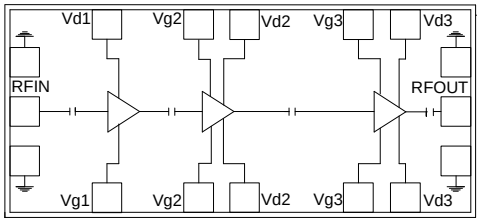
14 – 15.5 GHz 2 Watt Power Amplifier

Features

- **Frequency Range : 14 – 15.5GHz**
- **33 dBm output Psat**
- **26 dB Power gain**
- **25% PAE**
- **High IP3**
- **Dual bias operation**
- **On Chip Detector**
- **No external matching required**
- **DC decoupled input and output**
- **0.5 µm InGaAs pHEMT Technology**
- **Chip dimension: 3.4 x 1.8 x 0.1 mm**

Functional Diagram



Typical Applications

- **RADAR**
- **MMDS**
- **VSAT**

Description

2154051A is a three stage GaAs PHEMT Class AB Power Amplifier MMIC. The PA delivers output power of 33dBm with a small signal gain of 26dB and 25% PAE in 14GHz – 15.5GHz frequency band. The input/output are matched to 50 ohms and the circuit grounds are provided through vias to the backside metallization.

Absolute Maximum Ratings (1)

Parameter	Absolute Maximum	Units
Drain supply voltage (V_d=V_{d1}=V_{d2}=V_{d3})	+9	Volts
Gate supply voltage (V_g=V_{g1}=V_{g2}=V_{g3})	-0.7>V_g>-2.2	Volts
Drain current (I_{dq}=I_{dq1}+I_{dq2}+I_{dq3})	1050	mA
RF input power (RFin at V_d=7.5V)	20	dBm
Operating temperature	-50 to +80	^oC
Storage Temperature	-65 to +150	^oC

1. Operation beyond these limits may cause permanent damage to the component

Electrical Specifications [1] @ $V_{d1} = V_{d2} = V_{d3} = 7.5V$, $V_{g1} = V_{g2} = V_{g3} = -0.85V$, $Z_o = 50\ \Omega$, T_A[2] = 25°C, T_B[3] = 60°C

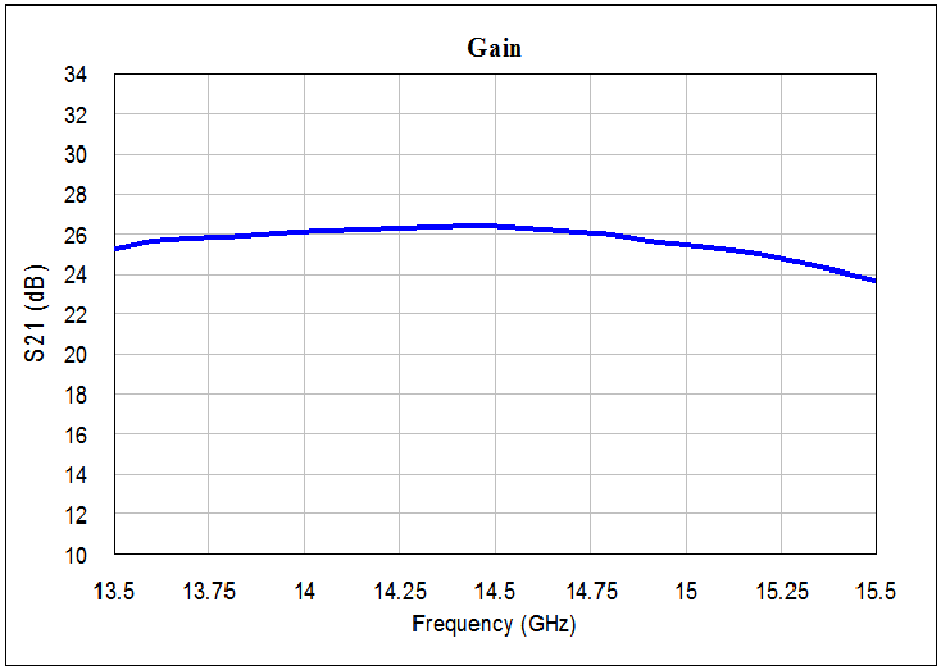
Parameter	Min.	Typ.	Max.	Units
Frequency Range	14		15.5	GHz
Gain	--	26	--	dB
Gain Flatness		+/- 0.7	--	dB
Input Return Loss	--	9.5	--	dB
Output Return Loss	--	8	--	dB
Output 1dB compression point (P1dB)	--	+32	--	dBm
Output Saturated Power(Psat)	--	+33	--	dBm
Output Third Order Intercept point (OIP3)	--	43	--	dBm
PAE [4]	--	25	--	%
Drain Bias Voltage (V_d=V_{d1}=V_{d2}=V_{d3})	-	7.5	9	V
Gate Bias Voltage (V_g=V_{g1}=V_{g2}=V_{g3})	-	-0.85	-0.7	V
Supply Current - I_{dq}	-	0.77	-	A
Supply Current - I_{dsat} [5]	-	1.1	-	A

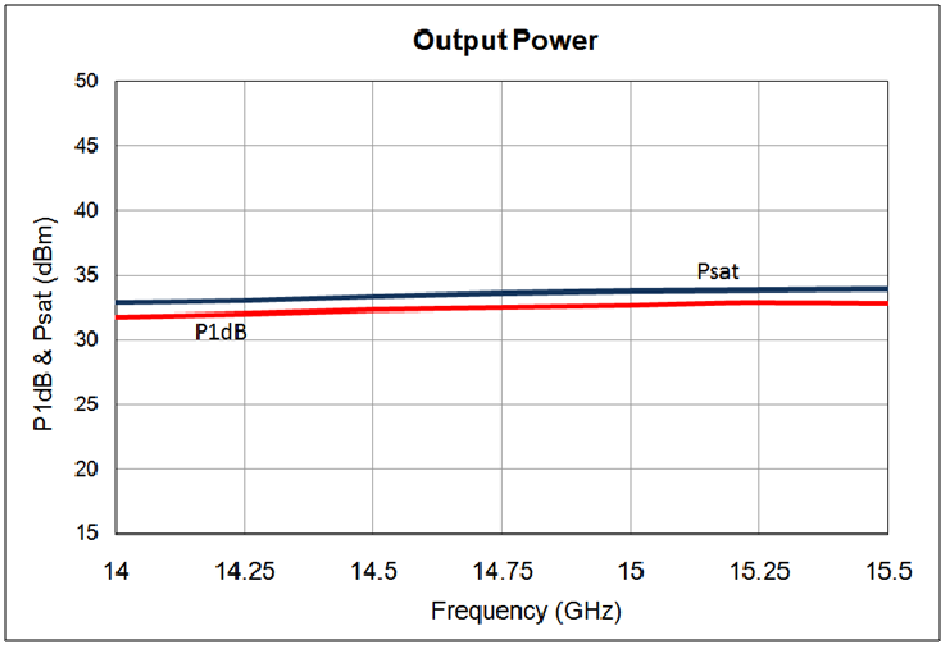
Note:

1. Electrical specifications measured in test fixture.
2. T_A - Ambient Temperature.
3. T_B – Base Plate Temperature.
4. Measured at output 1dB compression point.
5. I_{dsat} is the maximum current under input RF drive condition.

Test fixture data

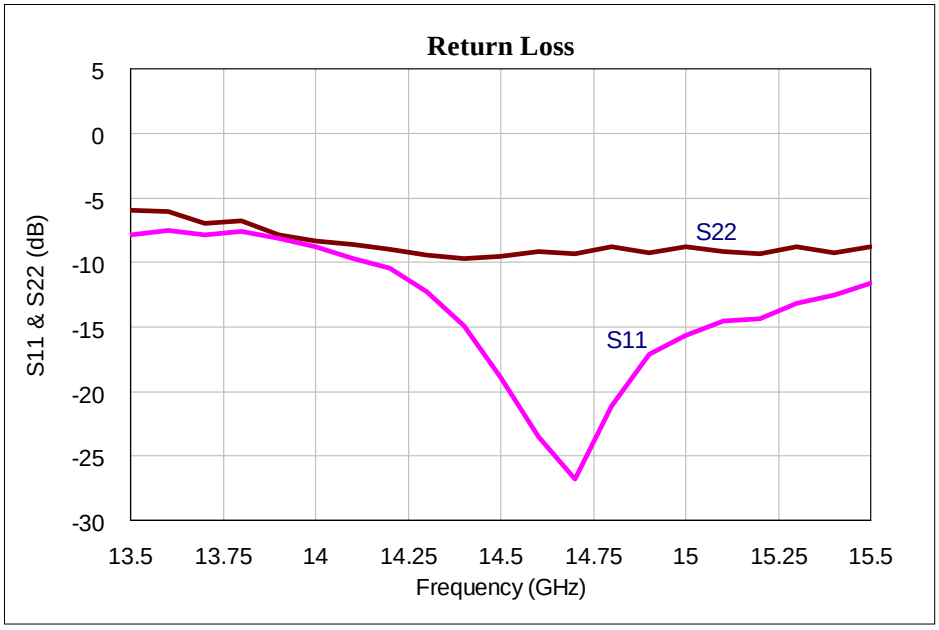
V_{d1} = V_{d2} = V_{d3}= 7.5V, V_{g1} = V_{g2} = V_{g3} = -0.85V, Total Current (Idq=0.77A, Idsat=1.1A); T_B = 60 ^oC

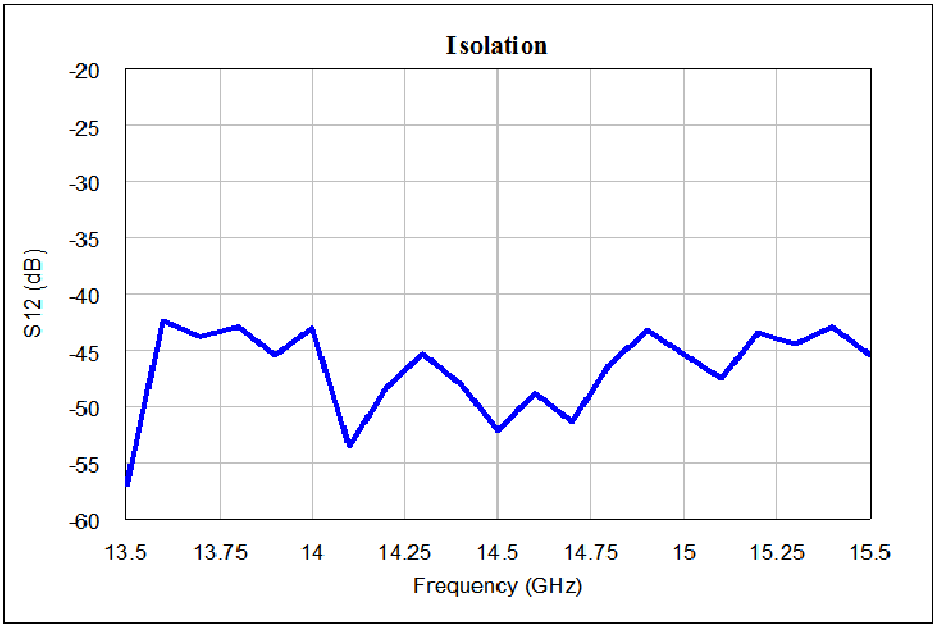




Test fixture data

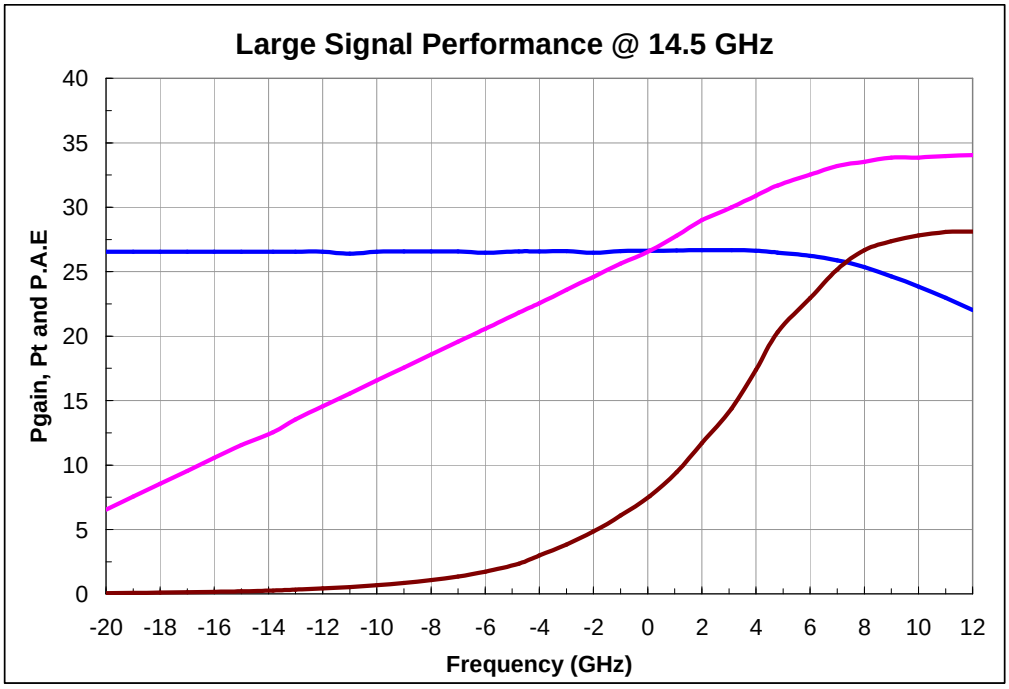
V_{d1} = V_{d2} = V_{d3}= 7.5V, V_{g1} = V_{g2} = V_{g3} = -0.85V, Total Current (Idq=0.77A, Idsat=1.1A); T_B = 60 ^oC





Test fixture data

V_{d1} = V_{d2} = V_{d3}= 7.5V, V_{g1} = V_{g2} = V_{g3} = -0.85V, Total Current (Idq=0.77A, Idsat=1.1A); T_B = 60 ^oC

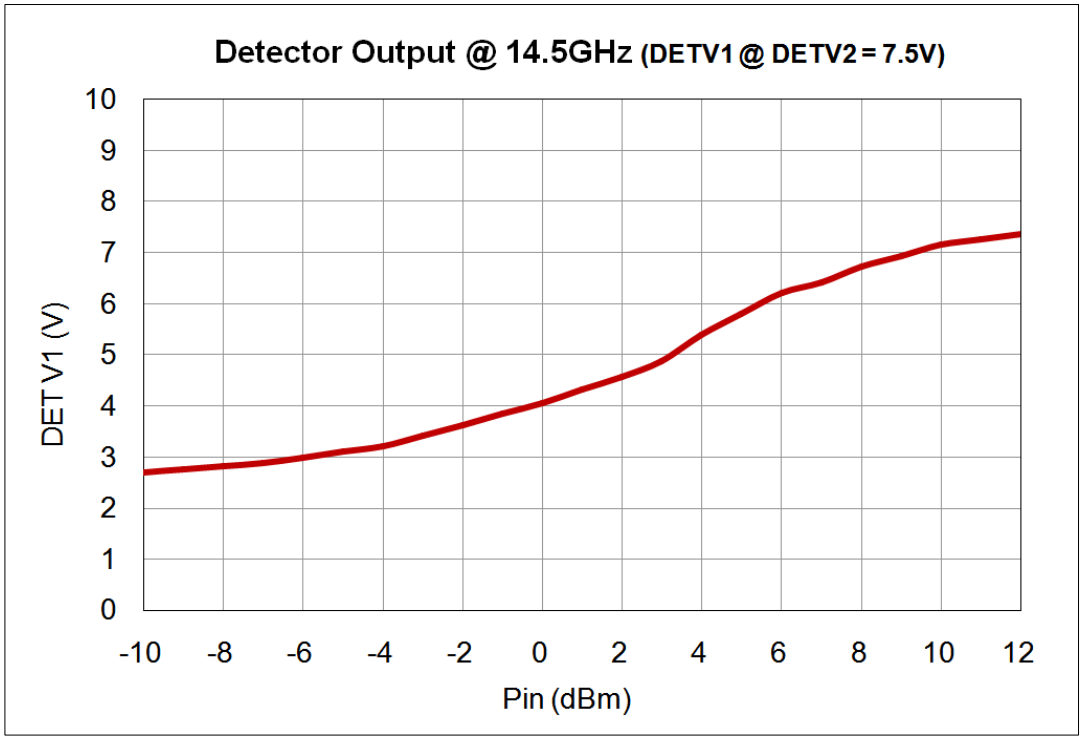


Power Detector Performance:

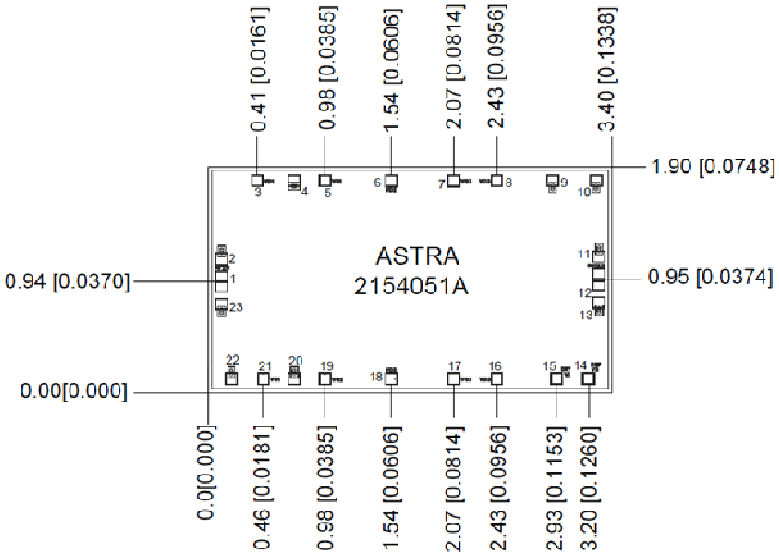
Test fixture data

V_{d1} = V_{d2} = V_{d3}= 7.5V, V_{g1} = V_{g2} = V_{g3} = -0.85V, Total Current (Idq=0.77A, Idsat=1.1A);
T_B = 60 ^{o}C; DetV2 = 7.5V

Pout (dBm)	14GHz	14.5GHz	15GHz	15.5GHz
33dBm	DetV1 = 7.0V	DetV1 = 7.2V	DetV1 = 7.3V	DetV1 = 7.4V
-30dBm	DetV1 = 2.7V	DetV1 = 2.7V	DetV1 = 2.7V	DetV1 = 2.7V



Mechanical Characteristics



Units: millimeters (inches)

Note:

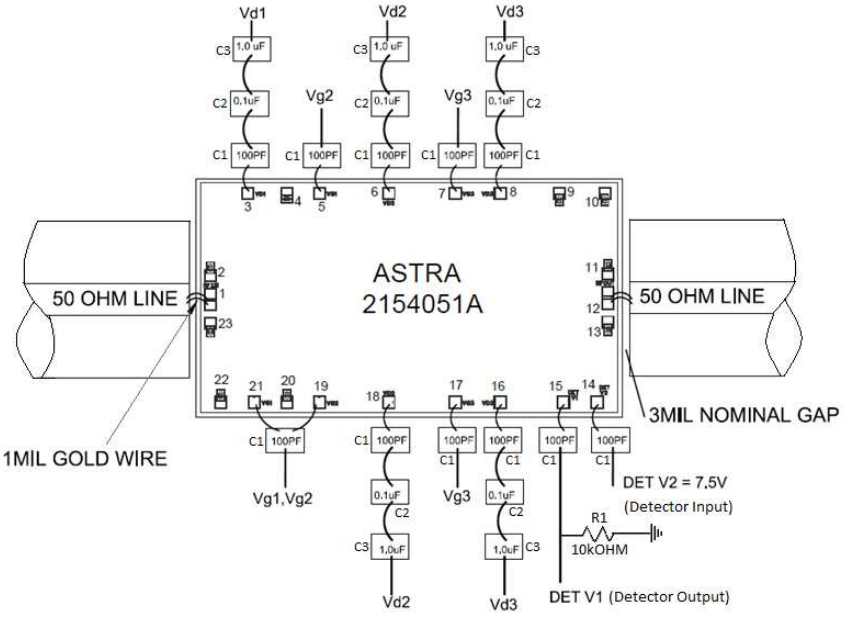
1. All RF and DC bond pads are 100µm x 100µm
2. Pad no. 1 : RF IN
3. Pad no. 21 : 1st stage gate voltage
4. Pad no. 3 : 1st stage drain voltage
5. Pad no. 5,19 : 2nd stage gate voltage
6. Pad no. 6,18 : 2nd stage drain voltage
7. Pad no. 7,17 : 3rd stage gate voltage
8. Pad no. 8,16 : 3rd stage drain voltage
9. Pad no. 12 : RF OUT

Off Chip Components used while recording test fixture data:

Component	Part Number/Description	Vendor
100pF SLC Bypass Capacitor “C1”	D12BV101K5PX/100pF±10%;50V or Equivalent	DLI
0.1uF MLC Capacitor “C2”	04023C105KAT2A/1uF±10%;25V or Equivalent	AVX Corp.
1uF MLC Capacitor “C3”	04023C105KAT2A/1uF±10%;25V or Equivalent	AVX Corp.
10kohm SMD Thick Film Resistor “R1”	CRCW040210K0FKED; 1/16Watts; ±1% or Equivalent	Vishay

Note: Please refer to the assembly diagram given below

Recommended Assembly Diagram



Note :

1. Two 1 mil (0.0254mm) bond wires of minimum length should be used for RF input, RF output and from chip bond pad to 100pF capacitor.
2. Input and output 50 ohm lines are on 5 mil RT Duroid substrate.
3. The bond numbers shown in assembly diagram are as per bond pad numbers printed on the die.
4. The RF input & output ports are DC decoupled on-chip.
5. Coefficient of thermal expansion matching is recommended for reliability purpose.
6. Use high thermal conductive material for die mounting for long term reliability.
7. Maintain base plate temperature less than 70 degC under RF operation for optimum performance.

Die attach: For Epoxy attachment, use of a two-component conductive epoxy is recommended. An epoxy fillet should be visible around the total die periphery. If Eutectic attachment is preferred, use of fluxless AuSn (80/20) 1-2 mil thick preform solder is recommended. Use of AuGe preform should be strictly avoided.

Wire bonding: For DC pad connections use either ball or wedge bonds. For best RF performance, use of 150 - 200µm length of wedge bonds is advised. Single Ball bonds of 250-300µm though acceptable, may cause a deviation in RF performance.

GaAs MMIC devices are susceptible to Electrostatic discharge. Proper precautions should be observed during handling, assembly & testing

All information and specifications are subject to change without prior notice
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