# Product Specification

# PE9304

**1 GHz - 7 GHz Low Power UltraCMOS™ Divide-by-2 Prescaler**
**Rad-hard for Space Applications**

## Features

- Fixed divide ratio of 2
- Low-power operation: 13.5 mA typical @ 3 V
- Small package: 8-lead Ceramic SOIC
- Guaranteed 100 Krads(Si) Total Dose Performance
- Superior Single Event Upset Immunity

## Product Description

*The PE9304 is a high-performance UltraCMOS™ prescaler with a fixed divide ratio of 2. Its operating frequency range is 1000 MHz to 7000 MHz. The PE9304 operates on a nominal 3 V supply and draws only 13.5 mA. It is packaged in a small 8-lead ceramic SOIC and is ideal for frequency scaling and clock generation solutions.*

*The PE9301 is manufactured on Peregrine's UltraCMOS™ process, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate, offering the performance of GaAs with the economy and integration of conventional CMOS.*

**Figure 1. Functional Diagram**

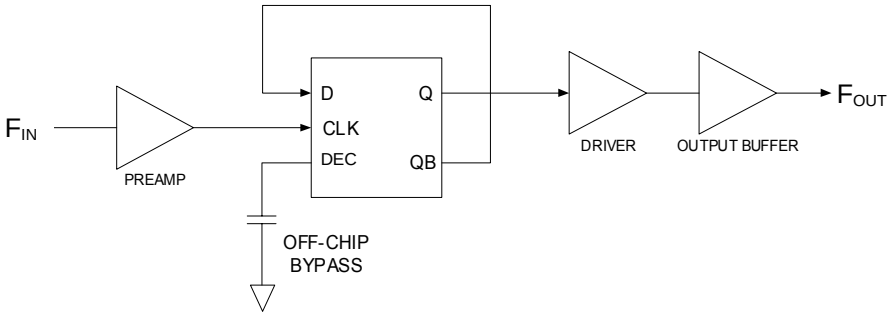



**Figure 2. Package Type**

8-lead CSOIC

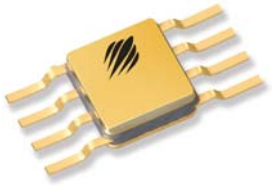
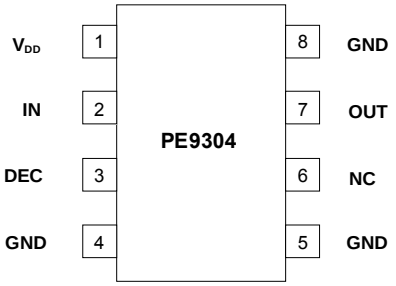


**Table 1. Electrical Specifications** ($Z_S = Z_L = 50\ \Omega$)

**$V_{DD}$ = 3.0 V, -40° C ≤ $T_A$ ≤ 85° C, unless otherwise specified**

| Parameter | Conditions | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|
| Supply Voltage | | 2.85 | 3.0 | 3.15 | V |
| Supply Current | | | 13.5 | 18.0 | mA |
| Input Frequency ($F_{IN}$) | | 1 | | 7 | GHz |
| Input Sensitivity ($P_{IN}$) | 1000 MHz ≤ $F_{IN}$ < 2000 MHz | +5 | | +12 | dBm |
| | 2000 MHz ≤ $F_{IN}$ < 6000 MHz | 0 | | +12 | dBm |
| | 6000 MHz ≤ $F_{IN}$ ≤ 7000 MHz | +5 | | +12 | dBm |
| Output Power ($P_{OUT}$) | 1000 MHz ≤ $F_{IN}$ < 2000 MHz | 0 | | | dBm |
| | 2000 MHz ≤ $F_{IN}$ < 6000 MHz | -7 | | | |
| | 6000 MHz ≤ $F_{IN}$ ≤ 7000 MHz | -12 | | | |

## Figure 3. Pin Configuration




## Table 2. Pin Descriptions

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | $V_{DD}$ | Power supply pin. Bypassing is required (eg. 1000pF & 100pF). |
| 2 | IN | Input signal pin. Should be coupled with a capacitor (eg. 2.2pF). |
| 3 | DEC | Decoupling Pin. This pin should have two capacitors in parallel (eg. 1000pf, 10nF) |
| 4 | GND | Ground pin. Ground pattern on the board should be as wide as possible to reduce ground impedance. |
| 5 | GND | Ground pin. |
| 6 | NC | No connection. This pin should be left open. |
| 7 | OUT | Divided frequency output pin. This pin should be coupled with a capacitor (eg. 2.2pF). |
| 8 | GND | Ground Pin. |

## Table 3. Absolute Maximum Ratings

| Symbol | Parameter/Conditions | Min | Max | Units |
|---|---|---|---|---|
| $V_{DD}$ | Supply voltage | | 3.3 | V |
| Pin | Input Power | | +12 | dBm |
| $V_{IN}$ | Voltage on input | -0.3 | $V_{DD}$ +0.3 | V |
| $T_{ST}$ | Storage temperature range | -65 | 150 | °C |
| $T_{OP}$ | Operating temperature range | -40 | 85 | °C |
| VESD | ESD voltage (Human Body Model, MIL-STD 883 Method 3015.7) | | 500 | V |
| | ESD voltage (Machine Model, JEDEC, JESD22-A114-B) | | 50 | V |
| | ESD voltage (Charged Device Model, JEDEC, JESD22-C101) | | 1000 | V |

Absolute Maximum Ratings are those values listed in the above table. Exceeding these values may cause permanent device damage. Functional operation should be restricted to the limits in the DC Electrical Specifications table. Exposure to absolute maximum ratings for extended periods may affect device reliability.

## Electrostatic Discharge (ESD) Precautions

When handling this UltraCMOS™ device, observe the same precautions that you would use with other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, precautions should be taken to avoid exceeding the rating specified in Table 3.

## Latch-Up Avoidance

Unlike conventional CMOS devices, UltraCMOS™ devices are immune to latch-up.

## Device Functional Considerations

The *PE9304* divides a 1000 MHz – 7000 MHz input signal by a factor of two thereby producing an output frequency at half the input frequency. To work properly at higher frequencies, the input and output signals (pins 2 & 7) must be AC coupled via an external capacitor, as shown in the test circuit in Figure 5.

The ground pattern on the board should be made as wide as possible to minimize ground impedance.

## Evaluation Kit Operation

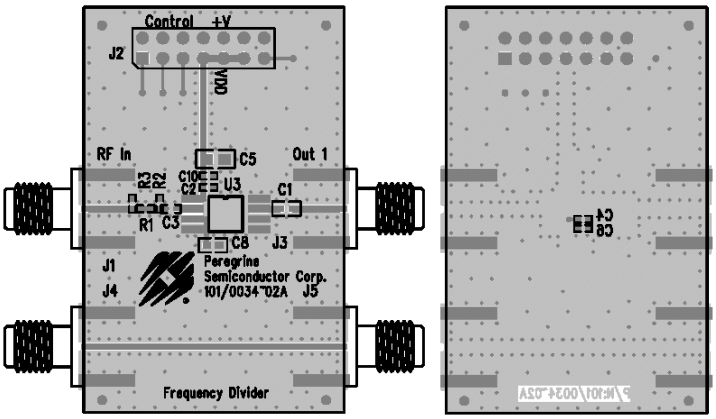
The Ceramic SOIC Prescaler Evaluation Board was designed to help customers evaluate the *PE9304* divide-by-2 prescaler. On this board, the device input (pin 2) is connected to the SMA connector J1 through a 50 Ω transmission line. A series capacitor (C3) provides the necessary DC block for the device input. A value of 2.2 pF was used for the evaluation board; other applications may require a different value.

The device output (pin 7) is connected to SMA connector J3 through a 50 Ω transmission line. A series capacitor (C1) provides the necessary DC block for the device output. This capacitor value must be chosen to have low impedance at the desired output frequency of the device. A value of 2.2 pF was chosen for the evaluation board.

J2 provides DC power to the device via pin 1. Two decoupling capacitors (C2=1000 pF, C10=100 pF) are included on this trace. It is the responsibility of the customer to determine proper supply decoupling for their design application.

The board is constructed using 4 layers. The top and bottom layers are comprised of Rogers low loss 4350 material having a core thickness of 0.010”; while the internal layers are comprised of FR-4. The overall board thickness is 0.062”.

**Figure 4. Evaluation Board Layout**
Peregrine specification 101/0034

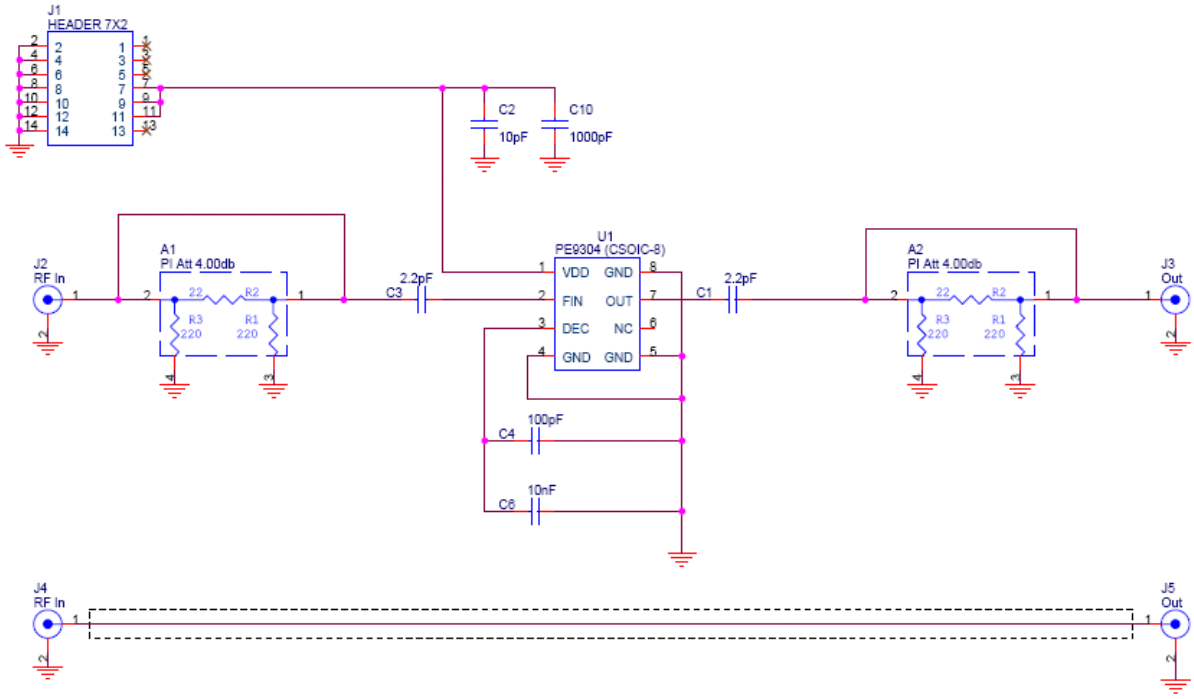



### Applications Support

If you have a problem with your evaluation kit or if you have applications questions, please contact applications support:

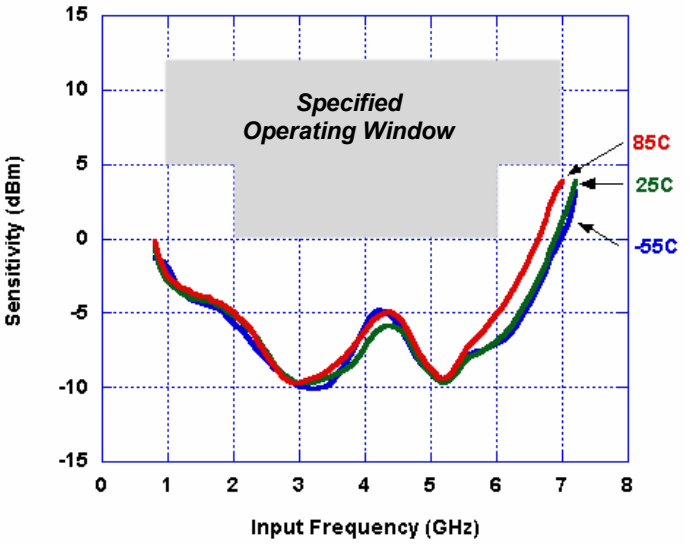
E-Mail: help@psemi.com (fastest response)
Phone: (858) 731-9400

**Figure 5. Evaluation Board Schematic**
Peregrine specification 102/0223

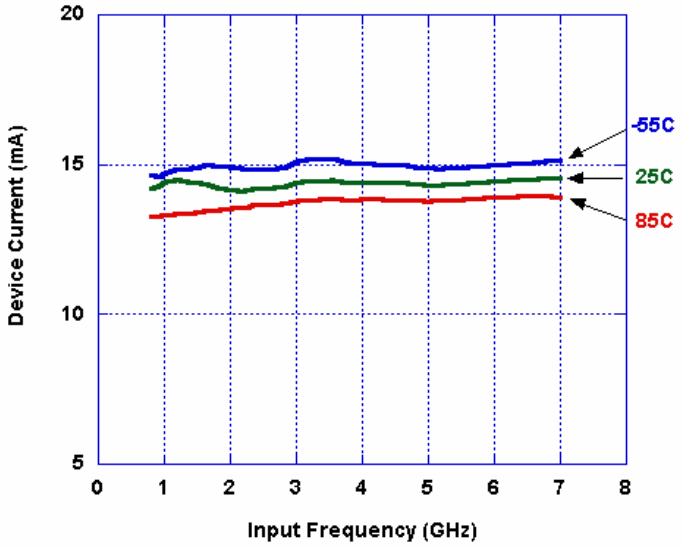


## Typical Performance Data @ +25 °C

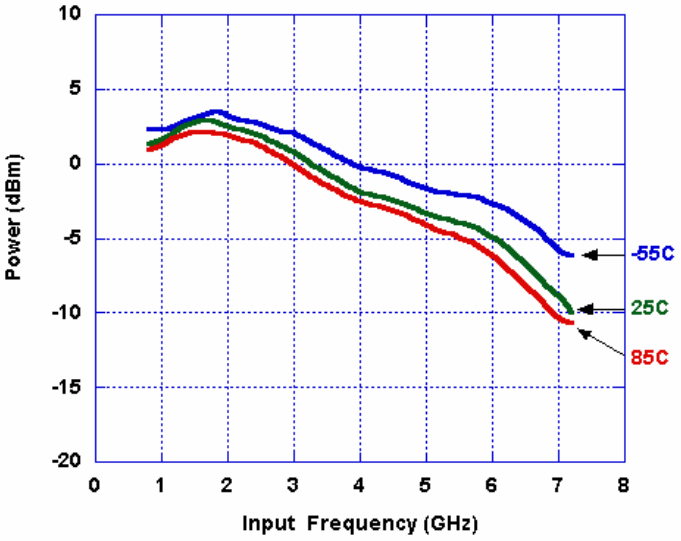
### Figure 6. Input Sensitivity




### Figure 7. Device Current

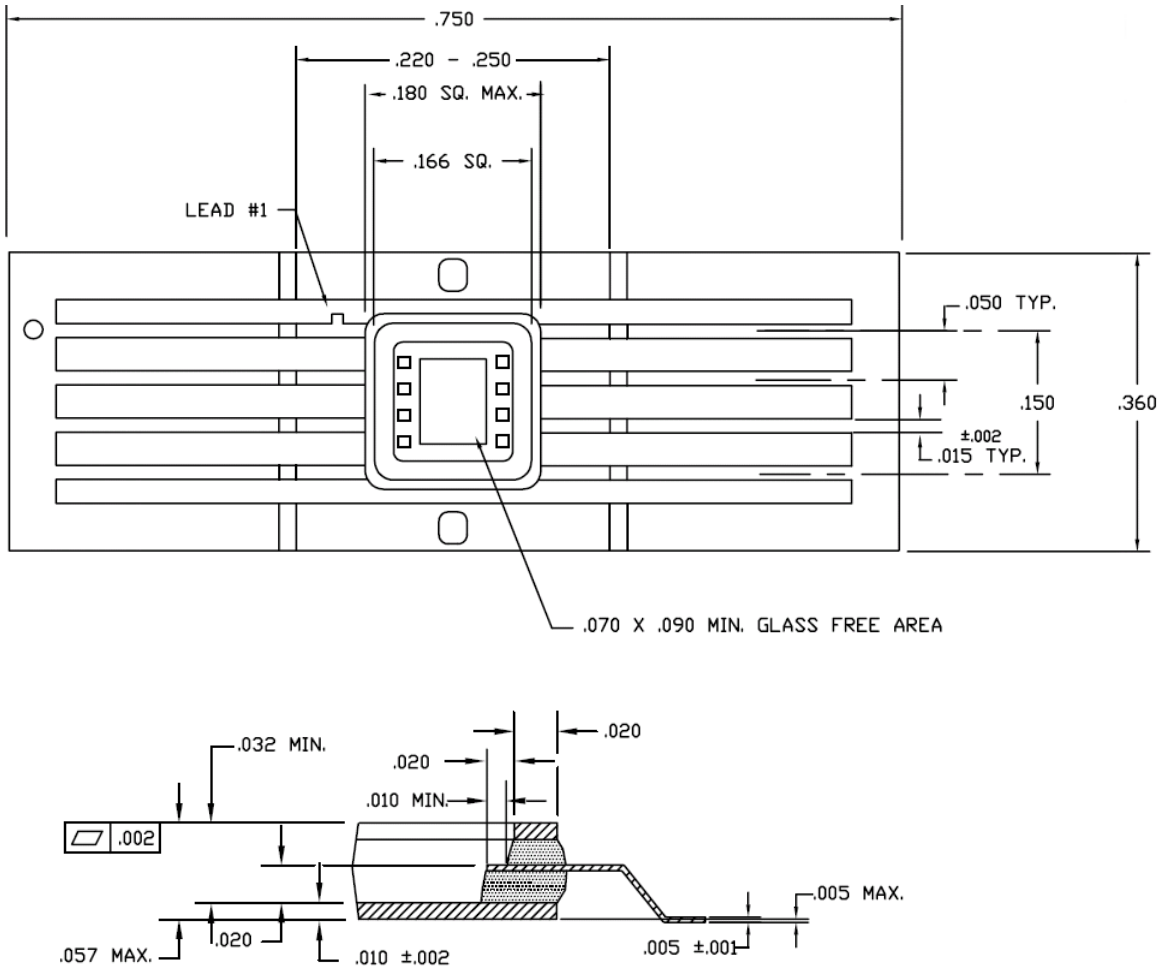



### Figure 8. Output Power



## Figure 9. Package Drawing

8-lead CSOIC




## Table 4. Ordering Information

| Order Code | Part Marking | Description | Package | Shipping Method |
|---|---|---|---|---|
| 9304-01 | PE9304 | PE9304-08CFPG-1A Engineering Samples | Gullwing Glass Flatpack | 20 / Tray |
| 9304-11 | PE9304 | PE9304-08CFPG-1A Flight Units | Gullwing Glass Flatpack | 50 / Tray |
| 9304-00 | PE9304-EK | PE9304 Evaluation Kit | Evaluation Kit | 1 / Box |

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