



# THE DATASHEET OF SN74LVT240ADGVR



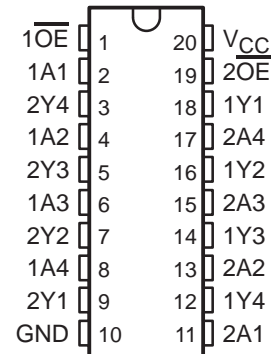
# SN74LVT240A

## 3.3-V ABT OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCBS134K – SEPTEMBER 1992 – REVISED JANUARY 2004

- Supports Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Supports Unregulated Battery Operation Down To 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $<0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- 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)

DB, DGV, DW, NS, OR PW PACKAGE  
(TOP VIEW)



### description/ordering information

This octal buffer and line driver is 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 SN74LVT240A is organized as two 4-bit buffer/line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

When  $V_{CC}$  is between 0 and 1.5 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V,  $\overline{OE}$  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.

This device is 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 device when it is 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.

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tube	SN74LVT240ADW	LVT240A
		Tape and reel	SN74LVT240ADWR	
	SOP – NS	Tape and reel	SN74LVT240ANSR	LVT240A
	SSOP – DB	Tape and reel	SN74LVT240ADBR	LX240A
	TSSOP – PW	Tube	SN74LVT240APW	LX240A
		Tape and reel	SN74LVT240APWR	
TVSOP – DGV	Tape and reel	SN74LVT240ADGVR	LX240A	

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



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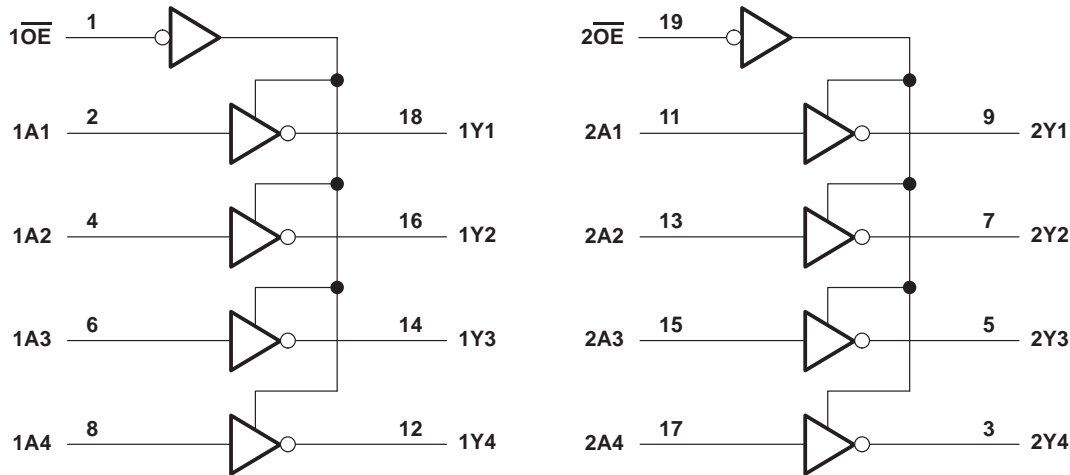
**SN74LVT240A**  
**3.3-V ABT OCTAL BUFFER/DRIVER**  
**WITH 3-STATE OUTPUTS**

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**FUNCTION TABLE**  
 (each 4-bit buffer)

INPUTS		OUTPUT
$\overline{OE}$	A	Y
L	H	L
L	L	H
H	X	Z

**logic diagram (positive logic)**



**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-impedance or power-off state, $V_O$ (see Note 1)	-0.5 V to 7 V
Voltage range applied to any output in the high state, $V_O$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Current into any output in the low state, $I_O$	128 mA
Current into any output in the high state, $I_O$ (see Note 2)	64 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	-50 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	-50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 3):	
DB package	70°C/W
DGV package	92°C/W
DW package	58°C/W
NS package	60°C/W
PW package	83°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 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 JESD 51-7.

# SN74LVT240A

## 3.3-V ABT OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

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### recommended operating conditions (see Note 4)

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	2.7	3.6	V
V <sub>IH</sub>	High-level input voltage	2		V
V <sub>IL</sub>	Low-level input voltage		0.8	V
V <sub>I</sub>	Input voltage		5.5	V
I <sub>OH</sub>	High-level output current		-32	mA
I <sub>OL</sub>	Low-level output current		64	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		5 ns/V
Δt/ΔV <sub>CC</sub>	Power-up ramp rate	200		μs/V
T <sub>A</sub>	Operating free-air temperature	-40	85	°C

NOTE 4: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. 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		MIN	TYP†	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = 2.7 V,	I <sub>I</sub> = -18 mA			-1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = 2.7 V to 3.6 V,	I <sub>OH</sub> = -100 μA	V <sub>CC</sub> -0.2			V
	V <sub>CC</sub> = 2.7 V,	I <sub>OH</sub> = -8 mA	2.4			
	V <sub>CC</sub> = 3 V,	I <sub>OH</sub> = -32 mA	2			
V <sub>OL</sub>	V <sub>CC</sub> = 2.7 V	I <sub>OL</sub> = 100 μA			0.2	V
		I <sub>OL</sub> = 24 mA			0.5	
	V <sub>CC</sub> = 3 V	I <sub>OL</sub> = 16 mA			0.4	
		I <sub>OL</sub> = 32 mA			0.5	
		I <sub>OL</sub> = 64 mA			0.55	
I <sub>I</sub>	V <sub>CC</sub> = 0 or 3.6 V,	V <sub>I</sub> = 5.5 V			10	μA
	V <sub>CC</sub> = 3.6 V	V <sub>I</sub> = V <sub>CC</sub> or GND	Control inputs	±1		
		V <sub>I</sub> = V <sub>CC</sub>	Data inputs	1		
		V <sub>I</sub> = 0		-5		
I <sub>off</sub>	V <sub>CC</sub> = 0,	V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5 V			±100	μA
I <sub>OZH</sub>	V <sub>CC</sub> = 3.6 V,	V <sub>O</sub> = 3 V			5	μA
I <sub>OZL</sub>	V <sub>CC</sub> = 3.6 V,	V <sub>O</sub> = 0.5 V			-5	μA
I <sub>OZPU</sub>	V <sub>CC</sub> = 0 to 1.5 V,	V <sub>O</sub> = 0.5 V to 3 V,	$\overline{OE}$ = don't care		±100	μA
I <sub>OZPD</sub>	V <sub>CC</sub> = 1.5 V to 0,	V <sub>O</sub> = 0.5 V to 3 V,	$\overline{OE}$ = don't care		±100	μA
I <sub>CC</sub>	V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>CC</sub> or GND	I <sub>O</sub> = 0,	Outputs high		0.19	mA
			Outputs low		5	
			Outputs disabled		0.19	
ΔI <sub>CC</sub> ‡	V <sub>CC</sub> = 3 V to 3.6 V, One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND				0.2	mA
C <sub>i</sub>	V <sub>I</sub> = 3 V or 0				4	pF
C <sub>o</sub>	V <sub>O</sub> = 3 V or 0				7	pF

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

‡ This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V<sub>CC</sub> or GND.



**SN74LVT240A**  
**3.3-V ABT OCTAL BUFFER/DRIVER**  
**WITH 3-STATE OUTPUTS**

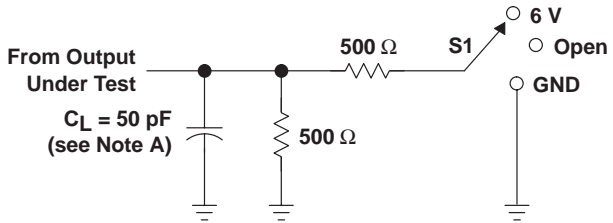
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$			$V_{CC} = 2.7\text{ V}$		UNIT
			MIN	TYP†	MAX	MIN	MAX	
$t_{PLH}$	A	Y	1.1	2.2	3.8	4.6		ns
$t_{PHL}$			1.3	2.6	4	4.2		
$t_{PZH}$	$\overline{OE}$	Y	1.1	2.6	4.6	5.6		ns
$t_{PZL}$			1.4	2.7	4.4	5		
$t_{PHZ}$	$\overline{OE}$	Y	2	2.9	4.4	4.6		ns
$t_{PLZ}$			1.8	3	4.3	4.3		

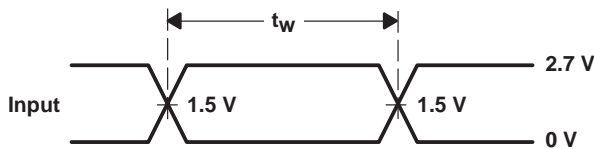
† All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

**PARAMETER MEASUREMENT INFORMATION**

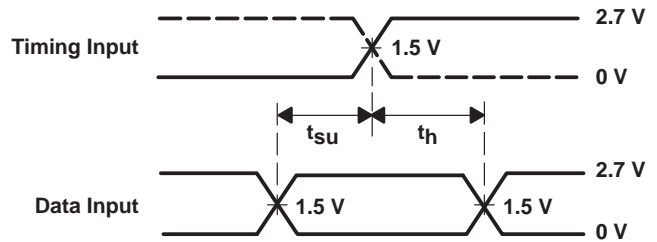


**LOAD CIRCUIT**

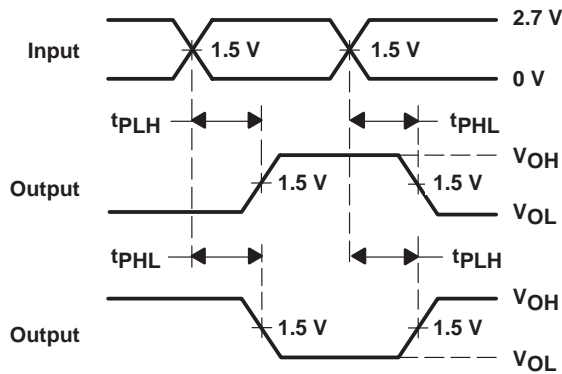
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



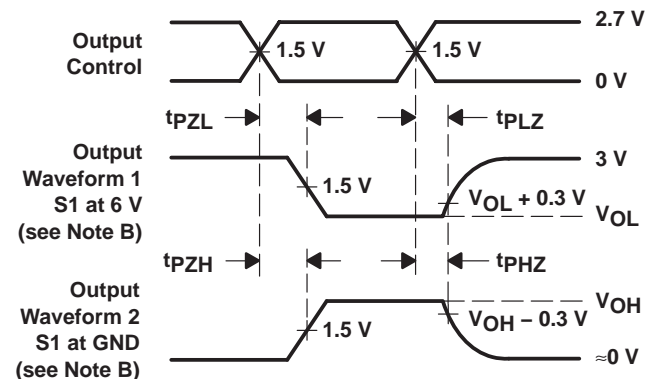
**VOLTAGE WAVEFORMS  
PULSE DURATION**



**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:  $PRR \leq 10$  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 (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVT240ADBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LX240A	<a href="#">Samples</a>
SN74LVT240ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVT240A	<a href="#">Samples</a>
SN74LVT240ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVT240A	<a href="#">Samples</a>
SN74LVT240ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVT240A	<a href="#">Samples</a>
SN74LVT240ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVT240A	<a href="#">Samples</a>
SN74LVT240APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LX240A	<a href="#">Samples</a>
SN74LVT240APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LX240A	<a href="#">Samples</a>
SN74LVT240APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LX240A	<a href="#">Samples</a>
SN74LVT240APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LX240A	<a href="#">Samples</a>

(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.

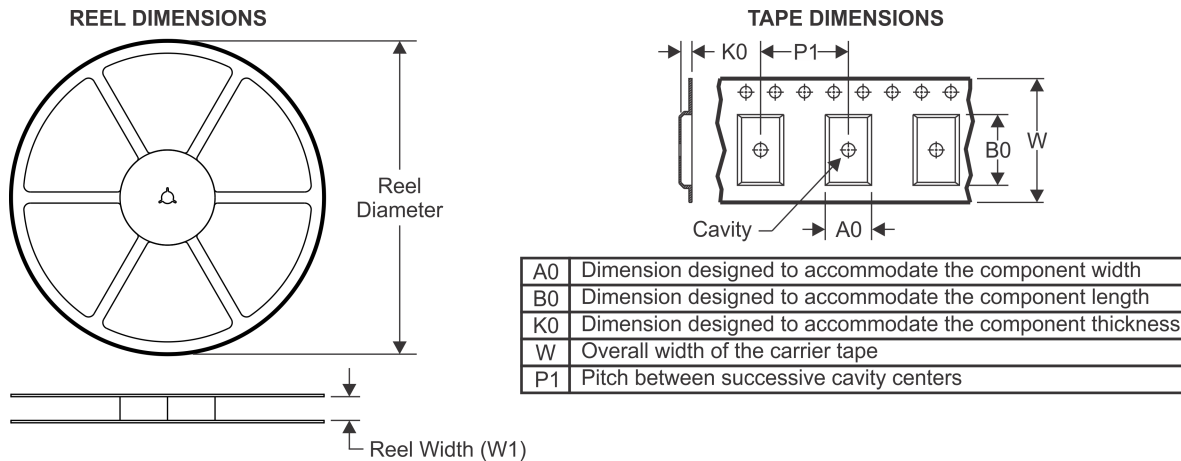
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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/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.

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**TAPE AND REEL INFORMATION**

**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
SN74LVT240ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVT240ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LVT240ANSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	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)
SN74LVT240ADBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74LVT240ADWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LVT240ANSR	SO	NS	20	2000	367.0	367.0	45.0

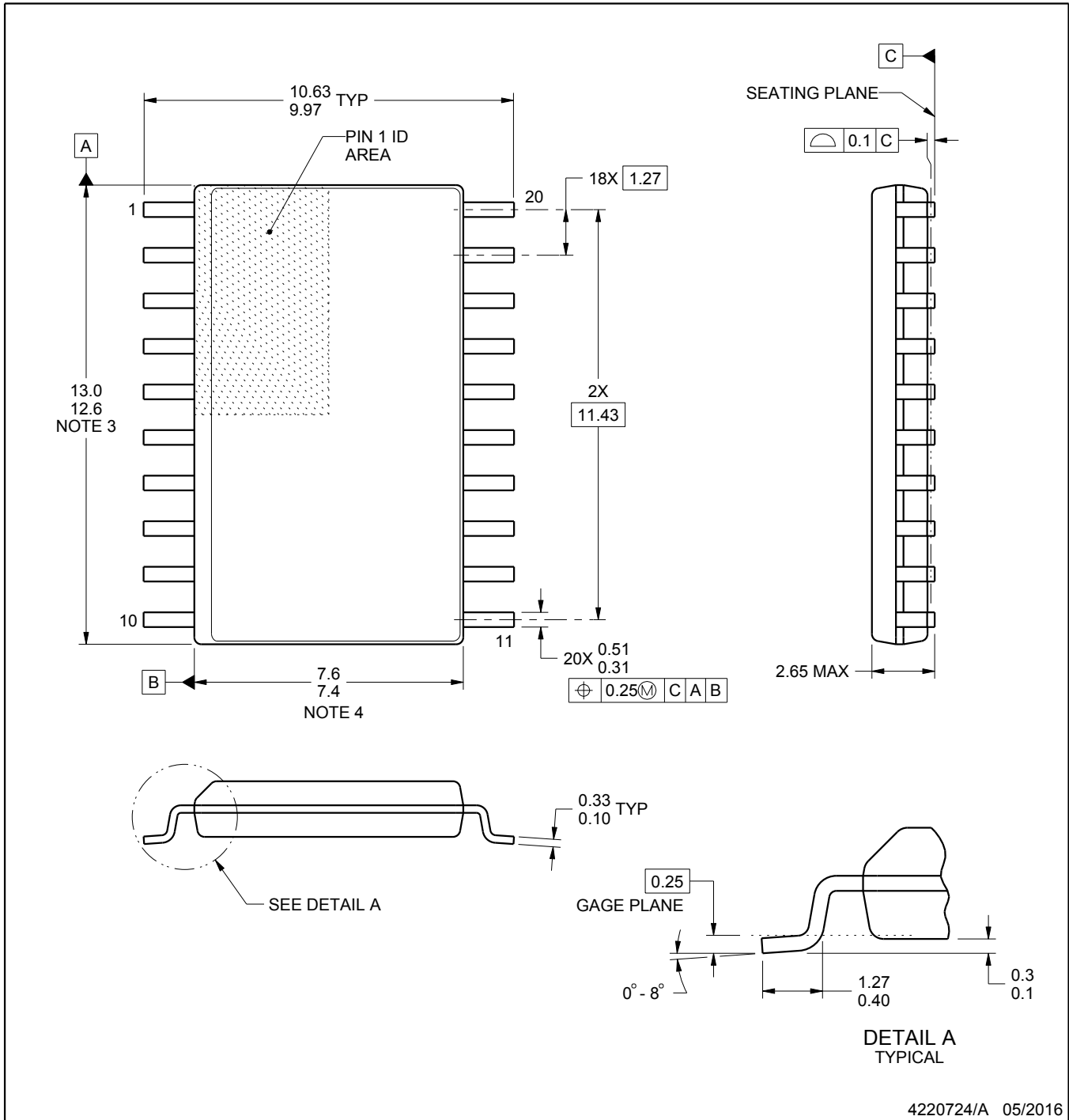
# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

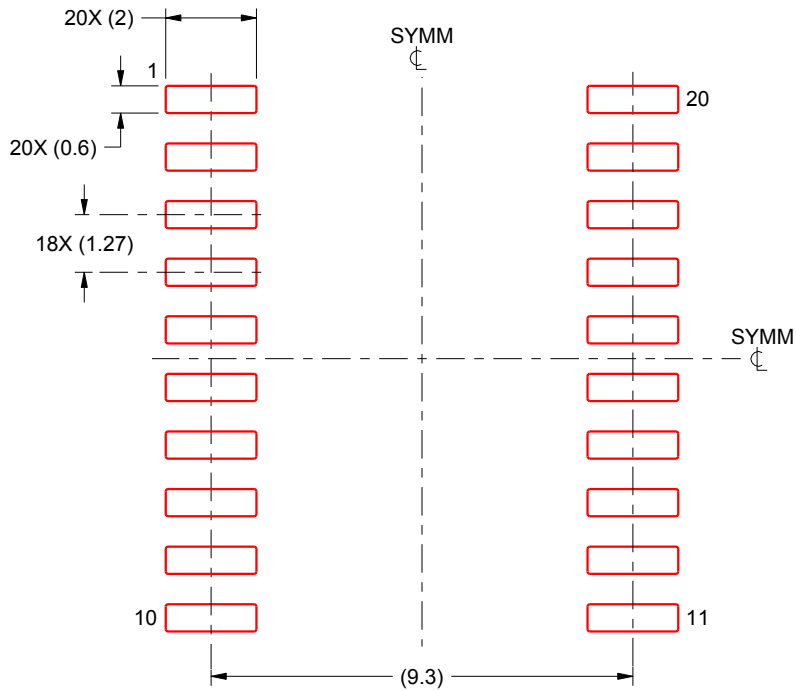
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-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.



PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# DB0020A



# PACKAGE OUTLINE

## TSSOP - 2 mm max height

SMALL OUTLINE PACKAGE



### 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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

DB0020A

TSSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4214851/A 12/2017

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0020A

TSSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4214851/A 12/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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