

# bq24715 2-3 Cell NVDC-1 Battery Charger Controller with Ultra-Fast Transient Response and High Light-Load Efficiency

## 1 Features

- 6-24V Input SMBus NVDC-1 2-3S Battery Charger Controller
- System Instant-on Operation with No Battery or Deeply Discharged Battery
- Ultra-Fast Transient Response of 100  $\mu$ s
- Ultra-Low Quiescent Current of 500  $\mu$ A and High PFM Light Load Efficiency 80% at 20mA load to Meet Energy Star and ErP Lot6
- Switching Frequency: 600kHz/800kHz/1MHz
- Programmable System/Charge Voltage (16 mV/step), Input/Charge Current (64 mA/step) with High Accuracy
  - $\pm 0.5\%$  Charge Voltage Regulation
  - $\pm 3\%$  Input/Charge Current Regulation
  - $\pm 2\%$  40x Input/16x Discharge Current Monitor Output
- Support Battery LEARN Function
- Maximize CPU Performance with Deeply Discharged Battery or No Battery
- Integrated NMOS ACFET and RBFET Driver
- 20-pin 3.5 x 3.5 mm<sup>2</sup> QFN Package

## 2 Applications

- Ultrabook, Notebook, and Tablet PC
- Industrial and Medical Equipment
- Portable Equipment

## 3 Description

The bq24715 is a NVDC-1 synchronous battery charge controller with low quiescent current, high light load efficiency for 2S or 3S Li-ion battery charging applications, offering low component count.

The power path management allows the system to be regulated at battery voltage but does not drop below the programmable system minimum voltage.

The bq24715 provides N-channel ACFET and RBFET drivers for the power path management. It also provides driver of the external P-channel battery FET. The loop compensation is fully integrated.

The bq24715 has programmable 11-bit charge voltage, 7-bit input/charge current and 6-bit minimal system voltage with very high regulation accuracies through the SMBus communication interface.

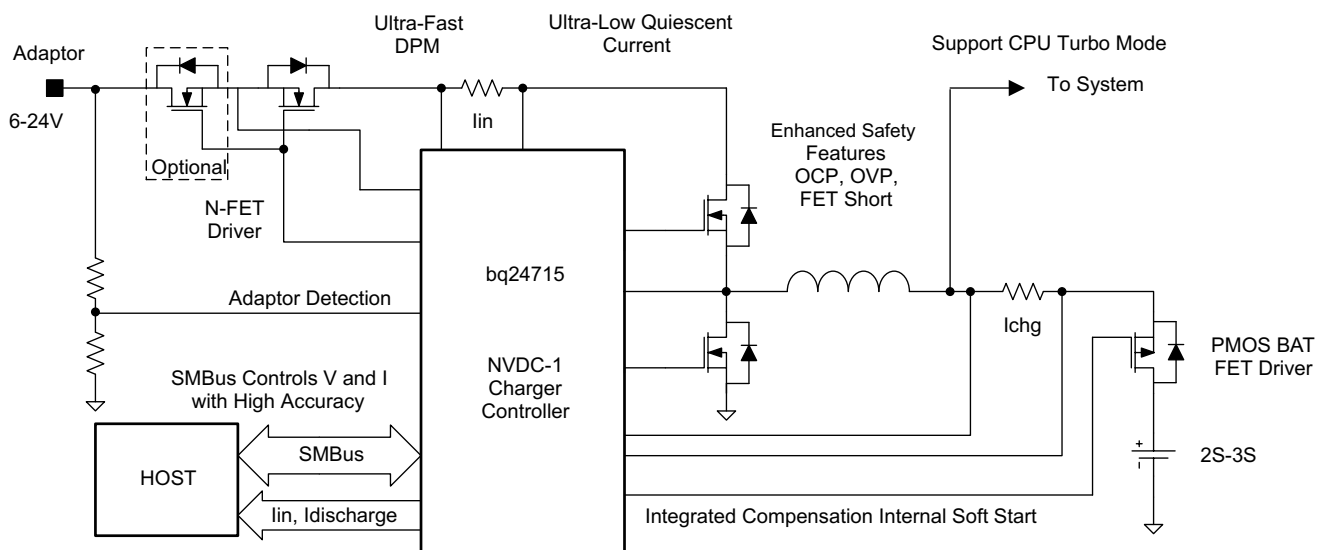
The bq24715 monitors adapter current or battery discharge current through the IOUT pin allowing the host to throttle down CPU speed when needed.

The bq24715 provides extensive safety features for over current, over voltage and MOSFET short circuit.

### Device Information

DEVICE NAME	PACKAGE (PIN)	BODY SIZE
bq24715	VQFN (20)	3.5 mm x 3.5 mm

### Simplified Application Diagram



## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (March 2013) to Revision A	Page
• Added device number to the title and added Device Info table per the new data sheet template.....	1

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Contact TI via [email](#) for full data sheet.

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
BQ24715RGRR	ACTIVE	VQFN	RGR	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR		BQ715	<a href="#">Samples</a>
BQ24715RGRT	ACTIVE	VQFN	RGR	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR		BQ715	<a href="#">Samples</a>

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
BQ24715RGRR	VQFN	RGR	20	3000	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1
BQ24715RGRT	VQFN	RGR	20	250	180.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1

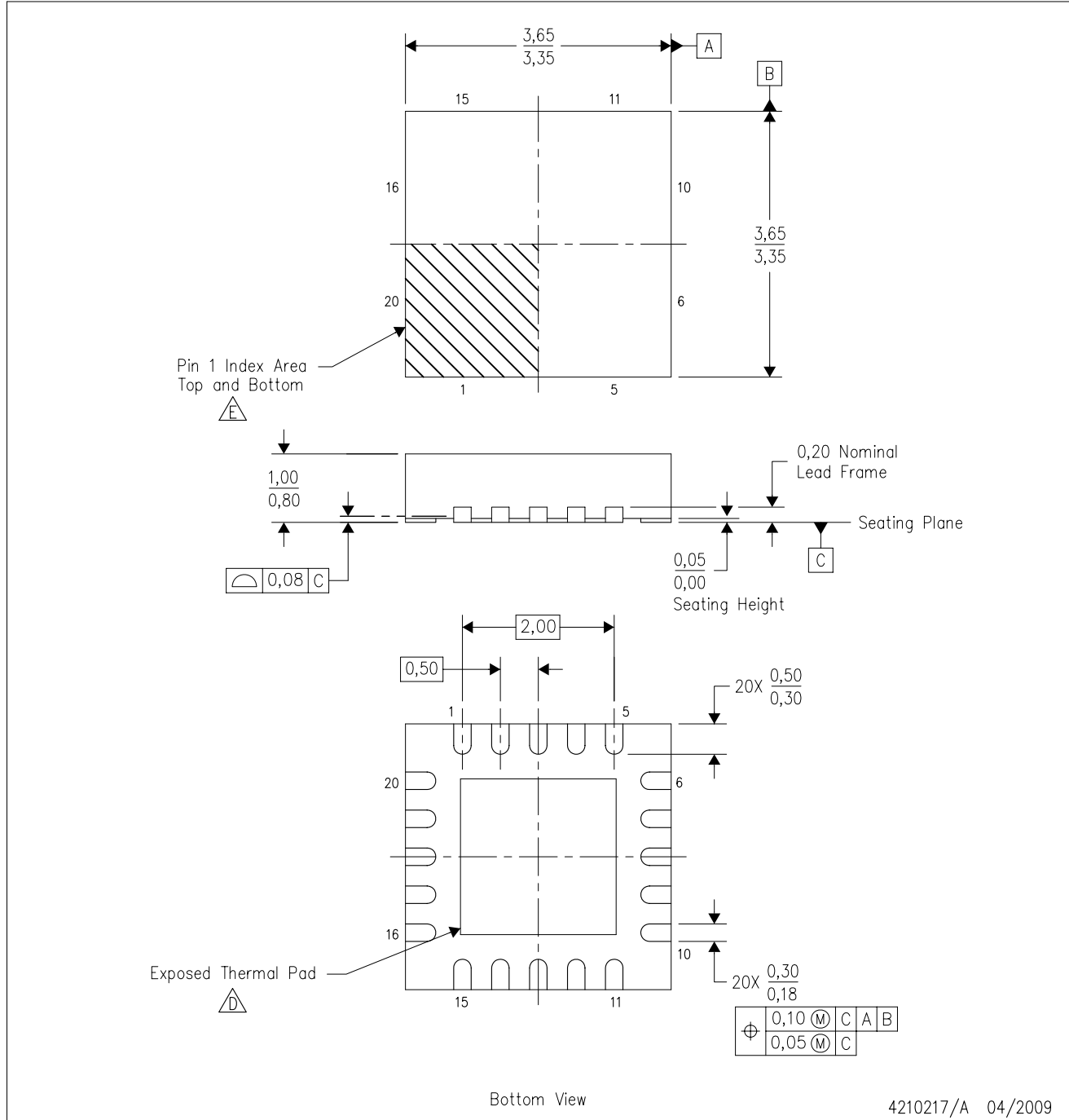
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ24715RGRR	VQFN	RGR	20	3000	367.0	367.0	35.0
BQ24715RGRT	VQFN	RGR	20	250	210.0	185.0	35.0

RGR (S-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



4210217/A 04/2009

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad dimensions.
  - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.

# THERMAL PAD MECHANICAL DATA

RGR (S-PVQFN-N20)

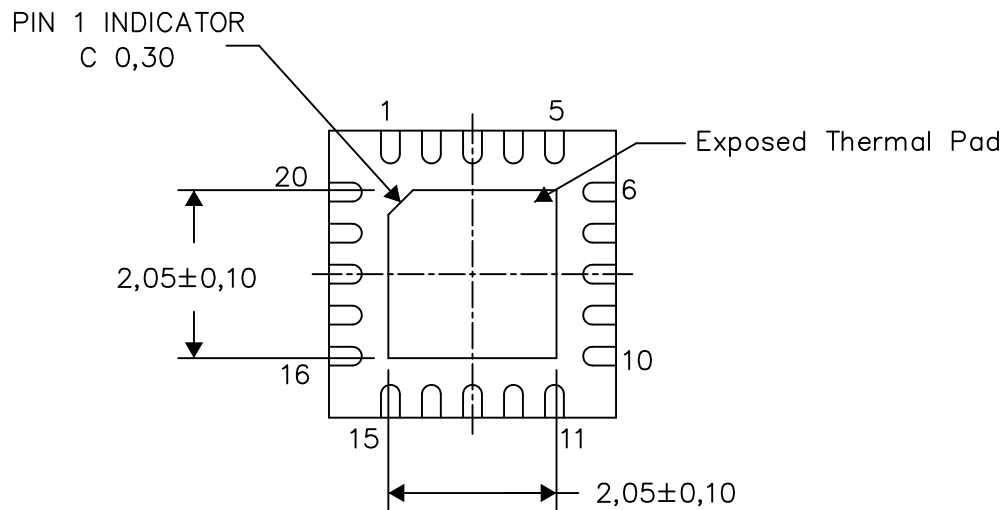
PLASTIC QUAD FLATPACK NO-LEAD

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

Exposed Thermal Pad Dimensions

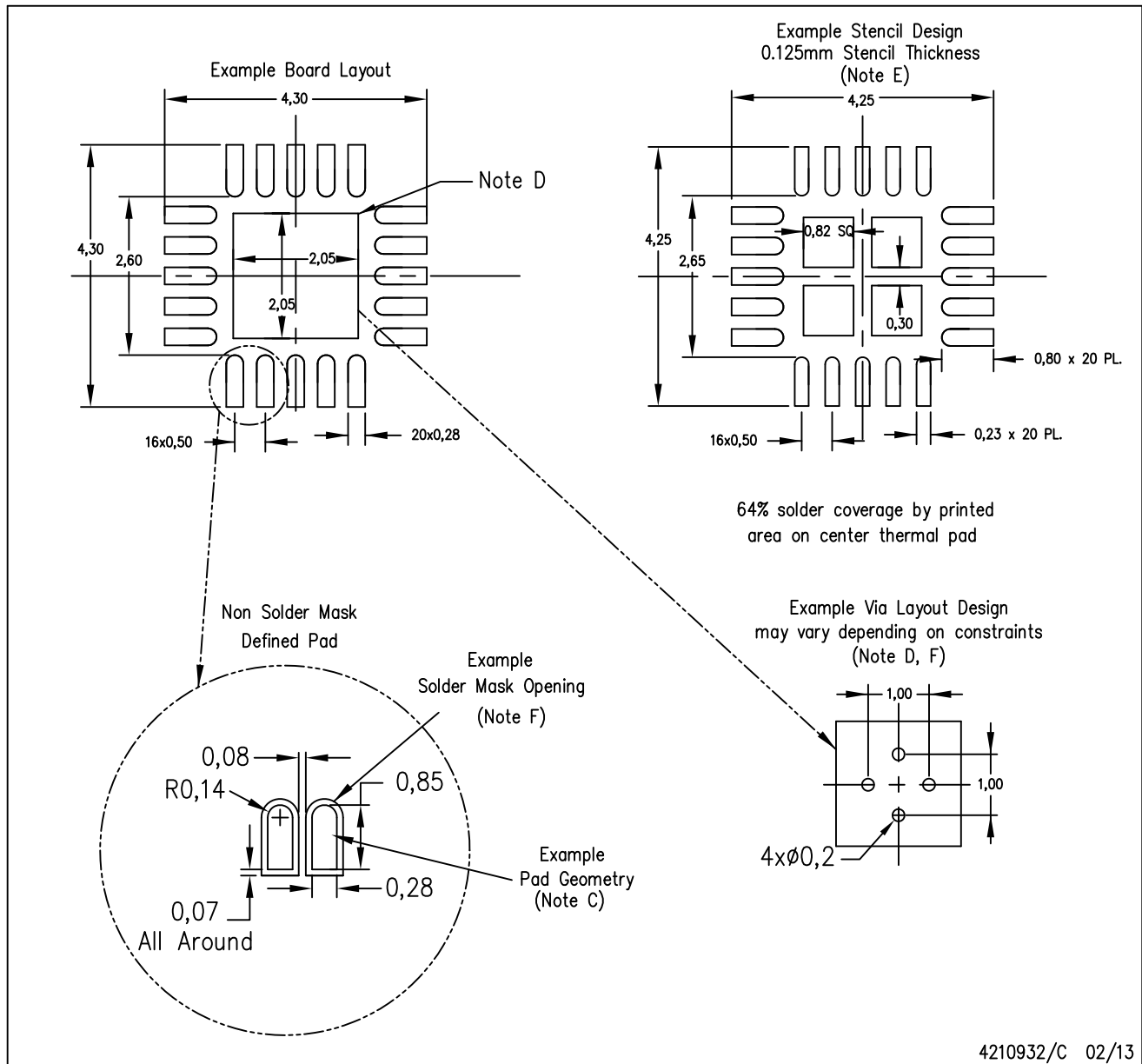
4210218/E 04/14

NOTE: All linear dimensions are in millimeters



RGR (S-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
- Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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