CY7C1089DV33

64-Mbit (8 M × 8) Static RAM

Features

- High speed
  - t_{AA} = 12 ns
- Low active power
  - I_{CC} = 300 mA at 12 ns
- Low complementary metal oxide semiconductor (CMOS) standby power
  - I_{SB2} = 100 mA
- Operating voltages of 3.3 ± 0.3 V
- 2.0-V data retention
- Automatic power-down when deselected
- Transistor-transistor logic (TTL)-compatible inputs and outputs
- Easy memory expansion with $\overline{CE}_1$ and CE_2 features
- Available in Pb-free 48-ball fine ball grid array (FBGA) package

Functional Description

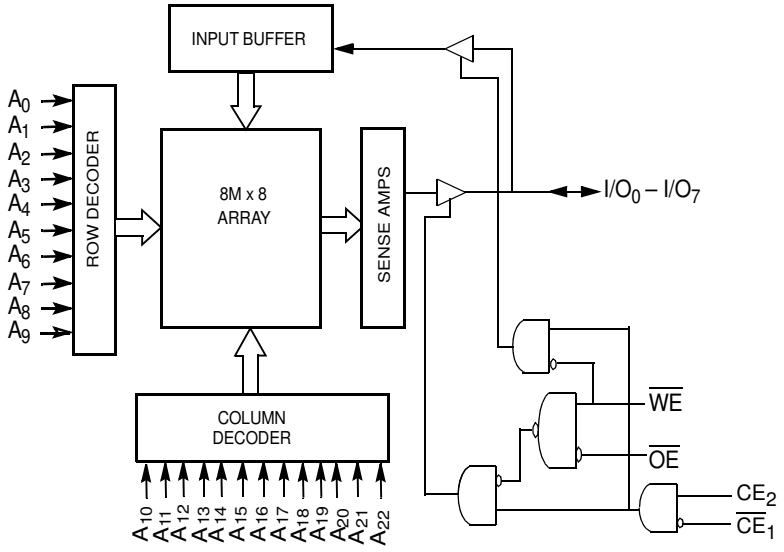
The CY7C1089DV33 is a high-performance CMOS static RAM organized as 8,388,608 words by 8 bits.

To write to the device, take Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) and Write Enable ($\overline{WE}$) input LOW. Data on the eight I/O pins (I/O_0 through I/O_7) is then written into the location specified on the address pins (A_0 through A_{22}).

To read from the device, take Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) LOW and Output Enable ($\overline{OE}$) LOW while forcing the 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. See 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_7) are placed in a high impedance state when the device is deselected ($\overline{CE}_1$ LOW or CE_2 HIGH), the outputs are disabled ($\overline{OE}$ HIGH), or during a write operation ($\overline{CE}_1$ LOW, CE_2 HIGH and $\overline{WE}$ LOW).

Logic Block Diagram



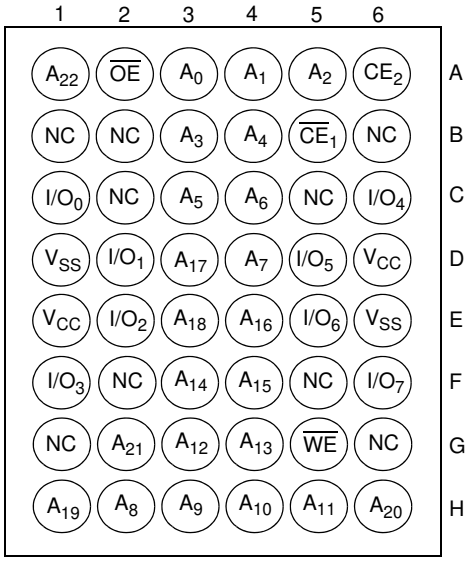
Selection Guide

Description	–12	Unit
Maximum access time	12	ns
Maximum operating current	300	mA
Maximum CMOS standby current	100	mA

Contents

Pin Configuration

Figure 1. 48-Ball FBGA (Top View) [1]



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

Maximum Ratings

Exceeding maximum ratings may shorten 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].....–0.5 V to +4.6 V

DC voltage applied to outputs in high-Z state[2]..... –0.5 V to V_{CC} + 0.5 V

DC input voltage[2]..... –0.5 V to V_{CC} + 0.5 V

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

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

Latch up current..... >140 mA

Operating Range

Range	Ambient Temperature	V_{CC}
Industrial	–40 °C to +85 °C	3.3V ± 0.3V

DC 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_{IN} ≤ V_{CC}	–1	+1	µA
I_{OZ}	Output leakage current	GND ≤ V_{OUT} ≤ V_{CC}, Output disabled	–1	+1	µA
I_{CC}	V_{CC} operating supply current	V_{CC} = Max, f = f_{MAX} = 1/t_{RC}, I_{OUT} = 0 mA CMOS levels	–	300	mA
I_{SB1}	Automatic CE power-down current — TTL inputs	Max V_{CC}, $\overline{CE}_1$ ≥ V_{IH}, CE_2 ≤ V_{IL}, V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}	–	120	mA
I_{SB2}	Automatic CE power-down current —CMOS inputs	Max V_{CC}, $\overline{CE}_1$ ≥ V_{CC} – 0.3V, CE_2 ≤ 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f = 0	–	100	mA

Capacitance

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

Parameter	Description	Test Conditions	FBGA	Unit
C_{IN}	Input capacitance	T_A = 25 °C, f = 1 MHz, V_{CC} = 3.3 V	32	pF
C_{OUT}	I/O capacitance		40	pF

Thermal Resistance

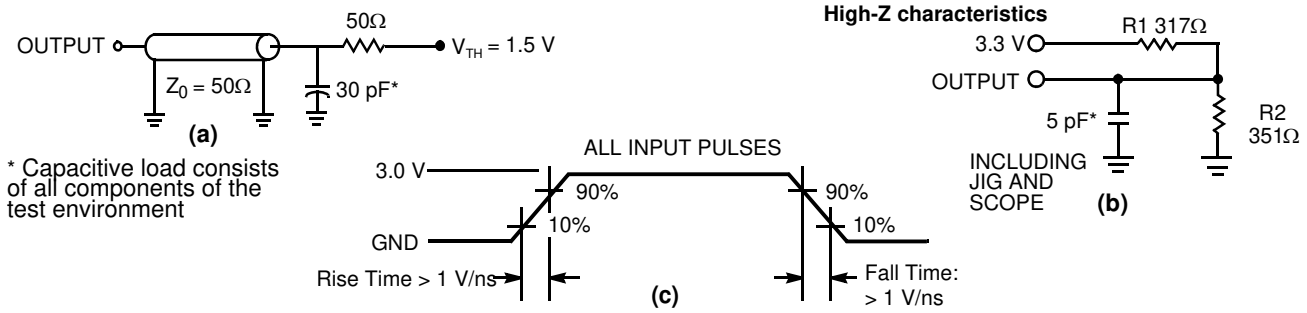
Tested initially and after any design or process changes that may affect these parameters.

Parameter	Description	Test Conditions	FBGA	Unit
Θ_{JA}	Thermal resistance (junction to ambient)	Still air, soldered on a 3 × 4.5 inch, four layer printed circuit board	55	°C/W
Θ_{JC}	Thermal resistance (junction to case)		23.04	°C/W

Note

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

Figure 2. AC Test Loads and Waveforms[3]

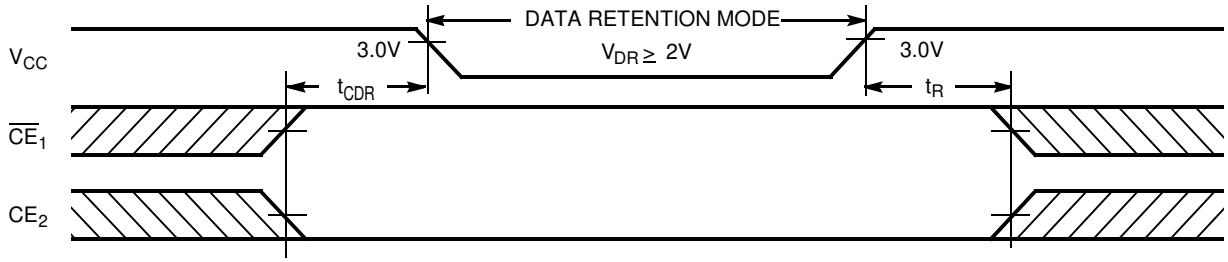


Data Retention Characteristics

Over the Operating Range

Parameter	Description	Conditions	Min	Typ	Max	Unit
V_{DR}	V_{CC} for data retention		2	–	–	V
I_{CCDR}	Data retention current	V_{CC} = 2 V, $\overline{CE}_1 \geq V_{CC} - 0.2$ V, $CE_2 \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V or $V_{IN} \leq 0.2$ V	–	–	100	mA
t_{CDR}[4]	Chip deselect to data retention time		0	–	–	ns
t_R[5]	Operation recovery time		12	–	–	ns

Figure 3. Data Retention Waveform



Notes
3. Valid SRAM operation does not occur until the power supplies have reached the minimum operating V_{DD} (3.0V). 100 µs (t_{power}) after reaching the minimum operating V_{DD}, normal SRAM operation begins including reduction in V_{DD} to the data retention (V_{CCDR}, 2.0V) voltage.
4. Tested initially and after any design or process changes that may affect these parameters.
5. Full device operation requires linear V_{CC} ramp from V_{DR} to $V_{CC(min.)} \geq 50$ µs or stable at $V_{CC(min.)} \geq 50$ µs.

AC Switching Characteristics

Over the Operating Range [6]

Parameter	Description	–12		Unit
		Min	Max	
Read Cycle				
t_{power}	V_{CC}(typical) to the first access[7]	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}	$\overline{CE}_1$ LOW and CE_2 HIGH to data valid	–	12	ns
t_{DOE}	$\overline{OE}$ LOW to data valid	–	7	ns
t_{LZOE}	$\overline{OE}$ LOW to low-Z	1	–	ns
t_{HZOE}	$\overline{OE}$ HIGH to high-Z [8]	–	7	ns
t_{LZCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to low-Z [8]	3	–	ns
t_{HZCE}	$\overline{CE}_1$ HIGH and CE_2 LOW to high-Z [8]	–	7	ns
t_{PU}	$\overline{CE}_1$ LOW and CE_2 HIGH to power-up [9]	0	–	ns
t_{PD}	$\overline{CE}_1$ HIGH and CE_2 LOW to power-down [9]	–	12	ns
Write Cycle [10, 11]				
t_{WC}	Write cycle time	12	–	ns
t_{SCE}	$\overline{CE}_1$ LOW and CE_2 HIGH 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	9	–	ns
t_{SD}	Data setup to write end	7	–	ns
t_{HD}	Data hold from write end	0	–	ns
t_{LZWE}	$\overline{WE}$ HIGH to low-Z[8]	3	–	ns
t_{HZWE}	$\overline{WE}$ LOW to high-Z[8]	–	7	ns

Notes

6. Test conditions assume signal transition time of 3 ns or less, timing reference levels of 1.5V, and input pulse levels of 0 to 3.0V. Test conditions for the read cycle use output loading shown in part a) of AC Test Loads and Waveforms[3], unless specified otherwise.
7. 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.
8. t_{HZOE}, t_{HZCE}, t_{HZWE}, t_{LZOE}, t_{LZCE}, and t_{LZWE} are specified with a load capacitance of 5 pF as in (b) of AC Test Loads and Waveforms[3].
9. These parameters are guaranteed by design and are not tested.
10. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}_1 = V_{IL}$, and $CE_2 = V_{IH}$. Chip enables must be active and $\overline{WE}$ must be LOW to initiate a write, and the transition of any of these signals can terminate. The input data setup and hold timing should be referenced to the edge of the signal that terminates the write.
11. The minimum write cycle time for Write Cycle No. 2 ($\overline{WE}$ controlled, $\overline{OE}$ LOW) is the sum of t_{HZWE} and t_{SD}.

Switching Waveforms

Figure 4. Read Cycle No. 1 [12, 13, 14]

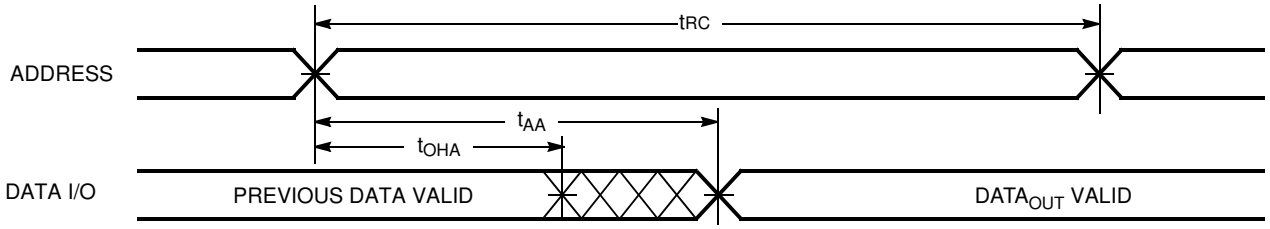
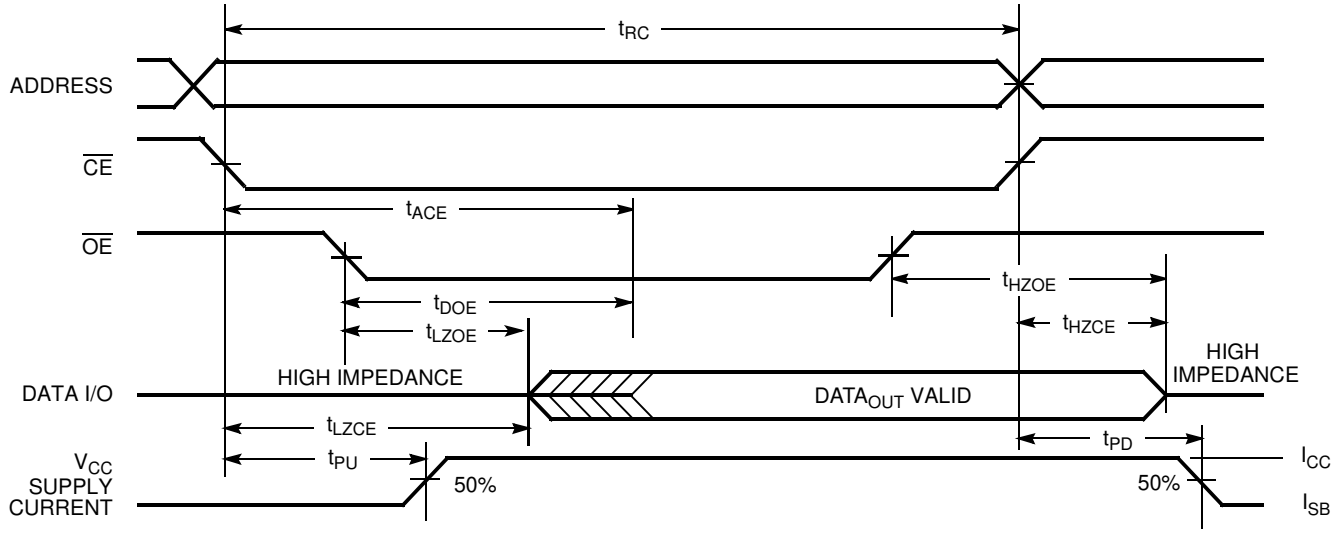


Figure 5. Read Cycle No. 2 ($\overline{OE}$ Controlled) [12, 14, 15]



Notes
12. $\overline{CE}$ refers to the internal logical combination of $\overline{CE}_1$ and CE_2 such that when $\overline{CE}_1$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW. For all other combinations, $\overline{CE}$ is HIGH.
13. The device is continuously selected. $\overline{CE} = V_{IL}$.
14. $\overline{WE}$ is HIGH for read cycle.
15. Address valid before or similar to $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Figure 6. Write Cycle No. 1 ($\overline{CE}$ Controlled) [16, 17, 18]

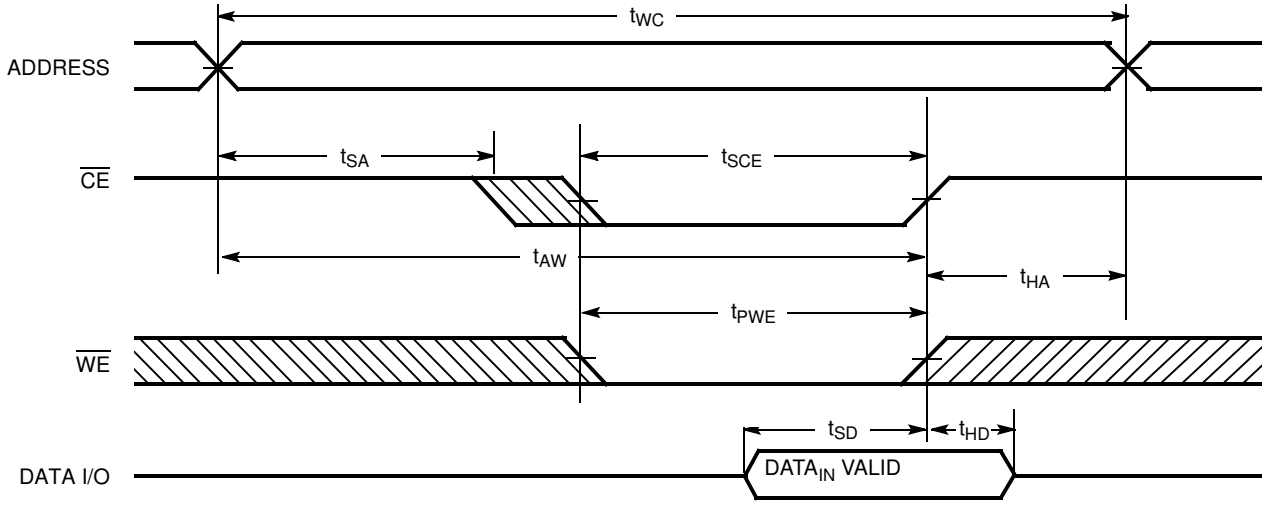
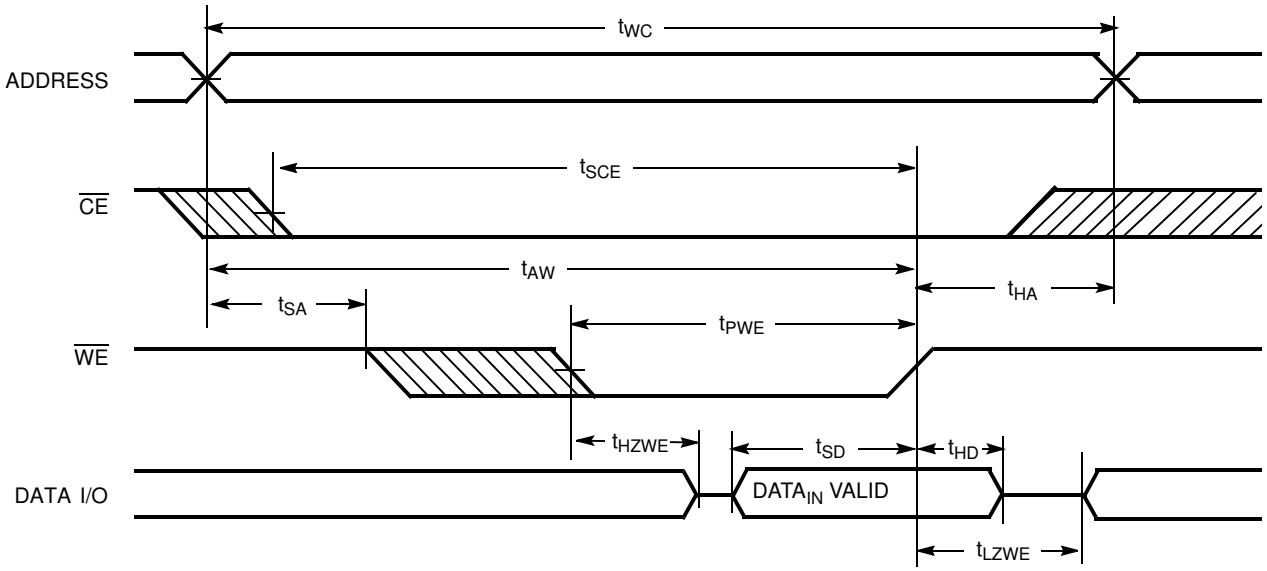


Figure 7. Write Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW) [16, 17, 18]



Notes
16. $\overline{CE}$ refers to the internal logical combination of $\overline{CE}_1$ and CE_2 such that when $\overline{CE}_1$ is LOW and CE_2 is HIGH, $\overline{CE}$ is LOW. For all other combinations, $\overline{CE}$ is HIGH.
17. Data I/O is high impedance if $\overline{OE} = V_{IH}$.
18. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high impedance state.

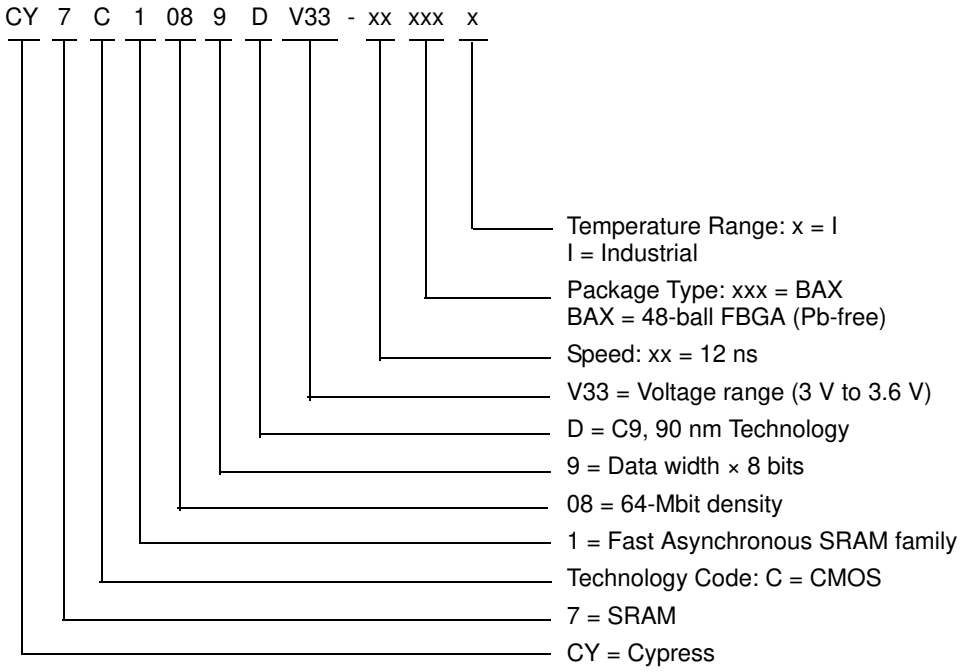
Truth Table

$\overline{CE_1}$	CE_2	$\overline{OE}$	$\overline{WE}$	$I/O_0 – I/O_7$	Mode	Power
H	X	X	X	High-Z	Power down	Standby (I_{SB})
X	L	X	X	High-Z	Power down	Standby (I_{SB})
L	H	L	H	Data Out	Read all bits	Active (I_{CC})
L	H	X	L	Data In	Write all bits	Active (I_{CC})
L	H	H	H	High-Z	Selected, Outputs disabled	Active (I_{CC})

Ordering Information

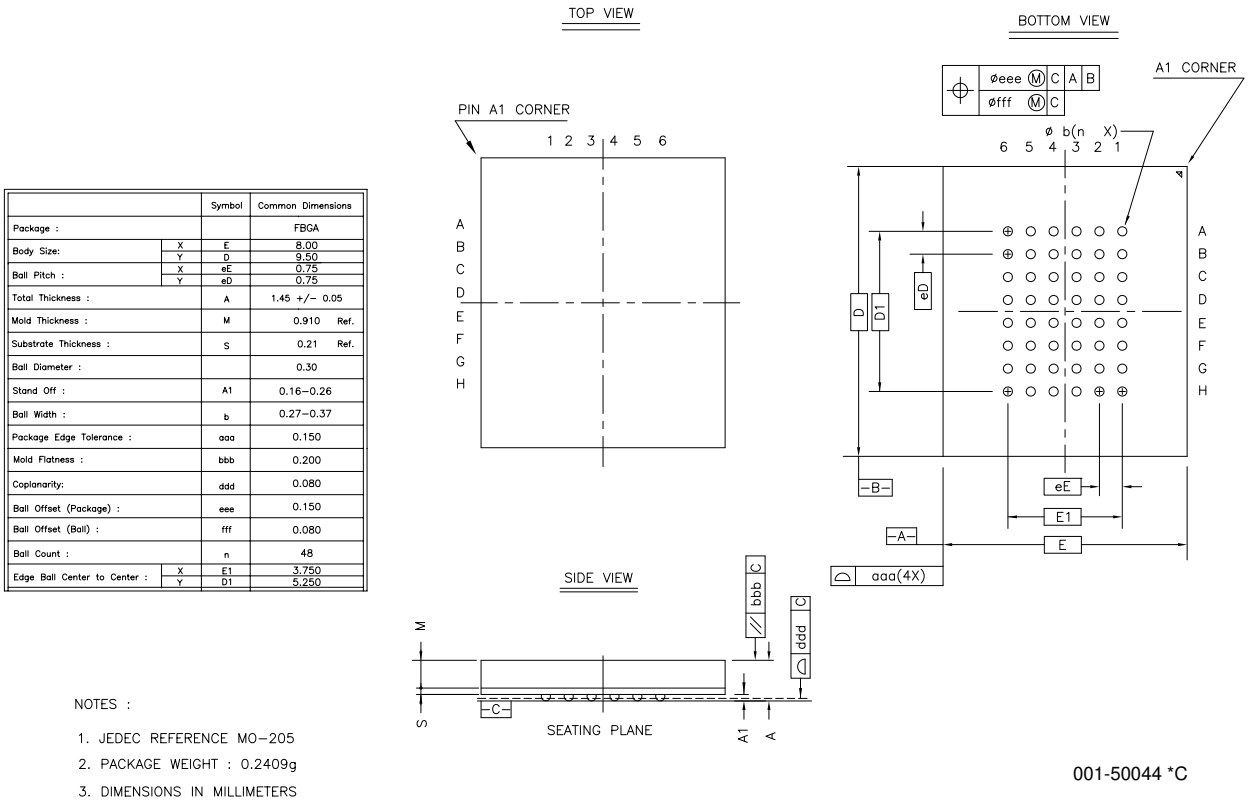
Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
12	CY7C1089DV33-12BAXI	001-50044	48-ball FBGA (8 × 9.5 × 1.4 mm) (Pb-free)	Industrial

Ordering Code Definition



Package Diagram

Figure 8. 48-Ball FBGA (8 x 9.5 x 1.4 mm) (001-50044)



		Symbol	Common Dimensions
Package :			FBGA
Body Size:	X	E	8.00
	Y	D	9.50
Ball Pitch :	X	eE	0.75
	Y	eD	0.75
Total Thickness :		A	1.45 +/- 0.05
Mold Thickness :		M	0.910 Ref.
Substrate Thickness :		S	0.21 Ref.
Ball Diameter :			0.30
Stand Off :		A1	0.16-0.26
Ball Width :		b	0.27-0.37
Package Edge Tolerance :		aaa	0.150
Mold Flatness :		bbb	0.200
Coplanarity:		ddd	0.080
Ball Offset (Package) :		eee	0.150
Ball Offset (Ball) :		fff	0.080
Ball Count :		n	48
Edge Ball Center to Center :	X	E1	3.750
	Y	D1	5.250

Acronyms

Acronym	Description
CMOS	complementary metal oxide semiconductor
FBGA	fine ball grid array
I/O	input/output
SRAM	static random access memory
TTL	transistor-transistor logic

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degrees Celsius
µA	microampere
mA	milliampere
MHz	megahertz
ns	nanosecond
pF	picofarad
V	volt
Ω	ohm
W	watt

Document History Page

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Revision	**ECN**	**Submission Date**	**Orig. of Change**	**Description of Change**
**	2746867	07/31/2009	VKN/AESA	New Data sheet
*A	3100499	12/02/2010	PRAS	Updated Note 12. Changed datasheet status from Preliminary to Final. Updated Package Diagram and Sales, Solutions, and Legal Information. Added Acronyms, Document Conventions and Ordering Code Definition.
*B	3178259	21/02/2011	PRAS	Post to external web.
*C	3720118	08/22/2012	TAVA	Minor Text edits.

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