AMGP-6445

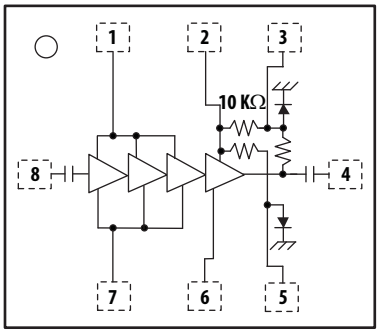
40.5 – 43.5 GHz SMT Packaged Linear Power Amplifier

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

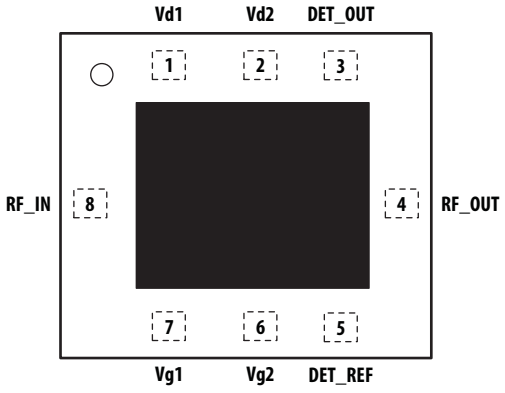
Features

- 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 50 V MM and 250 V 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				
Totel 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 [1]		V	
		Vd2		4.4			
Gate Supply Voltage		Vg1	-0.83	-0.63	-0.43	V	
		Vg2					
Quiescent Drain Supply Current (Idq)		Vd1		200 [2]		mA	Idq = Id1 + Id2
		Vd2		560			
RF Output Power (Pout)		RFOUT		28	30	dBm	CW
Frequency Range			40.5		43.5	GHz	
Thermal Resistance, θ_{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.

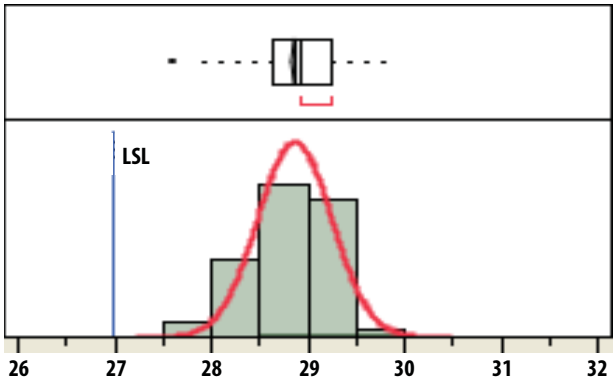
Table 3. RF Electrical Characteristics [1]

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

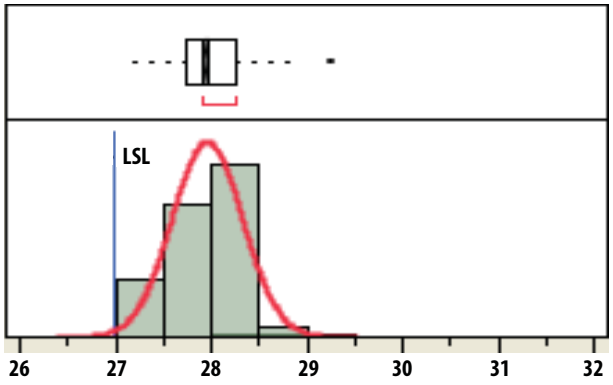
		Performance				
Parameter		**Min.**	**Typical**	**Max.**	**Unit**	**Comments**
Input Return Loss (S11)			-8		dB	
Output Return Loss (S22)			-8		dB	
Gain (S21)	Freq = 40.5 GHz Freq = 42 GHz Freq = 43.5 GHz	18	22.9 21.1 22.5		dBm	Freq = 40.5, 42, 43.5 GHz
Reverse Isolation (S21)			-40		dB	
P1dB	Freq = 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.

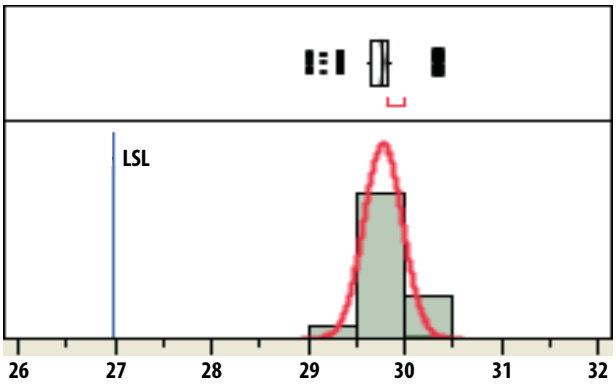
Product Consistency Distribution Charts at 40.5 GHz, 42 GHz and 43.5 GHz, Vdd = 5.5 V, Id = 0.7 A (Sample Size of 1500 pieces)



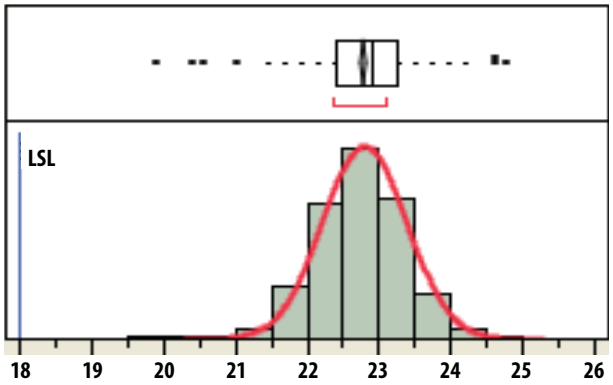
P1dB @ 40.5 GHz, Mean = 28.9 dBm, LSL = 27 dBm



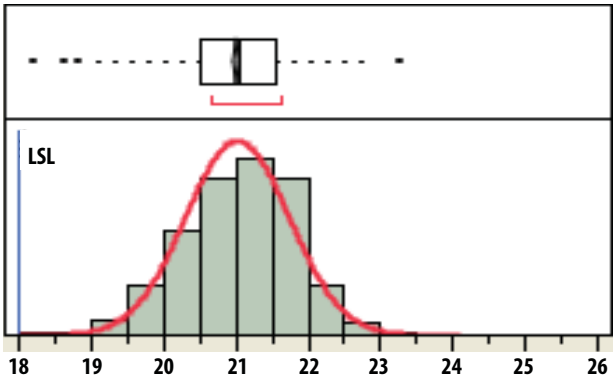
P1dB @ 42 GHz, Mean = 27.9 dBm, LSL = 27 dBm



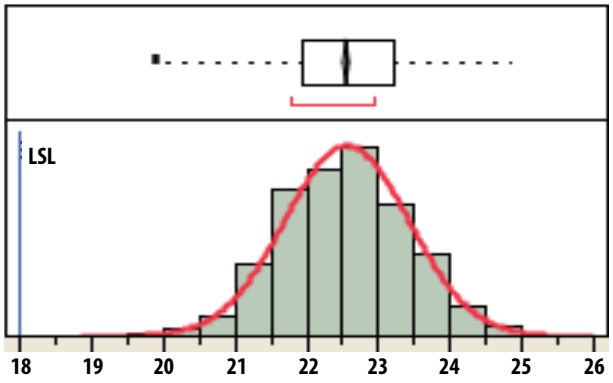
P1dB @ 43.5 GHz, Mean = 29.8 dBm, LSL = 27 dBm



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

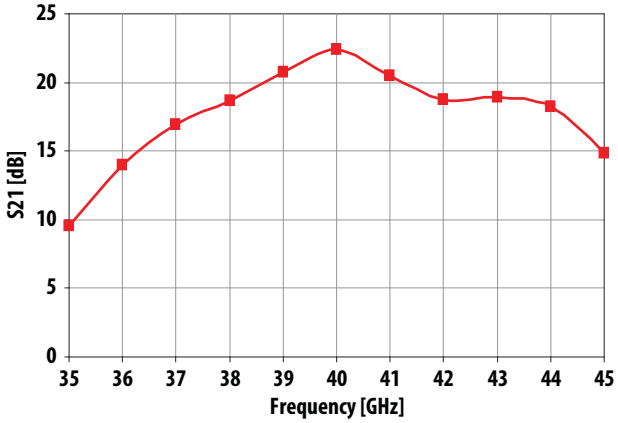


Figure 1. S21(dB) Frequency Sweep

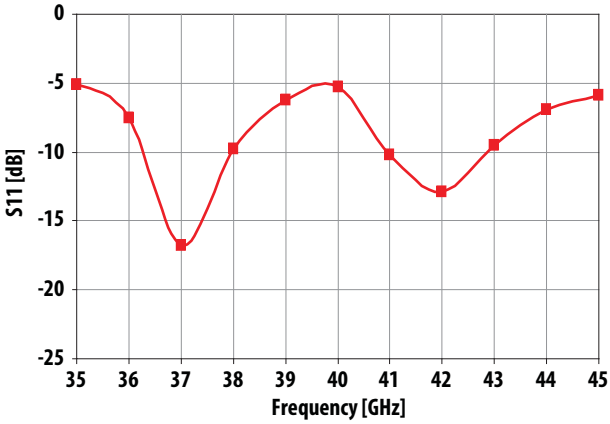


Figure 2. S11(dB) Frequency Sweep

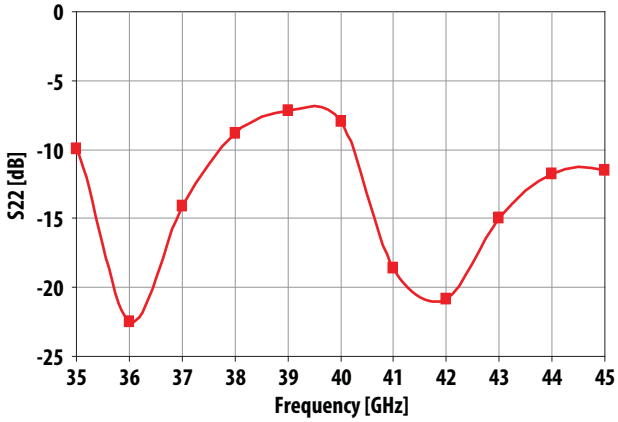


Figure 3. S22(dB) Frequency sweep

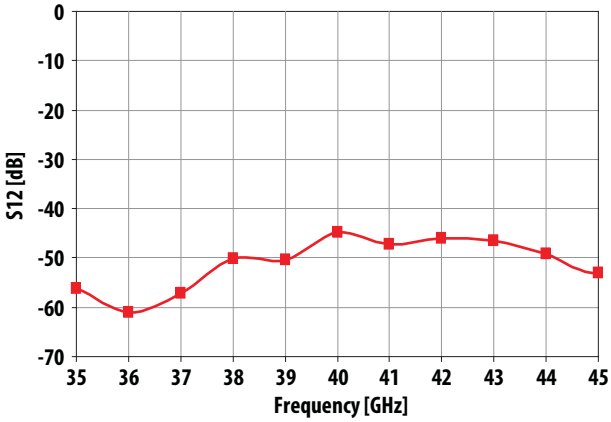


Figure 4. S12(dB) Frequency Sweep

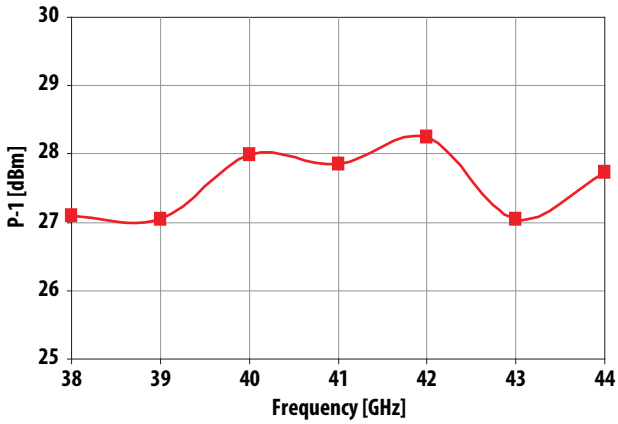


Figure 5. P-1(dBm) Frequency Sweep

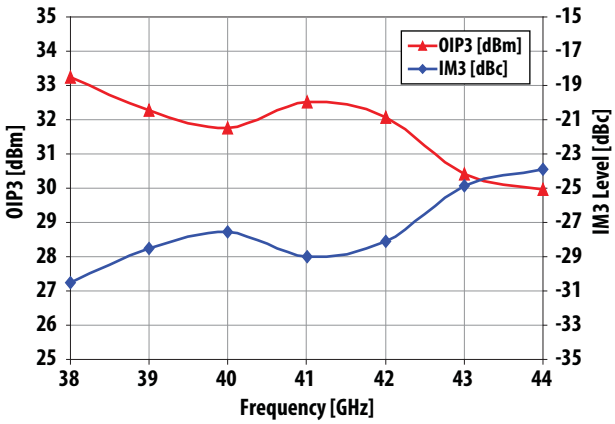


Figure 6. OIP3(dBm) Frequency Sweep at Po=18dBm/tone

Selected Over Temperature Performance Plots

All data measured on a 2.4 mm connector based evaluation board at Vdd1 = Vdd2 = 5 V, Idq = 0.7 A (Id1 + Id2), and 50 Ω at all ports. Idg has been maintained at 700 mA under different temperature conditions.

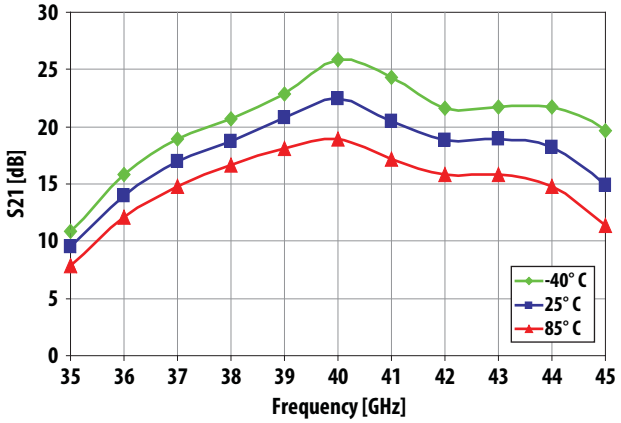


Figure 7. S21(dB) Frequency Sweep over Temperature

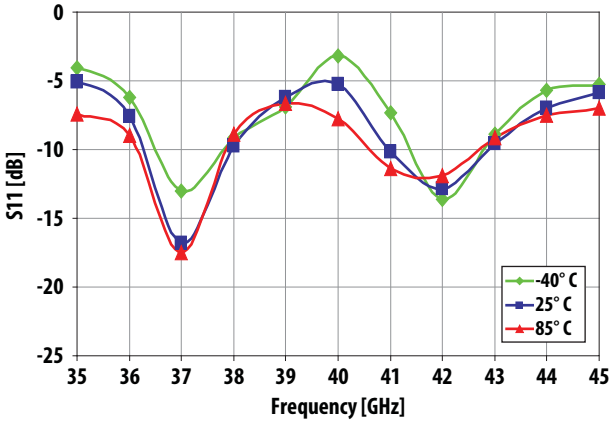


Figure 8. S11(dB) Frequency Sweep over Temperature

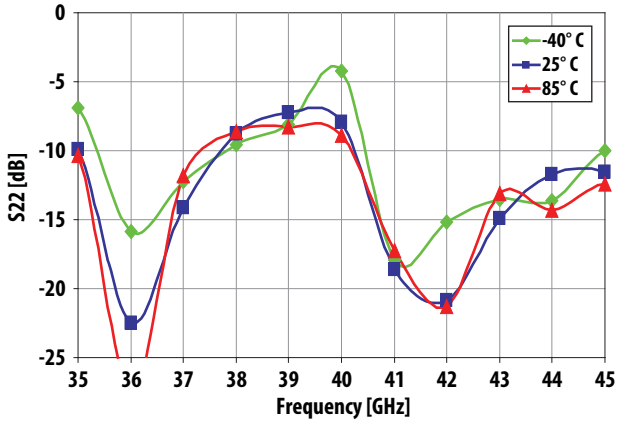


Figure 9. S22(dB) Frequency Sweep over Temperature

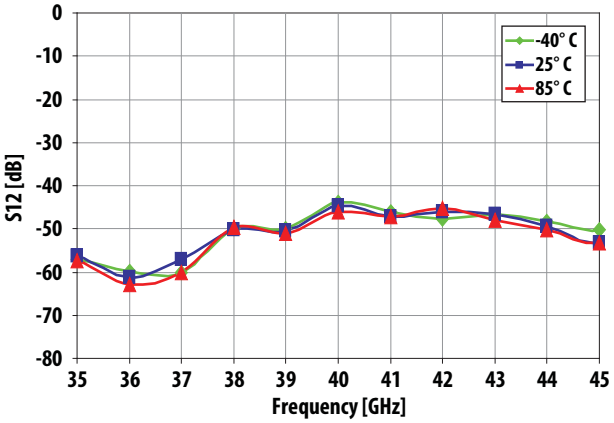


Figure 10. S12(dB) Frequency Sweep over Temperature

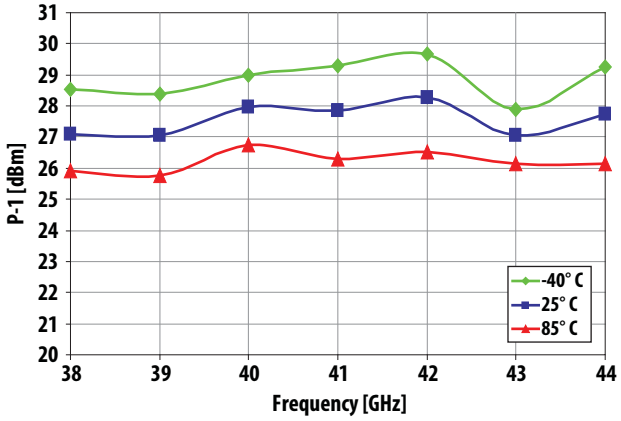


Figure 11. P-1(dBm) Frequency Sweep over Temperature

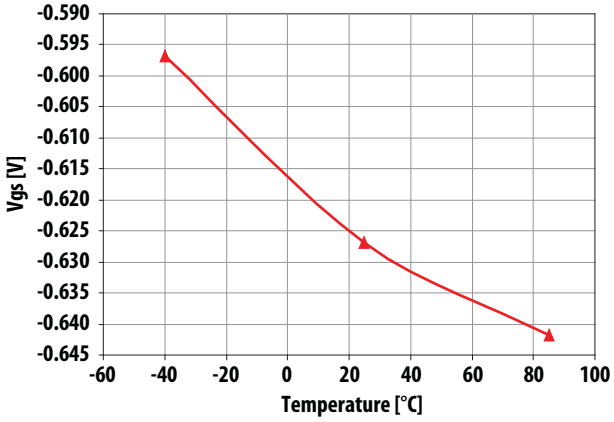


Figure 12. Typical Vg to obtain Idq = 700 mA over Temperature

Detector Performance Plots

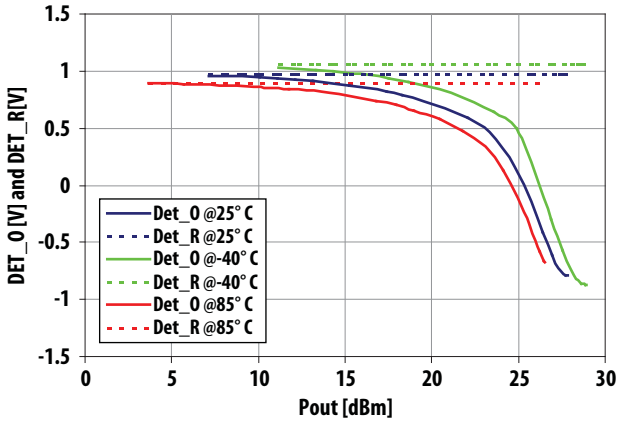


Figure 13. Detector voltages vs. Output Power at Freq = 40 GHz

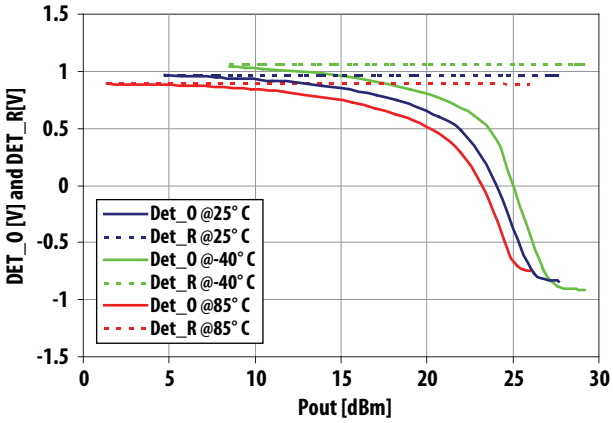


Figure 14. Detector voltages vs. Output Power at Freq = 41 GHz

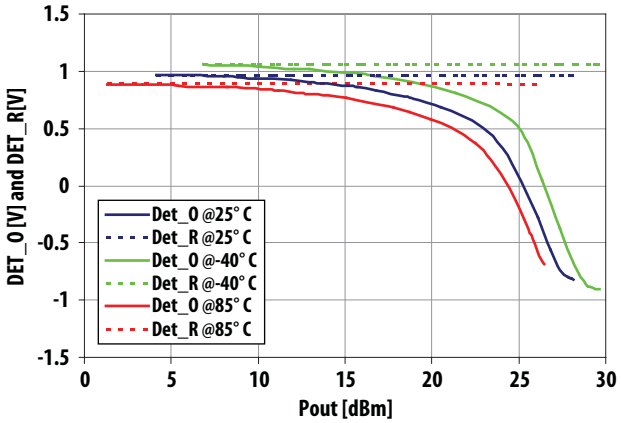


Figure 15. Detector voltages vs. Output Power at Freq = 42 GHz

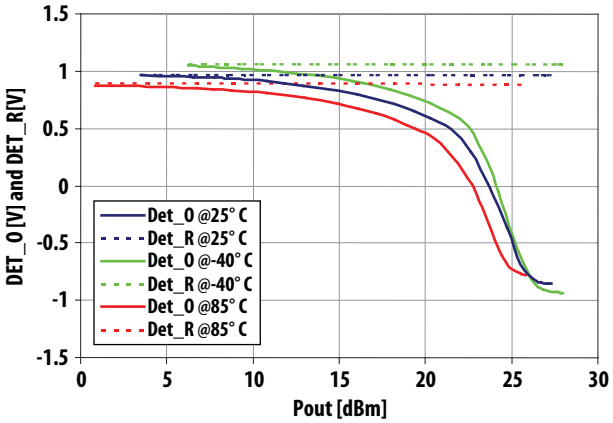


Figure 16. Detector voltages vs. Output Power at Freq = 43 GHz

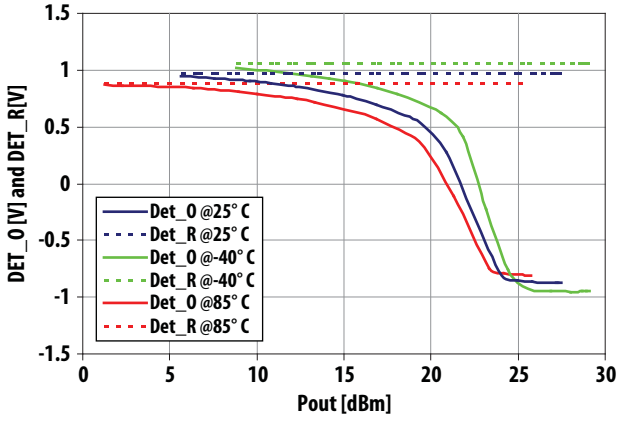


Figure 17. Detector voltages vs. Output Power at Freq = 44 GHz

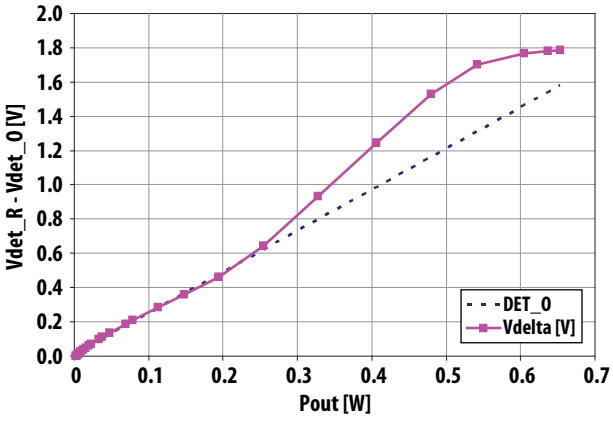
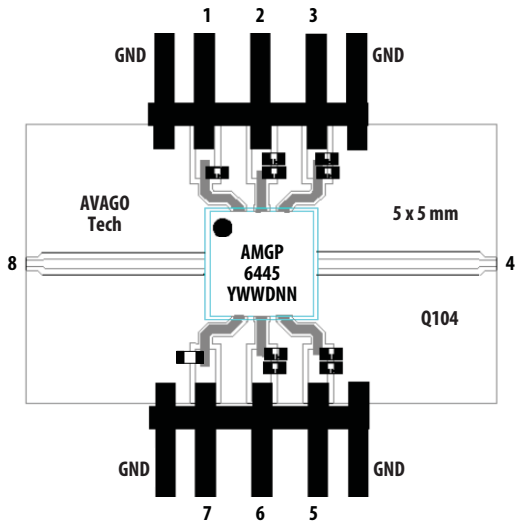


Figure 18. Typical detector sensitivity vs. Output Power at Freq = 42 GHz

Evaluation Board Description



Recommended turn on sequence

- Apply Vg1 and Vg2 at -1.5 V
- Apply Vd1 and Vd2 at 0 V
- Increase Vd to 5 V
- Increase Vg of -1.5 V to approximately -0.6 V to obtain Idsq = 0.7 A
- Apply RF Input not to exceed 20 dBm

Turn off in reverse order

Table 4. Typical Test Conditions

Pin		
Vd1,2	5 V	Drain Supply Voltage
Idq = Id1 + Id2	700 mA	Quiescent Drain Current
Vg1, 2	-0.6	Gate Supply Voltage

Notes:
Vg1 and Vg2 of -0.6 V may need be adjusted to obtain Idsq = 700 mA.

Demo board circuit

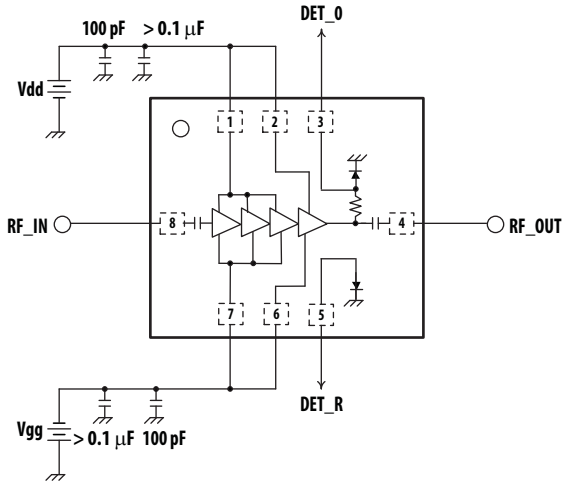


Figure 19.

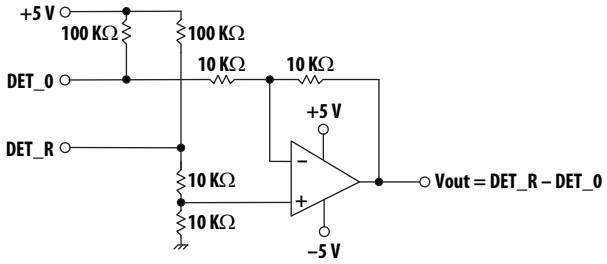


Figure 20.

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

Part Number	Devices per Container	Container
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**

AV02-3210EN - May 10, 2012