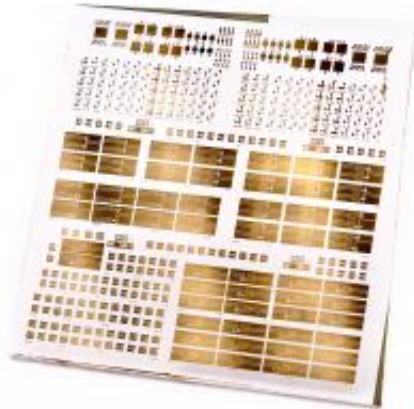


# World-first UHF IGZO Schottky diode presented: Breakthrough achievement towards low-cost passive thin-film RFID tags

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Imec's world-first ultrahigh frequency IGZO Schottky diode.

At this week's IEEE International Electron Devices Meeting (IEDM 2012), imec presented the world-first ultra-high frequency Schottky diode based on amorphous IGZO (Indium-Gallium-Zinc Oxide) as semiconductor. This breakthrough achievement will enable the development of thin-film passive UHF (ultra-high frequency) RFID

(radiofrequency ID) tags to replace item-level bar codes.

Passive intelligent item-level RFID tags are ideal for the retail sector and enable more accurate tracking of individual products (i.e. expiration, misplacement, theft, etc). Unlike bar codes which require one-per-one scanning by the reader, UHF RFID-tags could be scanned all together. However, today's UHF silicon-based RFID technology is too expensive for mass-market retail applications. Imec's research aims to dramatically reduce the cost of the entire RFID by combining ultra high frequency (UHF) operation with a thin-film-based technology. UHF [RFID tags](#) have a long reading range (5 to 10 meters) and employ small, printed, low-cost antennas. Compared to Silicon, IGZO based technology has the potential to result in a low-cost solution, since IGZO thin film active devices are fabricated using a cheaper, low-temperature process. This allows the development of chips direct on a plastic foils, such as on the product package. However, IGZO has intrinsically a lower performance than conventional Silicon and other conventional crystalline semiconductors. Therefore, it is a challenge to fabricate ultra-fast active devices based on IGZO.

The diode is the fundamental block in the power supply generator of passive, i.e., battery-less tags. It rectifies the carrier wave captured by the [antenna](#) and feeds the power supply on the tag. IGZO is an amorphous semiconductor with gap states that impede the formation of a stable Schottky barrier, irrespective of the metal used. To achieve a stable Schottky barrier, imec developed specific plasma and anneal treatments that alter the chemistry of the Schottky interface. The resulting IGZO Schottky diodes have a rectification ratio of up to nine orders of magnitude (at +1V and -1V), current densities of up to 800A/cm<sup>2</sup> at forward bias of 1V, and a cut-off frequency of 1.8 GHz. When incorporated in a single stage rectifier, the cut-off frequency is 1.1GHz. The rectifiers are demonstrated to operate at ultra-[high frequency](#) (868MHz) with low losses.

This achievement, together with imec's recent demonstration of a functioning bidirectional thin-film RFID circuit (at ISSCC2012), are critical research development steps towards the realization of intelligent item-level tagging with broad implementation opportunities in the retail sector.

Provided by IMEC

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