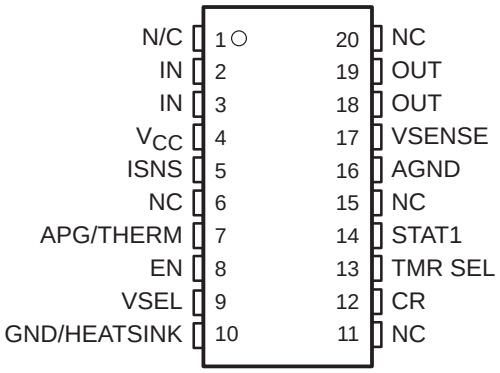
bq24004, bq24005, bq24006
TWO-CELL ADVANCED LINEAR Li-ION CHARGE MANAGEMENT IC WITH INTEGRATED POWER FET

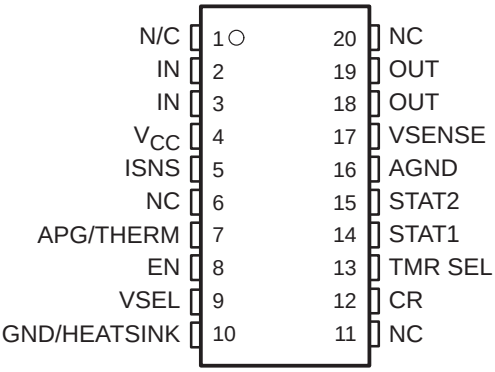
SLUS466 – SEPTEMBER 2000

- **Highly Integrated Solution With FET Pass Transistor and Reverse-Blocking Schottky and thermal Protection**
- **Integrated Voltage and Current Regulation With Programmable Charge Current**
- **Ideal for Linear Charger Designs for Two-Cell Li-Ion Packs With Coke or Graphite Anodes**
- **Up to 1.2-A Continuous Charge Current With Low Dropout Voltage (Maximum of 0.7 V)**
- **Safety-Charge Timer During Preconditioning and Fast Charge**
- **Integrated Cell Conditioning for Reviving Deeply Discharged Cells and Minimizing Heat Dissipation During Initial Stage of Charge**
- **Optional Temperature or Input-Power Monitoring Before and During Charge**
- **Soft-Start Circuit for Limiting the Current Ramp Rate to Maintain Compliance With the USB 1.1 Standard**
- **Various Charge-Status Output Options for Driving Single , Double, or Bicolor LEDs or Host-Processor Interface**
- **Charge Termination By Minimum Current and Time**
- **Low-Power Sleep Mode**
- **Packaging: 20-Lead TSSOP PowerPAD™**

bq24004
PWP PACKAGE
(TOP VIEW)



bq24005, bq24006
PWP PACKAGE
(TOP VIEW)



PRODUCT PREVIEW

description

The bq2400x series ICs are advanced Li-ion linear charge management devices for highly integrated and space-limited applications. They combine high-accuracy current and voltage regulation, FET pass-transistor and reverse-blocking Schottky, battery conditioning, temperature, or input-power monitoring, charge termination, charge-status indication, and charge timer in a small, 20-lead TSSOP PowerPAD™ package.

The bq2400x continuously measures battery temperature using an external thermistor. For safety reasons, the bq2400x inhibits charge until the battery temperature is within the user-defined thresholds. Alternatively, the user can monitor the input voltage to qualify charge. The bq2400x series then charge the battery in three phases: preconditioning, constant current and constant voltage. If the battery voltage is below the internal low-voltage threshold, the bq2400x uses trickle-charge to condition the battery. A preconditioning timer is provided for additional safety. Following preconditioning, the bq2400x applies a constant-charge current to the battery. An external sense resistor sets the magnitude of the current. The constant-current phase is maintained until the battery reaches the charge-regulation voltage. The bq2400x then transitions to the constant voltage phase. The user can configure the device for cells with either coke or graphite anodes. The accuracy of the voltage regulation is better than ±1.2% over the operating junction temperature and supply voltage range.

description (continued)

Charge is terminated by either of the following methods:

- Maximum time
- Minimum current detection

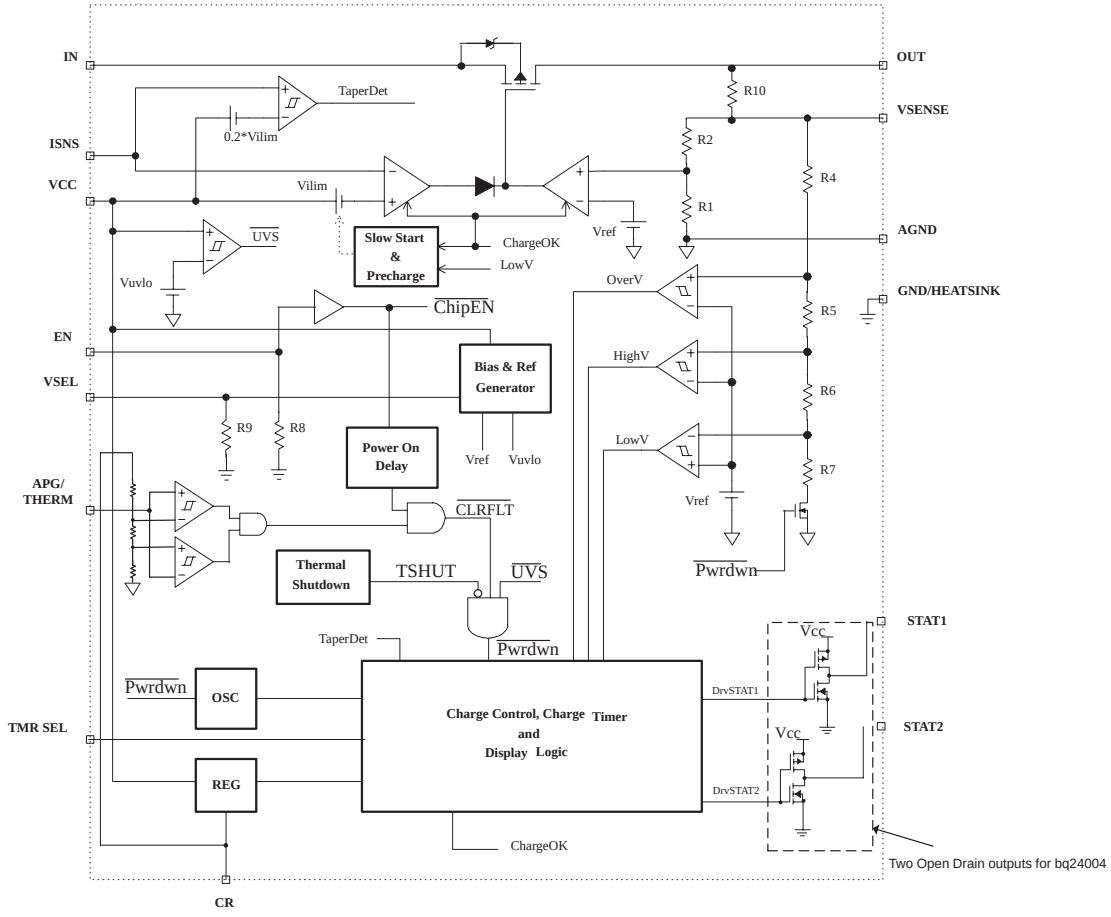
The bq2400x automatically restarts the charge if the battery voltage falls below an internal recharge threshold.

As shown in the following table, the bq2400x series ICs are available in 3 charge-status configuration options.

AVAILABLE OPTIONS

T_J	PACKAGE	Charge Status Configuration
	20-Pin HTTSOP PowerPAD™ (PWP)	
–40°C to 125°C	bq24004	Single LED
	bq24005	2 LEDs
	bq24006	Bicolor LED

functional block diagram



Terminal Functions

TERMINAL		I/O	DESCRIPTION
NAME	No.		
AGND	16		Ground pin; connect close to the battery terminal for remote sensing.
APG/THERM	7	I	Adapter power good input/thermistor sense
CR	12	I	Internal regulator bypass capacitor
EN	8	I	Active-high enable input with internal pull down. Low-Iq stand-by mode active when EN is low.
GND/HEATSINK	10		Ground pin, connect to PowerPAD™ heat-sink layout pattern
IN	2,3	I	Input voltage
ISNS	5	I	Current sense input
NC	1,6,11 15,20		No connect
OUT	18,19	O	Charge current output
STAT1	14	O	Display output 1
STAT2	15	O	Display output 2 (for bq24005 and bq24006 only)
TMR SEL	13	I	User selectable total charge timer
V_{CC}	4	I	Supply voltage
VSEL	9	I	Voltage regulation options
VSENSE	17	I	Remote voltage sense input

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