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## 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](#)

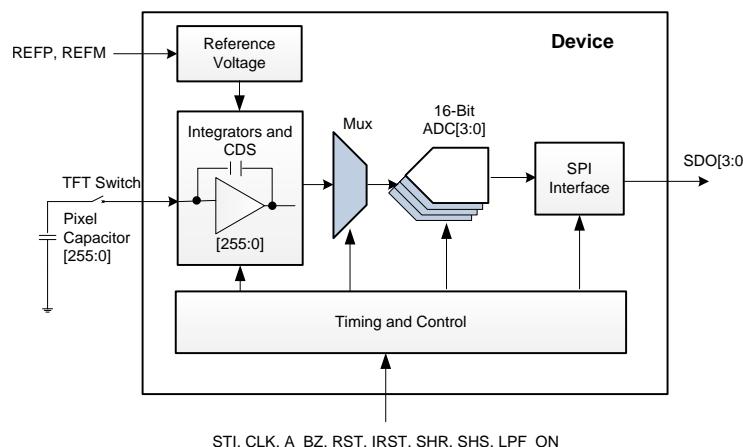
### Device Information<sup>(1)</sup>

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**.

**AFE1256**

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[www.ti.com](http://www.ti.com)**Table of Contents**

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**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.

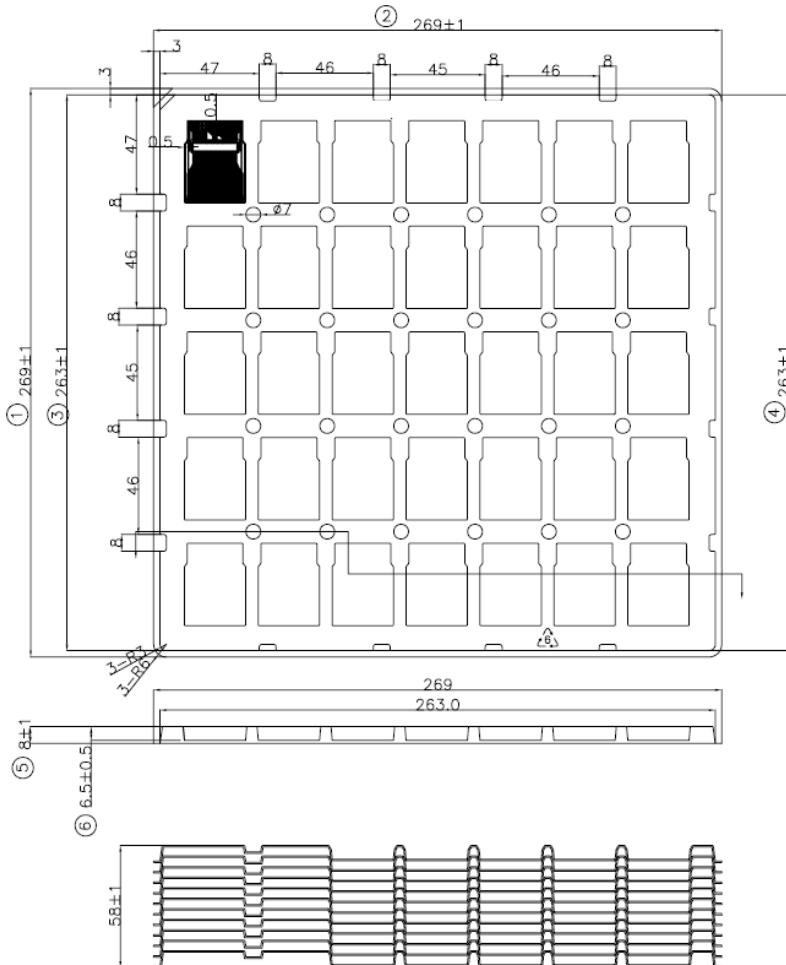
## AFE1256

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### 6.1 Tray Dimensions

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

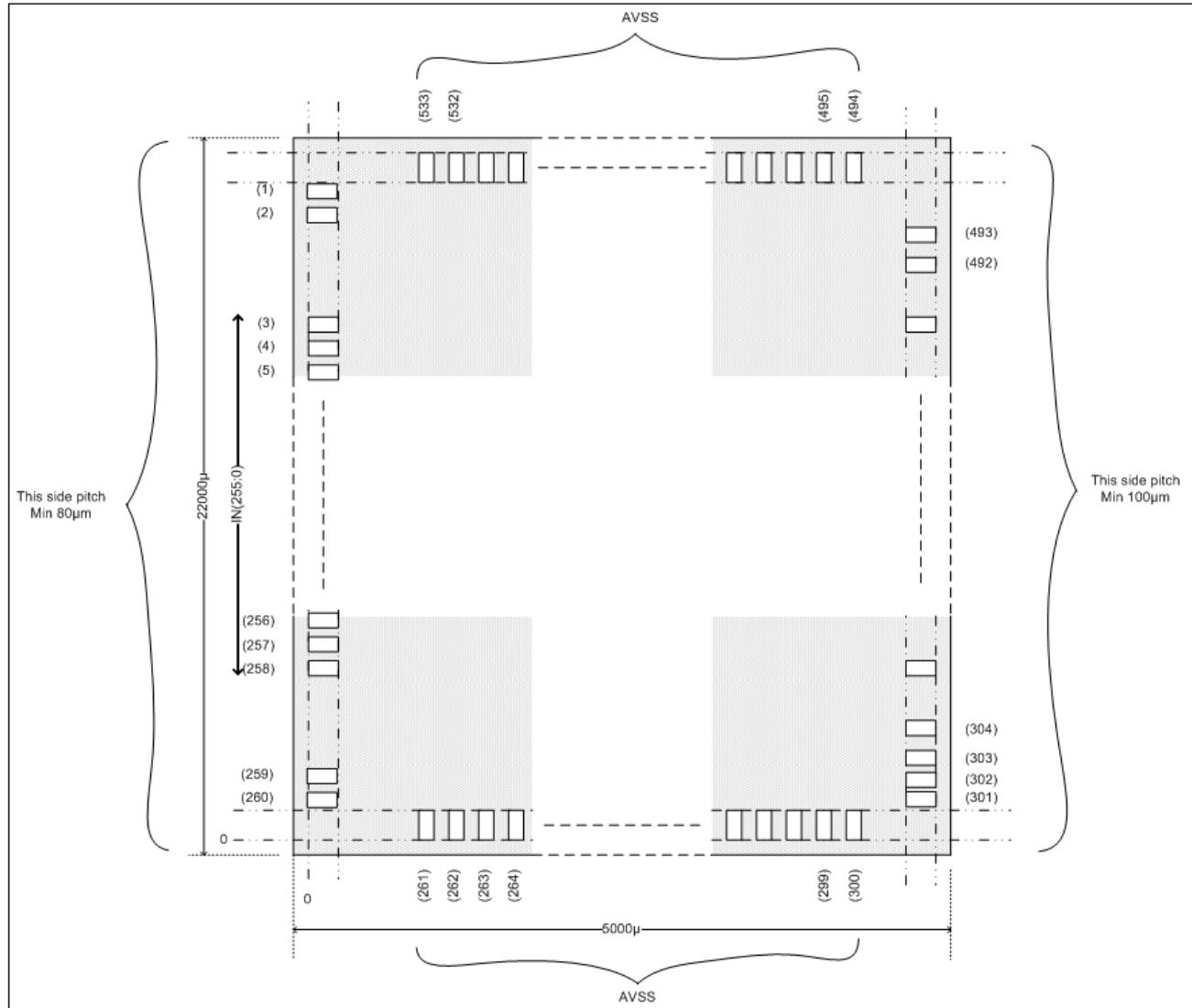


Remark :  
 1. Tray material : PS WHITE PREVENT  
 PREVENT CONDUCT ELECTRICITY MATERAIL  
 CONDUCT ELECTRICITY VALUE 10 ~10  $\Omega$   
 2. Material thickness:  $0.70 \pm 0.2$  mm  
 3. Singulation orientation: input side toward  
 the up and SR towards the top(as drawing).

**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**

## AFE1256

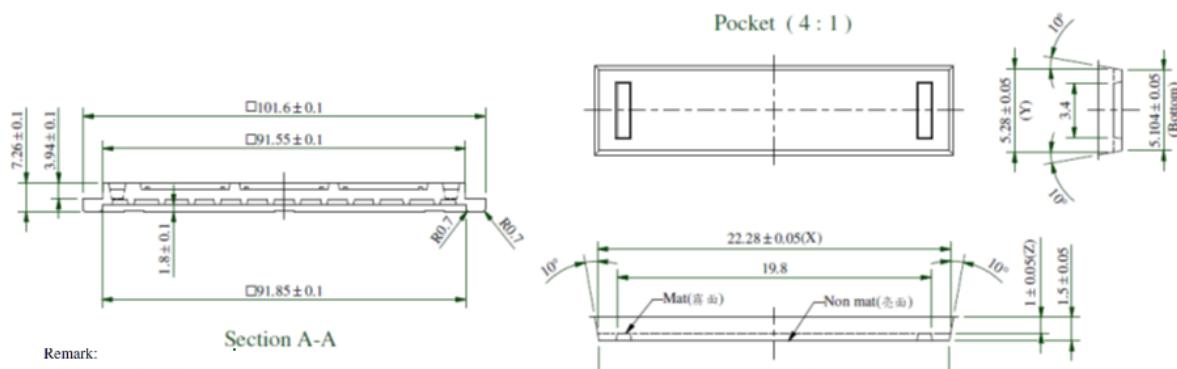
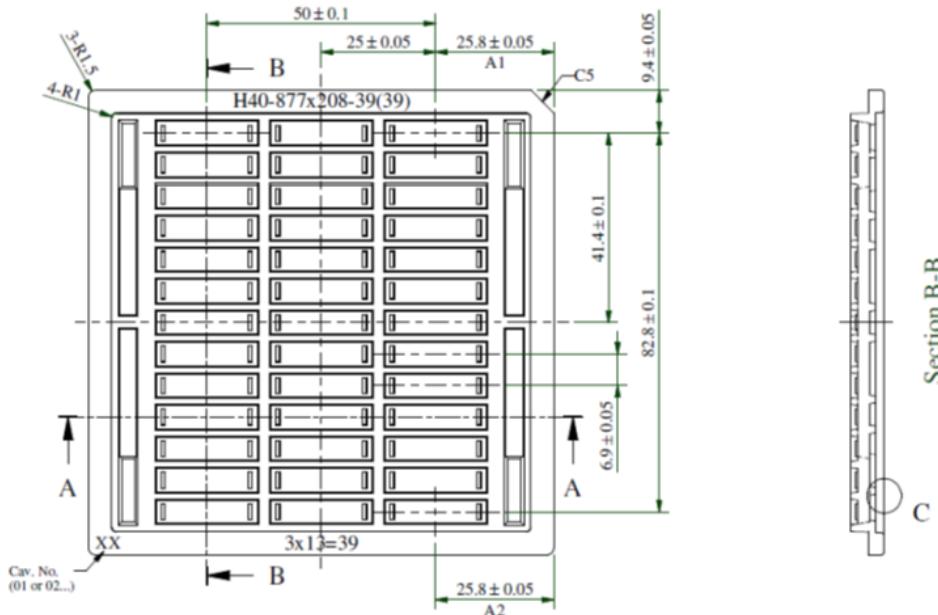
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### GBTD Die (continued)

Figure 3 provides the tray dimensions for the GBTD die.

**Tray Top Side**



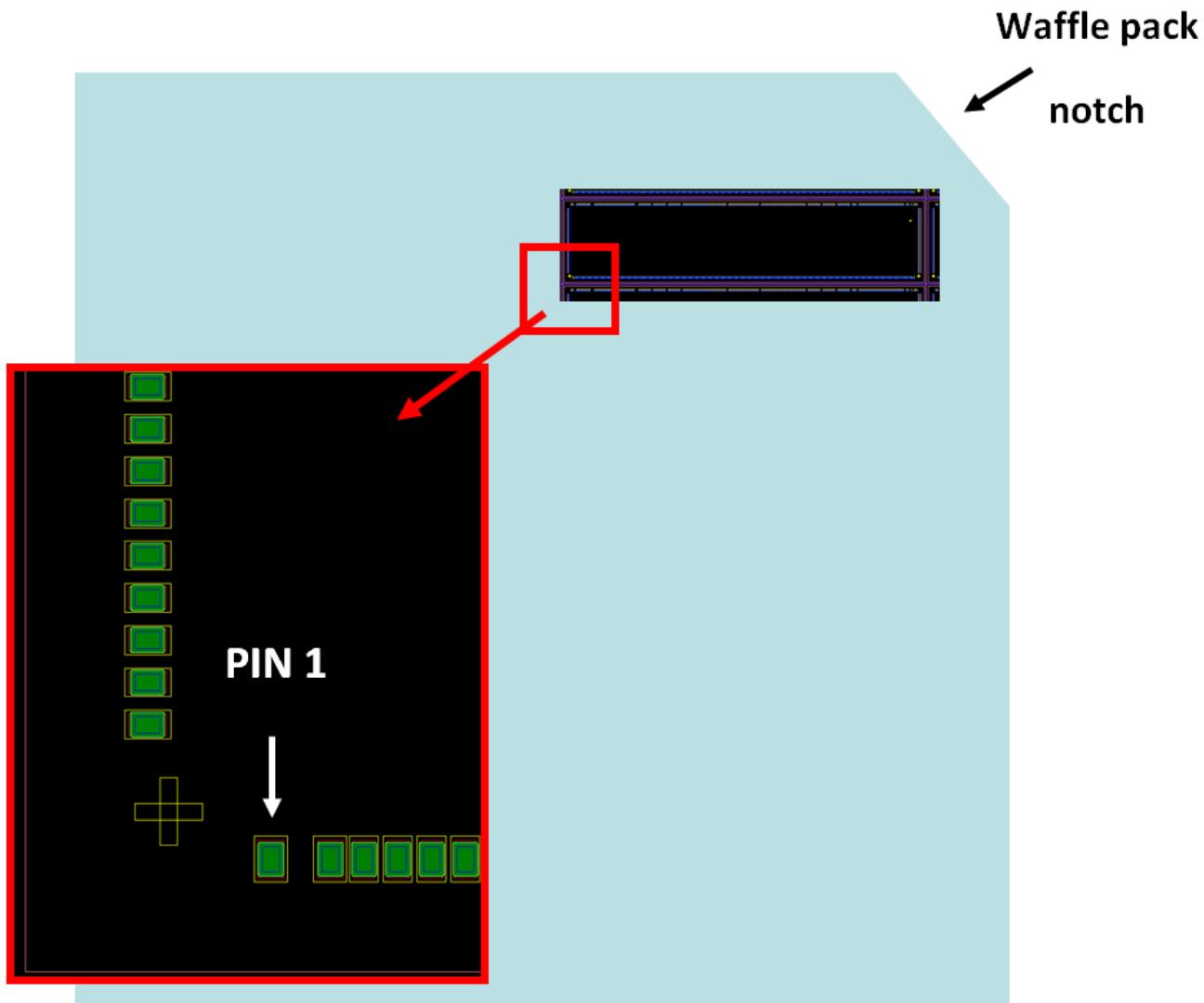
**Remark:**

1. Tray material : ABS
2. Tray color code : Black
3. Tray warpage : max. 0.15 mm
4. Surface resistance(R) :  
 $1 \times 10^9 \leq R < 1 \times 10^{12} \Omega/\text{SQ}$
5. Height of text : max. 0.10 mm
6. Pocket size : 22.28x5.28x1mm
7. Pocket position deviation : max.  $\pm 0.08$   
(A1-A2) $\leq \pm 0.08$ mm

**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 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	<span style="background-color: red; color: white;">Samples</span>
AFE1256TDS	ACTIVE	COF	TDS	314	35	Green (RoHS & no Sb/Br)	AU	Level-1-260C-UNLIM	0 to 85	AFE1256TDS	<span style="background-color: red; color: white;">Samples</span>

(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.

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