

## WS7931D

<http://www.sh-willsemi.com>

### CMOS medium band LTE LNA

#### Descriptions

The WS7931D is a low noise amplifier (LNA) for LTE receiver applications, available in a small 6-pin DFN package. The WS7931D requires only one external inductor for input matching.

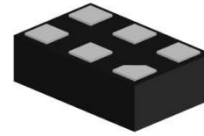
The WS7931D is designed to achieve low power dissipation and good performance. It is designed and optimized for the LTE medium band: 1805MHz to 2200MHz.

#### Features

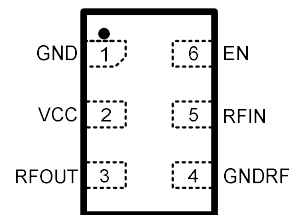
- Operating frequency: 1805 MHz to 2200 MHz
- Noise figure = 1.0 dB
- Gain = 12.1 dB
- Input 1 dB compression point = -3.5 dBm
- In-band input IP3 = +5.0 dBm
- Supply voltage: 1.8 V to 3.1 V
- Integrated supply decoupling capacitor
- Supply current: 5.6 mA
- Power-down mode leakage current < 1μA
- One external matching inductor required
- Output decoupled to ground
- ESD protection: HBM > 2.0kV for all pins
- Integrated output matching
- Package: 6-pin DFN, 1.1 x 0.7 x 0.55 mm<sup>3</sup>
- Process: CMOS

#### Applications

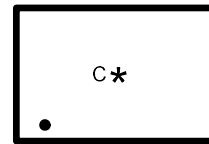
- Cell phones
- Tablets
- Other RF front-end modules



**DFN1107-6L (Bottom view)**



**Pin configuration (Top view)**



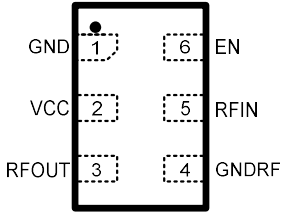
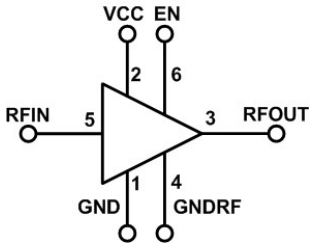
C = Device code  
\* = Month code (A~Z)

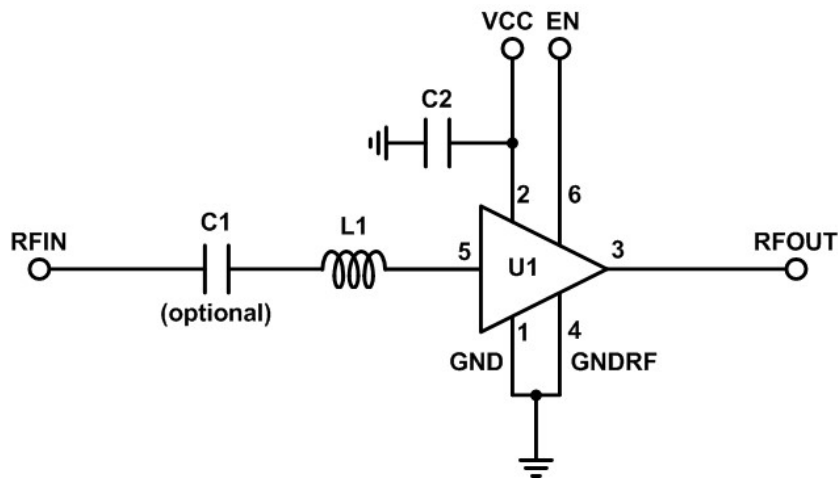
**Marking (Top view)**

#### Order information

Device	Package	Shipping
WS7931D-6/TR	DFN1107-6L	10000/Reel&Tape

**Pinning information**

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

**Application information**


Symbol	Description	Footprint	Value	Supplier	Comment
U1	WS7931D	1.1x0.7x0.55 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	8.2 nH	Murata LQW15	Input matching

### Quick reference data

freq = 2150 MHz;  $V_{CC} = 2.8\text{ V}$ ;  $V_{EN} > 2V_{CC}/3$ ; Temp = 25°C; input matched to 50  $\Omega$  with a 8.2 nH inductor. The condition is applied unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{CC}$	Supply voltage		1.8	2.8	3.1	V
$I_{CC}$	Supply current		4.0	5.6	10.2	mA
$G_p^{[1]}$	Power gain	f = 2150 MHz	10.1	12.1	14.1	dB
NF <sup>[1]</sup>	Noise figure	f = 2150 MHz		1.0	1.5	dB
IP <sub>1dB</sub> <sup>[1]</sup>	Input power at 1dBgain compression		-6.5	-3.5		dBm
IIP <sub>3</sub> <sup>[1]</sup>	Input third-order intercept point		+0.0	+5.0		dBm

[1] Guaranteed by device design; not tested in production

### Recommended operating conditions

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{CC}$	Supply voltage		1.8		3.1	V
Temp	Ambient temperature		-40	+25	+85	°C
$V_{EN}$	Input voltage on pin 6 (EN)	OFF state		0	$V_{CC}/3$	V
		ON state	$2V_{CC}/3$	$V_{CC}$		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	3.1	V
$V_{EN}$	Input voltage on pin EN		-0.3	3.1	V
$V_{RFIN}$	Input voltage on pin RFIN		-0.3	3.1	V
$V_{RFOUT}$	Input voltage on pin RFOUT		-0.3	3.1	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)		$\pm 2000$	V

**Characteristics**

1805 MHz ≤ f ≤ 2200 MHz; V<sub>CC</sub> = 2.8 V; V<sub>EN</sub> > 2V<sub>CC</sub>/3; Temp = 25°C; input mated to 50 Ω with a 8.2 nH inductor; The condition is applied unless otherwise specified.

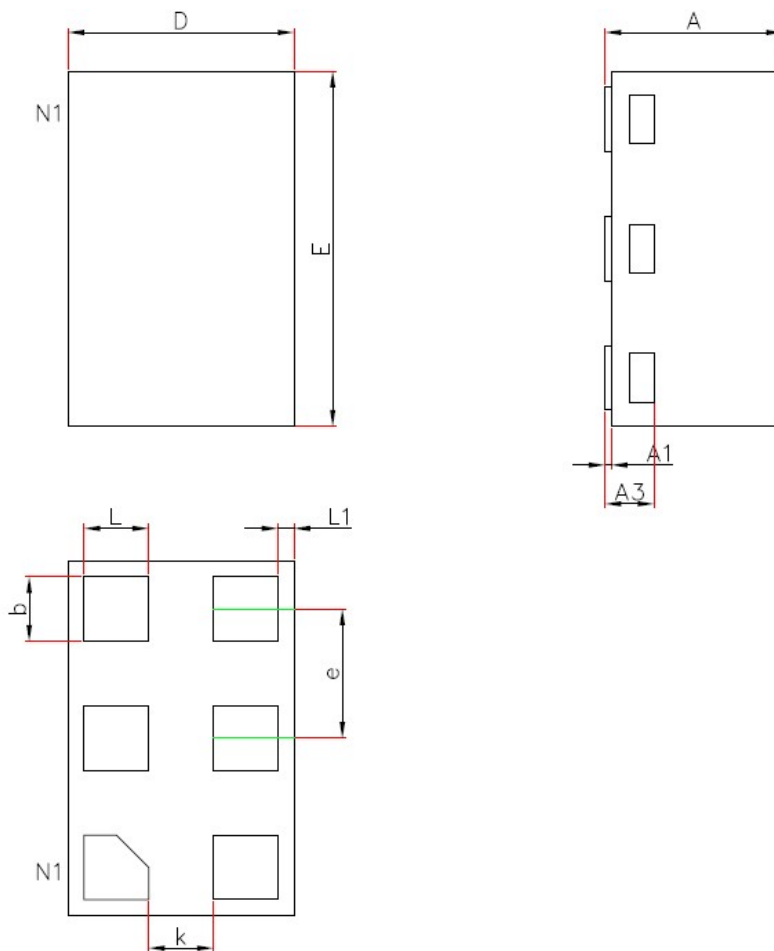
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CC</sub>	Supply current	On state		5.6		mA
		Off state			1	μA
G <sub>p</sub> <sup>[4]</sup>	Power gain	f = 1850 MHz	10.5	12.5	14.5	dB
		f = 2150 MHz	10.1	12.1	14.1	dB
RL <sub>in</sub>	Input return loss	f = 1850 MHz		9.0		dB
		f = 2150 MHz		8.0		dB
RL <sub>out</sub>	Output return loss	f = 1850 MHz		11.0		dB
		f = 2150 MHz		24.0		dB
ISL	Reverse isolation	f = 1850 MHz		34.5		dB
		f = 2150 MHz		34.0		dB
NF <sup>[4]</sup>	Noise figure	f = 1850 MHz		0.95	1.45	dB
		f = 2150 MHz		1.0	1.5	dB
IP <sub>1dB</sub> <sup>[4]</sup>	Input power at 1 dB gain compression	f = 1850 MHz	-6.5	-3.5		dBm
		f = 2150 MHz	-5.5	-2.5		dBm
IIP <sub>3</sub> <sup>[4]</sup>	Input third-order intercept point	f = 1850 MHz <sup>[1]</sup>	-1.0	+4.0		dBm
		f = 2150 MHz <sup>[2]</sup>	+0.0	+5.0		dBm
K	Rollett stability factor <sup>[3]</sup>		1			
t <sub>on</sub>	Turn-on time				5	μs
t <sub>off</sub>	Turn-off time				5	μs

[1] f<sub>1</sub> = 1840 MHz, f<sub>2</sub> = 1850 MHz, P<sub>in</sub> = -25 dBm

[2] f<sub>1</sub> = 2140 MHz, f<sub>2</sub> = 2150 MHz, P<sub>in</sub> = -25 dBm

[3] 10M~20GHz

[4] Guaranteed by device design; not tested in production

**Package outline dimensions**
**DFN1107-6L**


Symbol	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.500	0.550	0.600
A1	0.000	0.025	0.050
A3	0.152REF		
b	0.150	0.200	0.250
D	0.600	0.700	0.800
E	1.000	1.100	1.200
e	0.400BSC		
k	0.200REF		
L	0.124	0.200	0.276
L1	0.050REF		

**Tape & Reel dimensions**
