SGS-THOMSON MICROELECTRONICS

HCC/HCF4009UB
HCC/HCF4010B

HEX BUFFER/CONVERTERS

4009UB–INVERTING TYPE
4010B–NON INVERTING TYPE

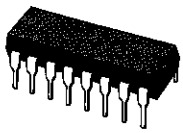
- CMOS TO DTL/TTL HEX CONVERTER
- HIGH-TO-LOW LEVEL LOGIC CONVERSION
- MULTIPLEXER: 1-TO-6 OR 6-TO-1
- HIGH"SINK" AND "SOURCE" CURRENT CAPABILITY
- 5V, 10V AND 15V PARAMETRIC RATINGS
- MAXIMUM INPUT CURRENT OF 100 µA AT 18V OVER FULL
- PACKAGE AND TEMPERATURE RANGE; 100nA AT 18V AND 25°C
- 100% TESTED FOR QUIESCENT CURRENT AT 20V
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N. 13A, " STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES "

DESCRIPTION

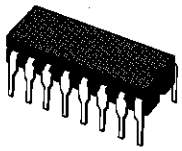
The **HCC4009UB/4010B** (extended temperature range) and the **HCF4009UB/4010B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in line plastic or ceramic packages and plastic micropackage.

The **HCC/HCF4009UB/4010B** are inverting and non-inverting Hex Buffer/Converters, respectively. Both devices can be used as CMOS to TTL or DTL logic-level converters, as current "sink" or "source" drivers or as multiplexer (1 to 6).

4049UB and **4050B** are prefered replacements for **4009UB** and **4010B**, respectively, in buffer applications.



EY
(Plastic Package)



F
(Ceramic Package)

M1
(Micro Package)

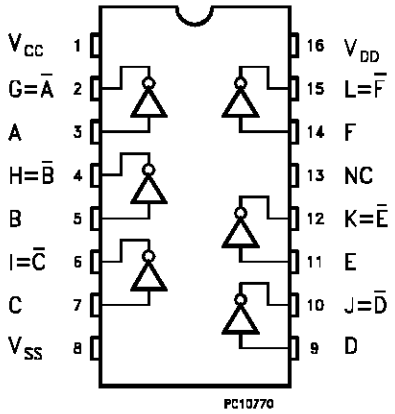
C1
(Chip Carrier)

ORDER CODES :

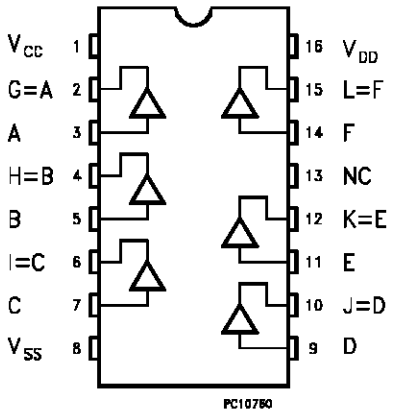
HCCXXXXBF	HCFXXXXBM1
HCFXXXXBEY	HCFXXXXBC1

PIN CONNECTIONS

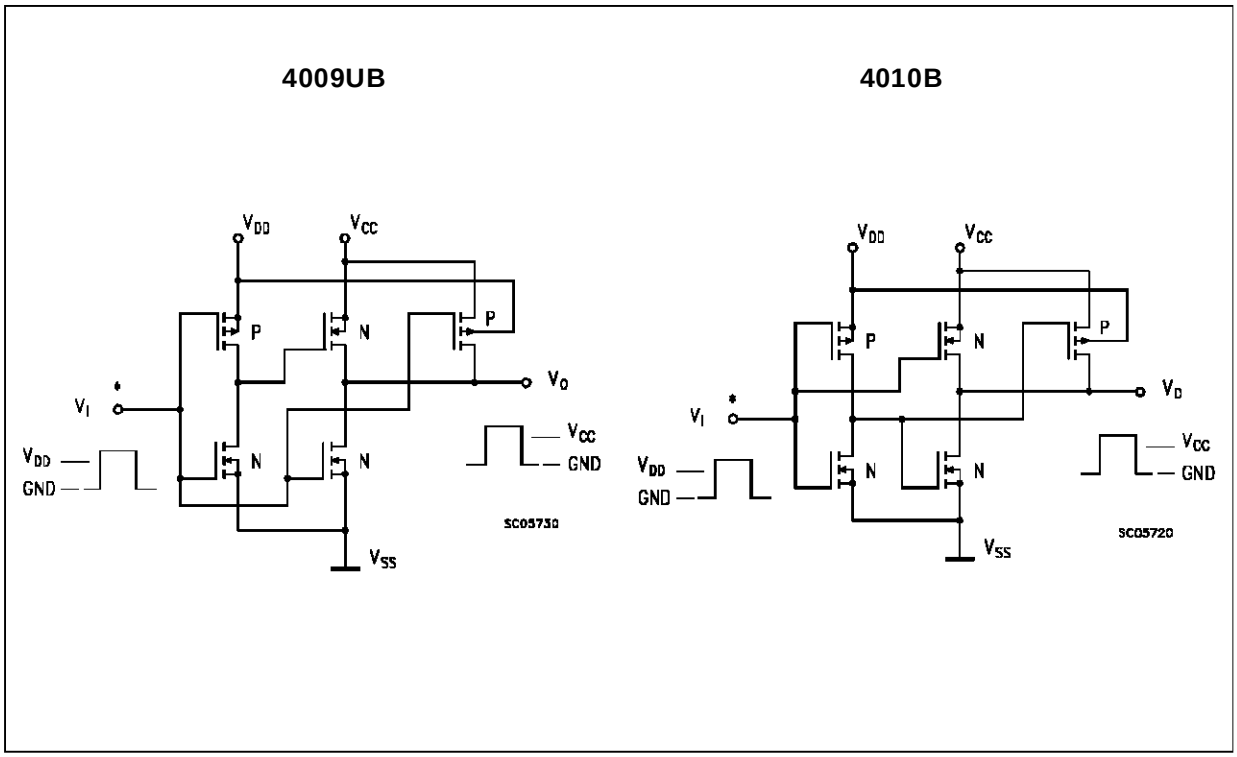
4009UB



4010B



SCHEMATIC DIAGRAM: COS/MOS TO DTL OR TTL CONVERTER (1 of 6 identical units)



Connect V_{CC} to DTL or TTL supply and V_{DD} to COS/MOS supply

ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{DD} *	Supply Voltage: **HCC** Types **HCF** Types	-0.5 to +20 -0.5 to +18	V V
V_i	Input Voltage	-0.5 to V_{DD} + 0.5	V
I_I	DC Input Current (any one input)	± 10	mA
P_{tot}	Total Power Dissipation (per package) Dissipation per Output Transistor for Top = Full Package Temperature Range	200 100	mW mW
T_{op}	Operating Temperature: **HCC** Types **HCF** Types	-55 to +125 -40 to +85	^oC ^oC
T_{stg}	Storage Temperature	-65 to +150	^oC

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

* All voltage values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage: **HCC** Types **HCF** Types	3 to 18 3 to 15	V V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature: **HCC** Types **HCF** Types	-55 to +125 -40 to +85	^oC ^oC

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		Test Conditios				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{LOW} * Min.	T_{LOW} * Max.	25 °C Min.	25 °C Typ.	25 °C Max.	T_{HIGH} * Min.	T_{HIGH} * Max.	
I_L	Quiescent Current	HCC Types	0/5			5		1		0.02	1		30	μA
			0/10			10		2		0.02	2		60	
			0/15			15		4		0.02	4		120	
			0/20			20		20		0.04	20		600	
		HCF Types	0/5			5		4		0.02	4		30	
			0/10			10		8		0.02	8		60	
			0/15			15		16		0.02	16		120	
V_{OH}	Output High Voltage		0/5			5	4.95		4.95			4.95		V
			0/10			10	9.95		9.95			9.95		
			0/15			15	14.95		14.95			14.95		
V_{OL}	Output Low Voltage		5/0			5		0.05			0.05		0.05	V
			10/0			10		0.05			0.05		0.05	
			15/0			15		0.05			0.05		0.05	
V_{IH}	Input High Voltage (4009UB)			0.5		5	4		4			4		V
				1		10	8		8			8		
				1.5		15	12.5		12.5			12.5		
V_{IH}	Input High Voltage (4010B)			4.5		5	3.5		3.5			3.5		V
				9		10	7		7			7		
				13.5		15	11		11			11		
V_{IL}	Input Low Voltage (4009UB)			4.5		5		1			1		1	V
				9		10		2			2		2	
				13.5		15		2.5			2.5		2.5	
V_{IL}	Input Low Voltage (4010B)			0.5		5		1.5			1.5		1.5	V
				1		10		3			3		3	
				1.5		15		4			4		4	
I_{OH}	Output Drive Current	HCC Types	0/5	2.5		5	-1		-0.8	-1.6		-0.58		mA
			0/5	4.6		5	-0.25		-0.2	-0.4		-0.15		
			0/10	9.5		10	-0.55		-0.45	-0.9		-0.33		
			0/15	13.5		15	-1.65		-1.5	-3		-1.1		
		HCF Types	0/5	2.5		5	-0.9		-0.8	-1.6		-0.65		
			0/5	4.6		5	-0.23		-0.2	-0.4		-0.18		
			0/10	9.5		10	-0.5		-0.45	-0.9		-0.38		
			0/15	13.5		15	-1.6		-1.5	-3		-1.25		
I_{OL}	Output Sink Current	HCC Types	0/5	0.4		5	3.75		3	4		2.1		mA
			0/10	0.5		10	10		8	10		5.6		
			0/15	1.5		15	30		24	36		16		
		HCF Types	0/5	0.4		5	3.6		3	4		2.4		
			0/10	0.5		10	0.96		8	10		6.4		
			0/15	1.5		15	40		24	36		1.9		
I_{IH}, I_{IL}	Input Leakage Current		0/18			18		±0.1		$±10^{-5}$	±0.1		±1	μA
C_I	Input Capacitance	4009UB		Any Input						15	22.6			
		4010B								5	7.5			pF

* T_{LOW} = -55 °C for **HCC** device: -40 °C for **HCF** device.

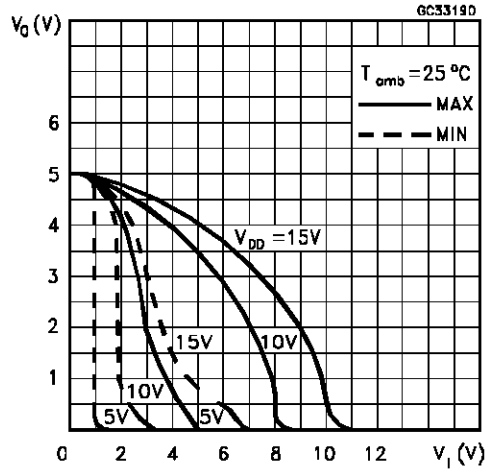
* T_{HIGH} = +125 °C for **HCC** device: +85 °C for **HCF** device.

The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V

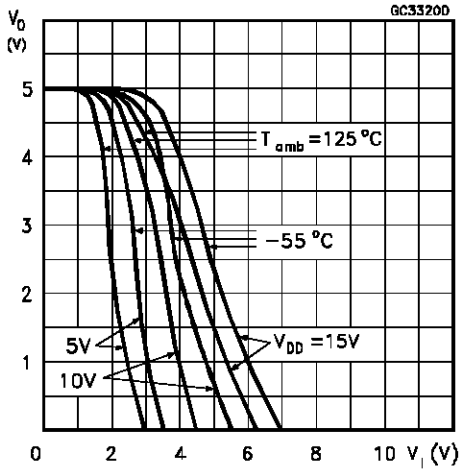
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, C_L = 50 pF, R_L = 200 KΩ, typical temperature coefficent for all V_{DD} values is 03 %/°C, all input rise and fall times= 20 ns)

Symbol	Parameter	Test Conditions			Value			Unit
		V_{DD} (V)	V_I (V)	V_{CC} (V)	Min.	Typ.	Max.	
t_{PLH}	Propagation Delay Time (4009UB)	5	5	5		70	140	ns
		10	10	10		40	80	
		10	10	5		35	70	
		15	15	15		30	60	
		15	15	5		30	60	
t_{PLH}	Propagation Delay Time (4010B)	5	5	5		100	200	ns
		10	10	10		50	100	
		10	10	5		50	100	
		15	15	15		35	70	
		15	15	5		35	70	
t_{PHL}	Propagation Delay Time (4009UB)	5	5	5		30	60	ns
		10	10	10		20	40	
		10	10	5		15	30	
		15	15	15		15	30	
		15	15	5		10	20	
t_{PHL}	Propagation Delay Time (4010B)	5	5	5		65	130	ns
		10	10	10		35	70	
		10	10	5		30	70	
		15	15	15		25	50	
		15	15	5		20	40	
t_{TLH}	Transition Time	5	5	5		150	350	ns
		10	10	10		75	150	
		15	15	15		55	110	
t_{THL}	Transition Time	5	5	5		35	70	ns
		10	10	10		20	40	
		15	15	15		15	30	

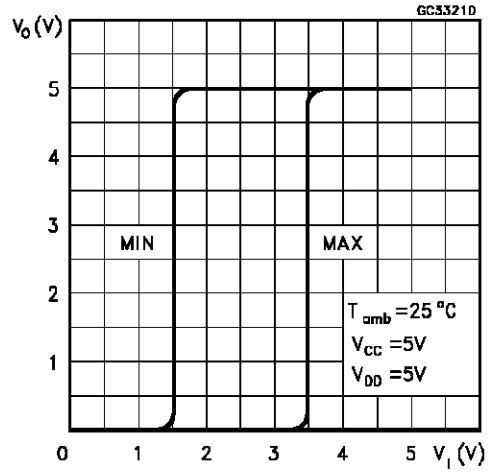
Minimum and Maximum Voltage Transfer Characteristics for 4009UB



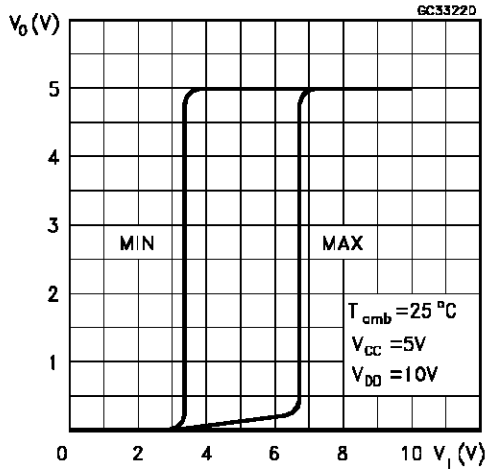
Typical Voltage Transfer Characteristics As a Function of Temperature for 4009UB



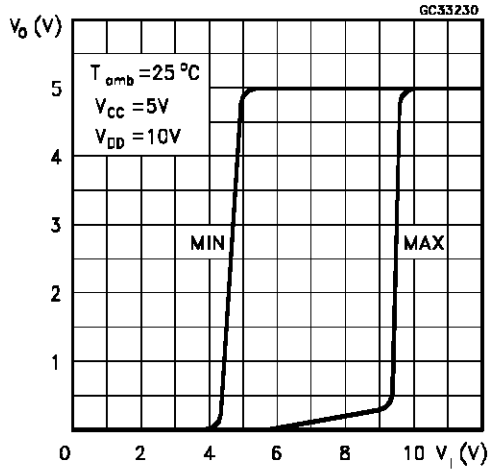
Minimum and Maximum Voltage Transfer Characteristics for 4010B



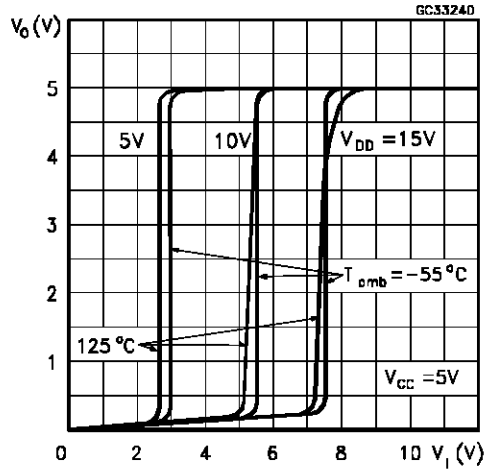
Minimum and Maximum Voltage Transfer Characteristics for 4010B



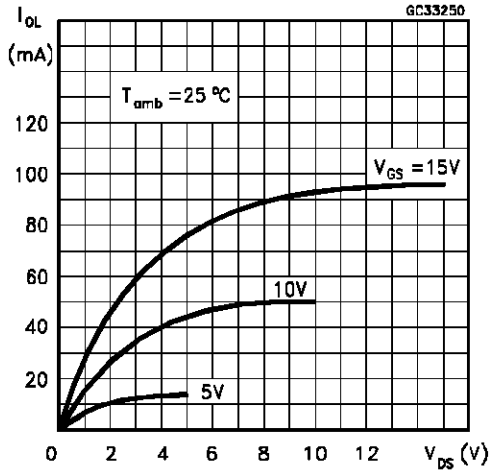
Minimum and Maximum Voltage Transfer Characteristics for 4010B



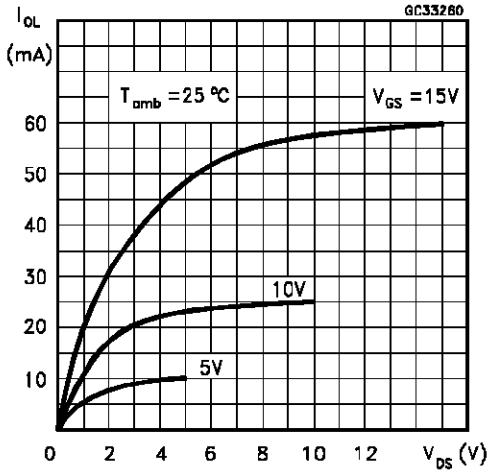
Typical Voltage Transfer Characteristics As a Function ot Temperature for 4010B



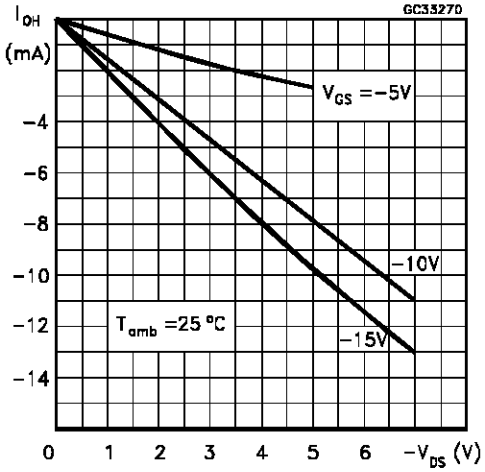
Typical Output Los (sink) Current Characteristics



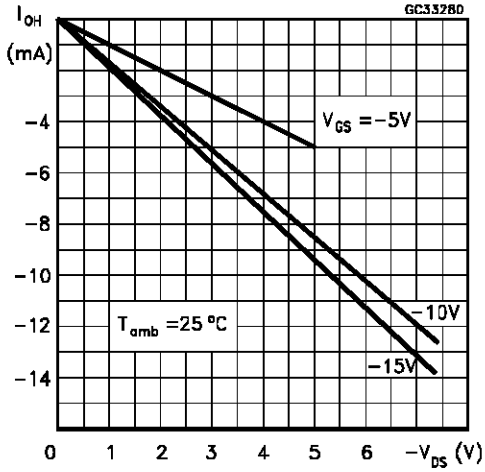
Minimum output Low (sink) Current Characteristics



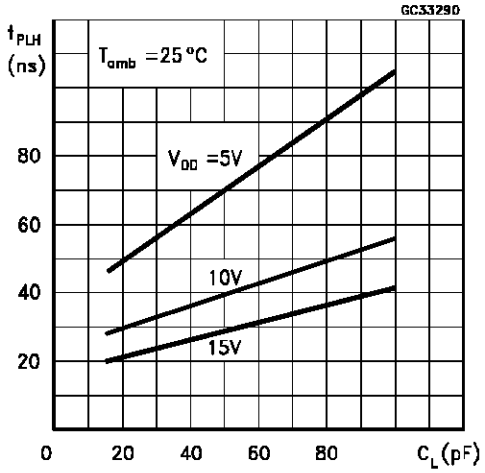
Typical Output High (source) Current Characteristics



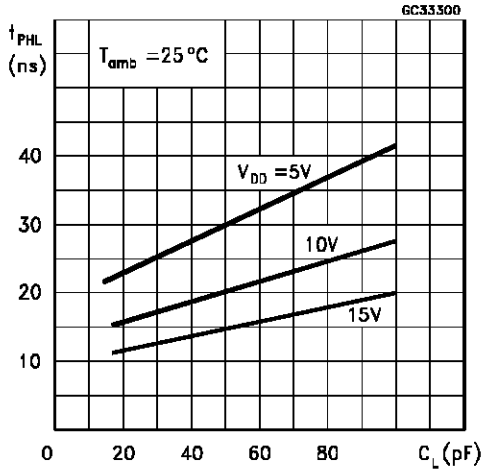
Minimum output High (source) Current Characteristics



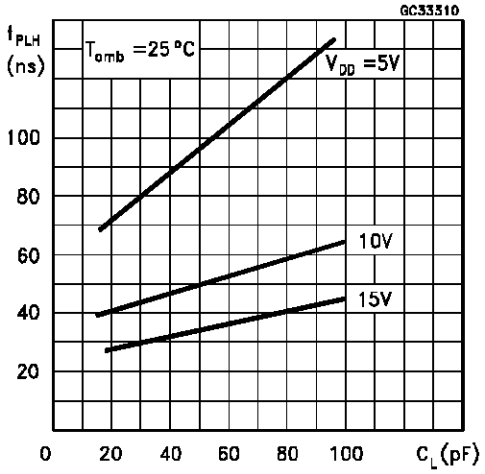
Typical Low to High Propagation Delay Time vs Load Capacitance for 4009UB



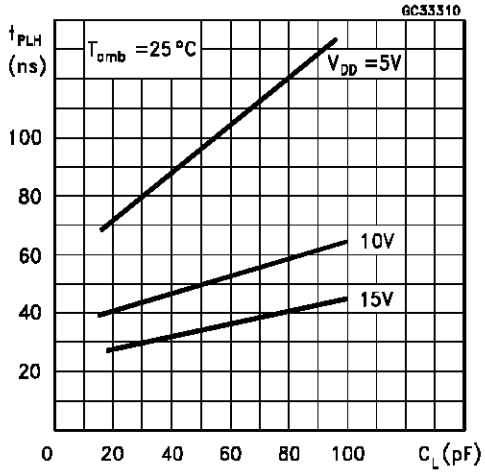
Typical High to Low Propagation Delay Time vs Load Capacitance for 4009UB



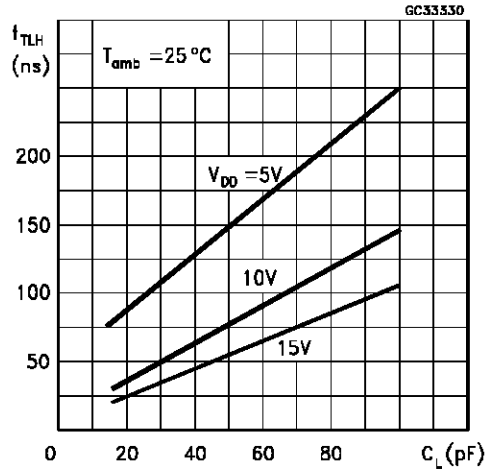
Typical Low to High Propagation Delay Time vs Load Capacitance for 4010B



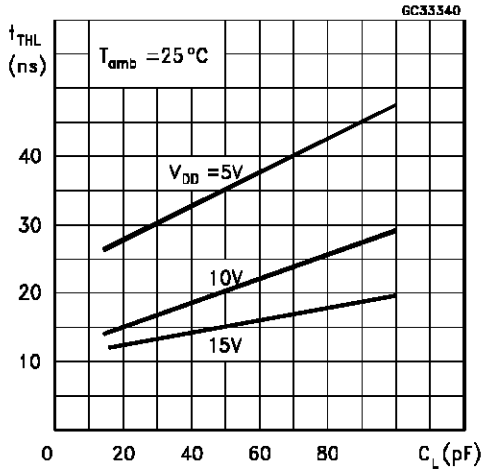
typical High to Low Propagation Delay Time vs Load Capacitance for 4010B



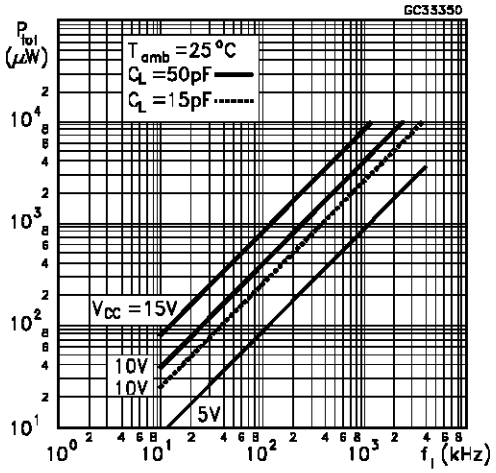
Typical Low to High Transition Time vs Load Capacitance



Typical High to Low Transition Time vs Load Capacitance

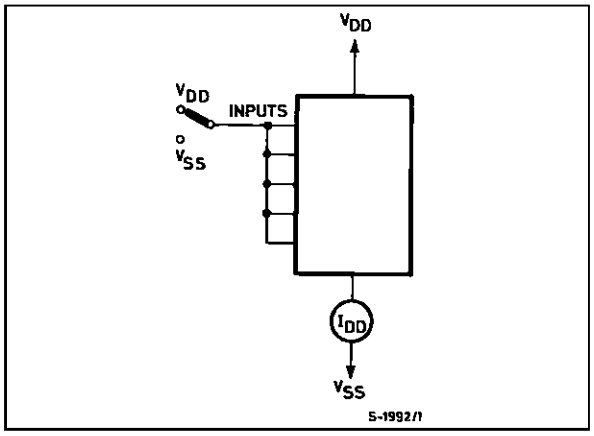


Typical Dissipation Characteristics

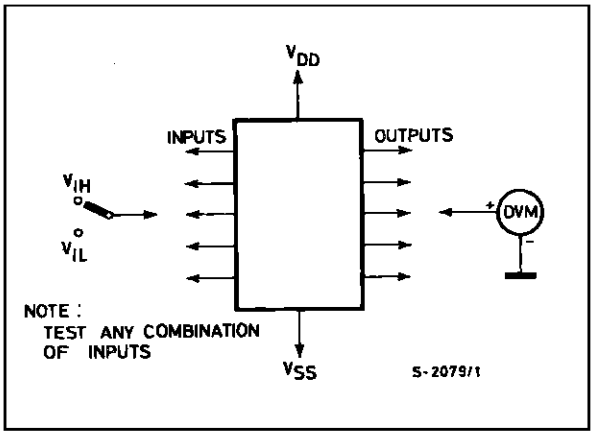


TEST CIRCUITS

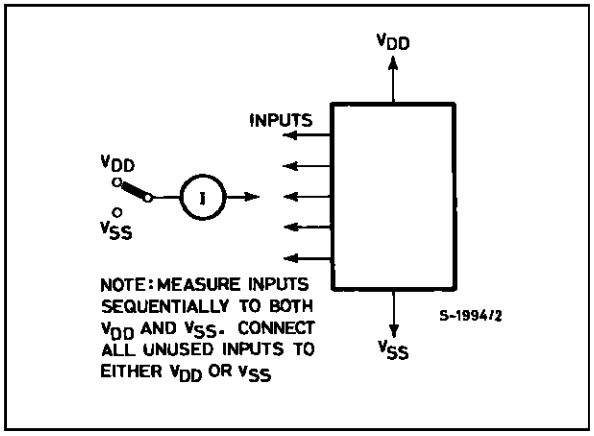
Quiescent Device Current.



Noise Immunity.

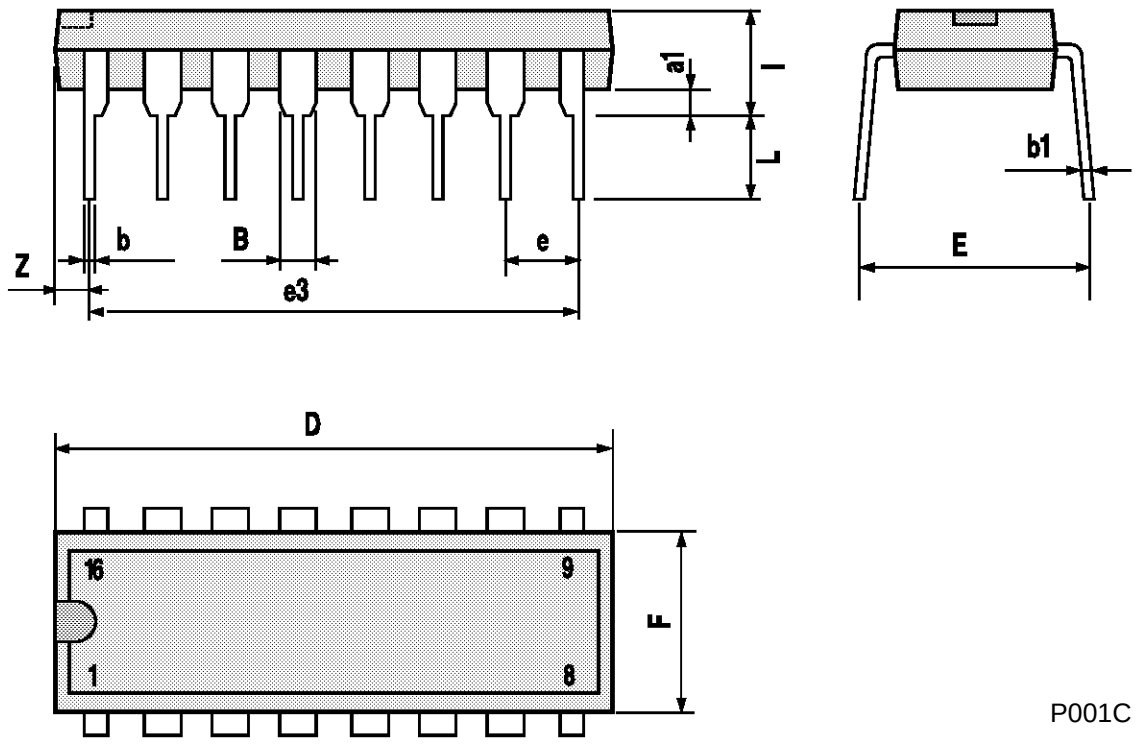


Input Leakage Current.



Plastic DIP16 (0.25) MECHANICAL DATA

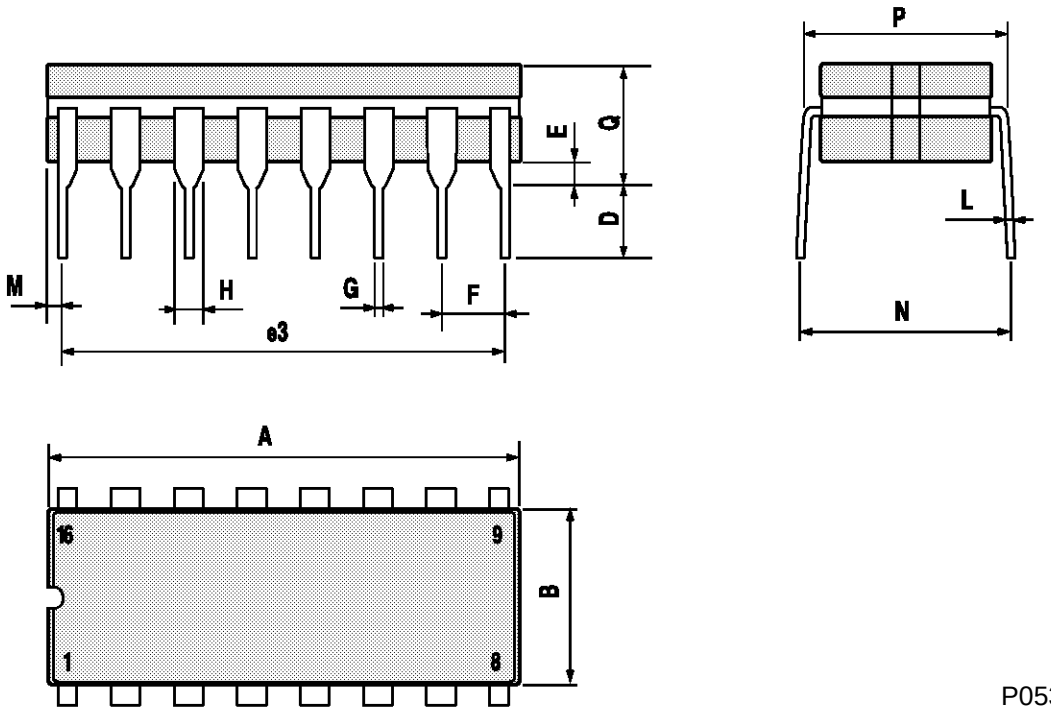
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

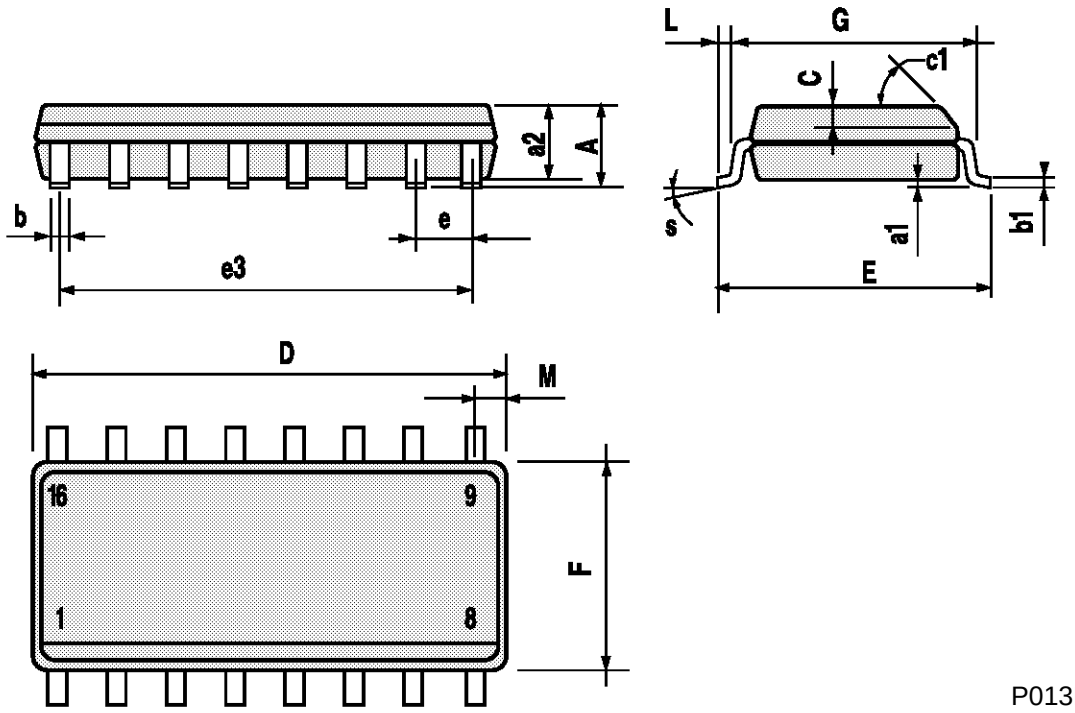
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



P053D

SO16 (Narrow) MECHANICAL DATA

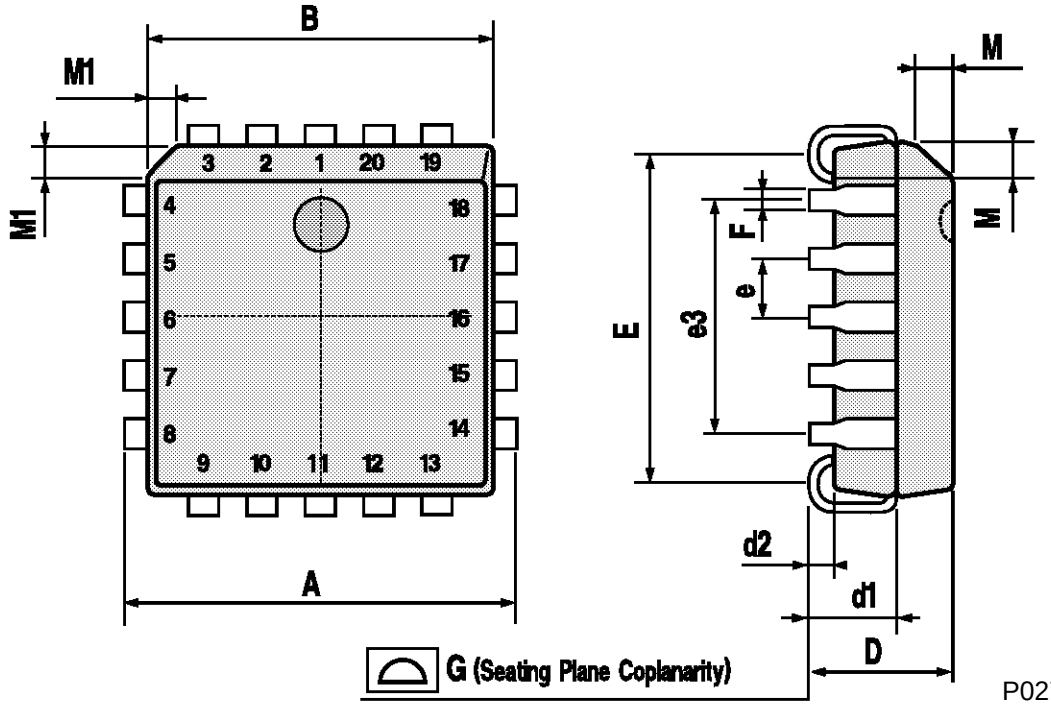
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



P013H

PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



P027A

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