FEATURES

Battery

- **Instant Accuracy – No Learning Cycle Required**
- **Supports the Smart Battery Specification SBS V1.1**
- **Works With the TI bq29312A Analog Front-End (AFE) Protection IC to Provide Complete Pack Electronics Solution**
- **Full Array of Programmable Voltage, Current, and Temperature Protection Features**
- **Integrated Time Base Removes Need for External Crystal with Optional Crystal Input**
- **Electronics for 7.2-V, 10.8-V or 14.4-V Battery Packs With Few External Components**
- **Based on a Powerful Low-Power RISC CPU Core With High-Performance Peripherals**
- **Integrated Field Programmable FLASH Memory Eliminates the Need for External Configuration Memory**
- **Measures Charge Flow Using a High-Resolution, 16-Bit Integrating Delta-Sigma Converter**
  - **Better Than 0.65 nVh of Resolution**
  - **Self-Calibrating**
  - **Offset Error Less Than 1 µV**
- **Uses 16-Bit Delta-Sigma Converter for Accurate Voltage and Temperature Measurements**
- **Extensive Data Reporting Options For Improved System Interaction**
- **Optional Pulse Charging Feature for Improved Charge Times**
- **Drives 3-, 4- or 5-Segment LED Display for Remaining Capacity Indication**
- **Supports SHA-1 Authentication**
- **Lifetime Data Logging**

APPLICATIONS

Portable Instrumentation

DESCRIPTION

The bq20z80 SBS-compliant gas gauge IC, incorporating patented Impedance Track™ technology, is designed for battery-pack or in-system installation. The bq20z80 measures and maintains an accurate record of available charge in Li-ion or Li-polymer batteries using its integrated high-performance analog peripherals. The bq20z80 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 bq29312A 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.

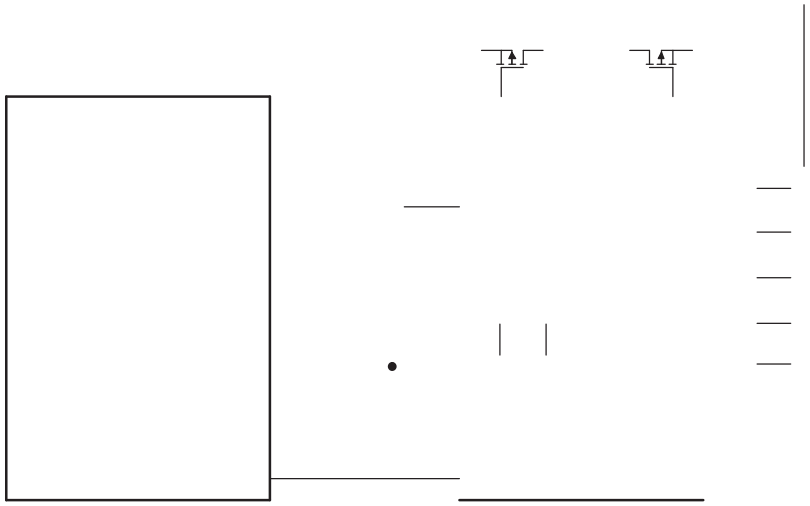
AVAILABLE OPTIONS

T_A	PACKAGE(1)	
	38-PIN TSSOP (DBT) Tube	38-PIN TSSOP (DBT) Tape and Reel
–40°C to 85°C	bq20z80ADBT(2)	bq20z80ADBTR(3)
–40°C to 85°C	bq20z80DBT(2)	bq20z80DBTR(3)

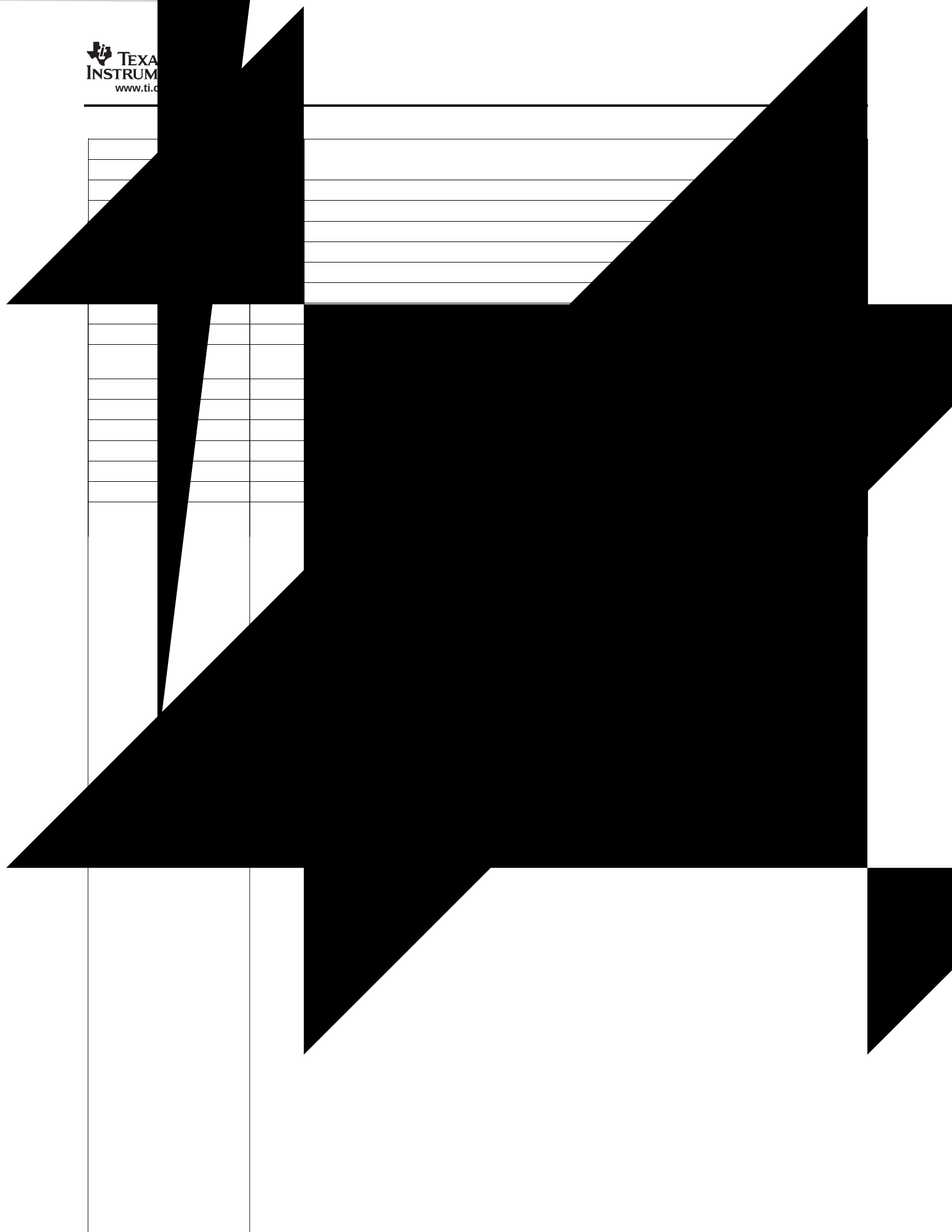
(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
(2) A single tube quantity is 50 units.
(3) A single reel quantity is 2000 units

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

SYSTEM DIAGRAM



TSSOP (DBT)
(TOP VIEW)



ABSOLUTE MAXIMUM RATINGS

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

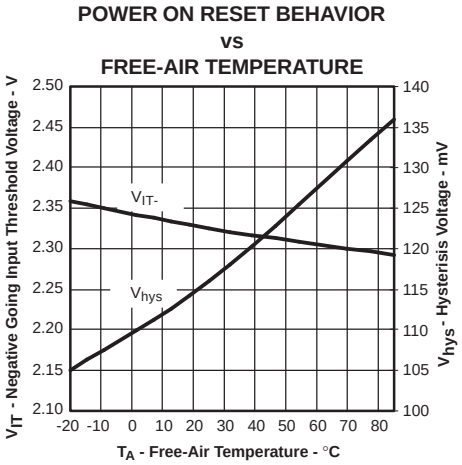
		RANGE
$V_{DDA}$and V_{DDD} relative to V_{SS}[(2)]	Supply voltage range	–0.3 V to 4.1and

ELECTRICAL CHARACTERISTICS

POWER-ON RESET

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{IT–}$	Negative-going voltage input		2.1	2.3	2.5	V
V_{HYS}	Power-on reset hysteresis		50	150	200	mV



INTEGRATING ADC (Coulomb Counter) CHARACTERISTICS

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(SR)}$	Input voltage range, $V_{(SR2)}$ and $V_{(SR1)}$	$V_{(SR)}$ = V(SR2) – V(SR1)	–0.25		0.25	V
$V_{(SROS)}$	Input offset			1		V
INL	Integral nonlinearity error			0.004%	0.019%	

PLL SWITCHING CHARACTERISTICS

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{(SP)}$	Start-up time (1)	0.5% frequency error		2	5	ms

(1) The frequency error is measured from the trimmed frequency of the internal system clock which is 128 oscillator frequency, nominally 4.194 MHz.

OSCILLATOR

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{(exo)}$	Frequency error from 32.768 kHz	ROSC = 100 kΩ	–2%	0.25%	2%	
		ROSC = 100 kΩ, V_{DD} = 3.3 V	–1%	0.25%	1%	
		XCK1 = 12-pF XTAL	–0.25%		0.25%	
$f_{(sxo)}$	Start-up time (1)	ROSC = 100 kΩ			250	s
		XCK1 = 12-pF XTAL			200	ms

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

DATA FLASH MEMORY CHARACTERISTICS

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{DR} Data rT4 126.4 Tm 1 -8 TTf (rT4 126.4 Tm 1 rT4 126.4 T2 0 1 70.464 126.46ed))Tj 1 0oention-8 Tf -8 TL (Pj 1 0464 126.46ed))Tj 1Se -8 Tf -8					

REGISTER BACKUP

SMBus TIMING SPECIFICATIONS

V_{DD} = 3 V to 3.6 V, T_A = –40°C to 85°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			s
$t_{HD:STA}$	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			s
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 V) to (V_{IHMIN} + 0.15 V)			300	ns
t_R	Clock/data rise time	0.9 VDD to (VILMAX – 0.15 V)			1000	

(1) The bq20z80 times out when any clock low exceeds $t_{TIMEOUT}$.
(2) $t_{HIGH:MAX}$. is minimum bus idle time. SMBC = 1 for t > 50 s causes reset of any transaction involving the bq20z80 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

FEATURE SET

Primary (1st Level) Safety Features

Secondary (2nd Level)

FEATURE SET (continued)

Gas Gauging

The bq20z80 uses the Impedance Track™ Technology to measure and calculate the available charge in battery cells. The achievable accuracy is better than the coulomb counting method 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.

LED Display

The bq20z80 can drive 3-, 4-, or 5- segment LED display for remaining capacity indication.

LifeTime Data Logging Features

The bq20z80 offers a lifetime data logging array, where all important measurements are stored for warranty and analysis purposes. The data monitored includes:

- Lifetime maximum temperature
- Lifetime minimum temperature
- Lifetime maximum battery cell voltage
- Lifetime minimum battery cell voltage
- Lifetime maximum battery pack voltage
- Lifetime minimum battery pack voltage
- Lifetime maximum charge current
- Lifetime maximum discharge current
- Lifetime maximum charge power
- Lifetime maximum discharge power
- Lifetime maximum average discharge current
- Lifetime maximum average discharge power
- Lifetime average temperature

Authentication

The bq20z80 supports authentication by the host using SHA-1.

Power Modes

The bq20z80 supports 3 different power modes to reduce power consumption:

- In Normal Mode, the bq20z80 performs measurements, calculations, protection decision, data update in 1 second intervals. Between these intervals, the bq20z80 is in a reduced power stage.
- In Sleep Mode, the bq20z80 performs measurements, calculations, protection decision, data update in adjustable time intervals. Between these intervals, the bq20z80 is in a reduced power stage.
- In Shutdown Mode the bq20z80 is completely disabled.

CONFIGURATION

Oscillator Function

The oscillator of the bq20z80 can be set up for internal or external operation. On power up, the bq20z80 automatically attempts to start the internal oscillator. If a 100-kΩ resistor is not connected to ROSC (pin 33), then it attempts to start the oscillator using an external 32.768-kHz crystal.

NOTE

Install either the 100-kΩ ROSC resistor *or* the 12-pF, 32.768-kHz crystal. Do not install both.

FEATURE SET (continued)

The performance of the internal oscillator depends on the tolerance of the 100-kΩ resistor between RSOC (pin 33) and VSSA (pin 34). Choose a resistor with a tolerance of ±0.1%, and 50-ppm or better temperature drift. Place this resistor as close as possible to the bq20z80. If a 12-pF crystal is used, place it as close as possible to the XCK1 (pin 34) and XCK2 (pin 33) pins. If not properly implemented, the PCB layout in this area can degrade oscillator performance.

System Present Operation

The bq20z80 pulls the PU pin high periodically (1 s). Connect this pin to the $\overline{\text{PRES}}$ pin of the bq20z80 via a resistor of approximately 5 kΩ. The bq20z80 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 bq20z80 detects this as system present.

BATTERY PARAMETER MEASUREMENTS

The bq20z80 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 bq20z80 detects charge activity when $V_{SR} = V_{(SR1)}-V_{(SR2)}$is positive and discharge activity when $V_{SR} = V_{(SR1)}-V_{(SR2)}$ is negative. The bq20z80 continuously integrates the signal over time, using an internal counter. The fundamental rate of the counter is 0.65 nVh.

Voltage

The bq20z80 updates the individual series cell voltages through the bq29312A at one second intervals. The bq20z80 configures the bq29312A to connect the selected cell, cell offset, or bq29312A VREF to the CELL pin of the bq29312A, which is required to be connected to VIN of the bq20z80. The internal ADC of the bq20z80 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 bq20z80 uses the SR1 and SR2 inputs to measure and calculate the battery charge and discharge current using a 5 mΩ to 20 mΩ (typical) sense resistor.

Auto Calibration

The bq20z80 provides an auto-calibration feature to cancel the voltage offset error across SR1 and SR2 for maximum charge measurement accuracy. The bq20z80 performs auto-calibration when the SMBus lines stay low continuously for a minimum of 5 s.

Temperature

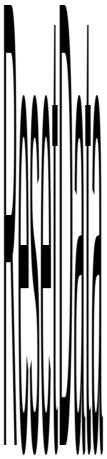
The bq20z80 TS1 and TS2 inputs, in conjunction with two identical NTC thermistors (default are Semitec 103AT), measure the battery environmental temperature. The bq20z80 can also be configured to use its internal temperature sensor.

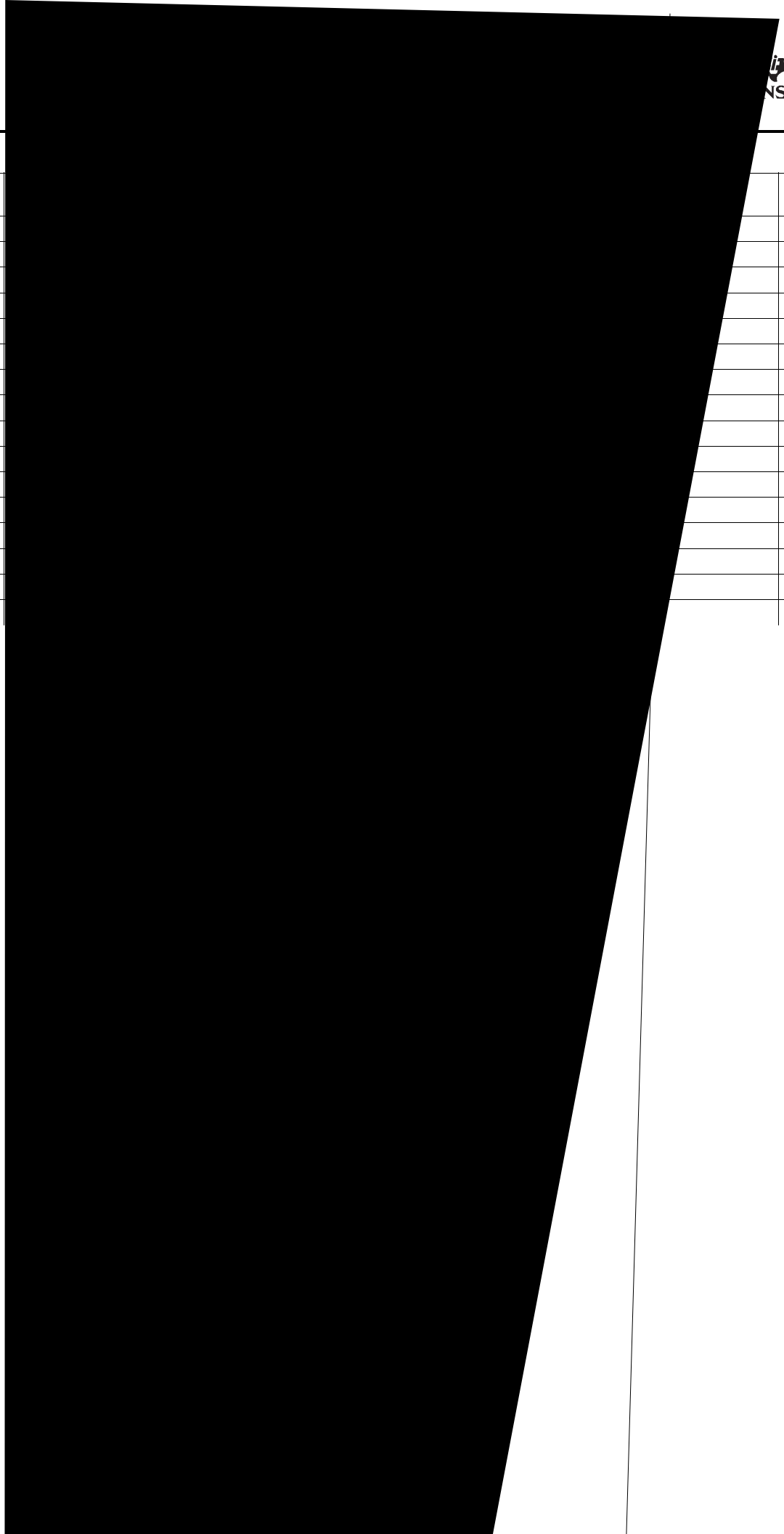
COMMUNICATIONS

The bq20z80 uses SMBus v1.1 with Master Mode and package error checking (PEC) options per the SBS specification.

SMBus On and Off State

The bq20z80 detects an SMBus off state when SMBC and SMBD are logic-low greater than an adjustable period of time. Clearing this state requires either SMBC or SMBD to transition high. Within 1 ms, the communication bus is available.





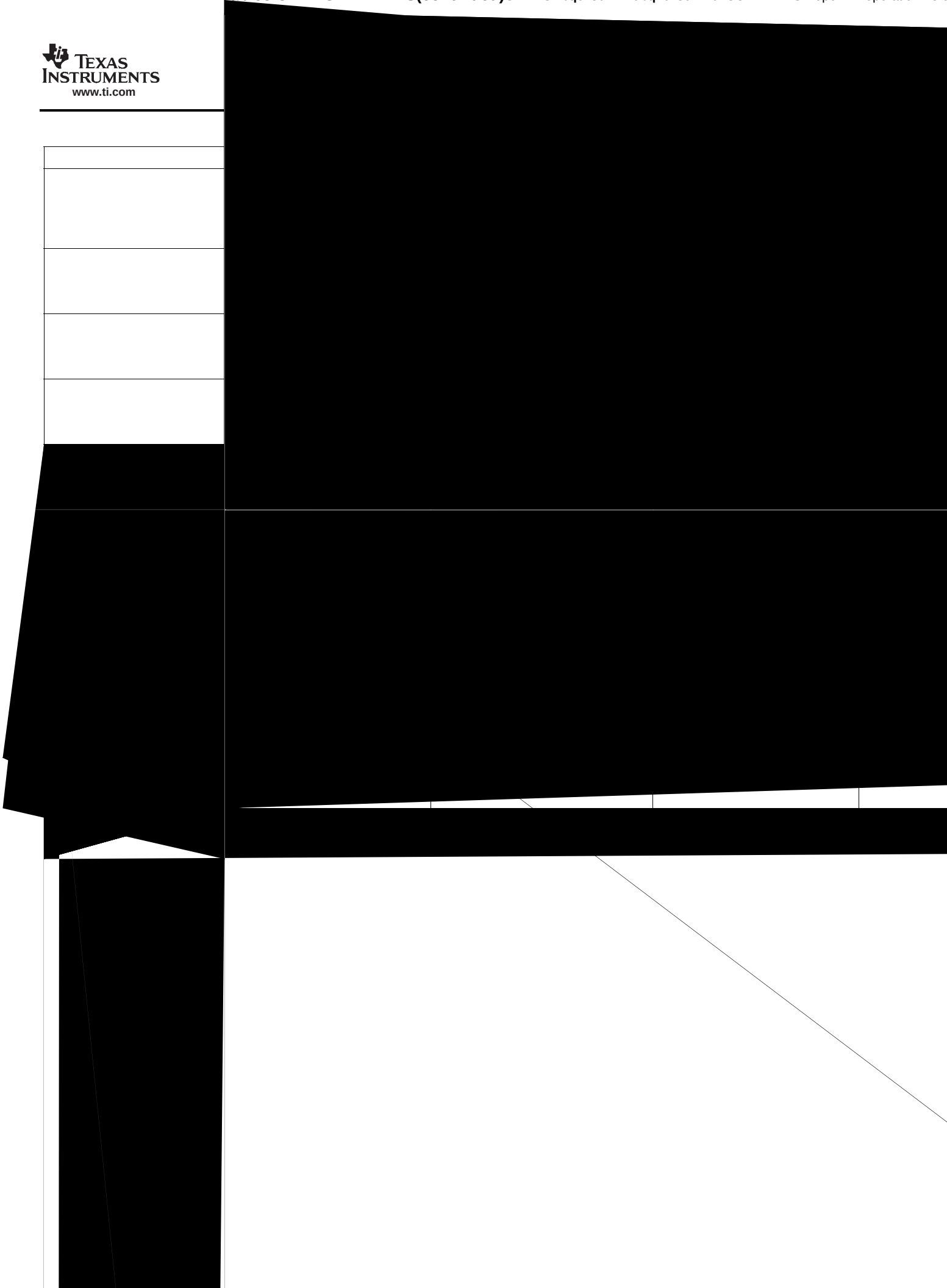


Table 4. CHANGE DETAILS (continued)

CHANGE	bq0z80-V102	bq20z80-V101	COMMENTS
Allow negative LED thresholds to permit LED alarms to be disabled	Configuring negative LED alarm threshold disables LED alarm functionality.	Feature not available	Allow better customization
Allow zero values for ALARM and CHARGING LED blink rates to disable them	Configuring zero value for the LED blink rates disables them.	Feature not available	Allow better customization
Restore initialization of dodcharge in relaxed state so that the correct dodcharge value is used in capacity estimation	dodcharge initialized to the correct value	dodcharge value set to zero	Improved gauging accuracy with correct initialization of dodcharge value.
Only clear offset calibration flag when SMBus lines go high.	Prevents offset calibration occurring just because a safety condition occurs and then clears when the SMBus lines are low.	Offset calibration occurs multiple times if safety condition occurs when SMBus lines are low.	More appropriate period between offset calibrations when SMBus lines are low.
Change so that setting AFE Fail Limit to zero disables PF_AFE_C	Configurable option to allow disabling PF_AFE_C trigger	Feature not available.	Allow better customization
Enable LED display to turn off after charge termination and if SMBus lines are detected low and LEDs enabled during charging.	LED display turns off after charge termination.	LED display stays on when charging terminates after SMBus lines are detected low.	Correct operation of the LED display under all conditions
Set charge FET state immediately when entering sleep	Charge FET state set correctly, immediately after entering sleep	The CHG FET would not get set to the correct state for sleep until the first voltage measurement.	Quicker transition of FET to the correct state in sleep
Change *DF:Operation Cfg B [CCT = 0]*, so that *SBS.CycleCount( )* threshold	Data flash default bases *SBS.CycleCount( )* calculation on mAh and not % of FCC	DF:Operation Cfg B [CCT = 1], making the default *SBS.CycleCount( )*	Data flash default changed to reflect common customer usage

Table 4. CHANGE DETAILS (continued)

CHANGE	bq0z80-V102	bq20z80-V101	COMMENTS
Implement disable of resistance update based on accumulative scale. If the product of 15 consecutive (default value) resistance scale factors is less than 0.5 or more than 1.5, then resistance update is disabled until the next valid soc measurement. Sets bit 2 of Operation Status to indicate resistance update disabled.	Prevent invalid soc values from causing incorrect resistance updates	Incorrect resistance updates that could result from invalid soc values	More reliable resistance updates under all system conditions
Implement disable of resistance update based on estimated capacity error. Sets bit 2 of Operation Status to indicate resistance update disabled.	Prevent invalid soc values from causing incorrect resistance updates	Incorrect resistance updates that could result from invalid soc values	More reliable resistance updates under all system conditions
Disable Qmax increment if due to Grid 14 and exit of discharge	Prevent unnecessary Qmax increments	Qmax increments can occur due to Grid 14 and exit of discharge	Improved Qmax data reliability under all system conditions.
Drive all unused pins low	Provides better ESD immunity	Not all unused pins driven low	Improved ESD immunity
Initial charge capacity calculation when dod0 is measured in the overdischarged state is corrected	Overdischarged state does not affect the accuracy of FCC calculations	An incorrect initial charge capacity affects FCC that is calculated during discharge or a Qmax update. If FCC is not changed by a Qmax update, then reported RemainingCapacity could be negative after 5 hours of relaxation	More reliable *SBS:FullChargeCapacity( )* *SBS:RemainingCapacity( )* calculation under all system conditions
Correct calculation of FCC and RemCap when dod0 is taken when the battery is overdischarged or overcharged. This allows RemCap to go negative, or greater than FCC (though is only reported from 0 - FCC).	Overcharged/Overdischarged does not affect the accuracy of FCC and RemCap calculations	The RemainingCapacity will increment (or decrement) during charging (discharging) even when the battery is in an overdischarged (overcharged) state.	More reliable *SBS:FullChargeCapacity( )* *SBS:RemainingCapacity( )* calculation under all system conditions
Change cell imbalance *DF:Battery Rest Time* from 1 byte to 2 bytes and set the default value to 1800 seconds	New feature providing improved customization	Feature not available	Improved customization for Cell Imbalance detection
Use upper and lower limit for resistance accumulative scale. Set default values to 300% and 30%.			More reliable resistance updates under all system conditions
Add *DF:CF MaxError limit* for setting *SBS.BatteryMode( ) [CONDITION FLAG]*. Set default value to 100%.	New feature providing improved customization	Feature not available	Improved customization
Use *SBS.AtRate( )*, UserRate and C/5 rate for relaxed capacity calculation, respectively, if set by Load Select; otherwise, use previous rate.			More reliable *SBS:FullChargeCapacity( )* *SBS:RemainingCapacity( )* calculation under all system conditions
Correct Host Watchdog from being reset by broadcasts	Host Watchdog functionality not affected by alarm or charger broadcasts	Host Watchdog reset by alarm or charger broadcasts	Reliable Host Watchdog functionality under all system conditions

Table 4. CHANGE DETAILS (continued)

CHANGE	bq0z80-V102	bq20z80-V101	COMMENTS
The voltage table chemistry ID can be read by writing 0x0008 to ManufacturerAccess and then reading from ManufacturerAccess. The default chemistry ID is 0x0100	New feature providing more information	Feature not available	Improved information access
SBS.BatteryMode( ) is initialized on high transition of the SMBus lines to *DF:Init BatteryMode*, instead of always clearing *SBS.BatteryMode( )* defined bits on high transition of the SMBus lines.	Customization allows for preserving *SBS.BatteryMode( )* settings through SMBus line transitions	Feature not available	Improved customization
Broadcast timers are set correctly on high transition of SMBus lines. The timers are set to 10 seconds on high transition of SMBus lines.	Broadcast timer accurate regardless of CC offset calibration or entry to sleep	Broadcast timer accuracy required a CC offset calibration and entry to sleep.	Improved broadcast timing accuracy to meet Smart Battery Data spec

bq20z80 to bq20z80-V101 Changes

CHANGE	bq20z80	bq20z80-V101	COMMENTS
Added authentication (optional SBS command 0x2f)	Command 0x2f has no function and is not acknowledged.	Command 0x2f is the *SBS.Authenticate( )* command to the bq20z80 to begin the SHA1 authentication.	Additional feature to enable host to authenticate the battery
Added Cell Balancing	Cell balancing not available	Added State of Charge cell balancing algorithm	Additional feature to enable longer lifetime of battery
Added charge fault FET Enable register	When charge faults occur, FET action is taken.	When charge faults occur, FET action is taken if enabled in *DF:FET Enable* register.	Adds flexibility to system interaction
Added pulse compensation for end of discharge	Applications with pulsed current loads and minimum voltage requirements can have less RemainingCapacity than reported.	The voltage pulses caused by pulsed current loads are measured and used to better estimate RemainingCapacity.	Added additional feature to improve capacity prediction
Added *SBS.BatteryStatus( ) [TDA, FD]* voltage thresholds	*SBS.BatteryStatus( ) [TDA, FD]* are only set on SBS.RSOC, detection of charge termination or faults	*SBS.BatteryStatus( ) [TDA, FD]* are now set and cleared based on *SBS.Voltage( )*	Adds flexibility to system interaction
Added option for LEDs in series with current source	LED display is only in parallel.	LED display is available in series (with current source) or parallel.	Adds capability for higher brightness LEDs
Configured pin 7 as active high fuse	Pin 7 is not connected	Pin 7 is now chargein	

CHANGE	bq20z80	bq20z80-V101	COMMENTS
Prevented lifetime updates until IT is enabled	Data flash lifetime data is updated under all conditions.	Data flash lifetime data is not updated until Impedance Track™ is enabled.	Improves suitability of lifetime data
Aligned SBS.RemainingCapacity( ) with *DF:Terminate Voltage*	*SBS.RemainingCapacity( )* could be above zero when *SBS.Voltage( )* reaches *DF:Terminate Voltage.*	Forces *SBS.RemainingCapacity( )* to zero when *SBS.Voltage( )* is below terminate voltage	Improves alignment between reporting and system status
Disabled LEDs for undervoltage conditions	When *SBS.OperationStatus( )* [CUV or PUV] is set, then the LED display could be activated.	When *SBS.OperationStatus( )* [CUV or PUV] is set, the LED display is disabled.	Reduces risk of deeply discharging the battery
Clear *SBS.BatteryStatus( ) [RCA]* when not *SBS.BatteryStatus( ) [DSG]*	*SBS.BatteryStatus( ) [RCA]* is not cleared when *SBS.BatteryStatus( ) [DSG]* is cleared.	*SBS.BatteryStatus( ) [RCA]* is now cleared when *SBS.BatteryStatus( ) [DSG]* is cleared.	Corrected to meet SBS specification
Allowed sleep mode for undervoltage conditions	When *SBS.OperationStatus( )* [CUV or PUV] is set, then entry to sleep mode is disabled.	When *SBS.OperationStatus( )* [CUV or PUV] is set, then entry to sleep mode is allowed.	Reduces risk of deeply discharging the battery
Improvements made to Lifetime data	Does not save maximum and minimum lifetime AverageCurrent or AveragePower. Only saves lifetime data when new values exceed old values by defined delta values	Saves maximum and minimum lifetime AverageCurrent and AveragePower. Lifetime data is saved after a defined period of time even if new values do not exceed old values by defined delta values	Improves lifetime data
Changes made to pulse charging	Voltages for pulse charging are sampled once a second.	Voltages for pulse charging are sampled 4 times a second.	Improves pulse charging
Changes made to charging timeouts	The precharge timeout timer runs when the charging current is below a defined threshold; so, it is possible that the precharge timer will run during charging taper current and cause an undesired precharge timeout during charging taper.	The fast charge and precharge timeout timers only run when precharging or charging, as indicated by FCHG and PCHG bits in ChargingStatus.	Improves operation of fast charge and precharge timeout timers
Changes made to discharge faults	Discharging fault is indicated whenever BatteryStatus [TDA] is set. Current discharging fault is not indicated for current faults detect by AFE. Separate discharging faults are indicated for voltage and temperature.	Discharging fault is indicated for any safety condition resulting in turning off the discharge FET. Current discharging fault is indicated for all detected overcurrent conditions, including overcurrent detected by AFE. Temperature and voltage discharge faults are not indicated separately.	Improves indication of discharging fault conditions
Improvements made to calibration functions	Voltage calibration functions may cause error in voltage calibration of several millivolts.	Voltage calibration functions are capable of accuracy within 1 millivolt.	Improved voltage calibration accuracy
Protect against simultaneous writes to data flash	A SMBus-initiated data flash write may occur at the same time as a data flash write initiated by the AGG, which my cause a data flash write error.	A SMBus-initiated data flash write cannot occur at the same time as any other data flash write.	Increased robustness of data flash writes
Corrected *SBS.ManufacturerAccess( )* access of silicon revision	*SBS.ManufacturerAccess( )* access of silicon revision is not functional.	*SBS.ManufacturerAccess( )* access of silicon revision is functional.	Allows host to determine bq20z80 silicon revision
Corrected data flash checksum operation	The data flash checksum includes non-accessible portions of the data flash that change when writing the data flash checksum, invalidating the checksum.	The data flash checksum only includes data flash that does not change when writing an updated data flash checksum.	Data flash checksum operation works correctly.
Corrections made to LED display	Fixed LED thresholds cannot be selected.	Fixed LED thresholds can be selected.	Correct operation of LED threshold settings
Erroneous readings are corrected that occurred after offset calibration when sleep mode is not entered.	Erroneous SBS voltage, current, and temperature readings occur after current offset calibration if sleep mode is not entered, corrupting the lifetime data.	No erroneous SBS voltage, current, and temperature readings occur after current offset calibration if sleep mode is not entered.	Improve reliability of lifetime data
Corrected the length of *SBS.ManufacturerData( )* command	*SBS.ManufactureData( )* returned additional data not specified in the data sheet.	Only returns the appropriate data	Correct data set made available to host
Changed DF:Charger Present default voltage to 12000 mV	*DF:Charger Present* default was 16800 mV.	Default changed to 12000 mV.	More realistic default for most applications
Corrected LED display lock-up fault when exiting sleep with LEDs on	LED display locks up if LEDs are ON as the bq20z80 exits sleep mode.	LED display operates normally regardless of power state transitions.	Correct operation of the LED display under all conditions

CHANGE	bq20z80	bq20z80-V101	COMMENTS
Added report of any inability to write DFF as flash write error in calibration mode	If writing the data flash is not allowed either due to a permanent failure or low voltage, then no indication is given when attempting to write data flash in calibration mode.	The inability to write data flash in calibration mode is reported as a flash write error.	Improved calibration system interaction
Corrected issue of improperly clearing AFE faults	AFE faults were detected and the pack protected but the fault would be cleared up to three times at an interval of 250 milliseconds before the	AFE faults are correctly handled, including the flags	Improved system interaction when faults occur

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
BQ20Z80ADBT-V110	ACTIVE	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80ADBT-V110G4	ACTIVE	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80ADBTR-V110	ACTIVE	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80ADBTRV110G4	ACTIVE	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBT	NRND	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBT-V110	NRND	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBT-V110G4	NRND	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBTG4	NRND	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBTR-V110	NRND	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ20Z80DBTR-V110G4	NRND	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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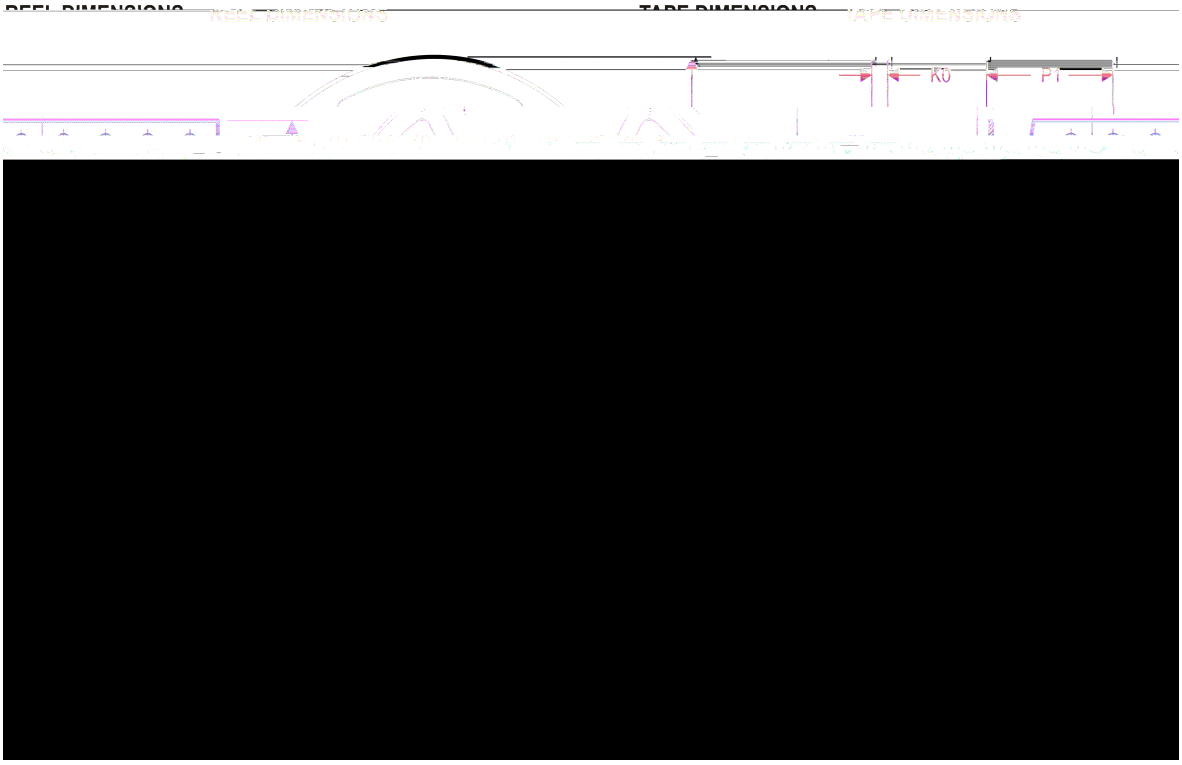
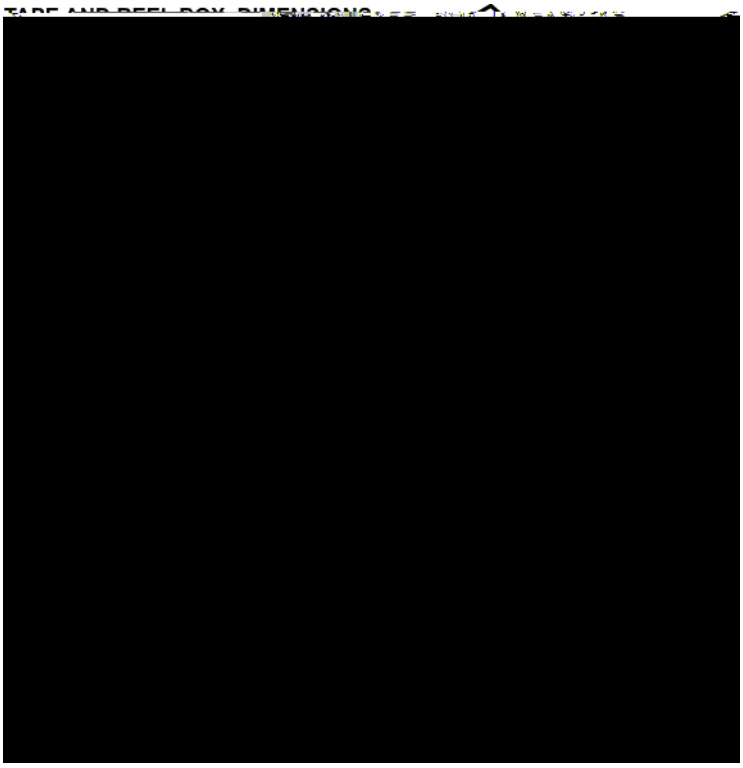
TAPE AND REEL INFORMATION



*All dimensions are nominal

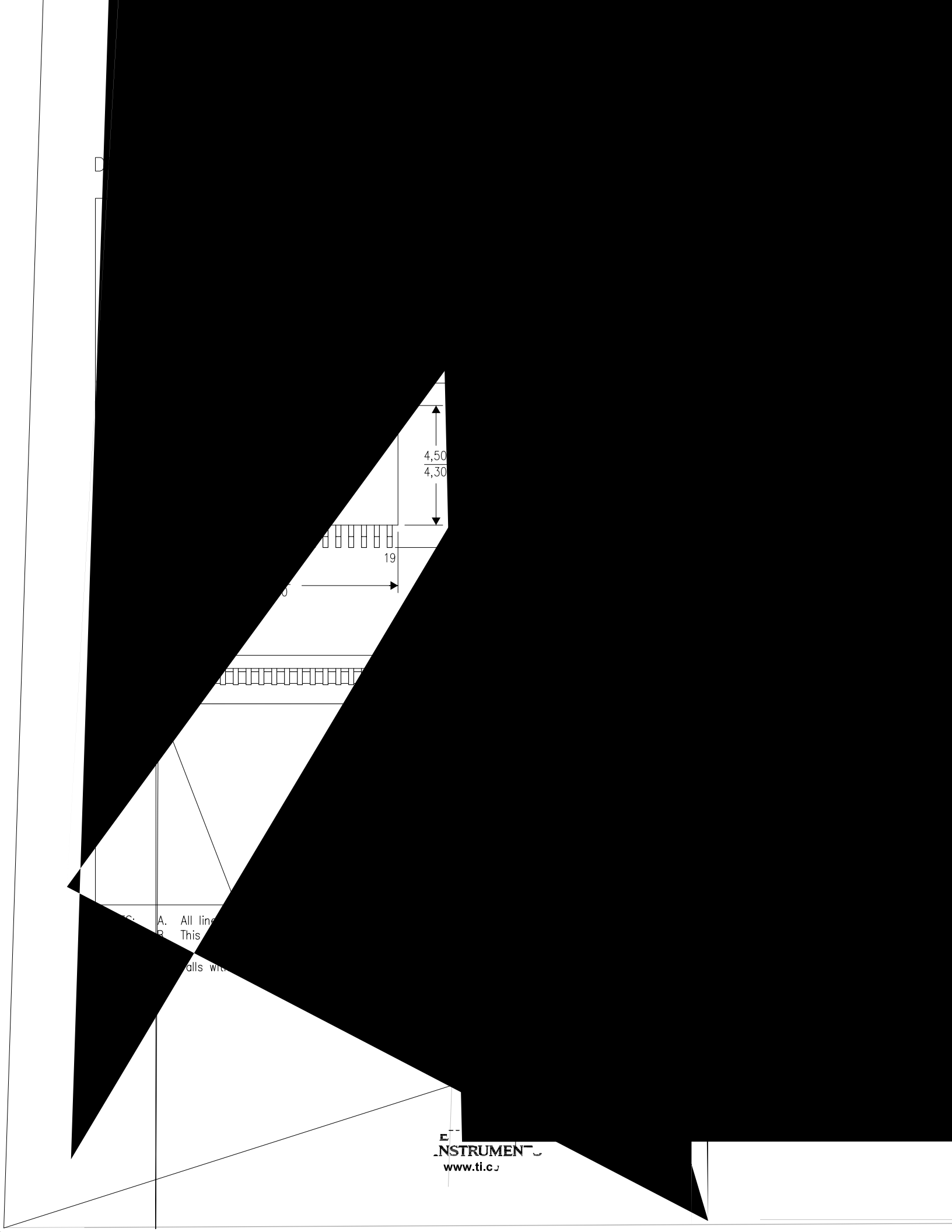
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
BQ20Z80ADBTR-V110	TSSOP	DBT	38	2000	330.0	16.4	6.9	10.2	1.8	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ20Z80ADBTR-V110	TSSOP	DBT	38				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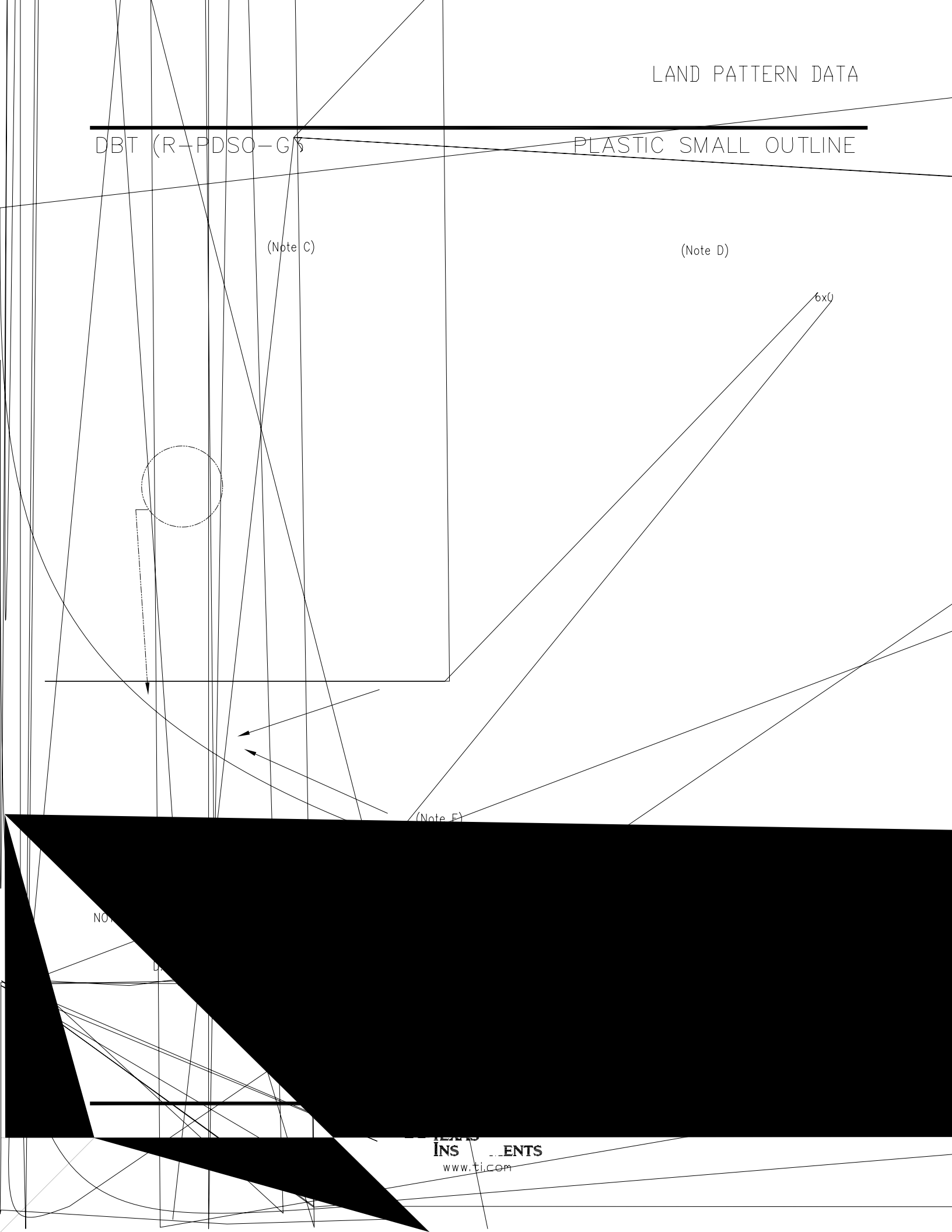

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