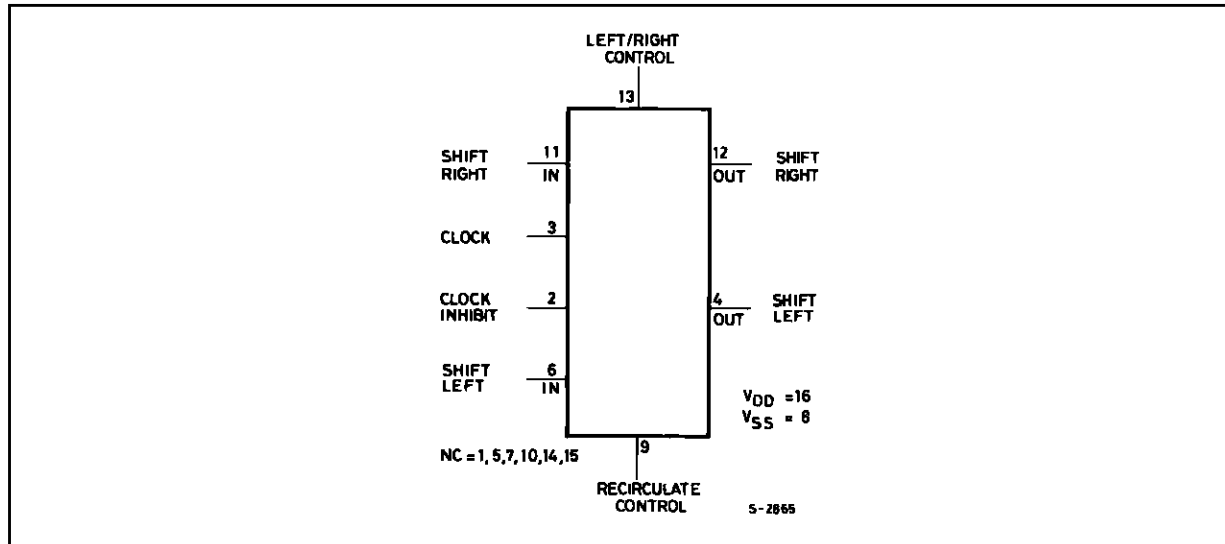


HCC/HCF40100B

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

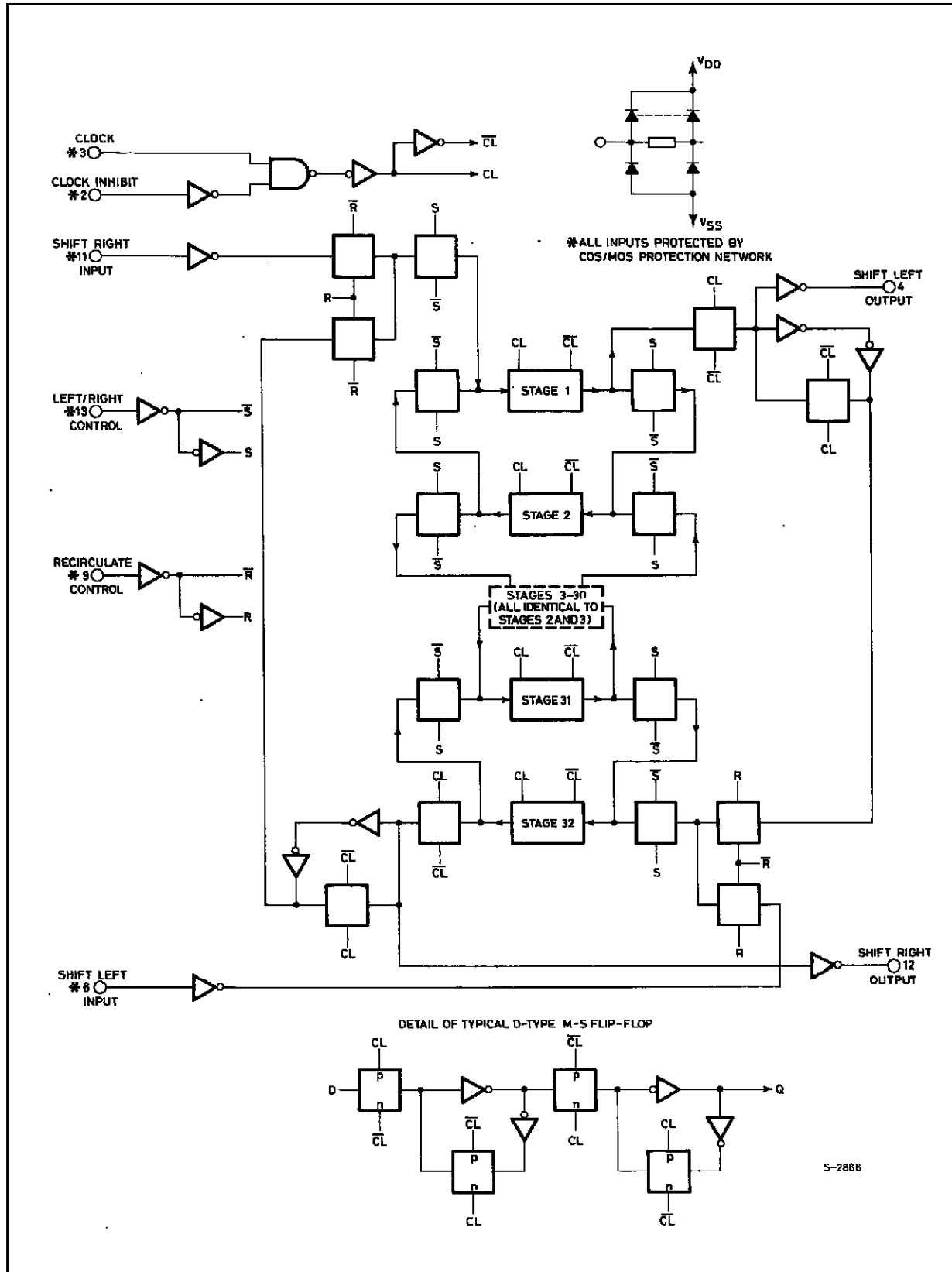
Symbol	Parameter	Value	Unit
V_{DD}^*	Supply Voltage : HCC Types HCF Types	- 0.5 to + 20 - 0.5 to + 18	V
V_i	Input Voltage	- 0.5 to $V_{DD} + 0.5$	V
I_i	DC Input Current (any one input)	± 10	mA
P_{tot}	Total Power Dissipation (per package) Dissipation per Output Transistor for T_{op} = Full Package-temperature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

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.

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	$^{\circ}C$ $^{\circ}C$

LOGIC DIAGRAM



HCC/HCF40100B

TRUTH TABLES

CONTROL

Left/Right Control	Clock Inhibit	Recirculate Control	Action	Input Bit Origin
1	0	1	Shift Left	Shift Left Input
1	0	0	Shift Left	Stage 1
0	0	1	Shift Right	Shift Right Input
0	0	0	Shift Right	Stage 32
X	1	X	No Shift	–

DATA TRANSFER

Initial State			Clock	Resulting State	
Data Input	Clock Inhibit	Internal Stage	Level Change	Internal Stage Q	Output
0	0	X		0	NC
X	0	0		NC	0
1	0	X		1	NC
X	0	1		NC	1
X	1	1	X	NC	NC

0 = Low level 1 = High level X = Don't Care. NC = No change.

* For Shift-Right Mode For Shift-left Mode

Data Input = SHIFT-RIGHT INPUT (Pin 11) Data input = SHIFT LEFT INPUT (Pin 6)

Internal Stage = Stage 1 (Q1) Internal Stage = Stage 32 (Q32)

Output = SHIFT-LEFT OUTPUT (Pin 4). Output = SHIFT-RIGHT OUTPUT (Pin 12).

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter	Test Conditions				Value						Unit		
		V _I (V)	V _O (V)	I _O (μ A)	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	μ A
			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		V	
		0/10		< 1	10		9.95				9.95			
		0/15		< 1	15		14.95				14.95			
V _{OL}	Output Low Voltage	5/0		< 1	5					0.05		0.05	V	
		10/0		< 1	10					0.05		0.05		
		15/0		< 1	15					0.05		0.05		

* 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 (μ A)	V _{DD} (V)	T _{Low} *		25°C			T _{High} *		
						Min.	Max.	Min.	Typ.	Max.	Min.		Max.
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		
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	
		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 = 200k Ω , typical temperature coefficient for all V_{DD} values is 0.3%/°C, all input rise and fall time = 20ns)

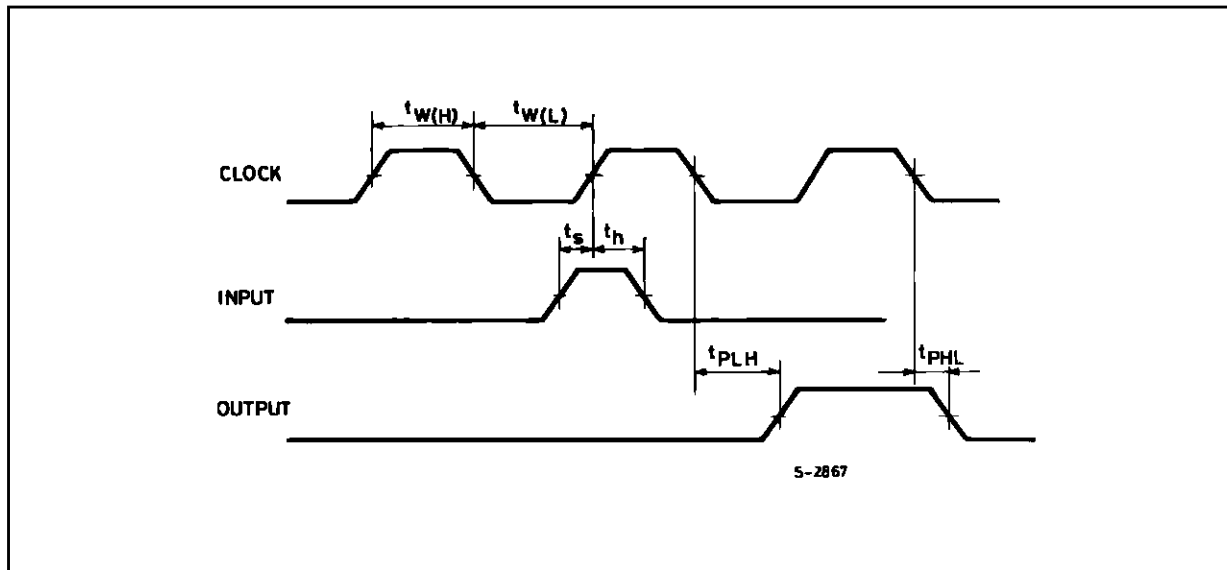
Symbol	Parameter	Test Conditions		Value			Unit
			V _{DD} (V)	Min.	Typ.	Max.	
t _{PLH} , t _{PHL}	Propagation Delay Time Clock to Shift Left/Right Output		5		360	720	ns
			10		165	330	
			15		115	230	
t _{THL} , t _{TLH}	Transition Time		5		100	200	ns
			10		50	100	
			15		40	80	

HCC/HCF40100B

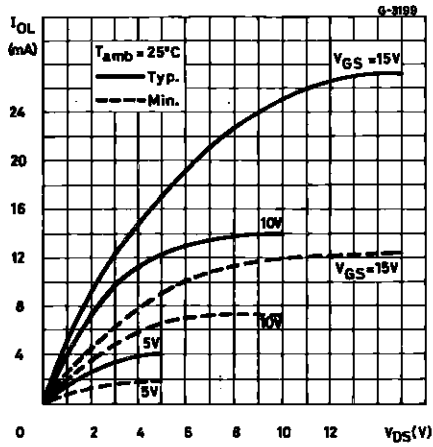
DYNAMIC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions		Value			Unit
			V _{DD} (V)	Min.	Typ.	Max.	
t _{setup}	Data Setup Time		5	100	50		ns
			10	20	10		
			15	10	5		
t _{hold}	Data Hold Time		5	275	170		ns
			10	100	75		
			15	75	50		
t _w	Clock Input Pulse Width Low Level		5	450	225		ns
			10	230	115		
			15	190	95		
t _w	Clock Input Pulse Width High Level		5	280	140		ns
			10	150	75		
			15	140	70		
f _{CL}	Maximum Clock Input Frequency		5	1	2		MHz
			10	2.5	5		
			15	3	6		

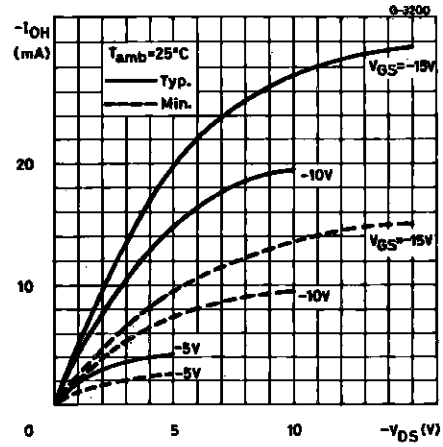
WAVEFORMS



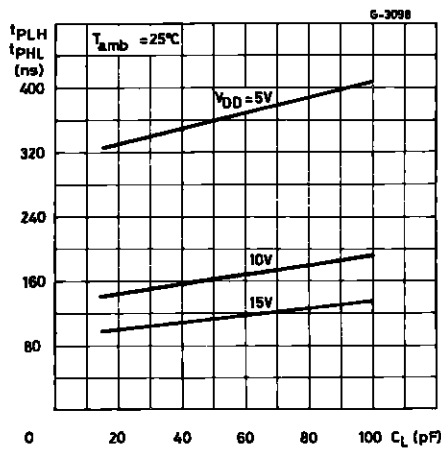
Output Low (sink) Current Characteristics.



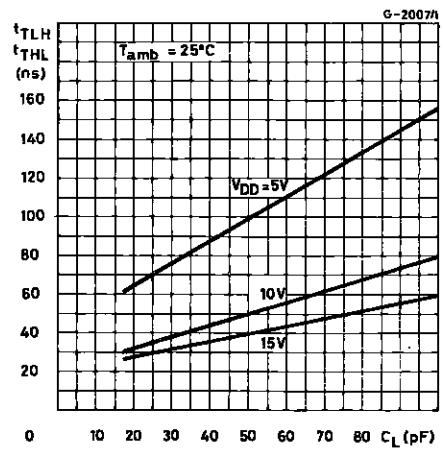
Output High (source) Current Characteristics.



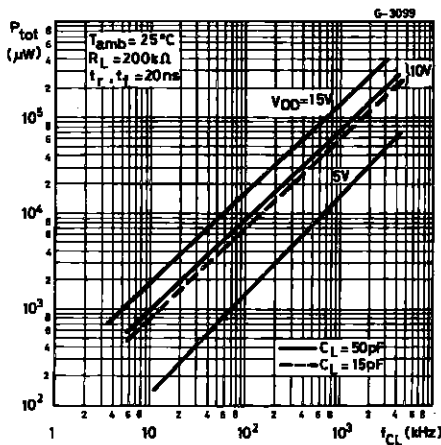
Typical Propagation Delay Time (clock to shift left right) vs. Load Capacitance.



Typical Transition Time vs. Load Capacitance.

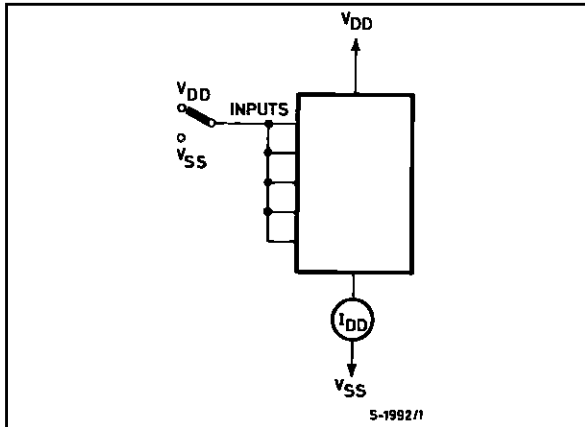


Typical Dynamic Power Dissipation vs. Clock Frequency.

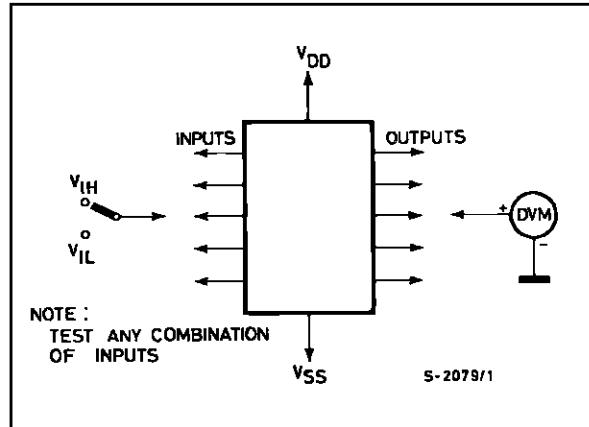


TEST CIRCUITS

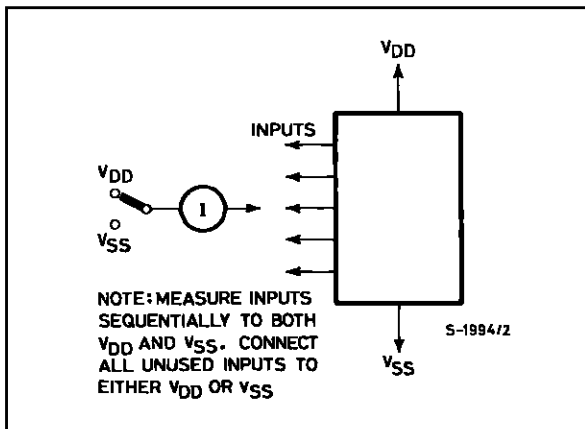
Quiescent Device Current.



Input Voltage.



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



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



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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