

2-Mbit (256 K × 8) Static RAM

Features

■ High speed: 45 ns

■ Wide voltage range: 4.5 V to 5.5 V

■ Pin compatible with CY62138V

■ Ultra low standby power

Typical standby current: 1 μA

Maximum standby current: 5 μA

■ 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

Complementary metal oxide semiconductor (CMOS) for optimum speed and power

Available in Pb-free 32-pin SOIC and 32-pin thin small outline package (TSOP) II packages

Functional Description

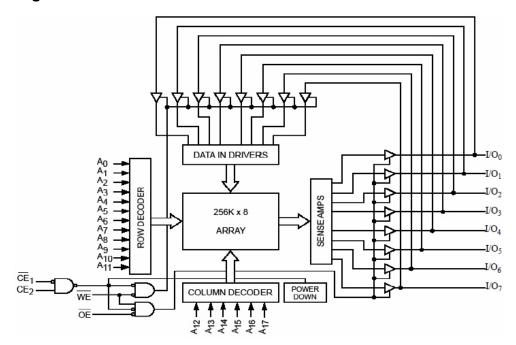
The CY62138F is a high performance CMOS static RAM organized as 256K words by 8 bits. This device features advanced circuit design to provide ultra low active current. This is ideal for providing More Battery $\mathsf{Life^{TM}}$ (MoBL§) in portable applications such as cellular telephones. The device also has an automatic power down feature that significantly reduces power consumption when addresses are not toggling. Placing the device into standby mode reduces power consumption by more than 99% when deselected (CE1 HIGH or CE2 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 (I/O₀ through I/O₇) is then written into the location specified on the address pins (A₀ through A₁₇).

To read from the device, take Chip Enable ($\overline{\text{CE}}_1$ LOW and CE₂ <u>HIGH</u>) and output enable ($\overline{\text{OE}}$) LOW while forcing Write Enable ($\overline{\text{WE}}$) HIGH. Under these conditions, the contents of the memory location specified by the address pins appear on the I/O pins.

The eight input and output pins (I/O $_0$ through I/O $_7$) are place<u>d in</u> a high impedance state when the device is de<u>sel</u>ected (\overline{CE}_1 HIGH or \overline{CE}_2 LOW), the <u>outputs</u> are disabled (\overline{OE} HIGH), or during a write operation (\overline{CE}_1 LOW and \overline{CE}_2 HIGH and \overline{WE} LOW).

Logic Block Diagram







Contents

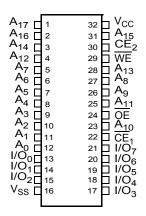
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Pin Configuration

Figure 1. 32-pin SOIC/TSOP II Pinout (Top View)



Product Portfolio

							Power D	Dissipatio	n	
Product	V _{CC} Range (V)			Speed	Operating I _{CC} (mA)			Standby I (A)		
Floudet			(ns)	f = 1 MHz		f = f _{max}		- Standby I _{SB2} (μ A)		
	Min	Typ ^[1]	Max		Typ [1]	Max	Typ [1]	Max	Typ ^[1]	Max
CY62138FLL	4.5 V	5.0 V	5.5 V	45	1.6	2.5	13	18	1	5

Note

^{1.} 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.



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-0.5 V to 6.0 V (V_{CCmax} + 0.5 V) DC voltage applied to outputs in High Z state $^{[2,\;3]}$ -0.5 V to 6.0 V (V $_{CCmax}$ + 0.5 V)

DC Input Voltage $^{[2,\ 3]}$ 0.5 V to 6.0 V (V _{CCma}	_{ax} + 0.5 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} [4]	
CY62138FLL	Industrial	–40 °C to +85 °C	4.5 V to 5.5 V	

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Co		Unit			
Parameter	Description	lest Co	Min	Typ ^[5]	Max	Oilit	
V _{OH}	Output HIGH voltage	$I_{OH} = -1.0 \text{ mA}$		2.4	_	-	V
V _{OL}	Output LOW voltage	I _{OL} = 2.1 mA		-	_	0.4	V
V _{IH}	Input HIGH voltage	V_{CC} = 4.5 V to 5.5 V		2.2	_	V _{CC} + 0.5	V
V _{IL}	Input LOW voltage	V_{CC} = 4.5 V to 5.5 V		-0.5	_	0.8	V
I _{IX}	Input leakage current	$GND \le V_1 \le V_{CC}$		-1	_	+1	μА
I _{OZ}	Output leakage current	$GND \le V_O \le V_{CC}, Ou$	tput disabled	-1	_	+1	μА
I _{CC}		$f = f_{max} = 1/t_{RC}$	$V_{CC} = V_{CC(max)}$, $I_{OUT} = 0 \text{ mA}$,	-	13	18	mA
	Current	f = 1 MHz	I _{OUT} = 0 mA, CMOS levels	_	1.6	2.5	
I _{SB2} ^[6]		$\overline{CE}_1 \ge V_{CC} - 0.2 \text{ V o}$ $V_{IN} \ge V_{CC} - 0.2 \text{ V or}$ $f = 0, V_{CC} = V_{CC(max)}$	$V_{IN} \leq 0.2 V$	_	1	5	μА

Notes

- Notes

 2. V_{IL(min)} = -2.0 V for pulse durations less than 20 ns.
 3. V_{IH(max)} = V_{CC} + 0.75 V for pulse durations less than 20 ns.
 4. 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.
 5. 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.
 6. Chip enables (CE₁ and CE₂) must be at CMOS level to meet the I_{SB2} / I_{CCDR} spec. Other inputs can be left floating.



Capacitance

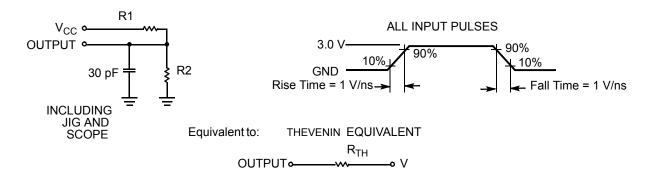
Parameter [7]	Description				
C _{IN}	Input capacitance	$T_A = 25 ^{\circ}\text{C}, f = 1 \text{MHz}, V_{CC} = V_{CC(typ)}$	10	pF	
C _{OUT}	Output capacitance		10	pF	

Thermal Resistance

Parameter [7]	Description	Test Conditions	32-pin SOIC	32-pin TSOP II	Unit
Θ_{JA}		Still air, soldered on a 3 × 4.5 inch two-layer printed circuit board	44.53	44.16	°C/W
ΘJC	Thermal resistance (Junction to Case)		24.05	11.97	°C/W

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms



Parameters	5.0 V	Unit
R1	1800	Ω
R2	990	Ω
R _{TH}	639	Ω
V _{TH}	1.77	V

Note

^{7.} Tested initially and after any design or process changes that may affect these parameters.



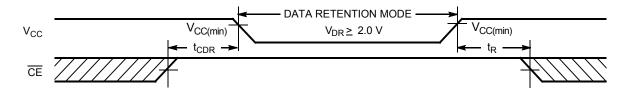
Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Typ ^[8]	Max	Unit
V_{DR}	V _{CC} for Data retention		2.0	-	-	V
I _{CCDR} ^[9]	Data retention current	$V_{CC} = V_{DR}$, $\overline{CE}_1 \ge V_{CC} - 0.2 \text{ V or } CE_2 \le 0.2 \text{ V}$, $V_{IN} \ge V_{CC} - 0.2 \text{ V or } V_{IN} \le 0.2 \text{ V}$	_	1	5	μА
t _{CDR} ^[8]	Chip deselect to data retention time		0	-	-	ns
t _R ^[10]	Operation recovery time		45	-	_	ns

Data Retention Waveform

Figure 3. Data Retention Waveform [11]



Notes

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

9. Chip enables (CE₁ and CE₂) must be at CMOS level to meet the I_{SB2} / I_{CCDR} spec. Other inputs can be left floating.

10. Full device AC operation requires linear V_{CC} ramp from V_{DR} to V_{CC(min)} ≥ 100 µs or stable at V_{CC(min)} ≥ 100 µs.

11. CE is the logical combination of CE₁ and CE₂. When CE₁ is LOW and CE₂ is HIGH, CE is LOW; when CE₁ is HIGH or CE₂ is LOW, CE is HIGH.



Switching Characteristics

Over the Operating Range

Parameter [12]	Deparintion	45	ns	11!4
Parameter	Description	Min	Max	Unit
Read Cycle				
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}	$\overline{\text{CE}}_1$ LOW and $\overline{\text{CE}}_2$ HIGH to data valid	_	45	ns
t _{DOE}	OE LOW to data valid	_	22	ns
t _{LZOE}	OE LOW to low Z [13]	5	_	ns
t _{HZOE}	OE HIGH to high Z [13, 14]	_	18	ns
t _{LZCE}	$\overline{\text{CE}}_1$ LOW and $\overline{\text{CE}}_2$ HIGH to low Z ^[13]	10	_	ns
t _{HZCE}	$\overline{\text{CE}}_1$ HIGH or $\overline{\text{CE}}_2$ LOW to high Z $^{[13, 14]}$	_	18	ns
t _{PU}	$\overline{\text{CE}}_1$ LOW and $\overline{\text{CE}}_2$ HIGH to power-up	0	_	ns
t _{PD}	$\overline{\text{CE}}_1$ HIGH or $\overline{\text{CE}}_2$ LOW to power-down	_	45	ns
Write Cycle [15	İ			
t _{WC}	Write cycle time	45	_	ns
t _{SCE}	CE₁ LOW and CE₂ 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}	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}	WE LOW to high Z [13, 14]	_	18	ns
t _{LZWE}	WE HIGH to low Z [13]	10	_	ns

 ^{12.} Test conditions for all parameters other than tri-state parameters assume signal transition time of 3 ns (1 V/ns) or less, 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 2 on page 5.
 13. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZCE} is less than t_{LZCE}, and t_{HZWE} is less than t_{LZWE} for any given device.
 14. t_{HZOE}, t_{HZCE}, and t_{HZWE} transitions are measured when the outputs enter a high impedance state.
 15. The internal write time of the memory is defined by the overlap of WE, CE₁ = V_{IL}, and CE₂ = V_{IH}. 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 must be referenced to the edge of the signal that terminates the write.



Switching Waveforms

Figure 4. Read Cycle 1 (Address Transition Controlled) [16, 17]

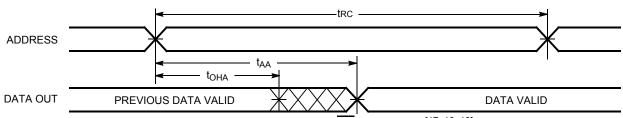


Figure 5. Read Cycle No. 2 (OE Controlled) [17, 18, 19]

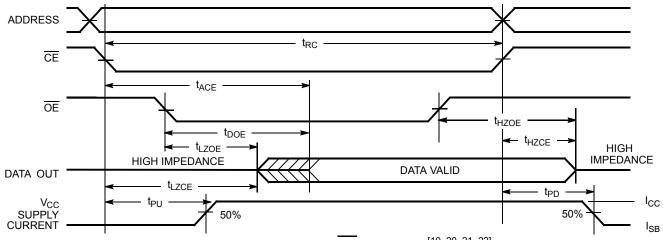
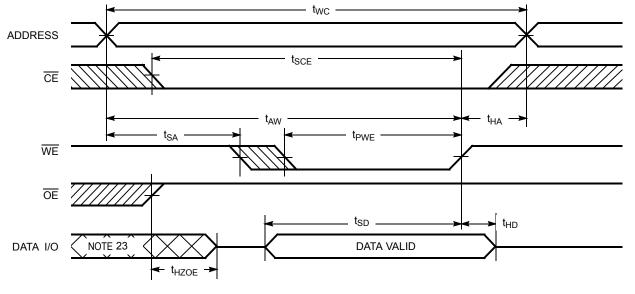


Figure 6. Write Cycle No. 1 (WE Controlled) [19, 20, 21, 22]



- 16. The device is continuously selected. \overline{OE} , $\overline{CE}_1 = V_{IL}$, $CE_2 = V_{IH}$.
- 17. WE is HIGH for read cycle.

- 17. We is Filled to feat cycle.
 18. Address valid before or similar to CE₁ transition LOW and CE₂ transition HIGH.
 19. CE is the logical combination of CE₁ and CE₂. When CE₁ is LOW and CE₂ is HIGH, CE is LOW; when CE₁ is HIGH or CE₂ is LOW, CE is HIGH.
 20. The internal write time of the memory is defined by the overlap of WE, CE₁ = V_{IL}, and CE₂ = V_{IH}. 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 must be referenced to the edge of the signal that terminates the write. 21. Data I/O is high impedance if OE = VIH.
- 21. If CE_1 goes HIGH or CE_2 goes LOW simultaneously with \overline{WE} HIGH, the output remains in high impedance state. 23. During this period, the I/Os are in output state. Do not apply input signals.



Switching Waveforms (continued)

Figure 7. Write Cycle No. 2 ($\overline{\text{CE}}_1$ or $\overline{\text{CE}}_2$ Controlled) [24, 25, 26, 27]

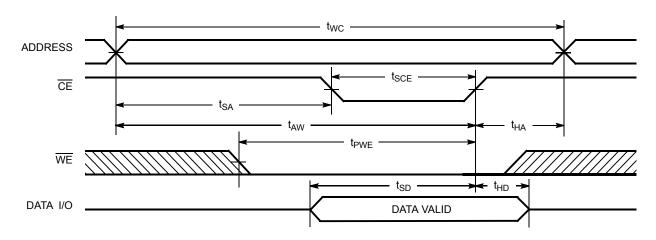
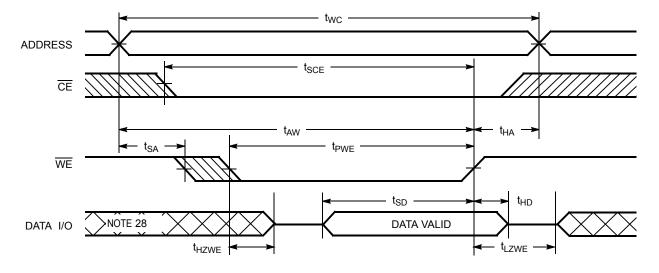


Figure 8. Write Cycle No. 3 (WE Controlled, OE LOW) [24, 27]



Note<u>s</u>

Notes

24. CE is the logical combination of CE₁ and CE₂. When CE₁ is LOW and CE₂ is HIGH, CE is LOW; when CE₁ is HIGH or CE₂ is HIGH.

25. The internal write time of the memory is defined by the overlap of WE, CE₁ = V_{IL}, and CE₂ = V_{IH}. 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 must be referenced to the edge of the signal that terminates the write.

26. Data I/O is high impedance if OE = V_{IH}.

27. If CE₁ goes HIGH or CE₂ goes LOW simultaneously with 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.



Truth Table

CE ₁	CE ₂	WE	OE	Inputs/Outputs	Mode	Power
Н	X ^[29]	X	X	High Z	Deselect/Power-down	Standby (I _{SB})
X ^[29]	L	Х	Χ	High Z	Deselect/Power-down	Standby (I _{SB})
L	Н	Н	L	Data out	Read	Active (I _{CC})
L	Н	Н	Н	High Z	Output disabled	Active (I _{CC})
L	Н	L	Χ	Data in	Write	Active (I _{CC})

Note
29. The 'X' (Don't care) state for the Chip enables ($\overline{\text{CE}}_1$ and $\overline{\text{CE}}_2$) in the truth table refer to the logic state (either HIGH or LOW). Intermediate voltage levels on these pins is not permitted.

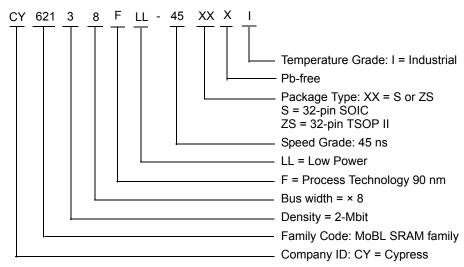


Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62138FLL-45SXI	51-85081	32-pin Small Outline Integrated Circuit (Pb-free)	Industrial
	CY62138FLL-45ZSXI	51-85095	32-pin Thin Small Outline Package II (Pb-free)	

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

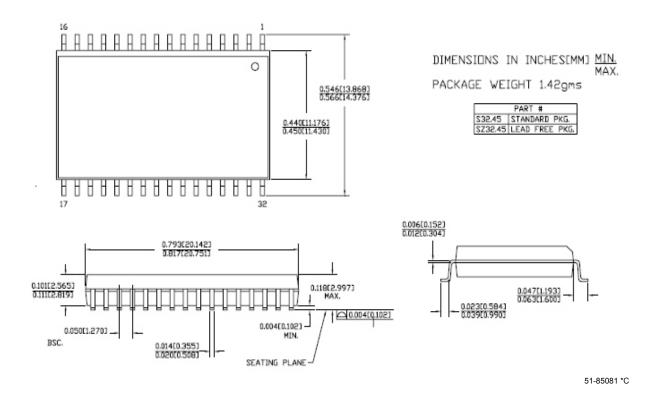
Ordering Code Definitions





Package Diagrams

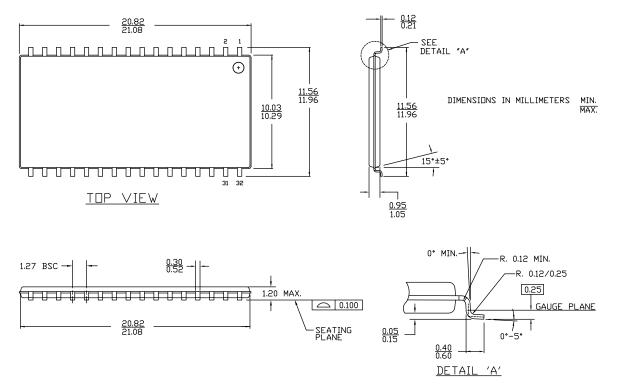
Figure 9. 32-pin (450 Mil) Molded SOIC, 51-85081





Package Diagrams (continued)

Figure 10. 32-pin TSOP II (20.95 × 11.76 × 1.0 mm) ZS32, 51-85095



51-85095 *B

Acronyms

Acronym	Description			
CMOS	complementary metal oxide semiconductor			
I/O	input/output			
OE	output enable			
SOIC	small outline integrated circuit			
SRAM	static random access memory			
TSOP	thin small outline package			
WE	write enable			

Documents Conventions

Units of Measure

Symbol	Unit of Measure		
°C	degree Celsius		
MHz	Mega Hertz		
μΑ	micro Amperes		
μS	micro seconds		
mA	milli Amperes		
ns	nano seconds		
Ω	ohms		
%	percent		
pF	pico Farads		
V	Volts		
W	Watts		



Document History Page

Document Title: CY62138F MoBL [®] , 2-Mbit (256 K × 8) Static RAM Document Number: 001-13194						
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change		
**	797956	See ECN	VKN	New Data Sheet		
*A	940341	See ECN	VKN	Added footnote #7 related to I _{SB2} and I _{CCDR}		
*B	3055174	13/10/2010	RAME	Updated As per new template Added Acronyms and Units of Measure table. Added Ordering Code Definitions. Footnotes updated Updated Package Diagram Figure 9 and Figure 10.		
*C	3061313	15/10/2010	RAME	Minor change: Corrected "IO" to "I/O"		
*D	3232735	04/18/2011	RAME	Removed the Note "For best practice recommendations, refer to the Cypress application note "System Design Guidelines" at http://www.cypress.com " in page 1.		
*E	3287636	06/20/2011	RAME	Updated Package Diagrams. Updated in new template.		



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