OPT8320 3D Time-of-Flight Sensor

1 Features

- Imaging Array:
  - 80 × 60 Array
  - 1/6” Sensor Format
  - Pixel Pitch: 30 µm
  - Frame Rate: Scalable Up to 1000-FPS Depth Output Rate with an Internal Raw Rate of 4000 FPS
- Optical Properties:
  - Responsivity: 0.35 A/W at 850 nm
  - Demodulation Contrast: 70% at 50 MHz
  - Demodulation Frequency: 10 MHz to 100 MHz
- Output Interface:
  - Digital Video Port (DVP): 8 Data Lanes, HD and VD Pins, and Clock
  - Synchronous Serial Interface (SSI): 1 Data Lane, Clock, and Chip Select
- Timing Generator:
  - Sensor Addressing Engine
  - Modulation Control
  - De-Aliasing
  - Master, Slave Sync Operation
  - High Dynamic Range Operation
- Depth Engine:
  - Pixel Binning
  - De-Aliasing
  - Histogram
  - Calibration
- Power Supply:
  - 3.3-V I/O, Analog
  - 1.8-V Analog, Digital, I/O
  - 1.8-V Demodulation (Typical)
- Optimized Optical Package (COG-56):
  - 8.03 mm × 5.32 mm × 0.745 mm
  - Integrated Optical Band-Pass Filter (830 nm to 867 nm)
  - Optical Fiducials for Easy Alignment
- Built-In Illumination Driver for Low-Power Applications
- Operating Temperature: 0°C to 70°C

2 Applications

- Depth Sensing:
  - Location and Proximity Sensing
  - 3D Scanning
  - 3D Machine Vision
  - Security and Surveillance
  - Gesture Controls
  - Augmented and Virtual Reality

3 Description

The OPT8320 time-of-flight (ToF) sensor is part of the TI 3D ToF image sensor family. The device is a high-performance, highly-integrated, complete system-on-chip (SoC) for array depth sensing, consisting of a versatile timing generator (TG), an optimally designed analog-to-digital converter (ADC), a depth engine, and an illumination driver.

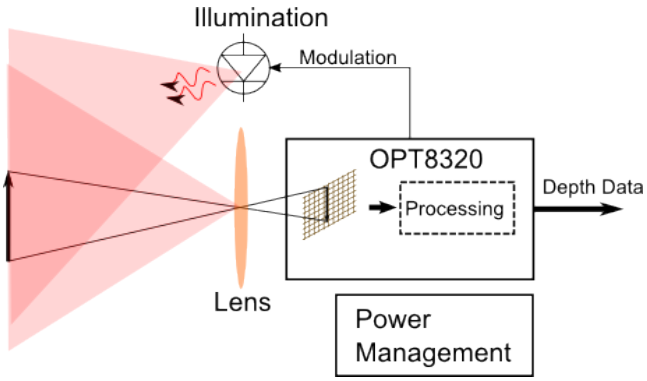
The programmability of the built-in TG offers the flexibility to optimize for various depth-sensing performance metrics [such as power, motion robustness, signal-to-noise ratio (SNR), and ambient cancellation]. The built-in depth engine computes the depth data from the digitized sensor data. In addition to the phase data, the depth engine provides auxiliary information consisting of amplitude, ambient, and flags for each pixel and the full-array statistical information in the form of a histogram.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
OPT8320	COG (56)	8.03 mm x 5.32 mm x 0.745 mm

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

Application Block Diagram



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

4 Revision History

DATE	REVISION	NOTES
April 2018	*	Initial release.

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5 Device and Documentation Support

5.1 Documentation Support

5.1.1 Related Documentation

Time-of-Flight Camera – An Introduction, SLOA190

Introduction to the Time-of-Flight (ToF) System Design, SBAU219

Illumination Driving for Time-of-Flight (ToF) Camera System, SBAA209

Lenses for 3D Time-of-Flight (ToF) Image Sensors, SBAA217

3D ToF System Estimator Tool

5.2 Community Resources

The following links connect to TI community resources. Linked contents are 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.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

5.3 Trademarks

E2E is a trademark of Texas Instruments.
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5.4 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.

5.5 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.

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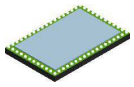
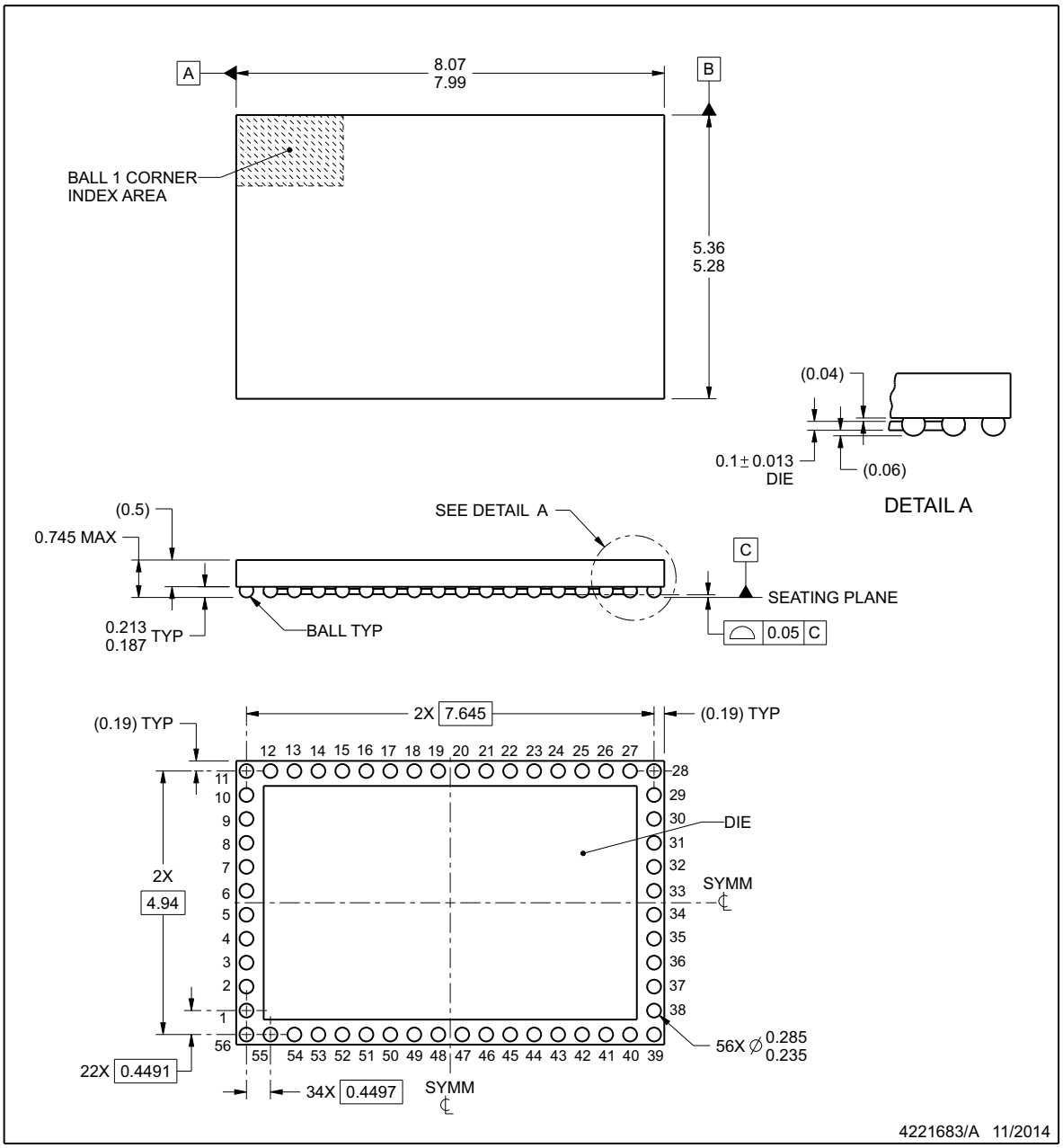
PACKAGE OUTLINE

NBP0056A



COG - 0.745 mm max height

CHIP ON GLASS



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. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum C and seating plane are defined by the spherical crowns of the solder balls.

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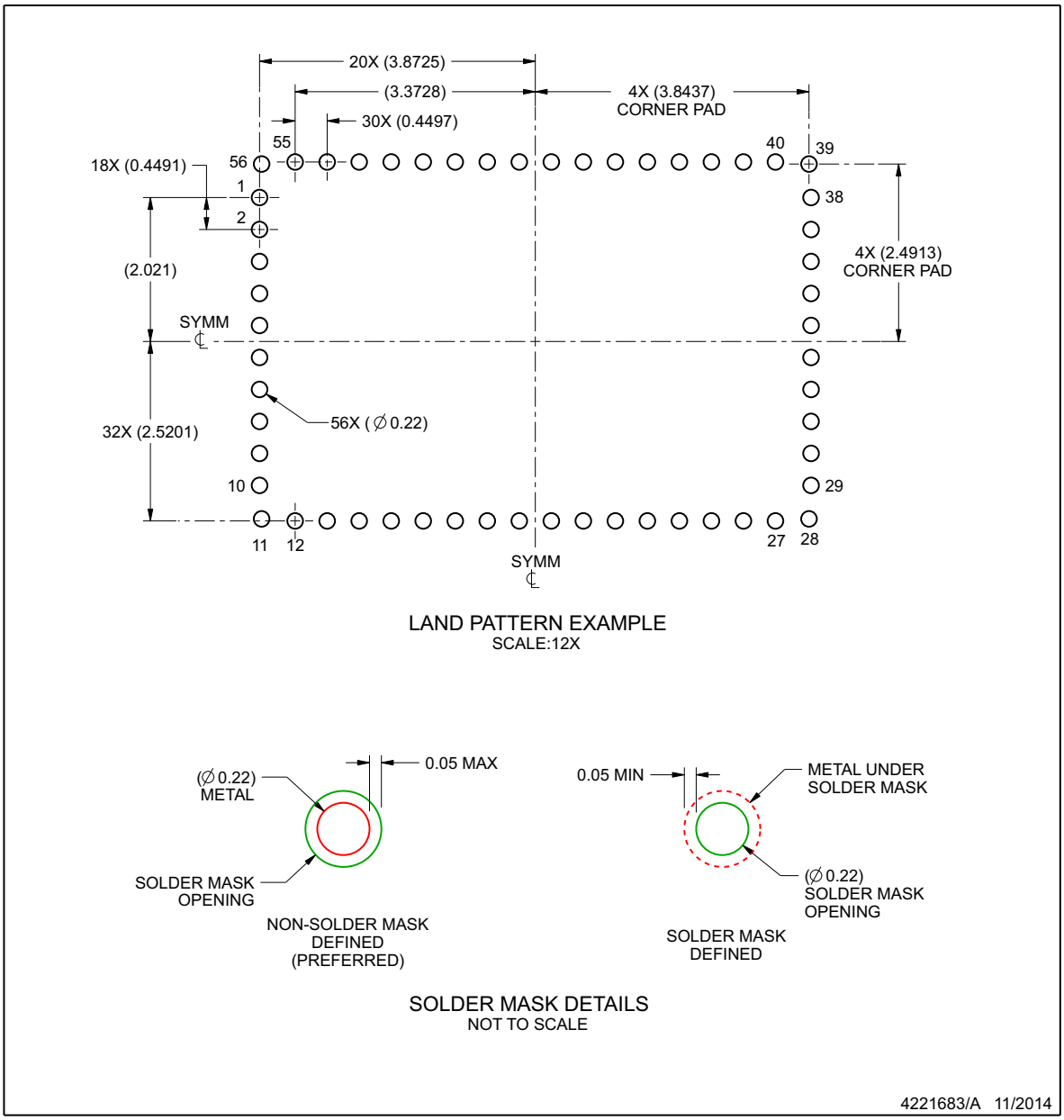
EXAMPLE BOARD LAYOUT

NBP0056A

COG - 0.745 mm max height

CHIP ON GLASS



NOTES: (continued)

5. PCB pads shift from original positions to prevent solder balls from touching sensor. X and Y direction: 0.05 mm. Corner pads: 0.03 mm.
6. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
   For information, see Texas Instruments literature number SSYZ015 (www.ti.com/lit/ssyz015).

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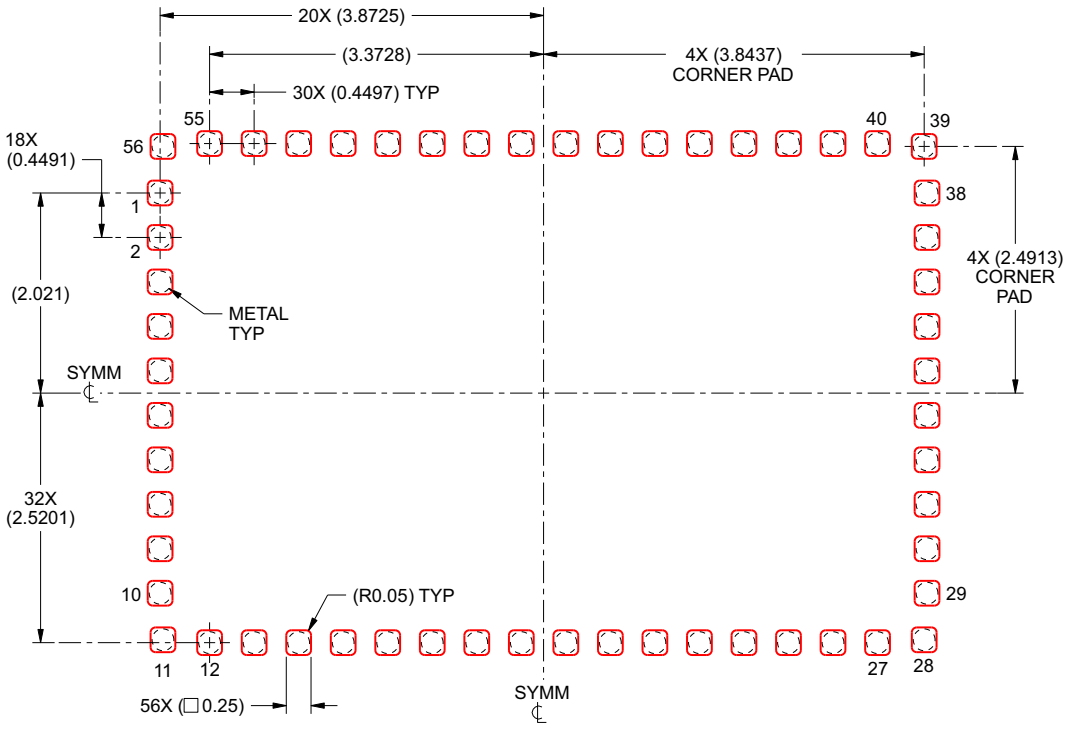
EXAMPLE STENCIL DESIGN

NBP0056A

COG - 0.745 mm max height

CHIP ON GLASS



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:15X

4221683/A 11/2014

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

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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
OPT8320NBPL	ACTIVE	COG	NBP	56	3000	RoHS & Green	SNAGCU	Level-3-260C-168 HR	0 to 70	OPT8320	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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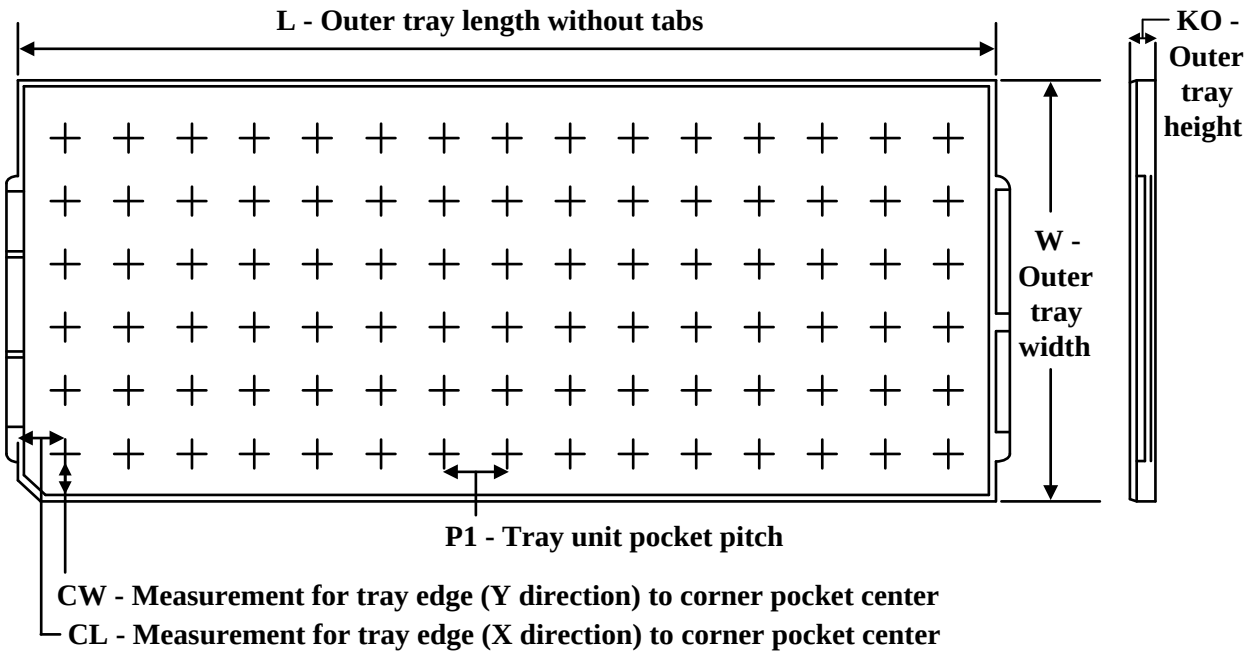
TRAY



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

*All dimensions are nominal

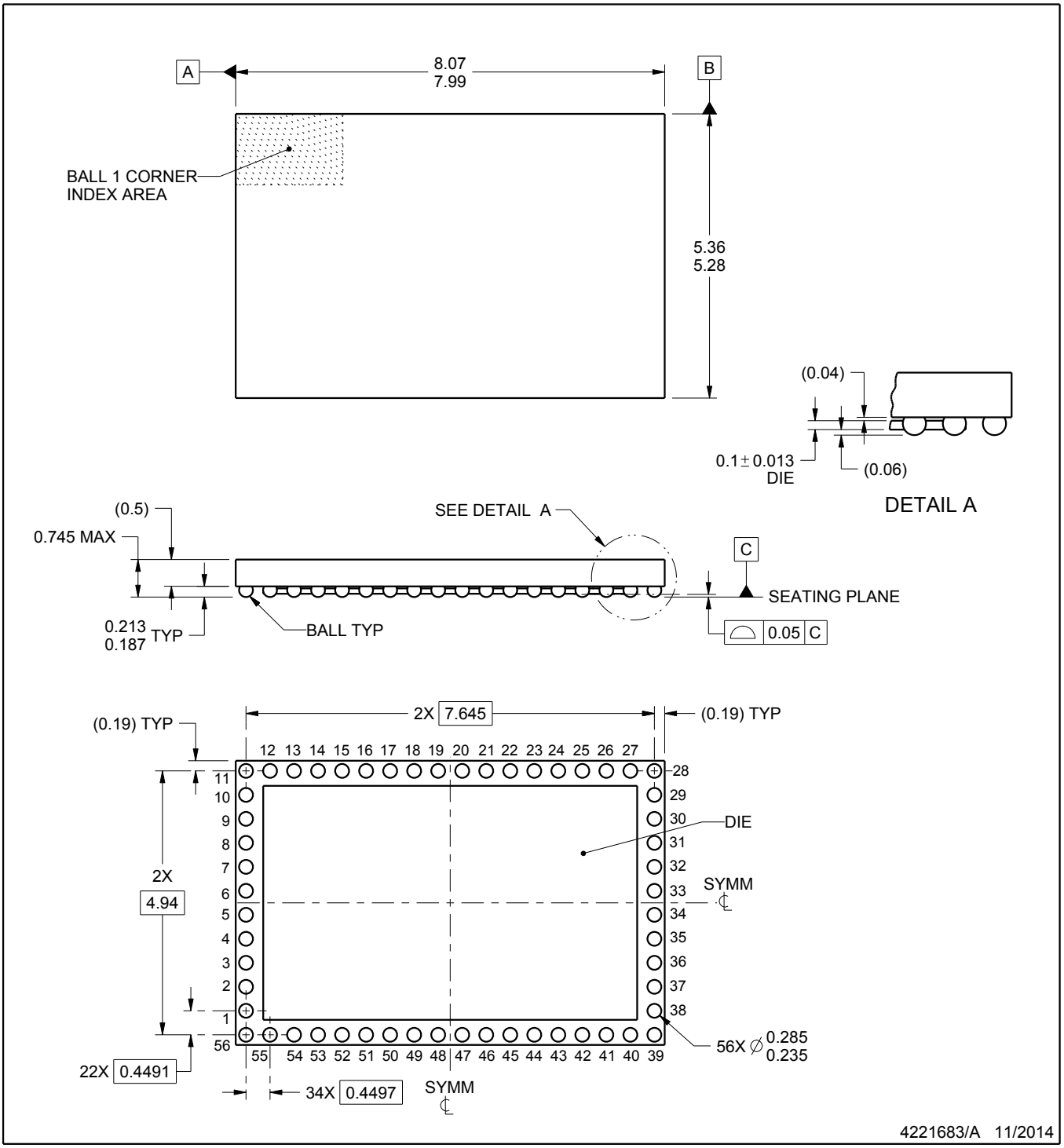
Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
OPT8320NBPL	NBP	COG	56	3000	10 x 30	150	315	135.9	7620	12.5	11.7	9.6

PACKAGE OUTLINE

NBP0056A

COG - 0.745 mm max height

CHIP ON GLASS



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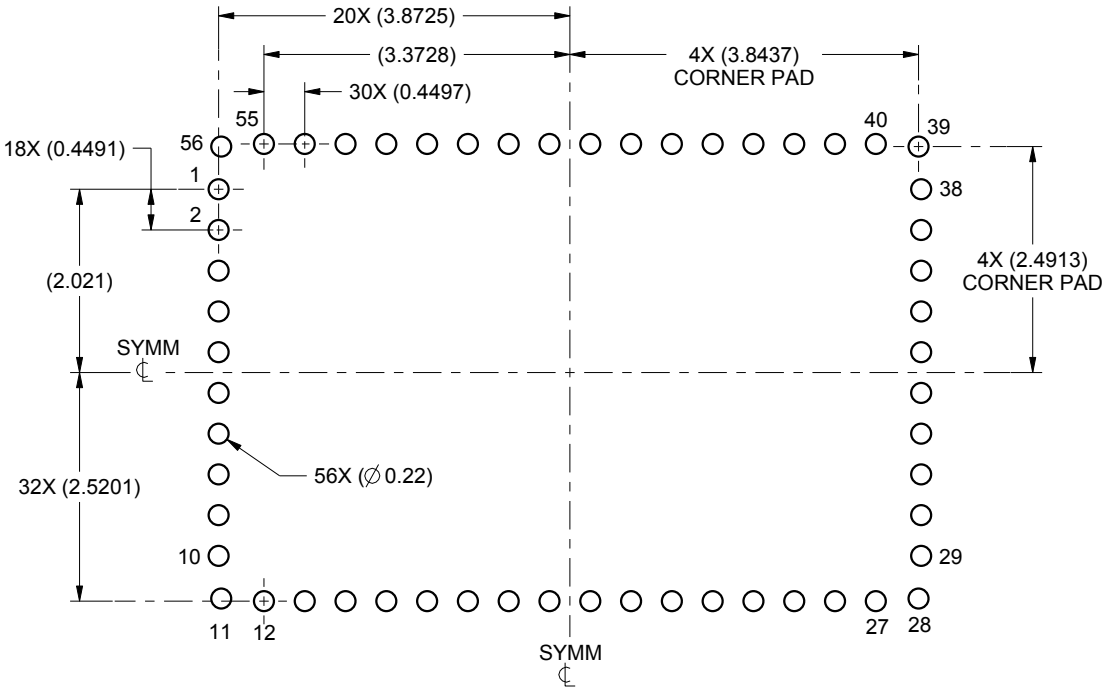
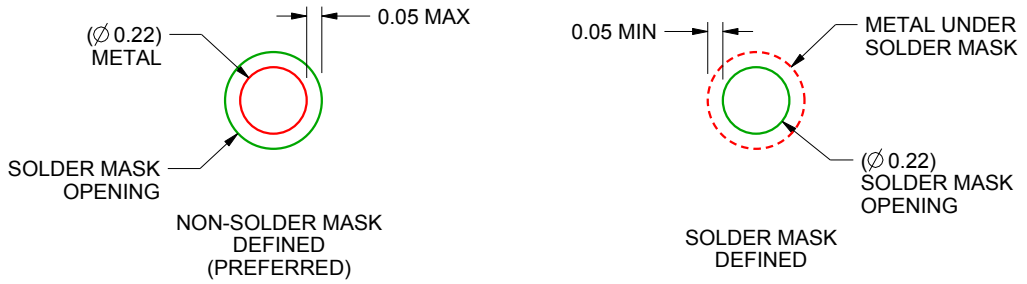


LAND PATTERN EXAMPLE
SCALE:12X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

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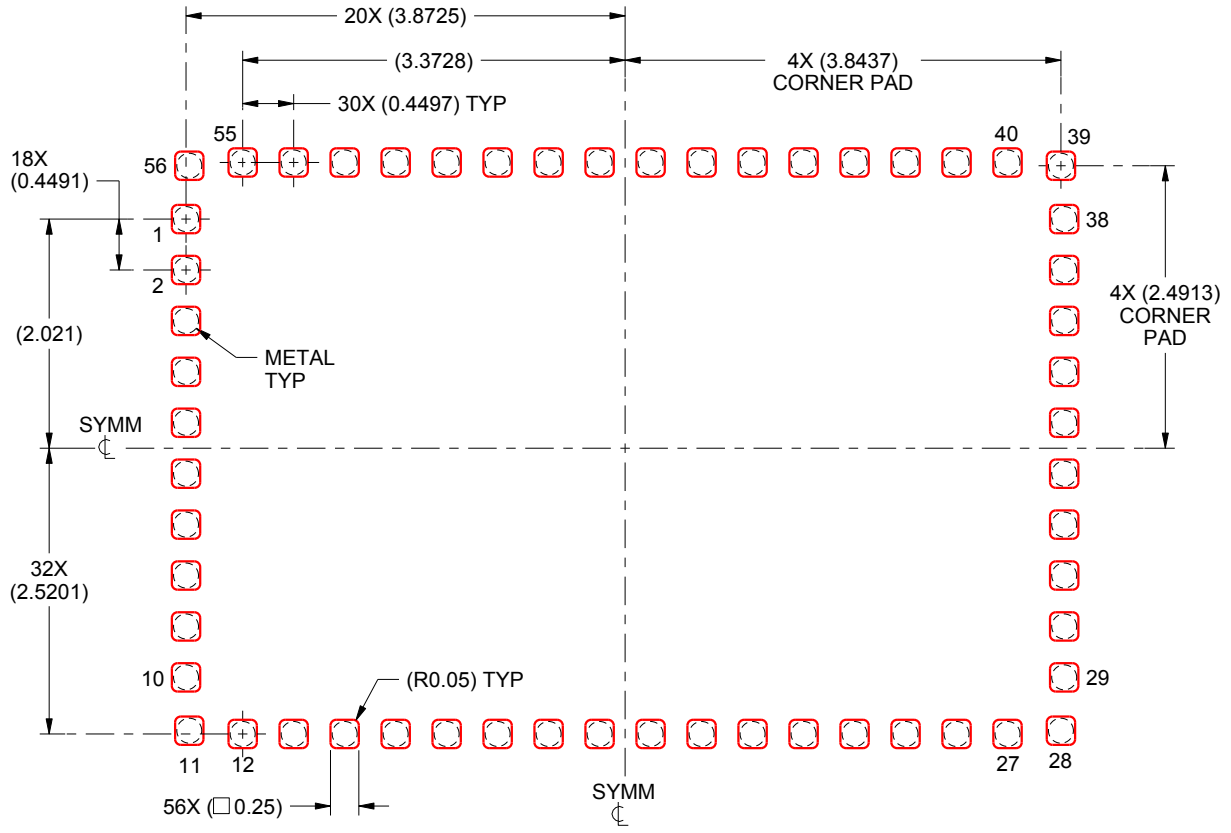

SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

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