GM76FV1664,GM76FU1664,GM76FQ1664,GM76FE1664,GM76FS1664

LG Semicon Co.,Ltd.

65,536 WORDS x 16 BIT
CMOS STATIC RAM

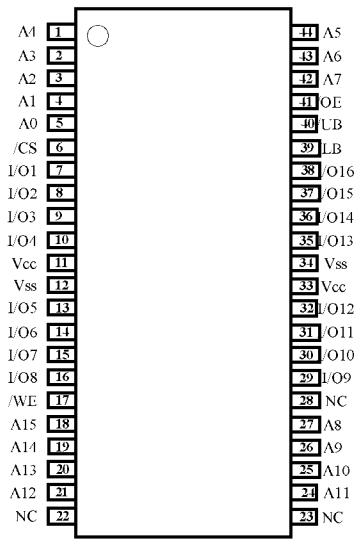
Description

The GM76FV1664 / GM76FU1664 / GM76FQ1664 / GM76FE1664 / GM76FS1664 is a 1,048,576 bits static random access memory organized as 65,536 words by 16 bits. Using a full CMOS technology and it provides high speed operation with minimum cycle time of 70/85ns. The device is placed in a low power standby mode with /CS high and the output enable (/OE) allows fast memory access. Thus it is suitable for high speed and low power applications, especially where battery back-up is required.

Features

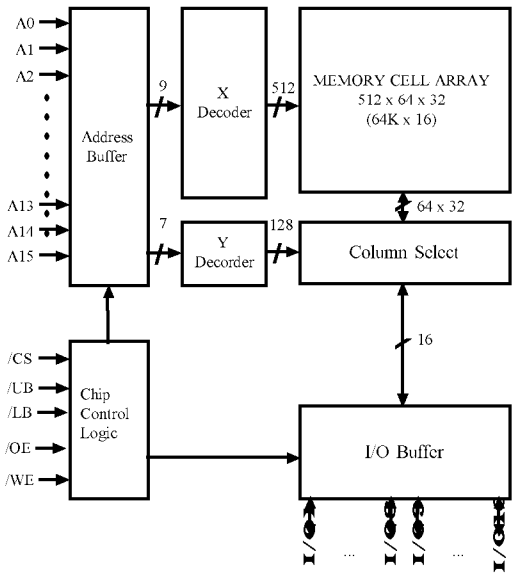
- Organization:64Kx16
- Data Byte Control : /LB = I/O1~I/O8, /UB = I/O9~I/O16
- Power Supply /Speed
  GM76FV1664 : 3.3V±0.3V / 70/85ns
  GM76FU1664 : 3.0V±0.3V / 70/85ns
  GM76FQ1664 : 2.5V±0.3V / 85/100ns
  GM76FE1664 : 2.0V±0.2V / 100/120ns
  GM76FS1664 : 1.8V±0.2V / 120/150ns
- Low Power Standby
  5uA(LL)/1uA(SL)
- Low Data Rentention Voltage:1.5V(Min)
- TTL compatible inpus and outputs
- Package Type : JEDEC Standard 44-TSOP(II)
- Temperature Range
  Commercial(0 ~ 70℃)
  Industrial(-40 ~ 85℃)

Pin Configuration



(Top View)

Block Diagram



Pin Description

Pin	Function
A0-A15	Address Inputs
/WE	Write Enable Input
/CS	Chip Select Input
/OE	Output Enable Input
I/O1-I/O16	Data Inputs/Outputs
/LB	Lower Byte(I/O1~I/O8)
/UB	Upper Byte(I/O9~I/O16)
Vcc	Power Supply (1.6V ~3.6V)
Vss	Ground
NC	No Connection

Absolute Maximum Ratings*

Symbol	Parameter		Rating	Unit
T_A	Ambient Temperature under Bias	GM76FV1664 GM76FU1664 GM76FQ1664 GM76FE1664 GM76FS1664	0 ~ 70	℃
		GM76FV1664-I GM76FU1664-I GM76FQ1664-I GM76FE1664-I GM76FS1664-I	-40 ~ 85	℃
T_{STG}	Storage Temperature		-55 ~ 150	℃
T_{SOL}	Soldering Temperature and Time		260, 5 (at lead)	℃, S
V_{CC}	Supply Voltage		-0.2 ~ 4.6V	V
V_{IN}	Input Voltage		-0.2 ~ 3.9V	V
$V_{I/O}$	Input and Output Voltage		-0.2 ~ 3.9V	V

*: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended DC Operating Conditions (T_A = - 40 ~ 85℃)

Symbol	Parameter	Product	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	GM76FV1664-(I) GM76FU1664-(I) GM76FQ1664-(I) GM76FE1664-(I) GM76FS1664-(I)	3.0 2.7 2.2 1.8 1.6	3.3 3.0 2.5 2.0 1.8	3.6 3.3 2.8 2.2 2.0	V
V_{IH}	Input High Voltage	GM76FV1664-(I) GM76FU1664-(I) GM76FQ1664-(I) GM76FE1664-(I) GM76FS1664-(I)	2.2 2.2 2.0 1.6 1.4	-	V_{CC} + 0.2	V
V_{IL}	Input Low Voltage	All Family	-0.2*	-	0.4	V

*Note : V_{IL}(min) = -1.5V for ≤ 30ns pulse

Truth Table

/CS	/OE	/WE	/LB	/UB	I/O1 ~ I/O8	I/O9 ~ I/O16	Vcc Current
H	X	X	X	X	Not Selected	Not Selected	Iccs1, Iccs2
L	L	H	L	L	Read	Read	Icc, Icc1, Icc2
			L	H	Read	High - Z	Icc, Icc1, Icc2
			H	L	High - Z	Read	Icc, Icc1, Icc2
L	X	L	L	L	Write	Write	Icc, Icc1, Icc2
			L	H	Write	Not Write/High - Z	Icc, Icc1, Icc2
			H	L	Not Write/High - Z	Write	Icc, Icc1, Icc2
L	H	H	X	X	High - Z	High - Z	Icc, Icc1, Icc2
L	X	X	H	H	High - Z	High - Z	Icc, Icc1, Icc2

*Note: X means don't care

Capacitance ($f = 1MHz$, $T_A = 25℃$)

Symbol	Parameter	Test Conditions	Min	Max	Unit
C_{IN}	Input Capacitance	$V_I = 0V$	-	6	pF
$C_{I/O}$	Output Capacitance	$V_O = 0V$	-	8	pF

*Note: This parameter is sampled and not 100% tested.

AC Operating Characteristics

Test Conditions ($T_A = -40 \sim 85℃$, unless otherwise noted.)

Parameter	Value
Input Pulse Level	0.4 to 2.2V for Vcc=3.3V,3.0V,2.5V 0.4 to 1.8V for Vcc=2.0V 0.4 to 1.6V for Vcc=1.8V
Input Rise and Fall Time	5ns
Input and Output Timing Reference Levels	1.5V for Vcc=3.3V,3.0V 1.1V for Vcc=2.5V 0.9V for Vcc=2.0V 0.8V for Vcc=1.8V
Output Load	$C_L = 30$ pF + 1TTL Load

DC and Operating Characteristics (T_A = - 40 ~ 85℃)

Symbol	Parameter	Conditions		Min	*Typ	Max	Unit
$I_{I(L)}$	Input Leakage Current	V_{IN} = Vss to V_{CC}		-1	-	1	uA
$I_{O(L)}$	Output Leakage Current	/CS=V_{IH} or /UB=V_{IH} or /LB=V_{IH} or /OE = V_{IH} or /WE = V_{IL} Vss ≤$V_{I/O}$≤V_{CC}		-1	-	1	uA
V_{OH}	High Level Output Voltage	I_{OH}	-1.0mA at Vcc=3.0/3.3V -0.5mA at Vcc=2.5V -0.44mA at Vcc=2.0V -0.44mA at Vcc=1.8V	2.4 2.0 1.6 1.4	-	-	V
V_{OL}	Low Level Output Voltage	I_{OL}	2.1mA at Vcc=3.0/3.3V 0.5mA at Vcc=2.5V 0.33mA at Vcc=2.0V 0.26mA at Vcc=1.8V	-	-	0.4	V
I_{CC}	Operating Supply Current	/CS = V_{IL} V_{IN} = V_{IH} or V_{IL}, I_{OUT} = 0mA		-	-	5.0	mA
I_{CC1}	Average Operating Current	/CS = V_{IL} V_{IN} = V_{IH} or V_{IL} I_{OUT} = 0mA tcycle = Min	Vcc=3.0/3.3V Vcc=2.5V Vcc=2.0V Vcc=1.8V	-	-	80 60 40 35	mA
I_{CC2}		/CS = 0.2V V_{IN} = V_{CC} - 0.2V/0.2V I_{OUT} = 0mA tcycle = 1*u*s		-	-	10	mA
I_{CCS1}	Standby Current (TTL)	/CS = V_{IH}	Vcc=3.0/3.3V Vcc=2.5/2.0/1.8V	-	-	0.5 0.3	mA
I_{CCS2}	Standby Current(CMOS)	/CS = V_{CC}-0.2V	LL - Version SL - Version	- -	- -	5 1	uA

*Typ. Values are measured at 25℃

AC Operating Characteristics (V_{CC} = 3.3V±0.3V, V_{CC} = 3.0V±0.3V, T_A = - 40 ~ 85℃)

Read Cycle

Symbol	Parameter	GM76FV1664-70 GM76FU1664-70		GM76FV1664-85 GM76FU1664-85		Unit
		Min	Max	Min	Max	
t_{RC}	Read cycle time	70	-	85	-	ns
t_{AA}	Address access time	-	70	-	85	ns
t_{CO}	Chip select access time (/CS)	-	70	-	85	ns
t_{BA}	Byte enable access time (/UB, /LB)	-	35	-	40	ns
t_{OE}	Output enable access time (/OE)	-	35	-	40	ns
t_{LZ}	Chip select to low - Z output (/CS)	10	-	10	-	ns
t_{OLZ}	Output enable to low - Z output (/OE)	5	-	5	-	ns
t_{BLZ}	Byte canble to low - Z output (/UB, /LB)	5	-	5	-	ns
t_{HZ}	Chip select to high - Z output (/CS)	-	25	-	30	ns
t_{OHZ}	Output enable to high -Z output (/OE)	-	25	-	30	ns
t_{BHZ}	Byte enable to high - Z output (/UB, /LB)	-	25	-	30	ns
t_{OH}	Output hold time	10	-	10	-	ns

Write Cycle

Symbol	Parameter	GM76FV1664-70 GM76FU1664-70		GM76FV1664-85 GM76FU1664-85		Unit
		Min	Max	Min	Max	
t_{WC}	Write cycle time	70	-	85	-	ns
t_{CW}	Chip select to end of write	65	-	70	-	ns
t_{BW}	Byte enable to end of write	65	-	70	-	ns
t_{AW}	Address valid to end of write	65	-	70	-	ns
t_{AS}	Address setup time	0	-	0	-	ns
t_{WP}	Write pulse width	50	-	60	-	ns
t_{WR}	Write recovery time	0	-	0	-	ns
t_{DW}	Data to write time overlap	30	-	35	-	ns
t_{DH}	Data hold from write time	0	-	0	-	ns
t_{WHZ}	Write to output in high - Z	-	25	-	30	ns
t_{OW}	Output active from end of write	5	-	5	-	ns

AC Operating Characteristics (V_{CC} = 2.5V ± 0.3V, T_A = - 40 ~ 85℃)

Read Cycle

Symbol	Parameter	GM76FQ1664-85		GM76FQ1664-10		Unit
		Min	Max	Min	Max	
t_{RC}	Read cycle time	85	-	100	-	ns
t_{AA}	Address access time	-	85	-	100	ns
t_{CO}	Chip select access time (/CS)	-	85	-	100	ns
t_{BA}	Byte enable access time (/UB, /LB)	-	40	-	50	ns
t_{OE}	Output enable access time (/OE)	-	40	-	50	ns
t_{LZ}	Chip select to low - Z output (/CS)	10	-	15	-	ns
t_{OLZ}	Output enable to low - Z output (/OE)	5	-	5	-	ns
t_{BLZ}	Byte canble to low - Z output (/UB, /LB)	10	-	10	-	ns
t_{HZ}	Chip select to high - Z output (/CS)	-	30	-	30	ns
t_{OHZ}	Output enable to high -Z output (/OE)	-	30	-	30	ns
t_{BHZ}	Byte enable to high - Z output (/UB, /LB)	-	30	-	30	ns
t_{OH}	Output hold time	10	-	10	-	ns

Write Cycle

Symbol	Parameter	GM76FQ1664-85		GM76FQ1664-10		Unit
		Min	Max	Min	Max	
t_{WC}	Write cycle time	85	-	100	-	ns
t_{CW}	Chip select to end of write	70	-	80	-	ns
t_{BW}	Byte enable to end of write	70	-	80	-	ns
t_{AW}	Address valid to end of write	70	-	80	-	ns
t_{AS}	Address setup time	0	-	0	-	ns
t_{WP}	Write pulse width	60	-	75	-	ns
t_{WR}	Write recovery time	0	-	0	-	ns
t_{DW}	Data to write time overlap	35	-	45	-	ns
t_{DH}	Data hold from write time	0	-	0	-	ns
t_{WHZ}	Write to output in high - Z	-	30	-	35	ns
t_{OW}	Output active from end of write	5	-	5	-	ns

AC Operating Characteristics (V_{CC} = 2.0V ± 0.2V, T_A = - 40 ~ 85℃)

Read Cycle

Symbol	Parameter	GM76FE1664-10		GM76FE1664-12		Unit
		Min	Max	Min	Max	
t_{RC}	Read cycle time	100	-	120	-	ns
t_{AA}	Address access time	-	100	-	120	ns
t_{CO}	Chip select access time (/CS)	-	100	-	120	ns
t_{BA}	Byte enable access time (/UB, /LB)	-	50	-	60	ns
t_{OE}	Output enable access time (/OE)	-	50	-	60	ns
t_{LZ}	Chip select to low - Z output (/CS)	20	-	20	-	ns
t_{OLZ}	Output enable to low - Z output (/OE)	5	-	10	-	ns
t_{BLZ}	Byte canble to low - Z output (/UB, /LB)	10	-	10	-	ns
t_{HZ}	Chip select to high - Z output (/CS)	-	30	-	40	ns
t_{OHZ}	Output enable to high -Z output (/OE)	-	30	-	40	ns
t_{BHZ}	Byte enable to high - Z output (/UB, /LB)	-	30	-	40	ns
t_{OH}	Output hold time	15	-	15	-	ns

Write Cycle

Symbol	Parameter	GM76FE1664-10		GM76FE1664-12		Unit
		Min	Max	Min	Max	
t_{WC}	Write cycle time	100	-	120	-	ns
t_{CW}	Chip select to end of write	80	-	100	-	ns
t_{BW}	Byte enable to end of write	80	-	100	-	ns
t_{AW}	Address valid to end of write	80	-	100	-	ns
t_{AS}	Address setup time	0	-	0	-	ns
t_{WP}	Write pulse width	75	-	85	-	ns
t_{WR}	Write recovery time	0	-	0	-	ns
t_{DW}	Data to write time overlap	45	-	50	-	ns
t_{DH}	Data hold from write time	0	-	0	-	ns
t_{WHZ}	Write to output in high - Z	-	35	-	40	ns
t_{OW}	Output active from end of write	5	-	5	-	ns

AC Operating Characteristics (V_{CC} = 2.0V ± 0.2V, T_A = - 40 ~ 85℃)

Read Cycle

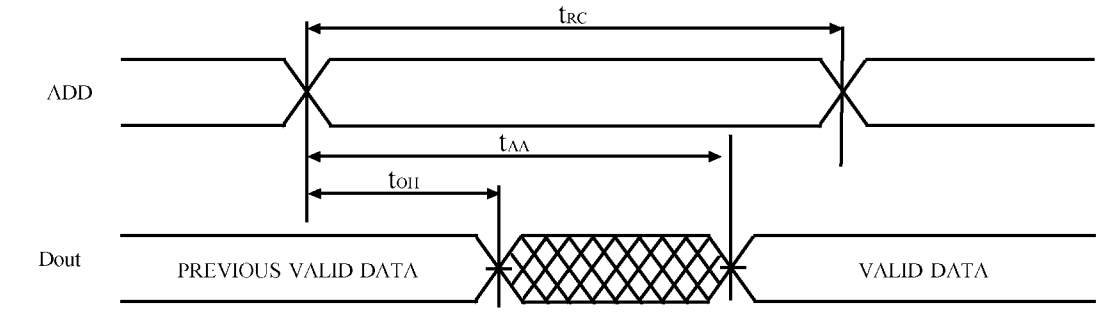
Symbol	Parameter	GM76FS1664-12		GM76FS1664-15		Unit
		Min	Max	Min	Max	
t_{RC}	Read cycle time	120	-	150	-	ns
t_{AA}	Address access time	-	120	-	150	ns
t_{CO}	Chip select access time (/CS)	-	120	-	150	ns
t_{BA}	Byte enable access time (/UB, /LB)	-	60	-	75	ns
t_{OE}	Output enable access time (/OE)	-	60	-	75	ns
t_{LZ}	Chip select to low - Z output (/CS)	20	-	20	-	ns
t_{OLZ}	Output enable to low - Z output (/OE)	10	-	10	-	ns
t_{BLZ}	Byte canble to low - Z output (/UB, /LB)	10	-	10	-	ns
t_{HZ}	Chip select to high - Z output (/CS)	-	40	-	50	ns
t_{OHZ}	Output enable to high -Z output (/OE)	-	40	-	50	ns
t_{BHZ}	Byte enable to high - Z output (/UB, /LB)	-	40	-	50	ns
t_{OH}	Output hold time	15	-	15	-	ns

Write Cycle

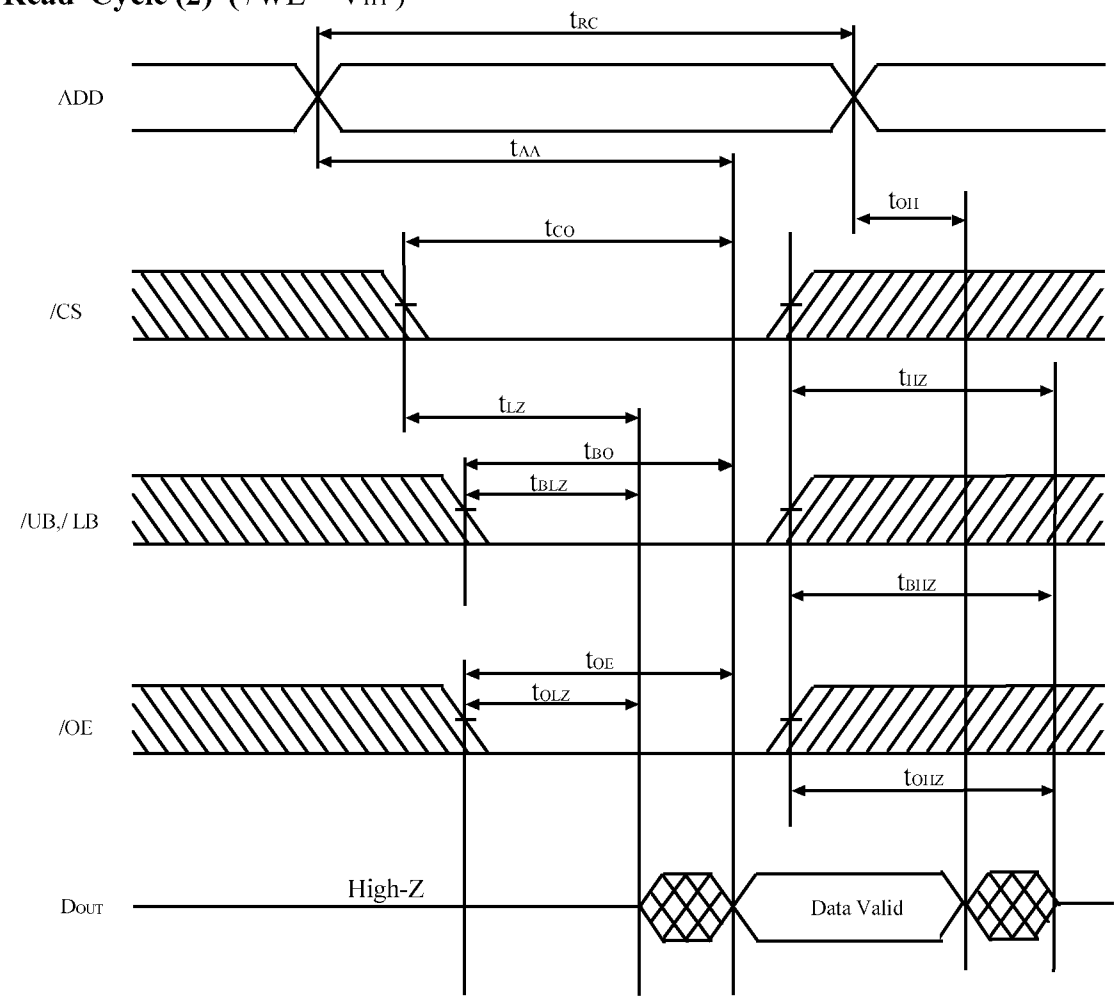
Symbol	Parameter	GM76FS1664-12		GM76FS1664-15		Unit
		Min	Max	Min	Max	
t_{WC}	Write cycle time	120	-	150	-	ns
t_{CW}	Chip select to end of write	100	-	120	-	ns
t_{BW}	Byte enable to end of write	100	-	120	-	ns
t_{AW}	Address valid to end of write	100	-	120	-	ns
t_{AS}	Address setup time	0	-	0	-	ns
t_{WP}	Write pulse width	85	-	100	-	ns
t_{WR}	Write recovery time	0	-	0	-	ns
t_{DW}	Data to write time overlap	50	-	60	-	ns
t_{DH}	Data hold from write time	0	-	0	-	ns
t_{WHZ}	Write to output in high - Z	-	60	-	70	ns
t_{OW}	Output active from end of write	5	-	5	-	ns

Timing Waveforms

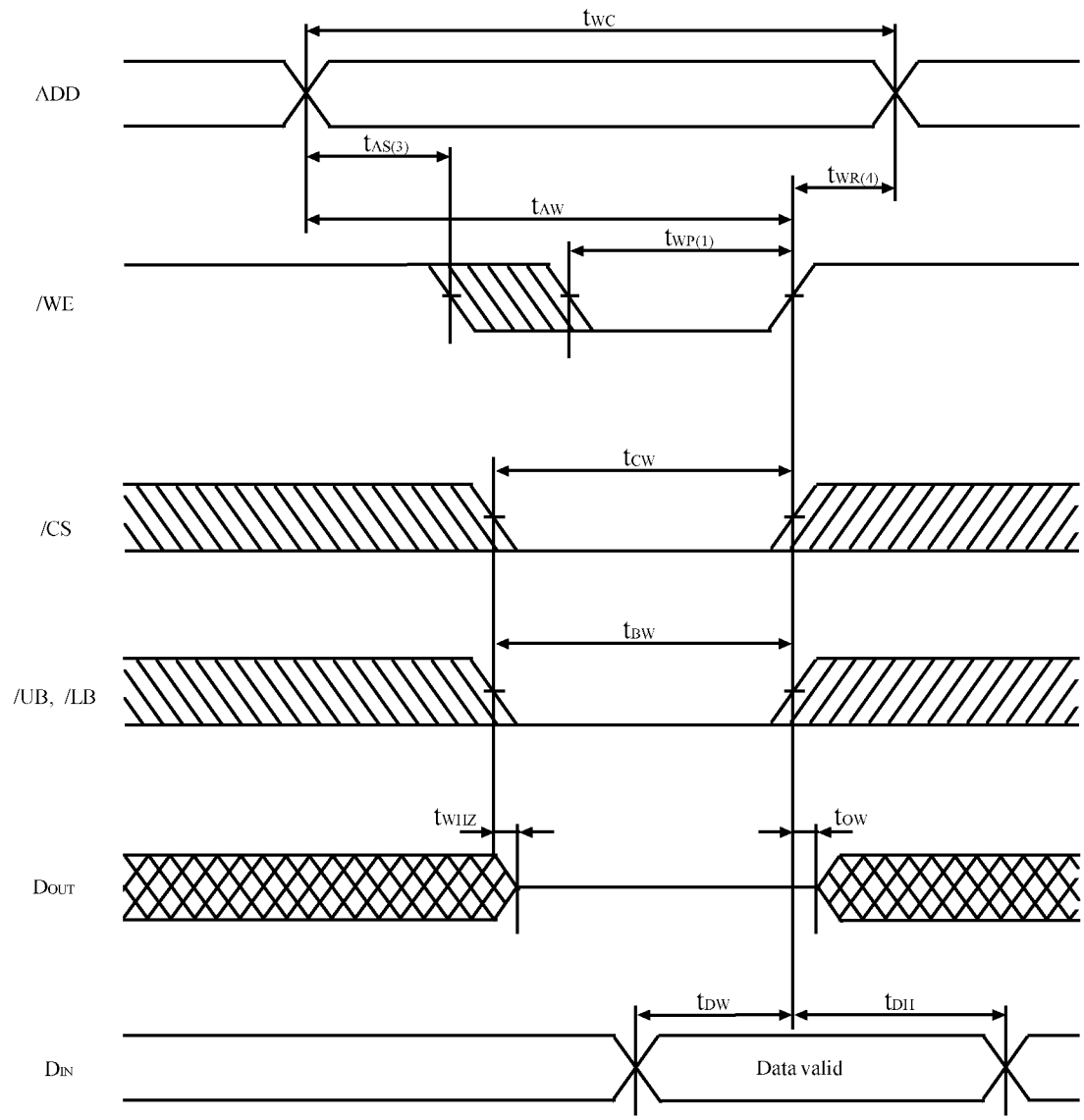
Read Cycle (1) (/CS = /OE = V_{IL}, /WE = V_{IH}, /UB and, or /LB = V_{IL})



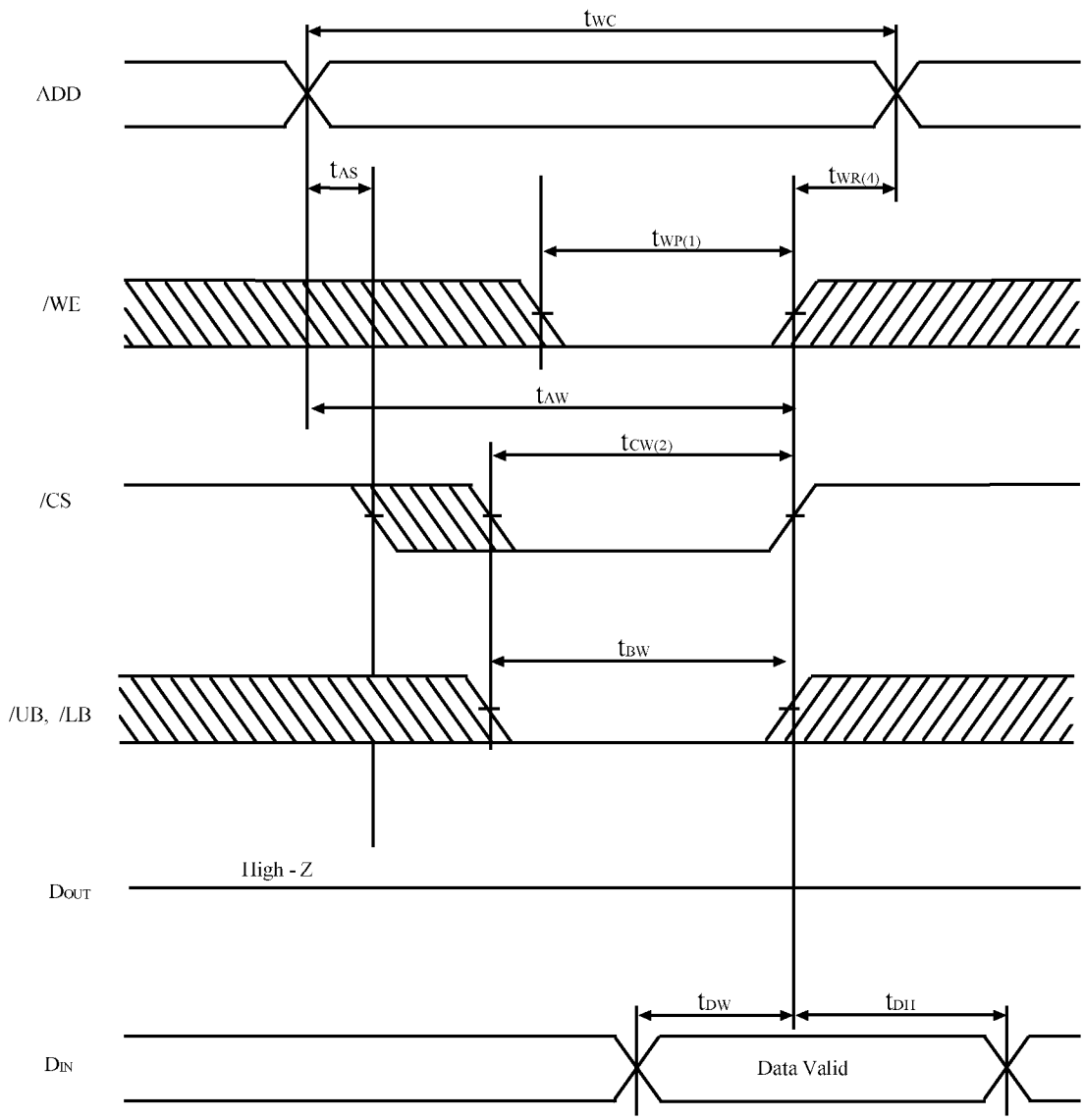
Read Cycle (2) (/WE = V_{IH})



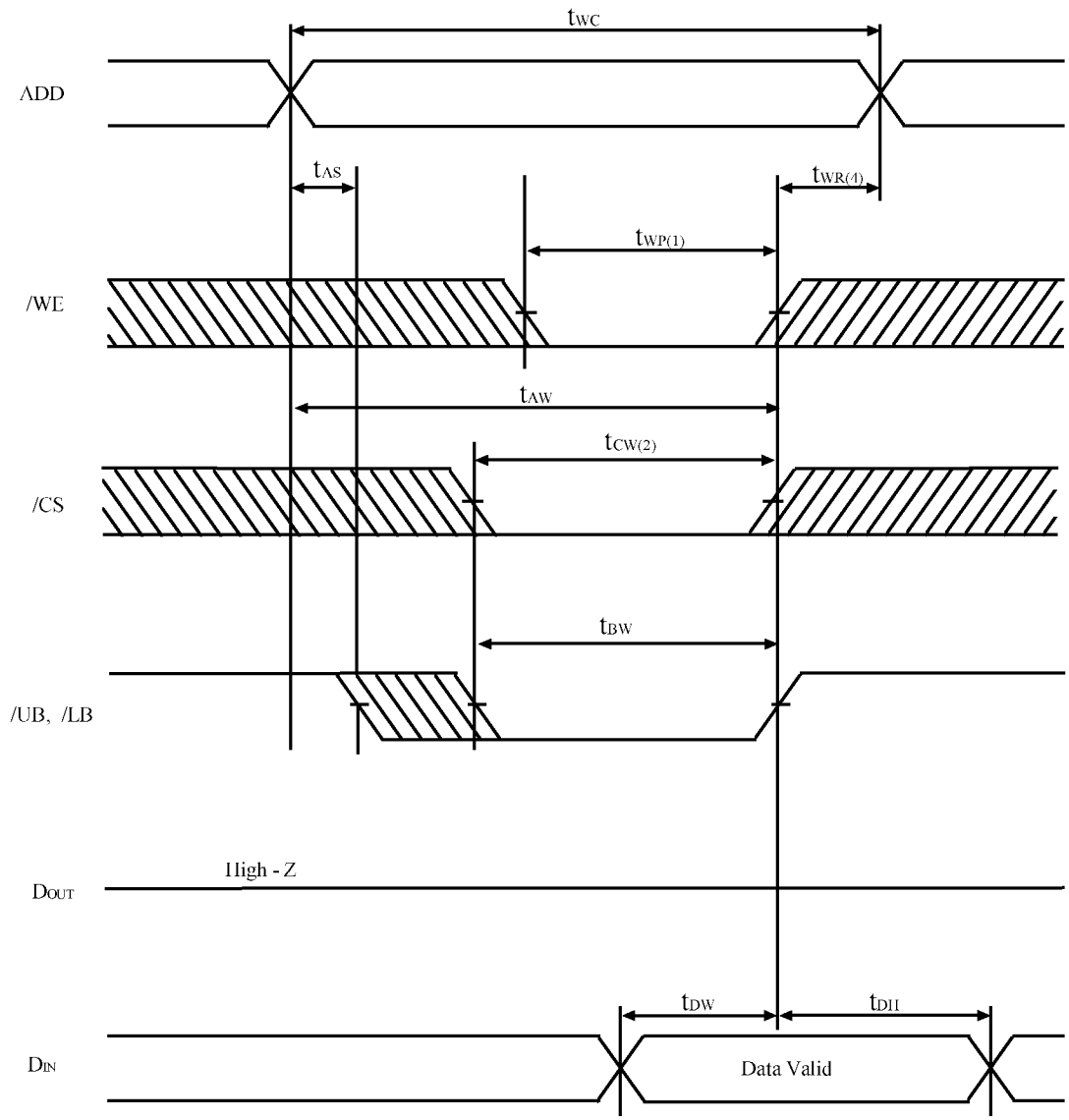
Write Cycle (1) (/WE Controlled)



Write Cycle (2) (/CS Controlled)



Write Cycle (3) (/UB, /LB Controlled)



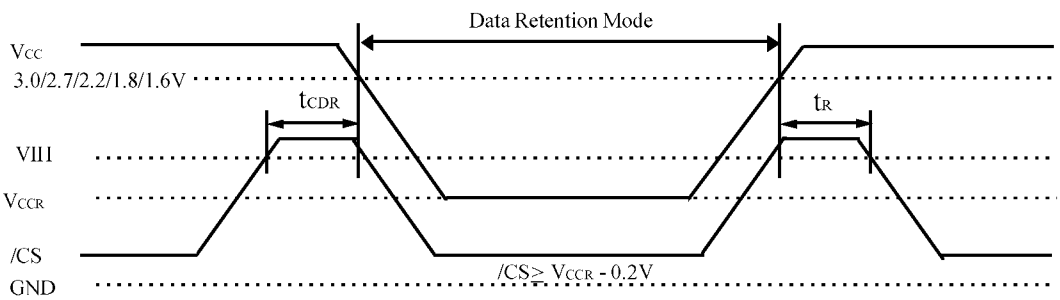
Notes (Write Cycle):

1. A write occurs during the overlap(tWP) of a low /CS and low /WE. A write begins at the latest transition among /CS going low and /WE going low : A write end at the earliest transition among /CS going high and /WE going high, tWP is measured from the beginning of write to the end of write.
2. tCW is measured from the later of /CS going low to end of write.
3. tAS is measured from the address valid to the beginning of write.
4. tWR is measured from the end of write to the address change. tWR applied in case a write ends as /CS, or /WE, or /UB, or /LB going high.

Data Retention Characteristics

Symbol	Parameter		Min	Typ	Max	Unit
V_{CCR}	Data Retention Supply Voltage		1.5	-	3.6	V
I_{CCR}	Data Retention Current	LL- Version SL - Version	- -		5 1	*u*A
t_{CDR}	Chip Select to Data Retention Time		0	-	-	ms
t_R	Operation Recovery Time		5	-	-	ms

Data Retention Timing



Note: When retaining data in standby mode, supply voltage can be lowered within a certain range.
Read or write cycle cannot be performed while the supply voltage is low.

Package Dimensions

Unit: Inches (mm)

44 TSOP-II