BQ25996 I²C Controlled 1-Cell 16A Switched Cap Parallel Battery Charger

1 Features

- 98.3% peak efficiency switched cap parallel charger supporting 1-cell battery and 16A fast charge
- Switched cap architecture with selectable and bi-directional 4:1, 3:1, 2:1 and 1:1 conversion ratios
- Provide gate drive signal for ACFET gate drive
- Low Power Mode pin for <5µA standby bias current
- Support wide range of input voltage
  - Up to 22V operational input voltage
  - Maximum 40V input voltage with optional external ACFET and 28V without external ACFET
- Integrated programmable protection features for safe operation
  - Input over-voltage protections (VAC_OVP and VBUS_OVP) with external ACFET up to 40V
  - Battery over-voltage protection (VBAT_OVP)
  - Input over-current protection (IBUS_OCP)
  - Output over-voltage protection (VOUT_OVP) and over-current protection (IBAT_OCP)
  - Input under-current protection (IBUS_UCP) to detect adapter unplug and prevent boost-back
  - Input and output short-circuit protections (IBUS_RCP and IBUS_SCP)
  - Junction over-temperature protection (TDIE_FLT)
- Programmable settings for system optimization
  - Interrupts and interrupt masks
  - ADC readings and configuration
- Integrated 16-bit ADC for voltage, current and temperature monitoring

2 Applications

- Smartphone, Tablet, Non-military Drone
- Chromebook, Notebook

3 Description

The BQ25996 is a 98.3% peak efficiency, 16A battery charging solution using dual-phase switched cap architecture for 1-cell Li-ion battery. The switched cap architecture allows the cable current to be one quarter, one third, or one half of the charging current depending on converter mode and input voltage, reducing the cable power loss and limiting temperature rise. The dual-phase architecture increases charging efficiency and reduces the input and output cap requirements. When used with a main charger such as BQ25790, the system enables the fast charging at the very low power loss from pre-charge through constant current (CC), constant voltage (CV), and termination.

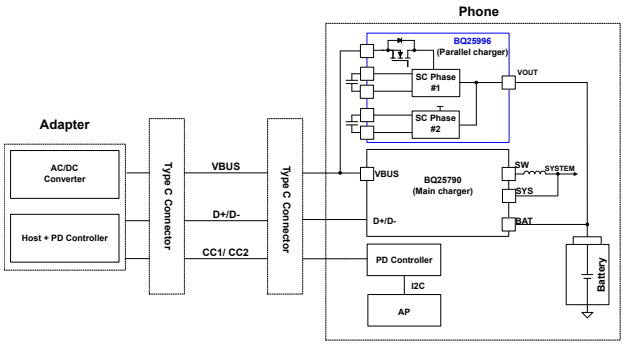
The BQ25996 also supports bypass mode charge through internal MOSFETs.

The device supports control and driver for external N-FETs or a single N-FET relative to a CMSRC regulation pin.

Package Information

PART NUMBER	PACKAGE(1)	BODY SIZE (NOM)
BQ25996	YFF (DSBGA 80)	3.2mm x 4.1mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Simplified Schematic

4 Device and Documentation Support

4.1 Device Support

4.1.1 Third-Party Products Disclaimer

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4.2 Documentation Support

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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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.

PACKAGE OPTION ADDENDUM

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)	
BQ25996YFFR	ACTIVE	DSBGA	YFF	80	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	–40 to 85	BQ25 996

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

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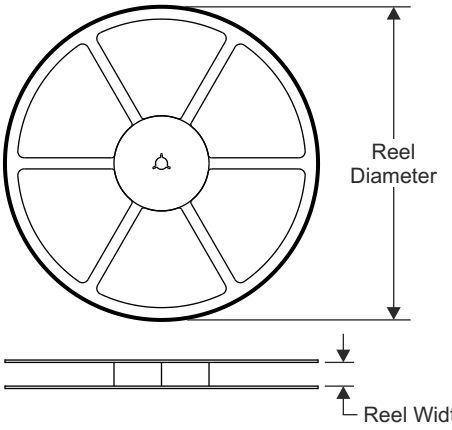
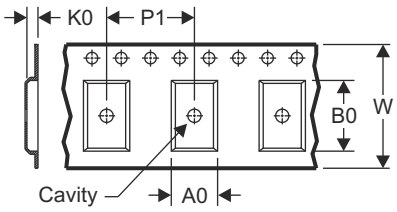
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

5.1 Tape and Reel Information

REEL DIMENSIONS

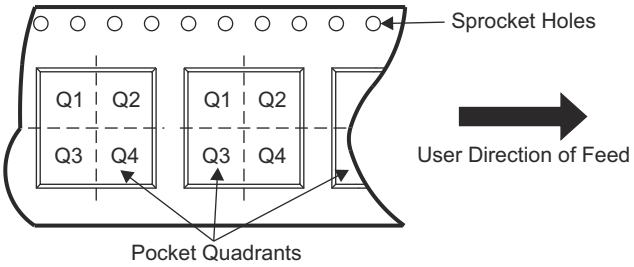


TAPE DIMENSIONS



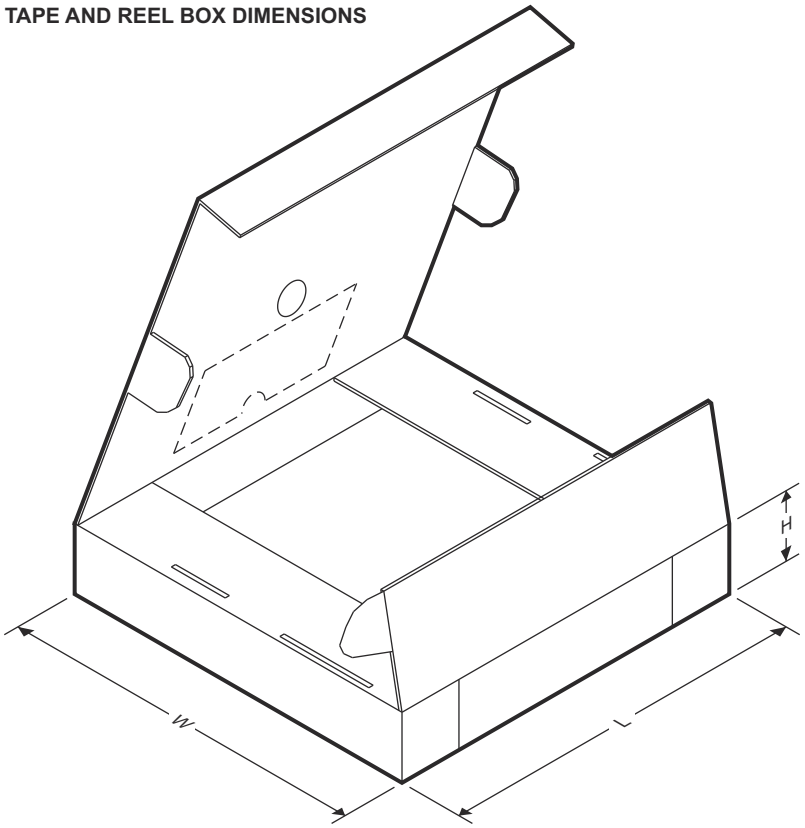
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
BQ25996YFFR	DSBGA	YFF	80	3000	330.0	12.4	3.4	4.45	0.75	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



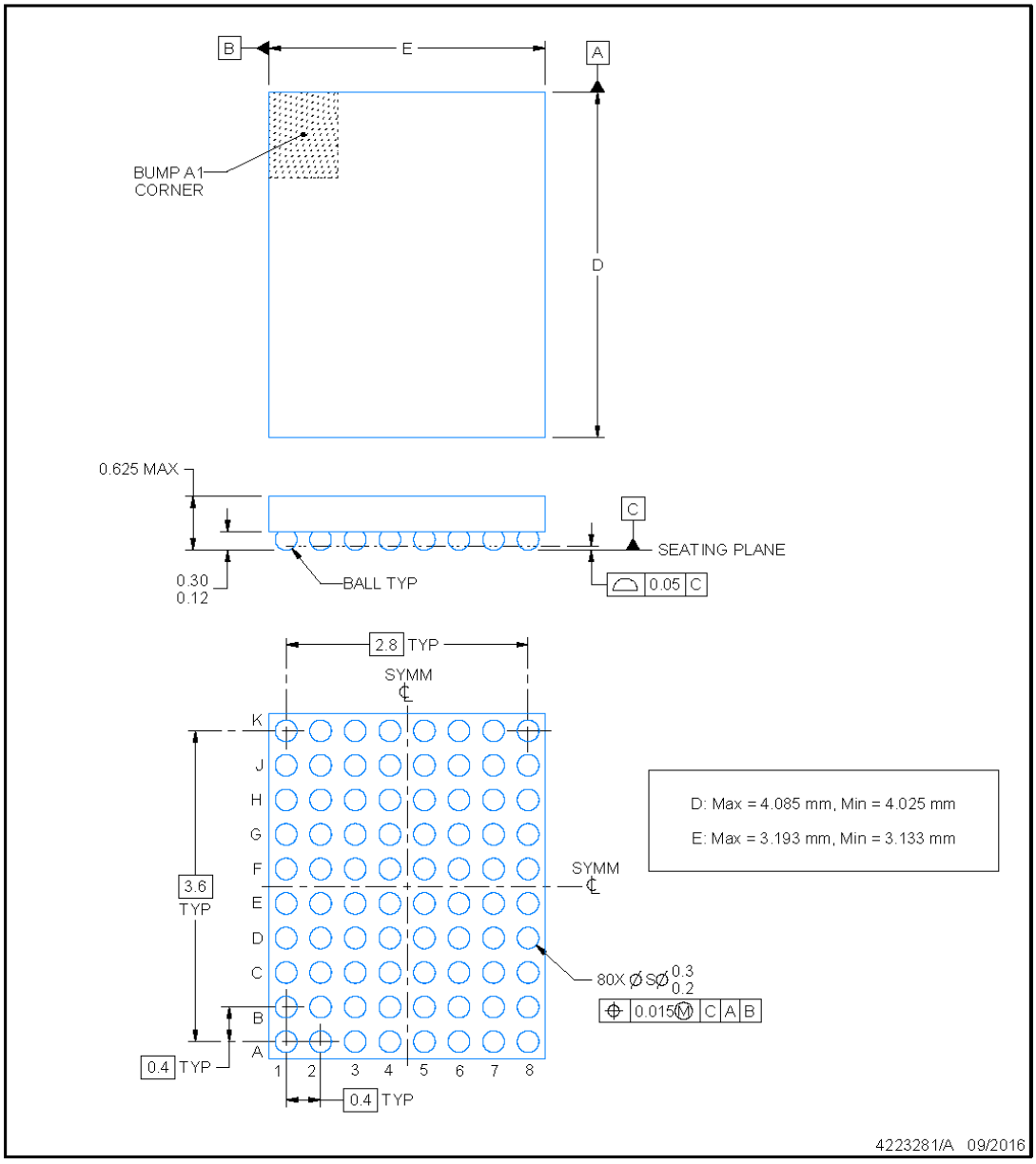
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ25996YFFR	DSBGA	YFF	80	3000	367.0	367.0	35.0

5.2 Mechanical Data

PACKAGE OUTLINE

YFF0080 **DSBGA - 0.625 mm max height**

DIE SIZE BALL GRID ARRAY



NOTES:

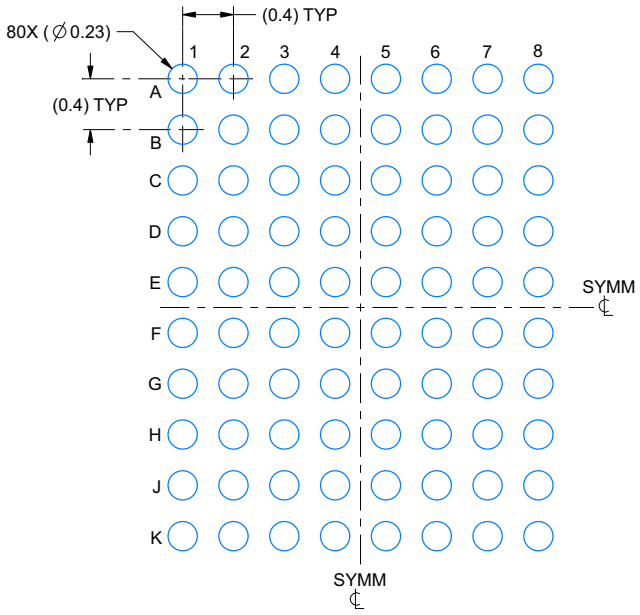
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

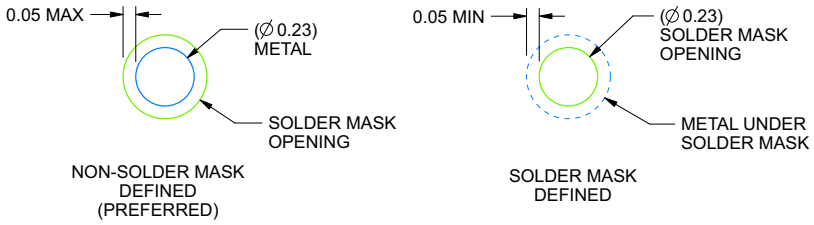
YFF0080

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:20X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

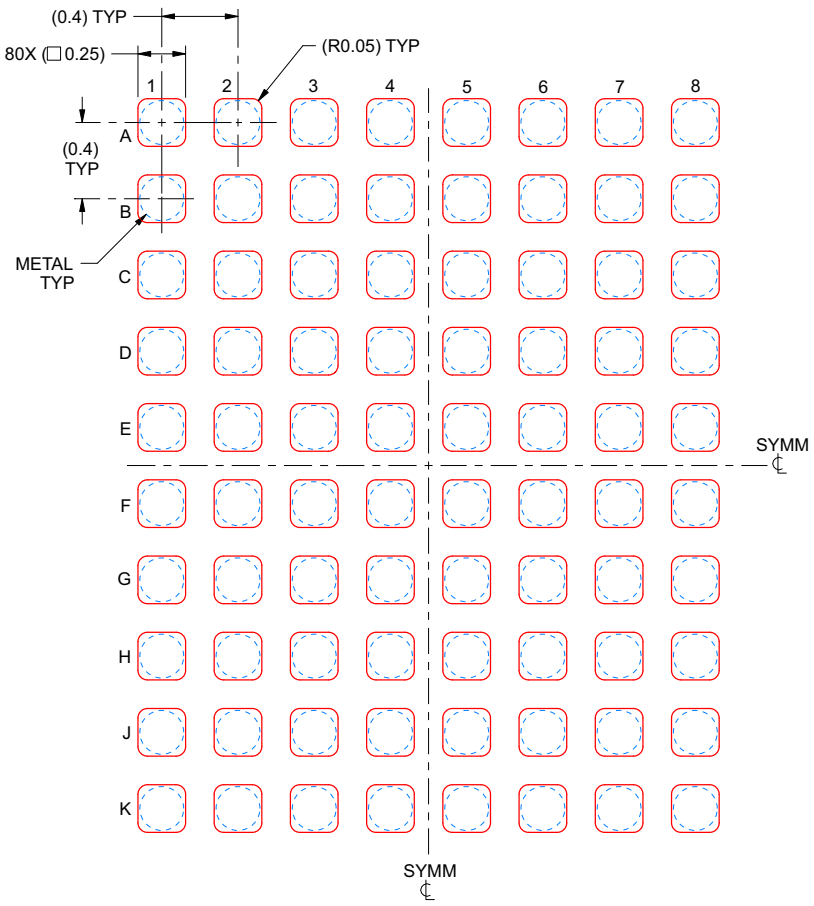
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YFF0080

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

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NOTES: (continued)

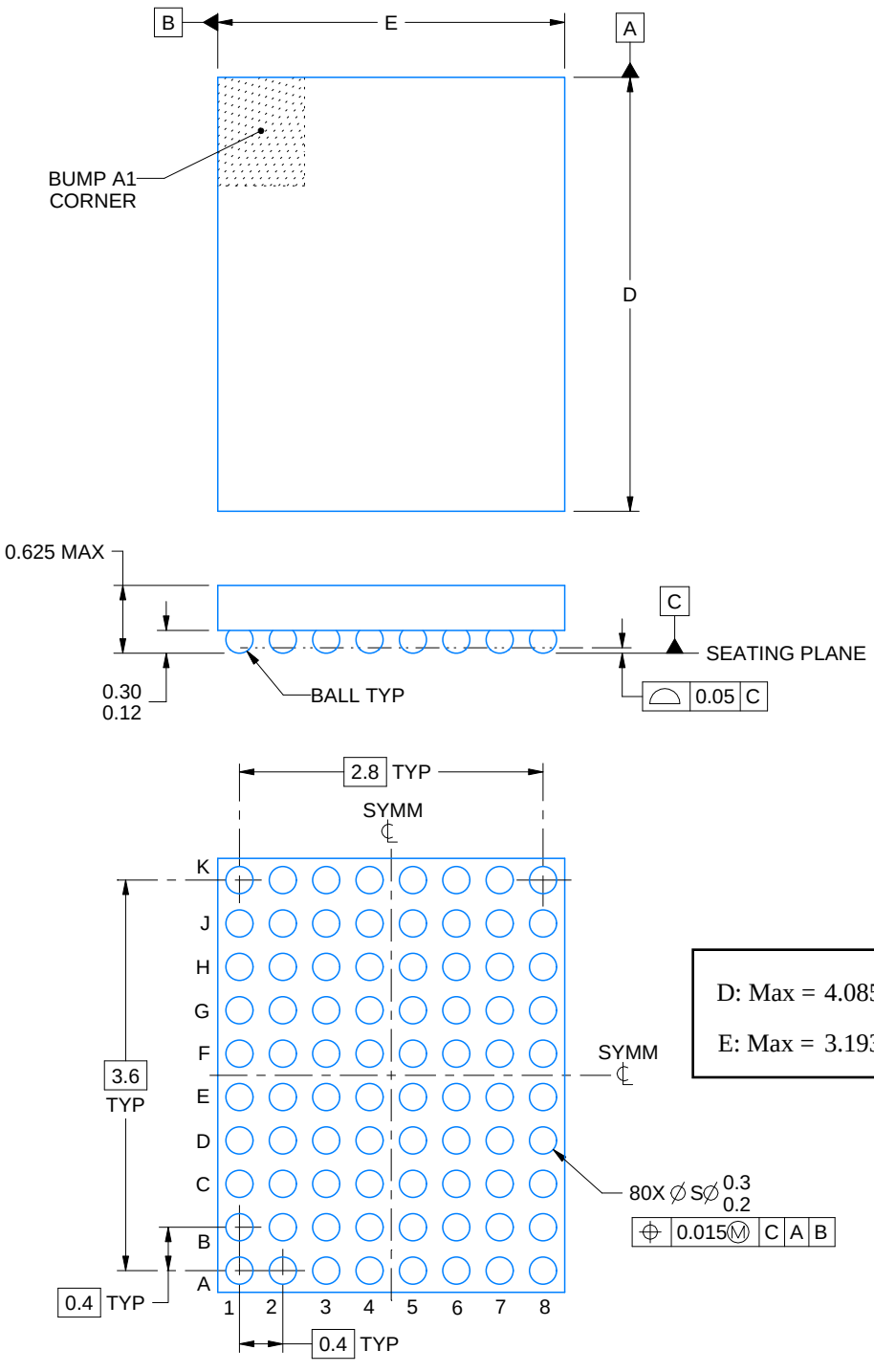
4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

PACKAGE OUTLINE

YFF0080

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



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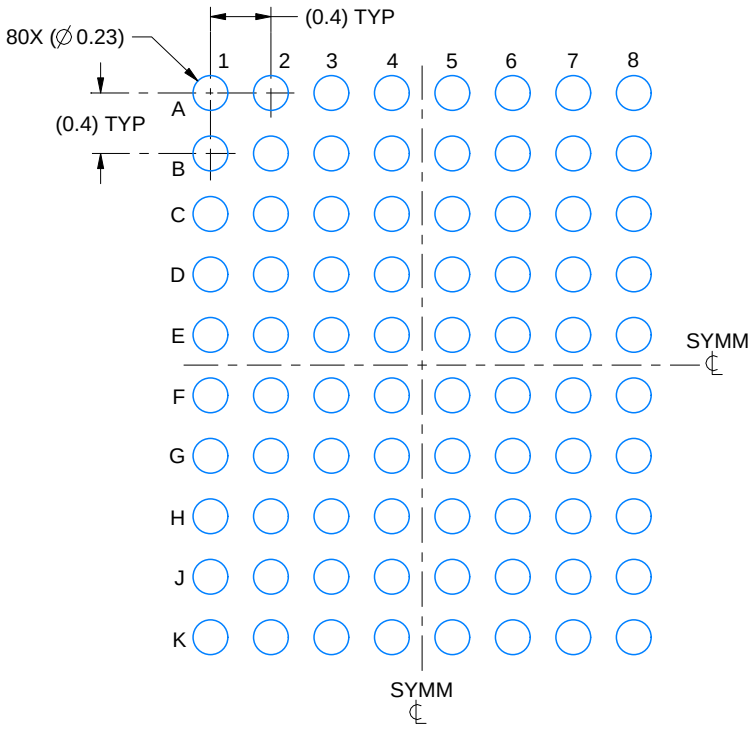
EXAMPLE BOARD LAYOUT

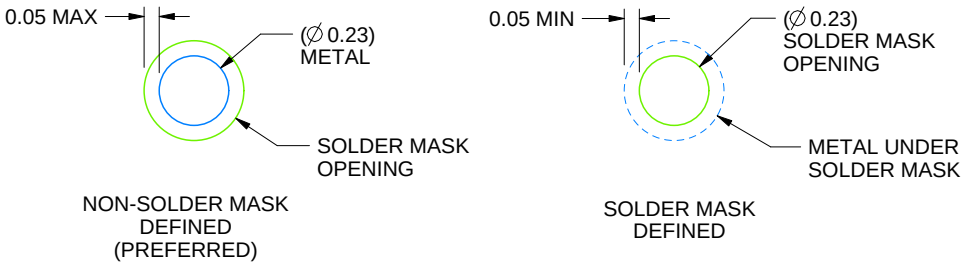
YFF0080

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:20X



SOLDER MASK DETAILS
NOT TO SCALE

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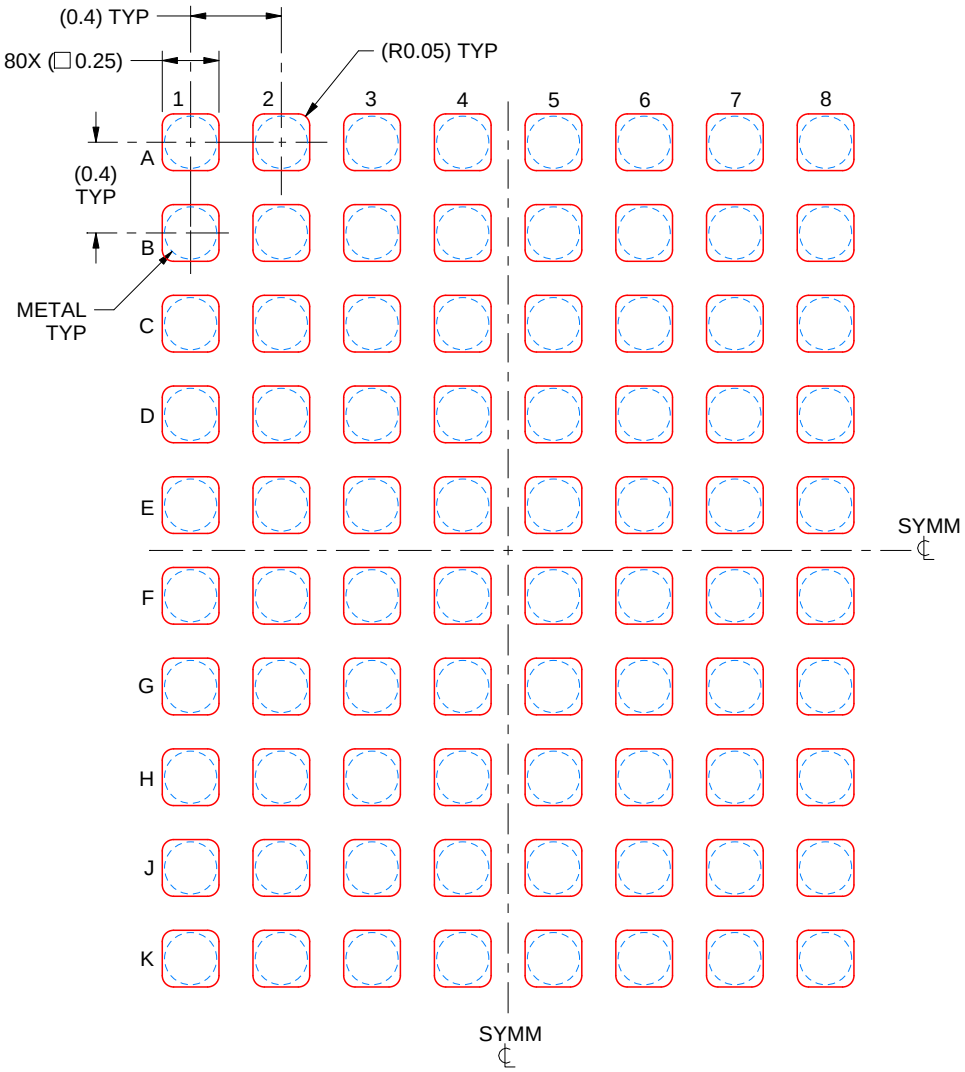

SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

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NOTES: (continued)

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