Benchmarq Products from Texas Instruments

DV2000S1 and DV2000TS1

Multi-Chemistry Switching Charger Development System

Features

- Safe management of fast charge for NiCd, NiMH, or Li-Ion battery packs
- On-board switching regulation for up to 3A charge current (set to 1A for shipment)
- Fast-charge termination by peak voltage, minimum current (Li-Ion), maximum temperature, or maximum charge time
- Programmable charge rate and time-out
- Programmable top-off option for NiMH packs
- Trickle charge for conditioning deeply discharged batteries
- Charge-status LED
- Direct battery connection

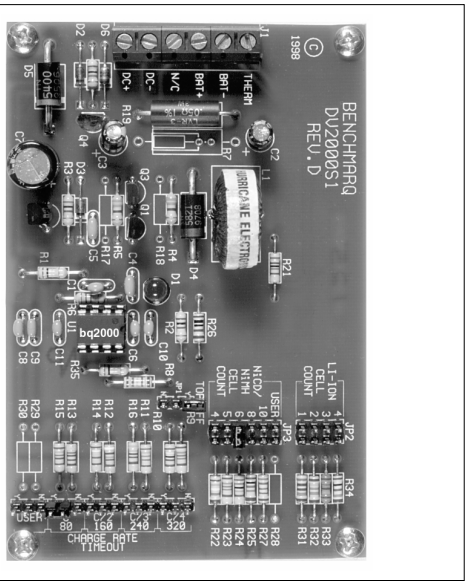
General Description

The DV2000S1 and DV2000TS1 are complete development and evaluation environments for bq2000 multi-chemistry charge- control ICs. The DV2000S1 and DV2000TS1 support up to 4 Li-Ion or 10 NiCd/NiMH cells and can be user-programmed for other cell counts.

Charge qualification precedes fast charge. During qualification, full-charge current is inhibited if the battery voltage or temperature is outside predetermined and user-defined thresholds, indicating a battery pack that is deeply discharged, shorted, hot, or cold. During the qualification interval, the LED flashes at a 1Hz rate. In the case of a low battery voltage, the IC applies a low-current trickle charge in an attempt to revive the battery or to close the pack protector's discharge switch. When battery voltage and temperature reach the required thresholds, full charge begins.

The bq2000 completes the fast charge with the appropriate charge algorithm. If the voltage on BAT input rises to the internal V_{MCV} threshold, the IC assumes a Li-Ion battery. Otherwise, the bq2000 assumes NiCd/NiMH chemistry. The user can further customize the algorithm by programming the device for top-off option (NiCd/NiMH only) and time-out period.

Please review the bq2000 data sheet before using the DV2000S1 and DV2000TS1 boards.



Connection Descriptions

J1

THERM	Thermistor connection
BAT-	Negative battery terminal and thermistor return
BAT+	Positive battery terminal
N/C	No connection
DC-	Charger supply ground
DC+	Charger supply positive

JP1	Top-off selection for NiCd or NiMH
JP2	Number of cell selection for Li-Ion
JP3	Number of cell selection for NiCd or NiMH

Fixed Configuration

The DV2000S1 and DV2000TS1 boards have the following fixed characteristics :

An external DC supply is required to power the board. Please see the Recommended DC Operating Conditions.

V_{CC} (5V) for the bq2000 is regulated on-board from the DC input on J1.

LED1 indicates the charge status according to the bq2000 data sheet.

Charge initiates on the later application of the battery or DC to the board.

As shipped, the DV2000S1 and DV2000TS1 buck mode-switching regulators are configured for charging current of 1A. This current is controlled by the value of sense resistors, R7 and R19 in the following equation:

$$I_{CHG} = 0.05 * \left(\frac{1}{R7} + \frac{1}{R19}\right)$$

At shipment, the value of R7 is 0.05Ω and R19 is not connected. These resistors can be changed depending on the application. The maximum charge current for this board is 3A.

The DV2000S1 and DV2000TS1 can be safely operated at currents up to 1A without adjusting the drive current for Q3. Please refer to the following table for the required adjustment to the Q3 drive for higher charging currents:

Charge Current	R17	R18
I_{CHG} < 1A	Not installed	Not installed
1A < I_{CHG} < 2A	300Ω	300Ω
2A < I_{CHG} < 3A	91Ω	91Ω

With the provided thermistor (part number 2322-640-63103, manufacturer Philips) connected between the THERM and BAT- contacts on J1, temperature values are as follows:

- Low-Temperature Fault (LTF): 0°C
- High-Temperature Fault (HTF): 40°C
- Temperature Cut-Off (TCO): 45°C

Jumper-Selectable Configuration

The DV2000S1 and DV2000TS1 must be configured as described below. See the jumper selection diagram.

Number of Cells Selection (JP2, JP3): These jumpers set the number of cells for either Li-Ion or NiCd/NiMH batteries. These jumpers should be changed only if the battery is absent or if DC power is turned off. Please note that only one jumper (either JP2 or JP3) should be selected at a time.

Please note that a "user" selectable position is also provided on JP3. This position can be used to configure the board for other cell counts by selecting an appropriate value for R28. Please refer to the bq2000 data sheet for the equation.

Top-off Option (JP1): This jumper enables (Y) or disables (N) the top-off option for NiMH batteries. This jumper has no effect on Li-Ion batteries.

Charge Rate and Time-out (JP4): The following charge rate and time-out are available. Please note that for each charge rate and time-out settings, there are two possible selections: one with top-off enabled (Y) and one with top-off disabled (N). This selection **must** match the jumper setting of JP1.

Charge Rate	Time-out (Li-Ion)	Time-out (NiCd/NiMH)
C/4	640 minutes	320 minutes
C/3	480 minutes	240 minutes
C/2	320 minutes	160 minutes

Figure 1. C/2 Time-out with Top-off

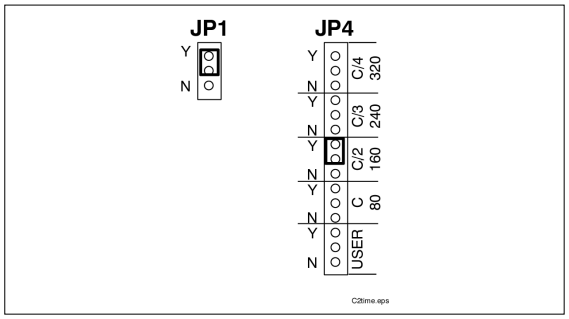
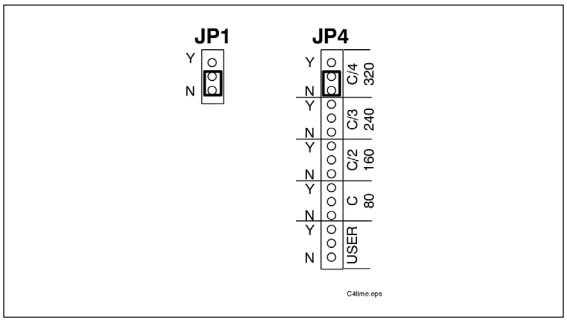


Figure 2. C/4 Time-out with No Top-off



Rev. D Board

Recommended DC Operating Conditions

Symbol	Description	Minimum	Typical	Maximum	Unit	Notes
I_{DC}	Maximum input current	-	-	3	A	
V_{DC}	Maximum input voltage	10 (see note)	-	25	V	DC+ to DC-
V_{BAT}	BAT input voltage	-	-	24	V	BAT+ to BAT-
V_{THERM}	THERM input voltage	0	-	5	V	Therm to BAT-
I_{CHG}	Battery charge current	-	-	3	A	

Note: V_{DC} must be above the battery charge voltage. Voltage drops across D5, Q3, L1, and R7 must be considered when calculating minimum V_{DC}.

C	160 minutes	80 minutes
User Specified*	User Specified	User Specified

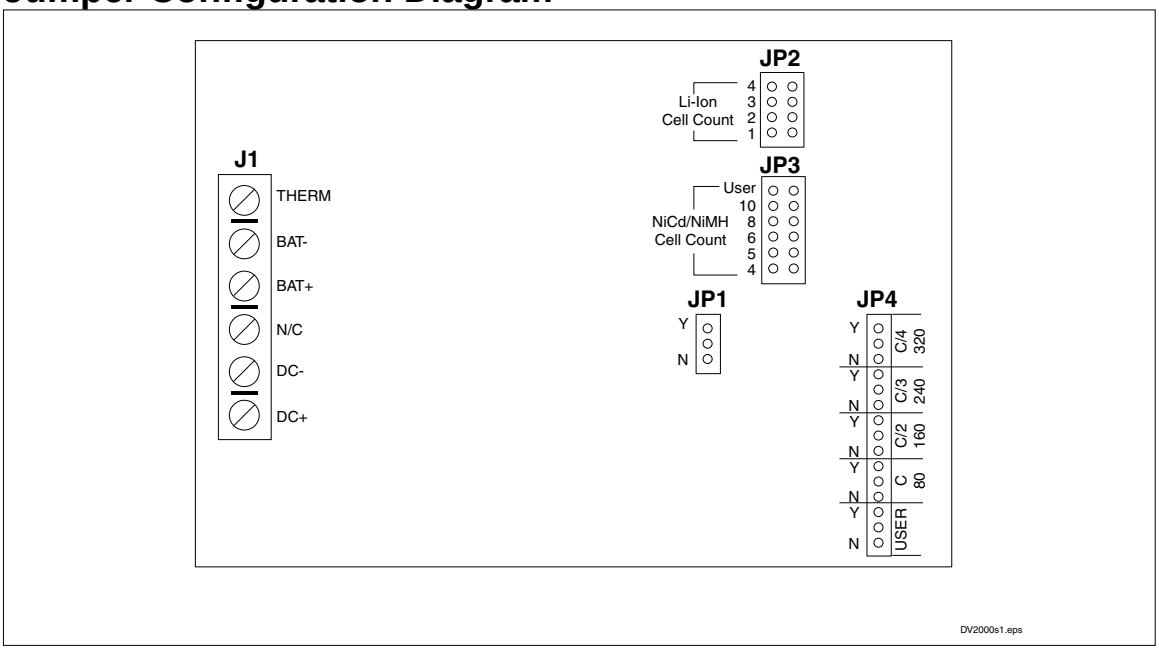
*Please see the bq2000 data sheet for the equation.

Figures 1 and 2 are examples of time-out with top-off jumper configurations.

Setup Procedure

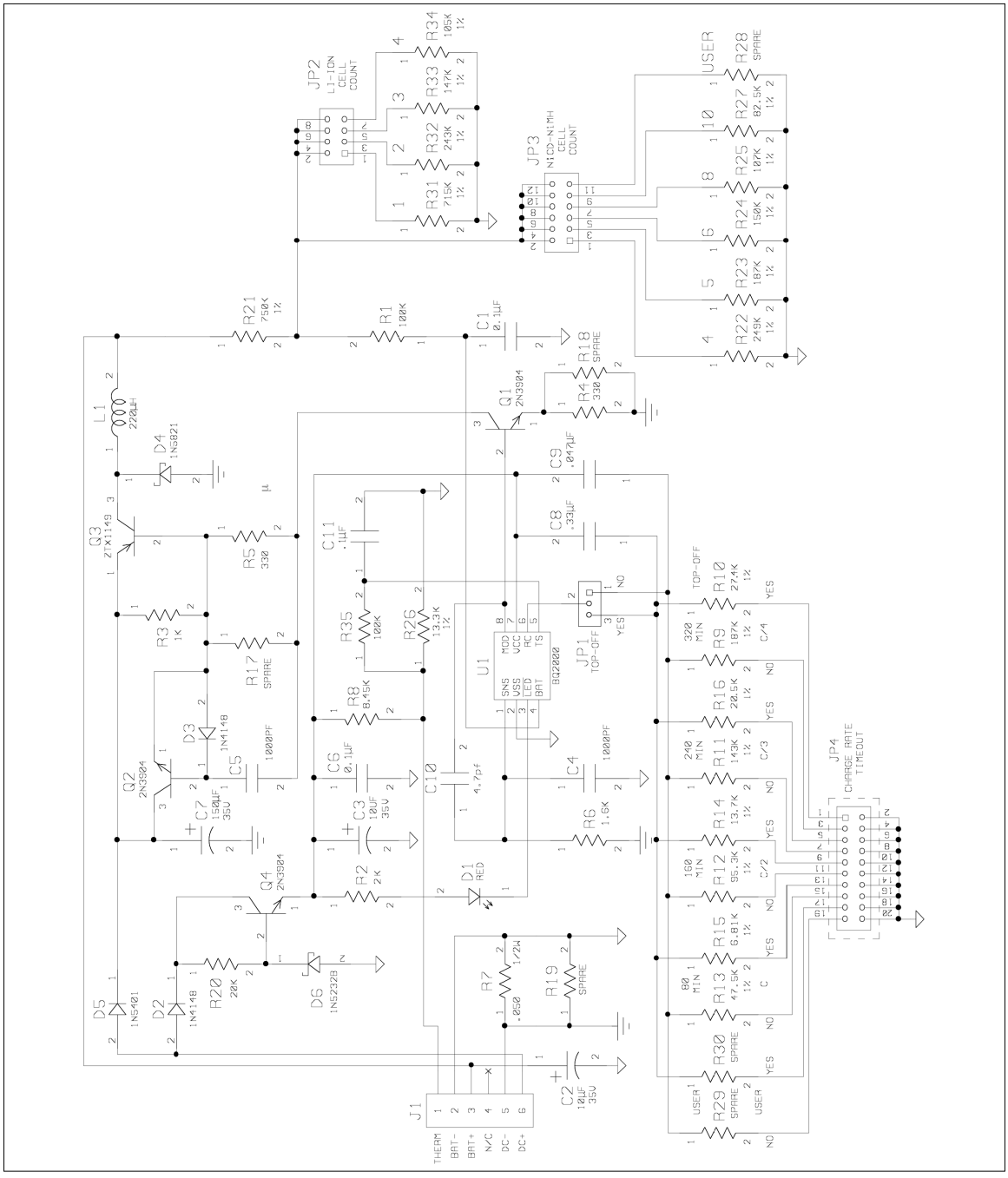
1. Configure the board for the number of cells and charging current as described in the above sections.
2. Set the jumpers for charge rate/time-out and top-off option.
3. Connect the battery pack to BAT+ and BAT-.
4. Connect the thermistor to THERM and BAT-.
5. Connect the charging supply to J1. Please see the Recommended DC Operationg Conditions.

Jumper Configuration Diagram



Rev. D Board

DV2000S1 and DV2000TS1 Board Schematic



Rev. D Board

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Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

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