

## 2-Mbit (256K x 8) Static RAM

### Features

- Very high speed: 45 ns
- Wide voltage range: 2.20V–3.60V
- Pin compatible with CY62138CV25/30/33
- Ultra low standby power
  - Typical standby current: 1  $\mu$ A
  - Maximum standby current: 5  $\mu$ A
- Ultra low active power
  - Typical active current: 1.6 mA @ f = 1 MHz
- Easy memory expansion with  $\overline{CE}_1$ ,  $CE_2$ , and  $\overline{OE}$  features
- Automatic power down when deselected
- CMOS for optimum speed and power
- Offered in Pb-free 36-ball VFBGA, 32-pin TSOP II, 32-pin SOIC, 32-pin TSOP I and 32-pin STSOP packages

### Functional Description <sup>[1]</sup>

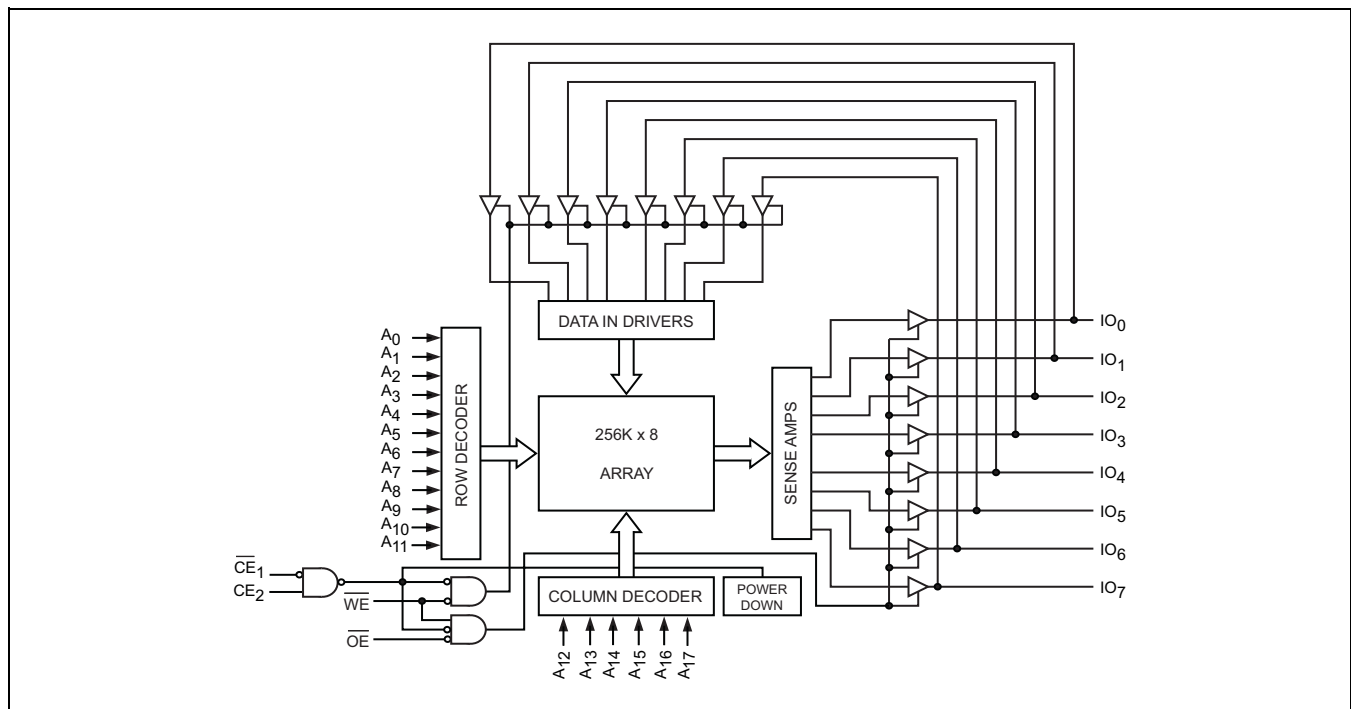
The CY62138FV30 is a high performance CMOS static RAM organized as 256K words by 8 bits. This device features advanced circuit design to provide ultra low active current. This is ideal for providing More Battery Life™ (MoBL®) in portable applications such as cellular telephones. The device also has an automatic power down feature that significantly reduces power consumption. Place the device into standby mode reducing power consumption when deselected ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW).

To write to the device, take Chip Enable ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Write Enable ( $\overline{WE}$ ) inputs LOW. Data on the eight IO pins ( $IO_0$  through  $IO_7$ ) is then written into the location specified on the address pins ( $A_0$  through  $A_{17}$ ).

To read from the device, take Chip Enable ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH) and Output Enable ( $\overline{OE}$ ) LOW while forcing Write Enable ( $\overline{WE}$ ) HIGH. Under these conditions, the contents of the memory location specified by the address pins appear on the IO pins.

The eight input and output pins ( $IO_0$  through  $IO_7$ ) are placed in a high impedance state when the device is deselected ( $\overline{CE}_1$  HIGH or  $CE_2$  LOW), the outputs are disabled ( $\overline{OE}$  HIGH), or during a write operation ( $\overline{CE}_1$  LOW and  $CE_2$  HIGH and  $\overline{WE}$  LOW).

### Logic Block Diagram

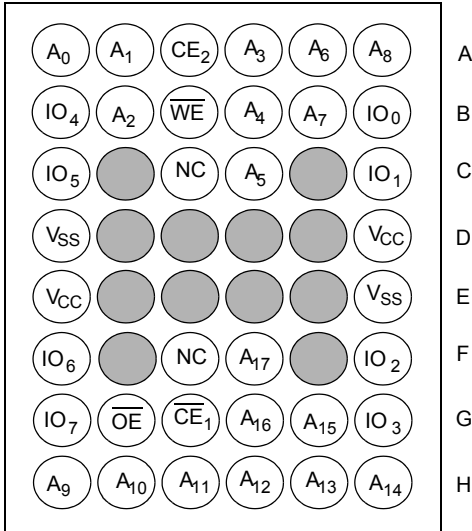


#### Note

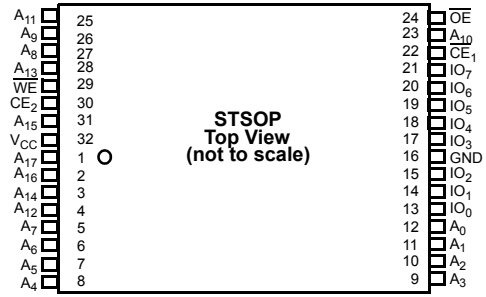
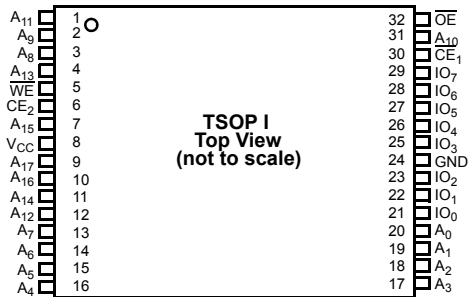
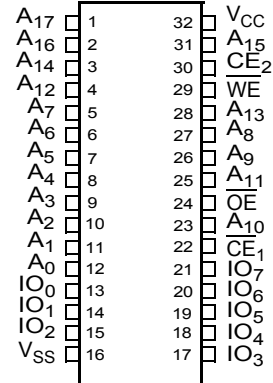
1. For best practice recommendations, refer to the Cypress application note "System Design Guidelines" at <http://www.cypress.com>.

**Pin Configuration [2]**

**36-Ball VFBGA  
Top View**



**32-Pin SOIC/TSOP II  
Top View**



**Product Portfolio**

Product	V <sub>CC</sub> Range (V)			Speed (ns)	Power Dissipation					
					Operating I <sub>CC</sub> (mA)				Standby I <sub>SB2</sub> (μA)	
	f = 1 MHz		f = f <sub>max</sub>							
	Min	Typ [3]	Max		Typ [3]	Max	Typ [3]	Max	Typ [3]	Max
CY62138FV30LL	2.2	3.0	3.6	45	1.6	2.5	13	18	1	5

**Note**

- NC pins are not connected on the die.
- Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at V<sub>CC</sub> = V<sub>CC(typ.)</sub>, T<sub>A</sub> = 25°C.

### Maximum Ratings

Exceeding maximum ratings may impair the useful life of the device. These user guidelines are not tested.

Storage Temperature .....	-65°C to +150°C
Ambient Temperature with Power Applied.....	55°C to +125°C
Supply Voltage to Ground Potential.....	-0.3V to 3.9V
DC Voltage Applied to Outputs in High-Z State <sup>[4, 5]</sup> .....	-0.3V to 3.9V

DC Input Voltage <sup>[4, 5]</sup> .....	-0.3V to 3.9V
Output Current into Outputs (LOW).....	20 mA
Static Discharge Voltage.....	> 2001V (MIL-STD-883, Method 3015)
Latch-up Current .....	> 200 mA

Product	Range	Ambient Temperature	V <sub>CC</sub> <sup>[6]</sup>
CY62138FV30LL	Industrial	-40°C to +85°C	2.2V to 3.6V

### Electrical Characteristics (Over the Operating Range)

Parameter	Description	Test Conditions	45 ns			Unit
			Min	Typ <sup>[3]</sup>	Max	
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -0.1 mA	2.0			V
		I <sub>OH</sub> = -1.0 mA, V <sub>CC</sub> ≥ 2.70V	2.4			V
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 0.1 mA			0.4	V
		I <sub>OL</sub> = 2.1 mA, V <sub>CC</sub> ≥ 2.70V			0.4	V
V <sub>IH</sub>	Input HIGH Voltage	V <sub>CC</sub> = 2.2V to 2.7V	1.8		V <sub>CC</sub> + 0.3V	V
		V <sub>CC</sub> = 2.7V to 3.6V	2.2		V <sub>CC</sub> + 0.3V	V
V <sub>IL</sub>	Input LOW Voltage	V <sub>CC</sub> = 2.2V to 2.7V	-0.3		0.6	V
		V <sub>CC</sub> = 2.7V to 3.6V				
		V <sub>CC</sub> = 2.2V to 3.6V	-0.3		0.6	V
I <sub>IX</sub>	Input Leakage Current	GND ≤ V <sub>I</sub> ≤ V <sub>CC</sub>	-1		+1	μA
I <sub>OZ</sub>	Output Leakage Current	GND ≤ V <sub>O</sub> ≤ V <sub>CC</sub> , output disabled	-1		+1	μA
I <sub>CC</sub>	V <sub>CC</sub> Operating Supply Current	f = f <sub>max</sub> = 1/t <sub>RC</sub>		13	18	mA
		f = 1 MHz	V <sub>CC</sub> = V <sub>CCmax</sub> I <sub>OUT</sub> = 0 mA CMOS levels	1.6	2.5	
I <sub>SB1</sub>	Automatic CE Power Down Current CMOS Inputs	$\overline{CE}_1 \geq V_{CC} - 0.2V$ or $CE_2 \leq 0.2V$ , V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V, V <sub>IN</sub> ≤ 0.2V), f = f <sub>max</sub> (address and data only), f = 0 ( $\overline{OE}$ , and $\overline{WE}$ ), V <sub>CC</sub> = 3.60V		1	5	μA
I <sub>SB2</sub> <sup>[7]</sup>	Automatic CE Power Down Current CMOS Inputs	$\overline{CE}_1 \geq V_{CC} - 0.2V$ or $CE_2 \leq 0.2V$ , V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V or V <sub>IN</sub> ≤ 0.2V, f = 0, V <sub>CC</sub> = 3.60V		1	5	μA

### Capacitance (For all packages) <sup>[8]</sup>

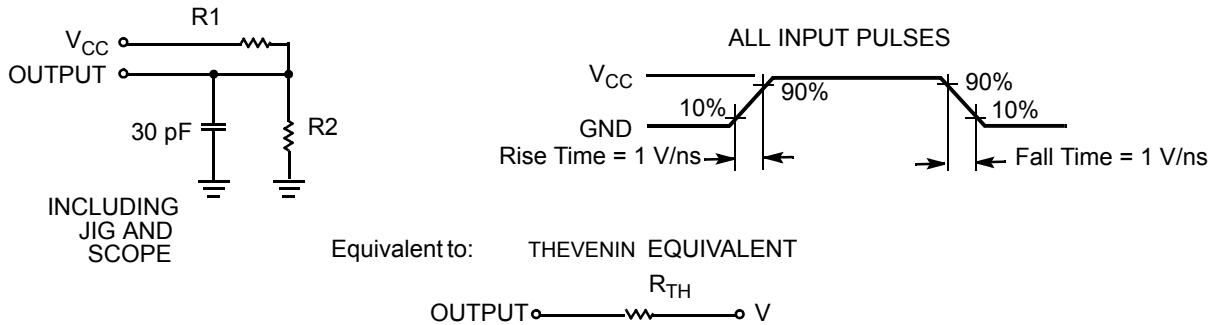
Parameter	Description	Test Conditions	Max	Unit
C <sub>IN</sub>	Input Capacitance	T <sub>A</sub> = 25°C, f = 1 MHz,	10	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = V <sub>CC(typ.)</sub>	10	pF

#### Notes

- V<sub>IL(min)</sub> = -2.0V for pulse durations less than 20 ns.
- V<sub>IH(max)</sub> = V<sub>CC</sub>+0.75V for pulse durations less than 20 ns.
- Full device AC operation assumes a 100 μs ramp time from 0 to V<sub>CC(min)</sub> and 200 μs wait time after V<sub>CC</sub> stabilization.
- Only chip enables ( $\overline{CE}_1$  and CE<sub>2</sub>) must be at CMOS level to meet the I<sub>SB2</sub> / I<sub>CCDR</sub> spec. Other inputs can be left floating.
- Tested initially and after any design or process changes that may affect these parameters.

**Thermal Resistance<sup>[8]</sup>**

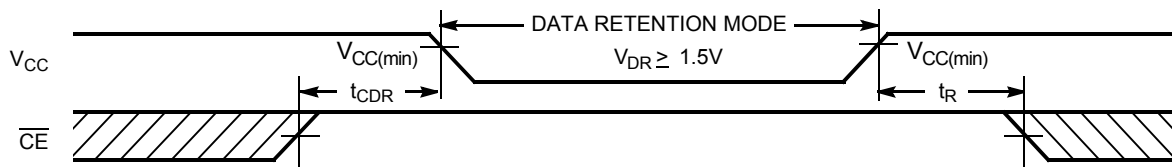
Parameter	Description	Test Conditions	SOIC	VFBGA	TSOP II	STSOP	TSOP I	Unit
$\Theta_{JA}$	Thermal Resistance (Junction to Ambient)	Still air, soldered on a 3 x 4.5 inch, two layer printed circuit board	44.53	38.49	44.16	59.72	50.19	°C/W
$\Theta_{JC}$	Thermal Resistance (Junction to Case)		24.05	17.66	11.97	15.38	14.59	°C/W

**AC Test Loads and Waveforms**


Parameters	2.5V (2.2V to 2.7V)	3.0V (2.7V to 3.6V)	Unit
R1	16667	1103	$\Omega$
R2	15385	1554	$\Omega$
$R_{TH}$	8000	645	$\Omega$
$V_{TH}$	1.20	1.75	V

**Data Retention Characteristics (Over the Operating Range)**

Parameter	Description	Conditions	Min	Typ <sup>[3]</sup>	Max	Unit
$V_{DR}$	$V_{CC}$ for Data Retention		1.5			V
$I_{CCDR}$ <sup>[7]</sup>	Data Retention Current	$V_{CC} = 1.5V$ , $\overline{CE}_1 \geq V_{CC} - 0.2V$ or $CE_2 \leq 0.2V$ , $V_{IN} \geq V_{CC} - 0.2V$ or $V_{IN} \leq 0.2V$		1	4	$\mu A$
$t_{CDR}$ <sup>[8]</sup>	Chip Deselect to Data Retention Time		0			ns
$t_R$ <sup>[9]</sup>	Operation Recovery Time		$t_{RC}$			ns

**Data Retention Waveform<sup>[10]</sup>**

**Notes:**

9. Full device AC operation requires linear  $V_{CC}$  ramp from  $V_{DR}$  to  $V_{CC(min)} \geq 100 \mu s$  or stable at  $V_{CC(min)} \geq 100 \mu s$ .

10.  $\overline{CE}$  is the logical combination of  $\overline{CE}_1$  and  $CE_2$ . When  $\overline{CE}_1$  is LOW and  $CE_2$  is HIGH,  $\overline{CE}$  is LOW; when  $\overline{CE}_1$  is HIGH or  $CE_2$  is LOW,  $\overline{CE}$  is HIGH.

**Switching Characteristics** (Over the Operating Range) <sup>[11]</sup>

Parameter	Description	45 ns		Unit
		Min	Max	
<b>Read Cycle</b>				
$t_{RC}$	Read Cycle Time	45		ns
$t_{AA}$	Address to Data Valid		45	ns
$t_{OHA}$	Data Hold from Address Change	10		ns
$t_{ACE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to Data Valid		45	ns
$t_{DOE}$	$\overline{OE}$ LOW to Data Valid		22	ns
$t_{LZOE}$	$\overline{OE}$ LOW to Low-Z <sup>[12]</sup>	5		ns
$t_{HZOE}$	$\overline{OE}$ HIGH to High-Z <sup>[12,13]</sup>		18	ns
$t_{LZCE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to Low Z <sup>[12]</sup>	10		ns
$t_{HZCE}$	$\overline{CE}_1$ HIGH or $CE_2$ LOW to High-Z <sup>[12, 13]</sup>		18	ns
$t_{PU}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to Power Up	0		ns
$t_{PD}$	$\overline{CE}_1$ HIGH or $CE_2$ LOW to Power Down		45	ns
<b>Write Cycle</b> <sup>[14]</sup>				
$t_{WC}$	Write Cycle Time	45		ns
$t_{SCE}$	$\overline{CE}_1$ LOW and $CE_2$ HIGH to Write End	35		ns
$t_{AW}$	Address Setup to Write End	35		ns
$t_{HA}$	Address Hold from Write End	0		ns
$t_{SA}$	Address Setup to Write Start	0		ns
$t_{PWE}$	$\overline{WE}$ Pulse Width	35		ns
$t_{SD}$	Data Setup to Write End	25		ns
$t_{HD}$	Data Hold from Write End	0		ns
$t_{HZWE}$	$\overline{WE}$ LOW to High-Z <sup>[12, 13]</sup>		18	ns
$t_{LZWE}$	$\overline{WE}$ HIGH to Low-Z <sup>[12]</sup>	10		ns

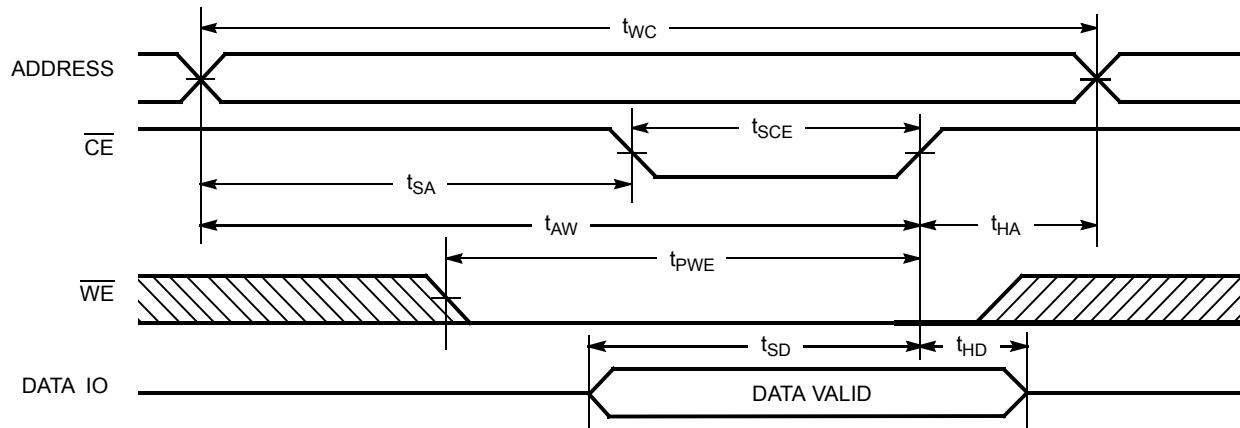
**Notes**

11. Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns or less (1 V/ns), timing reference levels of  $V_{CC(typ)}/2$ , input pulse levels of 0 to  $V_{CC(typ)}$ , and output loading of the specified  $I_{OL}/I_{OH}$  as shown in the "AC Test Loads and Waveforms" on page 4.
12. 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.
13.  $t_{HZOE}$ ,  $t_{HZCE}$ , and  $t_{HZWE}$  transitions are measured when the output enters a high impedance state.
14. The internal write time of the memory is defined by the overlap of  $\overline{WE}$ ,  $\overline{CE}_1 = V_{IL}$ , and  $CE_2 = V_{IH}$ . All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. Reference the data input setup and hold timing to the edge of the signal that terminates the write.

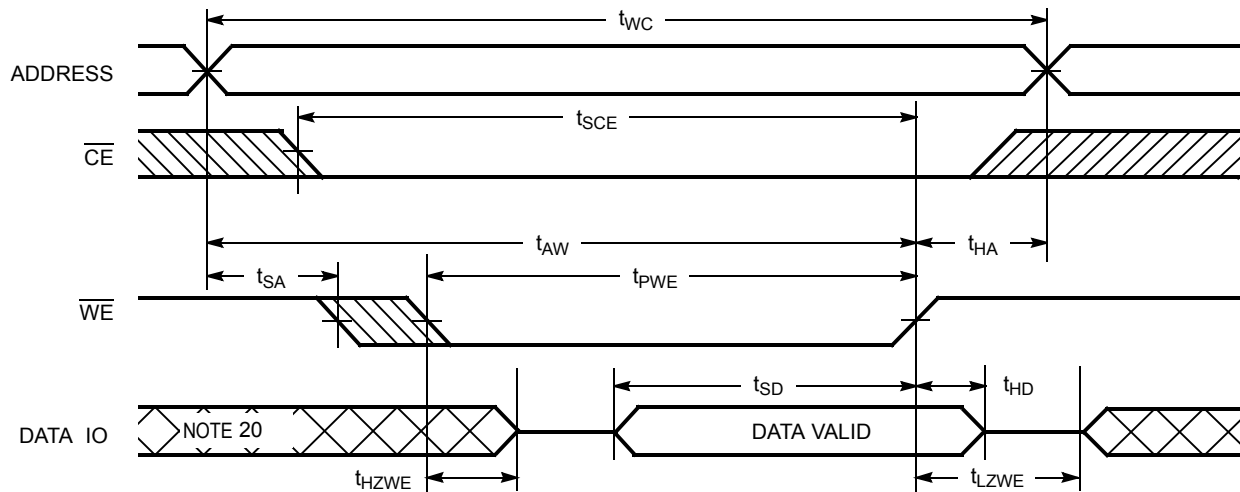


**Switching Waveforms** (continued)

**Write Cycle No. 2** ( $\overline{CE1}$  or  $CE2$  controlled) [10, 14, 18, 19]



**Write Cycle No. 3** ( $\overline{WE}$  controlled,  $\overline{OE}$  LOW) [10, 19]



**Truth Table**

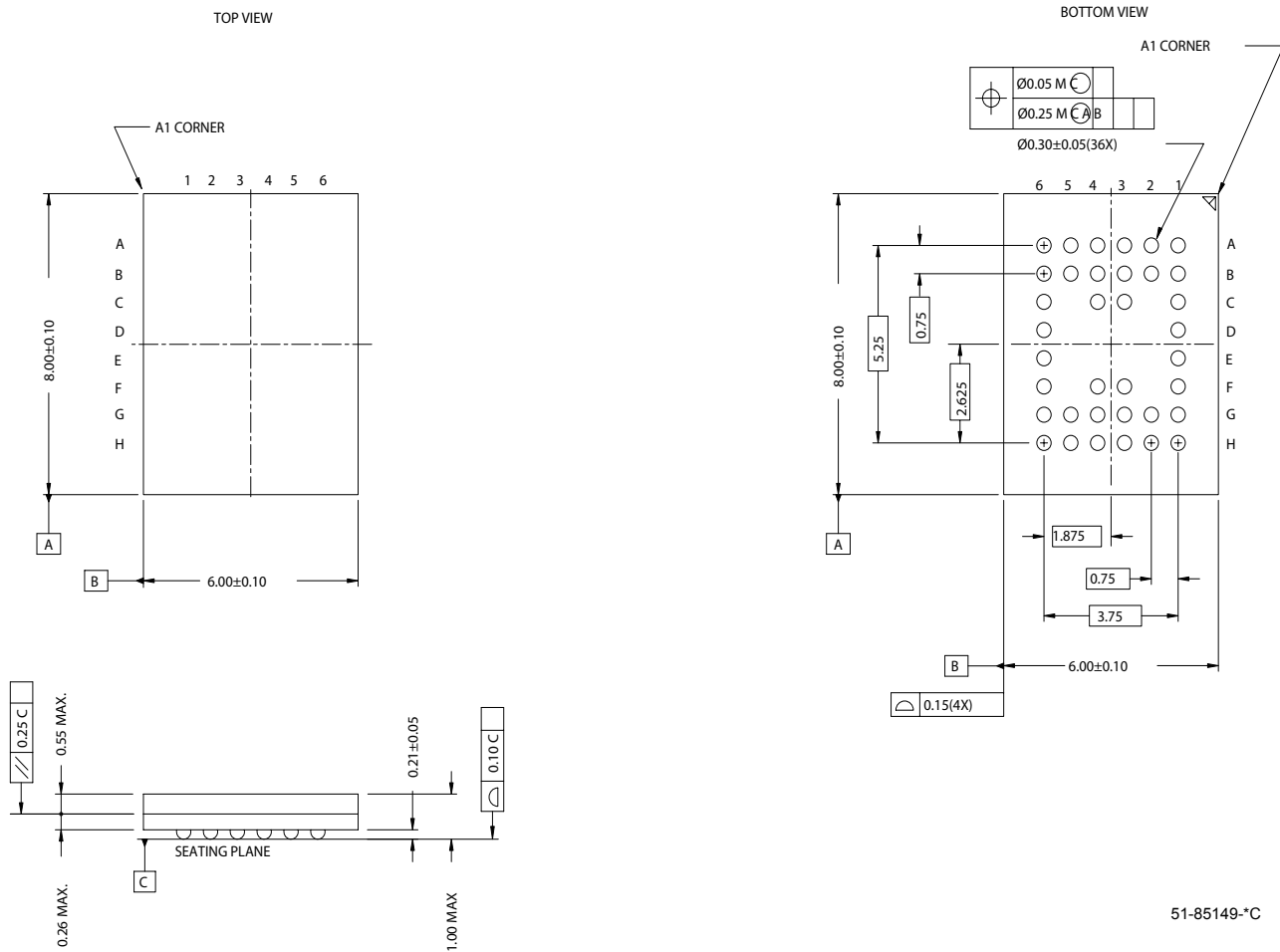
$\overline{CE}_1$	$CE_2$	$\overline{WE}$	$\overline{OE}$	Inputs/Outputs	Mode	Power
H	X	X	X	High-Z	Deselect/Power Down	Standby ( $I_{SB}$ )
X	L	X	X	High-Z	Deselect/Power Down	Standby ( $I_{SB}$ )
L	H	H	L	Data Out	Read	Active ( $I_{CC}$ )
L	H	H	H	High-Z	Output Disabled	Active ( $I_{CC}$ )
L	H	L	X	Data in	Write	Active ( $I_{CC}$ )

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62138FV30LL-45BVXI	51-85149	36-ball VFBGA (Pb-free)	Industrial
	CY62138FV30LL-45ZSXI	51-85095	32-pin TSOP II (Pb-free)	
	CY62138FV30LL-45ZAXI	51-85094	32-pin STSOP (Pb-free)	
	CY62138FV30LL-45ZXI	51-85056	32-pin TSOP I (Pb-free)	
	CY62138FV30LL-45SXI	51-85081	32-pin SOIC (Pb-free)	

Package Diagrams

Figure 1. 36-ball VFBGA (6 x 8 x 1 mm), 51-85149

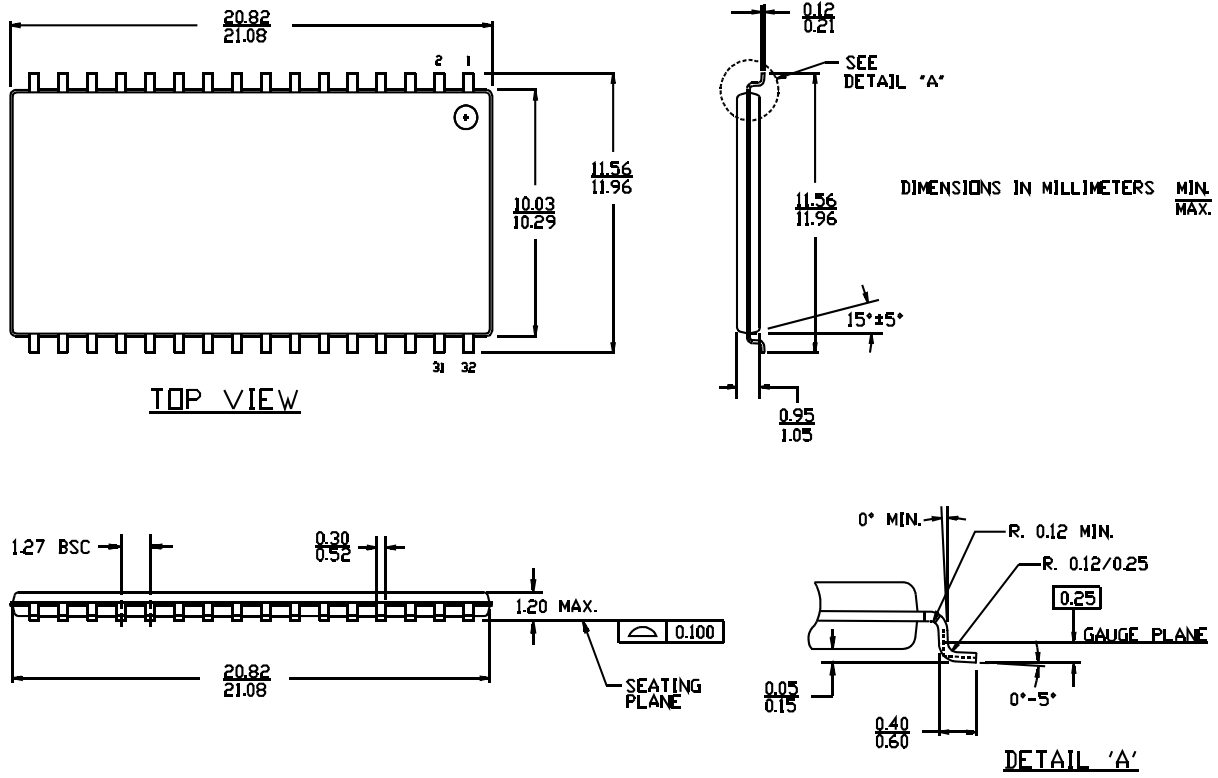


51-85149-\*C



Package Diagrams (continued)

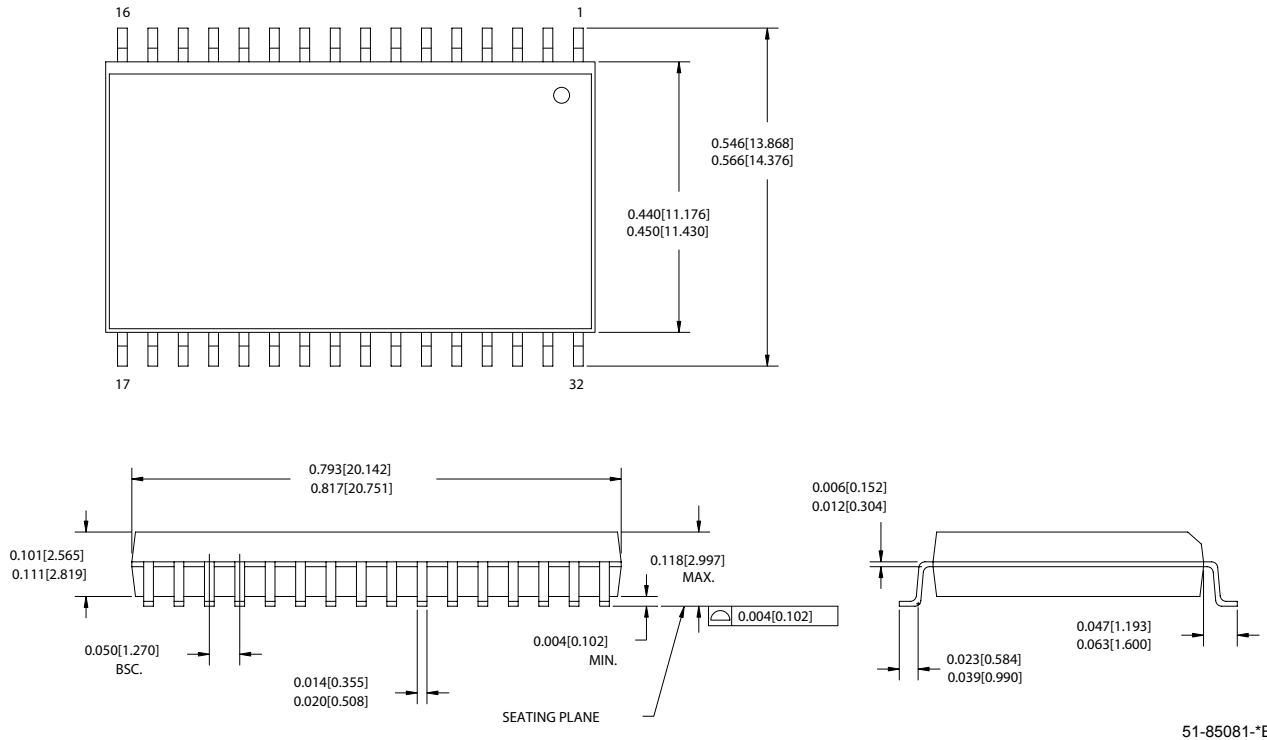
Figure 2. 32-pin TSOP II, 51-85095



51-85095-\*\*

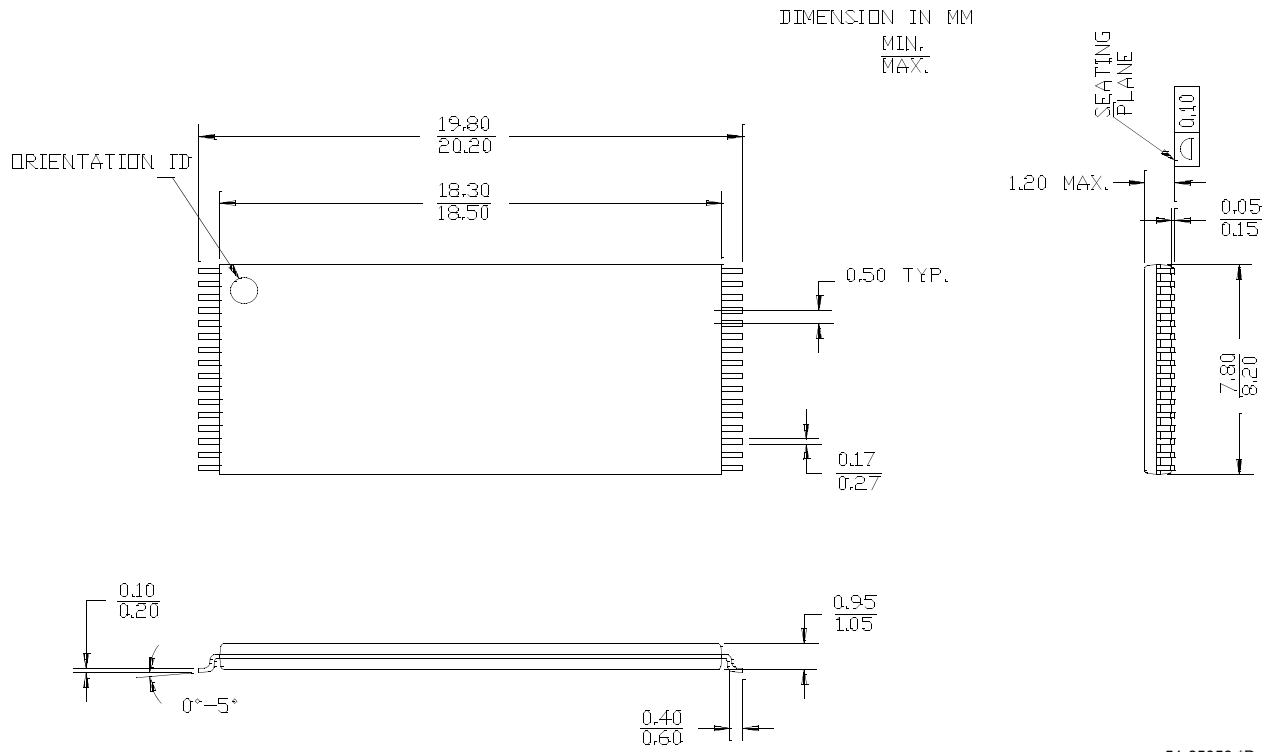
Package Diagrams (continued)

Figure 3. 32-pin (450 Mil) Molded SOIC, 51-85081



Package Diagrams (continued)

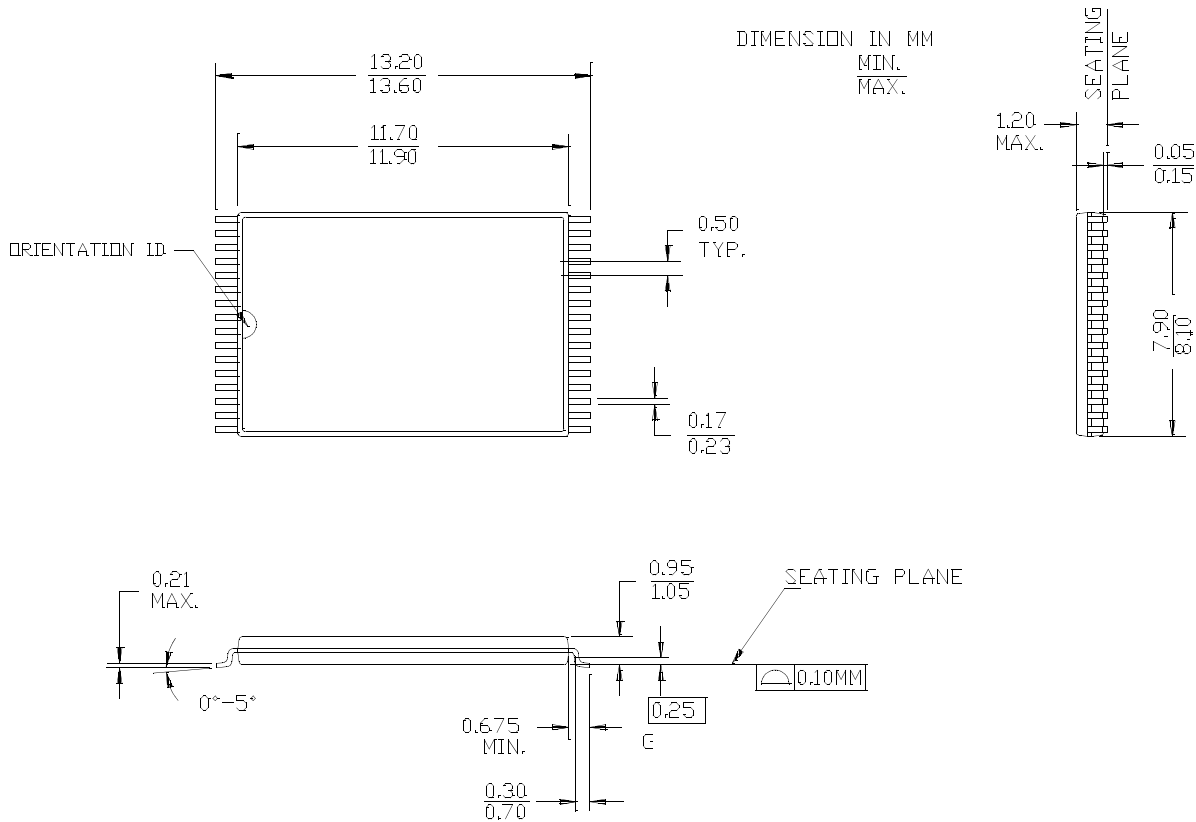
Figure 4. 32-pin TSOP I (8 x 20 mm), 51-85056



51-85056-D

Package Diagrams (continued)

Figure 5. 32-pin STSOP (8 x 13.4 mm), 51-85094



51-85094-\*D

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**Document History Page**

Document Title: CY62138FV30 MoBL <sup>®</sup> , 2-Mbit (256K x 8) Static RAM Document Number: 001-08029				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	463660	See ECN	NXR	New data sheet
*A	467351	See ECN	NXR	Added 32-pin TSOP II package, 32 pin TSOP I and 32 pin STSOP packages Changed ball A3 from NC to CE <sub>2</sub> in 36-ball FBGA pin out
*B	566724	See ECN	NXR	Converted from Preliminary to Final Corrected typo in 32 pin TSOP II pin configuration diagram on page #2 (changed pin 24 from CE <sub>1</sub> to OE and pin 22 from CE to CE <sub>1</sub> ) Changed the I <sub>CC(max)</sub> value from 2.25 mA to 2.5 mA for test condition f=1 MHz Changed the I <sub>SB2(typ)</sub> value from 0.5 μA to 1 μA Changed the I <sub>SB2(max)</sub> value from 2.5 μA to 5 μA Changed the I <sub>CCDR(typ)</sub> value from 0.5 μA to 1 μA and I <sub>CCDR(max)</sub> value from 2.5 μA to 4 μA
*C	797956	See ECN	VKN	Added 32-pin SOIC package Updated VIL spec for SOIC, TSOP-II, TSOP-I, and STSOP packages on Electrical characteristics table
*D	809101	See ECN	VKN	Corrected typo in the Ordering Information table
*E	940341	See ECN	VKN	Added footnote #7 related to I <sub>SB2</sub> and I <sub>CCDR</sub>

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