Using the TPS2394EVM-652

User's Guide



Literature Number: SLUU456
October 2010

TPS2394 Hot Swap Controller System

1 Introduction

This User's Guide describes the setup and operation of the TPS2394 System Test Board. The TPS2394EVM-652 User Guide also provides TPS2394EVM-652 Schematic, EVM Assembly and PCB Layout and List of Materials.

2 Description

The TPS2394EVM-652 is a -10-V to -80-V module using the TPS2394 hot-swap controller with external MOSFET. At power on, the output is a current ramp to control inrush current. 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 Power Systems

- -48-V distributed

2.2 Telecom

- ATCA
- Micro-ATCA
- Central Office
- Base Stations

2.3 Features

- -10-V to -80-V Operation
- Programmable Linear Inrush Slew Rate
- Programmable Current Limit
- Programmable UV and OV Hysteresis and Limits
- Fault timer Eliminates Nuisance Trips
- Power Good and Fault Outputs
- Retry Controller
- LED Status Display
- A Slide Switch Controled ENABLE Signal
- PCB Designed 5-A nominal operation (with thermal characteristics for proper MOSFET operation)
- Test Points Available to Monitor Circuit Operation

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3 Schematic

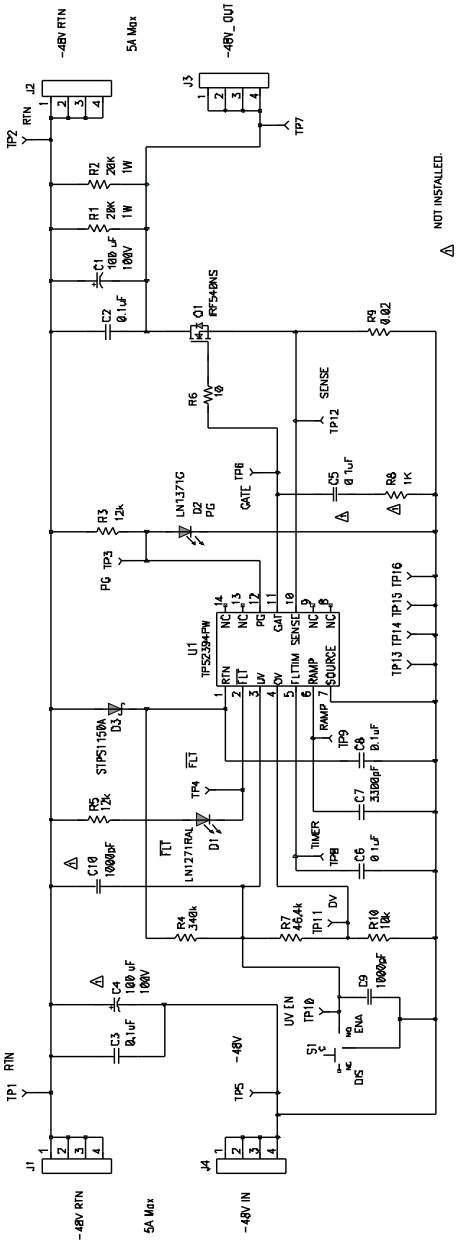


Figure 1. TPS2394EVM Schematic

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4 EVM Description

4.1 Application Changes

Components may be changed for operation at other voltages, current or start-up conditions. See the design example in the TPS2394 datasheet (TI Literature Number SLVSAA9) to assist with component selection.

4.2 Floating System

As the schematic is drawn, the EVM and power supply are floating with respect to GND. Therefore, a GND may be placed on any single point in the system. The GND is shown on the -48-V terminal so that UV, OV, etc, can be calculated, and viewed on the scope like positive voltage signals.

4.3 Reverse Voltage

Reverse voltage is often desired with negative voltage systems. Do not test reverse voltage directly with the TPS2394EVM. The input has an electrolytic capacitor since the EVM is used in labs with long leads to power supplies. The capacitor should be removed before attempting reverse voltage input.

NOTE: There is a series diode in the RTN line of the TPS2394. This is not strictly needed but is a good design practice.

The load is not protected form reverse voltage. There is a capacitor on the load side that should be removed in addition to removing the load for reverse voltage testing.

4.4 Output Status Logic Levels

The fault signal, $\overline{\text{FLT}}$, is a low true signal with the LED indicator and current limiting resistor between RTN and the lower rail. The signal output at the $\overline{\text{FLT}}$ test point covers the full range of the power supply.

The PG signal is high true and is connected between the LED indicator and the current limiting resistor. When the PG signal is false, it is at the negative rail. When PG is true, it is only about 1.5 V above the negative rail, the LED forward voltage drop.

The logic levels should be considered if they are used to interface remote equipment.

4.5 UV, OV

The EVM is set up to operate from 10 V to 56 V. The TPS2394 internal under voltage setting is 9 V.

4.6 Retry Controller

The TPS2394 is a retry controller. After a fault, the controller will attempt to turn the FET back on again. It turns the FET fully on when the fault is cleared

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5 Test Points

Table 1. Test Points

TEST POINT	NAME	DESCRIPTION
TP1	RTN	Input voltage power supply RTN
TP2	RTN	Load side RTN
TP3	PG	Power Good
TP4	$\overline{\text{FLT}}$	Fault
TP5	-48VIN	Input voltage power supply
TP6	GATE	Gate output
TP7	-48VOUT	Output voltage
TP8	TIMER	Fault timer capacitor
TP9	RAMP	Current output ramp
TP10	EN	Enable signal, high true (and under-voltage detection)
TP11	OV	Over-voltage detection
TP12	SENSE	Current sense input
TP13	-48V SCOPE	Isolated scope return
TP14	-48V SCOPE	Isolated scope return
TP15	-48V SCOPE	Isolated scope return
TP16	-48V SCOPE	Isolated scope return

6 Connectors

Table 2. Connectors

CONNECTOR	DESCRIPTION
J1	-48 V RTN, main power input
J2	-48 V RTN
J3	-48 V output
J4	-48 V, main power input

7 Enable Switche S1

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

8 Indicators

- Green LED indicator for Power Good (PG)
- Red LED indicator for FAULT ($\overline{\text{FLT}}$)

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9 EVM Assembly and PCB Layout

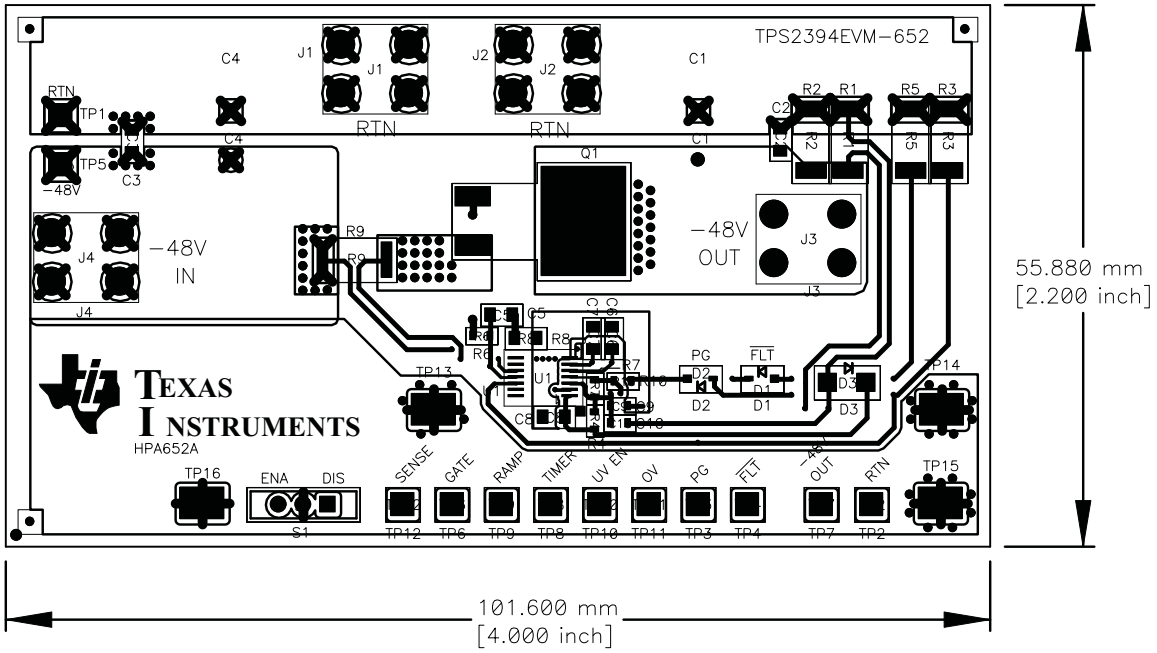


Figure 2. Board Top Side

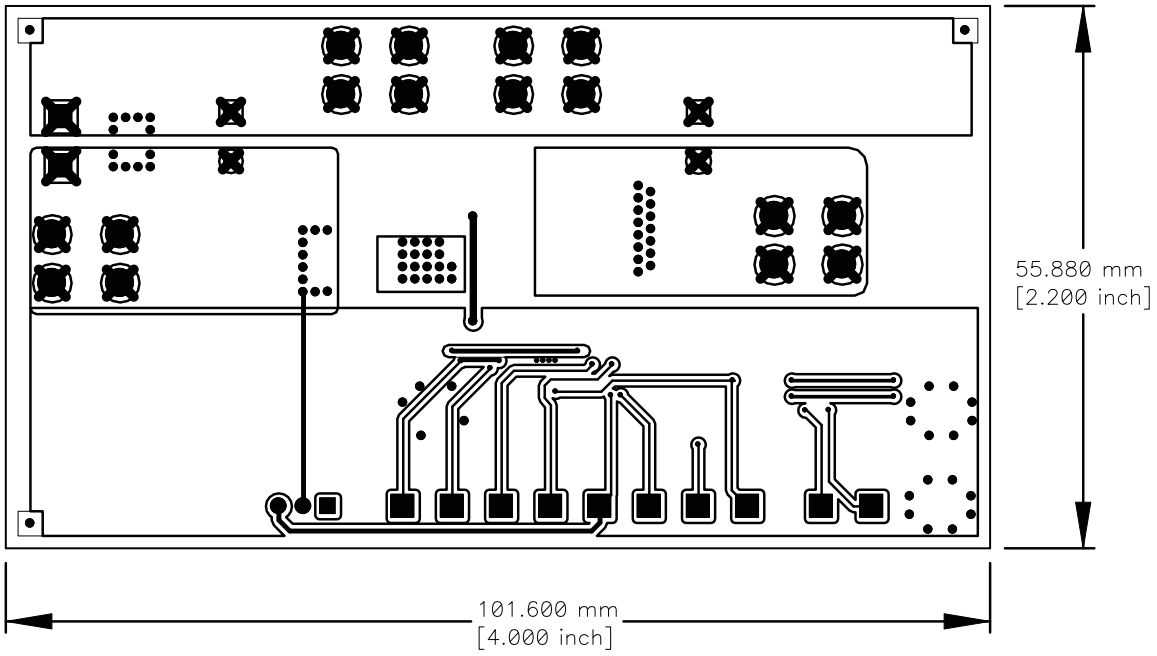


Figure 3. Board Bottom Side

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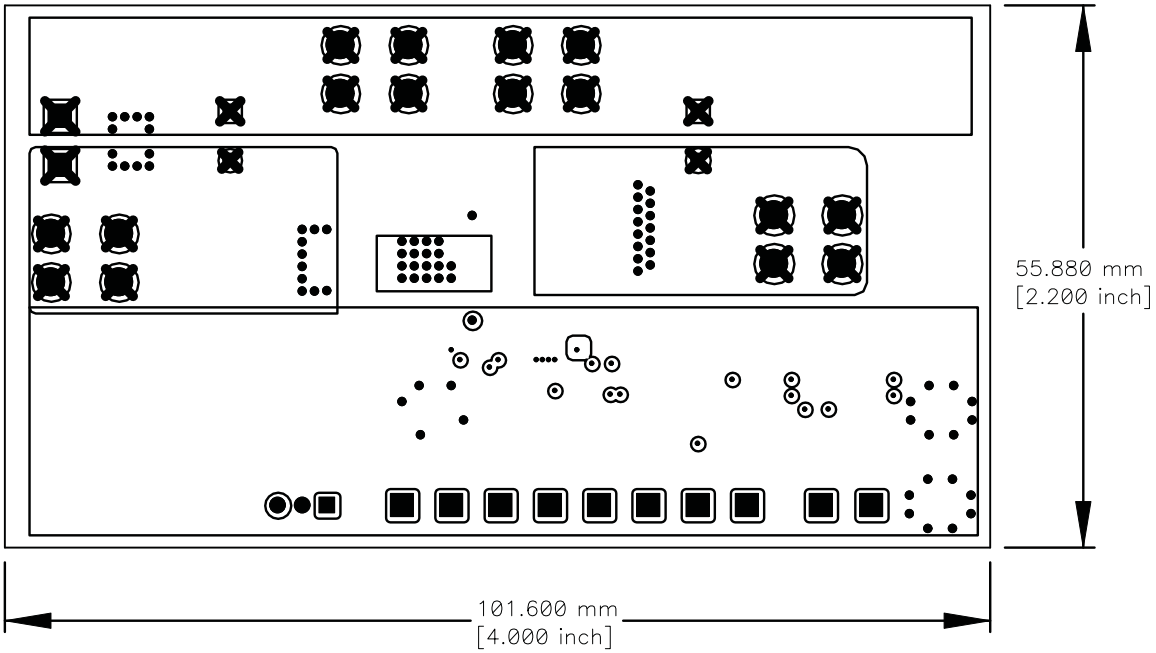


Figure 4. Board Layer 1

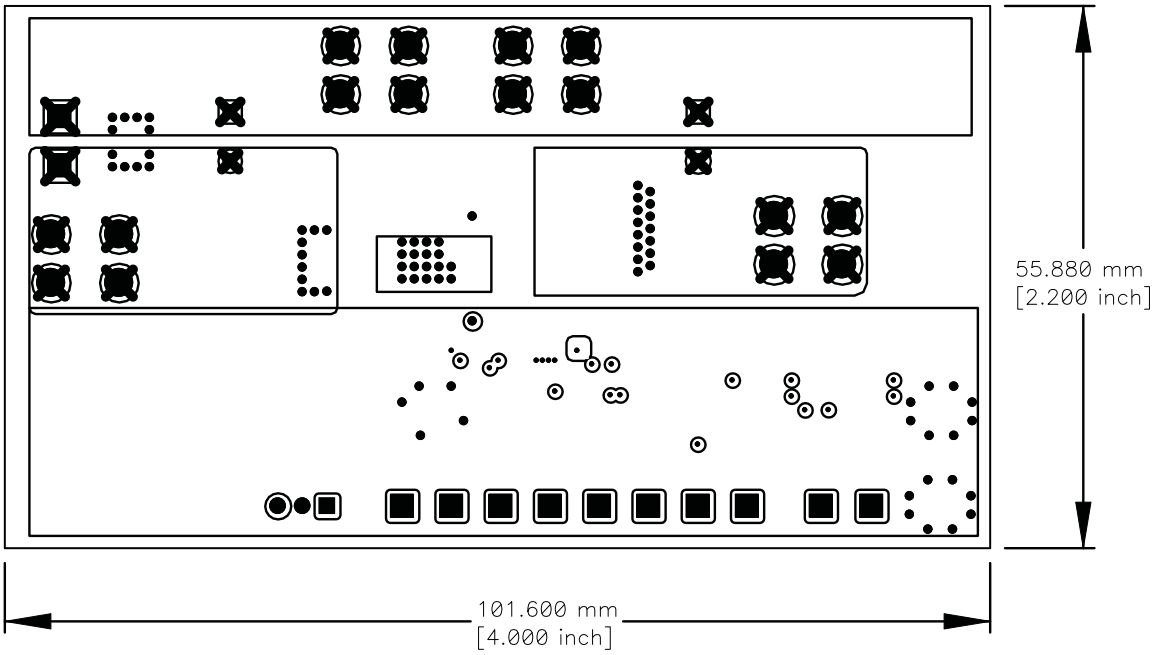


Figure 5. Board Layer 2

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10 List of Materials

Table 3. TPS2394EVM List of Materials

COUNT	REF DES	DESCRIPTION	MFR	PART NUMBER
1	C1	Capacitor, aluminum, 100 V, 20% Radial Can, 100 µF, 0.492 in.	Panasonic	EEU-FC2A101
0	C4	Capacitor, aluminum, 100 V, 20% Radial Can, 100 µF, 0.492 in.	Panasonic	EEU-FC2A101
3	C2, C3, C8	Capacitor, ceramic, 100 V, X7R, 10%, 0.1 µF, 805	STD	STD
0	C5	Capacitor, ceramic, 100 V, X7R, 10%, 0.1 µF, 805	STD	STD
1	C6	Capacitor, ceramic, 25 V, X7R, 10%, 0.1 µF, 805	STD	STD
1	C7	Capacitor, ceramic, 25 V, X7R, 10%, 3300 pF, 805	STD	STD
1	C9	Capacitor, ceramic, 100 V, XR7, 10%, 1000 pF, 603	STD	STD
0	C10	Capacitor, ceramic, 10 V, XR7, 10%, 1000 pF, 603	STD	STD
1	D1	Diode, LED, ultra bright red, 0.114 in. x 0.049 in.	Panasonic	LN1271RAL
1	D2	Diode, LED, green, 0.114 in. x 0.049 in.	Panasonic	LN1371G
1	D3	Diode, Schottky, 1000 mA, 150 V, SMA	STMicroelectronics	STPS1150A
4	J1, J2, J3, J4	Screw terminal, 0.310 in. x 0.310 in.	Keystone	7693
1	Q1	Transistor, NFET, 100 V, 33 A, 44 mΩ, D2PAK	IR	IRF540NS
2	R1, R2	Resistor, chip, 1 W, 5%, 20 kΩ, 2512	STD	STD
1	R10	Resistor, chip, 1/16 W, 1%, 10 kΩ, 603	STD	STD
2	R3, R5	Resistor, metal oxide, 1 W, 5%, 12 kΩ, 2512	STD	STD
1	R4	Resistor, chip, 1/16 W, 1%, 340 kΩ, 603	STD	STD
1	R6	Resistor, chip, 1/16 W, 1%, 10, 603	STD	STD
1	R7	Resistor, chip, 1/16 W, 1%, 46.4 kΩ, 603	STD	STD
1	R8	Resistor, chip, 1/10 W, 1%, 1 kΩ, 805	Std	Std
1	R9	Resistor, metal strip 2 W, 1%, 0.02, 2512	Stackpole	CSRN2512FK20L0
1	S1	Switch, SPDT, slide, PC-mount, 500 mA, 0.400 in. x 0.100 in.	EAO	09-03201-02
12	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12	Test point, white, thru hole , 0.125 x 0.125 in.	Keystone	5012
4	TP13, TP14, TP15, TP16	Test point, SM, 0.150 x 0.090, 0.185 x 0.135 in.	Keystone	5016
1	U1	-48 V Hot Swap Power Manager, PW14	TI	TPS2394PW
1	--	PCB, 4 in. x 2.37 in. x 0.062 in.	Any	HPA652
4	-REF-	Bumper, rubber	SPC Tech	2566

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 10 V to 80 V and the output voltage range of 10 V to 80 V .

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 50° C. The EVM is designed to operate properly with certain components above 50° C 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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