

# Automotive Single D Flip Flop

## NLV18SZ74

The NLV18SZ74 is an automotive-grade high performance, full function Edge triggered D Flip Flop.

### Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 2.7 ns  $t_{PD}$  at  $V_{CC} = 5$  V (typ)
- Inputs/Outputs Overvoltage Tolerant up to 5.5 V
- $I_{OFF}$  Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.0 V
- Available in US8 Package
- Chip Complexity < 100 FETs
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

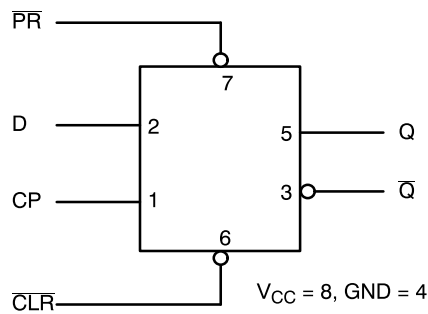


Figure 1. Logic Symbol

### PIN ASSIGNMENT

Pin	US8
1	CP
2	D
3	$\bar{Q}$
4	GND
5	Q
6	$\bar{CLR}$
7	PR
8	$V_{CC}$



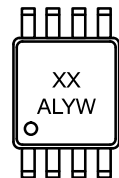
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

### MARKING DIAGRAMS



US8  
US SUFFIX  
CASE 493



XX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

# NLV18SZ74

## MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +6.5	V
V <sub>OUT</sub>	DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +6.5 -0.5 to +6.5	V
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current V <sub>OUT</sub> < GND	-50	mA
I <sub>OUT</sub>	DC Output Source/Sink Current	±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC Supply Current per Supply Pin or Ground Pin	±100	mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 secs	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 2)	250	°C/W
P <sub>D</sub>	Power Dissipation in Still Air	250	mW
MSL	Moisture Sensitivity	Level 1	-
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V <sub>ESD</sub>	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 1000	V
I <sub>Latchup</sub>	Latchup Performance (Note 4)	± 100	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 10mm-by-1inch, 2 ounce copper trace no air flow.
3. HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to EIA/JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115-A (Machine Model) be discontinued per JEDEC/JEP172A.
4. Tested to EIA/JESD78 Class II.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	1.65	5.5	V
V <sub>IN</sub>	DC Input Voltage	0	5.5	V
V <sub>OUT</sub>	DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	0 0 0	V <sub>CC</sub> 5.5 5.5	
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
t <sub>R</sub> , t <sub>F</sub>	Input Rise and Fall Time V <sub>CC</sub> = 1.65 V to 1.95 V V <sub>CC</sub> = 2.3 V to 2.7 V V <sub>CC</sub> = 3.0 V to 3.6 V V <sub>CC</sub> = 4.5 V to 5.5 V	0 0 0 0	20 20 10 5	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		1.65 to 1.95	0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	-	V
			2.3 to 5.5	0.70 V <sub>CC</sub>	-	-	0.70 V <sub>CC</sub>	-	
V <sub>IL</sub>	Low-Level Input Voltage		1.65 to 1.95	-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V
			2.3 to 5.5	-	-	0.30 V <sub>CC</sub>	-	0.30 V <sub>CC</sub>	

# NLV18SZ74

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	V <sub>CC</sub> - 0.1	V <sub>CC</sub>	-	V <sub>CC</sub> - 0.1	-	V
		I <sub>OH</sub> = -100 μA	1.65	1.29	1.4	-	1.29	-	
		I <sub>OH</sub> = -4 mA	2.3	1.9	2.1	-	1.9	-	
		I <sub>OH</sub> = -8 mA	2.7	2.2	2.4	-	2.2	-	
		I <sub>OH</sub> = -12 mA	3.0	2.4	2.7	-	2.4	-	
		I <sub>OH</sub> = -16 mA	3.0	2.3	2.5	-	2.3	-	
		I <sub>OH</sub> = -32 mA	4.5	3.8	4.0	-	3.8	-	
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	-	-	0.1	-	0.1	V
		I <sub>OL</sub> = 100 μA	1.65	-	0.08	0.24	-	0.24	
		I <sub>OL</sub> = 4 mA	2.3	-	0.2	0.3	-	0.3	
		I <sub>OL</sub> = 8 mA	2.7	-	0.22	0.4	-	0.4	
		I <sub>OL</sub> = 12 mA	3.0	-	0.28	0.4	-	0.4	
		I <sub>OL</sub> = 16 mA	3.0	-	0.38	0.55	-	0.55	
		I <sub>OL</sub> = 32 mA	4.5	-	0.42	0.55	-	0.55	
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	-	-	±0.1	-	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0	-	-	1.0	-	10	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	-	-	1.0	-	10	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# NLV18SZ74

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

Symbol	Parameter	V <sub>CC</sub> (V)	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -55 to 125°C		Units
				Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency (50% Duty Cycle) (Waveform 1)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	75	-	-	75	-	MHz
		2.5 ± 0.2		150	-	-	150	-	
		3.3 ± 0.3		200	-	-	200	-	
		5.0 ± 0.5		250	-	-	250	-	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	175	-	-	175	-	
		5.0 ± 0.5		200	-	-	200	-	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, CP to Q or $\bar{Q}$ (Waveform 1)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	-	6.5	12.5	-	13	ns
		2.5 ± 0.2		-	3.8	7.5	-	8.0	
		3.3 ± 0.3		-	2.8	6.5	-	7.0	
		5.0 ± 0.5		-	2.2	4.5	-	5.0	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	-	3.4	7.0	-	7.5	
		5.0 ± 0.5		-	2.6	5.0	-	5.5	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, PR or CLR to Q or $\bar{Q}$ (Waveform 2)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	-	6.5	14	-	14.5	ns
		2.5 ± 0.2		-	3.8	9.0	-	9.5	
		3.3 ± 0.3		-	2.8	6.5	-	7.0	
		5.0 ± 0.5		-	2.2	5.0	-	5.5	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	-	3.4	7.0	-	7.5	
		5.0 ± 0.5		-	2.6	5.0	-	5.5	
t <sub>S</sub>	Setup Time, D to CP (Waveform 1)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	6.5	-	-	6.5	-	ns
		2.5 ± 0.2		3.5	-	-	3.5	-	
		3.3 ± 0.3		2.0	-	-	2.0	-	
		5.0 ± 0.5		1.5	-	-	1.5	-	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	2.0	-	-	2.0	-	
		5.0 ± 0.5		1.5	-	-	1.5	-	
t <sub>H</sub>	Hold Time, D to CP (Waveform 1)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	0.5	-	-	0.5	-	ns
		2.5 ± 0.2		0.5	-	-	0.5	-	
		3.3 ± 0.3		0.5	-	-	0.5	-	
		5.0 ± 0.5		0.5	-	-	0.5	-	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	0.5	-	-	0.5	-	
		5.0 ± 0.5		0.5	-	-	0.5	-	
t <sub>W</sub>	Pulse Width, CP, CLR, PR (Waveform 3)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	6.0	-	-	6.0	-	ns
		2.5 ± 0.2		4.0	-	-	4.0	-	
		3.3 ± 0.3		3.0	-	-	3.0	-	
		5.0 ± 0.5		2.0	-	-	2.0	-	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	3.0	-	-	3.0	-	
		5.0 ± 0.5		2.0	-	-	2.0	-	
t <sub>REC</sub>	Recover Time PR; CLR to CP (Waveform 3)	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S <sub>1</sub> = Open	8.0	-	-	8.0	-	ns
		2.5 ± 0.2		4.5	-	-	4.5	-	
		3.3 ± 0.3		3.0	-	-	3.0	-	
		5.0 ± 0.5		3.0	-	-	3.0	-	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, S <sub>1</sub> = Open	3.0	-	-	3.0	-	
		5.0 ± 0.5		3.0	-	-	3.0	-	

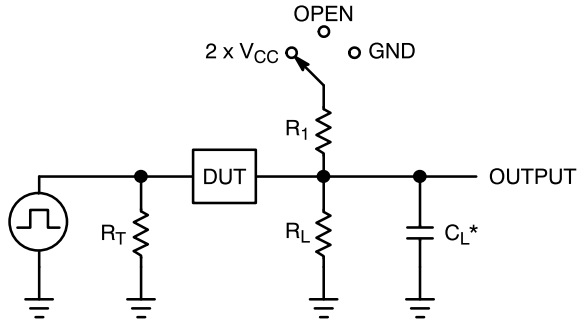
5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>/2 (per flip-flop). C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# NLV18SZ74

## CAPACITIVE CHARACTERISTICS ( $t_R = t_F = 3.0 \text{ ns}$ )

Symbol	Parameter	Condition	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = 5.5 \text{ V}$ , $V_{IN} = 0 \text{ V}$ or $V_{CC}$	2.5	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 5.5 \text{ V}$ , $V_{IN} = 0 \text{ V}$ or $V_{CC}$	2.5	pF
$C_{PD}$	Power Dissipation Capacitance (Note 6)	10 MHz, $V_{CC} = 3.3 \text{ V}$ , $V_{IN} = 0 \text{ V}$ or $V_{CC}$	9	pF
		10 MHz, $V_{CC} = 5.5 \text{ V}$ , $V_{IN} = 0 \text{ V}$ or $V_{CC}$	11	

6.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .



$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1 \text{ MHz}$

Figure 2. Test Circuit

Test	Switch Position	$C_L$ , pF	$R_L$ , $\Omega$	$R_1$ , $\Omega$
$t_{PLH} / t_{PHL}$	Open	See AC Characteristics Table		
$t_{PLZ} / t_{PZL}$	$2 \times V_{CC}$	50	500	500
$t_{PHZ} / t_{PZH}$	GND	50	500	500

X = Don't Care

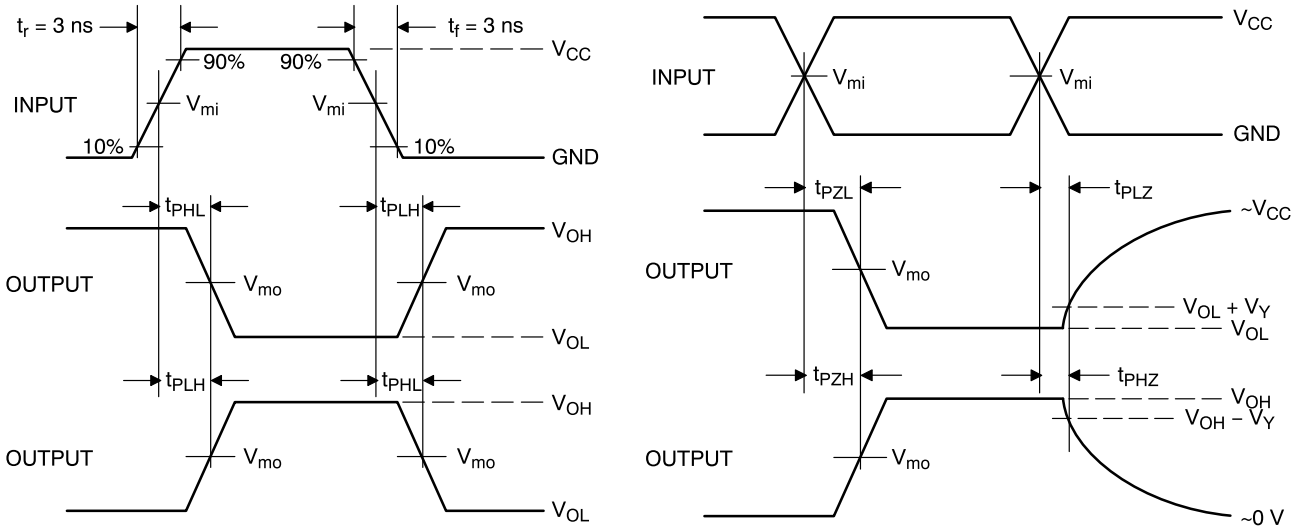


Figure 3. Switching Waveforms

# NLV18SZ74

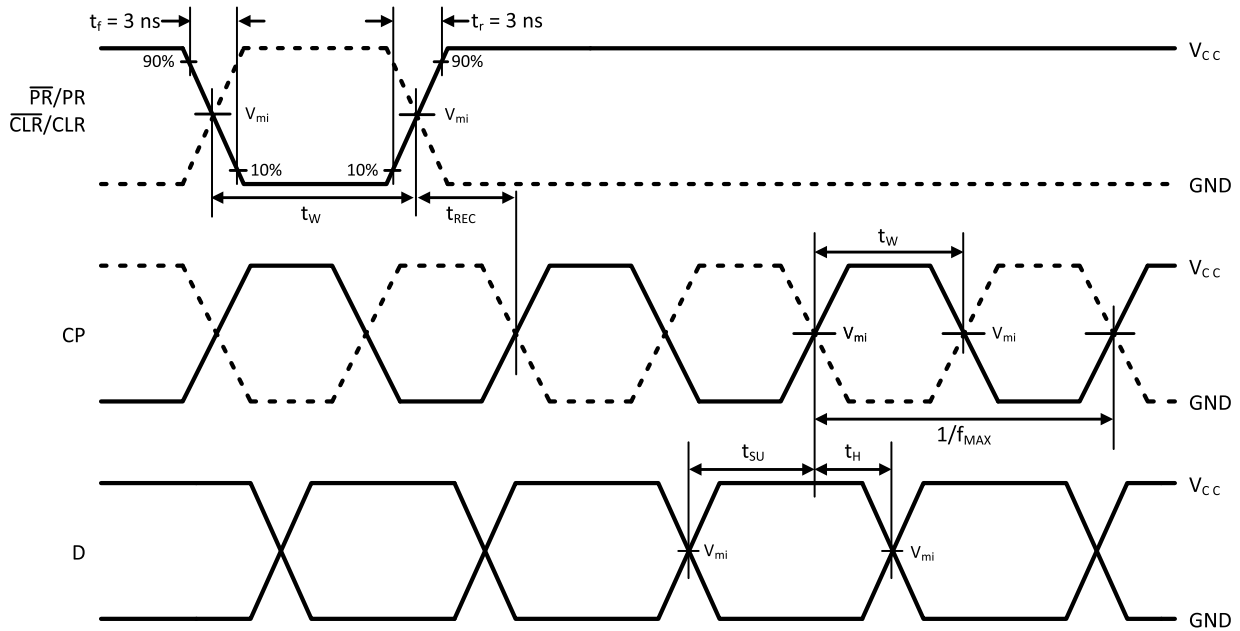


Figure 4. Setup, Hold and Recovery Time Waveforms

$V_{CC}, V$	$V_{mi}, V$	$V_{mo}, V$		$V_Y, V$
		$t_{PLH}, t_{PHL}$	$t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}$	
1.65 to 1.95	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.15
2.3 to 2.7	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.15
3.0 to 3.6	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.3
4.5 to 5.5	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.3

## DEVICE ORDERING INFORMATION

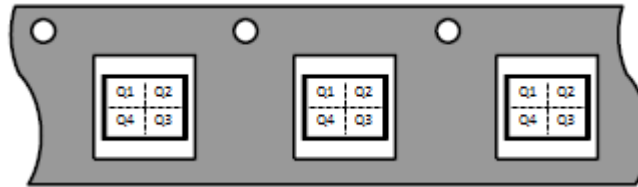
Device	Packages	Marking	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NLV18SZ74USG	US8	MH	Q4	3000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

## Pin 1 Orientation in Tape and Reel

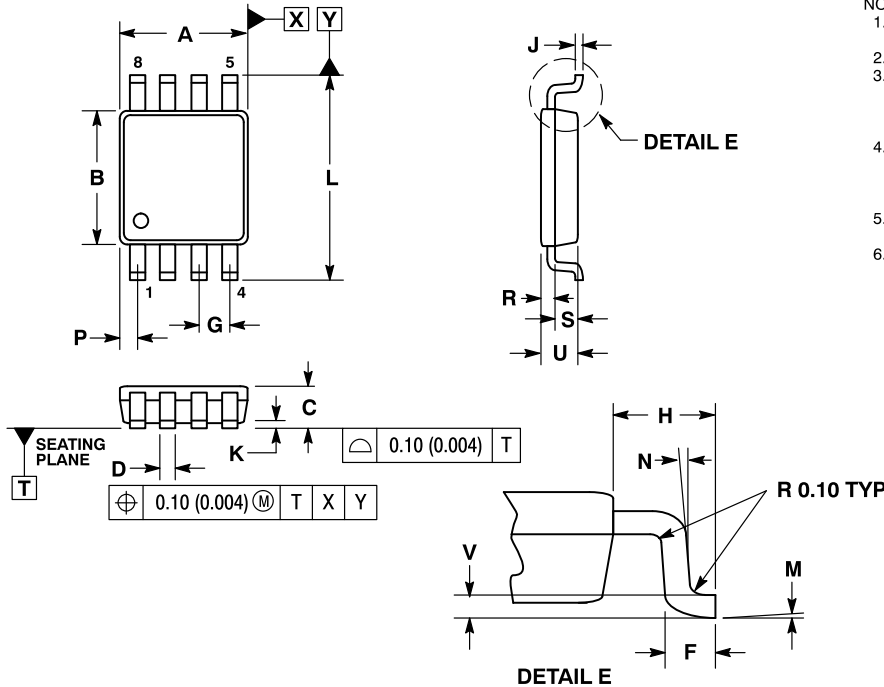
Direction of Feed



# NLV18SZ74

## PACKAGE DIMENSIONS

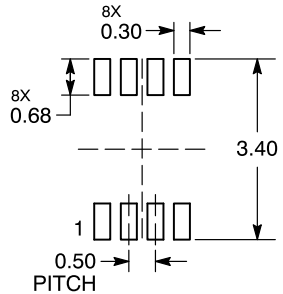
US8  
US SUFFIX  
CASE 493-02  
ISSUE D



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH, PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.14MM (0.0055") PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.14MM (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203MM (0.003-0.008").
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508MM (0.0002").

RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:  
Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

TECHNICAL SUPPORT  
North American Technical Support:  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:  
Phone: 00421 33 790 2910  
For additional information, please contact your local Sales Representative