PLESSEY
Semiconductors

SL490B

REMOTE CONTROL TRANSMITTER

Plessey Semiconductors have developed and produced a range of monolithic integrated circuits which give a wide variety of remote control facilities. As well as ultrasonic or infra red transmission, cable, radio or telephone links may also be utilised. Pulse position modulation (PPM) is used with or without carrier and automatic error detection is also incorporated. Although initially designed with TV remote control in mind the devices may equally easily be applied for use in radios, tuners, tape and record decks, lamps and lighting, toys and models, industrial control and monitoring.

The SL490B is an easily extendable, 32 command, pulse position modulation transmitter drawing neglible standby current. It may be used with the ML920 series of remote control receivers.

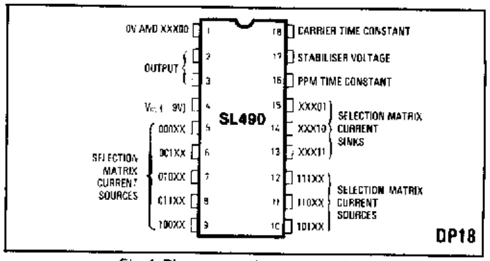

Fig.1 Pin connections - top view

FEATURES

- Ultrasonic or Infra-red Transmission
- Direct Drive for Ultransonic Transducer
- Direct Drive of Visible LED When Using Infra-red
- Very Low Power Requirements
- Pulse Position Modulation Gives Excellent Immunity From Noise and Multipath Reflections
- Single Pole Key Matrix
- Switch Resistance Up To 1kΩ Tolerated
- Few External Components
- Anti-Bounce Circuitry On Chip

QUICK REFERENCE DATA

- Power Supply: 9V, Standby 6μA, Operating 8mA
- Modulation: Pulse Position With or Without Carrier
- Coding: 5 Bit Word Giving a Primary Command Set of 32 Commands
- Key Entry: 8 × 4 Single Pole Key Matrix
- Data Rate: Selectable 1 Bit/Sec to 10k Bit/Sec.
- Carrier Frequency: Selectable 0Hz (no carrier) to 200kHz.

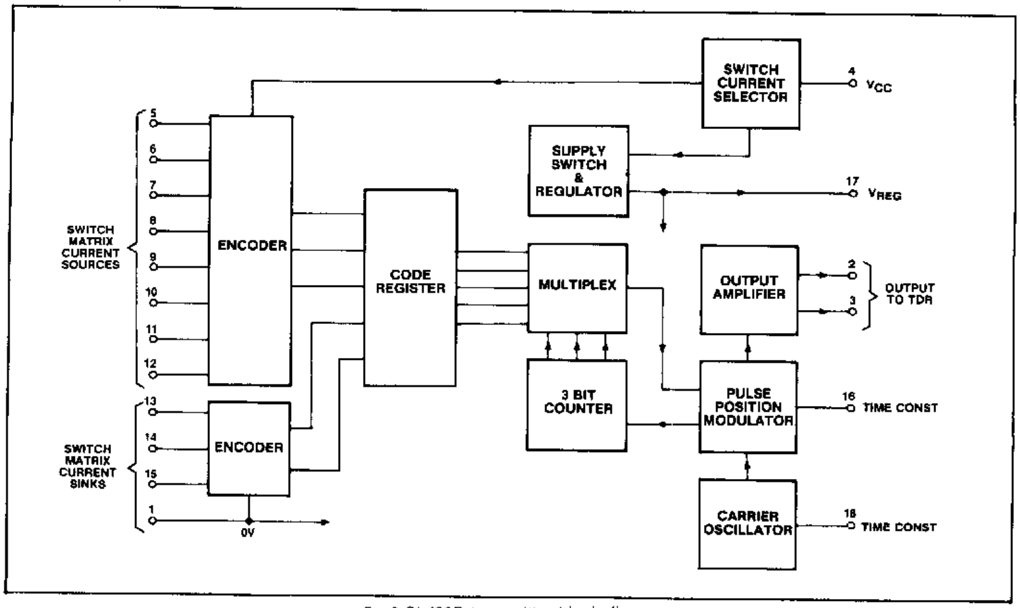

Fig.2 SL490B transmitter block diagram

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated)

T_{amb} = 25°C V_{CC} = −7V to +10.5V

Characteristic	Pin	Value			Units	Conditions
		Min.	Typ.	Max.		
Operating supply current	4		9.5	16	mA	V_{CC} = 9.5V
Standby supply current	4			10	μA	
Stabilised voltage	17	4.1		4.9	V	
Output current available from stabilised supply	17			1	mA	
Output voltage swing	2,3	V_{CC} -1			V	Unloaded
Output voltage	2			1	V	I_2 = 10mA } Peak value < 1ms
Output voltage	3			1	V	I_3 = 5mA } Peak value < 1ms
External switch resistance	5-15			5	kΩ	
External carrier resistor R2	18	20	40	80	kΩ	C2 = 680pF fc = 40kHz
t_1 deviation from calculated value	2,3			±10	%	R1 = 15k } t_1 = 0.95 C1 R1
using fixed timing components	2,3			±10	%	R1 = 60k } See Fig.4
PPM resistor	16	15	30	60	kΩ	
Variation of t_1 and t_0 with V_{CC}						
t_1 with V_{CC} = 7V/t_1 with V_{CC} = 10.5V	2,3			+4	%	
t_0 with V_{CC} = 7V/t_0 with V_{CC} = 10.5V	2,3			−4	%	
Ratio t_0/t_1	2,3	1.4		1.6		
Pulse width t_p	2,3	0.11 t_1		0.22 t_1		
Interword gap	2,3		3			The interword gap is 3 times t_1 derived by counting

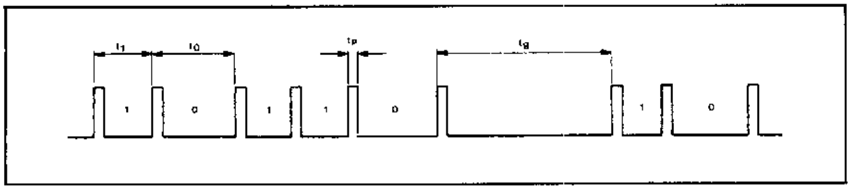

Fig.3 PPM word notation

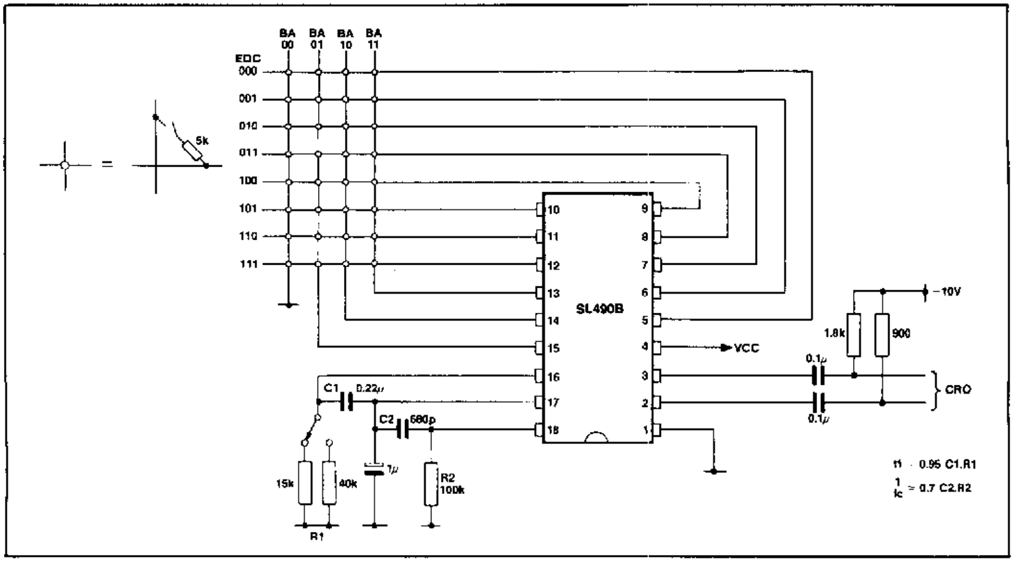

Fig.4 Test circuit

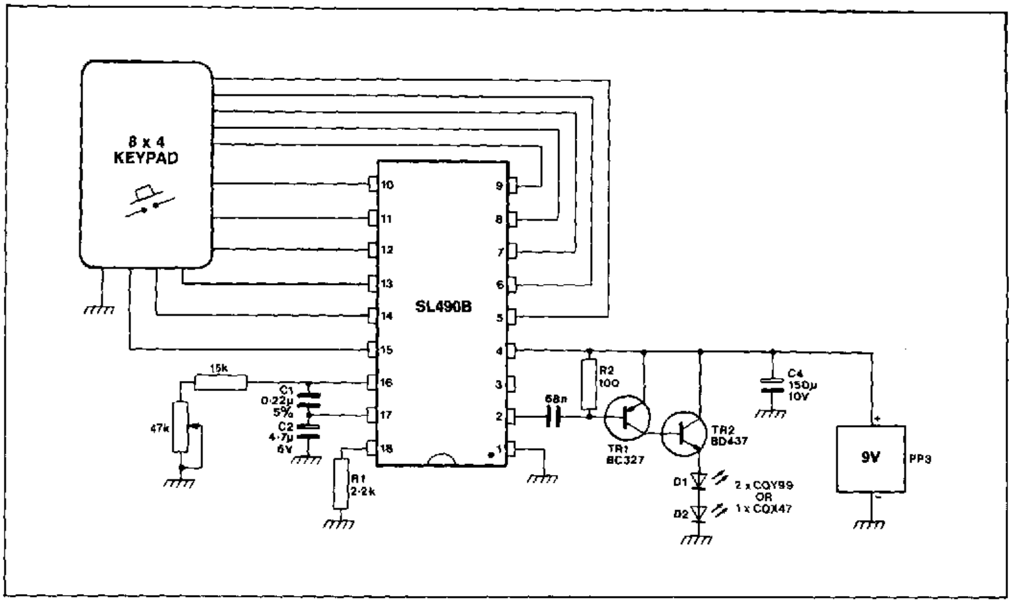

Fig.5 Infra-red application circuit

OPERATING NOTES

Fig.5 shows the circuit for a simple infra-red transmitter where the PPM output from pin 2 of the SL490B is fed to the base of the PNP transmitter TR1, producing an amplified current pulse about 15μsec wide. This pulse is further amplified by TR2 and applied to the infra-red diodes D1 and D2.

The current in the diodes and the infra-red output is controlled by the quantity, type, and connection method of the diodes and also by the gain at high currents of the transistors.

The most common solution where cost is important is to use 2 single-chip diodes, such as the CQY99 connected in series.

Improved output can be obtained by using four CQY99 diodes in a series parallel arrangement, but it is usually simpler to use 2 multichip diodes such as the CQX47 connected in parallel or a single CQX19 which gives similar results.

A significant increase in range can be obtained by using diodes such as the CQY99 in conjunction with a plated plastic parabolic reflector.

When building the transmitter, care should be taken with the choice of the capacitor C4 and with the circuit layout, particularly when multi-chip diodes are being used, as the current pulses can be as high as 6 to 8Amps.

Transistor choice is also important and any substitutes should have high current gain characteristics and switching speeds similar to those specified in Fig.3.

An increase in output can be obtained by connecting TR2 in common emitter configuration, but care should be taken not to exceed the rating of the diodes.

Choice of PPM Frequencies

Although the ML920 series of remote control receivers is designed to work over a wide range of PPM frequencies, the actual usable range may be restricted by the application. The analogue outputs on the ML920, ML922 and ML923 serve as a good example, since the outputs will step up or down, one step for each pair of PPM words received. This in turn fixes the rate of increment or decrement of the volume or colour controls of a TV set.

When the transmitter is being used with an infra-red link, with high current pulses fed to the diodes as in Fig.5, power consumption will increase with frequency. It is thus advisable that with a battery power supply, the slowest PPM rate consistent with adequate response time should be chosen.

Setting Up Procedure

When designing a remote control system using the SL490 in conjunction with the ML920 range of receiving circuits it is important from a manufacturing point of view for all transmitters to be interchangeable. The timing capacitor C1 should be chosen to give the required T1 time calculated from the formula T1 = 1.4CR with R = 33k. The R value should be made up of a series potentiometer resistor combination with sufficient adjustment to compensate for the I.C. and component tolerances.

The timing components on the receiver can be selected using the formula

$$f_{RX} = \frac{1}{0.15CR} \pm 20\% \text{ where } f_{RX} = \frac{40}{t_0}$$

t_0 being the PPM logic 0 time from the transmitter.

If the recommended value of potentiometer and fixed resistor, as shown in Fig.6, are used, then the value of R in the above formula should be 84kΩ. This gives the maximum frequency adjustment range, which is needed to cope with component and IC tolerances.

Final adjustment is made by setting the period on the receiver oscillator time constant pin to 1/40th of the transmitter PPM logic 0 time using the potentiometer. Connection to the receiver time constant pin should be made using a x10 oscilloscope probe to reduce circuit loading.

When adjusting the ML920, the monitor output can be used for setting up, but in this case, a figure of 1/20th of the transmitter PPM logic 0 time should be used as the monitor output is at half the oscillator frequency.

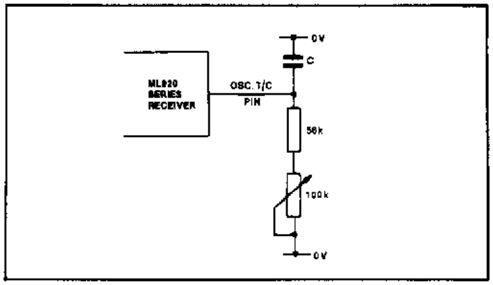

Fig. 6 Recommended receiver time constant components

ABSOLUTE MAXIMUM RATINGS

Supply voltage	7V to 9.5V
Total power dissipation	600mW
Operating temperature range	–10°C to +65°C
Storage temperature range	–55°C to +125°C