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Title:

Recent advances in resonator-based high temperature SAW-sensing

Abstract:

As a provider of complete systems for passive and wireless sensor systems, Vectron is focusing on resonator-based temperature sensor solutions to benefit from lower system cost as a result of the reader electronic’s lower complexity, compared to delay-line based solutions.This benefit allows handling of low as well as high volume applications as long as the number of sensors per reader is limited.

Vectron uses one reader architecture to support low, medium and high temperature sensor applications. For sensors for low temperature applications, the combination of quartz with an aluminium-based metallization system is used. Products for medium temperature requirements are under development with langasite as substrate material keeping an aluminium-based metallization system. For high temperature applications, a Pt/Al/AlxOy stack has been developed using langasite as substrate material. Details of the build-up of the metal stack will be presented.

Capable search strategies for new quartz substrate cuts with temperature coefficientsoptimised for a target application are widely available today. In contrast to that, the calculation of the temperature behaviour of SAW devices on langasite is highly challenging. The calculation results for material parameters known from literature differ significantly and do not reflect our measurement results well. To improve simulation accuracy, temperaturedependent material parameters have been measured for temperatures up to 600°C. By using these basic wave-propagation parameters as a basis for the calculation of SAW simulation parameters, a significant improvement of simulation accuracy can be reached.

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	Reducing the mechanical coupling between acoustic and interconnect area on the SAW chip through a customized package design results in significant improvement of aging stability of resonator-based sensors. Employing this approach to standard HTCC packages shows a rapid degradation of the package for temperatures above 400°C. The analysis of the failure mechanism and an approach for a promising solution will be demonstrated.

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