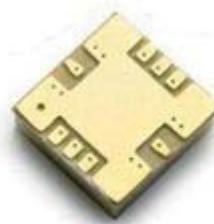


# AMGP-6445

40.5 – 43.5 GHz SMT Packaged Linear Power Amplifier

**AVAGO**  
TECHNOLOGIES

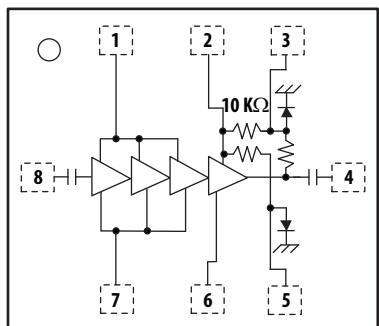
## Data Sheet



### Description

The AMGP-6445 is a linear power amplifier in a surface mount package designed for use in transmitters that operate at frequencies between 40.5 GHz and 43.5 GHz. In the operational frequency band, it provides 27dBm of output power (P-1 dB) and 19 dB of small-signal gain. This PA is designed for high linearity applications, and the PA shows more than +31 dBm OIP3 at 18 dBm/tone output power.

### Functional Block Diagram



Pin	Function
1	Vd1
2	Vd2
3	DET_O
4	RF_OUT
5	DET_R
6	Vg2
7	Vg1
8	RF_IN



**Attention: Observe Precautions for handling electrostatic sensitive devices.**  
ESD Machine Model: 50V  
ESD Human Body Model: 250V  
Refer to Avago Application Note A004R: *Electrostatic Discharge Damage and Control.*

Note: MSL Rating = Level 2A

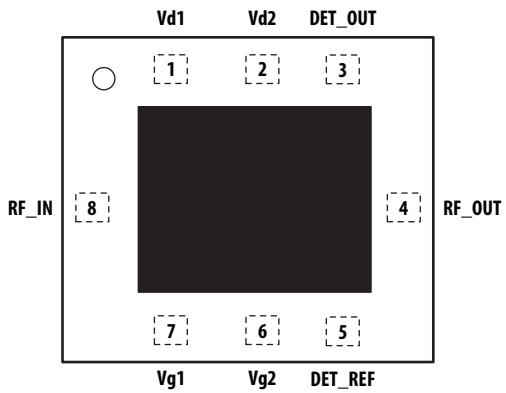
### Features

- 5 x 5 mm surface mount package
- RF frequency range from 40.5 to 43.5 GHz
- Gain: 19 dB Typical
- Output P1dB : +27.5 dBm Typical
- Output IP3: +31 dBm Typical
- 50 Ω Input and Output Match
- ESD protection all ports above 50V MM and 250V HBM
- Integrated temperature compensated power detector
- Vdd/Id: 5 V/700 mA
- 40° C to +85° C operation

### Application

- Microwave Radio Systems

### Package Diagram



## ELECTRICAL SPECIFICATIONS

**Table 1. Absolute Minimum and Maximum Ratings**

Parameter	Specifications			
Description	Min.	Max.	Unit	Comments
Drain Supply Voltage	Vd1	5.5	V	
	Vd2			
Gate Voltage	Vg1	-2	0	V
	Vg2			
Total Gate Current	Ig1	-3	mA	Ig, total = Ig1 + Ig2 Ig, total occurs at highest RF Pout condition.
	Ig2			
RF Input Power (Pin)	RFIN	20	dBm	CW
Powe Dissipation (Pd)		4	W	Pd = Vd1 x Id1 + Vd2 x Id2 + Pin - Pout
Channel Temperature		150	°C	
Storage Temperature	-65	150	°C	

**Table 2. Recommended Operating Range**

Parameter	Specifications					
Description	Pin	Min.	Typical	Max.	Unit	Comments
Drain Supply Voltage	Vd1		4.7 <sup>[1]</sup>		V	
	Vd2		4.4			
Gate Supply Voltage	Vg1	-0.83	-0.63	-0.43	V	
	Vg2					
Quiescent Drain Supply Current (Idq)	Vd1	200 <sup>[2]</sup>		mA	Idq = Id1 + Id2	
	Vd2	560				
RF Output Power (Pout)	RFOUT	28	30	dBm	CW	
Frequency Range		40.5	43.5	GHz		
Thermal Resistance, $\theta_{ch-b}$		13		°C/W	Channel to board	
Case Temperature		-40	+85	°C		
ESD	Human Body Model		250	V		
	Machine Model		50	V		

Notes:

1. Not recommend to operate below that this voltage level; otherwise, the amplifier may enter instability.
2. Not recommend to operate above that this current level; otherwise, the amplifier may enter instability.

**Table 3. RF Electrical Characteristics<sup>[1]</sup>**

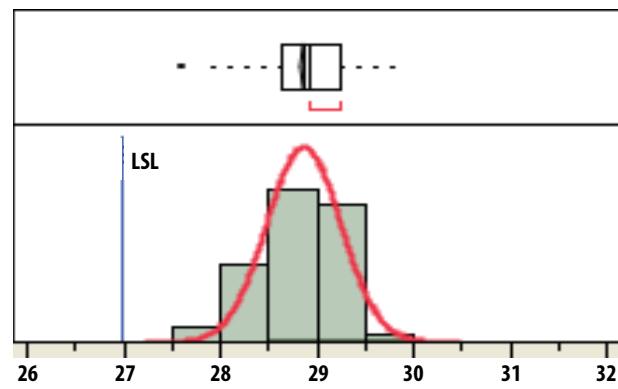
All data measured on a 2.4mm connector based evaluation board at Vdd1 = Vdd2 = 5 V (pulse), Idq = 0.7 A (Id1 + Id2), T<sub>C</sub> = 25° C, and 50 Ω at all ports.

Parameter	Performance				
	Min.	Typical	Max.	Unit	Comments
Input Return Loss (S11)		-8		dB	
Output Return Loss (S22)		-8		dB	
Gain (S21)	Freq = 40.5 GHz Freq = 42 GHz Freq = 43.5 GHz	18	22.9 21.1 22.5	dBm	Freq = 40.5, 42, 43.5 GHz
Reverse Isolation (S21)		-40		dB	
P1dB	Freq = 40.5 GHz Freq = 42 GHz Freq = 43.5 GHz	27	28.9 27.9 29.8	dBm	Freq = 40.5, 42, 43.5 GHz
IM3 Level		-23		dBc	Δf = 20 MHz, Po = 18 dBm/tone
Detector sensitivity		2.4		V/W	

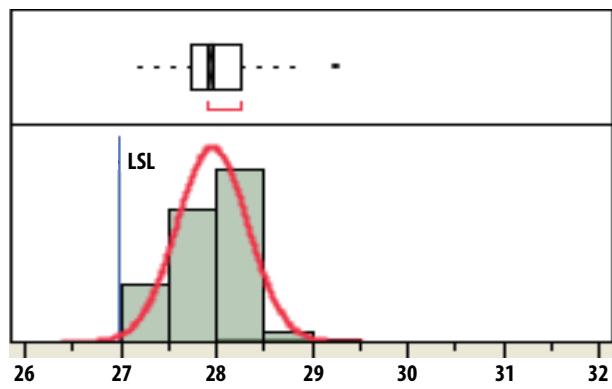
Note:

1. Gain and P1dB measurement accuracy is subjected to the tolerance of ± 0.5 dB, ± 0.5 dBm respectively.

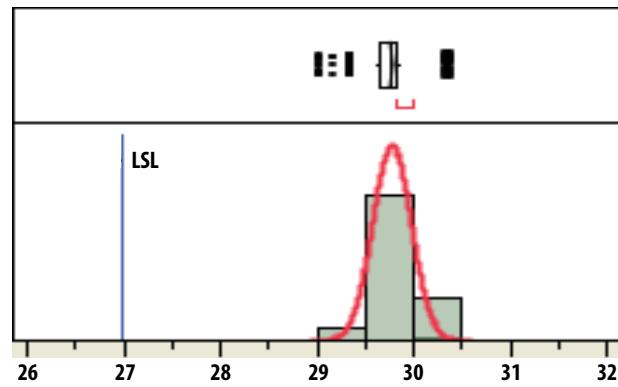
**Product Consistency Distribution Charts at 40.5 GHz, 42 GHz and 43.5 GHz, Vdd = 5.5 V, Id = 0.7 A  
(Sample Size of 1500 pieces)**



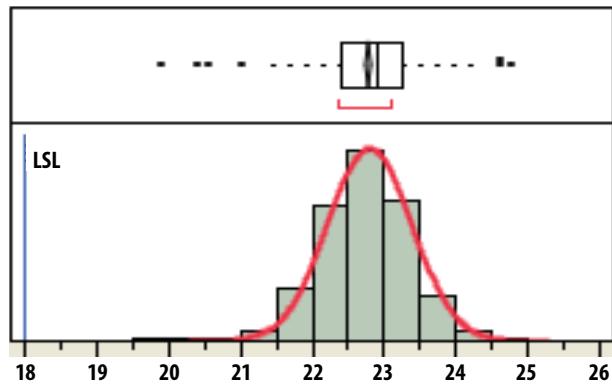
P1dB @ 40.5 GHz, Mean = 28.9 dBm, LSL = 27 dBm



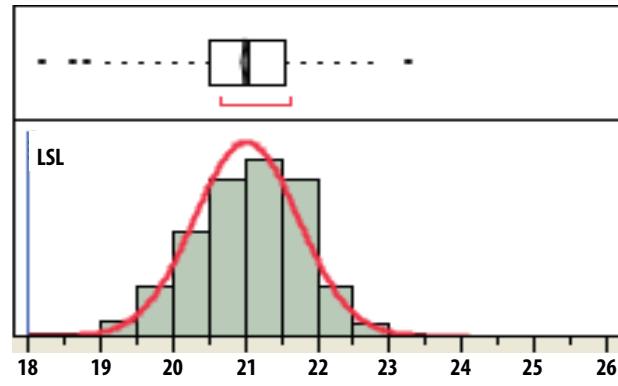
P1dB @ 42 GHz, Mean = 27.9 dBm, LSL = 27 dBm



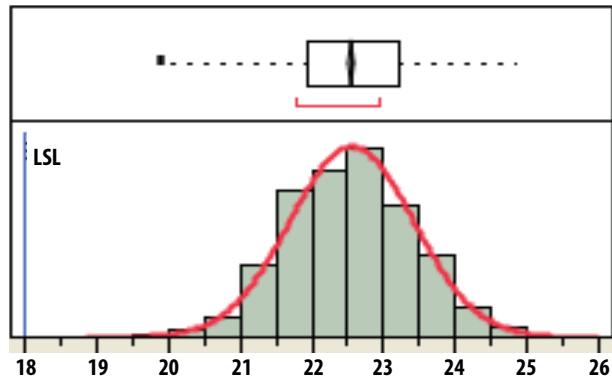
P1dB @ 43.5 GHz, Mean = 29.8 dBm, LSL = 27 dBm



Gain @ 40.5 GHz, Mean = 22.9 dB, LSL = 18 dB



Gain @ 42 GHz, Mean = 21.1 dB, LSL = 18 dB



Gain @ 43.5 GHz, Mean = 22.5 dB, LSL = 18 dB

## Selected performance plots

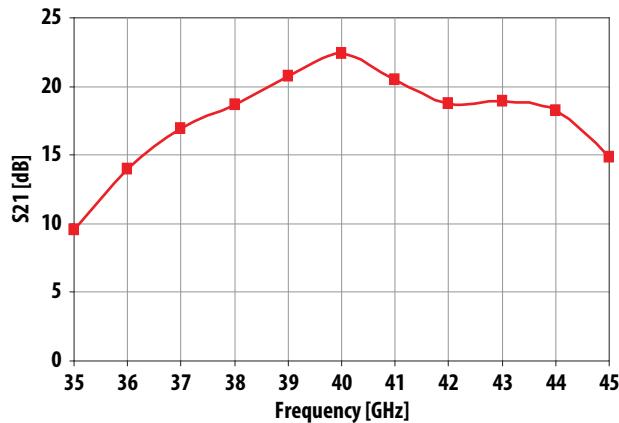


Figure 1. S<sub>21</sub>(dB) Frequency Sweep

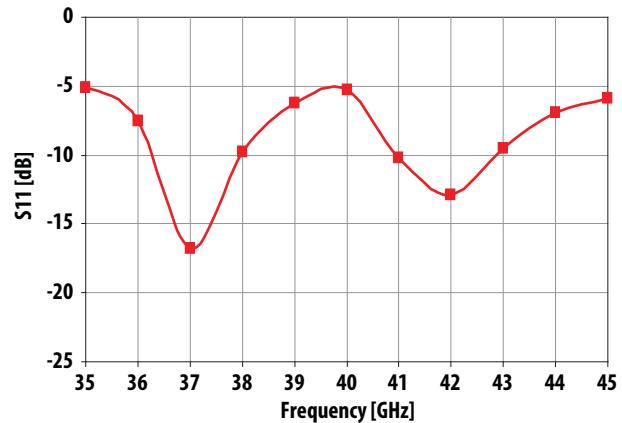


Figure 2. S<sub>11</sub>(dB) Frequency Sweep

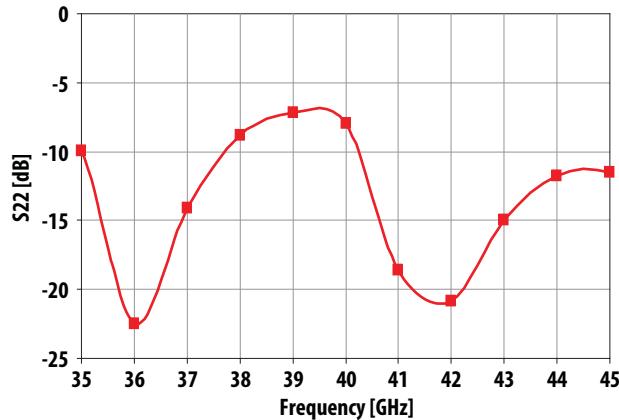


Figure 3. S<sub>22</sub>(dB) Frequency sweep

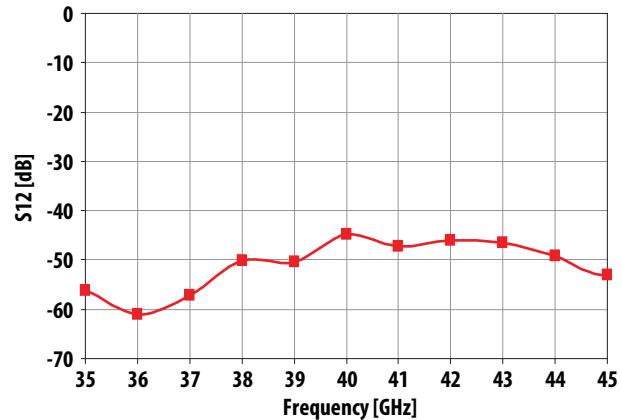


Figure 4. S<sub>12</sub>(dB) Frequency Sweep

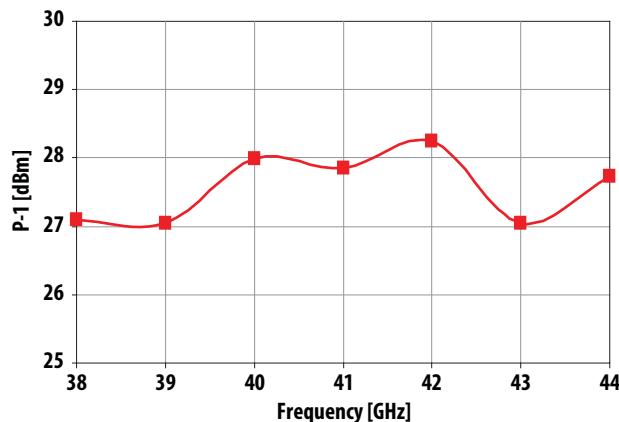


Figure 5. P-1(dBm) Frequency Sweep

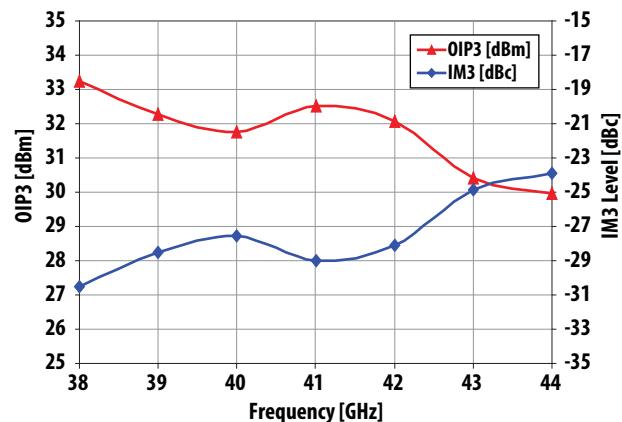


Figure 6. OIP3(dBm) Frequency Sweep at Po=18dBm/tone

## Selected Over Temperature Performance Plots

All data measured on a 2.4 mm connector based evaluation board at  $V_{dd1} = V_{dd2} = 5$  V,  $I_{dq} = 0.7$  A ( $I_{d1} + I_{d2}$ ), and  $50 \Omega$  at all ports.  $I_{dg}$  has been maintained at 700 mA under different temperature conditions.

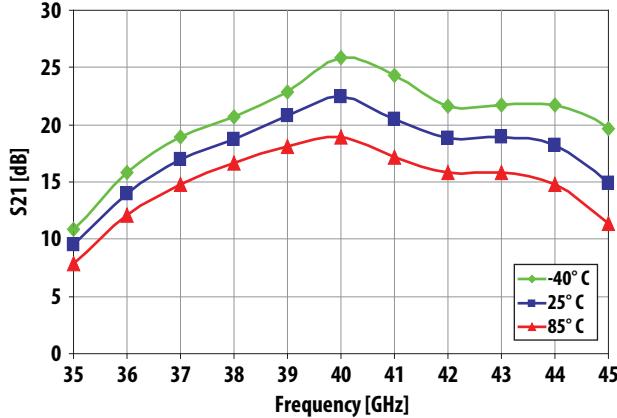


Figure 7.  $S_{21}$ (dB) Frequency Sweep over Temperature

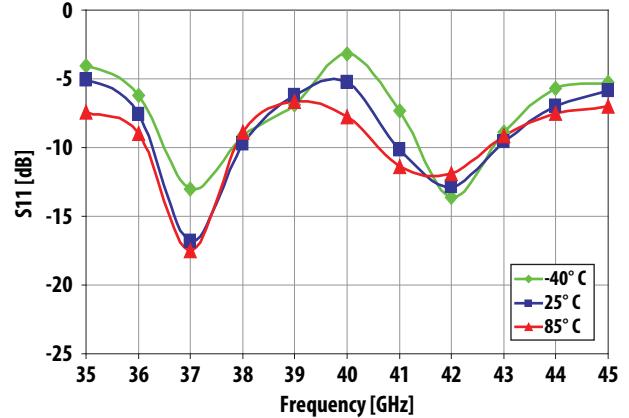


Figure 8.  $S_{11}$ (dB) Frequency Sweep over Temperature

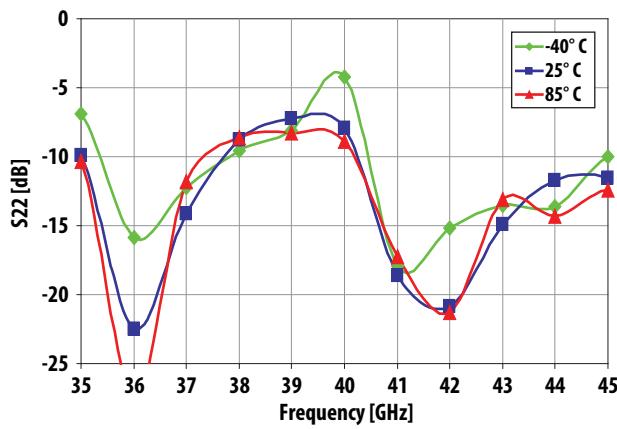


Figure 9.  $S_{22}$ (dB) Frequency Sweep over Temperature

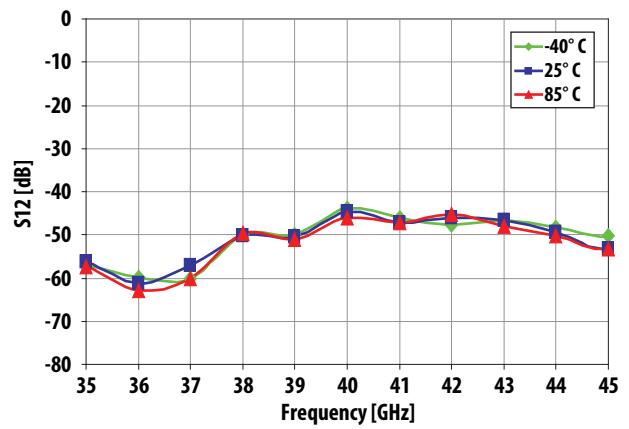


Figure 10.  $S_{12}$ (dB) Frequency Sweep over Temperature

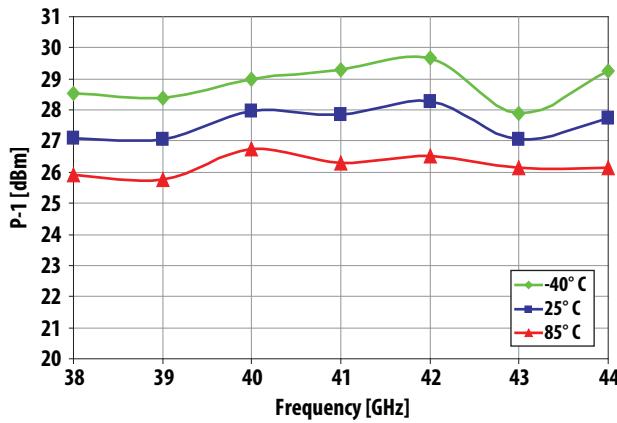


Figure 11.  $P_1$ (dBm) Frequency Sweep over Temperature

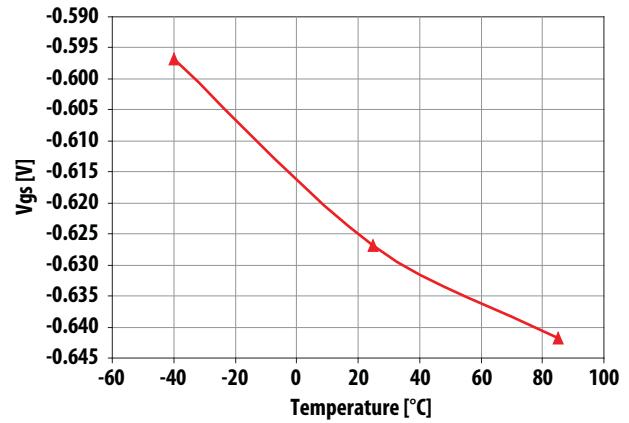


Figure 12. Typical  $V_g$  to obtain  $I_{dq} = 700$  mA over Temperature

## Detector Performance Plots

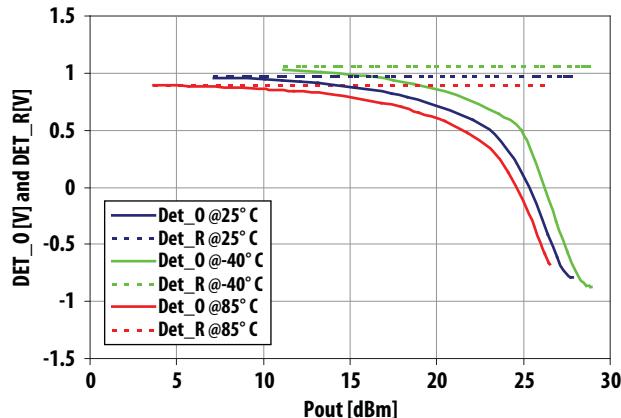


Figure 13. Detector voltages vs. Output Power at Freq = 40 GHz

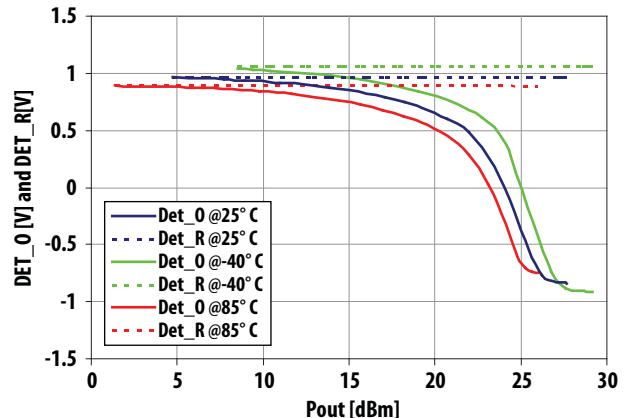


Figure 14. Detector voltages vs. Output Power at Freq = 41 GHz

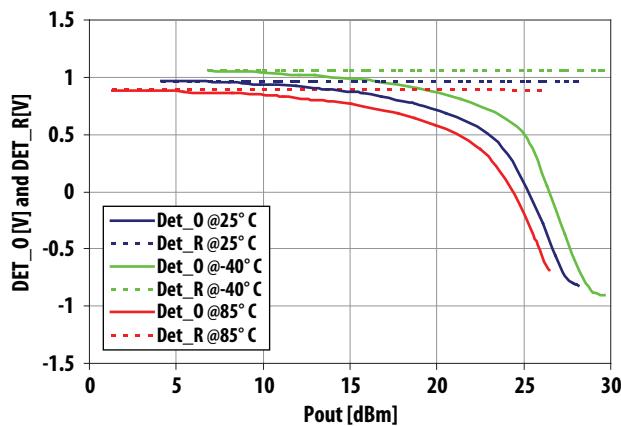


Figure 15. Detector voltages vs. Output Power at Freq = 42 GHz

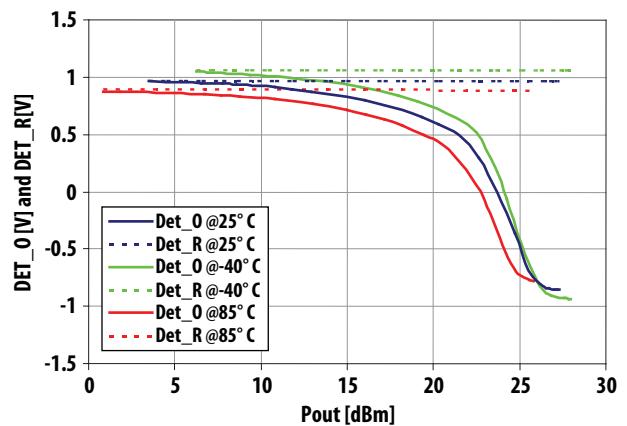


Figure 16. Detector voltages vs. Output Power at Freq = 43 GHz

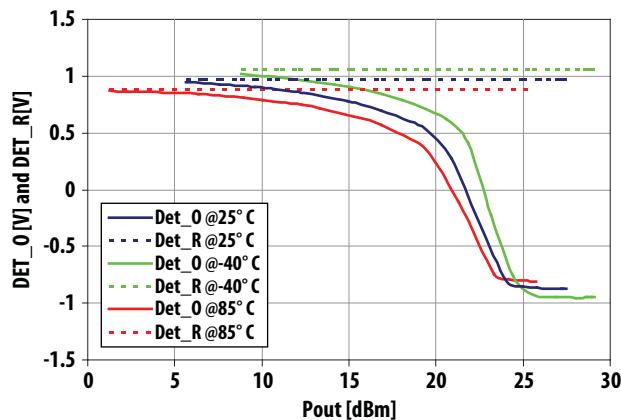


Figure 17. Detector voltages vs. Output Power at Freq = 44 GHz

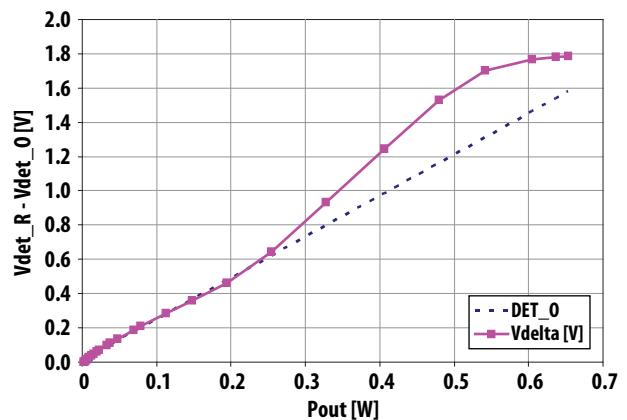
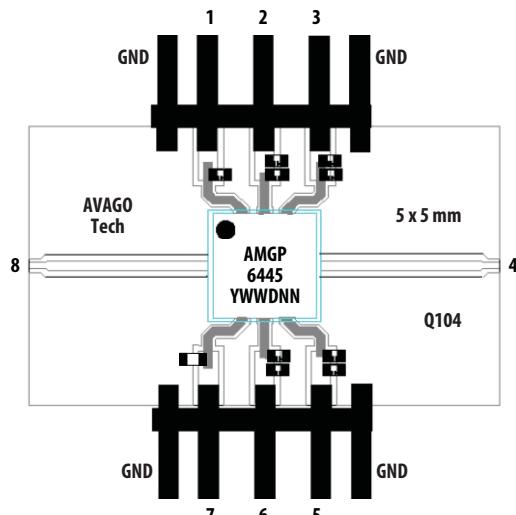


Figure 18. Typical detector sensitivity vs. Output Power at Freq = 42 GHz

## Evaluation Board Description



Recommended turn on sequence

- Apply  $V_{g1}$  and  $V_{g2}$  at -1.5 V
- Apply  $V_{d1}$  and  $V_{d2}$  at 0 V
- Increase  $V_d$  to 5 V
- Increase  $V_g$  of -1.5 V to approximately -0.6 V to obtain  $I_{dsq} = 0.7 \text{ A}$
- Apply RF Input not to exceed 20 dBm

Turn off in reverse order

**Table 4. Typical Test Conditions**

Pin		
$V_{d1,2}$	5 V	Drain Supply Voltage
$I_{dq} = I_{d1} + I_{d2}$	700 mA	Quiescent Drain Current
$V_{g1, 2}$	-0.6	Gate Supply Voltage

Notes:

$V_{g1}$  and  $V_{g2}$  of -0.6 V may need be adjusted to obtain  $I_{dsq} = 700 \text{ mA}$ .

## Demo board circuit

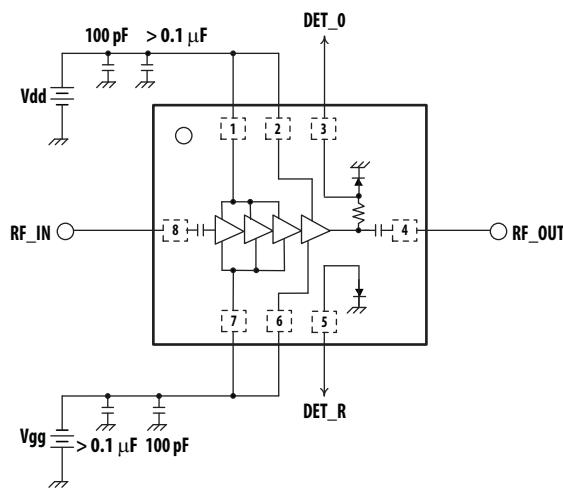


Figure 19.

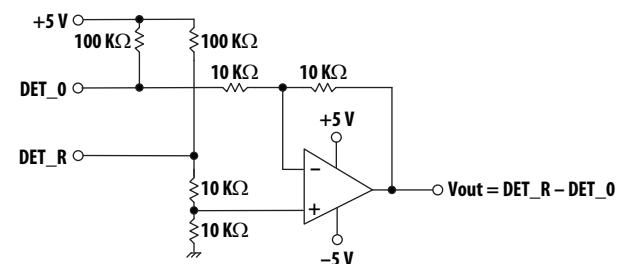


Figure 20.

## Integrated Detector Application Circuit

To obtain temperature compensated RF power detector function, a differential voltage between DET\_R and DET\_O must be obtained by using an operational amplifier in a differential mode configuration as shown in Figure 19.

## **Package Dimension, PCB Layout and Tape and Reel information**

Please refer to Avago Technologies Application Note 5521, AMxP-xxxx production Assembly Process (Land Pattern B).

## **Part Number Ordering Information**

<b>Part Number</b>	<b>Devices per Container</b>	<b>Container</b>
AMGP-6445-BLKG	10	antistatic bag
AMGP-6445-TR1G	100	7" Reel
AMGP-6445-TR2G	500	7" Reel

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

Avago, Avago Technologies, and the A logo are trademarks of Avago Technologies in the United States and other countries.  
Data subject to change. Copyright © 2005-2012 Avago Technologies. All rights reserved.  
AV02-3210EN - May 10, 2012

