4-Mbit (256K x 16) Pseudo Static RAM

Features

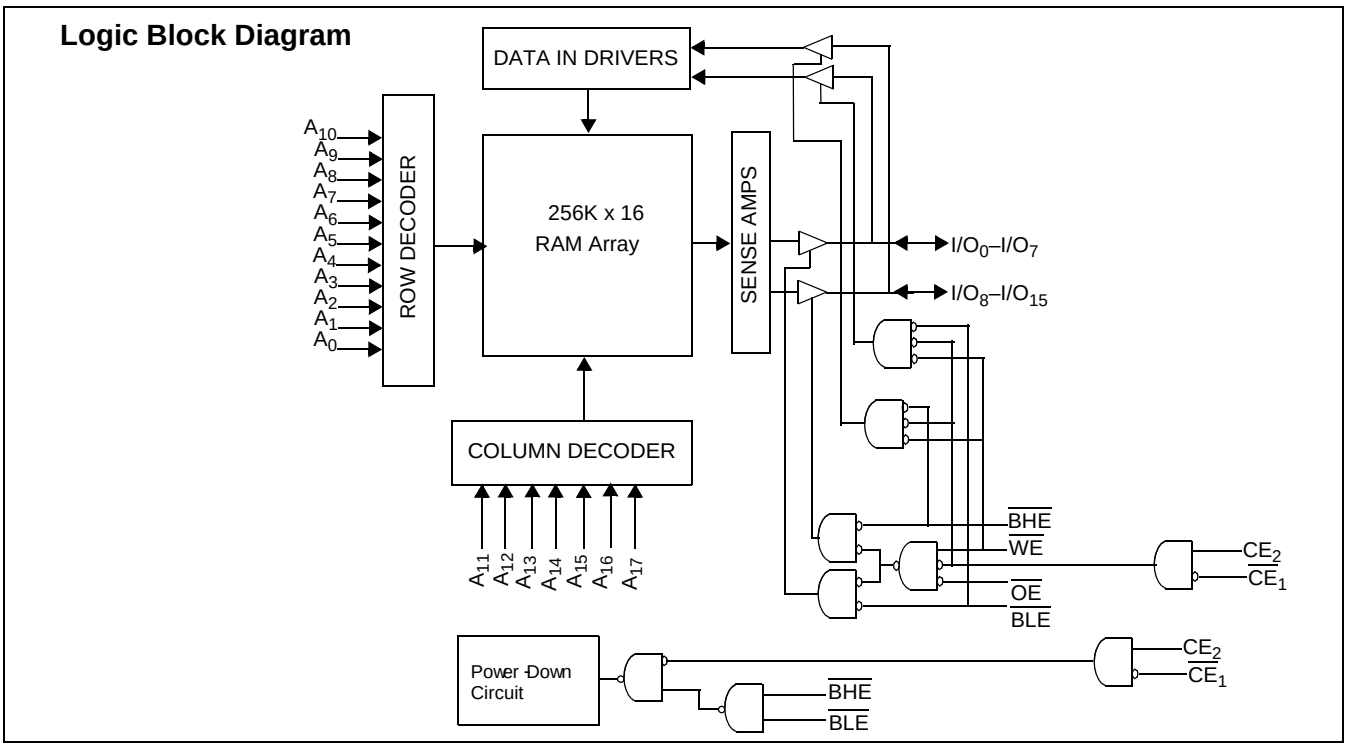
- **Advanced low-power MoBL® architecture**
- **High speed: 55 ns, 60 ns and 70 ns**
- **Wide voltage range: 2.7V to 3.3V**
- **Typical active current: 1 mA @ f = 1 MHz**
- **Low standby power**
- **Automatic power-down when deselected**

Functional Description[1]

The CYK256K16SCCB is a high-performance CMOS pseudo static RAM (PSRAM) organized as 256K 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 (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: deselected (CE_1 HIGH, CE_2 LOW, $\overline{OE}$ 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 (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 A_0 through A_{17} 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.

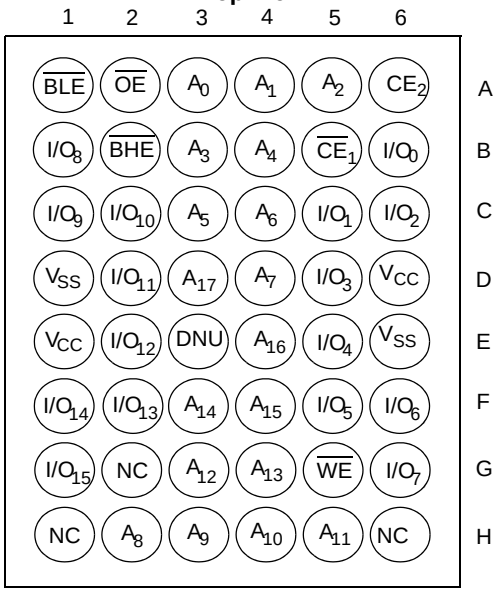
Logic Block Diagram



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

Pin Configuration[3, 4, 5]

48-ball VFBGA
Top View



Product Portfolio

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.[2]	Max.	Typ.[2]	Max.	Typ.[2]	Max.
CYK256K16SCCB	2.7	3.0	3.3	55	1	5	14	22	17	40
				60						
				70			8	15		

Notes:
2. 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.
3. Ball H1, G2, H6 are the address expansion pins for the 8-Mb, 16-Mb, and 32-Mb densities, respectively.
4. NC “no connect”—not connected internally to the die.
5. DNU (Do Not Use) pins have to be left floating or tied to V_{SS} to ensure proper application.

Maximum Ratings

(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 3.7V

DC Input Voltage[6, 7, 8] .....–0.4V to 3.7V

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	CYK256K16SCCB -55, 60, 70			Unit
			Min.	Typ.[2]	Max.	
V_{CC}	Supply Voltage		2.7	3.0	3.3	V
V_{OH}	Output HIGH Voltage	I_{OH} = –0.1 mA	V_{CC} – 0.4			V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA			0.4	V
V_{IH}	Input HIGH Voltage		0.8 * V_{CC}		V_{CC} + 0.4	V
V_{IL}	Input LOW Voltage	F = 0	–0.4		0.62	V
I_{IX}	Input Leakage Current	GND ≤ V_{IN} ≤ Vcc	–1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_{OUT} ≤ Vcc, Output Disabled	–1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{MAX} = 1/t_{RC}, V_{CC} = 3.3V, I_{OUT} = 0 mA, CMOS level		14 for –55 14 for –60 8 for –70	22 for –55 22 for –60 15 for –70	mA
		f = 1 MHz		1 for all speeds	5 for all speeds	
I_{SB1}	Automatic $\overline{CE}_1$ 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)		150	250	µA
I_{SB2}	Automatic $\overline{CE}_1$ 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		17	40	µA

Capacitance[9]

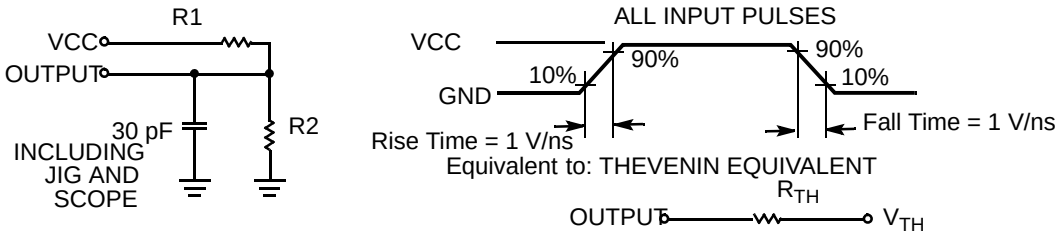
Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz V_{CC} = $V_{CC(typ)}$	8	pF
C_{OUT}	Output Capacitance		8	pF

Thermal Resistance[9]

Parameter	Description	Test Conditions	VFBGA	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

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.

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]

Parameter	Description	–55		–60		–70		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle								
t_{RC}	Read Cycle Time	55[14]		60		70		ns
t_{AA}	Address to Data Valid		55		60		70	ns
t_{OHA}	Data Hold from Address Change	5		8		10		ns
t_{ACE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Data Valid		55		60		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		25		25		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[11, 12]	5		5		5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[11, 12]		25		25		25	ns
t_{LZCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Low Z[11, 12]	5		5		5		ns
t_{HZCE}	$\overline{CE}_1$ HIGH and CE_2 LOW to High Z[11, 12]		25		25		25	ns
t_{DBE}	$\overline{BLE}/\overline{BHE}$ LOW to Data Valid		55		60		70	ns
t_{LZBE}	$\overline{BLE}/\overline{BHE}$ LOW to Low Z[11, 12]	5		5		5		ns
t_{HZBE}	$\overline{BLE}/\overline{BHE}$ HIGH to High-Z[11, 12]		10		10		25	ns
t_{SK}[14]	Address Skew		0		5		10	ns
Write Cycle[13]								
t_{WC}	Write Cycle Time	55		60		70		ns
t_{SCE}	$\overline{CE}_1$ LOW and CE_2 HIGH to Write End	45		45		60		ns
t_{AW}	Address Set-up to Write End	45		45		55		ns
t_{HA}	Address Hold from Write End	0		0		0		ns
t_{SA}	Address Set-up to Write Start	0		0		0		ns

Notes:

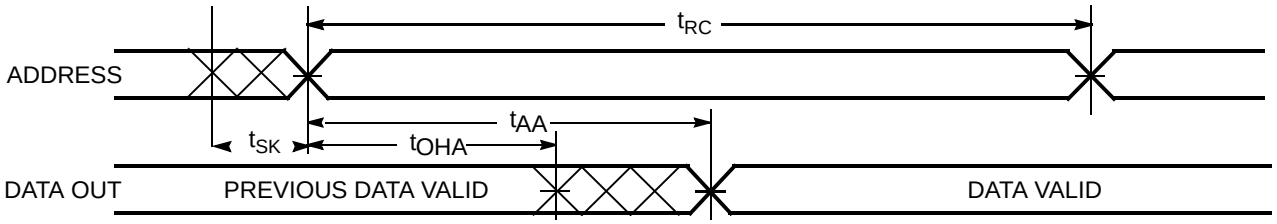
10. Test conditions assume signal transition time of 1 V/ns or higher, timing reference levels of $V_{CC(typ)}/2$, input pulse levels of 0V to $V_{CC(typ)}$, and output loading of the specified I_{OL}/I_{OH} and 30-pF load capacitance
11. t_{HZOE}, t_{HZCE}, t_{HZBE} and t_{HZWE} transitions are measured 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] (continued)

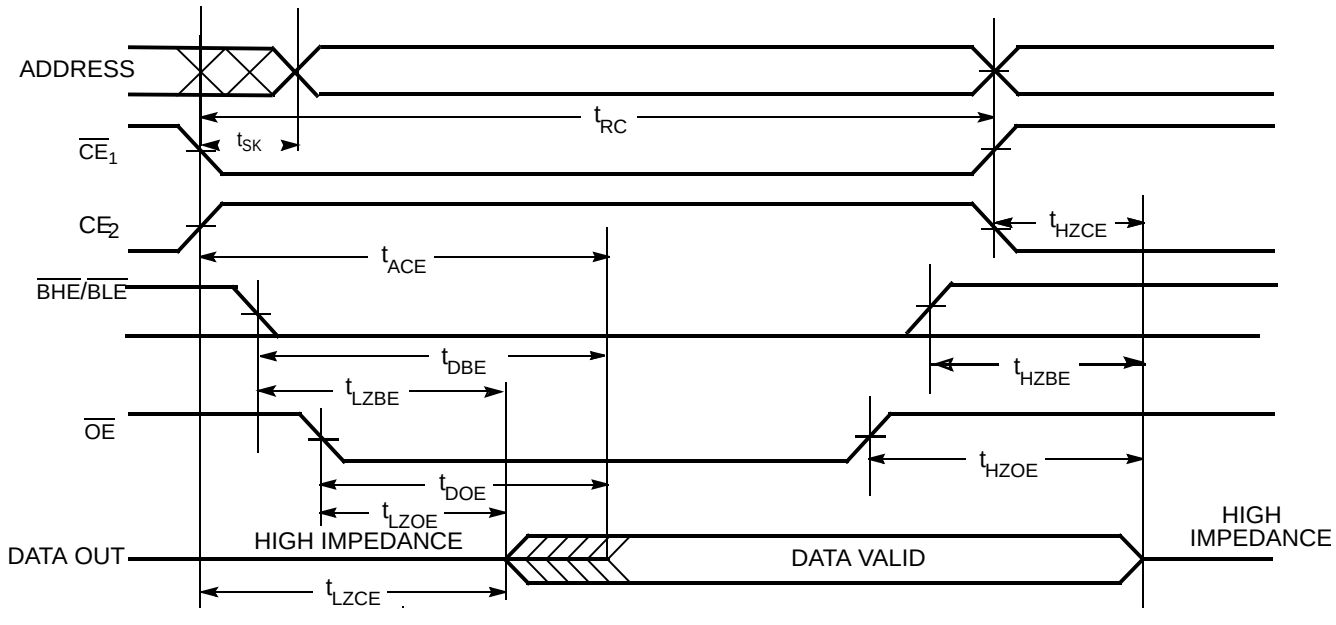
Parameter	Description	–55		–60		–70		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{PWE}	$\overline{WE}$ Pulse Width	40		40		45		ns
t_{BW}	$\overline{BLE}$/$\overline{BHE}$ LOW to Write End	50		50		55		ns
t_{SD}	Data Set-up to Write End	25		25		25		ns
t_{HD}	Data Hold from Write End	0		0		0		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[11, 12]		25		25		25	ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[11, 12]	5		5		5		ns

Switching Waveforms

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



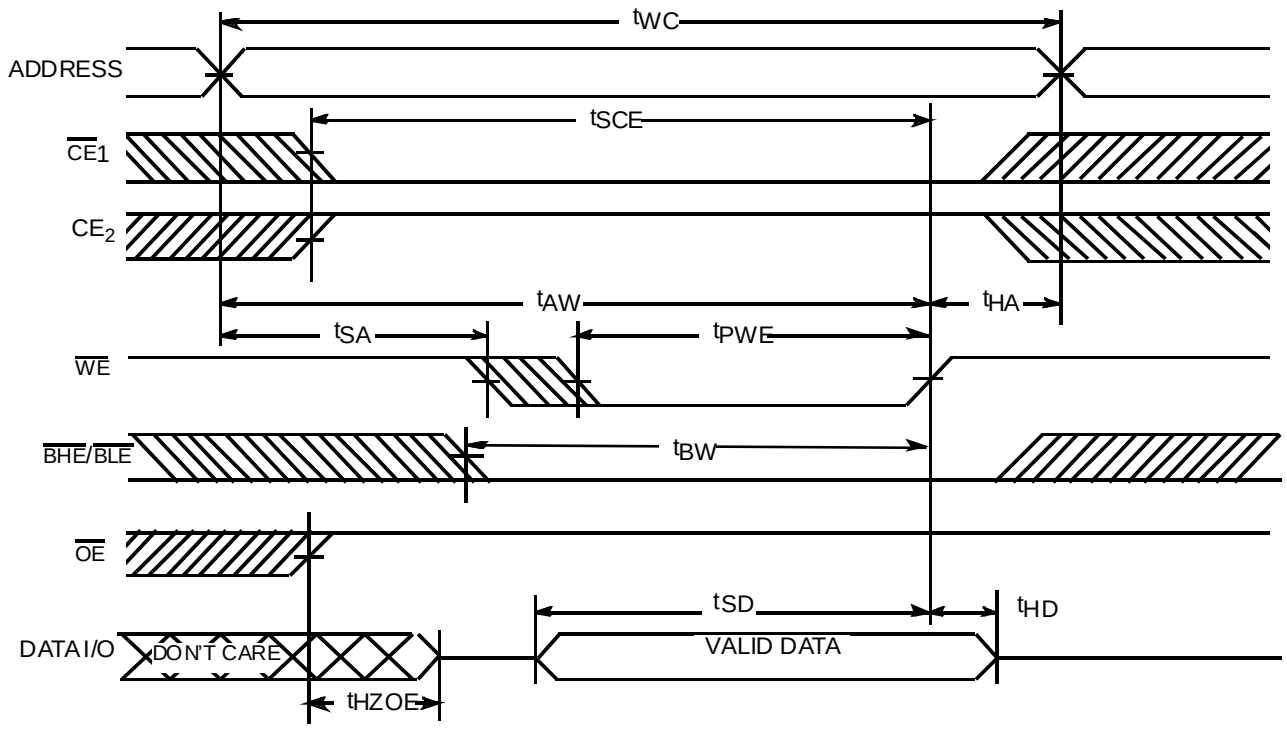
Read Cycle 2 ($\overline{OE}$ Controlled)[14, 16]



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

Switching Waveforms (continued)

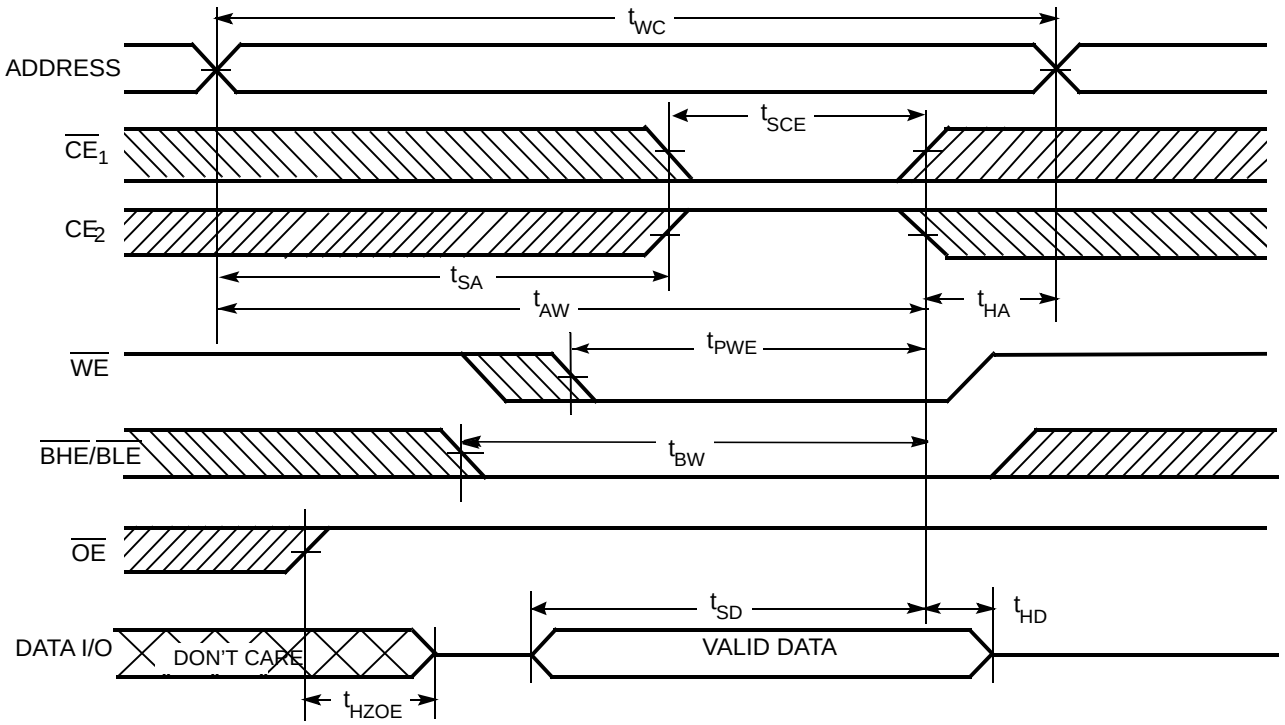
Write Cycle No. 1($\overline{WE}$ Controlled)[12, 13, 17, 18, 19]



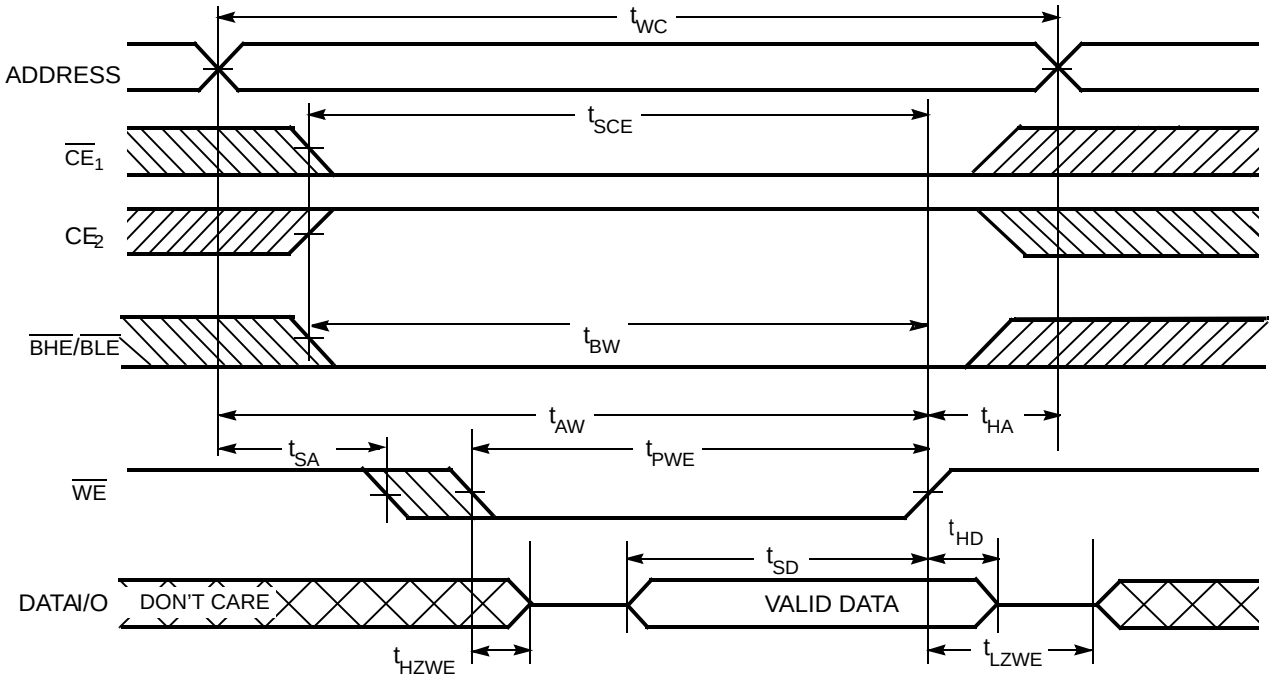
Notes:
17. Data I/O is high impedance if $\overline{OE} \geq V_{IH}$.
18. If Chip Enable goes INACTIVE simultaneously with $\overline{WE}$ =HIGH, the output remains in a high-impedance state.
19. During the DON'T CARE period in the DATA I/O waveform, the I/Os are in output state and input signals should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

Switching Waveforms (continued)

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

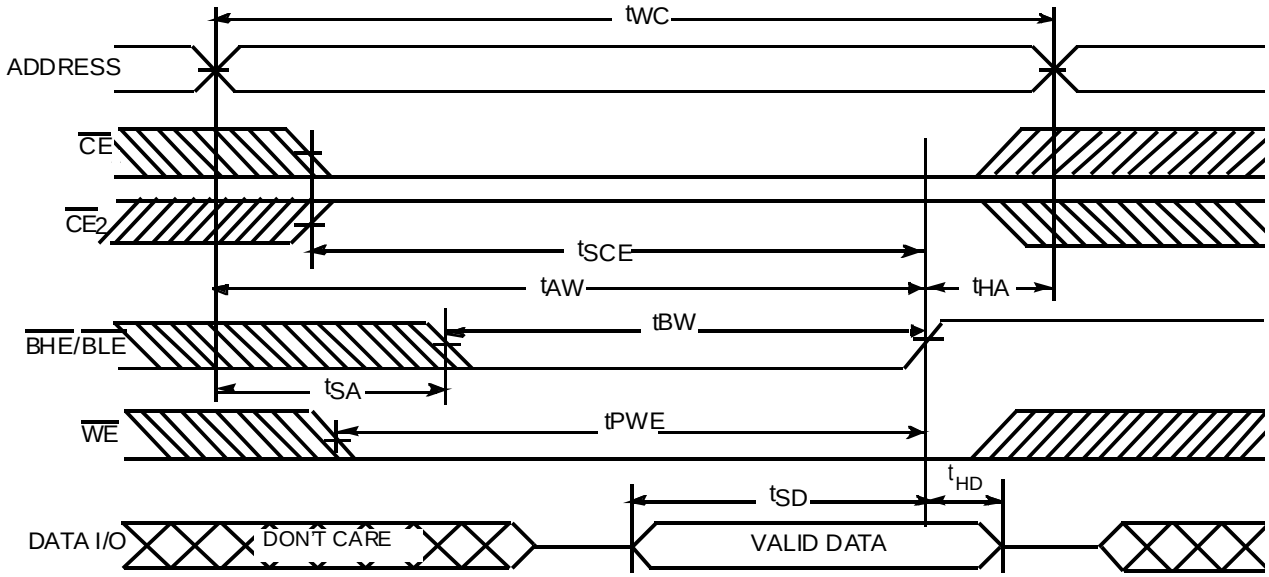


Write Cycle 3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[18, 19]



Switching Waveforms (continued)

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 (Upper Byte and Lower Byte)	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 (Upper Byte only)	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 (Lower Byte only)	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})

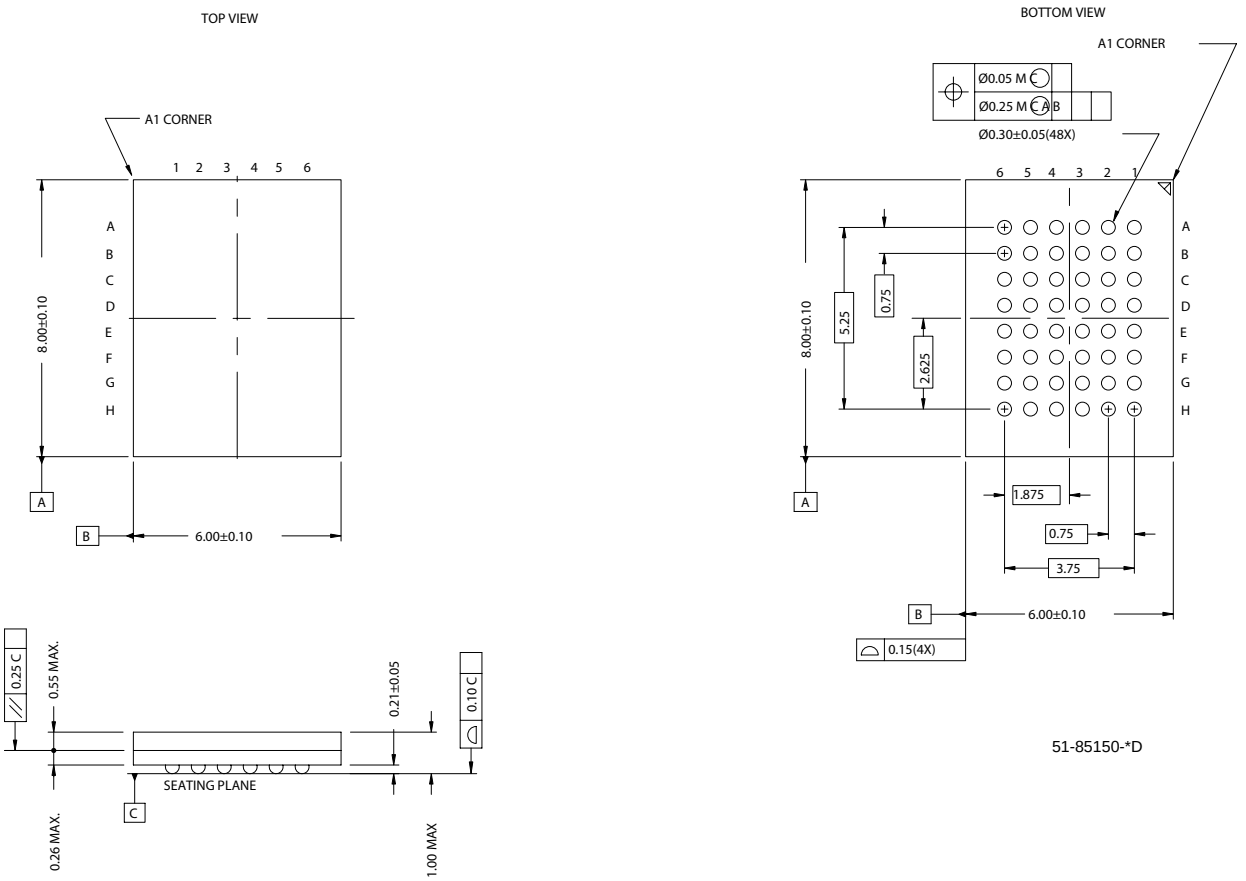
Note:
20. H = Logic HIGH, L = Logic LOW, X = Don't Care.

Ordering Information

Speed (ns)	Ordering Code	Package Diagram	Package Type	Operating Range
55	CYK256K16SCCBU-55BVI	51-85150	48-ball Very Fine Pitch BGA (6.0 x 8.0 x 1.0 mm)	Industrial
	CYK256K16SCBU-55BVXI		48-ball Very Fine Pitch BGA (6.0 x 8.0 x 1.0 mm) (Pb-Free)	
60	CYK256K16SCCBU-60BVI	51-85150	48-ball Very Fine Pitch BGA (6.0 x 8.0 x 1.0 mm)	Industrial
70	CYK256K16SCCBU-70BVI	51-85150	48-ball Very Fine Pitch BGA (6.0 x 8.0 x 1.0 mm)	Industrial
	CYK256K16SCBU-70BVXI		48-ball Very Fine Pitch BGA (6.0 x 8.0 x 1.0 mm) (Pb-Free)	

Package Diagram

48-ball VFBGA (6 x 8 x 1 mm) (51-85150)



Document History Page

Document Title: CYK256K16SCCB 4-Mbit (256K x 16) Pseudo Static RAM Document Number: 38-05526				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	215621	See ECN	REF	New data sheet
*A	218183	See ECN	REF	Changed ball E3 on package pinout from DNU to NC
*B	230855	See ECN	AJU	Changed from Advance Information to Preliminary Modified MAX limit on DC Input voltage in 'Maximum Ratings' section Fixed package name typo in 'Thermal Resistance' table Changed ordering code from CYK256K16SCCB to CYK256K16SCCBU in 'Ordering Information' section
*C	234474	See ECN	SYT	Changed ball E3 on package pinout from NC to DNU.
*D	260330	See ECN	PCI	Changed from Preliminary to Final
*E	298651	See ECN	PCI	Added 60-ns speed bin
*F	314013	See ECN	RKF	Added Pb-Free parts to the Ordering information
*G	522566	See ECN	NXR	Changed V_{IL} Max spec from 0.4 V to 0.6 V in DC Electrical Characteristics table
*H	562386	See ECN	NXR	Changed V_{IL} Max spec from 0.6 V to 0.62 V in DC Electrical Characteristics table