

28-BIT TO 56-BIT REGISTERED BUFFER WITH ADDRESS PARITY TEST ONE PAIR TO FOUR PAIR DIFFERENTIAL CLOCK PLL DRIVER

FEATURES

- JEDEC SSTE32882 Compliant
- 1-to-2 Register Outputs and 1-to-4 Clock Pair Outputs Support Stacked DDR3 DIMMs
- Chip Select Inputs Prevent Data Outputs from Changing State and Minimize System Power Consumption
- 1.5-V Phase Lock Loop Clock Driver Buffers One Differential Clock Pair (CK and $\overline{\text{CK}}$) and Distributes to Four Differential Outputs
- 1.5-V CMOS Inputs
- Checks Parity on Command and Address (CS-gated) Data Inputs
- Supports LVCMOS Switching Levels on $\overline{\text{RESET}}$ Input
- $\overline{\text{RESET}}$ Input:
 - Disables Differential Input Receivers
 - Resets All Registers
 - Forces All Outputs into Pre-defined States
- Optimal Pinout for DDR3 DIMM PCB Layout
- Supports Four Chip Selects
- Single Register Backside Mount Support

APPLICATIONS

- DDR3 Registered DIMMs up to DDR3-1333
- Single-, Dual- and Quad-Rank RDIMM

DESCRIPTION/ORDERING INFORMATION

This JEDEC SSTE32882-compliant, 28-bit 1:2 or 26-bit 1:2 and 4-bit 1:1 registering clock driver with parity is designed for operation on DDR3 Registered DIMMs up to DDR3-1333 with V_{DD} of 1.5 V.

All inputs are 1.5-V, CMOS-compatible. All outputs are 1.5-V CMOS drivers optimized to drive DRAM signals on terminated traces in DDR3 RDIMM applications. Clock outputs $\overline{\text{Yn}}$ and Yn and control net outputs DxCkEn , $\overline{\text{DxCsN}}$, and DxODTn can each be driven with a different strength and skew to optimize signal integrity, compensate for different loading, and balance signal travel speed.

The SN74SSQE32882 has two basic modes of operation associated with the Quad Chip Select Enable ($\overline{\text{QCSSEN}}$) input.

First, when the $\overline{\text{QCSSEN}}$ input pin is open or pulled high, the component has two chip select inputs, $\overline{\text{DCS0}}$ and $\overline{\text{DCS1}}$, and two copies of each chip select output, $\overline{\text{QACS0}}$, $\overline{\text{QACS1}}$, $\overline{\text{QBCS0}}$ and $\overline{\text{QBCS1}}$. This mode is the *QuadCS disabled* mode. Alternatively, when the $\overline{\text{QCSSEN}}$ input pin is pulled low, the component has four chip select inputs $\overline{\text{DCS}}[3:0]$, and four chip select outputs, $\overline{\text{QCS}}[3:0]$. This mode is the *QuadCS enabled* mode.

When $\overline{\text{QCSSEN}}$ is high or floating, the device also supports an operating mode that allows a single device to be mounted on the back side of a DIMM array. This device can then be configured to keep the input bus termination (IBT) feature enabled for all input signals independent of MIRROR. The SN74SSQE32882 operates from a differential clock (CK and $\overline{\text{CK}}$). Data are registered at the crossing of CK going high and $\overline{\text{CK}}$ going low. This data can either be re-driven to the outputs or used to access internal control registers. Details are covered in the Function Tables (each flip-flop) with $\overline{\text{QCSSEN}} = \text{low}$.

Input bus data integrity is protected by a parity function. All address and command input signals are summed; the last bit of the sum is then compared to the parity signal delivered by the system at the $\overline{\text{PAR_IN}}$ input one clock cycle later. If these two values do not match, the device pulls the open drain output $\overline{\text{ERROUT}}$ low. The control signals ($\overline{\text{DCKE0}}$, $\overline{\text{DCKE1}}$, $\overline{\text{DODT0}}$, $\overline{\text{DODT1}}$, and $\overline{\text{DCS}}[n:0]$) are not part of this computation.

The SN74SSQE32882 implements different power-saving mechanisms to reduce thermal power dissipation and to support system power-down states. Power consumption is further reduced by disabling unused outputs.

The package design is optimal for high-density DIMMs. By aligning input and output positions towards DIMM finger-signal ordering and SDRAM ballout, the device de-scrambles the DIMM traces and allows low crosstalk designs with low interconnect latency. Edge-controlled outputs reduce ringing and improve signal eye opening at the SDRAM inputs.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Copyright © 2008, Texas Instruments Incorporated



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.

ORDERING INFORMATION⁽¹⁾

T _{CASE}	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C - T _{case} (see Table 1)	176ZAL	Tape and Reel	SN74SSQE32882ZALR	TE32882E
	176ZCJ	Tape and Reel	SN74SSQE32882ZCJR	TE32882E

- (1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
 (2) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted). ⁽¹⁾

PARAMETER			VALUE	UNIT
V _{DD}	Supply voltage		−0.4 to +1.975	V
V _I	Receiver input voltage	See ⁽²⁾ and ⁽³⁾	−0.4 to V _{DD} + 0.5	V
V _{REF}	Reference voltage		−0.4 to V _{DD} + 0.5	V
V _O	Driver output voltage	See ⁽²⁾ and ⁽³⁾	−0.4 to V _{DD} + 0.5	V
I _{IK}	Input clamp current	V _I < 0 or V _I > V _{DD}	−50	mA
I _{OK}	Output clamp current	V _O < 0 or V _O > V _{DD}	±50	mA
I _O	Continuous output current	0 < V _O < V _{DD}	±50	mA
I _{CCC}	Continuous current through each V _{DD} or GND pin		±100	mA
T _{stg}	Storage temperature		−65 to +150	°C

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
 (2) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 (3) This value is limited to 2.2 V maximum.

Table 1. Case Temperature vs Speed Node

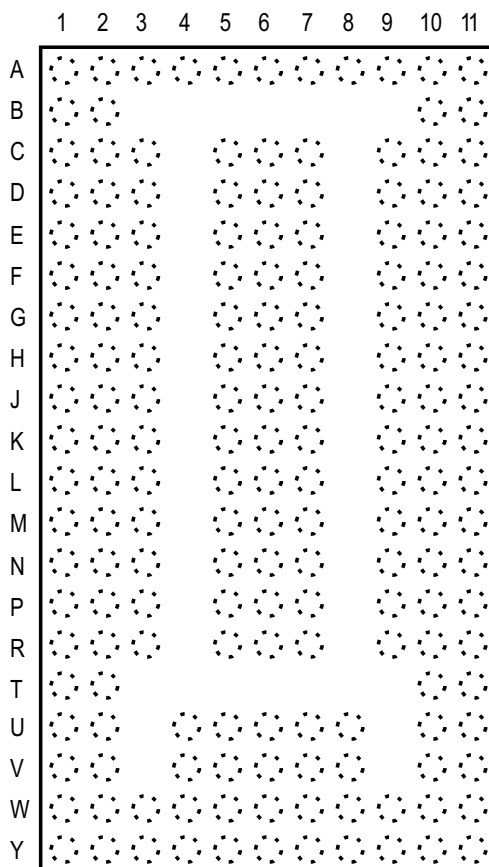
PARAMETER		DDR3-800	DDR3-1066	DDR3-1333	DDR3-1600	UNIT
T _{case}	Maximum case temperature ⁽¹⁾	+109	+108	+106	+103	°C

- (1) The temperature values fit to JEDEC RAW cards A, B, and C. The user must keep T_{case} below the specified values in order to keep the junction temperature below +125°C. Other combinations of features and termination resistors can require lower case temperature and extra cooling. These combinations depend on the specific application.

PACKAGE INFORMATION

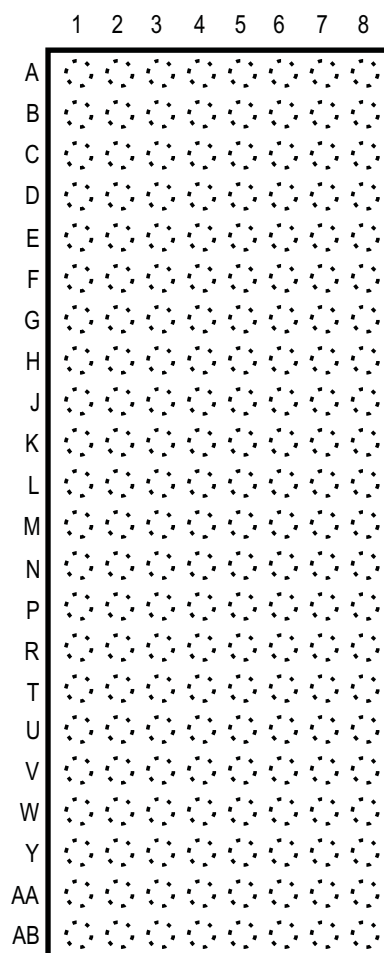
ZAL Package

The package is an 8-mm × 13.5-mm, 176-pin ball grid array (BGA) with 0.65-mm ball pitch in an 11 × 20 grid. The device pinout supports outputs on the outer two left and right columns to support easy DIMM signal routing. Corresponding inputs are placed in such a way that two devices can be placed back-to-back for four rank modules while the data inputs share the same vias. Each input and output is located close to an associated no-ball position or on the outer two rows to allow for low-cost via technology combined with the small, 0.65-mm ball pitch.



ZCJ Package

The package is an 6-mm × 15-mm, 176-pin ball grid array (BGA) with 0.65-mm ball pitch in an 8 × 22 grid. The device pinout supports outputs on the outer two left and right columns to support easy DIMM signal routing. Corresponding inputs are placed in such a way that two devices can be placed back-to-back for four rank modules while the data inputs share the same vias.



NOTE:

To request more information on SN74SSQE32882 DDR3 Register/PLL please contact support@ti.com.

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
SN74SSQE32882ZALR	NRND	NFBGA	ZAL	176	2000	Green (RoHS & no Sb/Br)	SNAGCU	Level-3-260C-168 HR	0 to 85	TE32882E	
SN74SSQE32882ZCJR	NRND	NFBGA	ZCJ	176		TBD	Call TI	Call TI	0 to 85		

(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.

TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74SSQE32882ZALR	NFBGA	ZAL	176	2000	330.0	24.4	8.3	13.8	1.8	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

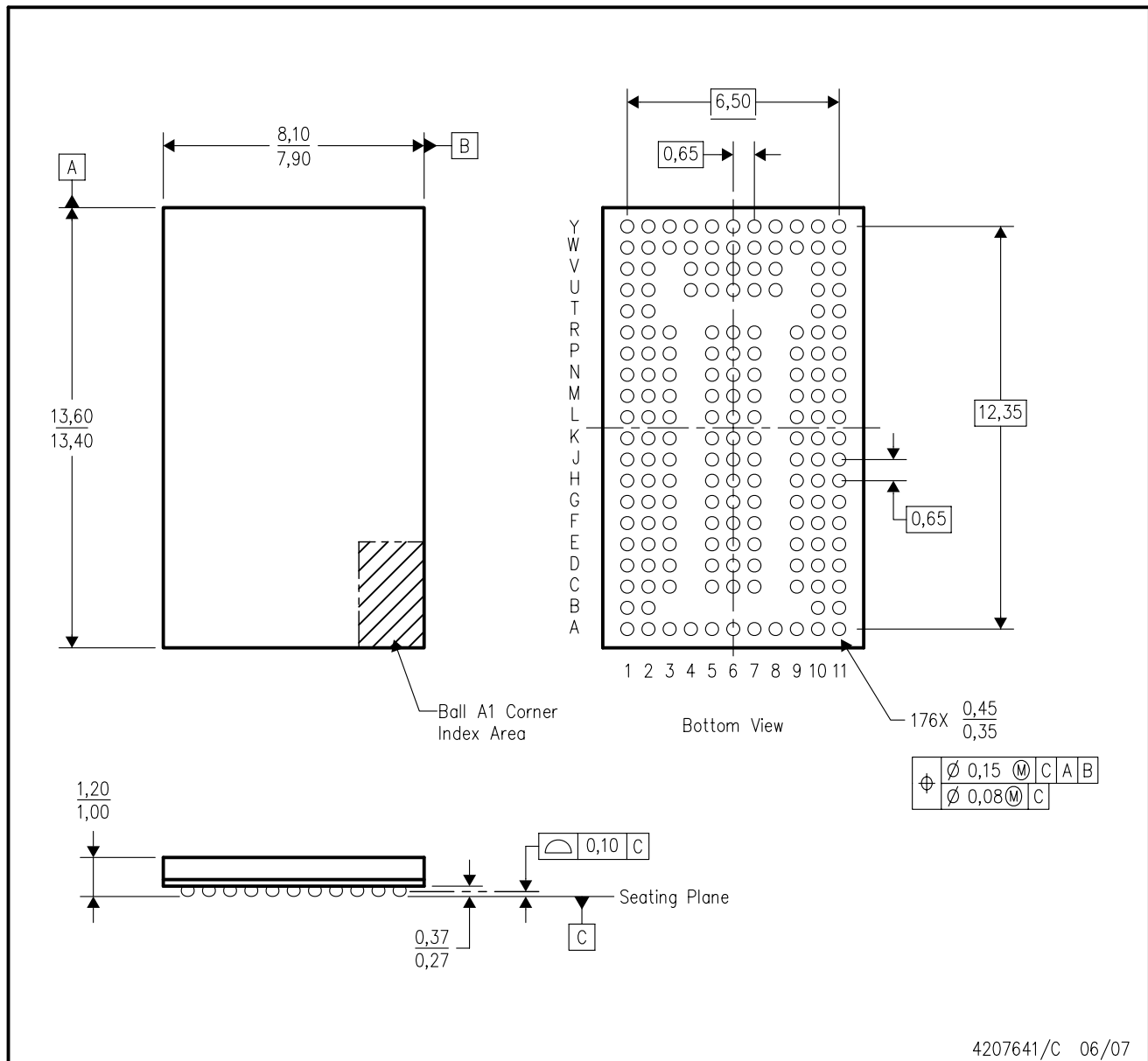


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74SSQE32882ZALR	NFBGA	ZAL	176	2000	336.6	336.6	31.8

ZAL (R-PBGA-N176)

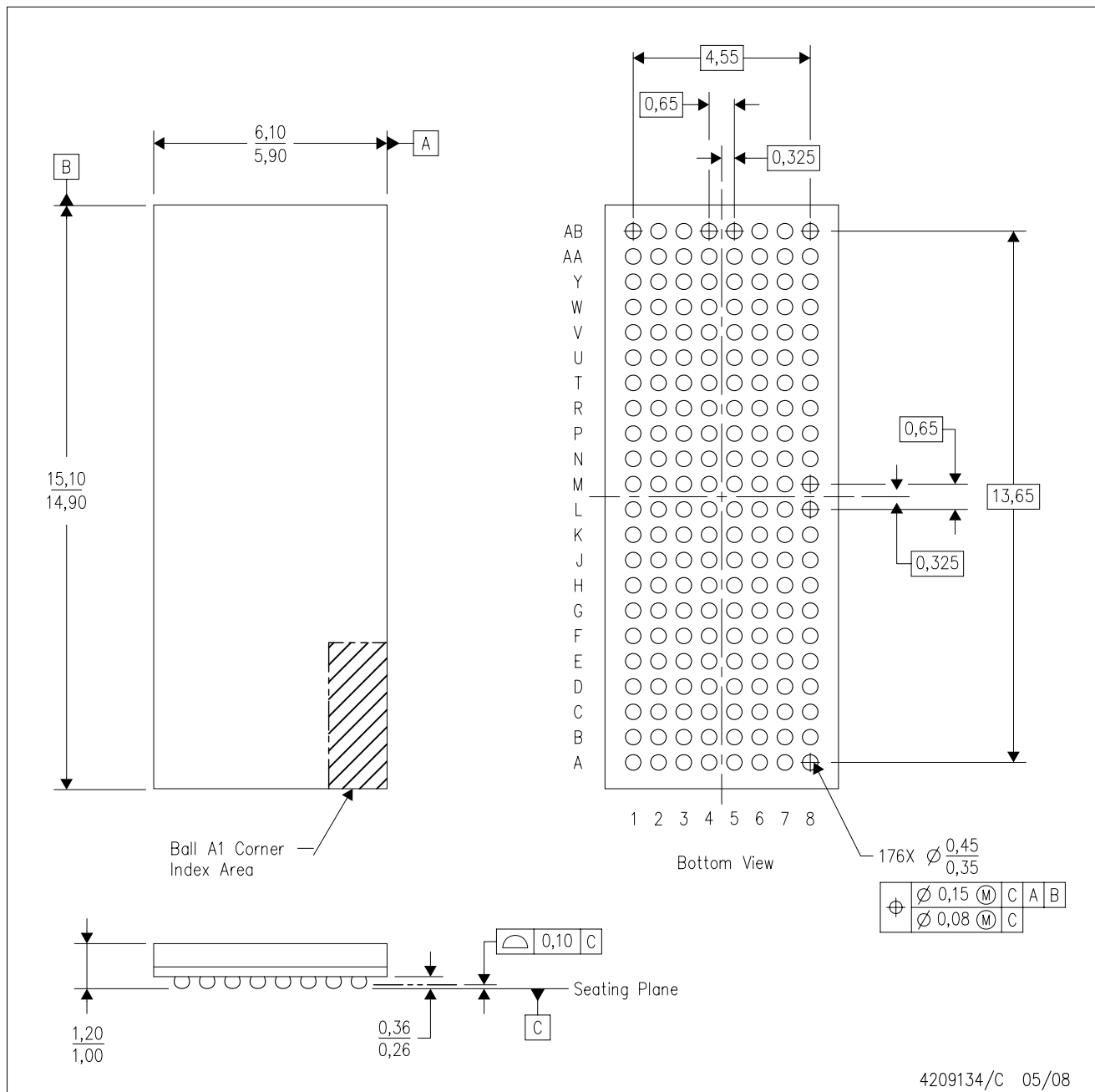
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. This package is lead-free.

ZCJ (R-PBGA-N176)

PLASTIC BALL GRID ARRAY



- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - nFBGA configuration
 - This is a lead-free solder ball design.

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

Applications

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

TI E2E Community

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2015, Texas Instruments Incorporated