Keyboard for 64-key ASCII code features very low power consumption

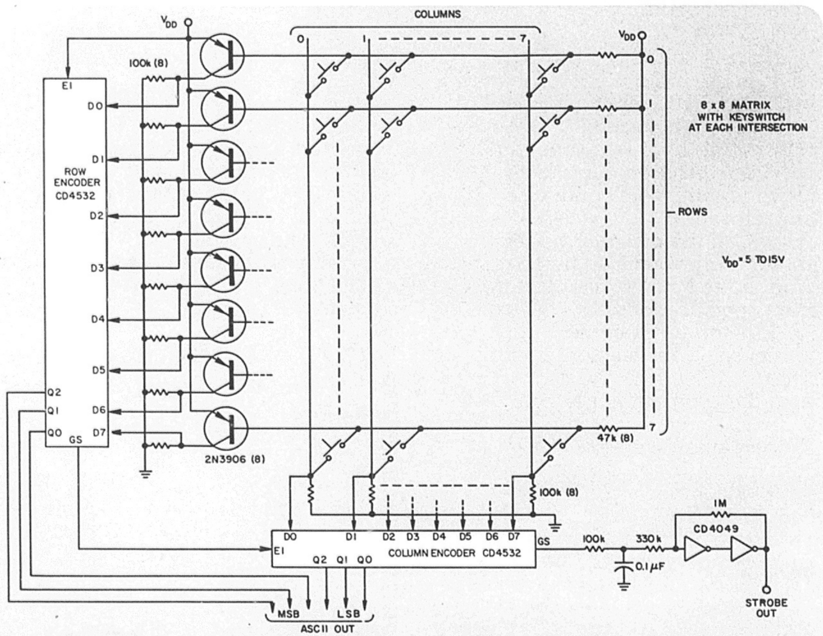
The substantial power consumption of most MOS alphanumeric keyboard encoders, typically 400 mW, is undesirable for portable and other power-critical applications. Fig. 1 shows an encoder circuit that draws nanowatts in standby and less than 0.5 mW at 5 V when any key is depressed. The keyboard encoder circuit uses only three standard CMOS ICs and a few discrete parts, and can encode up to 64 keys in the ASCII-6 character code (see table). Further, the circuit requires no clocks, and contains circuitry to remove keyswitch contact bounce.

The keyswitches are arranged in an 8 × 8 electrical matrix, with the position of each switch determining the corresponding ASCII bit pattern.

A CD4532 binary encoder encodes eight lines into three lines. Its gate-select output (GS) goes HIGH whenever any input, D0 to D7, is HIGH at the same time that its enable input (EI) is HIGH.

When a key is pressed, a connection is made between the base of one of the transistors that drives a keyswitch-matrix row and an input of the column encoder. The resulting current flow saturates the transistor, raises its collector voltage close to V_{dd} and presents a positive input to the column encoder to produce a HIGH at the column-encoder's GS output. A Schmitt trigger and filter made of inverters and associated circuitry remove contact bounce from the GS output, which becomes the strobe-out signal.

When the strobe-out signal goes HIGH, it indi-



1. Few components are needed to build this 64-key ASCII encoder. Low-power consumption—only nanowatts when in standby—allows its use in portable and other low-power applications.

The ASCII-6 code: keyswitch matrix

Character	Row	Column	ASCII	Character	Row	Column	ASCII
@	0	0	000000	(space)	4	0	100000
A	0	1	000001	!	4	1	100001
B	0	2	000010	"	4	2	100010
C	0	3	000011	#	4	3	100011
D	0	4	000100	$	4	4	100100
E	0	5	000101	%	4	5	100101
F	0	6	000110	&	4	6	100110
G	0	7	000111	'	4	7	100111
H	1	0	001000	(	5	0	101000
I	1	1	001001	)	5	1	101001
J	1	2	001010	*	5	2	101010
K	1	3	001011	+	5	3	101011
L	1	4	001100	,	5	4	101100
M	1	5	001101	-	5	5	101101
N	1	6	001110	.	5	6	101110
O	1	7	001111	/	5	7	101111
P	2	0	010000	0	6	0	110000
Q	2	1	010001	1	6	1	110001
R	2	2	010010	2	6	2	110010
S	2	3	010011	3	6	3	110011
T	2	4	010100	4	6	4	110100
U	2	5	010101	5	6	5	110101
V	2	6	010110	6	6	6	110110
W	2	7	010111	7	6	7	110111
X	3	0	011000	8	7	0	111000
Y	3	1	011001	9	7	1	111001
Z	3	2	011010	:	7	2	111010
[	3	3	011011	;	7	3	111011
\	3	4	011100	<	7	4	111100
]	3	5	011101	=	7	5	111101
↑	3	6	011110	>	7	6	111110
←	3	7	011111	?	7	7	111111

Note: The row-encoder output corresponds to the most-significant three bits and the column encoder to the least-significant three bits of a "trimmed" ASCII code. The Control and Shift functions found on some keyboards may be employed, if desired, in software presenting their lines to a CPU as two additional input bits.

cates that a key has been pressed and that valid data are present on the ASCII output lines. The leading edge of the strobe-out signal can be used to gate the ASCII data into a register or input port, or to provide a keyboard-interrupt request to a central processor. The outputs are directly compatible with NMOS, CMOS and low-threshold PMOS logic when the logic is operated from the same power supply as the keyboard.

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