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Large Random Telegraph Signal noise in Small Silicon CMOS Transistor Structures[1] GANGYI HU, MARK LEE, Univ of Texas, Dallas, CLINT NAQUIN, HAL EDWARDS, KENNETH MAGGIO, Texas Instrument — We report observation of random telegraph signal (RTS) noise with unusual large percentage magnitude in the source-drain current (I_{DS}) of very small channel area (<0.05 μm^2) Si metal-oxide-semiconductor field-effect transistors (MOSFETs) at low temperature. The relative current fluctuation magnitude ($\Delta I_{DS}/I_{DS}$) and switching rate have been studied as functions of bias, time, and temperature. RTS is normally explained by fluctuations in both density and mobility due to a single carrier captured or emitted by a trap defect in the gate oxide when biased near the threshold voltage. This mechanism leads to a $\Delta I_{DS}/I_{DS}$ of typically 1-5% in Si MOSFET structures. We observe a nearly perfect two-level RTS with a $\Delta I_{DS}/I_{DS}$ as high as 70%, while the switching rate gradually decreases over time scales of ∼1 hour at 15 K. This result may not be consistent with the trapping and detrapping process of one carrier. We speculate that our observed RTS could be due to a slow irreversible change in trap position that ultimately leads to no carrier being captured by a trap.

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