



**THE DATASHEET OF  
AFE1256GBTD**



# 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 x 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 x 5-mm gold-bumped die and a 38-mm x 28-mm, COF-314 TDS package in singulated forms.

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

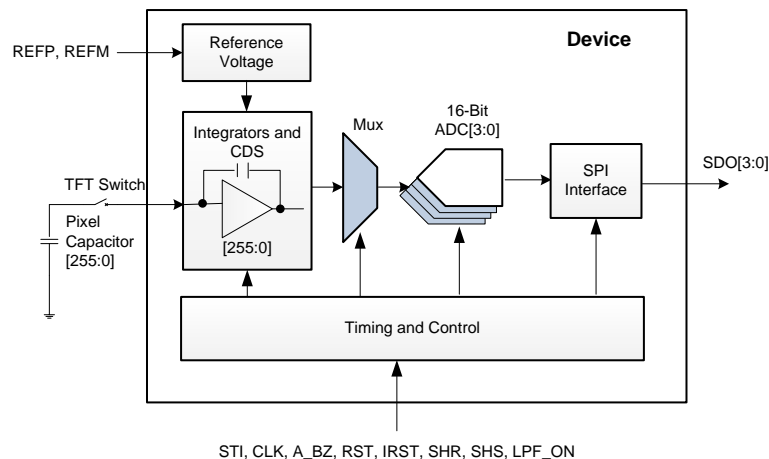
### Device Information<sup>(1)</sup>

ORDER NUMBER	PACKAGE	BODY SIZE
AFE1256GBTD	Gold-bump die (533)	22 mm x 5 mm
AFE1256TDS	COF (314)	38 mm x 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



## Table of Contents

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

## 4 Revision History

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

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

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

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

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

## 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*.

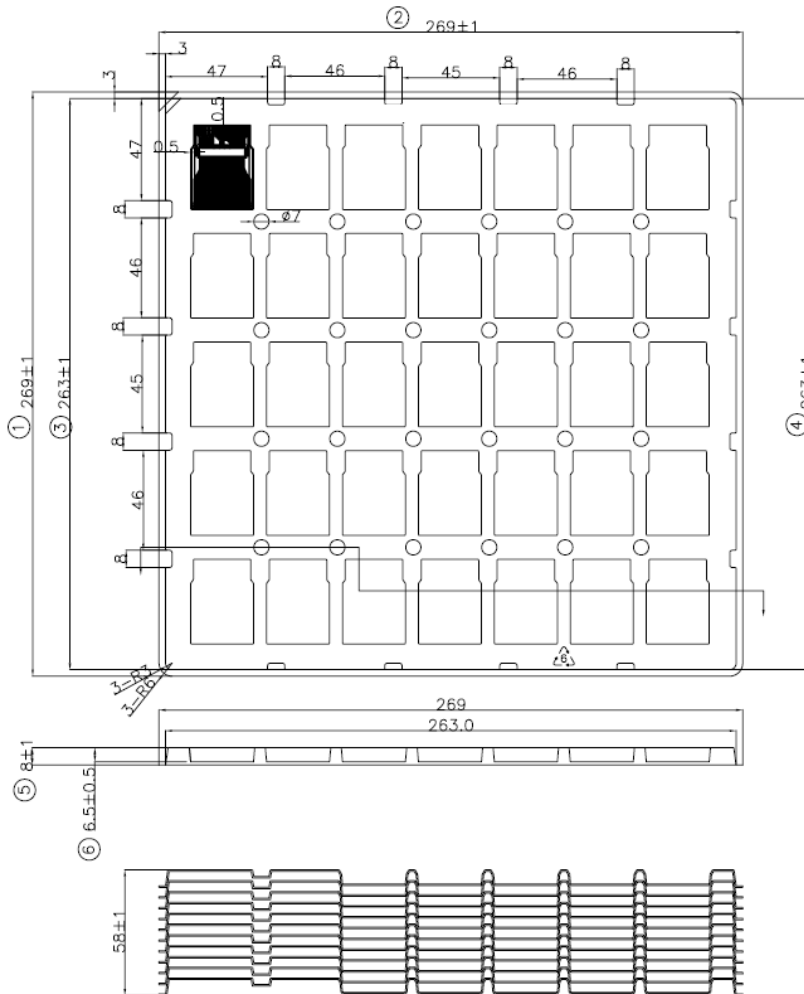
This glossary lists and explains terms, acronyms, and definitions.

## 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](#).



Remark : <sup>⑦</sup>  
 1.Tray material : PS WHITE PREVENT  
 PREVENT CONDUCT ELECTRICITY MATERIAL  
 CONDUCT ELECTRICITY VALUE 10 ~10 Ω  
 2.Material thickness: 0.70±0.2mm<sup>⑦</sup> "  
 3.Singulation orientation:input side toward  
 the up and SR towards the top(as drawing).

**Figure 1. TDS Tray Dimensions**

## 6.2 GBTD Die

Figure 2 does not take into account the scribe seal.

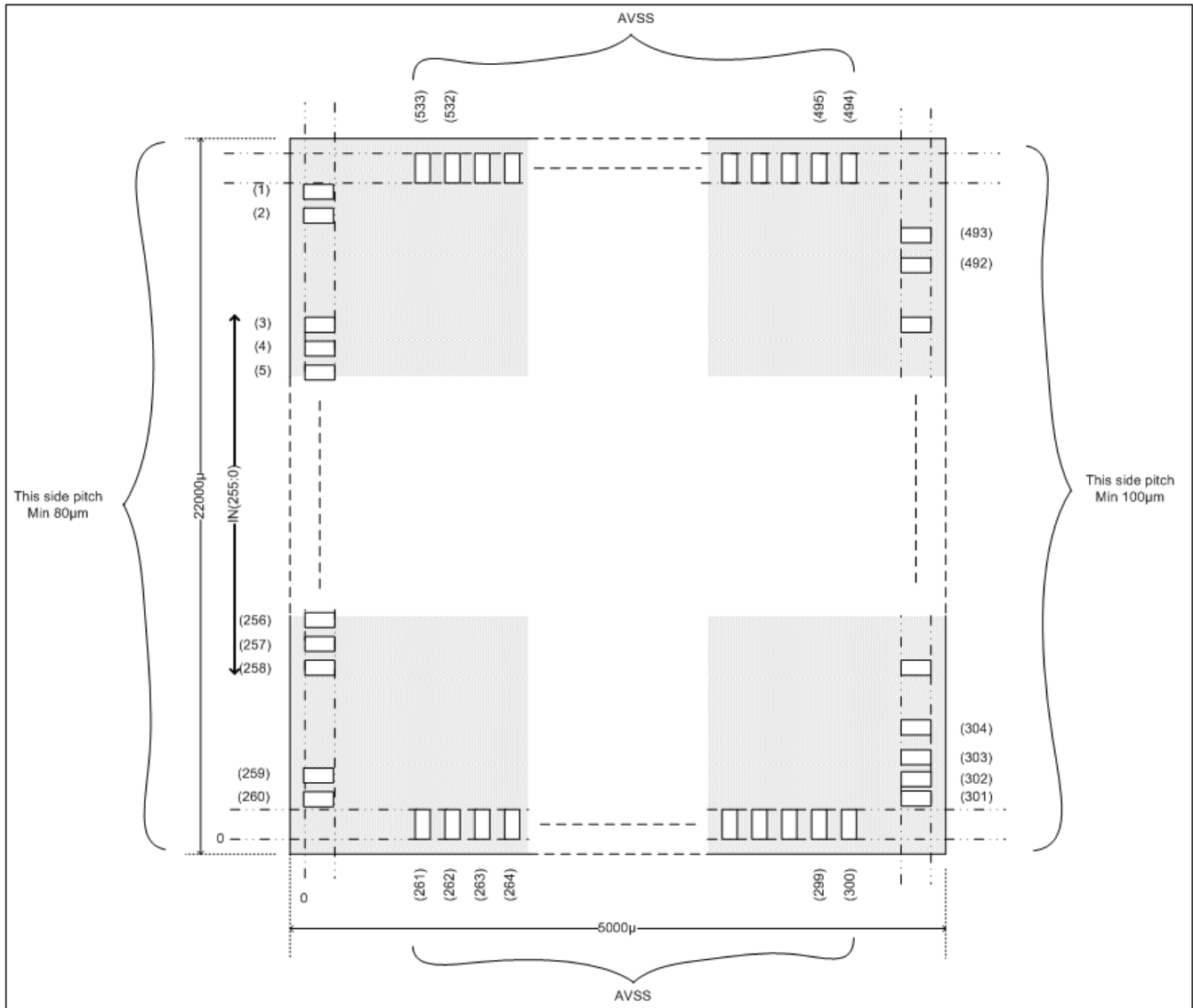
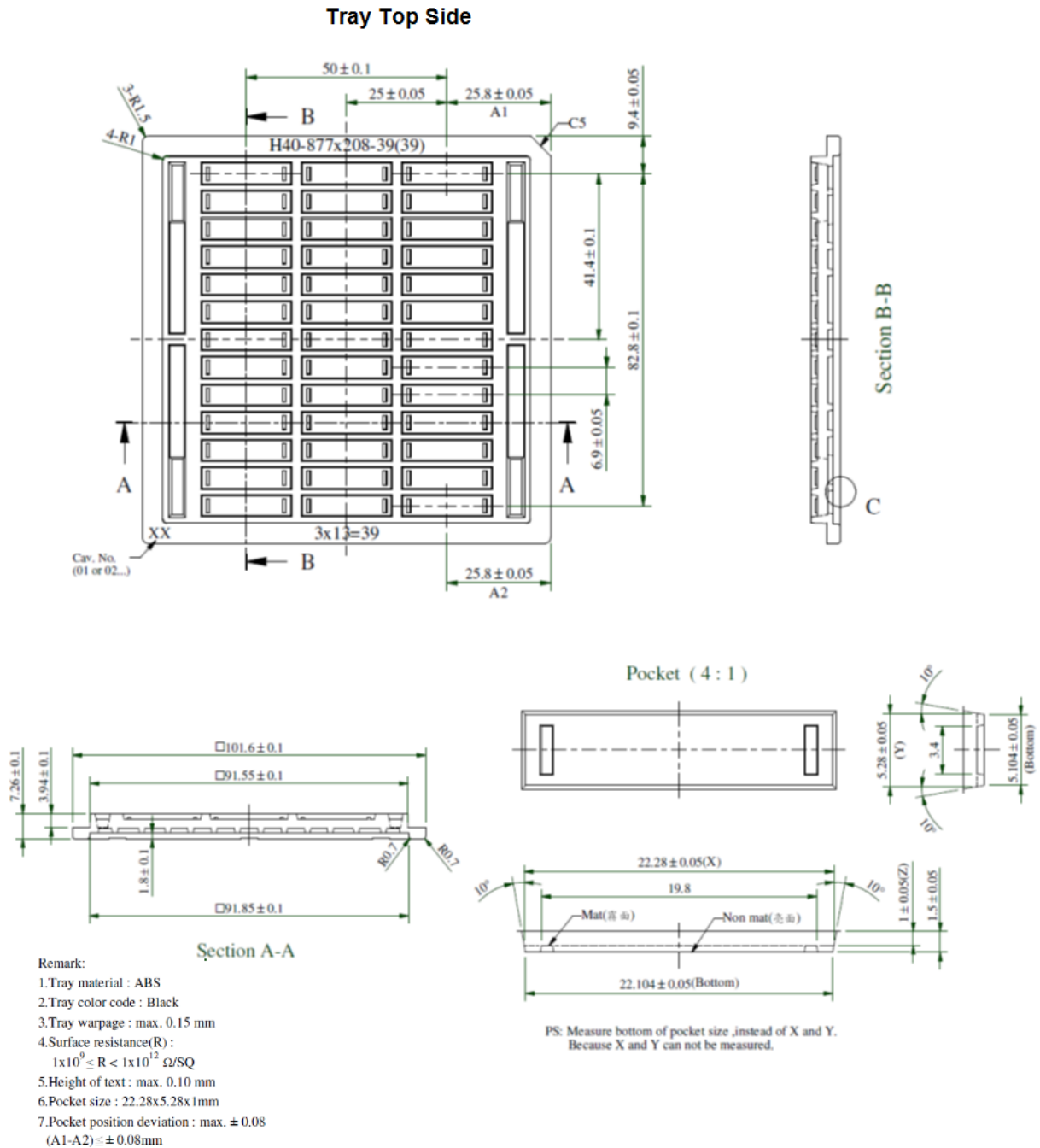


Figure 2. GBTD Die Mechanical Data

**GBTD Die (continued)**

Figure 3 provides the tray dimensions for the GBTD die.



**Figure 3. GBT 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](#).

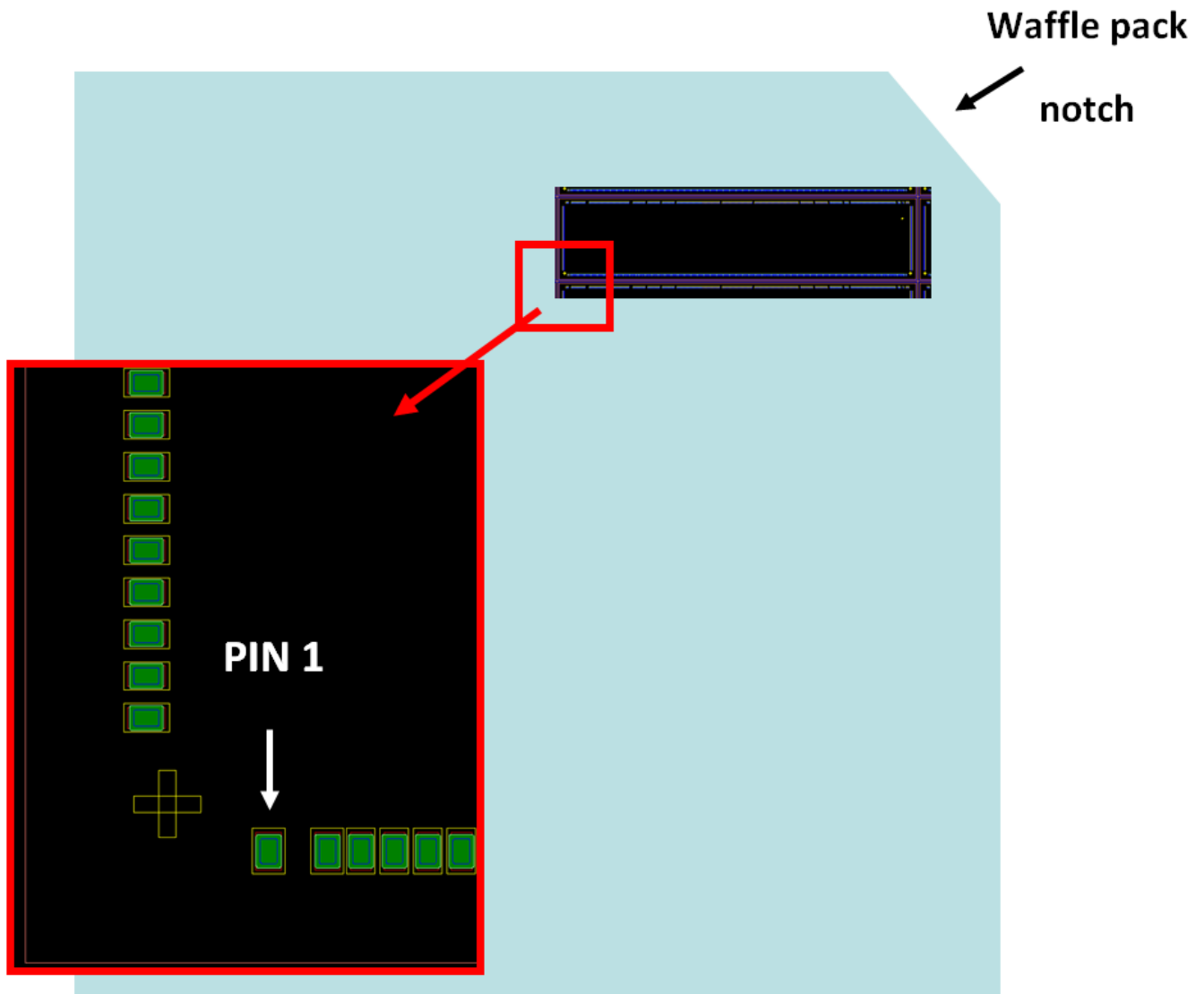


Figure 4. GBTD Die, Pin 1 Location

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
AFE1256GBTD	ACTIVE			0	39	Green (RoHS & no Sb/Br)	AU	Level-1-260C-UNLIM	0 to 85	AFE1256	<a href="#">Samples</a>
AFE1256TDS	ACTIVE	COF	TDS	314	35	Green (RoHS & no Sb/Br)	AU	Level-1-260C-UNLIM	0 to 85	AFE1256TDS	<a href="#">Samples</a>

(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.

**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) 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/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.

**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

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View AFE1256GBTD](#) on WIN SOURCE

 [Texas Instruments](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management