NB3N551

3.3 V / 5.0 V Ultra-Low Skew 1:4 Clock Fanout Buffer

ON Semiconductor®

http://onsemi.com

Description

The NB3N551 is a low skew 1−to 4 clock fanout buffer, designed for clock distribution in mind. The NB3N551 specifically guarantees low output−to−output skew. Optimal design, layout and processing minimize skew within a device and from device to device.

The output enable (OE) pin three−states the outputs when low.

Features

- Input/Output Clock Frequency up to 180 MHz
- Low Skew Outputs (50 ps typical)
- RMS Phase Jitter (12 kHz – 20 MHz): 43 fs (Typical)
- Output goes to Three−State Mode via OE
- Operating Range: V_{DD} = 3.0 V to 5.5 V
- Ideal for Networking Clocks
- Packaged in 8−pin SOIC
- Industrial Temperature Range
- These are Pb−Free Devices

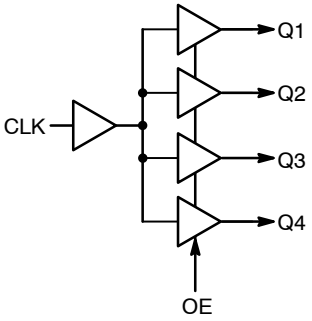
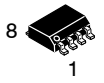
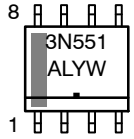


Figure 1. Block Diagram

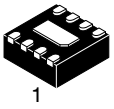
MARKING DIAGRAMS*



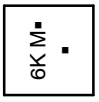
SOIC−8
D SUFFIX
CASE 751



3N551 = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package



DFN8
MN SUFFIX
CASE 506AA

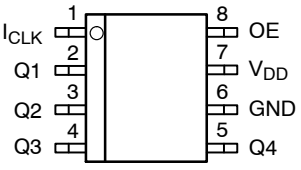


6K = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
NB3N551DG	SOIC−8 (Pb−Free)	98 Units/Rail
NB3N551DR2G	SOIC−8 (Pb−Free)	2500/Tape & Reel
NB3N551MNR4G	DFN−8 (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 Specification Brochure, BRD8011/D.

Table 1. OE, OUTPUT ENABLE FUNCTION

OE	Function
0	Disable
1	Enable

Table 2. PIN DESCRIPTION

Pin #	Name	Type	Description
1	I_{CLK}	(LV)CMOS/(LV)TTL Input	Clock Input. Internal pull−up resistor.
2	Q1	(LV)CMOS/(LV)TTL Output	Clock Output 1
3	Q2	(LV)CMOS/(LV)TTL Output	Clock Output 2
4	Q3	(LV)CMOS/(LV)TTL Output	Clock Output 3
5	Q4	(LV)CMOS/(LV)TTL Output	Clock Output 4
6	GND	Power	Negative supply voltage; Connect to ground, 0 V
7	V_{DD}	Power	Positive supply voltage (3.0 V to 5.5 V)
8	OE	(LV)CMOS/(LV)TTL Input	Output Enable for the clock outputs. Outputs are enabled when HIGH or when left open; OE pin has internal pull−up resistor. Three−states outputs when LOW.
−	EP	Thermal Exposed Pad	(DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open.

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V_{DD}	Positive Power Supply	GND = 0 V	–	7.0	V
V_I/V_O	Input/Output Voltage	t ≤ 1.5 ns	–	GND–1.5 ≤ V_I/V_O ≤ V_{DD}+1.5	V
T_A	Operating Temperature Range, Industrial	–	–	≥ –40 to ≤ +85	°C
T_{stg}	Storage Temperature Range	–	–	–65 to +150	°C
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	SOIC–8	190 130	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction–to–Case)	(Note 1)	SOIC–8	41 to 44	°C/W
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	DFN8 DFN8	129 84	°C/W
θ_{JC}	Thermal Resistance (Junction–to–Case)	(Note 1)	DFN8	35 to 40	°C/W

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.

1. JEDEC standard multilayer board – 2S2P (2 signal, 2 power)

Table 4. ATTRIBUTES

Characteristic		Value
ESD Protection	Human Body Model Machine Model	> 4 kV > 200 V
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 2)		Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL–94 code V–0 @ 0.125 in
Transistor Count		531 Devices
Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test		

2. For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

Table 5. DC CHARACTERISTICS (V_{DD} = 3.0 V to 3.6 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{DD}	Power Supply Current @ 135 MHz, No Load, V_{DD} = 3.3 V	–	20	40	mA
V_{OH}	Output HIGH Voltage – I_{OH} = −25 mA, V_{DD} = 3.3 V	2.4	–	–	V
V_{OL}	Output LOW Voltage – I_{OL} = 25 mA	–	–	0.4	V
V_{OH}	Output HIGH Voltage – I_{OH} = −12 mA (CMOS level)	V_{DD} − 0.4	–	–	V
$V_{IH, I_{CLK}}$	Input HIGH Voltage, I_{CLK}	(V_{DD}/2)+0.7	–	3.8	V
$V_{IL, I_{CLK}}$	Input LOW Voltage, I_{CLK}	–	–	(V_{DD}/2)−0.7	V
$V_{IH,}$ OE	Input HIGH Voltage, OE	2.0	–	VDD	V
$V_{IL,}$ OE	Input LOW Voltage, OE	0	–	0.8	V
ZO	Nominal Output Impedance	–	20	–	Ω
RPU	Input Pull−up Resistor, OE	–	220	–	kΩ
CIN	Input Capacitance, OE	–	5.0	–	pF
IOS	Short Circuit Current	–	± 50	–	mA

DC CHARACTERISTICS (V_{DD} = 4.5 V to 5.5 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{DD}	Power Supply Current @ 135 MHz, No Load, V_{DD} = 5.0 V	–	50	95	mA
V_{OH}	Output HIGH Voltage – I_{OH} = −35 mA	2.4	–	–	V
V_{OL}	Output LOW Voltage – I_{OL} = 35 mA	–	–	0.4	V
V_{OH}	Output HIGH Voltage – I_{OH} = −12 mA (CMOS level)	V_{DD} − 0.4	–	–	V
$V_{IH, I_{CLK}}$	Input HIGH Voltage, I_{CLK}	(V_{DD}/2) + 1	–	5.5	V
$V_{IL, I_{CLK}}$	Input LOW Voltage, I_{CLK}	–	–	(V_{DD}/2) − 1	V
$V_{IH,}$ OE	Input HIGH Voltage, OE	2.0	–	V_{DD}	V
$V_{IL,}$ OE	Input LOW Voltage, OE	0	–	0.8	V
ZO	Nominal Output Impedance	–	20	–	Ω
RPU	Input Pull−up Resistor, OE	–	220	–	kΩ
CIN	Input Capacitance, OE	–	5.0	–	pF
IOS	Short Circuit Current	–	±80	–	mA

Table 6. AC CHARACTERISTICS (V_{DD} = 3.0 V to 5.5 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
f_{in}	Input Frequency		–	–	180	MHz
t_{jitter} (ϕ)	RMS Phase Jitter (Integrated 12 kHz − 20 MHz) (See Figures 2 and 3)	$f_{carrier}$ = 25 MHz $f_{carrier}$ = 50 MHz	– –	43 16	– –	fs
$t_{jitter\ (pd)}$	Period Jitter (RMS, 1σ)		–	2.0	–	ps
t_r/t_f	Output rise and fall times; 0.8 V to 2.0 V		–	0.5	1.0	ns
t_{pd}	Propagation Delay, CLK to Qn, 0 − 180 MHz, (Note 4)		1.5	3.0	6.0	ns
t_{skew}	Output−to−Output Skew; (Note 5)		–	50	160	ps

3. Outputs loaded with external R_L = 33−Ω series resistor and C_L = 15 pF to GND for proper operation. Duty cycle out = duty in. A 0.01 μF decoupling capacitor should be connected between V_{DD} and GND. A 33 Ω series terminating resistor may be used on each clock output if the trace is longer than 1 inch.
4. Measured with rail−to−rail input clock.
5. Measured on rising edges at V_{DD} ÷ 2.

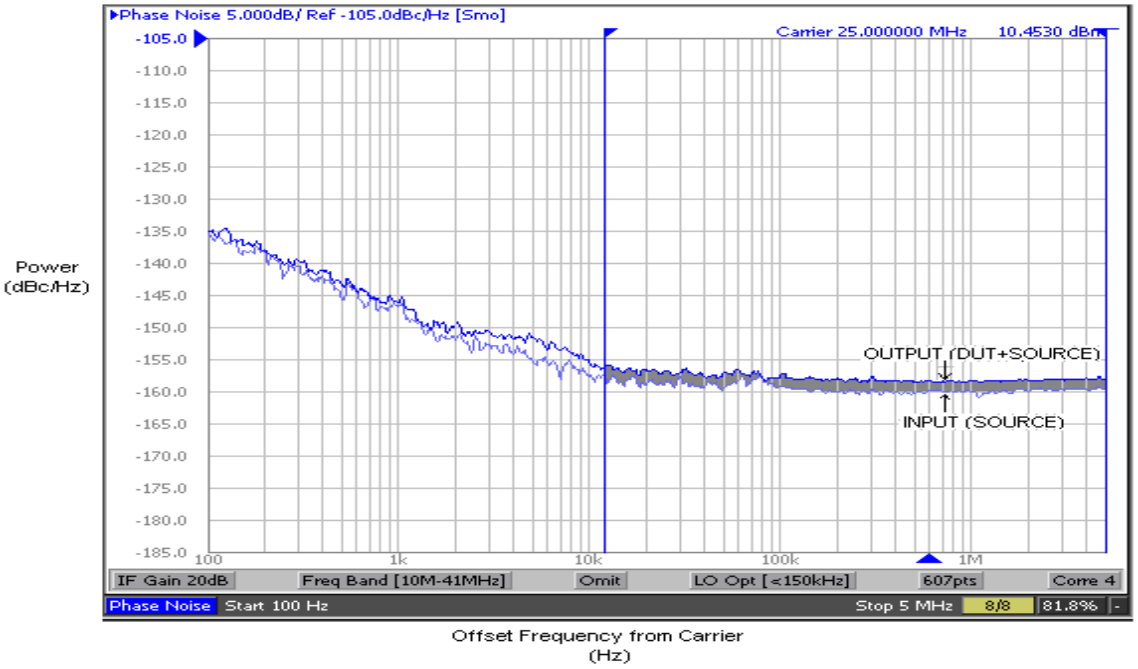


Figure 2. Phase Noise Plot at 25 MHz at an Operating Voltage of 3.3 V, Room Temperature

The above plot captured using Agilent E5052A shows Additive Phase Noise of the NB3N551 device measured with an input source generated by Agilent E8663B. The RMS phase jitter contributed by the device (integrated between 12 kHz to 20 MHz; as shown in the shaded region of the plot) is 43 fs (RMS Jitter of the input source is 203.31 fs and Output (DUT+Source) is 247.06 fs).

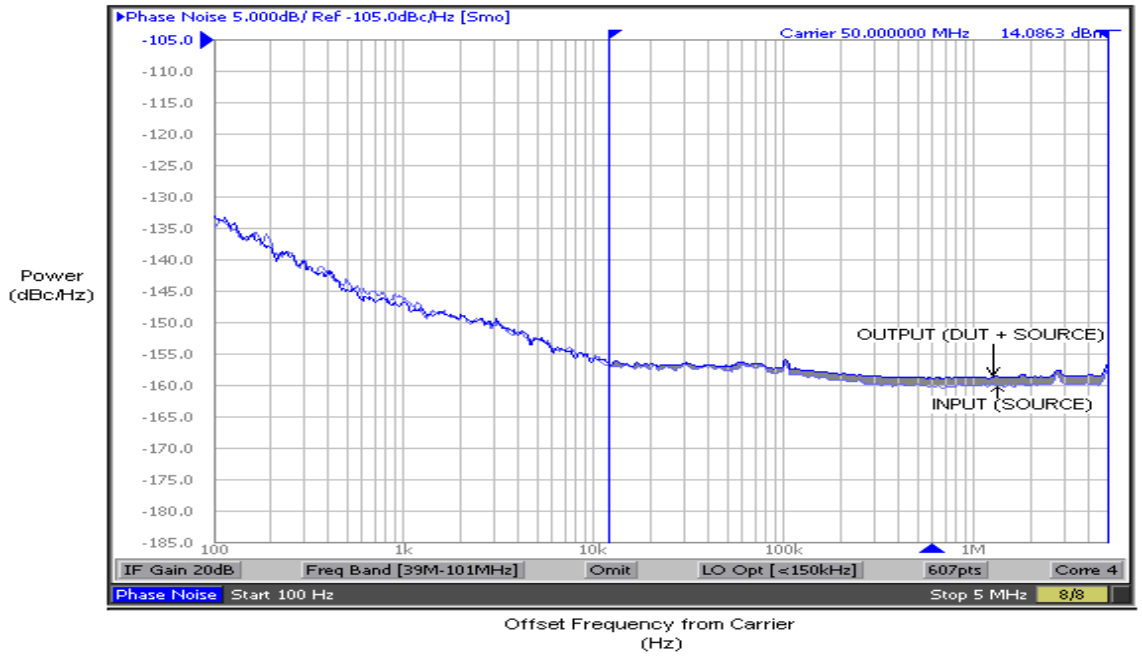
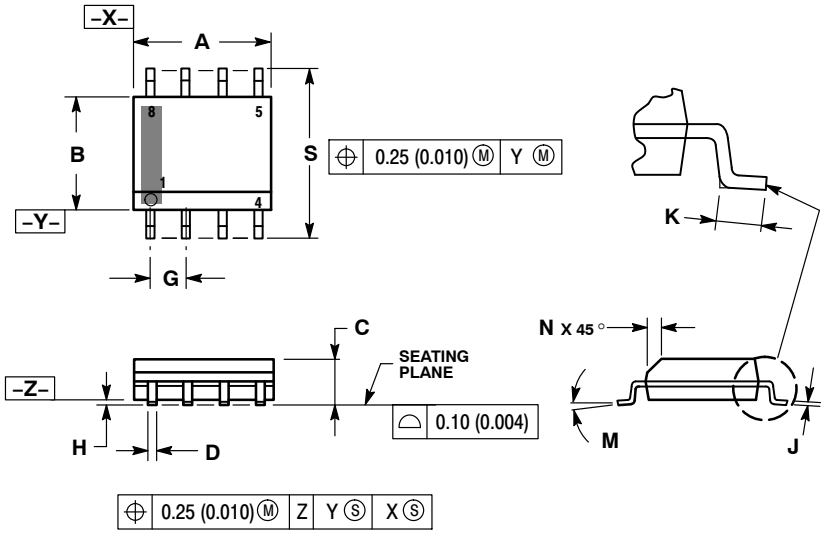


Figure 3. Phase Noise Plot at 50 MHz at an Operating Voltage of 5 V, Room Temperature

The above plot captured using Agilent E5052A shows Additive Phase Noise of the NB3N551 device measured with an input source generated by Agilent E8663B. The RMS phase jitter contributed by the device (integrated between 12 kHz to 20 MHz; as shown in the shaded region of the plot) is 16 fs (RMS Jitter of the input source is 104.08 fs and Output (DUT + Source) is 119.77 fs).

PACKAGE DIMENSIONS

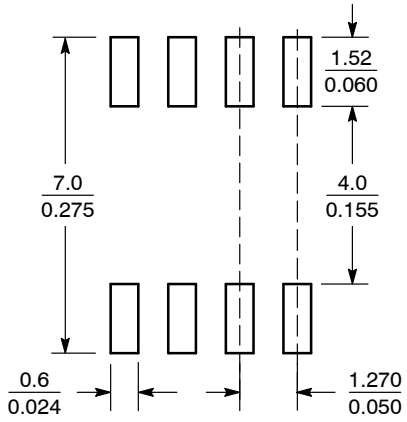
SOIC−8 NB
CASE 751−07
ISSUE AJ



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*

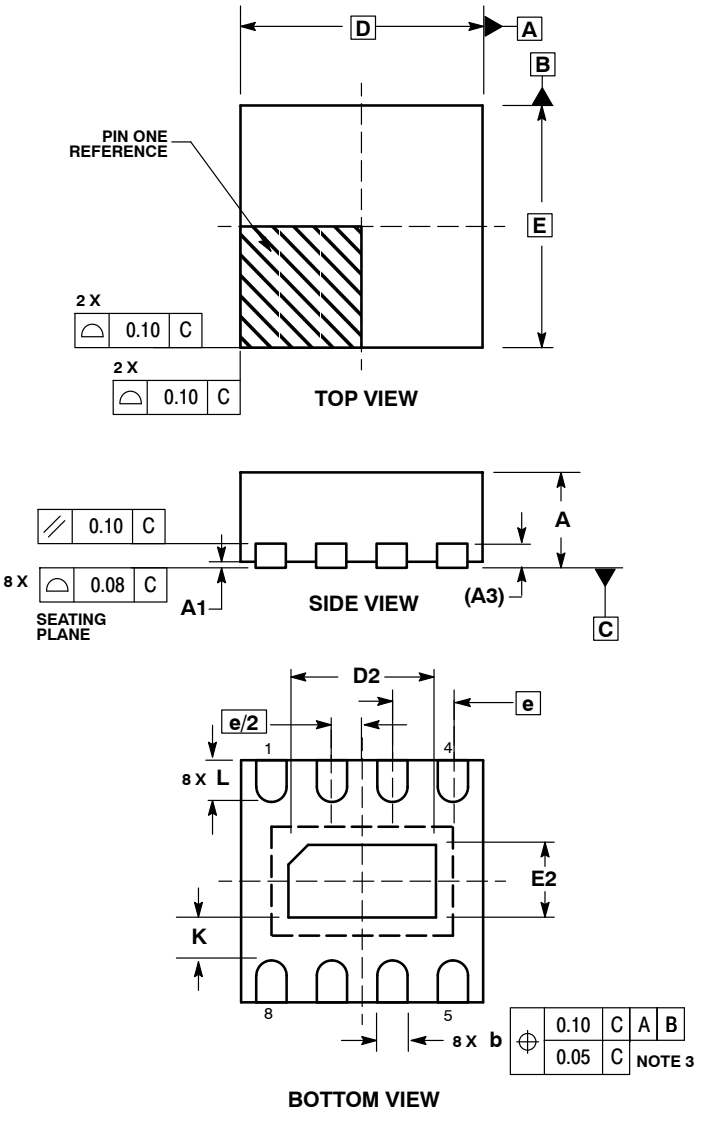


SCALE 6:1 (mm / inches)

*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

DFN8
CASE 506AA−01
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.00 BSC	
D2	1.10	1.30
E	2.00 BSC	
E2	0.70	0.90
e	0.50 BSC	
K	0.20	−−−
L	0.25	0.35

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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