

## General Description

Using the IDT CMOS oscillator technology, originally developed by Mobius Microsystems, the 3C02 replaces quartz crystal based resonators and oscillators with a monolithic CMOS IC at the thinnest possible form factors without the use of any mechanical frequency source or PLL. The product is specially designed to work with the next generation USB 3.0 Super Speed, PCIe® Gen1/2 and S-ATA interface controller ICs and systems.

## Features

- All-CMOS Temperature Compensated Oscillator
- Excellent Frequency Accuracy: +/- 100ppm total
- Ultra-low power operation (2mA typical at 1.8V supply)
- No quartz or PLL used: very low jitter performance leading to low link Bit Error Rates (BER)
- Excellent reliability: Shock and vibration resistant
- Many frequencies are supported
- Factory programmable from 6 to 133MHz

## Ordering Information

3C P 0 C 02 - FFF NSG X 8  
1 2 3 4 5 6 7 8 9

1) IDT Base Part Number for 100ppm CMOS Oscillator

2) Supply Voltage Configuration

- P: 1.8V to 3.3V continuous operation

3) Output Signal Type

- 0: LVCMOS Output

4) "C" indicates integrated CMOS Oscillator

5) "XX" is product specific code that indicated product sequence

6) FFF: Factory Programmed Frequency in MHz

7) Package Options\*

- NSG: 5x3.2, 4-Pin Package
- NVG: 2.5x2.0, 4-Pin Package<sup>2</sup>
- M: SOIC, 8-pin Package<sup>2</sup>

8) Temperature Grade

- "E" -20 to 70°C Extended Commercial Temperature Range
- " " 0 to 70°C Commercial Temperature Range, ie. default is blank<sup>2</sup>
- "R" -20 to 85°C Restricted Industrial Temperature Range<sup>2</sup>

9) Tape & Reel Option

- " ": Shipped in Tube i.e. default is blank
- 8: Shipped in Tape & Reel

<sup>1</sup>: This product is rated "Green", please contact factory for environmental compliancy information

<sup>2</sup>: Future product. Not available for design-in. Please contact your IDT representative for details

The Preliminary Information presented herein represents a product in pre-production. The noted characteristics are based on initial product characterization and/or qualification. Integrated Device Technology, Incorporated (IDT) reserves the right to change any circuitry or specifications without notice

## Pin Assignment

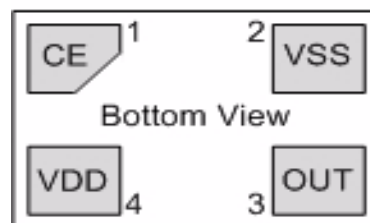
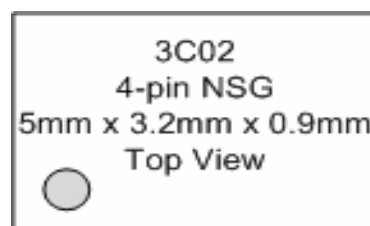


**Table 1. Pin Descriptions**

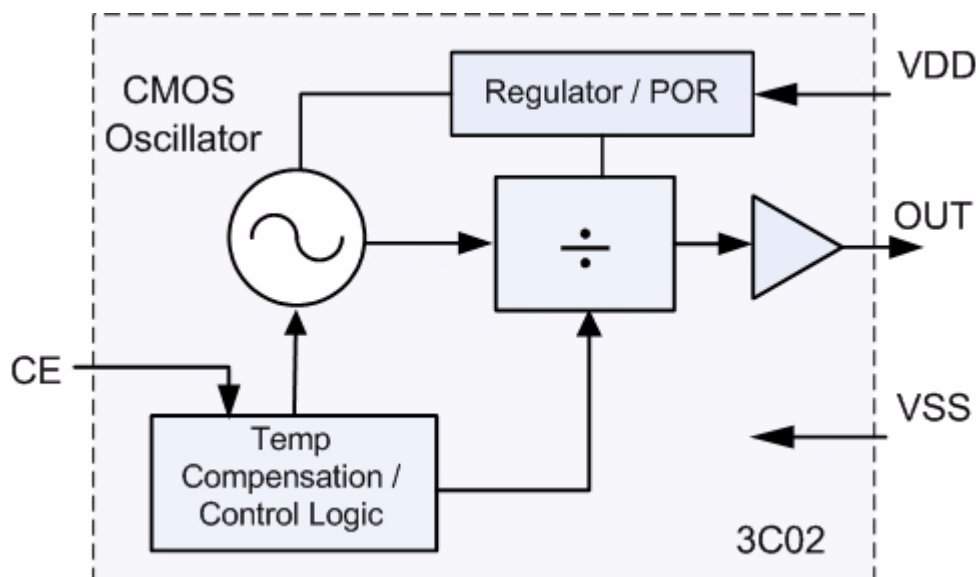
| No | Name | Type         | Description                                                                                                   |
|----|------|--------------|---------------------------------------------------------------------------------------------------------------|
| 1  | CE   | Input Pullup | Chip Enable. Internal Pullup. 3C02 is enabled when HIGH. When LOW, OUT has a weak pull-down to GND internally |
| 2  | VSS  | Power        | System Ground                                                                                                 |
| 3  | OUT  | Output       | Frequency Output                                                                                              |
| 4  | VDD  | Power        | Power Supply. Use a 0.1µF decoupling capacitor between VDD and VSS                                            |

## Table 2. Pin Descriptions

Below Pin Descriptions apply to SOIC-8 Package

| No      | Name | Type         | Description                                                                                                   |
|---------|------|--------------|---------------------------------------------------------------------------------------------------------------|
| 1       | CE   | Input Pullup | Chip Enable. Internal Pullup. 3C02 is enabled when HIGH. When LOW, OUT has a weak pull-down to GND internally |
| 4       | VSS  | Power        | System Ground                                                                                                 |
| 6       | OUT  | Output       | Frequency Output                                                                                              |
| 8       | VDD  | Power        | Power Supply. Use a 0.1 $\mu$ F decoupling capacitor between VDD and VSS                                      |
| 2,3,5,7 | NC   |              | No Connect Pins. These pins may be left floating.                                                             |

## Block Diagram



## Functional Description

3C02 is a monolithic all-CMOS frequency source. The internal CMOS Oscillator generates the factory-programmed frequencies with high accuracy and excellent phase noise and jitter. The device is a silicon alternative to quartz based crystal resonators and oscillators. Various programming and configuration options are supported as given in the Part Ordering Information section above. The easy-to-use device offers programmable frequencies and various supply voltage configurations. Offered in common crystal oscillator pin-outs, the 3C02 allows the designer to disable the oscillator via the CE pin to enter a very low current, quiescent state. The CMOS oscillator features very fast start-up time to enable rapid wake-up from the quiescent state. All required circuit elements other than those that are noted in the Pin Descriptions Table (Table.1) above are internal to the device.

## Absolute Maximum Ratings

NOTE: Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics* or *AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

| Item                             | Rating              |
|----------------------------------|---------------------|
| Supply Voltage, VDD              | 4.6V                |
| Input, V <sub>I</sub> (CE pin)   | -0.5V to VDD + 0.5V |
| Output, V <sub>O</sub> (OUT pin) | -0.5V to VDD + 0.5V |
| Storage Temperature              | -65°C to 150°C      |

## Electrical Characteristics<sup>5</sup> [3.3V]

VDD=3.0V to 3.6V, T<sub>A</sub>=-20 to 70°C unless otherwise noted. Typical values are measured at VDD=3.3V, T<sub>A</sub>=35°C

| Parameter              | Symbol            | Conditions                                                                                                                                      | Min     | Typ          | Max     | Units             |
|------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|---------|-------------------|
| ElectroStaticDischarge | ESD               | Human Body Model, tested per JESD D22-A114                                                                                                      | 4000    |              |         | V                 |
| Supply Voltage         | VDD               | Normal Operation <sup>3</sup>                                                                                                                   | 3.0     | 3.3          | 3.6     | V                 |
| Input LOW level        | V <sub>IL</sub>   | CE pin                                                                                                                                          | -0.3    |              | VDD*0.3 | V                 |
| Input HIGH level       | V <sub>IH</sub>   | CE pin                                                                                                                                          | VDD*0.7 |              | VDD+0.3 | V                 |
| Supply Current         | IDD               | Active supply current, VDD=3.3V, T=35°C, no output load                                                                                         |         | 2.5          | 3.0     | mA                |
| Quiescent Current      | IDDQ              | CE=LOW, output disabled                                                                                                                         |         | 0.2          | 1       | μA                |
| Output LOW level       | V <sub>OL</sub>   | I <sub>OL</sub> = -4mA                                                                                                                          |         |              | 0.5     | V                 |
| Output HIGH level      | V <sub>OH</sub>   | I <sub>OH</sub> = 4mA                                                                                                                           | VDD-0.5 |              |         | V                 |
| Output Frequency       | F <sub>OUT</sub>  | Factory Programmable.Contact IDT for frequencies not listed                                                                                     |         | 12,48,75,125 |         | MHz               |
| Frequency Stability    | F <sub>TOT</sub>  | Total Frequency Stability over temperature,supply variation,aging (1st year at 35°C),shock&vibration. "E" device option, over -20 to 70°C range |         |              | ±100    | ppm               |
| Rise Time              | RT                | 20% to 80% x VDD. Output load (C <sub>L</sub> ) =8pF, NSG-option                                                                                |         |              | 1.9     | ns                |
| Fall Time              | FT                | 80% to 20% x VDD. Output load (C <sub>L</sub> ) =8pF, NSG-option                                                                                |         |              | 1.9     | ns                |
| Duty Cycle             | DC                | Clock output duty cycle. Measured under 80MHz, VDD/2, C <sub>L</sub> =8pF                                                                       | 45      |              | 55      | %                 |
|                        |                   | Clock output duty cycle. Measured over 80MHz, VDD/2, C <sub>L</sub> =8pF                                                                        | 40      |              | 60      | %                 |
| Power-up time          | t <sub>on</sub>   | Output valid time after VDD meets the specified range&CE transition                                                                             | 50      | 100          | 400     | μs                |
| Period Jitter          | PJ <sub>RMS</sub> | Total RMS Period Jitter (including random and deterministic) <sup>1,2</sup>                                                                     |         | 3.5          |         | ps <sub>RMS</sub> |
| Cycle-cycle Jitter     | CJ                | The absolute value of max change in the periods of any 2 adjacent cycles <sup>1,2,4</sup>                                                       |         |              | 50      | ps                |
| Phase Noise            | PN                | 1MHz offset from carrier <sup>1,2</sup>                                                                                                         |         | -140         | -135    | dBc/Hz            |

Notes 1. Measured with a 50Ω to GND termination

2: Measured at 48MHz output frequency

3. The 3C02 will support continuous VDD operation from 1.62 to 3.6V. The device can be powered up with a supply voltage at any of the 3 main supply rails of 1.8V, 2.5V or 3.3V.

4. Measured over 1000 cycles per JEDEC standard 65

5. Electrical parameters are guaranteed by design and characterization over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500lpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

## Electrical Characteristics<sup>5</sup> [2.5V]

VDD=2.25V to 2.75V, T<sub>A</sub>=-20 to 70°C unless otherwise noted. Typical values are measured at VDD=2.5V, T<sub>A</sub>=35°C

| Parameter              | Symbol            | Conditions                                                                                                                                      | Min     | Typ          | Max     | Units             |
|------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|---------|-------------------|
| ElectroStaticDischarge | ESD               | Human Body Model, tested per JESD D22-A114                                                                                                      | 4000    |              |         | V                 |
| Supply Voltage         | VDD               | Normal Operation <sup>3</sup>                                                                                                                   | 2.25    | 2.5          | 2.75    | V                 |
| Input LOW level        | V <sub>IL</sub>   | CE pin                                                                                                                                          | -0.3    |              | VDD*0.3 | V                 |
| Input HIGH level       | V <sub>IH</sub>   | CE pin                                                                                                                                          | VDD*0.7 |              | VDD+0.3 | V                 |
| Supply Current         | IDD               | Active supply current, VDD=2.5V, T=35°C, no output load                                                                                         |         | 2.25         | 2.75    | mA                |
| Quiescent Current      | IDDQ              | CE=LOW, output disabled                                                                                                                         |         | 0.2          | 1       | μA                |
| Output LOW level       | V <sub>OL</sub>   | I <sub>OL</sub> = -3mA                                                                                                                          |         |              | 0.4     | V                 |
| Output HIGH level      | V <sub>OH</sub>   | I <sub>OH</sub> = 3mA                                                                                                                           | VDD-0.4 |              |         | V                 |
| Output Frequency       | F <sub>OUT</sub>  | Factory Programmable.Contact IDT for frequencies not listed                                                                                     |         | 12,48,75,125 |         | MHz               |
| Frequency Stability    | F <sub>TOT</sub>  | Total Frequency Stability over temperature,supply variation,aging (1st year at 35°C),shock&vibration. "E" device option, over -20 to 70°C range |         |              | ±100    | ppm               |
| Rise Time              | RT                | 20% to 80% x VDD. Output load (C <sub>L</sub> ) =7pF, NSG-option                                                                                |         |              | 2.3     | ns                |
| Fall Time              | FT                | 80% to 20% x VDD. Output load (C <sub>L</sub> ) =7pF, NSG-option                                                                                |         |              | 2.3     | ns                |
| Duty Cycle             | DC                | Clock output duty cycle. Measured under 100MHz at VDD/2, C <sub>L</sub> =7pF                                                                    | 45      |              | 55      | %                 |
|                        |                   | Clock output duty cycle. Measured over 100MHz at VDD/2, C <sub>L</sub> =7pF                                                                     | 40      |              | 60      | %                 |
| Power-up time          | t <sub>on</sub>   | Output valid time after VDD meets the specified range&CE transition                                                                             | 50      | 100          | 400     | μs                |
| Period Jitter          | PJ <sub>RMS</sub> | Total RMS Period Jitter (including random and deterministic) <sup>1,2</sup>                                                                     |         | 3.5          |         | ps <sub>RMS</sub> |
| Cycle-cycle Jitter     | CJ                | The absolute value of max change in the periods of any 2 adjacent cycles <sup>1,2,4</sup>                                                       |         |              | 50      | ps                |
| Phase Noise            | PN                | 1MHz offset from carrier <sup>1,2</sup>                                                                                                         |         | -140         | -135    | dBc/Hz            |

Notes 1. Measured with a 50Ω to GND termination

2: Measured at 48MHz output frequency

3. The 3C02 will support continuous VDD operation from 1.62 to 3.6V. The device can be powered up with a supply voltage at any of the 3 main supply rails of 1.8V, 2.5V or 3.3V.

4. Measured over 1000 cycles per JEDEC standard 65

5. Electrical parameters are guaranteed by design and characterization over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500lfpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

## Electrical Characteristics<sup>5</sup> [1.8V]

VDD=1.62V to 1.98V, T<sub>A</sub>=-20 to 70°C unless otherwise noted. Typical values are measured at VDD=1.8V, T<sub>A</sub>=35°C

| Parameter              | Symbol            | Conditions                                                                                                                                      | Min     | Typ          | Max     | Units             |
|------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|---------|-------------------|
| ElectroStaticDischarge | ESD               | Human Body Model, tested per JESD D22-A114                                                                                                      | 4000    |              |         | V                 |
| Supply Voltage         | VDD               | Normal Operation <sup>3</sup>                                                                                                                   | 1.62    | 1.8          | 1.98    | V                 |
| Input LOW level        | V <sub>IL</sub>   | CE pin                                                                                                                                          | -0.3    |              | VDD*0.3 | V                 |
| Input HIGH level       | V <sub>IH</sub>   | CE pin                                                                                                                                          | VDD*0.7 |              | VDD+0.3 | V                 |
| Supply Current         | IDD               | Active supply current, VDD=1.8V, T=35°C, no output load                                                                                         |         | 2.0          | 2.5     | mA                |
| Quiescent Current      | IDDQ              | CE=LOW, output disabled                                                                                                                         |         | 0.2          | 1       | μA                |
| Output LOW level       | V <sub>OL</sub>   | I <sub>OL</sub> = -1.8mA                                                                                                                        |         |              | 0.3     | V                 |
| Output HIGH level      | V <sub>OH</sub>   | I <sub>OH</sub> = 1.8mA                                                                                                                         | VDD-0.3 |              |         | V                 |
| Output Frequency       | F <sub>OUT</sub>  | Factory Programmable.Contact IDT for frequencies not listed                                                                                     |         | 12,48,75,125 |         | MHz               |
| Frequency Stability    | F <sub>TOT</sub>  | Total Frequency Stability over temperature,supply variation,aging (1st year at 35°C),shock&vibration. "E" device option, over -20 to 70°C range |         |              | ±100    | ppm               |
| Rise Time              | RT                | 20% to 80% x VDD. Output load (C <sub>L</sub> ) =4pF, NSG-option                                                                                |         |              | 2.75    | ns                |
| Fall Time              | FT                | 80% to 20% x VDD. Output load (C <sub>L</sub> ) =4pF, NSG-option                                                                                |         |              | 2.75    | ns                |
| Duty Cycle             | DC                | Clock output duty cycle. Measured at VDD/2, C <sub>L</sub> =4pF                                                                                 | 45      |              | 55      | %                 |
| Power-up time          | t <sub>on</sub>   | Output valid time after VDD meets the specified range&CE transition                                                                             | 50      | 100          | 400     | μs                |
| Period Jitter          | PJ <sub>RMS</sub> | Total RMS Period Jitter (including random and deterministic) <sup>1,2</sup>                                                                     |         | 3.5          |         | ps <sub>RMS</sub> |
| Cycle-cycle Jitter     | CJ                | The absolute value of max change in the periods of any 2 adjacent cycles <sup>1,2,4</sup>                                                       |         |              | 50      | ps                |
| Phase Noise            | PN                | 1MHz offset from carrier <sup>1,2</sup>                                                                                                         |         | -140         | -135    | dBc/Hz            |

Notes 1. Measured with a 50Ω to GND termination

2: Measured at 48MHz output frequency

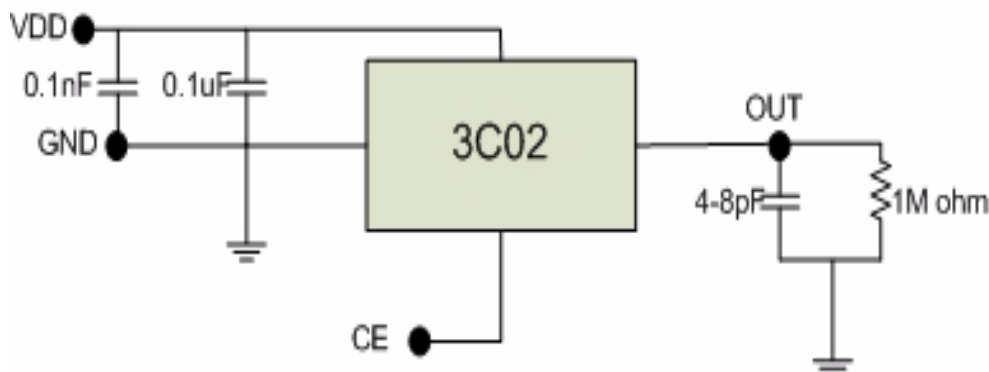
3. The 3C02 will support continuous VDD operation from 1.62 to 3.6V. The device can be powered up with a supply voltage at any of the 3 main supply rails of 1.8V, 2.5V or 3.3V.

4. Measured over 1000 cycles per JEDEC standard 65

5. Electrical parameters are guaranteed by design and characterization over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500lpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

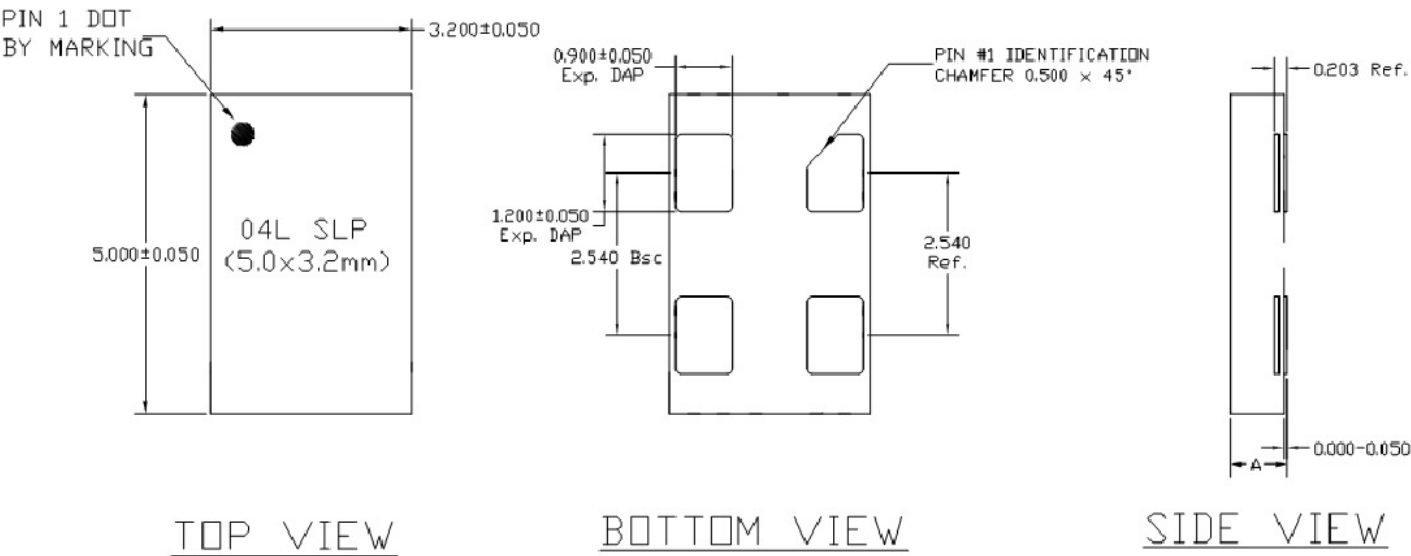
## Application Diagram

Below is a representative application diagram to evaluate the 3C02. For 50Ω terminated measurements, a balun is necessary to provide proper impedance matching



Package Outline and Package Dimensions

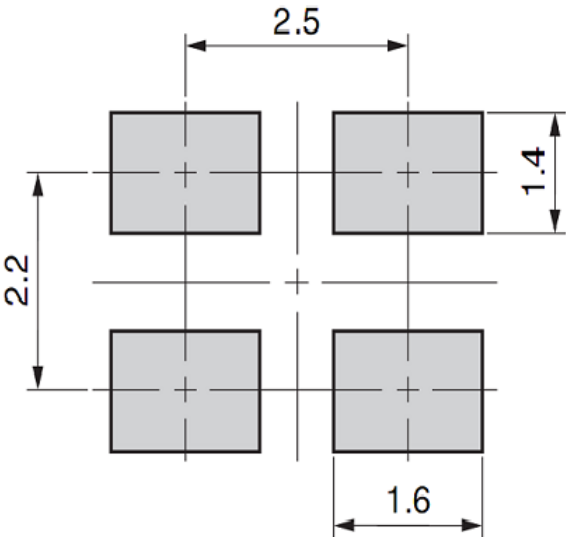
Package Outline for NSG -5.0x3.2x0.9mm, 4-pin package:



NOTE:  
1) TSLP AND SLP SHARE THE SAME EXPOSE OUTLINE  
BUT WITH DIFFERENT THICKNESS:

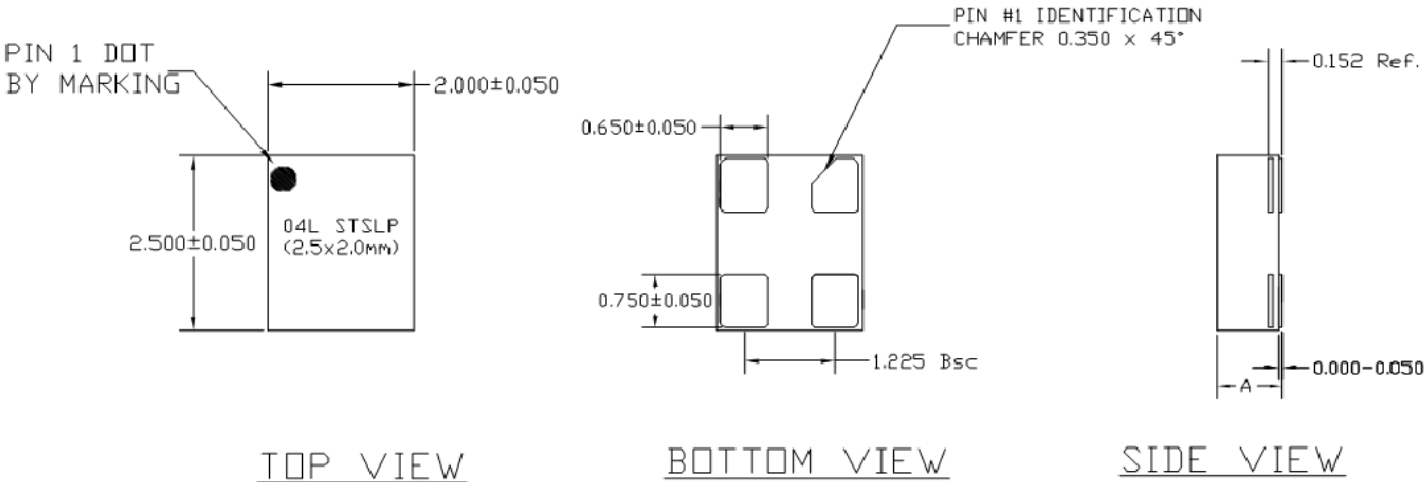
| A | MAX. | SLP   |
|---|------|-------|
|   | NOM. | 0.900 |
|   | MIN. | 0.850 |

Below is the recommended PCB land pattern for the 3C02 NSG package:



Package Outline and Package Dimensions

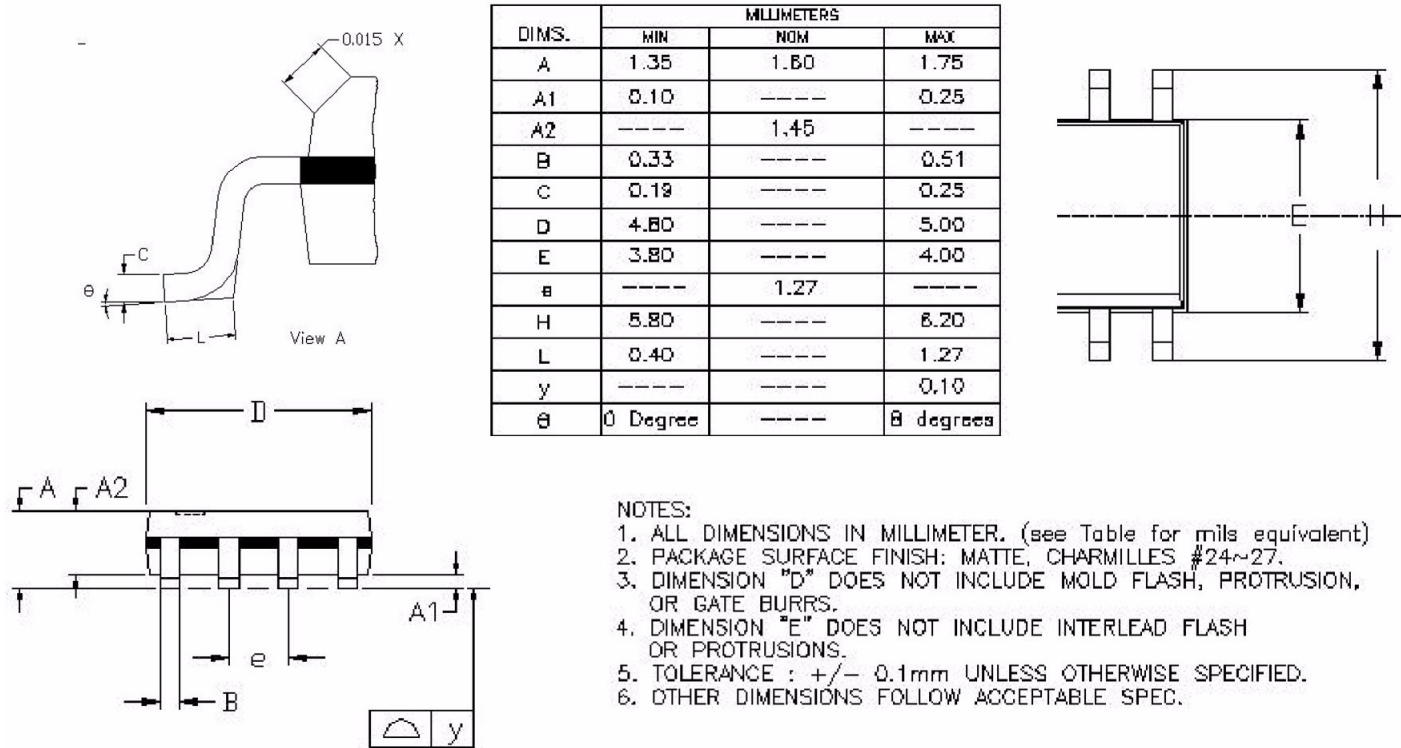
Package Outline for NVG -2.5x2.0x0.55mm, 4-pin package:



NOTE:

| A | STSLP |       |
|---|-------|-------|
|   | MAX.  | 0.600 |
|   | NOM.  | 0.550 |
|   | MIN.  | 0.500 |

Package Outline for SOIC, 8-pin package:





[www.IDT.com](http://www.IDT.com)

6024 Silver Creek Valley Road  
San Jose, California 95138

**Sales**

800-345-7015 (inside USA)  
+408-284-8200 (outside USA)  
Fax: 408-284-2775  
[www.IDT.com](http://www.IDT.com)

**Technical Support**

[mobius@idt.com](mailto:mobius@idt.com)  
+408-739-5400

DISCLAIMER Integrated Device Technology, Inc. (IDT) and its subsidiaries reserve the right to modify the products and/or specifications described herein at any time and at IDT's sole discretion. All information in this document, including descriptions of product features and performance, is subject to change without notice. Performance specifications and the operating parameters of the described products are determined in the independent state and are not guaranteed to perform the same way when installed in customer products. The information contained herein is provided without representation or warranty of any kind, whether express or implied, including, but not limited to, the suitability of IDT's products for any particular purpose, an implied warranty of merchantability, or non-infringement of the intellectual property rights of others. This document is presented only as a guide and does not convey any license under intellectual property rights of IDT or any third parties.

IDT's products are not intended for use in life support systems or similar devices where the failure or malfunction of an IDT product can be reasonably expected to significantly affect the health or safety of users. Anyone using an IDT product in such a manner does so at their own risk, absent an express, written agreement by IDT.

Integrated Device Technology, IDT and the IDT logo are registered trademarks of IDT. Other trademarks and service marks used herein, including protected names, logos and designs, are the property of IDT or their respective third party owners.

Copyright 2010. All rights reserved.