

# SN75ALS174A Quadruple Differential Line Driver

## 1 Features

- Meets or exceeds the requirements of ANSI EIA/TIA-422-B and RS-485
- High-speed advanced low-power Schottky circuitry
- Designed for up to 20Mbit/s operation in both serial and parallel applications
- Designed for multipoint transmission on long bus lines in noisy environments
- Low supply current requirements 55mA max
- Wide positive and negative input/output bus voltage ranges
- Driver output capacity: 60mA
- Thermal-shutdown protection
- Driver positive- and negative-current limiting
- Functionally interchangeable with SN75174

## 2 Applications

- [Motor drives](#)
- [Factory automation and control](#)

## 3 Description

The SN75ALS174A is a quadruple line driver with tri-state differential outputs. It is designed to meet the requirements of ANSI Standards EIA/TIA-422-B and RS-485. This device is optimized for balanced multipoint bus transmission at rates of up to 20Mbit/s.

Each driver features wide positive and negative common-mode output voltage ranges that make them suitable for party-line applications in noisy environments.

The SN75ALS174A provides positive- and negative-current limiting and thermal shutdown for protection from line fault conditions on the transmission bus line. Shutdown occurs at a junction temperature of approximately 150°C.

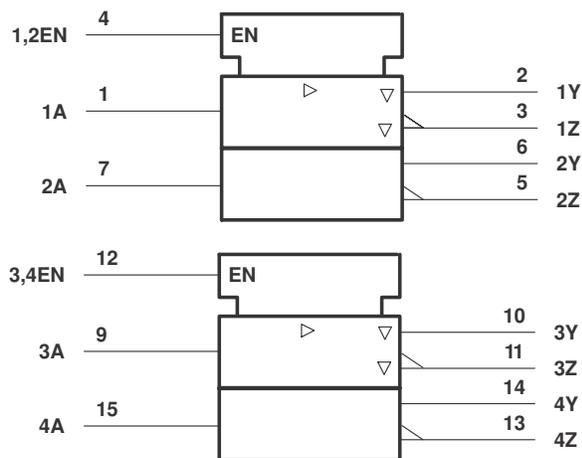
The SN75ALS174A is characterized for operation from 0°C to 70°C.

### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>
SN75ALS174A	PDIP (N) (16)	19.3mm x 9.4mm
	SOIC (DW) (20)	12.8mm x 10.3mm
	TSSOP (PW) (20)	6.5mm x 6.4mm

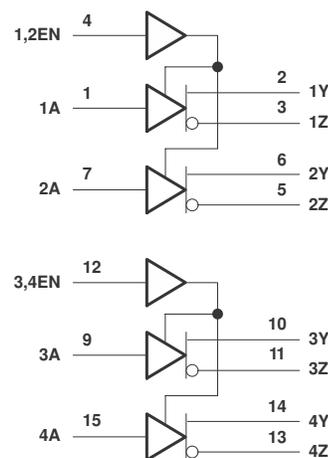
(1) For more information, see [Section 10](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



A. Pin numbers shown are for the N package.

### Logic Symbol <sup>1</sup>



A. Pin numbers shown are for the N package.

### Logic Diagram (Positive Logic)

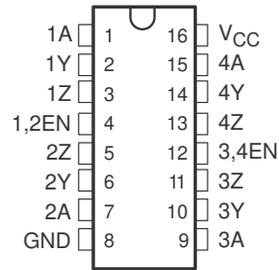
<sup>1</sup> This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



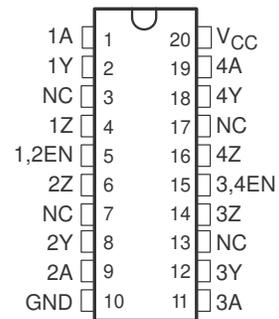
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## 4 Pin Configuration and Functions



### N Package (Top View)



NC – No internal connection

### DW, PW Package (Top View)

## 5 Specifications

### 5.1 Absolute Maximum Ratings

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

	MIN	MAX	UNIT
Supply voltage, $V_{CC}$ <sup>(2)</sup>	-0.5	7	V
Input voltage, $V_I$	-0.5	7	V
Output voltage range, $V_O$	-9	14	V
Continuous total dissipation	See the <i>Dissipation Rating</i> table		
Storage temperature, $T_{stg}$	-65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values are with respect to network GND.

### 5.2 Dissipation Rating Table

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING
DW	1125 mW	9.0 mW/°C	720 mW	596 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

### 5.3 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2		$V_{CC}$	V
$V_{IL}$	Low-level input voltage	0		0.8	V
$V_{OC}$	Common-mode output voltage	-7		12	V
$I_{OH}$	High-level output current	0		-60	mA
$I_{OL}$	Low-level output current	0		60	mA
$T_A$	Operating free-air temperature	0		70	°C

### 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	SN75ALS174A			UNIT	
	N (PDIP)	DW (SOIC)	PW		
	16 PINS	20 PINS	20 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	60.6	66.8	107.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	48.1	34.4	38.4	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	40.6	39.7	53.7	°C/W
$\psi_{JT}$	Junction-to-top characterization parameter	27.5	8.9	3.2	°C/W
$\psi_{JB}$	Junction-to-board characterization parameter	40.3	39	53.1	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	n/a	n/a	°C/W

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

## 5.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
$V_{IK}$	Input clamp voltage	$I_I = -18\text{mA}$			-1.5	V
$V_O$	Output voltage	$I_O = 0$	0		6	V
$ V_{OD1} $	Differential output voltage	$I_O = 0$	1.5		6	V
$ V_{OD2} $	Differential output voltage	$R_L = 100\Omega$	See Note Figure 6-1			$1/2 V_{OD1}$ or 2 <sup>(2)</sup>
		$R_L = 54\Omega$				1.5
$ V_{OD3} $	Differential output voltage	See <sup>(5)</sup>	1.5		5	V
$\Delta V_{OD} $	Change in magnitude of differential output voltage <sup>(3)</sup>	$R_L = 54\Omega$ or $100\Omega$	See Figure 6-1		$\pm 0.2$	V
$V_{OC}$	Common-mode output voltage <sup>(4)</sup>	$R_L = 54\Omega$ or $100\Omega$	See Figure 6-1		3	V
					-1	V
$\Delta V_{OC} $	Change in magnitude of common-mode output voltage <sup>(3)</sup>	$R_L = 54\Omega$ or $100\Omega$	See Figure 6-1		$\pm 0.2$	V
$I_O$	Output current with power off	$V_{CC} = 0, V_O = -7\text{V to } 12\text{V}$			$\pm 100$	$\mu\text{A}$
$I_{OZ}$	High-impedance-state output current	$V_O = -7\text{V to } 12\text{V}$			$\pm 100$	$\mu\text{A}$
$I_{IH}$	High-level input current	$V_I = 2.7\text{V}$			20	$\mu\text{A}$
$I_{IL}$	Low-level input current	$V_I = 0.4\text{V}$			-100	$\mu\text{A}$
$I_{OS}$	Short-circuit output current	$V_O = -7\text{V to } 12\text{V}$			$\pm 250$	$\text{mA}$
$I_{CC}$	Supply current (all drivers)	No load	Outputs enabled	36	55	$\text{mA}$
			Outputs disabled	16	30	$\text{mA}$

(1) All typical values are at  $V_{CC} = 5\text{V}$  and  $T_A = 25^\circ\text{C}$ .

(2) The minimum  $V_{OD2}$  with a  $100\Omega$  load is either  $1/2V_{OD1}$  or  $2\text{V}$ , whichever is greater.

(3)  $\Delta|V_{OD}|$  and  $\Delta|V_{OC}|$  are the changes in magnitude of  $V_{OD}$  and  $V_{OC}$ , respectively, that occur when the input is changed from a high level to a low level.

(4) In ANSI Standard EIA/TIA-422-B,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, is called output offset voltage,  $V_{OS}$ .

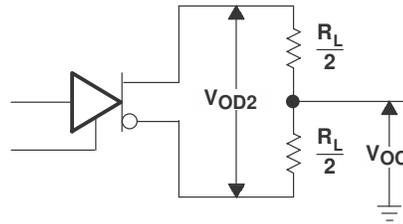
(5) See EIA Standard RS-485, Figures 3-5, Test Termination Measurement 2.

## 5.6 Switching Characteristics

over operating free-air temperature range (unless otherwise noted),  $C_L = 50\text{pF}$

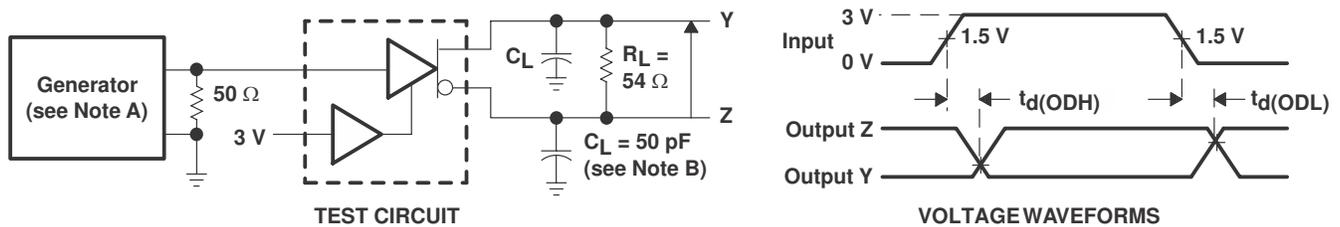
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential output delay time	$R_L = 54\Omega$ , See Figure 6-2	9	15	22	ns
$t_{PZH}$	Output enable time to high level	$R_L = 110\Omega$ , See Figure 6-3	30	45	70	ns
$t_{PZL}$	Output enable time to low level	$R_L = 110\Omega$ , See Figure 6-4	25	40	65	ns
$t_{PHZ}$	Output disable time from high level	$R_L = 110\Omega$ , See Figure 6-3	10	20	35	ns
$t_{PLZ}$	Output disable time from low level	$R_L = 110\Omega$ , See Figure 6-4	10	30	45	ns

## 6 Parameter Measurement Information



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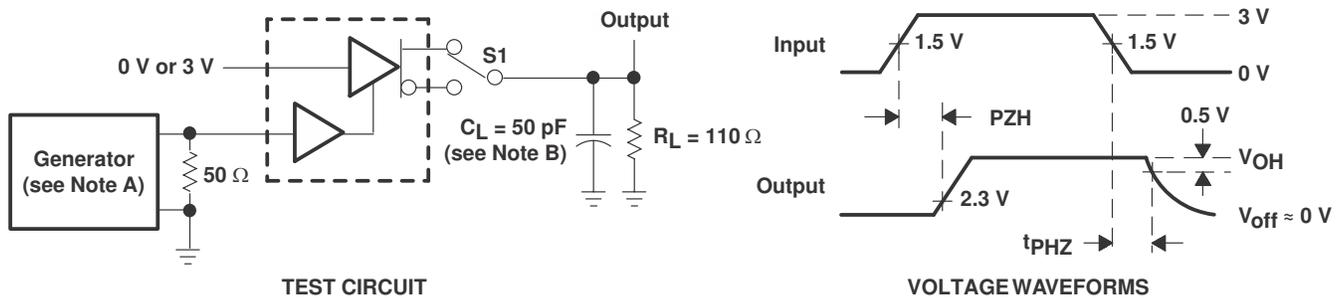
**Figure 6-1. Differential and Common-Mode Output Voltages**



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- A. The input pulse is supplied by a generator having the following characteristics: PRR = 1MHz,  $Z_O = 50\Omega$ , duty cycle = 50%,  $t_r$  5ns,  $t_f$  5ns.
- B.  $C_L$  includes probe and stray capacitance.

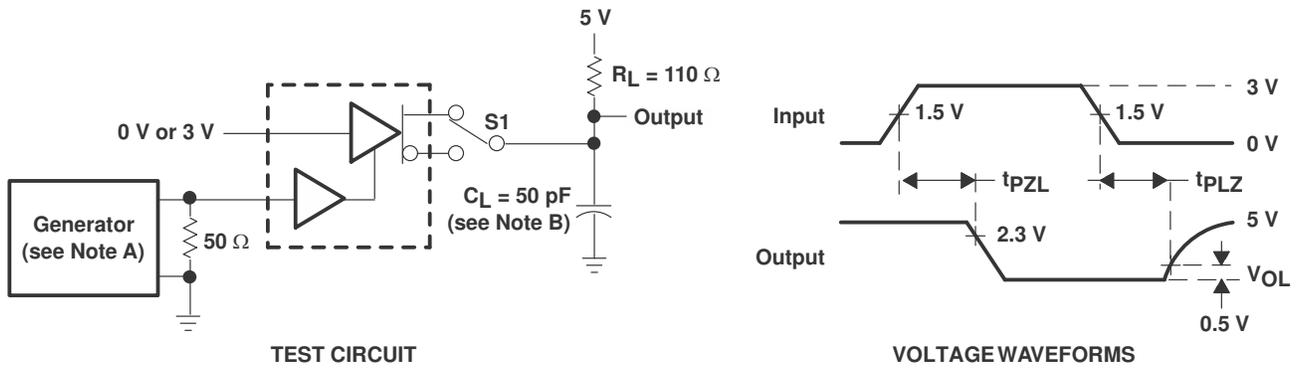
**Figure 6-2. Differential-Output Test Circuit and Delay and Transition Times Voltage Waveforms**



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- A. The input pulse is supplied by a generator having the following characteristics: PRR = 1MHz,  $Z_O = 50\Omega$ , duty cycle = 50%,  $t_r$  10ns,  $t_f$  10ns.
- B.  $C_L$  includes probe and stray capacitance.

**Figure 6-3. Test Circuit and Voltage Waveforms,  $t_{PZH}$  and  $t_{PHZ}$**



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- A. The input pulse is supplied by a generator having the following characteristics: PRR = 1MHz,  $Z_O = 50\Omega$ , duty cycle = 50%,  $t_r$  5ns,  $t_f$  5ns.
- B.  $C_L$  includes probe and stray capacitance.

**Figure 6-4. Test Circuit and Voltage Waveforms,  $t_{PZL}$  and  $t_{PLZ}$**

## 7 Detailed Description

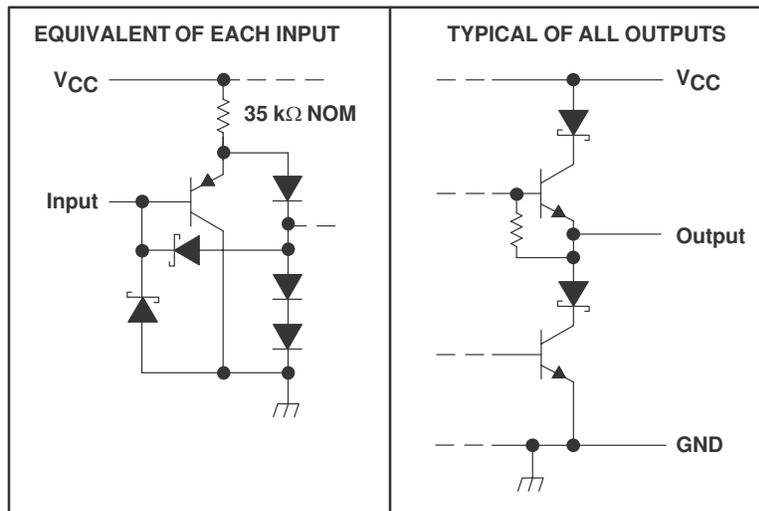
### 7.1 Device Functional Modes

Function Table (each driver)

INPUT A <sup>(1) (2)</sup>	ENABLES	OUTPUTS	
		Y	Z
H	H	H	L
L	H	L	H
X	L	Z	Z

(1) H = high level, L = low level, X = irrelevant.

(2) Z = high impedance (off)



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Figure 7-1. Schematics of Inputs and Outputs

## 8 Device and Documentation Support

### 8.1 Documentation Support

### 8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 8.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 8.4 Trademarks

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### 8.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 8.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision F (January 2018) to Revision G (April 2024)</b>	<b>Page</b>
• Changed the numbering format for tables, figures, and cross-references throughout the document.....	1
• Added the <i>Thermal Information</i> table.....	4
• Changed Note A in <a href="#">Figure 6-3</a> .....	6

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<b>Changes from Revision E (April 1998) to Revision F (January 2018)</b>	<b>Page</b>
• Added the PW package, <i>Applications</i> list, <i>Device Information</i> table, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. ....	1

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## 10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN75ALS174ADW</a>	Obsolete	Production	SOIC (DW)   20	-	-	Call TI	Call TI	0 to 70	
<a href="#">SN75ALS174ADWR</a>	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS174A
SN75ALS174ADWR.A	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS174A
<a href="#">SN75ALS174AN</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75ALS174AN
SN75ALS174AN.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75ALS174AN
<a href="#">SN75ALS174APWR</a>	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS174A
SN75ALS174APWR.A	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS174A

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

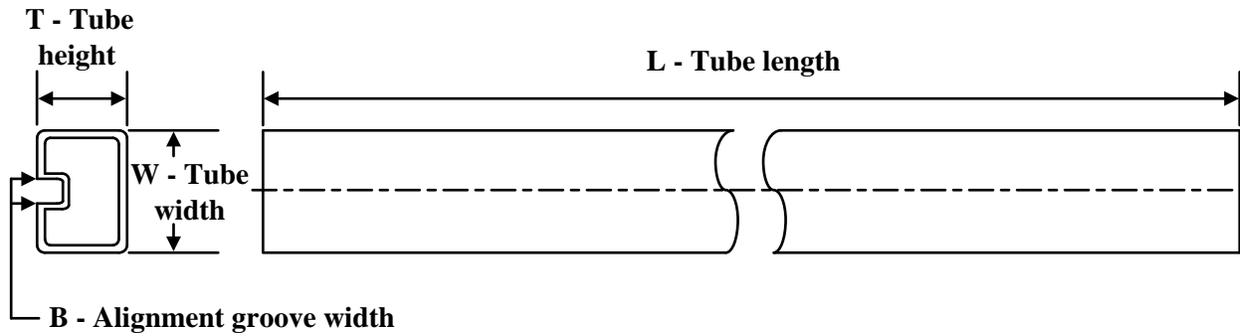

\*All dimensions are nominal

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
SN75ALS174ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN75ALS174APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	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)
SN75ALS174ADWR	SOIC	DW	20	2000	356.0	356.0	45.0
SN75ALS174APWR	TSSOP	PW	20	2000	353.0	353.0	32.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN75ALS174AN	N	PDIP	16	25	506	13.97	11230	4.32
SN75ALS174AN.A	N	PDIP	16	25	506	13.97	11230	4.32

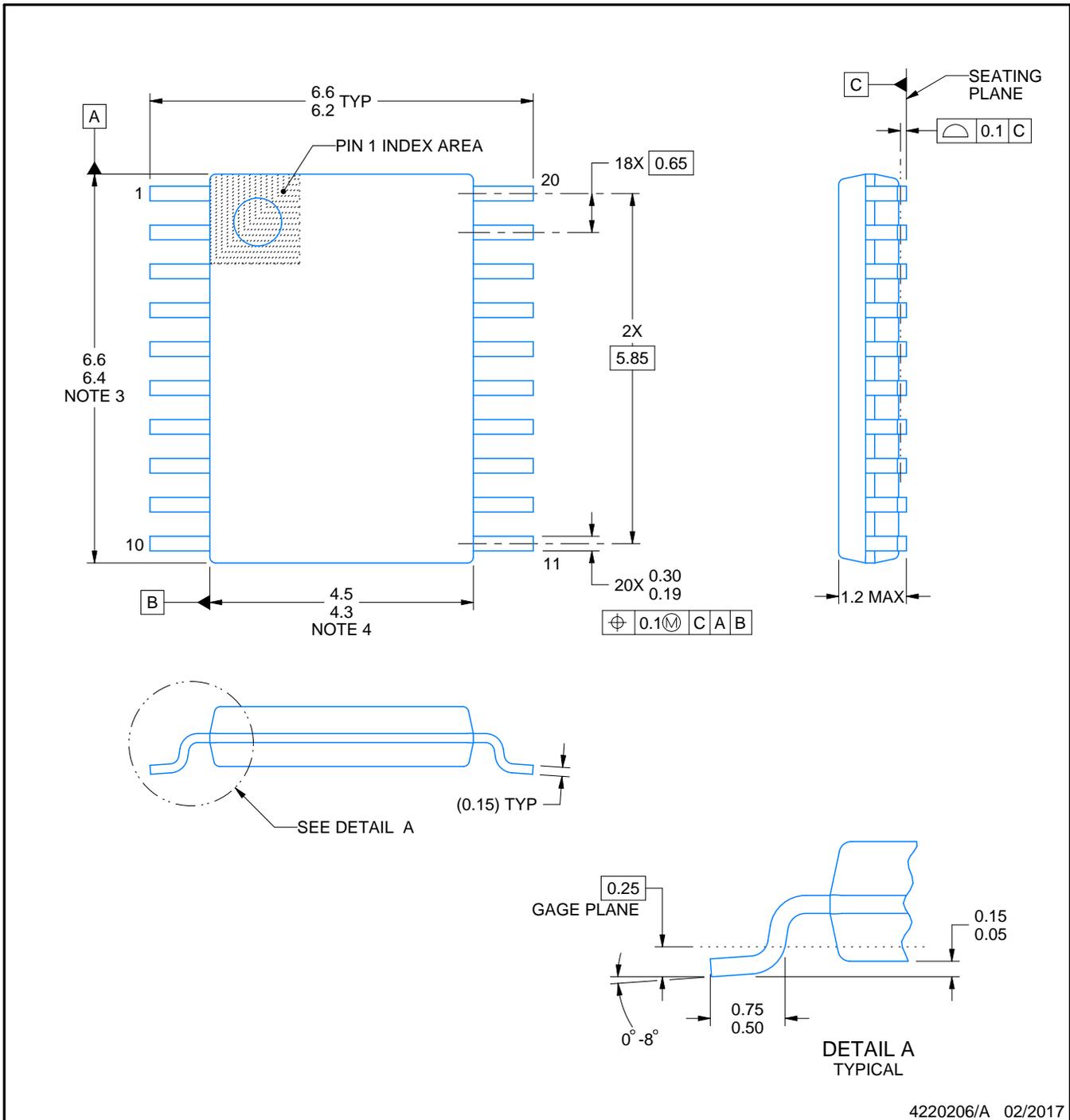
# PW0020A



# PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220206/A 02/2017

### NOTES:

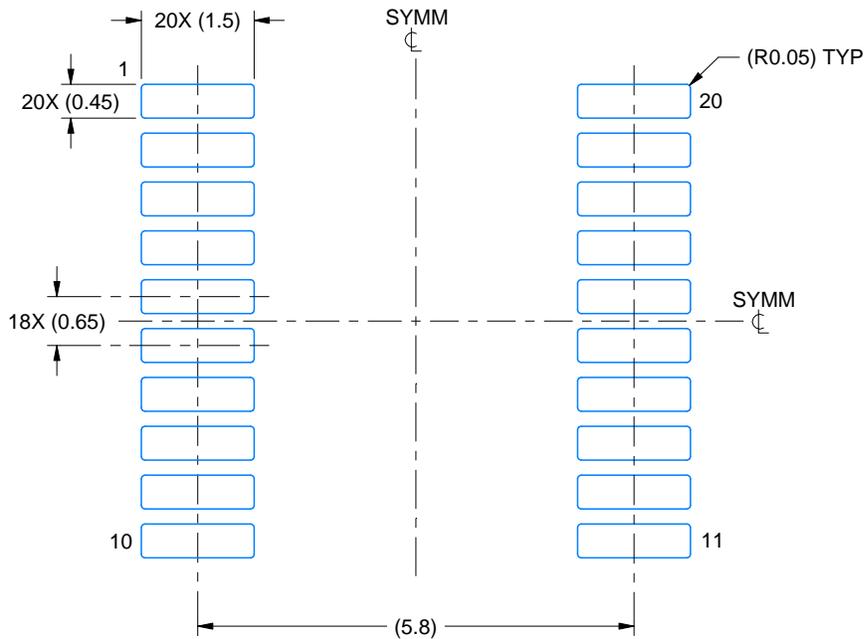
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

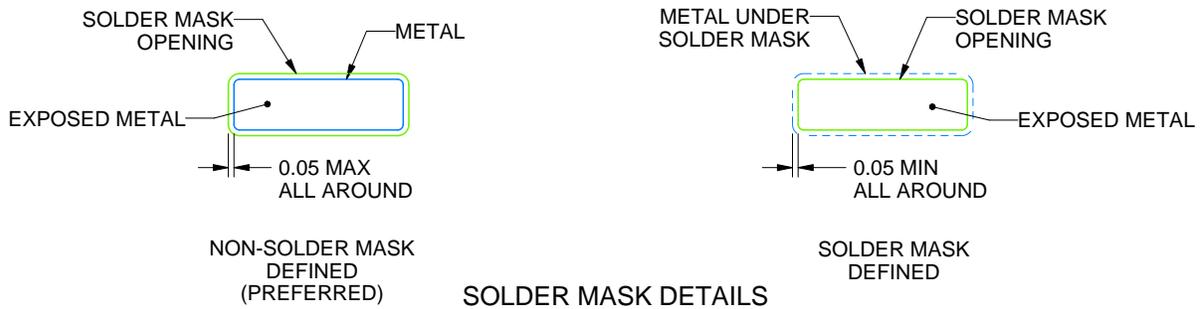
PW0020A

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)

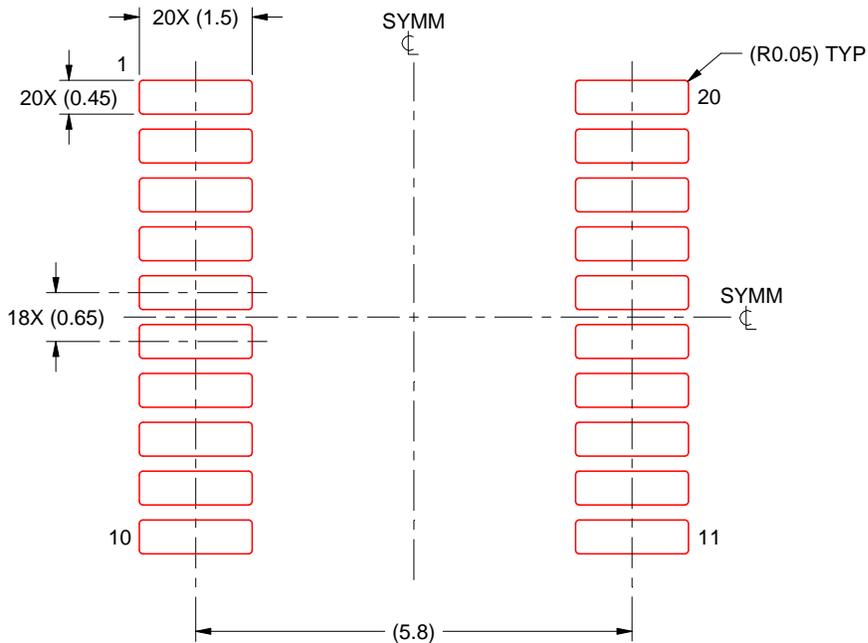
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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.

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

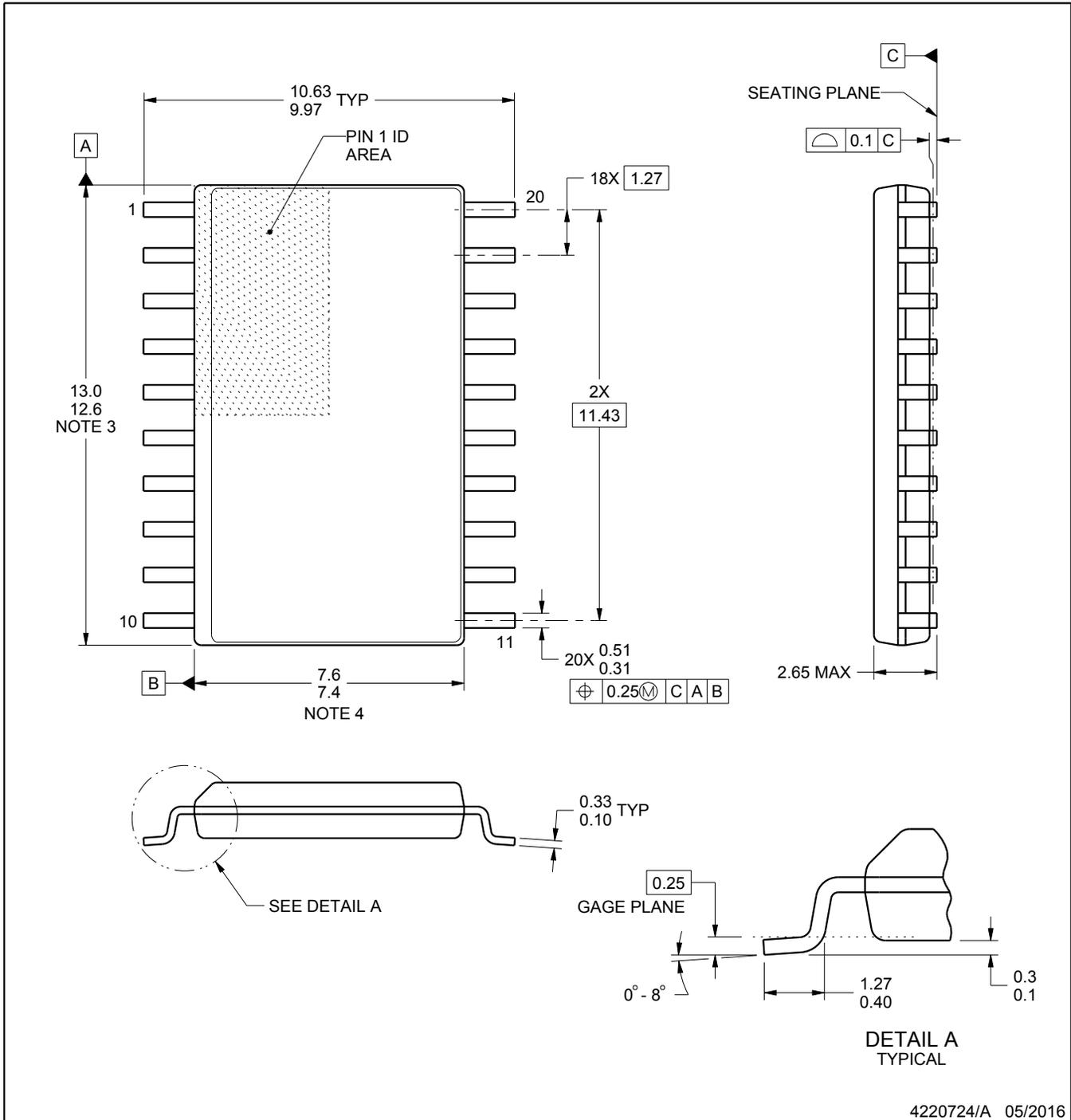
# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

NOTES:

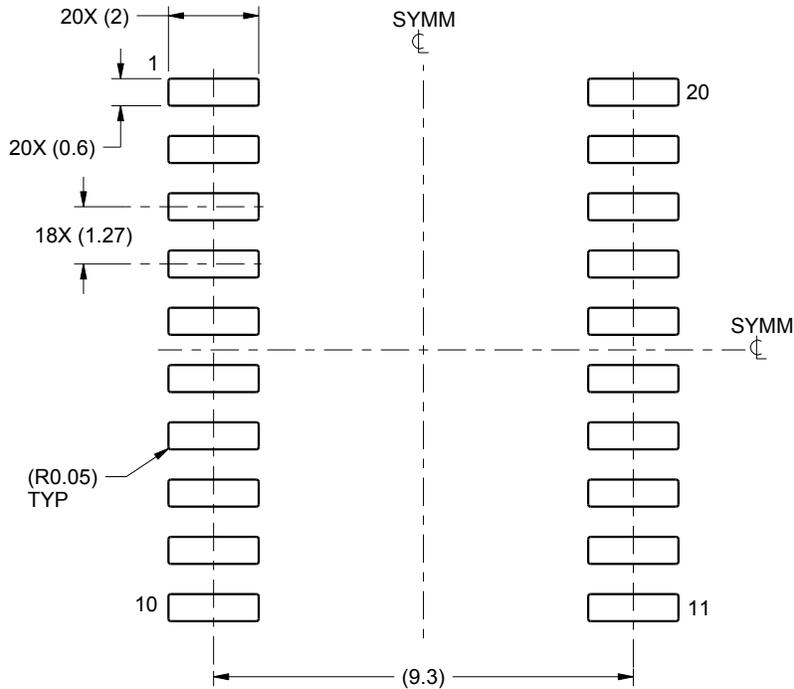
- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs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

# EXAMPLE BOARD LAYOUT

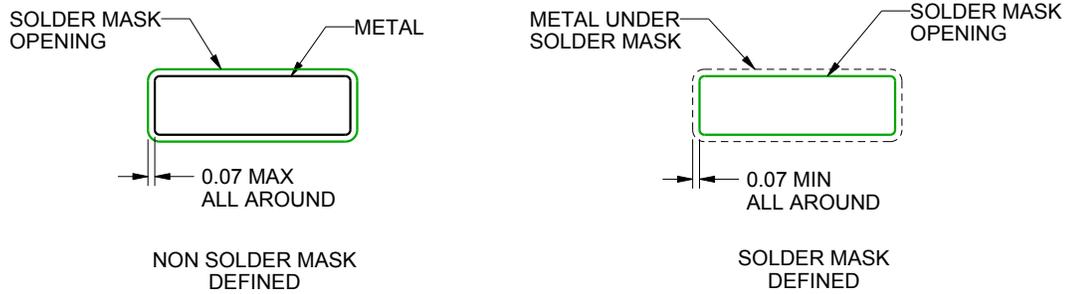
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

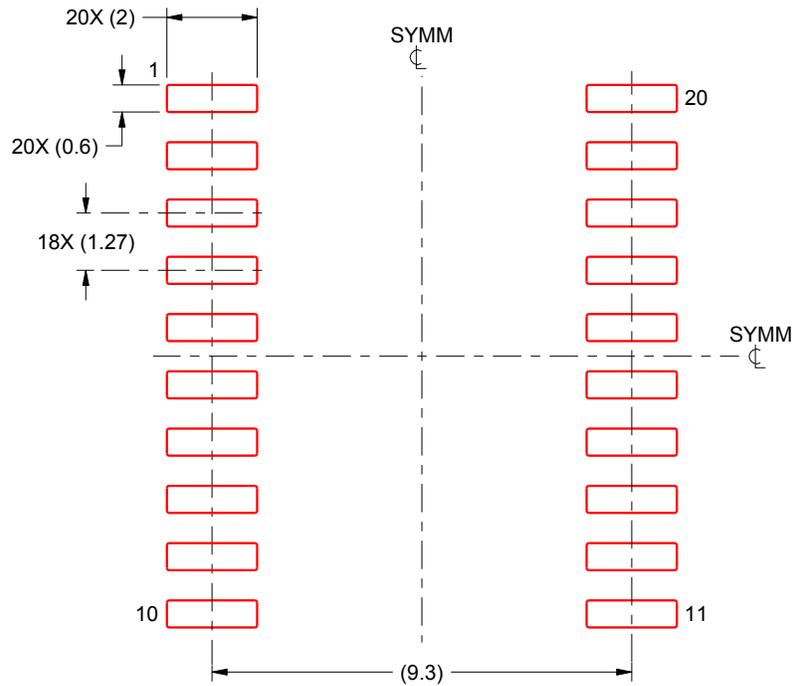
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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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