ISSI®

ADVANCE INFORMATION
MAY 1999

TARGET SPECIFICATION

IS62Ux25616 Series

256K x 16 LOW VOLTAGE, LOW POWER CMOS STATIC RAM

FEATURES

- Voltage range options
  - **-- 1.6V to 2.0V: IS62UT25616**
  - **-- 1.8V to 2.2V: IS62US25616**
  - **-- 2.3V to 2.7V: IS62UR25616**
  - **-- 2.7V to 3.3V: IS62UP25616**
- Battery backup (SL/LL version)
  -- 1.0V (min.) data retention
- Access times: 55, 70, and 100 ns
- Fully static operation and tri-state outputs
- Industrial temperature available
- Available in 48-ball mini BGA and 44-pin sTSOP (Type II)

DESCRIPTION

The *ISSI* IS62Ux25616 series is a low voltage, 262,144 words by 16 bits, CMOS SRAM. It is fabricated using *ISSI*'s low voltage, six transistor (6T), CMOS technology. The series is targeted to satisfy the demands of the state-of-the-art technologies such as cell phones and pagers.

When $\overline{CE}$ is HIGH (deselected), the device assumes a standby mode at which the power dissipation can be reduced down with CMOS input levels. Additionally, easy memory expansion is provided by using Chip Enable and Output Enable inputs, $\overline{CE}$ and $\overline{OE}$. The active LOW Write Enable ($\overline{WE}$) controls both writing and reading of the memory. A data byte allows Upper Byte ($\overline{UB}$) and Lower Byte ($\overline{LB}$) access.

The IS62Ux25616 series is packaged in the 48-ball mini BGA and the 44-pin sTSOP (Type II).

PRODUCT SERIES OVERVIEW

Part No.	Voltage (V)	Speeds (ns)	Active Icc (mA)	Standby Current (µA) LL	Standby Current (µA) SL	Temperature (°C)
IS62UP25616	3.0, ±0.3	55, 70, 100	25 @ 70 ns	10	2	0 to 70
IS62UP25616(1)	3.0, ±0.3	55, 70, 100	25 @ 70 ns	10	2	40 to 85
IS62UR25616	2.5, ±0.2	55, 70, 100	15 @ 70 ns	10	2	0 to 70
IS62UR25616(1)	2.5, ±0.2	55, 70, 100	15 @ 70 ns	10	2	40 to 85
IS62US25616	2.0, ±0.2	55, 70, 100	10 @ 70 ns	10	2	0 to 70
IS62US25616(1)	2.0, ±0.2	55, 70, 100	10 @ 70 ns	10	2	40 to 85
IS62UT25616	1.8, ±0.2	55, 70, 100	10 @ 70 ns	10	2	0 to 70
IS62UT25616(1)	1.8, ±0.2	55, 70, 100	10 @ 70 ns	10	2	40 to 85

Note:
1. Current value is max.

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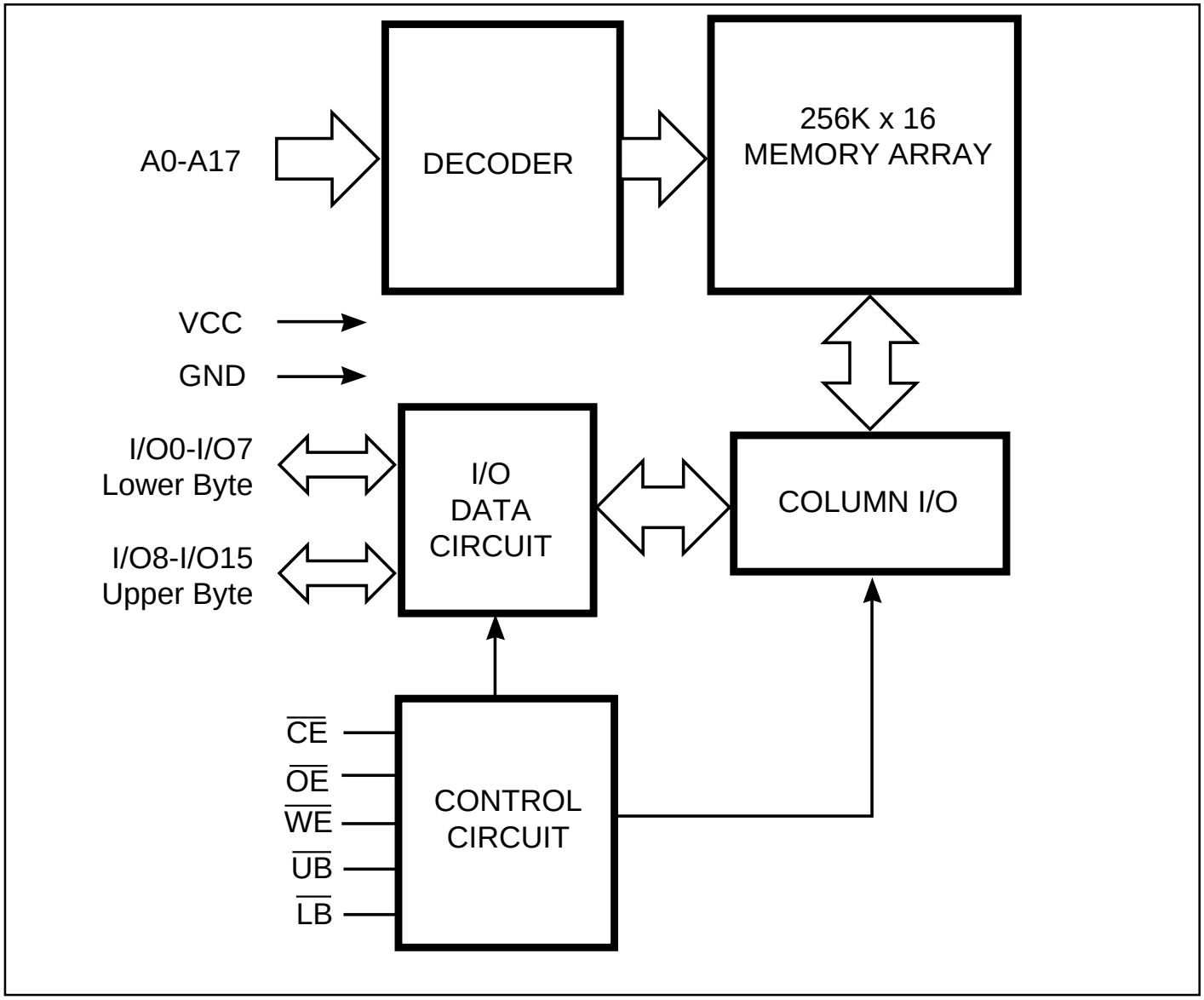
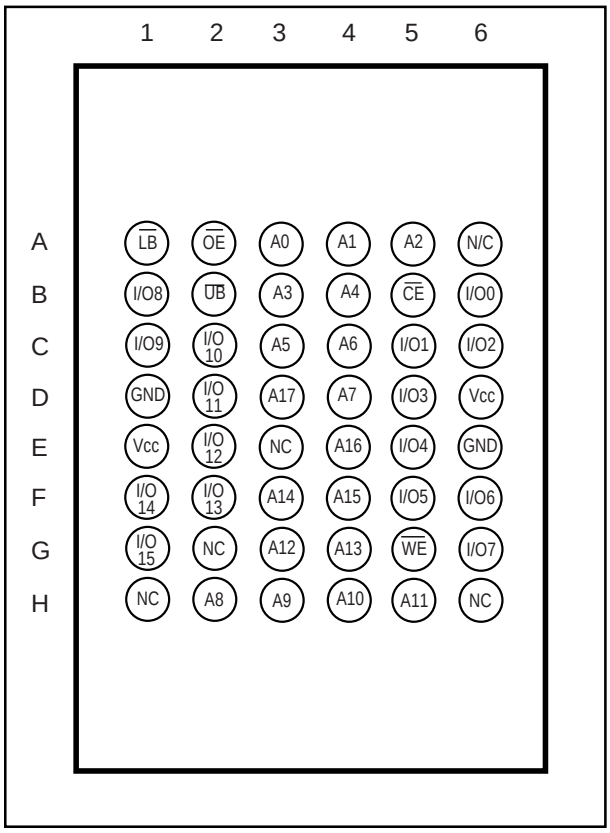
FUNCTIONAL BLOCK DIAGRAM

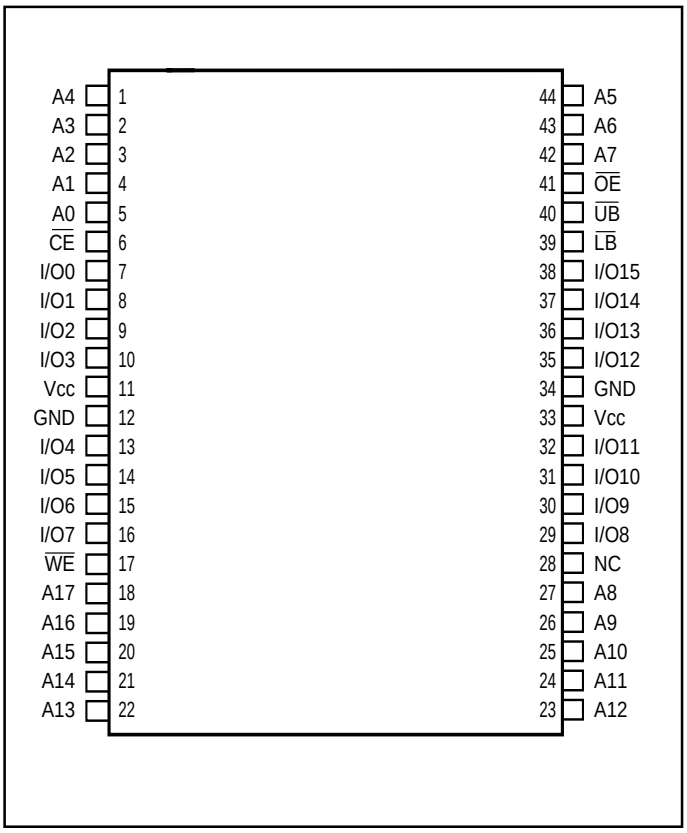


PIN CONFIGURATIONS

48-ball mini BGA (B)



44-pin sTSOP (Type II): (H)



PIN DESCRIPTIONS

A0-A16	Address Inputs
I/O0-I/O15	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{WE}$	Write Enable Input
$\overline{LB}$	Lower-byte Control (I/O0-I/O7)
$\overline{UB}$	Upper-byte Control (I/O8-I/O15)
NC	No Connection
Vcc	Power
GND	Ground

TRUTH TABLE

Mode	$\overline{WE}$	$\overline{CE}$	$\overline{OE}$	$\overline{LB}$	$\overline{UB}$	I/O PIN I/O0-I/O7	I/O PIN I/O8-I/O15	Vcc Current
Not Selected	X	H	X	X	X	High-Z	High-Z	I_{SB}, I_{SB1}
	X	X	X	H	H	High-Z	High-Z	
Output Disabled	H	L	H	X	X	High-Z	High-Z	I_{CC}, I_{CC1}
	X	L	X	H	H	High-Z	High-Z	
Read	H	L	L	L	H	D_{OUT}	High-Z	I_{CC}, I_{CC1}
	H	L	L	H	L	High-Z	D_{OUT}	
	H	L	L	L	L	D_{OUT}	D_{OUT}	
Write	L	L	X	L	H	D_{IN}	High-Z	I_{CC}, I_{CC1}
	L	L	X	H	L	High-Z	D_{IN}	
	L	L	X	L	L	D_{IN}	D_{IN}	

Notes:
1. H = V_{IH}, L = V_{IL}, X = Don't Care.
2. $\overline{UB}$, $\overline{LB}$ (Upper, Lower Byte enable).
   These active LOW inputs allow individual bytes to be written or read.
   When $\overline{LB}$ is LOW, data is written or read to the lower byte, I/O0-I/O7.
   When $\overline{UB}$ is LOW, data is written or read to the upper byte, I/O8-I/O15.

OPERATING RANGE

Range	Ambient Temperature
Commercial	0°C to +70°C
Industrial	–40°C to +85°C

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Parameter		Value	Unit
V_{CC}	Power Supply Voltage Related to GND		–0.5 to +4.0	V
V_{TERM}	Terminal Voltage with Respect to GND		–0.5 to Vcc + 0.5	V
T_{STG}	Storage Temperature		–65 to +150	°C
T_{BIAS}	Temperature Under Bias	Com.	–10 to +85	°C
		Ind.	–45 to +90	°C
P_T	Power Dissipation		2.0	W
Iout	DC Output Current		±20	mA

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.

CAPACITANCE(1)

Symbol	Parameter	Conditions	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	pF
C_{OUT}	Input/Output Capacitance	V_{OUT} = 0V	8	pF

Note:
1. Tested initially and after any design or process changes that may affect these parameters.

AC TEST CONDITIONS (Over Operating Range)

Parameter		Unit
Input Pulse Level(1)	IS62UP25616	0.4V to 2.2V
	IS62UR25616	0.4V to 2.2V
	IS62US25616	0.4V to 1.8V
	IS62UT25616	0.4V to 1.6V
Input Rise and Fall Times		5 ns
Input and Output Timing and Reference Level	IS62UP25616	1.5V
	IS62UR25616	1.1V
	IS62US25616	0.9V
	IS62UT25616	0.8V
Output Load (all test parameters except in Note 2) (see Figure 1)		C_{L1} = 30 pF + 1TTL Load
Output Load(1) (all High-Z and Low-Z parameters) (see Figure 1)		C_{L2} = 5 pF

Notes:
1. Including jig and scope capacitance.
2. V_{TM} = 2.8V for Vcc = 3.0V ± 0.3V
   V_{TM} = 2.3V for Vcc = 2.5V ± 0.2V
   V_{TM} = 1.8V for Vcc = 2.0V ± 0.2V
   V_{TM} = 1.6V for Vcc = 1.8V ± 0.2V

AC TEST LOADS

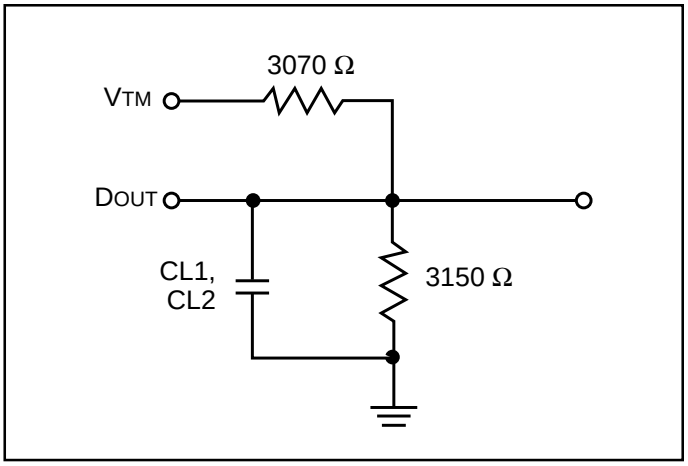


Figure 1

DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = 3.0V ± 0.3V, I_{OH} = –2.1 mA	2.2	—	V
		V_{CC} = 2.5V ± 0.2V, I_{OH} = –0.5 mA	2.0	—	
		V_{CC} = 2.0V ± 0.2V, I_{OH} = –0.44 mA	1.6	—	
		V_{CC} = 1.8V ± 0.2V, I_{OH} = –0.44 mA	1.4	—	
V_{OL}	Output LOW Voltage	V_{CC} = 3.0V ± 0.3V, I_{OL} = 2.1 mA	—	0.4	V
		V_{CC} = 2.5V ± 0.2V, I_{OL} = 0.5 mA	—		
		V_{CC} = 2.0V ± 0.2V, I_{OL} = 0.33 mA	—		
		V_{CC} = 1.8V ± 0.2V, I_{OL} = 0.26 mA	—		
V_{IH}	Input HIGH Voltage	IS62UP25616	2.2	V_{CC} + 0.2	V
		IS62UR25616	2.0	V_{CC} + 0.2	
		IS62US25616	1.6	V_{CC} + 0.2	
		IS62UT25616	1.4	V_{CC} + 0.2	
V_{IL}[(1)]	Input LOW Voltage		–0.2	0.4	V
I_{LI}	Input Leakage	GND ≤ V_{IN} ≤ V_{CC}	–1	1	µA
I_{LO}	Output Leakage	GND ≤ V_{OUT} ≤ V_{CC}, $\overline{CE}$ = V_{IH} or $\overline{OE}$ = V_{IH} or $\overline{WE}$ = V_{IL} or $\overline{UB}$ = V_{IH} or $\overline{LB}$ = V_{IH}	–1	1	µA

Note:
1. V_{IL} (min.) = –0.5V for pulse width less than 10 ns.

POWER SUPPLY CHARACTERISTICS[(1)] (Over Operating Range)

Symbol	Parameter	Test Conditions		Min.	Max.	Unit
I_{CC}	Static Operating Power Supply Current	$\overline{CE}$ = V_{IL}, V_{IN} = V_{IH} or V_{IL}, $I_{I/O}$ = 0 mA, f = 0	Vcc = 3.0V ± 0.3V	—	15	mA
			Vcc = 2.5V ± 0.2V	—	10	
			Vcc = 2.0V ± 0.2V	—	8	
			Vcc = 1.8V ± 0.2V	—	6	
I_{CC1}	Dynamic Operating Power Supply Current (IS62UP25616)	Vcc = 3.0V ± 0.3V I_{OUT} = 0 mA, f = f_{MAX}	55 ns	—	35	mA
			70 ns	—	25	
			100 ns	—	20	
I_{CC1}	Dynamic Operating Power Supply Current (IS62UR25616)	Vcc = 2.5V ± 0.2V I_{OUT} = 0 mA, f = f_{MAX}	55 ns	—	20	mA
			70 ns	—	15	
			100 ns	—	8	
I_{CC1}	Dynamic Operating Power Supply Current (IS62US25616)	Vcc = 2.0V ± 0.2V I_{OUT} = 0 mA, f = f_{MAX}	55 ns	—	12	mA
			70 ns	—	10	
			100 ns	—	7	
I_{CC1}	Dynamic Operating Power Supply Current (IS62UT25616)	Vcc = 1.8V ± 0.2V I_{OUT} = 0 mA, f = f_{MAX}	55 ns	—	11	mA
			70 ns	—	9	
			100 ns	—	6	
I_{SB}	TTL Standby Current (TTL Inputs)	V_{CC} = 3.0V ± 0.3V, $\overline{CE}$ = V_{IH}	IS62UP25616	—	0.5	mA
		V_{CC} = 2.5V ± 0.2V, $\overline{CE}$ = V_{IH}	IS62UR25616	—	0.3	
		V_{CC} = 2.0V ± 0.2V, $\overline{CE}$ = V_{IH}	IS62US25616	—	0.3	
		V_{CC} = 1.8V ± 0.2V, $\overline{CE}$ = V_{IH}	IS62UT25616	—	0.3	
I_{SB1}	CMOS Standby	$\overline{CE}$ ≥ V_{CC} – 0.2V	LL Versions	—	10	µA
			SL Versions	—	2	

Note:
1. At f = f_{MAX}, address and data inputs are cycling at the maximum frequency, f = 0 means no input lines change.

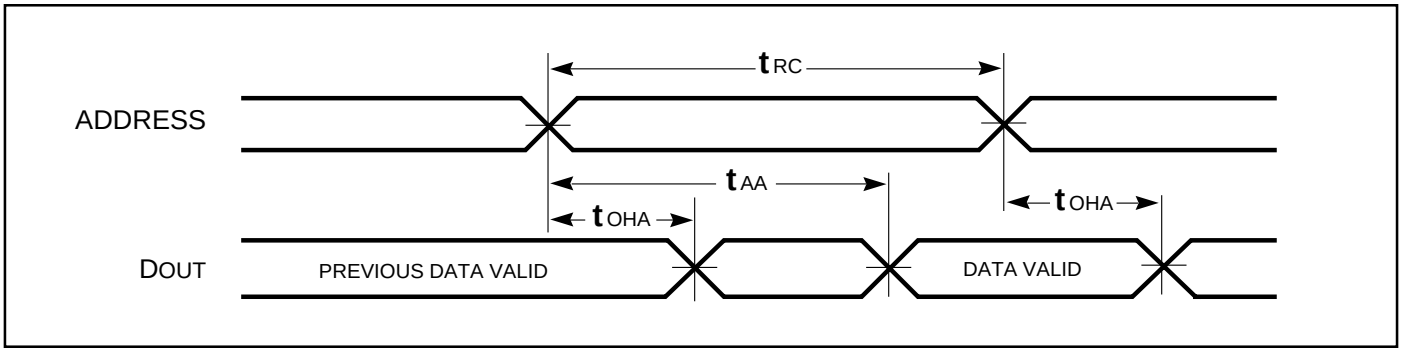
READ CYCLE SWITCHING CHARACTERISTICS[1] (Over Operating Range)

Symbol	Parameter	-55 Min.	-55 Max.	-70 Min.	-70 Max.	-100 Min.	-100 Max.	Unit
t_{RC}	Read Cycle Time	55	—	70	—	100	—	ns
t_{AA}	Address Access Time	—	55	—	70	—	100	ns
t_{OHA}	Output Hold Time	10	—	10	—	10	—	ns
t_{ACE}	$\overline{CE}$ Access Time	—	55	—	70	—	100	ns
t_{DOE}	$\overline{OE}$ Access Time	—	30	—	35	—	50	ns
t_{HZOE}[2]	$\overline{OE}$ to High-Z Output	—	20	—	25	—	30	ns
t_{LZOE}[2]	$\overline{OE}$ to Low-Z Output	5	—	5	—	5	—	ns
t_{HZCE}[2]	$\overline{CE}$ to High-Z Output	0	20	0	25	0	30	ns
t_{LZCE}[2]	$\overline{CE}$ to Low-Z Output	10	—	10	—	10	—	ns
t_{BA}	$\overline{LB}$, $\overline{UB}$ Access Time	—	55	—	70	—	100	ns
t_{HZB}	$\overline{LB}$, $\overline{UB}$ to High-Z Output	0	20	0	25	0	35	ns
t_{LZB}	$\overline{LB}$, $\overline{UB}$ to Low-Z Output	5	—	5	—	5	—	ns

Notes:
1. Test conditions assume signal transition times of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0.4 to 2.2V 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.

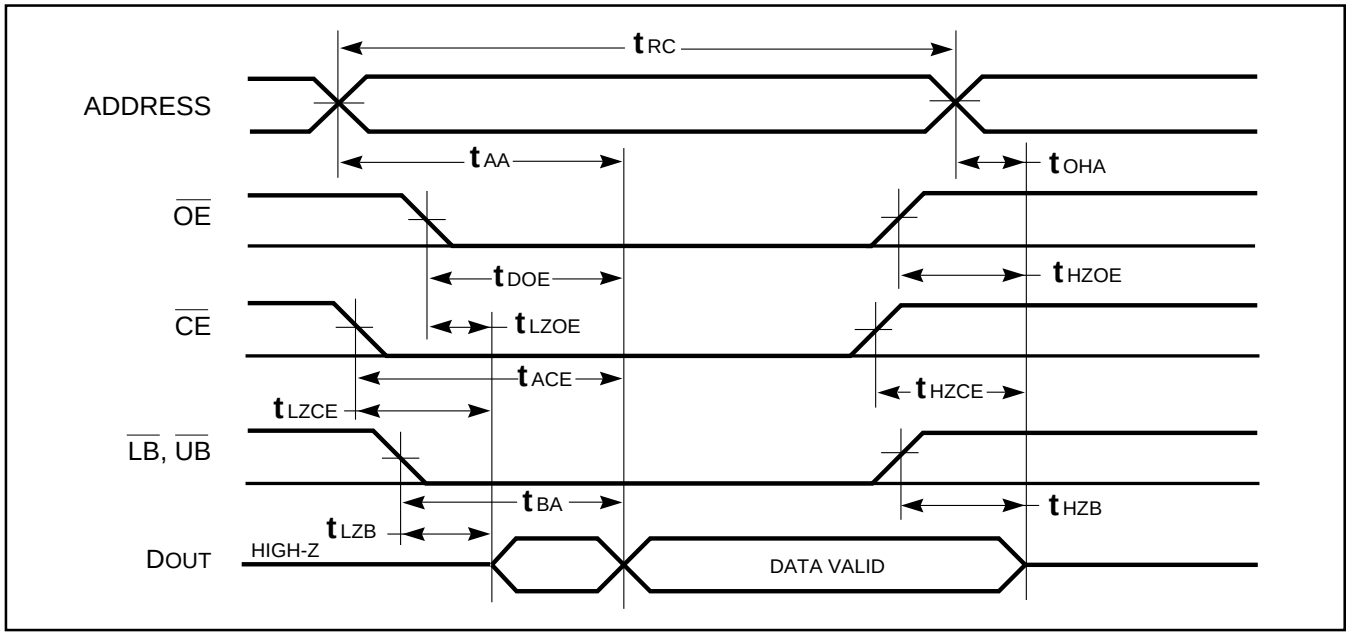
AC WAVEFORMS

READ CYCLE NO. 1[1,2] (Address Controlled) ($\overline{CE}$ = $\overline{OE}$ = V_{IL}, $\overline{UB}$ or $\overline{LB}$ = V_{IL})



AC WAVEFORMS

READ CYCLE NO. 2[1,3]



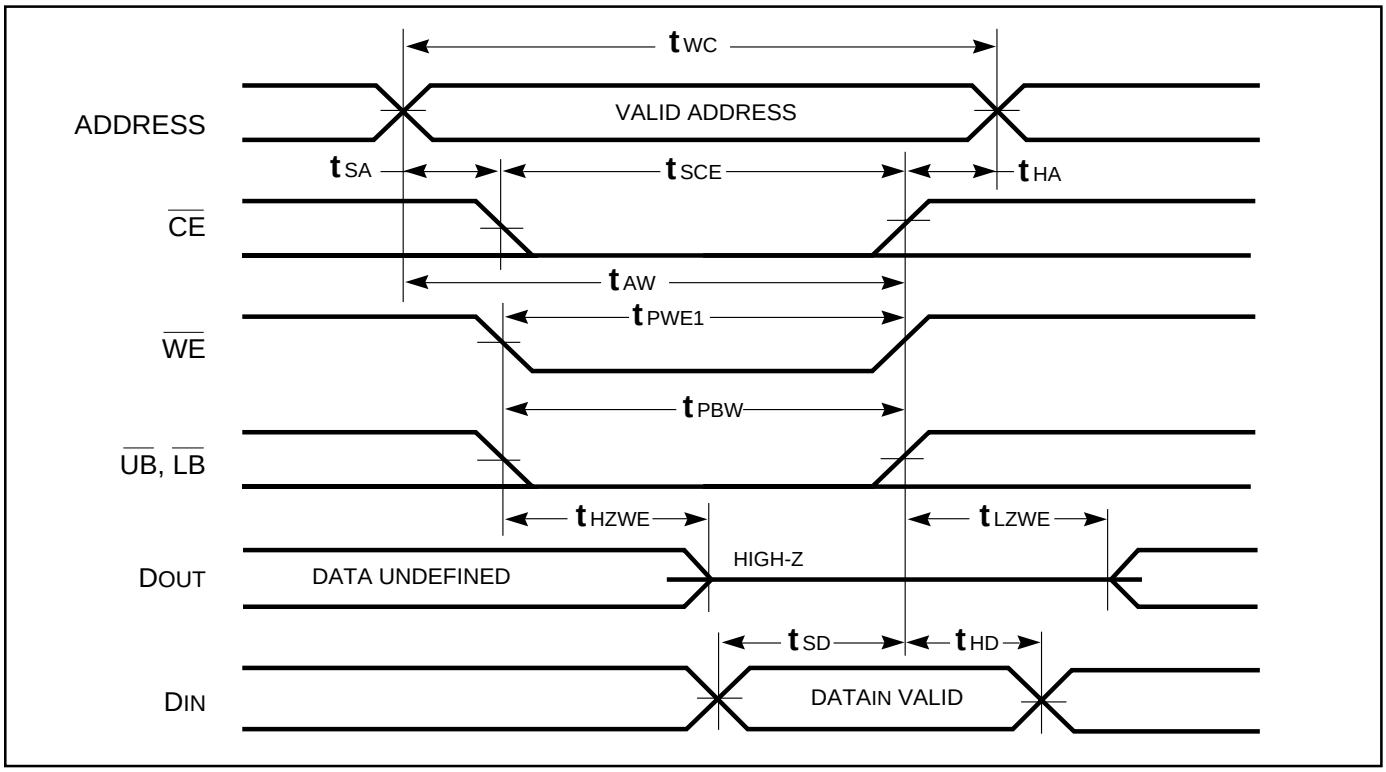
Notes:
1. $\overline{WE}$ is HIGH for a Read Cycle.
2. The device is continuously selected. $\overline{OE}$, $\overline{CE}$, $\overline{UB}$, or $\overline{LB}$ = V_{IL}.
3. Address is valid prior to or coincident with $\overline{CE}$ LOW transition.

WRITE CYCLE SWITCHING CHARACTERISTICS[1,2] (Over Operating Range)

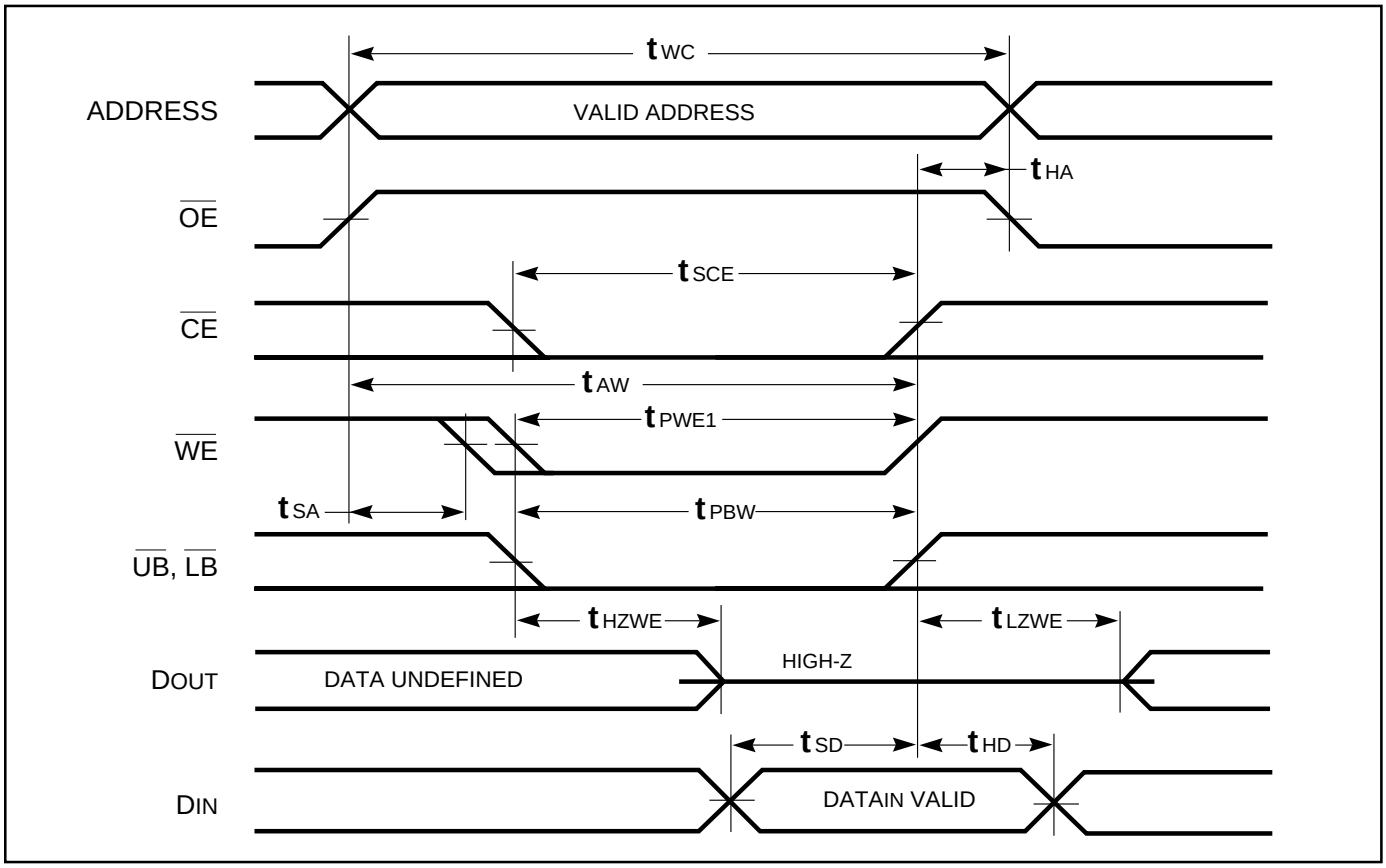
		-55		-70		-100		
Symbol	**Parameter**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Unit**
t_{WC}	Write Cycle Time	55	—	70	—	100	—	ns
t_{SCE}	$\overline{CE}$ to Write End	45	—	60	—	80	—	ns
t_{AW}	Address Setup Time to Write End	45	—	60	—	80	—	ns
t_{HA}	Address Hold from Write End	0	—	0	—	0	—	ns
t_{SA}	Address Setup Time	0	—	0	—	0	—	ns
t_{PWB}	$\overline{LB}$, $\overline{UB}$ Valid to End of Write	45	—	60	—	80	—	ns
t_{PWE1}	$\overline{WE}$ Pulse Width	45	—	60	—	80	—	ns
t_{PWE2}	$\overline{WE}$ Pulse Width	45	—	60	—	80	—	ns
t_{SD}	Data Setup to Write End	25	—	30	—	40	—	ns
t_{HD}	Data Hold from Write End	0	—	0	—	0	—	ns
t_{HZWE}[3]	$\overline{WE}$ LOW to High-Z Output	—	30	—	30	—	40	ns
t_{LZWE}[3]	$\overline{WE}$ HIGH to Low-Z Output	5	—	5	—	5	—	ns

Notes:
1. Test conditions assume signal transition times of 3 ns or less, timing reference levels of 1.5V, input pulse levels of 0.4V to 2.2V and output loading specified in Figure 1.
2. The internal write time is defined by the overlap of $\overline{CE}$ LOW and $\overline{UB}$ or $\overline{LB}$, and $\overline{WE}$ LOW. All signals must be in valid states to initiate a Write, but any one 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.
3. Tested with the load in Figure 1. Transition is measured ±200 mV from steady-state voltage. Not 100% tested.

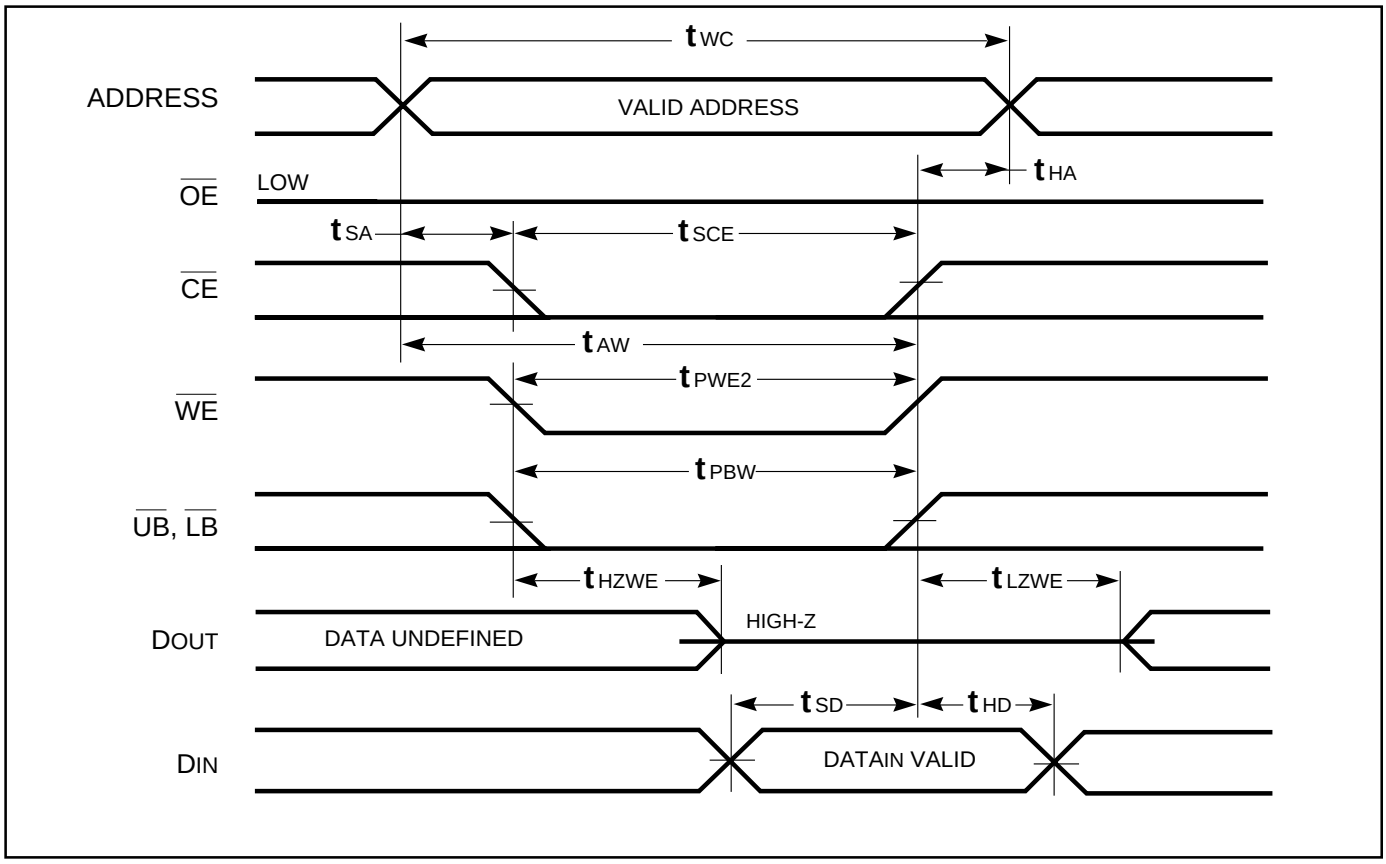
WRITE CYCLE NO. 1 ($\overline{CE}$ Controlled, $\overline{OE}$ is HIGH or LOW) (1)



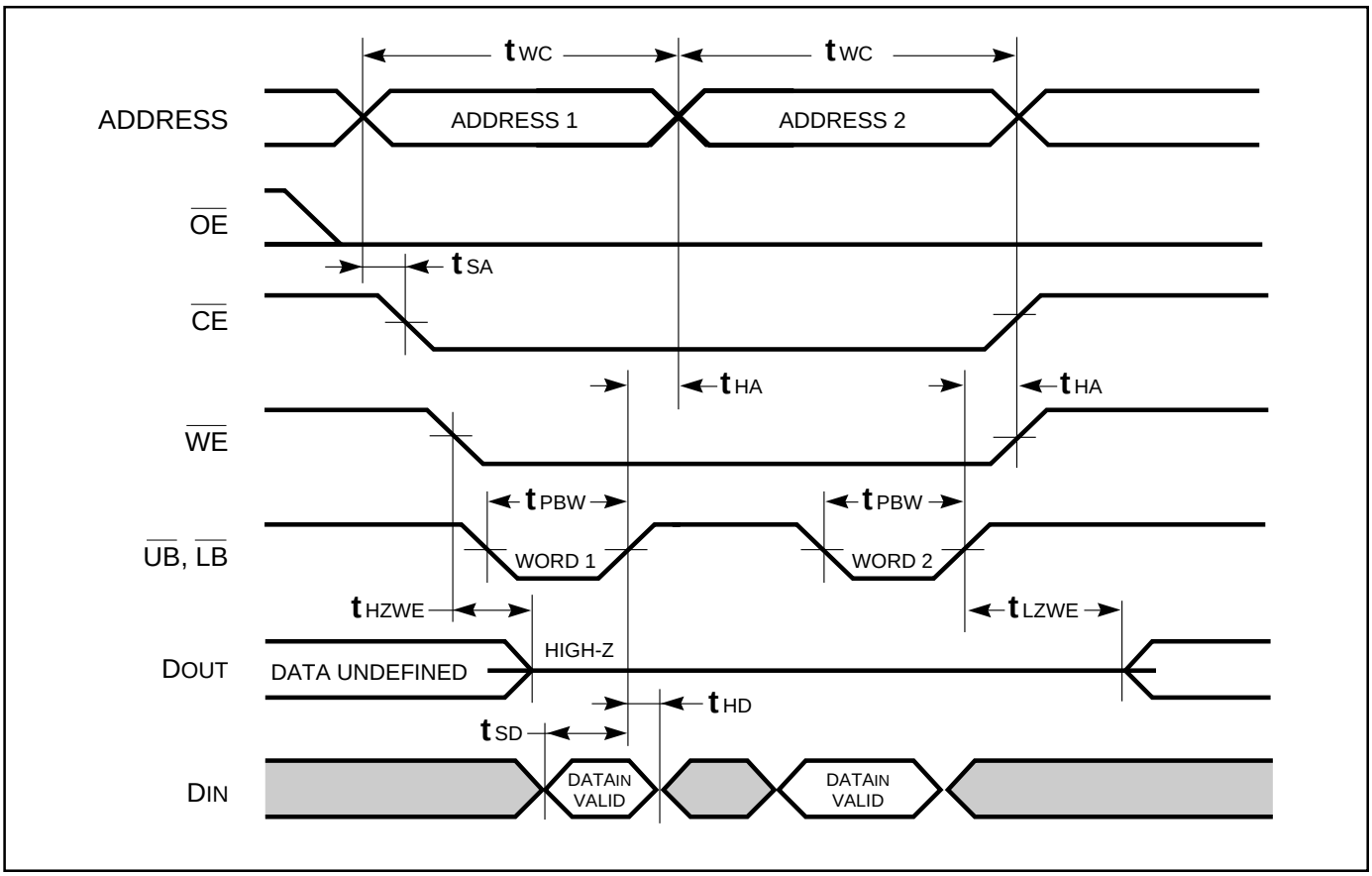
WRITE CYCLE NO. 2 ($\overline{OE}$ is HIGH During Write Cycle) (1,2)



WRITE CYCLE NO. 3 ($\overline{OE}$ is LOW During Write Cycle) (1)



WRITE CYCLE NO. 4 ($\overline{LB}$, $\overline{UB}$ Controlled, Back-to-Back Write) (1,3)



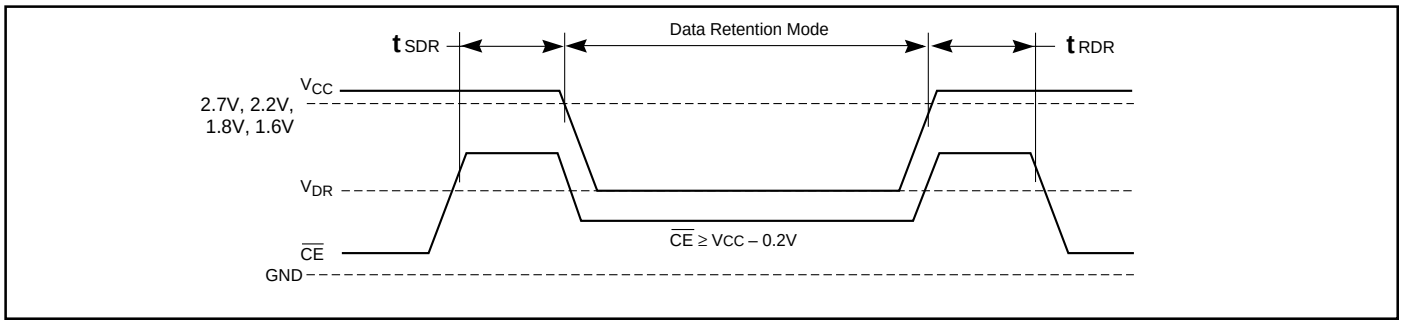
Notes:

1. The internal Write time is defined by the overlap of $\overline{CE}$ = LOW, $\overline{UB}$ and/or $\overline{LB}$ = LOW, and $\overline{WE}$ = LOW. All signals must be in valid states to initiate a Write, but any can be deasserted to terminate the Write. The t_{SA}, t_{HA}, t_{SD}, and t_{HD} timing is referenced to the rising or falling edge of the signal that terminates the Write.
2. Tested with $\overline{OE}$ HIGH for a minimum of 4 ns before $\overline{WE}$ = LOW to place the I/O in a HIGH-Z state.
3. $\overline{WE}$ may be held LOW across many address cycles and the $\overline{LB}$, $\overline{UB}$ pins can be used to control the Write function.

DATA RETENTION SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Condition	Min.	Max.	Unit	
V_{DR}	Vcc for Data Retention	See Data Retention Waveform	1.0	3.3	V	
I_{DR}	Data Retention Current	Vcc = 1.0V, $\overline{CE} \geq$ Vcc – 0.2V, $V_{IN} \geq V_{CC}$ – 0.2V	—	2	µA	**(For -LL version)**
		or $V_{IN} \leq$ 0.2V. No input may exceed Vcc+0.2V	—	1		**(For -SL version)**
t_{SDR}	Data Retention Setup Time	See Data Retention Waveform	0	—	ns	
t_{RDR}	Recovery Time	See Data Retention Waveform	t_{RC}	—	ns	

DATA RETENTION WAVEFORM ($\overline{CE}$ Controlled)



Note:
1. 2.7V: IS62UP25616; 2.2V: IS62UR25616; 1.8V: IS62US25616; 1.6V: IS62UT25616.

ORDERING INFORMATION — SL SERIES

Commercial Range: 0°C to +70°C

Speed (ns)	Order Part No.	Package
55	IS62UP25616SL-55H	sTSOP (II)
	IS62UP25616SL-55B	Mini BGA
	IS62UR25616SL-55H	sTSOP (II)
	IS62UR25616SL-55B	Mini BGA
	IS62US25616SL-55H	sTSOP (II)
	IS62US25616SL-55B	Mini BGA
	IS62UT25616SL-55H	sTSOP (II)
	IS62UT25616SL-55B	Mini BGA
70	IS62UP25616SL-70H	sTSOP (II)
	IS62UP25616SL-70B	Mini BGA
	IS62UR25616SL-70H	sTSOP (II)
	IS62UR25616SL-70B	Mini BGA
	IS62US25616SL-70H	sTSOP (II)
	IS62US25616SL-70B	Mini BGA
	IS62UT25616SL-70H	sTSOP (II)
	IS62UT25616SL-70B	Mini BGA
100	IS62UP25616SL-100H	sTSOP (II)
	IS62UP25616SL-100B	Mini BGA
	IS62UR25616SL-100H	sTSOP (II)
	IS62UR25616SL-100B	Mini BGA
	IS62US25616SL-100H	sTSOP (II)
	IS62US25616SL-100B	Mini BGA
	IS62UT25616SL-100H	sTSOP (II)
	IS62UT25616SL-100B	Mini BGA

Industrial Range: –40°C to +85°C

Speed (ns)	Order Part No.	Package
55	IS62UP25616SL-55HI	sTSOP (II)
	IS62UP25616SL-55BI	Mini BGA
	IS62UR25616SL-55HI	sTSOP (II)
	IS62UR25616SL-55BI	Mini BGA
	IS62US25616SL-55HI	sTSOP (II)
	IS62US25616SL-55BI	Mini BGA
	IS62UT25616SL-55HI	sTSOP (II)
	IS62UT25616SL-55BI	Mini BGA
70	IS62UP25616SL-70HI	sTSOP (II)
	IS62UP25616SL-70BI	Mini BGA
	IS62UR25616SL-70HI	sTSOP (II)
	IS62UR25616SL-70BI	Mini BGA
	IS62US25616SL-70HI	sTSOP (II)
	IS62US25616SL-70BI	Mini BGA
	IS62UT25616SL-70HI	sTSOP (II)
	IS62UT25616SL-70BI	Mini BGA
100	IS62UP25616SL-100HI	sTSOP (II)
	IS62UP25616SL-100BI	Mini BGA
	IS62UR25616SL-100HI	sTSOP (II)
	IS62UR25616SL-100BI	Mini BGA
	IS62US25616SL-100HI	sTSOP (II)
	IS62US25616SL-100BI	Mini BGA
	IS62UT25616SL-100HI	sTSOP (II)
	IS62UT25616SL-100BI	Mini BGA

ORDERING INFORMATION — SL LL RIES

Commercial Range: 0°C to +70°C

Speed (ns)	Order Part No.	Package
55	IS62UP25616LL-55H	sTSOP (II)
	IS62UP25616LL-55B	Mini BGA
	IS62UR25616LL-55H	sTSOP (II)
	IS62UR25616LL-55B	Mini BGA
	IS62US25616LL-55H	sTSOP (II)
	IS62US25616LL-55B	Mini BGA
	IS62UT25616LL-55H	sTSOP (II)
	IS62UT25616LL-55B	Mini BGA
70	IS62UP25616LL-70H	sTSOP (II)
	IS62UP25616LL-70B	Mini BGA
	IS62UR25616LL-70H	sTSOP (II)
	IS62UR25616LL-70B	Mini BGA
	IS62US25616LL-70H	sTSOP (II)
	IS62US25616LL-70B	Mini BGA
	IS62UT25616LL-70H	sTSOP (II)
	IS62UT25616LL-70B	Mini BGA
100	IS62UP25616LL-100H	sTSOP (II)
	IS62UP25616LL-100B	Mini BGA
	IS62UR25616LL-100H	sTSOP (II)
	IS62UR25616LL-100B	Mini BGA
	IS62US25616LL-100H	sTSOP (II)
	IS62US25616LL-100B	Mini BGA
	IS62UT25616LL-100H	sTSOP (II)
	IS62UT25616LL-100B	Mini BGA

Industrial Range: –40°C to +85°C

Speed (ns)	Order Part No.	Package
55	IS62UP25616LL-55HI	sTSOP (II)
	IS62UP25616LL-55BI	Mini BGA
	IS62UR25616LL-55HI	sTSOP (II)
	IS62UR25616LL-55BI	Mini BGA
	IS62US25616LL-55HI	sTSOP (II)
	IS62US25616LL-55BI	Mini BGA
	IS62UT25616SL-55HI	sTSOP (II)
	IS62UT25616LL-55BI	Mini BGA
70	IS62UP25616LL-70HI	sTSOP (II)
	IS62UP25616LL-70BI	Mini BGA
	IS62UR25616LL-70HI	sTSOP (II)
	IS62UR25616LL-70BI	Mini BGA
	IS62US25616LL-70HI	sTSOP (II)
	IS62US25616LL-70BI	Mini BGA
	IS62UT25616LL-70HI	sTSOP (II)
	IS62UT25616LL-70BI	Mini BGA
100	IS62UP25616LL-100HI	sTSOP (II)
	IS62UP25616LL-100BI	Mini BGA
	IS62UR25616LL-100HI	sTSOP (II)
	IS62UR25616LL-100BI	Mini BGA
	IS62US25616LL-100HI	sTSOP (II)
	IS62US25616LL-100BI	Mini BGA
	IS62UT25616LL-100HI	sTSOP (II)
	IS62UT25616LL-100BI	Mini BGA

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