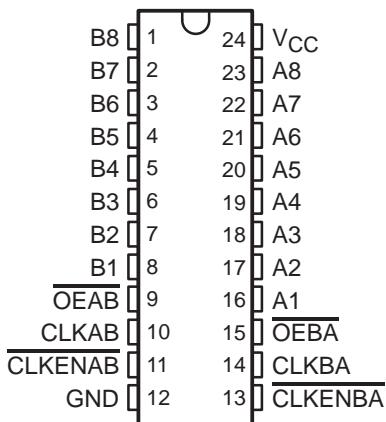


SN54LVTH2952, SN74LVTH2952
3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS

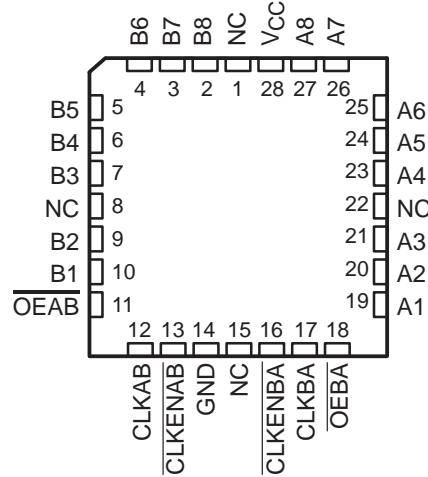
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- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Support Unregulated Battery Operation Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ C$
- I_{off} and Power-Up 3-State Support Hot Insertion
- Bus-Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)

SN54LVTH2952 . . . JT PACKAGE
 SN74LVTH2952 . . . DB, DGV, DW, NS, OR PW PACKAGE
 (TOP VIEW)



SN54LVTH2952 . . . FK PACKAGE
 (TOP VIEW)



NC – No internal connection

description/ordering information

These octal bus transceivers and registers are designed specifically for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

ORDERING INFORMATION

T_A	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tube	SN74LVTH2952DW	LVTH2952
		Tape and reel	SN74LVTH2952DWR	
	SOP – NS	Tape and reel	SN74LVTH2952NSR	LVTH2952
	SSOP – DB	Tape and reel	SN74LVTH2952DBR	LK952
	TSSOP – PW	Tube	SN74LVTH2952PW	LK952
		Tape and reel	SN74LVTH2952PWR	
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74LVTH2952DGVR	LK952
	CDIP – JT	Tube	SNJ54LVTH2952JT	SNJ54LVTH2952JT
		Tube	SNJ54LVTH2952FK	

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



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description/ordering information

The 'LVTH2952 devices consist of two 8-bit back-to-back registers that store data flowing in both directions between two bidirectional buses. Data on the A or B bus is stored in the registers on the low-to-high transition of the clock (CLKAB or CLKBA) input, provided that the clock-enable ($\overline{\text{CLKENAB}}$ or $\overline{\text{CLKENBA}}$) input is low. Taking the output-enable ($\overline{\text{OEAB}}$ or $\overline{\text{OEBA}}$) input low accesses the data on either port.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

When V_{CC} is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, $\overline{\text{OE}}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

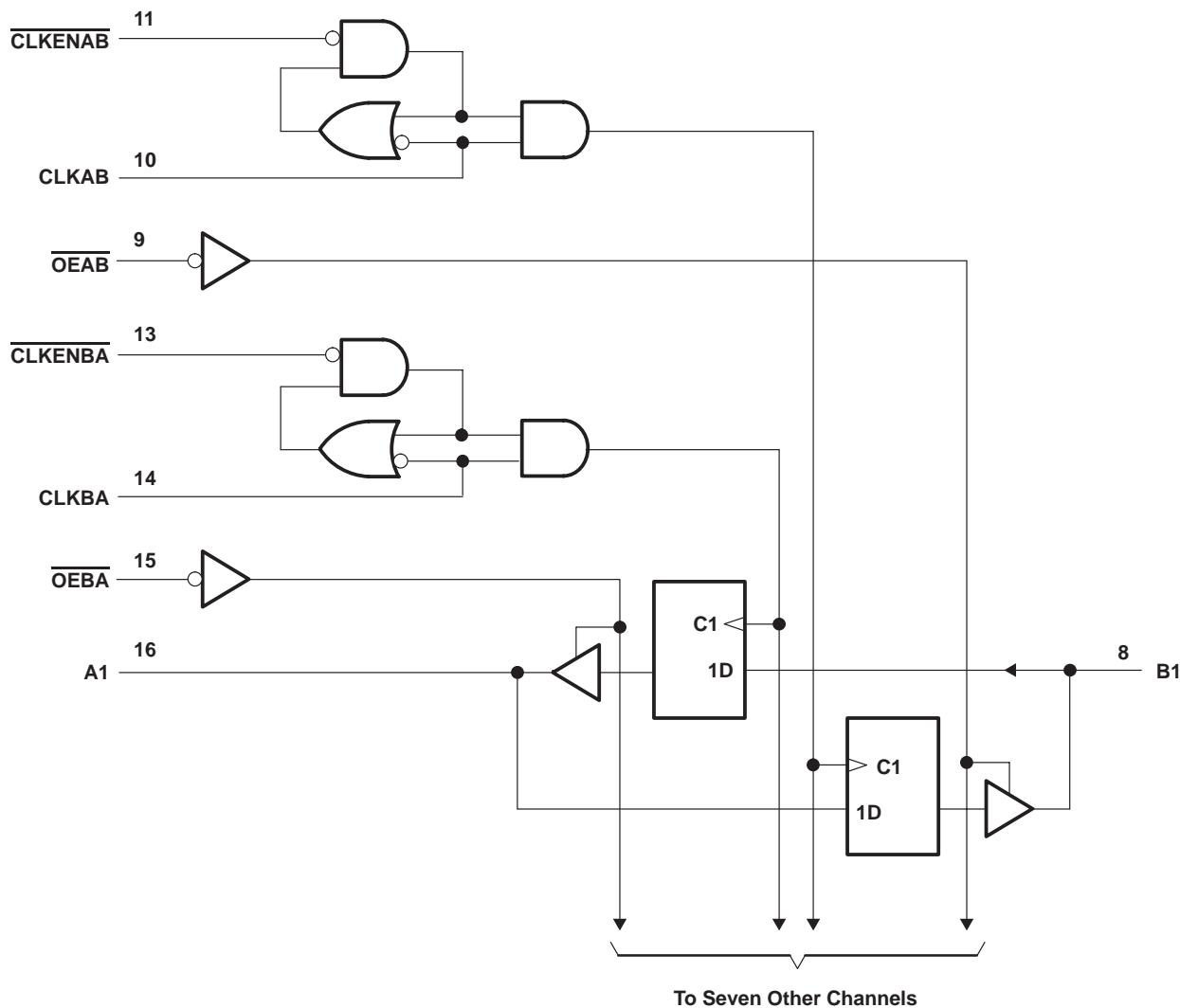
FUNCTION TABLE†

INPUTS				OUTPUT B
CLKENAB	CLKAB	$\overline{\text{OEAB}}$	A	
H	X	L	X	B_0^{\ddagger}
X	H or L	L	X	B_0^{\ddagger}
L	↑	L	L	L
L	↑	L	H	H
X	X	H	X	Z

† A-to-B data flow is shown; B-to-A data flow is similar, but uses $\overline{\text{CLKENBA}}$, CLKBA, and $\overline{\text{OEBA}}$.

‡ Level of B before the indicated steady-state input conditions were established

logic diagram (positive logic)



Pin numbers shown are for the DB, DGV, DW, JT, NS, and PW packages.

SN54LVTH2952, SN74LVTH2952

3.3-V ABT OCTÁL BUS TRANSCEIVERS AND REGISTERS

WITH 3-STATE OUTPUTS

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

† 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 current flows only when the output is in the high state and $V_O > V_{CC}$.
3. The package thermal impedance is calculated in accordance with JEDEC 51-7.

recommended operating conditions (see Note 4)

		SN54LVTH2952		SN74LVTH2952		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	2.7	3.6	2.7	3.6	V
V _{IH}	High-level input voltage	2		2		V
V _{IL}	Low-level input voltage		0.8		0.8	V
V _I	Input voltage		5.5		5.5	V
I _{OH}	High-level output current		-24		-32	mA
I _{OL}	Low-level output current		48		64	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
Δt/ΔV _{CC}	Power-up ramp rate		200	200		μs/V
T _A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 4: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



SN54LVTH2952, SN74LVTH2952
3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS

SCBS710F – OCTOBER 1997 – REVISED OCTOBER 2003

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

PARAMETER	TEST CONDITIONS	SN54LVTH2952			SN74LVTH2952			UNIT	
		MIN	TYP†	MAX	MIN	TYP†	MAX		
V_{IK}	$V_{CC} = 2.7 \text{ V}$, $I_I = -18 \text{ mA}$			-1.2			-1.2	V	
V_{OH}	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$, $I_{OH} = -100 \mu\text{A}$	$V_{CC} - 0.2$			$V_{CC} - 0.2$			V	
	$V_{CC} = 2.7 \text{ V}$, $I_{OH} = -8 \text{ mA}$	2.4			2.4				
	$V_{CC} = 3 \text{ V}$	$I_{OH} = -24 \text{ mA}$	2						
		$I_{OH} = -32 \text{ mA}$			2				
V_{OL}	$V_{CC} = 2.7 \text{ V}$	$I_{OL} = 100 \mu\text{A}$		0.2	0.2			V	
		$I_{OL} = 24 \text{ mA}$		0.5	0.5				
	$V_{CC} = 3 \text{ V}$	$I_{OL} = 16 \text{ mA}$		0.4	0.4				
		$I_{OL} = 32 \text{ mA}$		0.5	0.5				
		$I_{OL} = 48 \text{ mA}$		0.55					
		$I_{OL} = 64 \text{ mA}$			0.55				
	$V_{CC} = 3.6 \text{ V}$	$V_I = V_{CC} \text{ or GND}$		± 1	± 1			μA	
		$V_I = 0 \text{ or } 3.6 \text{ V}$		10	10				
		$V_I = 5.5 \text{ V}$		20	20				
		$V_I = V_{CC}$		1	1				
I_{off}	$V_{CC} = 0$, $V_I \text{ or } V_O = 0 \text{ to } 4.5 \text{ V}$					± 100		μA	
	$V_{CC} = 3 \text{ V}$	$V_I = 0.8 \text{ V}$	75		75			μA	
$I_I(\text{hold})$	$V_{CC} = 3 \text{ V}$	$V_I = 2 \text{ V}$	-75		-75				
		$V_I = 0 \text{ to } 3.6 \text{ V}$				± 500			
I_{OZPU}		$V_{CC} = 0 \text{ to } 1.5 \text{ V}$, $V_O = 0.5 \text{ V to } 3 \text{ V}$, $OE = \text{don't care}$			$\pm 100^*$	± 100		μA	
I_{OZPD}		$V_{CC} = 1.5 \text{ V to } 0$, $V_O = 0.5 \text{ V to } 3 \text{ V}$, $OE = \text{don't care}$			$\pm 100^*$	± 100		μA	
I_{CC}	$V_{CC} = 3.6 \text{ V}$, $I_O = 0$, $V_I = V_{CC} \text{ or GND}$	Outputs high		0.19	0.19			mA	
		Outputs low		5	5				
		Outputs disabled		0.19	0.19				
ΔI_{CC}^{\dagger}		$V_{CC} = 3 \text{ V to } 3.6 \text{ V}$, One input at $V_{CC} - 0.6 \text{ V}$, Other inputs at V_{CC} or GND		0.2	0.2			mA	
C_I		$V_I = 3 \text{ V or } 0$		4	4			pF	
C_{IO}		$V_O = 3 \text{ V or } 0$		9	9			pF	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

† All typical values are at $V_{CC} = 3.3 \text{ V}$, $T_A = 25^\circ\text{C}$.

‡ Unused terminals at V_{CC} or GND

§ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

¶ This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

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SN54LVTH2952, SN74LVTH2952

3.3-V ABT OCTAL BUS TRANSCEIVERS AND REGISTERS

WITH 3-STATE OUTPUTS

SCBS710F – OCTOBER 1997 – REVISED OCTOBER 2003

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

			SN54LVTH2952				SN74LVTH2952				UNIT	
			V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V			
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
f _{clock}	Clock frequency			150	150	150	150	150	150	150	MHz	
t _w	Pulse duration		CLK high	3.3	3.3	3.3	3.3	3.3	3.3	3.3	ns	
			CLK low	3.3	3.3	3.3	3.3	3.3	3.3	3.3		
t _{su}	Setup time	A or B before CLK↑	Data high	1.6	2.2	1.5	2.1				ns	
			Data low	1.6	2.2	1.5	2.1					
		CE before CLK↑	Data high	1.6	1.9	1.5	1.8					
			Data low	2	2.6	1.9	2.5					
t _h	Hold time	A or B after CLK↑		1	0.2	1	0.2				ns	
		CE after CLK↑		1.2	0.2	1.2	0.2					

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH2952				SN74LVTH2952				UNIT	
			V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V			
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN	MAX	
f _{max}			150	150	150	150	150		150	150	150	MHz
t _{PLH}	CLKBA or CLKAB	A or B	1.2	4.8	5.5	1.3	2.9	4.6		5.3		ns
t _{PHL}			1.2	4.8	5.5	1.3	3.1	4.6		5.3		
t _{PZH}	OEBA or OEAB	A or B	1	4.8	5.9	1.1	2.6	4.6		5.8		ns
t _{PZL}			1	4.8	5.9	1.1	3	4.6		5.8		
t _{PHZ}	OEBA or OEAB	A or B	1.2	5.6	6	1.3	3.6	5.4		5.9		ns
t _{PLZ}			1.5	5.4	5.6	1.6	3.6	5.1		5.3		

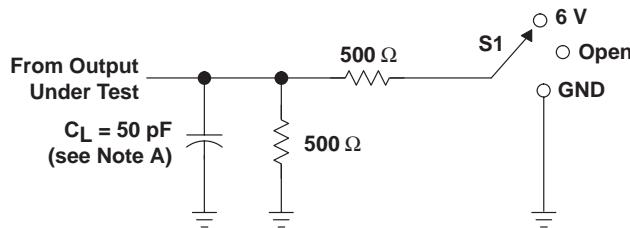
† All typical values are at T_A = 25°C.

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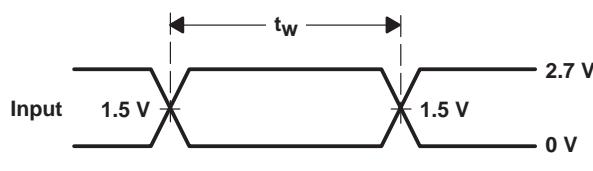
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PARAMETER MEASUREMENT INFORMATION

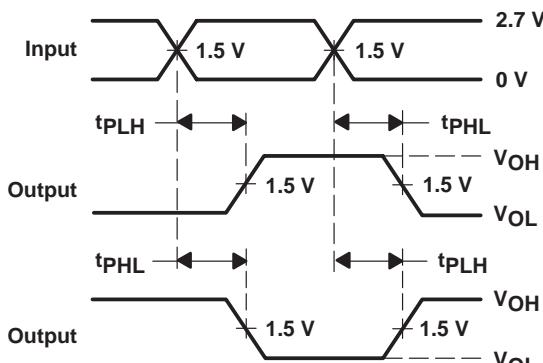


TEST	S1
tPLH/tPHL	Open
tPLZ/tPZL	6 V
tPHZ/tPZH	GND

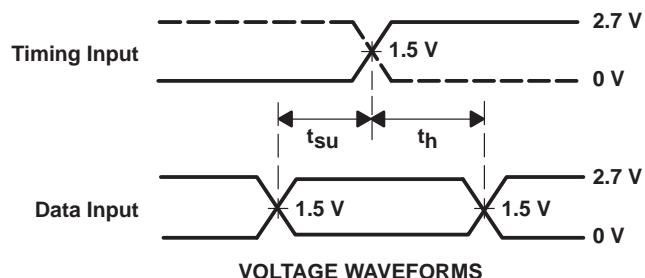
LOAD CIRCUIT FOR OUTPUTS



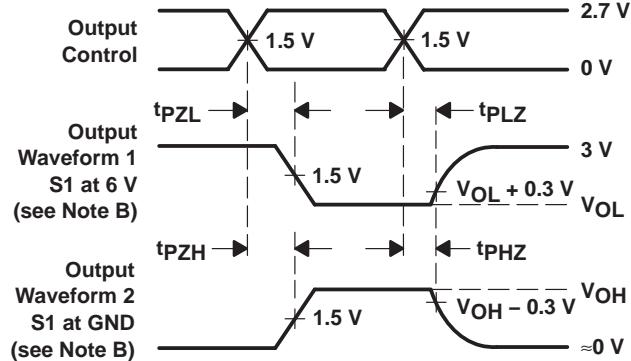
**VOLTAGE WAVEFORMS
 PULSE DURATION**



**VOLTAGE WAVEFORMS
 PROPAGATION DELAY TIMES
 INVERTING AND NONINVERTING OUTPUTS**



**VOLTAGE WAVEFORMS
 SETUP AND HOLD TIMES**



**VOLTAGE WAVEFORMS
 ENABLE AND DISABLE TIMES
 LOW- AND HIGH-LEVEL ENABLING**

NOTES: A. C_L includes probe and jig capacitance.

- B. 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.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ ns.
- D. The outputs are measured one at a time with one transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

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	MSL Peak Temp ⁽³⁾
74LVTH2952DGVR4	ACTIVE	TVSOP	DGV	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74LVTH2952DGVRG4	ACTIVE	TVSOP	DGV	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DBLE	OBsolete	SSOP	DB	24		TBD	Call TI	Call TI
SN74LVTH2952DBR	ACTIVE	SSOP	DB	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DBRE4	ACTIVE	SSOP	DB	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DBRG4	ACTIVE	SSOP	DB	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DGVR	ACTIVE	TVSOP	DGV	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952NSR	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952NSRE4	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952NSRG4	ACTIVE	SO	NS	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PW	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PWE4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PWG4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PWLE	OBsolete	TSSOP	PW	24		TBD	Call TI	Call TI
SN74LVTH2952PWR	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PWRE4	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTH2952PWRG4	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽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.

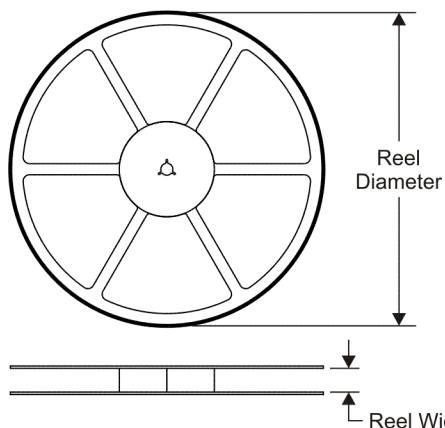
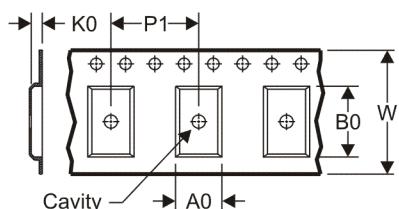
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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)

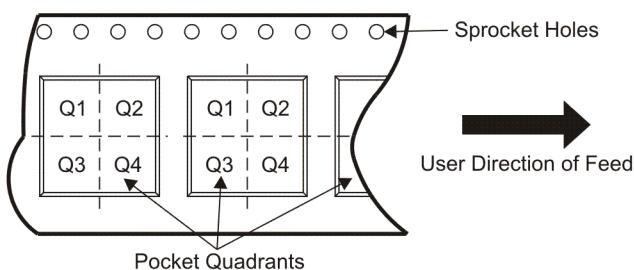
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
SN74LVTH2952DBR	SSOP	DB	24	2000	330.0	16.4	8.2	8.8	2.5	12.0	16.0	Q1
SN74LVTH2952DGVR	TVSOP	DGV	24	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
SN74LVTH2952NSR	SO	NS	24	2000	330.0	24.4	8.2	15.4	2.5	12.0	24.0	Q1
SN74LVTH2952PWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

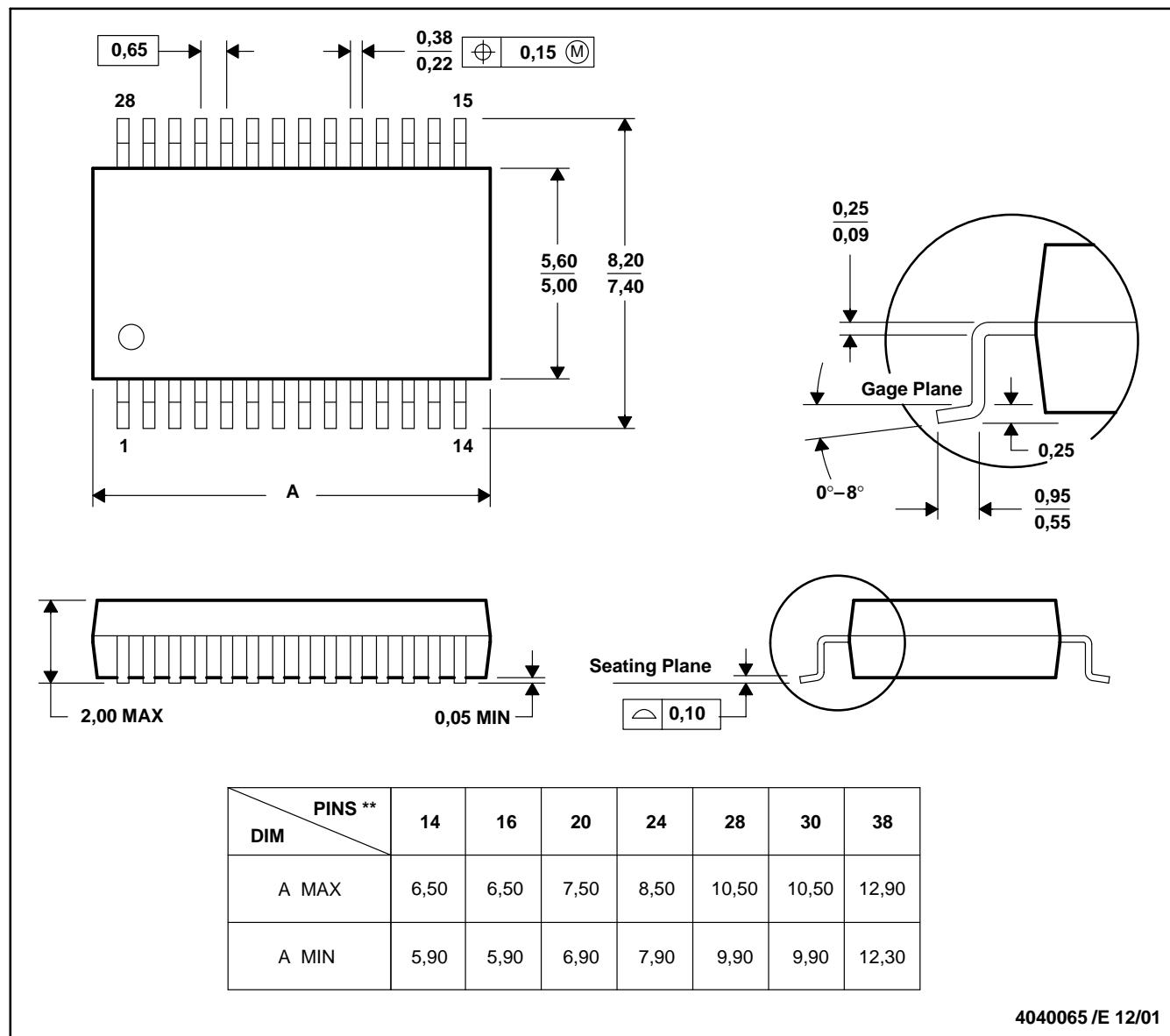

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVTH2952DBR	SSOP	DB	24	2000	346.0	346.0	33.0
SN74LVTH2952DGVR	TVSOP	DGV	24	2000	346.0	346.0	29.0
SN74LVTH2952NSR	SO	NS	24	2000	346.0	346.0	41.0
SN74LVTH2952PWR	TSSOP	PW	24	2000	346.0	346.0	33.0

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

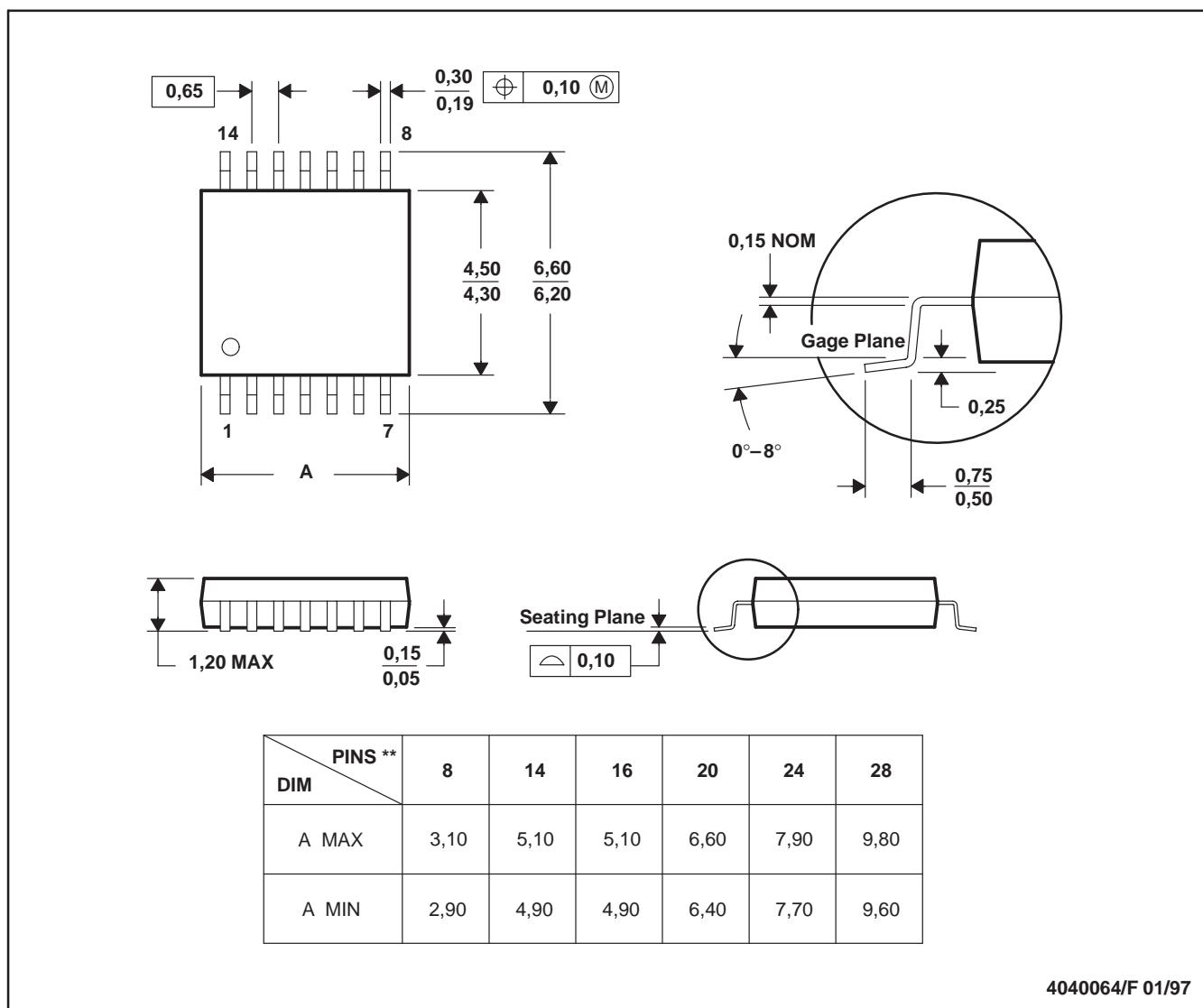


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



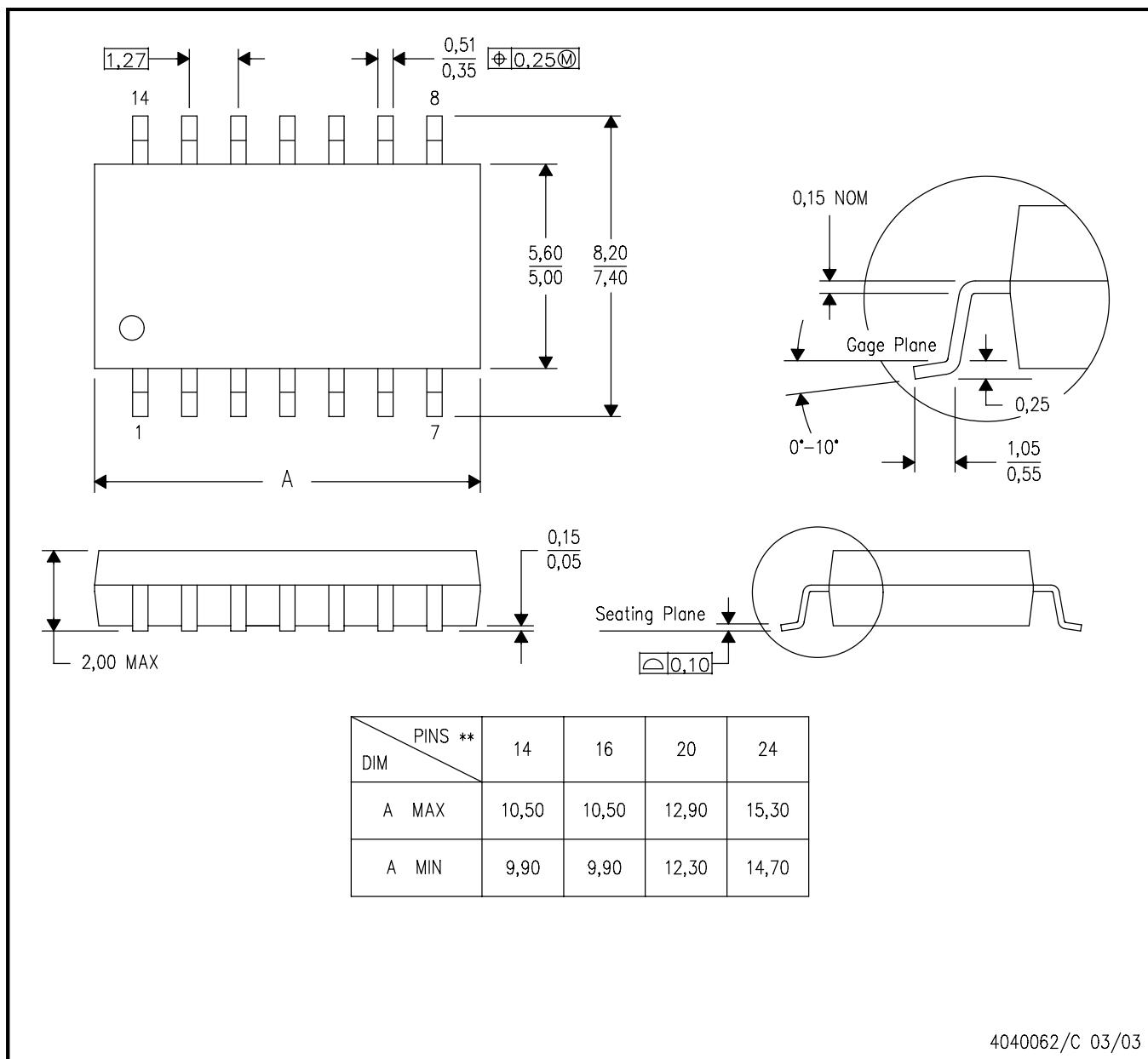
- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 - Falls within JEDEC MO-153

MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



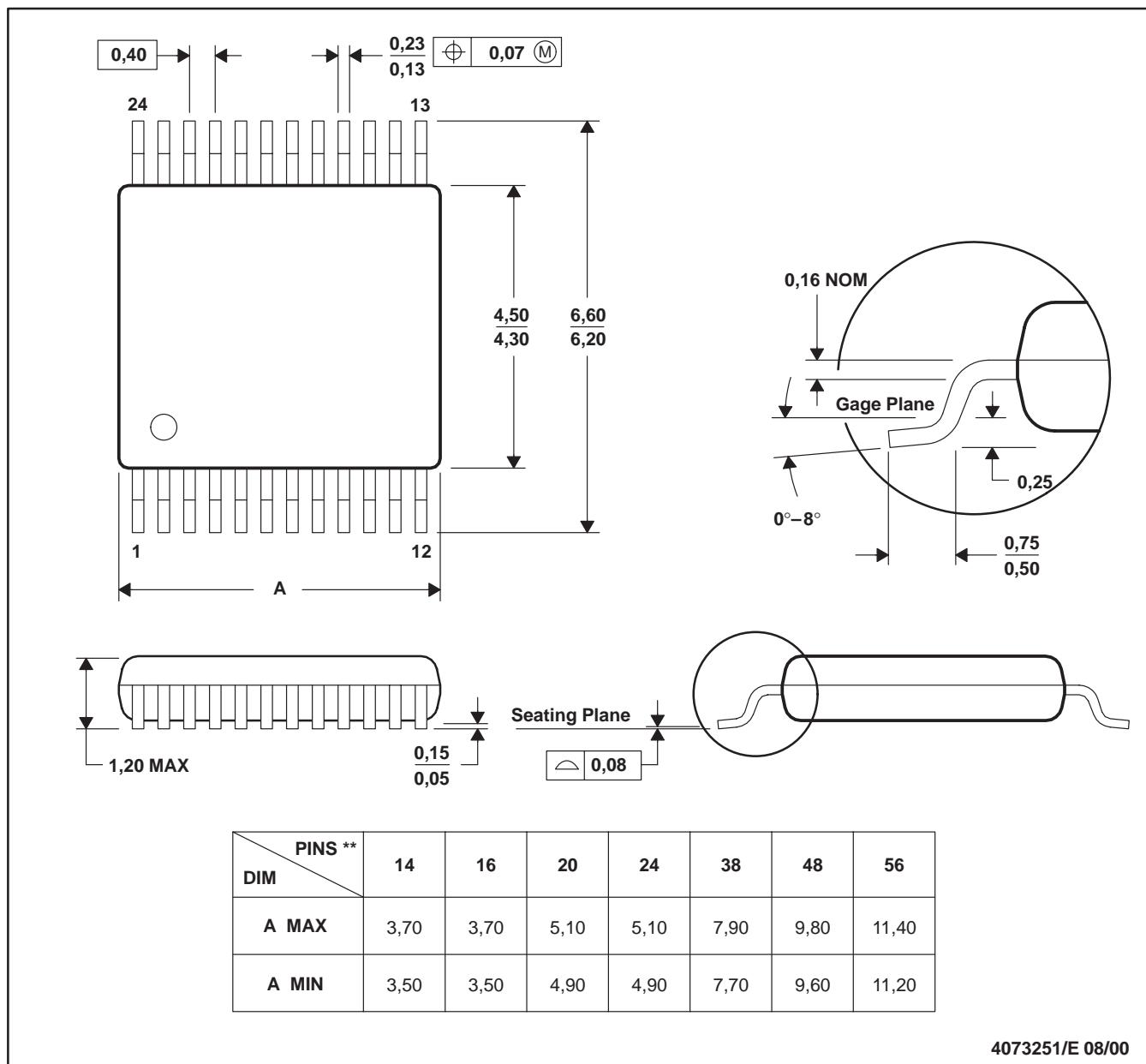
4040062/C 03/03

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

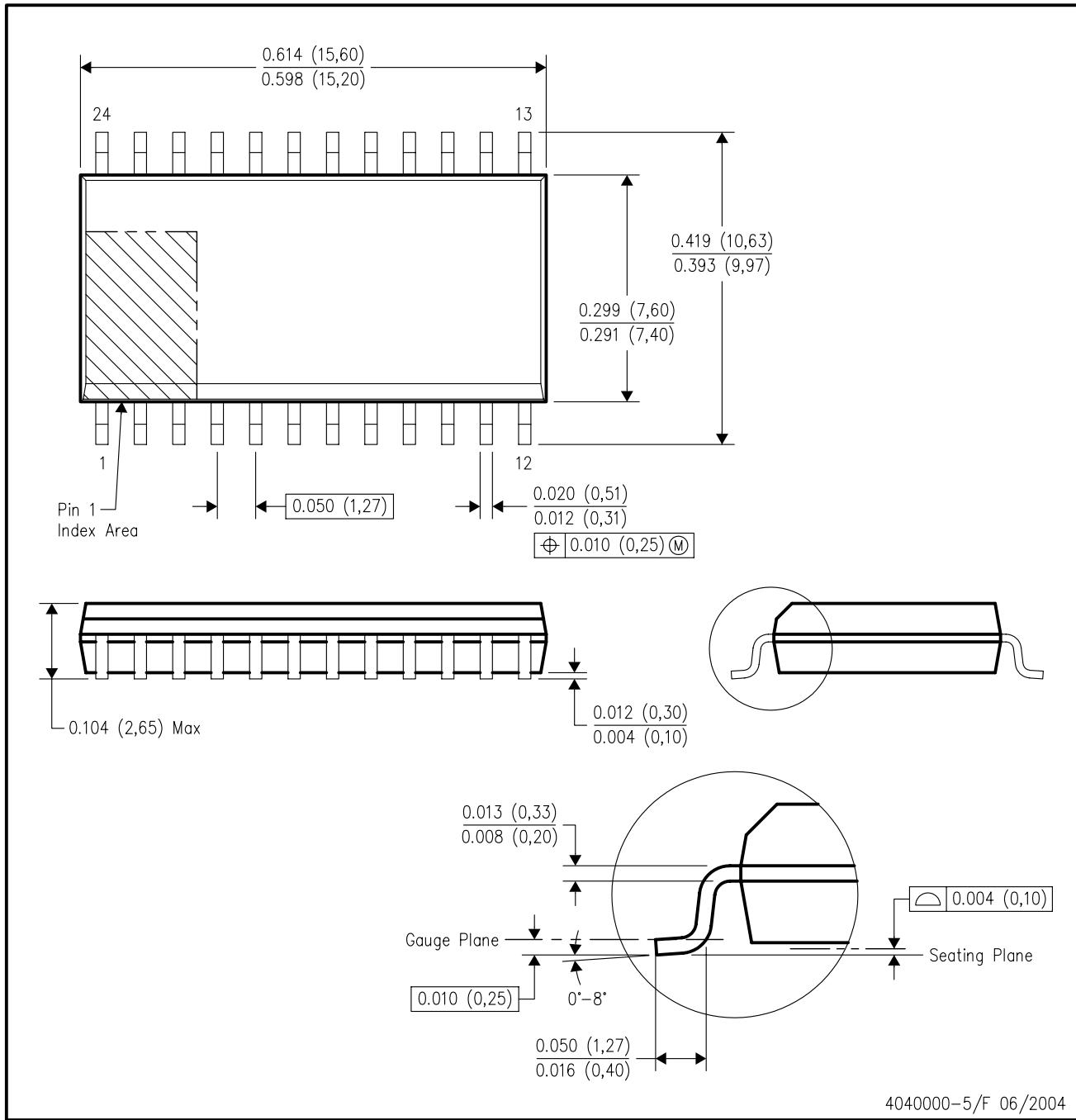
24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

DW (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0.15).
 - Falls within JEDEC MS-013 variation AD.

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

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