M54610P

8-BIT PARALLEL DATA INTERFACE FOR PRINTER

DESCRIPTION
The M54610P is a semiconductor integrated circuit consisting of an 8-bit parallel data interface function.
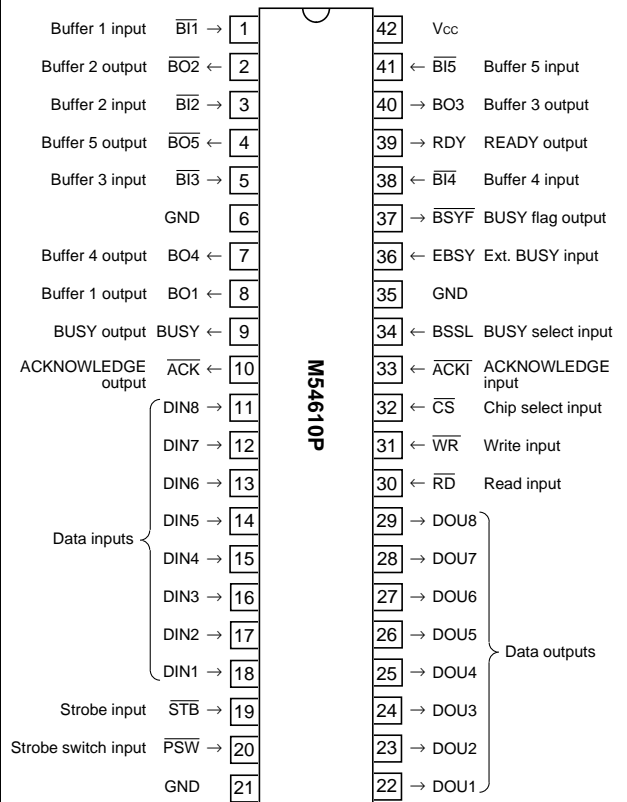
FEATURES
● I/O electrical characteristics equivalent to LSTTL
● 3-state 8-bit data output
● Strobe signal with polarity switching input
● Wide operating temperature range Ta = -20 – +75°C
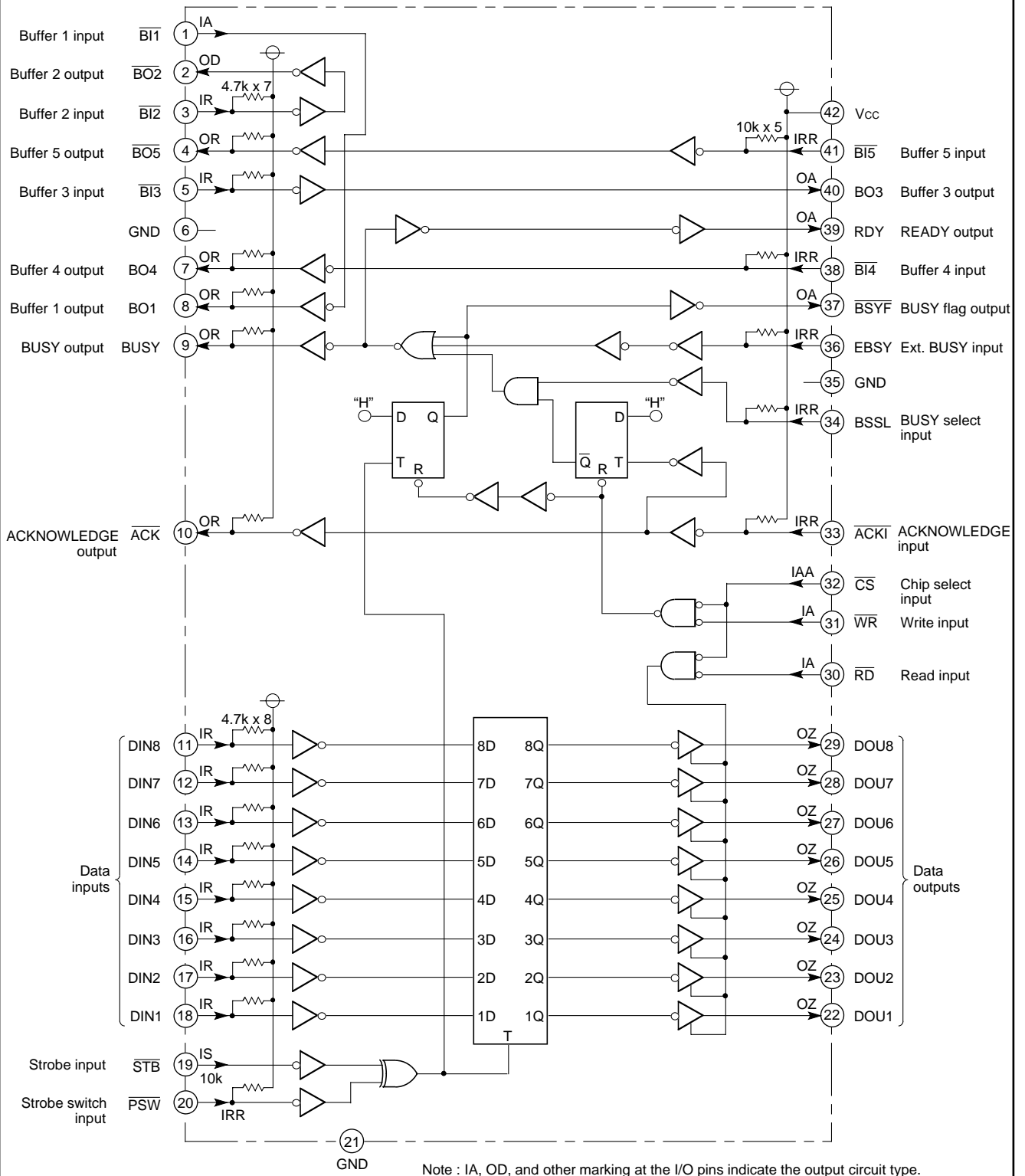
APPLICATION
Printer

FUNCTION
The M54610P, when used in a printer, is capable of implementing a standard 8-bit parallel data interface. As shown in the timing diagram, printing data DIN 1 through 8 and strobe pulses $\overline{STB}$ are input from a host computer. Data are exchanged by outputting the BUSY and $\overline{ACK}$ (ACKNOWLEDGE) signals to the host computer. Control signals EBSY, $\overline{CS}$, $\overline{WR}$, $\overline{RD}$ and $\overline{ACKI}$ are input from a printer controller, and this IC outputs DOU 1 through 8, and $\overline{BSYF}$.
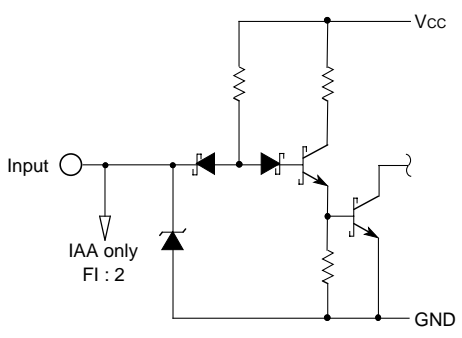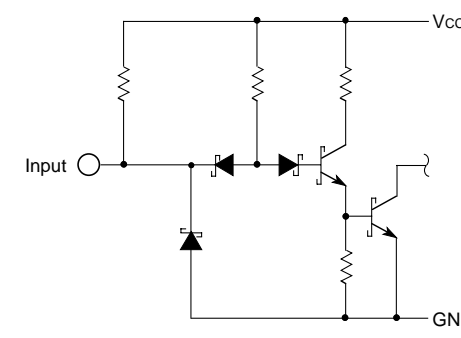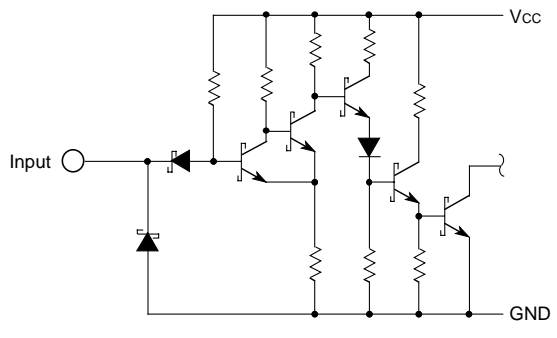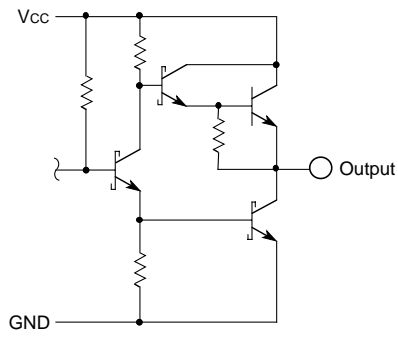
PIN CONFIGURATION (TOP VIEW)

Buffer 1 input	$\overline{BI1}$ →	1	42	Vcc	
Buffer 2 output	$\overline{BO2}$ ←	2	41 ←	$\overline{BI5}$	Buffer 5 input
Buffer 2 input	$\overline{BI2}$ →	3	40 →	BO3	Buffer 3 output
Buffer 5 output	$\overline{BO5}$ ←	4	39 →	RDY	READY output
Buffer 3 input	$\overline{BI3}$ →	5	38 ←	$\overline{BI4}$	Buffer 4 input
	GND	6	37 →	$\overline{BSYF}$	BUSY flag output
Buffer 4 output	BO4 ←	7	36 ←	EBSY	Ext. BUSY input
Buffer 1 output	BO1 ←	8	35	GND	
BUSY output	BUSY ←	9	34 ←	BSSL	BUSY select input
ACKNOWLEDGE output	$\overline{ACK}$ ←	10	33 ←	$\overline{ACKI}$	ACKNOWLEDGE input
	DIN8 →	11	32 ←	$\overline{CS}$	Chip select input
	DIN7 →	12	31 ←	$\overline{WR}$	Write input
	DIN6 →	13	30 ←	$\overline{RD}$	Read input
	DIN5 →	14	29 →	DOU8	
Data inputs	DIN4 →	15	28 →	DOU7	
	DIN3 →	16	27 →	DOU6	
	DIN2 →	17	26 →	DOU5	Data outputs
	DIN1 →	18	25 →	DOU4	
Strobe input	$\overline{STB}$ →	19	24 →	DOU3	
Strobe switch input	$\overline{PSW}$ →	20	23 →	DOU2	
	GND	21	22 →	DOU1	

M54610P

Outline 42P4B

BLOCK DIAGRAM

Pin	Name	Description
Buffer 1 input	$\overline{BI1}$	1 IA
Buffer 2 output	$\overline{BO2}$	2 OD
Buffer 2 input	$\overline{BI2}$	3 IR
Buffer 5 output	$\overline{BO5}$	4 OR
Buffer 3 input	$\overline{BI3}$	5 IR
GND		6
Buffer 4 output	BO4	7 OR
Buffer 1 output	BO1	8 OR
BUSY output	BUSY	9 OR
ACKNOWLEDGE output	$\overline{ACK}$	10 OR

4.7k x 7

10k x 5

42	Vcc	
41	$\overline{BI5}$	Buffer 5 input
40	BO3	Buffer 3 output
39	RDY	READY output
38	$\overline{BI4}$	Buffer 4 input
37	$\overline{BSYF}$	BUSY flag output
36	EBSY	Ext. BUSY input
35	GND	
34	BSSL	BUSY select input
33	$\overline{ACKI}$	ACKNOWLEDGE input
32	$\overline{CS}$	Chip select input
31	$\overline{WR}$	Write input
30	$\overline{RD}$	Read input

"H" D Q

"H" D
$\overline{Q}$ R T

4.7k x 8

Data inputs		
DIN8	11 IR	8D
DIN7	12 IR	7D
DIN6	13 IR	6D
DIN5	14 IR	5D
DIN4	15 IR	4D
DIN3	16 IR	3D
DIN2	17 IR	2D
DIN1	18 IR	1D

		Data outputs
8Q	29 OZ	DOU8
7Q	28 OZ	DOU7
6Q	27 OZ	DOU6
5Q	26 OZ	DOU5
4Q	25 OZ	DOU4
3Q	24 OZ	DOU3
2Q	23 OZ	DOU2
1Q	22 OZ	DOU1

Pin	Name	
Strobe input	$\overline{STB}$	19 IS
Strobe switch input	$\overline{PSW}$	20 IRR

10k

21 GND

Note : IA, OD, and other marking at the I/O pins indicate the output circuit type.

I/O CIRCUIT DIAGRAM

1 Input circuit form: IA, IAA	2 Input circuit form: IR, IRR
3 Input circuit form: IS	4 Output circuit form: OA
5 Output circuit form: OR, OD	6 Output circuit form: OZ

1 Input circuit form: IA, IAA

Vcc

Input

IAA only
FI : 2

GND

2 Input circuit form: IR, IRR

Vcc

Input

GND

3 Input circuit form: IS

Vcc

Input

GND

4 Output circuit form: OA

Vcc

Output

GND

5 Output circuit form: OR, OD

Vcc

Resistance
is infinite
for OD
circuit

Output

GND

6 Output circuit form: OZ

Vcc

Output

GND

PIN FUNCTION DESCRIPTION

Pin No.	Pin name	Function
⑨	BUSY	BUSY output to host
⑩	$\overline{\text{ACK}}$	ACKNOWLEDGE output to host
⑪ I ⑱	DIN8 I DIN1	8-bit parallel data input from host
⑲	$\overline{\text{STB}}$	Data strobe pulse input from host
⑳	$\overline{\text{PSW}}$	Polarity switching input for $\overline{\text{STB}}$
⑥ ㉑ ㉟	GND	GND
㉒ I ㉙	DOU1 I DOU8	8-bit parallel data output to printer controller (3-state)
㉚	$\overline{\text{RD}}$	Read input from printer controller
㉛	$\overline{\text{WR}}$	Write input from printer controller
㉜	$\overline{\text{CS}}$	Chip select input from printer controller
㉝	$\overline{\text{ACKI}}$	ACKNOWLEDGE input from printer controller
㉞	BSSL	BUSY select input. Switches busy timing.
㊱	EBSY	External BUSY input from printer controller
㊲	BSYF	BUSY flag output to printer controller
㊴	RDY	Inverted BUSY output to printer controller
㊷	Vcc	Power supply

OPERATION TIMING DIAGRAM
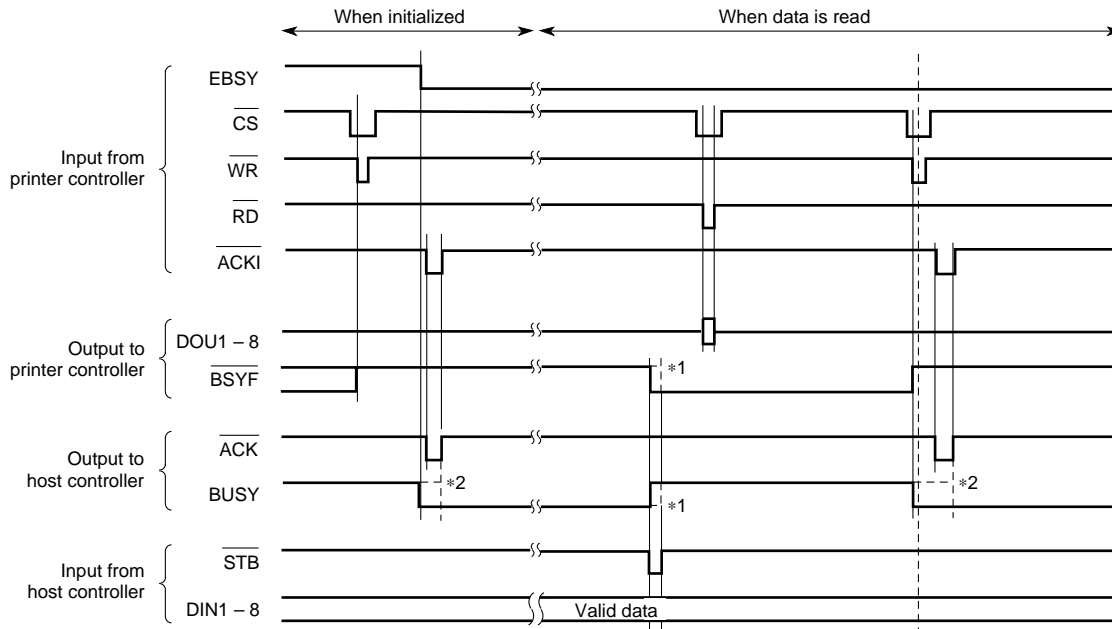
∗1 : The broken lines of $\overline{\text{BSYF}}$ and BUSY show the timing when $\overline{\text{PSW}}$ is low.

∗2 : The broken lines of BUSY signal show the timing when BSSL is low.

ABSOLUTE MAXIMUM RATINGS (Ta = -20 – 75°C unless otherwise noted)

Symbol	Parameter		Conditions	Ratings	Unit
Vcc	Supply voltage			-0.5 – +7	V
VI	Input voltage	IR, IS		-0.5 – +15	V
		IA, IAA, IRR		-0.5 – Vcc	
Vo	Output voltage	OR	When output is "H"	-0.5 – +15	V
		OA, OD	When output is "H"	-0.5 – Vcc	
		OZ	When output is "H"	-0.5 – +5.5	
Topr	Operating temperature			-20 – 75	°C
Tstg	Storage temperature			-55 – 125	°C

RECOMMENDED OPERATING CONDITIONS (Ta = -20 – 75°C unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min.	Typ.	Max.	
Vcc	Supply voltage		4.75	5	5.25	V
IOH	"H" output current	OR, OA	0		-400	μA
		OZ	0		-2.8	mA
		OD Vo = 5.5V	0		100	μA
IOL	"L" output current	OR, OA	0		8	mA
		OZ	0		8	
		OD	0		100	

ELECTRICAL CHARACTERISTICS (Ta = -20 – 75°C unless otherwise noted)

Symbol	Parameter		Test conditions		Min.	Typ.*	Max.	Unit
V_{IH}	"H" input voltage	IA, IAA, IRR, IR			2			V
V_{IL}	"L" input voltage	IA, IAA, IRR, IR					0.8	V
V_{T+}	Positive threshold voltage	IS	V_{CC} = 5V		1.4	1.6	1.9	V
V_{T-}	Negative threshold voltage	IS	V_{CC} = 5V		0.5	0.8	1.0	V
$V_{T+} - V_{T-}$	Hysterisis width	IS	V_{CC} = 5V		0.4	0.8		V
V_{IC}	Input clamp voltage	All inputs	V_{CC} = 4.75V, I_I = -1mA				-1.5	V
V_{OH}	"H" output voltage	OA	V_{CC} = 4.75V	I_{OH} = -400µA	2.7	3.1		V
		OZ		I_{OH} = -2.6mA	2.4	2.9		
		OR		I_{OH} = -400µA	2.4	3.1		
I_{OH}	"H" output current	OD	V_{CC} = 4.75V, V_O = 5.5V				100	µA
V_{OL}	"L" output voltage	OD	V_{CC} = 4.75V	I_{OL} = 24mA		0.3	0.4	V
		OA, OZ		I_{OL} = 8mA		0.3	0.4	
		OR		I_{OL} = 8mA		0.3	0.4	
I_{OZH}	OFF-state "H" output current	OZ	V_{CC} = 5.25V				20	µA
I_{OZL}	OFF-state "L" output current	OZ	V_{CC} = 5.25V				-20	µA
I_{IH}	"H" input current	IA, IS	V_{CC} = 5.25V, V_I = 2.7V				20	µA
		IAA					40	
I_{IH}	"H" input current	IRR	V_{CC} = 5.25V, V_I = 2.7V		-0.2		-0.4	mA
		IR			-0.4		-0.8	
I_{IL}	"L" input current	IA, IS	V_{CC} = 5.25V, V_I = 0.4V				-0.4	mA
		IAA					-0.8	
I_{IL}	"L" input current	IRR	V_{CC} = 5.25V, V_I = 0.4V				-1.1	mA
		IR					-1.8	
I_{OS}	Output short-circuit current	OA	(Note 1) V_{CC} = 5.25V, V_O = 0V		-20		-100	mA
		OZ			-30		-130	
		OR			-0.8		-1.5	
I_{CC}	Supply current		V_{CC} = 5.25V Point "A" in the operational timing diagram. When: 4.5V: $\overline{BI1}$ Open: $\overline{BI2}$, BSSL and $\overline{BI5}$ 0V: $\overline{BI3}$, DIN1 – 8, EBSY and $\overline{BI4}$.			35	45	mA

*: Typical values are at V_{CC} = 5V and Ta = 25°C.

Note 1: Measurements are conducted in the shortest possible time, and no two outputs are shorted simultaneously.

SWITCHING CHARACTERISTICS (Vcc = 5V and Ta = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions (Note 2)	Limits			Unit
			Min.	Typ.	Max.	
t_{PLH}	Output "L-H" and "H-L" propagation time 1 Buffer				200	ns
t_{PHL}					200	ns
t_{PLH}	Output "L-H" and "H-L" propagation time 2 Buffer				300	ns
t_{PHL}					300	ns
t_{PLH}	Output "L-H" and "H-L" propagation time EBSY to BUSY				500	ns
t_{PHL}					500	ns
t_{PLH}	Output "L-H" and "H-L" propagation time $\overline{STB}$ to DOU1 – 8				500	ns
t_{PHL}					500	ns
t_{PLH}	Output "L-H" propagation time $\overline{STB}$ to BUSY				500	ns
t_{PHL}	Output "H-L" propagation time $\overline{ACKI}$ to BUSY				500	ns
t_{PHL}	Output "H-L" propagation time $\overline{WR}$ to BUSY				500	ns
t_{PLH}	Output "L-H" propagation time $\overline{WR}$ to $\overline{BSYF}$				500	ns
t_{PHL}	Output "H-L" propagation time $\overline{STB}$ to $\overline{BSYF}$				500	ns
t_{PZH}	"H" output enabled time	$R_L = 1k\Omega$, $C_L = 30pF$			80	ns
t_{PZL}	"L" output enabled time	$R_L = 1k\Omega$, $C_L = 30pF$			80	ns
t_{PH2}	"H" output disabled time	$R_L = 1k\Omega$, $C_L = 5pF$			100	ns
t_{PL2}	"L" output disabled time	$R_L = 1k\Omega$, $C_L = 5pF$			100	ns

Note 2: Refer to switching test circuits for measurement conditions.

TIMING REQUIREMENTS (Vcc = 5V and Ta = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
$t_{W(STB)}$	$\overline{STB}$ "L" and "H" pulse width		500			ns
$t_{W(ACK)}$	$\overline{ACKI}$ pulse width		500			ns
$t_{W(WR)}$	$\overline{WR}$ pulse width		200			ns
$t_{SU(DIN)}$	DIN1 – DIN8 setup time to $\overline{STB}$		500			ns
$t_{h(DIN)}$	DIN1 – DIN8 holding time to $\overline{STB}$		500			ns
$t_{rec(WR)}$	$\overline{WR}$ recovery time to $\overline{ACKI}$		500			ns

SWITCHING TEST CIRCUIT
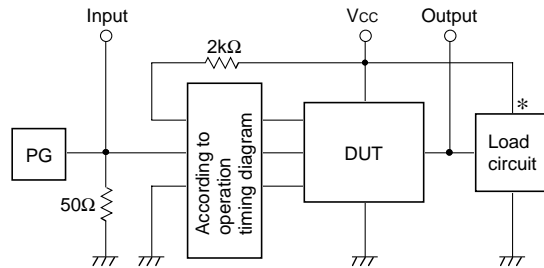
∗ The load circuit to the output circuit type is as follows
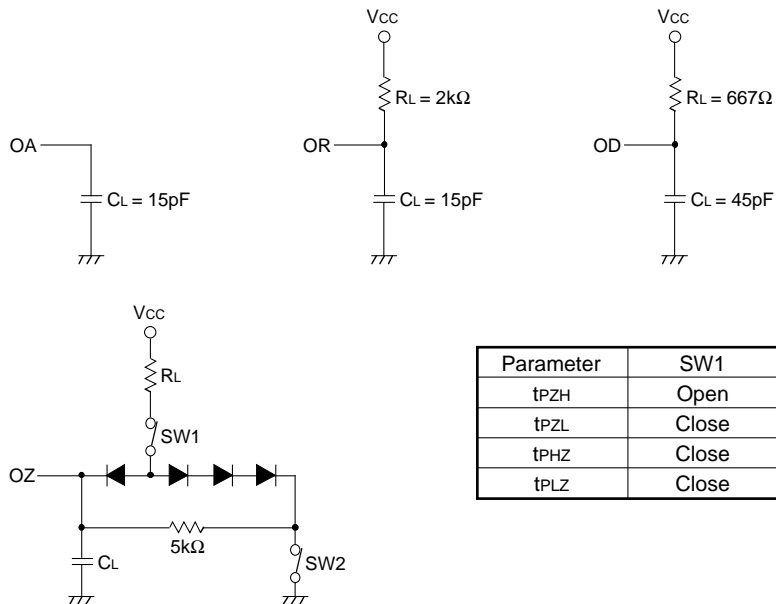
Parameter	SW1	SW2
t_{PZH}	Open	Close
t_{PZL}	Close	Open
t_{PHZ}	Close	Close
t_{PLZ}	Close	Close

(1) The pulse generator (PG) characteristics: PRR = 100kHz, t_r = 6ns, t_f = 6ns, t_w = 5µs, V_P = 3VP-P, Z_O = 50Ω
(2) The diodes used are all high-speed switching diodes (t_{rr} ≤ 4ns).
(3) The capacitance C_L includes stray wiring capacitance and the probe input capacitance.

TIMING DIAGRAM (Reference voltage = 1.3V)
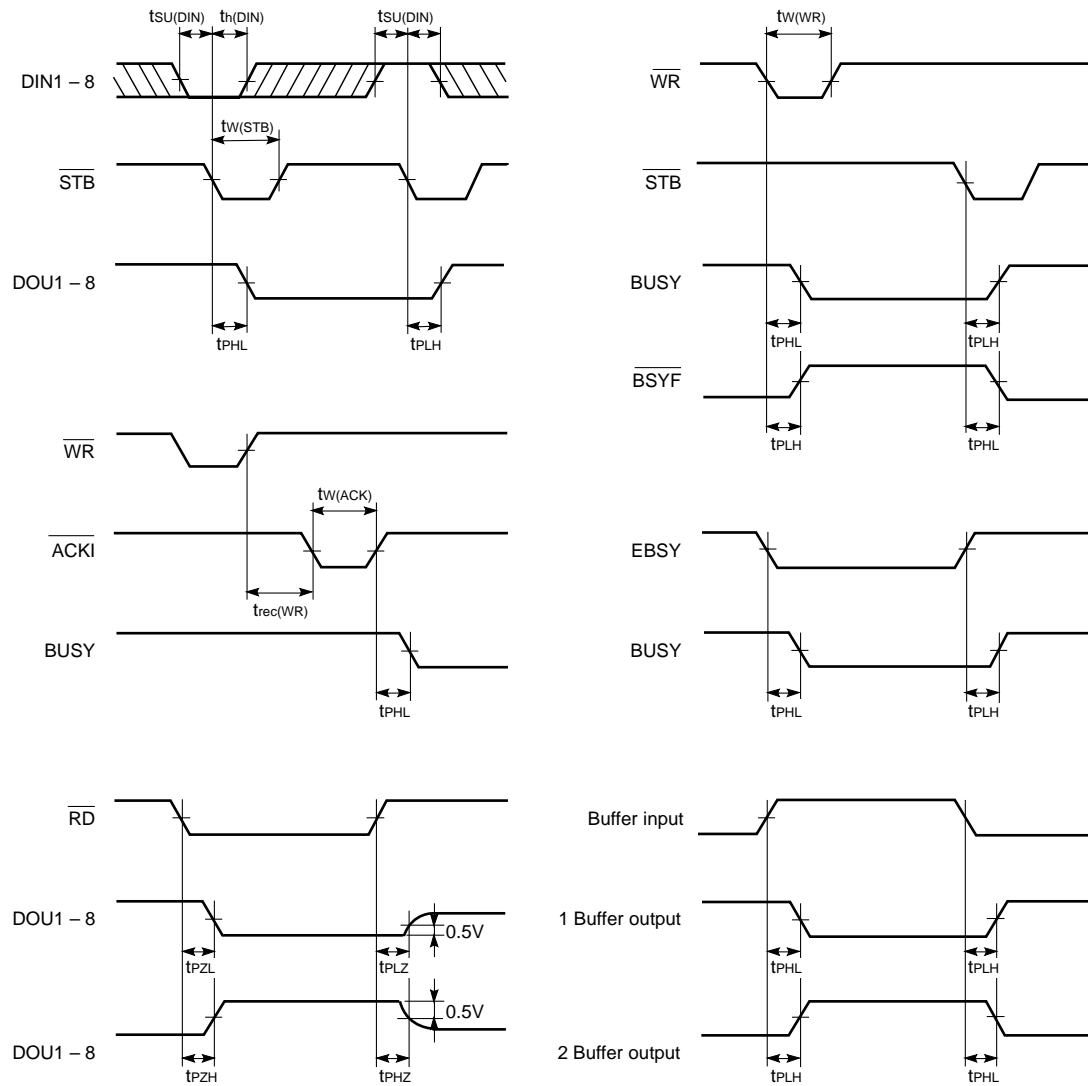
Note: The shaded are indicated the period when switching is possible.