

layout engineers. Indeed, the layout designer must analyze the circuit in detail in order to select the right layout approach. If he/she had only a netlist to work with, it would be almost impossible for him/her to lay out the circuit to meet all these requirements. A pictorial image of a circuit helps engineers greatly when working with a circuit. This is in fact the main reason why circuit schematics are a must for the layout design of integrated analog circuitry.

Graphics need to be used sensibly, nonetheless. Standard design style rules should be followed by all designers to ensure circuit schematics are easy to read. Standard rules are in fact followed worldwide even though there are no hard and fast guidelines in place for their use. These de facto conventions mean that not only circuit design, but also developed circuits are more easily exchanged and their reuse promoted. (We elaborate on these rules in Sect. 5.2.2.)

We will explore several analog design concepts with an example circuit. A typical and widely used analog circuit is the “bandgap” circuit, which produces a temperature-compensated and supply-voltage independent reference voltage. The circuit schematic for our example is depicted in Fig. 3.4 (left). It contains basic devices and a so-called “Miller opamp” as a function block (subcircuit) which we depict in Fig. 3.5. The opamp is represented in the bandgap schematic as a function block by a (green) triangular schematic icon labeled “moa”. The ports in this Miller opamp schematic (see Fig. 3.5, left) are the pins of the symbol in the bandgap schematic (see Fig. 3.4, left).

The basic device symbols are shown in green in our schematic examples. Assigned to each symbol are: an instance name (blue), device type designation (green), parameters with values for geometrical sizing (brown), and electrical parameters, if applicable. These details can be faded out in the editors to present a more uncluttered view. The net names are written in black beside the pins (red) in our schematic. Nets leading out through ports take their names from the ports (red-brown). Accordingly

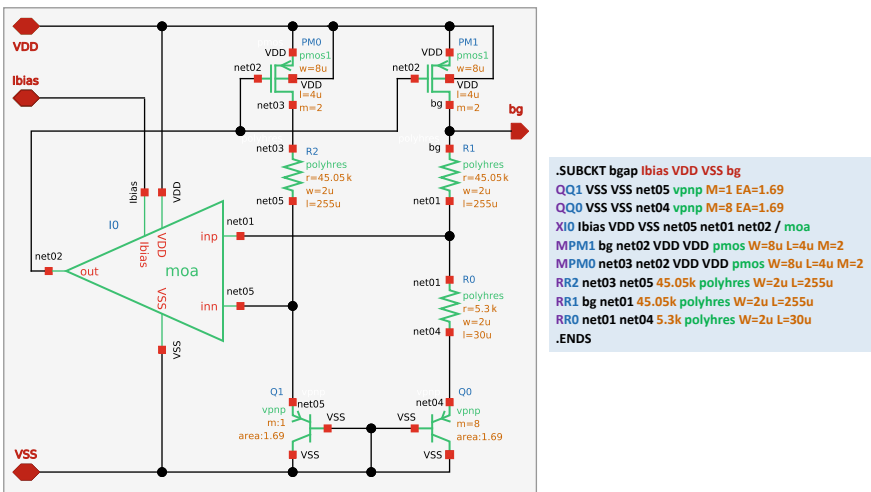


Fig. 3.4 Schematic (left) and netlist (right) of a bandgap circuit