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

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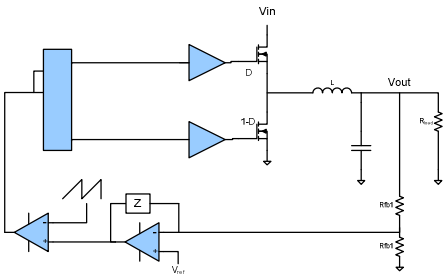
Abstract

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 manufactures 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 inductances. 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 5us and 100nS 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.

Traditional SMPS Test



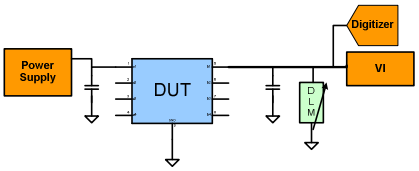
Typical SMPS Tests

- RDSON
- Current Limit
- Miscellaneous Thresholds (OVP, OCP)
- Efficiency
- Modulator Timing
  - •Frequency, Dead-time, Rise/Fall Time

Instruments Required

- •VI (Floating at High Current)
- •Differential Voltmeter
- •Time Measurement System
- •Power Supply
- •Digital System

Test Method

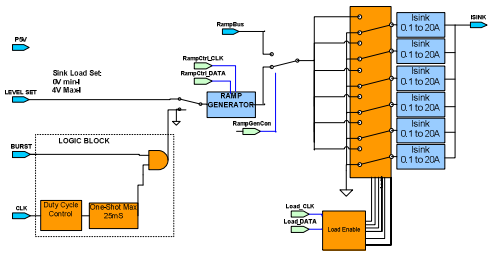


Transient Power Supply Tests

- Peak Droop and Kick
- Recovery Time

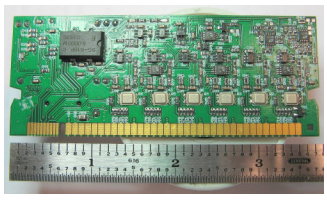
Requirements

- 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

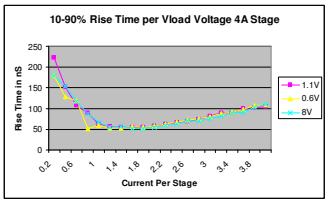


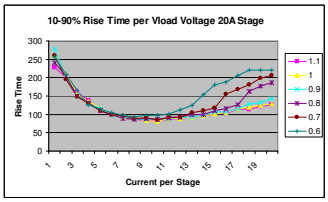
Characterized Capability

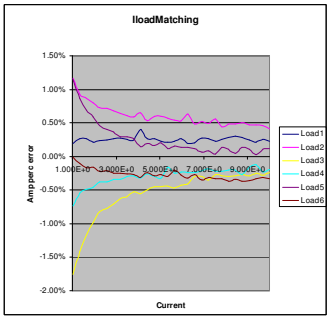
- Operating Voltage Range: 0.6V – 1.5V, 8V
- Current Sink: 20A per Channel
- Max Total Current : 120A
- Turn-on/off time: <100nS
- Programmable Current Level: 200mA-20A
- Programmable Turn-on/off time: 100ns-10us
- Current Monitoring on first channel
- Module limited duty-cycle and pulse width (10mS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

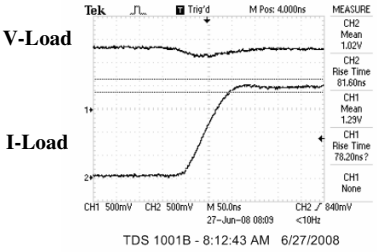


Results









ATE Digitizer Types

Instrument Type	Bandwidth	Max Sample Rate
VI	200 KHz	100KSPS
HF Digitizer	15 MHz	50MSPS
VHF Digitizer	225 MHz	80MSPS
Gigadig	8 GHz	20MSPS

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