Texas Instruments

–48-V ATCA Hot Swap Reference Design Using the TPS2393

Reference Design

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ABSTRACT

This reference design controls the dual −48-V power interface for a 200-W board in compliance with ATCA requirements. Although similar to the standard TPS2393 design, a number of components have been added to satisfy ATCA energy storage requirements and to protect the pass fet. These changes accommodate the large energy storage requirements of ATCA and improve board survivability.

1 Introduction

Nominal values for UV/OV and over current thresholds, as well as fault and ramp timing, are presented. If the designer needs to change any of these parameters the procedures are thoroughly covered in the User's Guide TI Literature number SLUU155.

ATCA specific circuitry includes R3, R14, RT1, Q4, D7, and components feeding INSA and INSB. R3 and R14 function as a power limiter which bleeds current into the ISENS pin of the TPS2393. As V_{IN} increases in magnitude more current is bled into ISENS, which effectively prebiases the overcurrent (OC) comparator. As the prebias current increases less load current is required to trip the OC comparator.

RT1 limits current into the bulk storage capacitor C5 during charging. This prevents the TPS2393 from declaring an OC fault condition while the capacitor is charging at startup. D7 allows current to flow from C5 to the load without being limited by RT1. During quiescent operation RT1 dissipates 0 W. During the charge cycle it could see 72 V and temporarily dissipate over 10 W. For this reason a positive temperature coefficient resistor is used.

Q4 and U2 prevent C5 from charging until the TPS2393 has asserted power good, $\overline{PG}$. This allows sequential charging of the onboard bulk capacitors. The 100 − 200-μF capacitors typically required at the input to power converters are allowed to charge first. Once they have completed charging and the TPS2393 declares power good Q4 is turned on and C5 is allowed to charge at a rate determined by RT1.

Insertion detection (ID) pins provided by ATCA are named ENABLE_A and ENABLE_B. These pins are tied to RTN_A and RTN_B, respectively, on the backplane. ID is not required by ATCA but some designs may use it. Since ATCA requires that boards remain operational even if one power feed disappears there can be a conflict with certain ID implementations. If a single return line goes open the associated ENABLE pin could sense a nonexistent module extraction which causes the board to shut down. The design presented is not susceptible to such false failures and continues to operate despite the loss of a single power feed. As ATCA designs mature the ID function will most likely migrate into the intelligent platform management interface (IPMI) controller, thus allowing more flexibility in response to ID events. If the designer does not need ID then INSA and INSB can simply be tied to the −VIN pin of the TPS2393.

Table 1 shows alternate component values for lower power boards.

Table 1. Component Values For Alternate Power Levels

POWER LEVEL (W)	R17 (mΩ)	C5 (μF)
50	16	1400
80	10	2240
130	6	3640
180	4.5	5040

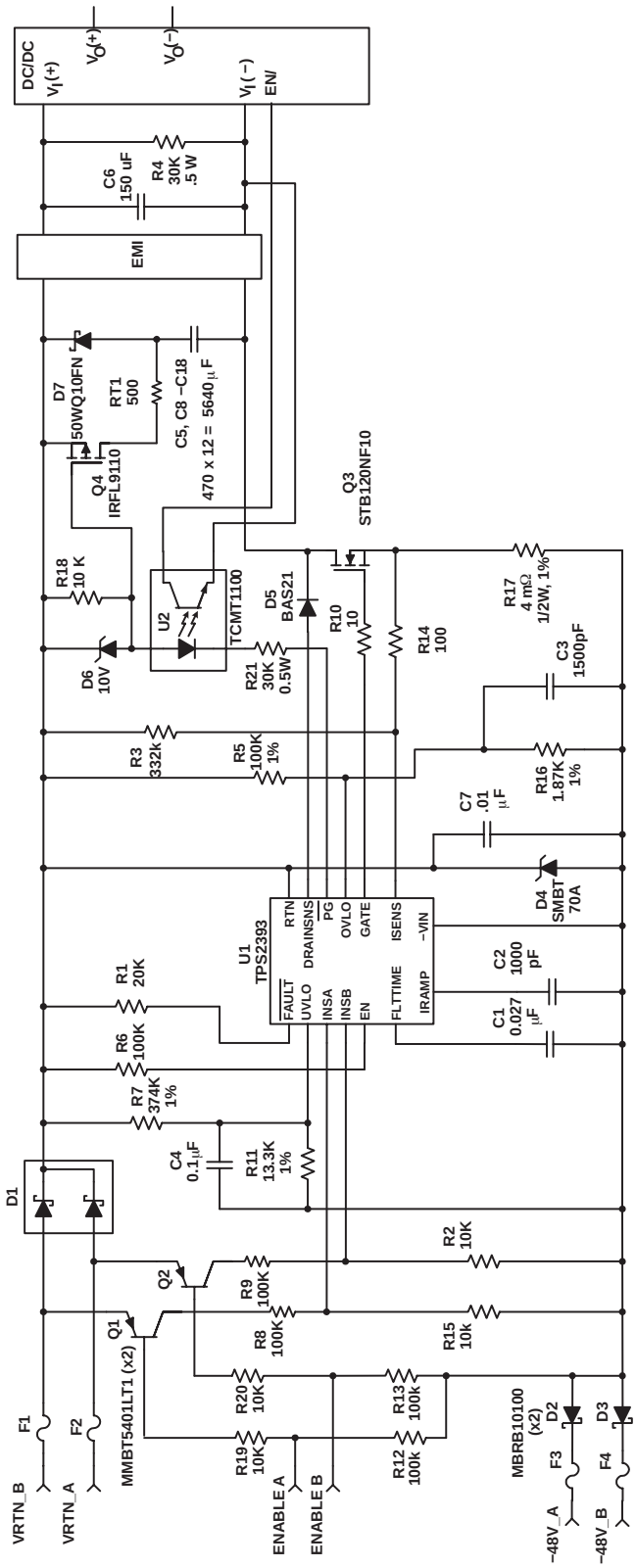

Figure 1. −48-V Hot Swap Power Manager Reference Design Schematic

Table 2. Reference Design List of Materials

REF DES	COUNT	DESCRIPTION	MFR	PART NUMBER
C6	1	Capacitor, aluminum, SM, 150 µF ±20%, 100 V, 0.670 mm X 0.697 mm	Panasonic	EEV−FK2A151M
C1	1	Capacitor, ceramic, 0.027 µF, 16 V, X7R, 10%, 805	Vishay	STD
C7	1	Capacitor, ceramic, 0.01 µF, 100 V, X7R, 10%, 1206	Panasonic	ECJ−3FB2J103K
C5, C8 − C18	12	Capacitor, aluminum, axial lead, 470 µF ±20%, 100 V, 38 mm x 18 mm	BC Components	2222 138 19471
C2	1	Capacitor, ceramic, 1000 pF, 16 V, X7R, 10%, 805	Vishay	STD
C3	1	Capacitor, ceramic, 1500 pF, 50 V, X7R, 10%, 805	Vishay	STD
C4	1	Capacitor, ceramic, 0.1 µF, 50 V, X7R, 10%, 805	Vishay	STD
D1	1	Diode, dual schottky, 20 A, 100 V, 326600	Vishay	MBRB20100CT
D2, D3	2	Diode, schottky, 10 A, 100 V, TO−263AB	Vishay	MBRB10100
D4	1	Diode, zener, 100 V TVS, SMB	Diodes Inc	SMBT70A
D5	1	Diode, switching, 200 mA, 200 V, 330 mW, SOT−23	Vishay	BAS21
D6	1	Diode, zener, 10 V, 350 mW, SOT−23	Vishay	BZX84C10
D7	1	Diode, schottky, 5.5 A, 100 V, DPAK	IR	50WQ10FN
F1, F2	2	Fuse, 10 A, 3AB	LittelFuse	325010
F3, F4	2	Fuse, 7 A, 3AB	LittelFuse	325007
U1	1	IC, −48-V Hot-Swap Power Controller, PW14	TI	TPS2393PW
U2	1	IC, optoc-coupler, MF4	Vishay	TCMT1100
Q1, Q2	1	Transistor, PNP, 150 V, 0.5 A, SOT−23	OnSemi	MMBT5401LT1
Q3	1	MOSFET, N-channel, 100 V, 120 A, 0.009 Ω, D2−PAK	ST Micro	STB120NF10
Q4	1	MOSFET, P-channel, 100 V, 1.1 A, 1.2 Ω, SOT−223	IR	IRFL9110
R1	1	Resistor, chip, 20 kΩ, 1 W, 5%, 2512	Vishay	CRCW2512−203J
R10	1	Resistor, chip, 10 Ω, 1/10 W, 1%, 805	Std	Std
R14	1	Resistor, chip, 100 Ω, 1/10 W, 1%, 805	Std	Std
R17	1	Resistor, chip, 0.004 Ω, 1/2 W, 1%, 2010	Vishay	WSL−2010.004<1%
R16	1	Resistor, chip, 1.87 kΩ, 1/10 W, 1%, 805	Std	Std
R5, R6, R8, R9, R12, R13	6	Resistor, chip, 100 kΩ, 1/10 W, 1%, 805	Std	Std
R11	1	Resistor, chip, 13.3 kΩ, 1/10 W, 1%, 805	Std	Std
R4, R21	2	Resistor, chip, 30 kΩ, 1/2 W, 5%, 2010	Vishay	CRCW2010−303J
R3	1	Resistor, chip, 332 kΩ, 1/10 W, 1%, 805	Std	Std
R7	1	Resistor, chip, 374 kΩ, 1/10 W, 1%, 805	Std	Std
R2, R15, RR18, R19, R20	5	Resistor, chip,10 kΩ, 1/10 W, 1%, 805	Std	Std
RT1	1	Resistor, positive temperature coefficient, 500 Ω, radial lead, 5 mm x 3.2 mm	BC Components	2322 660 52893

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