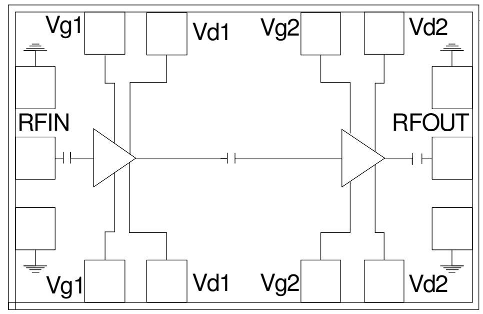
8.5 – 10 GHz 10 Watt Power Amplifier

Features

- **Frequency Range : 8.5 – 10GHz**
- **40 dBm Psat**
- **13 dB Power gain**
- **25% PAE**
- **High IP3**
- **Input Return Loss > 10 dB**
- **Output Return Loss > 9 dB**
- **Dual bias operation**
- **DC decoupled input and output**
- **0.5 µm InGaAs pHEMT Technology**
- **Chip dimension: 5.2 x 5.0 x 0.1 mm**

Functional Diagram



Typical Applications

- **RADAR**
- **Military & space**
- **LMDS, VSAT**

Description

The AMT2144111 is a X-band Power amplifier with 40dBm power output. The PA uses 2 stages of amplification and operates in 8.5 – 10 GHz frequency range. The PA features 13 dB of gain with input and output return losses of 10 dB and 9 dB respectively. The PA has a high IP3 of 47dBm and 25% PAE. This feature enables it to be used in the applications requiring efficiency along with linearity. The chip operates with dual bias supply voltage.The die is fabricated using a reliable 0.5µm InGaAs pHEMT technology. The Circuit grounds are provided through vias to the backside metallization.

Absolute Maximum Ratings (1)

Parameter	Absolute Maximum	Units
Drain bias voltage (Vd)	+10	volts
Drain current (Id)	4	A
RF input power (RFin at Vd=9V)	33	dBm
Operating temperature	-50 to +85	^{o}C
Storage Temperature	-65 to +150	^{o}C

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

Electrical Specifications [1] @ T_A = 25 °C, V_{d1} = V_{d2} = 8V, V_{g1} = V_{g2} = -1.1V Z_o =50 Ω

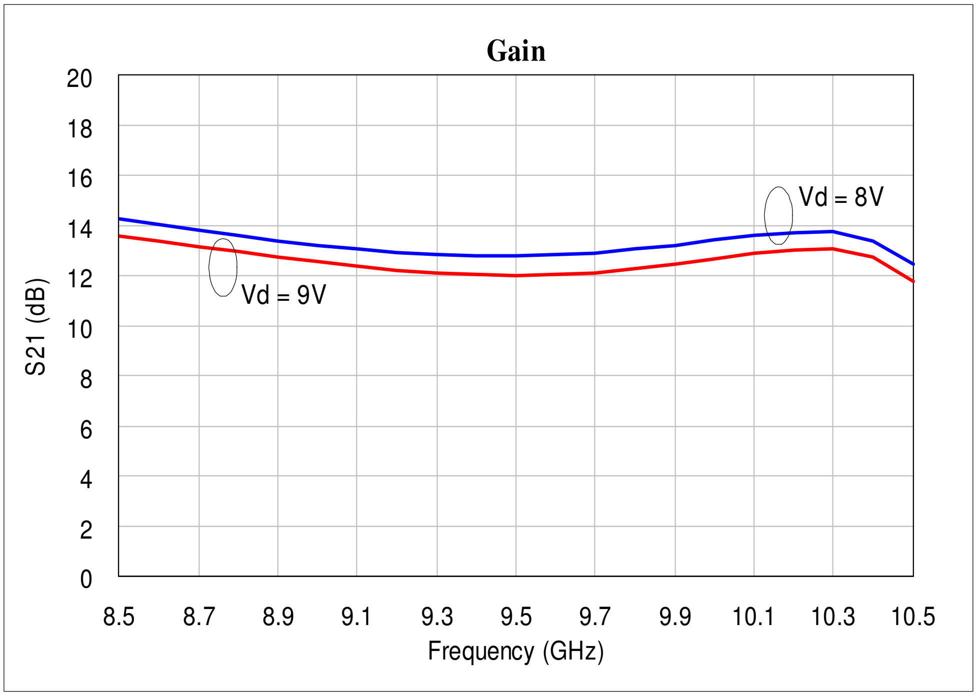
Parameter	Typ.	Units
Frequency Range	8.5 – 10	GHz
Gain	13	dB
Gain Flatness	+/-0.5	dB
Output Power (P1 dB)	38.4	dBm
Input Return Loss	10	dB
Output Return Loss	9	dB
Saturated output power (Psat)	40	dBm
Output Third Order Intercept (IP3)	47	dBm
Power Added Efficiency (PAE)	25%	--
Supply Current(I_{dq})	2.9	A
Supply Current(I_{dsat}[2])	4.3	A

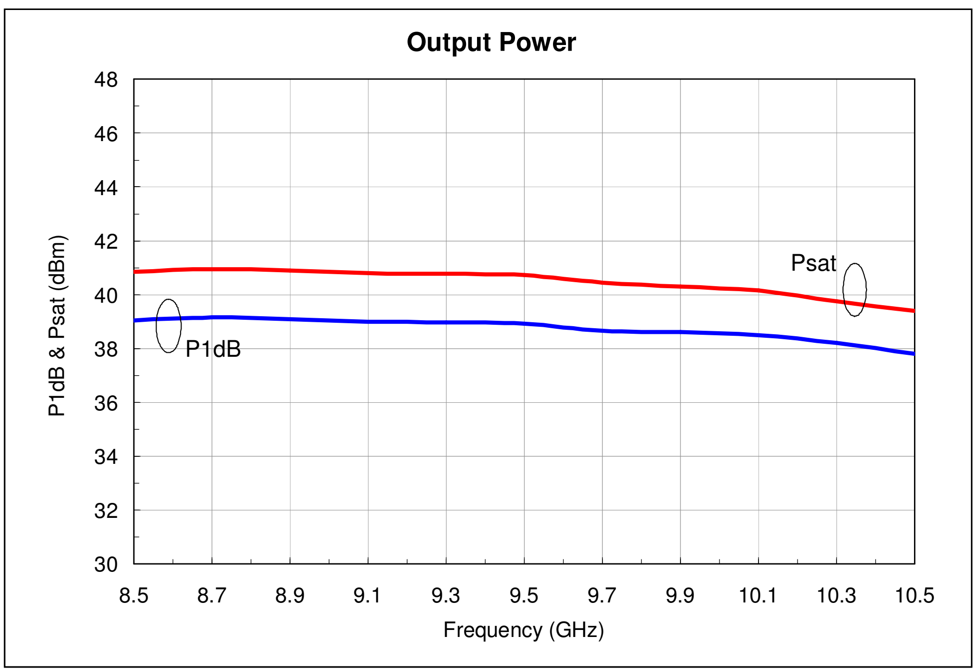
Note:

1. Electrical specifications as measured in test fixture.
2. I_{dsat} is the drain current corresponding to saturated output power.

Test fixture data

$V_{d1} = V_{d2} = V_d$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idq) =2.9A, $T_A = 25\,^{o}C$

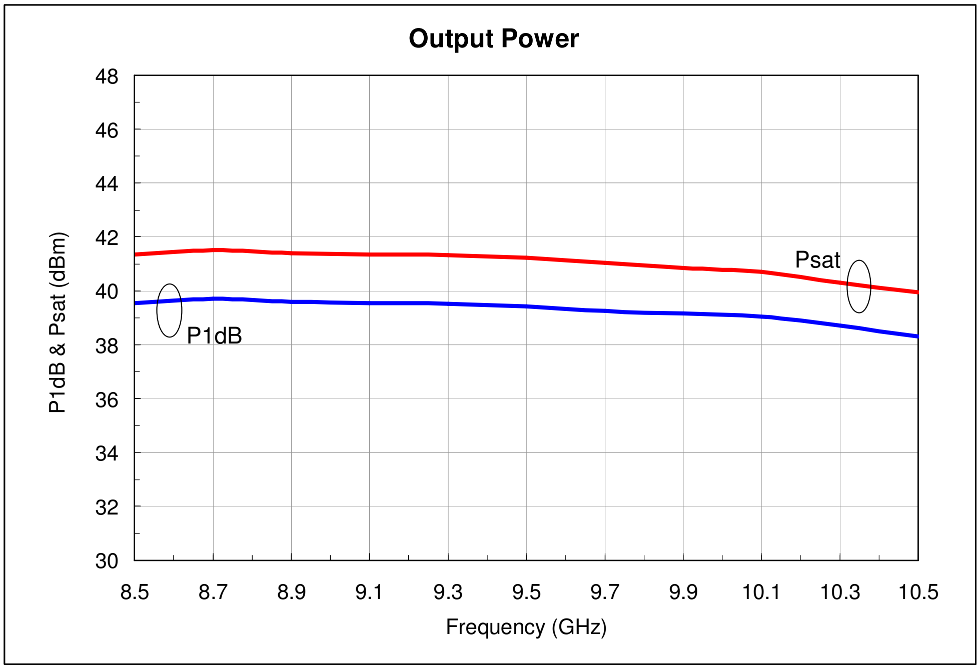




Output power plotted at Vd = 8V

Test fixture data

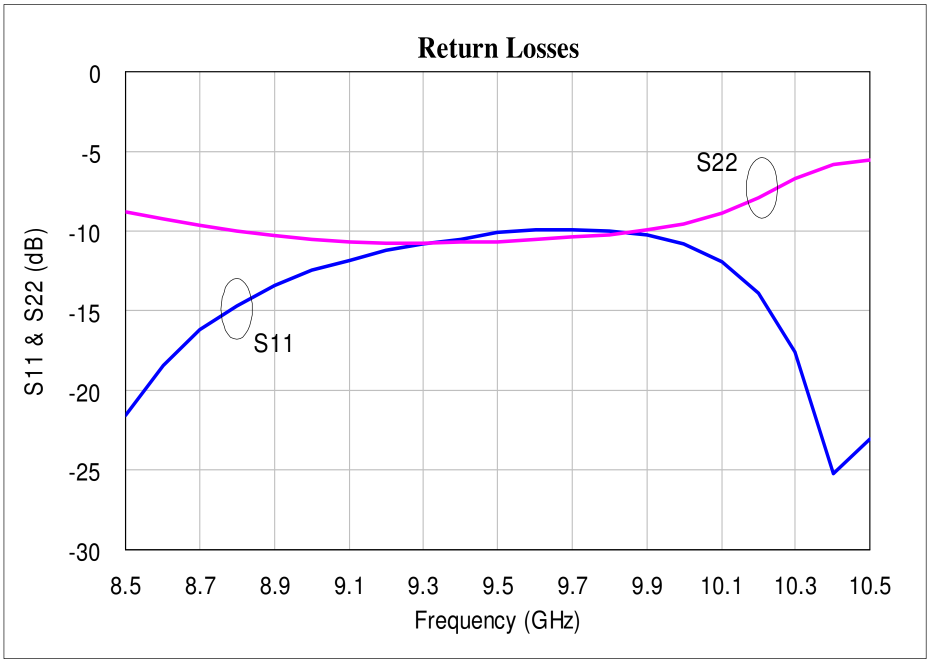
$V_{d1} = V_{d2} = V_d$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idq) =2.9A, $T_A = 25\,^oC$

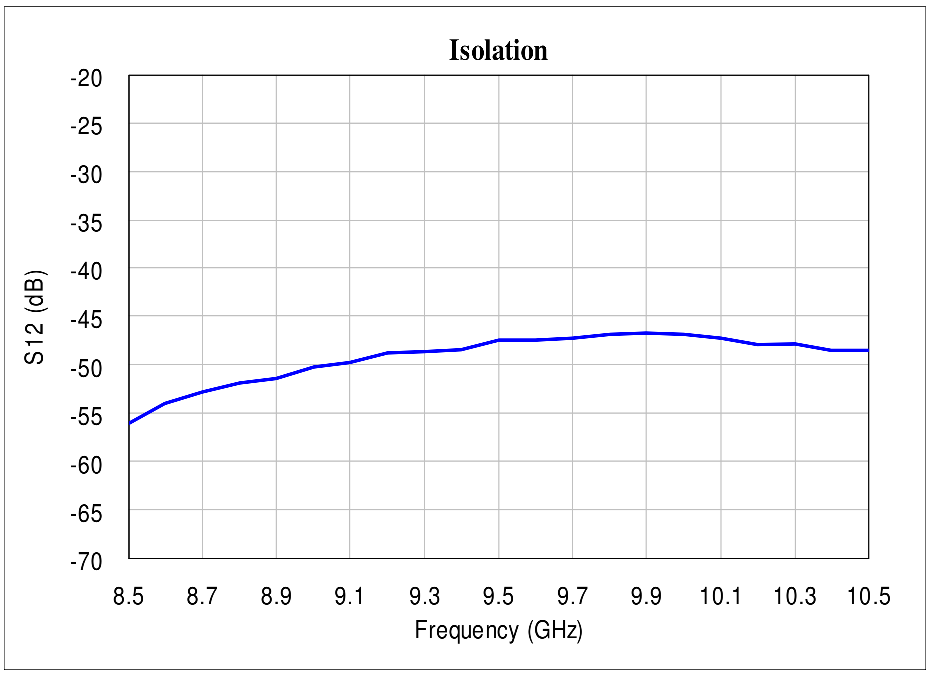


Output power plotted at Vd = 9V

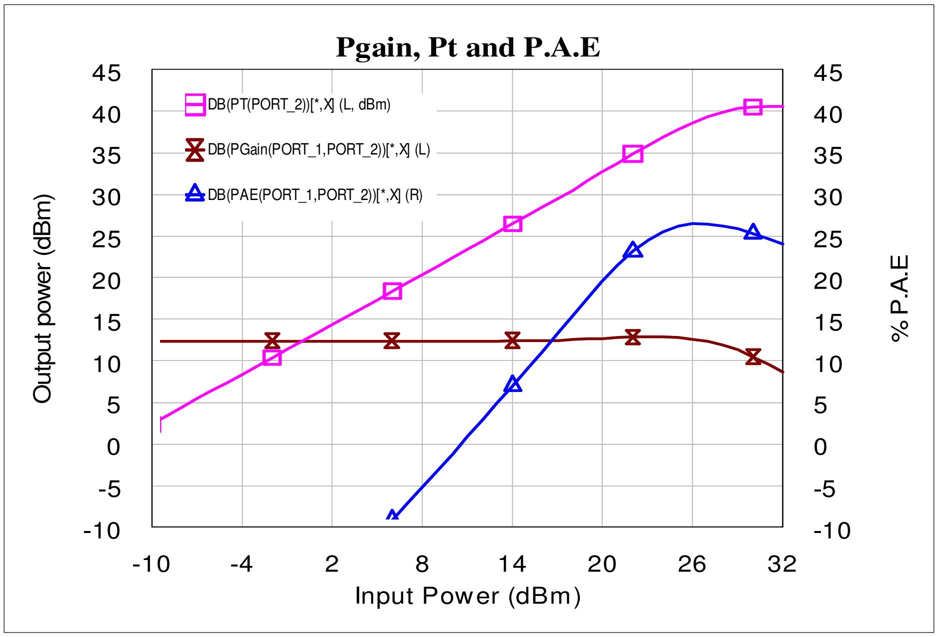
Test fixture data

$V_{d1} = V_{d2} = 8V$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idq) =2.9A, $T_A = 25\,^oC$

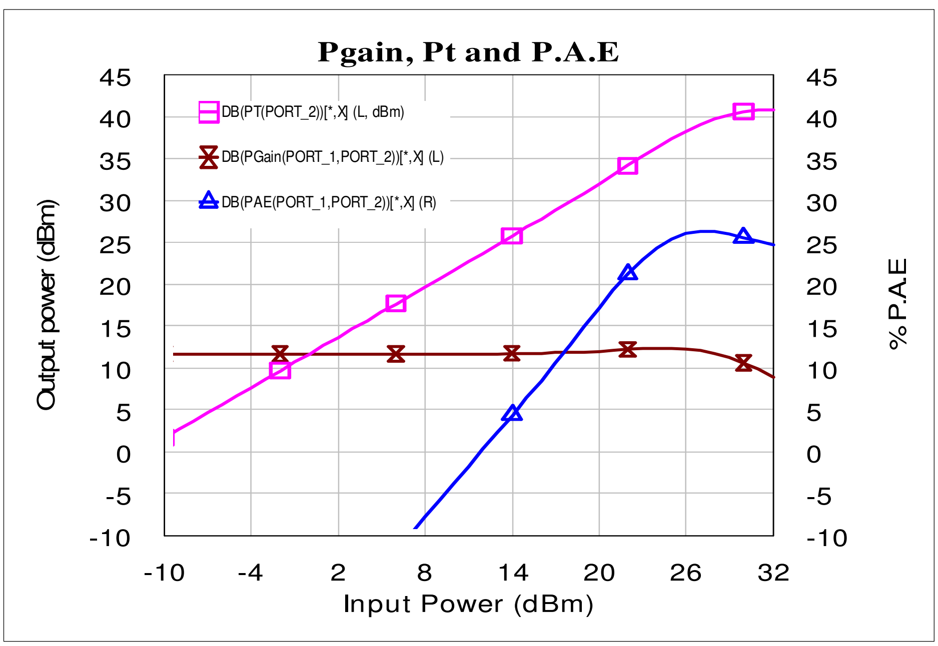




Output Power Plots:



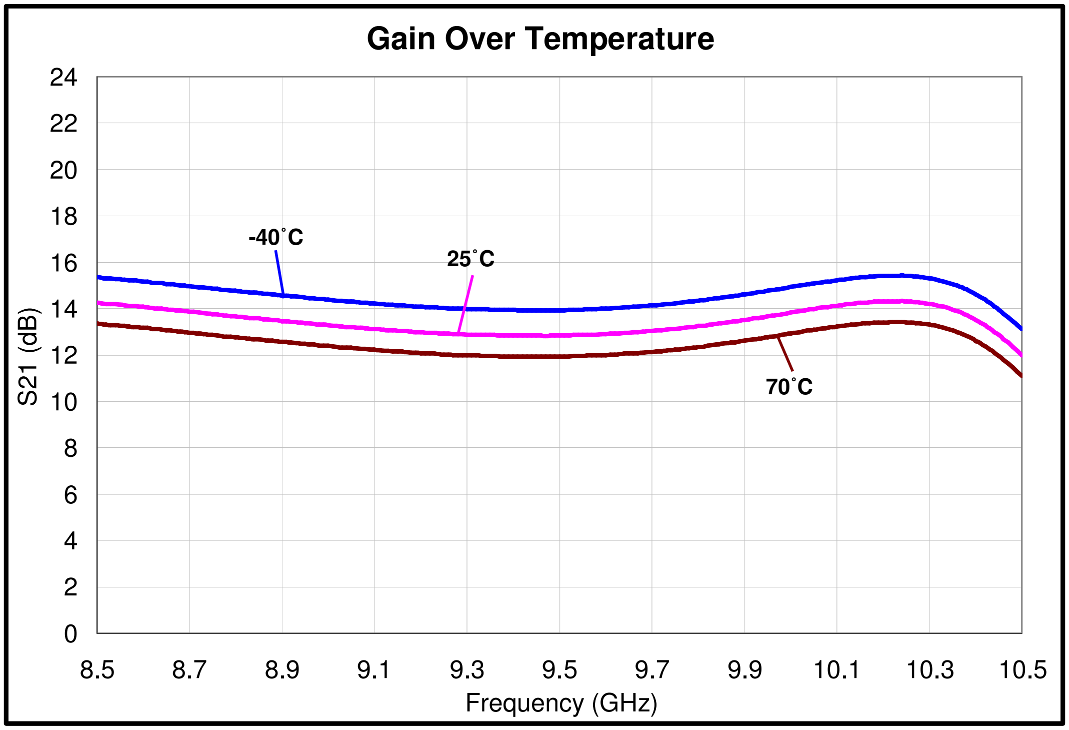
$V_{d1} = V_{d2} = 8V$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idsat) =4A, Freq = 9.5GHz, $T_A = 25\,^oC$

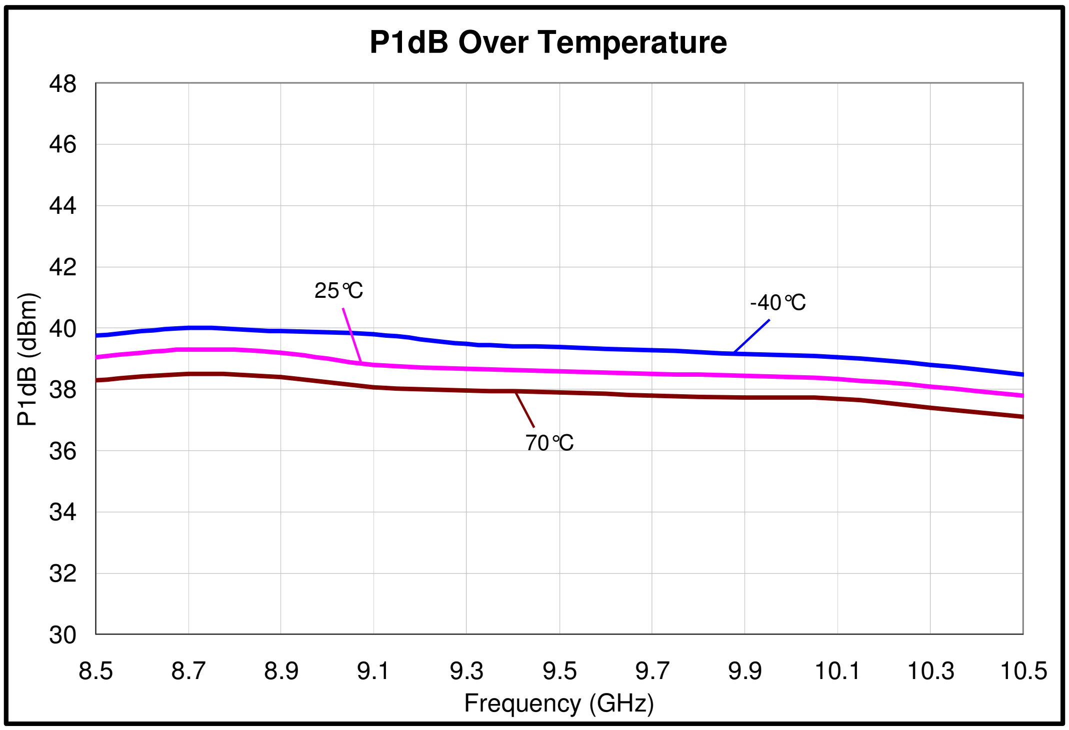


$V_{d1} = V_{d2} = 9V$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idsat) =4A, Freq = 9.5GHz, $T_A = 25\,^oC$

Temperature data

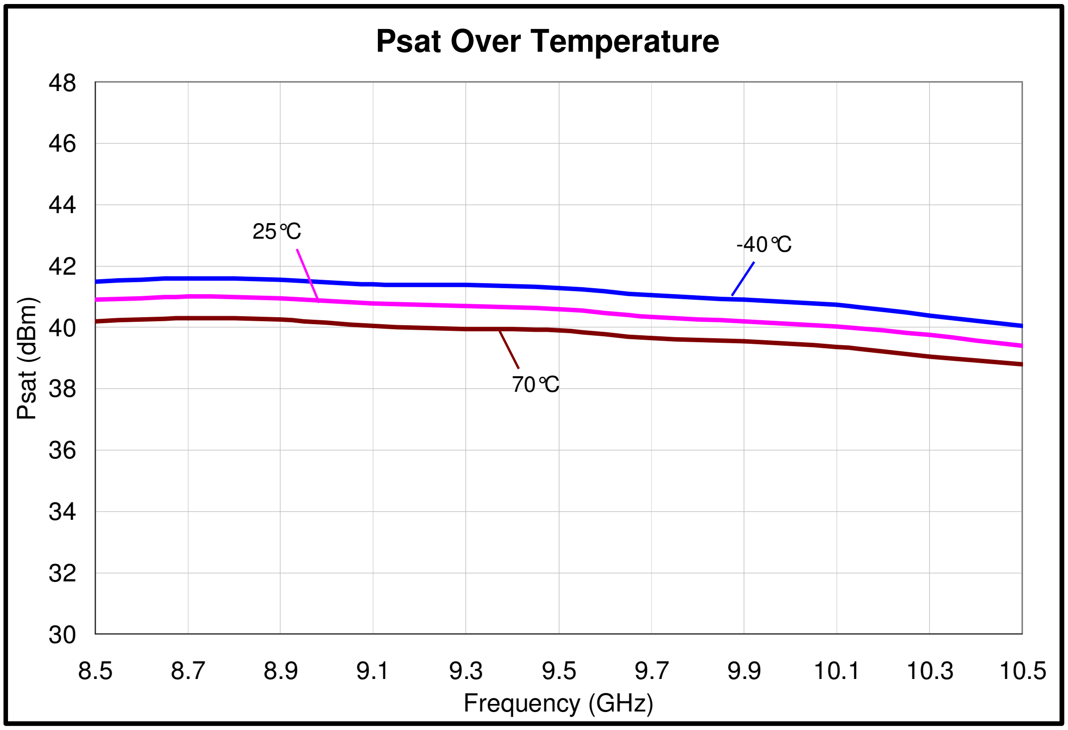
$V_{d1} = V_{d2} = 8V$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idq) =2.9A, $T_A = 25\,^{o}C$



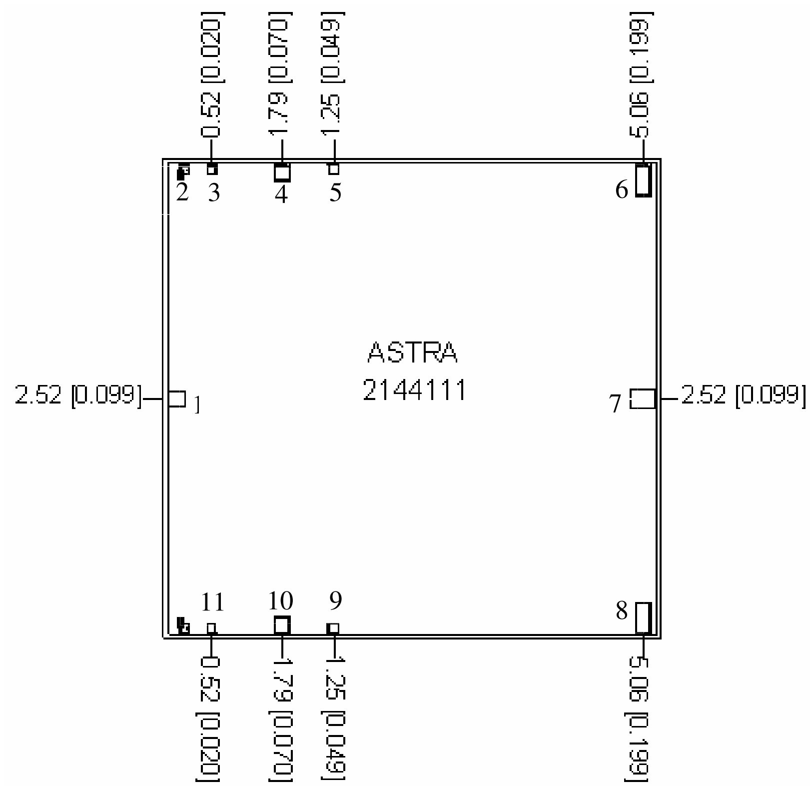


Temperature data

$V_{d1} = V_{d2} = 8V$, $V_{g1} = V_{g2} = -1.1V$, Total Current (Idq) =2.9A, $T_A = 25\,^oC$



Bond Pad Locations

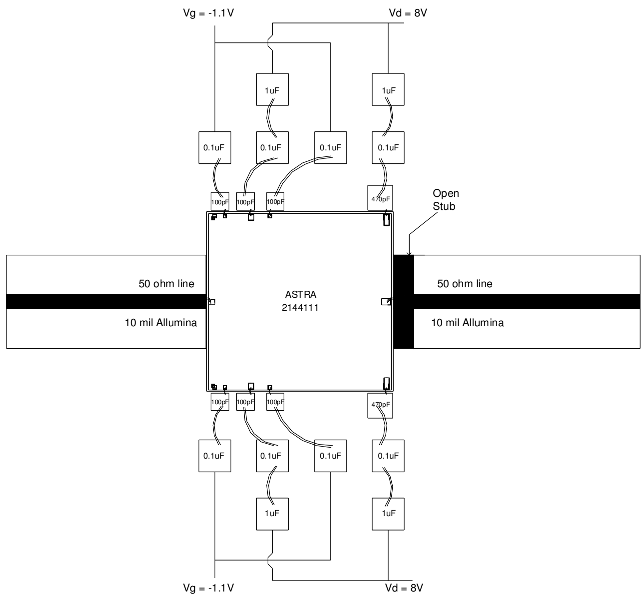


Units: millimeters (inches)

Note:

1. All RF and DC bond pads are 100µm x 100µm
2. Pad no. 1 : RF IN
3. Pad no. 3,11 : 1st stage gate voltage(V_{g1})
4. Pad no. 7 : RF Output
5. Pad no. 4,10 : 1st stage drain voltage(V_{d1})
6. Pad no. 5,9 : 2nd stage gate voltage(V_{g2})
7. Pad no. 6,8 : 2nd stage drain voltage (V_{d2})
8. All the dimensions shown above are measured taking bottom left corner as reference.

Recommended Assembly Diagram



Note :

1. Open stub of 4mm length, 1mm width and 0.1mm thickness to be placed at output immediate to the chip as shown above for proper matching.
2. Two 1 mil (0.0254mm) bond wires of minimum length should be used for RF input and output.
3. Two 1 mil (0.0254mm) bond wires of minimum length should be used from chip bond pad to 100pF capacitor.
4. Input and output 50 ohm lines are on 5 mil RT Duroid substrate.
5. 100pF,0.1uF and 1uF bypass capacitors are used as shown above.
6. The RF input & output ports are DC decoupled on-chip.
7. Proper heat sink like Copper tungsten or copper molybdenum to be used for better reliability of chip.

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