

# MGA-412P8

GaAs Enhancement-mode pHEMT Power Amplifier  
optimized for IEEE 802.11b/g applications



## Data Sheet

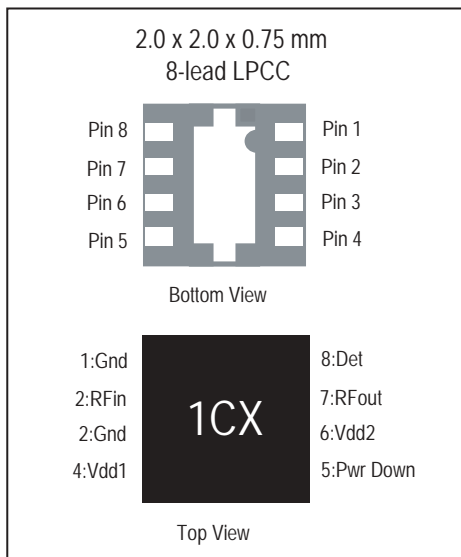
### Description

Avago Technologies's MGA-412P8 linear power amplifier is designed for applications in the (1.7-3) GHz frequency range. The amplifier is optimized for IEEE 802.11b/g WLAN applications and has a best-in-class efficiency (PAE) of 25.5% (54Mbps OFDM) achieved through the use of Avago Technologies' proprietary GaAs Enhancement-mode pHEMT process.

The MGA-412P8 is housed in a miniature 2.0 x 2.0 x 0.75mm<sup>3</sup> 8-lead leadless-plastic-chip-carrier (LPCC) package. The compact footprint, low profile and excellent thermal efficiency of the LPCC package makes the MGA-412P8 an ideal choice as a power amplifier for mobile IEEE 802.11b/g WLAN applications.

It achieves +19.0 dBm linear output power that meets 3% EVM at 54Mbps data rate (OFDM Modulation), and 23dBm at 11Mbps (CCCK modulation).

### Component Image



Note:  
Package marking provides Orientation and Identification  
"1C" = Product Code  
"X" = Date code indicates month of manufacture

### Features

- Advanced GaAs E-pHEMT
- Integrated power detector & power down functions
- High efficiency
- Single +3.3V Supply
- Small Footprint: 2x2mm<sup>2</sup>
- Low Profile: 0.8mm max.

### Specifications

- At 2.452 GHz; 3.3V (Typ.) :
- Gain: 25.5 dB
- P1dB: 25.3 dBm
- Pout linear with IEEE 802.11g OFDM modulation @54Mbps data rate: 19.0 dBm @ 3% EVM.
- Current @19dBm linear Pout: (54Mbps) : 95mA
- Reverse Isolation (typ): > 40dB
- Quiescent current (typ): 40mA
- Meets IEEE 802.11b @11Mbps (CCCK modulation) with Pout: 23dBm while consuming 200mA.

### Applications

- Power Amplifier for IEEE 802.11b/g WLAN applications
- Bluetooth Power Amplifier
- 2.4GHz ISM band applications



**Attention:** Observe precautions for handling electrostatic sensitive devices.  
ESD Machine Model = 50 V  
ESD Human Body Model = 200 V  
Refer to Avago Technologies Application Note A004R: *Electrostatic Discharge, Damage and Control.*

### Absolute Maximum Rating [1] $T_c=25^\circ\text{C}$

Symbol	Parameter	Units	Absolute Max.
$V_{dd}$	Device Voltage, RF output to ground	V	5
$P_{in}$	CW RF Input Power ( $V_{dd} = 3.3\text{V}$ )	dBm	10
$P_{diss}$	Total Power Dissipation <sup>[3]</sup>	W	0.8
$T_j$	Junction Temperature	$^\circ\text{C}$	150
$T_{STG}$	Storage Temperature	$^\circ\text{C}$	-65 to 150

### Thermal Resistance [2] ( $V_{dd} = 3.3\text{V}$ ), $\theta_{jc} = 33.3^\circ\text{C/W}$

Notes:

1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Thermal resistance measured using  $150^\circ\text{C}$  Liquid Crystal Measurement Technique.
3. Board (package belly) temperature,  $T_b$  is  $25^\circ\text{C}$ . Derate  $30\text{mW}/^\circ\text{C}$  for  $T_b > 123.36^\circ\text{C}$ .

### Product Consistency Distribution Charts [4,5]

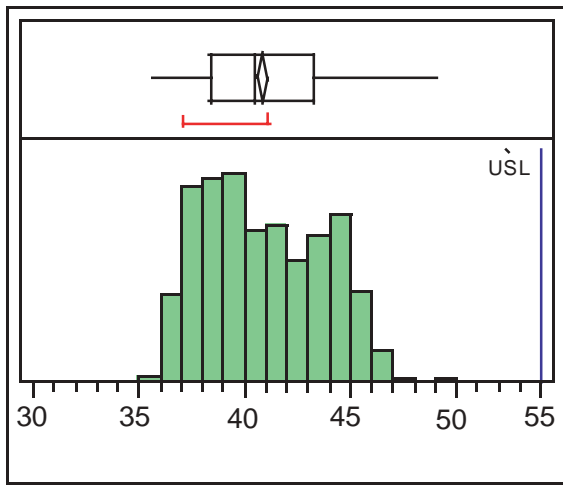


Figure 1.  $I_d$  @ 2.452GHz; Nominal = 40mA, USL: 55mA

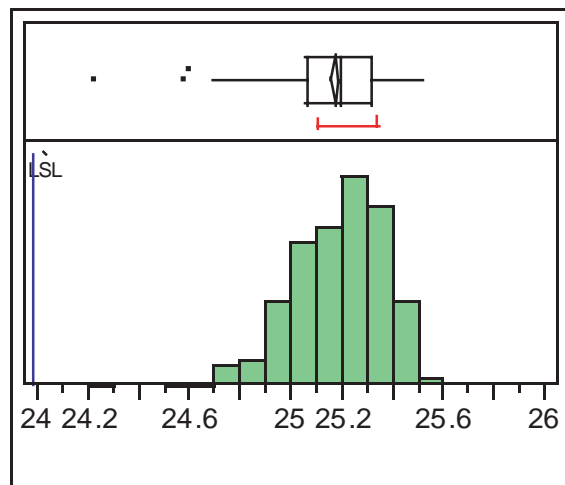


Figure 2.  $P_{1dB}$  @ 2.452GHz; Nominal = 25.3dBm, LSL: 24dB

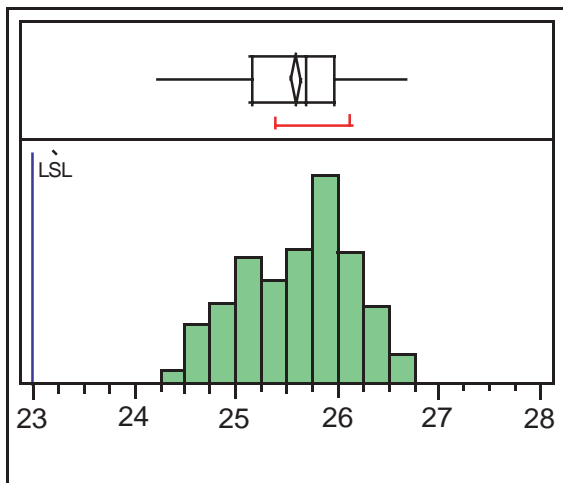


Figure 3. Gain @ 2.452GHz; Nominal = 25.5dB, LSL: 23 dB

Notes:

4. Distribution data sample size is 500 samples taken from 3 different wafers and 3 different lots. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
5. Measurements are made on production test board, which represents a trade-off between optimal Gain and  $P_{1dB}$ . Circuit losses have been de-embedded from actual measurements.

## Electrical Specifications[6]

Tc = 25 °C, 2.452 GHz [typical, measured on demo board].DC bias for RF parameters Vdd =Vsd=3.3V

Unless otherwise specified, all data are taken with OFDM 64-QAM modulated signal per IEEE802.11g specifications at 54Mbps data rate.

Symbol	Parameter	Units	MIN	TYP	MAX
Idq	Quiescent current	mA		40	55
Isd	Current drawn by Shutdown pin	mA		0.5	
I_leak	Total current consumption at shutdown(Vsd=0V)	uA		5	
G	Gain	dB	23	25.5	
Psat	Saturated Power	dBm		27	
P1dB	1 dB Compression Point	dBm	24	25.3	
	Gain Flatness (2.4 - 2.5GHz)	dB		1	
Poutn	Max Pout per IEEE 802.11b mask (CCCK modulation)	dBm		23	
Idn	Current @ 23dBm 802.11b BPSK	mA		200	
Poutl	Linear Power @ 3% EVM, 54Mbps OFDM	dBm		19	
Idl	Current @ 3% EVM	mA		95	
S11	Input Return Loss	dB		-5.5	
S22	Output Return Loss	dB		-11.5	
S12	Isolation	dB		>40	
OIP3	Large Signal, Output IP3 (2-tone at ± 10MHz from carrier freq)	dBm		38	

Notes:

6. Measurements taken on demo board as shown on Figure 4. Excess circuit losses have been de-embedded from actual measurements. Standard deviation and typical data based on at least 500 parts sample size from 2 wafer lots. Future wafers allocated to this product may have nominal values any where within the upper and lower spec limits.

# Demo board Diagram

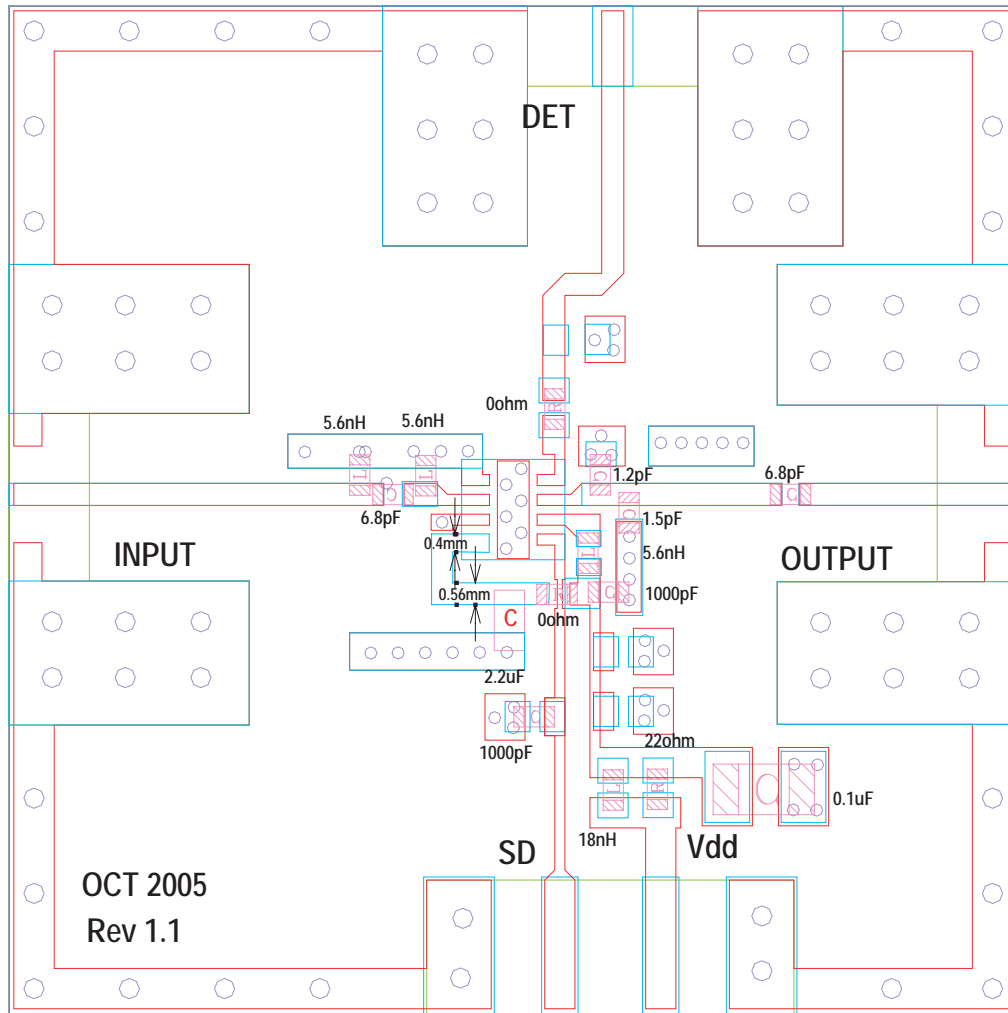
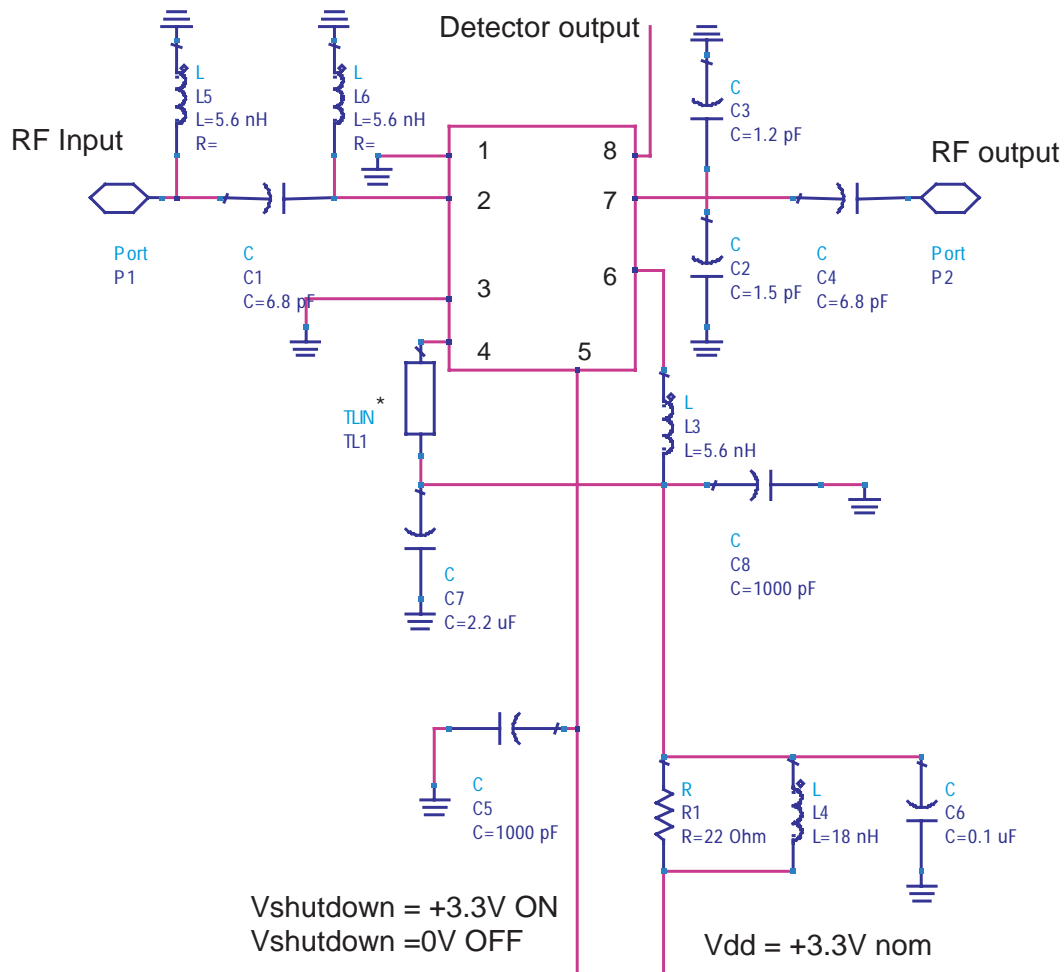


Figure 4. Demo board and Application Circuit Components

## Schematic Diagram



**Figure 5. Demo Board Schematic Diagram**

- \* 0.56mm wide on 10mil thick Rogers RO4350 board
  - Components L6, C2 and C3 should be located as close to the packaged device pins as possible.
  - Components R1 and L4 are used to isolate the test board from Power Supply effects.
  - Recommended PCB material is Roger, RO4350.
  - Suggested component values may vary according to layout and PCB material.

### MGA-412P8 Typical Performance I

Tc = +25 °C, Vdd = 3.3V Input Signal=CW unless stated otherwise.

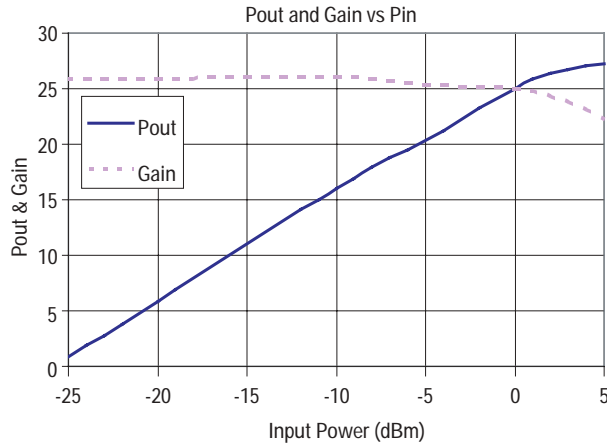


Figure 6. Output Power and Gain vs Input Power

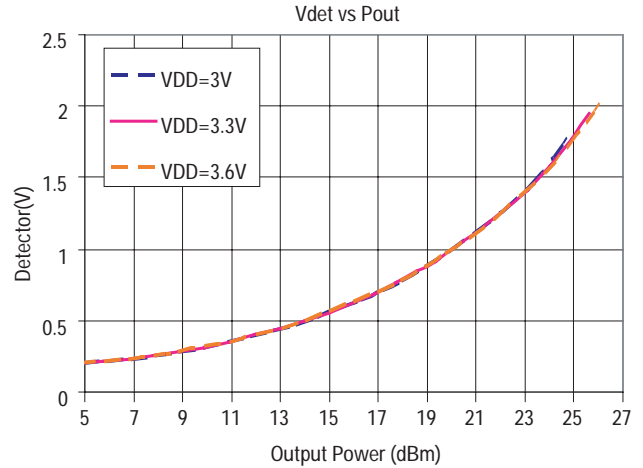


Figure 7. Detector vs Output Power

### MGA-412P8 Typical Performance II

Tc = +25 °C, Vdd = 3.3V Input Signal=OFDM signal with 54Mbps, Modulation=64QAM unless stated otherwise.

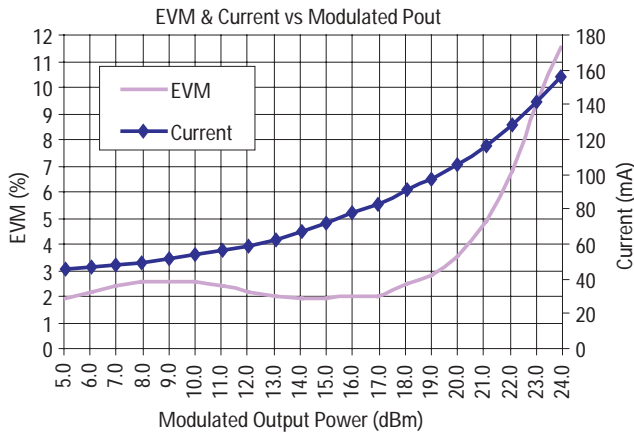


Figure 8. EVM & Current vs Output Power

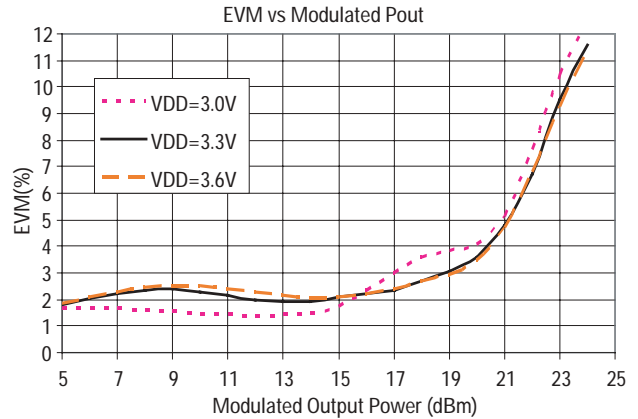


Figure 9. EVM vs Modulated Output Power

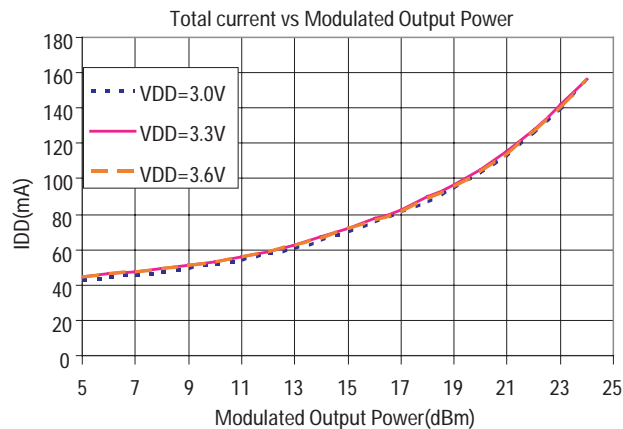


Figure 10. Total Current vs Modulated Output Power

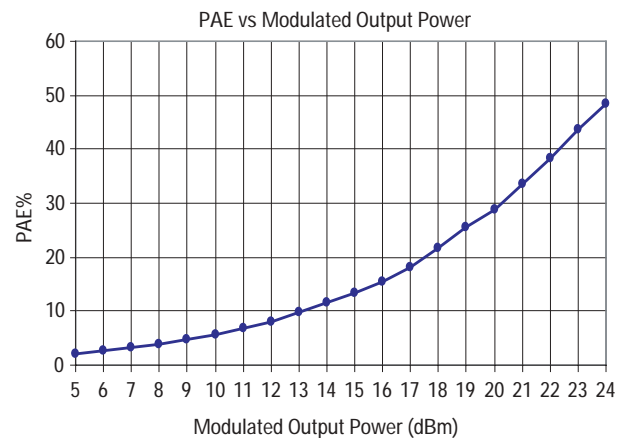
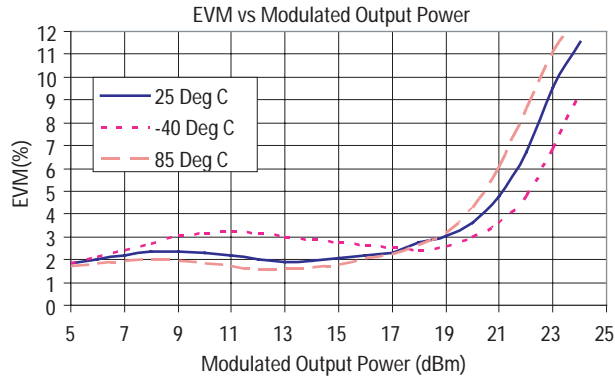
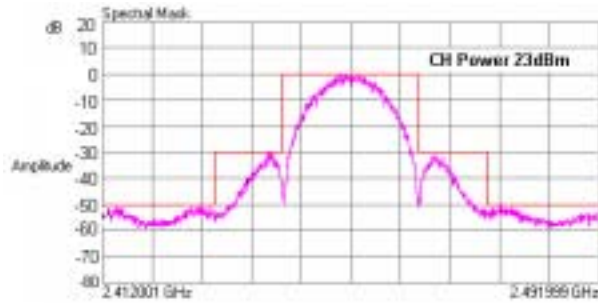


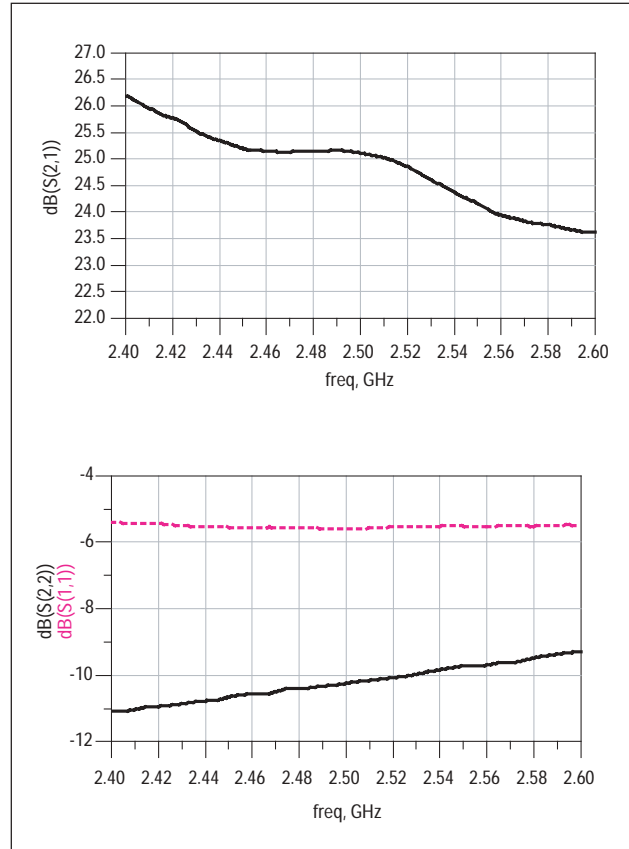
Figure 11. PAE vs Modulated Output Power



**Figure 12. EVM vs Modulated Output Power at different Temperature**

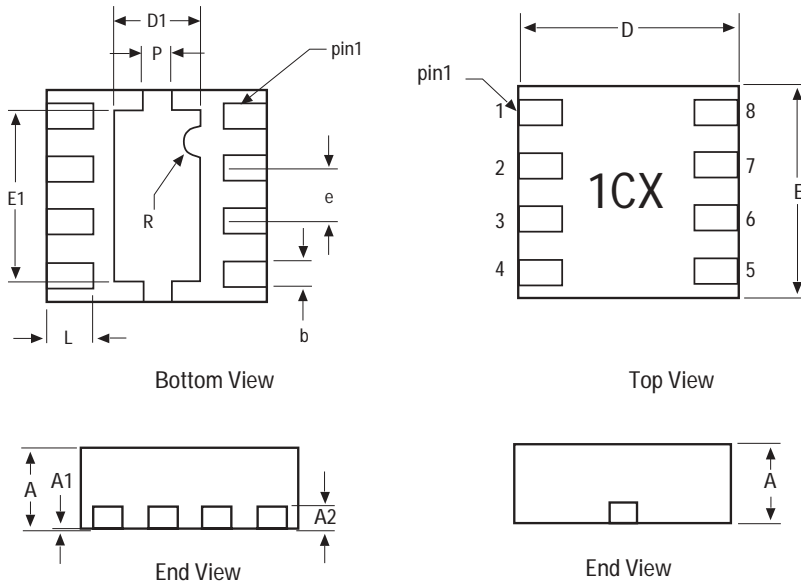


**Figure 13. Typical Spectral Plot conforming compliance to IEEE 802.11b 11Mbps CCK modulation mask at 23dBm output power**



**Figure 14. Typical Scattering Parameter Plots**

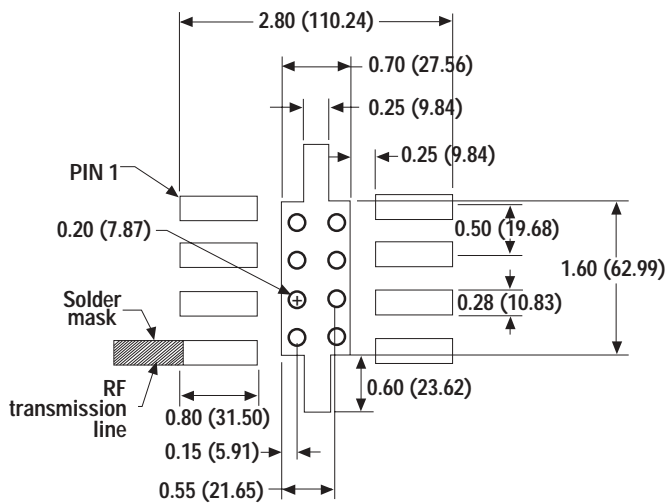
### 2 x 2LPCC (JEDEC DFP-N) Package Dimensions



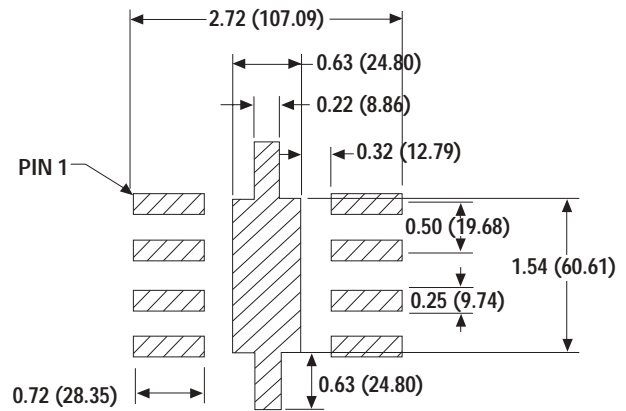
SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0	0.02	0.05
A2		0.203 REF	
b	0.225	0.25	0.275
D	1.9	2.0	2.1
D1	0.65	0.80	0.95
E	1.9	2.0	2.1
E1	1.45	1.6	1.75
e		0.50 BSC	

DIMENSIONS ARE IN MILLIMETERS

## PCB Land Pattern and Stencil Design

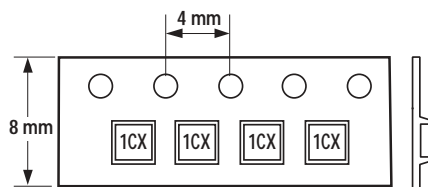
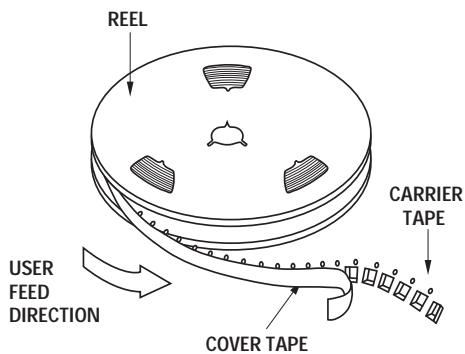


PCB Land Pattern (top view)



Stencil Layout (top view)

## Device Orientation



## Part Number Ordering Information

Part Number	No. of Devices	Container
MGA-412P8-TR1G	3000	7" Reel
MGA-412P8-TR2G	10000	13" Reel
MGA-412P8-BLKG	100	antistatic bag

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

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