

适用于可穿戴光学、电生物传感且具有 FIFO 的 AFE4900 超低功耗、集成式 AFE

1 特性

- 以高达 1kHz 的数据速率进行同步 PPG、ECG 信号采集
- ECG 信号链：
 - 高达 4kHz 的独立 ECG 采集
 - 输入偏置：具有 RLD 偏置的单引线 ECG
 - 可编程 INA 增益：2.15 至 12.92
 - 输入噪声（1Hz 至 150Hz）：1 kHz 数据率下为 2.5 μ Vrms，4kHz 数据率下为 1.25 μ Vrms
 - 交流、直流导联脱落检测：12.5nA 至 100nA
 - 申请获得 IEC 60601 测试报告
- PPG 接收器：
 - 支持三路时分多路复用 PD 输入
 - 来自 PD 的电流的 24 位表示
 - TIA 输入端的直流偏移消减 DAC（高达 $\pm 126\mu$ A），用于每个 LED 和环境
 - ADC 输出端的数字环境消减
 - 具有可编程带宽的噪声滤波器
 - 跨阻增益：10k Ω 至 2M Ω
 - 高达 100dB 的动态范围
 - 接收器在仅 PPG 模式下以大约 1 μ A/Hz 的采样率运行
 - 断电模式：大约 0 μ A
- PPG 发送器：
 - 四个采用共阳极配置的 LED
 - 高达 200mA 的 8 位 LED 电流
 - 并行点亮两个 LED 的模式
 - 可编程 LED 导通时间
 - 同时支持三个 LED，适用于 SpO₂ 或多波长 HRM
 - 平均电流为 30 μ A，适用于典型的心率监测情形：
 - 20mA 设置、60 μ s 脉冲持续时间、25Hz 采样率
- 使用外部或内部时钟进行计时
- 用于 ECG 和 PPG 且具有 128 样本深度的 FIFO
- I²C、SPI 接口：可通过引脚进行选择
- 2.6mm x 2.1mm、0.4mm 间距 DSBGA 封装
- 电源：
 - Rx: 1.8V 至 1.9V（LDO 旁路），2.0V 至 3.6V（LDO 使能）
 - Tx: 3V 至 5.25V
 - IO: 1.7V 至 Rx_SUP

2 应用

- 用于血压估算的同步 PPG、ECG
- HRM（可穿戴设备和智能耳戴式设备）
- 心率变异分析 (HRV)
- 脉动式血氧计 (SpO₂) 测量

3 说明

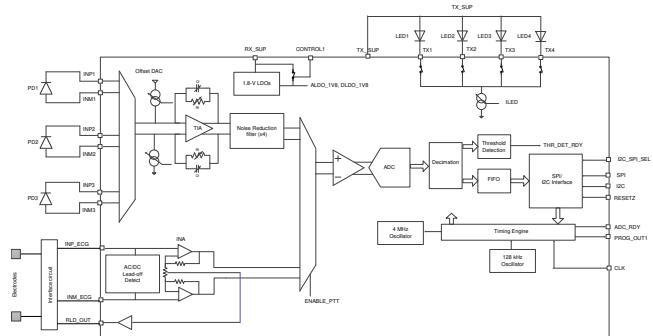
AFE4900 器件是一款用于同步心电图 (ECG)、光电血管容积图 (PPG) 信号采集的模拟前端 (AFE)。该器件还可用于光学生物传感应用，例如心率监测 (HRM) 和周围毛细血管氧饱和度 (SpO₂) 测量。PPG 信号链支持多达四个可切换发光二极管 (LED) 以及多达三个光电二极管 (PD)。LED 可以使用完全集成的 LED 驱动器打开。光电二极管的电流通过互阻抗放大器 (TIA) 转换为电压，并使用模数转换器 (ADC) 进行数字化。ECG 信号链具有一个连接至同一 ADC 的仪表放大器 (INA)，该放大器具有可编程增益。右腿驱动 (RLD) 放大器组可用于 ECG 输入引脚的偏置。支持交流和直流导联脱落检测方案。来自 PPG 和 ECG 相位的 ADC 代码可以存储在 128 样本先进先出 (FIFO) 块中，并使用 I²C 或串行外设接口 (SPI) 接口进行读取。

器件信息(1)

器件型号	封装	封装尺寸 (标称值)
AFE4900	DSBGA (30)	2.60mm x 2.10mm

(1) 如需了解所有可用封装，请参阅数据表末尾的封装选项附录。

简化框图



4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Revision A (February 2019) to Revision B	Page
• 已更改 更改了可编程 <i>INA</i> 增益的数值（位于特性 部分）	1
• 更改了机械封装 图像	5

Changes from Original (August 2017) to Revision A	Page
• 已更改 更改了可编程 <i>INA</i> 增益的数值（位于特性 部分）	1
• 已添加 添加了“申请获得 IEC 60601 测试报告”（位于特性 部分）	1

5 器件和文档支持

5.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com.cn 上的器件产品文件夹。单击右上角的通知我进行注册，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。

5.2 社区资源

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

5.3 商标

E2E is a trademark of Texas Instruments.

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5.4 静电放电警告



ESD 可能会损坏该集成电路。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措施和安装程序，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。

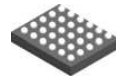
5.5 Glossary

SLYZ022 — *TI Glossary*.

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

6 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

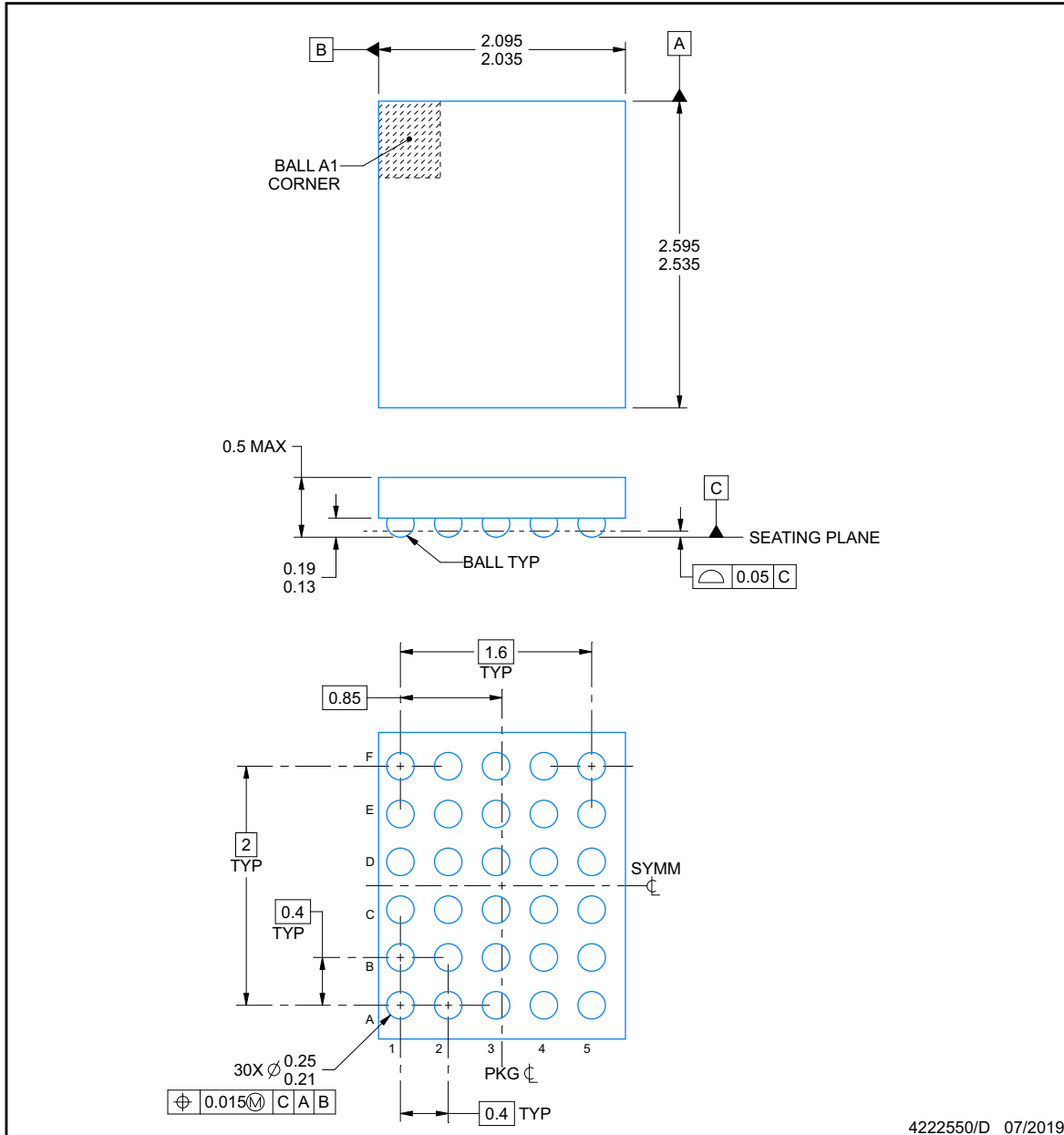


PACKAGE OUTLINE

YZ0030-C01

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



NOTES:

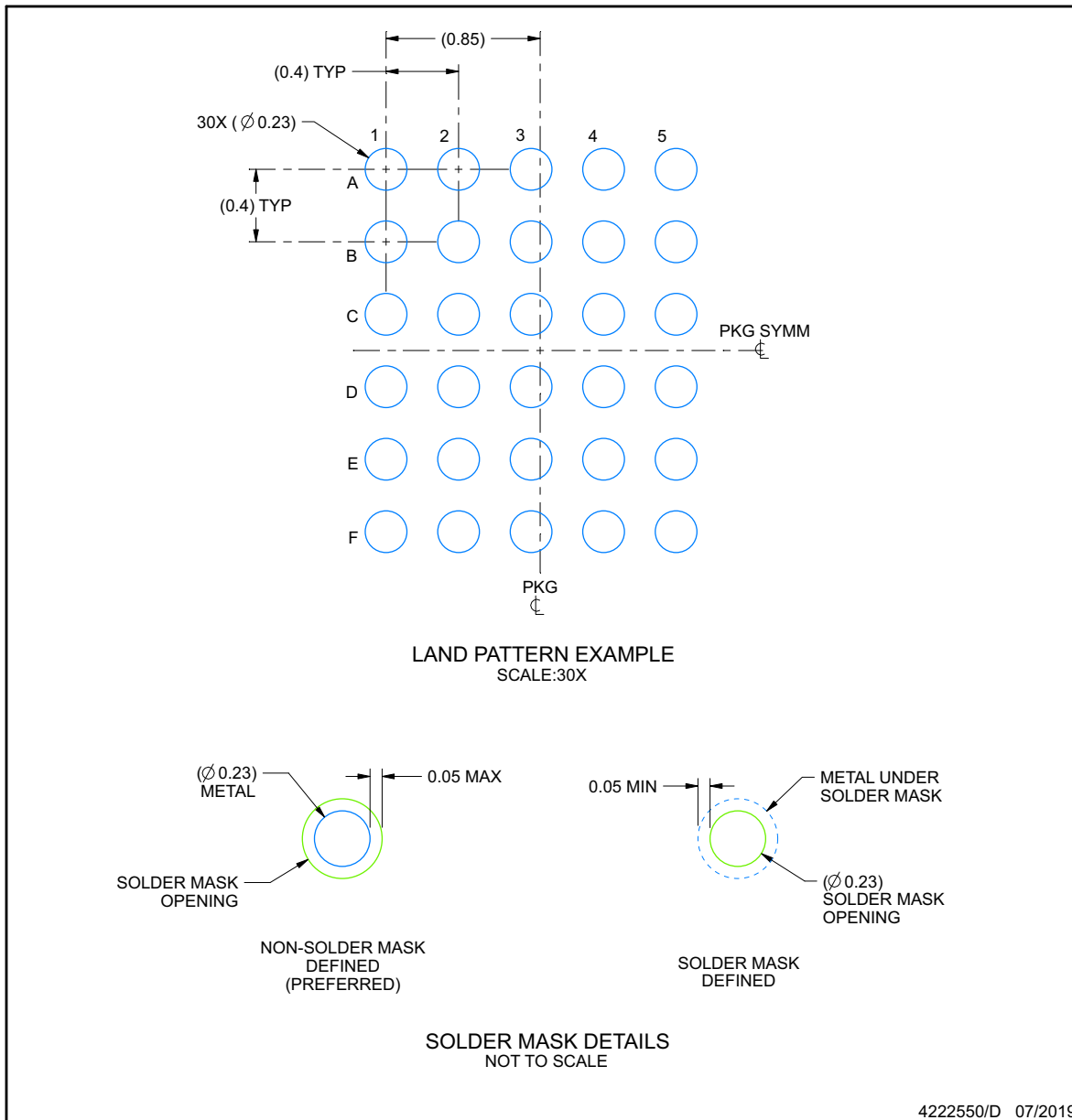
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

YZ0030-C01

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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NOTES: (continued)

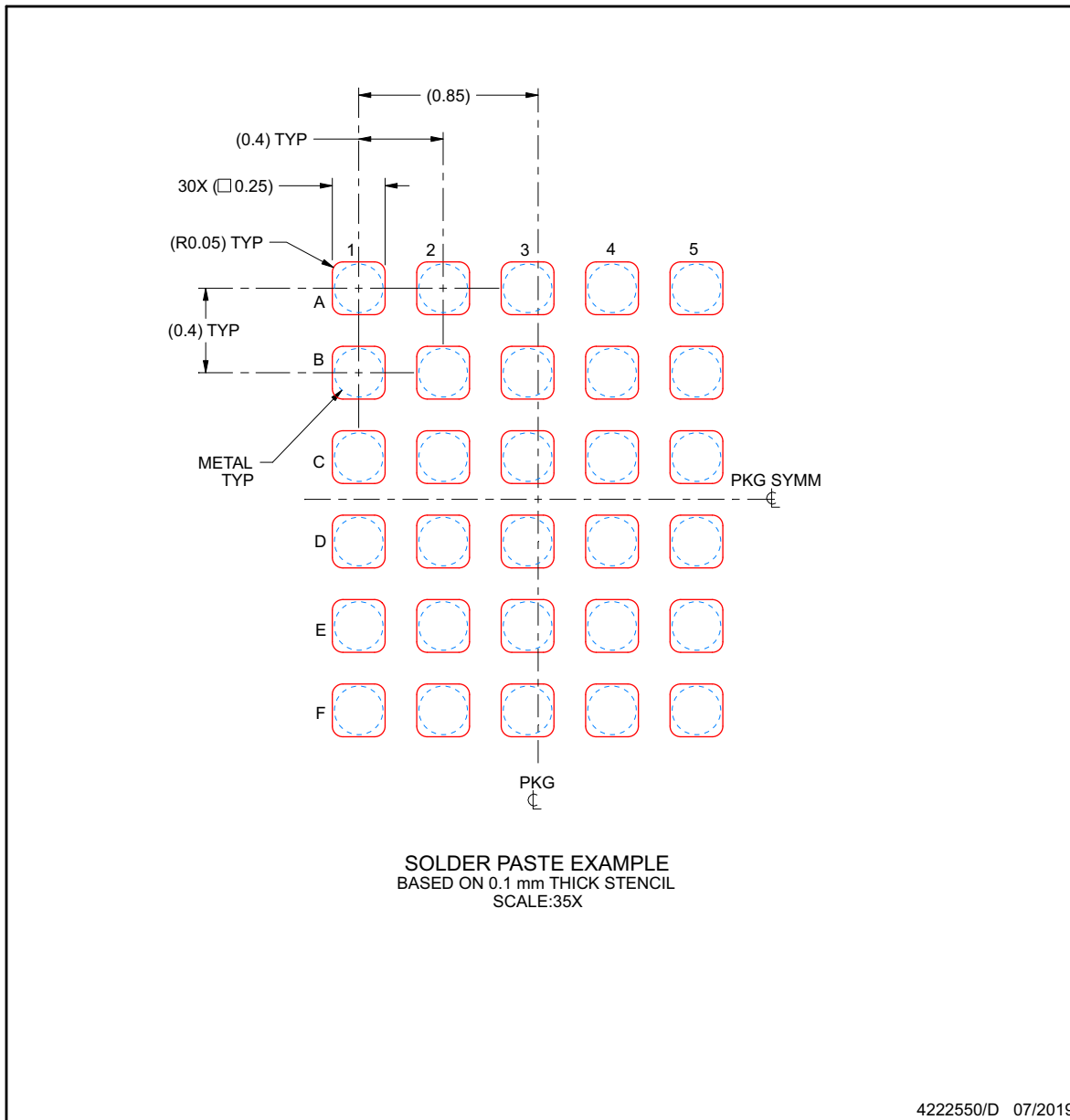
- 3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. See Texas Instruments Literature No. SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YZ0030-C01

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



NOTES: (continued)

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

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
AFE4900YZR	ACTIVE	DSBGA	YZ	30	3000	RoHS & Green	SAC396	Level-1-260C-UNLIM	-20 to 70	AFE4900	Samples
AFE4900YZT	ACTIVE	DSBGA	YZ	30	250	RoHS & Green	SAC396	Level-1-260C-UNLIM	-20 to 70	AFE4900	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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