Integrated Power Supply Test Methods
Enabled with a Dynamic Current Load Module

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Abstract
System-on-chip or system-in-package switched mode power supplies provide an opportunity for increased test coverage of the DC-DC converter performance. The conventional approach for testing a switched mode power supply is limited by the level of integration of the supply. In the case of a Voltage Regulator Module (VRM), semiconductor manufacturers normally test the component blocks separately. Tests like timing and threshold measurements validate the PWM block. RDSON, current Limit, and short circuit limit are typically applied to the gate driver and power FET components. In more integrated implementations, such as cell phone or digital camera SMPSs, a simple functional check is also performed, but validation is limited by the practical difficulty of realizing best performance in a manufacturing test fixture. Examples of these limitations may include off-package power train inductance and relatively high contactor parasitic inducances. Advances in circuit and packaging technologies provide new test opportunities. This poster will present a production test approach of an integrated SMPS enabled by a current level and slew programmable load. The module may be programmed to change current levels between 5A and 100A in order to emulate a system load of up to 100A. It resides on a characterization or production test board and can be used with automated test equipment instrumentation or bench equipment to enable testing of power supply kick, droop and efficiency. The poster describes the circuit performance and test methods enabled by the module, focusing on the advantages this technique may provide.

Test Method

Transient Power Supply Tests
- Peak Droop and Kick
- Recovery Time

Requirements
- Programmable Current Level and Rise/Fall Time
- Application to a range of load requirements
- High load (>100A) or lighter load (<4A) End Applications
- Usable on the bench and on ATE test fixtures
- Small Footprint module
- Test Fixture useable area ranges from 30-300in2

Characterized Capability
- Operating Voltage Range: 0.6V – 1.5V, 8V
- Current Sink: 20A per Channel
- Max Total Current : 120A
- Turn-on/off time: <100ns
- Programmable Current Level: 200mA-20A
- Programmable Turn-on/off time: 100ns-10us
- Current Monitoring on first channel
- Module limited duty-cycle and pulse width (10ns Max)

ATE Digitizer Types

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Bandwidth</th>
<th>Max Sample Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>200 KHz</td>
<td>100KSPS</td>
</tr>
<tr>
<td>HF Digitizer</td>
<td>15 MHz</td>
<td>50MSPS</td>
</tr>
<tr>
<td>VHF Digitizer</td>
<td>225 MHz</td>
<td>80MSPS</td>
</tr>
<tr>
<td>Gigadig</td>
<td>8 GHz</td>
<td>20MSPS</td>
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</tbody>
</table>

Conclusions
A programmable dynamic current load combined with existing ATE instrumentation types provides an opportunity to increase test coverage of more integrated power supplies. The next step is to apply these test methods to a PwrSOC or PSIP