



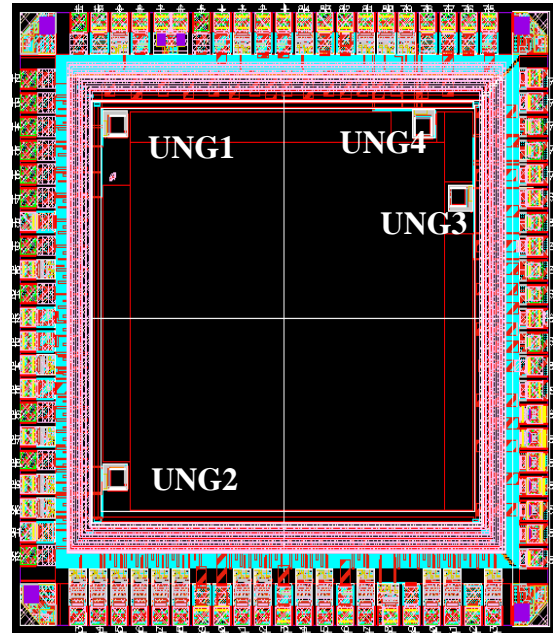
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Introducing the Unique Number Generator (UNG)

National Semiconductor offers an option that can assign a unique number ID to each integrated circuit (IC). This feature enables the end user to verify the IC's authenticity at any point during its use for the entire life cycle of the part. The die-specific ID can be read electrically either at wafer sort or in the field in its final assembled package. The UNG option is available on most of National Semiconductor's technology nodes

The UNG is a 256x1bit Serial Access "Self Programming" ROM

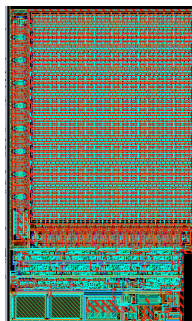
Each instance of the UNG module will program itself with a unique binary number, essentially offering a *Fingerprint* that is unique to each IC



UNG size comparison



Standard Pitch
Wire Bond Pad
102um x 102um



UNG (0.18um)
75um x 118um



Sample Unique Die IDs:

1bf1acd01b9f46a2e0106cff63542a00912c2f17045bab54c40325a34d7ca34a
0ff0e232488eaf033562a8452f9d0696a2ed5dce3417821930e4f33a85601380
bffbc246c134b89d296ada2a4e1602c012ec98f7c3fe951fcb60a1b30facd702

Unique Number Generator Applications:

- **Security**
 - **Eliminate Concerns of Counterfeit Parts**
 - Each IC can be quickly tested to ensure its authenticity
 - Die Level Security
 - Each die has a unique ID that cannot be duplicated
 - Portions of the ID can be used to enable customized product features
- **Anti-Piracy**
 - **Prevents IC designs/functions from being reverse engineered and copied**
 - This feature utilizes UNG and NVM and essentially kills the operation of a chip if the design is copied
- **Die ID**
 - Track Individual Die throughout the Production Test Flow
 - Track Die from Wafer Sort through Final Test
 - Eliminate Test Escapes and determine a Die's Test Flow History
 - Yield Enhancement
 - "Bad Die" and Customer Returns can be tracked all the way back to the physical location of the die on a wafer
 - Track Die for Temperature Characterization and Electrical Guard Banding
- **Improved Trim for Analog Blocks**
 - Track "circuit drift" through assembly

Unique Number Generator (UNG) Electrical Characteristics

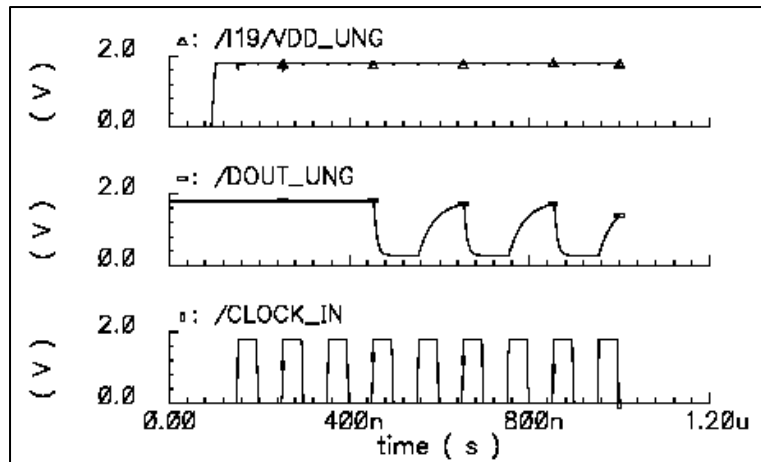
UNG is a 256x1bit Serial Access “Self Programming” ROM

- Bit Cell is constructed using SRAM type cell (UNG_LATCH)

6 pins (EN1B, EN2B, CLK, DOUT, PWR, VSS)

Wide Operating Window (example for 0.18um process)

- PWR = 1.7V +/- 10% (1.2V +/- 10% for 130nm process)
- $-40C < T_j < 125C$
- $DC < Freq < 5MHz$
- READ Time ~0.35ms
- Low Current
 - <10nA quiescent (leakage only)
 - <100uA active



Unique Number Generator (UNG) Testing/Reading



The QuickUSB board uses a Cypress USB microcontroller and an optional FPGA module for expandability

Read the UNG die ID using a PC USB Port option

- Fully functional Windows compatible software program
- Easily up-gradable to new technologies

Unique Number Generator Features:

- The UNG module is easy to implement; in most cases it can be added to existing designs on standard CMOS processes
- Module is delivered as a hard macro block to be used in parallel with existing IO's
- Module is delivered with the full TIG design kit EDA views (gds, cdl, Verilog, Milkyway, Release Notes)
- Two versions of UNG are available
 - **Power Down Read:** UNG module is disabled while IC is in mission mode and Read with IC powered down
 - **Direct Read:** UNG module can be embedded within the IC design and Read during IC mission mode
- The Die ID can be read at Wafer Sort, after Assembly, at Temperature and in the field using a custom test board (USB Die ID Reader Board)
- National can migrate/modify the design depending on the PL's application