NB3U1548C

3.3V/2.5V/1.8V/1.5V 160 MHz 1:4 LVCMOS/LVTTL Low Skew Over Voltage Tolerant Fanout Buffer

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Description

The NB3U1548C is an LVCMOS, overvoltage tolerant clock fanout buffer targeted for clock generation in high performance telecommunication, networking and computing applications. The device is optimized for low skew clock distribution in low voltage applications. The input overvoltage tolerance enables using this device in mixed mode voltage applications. An output enable pin controls whether the outputs are in the active or high impedance state. Guaranteed output skew characteristics make the NB3U1548C ideal for those applications demanding well defined performance and repeatability. The NB3U1548C is packaged in a small SOIC−8 and in an TSSOP−8 package.

Features

- Low skew 1:4 Fanout Buffer
- Supports 3.3 V, 2.5 V, 1.8 V and 1.5 V Power Supplies
- LVCMOS Input and Output Levels
- 3.6 V Overvoltage Tolerance at the Clock and Control Inputs
- Supports Clock Frequencies up to 160 MHz
- LVCMOS Compatible Control Input for Output Disable
- Output Disabled to a High Impedance State
- −40°C to 85°C Ambient Operating Temperature
- Available in Pb−Free RoHS Compliant Packages (SOIC−8, TSSOP−8)
- These Devices are Pb−Free and are RoHS Compliant

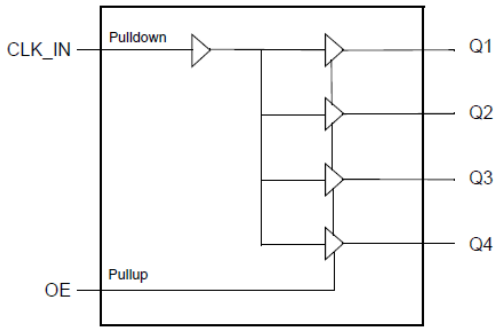
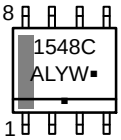


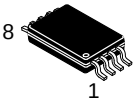
Figure 1. Block Diagram

MARKING DIAGRAMS

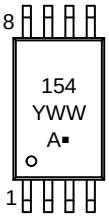


SOIC−8
D SUFFIX
CASE 751





TSSOP−8
DT SUFFIX
CASE 948S



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

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

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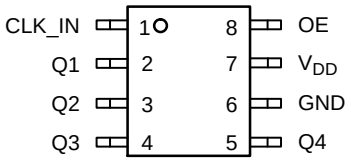


Figure 2. Pin Configuration (Top View)

Table 1. PIN DESCRIPTIONS

Number	Name	Type		Description
1	CLK_IN	Input	Pulldown	Single−ended clock input. LVCMOS interface levels.
2	Q1	Output		Single−ended clock output. LVCMOS interface levels.
3	Q2	Output		Single−ended clock output. LVCMOS interface levels.
4	Q3	Output		Single−ended clock output. LVCMOS interface levels.
5	Q4	Output		Single−ended clock output. LVCMOS interface levels.
6	GND	Power		Power supply ground.
7	VDD	Power		Power supply pin.
8	OE	Input	Pullup	Output enable pin. See Table 3. LVCMOS interface levels.

NOTE: *Pullup and Pulldown* refer to internal input resistors. See Table 2, *Pin Characteristics,* for typical values.

Table 2. PIN CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
CIN	Input Capacitance			4		pF
CPD	Power Dissipation Capacitance	V_{DD} = 3.465 V		14		pF
		V_{DD} = 2.375 V		13		pF
		V_{DD} = 1.95 V		13		pF
		V_{DD} = 1.6 V		12		pF
RPULLUP	Input Pullup Resistor			51		kΩ
RPULLDOWN	Input Pulldown Resistor			51		kΩ
ROUT	Output Impedance	V_{DD} = 3.3 V ± 5%		9		Ω
		V_{DD} = 2.5 V ± 5%		10		Ω
		V_{DD} = 1.8 V ± 0.15 V		12		Ω
		V_{DD} = 1.5 ± 0.1 V		15		Ω

Function Table

Table 3. OE CONFIGURATION TABLE

Input	
OE	**Operation**
0	Q[4:1] disabled (high−impedance)
1 (default)	Q[4:1] enabled

NOTE: OE is an asynchronous control.

Table 4. ABSOLUTE MAXIMUM RATINGS

Item	Rating
Supply Voltage, V_{DD}	4.6 V
Inputs, V_I	3.6 V
Outputs, V_O	−0.5 V to V_{DD} + 0.5 V
Package Thermal Impedance, θ_{JA} 8 Lead SOIC 8 Lead TSSOP	 102.5°C/W (0 mps) 151.2°C/W (0 mps)
Storage Temperature, T_{STG}	−65°C to 150°C

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. JEDEC standard multilayer board – 2S2P (2 signal, 2 power) with 6 cm^2 copper area.
2. For additional information, see Application Note AND8003/D.

Table 5. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter		Test Conditions	Min	Typ	Max	Units
POWER SUPPLY DC CHARACTERISTICS, V_{DD} = 3.3 V ± 5%, T_A = −40°C to 85°C							
V_{DD}	Power Supply Voltage			3.135	3.3	3.465	V
I_{DDQ}	Quiescent Power Supply Current		Inputs Open, Outputs Unloaded			1	mA
POWER SUPPLY DC CHARACTERISTICS, V_{DD} = 2.5 V ± 5%, T_A = −40°C to 85°C							
V_{DD}	Power Supply Voltage			2.375	2.5	2.625	V
I_{DDQ}	Quiescent Power Supply Current		Inputs Open, Outputs Unloaded			1	mA
POWER SUPPLY DC CHARACTERISTICS, V_{DD} = 1.8 V ± 0.15 V, T_A = −40°C to 85°C							
V_{DD}	Power Supply Voltage			1.65	1.8	1.95	V
I_{DDQ}	Quiescent Power Supply Current		Inputs Open, Outputs Unloaded			1	mA
POWER SUPPLY DC CHARACTERISTICS, V_{DD} = 1.5 V ± 0.1 V, T_A = −40°C to 85°C							
V_{DD}	Power Supply Voltage			1.4	1.5	1.6	V
I_{DDQ}	Quiescent Power Supply Current		Inputs Open, Outputs Unloaded			1	mA
LVCMOS DC CHARACTERISTICS, V_{DD} = 3.3 V ± 5%, T_A = −40°C to 85°C							
V_{IH}	Input High Voltage			0.65 * V_{DD}		3.6	V
V_{IL}	Input Low Voltage			−0.3		0.35 * V_{DD}	V
I_{IH}	Input High Current	CLK_IN	V_{DD} = V_{IN} = 3.465 V			165	μA
		OE	V_{DD} = V_{IN} = 3.465 V			5	μA
I_{IL}	Input Low Current	CLK_IN	V_{DD} = 3.465 V, V_{IN} = 0 V	−5			μA
		OE	V_{DD} = 3.465 V, V_{IN} = 0 V	−150			μA
V_{OH}	Output High Voltage	Q[4:1]	I_{OH} = −12 mA	2.6			V
V_{OL}	Output Low Voltage	Q[4:1]	I_{OL} = 12 mA			0.5	V
LVCMOS DC CHARACTERISTICS, V_{DD} = 2.5 V ± 5%, T_A = −40°C to 85°C							
V_{IH}	Input High Voltage			0.65 * V_{DD}		3.6	V
V_{IL}	Input Low Voltage			−0.3		0.35 * V_{DD}	V
I_{IH}	Input High Current	CLK_IN	V_{DD} = V_{IN} = 2.625 V			165	μA
		OE	V_{DD} = V_{IN} = 2.625 V			5	μA
I_{IL}	Input Low Current	CLK_IN	V_{DD} = 2.625 V, V_{IN} = 0 V	−5			μA
		OE	V_{DD} = 2.625 V, V_{IN} = 0 V	−150			μA

Table 5. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter		Test Conditions	Min	Typ	Max	Units
LVCMOS DC CHARACTERISTICS, V_{DD} = 2.5 V ± 5%, T_A = −40°C to 85°C							
V_{OH}	Output High Voltage	Q[4:1]	I_{OH} = −12 mA	1.8			V
V_{OL}	Output Low Voltage	Q[4:1]	I_{OL} = 12 mA			0.5	V
LVCMOS DC CHARACTERISTICS, V_{DD} = 1.8 V ± 0.15 V, T_A = −40°C to 85°C							
V_{IH}	Input High Voltage			0.65 * V_{DD}		3.6	V
V_{IL}	Input Low Voltage			−0.3		0.35 * V_{DD}	V
I_{IH}	Input High Current	CLK_IN	V_{DD} = V_{IN} = 1.95 V			165	μA
		OE				5	μA
I_{IL}	Input Low Current	CLK_IN	V_{DD} = 1.95 V, V_{IN} = 0 V	−5			μA
		OE	V_{DD} = 1.95 V, V_{IN} = 0 V	−150			μA
V_{OH}	Output High Voltage	Q[4:1]	I_{OH} = −6 mA	V_{DD} – 0.45			V
V_{OL}	Output Low Voltage	Q[4:1]	I_{OL} = 6 mA			0.45	V
LVCMOS DC CHARACTERISTICS, V_{DD} = 1.5 V ± 0.1 V, T_A = −40°C to 85°C							
V_{IH}	Input High Voltage			0.65 * V_{DD}		3.6	V
V_{IL}	Input Low Voltage			−0.3		0.35 * V_{DD}	V
I_{IH}	Input High Current	CLK_IN	V_{DD} = V_{IN} = 1.6 V			165	μA
		OE	V_{DD} = V_{IN} = 1.6 V			5	μA
I_{IL}	Input Low Current	CLK_IN	V_{DD} = 1.6 V, V_{IN} = 0 V	−5			μA
		OE	V_{DD} = 1.6 V, V_{IN} = 0 V	−150			μA
V_{OH}	Output High Voltage	Q[4:1]	I_{OH} = −4 mA	0.75 * V_{DD}			V
V_{OL}	Output Low Voltage	Q[4:1]	I_{OL} = 4 mA			0.25 * V_{DD}	V

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.

Table 6. AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
AC CHARACTERISTICS, V_{DD} = 3.3 V ± 5%, T_A = −40°C to 85°C						
f_{OUT}	Output Frequency				160	MHz
tp_{LH}	Propagation Delay (low to high transition); (Notes 4, 8)		0.7		2.1	ns
tp_{HL}	Propagation Delay (high to low transition); (Notes 4, 8)		0.7		2.1	ns
t_{PLZ}, t_{PHZ}	Disable Time, (active to high−impedance)				10	ns
t_{PZL}, t_{PZH}	Enable Time, (high−impedance to active)				10	ns
tsk(o)	Output Skew; (Notes 5, 6)				250	ps
tsk(pp)	Part−to−Part Skew; (Notes 5, 7)				800	ps
tjit	Buffer Additive Phase Jitter, RMS	25 MHz, Integration Range: 12 kHz − 5 MHz		0.094		ps
t_R / t_F	Output Rise/Fall Time	10% to 90%	0.33		1.2	ns
odc	Output Duty Cycle		48		53	%
AC CHARACTERISTICS, V_{DD} = 2.5 V ± 5%, T_A = −40°C to 85°C						
f_{OUT}	Output Frequency				160	MHz
tp_{LH}	Propagation Delay (low to high transition); (Notes 4, 8)		0.8		2.0	ns
tp_{HL}	Propagation Delay (high to low transition); (Notes 4, 8)		0.8		2.0	ns
t_{PLZ}, t_{PHZ}	Disable Time (active to high−impedance)				10	ns
t_{PZL}, t_{PZH}	Enable Time (high−impedance to active)				10	ns
tsk(o)	Output Skew; (Notes 5, 6)				250	ps
tsk(pp)	Part−to−Part Skew; (Notes 5, 7)				800	ps
tjit	Buffer Additive Phase Jitter, RMS	25 MHz, Integration Range: 12 kHz − 5 MHz		0.076		ps
t_R / t_F	Output Rise/Fall Time	10% to 90%	0.33		1.2	ns
odc	Output Duty Cycle		45		53	%
AC CHARACTERISTICS, V_{DD} = 1.8 V ± 0.15 V, T_A = −40°C to 85°C						
f_{OUT}	Output Frequency				160	MHz
tp_{LH}	Propagation Delay (low to high transition); (Notes 4, 8)		1.1		2.8	ns
tp_{HL}	Propagation Delay (high to low transition); (Notes 4, 8)		1.1		2.8	ns
t_{PLZ}, t_{PHZ}	Disable Time (active to high−impedance)				10	ns
t_{PZL}, t_{PZH}	Enable Time (high−impedance to active)				10	ns
tsk(o)	Output Skew; (Notes 5, 6)				250	ps
tsk(pp)	Part−to−Part Skew; (Notes 5, 7)				800	ps
tjit	Buffer Additive Phase Jitter, RMS	25 MHz, Integration Range: 12 kHz − 5MHz		0.193		ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm.

3. Characterized up to $F_{OUT} \leq 150$ MHz.
4. Measured from the $V_{DD}/2$ of the input to $V_{DD}/2$ of the output.
5. This parameter is defined in accordance with JEDEC Standard 65.
6. Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at $V_{DD}/2$.
7. Defined as skew between outputs on different devices operating at the same supply voltage, same temperature, same frequency and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at $V_{DD}/2$.
8. With rail to rail input clock.

Table 6. AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
AC CHARACTERISTICS, V_{DD} = 1.8 V ± 0.15 V, T_A = −40°C to 85°C						
t_R / t_F	Output Rise/Fall Time	0.63 V to 1.17 V	0.11		0.6	ns
odc	Output Duty Cycle		47		53	%
AC CHARACTERISTICS, V_{DD} = 1.5 V ± 0.1 V, T_A = −40°C to 85°C						
f_{OUT}	Output Frequency				160	MHz
tp_{LH}	Propagation Delay (low to high transition); (Notes 4, 8)		1.5		3.5	ns
tp_{HL}	Propagation Delay (high to low transition); (Notes 4, 8)		1.5		3.5	ns
t_{PLZ}, t_{PHZ}	Disable Time (active to high−impedance)				10	ns
t_{PZL}, t_{PZH}	Enable Time (high−impedance to active)				10	ns
tsk(o)	Output Skew; (Notes 5, 6)				250	ps
tsk(pp)	Part−to−Part Skew; (Notes 5, 7)				800	ps
tjit	Buffer Additive Phase Jitter, RMS	25 MHz, Integration Range: 12 kHz − 5 MHz		0.266		ps
t_R / t_F	Output Rise/Fall Time	0.525 V to 0.975 V	0.11		0.6	ns
odc	Output Duty Cycle		47		53	%

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm.

3. Characterized up to $F_{OUT} \leq 150$ MHz.
4. Measured from the $V_{DD}/2$ of the input to $V_{DD}/2$ of the output.
5. This parameter is defined in accordance with JEDEC Standard 65.
6. Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at $V_{DD}/2$.
7. Defined as skew between outputs on different devices operating at the same supply voltage, same temperature, same frequency and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at $V_{DD}/2$.
8. With rail to rail input clock.

Parameter Measurement Information

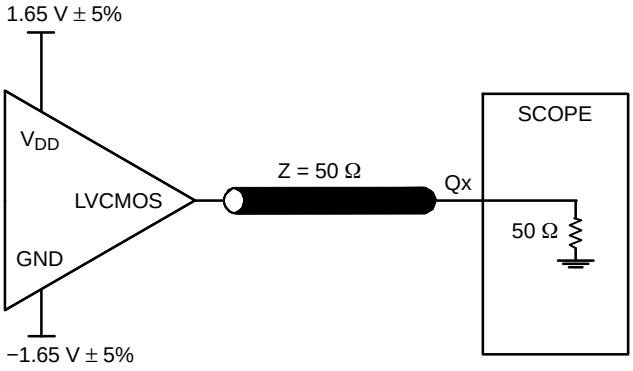


Figure 3. 3.3 V Output Load AC Test Circuit

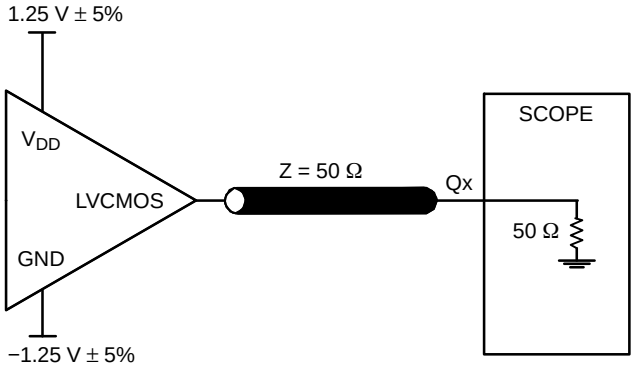


Figure 4. 2.5 V Output Load AC Test Circuit

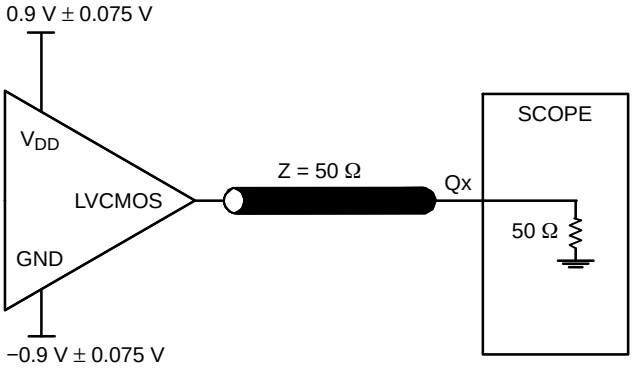


Figure 5. 1.8 V Output Load AC Test Circuit

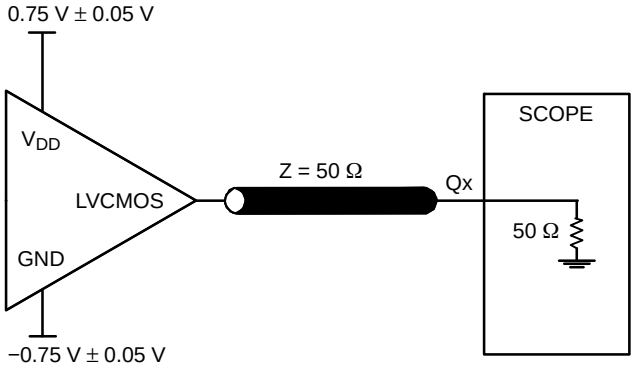


Figure 6. 1.5 V Output Load AC Test Circuit

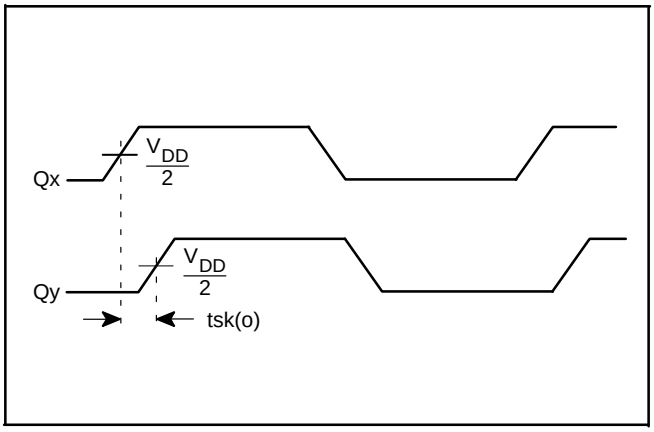


Figure 7. Output Skew

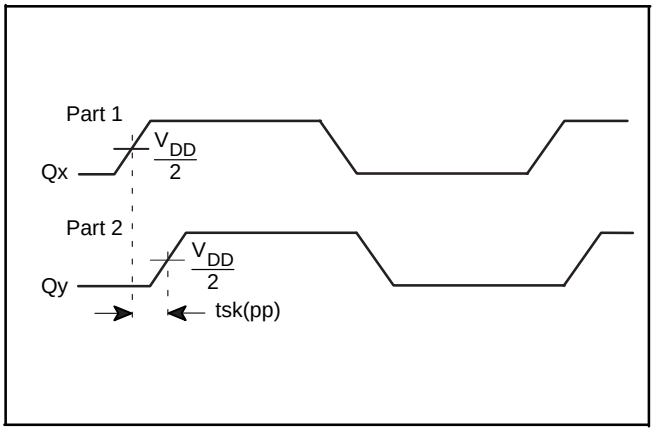


Figure 8. Part−to−Part Skew

Parameter Measurement Information, (continued)

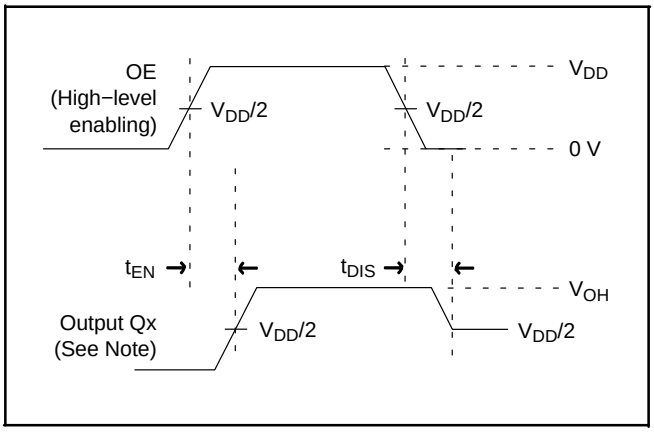


Figure 9. Output Enable/Disable Time

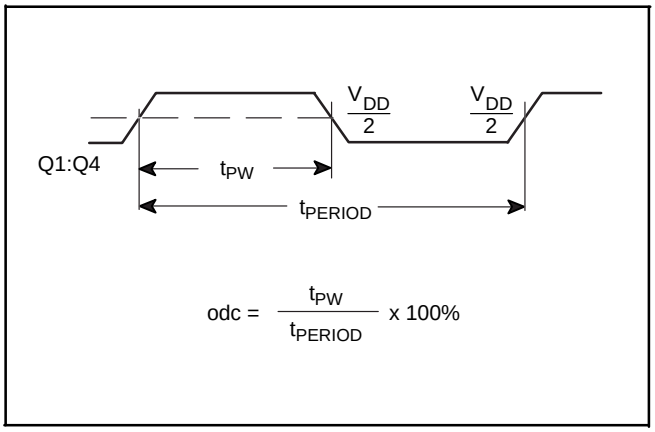


Figure 10. Output Duty Cycle/Pulse Width/Period

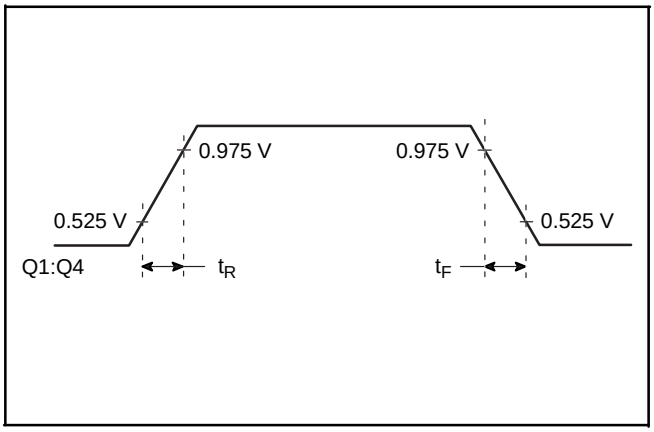


Figure 11. 1.5 V Output Rise/Fall Time

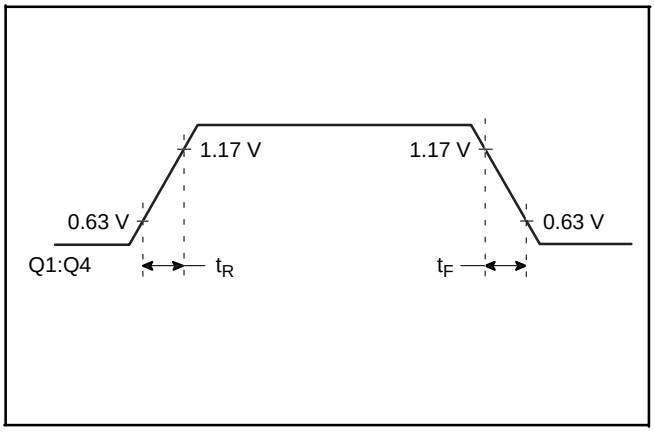


Figure 12. 1.8 V Output Rise/Fall Time

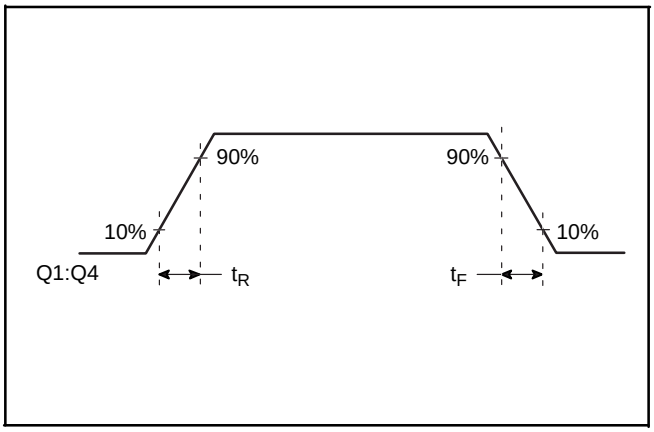


Figure 13. 2.5 V and 3.3 V Output Rise/Fall Time

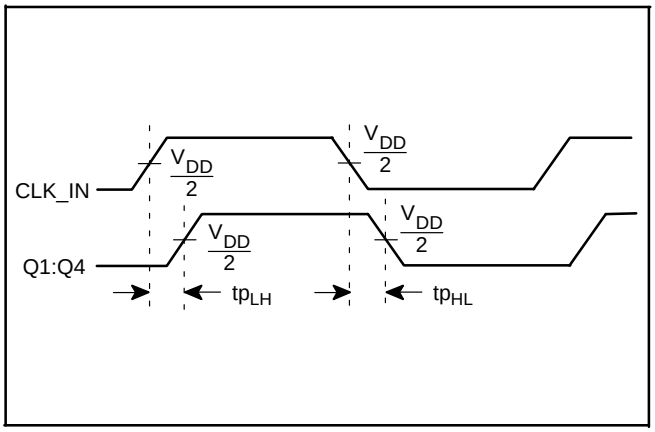


Figure 14. Propagation Delay

Table 7. THERMAL RESISTANCE θ_{JA}

θ_{JA} by Velocity			
FOR 8 LEAD SOIC, FORCED CONVECTION			
Meters per Second	**0**	**1**	**2.5**
Multi−Layer PCB, JEDEC Standard Test Boards	102.5°C/W	93.5°C/W	88.6°C/W
FOR 8 LEAD TSSOP, FORCED CONVECTION			
Meters per Second	**0**	**1**	**2.5**
Multi−Layer PCB, JEDEC Standard Test Boards	151.2°C/W	145.9°C/W	143.3°C/W
θ_{JA} by Velocity			

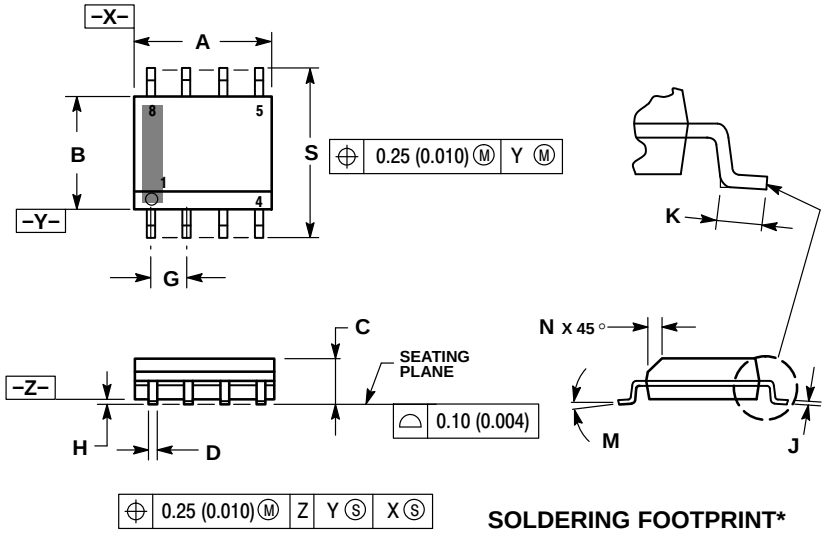
Table 8. ORDERING INFORMATION

Device	Package	Shipping†
NB3U1548CDG	SOIC−8 (Pb−Free)	96 Units / Tube
NB3U1548CDR2G	SOIC−8 (Pb−Free)	3000 / Tape & Reel
NB3U1548CDTR2G	TSSOP−8 (Pb−Free)	2500 / Tape & Reel

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

PACKAGE DIMENSIONS

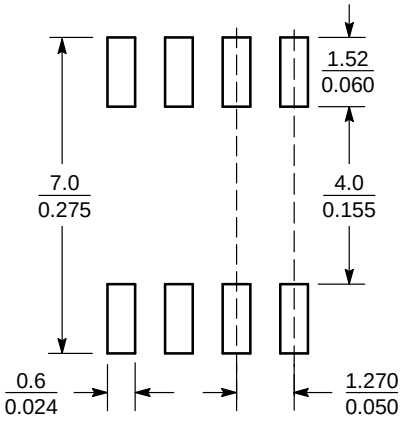
SOIC−8 NB
CASE 751−07
ISSUE AK



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*

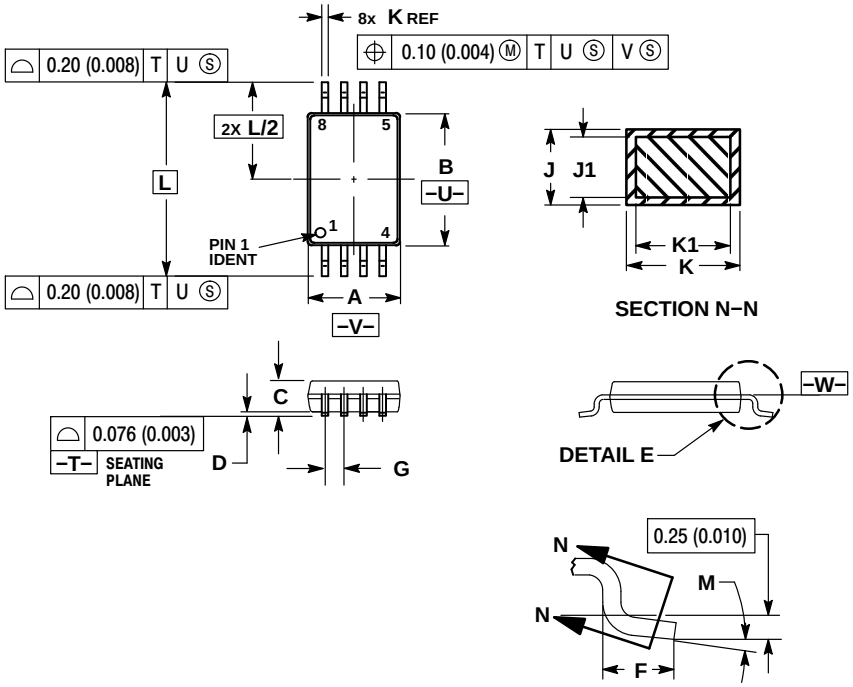


SCALE 6:1 (mm / inches)

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

PACKAGE DIMENSIONS

TSSOP−8
CASE 948S
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. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
6. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	4.30	4.50	0.169	0.177
C	---	1.10	---	0.043
D	0.05	0.15	0.002	0.006
F	0.50	0.70	0.020	0.028
G	0.65 BSC		0.026 BSC	
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°

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