Texas Instruments

–48-V ATCA Hot Swap Reference Design Using the TPS2350

Reference Design

−48-V ATCA Hot Swap Reference Design Using the TPS2350

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ABSTRACT

This reference design uses the TPS2350 to control dual −48-V power supplies for a 200-W board in compliance with ATCA requirements.

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1 Introduction

Fets are used to OR the −48-V feeds instead of the typical diodes. This significantly reduces the diode VI losses, especially as currents increase. Although similar to the standard TPS2350 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 bulk capacitors needed by ATCA and improve board survivability.

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 TPS2350 datasheet.

2 ATCA Specific Circuitry

R3 and R14 perform a power limiting function to protect FET Q3 from operating outside the specified SOA of Q3. As VIN increase R3 bleeds more current into the SNS pin of the TPS2350 which biases the overcurrent (OC) comparator in the TPS2350. As the bias current increases, less load current is required to trip the OC comparator, effectively lowering the programmed IMAX.

RT1 and Q10 control the current into C5 during charging. This prevents the TPS2350 from declaring an OC fault condition while C5 is charging at startup. If energy stored in C5 is needed to provide power to the load D7 allows current to flow without being limited by RT1. Although RT1 dissipates 0 watts during quiescent operation it could momentarily see 72 V during the charge cycle and temporarily dissipate over 10 W. For this reason a positive temperature coefficient resistor is used for RT1.

Q10 and U2 prevent C5 from charging until the TPS2350 has asserted power good (PG). This allows sequential charging of onboard bulk capacitors. The 100-μF − 200-μF capacitors typically required at power converter inputs are allowed to charge first. Once they have completed charging and the TPS2350 declares power good Q4 is turned on by PG 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 goes open 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 will continue to operate despite the loss of a single power feed. As ATCA designs mature the ID function most likely integrates into the intelligent platform management interface (IPMI) controller, thus allowing more flexibility in response to ID events. If ID is not required then Q1, Q2, R6−R9, R12, R13, D5, and D6 may all be removed from the circuit presented.

Table 1 shows alternate component values for lower power boards.

Table 1. Values For 50-W / 80-W / 130-W / 180-W Board

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

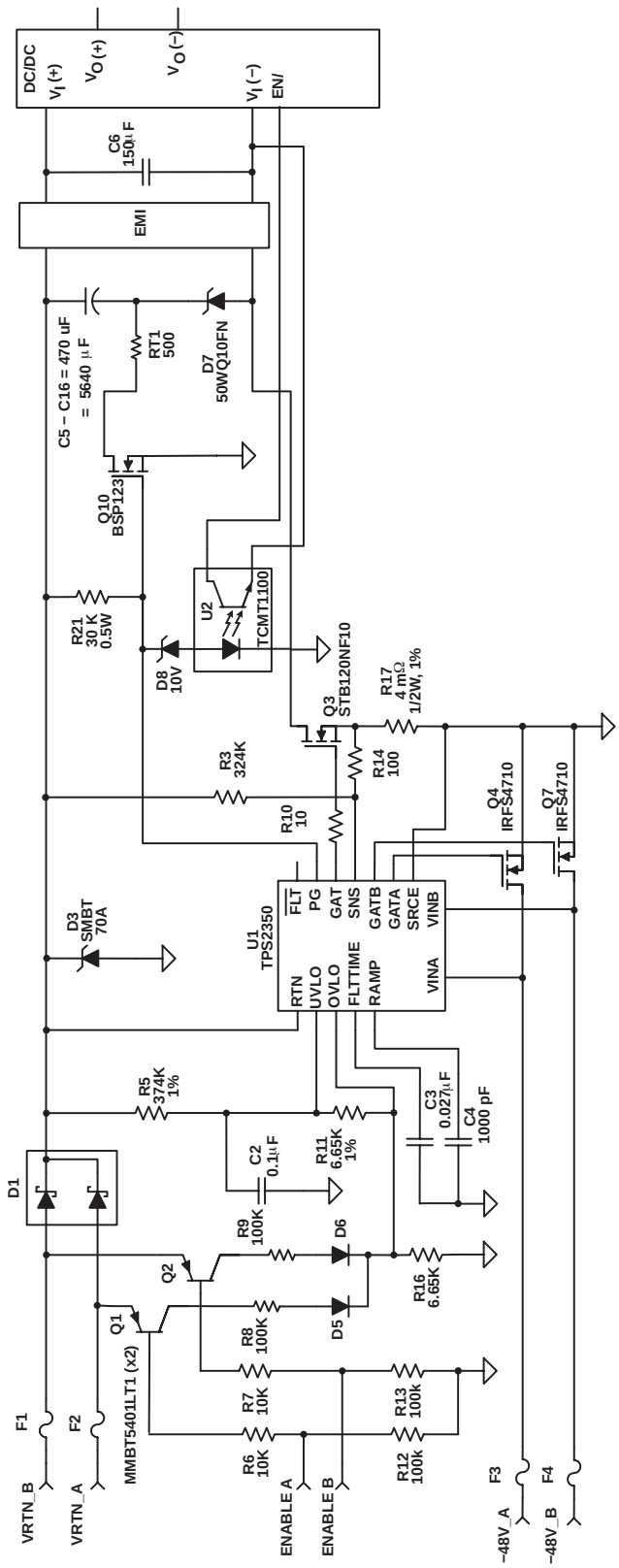

Figure 1. ATCA Hotswap Using the TPS2350

Table 2. TPS2350 Reference Design List of Materials

REF DES	COUNT	DESCRIPTION	MFR	PART NUMBER
C1	1	Capacitor, aluminum, SM, 150 µF ±20%, 100 V, 0.670 X 0.697	Panasonic	EEV−FK2A151M
C2	1	Capacitor, ceramic, 0.1 µF, 16 V, X7R, 10%, 805	Vishay	Std
C3	1	Capacitor, ceramic, 0.027 µF, 16 V, X7R, 10%, 805	Vishay	Std
C4	1	Capacitor, ceramic, 1000 pF, 16 V, X7R, 10%, 805	Vishay	Std
C5−C16	12	Capacitor, aluminum, axial lead, 470 µF ±20%, 100 V, 38mm x 18mm	BC Compo-nents	2222 138 19471
D1	1	Diode, dual schottky, 20 A, 100 V, D2PAK	Vishay	MBRB20100CT
D3	1	Diode, TVS, 70 V, 600 W, SMB	Diodes	SMBT70A
D5, D6	2	Diode, switching, 200 mA, 200 V, 330 mW, SOT−23	Vishay	BAS21
D7	1	Diode, schottky, 5.5 A, 100 V, DPAK	IR	50WQ10FN
D8	1	Diode, zener, 10 V, 350 mW, SOT−23	Vishay	BZX84C10
F1, F2	2	Fuse, 8 A, 250 V, 0.250 x 1.250	Littelfuse	326 008
F3, F4	2	Fuse, 7 A, 250 V, 0.250 x 1.250	Littelfuse	326 007
Q1, Q2	2	Bipolar, PNP, 150 V, 500 mA, SOT−23	ON Semi	MMBT5401LT1
Q10	1	MOSFET, N-channel, 100 V, 0.380 A, 6 Ω, SOT−23	Infineon	BSP123
Q3	1	MOSFET, N-channel, 100 V, 120 A, 0.009 Ω, D2−PAK	ST Micro	STB120NF10
Q4, Q7	2	MOSFET, N-channel, 100 V, 75 A, 0.014 Ω, D2−PAK	IR	IRFS4710
R10	1	Resistor, chip, 10 Ω, 1/10 W, 1%, 805	Std	Std
R11, R16	2	Resistor, chip, 6.65 kΩ, 1/10 W, 1%, 805	Std	Std
R14	1	Resistor, chip, 100 Ω, 1/10 W, 1%, 805	Std	Std
R15	1	Resistor, chip, 0.004 Ω, ½ W, 1%, 2010	Vishay	WSL−2010.004
R21	1	Resistor, chip, 30 kΩ, 1/2 W, 5%, 2010	Vishay	CRCW2010−303J
R3	1	Resistor, chip, 324 kΩ, 1/10 W, 1%, 805	Std	Std
R5	1	Resistor, chip, 374 kΩ, 1/10 W, 1%, 805	Std	Std
R6, R7	2	Resistor, chip, 10 kΩ, 1/10 W, 1%, 805	Std	Std
R8, R9, R12, R13	4	Resistor, chip, 100 kΩ, 1/10 W, 1%, 805	Std	Std
RT1	1	Thermistor, PTC, 500 Ω, 0.197 dia.	Vishay	2322 660 52893
U1	1	IC, Redundant −48-V Hot-Swap Controller, PW14	TI	TPS2350PW
U2	1	IC, opto-coupler, MF4	Vishay	TCMT1100

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