

Existing reliability methodology by testing discrete devices may not be enough for predicting the product reliability performance during the advanced technology development. Thus, not only using discrete devices, TSMC introduces ring oscillators (ROs) and a circuit block de-embedded from ARM CPU to test its 10nm and 16nm HK/MG FinFET technology reliability robustness. Timing delay shift in ROs after different stressing is used as an index to study the process impact. The CPU circuit block show underdrive operation is more prone to aging than overdrive operation and that speed degradation is more sensitive to AC stress than DC stress. The proposed timing characterization on ROs and CPU circuit blocks is useful in the technology early development stage.

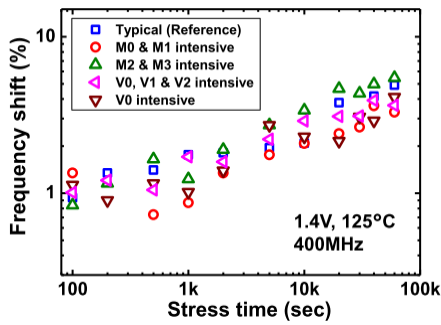


Fig. A. Time evolution of RO frequency drift with different BEOL loading. The degradation is suspected due to EM-induced metal R increase.

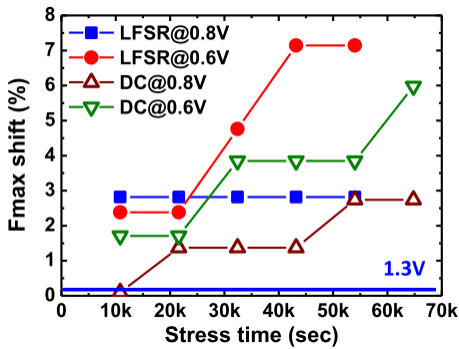


Fig. B. Underdrive operation (0.6V) of an ARM CPU circuit block is more prone to aging than overdrive operation (0.8V).

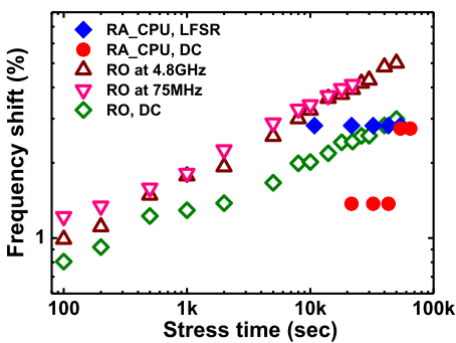


Fig. C. Frequency shift of the CPU circuit block is more sensitive to AC stress than DC stress.