

NB4L16MMNEVB

Evaluation Board User's Manual for NB4L16M



ON Semiconductor®

<http://onsemi.com>

EVAL BOARD USER'S MANUAL

DESCRIPTION

This document describes the NB4L16M evaluation board and the appropriate lab test setups. It should be used in conjunction with the NB4L16M data sheets which contain full technical details on the device specifications and operation.

The evaluation board is designed to facilitate a quick evaluation of the NB4L16M Differential Receiver / Driver / Translator. The NB4L16M is designed to function as a high speed receiver/driver/translator device with CML output for use in high speed signal amplification and backplane interface applications.

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 NB4L16M 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 differential modes of operation:

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

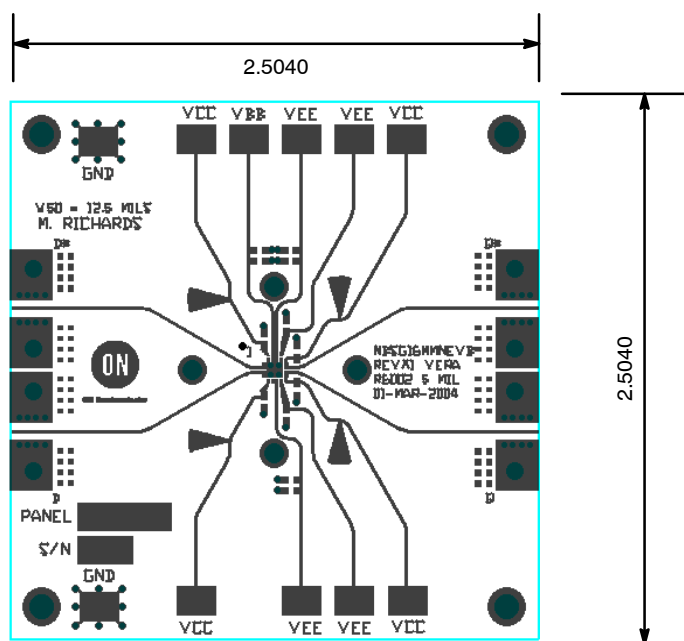


Figure 1. NB4L16MMN Evaluation PCB with Pin Label/Connection Change

NB4L16MMNEVB

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		8

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

Setup

Step 1: Connect Power

1a: Two power levels must be provided to the board for V_{CC} and V_{EE} via the surface mount clips.

Table 2. NB4L16M Power Supply Connections

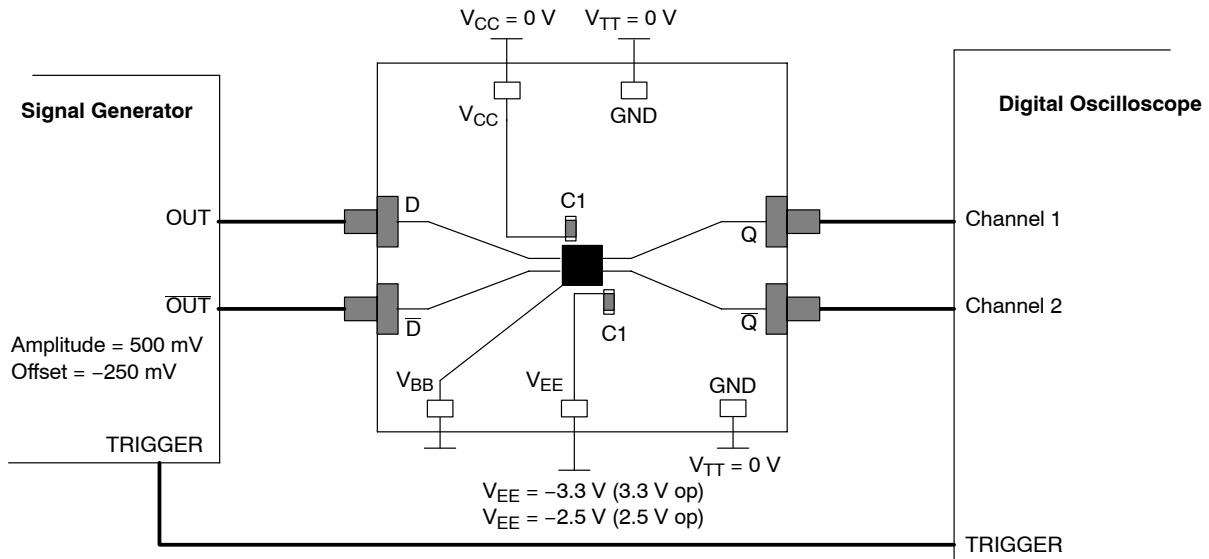
3.3 V Setup	2.5 V Setup
$V_{CC} = 0 \text{ V} = \text{GND}$	$V_{CC} = 0 \text{ V} = \text{GND}$
$V_{TT} = V_{CC} = 0 \text{ V} = \text{GND}$	$V_{TT} = V_{CC} = 0 \text{ V} = \text{GND}$
$V_{EE} = -3.3 \text{ V}$	$V_{EE} = -2.5 \text{ V}$

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 \bar{D}).

NOTE: Device may oscillate when the input is not driven.



NOTE: All differential cable pairs **must be** matched.

Figure 2. NB4L16M Board Setup – Time Domain (Differential Mode)

NB4L16MMNEVB

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 -250 mV.

NOTE: The V_{IHCMR} (Input High Voltage Common Mode Range) allows the signal generator offset to vary as long as V_{IH} is within the V_{IHCMR} 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 , \bar{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.

SETUP FOR FREQUENCY DOMAIN MEASUREMENTS

Table 3. 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		8

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

Setup

Step 1: Connect Power

1a: Two power levels must be provided to the board for V_{CC} and V_{EE} via the surface mount clips.

Table 4. NB4L16M Power Supply Connections

3.3 V Setup
$V_{CC} = 0$ V = GND
$V_{TT} = V_{CC} = 0$ V = GND
$V_{EE} = -3.3$ V

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.

NB4L16MMNEVB

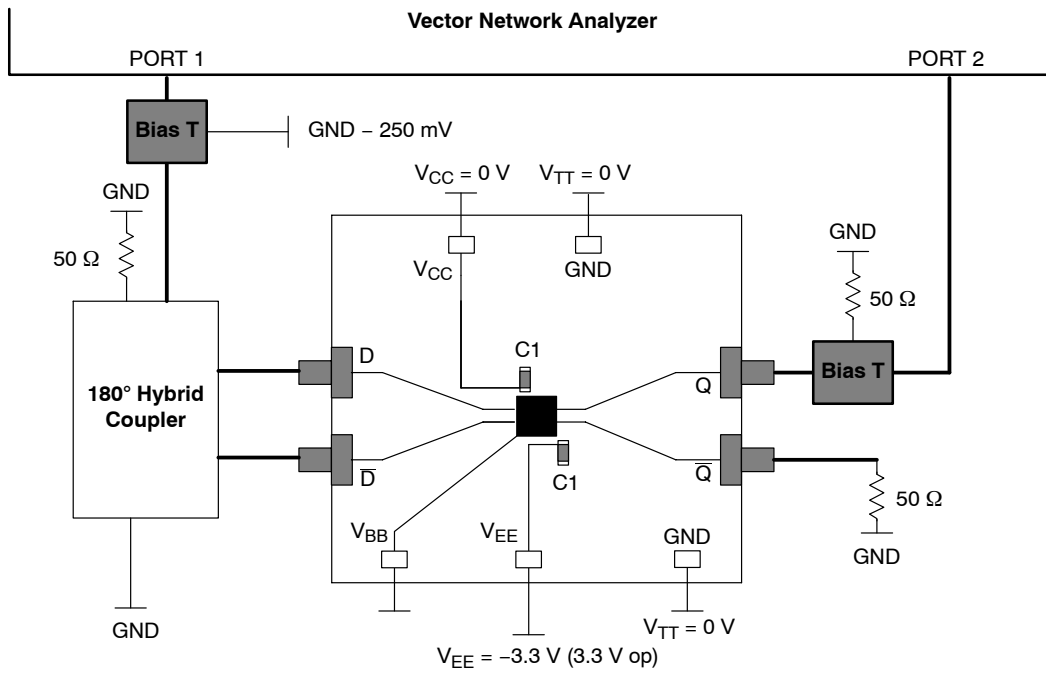


Figure 3. Board Setup – Frequency Domain (Differential Mode)

NB4L16MMNEVB

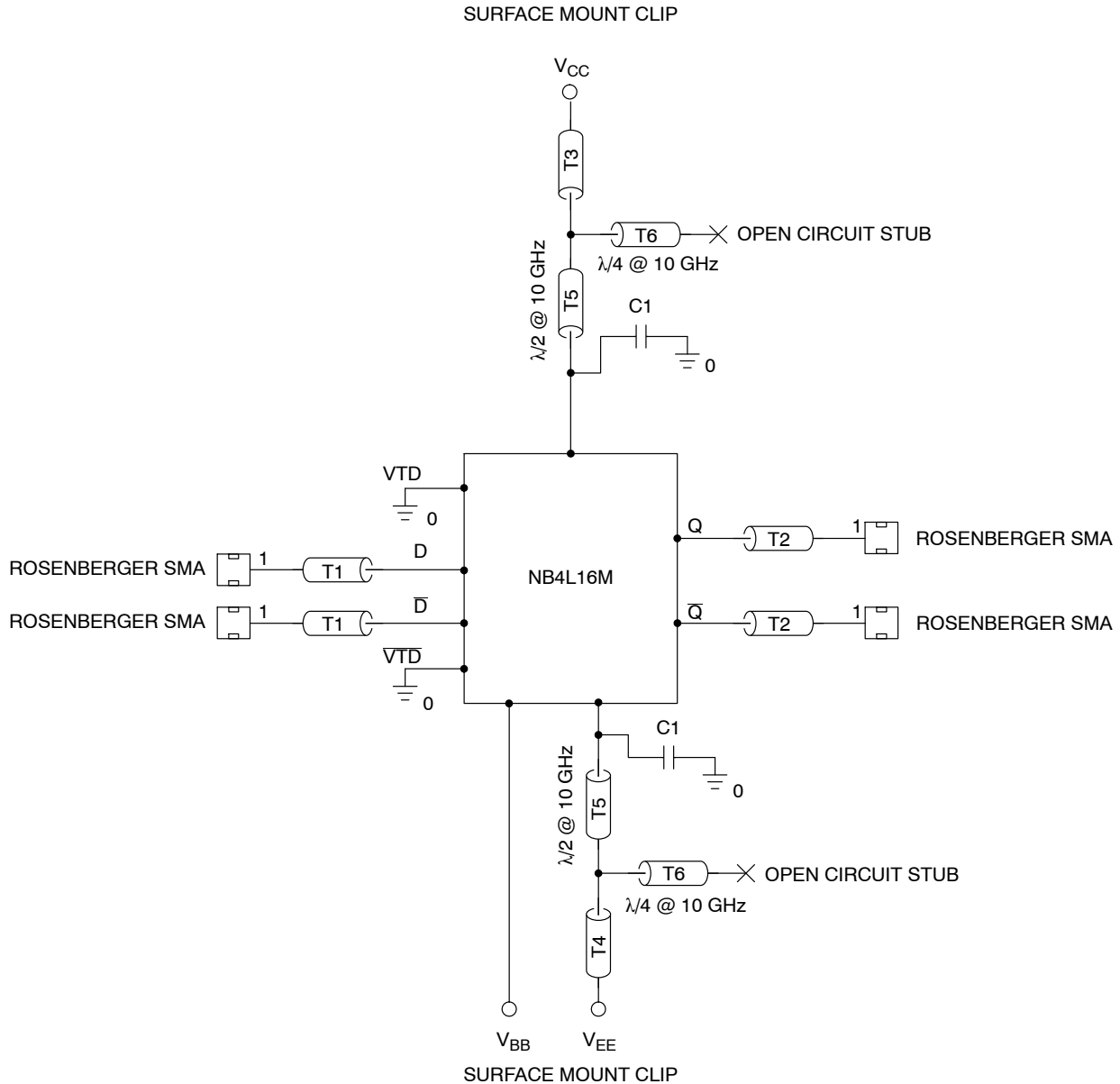
MORE INFORMATION ABOUT EVALUATION BOARD

Design Considerations for >10 GHz operation

While the NB4L16M 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



NOTE: C1, C2* = Decoupling cap
Tx = 50 Ω Transmission line

Figure 4. Evaluation Board Schematic

NB4L16MMNEVB

Table 5. PARTS LIST

Part No	Qty	Description	Manufacturer	WEB address
NB4L16MMN	1	2.5 V/3.3 V, 5 Gb/s Multi Level Clock/Data Input to CML Receiver/Driver/ Translator with Internal Termination	ON Semiconductor	http://www.onsemi.com
32K243-40ME3	4	Gold Plated Connector	Rosenberger	http://www.rosenberger.de
CO6BLBB2X5CO6 03CL04K6RAC	9	2 MHz – 30 GHz Capacitor 0603 0.1 μ F \pm 10%	Dielectric Laboratories Kemet	http://www.dilabs.com http://www.newark.com/
SO16	9	Test Point-Anvil	Keystone	http://www.newark.com http://www.digikey.com

Table 6. BOARD MATERIAL

Material	Thickness
Rogers 6002	5 mil
Copper Plating	32 mil

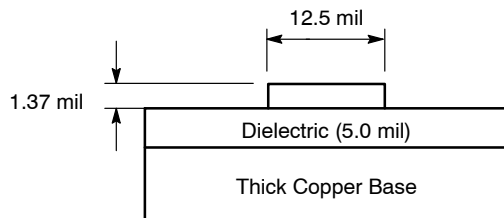


Figure 5. Board Stack-up

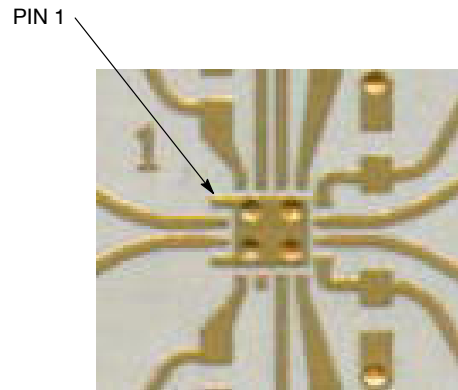
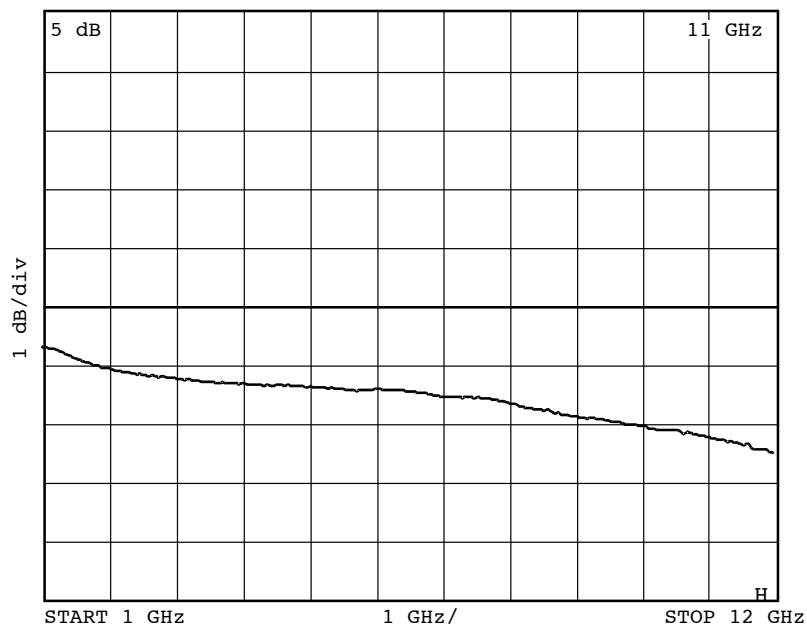


Figure 6. Layout Mask for NB4L16M



NOTE: The insertion loss curve can be used to calibrate out board loss if testing under small signal conditions.

Figure 7. Insertion Loss

NB4L16MMNEVB

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

NB4L16M/D, Data Sheet, *2.5V/3.3V, 5 Gb/s Multi Level Clock/Data Input to CML Driver / 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

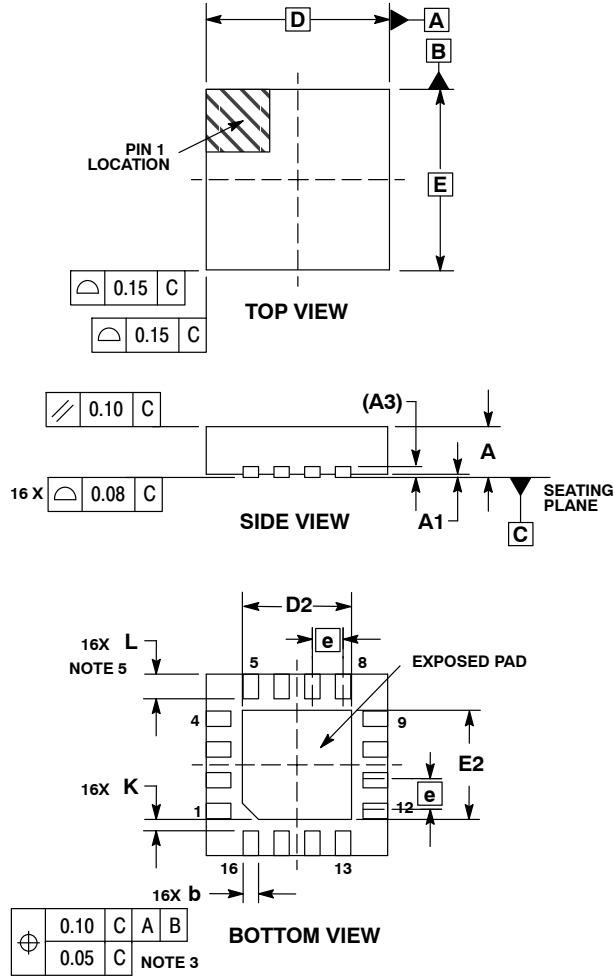
Part No	Description	Package	Shipping
NB4L16MMN	2.5V/3.3V, 5 Gb/s Multi Level Clock/Data Input to CML Driver / Receiver / Buffer / Translator with Internal Termination	3X3 mm QFN-16	123 Units/Tray
NB4L16MMNG	2.5V/3.3V, 5 Gb/s Multi Level Clock/Data Input to CML Driver / Receiver / Buffer / Translator with Internal Termination	3X3 mm QFN-16 (Pb-Free)	123 Units/Tray
NB4L16MMNR2	2.5V/3.3V, 5 Gb/s Multi Level Clock/Data Input to CML Driver / Receiver / Buffer / Translator with Internal Termination	3X3 mm QFN-16	3000 / Tape & Reel
NB4L16MMNEVB	NB4L16MN Evaluation Board		

†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.

NB4L16MMNEVB

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

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

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

The evaluation board/kit (research and development board/kit) (hereinafter the "board") is not a finished product and is as such not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and should as such only be used in laboratory/development areas by persons with an engineering/technical training and familiar with the risks associated with handling electrical/mechanical components, systems and subsystems. This person assumes full responsibility/liability for proper and safe handling. Any other use, resale or redistribution for any other purpose is strictly prohibited.

The board is delivered "AS IS" and without warranty of any kind including, but not limited to, that the board is production-worthy, that the functions contained in the board will meet your requirements, or that the operation of the board will be uninterrupted or error free. ON Semiconductor expressly disclaims all warranties, express, implied or otherwise, including without limitation, warranties of fitness for a particular purpose and non-infringement of intellectual property rights.

ON Semiconductor reserves the right to make changes without further notice to any board.

You are responsible for determining whether the board will be suitable for your intended use or application or will achieve your intended results. Prior to using or distributing any systems that have been evaluated, designed or tested using the board, you agree to test and validate your design to confirm the functionality for your application. Any technical, applications or design information or advice, quality characterization, reliability data or other services provided by ON Semiconductor shall not constitute any representation or warranty by ON Semiconductor, and no additional obligations or liabilities shall arise from ON Semiconductor having provided such information or services.

The boards are not designed, intended, or authorized for use in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body. Should you purchase or use the board for any such unintended or unauthorized application, you shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the board.

This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the technical requirements of these or other related directives.

FCC WARNING – This evaluation board/kit is intended for use for engineering development, demonstration, or evaluation purposes only and is not considered by ON Semiconductor to be a finished end product fit for general consumer use. It may generate, use, or radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment may cause interference with radio communications, in which case the user shall be responsible, at its expense, to take whatever measures may be required to correct this interference.

ON Semiconductor does not convey any license under its patent rights nor the rights of others.

LIMITATIONS OF LIABILITY: ON Semiconductor shall not be liable for any special, consequential, incidental, indirect or punitive damages, including, but not limited to the costs of requalification, delay, loss of profits or goodwill, arising out of or in connection with the board, even if ON Semiconductor is advised of the possibility of such damages. In no event shall ON Semiconductor's aggregate liability from any obligation arising out of or in connection with the board, under any theory of liability, exceed the purchase price paid for the board, if any.

For more information and documentation, please visit www.onsemi.com.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative