CY62128EV30 MoBL® Automotive

1-Mbit (128 K × 8) Static RAM

Features

- Very high-speed: 45 ns
- Temperature ranges:
  - Automotive-A: –40 °C to +85 °C
  - Automotive-E: –40 °C to +125 °C
- Wide voltage range: 2.2 V to 3.6 V
- Pin compatible with CY62128DV30
- Ultra low standby power
  - Typical standby current: 1 µA
  - Maximum standby current: 4 µA
- Ultra low active power
  - Typical active current: 1.3 mA at f = 1 MHz
- Easy memory expansion with $\overline{CE}_1$, CE_2, and $\overline{OE}$ features
- Automatic power down when deselected
- Complementary metal oxide semiconductor (CMOS) for optimum speed and power
- Offered in Pb-free 32-pin small outline integrated circuit (SOIC), 32-pin thin small outline package (TSOP) Type I, and 32-pin STSOP packages

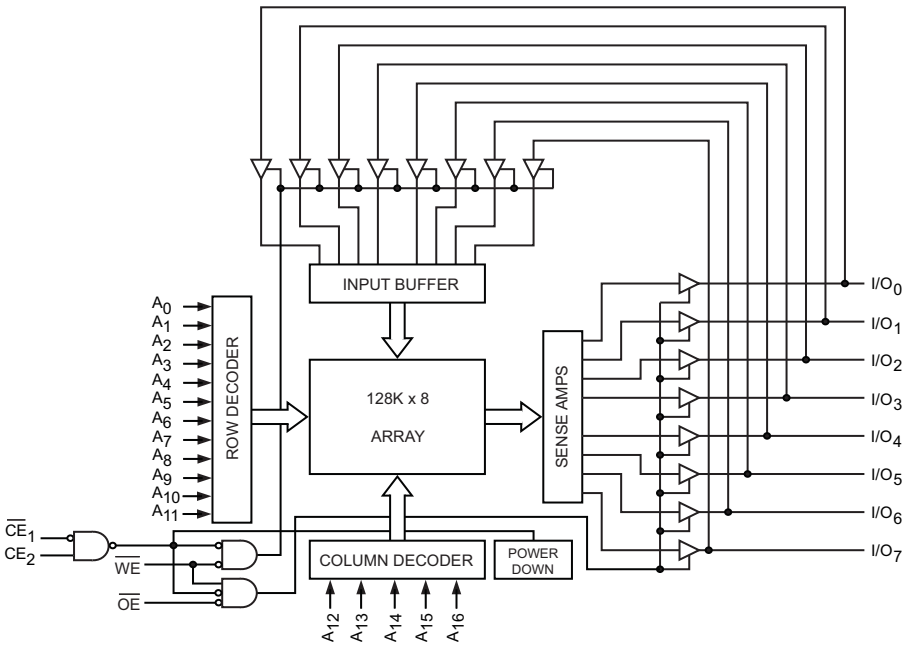
Functional Description

The CY62128EV30 is a high performance CMOS static RAM module organized as 128K 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 when addresses are not toggling. Placing the device in standby mode reduces power consumption by more than 99 percent when deselected ($\overline{CE}_1$ HIGH or CE_2 LOW). The eight input and output pins (I/O_0 through I/O_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 a write operation is in progress ($\overline{CE}_1$ LOW and CE_2 HIGH and $\overline{WE}$ 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 I/O pins is then written into the location specified on the Address pin (A_0 through A_{16}).

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 I/O pins.

Logic Block Diagram



Contents

Pin Configuration

Figure 1. 32-pin STSOP pinout [1]

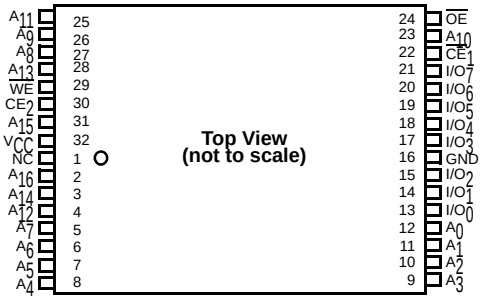


Figure 2. 32-pin TSOP I pinout [1]

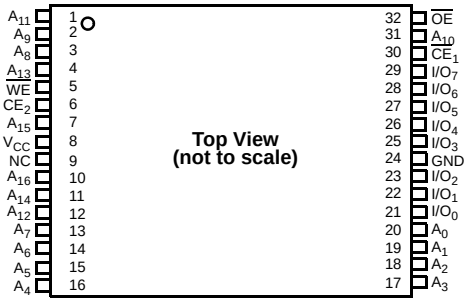
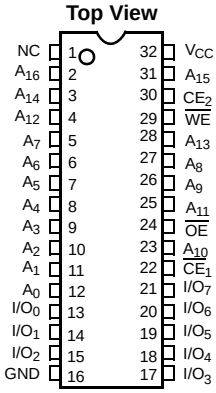


Figure 3. 32-pin SOIC pinout [1]



Product Portfolio

Product	Range	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
						Operating I_{CC} (mA)				Standby I_{SB2} (µA)	
						f = 1 MHz		f = f_{max}			
		Min	Typ [2]	Max		Typ [2]	Max	Typ [2]	Max	Typ [2]	Max
CY62128EV30LL	Automotive-A	2.2	3.0	3.6	45	1.3	2.0	11	16	1	4
CY62128EV30LL	Automotive-E	2.2	3.0	3.6	55	1.3	4.0	11	35	1	30

Notes
1. NC pins are not connected on the die.
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.

Pin Definitions

I/O Type	Description
Input	**A_0–A_{16}**. Address inputs
Input/output	**I/O_0–I/O_7**. Data lines. Used as input or output lines depending on operation.
Input/control	**$\overline{WE}$**. Write Enable, Active LOW. When selected LOW, a WRITE is conducted. When selected HIGH, a READ is conducted.
Input/control	**$\overline{CE_1}$**. Chip Enable 1, Active LOW.
Input/control	**CE_2**. Chip Enable 2, Active HIGH.
Input/control	**$\overline{OE}$**. Output Enable, Active LOW. Controls the direction of the I/O pins. When LOW, the I/O pins behave as outputs. When de-asserted HIGH, I/O pins are tri-stated, and act as input data pins.
Ground	**GND**. Ground for the device.
Power supply	**V_{CC}**. Power supply for the device.

Maximum Ratings

Exceeding maximum ratings may shorten the useful life of the device. 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 [3, 4] .....–0.3 V to $V_{CC(max)}$ + 0.3 V

DC voltage applied to outputs in High Z state [3, 4] .....–0.3 V to $V_{CC(max)}$ + 0.3 V

DC input voltage [3, 4] .....–0.3 V to $V_{CC(max)}$ + 0.3 V

Output current into outputs (LOW) ..... 20 mA

Static discharge voltage (MIL-STD-883, Method 3015) ..... > 2001 V

Latch up current .....> 200 mA

Operating Range

Device	Range	Ambient Temperature	V_{CC}[5]
CY62128EV30LL	Automotive-A	–40 °C to +85 °C	2.2 V to 3.6 V
	Automotive-E	–40 °C to +125 °C	

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	45 ns (Auto-A)			55 ns (Auto-E)			Unit
			Min	Typ [6]	Max	Min	Typ [6]	Max	
V_{OH}	Output HIGH voltage	I_{OH} = –0.1 mA, $V_{CC} \le$ 2.70 V	2.0	–	–	2.0	–	–	V
		I_{OH} = –1.0 mA, $V_{CC} \ge$ 2.70 V	2.4	–	–	2.4	–	–	V
V_{OL}	Output LOW voltage	I_{OL} = 0.1 mA	–	–	0.4	–	–	0.4	V
		I_{OL} = 2.1 mA, $V_{CC} \ge$ 2.70 V	–	–	0.4	–	–	0.4	V
V_{IH}	Input HIGH voltage	V_{CC} = 2.2 V to 2.7 V	1.8	–	V_{CC} + 0.3 V	1.8	–	V_{CC} + 0.3 V	V
		V_{CC} = 2.7 V to 3.6 V	2.2	–	V_{CC} + 0.3 V	2.2	–	V_{CC} + 0.3 V	V
V_{IL}	Input LOW voltage	V_{CC} = 2.2 V to 2.7 V	–0.3	–	0.6	–0.3	–	0.6	V
		V_{CC} = 2.7 V to 3.6 V	–0.3	–	0.8	–0.3	–	0.8	V
I_{IX}	Input leakage current	GND $\le V_{IN} \le V_{CC}$	–1	–	+1	–4	–	+4	µA
I_{OZ}	Output leakage current	GND $\le V_O \le V_{CC}$, output disabled	–1	–	+1	–4	–	+4	µA
I_{CC}	V_{CC} operating supply current	f = f_{max} = $1/t_{RC}$; V_{CC} = V_{CCmax}, I_{OUT} = 0 mA CMOS levels	–	11	16	–	11	35	mA
		f = 1 MHz; V_{CC} = V_{CCmax}, I_{OUT} = 0 mA CMOS levels	–	1.3	2.0	–	1.3	4.0	mA
I_{SB1}[7]	Automatic CE power-down current — CMOS inputs	$\overline{CE_1} \ge V_{CC}$ – 0.2 V, $CE_2 \le$ 0.2 V, $V_{IN} \ge V_{CC}$ – 0.2 V, $V_{IN} \le$ 0.2 V, f = f_{max} (address and data only), f = 0 (OE and $\overline{WE}$), V_{CC} = 3.60 V	–	1	4	–	1	35	µA
I_{SB2}[7]	Automatic CE power-down current — CMOS inputs	$\overline{CE_1} \ge V_{CC}$ – 0.2 V, $CE_2 \le$ 0.2 V, $V_{IN} \ge V_{CC}$ – 0.2 V or V_{IN} < 0.2 V, f = 0, V_{CC} = 3.60 V	–	1	4	–	1	30	µA

Notes

3. $V_{IL(min)}$ = –2.0 V for pulse durations less than 20 ns.
4. $V_{IH(max)}$ = V_{CC} + 0.75 V for pulse durations less than 20 ns.
5. Full device AC operation assumes a 100 µs ramp time from 0 to $V_{CC(min)}$ and 200 µs wait time after V_{CC} stabilization.
6. 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.
7. Chip enables ($\overline{CE_1}$ and CE_2) must be at CMOS level to meet the I_{SB1} / I_{SB2} / I_{CCDR} spec. Other inputs can be left floating.

Capacitance

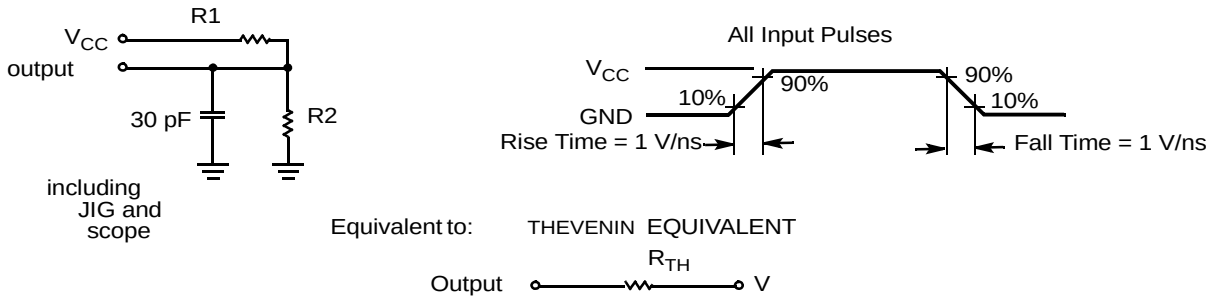
Parameter [8]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = $V_{CC(typ)}$	10	pF
C_{OUT}	Output capacitance		10	pF

Thermal Resistance

Parameter [8]	Description	Test Conditions	32-pin TSOP I	32-pin SOIC	32-pin STSOP	Unit
Θ_{JA}	Thermal resistance (Junction to ambient)	Still Air, soldered on a 3 × 4.5 inch, two-layer printed circuit board	33.01	48.67	32.56	°C/W
Θ_{JC}	Thermal resistance (Junction to case)		3.42	25.86	3.59	°C/W

AC Test Loads and Waveforms

Figure 4. AC Test Loads and Waveforms



Parameters	2.50 V	3.0 V	Unit
R1	16667	1103	Ω
R2	15385	1554	Ω
R_{TH}	8000	645	Ω
V_{TH}	1.20	1.75	V

Note
8. Tested initially and after any design or process changes that may affect these parameters.

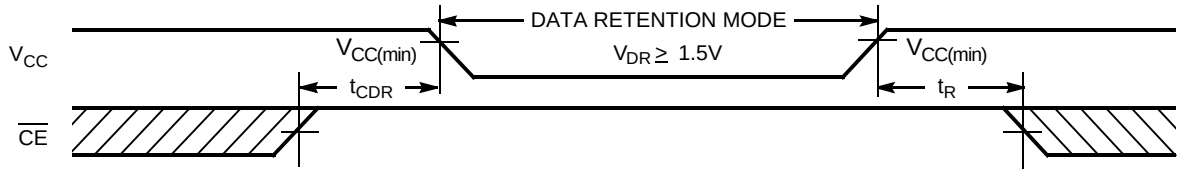
Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions		Min	Typ [9]	Max	Unit
V_{DR}	V_{CC} for data retention			1.5	–	–	V
I_{CCDR}[10]	Data retention current	V_{CC} = 1.5 V, $CE_1 \geq V_{CC} - 0.2$ V or $CE_2 \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} \leq 0.2$ V	Automotive-A	–	–	3	µA
			Automotive-E	–	–	30	µA
t_{CDR}[11]	Chip deselect to data retention time			0	–	–	ns
t_R[12]	Operation recovery time		CY62128EV30LL-45	45	–	–	ns
			CY62128EV30LL-55	55	–	–	

Data Retention Waveform

Figure 5. Data Retention Waveform [13]



Notes

9. 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.
10. Chip enables ($\overline{CE_1}$ and CE_2) must be at CMOS level to meet the I_{SB1} / I_{SB2} / I_{CCDR} spec. Other inputs can be left floating.
11. Tested initially and after any design or process changes that may affect these parameters.
12. Full device AC operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)} \geq 100$ µs or stable at $V_{CC(min)} \geq 100$ µs.
13. $\overline{CE}$ 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

Parameter [14, 15]	Description	45 ns (Automotive-A)		55 ns (Automotive-E)		Unit
		Min	Max	Min	Max	
Read Cycle						
t_{RC}	Read cycle time	45	–	55	–	ns
t_{AA}	Address to data valid	–	45	–	55	ns
t_{OHA}	Data hold from address change	10	–	10	–	ns
t_{ACE}	$\overline{CE}$ LOW to data valid	–	45	–	55	ns
t_{DOE}	$\overline{OE}$ LOW to data valid	–	22	–	25	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z [16]	5	–	5	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z [16, 17]	–	18	–	20	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z [16]	10	–	10	–	ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z [16, 17]	–	18	–	20	ns
t_{PU}	$\overline{CE}$ LOW to Power-up	0	–	0	–	ns
t_{PD}	$\overline{CE}$ HIGH to Power-down	–	45	–	55	ns
Write Cycle [18, 19]						
t_{WC}	Write cycle time	45	–	55	–	ns
t_{SCE}	$\overline{CE}$ LOW to write end	35	–	40	–	ns
t_{AW}	Address setup to write end	35	–	40	–	ns
t_{HA}	Address hold from write end	0	–	0	–	ns
t_{SA}	Address setup to write start	0	–	0	–	ns
t_{PWE}	$\overline{WE}$ pulse width	35	–	40	–	ns
t_{SD}	Data setup to write end	25	–	25	–	ns
t_{HD}	Data Hold from write end	0	–	0	–	ns
t_{HZWE}	$\overline{WE}$ LOW to High Z [16, 17]	–	18	–	20	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z [16]	10	–	10	–	ns

Notes

14. $\overline{CE}$ 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.
15. 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 Figure 4 on page 6.
16. 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.
17. t_{HZOE}, t_{HZCE}, and t_{HZWE} transitions are measured when the output enter a high impedance state.
18. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}$ = V_{IL}. All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input setup and hold timing should be referenced to the edge of the signal that terminates the write.
19. The minimum write pulse width for Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) should be equal to the sum of t_{SD} and t_{HZWE}.

Switching Waveforms

Figure 6. Read Cycle No. 1 (Address Transition Controlled) [20, 21]

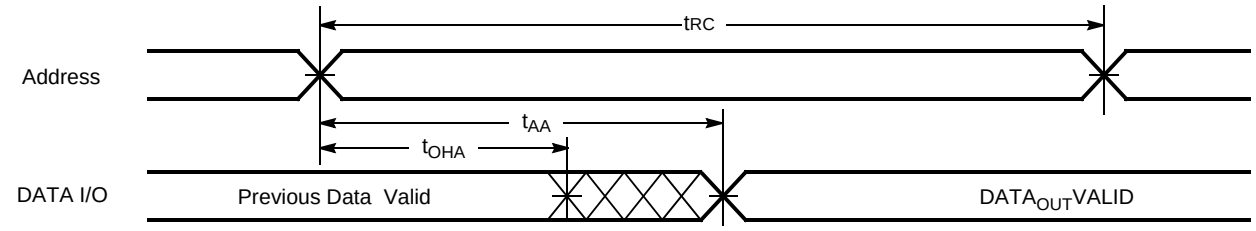
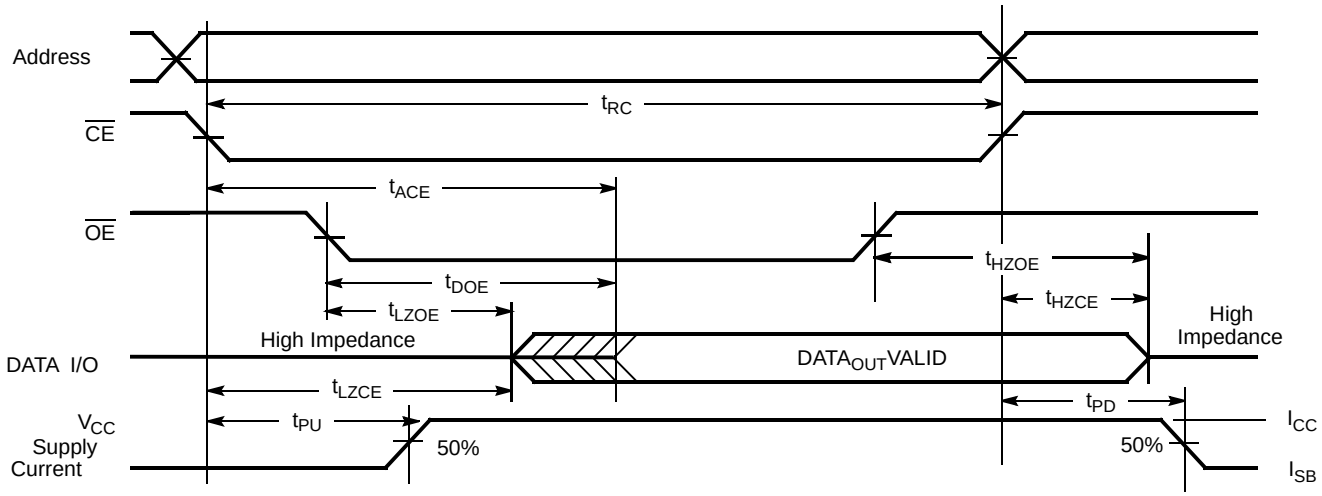


Figure 7. Read Cycle No. 2 ($\overline{OE}$ Controlled) [21, 22, 23]

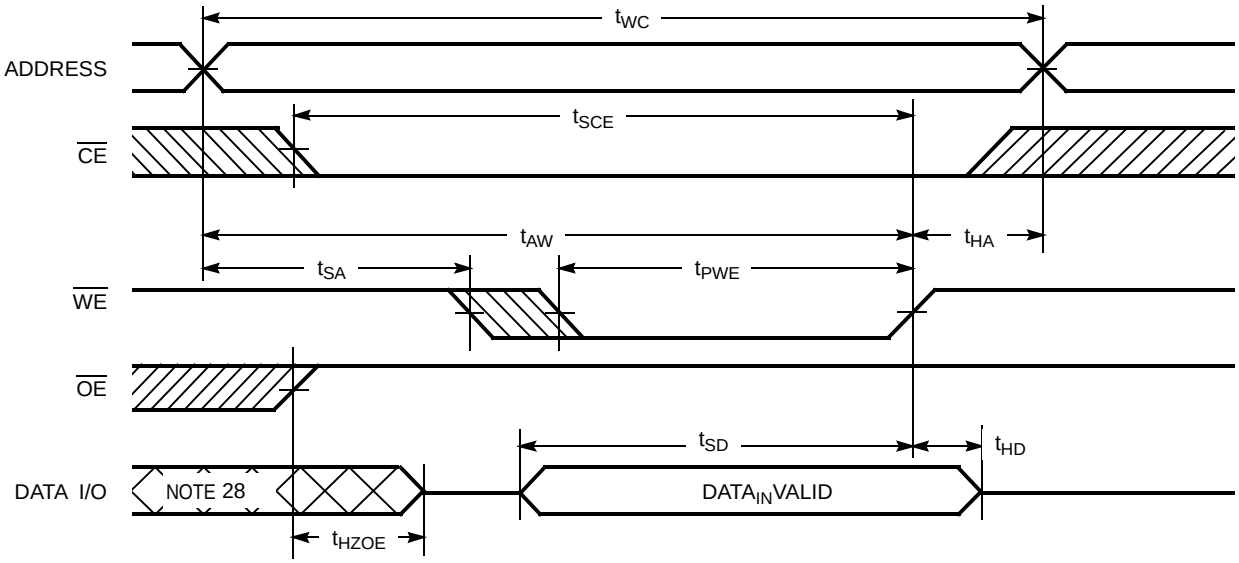


Notes

20. The device is continuously selected. $\overline{OE}$, $\overline{CE_1}$ = V_{IL}, CE_2 = V_{IH}.
21. $\overline{WE}$ is HIGH for read cycle.
22. $\overline{CE}$ 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.
23. Address valid before or similar to $\overline{CE_1}$ transition LOW and CE_2 transition HIGH.

Switching Waveforms (continued)

Figure 8. Write Cycle No. 1 ($\overline{WE}$ Controlled) [24, 25, 26, 27]



Notes

24. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}$ = V_{IL}. All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input setup and hold timing should be referenced to the edge of the signal that terminates the write.
25. $\overline{CE}$ 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.
26. Data I/O is high impedance if $\overline{OE}$ = V_{IH}.
27. If $\overline{CE_1}$ goes HIGH or CE_2 goes LOW simultaneously with $\overline{WE}$ HIGH, the output remains in high impedance state.
28. During this period, the I/Os are in output state. Do not apply input signals.

Switching Waveforms (continued)

Figure 9. Write Cycle No. 2 ($\overline{CE_1}$ or CE_2 Controlled) [29, 30, 31, 32]

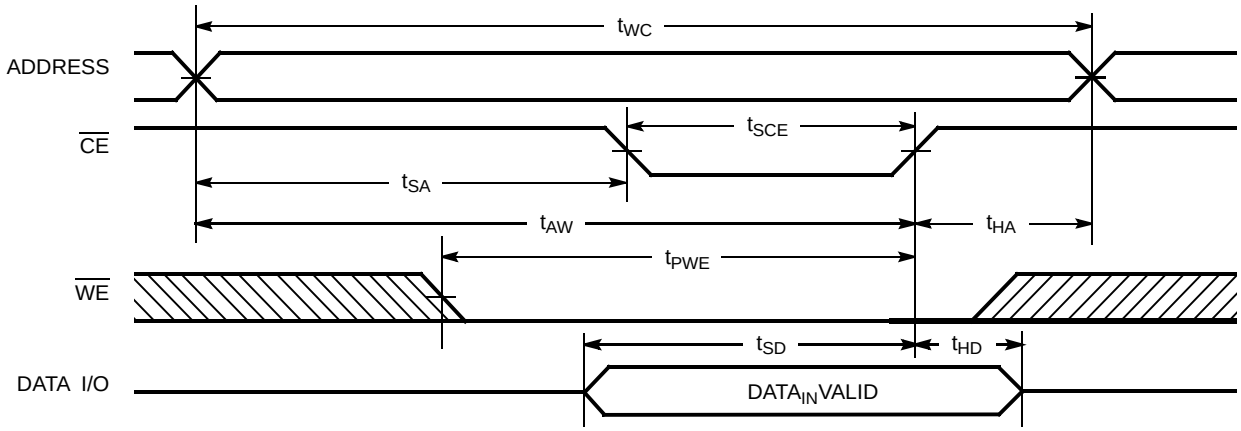
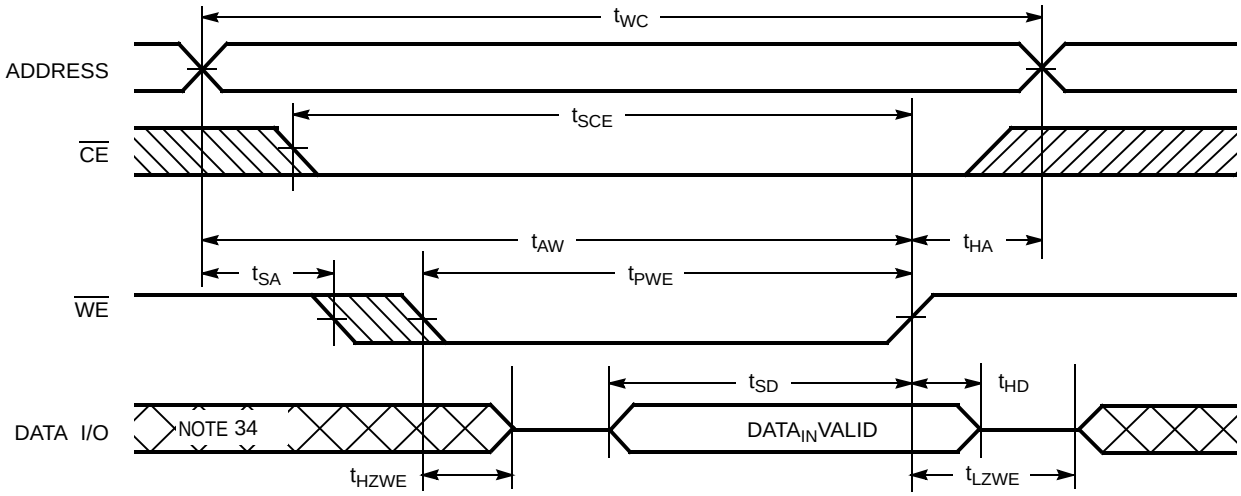


Figure 10. Write Cycle No. 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [29, 32, 33]



Notes

29. $\overline{CE}$ 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
30. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}$ = V_{IL}. All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input setup and hold timing should be referenced to the edge of the signal that terminates the write.
31. Data I/O is high impedance if $\overline{OE}$ = V_{IH}.
32. If $\overline{CE_1}$ goes HIGH or CE_2 goes LOW simultaneously with $\overline{WE}$ HIGH, the output remains in high impedance state.
33. The minimum write pulse width should be equal to the sum of t_{SD} and t_{HZWE}.
34. During this period, the I/Os are in output state. Do not apply input signals.

Truth Table

$\overline{CE_1}$	CE_2	$\overline{WE}$	$\overline{OE}$	Inputs/Outputs	Mode	Power
H	X [35]	X	X	High Z	Deselect/Power-down	Standby (I_{SB})
X [35]	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	Selected, outputs disabled	Active (I_{CC})

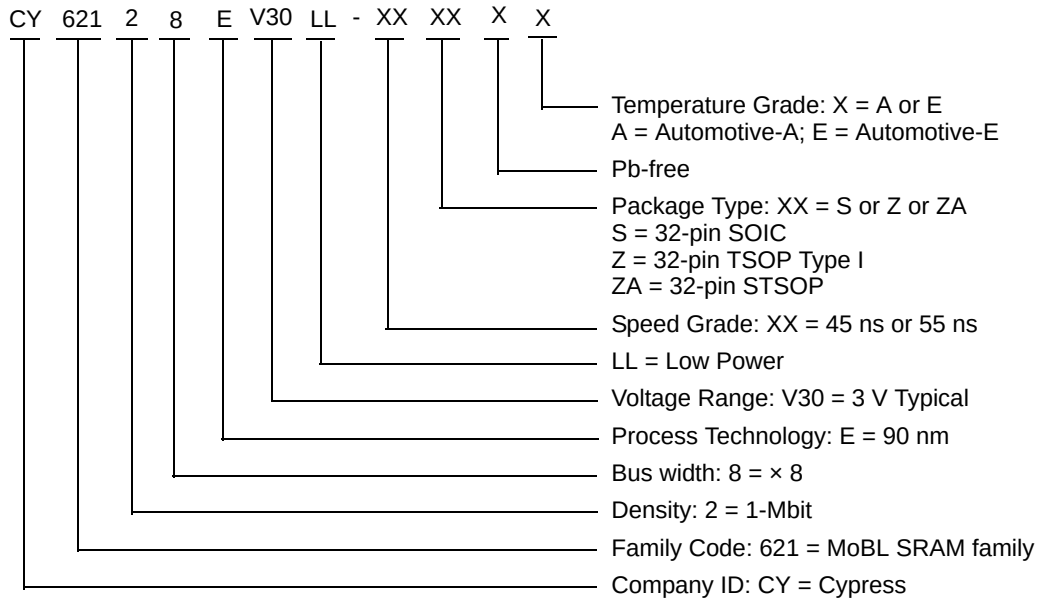
Note
35. The 'X' (Don't care) state for the Chip enables in the truth table refer to the logic state (either HIGH or LOW). Intermediate voltage levels on these pins is not permitted.

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62128EV30LL-45SXA	51-85081	32-pin 450-Mil SOIC (Pb-free)	Automotive-A
	CY62128EV30LL-45ZXA	51-85056	32-pin TSOP Type I (Pb-free)	
	CY62128EV30LL-45ZAXA	51-85094	32-pin STSOP (Pb-free)	
55	CY62128EV30LL-55ZXE	51-85056	32-pin TSOP Type I (Pb-free)	Automotive-E
	CY62128EV30LL-55SXE	51-85081	32-pin 450-Mil SOIC (Pb-free)	

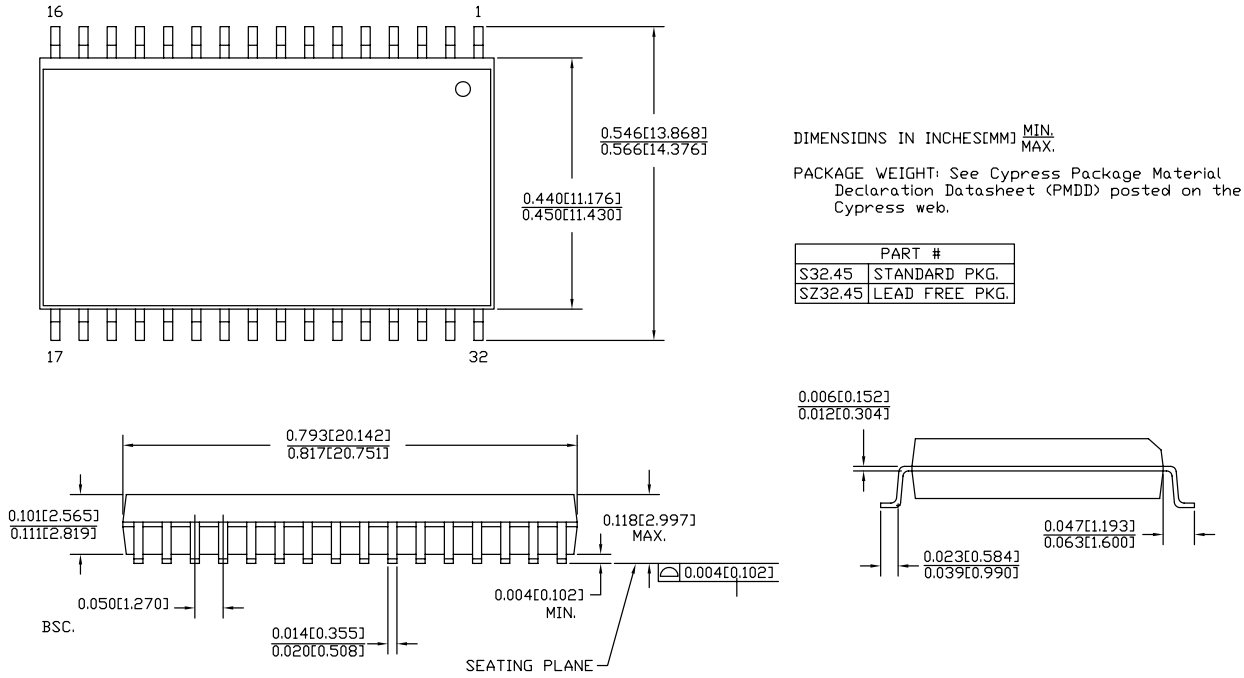
Contact your local Cypress sales representative for availability of these parts.

Ordering Code Definitions



Package Diagrams

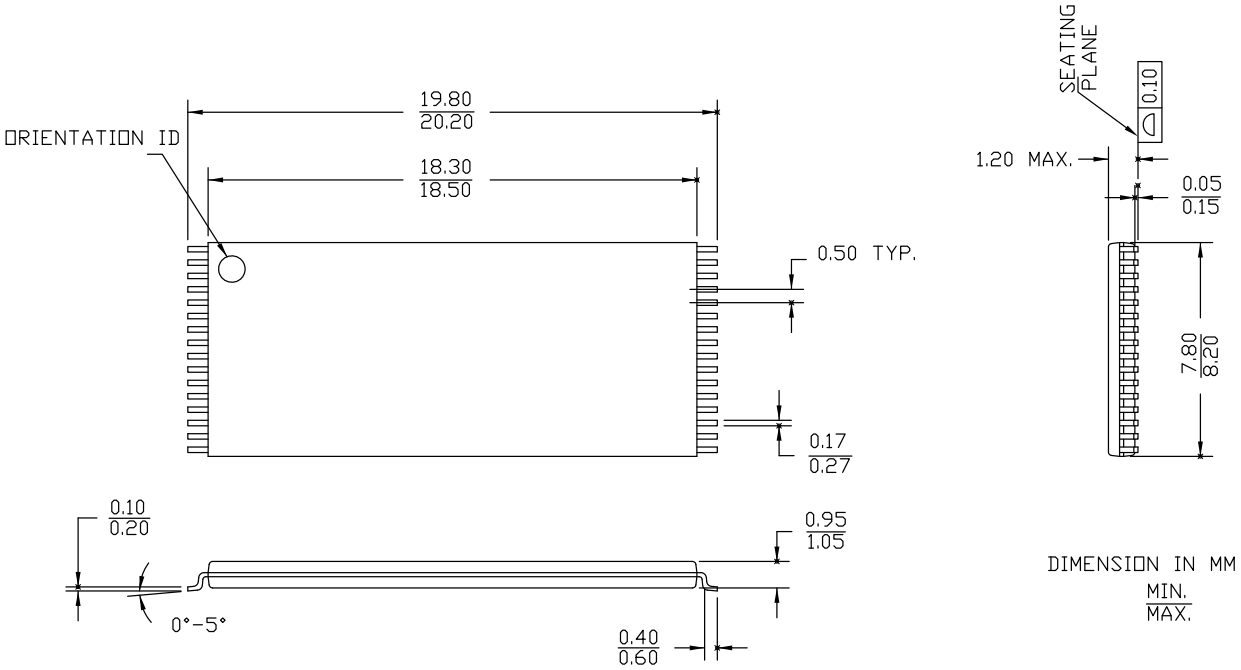
Figure 11. 32-pin SOIC (450 Mil) S32.45/SZ32.45 Package Outline, 51-85081



51-85081 *E

Package Diagrams (continued)

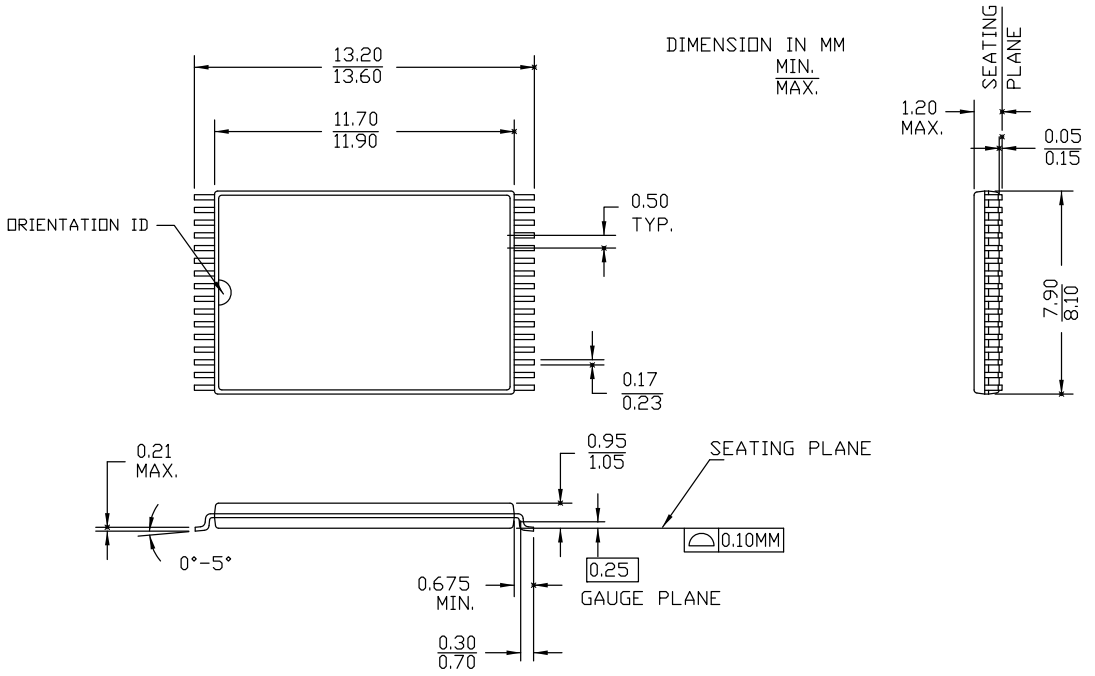
Figure 12. 32-pin TSOP I (8 × 20 × 1.0 mm) Z32R Package Outline, 51-85056



51-85056 *G

Package Diagrams (continued)

Figure 13. 32-pin Small TSOP (8 × 13.4 × 1.2 mm) ZA32 Package Outline, 51-85094



51-85094 *G

Acronyms

Acronym	Description
$\overline{CE}$	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
$\overline{OE}$	Output Enable
SOIC	Small Outline Integrated Circuit
SRAM	Static Random Access Memory
STSOP	Small Thin Small Outline Package
TSOP	Thin Small Outline Package
$\overline{WE}$	Write Enable

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
µA	microampere
µs	microsecond
mA	milliampere
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY62128EV30 MoBL® Automotive, 1-Mbit (128 K × 8) Static RAM Document Number: 001-65528				
Rev.	**ECN No.**	**Submission Date**	**Orig. of Change**	**Description of Change**
**	3115909	01/06/2011	RAME	New data sheet for Automotive SRAM parts. Created separate data sheet for Automotive SRAM parts from Document no. 38-05579 Rev. *H
*A	3288690	06/21/2011	RAME	Removed the Note “For best practice recommendations, refer to the Cypress application note “System Design Guidelines” at http://www.cypress.com website.” and its reference in Functional Description. Updated Electrical Characteristics (Test Conditions of I_{SB1} and I_{SB2} parameters). Updated Package Diagrams. Updated to new template.
*B	3543173	03/06/2012	TAVA	Updated Electrical Characteristics. Updated Switching Waveforms. Updated Package Diagrams.
*C	4582964	11/29/2014	VINI	Updated Maximum Ratings: Referred Notes 3, 4 in “Supply voltage to ground potential”. Updated Switching Characteristics: Added Note 19 and referred the same note in “Write Cycle”. Updated Switching Waveforms: Added Note 33 and referred the same note in Figure 10. Updated Package Diagrams: spec 51-85081 – Changed revision from *D to *E. spec 51-85056 – Changed revision from *F to *G. spec 51-85094 – Changed revision from *F to *G. Updated to new template.

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