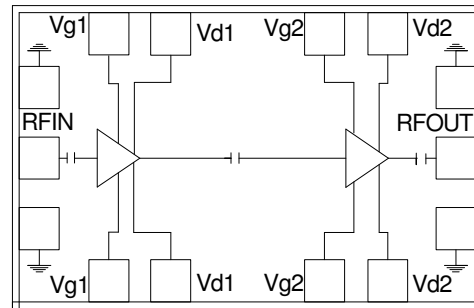


## 9 – 10GHz 12 Watt Power Amplifier

### Features

- ◆ Frequency Range : 9 – 10GHz
- ◆ 41 dBm Psat
- ◆ 24 dB Power gain
- ◆ 36% PAE
- ◆ High IP3
- ◆ Dual bias operation
- ◆ DC decoupled input and output
- ◆ On Chip Power Detector
- ◆ 0.25  $\mu\text{m}$  InGaAs pHEMT Technology
- ◆ Chip dimension: 4.8 x 3.9 x 0.1 mm

Functional Diagram



### Typical Applications

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

### Description

The AMT2144116A is a X-band Power amplifier with 41dBm power output. The PA uses 2 stages of amplification and operates in 9 – 10GHz frequency range. The PA features 24 dB of Small Signal Gain. The PA has a high IP3 of 48dBm and 36% 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 0.25 $\mu\text{m}$  InGaAs pHEMT technology. The Circuit grounds are provided through vias to the backside metallization.

### Absolute Maximum Ratings <sup>(1)</sup>

Parameter	Absolute Maximum	Units
Drain bias voltage (Vd)	+8.5	volts
Drain current (Id) at Vd=8V	5.2	A
Gate Voltage	-2.2 < Vg < -0.7	V
RF input power (RFin at Vd=8V)	25	dBm
Operating temperature	-50 to +85	°C
Storage Temperature	-65 to +150	°C

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

**Electrical Specifications <sup>(1)</sup> @ T<sub>A</sub> = 25 °C, V<sub>d1</sub> = V<sub>d2</sub> = 8V, V<sub>g1</sub> = V<sub>g2</sub> = -0.75V  
Z<sub>o</sub> = 50 Ω, Pulse Duty Cycle = 10%**

Parameter	Typ.	Units
Frequency Range	9 – 10	GHz
Gain	24	dB
Gain Flatness	+/-1.5	dB
Output Power (P1 dB)	40	dBm
Input Return Loss	9	dB
Output Return Loss	6	dB
Saturated output power (Psat)	41	dBm
Output Third Order Intercept (IP3)	48	dBm
Power Added Efficiency (PAE)	36%	--
Supply Current(I <sub>dq</sub> )	2.8	A

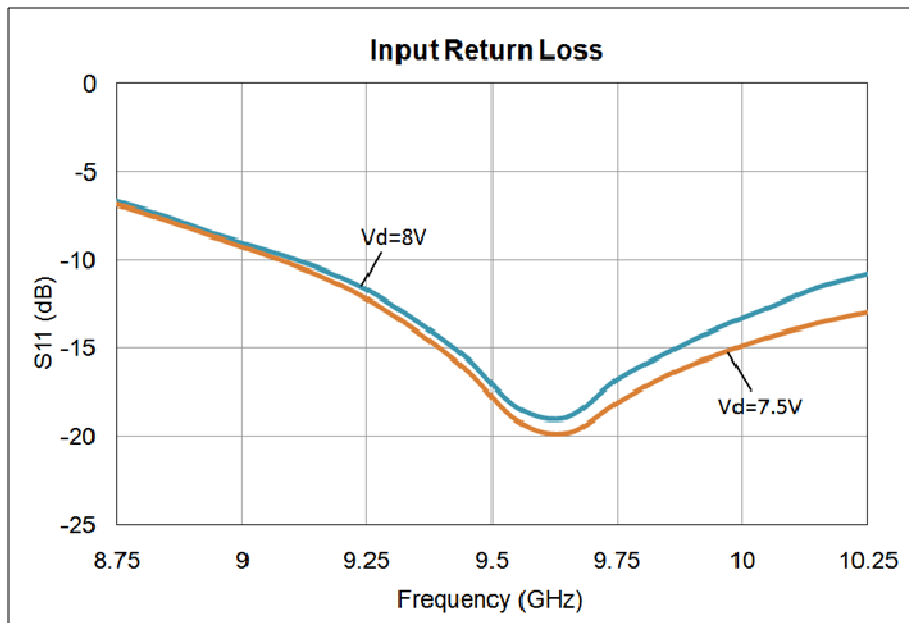
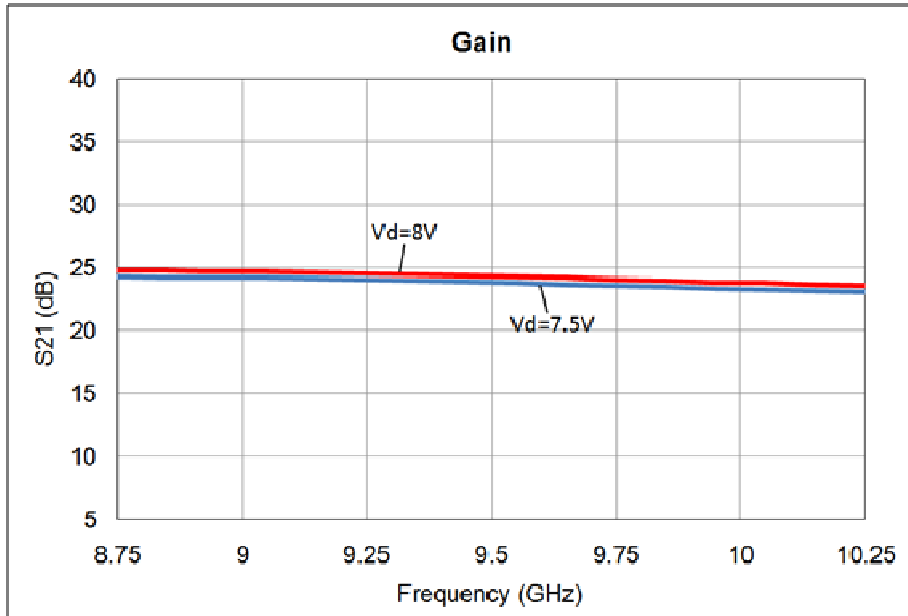
**Note:**

1. Electrical specifications as measured in test fixture.



**Test fixture data**

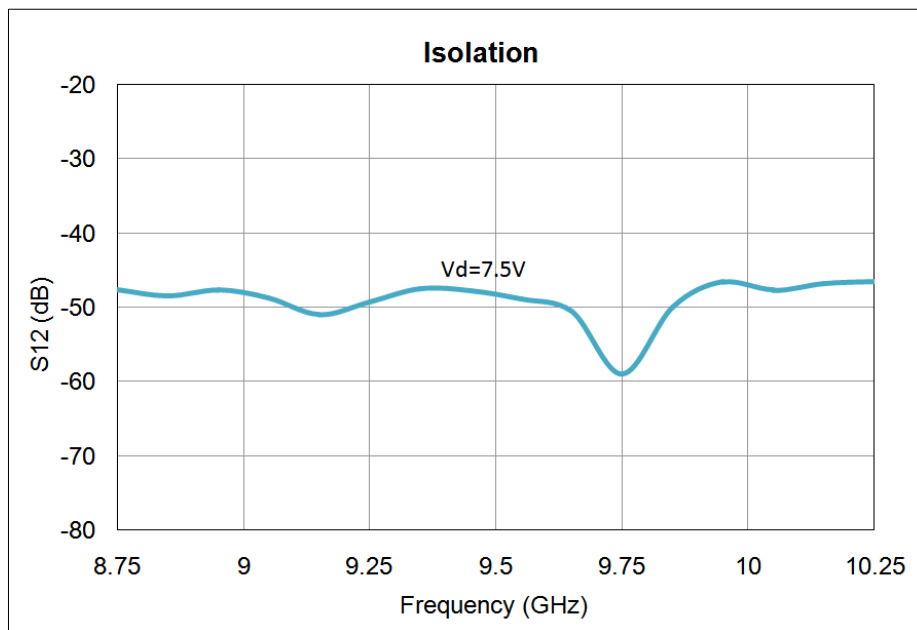
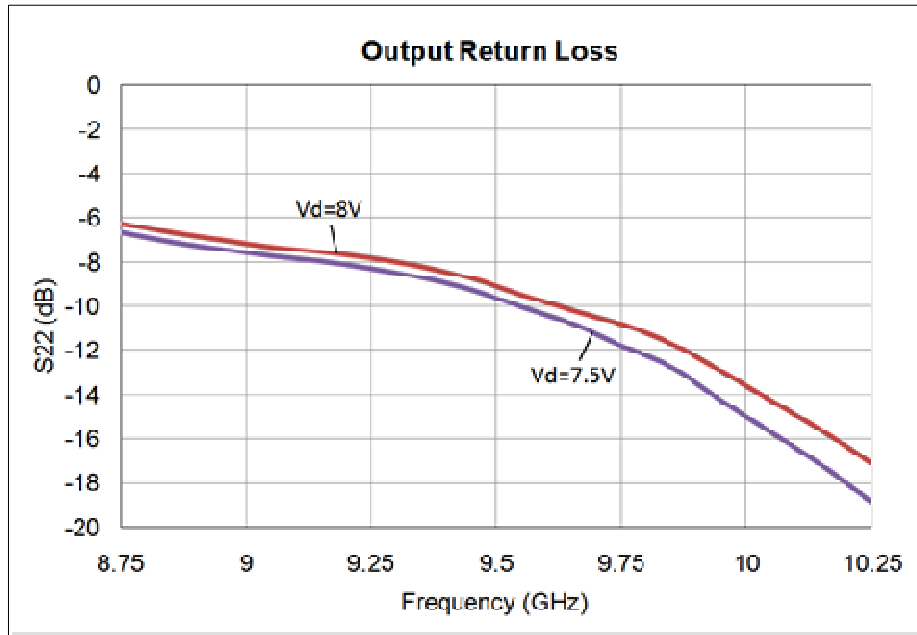
$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%





**Test fixture data**

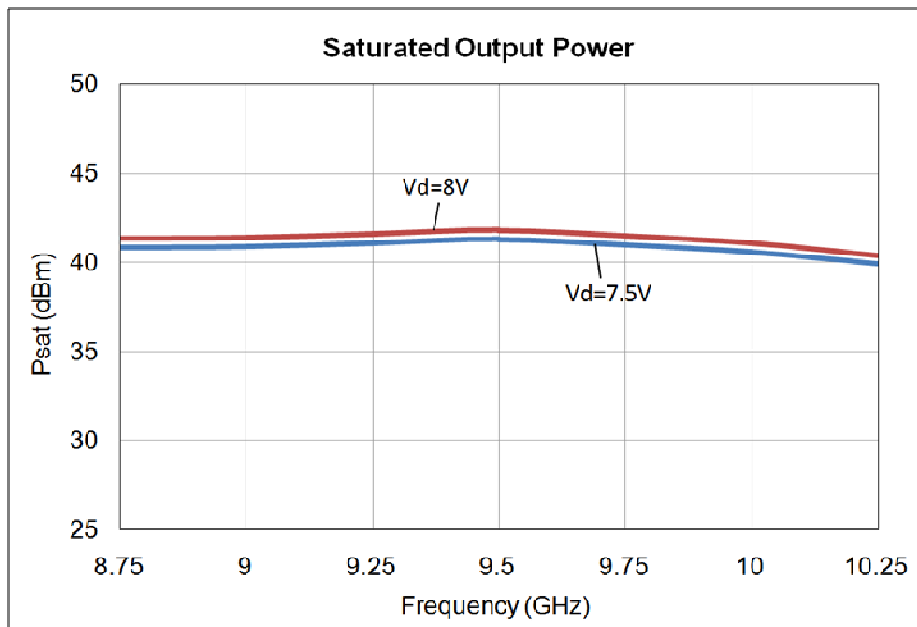
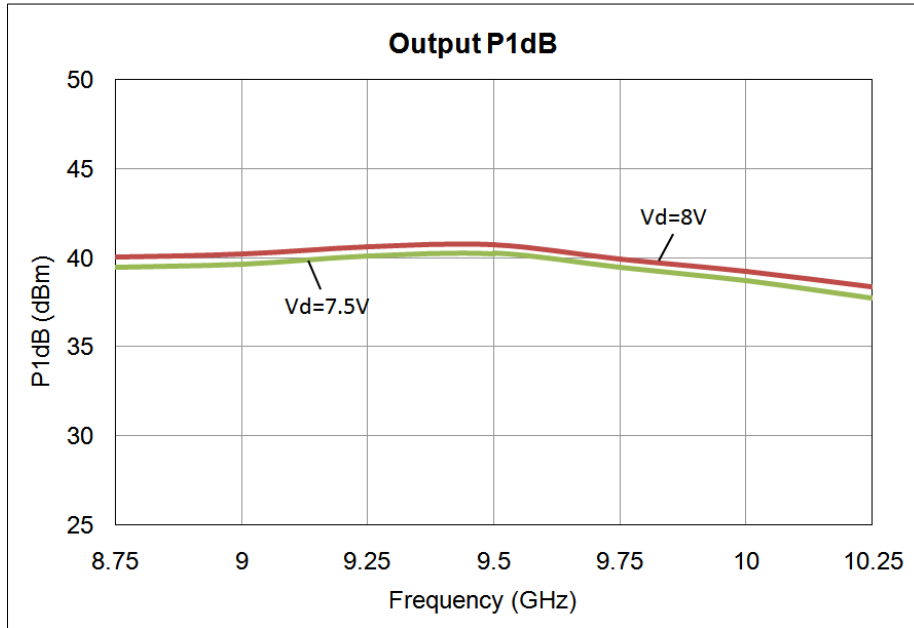
$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%





**Test fixture data**

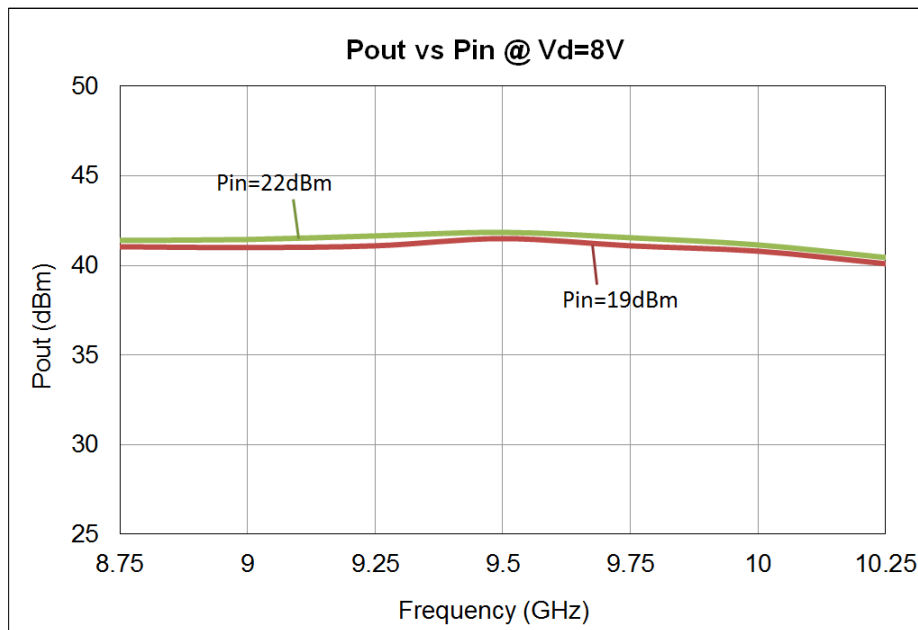
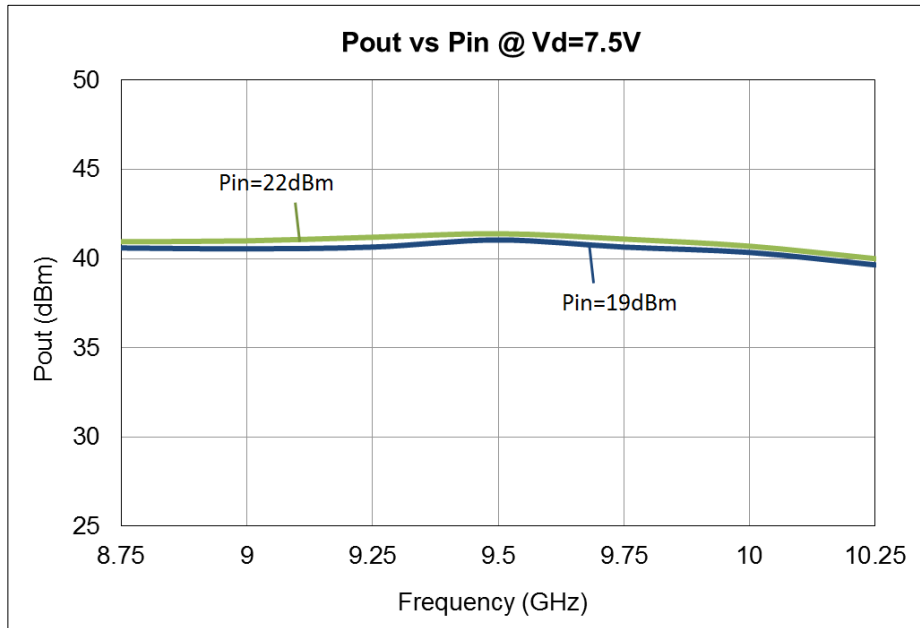
$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%





**Test fixture data**

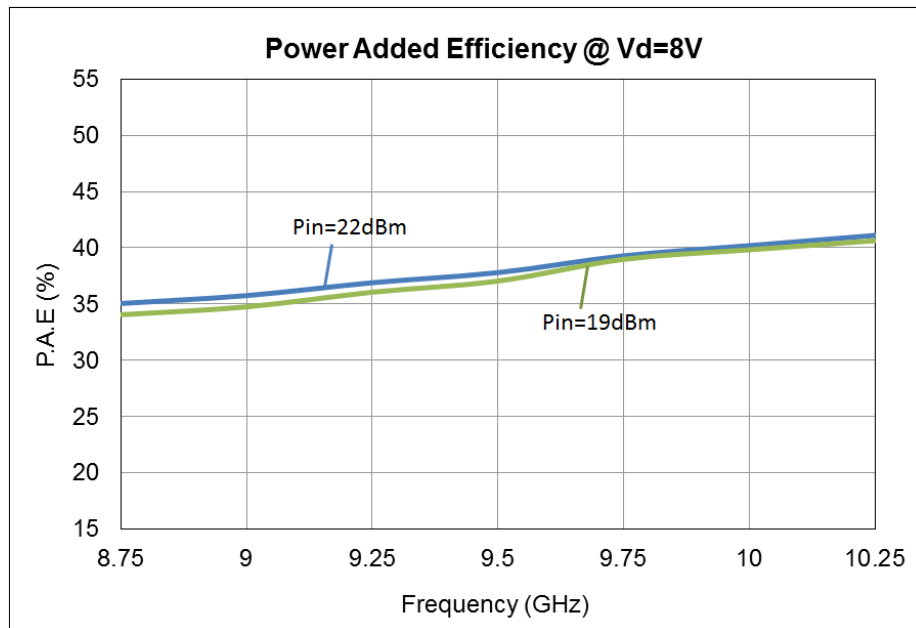
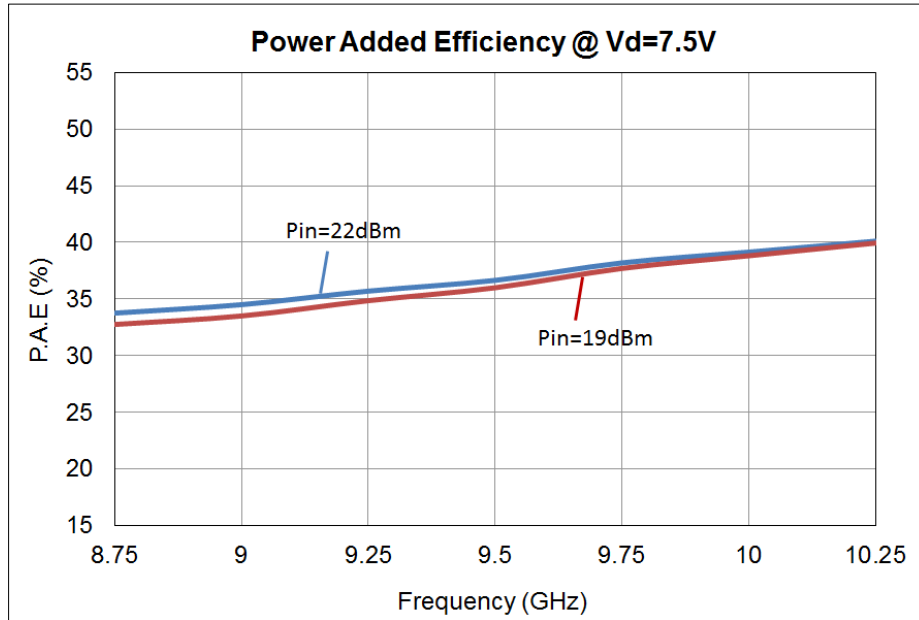
$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%





**Test fixture data**

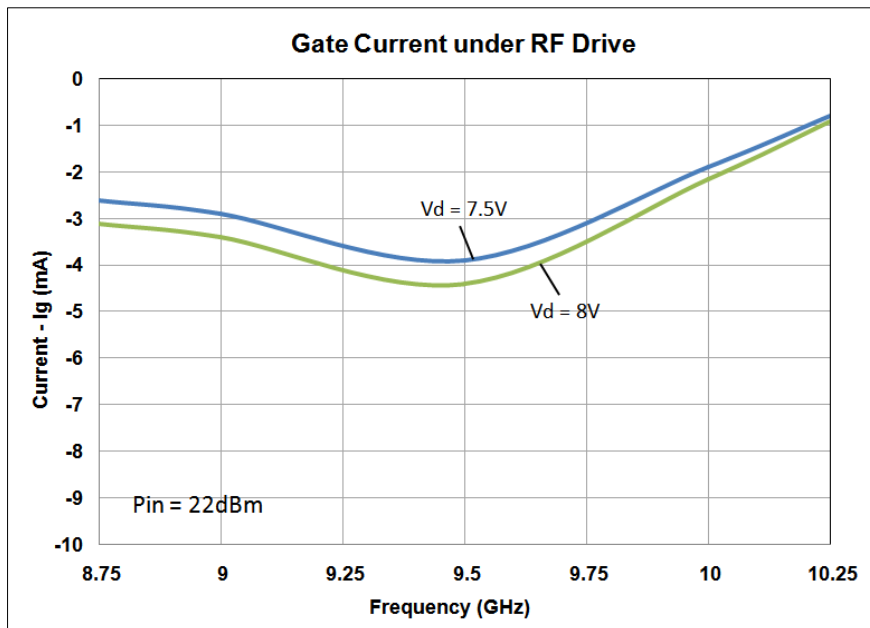
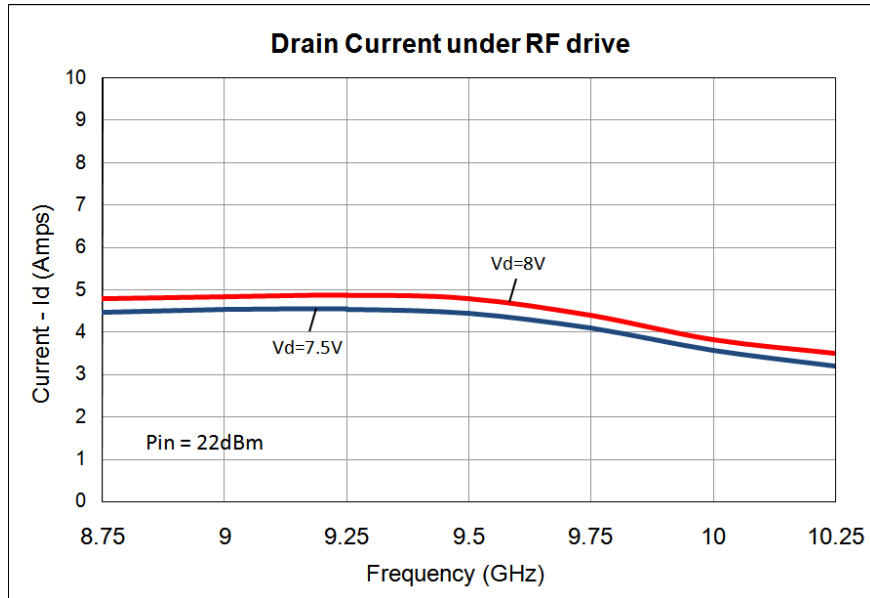
$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%





**Test fixture data**

$V_{d1} = V_{d2} = V_d$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) =  $2.8A@V_d=8V$ ,  $T_A = 25^\circ C$ ,  
(CW Mode)







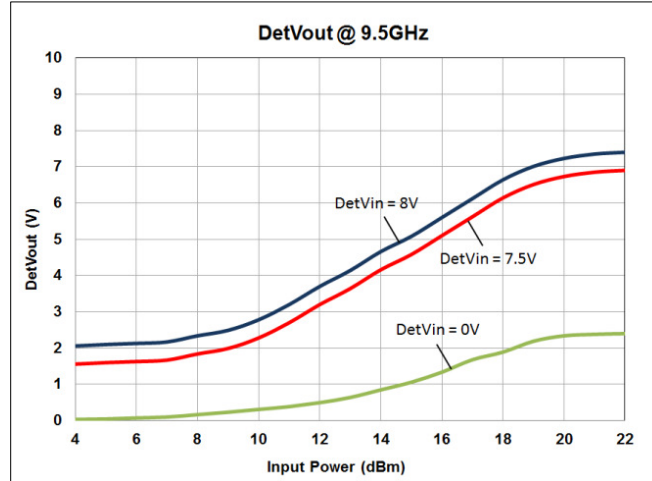
### Power Detector Performance:

#### Test fixture data

$V_{d1} = V_{d2} = 8V$ ,  $V_{g1} = V_{g2} = -0.75V$ , Total Current ( $I_{dq}$ ) = 2.8A,  $T_A = 25^\circ C$ ,  
Pulse Duty Cycle = 10%

Pout (dBm)	DetVout @ 9GHz	DetVout @ 9.5GHz	DetVout @ 10GHz
41dBm	6.6V @ DetVin = 7.5V 7.1V @ DetVin = 8V 2.2V @ DetVin = 0V	6.9V @ DetVin = 7.5V 7.4V @ DetVin = 8V 2.4V @ DetVin = 0V	6.8V @ DetVin = 7.5V 7.3V @ DetVin = 8V 2.3V @ DetVin = 0V
-30dBm	1.5V @ DetVin = 7.5V 2V @ DetVin = 8V 0V @ DetVin = 0V	1.5V @ DetVin = 7.5V 2V @ DetVin = 8V 0V @ DetVin = 0V	1.5V @ DetVin = 7.5V 2V @ DetVin = 8V 0V @ DetVin = 0V

**Description:** The Output Voltage of the detector "DetVout" increases with increase in RF output power of the power amplifier. The On Chip Detector can be operated by applying any input DC supply voltage "DetVin" over the range of 0V-8V and the output of the detector is tapped from "DetVout". The performance of the detector with respect to variation of input power of the PA at 9.5GHz is plotted below.

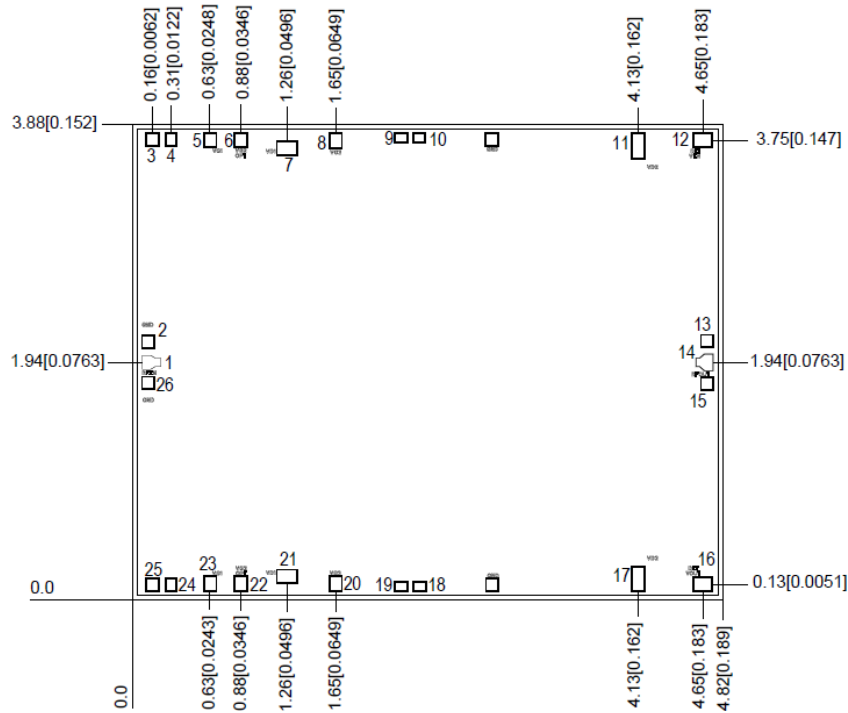


**Note:** Pad No.12 i.e Input Voltage of Power Detector 'DetVin' needs to be connected to ground in case of "DetVin=0V".

Component	Part Number/Description	Vendor
100pF SLC Capacitor "C1"	D12BV101K5PX/100pF±10%;50V or Equivalent	DLI
1uF MLC Capacitor "C2"	0402G104KXJRW1BC/1uF±10%;16V or Equivalent	Vishay
10kohm SMD Thick Film Resistor "R1"	CRCW040210K0FKED; 1/16Watts; ±1% or Equivalent	Vishay



## Bond Pad Locations

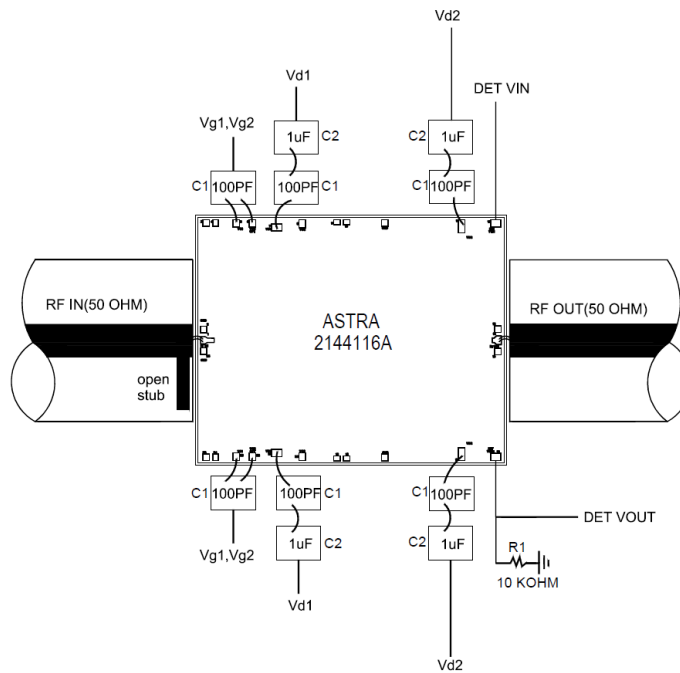


**Units:** millimeters (inches)

**Note:**

1. All RF and DC bond pads are 100 $\mu$ m x 100 $\mu$ m
2. Pad no. 1 : RF IN
3. Pad no. 5,23 : 1<sup>st</sup> stage gate voltage( $V_{g1}$ )
4. Pad no. 14 : RF Output
5. Pad no. 7,21 : 1<sup>st</sup> stage drain voltage( $V_{d1}$ )
6. Pad no. 6,22 : 2<sup>nd</sup> stage gate voltage( $V_{g2}$ )
7. Pad no. 11,17 : 2<sup>nd</sup> stage drain voltage ( $V_{d2}$ )
8. Pad no. 12 : Input Voltage for Power Detector (DetVin)
9. Pad no. 16 : Output Voltage for Power Detector (DetVout)
10. All the dimensions shown above are measured taking bottom left corner as reference.

## Recommended Assembly Diagram



### Note :

1. Open stub of 1mm length, 0.3mm width to be used at Input immediate to the chip for improvement of input return loss as shown in assembly diagram.
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 Single Layer bypass capacitors.
4. Input and output 50 ohm lines are on 5 mil RT Duroid substrate.
5. Apart from 100pF and 1uF, higher values of MLC or Polarised Capacitors such as 47uF can be used at drain in order to reduce output power pulse droop during pulsed mode of operation.
6. The RF input & output ports are DC decoupled on-chip.
7. This chip is not preferred to be operated under continuous DC voltages, unless it is applied with considerably low drain voltage level.
8. Proper heat sink like Copper tungsten or copper molybdenum to be used for better reliability of chip.

**Die attach:** Eutectic attachment using 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 to 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. Before using the product, please download and refer to datasheet from website.