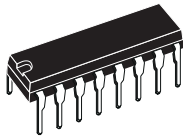
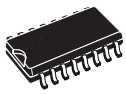
HCF4028B

BCD TO DECIMAL DECODER

- BCD TO DECIMAL DECODING OR BINARY TO OCTAL DECODING
- HIGH DECODED OUTPUT DRIVE CAPABILITY
- "POSITIVE LOGIC" INPUTS AND OUTPUTS: DECODED OUTPUTS GO HIGH ON SELECTION
- MEDIUM SPEED OPERATION : t_{PHL}, t_{PLH} = 80ns (Typ.) at V_{DD} = 10V
- QUIESCENT CURRENT SPECIF. UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- INPUT LEAKAGE CURRENT I_I = 100nA (MAX) AT V_{DD} = 18V T_A = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



DIP



SOP

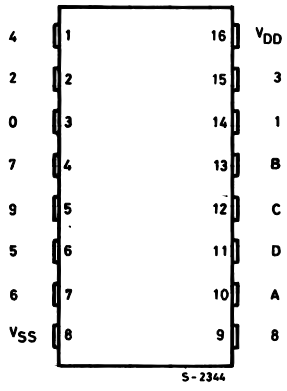
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4028BEY	
SOP	HCF4028BM1	HCF4028M013TR

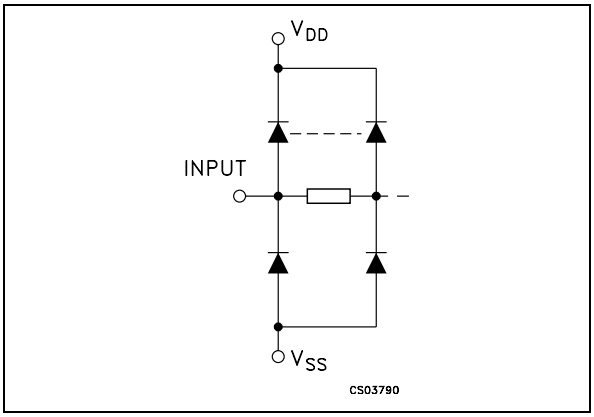
DESCRIPTION

HCF4028B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.
HCF4028B is a BCD to DECIMAL or BINARY to OCTAL decoder consisting of buffering on all 4 inputs, decoding logic gates, and 10 output buffers.
A BCD code applied to the four inputs, A to D, results in a high level at the selected one of 10 decimal decoded outputs. Similarly, a 3-bit binary code applied to inputs A through C is decoded in octal code at output 0 to 7 if D = "0". High drive capability is provided at all outputs to enhance dc and dynamic performance in high fan-out applications.

PIN CONNECTION



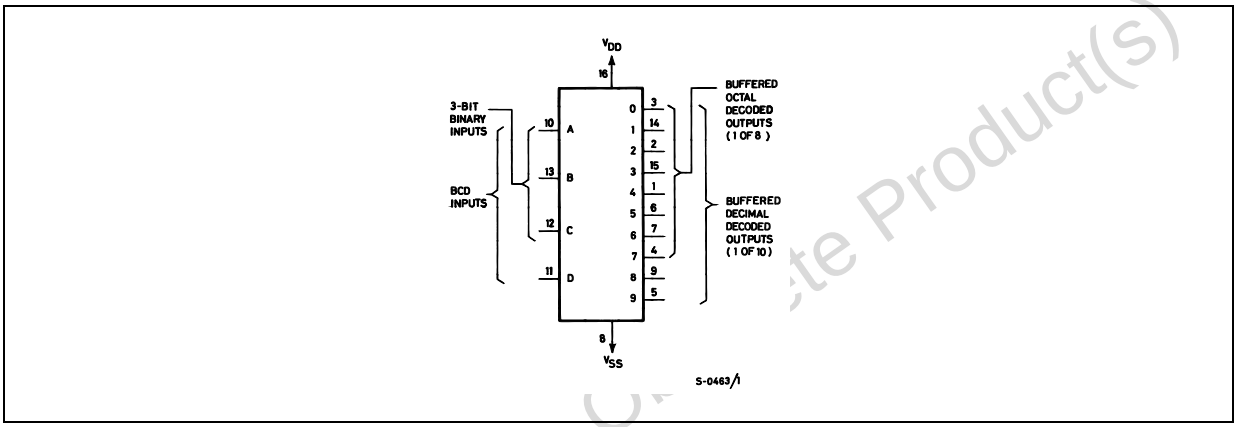
IINPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
10, 13, 12, 11	A, B, C, D	BCD Data Inputs
10, 13, 12	A, B, C	3-Bit Binary Inputs
3, 14, 2, 15, 1, 6, 7, 4, 9, 5	0 to 9	Buffered DECIMAL Decoded Outputs
3, 14, 2, 15, 1, 6, 7, 4	0 to 7	Buffered OCTAL Decoded Outputs
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

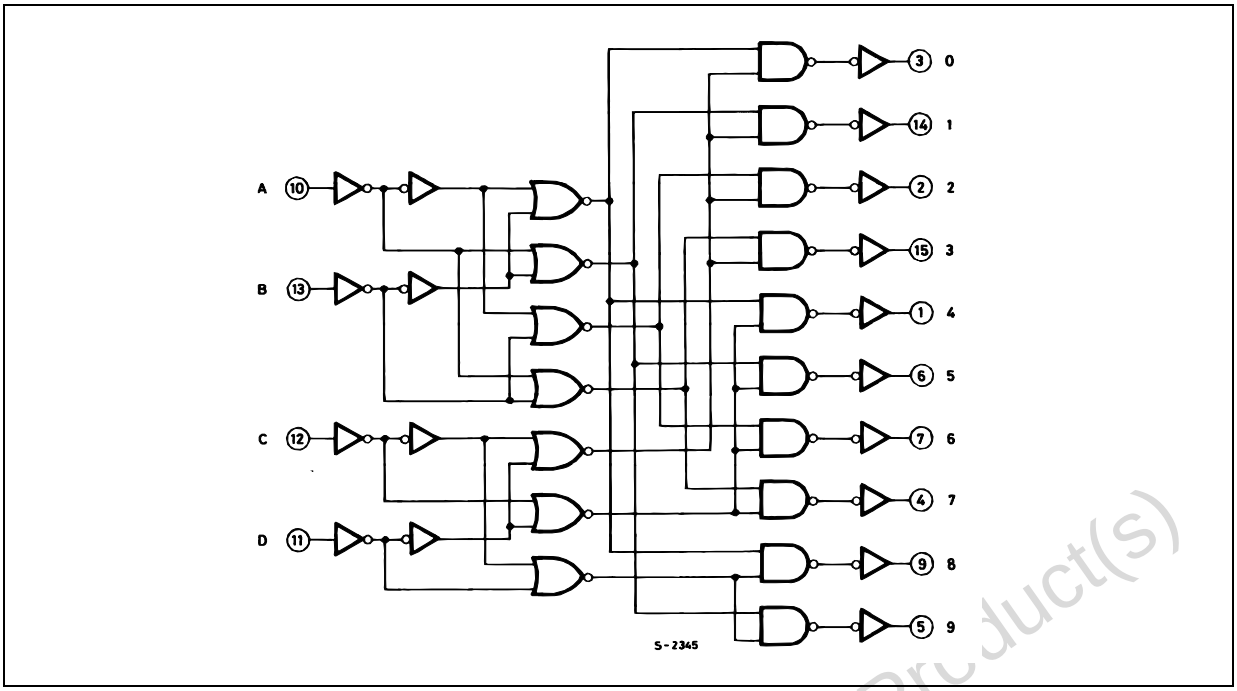
FUNCTIONAL DIAGRAM



TRUTH TABLE

INPUTS				OUTPUTS									
D	C	B	A	0	1	2	3	4	5	6	7	8	9
L	L	L	L	H	L	L	L	L	L	L	L	L	L
L	L	L	H	L	H	L	L	L	L	L	L	L	L
L	L	H	L	L	L	H	L	L	L	L	L	L	L
L	L	H	H	L	L	L	H	L	L	L	L	L	L
L	H	L	L	L	L	L	L	H	L	L	L	L	L
L	H	L	H	L	L	L	L	L	H	L	L	L	L
L	H	H	L	L	L	L	L	L	L	H	L	L	L
L	H	H	H	L	L	L	L	L	L	L	H	L	L
H	L	L	L	L	L	L	L	L	L	L	L	H	L
H	L	L	H	L	L	L	L	L	L	L	L	L	H
H	L	H	L	L	L	L	L	L	L	L	L	L	L
H	L	H	H	L	L	L	L	L	L	L	L	L	L
H	H	L	L	L	L	L	L	L	L	L	L	L	L
H	H	L	H	L	L	L	L	L	L	L	L	L	L
H	H	H	L	L	L	L	L	L	L	L	L	L	L
H	H	H	H	L	L	L	L	L	L	L	L	L	L

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.5 to +22	V
V_I	DC Input Voltage	-0.5 to V_{DD} + 0.5	V
I_I	DC Input Current	± 10	mA
P_D	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
T_{op}	Operating Temperature	-55 to +125	°C
T_{stg}	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.
All voltage values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	3 to 20	V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature	-55 to 125	°C

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions				Value							Unit
		V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_A = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent Current	0/5			5		0.04	5		150		150	μA
		0/10			10		0.04	10		300		300	
		0/15			15		0.04	20		600		600	
		0/20			20		0.08	100		3000		3000	
V_{OH}	High Level Output 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}	Low Level Output 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}	High Level Input Voltage		0.5/4.5	<1	5	3.5			3.5		3.5		V
			1/9	<1	10	7			7		7		
			1.5/18.5	<1	15	11			11		11		
V_{IL}	Low Level Input Voltage		0.5/4.5	<1	5			1.5		1.5		1.5	V
			9/1	<1	10			3		3		3	
			1.5/18.5	<1	15			4		4		4	
I_{OH}	Output Drive Current	0/5	2.5		5	-1.36	-3.2		-1.1		-1.1		mA
		0/5	4.6		5	-0.44	-1		-0.36		-0.36		
		0/10	9.5		10	-1.1	-2.6		-0.9		-0.9		
		0/15	13.5		15	-3.0	-6.8		-2.4		-2.4		
I_{OL}	Output Sink Current	0/5	0.4		5	0.44	1		0.36		0.36		mA
		0/10	0.5		10	1.1	2.6		0.9		0.9		
		0/15	1.5		15	3.0	6.8		2.4		2.4		
I_I	Input Leakage Current	0/18	any input		18		$\pm 10^{-5}$	±0.1		±1		±1	μA
C_I	Input Capacitance		any input				5	7.5					pF

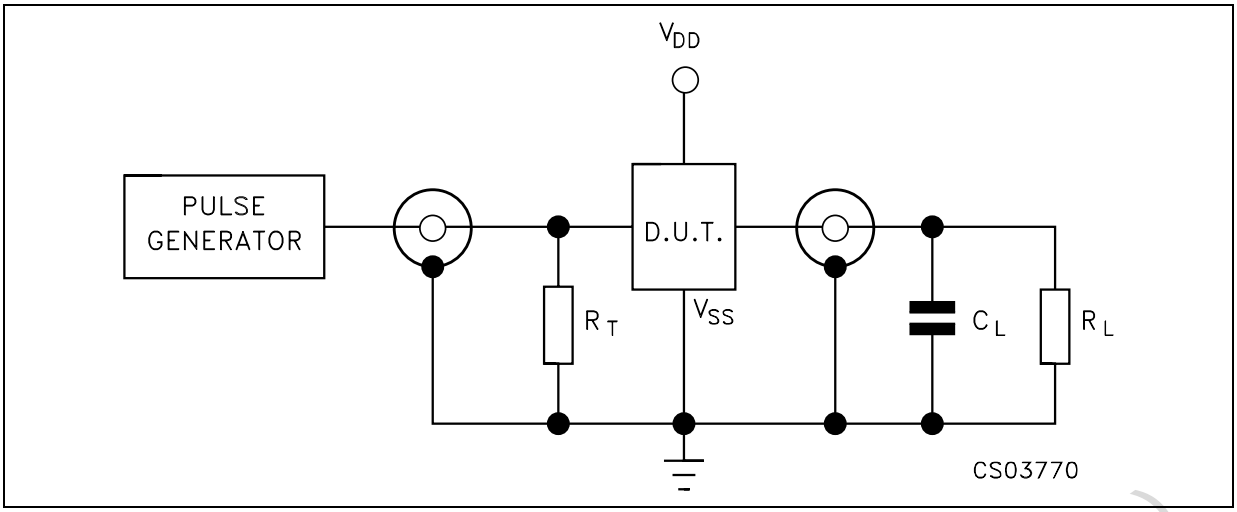
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200KΩ, $t_r = t_f$ = 20 ns)

Symbol	Parameter	Test Condition		Value (*)			Unit
		V_{DD} (V)		Min.	Typ.	Max.	
t_{PHL} t_{PLH}	Propagation Delay Time (Clock to "Out")	5			175	350	ns
		10			80	160	
		15			60	120	
t_{THL} t_{TLH}	Transition Time (Carry Out Line)	5			100	200	ns
		10			50	100	
		15			25	50	

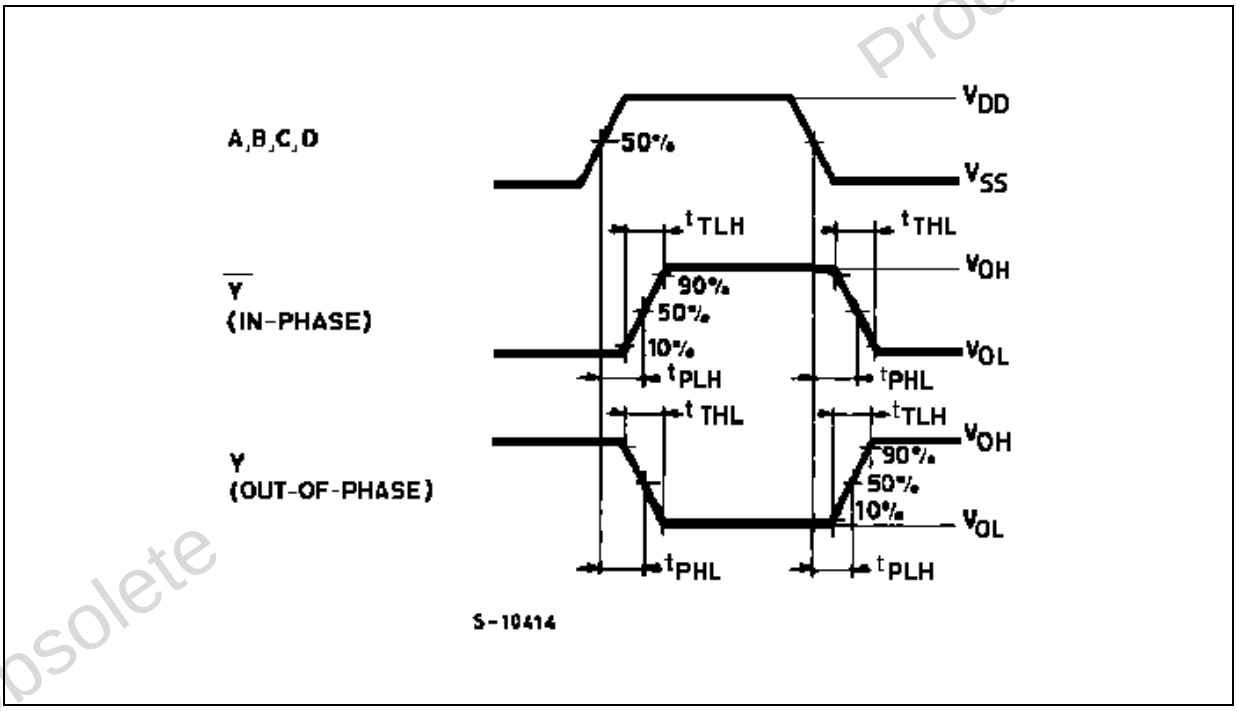
(*) Typical temperature coefficient for all V_{DD} value is 0.3 %/°C.

TEST CIRCUIT



C_L = 50pF or equivalent (includes jig and probe capacitance)
R_L = 200KΩ
R_T = Z_{OUT} of pulse generator (typically 50Ω)

WAVEFORM : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



TYPICAL APPLICATION

The circuit shown in fig. 1 converts any 4-bit code to a decimal or hexadecimal code. Fig. 2 shows a number of codes and the decimal or hexadecimal number in these codes, which must be applied to the input pins of HCF4028B to select a particular output. For example: in order to get a "high" on output 8 the input must be either an 8 expressed in 4-bit binary code or a 15 expressed in excess-3code.

FIGURE 1 : CODE CONVERSION CIRCUIT

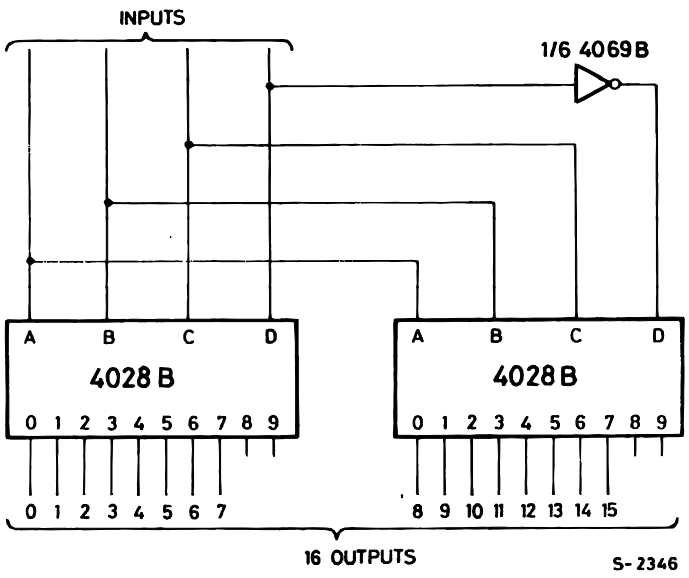


FIGURE 2 : CODE CONVERSION CHART

INPUTS				INPUT CODES						OUTPUT NUMBER															
				HEXA DECIMAL		DECIMAL																			
D	C	B	A	4 BIT BINARY	4 BIT GRAY	EXCESS 3	EXCESS 3 GRAY	AIKEN	4221	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	0	0			0	0	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	H	1	1			1	1	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	H	L	2	3		0	2	2	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	H	H	3	2	0	3	3		L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L
L	H	L	L	4	7	1	4	4		L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L
L	H	L	H	5	6	2			3	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L
L	H	H	L	6	4	3	1		4	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L
L	H	H	H	7	5	4	2			L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L
H	L	L	L	8	15	5				L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L
H	L	L	H	9	14	6			5	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L
H	L	H	L	10	12	7	9		6	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L
H	L	H	H	11	13	8		5		L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L
H	H	L	L	12	8	9	5	6		L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L
H	H	L	H	13	9		6	7	7	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L
H	H	H	L	14	11		8	8	8	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L
H	H	H	H	15	10		7	9	9	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H

FIGURE 3 : 6 BIT BINARY TO 1 OF 64 ADDRESS DECODER

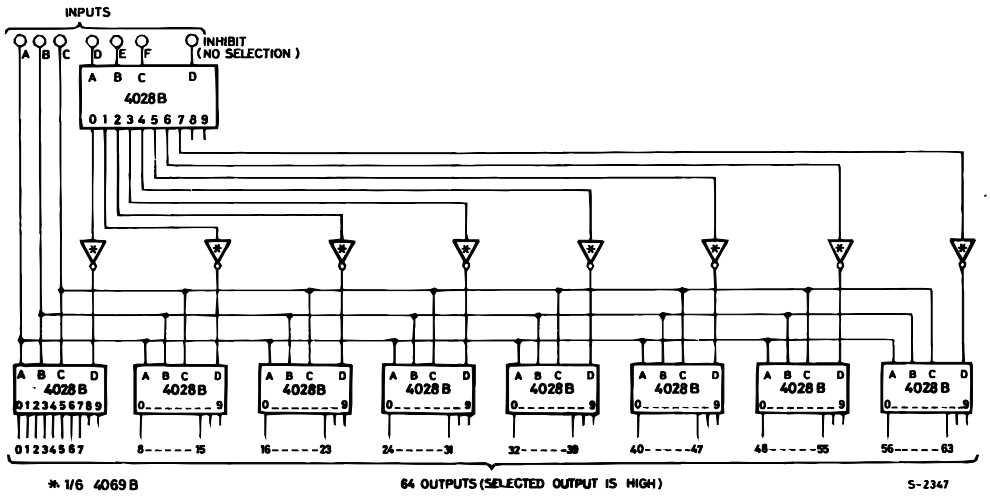
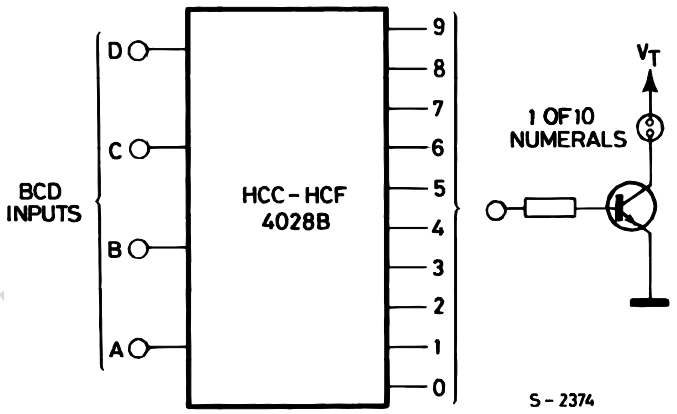
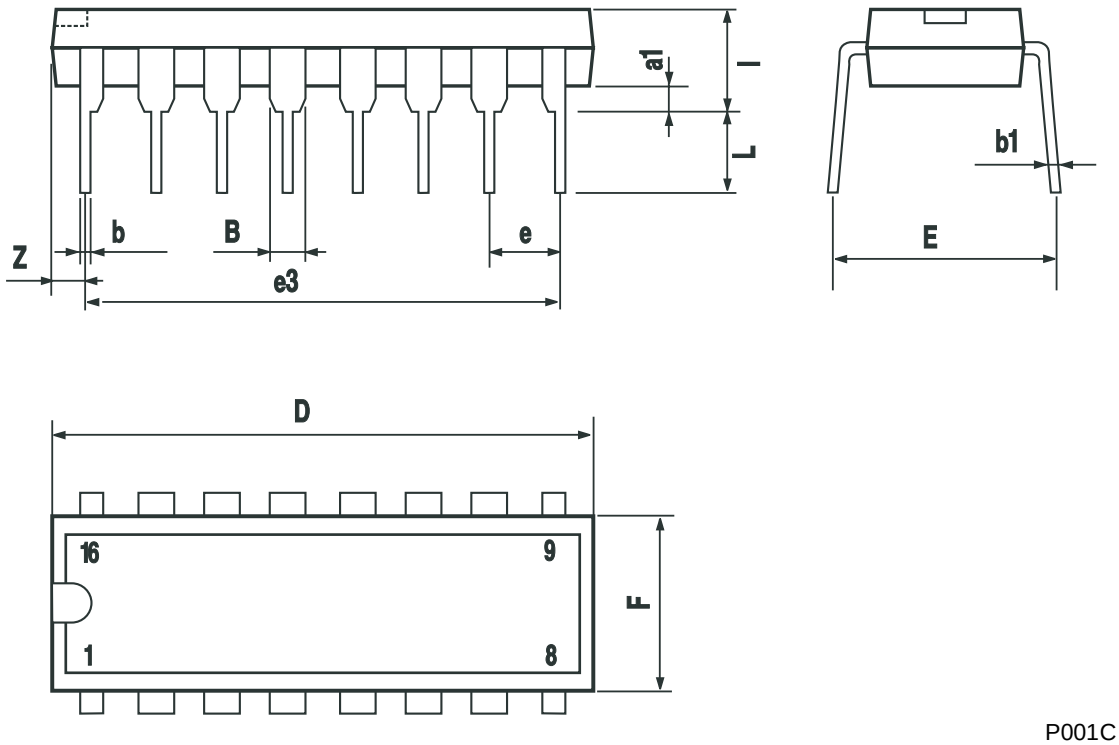


FIGURE 4 : NEON READOUT (NIXIE TUBE) DISPLAY APPLICATION



Plastic DIP-16 (0.25) MECHANICAL DATA

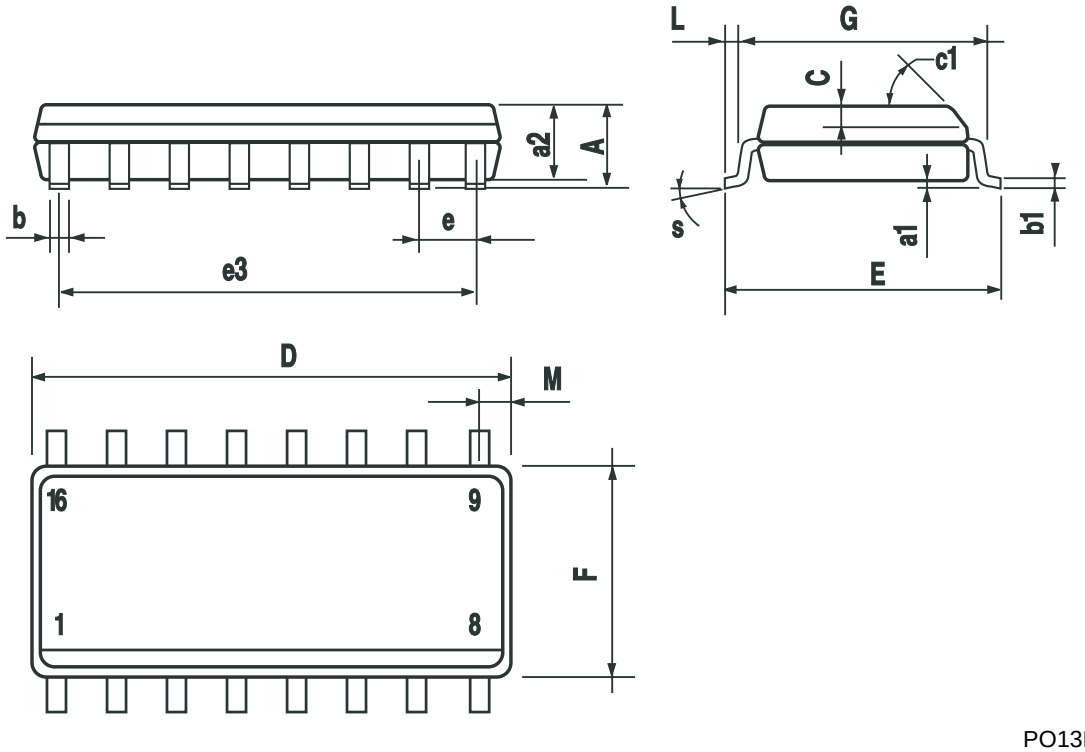
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		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.)					



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