NEC

MOS INTEGRATED CIRCUIT
μPD4443362

4M-BIT CMOS SYNCHRONOUS FAST STATIC RAM
128K-WORD BY 36-BIT
HSTL INTERFACE / REGISTER-REGISTER / LATE WRITE

Description

The μPD4443362 is a 131,072 words by 36 bits synchronous static RAM fabricated with advanced CMOS technology using Full-CMOS six-transistor memory cell.

The μPD4443362 is suitable for applications which require synchronous operation, high-speed, low voltage, high-density memory and wide bit configuration, such as cache and buffer memory.

The μPD4443362 is packaged in 100-pin plastic LQFP with a 1.4 mm package thickness for high density and low capacitive loading.

Features

- Fully synchronous operation
- HSTL Input / Output levels
- ★ • Fast clock access time : 3.8 ns (133 MHz)
- Asynchronous output enable control : /G
- Byte write control : /SBa (DQa1-9), /SBb (DQb1-9), /SBc (DQc1-9), /SBd (DQd1-9)
- Common I/O using three-state outputs
- Internally self-timed write cycle
- Late write with 1 dead cycle between Read-Write
- 3.3 V (Chip) / 1.5 V (I/O) supply
- 100-pin plastic LQFP package, 14 mm x 20 mm
- Sleep Mode : ZZ (Enables sleep mode, active high)

★ Ordering Information

Part number	Access time	Clock frequency	Package
μPD4443362GF-A75	3.8 ns	133 MHz	100-PIN PLASTIC LQFP (14 x 20)

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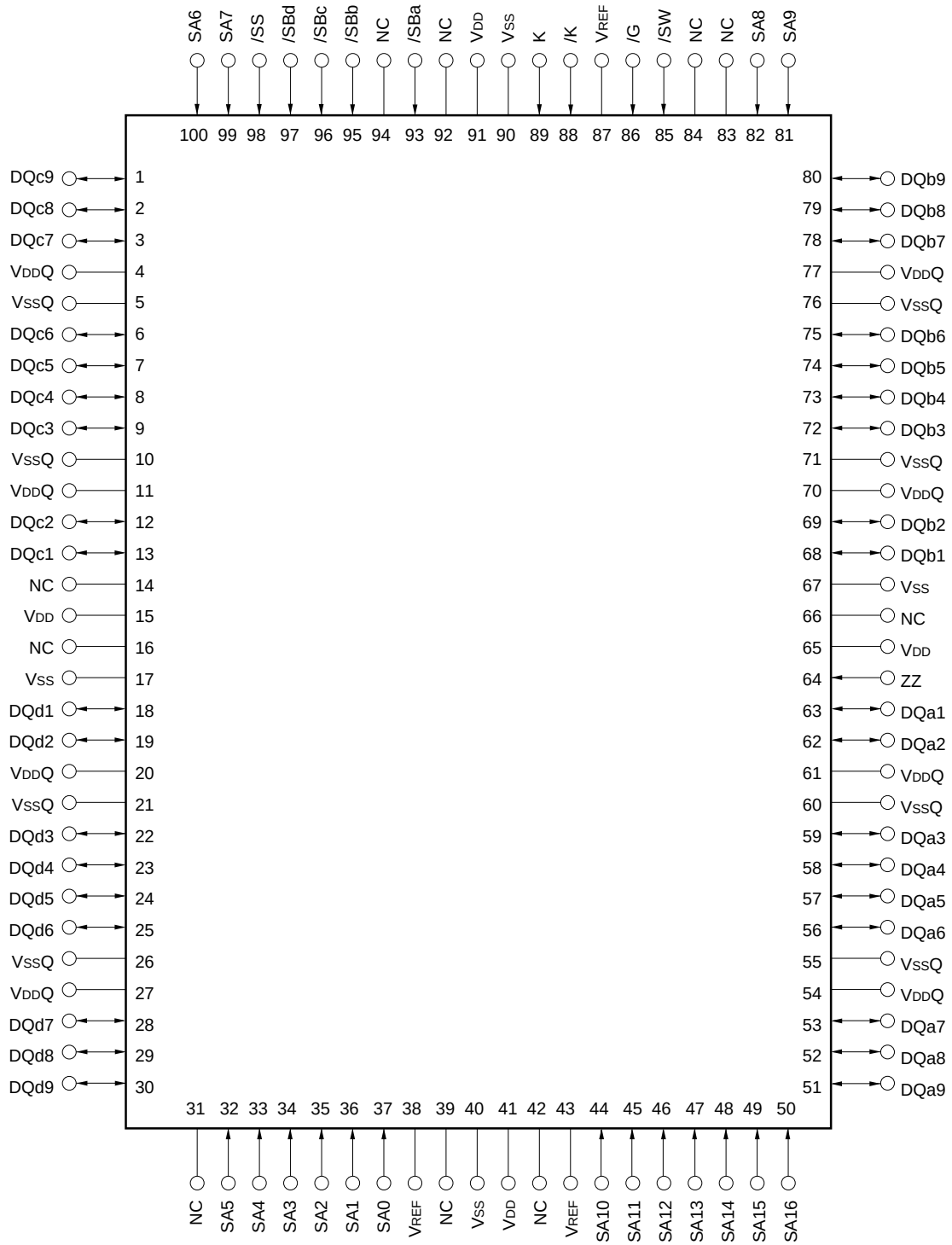
The mark ★ shows major revised points.

Pin Configuration (Marking Side)

/xxx indicates active low signal.

100-PIN PLASTIC LQFP (14 x 20)

[μPD4443362GF]



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

Pin Name and Functions

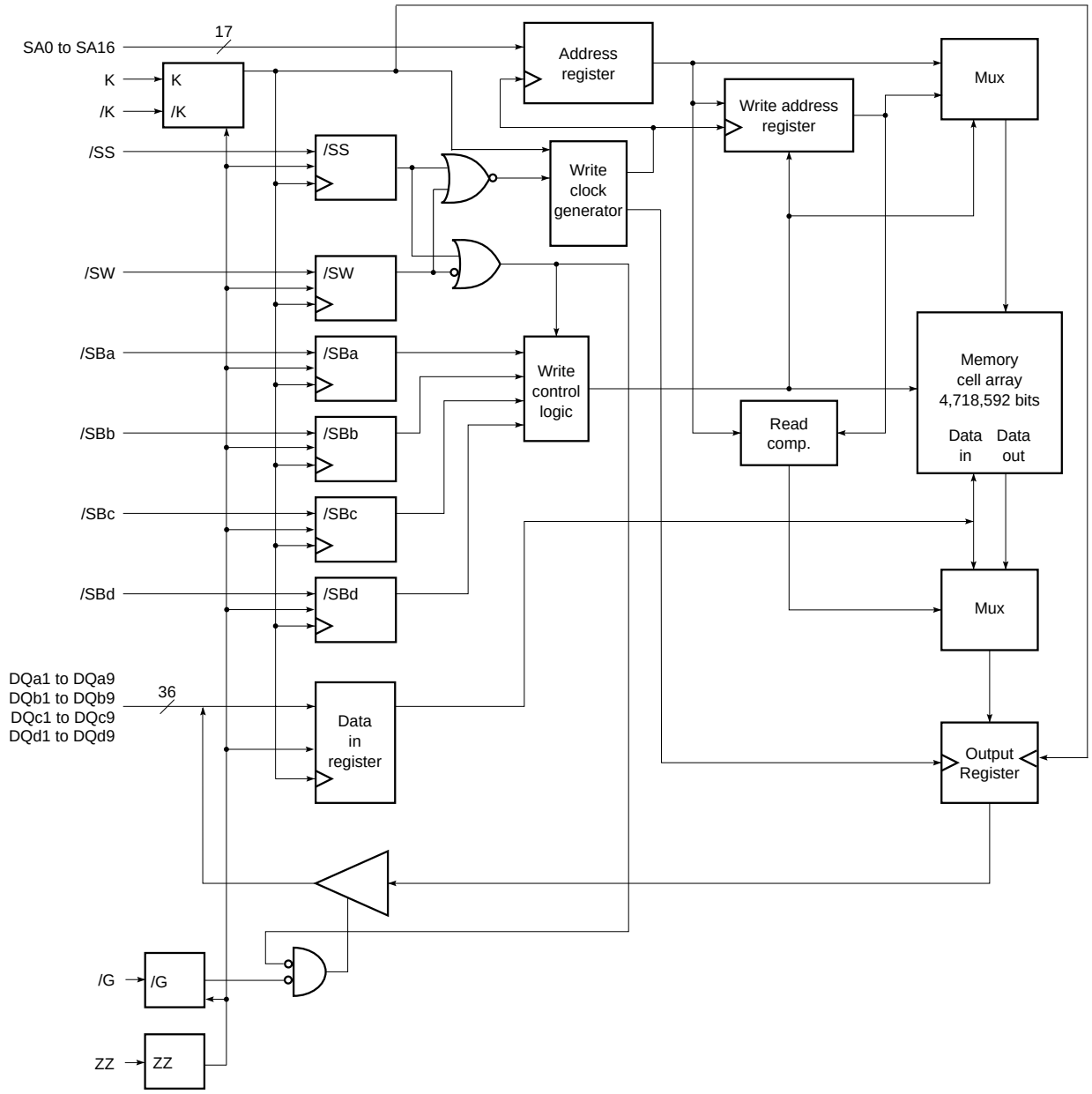
Pin name	Pin No.	Description
SA0 to SA16	37, 36, 35, 34, 33, 32, 100, 99, 82, 81, 44, 45, 46, 47, 48, 49, 50	Synchronous Address Input
DQa1 to DQa9	63, 62, 59, 58, 57, 56, 53, 52, 51	Synchronous Data Input / Output
DQb1 to DQb9	68, 69, 72, 73, 74, 75, 78, 79, 80	
DQc1 to DQc9	13, 12, 9, 8, 7, 6, 3, 2, 1	
DQd1 to DQd9	18, 19, 22, 23, 24, 25, 28, 29, 30	
/SS	98	Synchronous Chip Select
/SW	85	Synchronous Byte Write Enable
/SBa Note1	93	Synchronous Byte "a" Write Enable
/SBb Note1	95	Synchronous Byte "b" Write Enable
/SBc Note1	96	Synchronous Byte "c" Write Enable
/SBd Note1	97	Synchronous Byte "d" Write Enable
/G	86	Asynchronous Output Enable
ZZ Note2	64	Asynchronous Sleep Mode
K, /K	89, 88	Main Clock Input
V_{DD}	15, 41, 65, 91	Core 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
V_{REF}	38, 43, 87	Input Reference
NC	14, 16, 31, 39, 42, 66, 83, 84, 92, 94	No Connection

Notes 1. If Byte Write Operation is not used, Byte Write Pins (/SBa, /SBb, /SBc, /SBd) are to be tied to V_{SS}.

2. If Sleep Mode is not used, ZZ Pin is to be tied to V_{SS}.

Remark This device only supports Single Differential Clock, R / R Mode.
(R / R stands for Registered Input / Registered Output.)

Late Write Block Diagram



Synchronous Truth Table

ZZ	/SS	/SW	/SBa	/SBb	/SBc	/SBd	Mode	DQa1–9	DQb1–9	DQc1–9	DQd1–9	Power
L	H	×	×	×	×	×	Not selected	Hi-Z	Hi-Z	Hi-Z	Hi-Z	Active
L	L	H	×	×	×	×	Read	Dout	Dout	Dout	Dout	Active
L	L	L	L	L	L	L	Write	Din	Din	Din	Din	Active
L	L	L	L	H	H	H	Write	Din	Hi-Z	Hi-Z	Hi-Z	Active
L	L	L	H	L	L	L	Write	Hi-Z	Din	Din	Din	Active
L	L	L	H	H	H	H	Abort Write	Hi-Z	Hi-Z	Hi-Z	Hi-Z	Active
H	×	×	×	×	×	×	Sleep Mode	Hi-Z	Hi-Z	Hi-Z	Hi-Z	Standby

Remark × : Don't care

Output Enable Truth Table

Mode	/G	DQ
Read	L	Dout
Read	H	Hi-Z
Sleep (ZZ=H)	×	Hi-Z
★ Write (/SW=L)	×	Hi-Z, Din
Deselect (/SS=H)	×	Hi-Z

Remark × : Don't care

Electrical Specifications

Absolute Maximum Ratings

	Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Note
★	Supply voltage	V_{DD}		–0.5		+4.0	V	1
★	Output supply voltage	V_{DDQ}		–0.5		+4.0	V	1
	Input voltage	V_{IN}		–0.5		V_{DD}+0.3	V	1
	Input / Output voltage	$V_{I/O}$		–0.5		V_{DDQ}+0.3	V	1
★	Operating temperature	T_A		0		50	°C	
	Storage temperature	T_{stg}		–55		+125	°C	

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

Caution Exposing the device to stress above those listed in Absolute Maximum Rating 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 (T_A = 0 to 50 °C)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Core supply voltage	V_{DD}		3.135	3.3	3.465	V
Output buffer supply voltage	V_{DDQ}		1.4	1.5	1.6	V
Input reference voltage	V_{REF}		0.7	0.75	0.8	V
Low level input voltage	V_{IL}		–0.3 Note		V_{REF}–0.1	V
High level input voltage	V_{IH}		V_{REF}+0.1		V_{DDQ}+0.3	V

Note –0.8 V MIN. (Pulse width : 2 ns)

★ **Recommended AC Operating Conditions (T_A = 0 to 50 °C)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input reference voltage	$V_{REF\ (RMS)}$		–5%		+5%	V
Low level input voltage	V_{IL}		–0.3		V_{REF}–0.2	V
High level input voltage	V_{IH}		V_{REF}+0.2		V_{DDQ}+0.3	V

Capacitance (T_A = 25 °C, f = 1 MHz)

	Parameter Note	Symbol	Test conditions	MAX.	Unit
★	Input capacitance	C_{IN}	V_{IN} = 0 V	5.5	pF
	Input / Output capacitance	$C_{I/O}$	$V_{I/O}$ = 0 V	7.0	pF
	Clock Input Capacitance	C_{clk}	V_{clk} = 0 V	6.0	pF

Note These parameters are not 100% tested.

DC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
	Input leakage current	I_{LI}	V_{IN} = 0 to V_{DD}	–5		+5	μA
	DQ leakage current	I_{LO}	$V_{I/O}$ = 0 to $V_{DD}Q$	–5		+5	μA
★	Operating supply current	I_{DD}	V_{IN} = V_{IH} or V_{IL}, /SS = V_{IL}, ZZ = V_{IL}, Cycle = MAX., I_{DQ} = 0 mA			350	mA
★	Sleep mode power supply current	I_{SBZZ}	ZZ = V_{IH}, All other inputs = V_{IH} or V_{IL}, Cycle = DC, I_{DQ} = 0 mA			20	mA

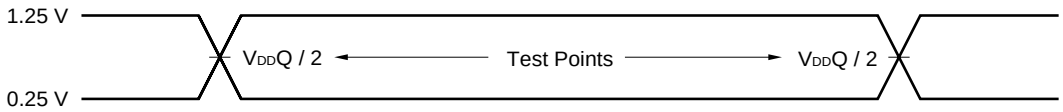
Output Voltage on Push-Pull Output Buffer Mode

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Low level output voltage	V_{OL}	I_{OL} = +2 mA	–		0.3	V
High level output voltage	V_{OH}	I_{OH} = –2 mA	$V_{DD}Q$–0.3		–	V

AC Characteristics (Recommended Operating Conditions Unless Otherwise Noted)

AC Characteristics Test Conditions

★ **Input waveform (rise and fall time = 0.5 ns (20 to 80%))**

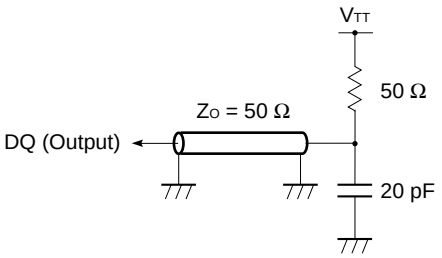


Output waveform

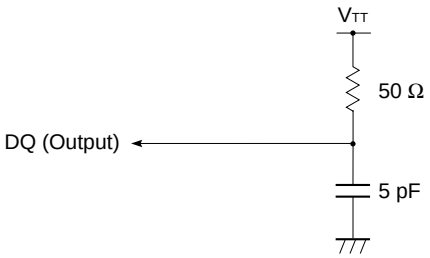
★ **Single Differential Clock, Registered Input / Registered Output Mode**

Parameter		Symbol	–A75 (133 MHz)		Unit	Notes
			MIN.	MAX.		
Clock cycle time		t_{KHKH}	7.5	–	ns	
Clock phase time		t_{KHKL} / t_{KLKH}	2.0	–	ns	
Setup times	Address	t_{AVKH}	1.5	–	ns	
	Write data	t_{DVKH}				
	Write enable	t_{WVKH}				
	Chip select	t_{SVKH}				
Hold times	Address	t_{KHAX}	0.5	–	ns	
	Write data	t_{KHDX}				
	Write enable	t_{KHWX}				
	Chip select	t_{KHSX}				
Clock access time		t_{KHQV}	–	3.8	ns	1
K high to Q change		t_{KHQX}	1.5	–	ns	2
/G low to Q valid		t_{GLQV}	–	3.8	ns	1
/G low to Q change		t_{GLQX}	0	–	ns	2
/G high to Q Hi-Z		t_{GHQZ}	0	3.8	ns	2
K high to Q Hi-Z (/SW)		t_{KHQZ}	1.5	3.8	ns	2
K high to Q Hi-Z (/SS)		t_{KHQZ2}	1.5	3.8	ns	2
K high to Q Lo-Z		t_{KHQX2}	1.5	–	ns	2
Sleep Mode Recovery		t_{ZZR}	–	7.5	ns	
Sleep Mode Enable		t_{ZZE}	–	7.5	ns	

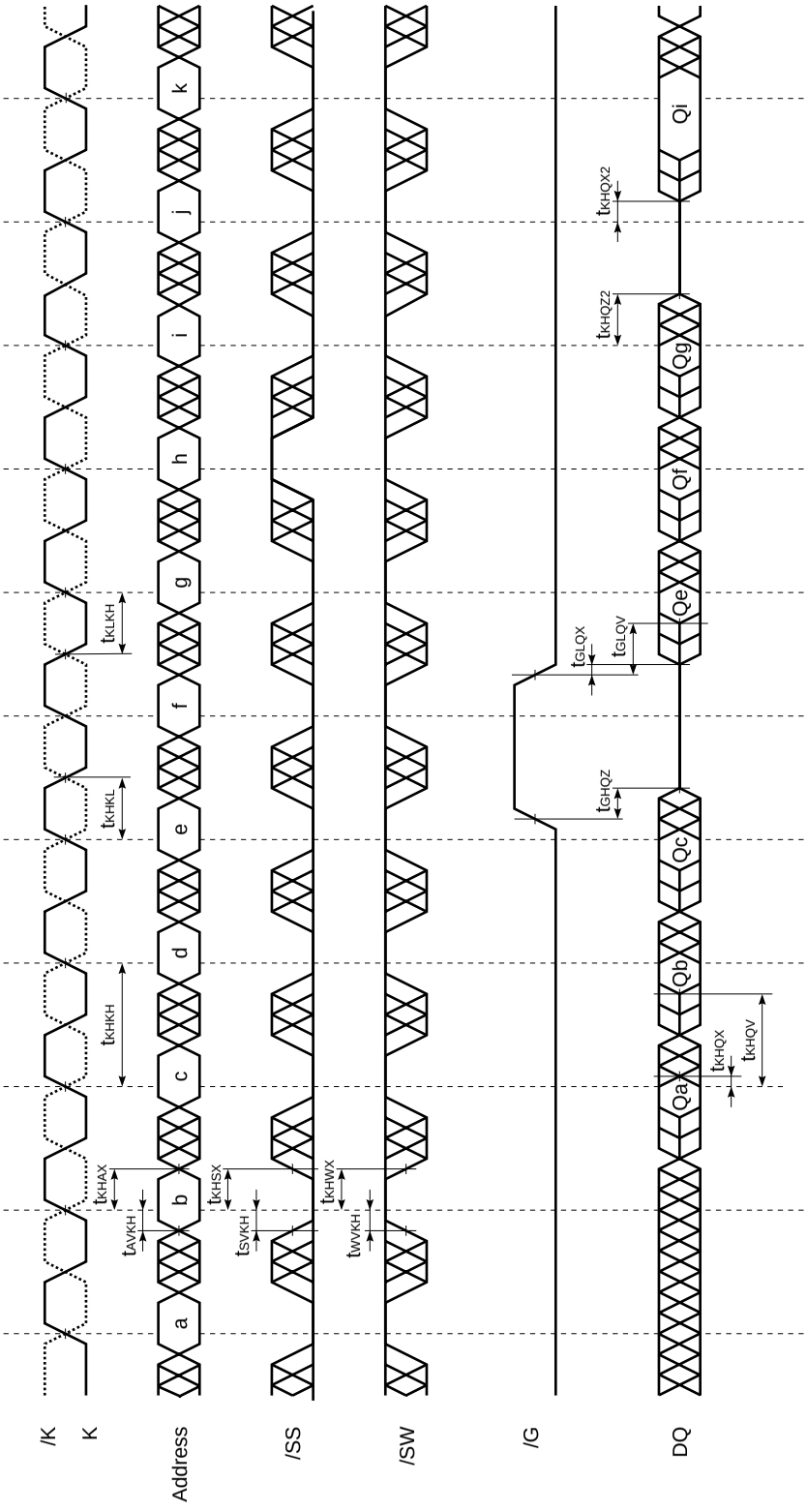
Notes 1. See figure. (V_{TT} = 0.75 V)



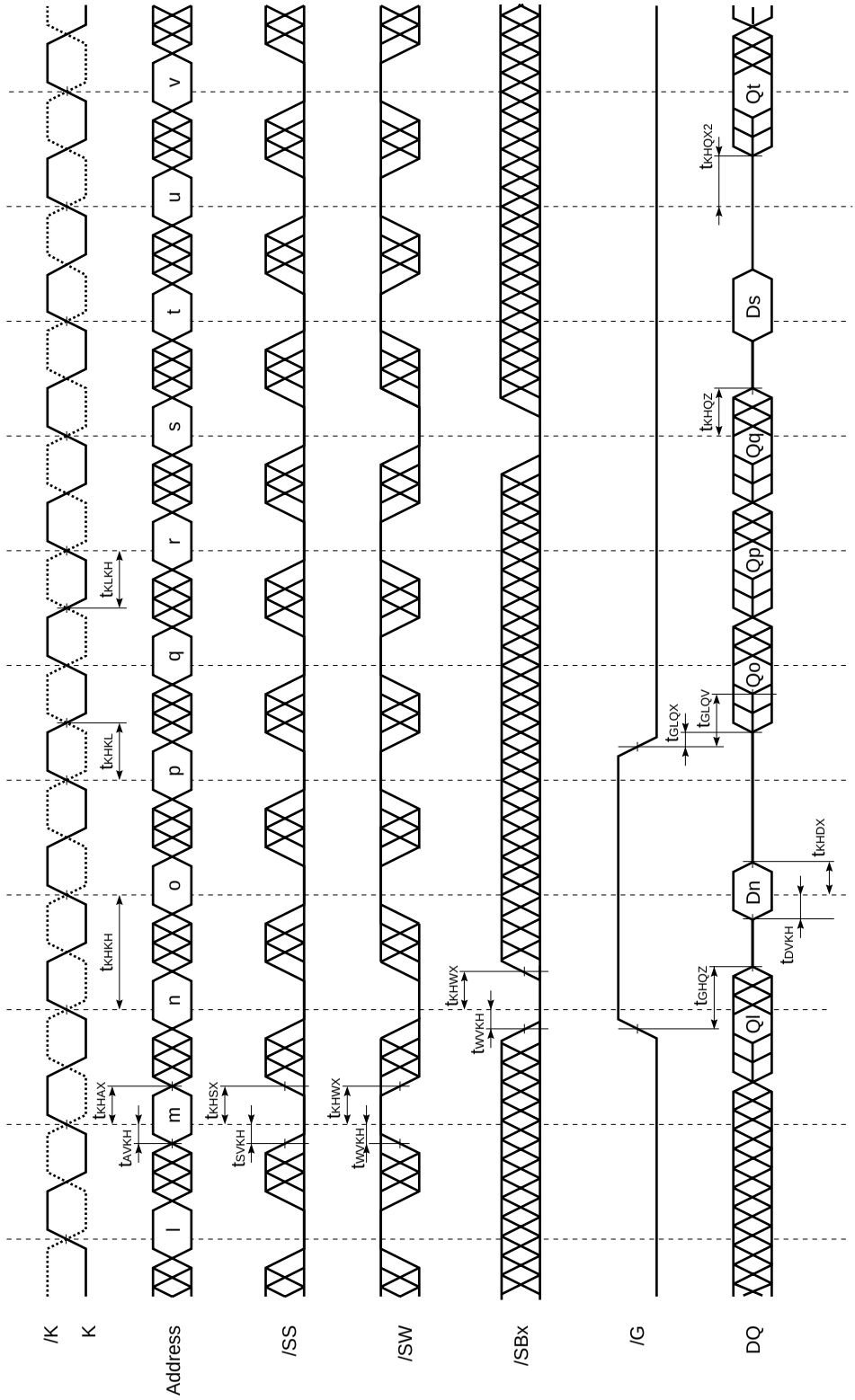
2. See figure. (V_{TT} = 0.75 V)



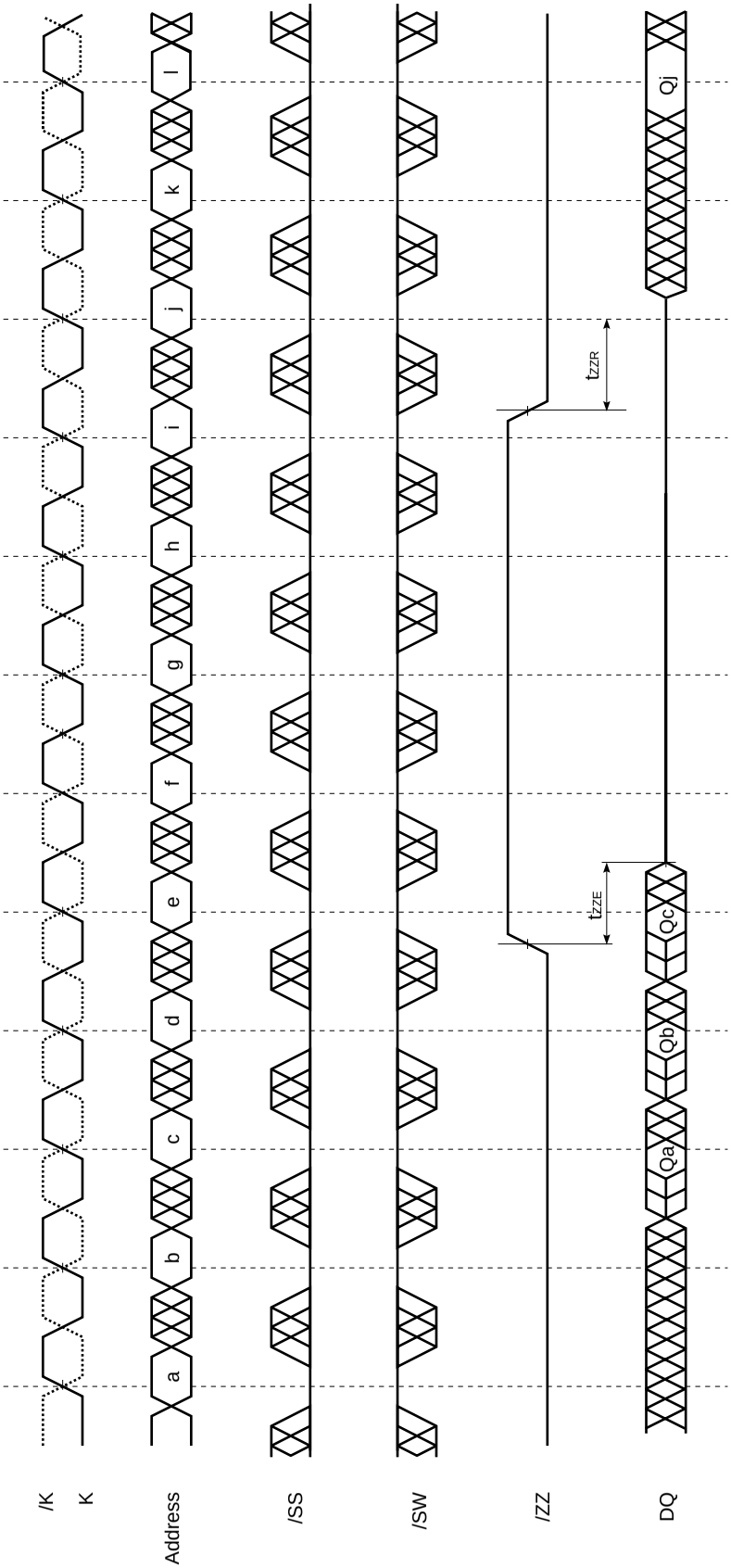
Read Operation



Write Operation

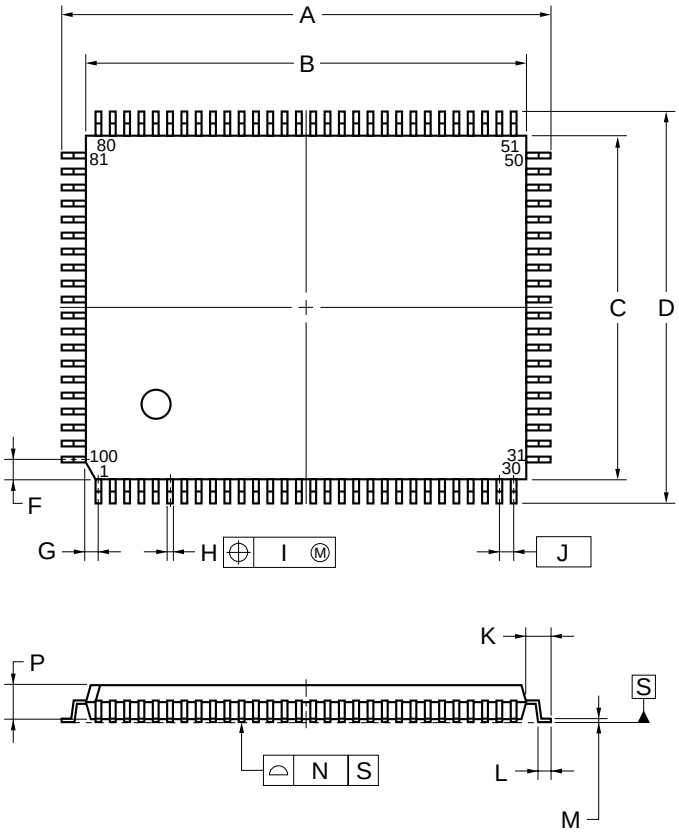


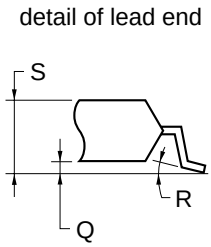
Sleep Mode



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 Conditions

Please consult with our sales offices for soldering conditions of the μPD4443362.

Type of Surface Mount Device

μPD4443362GF: 100-PIN PLASTIC LQFP (14 x 20)

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.

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