NEC

MOS INTEGRATED CIRCUIT

μPD4482161, 4482181, 4482321, 4482361

8M-BIT CMOS SYNCHRONOUS FAST SRAM
FLOW THROUGH OPERATION

Description

The μPD4482161 is a 524,288-word by 16-bit, the μPD4482181 is a 524,288-word by 18-bit, the μPD4482321 is a 262,144-word by 32-bit and the μPD4482361 is a 262,144-word by 36-bit synchronous static RAM fabricated with advanced CMOS technology using Full-CMOS six-transistor memory cell.

The μPD4482161, μPD4482181, μPD4482321 and μPD4482361 integrate unique synchronous peripheral circuitry, 2-bit burst counter and output buffer as well as SRAM core. All input registers are controlled by a positive edge of the single clock input (CLK).

The μPD4482161, μPD4482181, μPD4482321 and μPD4482361 are suitable for applications which require synchronous operation, high speed, low voltage, high density and wide bit configuration, such as cache and buffer memory.

ZZ has to be set LOW at the normal operation. When ZZ is set HIGH, the SRAM enters Power Down State (“Sleep”). In the “Sleep” state, the SRAM internal state is preserved. When ZZ is set LOW again, the SRAM resumes normal operation.

The μPD4482161, μPD4482181, μPD4482321 and μPD4482361 are packaged in 100-pin PLASTIC LQFP with a 1.4 mm package thickness for high density and low capacitive loading.

Features

- 3.3 V or 2.5 V core supply
- Synchronous operation
- ★ Operating temperature : T_A = 0 to 70 °C (-A65, -A75, -A85, -C75, -C85)
  T_A = –40 to +85 °C (-A65Y, -A75Y, -A85Y, -C75Y, -C85Y)
- Internally self-timed write control
- Burst read / write : Interleaved burst and linear burst sequence
- Fully registered inputs for flow through operation
- All registers triggered off positive clock edge
- 3.3 V or 2.5 V LVTTL Compatible : All inputs and outputs
- Fast clock access time : 6.5 ns (133 MHz), 7.5 ns (117 MHz), 8.5 ns (100 MHz)
- Asynchronous output enable : /G
- Burst sequence selectable : MODE
- Sleep mode : ZZ (ZZ = Open or Low : Normal operation)
- Separate byte write enable : /BW1 to /BW4, /BWE (μPD4482321, μPD4482361)
  /BW1, /BW2, /BWE (μPD4482161, μPD4482181)

  Global write enable : /GW
- Three chip enables for easy depth expansion
- Common I/O using three state outputs

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

Document No. M14521EJ3V0DS00 (3rd edition)
Date Published December 2002 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

© NEC Electronics Corporation 2000

★ **Ordering Information** (1/2)

Part number	Access Time ns	Clock Frequency MHz	Core Supply Voltage V	I/O Interface	Operating Temperature °C	Package
μPD4482161GF-A65	6.5	133	3.3 ± 0.165	3.3 V LVTTL Note	0 to 70	100-pin PLASTIC LQFP (14 × 20)
μPD4482161GF-A75	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482161GF-A85	8.5	100				
μPD4482181GF-A65	6.5	133		3.3 V LVTTL Note		
μPD4482181GF-A75	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482181GF-A85	8.5	100				
μPD4482321GF-A65	6.5	133		3.3 V LVTTL Note		
μPD4482321GF-A75	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482321GF-A85	8.5	100				
μPD4482361GF-A65	6.5	133		3.3 V LVTTL Note		
μPD4482361GF-A75	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482361GF-A85	8.5	100				
μPD4482161GF-C75	7.5	117	2.5 ± 0.125	2.5 V LVTTL		
μPD4482161GF-C85	8.5	100				
μPD4482181GF-C75	7.5	117				
μPD4482181GF-C85	8.5	100				
μPD4482321GF-C75	7.5	117				
μPD4482321GF-C85	8.5	100				
μPD4482361GF-C75	7.5	117				
μPD4482361GF-C85	8.5	100				

Note Although 2.5V LVTTL interface can also be used, a performance becomes equivalent to -A75 (117 MHz).

(2/2)

Part number	Access Time ns	Clock Frequency MHz	Core Supply Voltage V	I/O Interface	Operating Temperature °C	Package
μPD4482161GF-A65Y	6.5	133	3.3 ± 0.165	3.3 V LVTTL Note	−40 to +85	100-pin PLASTIC LQFP (14 × 20)
μPD4482161GF-A75Y	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482161GF-A85Y	8.5	100				
μPD4482181GF-A65Y	6.5	133		3.3 V LVTTL Note		
μPD4482181GF-A75Y	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482181GF-A85Y	8.5	100				
μPD4482321GF-A65Y	6.5	133		3.3 V LVTTL Note		
μPD4482321GF-A75Y	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482321GF-A85Y	8.5	100				
μPD4482361GF-A65Y	6.5	133		3.3 V LVTTL Note		
μPD4482361GF-A75Y	7.5	117		3.3 V or 2.5 V LVTTL		
μPD4482361GF-A85Y	8.5	100				
μPD4482161GF-C75Y	7.5	117	2.5 ± 0.125	2.5 V LVTTL		
μPD4482161GF-C85Y	8.5	100				
μPD4482181GF-C75Y	7.5	117				
μPD4482181GF-C85Y	8.5	100				
μPD4482321GF-C75Y	7.5	117				
μPD4482321GF-C85Y	8.5	100				
μPD4482361GF-C75Y	7.5	117				
μPD4482361GF-C85Y	8.5	100				

Note Although 2.5V LVTTL interface can also be used, a performance becomes equivalent to -A75Y (117 MHz).

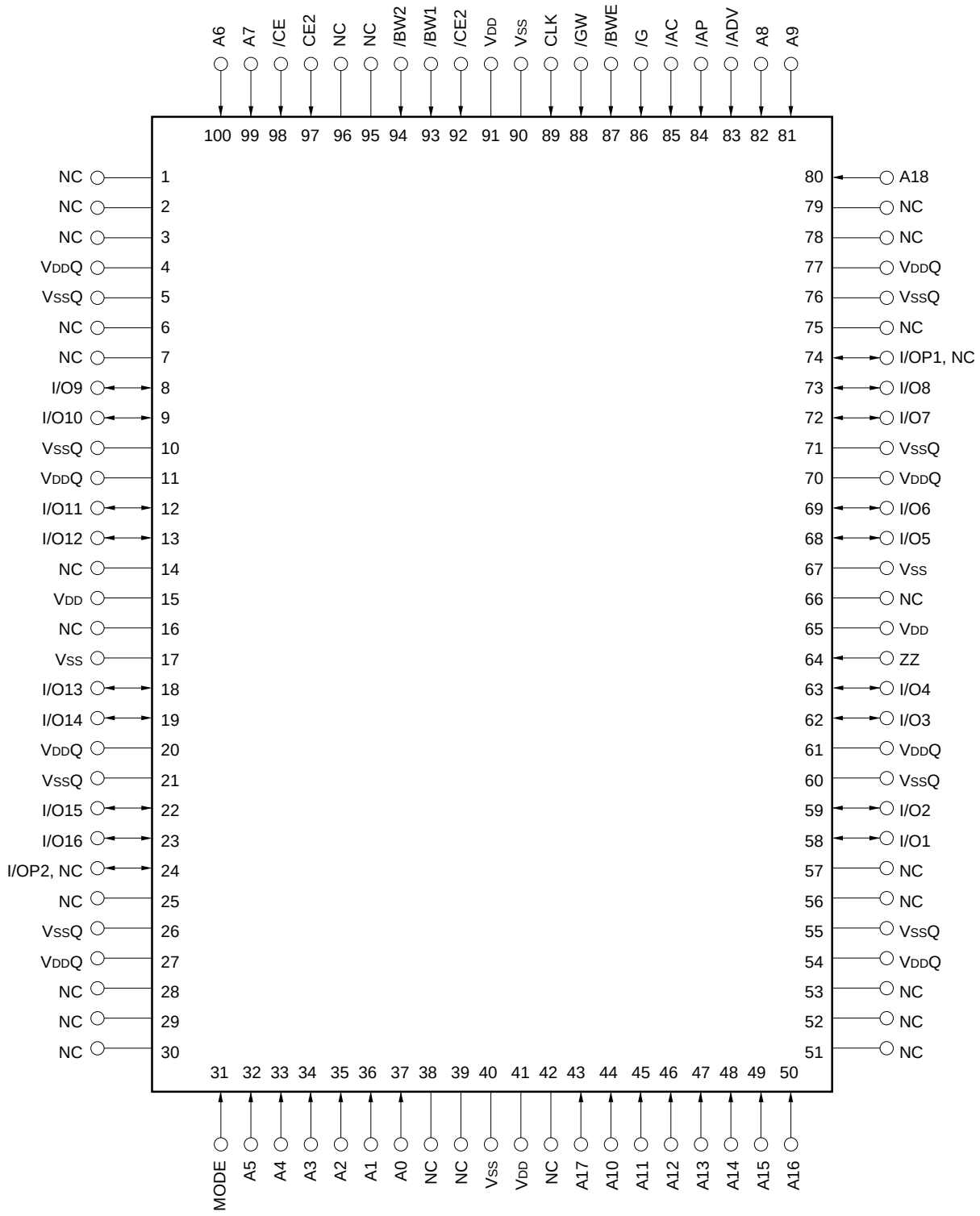
Pin Configurations

/xxx indicates active low signal.

100-pin PLASTIC LQFP (14 x 20)

[μPD4482161GF, μPD4482181GF]

Marking Side



Remark Refer to **Package Drawing** for the 1-pin index mark.

Pin Identification (μPD4482161GF, μPD4482181GF)

Symbol	Pin No.	Description
A0 to A18	37, 36, 35, 34, 33, 32, 100, 99, 82, 81, 44, 45, 46, 47, 48, 49, 50, 43, 80	Synchronous Address Input
I/O1 to I/O16	58, 59, 62, 63, 68, 69, 72, 73, 8, 9, 12, 13, 18, 19, 22, 23	Synchronous Data In, Synchronous / Asynchronous Data Out
I/OP1, NC Note	74	Synchronous Data In (Parity), Synchronous / Asynchronous Data Out (Parity)
I/OP2, NC Note	24	
/ADV	83	Synchronous Burst Address Advance Input
/AP	84	Synchronous Address Status Processor Input
/AC	85	Synchronous Address Status Controller Input
/CE, CE2, /CE2	98, 97, 92	Synchronous Chip Enable Input
/BW1, /BW2, /BWE	93, 94, 87	Synchronous Byte Write Enable Input
/GW	88	Synchronous Global Write Input
/G	86	Asynchronous Output Enable Input
CLK	89	Clock Input
MODE	31	Asynchronous Burst Sequence Select Input Do not change state during normal operation
ZZ	64	Asynchronous Power Down State Input
V_{DD}	15, 41, 65, 91	Power Supply
V_{SS}	17, 40, 67, 90	Ground
$V_{DD}Q$	4, 11, 20, 27, 54, 61, 70, 77	Output Buffer Power Supply
$V_{SS}Q$	5, 10, 21, 26, 55, 60, 71, 76	Output Buffer Ground
NC	1, 2, 3, 6, 7, 14, 16, 25, 28, 29, 30, 38, 39, 42, 51, 52, 53, 56, 57, 66, 75, 78, 79, 95, 96	No Connection

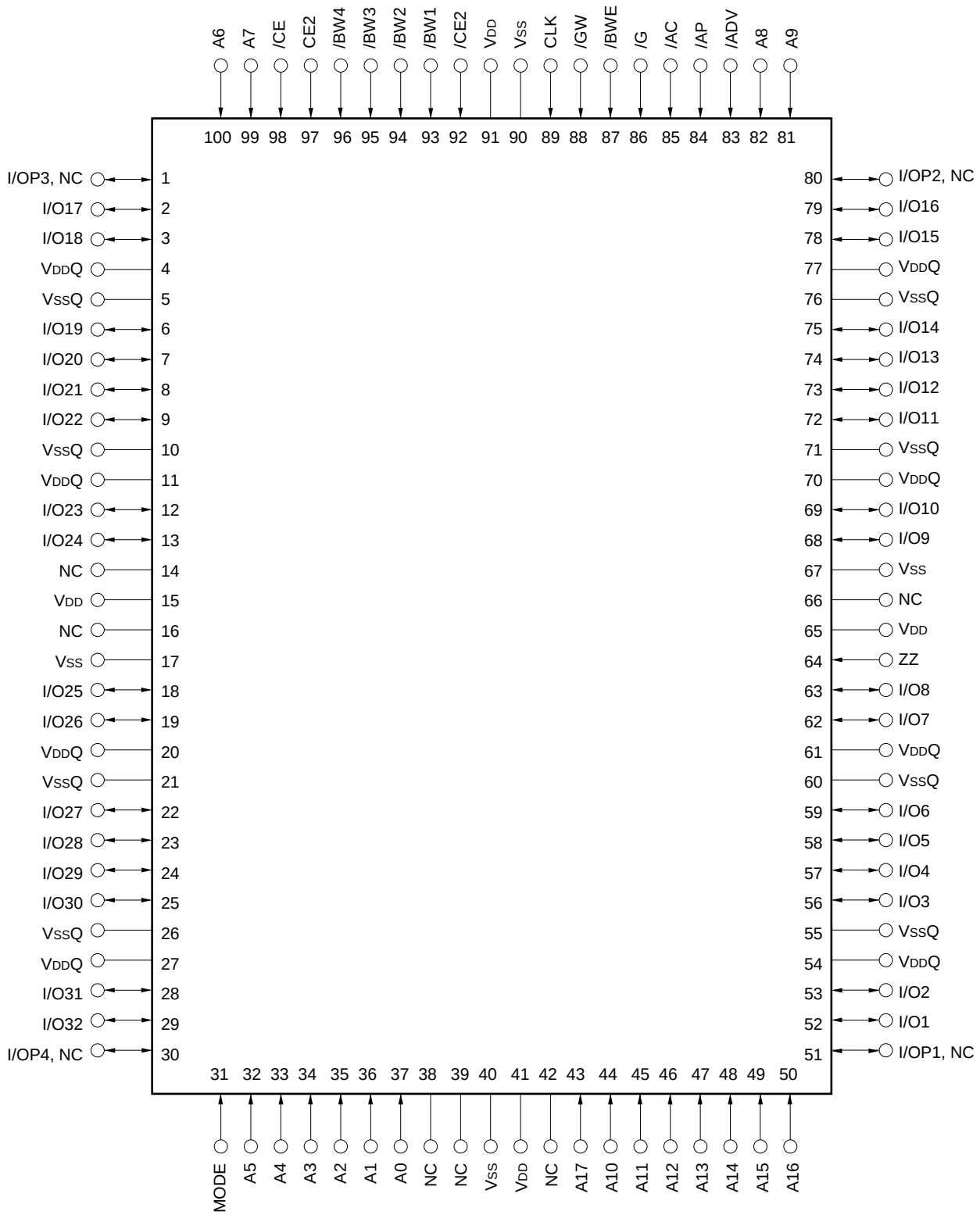
Note NC (No Connection) is used in the μPD4482161GF.

I/OP1 and I/OP2 are used in the μPD4482181GF.

100-pin PLASTIC LQFP (14 x 20)

[μPD4482321GF, μPD4482361GF]

Marking Side



Remark Refer to **Package Drawing** for the 1-pin index mark.

Pin Identification (μPD4482321GF, μPD4482361GF)

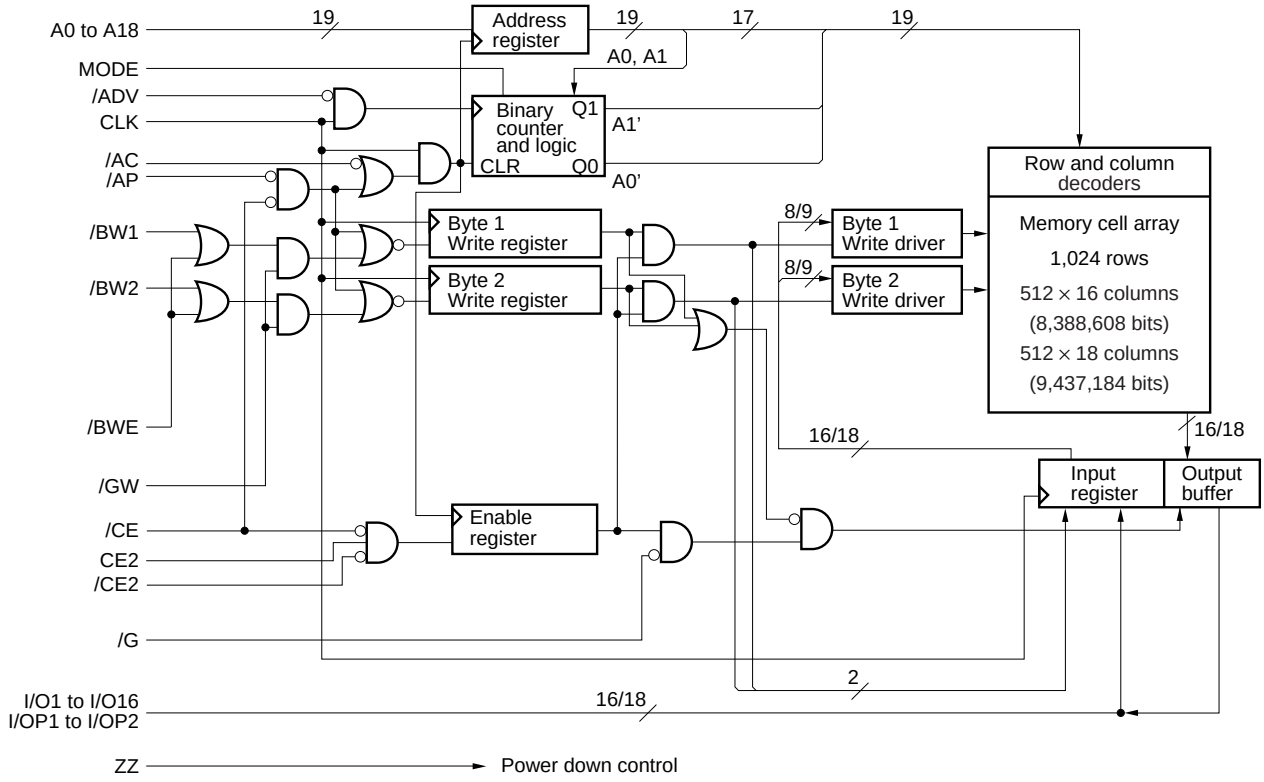
Symbol	Pin No.	Description
A0 to A17	37, 36, 35, 34, 33, 32, 100, 99, 82, 81, 44, 45, 46, 47, 48, 49, 50, 43	Synchronous Address Input
I/O1 to I/O32	52, 53, 56, 57, 58, 59, 62, 63, 68, 69, 72, 73, 74, 75, 78, 79, 2, 3, 6, 7, 8, 9, 12, 13, 18, 19, 22, 23, 24, 25, 28, 29	Synchronous Data In, Synchronous / Asynchronous Data Out
I/OP1, NC Note	51	Synchronous Data In (Parity), Synchronous / Asynchronous Data Out (Parity)
I/OP2, NC Note	80	
I/OP3, NC Note	1	
I/OP4, NC Note	30	
/ADV	83	Synchronous Burst Address Advance Input
/AP	84	Synchronous Address Status Processor Input
/AC	85	Synchronous Address Status Controller Input
/CE, CE2, /CE2	98, 97, 92	Synchronous Chip Enable Input
/BW1 to /BW4, /BWE	93, 94, 95, 96, 87	Synchronous Byte Write Enable Input
/GW	88	Synchronous Global Write Input
/G	86	Asynchronous Output Enable Input
CLK	89	Clock Input
MODE	31	Asynchronous Burst Sequence Select Input Do not change state during normal operation
ZZ	64	Asynchronous Power Down State Input
V_{DD}	15, 41, 65, 91	Power Supply
V_{SS}	17, 40, 67, 90	Ground
$V_{DD}Q$	4, 11, 20, 27, 54, 61, 70, 77	Output Buffer Power Supply
$V_{SS}Q$	5, 10, 21, 26, 55, 60, 71, 76	Output Buffer Ground
NC	14, 16, 38, 39, 42, 66	No Connection

Note NC (No Connection) is used in the μPD4482321GF.

I/OP1 to I/OP4 are used in the μPD4482361GF.

Block Diagrams

[μPD4482161, μPD4482181]



Burst Sequence

[μPD4482161, μPD4482181]

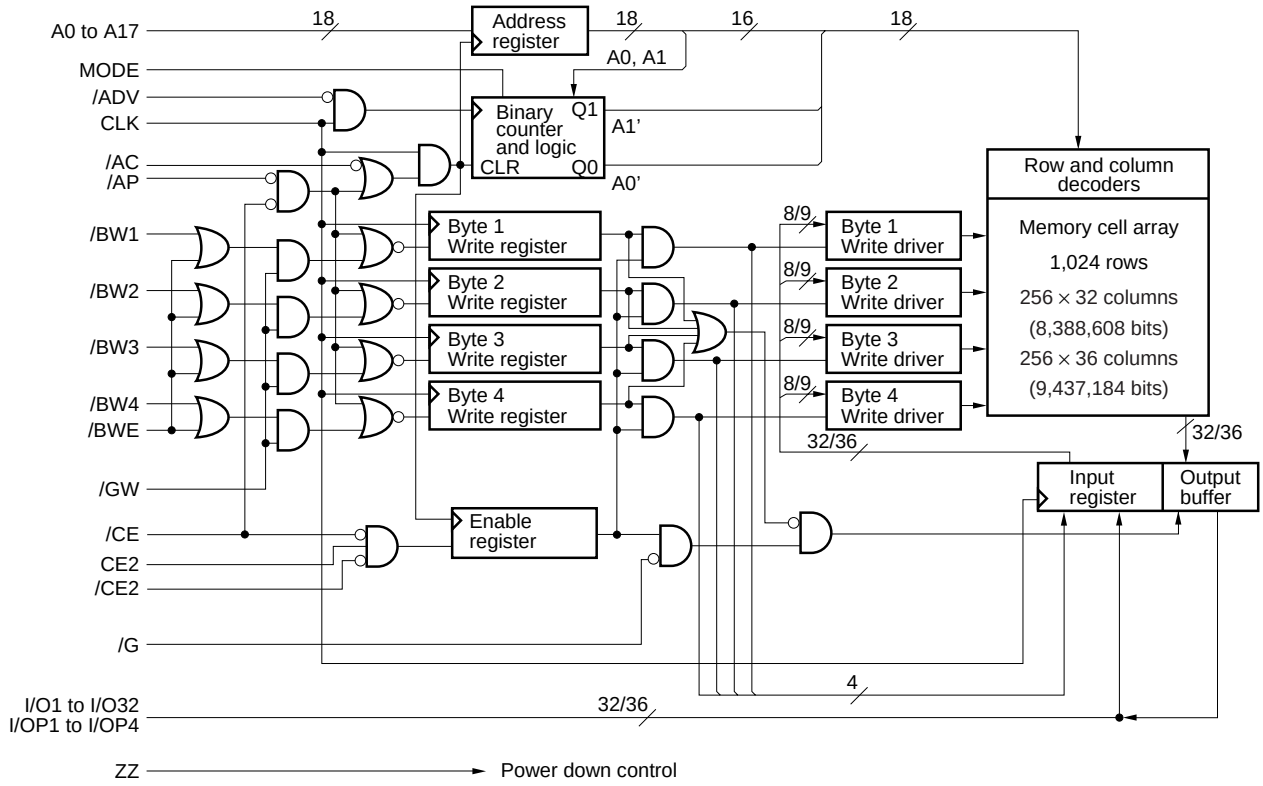
Interleaved Burst Sequence Table (MODE = V_{DD})

External Address	A18 to A2, A1, A0
1st Burst Address	A18 to A2, A1, /A0
2nd Burst Address	A18 to A2, /A1, A0
3rd Burst Address	A18 to A2, /A1, /A0

Linear Burst Sequence Table (MODE = V_{SS})

External Address	A18 to A2, 0, 0	A18 to A2, 0, 1	A18 to A2, 1, 0	A18 to A2, 1, 1
1st Burst Address	A18 to A2, 0, 1	A18 to A2, 1, 0	A18 to A2, 1, 1	A18 to A2, 0, 0
2nd Burst Address	A18 to A2, 1, 0	A18 to A2, 1, 1	A18 to A2, 0, 0	A18 to A2, 0, 1
3rd Burst Address	A18 to A2, 1, 1	A18 to A2, 0, 0	A18 to A2, 0, 1	A18 to A2, 1, 0

[μPD4482321, μPD4482361]



Burst Sequence

[μPD4482321, μPD4482361]

Interleaved Burst Sequence Table (MODE = V_{DD})

External Address	A17 to A2, A1, A0
1st Burst Address	A17 to A2, A1, /A0
2nd Burst Address	A17 to A2, /A1, A0
3rd Burst Address	A17 to A2, /A1, /A0

Linear Burst Sequence Table (MODE = V_{SS})

External Address	A17 to A2, 0, 0	A17 to A2, 0, 1	A17 to A2, 1, 0	A17 to A2, 1, 1
1st Burst Address	A17 to A2, 0, 1	A17 to A2, 1, 0	A17 to A2, 1, 1	A17 to A2, 0, 0
2nd Burst Address	A17 to A2, 1, 0	A17 to A2, 1, 1	A17 to A2, 0, 0	A17 to A2, 0, 1
3rd Burst Address	A17 to A2, 1, 1	A17 to A2, 0, 0	A17 to A2, 0, 1	A17 to A2, 1, 0

Asynchronous Truth Table

Operation	/G	I/O
Read Cycle	L	Dout
Read Cycle	H	High-Z
Write Cycle	×	High-Z, Din
Deselected	×	High-Z

Remark × : don't care

Synchronous Truth Table

Operation	/CE	CE2	/CE2	/AP	/AC	/ADV	/WRITE	CLK	Address
Deselected [Note]	H	×	×	×	L	×	×	L → H	None
Deselected [Note]	L	L	×	L	×	×	×	L → H	None
Deselected [Note]	L	×	H	L	×	×	×	L → H	None
Deselected [Note]	L	L	×	H	L	×	×	L → H	None
Deselected [Note]	L	×	H	H	L	×	×	L → H	None
Read Cycle / Begin Burst	L	H	L	L	×	×	×	L → H	External
Read Cycle / Begin Burst	L	H	L	H	L	×	H	L → H	External
Read Cycle / Continue Burst	×	×	×	H	H	L	H	L → H	Next
Read Cycle / Continue Burst	H	×	×	×	H	L	H	L → H	Next
Read Cycle / Suspend Burst	×	×	×	H	H	H	H	L → H	Current
Read Cycle / Suspend Burst	H	×	×	×	H	H	H	L → H	Current
Write Cycle / Begin Burst	L	H	L	H	L	×	L	L → H	External
Write Cycle / Continue Burst	×	×	×	H	H	L	L	L → H	Next
Write Cycle / Continue Burst	H	×	×	×	H	L	L	L → H	Next
Write Cycle / Suspend Burst	×	×	×	H	H	H	L	L → H	Current
Write Cycle / Suspend Burst	H	×	×	×	H	H	L	L → H	Current

Note Deselect status is held until new "Begin Burst" entry.

Remarks 1. × : don't care

2. /WRITE = L means any one or more byte write enables (/BW1, /BW2, /BW3 or /BW4) and /BWE are LOW or /GW is LOW.

/WRITE = H means the following two cases.

(1) /BWE and /GW are HIGH.

(2) /BW1 to /BW4 and /GW are HIGH, and /BWE is LOW.

Partial Truth Table for Write Enables

[μPD4482161, μPD4482181]

Operation	/GW	/BWE	/BW1	/BW2
Read Cycle	H	H	×	×
Read Cycle	H	L	H	H
Write Cycle / Byte 1 (I/O [1:8], I/OP1)	H	L	L	H
Write Cycle / Byte 2 (I/O [9:16], I/OP2)	H	L	H	L
Write Cycle / All Bytes	H	L	L	L
Write Cycle / All Bytes	L	×	×	×

Remark × : don't care

[μPD4482321, μPD4482361]

Operation	/GW	/BWE	/BW1	/BW2	/BW3	/BW4
Read Cycle	H	H	×	×	×	×
Read Cycle	H	L	H	H	H	H
Write Cycle / Byte 1 (I/O [1:8], I/OP1)	H	L	L	H	H	H
Write Cycle / Byte 2 (I/O [9:16], I/OP2)	H	L	H	L	H	H
Write Cycle / Byte 3 (I/O [17:24], I/OP3)	H	L	H	H	L	H
Write Cycle / Byte 4 (I/O [25:32], I/OP4)	H	L	H	H	H	L
Write Cycle / All Bytes	H	L	L	L	L	L
Write Cycle / All Bytes	L	×	×	×	×	×

Remark × : don't care

ZZ (Sleep) Truth Table

ZZ	Chip Status
≤ 0.2 V	Active
Open	Active
≥ V_{DD} – 0.2 V	Sleep

Electrical Specifications

Absolute Maximum Ratings

	Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Unit	Notes
★	Supply voltage	V_{DD}		-A65, -A75, -A85 -A65Y, -A75Y, -A85Y	–0.5		+4.0	V	
				-C75, -C85 -C75Y, -C85Y	–0.5		+3.0	V	
	Output supply voltage	V_{DDQ}			–0.5		V_{DD}	V	
	Input voltage	V_{IN}			–0.5		V_{DD} + 0.5	V	1, 2
	Input / Output voltage	$V_{I/O}$			–0.5		V_{DDQ} + 0.5	V	1, 2
★	Operating ambient temperature	T_A	-A65, -A75, -A85, -C75, -C85		0		70	°C	
			-A65Y, -A75Y, -A85Y, -C75Y, -C85Y		–40		+85		
	Storage temperature	T_{stg}			–55		+125	°C	

Notes 1. –2.0 V (MIN.)(Pulse width : 2 ns)

2. V_{DDQ} + 2.3 V (MAX.)(Pulse width : 2 ns)

Caution Exposing the device to stress above those listed in Absolute Maximum Ratings could cause permanent damage. The device is not meant to be operated under conditions outside the limits described in the operational section of this specification. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Recommended DC Operating Conditions (1/2)

	Parameter	Symbol	Conditions	-A65, -A75, -A85 -A65Y, -A75Y, -A85Y			Unit
				MIN.	TYP.	MAX.	
	Supply voltage	V_{DD}		3.135	3.3	3.465	V
	2.5 V LVTTL interface						
	Output supply voltage	V_{DDQ}		2.375	2.5	2.9	V
	High level input voltage	V_{IH}		1.7		V_{DDQ} + 0.3	V
	Low level input voltage	V_{IL}		–0.3 Note		+0.7	V
	3.3 V LVTTL interface						
	Output supply voltage	V_{DDQ}		3.135	3.3	3.465	V
	High level input voltage	V_{IH}		2.0		V_{DDQ} + 0.3	V
	Low level input voltage	V_{IL}		–0.3 Note		+0.8	V

Note –0.8 V (MIN.)(Pulse width : 2 ns)

Recommended DC Operating Conditions (2/2)

	Parameter	Symbol	Conditions	-C75, -C85 -C75Y, -C85Y			Unit
				MIN.	TYP.	MAX.	
	Supply voltage	V_{DD}		2.375	2.5	2.625	V
	Output supply voltage	V_{DDQ}		2.375	2.5	2.625	V
	High level input voltage	V_{IH}		1.7		V_{DDQ} + 0.3	V
	Low level input voltage	V_{IL}		–0.3 Note		+0.7	V

Note –0.8 V (MIN.)(Pulse width : 2 ns)

DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

	Parameter	Symbol	Test condition		MIN.	TYP.	MAX.	Unit	Note
	Input leakage current	I_{LI}	V_{IN} (except ZZ, MODE) = 0 V to V_{DD}		–2		+2	μA	
	I/O leakage current	I_{LO}	$V_{I/O}$ = 0 V to $V_{DD}Q$, Outputs are disabled.		–2		+2	μA	
★	Operating supply current	I_{DD}	Device selected, Cycle = MAX. $V_{IN} \le V_{IL}$ or $V_{IN} \ge V_{IH}$, $I_{I/O}$ = 0 mA	-A65 -A65Y			250	mA	
				-A75, -C75 -A75Y, -C75Y			225		
				-A85, -C85 -A85Y, -C85Y			200		
		I_{DD1}	Suspend cycle, Cycle = MAX. /AC, /AP, /ADV, /GW, /BWEs ≥ V_{IH} $V_{IN} \le V_{IL}$ or $V_{IN} \ge V_{IH}$, $I_{I/O}$ = 0 mA				150		
	Standby supply current	I_{SB}	Device deselected, Cycle = 0 MHz $V_{IN} \le V_{IL}$ or $V_{IN} \ge V_{IH}$, All inputs are static.				30	mA	
		I_{SB1}	Device deselected, Cycle = 0 MHz $V_{IN} \le 0.2$ V or $V_{IN} \ge V_{DD} - 0.2$ V $V_{I/O} \le 0.2$ V, All inputs are static.				15		
		I_{SB2}	Device deselected, Cycle = MAX. $V_{IN} \le V_{IL}$ or $V_{IN} \ge V_{IH}$				110		
	Power down supply current	I_{SBZZ}	ZZ ≥ V_{DD} – 0.2 V, $V_{I/O} \le V_{DD}Q$ + 0.2 V				15	mA	
	2.5 V LVTTL interface								
	High level output voltage	V_{OH}	I_{OH} = –2.0 mA		1.7			V	
			I_{OH} = –1.0 mA		2.1				
	Low level output voltage	V_{OL}	I_{OL} = +2.0 mA				0.7	V	
			I_{OL} = +1.0 mA				0.4		
	3.3 V LVTTL interface								
	High level output voltage	V_{OH}	I_{OH} = –4.0 mA		2.4			V	
	Low level output voltage	V_{OL}	I_{OL} = +8.0 mA				0.4	V	

Capacitance (T_A = 25 °C, f = 1 MHz)

Parameter	Symbol	Test condition	MIN.	TYP.	MAX.	Unit
Input capacitance	C_{IN}	V_{IN} = 0 V			6.0	pF
Input / Output capacitance	$C_{I/O}$	$V_{I/O}$ = 0 V			8.0	pF
Clock input capacitance	C_{clk}	V_{clk} = 0 V			6.0	pF

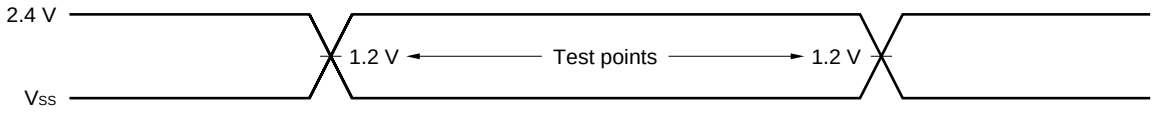
Remark These parameters are periodically sampled and not 100% tested.

AC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

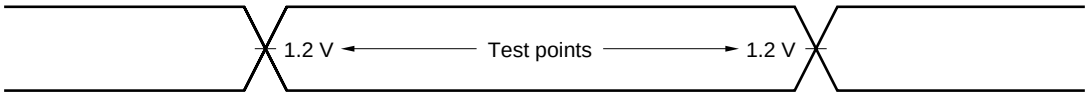
AC Test Conditions

2.5 V LVTTL interface

Input waveform (Rise / Fall time ≤ 2.4 ns)

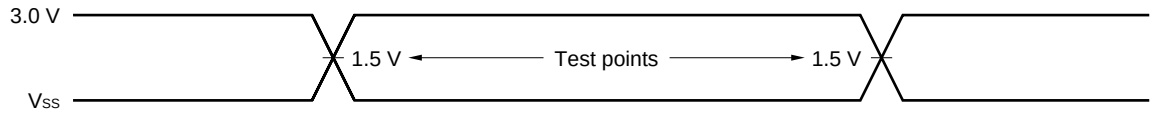


Output waveform

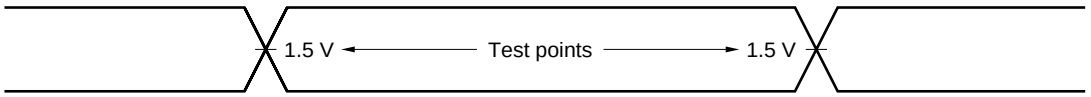


3.3 V LVTTL interface

Input waveform (Rise / Fall time ≤ 3.0 ns)



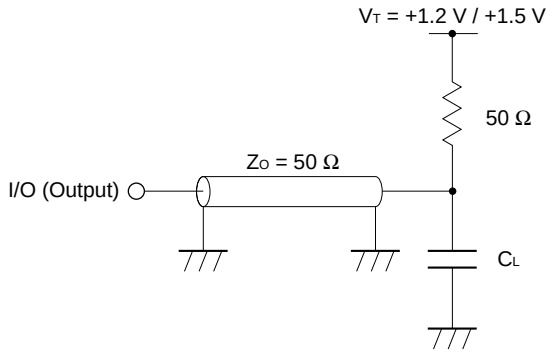
Output waveform



Output load condition

C_L : 30 pF
5 pF (TKHQX1, TKHQX2, TGLQX, TGHQZ, TKHQZ)

External load at test



Remark C_L includes capacitances of the probe and jig, and stray capacitances.

Read and Write Cycle (2.5 V LVTTL Interface)

★

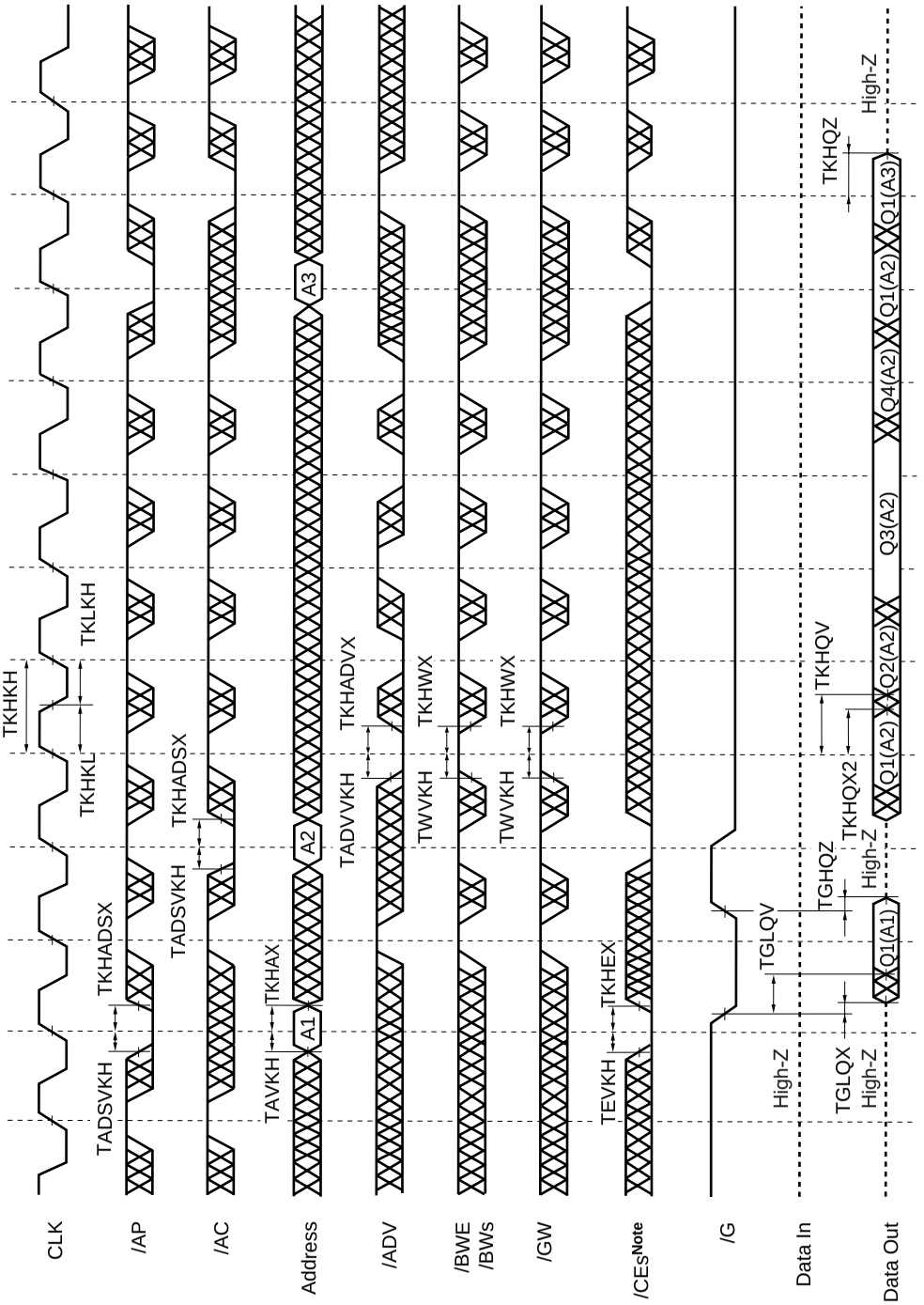
Parameter		Symbol		-A65, -A75, -C75 -A65Y, -A75Y, -C75Y (117 MHz)		-A85, -C85 -A85Y, -C85Y (100MHz)		Unit	Note
		Standard	Alias	MIN.	MAX.	MIN.	MAX.		
Cycle time		TKHKH	TCYC	8.6	–	10.0	–	ns	
Clock access time		TKHQV	TCD	–	7.5	–	8.5	ns	
Output enable access time		TGLQV	TOE	–	3.5	–	3.5	ns	
Clock high to output active		TKHQX1	TDC1	2.5	–	2.5	–	ns	
Clock high to output change		TKHQX2	TDC2	2.5	–	2.5	–	ns	
Output enable to output active		TGLQX	TOLZ	0	–	0	–	ns	
Output disable to output High-Z		TGHQZ	TOHZ	0	3.5	0	3.5	ns	
Clock high to output High-Z		TKHQZ	TCZ	2.5	5.0	2.5	5.0	ns	
Clock high pulse width		TKHKL	TCH	2.5	–	2.5	–	ns	
Clock low pulse width		TKLKH	TCL	2.5	–	2.5	–	ns	
Setup times	Address	TAVKH	TAS	1.5	–	2.0	–	ns	
	Address status	TADSVKH	TSS						
	Data in	TDVKH	TDS						
	Write enable	TWVKH	TWS						
	Address advance	TADVVKH	–						
	Chip enable	TEVKH	–						
Hold times	Address	TKHAX	TAH	0.5	–	0.5	–	ns	
	Address status	TKHADSX	TSH						
	Data in	TKHDX	TDH						
	Write enable	TKHWX	TWH						
	Address advance	TKHADVX	–						
	Chip enable	TKHEX	–						
Power down entry time		TZZE	TZZE	–	8.6	–	10.0	ns	
Power down recovery time		TZZR	TZZR	–	8.6	–	10.0	ns	

Read and Write Cycle (3.3 V LVTTL Interface)

★

Parameter		Symbol		-A65 -A65Y (133 MHz)		-A75 -A75Y (117 MHz)		-A85 -A85Y (100MHz)		Unit	Note
		Standard	Alias	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
Cycle time		TKHKH	TCYC	7.5	–	8.6	–	10.0	–	ns	
Clock access time		TKHQV	TCD	–	6.5	–	7.5	–	8.5	ns	
Output enable access time		TGLQV	TOE	–	3.5	–	3.5	–	3.5	ns	
Clock high to output active		TKHQX1	TDC1	2.5	–	2.5	–	2.5	–	ns	
Clock high to output change		TKHQX2	TDC2	2.5	–	2.5	–	2.5	–	ns	
Output enable to output active		TGLQX	TOLZ	0	–	0	–	0	–	ns	
Output disable to output High-Z		TGHQZ	TOHZ	0	3.5	0	3.5	0	3.5	ns	
Clock high to output High-Z		TKHQZ	TCZ	2.5	5.0	2.5	5.0	2.5	5.0	ns	
Clock high pulse width		TKHKL	TCH	2.5	–	2.5	–	2.5	–	ns	
Clock low pulse width		TKLKH	TCL	2.5	–	2.5	–	2.5	–	ns	
Setup times	Address	TAVKH	TAS	1.5	–	1.5	–	2.0	–	ns	
	Address status	TADSVKH	TSS								
	Data in	TDVKH	TDS								
	Write enable	TWVKH	TWS								
	Address advance	TADVVKH	–								
	Chip enable	TEVKH	–								
Hold times	Address	TKHAX	TAH	0.5	–	0.5	–	0.5	–	ns	
	Address status	TKHADSX	TSH								
	Data in	TKHDX	TDH								
	Write enable	TKHWX	TWH								
	Address advance	TKHADVX	–								
	Chip enable	TKHEX	–								
Power down entry time		TZZE	TZZE	–	7.5	–	8.6	–	10.0	ns	
Power down recovery time		TZZR	TZZR	–	7.5	–	8.6	–	10.0	ns	

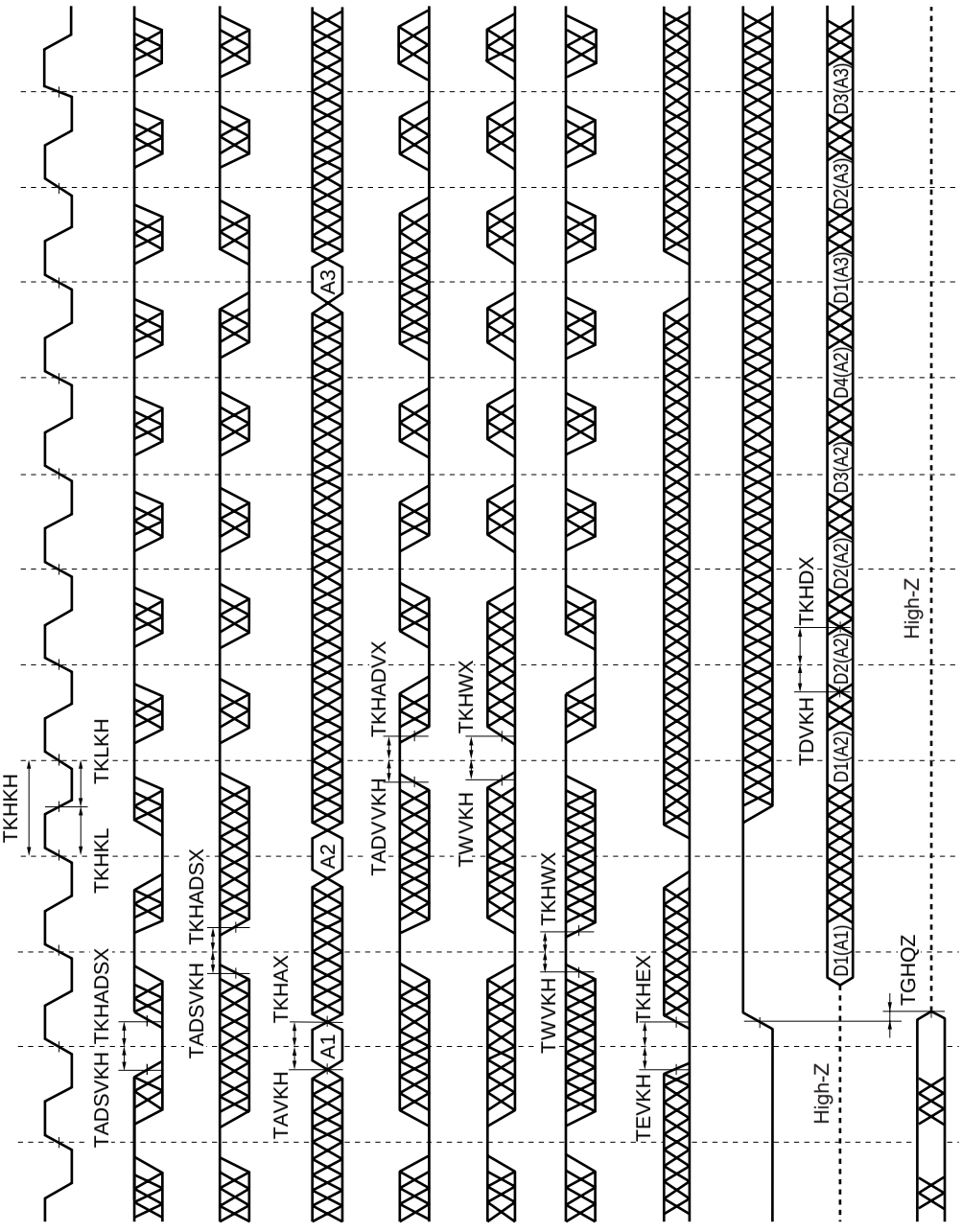
READ CYCLE



Note /CEs refers to /CE, CE2 and /CE2. When /CEs is LOW, /CE and /CE2 are LOW and CE2 is HIGH.
When /CEs is HIGH, /CE and /CE2 are HIGH and CE2 is LOW.

Remark Qn(A2) refers to output from address A2. Q1 to Q4 refer to outputs according to burst sequence.

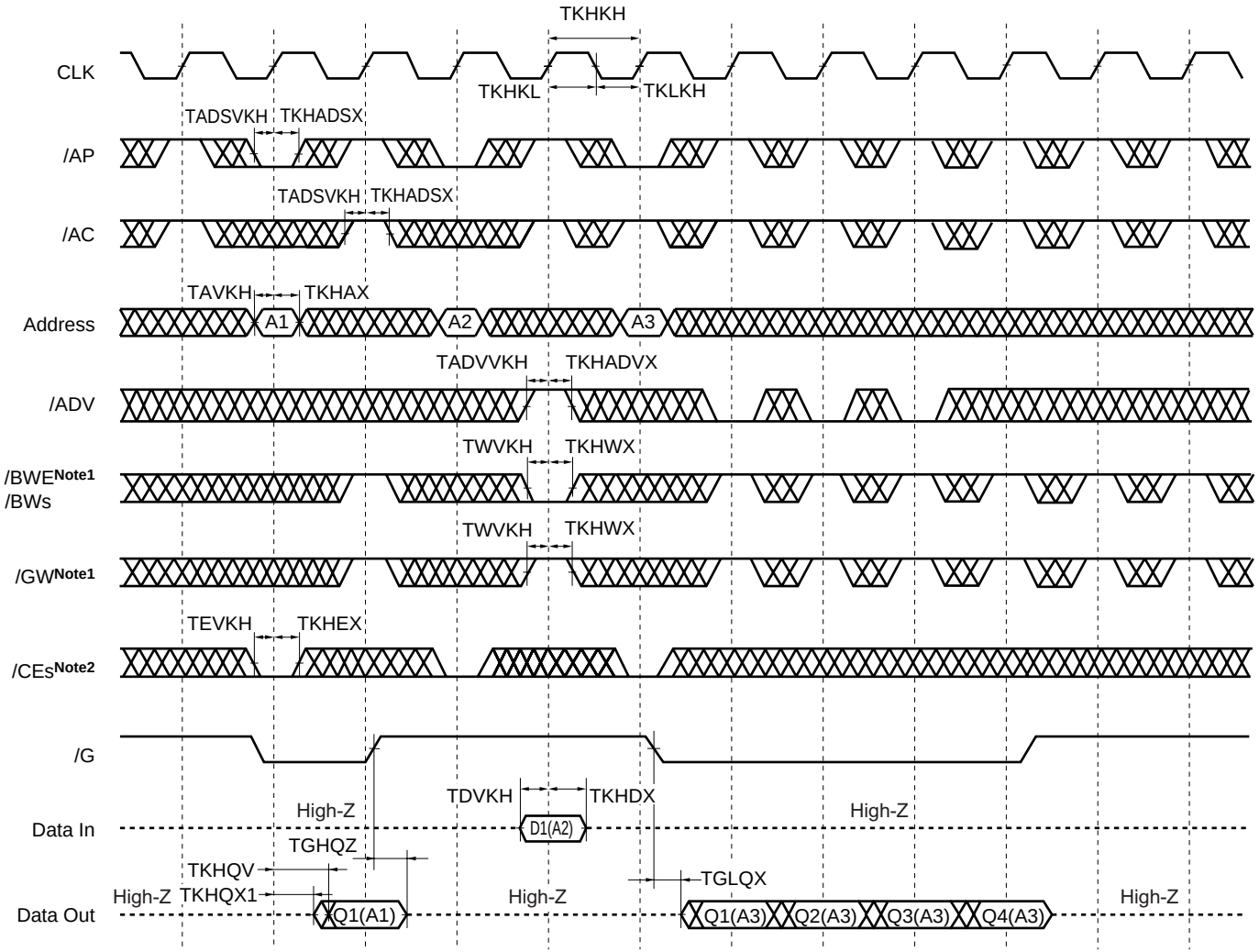
WRITE CYCLE



Notes 1. All bytes WRITE can be initiated by /GW LOW or /GW HIGH and /BWE, /BW1 to /BW4 LOW.

2. /CEs refers to /CE, CE2 and /CE2. When /CEs is LOW, /CE and /CE2 are LOW and CE2 is HIGH. When /CEs is HIGH, /CE and /CE2 are HIGH and CE2 is LOW.

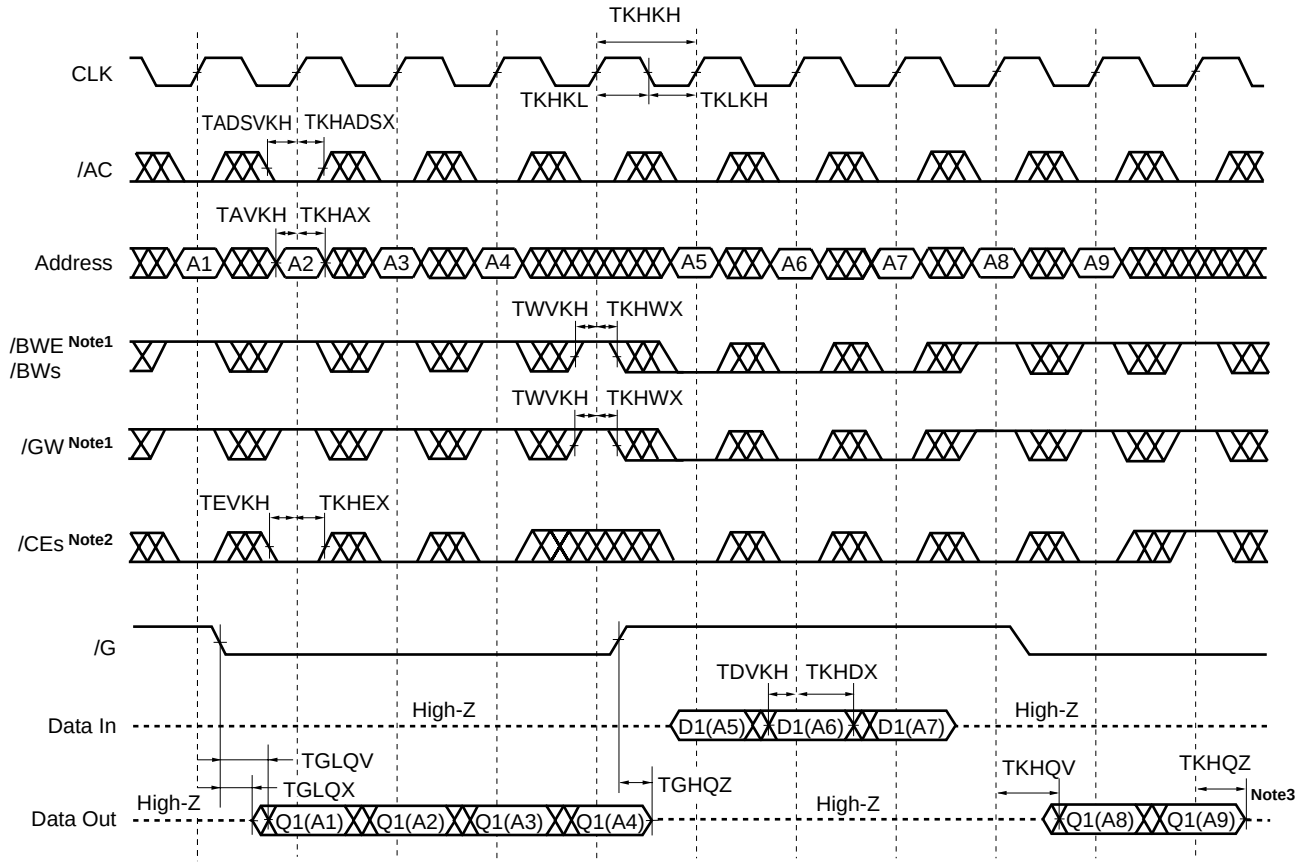
READ / WRITE CYCLE



Notes 1. All bytes WRITE can be initiated by /GW LOW or /GW HIGH and /BWE, /BW1 to /BW4 LOW.

2. /CEs refers to /CE, CE2 and /CE2. When /CEs is LOW, /CE and /CE2 are LOW and CE2 is HIGH. When /CEs is HIGH, /CE and /CE2 are HIGH and CE2 is LOW.

✦ SINGLE READ / WRITE CYCLE



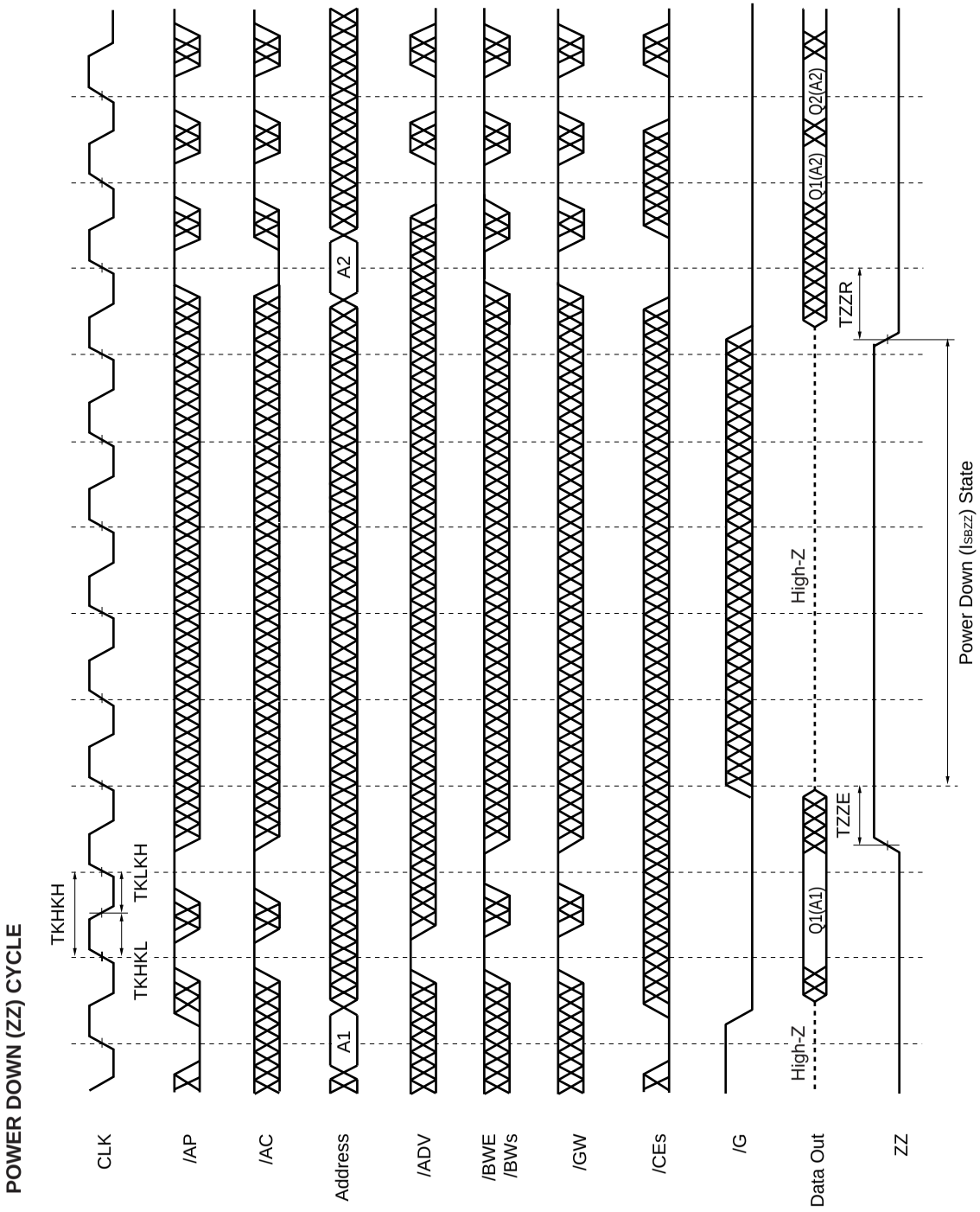
Notes **1.** All bytes WRITE can be initiated by /GW LOW or /GW HIGH and /BWE, /BW1 to /BW4 LOW.

2. /CEs refers to /CE, CE2 and /CE2. When /CEs is LOW, /CE and /CE2 are LOW and CE2 is HIGH. When /CEs is HIGH, /CE and /CE2 are HIGH and CE2 is LOW.

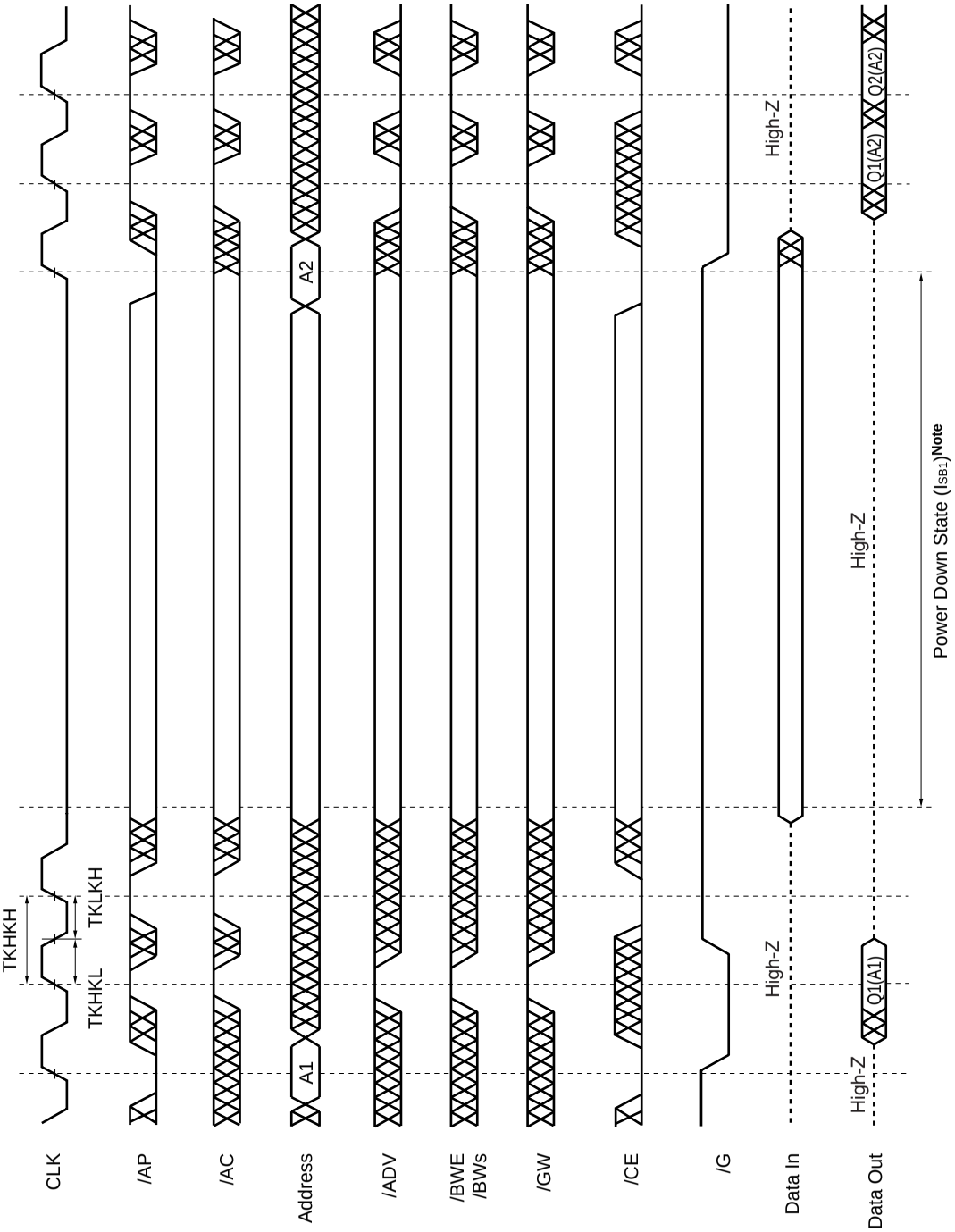
3. Outputs are disabled within one clock cycle after deselect.

Remark /AP is HIGH and /ADV is don't care.

POWER DOWN (ZZ) CYCLE



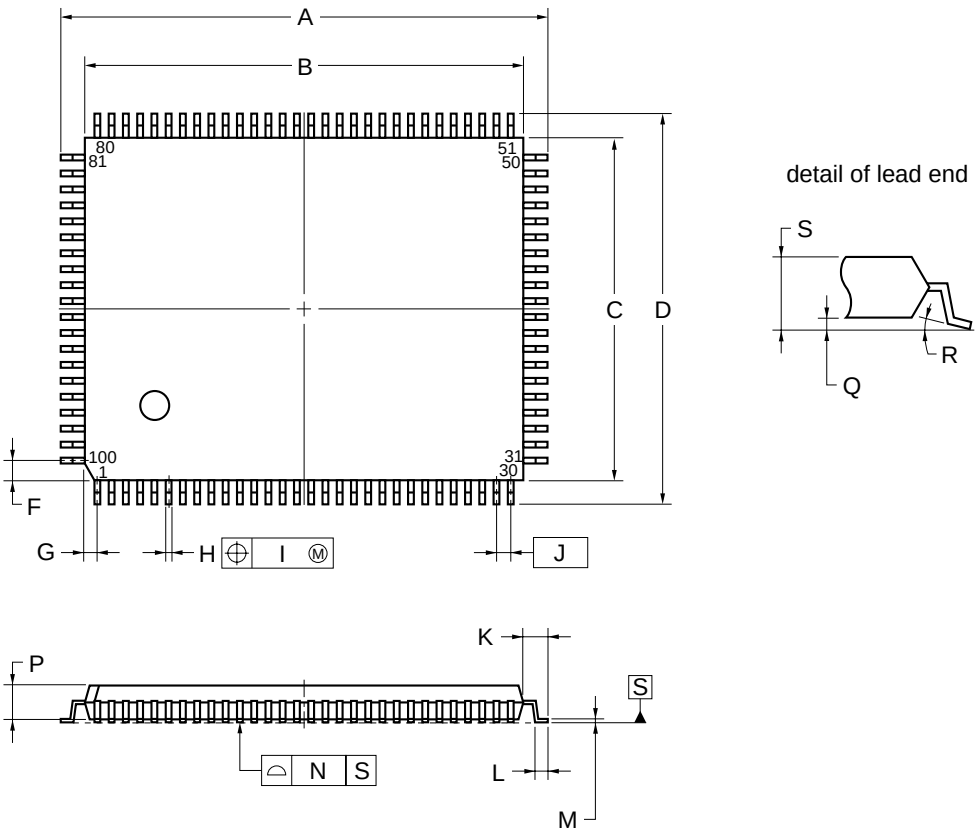
STOP CLOCK CYCLE



Note $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{DD} - 0.2$ V, $V_{I/O} \leq 0.2$ V

Package Drawing

100-PIN PLASTIC LQFP (14x20)



NOTE

Each lead centerline is located within 0.13 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	22.0±0.2
B	20.0±0.2
C	14.0±0.2
D	16.0±0.2
F	0.825
G	0.575
H	$0.32^{+0.08}_{-0.07}$
I	0.13
J	0.65 (T.P.)
K	1.0±0.2
L	0.5±0.2
M	$0.17^{+0.06}_{-0.05}$
N	0.10
P	1.4
Q	0.125±0.075
R	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$
S	1.7 MAX.

S100GF-65-8ET-1

Recommended Soldering Condition

Please consult with our sales offices for soldering conditions of the μPD4482161, 4482181, 4482321 and 4482361.

Types of Surface Mount Devices

μPD4482161GF : 100-pin PLASTIC LQFP (14 x 20)

μPD4482181GF : 100-pin PLASTIC LQFP (14 x 20)

μPD4482321GF : 100-pin PLASTIC LQFP (14 x 20)

μPD4482361GF : 100-pin PLASTIC LQFP (14 x 20)

Revision History

Edition/ Date	Page		Type of revision	Location	Description (Previous edition → This edition)
	This edition	Previous edition			
3rd edition/ Dec. 2002	Throughout	Throughout	Modification	–	Preliminary Data Sheet → Data Sheet
			Addition	–	Extended operating temperature products (T_A = –40 to +85 °C)
	p.20	–	Addition	Timing Chart	SINGLE READ / WRITE CYCLE

[MEMO]

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

- **The information in this document is current as of December, 2002. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".
  The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.
  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.
  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).
  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)
(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).