IS61NLP102436A/IS61NVP102436A
IS61NLP204818A/IS61NVP204818A

1Mb x 36 and 2Mb x 18
36Mb, PIPELINE 'NO WAIT' STATE BUS SRAM

FEBRUARY 2012

FEATURES

- 100 percent bus utilization
- No wait cycles between Read and Write
- Internal self-timed write cycle
- Individual Byte Write Control
- Single R/W (Read/Write) control pin
- Clock controlled, registered address, data and control
- Interleaved or linear burst sequence control using MODE input
- Three chip enables for simple depth expansion and address pipelining
- Power Down mode
- Common data inputs and data outputs
- $\overline{CKE}$ pin to enable clock and suspend operation
- JEDEC 100-pin TQFP package
- Power supply:
  NVP: V_{DD} 2.5V (± 5%), V_{DDQ} 2.5V (± 5%)
  NLP: V_{DD} 3.3V (± 5%), V_{DDQ} 3.3V/2.5V (± 5%)
- Industrial temperature available
- Lead-free available

DESCRIPTION

The 36 Meg 'NLP/NVP' product family feature high-speed, low-power synchronous static RAMs designed to provide a burstable, high-performance, 'no wait' state, device for networking and communications applications. They are organized as 1M words by 36 bits and 2M words by 18 bits, fabricated with *ISSI*'s advanced CMOS technology.

Incorporating a 'no wait' state feature, wait cycles are eliminated when the bus switches from read to write, or write to read. This 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 are controlled by a positive-edge-triggered single clock input. Operations may be suspended and all synchronous inputs ignored when Clock Enable, $\overline{CKE}$ is HIGH. In this state the internal device will hold their previous values.

All Read, Write and Deselect cycles are initiated by the ADV input. When the ADV is HIGH the internal burst counter is incremented. New external addresses can be loaded when ADV is LOW.

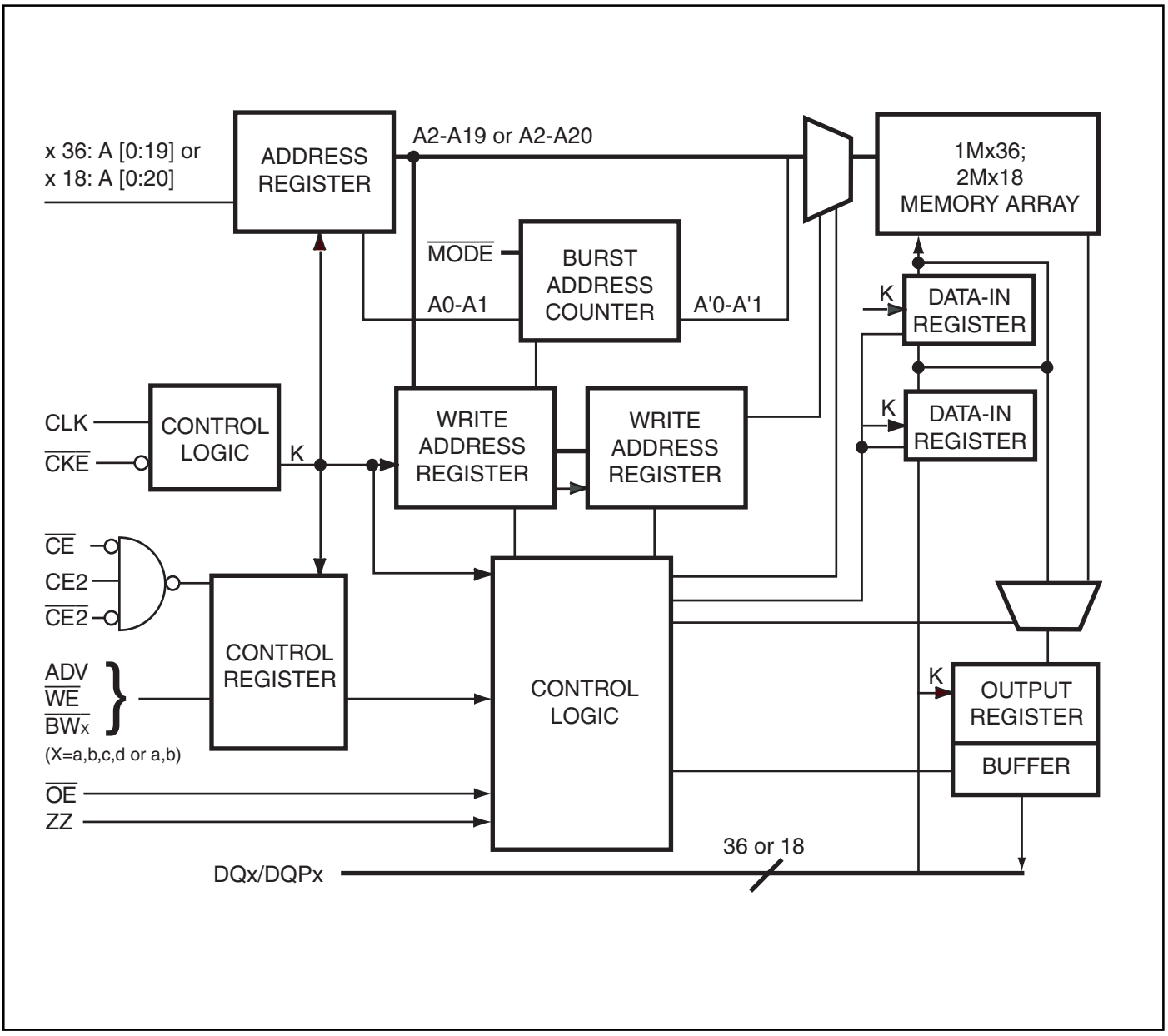
Write cycles are internally self-timed and are initiated by the rising edge of the clock inputs and when $\overline{WE}$ is LOW. Separate byte enables allow individual bytes to be written.

A burst mode pin (MODE) defines the order of the burst sequence. When tied HIGH, the interleaved burst sequence is selected. When tied LOW, the linear burst sequence is selected.

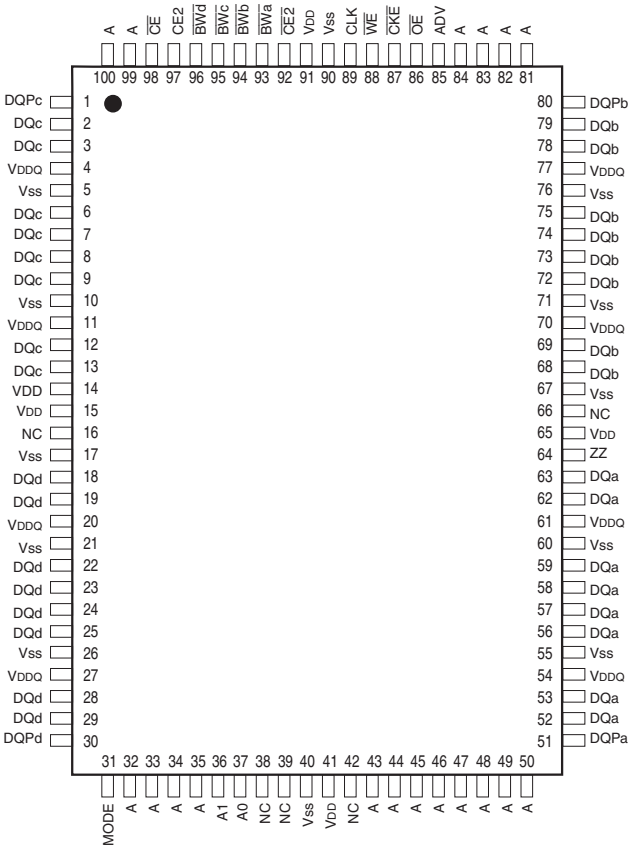
FAST ACCESS TIME

Symbol	Parameter	-200	-166	Units
t_{KQ}	Clock Access Time	3.1	3.5	ns
t_{KC}	Cycle Time	5	6	ns
	Frequency	200	166	MHz

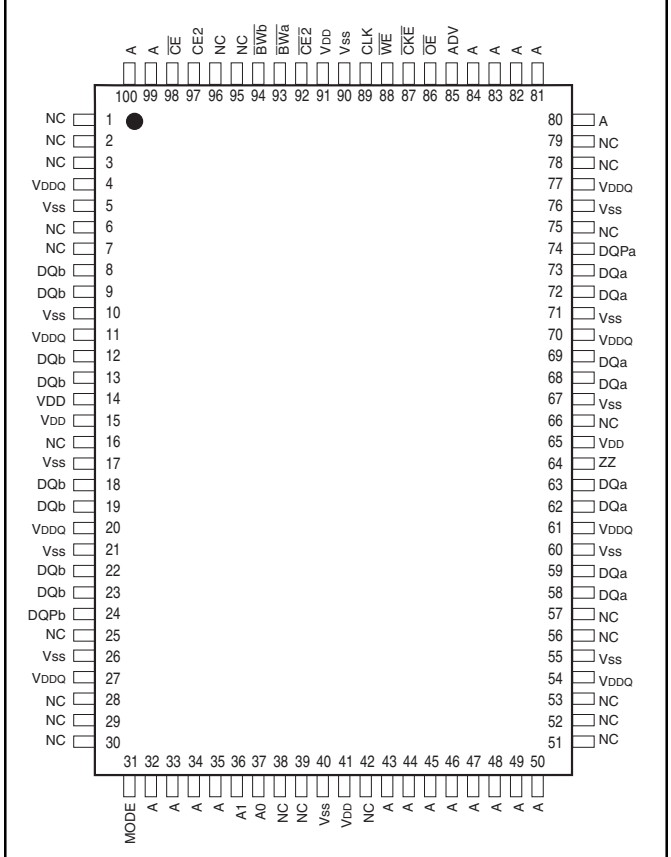
BLOCK DIAGRAM



PIN CONFIGURATION
100-Pin TQFP



1M x 36



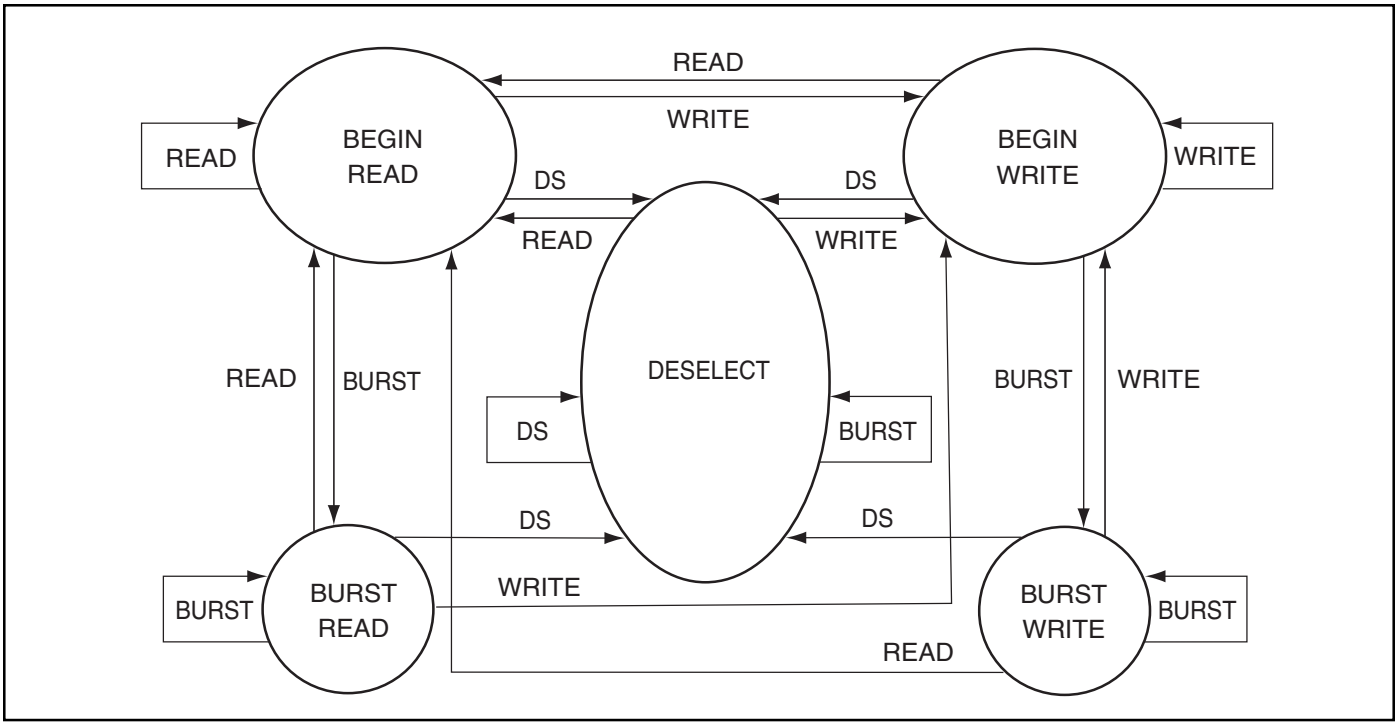
2M x 18

PIN DESCRIPTIONS

A0, A1	Synchronous Address Inputs. These pins must tied to the two LSBs of the address bus.
A	Synchronous Address Inputs
CLK	Synchronous Clock
ADV	Synchronous Burst Address Advance
$\overline{BW}$a-$\overline{BW}$d	Synchronous Byte Write Enable
$\overline{WE}$	Write Enable
$\overline{CKE}$	Clock Enable
Vss	Ground for Core
NC	Not Connected

$\overline{CE}$, CE2, $\overline{CE2}$	Synchronous Chip Enable
$\overline{OE}$	Output Enable
DQa-DQd	Synchronous Data Input/Output
DQPa-DQPd	Parity Data I/O
MODE	Burst Sequence Selection
V_{DD}	+3.3V/2.5V Power Supply
V_{SS}	Ground for output Buffer
V_{DDQ}	Isolated Output Buffer Supply: +3.3V/2.5V
ZZ	Snooze Enable

STATE DIAGRAM



SYNCHRONOUS TRUTH TABLE(1)

Operation	Address Used	$\overline{CE}$	CE2	$\overline{CE2}$	ADV	$\overline{WE}$	$\overline{BWx}$	$\overline{OE}$	$\overline{CKE}$	CLK
Not Selected	N/A	H	X	X	L	X	X	X	L	↑
Not Selected	N/A	X	L	X	L	X	X	X	L	↑
Not Selected	N/A	X	X	H	L	X	X	X	L	↑
Not Selected Continue	N/A	X	X	X	H	X	X	X	L	↑
Begin Burst Read	External Address	L	H	L	L	H	X	L	L	↑
Continue Burst Read	Next Address	X	X	X	H	X	X	L	L	↑
NOP/Dummy Read	External Address	L	H	L	L	H	X	H	L	↑
Dummy Read	Next Address	X	X	X	H	X	X	H	L	↑
Begin Burst Write	External Address	L	H	L	L	L	L	X	L	↑
Continue Burst Write	Next Address	X	X	X	H	X	L	X	L	↑
NOP/Write Abort	N/A	L	H	L	L	L	H	X	L	↑
Write Abort	Next Address	X	X	X	H	X	H	X	L	↑
Ignore Clock	Current Address	X	X	X	X	X	X	X	H	↑

Notes:
1. "X" means don't care.
2. The rising edge of clock is symbolized by ↑
3. A continue deselect cycle can only be entered if a deselect cycle is executed first.
4. $\overline{WE}$ = L means Write operation in Write Truth Table.
   $\overline{WE}$ = H means Read operation in Write Truth Table.
5. Operation finally depends on status of asynchronous pins (ZZ and $\overline{OE}$).

ASYNCHRONOUS TRUTH TABLE(1)

Operation	ZZ	$\overline{OE}$	I/O STATUS
Sleep Mode	H	X	High-Z
Read	L	L	DQ
	L	H	High-Z
Write	L	X	Din, High-Z
Deselected	L	X	High-Z

Notes:

1. X means "Don't Care".
2. For write cycles following read cycles, the output buffers must be disabled with $\overline{OE}$, otherwise data bus contention will occur.
3. Sleep Mode means power Sleep Mode where stand-by current does not depend on cycle time.
4. Deselected means power Sleep Mode where stand-by current depends on cycle time.

WRITE TRUTH TABLE (x18)

Operation	$\overline{WE}$	$\overline{BWa}$	$\overline{BWb}$
READ	H	X	X
WRITE BYTE a	L	L	H
WRITE BYTE b	L	H	L
WRITE ALL BYTEs	L	L	L
WRITE ABORT/NOP	L	H	H

Notes:

1. X means "Don't Care".
2. All inputs in this table must beet setup and hold time around the rising edge of CLK.

WRITE TRUTH TABLE (x36)

Operation	$\overline{WE}$	$\overline{BWa}$	$\overline{BWb}$	$\overline{BWc}$	$\overline{BWd}$
READ	H	X	X	X	X
WRITE BYTE a	L	L	H	H	H
WRITE BYTE b	L	H	L	H	H
WRITE BYTE c	L	H	H	L	H
WRITE BYTE d	L	H	H	H	L
WRITE ALL BYTEs	L	L	L	L	L
WRITE ABORT/NOP	L	H	H	H	H

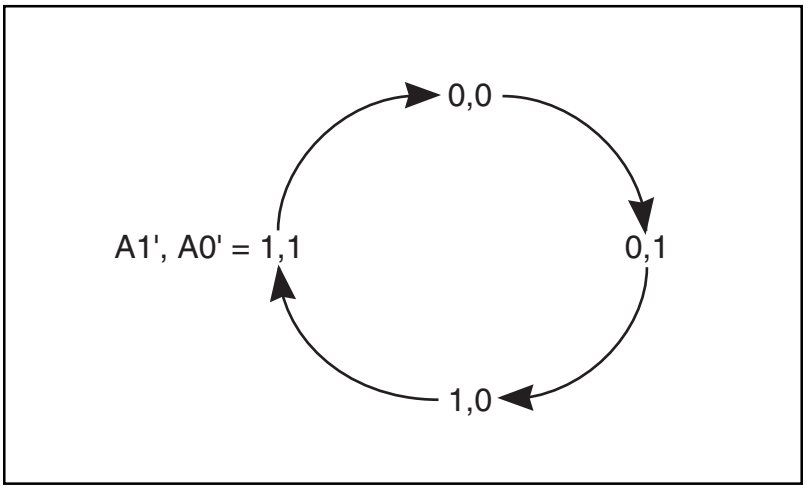
Notes:

1. X means "Don't Care".
2. All inputs in this table must beet setup and hold time around the rising edge of CLK.

INTERLEAVED BURST ADDRESS TABLE (MODE = V_{DD} or NC)

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_{SS})



ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	–65 to +150	°C
P_D	Power Dissipation	1.6	W
I_{OUT}	Output Current (per I/O)	100	mA
V_{IN}, V_{OUT}	Voltage Relative to V_{SS} for I/O Pins	–0.5 to V_{DDQ} + 0.3	V
V_{IN}	Voltage Relative to V_{SS} for for Address and Control Inputs	–0.3 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 circuity 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 (IS61NLPx)

Range	Ambient Temperature	V_{DD}	V_{DDQ}
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 (IS61NVPx)

Range	Ambient Temperature	V_{DD}	V_{DDQ}
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 Min.	3.3V Max.	2.5V Min.	2.5V Max.	Unit
V_{OH}	Output HIGH Voltage	I_{OH} = –4.0 mA (3.3V) I_{OH} = –1.0 mA (2.5V)	2.4	—	2.0	—	V
V_{OL}	Output LOW Voltage	I_{OL} = 8.0 mA (3.3V) I_{OL} = 1.0 mA (2.5V)	—	0.4	—	0.4	V
V_{IH}	Input HIGH Voltage		2.0	V_{DD} + 0.3	1.7	V_{DD} + 0.3	V
V_{IL}	Input LOW Voltage		–0.3	0.8	–0.3	0.7	V
I_{LI}	Input Leakage Current	$V_{SS} \le V_{IN} \le V_{DD}$(1)	–5	5	–5	5	µA
I_{LO}	Output Leakage Current	$V_{SS} \le V_{OUT} \le V_{DDQ}$, $\overline{OE} = V_{IH}$	–5	5	–5	5	µA

POWER SUPPLY CHARACTERISTICS(1) (Over Operating Range)

Symbol	Parameter	Test Conditions	Temp. range	-200 MAX x18	-200 MAX x36	-166 MAX x18	-166 MAX x36	Unit
I_{CC}	AC Operating Supply Current	Device Selected, $\overline{OE} = V_{IH}$, $ZZ \le V_{IL}$, All Inputs ≤ 0.2V or ≥ V_{DD} – 0.2V, Cycle Time ≥ t_{KC} min.	Com. Ind. typ.(2)	450 475 390	450 475	400 450 340	400 450	mA
I_{SB}	Standby Current TTL Input	Device Deselected, V_{DD} = Max., All Inputs ≤ V_{IL} or ≥ V_{IH}, $ZZ \le V_{IL}$, f = Max.	Com. Ind.	260 270	260 270	250 260	250 260	mA
I_{SBI}	Standby Current CMOS Input	Device Deselected, V_{DD} = Max., $V_{IN} \le V_{SS}$ + 0.2V or ≥V_{DD} – 0.2V f = 0	Com. Ind. typ.(2)	105 110 30	105 110	105 110 30	105 110	mA

Note:
1. MODE pin has an internal pullup and should be tied to V_{DD} or V_{SS}. It exhibits ±100µA maximum leakage current when tied to ≤ V_{SS} + 0.2V or ≥ V_{DD} – 0.2V.
2. Typical values are measured at Vcc = 3.3V, T_A = 25°C and not 100% tested.

CAPACITANCE[1,2]

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

Notes:
1. Tested initially and after any design or process changes that may affect these parameters.
2. Test conditions: T_A = 25°C, f = 1 MHz, V_{DD} = 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

3.3V I/O OUTPUT LOAD EQUIVALENT

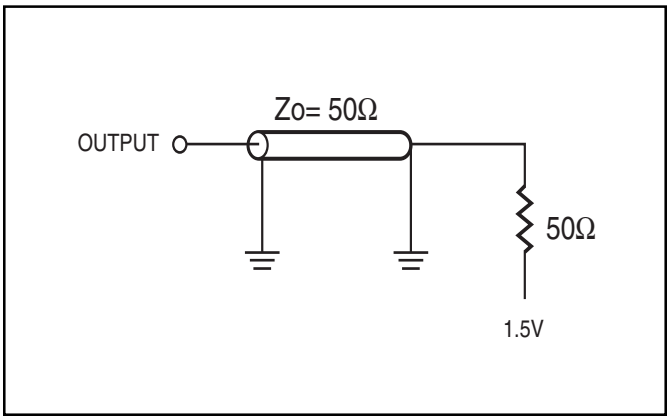


Figure 1

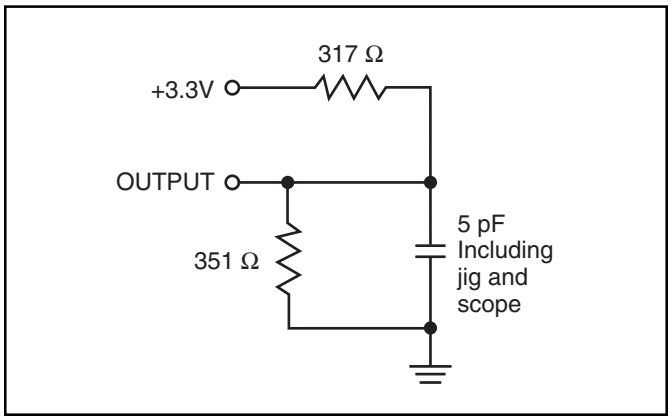


Figure 2

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

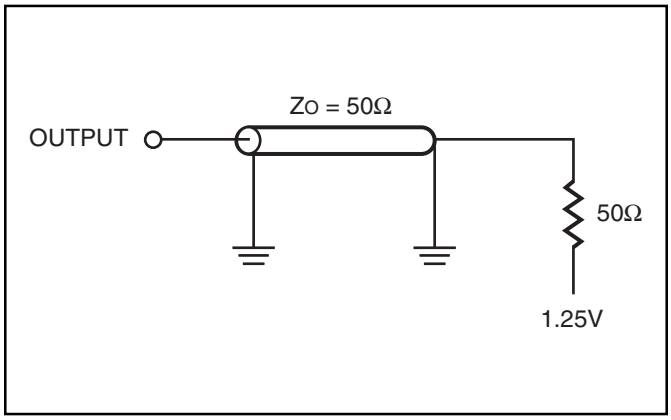


Figure 3

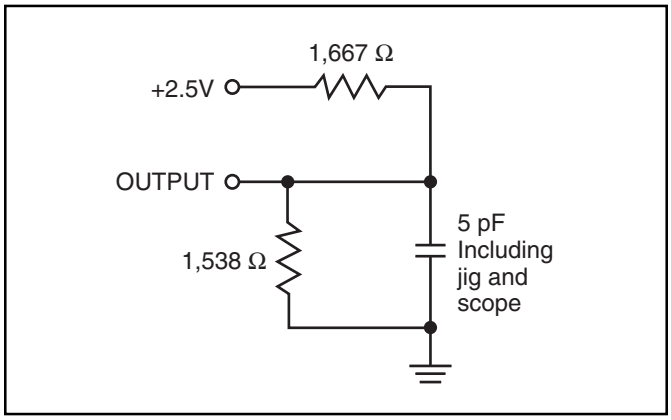


Figure 4

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

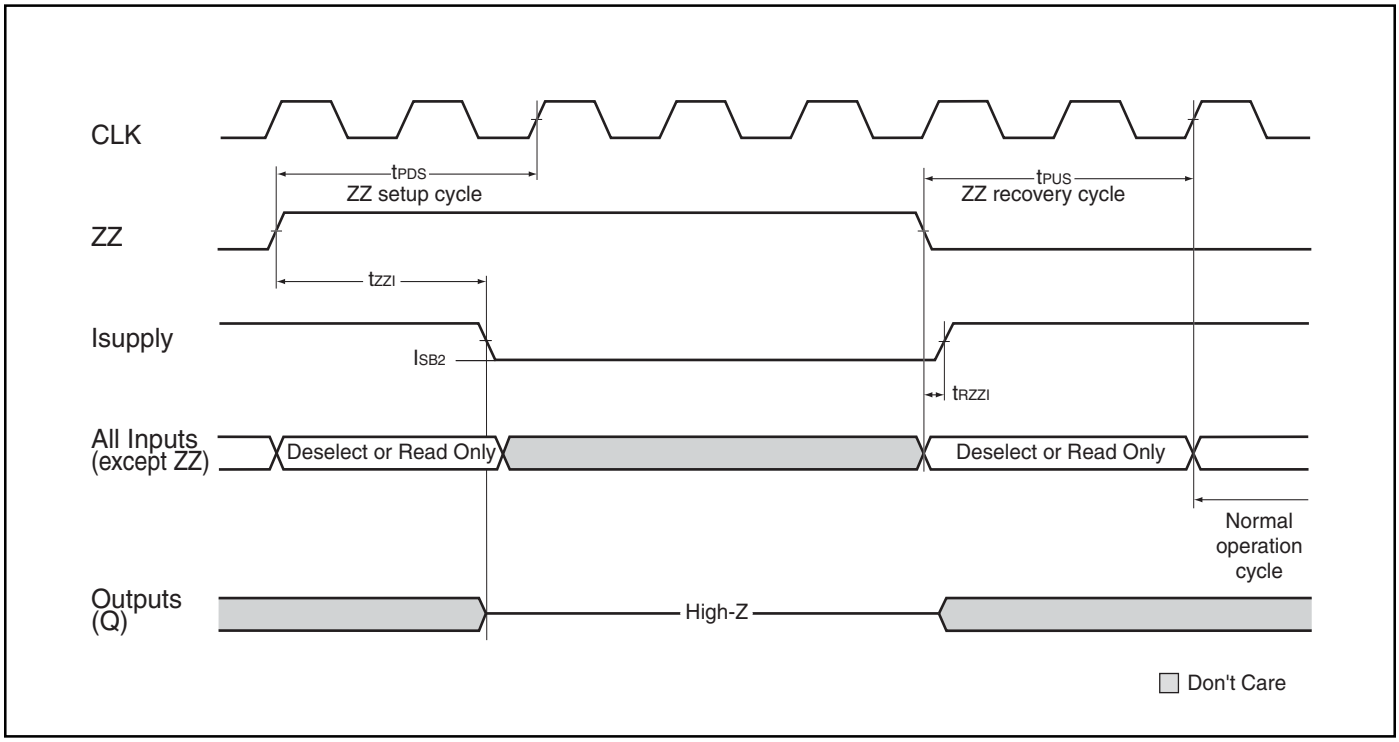
Symbol	Parameter	-200 Min.	-200 Max.	-166 Min.	-166 Max.	Unit
fmax	Clock Frequency	—	200	—	166	MHz
t_{KC}	Cycle Time	5	—	6	—	ns
t_{KH}	Clock High Time	2	—	2.5	—	ns
t_{KL}	Clock Low Time	2	—	2.5	—	ns
t_{KQ}	Clock Access Time	—	3.1	—	3.5	ns
t_{KQX}[2]	Clock High to Output Invalid	1.5	—	1.5	—	ns
t_{KQLZ}[2,3]	Clock High to Output Low-Z	1	—	1	—	ns
t_{KQHZ}[2,3]	Clock High to Output High-Z	—	3.0	—	3.4	ns
t_{OEQ}	Output Enable to Output Valid	—	3.1	—	3.5	ns
t_{OELZ}[2,3]	Output Enable to Output Low-Z	0	—	0	—	ns
t_{OEHZ}[2,3]	Output Disable to Output High-Z	—	3.0	—	3.4	ns
t_{AS}	Address Setup Time	1.4	—	1.5	—	ns
t_{WS}	Read/Write Setup Time	1.4	—	1.5	—	ns
t_{CES}	Chip Enable Setup Time	1.4	—	1.5	—	ns
t_{SE}	Clock Enable Setup Time	1.4	—	1.5	—	ns
t_{ADVS}	Address Advance Setup Time	1.4	—	1.5	—	ns
t_{DS}	Data Setup Time	1.4	—	1.5	—	ns
t_{AH}	Address Hold Time	0.4	—	0.5	—	ns
t_{HE}	Clock Enable Hold Time	0.4	—	0.5	—	ns
t_{WH}	Write Hold Time	0.4	—	0.5	—	ns
t_{CEH}	Chip Enable Hold Time	0.4	—	0.5	—	ns
t_{ADVH}	Address Advance Hold Time	0.4	—	0.5	—	ns
t_{DH}	Data Hold Time	0.4	—	0.5	—	ns
t_{PDS}	ZZ High to Power Down	—	2	—	2	cyc
t_{PUS}	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.

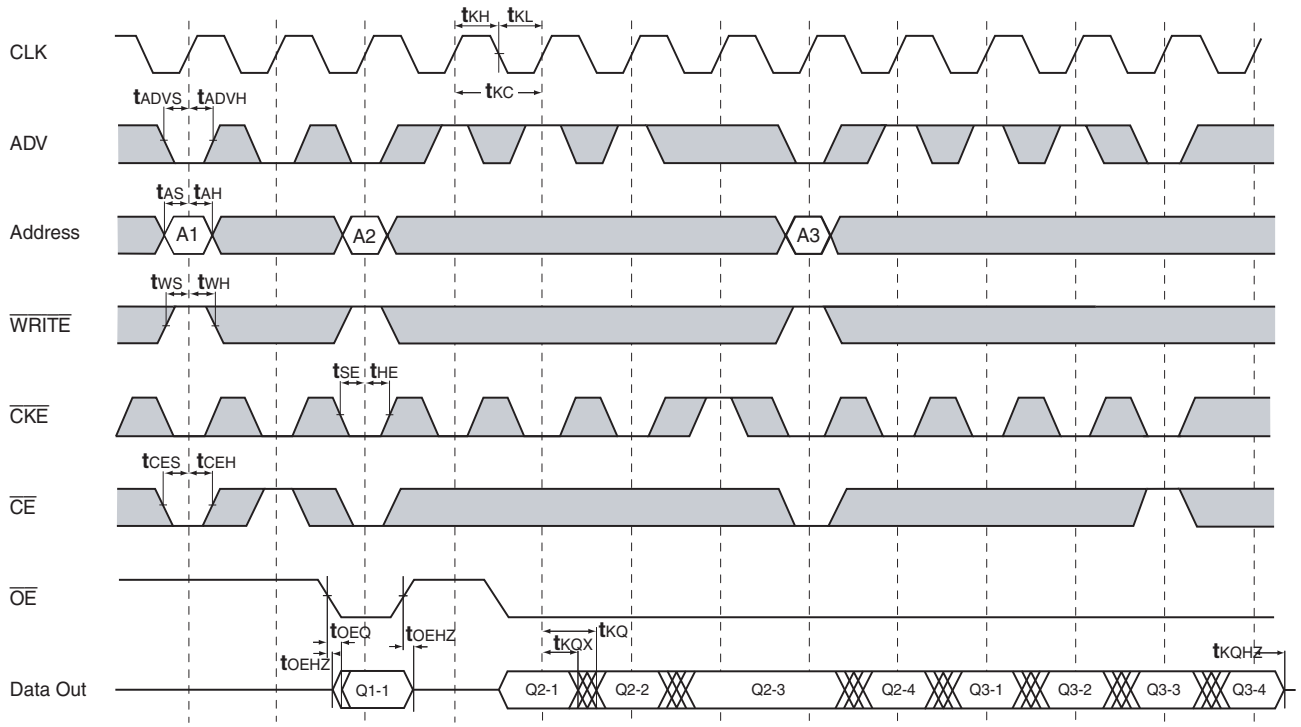
SLEEP MODE ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Max.	Unit
I_{SB2}	Current during SLEEP MODE	ZZ ≥ V_{IH}		75	mA
t_{PDS}	ZZ active to input ignored		2		cycle
t_{PUS}	ZZ inactive to input sampled		2		cycle
t_{ZZI}	ZZ active to SLEEP current		2		cycle
t_{RZZI}	ZZ inactive to exit SLEEP current		0		ns

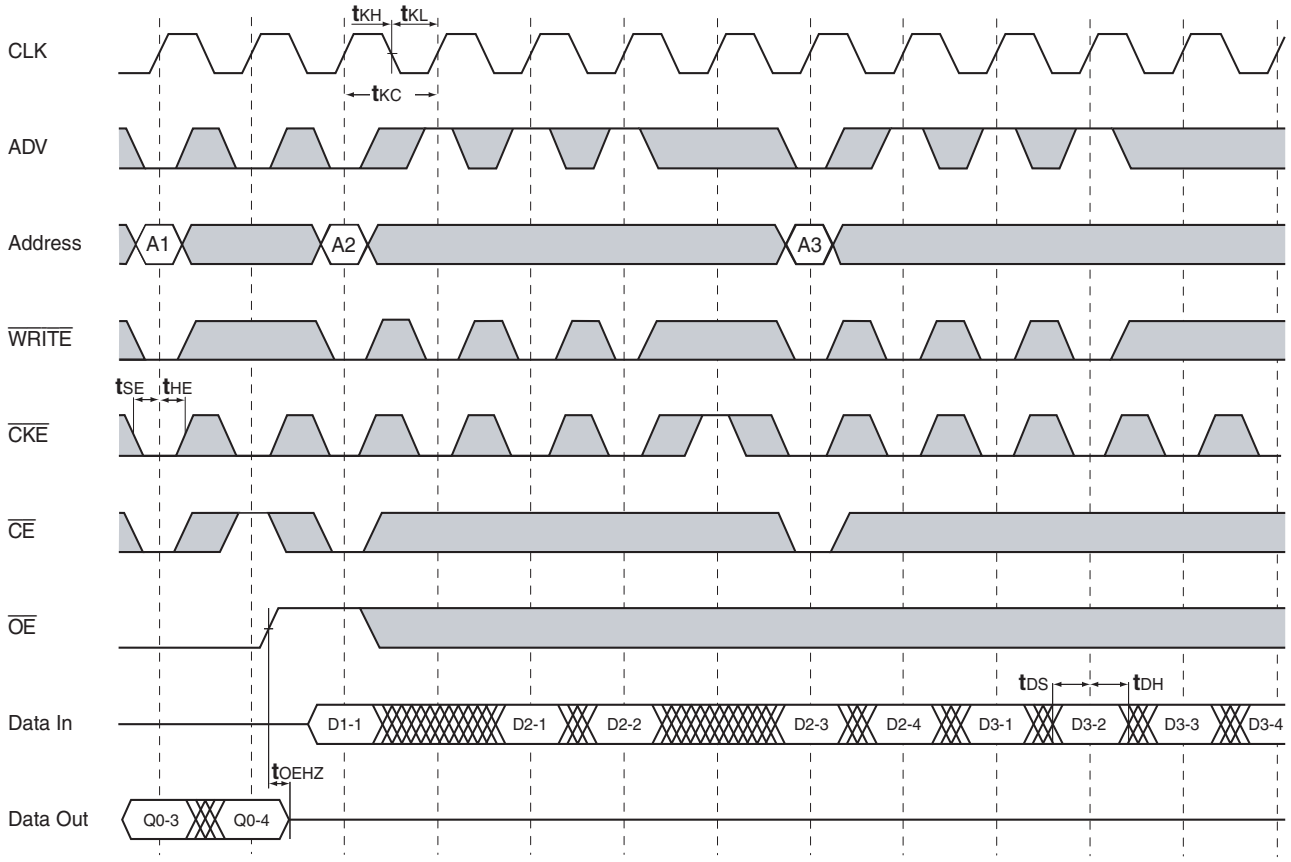
SLEEP MODE TIMING



READ CYCLE TIMING



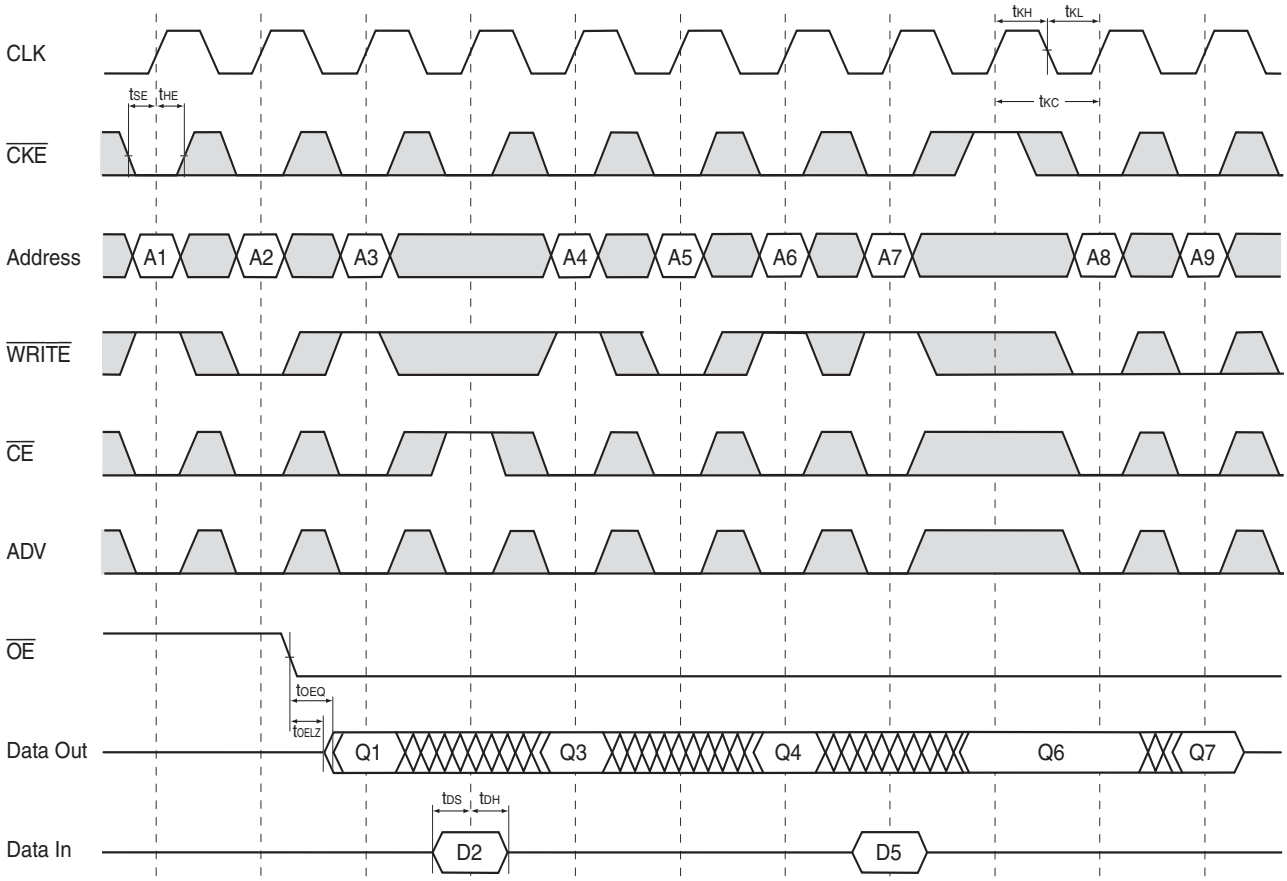
WRITE CYCLE TIMING



NOTES: $\overline{WRITE}$ = L means $\overline{WE}$ = L and $\overline{BW}$x = L
$\overline{WE}$ = L and $\overline{BWX}$ = L
$\overline{CE}$ = L means $\overline{CE}$1 = L, CE2 = H and $\overline{CE}$2 = L
$\overline{CE}$ = H means $\overline{CE}$1 = H, or $\overline{CE}$1 = L and $\overline{CE}$2 = H, or $\overline{CE}$1 = L and CE2 = L

Don't Care
Undefined

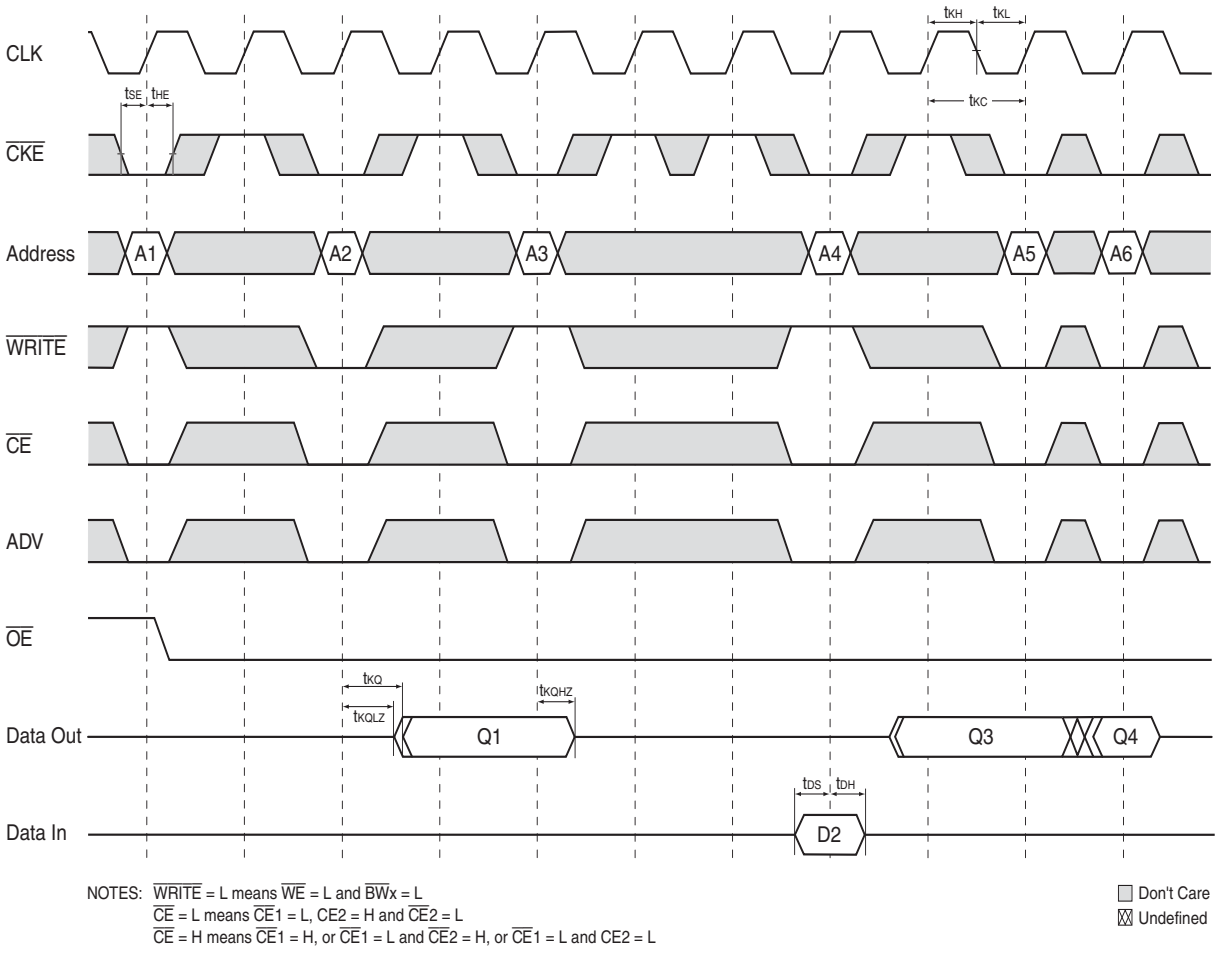
SINGLE READ/WRITE CYCLE TIMING



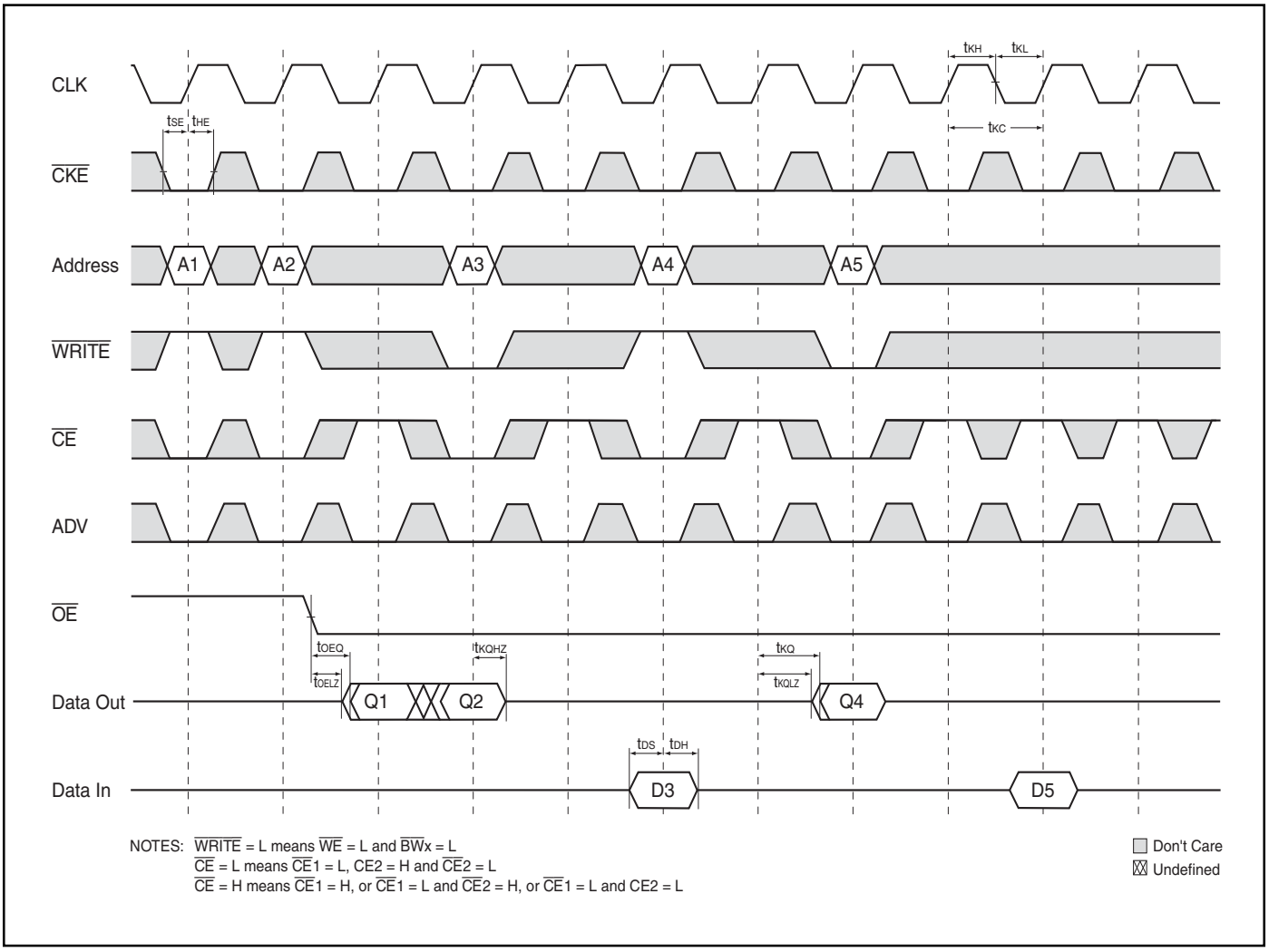
NOTES: $\overline{WRITE}$ = L means $\overline{WE}$ = L and $\overline{BW}$x = L
$\overline{CE}$ = L means $\overline{CE}$1 = L, CE2 = H and $\overline{CE}$2 = L
$\overline{CE}$ = H means $\overline{CE}$1 = H, or $\overline{CE}$1 = L and $\overline{CE}$2 = H, or $\overline{CE}$1 = L and CE2 = L

Don't Care
Undefined

$\overline{CKE}$ OPERATION TIMING



$\overline{CE}$ OPERATION TIMING



ORDERING INFORMATION (3.3V core/2.5V- 3.3V I/O)

Commercial Range: 0°C to +70°C

Configuration	Access Time	Order Part Number	Package
1Mx36	166	IS61NLP102436A-166TQ	100 TQFP
		IS61NLP102436A-166TQL	100 TQFP, Lead-free
2Mx18	166	IS61NLP204818A-166TQ	100 TQFP
		IS61NLP204818A-166TQL	100 TQFP, Lead-free

Industrial Range: -40°C to +85°C

Configuration	Access Time	Order Part Number	Package
1Mx36	166	IS61NLP102436A-166TQI	100 TQFP
		IS61NLP102436A-166TQLI	100 TQFP, Lead-free
2Mx18	166	IS61NLP204818A-166TQI	100 TQFP
		IS61NLP204818A-166TQLI	100 TQFP, Lead-free

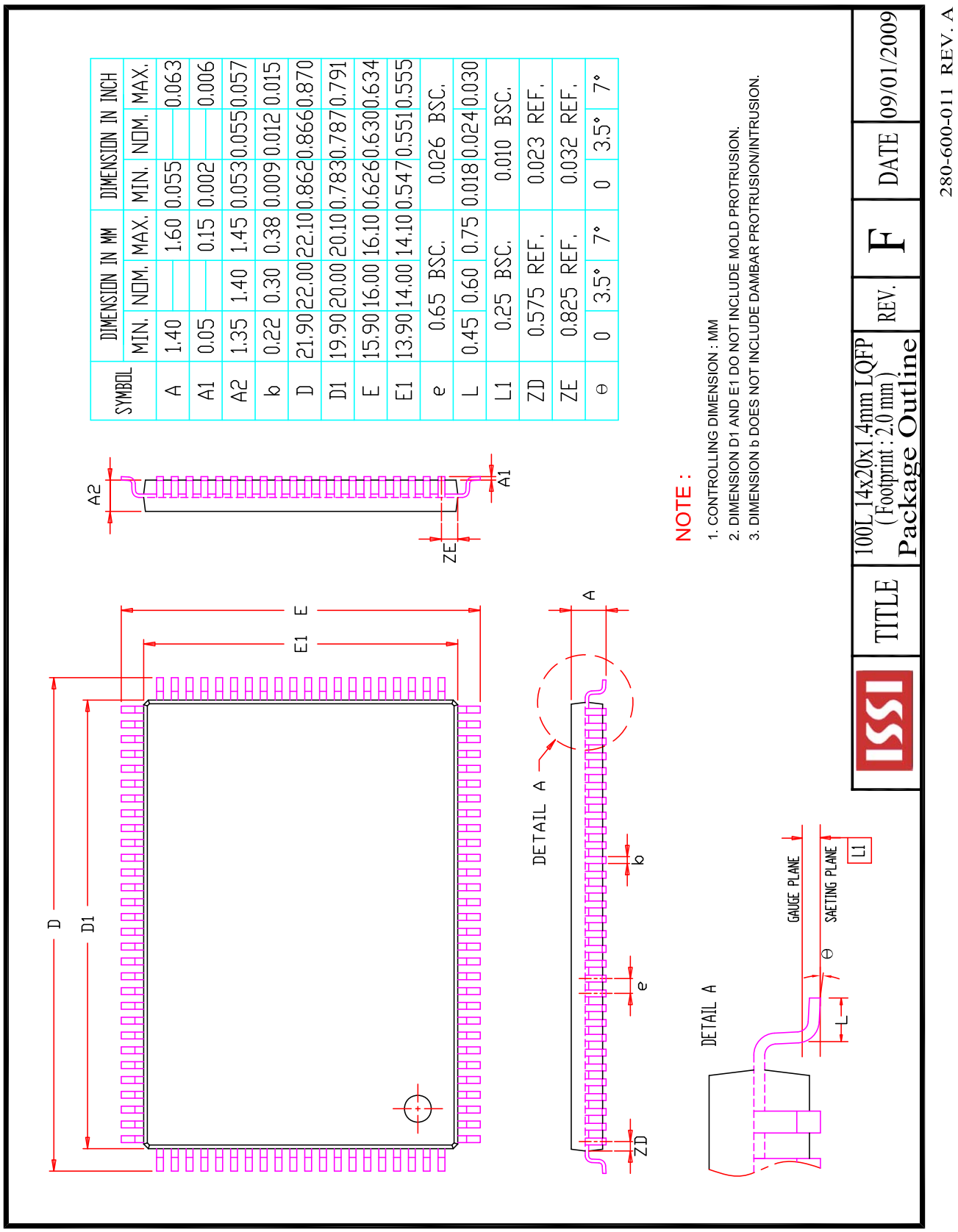
ORDERING INFORMATION (2.5V core/2.5V I/O)

Commercial Range: 0°C to +70°C

Configuration	Access Time	Order Part Number	Package
1Mx36	166	IS61NVP102436A-166TQ	100 TQFP
		IS61NVP102436A-166TQL	100 TQFP, Lead-free
2Mx18	166	IS61NVP204818A-166TQ	100 TQFP
		IS61NVP204818A-166TQL	100 TQFP, Lead-free

Industrial Range: -40°C to +85°C

Configuration	Access Time	Order Part Number	Package
1Mx36	166	IS61NVP102436A-166TQI	100 TQFP
		IS61NVP102436A-166TQLI	100 TQFP, Lead-free
2Mx18	166	IS61NVP204818A-166TQI	100 TQFP
		IS61NVP204818A-166TQLI	100 TQFP, Lead-free


SYMBOL
DIMENSION IN MM
MIN. NOM. MAX.
DIMENSION IN INCH
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 0.057
b 0.22 0.30 0.38 0.009 0.012 0.015
D 21.90 22.00 22.10 0.862 0.866 0.870
D1 19.90 20.00 20.10 0.783 0.787 0.791
E 15.90 16.00 16.10 0.626 0.630 0.634
E1 13.90 14.00 14.10 0.547 0.551 0.555
e 0.65 BSC. 0.026 BSC.
L 0.45 0.60 0.75 0.018 0.024 0.030
L1 0.25 BSC. 0.010 BSC.
ZD 0.575 REF. 0.023 REF.
ZE 0.825 REF. 0.032 REF.
θ 0 3.5° 7° 0 3.5° 7°
NOTE :
1. CONTROLLING DIMENSION : MM
2. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION.
A2
A1
ZE
E
E1
D
D1
DETAIL A
A
b
e
ZD
DETAIL A
GAUGE PLANE
SEATING PLANE
θ
L
L1
TITLE
100L 14x20x1.4mm LQFP
(Footprint : 2.0 mm)
Package Outline
REV.
F
DATE
09/01/2009
280-600-011 REV. A