August 1991

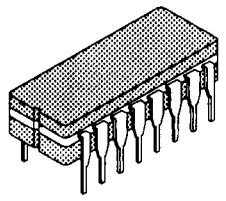
DATA SHEET

FUJITSU

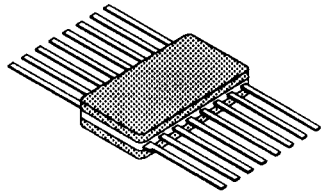
MB810A / 811A / 812A / 813A / 814A
Ultra High-Speed ECL ICs

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.



Ceramic DIP Package
DIP-16C-C01



Ceramic SOP Package
FPT-16C-C01

- 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

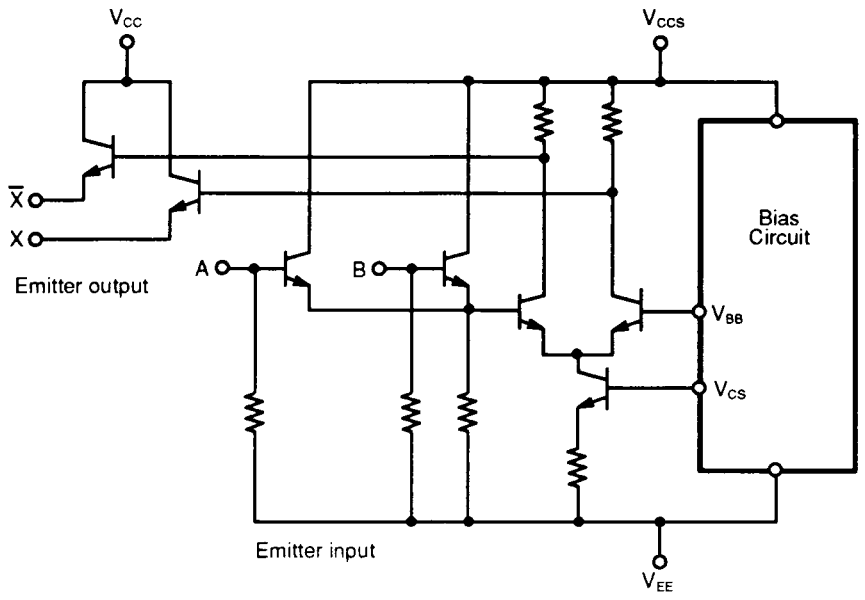
ABSOLUTE MAXIMUM RATINGS

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	°C
Storage Temperature	T_{STG}	–55 to +150	°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.

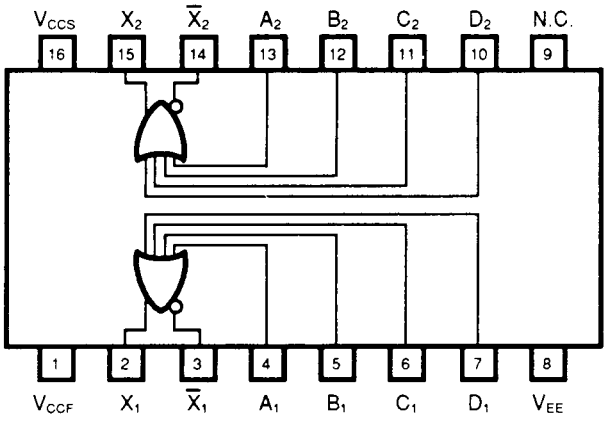
Fig.1 – MB810A SERIES BASIC GATE CIRCUIT



PIN ASSIGNMENTS

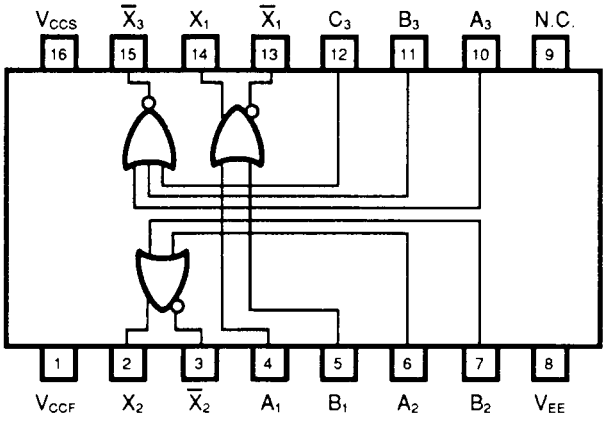
MB810A – Dual 4-Input OR/NOR Gate

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



Input				Output	
A	B	C	D	X	$\overline{X}$
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



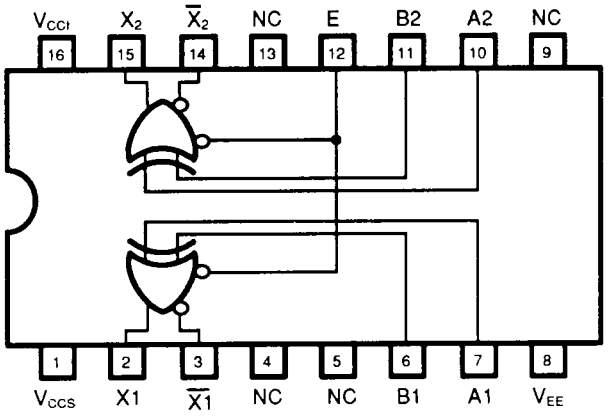
Input		Output	
A	B	X	$\overline{X}$
H	X	H	L
X	H	H	L
L	L	L	H

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

PIN ASSIGNMENTS (Continued)

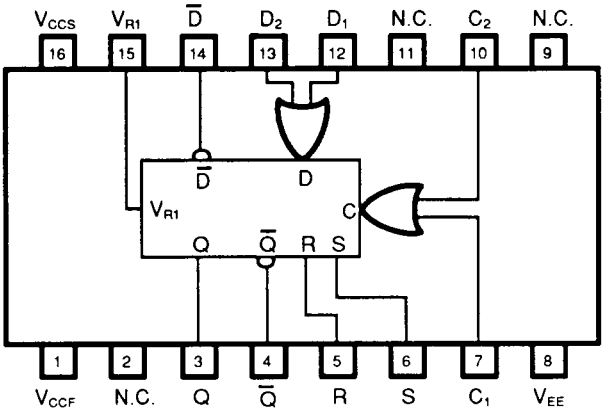
MB812A – Dual Exclusive OR/NOR Gate

$X = A\text{-}\overline{B} + \overline{A}\text{-}B \quad \overline{X} = A\text{-}B + \overline{A}\text{-}\overline{B}$



Input			Output	
A	B	$\overline{E}$	X	$\overline{X}$
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

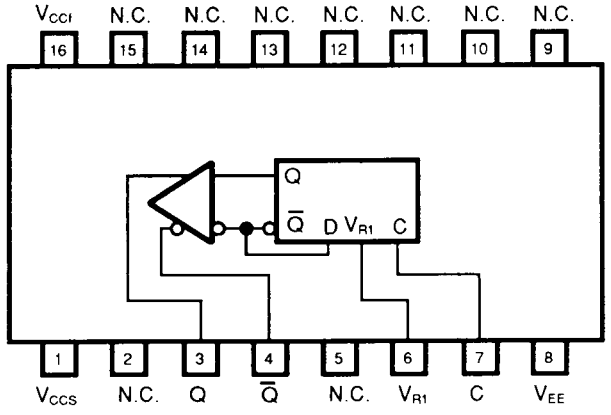
MB813A – 2-Input D-Type Flip-Flop with Set and Reset



Input				Output	
Set	Reset	Clock	D	Q	$\overline{Q}$
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	$\overline{Q_0}$

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

MB814A – T-Type Flip-Flop



Input	Output	
C	Q_{n+1}	$\overline{Q_{n+1}}$
L	Q_n	Q_n
↑	$\overline{Q_n}$	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
$\overline{Q_0}$	: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 ± 5%	V
Terminal Voltage	V_T	2.0 ± 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 = 50Ω) **(T_A = 0°C to +75°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 = 50Ω V_{EE} = −3.2V V_T = Ground Input Pulse tr = tf ≦ 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 = 50Ω V_{EE} = −3.2V V_T = Ground Input Pulse tr = tf ≦ 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		t_{tog}	1.0	1.5		GHz

AC CHARACTERISTICS

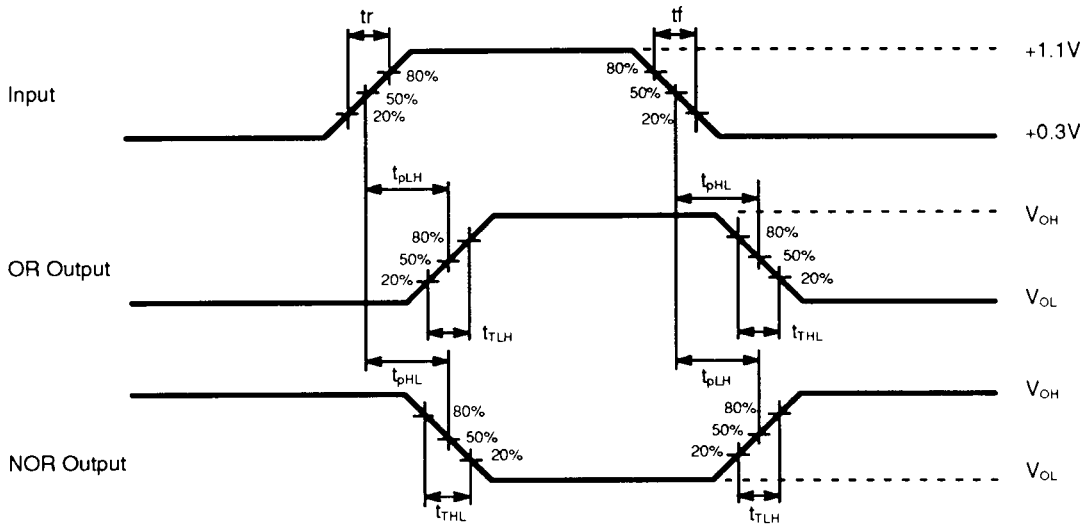
(MB814A) **(T_A = +25°C)**

Parameter	Condition	Symbol	Value			Unit
			Min	Typ	Max	
Propagation Delay Time	V_{CCS} = V_{CCF} = +2.0V R_T = 50Ω V_{EE} = −3.2V V_T = Ground Input Pulse tr = tf ≦ 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		t_{tog}	1.3	1.5		GHz

SWITCHING WAVE FORM

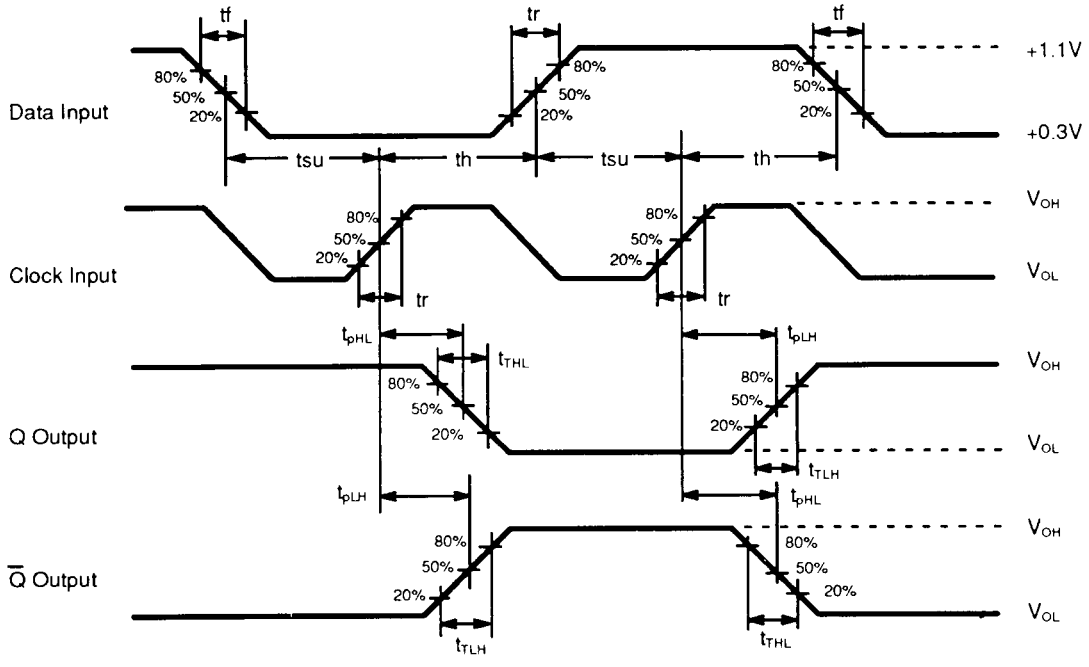
INPUT/OUTPUT WAVE FORM

MB810A, MB811A



Input Pulse tr = tf ≦ 0.5ns

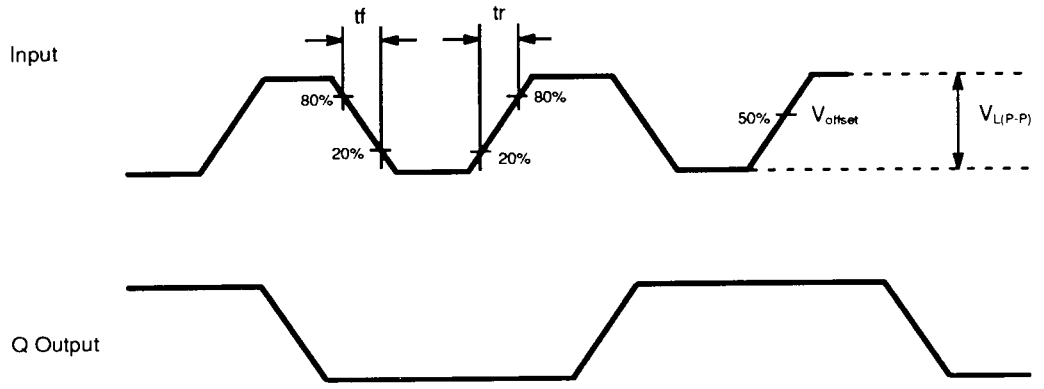
MB813A



Clock, Data Input Pulse	tr, tf ≦ 0.5ns
Set up	tsu ≧ 0.5ns
Hold Time	th ≧ 0.5ns

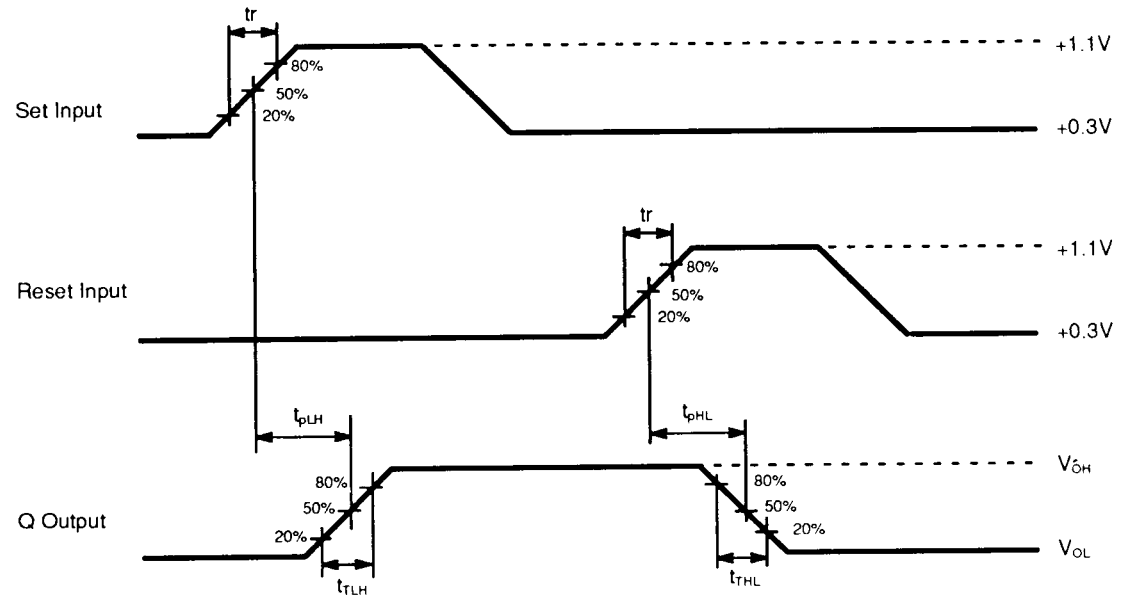
SWITCHING WAVE FORM (Continued)

TOGGLE WAVE FORM
MB813A, MB814A



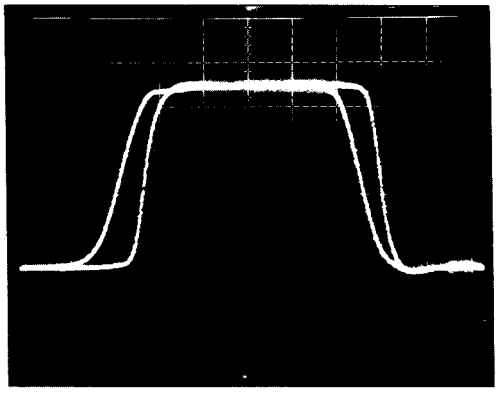
Q output PRR is 1/2PRR of Input
1/2PRR Input Duty Cycle = 50%
tr,tf ≦ 500ps
V_{offset} = +0.7V
$V_{L(P-P)}$ = 800mV

SET/RESET WAVE FORM
MB813A



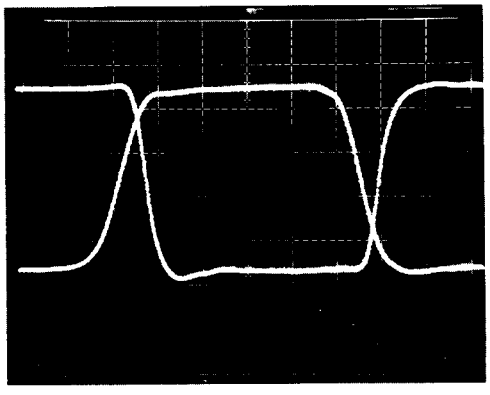
SWITCHING CHARACTERISTICS (MB811A)

X OUTPUT



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

$\overline{X}$ OUTPUT



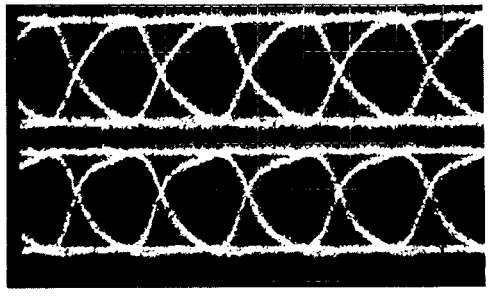
H = 1ns/div V = 200mV/div

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

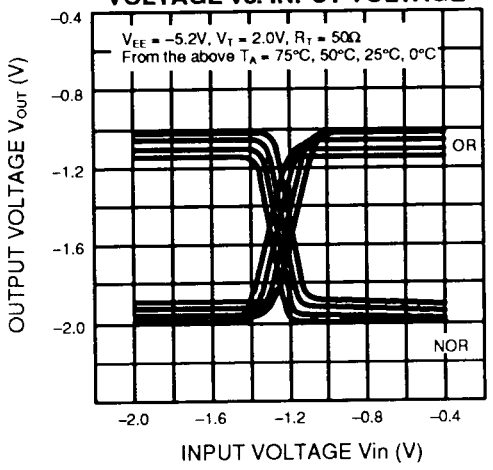


Fig 3 – MB810A, MB811A OUTPUT VOLTAGE vs. INPUT VOLTAGE

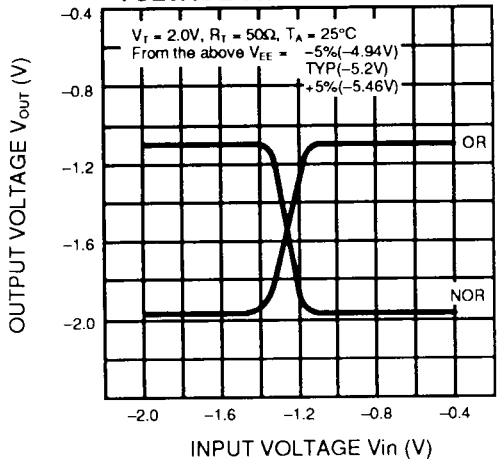


Fig 4 – INPUT CHARACTERISTIC

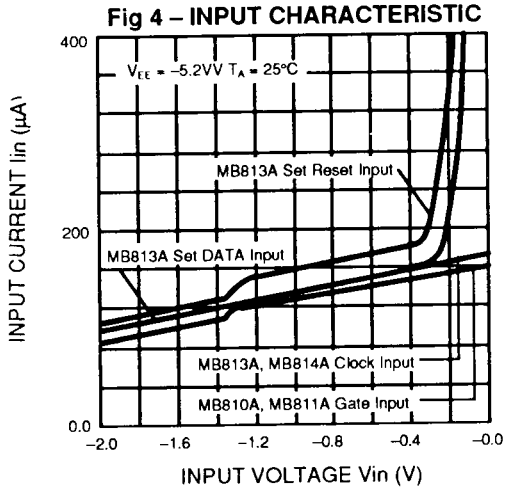


Fig 5 – SUPPLY CURRENT vs. SUPPLY VOLTAGE

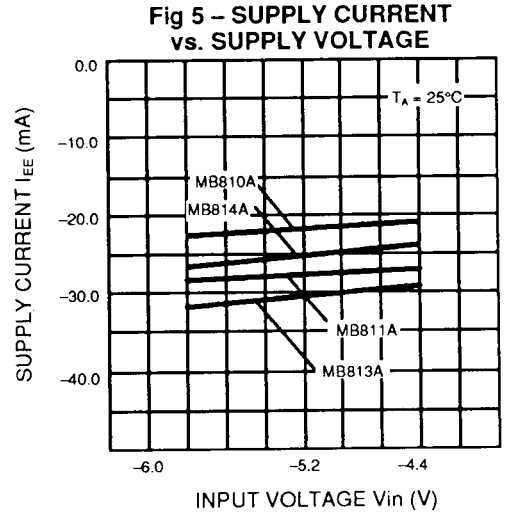
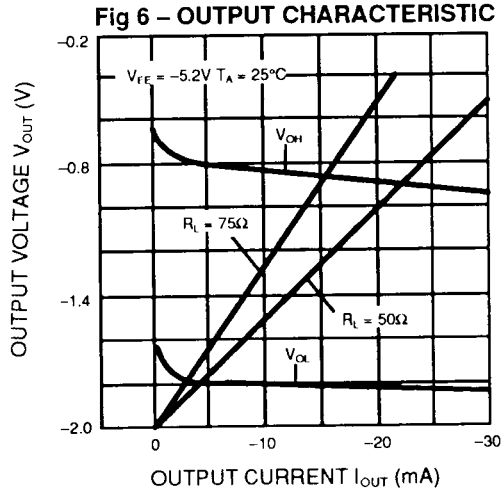


Fig 6 – OUTPUT CHARACTERISTIC



TYPICAL CHARACTERISTICS CURVES (Continued)

Fig 7 – MB810A, MB811A
PROPAGATION DELAY TIME
vs, TEMPERATURE

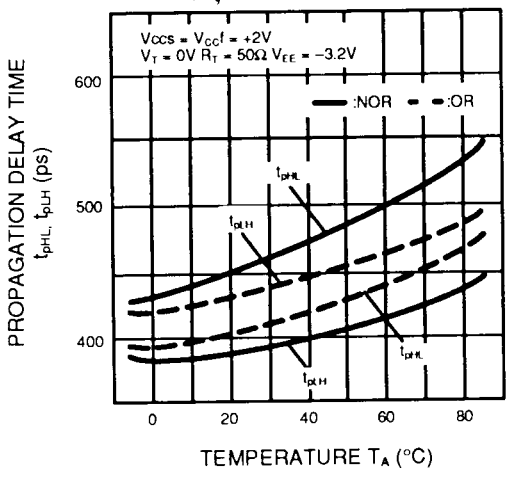
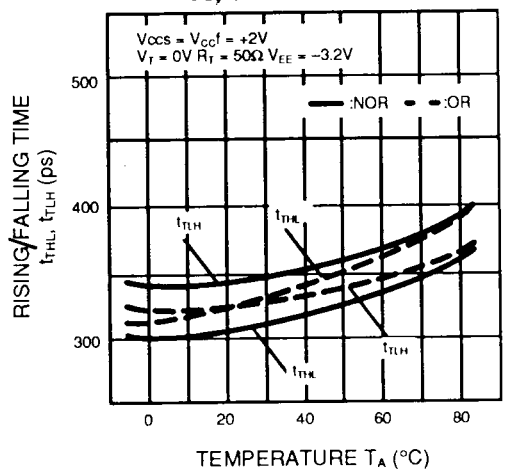


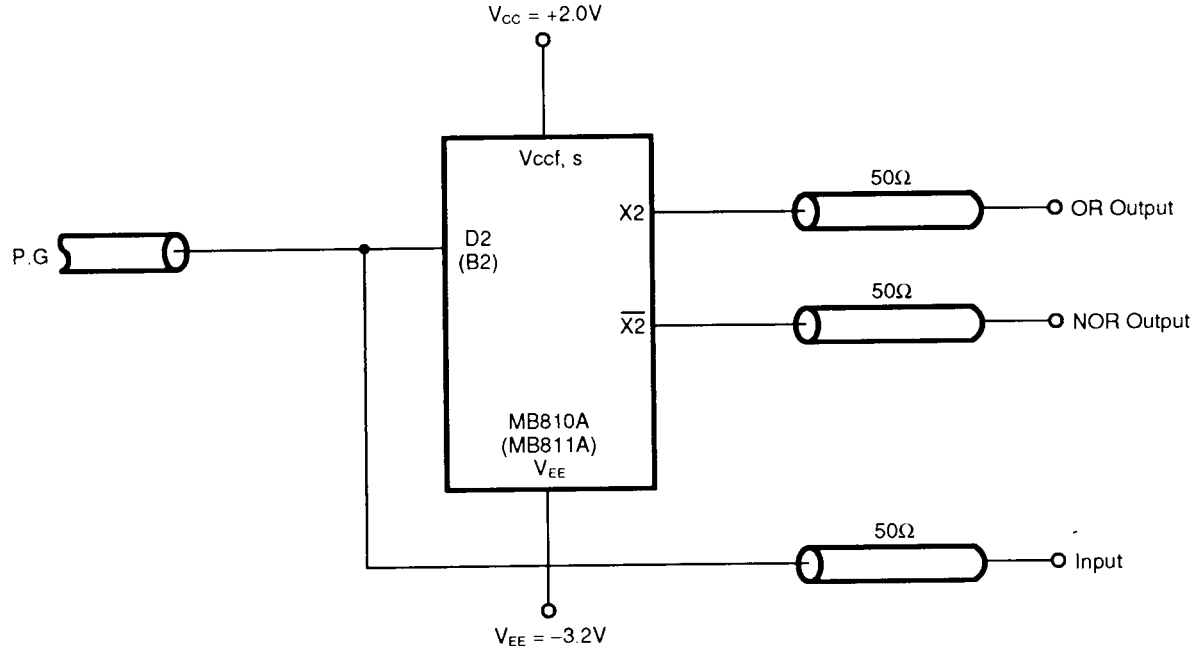
Fig 8 – MB810A, MB811A
RISING/FALLING TIME
vs, TEMPERATURE



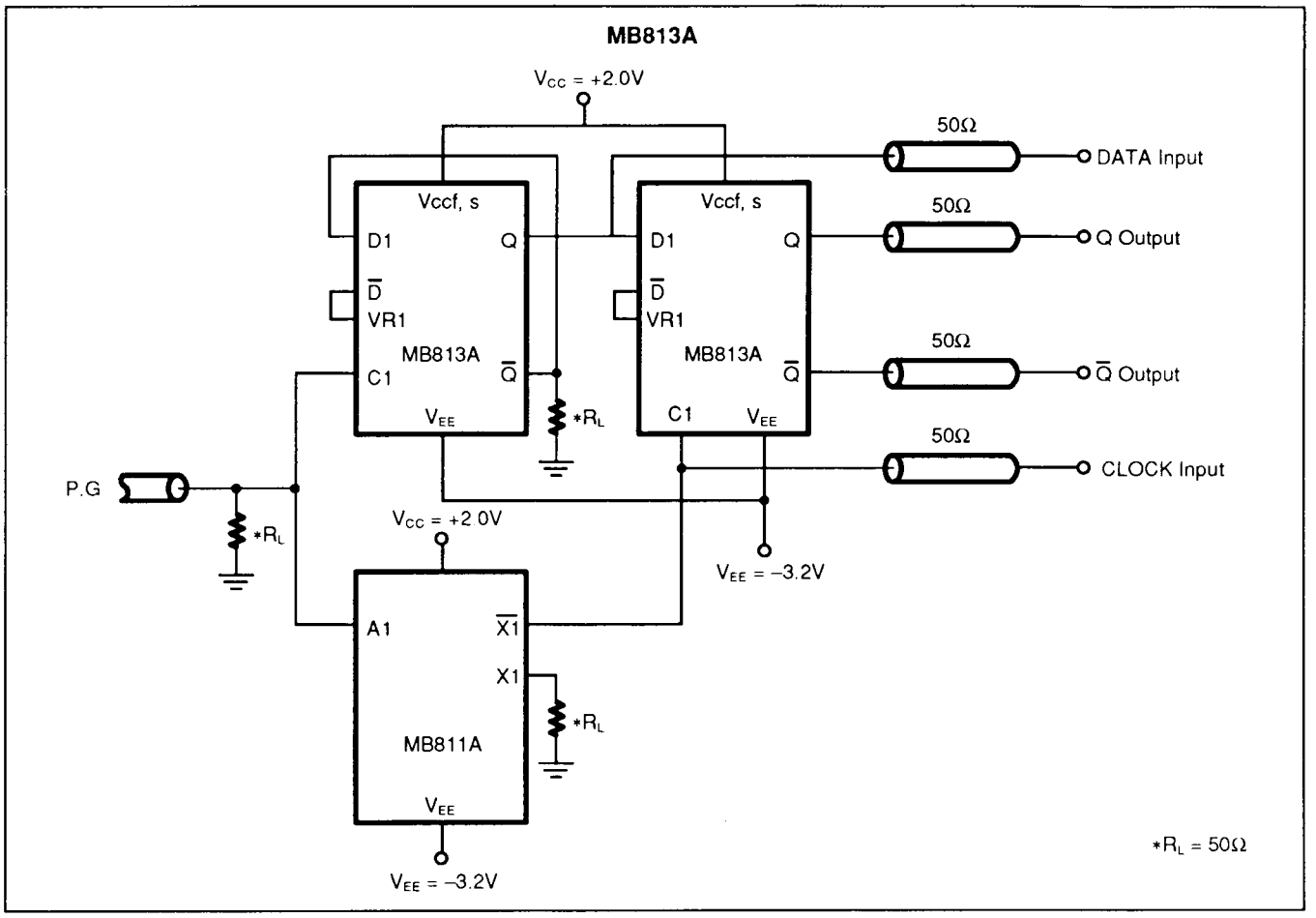
TEST CIRCUIT

SWITCHING CHARACTERISTICS

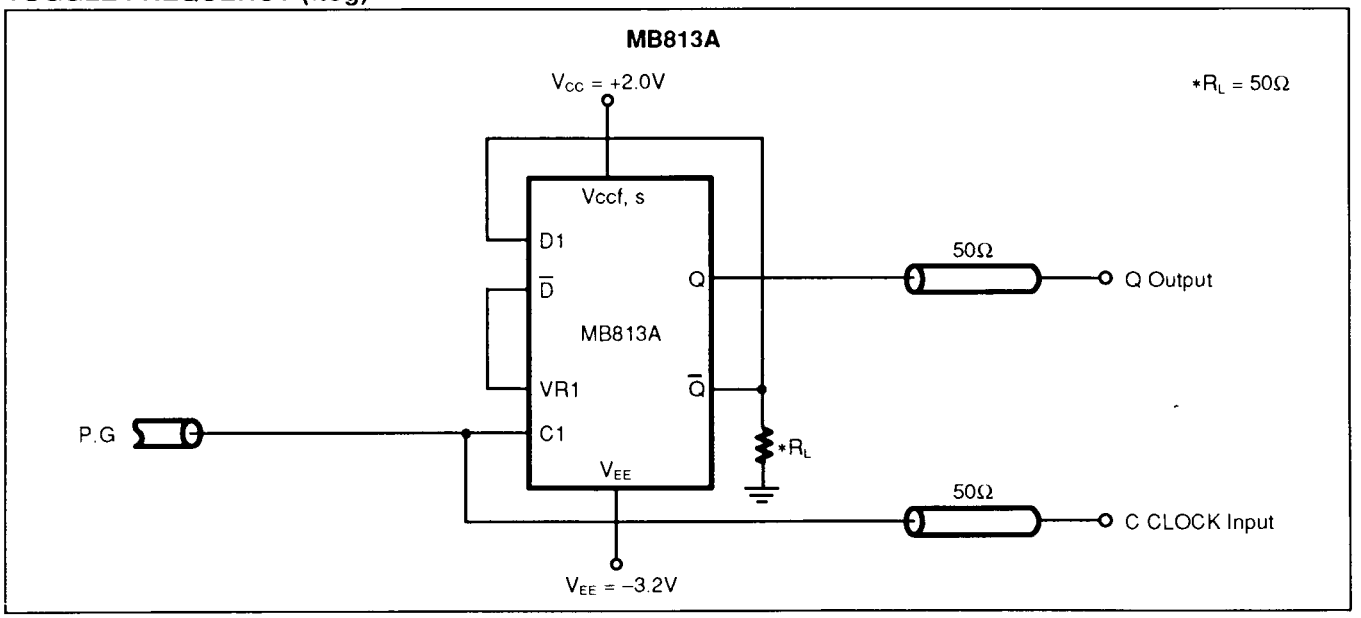
MB810A, MB811A



TEST CIRCUIT (Continued)

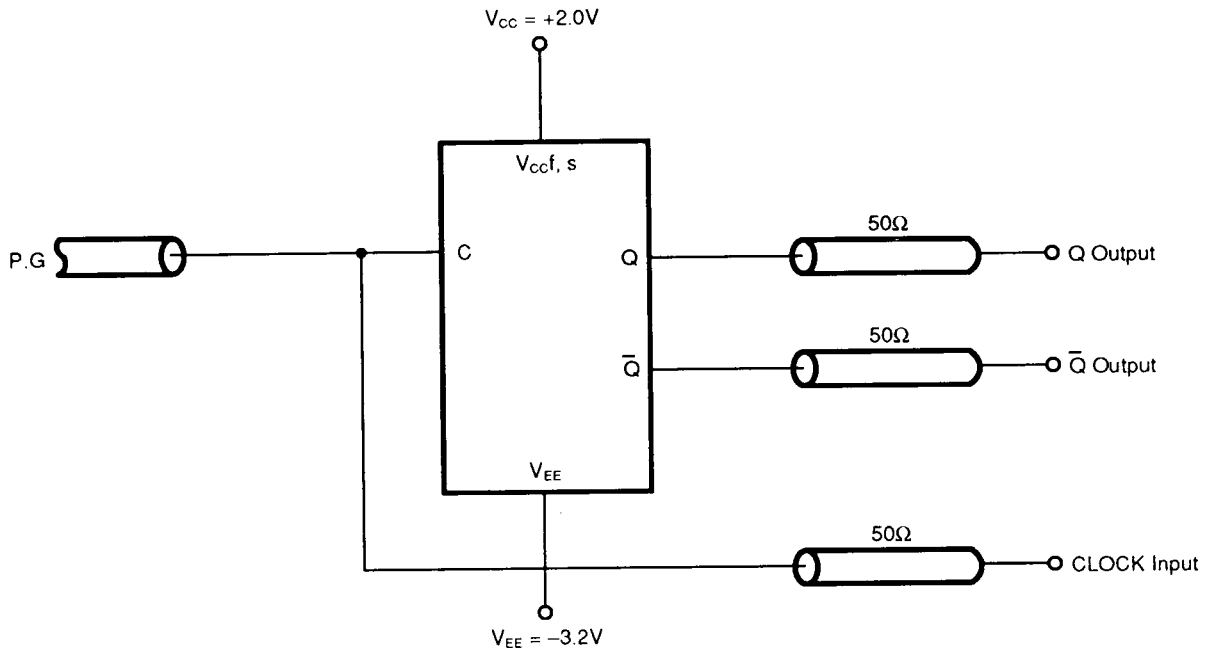


TOGGLE FREQUENCY (ftog)

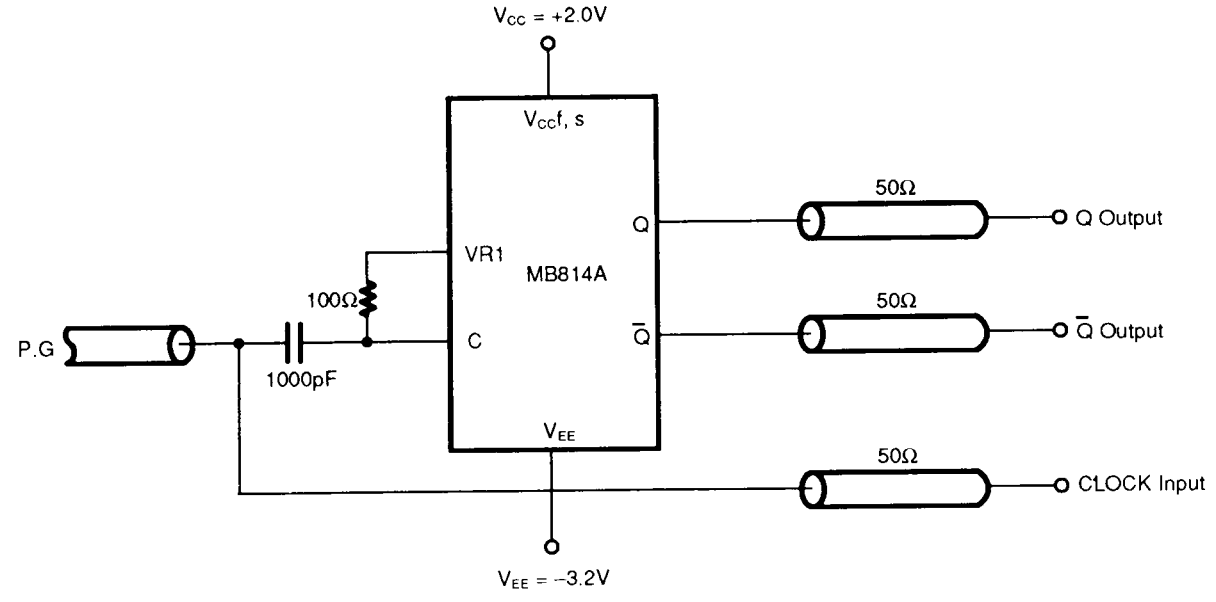


TEST CIRCUIT (Continued)

MB814A

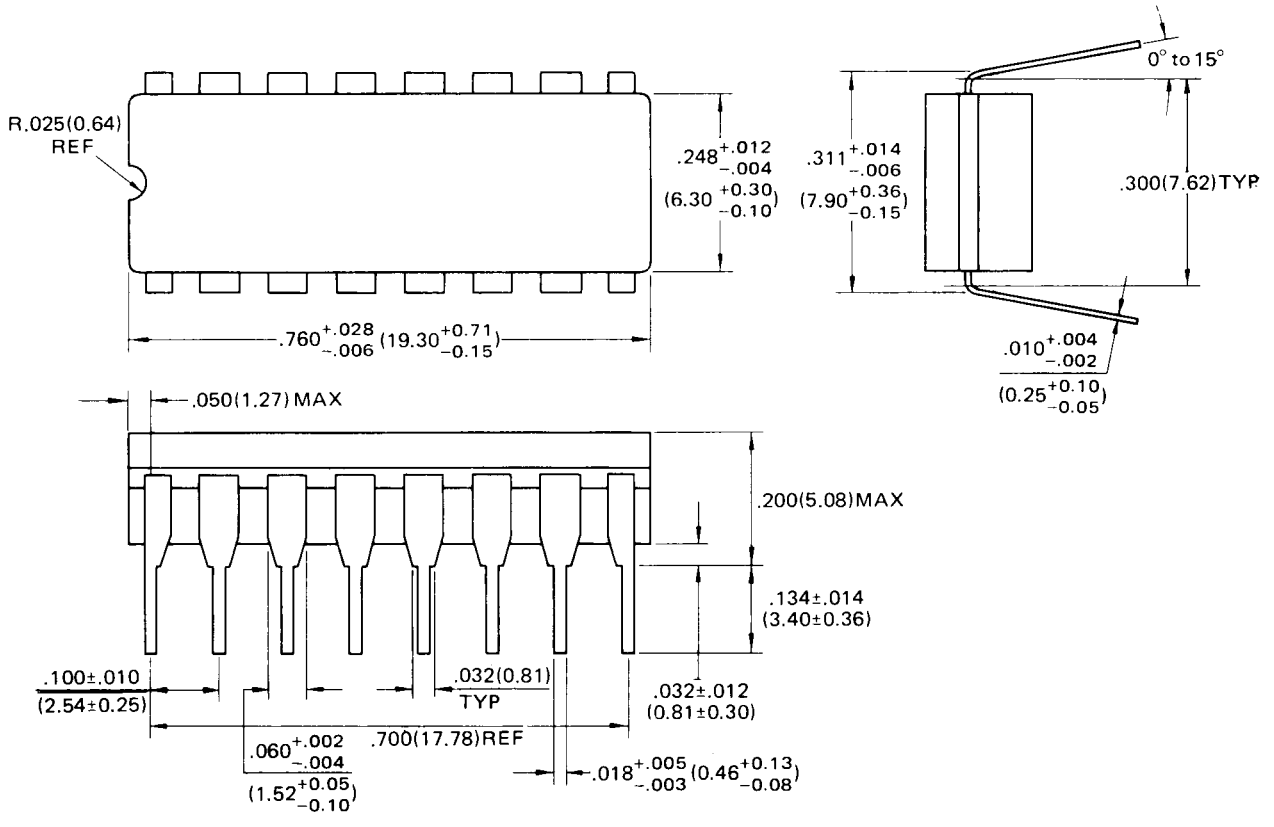


MB814A
(Capacity Coupling Input)



PACKAGE DIMENSIONS

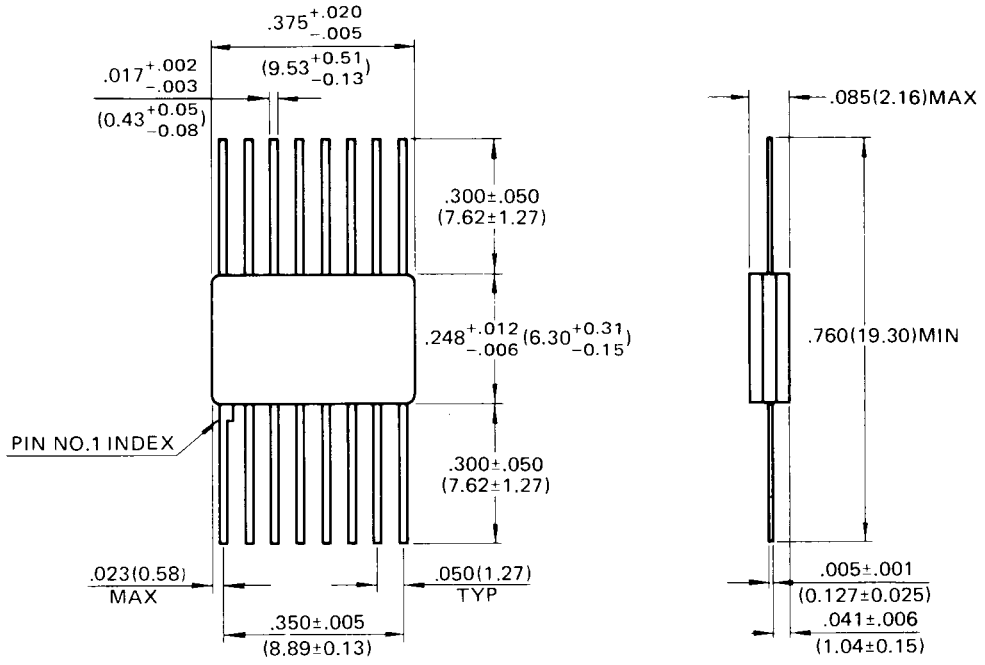
16-LEAD CERAMIC (CERDIP) DUAL IN-LINE PACKAGE
(CASE No.: DIP-16C-C01)



Dimensions in
inches (millimeters)

PACKAGE DIMENSIONS (Continued)

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



Dimensions in inches (millimeters)

Circuit diagrams utilizing Fujitsu products are included as a means of illustrating typical semiconductor applications. Complete Information sufficient for construction purposes is not necessarily given.

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