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CCS H80

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 13389-2014

Replacing GB/T 13389-1992

Practice for conversion between resistivity and dopant density for boron-doped, phosphorus-doped, and arsenic-doped silicon

掺硼掺磷掺砷硅单晶电阻率与掺杂剂浓度换算规程

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Standardization Administration of China

Table of Contents

Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules. This standard replaces GB/T 13389-1992 "phosphorus-doped silicon single crystal doped with boron resistivity and dopant concentration in terms of procedures," referring to SEMI MF723-0307 "doped with boron doped phosphorus doped silicon crystal resistivity and dopant concentration in terms of procedures" for the GB/T 13389-1992 revised. This standard compared with GB/T 13389-1992, mainly in the following changes.

--- Increased by formula (5), (6), (7), the dopant concentration of arsenic in terms of resistivity, the resistivity of the boron-doped silicon single hole concentration and conversion Phosphorus-doped silicon single crystal resistivity in terms of electron density formula and the corresponding scope of application;

--- Since all formulas are empirical or experimental results, so this standard test given in accordance with the formula for ease of use To better understand and use these conversion procedures;

--- Increase confounding factors (see Chapter 6);

--- Added Appendix and references. Please note that some of the content of this document may involve patents. Release mechanism of the present document does not assume responsibility for the identification of these patents. The standard equipment by the National Standardization Technical Committee and the semiconductor material (SAC/TC203) and National Semiconductor Equipment and Materials Standards Materials Branch of the Technical Committee (SAC/TC203/SC2) jointly proposed and managed. This standard was drafted. Grinm Semiconductor Materials Co., Ltd., Sichuan Xinguang Silicon Technology Co., Ltd., China Metrology Research Institute, Zhejiang silicon material quality inspection center, Hangzhou Haina Semiconductor Co., Ltd., Zhejiang Jinrui Hong Technology Co., Ltd., Xian Long Silicon-based Materials Co., Ltd. The main drafters of this standard. Sun Yan, Liang Hong, Gao Ying, Lou Chunlan, Zhang, Wang Feiyao, Cao Zi, He Liangen, Zhang Haiying, Zhang Qun community. This standard replaces the standards previously issued as follows:

--- GB/T 13389-1992. Doped with boron doped phosphorus doped silicon crystal and resistivity Dopant concentration conversion procedure

1 Scope

GB/T 13389-2014 is the Chinese national standard on practice for conversion between resistivity and dopant density for boron-doped, phosphorus-doped, and arsenic-doped silicon, in the field of electrical engineering. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 31 December 2014 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and has been in force since 1 September 2015. Classification: ICS 29.045, CCS H80. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This standard specifies the boron doped, phosphorous doped, monocrystalline silicon doped with arsenic conversion between resistivity and dopant concentration between the conversion also applies to the relationship Antimony-doped silicon single crystal, can also be extended to other silicon dopant activation and boron, phosphorus, similar. This standard applies to boron-doped concentration 1014cm-3 ~ 1 x 1020cm-3, the concentration of phosphorus doped 3 x 1013cm-3 ~ 1 x 1020cm-3, doped with arsenic concentration Of 1019cm-3 ~ 6 x 1020cm-3. Dopant concentration of the silicon single crystal doped with boron, phosphorus-doped can be extended to 1012cm-3. This standard can also be used at 23 °C resistivity silicon single crystal from the carrier concentration of the conversion, but does not include arsenic dopant carrier concentration The degree of conversion, or in terms of any other carrier concentration.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 1550 extrinsic conductivity type semiconductor material testing methods

GB/T 1551 silicon single crystal resistivity measuring method

GB/T 4326 extrinsic semiconductor single crystals Hall mobility and Hall coefficient measurements

GB/T 14264 semiconductor material terms

3 Terms and Definitions

GB/T 14264 and defined by the following terms and definitions apply to this document.

3.1 Autocorrelation capacitive error theself-consistencyerrors Resistivity and dopant concentration between the conversion formula or table, which is a variable, fitting the experimental data to derive further variant Volume, when using different variables will produce two complementary formulas, such as formula (1) and (2), the equation (3) and (4). Since these public Formula in mathematics is not completely equivalent, so the use of a formula derived therefrom or form will have a slight difference, the difference is called self Compatibility errors.

4 Method summary

Resistivity and mutual conversion between dopant concentration is based on boron doped phosphorus-doped silicon single crystal of the combined experience between the two data obtained, and Extending it to silicon in terms of having a similar activation energy of the other dopant, according to the same method also gives the resistivity and carrier concentration of relationship. The standard terms of the relationship expressed as a formula in the form of curves and tables, please pay special attention to the application of different formulas applying Fan Wai and the corresponding error.

Note 1. This standard is doped with boron, phosphorus-doped conversion Thurberetal1,2,3 initially based on data in the (3 x 1013cm-3 ~ 1 x 1020cm-3) of the phosphorus-doped silicon single Obtained crystal and (1014cm-3 ~ 1 x 1020cm-3) of the boron-doped silicon single crystal. Phosphorus number of data samples based on the two block Esaki and Miyahara

4 It is, Fair and phosphorus diffusion Tsai5 sample data is used to expand the data point to 1020cm-3 or more. In 1012cm-3 or less increased dotted line