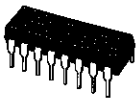
SGS-THOMSON MICROELECTRONICS

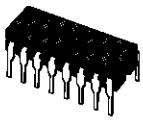
HCC/HCF4511B

BCD-TO-SEVEN SEGMENT LATCH/DECODER/DRIVER

- HIGH-OUTPUT-SOURCING CAPABILITY (up to 25 mA)
- INPUT LATCHES FOR BCD CODE STORAGE
- LAMP TEST AND BLANKING CAPABILITY
- 7-SEGMENT OUTPUTS BLANKED FOR BCD INPUT CODES > 1001
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100mA 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"

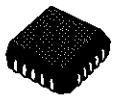


EY
(Plastic Package)



F
(Ceramic Frit Seal Package)

M1
(Micro Package)

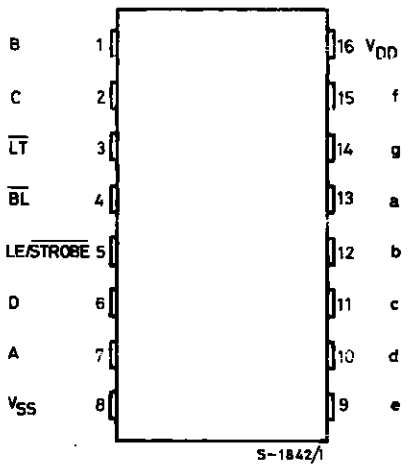


C1
(Plastic Chip Carrier)

ORDER CODES :

HCC4511BF HCF4511BM1
HCF4511BEY HCF4511BC1

PIN CONNECTIONS



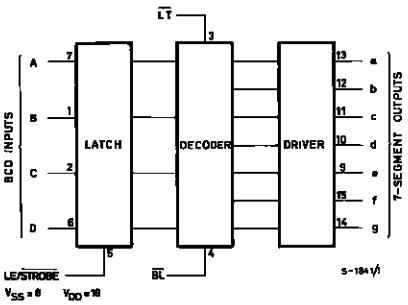
DESCRIPTION

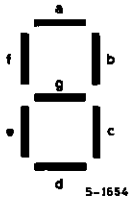
The **HCC 4511B** (extended temperature range) and the **HCF 4511B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in-line plastic or ceramic package and plastic micro package.

The **HCC/HCF 4511B** types are BCD-to-7-segment latch decoder drivers constructed with COS/MOS logic and n-p-n bipolar transistor output devices on a single monolithic structure. These devices combine the low quiescent power dissipation and high noise immunity features of COS/MOS with n-p-n bipolar output transistors capable of sourcing up to 25 mA. This capability allows the **HCC/HCF 4511B** types to drive LED's and other displays directly.

Lamp Test ($\overline{LT}$), Blanking ($\overline{BL}$), and Latch Enable or Strobe inputs are provided to test the display, shut off or intensity-modulate it, and store or strobe a BCD code, respectively. Several different signal may be multiplexed and displayed when external multiplexing circuitry is used.

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

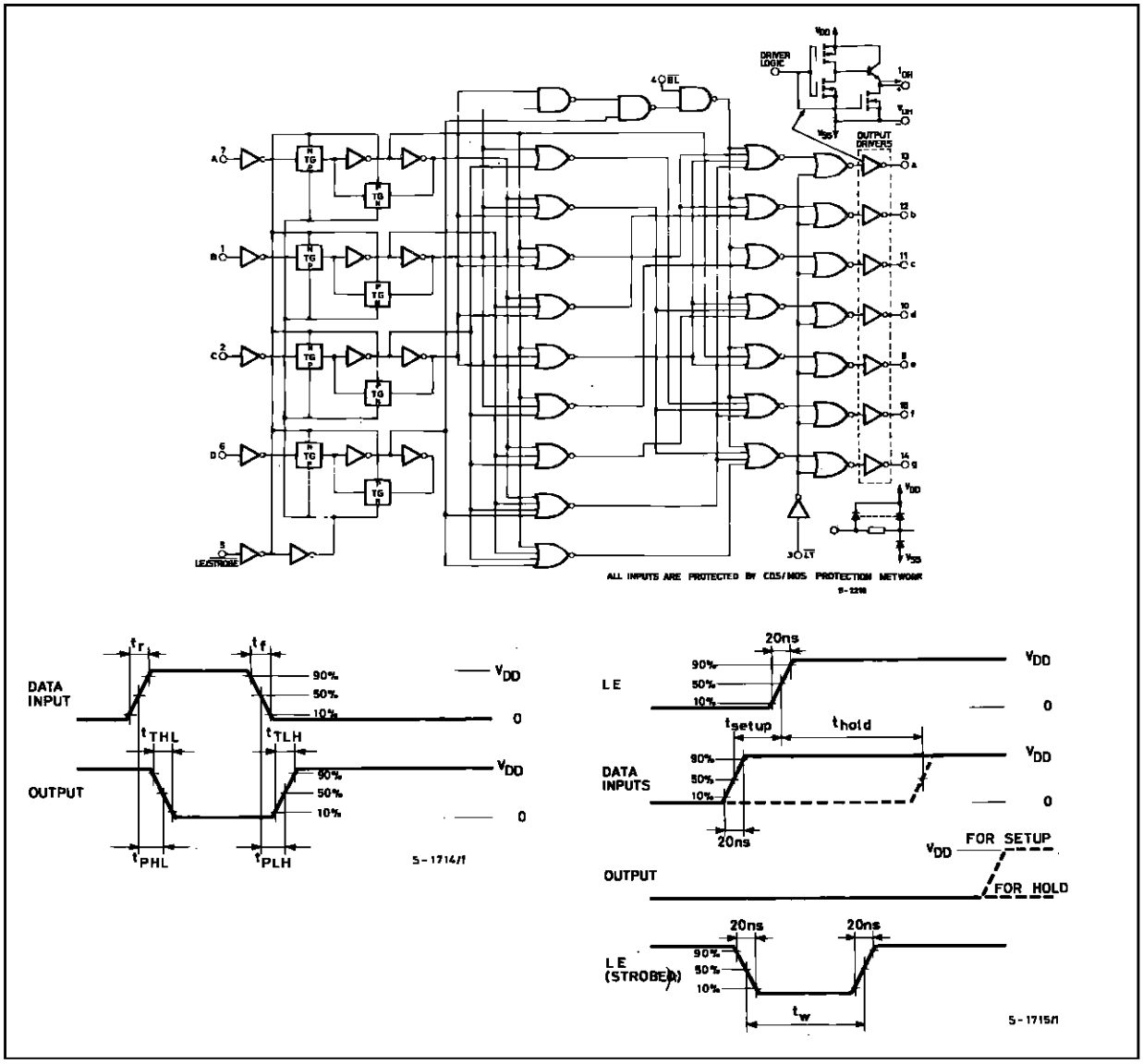
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functionnal operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure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



TRUTH TABLE

LE	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	8
X	0	1	X	X	X	X	0	0	0	0	0	0	0	Blank
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	0	1	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	0	1	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	0	0	0	0	0	0	0	0	Blank
0	1	1	1	1	1	1	0	0	0	0	0	0	0	Blank
1	1	1	X	X	X	X				*				*

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			5	4		4.1	4.55		4.2		V
			0/10			10	9		9.1	9.55		9.2		
			0/15			15	14		14.1	14.55		14.2		
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			0.5/3.8		5	3.5		3.5			3.5		V
				1/8.8		10	7		7			7		
				1.5/13.8		15	11		11			11		
V_{IL}	Input Low Voltage			3.8/0.5		5		1.5			1.5		1.5	V
				8.8/1		10		3			3		3	
				13.8/1.5		15		4			4		4	
V_{OH}	Output Drive Voltage	HCC Types			0	5	4.1		4.10	4.55		4.20		V
					5					4.25				
					10		3.80		3.90	4.10		3.90		
					15					3.95				
					20		3.55		3.40	3.75				
					25		3.40		3.10	3.55				
					0	10	9		9.10	9.55		9.20		V
					5					9.25				
					10		8.85		9	9.15				
					15					9.05				
					20		8.70		8.60	8.90		8.40		
					25		8.60		8.30	8.75				
					0	15	14		14.10	14.55		14.20		V
					5					14.30				
					10		13.90		14	14.20		14		
					15					14.10				
					20		13.75		13.70	13.95		13.50		
					25		13.65		13.50	13.80		13.10		

* 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)

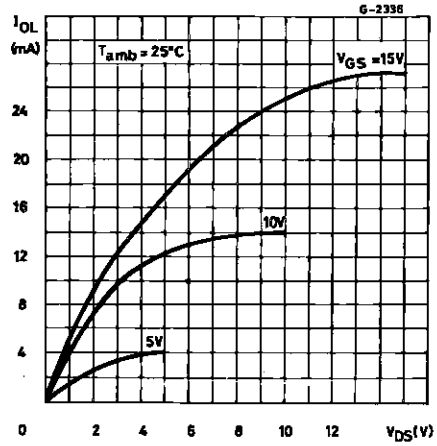
Symbol	Parameter		Test Conditions				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{Low}*		25°C			T_{High}*		
							Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
V_{OH}	Output Drive Voltage	HCF Types			0	5	4.1		4.1	4.57		4.1		V
					5					4.24				
					10		3.6		3.6	4.12		3.3		
					15					3.94				
					20		2.8		2.8	3.75		2.5		
					25					3.54				
					0	10	9.1		9.1	9.58		9.1		V
					5					9.26				
					10		8.75		8.75	9.17		8.45		
					15					9.04				
					20		8.1		8.1	8.90		7.8		
					25					8.75				
					0	15	14.1		14.1	14.59		14.1		V
					5					14.27				
					10		13.75		13.75	14.18		13.45		
					15					14.07				
					20		13.1		13.1	13.95		12.8		
					25					13.80				
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	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.

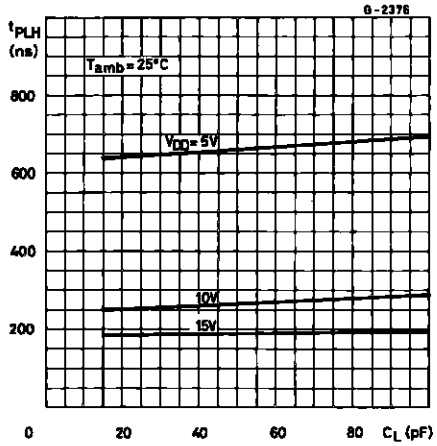
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25 ^{o}C, C_L = 50 pF, R_L = 200 KΩ, typical temperature coefficent for all V_{DD} values is 03 %/^{o}C, all input rise and fall times= 20 ns)

Symbol	Parameter	Test Conditions		Value			Unit
			V_{DD} (V)	Min.	Typ.	Max.	
t_{PHL}	Propagation Delay Time (data)		5		520	1040	ns
			10		210	420	
			15		150	300	
t_{PLH}	Propagation Delay Time (data)		5		660	1320	ns
			10		260	520	
			15		180	360	
t_{PHL}	Propagation Delay Time ($\overline{BL}$)		5		350	700	ns
			10		175	350	
			15		125	250	
t_{PLH}	Propagation Delay Time ($\overline{BL}$)		5		400	800	ns
			10		175	350	
			15		150	300	
t_{PHL}	Propagation Delay Time ($\overline{LT}$)		5		250	500	ns
			10		125	250	
			15		85	170	
t_{PLH}	Propagation Delay Time ($\overline{LT}$)		5		150	300	ns
			10		75	150	
			15		50	100	
t_{TLH}	Transition Time		5		40	80	ns
			10		30	60	
			15		20	40	
t_{THL}	Transition Time		5		125	310	ns
			10		75	185	
			15		65	160	
t_{setup}	Setup Time		5	150	75		ns
			10	70	35		
			15	40	20		
t_{hold}	Hold Time		5	0	-75		ns
			10	0	-35		
			15	0	-20		
t_W	Strobe Pulse Width		5	400	200		ms
			10	160	80		
			15	100	50		

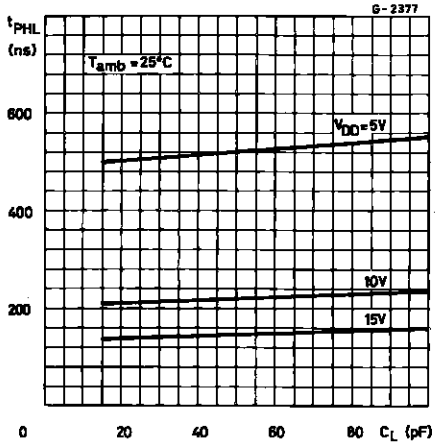
Typical Output Low (sink) Current Characteristics.



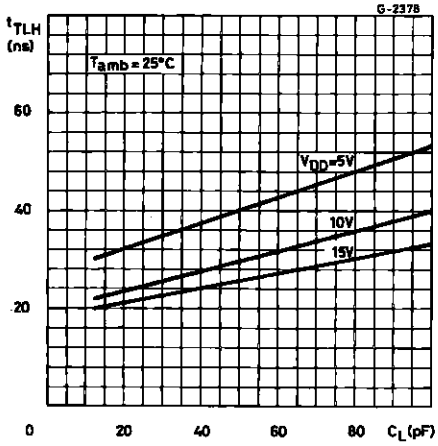
Typical data-to-output, low-to-high-level propagation delay time as a function of load capacitance.



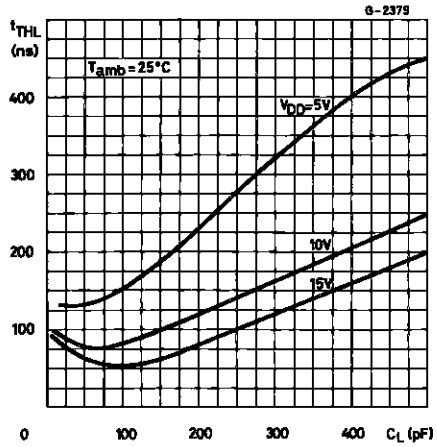
Typical data-to-output, high-to-low-level propagation delay time as a function of load capacitance.



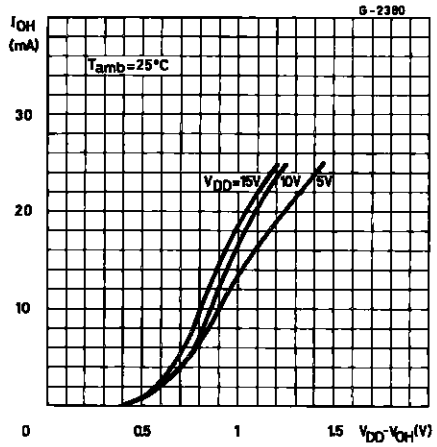
Typical low-to-high level transition ime as a function of load capacitance.



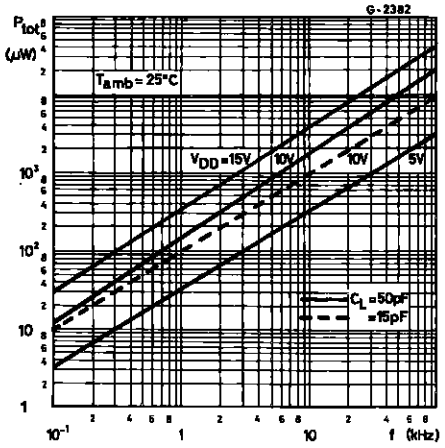
Typical high-to-low level transition ime as a function of load capacitance.



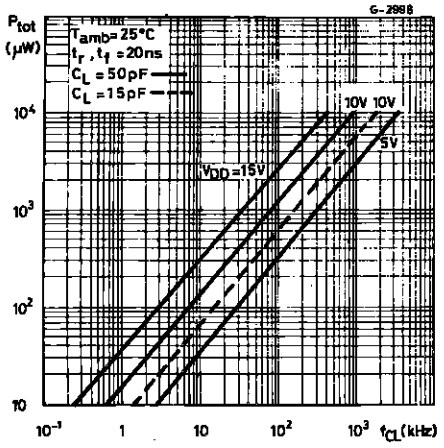
Typical Voltage drop (V_{DD} to output) vs. Output source Current as a Function of Supply.



Typical Dynamic Power Dissipation Characteristics.



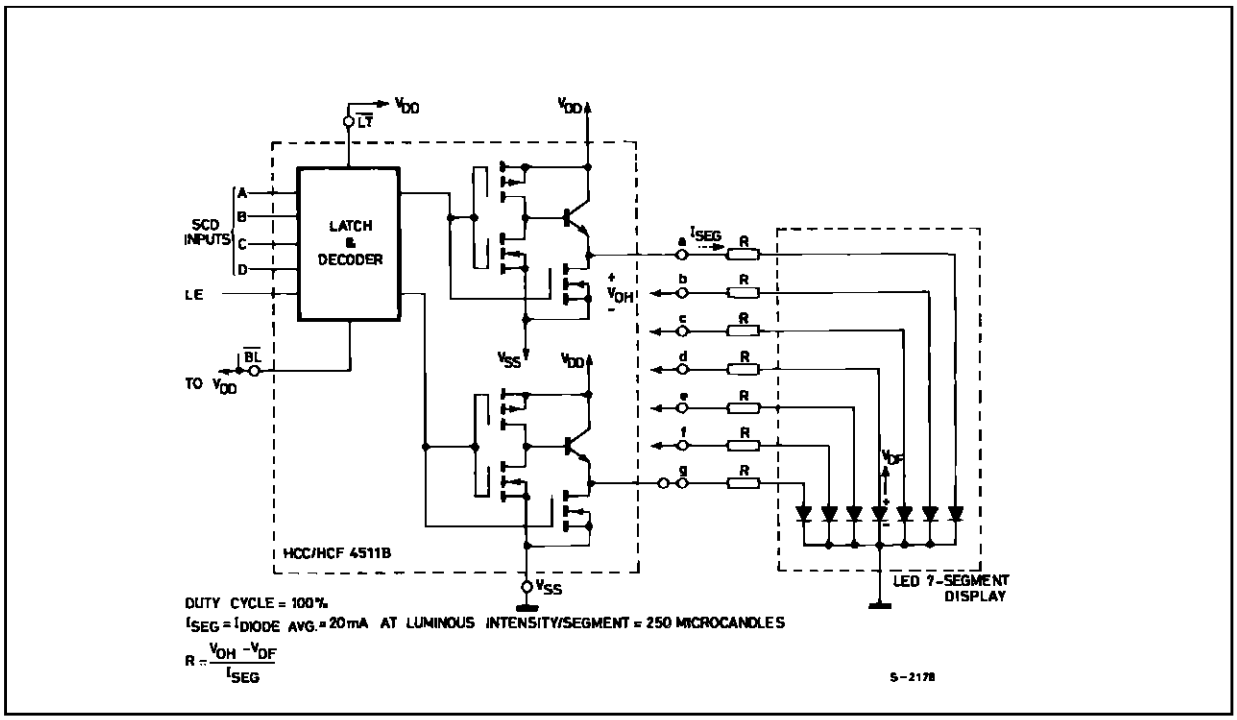
Derated Static Output Current Per Output.



Maximum continuous derated output current IOH applies to a single output with all other outputs sourcing an equal amount of current at the supply voltages shown. Operation above the derating curve is not recommenced.

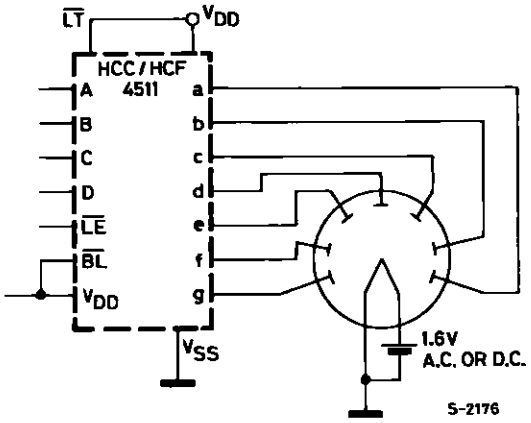
TYPICAL APPLICATIONS (interfacing with various displays)

DRIVING COMMON-CATHODE 7-SEGMENT LED DISPLAYS

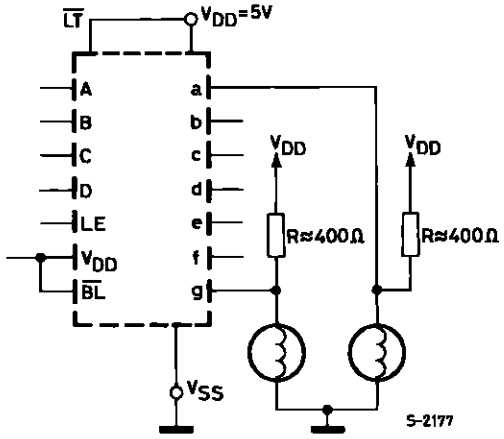


TYPICAL APPLICATIONS (continued)

Driving Low-voltage Fluorescent Displays. Driving Incandescent Displays.



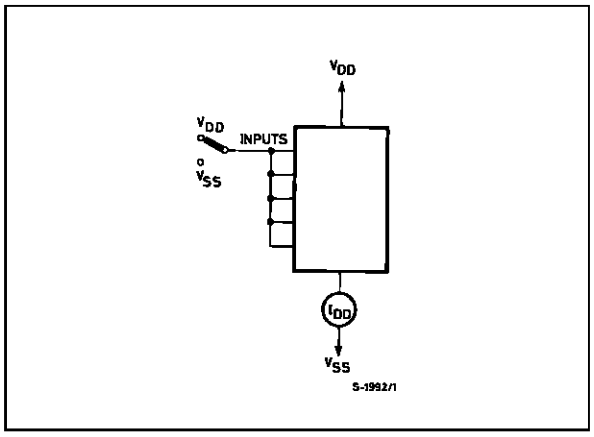
A medium-brightness intensity display can be obtained with low-voltage fluorescent displays such as the Tung-Sot Digivac S/G series.



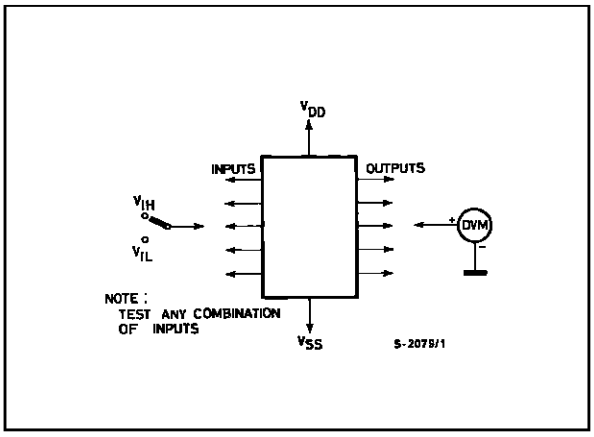
2 of 7 Segments Shown Connected
Resistors R from VDD VDD to each 7-segment driver output are choosen to keep all Numitron segments slightly on and warm.

TEST CIRCUITS

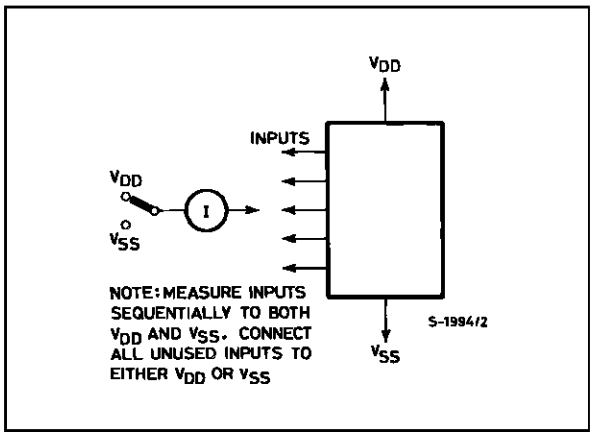
Quiescent Device Current.



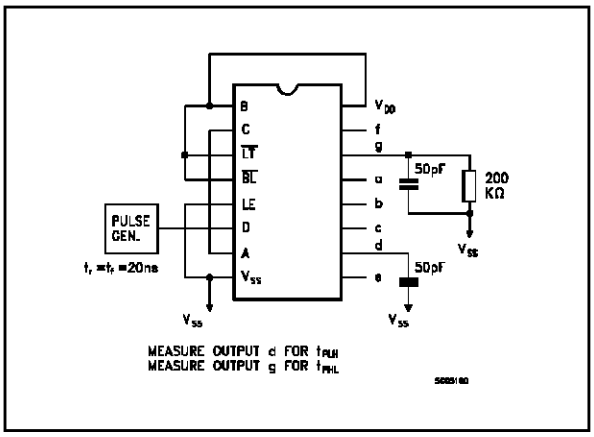
Noise Immunity.



Input Leakage Current.

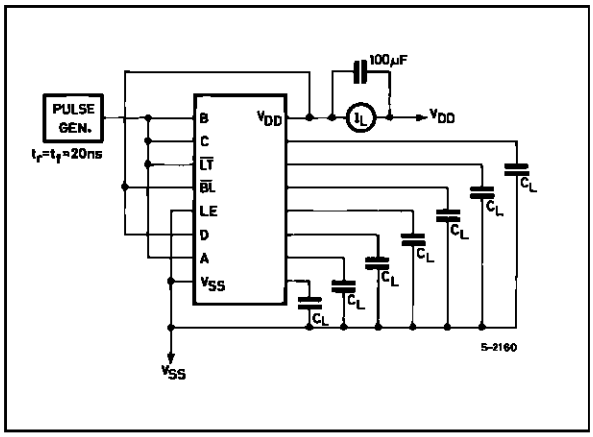


Data Propagation Delay.



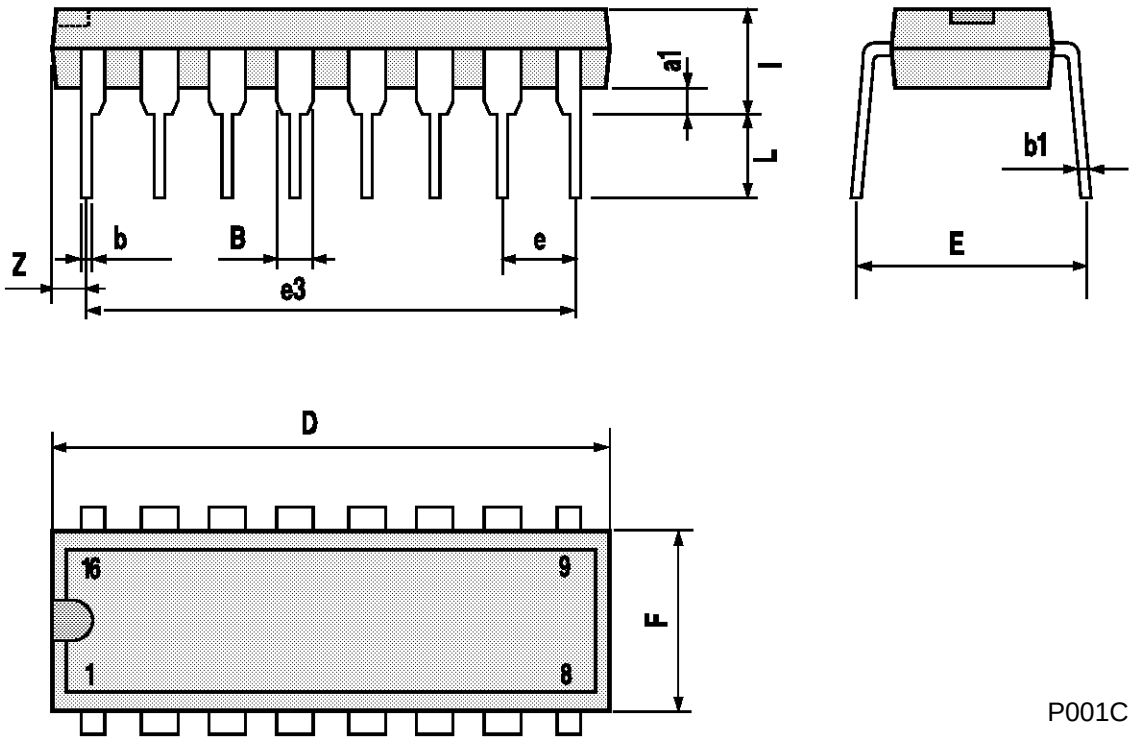
TEST CIRCUITS (continued)

Dynamic Power dissipation.



Plastic DIP16 (0.25) MECHANICAL DATA

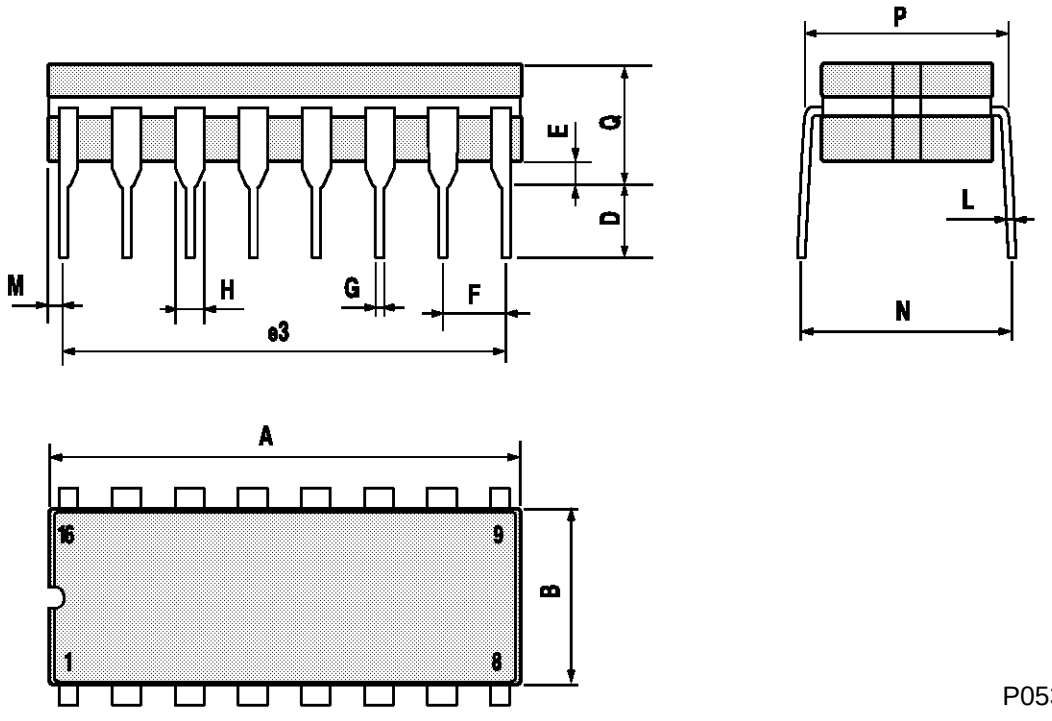
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

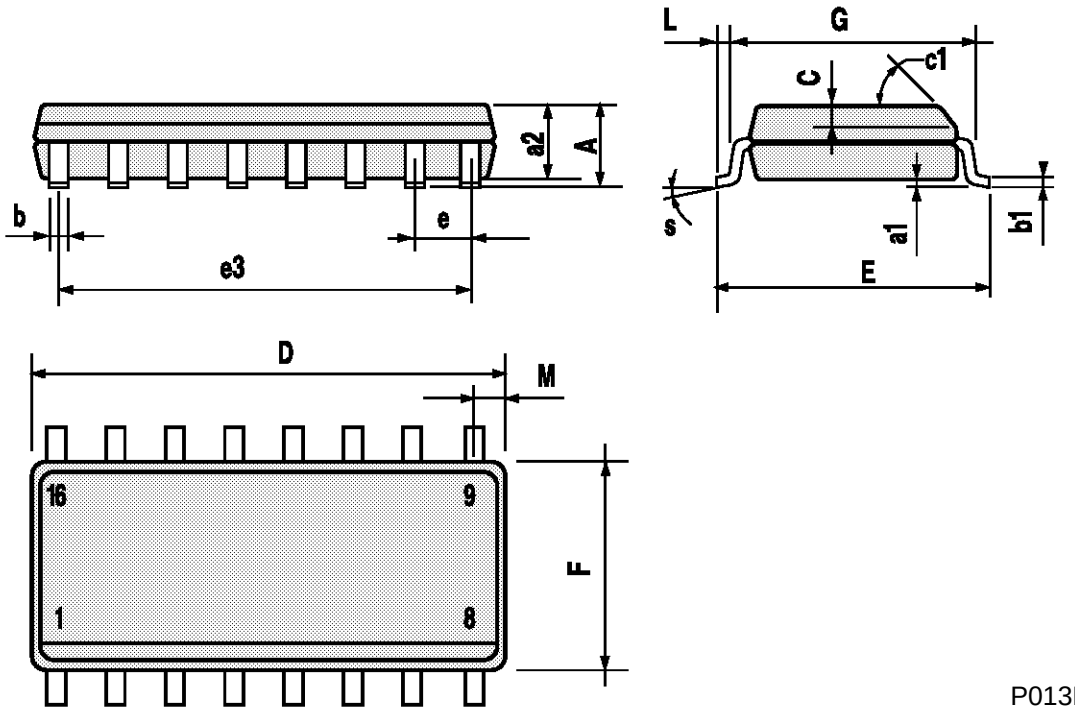
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q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



P053D

SO16 (Narrow) MECHANICAL DATA

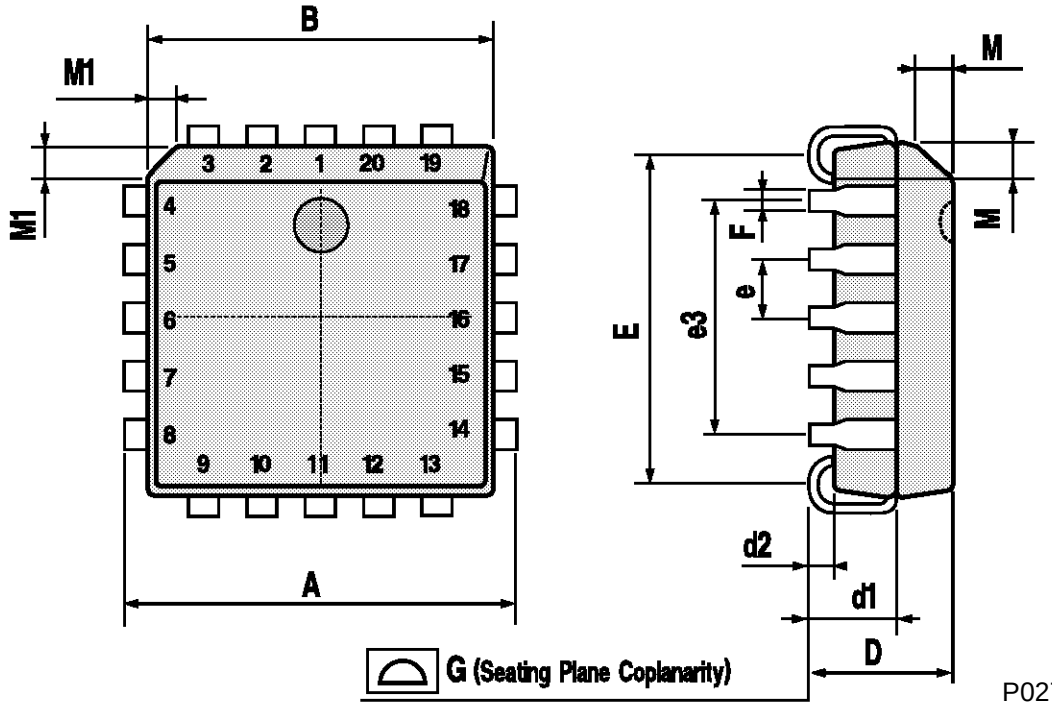
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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



P027A

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