CONFIGURAZIONI DI MIXER

(da Vendelin et al : MW Circuits Design)

The concept of the switching mixer model can also be applied to FETs when used as voltage-controlled resistors. In this mode, the drain-to-source resistance can be changed from a few ohms to many thousands of ohms simply by changing the gate-to-source potential. At frequencies below 1 GHz, virtually no pump power is required to switch the FET, and since no dc drain bias is required, the resulting FET mixer is passive. However, as the operating frequency is raised above 1 GHz, passive FET mixers require LO drive powers comparable to diode or active FET designs.

Regardless of the nonlinear or switching elements employed, mixers can be divided into several classes: (1) single ended, (2) single balanced, or (3) double balanced. Depending on the application and fabrication constraints, one topology can exhibit advantages over the other types. The simplest topology (Fig. 11.4*a*) consists of a single diode and filter networks. Although there is no isolation inherent in the structure (balance), if the RF, LO frequency, and IF are sufficiently separated, the filter (or diplexer) networks can provide the necessary isolation. In addition to simplicity, single-diode mixers have several advantages over other configurations. Typically, the best conversion loss is possible with a single device, especially at frequencies where balun or transformer construction is difficult or impractical. Local oscillation requirements are also minimal since only a single diode is employed and dc biasing can easily be accomplished to reduce drive requirements further. The disadvantages of the topology are (1) sensitivity to terminations, (2) no spurious response suppression, (3) minimal

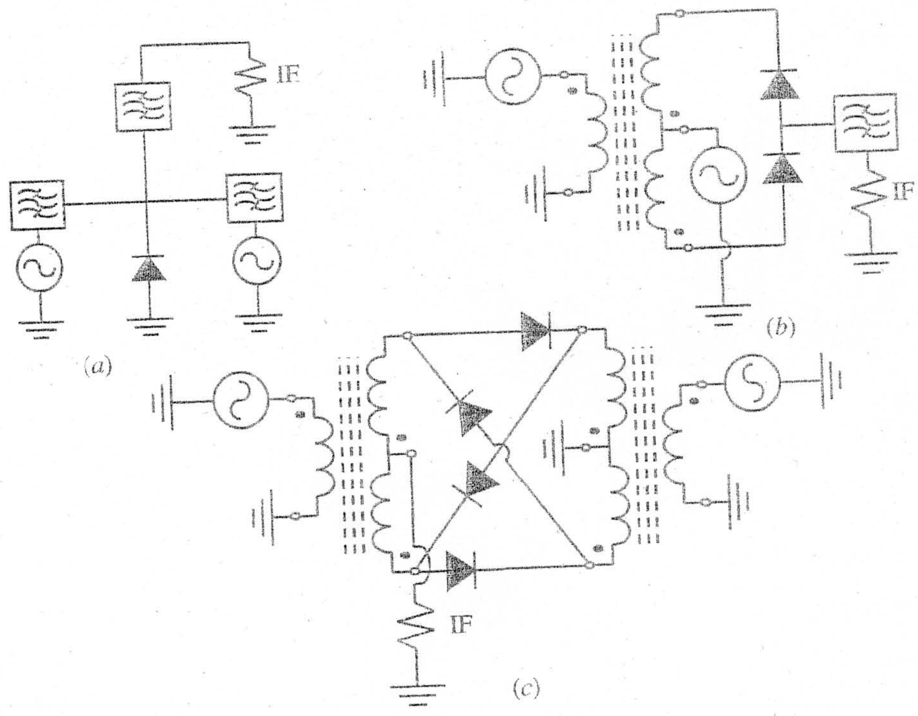

FIGURE 11.4 Common mixer topologies: (*a*) single ended; (*b*) single balanced; (*c*) double balanced.

TABLE 11.1 Mixer Topology Performance Considerations

Parameter	Single Ended	Single Balanced	Double Balanced
Conversion gain	High	Moderate	Low
Spurious performance	None	Moderate	High
Dynamic range	Low	Moderate	High
Isolation	None	Moderate	High
Pump power	Low	Moderate	High
Complexity	Low	Moderate	High
Bandwidth	Narrow	Wide	Wide

tolerance to large signals, and (4) narrow bandwidth due to spacing between the RF filter and mixer diode.

The next topology commonly used is the single-balanced structure shown in Figure 11.4*b*. These structures tend to exhibit slightly higher conversion loss than that of a single-ended design, but since the RF signal is divided between two diodes, the signal power-handling ability is better. However, more diodes require more LO power. Since the structure is balanced, some isolation between ports is obtained and there is some spurious suppression for RF or LO products, depending on which is balanced.

The double-balanced structure is the topology most commonly employed between 2 and 18 GHz. It exhibits the best large signal-handling capability, port-to-port isolation, and spurious rejection. Alas, double-balanced mixers usually exhibit the poorest conversion loss characteristics and require the most LO drive. However, in strong signal environments such as the EW arena, spurious rejection and large-signal performance usually outweigh the 1 dB or so loss in sensitivity. Some high-level mixer designs can employ multiple-diode rings with several diodes per leg in order to achieve the ultimate in large-signal performance. Such designs can easily require hundreds of milliwatts of pump power. A general performance comparison for various mixer topologies is shown in Table 11.1. It should be noted that these performance traits are quite general and are highly dependent on balun design, diode quality, and operating frequency.

Per maggiori dettagli si veda, ad es.,

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