# WS7916DC

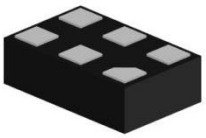
## CMOS High Gain GPS LNA

http//:www.sh-willsemi.com

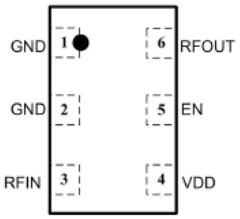
## Descriptions

The WS7916DC is a low noise amplifier (LNA) for GNSS receiver applications, available in a small 6-pin DFN package. The WS7916DC requires only one external inductor for input matching.

The WS7916DC is designed to achieve low power dissipation and good performance.



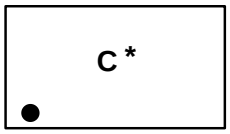
**DFN1510-6L (Bottom view)**




**Pin configuration (Top view)**

## Features

- Operating frequency: 1550 MHz to 1615 MHz
- Noise figure = 0.60 dB
- Gain = 17.0 dB
- Input 1 dB compression point = -7.0 dBm
- In-band input IP3 = +4.0 dBm
- Supply voltage: 1.8 V to 3.1 V
- Integrated supply decoupling capacitor
- Supply current: 8.0 mA
- Power-down mode leakage current < 10μA
- One external matching inductor required
- Output decoupled to ground
- ESD protection: HBM > 2.0kV for all pins
- Integrated input/output DC block capacitor
- Integrated output matching
- Package: 6-pin DFN, 1.5 x 1.0 x 0.55 $mm^3$
- Process: CMOS




C = Device code

* = Month code（A~Z）

**Marking (Top view)**

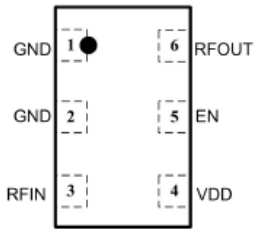
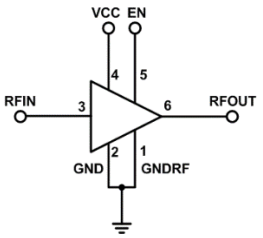
## Applications

- Cell phones
- Tablets
- Other RF front-end modules

Order information

| Device | Package | Shipping |
|---|---|---|
| WS7916DC-6/TR | DFN1510-6L | 3000/Reel&Tape |

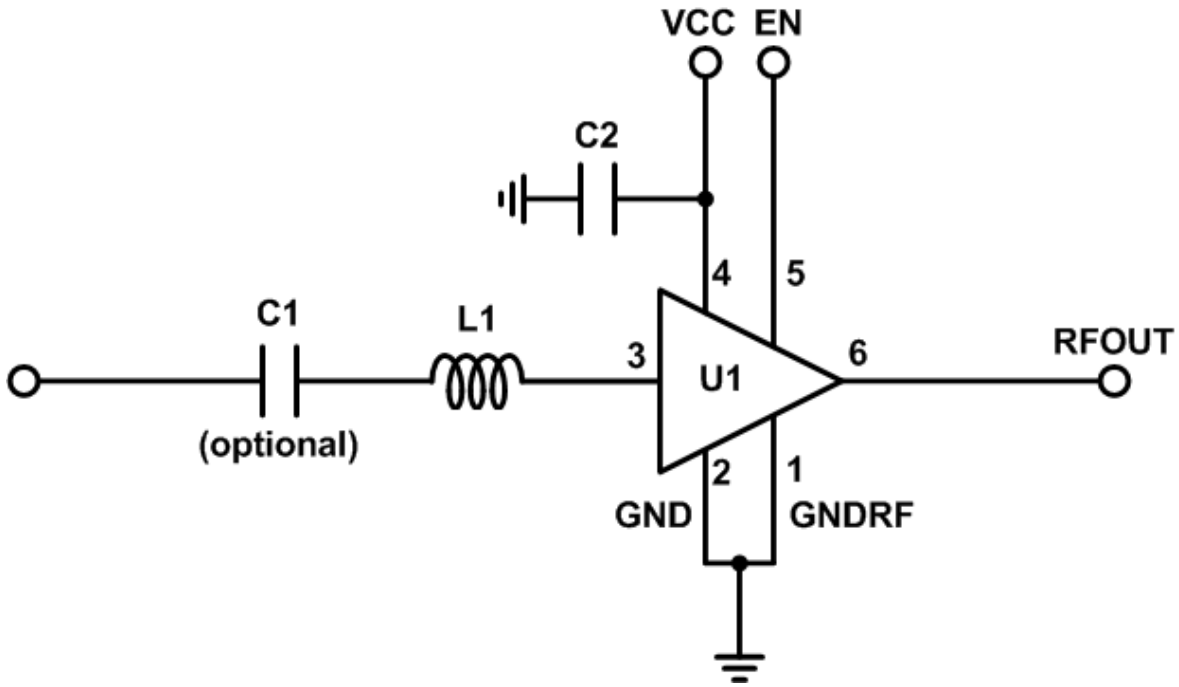
## Pinning Information

| Pin | Description | Transparent top view | Symbol view |
|---|---|---|---|
| 1 | GNDRF |  |  |
| 2 | GND | | |
| 3 | RFIN | | |
| 4 | VDD | | |
| 5 | EN | | |
| 6 | RFOUT | | |





## Application Information




| Symbol | Description | Footprint | Value | Supplier | Comment |
|---|---|---|---|---|---|
| U1 | WS7916DC | 1.5x1.0x0.55 $mm^3$ | NA | Will-Semi | DUT |
| C1 | Capacitor | 0402 | 1 nF | Various | DC blocking |
| C2 | Capacitor | 0402 | 1 nF | Various | Supply decoupling |
| L1 | Inductor | 0402 | 10 nH | Murata LQW15 | Input matching |

## Quick Reference Data

Freq = 1575.42 MHz; $V_{CC}$ = 2.8 V; $V_{EN}$ >1.2 V; Temp = 25°C; input matched to 50 Ω with a 10 nH inductor. The condition is applied unless otherwise specified.

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 1.6 | 2.8 | 3.1 | V |
| $I_{CC}$ | Supply current | | | 8.0 | | mA |
| $G_p$ | Power gain | | | 17.0 | | dB |
| NF | Noise figure | | | 0.60 | | dB |
| $IP_{1dB}$ | Input power at 1dB gain compression | | | -7.0 | | dBm |
| $IIP_3$ | Input third-order intercept point | | | +4.0 | | dBm |

## Recommended Operating Conditions

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 1.6 | 2.8 | 3.1 | V |
| Temp | Ambient temperature | | -40 | +25 | +85 | °C |
| $V_{EN}$ | Input voltage on pin 6 (EN) | OFF state | 0 | | 0.3 | V |
| | | ON state | 1.2 | | $V_{CC}$ | V |

## Absolute Maximum Ratings

Maximum ratings are absolute ratings, exceeding only one of these values may cause irreversible damage to the integrated circuit.

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | -0.3 | 3.3 | V |
| $V_{EN}$ | Input voltage on pin EN | | -0.3 | 3.3 | V |
| $V_{RFIN}$ | Input voltage on pin RFIN | | -0.3 | 3.3 | V |
| $V_{RFOUT}$ | Input voltage on pin RFOUT | | -0.3 | 3.3 | V |
| $P_{in}$ | RF input power | | | 0 | dBm |
| $T_{STG}$ | Storage temperature | | -65 | +150 | °C |
| $T_J$ | Junction temperature | | | 150 | °C |
| $V_{ESD}$ | ESD capability all pins | Human Body Model (HBM) | | ±2000 | V |

## Characteristics

1550 MHz ≤ f ≤ 1615 MHz; $V_{CC}$ = 2.8 V; $V_{EN}$ > 1.2 V; Temp = 25°C; input mated to 50 Ω with a 10 nH inductor; The condition is applied unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply current | On state | | 8.0 | | mA |
| | | Off state | | 8.5 | 10 | μA |
| $G_p$ | Power gain | f = 1575 MHz | | 17.0 | | dB |
| $RL_{in}$ | Input return loss | f = 1575 MHz | | 6.0 | | dB |
| $RL_{out}$ | Output return loss | f = 1575 MHz | | 18.0 | | dB |
| ISL | Reverse isolation | f = 1575 MHz | | 26.0 | | dB |
| NF | Noise figure | f = 1575 MHz | | 0.60 | | dB |
| $IP_{1dB}$ | Input power at 1 dB gain compression | f = 1575 MHz | | -7.0 | | dBm |
| $IIP_3$ | Input third-order intercept point [1] | | | +4.0 | | dBm |
| K | Rollett stability factor[2] | | 1 | | | |
| $t_{on}$ | Turn-on time | | | | 5 | μs |
| $t_{off}$ | Turn-off time | | | | 5 | μs |

[1] $f_1$ = 1713 MHz, $f_2$ = 1851 MHz, $P_{in}$ = -20 dBm

[2] 10M~20GHz

## Characteristics

1550 MHz ≤ f ≤ 1615 MHz; $V_{CC}$ = 1.8 V; $V_{EN}$ > 1.2 V; Temp = 25°C; input mated to 50 Ω with a 10 nH inductor; The condition is applied unless otherwise specified.

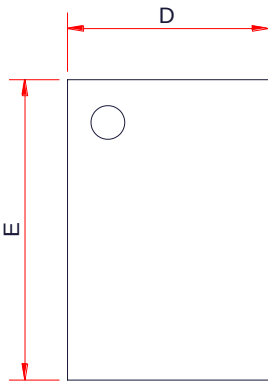
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply current | On state | | 8.2 | | mA |
| | | Off state | | 4.5 | 5.5 | μA |
| $G_p$ | Power gain | f = 1575 MHz | | 17.0 | | dB |
| $RL_{in}$ | Input return loss | f = 1575 MHz | | 5.8 | | dB |
| $RL_{out}$ | Output return loss | f = 1575 MHz | | 18.5 | | dB |
| ISL | Reverse isolation | f = 1575 MHz | | 25.5 | | dB |
| NF | Noise figure | f = 1575 MHz | | 0.60 | | dB |
| $IP_{1dB}$ | Input power at 1 dB gain compression | f = 1575 MHz | | -10.0 | | dBm |
| $IIP_3$ | Input third-order intercept point [1] | | | +3.5 | | dBm |
| K | Rollett stability factor[2] | | 1 | | | |
| $t_{on}$ | Turn-on time | | | | 5 | μs |
| $t_{off}$ | Turn-off time | | | | 5 | μs |

[1] f1 = 1713 MHz, f2 = 1851 MHz, Pin = -20 dBm

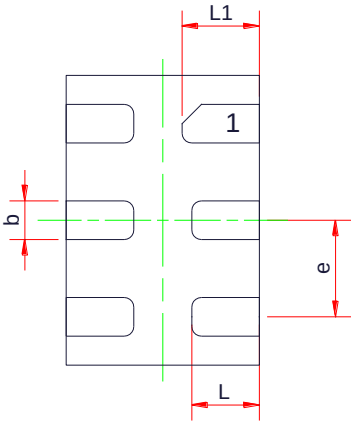
[2] 10M~20GHz

## Package Outline dimensions

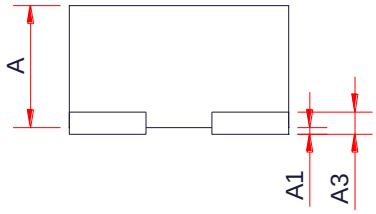
### DFN1510-6L




TOP VIEW




BOTTOM VIEW

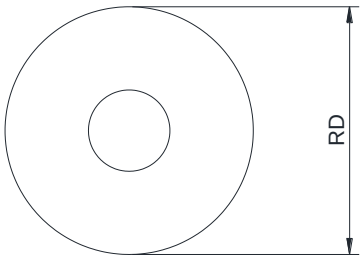



SIDE VIEW

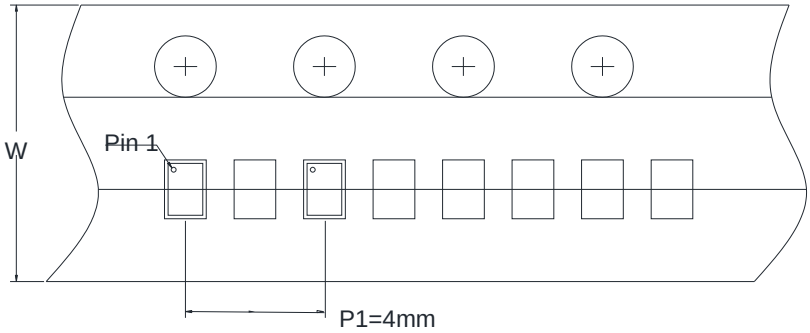
| Symbol | Dimensions in Millimeters | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 0.50 | 0.55 | 0.60 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.13Ref | | |
| D | 0.90 | 1.00 | 1.10 |
| E | 1.40 | 1.50 | 1.60 |
| b | 0.15 | 0.20 | 0.25 |
| e | 0.40 | 0.50 | 0.50 |
| L | 0.27 | - | 0.42 |
| L1 | 0.32 | - | 0.48 |

## TAPE AND REEL INFORMATION

### Reel Dimensions

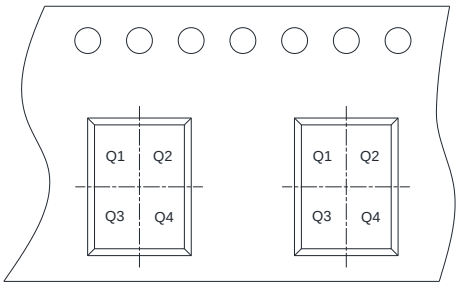



### Tape Dimensions




**Note：Tape material is plastic. Pitch between successive cavity centers is 2mm.**

### Quadrant Assignments For PIN1 Orientation In Tape






User Direction of Feed

| | | | | | |
|---|---|---|---|---|---|
| RD | Reel Dimension | ☑ 7inch | ☐ 13inch | | |
| W | Overall width of the carrier tape | ☑ 8mm | ☐ 12mm | ☐ 16mm | |
| P1 | Pitch between successive chip centers | ☐ 2mm | ☑ 4mm | ☐ 8mm | |
| Pin1 | Pin1 Quadrant | ☑ Q1 | ☐ Q2 | ☐ Q3 | ☐ Q4 |