BQ79758B-Q1 Functional Safety-Compliant Automotive 18S Battery Monitor With Current Sense

1 Features

- AEC-Q100 qualified with the following results:
  - Device temperature grade 1: –40°C to +125°C ambient operating temperature range
- Functional Safety-Compliant
  - Documentation to aid ISO 26262 system design
  - Systematic capability up to ASIL D
  - Hardware capability up to ASIL D
- Measure 9 to 18 batteries in series per device, stackable up to 64 devices
- Dedicated ADC with typical ±1mV accuracy
- Two independent Current Sense ADCs with ±0.1% gain error drift and input range +/-275mV.
- Programmable Over Current Detection comparators
- Support limp home mode with full redundancy
- Integrated post-ADC configurable digital low-pass filters
- Supports busbar without affecting measurement accuracy
- 10 GPIOs for temp sensor/analog/digital/I^{2}C controller/SPI controller
- Internal cell balancing
  - Balancing at 300mA
  - User controlled PWM adjustment cell balancing current
  - Built-in balancing thermal management with automatic pause and resume control
- Robust daisy chain communication and support Ring Architecture
- Hardware reset by host simulates POR-like event without battery removal
- On chip memory for one time custom programming
- Low power mode current <6µA
- Compatible with BQ79600-Q1 with SPI/UART interface

2 Applications

- Battery Management System (BMS) in hybrid and electric powertrain systems
- Energy storage battery packs with Battery Management Systems

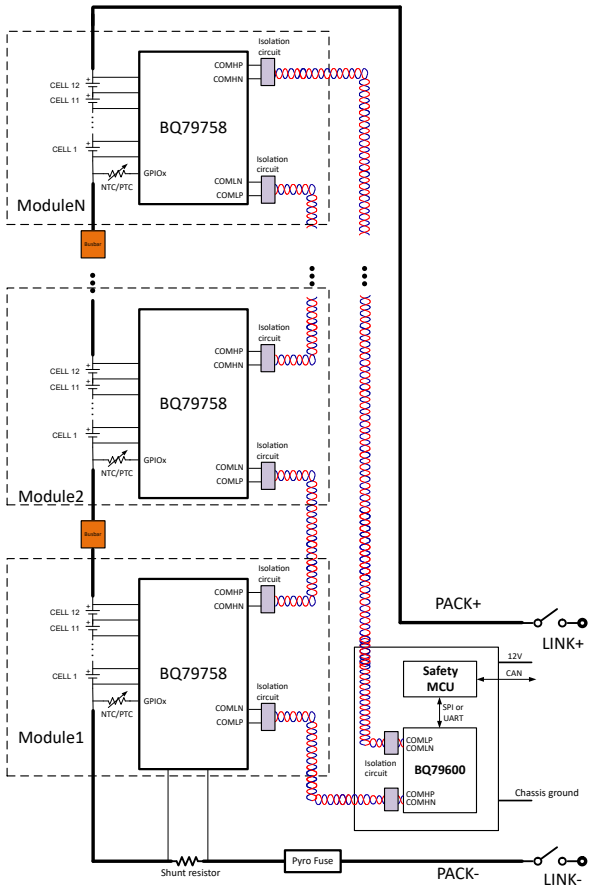
3 Description

The BQ79758B-Q1 provides high-accuracy cell voltage measurements for up to 18S battery modules in high-voltage battery management systems in xEV/EV. The monitor offers different channel options in the same package type, providing pin-to-pin compatibility and supporting high reuse of the established software and hardware across any platform. This device has a state-of-the-art ADC architecture/measurement system meeting stringent automotive standard and safety requirements. With the daisy-chain isolated by transformer (or capacitor), the device is designed for centralized or distributed architectures in xEV powertrain.

Package Information

PART NUMBER (2)	PACKAGE (1)	BODY SIZE (NOM)
BQ79758B-Q1	HTQFP (64-pin)	10.00mm × 10.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) All mentions of BQ79758 in drawings in this document refer to part number BQ79758B-Q1



Simplified System Diagram

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

4 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

4.1 Device Support

4.1.1 Third-Party Products Disclaimer

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4.2 Documentation Support

4.2.1 Related Documentation

The below documents are available in TI mySecure:

- Texas Instruments, Functional Safety Manual for BQ79758B-Q1
- Texas Instruments, BQ79758B-Q1 Functional Safety Analysis Report Summary
- Texas Instruments, BQ79758B-Q1 Functional Safety Report

4.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* 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.

4.4 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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4.5 Trademarks

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All trademarks are the property of their respective owners.

4.6 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.

4.7 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

5 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.

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5.1 Package Option Addendum

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)
BQ79758BQPAPRQ1	ACTIVE	HTQFP	PAP	64	1000	RoHS & Green	NIPDAU	MSL-3 260C-168HR	–40 to 125	BQ79758BQ

(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.
PRE_PROD Unannounced device, not in production, not available for mass market, nor on the web, samples not available.
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 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.

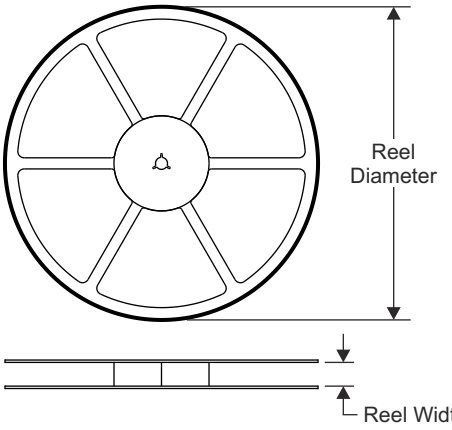
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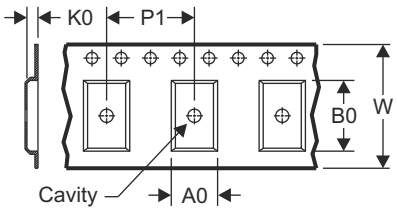
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5.2 Tape and Reel Information

REEL DIMENSIONS

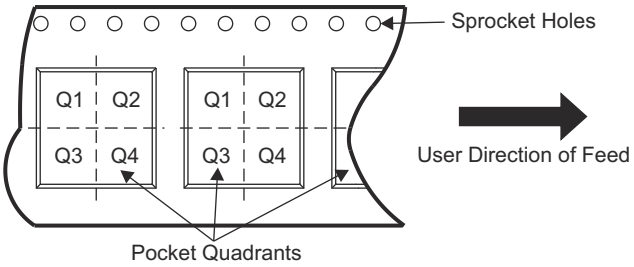


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

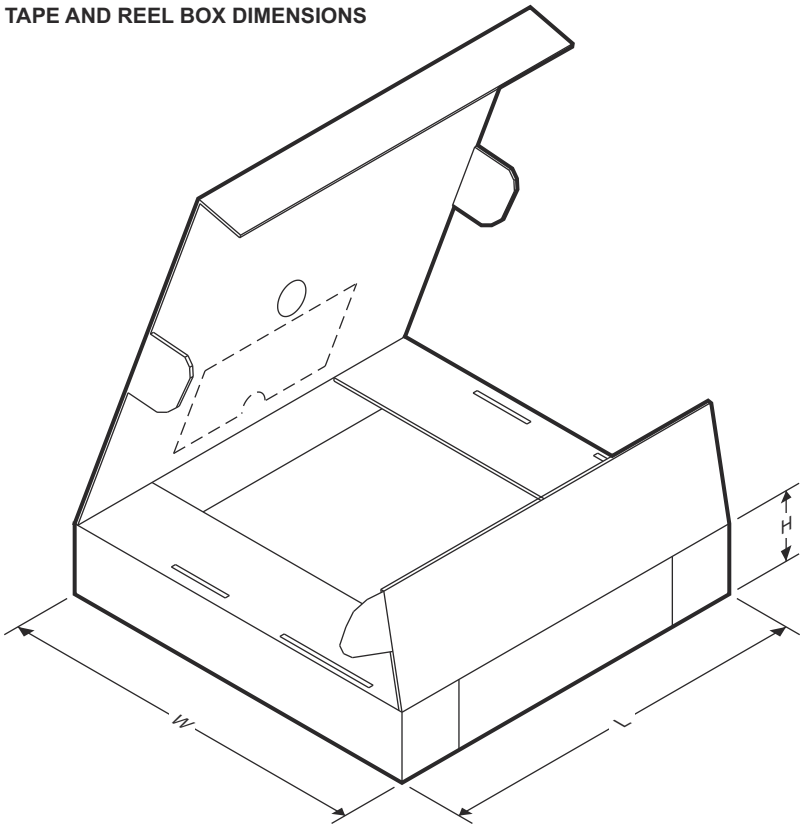
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	330.0	24	13	13	1.5	16.0	24.0	Q2

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TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	367.0	367.0	55.0

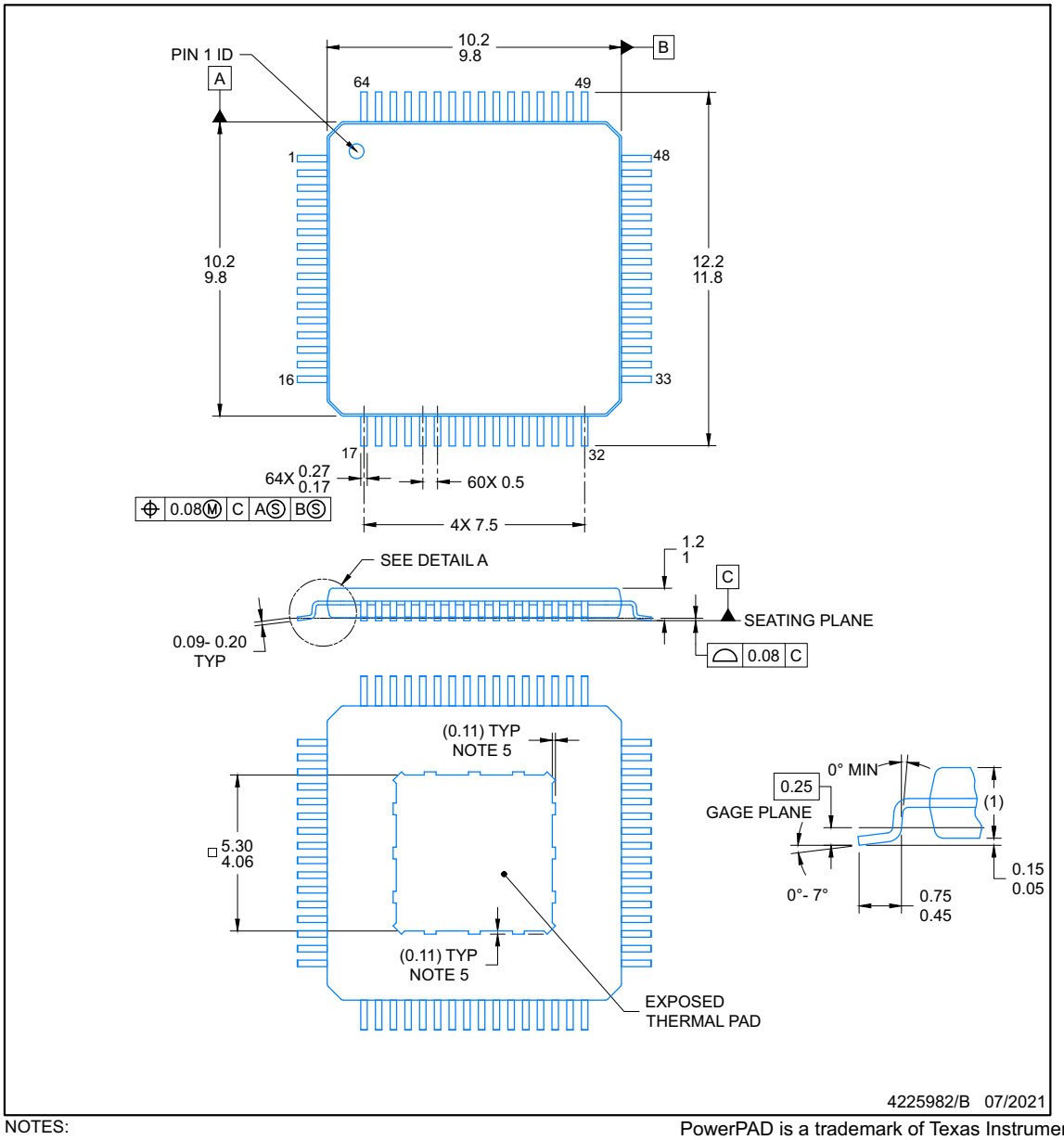
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5.3 Mechanical Data

PACKAGE OUTLINE

PAP0064N — **HTQFP - 1.2 mm max height**

PLASTIC QUAD FLATPACK



NOTES:

PowerPAD is a trademark of Texas Instruments

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. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Strap features may not be present.
6. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

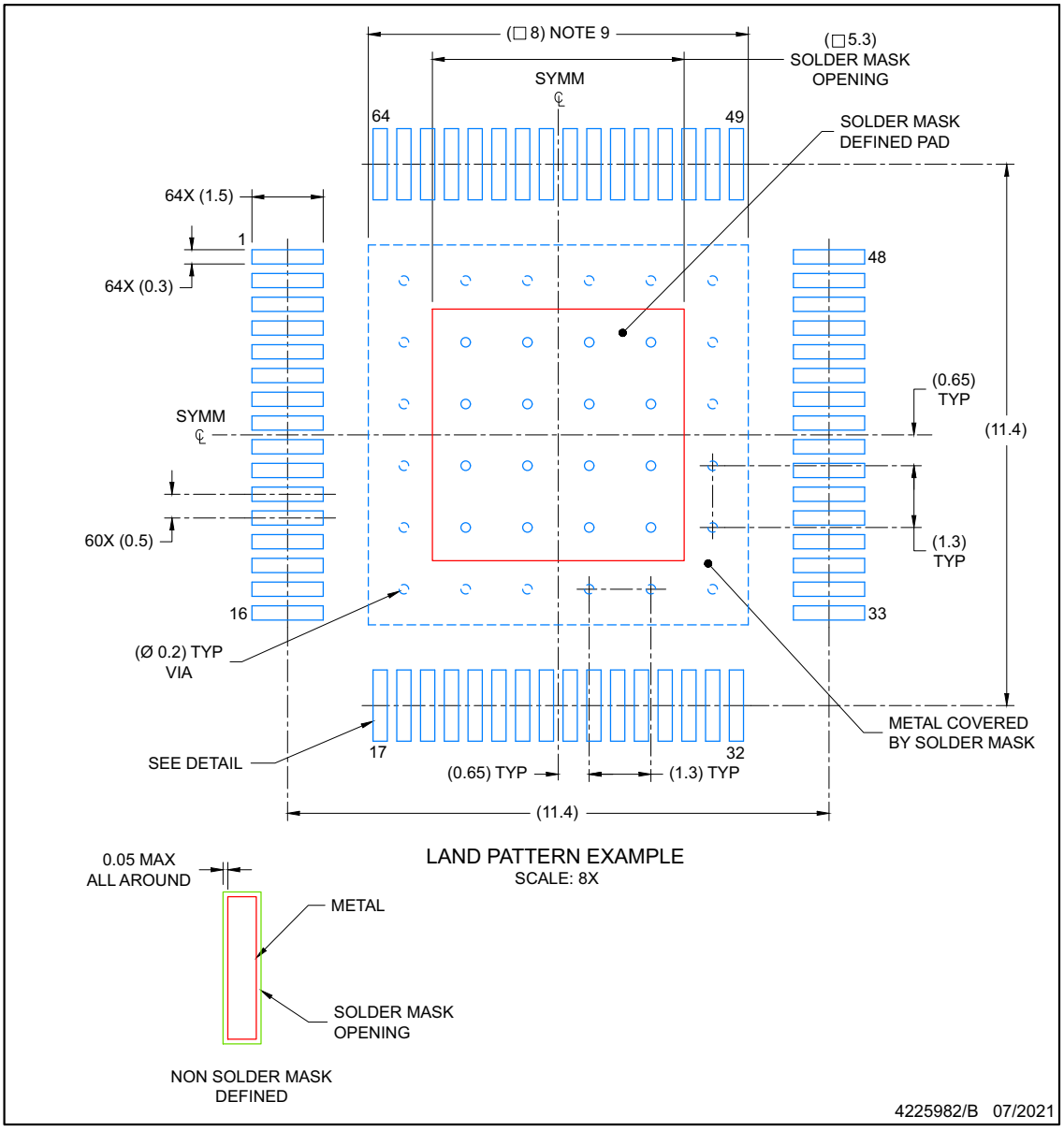
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EXAMPLE BOARD LAYOUT

PAP0064N

HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
9. This package is designed to be soldered to a thermal pad on the board. Refer to technical brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).

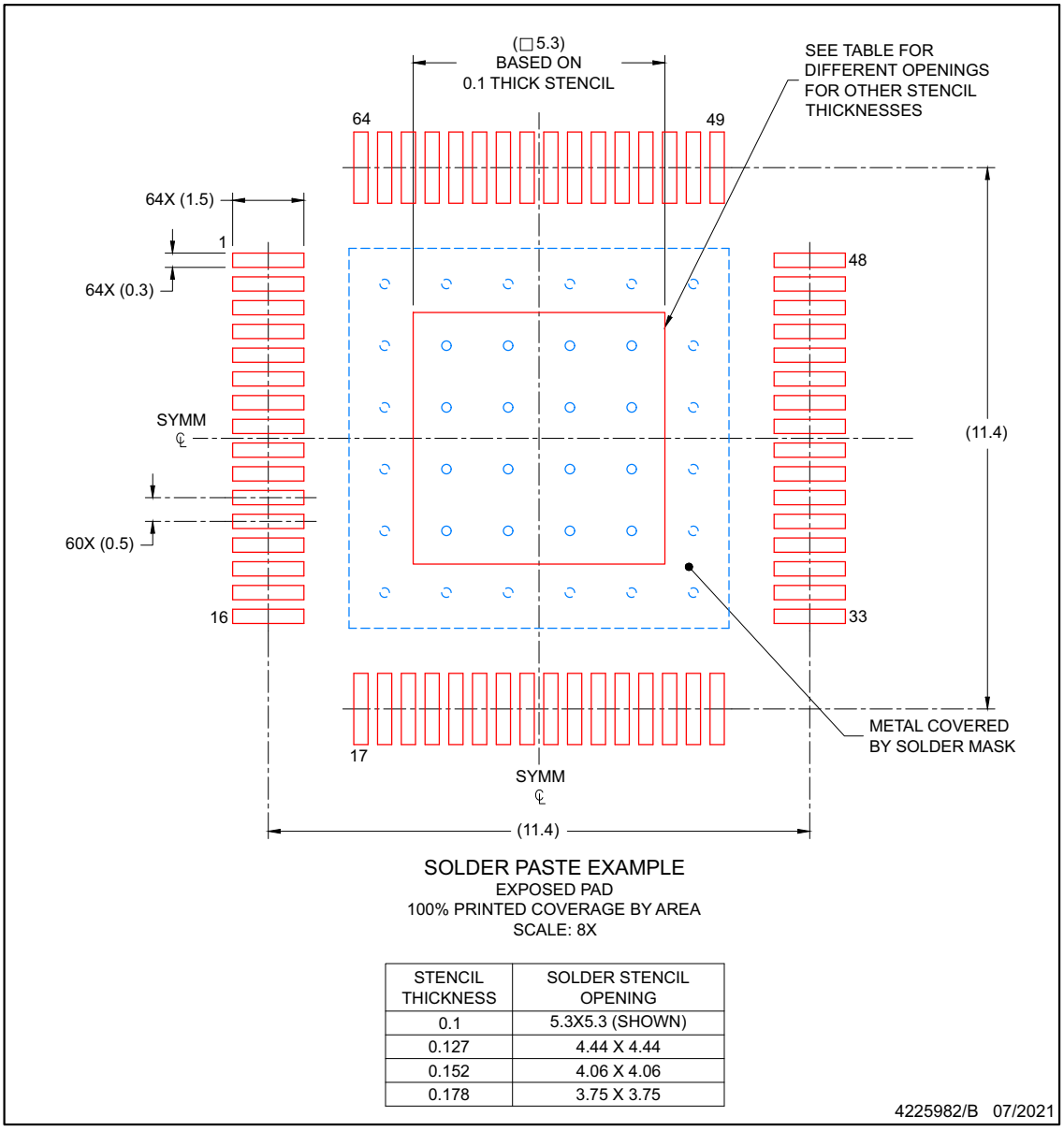
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EXAMPLE STENCIL DESIGN

PAP0064N

HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED COVERAGE BY AREA
SCALE: 8X

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	5.3X5.3 (SHOWN)
0.127	4.44 X 4.44
0.152	4.06 X 4.06
0.178	3.75 X 3.75

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NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
10. Board assembly site may have different recommendations for stencil design.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
BQ79758BQPAPRQ1	Active	Production	HTQFP (PAP) | 64	1000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	BQ79758BQ

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

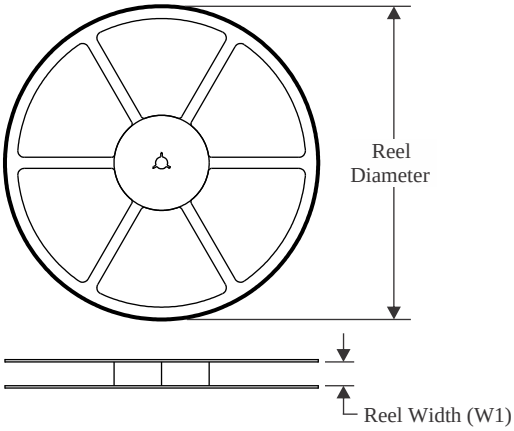
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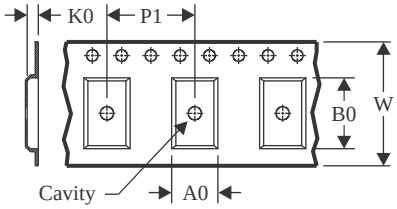
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TAPE AND REEL INFORMATION

REEL DIMENSIONS

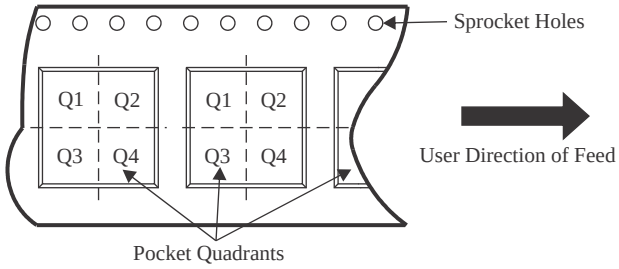


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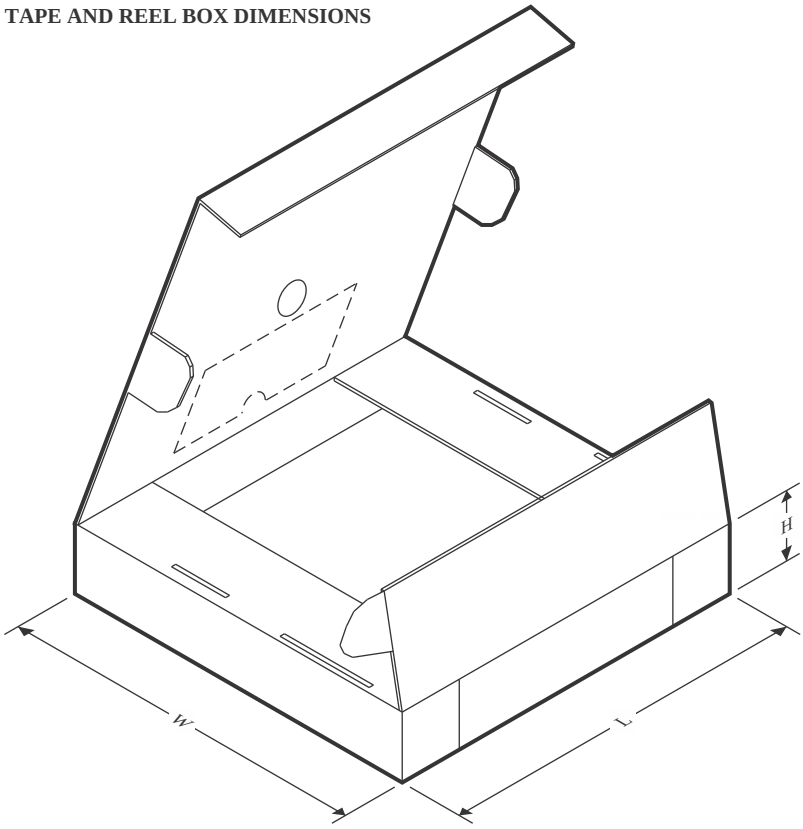
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	330.0	24.4	13.0	13.0	1.5	16.0	24.0	Q2
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	330.0	24.4	13.0	13.0	1.5	16.0	24.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	367.0	367.0	55.0
BQ79758BQPAPRQ1	HTQFP	PAP	64	1000	367.0	367.0	55.0

GENERIC PACKAGE VIEW

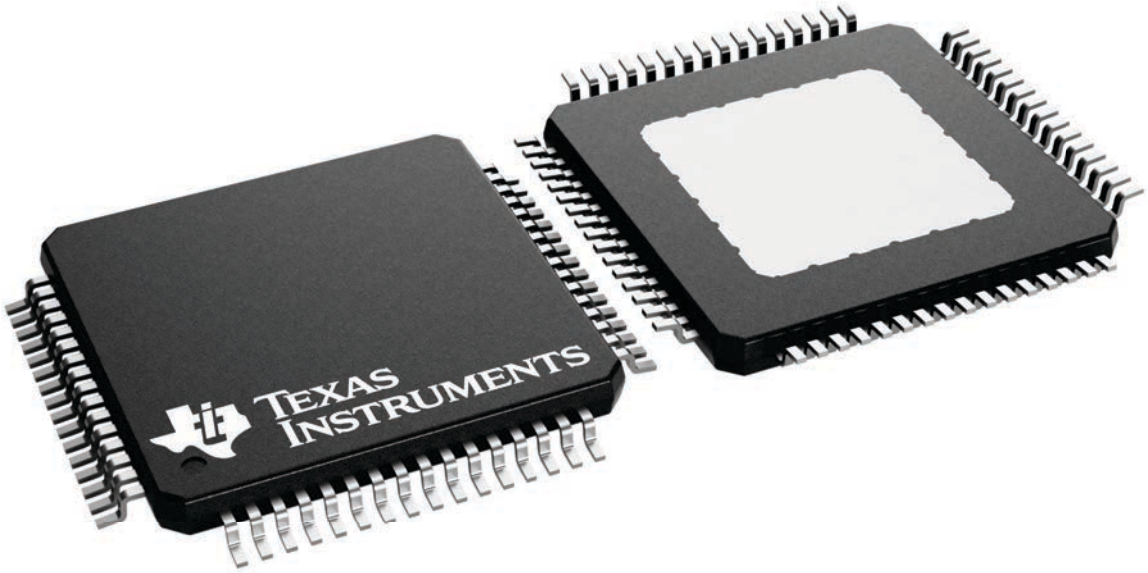
PAP 64

HTQFP - 1.2 mm max height

10 x 10, 0.5 mm pitch

QUAD FLATPACK

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



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