

DDC3256 256-Channel, Current-Input Analog-To-Digital Converter

1 Features

- Single-chip solution to directly measure 256 low-level currents simultaneously
- Adjustable full-scale charge range up to 320 pC
- Input current: 1 μ A (maximum)
- Adjustable speed with integration times as low as 50 μ s (20 KSPS per channel)
- Resolution: 24 bit
- Low power dissipation: 1.2 mW/channel
- Integral non-linearity: $\pm 0.025\%$ of reading ± 1 ppm of full scale range (all channels active)
- Low noise: 0.26 fCrms at 320 pC FSR with 20 pF sensor capacitance
- No charge loss
- On-chip temperature sensor
- Serial LVDS output interface
- Single 1.85-V supply
- In-package bypass capacitors and reference buffer to reduce PCB area and design complexity

2 Applications

- [CT Scanner](#) data acquisition system
- Photodiode sensors
- [X-ray](#) detection systems
- Optical fiber power monitoring
- Multi-channel current, voltage instrumentation

3 Description

The DDC3256 is a 24-bit, 256-channel, current-input analog-to-digital (A/D) converter. It combines both, current-to-voltage conversion by current integration, and A/D conversion.

Up to 256 individual low-level current output devices, such as photodiodes, can be directly connected to its inputs and digitized in parallel (simultaneously).

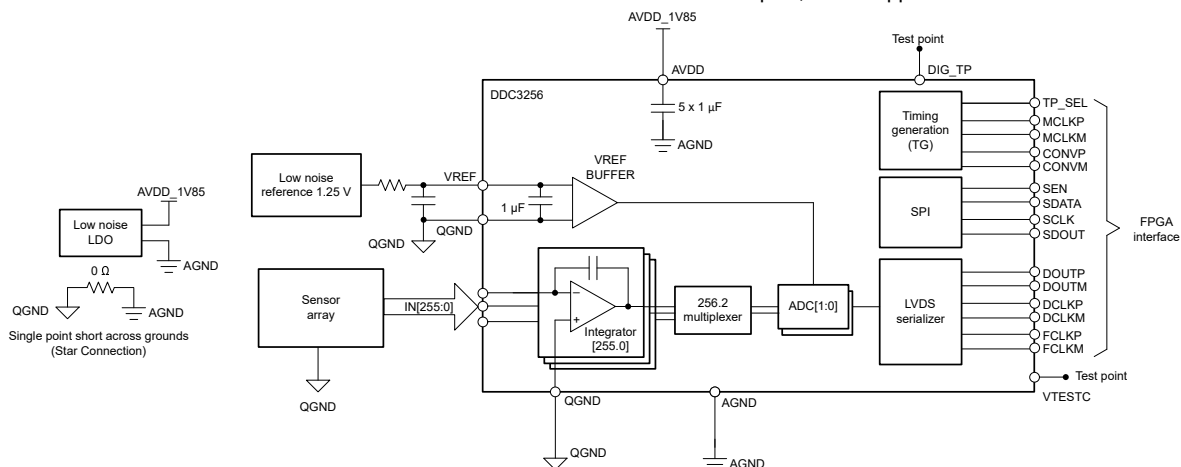
For each of the 256 inputs, the device has one low noise and low power integrator designed to capture all the charge from the sensor. The integration time is adjustable from 50 μ s to 1.6 ms, allowing currents in the order of fA to μ A to be continuously measured with outstanding precision. The outputs of the integrators are digitized by on-chip low power ADCs and the converted digital codes are transmitted over a single LVDS pair designed to minimize noise coupling in environments with high channel count.

The DDC3256 operates from single 1.85-V supply. The device is specified from 0°C to 70°C operating temperature and available in a 13.2 \times 17.2 mm² 336-ball 0.8 mm-pitch BGA. The on-chip reference buffer and bypass capacitors (on the BGA) help minimize the external component requirements and further reduce board space.

Package Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE (NOM) ⁽²⁾ |
|-------------|------------------------|-----------------------------------|
| DDC3256ZWX | ZWX (NFBGA, 336) | 17.2 mm \times 13.2 mm |

- (1) For all available packages, see the orderable addendum at the end of the data sheet.
- (2) The package size (length \times width) is a nominal value and includes pins, where applicable.



Simplified Schematic



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4 Revision History

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

| DATE | REVISION | NOTES |
|-----------|----------|-----------------|
| June 2023 | * | Initial Release |

5 Device and Documentation Support

5.1 Documentation Support

5.1.1 Related Documentation

For related documentation, see the following:

1. Texas Instruments, [TPS7A84 High-Current \(3 A\), High-Accuracy \(1%\), Low-Noise \(4.4 \$\mu\$ VRMS\), LDO Voltage Regulator data sheet](#)
2. Texas Instruments, [REF70 2 ppm/°C Maximum Drift, 0.23 ppm-p 1/f Noise, Precision Voltage Reference data sheet](#)

5.2 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.

Linked content is 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](#).

5.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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5.4 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.

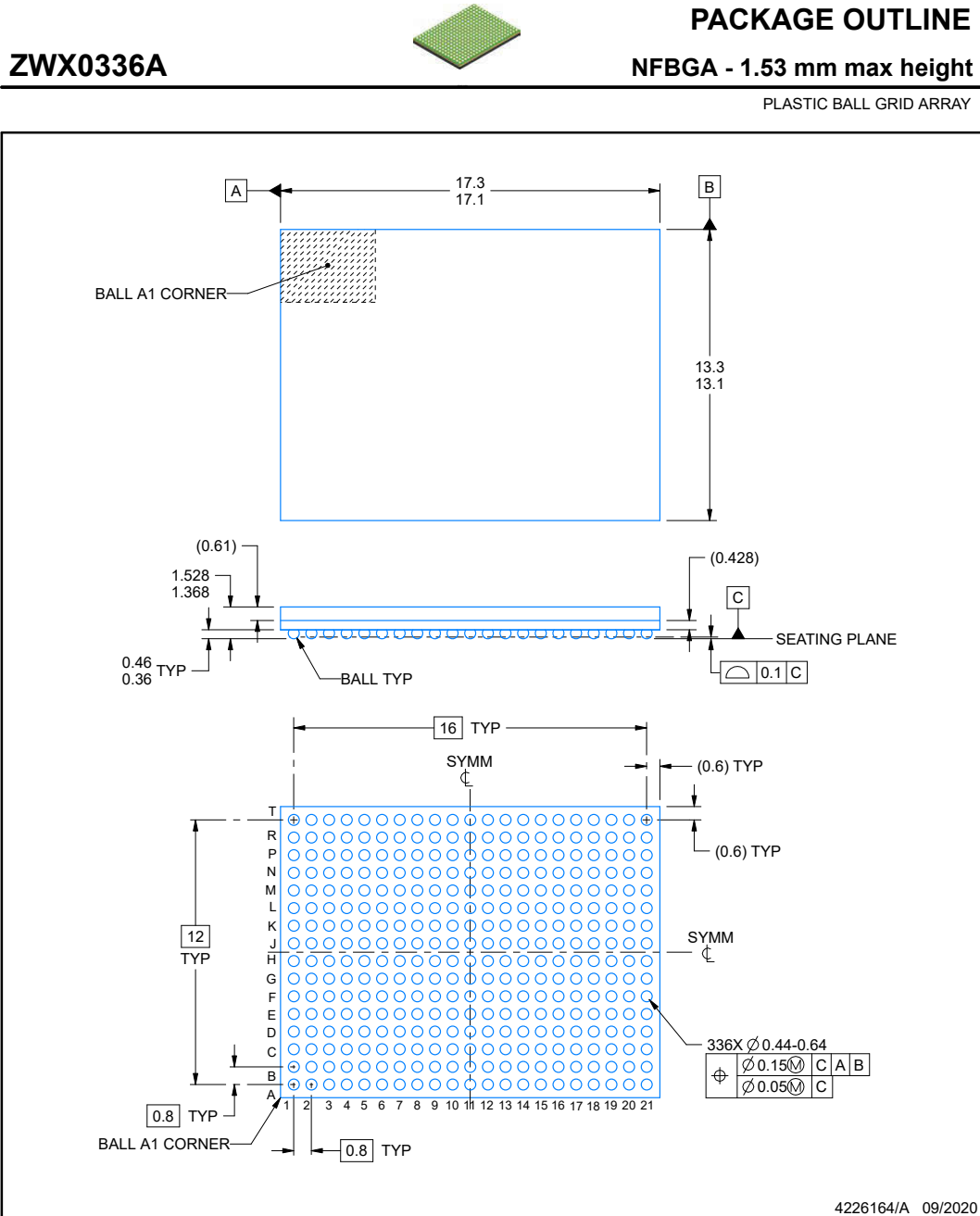
5.5 Glossary

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

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 Mechanical Data



NOTES:

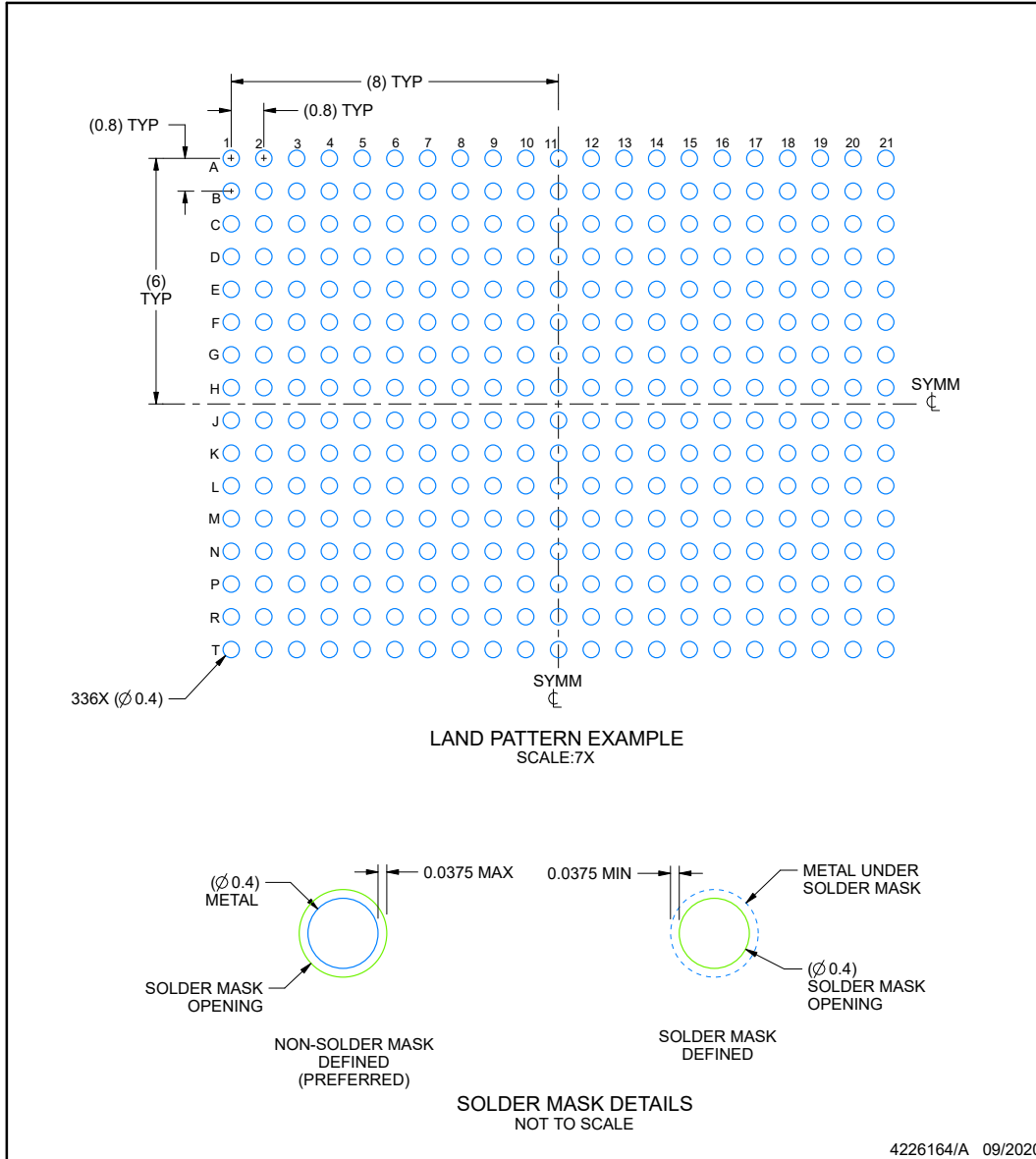
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

ZWX0336A

NFBGA - 1.53 mm max height

PLASTIC BALL GRID ARRAY



NOTES: (continued)

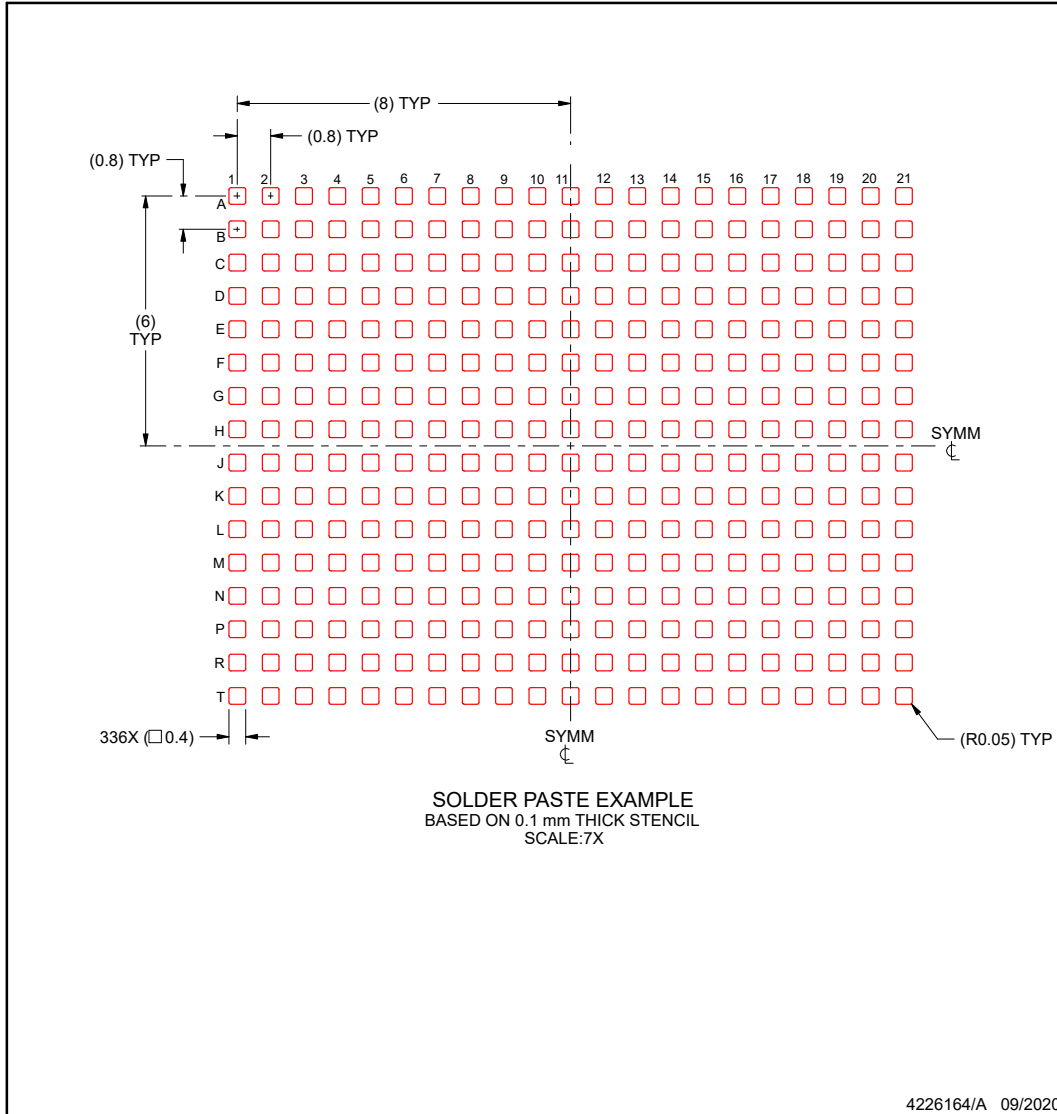
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For information, see Texas Instruments literature number SPRAA99 (www.ti.com/lit/spraa99).

EXAMPLE STENCIL DESIGN

ZWX0336A

NFBGA - 1.53 mm max height

PLASTIC 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 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| DDC3256ZWX | ACTIVE | NFBGA | ZWX | 336 | 108 | RoHS & Green | SNAGCU | Level-3-260C-168 HR | 0 to 70 | DDC3256 | 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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TRAY



Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | Unit array matrix | Max temperature (°C) | L (mm) | W (mm) | K0 (µm) | P1 (mm) | CL (mm) | CW (mm) |
|------------|--------------|--------------|------|-----|-------------------|----------------------|--------|--------|---------|---------|---------|---------|
| DDC3256ZWX | ZWX | NFBGA | 336 | 108 | 06X18 | 150 | 315 | 135.9 | 7620 | 17 | 13 | 14.45 |

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