

Latch/flip-flop

74F373/74F374

74F373 Octal transparent latch (3-State)
74F374 Octal D-type flip-flop (3-State)

FEATURES

- 8-bit transparent latch — 74F373
- 8-bit positive edge triggered register — 74F374
- 3-State outputs glitch free during power-up and power-down
- Common 3-State output register
- Independent register and 3-State buffer operation
- SSOP Type II Package

DESCRIPTION

The 74F373 is an octal transparent latch coupled to eight 3-State output devices. The two sections of the device are controlled independently by enable (E) and output enable (\overline{OE}) control gates.

The data on the D inputs is transferred to the latch outputs when the enable (E) input is high. The latch remains transparent to the data input while E is high, and stores the data that is present one setup time before the high-to-low enable transition.

The 3-State output buffers are designed to drive heavily loaded 3-State buses, MOS memories, or MOS microprocessors.

The active low output enable (\overline{OE}) controls all eight 3-State buffers independent of the latch operation. When \overline{OE} is low, latched or transparent data appears at the output.

When \overline{OE} is high, the outputs are in high impedance "off" state, which means they will neither drive nor load the bus.

The 74F374 is an 8-bit edge triggered register coupled to eight 3-State output buffers. The two sections of the device are controlled independently by clock (CP) and output enable (\overline{OE}) control gates.

The register is fully edge triggered. The state of the D input, one setup time before the low-to-high clock transition is transferred to the corresponding flip-flop's Q output.

The 3-State output buffers are designed to drive heavily loaded 3-State buses, MOS memories, or MOS microprocessors.

The active low output enable (\overline{OE}) controls all eight 3-State buffers independent of the register operation. When \overline{OE} is low, the data in the register appears at the outputs. When \overline{OE} is high, the outputs are in high impedance "off" state, which means they will neither drive nor load the bus.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F373	4.5ns	35mA

TYPE	TYPICAL f_{max}	TYPICAL SUPPLY CURRENT (TOTAL)
74F374	165MHz	55mA

ORDERING INFORMATION

DESCRIPTION	ORDER CODE	DRAWING NUMBER
	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^\circ C$ to $+70^\circ C$	
20-pin plastic DIP	N74F373N, N74F374N	SOT146-1
20-pin plastic SOL	N74F373D, N74F374D	SOT163-1
20-pin plastic SSOP type II	N74F373DB, N74374DB	SOT399-1

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

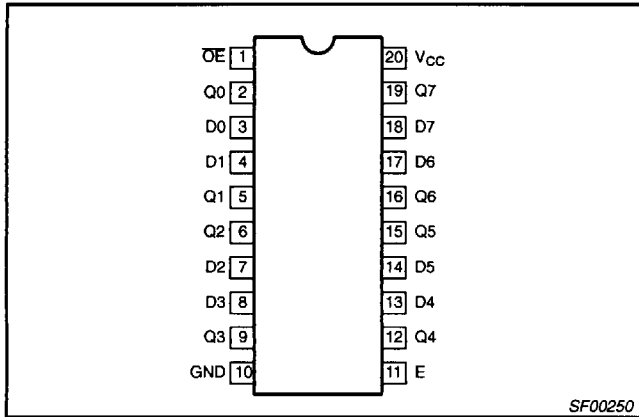
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0 - D7	Data inputs	1.0/1.0	20 μ A/0.6mA
E (74F373)	Enable input (active high)	1.0/1.0	20 μ A/0.6mA
\overline{OE}	Output enable inputs (active low)	1.0/1.0	20 μ A/0.6mA
CP (74F374)	Clock pulse input (active rising edge)	1.0/1.0	20 μ A/0.6mA
Q0 - Q7	3-State outputs	150/40	3.0mA/24mA

NOTE: One (1.0) FAST unit load is defined as: 20 μ A in the high state and 0.6mA in the low state.

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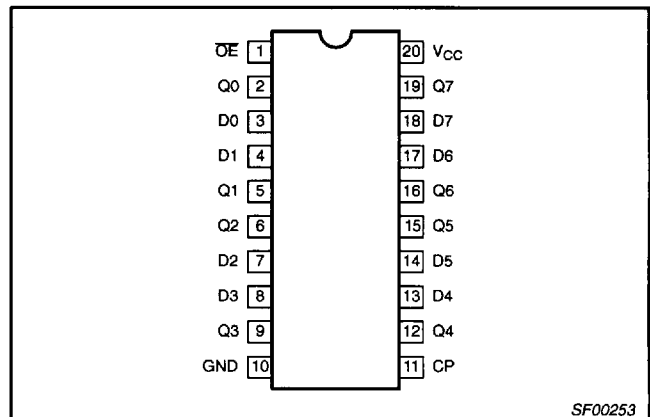
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PIN CONFIGURATION – 74F373



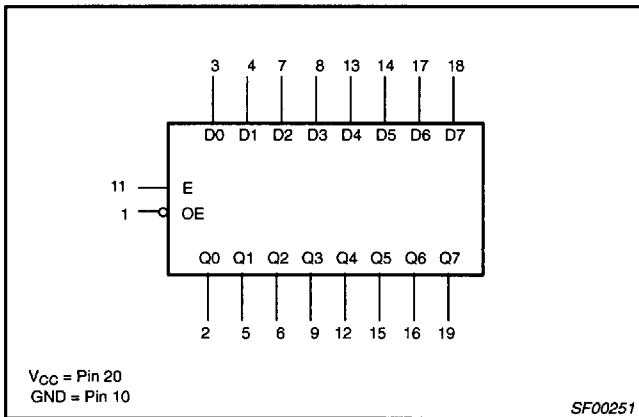
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PIN CONFIGURATION – 74F374



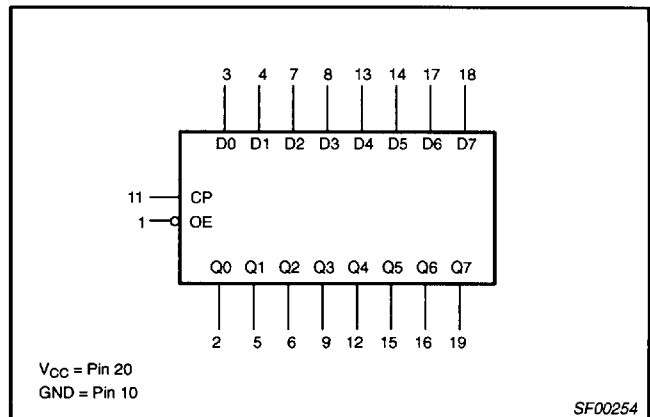
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LOGIC SYMBOL – 74F373



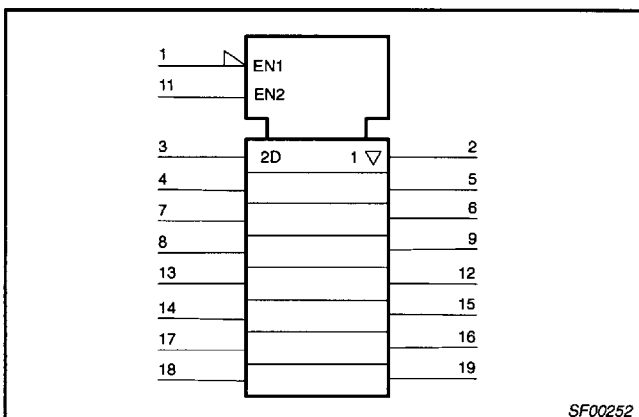
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IEC/IEE SYMBOL – 74F374



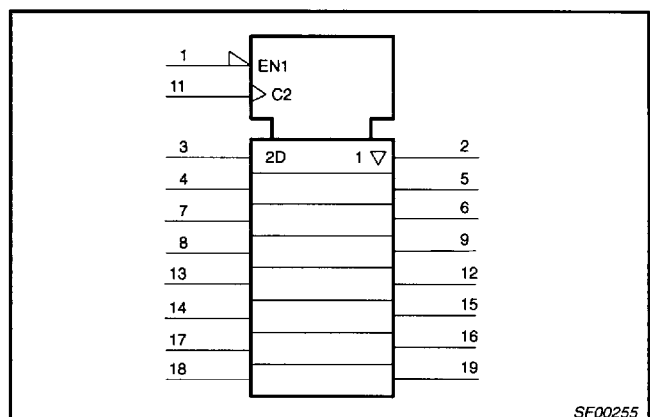
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IEC/IEEE SYMBOL – 74F373



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IEC/IEEE SYMBOL – 74F374

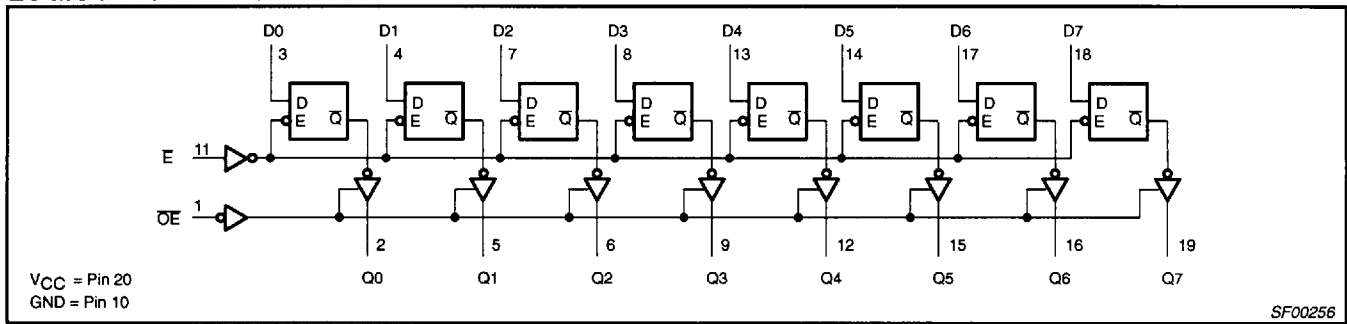


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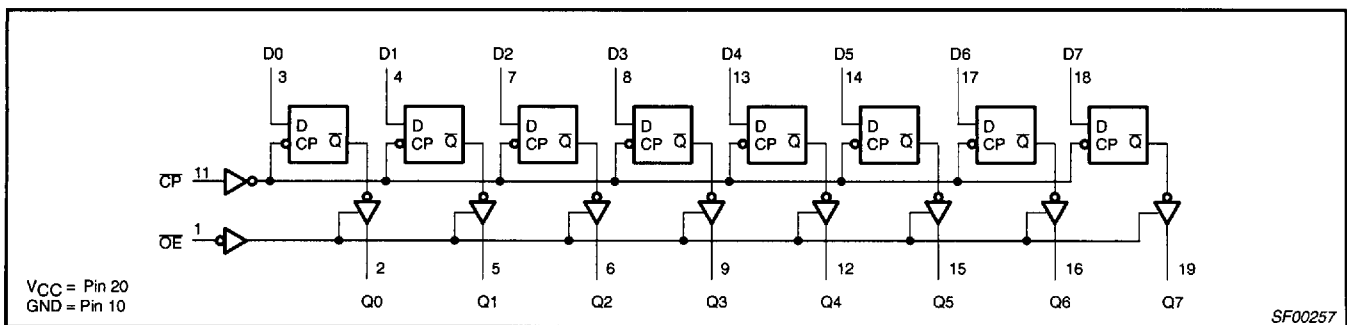
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LOGIC DIAGRAM FOR 74F373



LOGIC DIAGRAM FOR 74F374



FUNCTION TABLE FOR 74F373

INPUTS			INTERNAL REGISTER	OUTPUTS	OPERATING MODE
OE	E	Dn		Q0 - Q7	
L	H	L	L	L	Enable and read register
L	H	H	H	H	
L	↓	l	L	L	Latch and read register
L	↓	h	H	H	
L	L	X	NC	NC	Hold
H	L	X	NC	Z	Disable outputs
H	H	Dn	Dn	Z	

NOTES:

1. H = High-voltage level
2. h = High state must be present one setup time before the high-to-low enable transition
3. L = Low-voltage level
4. l = Low state must be present one setup time before the high-to-low enable transition
5. NC = No change
6. X = Don't care
7. Z = High impedance "off" state
8. ↓ = High-to-low enable transition

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FUNCTION TABLE FOR 74F374

INPUTS			INTERNAL REGISTER	OUTPUTS	OPERATING MODE
OE	CP	Dn		Q0 - Q7	
L	↑	l	L	L	Load and read register
L	↑	h	H	H	
L	↑	X	NC	NC	Hold
H	↑	X	NC	Z	Disable outputs
H	↑	Dn	Dn	Z	

NOTES:

1. H = High-voltage level
2. h = High state must be present one setup time before the low-to-high clock transition
3. L = Low-voltage level
4. l = Low state must be present one setup time before the low-to-high clock transition
5. NC = No change
6. X = Don't care
7. Z = High impedance "off" state
8. ↑ = Low-to-high clock transition
9. ↑ = Not low-to-high clock transition

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V _{CC}	Supply voltage	-0.5 to +7.0	V
V _{IN}	Input voltage	-0.5 to +7.0	V
I _{IN}	Input current	-30 to +5	mA
V _{OUT}	Voltage applied to output in high output state	-0.5 to V _{CC}	V
I _{OUT}	Current applied to output in low output state	48	mA
T _{amb}	Operating free air temperature range	0 to +70	°C
T _{stg}	Storage temperature range	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5.0	5.5	V
V _{IH}	High-level input voltage	2.0			V
V _{IL}	Low-level input voltage			0.8	V
I _{Ik}	Input clamp current			-18	mA
I _{OH}	High-level output current			-3	mA
I _{OL}	Low-level output current			24	mA
T _{amb}	Operating free air temperature range	0		+70	°C

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DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS ¹		LIMITS			UNIT
				MIN	TYP ²	MAX	
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IL} = MAX,	±10%V _{CC}	2.4			V
		V _{IH} = MIN, I _{OH} = MAX	±5%V _{CC}	2.7	3.4		V
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = MAX,	±10%V _{CC}		0.35	0.50	V
		V _{IH} = MIN, I _{OL} = MAX	±5%V _{CC}		0.35	0.50	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = I _{IK}			-0.73	-1.2	V
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 7.0V				100	μA
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.7V				20	μA
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.5V				-0.6	mA
I _{OZH}	Off-state output current, high-level voltage applied	V _{CC} = MAX, V _O = 2.7V				50	μA
I _{OZL}	Off-state output current, low-level voltage applied	V _{CC} = MAX, V _O = 0.5V				-50	μA
I _{OS}	Short-circuit output current ³	V _{CC} = MAX		-60		-150	mA
I _{CC}	Supply current (total)	74F373	V _{CC} = MAX		35	60	mA
		74F374			57	86	mA

NOTES:

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

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AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT	
			T _{amb} = +25°C V _{CC} = +5.0V C _L = 50pF, R _L = 500Ω			T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω			
			MIN	TYP	MAX	MIN	MAX		
t _{PLH} t _{PHL}	Propagation delay Dn to Qn	74F373	Waveform 3	3.0 2.0	5.3 3.7	7.0 5.0	3.0 2.0	8.0 6.0	ns
t _{PLH} t _{PHL}	Propagation delay E to Qn		Waveform 2	5.0 3.0	9.0 4.0	11.5 7.0	5.0 3.0	12.0 8.0	ns
t _{PZH} t _{PZL}	Output enable time to high or low level		Waveform 6 Waveform 7	2.0 2.0	5.0 5.6	11.0 7.5	2.0 2.0	11.5 8.5	ns
t _{PHZ} t _{PLZ}	Output disable time from high or low level		Waveform 6 Waveform 7	2.0 2.0	4.5 3.8	6.5 5.0	2.0 2.0	7.0 6.0	ns
f _{max}	Maximum clock frequency	74F374	Waveform 1	150	165		140		ns
t _{PLH} t _{PHL}	Propagation delay CP to Qn		Waveform 1	3.5 3.5	5.0 5.0	7.5 7.5	3.0 3.0	8.5 8.5	ns
t _{PZH} t _{PZL}	Output enable time to high or low level		Waveform 6 Waveform 7	2.0 2.0	9.0 5.3	11.0 7.5	2.0 2.0	12.0 8.5	ns
t _{PHZ} t _{PLZ}	Output disable time from high or low level		Waveform 6 Waveform 7	2.0 2.0	5.3 4.3	6.0 5.5	2.0 2.0	7.0 6.5	ns

AC SETUP REQUIREMENTS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT	
			T _{amb} = +25°C V _{CC} = +5.0V C _L = 50pF, R _L = 500Ω			T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω			
			MIN	TYP	MAX	MIN	MAX		
t _{su} (H) t _{su} (L)	Setup time, high or low level Dn to E	74F373	Waveform 4	0 1.0			0 1.0		ns
t _h (H) t _h (L)	Hold time, high or low level Dn to E		Waveform 4	3.0 3.0			3.0 3.0		ns
t _w (H)	E Pulse width, high		Waveform 1	3.5			4.0		ns
t _{su} (H) t _{su} (L)	Setup time, high or low level Dn to CP	74F374	Waveform 5	2.0 2.0			2.0 2.0		ns
t _h (H) t _h (L)	Hold time, high or low level Dn to CP		Waveform 5	0 0			0 0		ns
t _w (H) t _w (L)	CP Pulse width, high or low		Waveform 5	3.5 4.0			3.5 4.0		ns

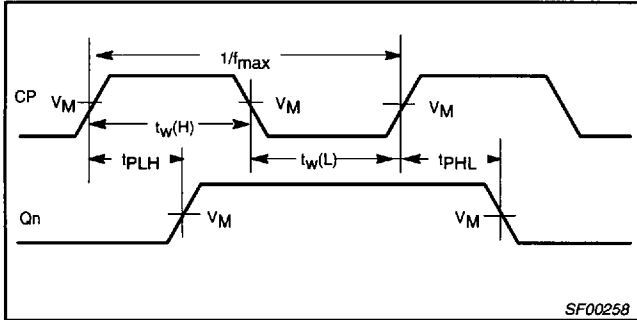
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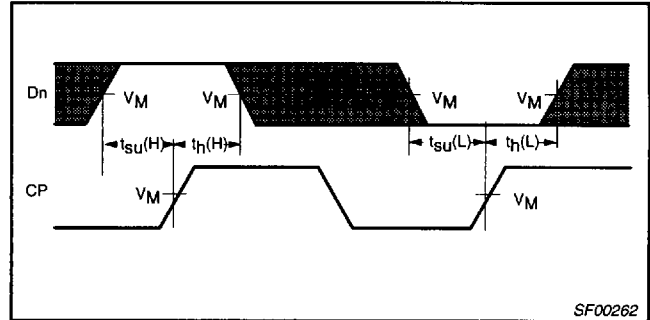
AC WAVEFORMS

For all waveforms, $V_M = 1.5V$.

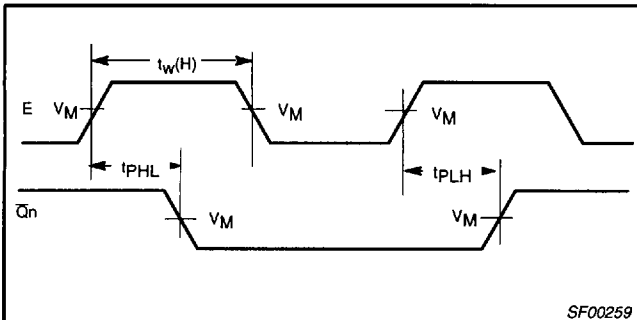
The shaded areas indicate when the input is permitted to change for predictable output performance.



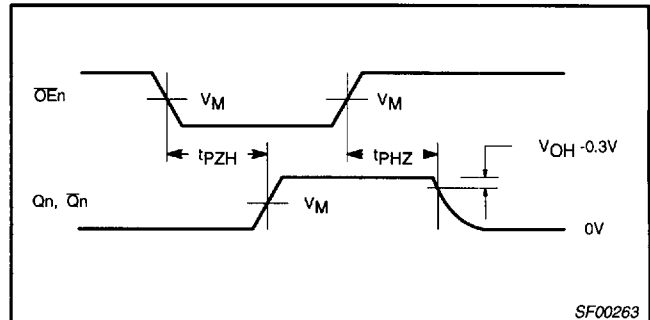
Waveform 1. Propagation delay for clock input to output, clock pulse widths, and maximum clock frequency



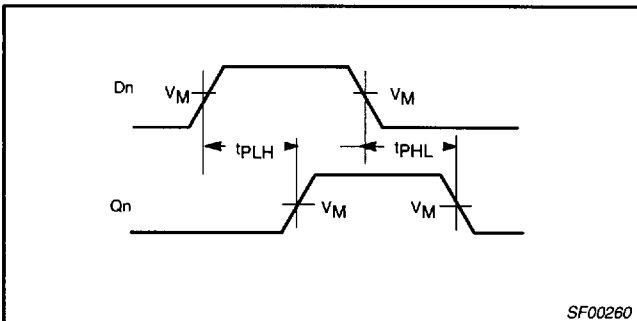
Waveform 5. Data setup time and hold times



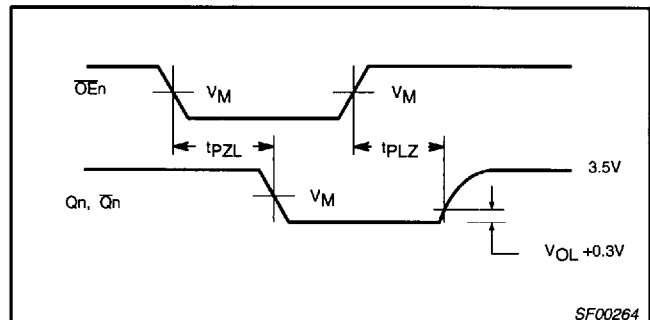
Waveform 2. Propagation delay for enable to output and enable pulse width



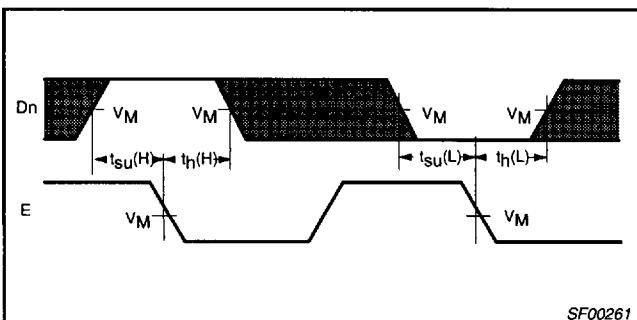
Waveform 6. 3-State output enable time to high level and output disable time from high level



Waveform 3. Propagation delay for data to output



Waveform 7. 3-State output enable time to low level and output disable time from low level



Waveform 4. Data setup time and hold times

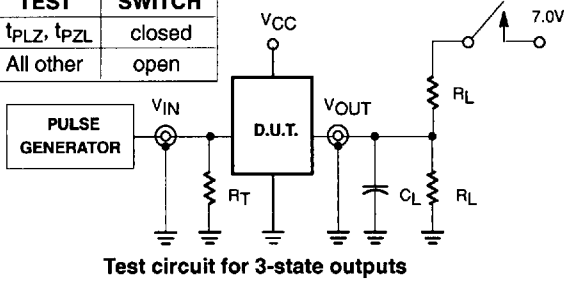
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TEST CIRCUIT AND WAVEFORMS

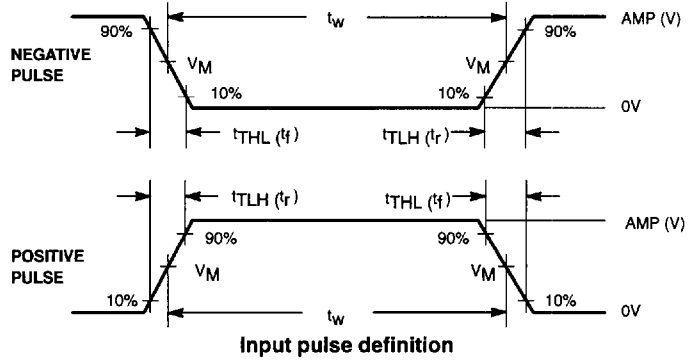
SWITCH POSITION

TEST	SWITCH
t_{PLZ}, t_{PZL}	closed
All other	open



DEFINITIONS:

- R_L = Load resistor; see AC electrical characteristics for value.
- C_L = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
- R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.



family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

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