

WS79191D-6/TR

CMOS High Gain GPS LNA

Descriptions

The WS79191D-6/TR is a low noise amplifier (LNA) for GNSS receiver applications, available in a small 6-pin DFN package. The WS79191D-6/TR requires only one external inductor for input matching.

The WS79191D-6/TR is designed to achieve low power dissipation and good performance.

Features

- Operating frequency: 1150 MHz to 1615 MHz
- Noise figure: 0.80 dB
- Gain: 18 dB
- Supply voltage: 1.5 V to 3.1 V
- Supply current: 7 mA@2.8V, 4.5mA@1.8V
- Power-down mode leakage current < 1μA
- One external matching inductor required
- ESD protection: HBM > 2KV for all pins
- Package: 6-pin DFN, 1.1 x 0.7 x 0.50 mm³

Applications

- Cell phones
- Tablets
- Other RF front-end modules
- Digital cameras
- Complete GNSS modules
- Personal health applications

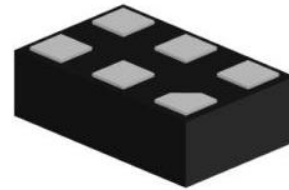


Figure1 DFN1107-6L (Bottom View)

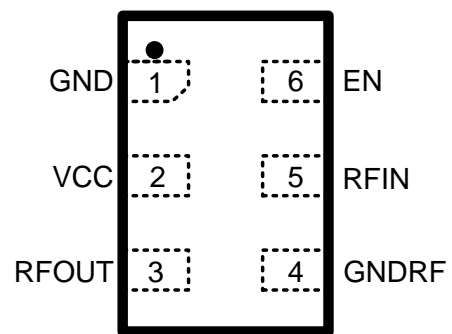
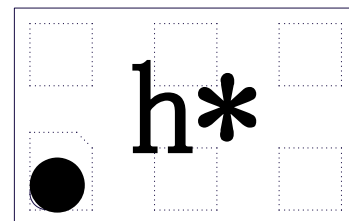


Figure2 Pin Configuration (Top View)



h = Device code

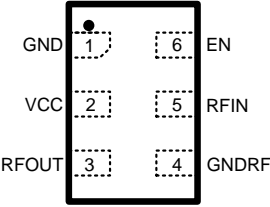
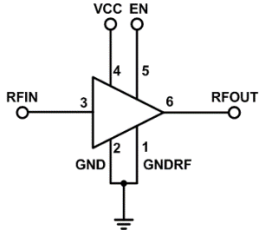
* = Month code (A~Z)

Figure3 Marking (Top View)

Order Information

Device	Package	Shipping
WS79191D-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

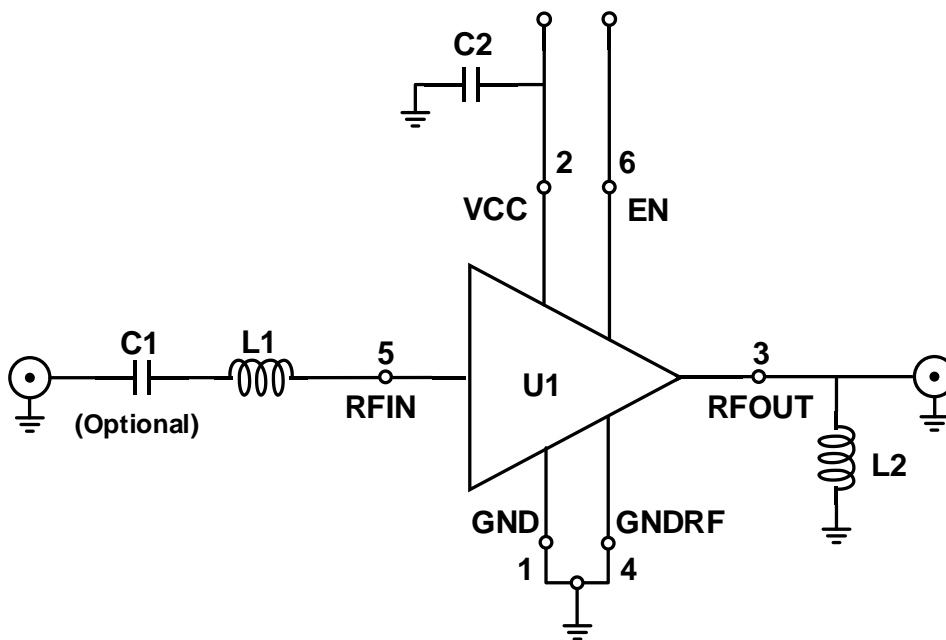


Figure4 Application Circuit

Symbol	Description	Footprint	Value	Supplier	Comment
U1	WS79191D-6/TR	1.1x0.7x0.5 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	12 nH for GPS L1 Band	Murata	Input matching
			22 nH for GPS L5 Band	LQW15	
L2	Inductor	0402	No mount for GPS L1 Band	Murata	Output matching
			3.9 nH for GPS L5 Band	LQW15	

Absolute Maximum Ratings

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

Parameter	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V_{CC}		-0.3	3.3	V
Input voltage on pin EN	V_{EN}		-0.3	V_{CC}	V
RF input power	P_{in}			10	dBm
Storage temperature	T_{STG}		-65	+150	°C
Junction temperature	T_J			150	°C
ESD capability all pins	V_{ESD}	Human Body Model	2000		V
		Charged Device Model	1000		V

Recommended Operating Conditions

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}		1.5	2.8	3.1	V
Ambient temperature	Temp		-40	+25	+85	°C
Input voltage on pin 6 (EN)	V_{EN}	OFF state	0		0.45	V
		ON state	0.8		V_{CC}	V

Characteristics

1550 MHz ≤ f ≤ 1615 MHz; V_{CC} = 2.8 V; V_{EN} ≥ 1.8 V; Temp = 25°C. Input matched 50 Ω using application diagram and component values as described in Application Information, unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I _{CC}	On state		7	15	mA
		Off state			1	μA
Power gain	G _p	f = 1575 MHz	16	17.5		dB
Input return loss	RL _{in}	f = 1575 MHz	5	7		dB
Output return loss	RL _{out}	f = 1575 MHz	15	20		dB
Reverse isolation	ISL	f = 1575 MHz	24	28		dB
Noise figure	NF	f = 1575 MHz		0.75	1.1	dB
Input power at 1 dB gain compression	IP _{1dB}	f = 1575 MHz		-9		dBm
Out of band Input third-order intercept point ^[1]	IIP _{3oob}			4		dBm
In band Input third-order intercept point ^[2]	IIP ₃			3.5		dBm
Rollett stability factor ^[3]	K		1			
Turn-on time	t _{on}				3	μs
Turn-off time	t _{off}				1	μs

[1] f₁ = 1713 MHz, f₂ = 1851 MHz, P_{in} = -30 dBm

[2] f₁ = 1575 MHz, f₂ = 1576 MHz, P_{in} = -30 dBm

[3] 10M~20GHz

1164 MHz \leq f \leq 1215 MHz; $V_{CC} = 2.8$ V; $V_{EN} \geq 1.8$ V; Temp = 25°C. Input matched 50 Ω using application diagram and component values as in Application Information, unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I _{CC}	On state		7	15	mA
		Off state			1	μ A
Power gain	G _p	f = 1175 MHz	17	18.5		dB
Input return loss	RL _{in}	f = 1175 MHz	5	9		dB
Output return loss	RL _{out}	f = 1175 MHz	10	15		dB
Reverse isolation	ISL	f = 1175 MHz	28	30		dB
Noise figure	NF	f = 1175 MHz		0.8	1.1	dB
Input P1dB	IP _{1dB}	f = 1175 MHz		-11		dBm
Out of band Input third-order intercept point ^[1]	IIP3 _{oob}			1		dBm
In band Input third-order intercept point ^[2]	IIP3			-2		dBm
Rollett stability factor ^[3]	K		1			
Turn-on time	t _{on}				3	μ s
Turn-off time	t _{off}				1	μ s

[1] f₁ = 1850 MHz, f₂ = 2500 MHz, P_{in} = -30 dBm

[2] f₁ = 1175 MHz, f₂ = 1176 MHz, P_{in} = -30 dBm

[3] 10M~20GHz

1550 MHz \leq f \leq 1615 MHz; $V_{CC} = 1.8$ V; $V_{EN} \geq 1.8$ V; Temp = 25°C. Input matched 50 Ω using application diagram and component values as described in Application Information, unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I _{CC}	On state		4.5	10	mA
		Off state			1	μ A
Power gain	G _p	f = 1575 MHz	14.5	16		dB
Input return loss	RL _{in}	f = 1575 MHz	3	6		dB
Output return loss	RL _{out}	f = 1575 MHz	14	19		dB
Reverse isolation	ISL	f = 1575 MHz	23	27		dB
Noise figure	NF	f = 1575 MHz		0.8	1.1	dB
Input power at 1 dB gain compression	IP _{1dB}	f = 1575 MHz		-11		dBm
Out of band Input third-order intercept point ^[1]	IIP _{3oob}			2		dBm
In band Input third-order intercept point ^[2]	IIP ₃			1.5		dBm
Rollett stability factor ^[3]	K		1			
Turn-on time	t _{on}				3	μ s
Turn-off time	t _{off}				1	μ s

[1] f₁ = 1713 MHz, f₂ = 1851 MHz, P_{in} = -30 dBm

[2] f₁ = 1575 MHz, f₂ = 1576 MHz, P_{in} = -30 dBm

[3] 10M~20GHz

1164 MHz $\leq f \leq$ 1215 MHz; $V_{CC} = 1.8$ V; $V_{EN} \geq 1.8$ V; Temp = 25°C. Input matched 50 Ω using application diagram and component values as in Application Information, unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I _{CC}	On state		4.5	10	mA
		Off state			1	μ A
Power gain	G _p	f = 1175 MHz	15.5	17		dB
Input return loss	RL _{in}	f = 1175 MHz	5	8		dB
Output return loss	RL _{out}	f = 1175 MHz	10	15		dB
Reverse isolation	ISL	f = 1175 MHz	25	29		dB
Noise figure	NF	f = 1175 MHz		0.9	1.2	dB
Input power at 1 dB gain compression	IP _{1dB}	f = 1175 MHz		-12		dBm
Out of band Input third-order intercept point ^[1]	IIP3 _{oob}			1		dBm
In band Input third-order intercept point ^[2]	IIP3			-3.6		dBm
Rollett stability factor ^[3]	K		1			
Turn-on time	t _{on}				3	μ s
Turn-off time	t _{off}				1	μ s

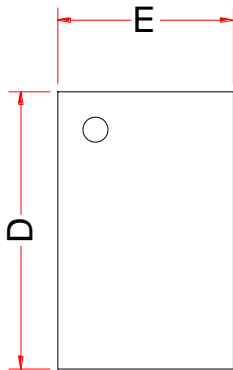
[1] f₁ = 1850 MHz, f₂ = 2500 MHz, P_{in} = -30 dBm

[2] f₁ = 1175 MHz, f₂ = 1176 MHz, P_{in} = -30 dBm

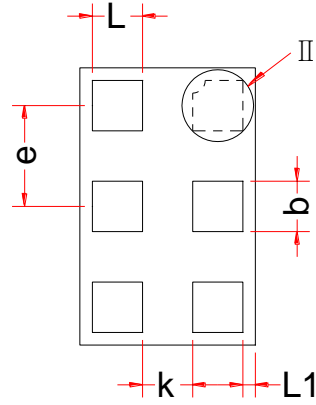
[3] 10M~20GHz

Package Dimensions

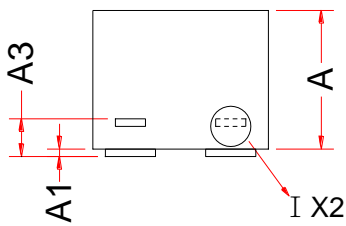
DFN1107-6L



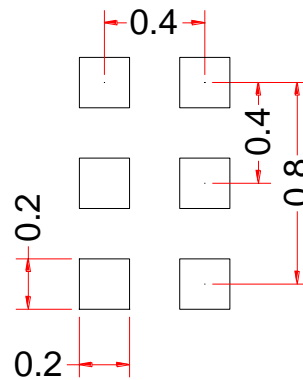
TOP VIEW



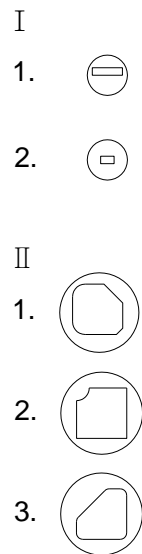
BOTTOM VIEW



SIDE VIEW



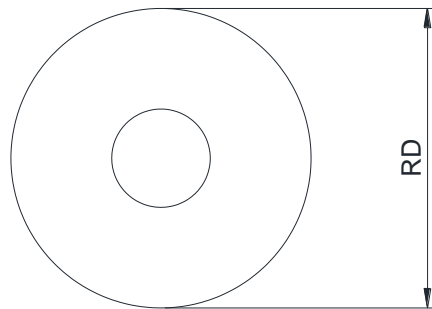
RECOMMENDED LAND PATTERN(unit:mm)



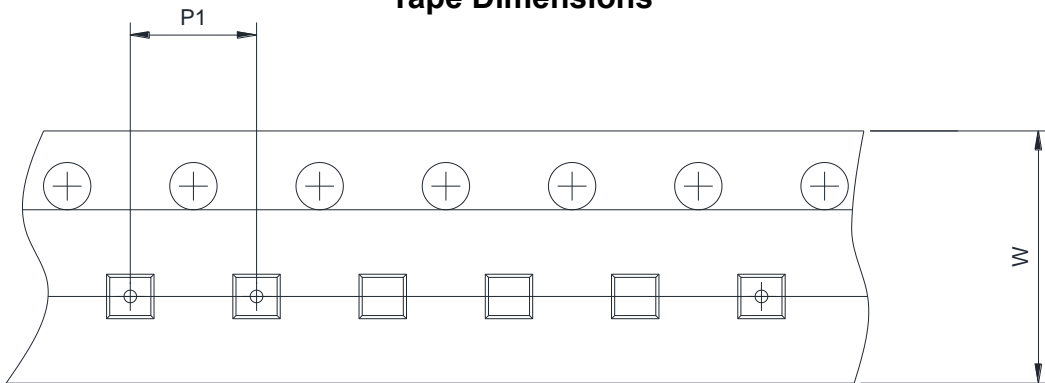
Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.40	0.50	0.60
A1	-0.004	-	0.05
A3	0.110 Ref.	-	0.152 Ref.
b	0.15	0.20	0.25
D	1.00	1.10	1.20
E	0.60	0.70	0.80
e	0.40 BSC.		
k	0.20 Ref.		
L	0.15	0.20	0.25
L1	0.050Ref.		

Tape and Reel Information

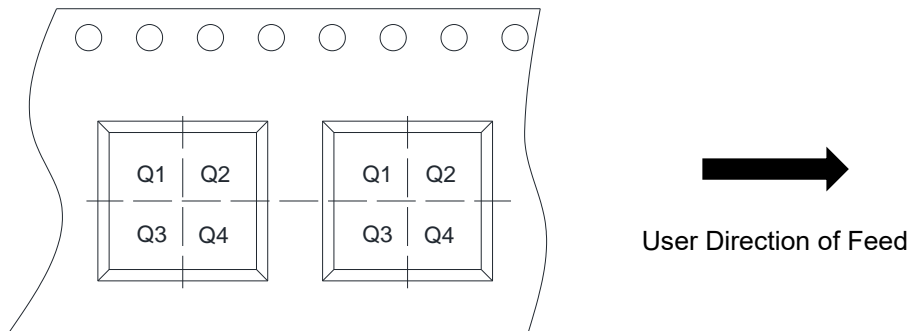
Reel Dimensions



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 checked="" type="checkbox"/> 2mm	<input 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