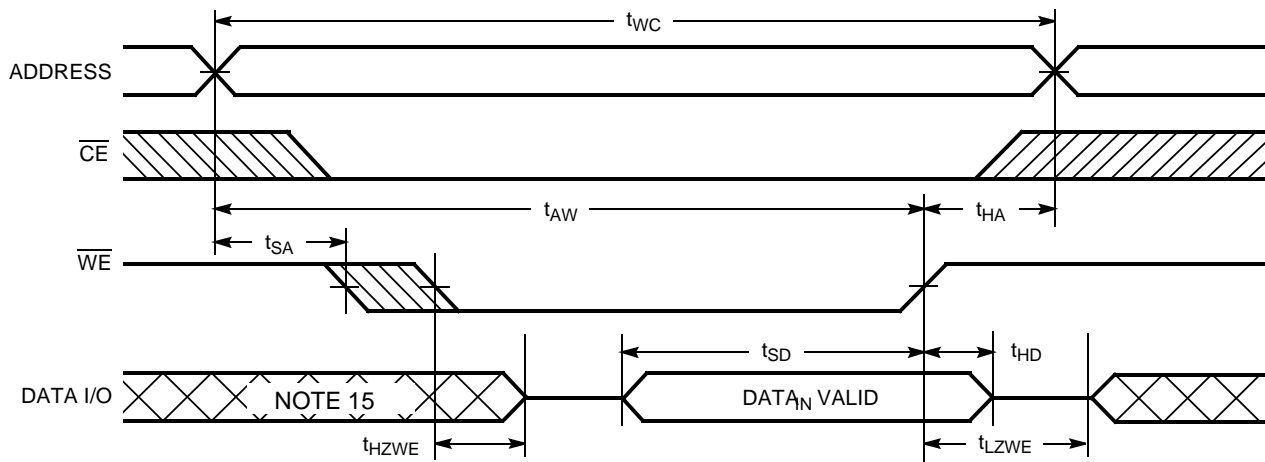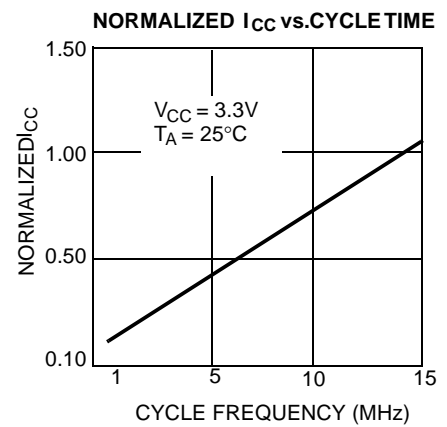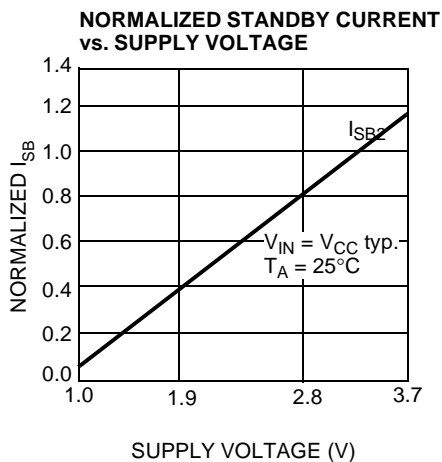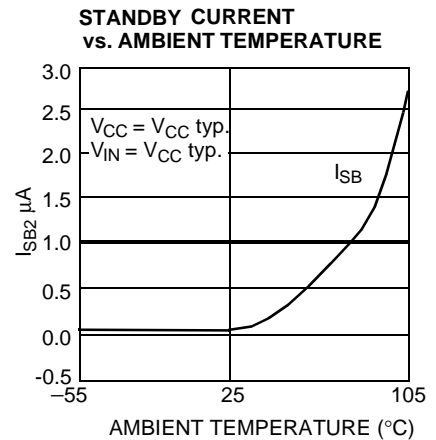
Switching Characteristics Over the Operating Range[4]

Parameter	Description	70 ns Min.	70 ns Max.	Unit
Read Cycle				
t_{RC}	Read Cycle Time	70		ns
t_{AA}	Address to Data Valid		70	ns
t_{OHA}	Data Hold from Address Change	10		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low-Z[6]	5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High-Z[6, 7]		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low-Z[6]	10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High-Z[6, 7]		25	ns
t_{PU}	$\overline{CE}$ LOW to Power-up	0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-down		70	ns
Write Cycle[8, 9]				
t_{WC}	Write Cycle Time	70		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	60		ns
t_{AW}	Address Set-up to Write End	60		ns
t_{HA}	Address Hold from Write End	0		ns
t_{SA}	Address Set-up to Write Start	0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	50		ns
t_{SD}	Data Set-up to Write End	30		ns
t_{HD}	Data Hold from Write End	0		ns
t_{HZWE}	$\overline{WE}$ LOW to High-Z[6, 7]		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low-Z[6]	10		ns

Switching Waveforms

Read Cycle No. 1[10, 11]
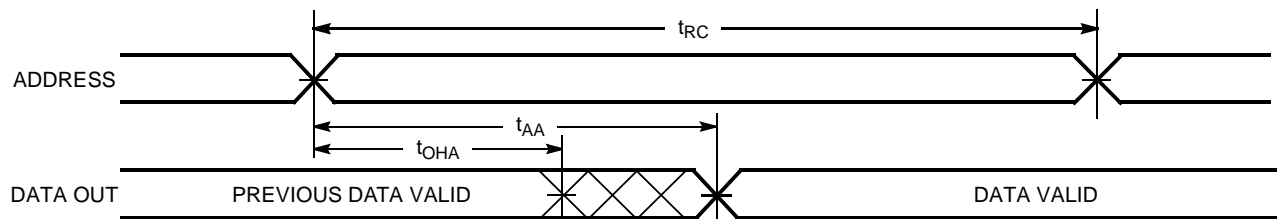
Notes:
6. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
7. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with C_L = 5 pF as in (b) of AC Test Loads. Transition is measured ± 500 mV from steady-state voltage.
8. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW and $\overline{WE}$ LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going HIGH. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.
9. The minimum write cycle time for write cycle #3 (WE controlled, OE LOW) is the sum of t_{HZWE} and t_{SD}.
10. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
11. $\overline{WE}$ is HIGH for read cycle.

Switching Waveforms (continued)

Read Cycle No. 2 [5., 11, 12]
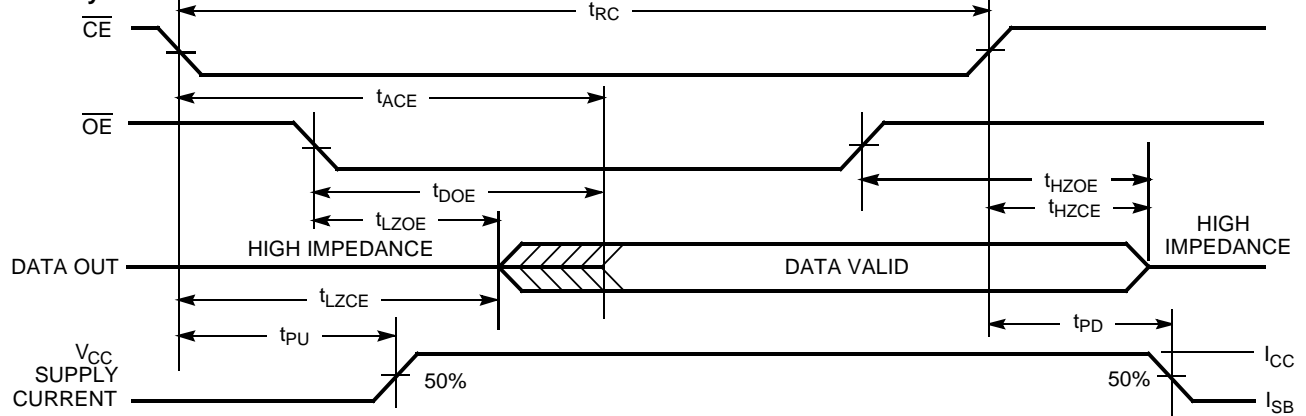
Write Cycle No. 1 (WE Controlled) [5, 8, 13, 14]
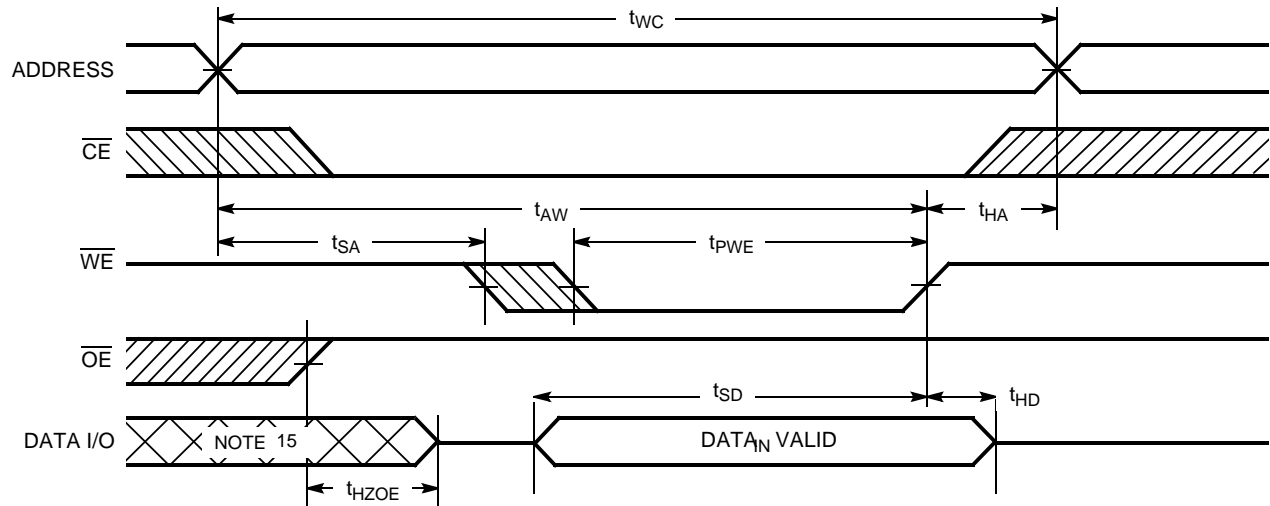
Write Cycle No. 2 (CE Controlled) [5, 8, 13, 14]
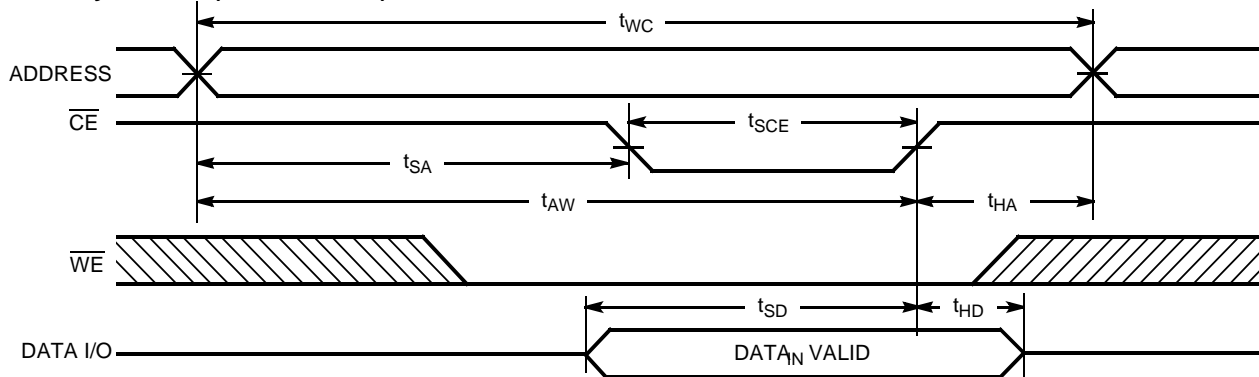
Notes:
12. Address valid prior to or coincident with CE transition LOW.
13. Data I/O is high impedance if OE = V_{IH}.
14. If CE goes HIGH simultaneously with WE HIGH, the output remains in a high-impedance state.
15. During this period, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No. 3 (WE Controlled, OE LOW) [5, 9, 14]

Typical DC and AC Characteristics

**NORMALIZED SUPPLY CURRENT
vs. SUPPLY VOLTAGE**

**STANDBY CURRENT
vs. AMBIENT TEMPERATURE**

**NORMALIZED STANDBY CURRENT
vs. SUPPLY VOLTAGE**

NORMALIZED I_{CC} vs. CYCLE TIME
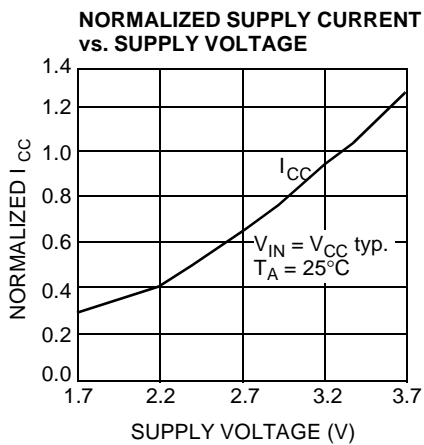
Truth Table

CS$_1$	CS$_2$	WE	OE	Inputs/Outputs	Mode	Power
H	X	X	X	High-Z	Deselect/Power-down	Standby (I$_{SB}$)
X	L	X	X	High-Z	Deselect/Power-down	Standby (I$_{SB}$)
L	H	H	L	Data Out	Read	Active (I$_{CC}$)
L	H	L	X	Data In	Write	Active (I$_{CC}$)
L	H	H	H	High-Z	Deselect, Output Disabled	Active (I$_{CC}$)

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	CY62138VLL-70BAI	BA36A	36-ball (7.0 mm x 7.0 mm x 1.2 mm) Fine Pitch BGA	Industrial

Package Diagram

36-ball Thin BGA BA36A
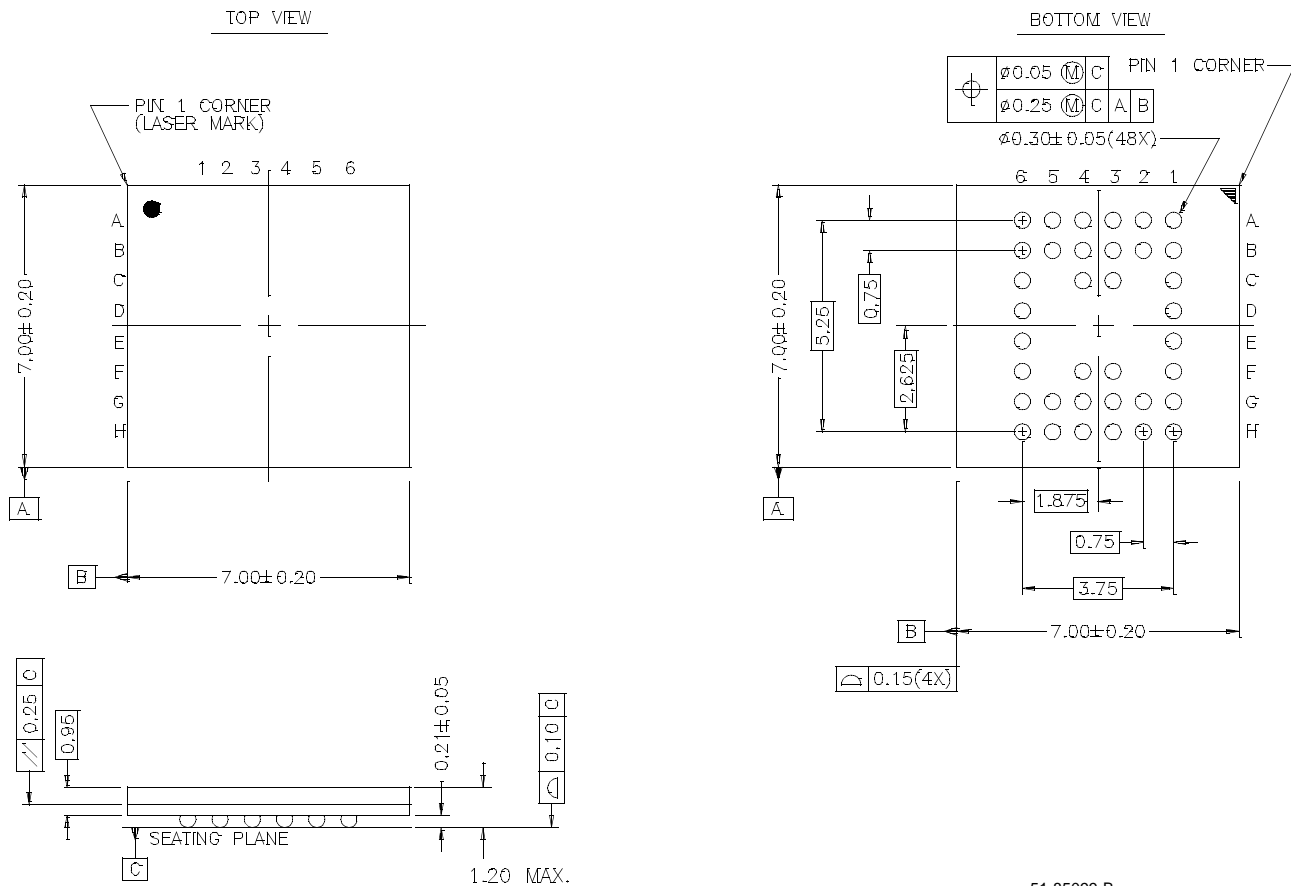
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REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	107348	06/12/01	SZV	Change from Spec #: 38-00729 to 38-05088
*A	114936	05/28/02	CBD	Replaced wrong package diagram with correct diagram (36-ball FBGA [see p. 7])