

NB7V52MMNGEVB

NB752MMNGEVB Evaluation Board User's Manual

Introduction

ON Semiconductor has developed the QFN16EVB evaluation board for its high-performance devices packaged in the 16-pin QFN. This evaluation board was designed to provide a flexible and convenient platform to quickly evaluate, characterize and verify the operation of various ON Semiconductor products. Many QFN16EVBs are dedicated with a device already installed, and can be ordered from www.onsemi.com at the specific device web page.

Evaluation Board Manual Contents:

- Information on 16-Lead QFN Evaluation Board
- Assembly Instructions
- Appropriate Lab Setup
- Board Schematic
- Bill of Materials

This user's manual provides detailed information on board contents, layout and its use. This manual should be used in conjunction with NB7V52M data sheet which contains full technical details on the device specifications and operations.

Board Layout

The QFN16 Evaluation Board provides a high bandwidth, 50 Ω controlled impedance environment and is implemented in four layers. The first layer or primary trace layer is 0.008" thick Rogers RO4003 material, and is designed to have equal electrical length on all signal traces from the device under test (DUT) pins to the SMA connectors. The second layer is the 1.0 oz copper ground plane and is primarily dedicated for the SMA connector ground plane. FR4 dielectric material is placed between the second and third layers and between third and fourth layers. The third layer is also 1.0 oz copper plane. A portion of this layer is designated for the device VCC and DUTGND power planes. The fourth layer is the secondary trace layer.



ON Semiconductor®

www.onsemi.com

EVAL BOARD USER'S MANUAL



Figure 1. NB7V52MMNGEVB Evaluation Board (Top View)



Figure 2. NB7V52MMNGEVB Evaluation Board (Bottom View)

NB7V52MMNGEVB

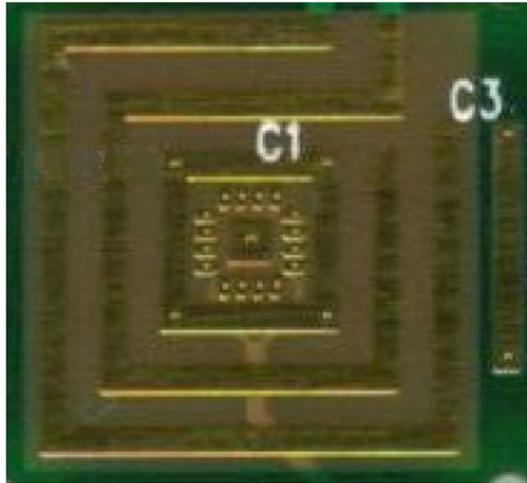


Figure 3. Enlarged Bottom View

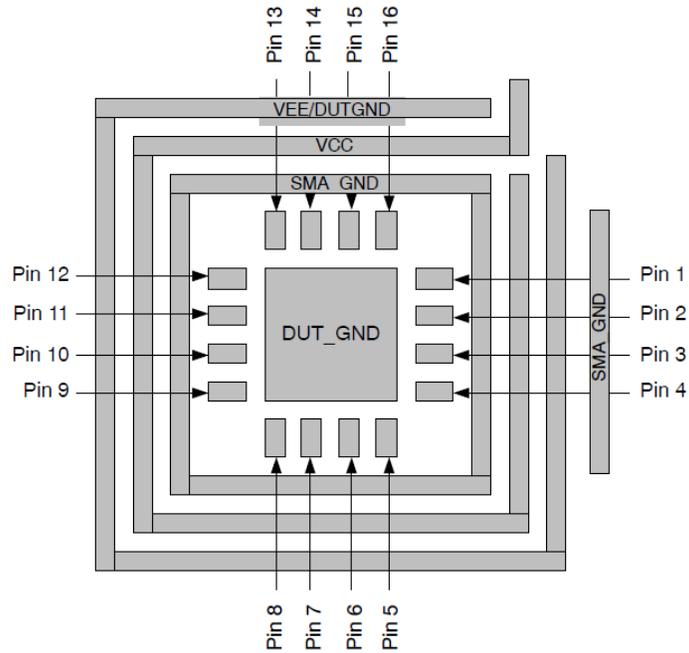


Figure 4. Enlarged Bottom View of Evaluation Board

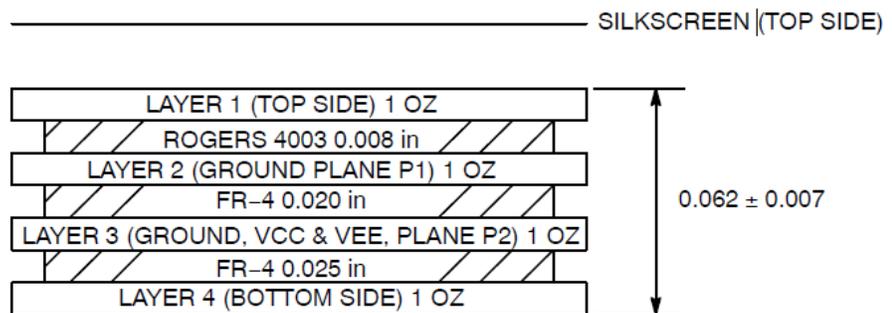


Figure 5. Evaluation Board Layout, 4-Layer

NB7V52MMNGEVB

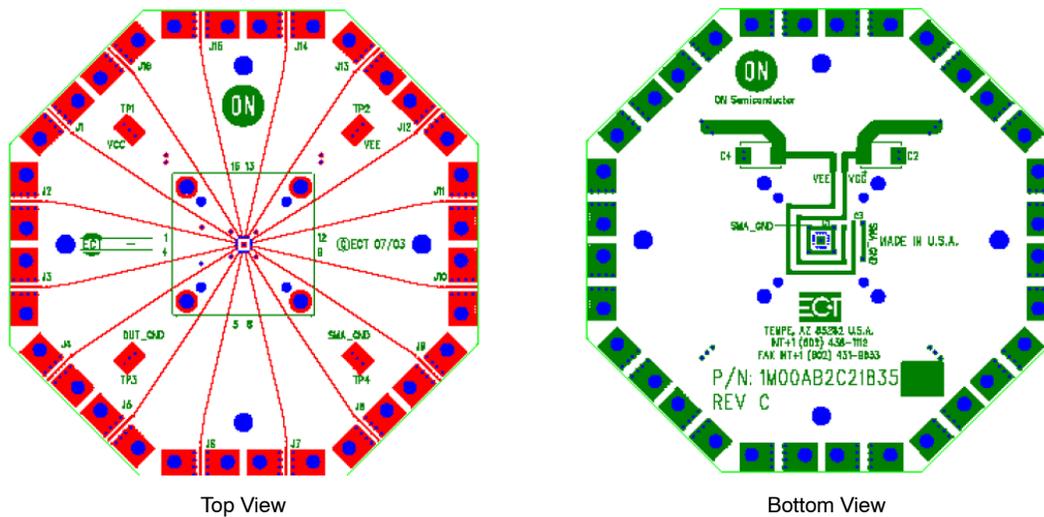


Figure 6. Evaluation Board Layout

Evaluation Board Assembly Instructions

The QFN-16 evaluation board is designed for characterizing devices in a 50 Ω laboratory environment using high bandwidth equipment. Each signal trace on the board has a via at the DUT pin, which provides an option of placing a termination resistor on the board bottom, depending on the input/output configuration (See Table 1, Example Configuration List). Table 5 contains the Bill of Materials for this evaluation board.

The QFN16EVB was designed to accommodate a custom QFN-16 socket. Therefore, some external components are installed on the bottom side of the board.

Solder the Device on the Evaluation Board

The soldering of a device to the evaluation board can be accomplished by hand soldering or solder reflow techniques using solder paste. Make sure pin 1 of the device is located properly and all the pins are aligned to the footprint pads. Solder the QFN-16 device to the evaluation board. As mentioned earlier, many QFN16EVB's are dedicated with a device already installed, and can be ordered from www.onsemi.com at the specific device webpage.

Connecting Power and Ground

On the top side of the evaluation board, solder the four surface mount test pint clips (anvils) to the pads labeled V_{CC} , $V_{EE}/DUTGND$, $SMAGND$, and $ExPad$. $ExPad$ is connected to the exposed flag and is typically recommended to be tied to $V_{EE}/DUTGND$, the negative supply of the device.

The positive power supply connector is labeled V_{CC} . Depending on the device, the negative power supply nomenclature is labeled either GND or V_{EE} . To help avoid confusion with the use of this board, the negative supply connector is labeled $V_{EE}/DUTGND$. $SMAGND$ is the ground for the SMA connectors and is not to be confused with the device ground, $V_{EE}/DUTGND$. $SMAGND$ and $DUTGND$ can be connected in a single-supply application.

The power pin layout and typical connection for the evaluation board is shown in Figure 7.

It is recommended to add bypass capacitors to reduce unwanted noise from the power supplies. Connect 0.1 μF capacitors from V_{CC} and $V_{EE}/DUTGND$ to $SMAGND$.

Output Loading/Termination

CML Outputs

For the termination of CML outputs, operation with negative supply voltages is recommended to enable the use of the 50- Ω internal impedance of an oscilloscope or other measurement instrument. Since CML output termination requires 50- Ω to V_{CC} , off-setting the power supply such that $V_{CC} = 0 V$ and $DUTGND = -2.5 V$ or $-1.8 V$, will allow oscilloscope and V_{CC} to be at the same potential. CML outputs can now be conveniently terminated using the 50- Ω internal impedance of oscilloscope or other measurement instrument.

Installing SMA Connectors

Each configuration indicates the number of SMA connectors needed to populate an evaluation board for a given device. Each input and output requires one SMA connector. Install all the required SMA connectors onto the board and solder the center signal conductor pin to the board on J1 through J16. Please note that the alignment of the signal connector pin of the SMA connector to the metal trace on the board can influence lab results. The launch and reflection of the signals are largely influenced by imperfect alignment and soldering of the SMA connector.

Validating the Assembled Board

After assembling the evaluation board, it is recommended to perform continuity checks on all soldered areas before commencing with the evaluation process. Time Domain Reflectometry (TDR) is another highly recommended validation test.

NB7V52MMNGEVB

Table 1. NB7V52M EVALUATION BOARD CONFIGURATION

Device	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16
Pin #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Connector	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes							
Wire	No	V _{EE}	No	No	V _{CC}	No	No	No	No							

NOTE: Exposed Pad = DUTGND, Exposed Pad should be tied to V_{EE}/DUTGND

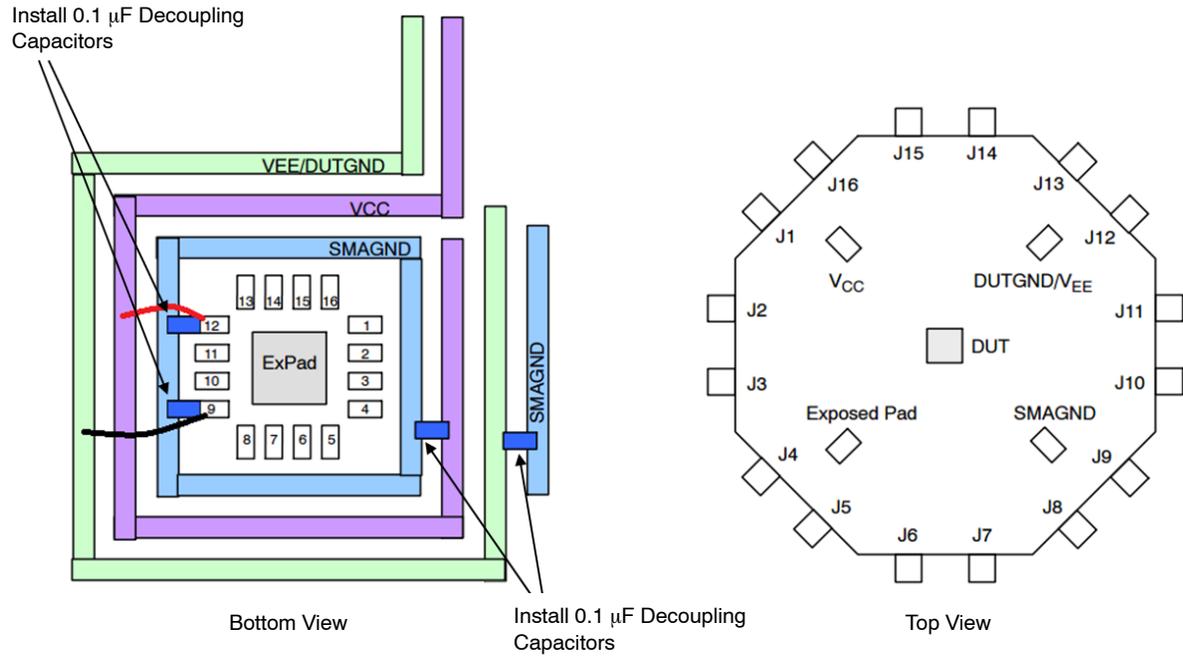


Figure 7. Power Supply Configuration for NB7V52MMNGEVB

NB7V52MMNGEVB

QUICK START LAB SET-UP USER'S GUIDE

Equipment Required

1. DC Power Supply
2. Generator
3. Oscilloscope
4. DC Power Supply Connectors
5. 50-Ω SMA Connectors for I/O's

Block Diagram

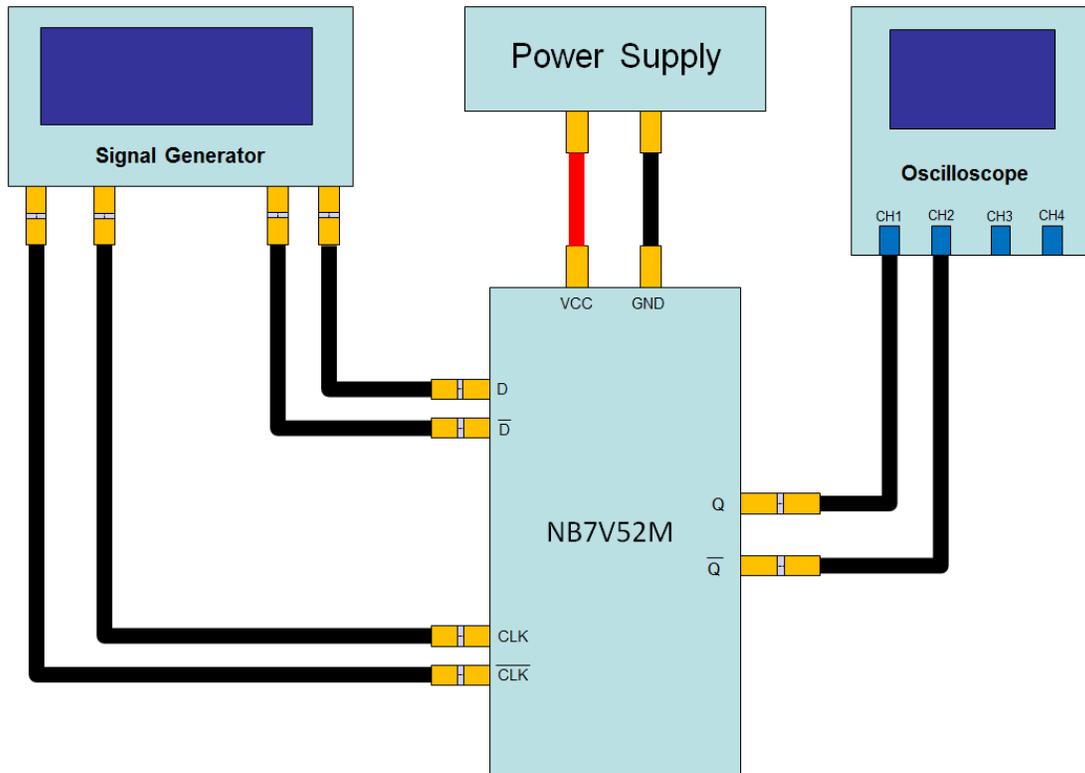


Figure 8. NB7V52MMNGEVB Test Block Diagram

Test and Measurement Setup Procedures

1. Connect VCC, SMAGND, and $V_{EE}/DUTGND$ of the NB7V52M to a DC power supply. See Table 2 for appropriate levels.
2. Connect output of generator to CLK & \overline{CLK} with 50-Ω connectors to DUT. See NB7V52M data sheet for appropriate input levels.
3. Connect output of generator to D & \overline{D} with 50-Ω connectors to DUT. See NB7V52M data sheet for appropriate input levels.
4. Connect NB7V52M outputs Q & \overline{Q} to appropriate oscilloscope channel. Board does not have 50-Ω output termination resistors, thus internal 50-Ω of oscilloscope can be used to properly terminate outputs.
5. Connect internal 50-Ω pins \overline{VTCLK} , \overline{VTCLK} , \overline{VTD} , \overline{VTD} , \overline{VTR} and \overline{VTR} to appropriate levels. See Figures 9–11 for appropriate Input level interface.
6. Connect R & \overline{R} Input/Output select values to appropriate levels. See Table 3 for levels.

NOTE: See [NB7V52M](#) data sheet for D to CLK set up and hold times.

Power-Up Sequence

1. Turn On DUT Power Supply
2. Enable Generator Outputs
3. Monitor Q & \overline{Q} Outputs with Oscilloscope

NB7V52MMNGEVB

Table 2. POWER SUPPLY LEVELS

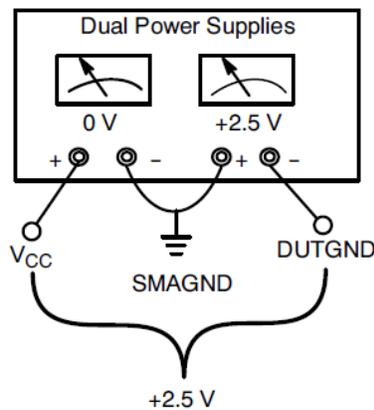
Outputs	Power Supply	V _{CC}	V _{EE} /DUTGND	SMAGND	ExPad (Typ)
CML	2.5 V	0 V	-2.5 V	0 V	V _{EE} /DUTGND
CML	1.8 V	0 V	-1.8 V	0 V	V _{EE} /DUTGND

Table 3. RESET INPUT/OUTPUT SELECT TRUTH TABLE

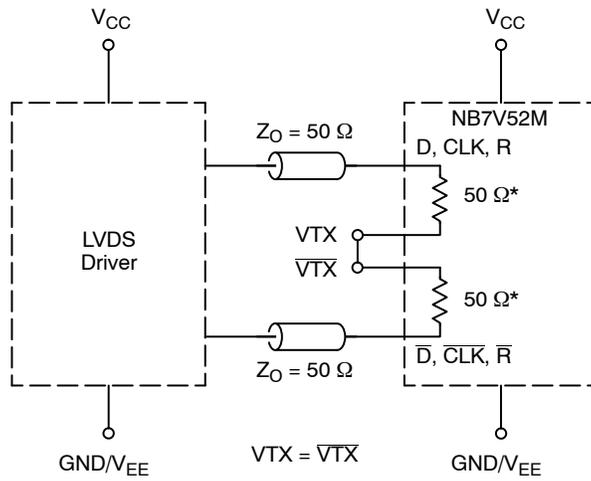
R	\bar{R}	D	CLK	Q
H	L	X	X	L
L	H	L	Z	L
L	H	H	Z	H

Table 4. NB7V52M CML OUTPUTS “SPLIT” POWER SUPPLY CONFIGURATION

Device Pin Power Supply Convertor	“Split” Power Supply
V _{CC}	V _{CC} = 0 V
SMAGND	V _{TT} = 0 V
DUTGND	DUTGND = -2.5 V or -1.8 V

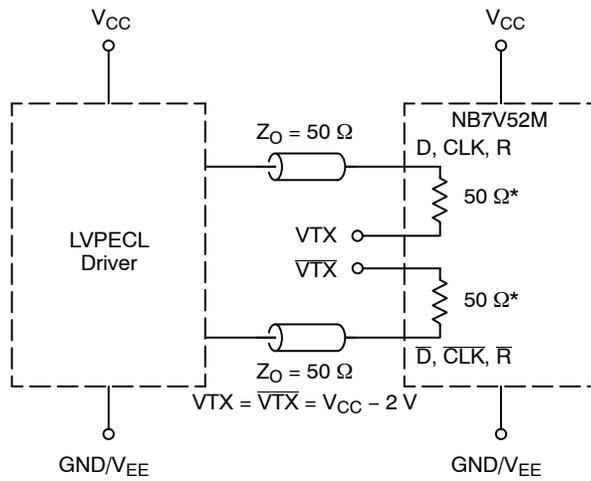


NB7V52MMNGEVB



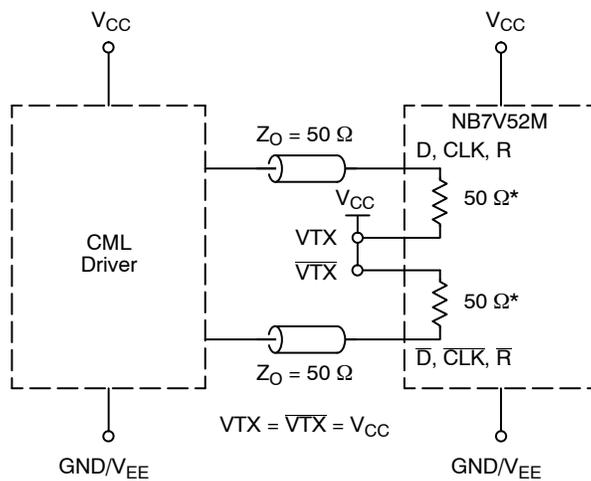
NOTE: $X = D, CLK, R$ & $\bar{X} = \bar{D}, \bar{CLK}, \bar{R}$

Figure 9. LVDS Interface



NOTE: $X = D, CLK, R$ & $\bar{X} = \bar{D}, \bar{CLK}, \bar{R}$

Figure 10. LVPECL Interface



NOTE: $X = D, CLK, R$ & $\bar{X} = \bar{D}, \bar{CLK}, \bar{R}$

Figure 11. Standard 50 Ω CML Interface

NB7V52MMNGEVB

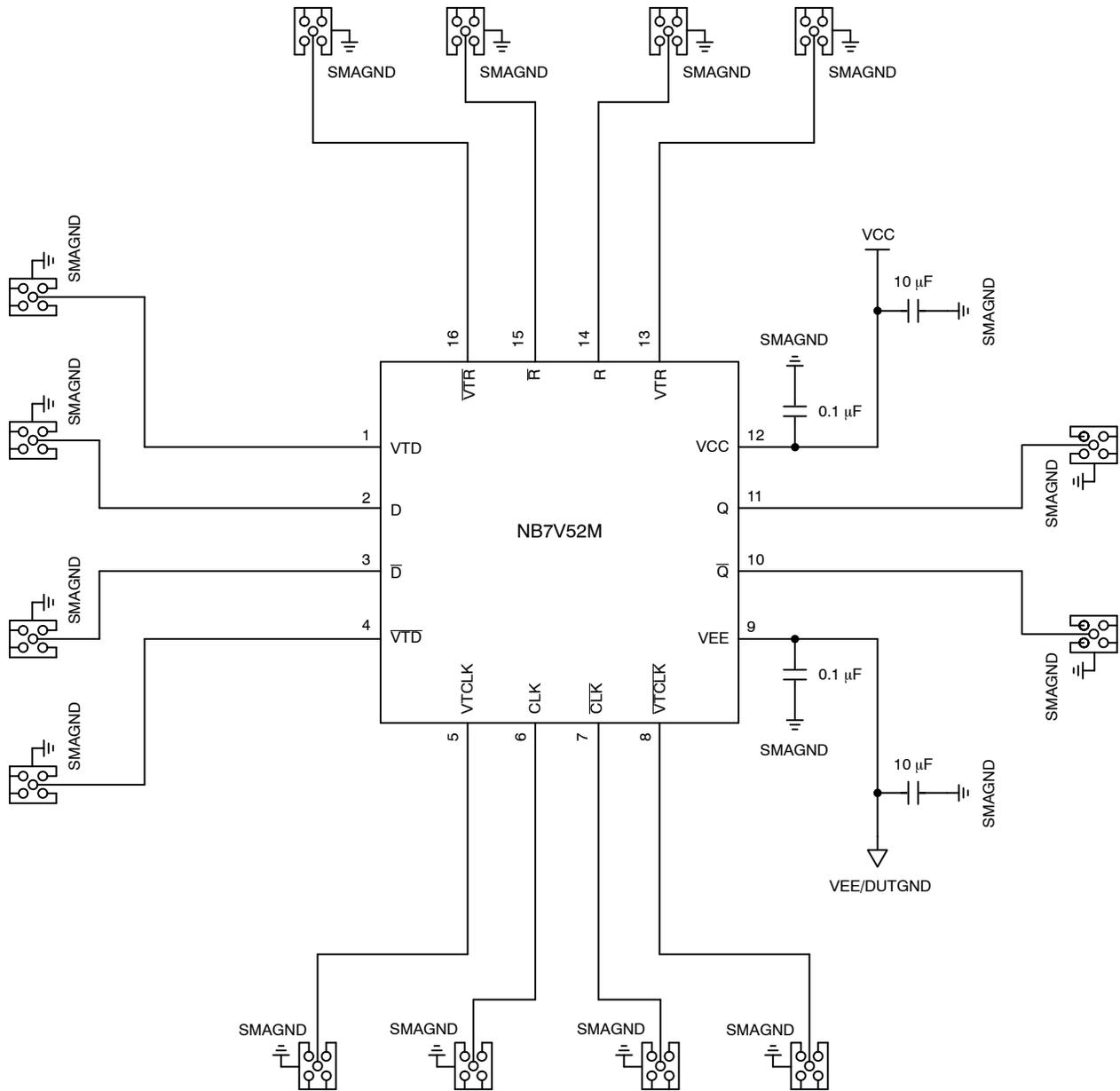


Figure 12. NB7V52MMNGEVB Schematic

NB7V52MMNGEVB

TYPICAL OUTPUT WAVEFORMS

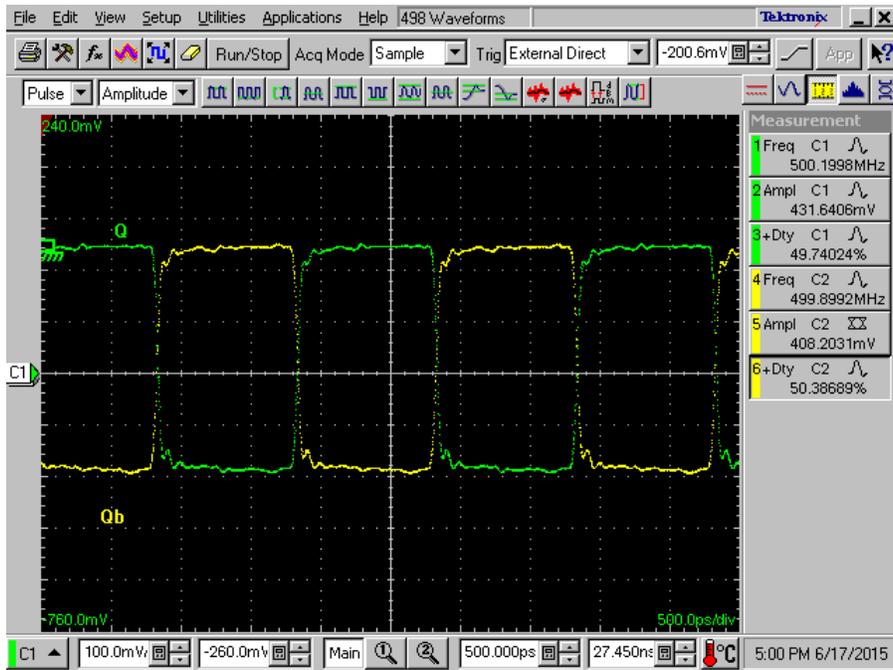


Figure 13. Typical Q & \bar{Q} at $F_{IN} = 1 \text{ GHz}$, $V_{CC} = 1.8 \text{ V}$, 25°C

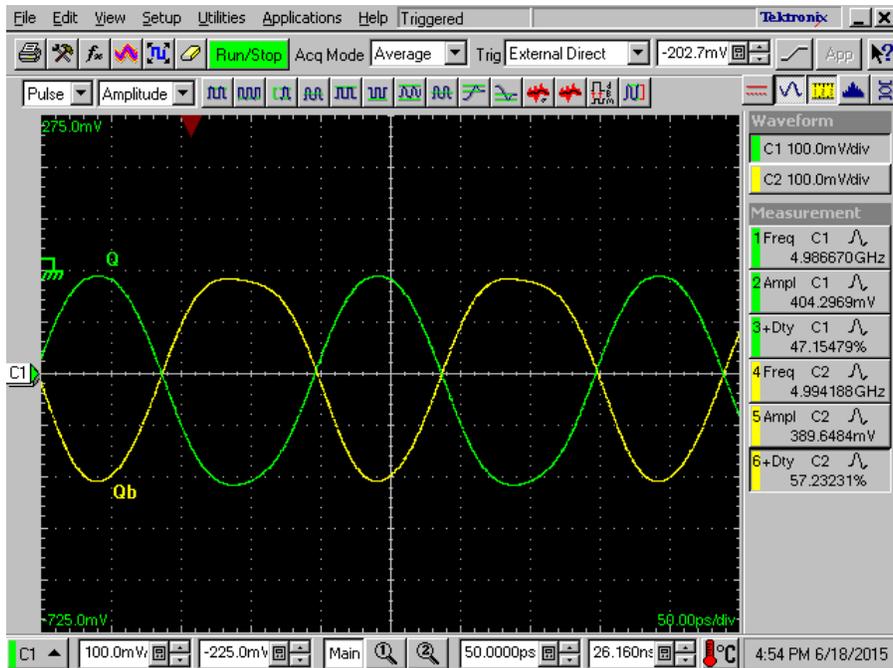


Figure 14. Typical Q & \bar{Q} at $F_{IN} = 10 \text{ GHz}$, $V_{CC} = 1.8 \text{ V}$, 25°C

NB7V52MMNGEVB

BILL OF MATERIALS

Table 5. NB7V52MMNGEVB BILL OF MATERIALS

Components	Qty.	Description	Manufacturer	Part Number	Web Site
SMA Connector	14	SMA Connector, Side Launch, Gold Plated	Rosenberger	32K243-40ME3	www.rosenberger.com
Surface Mount Test Points	4	SMT Miniature Test Point	Keystone	5015	www.keyelco.com
Chip Capacitor	2	0402 0.1 μ F \pm 10%	Kemet	C0402C105K9PACTU	www.kemet.com
Chip Capacitor	2	0603 0.1 μ F \pm 10%	Kemet	C0603C105K8PACTU	www.kemet.com
Chip Capacitor	2	22 μ F \pm 10%	Kemet	T495C226K025ATE300	www.kemet.com
Evaluation Board	1	QFN 16 Evaluation Board	ON Semiconductor	QFN16EVB	www.onsemi.com
Device Samples	1	QFN 16 Package Device	ON Semiconductor	NB7V52MMNG	www.onsemi.com

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** 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 not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and will 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 PROVIDED BY ONSEMI TO YOU "AS IS" AND WITHOUT ANY REPRESENTATIONS OR WARRANTIES WHATSOEVER. WITHOUT LIMITING THE FOREGOING, ONSEMI (AND ITS LICENSORS/SUPPLIERS) HEREBY DISCLAIMS ANY AND ALL REPRESENTATIONS AND WARRANTIES IN RELATION TO THE BOARD, ANY MODIFICATIONS, OR THIS AGREEMENT, WHETHER EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING WITHOUT LIMITATION ANY AND ALL REPRESENTATIONS AND WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, NON-INFRINGEMENT, AND THOSE ARISING FROM A COURSE OF DEALING, TRADE USAGE, TRADE CUSTOM OR TRADE PRACTICE.

onsemi 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 **onsemi** shall not constitute any representation or warranty by **onsemi**, and no additional obligations or liabilities shall arise from **onsemi** having provided such information or services.

onsemi products including 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. You agree to indemnify, defend and hold harmless **onsemi**, its directors, officers, employees, representatives, agents, subsidiaries, affiliates, distributors, and assigns, against any and all liabilities, losses, costs, damages, judgments, and expenses, arising out of any claim, demand, investigation, lawsuit, regulatory action or cause of action arising out of or associated with any unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of any products and/or 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 **onsemi** 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.

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

LIMITATIONS OF LIABILITY: **onsemi** 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 **onsemi** is advised of the possibility of such damages. In no event shall **onsemi**'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.

The board is provided to you subject to the license and other terms per **onsemi**'s standard terms and conditions of sale. For more information and documentation, please visit www.onsemi.com.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales