

## 96-BIT AC-PDP DRIVER

**DESCRIPTION**

The  $\mu$  PD16340 is a high withstand voltage CMOS driver designed for use with a flat display panel such as a PDP, VFD, or EL panel. It consists of a 96-bit bi-directional shift register, 96-bit latch and high withstand voltage CMOS driver. The logic block operates with a 5-V power supply interface (CMOS level input) so that it can be directly connected to a gate array and microcontroller. The driver block provides a high withstand voltage output: 80 V, +50/-75 mA MAX. The logic and driver blocks are made of CMOS circuits, consuming lower power.

**FEATURES**

- Circuit configuration switched by the IBS pin between three 32-bit bi-directional shift registers and six 16-bit bidirectional shift registers.
- Data control with transfer clock (external) and latch
- High-speed data transfer ( $f_{MAX.} = 40$  MHz MIN. at data latch)  
( $f_{MAX.} = 25$  MHz MIN. at cascade connection)
- High withstand output voltage (80 V, +50/-75 mA MAX.)
- 5-V CMOS input interface
- High withstand voltage CMOS structure

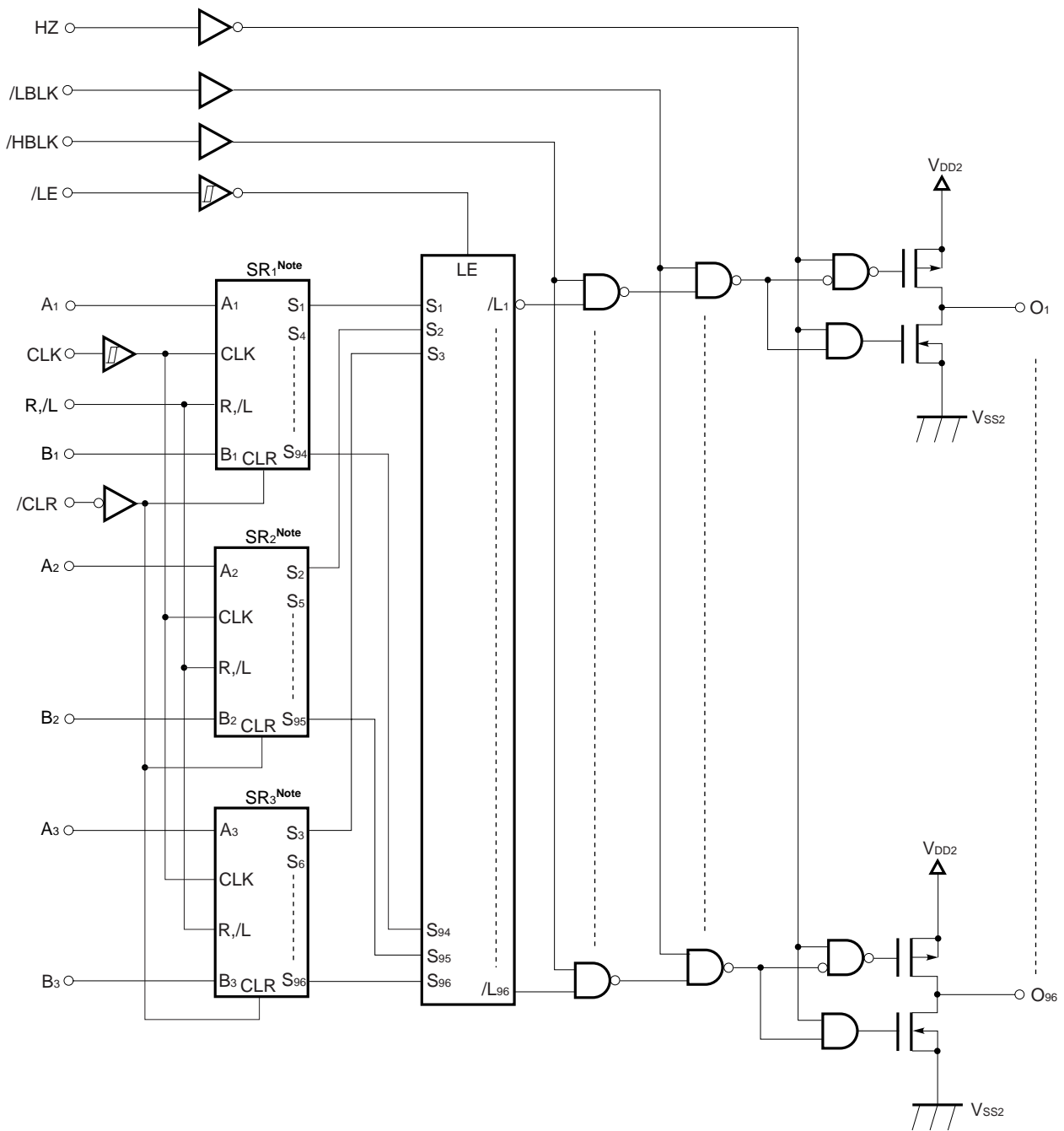
★ **ORDERING INFORMATION**

Part Number	Package
$\mu$ PD16340	Module

**Caution** Consult an NEC sales representative regarding the module. Since the module characteristics is based on the module specifications, there may be differences between the contents written in this document and real characteristics.

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

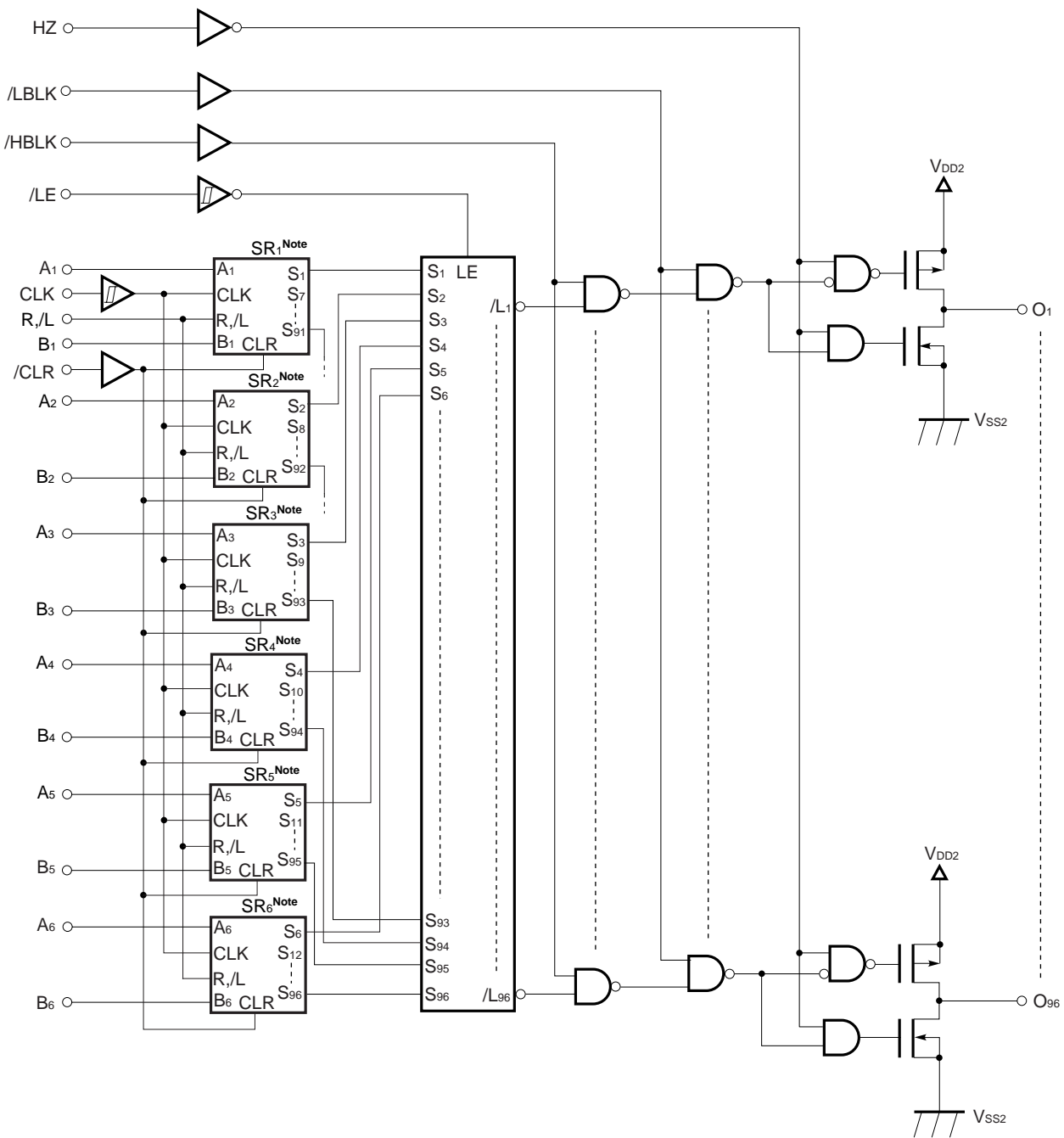
**BLOCK DIAGRAM 1 (IBS = H, 3-BIT INPUT, 32-BIT LENGTH SHIFT REGISTER)**



**Note** SR<sub>n</sub>: 32-bit shift register

**Remark** /xxx indicates active low signal.

**BLOCK DIAGRAM 2 (IBS = L, 6-BIT INPUT, 16-BIT LENGTH SHIFT REGISTER)**



**Note** SR<sub>n</sub>: 16-bit shift register

**PIN FUNCTIONS**

Symbol	Pin Name	Description
/LCLK	Low blanking input	/LCLK = L : All output = L
/HCLK	High blanking input	/HCLK = L : All output = H
/LE	Latch enable input	Latch on a falling edge
HZ	Output high impedance	H: All output set to the high-impedance state
/CLR	Register clear input	L: All shift register data cleared to the L level
A <sub>1</sub> -A <sub>3(6)</sub>	RIGHT data input/output <sup>Note</sup>	R,/L = H, the parenthesized pins are used in 6-bit input mode. A <sub>1</sub> -A <sub>3(6)</sub> : Input, B <sub>1</sub> -B <sub>3(6)</sub> : Output
B <sub>1</sub> -B <sub>3(6)</sub>	LEFT data input/output <sup>Note</sup>	R,/L = L, the parenthesized pins are used in 6-bit input mode. A <sub>1</sub> -A <sub>3(6)</sub> : Output, B <sub>1</sub> -B <sub>3(6)</sub> : Input
CLK	Clock input	Shift on a rising edge
R,/L	Shift control input	H: Right shift mode SR <sub>1</sub> : A <sub>1</sub> → S <sub>1</sub> .....S <sub>94</sub> → B <sub>1</sub> (SR <sub>2</sub> and SR <sub>3</sub> also shift in the same direction.) Left shift mode SR <sub>1</sub> : B <sub>1</sub> → S <sub>94</sub> .....S <sub>1</sub> → A <sub>1</sub> (SR <sub>2</sub> and SR <sub>6</sub> also shift in the same direction.)
IBS	Input mode switch	H: 32-bit shift registers, 3-bit input mode L: 16-bit shift registers, 6-bit input mode
O <sub>1</sub> to O <sub>96</sub>	High withstand voltage output	80 V, +50/-75 mA MAX.
V <sub>DD1</sub>	Logic power supply	5 V ± 10 %
V <sub>DD2</sub>	Driver power supply	10 to 70 V
V <sub>SS1</sub>	Logic ground	Connect to system ground
V <sub>SS2</sub>	Driver ground	Connect to system ground

**Note** In 3-bit input mode, unused I/O pins must be held at the L level.  
To use for module, the back side of IC chip must be held at the V<sub>ss</sub> (GND) level.

**TRUTH TABLE**

**Shift Register Block**

Input		Output		Shift Register
R <sub>n</sub> /L	CLK	A	B	
H	↑	Input	Output <sup>Note1</sup>	Right shift operation performed
H	H or L		Output	Hold
L	↑	Output <sup>Note2</sup>	Input	Left shift operation performed
L	H or L	Output		Hold

- Notes**
1. On the rising edge of the clock, the data of S<sub>91</sub>-S<sub>93</sub> (S<sub>85</sub>-S<sub>90</sub>) is shifted to S<sub>94</sub>-S<sub>96</sub> (S<sub>91</sub>-S<sub>96</sub>), and is output from B<sub>1</sub>-B<sub>3</sub> (B<sub>1</sub>-B<sub>6</sub>) (The parenthesized pins are used in 6-bit input mode.).
  2. On the rising edge of the clock, the data of S<sub>4</sub>-S<sub>6</sub> (S<sub>7</sub>-S<sub>12</sub>) is shifted to S<sub>1</sub>-S<sub>3</sub> (S<sub>1</sub>-S<sub>6</sub>), and is output from A<sub>1</sub>-A<sub>3</sub> (A<sub>1</sub>-A<sub>6</sub>) (The parenthesized pins are used in 6-bit input mode.).

**Latch Block**

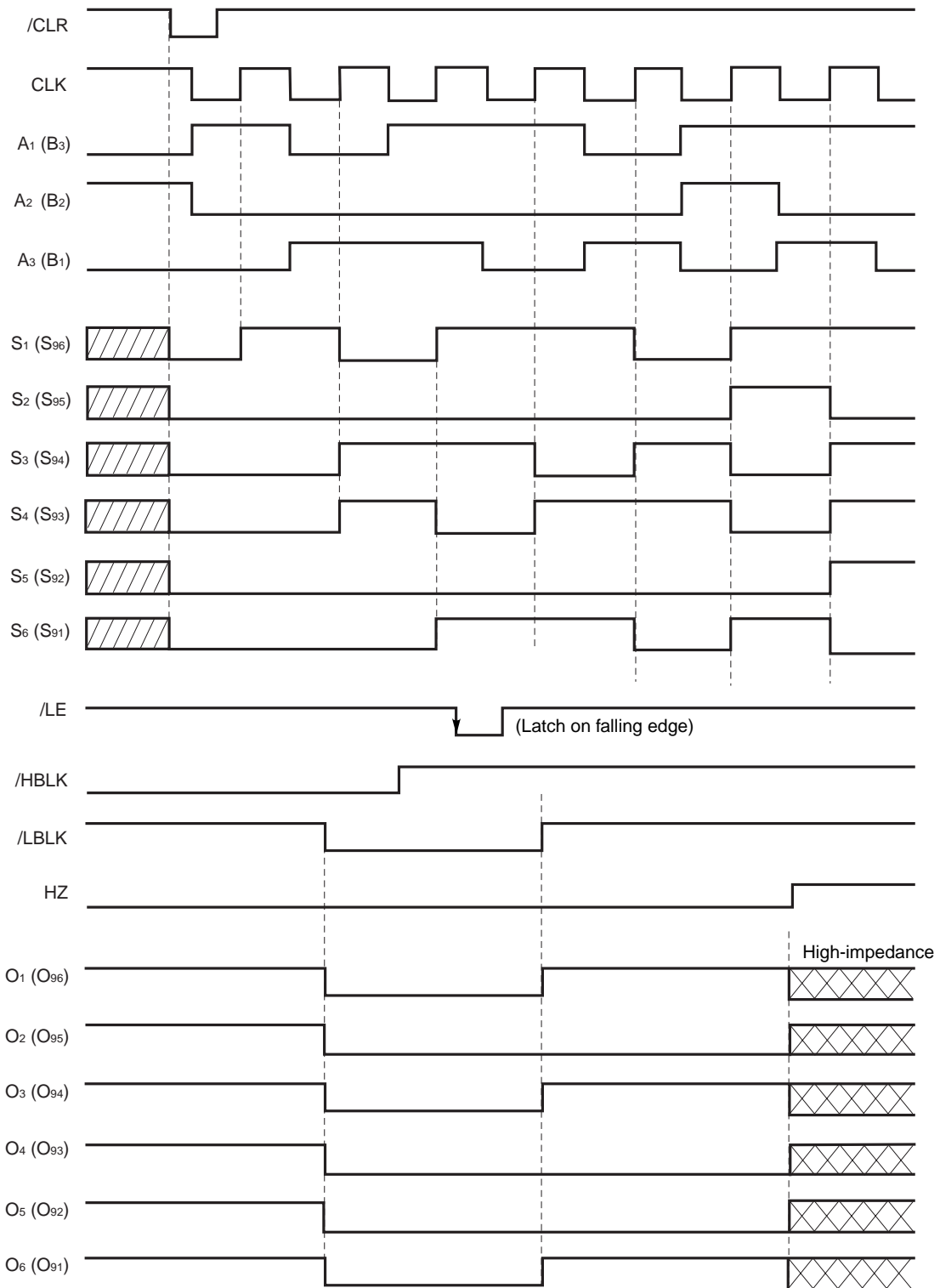
/LE	Output State of Latch Section (/L <sub>n</sub> )
↓	Latch S <sub>n</sub> data
H or L	Hold latch (output) data

**Driver Block**

A (B)	/HBLK	/LBLK	HZ	Output State of Driver Block
x	L	H	L	All driver output : H
x	x	L	L	All driver output : L
x	x	x	H	All driver output : High Impedance
L	H	H	L	L
H	H	H	L	H

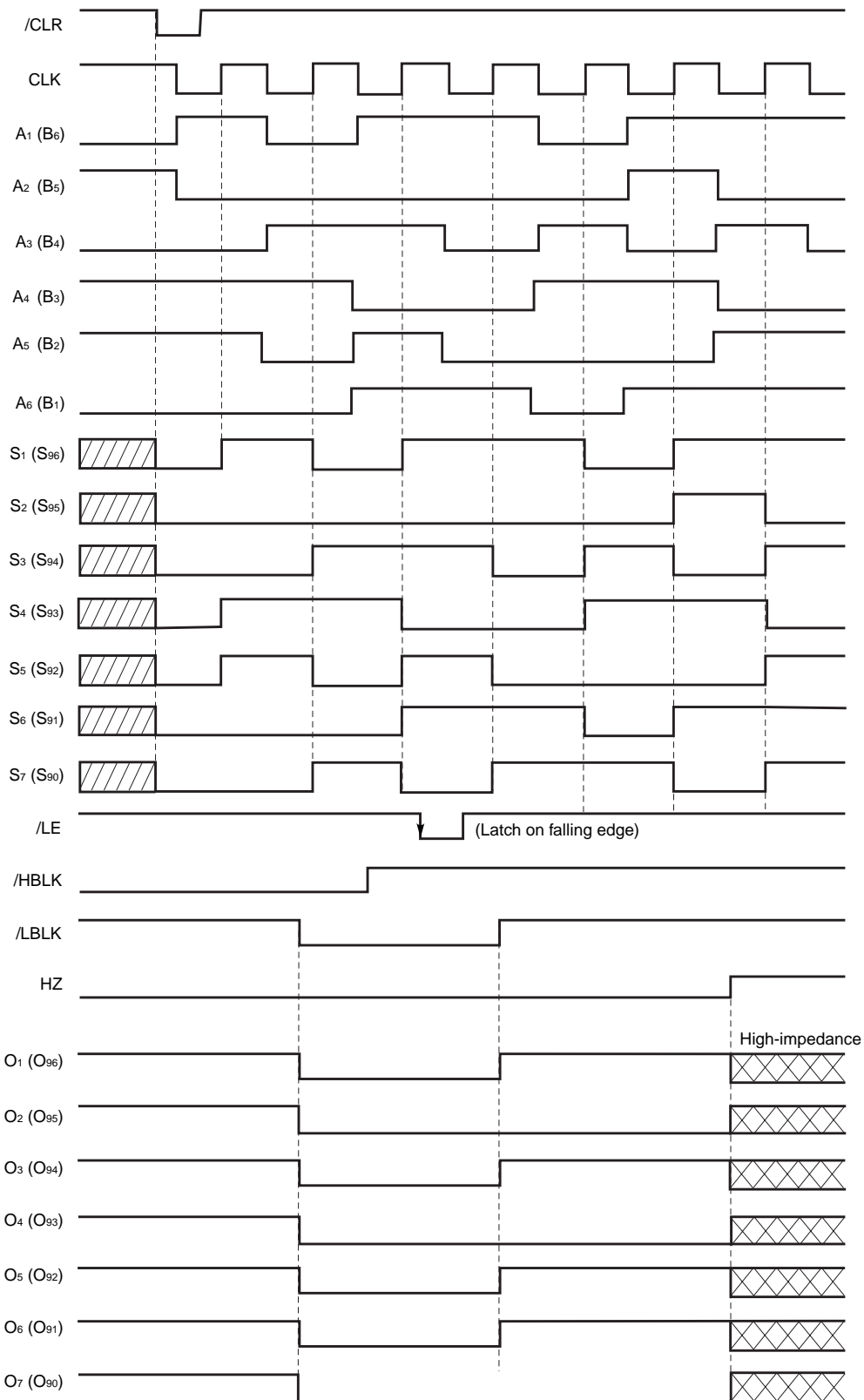
**Remark** x : H or L, H : High level, L : Low level

**TIMING CHART 1 (IBS = H, 3-BIT INPUT, RIGHT SHIFT)**



**Remark** Values in parentheses are when R,/L = L.

**TIMING CHART 2 (IBS = L, 6-BIT INPUT, RIGHT SHIFT)**



**Remark** Values in parentheses are when R,/L = L.

**ELECTRICAL SPECIFICATIONS**

**Absolute Maximum Ratings (T<sub>A</sub> = 25 °C, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

Parameter	Symbol	Ratings	Unit
Logic Supply Voltage	V <sub>DD1</sub>	-0.5 to +6.0	V
Driver Supply Voltage	V <sub>DD2</sub>	-0.5 to +80	V
Logic Input Voltage	V <sub>I</sub>	-0.5 to V <sub>DD1</sub> + 0.5	V
Driver Output Current	I <sub>O2</sub>	+50 / -75	mA
Operating Junction Temperature	T <sub>J</sub>	+125	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C

**Caution** If the absolute maximum rating of even one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

**Recommended Operating Range (T<sub>A</sub> = -40 to +85 °C, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Logic Supply Voltage	V <sub>DD1</sub>		4.5	5.0	5.5	V
Driver Supply Voltage	V <sub>DD2</sub>		15		70	V
High-Level Input Voltage	V <sub>IH</sub>		0.7 V <sub>DD1</sub>		V <sub>DD1</sub>	V
Low-Level Input Voltage	V <sub>IL</sub>		0		0.2 V <sub>DD1</sub>	V
Driver Output Current	I <sub>OH2</sub>				-60	mA
	I <sub>OL2</sub>				+40	mA

**Electrical Characteristics (T<sub>A</sub> = 25 °C, V<sub>DD1</sub> = 5.0 V, V<sub>DD2</sub> = 70 V, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
High-Level Output Voltage	V <sub>OH1</sub>	Logic, I <sub>OH1</sub> = -1.0 mA	0.9 V <sub>DD1</sub>		V <sub>DD1</sub>	V
Low-Level Output Voltage	V <sub>OL1</sub>	Logic, I <sub>OL1</sub> = 1.0 mA	0		0.1 V <sub>DD1</sub>	V
High-Level Output Voltage	V <sub>OH21</sub>	O <sub>1</sub> to O <sub>96</sub> , I <sub>OH2</sub> = -1.3 mA	69			V
	V <sub>OH22</sub>	O <sub>1</sub> to O <sub>96</sub> , I <sub>OH2</sub> = -13 mA	65			V
Low-Level Output Voltage	V <sub>OL21</sub>	O <sub>1</sub> to O <sub>96</sub> , I <sub>OL2</sub> = 5 mA			1.0	V
	V <sub>OL22</sub>	O <sub>1</sub> to O <sub>96</sub> , I <sub>OL2</sub> = 40 mA			10	V
Input Leakage Current	I <sub>IL</sub>	V <sub>1</sub> = V <sub>DD1</sub> or V <sub>SS1</sub>			±1.0	μ A
High-Level Input Voltage	V <sub>IH</sub>		0.7 V <sub>DD1</sub>			V
Low-Level Input Voltage	V <sub>IL</sub>				0.2 V <sub>DD1</sub>	V
★ ★ Static Current Dissipation	I <sub>DD1</sub>	Logic, T <sub>A</sub> = -40 to +85 °C			500	μ A
		Logic, T <sub>A</sub> = 25 °C			300	μ A
	I <sub>DD2</sub>	Driver, T <sub>A</sub> = -40 to +85 °C			1000	μ A
		Driver, T <sub>A</sub> = 25 °C			100	μ A

Switching Characteristics (T<sub>A</sub> = 25 °C, V<sub>DD1</sub> = 5.0 V, V<sub>DD2</sub> = 70 V, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V, Logic C<sub>L</sub> = 15 pF,

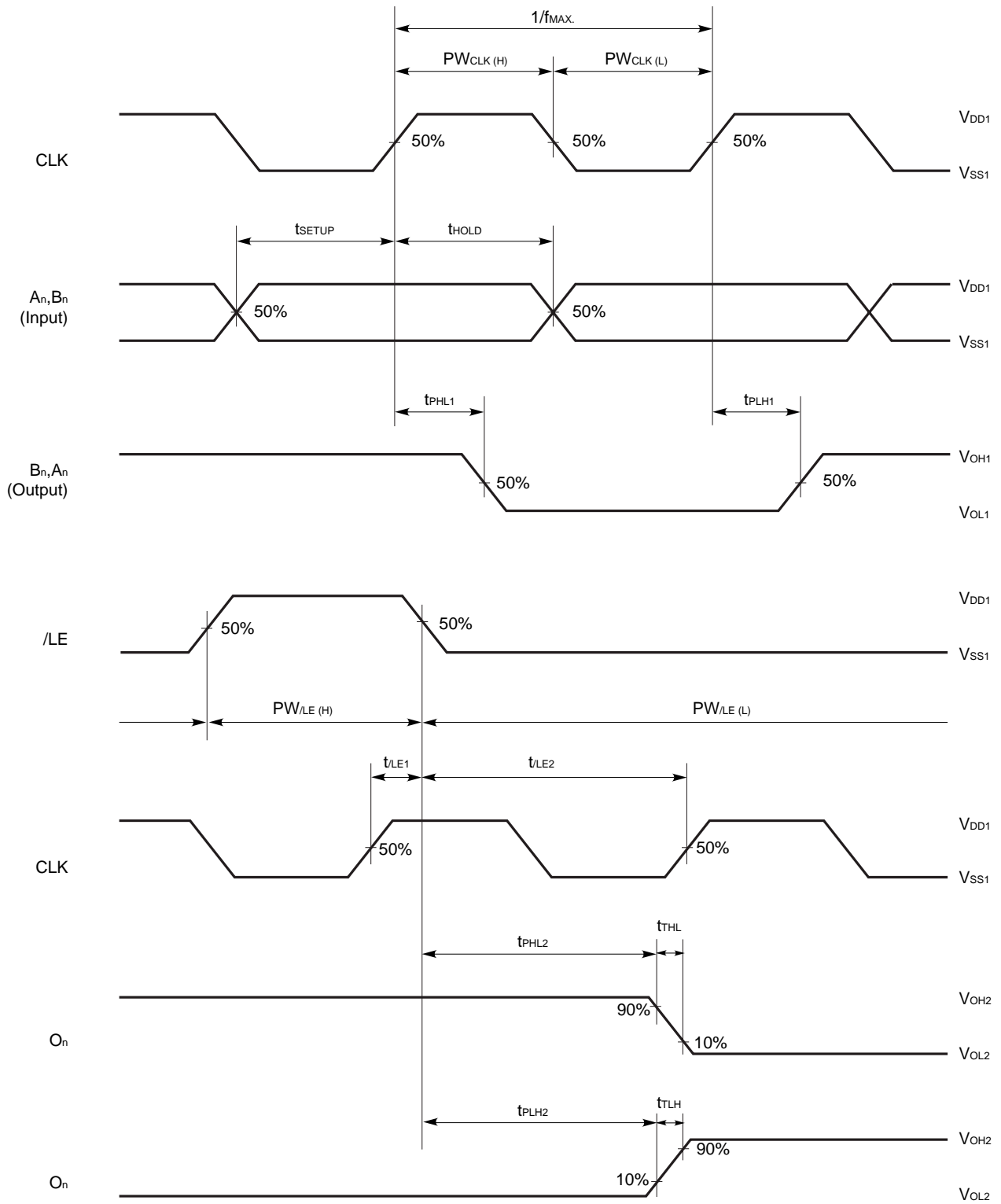
Driver C<sub>L</sub> = 50 pF, t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Propagation Delay Time	t <sub>PHL1</sub>	CLK ↑ → A/B			34	ns
	t <sub>PLH1</sub>				34	ns
	t <sub>PHL2</sub>	/LE ↓ → O <sub>1</sub> to O <sub>96</sub>			180	ns
	t <sub>PLH2</sub>				180	ns
	t <sub>PHL3</sub>	/HBLK → O <sub>1</sub> to O <sub>96</sub>			165	ns
	t <sub>PLH3</sub>				165	ns
	t <sub>PHL4</sub>	/LBLK → O <sub>1</sub> to O <sub>96</sub>			160	ns
	t <sub>PLH4</sub>				160	ns
	t <sub>PHZ</sub>	HZ → O <sub>1</sub> to O <sub>96</sub> , R <sub>L</sub> = 10 kΩ			300	ns
	t <sub>PZH</sub>				180	ns
	t <sub>PLZ</sub>				300	ns
	t <sub>PZL</sub>				180	ns
Rise Time	t <sub>TLH</sub>	O <sub>1</sub> to O <sub>96</sub>			120	ns
	t <sub>TLZ</sub>	O <sub>1</sub> to O <sub>96</sub> , R <sub>L</sub> = 10 kΩ			3	μs
	t <sub>TZH</sub>				120	ns
Fall Time	t <sub>THL</sub>	O <sub>1</sub> to O <sub>96</sub>			150	ns
	t <sub>THZ</sub>	O <sub>1</sub> to O <sub>96</sub> , R <sub>L</sub> = 10 kΩ			3	μs
	t <sub>TZL</sub>				150	ns
Maximum Clock Frequency	f <sub>MAX.</sub>	Data latch, duty = 50 %	40			MHz
		Cascade connection, Duty = 50 %	25			MHz
Input Capacitance	C <sub>I</sub>				15	pF

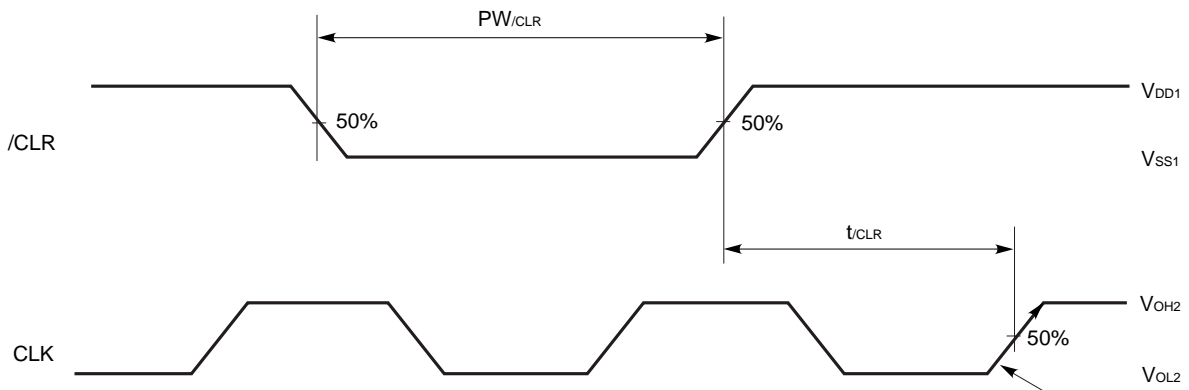
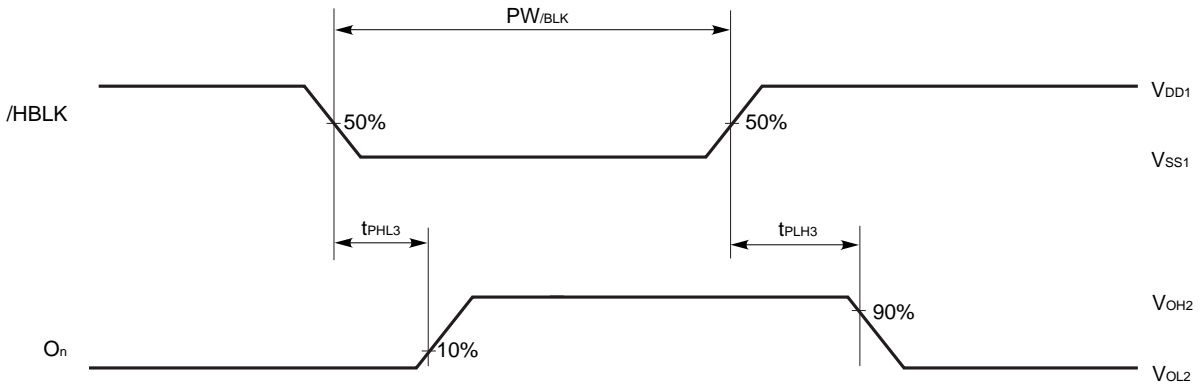
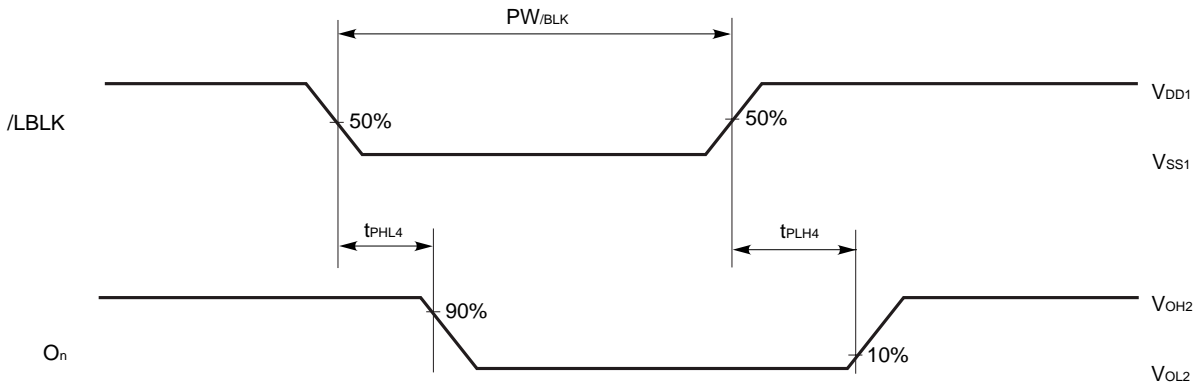
**Timing Requirement (T<sub>A</sub> = -40 to +85 °C, V<sub>DD1</sub> = 4.5 to 5.5 V, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V, t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Clock Pulse Width	PW <sub>CLK(H)</sub>		12			ns
	PW <sub>CLK(L)</sub>					
Latch Enable Pulse Width	PW <sub>LE(H)</sub>		12			ns
	PW <sub>LE(L)</sub>					
Blank Pulse Width	PW <sub>BLK</sub>	/HBLK, /LBLK	200			ns
HZ Pulse Width	PW <sub>HZ</sub>	R <sub>L</sub> = 10 kΩ	3.3			μs
/CLR Pulse Width	PW <sub>CLR</sub>		12			ns
Data Setup Time	t <sub>SETUP</sub>		4			ns
Data Hold Time	t <sub>HOLD</sub>		6			ns
Latch Enable Time	t <sub>LE1</sub>		12			ns
	t <sub>LE2</sub>		12			ns
★ /CLR Timing	t <sub>CLR</sub>		6			ns

Switching Characteristics Waveform (1/3)

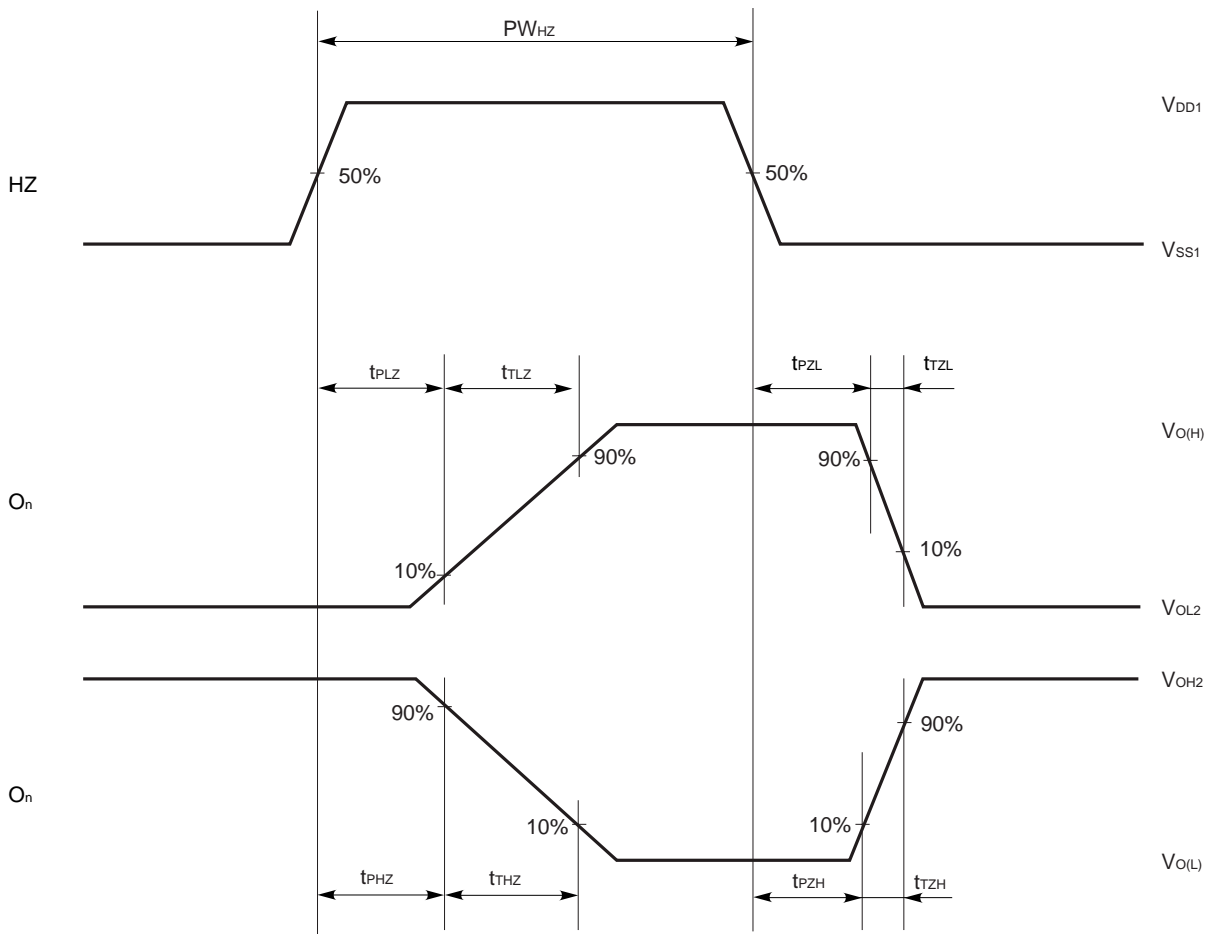


★ Switching Characteristics Waveform (2/3)



Clock rising edge for valid data

Switching Characteristics Waveform (3/3)



## 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.

**Reference Documents****NEC Semiconductor Device Reliability/Quality Control System(C10983E)****Quality Grades to NEC's Semiconductor Devices(C11531E)**

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    - 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 or medical equipment for life support, etc.
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