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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

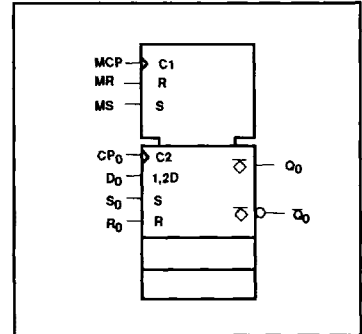
The 100231 is a high-speed version of the 100131. 100231 has three D-type master-slave flip-flops with true and complementary outputs. In addition to common clock, set and reset lines, each flip-flop also has individual clock, set and reset lines.

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
$\bar{Q}_0 - \bar{Q}_2$	Complementary Data Outputs

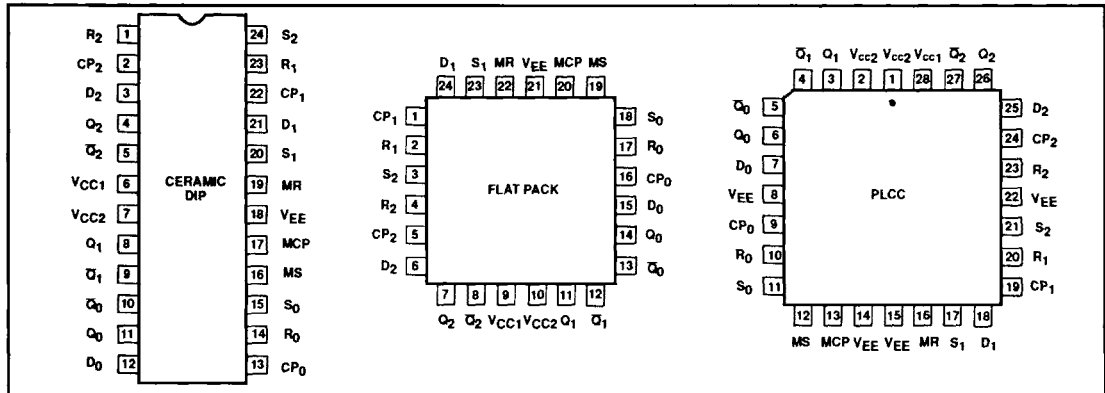
IEC/IEEE SYMBOL



ORDERING INFORMATION

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

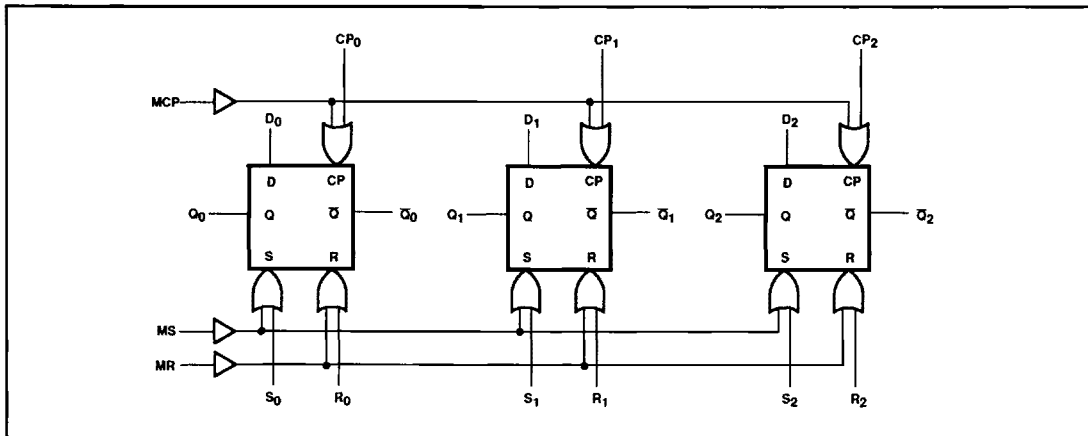
PIN CONFIGURATIONS



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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS							OUTPUTS	
D	MCP	CP _n	MS	S _n	MR	R _n	Q _n	Q̄ _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	undefined
X	X	X	X	H	H	X	undefined	undefined
X	X	X	X	H	X	H	undefined	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 $V_{CC1} = V_{CC2} = \text{ground}$, $T_A = 0^\circ\text{C}$ to $+85^\circ\text{C}$ 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	$^\circ\text{C}$
T_J	Maximum junction temperature	+150	$^\circ\text{C}$

NOTE:

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

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DC OPERATING CONDITIONS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN.	NOM.	MAX.	
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 10KH 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 $V_{CC1} = V_{CC2} = \text{ground}$, $V_{EE} = -4.8V$ to $-4.2V$, $T_A = 0^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise specified^{1,3,4}

SYMBOL	PARAMETER	TEST CONDITIONS ²	LIMITS			UNIT	
			MIN.	TYP.	MAX.		
V_{OH}	High level output voltage	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	Outputs loaded with 50Ω to $-2.0V$ $\pm 0.010V$	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:

- 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.
- 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.

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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 $V_{CC1} = V_{CC2} = \text{ground}$, $V_{EE} = -4.8V$ to $-4.2V$

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT
			$T_A = 0^\circ\text{C}$		$T_A = +25^\circ\text{C}$		$T_A = +85^\circ\text{C}$		
			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, \bar{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, \bar{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	Waveforms 2,3	$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				ns ns
t_{PLH} t_{PHL}	MS, MR to Q_n, \bar{Q}_n		$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				ns ns
t_{PLH} t_{PHL}	Propagation delay	Waveforms 2,3	$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				ns ns
t_{PLH} t_{PHL}	R_n, S_n to Q_n, \bar{Q}_n		$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				ns ns
t_{TLH} t_{THL}	Transition time Q_n, \bar{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			0.70		0.90		ns
t_h	Hold time CP_n, MCP to D_n				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.

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AC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT	
			$T_A = 0^\circ\text{C}$		$T_A = +25^\circ\text{C}$		$T_A = +85^\circ\text{C}$			
			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, \bar{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, \bar{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	Waveforms 2,3	$CP_n = V_{\text{ILMIN}}$	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}				MS, MR to Q_n, \bar{Q}_n	$CP_n = V_{\text{IHMAX}}$	1.10 1.10	2.80 2.80	1.10 1.10	2.80 2.80	1.10 1.10
t_{PLH} t_{PHL}	Propagation delay	Waveforms 2,3	$CP_n = V_{\text{ILMIN}}$			0.65 0.65	1.70 1.70	0.70 0.70	1.70 1.70	0.70 0.70
t_{PLH} t_{PHL}				R_n, S_n to Q_n, \bar{Q}_n	$CP_n = V_{\text{IHMAX}}$	0.70 0.70	2.00 2.00	0.70 0.70	1.90 1.90	0.70 0.70
t_{TLH} t_{THL}	Transition time Q_n, \bar{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
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	
$t_w(\text{H})$	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.

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AC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT
			$T_A = 0^\circ\text{C}$		$T_A = +25^\circ\text{C}$		$T_A = +85^\circ\text{C}$		
			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, \bar{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, \bar{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, \bar{Q}_n	Waveforms 2,3	$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				
t_{PLH} t_{PHL}			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}	Propagation delay R_n, S_n to Q_n, \bar{Q}_n	Waveforms 2,3	$CP_n = V_{ILMIN}$		$CP_n = V_{IHMAX}$				
t_{PLH} t_{PHL}			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_{TLH} t_{THL}	Transition time Q_n, \bar{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.

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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
			$T_A = 0^\circ\text{C}$		$T_A = +25^\circ\text{C}$		$T_A = +85^\circ\text{C}$		
			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, \bar{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, \bar{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, \bar{Q}_n	Waveforms 2,3	$CP_n = V_{\text{ILMIN}}$		$CP_n = V_{\text{IHMAX}}$				
			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}	Propagation delay R_n, S_n to Q_n, \bar{Q}_n	Waveforms 2,3	$CP_n = V_{\text{ILMIN}}$		$CP_n = V_{\text{IHMAX}}$				
			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}	R_n, S_n to Q_n, \bar{Q}_n	Waveforms 2,3	$CP_n = V_{\text{ILMIN}}$		$CP_n = V_{\text{IHMAX}}$				
			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, \bar{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
$t_w(\text{H})$	Pulse width High MR, MS, R_n, S_n, CP_n, MCP	Waveforms 1,2,3	2.50		2.50		2.50		ns

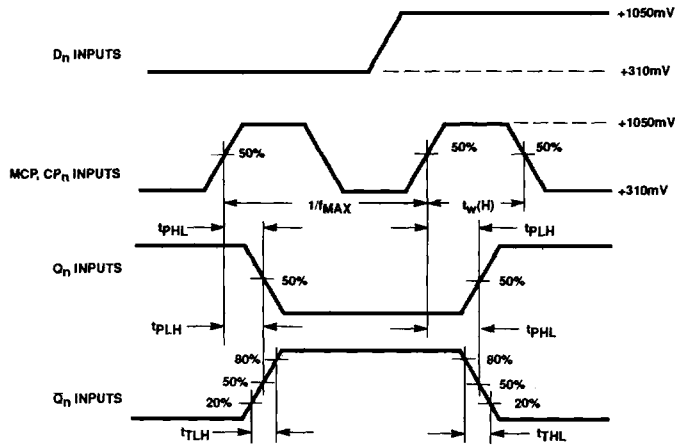
NOTE:

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

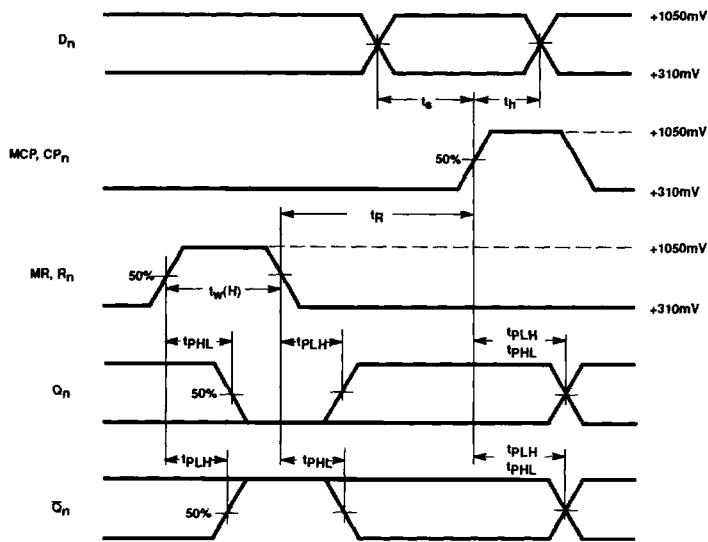
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AC WAVEFORMS



Waveform 1. Propagation Delays and Transition Times



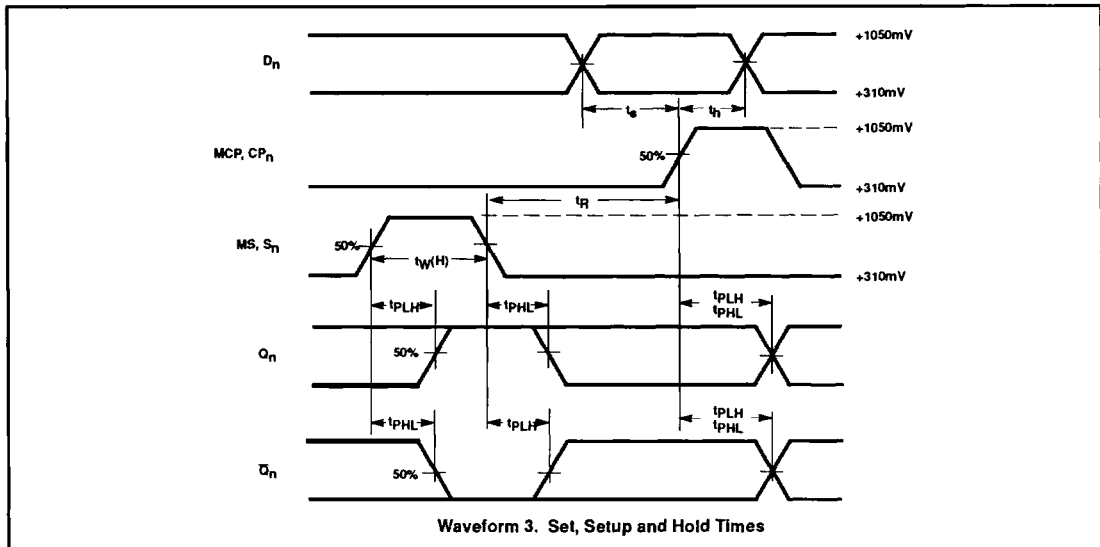
Waveform 2. Reset, Setup and Hold Times

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

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AC WAVEFORMS



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

TOGGLE FREQUENCY TEST CIRCUIT

