SN74SSTV32877
26-BIT REGISTERED BUFFER WITH SSTL_2 INPUTS AND OUTPUTS

SCES378B – OCTOBER 2001 – REVISED MAY 2002

- **Member of the Texas Instruments Widebus+™ Family**
- **Supports SSTL_2 Data Inputs**
- **Outputs Meet SSTL_2 Class II Specifications**
- **Differential Clock Inputs (CLK and $\overline{\text{CLK}}$)**
- **Supports LVCMOS Switching Levels on the $\overline{\text{RESET}}$ Input**
- **$\overline{\text{RESET}}$ Input Disables Differential Input Receivers, Resets All Registers, and Forces All Outputs Low**
- **Flow-through Architecture Optimizes PCB Layout**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

description

This 26-bit registered buffer is designed for 2.3-V to 2.7-V V_{CC} operation.

All inputs are SSTL_2, except the LVCMOS reset ($\overline{\text{RESET}}$) input. All outputs are SSTL_2, Class II compatible.

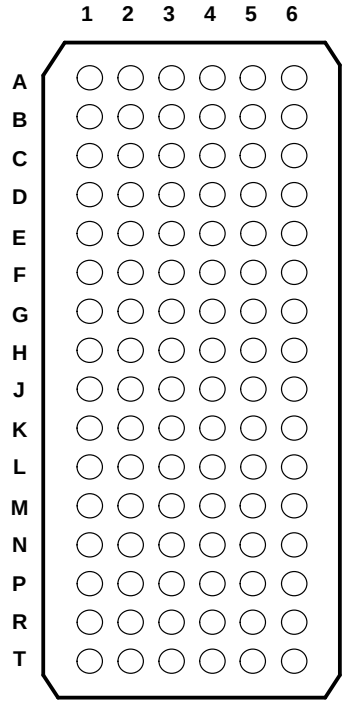
The SN74SSTV32877 operates from a differential clock (CLK and $\overline{\text{CLK}}$). Data are registered at the crossing of CLK going high and $\overline{\text{CLK}}$ going low.

The device supports low-power standby operation. When $\overline{\text{RESET}}$ is low, the differential input receivers are disabled, and undriven (floating) data, clock, and reference voltage (V_{REF}) inputs are allowed. In addition, when $\overline{\text{RESET}}$ is low, all registers are reset and all outputs are forced low. The LVCMOS $\overline{\text{RESET}}$ input always must be held at a valid logic high or low level. When $\overline{\text{OE}}$ and $\overline{\text{RESET}}$ are high, the outputs are in the high-impedance state.

To ensure defined outputs from the register before a stable clock has been supplied, $\overline{\text{RESET}}$ must be held in the low state during power up.

Obsolete Device

GKE PACKAGE
(TOP VIEW)



terminal assignments

	1	2	3	4	5	6
A	D1	V_{CC}	GND	V_{DDQ}	Q1	Q2
B	D3	D2	V_{REF}	GND	Q3	Q4
C	D5	D4	NC	GND	Q5	Q6
D	D7	D6	GND	V_{DDQ}	Q7	Q8
E	D9	D8	V_{CC}	GND	Q9	V_{DDQ}
F	D11	D10	GND	V_{DDQ}	Q10	GND
G	D13	D12	V_{CC}	V_{DDQ}	Q12	Q11
H	D15	D14	GND	GND	GND	Q13
J	CLK	NC	GND	GND	GND	Q14
K	$\overline{CLK}$	$\overline{RESET}$	V_{CC}	V_{DDQ}	Q15	Q16
L	D16	D17	GND	V_{DDQ}	Q17	GND
M	D18	D19	V_{CC}	GND	Q18	V_{DDQ}
N	D20	D21	GND	V_{DDQ}	Q20	Q19
P	D22	D23	NC	GND	Q22	Q21
R	D24	D25	$\overline{OE}$	GND	Q24	Q23
T	D26	V_{CC}	GND	V_{DDQ}	Q26	Q25

ORDERING INFORMATION

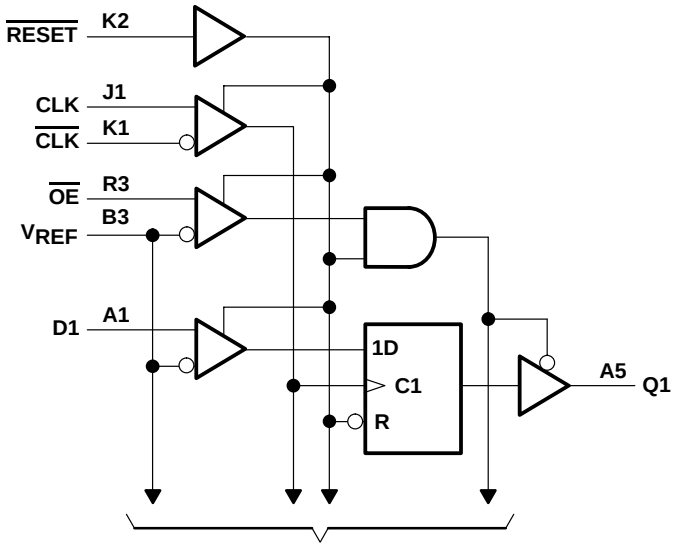
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	LFBGA – GKE	Tape and reel	SN74SSTV32877GKER	SV877

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

INPUTS					OUTPUT
$\overline{RESET}$	$\overline{OE}$	CLK	$\overline{CLK}$	D	Q
H	L	↑	↓	H	H
H	L	↑	↓	L	L
H	L	L or H	L or H	X	Q_0
H	H	X	X	X	Z
L	X or floating	X or floating	X or floating	X or floating	L

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} or V_{DDQ} . . . . . –0.5 V to 3.6 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to V_{CC} + 0.5 V
Output voltage range, V_O (see Notes 1 and 2) . . . . . –0.5 V to V_{DDQ} + 0.5 V
Input clamp current, I_{IK} (V_I < 0) . . . . . –50 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{DDQ}) . . . . . ±50 mA
Continuous output current, I_O (V_O = 0 to V_{DDQ}) . . . . . ±50 mA
Continuous current through each V_{CC}, V_{DDQ}, or GND . . . . . ±100 mA
Package thermal impedance, θ_{JA} (see Note 3) . . . . . 40°C/W
Storage temperature range, T_{stg} . . . . . –65°C to 150°C

† 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 “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 3.6 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

Obsolete Device

recommended operating conditions (see Note 4)

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		V_{DDQ}		2.7	V
V_{DDQ}	Output supply voltage		2.3		2.7	V
V_{REF}	Reference voltage ($V_{REF} = V_{DDQ}/2$)		1.15	1.25	1.35	V
V_{TT}	Termination voltage		V_{REF}–40mV	V_{REF}	V_{REF}+40mV	V
V_I	Input voltage		0		V_{CC}	V
V_{IH}	AC high-level input voltage	$\overline{OE}$, data inputs	V_{REF}+310mV			V
V_{IL}	AC low-level input voltage	$\overline{OE}$, data inputs			V_{REF}–310mV	V
V_{IH}	DC high-level input voltage	$\overline{OE}$, data inputs	V_{REF}+150mV			V
V_{IL}	DC low-level input voltage	$\overline{OE}$, data inputs			V_{REF}–150mV	V
V_{IH}	High-level input voltage	$\overline{RESET}$	1.7			V
V_{IL}	Low-level input voltage	$\overline{RESET}$			0.7	V
V_{ICR}	Common-mode input voltage range	CLK, $\overline{CLK}$	0.97		1.53	V
$V_{I(PP)}$	Peak-to-peak input voltage	CLK, $\overline{CLK}$	360			mV
I_{OH}	High-level output current				-20	mA
I_{OL}	Low-level output current				20	
T_A	Operating free-air temperature		0		70	°C

NOTE 4: The $\overline{RESET}$ input of the device must be held at V_{CC} or GND to ensure proper device operation. The differential inputs must not be floating unless $\overline{RESET}$ is low. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		V_{CC}	MIN	TYP†	MAX	UNIT
V_{IK}		I_I = –18 mA		2.3 V			–1.2	V
V_{OH}		I_{OH} = –100 µA		2.3 V to 2.7 V	V_{CC}–0.2			V
		I_{OH} = –16 mA		2.3 V	1.95			
V_{OL}		I_{OL} = 100 µA		2.3 V to 2.7 V			0.2	V
		I_{OL} = 16 mA		2.3 V			0.35	
I_I	All inputs	$V_I = V_{CC}$ or GND		2.7 V			±5	µA
I_{CC}	Static standby	$\overline{RESET}$ = GND	I_O = 0	2.7 V			40	µA
	Static operating	$\overline{RESET} = V_{CC}$, $V_I = V_{IH(AC)}$ or $V_{IL(AC)}$					95	mA
I_{CCD}	Dynamic operating – clock only	$\overline{RESET} = V_{CC}$, $V_I = V_{IH(AC)}$ or $V_{IL(AC)}$, CLK and $\overline{CLK}$ switching 50% duty cycle	I_O = 0	2.5 V		44		µA/ MHz
	Dynamic operating – per each data input	$\overline{RESET} = V_{CC}$, $V_I = V_{IH(AC)}$ or $V_{IL(AC)}$, CLK and $\overline{CLK}$ switching 50% duty cycle, One data input switching at one-half clock frequency, 50% duty cycle				5		µA/ clock MHz/ D input
I_{OZ}	Outputs	$V_O = V_{CC}$ or GND,	V_I ($\overline{OE}$) = V_{CC}	2.7 V			±10	µA
r_{OH}	Output high	I_{OH} = –20 mA		2.3 V to 2.7 V	7		20	Ω
r_{OL}	Output low	I_{OL} = 20 mA		2.3 V to 2.7 V	7		20	Ω
$r_{O(\Delta)}$	$\lvert r_{OH} - r_{OL} \rvert$	I_O = 20 mA, T_A = 25°C		2.5 V			6	Ω
C_i‡	Data inputs and $\overline{OE}$	$V_I = V_{REF} \pm 310$ mV		2.5 V	2.5	3.3	4	pF
	CLK, $\overline{CLK}$	V_{ICR} = 1.25 V,	$V_{I(PP)}$ = 360 mV		3	3.5	4	
	$\overline{RESET}$	$V_I = V_{CC}$ or GND			3	4	4.5	
C_o‡	Outputs	V_O = 1.7 V or 0.8 V		2.5 V	6.5	7.6	9	pF

† All typical values are at V_{CC} = 2.5 V, T_A = 25°C.
‡ Measured with 50-MHz input frequency

Obsolete Device

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

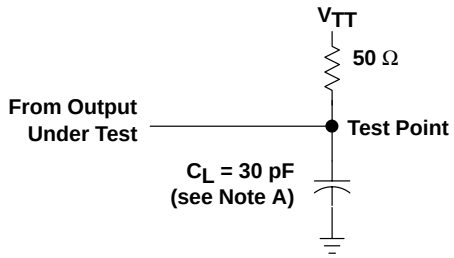
				V_{CC} = 2.5 V ± 0.2 V		UNIT
				MIN	MAX	
f_{clock}	Clock frequency				200	MHz
t_w	Pulse duration, CLK, $\overline{CLK}$ high or low			2.5		ns
t_{act}	Differential inputs active time (see Note 5)				22	ns
t_{inact}	Differential inputs inactive time (see Note 6)				22	ns
t_{su}	Setup time	Fast slew rate (see Notes 7 and 9)	Data before CLK↑, $\overline{CLK}$↓	0.75		ns
		Slow slew rate (see Notes 8 and 9)		0.9		
t_h	Hold time	Fast slew rate (see Notes 7 and 9)	Data after CLK↑, $\overline{CLK}$↓	0.75		ns
		Slow slew rate (see Notes 8 and 9)		0.9		

NOTES: 5. Data inputs must be low a minimum time of t_{act} min, after $\overline{RESET}$ is taken high.
6. Data and clock inputs must be held at valid levels (not floating) a minimum time of t_{inact} min, after $\overline{RESET}$ is taken low.
7. Data signal input slew rate ≥1 V/ns
8. Data signal input slew rate ≥0.5 V/ns and <1 V/ns
9. CLK, $\overline{CLK}$ input slew rates are ≥1 V/ns.

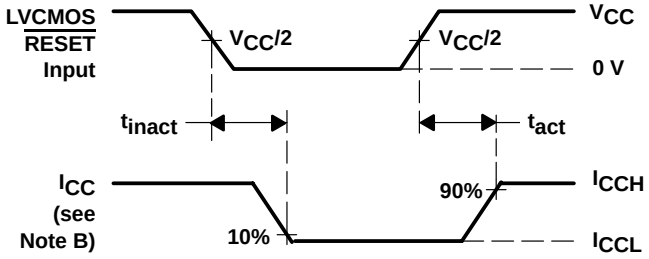
switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 2.5 V ± 0.2 V		UNIT
			MIN	MAX	
f_{max}			200		MHz
t_{pd}	CLK and $\overline{CLK}$	Q	1.1	2.8	ns
t_{PHL}	$\overline{RESET}$	Q		5	ns
t_{en}	$\overline{OE}$	Q		5	ns
t_{dis}	$\overline{OE}$	Q		6.3	ns

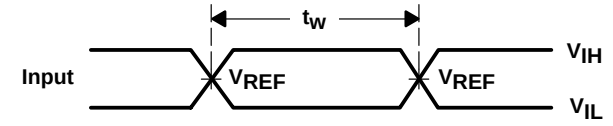
PARAMETER MEASUREMENT INFORMATION



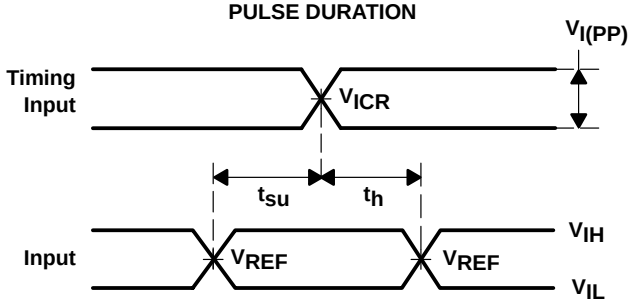
LOAD CIRCUIT



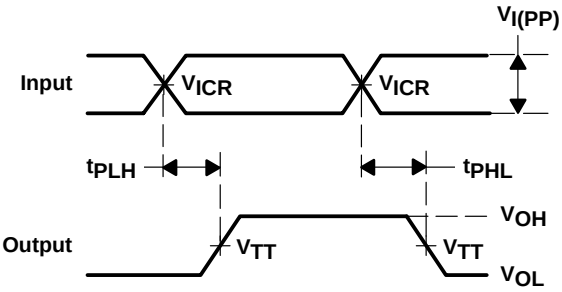
VOLTAGE AND CURRENT WAVEFORMS
INPUTS ACTIVE AND INACTIVE TIMES



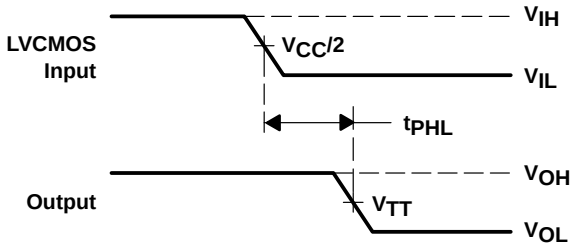
VOLTAGE WAVEFORMS
PULSE DURATION



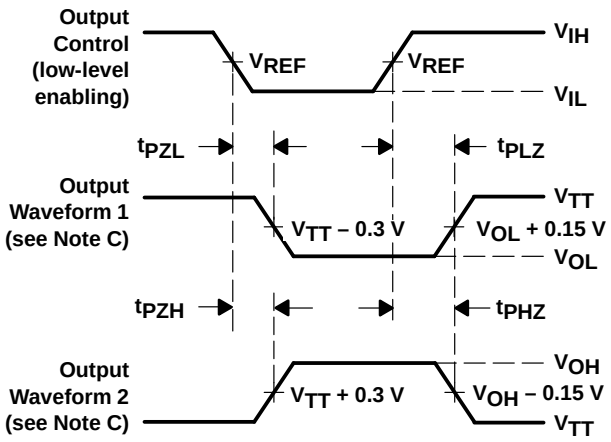
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES:
A. C_L includes probe and jig capacitance.
B. I_{CC} tested with clock and data inputs held at V_{CC} or GND, and I_O = 0 mA.
C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
D. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, input slew rate = 1 V/ns ±20% (unless otherwise noted).
E. The outputs are measured one at a time with one transition per measurement.
F. $V_{TT} = V_{REF} = V_{DDQ}/2$
G. $V_{IH} = V_{REF}$ + 310 mV (ac voltage levels) for differential inputs. $V_{IH} = V_{CC}$ for LVCMOS input.
H. $V_{IL} = V_{REF}$ – 310 mV (ac voltage levels) for differential inputs. V_{IL} = GND for LVCMOS input.
I. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
J. t_{PZL} and t_{PZH} are the same as t_{en}.
K. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms

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
SN74SSTV32877GKER	OBSOLETE	LFBGA	GKE	96		TBD	Call TI	Call TI	0 to 70	SV877	

(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)

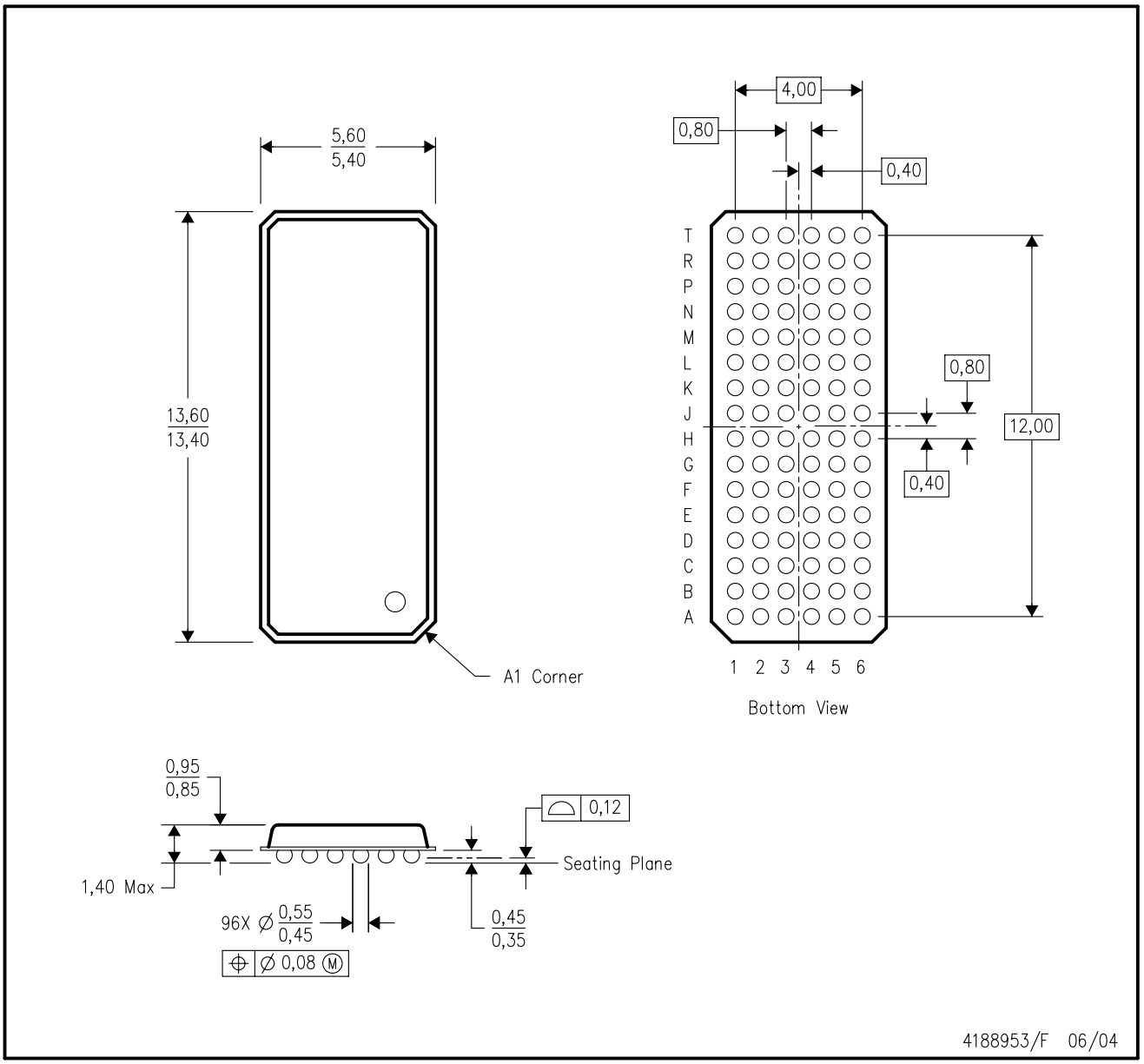
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

GKE (R–PBGA–N96) PLASTIC BALL GRID ARRAY



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–205 variation CC.
D. This package is tin–lead (SnPb). Refer to the 96 ZKE package (drawing 4204493) for lead–free.

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		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265