Linear Power Amplifier 2.4 - 2.5 GHz, 802.11b/g



Rev. V3

Features

- Ideal for 802.11b/g
- +23 dBm P1dB typical at 3.3 V
- 30 dB Gain typical
- 802.11g compliant to +16.5 dBm P_{OUT}, 3% EVM
- Micro-Amp Shutdown

Ordering Information^{1,2}

Part Number

MAAP-008516-TR3000

MAAP-008516-001SMB

2. All sample boards include 5 loose parts.

- Integrated Detector
- SiGe Process: Lowest Cost Solution
- Lead-Free 2.5 X 2 mm 14-Lead PQFN Package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAP-008516 is a three stage power amplifier, designed for WLAN applications. This power amplifier is available in a lead free 2.5 X 2 mm 14-Lead PQFN plastic package. The MAAP-008516 also features an integrated power detector, and consumes only 80 mA at -13.5 dBm input power under 802.11g modulation conditions.

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration

Pin No.	Pin Name	Description	
1	RF _{IN}	RF Input	
2	V _{EN1,2}	Power Enable	
3	V _{EN3}	Power Enable	
4	DETout	Detector Output	
5	DETIN	Detector Input	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	RF _{out} / V _{cc3}	RF Output, 3rd Stage Supply	
10	RF _{out} / V _{cc3}	RF Output, 3rd Stage Supply	
11	V _{CC2}	2nd Stage Supply	
12	GND	Ground	
13	V _{CC1}	1st Stage Supply	
14	GND	Ground	
Pad	Paddle ³	RF & DC Ground	

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

Package

3000 piece reel

Sample Test Board

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Electrical Specifications: F = 2.45 GHz, V_{CC} = 3.3 V, V_{EN} = 2.6 V, T_A = 25°C, Z_0 = 50 Ω

Parameter	Test Conditions		Min.	Тур.	Max.
Gain	—		27.5	30	_
Input Return Loss	_		—	15	—
Forward Isolation	_		—	50	—
P1dB	—		—	23	—
Current	ldle P _{IN} = -13.5 dBm, Modulated ⁴ P _{IN} = -13.5 dBm, C.W.		— 60	55 80 95	95 120 110
Off Current	V _{EN} = 0 V			3	20
Control Current	V _{EN} Current		_	4.5	7
Harmonics	2fo @ -13.5 dBm Input Power 3fo @ -13.5 dBm Input Power		_	-33 -55	-23 -45
Duty Cycle	—	%	—	100	—
Linear Output Power	DSS source; compliance with 802.11b EVM=3.0%, OFDM, QAM-64, 54 Mbps, 802.11g		_	21.5 16.5	
Detector Output	P _{IN} = -13.5 dBm, C.W.	V	—	0.65	—

4. OFDM, QAM-64, 54 Mbps

Absolute Maximum Ratings 5,6,7

Parameter	Absolute Maximum		
Input Power	-5 dBm		
Operating Supply Voltage	+4.0 Volts		
Operating Control Voltage	+3.0 Volts		
Operating Temperature	-20°C to +85°C		
Junction Temperature ⁸	+150°C		
Storage Temperature	-40°C to +150°C		

- 5. Exceeding any one or combination of these limits may cause permanent damage to this device.
- 6. M/A-COM Technology does not recommend sustained operation near these survivability limits.
- 7. These operating conditions will ensure MTTF > 1 x 10^6 hours.
- 8. Junction Temperature $(T_J) = T_C + \Theta jc * ((V * I) (P_{OUT} P_{IN}))$ Typical thermal resistance $(\Theta jc) = 25^{\circ} C/W.$
 - a) For $T_c = 25^{\circ}C$,

 T_J = 31 °C @ 3.3 V, 80 mA, P_{OUT} = 16.5 dBm, P_{IN} = -13.5 dBm

- b) For $T_c = 85^{\circ}C$,
- $T_{\rm J}$ = 91 °C @ 3.3 V, 90 mA, $P_{\rm OUT}$ = 15 dBm, $P_{\rm IN}$ = -13.5 dBm

Operating the MAAP-008516

The MAAP-008516 is static sensitive. Please handle with care. To operate the device, follow these steps.

- 1. Apply V_{CC} (3.3 V).
- 2. Apply V_{EN} (2.6 V).
- 3. Set input power.
- 4. Turn off in reverse order with V_{CC} last.

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Recommended PCB Configuration



Evaluation Board Schematic



External Parts List

Component	Value	Footprint	Manufacture	
C1	2.7 pF	0402	Murata	
C2	10 pF	0402	Murata	
C3	1.0 µF	0402	Murata	
C4	0.1 µF	0402	Murata	
C5	.70 pF	0402	ATC High Q	
C6	1000 pF	0402	Murata	
C7	1.0 pF	0402	ATC High Q	
L1	2.0 nH	0402	Coilcraft	
L2	10.0 nH	0402	Coilcraft	
L3	1.0 nH	0402	Coilcraft	
R1	220K Ω	0402	Panasonic	
R2	0 Ω	0402	Panasonic	
TL1	50 Ω, 20.6° @ 2.45 GHz			
TL2	50 Ω, 7.4° @ 2.45 GHz			

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Proper ESD control techniques should be used when handling these Class 1B devices.

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Typical Performance Curves: $V_{CC} = 3.3 \text{ V}$, $V_{EN} = 2.6 \text{ V}$, over Temperature

S21 vs. Frequency (2.4 GHz - 2.5 GHz) -Gain



S11 vs. Frequency (2.4 GHz - 2.5 GHz)



S22 vs. Frequency (2.4 GHz - 2.5 GHz)









S22 vs. Frequency



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Typical Performance Curves: $V_{CC} = 3.3 \text{ V}, V_{EN} = 2.6 \text{ V}$

P1dB @ 2.4 - 2.5 GHz



Modulated Current vs. P_{out} over Temperature @ 2.45 GHz



EVM vs. P_{OUT} @ 2.4 - 2.5 GHz, OFDM, QAM-64, 54 Mbps



V_{DET} vs. P_{OUT} over Temperature @ 2.45 GHz



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802.11b Spectrum Emission Mask @ 2.45 GHz



EVM vs. P_{OUT} over Temperature @ 2.45 GHz, OFDM, QAM-64, 54 Mbps⁹



9. Includes system level EVM of 0.7%

Lead-Free 2.5 x 2 mm 14-Lead PQFN[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations. Meets JEDEC moisture sensitivity level 1 requirements. Plating is 100% matte tin over copper.

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