

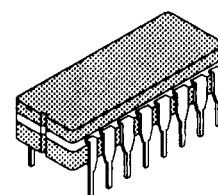
MB810A / 811A / 812A / 813A / 814A

Ultra High-Speed ECL ICs

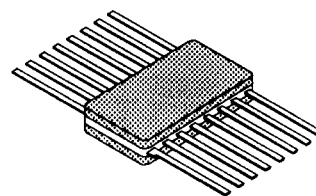
Ultra High-speed ECL Family

The Fujitsu MB810A series is an ultra high-speed logic designed for high-speed digital systems. The MB810A series is suitable for use in high-speed transmission equipment, radio installations, high-speed logic treatment equipment, high-performance measuring instruments, and high-speed gate array peripherals. The input and output levels and the power supply voltage are compatible with the ECL 10KH Series. The devices are housed in ceramic 16-pin small outline and dual-in-line packages.

- Ultra high-speed:
Propagation delay time – 400 ps/gate typical
- ECL Interface level:
10KH ECL compatible inputs and outputs
- Output rising/falling time – 350 ps typical
- Maximum clock frequency: 1.5 GHz typical
- Emitter Follower Output: Wired OR capability, 50 Ω line drive capability
- Stable bias circuit for the changeable power supply voltage
- Ceramic 16-pin packages:
DIP MB81xAC
SOP MB81xAZF



Ceramic DIP Package
DIP-16C-C01



Ceramic SOP Package
FPT-16C-C01

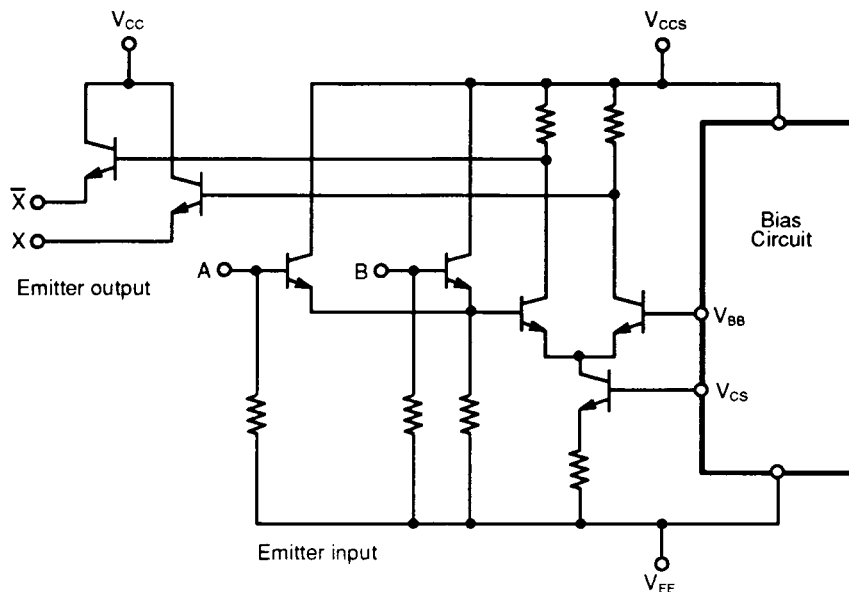
ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit
Power Supply Voltage ($V_{CCS} = V_{CCF} = 0$)	V_{EE}	-7.0 to 0	V
Input Voltage ($V_{CCS} = V_{CCF} = 0$)	V_{IN}	-3.0 to 0	V
Output Current	I_{OUT}	-50 to 0	mA
Operating Ambient Temperature	T_A	-30 to +125	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-55 to +150	$^{\circ}\text{C}$

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

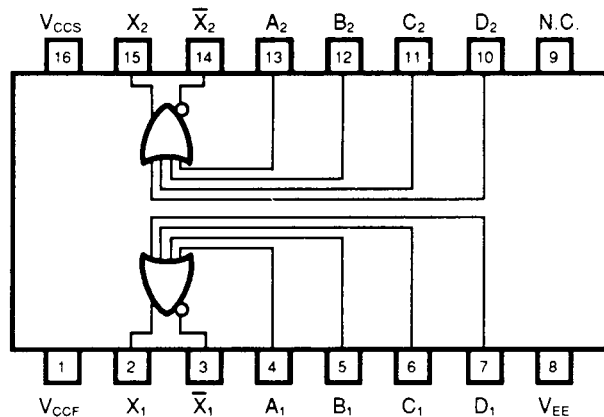
Fig.1 – MB810A SERIES BASIC GATE CIRCUIT



PIN ASSIGNMENTS

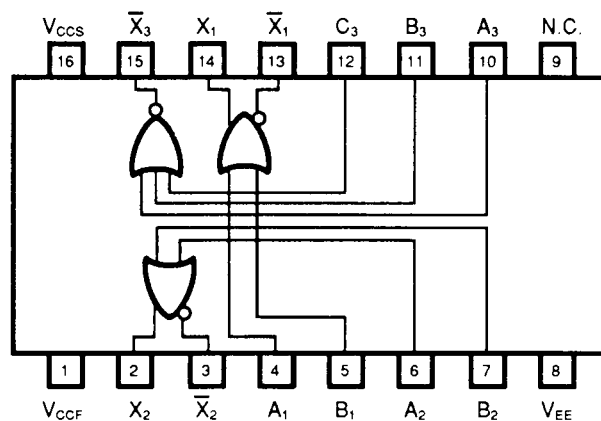
MB810A – Dual 4-Input OR/NOR Gate

$$X = A+B+C+D \quad \bar{X} = \overline{A+B+C+D}$$



Input				Output	
A	B	C	D	X	$\bar{X}$
H	X	X	X	H	L
X	H	X	X	H	L
X	X	H	X	H	L
X	X	X	H	H	L
L	L	L	L	L	H

MB811A – Triple 2-2-3-Input OR/NOR Gate



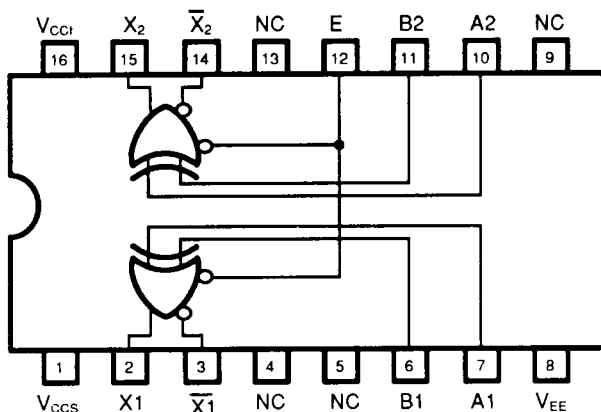
Input		Output	
A	B	X	$\bar{X}$
H	X	H	L
X	H	H	L
L	L	L	H

Input			Output
A	B	C	$\bar{X}$
H	X	X	L
X	H	X	L
X	X	H	L
L	L	L	H

PIN ASSIGNMENTS (Continued)

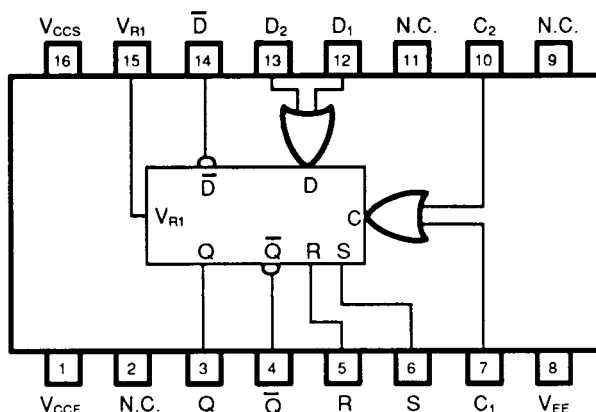
MB812A – Dual Exclusive OR/NOR Gate

$$X = A\bar{B} + \bar{A}B \quad \bar{X} = A\bar{B} + \bar{A}\bar{B}$$



Input			Output	
A	B	$\bar{E}$	X	$\bar{X}$
H	H	L	L	H
L	H	L	H	L
H	L	L	H	L
L	L	L	L	H
X	X	H	L	H

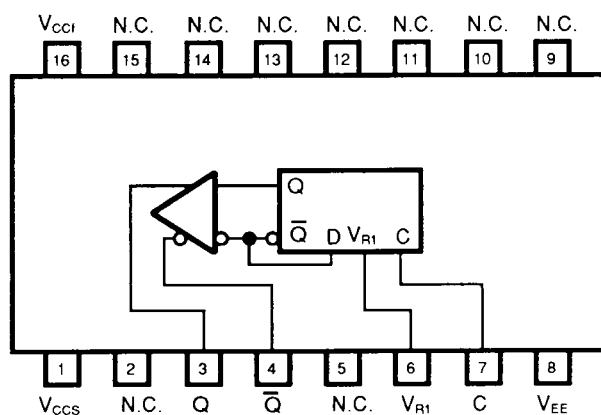
MB813A – 2-Input D-Type Flip-Flop with Set and Reset



Input				Output	
Set	Reset	Clock	D	Q	$\bar{Q}$
H	H	X	X	*	*
H	L	X	X	H	L
L	H	X	X	L	H
L	L	↑	H	H	L
L	L	↑	L	L	H
L	L	L	X	Q_0	$\bar{Q}_0$

D: Complement input of D.
If D only is used, $\bar{D}$ must be connected to V_{R1} externally.

MB814A – T-Type Flip-Flop



Input	Output	
C	Q_{n+1}	$\bar{Q}_{n+1}$
L	Q_n	Q_n
↑	$\bar{Q}_n$	Q_n

Notes:

- H :High
- L :Low
- X :Don't Care
- ↑ :L to H transition
- * :Irrelevant
- Q_0 :The level before establishment of Input condition
- $\bar{Q}_0$:Complementary output of Q_0
- Q_n :Before adding clock
- Q_{n+1} :After adding clock

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Power Supply ($V_{CCS} = V_{CCF} = 0$)	V_{EE}	$-5.2 \pm 5\%$	V
Terminal Voltage	V_T	$2.0 \pm 5\%^*$	V
Operating Ambient Temperature	T_A	0 to +75	°C

Note: *Each output is terminated through a 50 Ω resistor.

DC CHARACTERISTICS

(Recommended operating conditions otherwise noted. $V_{CCS} = V_{CCF} = 0V$, $R_T = 50\Omega$)

($T_A = 0^\circ\text{C}$ to $+75^\circ\text{C}$)

Parameter	Conditions		Symbol	Value			Unit
				Min	Typ	Max	
High-level Output Voltage	$V_{IH} = -0.73V$		V_{OH}	-1.02	-0.90	-0.73	V
Low-level Output Voltage	$V_{IL} = -1.87V$		V_{OL}	-1.87	-1.75	-1.60	V
High-level Threshold Voltage	$V_{IH} = -1.07V$		V_{OHA}	-1.02			V
Low-level Threshold Voltage	$V_{IL} = -1.48V$		V_{OLA}			-1.60	V
Input Current	$V_{IH} = -0.73V$	MB810A, MB811A	I_{IN}		0.12	0.21	mA
		MB812A			0.12	0.19	mA
		MB813A			0.15	0.28	mA
		MB814A			0.13	0.25	mA
Power Supply Current	MB811A, MB812A, MB813A		I_{EE}	-35	-26	-15	mA
	MB810A			-25	-19	-10	mA
	MB814A			-28	-21	-15	mA
Reference Voltage	MB813A, MB814A		V_{R1}	-1.38	-1.29	-1.18	V

AC CHARACTERISTICS

(MB810A, MB811A, MB812A)

(T_A = +25°C)

Parameter	Condition	Symbol	Value			Unit
			Min	Typ	Max	
Propagation Delay Time	$V_{CCS} = V_{CCF} = +2.0V$ $R_T = 50\Omega$ $V_{EE} = -3.2V$ $V_T = \text{Ground}$ Input Pulse $t_r = t_f \leq 500ps$ $V_{IH} = +1.1V$ $V_{IL} = +0.3V$ PRR = 100MHz	t_{PLH}		400	650	ps
		t_{PHL}		400	650	ps
Rising Time (20% to 80%)		t_{TLH}		350	550	ps
Falling Time (80% to 20%)		t_{THL}		350	550	ps

AC CHARACTERISTICS

(MB813A)

(T_A = +25°C)

Parameter	Condition	Symbol	Value			Unit
			Min	Typ	Max	
Propagation Delay Time (Clock, Reset and Set to output)	$V_{CCS} = V_{CCF} = +2.0V$ $R_T = 50\Omega$ $V_{EE} = -3.2V$ $V_T = \text{Ground}$ Input Pulse $t_r = t_f \leq 500ps$ $V_{IH} = +1.1V$ $V_{IL} = +0.3V$ PRR = 100MHz	t_{PLH}		900	1200	ps
		t_{PHL}		900	1200	ps
Rising Time (20% to 80%)		t_{TLH}		350	550	ps
Falling Time (80% to 20%)		t_{THL}		350	550	ps
Setup Time		t_{set}	500	250		ps
Hold Time		t_{hold}	500	250		ps
Clock Frequency		f_{log}	1.0	1.5		GHz

AC CHARACTERISTICS

(MB814A)

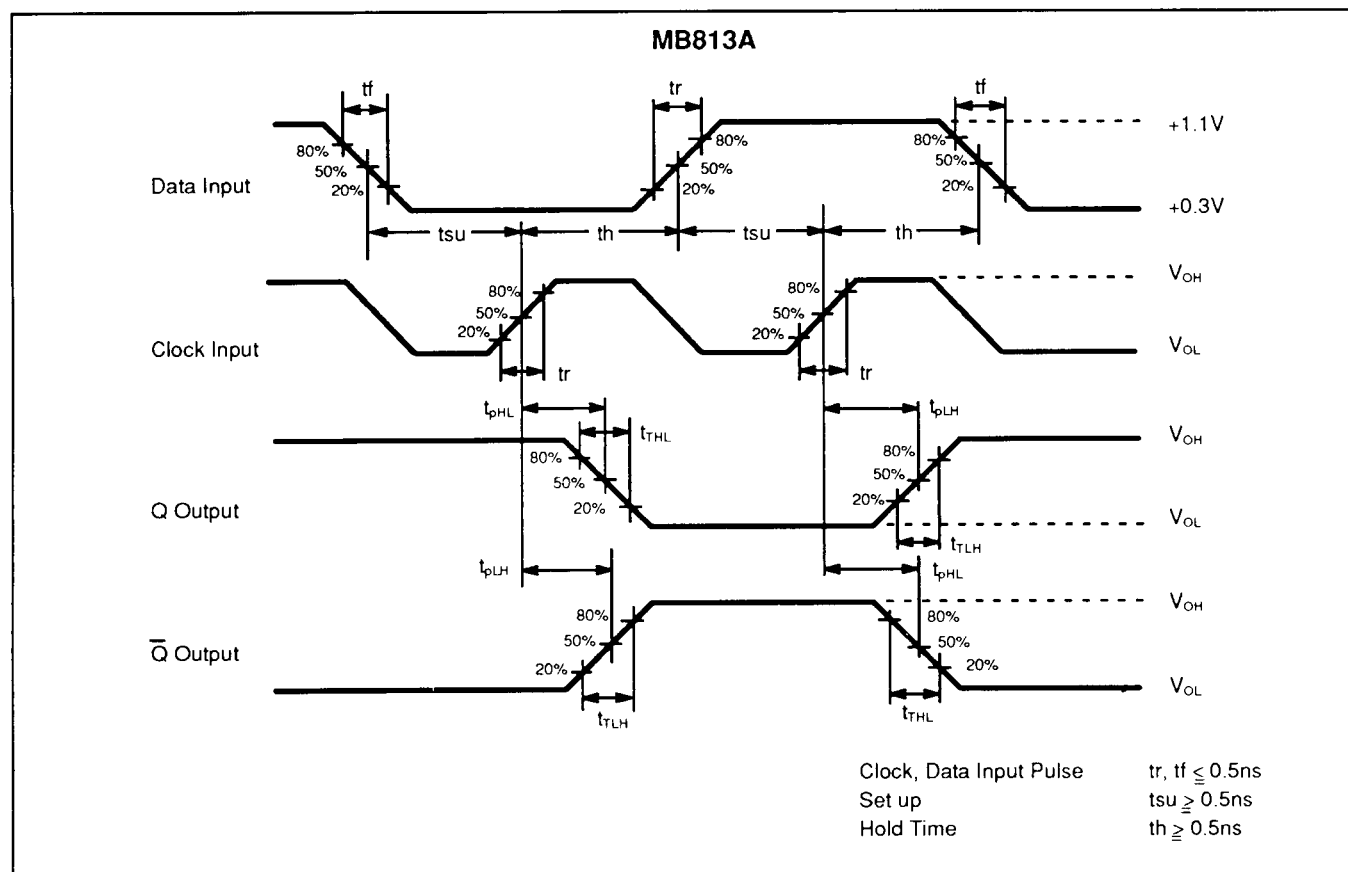
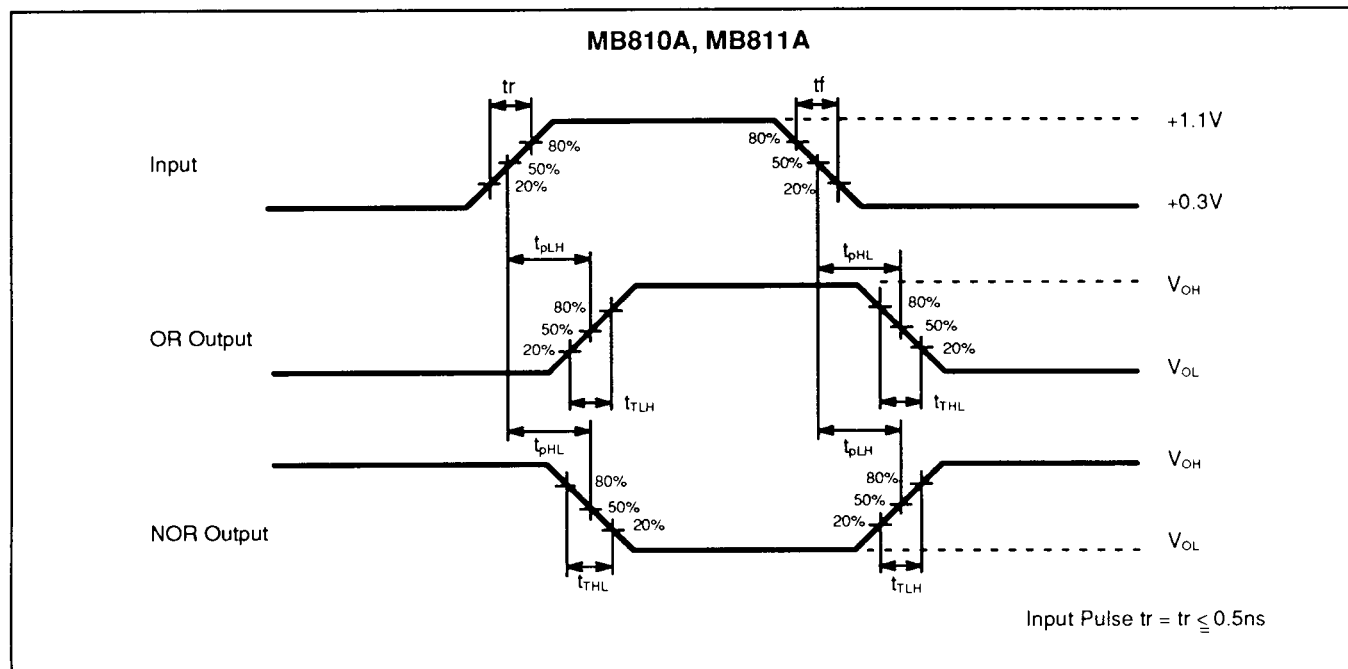
(T_A = +25°C)

Parameter	Condition	Symbol	Value			Unit
			Min	Typ	Max	
Propagation Delay Time	$V_{CCS} = V_{CCF} = +2.0V$ $R_T = 50\Omega$ $V_{EE} = -3.2V$ $V_T = \text{Ground}$ Input Pulse $t_r = t_f \leq 500ps$ $V_{IH} = +1.1V$ $V_{IL} = +0.3V$ PRR = 100MHz	t_{PLH}	500	900	1200	ps
		t_{PHL}	500	900	1200	ps
Rising Time (20% to 80%)		t_{TLH}		350	550	ps
Falling Time (80% to 20%)		t_{THL}		350	550	ps
Clock Frequency		f_{log}	1.3	1.5		GHz

MB810A
MB811A
MB812A
MB813A
MB814A

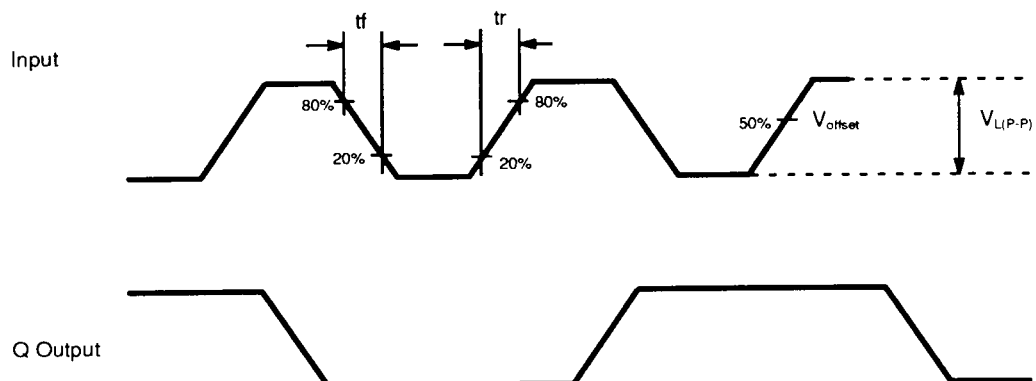
SWITCHING WAVE FORM

INPUT/OUTPUT WAVE FORM



SWITCHING WAVE FORM (Continued)

TOGGLE WAVE FORM
MB813A, MB814A



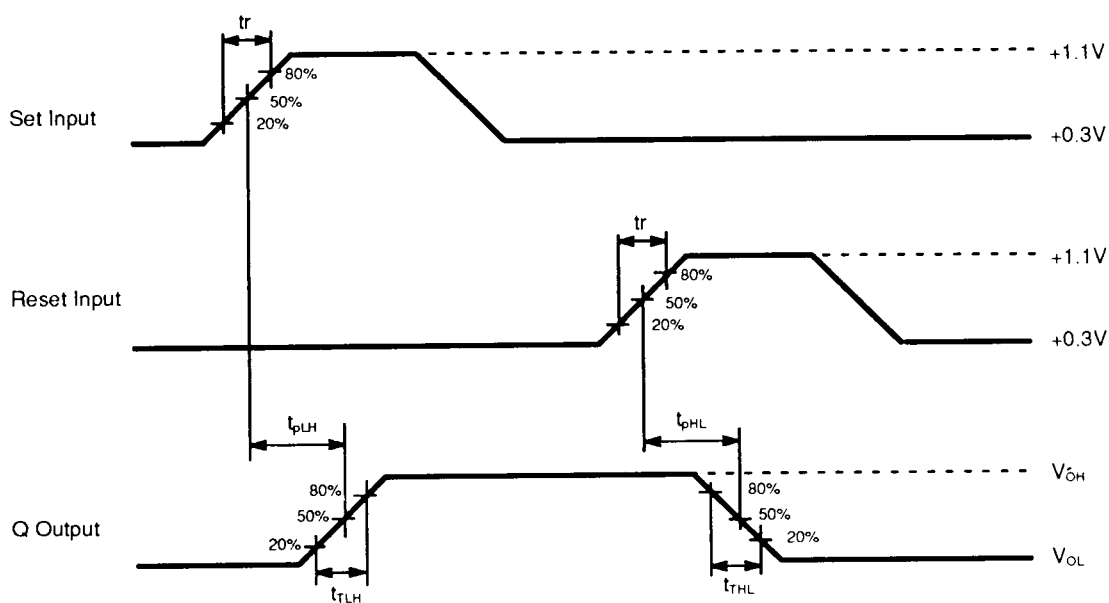
Q output PRR is 1/2PRR of Input
1/2PRR Input Duty Cycle = 50%

$t_r, t_f \leq 500\text{ps}$

$V_{offset} = +0.7\text{V}$

$V_{L(P-P)} = 800\text{mV}$

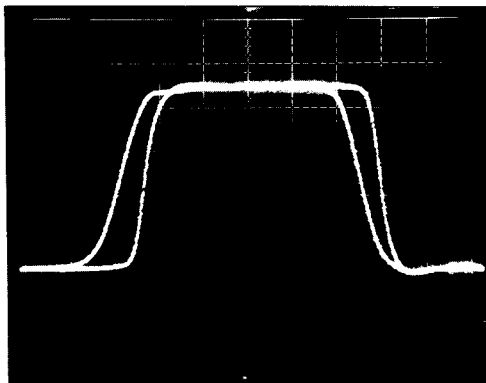
SET/RESET WAVE FORM
MB813A



MB810A
MB811A
MB812A
MB813A
MB814A

SWITCHING CHARACTERISTICS (MB811A)

X OUTPUT



H = 1ns/div V = 200mV/div

$\bar{X}$ OUTPUT



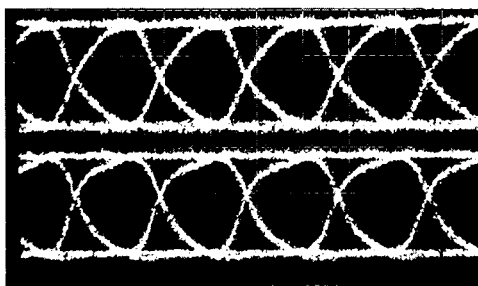
H = 1ns/div V = 200mV/div

EYE PATTERN

Bit Rate 1Gb/s

NOR Output

OR Output



H = 500ps/div V = 400mV/div

TYPICAL CHARACTERISTICS CURVES

Fig 2 – MB810A, MB811A OUTPUT VOLTAGE vs. INPUT VOLTAGE

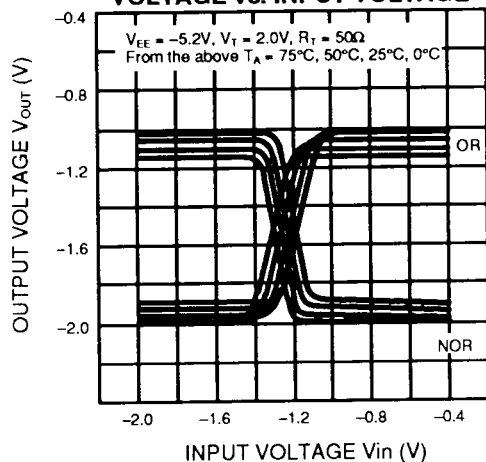


Fig 3 – MB810A, MB811A OUTPUT VOLTAGE vs. INPUT VOLTAGE

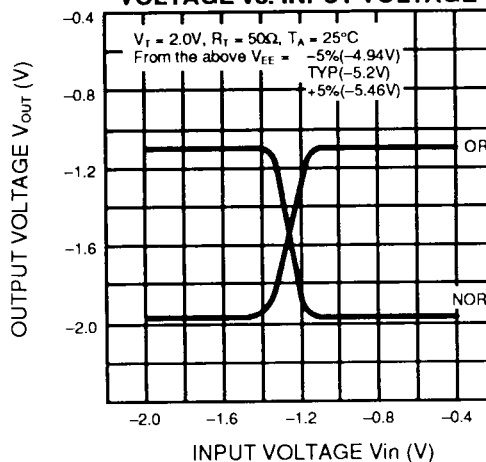


Fig 4 – INPUT CHARACTERISTIC

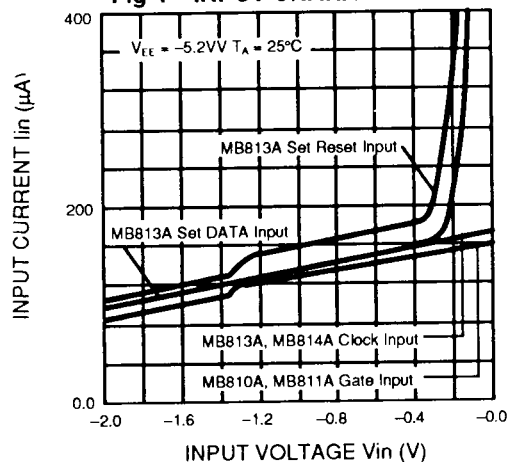


Fig 5 – SUPPLY CURRENT vs. SUPPLY VOLTAGE

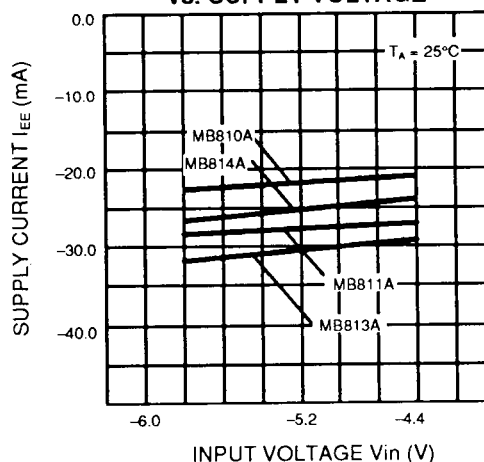
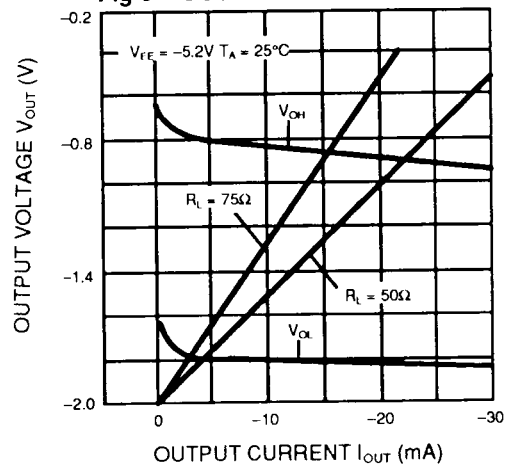


Fig 6 – OUTPUT CHARACTERISTIC



$V_{CCS} = V_{CCF} = +2V$
 $V_I = 0V$ $R_I = 50\Omega$ $V_{EE} = -3.2V$

— : NOR - - : OR

t_{pHL} , t_{pLH} (ps)

TEMPERATURE T_A ($^{\circ}C$)

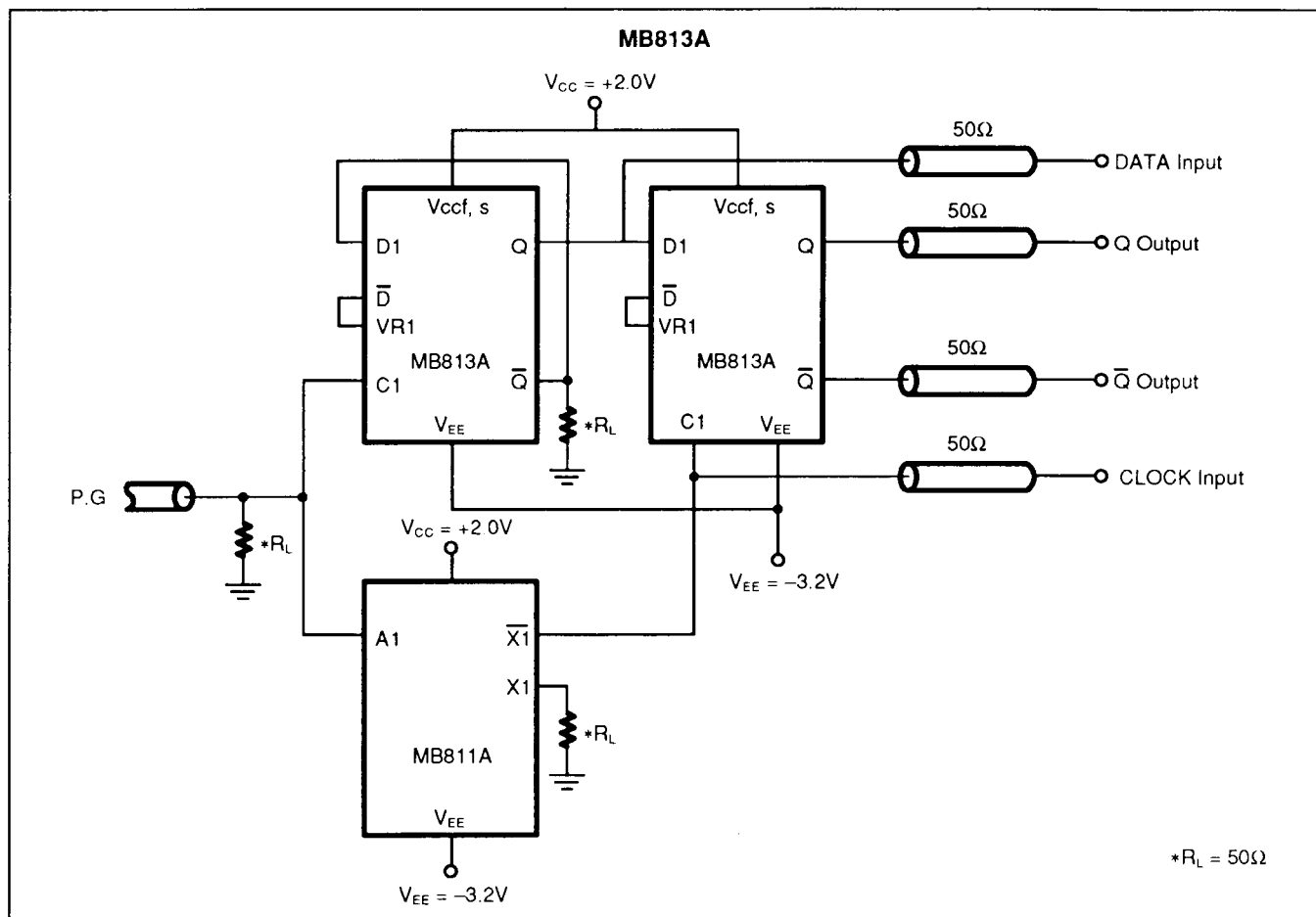
Timing diagram showing the effect of temperature on the propagation delay of the 74VHC00. The graph plots Rising/Falling Time (ps) on the y-axis (300 to 500) against Temperature T_A (°C) on the x-axis (0 to 80). Two sets of curves are shown: solid lines for NOR and dashed lines for OR. Each set includes t_{PLH} (pull-up low-to-high) and t_{PLL} (pull-up high-to-low) curves. The curves show that propagation delay increases with temperature. The NOR gates have higher delays than OR gates. The pull-up low-to-high delay (t_{PLH}) is consistently higher than the pull-up high-to-low delay (t_{PLL}).

Operating conditions:
 $V_{CCS} = V_{CCF} = +2V$
 $V_I = 0V$ $R_I = 50\Omega$ $V_{EE} = -3.2V$

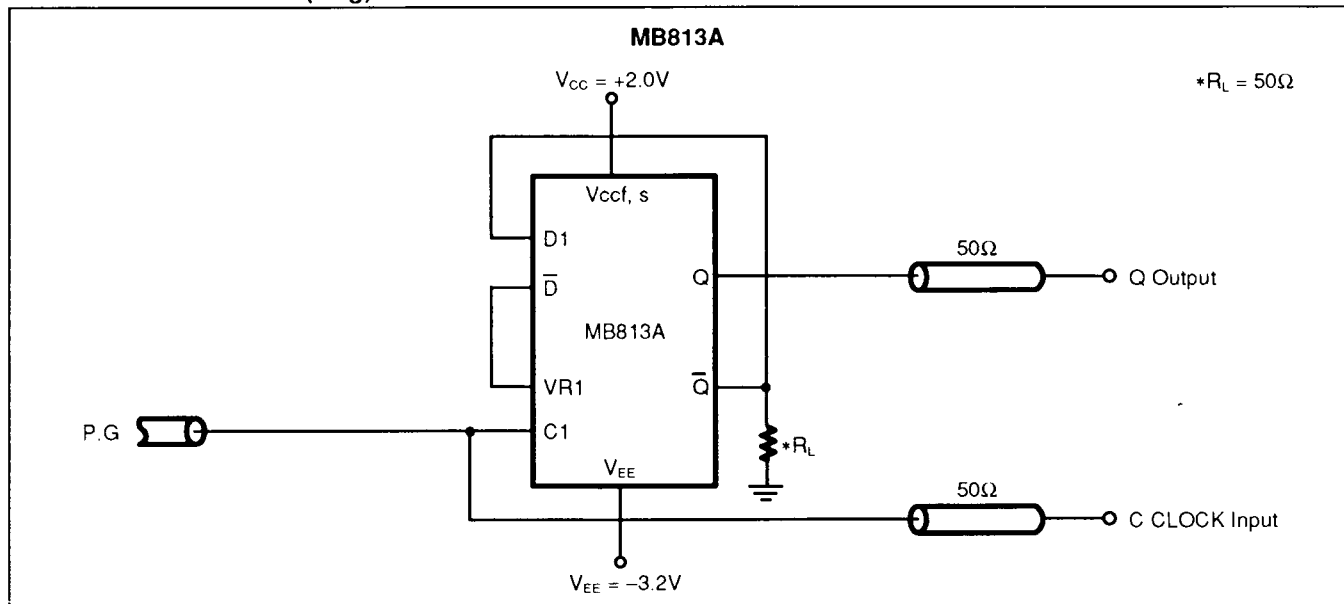
SWITCHING CHARACTERISTICS



TEST CIRCUIT (Continued)

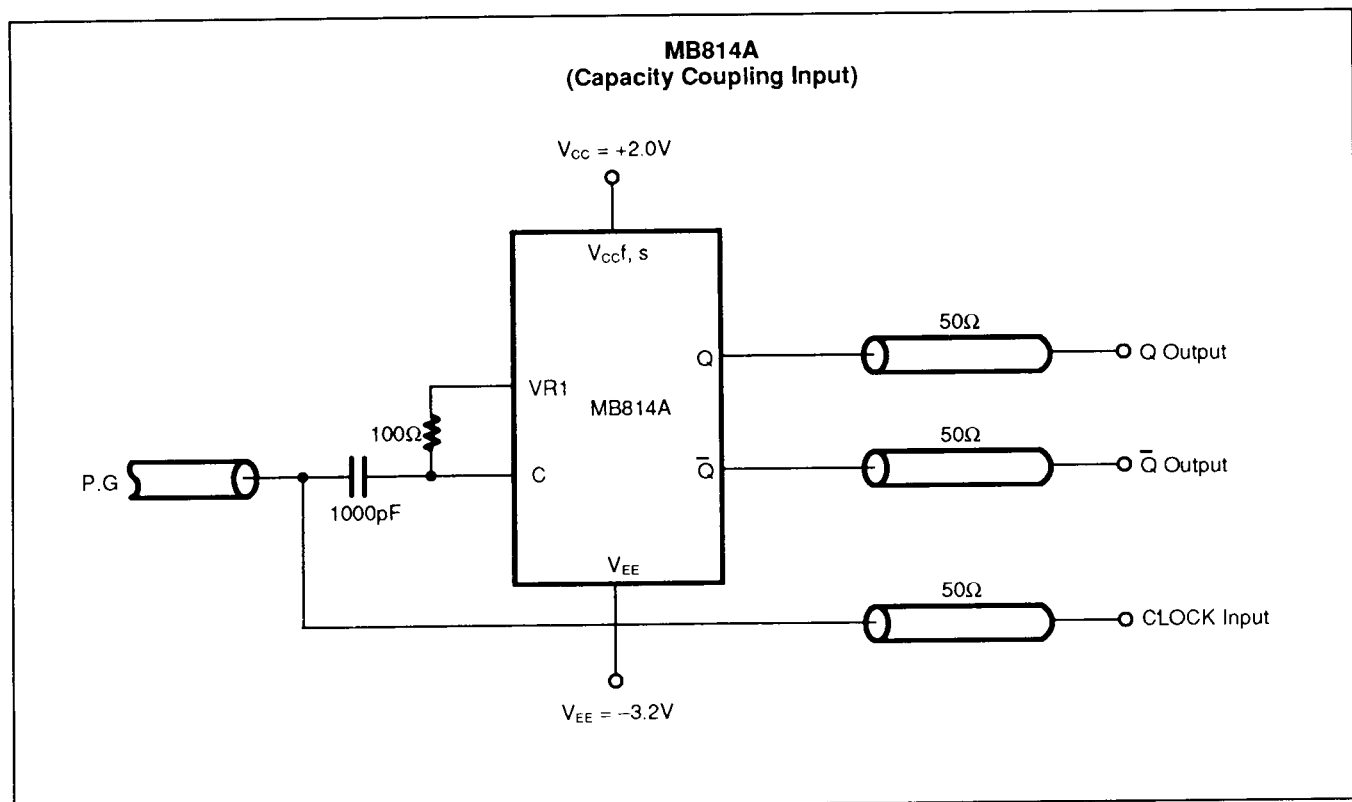
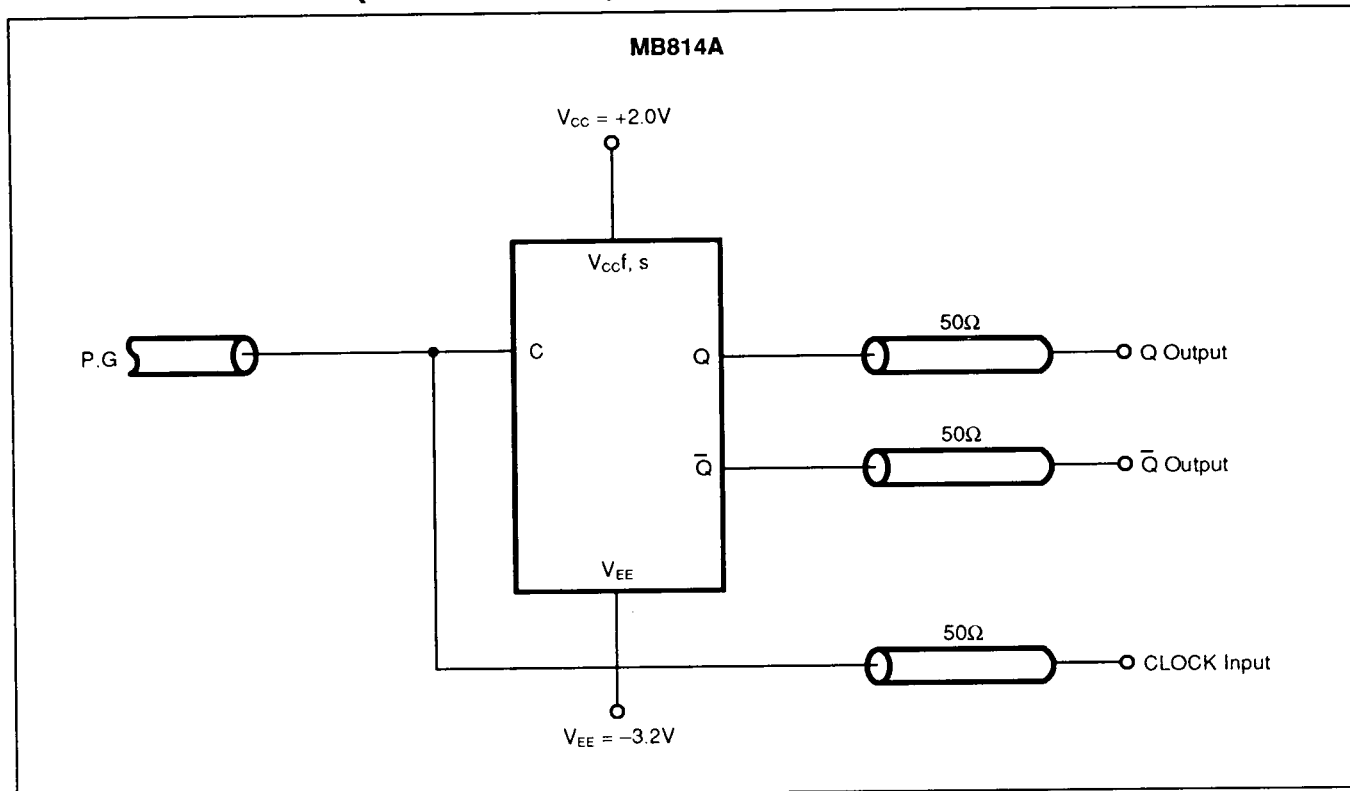


TOGGLE FREQUENCY (ftog)



MB810A
MB811A
MB812A
MB813A
MB814A

TEST CIRCUIT (Continued)



Technical drawings of a 16-pin DIP package showing top, side, and end views with dimensions in inches and millimeters.

Top View Dimensions:

- Overall Width: $.760^{+.028}_{-.006}$ (19.30 $^{+0.71}_{-0.15}$)
- Pin Pitch: $.050$ (1.27) MAX
- Pin Width: $.060^{+.002}_{-.004}$ (1.52 $^{+0.05}_{-0.10}$)
- Pin Spacing: $.032^{+.012}_{-.003}$ (0.81 $^{+0.30}_{-0.08}$)
- Pin Length: $.100 \pm .010$ (2.54 ± 0.25)
- Pin Angle: 0° to 15°
- Pin Thickness: $.010^{+.004}_{-.002}$ (0.25 $^{+0.10}_{-0.05}$)
- Pin Spacing (Typical): $.032$ (0.81) TYP
- Pin Length (Typical): $.134 \pm .014$ (3.40 ± 0.36)
- Pin Thickness (Typical): $.010$ (0.25) TYP

Side View Dimensions:

- Overall Height: $.248^{+.012}_{-.004}$ (6.30 $^{+0.30}_{-0.10}$)
- Pin Height: $.311^{+.014}_{-.006}$ (7.90 $^{+0.36}_{-0.15}$)
- Pin Spacing (Typical): $.300$ (7.62) TYP

End View Dimensions:

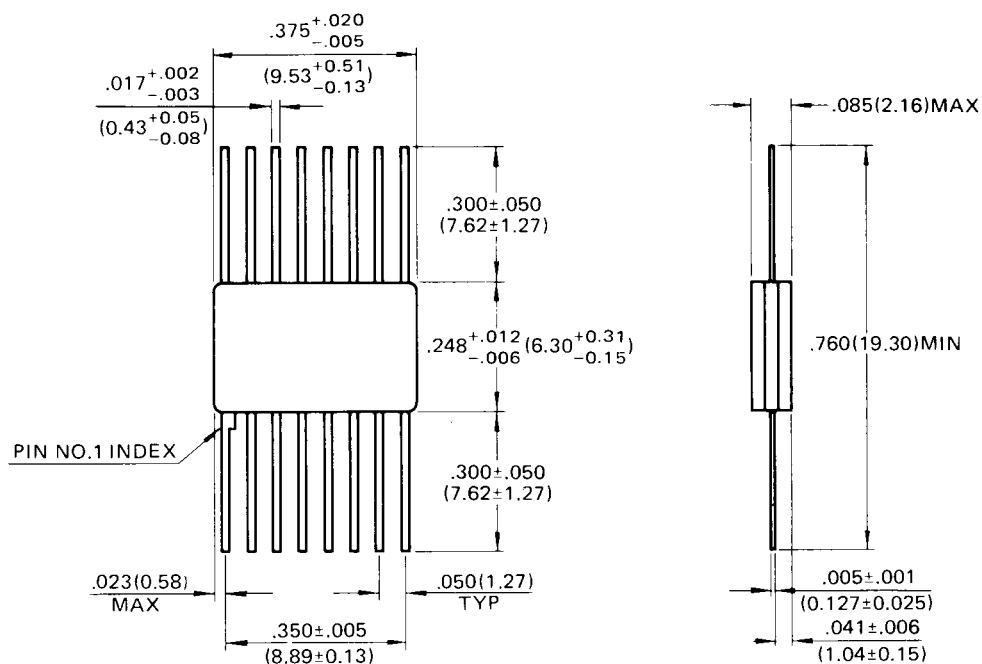
- Overall Length: $.700$ (17.78) REF
- Pin Length: $.18^{+.005}_{-.003}$ (0.46 $^{+0.13}_{-0.08}$)

Dimensions in
inches (millimeters)

MB810A
MB811A
MB812A
MB813A
MB814A

PACKAGE DIMENSIONS (Continued)

16-LEAD CERAMIC AXIAL FLAT PACKAGE
(CASE No.: FPT-16C-C01)



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Dimensions in
inches (millimeters)

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