

SBS 1.1-COMPLIANT GAS GAUGE ENABLED WITH IMPEDANCE TRACK™ TECHNOLOGY FOR USE WITH THE bq29330

FEATURES

- **Next Generation Patented Impedance Track™ Technology accurately Measures Available Charge in Li-Ion and Li-Polymer Batteries**
- **Better than 1% Error Over Lifetime of the Battery**
- **Instant Accuracy – No Learning Cycle Required**
- **Supports the Smart Battery Specification SBS V1.1**
- **Powerful 8-Bit RISC CPU With Ultra-Low Power Modes**
- **Works With the TI bq29330 Analog Front-End (AFE) Protection IC to Provide Complete Pack Electronics Solution**
- **Full Array of Programmable Protection Features**
 - Voltage, Current and Temperature
- **Fully Integrated High Accurate Clock**
- **Flexible Configuration for 2 to 4 Series Li-Ion and Li-Polymer Cells**
- **Integrated Field Programmable FLASH Memory Eliminates the Need for External Configuration Memory**
- **Smart Battery Charger Control Feature**
- **Two 16-Bit Delta-Sigma Converter**
 - Accurate Voltage and Temperature Measurements
 - Integrating Coloumb Counter for Charge Flow
 - Better Than 0.65 nVh of Resolution
 - Self-Calibrating
- **Supports SHA-1 Authentication**
- **20-Pin TSSOP (PW)**

APPLICATIONS

- **Notebook PCs**
- **Medical and Test Equipment**
- **Portable Instrumentation**

DESCRIPTION

The bq20z70 SBS-compliant gas gauge IC, incorporating patented Impedance Track™ technology, is designed for battery-pack or in-system installation. The bq20z70 measures and maintains an accurate record of available charge in Li-ion or Li-polymer batteries using its integrated high-performance analog peripherals. The bq20z70 monitors capacity change, battery impedance, open-circuit voltage, and other critical parameters of the battery pack, and reports the information to the system host controller over a serial-communication bus. It is designed to work with the bq29330 analog front-end (AFE) protection IC to maximize functionality and safety, and minimize component count and cost in smart battery circuits.

The Impedance Track technology continuously analyzes the battery impedance, resulting in superior gas-gauging accuracy. This enables remaining capacity to be calculated with discharge rate, temperature, and cell aging all accounted for during each stage of every cycle.

AVAILABLE OPTIONS

T _A	PACKAGE ⁽¹⁾	
	20-PIN TSSOP (PW) Tube	20-PIN TSSOP (PW) Tape and Reel
–40°C to 85°C	bq20z70PW ⁽²⁾	bq20z70PWR ⁽³⁾

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

(2) A single tube quantity is 50 units.

(3) A single reel quantity is 2000 units

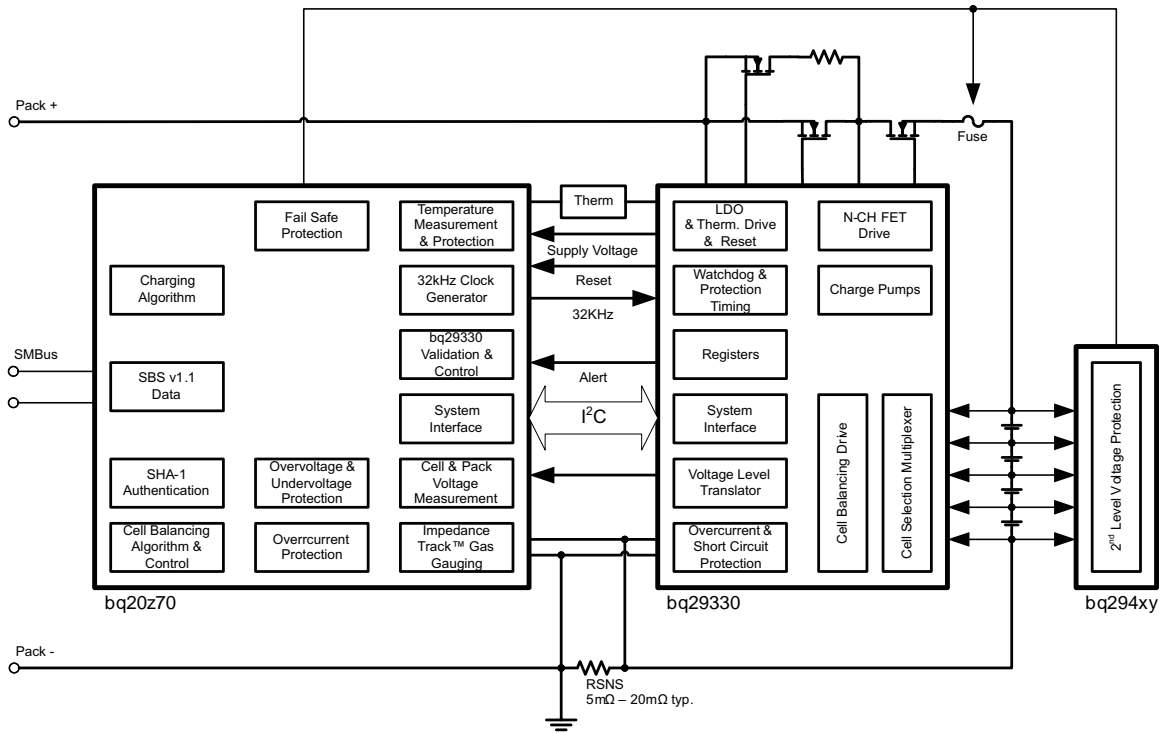


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bq20z70

SLUS686B—NOVEMBER 2005—REVISED JULY 2007



TSSOP (PW) (TOP VIEW)

XALERT	1	20	VCELL-
TS2	2	19	VCELL+
TS1	3	18	VCC
CLKOUT	4	17	VSS
PRES	5	16	MRST
PFIN	6	15	SRN
SAFE	7	14	SRP
SMBD	8	13	VSS
NC	9	12	SCLK
SMBC	10	11	SDATA

TERMINAL FUNCTIONS

TERMINAL		I/O ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	XALERT	I	Alert interrupt input from bq29330. Connect directly to bq29330 XALERT pin
2	TS2	I	2 nd thermistor voltage input connection to monitor temperature
3	TS1	I	1 st thermistor voltage input connection to monitor temperature
4	CLKOUT	O	32.768kHz output for bq29330 watchdog. Connect directly to bq29330 WDI pin
5	PRES	I	Active low input to sense system insertion
6	PFIN	I	Active low input to sense secondary protector output status
7	SAFE	O	Active high output to enforce additional level of safety, e.g. fuse blow
8	SMBD	I/OD	SMBus data open drain bidirectional pin used for communication with bq20z70
9	NC	–	Not used - leave floating
10	SMBC	I/OD	SMBus clock open drain bidirectional pin used for communication with bq20z70
11	SDATA	I/OD	Data transfer line from and to bq29330. Connect directly to SDATA pin of bq29330
12	SCLK	I/OD	Data clock line to bq29330. Connect directly to SCLK pin of bq29330
13	VSS	I/OD	VSS
14	SRP	IA	Connection for a small-value resistor to monitor the battery charge and discharge current flow
15	SRN	IA	Connection for a small-value resistor to monitor the battery charge and discharge current flow
16	MRST	I	Master reset input that forces the device into reset when held low. Connect directly to XRST pin of bq29330
17	VSS	P	Negative supply. Both VSS needs to be connected together
18	VCC	P	Positive supply
19	VCELL+	I	Positive differential cell input. Connect directly to CELL+ pin of bq29330
20	VCELL-	I	Negative differential cell input. Connect directly to CELL- pin of bq29330

(1) I = Input, IA = Analog input, I/O = Input/output, I/OD = Input/Open-drain output, O = Output, OA = Analog output, P = Power

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		RANGE
V_{CC} relative to V_{SS} ⁽²⁾	Supply voltage range on VCC pin	–0.3 V to 2.75 V
$V_{(I/O)}$ relative to V_{SS} ⁽²⁾	XALERT, PFIN, SAFE, SMBD, SMBC, SDATA, SCLK,	–0.3 V to 6.0 V
V_I relative to V_{SS} ⁽²⁾	TS2, TS1, CLKOUT, PRES, SRP, SRN, MRST, VCELL+, VCELL-	–0.3 V to $V_{CC} + 0.3$ V
T_A	Operating free-air temperature range	–40°C to 85°C
T_{stg}	Storage temperature range	–65°C to 150°C

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) V_{SS} refers to Voltage at VSS pin.

ELECTRICAL C

INTEGRATING ADC (Coulomb Counter) CHARACTERISTICS

SMBus TIMING SPECIFICATIONS

$V_{CC} = 2.4\text{ V to }2.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{SMB}	SMBus operating frequency	Slave mode, SMBC 50% duty cycle	10		100	kHz
f_{MAS}	SMBus master clock frequency	Master mode, no clock low slave extend		51.2		
t_{BUF}	Bus free time between start and stop		4.7			
$t_{HD:STA}$	Hold time after (repeated) start		4			s
$t_{SU:STA}$	Repeated start					



FEATURE SET

Primary (1st Level) Safety Features

The bq20z70 supports a wide range of battery and system protection features that can easily be configured. The primary safety features include:

- Cell over/under voltage protection
- Charge and Discharge overcurrent
- Short Circuit
- Charge and Discharge Overtemperature
- AFE Watchdog

Secondary (2nd Level) Safety Features

The secondary safety features of the bq20z70 can be used to indicate more serious faults via the SAFE (pin 7). This pin can be used to blow an in-line fuse to permanently disable the battery pack from charging or discharging. The secondary safety protection features include:

- Safety overvoltage
- Safety overcurrent in Charge and Discharge
- Safety overtemperature in Charge and Discharge
- Charge FET and 0 Volt Charge FET fault
- Discharge FET fault
- AFE communication fault

Charge Control Features

The bq20z70 charge control features include:

- Reports the appropriate charging current needed for constant current charging and the appropriate charging voltage needed for constant voltage charging © 2007 Texas Instruments Incorporated. All rights reserved. (1)Tj3705 1 0 0 1 275.26 422.8
- Determines the chemical state of charge of each battery cell using Impedance Track™ and can reduce the charge difference of the battery cells in fully charged state of the battery pack gradually using cell balj 1 0 0 1 496.6447

Gas Gauging

Authentication

FEATURE SET (continued)

Power Modes

The bq20z70 supports 3 different power modes to reduce power consumption:

- In Normal Mode, the bq20z70 performs measurements, calculations, protection decisions and data updates in 1 second intervals. Between these intervals, the bq20z70 is in a reduced power stage.
- In Sleep Mode, the bq20z70 performs measurements, calculations, protection decisions and data update in adjustable time intervals. Between these intervals, the bq20z70 is in a reduced power stage. The bq20z70 has a wake function that enables exit from Sleep mode, when current flow or failure is detected.
- In Shutdown Mode the bq20z70 is completely disabled.

CONFIGURATION

Oscillator Function

The bq20z70 fully integrates the system oscillators. Therefore, the bq20z70 requires no external components for this feature.

System Present Operation

The bq20z70 pulls the PU pin high periodically (1 s). Connect this pin to the $\overline{\text{PRES}}$ pin of the bq20z70 via a resistor of approximately 5 k Ω . The bq20z70 measures the $\overline{\text{PRES}}$ input during the PU-active period to determine its state. If $\overline{\text{PRES}}$ input is pulled to ground by external system, the bq20z70 detects this as system present.

BATTERY PARAMETER MEASUREMENTS

The bq20z70 uses an integrating delta-sigma analog-to-digital converter (ADC) for current measurement, and a second delta-sigma ADC for individual cell and battery voltage, and temperature measurement.

Charge and Discharge Counting

The integrating delta-sigma ADC measures the charge/discharge flow of the battery by measuring the voltage drop across a small-value sense resistor between the SR1 and SR2 pins. The integrating ADC measures bipolar signals from -0.25 V to 0.25 V. The bq20z70 detects charge activity when $V_{\text{SR}} = V_{(\text{SR}1)} - V_{(\text{SR}2)}$ is positive and discharge activity when $V_{\text{SR}} = V_{(\text{SR}1)} - V_{(\text{SR}2)}$ is negative. The bq20z70 continuously integrates the signal over time, using an internal counter. The fundamental rate of the counter is 0.65 nVh.

Voltage

The bq20z70 updates the individual series cell voltages through the bq29330 at one second intervals. The bq20z70 configures the bq29330 to connect the selected cell, cell offset, or bq29330 VREF to the CELL pin of the bq29330, which is required to be connected to VIN of the bq20z70. The internal ADC of the bq20z70 measures the voltage, scales and calibrates it appropriately. This data is also used to calculate the impedance of the cell for the Impedance Track™ gas-gauging.

Current

The bq20z70 uses the SRP and SRN inputs to measure and calculate the battery charge and discharge current using a 5 m Ω to 20 m Ω typ. sense resistor.

Auto Calibration

The bq20z70 provides an auto-calibration resistor/F2 -10 Tf (to99)Tj 1 0 0 1 495.75 5 0 0 1 162.88 635 Tm /F2 -Tf (to99)T

Temperature

FEATURE SET (continued)

COMMUNICATIONS

The bq20z70 uses SMBus v1.1 with Master Mode and package error checking (PEC) options per the SBS specification.

SMBus On and Off State

The bq20z70 detects an SMBus off state when SMBC and SMBD are logic-low for ≥ 2 seconds. Clearing this state requires either SMBC or SMBD to transition high. Within 1 ms, the communication bus is available.

SBS Commands



PACKAGE OPTION ADDENDUM

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3-Jul-2009

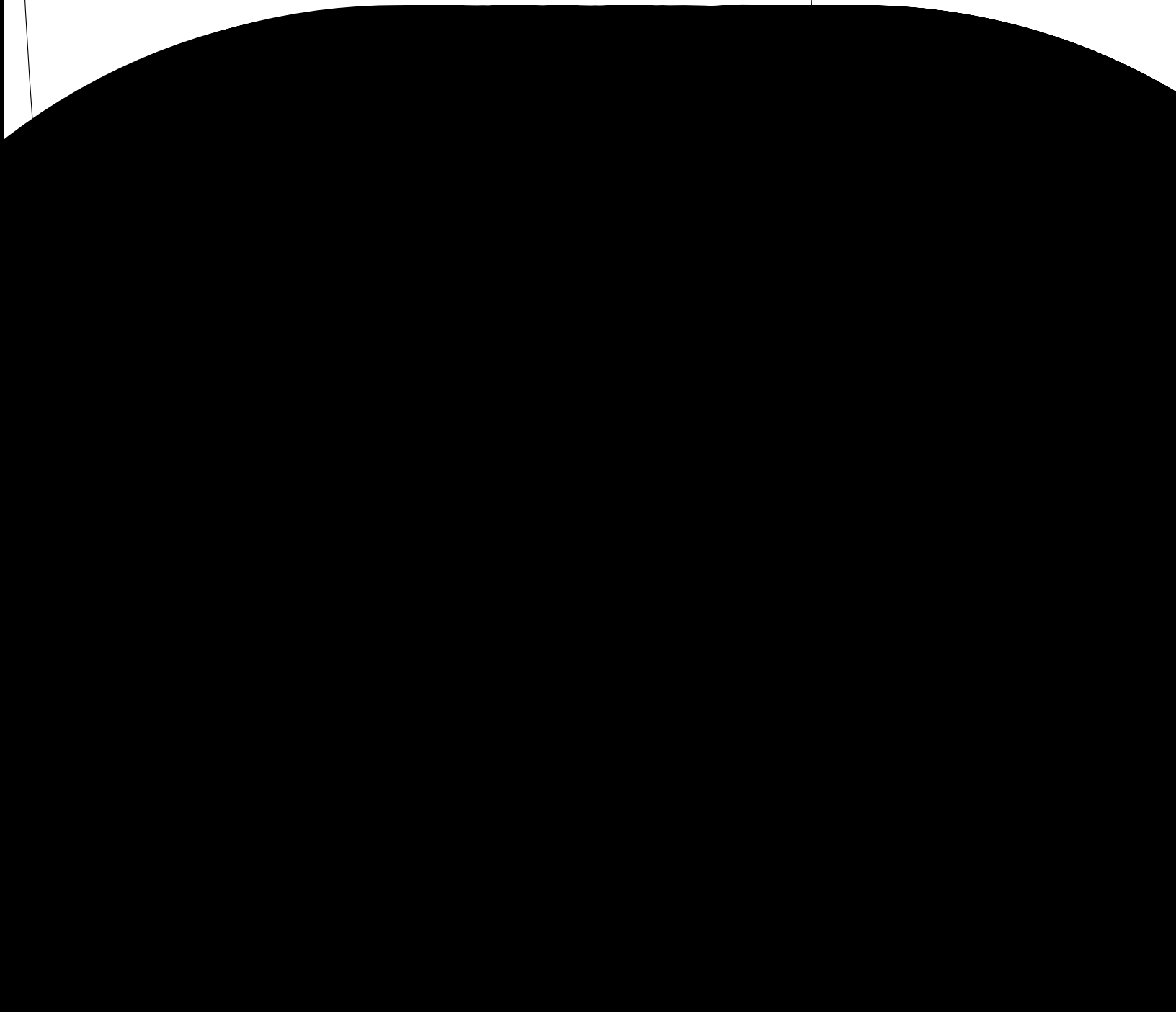
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MECHANICS

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

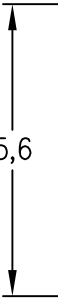
AAAAAAAAAAAA



LAN

PLASTIC SMALL OUTLINE

Example Board Layout



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - D. contact their board assembly site for stencil design recommendations. F

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