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Overcoming thermal noise in non-volatile spin wave logic SOURAV DUTTA, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, DMITRI NIKONOV, SASIKANTH MANIPATRUNI, IAN YOUNG, Components Research, Intel Corporation, Hillsboro, AZAD NAEEMI, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta — Spin waves are propagating disturbances in magnetically ordered materials. To compete as a promising candidate for beyond-CMOS application, the all-magnon based computing system must undergo the essential steps of careful selection of materials and demonstrate robustness with respect to thermal noise/variability. Here, we identify suitable materials and investigate two viable options for translating the theoretical idea of phase-dependent switching of the spin wave detector to a practical realization of a thermally reliable magnonic device by - (a) using the built-in strain in the ME cell, arising from the lattice mismatch and/or thermal expansion coefficient mismatch between the film and the substrate, for compensation of the demagnetization, and (b) using an exchange-spring structure that exhibits a strong exchange-coupling between the ME cell and PMA SWB and provides a modification of the energy landscape of the ME cell magnet. A high switching success and error-free logic functionality can be ensured if the amplitude of the detected spin wave ($< \theta >$) remains higher than a threshold value of around 6^o and the detected phase falls within the window from 280^o through 0 to 20^o or from 100^o to 200^o with a maximum allowable ϕ range of around 100^o.

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