PLESSEY
Semiconductors

T-74-11-01

SL523AC

120MHz DUAL WIDEBAND LOG AMPLIFIER

(CONFORMS TO MIL-STD-883C CLASS B)

The SL523AC is a wideband amplifier for use in successive detection logarithmic IF strips operating at centre frequencies between 10 and 100MHz. It is pin-compatible with the SL521 series of logarithmic amplifiers and comprises two amplifiers, internally connected in cascade. Small signal voltage gain is 24dB and an internal detector with an accurate logarithmic characteristic over a 20dB range produces a maximum output of 2.1mA. A strip of SL523s can be directly coupled and decoupling is provided on each amplifier. RF limiting occurs at an input voltage of 25mV RMS but the device will withstand input voltages up to 1.8V RMS without damage.

FEATURES

- MIL-M-38510 Change Notification Observed
- Full Quality Conformance Inspection
- Temperature Range: —55°C to +125°C
- Small Size/Weight
- Lower Power Consumption
- Readily Cascadable
- Accurate Logarithmic Detector Characteristic

QUICK REFERENCE DATA

- Small Signal Voltage Gain: 24dB
- Detector Output Current: 2.1mA
- Noise Figure: 4dB
- Frequency Range: 20-100MHz
- Supply Voltage +6V
- Supply Current 30mA

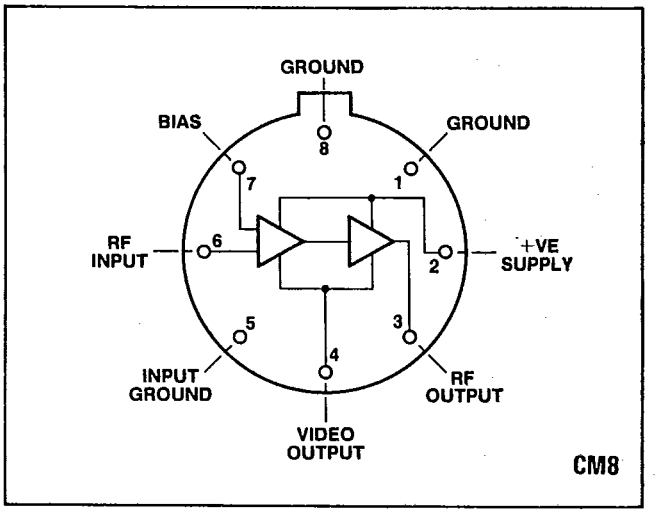

Fig.1 Pin connections (view from beneath)

ABSOLUTE MAXIMUM RATINGS

(Non simultaneous)

Storage temperature range	-55°C to +175°C
Operating temperature range	-55°C to +125°C
Maximum instantaneous voltage at video output	+12V
Supply voltage	+9V

CHANGE NOTIFICATION

The change notification requirements of MIL-M-38510 will be implemented on this device type. Known customers will be notified of any changes since last buy when ordering further parts if significant changes have been made.

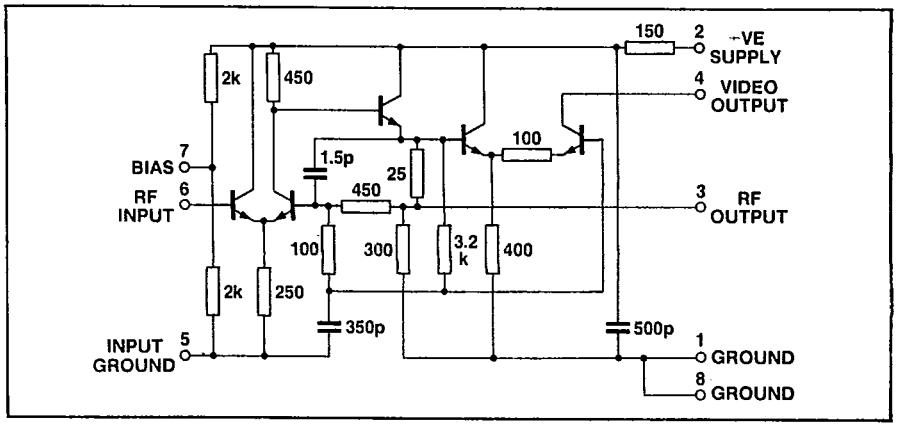

Fig.2 Circuit diagram (one amplifier)

Rev.	A		
Date	4 June 87		

SL523AC

ELECTRICAL CHARACTERISTICS

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Test conditions (unless otherwise stated):
Ambient temperature = -55°C to +125°C; Source impedance = 10Ω; Supply voltage = +6V; Load impedance = 8pF; Frequency = 60MHz; DC connection between Pins 6 and 7

Characteristic	Value Min.	Value Max.	Units	Sub Group	Conditions
Small signal voltage gain	22.6	25.4	dB	4,7	T_{amb} = +25°C, f = 30MHz
Small signal voltage gain	22	26	dB	4,7	T_{amb} = +25°C, f = 60MHz
	20	28	dB	5,6,8	
Upper cut-off frequency	100		MHz	5,6	
Lower cut-off frequency		20	MHz	5,6	
Maximum rectified video output current	1.9	2.3	mA	4	T_{amb} = 25°C; V_{IN} = 0.5V RMS, f = 60MHz
	1.7	2.5	mA	5,6	T_{amb} = -55°C to +125°C; V_{IN} = 0.5V RMS, f = 60MHz
Noise figure		5.25	dB	4	T_{amb} = +25°C; R_S = 450Ω, f = 60MHz
Supply current	25	36	mA	1,2,3	

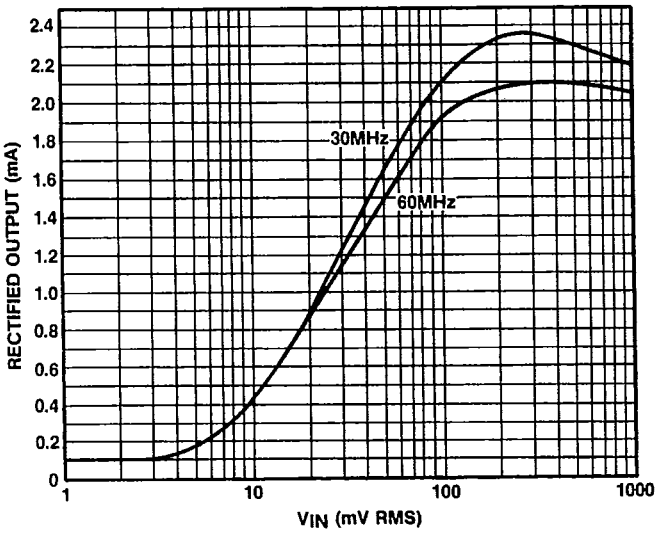


Fig.3 Rectified output current v. input signal (typical)

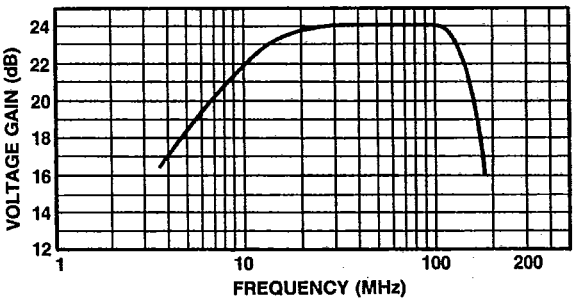


Fig.4 Voltage gain v. frequency (typical)

OPERATING NOTES

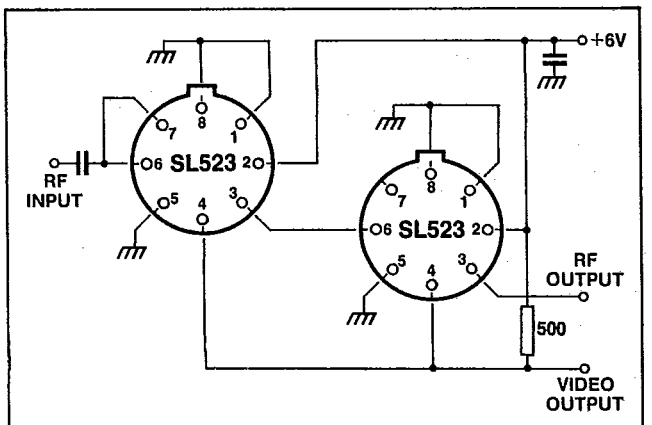
The amplifier is designed to be directly coupled (see Fig.5).

The fourth stage in an untuned cascade will give full output on the broad band noise generated by the first stage.

Noise may be reduced by inserting a single tuned circuit in the chain. As there is a large mismatch between stages a simple shunt or series circuit cannot be used. The network chosen must give unity voltage gain at resonance to avoid distorting the log law. The typical value for input impedance is 500 ohms in parallel with 5pF and the output impedance is typically 30 ohms.

Although a 1nF supply line decoupling capacitor is included in the can an extra capacitor is required when the amplifiers are cascaded. Minimum values for this capacitor are: 2 stages - 3nF, 3 or more stages - 30nF.

In cascades of 3 or more stages care must be taken to avoid oscillations caused either by inductance common to the input and output grounds of the strip or by feedback along the common video line. The use of a continuous ground plane will avoid ground inductance problems and a common base amplifier in the video line isolating the first two stages as shown in Fig.6 will eliminate feedback on the video line.



Frequency range: 10 to 100MHz
Log. range: 45dB
RF small signal gain: 48dB
Video output: 2V peak

Fig.5 Simple log. IF strip

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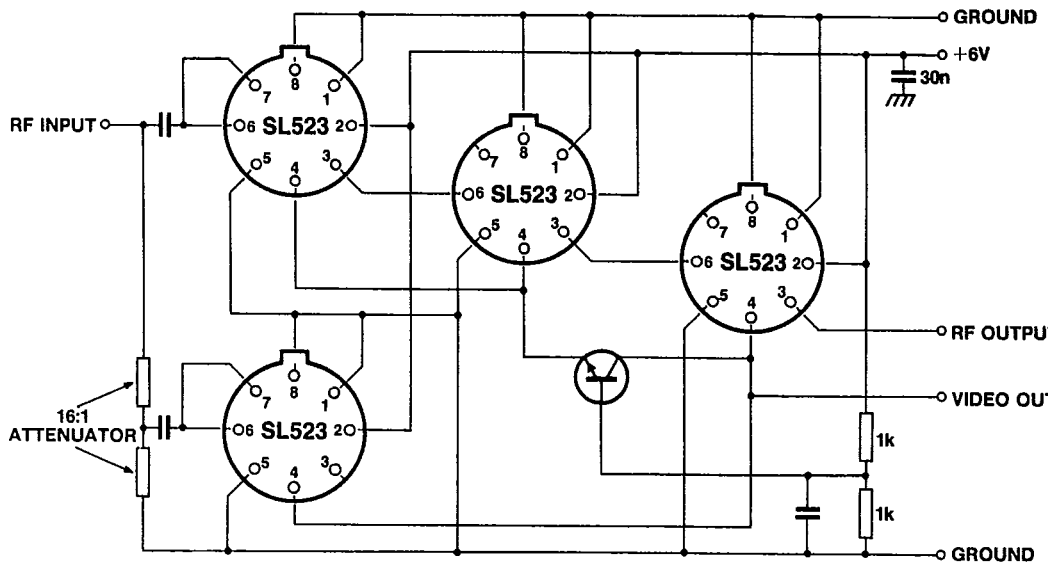


Frequency range: 10 to 90MHz
Log. range: 80dB
RF small signal gain: 72dB
Video output: 8mA peak
Log. accuracy: ±0.5dB (Typ.)

Fig.6 Wide dynamic range log. IF strip

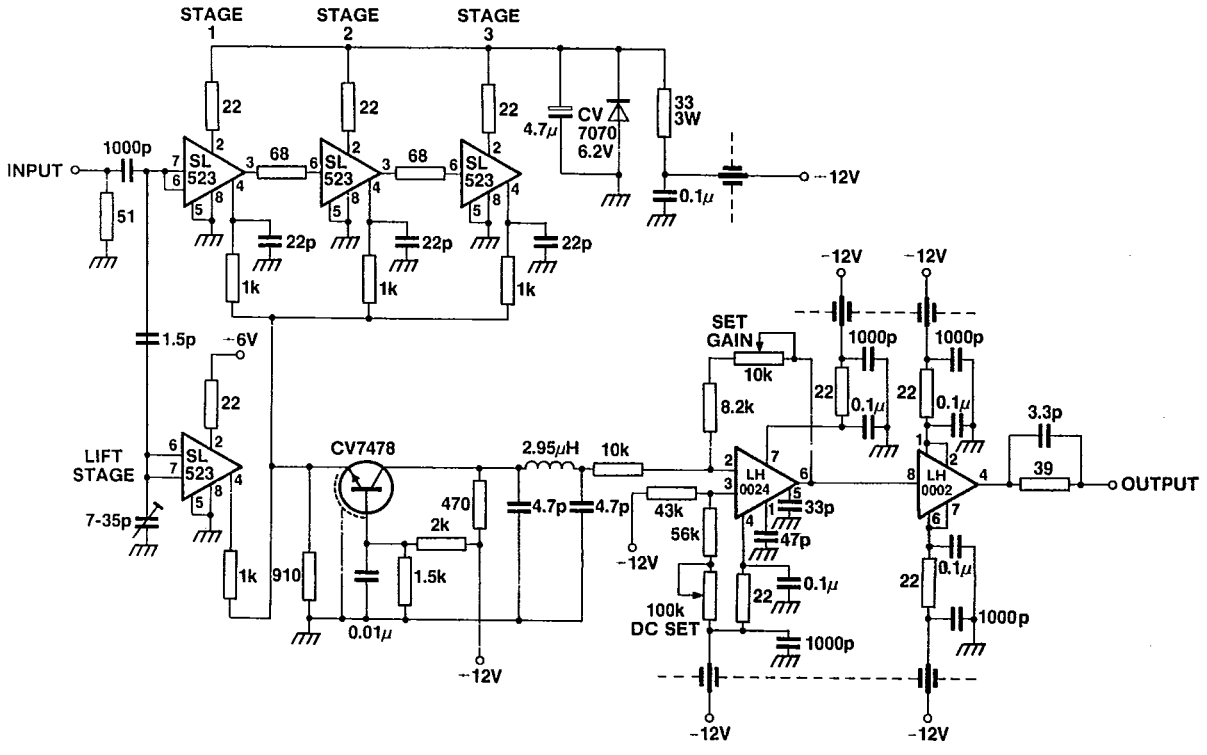


Fig.7 Wideband logarithmic amplifier

TYPICAL PERFORMANCE

Unselected SL523 devices were tested in a wideband logarithmic amplifier, described in RSRE Memo No. 3027 and shown in Fig.7.

The amplifier consists of six logarithmic stages and two 'lift' stages, giving an overall dynamic range of greater than 80dB. The response and error curves were plotted on an RHG Log Test Set and bandwidth measurements were made with a Telonic Sweeper and Tektronix oscilloscope.

Fig.8 shows the dynamic range error curve and frequency response obtained. The stage gains of the SL523 devices used were as shown in Table 1.

Stages	fo (MHz)	Gain (dB)	Max. Deviation (dB)
1	60	24.123	0.235
2	60	24.089	
3	60	23.888	
Lift	60	24.086	

Table 1 Stage gains of SL523 used in performance tests

The input v. output characteristic (Fig.8a) is calibrated at 10dB/cm in the X axis and 1V/cm in the Y axis. 80dB of dynamic range was attained.

The error characteristic (Fig.8b) is calibrated at 10dB/cm in the X axis and 1dB/cm in the Y axis; this shows the error between the log. input v. output characteristic and a mean straight line and shows that a dynamic range of 80dB was obtained with an accuracy of ±0.5dB.

As a comparision, the log amplifier of Fig.7 was constructed with randomly selected SL521s (two SL521s replacing each SL523). Again, a dynamic response of 80dB was obtained (Fig.9a) with an accuracy of ±0.75dB (Fig.9b).

Bandwidth curves are shown in Figs.8c and 9c, where the amplitude scale is 2dB/cm, with frequency markers at 10MHz intervals from 20 to 100MHz. Using SL523s (Fig.8c), the frequency response at 90MHz is 4dB down on maximum and there is a fall-off in response after 50MHz. Fig.9c shows that the frequency response of the amplifier falls off more gradually after 40MHz but again the response at 90MHz is 4dB down on maximum.

These tests show that the SL523 is a very successful dual-stage log amplifier element and, since it is pin-compatible with the SL521, enables retrofit to be carried out in existing log amplifiers. It will be of greatest benefit however, in the design of new log amplifiers, enabling very compact units to be realised with a much shorter summation line.

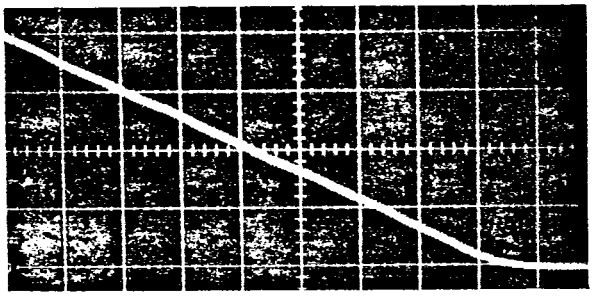


Fig.8a Input/output

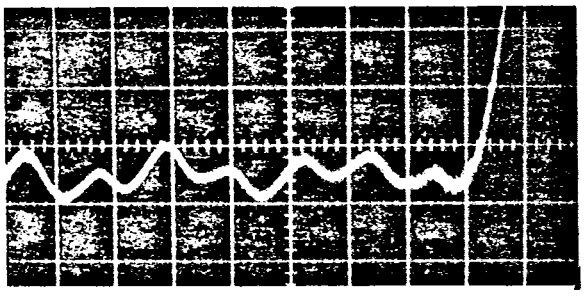


Fig.8b Error curve

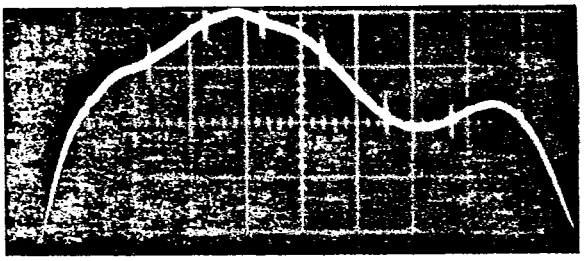


Fig.8c Frequency response, detected output

Fig.8 Characteristics of circuit shown in Fig.7 using SL523s

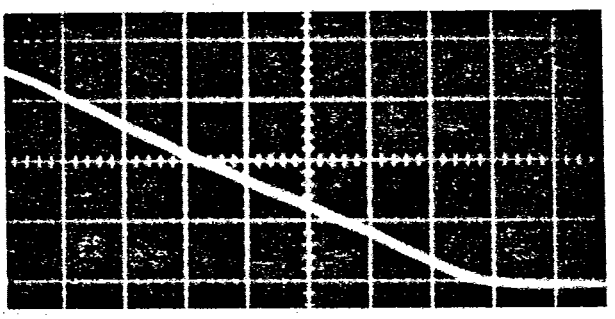


Fig.9a Input/output

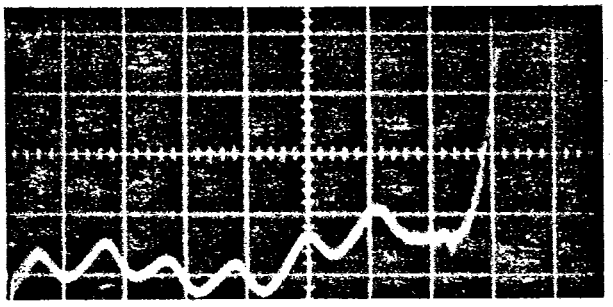


Fig.9b Error curve

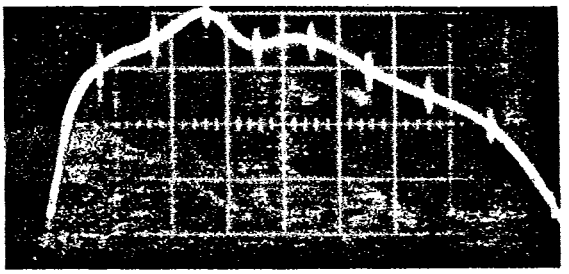


Fig.9c Frequency response, detected output

Fig.9 Characteristics of circuit shown in Fig.7 using SL521s

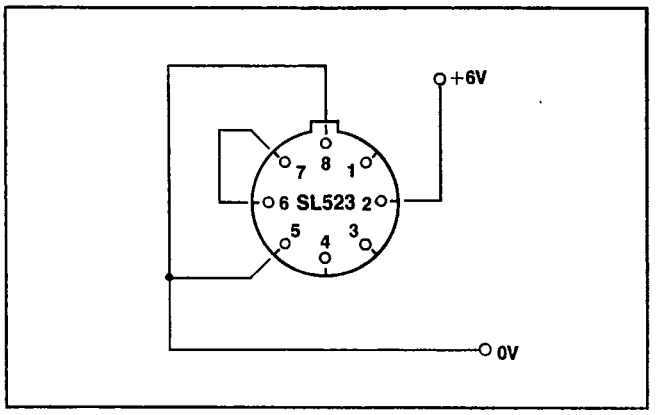
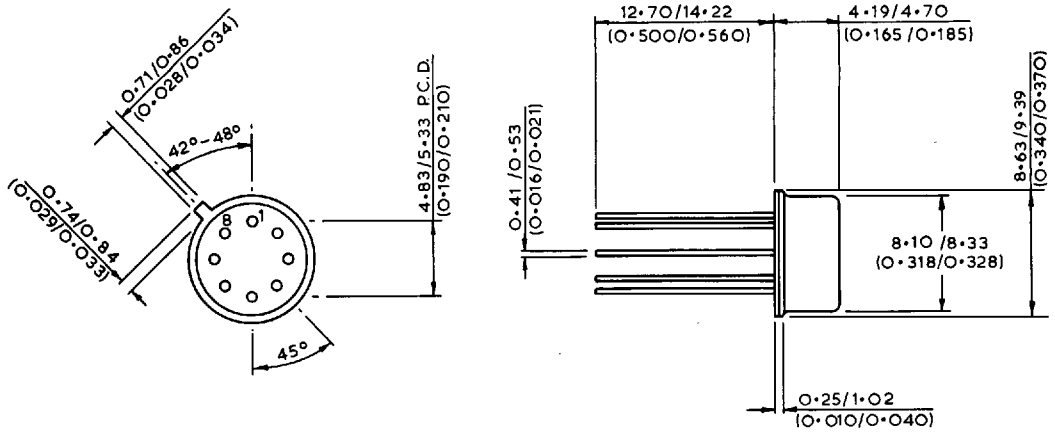
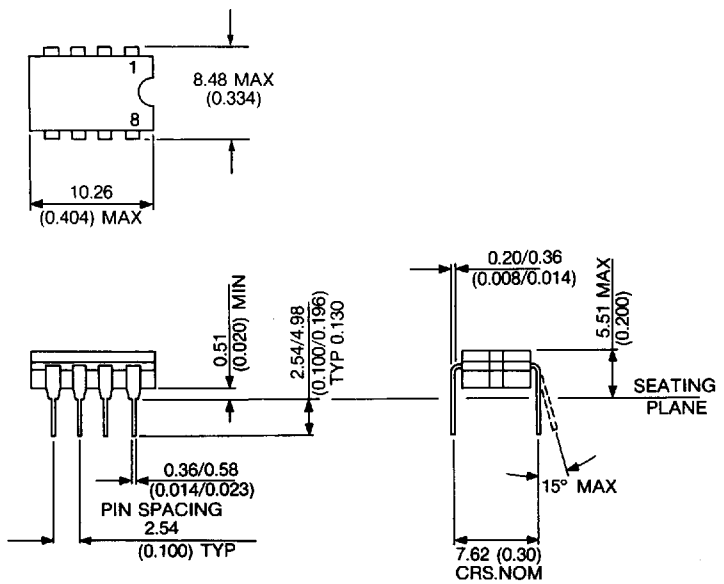


Fig.10 Burn-in/Life test circuit
NOTE: PDA is 5% and based on sub groups 1 and 4



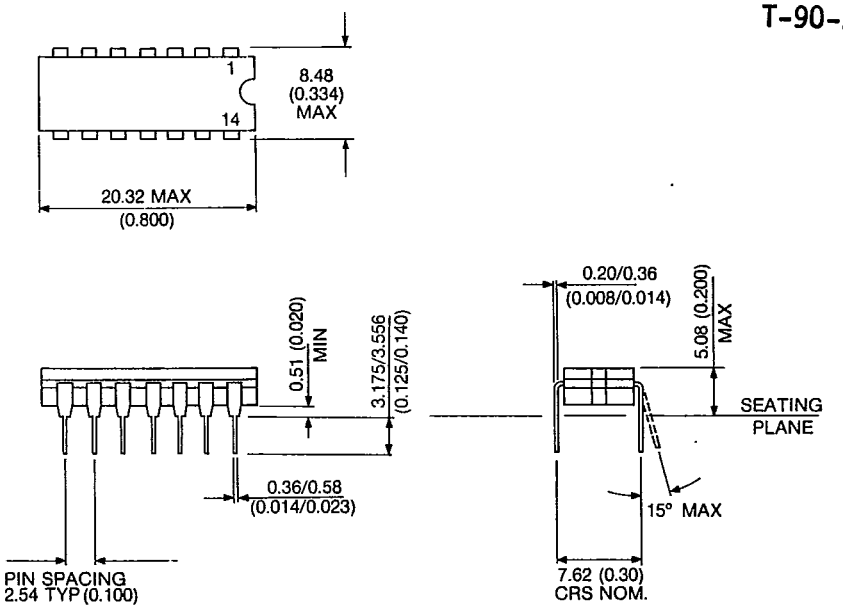
NOTE: This package does not have 'standoff' and therefore does not conform fully to MIL-M-38510F case outline A-1.

8-LEAD METAL CAN

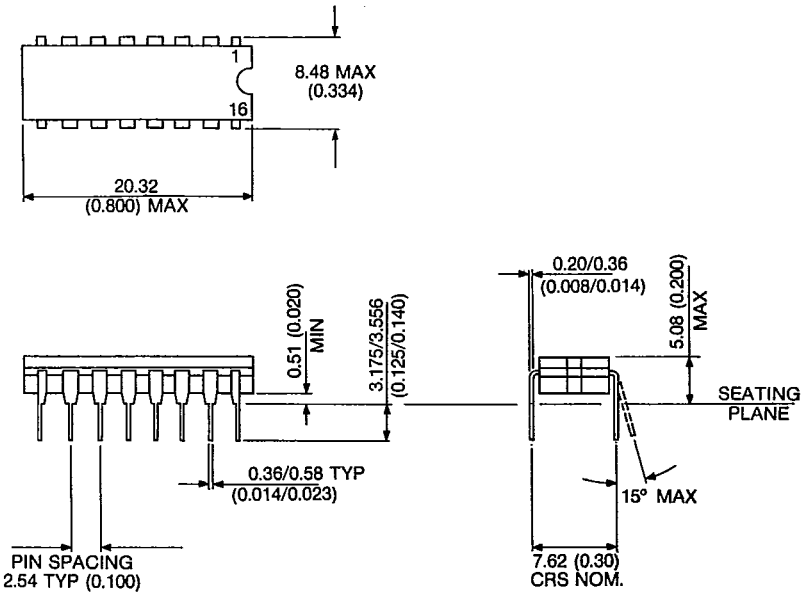


8 LEAD CERAMIC DIL CERDIP - DG8

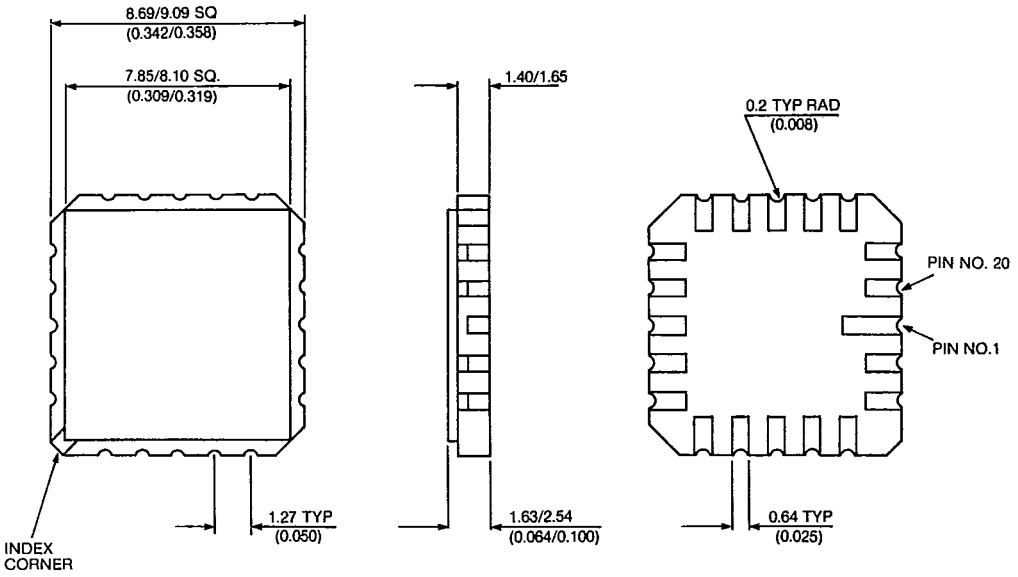
T-90-20



14 LEAD CERAMIC DIL CERDIP - DG14



16 LEAD CERAMIC DIL CERDIP - DG16



20-PIN LEADLESS CHIP CARRIER - LC20
(HERMETIC)