

DESCRIPTION

Sanland’s AL36 is an economical, easy-to-use GaAs MMIC Low Noise Amplifier (LNA). The LNA has low noise and high linearity achieved through the use of 0.25um GaAs Enhancement-mode pHEMT process. It is housed in a miniature 2.0 x 2.0 x 0.75mm³ 8-pin Quad-Flat-Non-Lead (QFN) package. The internal active bias circuitry provides stable performance over temperature and process variation. The device offers the ability to externally adjust supply current. Supply voltage is applied to the RFOUT/VDD pin through an RF choke inductor. The RFIN and RFOUT/VDD pins should be DC blocked to ensure proper operation. The AL36 operates in the frequency range of 0.7 to 3.8 GHz using a common layout and band-specific tunes.

Major Applications

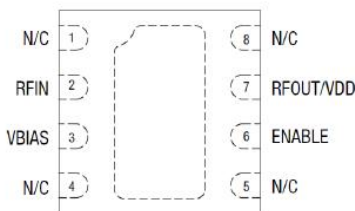
- LTE, GSM, WCDMA, HSDPA macro and micro base stations
- L and S band ultra low-noise receivers
- Cellular repeaters, DAS and RRH/RRUs
- High temperature transceiver applications to +105 °C

KEY FEATURES

- Ultra-low Evaluation Board NF:
 - 0.30 dB @ 850 MHz
 - 0.40 dB @ 1850 MHz
 - 0.50 dB @ 2500 MHz
 - 0.75 dB @ 3600 MHz
- High OIP3 performance: >+34 dBm over 700 to 3800 MHz
- Adjustable supply current from 30 to 100 mA
- Flexible bias voltage: 3 to 5 V
- Temperature and process-stable active bias
- Miniature DFN (8-pin, 2 x 2 mm) package (MSL1 @ 260 °C per JEDEC J-STD-020)



Pin Assignment



Pin Details

Pin Number	Name	Description
1,4,5,6,8	N/C	No connection. May be connected to ground with no change in performance.
2	RF in	RF input. DC blocking capacitor required.
3	VBIAS	Bias voltage for input gate. External resistor sets current consumption.
6	ENABLE	
7	RFOUT/VDD	RF output. Apply VDD through RF choke inductor. DC blocking capacitor required.

Absolute Maximum Ratings

Parameter	Rating	Unit
DC Power Supply	+5.5	V
Quiescent supply current	120	mA
RF Input Power	+21	dBm
Operating Temperature	-40 to +105	°C
Storage Temperature	-40 to +150	°C
Electrostatic discharge:		
Charged Device Model (CDM), Class 4	1000	V
Human Body Model (HBM), Class 1A	250	V
Machine Model (MM), Class A	30	V
Operation beyond any one of these limits may cause permanent damage.		

Thermal Data

Parameter	Specification			Units	Notes
	Min	Typ.	Max		
Thermal resistance		45		°C/W	
Channel temperature @ +85 °C reference (package heat slug)		101		°C	VDD = 5 V, IDQ = 70mA, no RF applied, dissipated power=0.35W
Test Conditions : VDD = 5 V, TA = +25 °C, PIN = -25 dBm, Characteristic Impedance [ZO] = 50 Ω, Unless Otherwise Noted.					

Important Note:

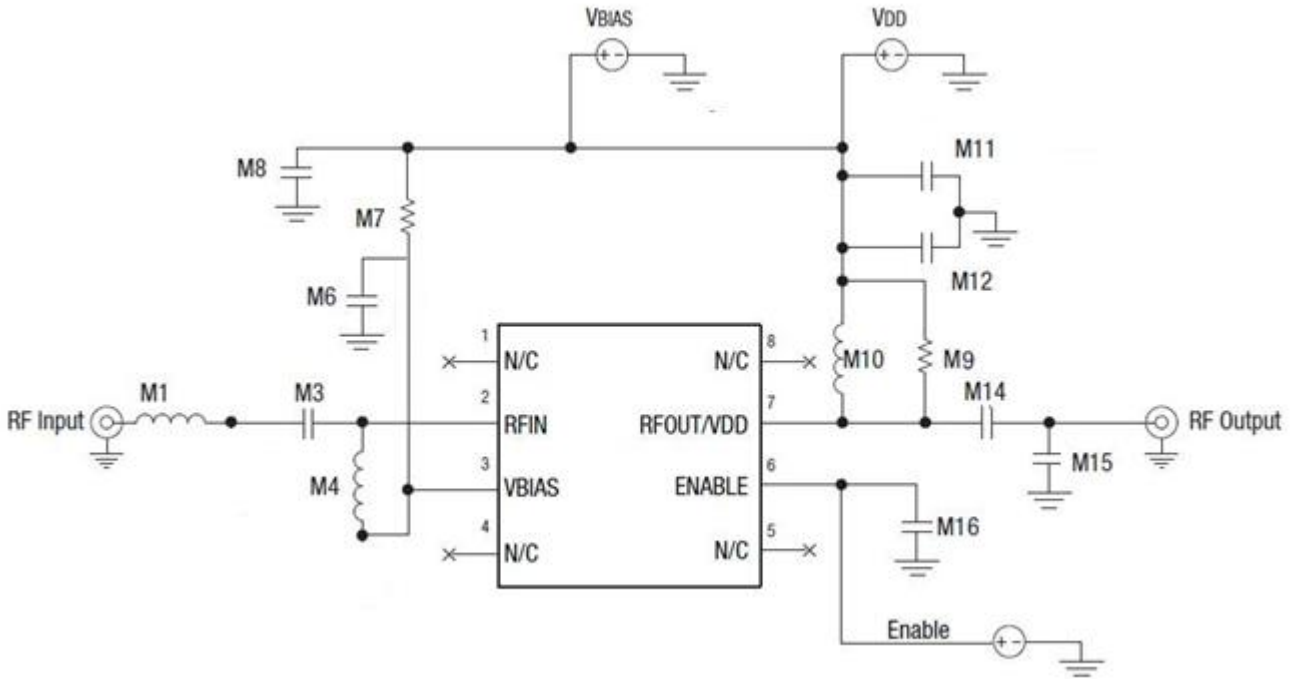
The information provided in this datasheet is deemed to be accurate and reliable only at present time. Sanland Technology Corp. reserves the right to make any changes to the specifications in this datasheet without prior notice.



Caution: ESD Sensitive
Appropriate precaution in handling, packaging
And testing devices must be observed.

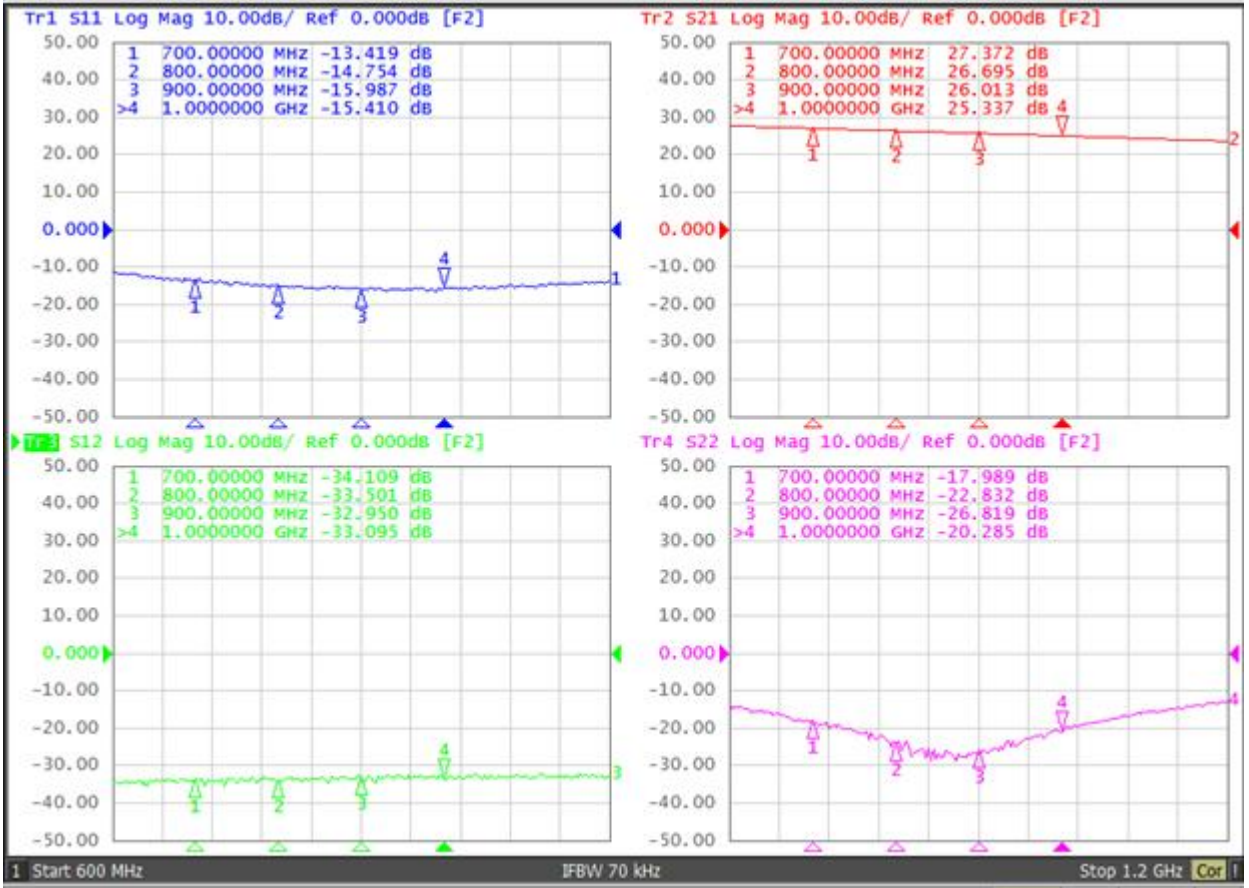
700 to 1000 MHz Optimized Tuning

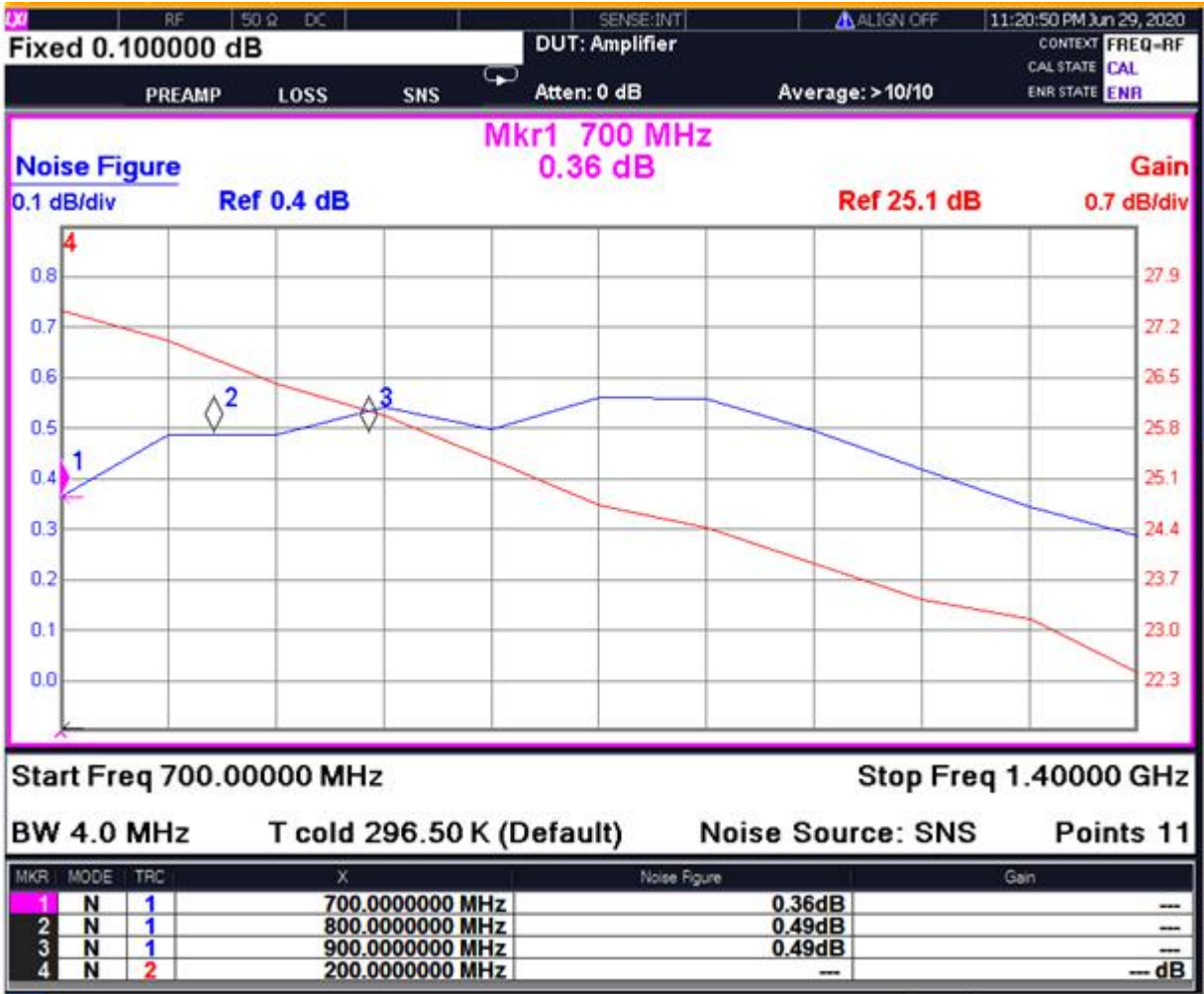
Parameter	Specification			Units	Notes
	Min	Typ.	Max		
RF Specifications					
NF		0.3	0.45	dB	850 MHz, includes Evaluation Board loss
S21	24.5	26.0		dB	850MHz
S11		11		dB	850MHz
S22		14		dB	850MHz
S12		30		dB	850MHz
OIP3	+31.0	+34		dBm	850 MHz, $\Delta f = 1$ MHz, PIN = -25 dBm/tone
OP1dB	+19.5	+22.5		dBm	850MHz
DC Specifications					
VDD		5		V	
IDQ		95		mA	Set with external resistor
IBIAS		500		μ A	
V Enable (Enable voltage)					
:	0		0.2	V	
Gain mode	1.5		5.5	V	
Power-down mode					
TR(Enable rise time)		250	500	ns	@850MHz
TF(Enable fall time)		250	500	ns	@850MHz
Test Conditions : VDD = 5 V, TA = +25 °C, PIN = -25 dBm, Characteristic Impedance [ZO] = 50 Ω , Unless Otherwise Noted					



Evaluation Board Bill of Materials (700 to 1000 MHz Tuning)

Component	Description	Value	Size	Manufacturer	Part Number
M1	Inductor	2.2nH	0402	Coilcraft	0402HP-2N2XJL
M3	Capacitor	20pF	0402	Murata	GJM1555C1H200JB01
M4	Inductor	15nH	0402	Coilcraft	0402HP-15NX_L
M6	Capacitor	68pF	0402	Murata	GRM1555C1H680JZ01
M7	Resistor	9.1kΩ	0402	Kamaya	RMC1/16S-912JTH
M8,M12	Capacitor	10000pF	0402	Murata	GRM155R71H103KA88
M9	Inductor	8.2nH	0402	Murata	LQG15HS8N2J02
M10	Resistor	330Ω	0402	Kamaya	RMC1/16S-331JTH
M11,M14	Capacitor	100pF	0402	Murata	GRM1555C1H101JZ01
M15	Capacitor	1.8pF	0402	Murata	GJM1555C1H1R8CB01
M16	Capacitor	1000pF	0402	Murata	GRM155R71H102KA01

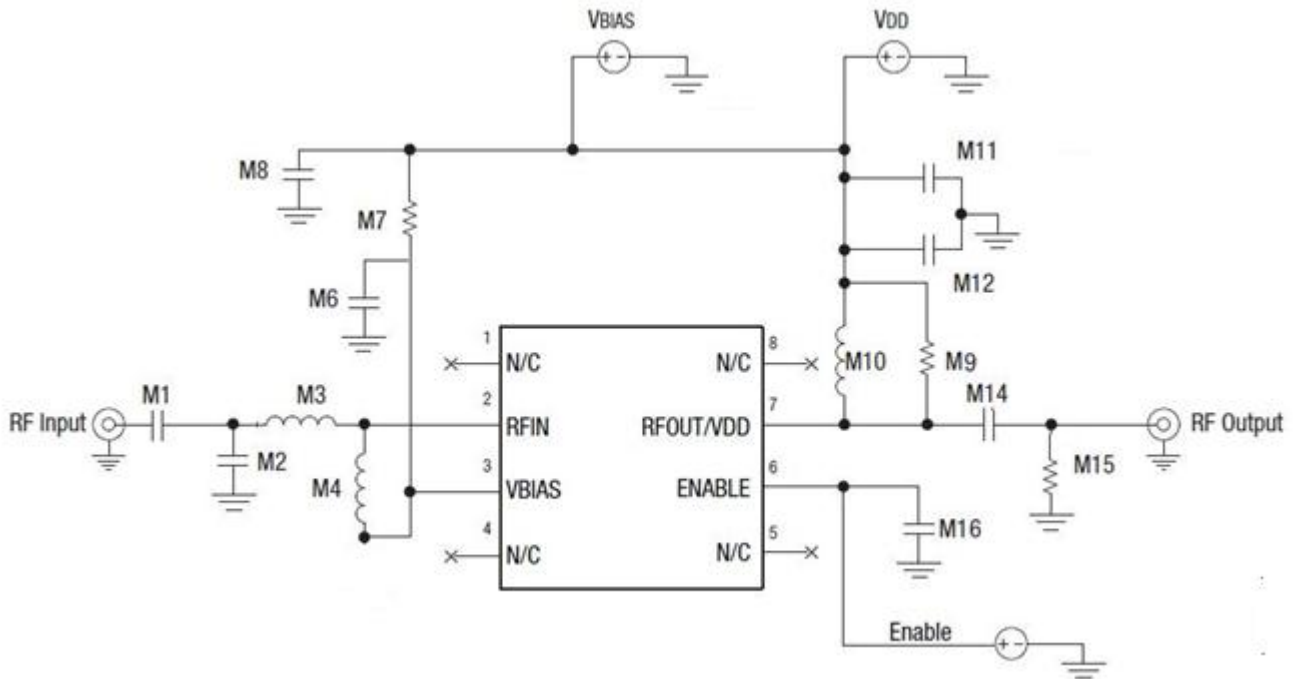




Evaluation Board NF, Gain, and Return Losses for 700 to 1000 MHz Tuning

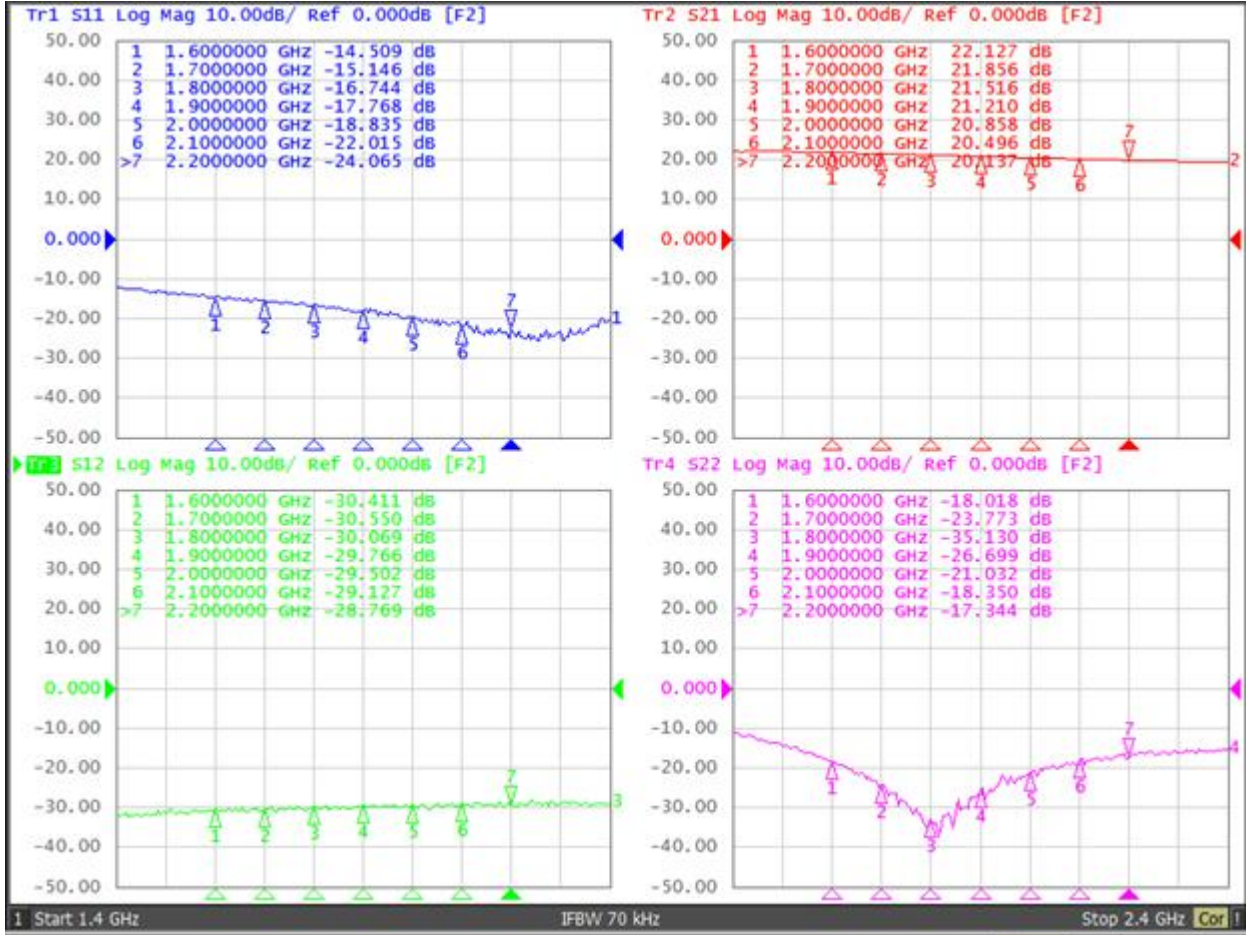
1600 to 2200 MHz Optimized Tuning

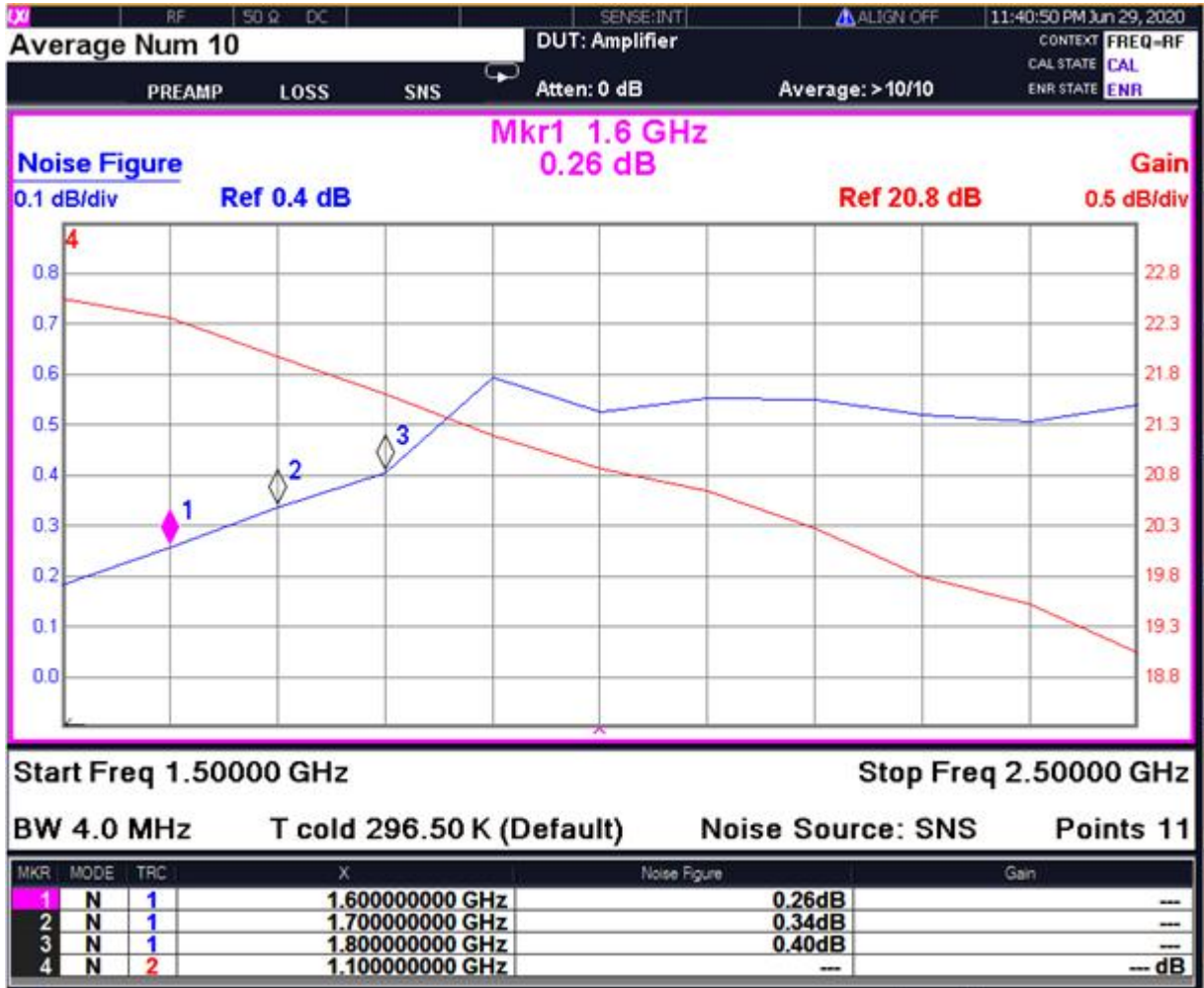
Parameter	Specification			Units	Notes
	Min	Typ.	Max		
RF Specifications					
NF		0.40	0.50	dB	1850 MHz, includes Evaluation Board loss
S21	19.0	21.5		dB	1850MHz
S11		13		dB	1850MHz
S22		13		dB	1850MHz
S12		31		dB	1850MHz
OIP3	+33	+39		dBm	1850 MHz, $\Delta f = 1$ MHz, PIN = -20 dBm/tone
OP1dB	+18.5	+21.5		dBm	1850MHz
DC Specifications					
VDD		5		V	
IDQ		83		mA	Set with external resistor
IBIAS		500		μ A	
V _{Enable} (Enable voltage) :					
Gain mode	0		0.2	V	
Power-down mode	1.5		5.5	V	
T _R (Enable rise time)		250	500	ns	@1800MHz
T _F (Enable fall time)		250	500	ns	@1800MHz
Test Conditions : VDD = 5 V, TA = +25 °C, PIN = -20 dBm, Characteristic Impedance [Z _O] = 50 Ω , Unless Otherwise Noted					



Evaluation Board Bill of Materials (1600 to 2200 MHz Tuning)

Component	Description	Value	Size	Manufacturer	Part Number
M1	Capacitor	20pF	0402	Murata	GJM1555C1H200JB01
M2	Capacitor	1pF	0402	Murata	GJM1555C1H1R0CB01
M3	Inductor	2nH	0402	Coilcraft	0402HP-2N0XJL
M4	Inductor	10nH	0402	Coilcraft	0402HP-10NX_L
M6	Capacitor	8.2pF	0402	Murata	GJM1555C1H8R2DB01
M7	Resistor	10kΩ	0402	Kamaya	RMC1/16S-103JTH
M8,M12,M16	Capacitor	1000pF	0402	Murata	GRM155R71H102KA01
M9	Resistor	1kΩ	0402	Kamaya	RMC1/16S-102JTH
M10	Inductor	3.6nH	0402	Murata	LQG15HS3N6S02
M11	Capacitor	22pF	0402	Murata	GRM1555C1H220JZ01
M14	Capacitor	3.6pF	0402	Murata	GJM1555C1H3R6CB01
M15	Resistor	2kΩ	0402	Kamaya	RMC1/16S-202JTH



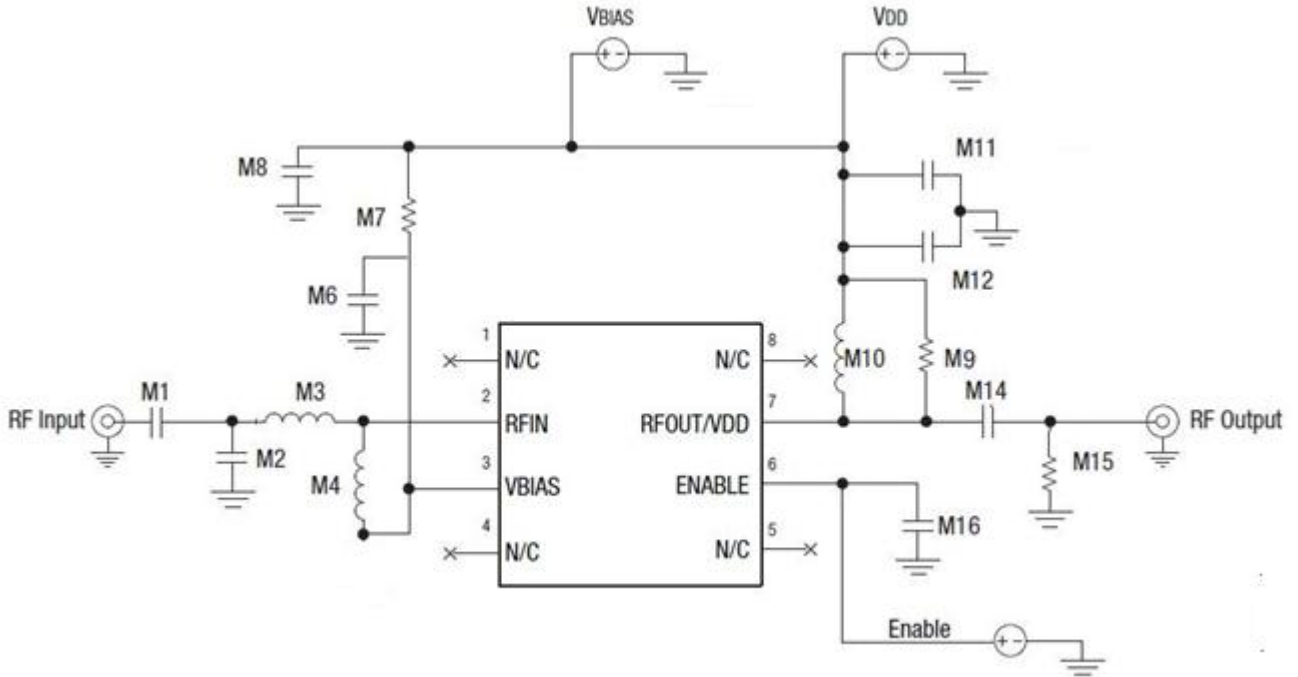


Evaluation Board NF, Gain, and Return Losses for 1.6 to 2.2 GHz Tuning

2300 to 2700 MHz Optimized Tuning

Parameter	Specification			Units	Notes
	Min	Typ.	Max		
RF Specifications					
NF		0.6	0.75	dB	2500 MHz, includes Evaluation Board loss
S21	17.5	19.0		dB	2500MHz
S11		-11		dB	2500MHz
S22		-19		dB	2500MHz
S12		30		dB	2500MHz
OIP3	+33	+36		dBm	2500 MHz, $\Delta f = 1$ MHz, PIN = -20 dBm/tone
OP1dB	+18	+19.7		dBm	2500MHz
DC Specifications					
VDD		5		V	
IDQ	58	72	86	mA	Set with external resistor
IBIAS		500		μ A	
V _{Enable} (Enable voltage) :					
Gain mode	0		0.2	V	
Power-down mode	1.5		5.5	V	
T _R (Enable rise time)		250	500	ns	@2500MHz
T _F (Enable fall time)		250	500	ns	@2500MHz
Test Conditions : VDD = 5 V, TA = +25 °C, PIN = -20 dBm, Characteristic Impedance [ZO] = 50 Ω , Unless Otherwise Noted					

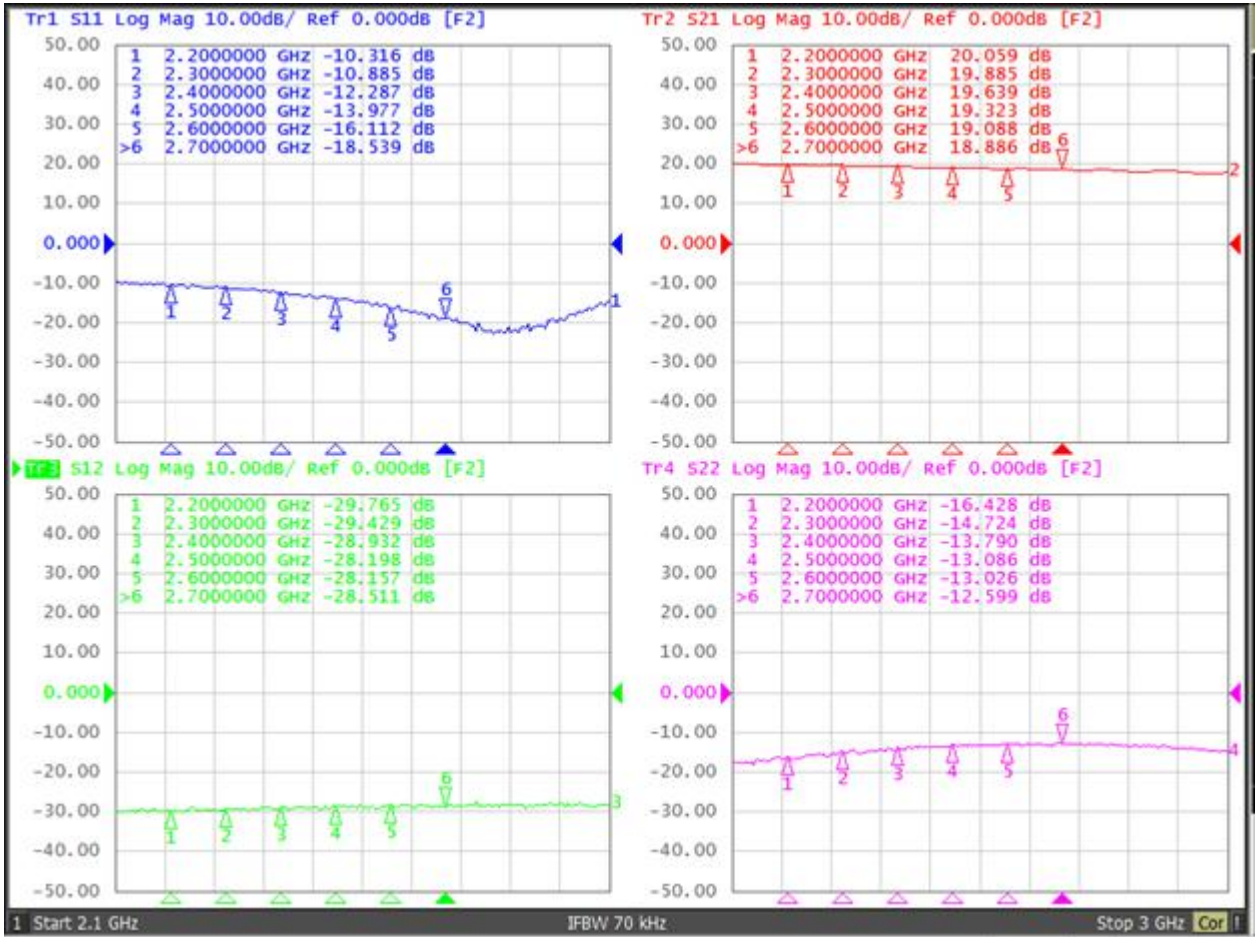
Evaluation Board Schematic



Evaluation Board Bill of Materials (2300 to 2700 MHz Tuning)

Component	Description	Value	Size	Manufacturer	Part Number
M1	Capacitor	20pF	0402	Murata	GJM1555C1H200JB01
M2	Capacitor	1.2pF	0402	Murata	GJM1555C1H1R2CB01
M3	Inductor	1nH	0402	Coilcraft	0402HP-1N0XJL
M4	Inductor	12nH	0402	Coilcraft	0402HP-12NX_L
M6	Capacitor	56pF	0402	Murata	GJM1555C1H560JZ01
M8,M12,M16	Capacitor	1000pF	0402	Murata	GRM155R71H102KA01
M7	Resistor	10kΩ	0402	Kamaya	RMC1/16S-103JTH
M11	Capacitor	10000pF	0402	Murata	GRM155R71H103KA88
M9	Resistor	1kΩ	0402	Kamaya	RMC1/16S-102JTH
M10	Inductor	2.7nH	0402	Murata	LQG15HS2N7S02
M11	Capacitor	22pF	0402	Murata	GRM1555C1H220JZ01
M14	Capacitor	3.9pF	0402	Murata	GJM1555C1H3R9CZ01
M15	Resistor	2kΩ	0402	Kamaya	RMC1/16S-202JTH

Typical Performance Characteristics, 2300 to 2700 MHz

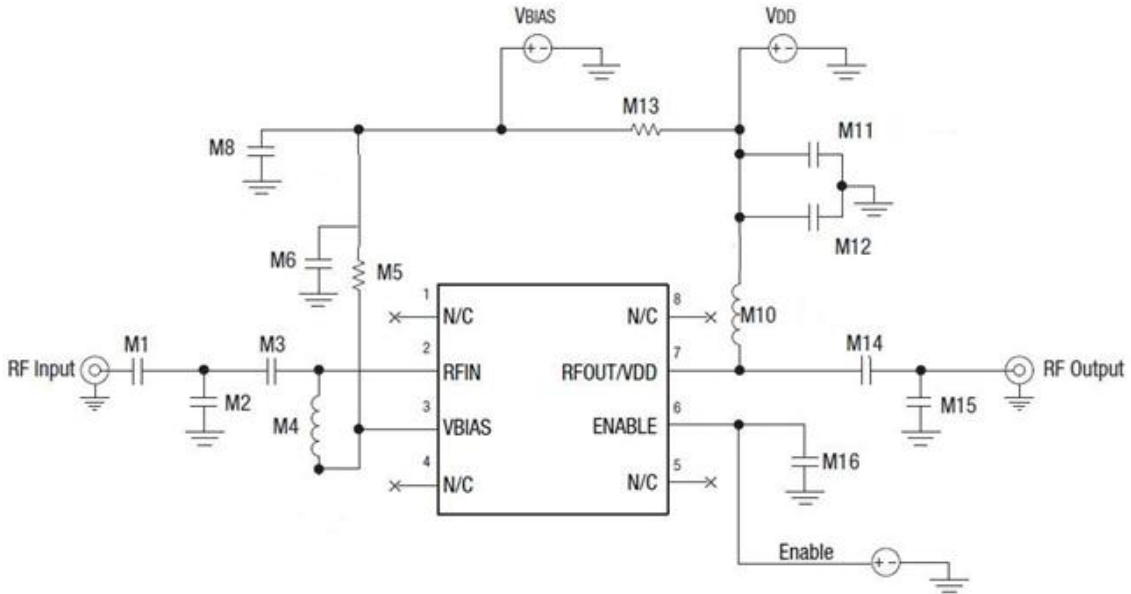




Evaluation Board NF, Gain, and Return Losses for 2.3 to 2.7 GHz Tuning

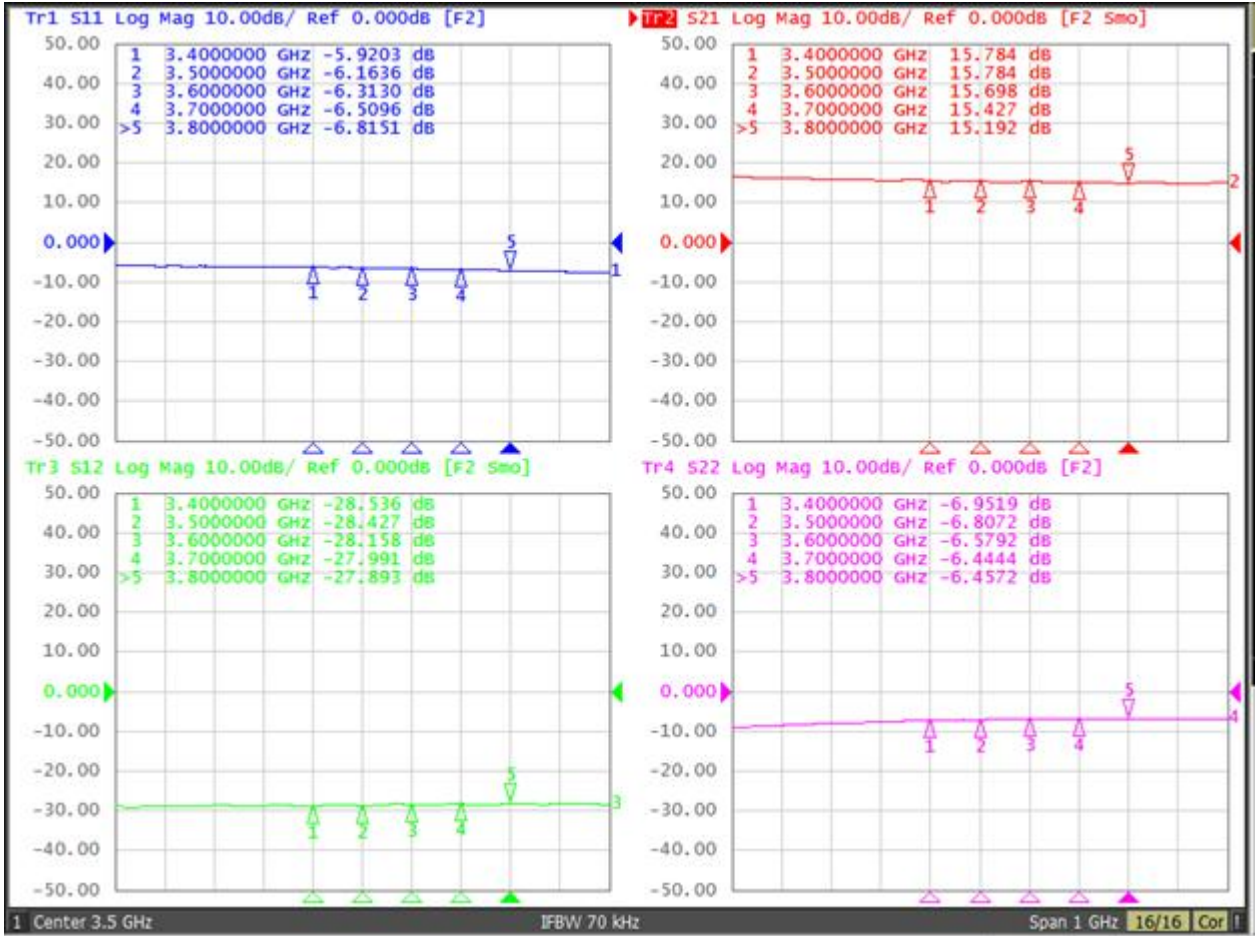
3400 to 3800 MHz Optimized Tuning

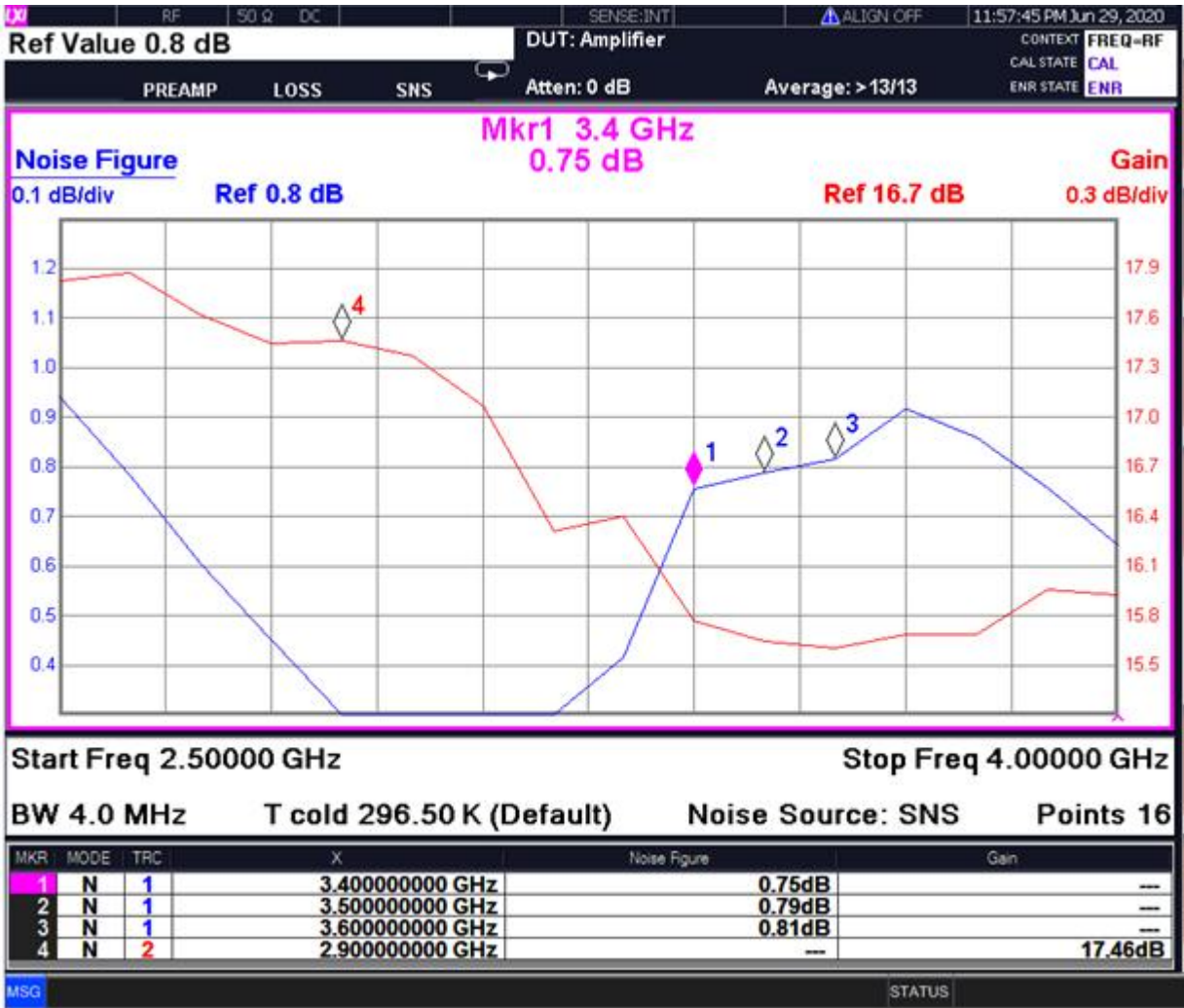
Parameter	Specification			Units	Notes
	Min	Typ.	Max		
RF Specifications					
NF		0.75	0.95	dB	3600 MHz, includes Evaluation Board loss
S21	14.5	15.7		dB	3600MHz
S11		7.6		dB	3600MHz
S22		8.9		dB	3600MHz
S12		29		dB	3600MHz
OIP3	+33	+37		dBm	3600 MHz, $\Delta f = 1$ MHz, PIN = -20 dBm/tone
OP1dB	+16	+21		dBm	3600MHz
DC Specifications					
VDD		5		V	
IDQ		95		mA	Set with external resistor
IBIAS		500		μ A	
V _{Enable} (Enable voltage) :					
Gain mode	0		0.2	V	
Power-down mode	1.5		5.5	V	
T _R (Enable rise time)		250	500	ns	@3500MHz
T _F (Enable fall time)		250	500	ns	@3500MHz
Test Conditions : VDD = 5 V, TA = +25 °C, PIN = -20 dBm, Characteristic Impedance [Z0] = 50 Ω , Unless Otherwise Noted					



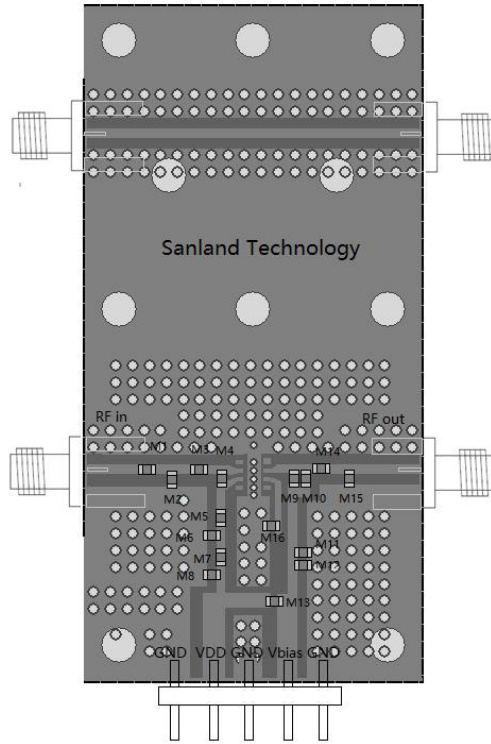
Evaluation Board Bill of Materials (3400 to 3800 MHz Tuning)

Component	Description	Value	Size	Manufacturer	Part Number
M1	Capacitor	20pF	0402	Murata	GJM1555C1H200JB01
M2	Capacitor	0.5pF	0402	Murata	GJM1555C1HR50CB01
M3	Capacitor	10pF	0402	Murata	GJM1555C1H100JB01
M4	Inductor	9nH	0402	Coilcraft	0402HP-9N0XJL
M5	Resistor	9.1kΩ	0402	Kamaya	RMC1/16SK910FTH
M6,M14	Capacitor	100pF	0402	Murata	GRM1555C1H101JZ01
M8	Capacitor	10000pF	0402	Murata	GRM155R71H103KA88
M10	Inductor	1nH	0402	Murata	LQG15HS1N0S02
M11	Capacitor	10pF	0402	Murata	GJM1555C1H100JB01
M12	Capacitor	1000pF	0402	Murata	GRM155R71H102KA01
M13	Resistor	0Ω	0402	Kamaya	RMC1/16SJPTH
M15	Capacitor	0.6pF	0402	Murata	GJM1555C1HR60BB01
M16	Capacitor	1000pF	0402	Murata	GRM155R71H102KA01

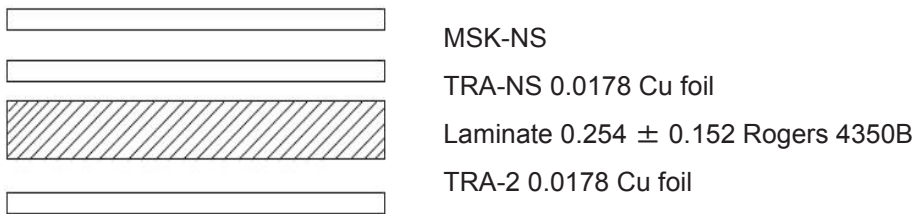




Evaluation Board NF, Gain, and Return Losses for 3.3 to 4.0 GHz Tuning



Evaluation Board Assembly Diagram



General Notes:

Material: Rogers R04350, $\epsilon_r = 3.66$

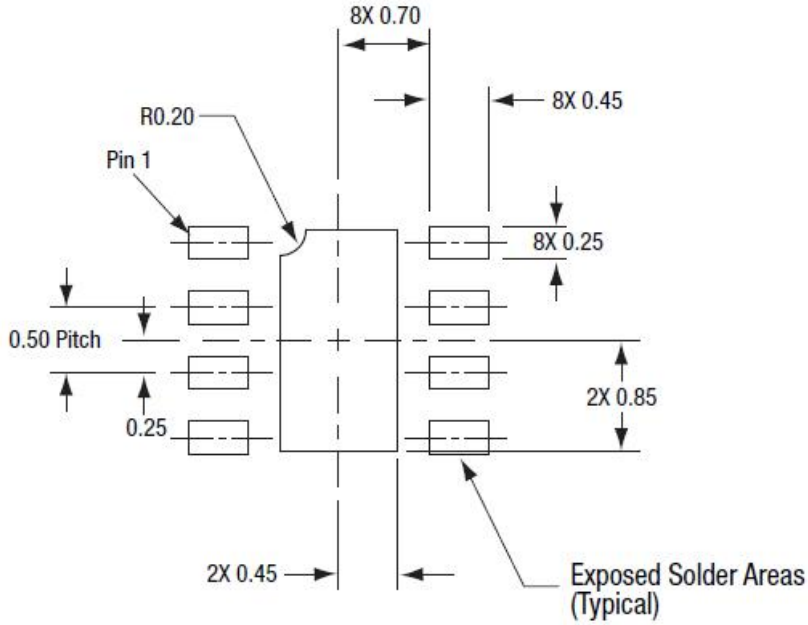
Layer 1 thickness: 0.254 mm

50 Ω transmission line width: 0.522 mm

Coplanar ground spacing: 0.394 mm

Via diameter: 0.254 mm

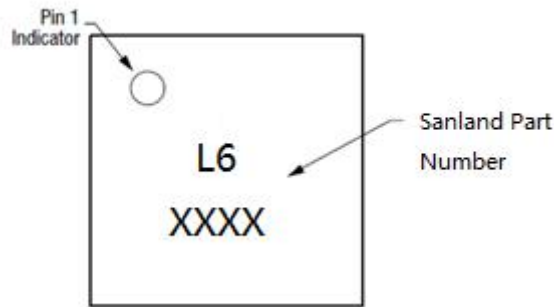
Layer Detail Physical Characteristics



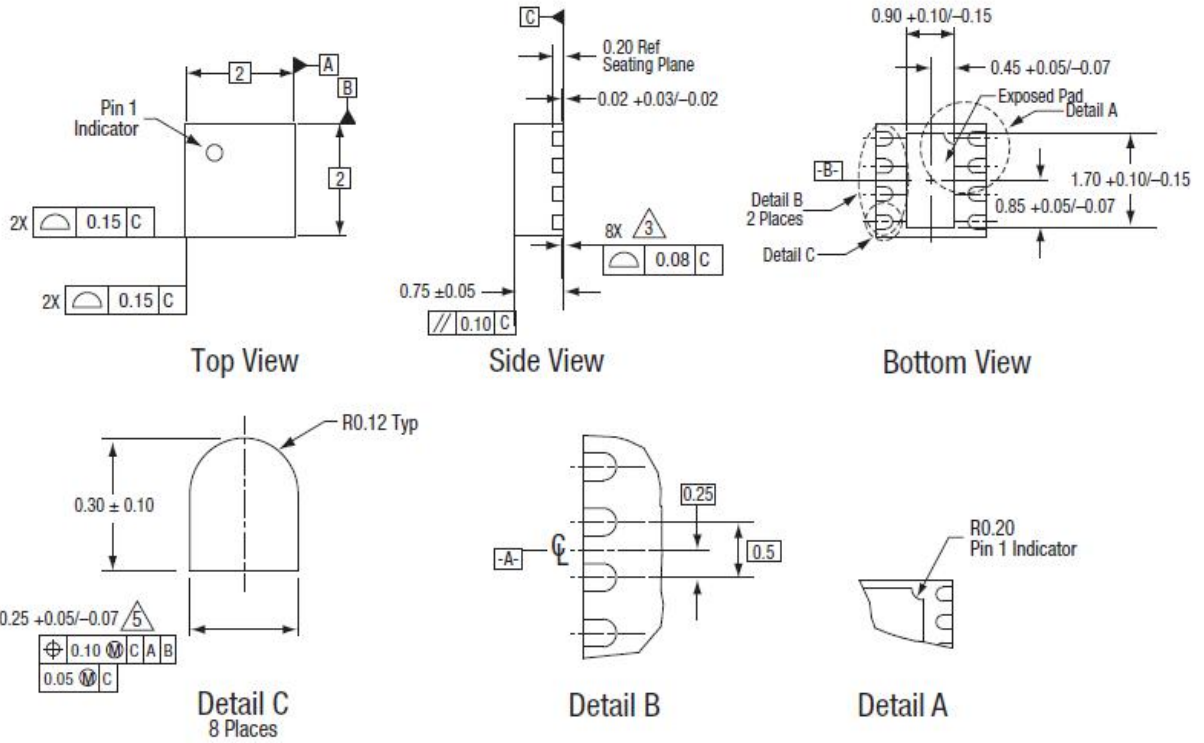
All dimensions are in millimeters

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PCB Layout Footprint (Top View)



Typical Part Markings (Top View)

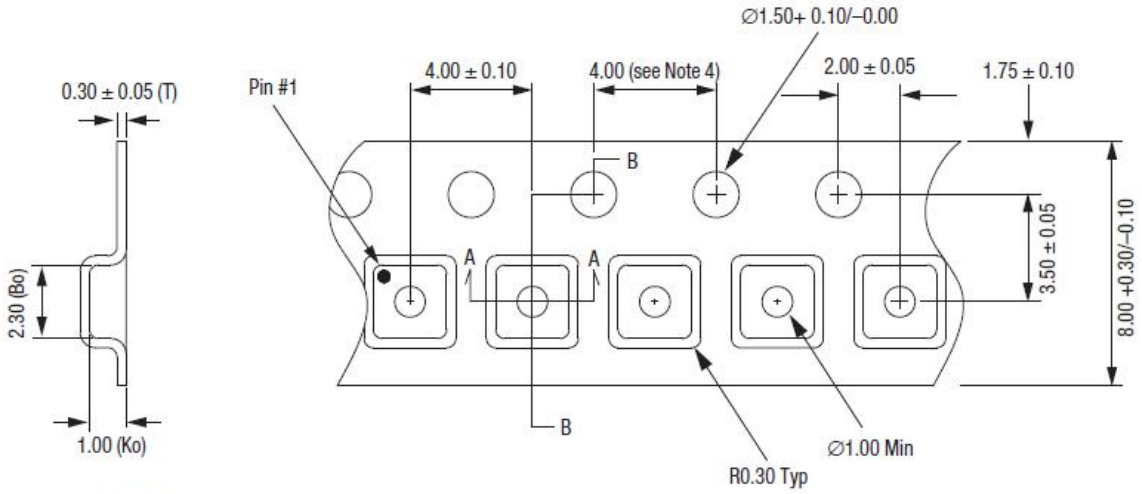


Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the exposed heat sink ground pad as well as the terminals.
4. Plating requirement per source control drawing (SCD) 2504.
5. Dimension applies to metallized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

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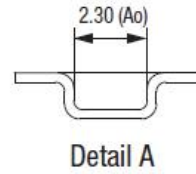
Package Dimensions



Detail B

Notes:

1. Carrier tape: black conductive polystyrene.
2. Cover tape material: transparent conductive HSA.
3. Cover tape size: 5.40 mm width.
4. Ten sprocket hole pitch cumulative tolerance = ± 0.20 mm.
5. ESD surface resistivity is $\leq 1 \times 10^9$ Ohms/square per EIA, JEDEC tape and reel specification.
6. Ao and Bo measurement point to be 0.30 mm from bottom pocket.
7. All measurements are in millimeters.



Detail A

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Tape and Reel Dimensions