

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.

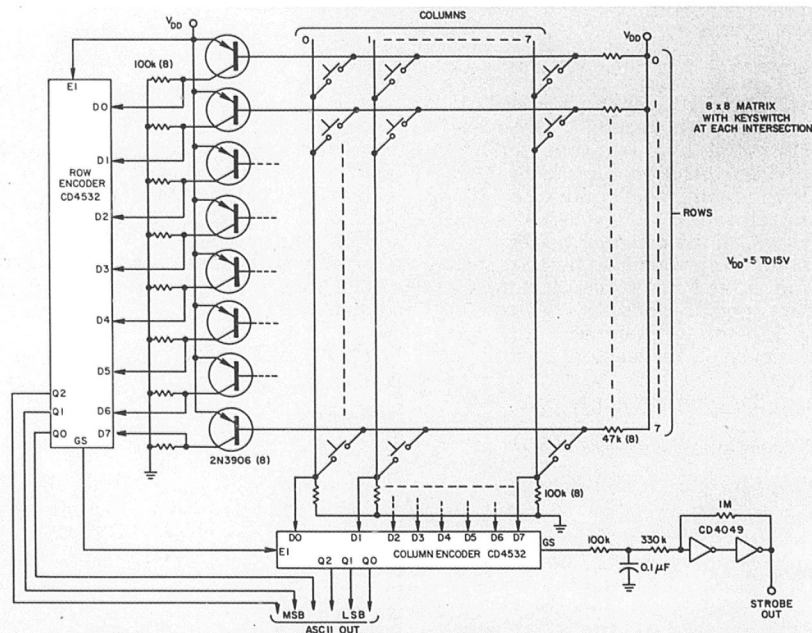
The keyswitches are arranged in an 8 × 8 electrical matrix, with the position of each switch determining the corresponding ASCII bit pattern.

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.

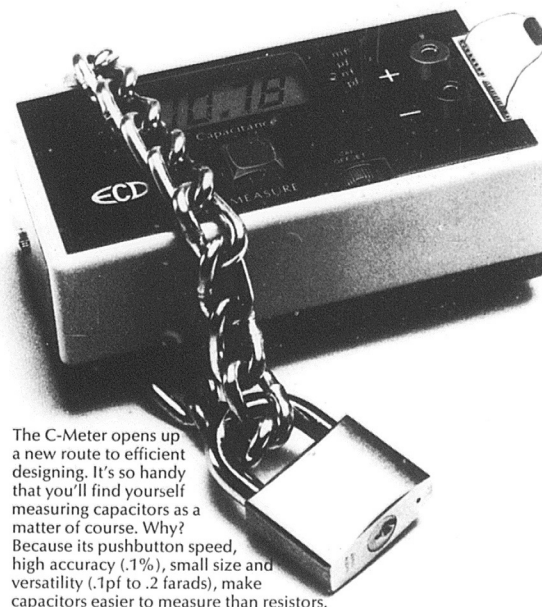
When the strobe-out signal goes HIGH, it indi-



1. Few components are needed to build this 64-key ASCII encoder. Low-power consumption—only nano-

watts when in standby—allows its use in portable and other low-power applications.

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CIRCLE NUMBER 71

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.

Max W. Hauser, Engineering Associate, Plasma Research Laboratory, Cory Hall, University of California, Berkeley, CA 94720.

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IFD Winner for September 1, 1976

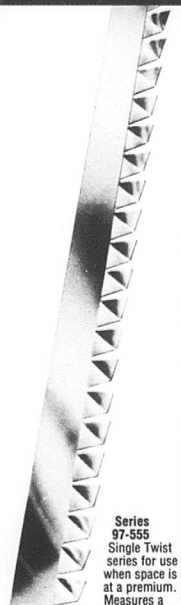
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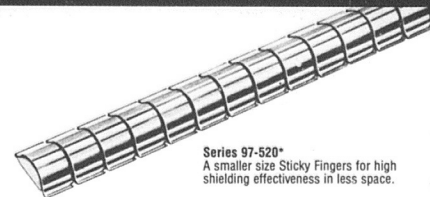
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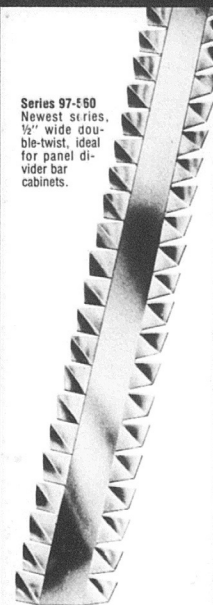
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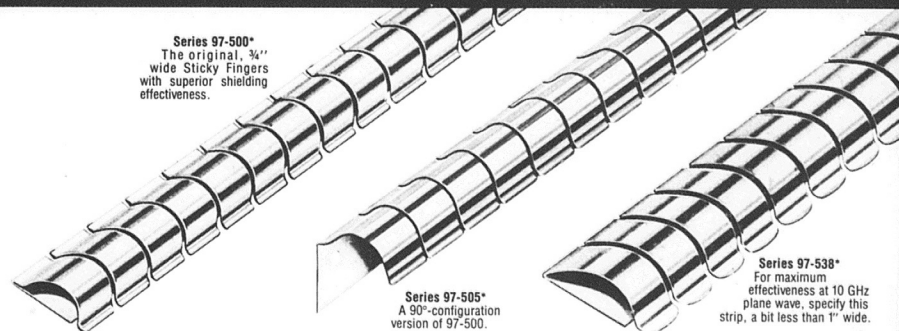
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