I-Fuse™ – OTP in ON Semiconductor 0.18um BCD Process (AT4K8O180GN0AA)

General

I-Fuse™ is an innovative method to logically program One-Time Programmable (OTP) memory with "Electro-migration by accelerating wear-out of logic devices". Unlike other Non-Volatile Memory (NVM) programming methods that use "oxide rupture" or "storing charges" techniques that require high voltage for programming, I-Fuse requires no charge pump. I-Fuse has 100x reliability, 10% cell size, and 10% of programming current compared to traditional fuse. I-Fuse is scalable from 700nm to 28nm and below.

The AT4K8O180GN0AA is organized as a 4Kx8 OTP memory with parallel programming mode. This is a kind of non-volatile memory fabricated in 0.18um standard CMOS core logic process. The OTP can be widely used in chip ID, security key, memory redundancy, parameter trimming, configuration setting, feature selection, and PROM, etc.

A disruptive OTP technology

I-Fuse advantages over eFuse & other OTP's: non-breaking scheme

- Non-breaking => less current to program
- Non-breaking => controlled programming => high reliability/temp
- Non-breaking => less damage to fuse => high data security

Key features

- Fully compatible with standard 0.18um CMOS core logic process
- High capacity: 4Kx8 parallel mode
- Low voltage: 1.8V read and 3.6V program
- High speed: 10us program time per bit, and 25ns read
- Asynchronous parallel mode
- One additional row to store any information
- Built-in backup ESD protection
- Built-in test mode to generate pseudo-checkerboard patterns

Unparalleled features for applications

Excelled areas poorly serviced by commercial OTP's

- High temperature (250°C): exceeds 175°C for Automotive Grade 0
- Low Vread (~1.0V): IoT, medical, mobile devices, etc.
- Low Vbreakdown in FINFET & SOI: AP, GPU, IoT, etc.
- Unique high data security: AP, GPU, IoT, STB, RF, etc.
- Low field returns: save costs and company quality reputation

Security features (optional)

- Undetectable program state - programmed fuse or not undetectable under SEM
- Security key - program key in information row, data read out and operated with key registers
- LOCK bits (Tamper resistant)
- US patent granted

Value proposition

- Pure logic, no additional masks or process steps
- Ultra low programming and read voltage for power saving mobile devices
- Faster program time (1~10us) and read access time (<20ns) for high performance applications
- Withstands up to 300°C endurance test, qualified for highest automotive grade
- Highly secure data scheme for DTV, set-top box and GPU, etc.
- Truly scalable and shrinkable for effort-free process migration

Press release

Vanguard International Signs OTP IP License Agreement with Attopsemi Technology (3/30/2015)

Attopsemi's I-Fuse™ OTP provides small size, high reliability, low program voltage, low power and wide temperature range to enable Vanguard's specialty IC wafer business in automotive and IoT applications.

"Attopsemi's I-Fuse™ passed High Temperature Storage (HTS) qualification at 300°C for 3,000 hours on VIS's 0.16um High Voltage process and surpassed the grade at Condition F in JEDEC document JESD22-A103C at 300°C for 1,000 hours. It also exceeds the HTS qualification at 175°C for 1,000 hours in AEC-Q100_Rev H Grade 0 automotive specification." said Jeffrey Lin, Director of Design Service Engineering at Vanguard.

Side note on Attopsemi

Founded in 2010
Patent portfolio over 60 filed, 38 granted