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功率器件稳态温度预测的非稳态测试及精度分析

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Unsteady Test for Steady-state Temperature Prediction of Power Devices and Accuracy Analysis

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摘要 结合功率器件非稳态导热的温度变化规律,采用非稳态的测试方法,对功率器件在不同条件下得到的时间常数及稳态温度的预测精度进行了测试和分析;并以此为依据,提出了一种综合利用功率器件升温及降温曲线,从而有效降低功率器件测试温升幅度的方法。实验及分析结果表明,在给定5%的误差范围内,单独采用温升测试数据对稳态温度进行预测时,温升测试幅度需达到总温升的70%左右。而综合利用升温及降温阶段的测试数据时,温升幅度可以降低至40%左右,对应的温升测试时间也缩短为前者的1/2。从而可以有效提高功率器件的热测试效率,并尽可能降低测试对器件造成的损害。

关键词: 非稳态导热 功率器件 稳态温度 非稳态测试 精度分析

Abstract: Combined with the temperature variation laws of power electronic devices in unsteady-state heat conduction, time constant and the prediction error of steady-state temperature in different test conditions are measured by unsteady test method. Based on this, a method that using test data both in heating and cooling phases of the power electronic devices is proposed, which can reduce the temperature rise in heating phase effectively. Experimental results show that the temperature increase ratio reaches 70% of the total temperature rise when only using the test data in heating phase to predict the steady-state temperature within the given error of 5%. While, the temperature increase ratio can be reduced to 40% when using the teat data both in heating and cooling phases, and the corresponding test time can be reduced to 1/2 of the former. With the proposed method, the test efficiency can be improved and the impact of testing on the devices can be minimized.

Keywords: unsteady-state heat conduction power electronic devices steady-state temperature unsteady test precision analysis

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