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Abstract

The van der Pauw method to calculate the sheet resistance and the mobility of a semiconductor is a pervasive technique both in the microelectronics industry and in the condensed matter science field. There are hundreds of papers dealing with the influence of the contact size, non-uniformities and other second order effects. In this paper we will develop a simple methodology to evaluate the error produced by finite size contacts, detect the presence of contact resistance, calculate it for each contact, and determine the linear or rectifying behavior of the contact. We will also calculate the errors produced by the use of voltmeters with finite input resistance in relation with the sample sheet resistance.

1.- Introduction

The four-point probe measuring technique is very well known from the beginning of the XX century when Wenner proposed it to measure the earth resistivity[1]. Later Valdes[2] adapted it for semiconductor measurements. The collinear four-point probe has been of great importance for the microelectronic industry. The determination of implantation uniformity over the whole wafer is an example.

The method undergoes an important change with the famous paper by van der Pauw[3] where the author solved the problem of measurements on arbitrary samples by placing four infinitely small contacts on the sample border. Nevertheless, from a theoretical point of view an ideal point contact has infinite resistance, thus to conduct a finite current requires an infinite applied potential and from the experimental point of view it is impossible to place this kind of contact on a sample. For these reasons it is possible to find a great quantity of papers and books [4,5] dealing with the influence of the contact size on the measurement accuracy. Some of the papers address the subject from a mathematical point of view[6] while others use experimental set-ups.[7] The influence of anisotropy[8] or non-uniformities[9] is also a point of concern. Some authors face the problem of inhomogeneities using more than four contacts as