

Signal Integrity/Power Integrity for SIP

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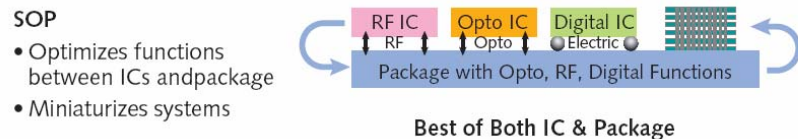
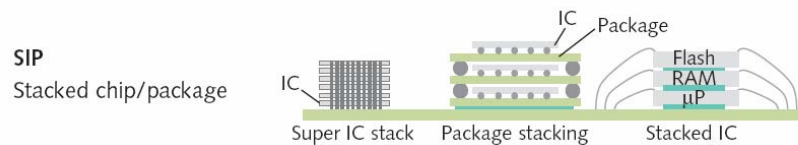
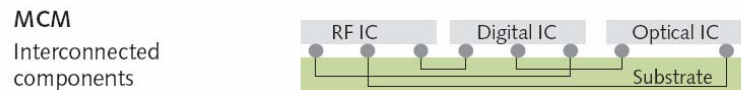
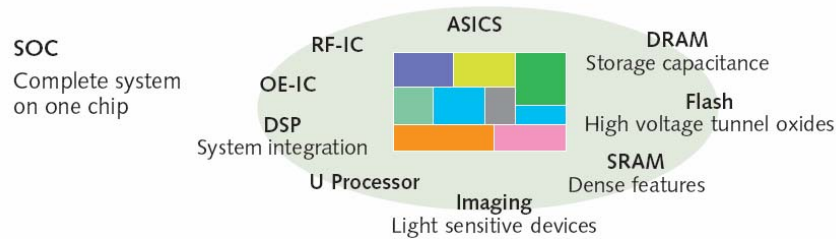


Agenda

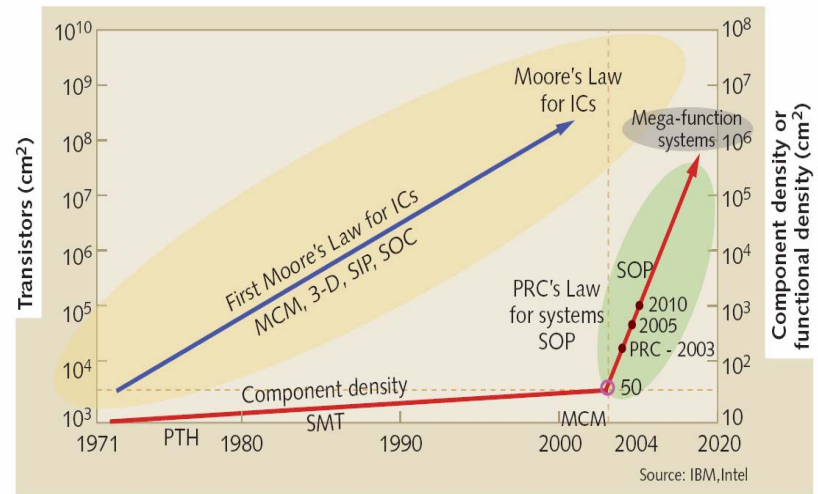
- SIP (System in Package) Wave
- Quick Review
 - Signal Integrity
 - Power Integrity
- Case Study
 - SSN Suppression in Mixed Signal SIP
- Summary

SIP Wave (1)

- Demand on SIP (System in Package)



Source : Advanced Packaging, June 2004



Source : Advanced Packaging, July, 2005

SIP Wave (2)

- Activity in Industry & University

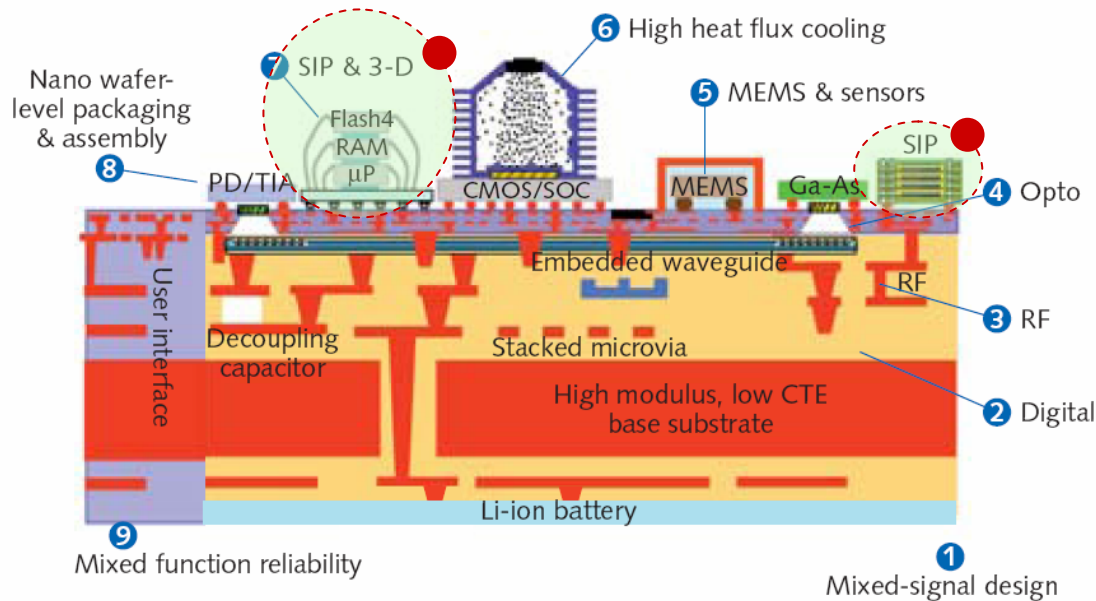
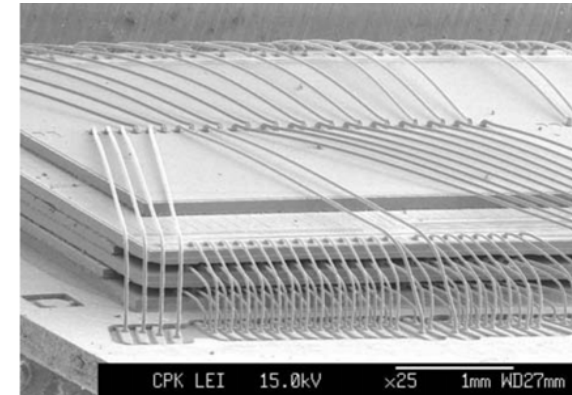
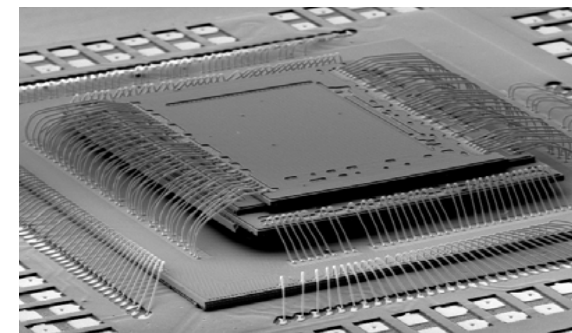


Figure 2. Research focus at PRC to realize SoP.

Source : Advanced Packaging, July 2005



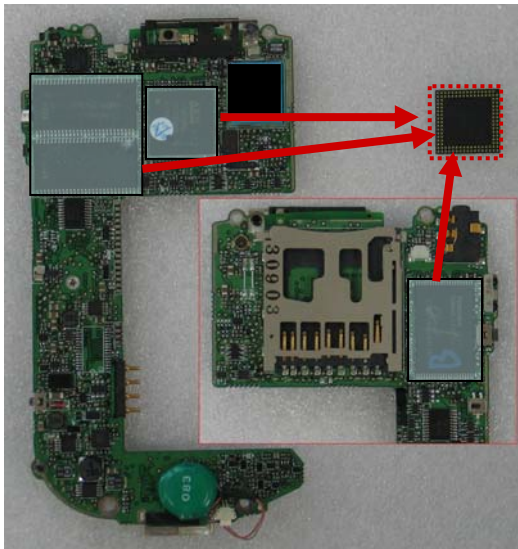
Source : Advanced Packaging, Aug. 2004



Source : IPT, Samsung, Dec. 2005

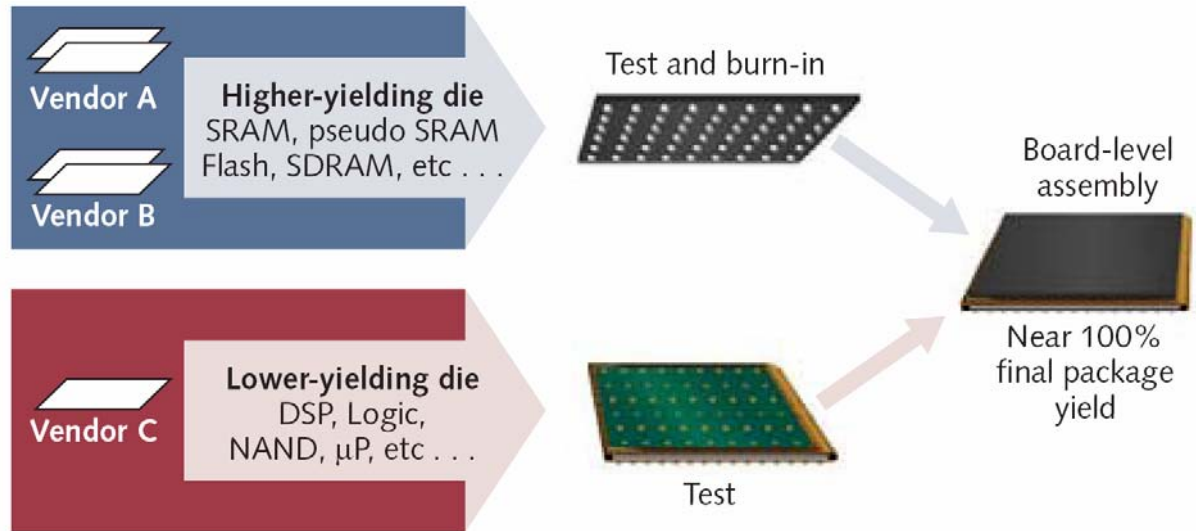
SIP Wave (3)

- POP (Package on Package) : One of SIP



Source : IPT, Samsung, 2005

Small Size Merit

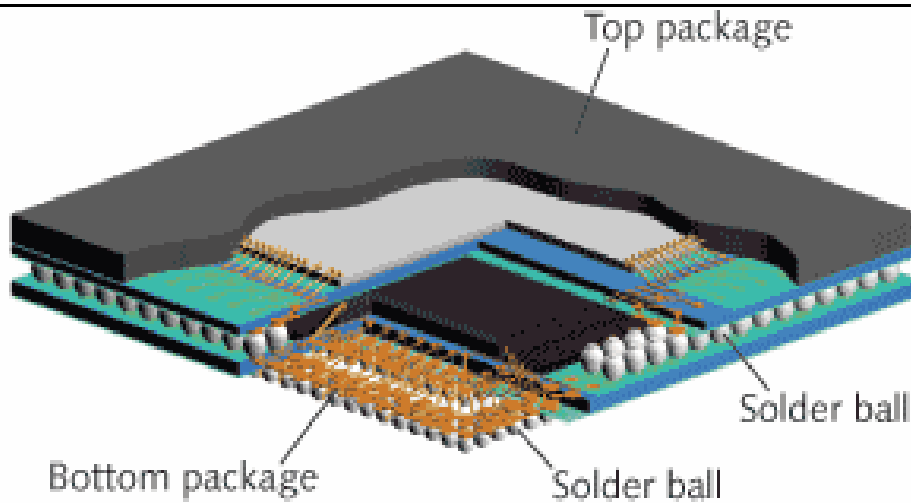


Source : Advanced Packaging, May 2004

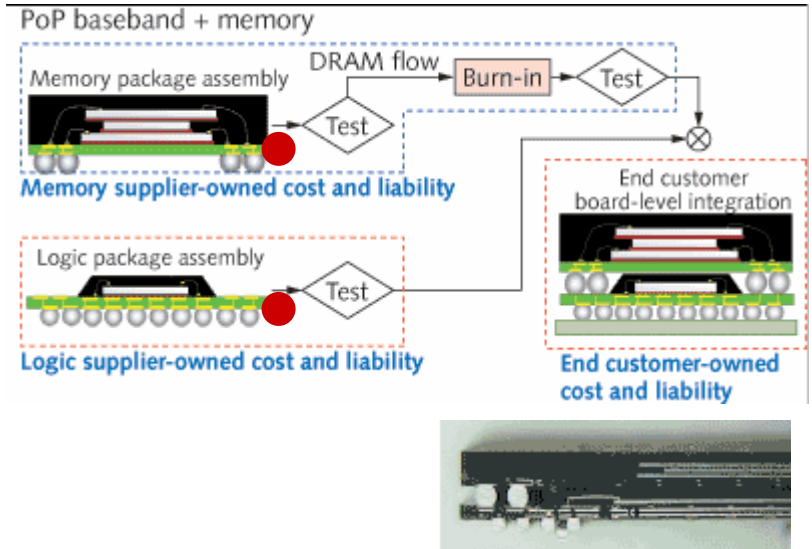
Supply Chain Merit

SIP Wave (4)

- POP (Package on Package) : one of SIP



Source : Advanced Packaging, July 2006



Source : Advanced Packaging, July 2006

SIP Wave (5)

- Demand on SIP : Service/Application Integration on Package

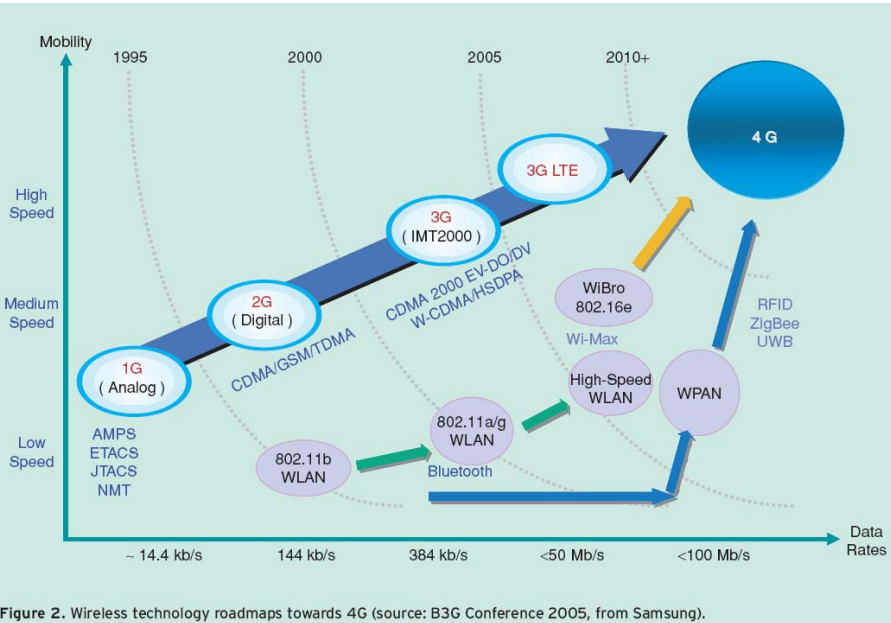
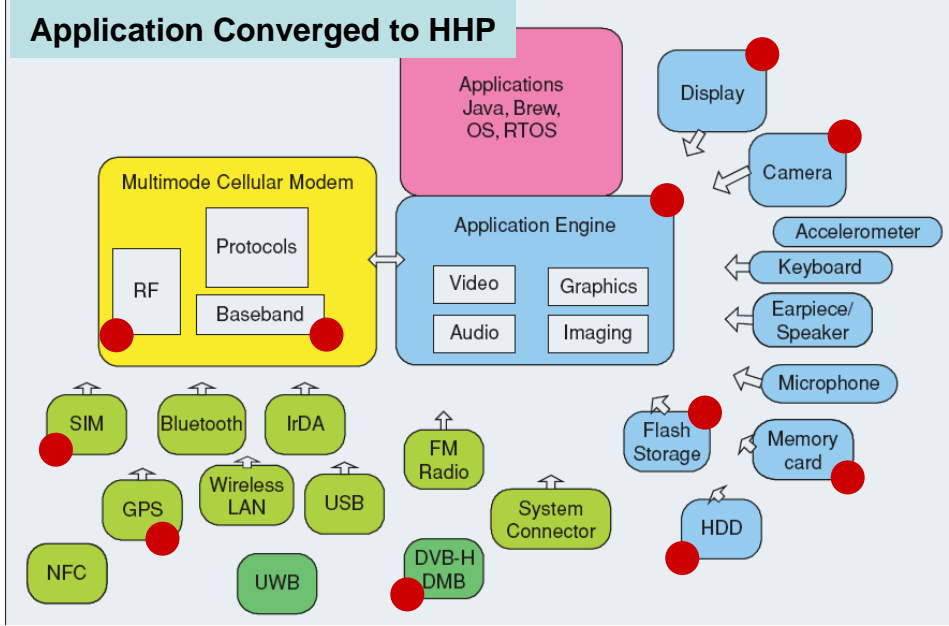


Figure 2. Wireless technology roadmaps towards 4G (source: B3G Conference 2005, from Samsung).

Source : IEEE Circuits and Systems Magazine, 2Q 2006



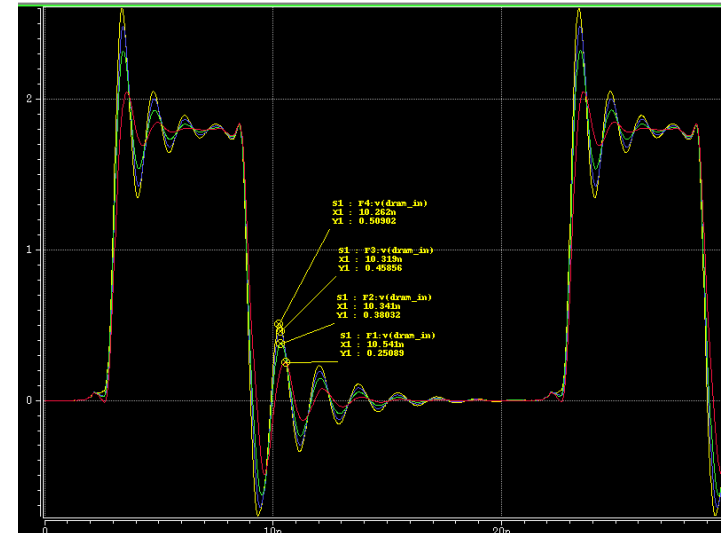
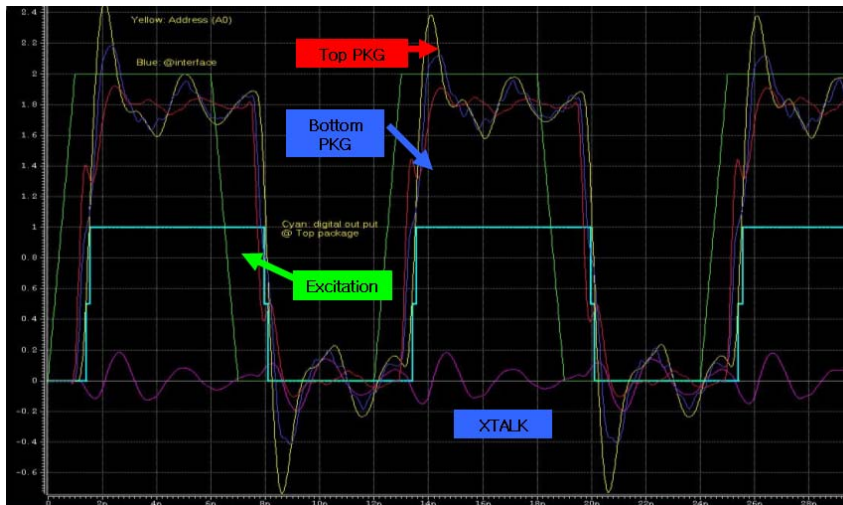
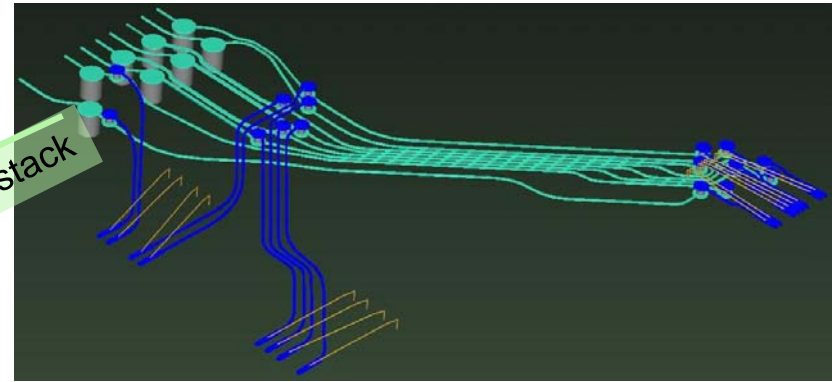
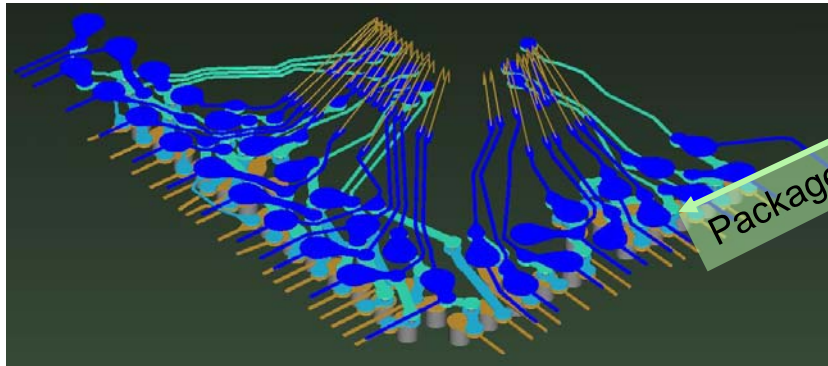
Source : IEEE Circuits and Systems Magazine, 2Q 2006

QR : Signal Integrity (1)

- Signal Integrity Consideration
 - Complex SDN Design on BGA Package
 - High IO / Complex Power Ring on IC
 - Package-level SDN model Using TPA (Top/Bottom for POP)
 - SPICE netlist
 - IO circuit model (ex. IBIS model, SPICE model)
 - Signal Integrity Simulation → Delay, Crosstalk
 - Using SPICE-Like Circuit Simulator

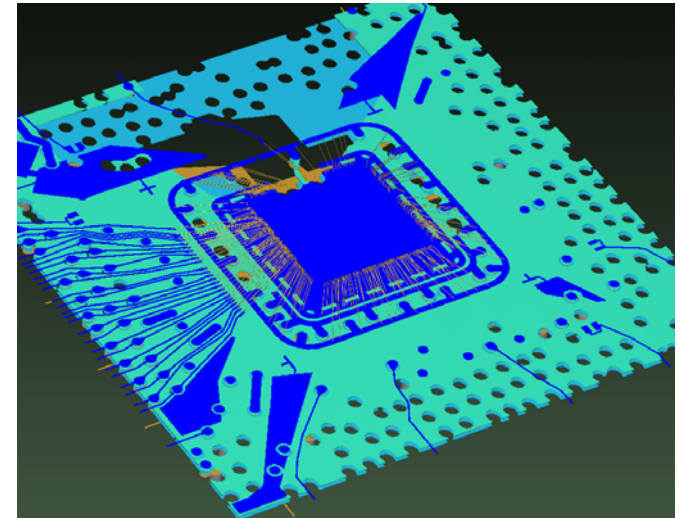
QR : Signal Integrity (2)

- Signal Integrity Simulation



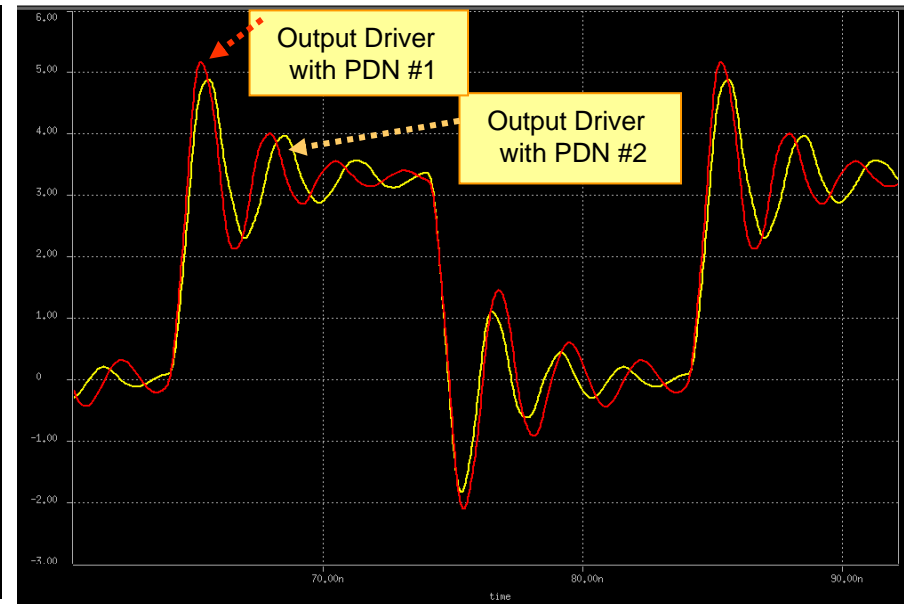
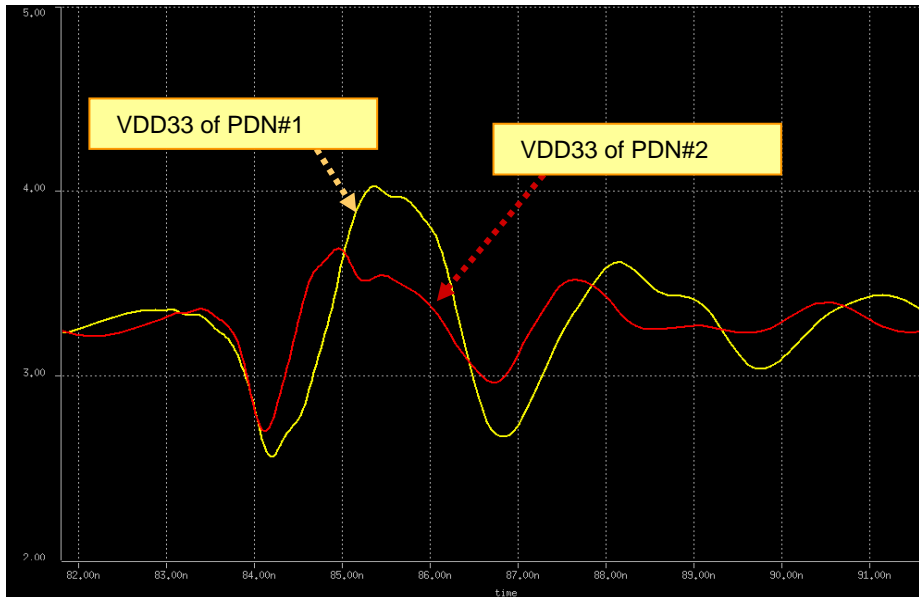
QR : Power Integrity (1)

- Power Delivery Network (PDN) Modeling
 - Complex Power/Ground Plane Design on BGA Package
 - High IO / Complex Power Ring on IC
- Package-level PDN model Using TPA (→ SPICE model)
- IO circuit model with on-chip PDN model
- Power Integrity Simulation
 - Using SPICE-Like Circuit Simulator



QR : Power Integrity (2)

- Example



- Power Supply Fluctuation

– $V(\omega) = j\omega LI(\omega)$ in Freq. Domain &

$$V = L \frac{dI}{dt}$$

in Time Domain

➔ Causing Output Driver Delay

Summary

- Introduction to SIP & Near-Future Trends
- SI Simulation for SIP design
- PI Simulation for SIP design
- RF Noise Blocking
 - Modeling Methodology
 - Unit Cell Approach using HFSS
 - H/W Verification