CY7C10212CV33

1-Mbit (64 K × 16) Static RAM

Features

- Temperature ranges
  - Automotive-E: –40 °C to 125 °C
- Pin and function compatible with CY7C10212CV33
- High speed
  - t_{AA} = 12 ns (Automotive-E)
- CMOS for optimum speed and power
- Low active power: 325 mW (max)
- Automatic power down when deselected
- Independent control of upper and lower bits
- Available in Pb-free 48-ball FBGA package

Functional Description

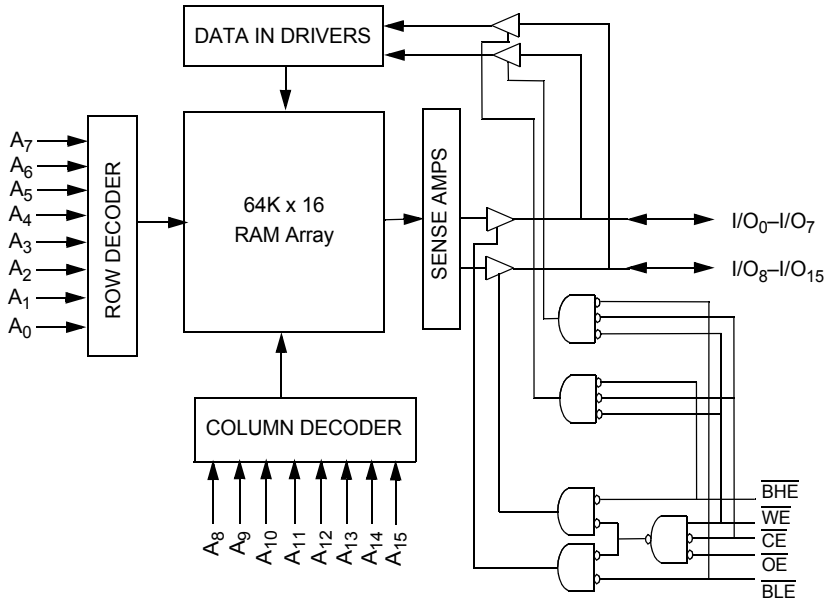
The CY7C10212CV33 is a high performance CMOS static RAM organized as 65,536 words by 16 bits. This device has an automatic power down feature that significantly reduces power consumption when deselected.

Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from I/O pins (I/O_0 through I/O_7), is written into the location specified on the address pins (A_0 through A_{15}). If Byte High Enable ($\overline{BHE}$) is LOW, then data from I/O pins (I/O_8 through I/O_{15}) is written into the location specified on the address pins (A_0 through A_{15}).

Reading from the device is accomplished by taking Chip Enable ($\overline{CE}$) and Output Enable ($\overline{OE}$) LOW while forcing the Write Enable ($\overline{WE}$) HIGH. If Byte Low Enable ($\overline{BLE}$) is LOW, then data from the memory location specified by the address pins appear on I/O_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory appears on I/O_8 to I/O_{15}. For more information, see the Truth Table on page 9 for a complete description of Read and Write modes.

The input and output pins (I/O_0 through I/O_{15}) are placed in a high impedance state when the device is deselected ($\overline{CE}$ HIGH), the outputs are disabled ($\overline{OE}$ HIGH), the $\overline{BHE}$ and $\overline{BLE}$ are disabled ($\overline{BHE}$, $\overline{BLE}$ HIGH), or during a write operation ($\overline{CE}$ LOW and $\overline{WE}$ LOW).

Logic Block Diagram



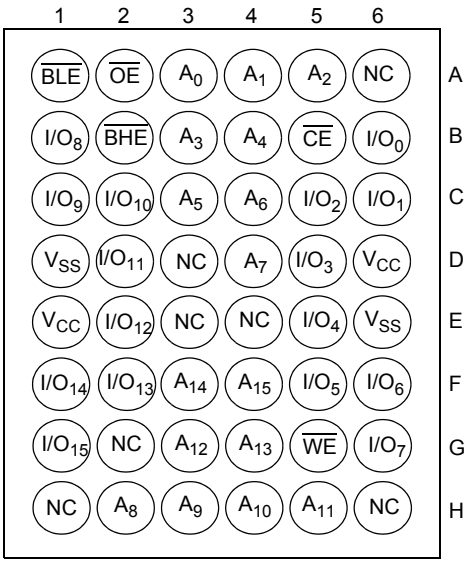
Contents

Selection Guide

Description	-12	Unit
Maximum Access Time	12	ns
Maximum Operating Current	90	mA
Maximum CMOS Standby Current	10	mA

Pin Configuration

Figure 1. 48-ball FBGA pinout [1]



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

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 on V_{CC} Relative to GND [2] .....–0.3 V to +4.6 V

DC Voltage Applied to Outputs in High Z State [2] ..... –0.3 V to V_{CC} + 0.3 V

DC Input Voltage [2] ..... –0.3 V to V_{CC} + 0.3 V

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

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

Latch Up Current ..... > 200 mA

Operating Range

Range	Ambient Temperature (T_A)	V_{CC}
Automotive-E	–40 °C to +125 °C	3.3 V ± 10%

Electrical Characteristics

Over the Operating Range

Parameter	Description	Test Conditions	-12		Unit
			Min	Max	
V_{OH}	Output HIGH Voltage	V_{CC} = Min, I_{OH} = –4.0 mA	2.4	–	V
V_{OL}	Output LOW Voltage	V_{CC} = Min, I_{OL} = 8.0 mA	–	0.4	V
V_{IH}	Input HIGH Voltage		2.0	V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage [2]		–0.3	0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}	–12	+12	µA
I/O_Z	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output disabled	–12	+12	µA
I_{CC}	V_{CC} Operating Supply Current	V_{CC} = Max, I_{OUT} = 0 mA, f = f_{MAX} = $1/t_{RC}$	–	90	mA
I_{SB1}	Automatic CE Power Down Current — TTL Inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{IH} V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	–	20	mA
I_{SB2}	Automatic CE Power Down Current — CMOS Inputs	Max V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3 V, V_{IN} ≥ V_{CC} – 0.3 V, or V_{IN} ≤ 0.3 V, f = 0	–	10	mA

Note

2. $V_{IL(min)}$ = –2.0 V and $V_{IH(max)}$ = V_{CC} + 0.5 V for pulse durations of less than 20 ns.

Capacitance

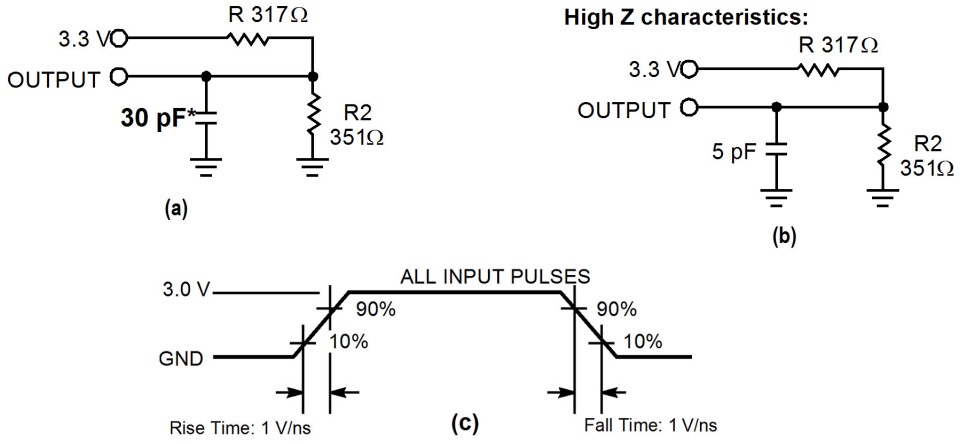
Parameter [3]	Description	Test Conditions	Max	Unit
C_{IN}	Input Capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 3.3 V	8	pF
C_{OUT}	Output Capacitance		8	pF

Thermal Resistance

Parameter [3]	Description	Test Conditions	48-ball FBGA	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA/JESD51	95.32	°C/W
Θ_{JC}	Thermal resistance (junction to case)		10.68	°C/W

AC Test Loads and Waveforms

Figure 2. AC Test Loads and Waveforms [4]



Notes
3. Tested initially and after any design or process changes that may affect these parameters.
4. Speed is tested using the Thevenin load shown in Figure 2 (a). High Z characteristics are tested using the test load shown in Figure 2 (b).

Switching Characteristics

Over the Operating Range

Parameter [5]	Description	-12		Unit
		Min	Max	
Read Cycle				
t_{power}[6]	V_{CC}(Typical) to the First Access	100	–	µs
t_{RC}	Read Cycle Time	12	–	ns
t_{AA}	Address to Data Valid	–	12	ns
t_{OHA}	Data Hold from Address Change	3	–	ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid	–	12	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid	–	6	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[7]	0	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[7, 8]	–	6	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[7]	3	–	ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[7, 8]	–	6	ns
t_{PU}[9]	$\overline{CE}$ LOW to Power Up	0	–	ns
t_{PD}[9]	$\overline{CE}$ HIGH to Power Down	–	12	ns
t_{DBE}	Byte Enable to Data Valid	–	6	ns
t_{LZBE}	Byte Enable to Low Z	0	–	ns
t_{HZBE}	Byte Disable to High Z	–	6	ns
Write Cycle[10]				
t_{WC}	Write Cycle Time	12	–	ns
t_{SCE}	$\overline{CE}$ LOW to Write End	9	–	ns
t_{AW}	Address Setup to Write End	9	–	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	8	–	ns
t_{SD}	Data Setup to Write End	6	–	ns
t_{HD}	Data Hold from Write End	0	–	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[7]	3	–	ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[7, 8]	–	6	ns
t_{BW}	Byte Enable to End of Write	8	–	ns

Notes

5. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5 V, and input pulse levels of 0 to 3.0 V.
6. t_{POWER} gives the minimum amount of time that the power supply is at typical V_{CC} values until the first memory access is performed.
7. At any 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.
8. t_{HZOE}, t_{HZBE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of Figure 2 on page 5. Transition is measured ±500 mV from steady state voltage.
9. This parameter is guaranteed by design and is not tested.
10. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW, $\overline{WE}$ LOW, and $\overline{BHE}$/$\overline{BLE}$ LOW. $\overline{CE}$, $\overline{WE}$, and $\overline{BHE}$/$\overline{BLE}$ is LOW to initiate a write. The transition of these signals terminate the write. The input data setup and hold timing is referenced to the leading edge of the signal that terminates the write.

Switching Waveforms

Figure 3. Read Cycle No. 1 (Address Transition Controlled) [11, 12]

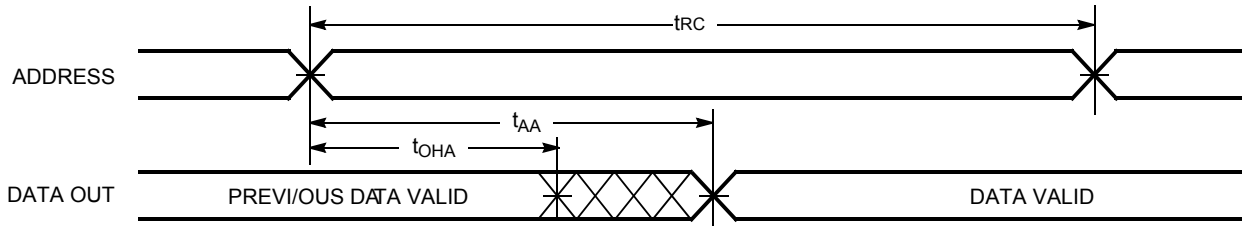
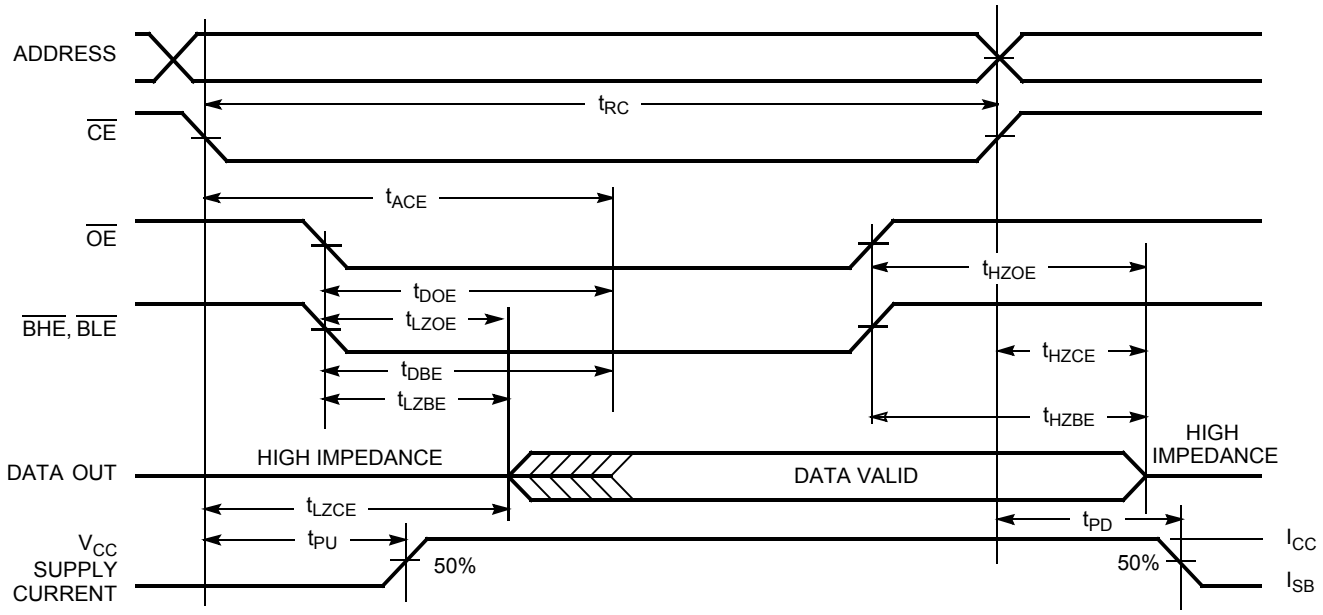


Figure 4. Read Cycle No. 2 ($\overline{OE}$ Controlled) [12, 13]



Notes
11. Device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{BHE}$, and/or $\overline{BLE}$ = V_{IL}.
12. $\overline{WE}$ is HIGH for read cycle.
13. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms *(continued)*

Figure 5. Write Cycle No. 1 ($\overline{CE}$ Controlled) [14, 15]

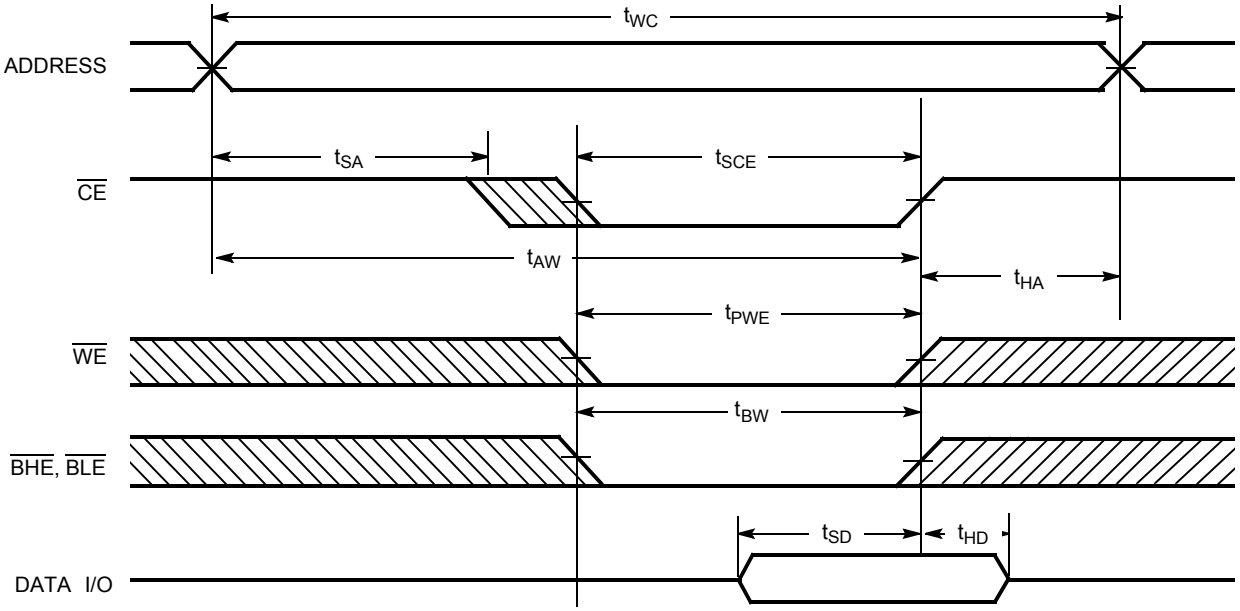
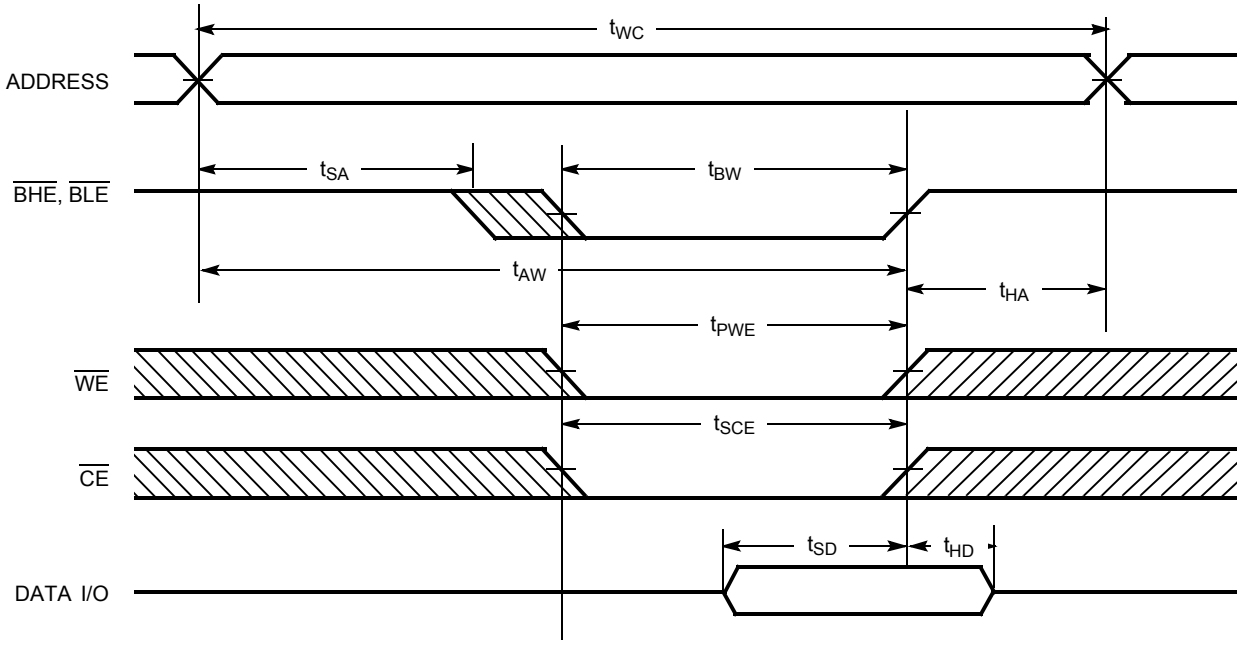


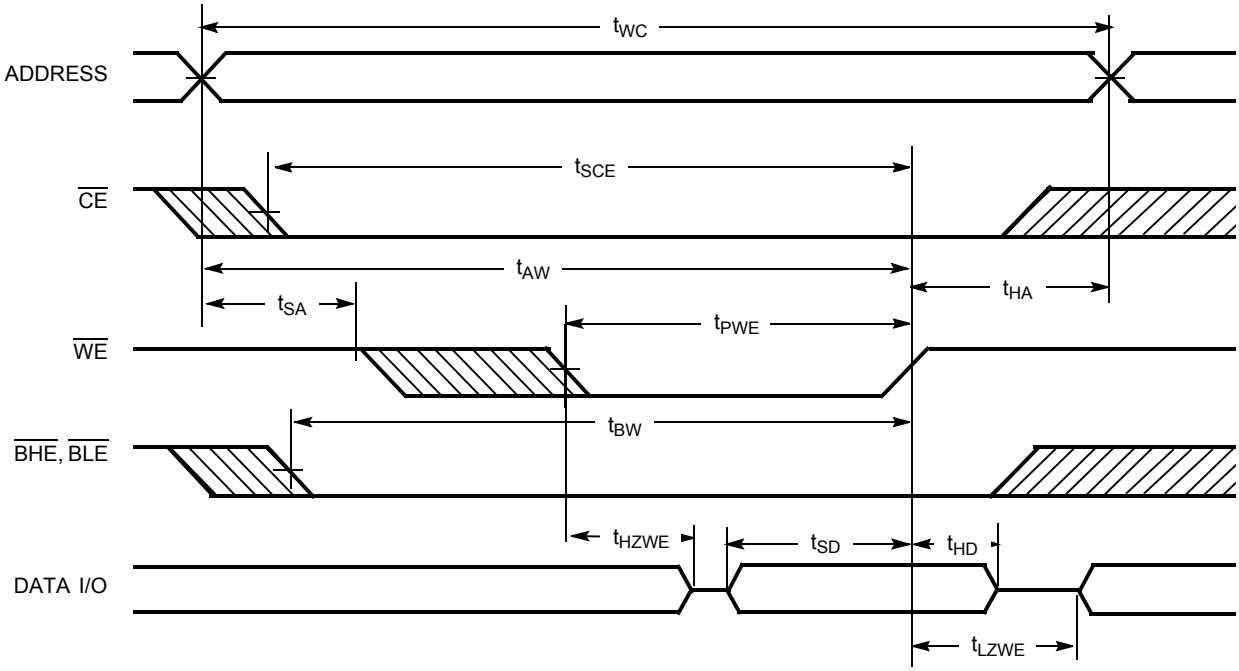
Figure 6. Write Cycle No. 2 ($\overline{BLE}$ or $\overline{BHE}$ Controlled)



Notes
14. Data I/O is high impedance if $\overline{OE}$, $\overline{BHE}$, and/or $\overline{BLE}$ = V_{IH}.
15. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high impedance state.

Switching Waveforms *(continued)*

Figure 7. Write Cycle No. 3 ($\overline{WE}$ Controlled, LOW)



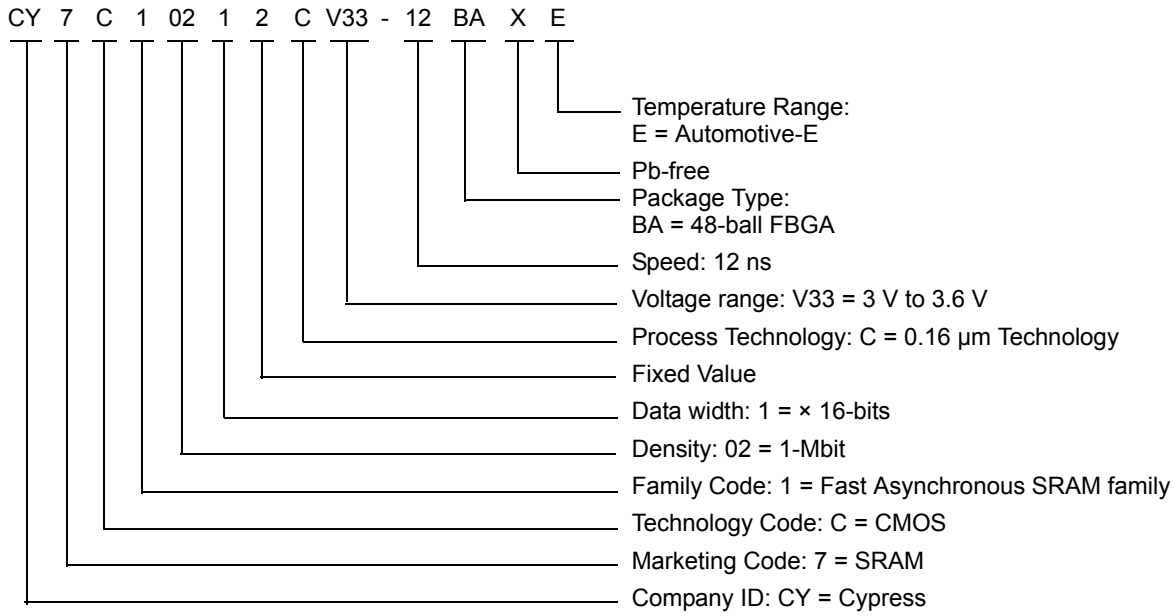
Truth Table

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$\overline{BLE}$	$\overline{BHE}$	$I/O_0 – I/O_7$	$I/O_8 – I/O_{15}$	Mode	Power
H	X	X	X	X	High Z	High Z	Power Down	Standby (I_{SB})
L	L	H	L	L	Data Out	Data Out	Read – All Bits	Active (I_{CC})
			L	H	Data Out	High Z	Read – Lower Bits Only	Active (I_{CC})
			H	L	High Z	Data Out	Read – Upper Bits Only	Active (I_{CC})
L	X	L	L	L	Data In	Data In	Write – All Bits	Active (I_{CC})
			L	H	Data In	High Z	Write – Lower Bits Only	Active (I_{CC})
			H	L	High Z	Data In	Write – Upper Bits Only	Active (I_{CC})
L	H	H	X	X	High Z	High Z	Selected, Outputs Disabled	Active (I_{CC})
L	X	X	H	H	High Z	High Z	Selected, Outputs Disabled	Active (I_{CC})

Ordering Information

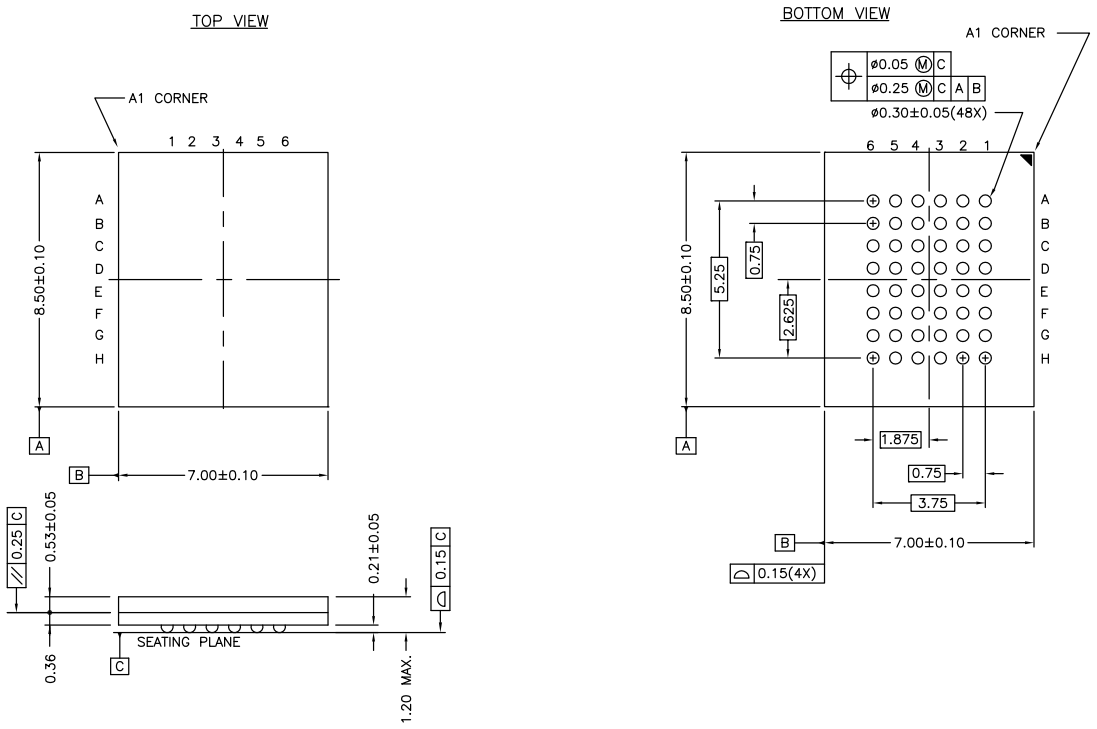
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
12	CY7C10212CV33-12BAXE	51-85106	48-ball FBGA (Pb-free)	Automotive-E

Ordering Code Definitions



Package Diagrams

Figure 8. 48-ball FBGA (7 × 8.5 × 1.2 mm) BA48A Package Outline, 51-85106



51-85106 *G

Acronyms

Acronym	Description
BGA	Ball Grid Array
$\overline{CE}$	Chip Enable
CMOS	Complementary Metal Oxide Semiconductor
FBGA	Fine-Pitch Ball Grid Array
I/O	Input/Output
$\overline{OE}$	Output Enable
SRAM	Static Random Access Memory
TQFP	Thin Quad Flat Pack
TTL	Transistor-Transistor Logic
$\overline{WE}$	Write Enable

Document Conventions

Units of Measure

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

Document History Page

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Rev.	**ECN No.**	**Submission Date**	**Orig. of Change**	**Description of Change**
**	3723052	10/29/2012	TAVA	New data sheet.
*A	4178071	10/30/2013	VINI	Updated in new template. Completing Sunset Review.

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