

## SN74AC241 Octal Buffers/Drivers with 3-State Outputs

### 1 Features

- Operation of 2 V to 6 V  $V_{CC}$
- Inputs accept voltages to 6 V
- Max  $t_{pd}$  of 7.5 ns at 5 V

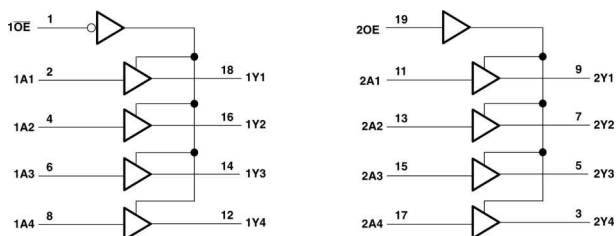
### 2 Description

These octal buffers and line drivers are designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

#### Package Information

PART NUMBER	PACKAGE <sup>1</sup>	BODY SIZE (NOM)
SN74AC241	N (PDIP, 20)	24.33 mm × 6.35 mm
	DW (SOIC, 20)	12.8 mm × 7.5 mm
	NS (SOP, 20)	12.6 mm × 5.3 mm
	DB (SSOP, 20)	7.2 mm × 5.3 mm
	PW (TSSOP, 20)	6.5 mm × 4.4 mm

1. For all available packages, see the orderable addendum at the end of the data sheet.



**Figure 2-1. Logic Diagram (Positive Logic)**



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## 3 Revision History

Changes from Revision E (October 2003) to Revision F (May 2023)	Page
• Added <i>Package Information</i> table, <i>Pin Functions</i> table, and <i>Thermal Information</i> table.....	1

## 4 Pin Configuration and Functions

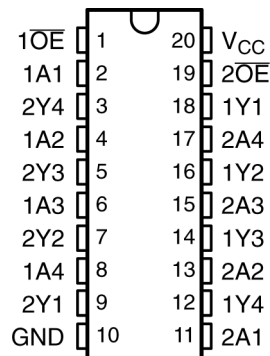


Figure 4-1. SN54AC241 DB, DW, N, NS, Or PW Package (Top View)

Table 4-1. Pin Functions

NAME <sup>1</sup>	PIN	TYPE	DESCRIPTION
1OE	1	I	Output enable 1
1A1	2	I	1A1 input
2Y4	3	O	2Y4 output
1A2	4	I	1A2 input
2Y3	5	O	2Y3 output
1A3	6	I	1A3 input
2Y2	7	O	2Y2 output
1A4	8	I	1A4 input
2Y1	9	O	2Y1 output
GND	10	—	Ground pin
2A1	11	I	2A1 input
1Y4	12	O	1Y4 output
2A2	13	I	2A2 input
1Y3	14	O	1Y3 output
2A3	15	I	2A3 input
1Y2	16	O	1Y2 output
2A4	17	I	2A4 input
1Y1	18	O	1Y1 output
2OE	19	I	Output enable 2
VCC	20	—	Power pin

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	7	V
V <sub>I</sub> <sup>1</sup>	Input voltage range	-0.5	V <sub>CC</sub> +0.5	V
V <sub>O</sub> <sup>1</sup>	Output voltage range	-0.5	V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input clamp current	(V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub> )	±20	mA
I <sub>OK</sub>	Output clamp current	(V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> )	±20	mA
I <sub>O</sub>	Continuous output current	(V <sub>O</sub> = 0 or V <sub>CC</sub> )	±50	mA
	Continuous current through V <sub>CC</sub> or GND		±200	mA
T <sub>stg</sub>	Storage temperature range	-65	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 “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 5.2 Recommended Operating Conditions

(see [Note 1](#))

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	2	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 3 V	2.1	V
		V <sub>CC</sub> = 4.5 V	1.15	
		V <sub>CC</sub> = 5.5 V	1.85	
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 3 V	0.9	V
		V <sub>CC</sub> = 4.5 V	1.35	
		V <sub>CC</sub> = 5.5 V	1.65	
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 3 V	-12	mA
		V <sub>CC</sub> = 4.5 V	-24	
		V <sub>CC</sub> = 5.5 V	-24	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 3 V	12	mA
		V <sub>CC</sub> = 4.5 V	24	
		V <sub>CC</sub> = 5.5 V	24	
Δt/Δv	Input transition rise or fall rate		8	ns/V
T <sub>a</sub>	Operating free-air temperature	-40	85	°C

- (1) 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.

### 5.3 Thermal Information

THERMAL METRIC <sup>(1)</sup>	DB	DW	N	NS	PW	UNIT
	20 PINS					
R <sub>θJA</sub>	70	58	69	60	83	°C/W

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>oh</sub> = -50 μA	3 V	2.9			2.9	V	
		4.5 V	4.4			4.4		
		5.5 V	5.4			5.4		
	I <sub>oh</sub> = -12 mA	3 V	2.56			2.46		
		4.5 V	3.86			3.76		
	I <sub>oh</sub> = -24 mA	5.5 V	4.86			4.76		
		I <sub>oh</sub> = -50 mA <sup>(1)</sup>	5.5 V					
I <sub>oh</sub> = -75 mA <sup>(1)</sup>	5.5 V				3.85			
V <sub>OL</sub>	I <sub>ol</sub> = 50 μA	3 V			0.1	0.1	V	
		4.5 V			0.1	0.1		
		5.5 V			0.1	0.1		
	I <sub>ol</sub> = 12 mA	3 V			0.36	0.44		
		4.5 V			0.36	0.44		
	I <sub>ol</sub> = 24 mA	5.5 V			0.36	0.44		
		I <sub>ol</sub> = 50 mA <sup>(1)</sup>	5.5 V					
I <sub>ol</sub> = 75 mA <sup>(1)</sup>	5.5 V				1.65			
I <sub>I</sub>	Data inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V		±0.1	±1	μA	
	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND			±0.1	±1		
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND, V <sub>I(OE)</sub> = V <sub>IL</sub> or V <sub>IH</sub>		5.5 V		±0.25	±2.5	μA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0		5.5 V		4	40	μA	
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		5 V	2.5			pF	

(1) Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

## 5.5 Switching Characteristics, V<sub>CC</sub> = 3.3 V ± 0.3 V

over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	1.5	6	9	1.5	10	ns
t <sub>PHL</sub>			1.5	6	9	1	10.5	
t <sub>PZH</sub>	OE or OE	Y	1.5	6.5	12.5	1	13	ns
t <sub>PZL</sub>			1.5	7	12	1.5	13	
t <sub>PHZ</sub>	OE or OE	Y	2	8	12	2	12.5	ns
t <sub>PLZ</sub>			1.5	7	12.5	1	13.5	

## 5.6 Switching Characteristics, V<sub>CC</sub> = 5 V ± 0.5 V

over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	1.5	5	7	1	7.5	ns
t <sub>PHL</sub>			1.5	4.5	7	1	7.5	
t <sub>PZH</sub>	OE or OE	Y	1.5	5.5	9	1	9.5	ns
t <sub>PZL</sub>			1.5	5.5	9	1	9.5	

**SN74AC241**

SCAS513F – JUNE 1995 – REVISED MAY 2023

 over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see [Figure 6-1](#))

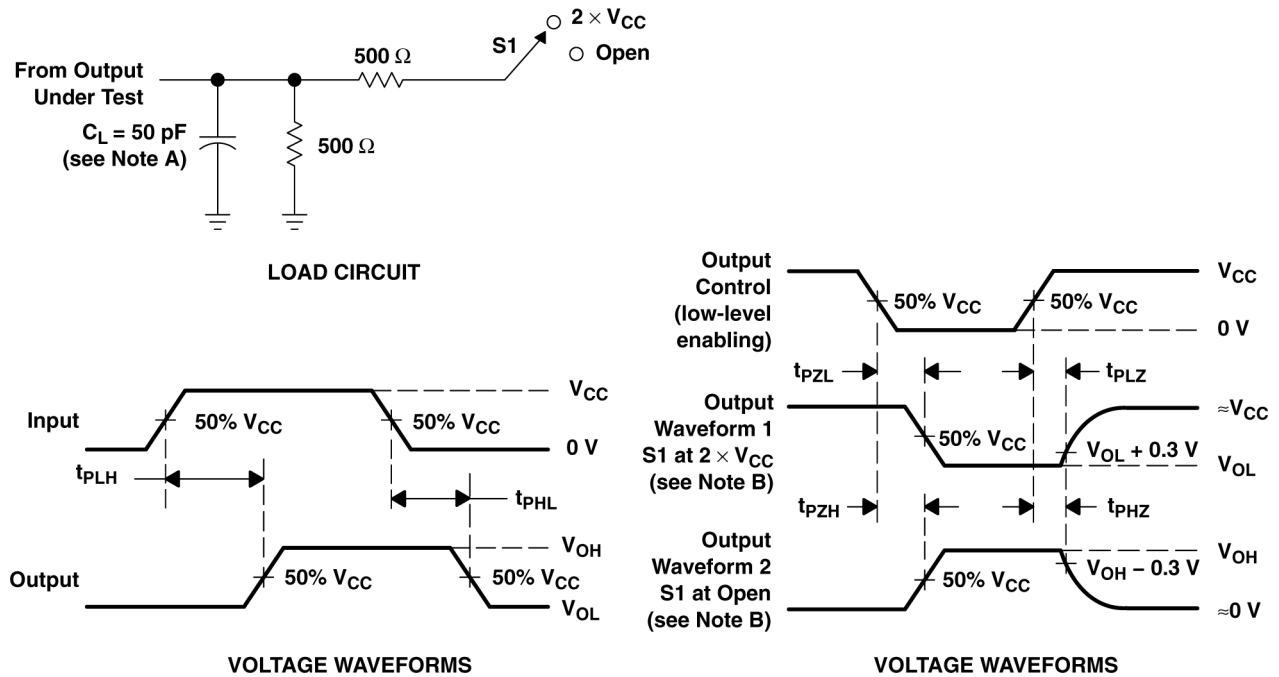
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	
$t_{PHZ}$	$\overline{OE}$ or OE	Y	1.5	6.5	10	1	10.5	ns
$t_{PLZ}$			1.5	6	10	1	10.5	

## 5.7 Operating Characteristics

 $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ 

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance per buffer/driver	$C_I = 50\text{ pF}$ , $f = 1\text{ MHz}$	45	pF

## 6 Parameter Measurement Information



- $C_L$  includes probe and jig capacitance.
- 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.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
- The outputs are measured one at a time with one input transition per measurement.

**Figure 6-1. Load Circuit and Voltage Waveforms**

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	Open

## 7 Detailed Description

### 7.1 Overview

The 'AC241 devices are organized as two 4-bit buffers/drivers with separate complementary output-enable ( $\overline{1OE}$  and  $2OE$ ) inputs. When  $\overline{1OE}$  is low or  $2OE$  is high, the device passes noninverted data from the A inputs to the Y outputs. When  $\overline{1OE}$  is high or  $2OE$  is low, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor and  $OE$  should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sinking or the current-sourcing capability of the driver.

### 7.2 Functional Block Diagram

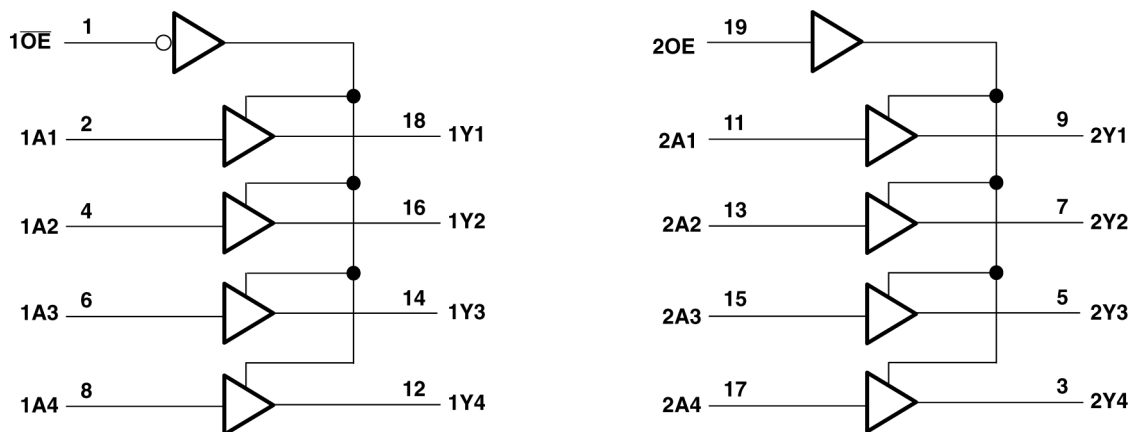


Figure 7-1. Logic Diagram (Positive Logic)

### 7.3 Device Functional Modes

Table 7-1. Function Tables

INPUTS		OUTPUT 1Y
$\overline{1OE}$	1A	
L	H	H
L	L	L
H	X	Z

INPUTS		OUTPUT 2Y
2OE	2A	
H	H	H
H	L	L
L	X	Z



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AC241DBR	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC241	<a href="#">Samples</a>
SN74AC241DW	LIFEBUY	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC241	
SN74AC241DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC241	<a href="#">Samples</a>
SN74AC241N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	-40 to 85	SN74AC241N	<a href="#">Samples</a>
SN74AC241NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC241	<a href="#">Samples</a>
SN74AC241PWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC241	<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.

**OBSELETE:** 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 finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material 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
SN74AC241DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74AC241DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74AC241NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74AC241PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	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)
SN74AC241DBR	SSOP	DB	20	2000	356.0	356.0	35.0
SN74AC241DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74AC241NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74AC241PWR	TSSOP	PW	20	2000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74AC241DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74AC241N	N	PDIP	20	20	506	13.97	11230	4.32

# PW0020A



# PACKAGE OUTLINE

## TSSOP - 1.2 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-153.

# EXAMPLE BOARD LAYOUT

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220206/A 02/2017

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

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220206/A 02/2017

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.



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

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4214851/B 08/2019

### 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

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4214851/B 08/2019

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

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4214851/B 08/2019

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.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - (C) Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - (D) The 20 pin end lead shoulder width is a vendor option, either half or full width.

# 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

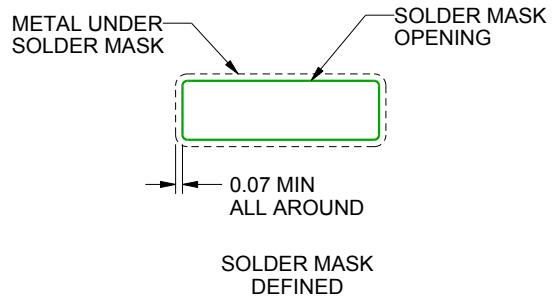
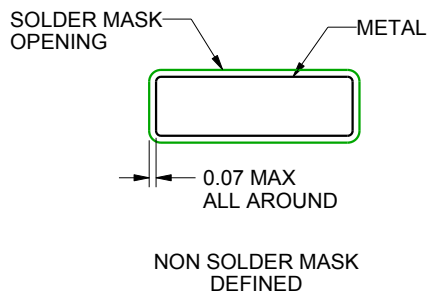
DW0020A

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.

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