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 device in a populated board
  - Post Assembly
  - Typically part of In-Circuit Test flow
Why Implement In-Circuit Programming?

• 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 Programming
    • Additional Cost, Inventory Control, Difficulty of making changes
  – In-Circuit Programming
    • Standard Parts Custom Configured in Test Flow
    • Requires compatible test flow
Challenges of In-Circuit Programming – Devices

• Slave Addressing
  – Typically still requires some board 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?
Challenges of In-Circuit Programming – System

• Powering PMBus
  – Pull-up supply? Devices?
  – Same Power during operation? In-Circuit Test Only?

• 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?
Challenges of In-Circuit Programming – Programming

• How to Program PMBUS
  – Direct Tester Interface
  – “Hi-jack” System Host

• Source files for Device Configurations
  – Vendor Specific Formats
  – Standard Configuration Files!
Challenges of In-Circuit Programming – Programming2

• 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?
Thank you!
Questions?