System Management
Interface Forum

Enabling In-Circuit Programming of Power Solutions via PMBus

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What is In-Circuit Programming?

- Writing of System Configuration Parameters to a Digitally Programmed Device in a populated board
  - Post Assembly
  - Typically part of In-Circuit Test flow

Why Implement In-Circuit Programming?

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- PMBus provides highly flexible programmable Solutions, but how to program “initial” parameters?
  - Bill of Materials (BOM or PIN) Programming
    - Schematic / BOM for programming for “conventional” design flow
    - Board Area, Inventory Control, Component Aging / Contamination
    - Limited Range/Resolution
  - Pre-Assembly Programming
    - Eliminates Board Components, Provides Digital Progamming
    - Additional Cost, Inventory Control, Difficulty of making changes
  - In-Circuit Programming
    - Standard Parts Custom Configured in Test Flow
    - Requires compatible test flow

PMBus Power Management. Defined. 1.3

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Challenges of In-Circuit Programming – Devices

- Slave Addressing
  - Typically still requires some BOM programming, so can't be eliminated
- Non-Volatile Memory!
  - Needed to STORE programming
  - OTP, Stacked OTP, EEPROM, FLASH, FRAM
    - How many times can it be STORED?
    - What is the STORE time?
    - How does the system know when STORE is complete?

Challenges of In-Circuit Programming – Devices

- Power Devices In-Circuit during test flow
  - How do devices “power-up” ?
  - Can they run on standby / auxiliary supplies or do they need main power?
  - Do they need auxiliary power to program their NVM?
- What is the “Default State” of the part?
  - ON_OFF_CONFIG?
    - Control (Enable) Pin? OPERATION command?
  - Can Control be held “off” in programming?
- Powering PMBus
  - Pull-up supply? Devices?
  - Same Power during operation? In-Circuit Test Only?

Challenges of In-Circuit Programming – System

- Communicating with PMBus
  - Interface with normal “HOST” controller?
  - Direct Tester Interface with PMBus?
    - Multi-Master System?
- Multi-Branch / Switched Buses?
  - Interface with each branch?
  - Control switches to interface with all branches?
- In-Field / In Service Updates?
  - Does the system need to support updates?
  - How will updated be supported?

Challenges of In-Circuit Programming – Programming

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- How to Program PMBUS
  - Direct Tester Interface
  - “Hijack” System Host
  - JTAG to PMBUS bridge device
- Source files for Device Configurations
  - Vendor Specific Formats
    - Most Common today, custom manufacturing tool from each vendor
  - Standard Configuration Files!
    - See Bjorn

Challenges of In-Circuit Programming – Programming

- Programming Errors!
  - Verifying Written Data
    - Write, Read?
    - Write, STORE, RESTORE, Read? - Device Rounding on Readback!
    - Write, STORE, Power-Cycle, Read?
  - Handling Long STORE times
    - Program & Wait?
    - Program All, Verify All?

Challenges of In-Circuit Programming – Programming

- Programming Errors (continued)
  - Detecting rejected commands
    - SMB_ALERT & STATUS_CML
  - Detecting bad data
    - Read Back everything?
    - NVM Validation (USER_DATA or MFR_SPECIFIC)
- Responding to Bad Data
  - RESET and Start Over?
  - Selective Restart?

Conclusions

- PMBUS provides a powerful and flexible tool for digitally programming Power Solutions
- Programming of Devices for Initial Power-On has unique challenges and opportunities
- In-Circuit Programming of PMBUS devices offers a number of valuable benefits over alternative programming methods
- Standard “Configuration File” format and programming tools will help.

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Thank you!

Questions?

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