

# NBSG14

## 2.5V/3.3V SiGe Differential 1:4 Clock/Data Driver with RSECL\* Outputs

### \*Reduced Swing ECL

The NBSG14 is a 1-to-4 clock/data distribution chip, optimized for ultra-low skew and jitter.

Inputs incorporate internal 50 Ω termination resistors and accept NECL (Negative ECL), PECL (Positive ECL), LVTTTL, LVCMOS, CML, or LVDS. Outputs are RSECL (Reduced Swing ECL), 400 mV.

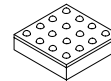
- Maximum Input Clock Frequency up to 12 GHz Typical
- Maximum Input Data Rate up to 12 Gb/s Typical
- 30 ps Typical Rise and Fall Times
- 125 ps Typical Propagation Delay
- RSPECL Output with Operating Range:  $V_{CC} = 2.375\text{ V}$  to  $3.465\text{ V}$  with  $V_{EE} = 0\text{ V}$
- RSNECL Output with RSNECL or NECL Inputs with Operating Range:  $V_{CC} = 0\text{ V}$  with  $V_{EE} = -2.375\text{ V}$  to  $-3.465\text{ V}$
- RSECL Output Level (400 mV Peak-to-Peak Output), Differential Output
- 50 Ω Internal Input Termination Resistors
- Compatible with Existing 2.5 V/3.3 V LVEP, EP, and LVEL Devices



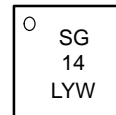
ON Semiconductor®

<http://onsemi.com>

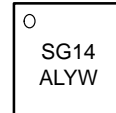
#### MARKING DIAGRAM\*



FCBGA-16  
BA SUFFIX  
CASE 489



QFN-16  
MN SUFFIX  
CASE 485G



A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week

\*For further details, refer to Application Note AND8002/D

#### ORDERING INFORMATION

Device	Package	Shipping
NBSG14BA	4x4 mm FCBGA-16	100 Units/Tray
NBSG14BAR2	4x4 mm FCBGA-16	500 / Tape & Reel
NBSG14MN	3x3 mm QFN-16	123 Units / Rail
NBSG14MNR2	3x3 mm QFN-16	3000 / Tape & Reel

Board	Description
NBSG14BAEVB	NBSG14BA Evaluation Board

# NBSG14

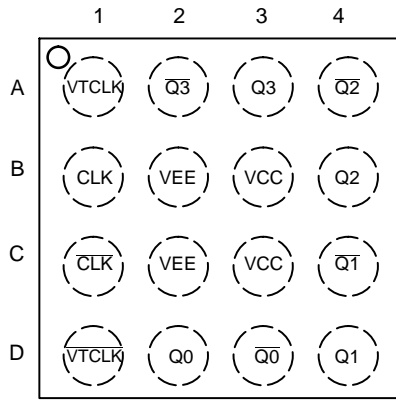


Figure 1. BGA-16 Pinout (Top View)

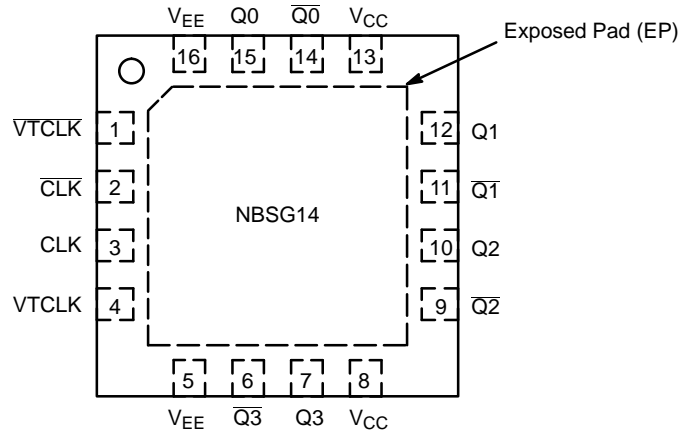


Figure 2. QFN-16 Pinout (Top View)

Table 1. Pin Description

Pin		Name	I/O	Description
BGA	QFN			
D1	1	$\overline{VTCLK}$	-	Internal 50 $\Omega$ Termination pin. See Table 2.
C1	2	$\overline{CLK}$	ECL, CML, LVCMOS, LVDS, LVTTTL Input	Inverted Differential Input. Internal 75 k $\Omega$ to $V_{EE}$ and 36.5 k $\Omega$ to $V_{CC}$ .
B1	3	CLK	ECL, CML, LVCMOS, LVDS, LVTTTL Input	Noninverted Differential Input. Internal 75 k $\Omega$ to $V_{EE}$ .
A1	4	VTCLK	-	Internal 50 $\Omega$ Termination Pin. See Table 2.
B2,C2	5,16	$V_{EE}$	-	Negative Supply Voltage. All $V_{EE}$ Pins must be Externally Connected to Power Supply to Guarantee Proper Operation.
A2*	6	$\overline{Q3}$	RSECL Output	Inverted Differential Output 3. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
A3*	7	Q3	RSECL Output	Noninverted Differential Output 3. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
B3,C3	8,13	$V_{CC}$	-	Positive Supply Voltage. All $V_{CC}$ Pins must be Externally Connected to Power Supply to Guarantee Proper Operation.
A4*	9	$\overline{Q2}$	RSECL Output	Inverted Differential Output 2. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
B4*	10	Q2	RSECL Output	Noninverted Differential Output 2. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
C4*	11	$\overline{Q1}$	RSECL Output	Inverted Differential Output 1. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
D4*	12	Q1	RSECL Output	Noninverted Differential Output 1. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
D3*	14	$\overline{Q0}$	RSECL Output	Inverted Differential Output 0. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
D2*	15	Q0	RSECL Output	Noninverted Differential Output 0. Typically Terminated with 50 $\Omega$ to $V_{TT} = V_{CC} - 2 V^*$
N/A	-	EP	-	Exposed Pad. The thermally exposed pad on package bottom (see case drawing) must be attached to a heat-sinking conduit.

1. In the differential configuration when the input termination pins ( $\overline{VTCLK}$ ,  $\overline{VTCLK}$ ) are connected to a common termination voltage, if no signal is applied then the device will be susceptible to self-oscillation.

\*Devices in BGA package typically terminated with 50  $\Omega$  to  $V_{TT} = V_{CC} - 1.5 V$ .

# NBSG14

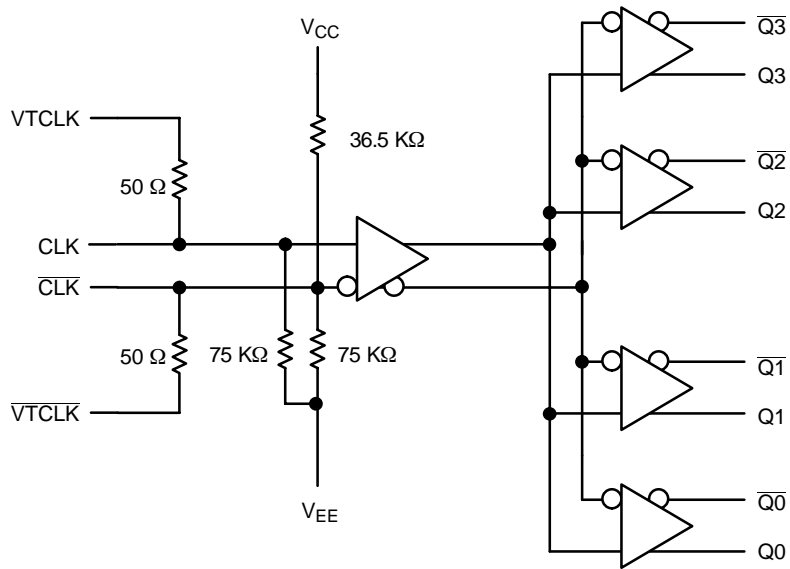


Figure 3. Logic Diagram

Table 2. INTERFACING OPTIONS

INTERFACING OPTIONS	CONNECTIONS
CML	Connect VTCLK and $\overline{VTCLK}$ to $V_{CC}$
LVDS	Connect VTCLK and $\overline{VTCLK}$ Together
AC-COUPLED	Bias VTCLK and $\overline{VTCLK}$ Inputs within Common Mode Range ( $V_{IHCMR}$ )
RSECL, PECL, NECL	Standard ECL Termination Techniques
LVTTTL, LVCMOS	An External Voltage ( $V_{THR}$ ) should be Applied to the Unused Differential Input. Nominal $V_{THR}$ is 1.5 V for LVTTTL and $V_{CC}/2$ for LVCMOS Inputs. This Voltage must be within the $V_{THR}$ Specification.

# NBSG14

**Table 3. ATTRIBUTES**

Characteristics		Value
Internal Input Pulldown Resistor (CLK, $\overline{\text{CLK}}$ )		75 k $\Omega$
Internal Input Pullup Resistor ( $\overline{\text{CLK}}$ )		36.5 k $\Omega$
ESD Protection	Human Body Model Machine Model	> 2 kV > 100 V
Moisture Sensitivity (Note 1)	FCBGA-16 QFN-16	Level 3 Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
Transistor Count		158
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test		

1. For additional information, see Application Note AND8003/D.

**Table 4. MAXIMUM RATINGS** (Note 2)

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
$V_{CC}$	Positive Power Supply	$V_{EE} = 0 \text{ V}$		3.6	V
$V_{EE}$	Negative Power Supply	$V_{CC} = 0 \text{ V}$		-3.6	V
$V_I$	Positive Input Negative Input	$V_{EE} = 0 \text{ V}$ $V_{CC} = 0 \text{ V}$	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	3.6 -3.6	V V
$V_{INPP}$	Differential Input Voltage  CLK- $\overline{\text{CLK}}$	$V_{CC} - V_{EE} \geq 2.8 \text{ V}$ $V_{CC} - V_{EE} < 2.8 \text{ V}$		2.8   $V_{CC} - V_{EE}$	V
$I_{IN}$	Input Current Through $R_T$ (50 $\Omega$ Resistor)	Static Surge		45 80	mA mA
$I_{OUT}$	Output Current	Continuous Surge		25 50	mA mA
$T_A$	Operating Temperature Range	16 FCBGA 16 QFN		-40 to +70 -40 to +85	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature Range			-65 to +150	$^{\circ}\text{C}$
$\theta_{JA}$	Thermal Resistance (Junction-to-Ambient) (Note 3)	0 LFPM 500 LFPM 0 LFPM 500 LFPM	16 FCBGA 16 FCBGA 16 QFN 16 QFN	108 86 41.6 35.2	$^{\circ}\text{C}/\text{W}$ $^{\circ}\text{C}/\text{W}$ $^{\circ}\text{C}/\text{W}$ $^{\circ}\text{C}/\text{W}$
$\theta_{JC}$	Thermal Resistance (Junction-to-Case)	2S2P (Note 3) 2S2P (Note 4)	16 FCBGA 16 QFN	5 4.0	$^{\circ}\text{C}/\text{W}$ $^{\circ}\text{C}/\text{W}$
$T_{sol}$	Wave Solder	< 15 Seconds		225	$^{\circ}\text{C}$

2. Maximum Ratings are those values beyond which device damage may occur.

3. JEDEC standard 51-6, multilayer board - 2S2P (2 signal, 2 power).

4. JEDEC standard multilayer board - 2S2P (2 signal, 2 power) with 8 filled thermal vias under exposed pad.

# NBSG14

**Table 5. DC CHARACTERISTICS, INPUT WITH RSPECL OUTPUT**  $V_{CC} = 2.5\text{ V}$ ;  $V_{EE} = 0\text{ V}$  (Note 5)

Symbol	Characteristic	-40°C			25°C			70°C(BGA)/85°C(QFN)**			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Negative Power Supply Current	45	60	75	45	60	75	45	60	75	mA
$V_{OH}$	Output HIGH Voltage (Note 6)	1525	1575	1625	1550	1610	1650	1575	1635	1675	mV
$V_{OUTPP}$	Output Amplitude Voltage	315	405	495	315	405	495	315	405	495	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended) (Notes 8 and 10)	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	mV
$V_{IL}$	Input LOW Voltage (Single-Ended) (Notes 9 and 10)	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	mV
$V_{THR}$	Input Threshold Voltage (Single-Ended) (Note 10)	$V_{EE} +$ 1125		$V_{CC-}$ 75	$V_{EE} +$ 1125		$V_{CC-}$ 75	$V_{EE} +$ 1125		$V_{CC-}$ 75	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 7)	1.2		2.5	1.2		2.5	1.2		2.5	V
$R_{TIN}$	Internal Input Termination Resistor	45	50	55	45	50	55	45	50	55	$\Omega$
$I_{IH}$	Input HIGH Current (@ $V_{IH}$ )		80	150		80	150		80	150	$\mu\text{A}$
$I_{IL}$	Input LOW Current (@ $V_{IL}$ )		25	100		25	100		25	100	$\mu\text{A}$

NOTE: SiGe circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfm is maintained.

5. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.125 V to -0.5 V.

6. All outputs loaded with 50  $\Omega$  to  $V_{CC} - 1.5\text{ V}$  for BGA package and  $V_{CC} - 2\text{ V}$  for QFN package.  $V_{OH}/V_{OL}$  measured at  $V_{IH}/V_{IL}$  (Typical).

7.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ ,  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

8.  $V_{IH}$  cannot exceed  $V_{CC}$ .  $|V_{IH} - V_{THR}| < 2600\text{ mV}$ .

9.  $V_{IL}$  always  $\geq V_{EE}$ .  $|V_{IL} - V_{THR}| < 2600\text{ mV}$ .

10.  $V_{THR}$  is the voltage applied to one input when running in single-ended mode.

\*Typicals used for testing purposes.

\*\*The device packaged in FCBGA-16 have maximum temperature specification of 70°C and devices packaged in QFN-16 have maximum temperature specification of 85°C.

**Table 6. DC CHARACTERISTICS, INPUT WITH RSPECL OUTPUT**  $V_{CC} = 3.3\text{ V}$ ;  $V_{EE} = 0\text{ V}$  (Note 11)

Symbol	Characteristic	-40°C			25°C			70°C(BGA)/85°C(QFN)**			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Negative Power Supply Current	45	60	75	45	60	75	45	60	75	mA
$V_{OH}$	Output HIGH Voltage (Note 12)	2325	2375	2425	2350	2410	2450	2375	2435	2475	mV
$V_{OUTPP}$	Output Amplitude Voltage	350	440	530	350	440	530	350	440	530	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended) (Notes 14 and 16)	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	$V_{CC-}$ 1435	$V_{CC-}$ 1000*	$V_{CC}$	mV
$V_{IL}$	Input LOW Voltage (Single-Ended) (Notes 15 and 16)	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	$V_{IH-}$ 2500	$V_{CC-}$ 1400*	$V_{IH-}$ 150	mV
$V_{THR}$	Input Threshold Voltage (Single-Ended) (Note 16)	$V_{EE} +$ 1125		$V_{CC-}$ 75	$V_{EE} +$ 1125		$V_{CC-}$ 75	$V_{EE} +$ 1125		$V_{CC-}$ 75	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 13)	1.2		3.3	1.2		3.3	1.2		3.3	V
$R_{TIN}$	Internal Input Termination Resistor	45	50	55	45	50	55	45	50	55	$\Omega$
$I_{IH}$	Input HIGH Current (@ $V_{IH}$ )		80	150		80	150		80	150	$\mu\text{A}$
$I_{IL}$	Input LOW Current (@ $V_{IL}$ )		25	100		25	100		25	100	$\mu\text{A}$

NOTE: SiGe Circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfm is maintained.

11. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3 V to -0.165 V.

12. All outputs loaded with 50  $\Omega$  to  $V_{CC} - 1.5\text{ V}$  for BGA package and  $V_{CC} - 2\text{ V}$  for QFN package.  $V_{OH}/V_{OL}$  measured at  $V_{IH}/V_{IL}$  (Typical).

13.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ ,  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

14.  $V_{IH}$  cannot exceed  $V_{CC}$ .  $|V_{IH} - V_{THR}| < 2600\text{ mV}$ .

15.  $V_{IL}$  always  $\geq V_{EE}$ .  $|V_{IL} - V_{THR}| < 2600\text{ mV}$ .

16.  $V_{THR}$  is the voltage applied to one input when running in single-ended mode.

\*Typicals used for testing purposes.

\*\*The device packaged in FCBGA-16 have maximum temperature specification of 70°C and devices packaged in QFN-16 have maximum temperature specification of 85°C.

# NBSG14

**Table 7. DC CHARACTERISTICS, NECL OR RSNECL INPUT WITH NECL OUTPUT**

$V_{CC} = 0\text{ V}$ ;  $V_{EE} = -3.465\text{ V}$  to  $-2.375\text{ V}$  (Note 17)

Symbol	Characteristic	-40°C			25°C			70°C(BGA)/85°C(QFN)**			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Negative Power Supply Current	45	60	75	45	60	75	45	60	75	mA
$V_{OH}$	Output HIGH Voltage (Note 18)	-975	-925	-875	-950	-890	-850	-925	-865	-825	mV
$V_{OUTPP}$	Output Amplitude Voltage $-3.465\text{ V} \leq V_{EE} \leq -3.0\text{ V}$ $-3.0\text{ V} < V_{EE} \leq -2.375\text{ V}$	350 315	440 405	530 495	350 315	440 405	530 495	350 315	440 405	530 495	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended) (Notes 20 and 22)	$V_{CC}-1435$	$V_{CC}-1000^*$	$V_{CC}$	$V_{CC}-1435$	$V_{CC}-1000^*$	$V_{CC}$	$V_{CC}-1435$	$V_{CC}-1000^*$	$V_{CC}$	mV
$V_{IL}$	Input LOW Voltage (Single-Ended) (Notes 21 and 22)	$V_{IH}-2500$	$V_{CC}-1400^*$	$V_{IH}-150$	$V_{IH}-2500$	$V_{CC}-1400^*$	$V_{IH}-150$	$V_{IH}-2500$	$V_{CC}-1400^*$	$V_{IH}-150$	mV
$V_{THR}$	Input Threshold Voltage (Single-Ended) (Note 22)	$V_{EE} + 1125$		$V_{CC}-75$	$V_{EE} + 1125$		$V_{CC}-75$	$V_{EE} + 1125$		$V_{CC}-75$	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 19)	$V_{EE} + 1.2$		0.0	$V_{EE} + 1.2$		0.0	$V_{EE} + 1.2$		0.0	V
$R_{TIN}$	Internal Input Termination Resistor	45	50	55	45	50	55	45	50	55	$\Omega$
$I_{IH}$	Input HIGH Current (@ $V_{IH}$ )		80	150		80	150		80	150	$\mu\text{A}$
$I_{IL}$	Input LOW Current (@ $V_{IL}$ )		25	100		25	100		25	100	$\mu\text{A}$

NOTE: SiGe circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500lpm is maintained.

17. Input and output parameters vary 1:1 with  $V_{CC}$ .

18. All outputs loaded with  $50\ \Omega$  to  $V_{CC} - 1.5\text{ V}$  for BGA package and  $V_{CC} - 2\text{ V}$  for QFN package.  $V_{OH}/V_{OL}$  measured at  $V_{IH}/V_{IL}$  (Typical).

19.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ ;  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

20.  $V_{IH}$  cannot exceed  $V_{CC}$ .  $|V_{IH} - V_{THR}| < 2600\text{ mV}$ .

21.  $V_{IL}$  always  $\geq V_{EE}$ .  $|V_{IL} - V_{THR}| < 2600\text{ mV}$ .

22.  $V_{THR}$  is the voltage applied to one input when running in single-ended mode.

\*Typicals used for testing purposes.

\*\*The device packaged in FCBGA-16 have maximum temperature specification of 70°C and devices packaged in QFN-16 have maximum temperature specification of 85°C.

**Table 8. AC CHARACTERISTICS for FCBGA-16**

$V_{CC} = 0\text{ V}$ ;  $V_{EE} = -3.465\text{ V}$  to  $-2.375\text{ V}$  or  $V_{CC} = 2.375\text{ V}$  to  $3.465\text{ V}$ ;  $V_{EE} = 0\text{ V}$

Symbol	Characteristic	-40°C			25°C			70°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{max}$	Maximum Frequency (See Figure 4) (Note 23)	10.7	12		10.7	12		10.7	12		GHz
$t_{PLH}$ , $t_{PHL}$	Propagation Delay to Output Differential	100	125	150	100	125	150	100	125	150	ps
$t_{SKEW}$	Duty Cycle Skew (Note 24) Within-Device Skew (Note 25) Device-to-Device Skew (Note 26)		2 6 25	10 15 50		2 6 25	10 15 50		2 6 25	10 15 50	ps
$t_{JITTER}$	RMS Random Clock Jitter (Figure 4) (Note 28) $f_{in} < 10\text{ GHz}$ Peak-to-Peak Data Dependent Jitter (Note 29) $f_{in} < 10\text{ Gb/s}$		0.2	1		0.2 10	1		0.2	1	ps
$V_{INPP}$	Input Voltage Swing/Sensitivity (Differential Configuration) (Note 27)	75		2600	75		2600	75		2600	mV
$t_r$ $t_f$	Output Rise/Fall Times (20% – 80%) @ 1 GHz	20	30	55	20	30	55	20	30	55	ps

23. Measured using a 500 mV source, 50% duty cycle clock source. All outputs loaded with  $50\ \Omega$  to  $V_{CC} - 1.5\text{ V}$ . Input edge rates 40 ps (20% – 80%).

24. See Figure 6.  $t_{SKEW} = |t_{PLH} - t_{PHL}|$  for a nominal 50% Differential Clock Input Waveform.

25. Within-Device skew is measured between outputs under identical transitions and conditions on any one device.

26. Device-to-device skew for identical transitions at identical  $V_{CC}$  levels.

27.  $V_{INPP}$  (MAX) cannot exceed  $V_{CC} - V_{EE}$  (applicable only when  $V_{CC} - V_{EE} < 2600\text{ mV}$ ).

28. Additive RMS Jitter with 50% duty cycle clock signal at 10 GHz.

29. Additive Peak-to-Peak data dependent jitter with NRZ PRBS 2<sup>31</sup>-1 data at 10 Gb/s.

# NBSG14

**Table 9. AC CHARACTERISTICS for QFN-16**

$V_{CC} = 0\text{ V}$ ;  $V_{EE} = -3.465\text{ V to } -2.375\text{ V}$  or  $V_{CC} = 2.375\text{ V to } 3.465\text{ V}$ ;  $V_{EE} = 0\text{ V}$

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{max}$	Maximum Frequency (See Figure 4) (Note 30)	10.5	12		10.5	12		10.5	12		GHz
$t_{PLH}$ , $t_{PHL}$	Propagation Delay to Output Differential	90	125	160	90	125	160	90	125	160	ps
$t_{SKEW}$	Duty Cycle Skew (Note 31) Within-Device Skew (Note 32) Device-to-Device Skew (Note 33)		3 6 25	15 15 50		3 6 25	15 15 50		3 6 25	15 15 50	ps
$t_{JITTER}$	RMS Random Clock Jitter (Figure 4) (Note 35) $f_{in} < 10\text{ GHz}$ Peak-to-Peak Data Dependent Jitter (Note 36) $f_{in} < 10\text{ Gb/s}$		0.2	1		0.2 10	1		0.2	1	ps
$V_{INPP}$	Input Voltage Swing/Sensitivity (Differential Configuration) (Note 34)	75		2600	75		2600	75		2600	mV
$t_r$ , $t_f$	Output Rise/Fall Times $Q, \bar{Q}$ (20% – 80%) @ 1 GHz	15	30	55	20	30	55	20	30	55	ps

30. Measured using a 500 mV source, 50% duty cycle clock source. All outputs loaded with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ . Input edge rates 40 ps (20% – 80%)

31. See Figure 6.  $t_{SKEW} = |t_{PLH} - t_{PHL}|$  for a nominal 50% Differential Clock Input Waveform.

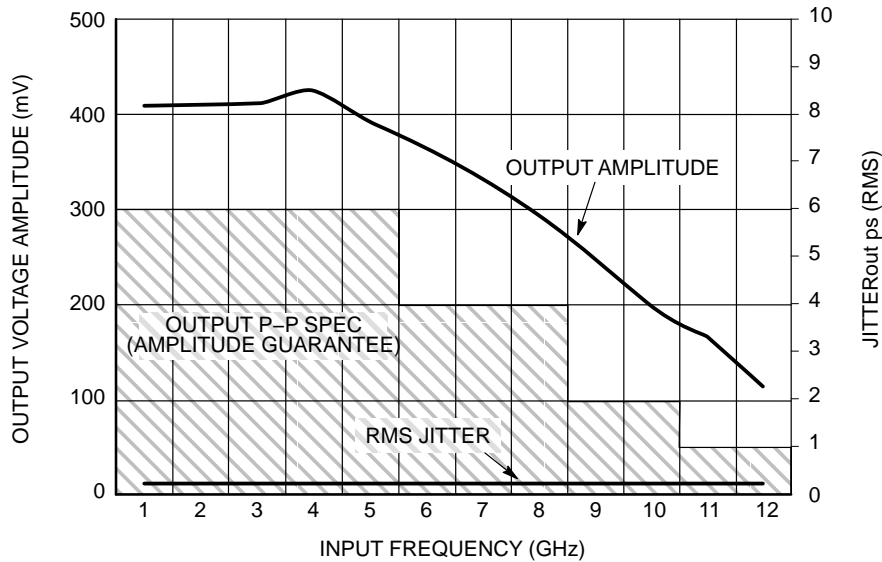
32. Within-Device skew is measured between outputs under identical transitions and conditions on any one device.

33. Device-to-device skew for identical transitions at identical  $V_{CC}$  levels.

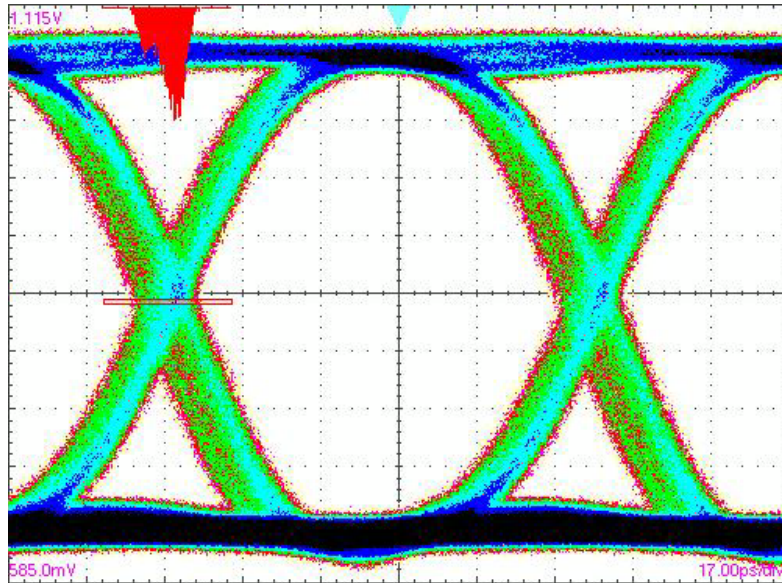
34.  $V_{INPP}$  (MAX) cannot exceed  $V_{CC} - V_{EE}$  (applicable only when  $V_{CC} - V_{EE} < 2600\text{ mV}$ ).

35. Additive RMS Jitter with 50% duty cycle clock signal at 10 GHz.

36. Additive Peak-to-Peak data dependent jitter with NRZ PRBS  $2^{31}-1$  data at 10 Gb/s.



**Figure 4. Output Voltage Amplitude ( $V_{OUTPP}$ ) / RMS Jitter vs. Input Frequency ( $f_{in}$ ) at Ambient Temperature (Typical)**

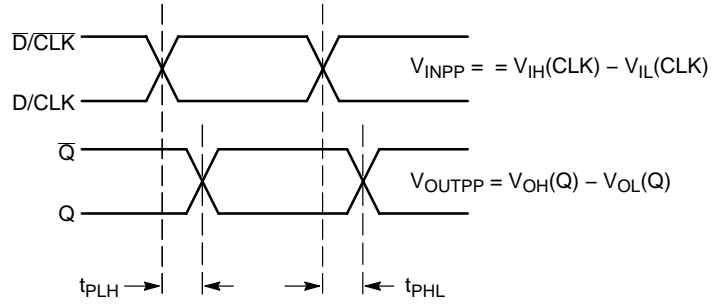


X = 17 ps/DIV, Y = 53 mV/DIV

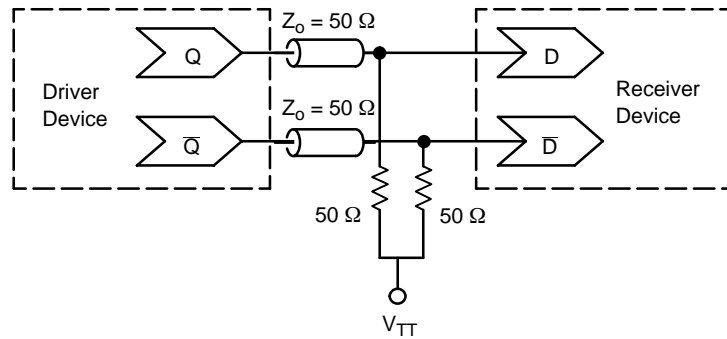
**Figure 5. Eye Diagram at 10.8 Gbps**  
( $V_{CC} - V_{EE} = 3.3\text{ V}$  @  $25^\circ\text{C}$  with Input Data Pattern of  $2^{31}-1$  PRBS.  
Total Pk-Pk System Jitter Including Signal Generator is 18 ps.  
This Data was taken by Acquiring 7000 Waveforms.)



# NBSG14



**Figure 6. AC Reference Measurement**



$$V_{TT} = V_{CC} - 1.5 \text{ V (BGA PACKAGE)}$$

$$V_{TT} = V_{CC} - 2.0 \text{ V (QFN PACKAGE)}$$

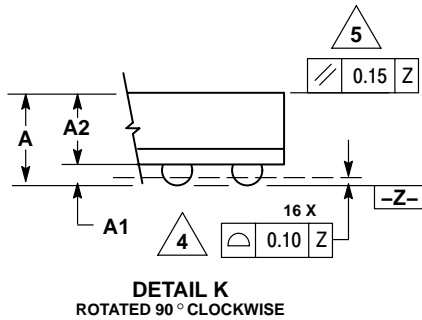
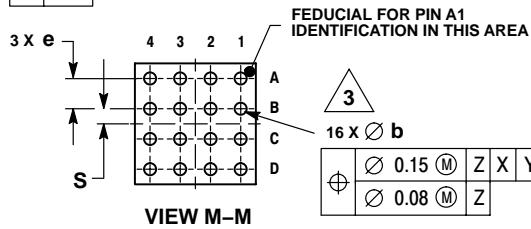
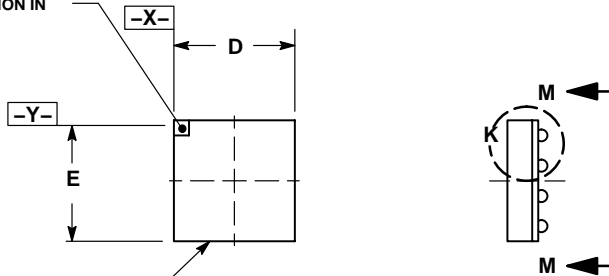
**Figure 7. Typical Termination for Output Driver and Device Evaluation  
(Refer to Application Note AND8020 – Termination of ECL Logic Devices)**

# NBSG14

## PACKAGE DIMENSIONS

**FCBGA-16  
BA SUFFIX**  
PLASTIC 4X4 (mm) BGA FLIP CHIP PACKAGE  
CASE 489-01  
ISSUE O

LASER MARK FOR PIN 1  
IDENTIFICATION IN  
THIS AREA



**NOTES:**

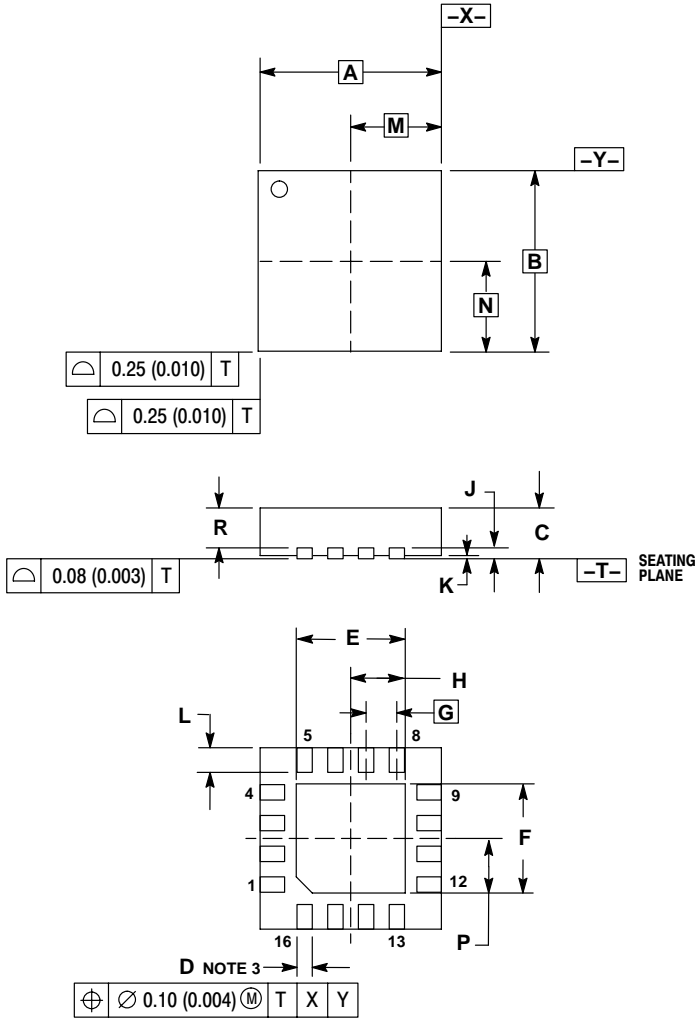
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION b IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO DATUM PLANE Z.
4. DATUM Z (SEATING PLANE) IS DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. PARALLELISM MEASUREMENT SHALL EXCLUDE ANY EFFECT OF MARK ON TOP SURFACE OF PACKAGE.

DIM	MILLIMETERS	
	MIN	MAX
A	1.40	MAX
A1	0.25	0.35
A2	1.20	REF
b	0.30	0.50
D	4.00	BSC
E	4.00	BSC
e	1.00	BSC
S	0.50	BSC

# NBSG14

## PACKAGE DIMENSIONS

16 PIN QFN  
MN SUFFIX  
CASE 485G-01  
ISSUE A



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D 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.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	3.00 BSC		0.118 BSC	
B	3.00 BSC		0.118 BSC	
C	0.80	1.00	0.031	0.039
D	0.23	0.28	0.009	0.011
E	1.75	1.85	0.069	0.073
F	1.75	1.85	0.069	0.073
G	0.50 BSC		0.020 BSC	
H	0.875	0.925	0.034	0.036
J	0.20 REF		0.008 REF	
K	0.00	0.05	0.000	0.002
L	0.35	0.45	0.014	0.018
M	1.50 BSC		0.059 BSC	
N	1.50 BSC		0.059 BSC	
P	0.875	0.925	0.034	0.036
R	0.60	0.80	0.024	0.031

**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.

## 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

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.

Copyright © Each Manufacturing Company.

All Datasheets cannot be modified without permission.

This datasheet has been download from :

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

100% Free DataSheet Search Site.

Free Download.

No Register.

Fast Search System.

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