NBSG16MMNEVB

NBSG16M Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This document describes the NBSG16M evaluation board and the appropriate lab test setups. It should be used in conjunction with the NBSG16M data sheets which contain full technical details on the device specifications and operation. The same PCB is used to evaluate the NBSG16MN and NB4L16M devices.

The evaluation board is designed to facilitate a quick evaluation of the NBSG16M GigaComm™ Differential Receiver/Driver/Translator. The NBSG16M 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 NBSG16M 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)

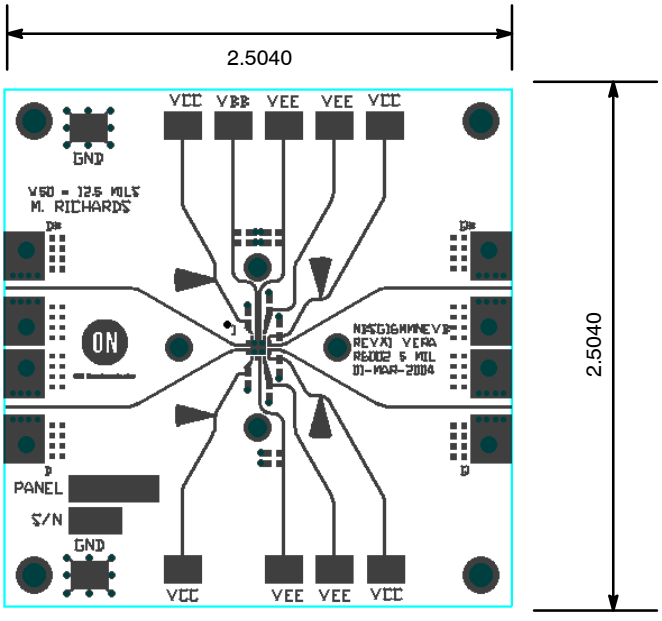


Figure 1. NBSG16MMN Evaluation PCB with Pin Label/Connection Change

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. NBSG16M POWER SUPPLY CONNECTIONS

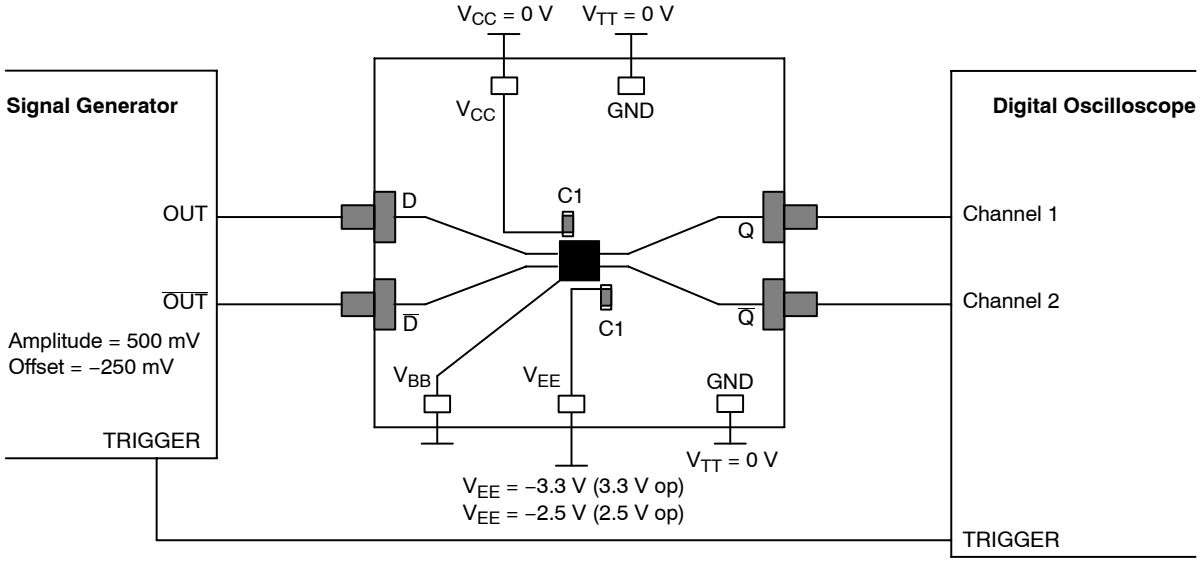
3.3 V Setup	2.5 V Setup
V_{CC} = 0 V = GND	V_{CC} = 0 V = GND
V_{TT} = V_{CC} = 0 V = GND	V_{TT} = V_{CC} = 0 V = GND
V_{EE} = −3.3 V	V_{EE} = −2.5 V

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 $\overline{D}$).

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



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

Figure 2. NBSG16M 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 −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, $\overline{Q}$) 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.

SETUP FOR FREQUENCY DOMAIN MEASUREMENTS

Table 3. BASIC EQUIPMENT

Description	Example Equipment (Note 1)	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

1. 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. NBSG16M POWER SUPPLY CONNECTIONS

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

Setup Test Configurations for Differential Operation

A) 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.

B) 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.

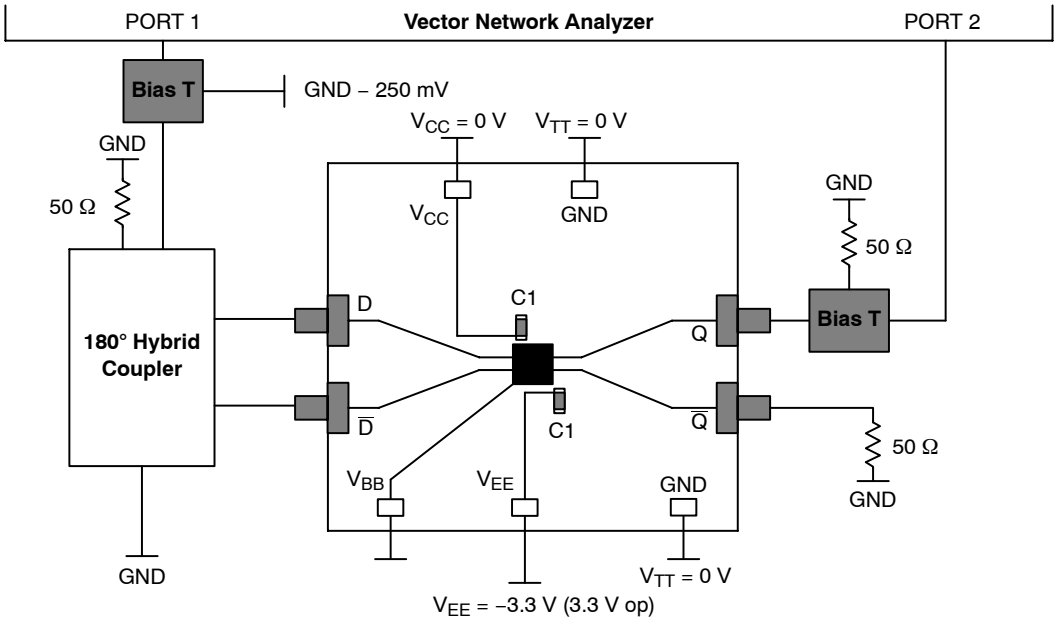


Figure 3. NBSG16M Board Setup – Frequency Domain (Differential Mode)

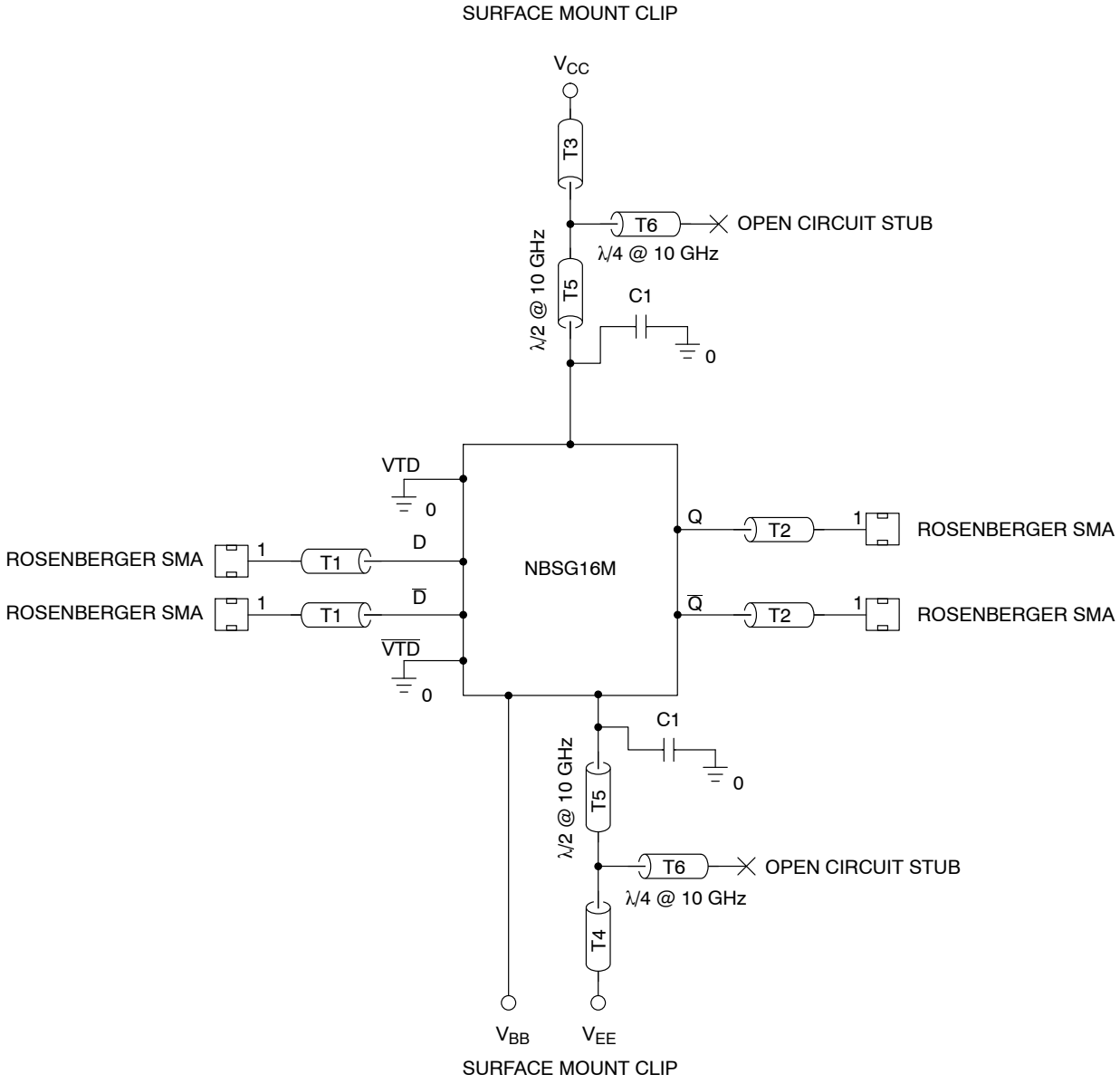
MORE INFORMATION ABOUT EVALUATION BOARD

Design Considerations for >10 GHz operation

While the NBSG16M 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



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

Figure 4. Evaluation Board Schematic

Table 5. PARTS LIST

Part No	Qty.	Description	Manufacturer	Web Address
NBSG16MMN	1	2.5 V/3.3 V SiGe Differential Receiver/Driver with CML Outputs	ON Semiconductor	http://www.onsemi.com/NBSG16M
32K243−40ME3	4	Gold Plated Connector	Rosenberger	http://www.rosenberger.de
CO6BLBB2X5CO6 03CL04K6RAC	9	2 MHz − 30 GHz Capacitor 0603 0.1 μF ±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

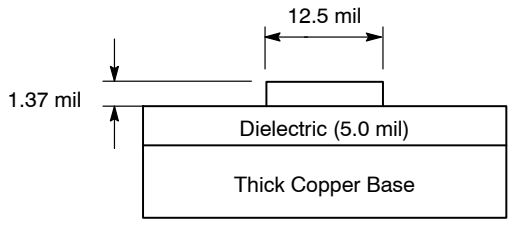


Figure 5. Board Stack-up

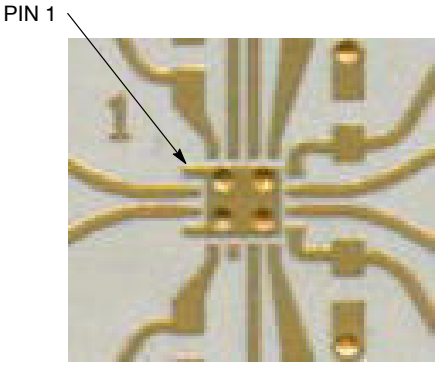
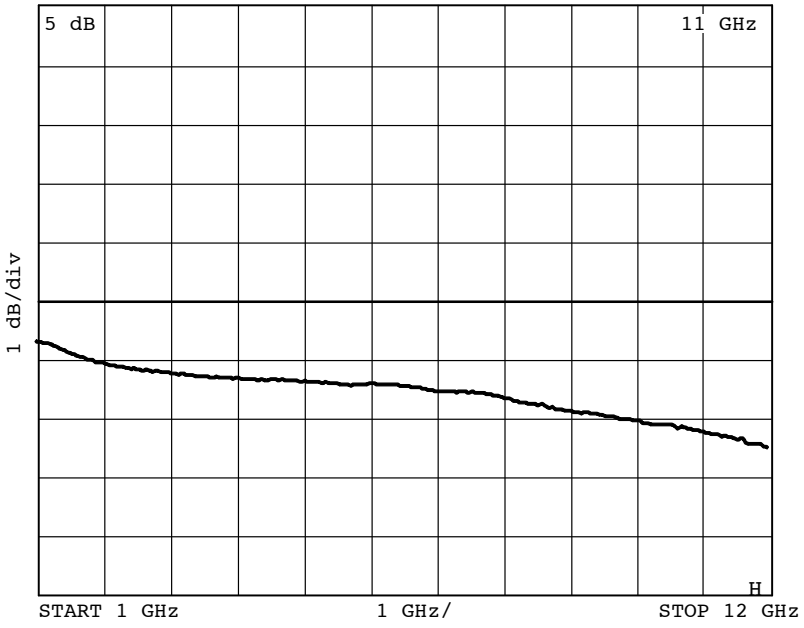


Figure 6. Layout Mask for NBSG16M



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

Figure 7. Insertion Loss

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

NBSG16M/D, Data Sheet, *NBSG16M, 2.5V/3.3V SiGe Differential Receiver/Driver with CML Outputs*

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

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

Table 7. ORDERING INFORMATION

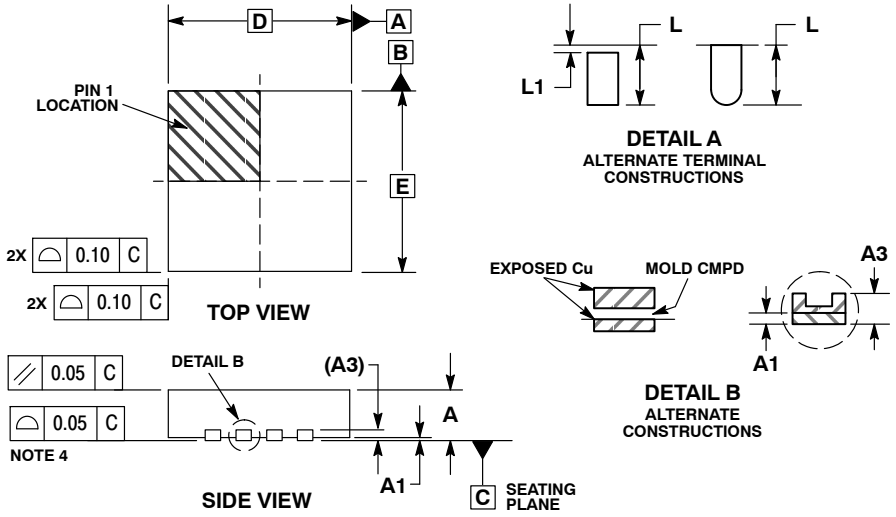
Part No	Description	Package	Shipping†
NBSG16MMN	2.5 V/3.3 V SiGe Differential Receiver/Driver with CML Outputs	3×3 mm QFN−16	123 Units/Tray
NBSG16MMNG	2.5 V/3.3 V SiGe Differential Receiver/Driver with CML Outputs	3×3 mm QFN−16 (Pb−Free)	123 Units/Tray
NBSG16MMNR2	2.5 V/3.3 V SiGe Differential Receiver/Driver with CML Outputs	3×3 mm QFN−16	3,000/Tape & Reel
NBSG16MMNEVB	NBSG16MN 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.

NBSG16MMNEVB

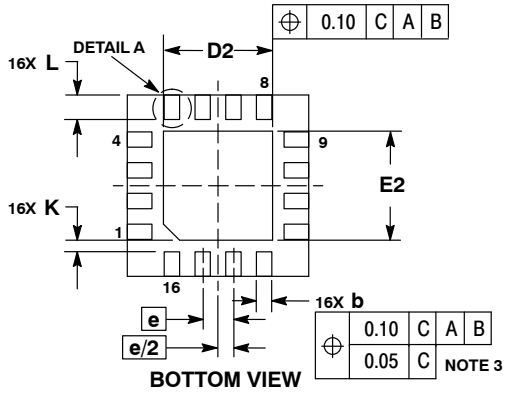
PACKAGE DIMENSIONS

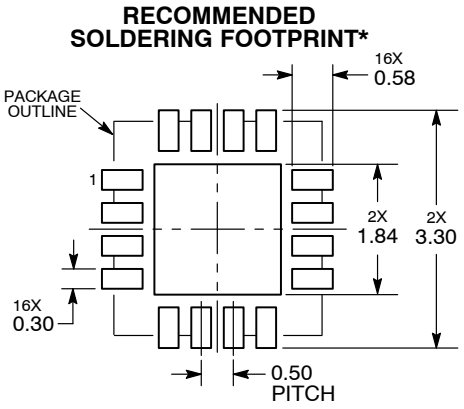
QFN16 3x3, 0.5P
CASE 485G−01
ISSUE F



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.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0.00	0.03	0.05
A3		0.20 REF	
b	0.18	0.24	0.30
D		3.00 BSC	
D2	1.65	1.75	1.85
E		3.00 BSC	
E2	1.65	1.75	1.85
e		0.50 BSC	
K		0.18 TYP	
L	0.30	0.40	0.50
L1	0.00	0.08	0.15





DIMENSIONS: MILLIMETERS

*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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PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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