Product Specification

PE9309

3.0–13.5 GHz Low Power UltraCMOS® Divide-by-4 Prescaler Radiation Tolerant for Space Applications

Features

- High-frequency operation: up to 13.5 GHz
- Fixed divide ratio of 4
- Low-power operation:16 mA typical @ 2.6V
- Small package: 8-lead CFP
- Available as DIE

Product Description

he PE9309 is a high-performance dynamic UltraCMOS® prescaler with a fixed divide ratio of 4. Its operating frequency range is 3.0 GHz to 13.5 GHz. The PE9309 operates on a single supply with a frequency-selecting bias resistor and draws only 16 mA. It is packaged in a small 8-lead CFP and is also available in Die form for hybrid application.

The PE9309 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 2. Package Type
8-lead CFP

Figure 1. Functional Schematic Diagram

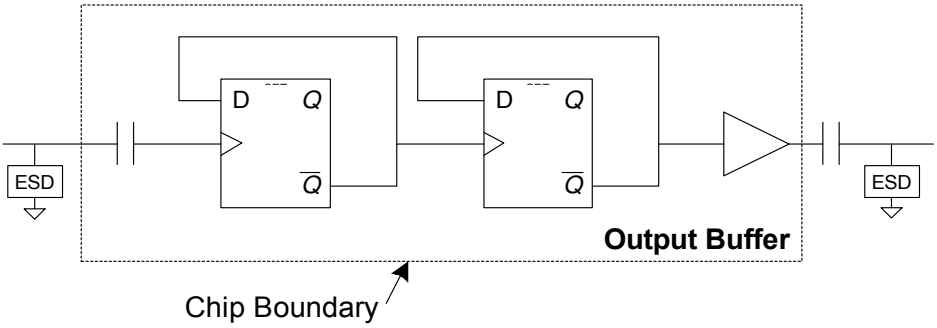


Table 1. Electrical Specifications ($Z_S = Z_L = 50\Omega$) –40 °C ≤ T_A ≤ +85 °C, unless otherwise specified

Parameter	Condition	Min	Typ	Max	Unit
Frequency		3.0		13.5	GHz
Output power, P_{OUT}	0.75 GHz ≤ F_{OUT} ≤ 3.375 GHz	0			dBm
Input power, P_{IN}	3.0 GHz ≤ F_{IN} < 13.5 GHz	0		7	dBm

Figure 3. Pin Configuration (Top View)

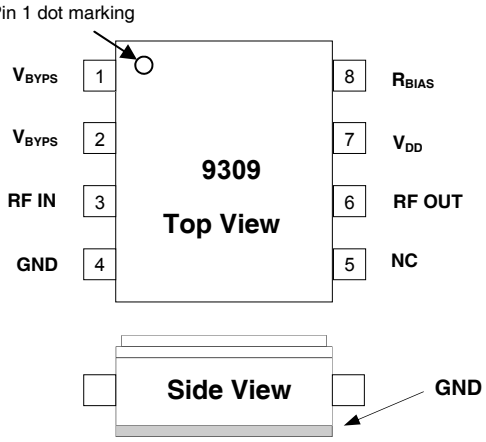


Table 2. Pin Descriptions

Pin #	Pin Name	Description
1	V_{BYPS}	Prescaler supply bypass
2	V_{BYPS}	Prescaler supply bypass
3	IN	RF input
4	GND	Ground
5	NC	Not connected
6	OUT	RF output
7	V_{DD}	Supply voltage
8	R_{BIAS}	Frequency-selecting bias resistor
GND	GND	Bottom of the package is ground. Connecting the bottom of the package to ground is required

Table 3. Operating Ranges

Parameter	Min	Typ	Max	Unit
Supply voltage, V_{DD}	2.45	2.6	2.75	V
Supply current, I_{DD}	6		23	mA

Table 4. Absolute Maximum Ratings

Symbol	Parameter/Condition	Min	Max	Unit
V_{DD}	DC supply voltage		3.0	V
T_{ST}	Storage temperature range	–65	150	°C
T_{OP}	Operating temperature range	–40	85	°C
V_{ESD}	ESD voltage (Human Body Model)		250	V
P_{IN_MAX}	Maximum input power		14	dBm

Exceeding absolute maximum ratings may cause permanent damage. Operation should be restricted to the limits in the Operating Ranges table. Operation between operating range maximum and absolute maximum for extended periods may reduce 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 specified rating.

Latch-Up Immunity

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

ELDRS

UltraCMOS devices do not include bipolar minority carrier elements, and therefore do no exhibit enhanced low dose rate sensitivity.

Device Functional Considerations

The PE9309 divides a 3.0 GHz to 13.5 GHz input signal by four, producing a 750 MHz to 3.375 GHz output signal. In order for the prescaler to work properly, several conditions need to be adhered to. It is crucial that pins 1, 2 and 7 be supplied with bypass capacitors to ground. In addition, the output signal (pin 6) needs to be ac coupled via an external capacitor as shown in the test circuit in *Figure 5*.

The input frequency range is selected by the value of R_{BIAS} according to *Figure 4*.

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

The bottom of the package is the primary ground connection and it needs to be soldered to the PCB ground.

Figure 4. Frequency vs R_{BIAS}

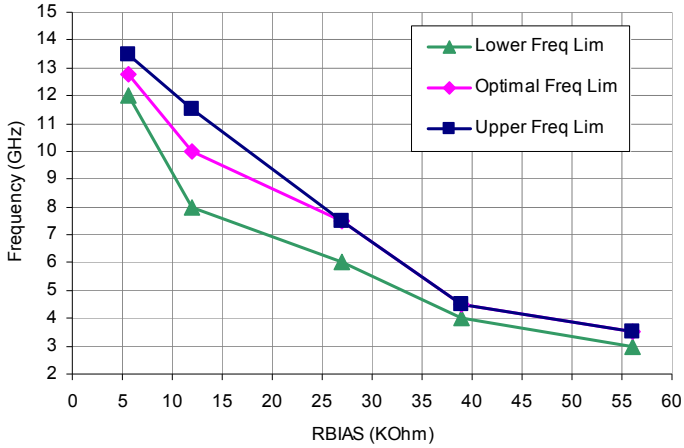
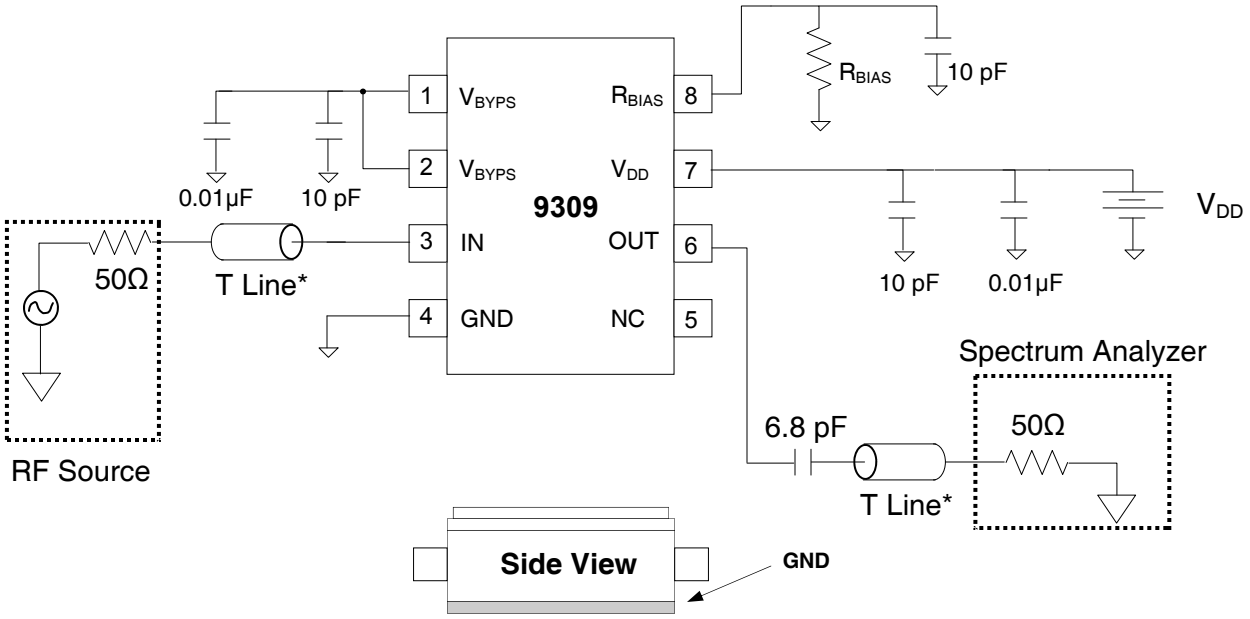


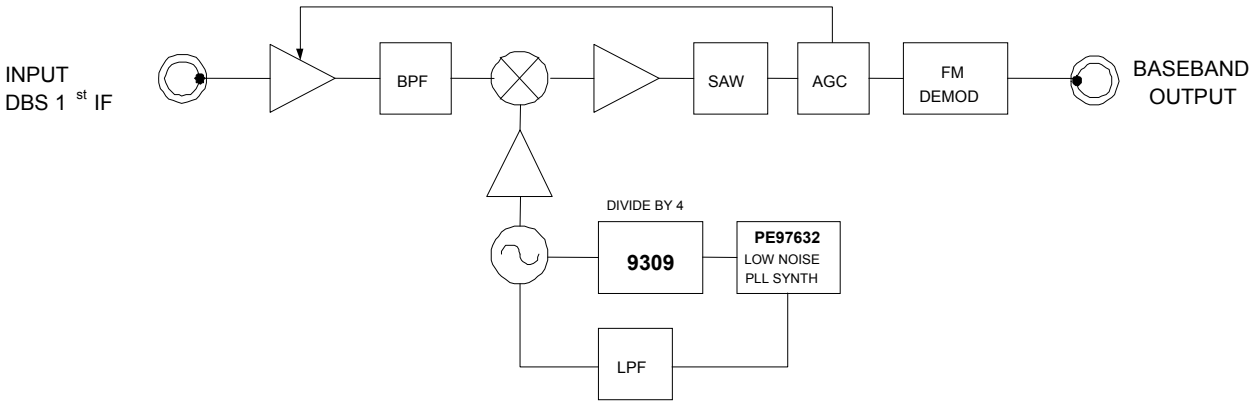
Figure 5. Test Circuit Block Diagram



*T Line = Transmission Line

Figure 6. High Frequency System Application

The wideband frequency of operation of the PE9309 makes it an ideal part for use in a DBS down converter system.



Evaluation Kit

The ceramic CFP prescaler evaluation board was designed to help customers evaluate the PE9309 divide-by-4 prescaler. On this board, the device input (pin 3) is connected to the SMA connector J5 through a 50Ω transmission line. The device output (pin 6) is connected to SMA connector J6 through a 50Ω transmission line.

J4 provides DC power to the device via pin 7. J2 powers U2. Multiple decoupling capacitors (C4, 6, 13, 16 = 10pF, C3, 5, 14, 15 = 0.01uF) are used. One out of eight different resistors for R_{BIAS} is selected by toggling SW1, SW2 and SW3 according to the table shown in *Figure 8.* Jumper on J3 should be on to lower setting (1 and 2). 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 comprise Rogers low loss 4350 material having a core thickness of 0.010" while the internal layers comprise FR-4. The overall board thickness is 0.062".

Figure 7. Evaluation Board Layouts

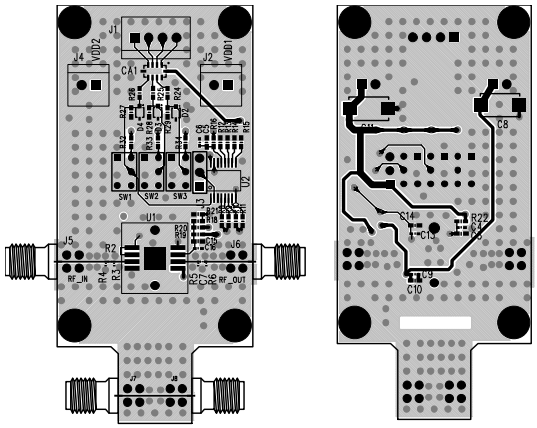


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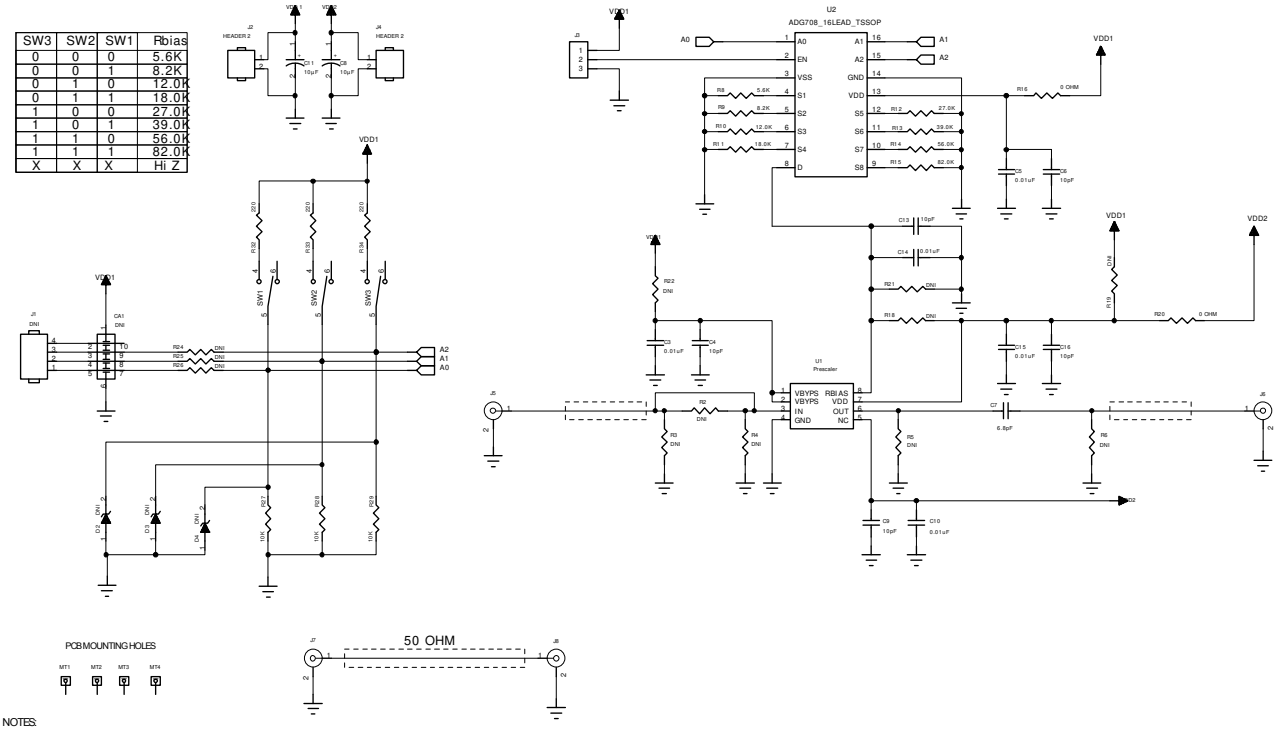
Figure 8. Evaluation Board Schematic

SW3	SW2	SW1	Rbias
0	0	0	5.6K
0	0	1	8.2K
0	1	0	12.0K
0	1	1	18.0K
1	0	0	27.0K
1	0	1	39.0K
1	1	0	56.0K
1	1	1	82.0K
X	X	X	Hi Z



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NOTES:

1. USE 101-0392-01 PCB
2. CAUTION:
   CONTAINS PARTS AND ASSEMBLIES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD)
3. ALL TRANSMISION LINES ARE:
   35MIL WIDTH, 14MIL GAPS, 20MIL CORE DIELECTRIC 3.48 Er AND 2.8MIL Cu THICKNESS.

Figure 9. Package Drawing
8-lead CFP

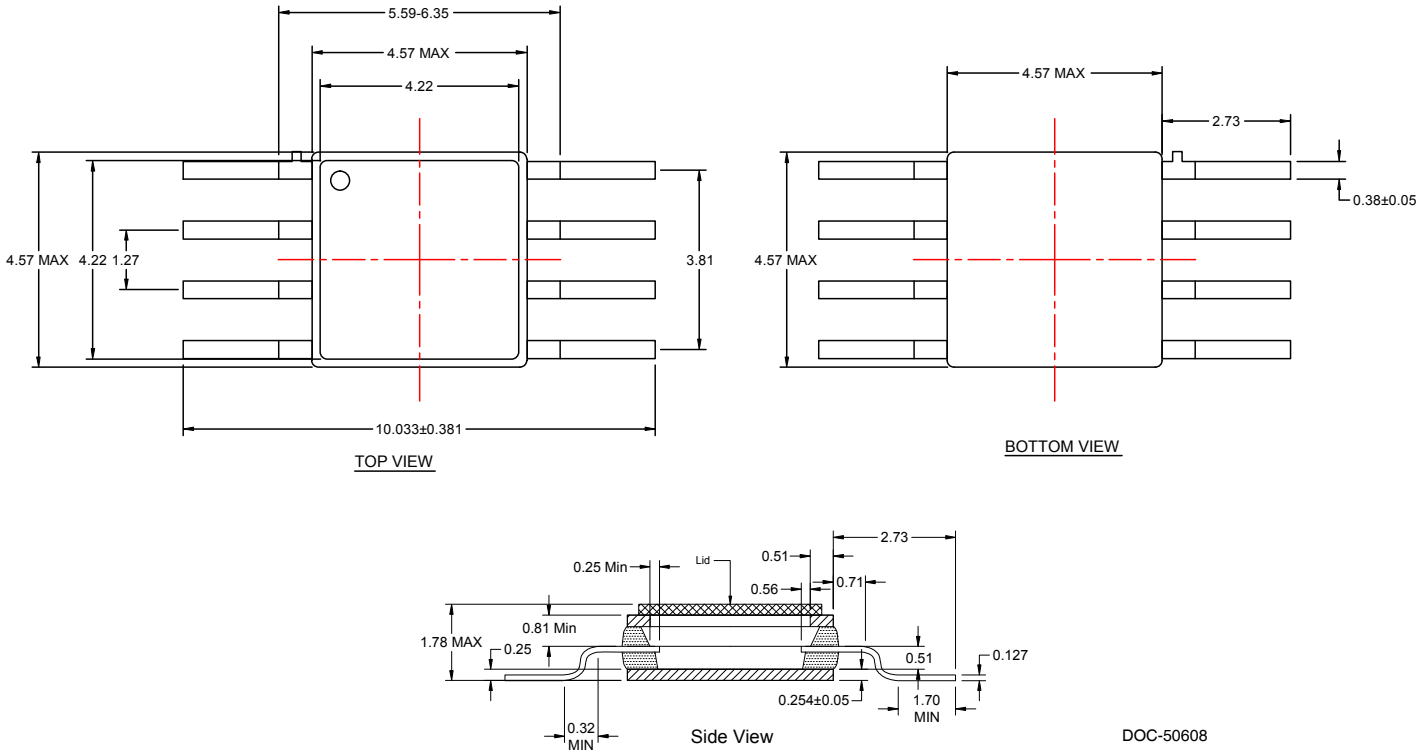
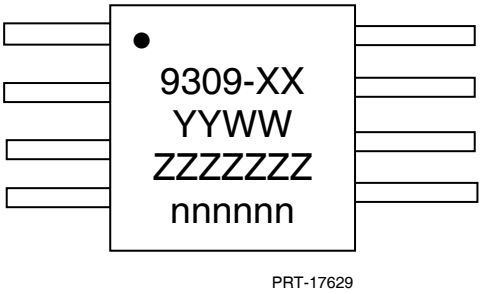


Figure 10. Top Marking Specifications



● = Pin 1 indicator

9309-XX = Part number (XX will be specified by the PO and/or the assembly instructions)

YYWW = Date code, last two digits of the year and work week

ZZZZZZZ = Lot code (up to seven digits)

nnnnnn = Serial number of the part (up to six digits)

Table 5. Ordering Information

Order Code	Description	Package	Shipping Method
9309–01*	PE9309–08CFPJ–B Engineering samples	8-lead CFP	50 / Tray
9309–11	PE9309–08CFPJ–B Production units	8-lead CFP	50 / Tray
9309–00	PE9309 Evaluation kit	Evaluation kit	1 / Box

Note: * The 9309-01 devices are engineering sample (ES) prototype units intended for use as initial evaluation units for customers of the PE9309-11 flight units. The PE9309-01 device provides the same functionality and footprint as the PE9309-11 space qualified device, and intended for engineering evaluation only. They are tested at +25 °C only and processed to a non-compliant flow (e.g. no burn-in, non-hermetic, etc). These units are non-hermetic and are not suitable for qualification, production, radiation testing or flight use.

Sales Contact and Information

Contact Information:
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Advance Information: The product is in a formative or design stage. The datasheet contains design target specifications for product development. Specifications and features may change in any manner without notice. ***Preliminary Specification:*** The datasheet contains preliminary data. Additional data may be added at a later date. Peregrine reserves the right to change specifications at any time without notice in order to supply the best possible product. ***Product Specification:*** The datasheet contains final data. In the event Peregrine decides to change the specifications, Peregrine will notify customers of the intended changes by issuing a CNF (Customer Notification Form).