

AXL2316 Data Sheet

Ultra Low Noise Amplifier for SDARS Antenna

1. Product Overview

1.1 General Description

AXL2316 has high linearity and low noise to be suitable for use in automotive SDARS antenna. The amplifier is available in a TDFN8 package and passes the stringent DC, RF, and reliability tests.

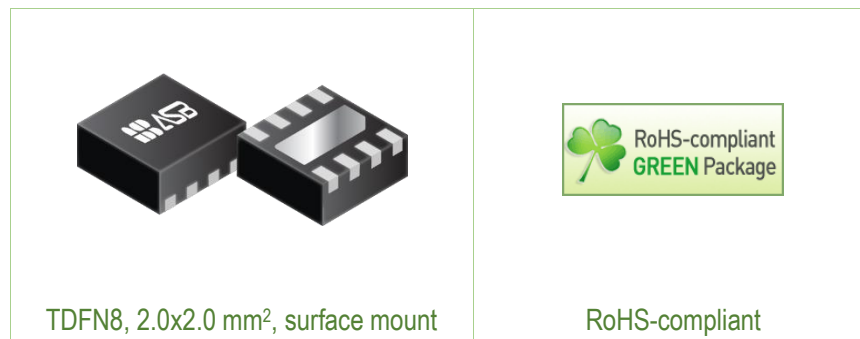
1.2 Features

- 0.42 dB NF at 2332 MHz
- 37.0 dB OIP3 at 2332 MHz
- 16.0 dB Gain at 2332 MHz
- 19.5 dB P1dB at 2332 MHz
- Integrated LNA on/off Control
- MTTF > 100 Years
- Flexible Bias Voltage and Current

1.3 Applications

- SDARS antenna

1.4 Package Profile & RoHS Compliance



2. Summary on Product Performances

2.1 Typical Performance

Supply voltage = +4 V, Bias Voltage = +4 V, Control Voltage = 0 V, $T_A = +25\text{ }^\circ\text{C}$, $Z_O = 50\ \Omega$.

Parameter	Typical			Unit
Frequency	2332	2332	2332	MHz
Gain	15.7	15.9	16.0	dB
S11	-12.0	-12.0	-12.0	dB
S22	-12.0	-12.0	-12.0	dB
Noise Figure ¹⁾	0.43	0.43	0.42	dB
Output IP3 ²⁾	35.0	36.0	37.0	dBm
Output P1dB	18.0	19.0	19.5	dBm
Current	45	55	65	mA
Device Voltage	4.0	4.0	4.0	V

1) Noise figure is measured at the SMA connectors of the evaluation board (i.e., not de-embedded to the device).

2) OIP3 is measured with two tones at the output power of +4 dBm/tone separated by 1 MHz.

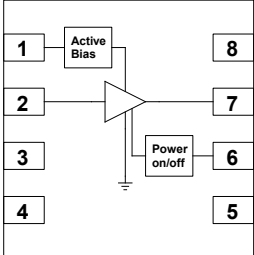
Parameter	Conditions	Min	Typ	Max	Unit
Power Shutdown Control (Vc)	On state		0		V
	Off state		1.0	Vd	V
Current	On state		65		mA
	Off state		3		mA
Switching Speed	Rise time (10% to 90%)		150		ns
	Fall time (90% to 10%)		150		ns

2.2 Product Specification

Supply voltage = +4 V, Bias Voltage = +4 V, Control Voltage = 0 V, $T_A = +25\text{ }^\circ\text{C}$, $Z_O = 50\ \Omega$.

Parameter	Min	Typ	Max	Unit
Frequency	2320	2332	2345	MHz
Noise Figure		0.42		dB
Gain		16.0		dB
S11		-12.0		dB
S22		-12.0		dB
Output IP3		37.0		dBm
Output P1dB		19.5		dBm
Current		65		mA
Device Voltage		4.0		V

2.3 Pin Configuration

Pin	Description	Simplified Outline
1	Vbias	
2	RF IN	
6	Vc (on/off function)	
7	RF OUT	
3, 4, 5, 8	NC or GND	
Backside paddle	GND	

2.4 Absolute Maximum Ratings

Parameters	Max. Ratings
Operation Case Temperature	-40 to +105 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operation Junction Temperature	+150 °C
Input RF Power (CW, 50 Ω matched)	+27 dBm

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R _{th}	Thermal resistance from junction to lead	90	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	TBD
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CAUTION: Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

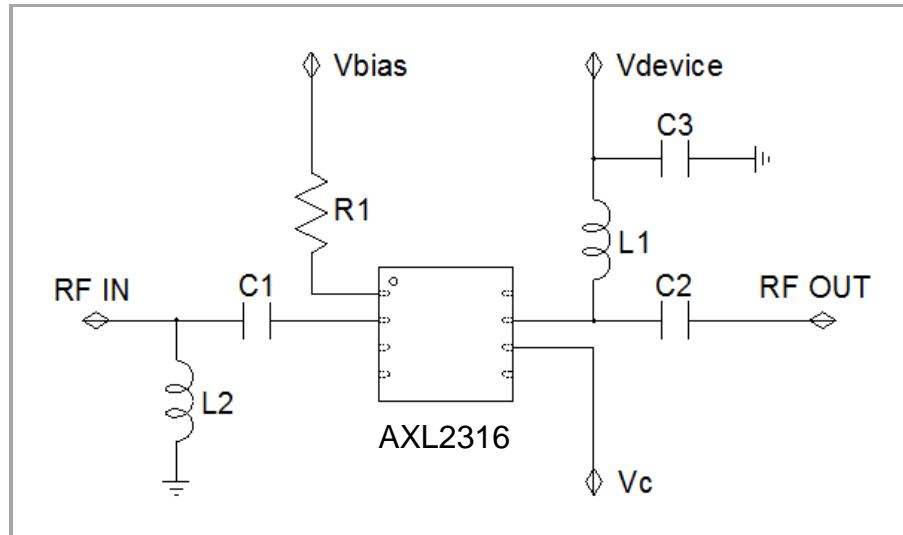
Moisture Sensitivity Level

MSL 3 at 260 °C reflow

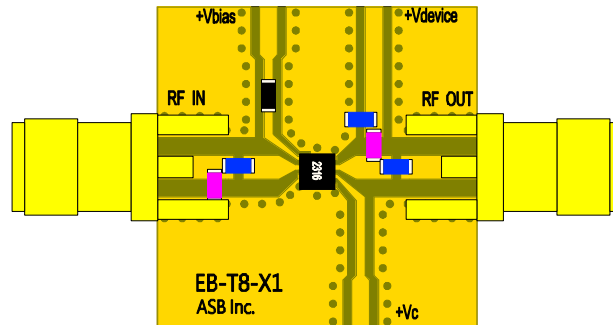
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3. Application: 2320~2345 MHz ($V_{\text{DEVICE}} = +4.0 \text{ V}$)

3.1 Application Circuit & Evaluation Board



* Backside paddle is RF/ DC ground



State	Vc (V)
LNA ON	0 or GND
OFF	1.0 ~ Vd

PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	18x18
EB No.	EB-T8-X1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AXL2316	-	-	MMIC amplifier	ASB
C1	10 pF	0603	DC blocking capacitor	Murata
C2	100 pF	0603	DC blocking capacitor	Murata
C3	1 μ F	0603	Decoupling capacitor	Murata
L1	6.8 nH	0603	RF choke inductor	Murata
L2	10 nH	0603	Input matching inductor	Murata
R1	1.5 k Ω	0603	Bias resistor	Samsung

3.2 Performance Table

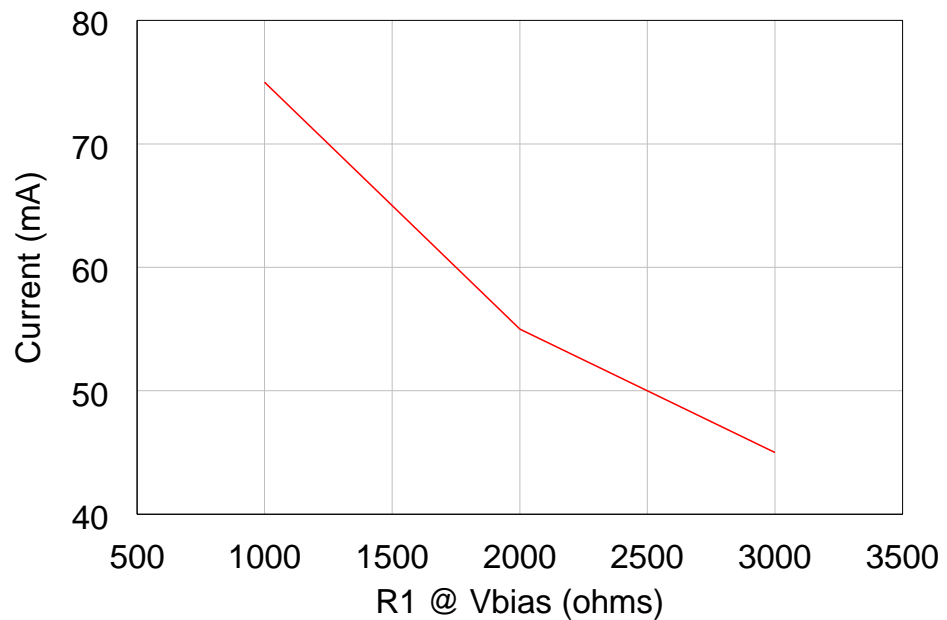
Supply voltage = +4 V, Bias Voltage = +4 V, Control Voltage = 0 V, $T_A = +25\text{ }^\circ\text{C}$, $Z_0 = 50\ \Omega$.

Parameter	Typical			Unit
Frequency	2332	2332	2332	MHz
Gain	15.7	15.9	16.0	dB
S11	-12.0	-12.0	-12.0	dB
S22	-12.0	-12.0	-12.0	dB
Noise Figure ¹⁾	0.43	0.43	0.42	dB
Output IP3 ²⁾	35.0	36.0	37.0	dBm
Output P1dB	18.0	19.0	19.5	dBm
Current	45	55	65	mA
Device Voltage	4.0	4.0	4.0	V

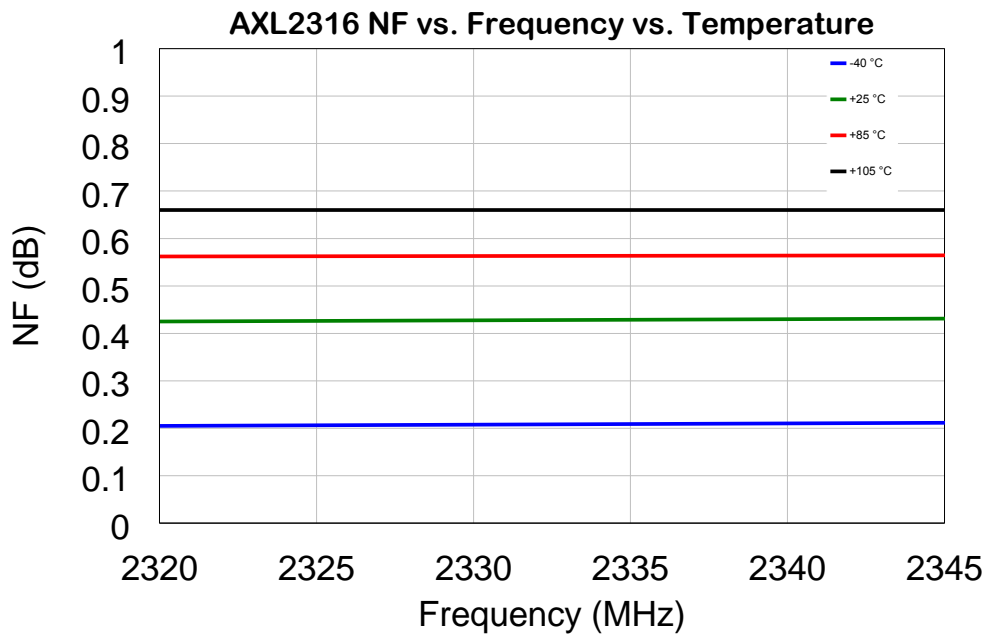
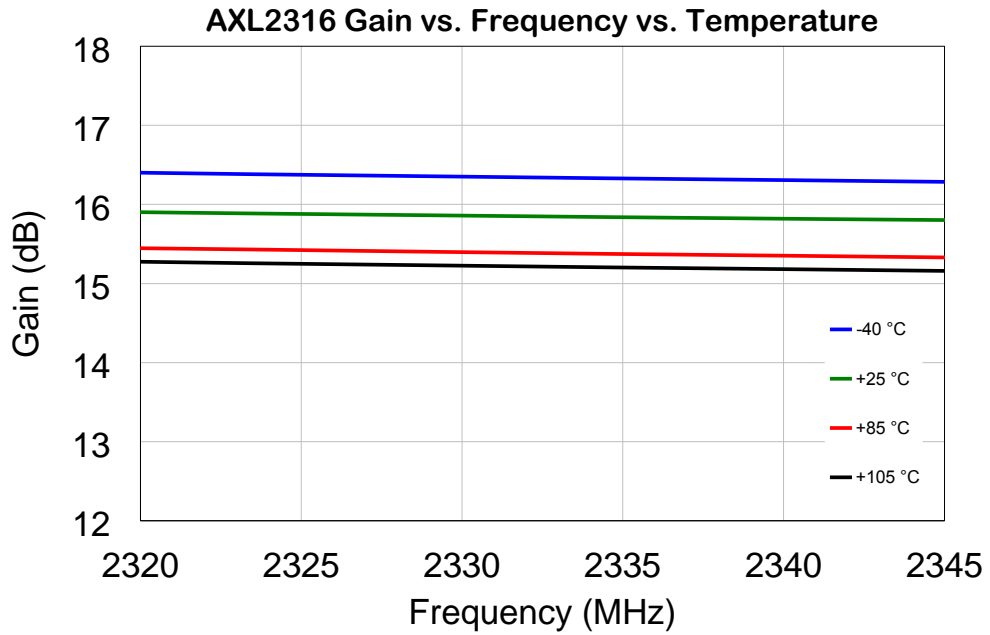
1) Noise figure is measured at the SMA connectors of the evaluation board (i.e., not de-embedded).

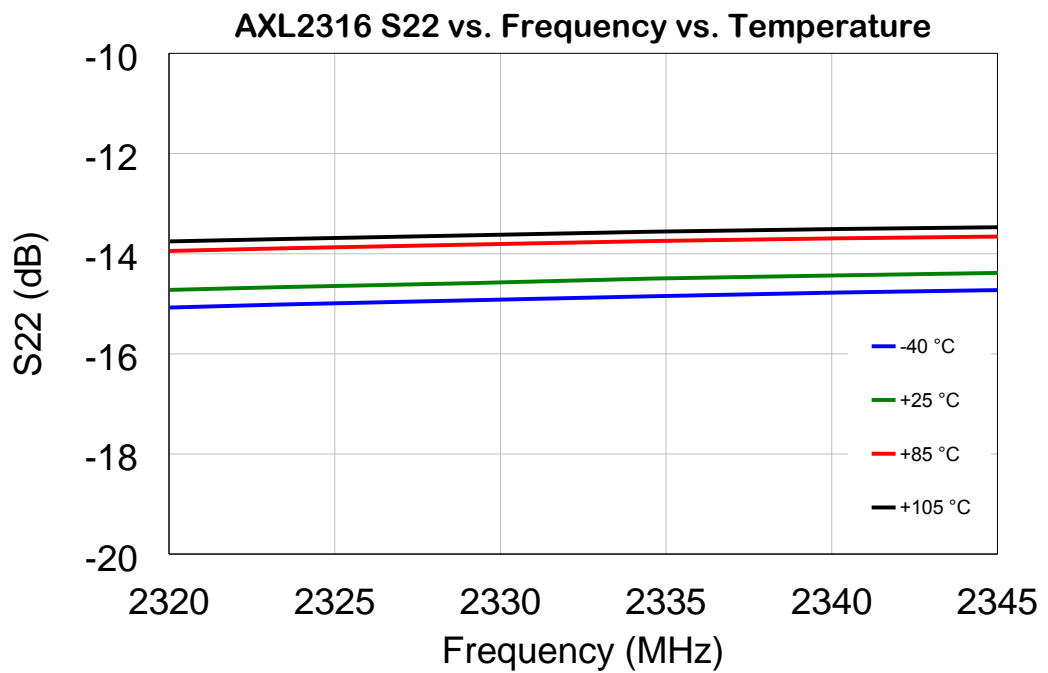
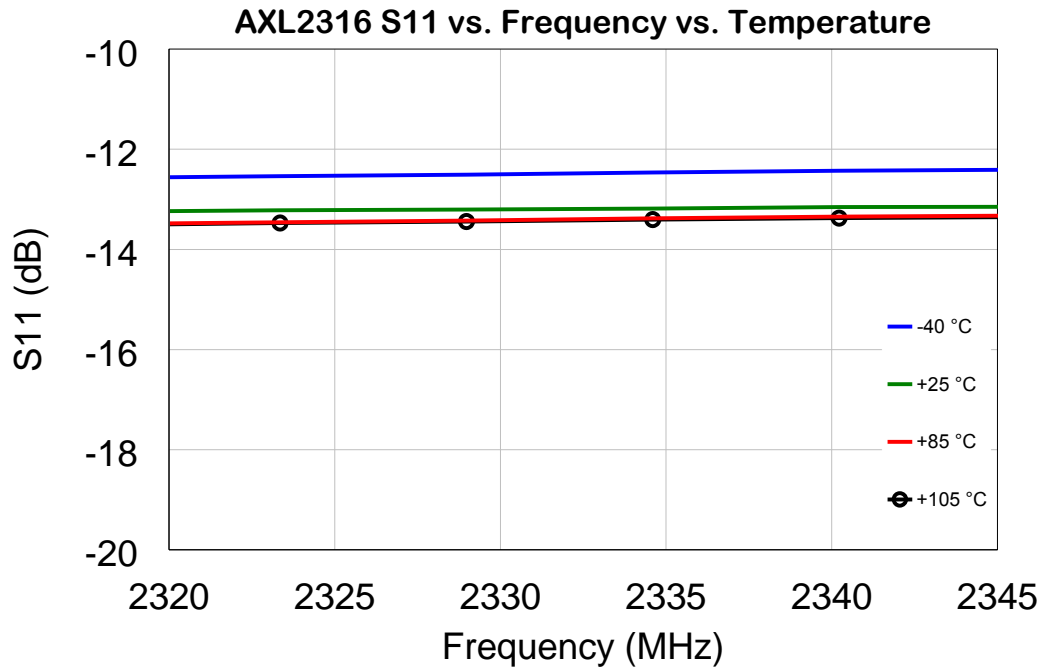
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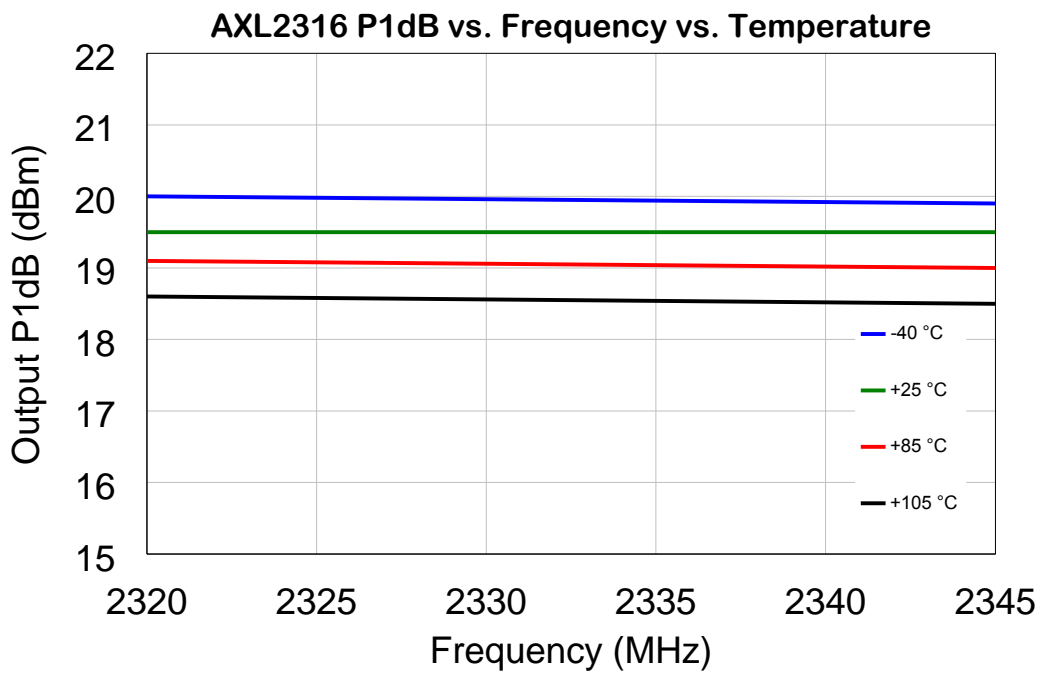
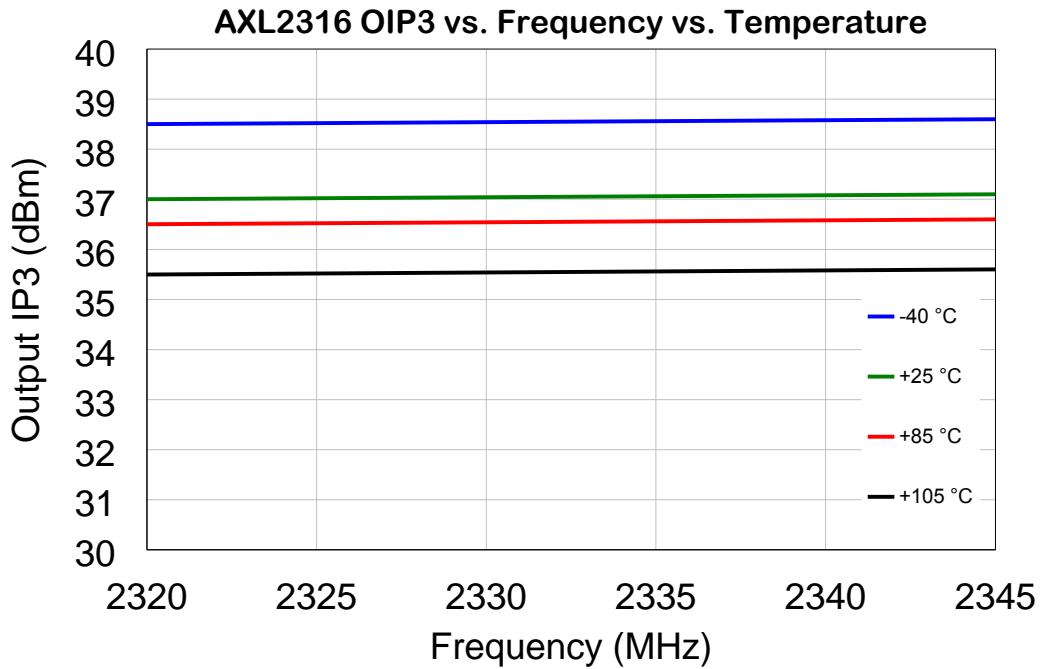
3.3 Bias Resistor Curve ($V_{\text{DEVICE}} = +4.0\text{ V}$, $V_{\text{BIAS}} = +4.0\text{ V}$)

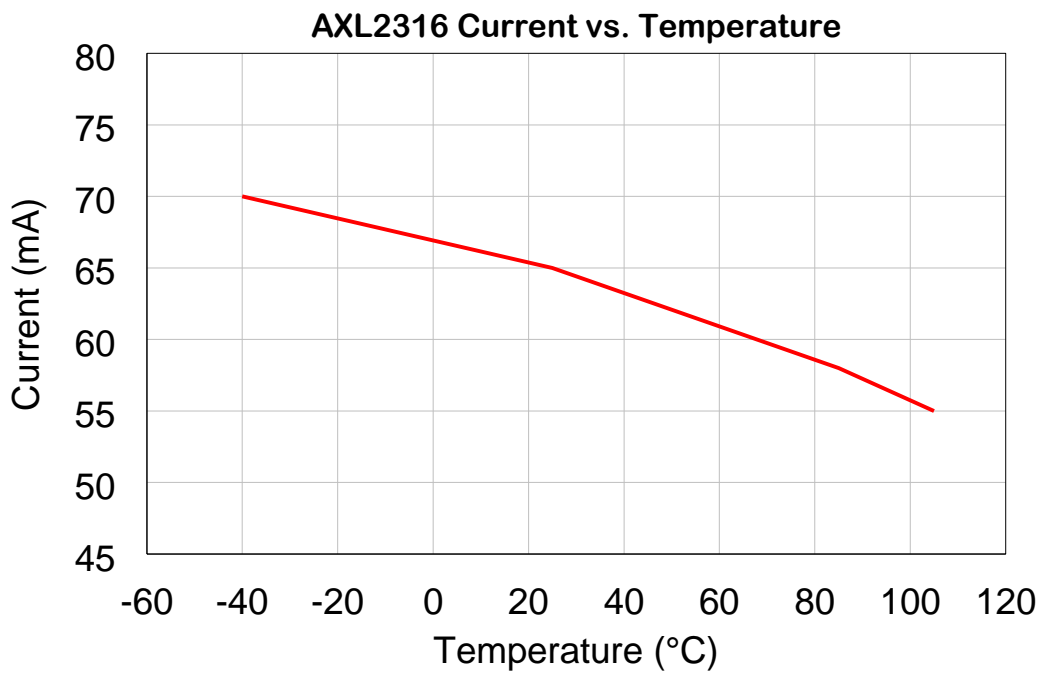
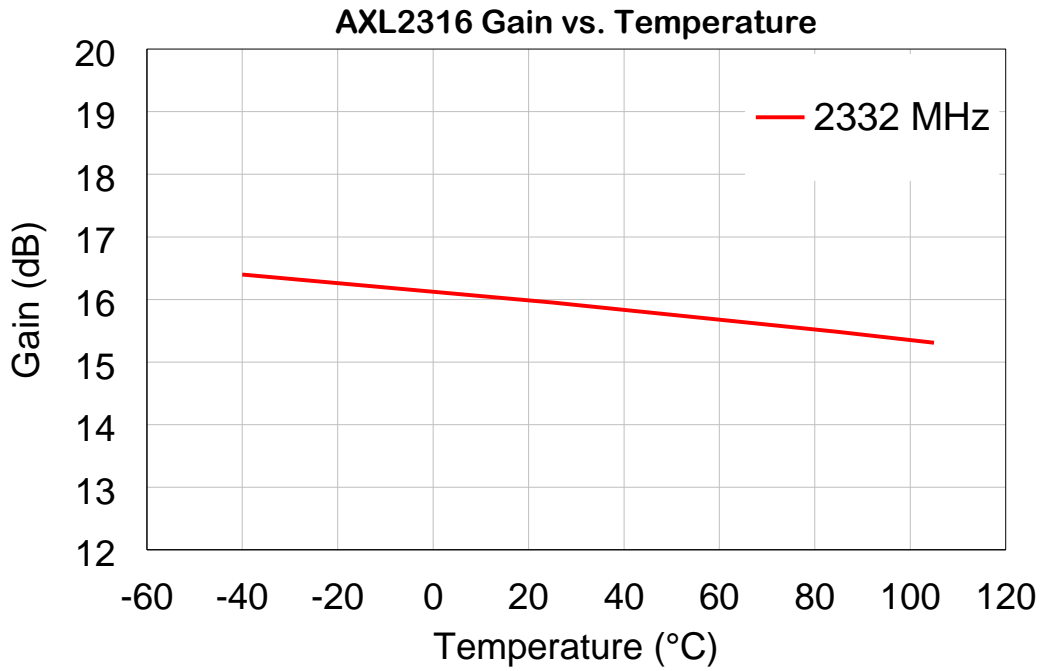


3.4 Plots of Noise Figure and Performances with Temperature



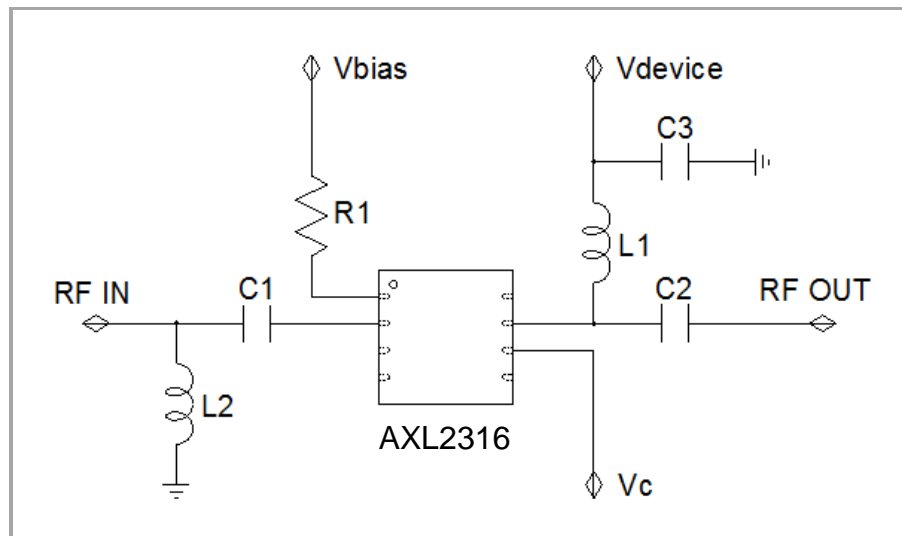




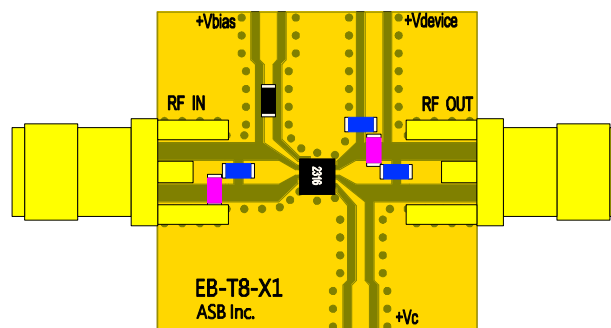


4. Application: 1100~1700 MHz ($V_{\text{DEVICE}} = V_{\text{BIAS}} = +1.8, +2.5, +3.3 \text{ V}$)

4.1 Application Circuit & Evaluation Board



* Backside paddle is RF/ DC ground



State	Vc (V)
LNA ON	0 or GND
OFF	1.0 ~ Vd

PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	18x18
EB No.	EB-T8-X1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AXL2316	-	-	MMIC Amplifier	ASB
C1	39 pF	0603	DC blocking capacitor	Murata
C2	100 pF	0603	DC blocking capacitor	Murata
C3	1 μ F	0603	Decoupling Capacitor	Murata
L1	12 nH	0603	RF Choke inductor	Murata
L2	10 nH	0603	Input matching inductor	Murata
R1	3 k Ω	0603	Bias resistor	Samsung

4.2 Performance Table

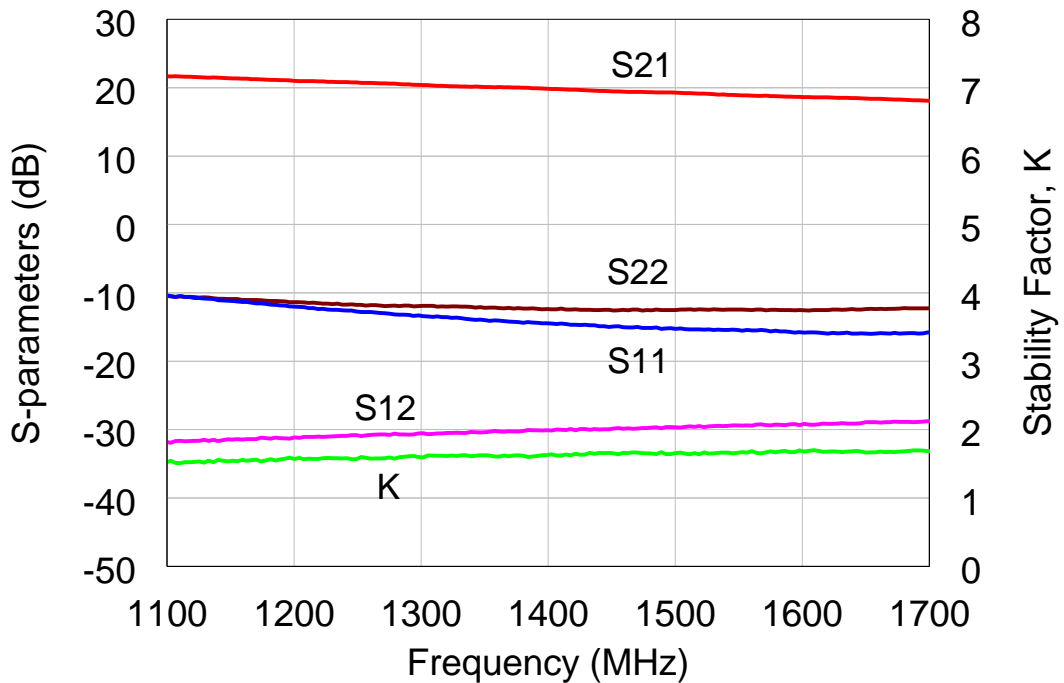
Supply voltage = +1.8, +2.5, +3.3 V, $T_A = +25\text{ }^\circ\text{C}$, $Z_0 = 50\ \Omega$.

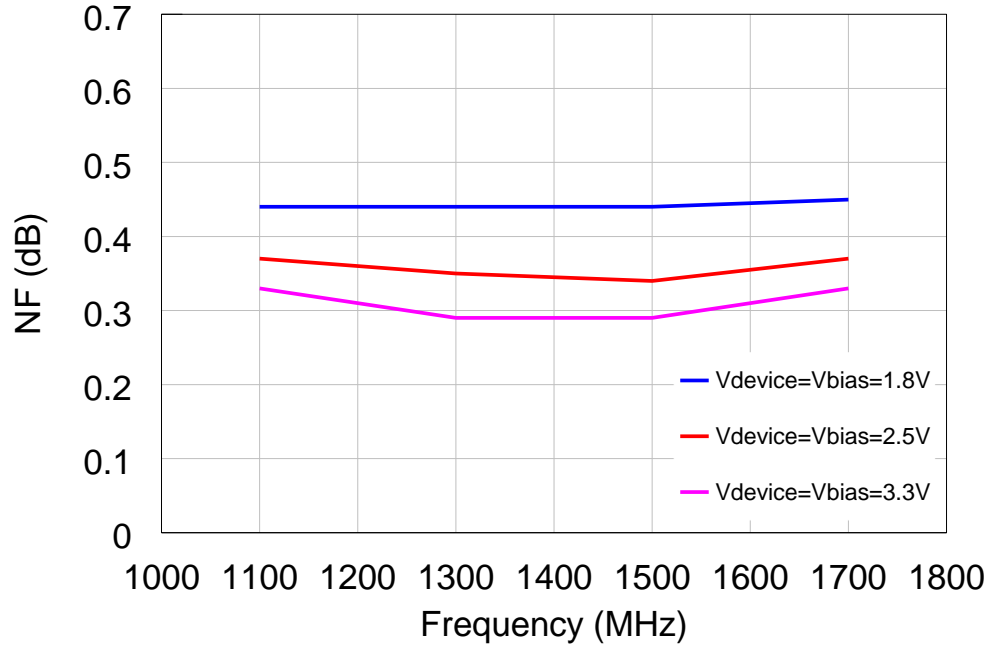
Parameter	Typical									Unit
	1100	1500	1700	1100	1500	1700	1100	1500	1700	
Frequency	1100	1500	1700	1100	1500	1700	1100	1500	1700	MHz
Gain	19.2	16.6	15.4	20.9	18.4	17.2	21.6	19.0	18.1	dB
S11	-10.0	-11.0	-11.0	-11.0	-15.0	-15.0	-10.0	-15.0	-15.0	dB
S22	-11.0	-12.0	-12.0	-11.0	-13.0	-12.0	-10.0	-12.0	-12.0	dB
Noise Figure ¹⁾	0.44	0.44	0.45	0.37	0.34	0.37	0.33	0.29	0.33	dB
Output IP3 ²⁾	19.0	19.0	19.0	24.0	24.0	24.0	29.0	30.0	30.0	dBm
Output P1dB	9.0	9.0	9.0	14.0	14.0	14.0	17.0	17.0	17.0	dBm
Current	10			20			30			mA
Device Voltage	1.8			2.5			3.3			V

1) Noise figure measured at the connectors on the board. (i.e. not de-embedded)

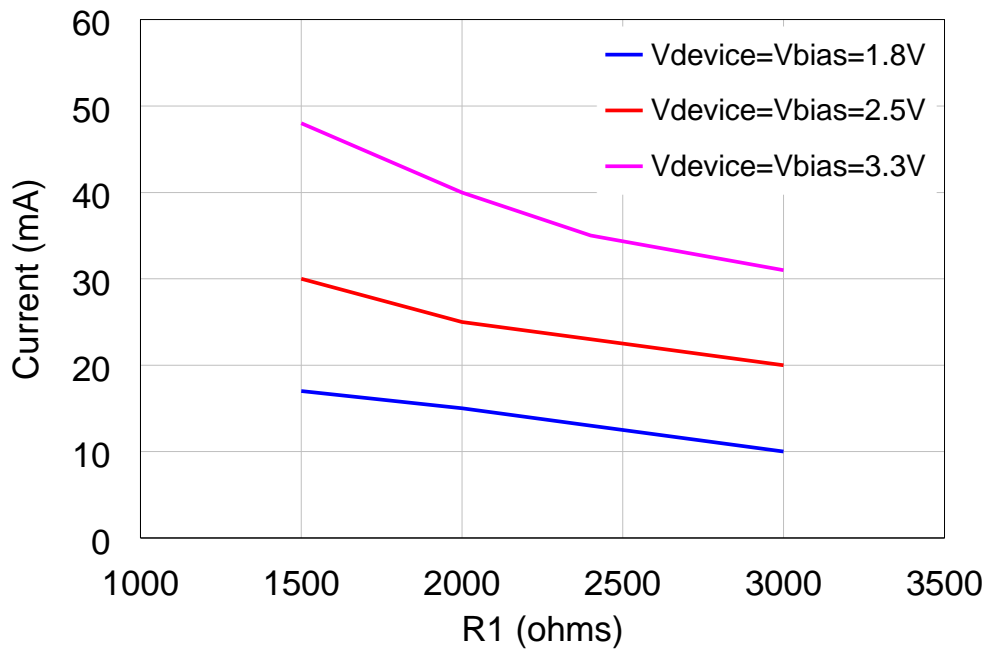
2) OIP3 is measured with two tones at the output power of +0 dBm/tone separated by 1 MHz.

4.3 Plot of S-parameters & Noise Figure

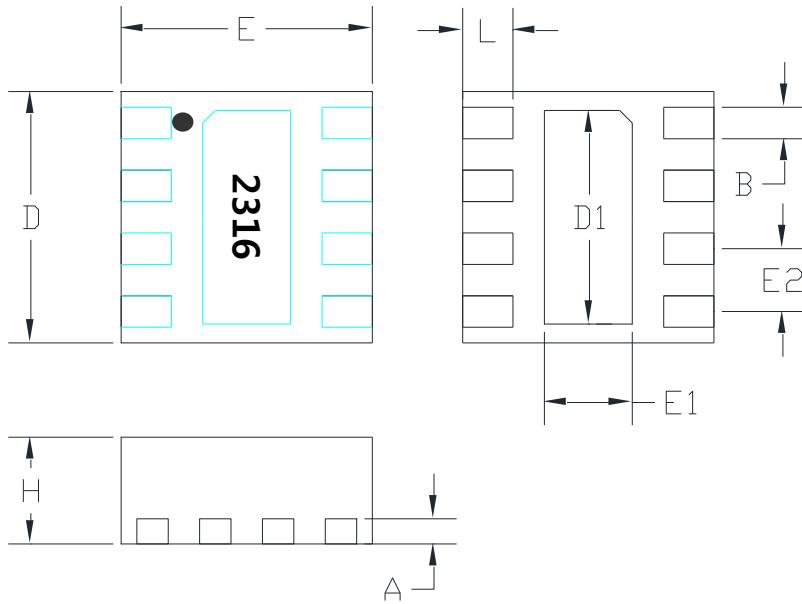




4.1 Bias Resistor Curve ($V_{DEVICE} = V_{BIAS}$)

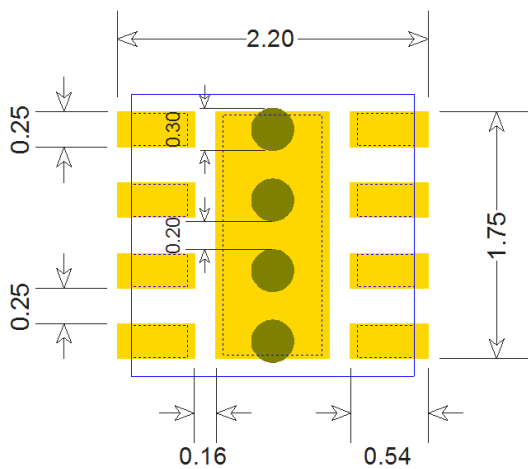


5. Package Outline (TDFN8)



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	-	0.20REF	-
B	0.18	0.23	0.28
D	1.95	2.00	2.03
D1	-	1.7BSC	-
E	1.95	2.00	2.03
E1	-	0.7BSC	-
E2	-	0.5BSC	-
L	0.35	0.40	0.45
H	0.80	0.85	0.90

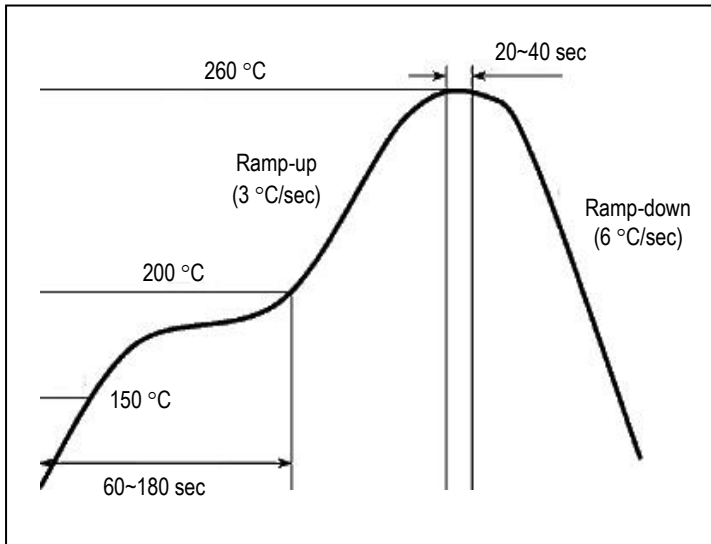
6. Surface Mount Recommendation (In mm)



NOTE

1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.
2. Recommend is that the ground via holes be placed on the bottom of the lead pin 2 and exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

7. Recommended Soldering Reflow Profile



(End of Datasheet)

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