

Fast Charge Development System

Features

- ▶ bq2007 fast-charge control evaluation and development
- ▶ Battery charge status display modes and driver interfaces are jumper configurable
 - On-board seven-step LED bargraph or ten-step BCD digit display
 - Charge status monitoring interface option
 - On-board charge status indication LEDs
- ▶ Fast-charge termination by $-\Delta V$, peak voltage detect (PVD), maximum voltage, maximum time, and maximum temperature
- ▶ Jumper-selectable for 4, 5, 6, 8, or 10 NiCd or NiMH cell pack charging
- ▶ Jumper-selectable standard or fast charge rates from 1 to 4 hours
- ▶ Discharge-before-charge push-button or automatic control

Introduction

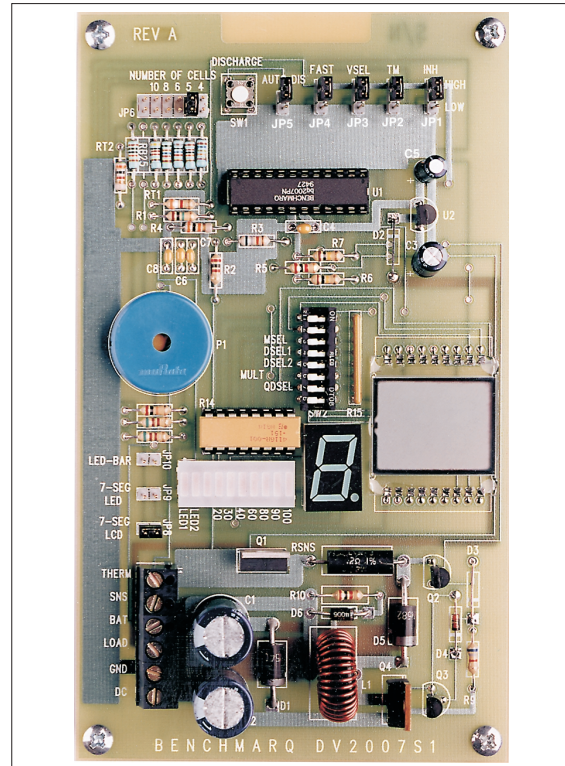
The bq2007 Fast Charge IC is a single-chip CMOS IC that performs charge control, charge status, and charge status display in a 24-pin DIP package. The DV2007S1 Development System offers a quick method to evaluate the bq2007 functional features and to validate selected parameters prior to design implementation.

Functional Description

The DV2007S1 provides the platform for a functional evaluation of the bq2007 features on single PCB. The board contain all the connections required to fully exercise the bq2007 feature sets. See the bq2007 data sheet (Aug. 1994 or later) and application note AB-0019 entitled "Using the bq2007 Display Mode Options."

Connection Descriptions

The DV2007S1 has external connections to configure the following features of the bq2007 IC. Jumpers J1–J4 are two-position, where center tap is to bq2007 input pin. HIGH position is VCC, LOW position is VSS, and no



jumper is float. Switch 2 (3–7) ON position is pulled up to VCC; OFF position is pulled down to VSS.

J1

THERM	Thermistor connection
SNS	Sense resistor/battery negative terminal
BAT	Battery positive terminal
LOAD	Discharge load connection
GND	Ground
DC	DC positive power supply input

SW1

DISCHARGE	Discharge control. Pressing switch initiates discharge-before-charge.
-----------	---

DV2007S1

SW2

- 3 MSEL Driver mode select. Display drivers configured for LCD or LED signal interface. MSEL ON position is LED levels; OFF position is LCD interface levels.
- 4 DSEL1 Display select 1 input selects charge status indication format for LED₁ and LED₂. See Table 1.
- 5 DSEL2 Display select 2 input selects charge status indication format for LED₁ and LED₂. See Table 1.
- 6 MULT Multi-cell pack select. MULT ON position when charging multi-cell packs and OFF position when charging packs with a fixed number of cells. Charge status monitoring uses charge timer when MULT in ON position and battery voltage thresholds when MULT in OFF position.

7 QDSEL

Charge status display select. Bargraph or BCD digit display mode. QDSEL ON position enables bargraph and OFF position enables BCD.

JP1 Charge inhibit input

INH Low suspends charge actions in low-power state. High is normal operation.

JP2 Timer mode select

TM Three-state input that selects the charge time-out period. See Table 2.

JP3 Voltage termination select

VSEL LOW enables $-\Delta V$ charge termination, whereas HIGH enables PVD termination. See Table 3.

JP4 Fast charge rate select

FAST Jumper connected to V_{CC} enables the fast charge rate and connected to V_{SS}

Table 1. DV2007 Charge Status Display Configuration

Mode	Charge Action State	LED ₁	LED ₂	DIS	ALARM
DSEL ₁ = OFF DSEL ₂ = OFF (Mode 1)	Battery absent	0	0	0	0
	Charge pending (temp. limit, low voltage)	0	Flashing	0	0
	Discharge in progress	0	1	1	0
	Charging	Flashing	0	0	0
	Charge complete	1	0	0	High tone
	Fault (low-voltage time-out)	0	0	0	Low tone
DSEL ₁ = ON DSEL ₂ = OFF (Mode 2)	Battery absent	0	0	0	0
	Discharge in progress, pending	1	1	1	0
	Charging	1	0	0	0
	Charge complete	0	1	0	High tone
	Fault (low-voltage time-out)	0	0	0	Low tone
DSEL ₁ = OFF DSEL ₂ = ON (Mode 3)	Battery absent	0	0	0	0
	Charge pending (temp. limit, low voltage)	0	Flashing	0	0
	Discharge in progress	0	Flashing	1	0
	Charging	Flashing	0	0	0
	Charge complete	1	0	0	High tone
	Fault (low-voltage time-out)	0	1	0	Low tone

Note: 1 = on; 0 = off; OFF = pulled down to V_{SS}; ON = pulled up to V_{CC}.

Table 2. DV2007 Charge Action Control Configuration

FAST Input State	TM Input State	Time-out Period (min)	MOD Duty Cycle	Holdoff period (sec)	Trickle Rep Rate $-\Delta V$ $\frac{C}{32}$	Trickle Rep Rate PVD $\frac{C}{64}$
Low	Removed	640 ($\frac{C}{8}$)	25%	2400	219Hz	109Hz
Low	Low	320 ($\frac{C}{4}$)	25%	1200	109Hz	55Hz
Low	High	160 ($\frac{C}{2}$)	25%	600	55Hz	27Hz
High	Removed	160 ($\frac{C}{2}$)	100%	600	219Hz	109Hz
High	Low	80 (C)	100%	300	109Hz	55Hz
High	High	40 (2C)	100%	150	55Hz	27Hz

Table 3. DV2007 VSEL Configuration

VSEL	Detection Method	Top-Off	Pulse Trickle Rate
Low	$-\Delta V$	Disabled	$\frac{C}{32}$
High	PVD	Enabled	$\frac{C}{64}$

enables the standard charge rate ($\frac{1}{4}$ fast charge rate). See Table 2.

JP5 Automatic discharge

AUTO DIS Automatic discharge is selected if JP5 is installed.

JP6 Number of cells

NOC These jumpers select from 4, 5, 6, 8, or 10 cells. One of the jumper locations is user-definable.

JP8 LCD mode enable

7-SEGLCD Jumper removed disables the LCD display.

JP9 LED mode enable

7-SEGLEDD Jumper removed disables the LED display.

JP10 Bargraph LED mode enable

LED BAR Jumper removed disables the on-board seven-step bargraph LED display.

DV2007S1

Example DV2007 Setup

Given:

Number of cells = 5; fast charge current = 750mA

Feature Selections:

- Charge single configuration packs (MULT = OFF)
- Charge at fast charge current (FAST = HIGH) and set charge safety timer for 1C rate (TM = LOW)
- Charge termination method is -ΔV (VSEL = LOW)
- Charge status display is mode 3 (DSEL₁ = OFF; DSEL₂ = ON)
- Charge status monitoring is LCD interface (MSEL = OFF) and BCD digit display (QDSEL = OFF)

Board Connections:

1. Calculate and install $R_{SNS} = 0.225V/750mA = 0.3\Omega \pm 1\% @ \frac{1}{4}W$.
2. Calculate discharge load resistor (maximum current is 3A; caution for power dissipation).
3. Verify current temperature sense network (RT1, RT2, RT and R3, R4)
4. Connect battery, discharge load resistor, thermistor, and power supply to J1 connector; verify polarity.
5. Verify correct configuration according to Table 4.
6. Turn on DC power supply.

Your DV2007 Setup:

Number of cells =
Fast charge current =
Discharge load resistor =
 $R_{SNS} = 0.225V/$ =

Your DV2007 Configuration: Complete Table 5.

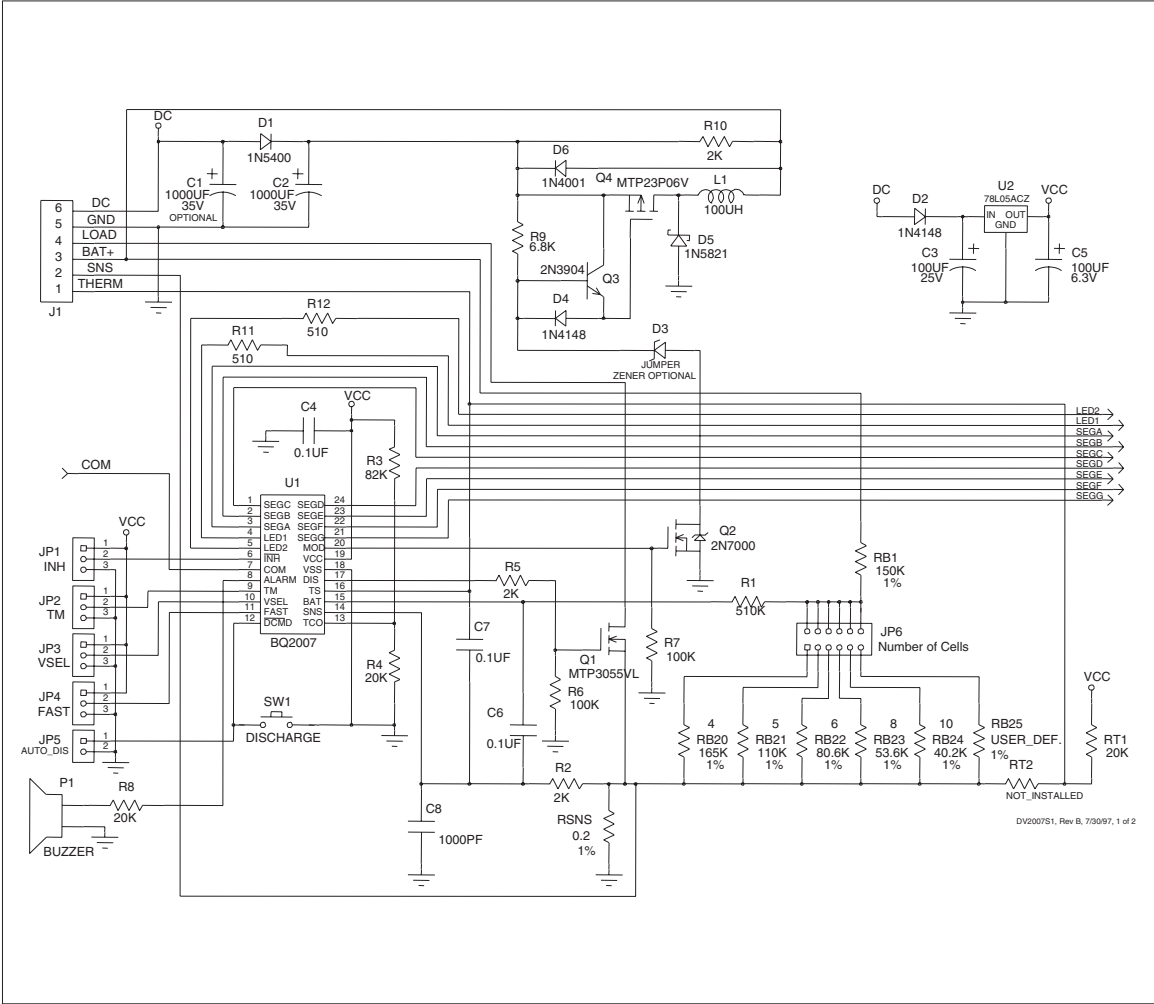
Table 4. Example DV2007 Configuration Table

SW2 Positions					Jumper Positions									
3	4	5	6	7	JP1	JP2	JP3	JP4	JP5	JP6	JP8	JP9	JP10	
OFF	OFF	ON	OFF	OFF	HIGH	LOW	LOW	HIGH	remove	5	install	remove	remove	

Table 5. Your DV2007 Configuration Table

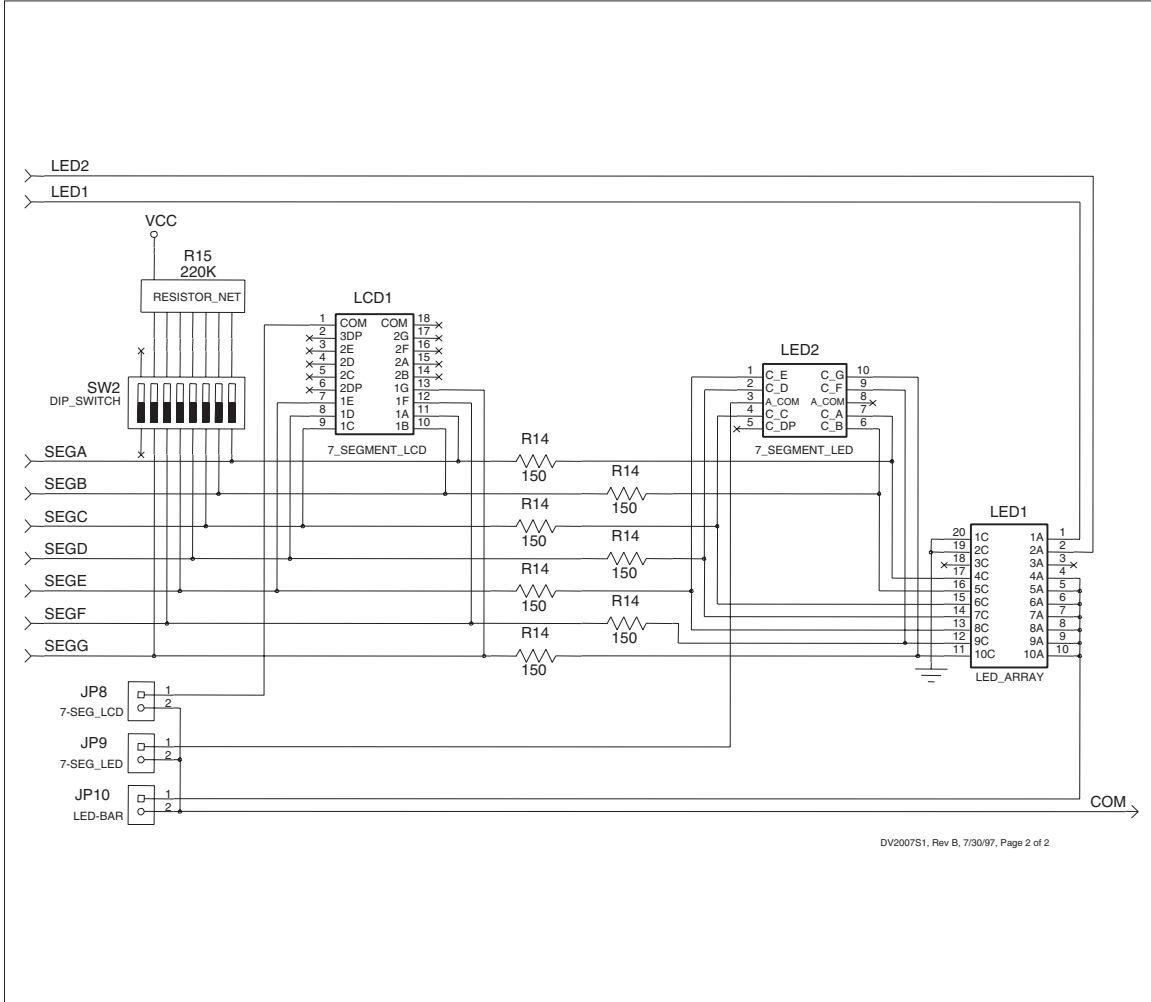
SW2 Positions					Jumper Positions									
3	4	5	6	7	JP1	JP2	JP3	JP4	JP5	JP6	JP8	JP9	JP10	
MSEL	DSEL1	DSEL2	MULT	QDSEL	INH	TM	VSEL	FAST	DIS	NOC	LCD	LED	BAR	

DV2007S1 Board Schematic



DV2007S1

DV2007S1 Board Schematic Continued



DV2007S1, Rev B, 7/30/97, Page 2 of 2

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.