

bq2023 SINGLE-WIRE ADVANCED BATTERY MONITOR IC FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

- **Multifunction Monitoring IC Designed to Work With an Intelligent Host Controller:**
 - Provides Accurate State of Charge Information for Rechargeable Batteries
 - Enhances Power and Charge Management in the System
- **Supply Operation Down to 2.4 V; Ideal for Single-Cell Li-Ion or Li-Pol Applications**
- **Communicates Over Single-Wire SDQ™ Serial Interface**
- **Resolves Signals Down to 3.05 μVh**
- **High-Accuracy Coulometric Charge and Discharge Current Integration**
- **Differential Current Sense Input**
- **Automatic and Continuous Offset Calibration and Compensation**
- **32 Bytes of General-Purpose RAM, 224 Bytes of FLASH, and 8 Bytes of Secure ID ROM**
- **Internal Temperature Sensor With 0.25°K Resolution Eliminates the Need for an External Thermistor**
- **Programmable Digital Output Port**
- **Battery-Pack Removal Detection Input Places the IC in the Sleep Mode When System Is Not Present**
- **High-Accuracy Internal Timebase Eliminates External Crystal Oscillator**
- **Low Power Consumption:**
 - Operating: 40 μA

description

The bq2023 is an advanced battery monitoring IC that accurately measures the charge and discharge currents in rechargeable battery packs. Intended for pack integration, the bq2023 contains all the necessary functions to form the basis for an accurate battery gas gauge in cellular phones, PDAs, or other portable products.

Gas gauging is accomplished by coulomb counting (i.e. removed from the battery). The bq2023 achieves that by using a low-value series sense resistor between the negative terminal and the negative contact. An internal voltage-to-frequency converter (VFC) converts the voltage drop to counts. The VFC is capable of resolving signals down to 3.05 μVh. The bq2023 has charge, discharge, and self-discharge registers, and a state-of-charge information. To improve accuracy, the bq2023 has an automatic offset calibration and compensation feature to correct errors in the VFC.

The bq2023 works with the host controller in the portable system. The host controller interprets the bq2023 data and controls the power-management system. The SDQ single-wire bus allows the bq2023 and the same communications node simultaneously.

The bq2023 provides 224 bytes of flash memory, 8-bytes of nonvolatile memory maintains formatted battery monitor information or other critical battery parameters while the battery is tested.

AVAILABLE OPTIONS

TA	PACK
	8-L
-20°C to 70°C	bq2023



Please be aware that an important notice concerning availability of Texas Instruments semiconductor products and disclaimers the

SDQ is a trademark of Texas Instruments.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS INSTRUMENTS

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

bq2023

**SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS**

SLUS480B – MAY 2001

detailed description

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

electrical characteristics over recommended operating free-air temperature range and supply voltage (unless otherwise noted)

dc

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{OL}	Digital output low SDQ and STAT pin	I _{OL} = 1 mA			0.4	V
I _{OL}	Digital output low sink current on SDQ pin				1	mA
V _{IL}	Digital input low SDQ pin				0.7	V
V _{IH}	Digital input high SDQ pin		1.7			V
V _{IH} (PDETH)	Digital input high PDET pin		V _{CC} -0.1		V _{CC} +0.3	V
R _{SR}	SR input impedance	0.1 V < (V _{SRP} , V _{SRN}) < V _{CC}	10			MΩ

ac

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _d (POR)	Power on reset delay	Delay required to attempt communication after V _{CC} > 2.4 V			500	ms



bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

recommended operating temperature and supply voltage

	TEST CONDITIONS	MIN	TYP	MAX	UNIT
	See Note 7			5	Years
s	See Note 7	10,000			Cycles
	See Note 7			200	μs
	60 μs +30 μs/byte, See Note 7			1,500	μs

$V_{CC} = 5$, See Note 7

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

timing requirements (continued)



Figure 2. SDQ Write Bit-ZERO Timing Diagram

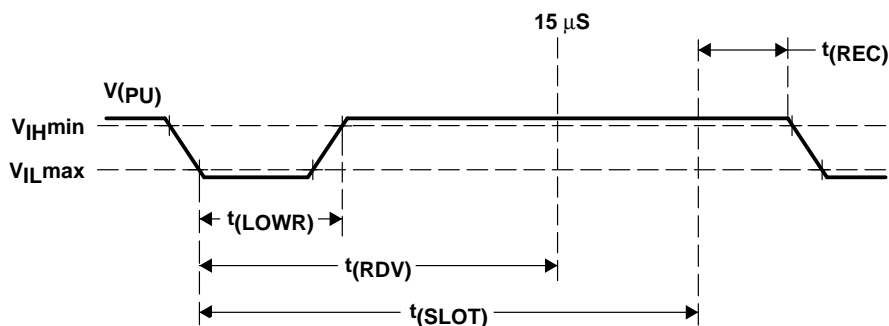
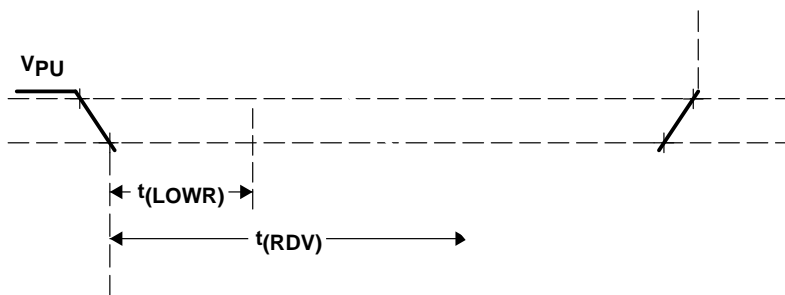


Figure 3. SDQ Read Bit-One Timing Diagram



TYPICAL CHARACTERISTICS

**VFC GAIN RESPONSE
 VS
 FREE-AIR TEMPERATURE**

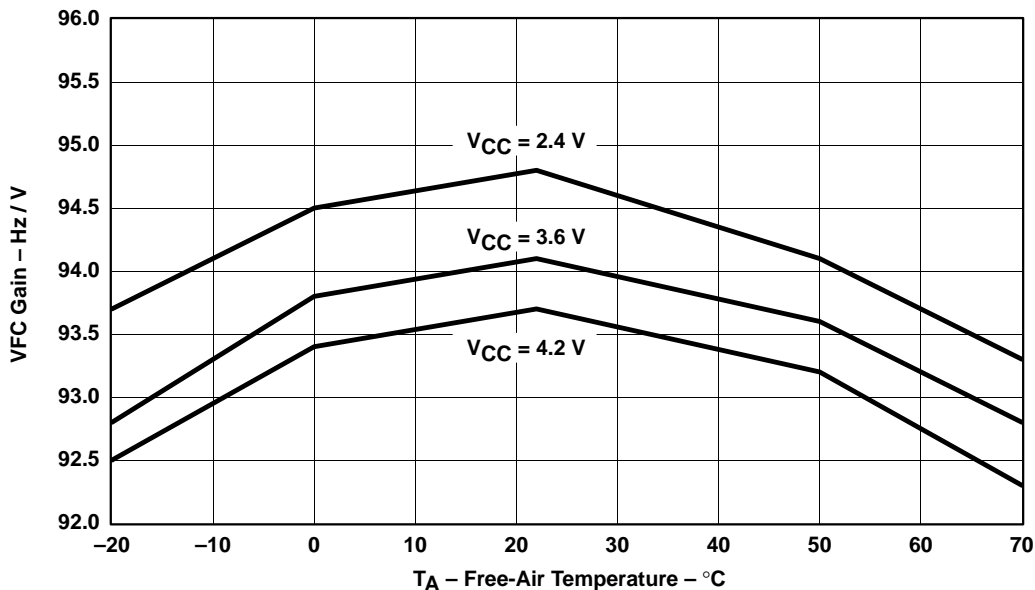
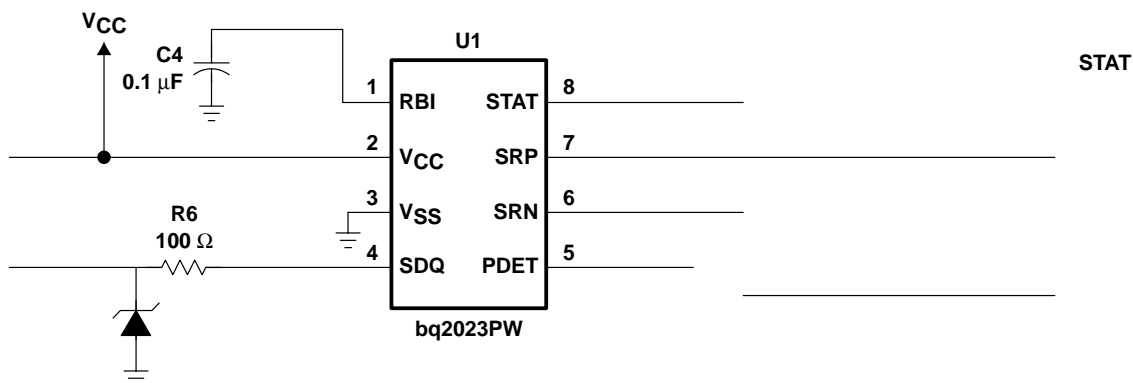


Figure 6

APPLICATION INFORMATION



C

R N T O

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

**ERY MONITOR IC
ICATIONS**

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

Yes

Memory?
No End of Data

Wait for Reset

R

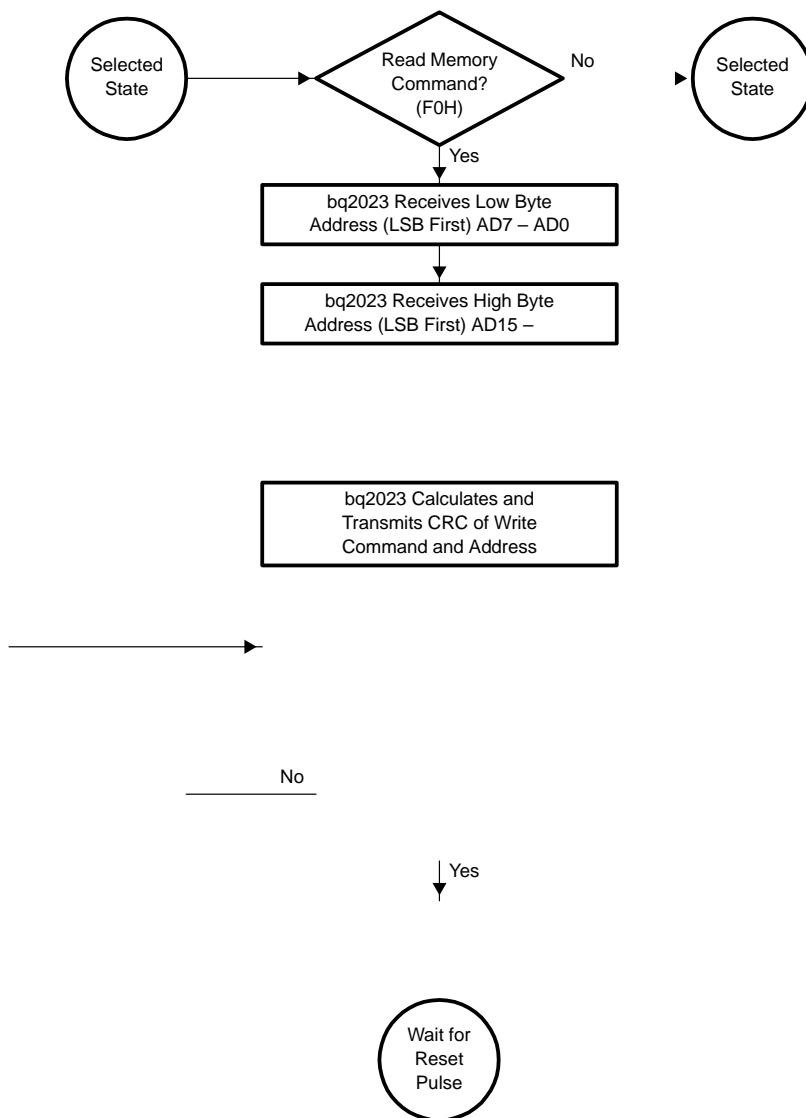
bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

APPLICATION INFORMATION



APPLICATION INFORMATION

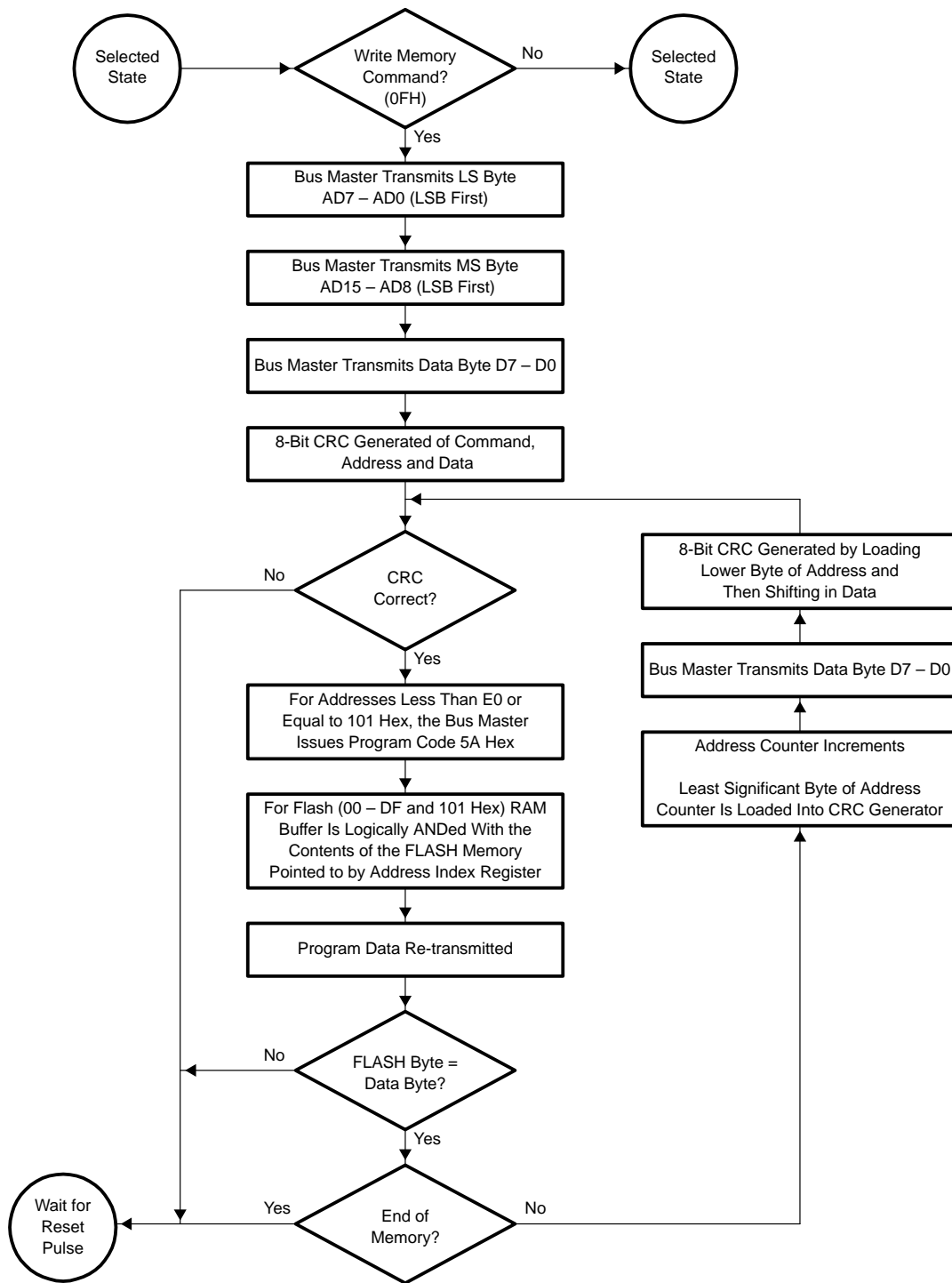


Figure 11. Write Memory Command Flow

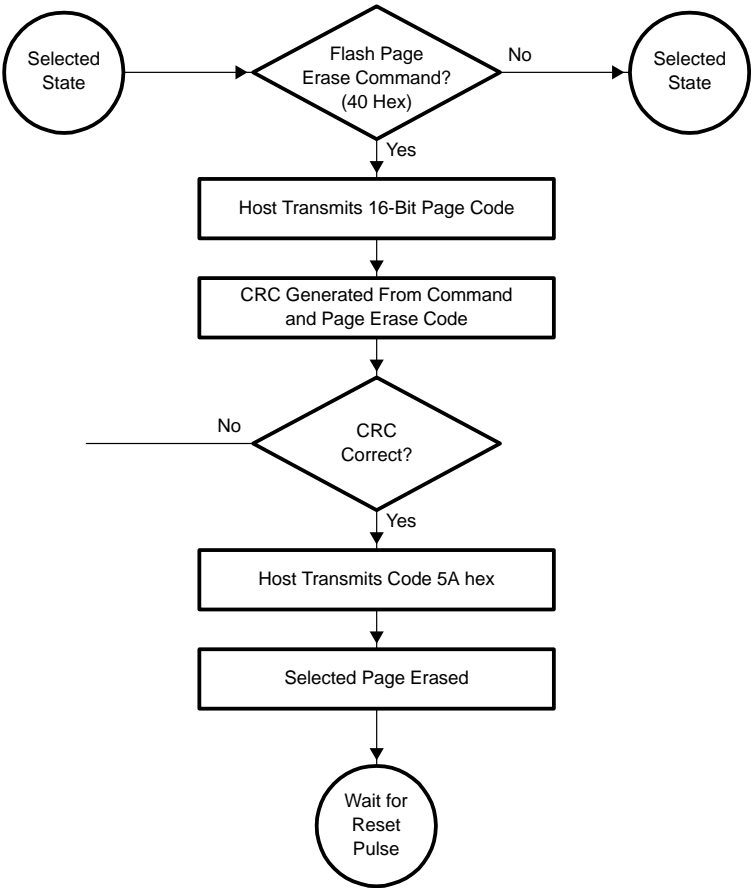
q2023

**SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS**

US480B – MAY 2001



APPLICATION INFORMATION



bq2023

**SINGLE-WIRE ADVANCED BATTERY MONITOR
FOR CELLULAR AND PDA APPLICATIONS**

SLUS480B – MAY 2001

**SINGLE-WIRE ADVANCED BATTERY MODE
FOR CELLULAR AND PDA APPLICATI**

SL

SRP <

If a second rollover occurs, the DTC bit is cleared. Access to the DTC bit should be timed to clear the DTC bit before the rollover occurs. The DTC bit is set when the rollover occurs. The reset of both the DTC bit and DTC is the reset of both the

NOTE:

During a charge. The results in these

4	3
STD	WOR
	E1

NOTE:

of this bit. It must be clear

**EXTRA
ELEMENTS**

bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLUS480B – MAY 2001

**CED BATTERY MONITOR IC
PDA APPLICATIONS**

TS

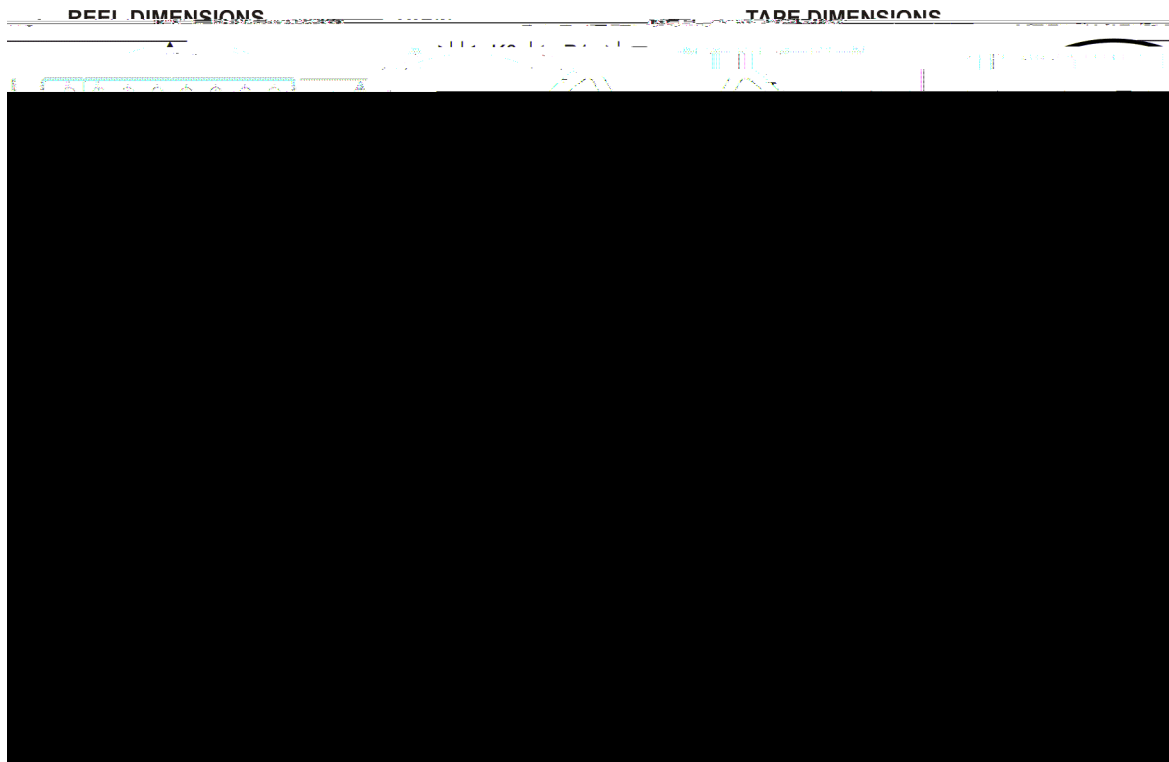
bq2023
SINGLE-WIRE ADVANCED BATTERY MONITOR IC
FOR CELLULAR AND PDA APPLICATIONS

SLU\$480B – MAY 2001

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
BQ2023PW	ACTIVE	TSSOP	PW	8	100	Green (RoHS & no Sb/Br)		

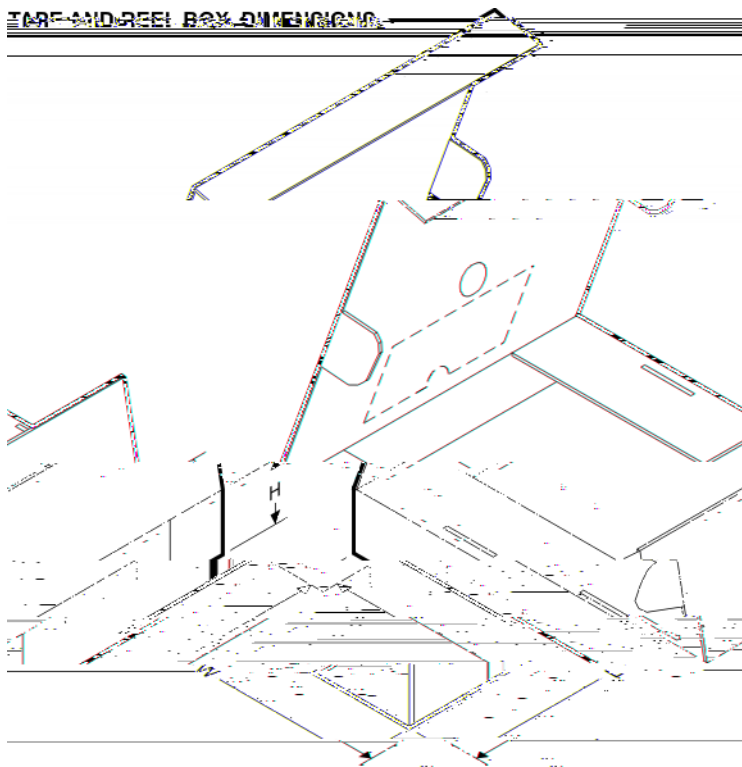
TAPE AND REEL INFORMATION



*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
BQ2023PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

TARE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ2023PWR	TSSOP	PW	8	2000	346.0	346.0	29.0

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. (T./F8 -8 Tf (applications)Tj 1 0 0 1 101f (and)Tj 1 0 0 1 51r774.32 134.6 Tm /F8 -8ye)Tj 1 0 0 1 43.m /F8 -8 Tf (perfo