

## XII. TRANSISTOR CIRCUITS

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### A. STUDY OF DEVICES EXHIBITING POWER-GAIN

The aim of this project is to develop a method for the unified treatment of the diverse physical processes that give rise to power-gain in amplifying devices, and to provide certain criteria from which one can predict whether a physical process or the properties of a material can be used to construct a potential power amplifier.

Terminal characteristics and equivalent circuit techniques, in most cases, successfully predict the necessary relations to its external circuitry that a given device must have for the existence of power-gain; they do not describe the physical processes that make the device a potential power amplifier. The need has arisen for a method versatile enough to describe the various physical processes that characterize the internal behavior of the device and its external circuitry in a unified manner.

The investigation of a unifying method based on the principles of irreversible thermodynamics is under way. The recognition of the fact that electrical circuits can be regarded as thermodynamic systems, and that diffusive and ohmic conduction can be treated in a unified manner with the phenomenological relations of irreversible thermodynamics led to a study of the conduction process in semiconductors from this point of view. This work is preliminary to the description of processes that render the transistor a power amplifier.

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