Closing the Loop: Advancing Circularity in Semiconductor Chips and Chip-integrated Components

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Growing concern over the environmental impacts of semiconductor manufacturing and the increasing disposal rates of chip-integrated products have brought renewed focus to improving sustainability across the microelectronics sector. The Circular Economy presents a compelling framework to shift from traditional linear production models toward restorative and regenerative systems. Applying circular principles to the semiconductor industry holds significant promise for advancing sustainability throughout the lifecycle of chips—from manufacturing to use and end-of-life (EoL) management.

This presentation will explore ongoing efforts to identify the requirements for enabling circular resource flows in semiconductor chips and chip-integrated microelectronic components and subassemblies (MCS). It will examine the challenges posed by the industry's highly specialized and fragmented supply chains, which complicate the closure of material loops. The presentation will also highlight emerging initiatives focused on the collection, recovery, and repurposing of EoL MCS for multiple lifecycle applications, along with research assessing the feasibility of chip and component reuse. Finally, it will identify critical intervention points across design, manufacturing, and EoL phases that are essential to supporting a transition toward a more circular and sustainable microelectronics ecosystem.