NB7L216MNEVB

Evaluation Board Manual for NB7L216

ON Semiconductor®

http://onsemi.com

Description

This document describes the NB7L216 evaluation board and the appropriate lab test setups. It should be used in conjunction with the NB7L216 data sheet which contains full technical details on the device specifications and operation.

The evaluation board is designed to facilitate a quick evaluation of the NB7L216 GigaComm™ High Gain Differential Receiver/Driver.

Board Lay–up

The evaluation board is implemented in two layers and provides a high bandwidth 50 Ω controlled impedance environment for higher performance. First layer or primary trace layer is 5 mils thick Rogers RO6002 material, which is engineered to have equal electrical length on all signal traces from NB7L216 device to the sense output. The second layer is 32 mils thick copper ground plane. For standard lab setup and test, a split (dual) power supply is required enabling the 50 ohm impedance in the scope to be used as termination of the ECL signals ($V_{TT} = V_{CC} - 2.0$ V, in split power supply setup, V_{TT} is the system ground).

EVALUATION BOARD MANUAL

What measurements can you expect to make?

With this evaluation board, the following measurements could be performed in single–ended[1] or differential modes of operation:

- Jitter
- Output Skew
- Gain/Return Loss
- Eye Pattern Generation
- Frequency Performance
- Output Rise and Fall Time
- V_{CMR} (Common Mode Range)

1. Single–ended measurements can only be made at $V_{CC} - V_{EE} = 3.3$ V using this board setup.
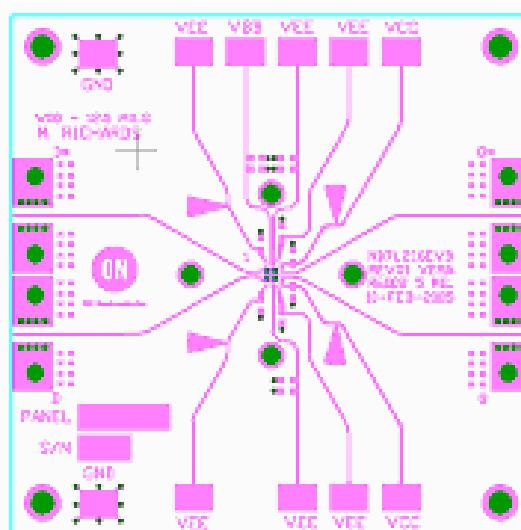
Figure 1. NB7L216 Evaluation Board

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Setup for Time Domain Measurements

Table 1. Basic Equipment

Description	Example Equipment (Note 1)	Qty.
Power Supply with 4 outputs	HP6624A	1
Oscilloscope	TDS8000 with 80E01 Sampling Head (Note 2)	1
Differential Signal Generator	HP 8133A, Advantest D3186	1
Matched High Speed Cables with SMA Connectors	Storm, Semflex	4
Power Supply Cables with Clips		3/4

1. Equipment used to generate example measurements.
2. 50 GHz sampling head used (for effective rise, fall and jitter performance measurement)

Setup

Step 1:

Connect Power

1a: Three power levels must be provided to the board for V_{CC}, V_{EE}, and GND via the surface mount clips. Using the split power supply mode, $GND = V_{TT} = V_{CC} - 2.0$ V.

NB7L216 Power Supply Connections	
3.3 V Setup	**2.5 V Setup**
$V_{CC} = 2.0$ V	$V_{CC} = 2.0$ V
$V_{TT} = GND$	$V_{TT} = GND$
$V_{EE} = -1.3$ V	$V_{EE} = -0.5$ V

Step 2:

Connect Inputs

For Differential Mode (3.3 V and 2.5 V operation)
  2a: Connect the differential output of the generator to the differential input of the device (D and $\overline{D}$).

For Single−Ended Mode (3.3 V operation only)
  2a: Connect the AC coupled single−ended output generator to input.

NOTE: Device may oscillate when the input is not driven. For best results, unconnected input should be terminated to V_{TT} through 50 Ω resistor

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$V_{CC} = 2.0$ V $V_{TT} = 0$ V

Advantest D3186
Signal Generator
(12 GHz)

OUT

$\overline{OUT}$

Amplitude = 500 mV
Offset = 660 mV

TRIGGER

V_{CC} GND

C1

D

$\overline{D}$

C1

V_{BB} V_{EE} GND

V_{BB}

$V_{EE} = -1.3$ V (3.3 V op)
$V_{EE} = -0.5$ V (2.5 V op)

$V_{TT} = 0$ V

Tektronix TDS8000
Digital Oscilloscope

Channel 1 (80E01)

Q

Channel 2 (80E01)

$\overline{Q}$

TRIGGER
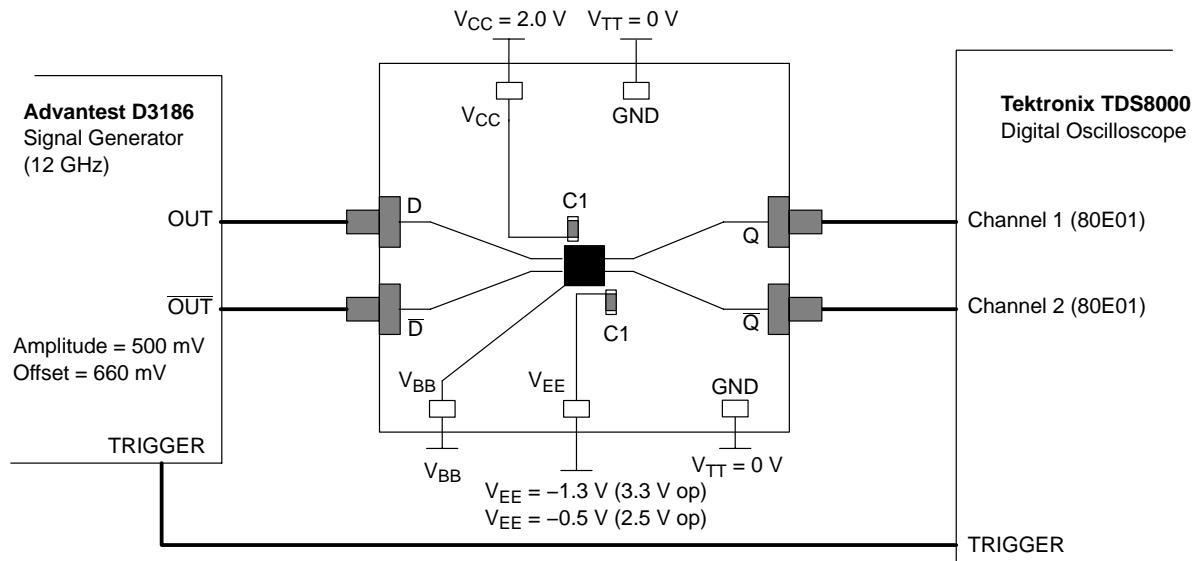
NOTE: All differential cable pairs **_must be_** matched.

Figure 2. NB7L216 Board Setup – Time Domain (Differential Mode)

Setup (continued)

Step 3:

Setup Input Signals

3a: Set the signal generator amplitude to 500 mV.

NOTE: The signal generator amplitude can vary from 75 mV to 900 mV to produce a 400 mV DUT
output.

3b: Set the signal generator offset to 660 mV (the center of a nominal RSECL output).

NOTE: The V_{CMR} (Voltage Common Mode Range) allows the signal generator offset to vary as long as
crosspoint is within the V_{CMR} range. Refer to the device data sheet for further information.

3c: Set the generator output for a PRBS data signal, or for a square wave clock signal with
a 50% duty cycle.

Step 4:

Connect Output Signals

4a: Connect the outputs of the device (Q, $\overline{Q}$) to the oscilloscope. The oscilloscope
sampling head must have internal 50 Ω termination to ground.

NOTE: Where a single output is being used, the unconnected output for the pair **_must be_** terminated to
V_{TT} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since
$V_{TT} = 0$ V, a standard 50 Ω SMA termination is recommended.

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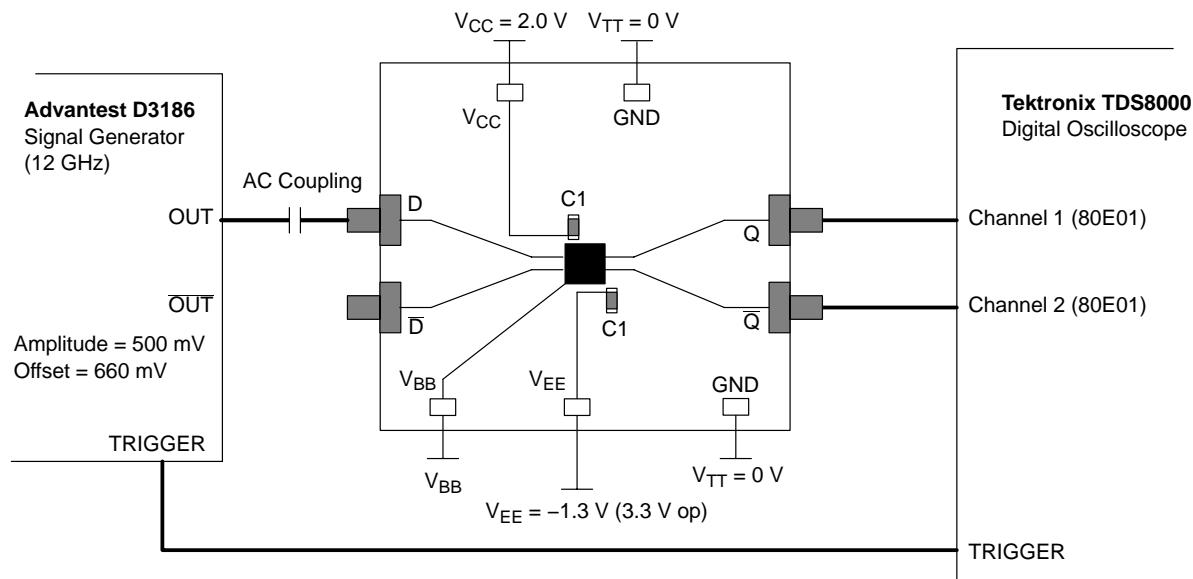
NOTE: All differential cable pairs **_must be_** matched.

Figure 3. NB7L216 Board Setup – Time Domain (Single–Ended Mode)

Setup for Frequency Domain Measurements

Table 2. Basic Equipment

Description	Example Equipment (Note 3)	Qty.
Power Supply with 4 outputs	HP 6624A	1
Vector Network Analyzer (VNA)	R&S ZVK (10 MHz to 40 GHz)	1
180° Hybrid Coupler	Krytar Model #4010180	1
Bias Tee with 50 Ω Resistor Termination	Picosecond Model #5542–219	1
Matched High Speed Cables with SMA Connectors	Storm, Semflex	3
Power Supply Cables with Clips		3/4

3. Equipment used to generate example measurements within this document.

Setup

Step 1:

Connect Power

1a:Three power levels must be provided to the board for V_{CC}, V_{EE}, and GND via the surface mount clips. Using the split power supply mode, GND = V_{TT} = V_{CC} – 2.0 V.

NB7L216 Power Supply Connections
3.3 V Setup
V_{CC} = 2.0 V
V_{TT} = GND
V_{EE} = –1.3 V

NOTE: For frequency domain measurements, 2.5 V power supply is not recommended because additional equipment (bias tee, etc.) is needed for proper operation. The input signal has to be properly offset to meet V_{CMR} range of the device.

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Setup Test Configurations For Differential Operation

Small Signal Setup

Step 2:	**Input Setup** 2a: Calibrate VNA from 1.0 GHz to 12 GHz. 2b: Set input level to –35 dBm at the output of the 180° Hybrid coupler (input of the DUT).
Step 3:	**Output Setup** 3a: Set display to measure S21 and record data.

Large Signal Setup

Step 2:	**Input Setup** 2a: Calibrate VNA from 1.0 GHz to 12 GHz. 2b: Set input levels to –2.0 dBm (500 mV) at the input of DUT.
Step 3:	**Output Setup** 3a: Set display to measure S21 and record data.
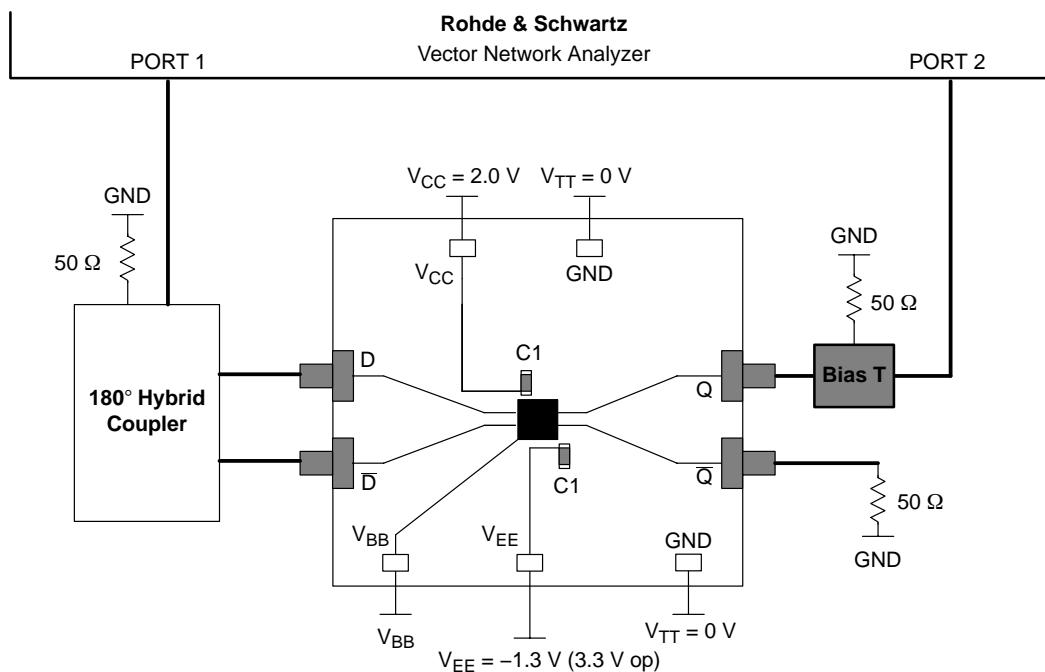
Figure 4. NB7L216 Board Setup – Frequency Domain (Differential Mode)

Setup Test Configurations For Single−Ended Operation

Single−Ended Mode − Small Signal

Step 2:	**Input Setup** 2a: Calibrate VNA from 1.0 GHz to 12 GHz. 2b: Set input level to −35 dBm at the input of DUT.
Step 3:	**Output Setup** 3a: Set display to measure S21 and record data.

Single−Ended Mode − Large Signal

Step 2:	**Input Setup** 2a: Calibrate VNA from 1.0 GHz to 12 GHz. 2b: Set input levels to +2 dBm (500 mV) at the input of DUT.
Step 3:	**Output Setup** 3a: Set display to measure S21 and record data.
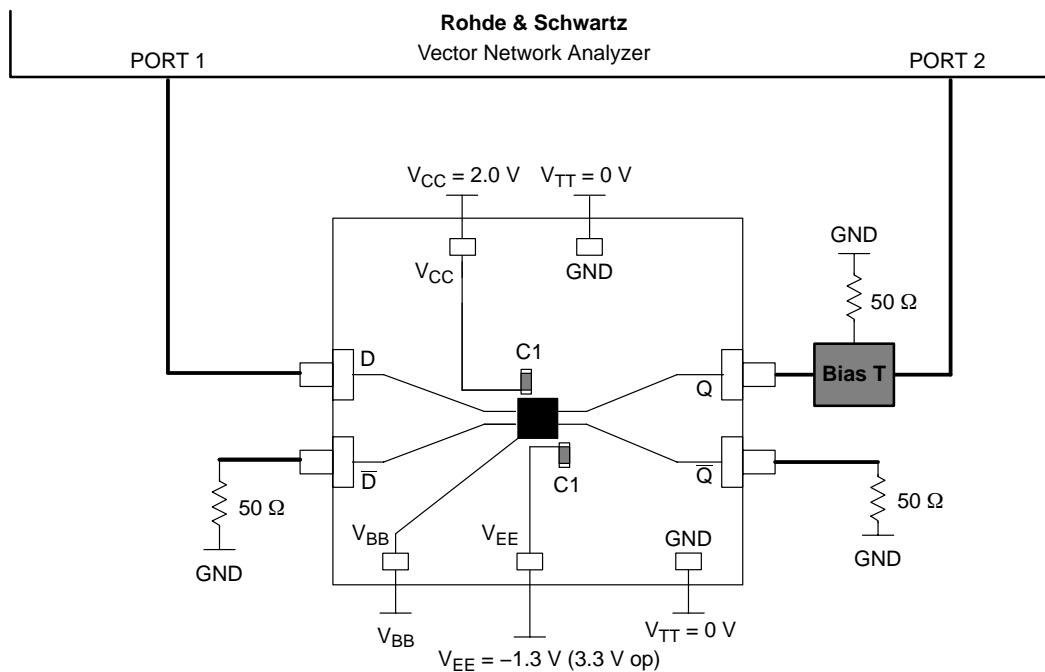
Figure 5. NB7L216 Board Setup − Frequency Domain (Single−Ended Mode)

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More Information About Evaluation Board

Design Considerations for >12 GHz operation

While the NB7L216 is specified to operate at 12 GHz, this evaluation board is designed to support operating frequencies up to 20 GHz.

The following considerations played a key role to ensure this evaluation board achieves high−end microwave performance:

- Optimal SMA connector launch
- Minimal insertion loss and signal dispersion
- Accurate Transmission line matching (50 ohms)
- Distributed effects while bypassing and noise filtering

SURFACE MOUNT CLIP

Figure 6. Evaluation Board Schematic
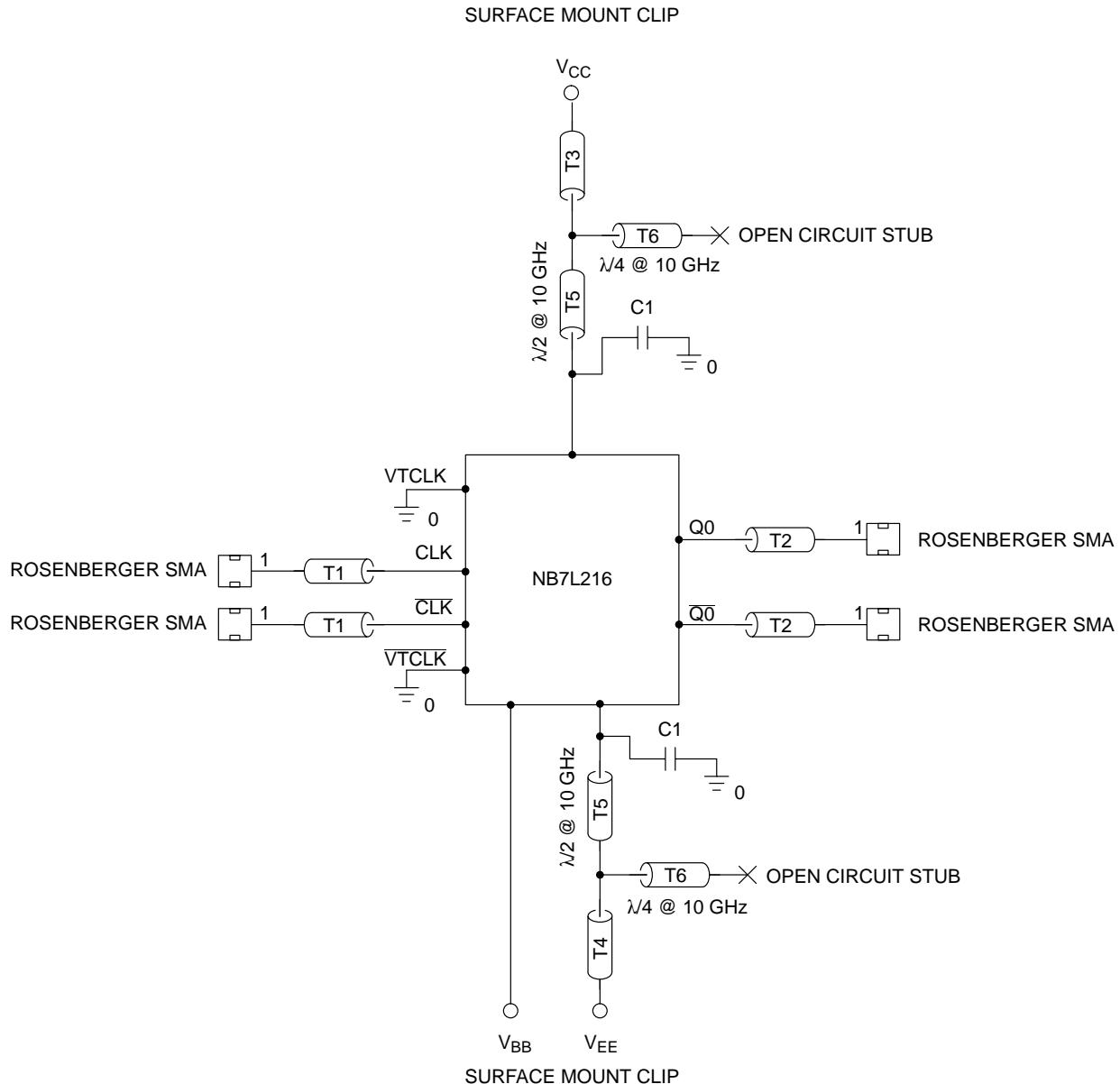
NOTE: C1, C2* = Decoupling cap
           Tx = 50 Ω Transmission line

Table 3. Parts List

Part No	QTY	Description	Manufacturer	WEB address
NB7L216	1	Evaulation Board	ON Semiconductor	http://www.onsemi.com
5016	11	Test Point – ANVIL	Keystone	http://www.newark.com http://www.digikey.com
32K243–40ME3	4	Gold plated connector	Rosenberger	http://www.rosenberger.de
CO6BLBB2X5UX CO603C104K6RAC	8	2 MHz – 30 GHz capacitor 0603 0.1 μF ± 10%	Dielectric Laboratories Kemet	http://www.dilabs.com http://www.newark.com

Table 4. Board Material

Material	Thickness
Rogers 6002	5 mil
Copper Plating	32 mil
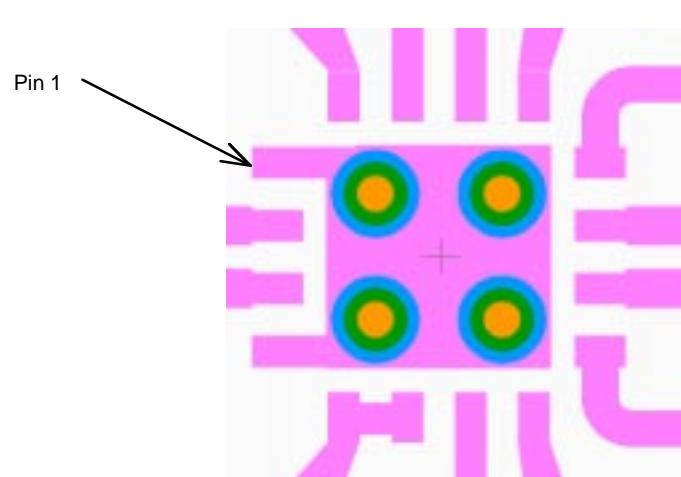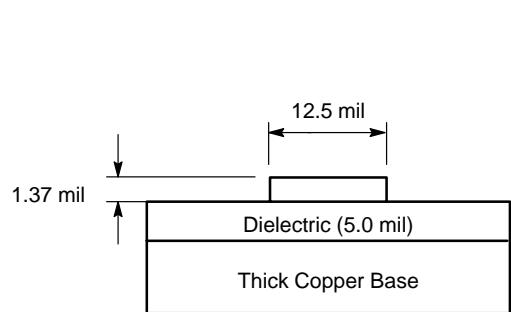
Figure 7. Board Stack–up

Figure 8. Layout Mask for NB7L216
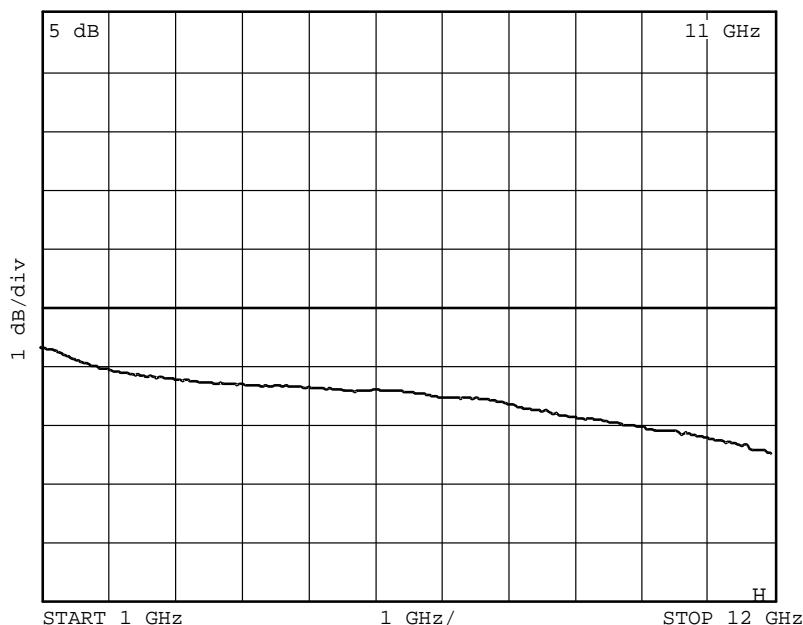
NOTE: The insertion loss curve can be used to calibrate out board loss if testing under small signal conditions.

Figure 9. Insertion Loss

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ADDITIONAL EVALUATION BOARD INFORMATION

www.onsemi.com

In all cases, the most up–to–date information can be found on our website.

- Sample orders for devices and boards
- New Product updates
- Literature download/order
- IBIS and Spice models

References

NB7L216 Data Sheet, *2.5V/3.3V, 12Gb/s Multi Level Clock/Data Input to RSECL, High Gain Receiver/Buffer/Translator with Internal Termination*

AND8077/D, Application Note, *GigaComm™ (SiGe) SPICE Modeling Kit.*

AND8075/D, Application Note, *Board Mounting Considerations for the FCBGA Packages.*

ORDERING INFORMATION

Device	Package	Shipping†
NB7L216MN	QFN–16	123 Units / Rail
NB7L216MNG	QFN–16 (Pb–Free)	123 Units / Rail
NB7L216MNR2	QFN–16	3000 / Tape & Reel
NB7L216MNR2G	QFN–16 (Pb–Free)	3000 / 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.

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PACKAGE DIMENSIONS

16 PIN QFN
CASE 485G–01
ISSUE B

TOP VIEW

| | 0.15 | C |

| | 0.15 | C |

PIN 1 LOCATION
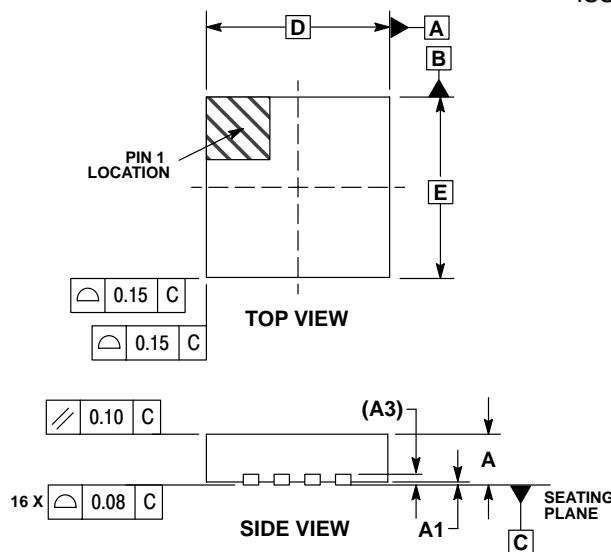
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. L_{max} CONDITION CAN NOT VIOLATE 0.2 MM MINIMUM SPACING BETWEEN LEAD TIP AND FLAG

| DIM | MILLIMETERS | |
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.18	0.30
D	3.00 BSC	
D2	1.65	1.85
E	3.00 BSC	
E2	1.65	1.85
e	0.50 BSC	
K	0.20	–––
L	0.30	0.50

SIDE VIEW

| // | 0.10 | C |

16 X | | 0.08 | C |

(A3)

A

A1

SEATING PLANE

C

BOTTOM VIEW

16X L
NOTE 5

16X K

16X b

| ⊕ | 0.10 | C | A | B |
| | 0.05 | C | NOTE 3 |

EXPOSED PAD

SOLDERING FOOTPRINT*

3.25 / 0.128

0.575 / 0.022

0.30 / 0.012

EXPOSED PAD

3.25 / 0.128

1.50 / 0.059

0.50 / 0.02

0.30 / 0.012

SCALE 10:1   (mm / inches)
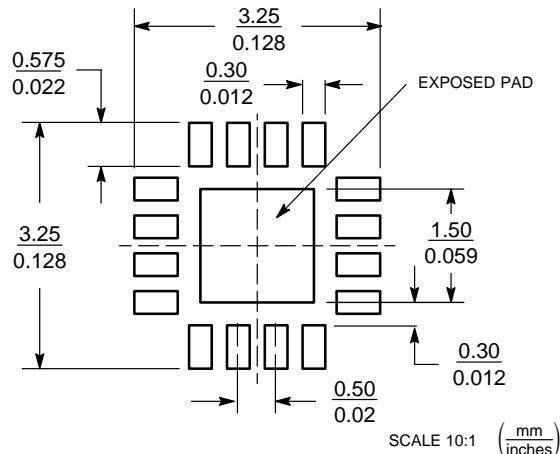
*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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