CYK001M16SCCA
MoBL®

16-Mbit (1M x 16) Pseudo Static RAM

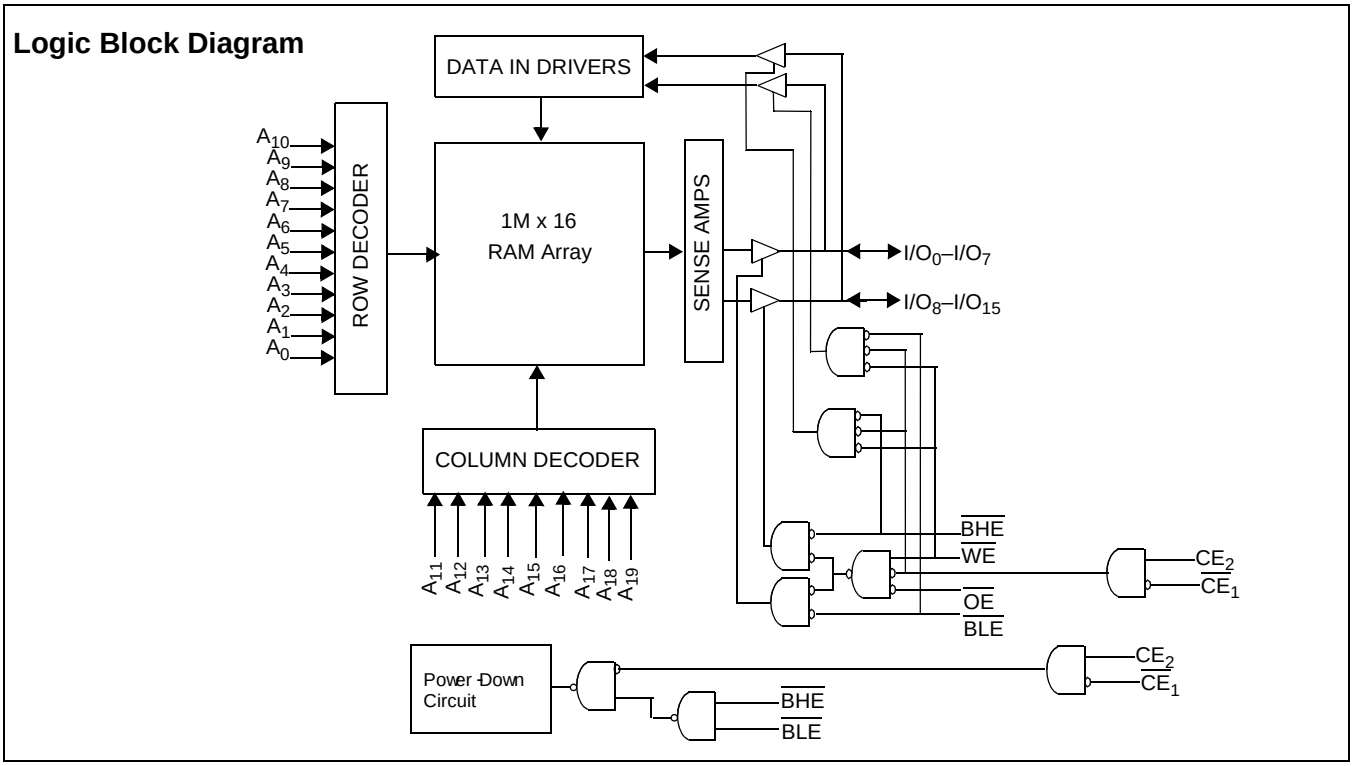
Features

- **Advanced low-power MoBL® architecture**
- **High speed: 55 ns, 70 ns**
- **Wide voltage range: 2.7V to 3.3V**
- **Typical active current: 3 mA @ f = 1 MHz**
- **Typical active current: 13 mA @ f = f_{MAX}**
- **Low standby power**
- **Automatic power-down when deselected**

Functional Description[1]

The CYK001M16SCCA is a high-performance CMOS pseudo static RAM (PSRAM) organized as 1M words by 16 bits that supports an asynchronous memory interface. 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 can be put into standby mode, reducing power consumption dramatically when deselected ($\overline{CE}_1$ LOW, CE_2 HIGH or both $\overline{BHE}$ and $\overline{BLE}$ are HIGH). The input/output pins (I/O_0 through I/O_{15}) are placed in a high-impedance state when the chip is deselected ($\overline{CE}_1$ HIGH, CE_2 LOW) or $\overline{OE}$ is deasserted HIGH, or during a write operation (Chip Enabled and Write Enable $\overline{WE}$ LOW). Reading from the device is accomplished by asserting the Chip Enables ($\overline{CE}_1$ LOW and CE_2 HIGH) 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 will appear on I/O_0 to I/O_7. If Byte High Enable ($\overline{BHE}$) is LOW, then data from memory will appear on I/O_8 to I/O_{15}. See the Truth Table for a complete description of read and write modes.

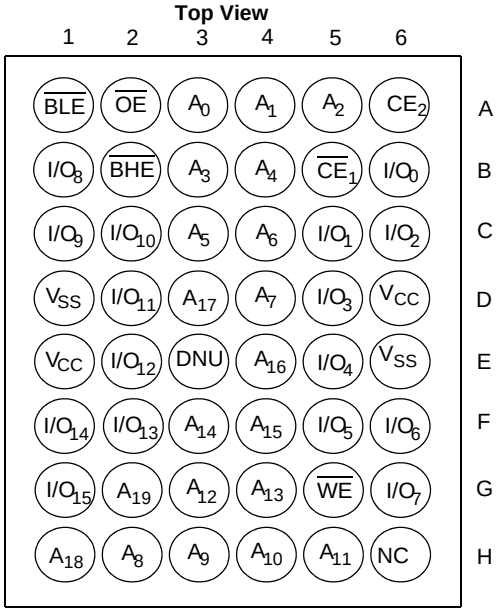
Logic Block Diagram



Note:
1. For best-practice recommendations, please refer to the Cypress application note "System Design Guidelines" on http://www.cypress.com.

Pin Configuration[2, 3, 4]

48-Ball FBGA
Top View



Product Portfolio[5]

Product	V_{CC} Range (V)			Speed (ns)	Power Dissipation					
					Operating, I_{CC} (mA)				Standby, I_{SB2} (μA)	
					f = 1 MHz		f = f_{MAX}			
	Min.	Typ.	Max.		Typ.[5]	Max.	Typ.[5]	Max.	Typ.[5]	Max.
CYK001M16SCCA	2.7	3.0	3.3	55	3	5	13	22	80	150
				70				17		

Notes:
2. DNU pins are to be left floating or tied to V_{SS}.
3. Ball H6 is the address expansion pins for the 32-Mb density.
4. NC “no connect”–not connected internally to the die.
5. Typical values are included for reference only and are not guaranteed or tested. Typical values are measured at $V_{CC} = V_{CC}$ (typ) and $T_A = 25°C$.

Maximum Ratings[6, 7, 8]

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .....–65°C to +150°C

Ambient Temperature with Power Applied .....–40°C to +85°C

Supply Voltage to Ground Potential ..... –0.4V to 4.6V

DC Voltage Applied to Outputs in High-Z State[6, 7, 8] ..... –0.4V to 3.3V

DC Input Voltage[6, 7, 8] .....–0.4V to 3.3V

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

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

Latch-up Current .....> 200 mA

Operating Range

Range	Ambient Temperature (T_A)	V_{CC}
Industrial	–25°C to +85°C	2.7V to 3.3V

DC Electrical Characteristics (Over the Operating Range)

Parameter	Description	Test Conditions	CYK001M16SCCA-55			CYK001M16SCCA-70			Unit
			Min.	Typ.[5]	Max.	Min.	Typ.[5]	Max.	
V_{CC}	Supply Voltage		2.7	3.0	3.3	2.7		3.3	V
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} – 0.4			V_{CC} – 0.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA			0.4			0.4	V
V_{IH}	Input HIGH Voltage		0.8 * V_{CC}		V_{CC} + 0.4	0.8 * V_{CC}		V_{CC} + 0.4	V
V_{IL}	Input LOW Voltage	f = 0	–0.4		0.4	–0.4		0.4	V
I_{IX}	Input Leakage Current	GND ≤ V_{IN} ≤ Vcc	–1		+1	–1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_{OUT} ≤ Vcc, Output Disabled	–1		+1	–1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{MAX} = $1/t_{RC}$, Vcc = 3.3V, I_{OUT} = 0mA, CMOS level		13	22		13	17	mA
		f = 1 MHz, Vcc = 3.3V, I_{OUT} = 0mA, CMOS level		3	5		3	5	
I_{SB1}	Automatic CE Power-down Current —CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V, CE_2 ≤ 0.2V V_{IN} ≥ V_{CC} – 0.2V, V_{IN} ≤ 0.2V, f = f_{MAX} (Address and Data Only), f = 0 (OE, WE, BHE and BLE), V_{CC} = 3.3V		100	525		100	525	µA
I_{SB2}	Automatic CE Power-down Current —CMOS Inputs	$\overline{CE}$ ≥ V_{CC} – 0.2V, CE_2 ≤ 0.2V V_{IN} ≥ V_{CC} – 0.2V or V_{IN} ≤ 0.2V, f = 0, V_{CC} = 3.3V		80	150		80	150	µA

Capacitance[9]

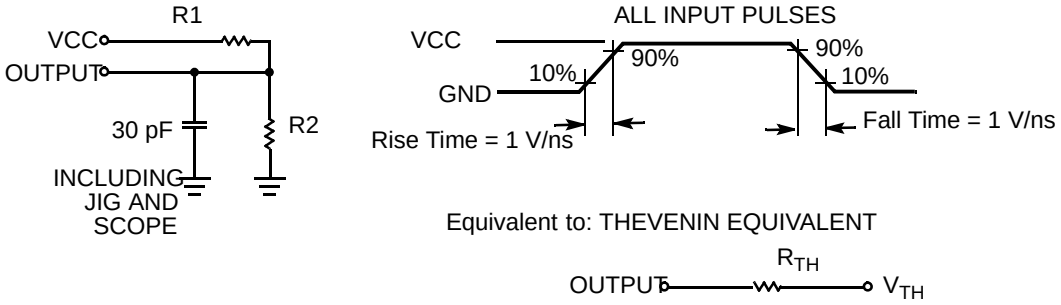
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz V_{CC} = $V_{CC(typ)}$	8	pF
C_{OUT}	Output Capacitance		8	pF

Notes:
6. $V_{IH(MAX)}$ = V_{CC} + 0.5V for pulse durations less than 20 ns.
7. $V_{IL(MIN)}$ = –0.5V for pulse durations less than 20 ns.
8. Overshoot and undershoot specifications are characterized and are not 100% tested.
9. Tested initially and after design or process changes that may affect these parameters.

Thermal Resistance[9]

Parameter	Description	Test Conditions	FBGA	Unit
θ_{JA}	Thermal Resistance (Junction to Ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, per EIA / JESD51.	55	°C/W
θ_{JC}	Thermal Resistance (Junction to Case)		17	°C/W

AC Test Loads and Waveforms



Parameters	3.0V V_{CC}	Unit
R1	22000	Ω
R2	22000	Ω
R_{TH}	11000	Ω
V_{TH}	1.50	V

Switching Characteristics (Over the Operating Range)[10, 11, 12, 13]

Parameter	Description	CYK001M16SCCA-55		CYK001M16SCCA-70		Unit
		Min.	Max.	Min.	Max.	
Read Cycle						
t_{RC}	Read Cycle Time	55[14]		70		ns
t_{AA}	Address to Data Valid		55		70	ns
t_{OHA}	Data Hold from Address Change	5		5		ns
t_{ACE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Data Valid		55		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		25		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[11, 12]	5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[11, 12]		25		25	ns
t_{LZCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Low Z[11, 12]	5		5		ns
t_{HZCE}	$\overline{CE}_1$ HIGH and CE_2 LOW to High Z[11, 12]		25		25	ns
t_{DBE}	$\overline{BLE}/\overline{BHE}$ LOW to Data Valid		55		70	ns
t_{LZBE}	$\overline{BLE}/\overline{BHE}$ LOW to Low Z[11, 12]	5		5		ns
t_{HZBE}	$\overline{BLE}/\overline{BHE}$ HIGH to High-Z[11, 12]		10		25	ns
t_{SK}[14]	Address Skew		0		10	ns

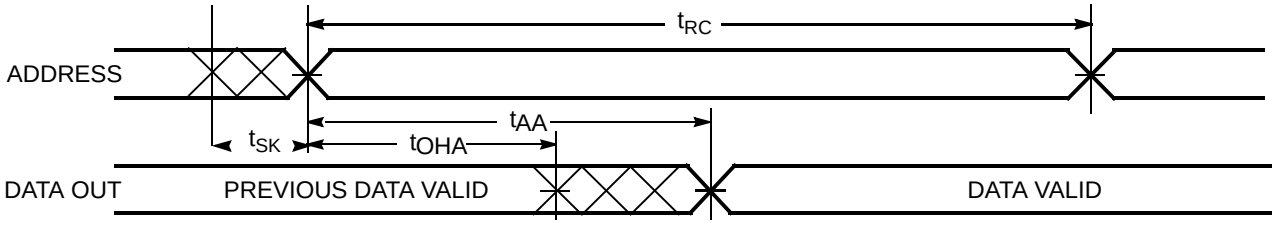
Notes:
10. Test conditions assume signal transition time of 1 V/ns or higher, timing reference levels of $V_{CC(typ)}/2$, input pulse levels of 0V to $V_{CC(typ)}$, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance.
11. t_{HZOE}, t_{HZCE}, t_{HZBE} and t_{HZWE} transitions are measured when the outputs enter a high-impedance state.
12. High-Z and Low-Z parameters are characterized and are not 100% tested.
13. The internal write time of the memory is defined by the overlap of $\overline{WE}$, $\overline{CE}_1 = V_{IL}$, $CE_2 = V_{IH}$, $\overline{BHE}$ and/or $\overline{BLE} = V_{IL}$. All signals must be ACTIVE to initiate a write and any of these signals can terminate a write by going INACTIVE. The data input set-up and hold timing should be referenced to the edge of the signal that terminates write.
14. To achieve 55-ns performance, the read access should be $\overline{CE}$ controlled. In this case t_{ACE} is the critical parameter and t_{SK} is satisfied when the addresses are stable prior to chip enable going active. For the 70-ns cycle, the addresses must be stable within 10 ns after the start of the read cycle.

Switching Characteristics (Over the Operating Range)[10, 11, 12, 13] (continued)

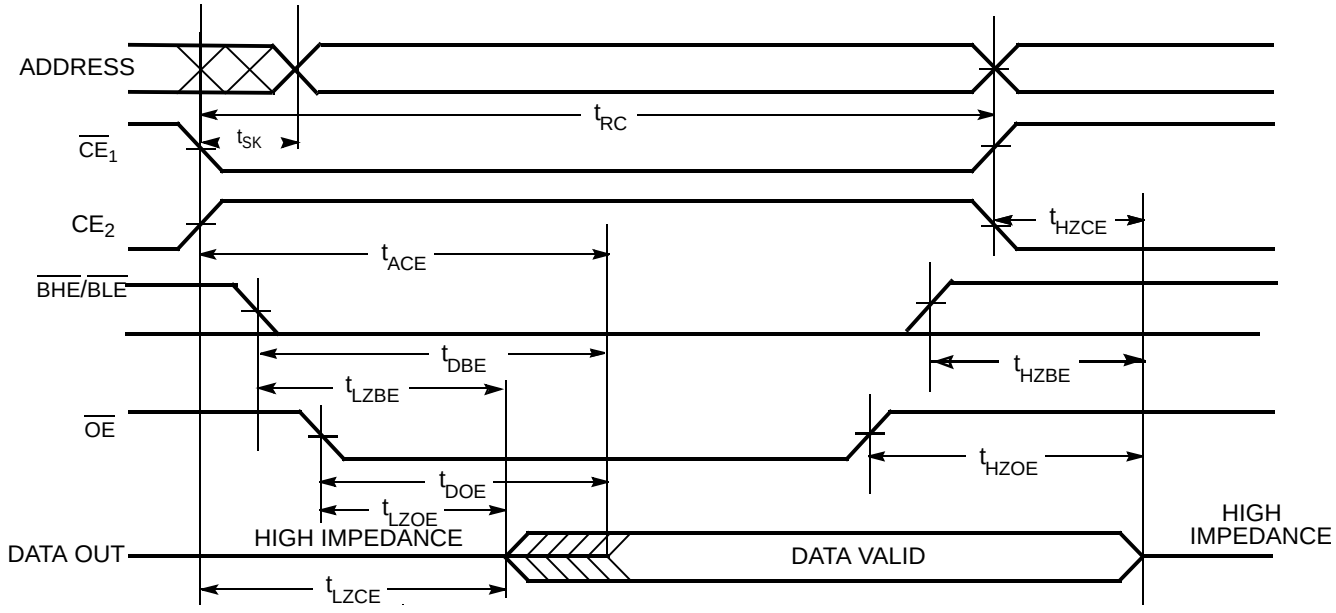
Parameter	Description	CYK001M16SCCA-55		CYK001M16SCCA-70		Unit
		Min.	Max.	Min.	Max.	
Write Cycle[13]						
t_{WC}	Write Cycle Time	55		70		ns
t_{SCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Write End	45		55		ns
t_{AW}	Address Set-up to Write End	45		55		ns
t_{HA}	Address Hold from Write End	0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	40		55		ns
t_{BW}	$\overline{BLE}$/$\overline{BHE}$ LOW to Write End	50		55		ns
t_{SD}	Data Set-up to Write End	25		25		ns
t_{HD}	Data Hold from Write End	0		0		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[11, 12]		25		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[11, 12]	5		5		ns

Switching Waveforms

Read Cycle 1 (Address Transition Controlled)[14, 15, 16]



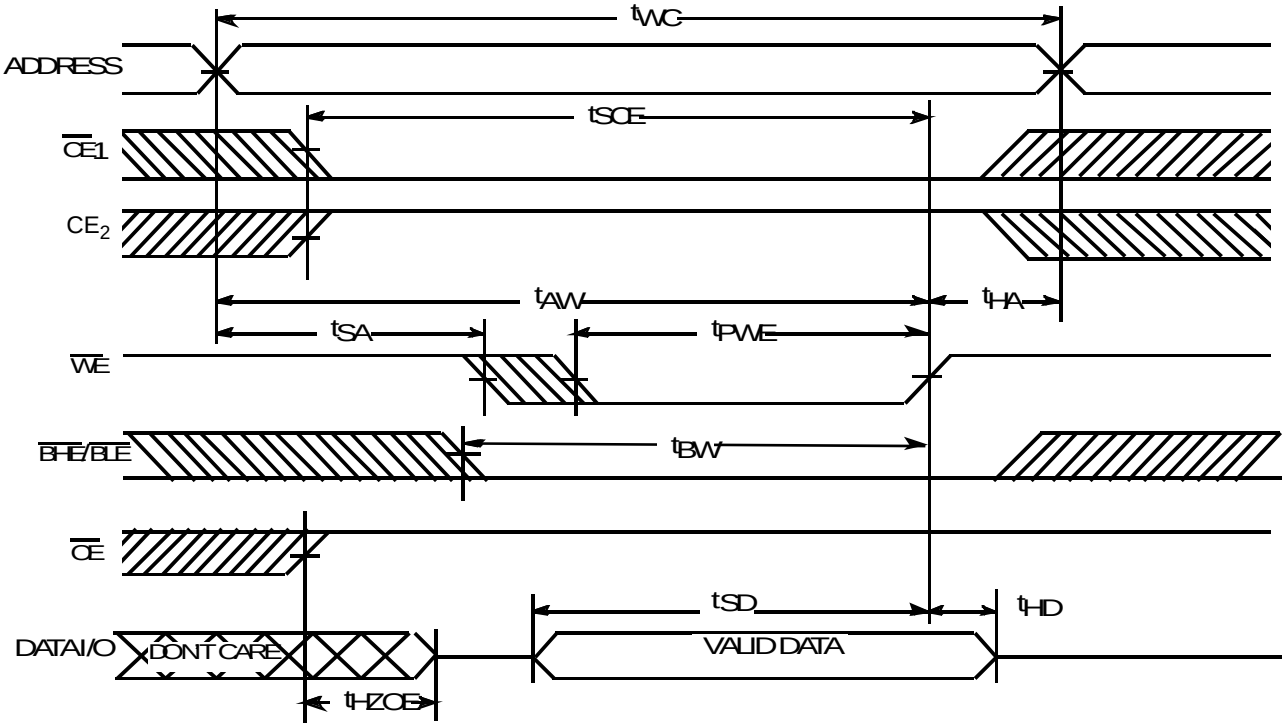
Read Cycle 2 ($\overline{OE}$ Controlled)[14, 16]



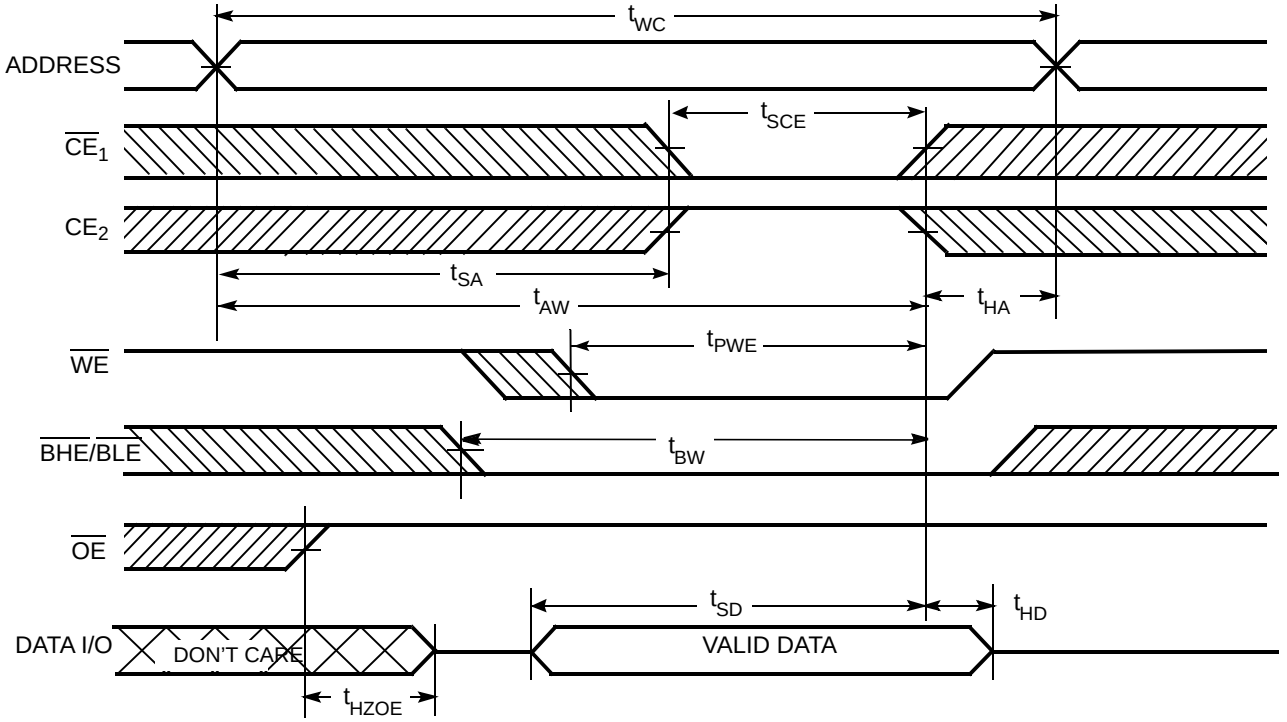
Notes:
15. Device is continuously selected. $\overline{OE}$, $\overline{CE}_1$ = V_{IL} and CE_2 = V_{IH}.
16. $\overline{WE}$ is HIGH for Read Cycle.

Switching Waveforms (continued)

Write Cycle No. 1($\overline{WE}$ Controlled)[12, 13, 17, 18, 19]



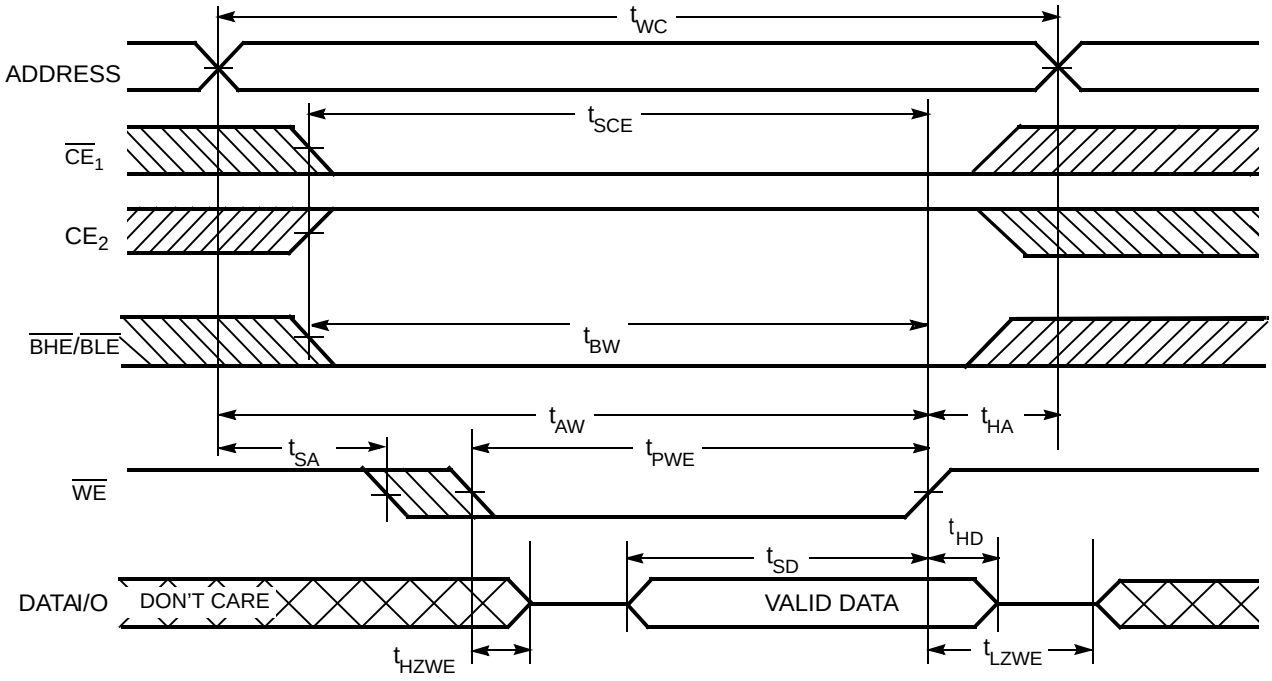
Write Cycle 2 ($\overline{CE_1}$ or CE_2 Controlled)[12, 13, 17, 18, 19]



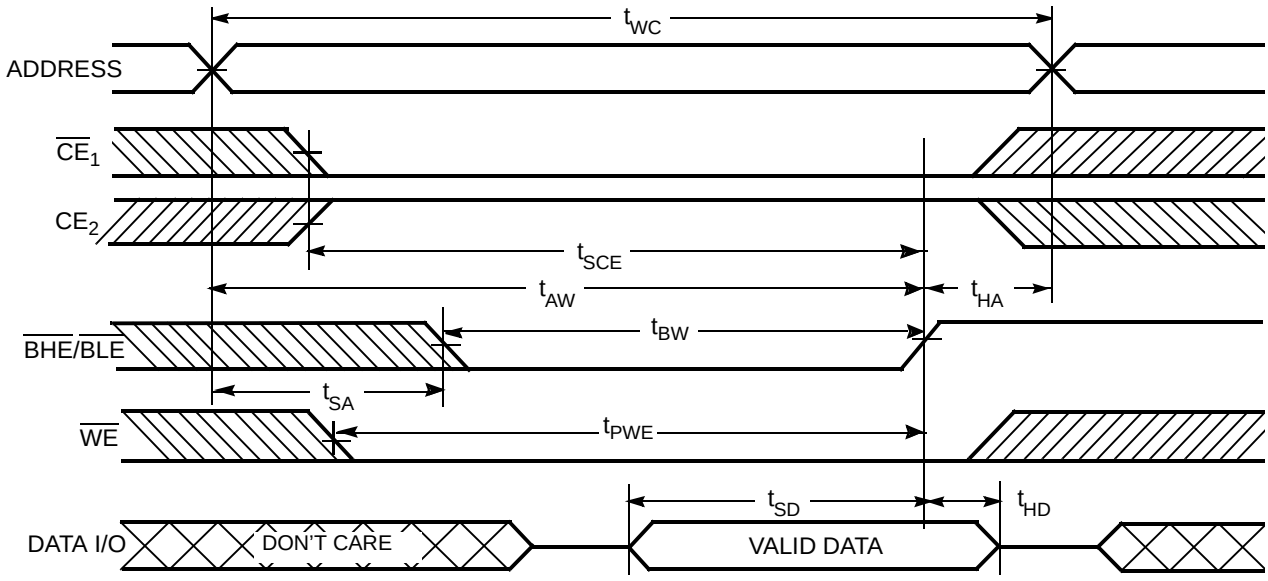
Notes:
17. Data I/O is high impedance if $\overline{OE} \geq V_{IH}$.
18. If Chip Enable goes INACTIVE simultaneously with $\overline{WE}$ =HIGH, the output remains in a high-impedance state.
19. During the DON'T CARE period in the DATA I/O waveform, the I/Os are in output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[18, 19]



Write Cycle No. 4 ($\overline{BHE}/\overline{BLE}$ Controlled, $\overline{OE}$ LOW)[18, 19]



Truth Table[20]

$\overline{CE}_1$	CE_2	$\overline{WE}$	$\overline{OE}$	$\overline{BHE}$	$\overline{BLE}$	Inputs/Outputs	Mode	Power
H	X	X	X	X	X	High Z	Deselect/Power-down	Standby (I_{SB})
X	L	X	X	X	X	High Z	Deselect/Power-down	Standby (I_{SB})
X	X	X	X	H	H	High Z	Deselect/Power-down	Standby (I_{SB})
L	H	H	L	L	L	Data Out (I/O_0–I/O_{15})	Read	Active (I_{CC})
L	H	H	L	H	L	Data Out (I/O_0–I/O_7); I/O_8–I/O_{15} in High Z	Read	Active (I_{CC})
L	H	H	L	L	H	Data Out (I/O_8–I/O_{15}); I/O_0–I/O_7 in High Z	Read	Active (I_{CC})
L	H	H	H	L	L	High Z	Output Disabled	Active (I_{CC})
L	H	H	H	H	L	High Z	Output Disabled	Active (I_{CC})
L	H	H	H	L	H	High Z	Output Disabled	Active (I_{CC})
L	H	L	X	L	L	Data In (I/O_0–I/O_{15})	Write (Upper Byte and Lower Byte)	Active (I_{CC})
L	H	L	X	H	L	Data In (I/O_0–I/O_7); I/O_8–I/O_{15} in High Z	Write (Lower Byte Only)	Active (I_{CC})
L	H	L	X	L	H	Data In (I/O_8–I/O_{15}); I/O_0 –I/O_7 in High Z	Write (Upper Byte Only)	Active (I_{CC})

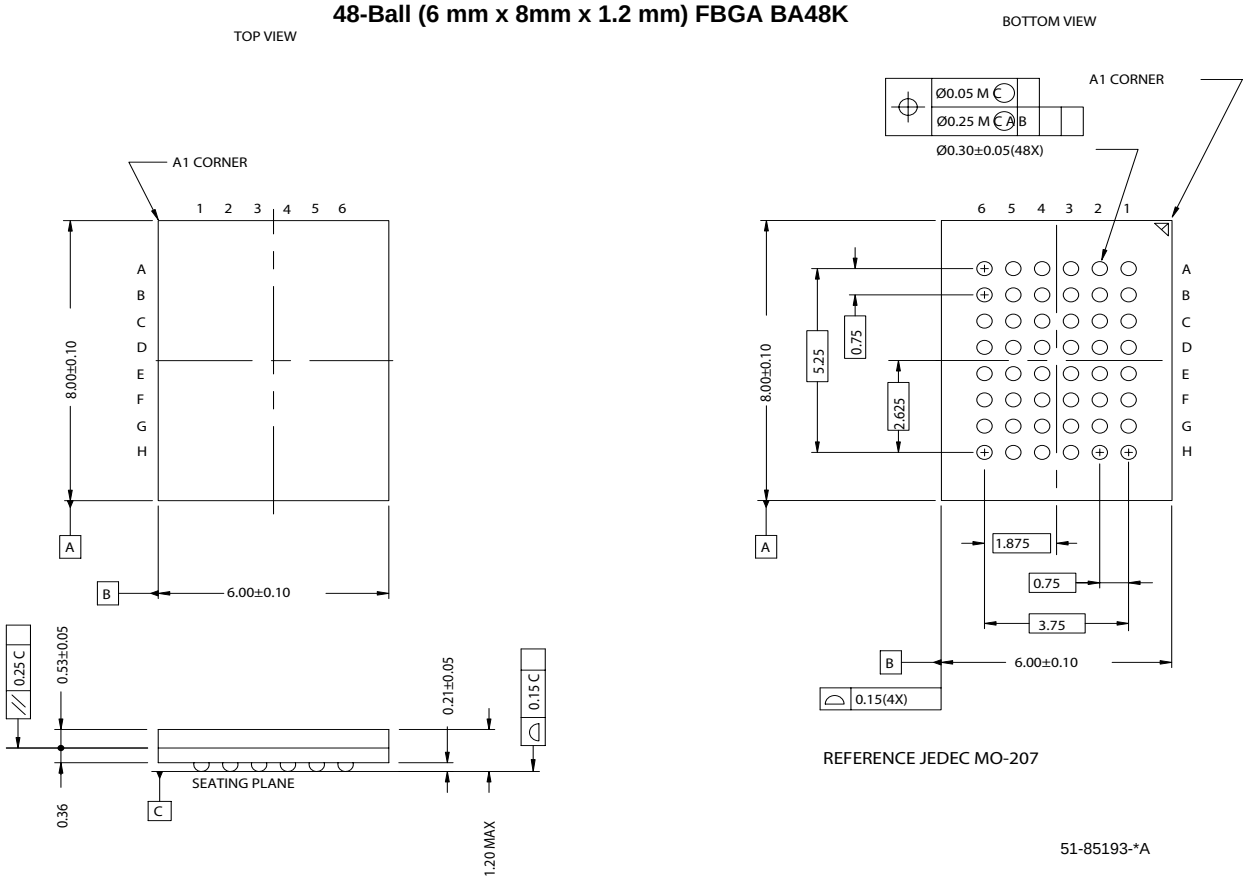
Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
55	CYK001M16SCCAU-55BAI	BA48K	48-ball Fine Pitch BGA (6.0 x 8.0 x 1.2 mm)	Industrial
70	CYK001M16SCCAU-70BAI	BA48K	48-ball Fine Pitch BGA (6.0 x 8.0 x 1.2 mm)	Industrial
55	CYK001M16SCAU-55BAXI	BA48K	48-ball Fine Pitch BGA (6.0 x 8.0 x 1.2 mm) (Pb-Free)	Industrial
70	CYK001M16SCAU-70BAXI	BA48K	48-ball Fine Pitch BGA (6.0 x 8.0 x 1.2 mm) (Pb-Free)	Industrial

Note:
20. H = Logic HIGH, L = Logic LOW, X = Don't Care

Package Diagrams

48-Ball (6 mm x 8mm x 1.2 mm) FBGA BA48K



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Document History Page

Document Title: CYK001M16SCCA 16-Mbit (1M x 16) Pseudo Static RAM Document Number: 38-05426				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	130539	01/27/04	AWK	New Data Sheet
*A	216680	03/26/04	REF	Added 55-ns Speed bin Updated from Advance Information to Final data sheet.
*B	220121	See ECN	REF	Changed the t_{OHA} parameter for 70 ns speed grade from 10 ns to 5 ns
*C	225580	See ECN	AJU	Changed Ordering code from CYK001M16SCCA to CYK001M16SCCAU on page 8
*D	313999	See ECN	RKF	Added Pb-Free parts to the Ordering information