

# SN54276, SN74276 QUADRUPLE J-K FLIP-FLOPS

SDLS091

OCTOBER 1976 — REVISED MARCH 1988

- Four J-K Flip-Flops in a Single Package . . . Can Reduce FF Package Count by 50%
- Separate Negative-Edge-Triggered Clocks with Hysteresis . . . Typically 200 mV
- Typical Clock Input Frequency . . . 50 MHz
- Fully Buffered Outputs

## description

These quadruple TTL J-K flip-flops incorporate a number of third-generation IC features that can simplify system design and reduce flip-flop package count by up to 50%. They feature hysteresis at each clock input, fully buffered outputs, and direct clear capability, and are presettable through a buffer that also features an input hysteresis loop. The negative-edge-triggering clocks are directly compatible with earlier Series 54/74 single and dual pulse-triggered flip-flops. These circuits can be used to emulate D- or T-type flip-flops by hard-wiring the inputs, or to implement asynchronous sequential functions.

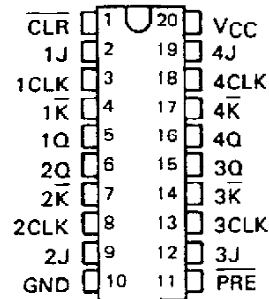
The SN54276 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; the SN74276 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (EACH FLIP-FLOP)

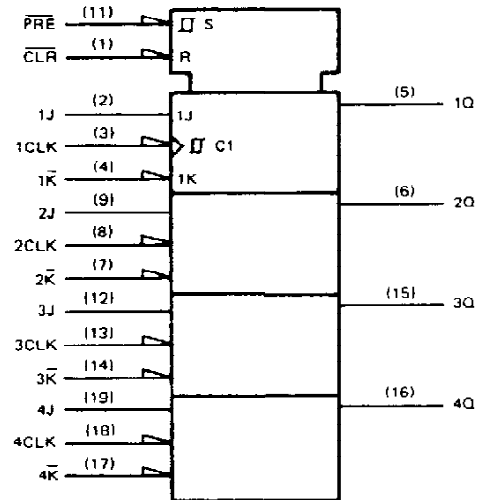
COMMON INPUTS		INPUTS			OUTPUT
PRE	CLR	CLK	J	K	Q
L	H	X	X	X	H
H	L	X	X	X	L
L	L	X	X	X	H <sup>†</sup>
H	H	↓	L	H	Q <sub>0</sub>
H	H	↓	H	H	H
H	H	↓	L	L	L
H	H	↓	H	L	TOGGLE
H	H	H	X	X	Q <sub>0</sub>

<sup>†</sup> This configuration is nonstable; that is, Q may not persist when preset and clear return to their inactive (high) level.

SN54276 . . . J PACKAGE  
SN74276 . . . N PACKAGE  
(TOP VIEW)



## logic symbol<sup>‡</sup>



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

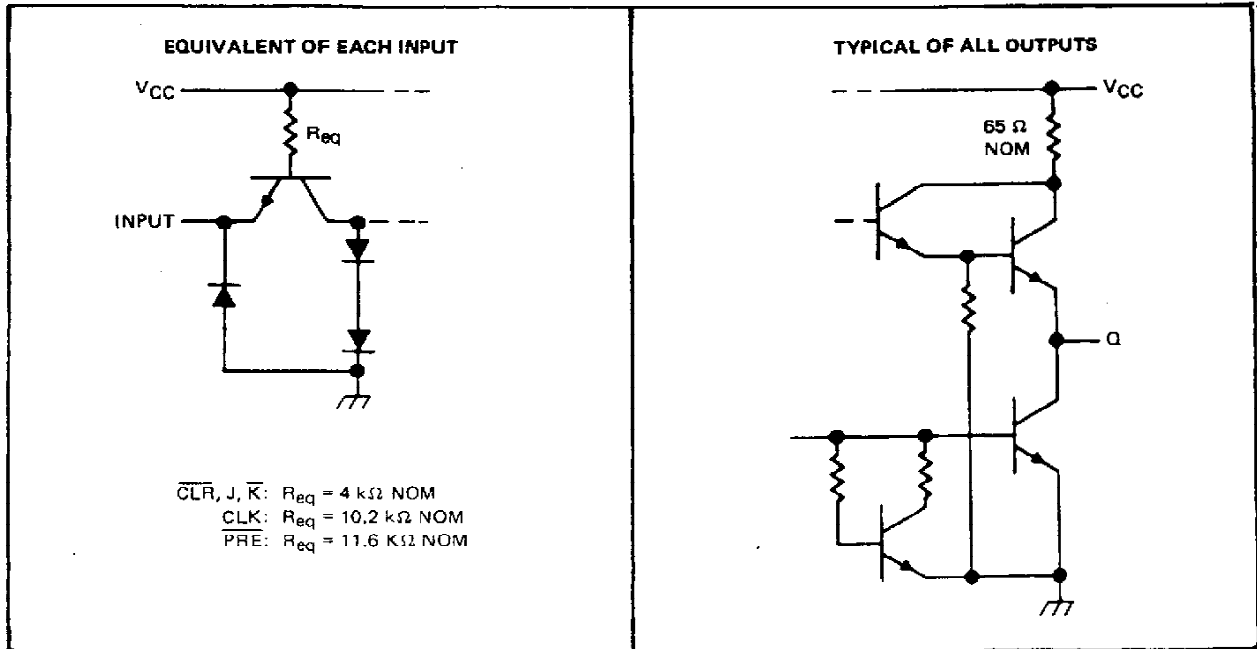
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# SN54276, SN74276 QUADRUPLE J-K FLIP-FLOPS

## schematics of inputs and outputs



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

Supply voltage, $V_{CC}$ (see Note 1) .....	7 V
Input voltage .....	5.5 V
Operating free-air temperature range: SN54276 .....	-55°C to 125°C
SN74276 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

# SN54276, SN74276 QUADRUPLE J-K FLIP-FLOPS

## recommended operating conditions

		SN54276			SN74276			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$		4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$				-800			-800	$\mu$ A
Low-level output current, $I_{OL}$				16			16	mA
Clock frequency		0		35	0		35	MHz
Pulse width, $t_W$	Clock high	13.5			13.5			ns
	Clock low	15			15			
	Preset or clear low	12			12			
Setup time, $t_{su}$	J, K inputs	3↓			3↓			ns
	Clear and preset inactive state	10↓			10↓			
Input hold time, $t_h$		10↓			10↓			ns
Operating free-air temperature, $T_A$		-55		125	0		70	$^{\circ}$ C

↓ The arrow indicates that the falling edge of the clock pulse is used for reference.

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

PARAMETER		TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{IH}$	High-level input voltage		2			V
$V_{IL}$	Low-level input voltage				0.8	V
$V_{IK}$	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$			-1.5	V
$V_{OH}$	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$	2.4	3.4		V
$V_{OL}$	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$		0.2	0.4	V
$I_I$	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			40	$\mu$ A
$I_{IL}$	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-1.6	mA
$I_{OS}$	Short-circuit output current§	$V_{CC} = \text{MAX}$	-30		-85	mA
$I_{CC}$	Supply current	$V_{CC} = \text{MAX}$		60	81	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$ .

§ Not more than one output should be shorted at a time.

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{\text{max}}$	Maximum clock frequency		35	50		MHz
$t_{PLH}$	Propagation delay time, low-to-high-level output from preset	$C_L = 15 \text{ pF}, R_L = 400 \Omega,$ See Note 2		15	25	ns
$t_{PHL}$	Propagation delay time, high-to-low-level output from clear			18	30	ns
$t_{PLH}$	Propagation delay time, low-to-high level output from clock			17	30	ns
$t_{PHL}$	Propagation delay time, high-to-low level output from clock			20	30	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN74276DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI	0 to 70		
SN74276DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI	0 to 70		
SN74276DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI	0 to 70		
SN74276N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	0 to 70		
SN74276N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	0 to 70		
SN74276N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	0 to 70		
SN74276N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	0 to 70		

(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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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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.

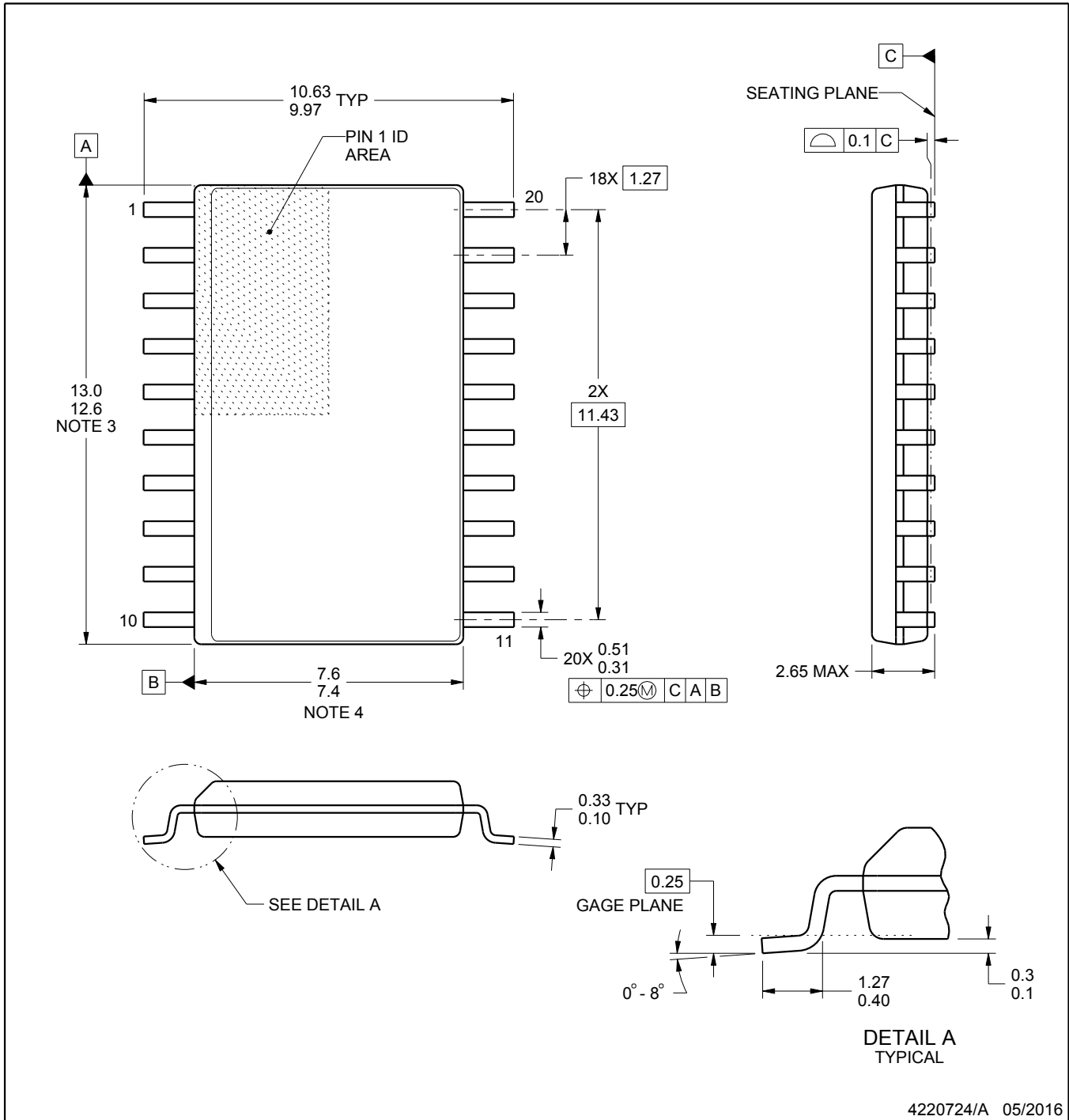
# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



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### NOTES:

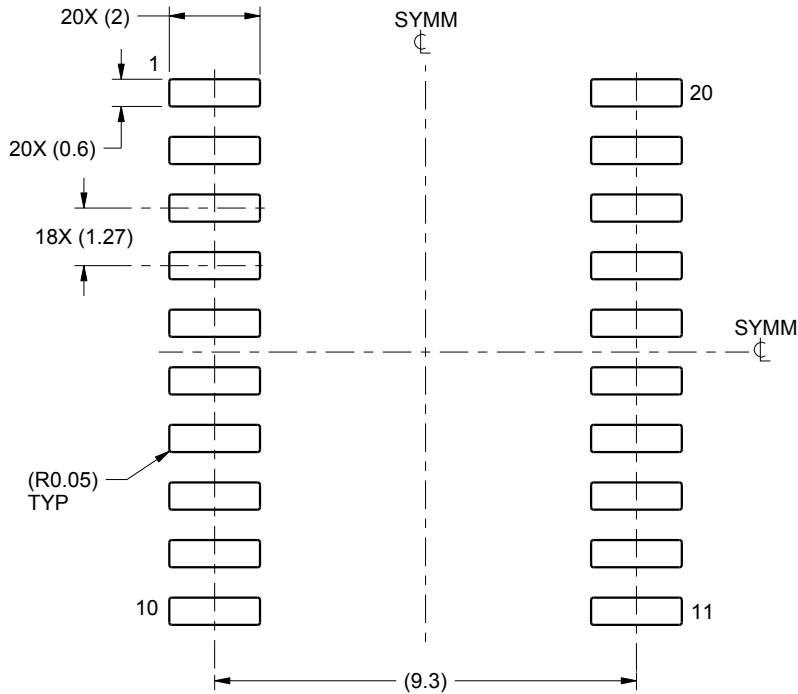
- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs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

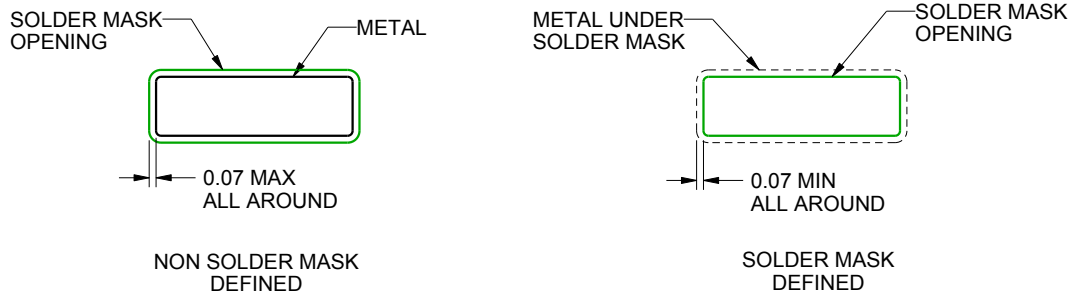
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

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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.

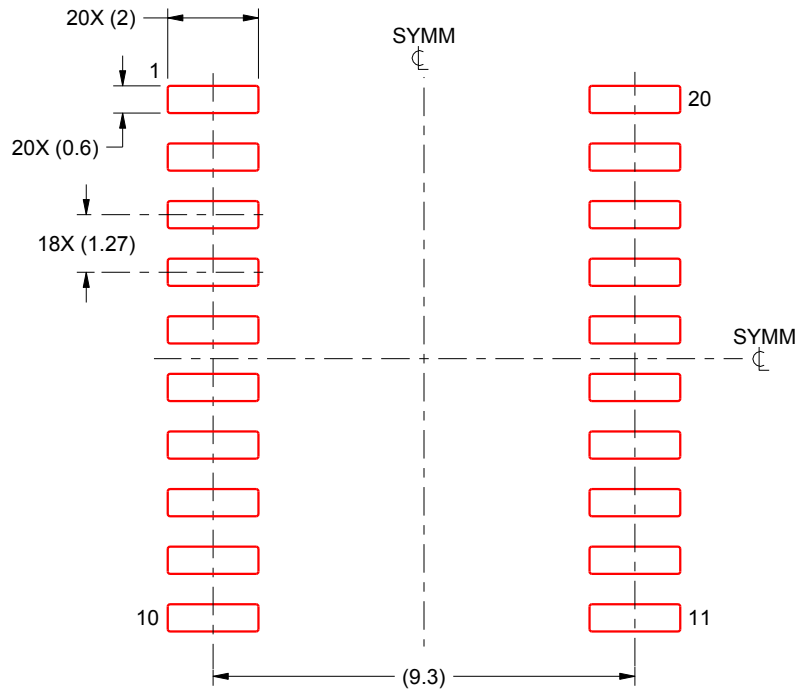


# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



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

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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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