Plessey Semiconductors

SL600 SERIES
COMMUNICATIONS CIRCUITS

SL620C & SL621C
AGC GENERATORS

The SL621C is an AGC generator designed specifically for use in SSB receivers in conjunction with the SL610C, SL611C and SL612C RF and IF amplifiers. In common with other advanced systems it generates a suitable AGC voltage directly from the detected audio waveform, provides a 'hold' period to maintain the AGC level during pauses in speech, and is immune to noise interference. In addition it will smoothly follow the fading signals characteristic of HF communication.

When used in a receiver comprising one SL610C and one SL612C amplifier and a suitable detector, the SL621C will maintain the output within a 4dB range for a 110dB range of receiver input signal.

The SL620C VOGAD (Voice Operated Gain Adjusting Device) is an AGC generator designed to work in conjunction with the SL630C audio amplifier (particularly when the latter is used as a microphone amplifier) to maintain the amplifier output between 70mV and 87mV rms for a 35 dB range of input. A one second 'hold' period is provided which prevents any increase of background noise during pauses in speech.

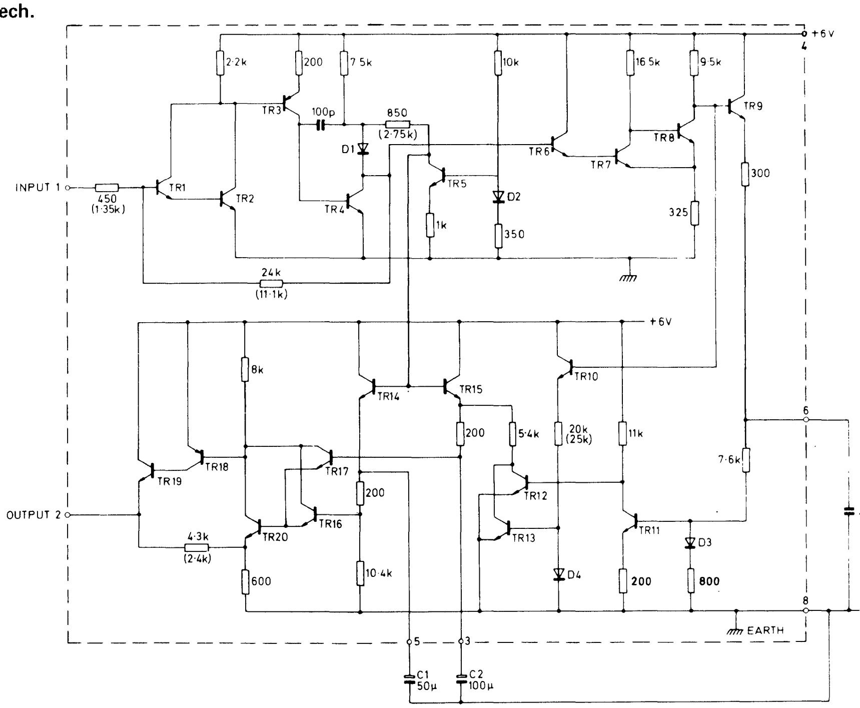

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Fig. 1 Circuit diagram of SL620C and SL621C (Component values in brackets refer to SL620C)

DESCRIPTION

The operation of the SL621C is described with reference to the circuit diagram, Fig. 1, and Fig. 2 which illustrates the dynamic response of a receiver controlled by the SL621C.

The SL621C consists of an input AF amplifier TR1 – TR4 (3 dB point: 10KHz) coupled to a DC output amplifier, TR16 – TR19, by means of a voltage back-off circuit, TR5 and two detectors, TR14 and TR15, having short and long rise and fall time constants respectively.

The detected audio signal at the input will rapidly establish an AGC level, via TR14, in time t_1 (see Fig. 2). Meanwhile the long time constant detector output will rise and after t_3 will control the output because this detector is the more sensitive.

If signals exist at the SL621C input which are greater than approximately 4mV rms they will actuate the trigger circuit TR6 – TR8 whose output pulses will provide a discharge current for C2 via TR10, TR13.

By this means the voltage on C2 can decay at a maximum rate, which corresponds to a rise in receiver gain of 20 dB/s. Therefore the AGC system will smoothly follow signals which are fading at this rate or slower. However, should the receiver input signals fade faster than this, or disappear completely as during pauses in speech, then the input to the AGC generator will drop below the 4mV rms threshold and the trigger will cease to operate. As C2 then has no discharge path, it will hold its charge (and hence the output AGC level) at the last attained value. The output of the short time constant detector will drop to zero in time t_2 after the disappearance of the signal.

The trigger pulses also charge C3 via TR9, so holding off TR12 via TR11. When the trigger pulses cease, C3 discharges and after t_5 turns on TR12. Capacitor C2 is discharged rapidly (in time t_4) via TR12 and so full receiver gain is restored. The hold time, t_5 is approximately one second with C3 = 100μF. If signals reappear during t_5, then C3 will re-charge and normal operation will continue. The C3 re-charge time is made long enough to prevent prolongation of the hold time by noise pulses.

Fig. 2 shows how a noise burst superimposed on speech will initiate rapid AGC action via the short time constant detector while the long time constant detector effectively remembers the pre-noise AGC level.

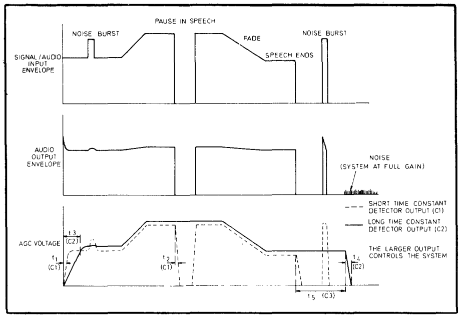

Fig. 2 Dynamic response of a system controlled by SL620C or SL621C AGC generator

OPERATING NOTES

The various time constants quoted are for C1 = 50μF and C2 = C3 = 100μF. These time constants may be altered by varying the appropriate capacitors.

An input coupling capacitor is required. This should normally be 0.33μF for an SL621C and about 1μF for an SL620C.

Fig. 3 shows how the SL621C may be connected into a typical SSB receiver.

Fig. 4 shows how the SL620C is used to control the gain of the SL630C audio amplifier. The operation of the SL620C is exactly the same as that of the SL621C and the diagram showing the dynamic response of the closed loop system, Fig. 2, is equally applicable to the SL630C/SL620C combination. Again, the time constants may be altered by varying the capacitor values.

The supply must either have a source resistance of less than 2Ω at LF or be decoupled by at least 500μF so that it is not affected by the current surge resulting from a sudden input on pin 1. The devices may be used with a supply of up to +9V.

In a receiver for both AM and SSB using an SL623C detector/Carrier AGC generator, the AGC outputs of the SL621C and SL623C may be connected together provided that no audio reaches the SL621C input while the SL623C is controlling the system.

AGC lines may require some RF decoupling but the total capacitance on the output of an SL620 or SL621 should not exceed 15000pF or the impulse suppression will suffer.

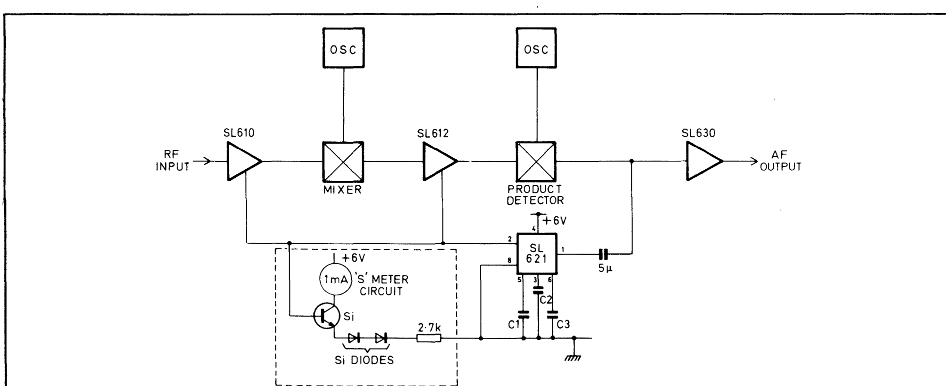

Fig. 3 SL621C used to control SSB receiver

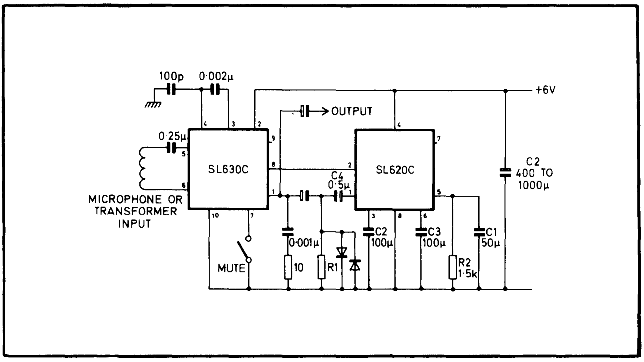

Fig. 4 SL620C used to control SL630C audio amplifier

ELECTRICAL CHARACTERISTICS SL 620C & SL 621C

Test conditions: Supply voltage = 6V
Temperature = +25°C
Input signal frequency = 1kHz

Characteristic	Circuit	Value Min.	Typ.	Max.	Units	Test Conditions
Input for 0.65V dc output	SL620C	55	70	85	mVrms	See Fig.5
Input for 1.5V dc output	SL620C	70	87	105	mVrms	See Fig.5 Measurement accuracy 1 dB
Input for 2.2V dc output	SL621C	6.0	7.0	10.0	mVrms	See Fig.6
Input for 4.6V dc output	SL621C	9.0	11.0	16.0	mVrms	See Fig.6
*Fast rise time, t_1	Both		20	30	ms	0–50% full output
*Fast decay time, t_2	Both	150	200	250	ms	100%–36% voltage on C_1 — C_1 = 50μF
*Slow rise time, t_3	Both	150	200	300	msec	Time to output transition point
Input 3 dB point	Both		10		kHz	
Maximum fade rate	SL620C SL621C		0.22 0.45		V/s V/s	C_2 = 100μF
*Hold collapse time, t_4	Both	150	200	250	ms	Full zero output
*Hold time, t_5	Both	0.75	1.0	1.25	s	C_3 = 100μF
A.C. ripple on output	Both		12	20	mVp-p	1kHz. Output open circuit
Maximum output voltage	SL620C SL621C	2.0 5.1			V V	
Quiescent current consumption	Both	2.5	3.1	4.1	mA	
Surge current	Both		30		mA	
Input resistance	SL620C SL621C	1 350	1.4 500	2 700	kΩ Ω	
Output resistance	SL620C SL621C	12 20	40 70	130 230	Ω Ω	

**See Figure 2*

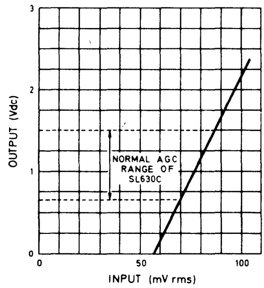

Fig. 5 Transfer characteristic of SL620C

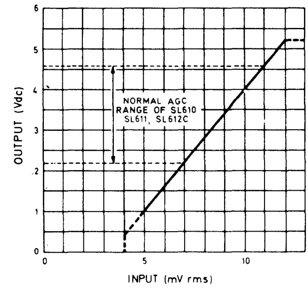

Fig. 6 Transfer characteristic of SL621C

ABSOLUTE MAXIMUM RATINGS

Storage temperature	−55°C to +150°C
Free air operating temperature	−25°C to +125°C
Chip-to-ambient thermal resistance	220°C/W
Chip-to-case thermal resistance	60°C/W
Supply voltage	12V

PLESSEY
Semiconductors

SL621C

AGC GENERATOR

The SL621C is an AGC generator designed specifically for use in SSB receivers in conjunction with the SL610C, SL611C and SL612C RF and IF amplifiers. In common with other advanced systems it generates a suitable AGC voltage *directly from the detected audio waveform, provides a 'hold'* period to maintain the AGC level during pauses in speech, and is immune to noise interference. In addition it will smoothly follow the fading signals characteristic of HF communication.

When used in a receiver comprising one SL610C and one SL612C amplifier and a suitable detector, the SL621C will maintain the output within a 4dB range for a 110dB range of receiver input signal.

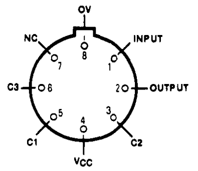

Fig. 1 Pin connections (bottom view)

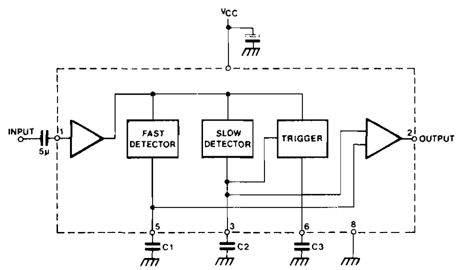

Fig. 2 Block diagram

FEATURES

- All Time Constants Set Externally
- Easy Interfacing
- Compatible with SL610/611/612

APPLICATIONS

- SSB Receivers
- Test Equipment

QUICK REFERENCE DATA

- Supply voltage: 6V
- Supply current: 3mA

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):
Supply voltage V_{CC} = 6V
Ambient temperature: −30°C to +85°C
Test frequency: 1kHz
Test circuit as Fig. 2

ABSOLUTE MAXIMUM RATINGS

Supply voltage: 12V
Storage temperature: −55°C to +125°C

Characteristic	Value Min.	Value Typ.	Value Max.	Units	Conditions
Supply current		3.1	4.3	mA	No signal
Cut-off frequency (−3dB)		6		kHz	
Input for 2.2V DC output	3	7	11	mVrms	
Input for 4.6V DC output	9	11	16	mVrms	
Maximum output voltage	5.1			V	
AC ripple on output		12	20	mV pk-pk	1kHz, output open circuit
Input resistance	350	500	700	Ω	
Output resistance		70	230	Ω	
'Fast' rise time t_1		20	55	ms	0 to 50% full output
'Fast' decay time t_2	150	200	330	ms	100% to 36% full output
'Slow' rise time t_3	150	200	300	ms	Time to output transistion point
Hold collapse time t_4	65	100	150	ms	90% to 10% full output
Hold time t_5	0.75	1.0	1.25	s	

APPLICATION NOTES

The SL621C consists of an input AF amplifier coupled to a DC output amplifier by means of two detectors having short and long rise and fall times respectively. The time constants of these detectors are set externally by capacitors on pins 5 (C_1) and 3 (C_2).

The detected audio signal at the input will rapidly establish an AGC level via the 'fast' detector time in t_1 (see Fig. 3). Meanwhile the long time constant detector output will rise and after t_3 will control the output because this detector is more sensitive.

Input signals greater than approximately 4mV rms will actuate a trigger circuit whose output pulses provide a discharge current for C_2.

By this means the voltage on C_2 can decay at a maximum rate, which corresponds to a rise in receiver gain of 20dB/s. Therefore the AGC system will smoothly follow signals which are fading at this rate or slower. However should the receiver input signals fade faster than this, or disappear completely as during pauses in speech, then the input to the AGC generator will drop below the 4mV rms threshold and the trigger will cease to operate. As C_2 then has no discharge path, it will hold its charge (and hence the output AGC level) at the last attained value. The output of the short time constant detector will drop to zero in time t_2 after the disappearance of the signal.

The trigger pulses also charge C_3. When the trigger pulses cease, C_3 discharges and after t_5 C_2 is discharged rapidly (in time t_4) and so full receiver gain is restored. The hold time, t_5 is approximately one second with $C_3 = 100\mu F$. If signals reappear during t_5, then C_3 will recharge and normal operation will continue. The C_3 recharge time is made long enough to prevent prolongation of the hold time by noise pulses.

Fig. 3 shows how a noise burst superimposed on speech will initiate rapid AGC action via the short time constant detector while the long time constant detector effectively remembers the pre-noise AGC level.

The various time constants quoted are for $C_1 = 50\mu F$ and $C_2 = C_3 = 100\mu F$. These time constants may be altered by varying the appropriate capacitors. C_1 controls t_1, t_2; C_2 controls t_3, t_4; C_3 controls t_5.

The supply must either have a source resistance of less than 2Ω at LF or be decoupled by at least 500µF so that it is not affected by the current surge resulting from a sudden input on pin 1.

In a receiver for both AM and SSB using an SL623C detector/carrier AGC generator, the AGC outputs of the SL621C and SL623C may be connected together provided that no audio reaches the SL621C input while the SL623C is controlling the system.

AGC lines may require some RF decoupling but the total capacitance on the output should not exceed 15000pF or the impulse suppression will suffer.

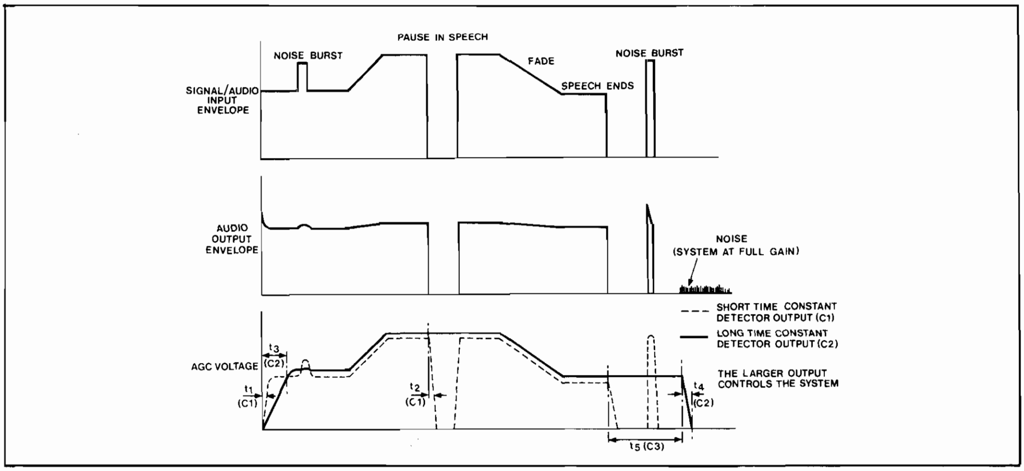

Fig. 3 Dynamic response of a system controlled by SL621C AGC generator

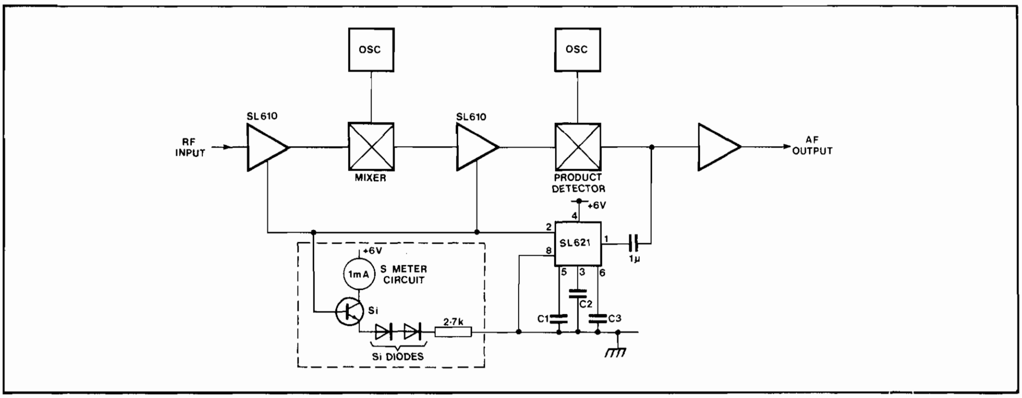

Fig. 4 SL621C used to control SSB receiver

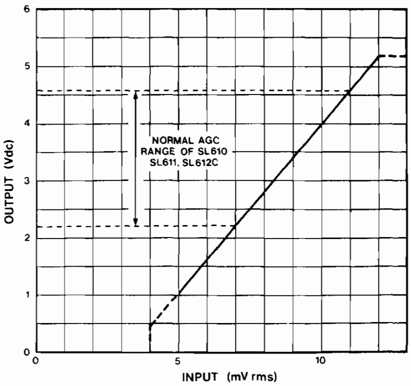

Fig. 5 Transfer characteristic of SL621C (typical)

Under some conditions,overload of the AGC output may occur in a receiver. Possible solutions are shown in Figs.6 and 7.

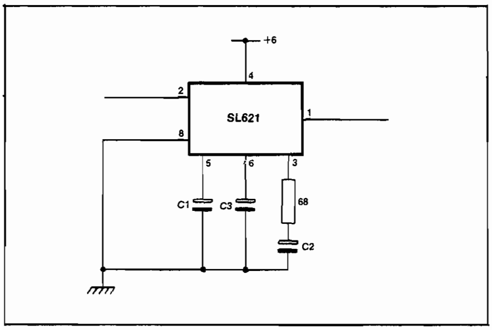

Fig.6

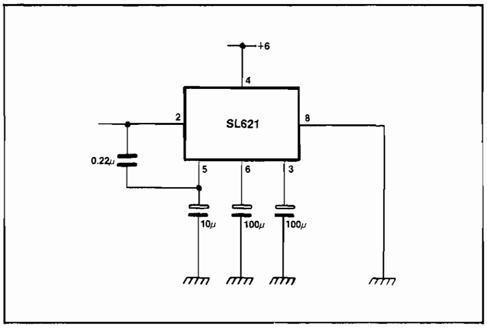

Fig.7