LTC4085

DESCRIPTION

Demonstration circuit DC937A is a complete power controller for a USB powered device. It is based on the LTC4085 and provides the following functions: 700mA CC/CV timer terminated temperature qualified charger suitable for Li-Ion cells, a USB power manager that insures compliance with the USB power specification and power path management for the battery. The LTC4085 uses the intermediate bus voltage topology that results in faster charging and lower power loss than the charger fed topology. All this functionality consumes less than 56mm^2 of PCB area.

Design files for this circuit board are available. Call the LTC factory.

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Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Input Voltage		4.5V - 5.5V
Battery Charger		
Iout	V_{IN} = 5V, Vbat=3.6V	700mA +/- 7%
Float Voltage	Vin = 5V, battery disconnected from BATT pin	4.20V+/- 35mV
Trickle Charge Threshold	V_{IN} = 5V	2.9V +/-0.1V
Recharge Threshold	V_{IN} = 5V	(Vfloat – 130mV) to (Vfloat-60mV)
USB Current		
Input Current 500mA Mode	V_{IN} = 5V, USB Active 500mA Mode	475mA typical, 500mA max
Input Current 100mA Mode	V_{IN} = 5V, USB Active 100mA Mode	93mA typical, 100mA max
Input Current Suspend Mode	V_{IN} =5V, USB Suspend	300uA max

OPERATING PRINCIPLES

DC937A is the demo board for LTC4085. This chip manages the power supplies that would be typical for a USB powered device. Power is input from either the USB cable or an adapter to an intermediate voltage bus. The intermediate voltage bus is preferentially powered from the adapter, then USB and finally if required from the battery via an ideal diode. The battery charger is a CC/CV timer terminated type capable of charge currents of up to 1500mA.

QUICK START PROCEDURE

Demonstration circuit DC937A is easy to set up to evaluate the performance of the LTC4085. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Connect input power supply, meters and output load as shown in Figure 1.

USB Charging

2. Place the USB ON/OFF jumper (JP1) in the ON position. Place the USB current jumper (JP2) in the 500mA position. Set the battery simulator voltage to zero, slowly raise the USB input voltage. When the supply voltage exceeds 3.8V the charger should activate and the charge LED D2 will illuminate. The battery will be in trickle charge mode, I_{BAT} is around 70mA. Increase the battery voltage to about 2.9V. The

battery charge current (I_{BAT}) will increase to 475mA. Note that the input current from the USB (I_{USB}) does not exceed the USB spec of 500mA.

3. Now increase the load on the SYSTEM LOAD OUTPUT (I_{OUT}). Note that as the output load is increased the charging current is decreased and the USB current remains within the 500mA limit.

4. Place the USB current jumper in the 100mA position and note that USB input current falls to maintain compliance with the USB input current spec. Also note that as the external load is increased the battery will start to discharge into the SYSTEM LOAD OUTPUT, illustrating the ideal diode function of the LTC4085

5. Place the USB ON/OFF jumper (JP1) in the OFF position and note that the USB current falls to under 300uA to comply with the USB suspend mode current.

Adapter Charging

6. Ramp up the wall adapter voltage. When the wall adapter exceeds 4.3 volts the LTC4085 will cease drawing current from the USB and switch over to the wall adapter. Both the AC-present LED (D1, red) and charge LED (D2, green) are on.

7. Note that the charge current to the battery has increased to 700mA.

8. Increase the battery voltage to 4.2V and note that the charge current falls to 0. This illustrates the constant voltage portion of the charging characteristic. In the mean time, the charge LED (D2) turns off.

Battery Powered Operation

9. Set Both USB input voltage and the adapter input voltage to zero. The battery will now power the load on the System Load Output, illustrating the ideal diode function of the LTC4085. Note that the battery is now being discharged.

Other

Frequency at charge timer cap C3 changes with charging current, indicating the adaptive feature to ensure the full charge of battery.

10. Pins are provided to all control functions in order to simplify wiring of the demo circuit into a system board.

11. NTC function; provision has been made for connection of an external 10k NTC, for temperature qualified charging. To use this feature set the NTC jumper in the external position and connect the external NTC to the NTC terminal and ground.
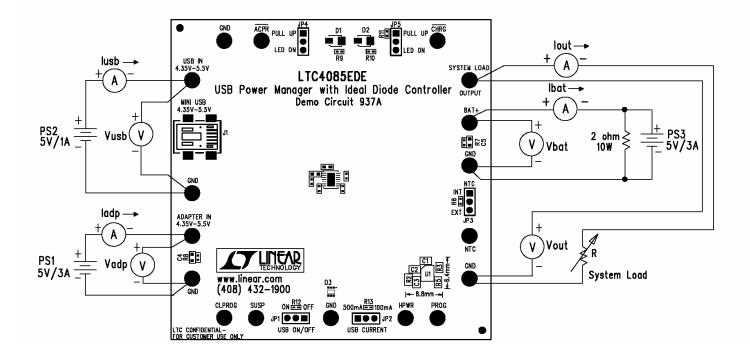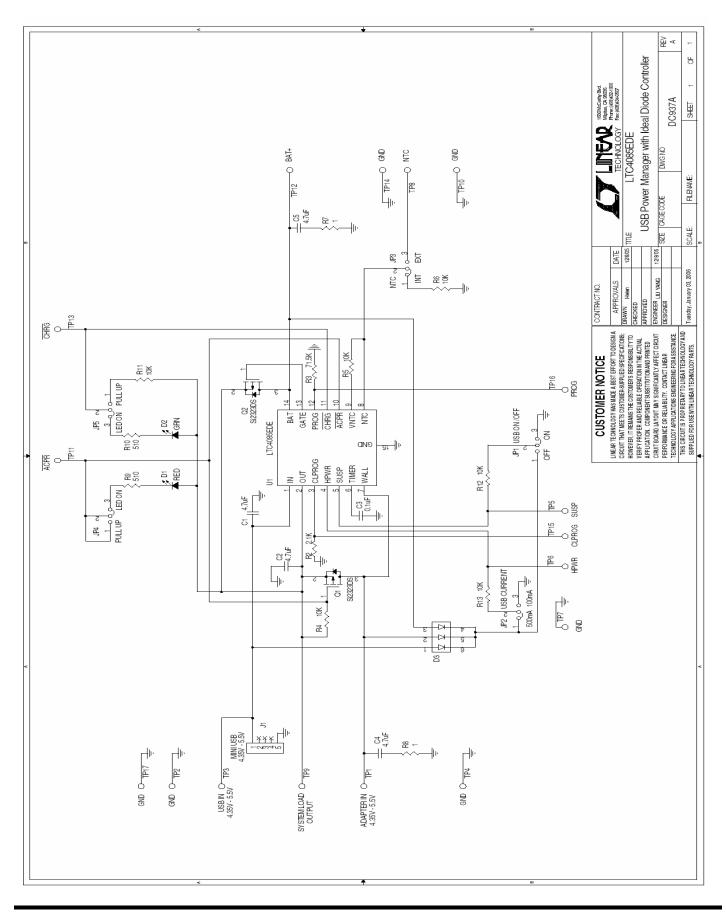
Figure 1. Proper Measurement Equipment Setup

Title block:

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CONTRACT NO.

APPROVALS | DATE
DRAWN Hsen | 12/8/05
CHECKED
APPROVED
ENGINEER LIU YANG | 12/8/05
DESIGNER

Tuesday, January 03, 2006

TITLE: USB Power Manager with Ideal Diode Controller

LTC4085EDE

SIZE | CAGE CODE | DWG NO. DC937A | REV A
B

FILENAME:
SCALE:

SHEET 1 OF 1

Schematic reference designators and labels:

TP17 GND
TP2 GND
TP3 USB IN 4.35V - 5.5V
MINI USB J1
TP9 SYSTEM LOAD OUTPUT
TP1 ADAPTER IN 4.35V - 5.5V
C4 4.7uF
R8 1
TP4 GND

U1 LTC4085EDE
IN, OUT, CLPROG, HPWR, SUSP, TIMER, WALL
BAT, GATE, PROG, CHRG, ACPR, VNTC, NTC, GND
14 13 12 11 10 8

C1 4.7uF
C2 4.7uF
C3 0.1uF
R2 2.1K
Q1 Si2323DS
R4 10K

D3

Q2 Si2323DS
R3 71.5K
R5 10K

TP13 CHRG
TP11 ACPR

R11 10K
JP5 PULL UP / LED ON
R10 510
D2 GRN
JP4 PULL UP / LED ON
R9 510
D1 RED

TP16 PROG

C5 4.7uF
R7 1
TP12 BAT+

TP14 GND
R6 10K
JP3 NTC INT EXT
TP8 NTC
TP10 GND

JP1 USB ON/OFF OFF ON
R12 10K
TP5 SUSP
TP15 CLPROG
R13 10K
JP2 USB CURRENT 500mA 100mA
TP6 HPWR
TP7 GND

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