

# SN54276, SN74276 QUADRUPL 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.

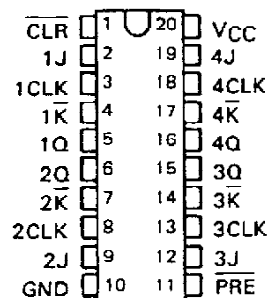
The SN54276 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; the SN74276 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (EACH FLIP-FLOP)

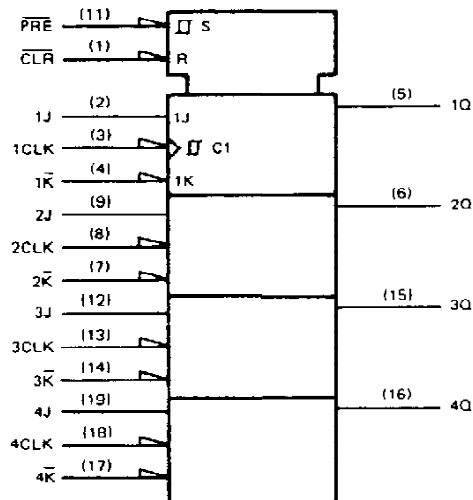
COMMON INPUTS		INPUTS			OUTPUT
PRE	CLR	CLK	J	K	Q
L	H	X	X	X	H
H	L	X	X	X	L
L	L	X	X	X	$H^{\dagger}$
H	H	J	L	H	$Q_0$
H	H	J	H	H	H
H	H	J	L	L	L
H	H	J	H	L	TOGGLE
H	H	H	X	X	$Q_0$

<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.

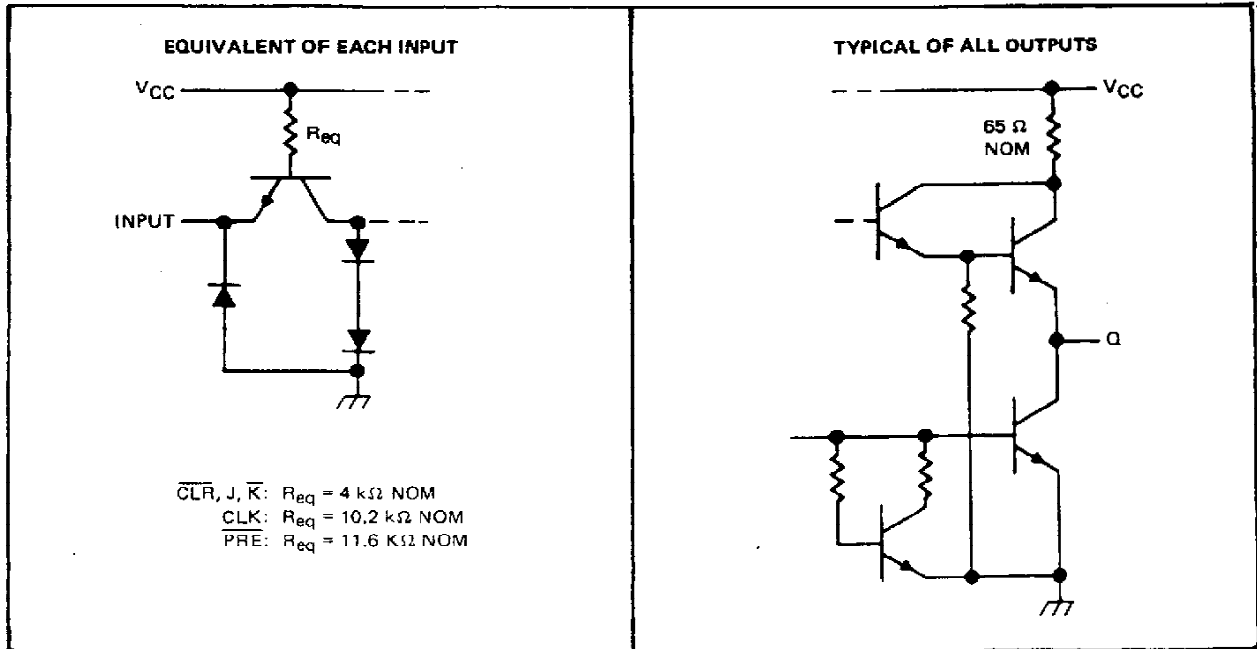
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# SN54276, SN74276 QUADRUPLE J-K FLIP-FLOPS

## 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	$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$
SN74276	$0^{\circ}\text{C}$ to $70^{\circ}\text{C}$
Storage temperature range	$-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$

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  $C_L = 15 \text{ pF}$ , $R_L = 400 \Omega$ , See Note 2	MIN	TYP	MAX	UNIT
$f_{max}$	Maximum clock frequency		35	50		MHz
$t_{PLH}$	Propagation delay time, low-to-high-level output from preset			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 <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74276DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74276DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74276DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74276N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74276N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74276N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74276N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DW (R-PDSO-G20)

# PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- 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 AC.

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- 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.

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## DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



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

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A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
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