15 dB Gain pHEMT Low Noise Amplifier, DIE
3 - 8 GHz

ENGLA00262A

Rev. V1

Features

- Operation Across 3 - 8 GHz
- Small Signal Gain: 15 dB
- Noise Figure: 2.1 dB
- I/O Return Loss: 15 dB
- OIP3: 21 dBm (3 V, 13 mA)
- Die Size:
  - 2.65 x 1.41 x 0.1 mm
  - 3.74 sq. mm
  - 0.104 x 0.056 inch
- RoHS* Compliant

Applications

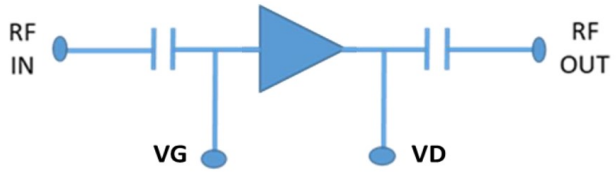
- S- & C-Band radar / driver amplifier functions; SATCOM
- Radio receivers / transmitters when biased for linearity
- Test & Measurement Systems

Description

The ENGLA00262A is a wideband GaAs pHEMT one-stage 15 dB gain low noise distributed amplifier, operating across 3 to 8 GHz. The design is 50 ohm matched. The LNA has a typical noise figure of 2.1 dB across 3 to 8 GHz, at room temperature. Output third-order intercept point (OIP3) is typically above 20 dBm at 3 V, 13 mA bias. 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
ENGLA00262A	Die

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

Electrical Specifications:

Freq. = 3 - 8 GHz, T_A = +25°C, VD = 3.0 V; IDS = 13.2 mA (Iq), VG ~ +0.48 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Small Signal Gain	—	dB	13	15	—
Noise Figure	—	dB	—	2.1	2.8
Input Return Loss	—	dB	12	15	—
Output Return Loss	—	dB	10	15	—
Output IP3	—	dBm	18	21	—
Supply Current	—	mA	—	13.2	25.0
Thermal Resistance	includes 25-µm thick AuSn solder mount	ºC/W	—	600	—

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain Voltage	—	3	4	V
Gate Voltage	—	0.48	0.7	V
Quiescent Drain Current	—	13	25	mA

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Drain Voltage	6 V
Gate Voltage	1 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

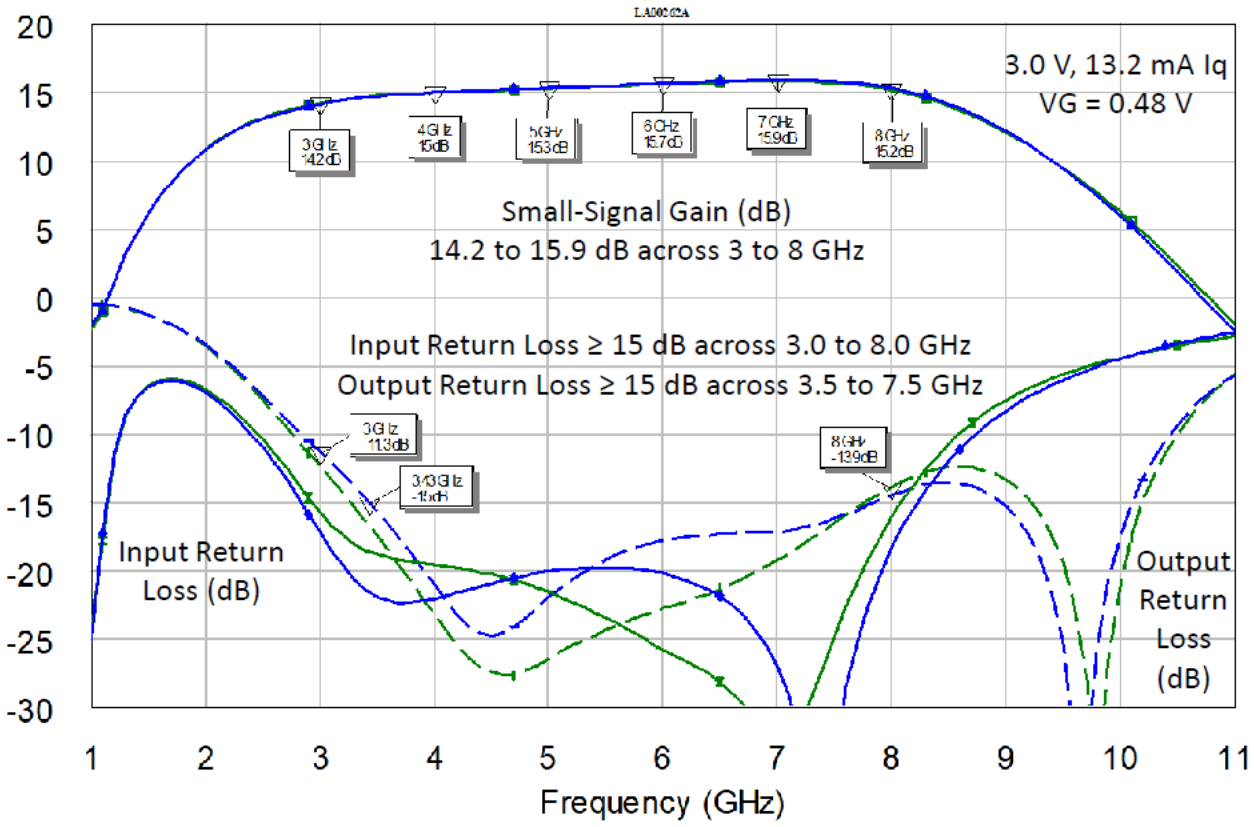
Please observe the following precautions to avoid damage:

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.

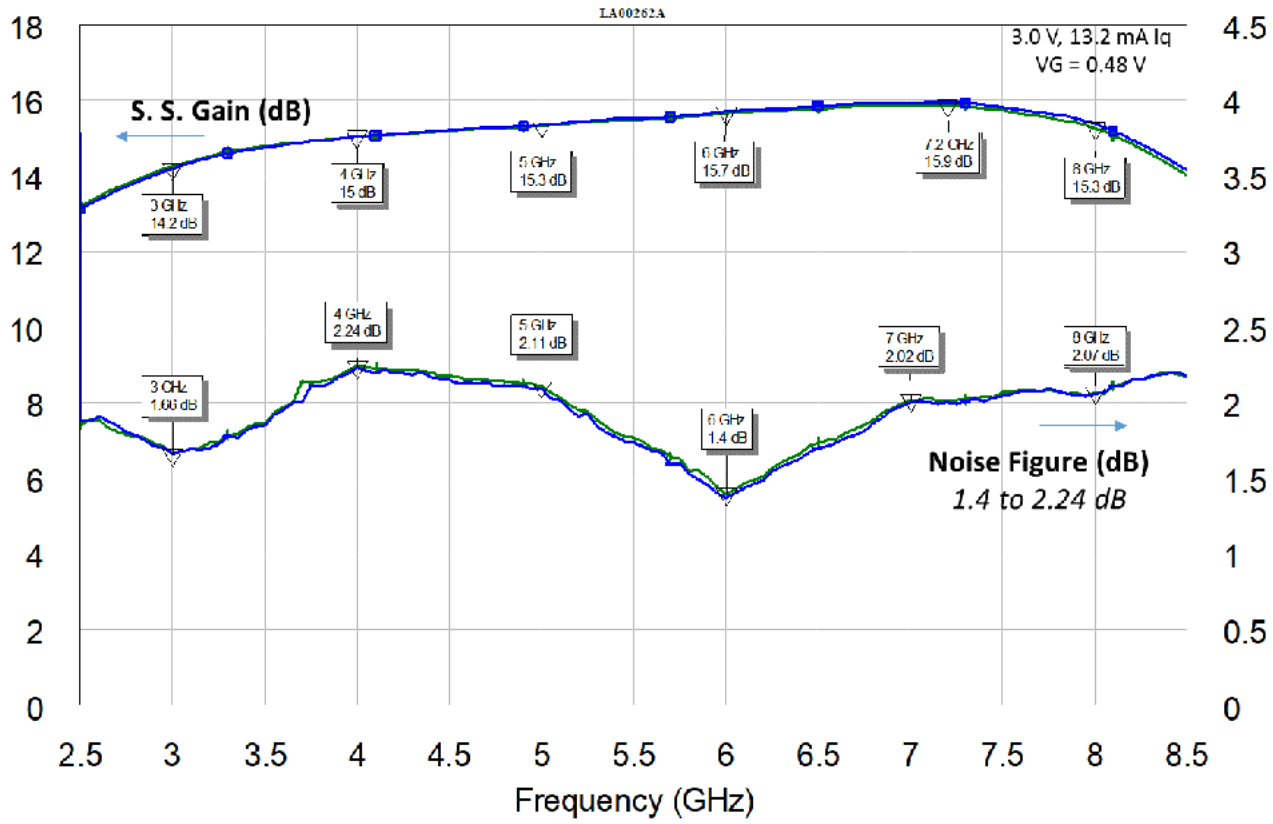
Measured RF Data: With Wirebonds and External Microstrip Flares

Gain and In / Out Return Loss (for two ENGLA00262A amplifiers): T = 25 ºC



Measured RF Data: With Wirebonds and External Microstrip Flares

Noise Figure <2.3 dB (for two ENGLA00262A amplifiers): T = 25 ºC



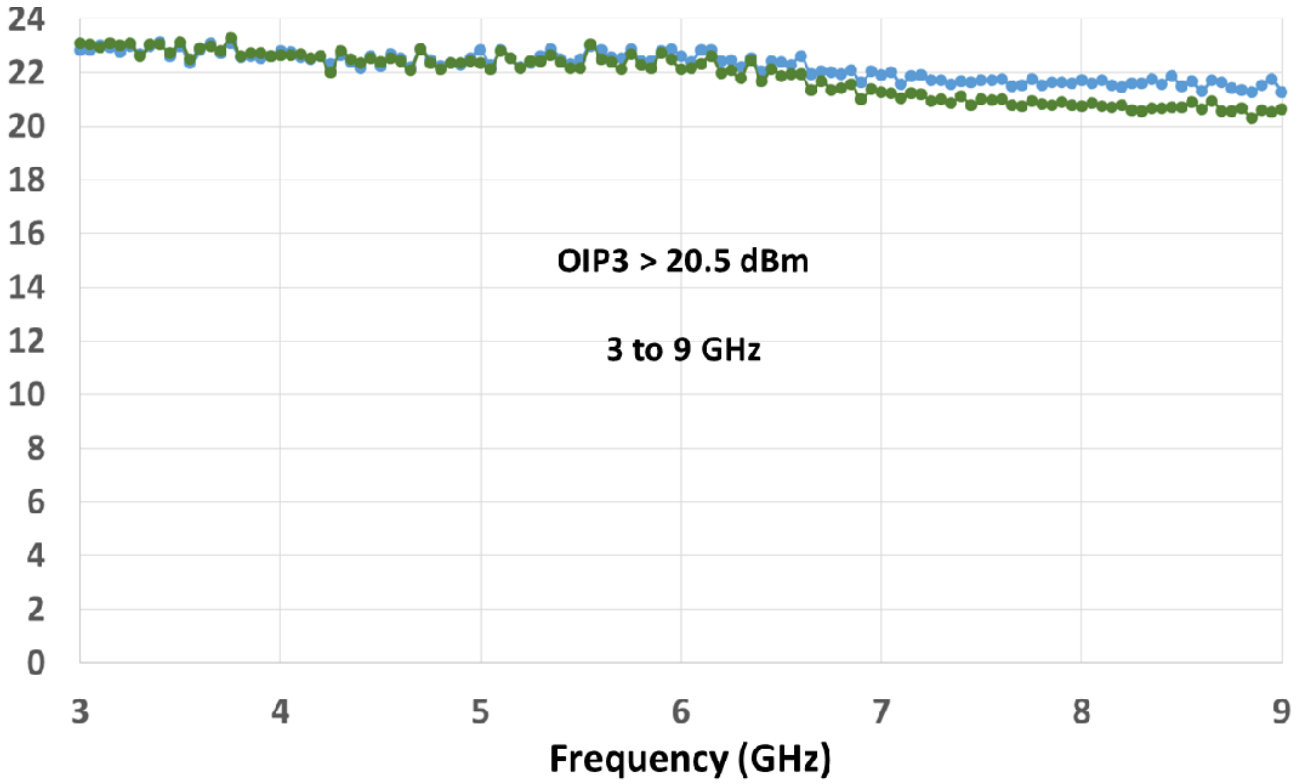
Measured RF Data: With Wirebonds and External Microstrip Flares

S-Parameters: T_A = +25°C, VD = 3.0 V; IDQ = 13.2 mA (Iq), VG ~ +0486 V

Freq	S11		S21		S12		S22	
	Mag	angle	Mag	angle	Mag	angle	Mag	angle
(GHZ)	(DB)	(deg)	(DB)	(deg)	(DB)	(deg)	(DB)	(deg)
2.00	-6.98	-98.48	10.89	-149.78	-24.37	76.59	-3.44	-116.85
2.25	-8.66	-122.15	12.22	-175.50	-22.90	53.77	-5.12	-132.59
2.50	-10.96	-142.99	13.12	160.54	-21.89	32.81	-7.11	-146.60
2.75	-13.83	-160.78	13.72	138.59	-21.15	13.96	-9.24	-158.18
3.00	-17.13	-172.46	14.20	117.95	-20.57	-3.42	-11.23	-169.18
3.25	-20.04	-176.68	14.55	98.15	-20.13	-19.86	-13.25	178.54
3.50	-21.85	-176.71	14.76	79.40	-19.81	-35.37	-15.53	164.29
3.75	-22.39	-178.15	14.91	61.34	-19.54	-50.04	-18.05	147.33
4.00	-22.15	175.95	15.04	44.06	-19.32	-63.91	-20.84	124.88
4.25	-21.59	166.55	15.11	27.24	-19.14	-77.23	-23.47	93.02
4.50	-21.08	154.23	15.21	10.77	-18.96	-90.31	-24.46	52.22
4.75	-20.58	142.23	15.28	-5.23	-18.79	-103.05	-23.33	14.95
5.00	-20.22	129.86	15.35	-21.36	-18.62	-115.46	-21.59	-12.31
5.25	-19.98	117.55	15.45	-37.24	-18.48	-127.74	-20.04	-33.61
5.50	-19.79	107.24	15.51	-52.99	-18.34	-140.03	-18.88	-51.68
5.75	-19.94	96.43	15.58	-69.22	-18.18	-152.27	-18.12	-67.43
6.00	-20.16	87.31	15.71	-85.29	-18.02	-164.39	-17.65	-82.49
6.25	-20.73	78.72	15.76	-101.60	-17.88	-176.42	-17.39	-95.91
6.50	-21.69	71.24	15.84	-118.53	-17.73	171.36	-17.34	-108.66
6.75	-23.30	61.96	15.91	-135.56	-17.59	158.85	-17.39	-119.67
7.00	-26.19	54.28	15.93	-153.30	-17.45	146.31	-17.38	-129.13
7.25	-32.96	48.13	15.94	-171.53	-17.34	133.59	-17.11	-137.82
7.50	-36.80	-152.78	15.83	169.74	-17.24	120.54	-16.46	-146.18
7.75	-24.35	-159.30	15.64	149.88	-17.16	107.23	-15.55	-156.86
8.00	-18.69	-169.88	15.38	129.90	-17.13	93.80	-14.62	-169.95
8.25	-14.79	177.84	14.84	109.35	-17.17	80.15	-13.86	173.76
8.50	-12.00	165.87	14.17	87.85	-17.30	66.07	-13.54	155.75
8.75	-9.82	153.90	13.35	67.21	-17.48	51.81	-13.83	136.58
9.00	-8.23	142.27	12.19	46.54	-17.70	37.81	-15.09	116.63

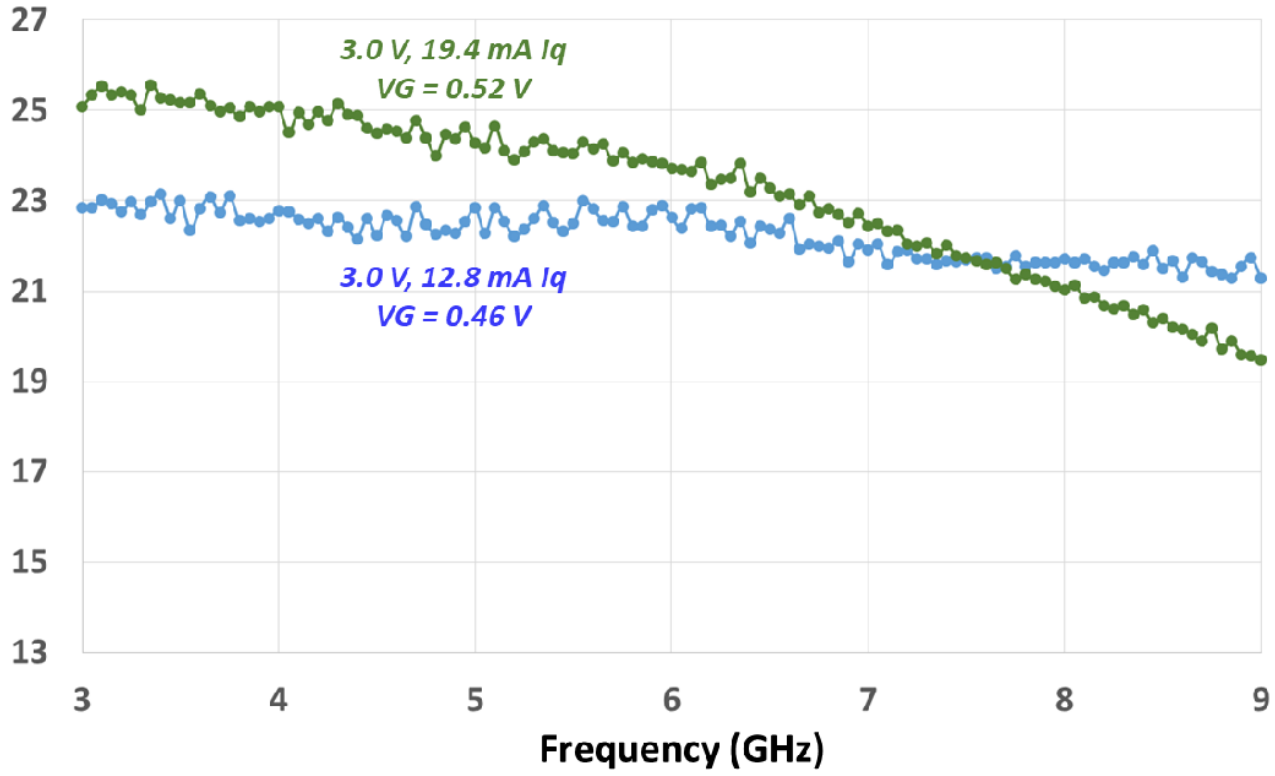
Measured RF Data: With Wirebonds and External Microstrip Flares

Output Third-Order Intercept Point: (2 ENGLA00262A amplifiers)
T = 25 ºC, VD = 3.0 V, IDQ = 12.8 mA, VG = 0.46 V

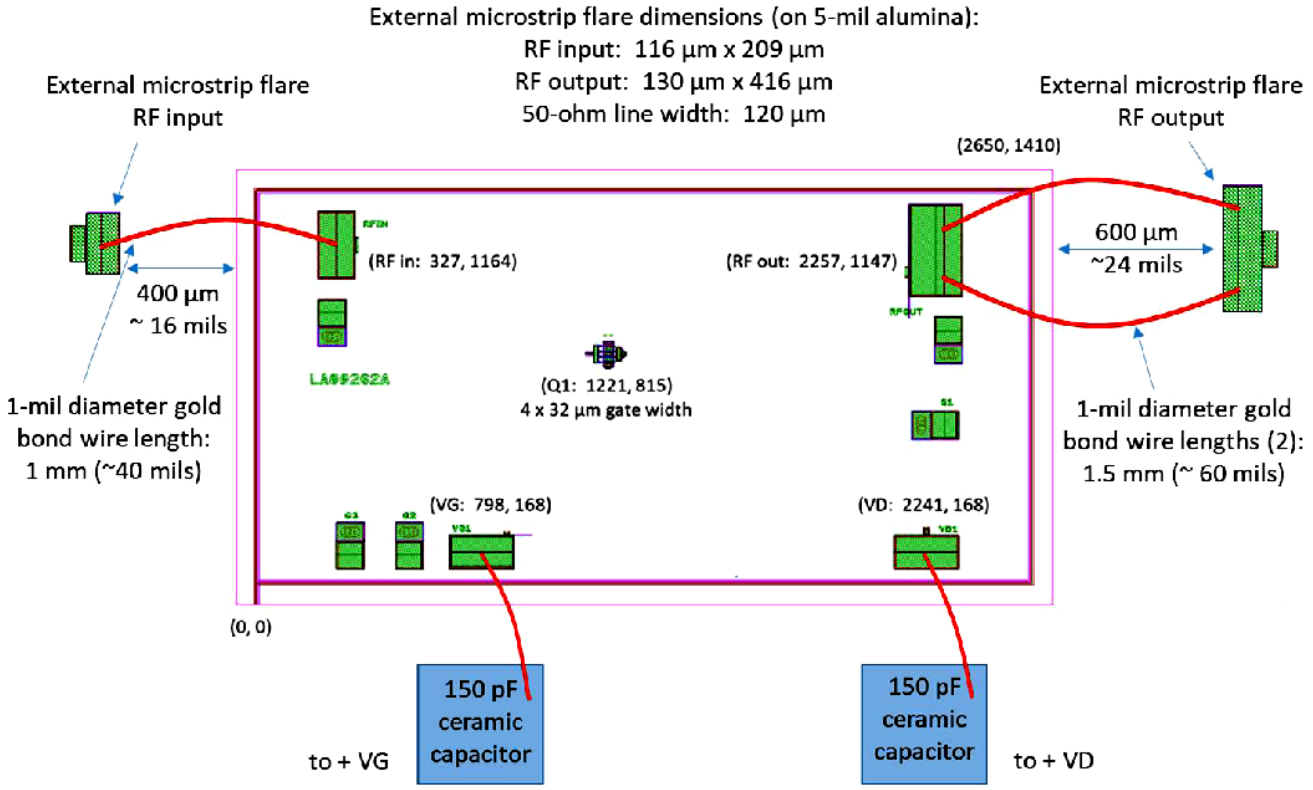


Measured RF Data: With Wirebonds and External Microstrip Flares

Output Third-Order Intercept Point: T = 25 ºC
Higher operating current increases OIP3 below 7 GHz



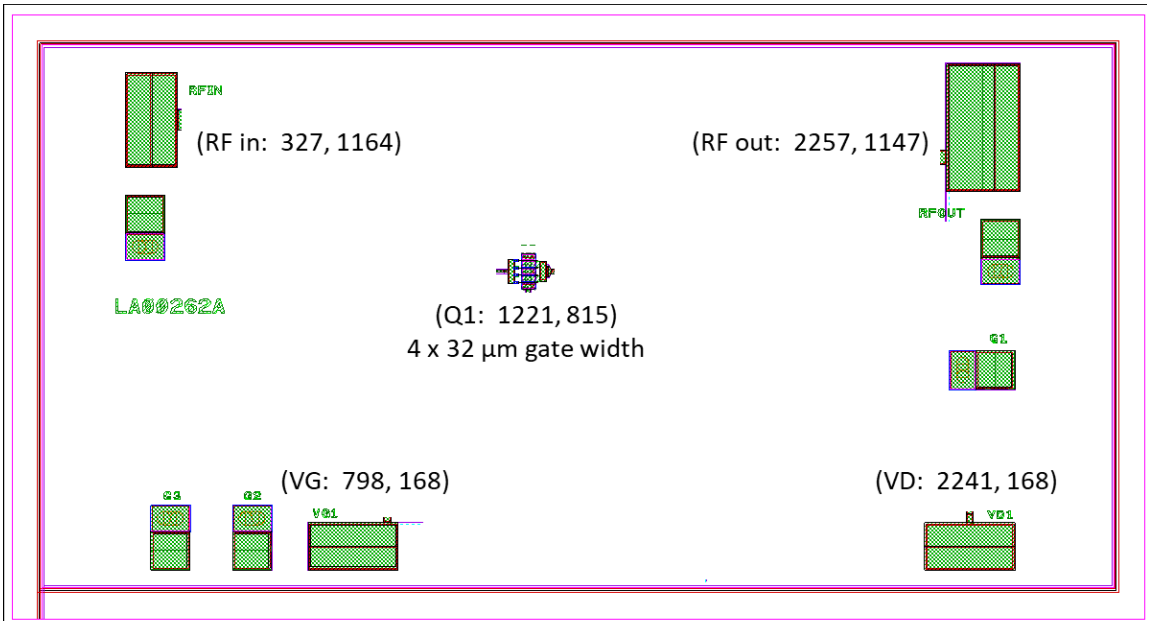
MMIC Assembly Drawing:
External Microstrip Flares, 150 pF Bypass Capacitors, & Bond Wires



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: 2.65 mm x 1.41 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): 100 µm. Typical tolerance +/- 10 µm.
3. Backside metallization is gold.
4. Bond pad metallization is gold.