

BQ25638 具有 NVDC 电源路径管理、USB OTG 升压输出以及最大 18V 输入的 I²C 控制型 5A 充电器

1 特性

- 适用于单节电池的高效 5A、1.5MHz 同步开关模式降压充电器
 - 输入电压为 5V 时，输出电流低至 10mA，效率大于 90%
 - 充电电流高达 5A，阶跃为 80mA
 - 充电终止范围为 30 至 1000mA，阶跃为 10mA
 - 灵活的 JEITA 曲线，可在过热条件下实现安全充电
- BATFET 控制，支持关断和完全系统复位
 - 纯电池模式下静态电流 1.5μA
 - 关断模式下电池漏电流为 100nA
- 支持 USB On-The-Go (OTG)
 - 升压模式运行，输出为 3.84V 至 9.6V
 - 可编程电流限制高达 3.2A
- 支持宽输入源
 - 3.9V 至 18V 宽输入工作电压范围，绝对最大输入电压为 26V
 - VINDPM 阈值自动跟踪电池电压
 - 输入电流优化器 (ICO)，无需过载适配器即可更最大限度地提高输入功率
- 使用 7mΩ BATFET 实现高效电池运行
- 窄 VDC (NVDC) 电源路径管理
 - 系统在电池耗尽或无电池的情况下可瞬时启动
 - 适配器满载时，电池可为系统补充电量
- 灵活的自主或 I²C 控制模式
- 用于电压、电流和温度监控的集成 12 位 ADC
 - ADCIN 引脚，可用于高达 1V 的外部信号
- 高精度
 - ±0.5% (待定) 充电电压调节
 - 充电电流调节范围为 ±5%
 - 输入电流调节范围为 ±5%
- 安全
 - 电池温度检测
 - 热调节和热关断
 - 电池/转换器过流保护
 - 充电安全计时器

2 应用

- 游戏和计算机配件
- 智能手机、平板电脑
- IP 摄像头、EPOS
- 便携式医疗设备
- 消费类可穿戴设备、智能手表
- 便携式扬声器、TWS 耳机

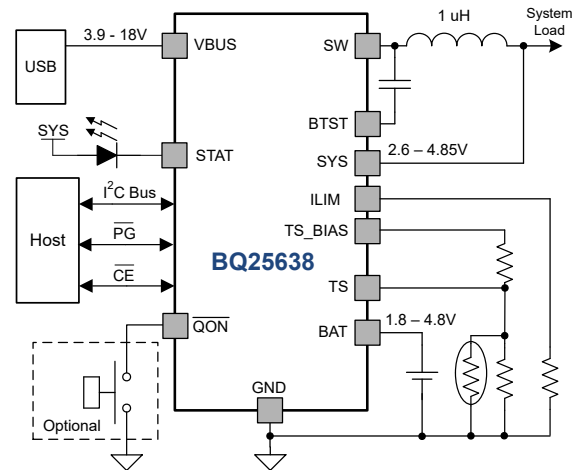
3 说明

BQ25638 是一款适用于单节锂离子电池和锂聚合物电池的高度集成型 5A 开关模式电池充电管理和系统电源路径管理器件。该解决方案在系统和电池之间高度集成了内置电流检测、环路补偿、输入反向阻断 FET (RBFET, Q1)、高侧开关 FET (HSFET, Q2)、低侧开关 FET (LSFET, Q3) 以及电池 FET (BATFET, Q4)。它使用 NVDC 电源路径管理，将系统电压调节至稍高于电池电压的水平，但是不会下降至低于可配置的最小系统电压。低阻抗电源路径提高了开关模式的工作效率、缩短了电池充电时间，并延长了放电阶段的电池寿命。具有充电和系统设置的 I²C 串行接口使得 BQ25638 成为一种真正灵活的解决方案。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾	封装尺寸 (标称值)
BQ25638	YBG (DSBGA 30)	2.6 mm × 2.1 mm	2.6 mm × 2.1 mm

- (1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。
- (2) 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。



BQ25638 简化应用



4 说明 (续)

该器件支持多种输入源, 包括标准 USB 主机端口、USB 充电端口以及兼容 USB 的高电压适配器。BQ25638D 根据内置 D+/D- USB 适配器检测接口设置默认输入电流限制。它符合用于输入电流和电压调节的 USB 2.0 和 USB 3.0 电源规格。此外, 输入电流优化器 (ICO) 还能够检测输入源未发生过载时的最大功率点。BQ25638 具有用于设置默认输入电流限制的 ILIM 引脚和用于控制热敏电阻偏置的 TS_BIAS 引脚。该器件还具有高达 3.2A 的恒定电流限制能力, 符合 USB On-the-Go (OTG) 运行功率额定值规格。

电源路径管理将系统电压调节至稍高于电池电压的水平, 但是不会下降至可编程最小系统电压以下。借助于这个特性, 即使在电池电量完全耗尽或者电池被拆除时, 系统也能保持运行。当达到输入电流限值或输入电压限值时, 电源路径管理系统会自动减小充电电流。如果系统负载持续增加, 则电源路径会使电池放电, 直到满足系统电源要求。该补充模式可防止输入源过载。

此器件无需主机控制即可启动并完成一个充电周期。它通过检测电池电压, 在四个不同阶段为电池充电: 涓流充电、预充电、恒定电流 (CC) 充电和恒定电压 (CV) 充电。在充电周期的末尾, 当充电电流低于预设阈值并且电池电压高于再充电阈值时, 充电器自动终止。TS 引脚 COOL、PRECOOL、NORMAL、WARM 和 PREWARM 温度区域支持端接。当整个电池电压下降到低于可编程充电阈值时, 充电器会自动启动新的充电周期。

此充电器提供针对电池充电和系统运行的多种安全特性, 其中包括电池负温度系数 (NTC) 热敏电阻监视、充电安全性计时器以及过压和过流保护。当结温超过可编程的阈值时, 热调节会减小充电电流。STAT 输出报告充电状态和任何故障状况。其他安全特性包括针对充电模式和 OTG 升压模式的电池温度感应、热关断以及输入 UVLO 和过压保护。PG 输出指示电源是否正常且高于可编程 PG_TH 值。当发生故障或状态改变时, INT 输出会立即通知主机。

该器件还提供了一个 12 位模数转换器 (ADC), 用于监视充电电流和输入/电池/系统 (VBUS、BAT、SYS、TS) 电压。此外, ADCIN 引脚可用于监测高达 1V 的外部信号。QON 引脚提供 BATFET 使能和复位控制, 以使器件退出低功耗运输模式或启动完全系统复位。

BQ25638 采用 2.6mm × 2.1mm 30 焊球 DSBGA 封装。

5 Device and Documentation Support

5.1 Device Support

5.1.1 第三方产品免责声明

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5.2 Documentation Support

5.2.1 Related Documentation

For related documentation see the following:

- [BQ25601 and BQ25601D \(PWR877\) Evaluation Module User's Guide](#)

5.3 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](#) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

5.4 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

5.5 Trademarks

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5.6 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

5.7 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

6 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.

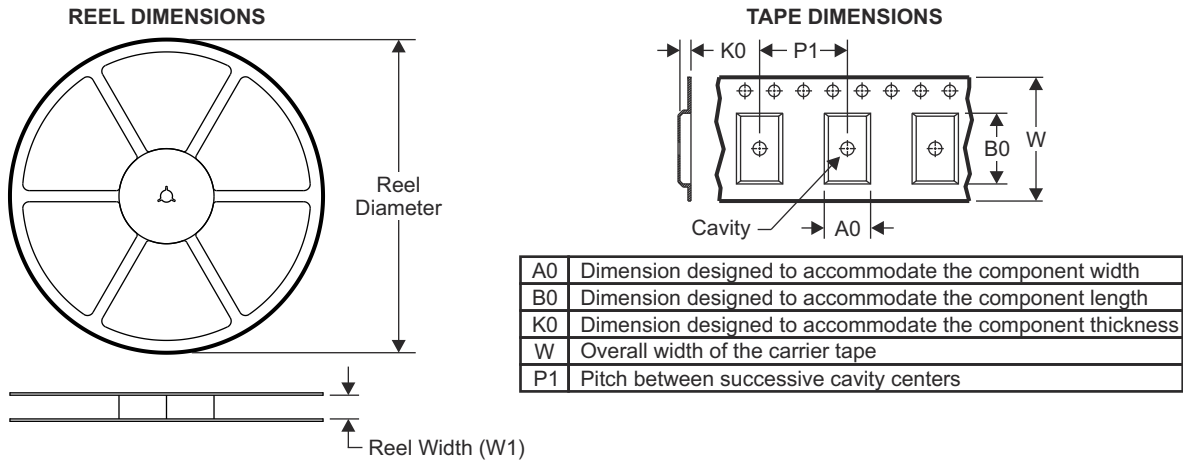
6.1 Package Option Addendum

6.1.1 Packaging Information

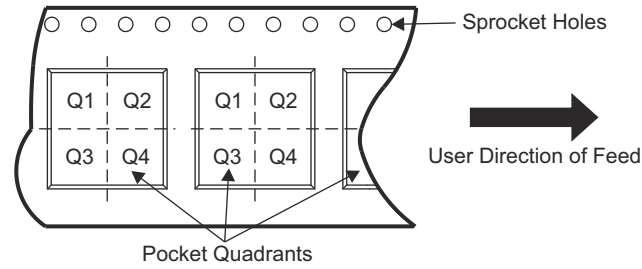
Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish ⁽⁴⁾	MSL Peak Temp ⁽³⁾	Op Temp (°C)	Device Marking ^{(5) (6)}
BQ25638YBGR	PREVIEW	DSBGA	YBG	30	3000		SNAGCU	Level-1-260C-UNLIM	-40 to 85	

- (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 <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) 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.
- (5) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device
- (6) Multiple Device markings will be inside parentheses. Only on 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.
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6.1.2 Tape and Reel Information

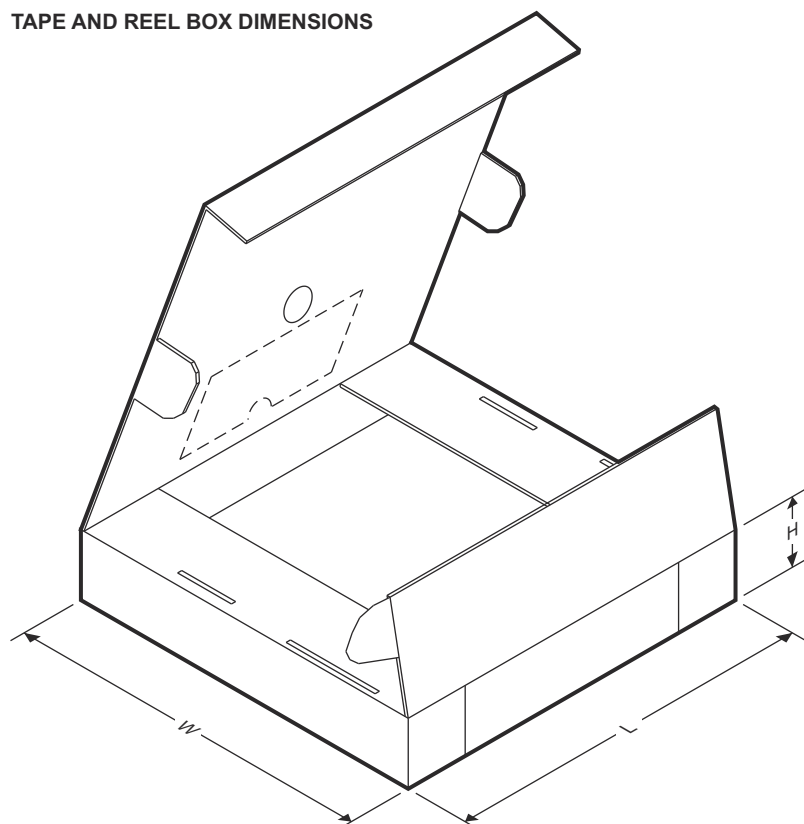


QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
BQ25638YBGR	DSBGA	YBG	30	3000	330.0	12.4	2.30	2.68	0.65	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ25638YBGR	DSBGA	YBG	30	3000	360.0	360.0	36.0

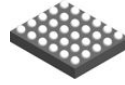
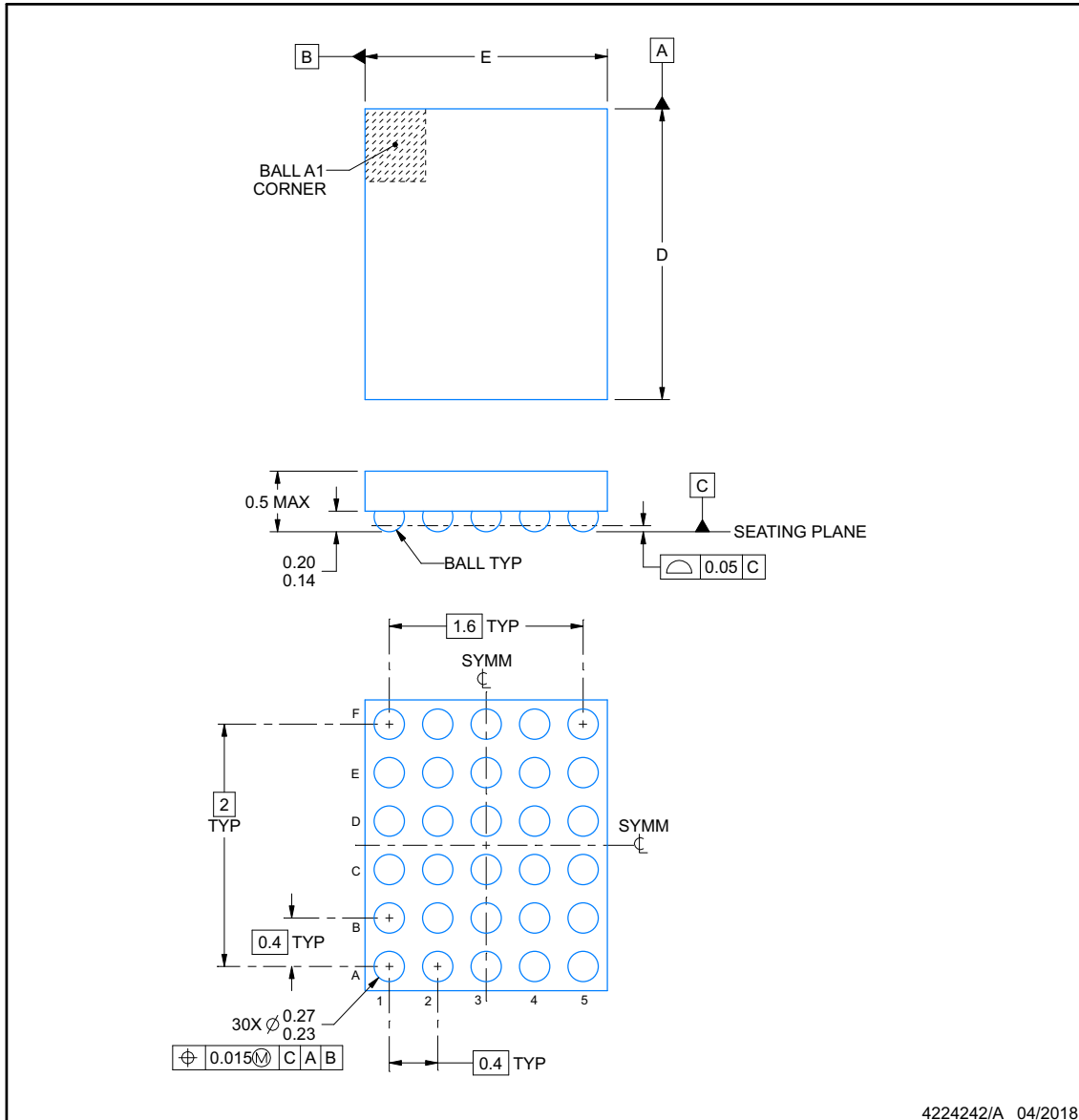
ADVANCE INFORMATION

6.2 Mechanical Data

PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY

**YBG0030**

NOTES:

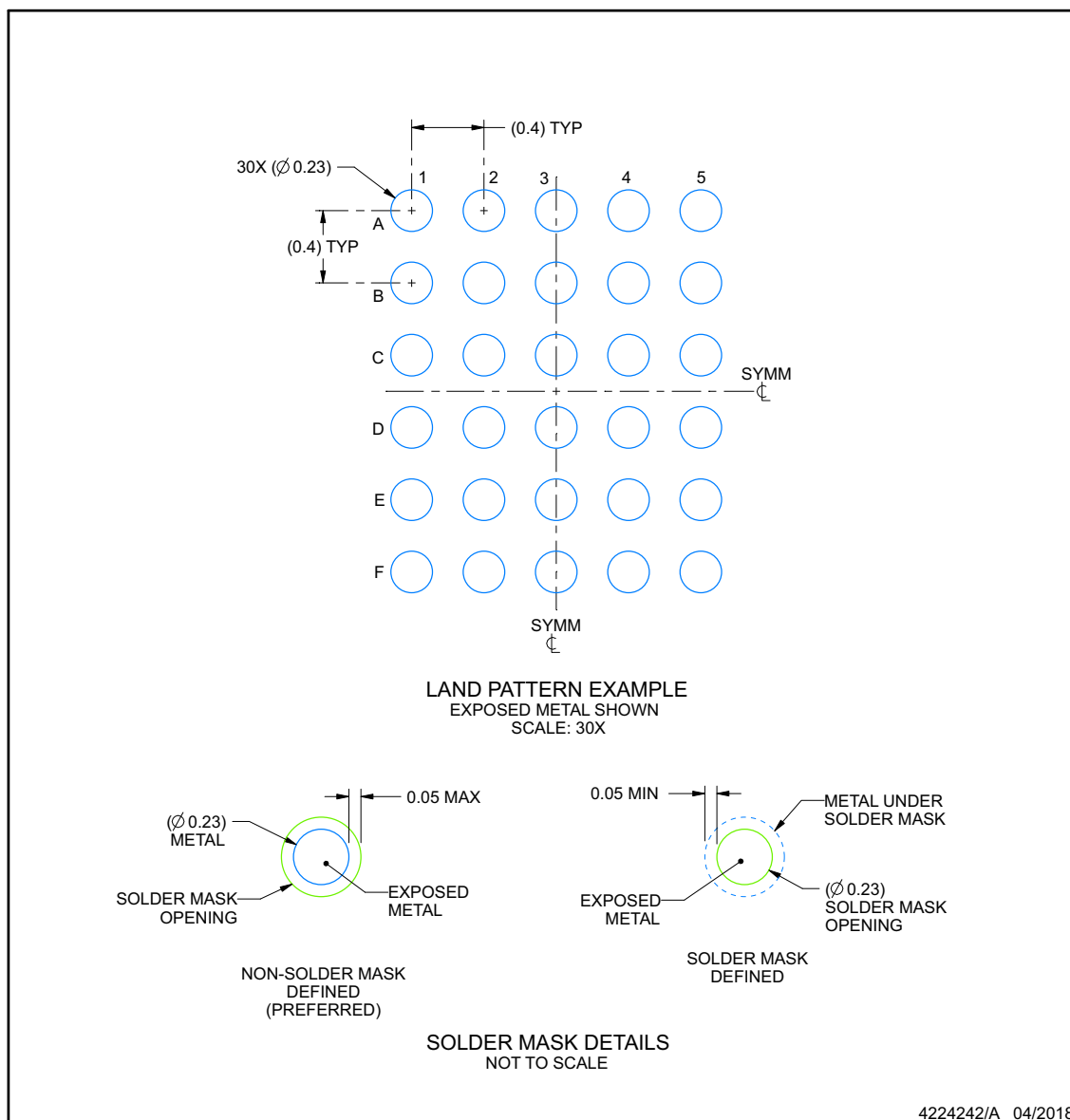
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

YBG0030

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY

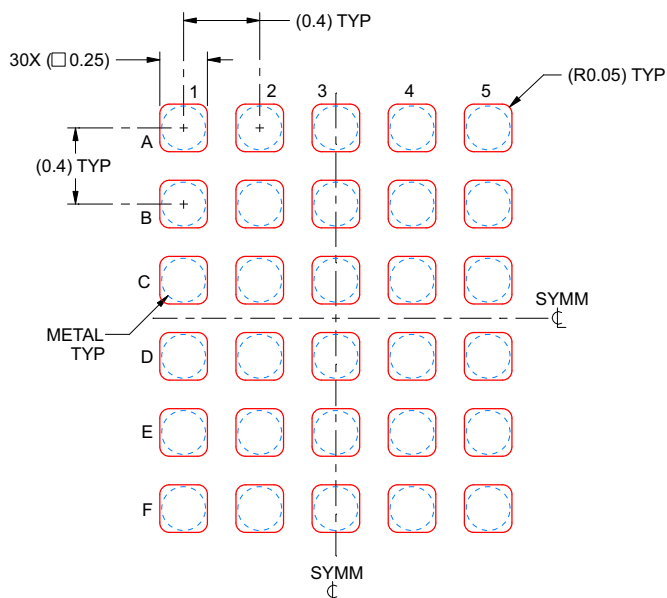


NOTES: (continued)

- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. See Texas Instruments Literature No. SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN**YBG0030****DSBGA - 0.5 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.

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)
BQ25638YBGR	Active	Production	DSBGA (YBG) 30	6000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	BQ25638
BQ25638YBGR.A	Active	Production	DSBGA (YBG) 30	6000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	BQ25638

- ⁽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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1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

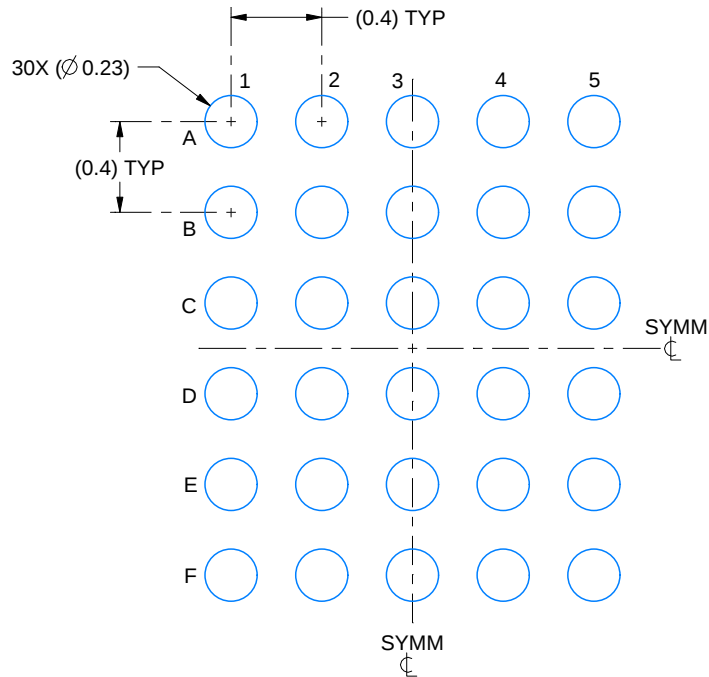
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

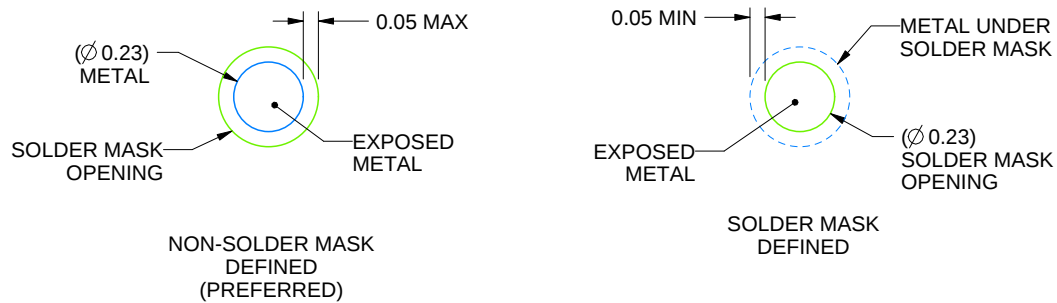
YBG0030

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 30X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

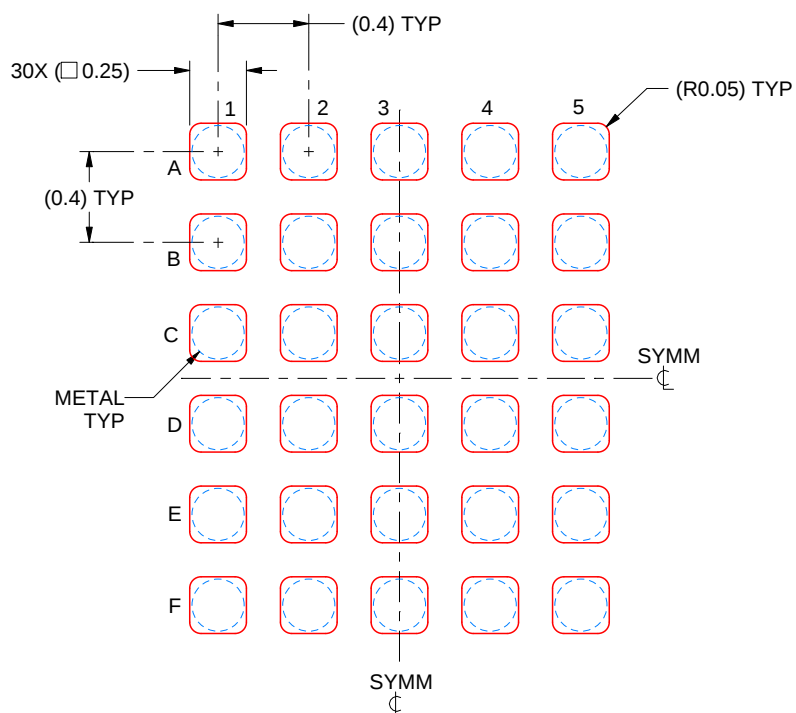
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. See Texas Instruments Literature No. SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YBG0030

DSBGA - 0.5 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.

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