MXD8921L

SiGe Low Noise Amplifier

with Bypass Mode for LTE Low Band

Rev1.2

General Description

MXD8921L high gain, low noise amplifier (LNA) is dedicated to LTE low band receive using advanced SiGe process. This product has two operation modes, low noise mode and bypass mode.

MXD8921L works under a 1.6V to 3.6V single power supply while consumes only 3.9 mA current in low noise mode, in bypass mode, the power consumption will be reduced to less than 1uA.

MXD8921L uses a small 1.1mm × 0.7mm × 0.45mm LGA 6-pin package.

Applications

- LTE low band receiving

Features

- Broadband frequency range:
  - 600MHz to 1.0GHz
- High Gain
  - 13.5dB gain at 600MHz to 1.0GHz
- Ultra low noise figure
  - 0.65dB NF at 600MHz to 1.0GHz
- Operation current only 3.9mA
- Small, LGA (6-pin, 1.1mm x 0.7mm x 0.45mm) package , MSL1

Pin Configuration/Application Diagram (Top view)

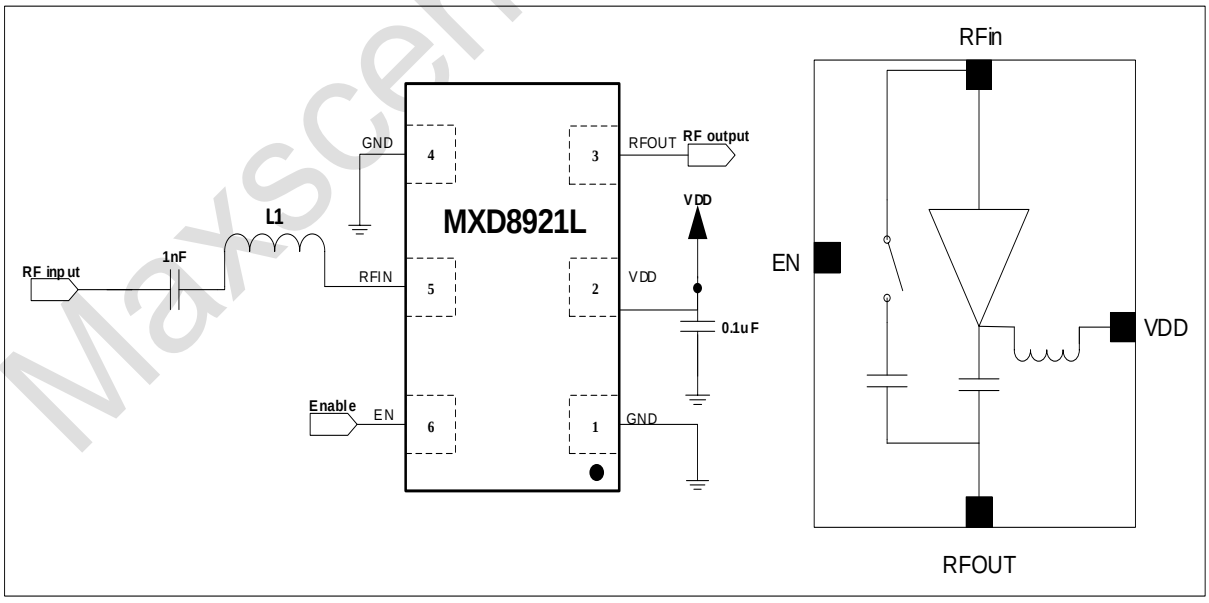


Figure 1 MXD8921L application circuit

Pin Descriptions & Input matching inductance

Table 1

Pin	Pin Name	I/O	Pin Description
1	GND	AG	Analog VSS
2	VDD	AP	Power supply
3	RFOUT	AO	LNA output
4	GND	AG	Analog VSS
5	RFIN	AI	LNA input from antenna
6	EN	DI	Pull high into low noise mode, pull low into bypass mode

Note: *DI* (digital input), *DO* (digital output), *DIO* (digital bidirectional), *AI* (analog input), *AO* (analog output), *AIO* (analog bidirectional), *AP* (analog power), *AG* (analog ground),

Table 2 Input matching inductance

Component	Matching Band	Vendor	Type	Part Number & value
L1	600MHz – 1GHz	Murata	Wired inductor, high Q	LQW15AN, 14nH
		various	Ceramic inductor, low Q	13nH

Recommended Operation Range

Table 3

Parameters	Symbol	Min	Typ	Max	Units
Operation Frequency	f1	600	-	1000	MHz
Power supply	V_{DD}	1.6	2.8	3.6	V
Control Voltage High	V_{CTL_H}	1.0	1.8	VDD	V
Control Voltage Low	V_{CTL_L}	0	0	0.3	V

Absolute Maximum Ratings

Table 4 Maximum ratings

Parameters	Symbol	Minimum	Maximum	Units
Supply voltage	V_{DD}	-0.3	+4.0	V
Digital control voltage	V_{CTL}	-0.3	VDD+0.3	V
RF input power	P_{IN}	-	+25	dBm
Operating temperature	T_{OP}	–40	+90	℃
Storage temperature	T_{STG}	–65	+160	℃
Electrostatic Discharge Human body model (HBM), Class 1B[Note1] Charged device model (CDM), Class III[Note2]	ESD_HBM ESD_CDM	-	2000 1000	V

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.
Note1: According to ESDA/JEDECJS-001-2014
Note2: According to ESDA/JEDECJS-002-2014

Specifications

Typically T_A=25℃ VDD=2.8V, All data measured on Maxscend's EVB, unless otherwise noted

Table 5 High Gain mode Electrical Specifications

Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Supply voltage	V_{DD}	1.6	2.8	3.6	V	
Supply current	I_{DD}	2.8	3.9	5.5	mA	V_{DD} = 2.8V, V_{EN}=1.8V
RF Specifications						
Power gain	G	11.5	13.5	15.5	dB	600M - 1.0GHz
Noise figure	NF	-	0.65	1.2	dB	600M - 1.0GHz
Input Return loss	|S11|	-	-10	-5	dB	600M - 1.0GHz
Output Return loss	|S22|	-	-10	-5	dB	600M - 1.0GHz
Stability factor	Kf	1.2	-	-		
Input 1 dB compression point	P1dB	-6	-2.8	-	dBm	at 850MHz
Input IP3	IIP3	5	10	-	dBm	Note1
Switch time	turn-on-time	-	-	6	μs	Bypass state to High gain state, to 90% of the Gain
	turn-off-time	-	-	1	μs	High Gain state to Bypass state, to 10% of the Gain

Note1: Pin=Pin2=-20dBm, F1=850MHz, F2=851MHz

Table 6 Bypass mode Electrical Specifications

Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Supply voltage	V_{DD}	1.6	2.8	3.6	V	
Supply current	I_{DD}	0	0.1	1	uA	V_{DD} = 2.8 V, V_{EN}=low
RF Specifications						
Insertion loss	IL	-7	-3.5	-	dB	600M - 1.0GHz
Input Return loss	|S11|	-	-10	-5	dB	600M - 1.0GHz
Output Return loss	|S22|	-	-10	-5	dB	600M - 1.0GHz
Input 1 dB compression point	P1dB	5	10	-	dBm	at 850MHz

Specifications

Typically T_A=25℃ VDD=1.8V, All data measured on Maxscend's EVB, unless otherwise noted

Table 7 High Gain mode Electrical Specifications

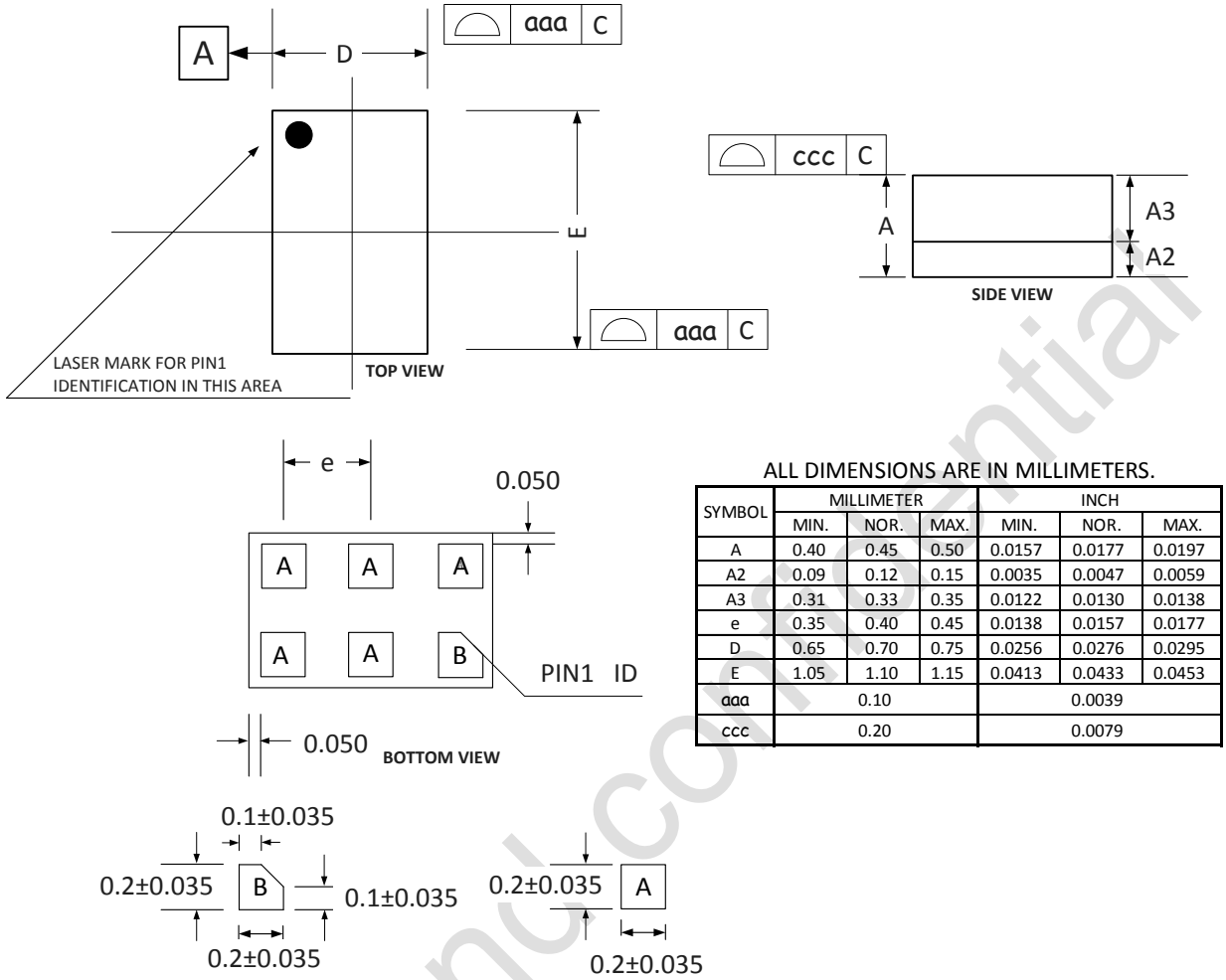
Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Supply voltage	V_{DD}	1.6	1.8	3.6	V	
Supply current	I_{DD}	2.6	3.8	5.3	mA	V_{DD} = 1.8V, V_{EN}=1.8V
RF Specifications						
Power gain	G	11.2	13.2	15.2	dB	600M - 1.0GHz
Noise figure	NF	-	0.65	1.2	dB	600M - 1.0GHz
Input Return loss	|S11|	-	-10	-5	dB	600M - 1.0GHz
Output Return loss	|S22|	-	-10	-5	dB	600M - 1.0GHz
Stability factor	Kf	1.2	-	-		
Input 1 dB compression point	P1dB	-8	-4.5	-	dBm	at 850MHz
Input IP3	IIP3	2	7	-	dBm	Note1
Switch time	turn-on-time	-	-	6	μs	Bypass state to High gain state, to 90% of the Gain
	turn-off-time	-	-	1	μs	High Gain state to Bypass state, to 10% of the Gain

Note1: Pin=Pin2=-20dBm, F1=850MHz, F2=851MHz

Table 8 Bypass mode Electrical Specifications

Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Supply voltage	V_{DD}	1.6	1.8	3.6	V	
Supply current	I_{DD}	0	0.1	1	uA	V_{DD} = 1.8 V, V_{EN}=low
RF Specifications						
Insertion loss	IL	-7.3	-3.8	-	dB	600M - 1.0GHz
Input Return loss	|S11|	-	-10	-5	dB	600M - 1.0GHz
Output Return loss	|S22|	-	-10	-5	dB	600M - 1.0GHz
Input 1 dB compression point	P1dB	5	10	-	dBm	at 850MHz

Package Outline Dimensions



ALL DIMENSIONS ARE IN MILLIMETERS.

SYMBOL	MILLIMETER			INCH		
	MIN.	NOR.	MAX.	MIN.	NOR.	MAX.
A	0.40	0.45	0.50	0.0157	0.0177	0.0197
A2	0.09	0.12	0.15	0.0035	0.0047	0.0059
A3	0.31	0.33	0.35	0.0122	0.0130	0.0138
e	0.35	0.40	0.45	0.0138	0.0157	0.0177
D	0.65	0.70	0.75	0.0256	0.0276	0.0295
E	1.05	1.10	1.15	0.0413	0.0433	0.0453
aaa	0.10			0.0039		
ccc	0.20			0.0079		

Figure 2 MXD8921L outline dimension

Marking Specification

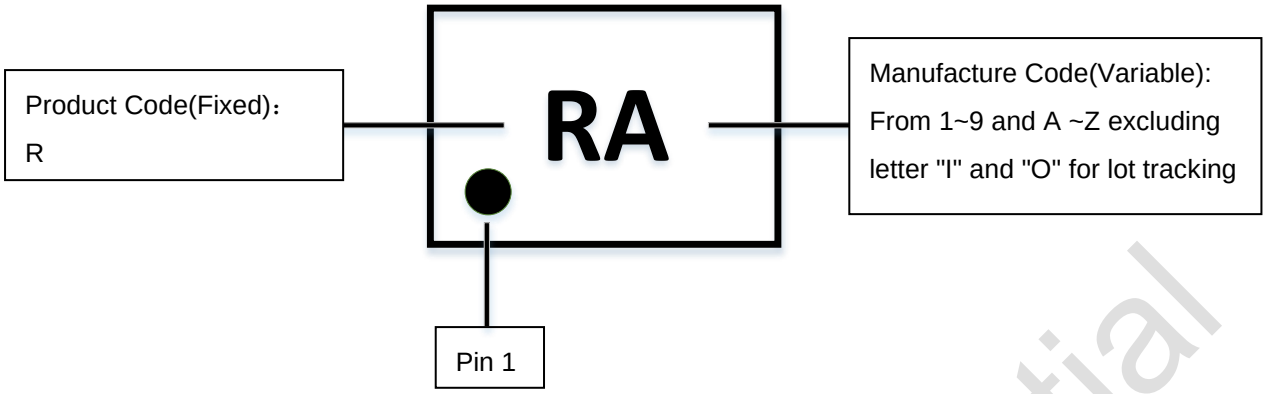
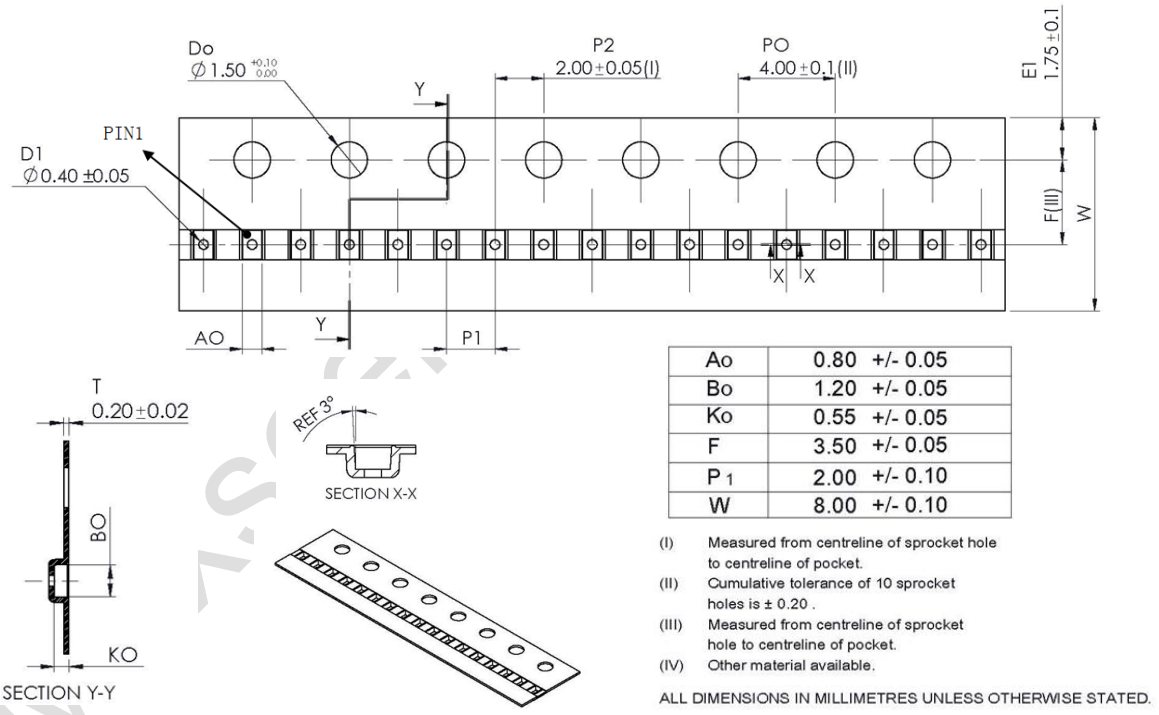


Figure 3 Marking specification (Top View)

Tape and Reel Dimensions



Ao	0.80 +/- 0.05
Bo	1.20 +/- 0.05
Ko	0.55 +/- 0.05
F	3.50 +/- 0.05
P 1	2.00 +/- 0.10
W	8.00 +/- 0.10

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Figure 4 Tape and reel dimensions

Reflow Chart

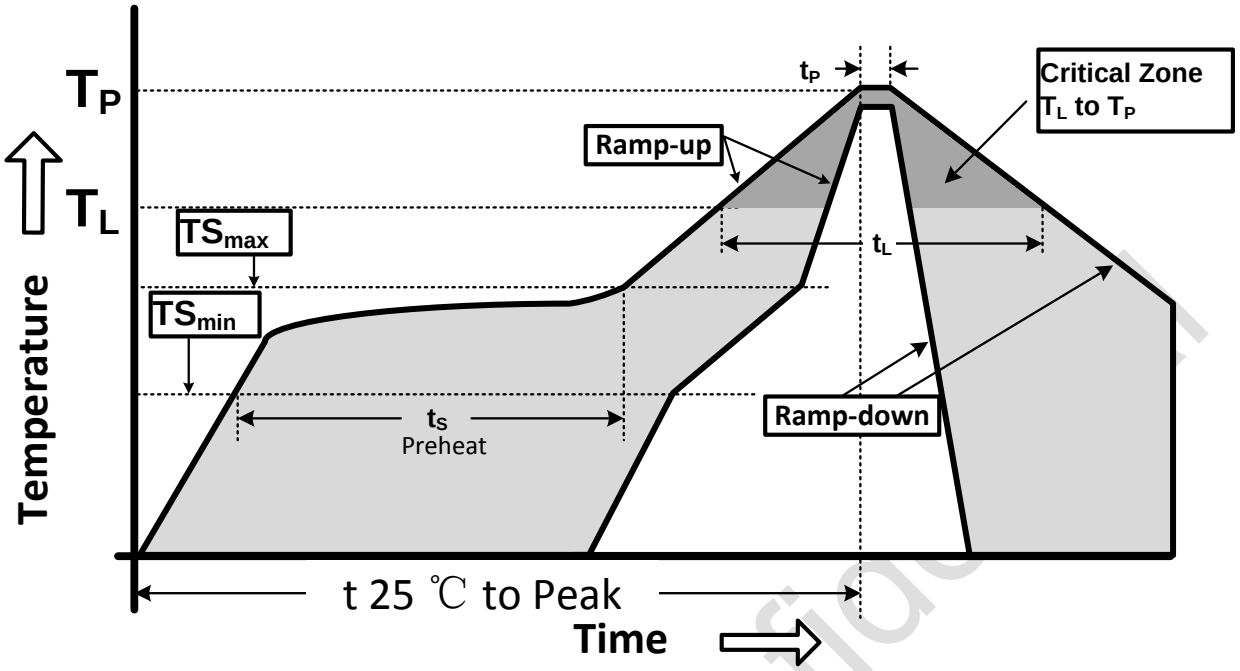


Figure 5 Recommended Lead-Free Reflow Profile

Table 9 Reflow condition

Profile Parameter	Lead-Free Assembly, Convection, IR/Convection
Ramp-up rate（TS_{max} to T_p）	3℃/second max.
Preheat temperature（TS_{min} to TS_{max}）	150℃ to 200℃
Preheat time（t_s）	60 - 180 seconds
Time above TL , 217℃（t_L）	60 - 150 seconds
Peak temperature（T_p）	260℃
Time within 5℃ of peak temperature(t_p)	20 - 40 seconds
Ramp-down rate	6℃/second max.
Time 25℃ to peak temperature	8 minutes max.

ESD Sensitivity

Integrated circuits are ESD sensitive and can be damaged by static electric charge. Proper ESD protection techniques should be used when handling these devices.

RoHS Compliant

This product does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), and are considered RoHS compliant.

1.3.1

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