PLESSEY
Semiconductors

SL480

INFRA-RED PULSE PRE-AMPLIFIER

The SL480 is a bipolar integrated circuit containing three amplifier stages. Its output is directly compatible with the ML920 range of remote control receiver circuits. It is packaged in an 8-lead plastic package. The gain of the amplifier stages may be adjusted to suit the application. The input impedance is approximately 20MΩ.

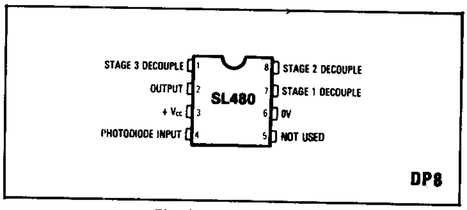

Fig. 1 Pin connections

FEATURES

- Minimum Component Solution to Infra-Red Detection
- Adjustable Gain
- Directly Compatible With Plessey ML920 Range of Receivers
- May Be Used As A General Purpose 100kHz Limiting Amplifier

ABSOLUTE MAXIMUM RATINGS

Supply, Vcc	20V
Maximum power dissipation	480mW
Operating temperature range	−10°C to +65°C
Storage temperature range	−55°C to +125°C

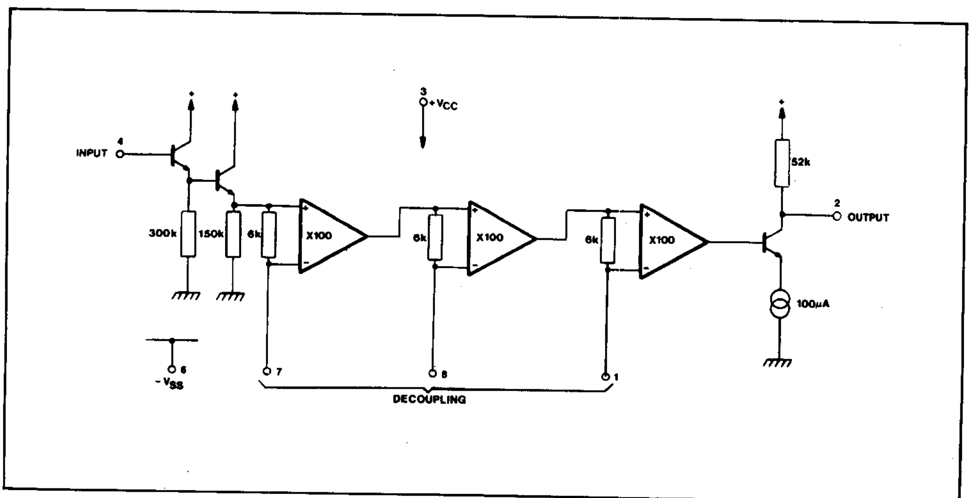

Fig. 2 SL480 block diagram

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):
$T_{amb} = 25°C$
$V_{CC} = +15V$

Characteristic	Pin	Value			Units	Conditions
		Min.	Typ.	Max.		
Operating voltage range	3	12		18	V	
Supply current	3		1.5	4	mA	
Open loop gain	4, 2		100		dB	Sum of 3 stage gains
Input impedance	4		20		MΩ	
Output current sink	2		100		μA	
Internal pullup resistor	2		50		kΩ	
Quiescent O/P voltage (low)	2	9	11		V	At reduced gain
Pulse output (high)	2	14.5			V	No load

OPERATING NOTES

An external resistor of, typically, 330kΩ between pins 4 and 3 provides current for the photo detector diode connected across pins 4 and 6. Any voltage generated across the diode by incident light is amplified.

The gain of each stage may be readily adjusted by external resistors in series with decoupling capacitors between pins 7, 8 or 1 and ground. For maximum gain the resistors are dispensed with except at pin 8.

Typical decoupling capacitors are 22nF. The output goes high towards Vcc when light is detected. This is compatible with the PPM input of the ML920 series of remote control receivers. The SL480 is compatible with the full power supply range of the ML920 series and can also be used at a lower supply voltage as long as Vcc is common to Vss of the MOS device, i.e. common positive.

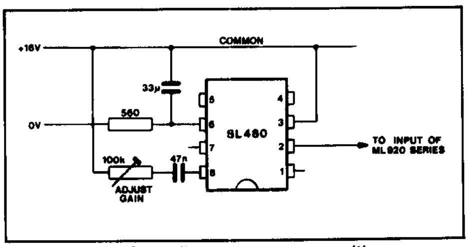

Fig.3 Gain adjustment, common positive

The circuit diagram of the SL480 infra-red pulse amplifier is shown in Fig.5. Pulses generated by an infra-red receiver diode are amplified to a suitable level for direct connection to the input of any of the Plessey Semiconductors ML900 series of remote control receiver circuits.

For basic operation, the receiving diode and SL480 input is biased with a single resistor to the positive supply. Any infra-red light reaching the diode generates a leakage current which causes a voltage drop across the bias resistor.

The SL480 input stage consists of a compound emitter follower (TR1 and TR2) which provides a high input impedance and allows a relatively high diode load resistor as well as a voltage drop of around 1.3V between the input and the bases of the first amplifier stage (TR6, TR7).

Transistors TR6 and TR7 form a differential amplifier which is designed to prevent low frequency or DC input signals from reaching subsequent stages of the amplifier. Since the bases of transistors TR6 and TR7 are internally connected by the 6.3k resistor R3, low frequency signals are applied to both sides simultaneously causing no change in collector current and therefore no output to the second stage. Higher frequency signals are amplified because TR7 base is decoupled externally on pin 7.

Stage 2 gain is provided by a similar differential amplifier to stage 1 except that the relatively stable DC input voltage provided by stage 1 output allows the use of a tail resistor R11 rather than a current source. Decoupling of AC signals is provided at pin 8.

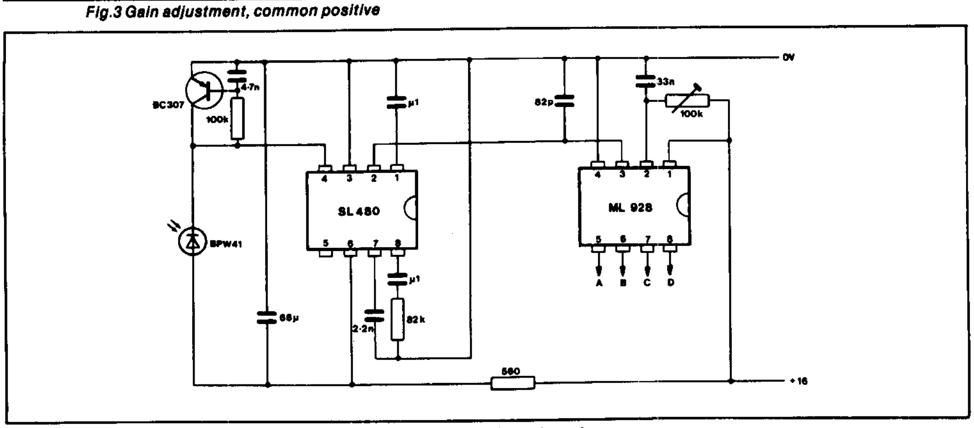

Fig.4 Compact infra-red receiver

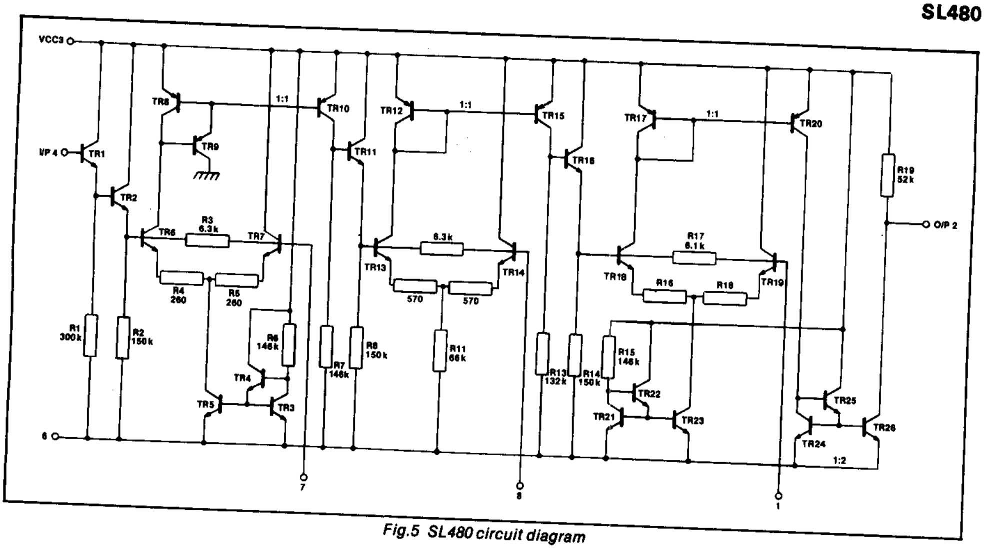

Fig.5 SL480 circuit diagram

Stage 3 is similar to stage 1, but with an extra current mirror (TR24 to TR26) to provide signal inversion at the output.

The standing current through the output load resistor and thus the output voltage, is set by the current in R15. This current will amount to about 100μA, and give an output voltage about 5V below the positive rail with a 15V supply.

It should be noted that there is a parasitic zener diode of about 6V in parallel with the output load resistor R19; this diode will be destroyed if the output is shorted to the negative supply rail. Stage 3 decoupling is provided at pin 1.

With a 15V supply, the input stage will operate with input voltages ranging from 15V down to 5V. This will allow the device to function satisfactorily in high ambient light conditions which produce high leakage currents in the receiving diode. A single transistor circuit is shown in Fig.6, which prevents the input voltage to the SL480 changing for diode leakage currents up to several milliamps. By careful choice of R and C values, this circuit can be made to give extra rejection of low frequency modulation such as that produced by incandescent lamps.

If required, the gain of each stage of the SL480 can be set individually by connecting a resistor in series with the decoupling capacitor. A 6k resistor will reduce the stage gain to half its full value of about 40dB. Normally it is only necessary to reduce the gain of the second stage with about 33-56k.

If preferred the decoupling components on pins 1, 7 and 8 can be earthed to the negative supply on pin 6.

As with any high gain device, care is needed in the layout of printed circuit boards to prevent instability. All decoupling and input components should be mounted close to the SL480. A suitable printed circuit layout for the SL480 is shown in Fig.7.

Decoupling of the power supplies local to the SL480 is advisable. A resistor of about 560ohms in series with the negative rail and a parallel capacitor of 33 microfarads being adequate (see Fig.6).

The decoupling resistor should always be in the negative supply as the ML920 series remote control circuits have a threshold close to the positive rail, and any voltage drop here would reduce the noise immunity.

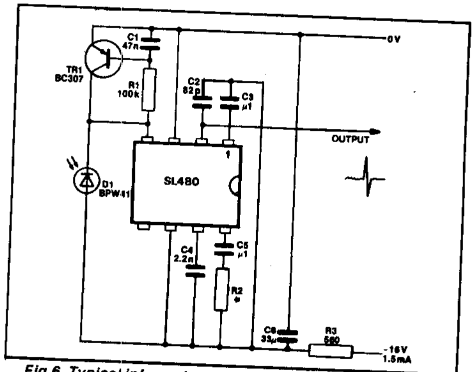

Fig.6 Typical infra-red amplifier application with improved detector biasing

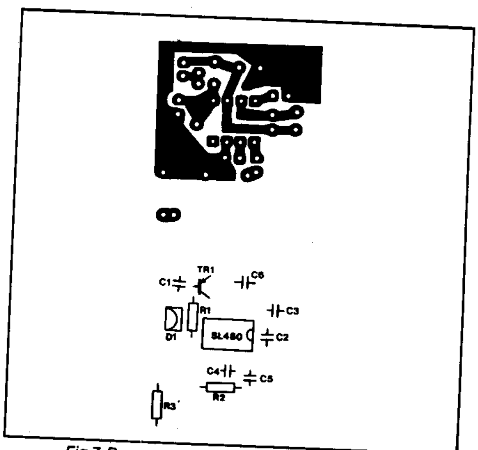

Fig.7 Recommended printed circuit layout