MXD8921H

SiGe Low Noise Amplifier

with Bypass Mode for LTE Mid-High Band

Rev1.3

General Description

MXD8921H high gain, low noise amplifier (LNA) is dedicated to LTE middle band and high band receive using advanced SiGe process. This product has two operation modes, low noise mode and bypass mode.

MXD8921H works under a 1.6V to 3.6V single power supply while consumes 4.2 mA current in low noise mode, in bypass mode, the power consumption will be reduced to less than 1uA.

MXD8921H uses a small 1.1mm × 0.7mm × 0.45mm LGA 6-pin package.

Applications

- LTE high-mid band receiving

Features

- Broadband frequency range: 1.7G to 2.7 GHz
- High Gain
  - 14.6dB gain at 1.7GHz to 1.8GHz
  - 14.5dB gain at 1.8GHz to 2.2GHz
  - 13.5dB gain at 2.3GHz to 2.7GHz
- Ultra low noise figure
  - 0.60dB noise figure at 1.7GHz to 1.8GHz
  - 0.65dB noise figure at 1.8GHz to 2.2GHz
  - 0.8dB noise figure at 2.3GHz to 2.7GHz
- Operation current 4.2mA
- Single supply voltage range 1.6V to 3.6V
- Small, LGA (6-pin, 1.1mm x 0.7mm x 0.45mm) package ，MSL1

Pin Configuration/Application Diagram (Top view)

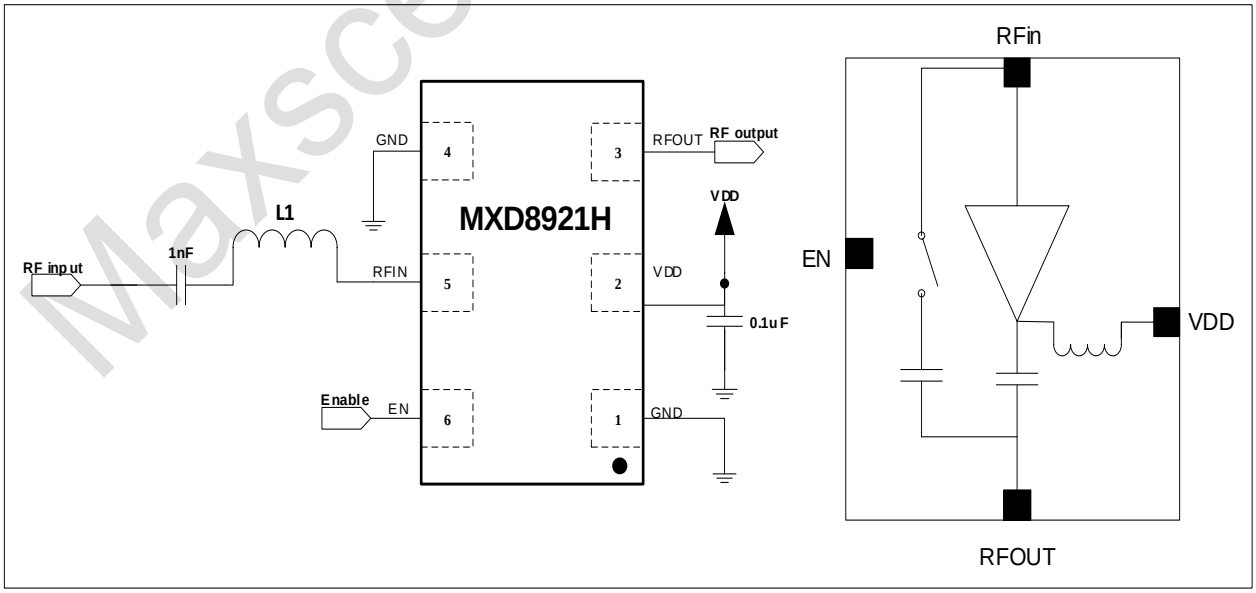


Figure 1 MXD8921H application circuit

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	1700MHz – 1800MHz	Murata	Wired inductor, high Q	LQW15AN, 5.1nH
		various	Ceramic inductor, low Q	4.7nH
	1800MHz – 2200MHz	Murata	Wired inductor, high Q	LQW15AN, 4.6nH
		various	Ceramic inductor, low Q	4nH
	2300MHz – 2700MHz	Murata	Wired inductor, high Q	LQW15AN, 3.9nH
		various	Ceramic inductor, low Q	3.3nH

Recommended Operation Range

Table 3

Parameters	Symbol	Min	Typ	Max	Units
Operation Frequency	f1	1700	-	2700	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}	3	4.2	5.8	mA	V_{DD} = 2.8V, V_{EN}=1.8V
RF Specifications						
Power gain	G	12.6 12.5 11.5	14.6 14.5 13.5	16.6 16.5 15.5	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Noise figure	NF	- - -	0.6 0.65 0.8	0.95 1.0 1.15	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Input Return loss	|S11|	- - -	-8 -10 -12	-4 -5 -6	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Output Return loss	|S22|	- - -	-8 -12 -14	-4 -6 -8	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Isolation	ISL	-	-23	-18	dB	1700 to 2700MHz
Stability factor	Kf	1.0	-	-		
Input 1 dB compression point	P1dB	-8.3 -6	-4.8 -2.5	- -	dBm dBm	at 2GHz at 2.5GHz
Input IP3	IIP3	0 2	5 7	- -	dBm dBm	Note1 Note2
Switch time	turn-on-time	-	-	4	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=2000MHz, F2=2001MHz
Note2: Pin=Pin2=-20dBm, F1=2500MHz, F2=2501MHz

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	-8 -7	-5 -4	- -	dB dB	1700-1800MHz 1800-2700MHz
Input Return loss	|S11|	-	-10	-5	dB	1700 to 2700MHz
Output Return loss	|S22|	-	-10	-5	dB	1700 to 2700MHz
Input 1 dB compression point	P1dB	5	10	-	dBm	1700 to 2700MHz

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

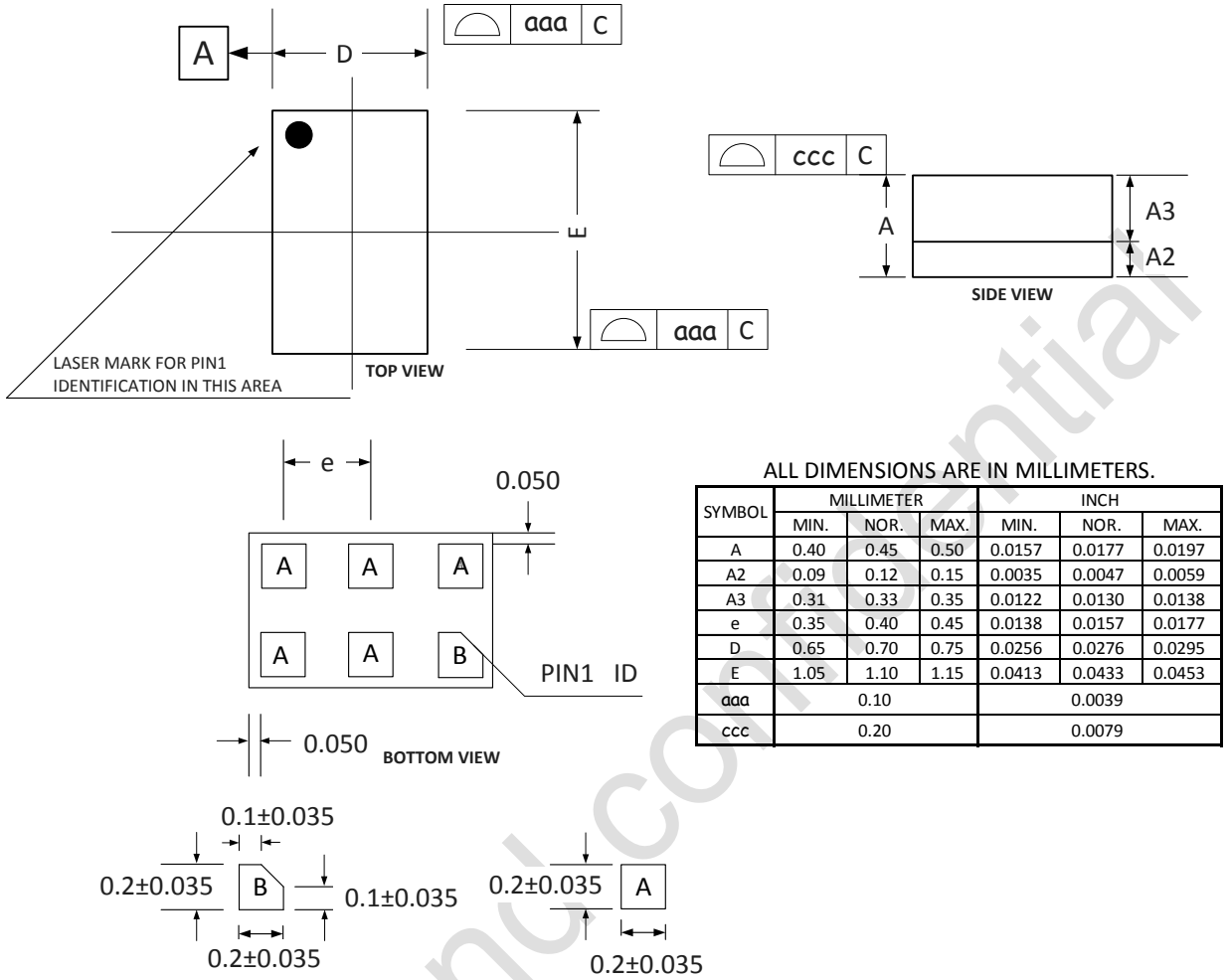
Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Supply voltage	V_{DD}	1.6	1.8	3.6	V	
Supply current	I_{DD}	2.8	4.0	5.6	mA	V_{DD} = 1.8V, V_{EN}=1.8V
RF Specifications						
Power gain	G	12.3 12.2 11.2	14.3 14.2 13.2	16.3 16.2 15.2	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Noise figure	NF	- - -	0.6 0.65 0.8	0.95 1.0 1.15	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Input Return loss	|S11|	- - -	-8 -10 -12	-4 -5 -6	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Output Return loss	|S22|	- - -	-8 -12 -14	-4 -6 -8	dB dB dB	1700-1800MHz 1800-2200MHz 2300-2700MHz
Isolation	ISL	-	-23	-18	dB	1700 to 2700MHz
Stability factor	Kf	1.0	-	-		
Input 1 dB compression point	P1dB	-10.5 -8.5	-7 -5	- -	dBm dBm	at 2GHz at 2.5GHz
Input IP3	IIP3	-1 0	3 5	-	dBm dBm	Note1 Note2
Switch time	turn-on-time	-	-	4	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=2000MHz, F2=2001MHz
Note2: Pin=Pin2=-20dBm, F1=2500MHz, F2=2501MHz

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	-8.4 -7.4	-5.4 -4.4	- -	dB dB	1700-1800MHz 1800-2700MHz
Input Return loss	|S11|	-	-10	-5	dB	1700 to 2700MHz
Output Return loss	|S22|	-	-10	-5	dB	1700 to 2700MHz
Input 1 dB compression point	P1dB	5	10	-	dBm	1700 to 2700MHz

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 MXD8921H outline dimension

Marking Specification

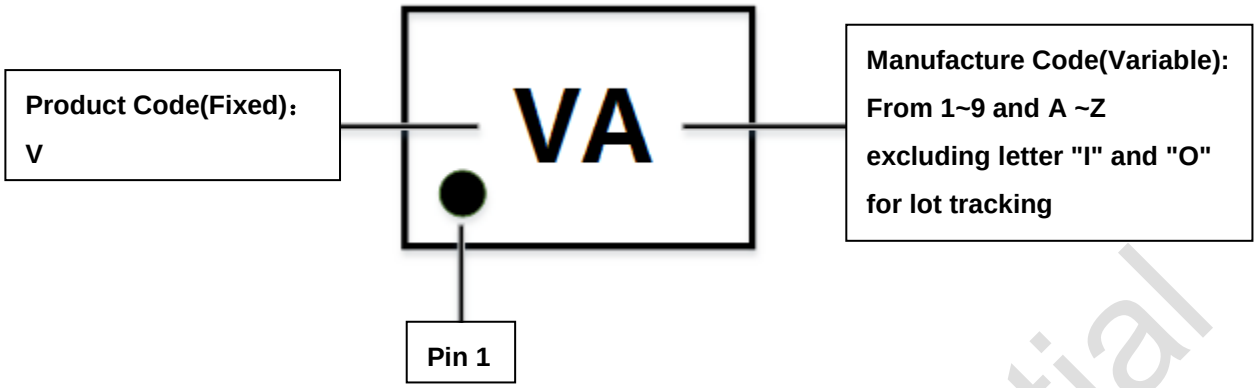
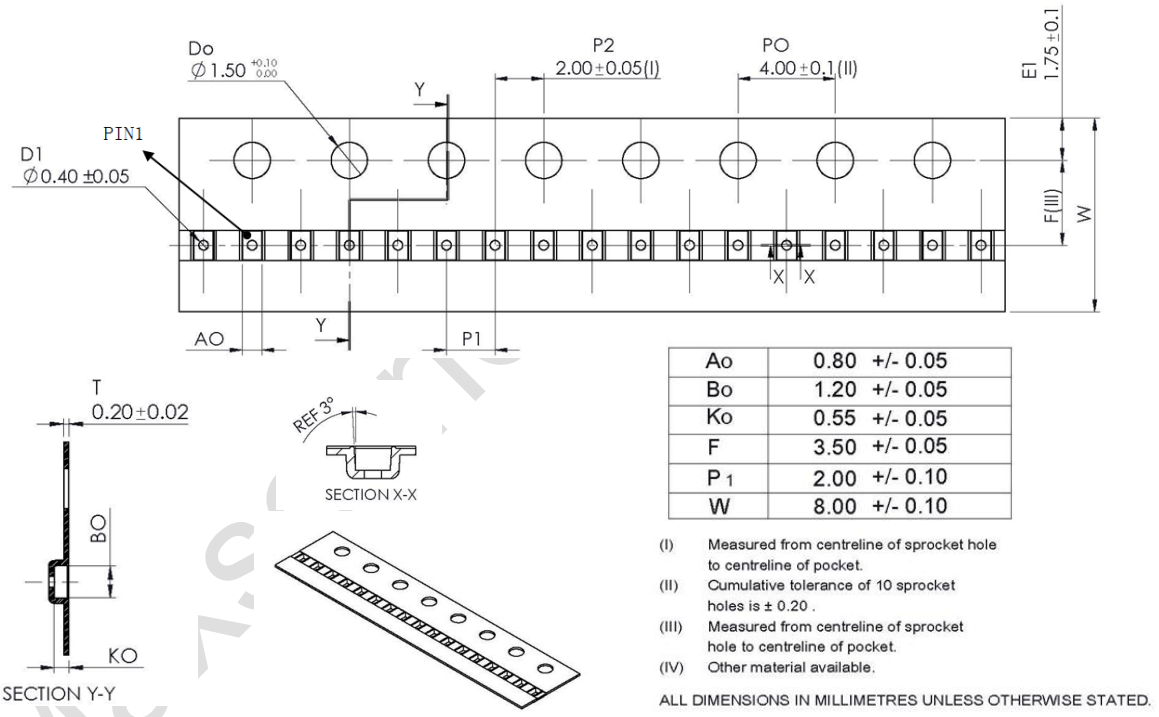


Figure 3 Marking specification (Top View)

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

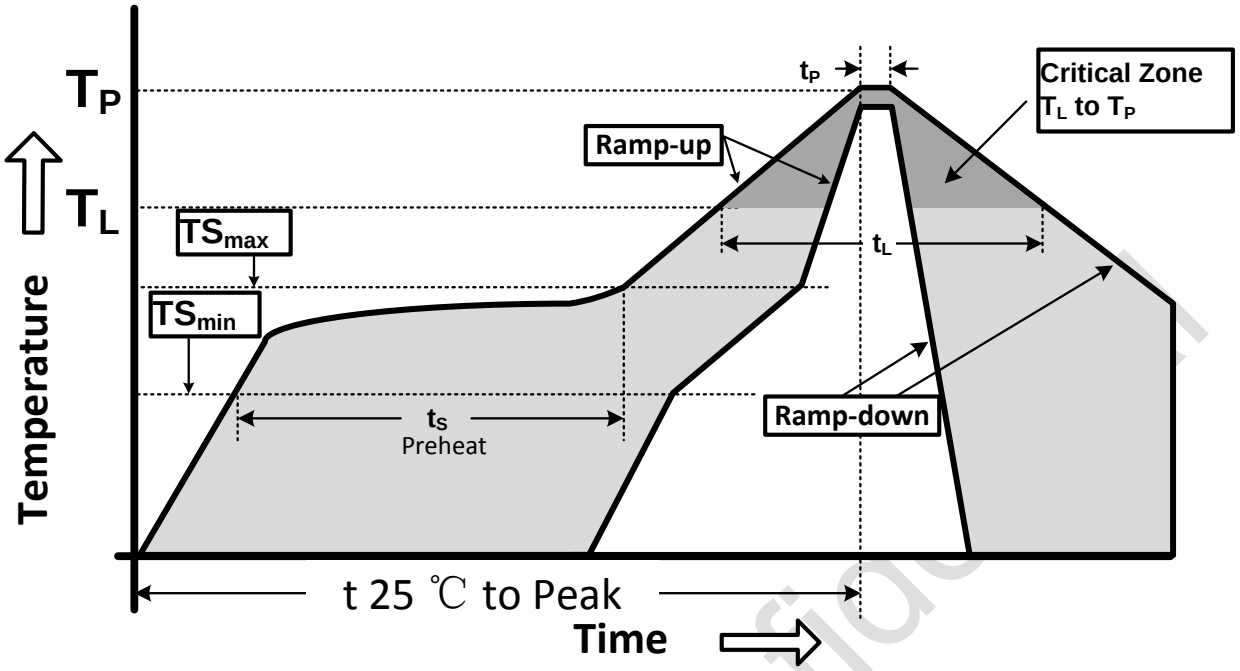


Figure 5 Recommended Lead-Free Reflow Profile

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