Designing Oscillators with low 1/f-noise

One key parameter of oscillators is the purity of the oscillator signal. While harmonics can be filtered out by a simple lowpass-filter, the spurious around the signal have to be minimized by construction of the oscillator.

For low 1/f noise, the following items have to be taken into account:

- High Q-factor of the resonator
- Low 1/f-noise of the used active components

High Q-factor is equivalent to low losses in all parts. The following details should be checked:

- Q of resonator device
- series resistance of capacitors
- series resistance of tuning diode
- loss of printed circuit board

Low 1/f noise of the transistor in the oscillator is very important, because the 1/f noise appears as sideband noise around the carrier frequency of the oscillator output signal.

There are some basic rules to select the right transistor for an optimized design:

- The best oscillator transistor is a device with the lowest possible $f_T$.
  A good rule of thumb is: $f_T \leq 2 \times f_{osz}$.
- The 1/f noise is directly related to the current density in the transistor. Large transistors with high $I_{c,max}$ used at low currents have best 1/f performance. Please take into account, that the $f_T$ drops down at low currents and the capacitances of a large transistor are higher.
Published by Siemens AG Bereich Bauelemente, Vertrieb, Produkt-Information, Balanstraße 73, D-81541 München

© Siemens AG 1996. All Rights Reserved

As far as patents or other rights of third parties are concerned, liability is only assumed for components per se, not for applications, processes and circuits implemented within components or assemblies.

The information describes the type of component and shall not be considered as assured characteristics.

Terms of delivery and rights to change design reserved.

For questions on technology, delivery and prices please contact the Offices of Semiconductor Group in Germany or the Siemens Companies and Representatives world-wide (see address list).

Due to technical requirements components may contain dangerous substances. For information on the type in question please contact your nearest Siemens Office, Semiconductor Group.

Siemens AG is an approved CECC manufacturer.