

NLSV8T244

8-Bit Dual-Supply Non-Inverting Level Translator

The NLSV8T244 is a 8-bit configurable dual-supply voltage level translator. The input A_n and output B_n ports are designed to track two different power supply rails, V_{CCA} and V_{CCB} respectively. Both supply rails are configurable from 0.9 V to 4.5 V allowing universal low-voltage translation from the input A_n to the output B_n port.

Features

- Wide V_{CCA} and V_{CCB} Operating Range: 0.9 V to 4.5 V
- High-Speed w/ Balanced Propagation Delay
- Inputs and Outputs have OVT Protection to 4.5 V
- Non-preferential V_{CCA} and V_{CCB} Sequencing
- Outputs at 3-State until Active V_{CC} is Reached
- Power-Off Protection
- Outputs Switch to 3-State with V_{CCB} at GND
- Ultra-Small Packaging: 4.0 mm x 2.0 mm UDFN20
- This is a Pb-Free Device

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

Important Information

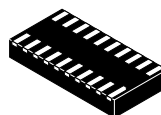
- ESD Protection for All Pins:
HBM (Human Body Model) > 6000 V



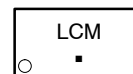
ON Semiconductor®

<http://onsemi.com>

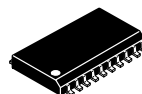
MARKING DIAGRAMS



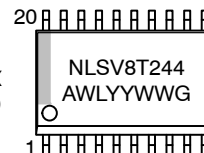
**UQFN20
MU SUFFIX
CASE 517AK**



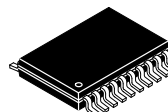
LC = Specific Device Code
M = Date Code
▪ = Pb-Free Package



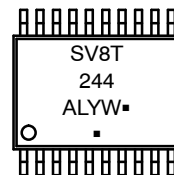
**SOIC-20
DW SUFFIX
CASE 751D**



A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb-Free Package



**TSSOP-20
DT SUFFIX
CASE 948E**



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

NLSV8T244

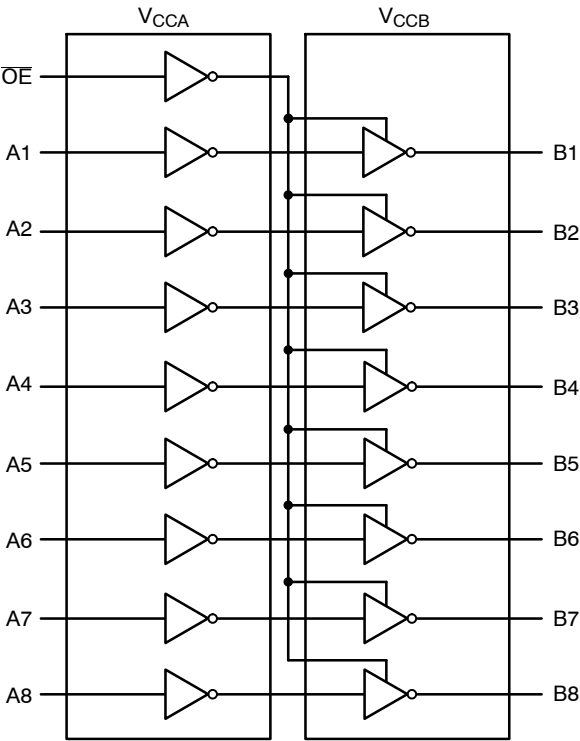


Figure 1. Logic Diagram

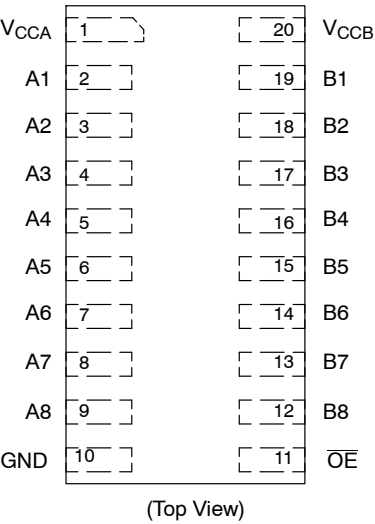


Figure 2. Pin Assignment

TRUTH TABLE

Inputs		Outputs
OE	A _n	B _n
L	L	L
L	H	H
H	X	3-State

PIN ASSIGNMENT

PIN	FUNCTION
V _{CCA}	Input Port DC Power Supply
V _{CCB}	Output Port DC Power Supply
GND	Ground
A _n	Input Port
B _n	Output Port
OE	Output Enable

NLSV8T244

MAXIMUM RATINGS

Symbol	Rating	Value	Condition	Unit
V_{CCA}, V_{CCB}	DC Supply Voltage	-0.5 to +5.5		V
V_I	DC Input Voltage A_n	-0.5 to +5.5		V
V_C	Control Input $\overline{OE}$	-0.5 to +5.5		V
V_O	DC Output Voltage (Power Down) B_n	-0.5 to +5.5	$V_{CCA} = V_{CCB} = 0$	V
	(Active Mode) B_n	-0.5 to +5.5		V
	(Tri-State Mode) B_n	-0.5 to +5.5		V
I_{IK}	DC Input Diode Current	-20	$V_I < GND$	mA
I_{OK}	DC Output Diode Current	-50	$V_O < GND$	mA
I_O	DC Output Source/Sink Current	± 50		mA
I_{CCA}, I_{CCB}	DC Supply Current Per Supply Pin	± 100		mA
I_{GND}	DC Ground Current per Ground Pin	± 100		mA
T_{STG}	Storage Temperature	-65 to +150		°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CCA}, V_{CCB}	Positive DC Supply Voltage	0.9	4.5	V
V_I	Bus Input Voltage	GND	4.5	V
V_C	Control Input $\overline{OE}$	GND	4.5	V
V_{IO}	Bus Output Voltage (Power Down Mode) B_n	GND	4.5	V
	(Active Mode) B_n	GND	V_{CCB}	V
	(Tri-State Mode) B_n	GND	4.5	V
T_A	Operating Temperature Range	-40	+85	°C
$\Delta t / \Delta V$	Input Transition Rise or Rate V_I , from 30% to 70% of V_{CC} ; $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	0	10	nS

NLSV8T244

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CCA} (V)	V _{CCB} (V)	-40°C to +85°C		Unit
					Min	Max	
V _{IH}	Input HIGH Voltage (An, OE)		3.6 – 4.5	0.9 – 4.5	2.2	–	V
			2.7 – 3.6		2.0	–	
			2.3 – 2.7		1.6	–	
			1.4 – 2.3		0.65 * V _{CCA}	–	
			0.9 – 1.4		0.9 * V _{CCA}	–	
V _{IL}	Input LOW Voltage (An, OE)		3.6 – 4.5	0.9 – 4.5	–	0.8	V
			2.7 – 3.6		–	0.8	
			2.3 – 2.7		–	0.7	
			1.4 – 2.3		–	0.35 * V _{CCA}	
			0.9 – 1.4		–	0.1 * V _{CCA}	
V _{OH}	Output HIGH Voltage	I _{OH} = -100 µA; V _I = V _{IH}	0.9 – 4.5	0.9 – 4.5	V _{CCB} - 0.2	–	V
		I _{OH} = -0.5 mA; V _I = V _{IH}	0.9	0.9	0.75 * V _{CCB}	–	
		I _{OH} = -2 mA; V _I = V _{IH}	1.4	1.4	1.05	–	
		I _{OH} = -6 mA; V _I = V _{IH}	1.65	1.65	1.25	–	
		I _{OH} = -12 mA; V _I = V _{IH}	2.3	2.3	2.0	–	
			2.3	2.3	1.8	–	
		I _{OH} = -18 mA; V _I = V _{IH}	2.7	2.7	2.2	–	
			2.3	2.3	1.7	–	
		I _{OH} = -24 mA; V _I = V _{IH}	3.0	3.0	2.4	–	
V _{OL}	Output LOW Voltage	I _{OL} = 100 µA; V _I = V _{IL}	0.9 – 4.5	0.9 – 4.5	–	0.2	V
		I _{OL} = 0.5 mA; V _I = V _{IL}	1.1	1.1	–	0.3	
		I _{OL} = 2 mA; V _I = V _{IL}	1.4	1.4	–	0.35	
		I _{OL} = 6 mA; V _I = V _{IL}	1.65	1.65	–	0.3	
		I _{OL} = 12 mA; V _I = V _{IL}	2.3	2.3	–	0.4	
			2.7	2.7	–	0.4	
		I _{OL} = 18 mA; V _I = V _{IL}	2.3	2.3	–	0.6	
			3.0	3.0	–	0.45	
		I _{OL} = 24 mA; V _I = V _{IL}	3.0	3.0	–	0.6	
I _I	Input Leakage Current	V _I = V _{CCA} or GND	0.9 – 4.5	0.9 – 4.5	-1.0	1.0	µA
I _{OFF}	Power-Off Leakage Current	OE = 0 V	0 0.9 – 4.5	0.9 – 4.5 0	-1.0 -1.0	1.0 1.0	µA
I _{CCA}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	2.0	µA
I _{CCB}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	2.0	µA
I _{CCA} + I _{CCB}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	4.0	µA
ΔI _{CCA}	Increase in I _{CC} per Input Voltage, Other Inputs at V _{CCA} or GND	V _I = V _{CCA} - 0.6 V; V _I = V _{CCA} or GND	4.5 3.6	4.5 3.6	–	10 5.0	µA
ΔI _{CCB}	Increase in I _{CC} per Input Voltage, Other Inputs at V _{CCA} or GND	V _I = V _{CCA} - 0.6 V; V _I = V _{CCA} or GND	4.5 3.6	4.5 3.6	–	10 5.0	µA
I _{OZ}	I/O Tri-State Output Leakage Current	T _A = 25°C, OE = 0 V	0.9 – 4.5	0.9 – 4.5	-1.0	1.0	µA

NLSV8T244

TOTAL STATIC POWER CONSUMPTION ($I_{CCA} + I_{CCB}$)

V _{CCA} (V)	-40°C to +85°C										Unit
	V _{CCB} (V)										
	4.5		3.3		2.8		1.8		0.9		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
4.5		2		2		2		2		< 1.5	μA
3.3		2		2		2		2		< 1.5	μA
2.8		< 2		< 1		< 1		< 0.5		< 0.5	μA
1.8		< 1		< 1		< 0.5		< 0.5		< 0.5	μA
0.9		< 0.5		< 0.5		< 0.5		< 0.5		< 0.5	μA

NOTE: Connect ground before applying supply voltage V_{CCA} or V_{CCB} . This device is designed with the feature that the power-up sequence of V_{CCA} and V_{CCB} will not damage the IC.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CCA} (V)	-40°C to +85°C										Unit
			V _{CCB} (V)										
			4.5		3.3		2.8		1.8		1.2		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL} (Note 1)	Propagation Delay, A _n to B _n	4.5		1.6		1.8		2.0		2.1		2.3	nS
		3.3		1.7		1.9		2.1		2.3		2.6	
		2.8		1.9		2.1		2.3		2.5		2.8	
		1.8		2.1		2.4		2.5		2.7		3.0	
		1.2		2.4		2.7		2.8		3.0		3.3	
t _{PZH} , t _{PZL} (Note 1)	Output Enable, OE to B _n	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.3		3.7		3.9		4.1		4.3		4.6	
		2.5		3.9		4.1		4.3		4.5		4.8	
		1.8		4.1		4.4		4.5		4.7		5.0	
		1.2		4.4		4.7		4.8		5.0		5.3	
t _{PHZ} , t _{PLZ} (Note 1)	Output Disable, OE to B _n	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.3		3.7		3.9		4.1		4.3		4.6	
		2.5		3.9		4.1		4.3		4.5		4.8	
		1.8		4.1		4.4		4.5		4.7		5.0	
		1.2		4.4		4.7		4.8		5.0		5.3	
t _{OSHL} , t _{OSLH} (Note 1)	Output to Output Skew, Time	4.5		0.15		0.15		0.15		0.15		0.15	nS
		3.3		0.15		0.15		0.15		0.15		0.15	
		2.5		0.15		0.15		0.15		0.15		0.15	
		1.8		0.15		0.15		0.15		0.15		0.15	
		1.2		0.15		0.15		0.15		0.15		0.15	

1. Propagation delays defined per Figure 3.

CAPACITANCE

Symbol	Parameter	Test Conditions	Typ (Note 2)	Unit
C_{IN}	Control Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3 V$, $V_I = 0 V$ or $V_{CCA/B}$	3.5	pF
$C_{I/O}$	I/O Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3 V$, $V_I = 0 V$ or $V_{CCA/B}$	5.0	pF
C_{PD}	Power Dissipation Capacitance	$V_{CCA} = V_{CCB} = 3.3 V$, $V_I = 0 V$ or V_{CCA} , $f = 10 MHz$	20	pF

2. Typical values are at $T_A = +25^\circ C$.

3. C_{PD} is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from:
 $I_{CC(operating)} \cong C_{PD} \times V_{CC} \times f_{IN} \times N_{SW}$ where $I_{CC} = I_{CCA} + I_{CCB}$ and N_{SW} = total number of outputs switching.

NLSV8T244

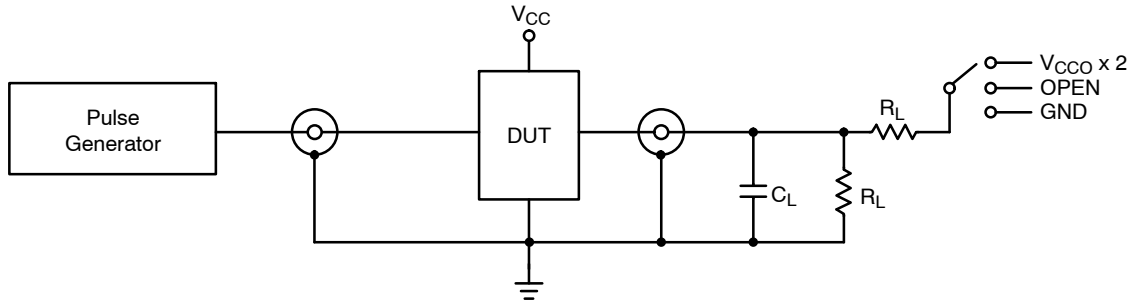
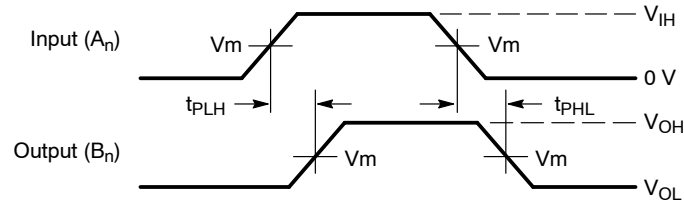


Figure 3. AC (Propagation Delay) Test Circuit

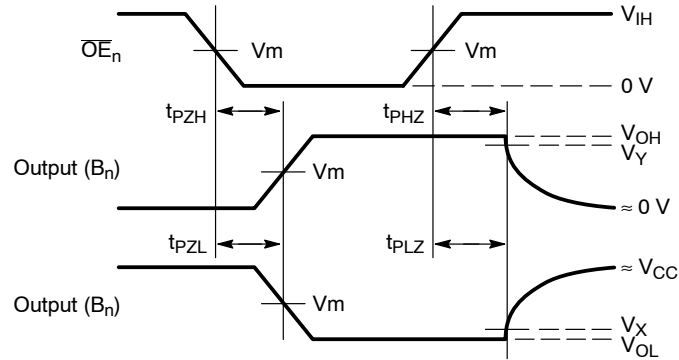
Test	Switch
t_{PLH} , t_{PHL}	OPEN
t_{PLZ} , t_{PZL}	$V_{CCO} \times 2$
t_{PHZ} , t_{PZH}	GND

$C_L = 15 \text{ pF}$ or equivalent (includes probe and jig capacitance)
 $R_L = 2 \text{ k}\Omega$ or equivalent
 Z_{OUT} of pulse generator = 50Ω



Waveform 1 - Propagation Delays

$t_R = t_F = 2.0 \text{ ns}$, 10% to 90%; $f = 1 \text{ MHz}$; $t_W = 500 \text{ ns}$



Waveform 2 - Output Enable and Disable Times

$t_R = t_F = 2.0 \text{ ns}$, 10% to 90%; $f = 1 \text{ MHz}$; $t_W = 500 \text{ ns}$

Figure 4. AC (Propagation Delay) Test Circuit Waveforms

Symbol	V_{CC}				
	3.0 V – 4.5 V	2.3 V – 2.7 V	1.65 V – 1.95 V	1.4 V – 1.6 V	0.9 V – 1.3 V
V_{mA}	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$
V_X	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$
V_Y	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$

NLSV8T244

ORDERING INFORMATION

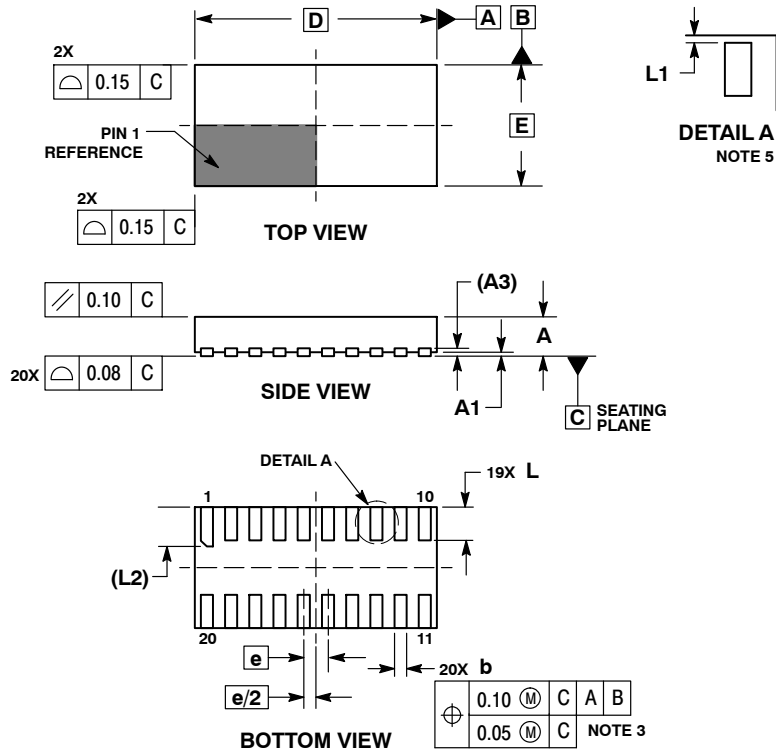
Device	Package	Shipping [†]
NLSV8T244MUTAG	UQFN20 (Pb-Free)	3000 / Tape & Reel
NLSV8T244DTR2G	TSSOP-20 (Pb-Free)	2500 / Tape & Reel
NLSV8T244DWR2G	SOIC-20 (Pb-Free)	1000 / Tape & Reel

[†]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.

NLSV8T244

PACKAGE DIMENSIONS

UDFN20 4x2, 0.4P
CASE 517AK
ISSUE O

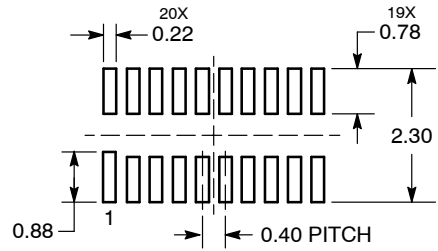


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE. FLASH MAY NOT EXCEED 0.03 ONTO BOTTOM SURFACE OF TERMINALS.
5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.15	0.25
D	4.00 BSC	
E	2.00 BSC	
e	0.40 BSC	
L	0.50	0.60
L1	0.00	0.03
L2	0.60	0.70

MOUNTING FOOTPRINT SOLDERMASK DEFINED

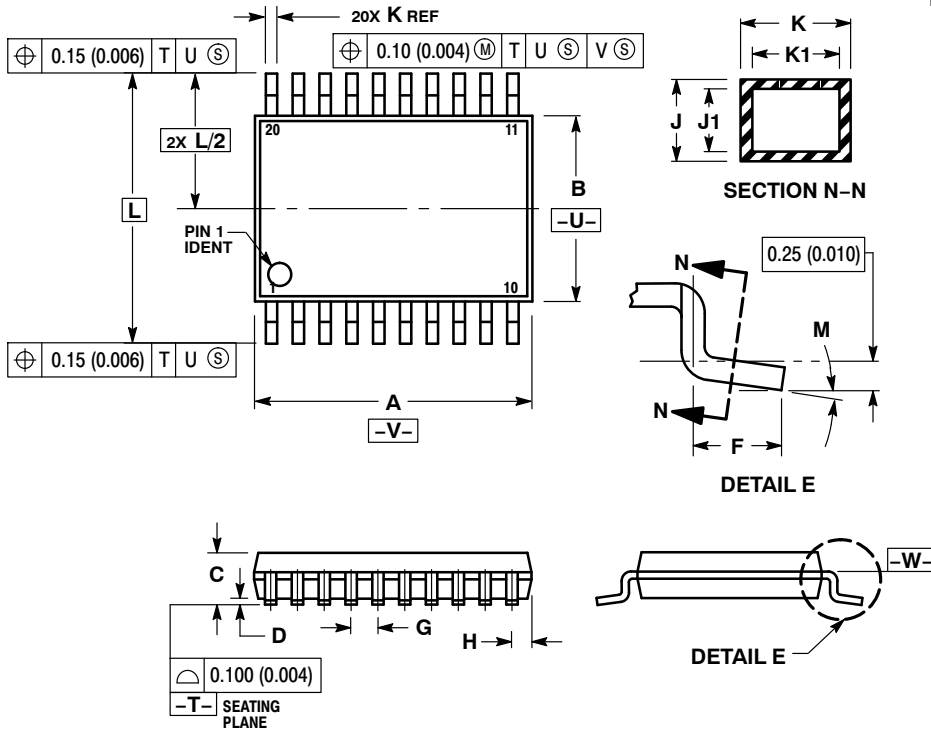


DIMENSIONS: MILLIMETERS

NLSV8T244

PACKAGE DIMENSIONS

TSSOP-20
CASE 948E-02
ISSUE C

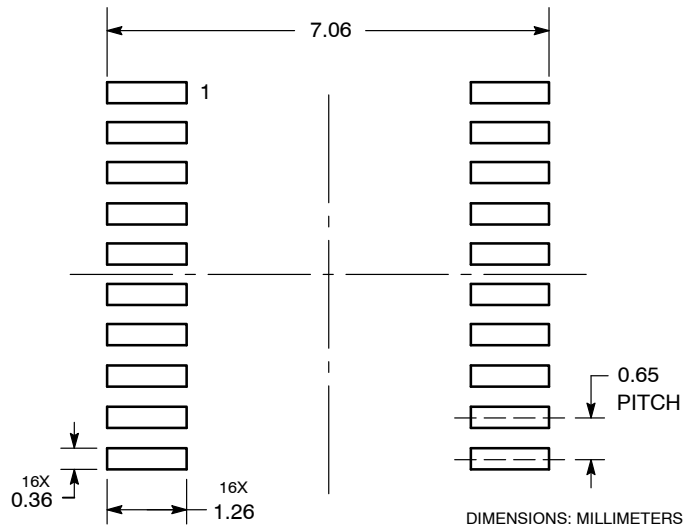


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

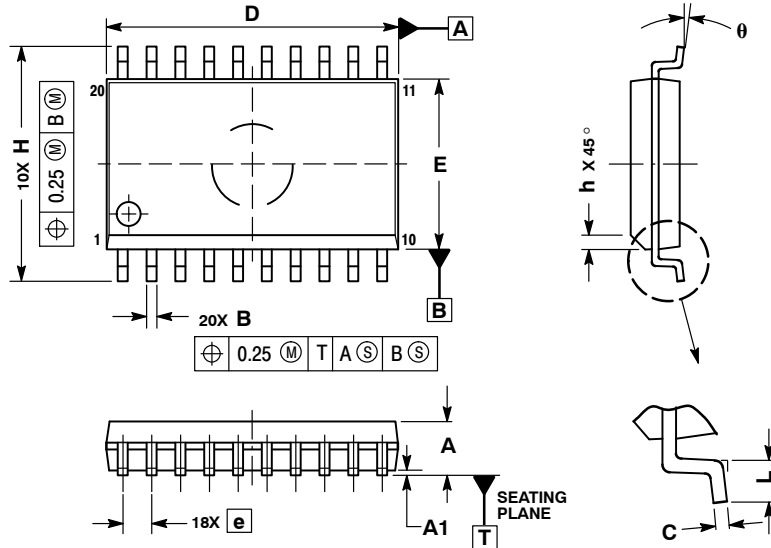
SOLDERING FOOTPRINT



NLSV8T244

PACKAGE DIMENSIONS

SOIC-20 WB
CASE 751D-05
ISSUE G



NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

MILLIMETERS		
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC 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:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative