

# NB4N840MMNEVB

## Evaluation Board User's Manual for NB4N840M



ON Semiconductor®

<http://onsemi.com>

### EVAL BOARD USER'S MANUAL

#### Description

The NB4N840M Evaluation Board was designed to provide a flexible and convenient platform to quickly evaluate, characterize and verify the performance and operation of the NB4N840M dual 2 x 2 Crosspoint Switch. This user's manual provides detailed information on the board's contents, layout and use. The manual should be used in conjunction with the NB4N840M data sheet which contains full technical details on device specifications and operation.

The NB4N840M is a high-bandwidth fully differential dual 2 x 2 crosspoint switch with CML inputs/outputs that is suitable for applications such as SDH/SONET DWDM and high speed switching. Fully differential design techniques are used to minimize jitter accumulation, crosstalk, and signal skew, which make this device ideal for loop-through and protection channel switching

applications. Each 2 x 2 crosspoint switch can fan-out and/or multiplex up to 3.2 Gb/s data and 2.7 GHz clock signals.

Internally terminated differential CML inputs accept AC-coupled LVPECL (Positive ECL) or direct coupled CML signals. By providing internal 50  $\Omega$  input and output termination resistor, the need for external components is eliminated and interface reflections are minimized. Differential 16 mA CML outputs provide matching internal 50  $\Omega$  terminations, and 400 mV output swings when externally terminated, 50  $\Omega$  to V<sub>CC</sub>.

Single-ended LVCMOS/LVTTL SEL inputs control the routing of the signals through the crosspoint switch which makes this device configurable as 1:2 fan-out, repeater or 2 x 2 crosspoint switch. The device is housed in a low profile 5 x 5 mm 32-pin QFN package.

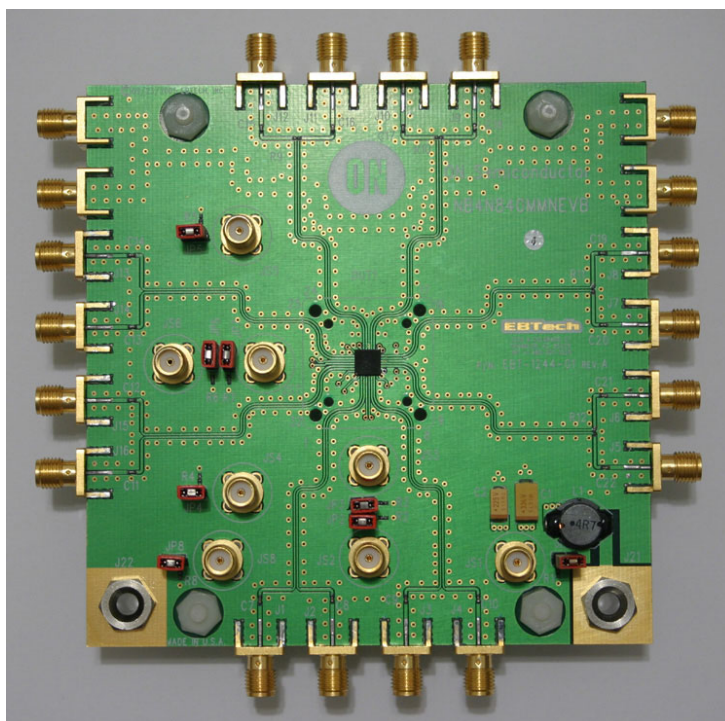


Figure 1. NB4N840M Evaluation Board

# NB4N840MMNEVB

## Board Features

- Fully assembled evaluation board
- Accommodates the electrical characterization of the NB4N840M in the QFN32 package
- Equal length input and output data lines to minimize skew
- Selectable jumpers
- Single + 3.3 V supply

## This Evaluation Board Manual Contains

- Information on the NB4N840M Evaluation Board
- Appropriate Lab Setup Details
- Evaluation Board Layout
- Bill of Materials

## Setup for Measurements

### Step 1: Basic Equipment

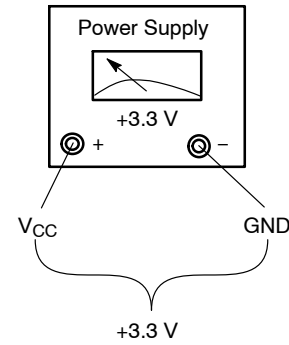
- Signal Generator
- Oscilloscope
- Power Supply
- Voltmeter
- Matched High-Speed Cables with SMA Connectors

### Step 2: Power Supply Connections

+ 3.3 V must be provided to the board for  $V_{CC}$ .

**Table 1. Power Supply Connections**

Supply	Value	Connector
$V_{CC}$	+ 3.3 V	J21
GND	0 V	J22



**Figure 2. Power Supply Connections**

### Step 3: Input Connections

DA<sub>n</sub> and DB<sub>n</sub> require CML drive levels and provide internal 50 Ω to  $V_{CC}$  termination resistors to eliminate external components and minimize reflections. Ensure that the CML devices driving these inputs are not redundantly terminated.

**Table 2. Input Connectors**

Inputs	Board Connector
DA0	J13
$\overline{DA0}$	J14
DA1	J15
$\overline{DA1}$	J16
DB0	J3
$\overline{DB0}$	J4
DB1	J1
$\overline{DB1}$	J2

### Step 4: Control and Select Pins

Jumpers JP1, JP2, JP5, and JP6 select the input signals for channel A and B outputs. Jumpers JP3, JP4, JP7, and JP8 enable the output drivers for channel A and B (refer to Table 3 for output routing).

**Table 3. Output Routing**

ROUTING CONTROLS		OUTPUT CONTROLS		OUTPUT SIGNALS	
SELA0 / SELB0 JP6 / JP2	SELA1 / SELB1 JP5 / JP1	ENA0 / ENA1 JP7 / JP8	ENB0 / ENB1 JP3 / JP4	Signal at QA0 / QB0	Signal at QA1 / QB1
L	L	H	H	DA0 / DB0	DA0 / DB0
L	H	H	H	DA0 / DB0	DA1 / DB1
H	L	H	H	DA1 / DB1	DA0 / DB0
H	H	H	H	DA1 / DB1	DA1 / DB1
X	X	L	L	Power Down	Power Down

## NB4N840MMNEVB

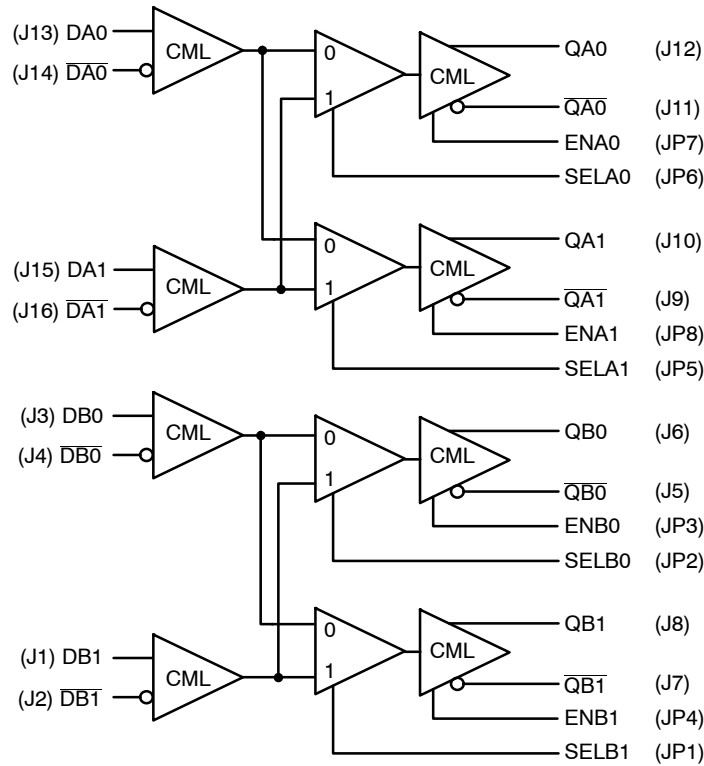


Figure 3. NB4N840M Evaluation Board Connector Configuration

### Step 5: Output Connections

The CML outputs,  $QAn$  and  $QBn$ , must be AC-coupled to a  $50\ \Omega$  termination ( $100\ \Omega$  differential) load. On-board  $100\text{-}\Omega$  differential terminations are provided to reduce noise on outputs that are not used. Connect the  $QAn/QBn$  CML outputs to the oscilloscope with equally matched cables.

#### 1. Monitoring One or More CML Outputs with $50\ \Omega$ Oscilloscope Inputs

- Leave the coupling capacitors in series with the outputs.
- Remove the associated  $100\ \Omega$  differential load resistors from the evaluation board on the outputs (R9–R12).
- It is important to remove the  $100\ \Omega$  resistor on the output monitored, otherwise the load impedance will not match the characteristic impedance of the line and the resulting reflections will cause a degradation in the output signal quality.
- If you are observing a single-ended output, balance the other half with a  $50\ \Omega$  termination to ground (through the AC-coupling capacitor).

#### 2. Monitoring CML Outputs with High-Impedance Oscilloscope Inputs

- Leave the coupling capacitors in series with the outputs.
- Make sure the differential load resistors are on all the outputs (R9–R12).

Table 4. Output Connectors

Outputs	Board Connector
QA0	J12
$\overline{QA0}$	J11
QA1	J10
$\overline{QA1}$	J9
QB0	J6
$\overline{QB0}$	J5
QB1	J8
$\overline{QB1}$	J7

# NB4N840MMNEVB

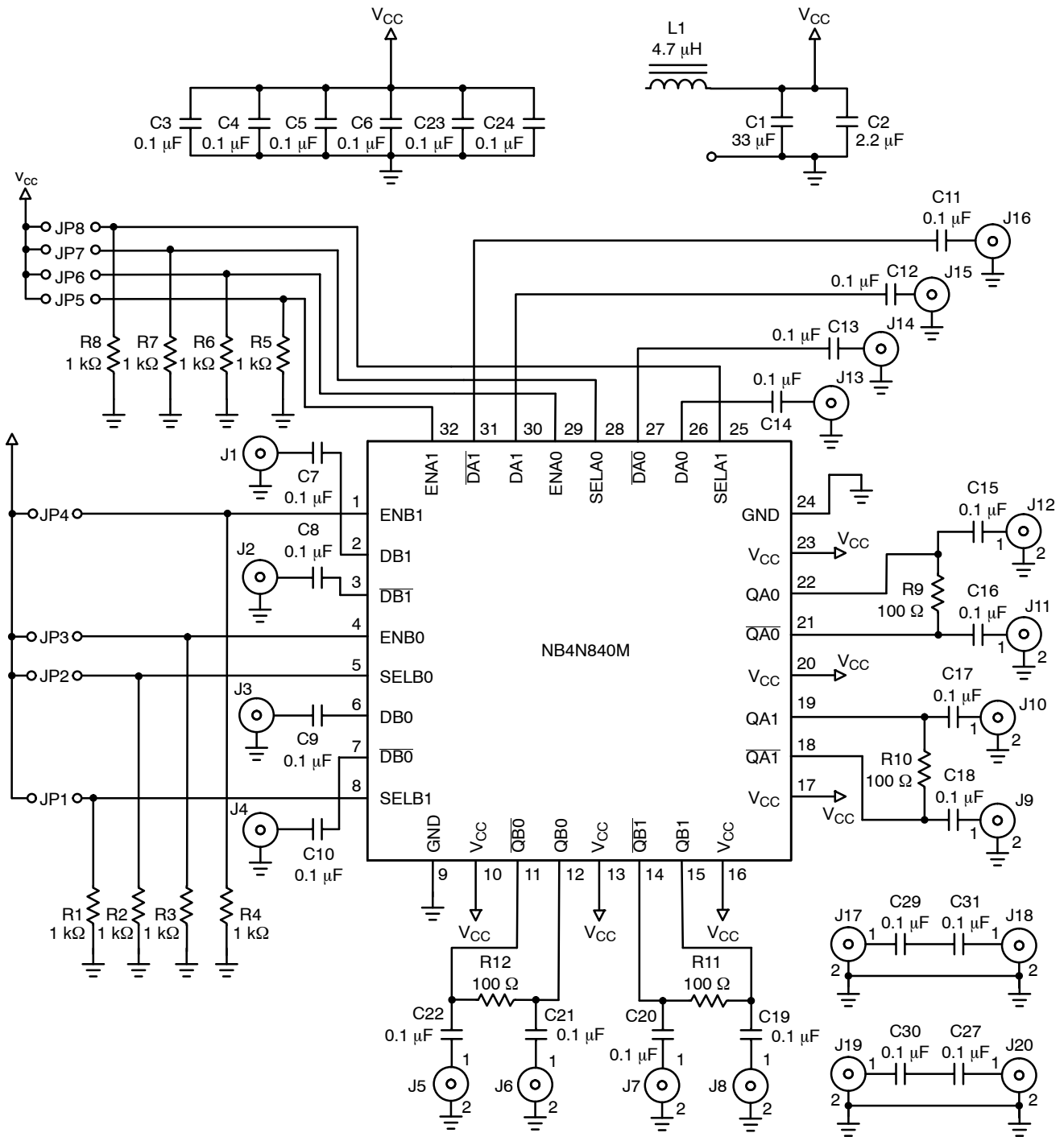


Figure 4. Evaluation Board Schematic

# NB4N840MMNEVB

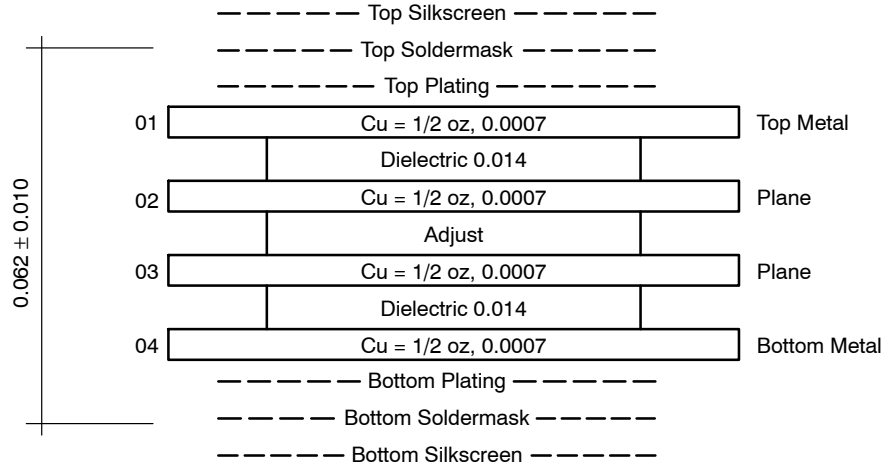
**Table 5. BILL OF MATERIALS**

Ref. Number	Qty	Description	Manufacturer	Manufacturer Part No. (Notes 1, 2)
R1 – R8	8	1 k $\Omega$ $\pm$ 1%, 0402, Resistors	Multicomp	MC0402WGF1001TCE-TR
R9 – R12	4	100 $\Omega$ $\pm$ 1%, 0402, Resistors	Multicomp	MC0402WGF1000TCE-TR
C1	1	33 $\mu$ F $\pm$ 10%, size "D", Tantalum Capacitor	Kemet	T491D336K016AT
C2	1	2.2 $\mu$ F $\pm$ 10%, size "C", Tantalum Capacitor	Kemet	T491C225K035AT
C3 – C24, C27, C29 – C31	26	0.1 $\mu$ F $\pm$ 10%, 0402, Ceramic Capacitors	Kemet	C0402C104K4RAC-TU
L1	1	4.7 $\mu$ H Inductor	Coilcraft	DT3316P-472MLB
U1	1	32 pin QFN	ON Semiconductor	NB4N840MMNG
J1 – J20	20	SMA Edge Mount Connectors	Johnson	142-0701-851
JS1 – JS8	8	SMA Connectors	Johnson	142-0701-201
J21, J22	2	Test Point Jacks		
JP1 – JP8	8	1x2 Pin Headers, (0.1 inch pitch)	SPC	SPC20485
JP1 – JP8	8	Shunts	SPC	SPC19809

1. Specified parts are RoHS-compliant.
2. Only RoHS-compliant equivalent parts may be substituted.

## Board Lay-Up

This board is implemented in four layers and provides a high bandwidth 50  $\Omega$  controlled impedance environment. The pictures in Figures 5 through 9 show views of the four layers of the evaluation board. Board material is FR4.



**Figure 5. Evaluation Board Lay-Up**

# NB4N840MMNEVB

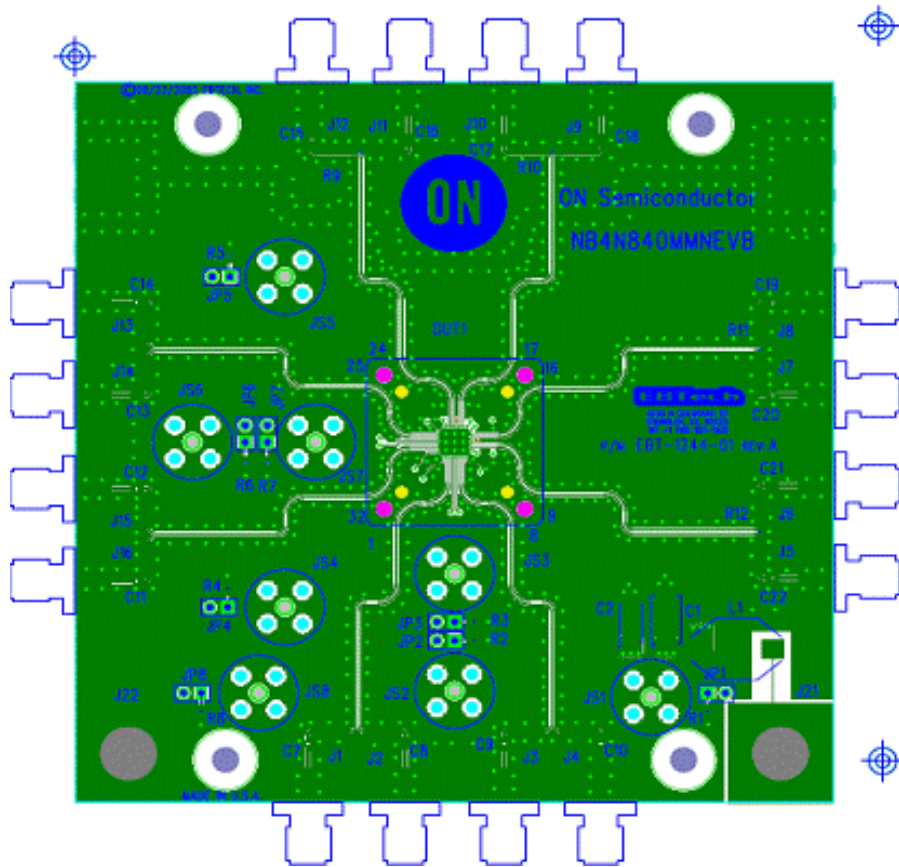


Figure 6. NB4N840MMN Evaluation Board Top (Component) Layer

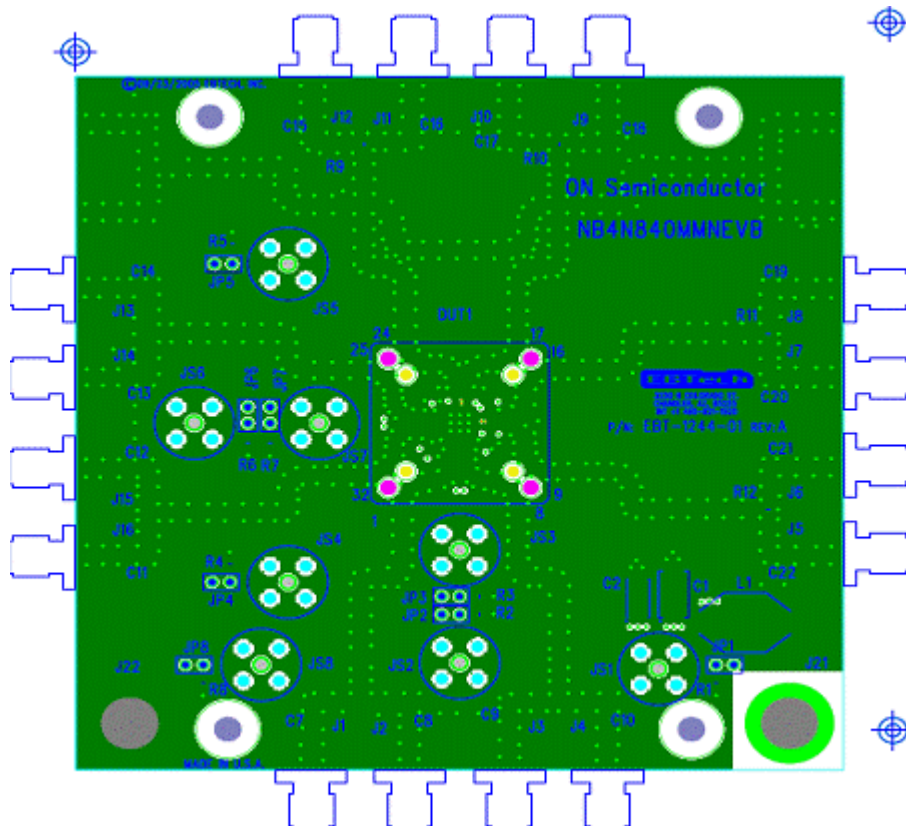


Figure 7. Ground Layer

# NB4N840MMNEVB

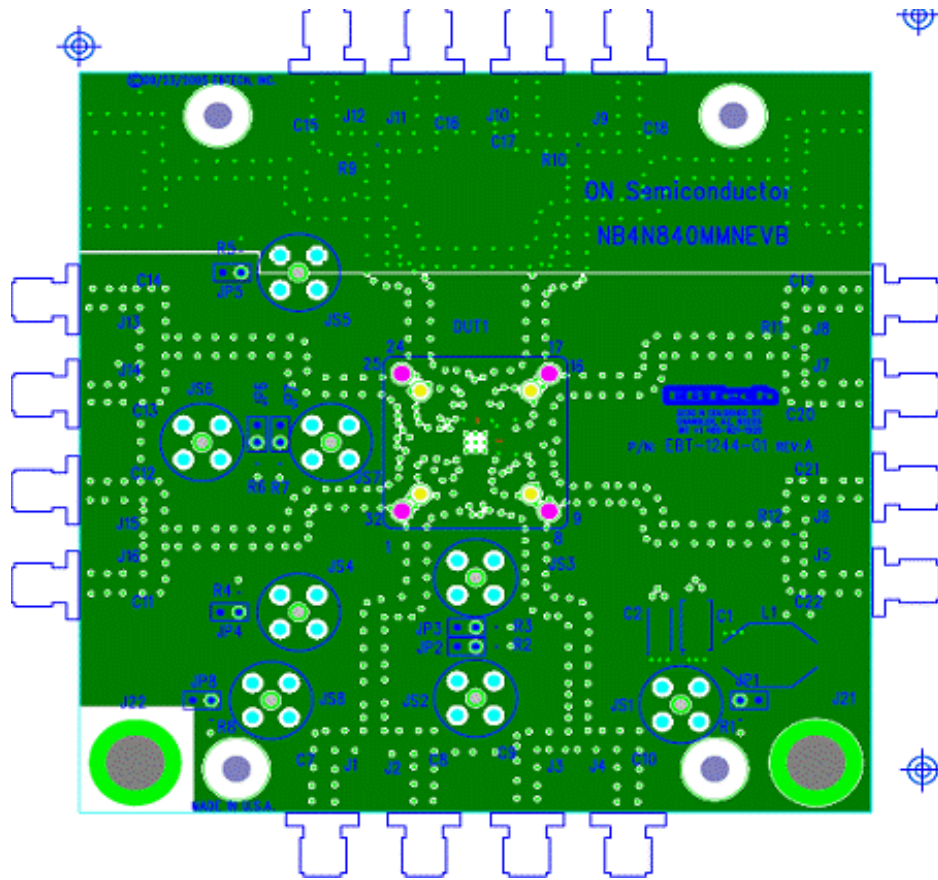


Figure 8. Power Layer

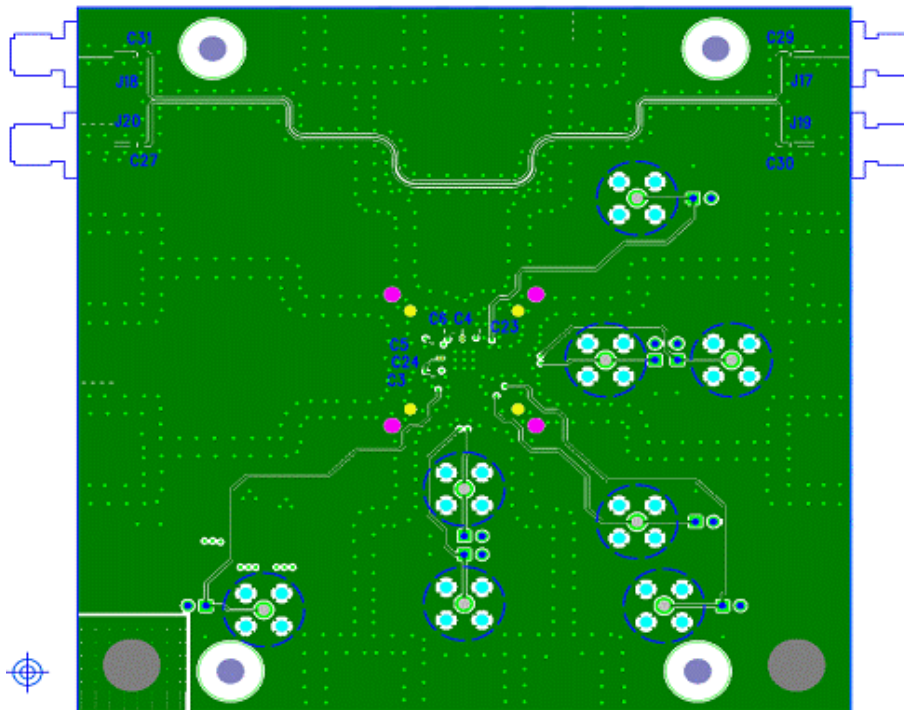


Figure 9. Bottom Layer



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](http://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](http://www.onsemi.com).

---

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

ON Semiconductor Website: [www.onsemi.com](http://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