

# SN54F74, SN74F74 DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SDFS046A – MARCH 1987 – REVISED OCTOBER 1993

- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

## description

These devices contain two independent positive-edge-triggered D-type flip-flops. A low level at the preset (PRE) or clear (CLR) inputs sets or resets the outputs regardless of the levels of the other inputs. When PRE and CLR are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold-time interval, data at the D input may be changed without affecting the levels at the outputs.

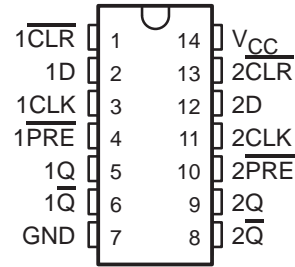
The SN54F74 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F74 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE**

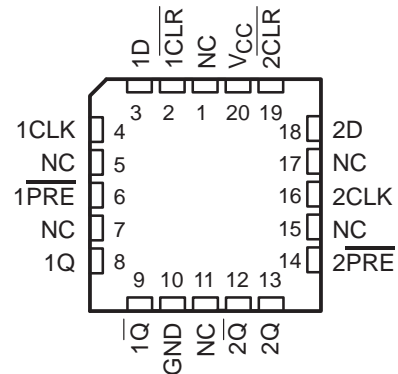
INPUTS				OUTPUTS	
PRE	CLR	CLK	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H <sup>†</sup>	H <sup>†</sup>
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q <sub>0</sub>	$\bar{Q}$ <sub>0</sub>

† The output levels are not guaranteed to meet the minimum levels for  $V_{OH}$ . Furthermore, this configuration is nonstable; that is, it will not persist when PRE or CLR returns to its inactive (high) level.

**SN54F74 . . . J PACKAGE  
SN74F74 . . . D OR N PACKAGE  
(TOP VIEW)**



**SN54F74 . . . FK PACKAGE  
(TOP VIEW)**



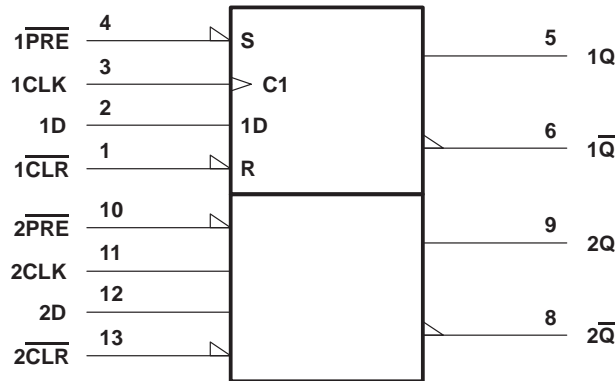
NC – No internal connection

# SN54F74, SN74F74

## DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

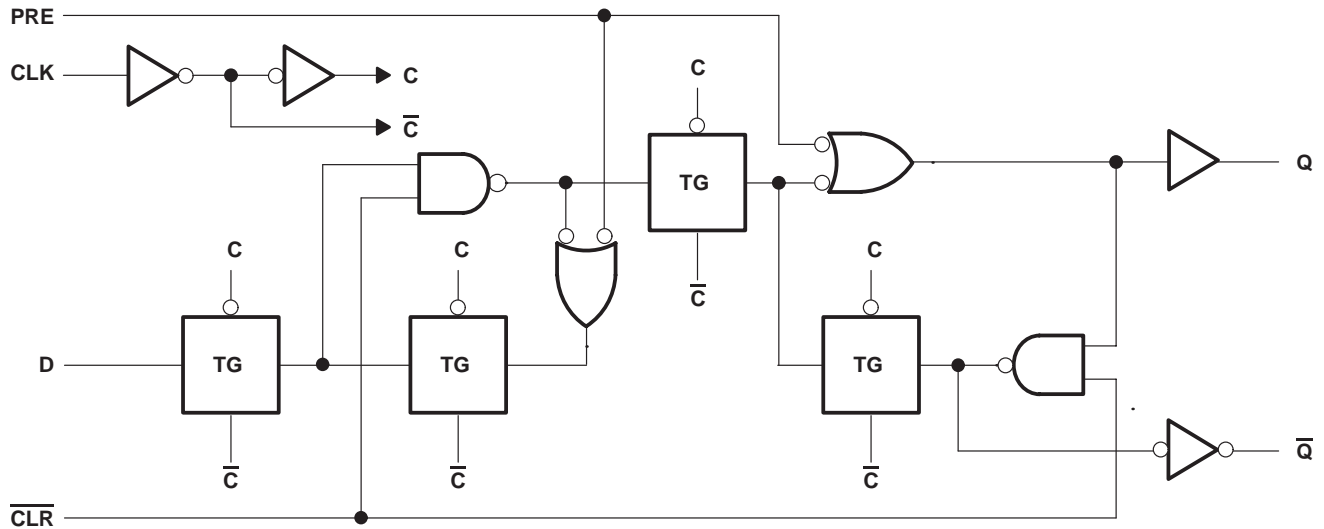
SDFS046A – MARCH 1987 – REVISED OCTOBER 1993

### logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

### logic diagram, each flip-flop (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 .....	-0.5 V to $V_{CC}$
Current into any output in the low state .....	40 mA
Operating free-air temperature range: SN54F74 .....	-55°C to 125°C
SN74F74 .....	0°C to 70°C
Storage temperature range .....	-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.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

# SN54F74, SN74F74 DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SDFS046A – MARCH 1987 – REVISED OCTOBER 1993

## recommended operating conditions

		SN54F74			SN74F74			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$I_{IK}$	Input clamp current			-18			-18	mA
$I_{OH}$	High-level output current			-1			-1	mA
$I_{OL}$	Low-level output current			20			20	mA
$T_A$	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54F74			SN74F74			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2			-1.2	V
$V_{OH}$		$V_{CC} = 4.5\text{ V}$ ,	$I_{OH} = -1\text{ mA}$	2.5	3.4		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		0.3	0.5	V
$I_I$		$V_{CC} = 5.5\text{ V}$ ,	$V_I = 7\text{ V}$			0.1			0.1	mA
$I_{IH}$		$V_{CC} = 5.5\text{ V}$ ,	$V_I = 2.7\text{ V}$			20			20	μA
$I_{IL}$	Data, CLK	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 0.5\text{ V}$			-0.6			-0.6	mA
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$					-1.8			-1.8	
$I_{OS}‡$		$V_{CC} = 5.5\text{ V}$ ,	$V_O = 0$	-60		-150	-60		-150	mA
$I_{CC}$		$V_{CC} = 5.5\text{ V}$ ,	See Note 2		10.5	16		10.5	16	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 2:  $I_{CC}$  is measured with D, CLK, and  $\overline{\text{PRE}}$  grounded then with D, CLK, and  $\overline{\text{CLR}}$  grounded.

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

			$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$		SN54F74		SN74F74		UNIT
			'F74						
			MIN	MAX	MIN	MAX	MIN	MAX	
$f_{\text{clock}}$	Clock frequency		0	100	0	80	0	100	MHz
$t_w$	Pulse duration		CLK high, $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low		4	4	4	4	ns
			CLK low		5	6	5	5	
$t_{su}$	Setup time, data before CLK↑		High		2	3	2	2	ns
			Low		3	4	3	3	
	Setup time, inactive-state before CLK↑§		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ to CLK		2	3	2	2	
$t_h$	Hold time, data after CLK↑		High		1	2	1	1	ns
			Low		1	2	1	1	

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



**SN54F74, SN74F74**  
**DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS**  
**WITH CLEAR AND PRESET**

SDFS046A – MARCH 1987 – REVISED OCTOBER 1993

**switching characteristics (see Note 3)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = 25°C			V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†			UNIT	
			'F74			SN54F74		SN74F74		
			MIN	TYP	MAX	MIN	MAX	MIN		MAX
f <sub>max</sub>			100	145		80		100	MHz	
t <sub>PLH</sub>	CLK	Q or $\bar{Q}$	3	4.9	6.8	3.8	8.5	3	7.8	ns
t <sub>PHL</sub>			3.6	5.8	8	4.4	10.5	3.6	9.2	
t <sub>PLH</sub>	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\bar{Q}$	2.4	4.2	6.1	3.2	8	2.4	7.1	ns
t <sub>PHL</sub>			2.7	6.6	9	3.5	11.5	2.7	10.5	

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

NOTE 3: Load circuits and waveforms are shown in Section 1.

**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>
5962-9759201Q2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9759201QCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
5962-9759201QDA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
JM38510/34101B2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
JM38510/34101BCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
JM38510/34101BDA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
SN54F74J	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
SN74F74D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74F74DR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74F74N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74F74N3	OBSOLETE	PDIP	N	14		None	Call TI	Call TI
SN74F74NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SNJ54F74FK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54F74J	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
SNJ54F74W	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC

<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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**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.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<b>Products</b>		<b>Applications</b>	
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>	Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265