

# AFE1256 256-Channel, Analog Front-End for Digital X-Ray, Flat-Panel Detectors

## 1 Features

- 256 Channels
- On-Chip, 16-Bit ADC
- Photodiode Short Immunity
- Column Short Immunity
- High Performance:
  - Noise: 758 e-RMS with 28-pF Sensor Capacitor in 1.2-pC Range
  - Integral Nonlinearity:  $\pm 2$  LSB with Internal 16-Bit ADC
  - Minimum Scan Time:
    - 37.9  $\mu$ s in Normal Mode
    - 20  $\mu$ s in 2x Binning Mode
- Integration:
  - Eight Selectable Full-Scale Ranges: 0.15 pC (Min) to 9.6 pC (Max)
  - Built-In Correlated Double Sampler
  - 2x Binning (Averages Charge of Two Adjacent Channels) for Faster Throughput
  - Pipelined Integrate and Read: Allows Data Read During Integration
- Flexibility:
  - Electron and Hole Integration
- Low Power:
  - 2.9 mW/Ch with ADC
  - 2.3 mW/Ch without ADC
  - 0.1 mW/Ch in Nap Mode
  - Total Power-Down Feature
- 22-mm  $\times$  5-mm Gold-Bump Die, Suitable for TCP and COF

## 2 Application

Flat-Panel, X-Ray Detector

## 3 Description

The AFE1256 is a 256-channel, analog front-end (AFE) designed to suit the requirements of flat-panel detectors (FPDs) based on digital X-ray systems. The device includes 256 integrators, a programmable gain amplifier (PGA) for full-scale, charge-level selection, a correlated double sampler (CDS) with dual banking, 256:4 analog multiplexers, and four 16-bit, successive-approximation register (SAR) analog-to-digital converters (ADCs) onboard. Serial data from the ADCs are available in SPI™ format.

Hardware-selectable integration polarity allows for the integration of positive or negative charge and provides more flexibility in system design. The Nap feature enables substantial power saving. This power savings is especially useful in battery-powered systems.

The device is available as a 22-mm  $\times$  5-mm gold-bumped die and a 38-mm  $\times$  28-mm, COF-314 TDS package in singulated forms.

To request a full data sheet or other design resources: [request AFE1256](#)

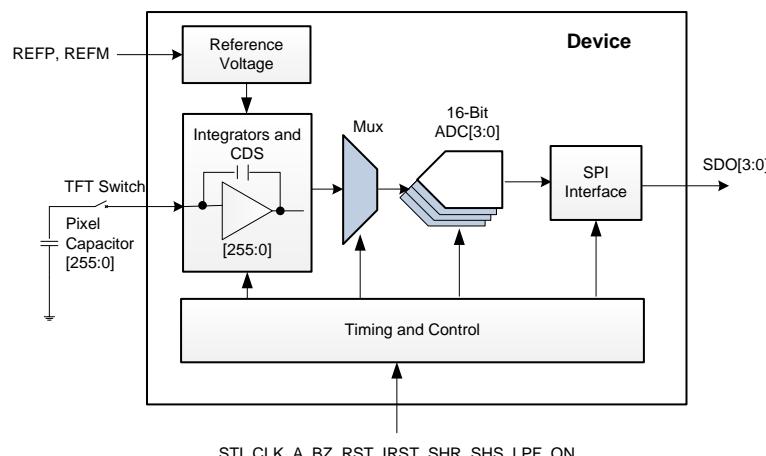
### Device Information<sup>(1)</sup>

| ORDER NUMBER | PACKAGE             | BODY SIZE            |
|--------------|---------------------|----------------------|
| AFE1256GBT   | Gold-bump die (533) | 22 mm $\times$ 5 mm  |
| AFE1256TDS   | COF (314)           | 38 mm $\times$ 28 mm |

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

(2) Product-preview device.

## AFE1256 Schematic



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.

## Table of Contents

|          |   |          |          |   |          |
|----------|---|----------|----------|---|----------|
| <b>1</b> | <b>Features</b> .....                         | <b>1</b> | 5.2      | Electrostatic Discharge Caution .....                                   | <b>3</b> |
| <b>2</b> | <b>Application</b> .....                      | <b>1</b> | 5.3      | Glossary .....  | <b>3</b> |
| <b>3</b> | <b>Description</b> .....                      | <b>1</b> | <b>6</b> | <b>Mechanical, Packaging, and Orderable</b><br><b>Information</b> ..... | <b>3</b> |
| <b>4</b> | <b>Revision History</b> .....                 | <b>2</b> | 6.1      | Tray Dimensions .....   | <b>4</b> |
| <b>5</b> | <b>Device and Documentation Support</b> ..... | <b>3</b> | 6.2      | GBTD Die.....   | <b>5</b> |
|          | 5.1 Trademarks.....                           | 3        |          |   |          |

## 4 Revision History

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

| Changes from Revision C (August 2015) to Revision D | Page     |
|---|----------|
| • Added link to request full data sheet .....       | <b>1</b> |

| Changes from Revision B (April 2014) to Revision C               | Page     |
|--|----------|
| • Changed document status from Mixed to Production Data .....    | <b>1</b> |
| • Deleted TDQ package from document.....                         | <b>1</b> |
| • Changed last paragraph of <i>Description</i> section .....     | <b>1</b> |
| • Deleted second row from <i>Device Information</i> table .....  | <b>1</b> |
| • Changed <i>Tray Dimensions</i> section: deleted Figure 1 ..... | <b>4</b> |

| Changes from Revision A (March 2014) to Revision B | Page     |
|--|----------|
| • Changed TDS package to Production Data .....     | <b>1</b> |

| Changes from Original (October 2013) to Revision A | Page     |
|--|----------|
| • Made changes to product preview data sheet ..... | <b>1</b> |

## 5 Device and Documentation Support

### 5.1 Trademarks

SPI is a trademark of Motorola.

All other trademarks are the property of their respective owners.

### 5.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 5.3 Glossary

[SLYZ022](#) — *TI Glossary*.

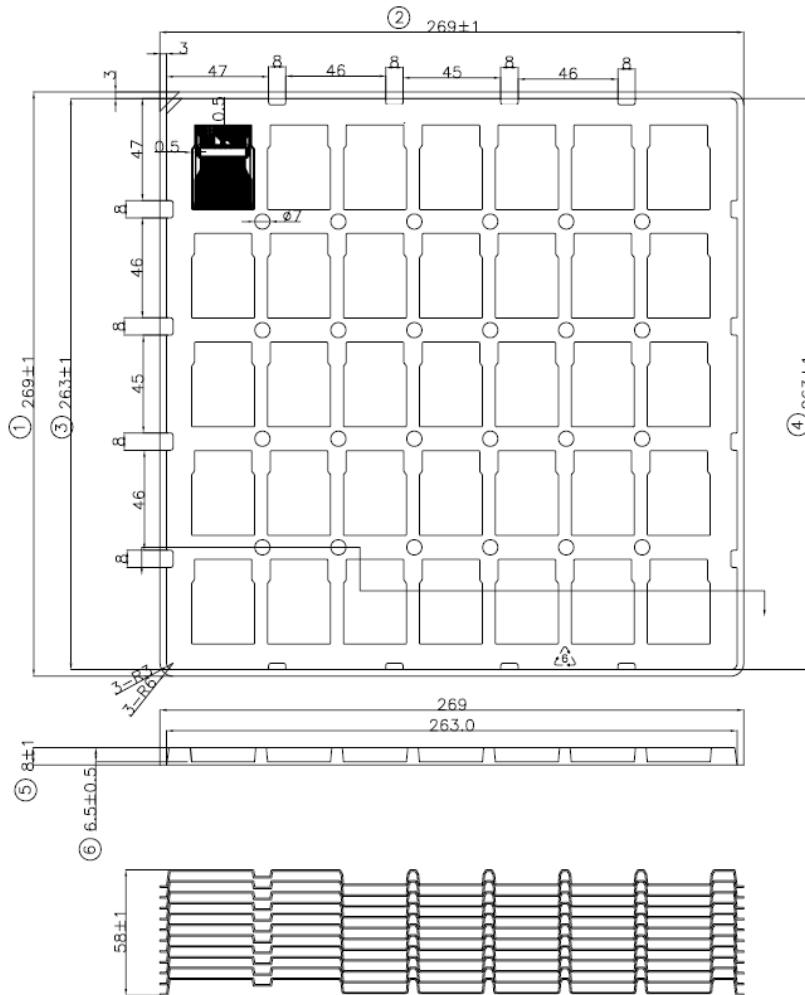
This glossary lists and explains terms, acronyms, and definitions.

## 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 Tray Dimensions

Tray dimensions for the TDS package is shown in [Figure 1](#).

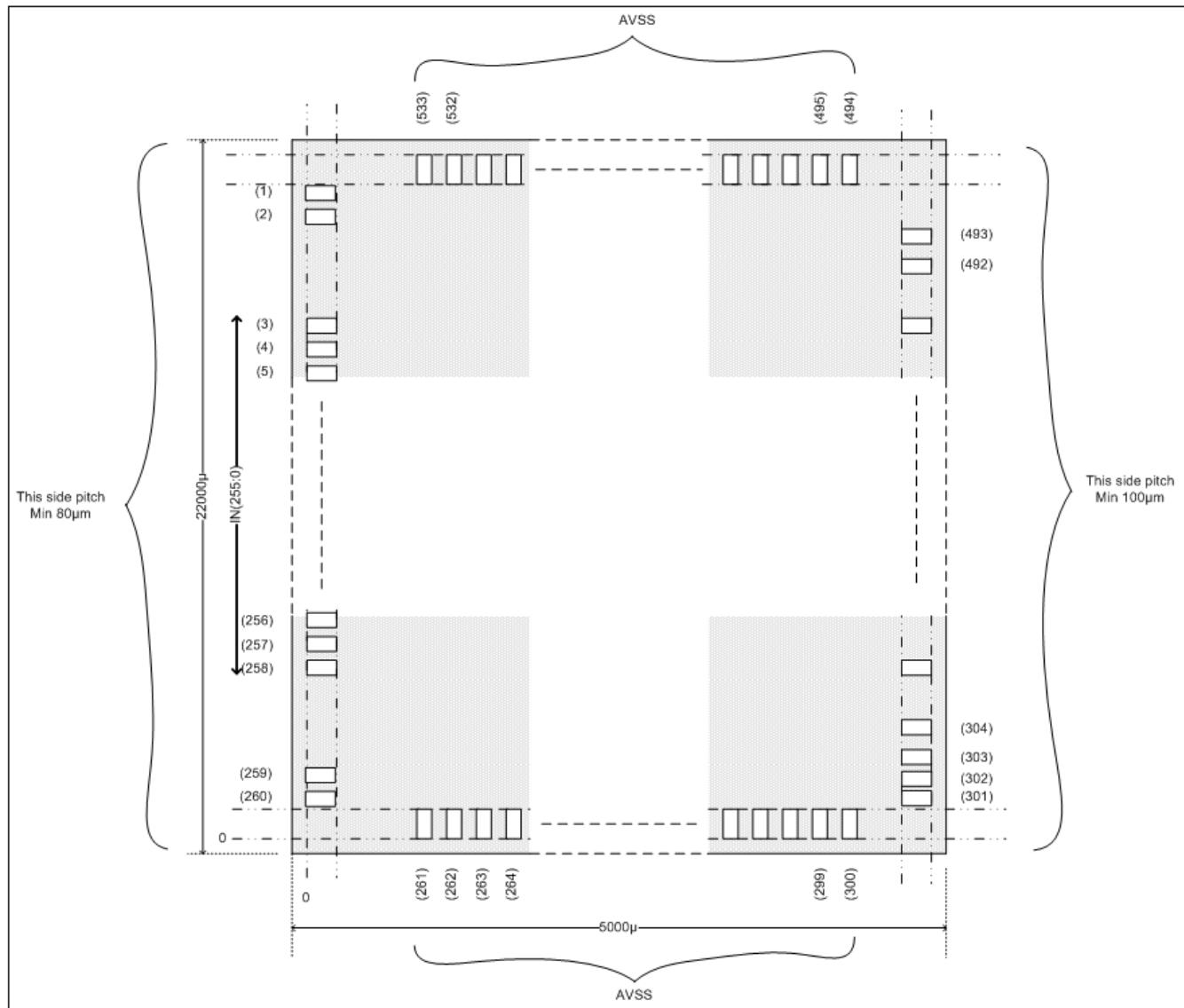


**Figure 1. TDS Tray Dimensions**

Remark : ⑦  
1. Tray material : PS WHITE PREVENT  
PREVENT CONDUCT ELECTRICITY MATERAIL  
CONDUCT ELECTRICITY VALUE 10 ~10  $\Omega$   
2. Material thickness:  $0.70 \pm 0.2\text{mm}$  "  
3. Singulation orientation: input side toward  
the up and SR towards the top(as drawing).

## 6.2 GBTD Die

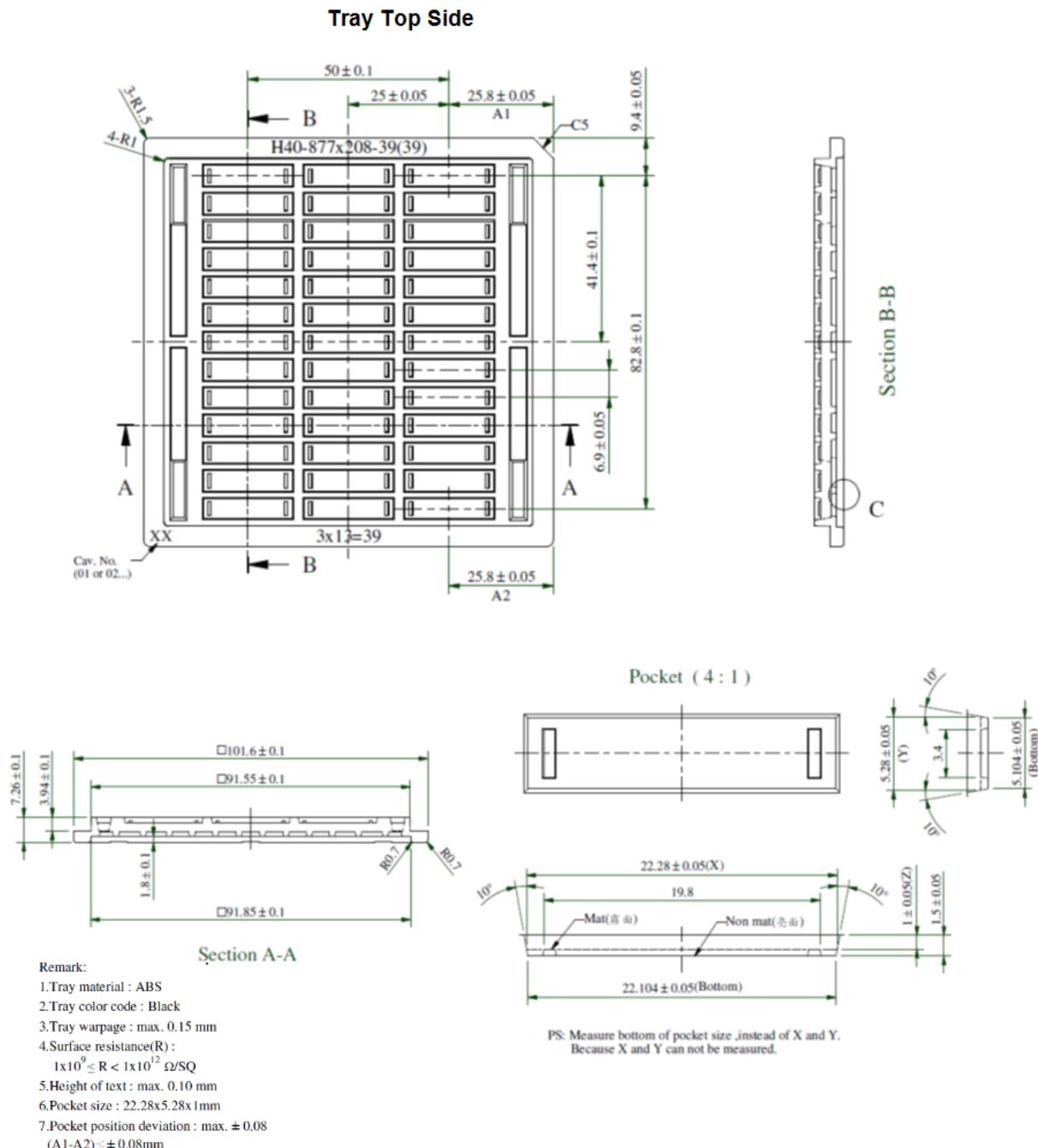
Figure 2 does not take into account the scribe seal.



**Figure 2. GBTD Die Mechanical Data**

## GBTD Die (continued)

Figure 3 provides the tray dimensions for the GBTD die.



**Figure 3. GBTD Die Tray Dimension Details**

## GBTD Die (continued)

Dies are placed active side up (bumps up) into waffle pack. The waffle pack notch is at the upper right, as shown in Figure 4.

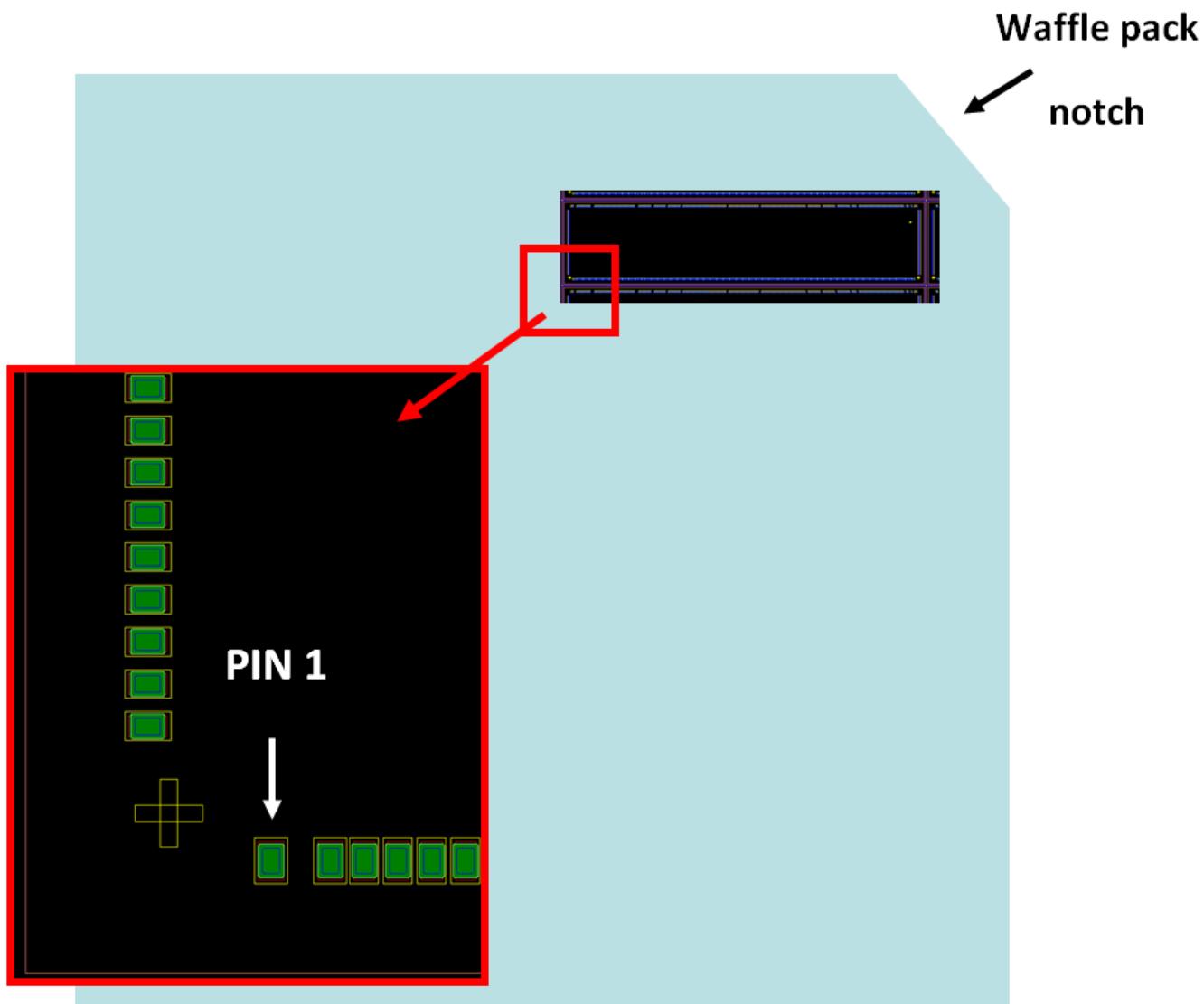


Figure 4. GBTD Die, Pin 1 Location

**PACKAGING INFORMATION**

| Orderable part number | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier     | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------|---------------|----------------------|-----------------|---------------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| AFE1256GBT            | Active        | Production           | null (null)   0 | 39   TUBE                 | Yes         | Call TI                              | Call TI                           | 0 to 70      | AFE1256             |
| AFE1256GBT.D          | Active        | Production           | null (null)   0 | 39   TUBE                 | Yes         | Call TI                              | Call TI                           | 0 to 70      | AFE1256             |
| AFE1256TDS            | Active        | Production           | COF (TDS)   314 | 35   JEDEC<br>TRAY (10+1) | Yes         | AU                                   | N/A for Pkg Type                  | 0 to 70      | AFE1256TDS          |
| AFE1256TDS.D          | Active        | Production           | COF (TDS)   314 | 35   JEDEC<br>TRAY (10+1) | Yes         | AU                                   | N/A for Pkg Type                  | 0 to 70      | AFE1256TDS          |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025