

SN54LVTH373, SN74LVTH373 3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS689H – MAY 1997 – REVISED OCTOBER 2003

- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Support Unregulated Battery Operation Down to 2.7 V
- I_{off} and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)

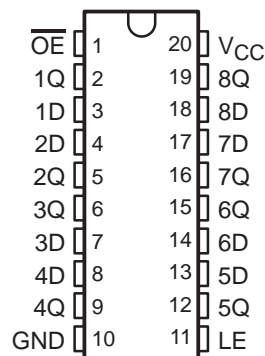
description/ordering information

These octal latches are designed specifically for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

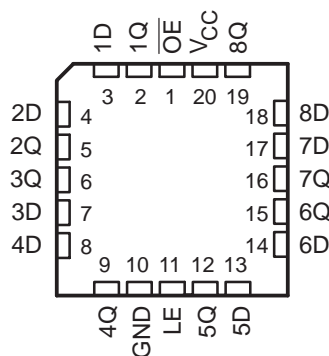
While the latch-enable (LE) input is high, the Q outputs follow the data (D) inputs. When LE is taken low, the Q outputs are latched at the logic levels set up at the D inputs.

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 the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components.

SN54LVTH373 . . . J OR W PACKAGE
SN74LVTH373 . . . DB, DW, NS, OR PW PACKAGE
(TOP VIEW)



SN54LVTH373 . . . FK PACKAGE
(TOP VIEW)



ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – DW	Tube	SN74LVTH373DW	LVTH373
		Tape and reel	SN74LVTH373DWR	
	SOP – NS	Tape and reel	SN74LVTH373NSR	LVTH373
	SSOP – DB	Tape and reel	SN74LVTH373DBR	LXH373
-55°C to 125°C	TSSOP – PW	Tube	SN74LVTH373PW	LXH373
		Tape and reel	SN74LVTH373PWR	
	CDIP – J	Tube	SNJ54LVTH373J	SNJ54LVTH373J
	CFP – W	Tube	SNJ54LVTH373W	SNJ54LVTH373W
	LCCC – FK	Tube	SNJ54LVTH373FK	SNJ54LVTH373FK

† 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.

 **TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated
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.

SN54LVTH373, SN74LVTH373

3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS689H – MAY 1997 – REVISED OCTOBER 2003

description/ordering information (continued)

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

When V_{CC} is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, \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.

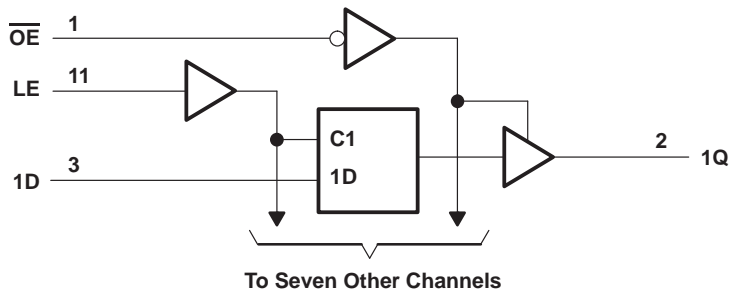
Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

FUNCTION TABLE
(each latch)

INPUTS			OUTPUT
\overline{OE}	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q_0
H	X	X	Z

logic diagram (positive logic)



SN54LVTH373, SN74LVTH373 3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS689H – MAY 1997 – REVISED OCTOBER 2003

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC}	–0.5 V to 4.6 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
Voltage range applied to any output in the high state, V_O (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Current into any output in the low state, I_O : SN54LVTH373	96 mA
SN74LVTH373	128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVTH373	48 mA
SN74LVTH373	64 mA
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 3): DB package	70°C/W
DW package	58°C/W
NS package	60°C/W
PW package	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 clamp-current ratings are observed.
 2. This current flows only when the output is in the high state and $V_O > V_{CC}$.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

		SN54LVTH373		SN74LVTH373		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage	2.7	3.6	2.7	3.6	V
V_{IH}	High-level input voltage	2		2		V
V_{IL}	Low-level input voltage		0.8		0.8	V
V_I	Input voltage		5.5		5.5	V
I_{OH}	High-level output current		–24		–32	mA
I_{OL}	Low-level output current		48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200		200		μs/V
T_A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 4: All unused control 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.



SN54LVTH373, SN74LVTH373

3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES

WITH 3-STATE OUTPUTS

SCBS689H – MAY 1997 – REVISED OCTOBER 2003

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

PARAMETER	TEST CONDITIONS		SN54LVTH373			SN74LVTH373			UNIT	
			MIN	TYP†	MAX	MIN	TYP†	MAX		
V_{IK}	$V_{CC} = 2.7\text{ V}$, $I_I = -18\text{ mA}$		-1.2			-1.2			V	
V_{OH}	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$, $I_{OH} = -100\text{ }\mu\text{A}$		$V_{CC}-0.2$			$V_{CC}-0.2$			V	
	$V_{CC} = 2.7\text{ V}$, $I_{OH} = -8\text{ mA}$		2.4			2.4				
	$V_{CC} = 3\text{ V}$	$I_{OH} = -24\text{ mA}$	2			2				
V_{OL}	$V_{CC} = 2.7\text{ V}$	$I_{OL} = 100\text{ }\mu\text{A}$	0.2			0.2			V	
		$I_{OL} = 24\text{ mA}$	0.5			0.5				
	$V_{CC} = 3\text{ V}$	$I_{OL} = 16\text{ mA}$	0.4			0.4				
		$I_{OL} = 32\text{ mA}$	0.5			0.5				
		$I_{OL} = 48\text{ mA}$	0.55			0.55				
		$I_{OL} = 64\text{ mA}$				0.55				
I_I	Control inputs	$V_{CC} = 0\text{ or }3.6\text{ V}$, $V_I = 5.5\text{ V}$	10			10			μA	
		$V_{CC} = 3.6\text{ V}$, $V_I = V_{CC}\text{ or GND}$	± 1			± 1				
	Data inputs	$V_{CC} = 3.6\text{ V}$	$V_I = V_{CC}$	1			1			
			$V_I = 0$	-5			-5			
I_{off}	$V_{CC} = 0$, $V_I\text{ or }V_O = 0\text{ to }4.5\text{ V}$					± 100			μA	
$I_I(\text{hold})$	Data inputs	$V_{CC} = 3\text{ V}$	$V_I = 0.8\text{ V}$	75			75			μA
			$V_I = 2\text{ V}$	-75			-75			
		$V_{CC} = 3.6\text{ V}\ddagger$, $V_I = 0\text{ to }3.6\text{ V}$				500 -750				
I_{OZH}	$V_{CC} = 3.6\text{ V}$, $V_O = 3\text{ V}$		5			5			μA	
I_{OZL}	$V_{CC} = 3.6\text{ V}$, $V_O = 0.5\text{ V}$		-5			-5			μA	
I_{OZPU}	$V_{CC} = 0\text{ to }1.5\text{ V}$, $V_O = 0.5\text{ V to }3\text{ V}$, $\overline{OE} = \text{don't care}$		$\pm 100^*$			± 100			μA	
I_{OZPD}	$V_{CC} = 1.5\text{ V to }0$, $V_O = 0.5\text{ V to }3\text{ V}$, $\overline{OE} = \text{don't care}$		$\pm 100^*$			± 100			μA	
I_{CC}	$V_{CC} = 3.6\text{ V}$, $I_O = 0$, $V_I = V_{CC}\text{ or GND}$	Outputs high	0.19			0.19			mA	
		Outputs low	5			5				
		Outputs disabled	0.19			0.19				
$\Delta I_{CC}\S$	$V_{CC} = 3\text{ V to }3.6\text{ V}$, One input at $V_{CC} - 0.6\text{ V}$, Other inputs at V_{CC} or GND		0.2			0.2			mA	
C_i	$V_I = 3\text{ V or }0$		3			3			pF	
C_o	$V_O = 3\text{ V or }0$		7			7			pF	

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

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

§ This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.



SN54LVTH373, SN74LVTH373 3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS689H – MAY 1997 – REVISED OCTOBER 2003

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

	SN54LVTH373				SN74LVTH373				UNIT
	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_w Pulse duration, LE high	3		3		3		3		ns
t_{su} Setup time, data before LE↓	1.1		0.4		1.1		0.4		ns
t_h Hold time, data after LE↓	1.7		2		1.4		1.4		ns

switching characteristics over recommended free-air temperature, $C_L = 50\text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH373				SN74LVTH373				UNIT	
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$			
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
t_{PLH}	D	Q	1.4	4.1		4.7	1.5	2.6	3.9		4.5	ns
t_{PHL}			1.4	4.1		4.7	1.5	2.6	3.9		4.5	
t_{PLH}	LE	Q	1.6	4.4		5.1	1.7	2.7	4.2		4.9	ns
t_{PHL}			1.6	4.4		5.1	1.7	2.7	4.2		4.9	
t_{PZH}	\overline{OE}	Q	1.2	5		6.1	1.3	3	4.8		5.9	ns
t_{PZL}			1.2	5		5.7	1.3	3	4.8		5.5	
t_{PHZ}	\overline{OE}	Q	1.6	5.5		5.7	1.9	3	4.6		4.9	ns
t_{PLZ}			0.8	4.8		4.9	1.9	3	4.5		4.6	

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

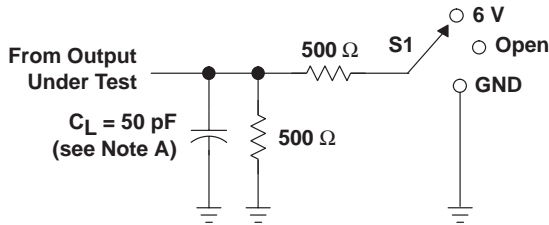
SN54LVTH373, SN74LVTH373

3.3-V ABT OCTAL TRANSPARENT D-TYPE LATCHES

WITH 3-STATE OUTPUTS

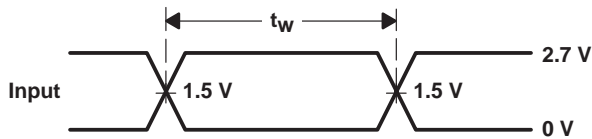
SCBS689H – MAY 1997 – REVISED OCTOBER 2003

PARAMETER MEASUREMENT INFORMATION

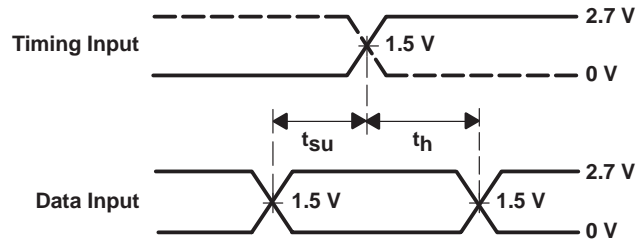


LOAD CIRCUIT

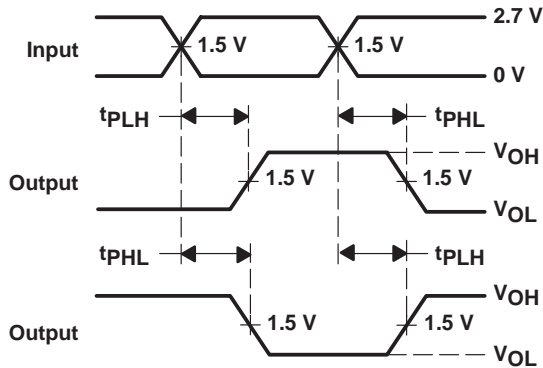
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



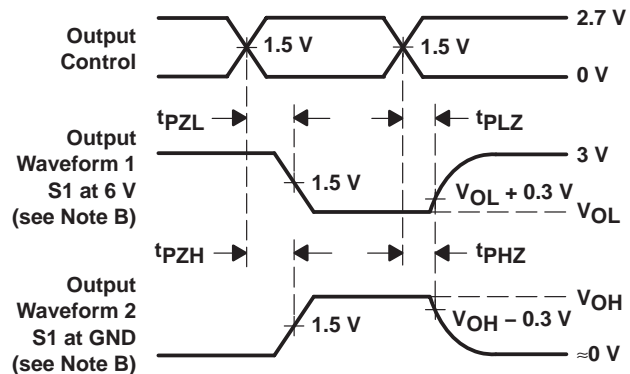
VOLTAGE WAVEFORMS
PULSE DURATION



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:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - 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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9950901Q2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9950901Q2A SNJ54LVTH 373FK	Samples
5962-9950901QRA	ACTIVE	CDIP	J	20	20	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9950901QR A SNJ54LVTH373J	Samples
5962-9950901QSA	ACTIVE	CFP	W	20	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9950901QS A SNJ54LVTH373W	Samples
SN74LVTH373DBR	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH373	Samples
SN74LVTH373DW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH373	Samples
SN74LVTH373DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH373	Samples
SN74LVTH373NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH373	Samples
SN74LVTH373PW	ACTIVE	TSSOP	PW	20	70	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH373	Samples
SN74LVTH373PWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH373	Samples
SN74LVTH373PWRE4	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH373	Samples
SN74LVTH373PWRG4	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH373	Samples
SNJ54LVTH373FK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9950901Q2A SNJ54LVTH 373FK	Samples
SNJ54LVTH373J	ACTIVE	CDIP	J	20	20	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9950901QR A SNJ54LVTH373J	Samples
SNJ54LVTH373W	ACTIVE	CFP	W	20	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9950901QS A SNJ54LVTH373W	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 ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm 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.

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.

OTHER QUALIFIED VERSIONS OF SN54LVTH373, SN74LVTH373 :

● Catalog : [SN74LVTH373](#)

● Enhanced Product : [SN74LVTH373-EP](#), [SN74LVTH373-EP](#)

● Military : [SN54LVTH373](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

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
SN74LVTH373DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVTH373DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LVTH373NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74LVTH373PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	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)
SN74LVTH373DBR	SSOP	DB	20	2000	356.0	356.0	35.0
SN74LVTH373DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LVTH373NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74LVTH373PWR	TSSOP	PW	20	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)
5962-9950901Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
SN74LVTH373DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74LVTH373PW	PW	TSSOP	20	70	530	10.2	3600	3.5
SNJ54LVTH373FK	FK	LCCC	20	55	506.98	12.06	2030	NA

DB0020A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

1. All linear dimensions are in millimeters. Any 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.
5. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4214851/B 08/2019

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/B 08/2019

NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

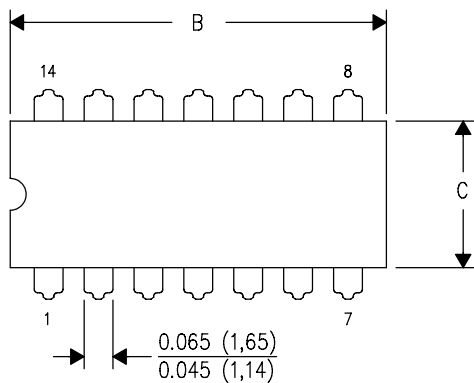


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

GENERIC PACKAGE VIEW

FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4229370VA\

DW0020A



PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

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 0.43 mm per side.
5. Reference JEDEC registration MS-013.

EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

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

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within Mil-Std 1835 GDFP2-F20

PW0020A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220206/A 02/2017

EXAMPLE BOARD LAYOUT

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220206/A 02/2017

NOTES: (continued)

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

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated