



# 128K x 32, 128K x 36, 256K x 18 4 Mb SYNCHRONOUS FLOW-THROUGH STATIC RAM

FEBRUARY 2014

## FEATURES

- Internal self-timed write cycle
- Individual Byte Write Control and Global Write
- Clock controlled, registered address, data and control
- Burst sequence control using MODE input
- Three chip enable option for simple depth expansion and address pipelining
- Common data inputs and data outputs
- Auto Power-down during deselect
- Single cycle deselect
- Snooze MODE for reduced-power standby
- Power Supply  
 LF:  $V_{DD} 3.3V \pm 5\%$ ,  $V_{DDQ} 3.3V/2.5V \pm 5\%$   
 VF:  $V_{DD} 2.5V -5\% +10\%$ ,  $V_{DDQ} 2.5V -5\% +10\%$
- JEDEC 100-Pin QFP, 119-pin BGA, and 165-pin BGA packages
- Automotive temperature available
- Lead-free available

## DESCRIPTION

The *ISSI* IS61(64)LF12832A, IS64VF12832A, IS61(64)LF/VF12836A and IS61(64)LF/VF25618A are high-speed, low-power synchronous static RAMs designed to provide burstable, high-performance memory for communication and networking applications. The IS61(64)LF12832A is organized as 131,072 words by 32 bits. The IS61(64)LF/VF12836A is organized as 131,072 words by 36 bits. The IS61(64)LF/VF25618A is organized as 262,144 words by 18 bits. Fabricated with *ISSI's* advanced CMOS technology, the device integrates a 2-bit burst counter, high-speed SRAM core, and high-drive capability outputs into a single monolithic circuit. All synchronous inputs pass through registers controlled by a positive-edge-triggered single clock input.

Write cycles are internally self-timed and are initiated by the rising edge of the clock input. Write cycles can be one to four bytes wide as controlled by the write control inputs.

Separate byte enables allow individual bytes to be written. Byte write operation is performed by using byte write enable ( $\overline{BWE}$ ) input combined with one or more individual byte write signals ( $\overline{BWx}$ ). In addition, Global Write ( $\overline{GW}$ ) is available for writing all bytes at one time, regardless of the byte write controls.

Bursts can be initiated with either  $\overline{ADSP}$  (Address Status Processor) or  $\overline{ADSC}$  (Address Status Cache Controller) input pins. Subsequent burst addresses can be generated internally and controlled by the  $\overline{ADV}$  (burst address advance) input pin.

The mode pin is used to select the burst sequence order, Linear burst is achieved when this pin is tied LOW. Interleave burst is achieved when this pin is tied HIGH or left floating.

## FAST ACCESS TIME

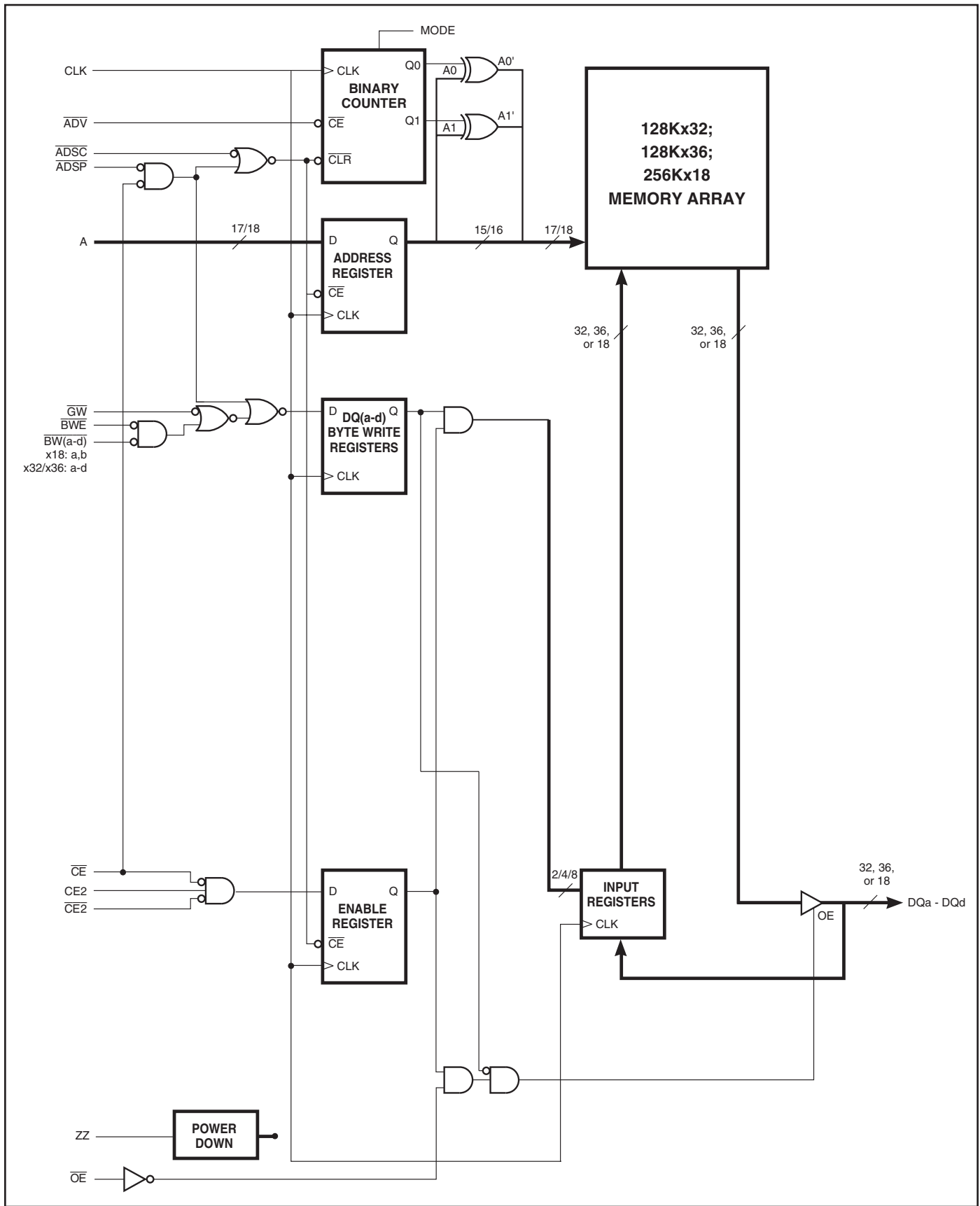
Symbol	Parameter	-6.5	-7.5	Units
tkQ	Clock Access Time	6.5	7.5	ns
tkc	Cycle Time	7.5	8.5	ns
	Frequency	133	117	MHz

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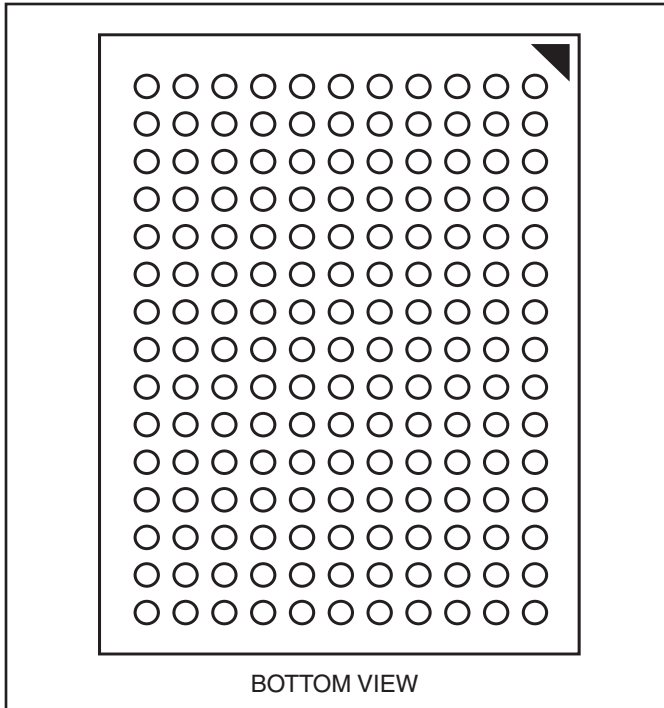
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**BLOCK DIAGRAM**



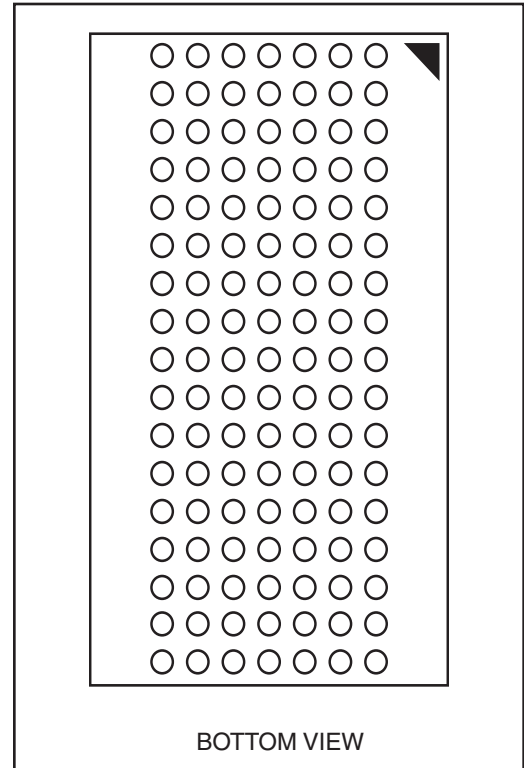
**165-PIN BGA**

165-Ball, 13x15 mm BGA



**119-PIN BGA**

119-Ball, 14x22 mm BGA



## 119 BGA PACKAGE PIN CONFIGURATION

128K x 36 (TOP VIEW)

	1	2	3	4	5	6	7
<b>A</b>	V <sub>DDQ</sub>	A	A	$\overline{\text{ADSP}}$	A	A	V <sub>DDQ</sub>
<b>B</b>	NC	CE2	A	$\overline{\text{ADSC}}$	A	$\overline{\text{CE2}}$	NC
<b>C</b>	NC	A	A	V <sub>DD</sub>	A	A	NC
<b>D</b>	DQc	DQPc	V <sub>SS</sub>	NC	V <sub>SS</sub>	DQPb	DQb
<b>E</b>	DQc	DQc	V <sub>SS</sub>	$\overline{\text{CE}}$	V <sub>SS</sub>	DQb	DQb
<b>F</b>	V <sub>DDQ</sub>	DQc	V <sub>SS</sub>	$\overline{\text{OE}}$	V <sub>SS</sub>	DQb	V <sub>DDQ</sub>
<b>G</b>	DQc	DQc	$\overline{\text{BWc}}$	$\overline{\text{ADV}}$	$\overline{\text{BWb}}$	DQb	DQb
<b>H</b>	DQc	DQc	V <sub>SS</sub>	$\overline{\text{GW}}$	V <sub>SS</sub>	DQb	DQb
<b>J</b>	V <sub>DDQ</sub>	V <sub>DD</sub>	NC	V <sub>DD</sub>	NC	V <sub>DD</sub>	V <sub>DDQ</sub>
<b>K</b>	DQd	DQd	V <sub>SS</sub>	CLK	V <sub>SS</sub>	DQa	DQa
<b>L</b>	DQd	DQd	$\overline{\text{BWd}}$	NC	$\overline{\text{BWA}}$	DQa	DQa
<b>M</b>	V <sub>DDQ</sub>	DQd	V <sub>SS</sub>	$\overline{\text{BWE}}$	V <sub>SS</sub>	DQa	V <sub>DDQ</sub>
<b>N</b>	DQd	DQd	V <sub>SS</sub>	A <sub>1</sub> *	V <sub>SS</sub>	DQa	DQa
<b>P</b>	DQd	DQPd	V <sub>SS</sub>	A <sub>0</sub> *	V <sub>SS</sub>	DQPa	DQa
<b>R</b>	NC	A	MODE	V <sub>DD</sub>	NC	A	NC
<b>T</b>	NC	NC	A	A	A	NC	ZZ
<b>U</b>	V <sub>DDQ</sub>	NC	NC	NC	NC	NC	V <sub>DDQ</sub>

**Note:** \* A<sub>0</sub> and A<sub>1</sub> are the two least significant bits (LSB) of the address field and set the internal burst counter if burst is desired.

## PIN DESCRIPTIONS

Symbol	Pin Name
A	Address Inputs
A <sub>0</sub> , A <sub>1</sub>	Synchronous Burst Address Inputs
$\overline{\text{ADV}}$	Synchronous Burst Address Advance
$\overline{\text{ADSP}}$	Address Status Processor
$\overline{\text{ADSC}}$	Address Status Controller
$\overline{\text{GW}}$	Global Write Enable
CLK	Synchronous Clock
$\overline{\text{CE}}$ , CE2, $\overline{\text{CE2}}$	Synchronous Chip Select
$\overline{\text{BWx}}$ (x=a-d)	Synchronous Byte Write Controls
$\overline{\text{BWE}}$	Byte Write Enable

Symbol	Pin Name
$\overline{\text{OE}}$	Output Enable
ZZ	Power Sleep Mode
MODE	Burst Sequence Selection
NC	No Connect
DQa-DQd	Data Inputs/Outputs
DQPa-Pd	Output Power Supply
V <sub>DD</sub>	Power Supply
V <sub>DDQ</sub>	Output Power Supply
V <sub>SS</sub>	Ground

## 119 BGA PACKAGE PIN CONFIGURATION

256Kx18 (TOP VIEW)

	1	2	3	4	5	6	7
<b>A</b>	V <sub>DDQ</sub>	A	A	$\overline{\text{ADSP}}$	A	A	V <sub>DDQ</sub>
<b>B</b>	NC	CE2	A	$\overline{\text{ADSC}}$	A	$\overline{\text{CE2}}$	NC
<b>C</b>	NC	A	A	V <sub>DD</sub>	A	A	NC
<b>D</b>	DQb	NC	V <sub>SS</sub>	NC	V <sub>SS</sub>	DQP <sub>a</sub>	NC
<b>E</b>	NC	DQb	V <sub>SS</sub>	$\overline{\text{CE}}$	V <sub>SS</sub>	NC	DQ <sub>a</sub>
<b>F</b>	V <sub>DDQ</sub>	NC	V <sub>SS</sub>	$\overline{\text{OE}}$	V <sub>SS</sub>	DQ <sub>a</sub>	V <sub>DDQ</sub>
<b>G</b>	NC	DQb	$\overline{\text{BWb}}$	$\overline{\text{ADV}}$	V <sub>SS</sub>	NC	DQ <sub>a</sub>
<b>H</b>	DQb	NC	V <sub>SS</sub>	$\overline{\text{GW}}$	V <sub>SS</sub>	DQ <sub>a</sub>	NC
<b>J</b>	V <sub>DDQ</sub>	V <sub>DD</sub>	NC	V <sub>DD</sub>	NC	V <sub>DD</sub>	V <sub>DDQ</sub>
<b>K</b>	NC	DQb	V <sub>SS</sub>	CLK	V <sub>SS</sub>	NC	DQ <sub>a</sub>
<b>L</b>	DQb	NC	V <sub>SS</sub>	NC	$\overline{\text{BWa}}$	DQ <sub>a</sub>	NC
<b>M</b>	V <sub>DDQ</sub>	DQb	V <sub>SS</sub>	$\overline{\text{BWE}}$	V <sub>SS</sub>	NC	V <sub>DDQ</sub>
<b>N</b>	DQb	NC	V <sub>SS</sub>	A <sub>1</sub> *	V <sub>SS</sub>	DQ <sub>a</sub>	NC
<b>P</b>	NC	DQP <sub>b</sub>	V <sub>SS</sub>	A <sub>0</sub> *	V <sub>SS</sub>	NC	DQ <sub>a</sub>
<b>R</b>	NC	A	MODE	V <sub>DD</sub>	NC	A	NC
<b>T</b>	NC	A	A	NC	A	A	ZZ
<b>U</b>	V <sub>DDQ</sub>	NC	NC	NC	NC	NC	V <sub>DDQ</sub>

Note: \* A<sub>0</sub> and A<sub>1</sub> are the two least significant bits (LSB) of the address field and set the internal burst counter if burst is desired.

## PIN DESCRIPTIONS

Symbol	Pin Name
A	Address Inputs
A <sub>0</sub> , A <sub>1</sub>	Synchronous Burst Address Inputs
$\overline{\text{ADV}}$	Synchronous Burst Address Advance
$\overline{\text{ADSP}}$	Address Status Processor
$\overline{\text{ADSC}}$	Address Status Controller
$\overline{\text{GW}}$	Global Write Enable
CLK	Synchronous Clock
$\overline{\text{CE}}$ , CE2, $\overline{\text{CE2}}$	Synchronous Chip Select
$\overline{\text{BWx}}$ (x=a,b)	Synchronous Byte Write Controls
$\overline{\text{BWE}}$	Byte Write Enable

Symbol	Pin Name
$\overline{\text{OE}}$	Output Enable
ZZ	Power Sleep Mode
MODE	Burst Sequence Selection
NC	No Connect
DQ <sub>a</sub> -DQ <sub>b</sub>	Data Inputs/Outputs
DQP <sub>a</sub> -P <sub>b</sub>	Output Power Supply
V <sub>DD</sub>	Power Supply
V <sub>DDQ</sub>	Output Power Supply
V <sub>SS</sub>	Ground

## 165 BGA PACKAGE PIN CONFIGURATION

128K x 36 (TOP VIEW)

	1	2	3	4	5	6	7	8	9	10	11
<b>A</b>	NC	A	$\overline{CE}$	$\overline{BWc}$	$\overline{BWb}$	CE2	$\overline{BWE}$	ADSC	$\overline{ADV}$	A	NC
<b>B</b>	NC	A	CE2	$\overline{BWd}$	$\overline{BWa}$	CLK	$\overline{GW}$	$\overline{OE}$	$\overline{ADSP}$	A	NC
<b>C</b>	DQPc	NC	VDDQ	VSS	VSS	VSS	VSS	VSS	VDDQ	NC	DQPb
<b>D</b>	DQc	DQc	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQb	DQb
<b>E</b>	DQc	DQc	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQb	DQb
<b>F</b>	DQc	DQc	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQb	DQb
<b>G</b>	DQc	DQc	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQb	DQb
<b>H</b>	NC	NC	NC	VDD	VSS	VSS	VSS	VDD	NC	NC	ZZ
<b>J</b>	DQd	DQd	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQa	DQa
<b>K</b>	DQd	DQd	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQa	DQa
<b>L</b>	DQd	DQd	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQa	DQa
<b>M</b>	DQd	DQd	VDDQ	VDD	VSS	VSS	VSS	VDD	VDDQ	DQa	DQa
<b>N</b>	DQPd	NC	VDDQ	VSS	NC	NC	NC	VSS	VDDQ	NC	DQPa
<b>P</b>	NC	NC	A	A	NC	A1*	NC	A	A	A	NC
<b>R</b>	MODE	NC	A	A	NC	A0*	NC	A	A	A	A

**Note:** \* A0 and A1 are the two least significant bits (LSB) of the address field and set the internal burst counter if burst is desired.

## PIN DESCRIPTIONS

Symbol	Pin Name
A	Address Inputs
A0, A1	Synchronous Burst Address Inputs
$\overline{ADV}$	Synchronous Burst Address Advance
$\overline{ADSP}$	Address Status Processor
$\overline{ADSC}$	Address Status Controller
$\overline{GW}$	Global Write Enable
CLK	Synchronous Clock
$\overline{CE}$ , CE2, CE2	Synchronous Chip Select
$\overline{BWx}$ (x=a,b,c,d)	Synchronous Byte Write Controls

Symbol	Pin Name
$\overline{BWE}$	Byte Write Enable
$\overline{OE}$	Output Enable
ZZ	Power Sleep Mode
MODE	Burst Sequence Selection
NC	No Connect
DQx	Data Inputs/Outputs
DQPx	Data Inputs/Outputs
VDD	3.3V/2.5V Power Supply
VDDQ	Isolated Output Power Supply 3.3V/2.5V
VSS	Ground



## 165 BGA PACKAGE PIN CONFIGURATION

256K x 18 (TOP VIEW)

	1	2	3	4	5	6	7	8	9	10	11
<b>A</b>	NC	A	$\overline{CE}$	$\overline{BWb}$	NC	$\overline{CE2}$	$\overline{BWE}$	$\overline{ADSC}$	ADV	A	A
<b>B</b>	NC	A	CE2	NC	$\overline{BWa}$	CLK	$\overline{GW}$	$\overline{OE}$	$\overline{ADSP}$	A	NC
<b>C</b>	NC	NC	V <sub>DDQ</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DDQ</sub>	NC	DQP <sub>a</sub>
<b>D</b>	NC	DQ <sub>b</sub>	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	NC	DQ <sub>a</sub>
<b>E</b>	NC	DQ <sub>b</sub>	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	NC	DQ <sub>a</sub>
<b>F</b>	NC	DQ <sub>b</sub>	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	NC	DQ <sub>a</sub>
<b>G</b>	NC	DQ <sub>b</sub>	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	NC	DQ <sub>a</sub>
<b>H</b>	NC	NC	NC	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	NC	NC	ZZ
<b>J</b>	DQ <sub>b</sub>	NC	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	DQ <sub>a</sub>	NC
<b>K</b>	DQ <sub>b</sub>	NC	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	DQ <sub>a</sub>	NC
<b>L</b>	DQ <sub>b</sub>	NC	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	DQ <sub>a</sub>	NC
<b>M</b>	DQ <sub>b</sub>	NC	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	DQ <sub>a</sub>	NC
<b>N</b>	DQP <sub>b</sub>	NC	V <sub>DDQ</sub>	V <sub>SS</sub>	NC	NC	NC	V <sub>SS</sub>	V <sub>DDQ</sub>	NC	NC
<b>P</b>	NC	NC	A	A	NC	A <sub>1</sub> *	NC	A	A	A	NC
<b>R</b>	MODE	NC	A	A	NC	A <sub>0</sub> *	NC	A	A	A	A

Note: \* A<sub>0</sub> and A<sub>1</sub> are the two least significant bits (LSB) of the address field and set the internal burst counter if burst is desired.

## PIN DESCRIPTIONS

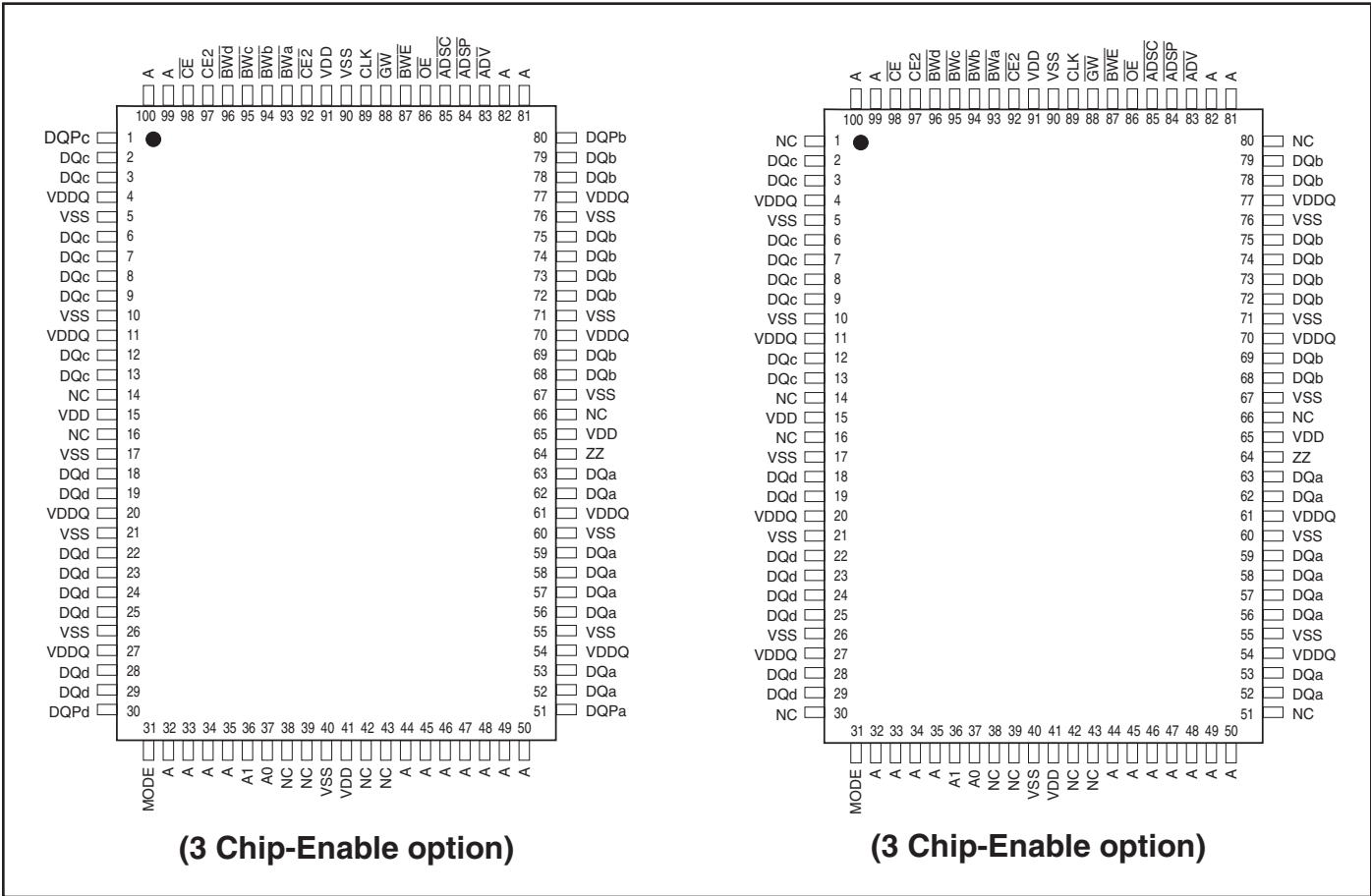
Symbol	Pin Name
A	Address Inputs
A <sub>0</sub> , A <sub>1</sub>	Synchronous Burst Address Inputs
ADV	Synchronous Burst Address Advance
$\overline{ADSP}$	Address Status Processor
$\overline{ADSC}$	Address Status Controller
$\overline{GW}$	Global Write Enable
CLK	Synchronous Clock
$\overline{CE}$ , $\overline{CE2}$ , CE2	Synchronous Chip Select
$\overline{BWx}$ (x=a,b)	Synchronous Byte Write Controls

Symbol	Pin Name
$\overline{BWE}$	Byte Write Enable
$\overline{OE}$	Output Enable
ZZ	Power Sleep Mode
MODE	Burst Sequence Selection
NC	No Connect
DQ <sub>x</sub>	Data Inputs/Outputs
DQP <sub>x</sub>	Data Inputs/Outputs
V <sub>DD</sub>	3.3V/2.5V Power Supply
V <sub>DDQ</sub>	Isolated Output Power Supply 3.3V/2.5V
V <sub>SS</sub>	Ground

**PIN CONFIGURATION**

**100-PIN QFP (128K x 36)**

**100-PIN QFP (128K x 32)**



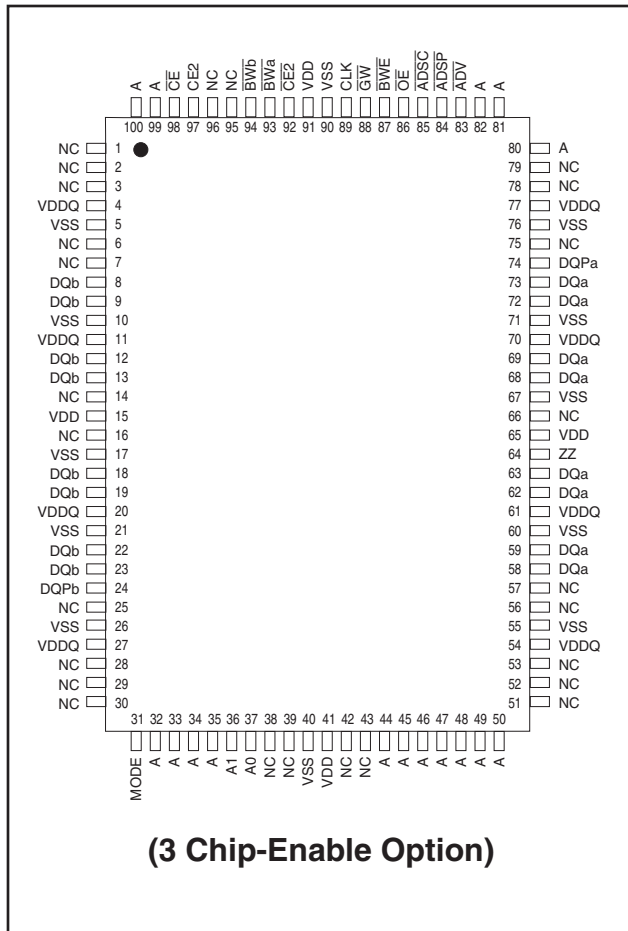
**PIN DESCRIPTIONS**

A0, A1	Synchronous Address Inputs. These pins must tied to the two LSBs of the address bus.	DQa-DQd	Synchronous Data Input/Output
A	Synchronous Address Inputs	DQPa-DQPd	Parity Data Input/Output
$\overline{\text{ADSC}}$	Synchronous Controller Address Status	$\overline{\text{GW}}$	Synchronous Global Write Enable
$\overline{\text{ADSP}}$	Synchronous Processor Address Status	MODE	Burst Sequence Mode Selection
$\overline{\text{ADV}}$	Synchronous Burst Address Advance	$\overline{\text{OE}}$	Output Enable
$\overline{\text{BWA-BWd}}$	Synchronous Byte Write Enable	VDD	3.3V/2.5V Power Supply
$\overline{\text{BWE}}$	Synchronous Byte Write Enable	VDDQ	Isolated Output Buffer Supply: 3.3V/2.5V
$\overline{\text{CE}}, \overline{\text{CE2}}, \overline{\text{CE2}}$	Synchronous Chip Enable	VSS	Ground
CLK	Synchronous Clock	ZZ	Snooze Enable



## PIN CONFIGURATION

### 100-PIN QFP (256K x 18)



## PIN DESCRIPTIONS

A0, A1	Synchronous Address Inputs. These pins must tied to the two LSBs of the address bus.	DQPa-DQPb	Parity Data I/O; DQPa is parity for DQa1-8; DQPb is parity for DQb1-8
A	Synchronous Address Inputs	$\overline{GW}$	Synchronous Global Write Enable
$\overline{ADSC}$	Synchronous Controller Address Status	MODE	Burst Sequence Mode Selection
$\overline{ADSP}$	Synchronous Processor Address Status	$\overline{OE}$	Output Enable
$\overline{ADV}$	Synchronous Burst Address Advance	VDD	3.3V/2.5V Power Supply
$\overline{BWA}$ - $\overline{BWB}$	Synchronous Byte Write Enable	VDDQ	Isolated Output Buffer Supply: 3.3V/2.5V
$\overline{BWE}$	Synchronous Byte Write Enable	VSS	Ground
$\overline{CE}$ , $\overline{CE2}$ , $\overline{CE2}$	Synchronous Chip Enable	$\overline{ZZ}$	Snooze Enable
CLK	Synchronous Clock		
DQa-DQb	Synchronous Data Input/Output		



**TRUTH TABLE<sup>(1-8)</sup>**

OPERATION	ADDRESS	$\overline{CE}$	$\overline{CE2}$	CE2	ZZ	$\overline{ADSP}$	$\overline{ADSC}$	$\overline{ADV}$	$\overline{WRITE}$	$\overline{OE}$	CLK	DQ
Deselect Cycle, Power-Down	None	H	X	X	L	X	L	X	X	X	L-H	High-Z
Deselect Cycle, Power-Down	None	L	X	L	L	L	X	X	X	X	L-H	High-Z
Deselect Cycle, Power-Down	None	L	H	X	L	L	X	X	X	X	L-H	High-Z
Deselect Cycle, Power-Down	None	L	X	L	L	H	L	X	X	X	L-H	High-Z
Deselect Cycle, Power-Down	None	L	H	X	L	H	L	X	X	X	L-H	High-Z
Snooze Mode, Power-Down	None	X	X	X	H	X	X	X	X	X	X	High-Z
Read Cycle, Begin Burst	External	L	L	H	L	L	X	X	X	L	L-H	Q
Read Cycle, Begin Burst	External	L	L	H	L	L	X	X	X	H	L-H	High-Z
Write Cycle, Begin Burst	External	L	L	H	L	H	L	X	L	X	L-H	D
Read Cycle, Begin Burst	External	L	L	H	L	H	L	X	H	L	L-H	Q
Read Cycle, Begin Burst	External	L	L	H	L	H	L	X	H	H	L-H	High-Z
Read Cycle, Continue Burst	Next	X	X	X	L	H	H	L	H	L	L-H	Q
Read Cycle, Continue Burst	Next	X	X	X	L	H	H	L	H	H	L-H	High-Z
Read Cycle, Continue Burst	Next	H	X	X	L	X	H	L	H	L	L-H	Q
Read Cycle, Continue Burst	Next	H	X	X	L	X	H	L	H	H	L-H	High-Z
Write Cycle, Continue Burst	Next	X	X	X	L	H	H	L	L	X	L-H	D
Write Cycle, Continue Burst	Next	H	X	X	L	X	H	L	L	X	L-H	D
Read Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	H	L	L-H	Q
Read Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	H	H	L-H	High-Z
Read Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	H	L	L-H	Q
Read Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	H	H	L-H	High-Z
Write Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	L	X	L-H	D
Write Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	L	X	L-H	D

**NOTE:**

1. X means "Don't Care." H means logic HIGH. L means logic LOW.
2. For  $\overline{WRITE}$ , L means one or more byte write enable signals ( $\overline{BWA-d}$ ) and  $\overline{BWE}$  are LOW or  $\overline{GW}$  is LOW.  $\overline{WRITE} = H$  for all  $\overline{BWx}$ ,  $\overline{BWE}$ ,  $\overline{GW}$  HIGH.
3.  $\overline{BWA}$  enables WRITES to DQa's and DQP<sub>a</sub>.  $\overline{BWb}$  enables WRITES to DQb's and DQP<sub>b</sub>.  $\overline{BWc}$  enables WRITES to DQc's and DQP<sub>c</sub>.  $\overline{BWD}$  enables WRITES to DQd's and DQP<sub>d</sub>. DQP<sub>a</sub> and DQP<sub>b</sub> are available on the x18 version. DQP<sub>a</sub>-DQP<sub>d</sub> are available on the x36 version.
4. All inputs except  $\overline{OE}$  and ZZ must meet setup and hold times around the rising edge (LOW to HIGH) of CLK.
5. Wait states are inserted by suspending burst.
6. For a WRITE operation following a READ operation,  $\overline{OE}$  must be HIGH before the input data setup time and held HIGH during the input data hold time.
7. This device contains circuitry that will ensure the outputs will be in High-Z during power-up.
8.  $\overline{ADSP}$  LOW always initiates an internal READ at the L-H edge of CLK. A WRITE is performed by setting one or more byte write enable signals and  $\overline{BWE}$  LOW or  $\overline{GW}$  LOW for the subsequent L-H edge of CLK. See WRITE timing diagram for clarification.

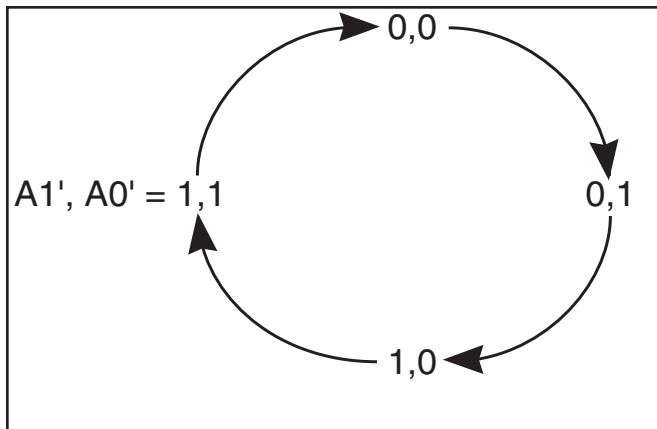
**PARTIAL TRUTH TABLE**

Function	$\overline{GW}$	$\overline{BWE}$	$\overline{BWA}$	$\overline{BWb}$	$\overline{BWc}$	$\overline{BWD}$
Read	H	H	X	X	X	X
Read	H	L	H	H	H	H
Write Byte 1	H	L	L	H	H	H
Write All Bytes	H	L	L	L	L	L
Write All Bytes	L	X	X	X	X	X

**INTERLEAVED BURST ADDRESS TABLE (MODE = V<sub>DD</sub> or No Connect)**

External Address A1 A0	1st Burst Address A1 A0	2nd Burst Address A1 A0	3rd Burst Address A1 A0
00	01	10	11
01	00	11	10
10	11	00	01
11	10	01	00

**LINEAR BURST ADDRESS TABLE (MODE = V<sub>SS</sub>)**



**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

Symbol	Parameter	Value	Unit
T <sub>STG</sub>	Storage Temperature	-55 to +150	°C
P <sub>D</sub>	Power Dissipation	1.6	W
I <sub>OUT</sub>	Output Current (per I/O)	100	mA
V <sub>IN</sub> , V <sub>OUT</sub>	Voltage Relative to V <sub>SS</sub> for I/O Pins	-0.5 to V <sub>DDQ</sub> + 0.5	V
V <sub>IN</sub>	Voltage Relative to V <sub>SS</sub> for for Address and Control Inputs	-0.5 to V <sub>DD</sub> + 0.5	V
V <sub>DD</sub>	Voltage on V <sub>DD</sub> Supply Relative to V <sub>SS</sub>	-0.5 to 4.6	V

**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.
2. This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, precautions may be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit.
3. This device contains circuitry that will ensure the output devices are in High-Z at power up.

### OPERATING RANGE (IS61/64LFxxxxx)

Range	Ambient Temperature	V <sub>DD</sub>	V <sub>DDQ</sub>
Commercial	0°C to +70°C	3.3V ± 5%	3.3V/2.5V ± 5%
Industrial	-40°C to +85°C	3.3V ± 5%	3.3V/2.5V ± 5%
Automotive	-40°C to +125°C	3.3V ± 5%	3.3V/2.5V ± 5%

### OPERATING RANGE (IS61/64VFxxxxx)

Range	Ambient Temperature	V <sub>DD</sub>	V <sub>DDQ</sub>
Commercial	0°C to +70°C	2.5V -5% +10%	2.5V -5% +10%
Industrial	-40°C to +85°C	2.5V -5% +10%	2.5V -5% +10%
Automotive	-40°C to +125°C	2.5V -5% +10%	2.5V -5% +10%

### DC ELECTRICAL CHARACTERISTICS (Over Operating Range)

Symbol	Parameter	Test Conditions	3.3V		2.5V		Unit
			Min.	Max.	Min.	Max.	
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = -4.0 mA (3.3V) I <sub>OH</sub> = -1.0 mA (2.5V)	2.4	—	2.0	—	V
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 8.0 mA (3.3V) I <sub>OL</sub> = 1.0 mA (2.5V)	—	0.4	—	0.4	V
V <sub>IH</sub>	Input HIGH Voltage <sup>(1)</sup>		2.0	V <sub>DD</sub> + 0.3	1.7	V <sub>DD</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		-0.3	0.8	-0.3	0.7	V
I <sub>LI</sub>	Input Leakage Current	V <sub>SS</sub> ≤ V <sub>IN</sub> ≤ V <sub>DD</sub> <sup>(1)</sup>	-5	5	-5	5	μA
I <sub>LO</sub>	Output Leakage Current	V <sub>SS</sub> ≤ V <sub>OUT</sub> ≤ V <sub>DDQ</sub> , $\overline{OE} = V_{IH}$	-5	5	-5	5	μA

**Note:**

- V<sub>ILL</sub>(min) = -2.0V AC (pulse width < t<sub>KC</sub>/ 2). Guaranteed by design.  
 V<sub>IHH</sub>(max) = V<sub>DD</sub> + 1.5V AC (pulse width < t<sub>KC</sub>/ 2). Guaranteed by design.

**POWER SUPPLY CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

Symbol	Parameter	Test Conditions	Temp. range	6.5 MAX		7.5 MAX		Unit
				x18	x32/x36	x18	x32/x36	
I <sub>CC</sub>	AC Operating Supply Current	Device Selected, OE = V <sub>IH</sub> , ZZ ≤ V <sub>IL</sub> , All Inputs ≤ 0.2V or ≥ V <sub>DD</sub> - 0.2V, Cycle Time ≥ t <sub>kc</sub> min.	Com.	175	175	155	155	mA
			Ind.	180	180	160	160	
			Auto.	190	190	175	175	
			typ. <sup>(2)</sup>	120		110		
I <sub>SB</sub>	Standby Current TTL Input	Device Deselected, V <sub>DD</sub> = Max., All Inputs ≤ V <sub>IL</sub> or ≥ V <sub>IH</sub> , ZZ ≤ V <sub>IL</sub> , f = Max.	Com.	90	90	90	90	mA
			Ind.	100	100	100	100	
			Auto.	120	120	120	120	
I <sub>SBI</sub>	Standby Current CMOS Input	Device Deselected, V <sub>DD</sub> = Max., V <sub>IN</sub> ≤ V <sub>SS</sub> + 0.2V or ≥ V <sub>DD</sub> - 0.2V f = 0	Com.	70	70	70	70	mA
			Ind.	75	75	75	75	
			Auto.	90	90	90	90	
			typ.	40		40		
I <sub>SB2</sub>	Sleep Mode	ZZ > V <sub>IH</sub>	Com.	30	30	30	30	mA
			Ind.	35	35	35	35	
			Auto.	45	45	45	45	
			typ.	25		25		

**Note:**

- MODE pin has an internal pullup and should be tied to V<sub>DD</sub> or V<sub>SS</sub>. It exhibits ±100 μA maximum leakage current when tied to ≤ V<sub>SS</sub> + 0.2V or ≥ V<sub>DD</sub> - 0.2V.
- Typical values are measured at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C and not 100% tested.

**CAPACITANCE<sup>(1,2)</sup>**

Symbol	Parameter	Conditions	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	6	pF
C <sub>OUT</sub>	Input/Output Capacitance	V <sub>OUT</sub> = 0V	8	pF

**Notes:**

- Tested initially and after any design or process changes that may affect these parameters.
- Test conditions: T<sub>A</sub> = 25°C, f = 1 MHz, V<sub>DD</sub> = 3.3V.

### 3.3V I/O AC TEST CONDITIONS

Parameter	Unit
Input Pulse Level	0V to 3.0V
Input Rise and Fall Times	1.5 ns
Input and Output Timing and Reference Level	1.5V
Output Load	See Figures 1 and 2

### AC TEST LOADS

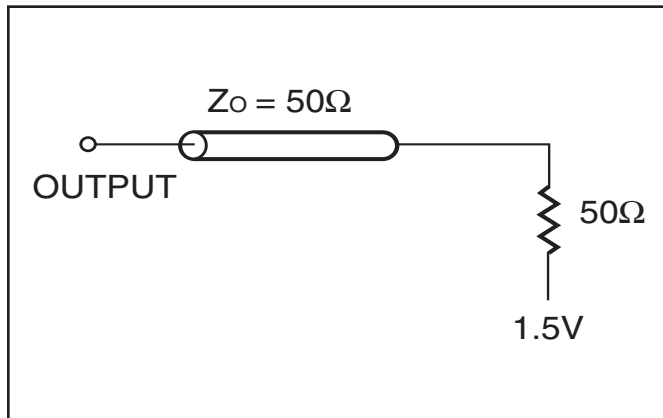


Figure 1

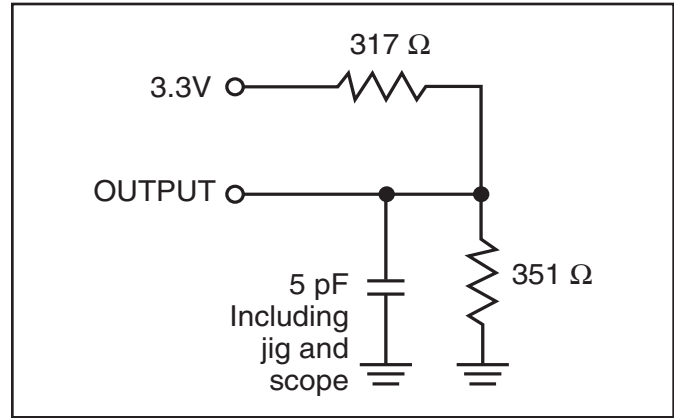


Figure 2

## 2.5V I/O AC TEST CONDITIONS

Parameter	Unit
Input Pulse Level	0V to 2.5V
Input Rise and Fall Times	1.5 ns
Input and Output Timing and Reference Level	1.25V
Output Load	See Figures 3 and 4

## 2.5V I/O OUTPUT LOAD EQUIVALENT

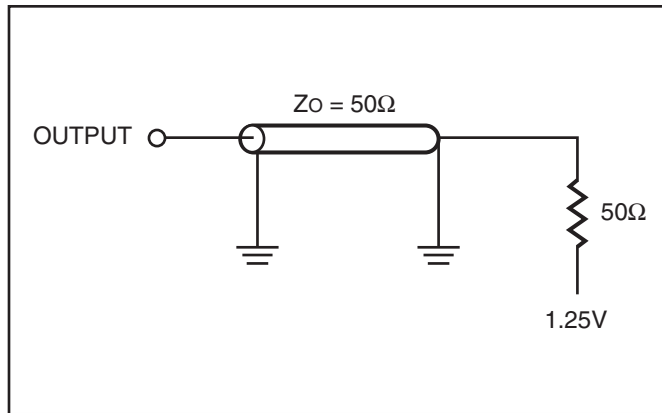


Figure 3

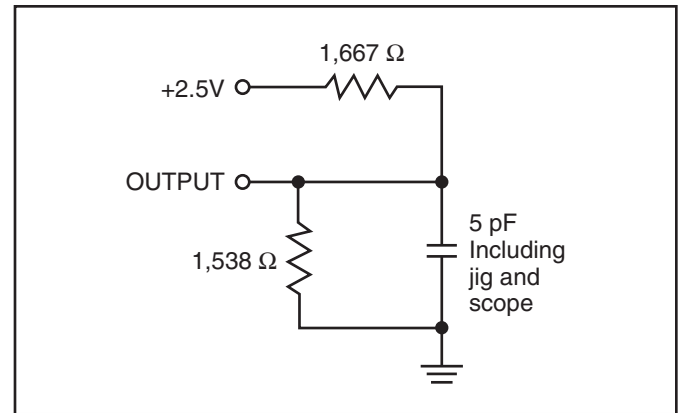


Figure 4

**READ/WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

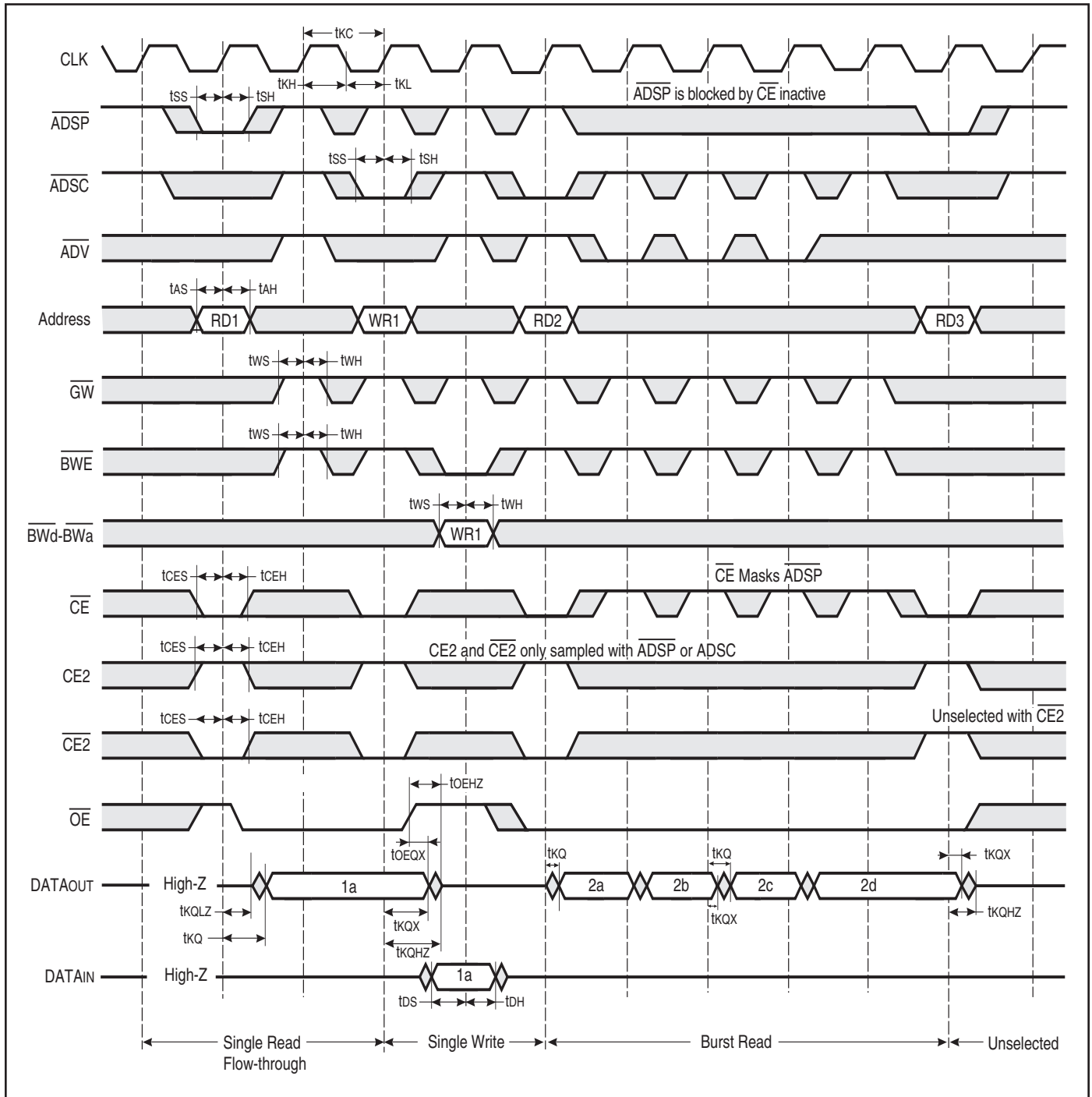
Symbol	Parameter	6.5		7.5		Unit
		Min.	Max.	Min.	Max.	
fmax	Clock Frequency	—	133	—	117	MHz
t <sub>KC</sub>	Cycle Time	7.5	—	8.5	—	ns
t <sub>KH</sub>	Clock High Time	2.2	—	2.5	—	ns
t <sub>KL</sub>	Clock Low Time	2.2	—	2.5	—	ns
t <sub>KQ</sub>	Clock Access Time	—	6.5	—	7.5	ns
t <sub>KQX</sub> <sup>(2)</sup>	Clock High to Output Invalid	2.5	—	2.5	—	ns
t <sub>KQLZ</sub> <sup>(2,3)</sup>	Clock High to Output Low-Z	2.5	—	2.5	—	ns
t <sub>KQHZ</sub> <sup>(2,3)</sup>	Clock High to Output High-Z	—	3.8	—	4.0	ns
t <sub>OEQ</sub>	Output Enable to Output Valid	—	3.2	—	3.4	ns
t <sub>OEQX</sub> <sup>(2)</sup>	Output Enable to Output Invalid	2.5	—	2.5	—	ns
t <sub>OELZ</sub> <sup>(2,3)</sup>	Output Enable to Output Low-Z	0	—	0	—	ns
t <sub>OEHZ</sub> <sup>(2,3)</sup>	Output Disable to Output High-Z	—	3.5	—	3.5	ns
t <sub>AS</sub>	Address Setup Time	1.5	—	1.5	—	ns
t <sub>SS</sub>	Address Status Setup Time	1.5	—	1.5	—	ns
t <sub>WS</sub>	Read/Write Setup Time	1.5	—	1.5	—	ns
t <sub>CES</sub>	Chip Enable Setup Time	1.5	—	1.5	—	ns
t <sub>AVS</sub>	Address Advance Setup Time	1.5	—	1.5	—	ns
t <sub>DS</sub>	Data Setup Time	1.5	—	1.5	—	ns
t <sub>AH</sub>	Address Hold Time	0.5	—	0.5	—	ns
t <sub>WH</sub>	Write Hold Time	0.5	—	0.5	—	ns
t <sub>SH</sub>	Address Status Hold Time	0.5	—	0.5	—	ns
t <sub>CEH</sub>	Chip Enable Hold Time	0.5	—	0.5	—	ns
t <sub>AVH</sub>	Address Advance Hold Time	0.5	—	0.5	—	ns
t <sub>DH</sub>	Data Hold Time	0.5	—	0.5	—	ns
t <sub>PDS</sub>	ZZ High to Power Down	—	2	—	2	cyc
t <sub>PUS</sub>	ZZ Low to Power Down	—	2	—	2	cyc

**Notes:**

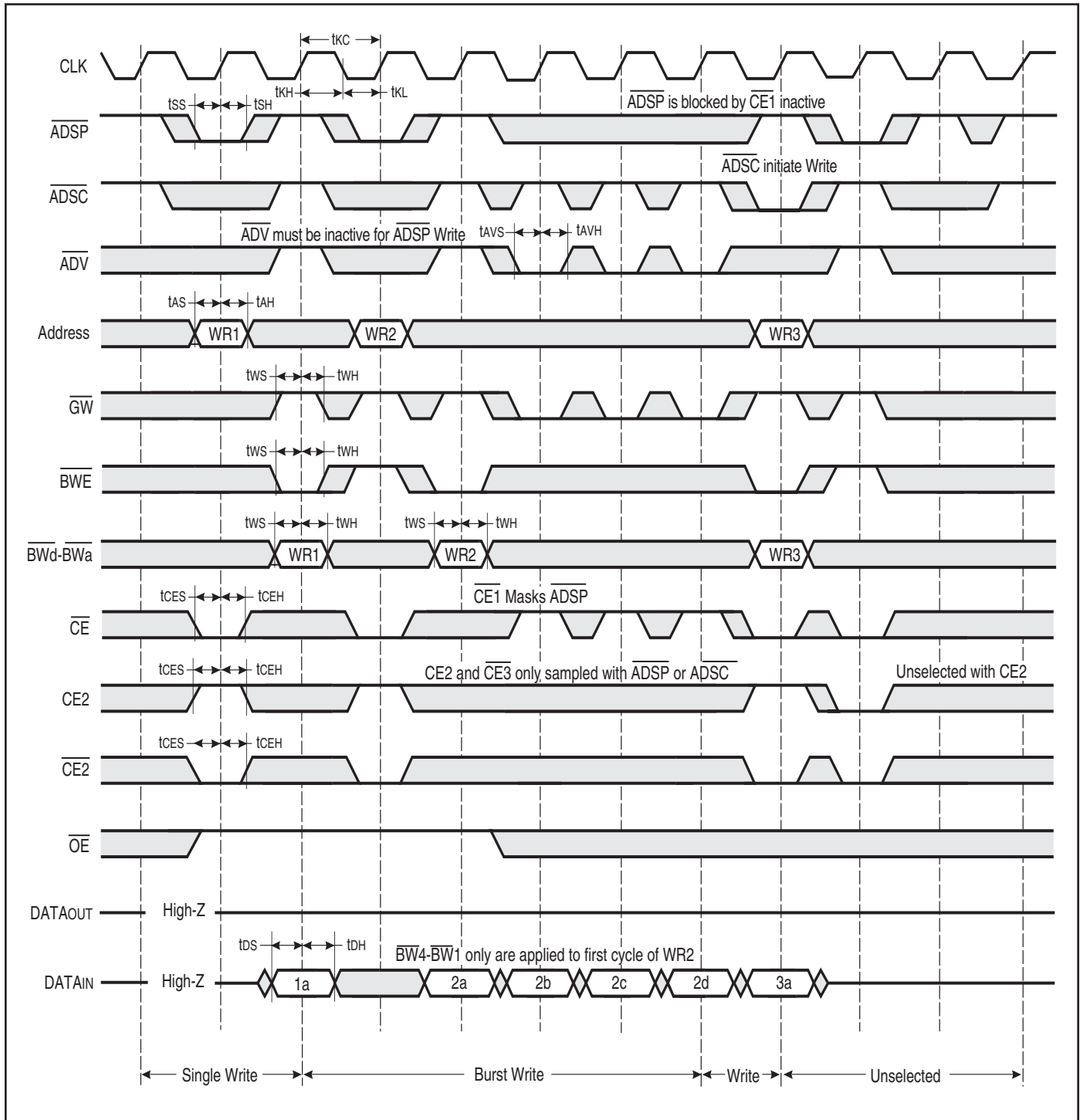
1. Configuration signal MODE is static and must not change during normal operation.
2. Guaranteed but not 100% tested. This parameter is periodically sampled.
3. Tested with load in Figure 2.



**READ/WRITE CYCLE TIMING**



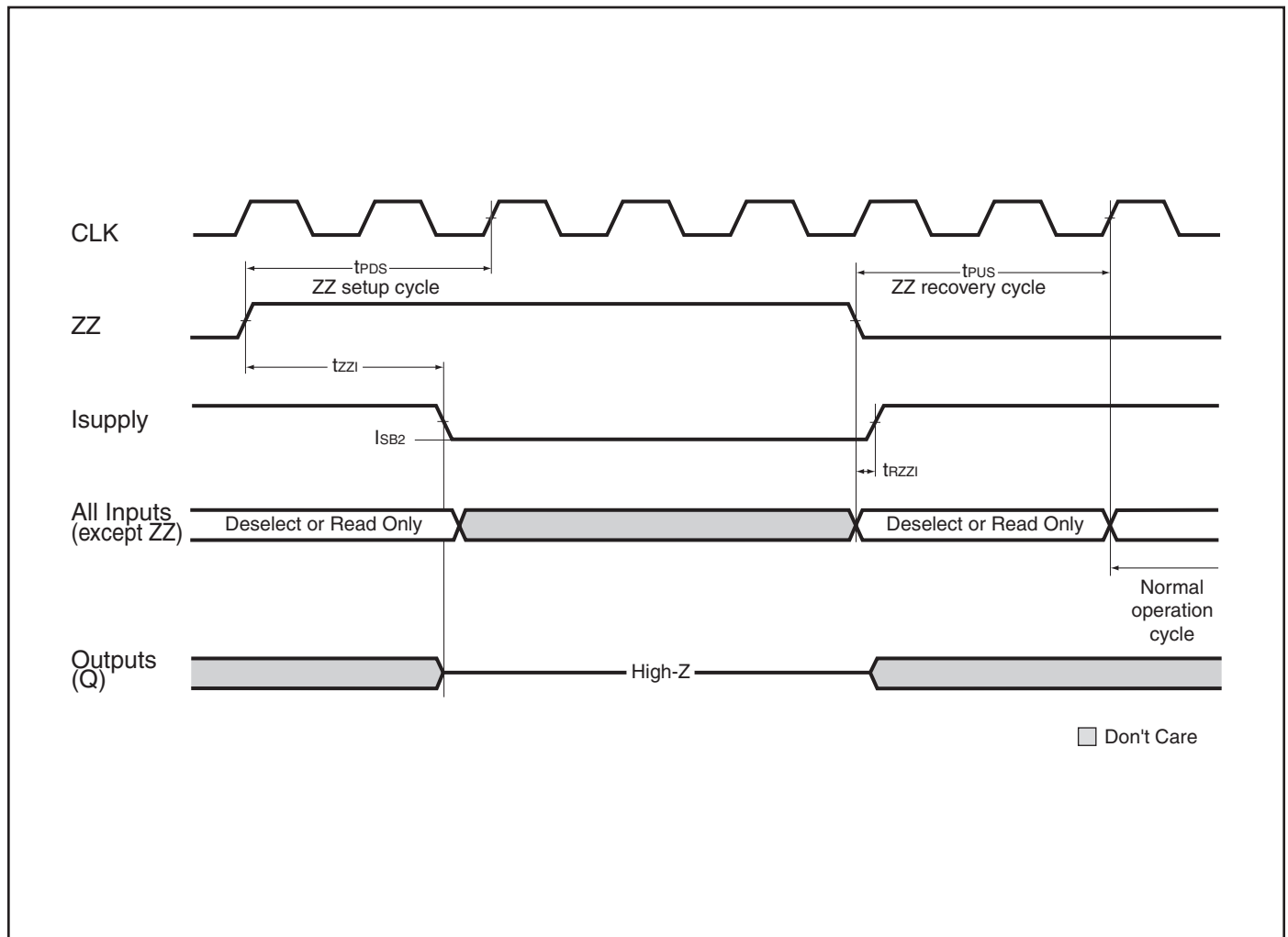
**WRITE CYCLE TIMING**



### SNOOZE MODE ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Max.	Unit
ISB2	Current during SNOOZE MODE	ZZ ≥ Vih	—	60	mA
tPDS	ZZ active to input ignored		—	2	cycle
tPUS	ZZ inactive to input sampled		2	—	cycle
tZZI	ZZ active to SNOOZE current		—	2	cycle
tRZZI	ZZ inactive to exit SNOOZE current		0	—	ns

### SNOOZE MODE TIMING





**ORDERING INFORMATION ( $V_{DD} = 3.3V/V_{DDQ} = 2.5V/3.3V$ )**

**Commercial Range: 0°C to +70°C**

Configuration	Access Time	Order Part Number	Package
128Kx32	6.5	IS61LF12832A-6.5TQ	100 QFP
		IS61LF12832A-6.5B2	119 BGA
		IS61LF12832A-6.5B3	165 BGA
128Kx32	7.5	IS61LF12832A-7.5TQ	100 QFP
		IS61LF12832A-7.5B2	119 BGA
		IS61LF12832A-7.5B3	165 BGA
128Kx36	6.5	IS61LF12836A-6.5TQ	100 QFP
		IS61LF12836A-6.5B2	119 BGA
		IS61LF12836A-6.5B3	165 BGA
128Kx36	7.5	IS61LF12836A-7.5TQ	100 QFP
		IS61LF12836A-7.5B2	119 BGA
		IS61LF12836A-7.5B3	165 BGA
256Kx18	6.5	IS61LF25618A-6.5TQ	100 QFP
		IS61LF25618A-6.5TQL	100 QFP, Lead-free
		IS61LF25618A-6.5B2	119 BGA
		IS61LF25618A-6.5B3	165 BGA
256Kx18	7.5	IS61LF25618A-7.5TQ	100 QFP
		IS61LF25618A-7.5B2	119 BGA
		IS61LF25618A-7.5B3	165 BGA



**ORDERING INFORMATION ( $V_{DD} = 3.3V/V_{DDQ} = 2.5V/3.3V$ )**

**Industrial Range: -40°C to +85°C**

Configuration	Access Time	Order Part Number	Package
128Kx32	6.5	IS61LF12832A-6.5TQI	100 QFP
		IS61LF12832A-6.5B2I	119 BGA
		IS61LF12832A-6.5B3I	165 BGA
128Kx32	7.5	IS61LF12832A-7.5TQI	100 QFP
		IS61LF12832A-7.5TQLI	100 QFP, Lead-free
		IS61LF12832A-7.5B2I	119 BGA
		IS61LF12832A-7.5B3I	165 BGA
128Kx36	6.5	IS61LF12836A-6.5TQI	100 QFP
		IS61LF12836A-6.5TQLI	100 QFP, Lead-free
		IS61LF12836A-6.5B2I	119 BGA
		IS61LF12836A-6.5B3I	165 BGA
128Kx36	7.5	IS61LF12836A-7.5TQI	100 QFP
		IS61LF12836A-7.5TQLI	100 QFP, Lead-free
		IS61LF12836A-7.5B2I	119 BGA
		IS61LF12836A-7.5B3I	165 BGA
256Kx18	6.5	IS61LF25618A-6.5TQI	100 QFP
		IS61LF25618A-6.5B2I	119 BGA
		IS61LF25618A-6.5B3I	165 BGA
256Kx18	7.5	IS61LF25618A-7.5TQI	100 QFP
		IS61LF25618A-7.5TQLI	100 QFP, Lead-free
		IS61LF25618A-7.5B2I	119 BGA
		IS61LF25618A-7.5B3I	165 BGA

**Automotive Range: -40°C to +125°C**

Configuration	Access Time	Order Part Number	Package
128Kx32	7.5	IS64LF12832A-7.5TQA3	100 QFP
		IS64LF12832A-7.5TQLA3	100 QFP, Lead-free
128Kx36	7.5	IS64LF12836A-7.5TQA3	100 QFP
		IS64LF12836A-7.5B3LA3	165 BGA, Lead-free
256Kx18	7.5	IS64LF25618A-7.5TQA3	100 QFP



**ORDERING INFORMATION (V<sub>DD</sub> = 2.5V /V<sub>DDQ</sub> = 2.5V)**

**Commercial Range: 0°C to +70°C**

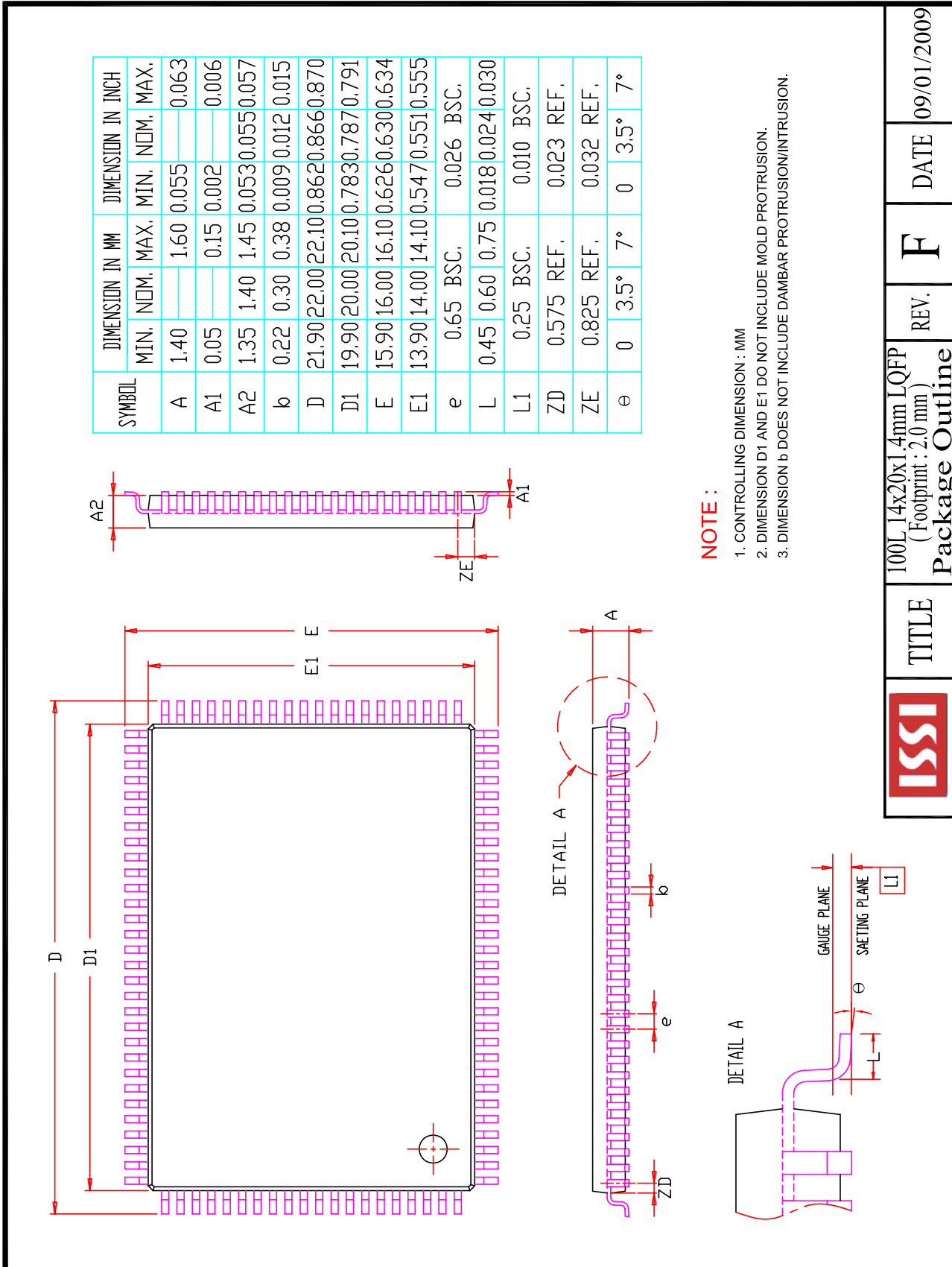
Configuration	Access Time	Order Part Number	Package
128Kx36	6.5	IS61VF12836A-6.5TQ	100 QFP
		IS61VF12836A-6.5B2	119 BGA
		IS61VF12836A-6.5B3	165 BGA
128Kx36	7.5	IS61VF12836A-7.5TQ	100 QFP
		IS61VF12836A-7.5B2	119 BGA
		IS61VF12836A-7.5B3	165 BGA
256Kx18	6.5	IS61VF25618A-6.5TQ	100 QFP
		IS61VF25618A-6.5B2	119 BGA
		IS61VF25618A-6.5B3	165 BGA
256Kx18	7.5	IS61VF25618A-7.5TQ	100 QFP
		IS61VF25618A-7.5B2	119 BGA
		IS61VF25618A-7.5B3	165 BGA

**Industrial Range: -40°C to +85°C**

Configuration	Access Time	Order Part Number	Package
128Kx36	6.5	IS61VF12836A-6.5TQI	100 QFP
		IS61VF12836A-6.5B2I	119 BGA
		IS61VF12836A-6.5B3I	165 BGA
128Kx36	7.5	IS61VF12836A-7.5TQI	100 QFP
		IS61VF12836A-7.5B2I	119 BGA
		IS61VF12836A-7.5B3I	165 BGA
256Kx18	6.5	IS61VF25618A-6.5TQI	100 QFP
		IS61VF25618A-6.5B2I	119 BGA
		IS61VF25618A-6.5B3I	165 BGA
256Kx18	7.5	IS61VF25618A-7.5TQI	100 QFP
		IS61VF25618A-7.5B2I	119 BGA
		IS61VF25618A-7.5B3I	165 BGA

**Automotive Range: -40°C to +125°C**

Configuration	Access Time	Order Part Number	Package
128Kx32	7.5	IS64VF12832A-7.5TQLA3	100 QFP, Lead-free
128Kx36	7.5	IS64VF12836A-7.5TQA3	100 QFP
256Kx18	7.5	IS64VF25618A-7.5TQA3	100 QFP

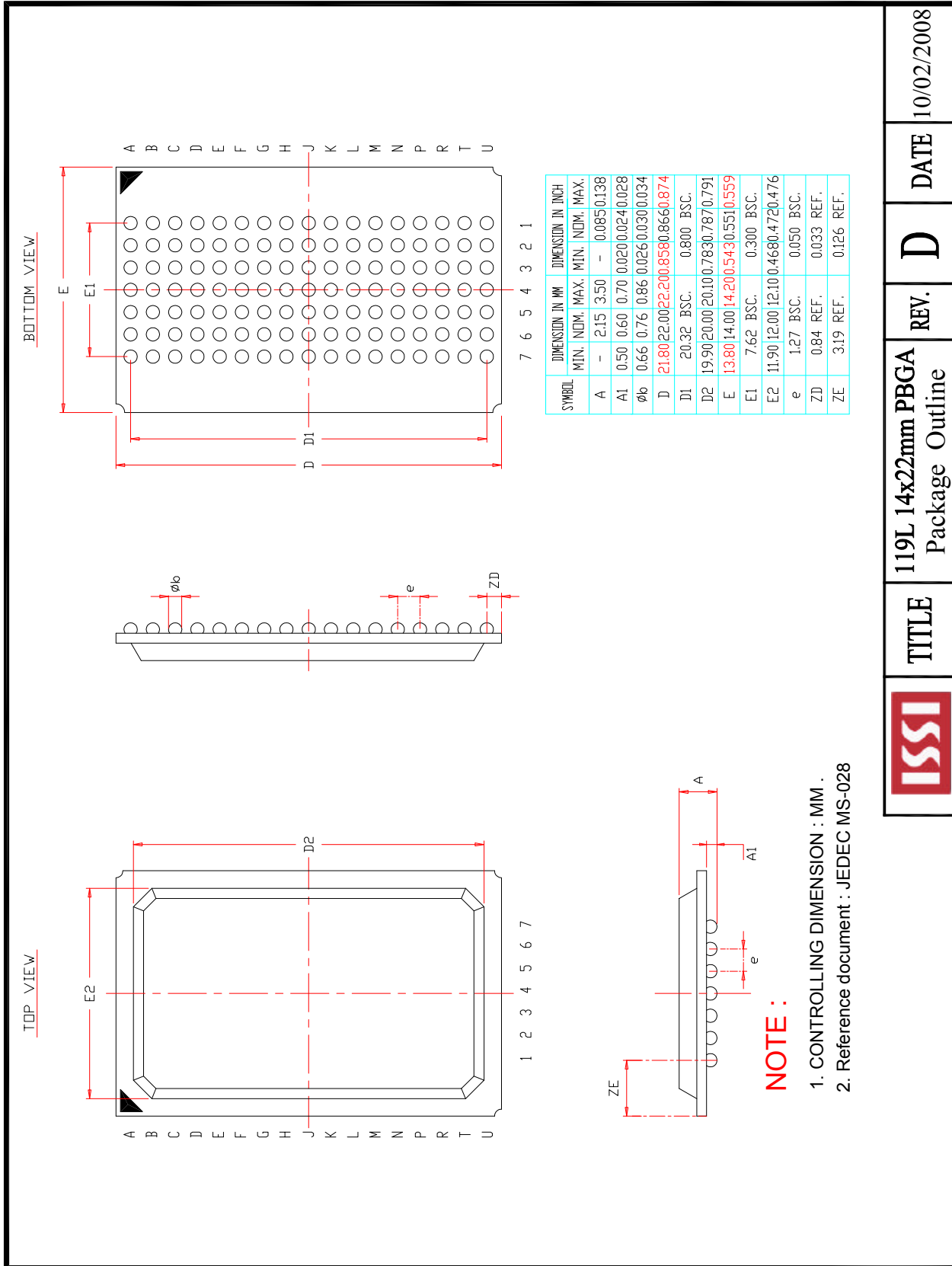


SYMBOL	DIMENSION IN MM		DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN. NOM. MAX.	
A	1.40		1.60	0.055	0.063
A1	0.05		0.15	0.002	0.006
A2	1.35	1.40	1.45	0.053	0.055
b	0.22	0.30	0.38	0.009	0.012
D	21.90	22.00	22.10	0.862	0.866
D1	19.90	20.00	20.10	0.783	0.791
E	15.90	16.00	16.10	0.626	0.630
E1	13.90	14.00	14.10	0.547	0.551
e	0.65 BSC.		0.026 BSC.		
L	0.45	0.60	0.75	0.018	0.024
L1	0.25 BSC.		0.010 BSC.		
ZD	0.575 REF.		0.023 REF.		
ZE	0.825 REF.		0.032 REF.		
theta	0	3.5°	7°	0	3.5°

**NOTE :**

1. CONTROLLING DIMENSION : MM
2. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.

	TITLE	REV.	DATE
	100L14x20x1.4mm LQFP (Footprint : 2.0 mm) Package Outline	F	09/01/2009



	TITLE	119L 14x22mm PBGA Package Outline	REV.	D	DATE	10/02/2008
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