The Circle of Life: Using PMBus from Start to Finish

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The Product Life Cycle

- Can PMBus optimize and assist with the Product Life Cycle Goals?
  - Improve design / verification time
  - Field operation & Update
  - Lifetime statistics
  - Total Cost of Ownership Reduction

- Let’s examine each step in detail ...
Design & Validation Cycle

- Let’s compare
  - Traditional (non Bus enabled) Power
  - PMBus enabled Power

![Design & Validation Cycle Diagram]
Schematic Phase: Analog v Digital Power

- Analog Power adds extra components for characterization & validation
- ASIC Vendors don’t provide Ref schematics with validation circuitry
  - Slows schematic design to aid Validation, Adds cost, space

<table>
<thead>
<tr>
<th>Schematic</th>
<th>Traditional Power</th>
<th>PMBus Power</th>
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<tbody>
<tr>
<td>Traditional</td>
<td>1 Week</td>
<td>1 Day</td>
</tr>
<tr>
<td>PMBus</td>
<td></td>
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Debug Phase: Traditional Power

- **Why did it shut down??**
  - Debugging an Analog Power Supply is frustrating
  - Was it OCP, OVP, OTP ... ???

![Analog Power](image)
Debug Phase: PMBus Power

- **Software tools aid debug**
  - Read out fault status
  - Change Warning/Fault limits on the fly
  - Change fault behavior on the fly (shut-down, ignore, hiccup ...)

![Diagram of PMBus Power Debug Phase]
Optimization Phase

- Change Hardware components for Fsw, compensation ...
- Change parameters at the press of a button ...

**Traditional Power**

**PMBus Power**

<table>
<thead>
<tr>
<th>Rail Optimization</th>
<th>Traditional</th>
<th>1 Week</th>
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<tr>
<td></td>
<td>PMBus</td>
<td>1 Day</td>
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System Characterization Phase

- **Sequencing**
- **Margining**
  - Control voltage, slew rate, avoid Fault shutdown
- **Total Power Budget**

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System Validation

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<tr>
<th></th>
<th>Traditional</th>
<th>1 Month</th>
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<tbody>
<tr>
<td>PMBus</td>
<td>5 Days</td>
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</table>
In Field Diagnostics & Updates

- Remote debug & Update (VR vendor → OEM)
- Customer Support (OEM → End Customer)

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<thead>
<tr>
<th>Field Update</th>
<th></th>
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<tbody>
<tr>
<td>Traditional</td>
<td>n/a</td>
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<tr>
<td>PMBus</td>
<td>✓</td>
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Lifetime Statistics

- Collect Data (e.g. use an additional NVM) for e.g. analysis of environment or optimization of future systems
  - Operational hours
  - Peak temperature
  - Peak current
  - Peak Voltage
  - Faults

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Conclusion:
Time is Money – PMBus Delivers!

- Competitive Products exist (from Infineon & others) to build complete digital power systems
- Tools exist to accelerate the Design Cycle
- PMBus enables Faster Time To Market

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<tr>
<th></th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>Traditional Design</td>
<td>6 wks</td>
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<tr>
<td>PMBus Design</td>
<td>1 wk</td>
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