



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 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 banches?



Challenges of In-Circuit Programming – Programming

- How to Program PMBUS
 - Direct Tester Interface
 - “Hi-jack” System Host
- Source files for Device Configurations
 - Vender 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?

