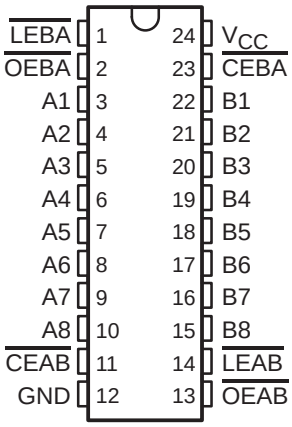
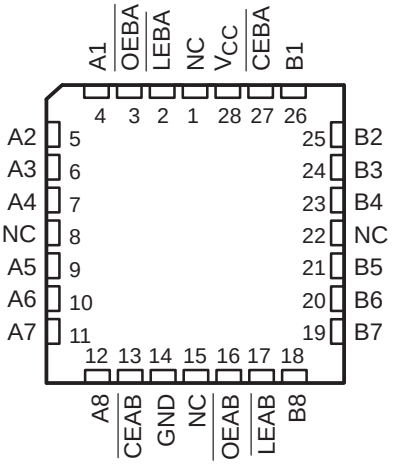
- **State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low Static Power Dissipation**
- **Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})**
- **Support Unregulated Battery Operation Down to 2.7 V**
- **Typical V_{OLP} (Output Ground Bounce) < 0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17**
- **Bus-Hold Data Inputs Eliminate the Need for External Pullup Resistors**
- **Support Live Insertion**
- **Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Ceramic (JT) DIPs**

SN54LVT543 . . . JT PACKAGE
SN74LVT543 . . . DB, DW, OR PW PACKAGE
(TOP VIEW)



SN54LVT543 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

These octal transceivers 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.

The ’LVT543 contain two sets of D-type latches for temporary storage of data flowing in either direction. Separate latch-enable ($\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$) and output-enable ($\overline{\text{OEAB}}$ or $\overline{\text{OEBA}}$) inputs are provided for each register to permit independent control in either direction of data flow.

The A-to-B enable ($\overline{\text{CEAB}}$) input must be low in order to enter data from A or to output data from B. If $\overline{\text{CEAB}}$ is low and $\overline{\text{LEAB}}$ is low, the A-to-B latches are transparent; a subsequent low-to-high transition of $\overline{\text{LEAB}}$ puts the A latches in the storage mode. With $\overline{\text{CEAB}}$ and $\overline{\text{OEAB}}$ both low, the 3-state B outputs are active and reflect the data present at the output of the A latches. Data flow from B to A is similar but requires using the $\overline{\text{CEBA}}$, $\overline{\text{LEBA}}$, and $\overline{\text{OEBA}}$ inputs.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

description (continued)

To ensure the high-impedance state during power up or power down, $\overline{OE}$ 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.

The SN74LVT543 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

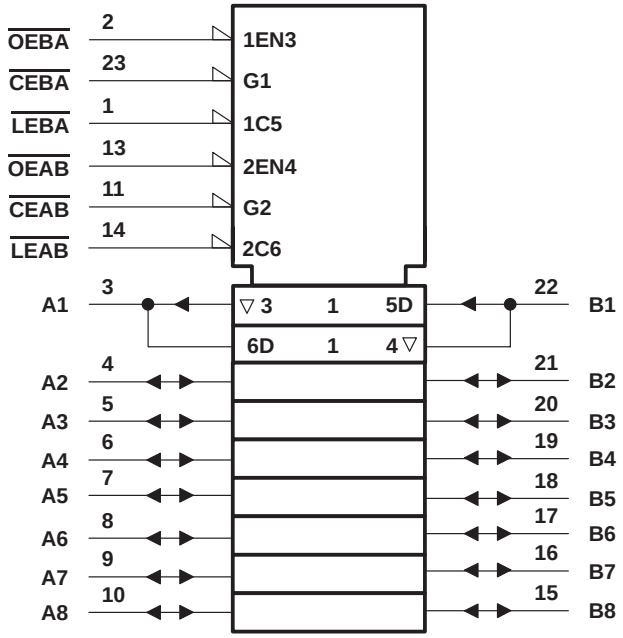
The SN54LVT543 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74LVT543 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE†

INPUTS				OUTPUT
$\overline{CEAB}$	$\overline{LEAB}$	$\overline{OEAB}$	A	B
H	X	X	X	Z
X	X	H	X	Z
L	H	L	X	B_0‡
L	L	L	L	L
L	L	L	H	H

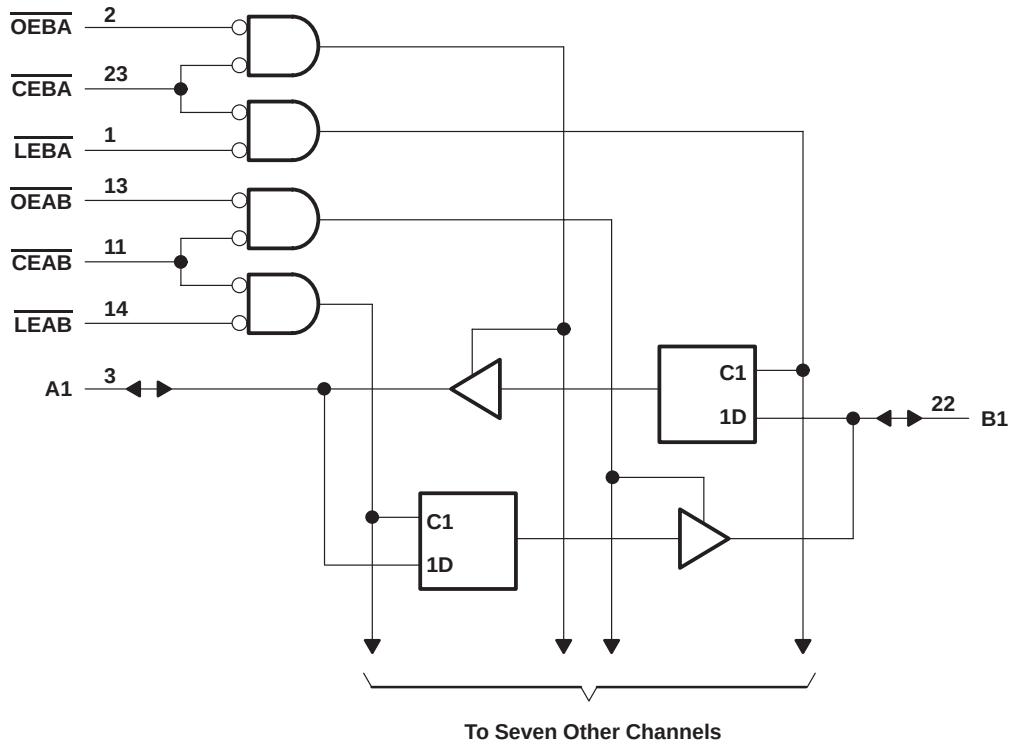
† A-to-B data flow is shown; B-to-A flow control is the same except that it uses $\overline{CEBA}$, $\overline{LEBA}$, and $\overline{OEBA}$.
‡ Output level before the indicated steady-state input conditions were established

logic symbol§



§ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the DB, DW, JT, and PW packages.

logic diagram (positive logic)



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

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

Supply voltage range, V_{CC} . . . . . –0.5 V to 4.6 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, V_O (see Note 1) . . . . –0.5 V to 7 V
Current into any output in the low state, I_O: SN54LVT543 . . . . . 96 mA
SN74LVT543 . . . . . 128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVT543 . . . . . 48 mA
SN74LVT543 . . . . . 64 mA
Input clamp current, I_{IK} (V_I < 0) . . . . . –50 mA
Output clamp current, I_{OK} (V_O < 0) . . . . . –50 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 3): DB package . . . . . 0.65 W
DW package . . . . . 1.7 W
PW package . . . . . 0.7 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 current flows only when the output is in the high state and $V_O > V_{CC}$.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 4)

			SN54LVT543		SN74LVT543		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
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.

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

PARAMETER	TEST CONDITIONS			SN54LVT543			SN74LVT543			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	V_{CC} = 2.7 V,	I_I = –18 mA				–1.2			–1.2	V
V_{OH}	V_{CC} = MIN to MAX‡,	I_{OH} = –100 µA		V_{CC}–0.2			V_{CC}–0.2			V
	V_{CC} = 2.7 V,	I_{OH} = – 8 mA		2.4			2.4			
	V_{CC} = 3 V	I_{OH} = – 24 mA		2						
		I_{OH} = –32 mA					2			
V_{OL}	V_{CC} = 2.7 V	I_{OL} = 100 µA				0.2			0.2	V
		I_{OL} = 24 mA				0.5			0.5	
	V_{CC} = 3 V	I_{OL} = 16 mA				0.4			0.4	
		I_{OL} = 32 mA				0.5			0.5	
		I_{OL} = 48 mA				0.55				
		I_{OL} = 64 mA							0.55	
I_I	V_{CC} = 3.6 V,	V_I = V_{CC} or GND	Control inputs			±1			±1	µA
	V_{CC} = 0 or MAX‡,	V_I = 5.5 V				10			10	
	V_{CC} = 3.6 V	V_I = 5.5 V	A or B ports§			20			20	
		V_I = V_{CC}				5			5	
		V_I = 0				–10			–10	
I_{off}	V_{CC} = 0,	V_I or V_O = 0 to 4.5 V							±100	µA
$I_{I(hold)}$	V_{CC} = 3 V	V_I = 0.8 V	A or B ports	75			75			µA
		V_I = 2 V		–75			–75			
I_{OZH}	V_{CC} = 3.6 V,	V_O = 3 V				1			1	µA
I_{OZL}	V_{CC} = 3.6 V,	V_O = 0.5 V				–1			–1	µA
I_{CC}	V_{CC} = 3.6 V, V_I = V_{CC} or GND	I_O = 0,	Outputs high		0.13	0.19		0.13	0.19	mA
			Outputs low		8.8	12		8.8	12	
			Outputs disabled		0.13	0.19		0.13	0.19	
ΔI_{CC}¶	V_{CC} = 3 V to 3.6 V, Other inputs at V_{CC} or GND	One input at V_{CC} – 0.6 V,				0.2			0.2	mA
C_i	V_I = 3 V or 0				4.5			4.5		pF
C_{io}	V_O = 3 V or 0				11			11		pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
§ Unused terminals at V_{CC} or GND
¶ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

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

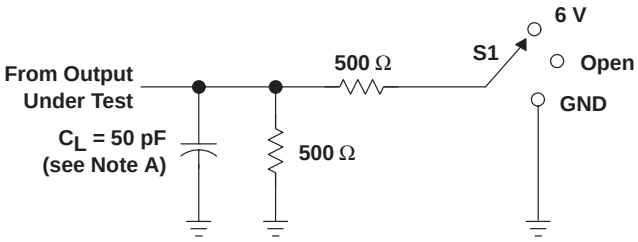
				SN54LVT543				SN74LVT543				UNIT
				V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 2.7 V		
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration,	$\overline{LEAB}$ or $\overline{LEBA}$ low		3.3		3.3		3.3		3.3		ns
t_{su}	Setup time	A or B before $\overline{LEAB}$ or $\overline{LEBA}\uparrow$	Data high	0		0		0		0		ns
			Data low	0.8		1.1		0.8		1.1		
		A or B before $\overline{CEAB}$ or $\overline{CEBA}\uparrow$	Data high	0		0		0		0		
			Data low	0.9		1.2		0.9		1.2		
t_h	Hold time	A or B after $\overline{LEAB}$ or $\overline{LEBA}\uparrow$		1.7		1.7		1.7		1.7		ns
		A or B after $\overline{CEAB}$ or $\overline{CEBA}\uparrow$		1.8		1.8		1.8		1.8		

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVT543				SN74LVT543					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	
t_{PLH}	A or B	B or A	1	4.9		5.7	1	2.9	4.7		5.5	ns
t_{PHL}			1	4.8		6	1	3.3	4.6		5.8	
t_{PLH}	$\overline{LE}$	A or B	1	6.1		7.5	1	4	5.9		7.3	ns
t_{PHL}			1	5.9		7.5	1	4.1	5.7		7.3	
t_{PZH}	$\overline{OE}$	A or B	1	6		7.8	1	4.1	5.8		7.6	ns
t_{PZL}			1.1	6.6		8.4	1.1	4.5	6.4		8.2	
t_{PHZ}	$\overline{OE}$	A or B	2.4	6.7		7.3	2.4	4.8	6.5		7.1	ns
t_{PLZ}			2	6		6.1	2	4	5.8		5.9	
t_{PZH}	$\overline{CE}$	A or B	1	6.2		7.8	1	4.2	6		7.6	ns
t_{PZL}			1.4	6.9		8.5	1.4	4.7	6.7		8.3	
t_{PHZ}	$\overline{CE}$	A or B	2.3	6.6		7.3	2.3	4.7	6.4		7.1	ns
t_{PLZ}			2	5.6		5.8	2	3.8	5.4		5.6	

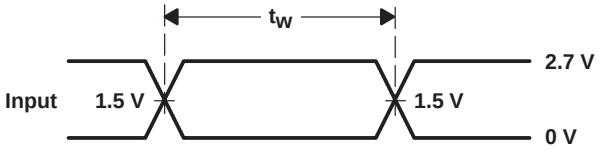
† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION

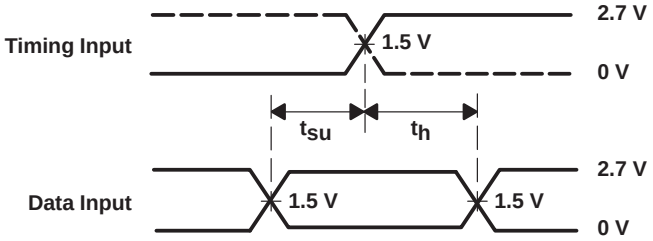


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

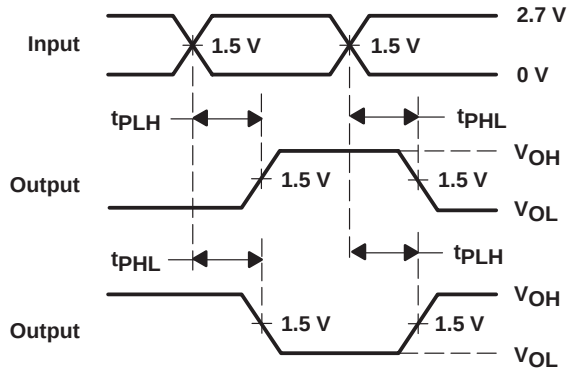
LOAD CIRCUIT FOR OUTPUTS



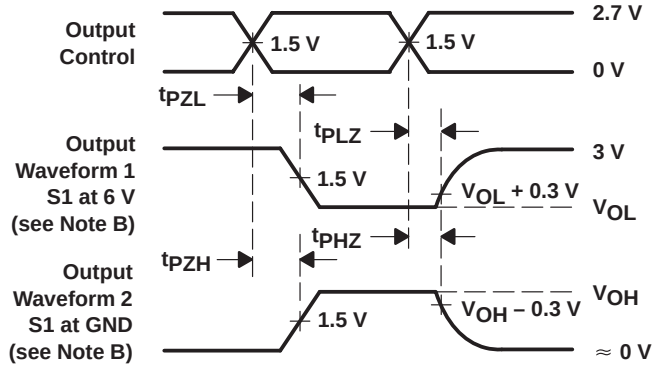
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



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 ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

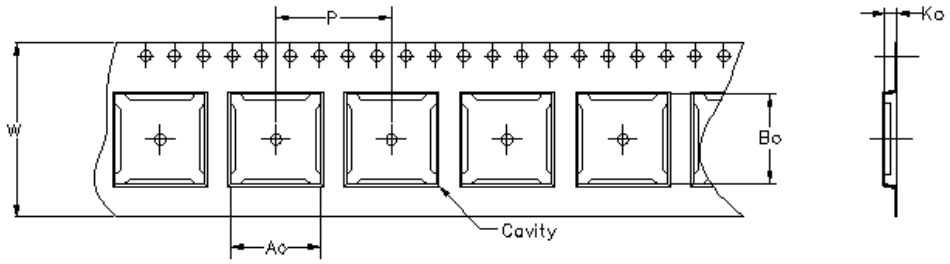
PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
SN74LVT543DBLE	OBSOLETE	SSOP	DB	24		TBD	Call TI	Call TI
SN74LVT543DW	NRND	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVT543DWR	NRND	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVT543NSR	OBSOLETE	SO	NS	24		TBD	Call TI	Call TI
SN74LVT543PWLE	OBSOLETE	TSSOP	PW	24		TBD	Call TI	Call TI
SN74LVT543PWR	NRND	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.

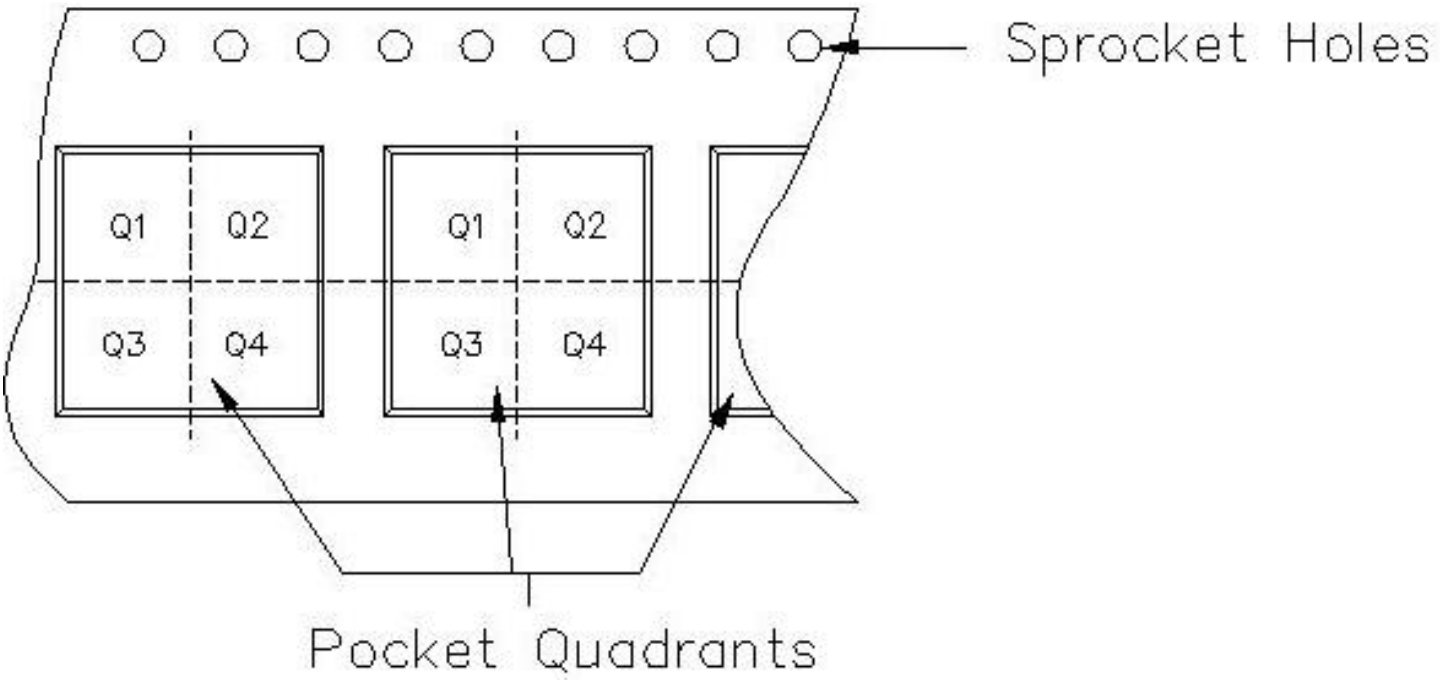
[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.



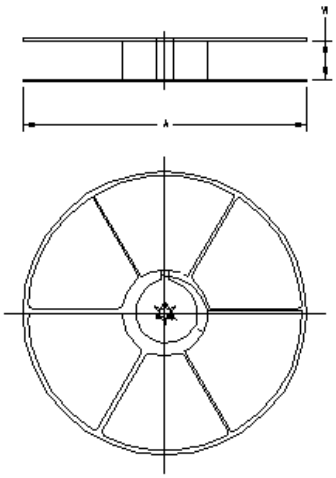
Carrier tape design is defined largely by the component lentgh, width, and thickness.

Ao = Dimension designed to accommodate the component width.
Bo = Dimension designed to accommodate the component length.
Ko = Dimension designed to accommodate the component thickness.
W = Overall width of the carrier tape.
P = Pitch between successive cavity centers.



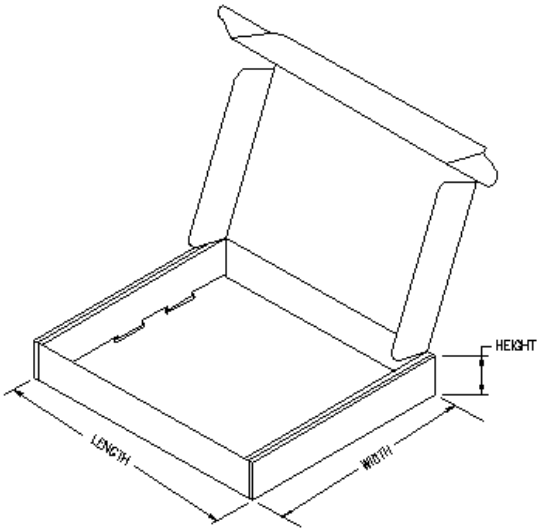
TAPE AND REEL INFORMATION

Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVT543DWR	DW	24	TAI	330	24	10.75	15.7	2.7	12	24	Q1
SN74LVT543PWR	PW	24	MLA	330	16	6.95	8.3	1.6	8	16	Q1

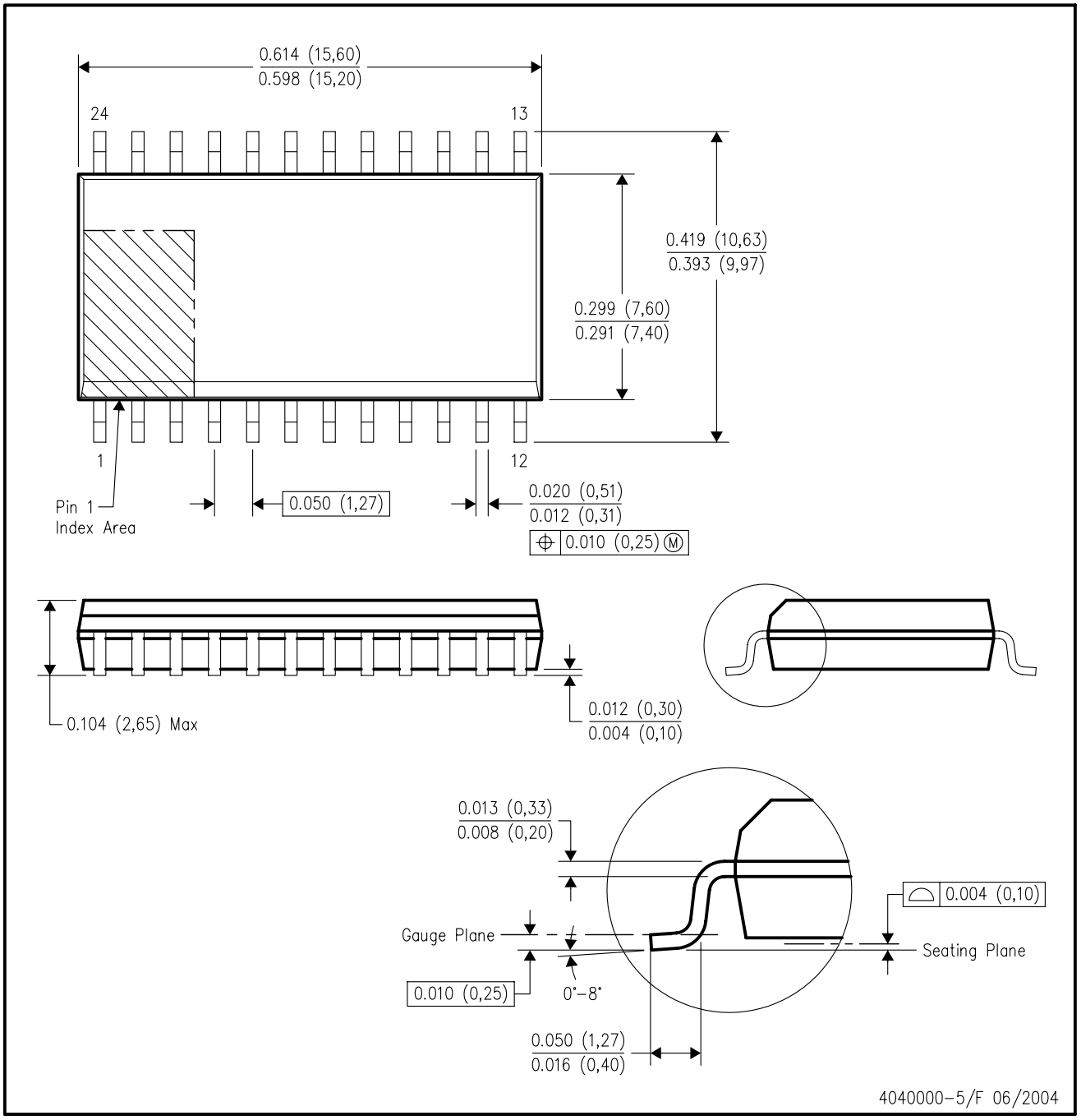


TAPE AND REEL BOX INFORMATION

Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
SN74LVT543DWR	DW	24	TAI	346.0	346.0	41.0
SN74LVT543PWR	PW	24	MLA	346.0	346.0	33.0



DW (R–PDSO–G24) PLASTIC SMALL–OUTLINE PACKAGE

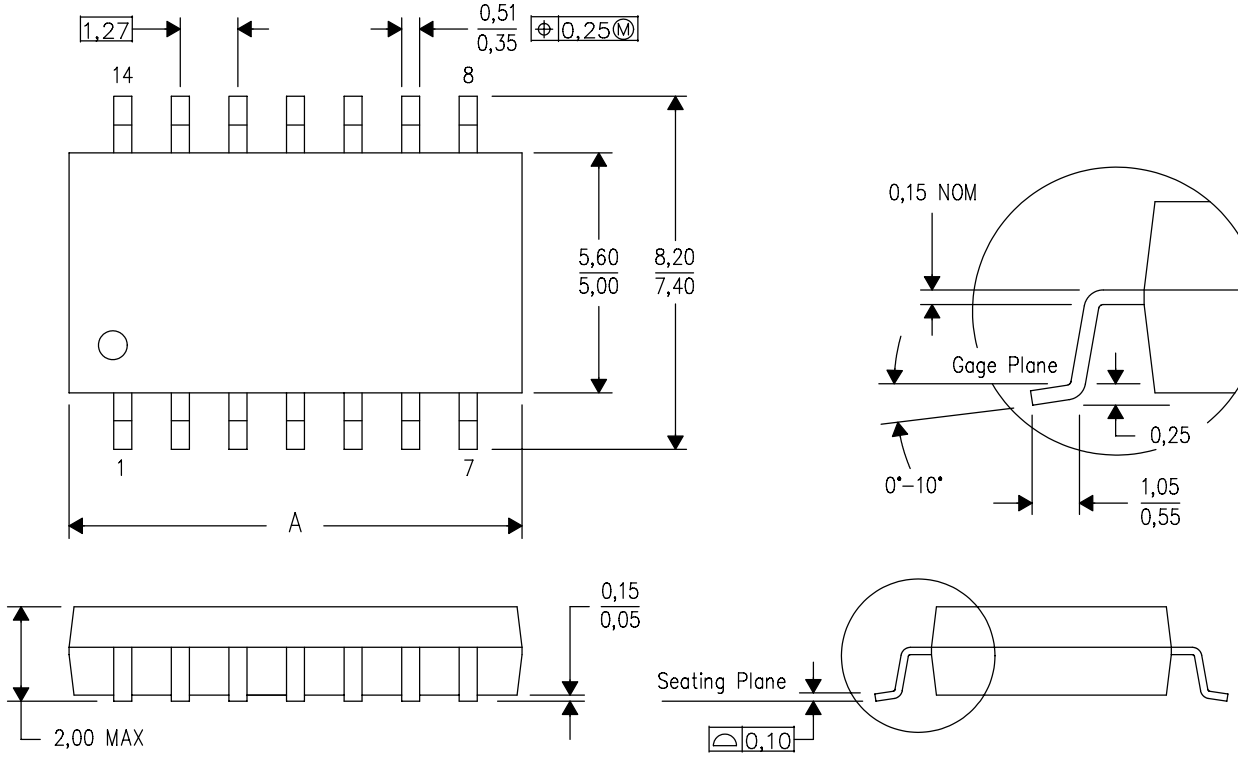


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AD.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

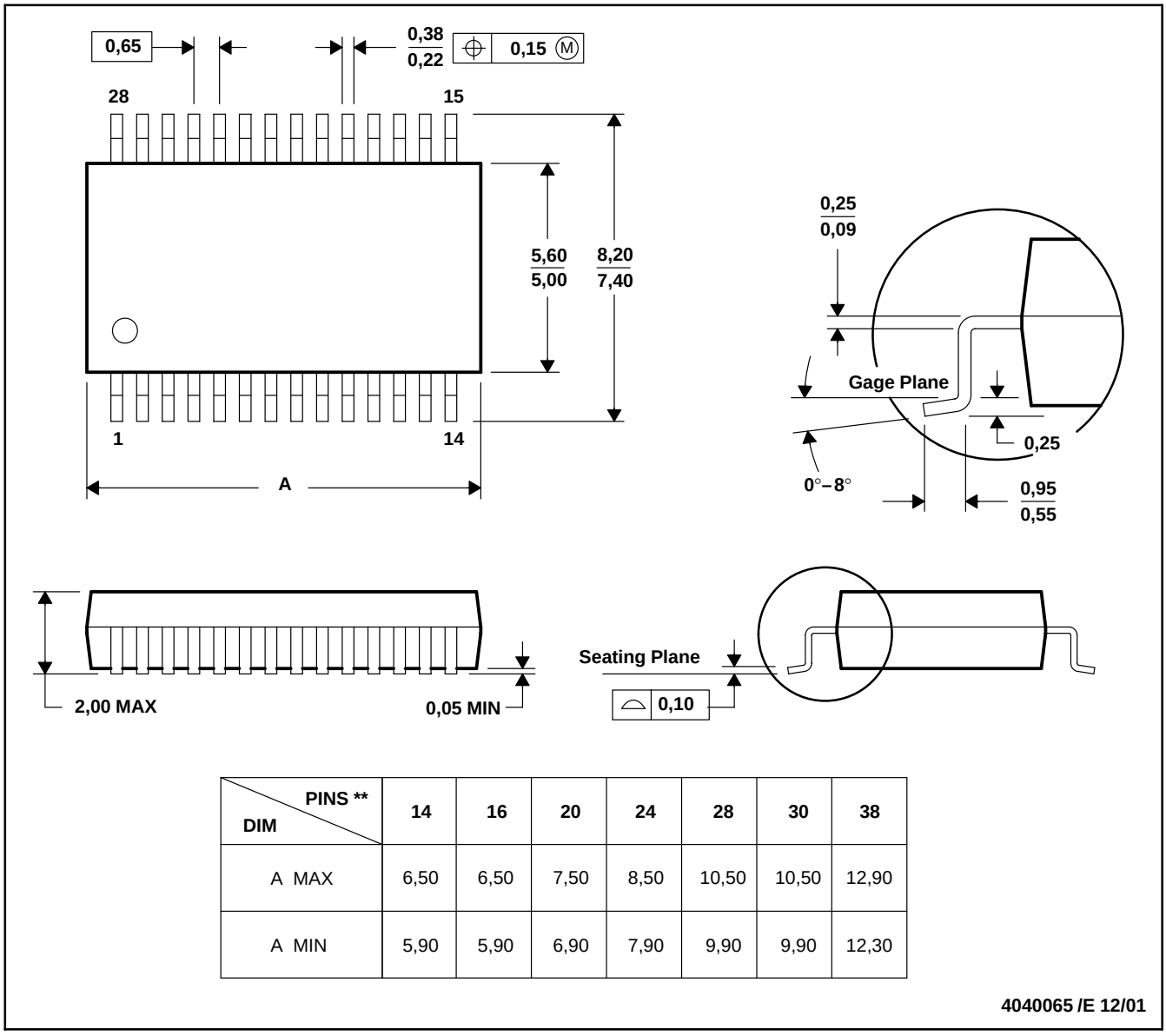
4040062/C 03/03

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.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



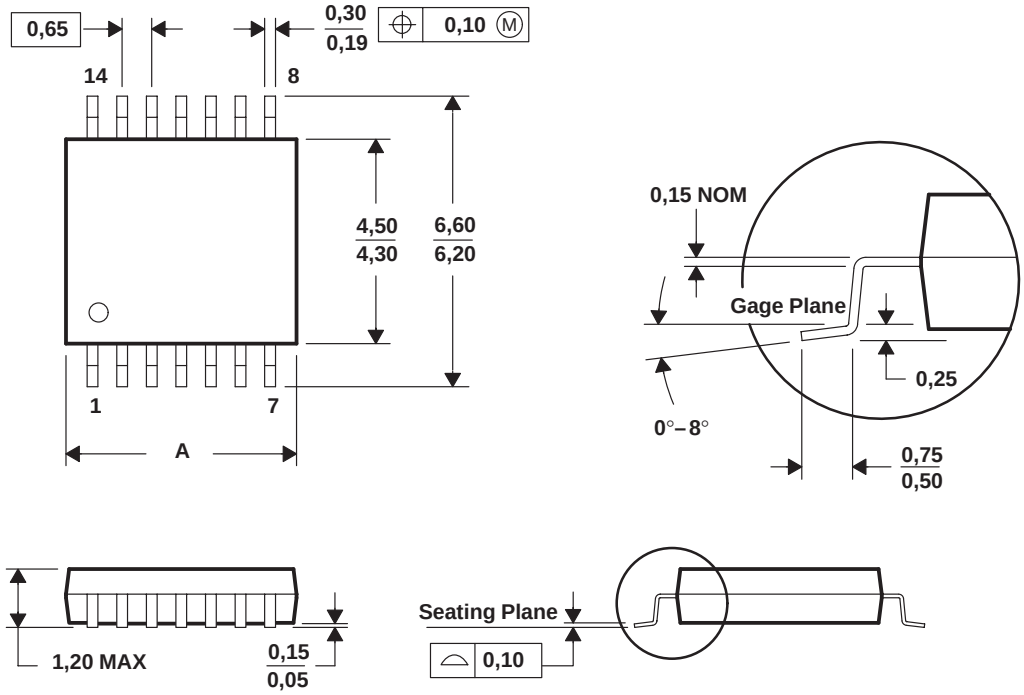
DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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-153

IMPORTANT NOTICE

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