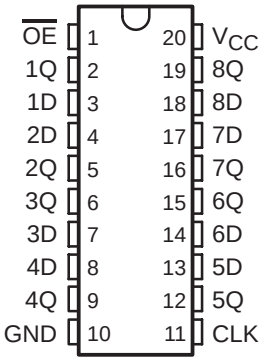
- **Controlled Baseline**
  - **One Assembly/Test Site, One Fabrication Site**
- **Extended Temperature Performance of −40°C to 105°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Supports Mixed-Mode Voltage Operation on All Ports**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

PW PACKAGE
(TOP VIEW)



description/ordering information

The SN74LV374A is an octal edge-triggered D-type flip-flop designed for 2-V to 5.5-V V_{CC} operation.

This device features 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. It is 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 set up at 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 logic levels) or 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 need for interface or pullup components.

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

ORDERING INFORMATION

T_A	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 105°C	TSSOP − PW	Tape and reel	SN74LV374ATPWREP	LV374AEP

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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.

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description/ordering information (continued)

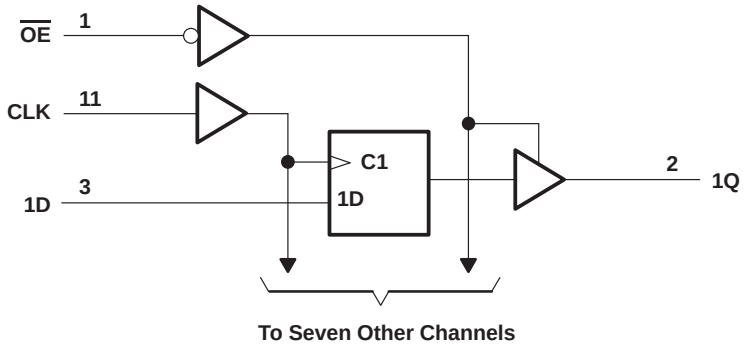
To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

FUNCTION TABLE
(each flip-flop)

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

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) . . . . . −0.5 V to 7 V
Voltage range applied to any output in the high-impedance or
power-off state, V_O (see Note 1) . . . . . −0.5 V to 7 V
Output voltage range, V_O (see Notes 1 and 2) . . . . . −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) . . . . . −50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ±35 mA
Continuous current through V_{CC} or GND . . . . . ±70 mA
Package thermal impedance, θ_{JA} (see Note 3) . . . . . 83°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 and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		V
		V_{CC} = 2.3 V to 2.7 V	$V_{CC} \times 0.7$		
		V_{CC} = 3 V to 3.6 V	$V_{CC} \times 0.7$		
		V_{CC} = 4.5 V to 5.5 V	$V_{CC} \times 0.7$		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5	V
		V_{CC} = 2.3 V to 2.7 V		$V_{CC} \times 0.3$	
		V_{CC} = 3 V to 3.6 V		$V_{CC} \times 0.3$	
		V_{CC} = 4.5 V to 5.5 V		$V_{CC} \times 0.3$	
V_I	Input voltage		0	5.5	V
V_O	Output voltage	High or low state	0	V_{CC}	V
		3-state	0	5.5	
I_{OH}	High-level output current	V_{CC} = 2 V		−50	μA
		V_{CC} = 2.3 V to 2.7 V		−2	mA
		V_{CC} = 3 V to 3.6 V		−8	
		V_{CC} = 4.5 V to 5.5 V		−16	
I_{OL}	Low-level output current	V_{CC} = 2 V		50	μA
		V_{CC} = 2.3 V to 2.7 V		2	mA
		V_{CC} = 3 V to 3.6 V		8	
		V_{CC} = 4.5 V to 5.5 V		16	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 2.3 V to 2.7 V		200	ns/V
		V_{CC} = 3 V to 3.6 V		100	
		V_{CC} = 4.5 V to 5.5 V		20	
T_A	Operating free-air temperature		−40	105	°C

NOTE 4: 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.

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

PARAMETER	TEST CONDITIONS		V_{CC}	MIN	TYP	MAX	UNIT
V_{OH}	I_{OH} = −50 μA		2 V to 5.5 V	V_{CC}−0.1			V
	I_{OH} = −2 mA		2.3 V	2			
	I_{OH} = −8 mA		3 V	2.48			
	I_{OH} = −16 mA		4.5 V	3.8			
V_{OL}	I_{OL} = 50 μA		2 V to 5.5 V			0.1	V
	I_{OL} = 2 mA		2.3 V			0.4	
	I_{OL} = 8 mA		3 V			0.44	
	I_{OL} = 16 mA		4.5 V			0.55	
I_I	V_I = 5.5 V or GND		0 to 5.5 V			±1	μA
I_{OZ}	$V_O = V_{CC}$ or GND		5.5 V			±5	μA
I_{CC}	$V_I = V_{CC}$ or GND,	I_O = 0	5.5 V			20	μA
I_{off}	V_I or V_O = 0 to 5.5 V		0			5	μA
C_i	$V_I = V_{CC}$ or GND		3.3 V		2.9		pF

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

		T_A = 25°C		MIN	MAX	UNIT
		MIN	MAX			
t_w	Pulse duration, CLK high or low	5		5.5		ns
t_{su}	Setup time, data before CLK↑	4.5		4.5		ns
t_h	Hold time, data after CLK↑	2		2		ns

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

		T_A = 25°C		MIN	MAX	UNIT
		MIN	MAX			
t_w	Pulse duration, CLK high or low	5		5		ns
t_{su}	Setup time, data before CLK↑	3		3		ns
t_h	Hold time, data after CLK↑	2		2		ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
f_{max}			C_L = 50 pF	55	110		50		MHz
t_{pd}	CLK	Q			8.3	16.2	1	18.5	ns
t_{en}	$\overline{OE}$	Q			7.7	14.5	1	17.5	
t_{dis}	$\overline{OE}$	Q			5.9	14	1	16	
$t_{sk(o)}$						1.5			

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
f_{max}			C_L = 50 pF	85	170		75		MHz
t_{pd}	CLK	Q			5.9	10.1	1	13.5	ns
t_{en}	$\overline{OE}$	Q			5.5	9.6	1	13	
t_{dis}	$\overline{OE}$	Q			4	8.8	1	10	
$t_{sk(o)}$						1			

noise characteristics, V_{CC} = 3.3 V, C_L = 50 pF, T_A = 25°C (see Note 5)

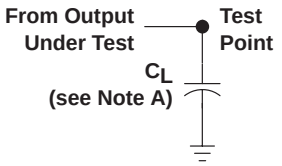
PARAMETER		MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.6	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.5	−0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.9		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

NOTE 5: Characteristics are for surface-mount packages only.

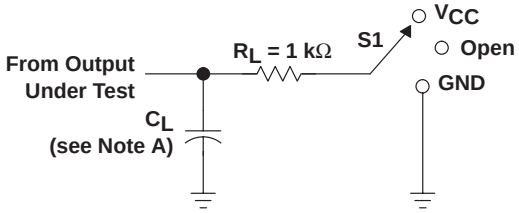
operating characteristics, T_A = 25°C

PARAMETER			TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	Outputs enabled	C_L = 50 pF, f = 10 MHz	3.3 V	21.1	pF
				5 V	22.8	

PARAMETER MEASUREMENT INFORMATION

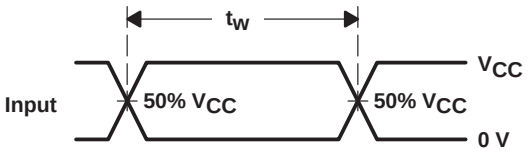


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

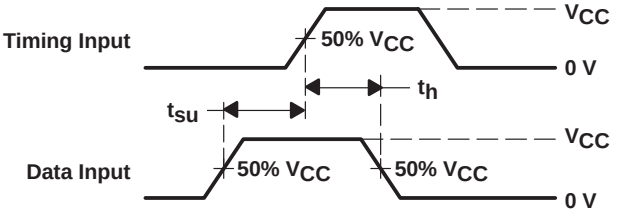


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

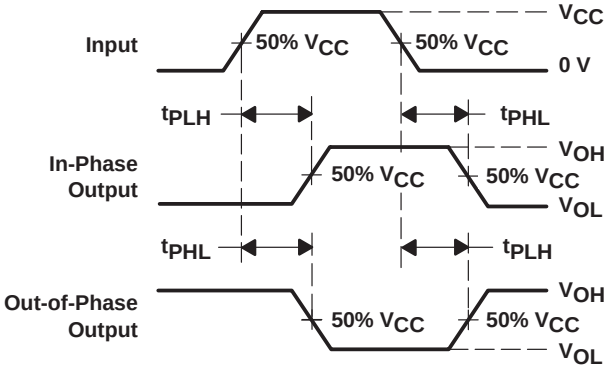
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}



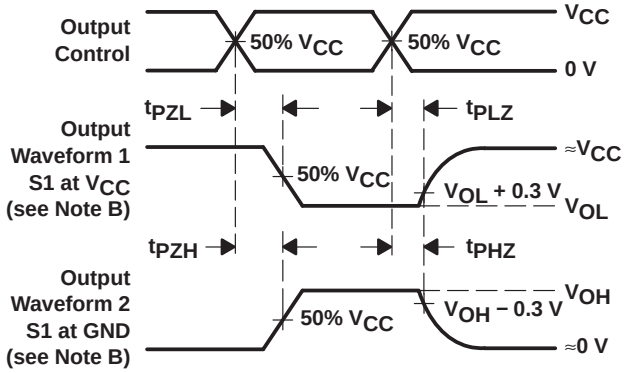
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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 ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
D. The outputs are measured one at a time, with one input transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PHL} and t_{PLH} are the same as t_{pd}.
H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV374ATPWREP	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV374AEP	Samples
V62/03663-01XE	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV374AEP	Samples

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN74LV374A-EP :

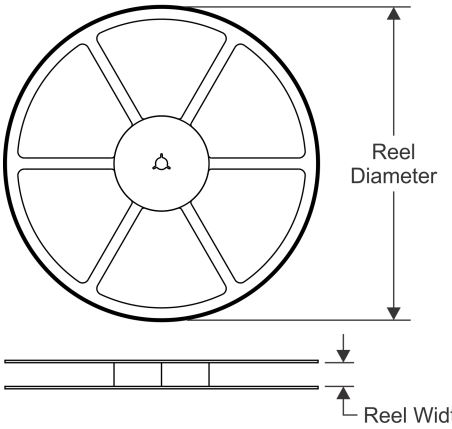
- Catalog: SN74LV374A
- Automotive: SN74LV374A-Q1

NOTE: Qualified Version Definitions:

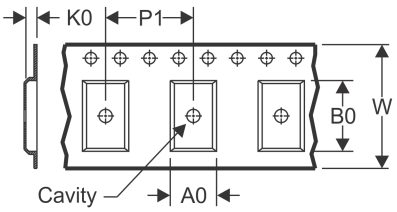
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

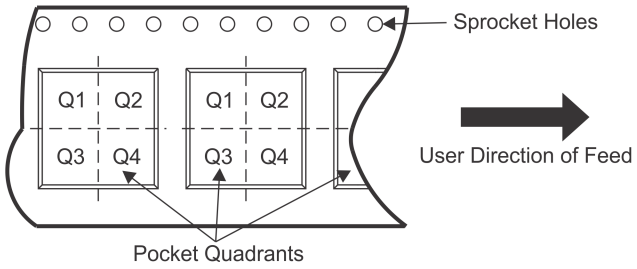


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

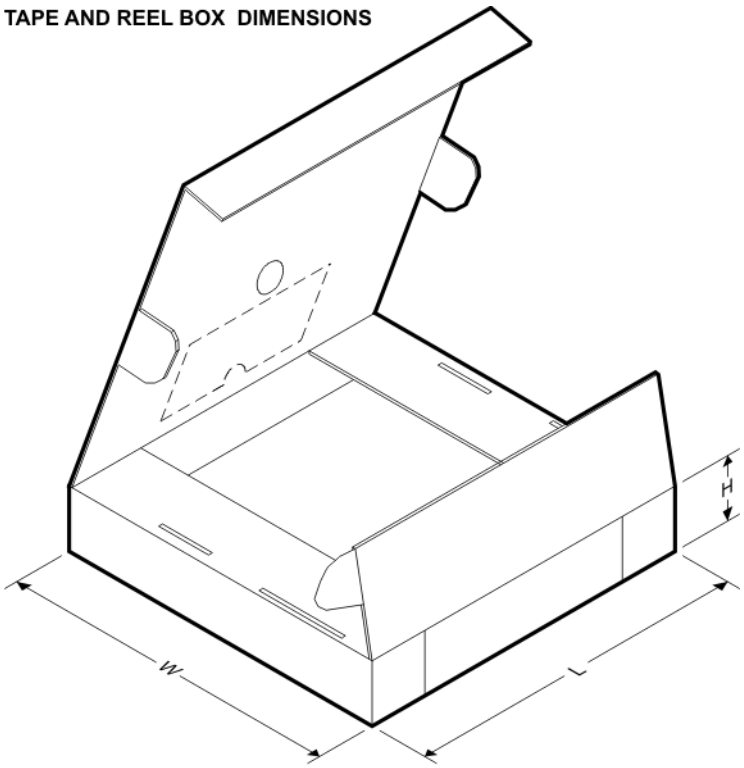
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LV374ATPWREP	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	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)
SN74LV374ATPWREP	TSSOP	PW	20	2000	367.0	367.0	38.0

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