

BQ7718 Overvoltage Protection for 2-Series to 5-Series Cell Li-Ion Batteries with Internal Delay Timer

1 Features

- 2-, 3-, 4-, and 5-series cell overvoltage protection
- Internal delay timer
- Fixed OVP threshold
- High-accuracy overvoltage protection: ± 10 mV
- Low power consumption $I_{CC} \approx 1 \mu\text{A}$ ($V_{\text{CELL(ALL)}} < V_{\text{PROTECT}}$)
- Low leakage current per cell input < 100 nA
- **Functional Safety-Capable**
 - [Documentation available to aid functional safety system design](#)
- Package footprint options:
 - Small 8-pin QFN (3.00 mm \times 4.00 mm)
 - Leaded 8-pin MSOP (3.00 mm \times 5.00 mm, including leads)

2 Applications

- Protection for li-ion battery packs used in:
 - [Handheld garden tools](#)
 - [Handheld power tools](#)
 - [Cordless vacuum cleaners](#)
 - [UPS battery backup](#)
 - [Light electric vehicles \(eBike, eScooter, pedal assist bicycles\)](#)

3 Description

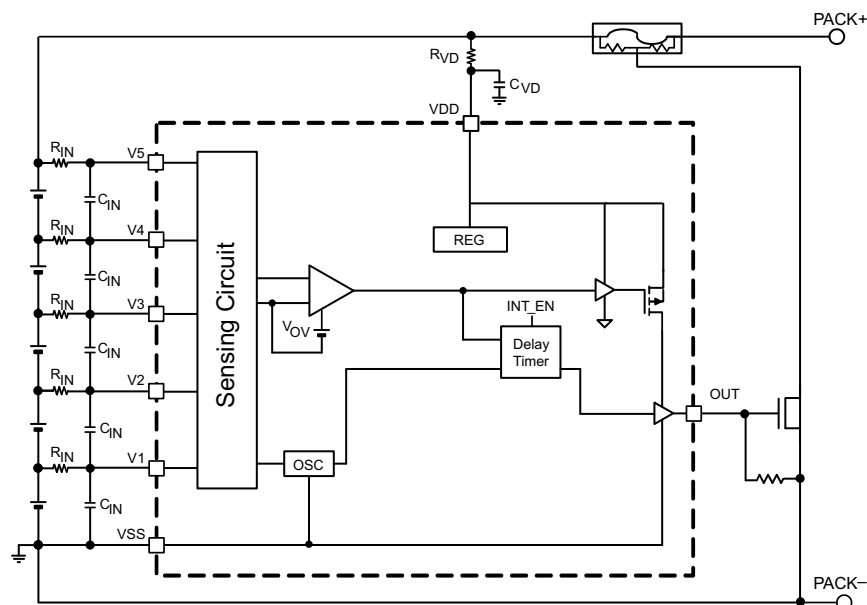
The BQ7718xy family of products provides an overvoltage monitor and protector for Li-Ion battery pack systems. Each cell is monitored independently for an overvoltage condition. For quicker production-line testing, the BQ7718xy device provides a Customer Test Mode (CTM) with greatly reduced delay time.

In the BQ7718xy device, an internal delay timer is initiated upon detection of an overvoltage condition on any cell. Upon expiration of the delay timer, the output is triggered into its active state (either high or low depending on the configuration).

Device Information Table

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------------------|---------|--|
| BQ771800 ⁽¹⁾ | DPJ (8) | 3.00 mm \times 4.00 mm |
| BQ771800 ⁽²⁾ | DGK (8) | 3.00 mm \times 3.00 mm (3.00 mm \times 5.00 mm, including leads) |

- (1) For available catalog packages, see the orderable addendum at the end of the data sheet and [Section 5](#).
 (2) Contact TI for more information.



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Simplified Schematic



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4 Revision History

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

| Changes from Revision K (April 2021) to Revision L (June 2021) | Page |
|---|-------------|
| • Changed the BQ771825 device to Production Data..... | 3 |

| Changes from Revision J (September 2020) to Revision K (June 2021) | Page |
|---|-------------|
| • Added the BQ771825 device to the <i>Device Comparison Table</i> | 3 |

| Changes from Revision I (July 2020) to Revision J (September 2020) | Page |
|---|-------------|
| • Added the BQ771824 device to the <i>Device Comparison Table</i> | 3 |
| • Added BQ771824 to the <i>DC Characteristics</i> | 6 |
| • Added BQ771824 delay settings..... | 7 |

| Changes from Revision H (February 2020) to Revision I (July 2020) | Page |
|--|-------------|
| • Added the Functional Safety-Capable feature..... | 1 |
| • Added the BQ771823 device to the <i>Device Comparison Table</i> | 3 |
| • Added BQ771823 to the <i>DC Characteristics</i> | 6 |
| • Added BQ771823 delay settings to <i>Section 7.6</i> | 7 |

5 Device Comparison Table

| T _A | Part Number | Package | Package Designator | OVP (V) | OV Hysteresis (V) | Output Delay | Output Drive | Tape and Reel (Large) | Tape and Reel (Small) |
|----------------|-------------------------|-------------------------|--------------------|---------------|------------------------|----------------|---|---|---|
| -40°C to 110°C | BQ771800 | 8-Pin QFN or 8-Pin MSOP | DPJ/DGK | 4.300 | 0.300 | 4 s | CMOS Active High | BQ771800DPJR | BQ771800DPJT |
| | BQ771801 | | | 4.275 | 0.050 | 3 s | NCH Active Low, Open Drain | BQ771801DPJR | BQ771801DPJT |
| | BQ771802 | | | 4.225 | 0.300 | 1 s | NCH Active Low, Open Drain | BQ771802DPJR | BQ771802DPJT |
| | BQ771803 | | | 4.275 | 0.050 | 1 s | NCH Active Low, Open Drain | BQ771803DPJR BQ771803DGKR ⁽²⁾ | BQ771803DPJT BQ771803DGKT ⁽²⁾ |
| | BQ771806 | | | 4.350 | 0.300 | 3 s | CMOS Active High | BQ771806DPJR | BQ771806DPJT |
| | BQ771807 | | | 4.450 | 0.300 | 3 s | CMOS Active High | BQ771807DPJR | BQ771807DPJT |
| | BQ771808 | | | 4.200 | 0.050 | 1 s | NCH Active Low, Open Drain | BQ771808DPJR | BQ771808DPJT |
| | BQ771809 | | | 4.200 | 0.050 | 1 s | CMOS Active High | BQ771809DPJR | BQ771809DPJT |
| | BQ771811 | | | 4.225 | 0.050 | 1 s | CMOS Active High | BQ771811DPJR | BQ771811DPJT |
| | BQ771815 | | | 4.225 | 0.050 | 1 s | NCH Active Low, Open Drain | BQ771815DPJR | BQ771815DPJT |
| | BQ771817 | | | 4.275 | 0.050 | 1 s | CMOS Active High | BQ771817DPJR | BQ771817DPJT |
| | BQ771818 | | | 4.300 | 0.300 | 1 s | CMOS Active High | BQ771818DPJR BQ771818DGKR | BQ771818DPJT BQ771818DGKT |
| | BQ771823 | | | 4.275 | 0.300 | 3 s | NCH Active Low, Open Drain | BQ771823DPJR | — |
| | BQ771824 | | | 3.850 | 0.300 | 4 s | CMOS Active High | BQ771824DPJR | — |
| | BQ771825 | | | 3.950 | 0.050 | 3 s | NCH Active Low, Open Drain | BQ771825DPJR BQ771825DGKR ⁽²⁾ | BQ771825DPJT BQ771825DGKT ⁽²⁾ |
| | BQ7718xy ⁽¹⁾ | | | 3.850 – 4.650 | Latch, 0.05, 0.25, 0.3 | 1, 4, 3, 5.5 s | NCH, Active Low, Open Drain, CMOS Active High | BQ7718xyDPJR | BQ7718xyDPJT |

- (1) Future option. Contact TI for more information.
(2) Contact TI for more information.

6 Pin Configuration and Functions

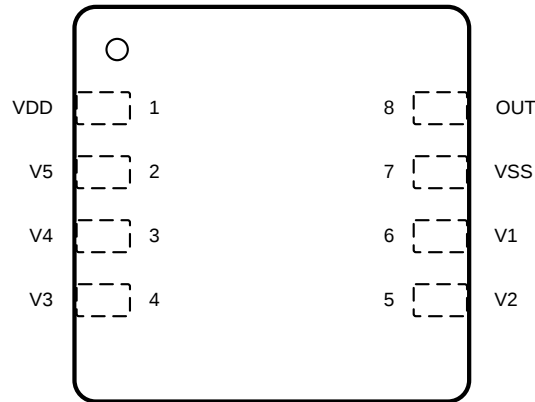


Figure 6-1. DPJ Package 8-Pin (WSON) Top View

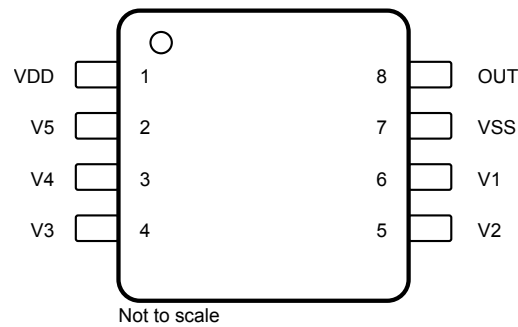


Figure 6-2. DGK Package 8-Pin (PDSO) Top View

Table 6-1. Pin Functions

| NO. | NAME | TYPE I/O | DESCRIPTION |
|-----|------|----------|---|
| 1 | VDD | P | Power supply |
| 2 | V5 | I | Sense input for positive voltage of the fifth cell from the bottom of the stack |
| 3 | V4 | I | Sense input for positive voltage of the fourth cell from the bottom of the stack |
| 4 | V3 | I | Sense input for positive voltage of the third cell from the bottom of the stack |
| 5 | V2 | I | Sense input for positive voltage of the second cell from the bottom of the stack |
| 6 | V1 | I | Sense input for positive voltage of the lowest cell in the stack |
| 7 | VSS | P | Electrically connected to IC ground and negative terminal of the lowest cell in the stack |
| 8 | OUT | O | Output drive for overvoltage fault signal |

O = Output, I = Input, P = Power connection

7 Specifications

7.1 Absolute Maximum Ratings

Over-operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | MIN | MAX | UNIT |
|--|---|-----------------------------------|-----|------|
| Supply voltage range | VDD – VSS | –0.3 | 30 | V |
| Input voltage range | V5 – VSS or V4 – VSS or V3 – VSS or V2 – VSS or V1 – VSS | –0.3 | 30 | V |
| Output voltage range | OUT – VSS | –0.3 | 30 | V |
| Continuous total power dissipation, P _{TOT} | | See Section 7.4 . | | |
| Functional temperature | | –40 | 110 | °C |
| Storage temperature range, T _{STG} | | –65 | 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.

7.2 ESD Ratings

| | | | VALUE | UNIT |
|---------------------------|-------------------------|--|-------|------|
| V _(ESD) Rating | Electrostatic discharge | Human body model (HBM) ESD stress voltage ⁽¹⁾ | ±2000 | V |
| | | Charged device model (CDM) ESD stress voltage ⁽²⁾ | ±500 | |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

7.3 Recommended Operating Conditions

Over-operating free-air temperature range (unless otherwise noted)

| | | MIN | MAX | UNIT |
|---|---|-----|-----|------|
| Supply voltage, V _{DD} | ⁽¹⁾ | 3 | 25 | V |
| Input voltage range | V5–V4 or V4–V3 or V3–V2 or V2–V1 or V1–VSS | 0 | 5 | V |
| Operating ambient temperature range, T _A | | –40 | 110 | °C |

- (1) See [Section 9.2](#).

7.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | BQ7718xy | | UNIT |
|-------------------------------|--|------------|--|------|
| | | DPJ (WSON) | | |
| | | 8 PINS | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 56.6 | | °C/W |
| R _{θJCtop} | Junction-to-case(top) thermal resistance | 56.4 | | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 30.6 | | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 1.0 | | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 37.8 | | °C/W |
| R _{θCbot} | Junction-to-case(bottom) thermal resistance | 11.3 | | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

7.5 DC Characteristics

Typical values stated where $T_A = 25^\circ\text{C}$ and $V_{DD} = 18\text{ V}$, MIN/MAX values stated where $T_A = -40^\circ\text{C}$ to 110°C and $V_{DD} = 3\text{ V}$ to 25 V (unless otherwise noted).

| SYMBOL | PARAMETER | CONDITION | MIN | TYP | MAX | UNIT |
|---|--|--|------|-------|-----|---------------|
| Voltage Protection Threshold VCx | | | | | | |
| V_{OV} | $V_{(PROTECT)}$ Overvoltage Detection | BQ771800 | | 4.300 | | V |
| | | BQ771801 | | 4.275 | | V |
| | | BQ771803 | | 4.275 | | V |
| | | BQ771802 | | 4.225 | | V |
| | | BQ771806 | | 4.350 | | V |
| | | BQ771807 | | 4.450 | | V |
| | | BQ771808 | | 4.200 | | V |
| | | BQ771809 | | 4.200 | | V |
| | | BQ771811 | | 4.225 | | V |
| | | BQ771815 | | 4.225 | | V |
| | | BQ771817 | | 4.275 | | V |
| | | BQ771818 | | 4.300 | | V |
| | | BQ771823 | | 4.275 | | V |
| BQ771824 | | 3.850 | | V | | |
| V_{HYS} | OV Detection Hysteresis | BQ771800 | 250 | 300 | 400 | mV |
| | | BQ771801 | 0 | 50 | 100 | mV |
| | | BQ771802 | 250 | 300 | 400 | mV |
| | | BQ771803 | 0 | 50 | 100 | mV |
| | | BQ771806 | 250 | 300 | 400 | mV |
| | | BQ771807 | 250 | 300 | 400 | mV |
| | | BQ771808 | 0 | 50 | 100 | mV |
| | | BQ771809 | 0 | 50 | 100 | mV |
| | | BQ771811 | 0 | 50 | 100 | mV |
| | | BQ771815 | 0 | 50 | 100 | mV |
| | | BQ771817 | 0 | 50 | 100 | mV |
| | | BQ771818 | 250 | 300 | 400 | mV |
| | | BQ771823 | 250 | 300 | 400 | mV |
| BQ771824 | 250 | 300 | 400 | mV | | |
| V_{OA} | OV Detection Accuracy | $T_A = 25^\circ\text{C}$ | -10 | | 10 | mV |
| $V_{OADRIFT}$ | OV Detection Accuracy Across Temperature | $T_A = -40^\circ\text{C}$ | -40 | | 44 | mV |
| | | $T_A = 0^\circ\text{C}$ | -20 | | 20 | mV |
| | | $T_A = 60^\circ\text{C}$ | -24 | | 24 | mV |
| | | $T_A = 110^\circ\text{C}$ | -54 | | 54 | mV |
| Supply and Leakage Current | | | | | | |
| I_{CC} | Supply Current | $(V_5-V_4) = (V_4-V_3) = (V_3-V_2) = (V_2-V_1) = (V_1-V_{SS}) = 4\text{ V}$ (See Figure 8-2 .) | | 1 | 2 | μA |
| I_{IN} | Input Current at Vx Pins | $(V_5-V_4) = (V_4-V_3) = (V_3-V_2) = (V_2-V_1) = (V_1-V_{SS}) = 4\text{ V}$ (See Figure 8-2 .) | -0.1 | | 0.1 | μA |

Typical values stated where $T_A = 25^\circ\text{C}$ and $V_{DD} = 18\text{ V}$, MIN/MAX values stated where $T_A = -40^\circ\text{C}$ to 110°C and $V_{DD} = 3\text{ V}$ to 25 V (unless otherwise noted).

| SYMBOL | PARAMETER | CONDITION | MIN | TYP | MAX | UNIT |
|--|-----------------------------------|---|-----|-----------|-----|------|
| Output Drive OUT, CMOS Active HIGH Versions Only | | | | | | |
| V_{OUT1} | Output Drive Voltage, Active High | (V5–V4), (V4–V3), (V3–V2), (V2–V1), or (V1–VSS) > V_{OV} , VDD = 18 V, $I_{OH} = 100\ \mu\text{A}$ | 6 | | | V |
| | | If three of four cells are short circuited and only one cell remains powered and > V_{OV} , VDD = V_x (cell voltage), $I_{OH} = 100\ \mu\text{A}$ | | VDD – 0.3 | | V |
| | | (V5–V4), (V4–V3), (V3–V2), (V2–V1), and (V1–VSS) < V_{OV} , VDD = 18 V, $I_{OL} = 100\ \mu\text{A}$ measured into pin | | 250 | 400 | mV |
| I_{OUTH1} | OUT Source Current (during OV) | (V5–V4), (V4–V3), (V3–V2), (V2–V1), or (V1–VSS) > V_{OV} , VDD = 18 V. OUT = 0 V. Measured out of OUT pin | | | 4.5 | mA |
| I_{OUTL1} | OUT Sink Current (no OV) | (V5–V4), (V4–V3), (V3–V2), (V2–V1), and (V1–VSS) < V_{OV} , VDD = 18 V, OUT = VDD. Measured into OUT pin | 0.5 | | 14 | mA |
| Output Drive OUT, NCH Open Drain Active LOW Versions Only | | | | | | |
| V_{OUT2} | Output Drive Voltage, Active Low | (V5–V4), (V4–V3), (V3–V2), (V2–V1), or (V1–VSS) > V_{OV} , VDD = 18 V, $I_{OL} = 100\ \mu\text{A}$ measured into OUT pin | | 250 | 400 | mV |
| I_{OUTH2} | OUT Sink Current (during OV) | (V5–V4), (V4–V3), (V3–V2), (V2–V1), or (V1–VSS) > V_{OV} , VDD = 18 V. OUT = VDD. Measured into OUT pin | 0.5 | | 14 | mA |
| I_{OUTL2} | OUT Source Current (no OV) | (V5–V4), (V4–V3), (V3–V2), (V2–V1), and (V1–VSS) < V_{OV} , VDD = 18 V. OUT = VDD. Measured out of OUT pin | | | 100 | nA |

7.6 Timing Requirements

| | | | MIN | NOM | MAX | UNIT |
|--------------------|--|--|-----|-----|-----|------|
| Delay Timer | | | | | | |
| t_{DELAY} | OV Delay Time | BQ771800, BQ771824 | 3.2 | 4 | 4.8 | s |
| | | BQ771801, BQ771807, BQ771823 | 2.4 | 3 | 3.6 | s |
| | | BQ771802, BQ771803, BQ771811, BQ771815, BQ771818 | 0.8 | 1 | 1.2 | s |
| | | Preview option only. Contact TI. | 4.4 | 5.5 | 6.6 | s |
| $X_{CTMDELAY}$ | Fault Detection Delay Time during Customer Test Mode | See Section 8.4.3 . | | 15 | | ms |

7.7 Typical Characteristics

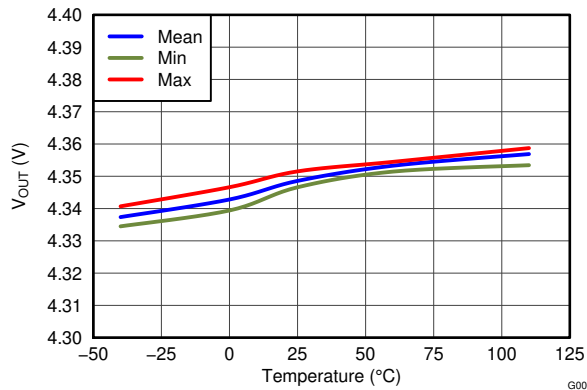


Figure 7-1. Overvoltage Threshold (OVT) vs. Temperature

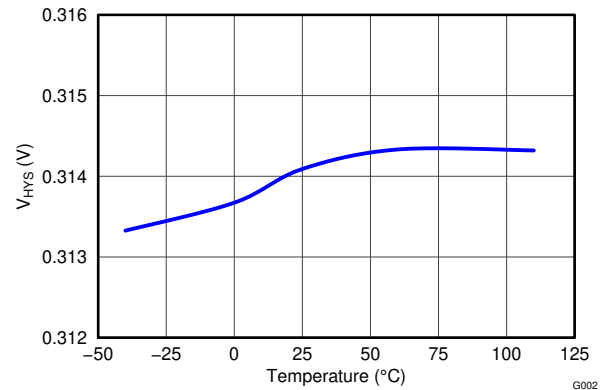


Figure 7-2. Hysteresis V_{HYS} vs. Temperature

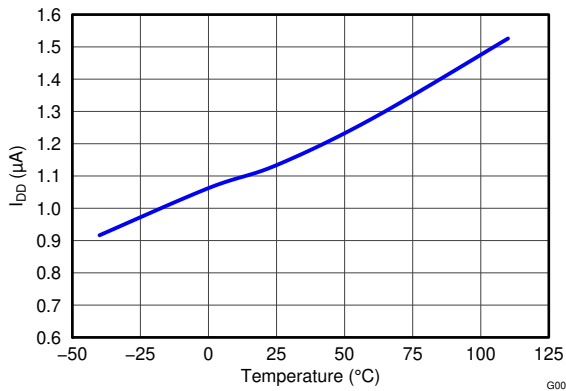


Figure 7-3. I_{DP} Current Consumption vs. Temperature at $V_{DD} = 16\text{ V}$

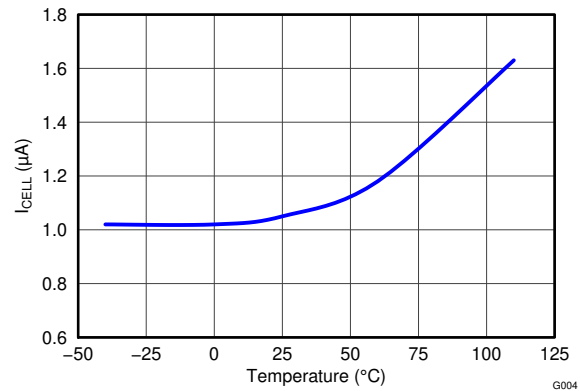


Figure 7-4. I_{CELL} vs. Temperature at $V_{CELL} = 9.2\text{ V}$

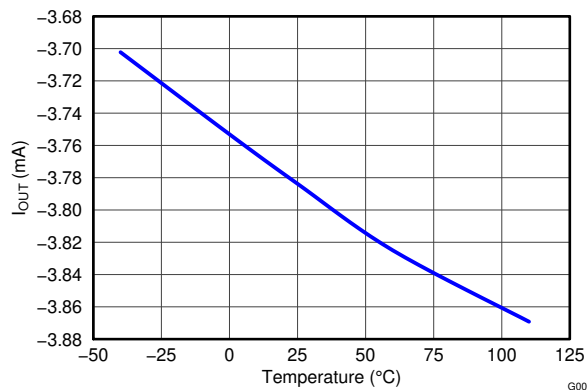


Figure 7-5. Output Current I_{OUT} vs. Temperature

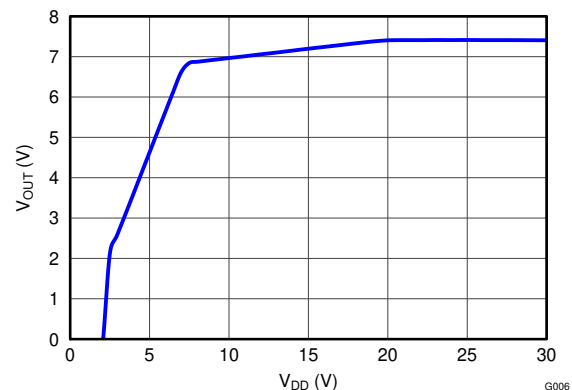


Figure 7-6. V_{OUT} vs. V_{DD}

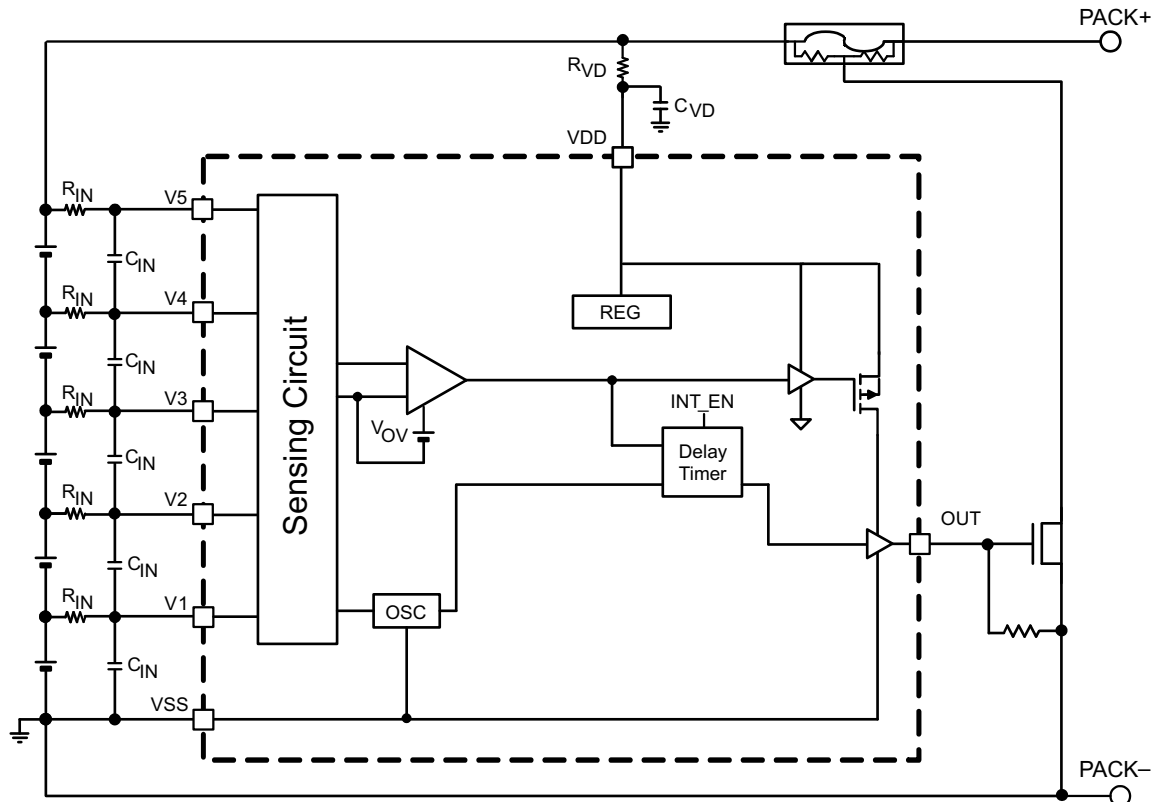
8 Detailed Description

8.1 Overview

In the BQ7718xy family of devices, each cell is monitored independently and an external delay timer is initiated if an overvoltage condition is detected on any cell.

For quicker production-line testing, the device provides a Customer Test Mode with greatly reduced delay time.

8.2 Functional Block Diagram



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8.3 Feature Description

In the BQ7718xy device, each cell is monitored independently. Overvoltage is detected by comparing the actual cell voltage to a protection voltage reference, V_{OV} . If any cell voltage exceeds the programmed OV value, a timer circuit is activated. When the timer expires, the OUT pin goes from inactive to active state.

For NCH Open Drain Active Low configurations, the OUT pin pulls down to VSS when active (OV present) and is high impedance when inactive (no OV).

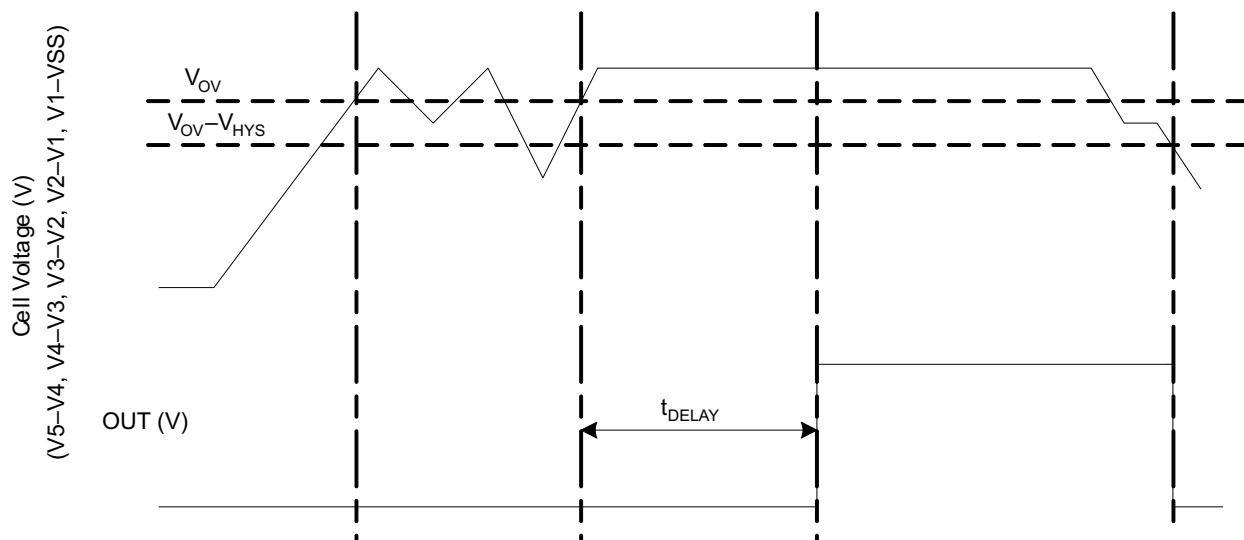


Figure 8-1. Timing for Overvoltage Sensing

8.3.1 Sense Positive Input for V_x

This is an input to sense each single battery cell voltage. A series resistor and a capacitor across the cell for each input is required for noise filtering and stable voltage monitoring.

8.3.2 Output Drive, OUT

This pin serves as the fault signal output, and may be ordered in either active HIGH or LOW options.

8.3.3 Supply Input, VDD

This pin is the unregulated input power source for the IC. A series resistor is connected to limit the current, and a capacitor is connected to ground for noise filtering.

8.4 Device Functional Modes

8.4.1 NORMAL Mode

When all of the cell voltages are below the overvoltage threshold, V_{OV} , the device operates in NORMAL mode. The device monitors the differential cell voltages connected across ($V1 - VSS$), ($V2 - V1$), ($V3 - V2$), ($V4 - V3$), and ($V5 - V4$). The OUT pin is inactive and if configured:

The OUT pin is inactive and if configured:

- Active high is low.
- Active low is being externally pulled up and is an open drain.

8.4.2 OVERVOLTAGE Mode

OVERVOLTAGE mode is detected if any of the cell voltages exceeds the overvoltage threshold, V_{OV} for configured OV delay time. The OUT pin is activated after a delay time set by the capacitance in the CD pin. The OUT pin will either pull high internally, if configured as active high, or will be pulled low internally, if configured as active low. When all of the cell voltages fall below the ($V_{OV} - V_{HYS}$), the device returns to NORMAL mode.

8.4.3 Customer Test Mode

Customer Test Mode (CTM) helps to reduce test time for checking the overvoltage delay timer parameter once the circuit is implemented in the battery pack. To enter CTM, VDD should be set to at least 10 V higher than V5 (see Figure 8-2). The delay timer is greater than 10 ms, but considerably shorter than the timer delay in normal operation. To exit Customer Test Mode, remove the VDD to a V5 voltage differential of 10 V so that the decrease in this value automatically causes an exit.

CAUTION

Avoid exceeding any Absolute Maximum Voltages on any pins when placing the part into Customer Test Mode. Also avoid exceeding Absolute Maximum Voltages for the individual cell voltages (V5–V4), (V4–V3), (V3–V2), (V2–V1), and (V1–VSS). Stressing the pins beyond the rated limits may cause permanent damage to the device.

Figure 8-2 shows the timing for the Customer Test Mode.

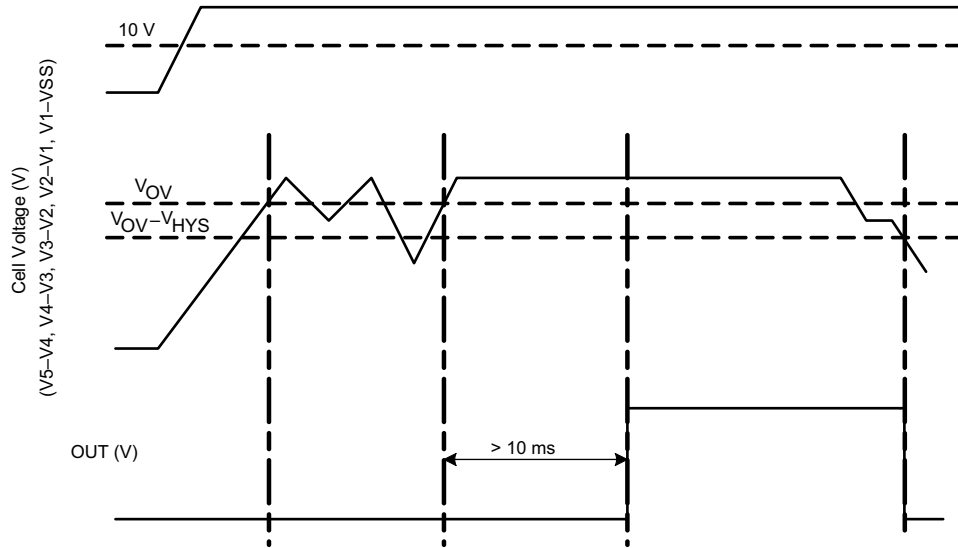


Figure 8-2. Timing for Customer Test Mode

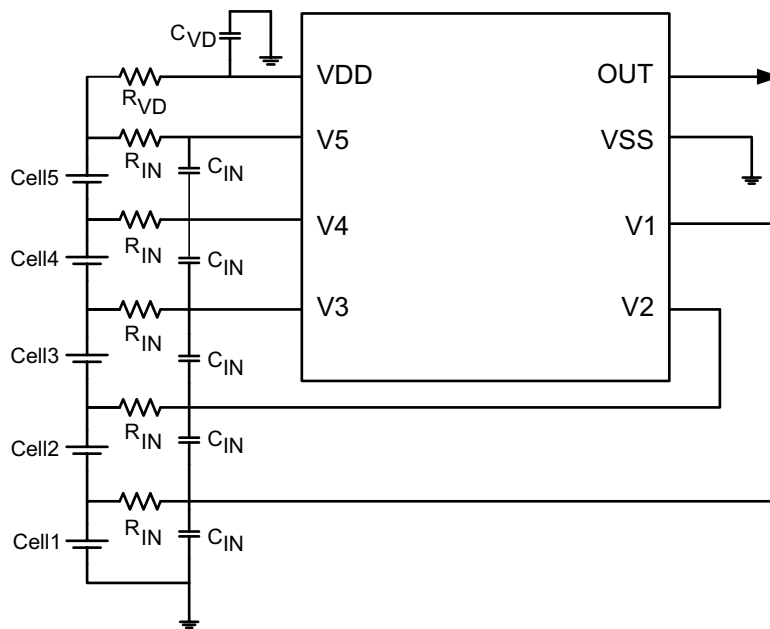
9 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

In the case of an Open Drain Active Low configuration, an external pull-up resistor is required on the OUT pin. Changes to the ranges stated in [Table 9-1](#) will impact the accuracy of the cell measurements.



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Figure 9-1. Application Configuration

9.1.1 Design Requirements

Changes to the ranges stated in [Table 9-1](#) will impact the accuracy of the cell measurements. [Figure 9-1](#) shows each external component.

Table 9-1. Parameters

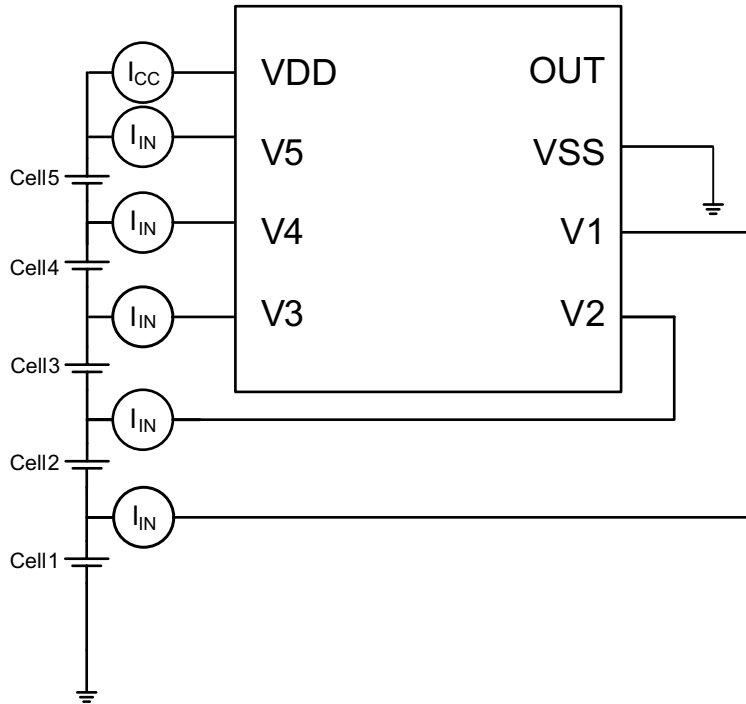
| PARAMETER | EXTERNAL COMPONENT | MIN | NOM | MAX | UNIT |
|--|--------------------|------|------|------|---------------|
| Voltage monitor filter resistance | R_{IN} | 900 | 1000 | 1100 | Ω |
| Voltage monitor filter capacitance | C_{IN} | 0.01 | | 0.1 | μF |
| Supply voltage filter resistance | R_{VD} | 100 | | 1K | Ω |
| Supply voltage filter capacitance | C_{VD} | | 0.1 | | μF |
| CD external delay capacitance | | | 0.1 | 1 | μF |
| OUT Open drain version pull-up resistance to PACK+ | | | 100 | | k Ω |

Note

The device is calibrated using an R_{IN} value = 1 k Ω . Using a value other than this recommended value changes the accuracy of the cell voltage measurements and V_{OV} trigger level.

9.1.2 Detailed Design Procedure

Figure 9-2 shows the measurement for current consumption for the product for both VDD and V_x .



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Figure 9-2. Configuration for IC Current Consumption Test

9.1.2.1 Application Curves

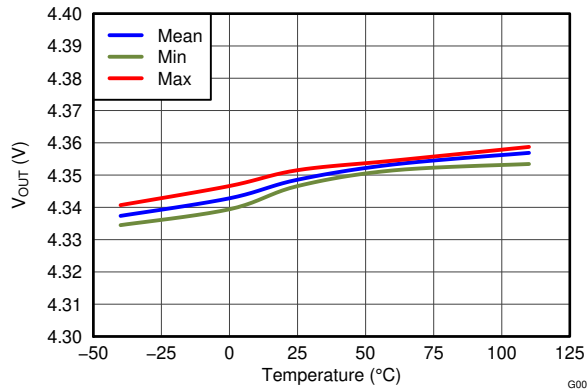


Figure 9-3. Overvoltage Threshold (OVT) vs. Temperature

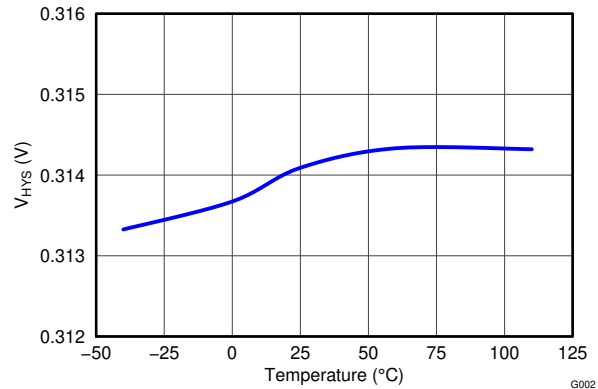


Figure 9-4. Hysteresis V_{HYS} vs. Temperature

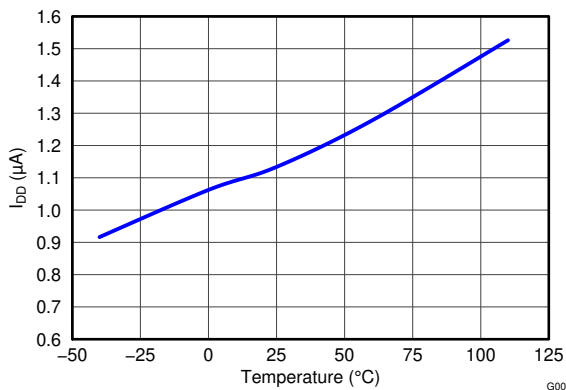


Figure 9-5. I_{DD} Current Consumption vs. Temperature at $V_{DD} = 16\text{ V}$

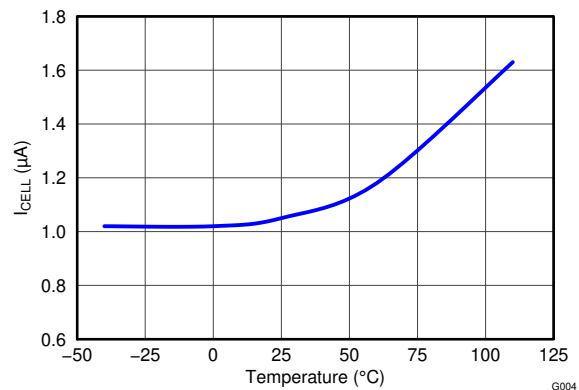


Figure 9-6. I_{CELL} vs. Temperature at $V_{CELL} = 9.2\text{ V}$

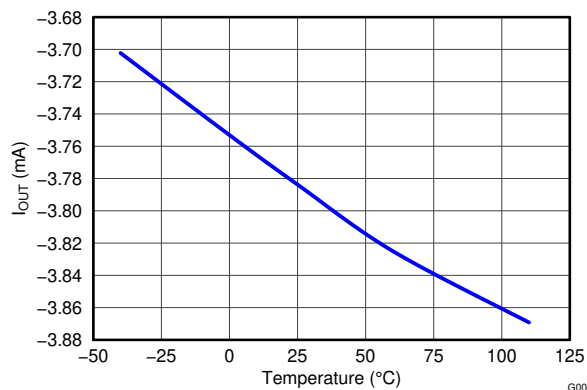


Figure 9-7. Output Current I_{OUT} vs. Temperature

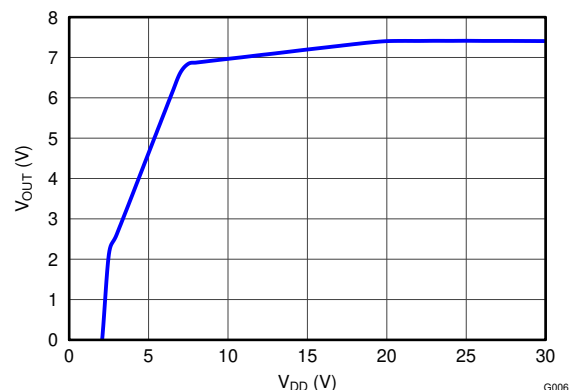
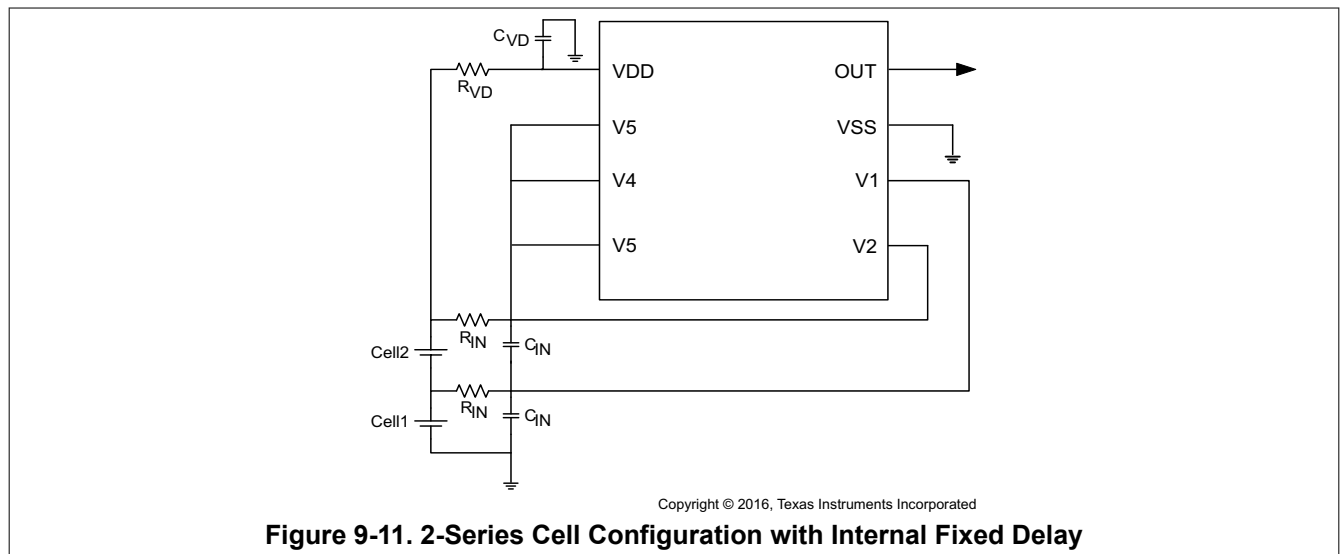
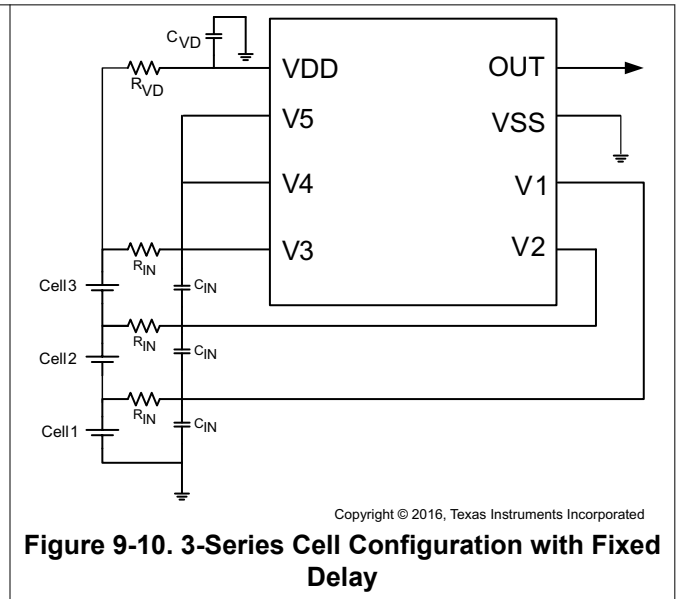
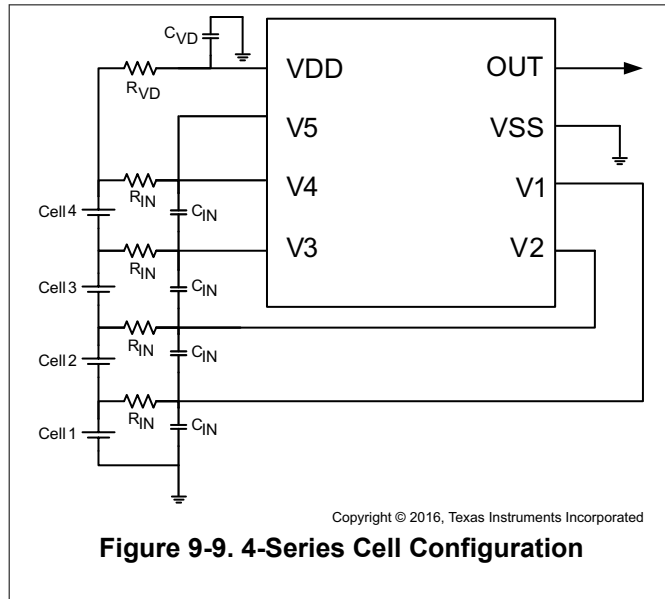


Figure 9-8. V_{OUT} vs. V_{DD}

9.2 Systems Examples

In these application examples, an external pull-up resistor is required on the OUT pin to configure for an Open Drain Active Low operation.



10 Power Supply Recommendations

The maximum power of this device is 25 V on VDD.

11 Layout

11.1 Layout Guidelines

- Ensure the RC filters for the V1 and VDD pins are placed as close as possible to the target terminal.
- The VSS pin should be routed to the CELL– terminal.

11.2 Layout Example

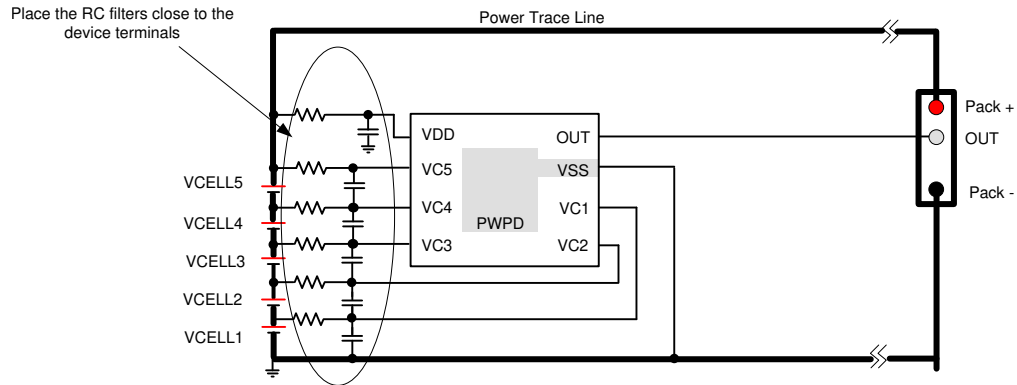


Figure 11-1. Example Layout

12 Device and Documentation Support

12.1 Documentation Support

For additional information, see the [BQ7718 technical documentation](#), including the documentation available to aid functional safety system design.

12.2 Third-Party Products Disclaimer

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12.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

12.4 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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12.6 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

12.7 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| BQ771800DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771800 | Samples |
| BQ771800DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771800 | Samples |
| BQ771801DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771801 | Samples |
| BQ771801DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771801 | Samples |
| BQ771802DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771802 | Samples |
| BQ771802DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771802 | Samples |
| BQ771803DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771803 | Samples |
| BQ771803DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771803 | Samples |
| BQ771806DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771806 | Samples |
| BQ771806DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771806 | Samples |
| BQ771807DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771807 | Samples |
| BQ771807DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771807 | Samples |
| BQ771808DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771808 | Samples |
| BQ771808DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771808 | Samples |
| BQ771809DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771809 | Samples |
| BQ771809DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771809 | Samples |
| BQ771811DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771811 | Samples |
| BQ771811DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771811 | Samples |
| BQ771815DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771815 | Samples |
| BQ771815DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771815 | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| BQ771817DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771817 | Samples |
| BQ771817DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771817 | Samples |
| BQ771818DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771818 | Samples |
| BQ771818DPJT | ACTIVE | WSO | DPJ | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771818 | Samples |
| BQ771823DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 110 | 771823 | Samples |
| BQ771824DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 110 | 771824 | Samples |
| BQ771825DPJR | ACTIVE | WSO | DPJ | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 771825 | Samples |

(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.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

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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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| BQ771800DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771800DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771801DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771801DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771802DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771802DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771803DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771803DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771806DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771806DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771807DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771807DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771808DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771808DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771809DPJR | WSO | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771809DPJT | WSO | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |

| 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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| BQ771811DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771811DPJT | WSON | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771815DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771815DPJT | WSON | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771817DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771817DPJT | WSON | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771818DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771818DPJT | WSON | DPJ | 8 | 250 | 180.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771823DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771824DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |
| BQ771825DPJR | WSON | DPJ | 8 | 3000 | 330.0 | 12.4 | 3.3 | 4.3 | 1.1 | 8.0 | 12.0 | Q2 |

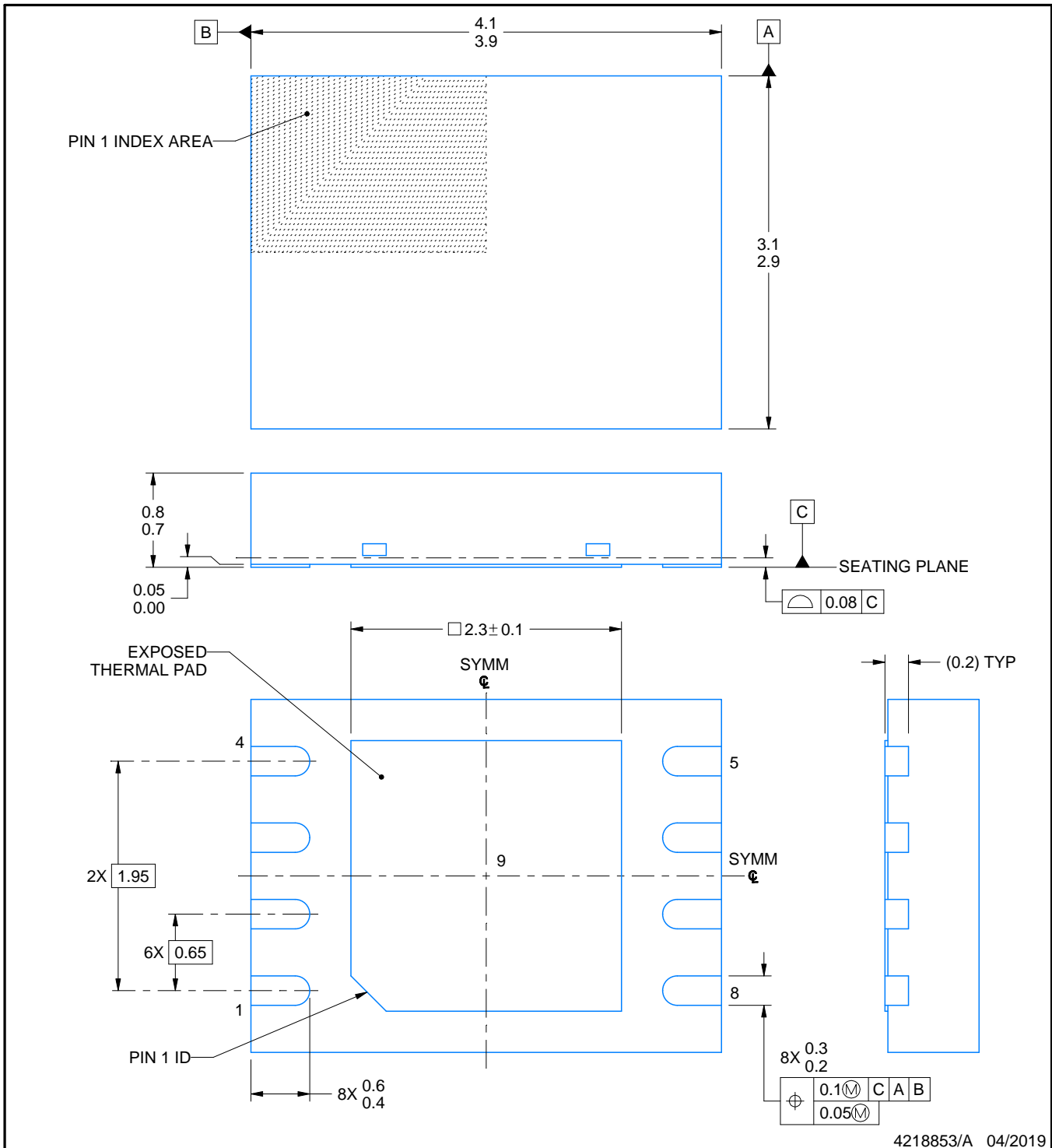
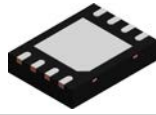
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| BQ771800DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771800DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771801DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771801DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771802DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771802DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771803DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771803DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771806DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771806DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771807DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771807DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771808DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771808DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771809DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771809DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771811DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771811DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|---------------------|------------------------|-------------|------------|--------------------|-------------------|--------------------|
| BQ771815DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771815DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771817DPJR | WSON | DPJ | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| BQ771817DPJT | WSON | DPJ | 8 | 250 | 182.0 | 182.0 | 20.0 |
| BQ771818DPJR | WSON | DPJ | 8 | 3000 | 346.0 | 346.0 | 33.0 |
| BQ771818DPJT | WSON | DPJ | 8 | 250 | 210.0 | 185.0 | 35.0 |
| BQ771823DPJR | WSON | DPJ | 8 | 3000 | 367.0 | 367.0 | 35.0 |
| BQ771824DPJR | WSON | DPJ | 8 | 3000 | 367.0 | 367.0 | 35.0 |
| BQ771825DPJR | WSON | DPJ | 8 | 3000 | 367.0 | 367.0 | 35.0 |



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NOTES:

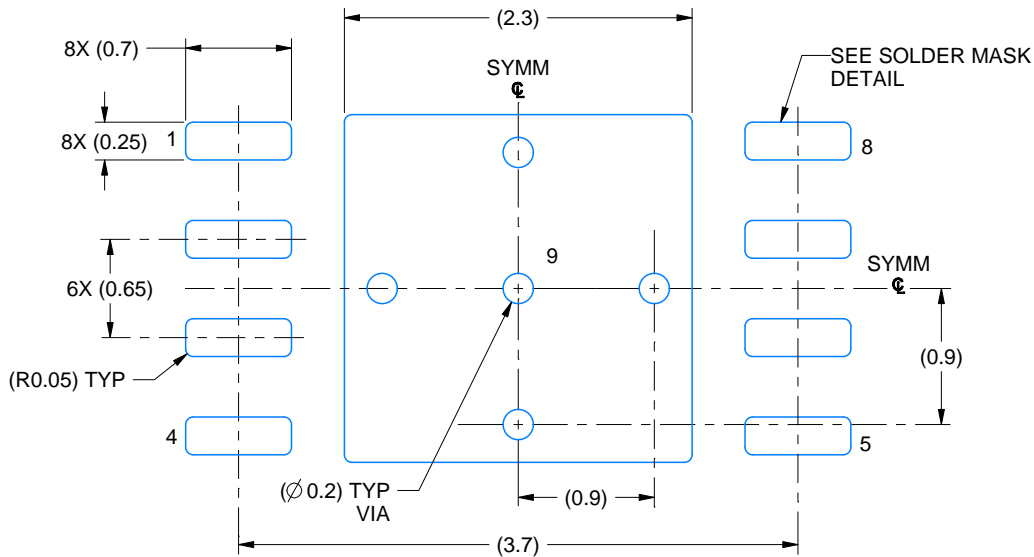
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

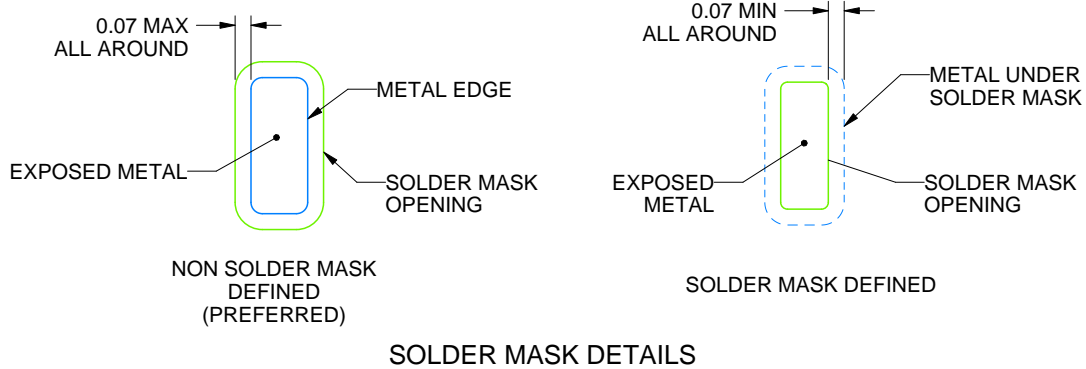
DPJ0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



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NOTES: (continued)

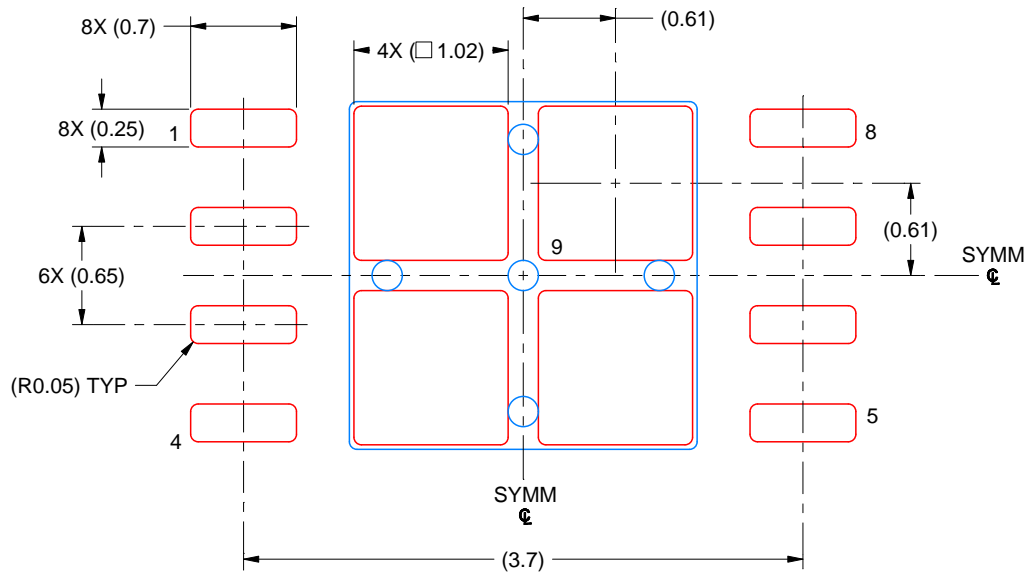
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DPJ0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 20X

EXPOSED PAD 9
79% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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