

T-74-11-01

SL531AC

250MHz TRUE LOG IF AMPLIFIER (CONFORMS TO MIL-STD-883C CLASS B)

The SL531AC is a wide band amplifier designed for use in logarithmic IF amplifiers of the true log type. The input and log output of a true log amplifier are at the same frequency i.e. detection does not occur. In successive detection log amplifiers (using SL521, SL1521 types) the log output is detected.

The small signal gain is 10dB and bandwidth is over 500MHz. At high signal levels the gain of a single stage drops to unity. A cascade of such stages give a close approximation to a log characteristic at centre frequencies between 10 and 200MHz.

An important feature of the device is that the phase shift is nearly constant with signal level. Thus any phase information on the input signal is preserved through the strip.

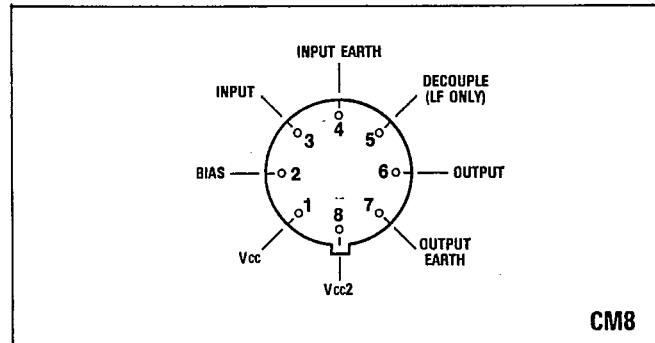


Fig.1 Pin connections

FEATURES

- MIL-M-38510 Change Notification Observed
- Full Quality Conformance Inspection
- Low Phase Shift v. Amplitude
- On-Chip Supply Decoupling
- Low External Components Count

APPLICATIONS

True Log Strips with:-

- Log Range 70dB
- Centre Frequencies 10 - 200MHz
- Phase Shift ± 0.5 degrees/10dB

ABSOLUTE MAXIMUM RATINGS

Supply voltage	+15V
Storage temperature range	-55 °C to +150 °C
Operating temperature range	-55 °C to +125 °C
	See operating notes
Max. junction temperature	+175 °C
Junction - ambient thermal resistance	210 °C/Watt
Junction - case thermal resistance	60 °C/Watt

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.

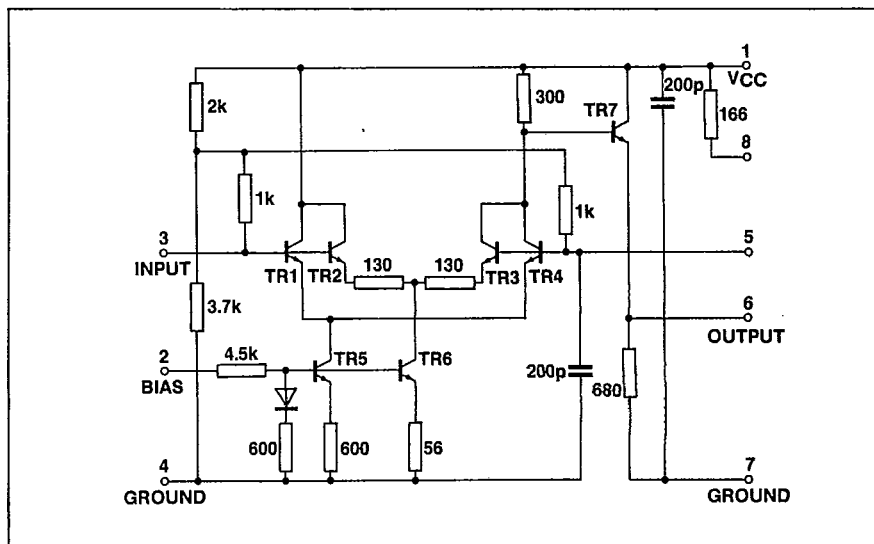


Fig.2 Circuit diagram SL531

Rev.	A		
Date	1 Jan 87		

CIRCUIT DESCRIPTION

The SL531 transfer characteristic has two regions. For small input signals it has a nominal gain of 10dB, at large signals the gain falls to unity (see Fig.7). This is achieved by operating a limiting amplifier and a unity gain amplifier in parallel (see Fig.3). TR1 and TR4 comprise the long tailed pair limiting amplifier, the tail current being supplied by TR5, see Fig.2. TR2 and TR3 form the unit gain amplifier the gain of which is defined by the emitter resistors. The outputs of both stages are summed in the 300Ω resistor and TR7 acts as an emitter follower output buffer. Important features are the amplitude and phase linearity of the unity gain stage which is achieved by the use of 5GHz transistors with carefully optimised geometries.

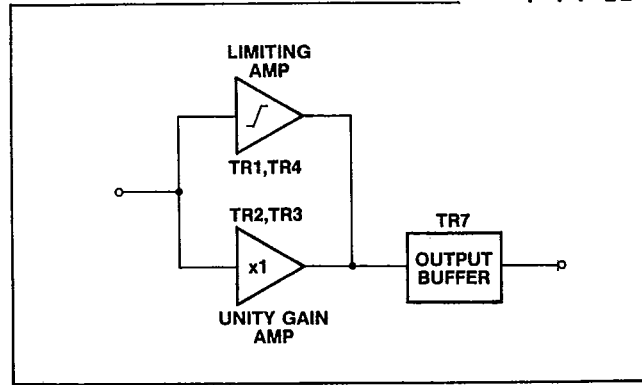


Fig.3 Block diagram

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):

Test circuit Fig.4.

Frequency 60MHz

Supply voltage 9V

Temperature (ambient) = -55 °C to +125 °C

V_{IN} = -30dBm

Characteristic	Value		Units	Sub group	Conditions
	Min.	Max.			
Small signal voltage gain	7.5	12.5	dB	4,5,6	
High level slope gain	-1.2	+1.2	dB	4,5,6	
Upper cut-off frequency	250		MHz	4,5,6	-3dB w.r.t. 60MHz gain
Lower cut-off frequency		10	MHz	4,5,6	-3dB w.r.t. 60MHz gain
Supply current		25	mA	1,2,3	
Phase change with input amplitude	-2	+2	Degrees	4	V _{IN} = -30dBm to +10dBm
Phase change with input amplitude	-4	+4	Degrees	5,6	V _{IN} = -30dBm to +10dBm

NOTES

- Subgroups 7, 8, 9, 10, 11 are not required.

OPERATING NOTES

Supply Voltage Options

An on chip resistor is provided which can be used to drop the supply voltage instead of the external 180Ω shown in the test circuit. The extra dissipation in this resistor reduces the maximum ambient operating temperature to 100 °C. It is also possible to use a 6V supply connected directly to pins 1 and 2. Problems with feedback on the supply line etc may occur in this connection and RF chokes may be required in the supply line between stages.

Layout Precautions

The internal decoupling capacitors help prevent high frequency instability, however normal high frequency layout precautions are still necessary. Coupling capacitors should be physically small and be connected with short leads. It is most important that the ground connections are made with short leads to a continuous ground plane.

Low Frequency Response

The LF response is determined by the on chip capacitors. It can be extended by extra external decoupling on pins 5 and 1.

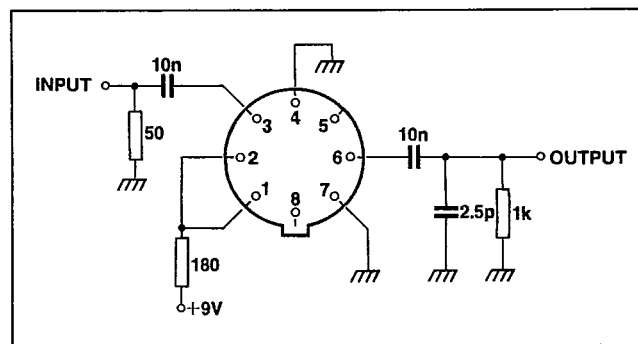


Fig.4 Test circuit

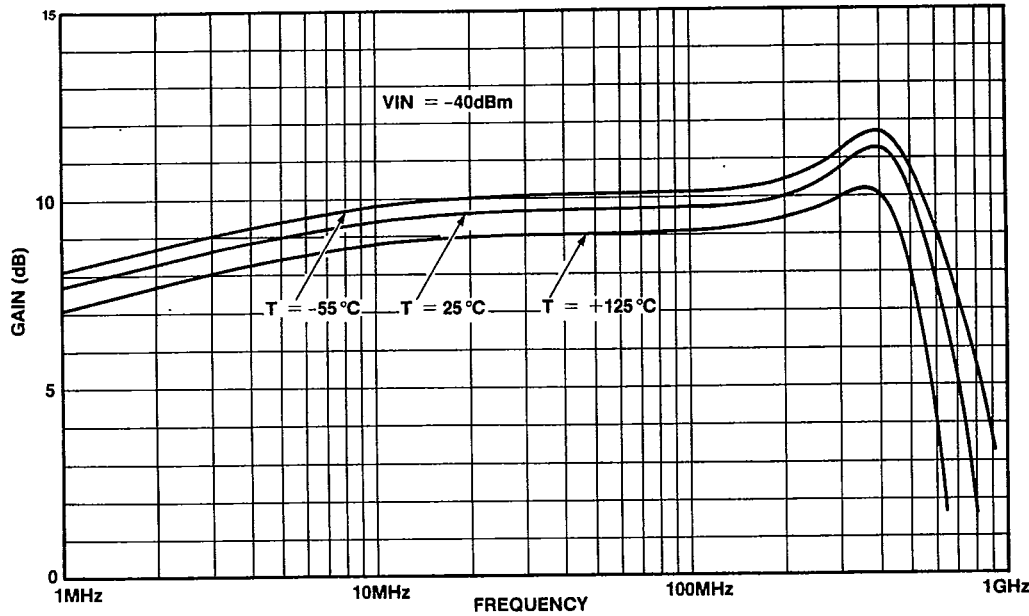


Fig.5 Small signal frequency response

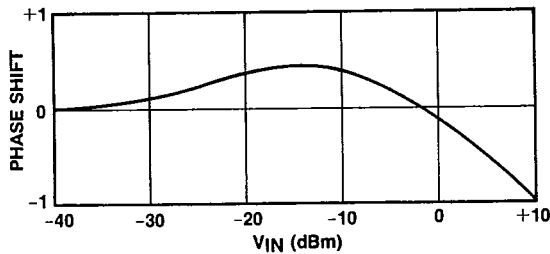


Fig.6 Phase v. input

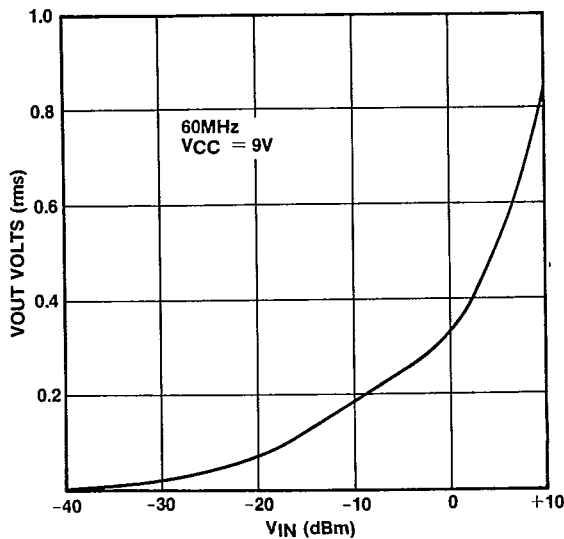


Fig.8 Transfer characteristics logarithmic input scale

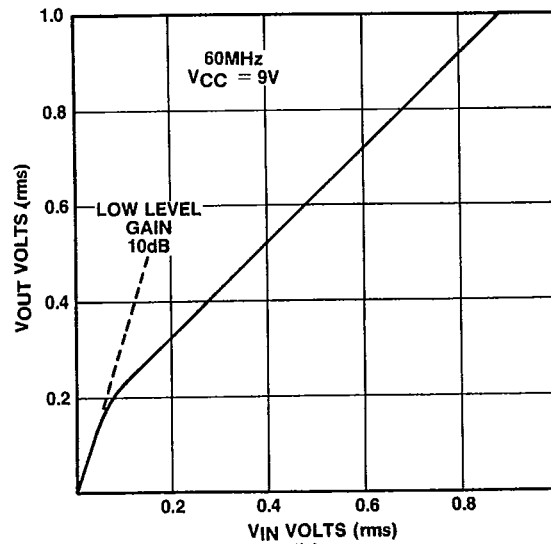


Fig.7 Transfer characteristics linear plot

TYPICAL APPLICATIONS - 6 STAGE LOG STIP

Input log range 0dBm to -70dBm
Low level gain 60dB (-70dBm in)
Output dynamic range 20dB
Phase shift (over log range) $\pm 3^\circ$
Frequency range 10 - 200MHz

The circuit shown in Fig.9 is designed to illustrate the use of the SL531 in a complex strip. The supply voltage is fed to each stage via an external 180 Ω resistor to allow operation to 125 $^\circ$ C ambient. If the ambient can be limited to +100 $^\circ$ C then the internal resistor can be used to reduce the external component count. Interstage coupling is very simple with just a capacitor to isolate bias levels being necessary. No connection is necessary to pin 5 unless operation below 10MHz is required. It is important to provide extra decoupling on pin 1 of the first stage to prevent positive feedback occurring down the supply line. An SL560 is used as a unity gain buffer, the output of the log strip being attenuated before the SL560 to give a nominal 0dBm output into 50 Ω .

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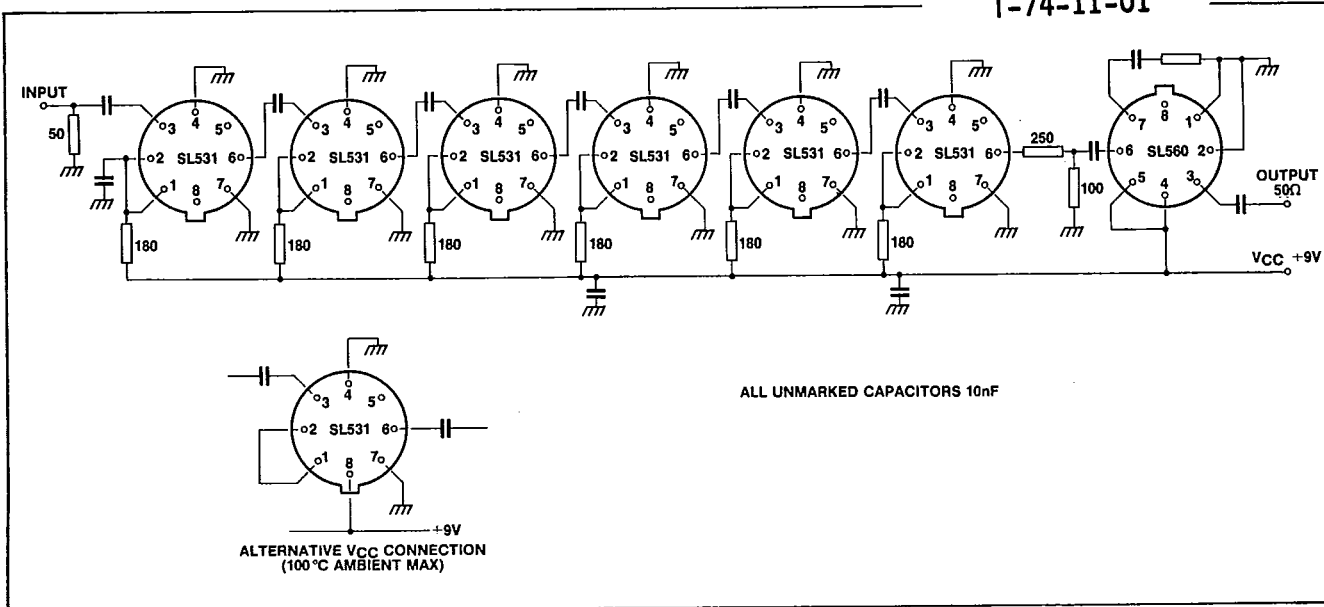


Fig.9 Circuit diagram 6 stage strip

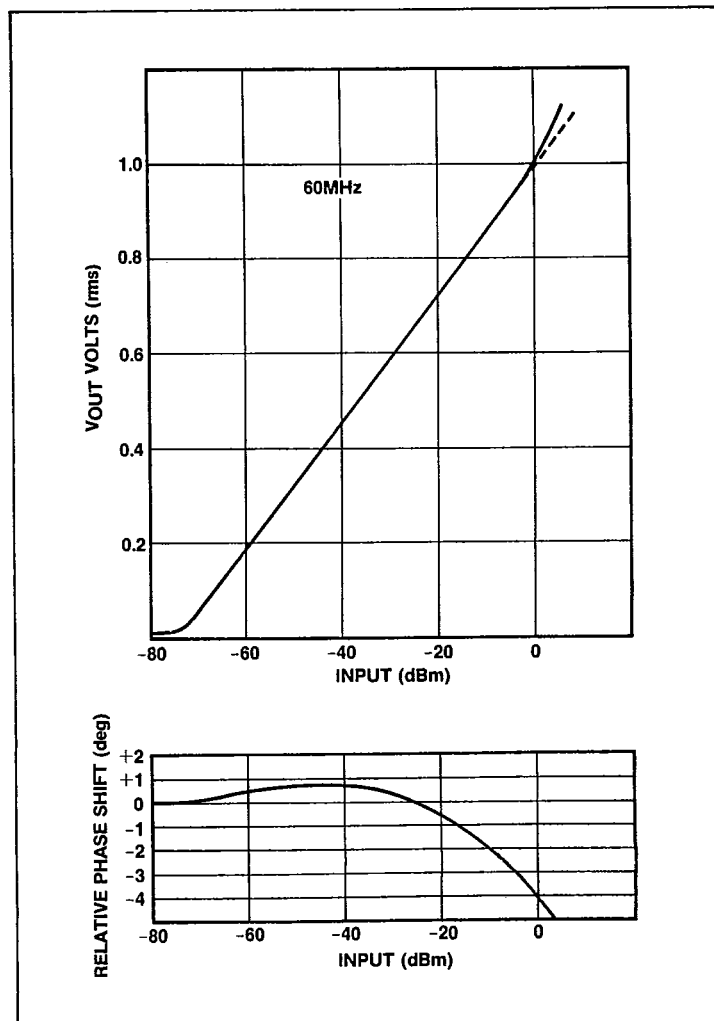


Fig.10 Transfer function of log strip

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ADDITIONAL INFORMATION

The following parameters are typical for the SL531AC at +25°C, but not tested.

Parameter	Value	Test conditions
Input impedance	2.5pF parallel with 1k Ω	f = 10 - 200MHz
Output impedance	15 Ω series with 25nH	

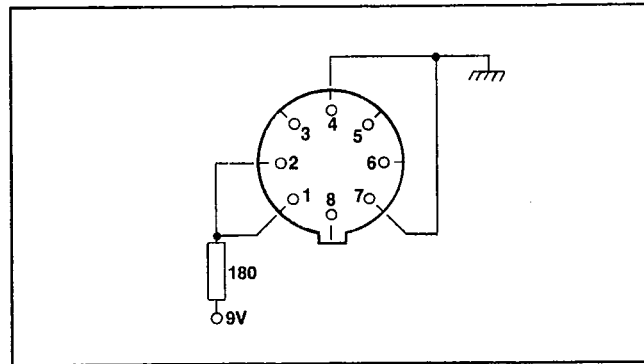
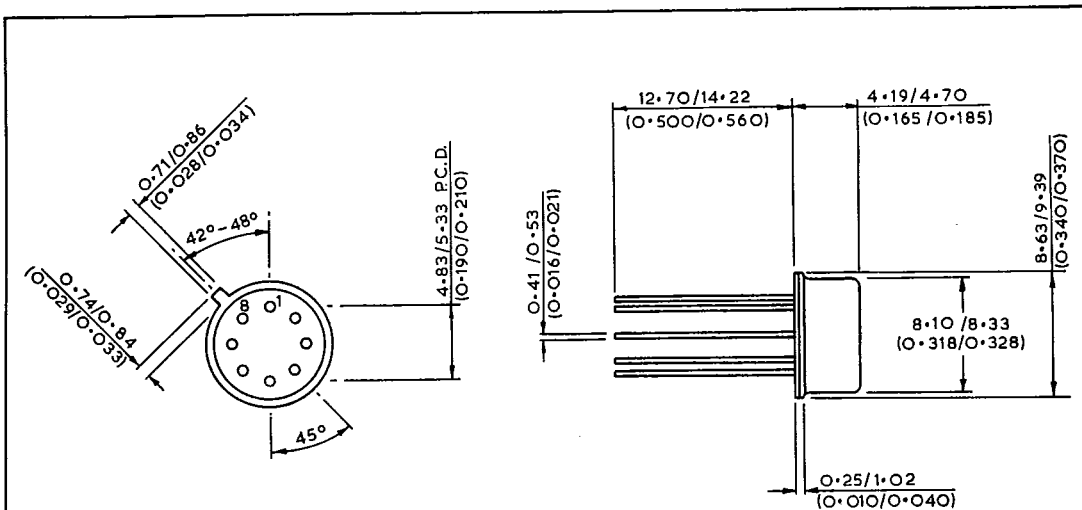


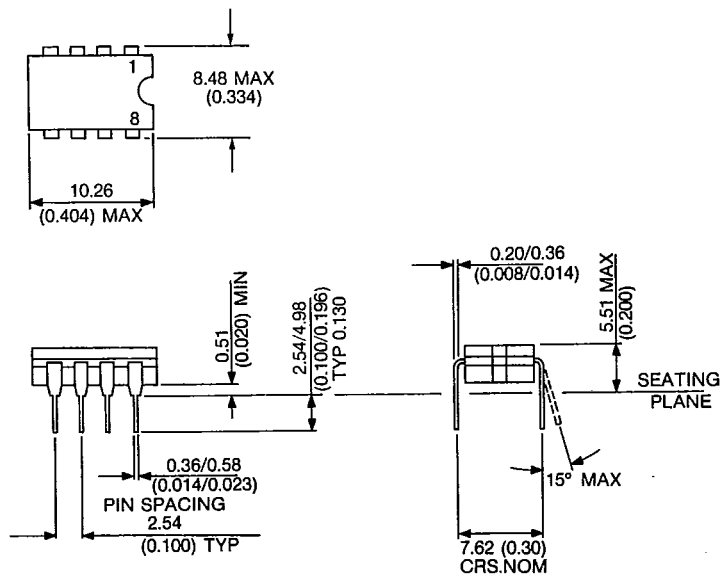
Fig.11 Burn-in/life test circuit
NOTE: PDA is 5% and based on sub groups 1 and 4.

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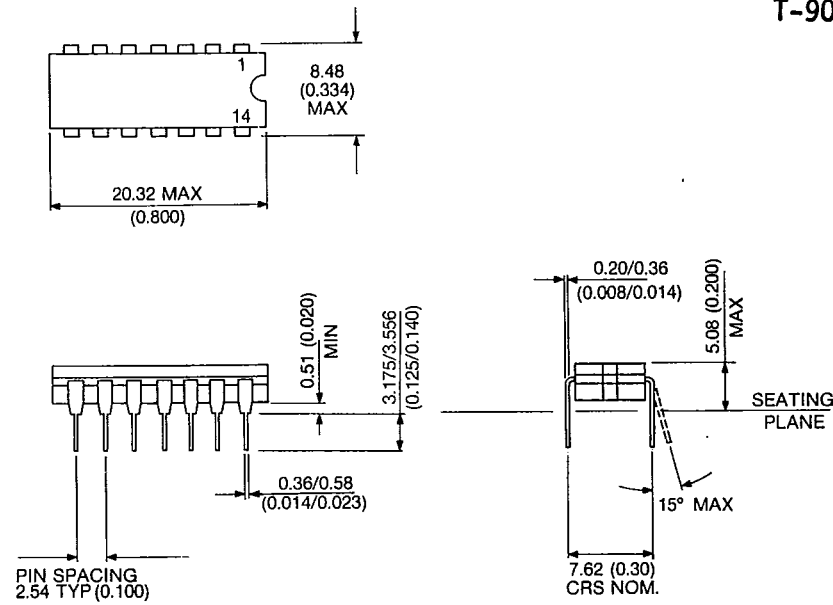
NOTE: This package does not have 'standoff' and therefore does not conform fully to MIL-M-38510F case outline A-1.

8-LEAD METAL CAN

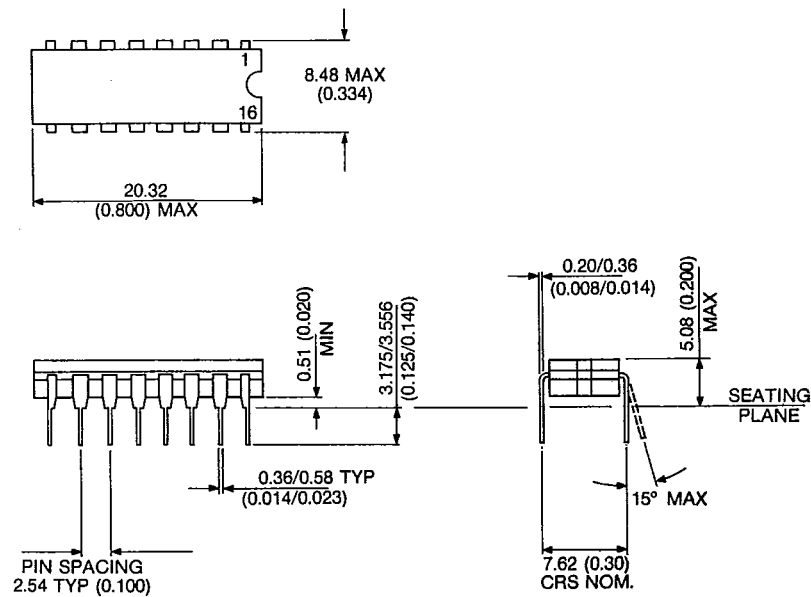


8 LEAD CERAMIC DIL Cerdip - DG8

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14 LEAD CERAMIC DIL Cerdip - DG14



16 LEAD CERAMIC DIL Cerdip - DG16

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