

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.

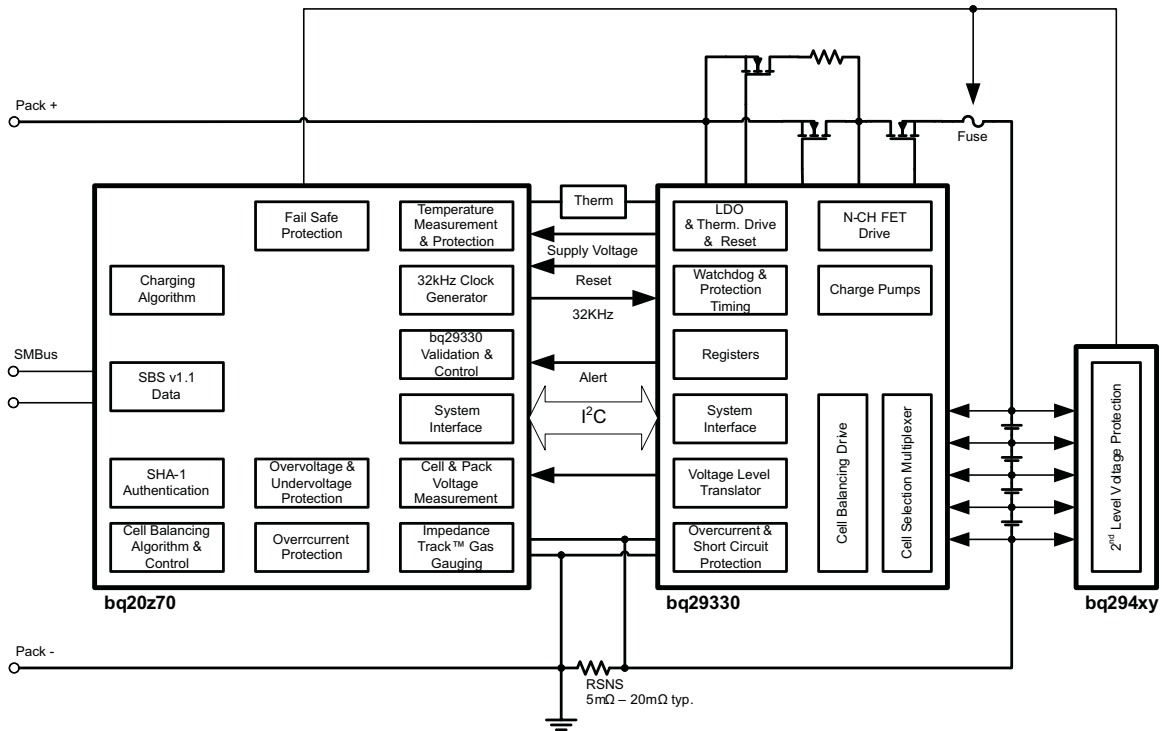
(3) A single reel quantity is 2000 units



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IMPEDANCE TRACK is a trademark of Texas Instruments.

SYSTEM PARTITIONING DIAGRAM



**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/OD) 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 CHARACTERISTICS

V_{CC} = 2.4 V to 2.6 V, T_A = -40°C - 85°C (unless otherwise noted)

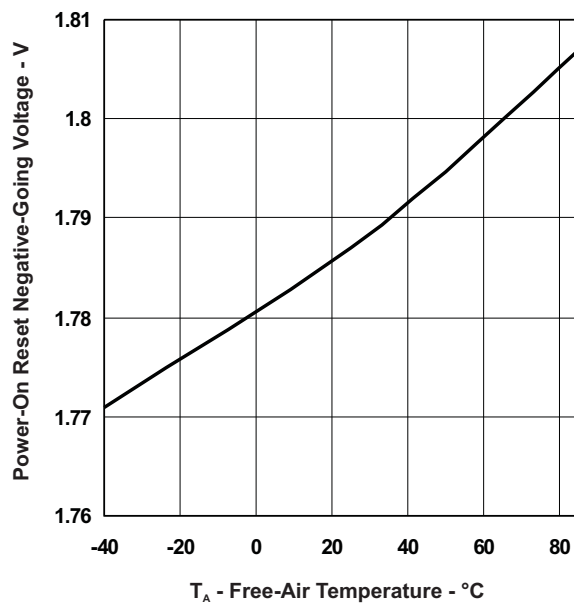
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{DD}	Supply voltage	VDDA and VDDD	2.4	2.5	2.6	V
I _{DD}	Operating mode current	No flash programming	400 ⁽¹⁾			μA
		bq20z70 + bq29330	475			
I _(SLP)	Low-power storage mode current	Sleep mode	8 ⁽¹⁾			μA
		bq20z70 + bq29330	48			
I _(SLP)	Shutdown Current	Shutdown Mode	0.1 ⁽¹⁾			μA
		bq20z70 + bq29330	0.2			
V _{OL}	Output voltage low CLKOUT, SAFE, SMBD, SMBC, SDATA, SCLK	I _{OL} = 7 mA	0.4			V
V _{OH}	Output high voltage CLKOUT, SAFE, SMBD, SMBC, SDATA, SCLK	I _{OH} = -0.5 mA	V _{CC} - 0.5			V
V _{IL}	Input voltage low $\overline{\text{PRES}}$, $\overline{\text{PFIN}}$, SMBD, SMBC, SDATA, $\overline{\text{MRST}}$		0.8			V
V _{IH}	Input voltage high $\overline{\text{PRES}}$, $\overline{\text{PFIN}}$, SMBD, SMBC, SDATA, $\overline{\text{MRST}}$		2.0			V
C _{IN}	Input capacitance		5			pF
V _(AI1)	Input voltage range TS1, TS2, VCELL+, VCELL-		- 0.2	0.8 x V _{CC}		V
V _(AI2)	Input voltage range SRP, SRN		- 0.2	0.2		V
Z _(AI1)	Input impedance TS1, TS2, VCELL+, VCELL -	0 V - 1 V	8			MΩ
Z _(AI2)	Input impedance SRP, SRN	0 V - 1 V	2.5			MΩ

(1) This value does not include the bq29330

POWER-ON RESET

V_{CC} = 2.4 V to 2.6 V, T_A = -40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{IT-}	Negative-going voltage input		1.7	1.8	1.9	V
V _{HYS}	Power-on reset hysteresis		50	125	200	mV



INTEGRATING ADC (Coulomb Counter) CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(SR)}$ Input voltage range, $V_{(SRN)}$ and $V_{(SRP)}$	$V_{(SR)} = V_{(SRP)} - V_{(SRN)}$	-0.20		0.20	V
$V_{(SROS)}$ Input offset	$T_A = 25^\circ\text{C to }85^\circ\text{C}$		10		μV
INL Integral nonlinearity error			$\pm 0.007\%$	$\pm 0.037\%$	

OSCILLATOR

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
HIGH FREQUENCY OSCILLATOR					
$f_{(OSC)}$ Operating frequency			4.194		MHz
$f_{(EIO)}$ Frequency error ⁽¹⁾⁽²⁾		-3%	0.25%	3%	
	$T_A = 20^\circ\text{C to }70^\circ\text{C}$	-2%	0.25%	2%	
$f_{(sxo)}$ Start-up time ⁽³⁾			2.5	5	ms
LOW FREQUENCY OSCILLATOR					
$f_{(LOSC)}$ Operating frequency			32.768		kHz
$f_{(LEIO)}$ Frequency error ⁽²⁾⁽⁴⁾		-2.5%	0.25%	2.5%	
	$T_A = 20^\circ\text{C to }70^\circ\text{C}$	-1.5%	0.25%	1.5%	
$f_{(LSxo)}$ Start-up time ⁽⁵⁾				500	μs

(1) The frequency error is measured from 4.194 MHz.

(2) The frequency drift is included and measured from the trimmed frequency at $V_{CC} = 2.5\text{ V}$, $T_A = 25^\circ\text{C}$.

(3) The start-up time is defined as the time it takes for the oscillator output frequency to be within 1% of the specified frequency.

(4) The frequency error is measured from 32.768 kHz.

(5) The start-up time is defined as the time it takes for the oscillator output frequency to be $\pm 3\%$.

DATA FLASH MEMORY CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{DR} Data retention	See ⁽¹⁾		10		Years
Flash programming write-cycles	See ⁽¹⁾	20,000			Cycles
$t_{(WORDPROG)}$ Word programming time	See ⁽¹⁾			2	ms
$I_{(DDPROG)}$ Flash-write and erase supply current	See ⁽¹⁾		5	10	mA

(1) Specified by design. Not production tested

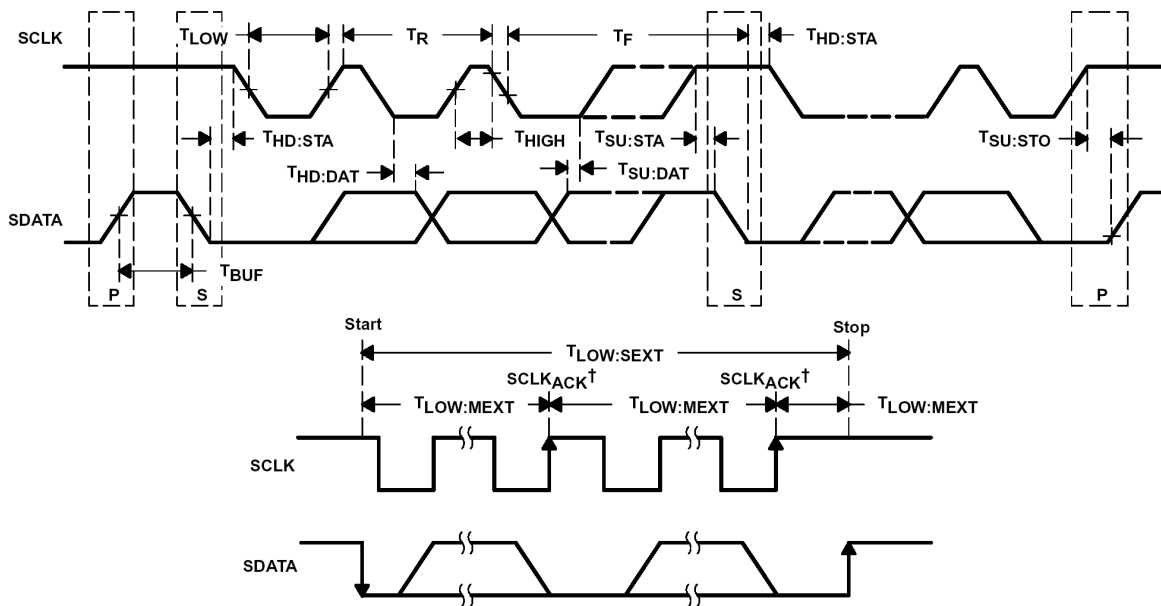
SMBus TIMING SPECIFICATIONS

$V_{CC} = 2.4\text{ V to }2.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (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		μs
$t_{HD:STA}$	Hold time after (repeated) start		4		
$t_{SU:STA}$	Repeated start setup time		4.7		
$t_{SU:STO}$	Stop setup time		4		
$t_{HD:DAT}$	Data hold time	Receive mode	0		ns
		Transmit mode	300		
$t_{SU:DAT}$	Data setup time		250		
$t_{TIMEOUT}$	Error signal/detect	See (1)	25	35	ms
t_{LOW}	Clock low period		4.7		μs
t_{HIGH}	Clock high period	See (2)	4	50	
$t_{LOW:SEXT}$	Cumulative clock low slave extend time	See (3)		25	ms
$t_{LOW:MEXT}$	Cumulative clock low master extend time	See (4)		10	
t_F	Clock/data fall time	$(V_{ILMAX} - 0.15\text{ V})$ to $(V_{IHMIN} + 0.15\text{ V})$		300	ns
t_R	Clock/data rise time	$0.9\text{ VCC to } (V_{ILMAX} - 0.15\text{ V})$		1000	

- (1) The bq20z70 times out when any clock low exceeds $t_{TIMEOUT}$.
- (2) $t_{HIGH:MAX}$ is minimum bus idle time. SMBC = 1 for $t > 50\ \mu\text{s}$ causes reset of any transaction involving the bq20z70 that is in progress.
- (3) $t_{LOW:SEXT}$ is the cumulative time a slave device is allowed to extend the clock cycles in one message from initial start to the stop.
- (4) $t_{LOW:MEXT}$ is the cumulative time a master device is allowed to extend the clock cycles in one message from initial start to the stop.

SMBus TIMING DIAGRAM



* $SCLK_{ACK}$ is the acknowledge-related clock pulse generated by the master.

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 to a smart charger using SMBus broadcasts.
- 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 balancing algorithm during charging. This prevents fully charged cells from overcharging and causing excessive degradation and also increases the usable pack energy by preventing premature charge termination
- Supports pre-charging/zero-volt charging
- Support fast charging
- Supports charge inhibit and charge suspend if battery pack temperature is out of temperature range
- Reports charging fault and also indicate charge status via charge and discharge alarms.

Gas Gauging

The bq20z70 uses the Impedance Track™ Technology to measure and calculate the available charge in battery cells. The achievable accuracy is better than 1% error over the lifetime of the battery and there is no full charge discharge learning cycle required.

See *Theory and Implementation of Impedance Track Battery Fuel-Gauging Algorithm* application note (SLUA364) for further details.

Authentication

The bq20z70 supports authentication by the host using SHA-1.

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 feature to cancel the voltage offset error across SRN and SRP for maximum charge measurement accuracy. The bq20z70 performs auto-calibration when the SMBus lines stay low continuously for a minimum of 5 s.

Temperature

The bq20z70 has an internal temperature sensor and 2 external temperature sensor inputs TS1 and TS2 used in conjunction with two identical NTC thermistors (default are Semitec 103AT) to sense the battery environmental temperature. The bq20z70 can be configured to use internal or external temperature sensors.

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.

FEATURE SET (continued)

SBS Commands

Table 1. SBS COMMANDS

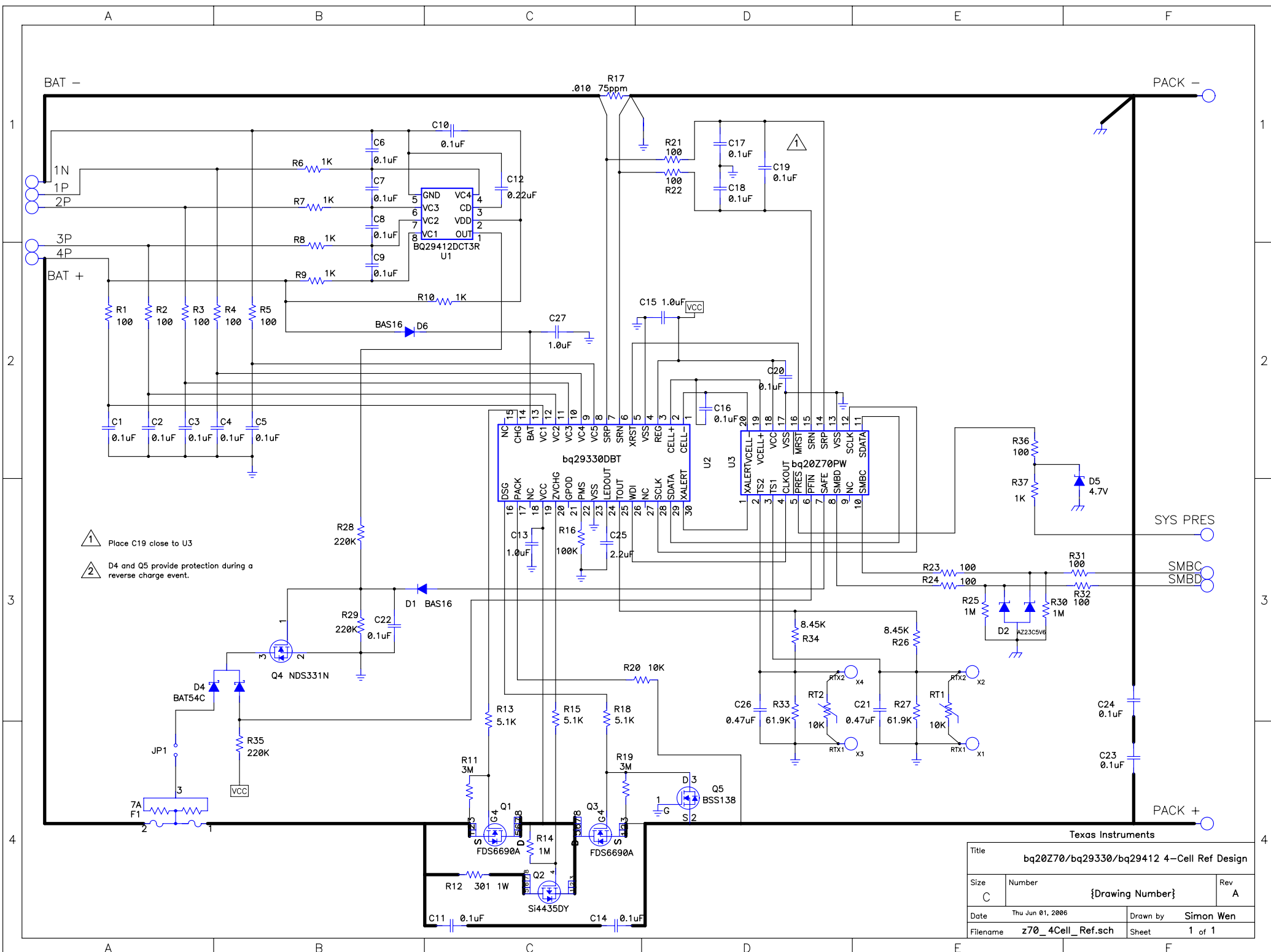
SBS Cmd	Mode	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
0x00	R/W	ManufacturerAccess	hex	2	0x0000	0xffff	—	
0x01	R/W	RemainingCapacityAlarm	unsigned int	2	0	65535	—	mAh or 10mWh
0x02	R/W	RemainingTimeAlarm	unsigned int	2	0	65535	—	min
0x03	R/W	BatteryMode	hex	2	0x0000	0xffff	—	
0x04	R/W	AtRate	signed int	2	-32768	32767	—	mA or 10mW
0x05	R	AtRateTimeToFull	unsigned int	2	0	65535	—	min
0x06	R	AtRateTimeToEmpty	unsigned int	2	0	65535	—	min
0x07	R	AtRateOK	unsigned int	2	0	65535	—	
0x08	R	Temperature	unsigned int	2	0	65535	—	0.1°K
0x09	R	Voltage	unsigned int	2	0	20000	—	mV
0x0a	R	Current	signed int	2	-32768	32767	—	mA
0x0b	R	AverageCurrent	signed int	2	-32768	32767	—	mA
0x0c	R	MaxError	unsigned int	1	0	100	—	%
0x0d	R	RelativeStateOfCharge	unsigned int	1	0	100	—	%
0x0e	R	AbsoluteStateOfCharge	unsigned int	1	0	100	—	%
0x0f	R/W	RemainingCapacity	unsigned int	2	0	65535	—	mAh or 10mWh
0x10	R	FullChargeCapacity	unsigned int	2	0	65535	—	mAh or 10mWh
0x11	R	RunTimeToEmpty	unsigned int	2	0	65535	—	min
0x12	R	AverageTimeToEmpty	unsigned int	2	0	65535	—	min
0x13	R	AverageTimeToFull	unsigned int	2	0	65535	—	min
0x14	R	ChargingCurrent	unsigned int	2	0	65535	—	mA
0x15	R	ChargingVoltage	unsigned int	2	0	65535	—	mV
0x16	R	BatteryStatus	unsigned int	2	0x0000	0xffff	—	
0x17	R/W	CycleCount	unsigned int	2	0	65535	—	
0x18	R/W	DesignCapacity	unsigned int	2	0	65535	—	mAh or 10mWh
0x19	R/W	DesignVoltage	unsigned int	2	7000	16000	14400	mV
0x1a	R/W	SpecificationInfo	unsigned int	2	0x0000	0xffff	0x0031	
0x1b	R/W	ManufactureDate	unsigned int	2	0	65535	0	
0x1c	R/W	SerialNumber	hex	2	0x0000	0xffff	0x0001	
0x20	R/W	ManufacturerName	String	11+1	—	—	Texas Instruments	ASCII
0x21	R/W	DeviceName	String	7+1	—	—	bq20z70	ASCII
0x22	R/W	DeviceChemistry	String	4+1	—	—	LION	ASCII
0x23	R	ManufacturerData	String	14+1	—	—	—	ASCII
0x2f	R/W	Authenticate	String	20+1	—	—	—	ASCII
0x3c	R	CellVoltage4	unsigned int	2	0	65535	—	mV
0x3d	R	CellVoltage3	unsigned int	2	0	65535	—	mV
0x3e	R	CellVoltage2	unsigned int	2	0	65535	—	mV
0x3f	R	CellVoltage1	unsigned int	2	0	65535	—	mV

Table 2. EXTENDED SBS COMMANDS

SBS Cmd	Mode	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
0x45	R	AFEData	String	11+1	—	—	—	ASCII
0x46	R/W	FETControl	hex	1	0x00	0xff	—	
0x4f	R	StateOfHealth	unsigned int	1	0	100	—	%
0x51	R	SafetyStatus	hex	2	0x0000	0xffff	—	
0x53	R	PFStatus	hex	2	0x0000	0xffff	—	
0x54	R	OperationStatus	hex	2	0x0000	0xffff	—	
0x55	R	ChargingStatus	hex	2	0x0000	0xffff	—	
0x57	R	ResetData	hex	2	0x0000	0xffff	—	
0x5a	R	PackVoltage	unsigned int	2	0	65535	—	mV
0x5d	R	AverageVoltage	unsigned int	2	0	65535	—	mV
0x60	R/W	UnSealKey	hex	4	0x00000000	0xffffffff	—	
0x61	R/W	FullAccessKey	hex	4	0x00000000	0xffffffff	—	
0x62	R/W	PFKey	hex	4	0x00000000	0xffffffff	—	
0x63	R/W	AuthenKey3	hex	4	0x00000000	0xffffffff	—	
0x64	R/W	AuthenKey2	hex	4	0x00000000	0xffffffff	—	
0x65	R/W	AuthenKey1	hex	4	0x00000000	0xffffffff	—	
0x66	R/W	AuthenKey0	hex	4	0x00000000	0xffffffff	—	
0x70	R/W	ManufacturerInfo	String	8+1	—	—	—	
0x71	R/W	SenseResistor	unsigned int	2	0	65535	—	$\mu\Omega$
0x77	R/W	DataFlashSubClassID	hex	2	0x0000	0xffff	—	
0x78	R/W	DataFlashSubClassPage1	hex	32	—	—	—	
0x79	R/W	DataFlashSubClassPage2	hex	32	—	—	—	
0x7a	R/W	DataFlashSubClassPage3	hex	32	—	—	—	
0x7b	R/W	DataFlashSubClassPage4	hex	32	—	—	—	
0x7c	R/W	DataFlashSubClassPage5	hex	32	—	—	—	
0x7d	R/W	DataFlashSubClassPage6	hex	32	—	—	—	
0x7e	R/W	DataFlashSubClassPage7	hex	32	—	—	—	
0x7f	R/W	DataFlashSubClassPage8	hex	32	—	—	—	

Application Schematic

The application schematic is on the following page.



1 Place C19 close to U3

2 D4 and Q5 provide protection during a reverse charge event.

Texas Instruments			
Title bq20Z70/bq29330/bq29412 4-Cell Ref Design			
Size C	Number {Drawing Number}	Rev A	
Date Thu Jun 01, 2006	Drawn by Simon Wen		
Filename z70_4Cell_Ref.sch	Sheet 1 of 1		

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
BQ20Z70PW-V160	Active	Production	TSSOP (PW) 20	70 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70
BQ20Z70PW-V160.A	Active	Production	TSSOP (PW) 20	70 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70
BQ20Z70PWR-V150	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70
BQ20Z70PWR-V150.A	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70
BQ20Z70PWR-V160	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70
BQ20Z70PWR-V160.A	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20Z70

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
BQ20Z70PW-V160	PW	TSSOP	20	70	530	10.2	3600	3.5
BQ20Z70PW-V160.A	PW	TSSOP	20	70	530	10.2	3600	3.5

PW0020A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220206/A 02/2017

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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