

## WS7916DE-6/TR

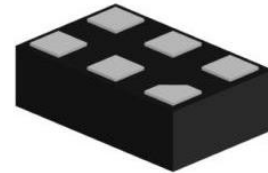
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### CMOS High Gain GPS LNA

#### Descriptions

The WS7916DE-6/TR is a low noise amplifier (LNA) for GNSS receiver applications, available in a small 6-pin DFN package. The WS7916DE-6/TR requires only one external inductor for input matching.

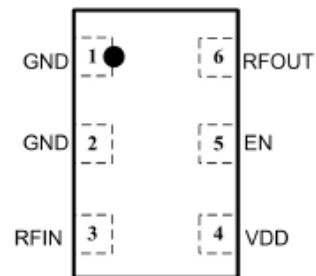
The WS7916DE-6/TR is designed to achieve low power dissipation and good performance.



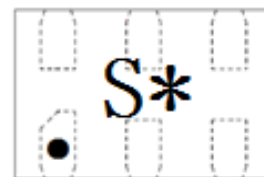
**DFN1510-6L (Bottom view)**

#### Features

- Operating frequency: 1550 MHz to 1615 MHz
- Noise figure = 0.55 dB
- Gain = 19.0 dB
- Input 1 dB compression point = -11.5 dBm
- In-band input IP3 = -0.7 dBm
- Supply voltage: 1.6 V to 3.1 V
- Integrated supply decoupling capacitor
- Supply current: 8.5 mA
- Power-down mode leakage current < 1μA
- 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<sup>3</sup>



**Pin configuration (Top view)**



S = Device code  
\* = Month code (A~Z)

**Marking (Top view)**

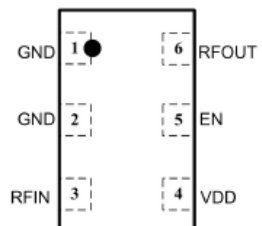
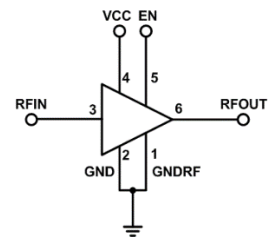
#### Applications

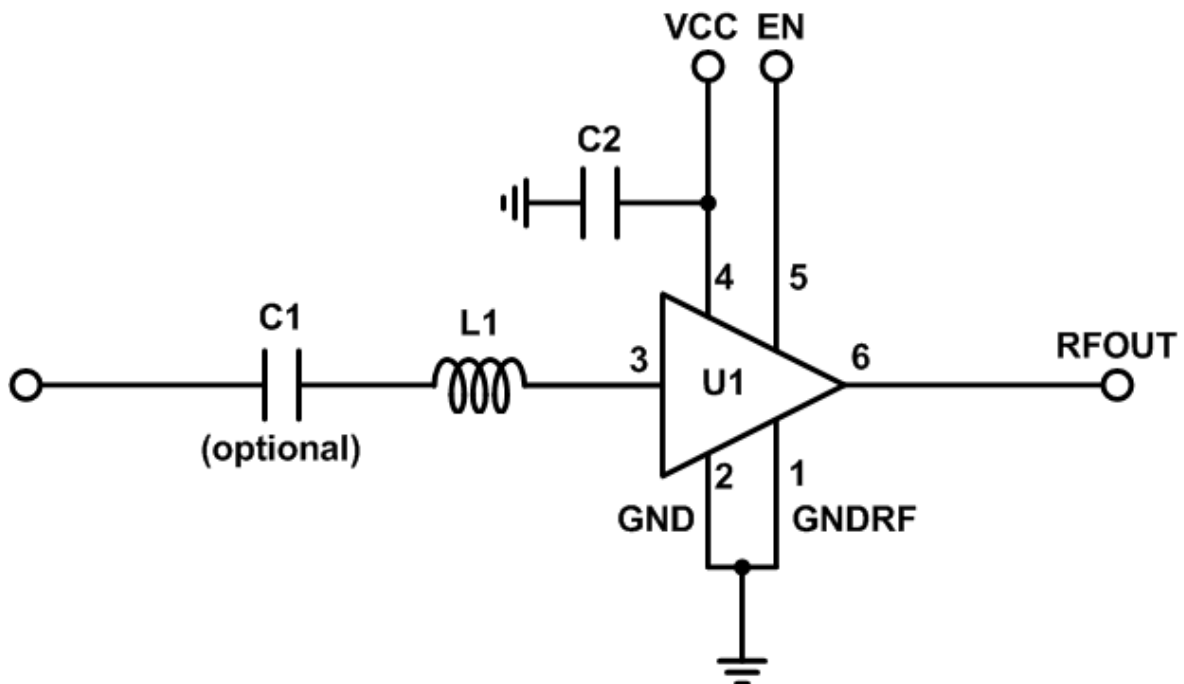
- Cell phones
- Tablets PCs
- Other RF front-end modules
- Personal Navigation Devices,
- Digital Video Cameras
- RF Front End modules;
- Complete GPS chipset modules;
- Theft protection(laptop, ATM);

#### Order information

| Device        | Package    | Shipping       |
|---------------|------------|----------------|
| WS7916DE-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     | WS7916DE-6/TR | 1.5x1.0x0.55 mm <sup>3</sup> | NA    | Will-Semi    | DUT               |
| C1     | Capacitor     | 0402                         | 1 nF  | Various      | DC blocking       |
| C2     | Capacitor     | 0402                         | 1 nF  | Various      | Supply decoupling |
| L1     | Inductor      | 0402                         | 12 nH | Murata LQW15 | Input matching    |

### Quick Reference Data

Freq = 1575.42 MHz;  $V_{CC} = 2.8\text{ V}$ ;  $V_{EN} > 1.2\text{ V}$ ; Temp = 25°C; input matched to 50  $\Omega$  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                      |           |     | 8.5   |     | mA   |
| $G_p$      | Power gain                          |           |     | 19.0  |     | dB   |
| NF         | Noise figure                        |           |     | 0.55  |     | dB   |
| $IP_{1dB}$ | Input power at 1dB gain compression |           |     | -11.5 |     | dBm  |
| $IIP_3$    | Input third-order intercept point   |           |     | -0.7  |     | 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       | 3.6      | V    |
| $V_{EN}$    | Input voltage on pin EN    |           | -0.3       | $V_{CC}$ | V    |
| $V_{RFIN}$  | Input voltage on pin RFIN  |           | -0.3       | $V_{CC}$ | V    |
| $V_{RFOUT}$ | Input voltage on pin RFOUT |           | -0.3       | $V_{CC}$ | V    |
| $P_{in}$    | RF input power             |           |            | 20       | dBm  |
| $T_{STG}$   | Storage temperature        |           | -65        | +150     | °C   |
| $T_J$       | Junction temperature       |           |            | 150      | °C   |
| $V_{ESD}$   | ESD capability all pins    | HBM       | $\pm 2000$ |          | V    |
|             | ESD capability all pins    | CDM       | $\pm 500$  |          | V    |

**Characteristics**

1550 MHz  $\leq$  f  $\leq$  1615 MHz; V<sub>CC</sub> = 2.8 V; V<sub>EN</sub> > 1.2 V; Temp = 25°C; input matched to 50  $\Omega$  with a 12 nH inductor; The condition is applied unless otherwise specified.

| Symbol            | Parameter  | Conditions   | Min | Typ   | Max | Unit    |
|-------------------|--|--------------|-----|-------|-----|---------|
| I <sub>CC</sub>   | Supply current                                   | On state     |     | 8.5   |     | mA      |
|                   |  | Off state    |     | 1     |     | $\mu$ A |
| G <sub>p</sub>    | Power gain                                       | f = 1575 MHz |     | 19.0  |     | dB      |
| RL <sub>in</sub>  | Input return loss                                | f = 1575 MHz |     | 9.0   |     | dB      |
| RL <sub>out</sub> | Output return loss                               | f = 1575 MHz |     | 11.0  |     | dB      |
| ISL               | Reverse isolation                                | f = 1575 MHz |     | 35.0  |     | dB      |
| NF                | Noise figure                                     | f = 1575 MHz |     | 0.55  |     | dB      |
| IP <sub>1dB</sub> | Input power at 1dB gain compression              | f = 1575 MHz |     | -11.5 |     | dBm     |
| IIP <sub>3</sub>  | Input third-order intercept point <sup>[1]</sup> |              |     | -0.7  |     | dBm     |
| K                 | Rollett stability factor <sup>[2]</sup>          |              | 1   |       |     |         |
| t <sub>on</sub>   | Turn-on time                                     |              |     |       | 3   | $\mu$ s |
| t <sub>off</sub>  | Turn-off time                                    |              |     |       | 3   | $\mu$ s |

[1] f<sub>1</sub> = 1713 MHz, f<sub>2</sub> = 1851 MHz, P<sub>in</sub> = -20 dBm

[2] 10M~20GHz

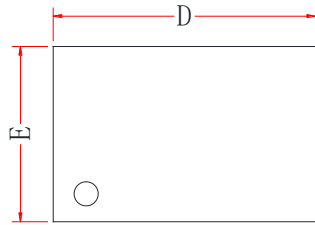
**Characteristics**

1550 MHz ≤ f ≤ 1615 MHz; V<sub>CC</sub> = 1.8 V; V<sub>EN</sub> > 1.2 V; Temp = 25°C; input matched to 50 Ω with a 12 nH inductor; The condition is applied unless otherwise specified.

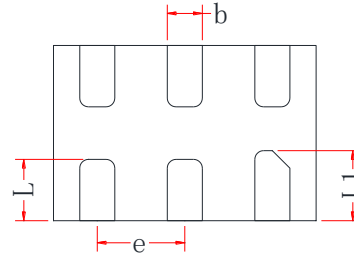
| Symbol            | Parameter  | Conditions   | Min | Typ   | Max | Unit |
|-------------------|--|--------------|-----|-------|-----|------|
| I <sub>CC</sub>   | Supply current                                   | On state     |     | 7.3   |     | mA   |
|                   |  | Off state    |     | 1     |     | μA   |
| G <sub>p</sub>    | Power gain                                       | f = 1575 MHz |     | 18.8  |     | dB   |
| RL <sub>in</sub>  | Input return loss                                | f = 1575 MHz |     | 8.0   |     | dB   |
| RL <sub>out</sub> | Output return loss                               | f = 1575 MHz |     | 10.0  |     | dB   |
| ISL               | Reverse isolation                                | f = 1575 MHz |     | 35.0  |     | dB   |
| NF                | Noise figure                                     | f = 1575 MHz |     | 0.55  |     | dB   |
| IP <sub>1dB</sub> | Input power at 1 dB gain compression             | f = 1575 MHz |     | -12.5 |     | dBm  |
| IIP <sub>3</sub>  | Input third-order intercept point <sup>[1]</sup> |              |     | -0.8  |     | dBm  |
| K                 | Rollett stability factor <sup>[2]</sup>          |              | 1   |       |     |      |
| t <sub>on</sub>   | Turn-on time                                     |              |     |       | 3   | μs   |
| t <sub>off</sub>  | Turn-off time                                    |              |     |       | 3   | μs   |

[1] f<sub>1</sub> = 1713 MHz, f<sub>2</sub> = 1851 MHz, P<sub>in</sub> = -20 dBm

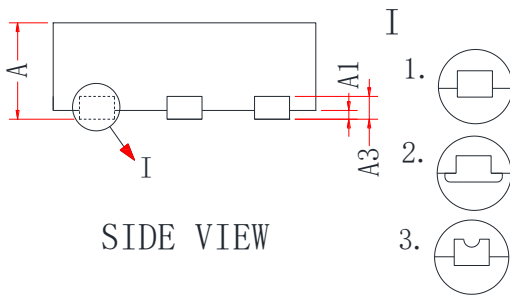
[2] 10M~20GHz

**Package Outline dimensions**
**DFN1510-6L**


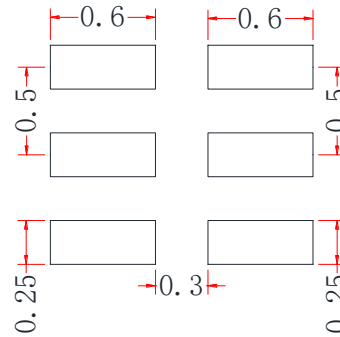
TOP VIEW



BOTTOM VIEW

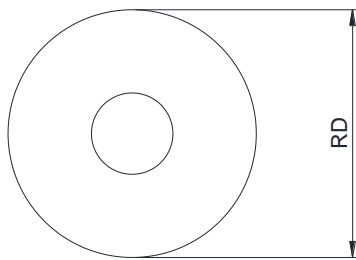
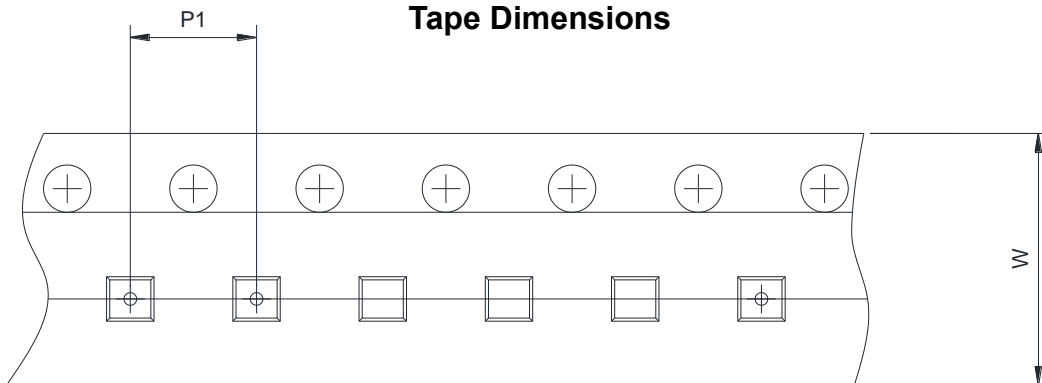
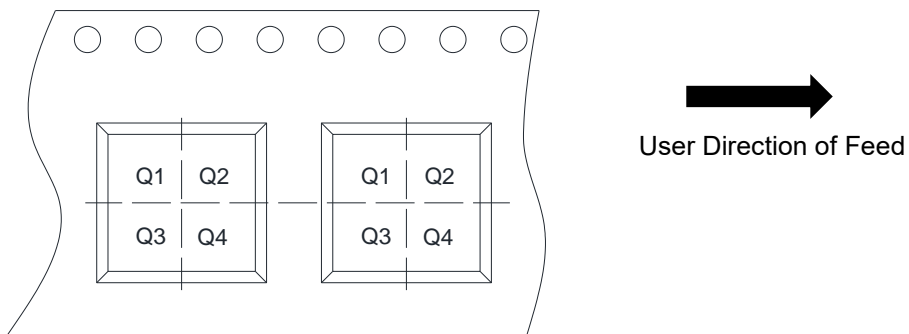


SIDE VIEW



RECOMMENDED LAND PATTERN (Unit:mm)

| Symbol | Dimensions in Millimeters |      |      |
|--------|---------------------------|------|------|
|        | Min.                      | Typ. | Max. |
| A      | 0.50                      | 0.55 | 0.60 |
| A1     | 0.00                      | -    | 0.05 |
| A3     | 0.13Ref                   |      |      |
| D      | 1.40                      | 1.50 | 1.60 |
| E      | 0.90                      | 1.00 | 1.10 |
| b      | 0.15                      | 0.20 | 0.25 |
| e      | 0.40                      | 0.50 | 0.60 |
| L      | 0.27                      | -    | 0.43 |
| L1     | 0.32                      | -    | 0.48 |

**Tape and Reel Information**
**Reel Dimensions**

**Tape Dimensions**

**Quadrant Assignments For PIN1 Orientation In Tape**


|      |   |   |   |
|------|---|---|---|
| RD   | Reel Dimension                          | <input checked="" type="checkbox"/> 7inch | <input type="checkbox"/> 13inch   |
| W    | Overall width of the carrier tape       | <input checked="" type="checkbox"/> 8mm   | <input type="checkbox"/> 12mm <input type="checkbox"/> 16mm                         |
| P1   | Pitch between successive cavity centers | <input type="checkbox"/> 2mm              | <input checked="" type="checkbox"/> 4mm <input type="checkbox"/> 8mm                |
| Pin1 | Pin1 Quadrant                           | <input checked="" type="checkbox"/> Q1    | <input type="checkbox"/> Q2 <input type="checkbox"/> Q3 <input type="checkbox"/> Q4 |

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