PLESSEY
Semiconductors

SL623C

AM DETECTOR, AGC AMPLIFIER & SSB DEMODULATOR

The SL623C is a silicon integrated circuit combining the functions of low level, low distortion AM detector and AGC generator with SSB demodulator. It is designed specially for use in SSB/AM receivers in conjunction with SL610C, SL611C and SL612C RF and IF amplifiers. It is complementary to the SL621C SSB AGC generator.

The AGC voltage is generated directly from the detected carrier signal and is independent of the depth of modulation used. Its response is fast enough to follow the most rapidly fading signals. When used in a receiver comprising one SL610C and one SL612C amplifier, the SL623C will maintain the output within a 5dB range for a 90dB range of receiver input signal.

The AM detector, which will work with a carrier level down to 100mV, contributes negligible distortion up to 90% modulation. The SSB demodulator is of single balanced form. The SL623C is designed to operate at intermediate frequencies up to 30MHz. In addition it functions at frequencies up to 120MHz with some degradation in detection efficiencies.

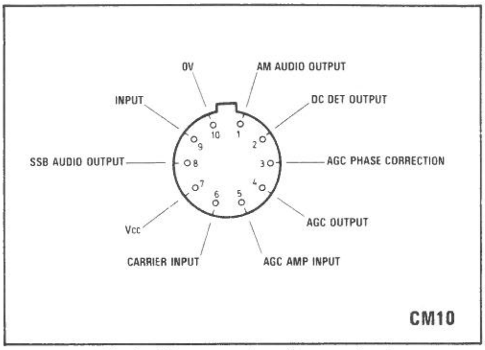

Fig. 1 Pin connections (bottom view)

FEATURES

- Negligible Distortion
- Easy Interfacing
- Fast Response Time

APPLICATIONS

- AM SSB Receivers
- Test Equipment

QUICK REFERENCE DATA

- Supply Voltage: 6V
- Maximum Frequency: 30MHz

ABSOLUTE MAXIMUM RATINGS

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

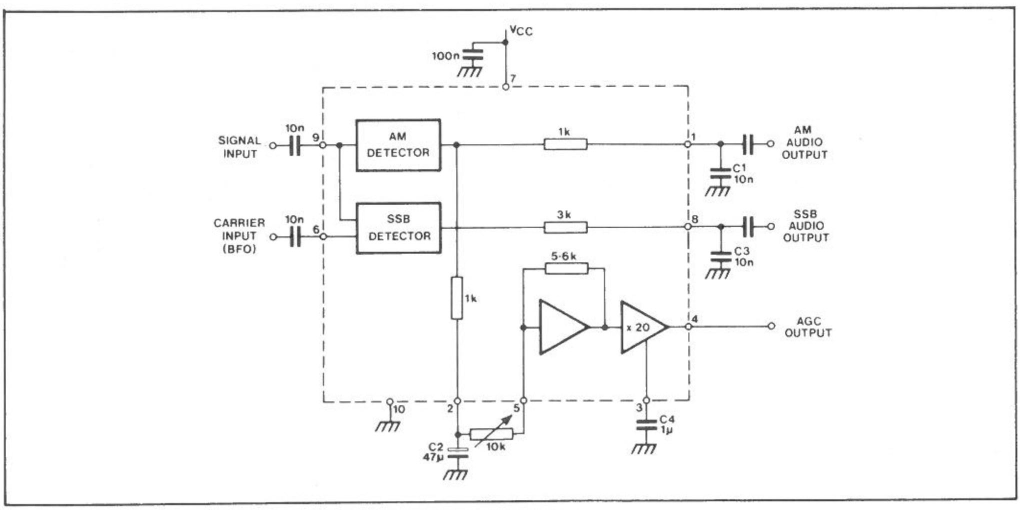

Fig. 2 block diagram

ELECTRICAL CHARACTERISTICS

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

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
Supply current		9	11	mA	No signal, Pin 4 open
Input impedance		800		Ω	Pins 6, 9
SSB audio output	22	30	47	mVrms	Signal input 20mV rms @ 1.748 MHz. Ref. signal input 100mV @ 1.750 MHz
AM audio output	43	55	67	mV rms	Signal input 125mV rms @ 1.75MHz modulated to 80% at 1kHz
AGC range (Note 1)			6	dB	Initial signal input 125mV rms at 1.75MHz modulated to 80% at 1kHz. Output set to 2.0V with 10kΩ potentiometer between Pins 2 & 5.

NOTES
1. The AGC range is the change in input level to increase AGC output voltage from 2.0V to 4.6V

APPLICATION NOTES

AGC Generator

Pin 3, the AGC amplifier phase correction point should be decoupled to ground by a 1 microfarad capacitor (C4), keeping leads as short as possible. The value of C4 is quite critical, and should not be altered: if it is increased the increased phase shift in the AGC loop may cause the receiver to become unstable at LF and if it is reduced the modulation level of the incoming signal will be reduced by fast-acting AGC.

The AGC output (Pin 4) will drive at least two SL610/11/12 amplifiers. The SL623AGC output is an emitter follower similar to that of the SL621C. Hence the outputs of the two devices may be connected in parallel when constructing AM/SSB systems.

Less signal is needed to drive the SSB demodulator than the AM detector. In a combined AM/SSB system, therefore, the signal will automatically produce an SSB AGC voltage via the SL621C as long as a carrier (BFO) is present at the input to the SSB demodulator of the SL623C. The AGC generator of the SL623 will not contribute in such a configuration.

For AM operation the BFO must be disconnected from the carrier input of the SSB demodulator. In the absence of an input signal, the SL621C will then return to its quiescent state. To switch over a receiver using the SL623C from SSB to AM operation it is therefore necessary to turn off the BFO and transfer the audio pick-off from the SSB to the AM detector.

Neglecting to disconnect the SSB carrier input during AM operation can result in heterodyning due to pick-up of carrier on the input signal. In some sets different filters are used for AM and SSB; these will also need to be switched.

The 10 kilohm gain-setting preset potentiometer is adjusted so that a DC output of 2 volts is achieved for an input of 125mV rms. There will then be full AGC output from the SL623C for a 4dB increase in input. A fixed resistor of 1.5 kilohms can often be used instead of the potentiometer.

SSB Demodulator

The carrier input is applied to Pin 6, via a low-leakage capacitor. It should have an amplitude of about 100mV rms and low second harmonic content to avoid disturbing the DC level at the detector output.

Pin 8 is the SSB output and should be decoupled at RF by a 0.01 microfarad capacitor. The output impedance of the detector is 3 kilohm and the terminal is at a potential of about +2V which may be used to bias an emitter follower if a lower output impedance is required. The input to the audio stage of a receiver using an SL623C should be switched between the AM and the SSB outputs – no attempt should be made to mix them. Since the SL621C is normally used in circumstances where low-level audio is obtained from the detector, the relatively high SSB audio output of the SL623C must be attenuated before being applied to the SL621C. This is most easily done by connecting the SL623C to the SL621C via a 2 kilohm resistor in series with a 0.5 microfarad capacitor.

Input Conditions

The input impedance is about 800 ohms in parallel with 5pF. Connection must be made to the input via a capacitor to preserve the DC bias. An input of about 125mV rms is required for satisfactory carrier AGC performance and 20mV rms for SSB detection. Normally, the AGC will cope with this variation but in an extreme case a receiver using an SL623C and having the same gain to the detector in both AM and SSB modes will be some 10dB less sensitive to AM.

PLESSEY
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SL640C & SL641C

DOUBLE BALANCED MODULATORS

The SL640C and SL641C are double balanced modulators intended for use in radio systems at frequencies up to 75MHz. The SL640 has an integral output load resistor (Pin 5) together with an emitter follower output (Pin 6) whereas the SL641 has a single output designed as a current drive to a tuned circuit.

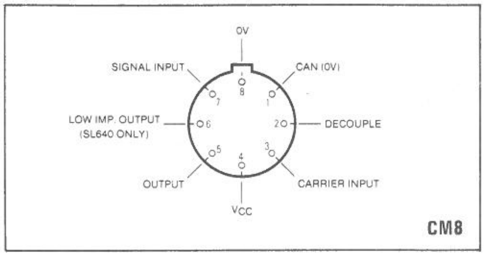

Fig. 1 Pin connections (bottom view)

FEATURES

- No External Bias Networks Needed
- Easy Interfacing
- Choice of Voltage or Current Outputs

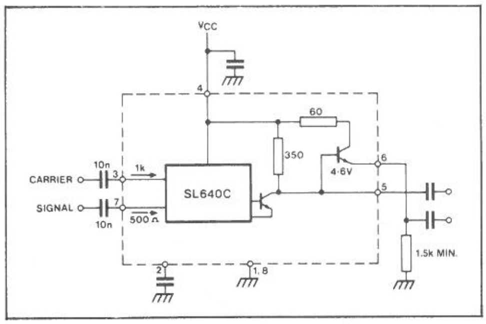

Fig. 2 Block diagram (SL640C)

APPLICATIONS

- Mixers In Radio Transceivers
- Phase Comparators
- Modulators

QUICK REFERENCE DATA

- Supply Voltage: 6V
- Conversion Gain: 0dB
- Maximum Inputs: 200mV rms

ABSOLUTE MAXIMUM RATINGS

Supply voltage 9V
Storage temperature: −55°C to +125°C

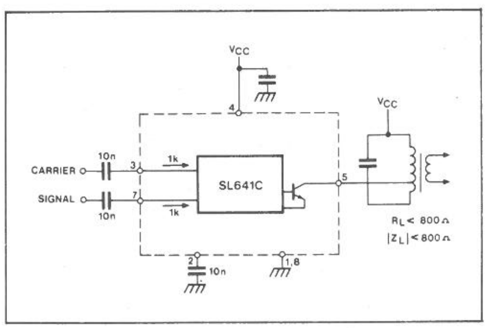

Fig. 3 Block diagram (SL641C)

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):
Supply voltage V_{CC}: 6V
Ambient temperature: −30°C to +85°C

Characteristic	Circuit	Value			Units	Conditions
		Min.	Typ.	Max.		
Supply current	SL640C		12	17	mA	
	SL641C		10	13	mA	
Conversion gain	SL640C	−3	0	+3	dB	
Conversion transconductance	SL641C	1.75	2.5	3.5	mmho	
Noise figure			10		dB	
Carrier input impedance			1		kΩ	
Signal input impedance	SL640C		500		Ω	
	SL641C		1		kΩ	
Maximum input voltage	SL640C		210		mV rms	
	SL641C		250		mV rms	
Signal leak	SL640C		−30	−18	dB	Signal: 70mV rms, 1.75MHz Carrier: 100mV rms, 28.25 MHz Output: 30MHz
Carrier leak	SL640C		−30	−20	dB	
Signal leak	SL641C		−18	−12	dB	Signal: 70mV rms, 30MHz Carrier: 100mV rms, 28.25 MHz Output: 1.75MHz
Carrier leak	SL641C		−25	−12	dB	
Intermodulation products	SL640C		−45	−35	dB	Signal1: 42.5mV rms, 1.75MHz Signal2: 42.5mV rms, 2MHz Carrier: 100mV rms, 28.25MHz Output: 29.75MHz
	SL641C		−45	−30	dB	Signal1: 42.5mV rms, 30MHz Signal2: 42.5mV rms, 31MHz Carrier:100mV rms, 28.25MHz Output: 3.75MHz

APPLICATION NOTES

The SL640C and SL641C require input and output coupling capacitors which normally should be chosen to present a low reactance compared with the input and output impedances (see Electrical Characteristics). However, for minimum carrier leak at high frequencies the signal input should be driven from a low impedance source, in which case the signal input capacitor reactance should be comparable with the source impedance. Pin 2 must be decoupled to earth via a capacitor which presents the lowest possible impedance at both carrier and signal frequencies. The presence of these frequencies at Pin 2 would give rise to poor rejection figures and to distortion.

The output of the SL641C is an open collector. If both sidebands are developed across the load its dynamic impedance must be less than 800 ohms. If only one sideband is significant this may be raised to 1600 ohms and it may be further raised if the maximum input swing of 200mV rms is not used. The DC resistance of the load should not exceed 800 ohms. If the circuit is connected to a +6V supply and the load impedance to +9V, the load may be increased to 1.8 kilohms at AC or DC. This, of course increases the gain of the circuit.

There are two outputs from the SL640C; one is a voltage source of output impedance 350 ohms and 8pF and the other is the emitter of an emitter follower connected to the first output. The output on pin 6 requires a discrete load resistor of not less than 1500 ohms to ground. The emitter follower output should not be used to drive capacitive loads as emitter followers act as detectors under such circumstances with resultant distortion and harmonic generation. Frequency-shaping components may be connected to the voltage output and the shaped signal taken from the emitter follower.

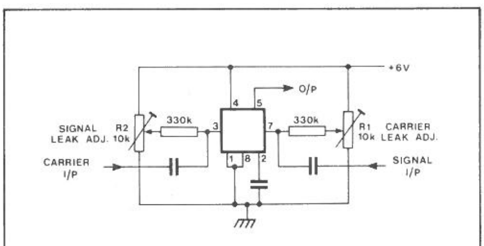

Fig. 4 Signal and carrier leak adjustment

Signal and carrier leak may be reduced by altering the bias on the carrier and signal input pins, as shown in Fig.4. With carrier but no signal R1 is adjusted for minimum carrier leak. A similar network is connected to the carrier input and with signal and carrier present, signal leak is minimised by means of R2.