DESIGN NOTES

AdvancedTCA Hot Swap Controller Monitors Power Distribution

Design Note 397

Mitchell Lee

Introduction

AdvancedTCA® is a modular computing architecture developed by the PCI Industrial Computer Manufacturers Group for use in central office telecom environments. PICMG® 3.0 defines, among other things, the electrical and mechanical attributes of the backplane, connectors and removable cards in these –48V systems.

Each removable card, or front board, is designed for live insertion into a working system. A power draw of up to 200W per front board is allowed, placing the maximum load current in the 4A to 5A range.

Card-centric inrush limiting and quantitative current and voltage monitoring are highly desirable to sanitize the incoming battery feeds, minimize power plane disturbances, allow for budgeting power consumption and permit failure prediction in an otherwise functional system. The LTC®4261 Hot Swap™ controller provides these features. Also included is a digital interface for controlling the functions of the LTC4261, and for reading the current and voltage measurement registers.

Circuit Solutions

Figure 1 shows a complete circuit designed to handle up to the maximum available power. The LTC4261's accurate current limit is set to provide at least 5.5A under all conditions, a comfortable margin for 200W, yet trips off just under 7A to preserve fuse integrity in the presence of nuisance overloads. At insertion the LTC4261 allows contact bounce to settle, then soft starts the load using a ramped current. Inrush current is increased gradually to a few hundred milliamperes and held there until the MOSFET is fully on.

Current is monitored by the SENSE pin and an 8mΩ shunt resistor. Direct measurement of the current is possible via the I^2C port, with 10-bit resolution and 8A full scale.

Cutting Diode Dissipation

ATCA's redundant –48V power feeds are combined on-card with ORing diodes. At 5A current consumption even Schottky rectifiers present a serious problem in terms of both voltage drop and power dissipation: a conducting pair drop more than 1V and dissipate 6W. Following the diode manufacturer's recommendations, 8 square inches of board area are needed to satisfy the heat sinking requirements.

Diode dissipation, voltage loss and board area is reduced in Figure 1 by using MOSFETs as active rectifiers with the LTC4354 diode OR driver. Total dissipation is cut to less than 1W for two conducting "diodes" at maximum load.

Zero Volt Transient

The so-called Zero Volt Transient requirement is a legacy of earlier telecom equipment standards stipulating uninterrupted system operation during the course of a 5ms input voltage dropout. An energy of 1J is needed to sustain a 200W load during this interval.

The accepted method of energy storage to satisfy the 1J requirement is a bulk reservoir capacitor which is charged through resistors. This technique dictates the use of bulky high voltage storage capacitors, such as 100V (or rare 80V) rated units which can handle the maximum input voltage of 75V. Since the zero volt transient test commences at 44V, nothing is gained by storing a higher voltage. Compact 50V capacitors are used instead, by limiting the charging voltage with a simple zener-transistor circuit.

The ATCA connector pin configuration presents a special design challenge. Here extraction is inferred from the difference between each ENABLE and its associated VRTN, thereby ignoring input dropouts. A PNP transistor pulls up on $\overline{EN}$ in the event of an ENABLE disconnect, shutting down the LTC4261 and permitting safe extraction with no connector damage. During a zero volt transient, no signal reaches the $\overline{EN}$ pin; power flows uninterrupted to the load when the input voltage recovers.

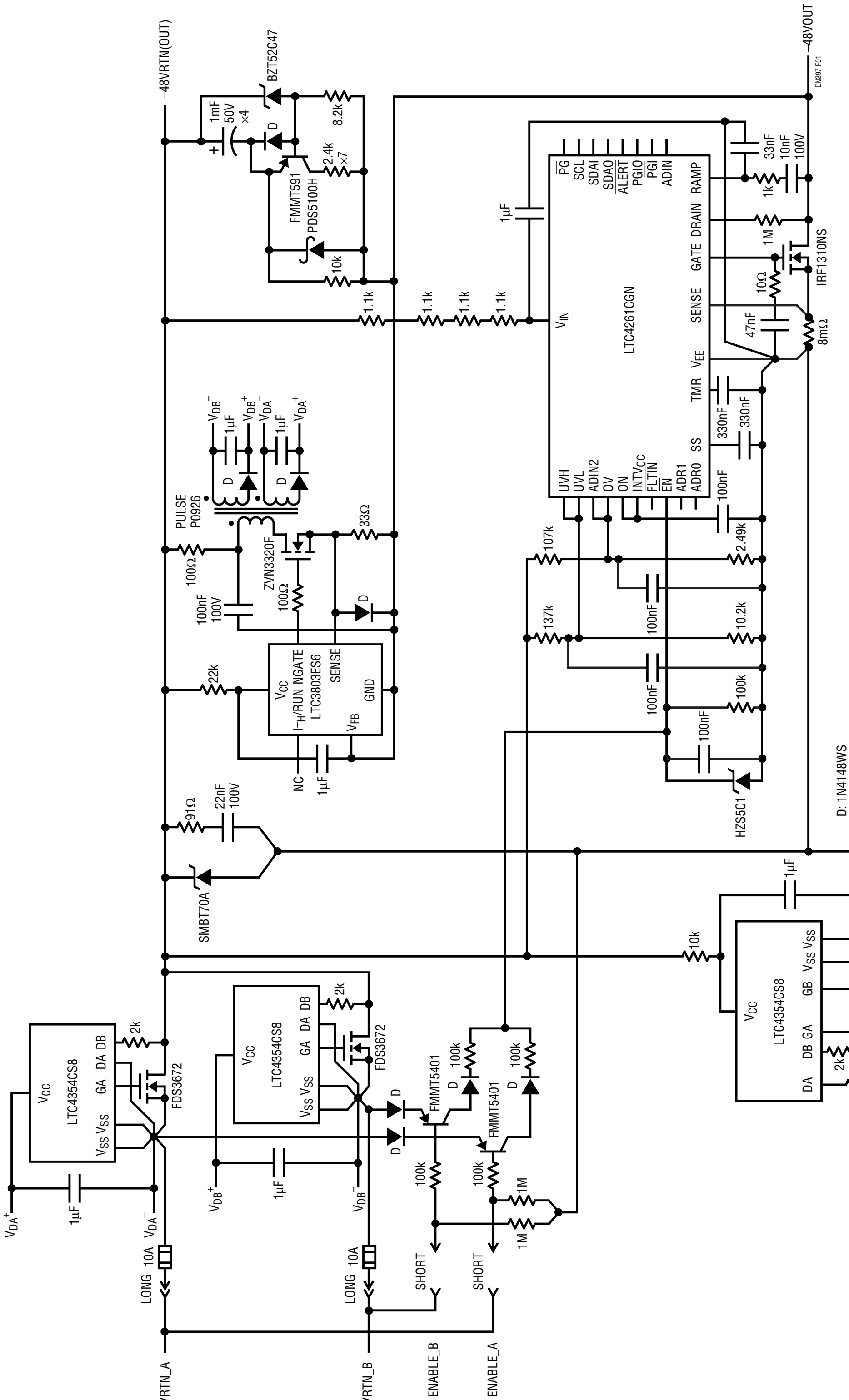

Figure 1. AdvancedTCA Hot Swap Controller with I²C Current and Voltage Monitor

Data Sheet Download

www.linear.com

For applications help,
call (408) 432-1900, Ext. 2452

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

dn3mlf LT/TP 0906 305K • PRINTED IN THE USA