NB7L86MMNEVB

NB7L86M Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This document describes the NB7L86M evaluation board (see Figure 1) and the appropriate lab test setups. It should be used in conjunction with the NB7L86M data sheet which contains full technical details on the device specification and operation. This evaluation board is offered as a convenience for the customers interested in performing their own engineering characterization and performance assessment of the NB7L86M.

Board Lay−up

The board is implemented in two layers and provides a high bandwidth 50 Ω controlled impedance environment for higher performance. The 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 the NB7L86M device to the sense output. The second layer is 32 mils thick copper ground plane.

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

This Evaluation Board Manual Contains:

- Information on NB7L86MMNEVB Evaluation Board
- Appropriate Lab Setup
- Bill of Materials

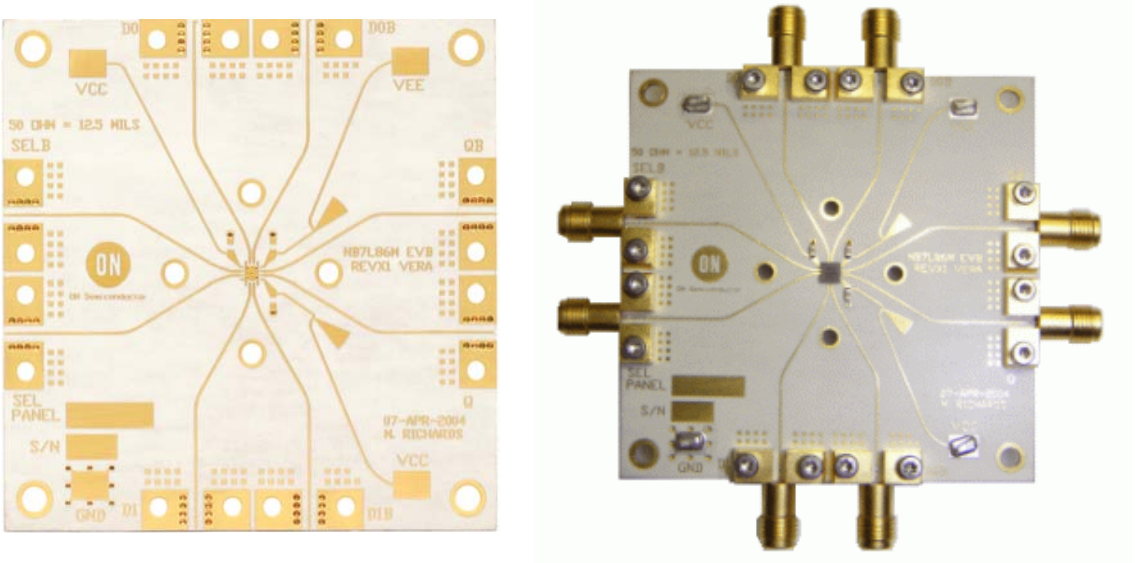


Figure 1. Evaluation Board Layout and Photo

Table 1. BASIC EQUIPMENT NEEDED

Description	Example Equipment (Note 1)	Qty
Power Supply with 2 outputs	HP6624A	1
Oscilloscope	TDS8000 with 08E01 Sampling Module	1
Differential Signal Generator	HP 8133A, Advantest D3186	1
High speed cables with SMA	Storm, Semflex	8
Power Supply cables with clips		4

1. Listed equipment used to generate example measurements within this document.

FOUR STEP SETUP PROCESS

Step 1: Power Supplies

The NB7L86MM is powered by 2.5 V or 3.3 V power supplies. For straightforward lab setup operation negative voltages are recommended to enable the 50 Ω internal impedance of the oscilloscope to be used as a termination for the CML signals (V_{CC} = 0.0 V, V_{EE} = ± 2.5 V or −3.3 V and GND = 0.0 V).

The power is supplied to the board via individual clip connectors labeled V_{CC} and GND.

Step 2: Connect Input signals

Termination

CML outputs need to be terminated to V_{CC} via a 50 Ω resistor. The input pins contain internal 50 Ω resistors (VT pins). For CML inputs, the VT pins are typically tied to V_{CC}.

For Differential mode (3.3 V and 2.5 V Operation)

Step 2a: Connect the differential output of the generator to the differential input of the device (Dx and DBx).

Step 3: Setup Input Signal

Step 3a: Set Voltage Amplitude on Generator to 400 mV

NOTE: The amplitude can be varied from 150 mV to 900 mV and still be able to produce about 400 mV output

Step 3b: Set voltage offset on generator to be 0 V (or −200 mV for a CML Input).

- Square Wave Clock Signal (50% Duty Cycle) or PRBS
- Frequency Range DC to 12 GHz

Step 4: Connect Output signals

Connect outputs of the device (Q2, $\overline{Q2}$) to the oscilloscope. The oscilloscope must contain a 50 Ω resistor to ground

TIME DOMAIN SETUP FOR THE AND/NAND FUNCTION

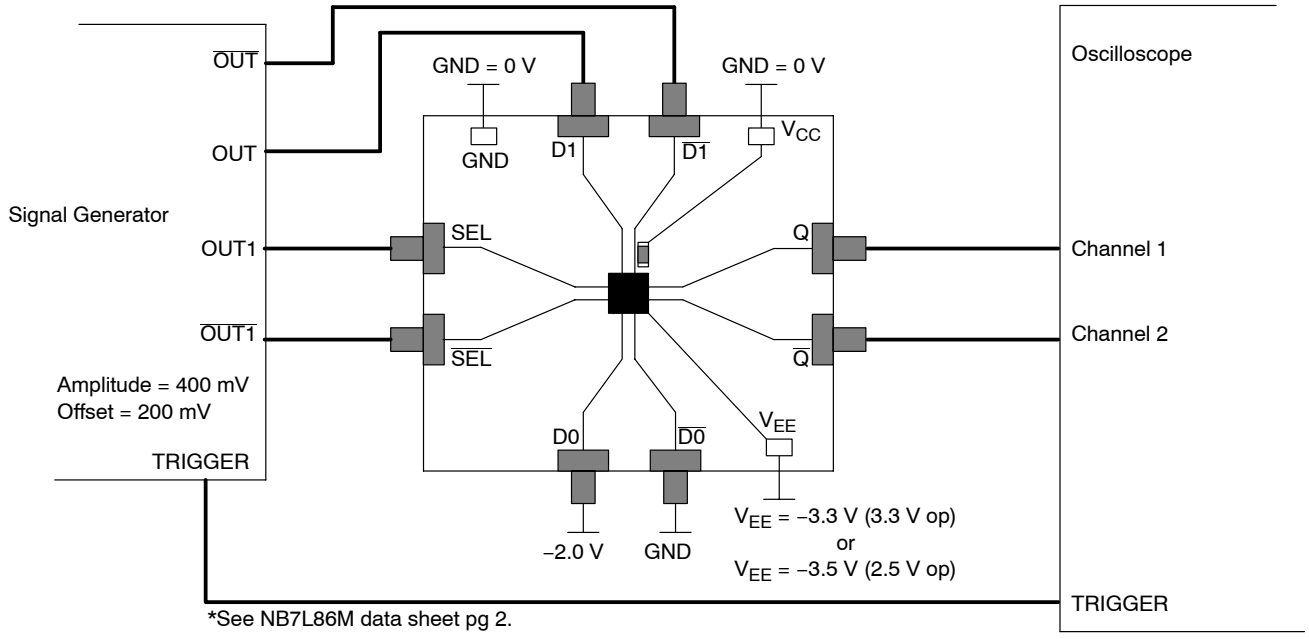


Figure 2. NB7L86M Board Setup − Time Domain (AND/NAND Function)

Step 1: Connect Power

1a. Connect the following supplies to the evaluation board via surface mount clips.

Table 2. POWER SUPPLY SUMMARY TABLE

3.3 V Setup	2.5 V Setup
V_{CC} = 0 V	V_{CC} = 0 V
GND = 0 V	GND = 0 V
V_{EE} = −3.3 V	V_{EE} = −2.5 V

Step 2: Connect the Inputs

For Differential Mode (3.3 V and 2.5 V operation)

2a: Connect the differential outputs of the generator to the differential inputs of the device (D1/$\overline{D1}$ and SEL/$\overline{SEL}$).

2b: Connect the DO input to −2.0 V.

2c: Connect the $\overline{DO}$ input to V_{CC}.

2d: Connect the generator trigger to the oscilloscope trigger.

Step 3: Setup Input Signal

3a: Set the signal generator amplitude to 400 mV. Note that 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 −200 mV (the center of a nominal CML output). Note that the V_{CMR} (Input Common Mode Range) allows the signal generator offset to vary as long as V_{CM} is within the V_{CMR} range. Refer to the device data sheet for further information.

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

Step 4: Connect Output Signals

4a: Connect the outputs of the evaluation board (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_{CC} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since V_{CC} = 0 V, a standard 50 Ω SMA termination is recommended.

TIME DOMAIN SETUP FOR OR/NOR FUNCTION

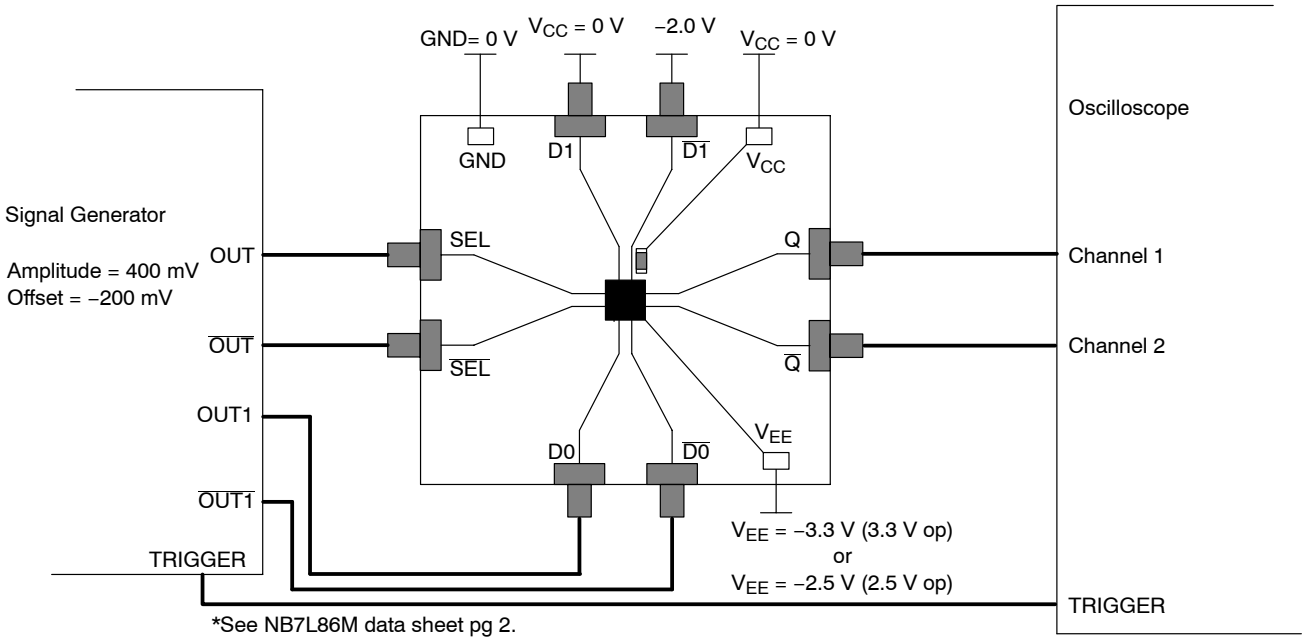


Figure 3. NB7L86M Board Setup – Time Domain (OR/NOR Function)

Step 1: Connect Power

1a: Connect the following supplies to the evaluation board via surface mount clips.

Table 3. POWER SUPPLY SUMMARY TABLE

3.3 V Setup	2.5 V Setup
V_{CC} = 0 V	V_{CC} = 0 V
GND = 0 V	GND = 0 V
V_{EE} = −3.3 V	V_{EE} = −2.5 V

Step 2: Connect the Inputs

For Differential Mode (3.3 V and 2.5 V operation)

2a: Connect the differential outputs of the generator to the differential inputs of the device (D0/$\overline{D0}$ and SEL/$\overline{SEL}$).

2a: Connect the $\overline{D1}$ input to −2.0 V.

2b: Connect the D1 input to V_{CC}.

2e: Connect the generator trigger to the oscilloscope trigger.

Step 3: Setup Input Signal

3a: Set the signal generator amplitude to 400 mV. Note that 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 −200 mV (the center of a nominal CML output). Note that the V_{CMR} (Input Common Mode Range) allows the signal generator offset to vary as long as V_{CM} is within the V_{CMR} range. Refer to the device data sheet for further information.

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

Step 4: Connect Output Signals

4a: Connect the outputs of the evaluation board (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_{CC} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since V_{CC} = 0 V, a standard 50 Ω SMA termination is recommended.

TIME DOMAIN SETUP FOR XOR/XNOR FUNCTION

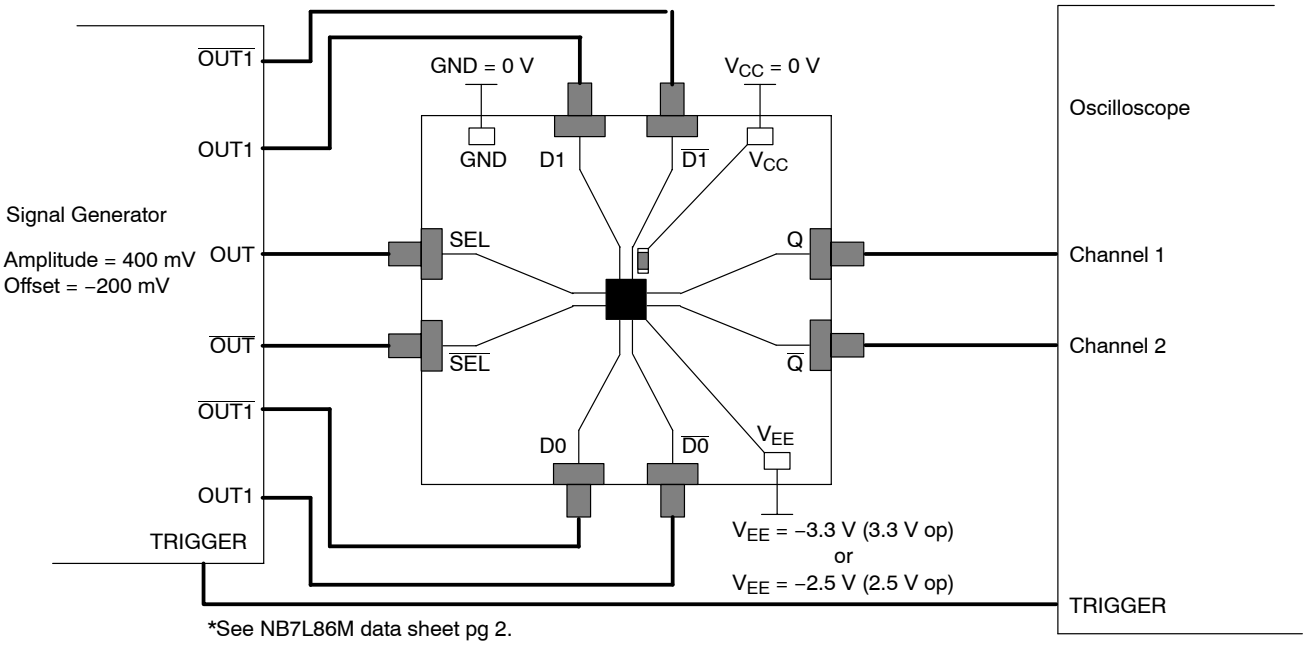


Figure 4. NB7L86M Board Setup – Time Domain (XOR/XNOR Function)

Step 1: Connect Power

1a: Connect the following supplies to the evaluation board via surface mount clips

Table 4. POWER SUPPLY SUMMARY TABLE

3.3 V Setup	2.5 V Setup
V_{CC} = 0 V	V_{CC} = 0 V
GND = 0 V	GND = 0 V
V_{EE} = −3.3 V	V_{EE} = −2.5 V

Step 2: Connect the Inputs

For Differential Mode (3.3 V and 2.5 V operation)

2a: Connect the differential outputs of the generator to the differential inputs of the device (OUT $\overline{OUT}$ to SEL/$\overline{SEL}$; OUT1/$\overline{OUT1}$ to DO&$\overline{D1}$/$\overline{D0}$&D1 respectively).

Step 2e: Connect the generator trigger to the oscilloscope trigger.

Step 3: Setup Input Signal

3a: Set the signal generator amplitude to 400 mV. Note that 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 −200 mV (the center of a nominal CML output). Note that the V_{CMR} (Input Common Mode Range) allows the signal generator offset to vary as long as V_{CM} is within the V_{CMR} range. Refer to the device data sheet for further information.

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

Step 4: Connect Output Signals

4a: Connect the outputs of the evaluation board (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_{CC} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since V_{CC} = 0 V, a standard 50 Ω SMA termination is recommended.

TIME DOMAIN SETUP FOR 2:1 MUX FUNCTION

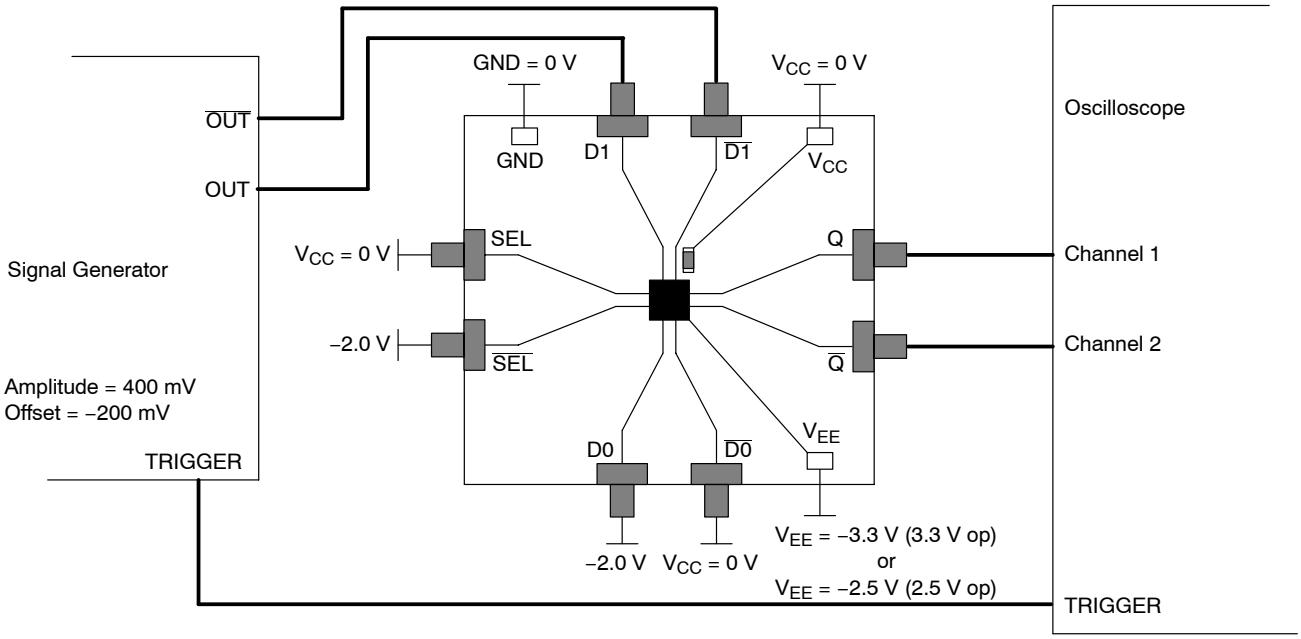


Figure 5. NB7L86M Board Setup – Time Domain (2:1 MUX Function)

Step 1: Connect Power

1a: Connect the following supplies to the evaluation board via surface mount clips.

Table 5. POWER SUPPLY SUMMARY TABLE

3.3 V Setup	2.5 V Setup
V_{CC} = 0 V	V_{CC} = 0 V
GND = 0 V	GND = 0 V
V_{EE} = –3.3 V	V_{EE} = –2.5 V

Step 2: Connect the Inputs

For Differential Mode (3.3 V and 2.5 V operation)

2a: Connect the differential outputs of the generator to the differential inputs of the device (D1/$\overline{D1}$).

2b: Connect the D0 input to –2.0 V and the $\overline{D0}$ input to V_{CC}.

Connect the SEL input to V_{CC} and the $\overline{SEL}$ input to –2.0 V.

Connect the generator trigger to the oscilloscope trigger.

Step 3: Setup Input Signal

3a: Set the signal generator amplitude to 400 mV. Note that 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 –200 mV (the center of a nominal CmL output). Note that the V_{CMR} (Input Common Mode Range) allows the signal generator offset to vary as long as V_{CM} is within the V_{CMR} range. Refer to the device data sheet for further information.

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

Step 4: Connect Output Signals

4a: Connect the outputs of the evaluation board (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_{CC} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since V_{CC} = 0 V, a standard 50 Ω SMA termination is recommended.

MORE INFORMATION ABOUT EVALUATION BOARD

Design Considerations for >10 GHz operation

While the NB7L86M 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 Ω)
- Distributed effects while bypassing and noise filtering

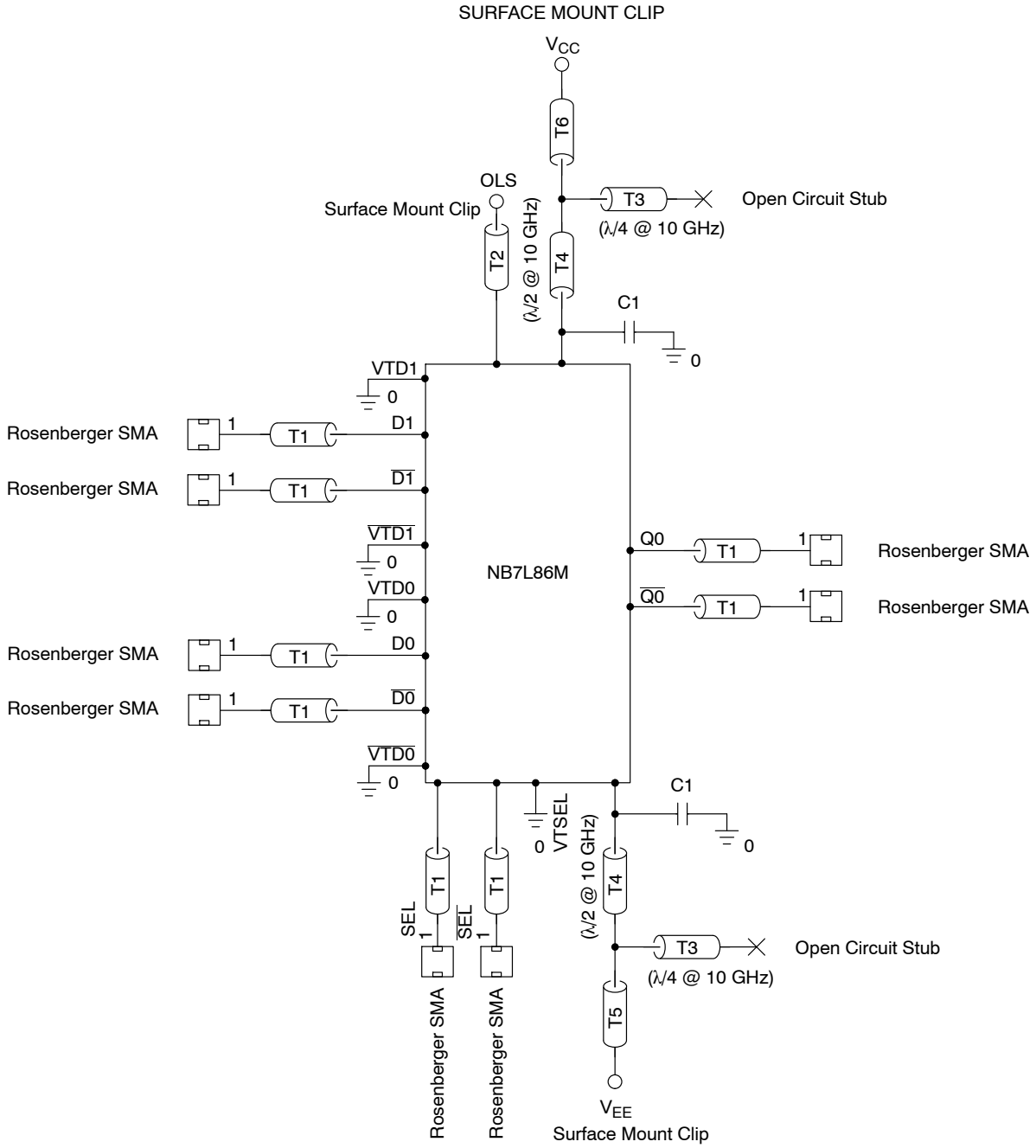


Figure 6. Evaluation Board Schematic

Table 6. BILL OF MATERIALS

Part No	Qty	Description	Manufacturer	Web Address
NB7L86MMN	1	Differential Smart Gate with CML Output	ON Semiconductor	http://www.onsemi.com
32K243−40ME3	8	Gold plated connector	Rosenberger	http://www.rosenberger.de http://www.rosenberger.com
5016	4	Test Point − Anvil	Keystone	
CO6BLBB2X5UX or C0603C104K4RAC	3	2 MHz − 30 GHz capacitor 0603 0.1 μF ± 10%	Dielectric Laboratories Kemet*	http://www.dilabs.com www.newark.com

*Components are available through most distributors, i.e. www.newark.com, www.digikey.com.

Table 7. BOARD MATERIAL

Material	Thickness
Rogers 6002	5.0 mil
Copper Plating	32 mil

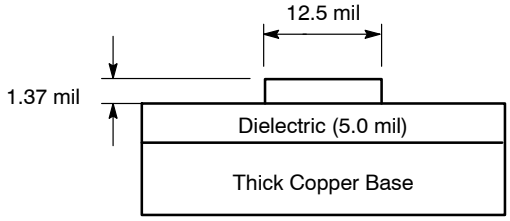


Figure 7. Board Stack−up

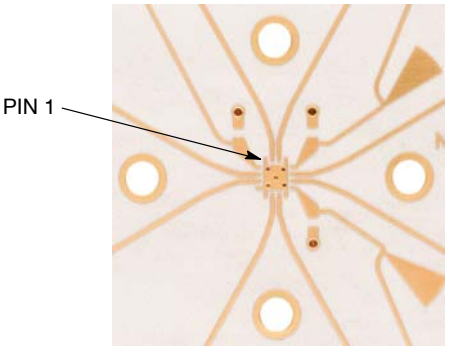
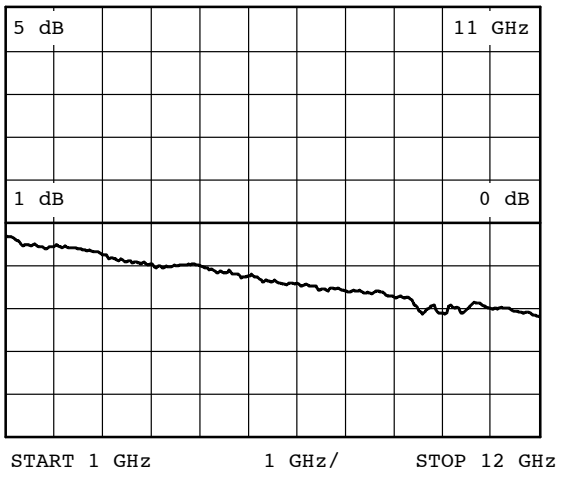


Figure 8. Layout Mask for NB7L86M



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

NB7L86M/D, Data Sheet.

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

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

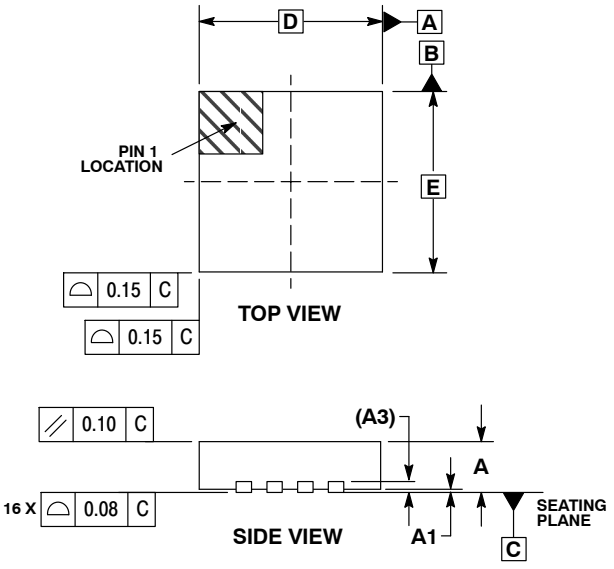
ORDERING INFORMATION

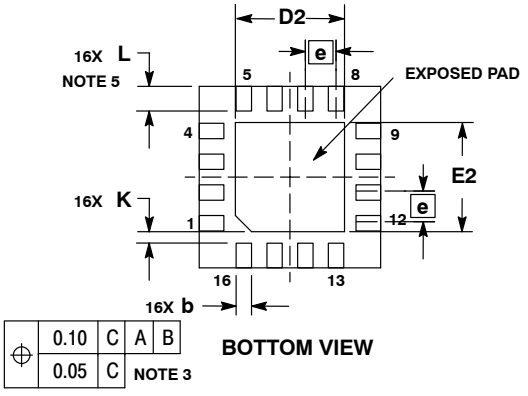
Device	Package	Shipping†
NB7L86MMN	QFN−16	123 Units/Rail
NB7L86MMNG	QFN−16 (Pb−Free)	123 Units/Rail
NB7L86MMNR2	QFN−16	3000 Tape & Reel
NB7L86MMNR2G	QFN−16 (Pb−Free)	3000 Tape & Reel
NB7L86MMNEVB	N/A	N/A

†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.

PACKAGE DIMENSIONS

16 PIN QFN
MN SUFFIX
CASE 485G−01
ISSUE B

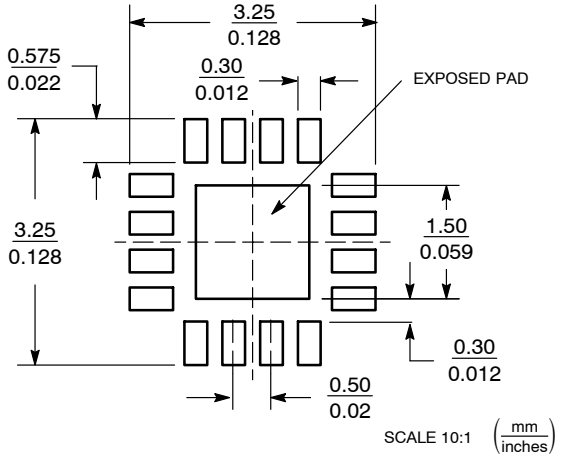




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. L_{max} CONDITION CAN NOT VIOLATE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

	MILLIMETERS	
DIM	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

SOLDERING FOOTPRINT*



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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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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:
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Japan Customer Focus Center
Phone: 81−3−5817−1050

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