4Mb Async. FAST SRAM
A-die Specification

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Document Title

256Kx16 & 512Kx8 Bit Asynchronous FAST SRAM

Revision History

Rev. No.	History	Draft Date	Remark
0.0	Initial Draft	Mar. 2013	Preliminary
1.0	Final spec release	Jul. 2013	Final
1.1	Add wide Vcc range support 1.65 ~ 3.6V	Aug. 2013	Final

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256Kx16 & 512Kx8 Bit Asynchronous FAST SRAM

Features

- Fast Access Time 8, 10, 15ns(Max)
- CMOS Low Power Dissipation
  Standby (TTL) : 10mA (Max.)
  (CMOS) : 6mA (Max.)
  Operating : 35mA (8ns, Max.)
  30mA (10ns, Max.)
  25mA (15ns, Max.)
- Single 3.3 ±0.3V or 5.0 ±0.5V Power Supply
  - S6R40xxV1A : 3.3 ±0.3V Power Supply
  - S6R40xxC1A : 5.0 ±0.5V Power Supply
- Wide range of Power Supply
  - S6R40xxW1A : 1.65V ~ 3.6V Power Supply
- TTL Compatible Inputs and Outputs
- Fully Static Operation, No Clock or Refresh required
- Three State Outputs
- Data Byte Control(x16 Mode)
  LB : I/O0~ I/O7, UB : I/O8~ I/O15
- Standard 44 TSOP2 Package Pin Configuration
- Operating in Commercial and Industrial Temperature range.

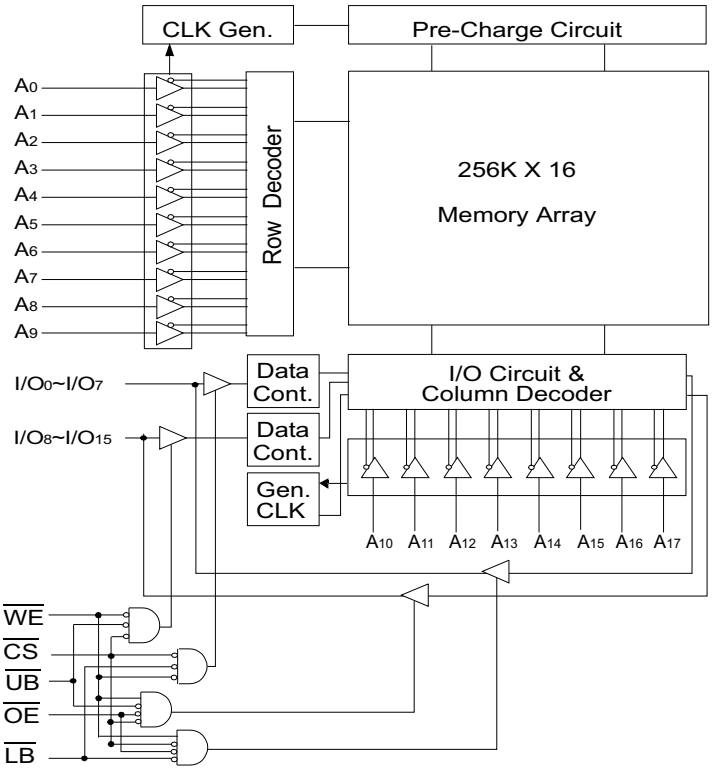
General Description

The S6R4016(V/C/W)1A and S6R4008(V/C/W))1A are a 4,194,304-bit high-speed Static Random Access Memory organized as 256K (512K) words by 16(8) bits. The S6R4016(V/C/W)1A (S6R4008(V/C/W)1A) uses 16(8) common input and output lines and have an output enable pin which operates faster than address access time at read cycle. And S6R4016(V/C/W)1A allows that lower and upper byte access by data byte control($\overline{UB}$, $\overline{LB}$). The device is fabricated using advanced CMOS process,6-TR based cell technology and designed for high-speed circuit technology. It is particularly well suited for use in high-density high-speed system applications. The S6R4016(V/C/W)1A and S6R4008(V/C/W)1A are packaged in a 400mil 44-pin TSOP(II).

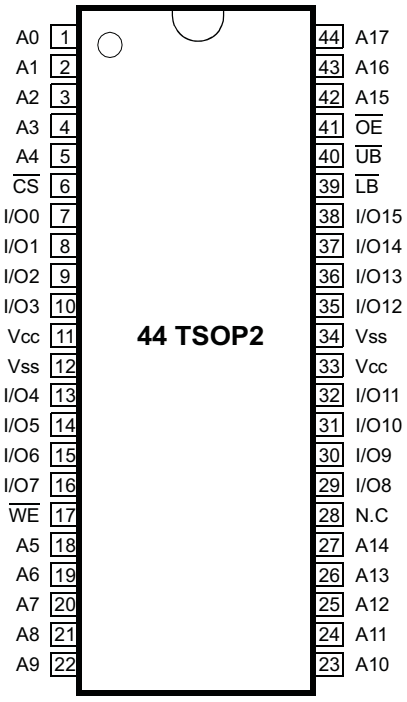
4Mb Asynchronous FAST SRAM Ordering Information

Density	Org.	Vcc (V)	Speed		Part Number	Package	TEMP
			tAA(ns)	tOE(ns)			
4Mb	256Kx16	5.0	8	4	S6R4016C1A-UC(I)08	44 TSOP2	C : Commercial Temperature I : Industrial Temperature
		5.0	10	5	S6R4016C1A-UC(I)10	44 TSOP2	
		3.3	8	4	S6R4016V1A-UC(I)08	44 TSOP2	
		3.3	10	5	S6R4016V1A-UC(I)10	44 TSOP2	
		2.5, 3.3	8	4	S6R4016W1A-UC(I)08	44 TSOP2	
		2.5, 3.3	10	5	S6R4016W1A-UC(I)10	44 TSOP2	
		1.8	15	7	S6R4016W1A-UC(I)15	44 TSOP2	
	512Kx8	5.0	8	4	S6R4008C1A-UC(I)08	44 TSOP2	
		5.0	10	5	S6R4008C1A-UC(I)10	44 TSOP2	
		3.3	8	4	S6R4008V1A-UC(I)08	44 TSOP2	
		3.3	10	5	S6R4008V1A-UC(I)10	44 TSOP2	
		2.5, 3.3	8	4	S6R4008W1A-UC(I)08	44 TSOP2	
		2.5, 3.3	10	5	S6R4008W1A-UC(I)10	44 TSOP2	
		1.8	15	7	S6R4008W1A-UC(I)15	44 TSOP2	

Logic Block Diagram - S6R4016(V/C/W)1A (256K x 16)



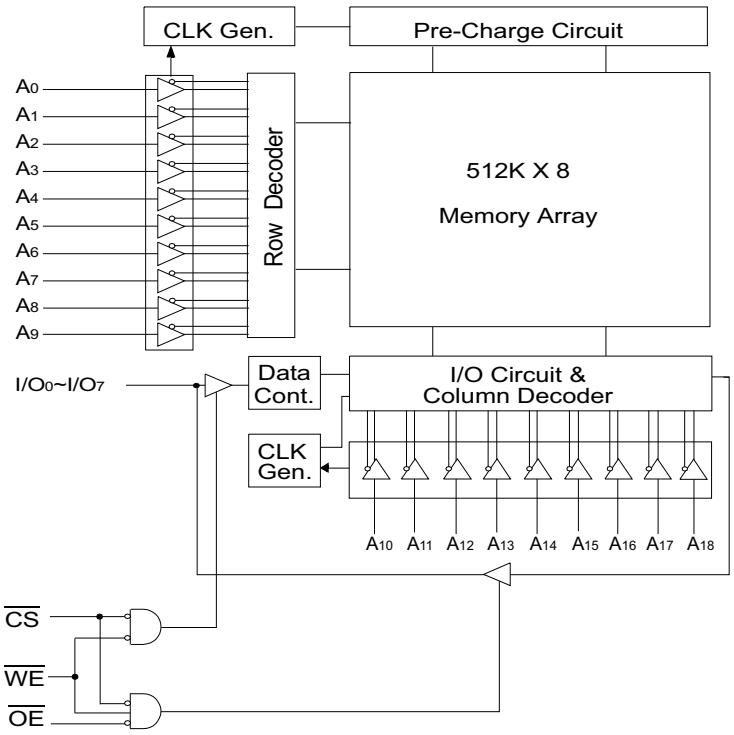
44 TSOP2 Package Pin Configurations(Top View) - S6R4016(V/C/W)1A (256K x 16)



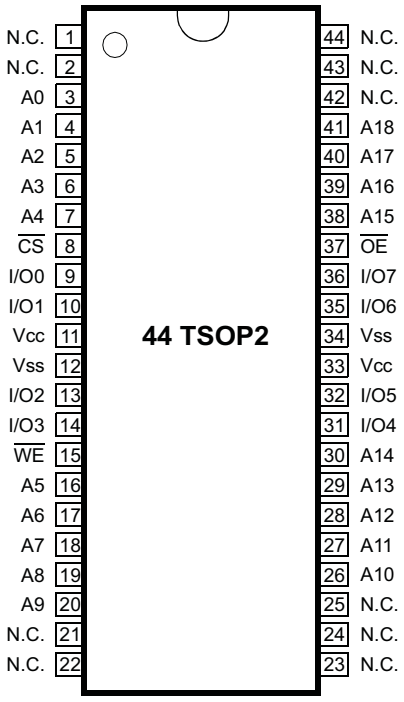
Pin Function

Pin Name	Pin Function
A0 - A17	Address Inputs
$\overline{WE}$	Write Enable
$\overline{CS}$	Chip Select
$\overline{OE}$	Output Enable
$\overline{LB}$	Lower-byte Control(I/O0~I/O7)
$\overline{UB}$	Upper-byte Control(I/O8~I/O15)
I/O0 ~ I/O15	Data Inputs/Outputs
Vcc	Power
Vss	Ground
N.C	No Connection

Logic Block Diagram - S6R4008(V/C/W)1A (512K x 8)



44 TSOP2 Package Pin Configurations(Top View) - S6R4008(V/C/W)1A (512K x 8)



Pin Function

Pin Name	Pin Function
A_0 - A_{18}	Address Inputs
$\overline{WE}$	Write Enable
$\overline{CS}$	Chip Select
$\overline{OE}$	Output Enable
I/O_0 ~ I/O_7	Data Inputs/Outputs
V_{CC}	Power
V_{SS}	Ground
N.C	No Connection

Absolute Maximum Ratings*

Parameter		Symbol	Rating	Unit
Voltage on Any Pin Relative to VSS	3.3V Product	V_{IN}, V_{OUT}	-0.5 to Vcc+0.5V	V
	5.0V Product			
	Wide Vcc** Product			
Voltage on Vcc Supply Relative to VSS	3.3V Product	V_{IN}, V_{OUT}	-0.5 to 4.6	V
	5.0V Product		-0.5 to 7.0	
	Wide Vcc** Product		-0.5 to 4.6	
Power Dissipation		P_D	1.0	W
Storage Temperature		T_{STG}	-65 to 150	°C
Operating Temperature	Commercial	T_A	0 to 70	°C
	Industrial	T_A	-40 to 85	°C

* 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.

** Wide Vcc Range is 1.65V ~ 3.6V

Recommended DC Operating Conditions* (T_A=0 to 70°C)

Parameter	Operating Vcc(V)	Symbol	Min	Typ	Max	Unit
Supply Voltage	5.0	V_{CC}	4.5	5.0	5.5	V
	3.3	V_{CC}	3.0	3.3	3.6	
	Wide 2.4 ~ 3.6	V_{CC}	2.4	2.5/3.3	3.6	
	Wide 1.65 ~ 2.2	V_{CC}	1.65	1.8	2.2	
Ground		V_{SS}	0	0	0	V
Input High Voltage	5.0	V_{IH}	2.2	-	V_{CC}+0.5	V
	3.3	V_{IH}	2.0	-	V_{CC}+0.5	
	Wide 2.4 ~ 3.6	V_{IH}	2.0	-	V_{CC}+0.3	
	Wide 1.65 ~ 2.2	V_{IH}	1.4	-	V_{CC}+0.2	
Input Low Voltage	5.0	V_{IL}	-0.3	-	0.8	V
	3.3	V_{IL}	-0.3	-	0.8	
	Wide 2.4 ~ 3.6	V_{IL}	-0.3	-	0.7	
	Wide 1.65 ~ 2.2	V_{IL}	-0.2	-	0.4	

* The above parameters are also guaranteed for industrial temperature range.

DC and Operating Characteristics*(T_A=0 to 70°C)

Parameter	Symbol	Test Conditions			Min	Max	Unit
Input Leakage Current	I_{LI}	V_{IN}=V_{SS} to V_{CC}			-2	2	µA
Output Leakage Current	I_{LO}	$\overline{CS}$=V_{IH} or $\overline{OE}$=V_{IH} or $\overline{WE}$=V_{IL} V_{OUT}=V_{SS} to V_{CC}			-2	2	µA
Operating Current**	ICC	Min. Cycle, 100% Duty CS=VIL, VIN=VIH or VIL, IOUT=0mA	Com.	8ns	-	35	mA
				10ns	-	30	
				15ns		25	
			Ind.	8ns	-	35	
				10ns	-	30	
				15ns		25	
Standby Current	I_{SB}	Min. Cycle, $\overline{CS}$=V_{IH}			-	10	mA
	I_{SB1}	f=0MHz, $\overline{CS}$≥V_{CC}-0.2V, V_{IN}≥V_{CC}-0.2V or V_{IN}≤0.2V			-	6	
Output Low Voltage Level	V_{OL}	Vcc=4.5V, I_{OL}=8mA, 5.0V Product			-	0.4	V
		Vcc=3.0V, I_{OL}=8mA, 3.3V Product & Wide Vcc** Product			-	0.4	
		Vcc=2.4V, I_{OL}=1mA, Wide Vcc** Product			-	0.4	
		Vcc=1.65V, I_{OL}=1mA, Wide Vcc** Product			-	0.2	
Output High Voltage Level	V_{OH}	Vcc=4.5V, I_{OH}=-4mA, 5.0V Product			2.4	-	V
		Vcc=3.0V, I_{OH}=-4mA, 3.3V Product & Wide Vcc** Product			2.4	-	
		Vcc=2.4V, I_{OH}=-1mA, Wide Vcc** Product			1.8	-	
		Vcc=1.65V, I_{OH}=-1mA, Wide Vcc** Product			1.4	-	

* The above parameters are also guaranteed for industrial temperature range.

** Wide Vcc Range is 1.65V ~ 3.6V

Capacitance*(T_A=25°C, f=1.0MHz)

Item	Symbol	Test Conditions	TYP	Max	Unit
Input/Output Capacitance	$C_{I/O}$	$V_{I/O}$=0V	-	8	pF
Input Capacitance	C_{IN}	V_{IN}=0V	-	6	pF

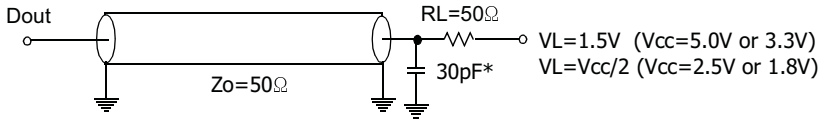
* Capacitance is sampled and not 100% tested.

Test Conditions*

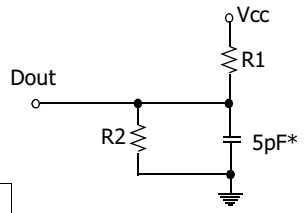
Parameter	Value
Input Pulse Level	0 to 3.0V (Vcc=3.3V or 5.0V)
	0 to 2.5V (Vcc=2.5V)
	0 to 1.8V (Vcc=1.8V)
Input Rise and Fall Time	1V/1ns
Input and Output Timing Reference Levels	1.5V (Vcc=3.3V or 5.0V)
	1/2Vcc (Vcc= 1.8V or 2.5V)
Output Load	See Fig. 1

* The above parameters are also guaranteed at industrial temperature range.

Output Load(A)



Output Load(B)
(for tHZ, tLZ, tWHZ, tOLZ & tOHZ)

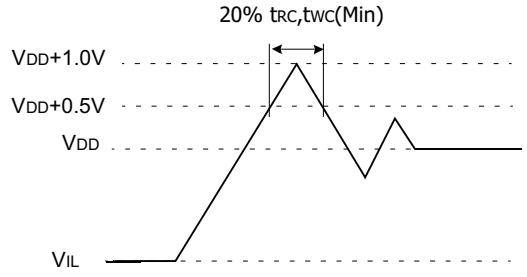


Vcc	5.0V	3.3V	2.5V	1.8V
R1	480Ω	319Ω	1909Ω	13500Ω
R2	255Ω	353Ω	1105Ω	10800Ω

* Including Scope and Jig Capacitance

Fig. 1

Overshoot Timing



Undershoot Timing

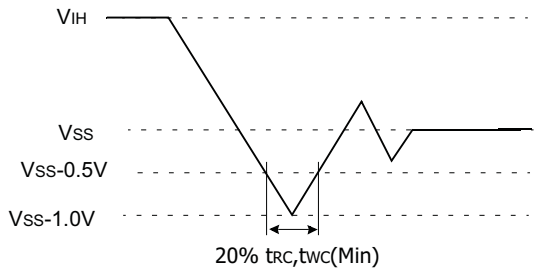


Fig. 2

Functional Description (x8 Mode)

$\overline{CS}$	$\overline{WE}$	$\overline{OE}$	Mode	I/O Pin	Supply Current
H	X	X*	Not Select	High-Z	ISB, ISB1
L	H	H	Output Disable	High-Z	ICC
L	H	L	Read	DOUT	ICC
L	L	X	Write	DIN	ICC

* X means Don´t Care.

Functional Description (x16 Mode)

$\overline{CS}$	$\overline{WE}$	$\overline{OE}$	$\overline{LB}$**	$\overline{UB}$**	Mode	I/O Pin		Supply Current
						I/O_0~I/O_7	I/O_8~I/O_{15}	
H	X	X*	X	X	Not Select	High-Z	High-Z	I_{SB}, I_{SB1}
L	H	H	X	X	Output Disable	High-Z	High-Z	I_{CC}
L	X	X	H	H				
L	H	L	L	H	Read	D_{OUT}	High-Z	I_{CC}
			H	L		High-Z	D_{OUT}	
			L	L		D_{OUT}	D_{OUT}	
L	L	X	L	H	Write	D_{IN}	High-Z	I_{CC}
			H	L		High-Z	D_{IN}	
			L	L		D_{IN}	D_{IN}	

* X means Don't Care.

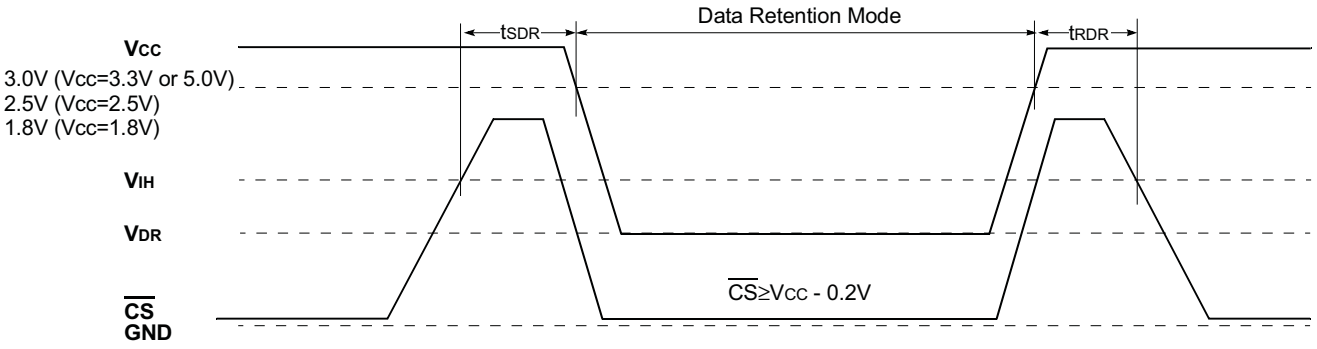
Data Retention Characteristics* (T_A=0 to 70°C)

Parameter	Product	Operating Vcc(V)	Symbol	Test Condition	Min.	Typ.	Max.	Unit
V_{CC} for Data Retention	5.0V Product	5.0	V_{DR}	$\overline{CS}$ ≥V_{CC} - 0.2V	2.0	-	5.5	V
	3.3V Product	3.3			2.0	-	3.6	
	Wide 2.4V ~ 3.6V	2.5/3.3			2.0	-	3.6	
	Wide 1.65V ~ 2.2V	1.8			1.5	-	3.6	
Data Retention Current	5.0V Product	5.0	I_{DR}	V_{CC}=2.0V $\overline{CS}$≥V_{CC} - 0.2V V_{IN}≥V_{CC} - 0.2V or V_{IN}≤0.2V	-	-	5	mA
	3.3V Product	3.3			-	-	5	
	Wide 2.4V ~ 3.6V	2.5/3.3			-	-	6	
	Wide 1.65V ~ 2.2V	1.8		V_{CC}=1.5V $\overline{CS}$≥V_{CC} - 0.2V V_{IN}≥V_{CC} - 0.2V or V_{IN}≤0.2V	-	-	6	
Data Retention Set-Up Time			t_{SDR}	See Data Retention Wave form(below)	0	-	-	ns
Recovery Time			t_{RDR}		5	-	-	ms

* The above parameters are also guaranteed at industrial temperature range.

Data Retention Wave Form

$\overline{CS}$ controlled



Read Cycle*

Parameter	Symbol	8ns		10ns		15ns		Unit
		Min	Max	Min	Max	Min	Max	
Read Cycle Time	t_{RC}	8	-	10	-	15	-	ns
Address Access Time	t_{AA}	-	8	-	10	-	15	ns
Chip Select to Output	t_{CO}	-	8	-	10	-	15	ns
Output Enable to Valid Output	t_{OE}	-	4	-	5	-	7	ns
$\overline{UB}$, $\overline{LB}$ Access Time **	t_{BA}	-	4	-	5	-	7	ns
Chip Enable to Low-Z Output	t_{LZ}	3	-	3	-	3	-	ns
Output Enable to Low-Z Output	t_{OLZ}	0		0	-	0	-	ns
$\overline{UB}$, $\overline{LB}$ Enable to Low-Z Output **	t_{BLZ}	0		0	-	0	-	ns
Chip Disable to High-Z Output	t_{HZ}	0	4	0	5	0	7	ns
Output Disable to High-Z Output	t_{OHZ}	0	4	0	5	0	7	ns
$\overline{UB}$, $\overline{LB}$ Disable to High-Z Output **	t_{BHZ}	0	4	0	5	0	7	ns
Output Hold from Address Change	t_{OH}	3	-	3	-	3	-	ns
Chip Selection to Power Up Time	t_{PU}	0	-	0	-	0	-	ns
Chip Selection to Power DownTime	t_{PD}	-	8	-	10	-	15	ns

* The above parameters are also guaranteed for industrial temperature range.

Write Cycle*

Parameter	Symbol	8ns		10ns		15ns		Unit
		Min	Max	Min	Max	Min	Max	
Write Cycle Time	t_{WC}	8	-	10	-	15	-	ns
Chip Select to End of Write	t_{CW}	6	-	7	-	12	-	ns
Address Set-up Time	t_{AS}	0	-	0	-	0	-	ns
Address Valid to End of Write	t_{AW}	6	-	7	-	12	-	ns
Write Pulse Width($\overline{OE}$ High)	t_{WP}	6	-	7	-	12	-	ns
Write Pulse Width($\overline{OE}$ Low)	t_{WP1}	8	-	10	-	15	-	ns
$\overline{UB}$, $\overline{LB}$ Valid to End of Write **	t_{BW}	6	-	7	-	12	-	ns
Write Recovery Time	t_{WR}	0	-	0	-	0	-	ns
Write to Output High-Z	t_{WHZ}	0	4	0	5	0	7	ns
Data to Write Time Overlap	t_{DW}	4	-	5	-	8	-	ns
Data Hold from Write Time	t_{DH}	0	-	0	-	0	-	ns
End of Write to Output Low-Z	t_{OW}	3	-	3	-	3	-	ns

* The above parameters are also guaranteed for industrial temperature range.

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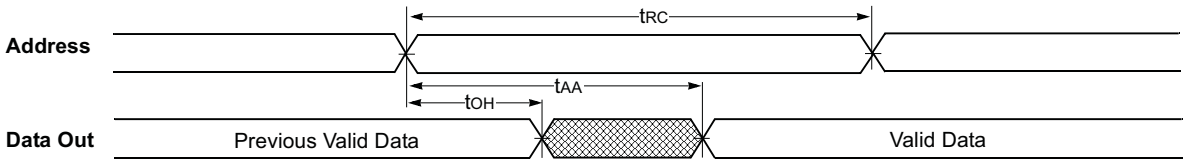
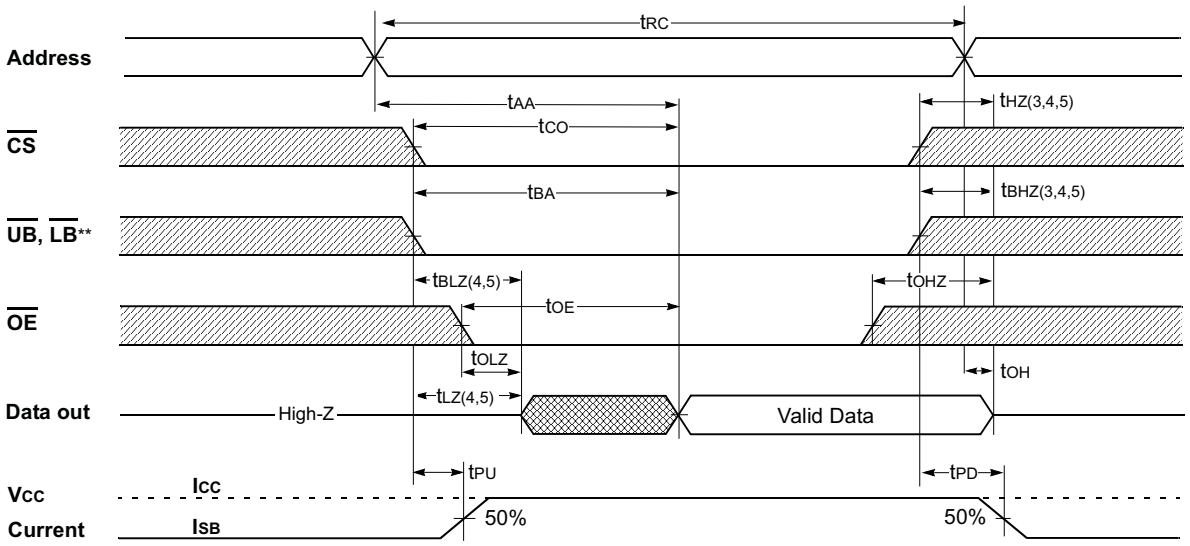
Timing Diagrams

Timing Waveform Of Read Cycle(1) (Address Controlled, $\overline{CS}$=$\overline{OE}$=V_{IL}, $\overline{WE}$=V_{IH}, $\overline{UB}$, $\overline{LB}$=V_{IL} **)



** Those parameters are applied for x16 mode only.

Timing Waveform Of Read Cycle(2) ($\overline{WE}$=V_{IH})

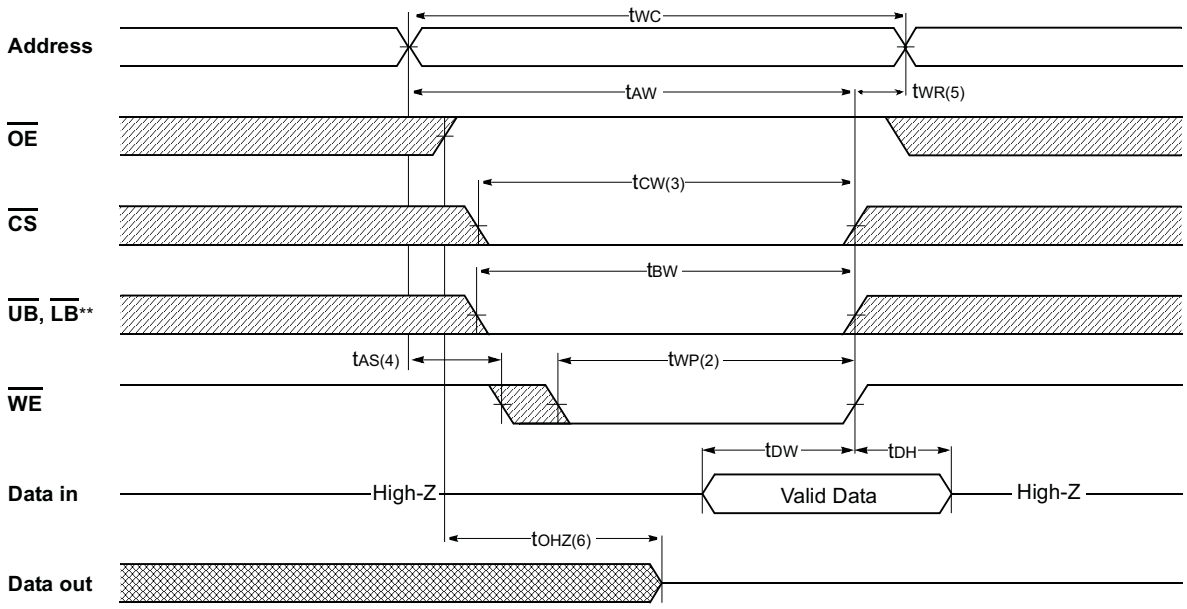


NOTES(Read Cycle)

1. $\overline{WE}$ is high for read cycle.
2. All read cycle timing is referenced from the last valid address to the first transition address.
3. t_{HZ} and t_{OHZ} are defined as the time at which the outputs achieve the open circuit condition and are not referenced to V_{OH} or V_{OL} levels.
4. At any given temperature and voltage condition, t_{HZ}(Max.) is less than t_{LZ}(Min.) both for a given device and from device to device.
5. Transition is measured ±200mV from steady state voltage with Load(B). This parameter is sampled and not 100% tested.
6. Device is continuously selected with $\overline{CS}$=V_{IL}.
7. Address valid prior to coincident with $\overline{CS}$ transition low.
8. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycle.

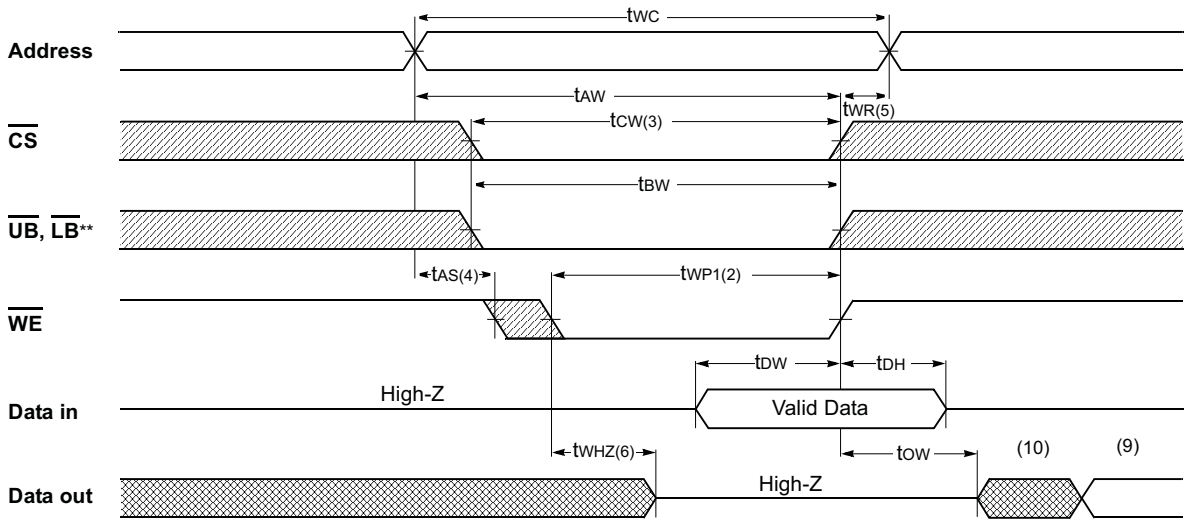
** Those parameters are applied for x16 mode only.

Timing Waveform Of Write Cycle(1) ($\overline{OE}$ Clock)



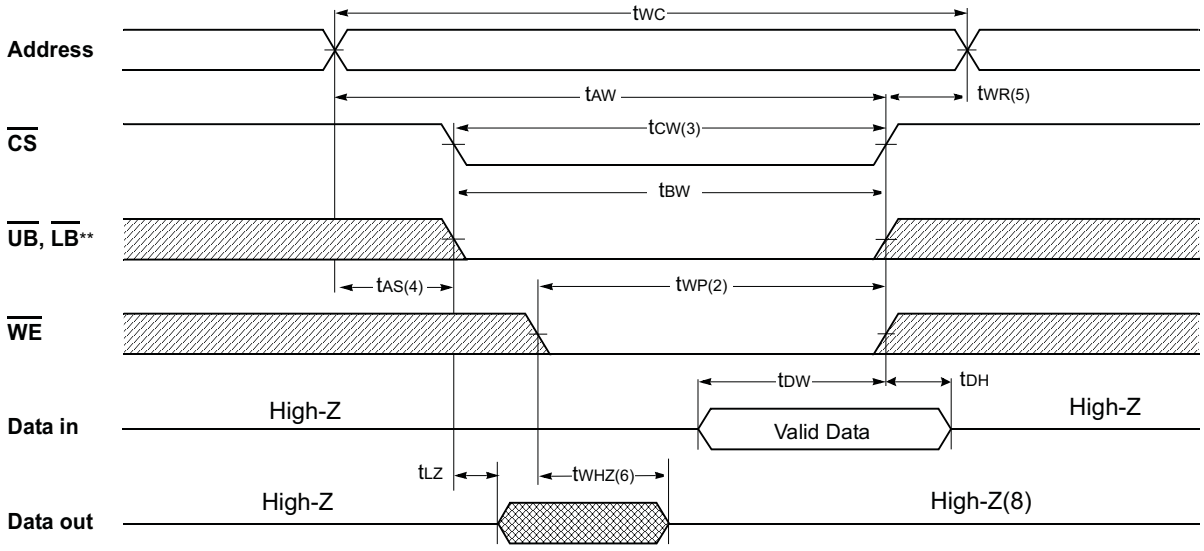
** Those parameters are applied for x16 mode only.

Timing Waveform Of Write Cycle(2) ($\overline{OE}$=Low fixed)



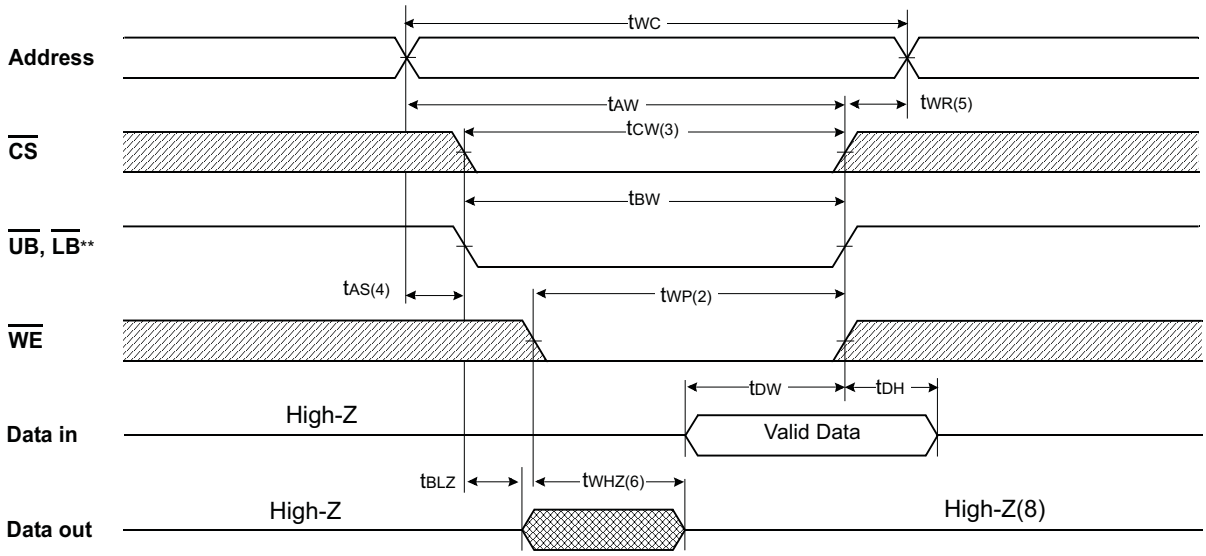
** Those parameters are applied for x16 mode only.

Timing Waveform Of Write Cycle(3) ($\overline{CS}$=Controlled)



** Those parameters are applied for x16 mode only.

Timing Waveform Of Write Cycle(4) ($\overline{UB}$, $\overline{LB}$ Controlled)



NOTES(Write Cycle)

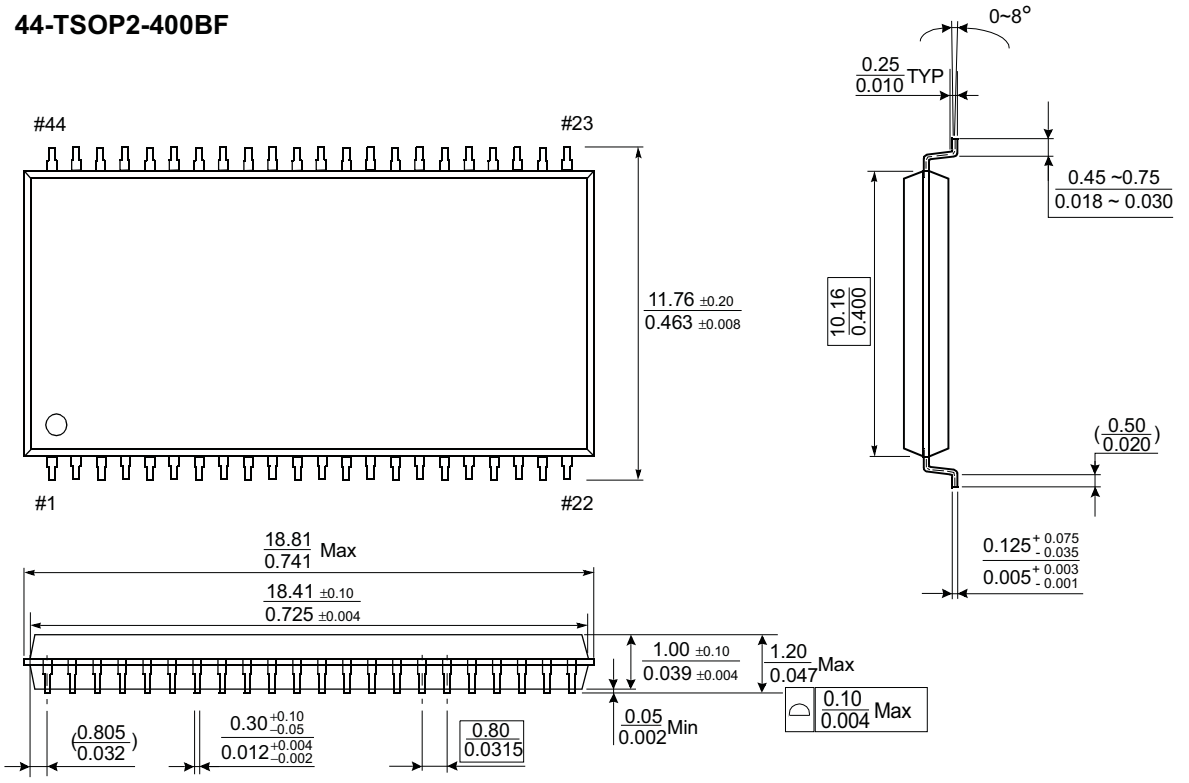
1. All write cycle timing is referenced from the last valid address to the first transition address.
2. A write occurs during the overlap of a low $\overline{CS}$,$\overline{WE}$,$\overline{LB}$ and $\overline{UB}$. A write begins at the latest transition $\overline{CS}$ going low and $\overline{WE}$ going low ; A write ends at the earliest transition $\overline{CS}$ going high or $\overline{WE}$ going high. t_{WP} is measured from the beginning of write to the end of write.
3. t_{CW} is measured from the later of $\overline{CS}$ going low to end of write.
4. t_{AS} is measured from the address valid to the beginning of write.
5. t_{WR} is measured from the end of write to the address change. t_{WR} applied in case a write ends as $\overline{CS}$ or $\overline{WE}$ going high.
6. If $\overline{OE}$, $\overline{CS}$ and $\overline{WE}$ are in the Read Mode during this period, the I/O pins are in the output low-Z state. Inputs of opposite phase of the output must not . be applied because bus contention can occur.
7. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycle.
8. If $\overline{CS}$ goes low simultaneously with $\overline{WE}$ going or after $\overline{WE}$ going low, the outputs remain high impedance state.
9. Dout is the read data of the new address.
10. When $\overline{CS}$ is low : I/O pins are in the output state. The input signals in the opposite phase leading to the output should not be applied.

** Those parameters are applied for x16 mode only.

Package Dimensions

Units:millimeters/Inches

44-TSOP2-400BF



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