AN45

Tuned Amplifier Application for the SL6140

Application Note

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The SL6140 wideband AGC amplifier, when used in a 50Ω system, has a gain of 15dB. By tuning, or matching, the inputs and outputs of the device the gain can be increased. This produces a higher gain amplifier that will work over a limited bandwidth. The bandwidth of the amplifier depends upon the Q factor of the tuned/matching circuits used.

Fig. 1 shows a single ended amplifier with tuned input and output networks.

The input circuit consists of a parallel LC network connected across the differential inputs. The input signal is applied to one input, via a coupling capacitor (C1), the other input being decoupled. The coupling capacitor also forms part of the impedance matching network, matching a 50Ω source with the high impedance of the device (see Smith chart, Fig. 3).

$$f = \frac{1}{2\pi \frac{\sqrt{L \times C \times C1}}{\sqrt{(C + C1)}}}$$

The tuned frequency is given by the following equation:

The output circuit consists of a parallel LC network connected from one of the open collector ouputs of the device to V_{CC}. The coupling capacitor (C2) and LC network transforms the 50Ω load to a high impedance load for the open collector outputs of the device, hence improving the gain.

By adjusting C1 and C2 the gain can be optimised, but if too high an impedance is seen by the input or output of the device the circuit may oscillate. L1 and L2 are adjusted to set the tuned frequency.

The high gain is achieved at the expense of bandwidth, so for maximum gain the matching network should be designed to provide the minimum bandwidth necessary for the particular application.

An alternative method of tuning the output of the device is to transformer-couple to the 50Ω load as shown in Fig. 2. The primary winding is connected across the outputs (a centre tap providing V_{CC}) and resonated at the required frequency with a capacitor. This circuit has a 6dB improvement of gain over the previous circuit as both outputs are used.

PCB LAYOUT

For best performance a ground plane should be used with 50Ω source and load. Also the matching network and decoupling capacitors should be placed as close to the device as possible.

If a very high gain, low bandwidth amplifier is required the addition of some shielding between input and output may be necessary to prevent oscillation.

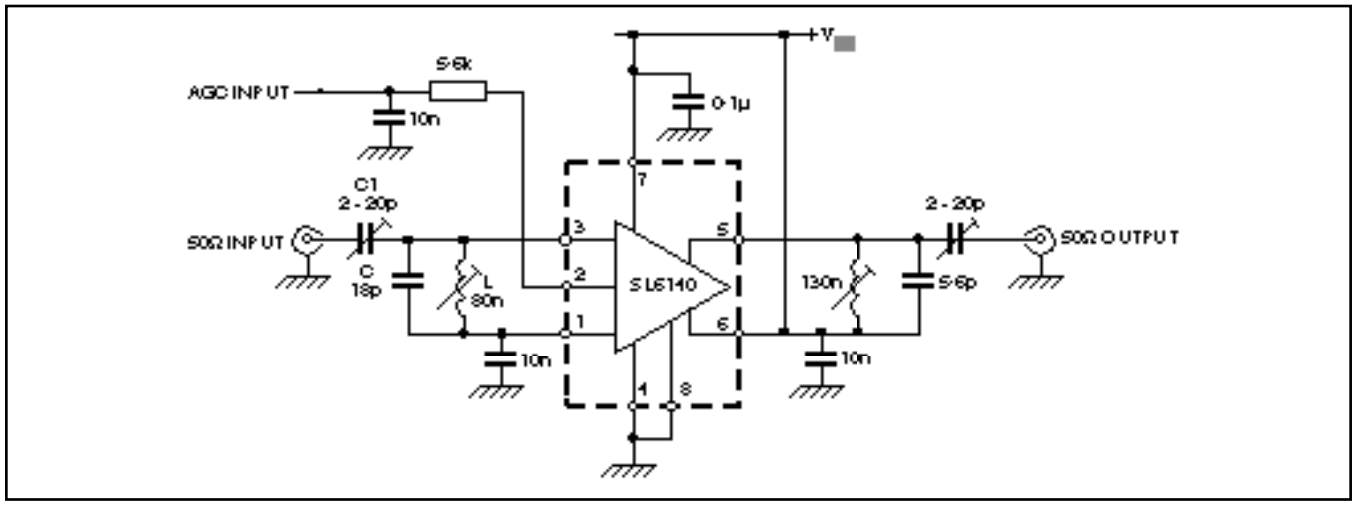

Fig. 1 A 100MHz tuned amplifier application with 35dB power gain (CM pinout)

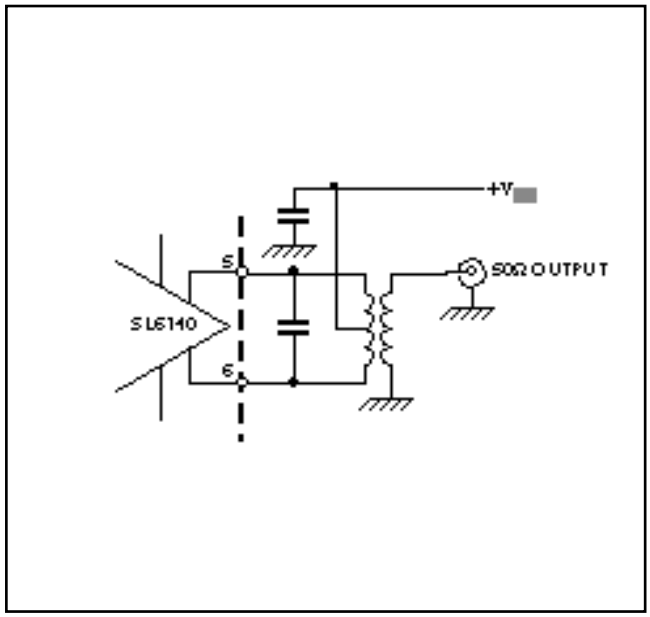

Fig. 2 Differential tuned output

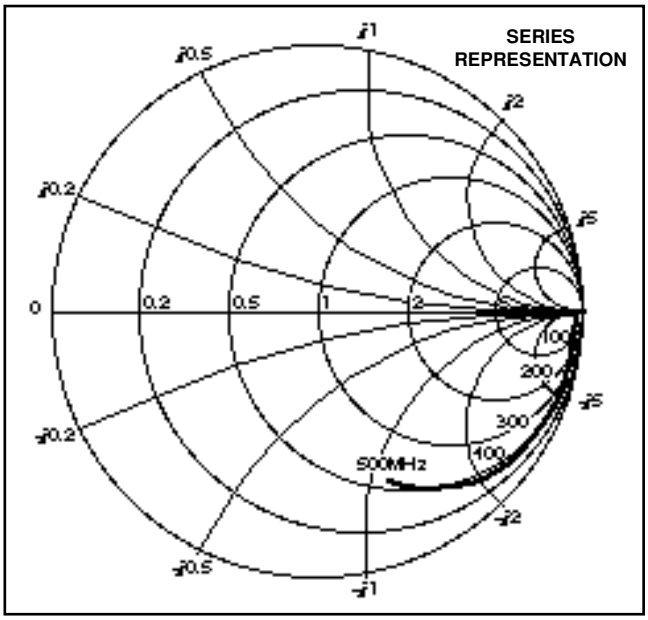

Fig. 3 Input impedance of SL6140 (50Ω normalised)

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