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ECL Products	

100231

Triple D–Type Master–Slave Flip–Flop

FEATURES

- **Typical propagation delay: 1.3ns**
- **Typical supply current ($-I_{EE}$): 110mA**

DESCRIPTION

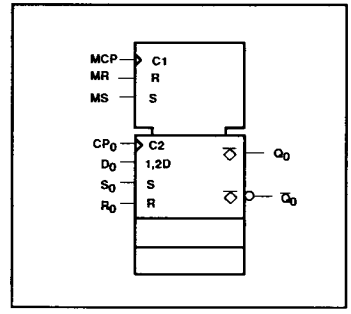
The 100231 is a high–speed version of the 100131. 100231 has three D–type master–slave flip–flops with true and complementary outputs. In addition to common clock, set and reset lines, each flip–flop also has individual clock, set and reset lines.

Unused inputs must be tied to a low voltage, V_{IL} or V_{EE}.

PIN DESCRIPTION

PINS	DESCRIPTION
$D_0 - D_2$	Data Inputs
MCP	Master Clock Input
$CP_0 - CP_2$	Individual Clock Inputs
MS	Master Set Input
$S_0 - S_2$	Individual Set Inputs
MR	Master Reset Input
$R_0 - R_2$	Individual Reset Input
$Q_0 - Q_2$	True Data Outputs
$\overline{Q}_0 - \overline{Q}_2$	Complementary Data Outputs

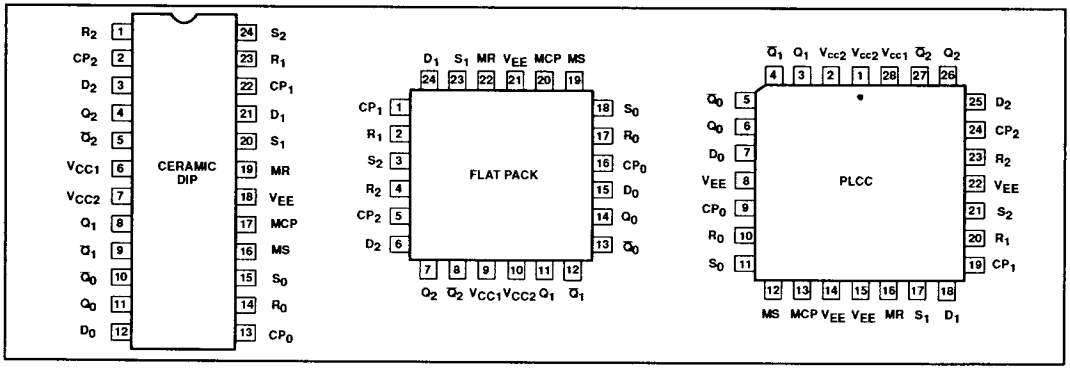
IEC/IEEE SYMBOL



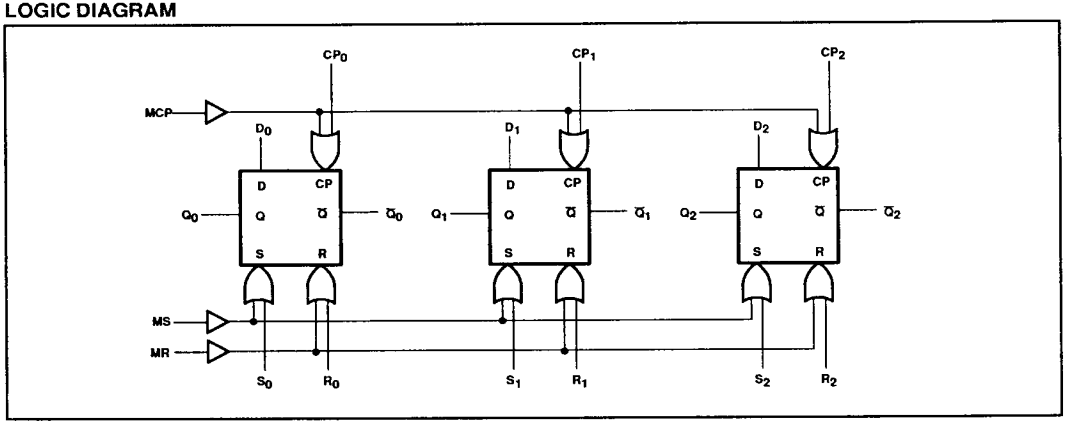
ORDERING INFORMATION

DESCRIPTION	ORDER CODE
24–Pin Ceramic DIP (400 mils wide)	100231F
24–Pin Ceramic Flat Pack	100231Y
28–Pin PLCC	100231A

PIN CONFIGURATIONS



LOGIC DIAGRAM



FUNCTION TABLE

INPUTS							OUTPUTS	
D	MCP	CP_n	MS	S_n	MR	R_n	Q_n	$\overline{Q}_n$
X	X	X	L	L	H	X	L	H
X	X	X	L	L	X	H	L	H
X	X	X	H	X	L	L	H	L
X	X	X	X	H	L	L	H	L
X	X	X	H	X	H	X	undefined	
X	X	X	H	X	X	H	undefined	
X	X	X	X	H	H	X	undefined	
X	X	X	X	H	X	H	undefined	
H	↑	L	L	L	L	L	H	L
L	↑	L	L	L	L	L	L	H
H	L	↑	L	L	L	L	H	L
L	L	↑	L	L	L	L	L	H
X	↕	↕	L	L	L	L	NC	NC

NOTES:
H = High voltage level
L = Low voltage level
X = Don't care
↑ = Low–to–High transition
↕ = No Low–to–High transition
NC = No change

ABSOLUTE MAXIMUM RATINGS $V_{CC1} = V_{CC2}$ = ground, T_A = 0°C to +85°C unless otherwise specified.

SYMBOL	PARAMETER	LIMITS	UNIT
V_{EE}	Supply voltage range	–7.0 to +0.5	V
V_{IN}	Input voltage (V_{IN} should never be more negative than V_{EE})	V_{EE} to +0.5	V
I_O	Output source current (continuous)	–55	mA
T_S	Storage temperature range	–65 to +150	°C
T_J	Maximum junction temperature	+150	°C

NOTE:
Operation beyond the limits set forth in this table may impair the useful life of the device.

DC OPERATING CONDITIONS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS MIN.	LIMITS NOM.	LIMITS MAX.	UNIT
V_{CC1}, V_{CC2}	Circuit ground		0	0	0	V
V_{EE}	Supply voltage		–4.8	–4.5	–4.2	V
V_{EE}	Supply voltage when operating with the 10K or the I0KH ECL family.		–5.7			V
V_{IH}	High level input voltage	V_{EE} = –4.2V	–1150		–880	mV
		V_{EE} = –4.5V	–1165			
		V_{EE} = –4.8V	–1165			
V_{IL}	Low level input voltage	V_{EE} = –4.2V	–1810		–1475	mV
		V_{EE} = –4.5V			–1475	mV
		V_{EE} = –4.8V			–1490	mV
T_A	Operating ambient temperature range		0	+25	+85	°C

NOTE:
When operating at other than the specified V_{EE} voltages (–4.2V, –4.5V, –4.8V), the DC and AC electrical characteristics will vary slightly from their specified values.

DC ELECTRICAL CHARACTERISTICS

$V_{CC1} = V_{CC2}$ = ground, V_{EE} = –4.8V to –4.2V, T_A = 0°C to +85°C unless otherwise specified[1,3,4]

SYMBOL	PARAMETER		TEST CONDITIONS[2]			LIMITS MIN.	LIMITS TYP.	LIMITS MAX.	UNIT
V_{OH}	High level output voltage		Outputs loaded with 50Ω to –2.0V ±0.010V	Inputs at V_{IHMAX} or V_{ILMIN}	V_{EE} = –4.2V	–1020		–870	mV
					V_{EE} = –4.5V	–1025	–955	–880	mV
					V_{EE} = –4.8V	–1035		–880	mV
V_{OHT}	High level output threshold voltage			Apply V_{IHMIN} or V_{ILMAX} to one input at a time. Other inputs at V_{IHMAX} or V_{ILMIN}.	V_{EE} = –4.2V	–1030			mV
					V_{EE} = –4.5V	–1035			mV
					V_{EE} = –4.8V	–1045			mV
V_{OLT}	Low level output threshold voltage			Apply V_{IHMIN} or V_{ILMAX} to one input at a time. Other inputs at V_{IHMAX} or V_{ILMIN}.	V_{EE} = –4.2V			–1595	mV
					V_{EE} = –4.5V			–1610	mV
					V_{EE} = –4.8V			–1610	mV
V_{OL}	Low level output voltage			Inputs at V_{IHMAX} or V_{ILMIN}.	V_{EE} = –4.2V	–1810		–1605	mV
					V_{EE} = –4.5V	–1810	–1705	–1620	mV
					V_{EE} = –4.8V	–1830		–1620	mV
I_{IH}	High level input current	D_n, CP_n	One input under test at V_{IHMAX}. Other inputs at V_{ILMIN}.					240	µA
		MCP, MS, MR						450	µA
		R_n, S_n						530	µA
I_{IL}	Low level input current		One input under test at V_{ILMIN}. Other inputs at V_{IHMAX}.			0.5			µA
$-I_{EE}$	V_{EE} supply current		All inputs at V_{IHMAX}			74	110	149	mA

NOTES:
1. The specified limits represent the worst case values for the parameter. Since these worst case values normally occur at the supply voltage and temperature extremes, additional noise immunity can be achieved by decreasing the allowable operating condition ranges.
2. Conditions for testing shown in the tables are not necessarily worst case. For worst case testing guidelines, refer to DC Testing, Chapter 1, Section 3.

NOTES (CONTINUED):

3. The specified limits shown in the DC electrical characteristics table can be met only after thermal equilibrium has been established. Thermal equilibrium is established by applying power for at least 2 minutes, while maintaining transverse airflow of 2.5 meters/sec (500 linear feet/min) over the device, mounted either in a test socket or on a printed circuit board. Test voltage values are given in the DC operating conditions table.
4. The device can function down to V_{EE} = –5.7V, allowing operation with either the 10K or the 10KH family. Correction factors can be used to calculate new DC limits for the extended V_{EE} range. For more information, see Chapters 5 and 10, Section 4.

AC ELECTRICAL CHARACTERISTICS

Ceramic DIP $V_{CC1} = V_{CC2}$ = ground, V_{EE} = –4.8V to –4.2V

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS						UNIT
				T_A = 0°C		T_A = +25°C		T_A = +85°C		
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{MAX}	Maximum toggle frequency CP_n	Waveform 1		400		400		400		MHz
t_{PLH} t_{PHL}	Propagation delay MCP to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.75 0.75	2.00 2.00	0.75 0.75	2.00 2.00	0.70 0.70	2.05 2.05	ns ns
t_{PLH} t_{PHL}	Propagation delay CP_n to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.70 0.70	1.80 1.80	0.70 0.70	1.80 1.80	0.70 0.70	1.80 1.80	ns ns
t_{PLH} t_{PHL}	Propagation delay MS, MR to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	1.05 1.05	2.50 2.50	1.05 1.05	2.50 2.50	1.05 1.05	2.50 2.50	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	1.10 1.10	2.80 2.80	1.10 1.10	2.80 2.80	1.10 1.10	2.80 2.80	ns ns
t_{PLH} t_{PHL}	Propagation delay R_n, S_n to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	0.65 0.65	1.70 1.70	0.70 0.70	1.70 1.70	0.70 0.70	1.90 1.90	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	0.70 0.70	2.00 2.00	0.70 0.70	1.90 1.90	0.70 0.70	2.20 2.20	ns ns
t_{TLH} t_{THL}	Transition time Q_n, $\overline{Q}_n$	Waveform 1		0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	ns ns
t_s	Setup time D_n to CP_n, MCP	Waveforms 2,3		0.90		0.70		0.90		ns
t_h	Hold time CP_n, MCP to D_n			0.60		0.60		0.80		ns
t_R	Release time R_n, S_n to CP_n, MCP	Waveforms 2,3		1.50		1.30		1.50		ns
t_R	Release time MR, MS to CP_n, MCP			2.50		2.30		2.50		ns
t_w(H)	Pulse width High MR, MS, R_n, S_n, CP_n, MCP	Waveforms 1,2,3		2.50		2.50		2.50		ns

NOTE:
For AC test setup information, see AC Testing, Chapter 2, Section 3.

AC ELECTRICAL CHARACTERISTICS

Ceramic DIP $V_{CC1} = V_{CC2}$ = ground, $V_{EE} = -5.2V \pm 5\%$

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS						UNIT
				$T_A = 0°C$		$T_A = +25°C$		$T_A = +85°C$		
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{MAX}	Maximum toggle frequency CP_n	Waveform 1		400		400		400		MHz
t_{PLH} t_{PHL}	Propagation delay MCP to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.75 0.75	2.00 2.00	0.75 0.75	2.00 2.00	0.70 0.70	2.05 2.05	ns ns
t_{PLH} t_{PHL}	Propagation delay CP_n to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.70 0.70	1.80 1.80	0.70 0.70	1.80 1.80	0.70 0.70	1.80 1.80	ns ns
t_{PLH} t_{PHL}	Propagation delay MS, MR to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	1.05 1.05	2.50 2.50	1.05 1.05	2.50 2.50	1.05 1.05	2.50 2.50	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	1.10 1.10	2.80 2.80	1.10 1.10	2.80 2.80	1.10 1.10	2.80 2.80	ns ns
t_{PLH} t_{PHL}	Propagation delay R_n, S_n to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	0.65 0.65	1.70 1.70	0.70 0.70	1.70 1.70	0.70 0.70	1.90 1.90	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	0.70 0.70	2.00 2.00	0.70 0.70	1.90 1.90	0.70 0.70	2.20 2.20	ns ns
t_{TLH} t_{THL}	Transition time Q_n, $\overline{Q}_n$	Waveform 1		0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	ns ns
t_s	Setup time D_n to CP_n, MCP	Waveforms 2,3		0.90		0.70		0.90		ns
t_h	Hold time CP_n, MCP to D_n			0.60		0.60		0.80		ns
t_R	Release time R_n, S_n to CP_n, MCP	Waveforms 2,3		1.50		1.30		1.50		ns
t_R	Release time MR, MS to CP_n, MCP			2.50		2.30		2.50		ns
$t_w(H)$	Pulse width High MR, MS, R_n, S_n, CP_n, MCP	Waveforms 1,2,3		2.50		2.50		2.50		ns

NOTE:
For AC test setup information, see AC Testing, Chapter 2, Section 3.

AC ELECTRICAL CHARACTERISTICS

Flat Pack and PLCC $V_{CC1} = V_{CC2} =$ ground, $V_{EE} = -4.8V$ to $-4.2V$

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS						UNIT
				$T_A = 0°C$		$T_A = +25°C$		$T_A = +85°C$		
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{MAX}	Maximum toggle frequency CP_n	Waveform 1		400		400		400		MHz
t_{PLH} t_{PHL}	Propagation delay MCP to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.75 0.75	1.80 1.80	0.75 0.75	1.80 1.80	0.70 0.70	1.85 1.85	ns ns
t_{PLH} t_{PHL}	Propagation delay CP_n to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.70 0.70	1.60 1.60	0.70 0.70	1.60 1.60	0.70 0.70	1.70 1.70	ns ns
t_{PLH} t_{PHL}	Propagation delay MS, MR to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	1.05 1.05	2.30 2.30	1.05 1.05	2.30 2.30	1.05 1.05	2.40 2.40	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	1.10 1.10	2.60 2.60	1.10 1.10	2.50 2.50	1.10 1.10	2.70 2.70	ns ns
t_{PLH} t_{PHL}	Propagation delay R_n, S_n to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	0.65 0.65	1.50 1.50	0.70 0.70	1.50 1.50	0.70 0.70	1.70 1.70	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	0.70 0.70	1.80 1.80	0.70 0.70	1.70 1.70	0.70 0.70	2.00 2.00	ns ns
t_{TLH} t_{THL}	Transition time Q_n, $\overline{Q}_n$	Waveform 1		0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	ns ns
t_s	Setup time D_n to CP_n, MCP	Waveforms 2,3		0.80		0.60		0.80		ns
t_h	Hold time CP_n, MCP to D_n			0.50		0.50		0.70		ns
t_R	Release time R_n, S_n to CP_n, MCP	Waveforms 2,3		1.40		1.20		1.40		ns
t_R	Release time MR, MS to CP_n, MCP			2.40		2.20		2.40		ns
$t_w(H)$	Pulse width High MR, MS, R_n, S_n, CP_n, MCP	Waveforms 1,2,3		2.50		2.50		2.50		ns

NOTE:
For AC test setup information, see AC Testing, Chapter 2, Section 3.

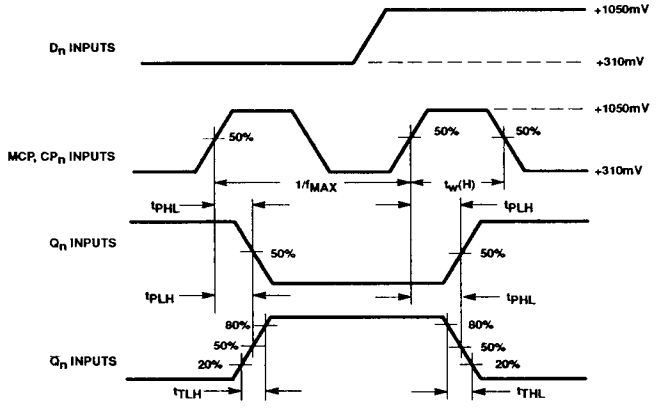
AC ELECTRICAL CHARACTERISTICS

Flat Pack and PLCC $V_{CC1} = V_{CC2} = \text{ground}$, $V_{EE} = -5.2V \pm 5\%$

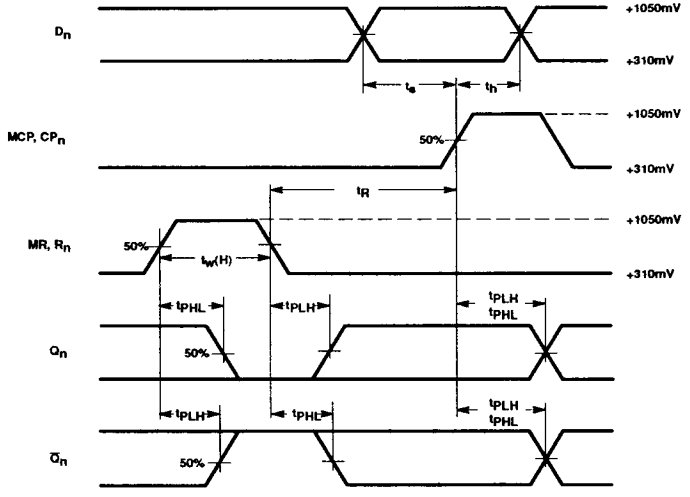
SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS						UNIT
				$T_A = 0°C$		$T_A = +25°C$		$T_A = +85°C$		
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
f_{MAX}	Maximum toggle frequency CP_n	Waveform 1		400		400		400		MHz
t_{PLH} t_{PHL}	Propagation delay MCP to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.75 0.75	1.80 1.80	0.75 0.75	1.80 1.80	0.70 0.70	1.85 1.85	ns ns
t_{PLH} t_{PHL}	Propagation delay CP_n to Q_n, $\overline{Q}_n$	Waveforms 1,2,3		0.70 0.70	1.60 1.60	0.70 0.70	1.60 1.60	0.70 0.70	1.70 1.70	ns ns
t_{PLH} t_{PHL}	Propagation delay MS, MR to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	1.05 1.05	2.30 2.30	1.05 1.05	2.30 2.30	1.05 1.05	2.40 2.40	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	1.10 1.10	2.60 2.60	1.10 1.10	2.50 2.50	1.10 1.10	2.70 2.70	ns ns
t_{PLH} t_{PHL}	Propagation delay R_n, S_n to Q_n, $\overline{Q}_n$	Waveforms 2,3	$CP_n = V_{ILMIN}$	0.65 0.65	1.50 1.50	0.70 0.70	1.50 1.50	0.70 0.70	1.70 1.70	ns ns
t_{PLH} t_{PHL}			$CP_n = V_{IHMAX}$	0.70 0.70	1.80 1.80	0.70 0.70	1.70 1.70	0.70 0.70	2.00 2.00	ns ns
t_{TLH} t_{THL}	Transition time Q_n, $\overline{Q}_n$	Waveform 1		0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	0.45 0.45	1.40 1.40	ns ns
t_s	Setup time D_n to CP_n, MCP	Waveforms 2,3		0.80		0.60		0.80		ns
t_h	Hold time CP_n, MCP to D_n			0.50		0.50		0.70		ns
t_R	Release time R_n, S_n to CP_n, MCP	Waveforms 2,3		1.40		1.20		1.40		ns
t_R	Release time MR, MS to CP_n, MCP			2.40		2.20		2.40		ns
$t_w(H)$	Pulse width High MR, MS, R_n, S_n, CP_n, MCP	Waveforms 1,2,3		2.50		2.50		2.50		ns

NOTE:
For AC test setup information, see AC Testing, Chapter 2, Section 3.

AC WAVEFORMS



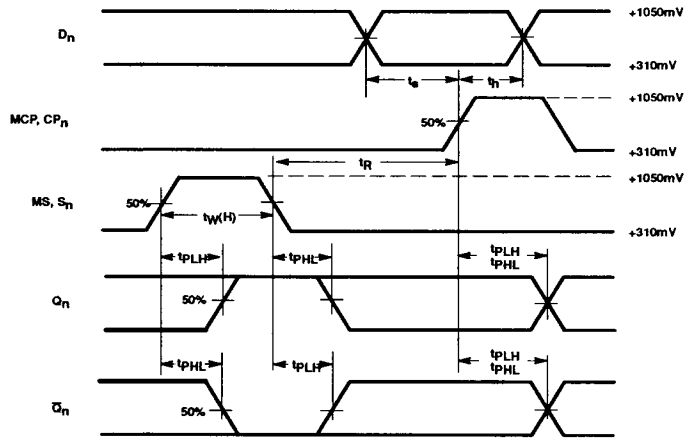
Waveform 1. Propagation Delays and Transition Times



Waveform 2. Reset, Setup and Hold Times

NOTE:
All power and signal voltages shifted up 2.0V for AC bench test purposes.

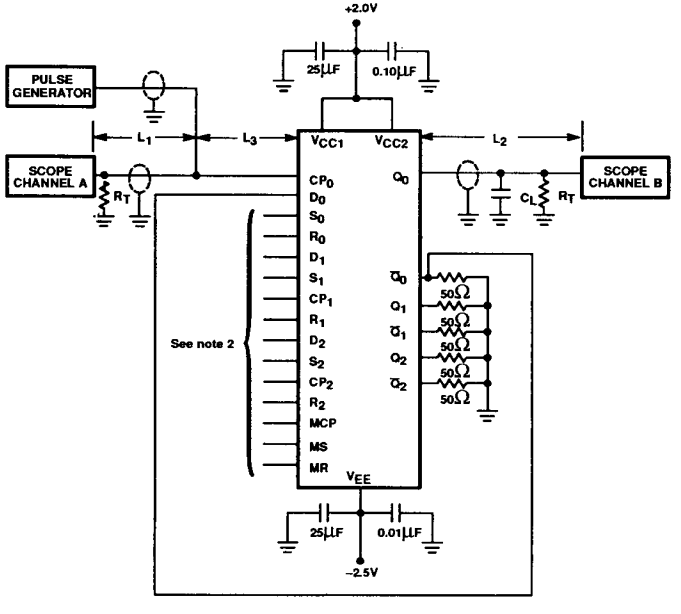
AC WAVEFORMS



Waveform 3. Set, Setup and Hold Times

NOTE:
All power and signal voltages shifted up 2.0V for AC bench test purposes.

TOGGLE FREQUENCY TEST CIRCUIT



NOTES:

1. The 0.01μF and 0.1μF decoupling capacitors should be NPO Ceramic or MLC type. All decoupling capacitors should be placed as close as physically possible to the Device Under Test (DUT), and lead lengths should be kept to less than 1/4 inch (6mm).
2. Those inputs not connected to the pulse generator should be connected to either a High or a Low state, consistent with the logic function required.
3. All unused outputs are loaded the same way as the output under test, substituting a 50Ω termination for the scope. The tolerance of all resistors should be ±1% or better.
4. L_1 and L_2 are equal length, 50Ω impedance lines. L_3, the lead length from the DUT input pin to the junction of the cables from the pulse generator and the scope, should not exceed 1/4 inch (6mm).
5. R_T = 50Ω termination internal to scope.
6. Fixture and stray capacitance (not including scope cable capacitance) = $C_L \leq 3pF$.
7. Any unterminated stubs or unmatched connections anywhere along the transmission line between the pulse generator and the DUT or between the DUT and the scope should not exceed 1/4 inch (6mm) in length. (Refer to section on AC test procedure).
8. All power and signal voltages shifted up 2.0V for AC bench test purposes.