

SBS 1.1-COMPLIANT GAS GAUGE and PROTECTION ENABLED WITH IMPEDANCE TRACK™ AND HEATER CONTROL TRM ADDENDUM

Check for Samples: [bq34z651](#)

CHANGE FEATURES

- Added temperature-based, heater-enable control
- Reference is *bq20z60-R1/bq20z65-R1 Technical Reference Manual (SLUU386)*

- A bq20z60-R1–based option is not available.

APPLICATIONS

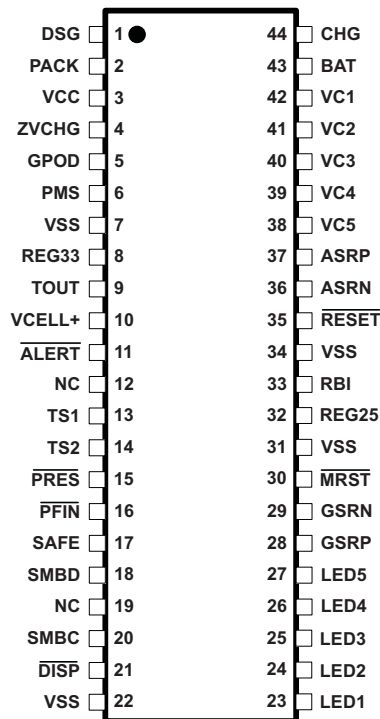
- Li-Ion batteries used in cold environments

DESCRIPTION

The bq34z651 is a new firmware solution for the mass market. The bq34z651 provides the full feature set enabled in the bq20z65-R1 device, with the addition of being able to control an external battery heater when the battery's temperature is extremely cold.

PINOUT

The bq34z651 will use the GPOD pin for the heater control so the pin out remains the same as the bq20z65-R1.



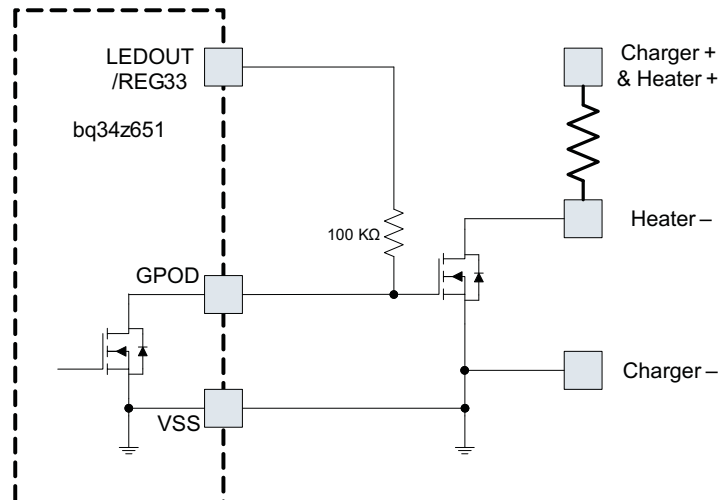
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HEATER CONTROL

Hardware Connection

The bq34z651 uses the GPOD pin (Pin 5) to control the external heater. The polarity of the GPOD pin is set by **DF:OperationCfgA[HPOL]**.

OperationCfgC[HPOL]	GPOD
0	Active Low
1	Active High



Heater Activation

The bq34z651 can control the GPOD output based on the detection of the charger, temperature(), and **DF:OperationCfg[HEATALL]**.

The GPOD pin will activate under the following conditions:

When the charge cycle begins (*Charger Detection* changes to *Charger Detected*) AND Temperature() \leq **DF:Heater Temp**.

OR

When the charge cycle has already started (*Charger Detection* occurred prior to the last *Heater ON* check) AND If Temperature() \leq **DF:Heater Temp** – **DF:Heater Hys**.

The GPOD pin will deactivate under the following conditions:

If Temperature > **DF:Heater Temp**.

If **OperationCfg[HEATALL]** = 0, then GPOD can only activate when a charger is detected.

Charger Detection

The bq34z651 detects that a charger is present when the voltage on PACK > **DF:Charger Present**.

SMBus Broadcasts and FET Control

When the heater is enabled [GPOD = Active], the CHG FET is turned OFF and the following data is available via the SMBus. For smart charger broadcasts to occur Operation Cfg B [**BCAST**] needs to be set.

SMBus Broadcast	Data Flash Value
ChargingCurrent()	Heater Current
ChargingVoltage()	Heater Voltage

When the heater is disabled [GPOD = Inactive], then the FET operation and SMBus data follow the standard bq20z65-R1 charge control operation.

Data Flash Configuration

Table 1. Operation Cfg A (Offset 0) Additions

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
High Byte	LEDR	LEDRCA	CHGLED	DMODE	LED1	LED0	CC1	CC0
Low Byte	HEATALL	HPOL	SLEEP	TEMP1	TEMP0	SLED	ZVCHG1	ZVCHG0

HEATALL (Bit 7): HEATALL enables activation of the GPOD output under ALL conditions.

0 = GPOD is only activated when the charger is detected and the temperature conditions permit it (default).

1 = GPOD is only activated when the temperature conditions permit it.

HPOL (Bit 6): HPOL determines the active polarity of the GPOD pin.

0 = GPOD is active Low (default).

1 = GPOD is active high.

For testing, FETControl() [OD] can still be used to test the heater enable function.

The following data flash configurations are in the **Charge Control Class**.

Table 2. Heater Temp

Subclass ID	Subclass Name	Offset	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
TBD	Heater Control	0	Heater Temp	Signed Integer	2	-126	127	0	1°C

Table 3. Heater ON Temp

Subclass ID	Subclass Name	Offset	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
TBD	Heater Control	2	Heater Hys	Integer	1	0	255	20	0.1°C

Table 4. Heater Voltage

Subclass ID	Subclass Name	Offset	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
TBD	Heater Control	4	Heater Voltage	Integer	2	0	65535	0	mV

Table 5. Heater Current

Subclass ID	Subclass Name	Offset	Name	Format	Size in Bytes	Min Value	Max Value	Default Value	Unit
TBD	Heater Control	6	Heater Current	Integer	2	0	65535	0	mA

Heater Disable

The bq34z651 disables the use of the GPOD pin for heater control if both **Heater Temp** and **Heater Hys** are set to 0.

GPOD CHANGE

In the bq20z65-R1, the GPOD pin can be used for a pre-charge option. The bq34z651 cannot use this function and will perform a *No Action* when ZVCHG1,0 = 10.

ZVCHG1	ZVCHG0	FET USED
0	0	ZVCHG FET
0	1	CHG FET
1	0	No Action
1	1	No Action

MANUFACTURING INFO CHANGE

In the bq34z651, the Manufacturing Info 4 block (20 bytes) is not available. Manufacturing Info 0, 1, 2, and 3 remain.

MASTER MODE START/STOP ISSUE

When any SMBus-compatible device is used in a multi-master system, master mode collisions are inevitable. To account for this, the SMBus standard includes a bus arbitration definition. However, to support improved robust communication conditions when the bq34z651 is enabled to broadcast, it has been enabled with additional SMBus control. The bq34z651 ensures a delay between receipt of a transaction and mastering the bus. A collision could still occur but only if both masters attempt to begin a transaction at exactly the same time.

The bq34z651 introduces a delay between the selected host command and the gas gauge master transaction. An internal timer is started at the end of the selected SMBus host transaction (**SMB Sync Command**), generating an interrupt when the timer reaches the end of the delay time. This interrupt sets up the SMBus hardware to generate the master transaction. The start occurs only if there is a master transaction request pending, which means the device must be configured for broadcast and SMBus synchronization, and there must be an alarm condition or charger update pending.

SMB Sync Delay

Sets the duration of the delay.

Units are 488 μ s, which is the low-frequency oscillator input divided by 16. There is an additional delay of about 700 μ s for the execution of the end of SMBus handling and timer setup. This means the units are 488 + 700 μ s. Such precision is unlikely to be necessary, since there should be a reliable "dead time" after a given command.

Setting the delay time to zero disables SMBus synchronization and returns the gauge to the previous completely asynchronous operation.

SMB Sync Command

Sets the host command which triggers the delay to the subsequent SMBus master transaction.

Setting the command to 0xff enables triggering after any command.

Selecting a useful command requires monitoring the host communication to determine its repeatable patterns. A command will need to be determined, which is used somewhat frequently in all operational modes and is followed by a predictable "dead time." If communication is particularly sparse, it might be advisable to use the "any command" setting of 0xff.

SCHMATIC

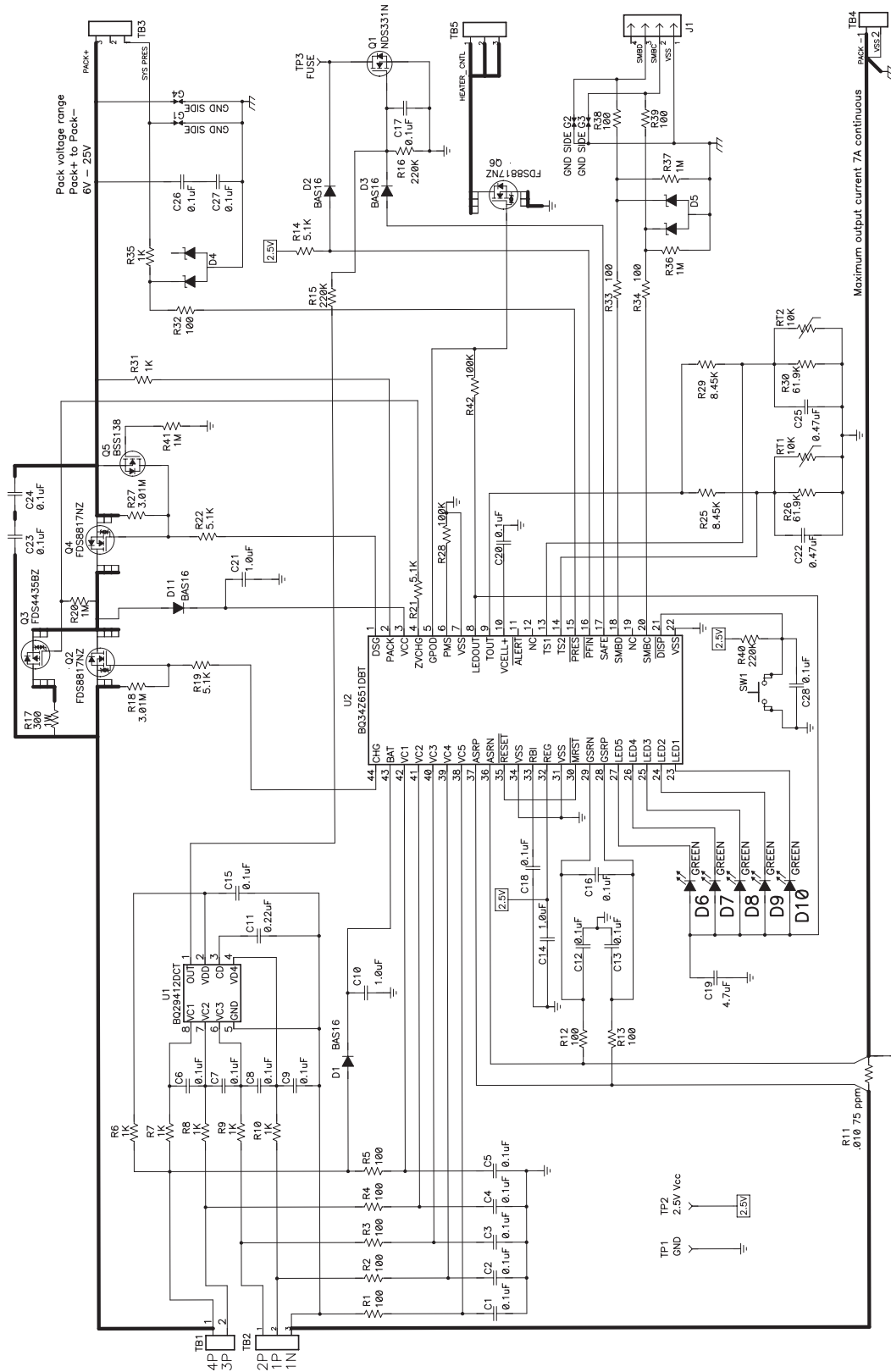


Figure 1. Reference Schematic

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