DATA SHEET

SKY67177-11: 2.3 to 5 GHz High Gain, Low Noise Amplifier with Bypass

Applications

- 4G LTE and 5G NR base stations
- Massive MIMO active antenna array
- Receive LNA for micro-cell, macro-cell and massive MIMO base stations
- Land mobile radios and military communications

Features

- Gain 34 dB @ 3.8 GHz
- Low noise figure 0.6 dB @ 3.8 GHz
- High IP3 performance:
  - IIP3 = –2 dBm @ 3.8 GHz, high gain mode
  - IIP3 = +14 dBm @ 3.8 GHz, bypass mode
- Low current
- Temperature and process-stable active bias up to +115 °C
- QFN (16-pin 3 x 3 mm) package (MSL1 @ 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see Skyworks Certificate of Conformance.

Description

The SKY67177-11 is a high gain low-noise amplifier with second stage bypass and exceptional linearity.

The compact 3 x 3 mm, 16-pin QFN package LNA is designed for 4G LTE and 5G NR base stations operating from 2.3 to 5 GHz.

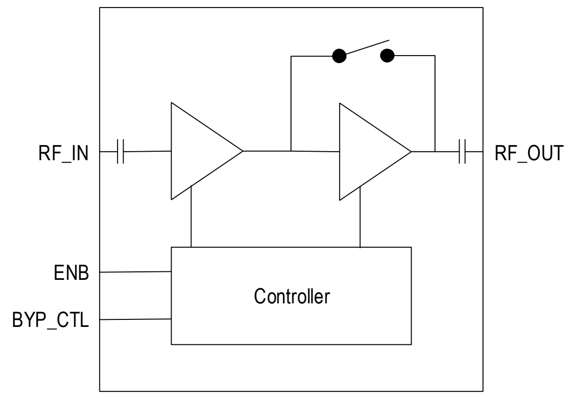


Figure 1. Block Diagram

The internal active bias circuitry provides stable performance over temperature and process variation.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

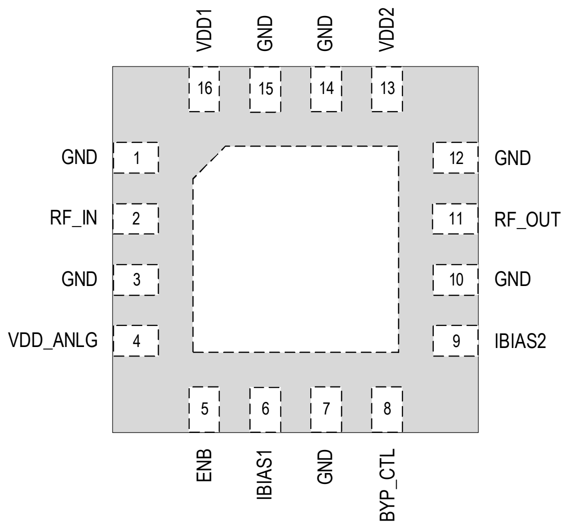


Figure 2. Pinout (Top View)

Table 1. Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	9	IBIAS2	Stage 2 amplifier current set
2	RF_IN	RF input	10	GND	Ground
3	GND	RF/DC ground	11	RF_OUT	RF output port
4	VDD_ANLG	+5 V analog control voltage supply	12	GND	Ground
5	ENB	Amplifier enabled or disabled mode of operation	13	VDD2	+5 V Stage 2 amplifier bias voltage supply
6	IBIAS1	Stage 1 amplifier current set	14	GND	Ground
7	GND	Ground	15	GND	Ground
8	BYP_CTL	Controls second stage amplifier bypass mode of operation	16	VDD1	+5 V stage 1 amplifier bias voltage supply

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY67177-11 are provided in Table 2, followed by other electrical specifications and performance graphs.

Table 2. Absolute Maximum Ratings[1]

Parameter	Symbol	Min	Max	Units
Supply voltage	V_{DD1}, V_{DD2}, V_{DD_ANLG}	0	5.5	V
Quiescent supply current	I_{DQ}		170	mA
RF peak input power[2]	P_{IN}		34	dBm
RF peak input power[3]	P_{IN}		39	dBm
Storage temperature	T_{STG}	–50	+150	°C
Operating temperature	T_C	–40	+115	°C
Junction temperature	T_J		+150	°C
Thermal resistance	Θ_{JC}		50	°C/W
Electrostatic discharge: Human Body Model Charge Device Model	 HBM CDM	 1.25 1		 kV kV

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. Exceeding more than one limit listed may result in permanent damage to the device unless otherwise specified.
2. LTE 20 MHz FDD @ Tc = 105 °C, Pave = +25 dBm, PAR = 9 dB @ supply voltage = +5.0 V.
3. LTE 20 MHz TDD @ Tc = 105 °C, 70 µs pulse duration with 60 sec period, P_{AVG} = +30 dBm, PAR = 9 dB @ supply voltage = +5.0 V.

ESD Handling: Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this device.

Thermal Data[1]

T_C = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Thermal resistance	Θ_{JC}	V_{DD1} = V_{DD2} = V_{DD_ANLG} = 5.0 V, I_{DQ} = 125mA, no RF applied		40		°C/W
Stage temperature (T_C) @ +105 °C reference (package heat slug)	T_J			130		°C

1. Performance is guaranteed only under the conditions listed in this table. Modes are established as indicated in the Operating Modes Truth Table. Minimum and maximum values are verified in production by measurement at 25 °C under typical operating conditions.

Table 3. Electrical Specifications for 3.3 to 4.2 GHz Optimized Tuning, BOM2[1]

(V_{DD1} = V_{DD2} = V_{DD_ANLG} = 5.0 V, T_C = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
RF Specifications						
Gain (high gain mode)	|S21|HG	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz	32 32 32	34 34 34	36 36 36	dB
Gain (bypass mode)	|S21|BP	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		15 15 15		dB
Gain ripple[2]	Grp	Freq: 3300 to 4200 MHz (200 MHz bandwidth) Freq: 3300 to 4200 MHz (600 MHz bandwidth)		0.25 0.45	0.45 0.7	dB
Reverse isolation (high gain mode)	|S12|	RF_out to RF_in Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz	47 47 47	50 50 50		dB
Input return loss (high gain mode)	|S11|HG	@ 3300 MHz @ 3800 MHz @ 4200 MHz	15 15 15	17 17 17		dB
Input return loss (bypass mode)	|S11|BP	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		17 17 17		dB
Output return loss (high gain mode)	|S22|HG	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz	10 10 10	13 13 13		dB
Output return loss (bypass mode)	|S22|BP	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		13 13 13		dB
Noise figure (high gain mode)	NFHG	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		0.6 0.6 0.6	1.0 1.0 1.0	dB
Noise figure (bypass mode)	NFBP	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		0.8 0.8 0.8		dB
Third order input intercept point (high gain mode)	IIP3HG	PIN = –33 dBm/tone, Δ tone = 1 MHz @ 3300 MHz @ 3800 MHz @ 4200 MHz	–3 –4 –6	–1 –2 –4		dBm
Third order input intercept point (bypass mode)	IIP3BP	PIN = –20 dBm/tone, Δ tone = 1 MHz Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		13 14 15		dBm
Input 1dB compression point (high gain mode)	IP1dBHG	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz	–17 –17 –17	–14 –14 –14		dBm
Input 1dB compression point (bypass mode)	IP1dBBP	Test freq = 3300 MHz Test freq = 3800 MHz Test freq = 4200 MHz		3 2 2		dBm
Switching time	Ts	Settling time 50% DC control signal to 0.2 dB of final RF value		0.8	1	uS

1. The min/max limits, valid over temperature –40 °C to 105 °C and voltage 4.75 V to 5.25 V, are verified by characterization.
2. 200 MHz and 600 MHz BW specifications would require different external tune BOM.

Typical Performance Characteristics, BOM2

3300 to 4200 MHz, (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

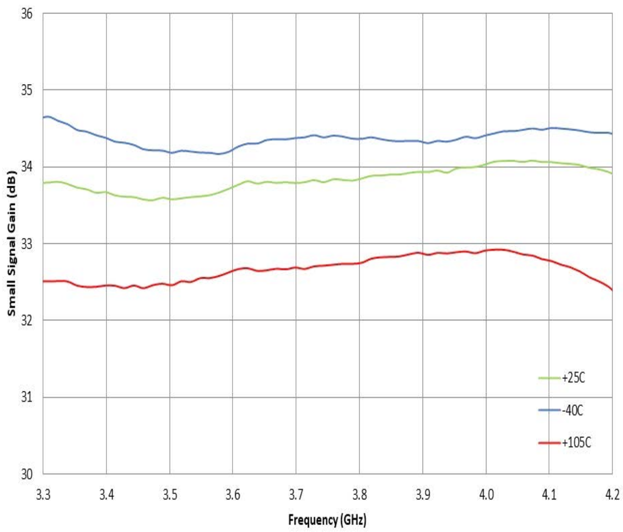


Figure 3. Small Signal Gain (dB) vs Frequency (GHz)

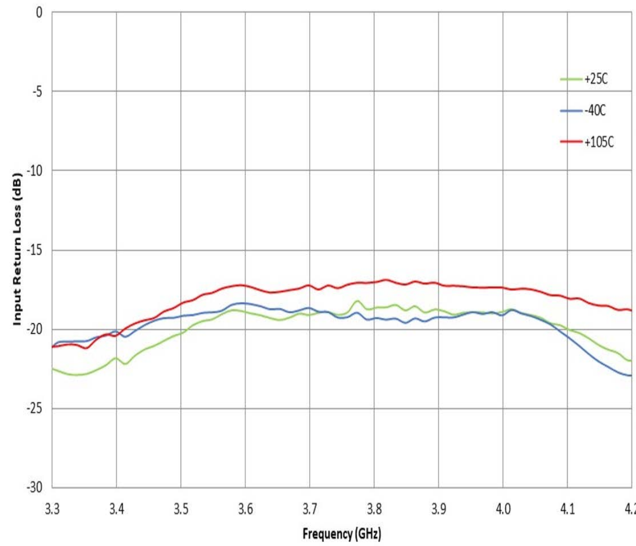


Figure 4. Input Return Loss (dB) vs Frequency (GHz)

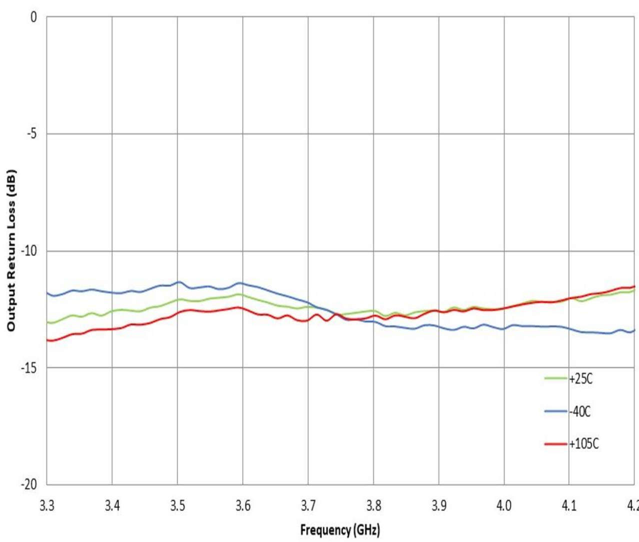


Figure 5. Output Return Loss (dB) vs Frequency (GHz)

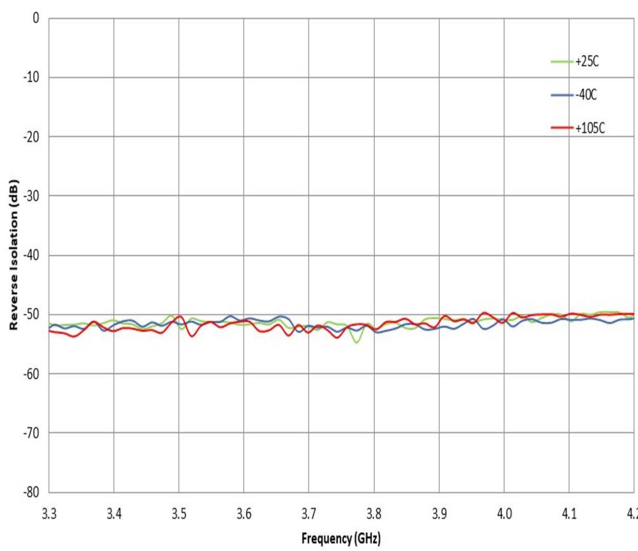


Figure 6. Reverse Isolation (dB) vs Frequency (GHz)

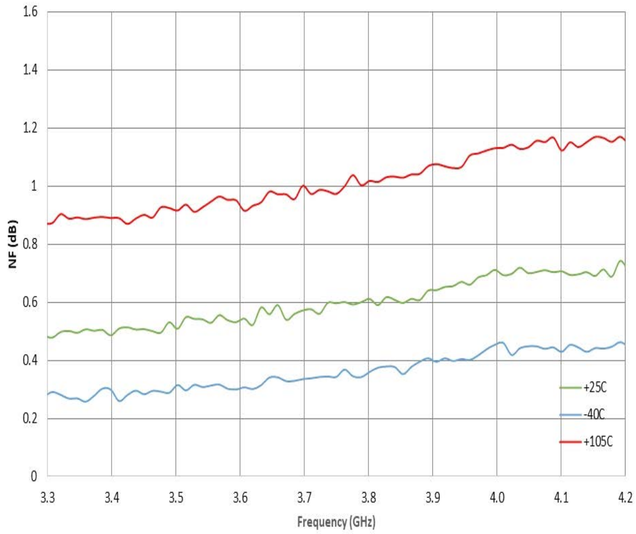


Figure 7. Noise Figure (dB) vs Frequency (GHz)

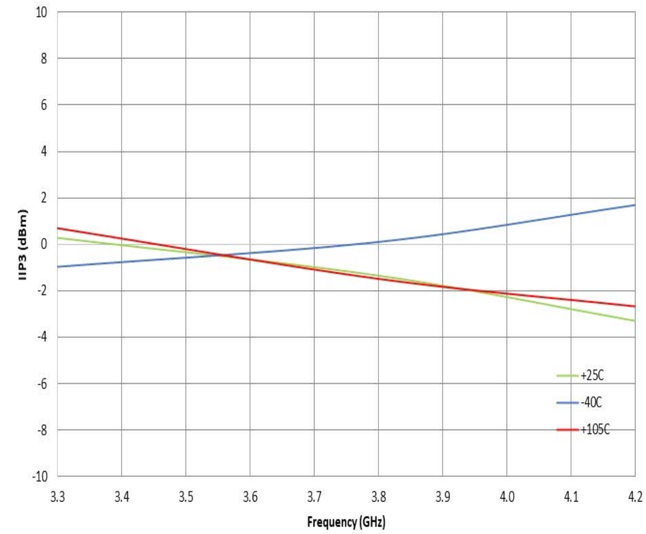


Figure 8. IIP3 (dBm) vs Frequency (GHz)

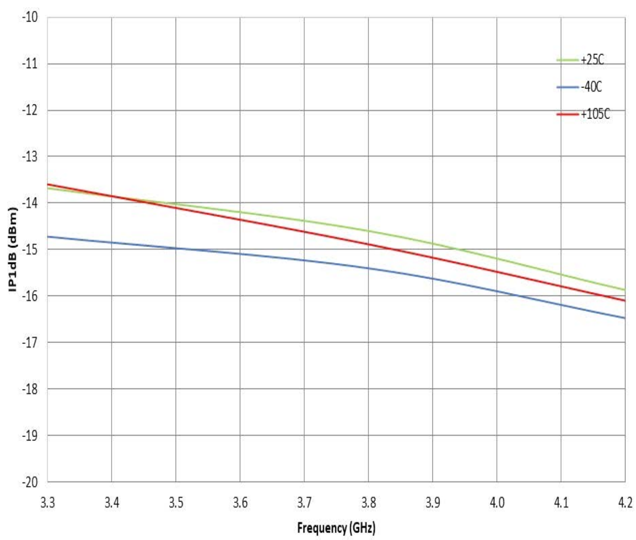


Figure 9. IP1dB (dBm) vs Frequency (GHz)

Typical Performance Characteristics, BOM2

0 to 24 GHz (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

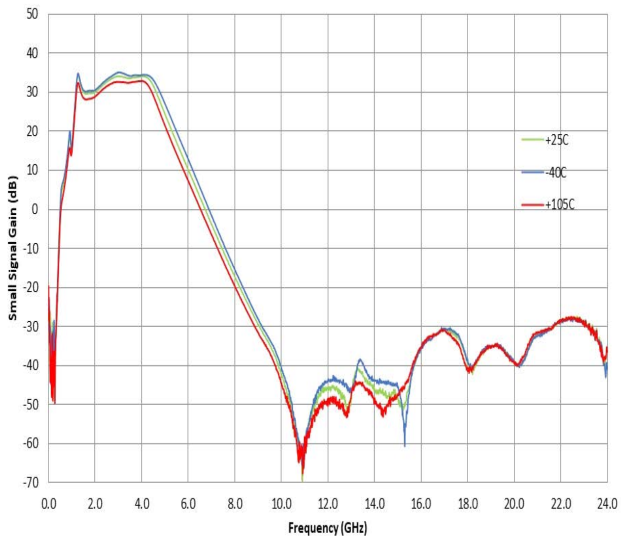


Figure 10. Small Signal Gain (dB) vs Frequency (GHz)

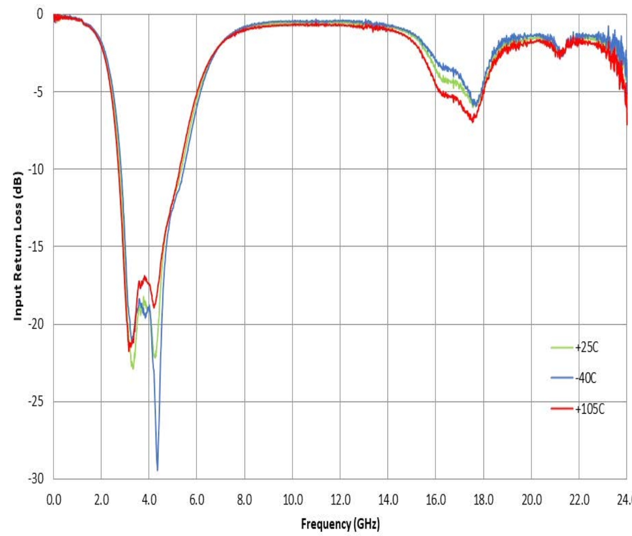


Figure 11. Input Return Loss (dB) vs Frequency (GHz)

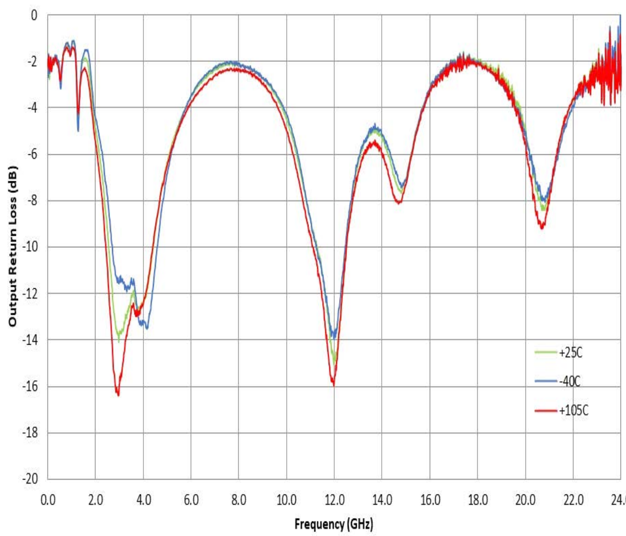


Figure 12. Output Return Loss (dB) vs Frequency (GHz)

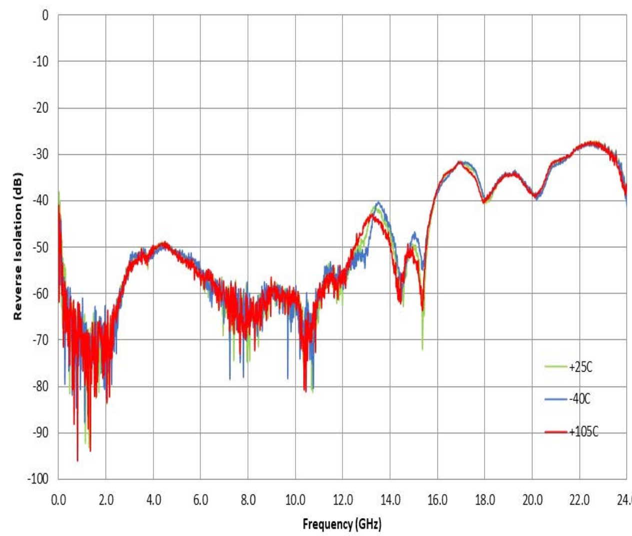


Figure 13. Reverse Isolation (dB) vs Frequency (GHz)

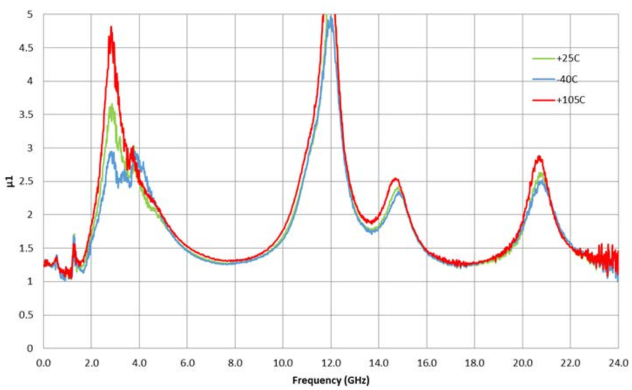


Figure 14. Stability Factor, µ1 vs Frequency (GHz)

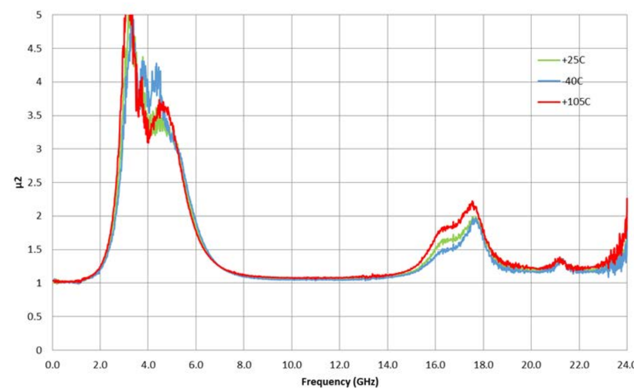


Figure 15. Stability Factor, µ2 vs Frequency (GHz)

Table 4. Electrical Specifications for 2.3 to 2.7 GHz Optimized Tuning, BOM1

(V_{DD1} = V_{DD2} = V_{DD_ANLG} = 5.0 V, T_C = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
RF Specifications						
Gain (high gain mode)	|S21|HG	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz	32 32 32	34.5 34.5 34.5	37 37 37	dB
Gain (bypass mode)	|S21|BP	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		15.5 15 15		dB
Gain ripple	Grp	Freq = 2300 to 2700 MHz (200 MHz bandwidth)		0.4	0.8	dB
Reverse Isolation (high gain mode)	|S12|	RF_out to RF_in Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz	47 47 47	55 55 55		dB
Input return loss (high gain mode)	|S11|HG	@ 2300 MHz @ 2500 MHz @ 2700 MHz	14 14 14	18 18 18		dB
Input return loss (bypass mode)	|S11|BP	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		20 18 16		dB
Output return loss (high gain mode)	|S22|HG	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz	9 9 9	12 12 12		dB
Output return loss (bypass mode)	|S22|BP	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		18 13 11		dB
Noise figure (high gain mode)	NFHG	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		0.6 0.6 0.6	1.0 1.0 1.0	dB
Noise figure (bypass mode)	NFBP	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		0.6 0.6 0.6		dB
Third order input intercept point (high gain mode)	IIP3HG	PIN = –33 dBm/tone, Δ tone = 1 MHz @ 2300 MHz @ 2500 MHz @ 2700 MHz	–7 –7 –7	–4 –4 –4		dBm
Third order input intercept point (bypass mode)	IIP3BP	PIN = –20 dBm/tone, Δ tone = 1 MHz Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		10 11.5 12		dBm
Input 1dB compression point (high gain mode)	IP1dBHG	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz	–18 –18 –18	–15 –15 –15		dBm
Input 1dB compression point (bypass mode)	IP1dBBP	Test freq = 2300 MHz Test freq = 2500 MHz Test freq = 2700 MHz		1 1.2 1.5		dBm
Switching time	Ts	Settling time 50% DC VPD control signal to 0.2 dB of final RF value		0.8	1	uS

Typical Performance Characteristics, BOM1

2300 to 2700 MHz, (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

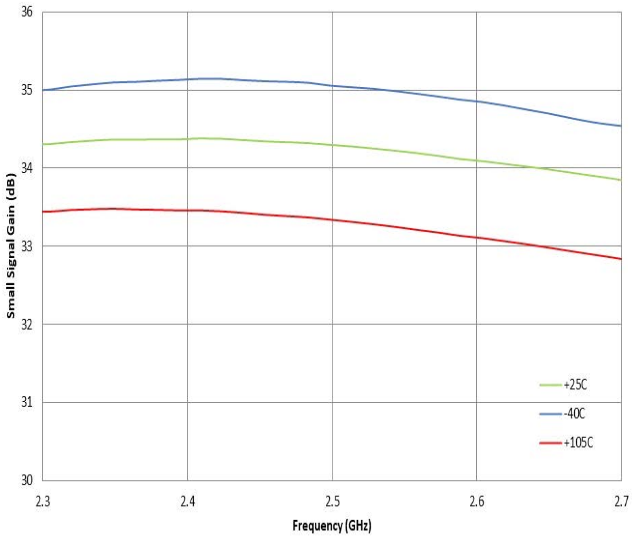


Figure 16. Small Signal Gain (dB) vs Frequency (GHz)

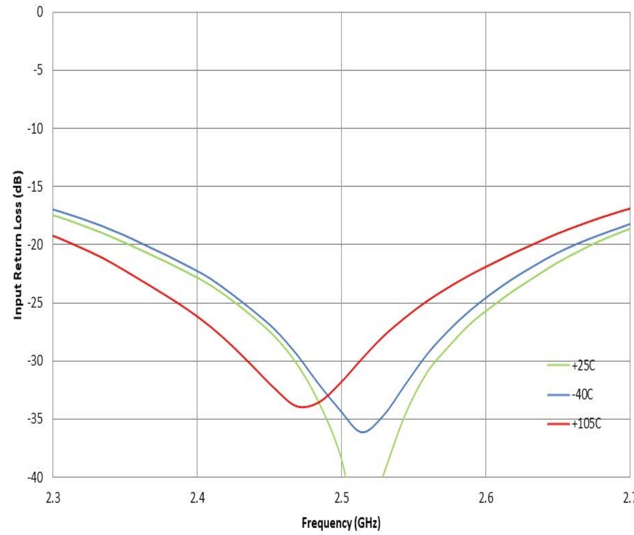


Figure 17. Input Return Loss (dB) vs Frequency (GHz)

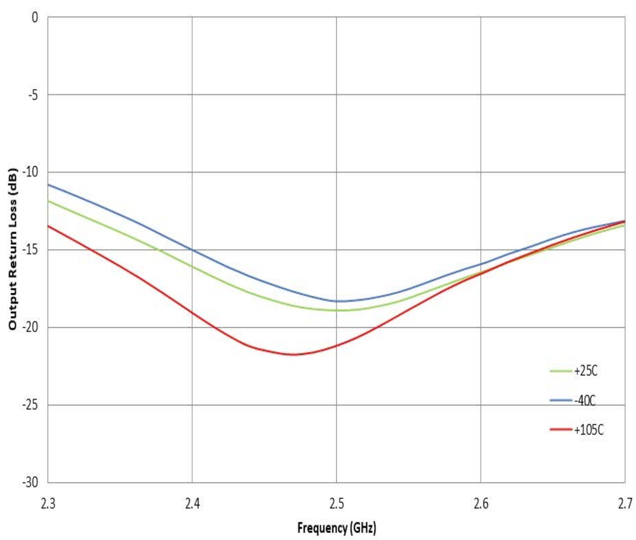


Figure 18. Output Return Loss (dB) vs Frequency (GHz)

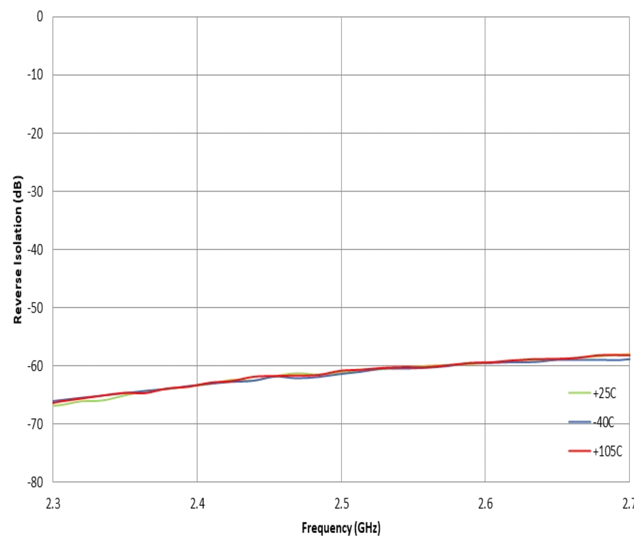


Figure 19. Reverse Isolation (dB) vs Frequency (GHz)

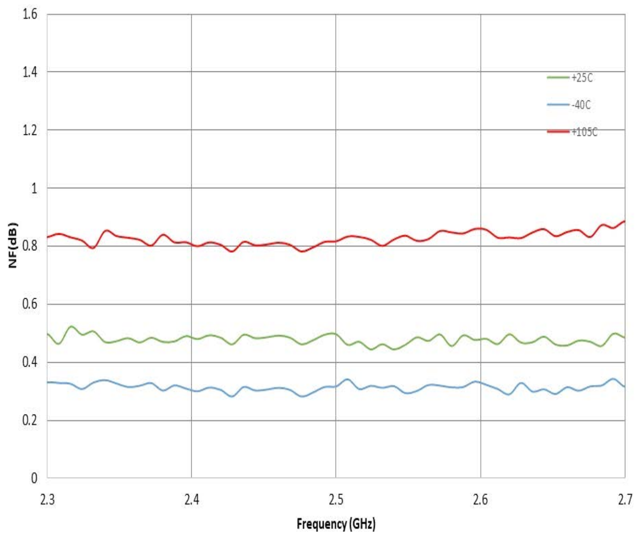


Figure 20. Noise Figure (dB) vs Frequency (GHz)

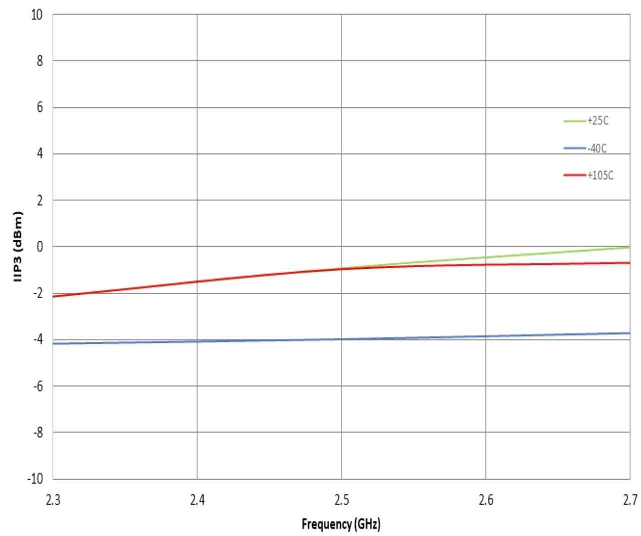


Figure 21. IIP3 (dBm) vs Frequency (GHz)

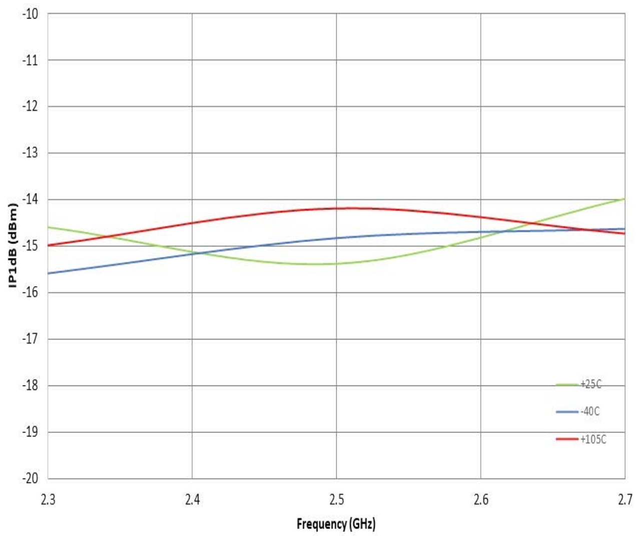


Figure 22. IP1dB (dBm) vs Frequency (GHz)

Typical Performance Characteristics, BOM1

0 to 24 GHz, (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

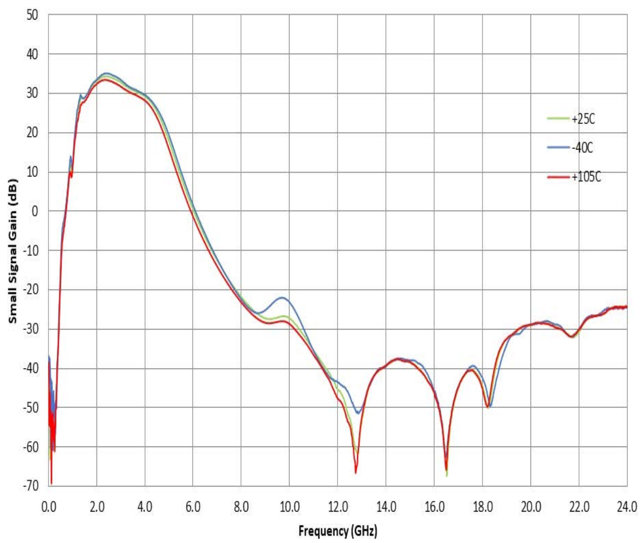


Figure 23. Small Signal Gain (dB) vs Frequency (GHz)

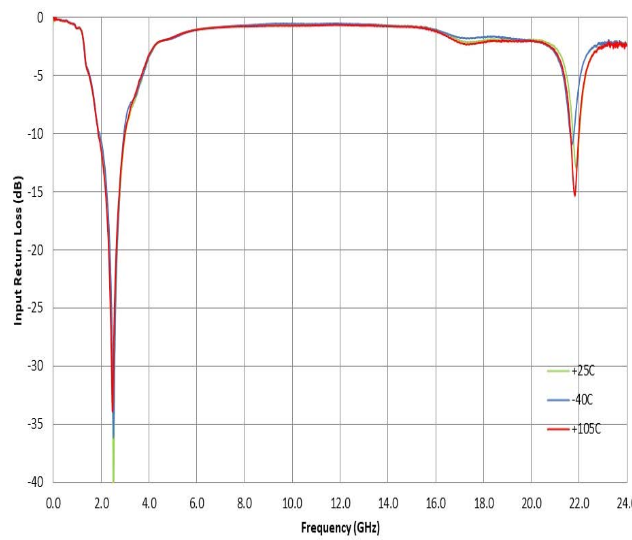


Figure 24. Input Return Loss (dB) vs Frequency (GHz)

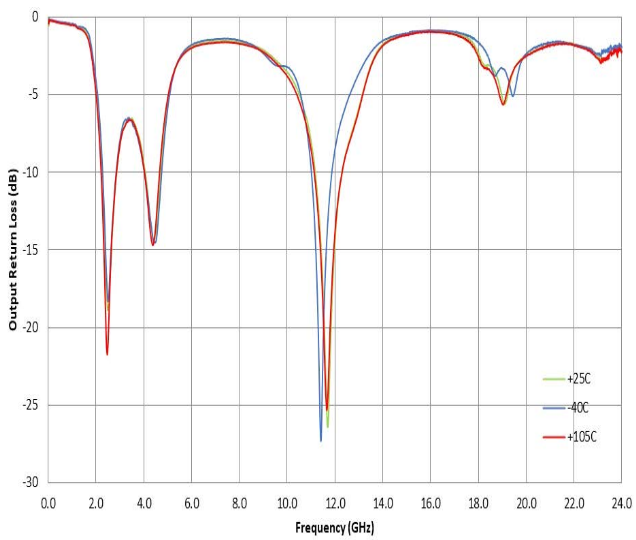


Figure 25. Output Return Loss (dB) vs Frequency (GHz)

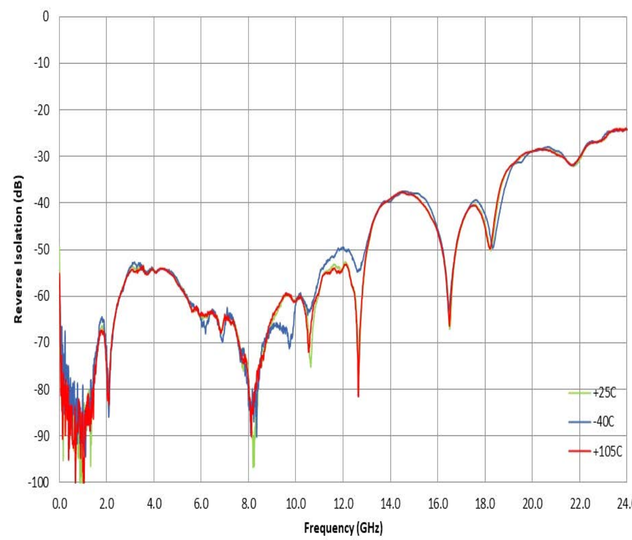


Figure 26. Reverse Isolation (dB) vs Frequency (GHz)

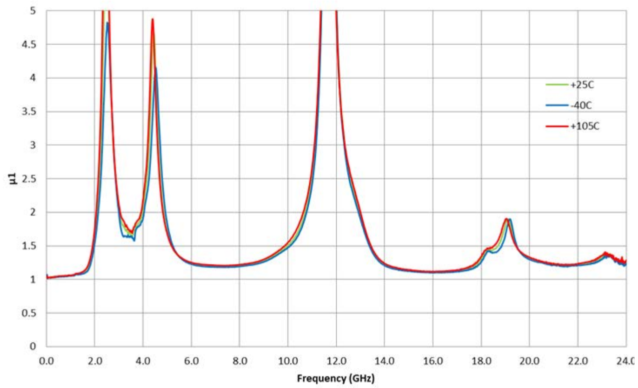


Figure 27. Stability Factor, μ1 vs Frequency (GHz)

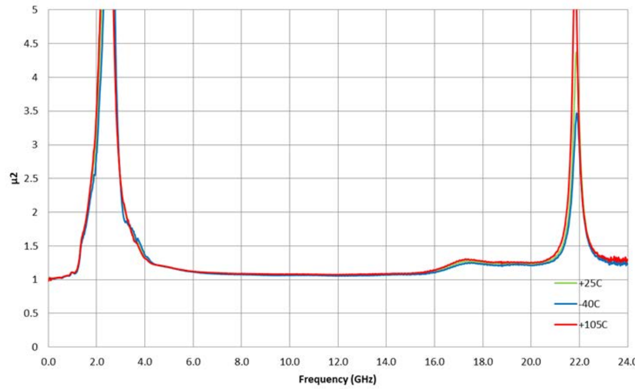


Figure 28. Stability Factor, μ2 vs Frequency (GHz)

Table 5. Electrical Specifications for 4.8 to 5.0 GHz Optimized Tuning, BOM3

(V_{DD1} = V_{DD2} = V_{DD}_ANLG = 5.0 V, T_C = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
RF Specifications						
Gain (high gain mode)	|S21|HG	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz	31.5 31.5 31.5	34 34 34	36 36 36	dB
Gain (bypass mode)	|S21|BP	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		13.5 12.5 11.5		dB
Gain ripple	Grp	Freq: 4800 to 5000 MHz (200 MHz bandwidth)		0.8	1.0	dB
Reverse isolation (high gain mode)	|S12|	RF_out to RF_in Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz	42 42 42	47 47 47		dB
Input return loss (high gain mode)	|S11|HG	@ 4800 MHz @ 4900 MHz @ 5000 MHz	12.5 12.5 12.5	17 17 17		dB
Input return loss (bypass mode)	|S11|BP	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		20 18 15		dB
Output return loss (high gain mode)	|S22|HG	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz	10 10 10	14 20 15		dB
Output return loss (bypass mode)	|S22|BP	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		11 10 9		dB
Noise figure (high gain mode)	NFHG	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		1 1 1	1.6 1.6 1.6	dB
Noise figure (bypass mode)	NFBP	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		1 1 1		dB
Third order input intercept point (high gain mode)	IIP3HG	PIN = –33 dBm/tone, Δ tone = 1 MHz @ 4800 MHz @ 4900 MHz @ 5000 MHz	–9 –10 –10	–6 –7 –7		dBm
Third order input intercept point (bypass mode)	IIP3BP	PIN = –20 dBm/tone, Δ tone = 1 MHz Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		13 14 15		dBm
Input 1dB compression point (high gain mode)	IP1dBHG	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz	–18 –19 –19	–15 –16 –16		dBm
Input 1dB compression point (bypass mode)	IP1dBBP	Test freq = 4800 MHz Test freq = 4900 MHz Test freq = 5000 MHz		–3 –2 –1		dBm
Switching time	Ts	Settling time 50% DC VPD control signal to 0.2 dB of final RF value		0.8	1.0	uS

Typical Performance Characteristics, BOM3

4800 to 5000 MHz, (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

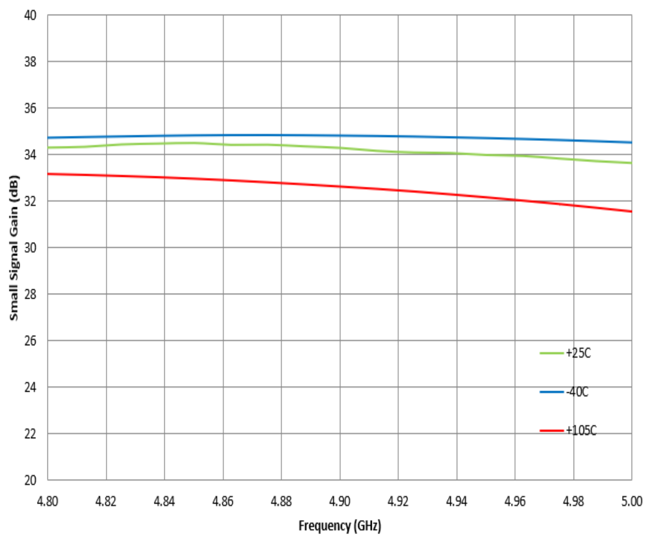


Figure 29. Small Signal Gain (dB) vs Frequency (GHz)

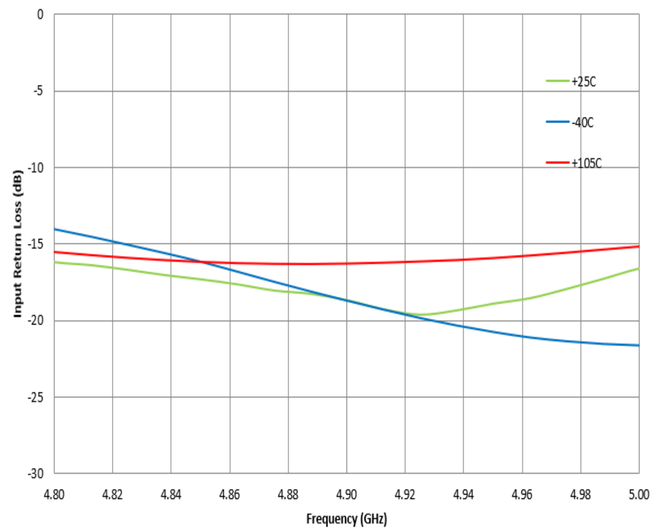


Figure 30. Input Return Loss (dB) vs Frequency (GHz)

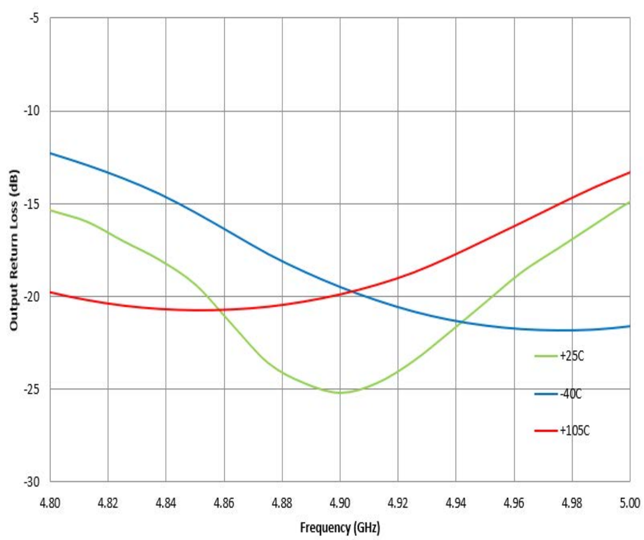


Figure 31. Output Return Loss (dB) vs Frequency (GHz)

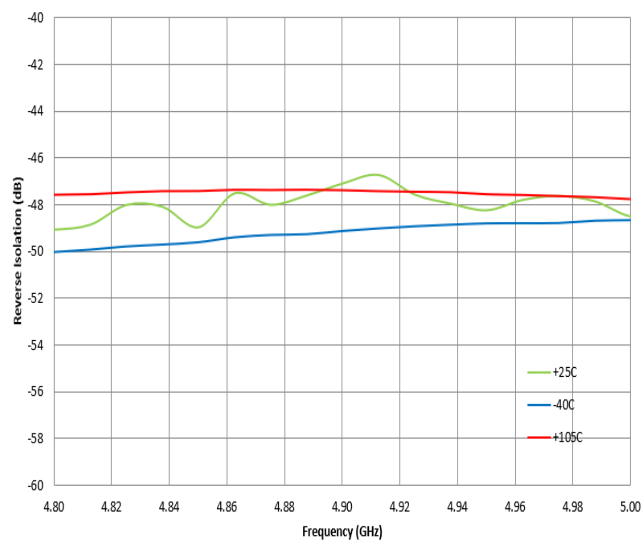


Figure 32. Reverse Isolation (dB) vs Frequency (GHz)

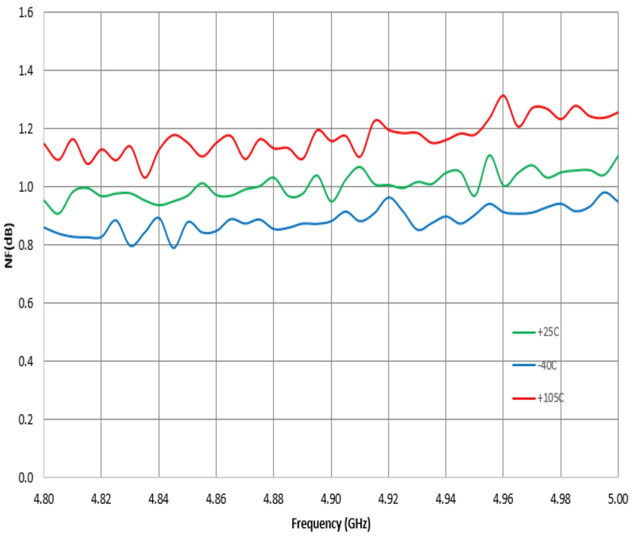


Figure 33. Noise Figure (dB) vs Frequency (GHz)

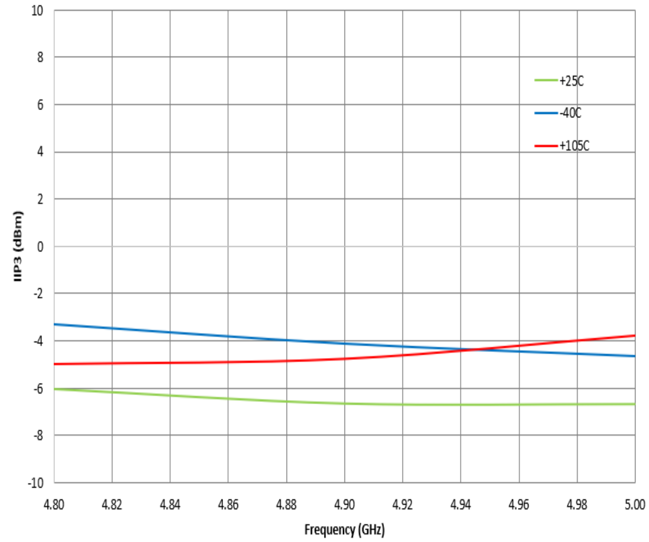


Figure 34. IIP3 (dBm) vs Frequency (GHz)

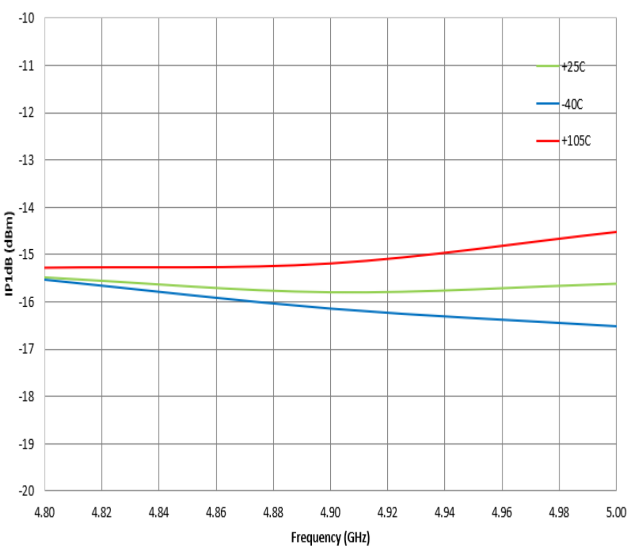


Figure 35. IP1dB (dBm) vs Frequency (GHz)

Typical Performance Characteristics, BOM3

0 to 20 GHz, (VDD1 = VDD2 = VDD_ANLG = 5.0 V, Tc = +25 °C, PIN = –30 dBm, Characteristic Impedance (Zo) = 50 Ω, High Gain Mode, Unless Otherwise Noted)

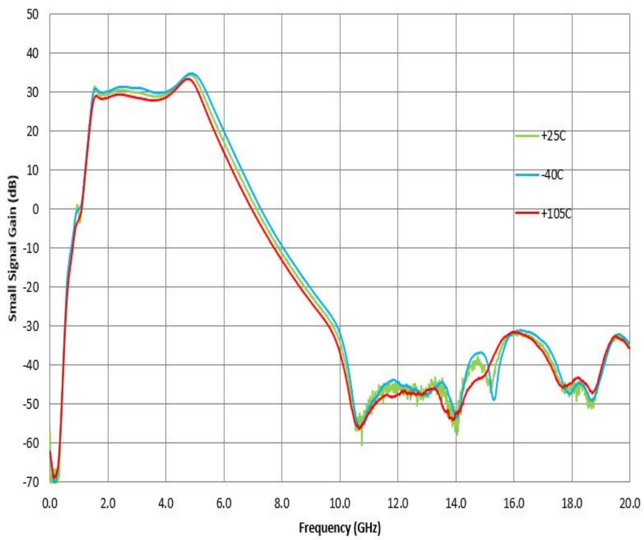


Figure 36. Small Signal Gain (dB) vs Frequency (GHz)

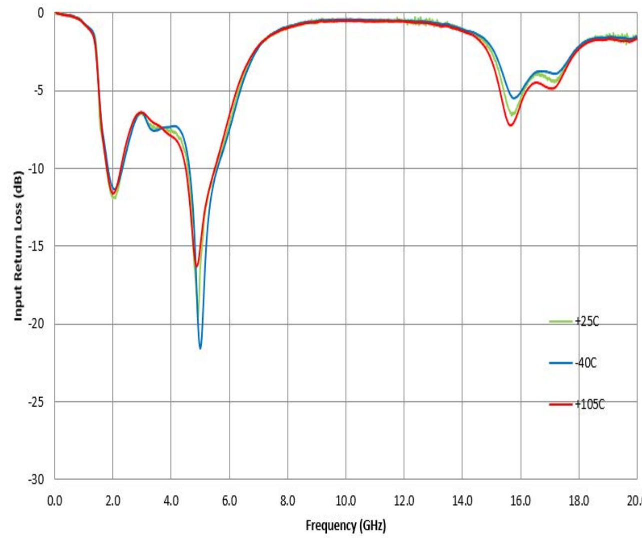


Figure 37. Input Return Loss (dB) vs Frequency (GHz)

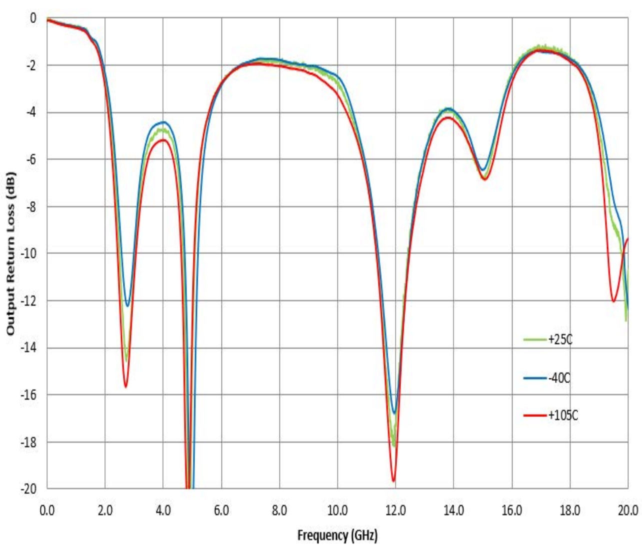


Figure 38. Output Return Loss (dB) vs Frequency (GHz)

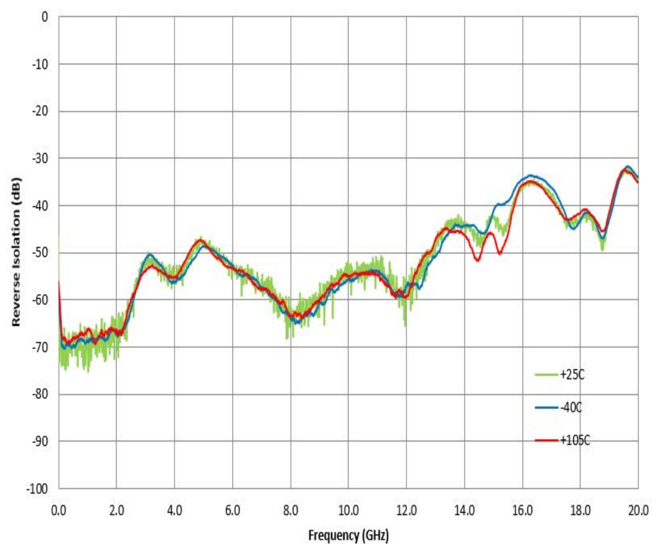


Figure 39. Reverse Isolation (dB) vs Frequency (GHz)

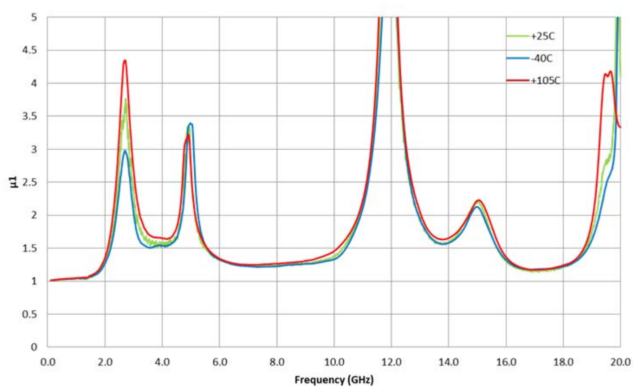


Figure 40. Stability Factor, µ1 vs Frequency (GHz)

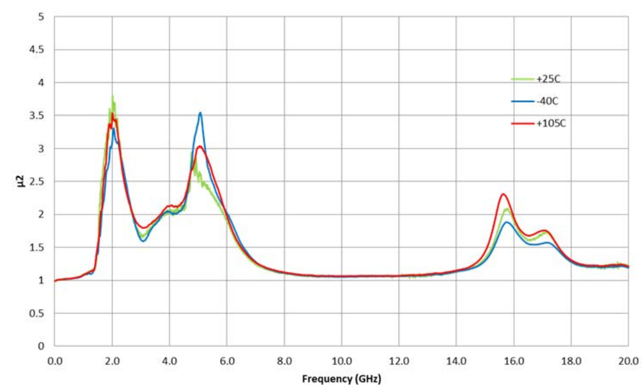


Figure 41. Stability Factor, µ2 vs Frequency (GHz)

Table 6. DC Electrical Specifications

Table 7. (V_{DD1} = V_{DD2} = V_{DD_ANLG} = 5.0 V, T_C = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply voltage	Vdd		4.75	5.0	5.25	V
Quiescent current	IDQ			120	145	mA
Operating temperature	T_C		–40		105	°C
Logic high level	VIH		1.17		3.3	V
Logic low level	VIL		–0.3		0.63	V

Table 8. Truth Table

Enable Truth		Bypass Truth	
ENB	**Function**	**BYP_CTL**	**Function**
Low	LNA power on	Low	High gain mode
High	LNA power down	High	Low gain mode (bypass mode)

Evaluation Board Description

An Evaluation Board (EVB) is used to test the performance of the SKY67177-11. The evaluation board schematic diagram is shown below, followed by the Bill of Materials (BOM) for the three EVB versions.

Operational Application

To bias up the SKY67177-11 perform the following power supply and control signal turn-on sequence:

1. Ground all GND connectors.
2. Set ENB and BYPASS_CTRL to LOW.
3. Apply 5.0 V to VDD1, and VDD2, and VDD_ANLG.
4. Apply RF input signal.

To power down the SKY67177-11 perform the following power supply and control signal turn-off sequence:

1. Turn Off RF input signal.
2. Set ENB and BYPASS_CTRL to LOW.
3. Apply 0 V to VDD1, VDD2, and VDD_ANLG.

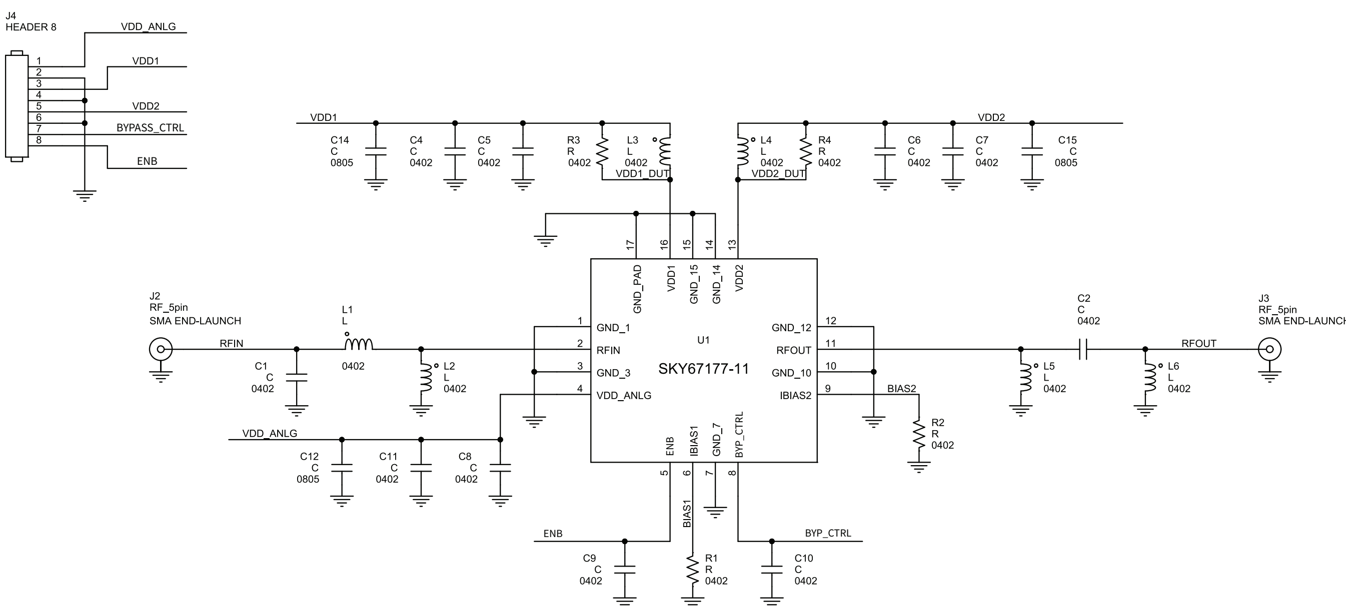


Figure 42. Evaluation Board Schematic

Table 9. Evaluation Board Bill of Materials for 2.3 to 2.7 GHz, BOM1

Reference	Value	Manufacturer	Part Number	Size	Description
C1	0.39 pF	Murata	GJM1555C1HR39WB01D	0402	0.39 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
C2	1.1 pF	Murata	GJM1555C1H1R1WB01D	0402	1.1 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
C4, C7	47 pF	Murata	GRM1555C1E470JA01D	0402	Multilayer ceramic capacitor MLCC - SMD/SMT 47 pF 25 V DC 5% C0G
C5, C6	1 uF	Murata	GRM155C81E105ME11D	0402	Multilayer ceramic capacitor MLCC - SMD/SMT 1 uF 25 V DC 20% X6S
C8	0.1 uF	Murata	GRM155C81E104MA12D	0402	Multilayer ceramic capacitor MLCC - SMD/SMT 0.1 uF 25 V DC 20% X6S
C9	DNI			0402	
C10	DNI			0402	
C11	4.7 uF	Murata	GRM155D81C475ME15D	0402	Multilayer ceramic capacitor MLCC - SMD/SMT 4.7 uF 16 V DC 20% X5S
C12, C14, C15	10 uF	Murata	GRM21BC71E106ME11L	0805	Multilayer ceramic capacitor MLCC - SMD/SMT 10 uF 25 V DC 20% X7S
L1	2.9 nH	Murata	LQW15AN2N9B00D	0402	2.9 nH unshielded drum core, wirewound inductor 750 mA 70 mΩ max
L2	3.6 nH	Murata	LQW15AN3N6B8ZD	0402	3.6 nH unshielded drum core, wirewound inductor 1.95 A 30 mΩ max
L3	5.4 nH	Murata	LQW15AN5N4B8ZD	0402	5.4 nH unshielded drum core, wirewound inductor 1.77 A 40 mΩ max
L4	1.6 nH	Murata	LQG15HH1N6B02D	0402	1.6 nH unshielded multilayer inductor 1 A 70 mΩ max
L5	0.4 pF	Murata	GJM1555C1HR40WB01D	0402	0.4 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
L6	4.7 nH	Murata	LQG15HH4N7B02D	0402	4.7 nH unshielded multilayer inductor 700 mA 160 mΩ max
R1	8.2 kΩ	Panasonic ECG	ERJ-2RKF8201X	0402	Resistor, SMD 8.2 kΩ 1% 1/10 W
R2	7.5 kΩ	Panasonic ECG	ERJ-2RKF7501X	0402	Resistor, SMD 7.5 kΩ 1% 1/10 W
R3	200 Ω	Panasonic ECG	ERJ-2RKF2000X	0402	Resistor, SMD 200 Ω 1% 1/10 W
R4	220 Ω	Panasonic ECG	ERJ-U02F2200X	0402	Resistor, SMD 220 Ω 1% 1/10 W
J2, J3	SMA RF connectors	Cinch Connectivity Solutions	R19-070-18-0032210MM	0.062-in. board thickness	SMA connector jack, female socket 50 Ω board edge, end launch solder tab
J4	8 pos header right angle	TE Connectivity	5-103329-8	2.54 mm pitch	Conn header R/A 8 pos 2.54 mm
U1	16-pin QFN	Skyworks Solutions	SKY67177-11	3 mm x 3 mm	2.3 to 5 GHz high gain low-noise amplifier with bypass
PCB		Skyworks Solutions	EN53-D725-001_V1		

Table 10. Evaluation Board Bill of Materials for 3.3 to 4.2 GHz, BOM2

Reference	Value	Manufacturer	Part Number	Size	Description
C1	0.7 pF	Murata	GJM1555C1HR70WB01D	0402	Multilayer ceramic capacitor MLCC - SMD/SMT 0.7 pF 50 V DC 0.05 pF C0G
C2	0.7 nH	TDK	MHQ1005P0N7BT000	0402	RF inductor - SMD IND 0402 0.7 nH S-HQ SMD RF IND
C4, C7	47 pF	Murata	GRM1555C1E470JA01D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 47 pF 25 V DC 5% C0G
C5, C6	1 uF	Murata	GRM155C81E105ME11D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 1 uF 25 V DC 20% 0402 X6S
C8	0.1 uF	Murata	GRM155C81E104MA2D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 0.1 uF 25 V DC 20% X6S
C9	DNI			0402	
C10	DNI			0402	
C11	4.7 uF	Murata	GRM155D81C475ME15D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 4.7 uF 16 V DC 20% X5S
C12, C14, C15	10 uF	Murata	GRM21BC71E106ME11L	0805	Multilayer ceramic capacitor MLCC SMD/SMT 10 uF 25 V DC 20% X7S
L1	0.8 nH	TDK	MHQ1005P0N8BT000	0402	RF inductor - SMD IND 0.8 nH S-HQ SMD RF IND
L2	1.5 nH	Murata	LQW15AN1N5B00D	0402	1.5 nH unshielded drum core, wirewound inductor 1 A 30 mΩ max
L3, L4	2.4 nH	Murata	LQG15HS2N4B02D	0402	Fixed inductor, 2.4 nH 850 mA, 110 mΩ SMD
L5	0.2 pF	Murata	GJM1555C1HR20WB01D	0402	0.2 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
L6	430 Ω	Murata	ERJ-2RKF4300X	0402	Resistor, SMD 430 Ω 1% 1/10 W
R1	8.2 kΩ	Panasonic ECG	ERJ-2RKF8201X	0402	Resistor, SMD 8.2 kΩ 1% 1/10 W
R2	7.5 kΩ	Panasonic ECG	ERJ-2RKF7501X	0402	Resistor, SMD 7.5 kΩ 1% 1/10 W
R3, R4	620 Ω	Panasonic ECG	ERJ-2RKF6200X	0402	Resistor, SMD 620 Ω 1% 1/10 W
J2, J3	SMA RF connectors	Cinch Connectivity Solutions	R19-070-18-0032210MM	0.062" board thickness	SMA connector jack, female socket 50 Ω board edge, end launch solder tab
J4	8 pos header right angle	TE Connectivity	5-103329-8	2.54 mm pitch	Conn header R/A 8 pos 2.54 mm
U1	16-pin QFN	Skyworks Solutions	SKY67177-11	3mm x 3mm	2.3 to 5 GHz high gain low-noise amplifier with bypass
PCB		Skyworks Solutions	EN53-D725-001_V1		

Table 11. Evaluation Board Bill of Materials for 4.8 to 5.0 GHz, BOM3

Reference	Value	Manufacturer	Manufacturer Part Number	Size	Description
C1	0.8 pF	Murata	GJM1555C1HR80WB01D	0402	0.8 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
C2	0.9 pF	Murata	GJM1555C1HR90WB01D	0402	0.9 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
C4, C7	47 pF	Murata	GRM1555C1E470JA01D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 47 pF 25 V DC 5% C0G
C5, C6	1 uF	Murata	GRM155C81E105ME11D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 1 uF 25 V DC 20% X6S
C8	0.1 uF	Murata	GRM155C81E104MA2D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 0.1 uF 25 V DC 20% X6S
C9	DNI			0402	
C10	DNI			0402	
C11	4.7 uF	Murata	GRM155D81C475ME15D	0402	Multilayer ceramic capacitor MLCC SMD/SMT 4.7 uF 16 V DC 20% X5S
C12, C14, C15	10 uF	Murata	GRM21BC71E106ME11L	0805	Multilayer ceramic capacitor MLCC SMD/SMT 10 uF 25 V DC 20% X7S
L1	0.7 nH	TDK	MHQ1005P0N7BT000	0402	RF inductor - SMD IND 0402 0.7 nH S-HQ SMD RF inductor
L2	2.7 nH	Murata	LQW15AN2N7B00	0402	2.7 nH unshielded drum core, wirewound inductor 850 mA 50 mΩ max
L3, L4	0.8 nH	Coilcraft	0402DC-N80XJRW	0402	0.8 nH unshielded wirewound inductor 2.8 A 25 mΩ max
L5	0.2 pF	Murata	GJM1555C1HR20WB01D	0402	0.2 pF ±0.05 pF 50 V ceramic capacitor C0G, NP0
L6	3.9 nH	Murata	LQG15HS3N9S02	0402	Fixed inductor 3.9 nH ±0.3nH 750 mA 140 mΩ SMD
R1	8.2 kΩ	Panasonic ECG	ERJ-2RKF8201X	0402	Resistor, SMD 8.2 kΩ 1% 1/10 W
R2	7.5 kΩ	Panasonic ECG	ERJ-2RKF7501X	0402	Resistor, SMD 7.5 kΩ 1% 1/10 W
R3, R4	499 Ω	Panasonic ECG	ERJ-2RKF4990X	0402	Resistor, SMD 499 Ω 1% 1/10 W
J2, J3	SMA RF connectors	Cinch Connectivity Solutions	R19-070-18-0032210MM	0.062-in. board thickness	SMA connector jack, female socket 50 Ω board edge, end launch solder tab
J4	8 pos header right angle	TE Connectivity	5-103329-8	2.54 mm pitch	Conn header R/A 8 pos 2.54 mm
U1	16-pin QFN	Skyworks Solutions	SKY67177-11	3 mm x 3 mm	2.3 to 5 GHz high gain low-noise amplifier with bypass

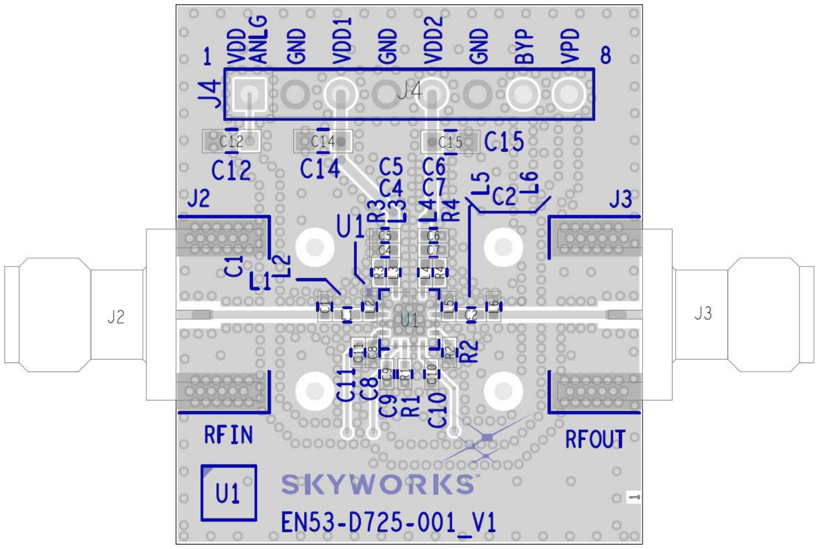


Figure 43. Evaluation Board Assembly Diagram

50 OHM +/-10%	CROSS SECTION	NAME	THICKNESS	MATERIALS
W=0.442mm CPW=0.236mm		TMASK	0.018mm	SOLDERMASK
		L1	0.053mm	CU-0.5OZ_OUTER
REFGND		DIELECTRIC	0.254mm	RO4350B-CORE-254UM
		L2	0.018mm	CU-0.5OZ_INNER
		DIELECTRIC	0.850mm	FR4-PREPREG-ADJ
		L3	0.018mm	CU-0.5OZ_INNER
		DIELECTRIC	0.254mm	FR-4
		L4	0.053mm	CU-0.5OZ_OUTER
		BMASK	0.018mm	SOLDERMASK

OVERALL BOARD THICKNESS (METAL-TO-METAL) : 1.5 mm +/- 10%

Figure 44. Layer Detail Physical Characteristics

Package and Handling Information

Typical part marking is shown below, followed by package dimensions, PCB layout, and tape and reel information.

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY67177-11 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, “Solder Reflow Information,” document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

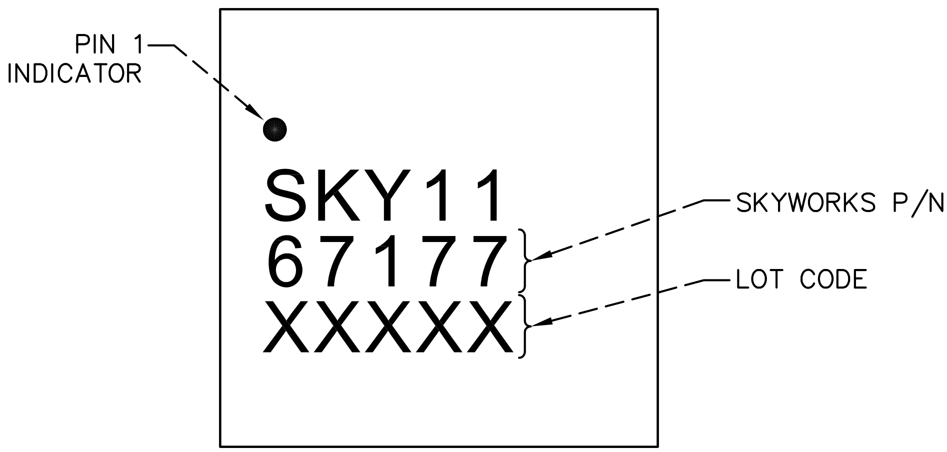


Figure 45. Typical Part Marking

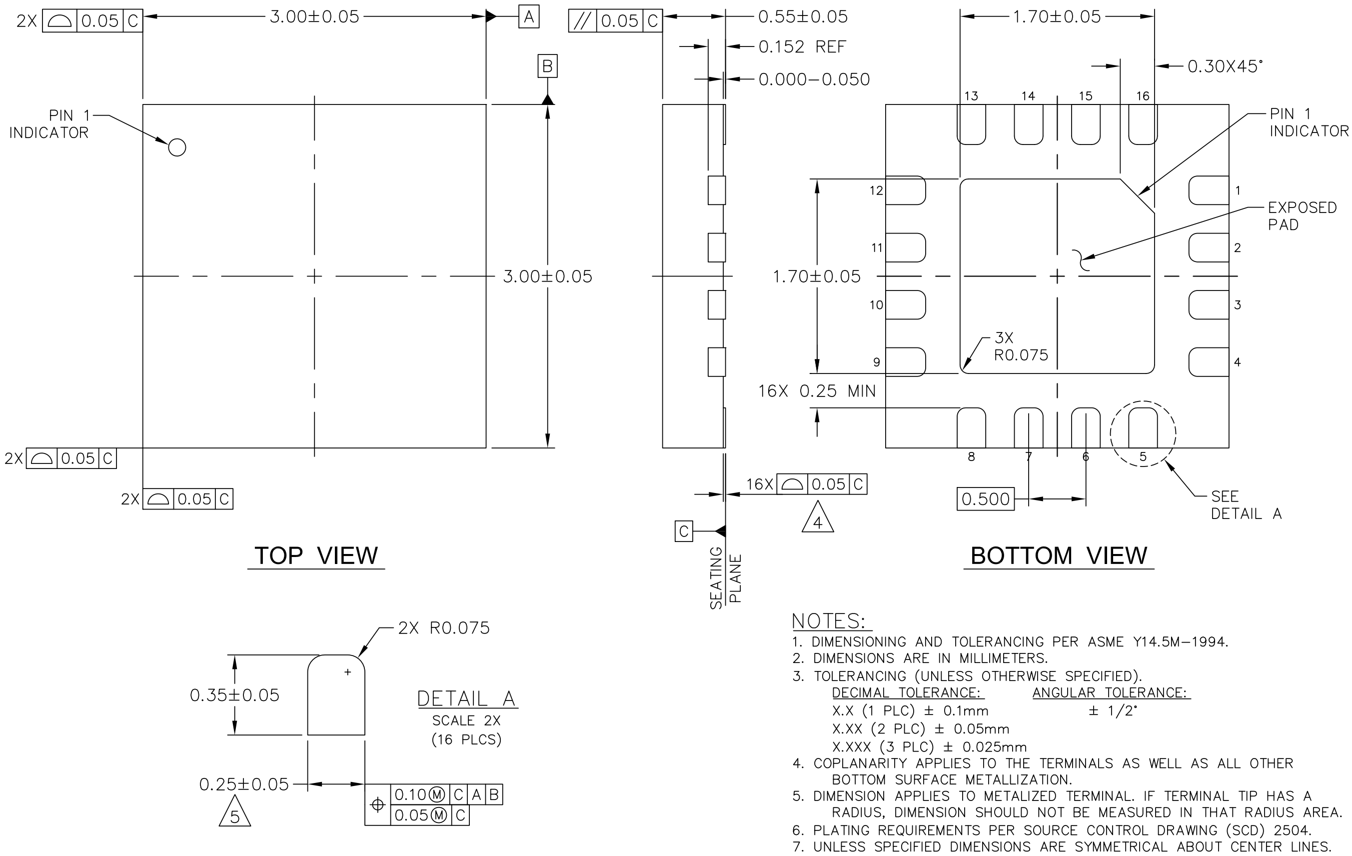


Figure 46. Package Dimensions

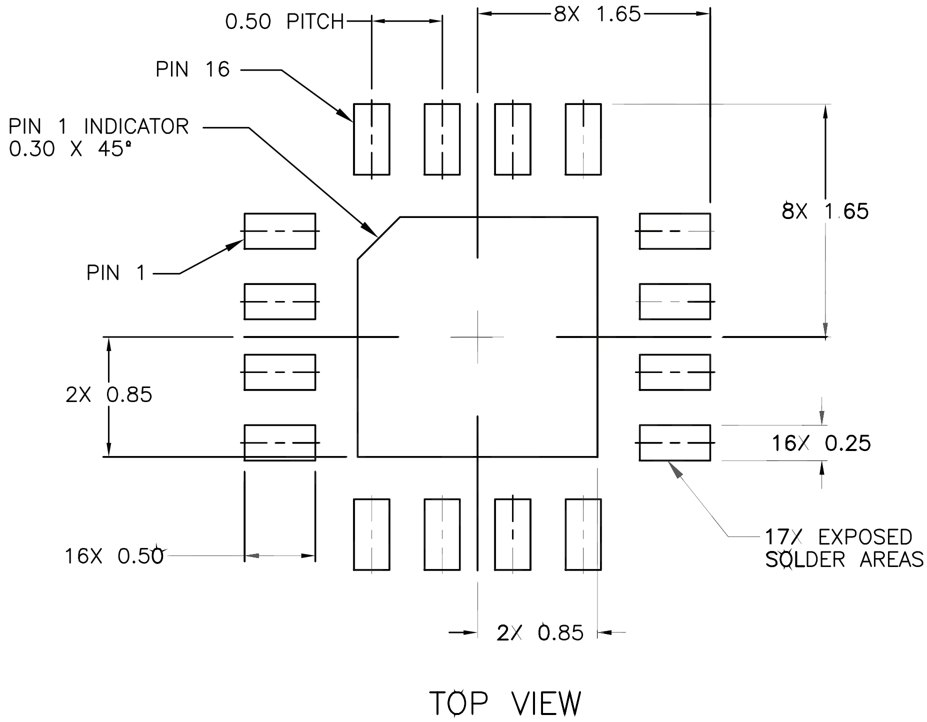
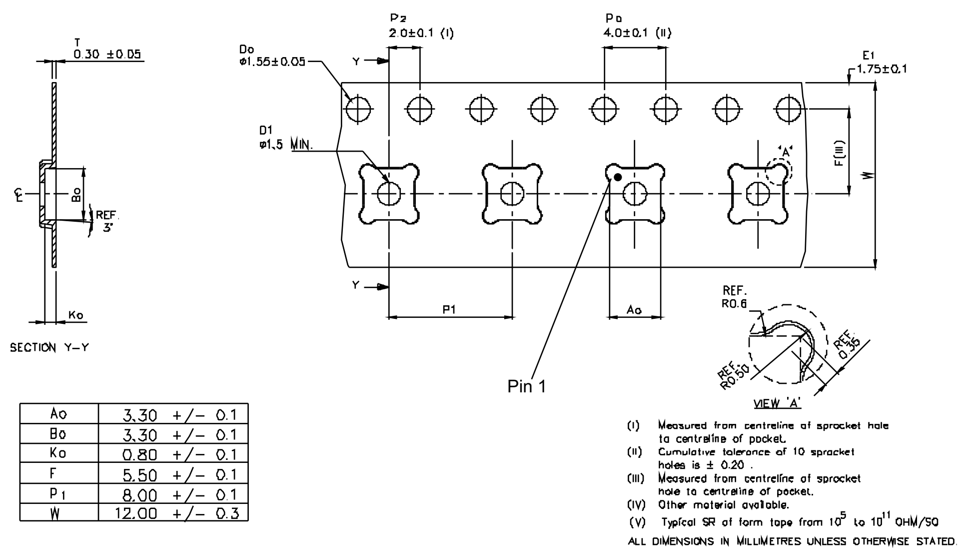


Figure 47. PCB Layout Footprint



Ao	3.30 +/− 0.1
Bo	3.30 +/− 0.1
Ko	0.80 +/− 0.1
F	5.50 +/− 0.1
P1	8.00 +/− 0.1
W	12.00 +/− 0.3

Figure 48. Tape and Reel Dimensions

Ordering Information

Part Number	Part Description	Evaluation Board Part Numbers
SKY67177-11	2.3 to 5 GHz High Gain Low-Noise Amplifier with Bypass	SKY67177-11EK1 (2.3 to 2.7 GHz) SKY67177-11EK2 (3.3 to 4.2 GHz) SKY67177-11EK3 (4.8 to 5.0 GHz)