

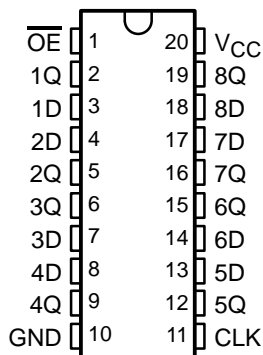
# SN54AHC374, SN74AHC374 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

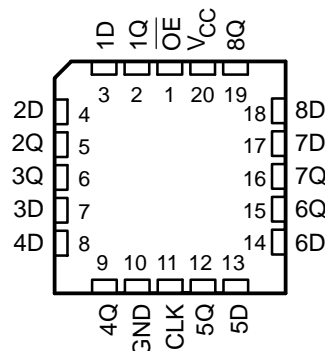
- Operating Range 2-V to 5.5-V  $V_{CC}$
- 3-State Outputs Drive Bus Lines Directly
- Latch-Up Performance Exceeds 250 mA Per JESD 17

- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

SN54AHC374 . . . J OR W PACKAGE  
SN74AHC374 . . . DB, DGV, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54AHC374 . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

The 'AHC374 devices are octal edge-triggered D-type flip-flops that feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels of the data (D) inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pullup components.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube	SN74AHC374N	SN74AHC374N
	SOIC – DW	Tube	SN74AHC374DW	AHC374
		Tape and reel	SN74AHC374DWR	
	SOP – NS	Tape and reel	SN74AHC374NSR	AHC374
	SSOP – DB	Tape and reel	SN74AHC374DBR	HA374
	TSSOP – PW	Tube	SN74AHC374PW	HA374
		Tape and reel	SN74AHC374PWR	
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74AHC374DGV	HA374
	CDIP – J	Tube	SNJ54AHC374J	SNJ54AHC374J
	CFP – W	Tube	SNJ54AHC374W	SNJ54AHC374W
	LCCC – FK	Tube	SNJ54AHC374FK	SNJ54AHC374FK

† 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).



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54AHC374, SN74AHC374  
OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

description/ordering information (continued)

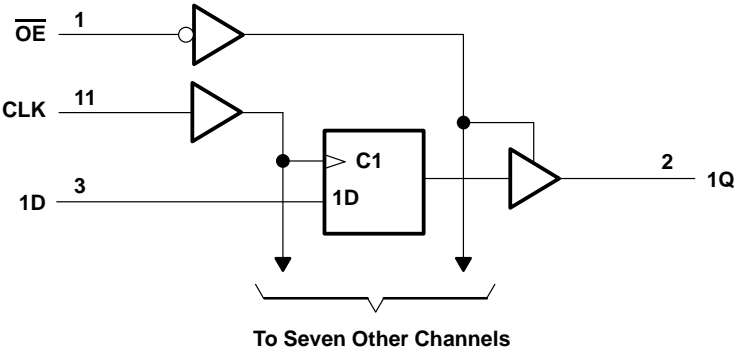
$\overline{OE}$  does not affect internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

FUNCTION TABLE  
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	$\uparrow$	H	H
L	$\uparrow$	L	L
L	H or L	X	$Q_0$
H	X	X	Z

logic diagram (positive logic)



## SCLS240I – OCTOBER 1995 – REVISED JULY 2003

Supply voltage range, $V_{CC}$	−0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	−0.5 V to 7 V
Output voltage range, $V_O$ (see Note 1)	−0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	−20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±25 mA
Continuous current through $V_{CC}$ or GND	±75 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	70°C/W
DGV package	92°C/W
DW package	58°C/W
N package	69°C/W
NS package	60°C/W
PW package	83°C/W
Storage temperature range, $T_{Stg}$	−65°C to 150°C

NOTES:

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JEDEC 51-7.

			SN54AHC374		SN74AHC374		UNIT
			MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage		2	5.5	2	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5		1.5		V
		V <sub>CC</sub> = 3 V	2.1		2.1		
		V <sub>CC</sub> = 5.5 V	3.85		3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0.5		0.5		V
		V <sub>CC</sub> = 3 V	0.9		0.9		
		V <sub>CC</sub> = 5.5 V	1.65		1.65		
V <sub>I</sub>	Input voltage		0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V	−50		−50		μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V	−4		−4		mA
		V <sub>CC</sub> = 5 V ± 0.5 V	−8		−8		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V	50		50		μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V	4		4		mA
		V <sub>CC</sub> = 5 V ± 0.5 V	8		8		
Δt/Δv	Input transition rise or fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V	100		100		ns/V
		V <sub>CC</sub> = 5 V ± 0.5 V	20		20		
T <sub>A</sub>	Operating free-air temperature		−55	125	−40	85	°C



# SN54AHC374, SN74AHC374

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54AHC374		SN74AHC374		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 µA	2 V	1.9	2		1.9		1.9		V
		3 V	2.9	3		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		2.48		
	I <sub>OH</sub> = -8 mA	4.5 V	3.94			3.8		3.8		
V <sub>OL</sub>	I <sub>OL</sub> = 50 µA	2 V			0.1		0.1		0.1	V
		3 V			0.1		0.1		0.1	
		4.5 V			0.1		0.1		0.1	
	I <sub>OL</sub> = 4 mA	3 V			0.36		0.5		0.44	
	I <sub>OL</sub> = 8 mA	4.5 V			0.36		0.5		0.44	
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V			±0.1		±1*		±1	µA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V			±0.25		±2.5		±2.5	µA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			4		40		40	µA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		4	10				10	pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5 V		6						pF

\* On products compliant to MIL-PRF-38535, this parameter is not production tested at V<sub>CC</sub> = 0 V.

**timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)**

		T <sub>A</sub> = 25°C		SN54AHC374		SN74AHC374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration, CLK high or low	5		5.5		5.5		ns
t <sub>su</sub>	Setup time, data before CLK↑	4.5		4		4		ns
t <sub>h</sub>	Hold time, data after CLK↑	2		2		2		ns

**timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

		T <sub>A</sub> = 25°C		SN54AHC374		SN74AHC374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration, CLK high or low	5		5		5		ns
t <sub>su</sub>	Setup time, data before CLK↑	3		3		3		ns
t <sub>h</sub>	Hold time, data after CLK↑	2		2		2		ns



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# SN54AHC374, SN74AHC374 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN54AHC374		SN74AHC374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			C <sub>L</sub> = 15 pF	80*	130*		70*		70		MHz
			C <sub>L</sub> = 50 pF	55	85		50		50		
t <sub>PLH</sub>	CLK	Q	C <sub>L</sub> = 15 pF		8.1*	12.7*	1*	15*	1	15	ns
t <sub>PHL</sub>					8.1*	12.7*	1*	15*	1	15	
t <sub>PZH</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF		7.1*	11*	1*	13*	1	13	ns
t <sub>PZL</sub>					7.1*	11*	1*	13*	1	13	
t <sub>PHZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF		7.5*	10.5*	1*	12.5*	1	12.5	ns
t <sub>PLZ</sub>					7.5*	10.5*	1*	12.5*	1	12.5	
t <sub>PLH</sub>	CLK	Q	C <sub>L</sub> = 50 pF		10.6	16.2	1	18.5	1	18.5	ns
t <sub>PHL</sub>					10.6	16.2	1	18.5	1	18.5	
t <sub>PZH</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF		9.6	14.5	1	16.5	1	16.5	ns
t <sub>PZL</sub>					9.6	14.5	1	16.5	1	16.5	
t <sub>PHZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF		10.2	14	1	16	1	16	ns
t <sub>PLZ</sub>					10.2	14	1	16	1	16	
t <sub>sk(o)</sub>			C <sub>L</sub> = 50 pF			1.5**				1.5	ns

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

\*\* On products compliant to MIL-PRF-38535, this parameter does not apply.

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN54AHC374		SN74AHC374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			C <sub>L</sub> = 15 pF	130*	185*		110*		110		MHz
			C <sub>L</sub> = 50 pF	85	120		75		75		
t <sub>PLH</sub>	CLK	Q	C <sub>L</sub> = 15 pF		5.4*	8.1*	1*	9.5*	1	9.5	ns
t <sub>PHL</sub>					5.4*	8.1*	1*	9.5*	1	9.5	
t <sub>PZH</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF		5.1*	7.6*	1*	9*	1	9	ns
t <sub>PZL</sub>					5.1*	7.6*	1*	9*	1	9	
t <sub>PHZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF		4.6*	6.8*	1*	8*	1	8	ns
t <sub>PLZ</sub>					4.6*	6.8*	1*	8*	1	8	
t <sub>PLH</sub>	CLK	Q	C <sub>L</sub> = 50 pF		6.9	10.1	1	11.5	1	11.5	ns
t <sub>PHL</sub>					6.9	10.1	1	11.5	1	11.5	
t <sub>PZH</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF		6.6	9.6	1	11	1	11	ns
t <sub>PZL</sub>					6.6	9.6	1	11	1	11	
t <sub>PHZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF		6.1	8.8	1	10	1	10	ns
t <sub>PLZ</sub>					6.1	8.8	1	10	1	10	
t <sub>sk(o)</sub>			C <sub>L</sub> = 50 pF			1**				1	ns

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

\*\* On products compliant to MIL-PRF-38535, this parameter does not apply.



# SN54AHC374, SN74AHC374

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

noise characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 4)

PARAMETER	SN74AHC374			UNIT
	MIN	TYP	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic $V_{OL}$		0.5	1	V
$V_{OL(V)}$ Quiet output, minimum dynamic $V_{OL}$		–0.5	–0.8	V
$V_{OH(V)}$ Quiet output, minimum dynamic $V_{OH}$		4		V
$V_{IH(D)}$ High-level dynamic input voltage		3.5		V
$V_{IL(D)}$ Low-level dynamic input voltage			1.5	V

NOTE 4: Characteristics are for surface-mount packages only.

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

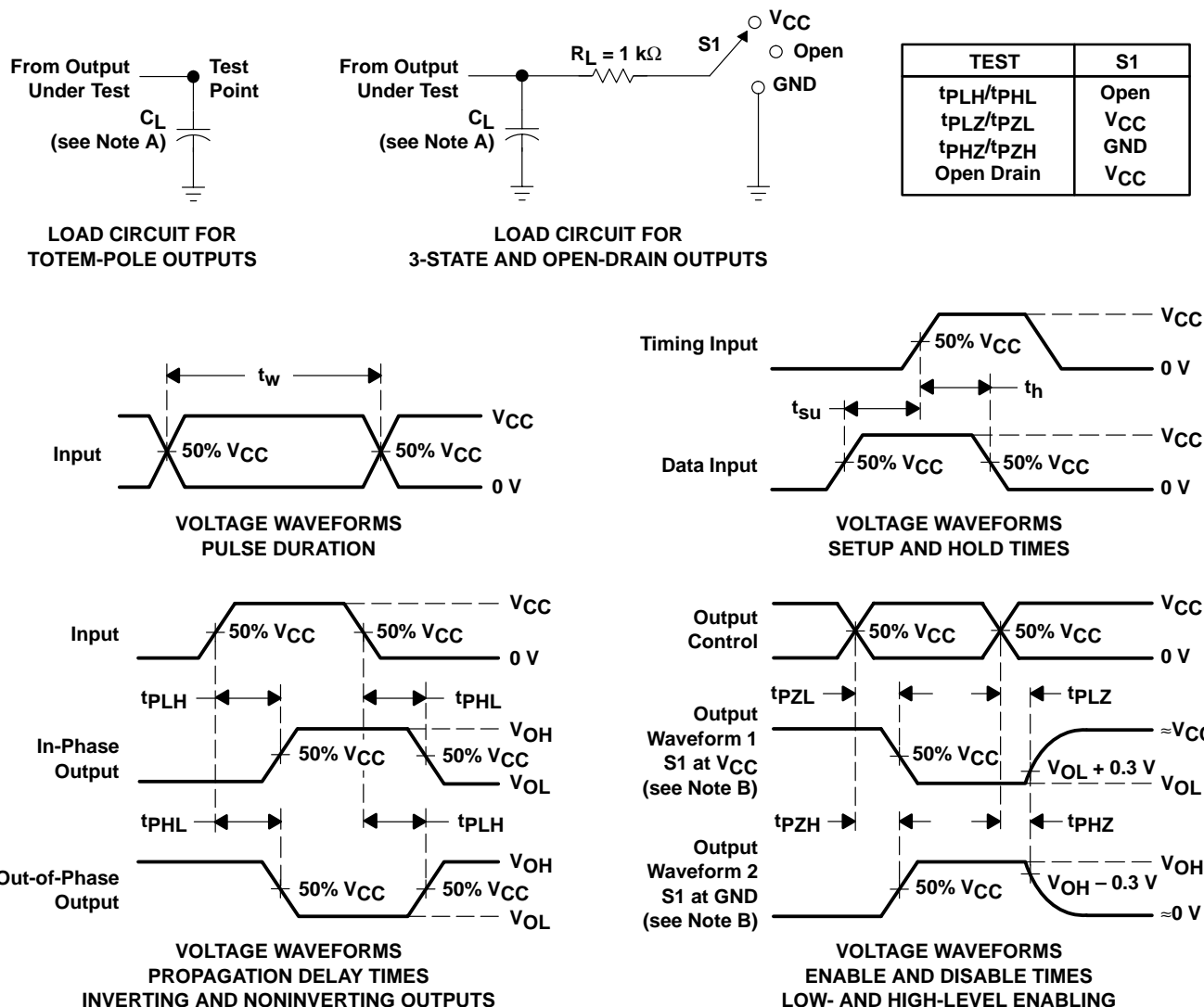
PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	No load, $f = 1\text{ MHz}$	32	pF



# SN54AHC374, SN74AHC374 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS240I – OCTOBER 1995 – REVISED JULY 2003

## 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
- D. The outputs are measured one at a time with one input transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**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>
5962-9686401Q2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
5962-9686401QRA	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
5962-9686401QSA	ACTIVE	CFP	W	20	1	TBD	Call TI	Level-NC-NC-NC
SN74AHC374DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74AHC374DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DGVR	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DGVRE4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AHC374NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AHC374NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374PWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374PWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI
SN74AHC374PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC374PWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54AHC374FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC374J	ACTIVE	CDIP	J	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC374W	ACTIVE	CFP	W	20	1	TBD	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.



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(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**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.

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