FEBURARY 2023

1Mx16 HIGH-SPEED ASYNCHRONOUS CMOS STATIC RAM WITH 3.3V/1.8V SUPPLY

FEATURES

- High-speed access time: 10ns, 12ns
- High- performance, low power CMOS process
- Multiple center power and ground pins for greater noise immunity
- Easy memory expansion with CS# and OE#
- TTL compatible inputs and outputs
- Single power supply
  - 1.65V-2.2V VDD (IS61/64WV102416DALL)
  - 2.4V-3.6V VDD (IS61/64WV102416DBLL)
- Packages available :
  - 48 ball mini BGA (6mm x 8mm)
  - 48 pin TSOP (Type I)
- Industrial and Automotive temperature support
- Lead-free available
- Data Control for upper and lower bytes

DESCRIPTION

The *ISSI* IS61/64WV102416DALL/BLL are high-speed, 16M bit static RAMs organized as 1024K words by 16 bits. It is fabricated using *ISSI*'s high-performance CMOS technology.

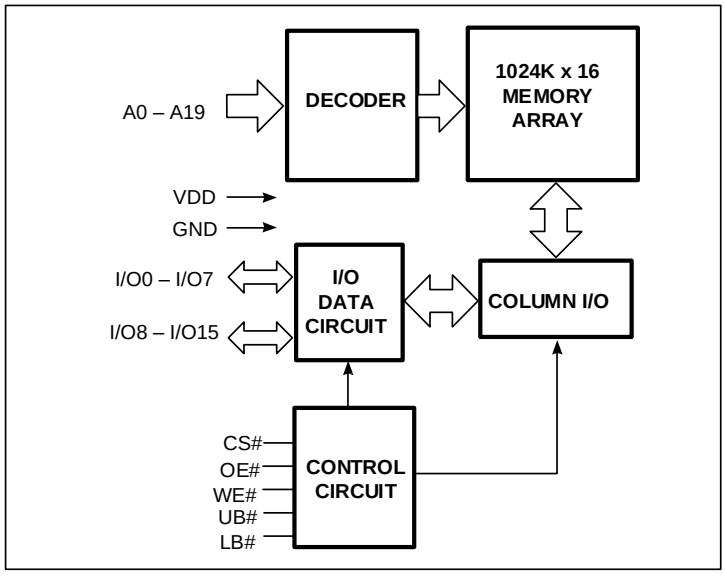
This highly reliable process coupled with innovative circuit design techniques, yields high-performance and low power consumption devices.

When CS# is HIGH (deselected), the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels. Easy memory expansion is provided by using Chip Enable and Output Enable inputs. The active LOW Write Enable (WE#) controls both writing and reading of the memory.

A data byte allows Upper Byte (UB#) and Lower Byte (LB#) access.

The device is packaged in the JEDEC standard 48-Pin TSOP (TYPE I) and 48-pin mini BGA (6mm x 8mm).

FUNCTIONAL BLOCK DIAGRAM



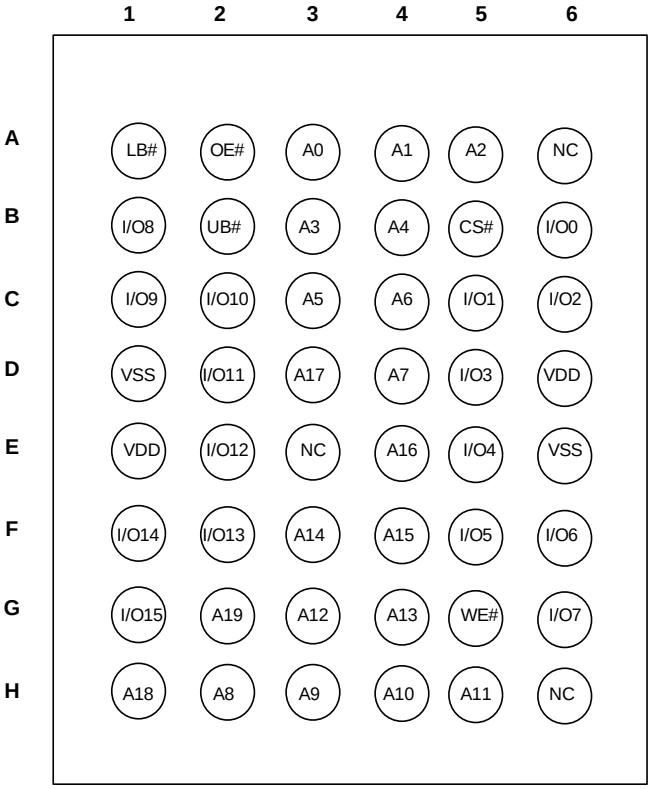
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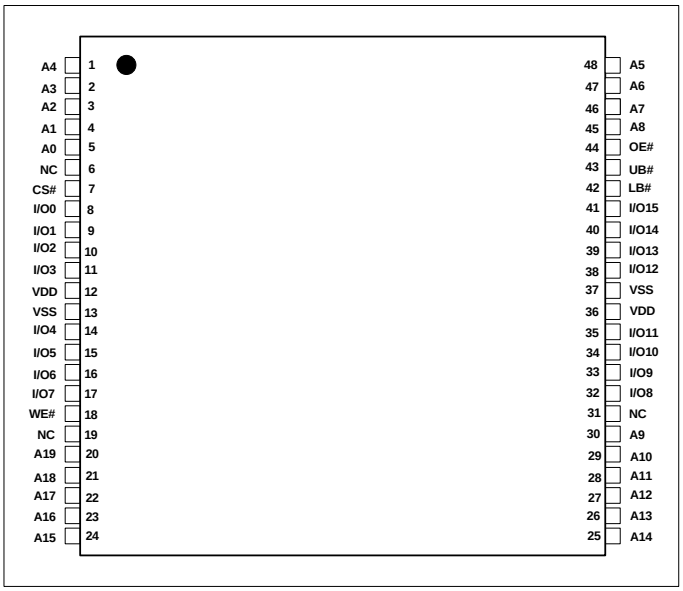
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PIN CONFIGURATIONS

48-Pin mini BGA (6mm x 8mm)



48-Pin TSOP ,TYPE I (12mm x 20mm)



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PIN DESCRIPTIONS

A0-A19	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
CS#	Chip Enable Input
OE#	Output Enable Input
WE#	Write Enable Input
LB#	Lower-byte Control (I/O0-I/O7)
UB#	Upper-byte Control (I/O8-I/O15)
NC	No Connection
VDD	Power
VSS	Ground

FUNCTION DESCRIPTION

SRAM is one of random access memories. Each byte or word has an address and can be accessed randomly. SRAM has three different modes supported. Each function is described below with Truth Table.

STANDBY MODE

Device enters standby mode when deselected (CS# HIGH). The input and output pins (I/O0-15) are placed in a high impedance state. CMOS input in this mode will maximize saving power.

WRITE MODE

Write operation issues with Chip selected (CS#) and Write Enable (WE#) input LOW. The input and output pins (I/O0-15) are in data input mode. Output buffers are closed during this time even if OE# is LOW. UB# and LB# enables a byte write feature. By enabling LB# LOW, data from I/O pins (I/O0 through I/O7) are written into the location specified on the address pins. And with UB# being LOW, data from I/O pins (I/O8 through I/O15) are written into the location.

READ MODE

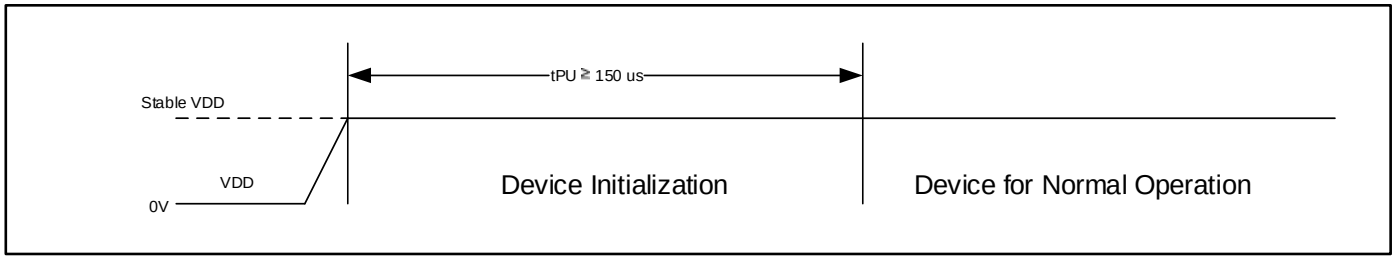
Read operation issues with Chip selected (CS# LOW) and Write Enable (WE#) input HIGH. When OE# is LOW, output buffer turns on to make data output. Any input to I/O pins during READ mode is not permitted. UB# and LB# enables a byte read feature. By enabling LB# LOW, data from memory appears on I/O0-7. And with UB# being LOW, data from memory appears on I/O8-15.

In the READ mode, output buffers can be turned off by pulling OE# HIGH. In this mode, internal device operates as READ but I/Os are in a high impedance state. Since device is in READ mode, active current is used.

POWER UP INITIALIZATION

The device includes on-chip voltage sensor used to launch POWER-UP initialization process.
When VDD reaches stable level, the device requires 150us of tPU (Power-Up Time) to complete its self-initialization process.
When initialization is complete, the device is ready for normal operation.

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TRUTH TABLE

Mode	CS#	WE#	OE#	LB#	UB#	I/O0-I/O7	I/O8-I/O15	VDD Current
Not Selected	H	X	X	X	X	High-Z	High-Z	ISB1, ISB2
Output Disabled	L	H	H	L	L	High-Z	High-Z	ICC
	L	H	H	H	L	High-Z	High-Z	
Read	L	H	L	L	H	DOUT	High-Z	ICC
	L	H	L	H	L	High-Z	DOUT	
	L	H	L	L	L	DOUT	DOUT	
Write	L	L	X	L	H	DIN	High-Z	ICC
	L	L	X	H	L	High-Z	DIN	
	L	L	X	L	L	DIN	DIN	

ABSOLUTE MAXIMUM RATINGS AND Operating Range

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Parameter	Value	Unit
Vterm	Terminal Voltage with Respect to VSS	–0.5 to V_{DD} + 0.5V	V
V_{DD}	V_{DD} Related to VSS	–0.3 to 4.0	V
tStg	Storage Temperature	–65 to +150	°C
P_T	Power Dissipation	1.0	W

Notes:

1. Stress 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 operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

PIN CAPACITANCE (1)

Parameter	Symbol	Test Condition	Max	Units
Input capacitance	C_{IN}	T_A = 25°C, f = 1 MHz, V_{DD} = V_{DD}(typ)	6	pF
DQ capacitance (IO0–IO15)	$C_{I/O}$		8	pF

Note:
1. These parameters are guaranteed by design and tested by a sample basis only.

OPERATING RANGE

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Range	Ambient Temperature	PART NUMBER	VDD	SPEED (MAX)
Commercial	0°C to +70°C	IS61WV102416DALL	1.65V – 2.2V	12 ns(1)
		IS61WV102416DBLL	2.4V – 3.6V	10ns
Industrial	-40°C to +85°C	IS61WV102416DALL	1.65V – 2.2V	12 ns(1)
		IS61WV102416DBLL	2.4V – 3.6V	10ns
Automotive (A3)	-40°C to +125°C	IS64WV102416DALL	1.65V – 2.2V	12 ns
		IS64WV102416DBLL	2.4V – 3.6V	

Note:
1. Contact ISSI MKT for 1.8V 10ns device.

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AC TEST CONDITIONS (OVER THE OPERATING RANGE)

Parameter	Unit (1.65V~2.2V)	Unit (2.4V~3.6V)
Input Pulse Level	0V to V_{DD}	0V to V_{DD}
Input Rise and Fall Time	1.5 ns	1.5 ns
Output Timing Reference Level	½ V_{DD}	½ V_{DD}
R1 (ohm)	13500	319
R2 (ohm)	10800	353
V_{TM} (V)	1.8V	3.3V
Output Load Conditions	Refer to Figure 1 and 2	

AC TEST LOADS

FIGURE 1

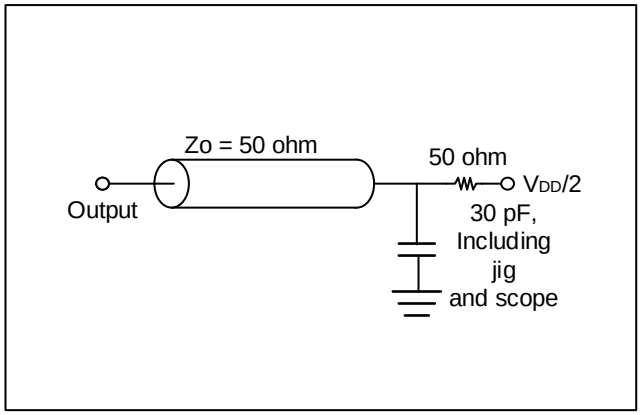
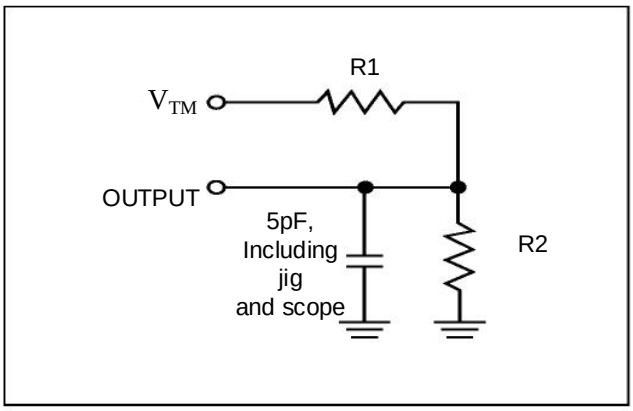


FIGURE 2



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DC ELECTRICAL CHARACTERISTICS

DC ELECTRICAL CHARACTERISTICS-I (OVER THE OPERATING RANGE)

VDD = 1.65V – 2.2V

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = -0.1 mA	1.4	—	V
V_{OL}	Output LOW Voltage	I_{OL} = 0.1 mA	—	0.2	V
V_{IH}(1)	Input HIGH Voltage		1.4	V_{DD} + 0.2	V
V_{IL}(1)	Input LOW Voltage		–0.2	0.4	V
I_{LI}	Input Leakage	GND < V_{IN} < V_{DD}	–1	1	µA
I_{LO}	Output Leakage	GND < V_{IN} < V_{DD}, Output Disabled	–1	1	µA

Note:
1. VILL(min) = -1.0V AC (pulse width < 10ns). Not 100% tested.
   VIHH (max) = VDD + 1.0V AC (pulse width < 10ns). Not 100% tested.

DC ELECTRICAL CHARACTERISTICS-I (OVER THE OPERATING RANGE)

VDD = 2.4V – 3.6V

Symbol	Parameter		Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	2.4V ~ 2.7V	V_{DD} = Min., I_{OH} = -1.0 mA	2.0	—	V
		2.7V ~ 3.6V	V_{DD} = Min., I_{OH} = -4.0 mA	2.2		
V_{OL}	Output LOW Voltage	2.4V ~ 2.7V	V_{DD} = Min., I_{OL} = 2.0 mA	—	0.4	V
		2.7V ~ 3.6V	V_{DD} = Min., I_{OL} = 8.0 mA	—	0.4	
V_{IH}(1)	Input HIGH Voltage	2.4V ~ 2.7V		2.0	V_{DD} + 0.3	V
		2.7V ~ 3.6V		2.0		
V_{IL}(1)	Input LOW Voltage	2.4V ~ 2.7V		–0.3	0.6	V
		2.7V ~ 3.6V		–0.3	0.8	
I_{LI}	Input Leakage		VSS < V_{IN} < V_{DD}	–2	2	µA
I_{LO}	Output Leakage		VSS < V_{IN} < V_{DD}, Output Disabled	–2	2	µA

Note:
1. VIL(min) = -0.3V DC ; VIL(min) = -2.0V AC (pulse width 2.0ns). Not 100% tested.
   VIH (max) = VDD + 0.3V DC ; VIH(max) = VDD + 2.0V AC (pulse width 2.0ns). Not 100% tested.

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POWER SUPPLY CHARACTERISTICS-II FOR POWER [1, 2] (OVER THE OPERATING RANGE)

IS61/64WV102416DALL (VDD = 1.65V – 2.2V) & IS61/64WV102416DBLL (VDD = 2.4V – 3.6V)

Symbol	Parameter	Test Conditions	Grade	-10 Max.	-12 Max.	Unit
ICC	V_{DD} Dynamic Operating Supply Current	V_{DD} = MAX, I_{OUT} = 0 mA, f = f_{MAX}	Com.	90	85	mA
			Ind.	100	95	
			Auto.	140	135	
ICC1	Operating Supply Current	V_{DD} = MAX, I_{OUT} = 0 mA, f = 0	Com.	80	80	mA
			Ind.	90	90	
			Auto.	110	110	
ISB1	TTL Standby Current (TTL Inputs)	V_{DD} = MAX, V_{IN} = V_{IH} or V_{IL}, CS# ≥ V_{IH}, f = 0	Com.	60	60	mA
			Ind.	70	70	
			Auto.	110	110	
ISB2	CMOS Standby Current (CMOS Inputs)	V_{DD} = MAX, CS# ≥ V_{DD} - 0.2V, V_{IN} ≥ V_{DD} - 0.2V, or V_{IN} ≤ 0.2V, f = 0	Com.	50	50	mA
			Ind.	60	60	
			Auto.	100	100	
			Typ. [2]	10		

Notes:
1. At f = fMAX, address and data inputs are cycling at the maximum frequency, f = 0 means no input line change.
2. Typical values are measured at V_{DD} = 3.0V/1.8V, T_A = 25 °C and not 100% tested.

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AC CHARACTERISTICS (OVER OPERATING RANGE)

READ CYCLE AC CHARACTERISTICS

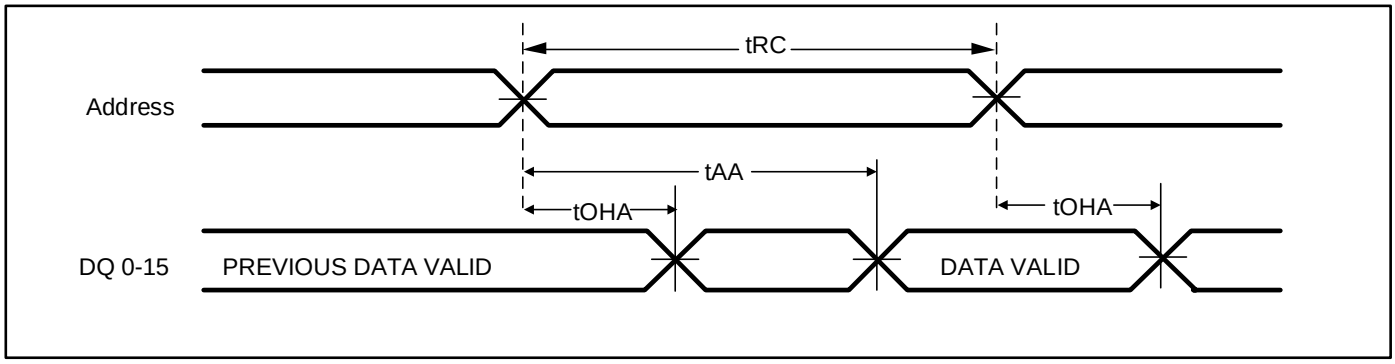
Parameter	Symbol	-10[1]		-12[1]		unit	notes
		Min	Max	Min	Max		
Read Cycle Time	tRC	10	-	12	-	ns	
Address Access Time	tAA	-	10	-	12	ns	
Output Hold Time	tOHA	2.5	-	2.5	-	ns	
CS# Access Time	tACE	-	10	-	12	ns	
OE# Access Time	tDOE	-	6	-	7	ns	
OE# to High-Z Output	tHZOE	0	5	0	6	ns	2
OE# to Low-Z Output	tLZOE	0	-	0	-	ns	2
CS# to High-Z Output	tHZCE	0	5	0	6	ns	2
CS# to Low-Z Output	tLZCE	3	-	3	-	ns	2
UB#, LB# Access Time	tBA	-	6	-	7	ns	
UB#, LB# to High-Z Output	tHZB	0	5	0	6	ns	2
UB#, LB# to Low-Z Output	tLZB	0	-	0	-	ns	2

Notes:
1. Test conditions assume signal transition times of 1.5 ns or less, timing reference levels of $V_{DD}/2$, input pulse levels of 0V to V_{DD} and output loading specified in Figure 1.
2. Tested with the load in Figure 2. Transition is measured ±500 mV from steady-state voltage. Not 100% tested.

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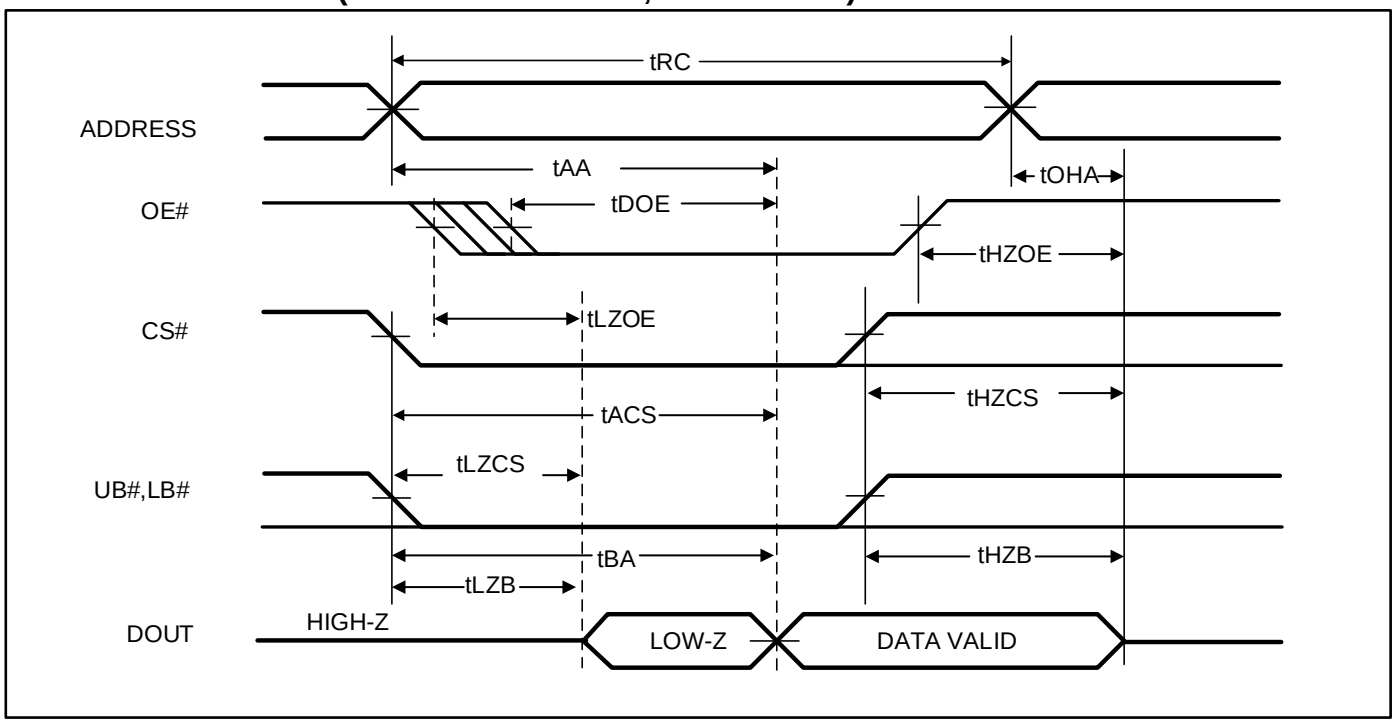
AC WAVEFORMS

READ CYCLE NO. 1[1] (Address Controlled, CS# = OE# = UB# = LB# = LOW, WE# = HIGH)



Notes:
1. The device is continuously selected.

READ CYCLE NO. 2[1] (OE# CONTROLLED, WE# = HIGH)



Notes:
1. Address is valid prior to or coincident with CS# LOW transition.

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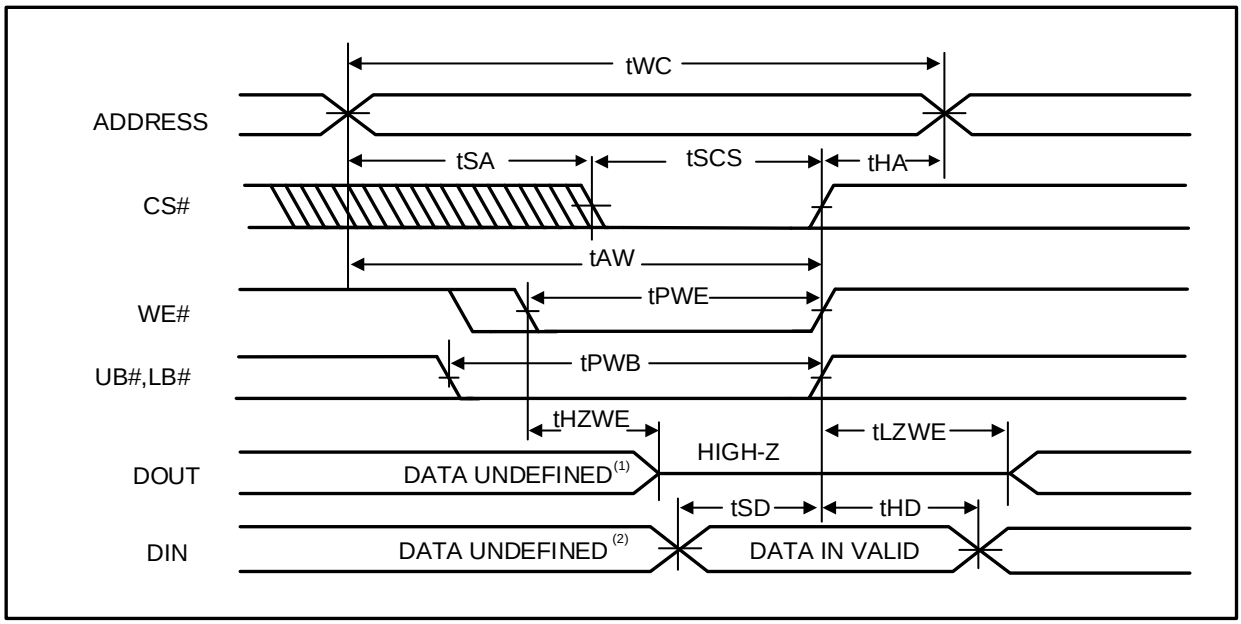
WRITE CYCLE AC CHARACTERISTICS

Parameter	Symbol	-10(1)		-12(1)		unit	notes
		Min	Max	Min	Max		
Write Cycle Time	tWC	10	-	12	-	ns	
CS# to Write End	tSCS	8	-	9	-	ns	
Address Setup Time to Write End	tAW	8	-	9	-	ns	
UB#,LB# to Write End	tPWB	8	-	9	-	ns	
Address Hold from Write End	tHA	0	-	0	-	ns	
Address Setup Time	tSA	0	-	0	-	ns	
WE# Pulse Width	tPWE1	8	-	9	-	ns	
WE# Pulse Width (OE# = LOW)	tPWE2	10	-	12	-	ns	2
Data Setup to Write End	tSD	6	-	7	-	ns	
Data Hold from Write End	tHD	0	-	0	-	ns	
WE# LOW to High-Z Output	tHZWE	-	4	-	5	ns	
WE# HIGH to Low-Z Output	tLZWE	2	-	2	-	ns	

Notes:
1 The internal write time is defined by the overlap of CS# = LOW, UB# or LB# = LOW, and WE# = LOW. All conditions must be in valid states to initiate a Write, but any condition can go inactive to terminate the Write. The Data Input Setup and Hold timing are referenced to the rising or falling edge of the signal that terminates the write.
2 Tested tPWE > tHZWE + tSD when OE# is LOW.

AC WAVEFORMS

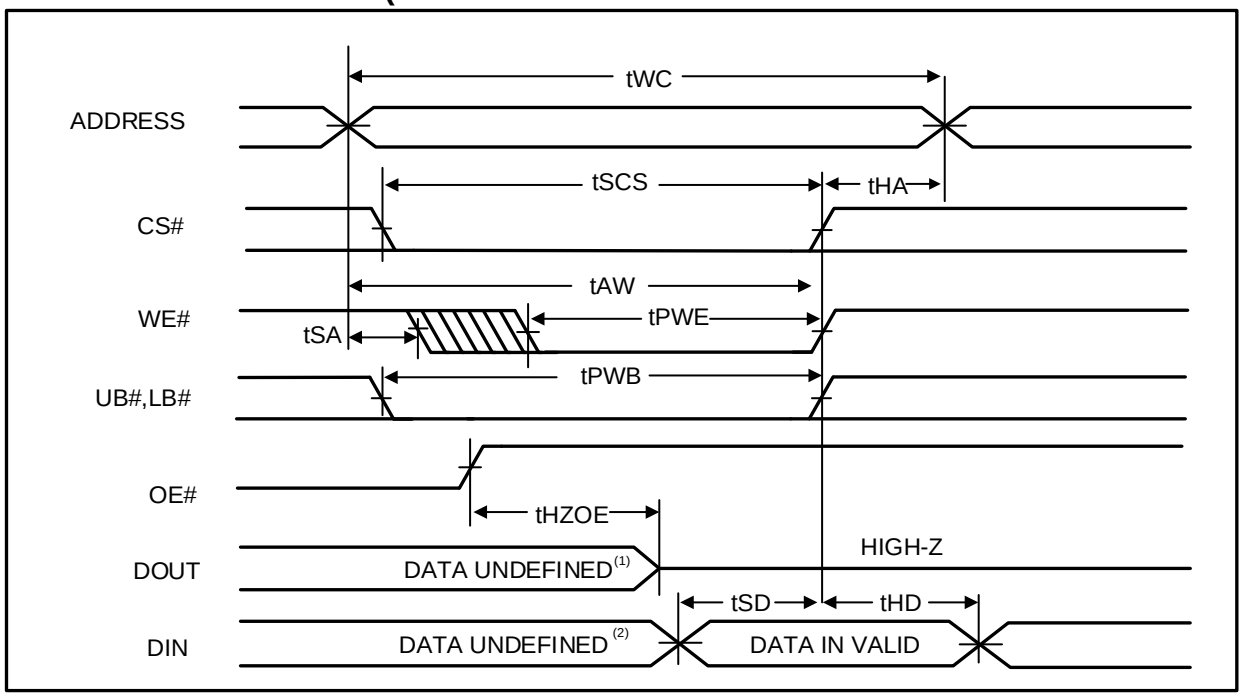
WRITE CYCLE NO. 1(1) (CS# CONTROLLED, OE# = HIGH OR LOW)



Note:
1. tHZWE is is based on the assumption when tSA=0nS after READ operation. Actual DOUT for tHZWE may not appear if OE# goes high before Write Cycle.

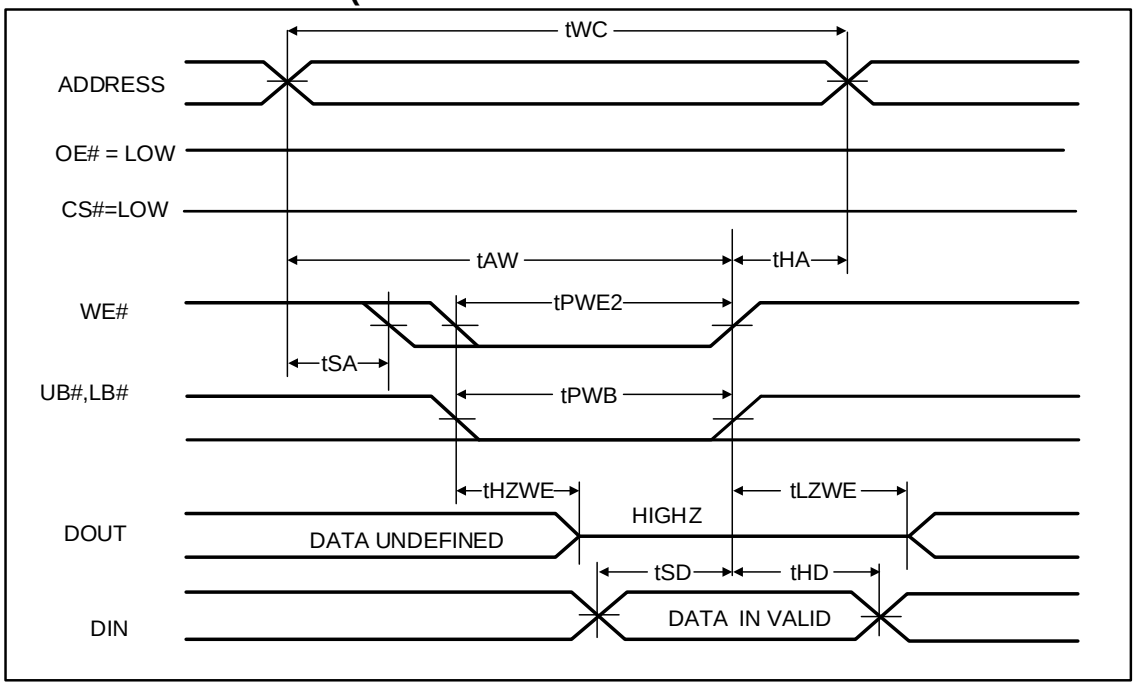
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WRITE CYCLE NO. 2[1, 2] (WE# CONTROLLED: OE# IS HIGH DURING WRITE CYCLE)



Notes:
1. tHZOE is the time DOUT goes to High-Z after OE# goes high.
2. During this period the I/Os are in output state. Do not apply input signals.

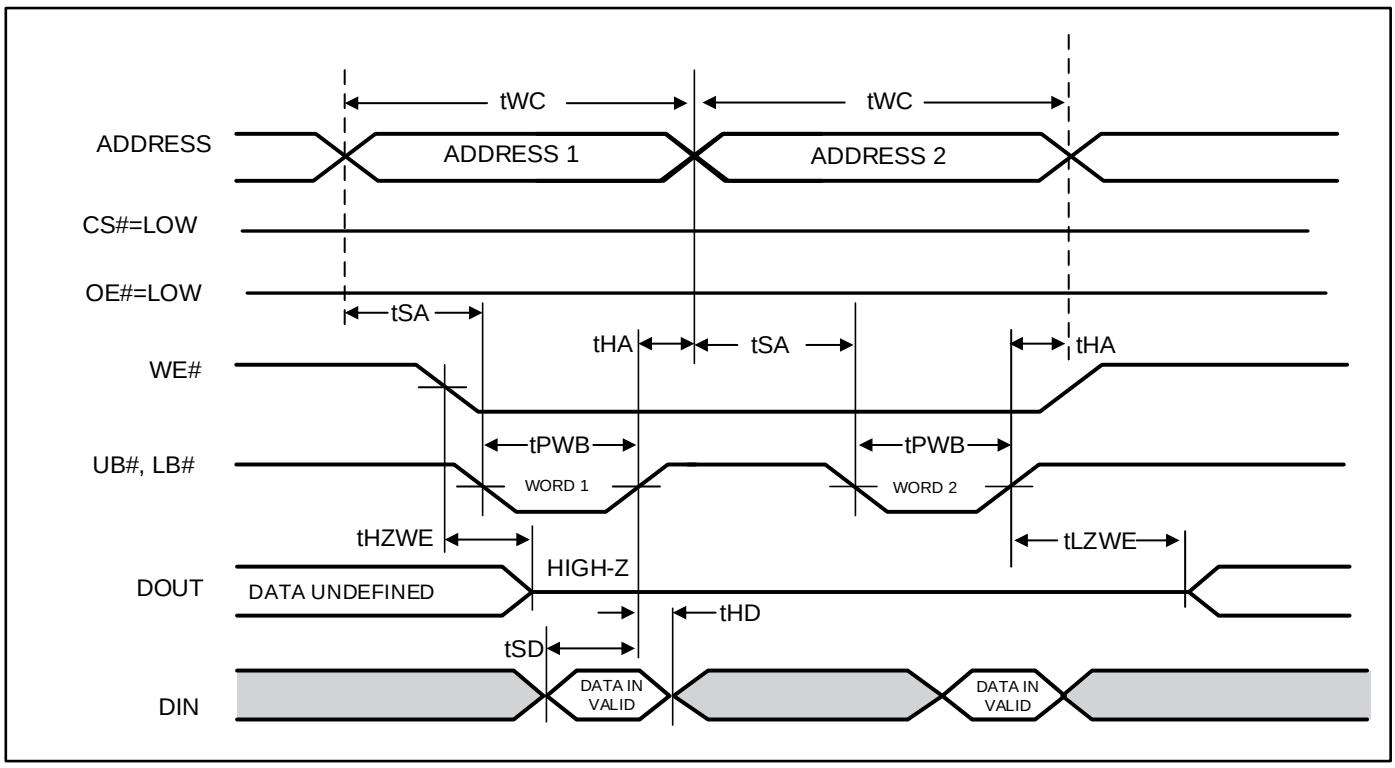
WRITE CYCLE NO. 3[1] (WE# CONTROLLED: OE# IS LOW DURING WRITE CYCLE)



Note:
1. If OE# is low during write cycle, tHZWE must be met in the application. Do not apply input signal during this period. Data output from the previous READ operation will drive IO BUS.

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WRITE CYCLE NO. 4[1, 2, 3] (UB# & LB# Controlled, CS# = OE# = LOW)



Notes:

1. If OE# is low during write cycle, tHZWE must be met in the application. Do not apply input signal during this period. Data output from the previous READ operation will drive IO BUS.
2. Due to the restriction of note1, OE# is recommended to be HIGH during write period.
3. WE# stays LOW in this example. If WE# toggles,, tPWE and tHZWE must be considered

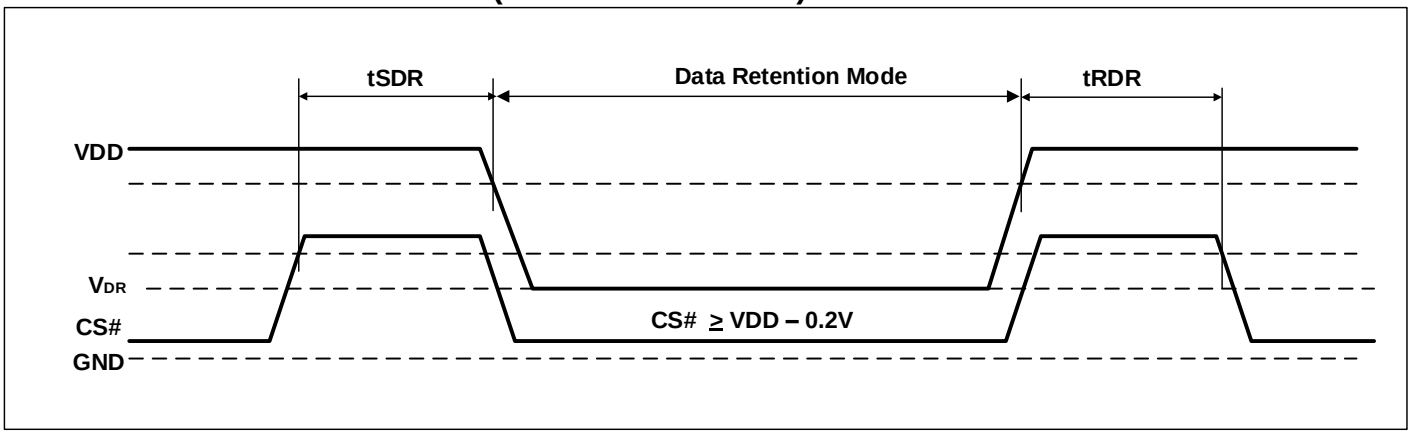
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DATA RETENTION CHARACTERISTICS

Symbol	Parameter	Test Condition	OPTION	Min.	Typ.(2)	Max.	Unit
V_{DR}	V_{DD} for Data Retention	See Data Retention Waveform	V_{DD} = 2.4V to 3.6V	2.0		3.6	V
			V_{DD} = 1.65V to 2.2V	1.2		3.6	
I_{DR}	Data Retention Current	V_{DD}= V_{DR}(min), CS# ≥ V_{DD} – 0.2V	Com.	-	10	50	mA
			Ind.	-	-	60	
			Auto	-	-	100	
t_{SDR}	Data Retention Setup Time	See Data Retention Waveform		0	-	-	ns
t_{RDR}	Recovery Time	See Data Retention Waveform		tRC	-	-	ns

Note:
1. If CS# ≥ VDD–0.2V, all other inputs including UB# and LB# must meet this condition.
2. Typical values are measured at V_{DD} = V_{DR} (Min), T_A = 25 °C and not 100% tested.

DATA RETENTION WAVEFORM (CS# CONTROLLED)



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ORDERING INFORMATION

IS61/64WV102416DALL (1.65V – 2.2V)

Commercial Range: 0°C to +70°C

Speed (ns)	Order Part No.	Package
10	**Contact ISSI MKT for 10ns**	
12	IS61WV102416DALL-12B	mini BGA (6mm x 8mm)
12	IS61WV102416DALL-12BL	mini BGA (6mm x 8mm), Lead-free
12	IS61WV102416DALL-12TL	TSOP (Type I), Lead-free

Industrial Range: -40°C to +85°C

Speed (ns)	Order Part No.	Package
10	**Contact ISSI MKT for 10ns**	
12	IS61WV102416DALL-12BI	mini BGA (6mm x 8mm)
12	IS61WV102416DALL-12BLI	mini BGA (6mm x 8mm), Lead-free
12	IS61WV102416DALL-12TLI	TSOP (Type I), Lead-free

Automotive (A3) Range: –40°C to +125°C

Speed (ns)	Order Part No.	Package
12	IS64WV102416DALL-12BA3	mini BGA (6mm x 8mm)
12	IS64WV102416DALL-12BLA3	mini BGA (6mm x 8mm), Lead-free
12	IS64WV102416DALL-12CTLA3	TSOP (Type I), Copper Lead-frame, Lead-free

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IS61/64WV102416DBLL (2.2V - 3.6V)

Commercial Range: 0°C to +70°C

Speed (ns)	Order Part No.	Package
10	IS61WV102416DBLL-10B	mini BGA (6mm x 8mm)
10	IS61WV102416DBLL-10BL	mini BGA (6mm x 8mm), Lead-free
10	IS61WV102416DBLL-10TL	TSOP (Type I), Lead-free

Industrial Range: -40°C to +85°C

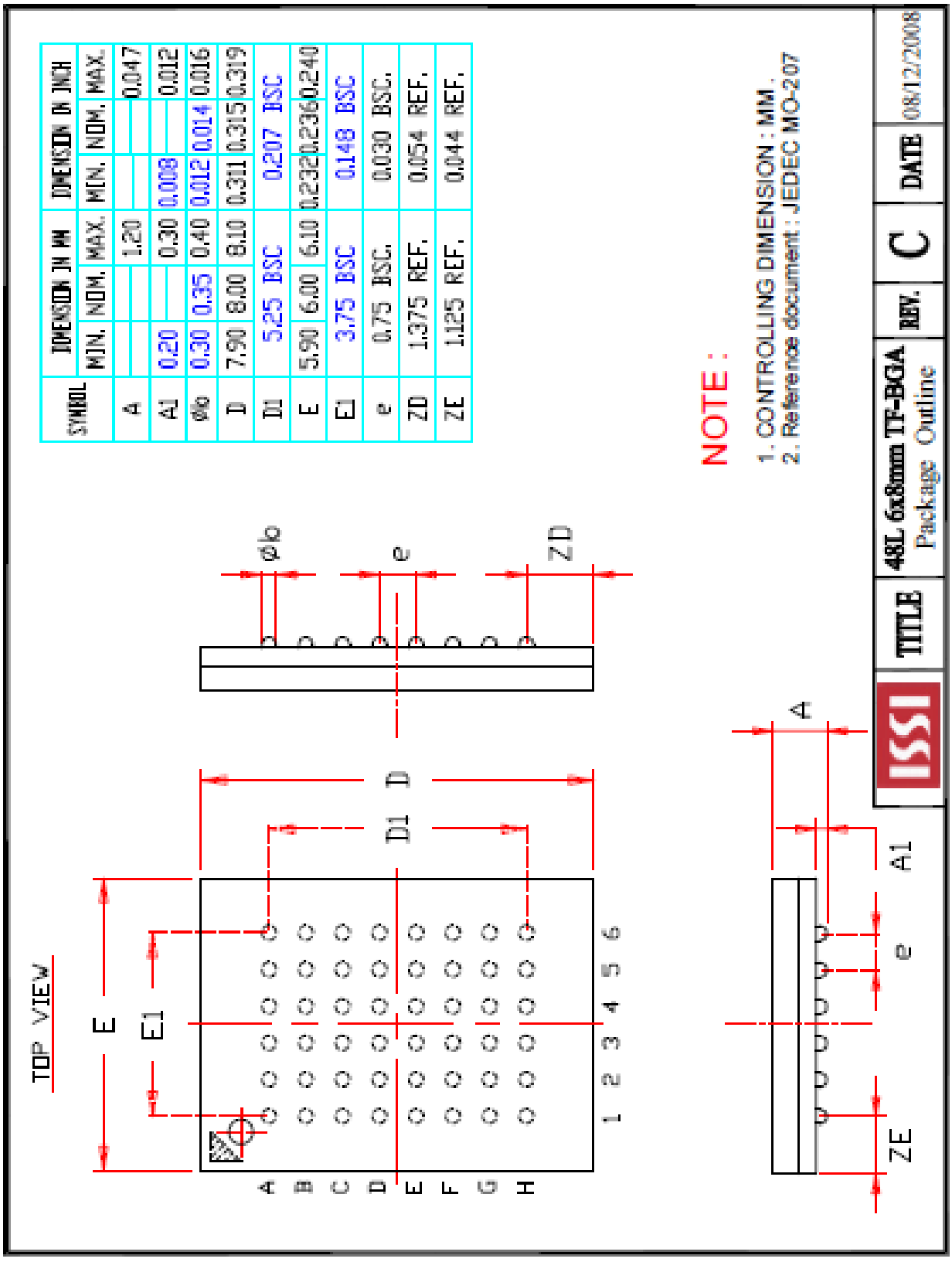
Speed (ns)	Order Part No.	Package
10	IS61WV102416DBLL-10BI	mini BGA (6mm x 8mm)
10	IS61WV102416DBLL-10BLI	mini BGA (6mm x 8mm), Lead-free
10	IS61WV102416DBLL-10TLI	TSOP (Type I), Lead-free

Automotive (A3) Range: –40°C to +125°C

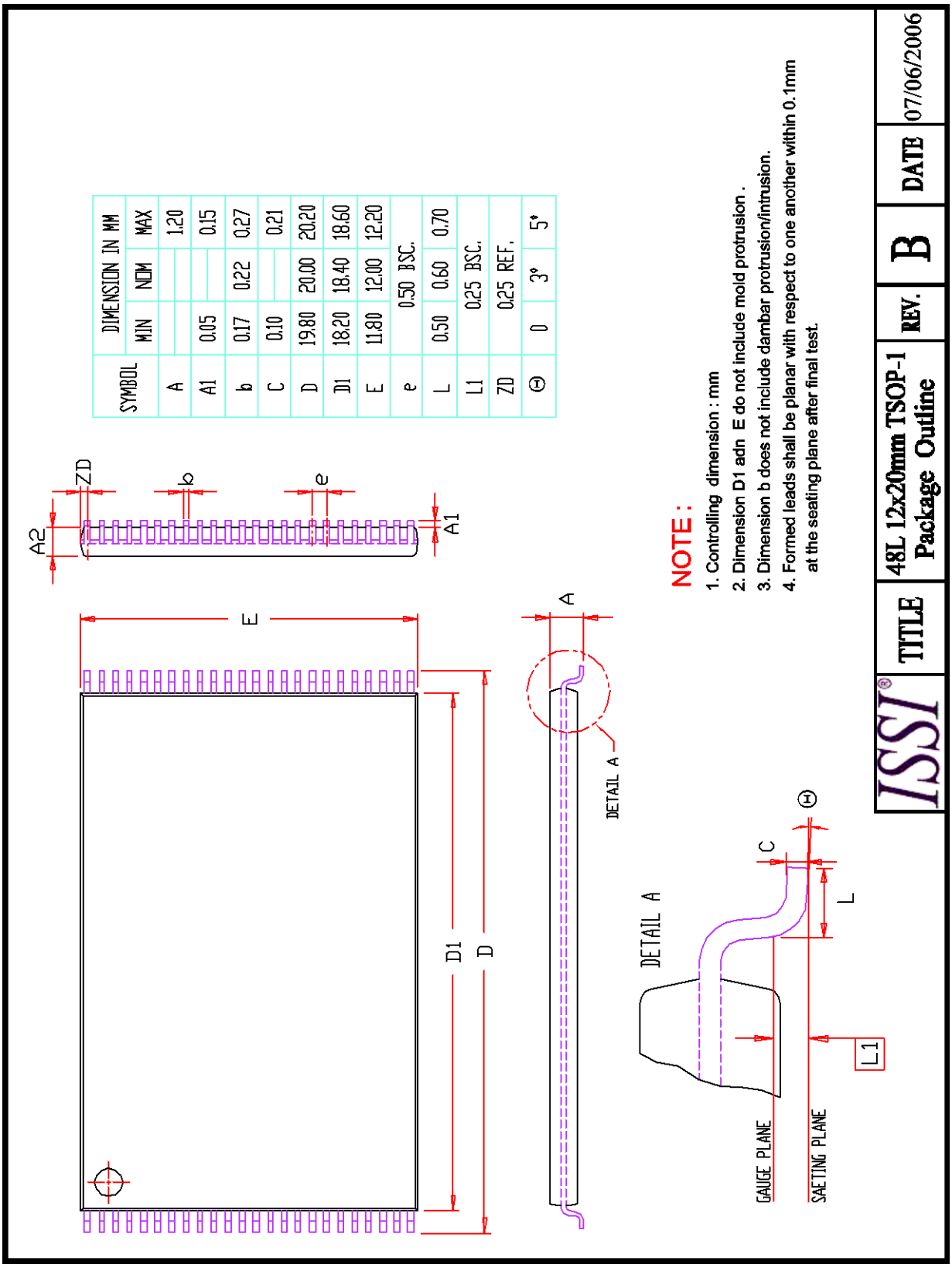
Speed (ns)	Order Part No.	Package
12	IS64WV102416DBLL-12BA3	mini BGA (6mm x 8mm)
12	IS64WV102416DBLL-12BLA3	mini BGA (6mm x 8mm), Lead-free
12	IS64WV102416DBLL-12CTLA3	TSOP (Type I), Copper Lead-frame, Lead-free

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PACKAGE INFORMATION



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