

# Keyboard Encoder Read Only Memory KEM

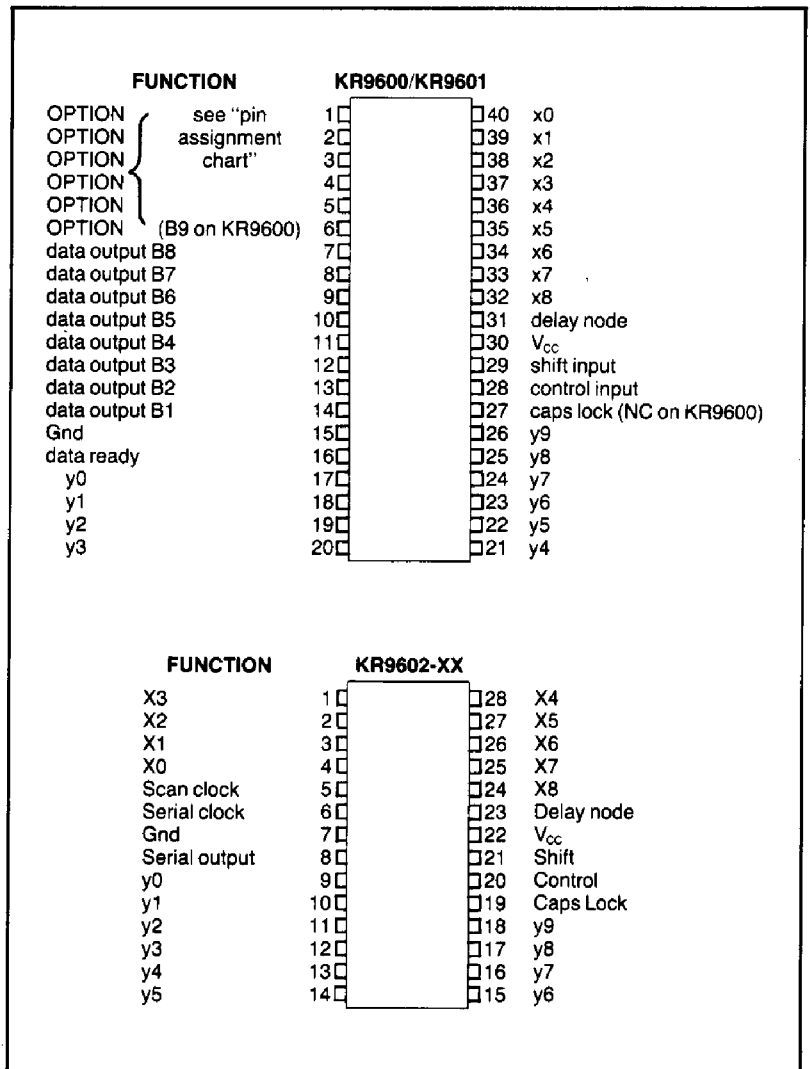
## FEATURES

- On-chip "caps" lock (KR9601, KR9602)
- On-chip auto repeat (KR9601, KR9602)
- Contact bounce protection
- N Key Rollover or Lockout operation
- Hysteresis on keyboard matrix inputs
- Tri-state TTL compatible data outputs
- Serial output (on KR9602 only)
- Quad Mode (Normal, shift, control, shift-control)
- High frequency clock input
- Pin-compatible with KR3600 (KR9600)
- Static charge protection on all inputs and outputs
- + 5 volt supply

## EXTERNALLY SELECTABLE OPTIONS ON KR9600 AND KR9601

- Pulse or level data ready output signal
- External clock input
- On chip master/slave oscillator
- All 10 output bits available
- Lockout/Rollover external selection
- Chip enable external selection
- Data complement control
- Any Key Down output
- Selectable Auto-Repeat rate
- Programmable Auto-Repeat rate

## PIN CONFIGURATION\*



\*PLCC (J LEAD QUAD PACK) also available.

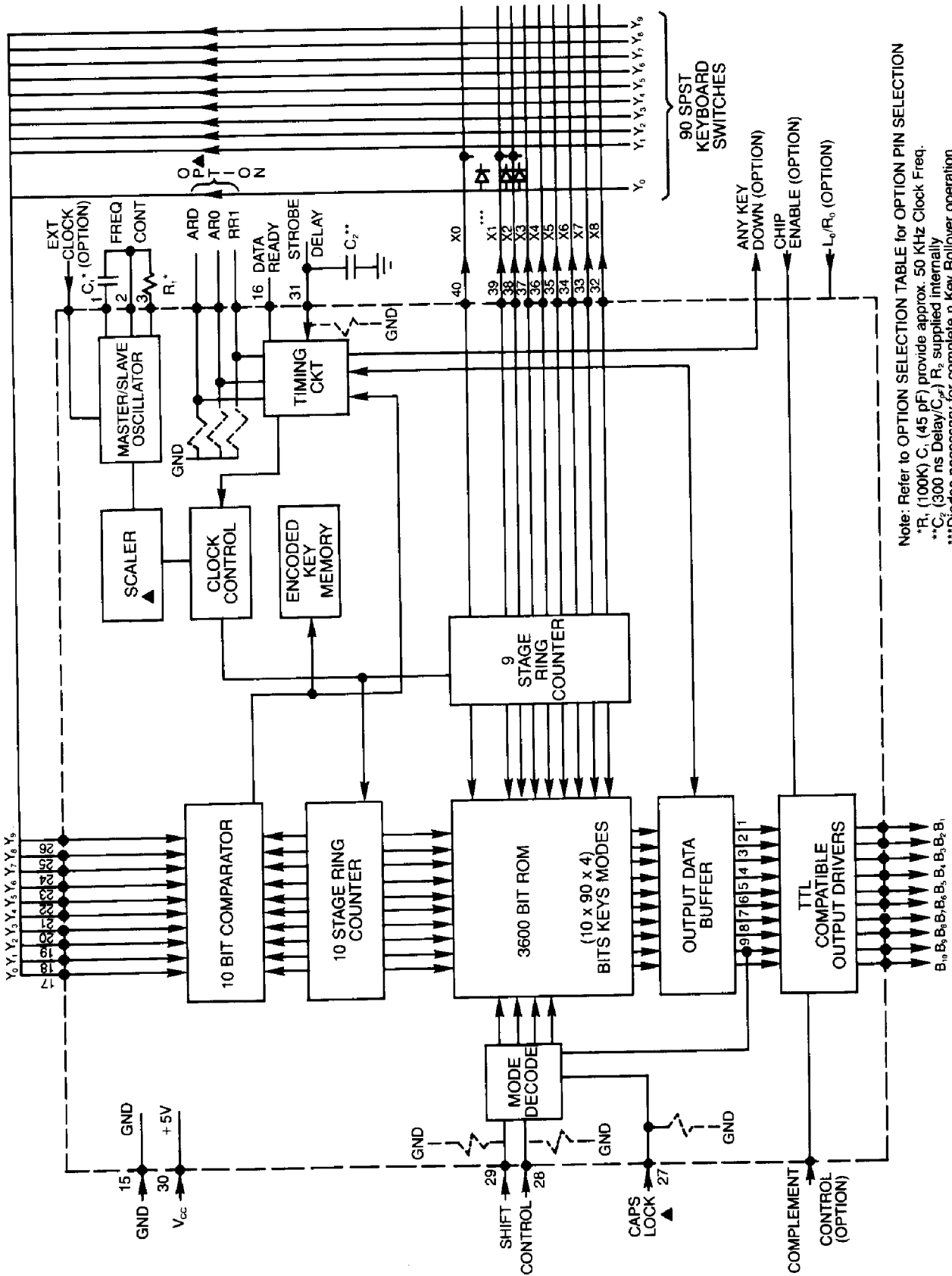
## GENERAL DESCRIPTION

The KR9600/1/2 is a keyboard encoder that contains all the logic necessary to debounce and encode SPST key-switches into a fully decoded data output of up to 10 bits. The KR9600/1/2 contains a 3600 bit ROM, 9 stage and 10 stage ring counters, a 10 bit comparator, timing circuitry, a 90 bit memory to store the location of encoded keys for N key rollover operation, an externally controllable delay net-

work for eliminating the effect of contact bounce, an output data buffer and TTL compatible output drivers.

The KR9600 and the KR9601 provide a parallel data output in a 40 pin configuration with pin selectable options, while the KR9602 provides a serial asynchronous output in a 28 pin configuration with mask programmable options. (Ref. KR9600/1/2 custom coding information sheet).

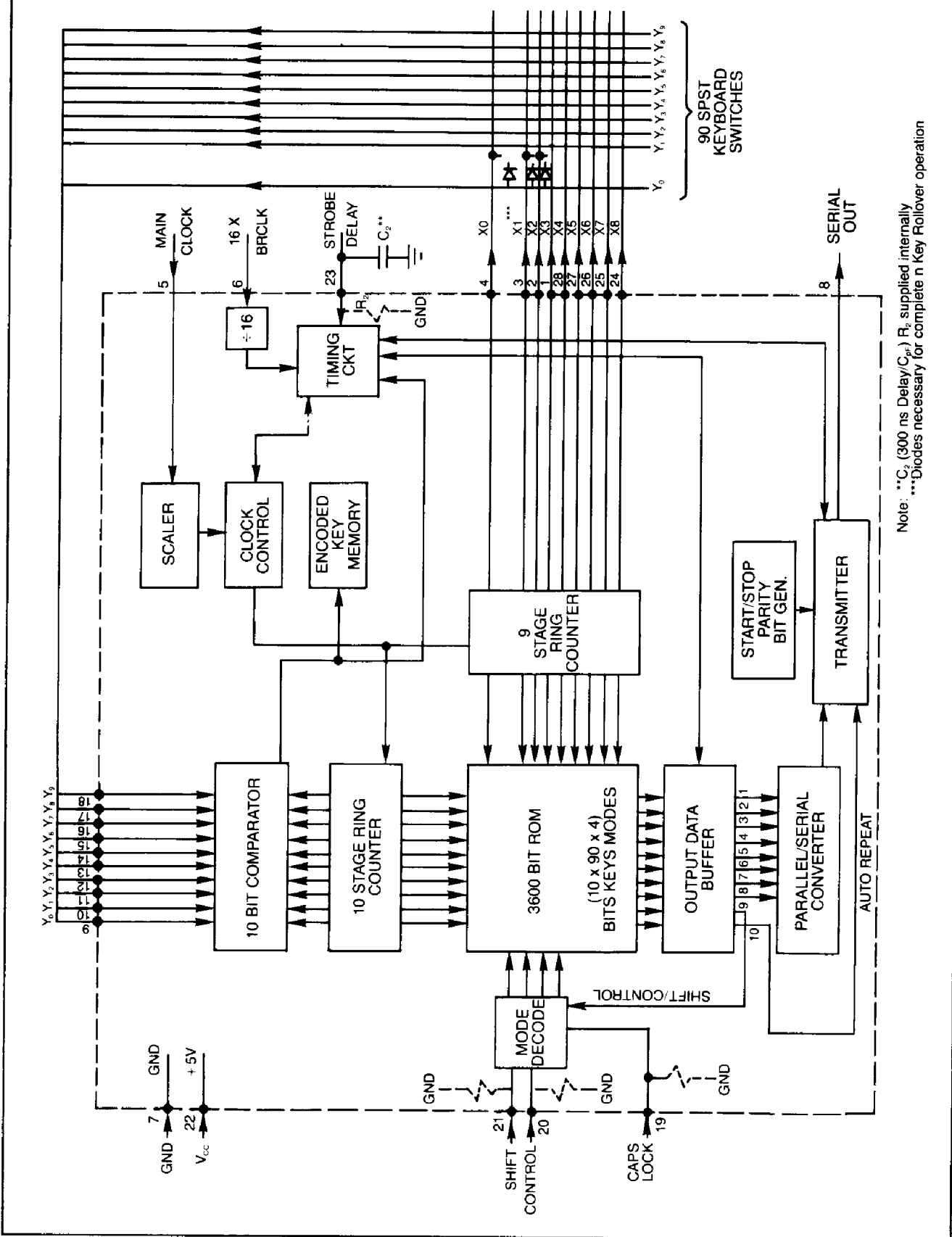
# BLOCK DIAGRAM FOR KR9600/KR9601



Note: Refer to OPTION SELECTION TABLE for OPTION PIN SELECTION  
 \*R<sub>1</sub> (100K) C<sub>1</sub> (45 pF) provide approx. 50 KHz Clock Freq.  
 \*\*C<sub>2</sub> (300 ns Delay/C<sub>2</sub>) R<sub>2</sub> supplied internally  
 \*\*\*Diodes necessary for complete n Key Rollover operation

▲ Not Available on KR9600

# BLOCK DIAGRAM FOR THE KR9602



Note: \*\*C<sub>2</sub> (300 ns Delay/C<sub>pr</sub>) R<sub>2</sub> supplied internally  
 \*\*\*Diodes necessary for complete n Key Rollover operation

## DESCRIPTION OF PIN FUNCTIONS

NAME	SYMBOL	KR9600 PIN #	KR9601 PIN #	KR9602 PIN #	FUNCTION
X OUTPUTS	X0-X8	40-32	40-32	4-1 28-24	External outputs from the 9-stage ring counter to the keyboard to form X-Y matrix with the keyboard switches as the crosspoints.
Y INPUTS	Y0-Y9	17-26	17-26	9-18	External inputs from the keyboard X-Y matrix.
EXTERNAL CLOCK (see note)	***	1	1	5	External clock input.
SERIAL CLOCK	***	***	***	6	Serial input Baud rate clock, for KR9602.
DATA OUTPUTS	B8-B1	7-14	7-14	8	Data outputs B1-B8. Parallel outputs for the KR9600/9601, serial output for the KR9602.
DATA READY	DR	16	16	N/A	This output, which can be a level or a pulse, signals that a key closure has been detected and that data is available at the output port.
DELAY NODE INPUT	DELAY	31	31	23	Externally controllable delay network for eliminating the effect of switch contact bounce.
SHIFT INPUT	SHIFT	29	29	21	This input is used to select the shift mode data.
CONTROL INPUT	CNTRL	28	28	20	This input is used to select the control mode data. Simultaneous assertion of shift and control inputs will place the encoder into the shift-control mode.
CAPS LOCK	CAPS	see note	27	19	This input "ANDed" with bit B9 of the ROM will cause a mode shift. See "programming options".
POWER SUPPLY	V <sub>cc</sub>	30	30	22	+5V power supply.
GROUND	Gnd	15	15	7	Ground.
OPTION PINS		see note	1-6	N/A	See option selection table for pin assignment.

Note: Caps Lock and Auto-Repeat are not available on KR9600.  
See option selection table for pin assignment.

## DESCRIPTION OF OPERATION

The main clocks for the KR9600 and KR9601 are derived from either an external clock source or the Internal oscillator. The KR9602 requires an external clock. The external clock is routed to a divider with a mask programmable division rate from 1 to 63 to generate the internal clock.

The keys are scanned in a nine output by ten input matrix, each key having a unique input-output combination connected to it. The inputs all go selectively to a level detector which has logically variable (1's and 0's) levels and hysteresis. The outputs are enabled one at a time from output X0 towards X8, at a rate of 10-100KHz, through a 9 stage ring counter. The 10 inputs are searched one at a time from Y0 to Y9, through a 10 stage ring counter, each time one of the outputs is enabled. The output and input pins all have pullups to V<sub>cc</sub> and are precharged each clock even if the scan is stopped at one key. When a level on the selected path to the comparator matches a level on the corresponding comparator input from the 10 stage ring counter and the key has not been encoded, the switch bounce delay network is enabled. The key down stroke is examined, without advance to the next key location, until the key has been stable for the length of the DELAY CAP pin to discharge. The code for the depressed key is transferred to the output data buffer and the data ready signal appears.

The scan has two modes as determined by the LOKout/Rollover option. Once a key is determined to be down the scan will not advance if in the LOKout mode. Consequently a new key closure is not detected until the previously depressed key is released. The scan sequence will resume upon key release and the output data buffer stores the code of the last key encoded. In the Rollover mode a "1" is stored in the encoded key memory and the scan sequence is resumed and the code for the last encoded key remains in the data output buffer. Each depressed key is encoded regardless of the state of the previously depressed keys. The internal keyboard ROM is 10 bits wide. Bits 1-8 are output via data outputs B1-B8. Bits 9 and 10 may be output as data and/or utilized respectively for Caps-lock and Auto-repeat select. This allows mask programmable selection of which keys will have caps-lock and auto-repeat. When selected, the auto repeat will commence with a "long" delay after key depression followed by "short" delays. The duration of the delays varying with the clock frequency and the state of the ARD, AR0, and AR1 signals.

A Chip Enable input is available to enable the parallel output buffer. Data Ready can be put in the high-impedance state with Chip Enable (CE) or can be open drain as a mask programmable option to facilitate wire-oring as an interrupt.

In the serial output version of KR9602, when a key is debounced and then called valid, the serial shift register is loaded with the data (8 bits B1-B8) from the ROM, the data from the parity generator, and the data from the start and stop bits generator. Bits B9 and B10 are internally used respectively for Caps-lock and Auto-repeat select. The data register is then allowed to shift data out at the rate of one bit per 16 clocks of the baud rate clock pin, on the negative edge of that clock. If the baud rate clock is too slow with respect to the internal clock, and the keyboard were allowed to continue scanning when the data register is loaded, then new data could be loaded on top of shifting-out data.

To avoid this, if a new key is depressed before the previous data is fully shifted out of the device, including the stop bits, the delay cap will be allowed to decay but the internal logic will delay its effect until the shift out of the previous data is completed. If the new key is released before the end of the extended delay time it will not be encoded.

### OPTION SELECTION TABLE

Since the selected coding of each key and all the options are defined during the manufacture of the chip, the coding and options can be changed to fit any particular application of the keyboard. Up to 360 codes of up to ten bits can be programmed into the KR9600/KR9601 ROM covering most popular codes such as ASCII, EBCDIC, SELECTRIC etc. as well as many specialized codes.\*

### Pin Assignment for KR9600/KR9601

The chip pins from pin #1 thru pin #6 are optionally connected to differing logic functions. Many of the functions are available on more than one pin.

PIN	FUNCTION (input unless noted)
1	Ext clock (opt. internal divisor of 1-63)**
1	Pin 1 of Internal oscillator.
2	Pin 2 of Internal oscillator.
2	Lo/Ro CC CE ARD** AR0** AR1**
3	Pin 3 of Internal oscillator.
3	Lo/Ro CC CE ARD** AR0** AR1**
4	AKO output
4	Lo/Ro CC CE ARD** AR0** AR1**
5	AKO or B10 output
5	Lo/Ro CC CE ARD** AR0** AR1**
6	B9 or AKO** output

### Options Available for the KR9602:

The following options can be obtained on the KR9602 only with a mask program, and are not pin selectable:

Lo/Ro, CC, AUTO-REPEAT, LONG DELAY, SHORT DELAY, CLOCK DIVISOR 1,2,4,8,16,32,63; PARITY, 1 OR 2 STOP BITS.

### Legend

CC = COMPLEMENT CONTROL  
 Lo/Ro = LOCKOUT/ROLLOVER  
 B9 = B9 (DATA) OUTPUT  
 INTERNAL CLOCK = SELF CONTAINED OSCILLATOR (Not available in KR9602)  
 EXTERNAL CLOCK = EXTERNAL FREQUENCY SOURCE  
 ARD = INITIAL AUTO-REPEAT DELAY  
 ARO, AR1 = SECONDARY AUTO-REPEAT DELAY, OR NO AUTO-REPEAT WHEN BOTH ARE FALSE.

AKO = ANY KEY DOWN  
 CE = CHIP ENABLE  
 B10 = B10 (DATA) OUTPUT

\*Contact local sales office for custom coding sheet.  
 \*\*Not available on the KR9600.

### PROGRAMMING OPTIONS

The various options on the KR9600 and KR9601 are user selectable via externally programmable pins, but they are fixed, internally mask programmed, for the KR9602.

#### Oscillator:

The main clocks are derived from either an external clock source or from the Internal oscillator. The resultant signal is then routed to a divider with a mask programmable division rate from 2 to 63. If no division is required then the divider is bypassed. The external clock requires one pin (pin #1), while the Internal oscillator needs three pins (pins #1, 2, 3) for frequency selection via an external resistor and capacitor.

#### Lockout/Rollover: LO/RO

This option selects the operation of the key scan when a new key is detected. In Lockout the scan stops as long as the key is down. In Rollover the scan stops till the new key is debounced by the DELAY CAP and the key code is output. Then the key position is marked as down and the scan continues until another new key is seen. The option is selected either by an external pin or internally mask programmed, fixed in either state. The external LOCKOUT selection is optionally hi or low active. A pull-down resistor to ground is optional.

#### Complement Control: CC

This option inverts the logic true state of the DATA OUT-

PUTS and can optionally additionally invert the logic true state of the DATA READY pin. The option can be internally fixed as true or false where true will output a high logic level. When externally selected the option can be either input high or low active true. The pulldown to ground is optional.

#### Data Ready:

The data ready pin is optionally either a pulse or level upon an output state ready to transfer. This transfer occurs when a new key is encoded or when the current key is repeating via the repeat logic. This output is individually capable of being disabled via CE or inverted via CC. To invert DATA READY is to have the pulse go logic low or the level fall to logic low active when the output is allowed to drive out of the chip.

#### Any Key Down: AKO output

The AKO output is an indicator to tell that there is at least one key determined to be depressed. The output is optionally logic high or low true. The CE can be separately used to set the output in the high impedance mode. AKO will reset one full keyboard scan time after the last key is released. AKO cannot be inverted by CC (complement control).

#### Chip Enable: $\overline{CE}$

The chip enable option can be internally fixed to true or

can be externally selected. When an external pin is used the true level is only low true. The true state means that the outputs connected to CE will go to the driven state from the high-impedance condition. Output pins B1-B10 are always affected by Chip Enable (CE), optional for Data Ready and Any Key Down. A pulldown to ground is optional.

### Shift Control Lock: S C L

These three pins determine what will be output in response to a new key being detected. The Caps Lock pin is optional on the KR9601 and KR9602 but it is not available on the KR9600. All three pins have optional pulldown resistors to ground. The Lock option is allowed if data bit nine of the ten data bits is programmed as true. In other words the Rom is read with no lock logic allowed, but with the full influence of the Shift and Control pins. This determines the B9 output which is used to see if this key can be shifted (be it a control code or not) by modifying the effect of the Shift upon a second read of the rom. The operation of the allowed Lock follows this table:

L	B9	S	C	Result	
F	F	F	F	N	
F	F	F	T	C	
F	F	T	F	S	L = CAPS LOCK
F	F	T	T	SC	B9 = DATA OUTPUT B9
F	T	F	F	N	N = NORMAL
F	T	F	T	C	S = SHIFT
F	T	T	F	S	C = CONTROL
F	T	T	T	SC	SC = SHIFT and CONTROL
T	F	F	F	N	
T	F	F	T	C	
T	F	T	F	S	
T	F	T	T	SC	
T	T	F	F	S	Force N->S allow shift (ie m->M)
T	T	F	T	SC	Force C->SC shift of Control
T	T	T	F	*S/N	Opt Force S->N allow reverse (ie M->m)
T	T	T	T	*SC/C	Opt Force SC->C remove shift in Shift-Control

\*The mask programmable option for the removal of the shift is coded as either ON for all keys or OFF. Note that the B9 DATA output (and all the others) is the code of the second decode. Note that shift only occurs when both the lock is true and the unmodified code gives a B9 ROM output as true.

### Repeat: ARD AR0 AR1

When the Auto-repeat option is selected and a key is pressed, either of two delays can be selected. Typically a long initial delay after the key is pressed, and short delays afterwards if the key is still pressed. These delays

consist of a programmable number of scan frequency time clocks varying from 2 to 131071 clock times.

This option is masked programmable and dependent on the programming of the data bit 10 of the ten data outputs to be true for the resultant key code (after lock logic) and upon whether any repeat action should occur at all.

There are three optional pins associated with the auto repeat logic: AR0, AR1, and ARD. Each of these can individually optionally have a pulldown resistor to ground. ARD controls the selection of the initial repeat delay count code, while the combination of AR0 and AR1 controls the selection of the short delays as shown below. If no external pins are desired then those functions can be mask programmed.

### TYPICAL INITIAL REPEAT DELAY COUNTS

ARD = hi 80000 clock times  
ARD = low 40000 clock times

The repeat delays are selected by a two bit code where one decode is used to disable the repeat operation completely.

### TYPICAL SECONDARY REPEAT COUNTS

AR0	AR1	Count
0	0	All Auto-Repeat Disabled
0	1	6250
1	0	3125
1	1	1250

### Typical Example:

One typical approach would be to mask program ARD for only one long delay value and mask AR0 to ground. This way one can save two option pins for ARD and AR0 and still be able to select or disable auto-repeat via AR1 and have the option of having one fixed short delay value.

### ROM Data:

The actual programming data is in 10 bit wide characters with four function codes for each key position. There are 90 key positions organized as 9 "X" outputs with 10 "Y" inputs. The four functions as previously defined are Control, Shift, Normal, and Shift-Control.

The use of the optional Lock requires the programming of the B9 data bit. The use of the optional Auto-Repeat requires the programming of the B10 data bit. If the B9 or B10 outputs are used then these will show the result of the contents of the "corrected" key function data bits. The "corrected" function is the possibly changed Normal to Shift etc. etc. so that the output is that of the 'Shifted key code' NOT that of the initial key code.

### Minimum Switch Closure:

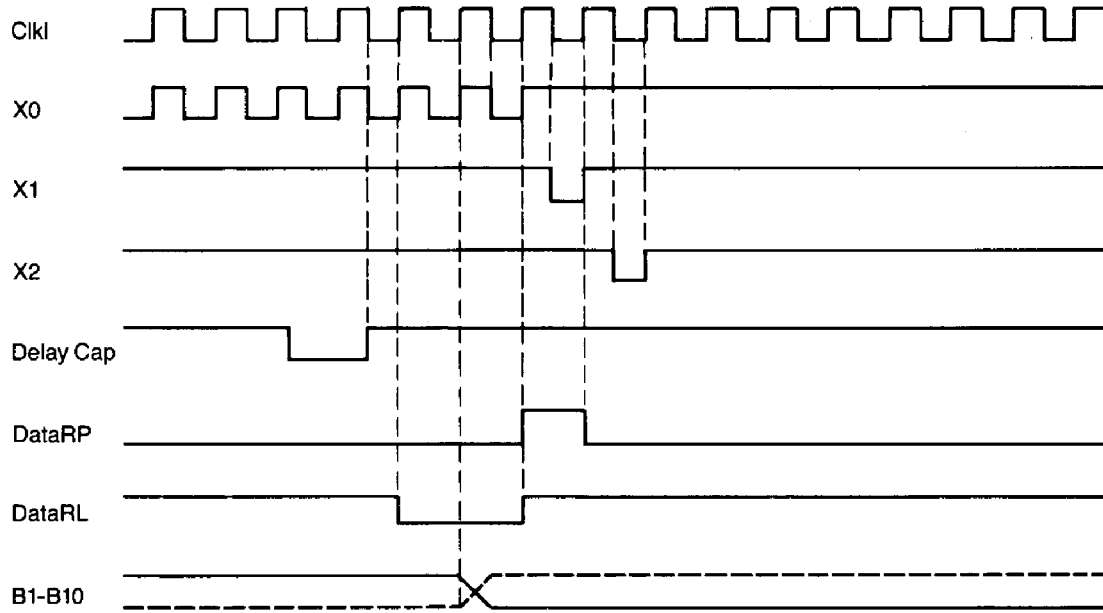
$$T = \text{Switch bounce} + (90 \times 1/f) + \text{Strobe delay} + \text{Strobe width}$$

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|
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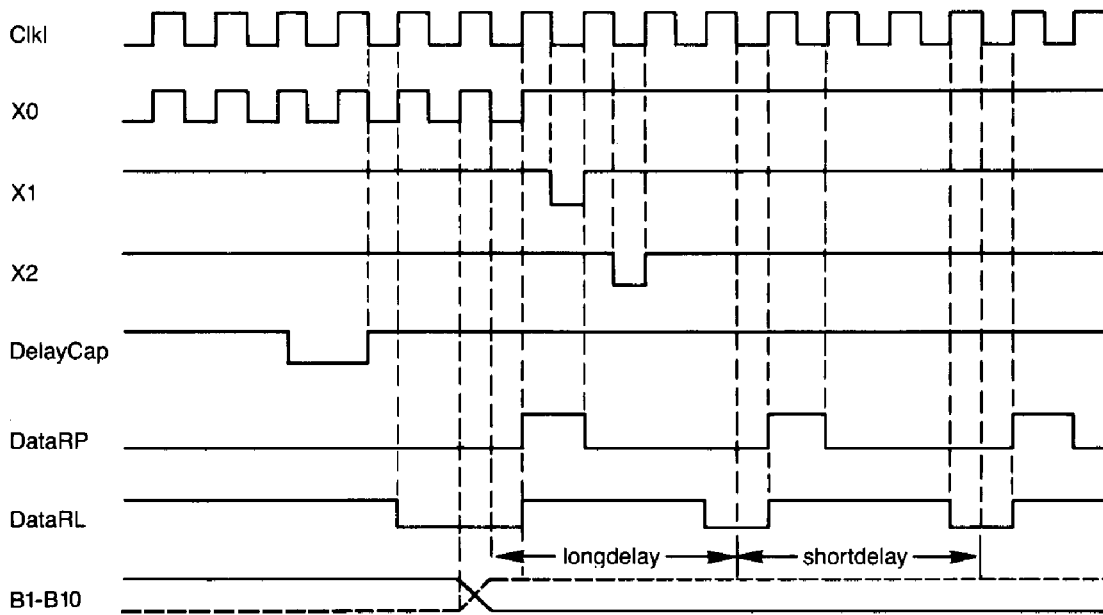
maximum expected	determined by frequency of operation	determined by external capacitance	minimum time required by external circuitry
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**CONDITIONS:**

The clock divider is 1 so that Ck1 is "same as clock IN".  
A key is pressed down at X0Y0 but the delay cap has not timed out.  
Data Ready is high true and we have already had another key.  
DataRP = Data Ready as a Pulse      DataRL = Data Ready as a Level



Condition: Test mode autorepeat at divide by 4 and keep key down



## ELECTRICAL CHARACTERISTICS: KR9600, KR9601, KR9602

### MAXIMUM GUARANTEED RATINGS

Operating Temperature Range**	0°C to +70°C
Storage Temperature Range	-55°C to +150°C
Lead Temperature (soldering, 10 sec.)	+325°C
Positive Voltage on any Pin, with respect to ground	+8.0V
Negative Voltage on any Pin, with respect to ground	-0.3V

### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 0°C to 70°C, V<sub>CC</sub> = +5V ± 5%, unless otherwise noted)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	COMMENTS
<b>D.C. CHARACTERISTICS</b>						
<b>INPUT VOLTAGE LEVELS</b>						
Low Level	V <sub>IL</sub>			0.8	V	All inputs
High Level	V <sub>IH</sub>	2.0			V	Except Y + 16X CLK
		2.2			V	16X CLK only
<b>Y INPUTS</b>						
High Level	V <sub>YIH</sub>	2.8			V	Y input
Low Level	V <sub>YIL</sub>			0.8	V	Y input
<b>INPUT CURRENT</b>						
Leakage	I <sub>L</sub>			10.0	μA	All inputs except Y V <sub>IN</sub> = 5V
Input with Pull-down resistor selected as option		75		220	μA	V <sub>IN</sub> = 5V
Y inputs	I <sub>YIL</sub>	-100	-400	-500	μA	V <sub>YIL</sub> = 1 volt Y inputs only
<b>OUTPUT VOLTAGE LEVELS</b>						
Low Level	V <sub>OL</sub>			0.4	V	I <sub>OL</sub> = 1.6 mA
High Level	V <sub>OH</sub>	2.4			V	I <sub>OH</sub> = 100 μA
						Except X outputs
X output voltage	V <sub>OL</sub> V <sub>OH</sub>	3.4	0.4 4.0		V V	600 μA clock high I <sub>OH</sub> = 10 μA B1-B10
<b>TRI-STATE LEAKAGE</b>						
INPUT CAPACITANCE				10	μA	
All inputs	C <sub>IN</sub>			10	pF	Except Y inputs
<b>POWER SUPPLY CURRENT</b>						
	I <sub>CC</sub>		20	40	mA	KR9600/01
	I <sub>CC</sub>		15	35	mA	KR9602
<b>A.C. CHARACTERISTICS</b>						
<b>CLOCK FREQUENCY*</b>						
	F <sub>IN</sub>	0.01		4	MHz	KR9601/02
		0.01		0.1	MHz	KR9600
16X CLOCK FREQUENCY		DC		640	KHz	KR9602
Chip enable access time	T <sub>CE</sub>			250	ns	
<b>SWITCH CHARACTERISTICS</b>						
Min switch closure						see timing diagram
Contact closure resistance	Z <sub>CC</sub> Z <sub>CC</sub>	1 x 10 <sup>7</sup>		300	ohms	

NOTE: The KR9600 is a direct replacement for the KR3600. Please note that due to the logic level of the KR9600, when replacing the KR3600 in a N-Key rollover system where diodes are utilized, the polarity of the diodes must be reversed.

\* Divisor on KR9601/02 must be selected such that the resulting internal scan frequency is 10 KHz min to 100 KHz max.

\*\* Parts optionally available in extended temperature ranges in hermetic packages. Inquire at factory.



## KR9600-PRO DESCRIPTION

The KR9600 PRO is a MOS/LSI device intended to simplify the interface of a microprocessor to a keyboard matrix. Like the other KR9600 parts, the KR9600 PRO contains all of the logic to de-bounce and encode key-switch closures, while providing either a 2-key or N-key rollover.

The output of the KR9600 PRO is a simple binary code which may be converted to a standard information code by a PROM or directly by a microprocessor. This permits a user maximum flexibility of key layout with simple field programming.

The code in the KR9600 is shown in Table I. The format is simple: output bits, 9, 8, 7, 6, 5, 4 and 1 are a binary sequence. The count starts at X0, Y0 and increments through X0Y1, X0Y2...X8Y9. Bit 9 is the LSB; bit 1 is the MSB.

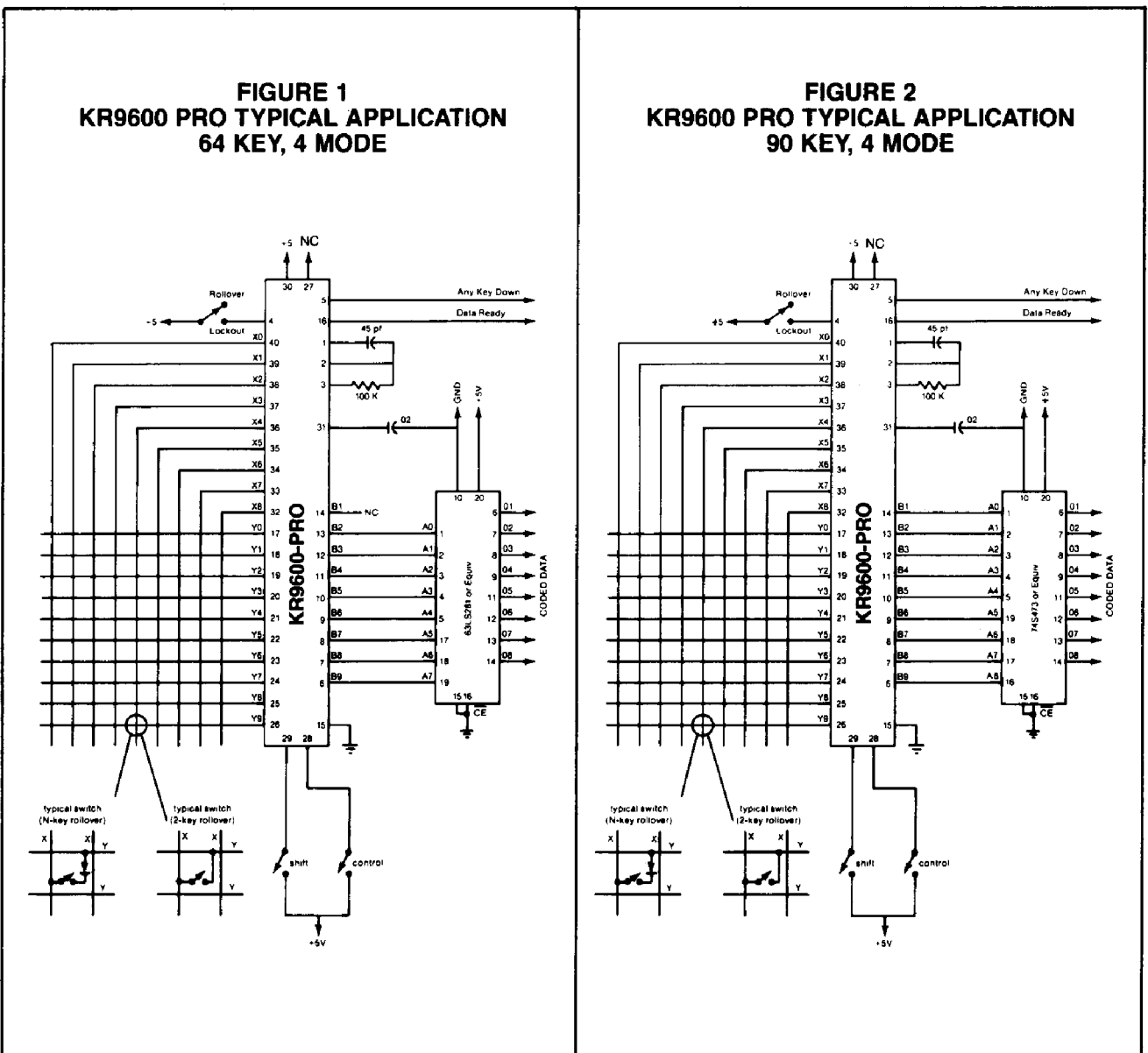
Bits 2 and 3 indicate the mode as follows:

Bit 2	Bit 3	Mode
0	0	Normal
0	1	Shift
1	0	Control
1	1	Shift Control

For maximum ease of use and flexibility, an internal scanning oscillator is used, with pin selection of N-key rollover (also known as 2-key rollover) and N-key rollover. An "any-key-down" output is provided for such uses as repeat oscillator keying.

Figure 1 shows a PROM-encoded 64 key, 4 mode application, using a 256 x 8 PROM, and Figure 2 a full 90 key, 4 mode application utilizing a 512 x 8 PROM.

If N-key rollover operation is desired, it is recommended that a diode be inserted in series with each switch as shown. This prevents "phantom" key closures from resulting if three or more keys are depressed simultaneously.



**TABLE 1**  
**KR9600-PRO CODING SHEET AND OPTIONS**

XY	Normal B-12345678 910	Shift B-12345678 910	Control B-12345678 910	Shift/Control B-12345678 910
00	00000000	00100000	01000000	01100000
01	00000001	00100001	01000001	01100001
02	00000010	00100010	01000010	01100010
03	00000011	00100011	01000011	01100011
04	00000100	00100100	01000100	01100100
05	00000101	00100101	01000101	01100101
06	00000110	00100110	01000110	01100110
07	00000111	00100111	01000111	01100111
08	00001000	00100100	01000100	01100100
09	00001001	00100101	01000101	01100101
10	00001010	00100110	01000110	01100110
11	00001011	00100111	01000111	01100111
12	00001100	00100100	01000100	01100100
13	00001101	00100101	01000101	01100101
14	00001110	00100110	01000110	01100110
15	00001111	00100111	01000111	01100111
16	00001000	00101000	01001000	01101000
17	00001001	00101001	01001001	01101001
18	00001010	00101010	01001010	01101010
19	00001011	00101011	01001011	01101011
20	00001100	00101100	01001100	01101100
21	00001101	00101101	01001101	01101101
22	00001110	00101110	01001110	01101110
23	00001111	00101111	01001111	01101111
24	00001000	00101100	01001100	01101100
25	00001100	00101101	01001101	01101101
26	00001010	00101101	01001010	01101010
27	00001011	00101101	01001011	01101011
28	00001100	00101100	01001100	01101100
29	00001101	00101101	01001101	01101101
30	00001110	00101110	01001110	01101110
31	00001111	00101111	01001111	01101111
32	00010000	00110000	01010000	01110000
33	00010001	00110001	01010001	01110001
34	00010010	00110010	01010010	01110010
35	00010011	00110011	01010011	01110011
36	00010100	00110010	01010010	01110010
37	00010101	00110011	01010011	01110011
38	00010110	00110010	01010010	01110010
39	00010111	00110011	01010011	01110011
40	00011000	00110100	01010100	01110100
41	00011001	00110101	01010101	01110101
42	00011010	00110110	01010110	01110110
43	00011011	00110111	01010111	01110111
44	00010100	00110100	01010100	01110100
45	00010101	00110101	01010101	01110101
46	00010110	00110110	01010110	01110110
47	00010111	00110111	01010111	01110111
48	00011000	00111000	01011000	01111000
49	00011001	00111001	01011001	01111001
50	00011010	00111010	01011010	01111010
51	00011011	00111011	01011011	01111011
52	00011100	00111100	01011100	01111100
53	00011101	00111101	01011101	01111101
54	00011110	00111110	01011110	01111110
55	00011111	00111111	01011111	01111111
56	00011000	00111000	01011000	01111000
57	00011001	00111001	01011001	01111001
58	00011010	00111010	01011010	01111010
59	00011011	00111011	01011011	01111011
60	00011100	00111100	01011100	01111100
61	00011101	00111101	01011101	01111101
62	00011110	00111110	01011110	01111110
63	00011111	00111111	01011111	01111111
64	10000000	10100000	11000000	11100000
65	10000001	10100001	11000001	11100001
66	10000010	10100010	11000010	11100010
67	10000011	10100011	11000011	11100011
68	10000100	10100100	11000100	11100100
69	10000101	10100101	11000101	11100101
70	10000110	10100110	11000110	11100110
71	10000111	10100111	11000111	11100111
72	10000100	10100100	11000100	11100100
73	10000101	10100101	11000101	11100101
74	10000110	10100110	11000110	11100110
75	10000111	10100111	11000111	11100111
76	10000100	10100100	11000100	11100100
77	10000101	10100101	11000101	11100101
78	10000110	10100110	11000110	11100110
79	10000111	10100111	11000111	11100111
80	10001000	10101000	11001000	11101000
81	10001001	10101001	11001001	11101001
82	10001010	10101010	11001010	11101010
83	10001011	10101011	11001011	11101011
84	10001100	10101100	11001100	11101100
85	10001101	10101101	11001101	11101101
86	10001110	10101110	11001110	11101110
87	10001111	10101111	11001111	11101111
88	10001100	10101100	11001100	11101100
89	10001101	10101101	11001101	11101101

**OPTIONS:**

Internal Oscillator (Pins 1, 2, 3)  
Lockout/Rollover (Pin 4)  
Internal Resistor to GND  
Lockout is Logic 1

Pulse Data Ready  
Any Key Down (Pin 5) Positive Output  
Internal Resistor to GND on Shift  
and Control Pins

# CODING FOR KR9600-STD

XY	Normal		Shift		Control		Shift Control		
	B-12345678910		B-12345678910		B-12345678910		B-12345678910		
00	1	1000110001	D	0011110001	1	1000110011	SUB	0101100001	
01	q	1000110101	Q	1000100101	q	1000111111	DLE	0000100001	
02	a	1000010101	A	1000000101	a	1000011111	@	0000000101	
03	z	0101110101	Z	0101100101	z	0101111111	P	0000100101	
04	HT	1001000001	HT	1001000001	HT	1001000001	I	1001000101	
05	H	0001000101	H	0001000101	H	0001000101	H	0001000111	
06	+	1101011001	+	1101011001	+	1101011001	+	1101011011	
07	SO	0111001001	SO	0111110001	SO	0111000001	SO	0111000011	
08	p	0000110101	@	0000000101	NUL	0000000001	NUL	0000000001	
09	1	1000111001	1	1000011001	SOH	1000000001	SOH	1000000001	
10	2	0100111001	@	0000000101	2	0100111011	ETB	1101100001	
11	w	1101101011	W	1101001011	w	1101111111		0011100101	
12	s	1100110101	S	1100100101	s	1100111111	A	1000000101	
13	x	0001110101	X	0001001011	x	0001111111	Q	1000100101	
14	RS	0111100001	RS	0111100001	RS	0111100001	FS	0011100001	
15	%	1010011001	%	1010011001	%	1010011001	%	1010011011	
16	m	1011010101	]	1011100101	CR	1011000001	CR	1011000001	
17	SI	1111000001	]	1111000001	SI	1111000001	SI	1111000011	
18	n	0111010101	]	0111100101	SO	0111000001	SO	0111000001	
19	z	0100111001	]	0100011001	STX	0100000001	STX	0100000001	
20	2	1100111001	]	1100011001	3	1100111011	NAK	1010100001	
21	e	1010010101	]	1010000101	4	1010011111	DC3	1100100101	
22	d	0010010101	]	0010000101	d	0010011111	B	0000000101	
23	c	1100010101	]	1100000101	c	1100011111	R	0100100101	
24	-	1111100100	]	1111100100	-	1111100100		0111100100	
25	\$	0010011001	]	0010011001	\$	0010011001	\$	0010011011	
26	L	0011000101	]	0011000101	L	0011000101	L	0011000111	
27	US	1111100001	]	1111100001	US	1111100001	US	1111100011	
28	6	0110111001	]	0110011001	ACK	0110000001	ACK	0110000001	
29	k	1101010101	]	1101001011	DEL	1111111101	DEL	1111111101	
30	4	0010111001	]	0010011001	4	0010111011	DC4	0010100001	
31	r	0100110101	]	0100010101	r	0100111111	ENQ	1010000001	
32	F	0110001011	]	0110000101	f	0110011111	C	1100000101	
33	SP	0000011000	]	0000011000	SP	0000011000	SP	0000011000	
34	CAN	0001101000	]	0001101000	CAN	0001100000	BS	0001000000	
35	CR	1011000001	]	1011000001	CR	1011000001	M	1011000101	
36		1101111001	]	1101111001		1101111111	K	1101000101	
37	VT	1101000000	]	1101000000	VT	1101000000	VT	1101000010	
38	7	1110111001	]	1110011001	BEL	1110000001	BEL	1110000001	
39	5	0100011001	]	0100011001	5	0100011001		0100011011	
40	5	1010111001	]	1010011001	5	1010111011	STX	0100000001	
41	l	0010110101	]	0010010101	l	0010111111	EOT	0010000001	
42	g	1110010101	]	1110000101	G	1110011111	D	0010000101	
43	0101101011	]	0101010101	g	0110111111	S	1100100101		
44	ETX	1100000001	]	1100000001	ETX	1100000001	ETX	1100000001	
45	]	1011111001	]	1011111001	]	1011111101	N	0111000101	
46	?	1111111001	]	1111111001	?	1111111011	[	1101100101	
47	-	1011011001	]	1011111001	-	1011011001	-	1011011011	
48	1001011001	]	1001011001	]	1001011001	]	1001011011	]	1001011011
49	SP	0000011001	]	0000011001	SP	0000011001	SP	0000011011	
50	6	0110111001	]	0111111001	e	0110111011	SOH	1000000001	
51	y	0001101011	]	0001001011	y	1101111111	DC1	1000100001	
52	Y	0001010101	]	0001000101	Y	0001011111	E	1010000101	
53	b	0100010101	]	0100000101	b	0100011111	T	0010100101	
54	:	0101111001	]	0101011001	:	0101111011	SYN	0110100001	
55	>	0111111001	]	0111111001	>	0111111011	Z	0101100101	
56	:	1101111001	]	1101011001	:	1101111011	Y	1001100101	
57	NUL	0000000001	]	0000000001	NUL	0000000001	NUL	0000000001	
58	0101011001	]	0101011001	]	0101011001	]	0101011011	]	0101011011
59	1	1000011001	]	1000011001	1	1000011001	1	1000011011	
60	7	1110111001	]	1110011001	7	1110111011	ETX	1100000001	
61	u	1010110101	]	1010100101	u	1010111111	BEL	1110000001	
62	j	0101010101	]	0101000101	j	0101011111	F	0110000101	
63	n	0111010101	]	0111000101	n	0111011111	U	1010100101	
64	1011111000	]	1011111000	]	1011111010	]	1011111100	]	1011111100
65	<	0011111001	]	0011111001	<	0011111011	W	1110100101	
66	P	0000101011	]	0000000101	P	0000111111	J	0101000101	
67	0	0000111001	]	0000100101	0	0000111011	DC2	0100100001	
68	&	0110011001	]	0110011001	&	0110011001	&	0110011011	
69	#	1100011001	]	1100011001	#	1100011001	#	1100011011	
70	8	0001111001	]	0101011001	8	0001111011	ESC	1101100001	
71	i	1001010101	]	1001000101	i	1001011111	ACK	0110000001	
72	k	1101010101	]	1101000101	k	1101011111	G	1110000101	
73	m	1011010101	]	1011000101	m	1011011111	V	0110100101	
74	/	1110110101	]	1111111001	/	1110110101	.	1100110101	
75	*	1110011001	]	0100011001	*	1110011001	*	0100011001	
76	LF	0101000000	]	0101000000	LF	0101000000	GS	1011100000	
77	=	1011111001	]	1101011001	=	1011111001	+	1101011001	
78	FF	0011001001	]	0011111001	FF	0011000001	FF	0011000011	
79	(	0001011001	]	0001011001	(	0001011001	(	0001011011	
80	9	1001111001	]	0001011001	9	1001111011	EM	1001100001	
81	o	1111010101	]	1111000101	o	1111011111	]	1011100101	
82	l	0011010101	]	0011000101	l	0011011111	X	0001100101	
83	.	0011011001	]	0011011001	.	0011011001	.	0011011011	
84	:	0111011001	]	0111011001	:	0111011001	:	0111011011	
85	;	1101111001	]	0101111001	;	1101111001	;	0101111001	
86	]	1011001011	]	1101100101	]	1011001011	[	1101100101	
87	-	1011011001	]	1111100101	-	1011011001	-	1111100101	
88	0	0000111001	]	0000111001	0	0000111001	0	0000111001	
89	8	1001111001	]	1001011001	8	1001000001	HT	1001000001	

**OPTIONS:**

Internal Oscillator (Pins 1, 2, 3)  
 Any Key Down (Pin 4) Positive Output  
 N-Key Rollover only  
 Pulse Data Ready signal

Internal Resistor to GND on Shift and  
 Control Pins  
 KR9600-STD outputs provides ASCII  
 bits 1-6 on B1-B6, and bit 7 on B8

## CODING FOR KR9601 AND KR9602 STD

XY	Normal B-12345678 910	Shift B-12345678 910	Control B-12345678 910	Shift/Control B-12345678 910
00	00000001 00	01010101 00	10101001 00	10101001 00
01	00000010 01	01010110 01	10101010 01	10101010 01
02	00000011 01	01010111 01	10101011 01	10101011 01
03	00000100 01	01011000 01	10101100 01	10101100 01
04	00000101 01	01011001 01	10101101 01	10101101 01
05	00000110 01	01011010 01	10101110 01	10101110 01
06	00000111 01	01011011 01	10101111 01	10101111 01
07	00001000 01	01011100 01	10110000 01	10110000 01
08	00001001 01	01011101 01	10110001 01	10110001 01
09	00001001 01	01011101 01	10110001 01	10110001 01
10	00001010 01	01011110 01	10110010 01	10110010 01
11	00001011 01	01011111 01	10110011 01	10110011 01
12	00001100 01	01100000 01	10110100 01	10110100 01
13	00001100 01	01100000 01	10110100 01	10110100 01
14	00001101 01	01100001 01	10110101 01	10110101 01
15	00001110 01	01100010 01	10110110 01	10110110 01
16	00001111 01	01100011 01	10110111 01	10110111 01
17	00010000 01	01100100 01	10111000 01	10111000 01
18	00010001 01	01100101 01	10111001 01	10111001 01
19	00010010 01	01100110 01	10111010 01	10111010 01
20	00010011 01	01100111 01	10111011 01	10111011 01
21	00010100 11	01101000 11	10111100 11	10111100 11
22	00010101 11	01101001 11	10111101 11	10111101 11
23	00010110 11	01101010 11	10111110 11	10111110 11
24	00010111 11	01101011 11	10111111 11	10111111 11
25	00011000 11	01101100 11	11000000 11	11000000 11
26	00011001 11	01101101 11	11000001 11	11000001 11
27	00011010 11	01101110 11	11000010 11	11000010 11
28	00011011 11	01101111 11	11000011 11	11000011 11
29	00011100 11	01110000 11	11000100 11	11000100 11
30	00011101 01	01110001 01	11000101 01	11000101 01
31	00011110 01	01110010 01	11000110 01	11000110 01
32	00011111 01	01110011 01	11000111 01	11000111 01
33	00011111 01	01110011 01	11000111 01	11000111 01
34	00100000 01	01110100 01	11001000 01	11001000 01
35	00100001 01	01110101 01	11001001 01	11001001 01
36	00100010 01	01110110 01	11001010 01	11001010 01
37	00100011 01	01110111 01	11001011 01	11001011 01
38	00100100 01	01111000 01	11001100 01	11001100 01
39	00100101 01	01111001 01	11001101 01	11001101 01
40	00100110 11	01111010 11	11001110 11	11001110 11
41	00100111 11	01111011 11	11001111 11	11001111 11
42	00101000 11	01111100 11	11010000 11	11010000 11
43	00101001 11	01111101 11	11010001 11	11010001 11
44	00101010 11	01111110 11	11010010 11	11010010 11
45	00101011 11	01111111 11	11010011 11	11010011 11
46	00101100 11	10000000 11	11010100 11	11010100 11
47	00101101 11	10000001 11	11010101 11	11010101 11
48	00101110 11	10000010 11	11010110 11	11010110 11
49	00101111 01	10000011 01	11010111 01	11010111 01
50	00110000 01	10000100 01	11011000 01	11011000 01
51	00110001 01	10000101 01	11011001 01	11011001 01
52	00110010 01	10000110 01	11011010 01	11011010 01
53	00110011 01	10000111 01	11011011 01	11011011 01
54	00110011 01	10000111 01	11011011 01	11011011 01
55	00110011 01	10000111 01	11011011 01	11011011 01
56	00110100 01	10001000 01	11011100 01	11011100 01
57	00110101 00	10001001 01	11011101 00	11011101 00
58	00110110 01	10001010 01	11011110 01	11011110 01
59	00110111 01	10001011 01	11011111 01	11011111 01
60	00111000 11	10001100 11	11100000 11	11100000 11
61	00111001 11	10001101 11	11100001 11	11100001 11
62	00111010 11	10001110 11	11100010 11	11100010 11
63	00111011 11	10001111 11	11100011 11	11100011 11
64	00111100 11	10010000 11	11100100 11	11100100 11
65	00111101 11	10010001 11	11100101 11	11100101 11
66	00111110 11	10010010 11	11100110 11	11100110 11
67	00111111 11	10010011 11	11100111 11	11100111 11
68	00111111 11	10010011 11	11100111 11	11100111 11
69	00111111 11	10010011 11	11100111 11	11100111 11
70	01000000 01	10010100 01	11101000 01	11101000 01
71	01000001 01	10010101 01	11101001 01	11101001 01
72	01000010 01	10010110 01	11101010 01	11101010 01
73	01000011 01	10010111 01	11101011 01	11101011 01
74	01000100 01	10011000 01	11101100 01	11101100 01
75	01000101 01	10011001 01	11101101 01	11101101 01
76	01000110 01	10011010 01	11101110 01	11101110 01
77	01000111 01	10011011 01	11101111 01	11101111 01
78	01001000 01	10011100 01	11110000 01	11110000 01
79	01001001 01	10011101 01	11110001 01	11110001 01
80	01001010 01	10011110 01	11110010 01	11110010 01
81	01001011 01	10011111 01	11110011 01	11110011 01
82	01001100 01	10100000 01	11110100 01	11110100 01
83	01001101 01	10100001 01	11110101 01	11110101 01
84	01001110 01	10100010 01	11110110 01	11110110 01
85	01001111 01	10100011 01	11110111 01	11110111 01
86	01010000 01	10100100 01	11110000 01	11110000 01
87	01010001 01	10100101 01	11110001 01	11110001 01
88	01010010 01	10100110 01	11110010 01	11110010 01
89	01010011 01	10100111 01	11110011 01	11110011 01

### OPTIONS FOR THE KR9601-STD:

- PINS 1, 2, 3 INTERNAL OSCILLATOR [input clock divisor = 1]
- PIN 4 CE [Active Low]
- PIN 5 AR1 [AR0 fixed at Lo = 0]  
[FIXED LONG DELAY OF 40000 CLOCK TIMES]  
[FIXED SHORT DELAY OF 6250 CLOCK TIMES]
- PIN 6 AKO [positive true]
- Pulsed DATA READY signal
- N-KEY ROLLOVER
- Pull-down resistor to ground at the following pins:
  - SHIFT
  - CONTROL
  - CAPS-LOCK
  - ARO

### OPTIONS FOR THE KR9602-STD:

- N-KEY ROLLOVER
- AUTO-REPEAT  
[FIXED LONG DELAY OF 40000 CLOCK TIMES]  
[FIXED SHORT DELAY OF 6250 CLOCK TIMES]
- 1 STOP bit.
- No PARITY bit.
- Input clock divisor of 63
- Pull-down resistor to ground at the following pins:
  - SHIFT
  - CONTROL
  - CAPS-LOCK

## CODING FOR KR9602-012 (ASCII)

XY	Normal B-12345678910	Shift B-12345678910	Control B-12345678910	Shift Control B-12345678910
00	0000110001	1001010001	0000110001	1001010001
01	1001110001	0001010001	1001110001	0001010001
02	0001110001	0101010001	0001110001	0101010001
03	1101110001	0110010001	1101110001	0110010001
04	0110110001	0111101001	0110110001	0111101001
05	1010110001	1010010001	1010110001	1010010001
06	0010110001	0010010001	0010110001	0010010001
07	1100110001	1100010001	1100110001	1100010001
08	0100110001	0000010001	0100110001	0000010001
09	1000110001	1000100001	1000110001	1000100001
10	0001000001	0001000001	0001000001	0001000001
11	1010110001	1101010001	1011100001	1101010001
12	1011010001	1111101001	1111100001	1111101001
13	1010101001	1010111001	1011100001	1010101001
14	1101101001	1101111001	1101100000	1101101000
15	1111011011	0000101011	0000100011	0000100111
16	1111011011	1111001011	1111000011	1111000111
17	1001011011	1001001011	1001000011	1001000111
18	1010111011	1010101011	1010100011	1010100111
19	1001111011	1001101011	1001100011	1001100111
20	0010111011	0010101011	0010100011	0010100111
21	0100111011	0100101011	0100100011	0100100111
22	1010011011	1010001011	1010000011	1010000111
23	1110111011	0101001011	1110100011	1110100111
24	1000111011	1000101011	1000100011	1000100111
25	1101100000	1101100000	1101100000	1101100000
26	1001000001	1001000101	1001000001	1001000101
27	1011000001	1011000001	1011000001	1011000001
28	0000011001	0111111001	0000011001	0111111001
29	1110010001	0100010001	1110010001	0100010001
30	1101110001	0101110001	1101110001	0101110001
31	0011011011	0011001011	0011000011	0011000111
32	1100011011	1100010111	1101000011	1100000111
33	0101011011	0101001011	0101000011	0101000111
34	0001011011	0001001011	0001000011	0001000111
35	1110011011	1110001011	1110000011	1110000111
36	0110011011	0110001011	0110000011	0110000111
37	0010011011	0010001011	0010000011	0010000111
38	1100111011	1100101011	1100100011	1100100111
39	1000011011	1000010111	1000000011	1000000111
40	1111010001	1111100001	1111100001	1111100001
41	0111010001	0111100001	0111100001	0111100001
42	0011010001	0011100001	0011100001	0011100001
43	1011011011	1011001011	1011000011	1011000111
44	0111011011	0111001011	0111000011	0111000111
45	0100011011	0100010111	0100000011	0100000111
46	0110111011	0110101011	0110100101	0110100111
47	1100011011	1100010111	1101001011	1100000111
48	0001100011	0001100011	0001100101	0001100111
49	0101111011	0101101011	0101100011	0101100111
50	0011101001	0011111001	0011100001	0011100101
51	0000010001	0000010001	0000010001	0000010001
52	1010000001	1010000001	1010000101	1010000101
53	0110000001	0110000001	0110000101	0110000101
54	1110000001	1110000001	1110000101	1110000101
55	1001000001	1001000001	1001000101	1001000101
56	0101000001	0101000001	0101000101	0101000101
57	1101000001	1101000001	1101000101	1101000101
58	0111000001	0111000001	0111000101	0111000101
59	1111000001	1111000001	1111000101	1111000101
60	0000100001	0000100001	0000100101	0000100101
61	1000100001	1000100001	1000100101	1000100101
62	0100100001	0100100001	0100100101	0100100101
63	1001000001	1001000001	1001001011	1001001011
64	0010000001	0010000001	0010000101	0010000101
65	1010100001	1010100001	1010100101	1010100101
66	0110100001	0110100001	0110100101	0110100101
67	1110100001	1110100001	1110100101	1110100101
68	0001100001	0001100001	0001100101	0001100101
69	1001100001	1001100001	1001100101	1001100101
70	0101100001	0101100001	0101100101	0101100101
71	0011100001	0011100001	0011100101	0011100101
72	1011100001	1011100001	1011100101	1011100101
73	0111100001	0111100001	0111100101	0111100101
74	1111100001	1111100001	1111100101	1111100101
75	0000000001	0000000001	0000000101	0000000101
76	1000000001	1000000001	1000000101	1000000101
77	0100000001	0100000001	0100000101	0100000101
78	1100000001	1100000001	1100000101	1100000101
79	0010000001	0010000001	0010000101	0010000101
80	0000110111	0000110011	0000110111	0000110011
81	1001110111	1001110011	1001110111	1001110011
82	0001100011	0001110011	0001100011	0001110011
83	1110110111	1110110011	1110110111	1110110011
84	1100100011	0110110011	1100100011	0110110011
85	1010110111	1010110011	1010110111	1010110011
86	0100100011	0010110011	0100100011	0010110011
87	1100110111	1100110011	1100110111	1100110011
88	0010100011	0100110011	0010100011	0100110011
89	1000110011	1000110011	1000110111	1000110011

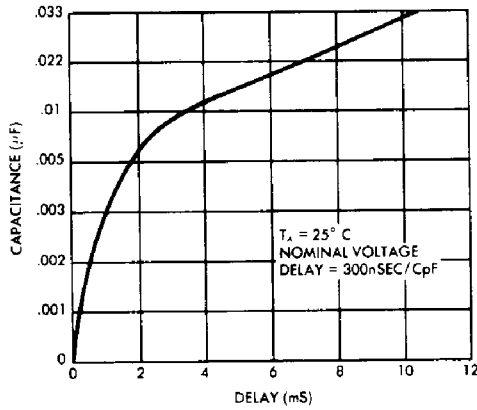
SECTION VIII

**OPTIONS FOR THE KR9602-012 ASCII:**

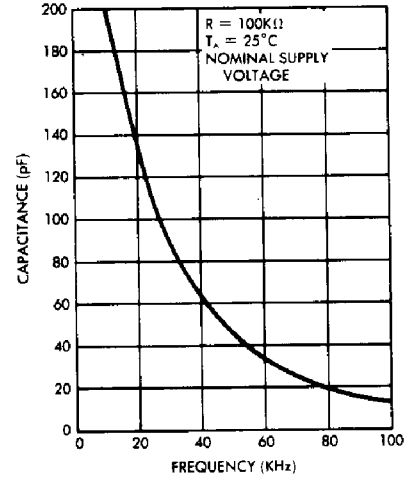
- Lockout
- Auto Repeat
  - (Fixed Long Delay of 60,000 Clock Times)
  - (Fixed Short Delay of 2000 Clock Times)
- One Stop Bit
- Input Clock Divisor of 32

- No Parity
- Eight Data Bits
- Pull down Resistor to Ground is at the following pins:
  - SHIFT
  - CONTROL
  - CAPS LOCK

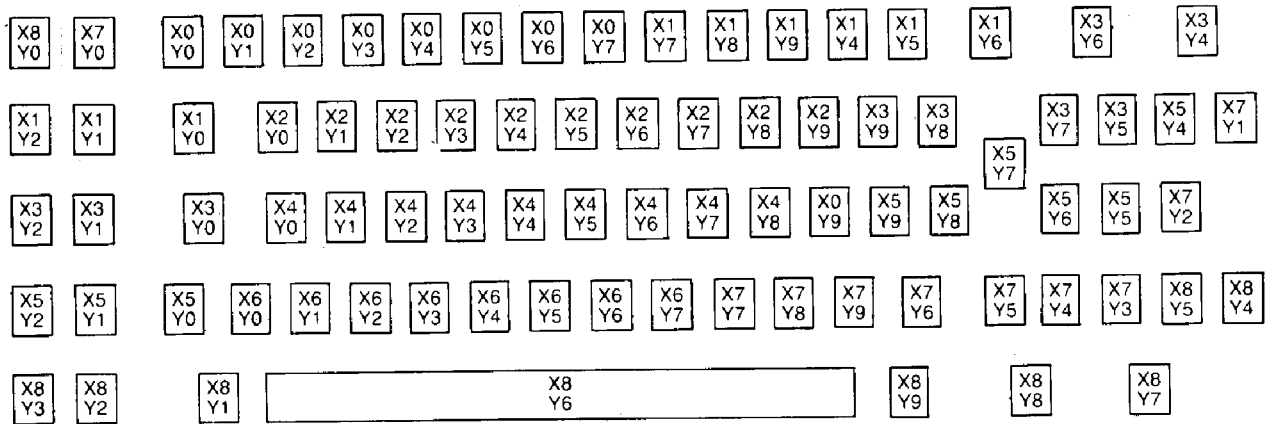
### STROBE DELAY vs C2 FOR KR9600/1/2



### OSCILLATOR FREQUENCY vs C1 FOR KR9600/KR9601



### KEYBOARD LAYOUT FOR KR9601/9602-STD



## STANDARD MICROSYSTEMS CORPORATION

35 Marcus Blvd., Hauppauge, N.Y. 11788  
 (516) 273-3100 TWX 510-227-8896

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