SGS-THOMSON MICROELECTRONICS

HCC/HCF4014B
HCC/HCF4021B

8-STAGE STATIC SHIFT REGISTERS

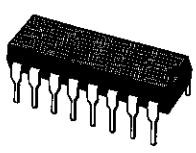
4014B SYNCHRONOUS PARALLEL OR SERIAL INPUT/SERIAL OUTPUT

4021B ASYNCHRONOUS PARALLEL INPUT OR SYNCHRONOUS SERIAL INPUT/SERIAL OUTPUT

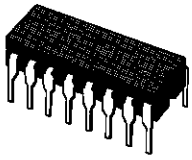
- MEDIUM-SPEED OPERATION-12MHz (typ.) CLOCK RATE AT $V_{DD} - V_{SS} = 10V$
- FULLY STATIC OPERATION
- 8 MASTER-SLAVE FLIP-FLOPS PLUS OUTPUT BUFFERING AND CONTROL GATING
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N° 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

DESCRIPTION

The **HCC4014B, HCC4021B** (extended temperature range) and the **HCF4014B, HCF4021B** (intermediate temperature range) are monolithic integrated circuits, available in 16-lead dual in-line plastic or ceramic package and plastic micro package. The **HCC/HCF4014B** and **HCC/HCF4021B** series types are 8-stage parallel-or serial-input/serial-output registers having common CLOCK and PARALLEL/SERIAL CONTROL inputs, a single SERIAL data input, and individual parallel "JAM" inputs to each register stage. Each register stage is a D type, master-slave flip-flop in addition to an output from stage 8, "Q" outputs are also available from stages 6 and 7. Parallel as well as serial entry is made into the register synchronously with the positive clock line transition in the **HCC/HCF4014B**. In the **HCC/HCF4021B** serial entry is synchronous with the clock but parallel entry is asynchronous. In both types, entry is controlled by the PARALLEL/SERIAL CONTROL input. When the PARALLEL/SERIAL CONTROL input is low, data is serially shifted into the 8-stage register synchronously with the positive transition of the clock line. When the PARALLEL/SERIAL CONTROL input is high, data is jammed into the 8-stage register via the parallel input lines and synchronous with the positive transition of the clock line. In the **HCC/HCF4021B**, the CLOCK input of the internal stage is "forced" when asynchronous parallel entry is made. Register expansion using multiple package is permitted.



EY
(Plastic Package)



F
(Ceramic Package)



M1
(Micro Package)

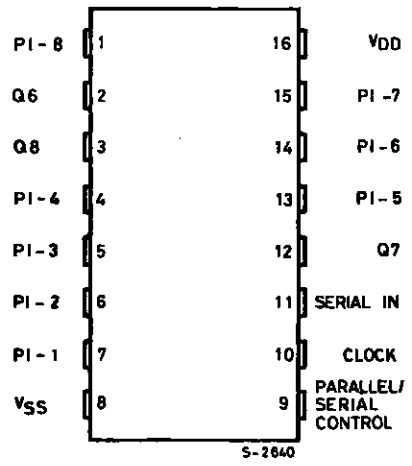


C1
(Plastic Chip Carrier)

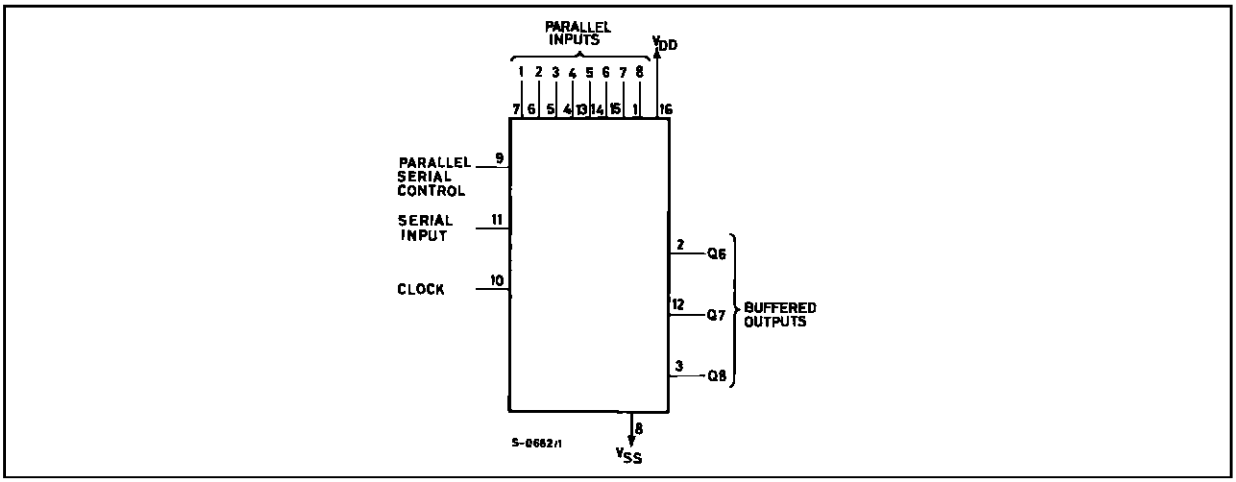
ORDER CODES :

HCC40XXBF	HCF40XXBM1
HCF40XXBEY	HCF40XXBC1

PIN CONNECTIONS



FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

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 T_{op} = Full Package-temperature Range	200 100	mW mW
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	– 55 to + 125 – 40 to + 85	°C °C
T_{stg}	Storage Temperature	– 65 to + 150	°C

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.

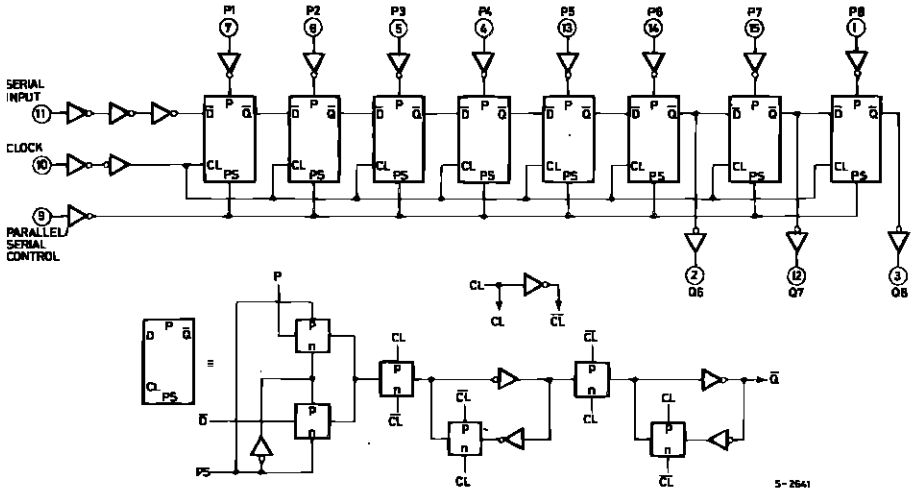
* All voltage values are referred to V_{SS} pin voltage.

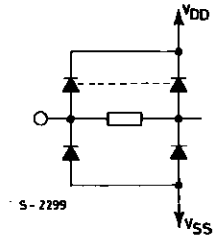
RECOMMENDED OPERATING CONDITIONS

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	°C °C

LOGIC DIAGRAMS

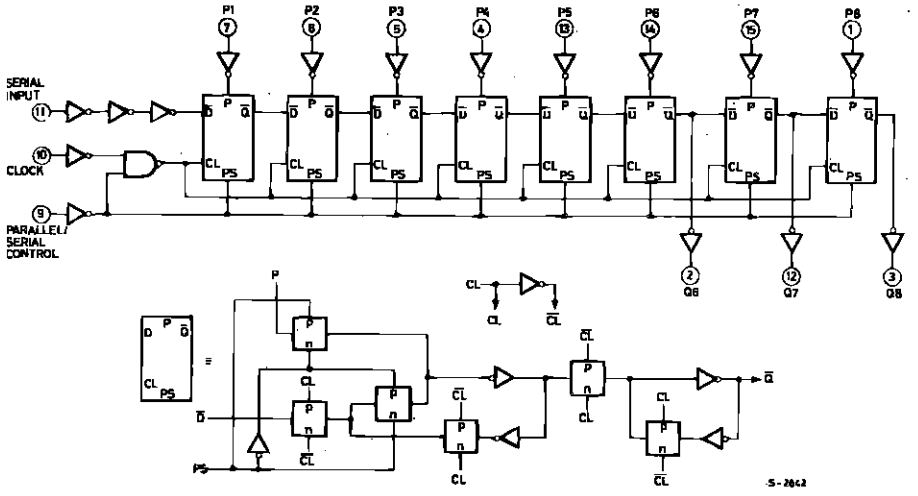
4014B

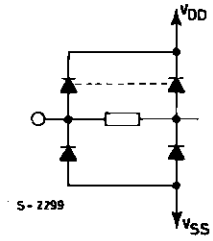




ALL INPUTS ARE PROTECTED BY COS/MOS PROTECTION NETWORK

4021B





ALL INPUTS ARE PROTECTED BY COS/MOS PROTECTION NETWORK

TRUTH TABLES

HCC/HCF 4014B

CL	Serial Input	Parallel/ Serial Control	PI–1	PI–n	Q_1 (internal)	Q_n	
_/‾	X	1	0	0	0	0	
_/‾	X	1	1	0	1	0	
_/‾	X	1	0	1	0	1	
_/‾	X	1	1	1	1	1	
_/‾	0	0	X	X	0	Q_n–1	
_/‾	1	0	X	X	1	Q_n–1	I
‾_	X	X	X	X	Q_1	Q_n	NC

X = don't care case.
NC = no change.

HCC/HCF4021B

CL	Serial Input	Parallel/ Serial Control	PI–1	PI–n	Q_1 (internal)	Q_n	
X	X	1	0	0	0	0	
X	X	1	0	1	0	1	
X	X	1	1	0	1	0	
X	X	1	1	1	1	1	
_/‾	0	0	X	X	0	Q_n–1	I
	1	0	X	X	1	Q_n–1	
‾_	X	0	X	X	Q_1	Q_n	NC

X = don't care case.
NC = no change

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		Test Conditions				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (µA)	V_{DD} (V)	T_{Low}*		25°C			T_{High}*		
							Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
I_L	Quiescent Current	HCC Types	0/ 5			5		5		0.04	5		150	µA
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
		HCF Types	0/ 5			5		20		0.04	20		150	
			0/10			10		40		0.04	40		300	
			0/15			15		80		0.04	80		600	
V_{OH}	Output High Voltage		0/ 5		< 1	5	4.95		4.95			4.95		V
			0/10		< 1	10	9.95		9.95			9.95		
			0/15		< 1	15	14.95		14.95			14.95		
V_{OL}	Output Low Voltage		5/0		< 1	5		0.05			0.05		0.05	V
			10/0		< 1	10		0.05			0.05		0.05	
			15/0		< 1	15		0.05			0.05		0.05	
V_{IH}	Input High Voltage			0.5/4.5	< 1	5	3.5		3.5			3.5		V
				1/9	< 1	10	7		7			7		
				1.5/13.5	< 1	15	11		11			11		
V_{IL}	Input Low Voltage			4.5/0.5	< 1	5		1.5			1.5		1.5	V
				9/1	< 1	10		3			3		3	
				13.5/1.5	< 1	15		4			4		4	

* 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} = 5V, 2V min. with V_{DD} = 10V, 2.5 V min. with V_{DD} = 15V.

STATIC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter		Test Conditions				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{Low}*		25°C			T_{High}*		
							Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
I_{OH}	Output Drive Current	HCC Types	0/ 5	2.5		5	– 2		– 1.6	– 3.2		– 1.15		mA
			0/ 5	4.6		5	– 0.64		– 0.51	– 1		– 0.36		
			0/10	9.5		10	– 1.6		– 1.3	– 2.6		– 0.9		
			0/15	13.5		15	– 4.2		– 3.4	– 6.8		– 2.4		
		HCF Types	0/ 5	2.5		5	– 1.53		– 1.36	– 3.2		– 1.1		
			0/ 5	4.6		5	– 0.52		– 0.44	– 1		– 0.36		
			0/10	9.5		10	– 1.3		– 1.1	– 2.6		– 0.9		
			0/15	13.5		15	– 3.6		– 3.0	– 6.8		– 2.4		
I_{OL}	Output Sink Current	HCC Types	0/ 5	0.4		5	0.64		0.51	1		0.36		mA
			0/10	0.5		10	1.6		1.3	2.6		0.9		
			0/15	1.5		15	4.2		3.4	6.8		2.4		
		HCF Types	0/ 5	0.4		5	0.52		0.44	1		0.36		
			0/10	0.5		10	1.3		1.1	2.6		0.9		
			0/15	1.5		15	3.6		3.0	6.8		2.4		
I_{IH}, I_{IL}	Input Leakage Current	HCC Types	0/18	Any Input		18		± 0.1		$\pm 10^{-5}$	± 0.1		± 1	μA
		HCF Types	0/15			15		± 0.3		$\pm 10^{-5}$	± 0.3		± 1	
C_I	Input Capacitance			Any Input						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} = 5V, 2V min. with V_{DD} = 10V, 2.5 V min. with V_{DD} = 15V.

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200kΩ, typical temperature coefficient for all V_{DD} = 0.3%/°C values, all input rise and fall time = 20ns)

Symbol	Parameter	Test Conditions	Value				Unit
			V_{DD} (V)	Min.	Typ.	Max.	
CLOCKED OPERATION							
t_{PLH}, t_{PHL}	Propagation Delay Time		5		160	320	ns
			10		80	160	
			15		60	120	
t_{THL}, t_{TLH}	Transition Time		5		100	200	ns
			10		50	100	
			15		40	80	
f_{CL}*	Maximum Clock Input Frequency		5	3	6		MHz
			10	6	12		
			15	8.5	17		
t_W	Clock Pulse Width		5	180	90		ns
			10	80	40		
			15	50	25		

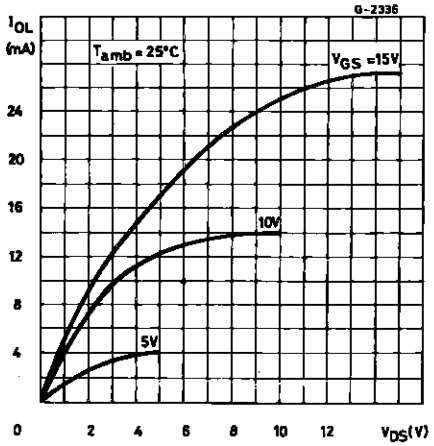
* If more than one unit is cascaded t_rCL should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage of the estimated capacitive load.

DYNAMIC ELECTRICAL CHARACTERISTICS (Continued)

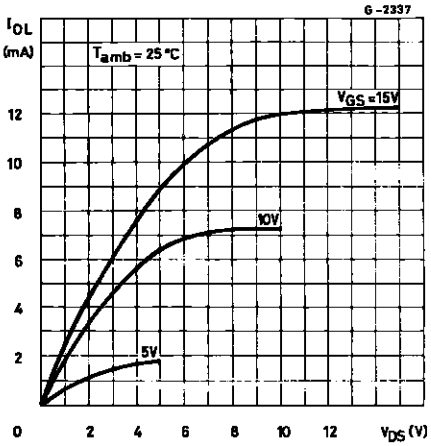
Symbol	Parameter	Test Conditions		Value			Unit
			V_{DD} (V)	Min.	Typ.	Max.	
CLOCKED OPERATION							
t_r, t_f	Clock Input Rise or Fall Time		5			15	µs
			10			15	
			15			15	
t_{setup}	Setup Time, serial Input (ref. to CL)		5	120	60		ns
			10	80	40		
			15	60	30		
t_{setup}	Setup Time, parallel Input (4014B) (ref. to CL)		5	80	40		ns
			10	50	25		
			15	40	20		
t_{setup}	Setup Time, parallel Input (4021B) (ref. to P/S)		5	50	25		ns
			10	30	15		
			15	20	10		
t_{setup}	Setup Time, parallel/serial Control (4014B) (ref. to CL)		5	180	90		ns
			10	80	40		
			15	60	30		
t_{hold}	Hold Time, serial in, parallel in, parallel/serial Cotrol		5	0			ns
			10	0			
			15	0			
t_{WH}	P/S Pulse Width (4021B)		5	160	80		ns
			10	80	40		
			15	50	25		
t_{rem}	P/S Removal time (4021B) (ref. to CL)		5	280	140		ns
			10	140	70		
			15	100	50		

* If more than one unit is cascaded t_rCL should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage of the estimated capacitive load.

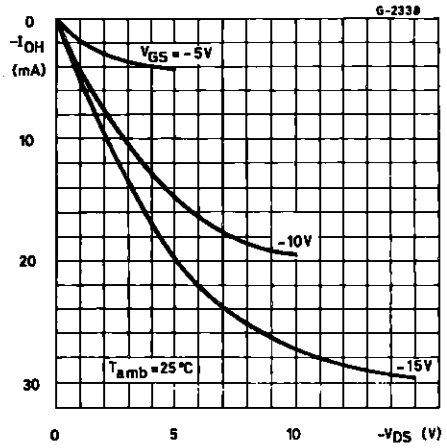
Typical Output Low (sink) Current Characteristics.



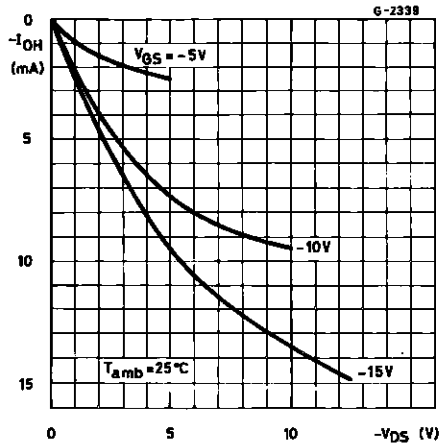
Minimum Output Low (sink) Current Characteristics.



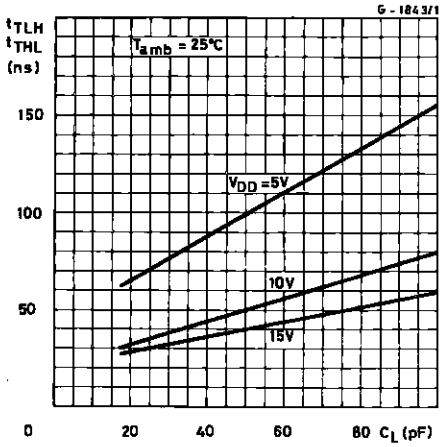
Typical Output High (source) Current Characteristics.



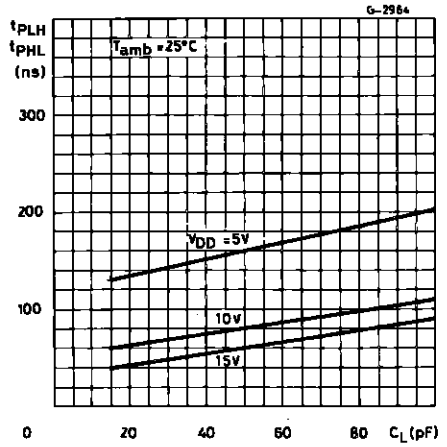
Minimum Output High (source) Current Characteristics.



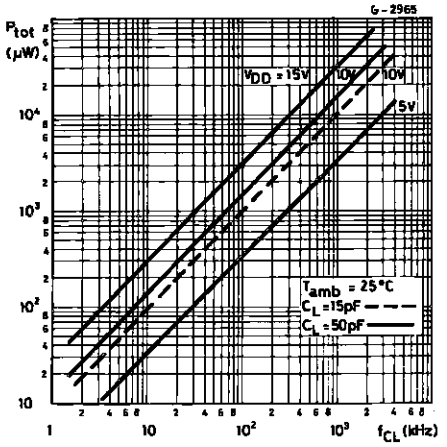
Typical Transition Time vs. Load Capacitance.



Typical Propagation Delay Time vs. Load Capacitance.

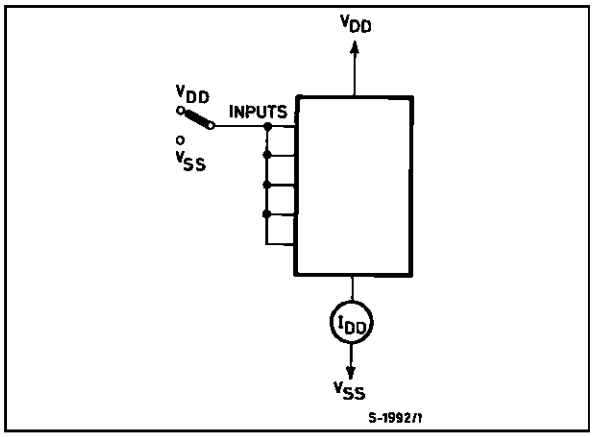


Typical Dynamic Power Dissapating vs. Clock Input Frequency.

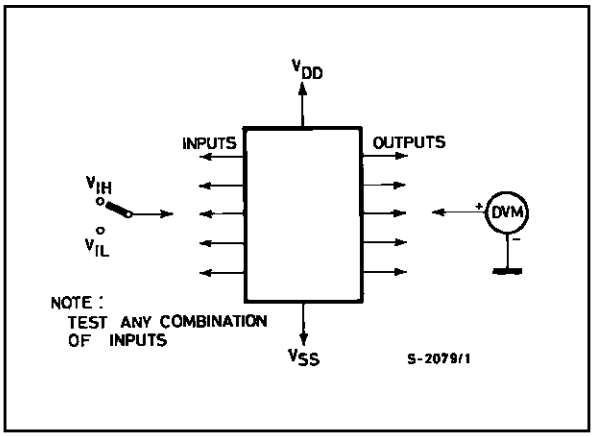


TEST CIRCUITS

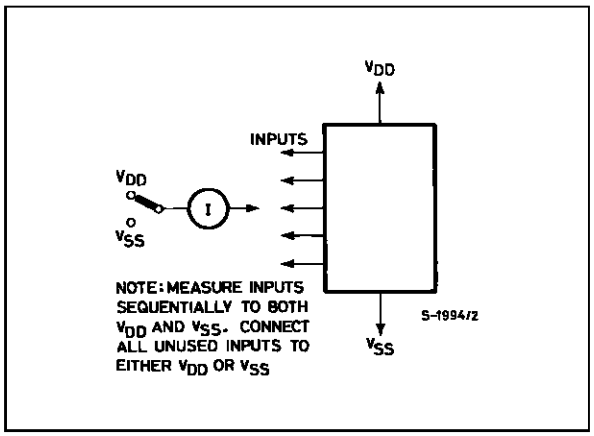
Quiescent Device Current.



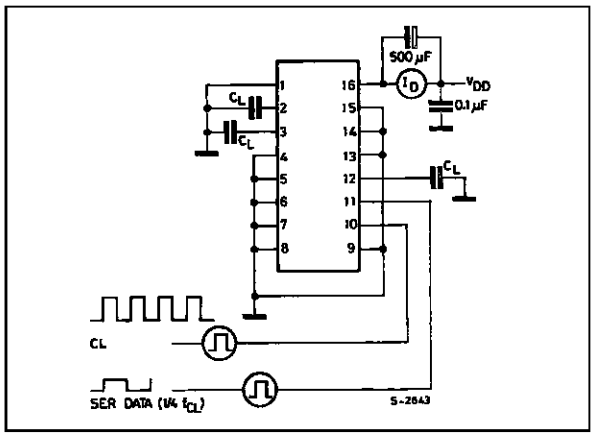
Noise Immunity.



Input Leakage Current.

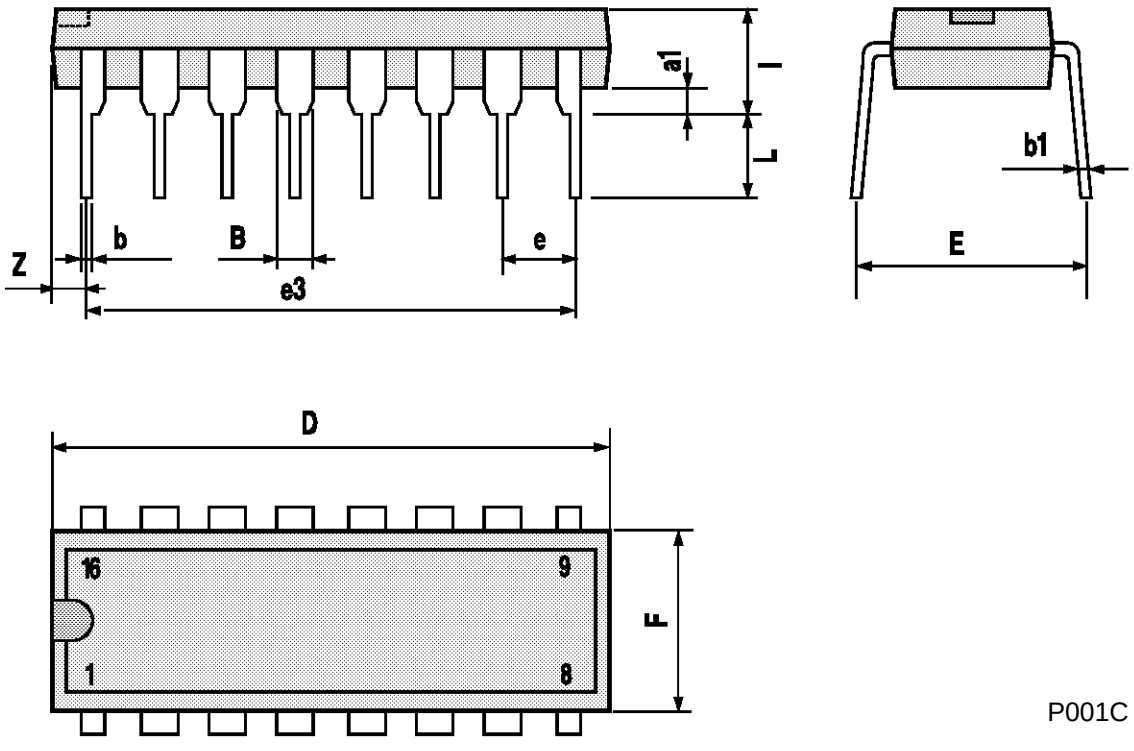


Dynamic Power Dissipation.



Plastic DIP16 (0.25) MECHANICAL DATA

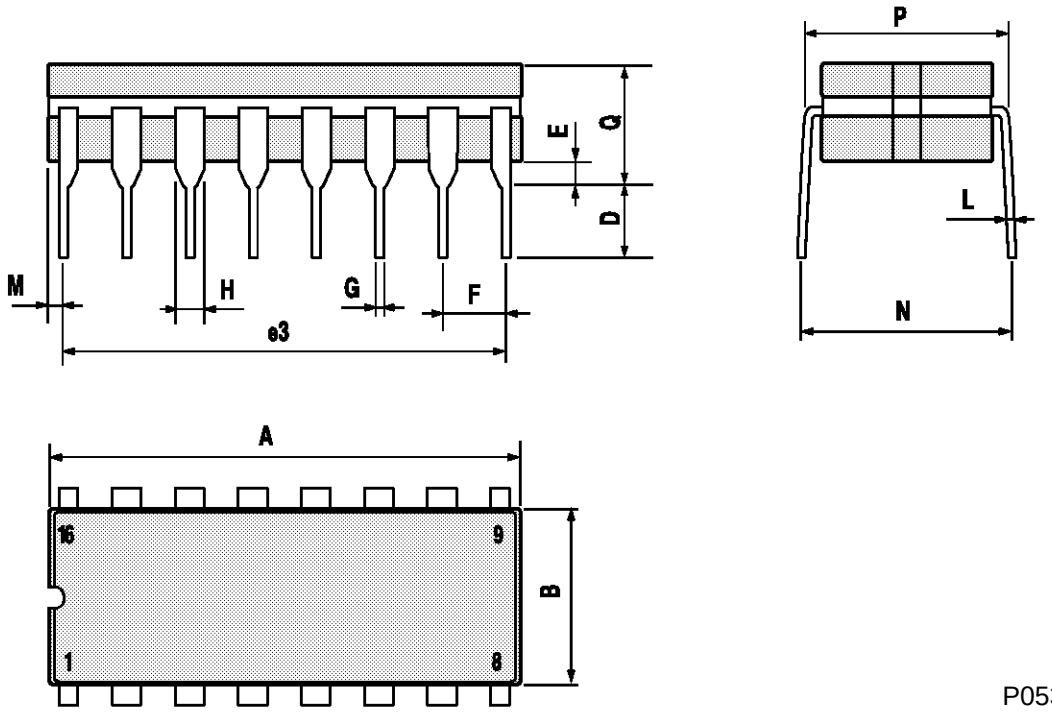
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

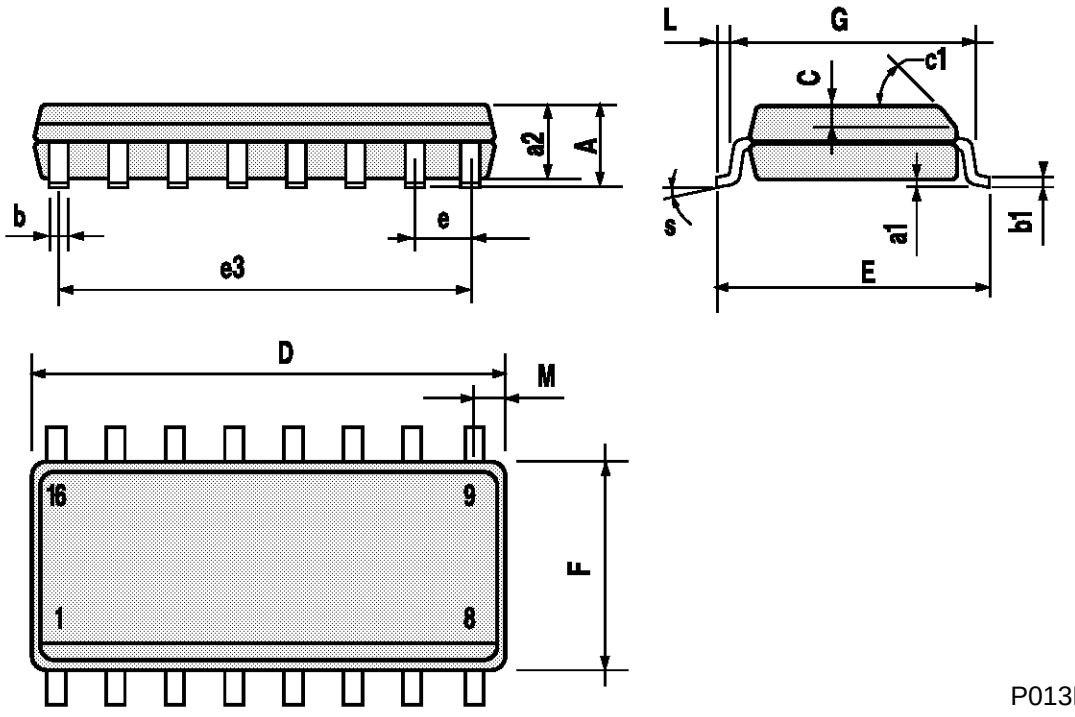
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q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



P053D

SO16 (Narrow) MECHANICAL DATA

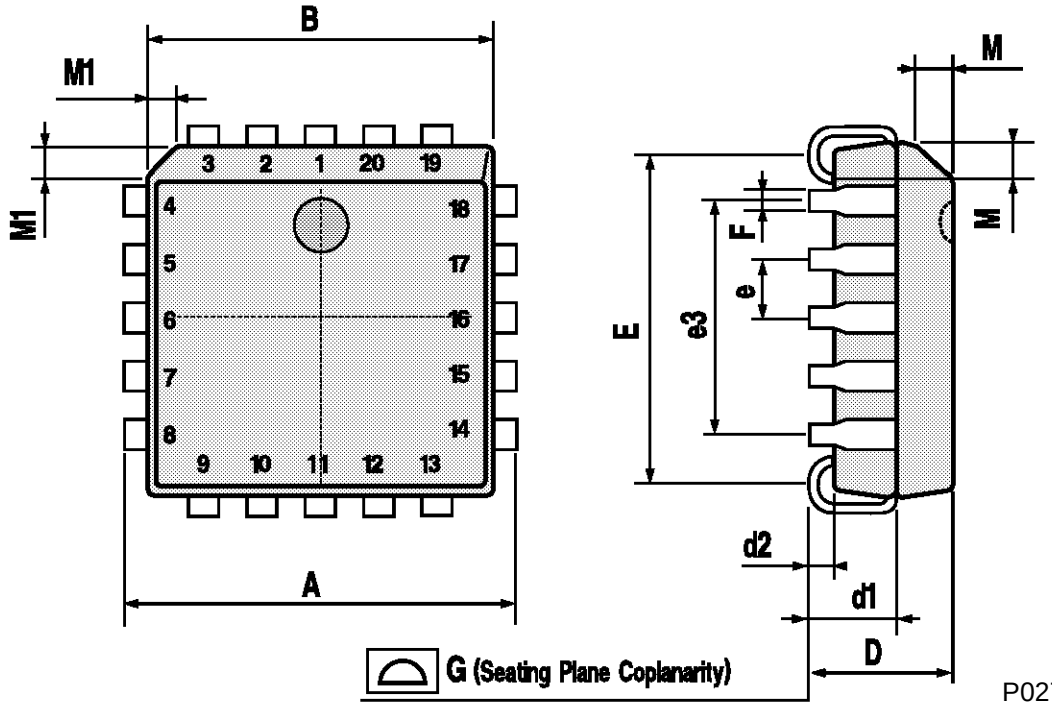
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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



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