Using the TPS2590EVM

User's Guide



Literature Number: SLUU373 July 2009



TPS2590 Hot Swap Controller System Test Board

This User's Guide describes the setup and operation of the TPS2590 System Test Board.

1 Introduction

This User's Guide describes the features of the TPS2590EVM. The TPS2590 schematic, layout and List of Materials are provided as well as a setup and getting started.

2 Description

The EVM is a 3-V to 18-V module using the TPS2590/91 hot-swap controller with integrated MOSFET. At power on, the output is power limited to control inrush current and protect the MOSFET. On an over-current condition, the controller interrupts power to the load at high speed and signals load status. Operating current, fault current and fault timer settings are hardware programmable.

2.1 Applications

- Server
 - Plug-in Circuit Boards
 - RAID / Disk Drive
- Telecom
 - ATCA
 - Micro-ATCA
- General Hot Plug

2.2 Features

- 3-V to 20-V Operation
- Controlled Inrush Current
- Fast Circuit Breaker Control
- Hardware Programmable
 - Operating Current
 - Fault Current
 - Fault Timer to Avoid Nuisance Tripping
 - Latch Off or Retry. TPS2590 is Pin Selectable
- LED Status Display
- A Slide Switch Controls the ENABLE Signal.
- Copper Pour with Vias to the Internal Ground takes Advantage of the Power Pad Package
- On-Board Transorb is for Over-Voltage Input Protection
- Common Diode at Output Prevents Negative Spike when Load is Removed While Powered On
- Monitor Circuit Operation Test Points

www.ti.com EVM Block Diagram

3 EVM Block Diagram

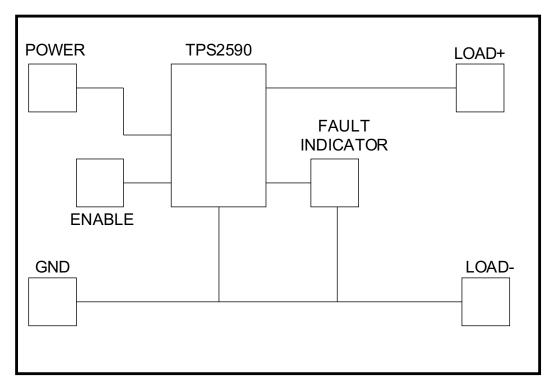


Figure 1. PR893E1 EVM Block Diagram



Schematic www.ti.com

4 Schematic

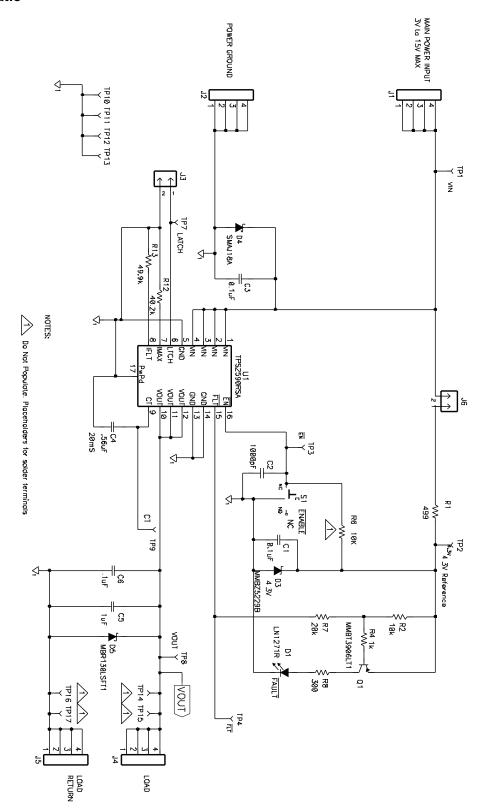


Figure 2. PR893E1 Schematic, TPS2590EVM



www.ti.com List of Materials

5 List of Materials

Table 1. TPS2540EVM List of Materials

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFR
2	C1, C3	Capacitor, ceramic, 0.1 μF, 603	STD	muRata
1	C2	Capacitor, ceramic, 1000 pF, 603	STD	muRata
1	C4	Capacitor, ceramic, 10 V , 0.56 μF, 805	STD	muRata
1	C5	Capacitor, ceramic, 25 V, 1 μF, 1206	STD	muRata
1	C6	Capacitor, ceramic, 0.1 μF, 603	STD	muRata
1	D1	Diode, LED, red, 20 mA, 0.9 mcd, 0.068 x 0.049 inch	LN1271R	Panasonic
1	D3	Diode, Zener, 4.3 V, 300 mW, SOT23	MMBZ5229B	Motorola
1	D4	Diode, SMT TVS 400 W, 1 A, 18 V, SMA	SMAJ15A	Diodes
1	D5	Diode, Schottky, 1000 mA, 30 V, SOD123	MBR130LSFT1	STD
4	J1, J2, J4, J5	Screw terminal, 0.310 x 0.310 inch	7693	Keystone
2	J3, J6	Header, 2 pin, 100-mil spacing, (36-pin strip), 0.100 inch x 2	PTC36SAAN	Sullins
1	Q1	Bipolar, PNP, xx-V, yy-mA, zz-W, SOT23	MMBT3906LT1	On Semi
1	R1	Resistor, chip, 0.5 W, 1%, 499 Ω, 2512	STD	STD
1	R12	Resistor, chip, 1/16 W, 1%, 40.2 kΩ, 603	STD	Vishay
1	R13	Resistor, chip, 1/16 W, 1%, 49.9 kΩ, 603	STD	Vishay
1	R2	Resistor, chip, 1/16 W, 5%, 10 kΩ, 603	STD	Vishay
1	R4	Resistor, chip, 1/16 W, 1%, 1 kΩ, 603	STD	Vishay
1	R7	Resistor, chip, 1/16 W, 5%, 20 kΩ, 603	STD	Vishay
1	R8	Resistor, chip, 1/10 W, 5%, 300, 805	STD	Vishay
1	S1	Switch, SPDT, slide, PC mount, 500 mA, 0.400 x 0.100 inch	09-03201-02	EAO
1	TP1	Test point, white, thru hole, V _{IN} , 0.125 x 0.125 inch	5012	Keystone
4	TP10, TP11, TP12, TP13	Test Point, SM, 0.150 x 0.090, GND, 0.185 x 0.135 inch	5016	Keystone
1	TP2	Test point, white, thru hole, 4.3 V, 0.125 x 0.125 inch	5012	Keystone
1	TP3	Test point, white, thru hole, EN, 0.125 x 0.125 inch	5012	Keystone
1	TP4	Test point, white, thru hole, FLT, 0.125 x 0.125 inch	5012	Keystone
1	TP7	Test point, white, thru hole, LATCH, 0.125 x 0.125 inch	5012	Keystone
1	TP8	Test point, white, thru hole, V _{OUT} , 0.125 x 0.125 inch	5012	Keystone
1	TP9	Test point, white, thru hole, C _T , 0.125 x 0.125 inch	5012	Keystone
1	U1	0 V to 12 V Integrated FET Hot Swap, QFN-16	TPS2590RSA	TI



Board Outlines www.ti.com

6 Board Outlines

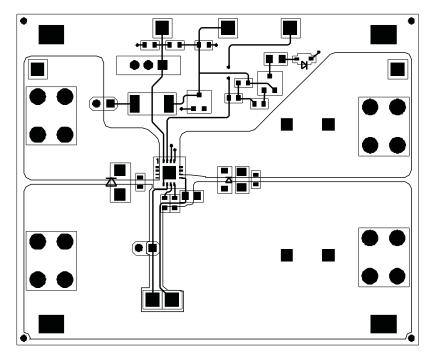


Figure 3. Board Outline (TOP)

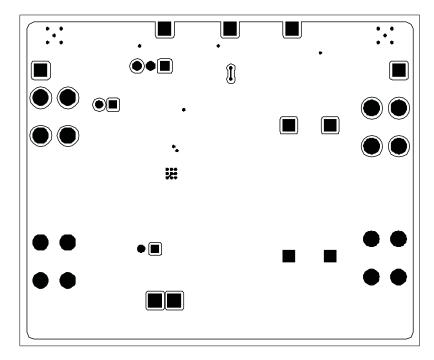


Figure 4. Board Outline (BOTTOM)



www.ti.com Board Outlines

6.1 Test Points

Test Points TP14, TP15, TP16, TP17, are not installed. These are placed on the board unmarked near Load and Load Return. This is a user option to hardwire additional capacitors, etc to the output.

Table 2. Test Points

NAME	DESCRIPTION
VIN	Input voltage power supply
4.3V	4.3-V reference
EN	Enable signal, high true
FLT	Fault signal, low true
LATCH	Latch signal, high true, low for retry
VOUT	Output voltage
CT	Fault timer capacitor
GND	Scope ground test point

6.2 Connectors

Table 3. Connectors

CONNECTOR	DESCRIPTION
J1	Main Power Input, VIN
J2	Main Power Ground, GND
J4	Load
J5	Load Ground, GND

6.3 Jumpers

R9 is used to disconnect the LEDs for test measurement of TPS2590 quiescent current. This 0- Ω resistor is normally installed.

Table 4. Jumpers

JUMPER	DESCRIPTION
J3	TPS2590 Only Off=Latch, On=Retry

6.4 Switches

6.4.1 Enable Switch S1

The Enable slide switch turns on the hot plug controller to ramp the output voltage .When the switch is off, the output is off.

6.5 Indicators

Red LED indicator for FAULT (FLT)



Equipment Needed www.ti.com

7 Equipment Needed

7.1 Voltage Source

The input voltage source, VIN is a 20-V variable dc source at 10 A.

7.2 Oscilloscope

A digital oscilloscope can be used to monitor the test points.

7.3 Current Probe

A current probe is helpful to observe turn on characteristics of the external load.

7.4 Recommended Wire Gague

Power is limited to 5 W; 18-gage wire minimum is recommended.

8 Equipment Supplied

The TPS2590 Module configured with TPS2590 is supplied.

Table 5. EVM Configurations

EVALUATION MODULE	COMPONENT	
HPA490EVM-001	TPS2590	

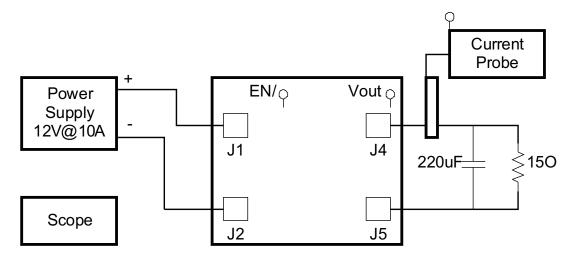


9 Getting Started (Example)

9.1 Equipment Connections

Reference Figure 5.

- Input power supply positive voltage to J1 and negative voltage to GND, J2. Connectors J1 and J2 can accept #6 ring or spade lugs.
- RC load at J4 and the load return at J5. The example here uses 220 μF, 15 Ω.
- Scope to current probe to measure the load current.
- Scope the V_{OUT} and EN.



Note:

 $\,\circ\,$ Connects to Scope

Figure 5. Equipment Connections

9.2 Operation

- Turn on the power supply.
- Trigger the scope on EN low going edge.
- Slide the EN to the EN position as screened on the circuit board.



9.3 Test Results

Observe waveforms similar to Figure 6.

- The current to the load is not constant but increases after the initial inrush. Current is low initially because the voltage across the internal MOSFET is initially at its highest level and the controller is power limiting the MOSFET.
- Although the current limit, I_{FLT}, is set to 4 A, the start up current never goes above 2.2 A because of the power limiting. However, 4 A is available to the steady state load when the MOSFET is fully enhanced.
- At the end of the capacitor charge time, the current drops to the DC level powering the resistive part of the load, about 0.8 A.

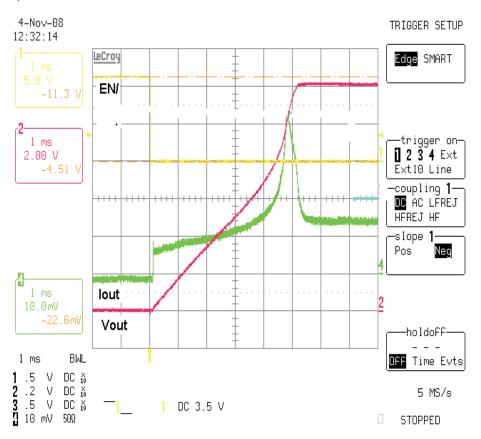


Figure 6. Example Scope Trace



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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range and output voltage range of 3 VDC to 18 VDC.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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