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T-77-11

# MV2000

## REMOTE KEYBOARD TRANSMITTER

The MV2000 is a fully integrated keyswitch encoder and pulse position modulation (PPM) transmitter, designed for the encoding of a keyboard with up to 88 switches. Three separate shift or control inputs are also provided to give up to eight functions for each keyswitch. The PPM output may be used to drive an infra-red LED for remote keyboard operation or provide a simple direct wire link to a VDU. The output codes are intended to be decoded directly by a microprocessor.

### FEATURES

- Infra-red transmission for remote operation
- Very low supply current
- PPM output gives excellent immunity from noise and multi path reflections
- Error check code for data integrity
- Few external components

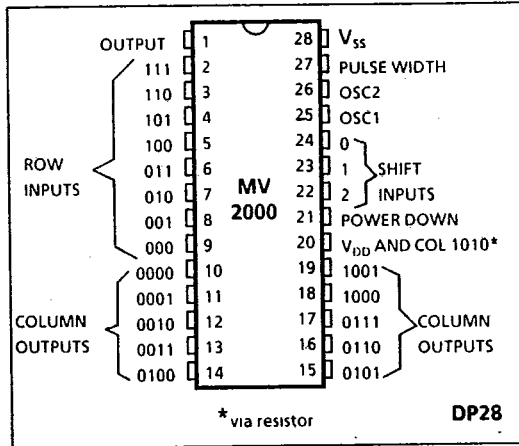


Fig 1 Pin Connections (top view)

### ABSOLUTE MAXIMUM RATINGS

- Supply voltage -0.5V to 11V
- Input voltage (all pins) -0.5V to V<sub>DD</sub> + 0.5V
- Operating temperature range 0°C to + 70°C
- Storage temperature range -55°C to + 125°C

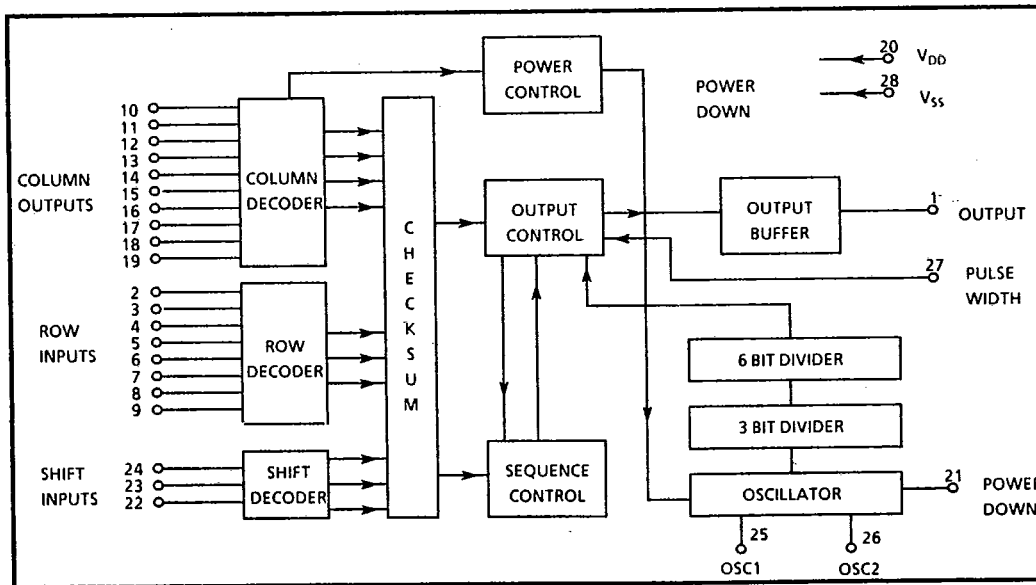


Fig MV2000 Block Diagram

**ELECTRICAL CHARACTERISTICS**

Test conditions (unless otherwise stated)  
 $T_{amb} = 0^{\circ}C$  to  $70^{\circ}C$ ,  $V_{DD} = +3V$  to  $+10.5V$

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Characteristic	Pin	Value			Units	Conditions
		Min	Typ	Max		
Operating supply current	20		2.5	10	mA	Circuit fig 4
Standby supply current	20		0.1	2	$\mu A$	All inputs open circuit
Output source current	1	100	200	300	mA	$V_{DD} = 9V, V_{OH} = 1V$
		50	100	200	mA	$V_{DD} = 6V, V_{OH} = 1V$
Keyboard contact resistance	2-19					
		Closed	0	20	$k\Omega$	
	Open	100	$\infty$	$k\Omega$		
Oscillator Frequency	25,26	200	500	4000	kHz	$V_{DD} = 10.5V$
				10	MHz	

**PIN DESCRIPTIONS**

Pin No.	Description
1	Totem pole output for driving NPN switching transistor
2-9	Keyboard matrix row inputs (7-0)
10-19	Keyboard matrix column outputs (0-9)
20	Positive supply, $V_{DD}$ . Also column 10 via resistor
21	Power down input - normally held at $V_{DD}$ . Taking this input low will force the device into its power down state

Pin No.	Description
22-24	Shift/Control inputs, may be pulled high or low by resistors or connected directly to $V_{DD}$ or $V_{SS}$
25	Oscillator 1 - input to internally biased inverter. May be driven from external source
26	Oscillator 2 - output of internally biased inverter
27	Pulse Width input - time constant determines output pulse width
28	Negative supply, $V_{SS}$

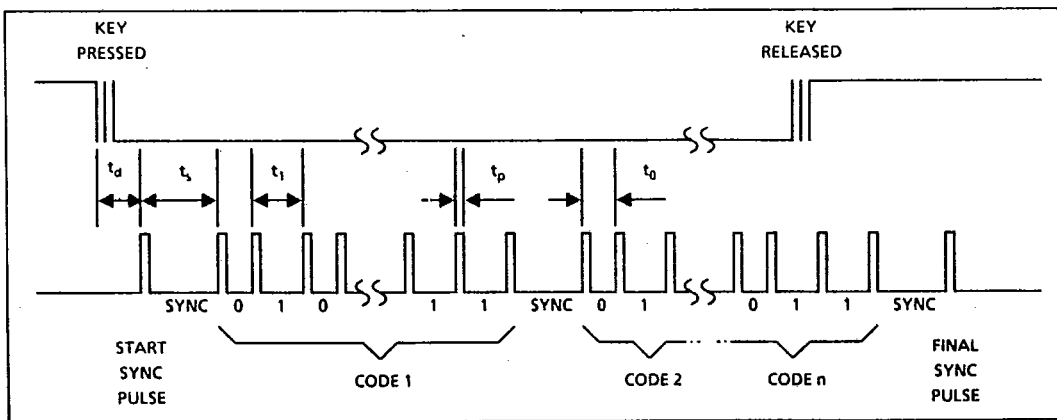


Fig 3 PPM Data Timing

**TIMING** (see fig 3)

Delay time,  $t_d = 1024$  clock cycles (min)  
 Sync time,  $t_s = 2560$  clock cycles  
 Logic 0 time,  $t_0 = 1536$  clock cycles  
 Logic 1 time,  $t_1 = 2048$  clock cycles  
 Pulse time,  $t_p$ , determined by time constant on pin 27  
 Ratio  $t_0:t_1:t_s = 3:4:5$

The Error Check Code is obtained by first adding the two halves of the previous ten bits of the code (LSBs first) and then inverting the resultant 6-bit code ( $E_C$  being the carry bit).

ie. 
$$\begin{array}{r} R_1 R_0 S_2 S_1 S_0 \\ C_3 C_2 C_1 C_0 R_3 + \\ \hline E_C E_4 E_3 E_2 E_1 E_0 \end{array}$$

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**CODE FORMAT**

A sixteen bit code is output, consisting of a seven bit key code, three shift key status bits and a six bit error check code.

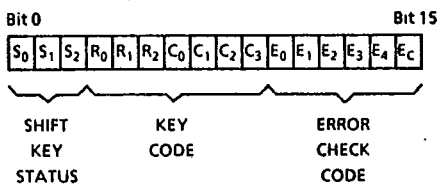
Key Code =  $C_3 C_2 C_1 C_0 R_2 R_1 R_0$   
 (COLUMN) (ROW)

**Example**

Shift 0 input held at  $V_{DD}$   
 Shift 1 and 2 inputs held at  $V_{SS}$   
 Column 2 connected to Row 5

Key Code = 0010 101  
 (COLUMN) (ROW)

Transmitted sequence:- (Bit 0 transmitted first)



Transmitted sequence:-

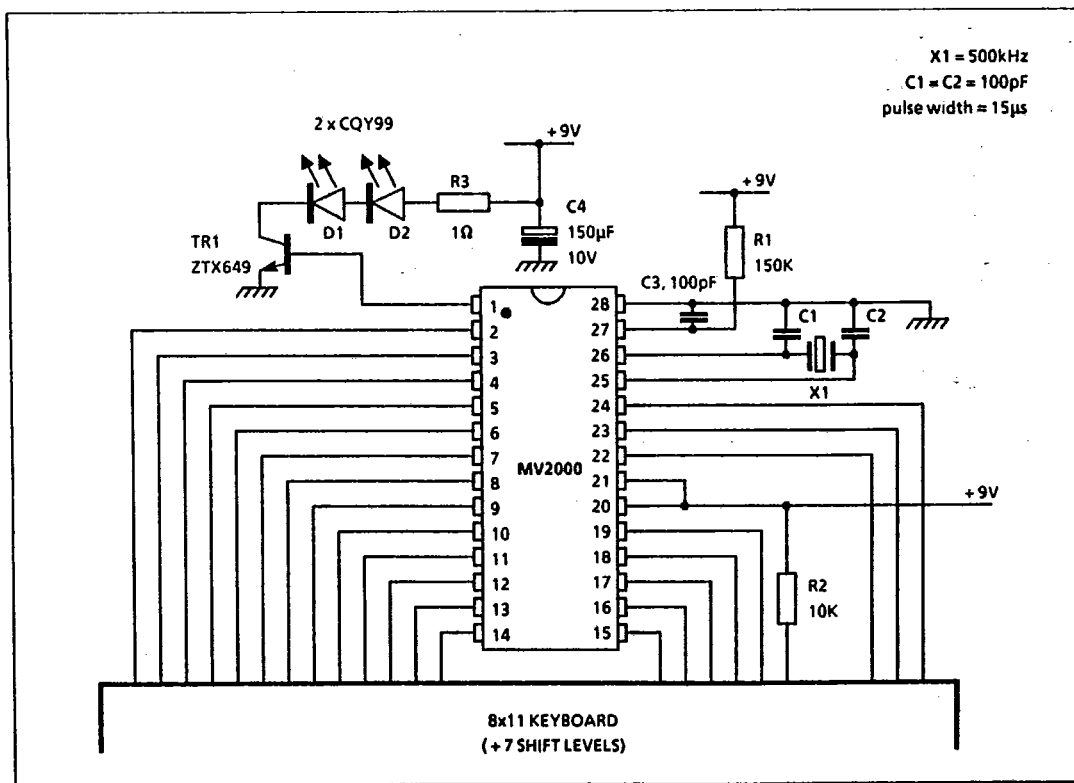
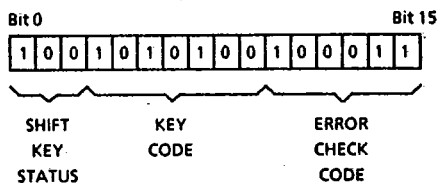


Fig 4 Infra-Red Application Circuit

**OPERATION**

The circuit diagram of Fig. 4 shows a typical application using the MV2000 with data being transmitted via an infra-red link. Until a key is pressed, the device remains in its standby mode with power internally disconnected from the oscillator and most of the logic to minimise the drain on the supply.

When a column and a row are connected by the pressing of a key, power is applied to the rest of the device, the oscillator started and a delay imposed before any change at the output occurs. After this time, an initial synchronising pulse is transmitted, followed by the code word, which is repeated, separated by sync bits, for as long as the key remains pressed (Fig. 3). When the key is released, the word being transmitted is completed. If another key is pressed, the code for this new key is transmitted immediately following the end of the code for the previous key, but separated from it by a sync bit. If no other key is pressed, a final

sync pulse is added to the end of the last word to be transmitted and the MV2000 then returns to its power down mode.

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If more than one key is pressed at the same time, the code transmitted will be that corresponding to the first key detected in the matrix scan of the keyboard.

Pressing one or more of the "shift" keys on the keyboard in conjunction with another key changes the state of the corresponding shift bits in the code transmitted. Pressing a shift key on its own does not initiate a transmission.

In any design using the MV2000 for infra-red transmission, consideration must be given to the arrangement of diodes used, possibly using a small resistance in series to limit the current. The transistor TR1 must also be chosen such that its characteristics include high current gain and fast switching speeds.