

Contents

Pin Configuration	3	Ordering Information	12
Product Portfolio	3	Ordering Code Definitions	12
Maximum Ratings	4	Package Diagrams	13
Operating Range	4	Acronyms	16
Electrical Characteristics	4	Document Conventions	16
Capacitance	5	Units of Measure	16
Thermal Resistance	5	Document History Page	17
AC Test Loads and Waveforms	5	Sales, Solutions, and Legal Information	20
Data Retention Characteristics	6	Worldwide Sales and Design Support	20
Data Retention Waveform	6	Products	20
Switching Characteristics	7	PSoC® Solutions	20
Switching Waveforms	8	Cypress Developer Community	20
Truth Table	11	Technical Support	20

Pin Configuration

Figure 1. 32-pin STSOP pinout ^[1]

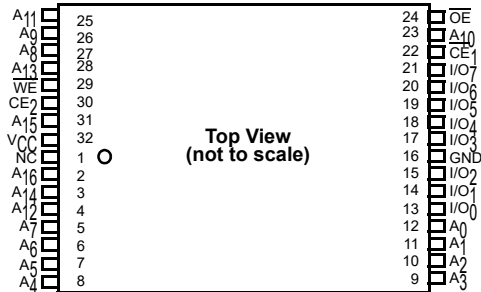


Figure 2. 32-pin TSOP I pinout ^[1]

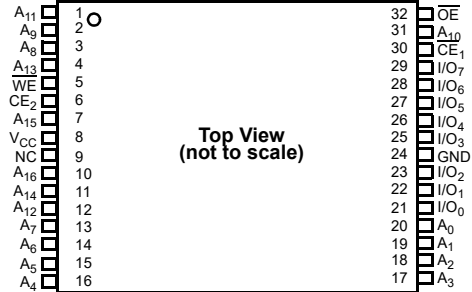
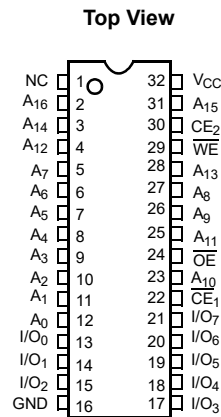


Figure 3. 32-pin SOIC pinout ^[1]



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	Industrial	2.2	3.0	3.6	45	1.3	2.0	11	16	1	4

Notes

- 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_{CC} = V_{CC(typ)}, T_A = 25 °C.

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	Industrial	-40 °C to +85 °C	2.2 V to 3.6 V

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	45 ns (Industrial)			Unit
			Min	Typ ^[6]	Max	
V_{OH}	Output HIGH voltage	$I_{OH} = -0.1$ mA	2.0	—	—	V
		$I_{OH} = -1.0$ mA, $V_{CC} \geq 2.70$ V	2.4	—	—	V
V_{OL}	Output LOW voltage	$I_{OL} = 0.1$ mA	—	—	0.4	V
		$I_{OL} = 2.1$ mA, $V_{CC} \geq 2.70$ V	—	—	0.4	V
V_{IH}	Input HIGH voltage	$V_{CC} = 2.2$ V to 2.7 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	V
V_{IL}	Input LOW voltage	$V_{CC} = 2.2$ V to 2.7 V	-0.3	—	0.6	V
		$V_{CC} = 2.7$ V to 3.6 V	-0.3	—	0.8	V
I_{IX}	Input leakage current	$GND \leq V_I \leq V_{CC}$	-1	—	+1	μA
I_{OZ}	Output leakage current	$GND \leq V_O \leq V_{CC}$, output disabled	-1	—	+1	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	mA
		$f = 1$ MHz	—	1.3	2.0	mA
$I_{SB1}^{[7]}$	Automatic CE power-down current – CMOS inputs	$\overline{CE}_1 \geq V_{CC} - 0.2$ V, $CE_2 < 0.2$ V $V_{IN} \geq V_{CC} - 0.2$ V, $V_{IN} \leq 0.2$ V $f = f_{max}$ (address and data only), $f = 0$ ($\overline{OE}$ and $\overline{WE}$), $V_{CC} = 3.60$ V	—	1	4	μA
$I_{SB2}^{[7]}$	Automatic CE power-down current – CMOS inputs	$\overline{CE}_1 \geq V_{CC} - 0.2$ V, $CE_2 < 0.2$ V $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} < 0.2$ V, $f = 0$, $V_{CC} = 3.60$ V	—	1	4	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 (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

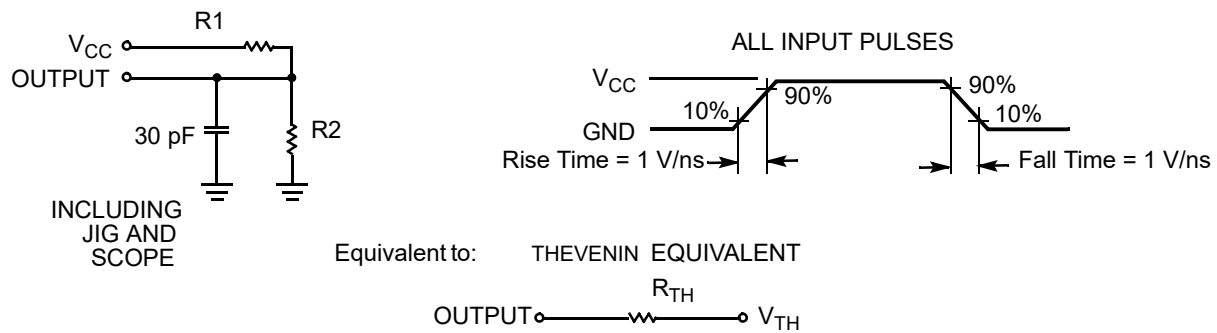
Parameter ^[8]	Description	Test Conditions	Max	Unit
C_{IN}	Input capacitance	$T_A = 25\text{ }^{\circ}\text{C}$, $f = 1\text{ MHz}$, $V_{CC} = V_{CC(typ)}$	10	pF
C_{OUT}	Output capacitance		10	pF

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, four-layer printed circuit board	56.90	79.34	69.47	$^{\circ}\text{C/W}$
Θ_{JC}	Thermal resistance (junction to case)		14.81	18.49	13.39	$^{\circ}\text{C/W}$

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.

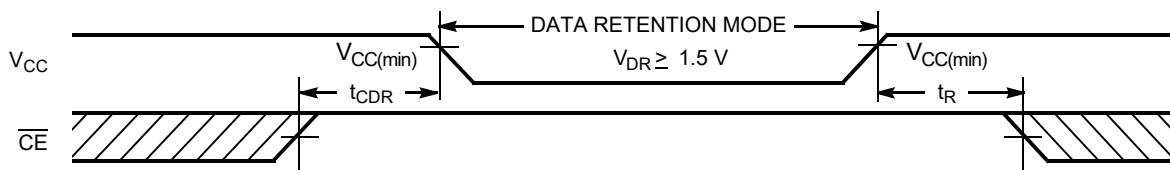
Data Retention Characteristics

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	$V_{CC} = 1.5\text{ V}$, $CE_1 \geq V_{CC} - 0.2\text{ V}$ or $CE_2 \leq 0.2\text{ V}$, $V_{IN} \geq V_{CC} - 0.2\text{ V}$ or $V_{IN} \leq 0.2\text{ V}$	–	–	3	μA
$t_{CDR}^{[11]}$	Chip deselect to data retention time		0	–	–	ns
$t_R^{[12]}$	Operation recovery time		45	–	–	ns

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 $V_{CC} = V_{CC(typ)}$, $T_A = 25^\circ\text{C}$.

10. Chip enables (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 $V_{CC(min)} \geq 100\text{ }\mu\text{s}$ or stable at $V_{CC(min)} \geq 100\text{ }\mu\text{s}$.

13. $\overline{CE}$ is the logical combination of CE_1 and CE_2 . When CE_1 is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW; when 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 (Industrial)		Unit
		Min	Max	
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}	$\overline{CE}$ LOW to data valid	–	45	ns
t _{DOE}	$\overline{OE}$ LOW to data valid	–	22	ns
t _{LZOE}	$\overline{OE}$ LOW to low Z ^[16]	5	–	ns
t _{HZOE}	$\overline{OE}$ HIGH to high Z ^[16, 17]	–	18	ns
t _{LZCE}	$\overline{CE}$ LOW to low Z ^[16]	10	–	ns
t _{HZCE}	$\overline{CE}$ HIGH to high Z ^[16, 17]	–	18	ns
t _{PU}	$\overline{CE}$ LOW to power-up	0	–	ns
t _{PD}	$\overline{CE}$ HIGH to power-down	–	45	ns
Write Cycle ^[18, 19]				
t _{WC}	Write cycle time	45	–	ns
t _{SCE}	$\overline{CE}$ LOW 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 ^[16, 17]	–	18	ns
t _{LZWE}	$\overline{WE}$ HIGH to low Z ^[16]	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 5](#).
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 sum of t_{HZWE} and t_{SD} .

Switching Waveforms

Figure 6. Read Cycle 1 (Address Transition Controlled) [21, 22]

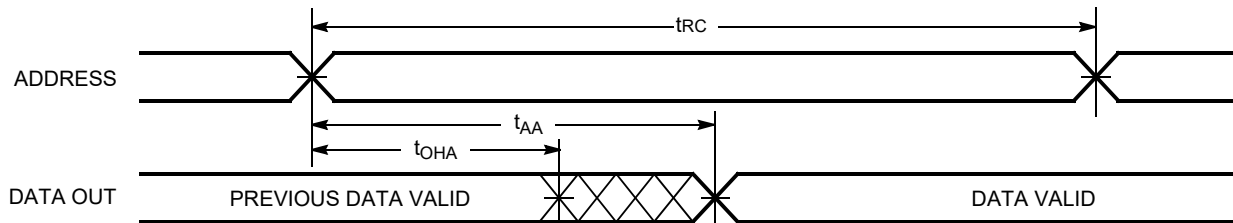
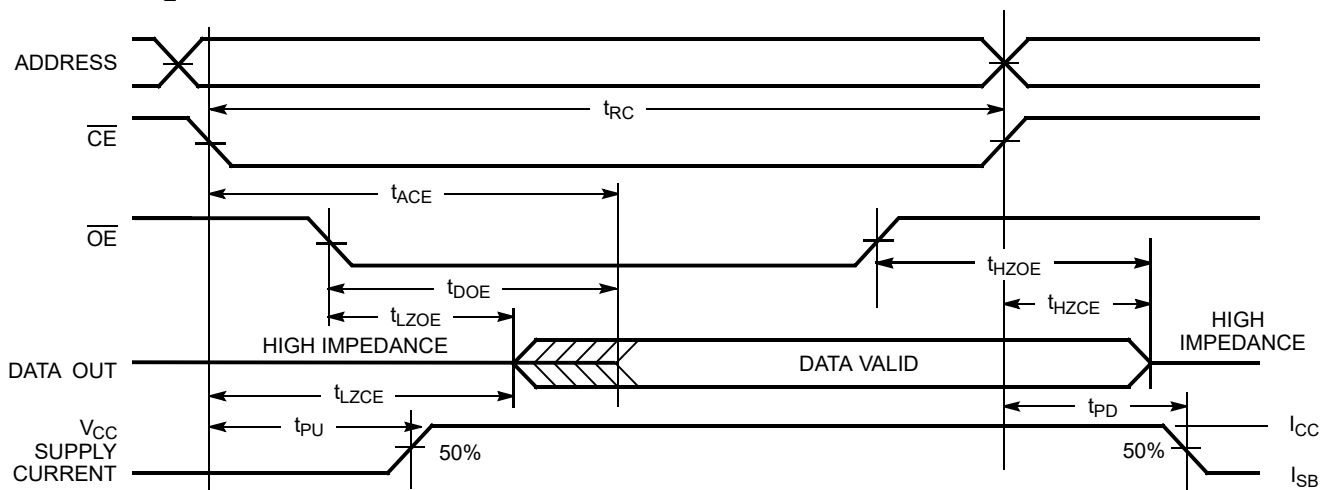


Figure 7. Read Cycle No. 2 ($\overline{\text{OE}}$ Controlled) [22, 23, 24]



Notes

20. The internal write time of the memory is defined by the overlap of $\overline{\text{WE}}$, $\overline{\text{CE}} = \text{V}_{\text{IL}}$. 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.
21. The device is continuously selected. OE , $\text{CE}_1 = \text{V}_{\text{IL}}$, $\text{CE}_2 = \text{V}_{\text{IH}}$.
22. $\overline{\text{WE}}$ is HIGH for read cycle.
23. $\overline{\text{CE}}$ is the logical combination of $\overline{\text{CE}}_1$ and CE_2 . When $\overline{\text{CE}}_1$ is LOW and CE_2 is HIGH, $\overline{\text{CE}}$ is LOW; when $\overline{\text{CE}}_1$ is HIGH or CE_2 is LOW, $\overline{\text{CE}}$ is HIGH.
24. Address valid before or similar to CE_1 transition LOW and CE_2 transition HIGH.

Switching Waveforms (continued)

Figure 8. Write Cycle No. 1 ($\overline{WE}$ Controlled) [25, 26, 27, 28]

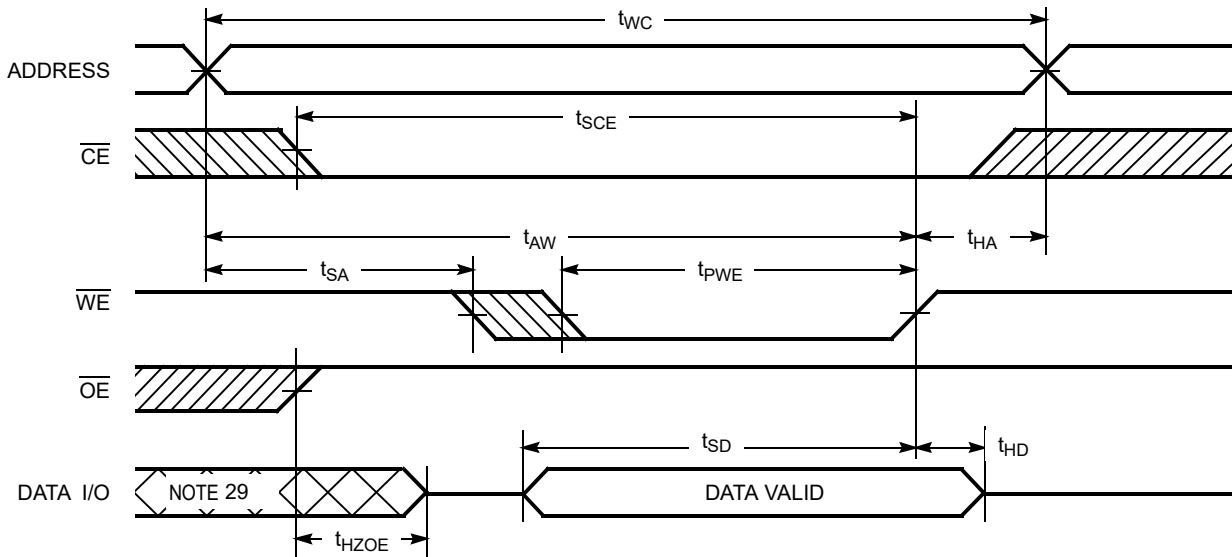
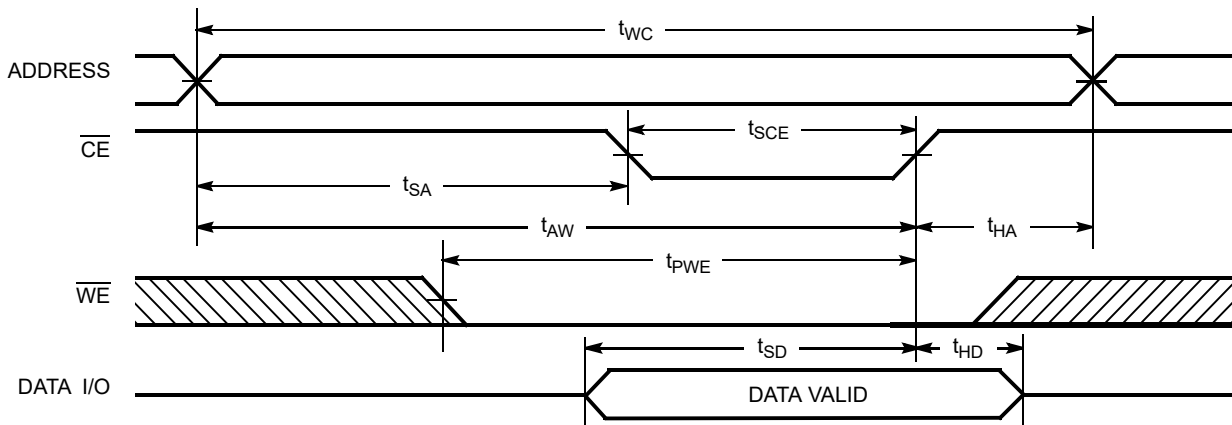


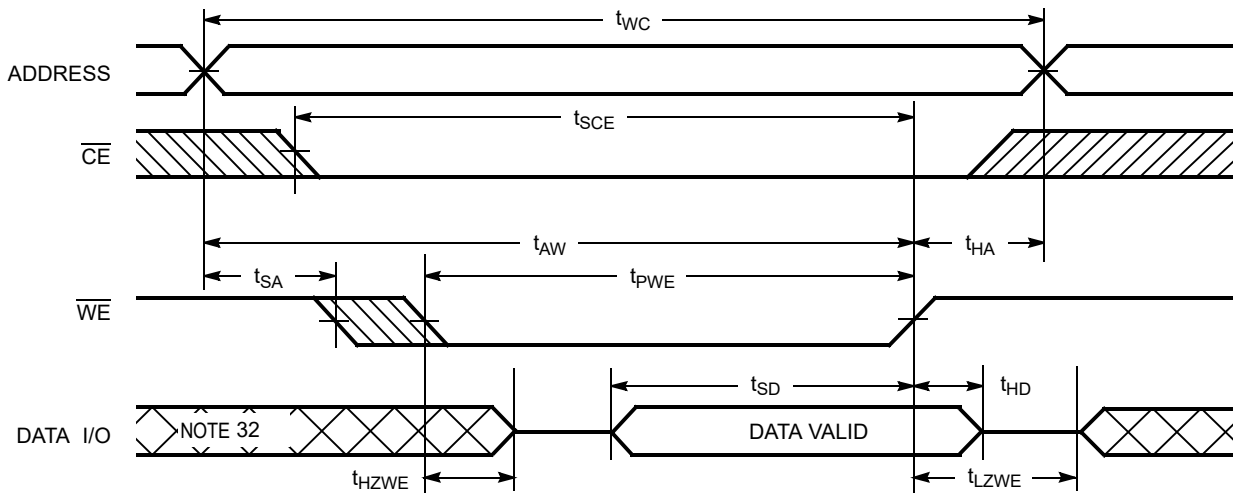
Figure 9. Write Cycle No. 2 ($\overline{CE}_1$ or $\overline{CE}_2$ Controlled) [25, 26, 27, 28]



Notes

25. 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.
26. $\overline{CE}$ is the logical combination of $\overline{CE}_1$ and $\overline{CE}_2$. When $\overline{CE}_1$ is LOW and $\overline{CE}_2$ is HIGH, $\overline{CE}$ is LOW; when $\overline{CE}_1$ is HIGH or $\overline{CE}_2$ is LOW, $\overline{CE}$ is HIGH.
27. Data I/O is high impedance if $\overline{OE} = V_{IH}$.
28. If $\overline{CE}_1$ goes HIGH or $\overline{CE}_2$ goes LOW simultaneously with $\overline{WE}$ HIGH, the output remains in high impedance state.
29. During this period, the I/Os are in output state. Do not apply input signals.

Switching Waveforms (continued)

Figure 10. Write Cycle No. 3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW) [30, 31, 33]

Notes

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

31. If $\overline{\text{CE}}_1$ goes HIGH or CE_2 goes LOW simultaneously with $\overline{\text{WE}}$ HIGH, the output remains in high impedance state.

32. During this period, the I/Os are in output state. Do not apply input signals.

33. The minimum write pulse width for WRITE Cycle No.3 ($\overline{\text{WE}}$ Controlled, $\overline{\text{OE}}$ LOW) should be sum of t_{HZWE} and t_{SD} .

Truth Table

$\overline{CE}_1$	CE_2	$\overline{WE}$	$\overline{OE}$	Inputs/Outputs	Mode	Power
H	X ^[34]	X	X	High Z	Deselect/power-down	Standby (I_{SB})
X ^[34]	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

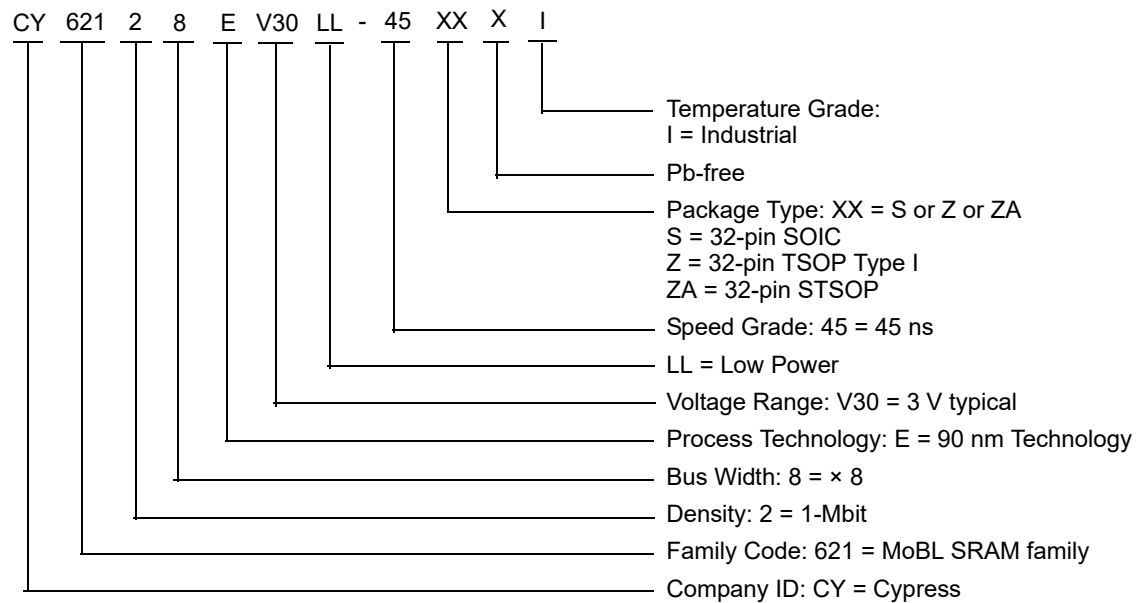
34. The 'X' (Don't care) state for the Chip enables in the truth table refer to the logic state (either HIGH or LOW). Intermediate voltage levels on these pins is not permitted.

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
45	CY62128EV30LL-45SXI	51-85081	32-pin 450-Mil SOIC (Pb-free)	Industrial
	CY62128EV30LL-45ZXI	51-85056	32-pin TSOP Type I (Pb-free)	
	CY62128EV30LL-45ZAXI	51-85094	32-pin STSOP (Pb-free)	

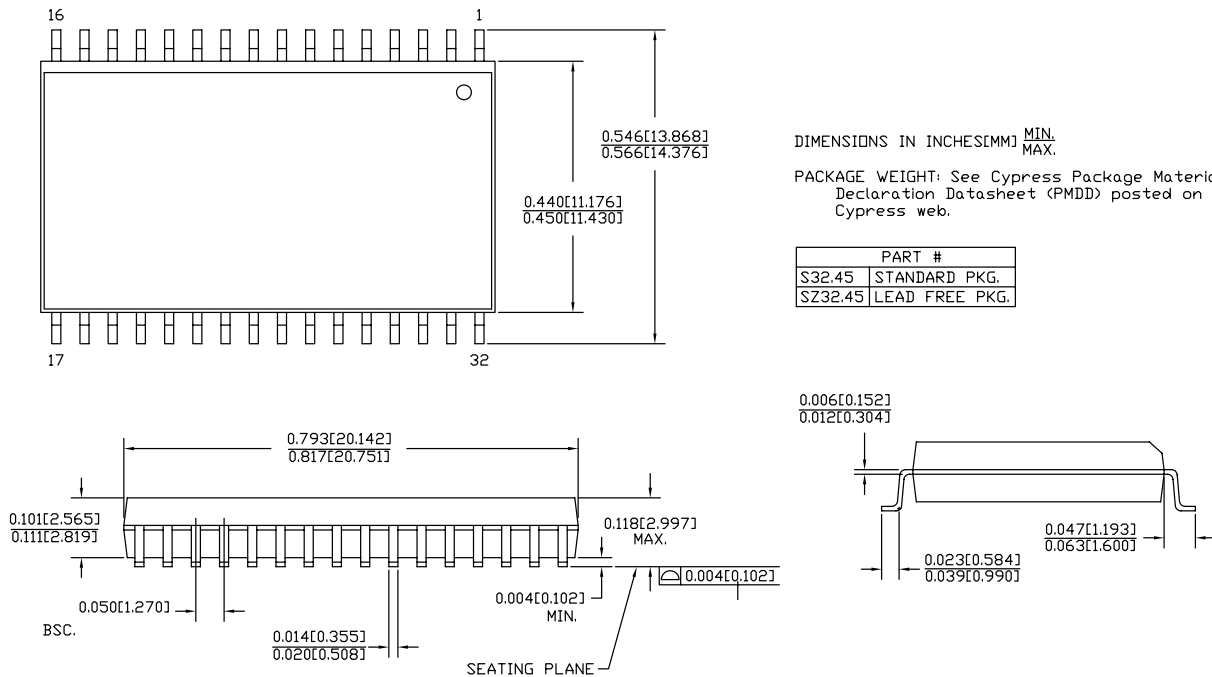
Contact your local Cypress sales representative for availability of these parts.

Ordering Code Definitions



Package Diagrams

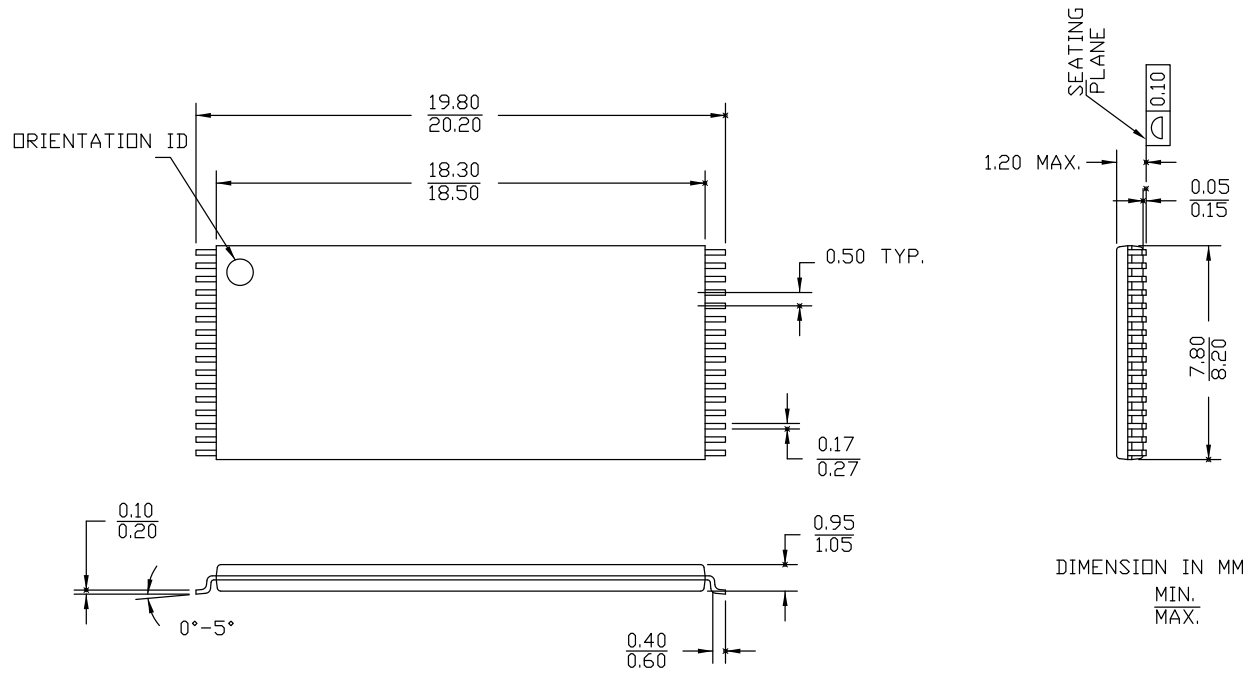
Figure 11. 32-pin Molded SOIC (450 Mils) Package Outline, 51-85081



51-85081 *E

Package Diagrams (continued)

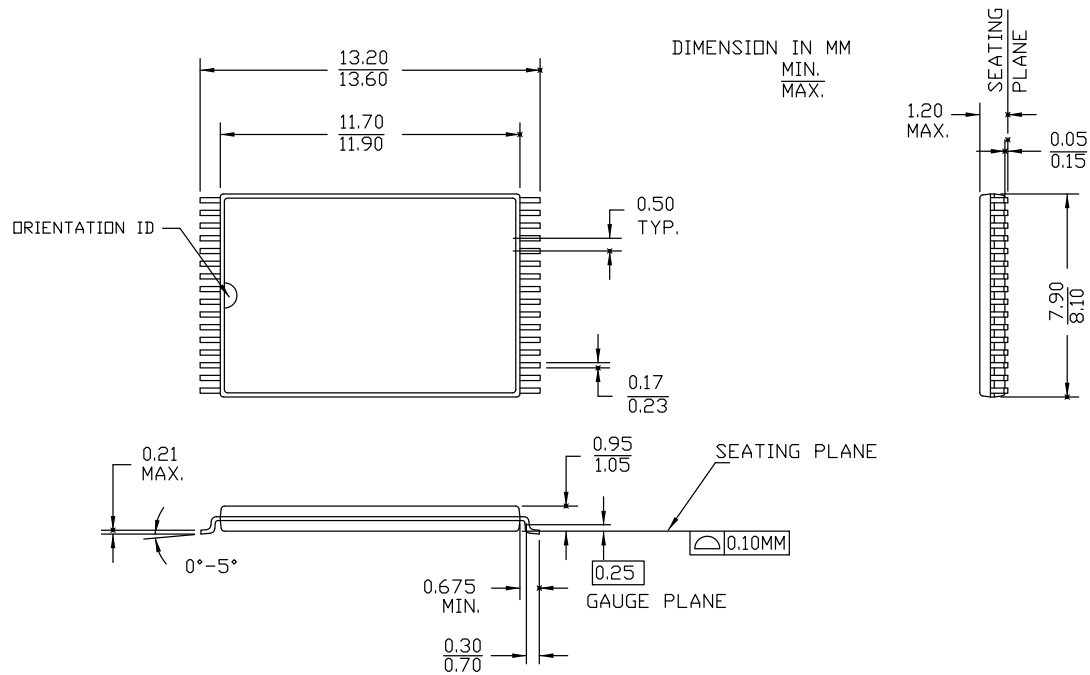
Figure 12. 32-pin TSOP I (8 × 20 × 1.0 mm) Package Outline, 51-85056



51-85056 *G

Package Diagrams (continued)

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



51-85094 *G

Acronyms

Acronym	Description
BHE	Byte High Enable
BLE	Byte Low Enable
CE	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
I/O	Input/Output
OE	Output Enable
SOIC	Small Outline Integrated Circuit
SRAM	Static Random Access Memory
STSOP	Shrunk Thin Small Outline Package
TSOP	Thin Small Outline Package
WE	Write Enable

Document Conventions

Units of Measure

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

Document History Page

Document Title: CY62128EV30 MoBL®, 1-Mbit (128K × 8) Static RAM
Document Number: 38-05579

Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	285473	PCI	11/03/2004	New data sheet.
*A	461631	NXR	05/12/2006	Changed status from Preliminary to Final. Removed 35 ns speed bin related information in all instances across the document. Removed "L" version (of CY62128EV30 part) related information in all instances across the document. Removed Reverse TSOP I Package related information in all instances across the document. Updated Electrical Characteristics: Changed typical value of I_{CC} parameter from 8 mA to 11 mA corresponding to Test Condition "f = f_{max}". Changed maximum value of I_{CC} parameter from 12 mA to 16 mA corresponding to Test Condition "f = f_{max}". Changed maximum value of I_{CC} parameter from 1.5 mA to 2.0 mA corresponding to Test Condition "f = 1 MHz". Changed typical value of I_{SB2} parameter from 0.5 μA to 1 μA. Changed maximum value of I_{SB2} parameter from 1 μA to 4 μA. Updated AC Test Loads and Waveforms: Updated Figure 4: Changed value of AC Test load Capacitance from 50 pF to 30 pF. Updated Data Retention Characteristics: Changed maximum value of I_{CCDR} parameter from 1 μA to 3 μA corresponding to Test Condition "LL". Updated Switching Characteristics: Changed minimum value of t_{LZOE} parameter from 3 ns to 5 ns corresponding to 45 ns speed bin. Changed minimum value of t_{LZCE} parameter from 6 ns to 10 ns corresponding to 45 ns speed bin. Changed maximum value of t_{HZCE} parameter from 22 ns to 18 ns corresponding to 45 ns speed bin. Changed minimum value of t_{PWE} parameter from 30 ns to 35 ns corresponding to 45 ns speed bin. Changed minimum value of t_{SD} parameter from 22 ns to 25 ns corresponding to 45 ns speed bin. Changed minimum value of t_{LZWE} parameter from 6 ns to 10 ns corresponding to 45 ns speed bin. Updated Ordering Information: Updated part numbers. Updated Package Diagrams: Removed spec 51-85089 *C. Updated to new template.
*B	464721	NXR	05/25/2006	Updated Logic Block Diagram .
*C	1024520	VKN	05/07/2007	Added Automotive-A and Automotive-E Temperature Range related information in all instances across the document. Updated Electrical Characteristics: Added Note 7 and referred the same note in I_{SB2} parameter. Updated Data Retention Characteristics: Added Note 10 and referred the same note in I_{CCDR} parameter. Updated Ordering Information: Updated part numbers.

Document History Page (continued)

Document Title: CY62128EV30 MoBL®, 1-Mbit (128K × 8) Static RAM Document Number: 38-05579				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
*D	2257446	NXR	03/27/2008	Updated Maximum Ratings : Changed the Maximum rating of "Ambient Temperature with Power Applied" from "55 °C to +125 °C" to "–55 °C to +125 °C". Updated to new template.
*E	2702841	VKN / PYRS	05/06/2009	Updated Switching Characteristics : Updated description of t_{PD} parameter. Updated Ordering Information : Updated part numbers.
*F	2781490	VKN	10/08/2009	Updated Ordering Information : Updated part numbers.
*G	2934428	VKN	06/03/2010	Updated Truth Table : Added Note 34 and referred the same note in "X" in " $\overline{CE}_1$ " and " CE_2 " columns. Updated Package Diagrams : spec 51-85081 – Changed revision from *B to *C. spec 51-85056 – Changed revision from *D to *E. spec 51-85094 – Changed revision from *D to *E. Updated to new template. Completing Sunset Review.
*H	3026548	AJU	09/12/2010	Updated Pin Configuration : Updated Figure 1 . Updated Figure 2 . Updated Figure 3 . Updated Ordering Information : No change in part numbers. Added Ordering Code Definitions . Added Acronyms and Units of Measure . Minor edits.
*I	3115909	RAME	01/06/2011	Separated Automotive and Industrial parts from this data sheet. Removed Automotive related information in all instances across the document.
*J	3292906	AJU	06/25/2011	Updated Functional Description : 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. Updated Package Diagrams : spec 51-85056 – Changed revision from *E to *F. spec 51-85094 – Changed revision from *E to *F. Updated to new template. Completing Sunset Review.
*K	4499499	MEMJ	09/11/2014	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 *C to *E. spec 51-85056 – Changed revision from *F to *G. spec 51-85094 – Changed revision from *F to *G. Updated to new template. Completing Sunset Review.

Document History Page (continued)

Document Title: CY62128EV30 MoBL®, 1-Mbit (128K × 8) Static RAM Document Number: 38-05579				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
*L	4581542	VINI	11/27/2014	Updated Functional Description : Added "For a complete list of related resources, click here ." at the end. Updated Maximum Ratings : Referred Notes 3, 4 in "Supply voltage to ground potential".
*M	4920942	VINI	09/15/2015	Updated to new template. Completing Sunset Review.
*N	5445076	VINI	09/22/2016	Updated Thermal Resistance : Replaced "two-layer" with "four-layer" in "Test Conditions" column. Updated all values of Θ_{JA} and Θ_{JC} parameters. Updated to new template. Completing Sunset Review.
*O	5975600	AESATMP9	11/24/2017	Updated Cypress Logo and Copyright.
*P	6526489	VINI	03/29/2019	Updated to new template.

Sales, Solutions, and Legal Information

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at [Cypress Locations](#).

Products

Arm [®] Cortex [®] Microcontrollers	cypress.com/arm
Automotive	cypress.com/automotive
Clocks & Buffers	cypress.com/clocks
Interface	cypress.com/interface
Internet of Things	cypress.com/iot
Memory	cypress.com/memory
Microcontrollers	cypress.com/mcu
PSoC	cypress.com/psoc
Power Management ICs	cypress.com/pmic
Touch Sensing	cypress.com/touch
USB Controllers	cypress.com/usb
Wireless Connectivity	cypress.com/wireless

PSoC[®] Solutions

[PSoC 1](#) | [PSoC 3](#) | [PSoC 4](#) | [PSoC 5LP](#) | [PSoC 6 MCU](#)

Cypress Developer Community

[Community](#) | [Projects](#) | [Video](#) | [Blogs](#) | [Training](#) | [Components](#)

Technical Support

cypress.com/support

© Cypress Semiconductor Corporation, 2004–2019. This document is the property of Cypress Semiconductor Corporation and its subsidiaries ("Cypress"). This document, including any software or firmware included or referenced in this document ("Software"), is owned by Cypress under the intellectual property laws and treaties of the United States and other countries worldwide. Cypress reserves all rights under such laws and treaties and does not, except as specifically stated in this paragraph, grant any license under its patents, copyrights, trademarks, or other intellectual property rights. If the Software is not accompanied by a license agreement and you do not otherwise have a written agreement with Cypress governing the use of the Software, then Cypress hereby grants you a personal, non-exclusive, nontransferable license (without the right to sublicense) (1) under its copyright rights in the Software (a) for Software provided in source code form, to modify and reproduce the Software solely for use with Cypress hardware products, only internally within your organization, and (b) to distribute the Software in binary code form externally to end users (either directly or indirectly through resellers and distributors), solely for use on Cypress hardware product units, and (2) under those claims of Cypress's patents that are infringed by the Software (as provided by Cypress, unmodified) to make, use, distribute, and import the Software solely for use with Cypress hardware products. Any other use, reproduction, modification, translation, or compilation of the Software is prohibited.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, CYPRESS MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS DOCUMENT OR ANY SOFTWARE OR ACCOMPANYING HARDWARE, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. No computing device can be absolutely secure. Therefore, despite security measures implemented in Cypress hardware or software products, Cypress shall have no liability arising out of any security breach, such as unauthorized access to or use of a Cypress product. CYPRESS DOES NOT REPRESENT, WARRANT, OR GUARANTEE THAT CYPRESS PRODUCTS, OR SYSTEMS CREATED USING CYPRESS PRODUCTS, WILL BE FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (collectively, "Security Breach"). Cypress disclaims any liability relating to any Security Breach, and you shall and hereby do release Cypress from any claim, damage, or other liability arising from any Security Breach. In addition, the products described in these materials may contain design defects or errors known as errata which may cause the product to deviate from published specifications. To the extent permitted by applicable law, Cypress reserves the right to make changes to this document without further notice. Cypress does not assume any liability arising out of the application or use of any product or circuit described in this document. Any information provided in this document, including any sample design information or programming code, is provided only for reference purposes. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. "High-Risk Device" means any device or system whose failure could cause personal injury, death, or property damage. Examples of High-Risk Devices are weapons, nuclear installations, surgical implants, and other medical devices. "Critical Component" means any component of a High-Risk Device whose failure to perform can be reasonably expected to cause, directly or indirectly, the failure of the High-Risk Device, or to affect its safety or effectiveness. Cypress is not liable, in whole or in part, and you shall and hereby do release Cypress from any claim, damage, or other liability arising from any use of a Cypress product as a Critical Component in a High-Risk Device. You shall indemnify and hold Cypress, its directors, officers, employees, agents, affiliates, distributors, and assigns harmless from and against all claims, costs, damages, and expenses, arising out of any claim, including claims for product liability, personal injury or death, or property damage arising from any use of a Cypress product as a Critical Component in a High-Risk Device. Cypress products are not intended or authorized for use as a Critical Component in any High-Risk Device except to the limited extent that (i) Cypress's published data sheet for the product explicitly states Cypress has qualified the product for use in a specific High-Risk Device, or (ii) Cypress has given you advance written authorization to use the product as a Critical Component in the specific High-Risk Device and you have signed a separate indemnification agreement.

Cypress, the Cypress logo, Spansion, the Spansion logo, and combinations thereof, WICED, PSoC, CapSense, EZ-USB, F-RAM, and Traveo are trademarks or registered trademarks of Cypress in the United States and other countries. For a more complete list of Cypress trademarks, visit cypress.com. Other names and brands may be claimed as property of their respective owners.