

AFE3256 256-Channel, Analog Front-End for Digital X-Ray, Flat-Panel Detectors

1 Features

- 256 channels
- On-chip, 16-bit ADC
- High performance:
 - Noise: 440 electrons RMS (1.2-pC input charge range)
 - Low correlated noise
 - Full-channel integral nonlinearity: ± 2 LSB at 16 bit
 - Scan time: $< 16 \mu\text{s}$ to $204.8 \mu\text{s}$
- Integration:
 - Programmable full-scale input charge range: 0.3pC to 12.5pC with resolution of 0.3pC
 - Internal timing generator (TG)
 - Built-in correlated double sampler
 - Software programmable electron or hole integration mode
 - Pipelined integrate-and-read for improved throughput—data-read during integration
 - Serial LVDS output
 - On-chip temperature sensor
- Simple power supply scheme:
 - Single 1.85V power supply operation
- Multiple power modes with power consumption ranging from 1mW/ch to 2mW/ch
- Power-down modes: sleep and standby
- Binning mode support
- Custom chip-on-film (COF) packages

2 Applications

- Flat-panel, X-ray detectors
- Charge detectors
- Capacitance measurement

3 Description

The AFE3256 is a 256-channel, analog front-end (AFE) designed to suit the requirements of flat-panel detector (FPD) based digital X-ray systems. The device includes 256 integrators, correlated double samplers (CDSs) with dual banking, and 256:2 analog multiplexers. The device also features two 16-bit successive-approximation register (SAR) analog-to-digital converters (ADCs). Serial data from the ADCs are available in low-voltage differential signaling (LVDS) format.

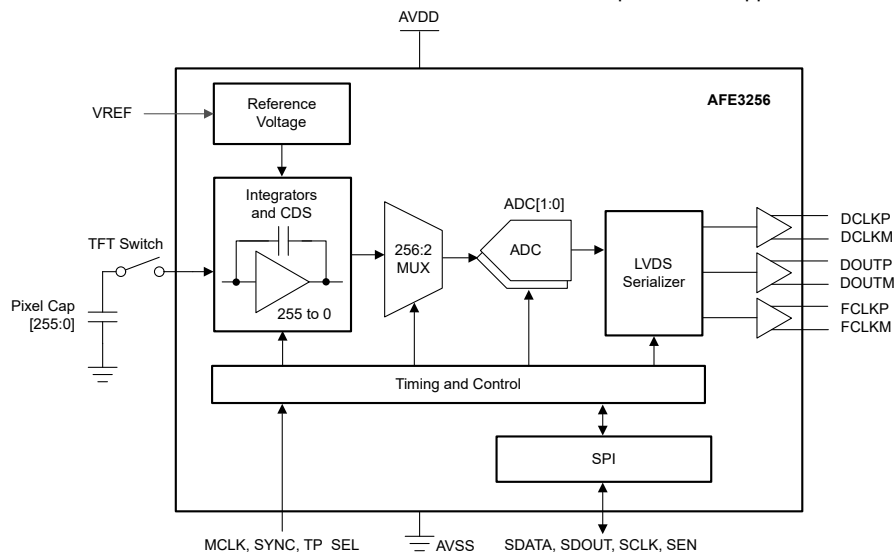
The device, also commonly referred to as a readout integrated circuit (ROIC), optimizes the overall system performance using features such as multiple power modes and in-system debug options.

The sleep and standby modes enable substantial power saving which is critical for battery-powered systems.

Package Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾
AFE3256	TFU (COF, 320)	38mm x 28mm
AFE3256	TFV (COF, 315)	48mm x 17.33mm

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



AFE3256 Block Diagram



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4 Revision History

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

Changes from Revision * (October 2023) to Revision A (April 2024)	Page
• Added AFE3256TFV package details across the document.....	1

5 Device and Documentation Support

5.1 Documentation Support

5.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [TPS7A8300 2- \$\mu\$ A, 6- \$\mu\$ VRMS, RF, LDO Voltage Regulator data sheet](#)
- Texas Instruments, [REF70 2 ppm/ \$^{\circ}\$ C Maximum Drift, 0.23 ppm-p 1/f Noise, Precision Voltage Reference data sheet](#)

5.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

5.3 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](#).

5.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

5.5 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.

5.6 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.

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
AFE3256TFU	ACTIVE	COF	TFU	320	30	Non-RoHS & Non-Green	AU	N / A for Pkg Type	0 to 70	AFE3256	Samples
AFE3256TFV	ACTIVE	COF	TFV	315	36	Non-RoHS & Non-Green	AU	N / A for Pkg Type	0 to 70	AFE3256	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.

OBSOLETE: 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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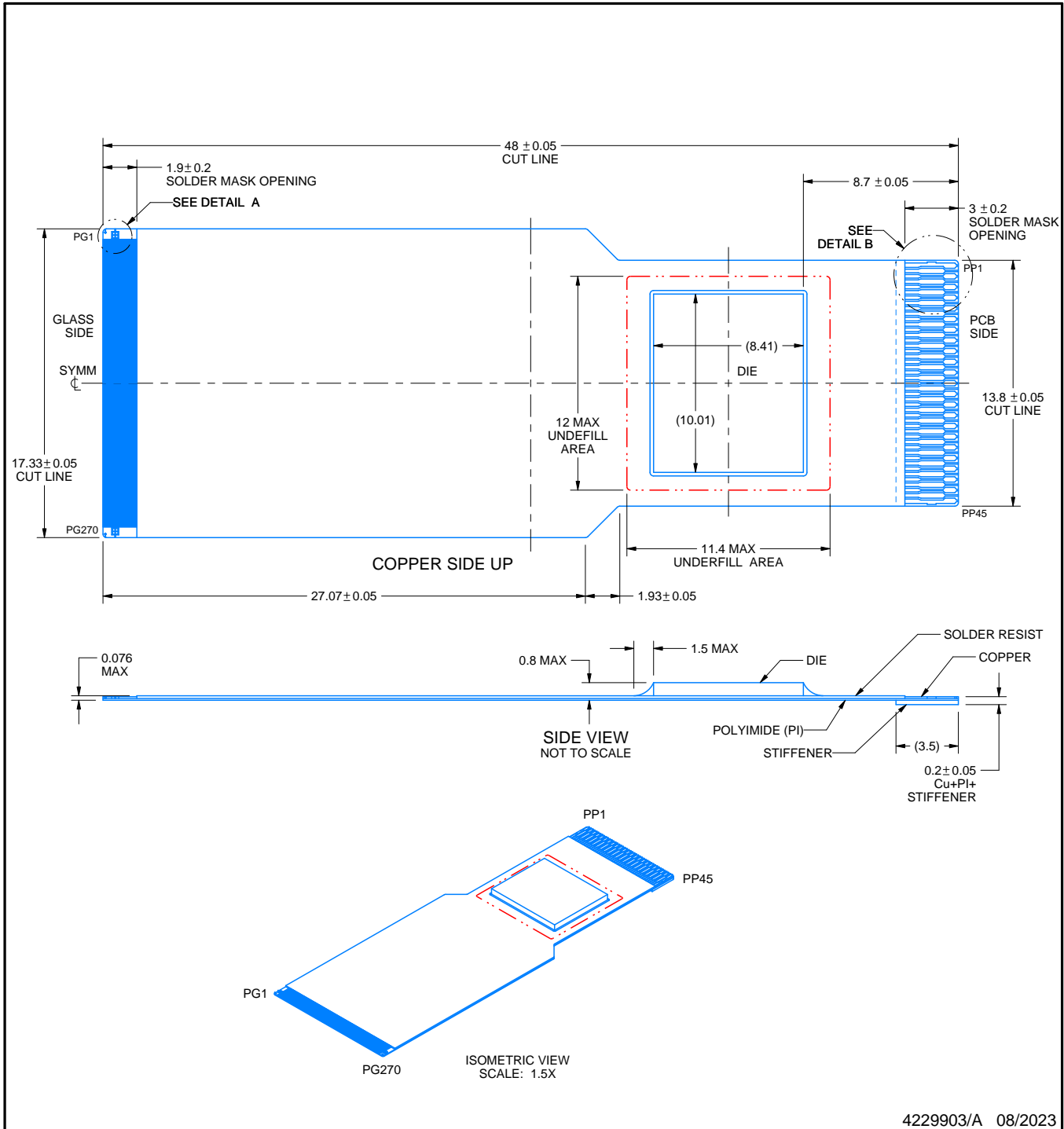
TFV0315A



PACKAGE OUTLINE

COF - 0.8 mm max height

CHIP ON FLEX



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NOTES:

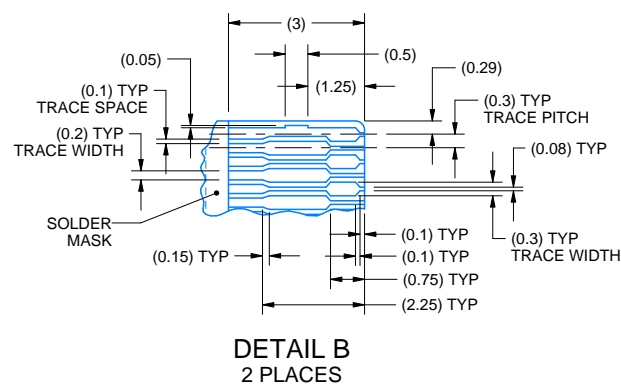
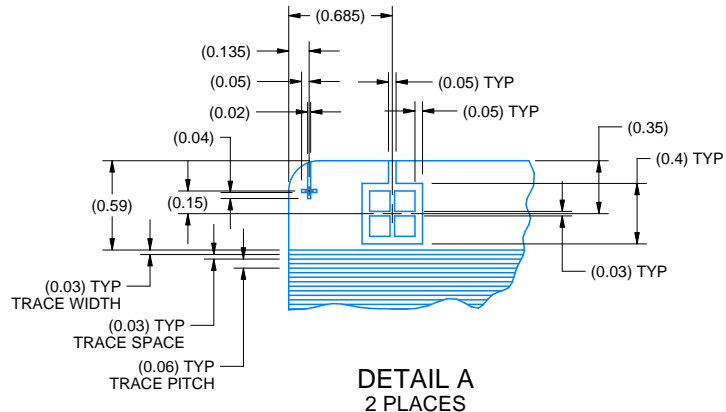
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Flip chip application only.
4. The shrink factor of the COF on the glass side is 0.9987.

PACKAGE OUTLINE

TFV0315A

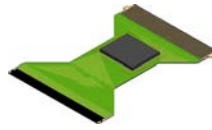
COF - 0.8 mm max height

CHIP ON FLEX



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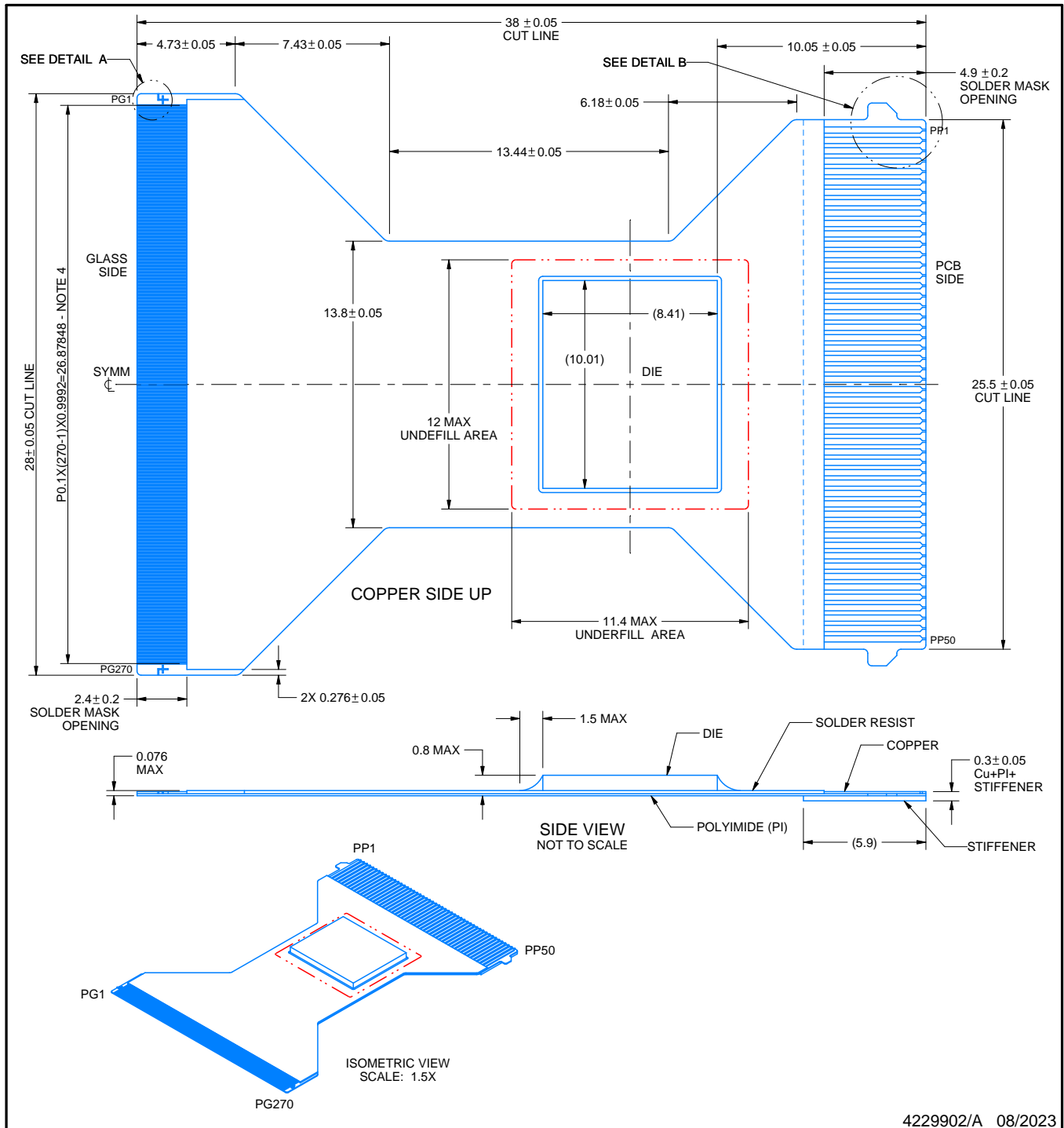
TFU0320A



PACKAGE OUTLINE

COF - 0.8 mm max height

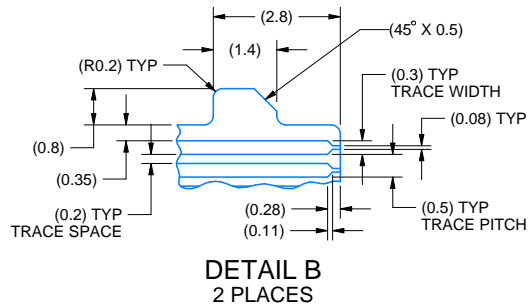
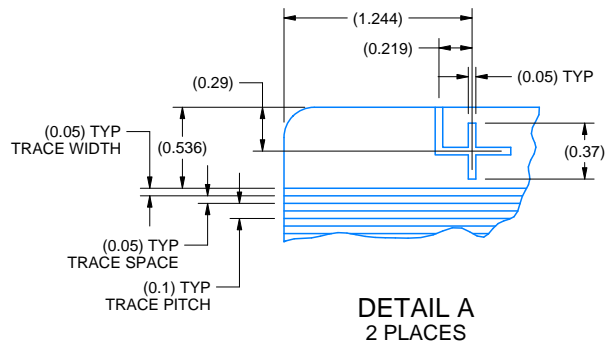
CHIP ON FLEX



4229902/A 08/2023

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.
3. Flip chip application only.
4. The shrink factor of the COF on the glass side is 0.9992.



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