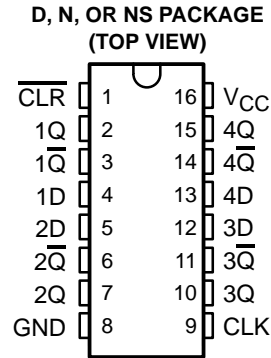


# SN74F175 QUADRUPLE D-TYPE FLIP-FLOP WITH CLEAR

SDFS058B – D293, MARCH 1987 – REVISED MAY 2002

- Contains Four Flip-Flops With Double-Rail Outputs
- Buffered Clock and Direct Clear Inputs
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators



## description

This positive-edge-triggered flip-flop utilizes TTL circuitry to implement D-type flip-flop logic with a direct clear (CLR) input. Information at the data (D) inputs meeting setup-time requirements is transferred to outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock (CLK) input is at either the high or low level, the D-input signal has no effect at the output.

## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74F175N	SN74F175N
	SOIC – D	Tube	SN74F175D	F175
		Tape and reel	SN74F175DR	
	SOP – NS	Tape and reel	SN74F175NSR	74F175

† 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).

## FUNCTION TABLE

INPUTS			OUTPUTS	
CLR	CLK	D	Q	Q̄
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q <sub>0</sub>	Q̄ <sub>0</sub>



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**TEXAS  
INSTRUMENTS**

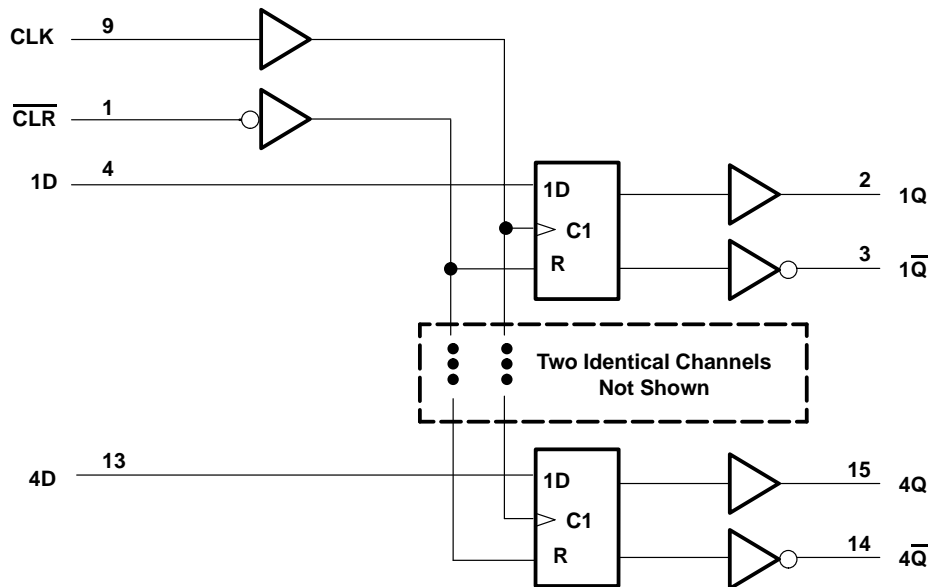
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# SN74F175 QUADRUPLE D-TYPE FLIP-FLOP WITH CLEAR

SDFS058B – D293, MARCH 1987 – REVISED MAY 2002

## 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 7 V
Input voltage range, $V_I$ (see Note 1) .....	-1.2 V to 7 V
Input current range .....	-30 mA to 5 mA
Voltage range applied to any output in the high state, $V_O$ .....	-0.5 V to $V_{CC}$
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package .....	73°C/W
N package .....	67°C/W
NS package .....	64°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 voltage ratings may be exceeded if the input current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 3)

	MIN	NOM	MAX	UNIT
$V_{CC}$ Supply voltage	4.5	5	5.5	V
$V_{IH}$ High-level input voltage	2			V
$V_{IL}$ Low-level input voltage			0.8	V
$I_{IK}$ Input clamp current			-18	mA
$I_{OH}$ High-level output current			-1	mA
$I_{OL}$ Low-level output current			20	mA
$T_A$ Operating free-air temperature	0		70	°C

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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# SN74F175 QUADRUPLE D-TYPE FLIP-FLOP WITH CLEAR

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

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V}$ ,	$I_{OH} = -1\text{ mA}$	2.5	3.4		V
	$V_{CC} = 4.75\text{ V}$ ,	$I_{OH} = -1\text{ mA}$	2.7			
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ ,	$I_{OL} = 20\text{ mA}$		0.3	0.5	V
$I_I$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 7\text{ V}$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 2.7\text{ V}$			20	$\mu\text{A}$
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 0.5\text{ V}$			-0.6	mA
$I_{OS}‡$	$V_{CC} = 5.5\text{ V}$ ,	$V_O = 0$	-60		-150	mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$ ,	See Note 4		22.5	34	mA

† 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, and the duration of the short circuit should not exceed one second.

NOTE 4:  $I_{CC}$  is measured with outputs open, with 4.5 V applied to all data inputs after a momentary ground, followed by 4.5 V applied to CLK.

**timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)**

			$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$		MIN	MAX	UNIT
			MIN	MAX			
$f_{\text{clock}}$	Clock frequency		100			100	MHz
$t_w$	Pulse duration		CLK high		4	4	ns
			CLK low		5	5	
			CLR low		5	5	
$t_{\text{su}}$	Setup time, data before CLK↑		High or low		3	3	ns
	Setup time, inactive state, data before CLK↑§		CLR high		5	5	
$t_h$	Hold time, data after CLK↑		High or low		1	1	ns

§ Inactive-state setup time also is referred to as recovery time.

**switching characteristics (see Figure 1)**

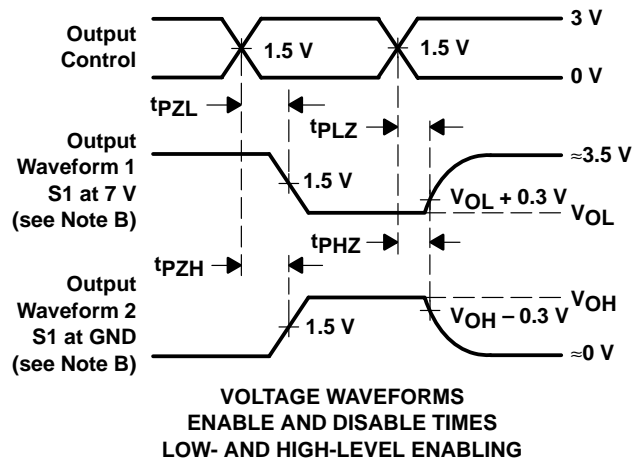
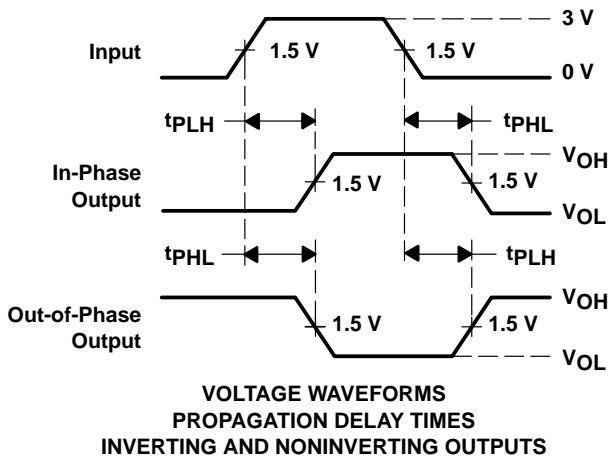
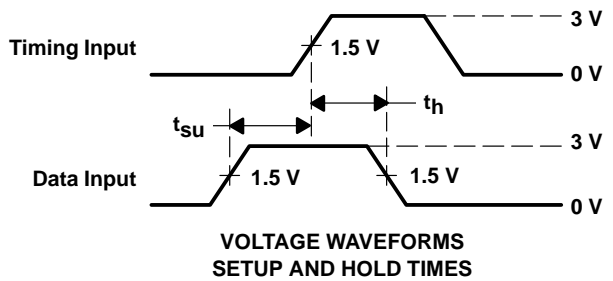
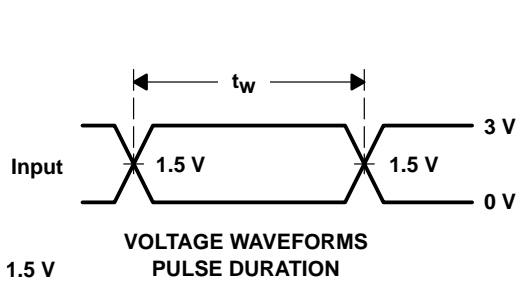
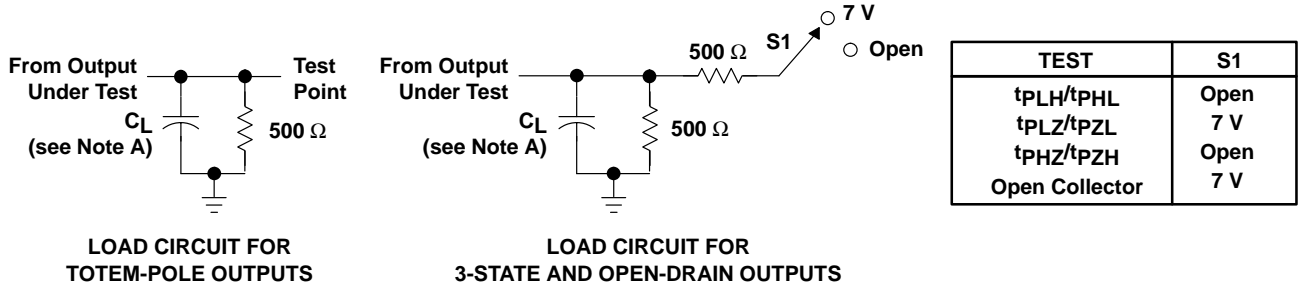
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$			$V_{CC} =$ 4.5 V to 5.5 V		UNIT
			MIN	TYP	MAX	MIN	MAX	
$f_{\text{max}}$			100	140		100		MHz
$t_{\text{PLH}}$	CLK	Q or $\bar{Q}$	3.2	4.6	6.5	3.2	7.5	ns
$t_{\text{PHL}}$			3.2	6.1	8.5	3.2	9.5	
$t_{\text{PLH}}$	CLR	$\bar{Q}$	3.2	6.1	8.5	3.2	9	ns
$t_{\text{PHL}}$		Q	3.7	8.6	11.5	3.7	13	



# SN74F175 QUADRUPLE D-TYPE FLIP-FLOP WITH CLEAR

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## PARAMETER MEASUREMENT INFORMATION



- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ , duty cycle = 50%.  
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

**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
SN74F175DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	F175	<a href="#">Samples</a>
SN74F175N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74F175N	<a href="#">Samples</a>
SN74F175NSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74F175	<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 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
SN74F175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74F175NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	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)
SN74F175DR	SOIC	D	16	2500	340.5	336.1	32.0
SN74F175NSR	SO	NS	16	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)
SN74F175N	N	PDIP	16	25	506	13.97	11230	4.32
SN74F175N	N	PDIP	16	25	506	13.97	11230	4.32

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.



# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



4220735/A 12/2021

#### 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 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



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NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021



NOTES: (continued)

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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

# 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.

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