Intel® 810 Embedded Client Reference Design — DC/DC ATX Power Supply

Scalable Platform with Integrated Flat Panel Display

Application Note

June 2001

Order Number: 273549-001

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Revision History

Date	Revision	Description
June 2001	001	Initial release of document

1.0 Introduction

This application note discusses the approach used to design a DC/DC power supply that, when coupled with an external AC to DC brick power supply, can be substituted for a standard ATX power supply in applied computing applications.

2.0 Rationale for the Design

Desktop PC manufacturers have popularized the ATX Power Supply standard. As a result, there are extremely low cost, mass-produced, PC motherboards designed to be powered by a standard ATX power supply. These motherboards are so attractively priced, that in all but the highest volumes of embedded applications does it make sense to use a custom design. Even in situations where the form factor of a standard motherboard is not quite right for an embedded application, trade-offs are usually made due to their low cost.

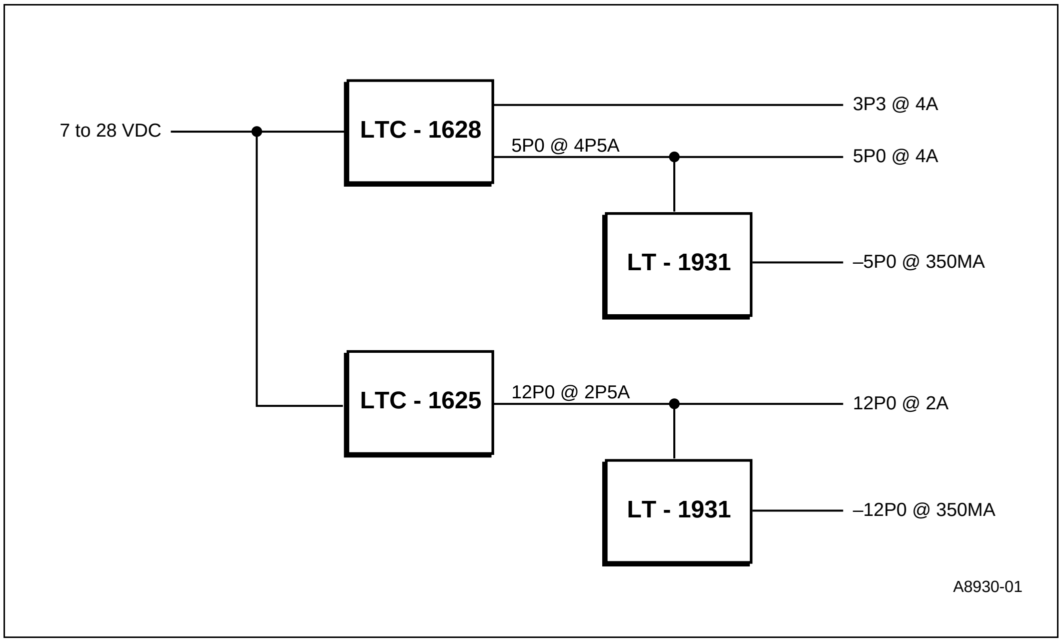
Many embedded applications have a DC supply available, or they do not have the space that would be required to support a standard ATX power supply. Usually, embedded applications do not have the same power supply load requirements (e.g., no CD, no DVD, no monitor, no floppy, etc.) as a standard PC. Therefore, a standard ATX power supply is not applicable in the majority of embedded instances.

Many embedded applications could make use of a module that accepts a DC voltage and creates all of the standard signals provided by an ATX power supply. Powering an embedded application from a low voltage DC supply also serves to reduce requirements for international safety certification (UL, CSA, VDE).

3.0 System Block Diagram

Three major components comprise the bulk of the control circuitry for the design. Figure 1 shows how these components are interconnected. Linear Technology Corp. was selected as the supplier for these components. However, similar devices are available from other manufacturers. One LTC-1628 is used to generate the 3.3VDC and 5.0VDC supplies. One LTC-1625 is used to generate the 12.0VDC supply, and two LT-1931 devices are used to generate the –5.0VDC and –12.0VDC supplies.

Figure 1. Block Diagram



Note: The DC input can range anywhere from 7VDC to 28VDC. This range is wide enough to accept being powered by many low cost mass-produced AC/DC external bricks, wall mounts, or batteries. The 5.0VDC supply shown in Figure 1, is actually used to feed both the 5.0VDC and 5.0VDC standby supplies that are normally provided by a standard ATX power supply.

4.0 Significant Design Features

This power supply design has several significant features that help to minimize its size:

- The main 5VDC supply is generated from the 5VDC standby supply by simply using a FET.
- The 5VDC standby supply and the 3.3VDC supply are generated from one dual phase switcher.
- The use of 22µF multi-layer ceramic capacitors.

Since the 5VDC standby supply is always on when the 5VDC supply is on, the standby supply was sized to accommodate the current demand of both supplies. Therefore, when the 5VDC supply is commanded on by the motherboard, a simple FET is used to connect the standby supply to the 5VDC supply. This has two advantages:

1. Unusually high standby current availability.
2. The second supply (5VDC) is generated from a mere FET, minimizing size and cost.

Since both the 3.3VDC supply and the 5VDC standby supplies are generated from a dual phase switcher, the input filter capacitors can be shared between switching cycles. Again, this has the effect of reducing cost and size.

The recent availability of relatively low cost, large value ceramic multi-layer capacitors allows for the substitution of larger tantalum or even larger electrolytic capacitors, which would otherwise be used. Again, this helps to reduce overall system volume.

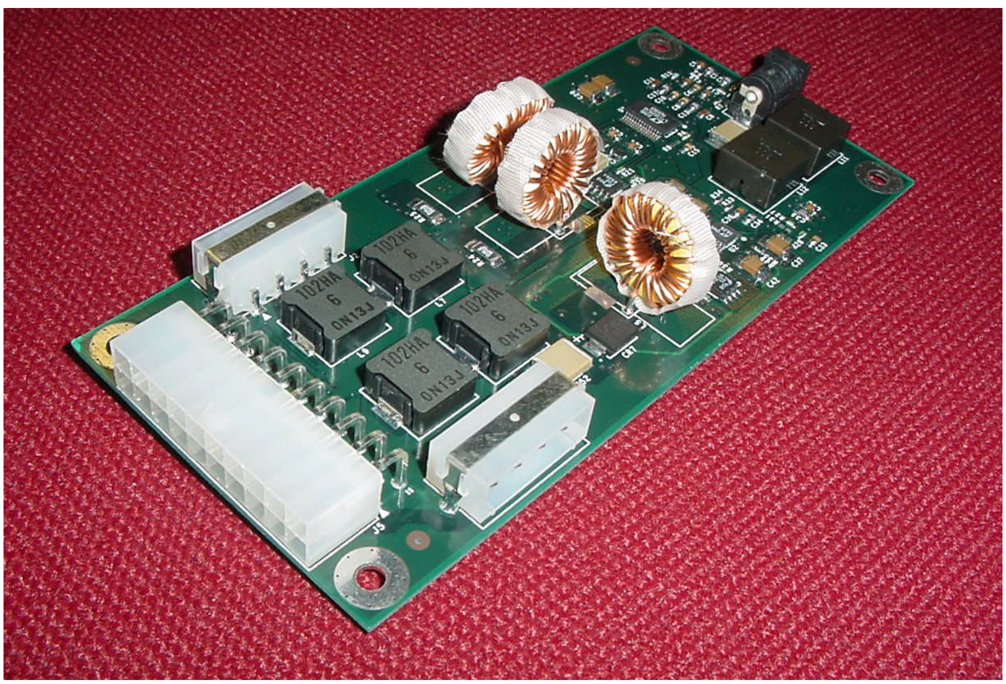
5.0 Design Considerations

When selecting your power supply components, be sure to consider the efficiency of the design. The efficiency may make the difference between passive cooling and active ventilation. If you are concerned about emission, choose toroid inductors. Closely follow the layout guidelines of the power supply component manufacturer . If you decide to integrate the power supply design onto your processor board, localize the power supply to one edge of the board away from noise sensitive CPU circuitry. Isolate the power and ground planes of your power supply from the main board power and ground planes while connecting them at one common point.

6.0 Mechanical Depiction

The picture below illustrates the physical realization of such a power supply. Note the use of a standard ATX power supply connector to facilitate connection to a standard motherboard. Also, note the existence of two standard PC accessory connectors for providing power to a hard drive or other accessories required by the embedded application.

Figure 2. Proof of Concept Board



7.0 Vendor List

Table 1 provides a vendor list as a service to our customers for reference only. The inclusion of this list should not be considered a recommendation or product endorsement by Intel Corporation.

Table 1. Vendor List

Product Type: Power Control Circuits
Linear Technology (http://www.linear-tech.com/)
Analog Devices (http://www.analog.com/)
Product Type: Capacitors
United Chemi-Con (http://www.chemi-con.com/)
AVX (http://www.avxcorp.com/products/capacitors)
Product Type: Inductors
Central Technologies (http://www.ctparts.com/)
Coilcraft (http://www.coilcraft.com/)
Coiltronics (http://www.coiltronics.com/)
Product Type: FETs
Siliconix (http://www.siliconix.com/)
Fairchild (http://www.fairchildsemi.com/)