9 dB Gain pHEMT Low Noise Amplifier, DIE
6 - 13 GHz

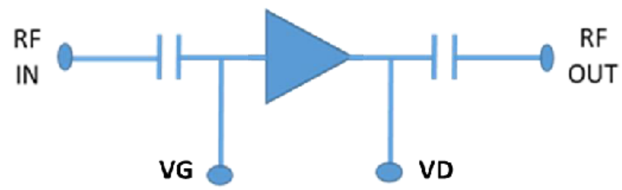
ENGLA00267A
Rev. V1

Features
- Operation Across 6 - 13 GHz
- Small Signal Gain: 8.5 dB @ 13 GHz
- Noise Figure:
  1.7 - 3.9 dB, <2 dB from 11 - 13 GHz
- I/O Return Loss: 12.5 dB or better
- Die Size:
  2.30 x 2.12 mm
  4.88 sq. mm
  0.091 x 0.083 inch
- RoHS* Compliant

Applications
- Radar / driver amplifier functions; SATCOM
- Radio receivers / transmitters when biased for linearity
- Test & Measurement Systems

Description
The ENGLA00267A is a wideband pHEMT two-stage 9 dB gain low noise distributed amplifier, operating across 6 to 13 GHz. The design is 50-ohm matched. The amplifier has a typical noise figure of 1.7 - 3.9 dB across 6 to 13 GHz; noise figure is <2 dB from 11 to 13 GHz at room temperature. The amplifier has gold backside metallization and is designed for gold-tin eutectic or high thermal conductivity silver epoxy attachment.

Functional Block Diagram
MMIC RF ports are DC-blocked. RF ports designed for 50 ohms.



Ordering Information

Part Number	Package
ENGLA00267A	Die

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications:
Freq. = 6 - 13 GHz, T_A = +25°C, VD = 5.0 V; IDS = 30 mA (Iq), VG ~ +0.35 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Small Signal Gain	—	dB	8	9	—
Noise Figure	—	dB	—	1.7 - 3.9	4.5
Input Return Loss	—	dB	10	14	—
Output Return Loss	—	dB	10	12.5	—
Output IP3	8 - 12 GHz	dBm	—	28	—
Supply Current	—	mA	—	30	80
Thermal Resistance	includes 25-µm thick AuSn solder mount	ºC/W	—	200	—

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain Voltage	—	5	6	V
Gate Voltage	—	0.35, 0.48	1.0	V
Quiescent Drain Current	—	30	80	mA

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Drain Voltage	6 V
Gate Voltage	1.2 V
RF Input Power	20 dBm
Operating Temperature	-55°C to +100°C
Storage Temperature	-65°C to +150°C

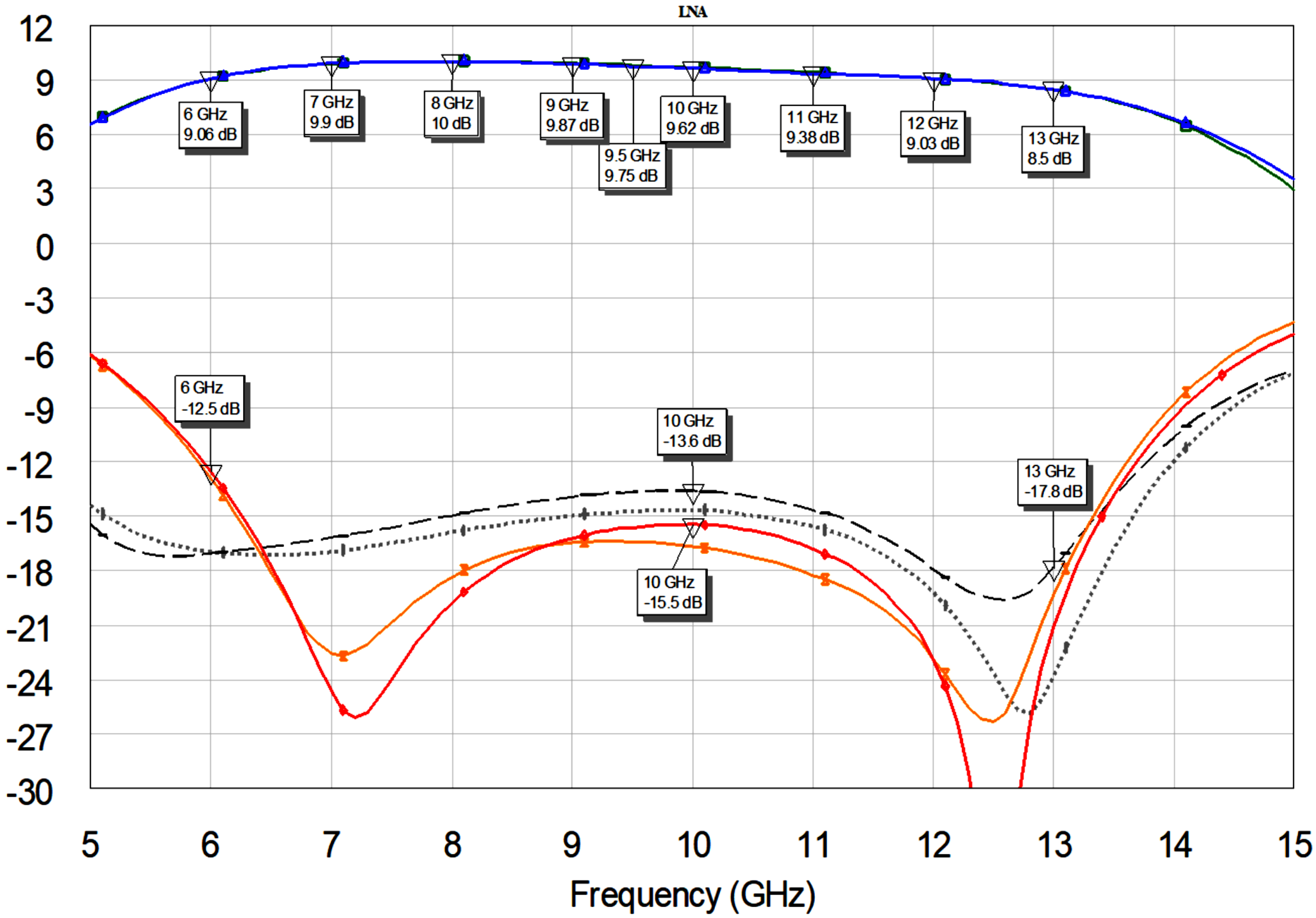
1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures
Please observe the following precautions to avoid damage:

Static Sensitivity
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

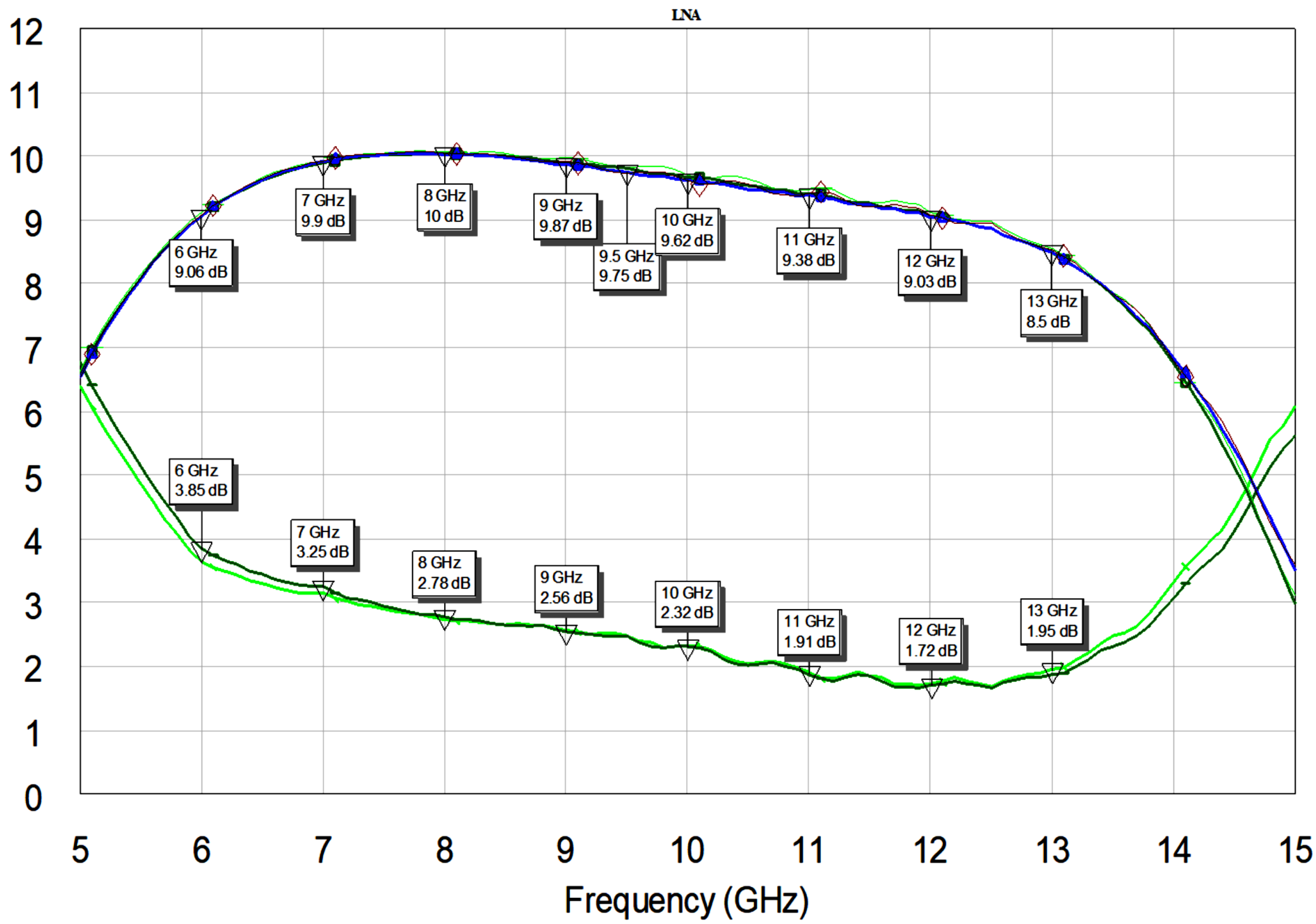
Measured RF Data: With Wirebonds and External Microstrip Flares

Small Signal Gain and In / Out Return Loss (for two ENGLA00267A amplifiers):
***T = 25 ºC, VD* = 5.0 V, IQ = 30 mA, VG = 0.35 V**



Measured RF Data: With Wirebonds and External Microstrip Flares

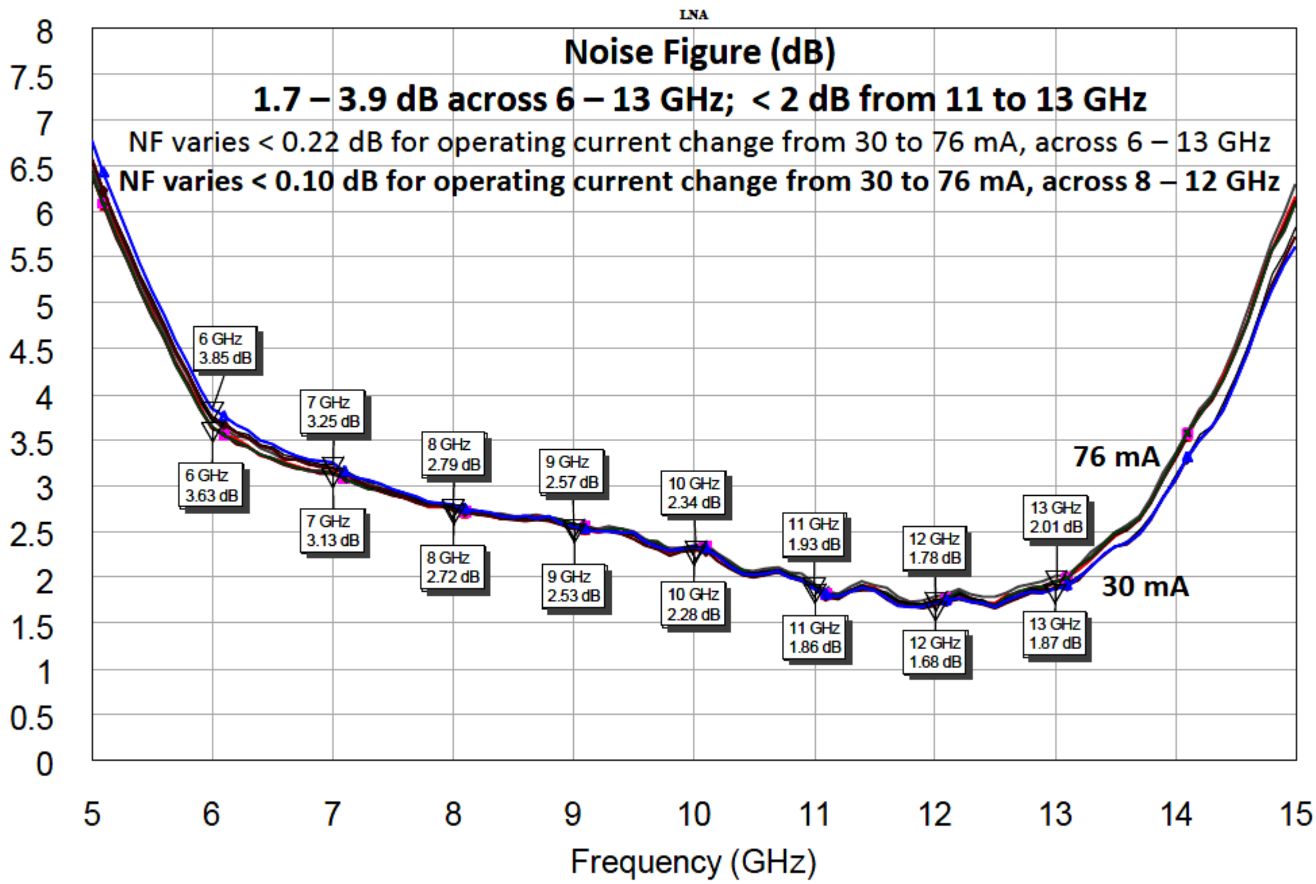
Small Signal Gain and Noise Figure (for two ENGLA00267A amplifiers):
***T = 25 ºC, VD* = 5.0 V, IQ = 30 mA, VG = 0.35 V**



Measured RF Data: With Wirebonds and External Microstrip Flares

Noise Figure (for two ENGLA00267A amplifiers):

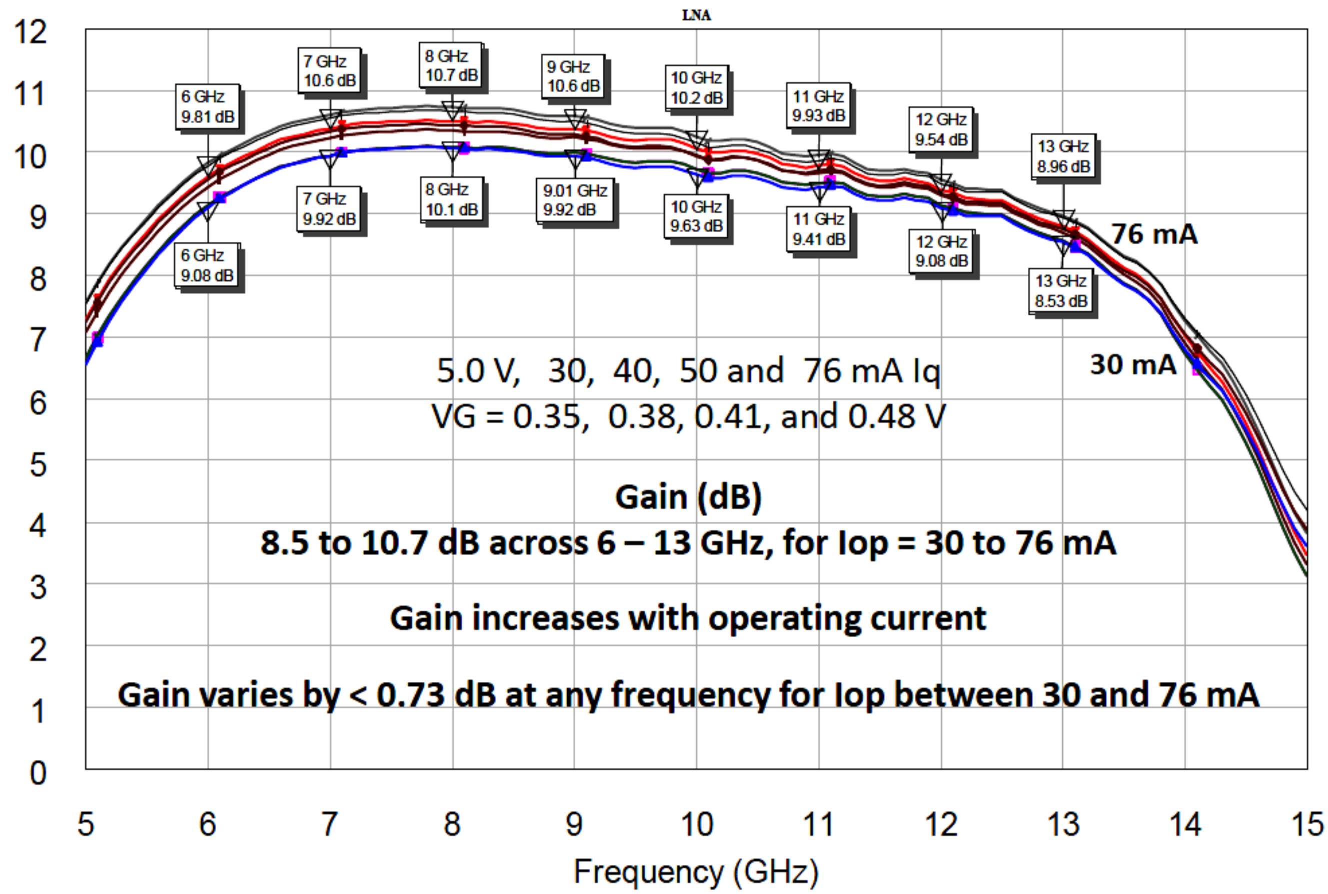
5.0 V, 30, 40, 50 and 76 mA Iq
VG = 0.35, 0.38, 0.41, and 0.48 V



Measured RF Data: With Wirebonds and External Microstrip Flares

Small Signal Gain (for two ENGLA00267A amplifiers):

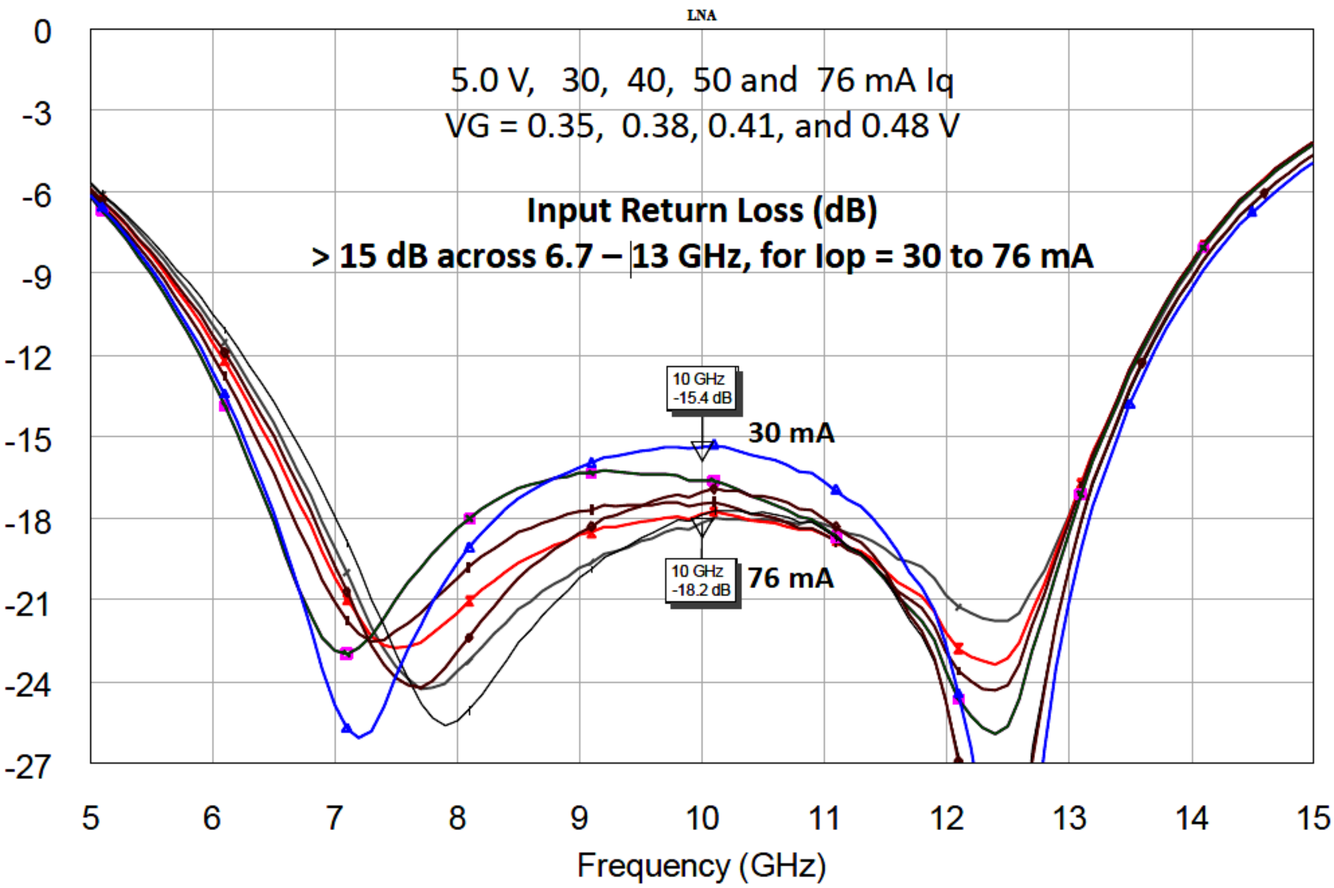
5.0 V, 30, 40, 50 and 76 mA Iq
VG = 0.35, 0.38, 0.41, and 0.48 V



Measured RF Data: With Wirebonds and External Microstrip Flares

Input Return Loss (for two ENGLA00267A amplifiers):

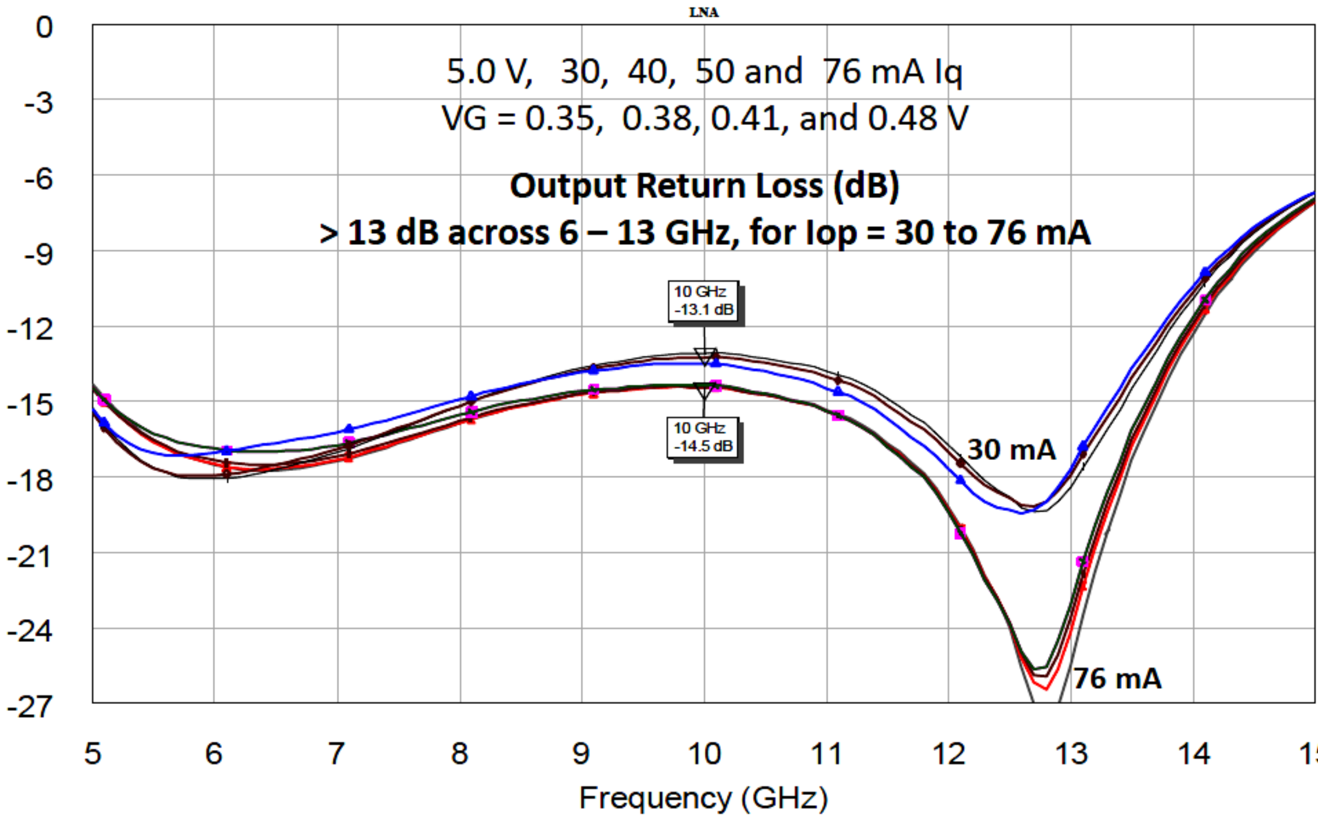
5.0 V, 30, 40, 50 and 76 mA Iq
VG = 0.35, 0.38, 0.41, and 0.48 V



Measured RF Data: With Wirebonds and External Microstrip Flares

Output Return Loss (for two ENGLA00267A amplifiers):

5.0 V, 30, 40, 50 and 76 mA Iq
VG = 0.35, 0.38, 0.41, and 0.48 V



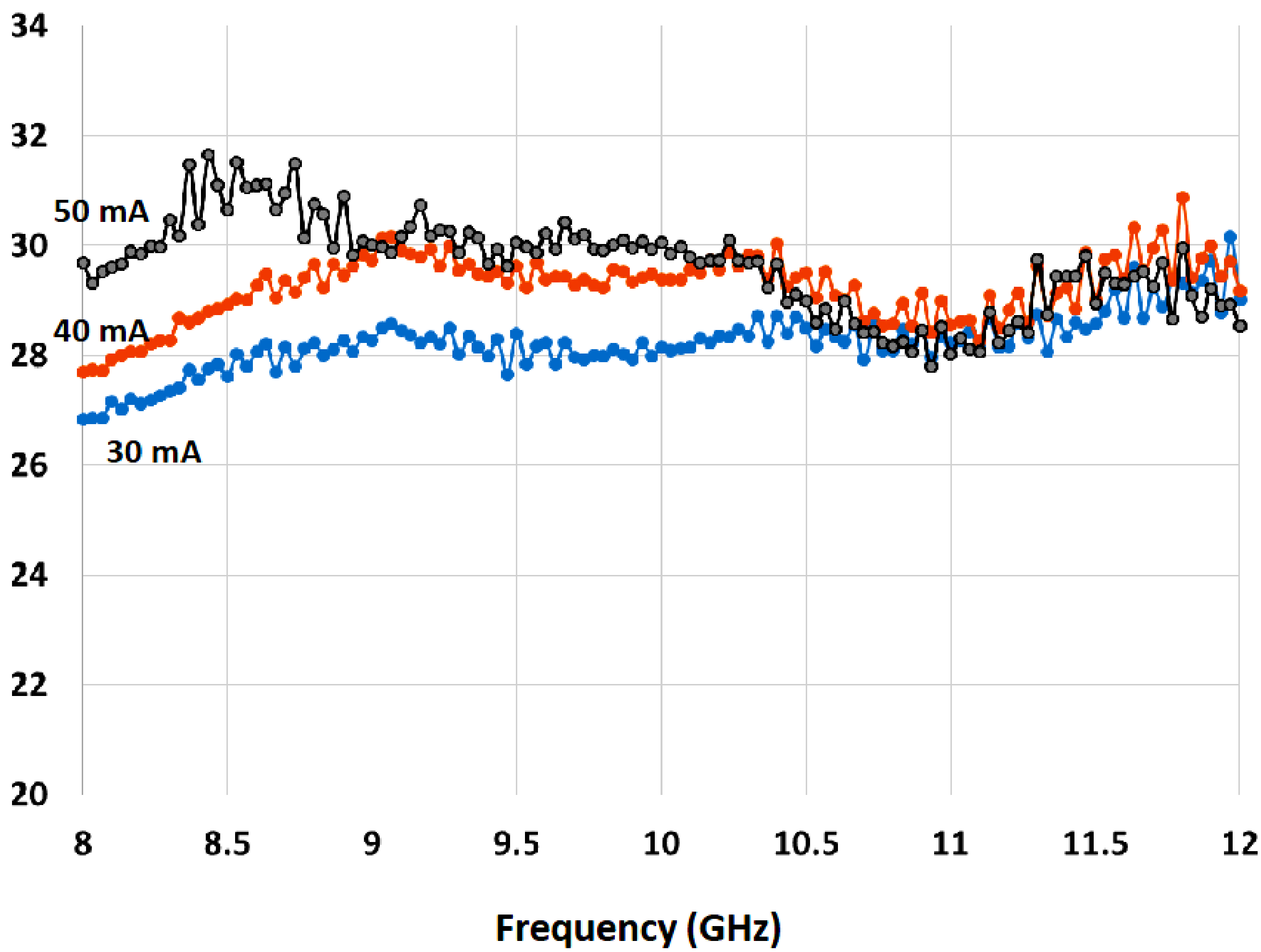
Measured RF Data: With Wirebonds and External Microstrip Flares

S-Parameters: T_A = +25°C, VD = 5.0 V; IDS = 30 mA (Iq), VG ~ +0.35 V

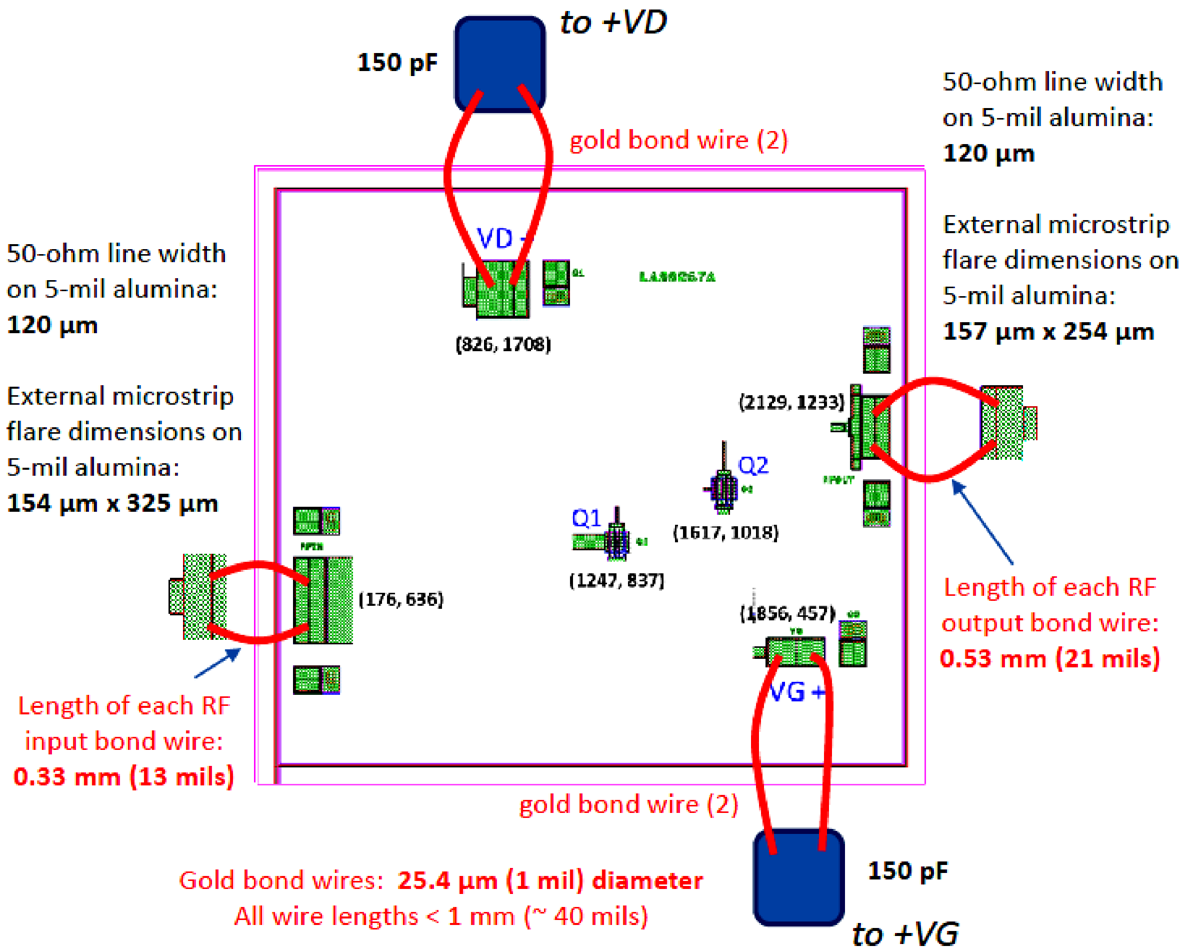
	S11		S21		S12		S22	
Freq (GHZ)	Mag (DB)	(angle) (deg)	Mag (DB)	(angle) (deg)	Mag (DB)	(angle) (deg)	Mag (DB)	(angle) (deg)
5	-6.13	114.96	6.53	140.10	-26.11	123.09	-15.45	70.16
5.5	-8.84	97.33	8.08	114.76	-24.15	94.64	-17.15	17.98
6	-12.54	83.30	9.06	89.78	-22.74	68.47	-17.07	-22.14
6.5	-17.72	77.23	9.62	65.86	-21.71	44.54	-16.65	-48.56
7	-24.64	98.56	9.91	43.22	-20.88	22.63	-16.18	-66.16
7.5	-24.01	154.87	10.02	21.79	-20.22	2.29	-15.62	-79.71
8	-19.77	166.21	10.03	1.32	-19.65	-16.73	-14.96	-92.17
8.5	-17.42	162.93	9.98	-18.34	-19.11	-34.80	-14.38	-104.74
9	-16.21	156.83	9.87	-37.39	-18.61	-52.06	-13.93	-117.57
9.5	-15.63	149.86	9.75	-56.07	-18.12	-68.74	-13.69	-131.07
10	-15.45	142.58	9.62	-74.39	-17.64	-85.19	-13.60	-145.24
10.5	-15.81	134.13	9.48	-92.70	-17.13	-101.26	-13.95	-159.06
11	-16.84	125.43	9.38	-111.05	-16.53	-117.85	-14.66	-172.00
11.5	-18.69	115.79	9.24	-129.53	-16.06	-134.74	-15.93	177.11
12	-22.85	103.49	9.03	-148.78	-15.54	-151.81	-17.90	172.33
12.5	-42.35	56.62	8.87	-168.95	-15.02	-170.21	-19.54	-176.95
13	-21.09	-94.24	8.48	170.08	-14.66	170.80	-17.81	-157.77
13.5	-13.86	-112.12	7.84	147.96	-14.47	150.21	-13.94	-159.14
14	-9.55	-129.51	6.83	125.86	-14.67	129.02	-10.66	-173.51
14.5	-6.74	-147.25	5.40	103.90	-15.09	108.13	-8.34	165.05
15	-4.96	-163.97	3.51	84.17	-16.01	87.63	-6.95	141.71

Measured RF Data: With Wirebonds and External Microstrip Flares

Output Third-Order Intercept Point: T = 25 ºC, VD = 5.0 V, IQ = 30, 40, 50 mA



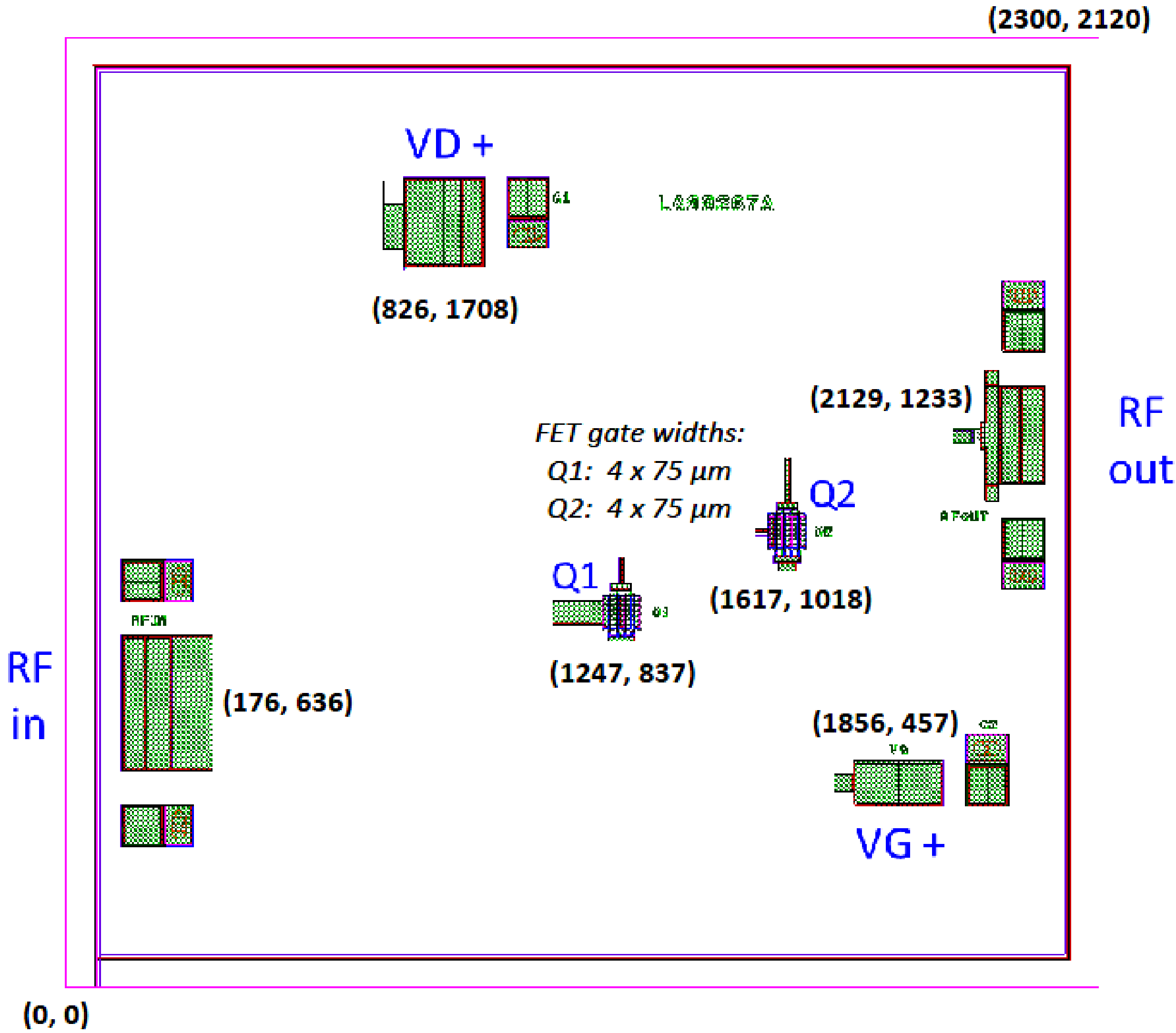
MMIC Assembly Drawing:
External Microstrip Flares, 150 pF Bypass Capacitors, & Bond Wires



Assembly Comments

1. If mounting the MMIC using either AuSn solder, or high thermal conductivity silver epoxy, the regions underneath the FET heat sources should be void free. Even small voids underneath the FETs could cause FET channel temperature to significantly increase.
2. RF ports are DC blocked.
3. At X-band, RF I/O port impedances are near 50 ohms.

Outline Drawing – MMIC Dimensions: 230 mm x 2.12 mm
FET (heat source) and bond pad center coordinates shown (μm)



Notes:
1. All dimensions are given in micrometers (μm) unless specified. Typ. tolerance: +25 μm / -25 μm.
2. GaAs thickness (excluding front side/back side metallization): 75 μm. Typical tolerance +/- 8 μm.
3. Backside metallization is gold.
4. Bond pad metallization is gold.