



**1M x 36, 2M x 18**  
**36Mb SYNCHRONOUS FLOW-THROUGH**  
**STATIC RAM**

APRIL 2008

**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:  $V_{DD} 2.5V \pm 5\%$ ,  $V_{DDQ} 2.5V \pm 5\%$
- JEDEC 100-Pin TQFP and 165-pin PBGA packages.
- Lead-free available

**DESCRIPTION**

The *ISSI* IS61LF/VF102436A and IS61LF/VF204818A are high-speed, low-power synchronous static RAMs designed to provide burstable, high-performance memory for communication and networking applications. The IS61LF/VF102436A is organized as 1,048,476 words by 36 bits. The IS61LF/VF204818A is organized as 2M-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.

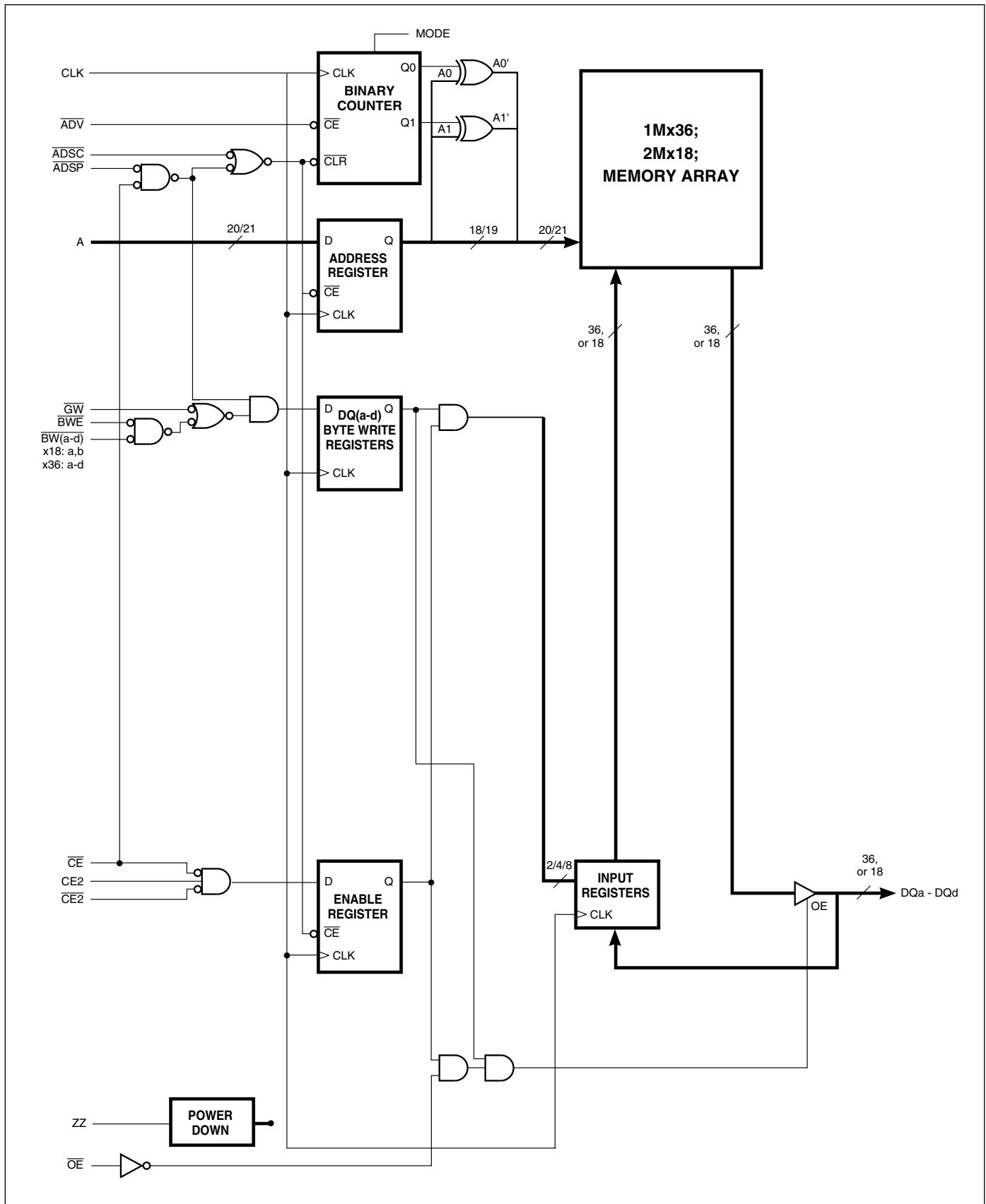
The mode pin is used to select the burst sequence order, Linear burst is achieved when this pin is tied LOW. Interleave burst is achieved when this pin is tied HIGH or left floating.

**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

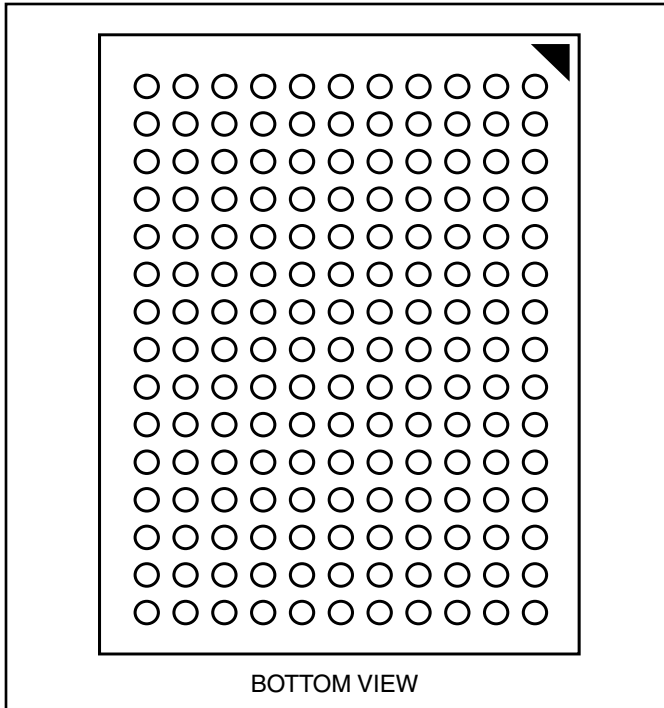
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**BLOCK DIAGRAM**



**165-PIN BGA**

165-Ball, 13x15 mm BGA



## 165 PBGA PACKAGE PIN CONFIGURATION

1M x 36 (TOP VIEW)

	1	2	3	4	5	6	7	8	9	10	11
<b>A</b>	NC	A	$\overline{CE}$	$\overline{BWc}$	$\overline{BWb}$	$\overline{CE2}$	$\overline{BWE}$	$\overline{ADSC}$	$\overline{ADV}$	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	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	DQPb
<b>D</b>	DQc	DQc	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>	DQb	DQb
<b>E</b>	DQc	DQc	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>	DQb	DQb
<b>F</b>	DQc	DQc	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>	DQb	DQb
<b>G</b>	DQc	DQc	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>	DQb	DQb
<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>	DQd	DQd	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>	DQa	DQa
<b>K</b>	DQd	DQd	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>	DQa	DQa
<b>L</b>	DQd	DQd	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>	DQa	DQa
<b>M</b>	DQd	DQd	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>	DQa	DQa
<b>N</b>	DQPd	NC	V <sub>DDQ</sub>	V <sub>SS</sub>	NC	A	NC	V <sub>SS</sub>	V <sub>DDQ</sub>	NC	DQPd
<b>P</b>	NC	NC	A	A	NC	A <sub>1</sub> *	NC	A	A	A	A
<b>R</b>	MODE	A	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.  
(Under Evaluation)

## PIN DESCRIPTIONS

Symbol	Pin Name
A	Address Inputs
A <sub>0</sub> , A <sub>1</sub>	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
$\overline{CE}$ , $\overline{CE2}$ , 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
DQa-DQd	Data Inputs/Outputs
DQPd-Pd	Data Inputs/Outputs
V <sub>DD</sub>	Power Supply
V <sub>DDQ</sub>	Output Power Supply
V <sub>SS</sub>	Ground

**165 PBGA PACKAGE PIN CONFIGURATION**  
2M 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	$\overline{CE2}$	$\overline{BWE}$	$\overline{ADSC}$	$\overline{ADV}$	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	A	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	A
<b>R</b>	MODE	A	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.  
(Under Evaluation)

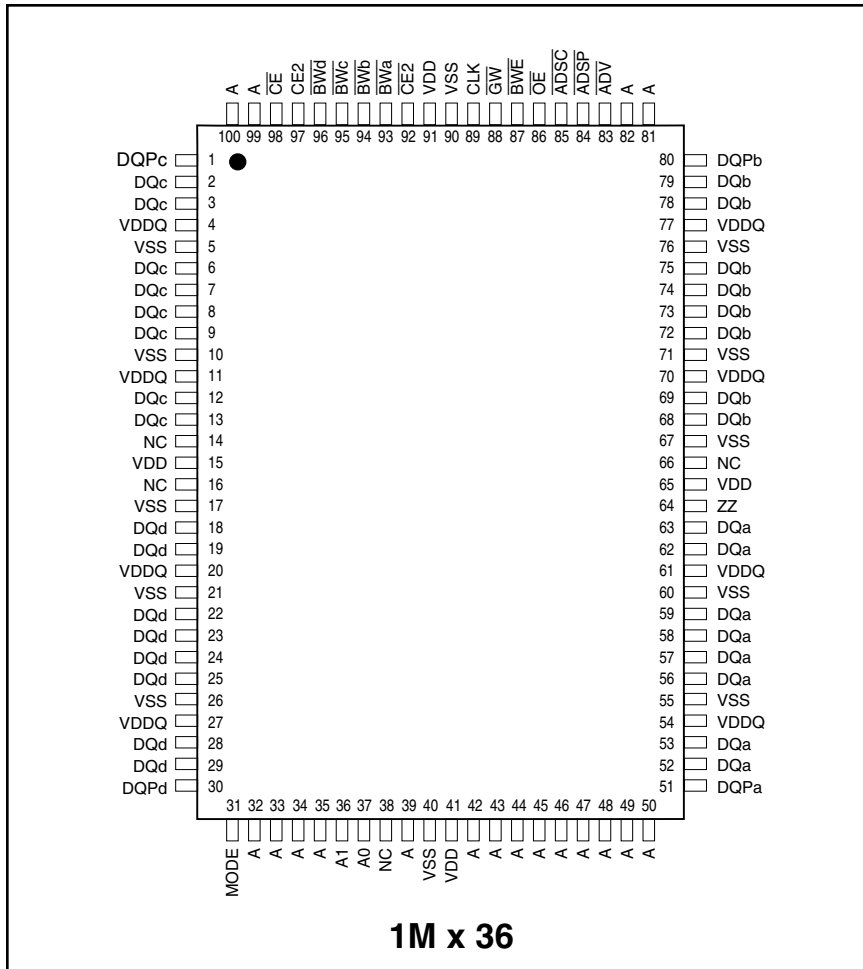
**PIN DESCRIPTIONS**

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
$\overline{CE}$ , $\overline{CE2}$ , 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>a</sub> -DQ <sub>d</sub>	Data Inputs/Outputs
DQP <sub>a</sub> -Pd	Data Inputs/Outputs
V <sub>DD</sub>	Power Supply
V <sub>DDQ</sub>	Output Power Supply
V <sub>SS</sub>	Ground

## PIN CONFIGURATION

### 100-Pin TQFP

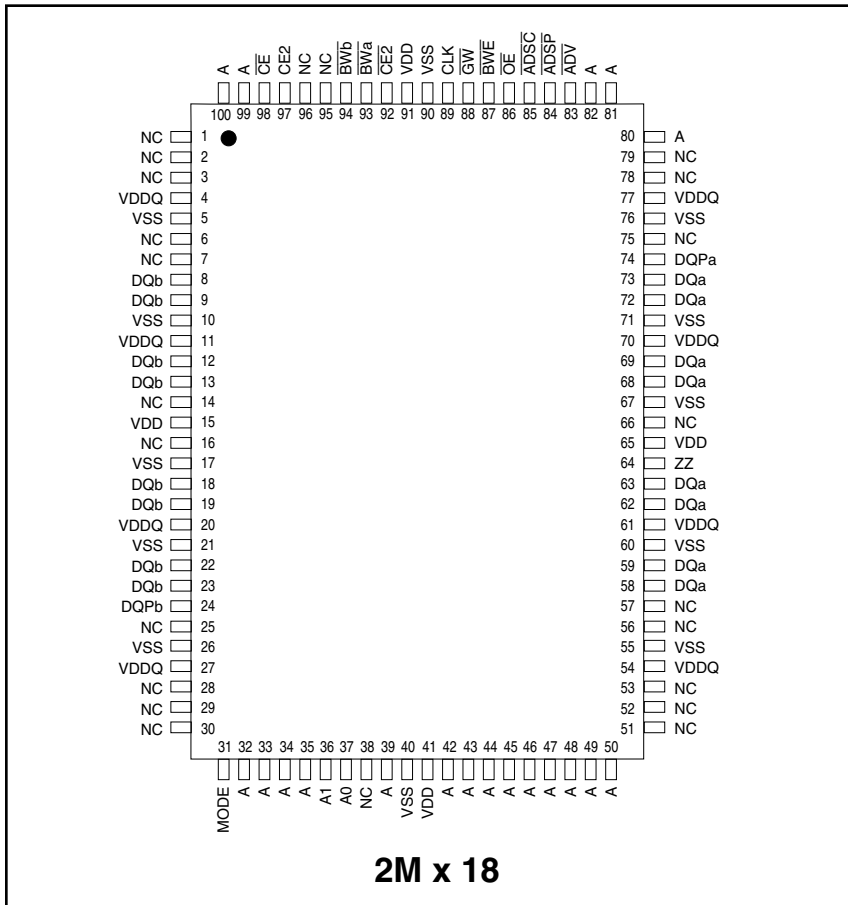


## PIN DESCRIPTIONS

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

## PIN CONFIGURATION

### 100-Pin TQFP



## PIN DESCRIPTIONS

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

TRUTH TABLE<sup>(1-8)</sup> (3CE option)

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:

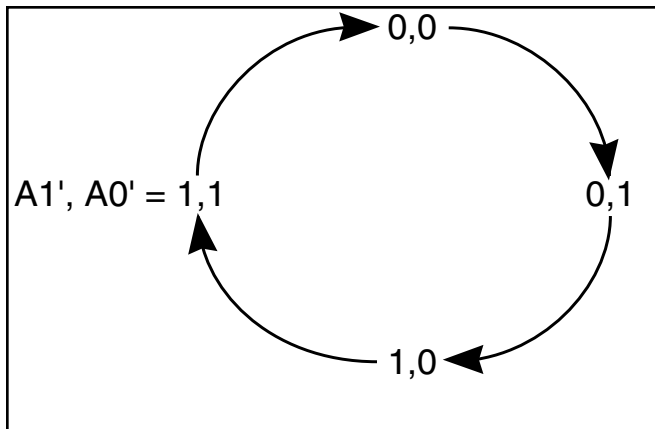
1. X means "Don't Care." H means logic HIGH. L means logic LOW.
2. For  $\overline{WRITE}$ , L means one or more byte write enable signals ( $\overline{BWA-h}$ ) and  $\overline{BWE}$  are LOW or  $\overline{GW}$  is LOW.  $\overline{WRITE} = H$  for all  $\overline{BWx}$ ,  $\overline{BWE}$ ,  $\overline{GW}$  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>.  $\overline{BWE}$  enables WRITES to DQe's and DQP<sub>e</sub>.  $\overline{BWF}$  enables WRITES to DQf's and DQP<sub>f</sub>.  $\overline{BWG}$  enables WRITES to DQg's and DQP<sub>g</sub>.  $\overline{BWH}$  enables WRITES to DQh's and DQP<sub>h</sub>. DQP<sub>a</sub>-DQP<sub>h</sub> are available on the x72 version. 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.



**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 (IS61LFxxxx)**

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%

**OPERATING RANGE (IS61VFxxxx)**

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

**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		2.0	V <sub>DD</sub> + 0.3	1.7	V <sub>DD</sub> + 0.3	V
V <sub>IL</sub>	Input LOW Voltage		-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> , OE = V <sub>IH</sub>	-5	5	-5	5	μA

**Note:**

- V<sub>IL</sub> (min.) = -2.0V AC (pulse width 2.0 ns). Not 100% tested.  
 V<sub>IH</sub> (max.) = V<sub>DD</sub> + 2.0V AC (pulse width 2.0 ns). Not 100% tested.

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

Symbol	Parameter	Test Conditions	Temp. range	6.5 MAX		7.5 MAX		Unit
				x18	x36	x18	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. Ind. typ. <sup>(2)</sup>	360 375 295	360 375	340 350 295	340 350	mA
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. Ind.	155 160	155 160	155 160	155 160	mA
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. Ind. typ. <sup>(2)</sup>	140 145 80	140 145	140 145 80	140 145	mA

**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>CC</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:**

1. Tested initially and after any design or process changes that may affect these parameters.
2. 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

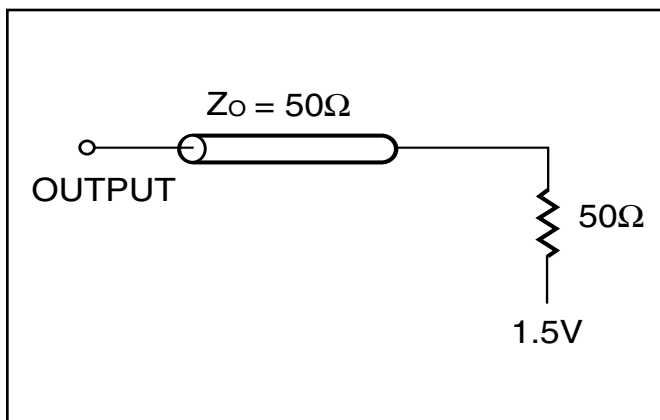


Figure 1

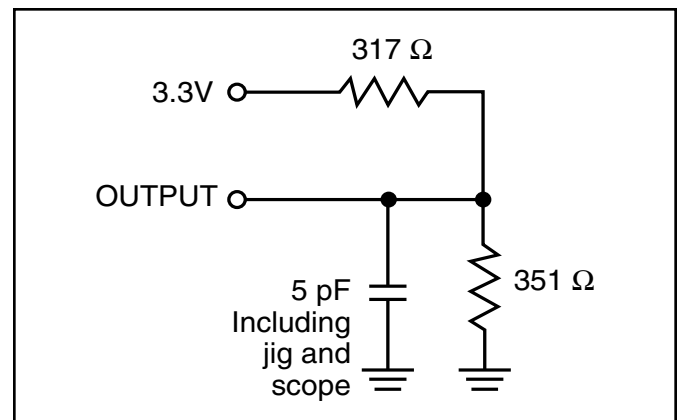


Figure 2

## 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

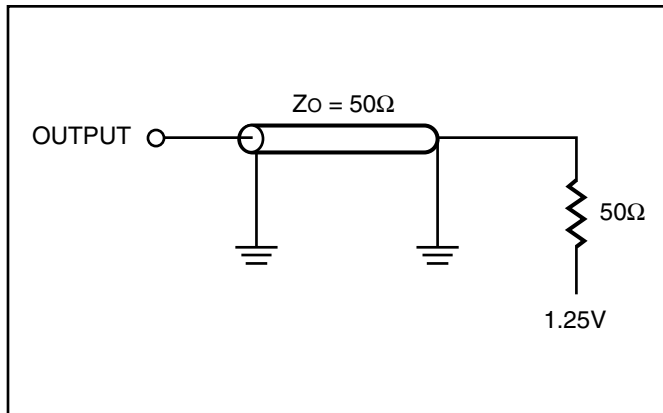


Figure 3

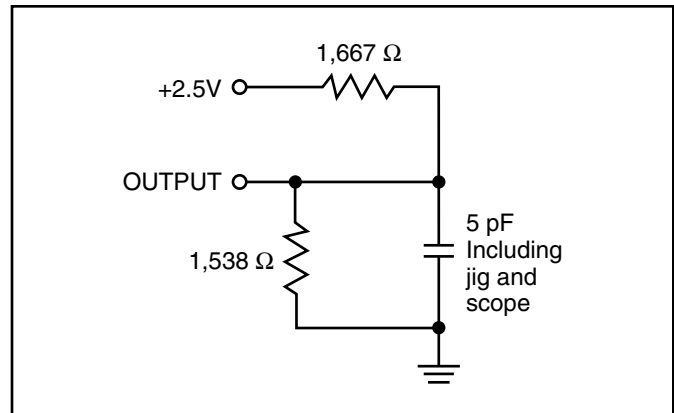


Figure 4

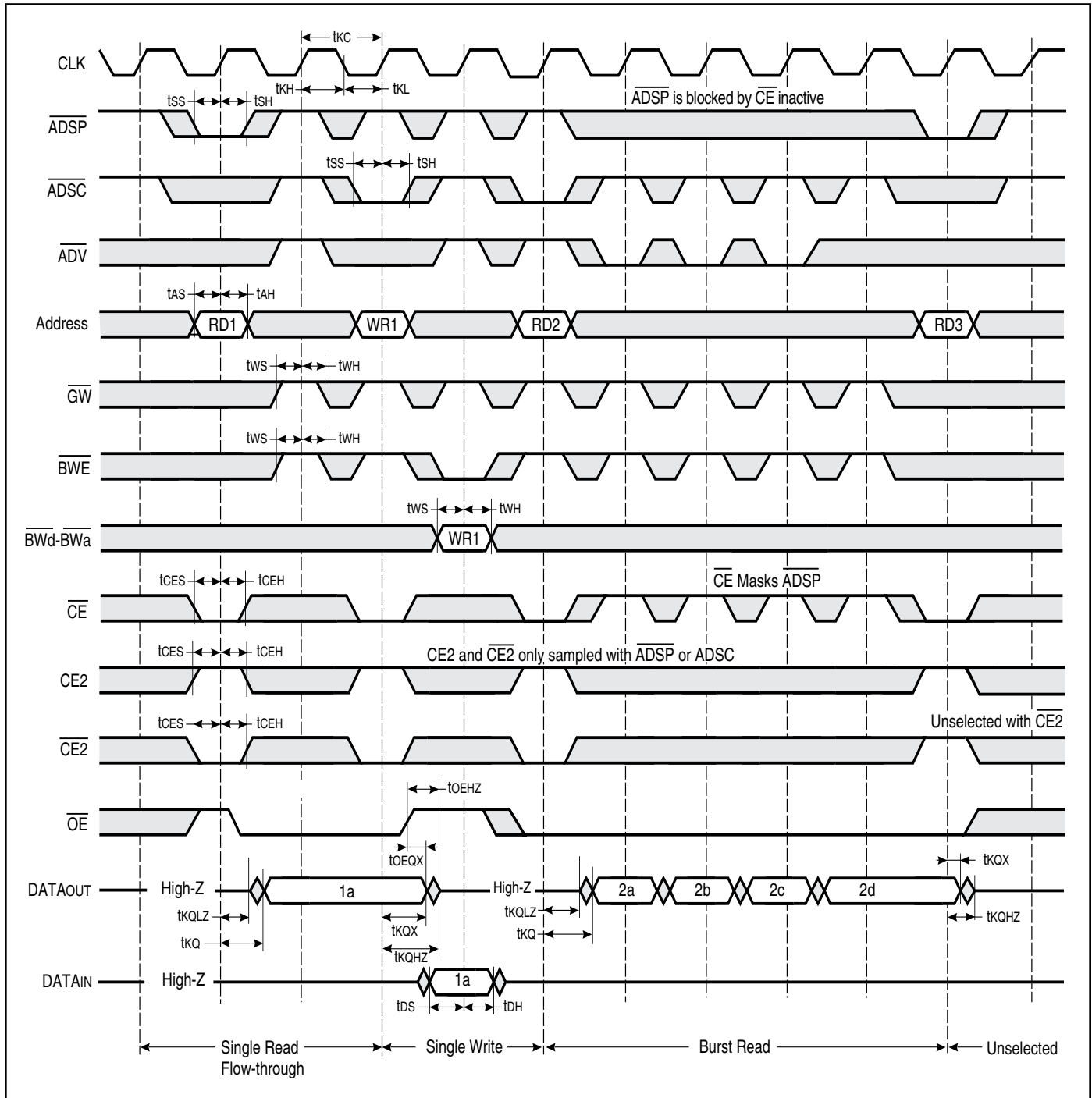
**READ/WRITE CYCLE SWITCHING CHARACTERISTICS<sup>(1)</sup>** (Over Operating Range)

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>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>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>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>pds</sub>	ZZ Low to Power Down	—	2	—	2	cyc

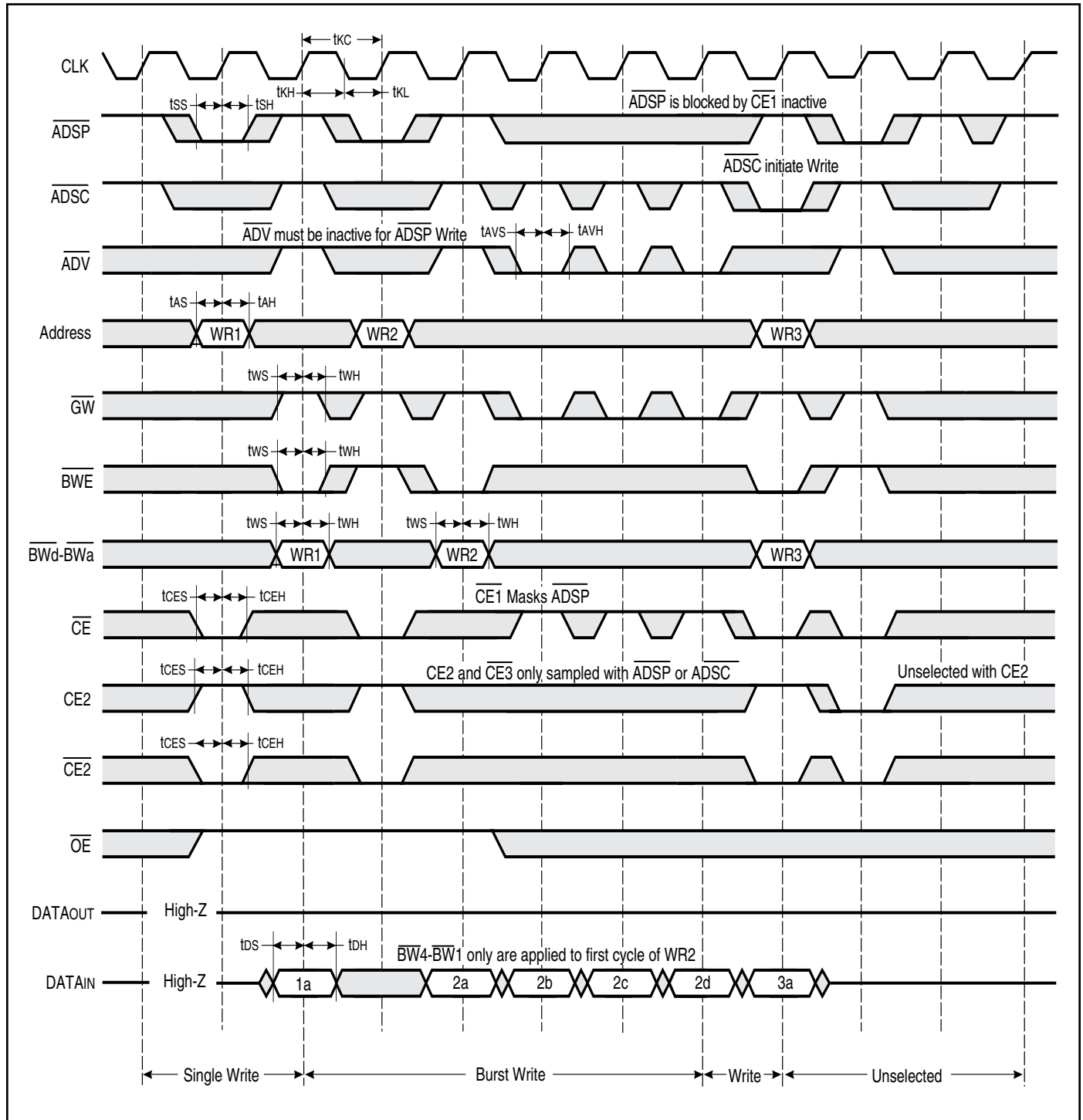
**Notes:**

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

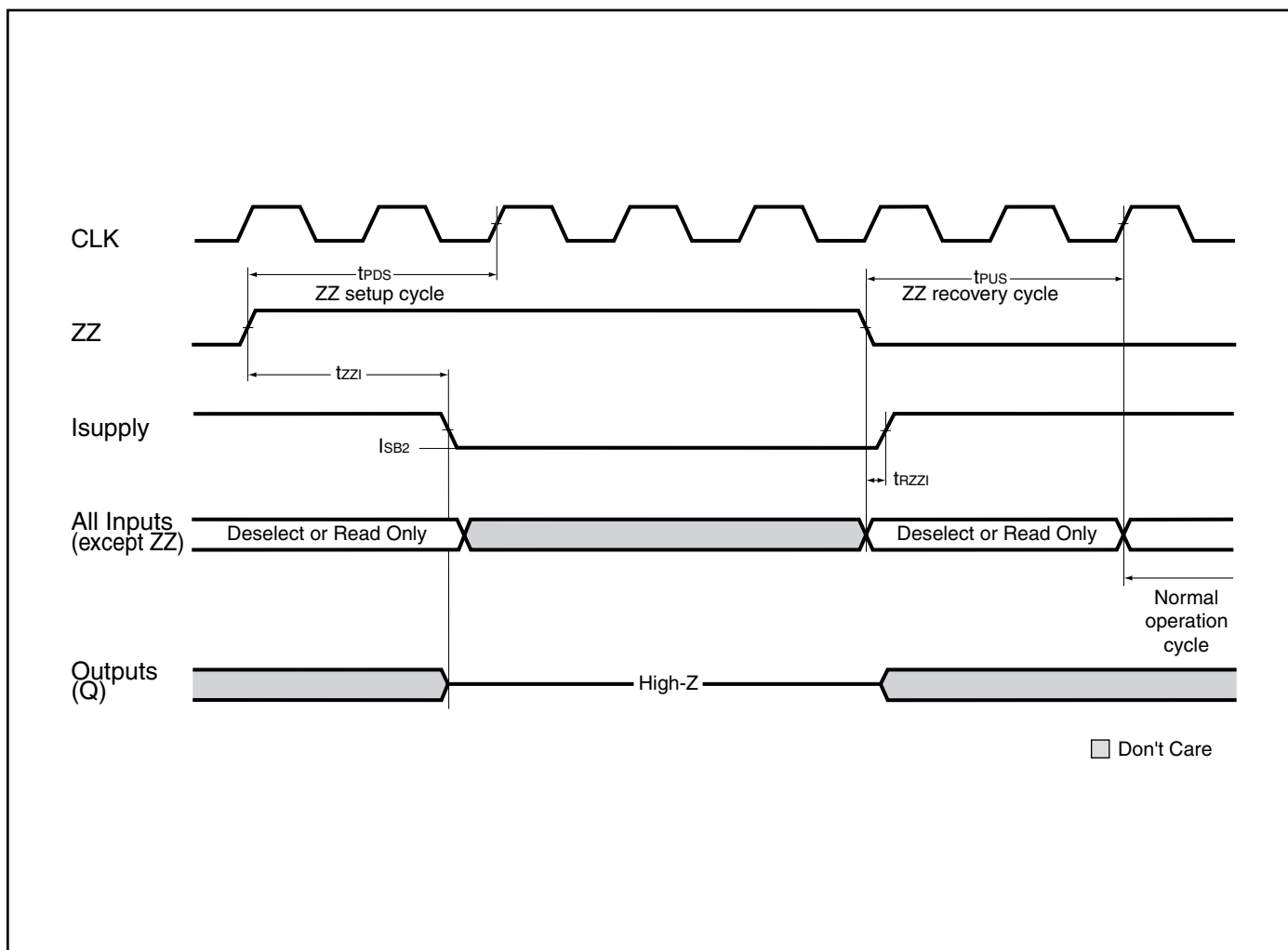


## SNOOZE MODE ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	typ. <sup>(1)</sup>	Max.	Unit
I <sub>SB2</sub>	Current during SNOOZE MODE	ZZ ≥ V <sub>ih</sub>	—	27	90	mA
t <sub>PDS</sub>	ZZ active to input ignored		—		2	cycle
t <sub>PUS</sub>	ZZ inactive to input sampled		2		—	cycle
t <sub>ZZI</sub>	ZZ active to SNOOZE current		—		2	cycle
t <sub>RZZI</sub>	ZZ inactive to exit SNOOZE current		0		—	ns

1. Typical values are measured at V<sub>cc</sub> = 3.3V, T<sub>A</sub> = 25°C and not 100% tested.

## SNOOZE MODE TIMING







IS61LF102436A IS61LF204818A  
IS61VF102436A IS61VF204818A

**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
1Mx36	6.5	IS61LF102436A-6.5TQL	100 TQFP, Lead-free
		IS61LF102436A-6.5B3	165 PBGA
2Mx18	6.5	IS61LF204818A-6.5TQ	100 TQFP
		IS61LF204818A-6.5TQL	100 TQFP, Lead-free
		IS61LF204818A-6.5B3	165 PBGA

**Industrial Range: -40°C to +85°C**

Configuration	Access Time	Order Part Number	Package
1Mx36	6.5	IS61LF102436A-6.5TQLI	100 TQFP, Lead-free
		IS61LF102436A-6.5B3I	165 PBGA
1Mx36	7.5	IS61LF102436A-7.5TQI	100 TQFP
		IS61LF102436A-7.5TQLI	100 TQFP, Lead-free
		IS61LF102436A-7.5B3I	165 PBGA
		IS61LF102436A-7.5B3LI	165 PBGA, Lead-free
2Mx18	6.5	IS61LF204818A-6.5TQI	100 TQFP
		IS61LF204818A-6.5B3I	165 PBGA
2Mx18	7.5	IS61LF204818A-7.5TQI	100 TQFP
		IS61LF204818A-7.5TQLI	100 TQFP, Lead-free
		IS61LF204818A-7.5B3I	165 PBGA

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

**Commercial Range: 0°C to +70°C**

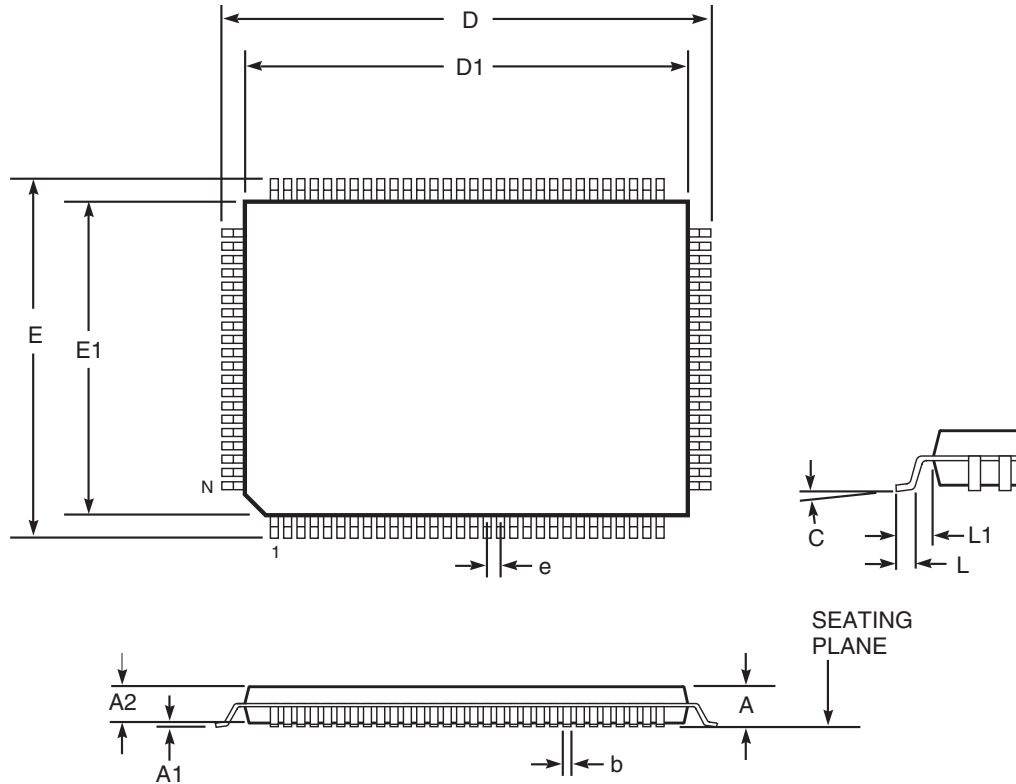
Configuration	Access Time	Order Part Number	Package
1Mx36	6.5	IS61VF102436A-6.5TQ	100 TQFP
		IS61VF102436A-6.5B3	165 PBGA
1Mx36	7.5	IS61VF102436A-7.5TQ	100 TQFP
		IS61VF102436A-7.5B3	165 PBGA
2Mx18	6.5	IS61VF204818A-6.5TQ	100 TQFP
		IS61VF204818A-6.5B3	165 PBGA
2Mx18	7.5	IS61VF204818A-7.5TQ	100 TQFP
		IS61VF204818A-7.5B3	165 PBGA

**Industrial Range: -40°C to +85°C**

Configuration	Access Time	Order Part Number	Package
1Mx36	6.5	IS61VF102436A-6.5TQI	100 TQFP
		IS61VF102436A-6.5B3I	165 PBGA
1Mx36	7.5	IS61VF102436A-7.5TQI	100 TQFP
		IS61VF102436A-7.5TQLI	100 TQFP, Lead-free
		IS61VF102436A-7.5B3I	165 PBGA
2Mx18	6.5	IS61VF204818A-6.5TQI	100 TQFP
		IS61VF204818A-6.5B3I	165 PBGA
2Mx18	7.5	IS61VF204818A-7.5TQI	100 TQFP
		IS61VF204818A-7.5B3I	165 PBGA

# PACKAGING INFORMATION

TQFP (Thin Quad Flat Pack Package)  
Package Code: TQ



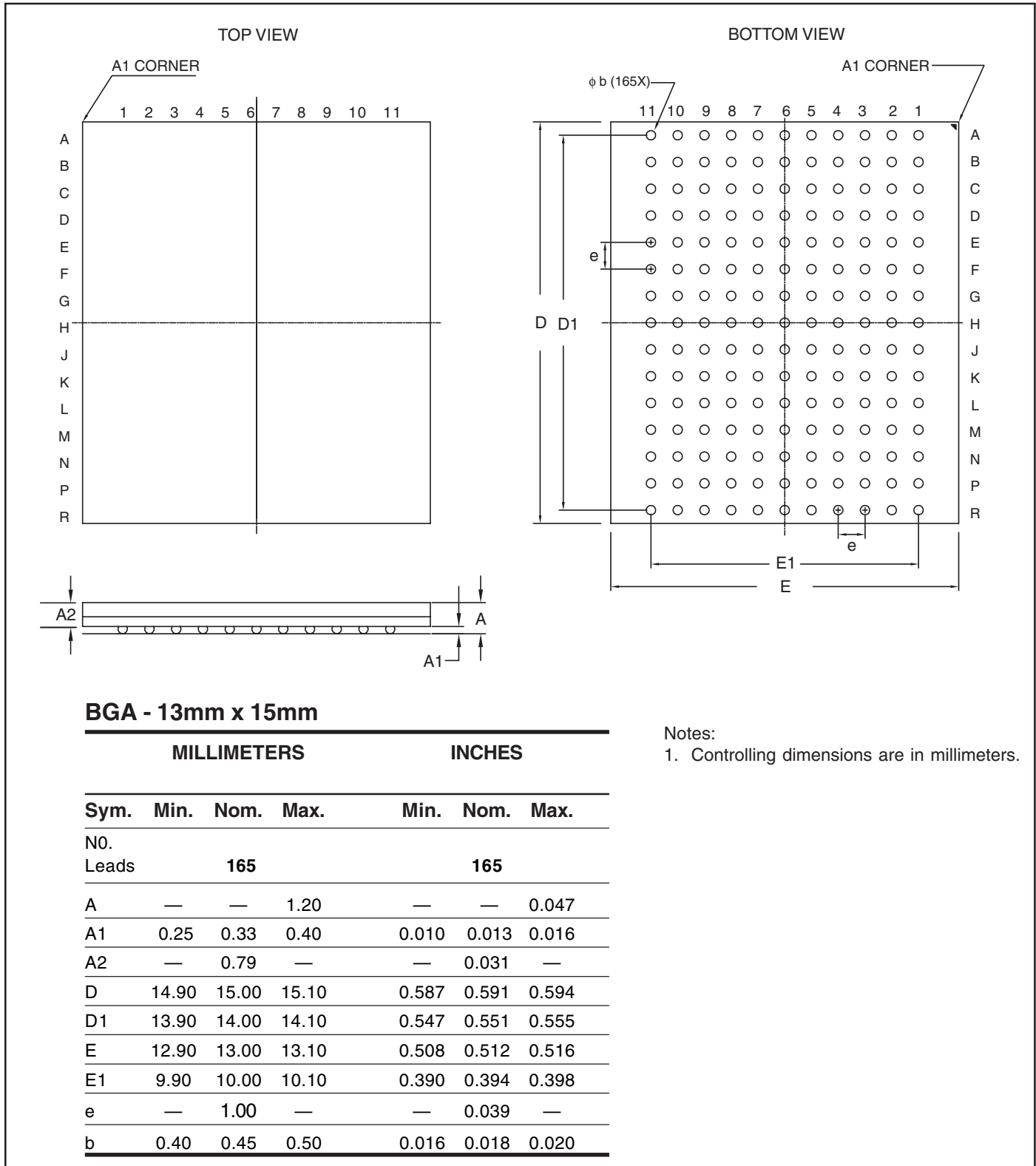
Thin Quad Flat Pack (TQ)									
Symbol	Millimeters		Inches		Symbol	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
Ref. Std.									
No. Leads (N)	100				128				
A	—	1.60	—	0.063	—	1.60	—	0.063	
A1	0.05	0.15	0.002	0.006	0.05	0.15	0.002	0.006	
A2	1.35	1.45	0.053	0.057	1.35	1.45	0.053	0.057	
b	0.22	0.38	0.009	0.015	0.17	0.27	0.007	0.011	
D	21.90	22.10	0.862	0.870	21.80	22.20	0.858	0.874	
D1	19.90	20.10	0.783	0.791	19.90	20.10	0.783	0.791	
E	15.90	16.10	0.626	0.634	15.80	16.20	0.622	0.638	
E1	13.90	14.10	0.547	0.555	13.90	14.10	0.547	0.555	
e	0.65 BSC		0.026 BSC		0.50 BSC		0.020 BSC		
L	0.45	0.75	0.018	0.030	0.45	0.75	0.018	0.030	
L1	1.00 REF.		0.039 REF.		1.00 REF.		0.039 REF.		
C	0°	7°	0°	7°	0°	7°	0°	7°	

**Notes:**

1. All dimensioning and tolerancing conforms to ANSI Y14.5M-1982.
2. Dimensions D1 and E1 do not include mold protrusions. Allowable protrusion is 0.25 mm per side. D1 and E1 do include mold mismatch and are determined at datum plane -H-.
3. Controlling dimension: millimeters.

# PACKAGING INFORMATION

## Ball Grid Array Package Code: B (165-pin)



Notes:  
1. Controlling dimensions are in millimeters.

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