

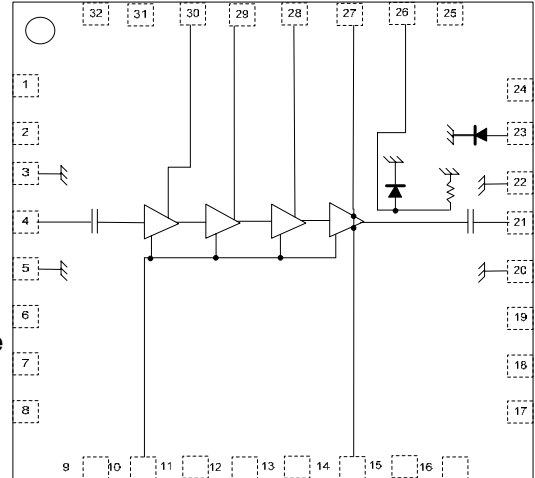
MMA-374030-M5 37 - 41 GHz, 1 W MMIC Power Amplifier

Features:

- Frequency Range: 37 - 41 GHz
- P1dB: +30.5 dBm
- IM3 Level: -41 dBc @Po = 18 dBm / tone
- Gain: 22 dB
- Vdd = 4 to 6 V
- Idsq = 1000 to 2000 mA
- Input and Output Fully Matched to 50 Ω
- Integrated power detector
- Surface Mount, RoHs Compliant QFN 5 x 5 mm package

Applications:

- P2P Radio
- V-sat



Functional Block Diagram

Description:

The MMA-374030-M5 is a high linearity power amplifier in a surface mount package designed for use in transmitters that operate at frequencies between 37 GHz and 41 GHz with an OIP3 = 39 dBm. In the operational frequency band, it provides 30.5 dBm of output power (P-1 dB) and 22 dB of small-signal gain. This PA is also designed for high linearity applications, and the PA shows better than -41 dBc of IM3 level at 18 dBm / tone output power level.

Absolute Maximum Ratings: (Ta = 25 °C)*

SYMBOL	PARAMETERS	UNITS	Min.	Max.
Vds	Drain-Source Voltage	V		6.5
Vg	Gate-Source Voltage	V	-2.1	0
Ig	First Gate Current	mA	-11	11
Pd	Power Dissipation	W		11.2
Pin max	RF Input Power	dBm		20
Toper	Operating Temperature	°C		-40 to +85
Tch	Channel Temperature	°C		+150
Tstg	Storage Temperature	°C		-55 to +150
Tmax	Max. Assembly Temp (20 sec max)	°C		+250

*Operation of this device above any one of these parameters may cause permanent damage.

MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Electrical Specifications: $V_{ds} = 5\text{ V}$, $V_{gs} = 0.85\text{ V}$, $I_{dsq} = 1200\text{ mA}$, $T_a = 25\text{ }^{\circ}\text{C}$ $Z_0 = 50\text{ }\Omega$

Parameter	Units	Typical Data
Frequency Range	GHz	37 - 41
Gain (Typ / Min)	dB	24 / 22
Gain Flatness (Typ / Max)	$\pm$ dB	1.5 / 1.8
Input RL (Typ / Max)	dB	10 / 8
Output RL (Typ / Max)	dB	10 / 8
Output P1dB (Typ / Min)	dBm	29 / 28
Output P3dB (Typ / Min)	dBm	31 / 30.5
IM3 Level ⁽¹⁾	dBc	-41
Thermal Resistance	$^{\circ}\text{C}/\text{W}$	5.5
Operating Current at P1dB (Typ / Max)	mA	1400 / 1600

(1) Output IP3 is measured with two tones at output power of 18 dBm / tone separated by 20 MHz.

ESD Caution

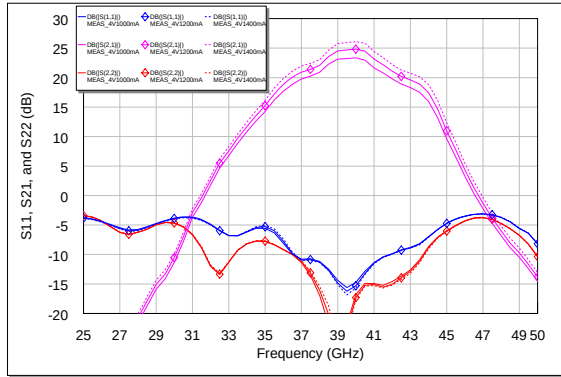


High-performance RF integrated circuits are highly sensitive to electrostatic discharge (ESD) and may contain unprotected inputs and outputs. Handling and assembly should be conducted in an ESD-controlled environment. It is recommended that ESD precautions and protocols are adopted to minimise the risk of electrostatic discharge and protect product integrity.

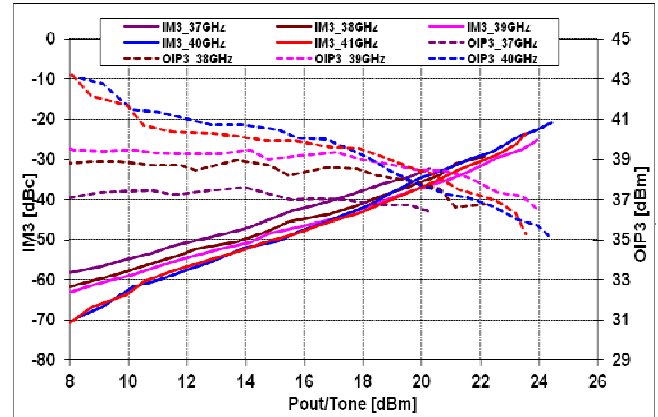
MMA-374030-M5

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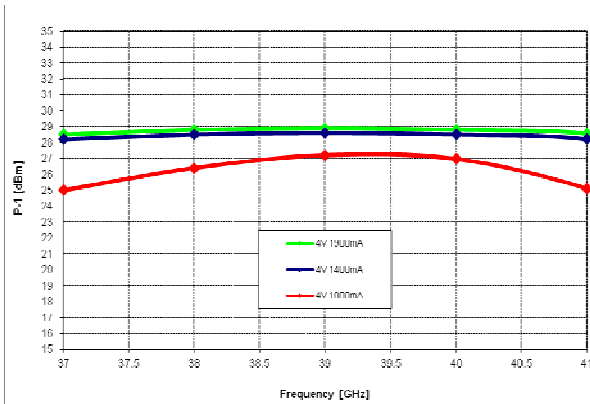
Typical Bias dependent RF Performance: $V_{ds} = 4\text{ V}$



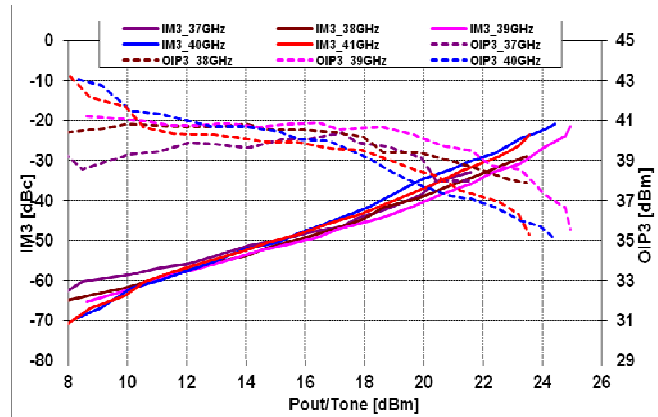
SS performance vs. Frequency ($I_{ds} = 1, 1.2, \text{ and } 1.4\text{ A}$)



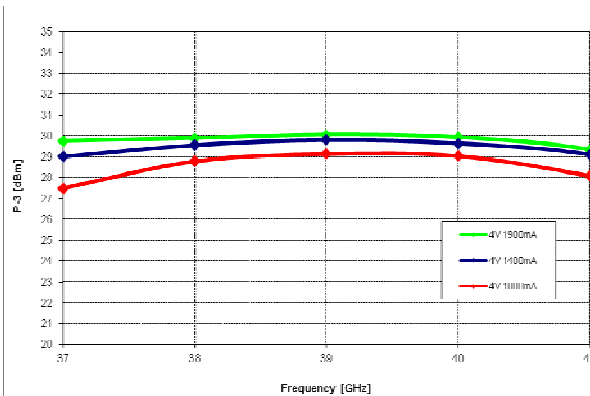
@ $V_{ds} = 4\text{ V}$, $I_{dsq} = 1000\text{ mA}$



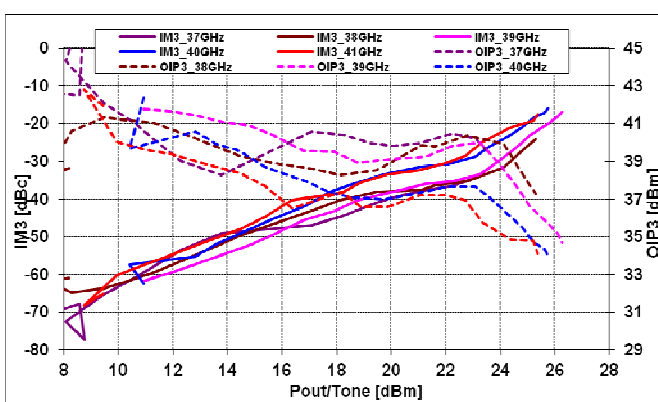
Bias dependent P-1 vs. Frequency



@ $V_{ds} = 4\text{ V}$, $I_{dsq} = 1200\text{ mA}$



Bias dependent P-3 vs. Frequency

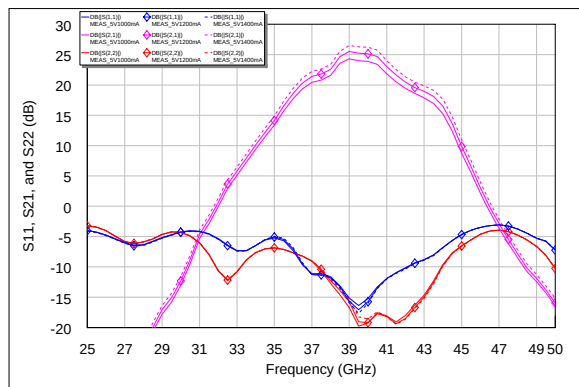


@ $V_{ds} = 4\text{ V}$, $I_{dsq} = 1600\text{ mA}$

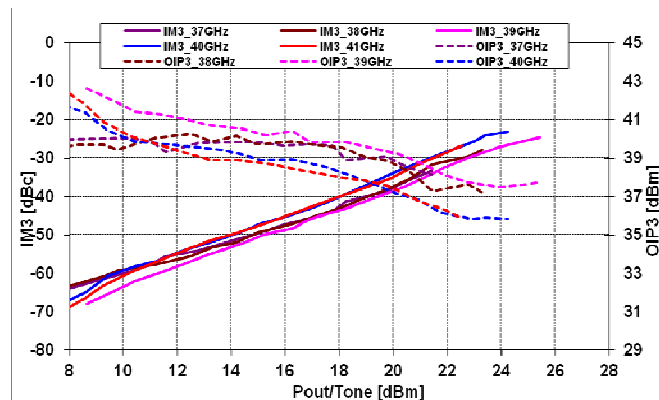
MMA-374030-M5

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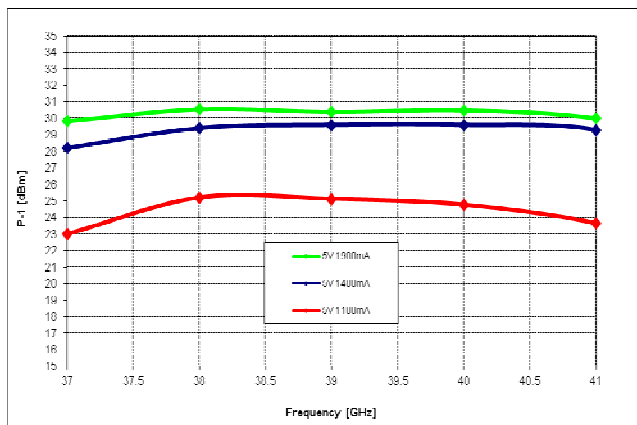
Typical Bias dependent RF Performance: $V_{ds} = 5V$



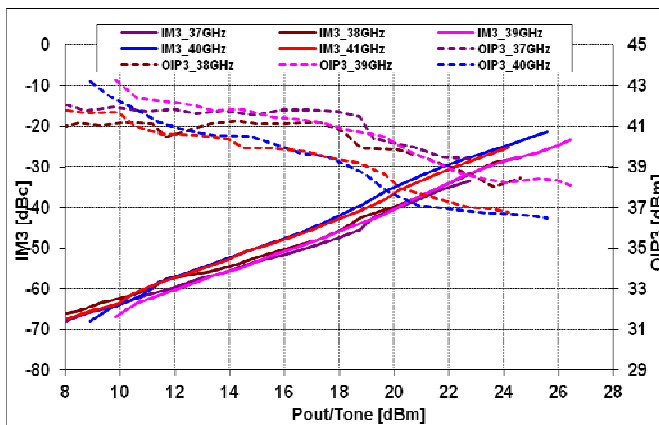
SS performance vs. Frequency ($I_{ds} = 1, 1.2, \text{ and } 1.4 A$)



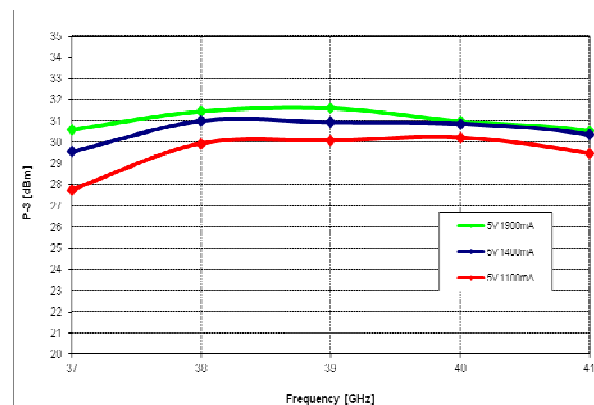
@ $V_{ds} = 5 V$, $I_{dsq} = 1000 mA$



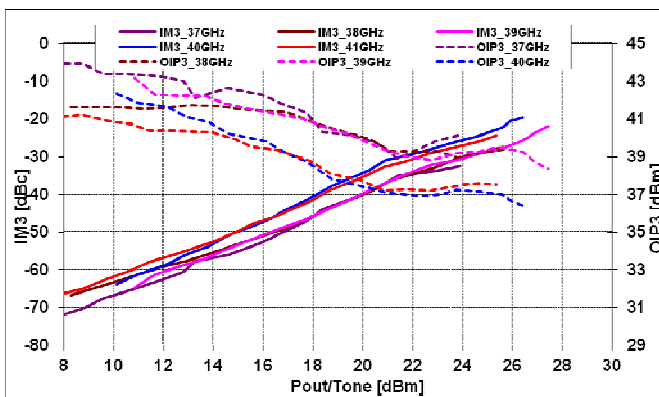
Bias dependent P-1 vs. Frequency



@ $V_{ds} = 5 V$, $I_{dsq} = 1200 mA$



Bias dependent P-3 vs. Frequency

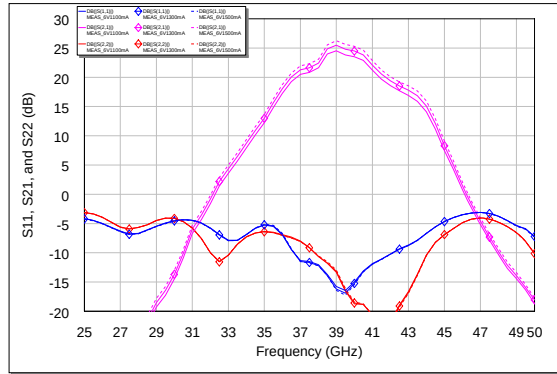


@ $V_{ds} = 5 V$, $I_{dsq} = 1500 mA$

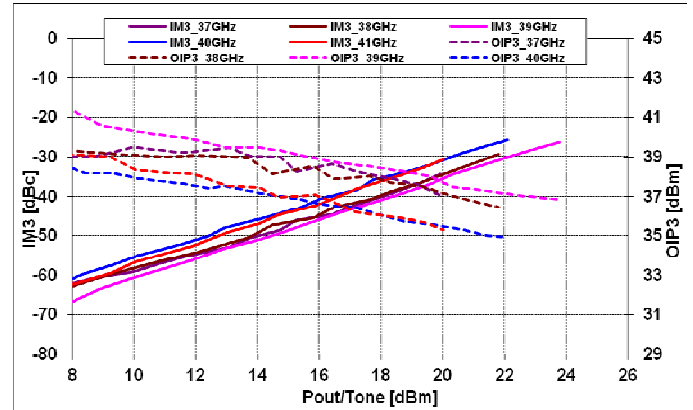
MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

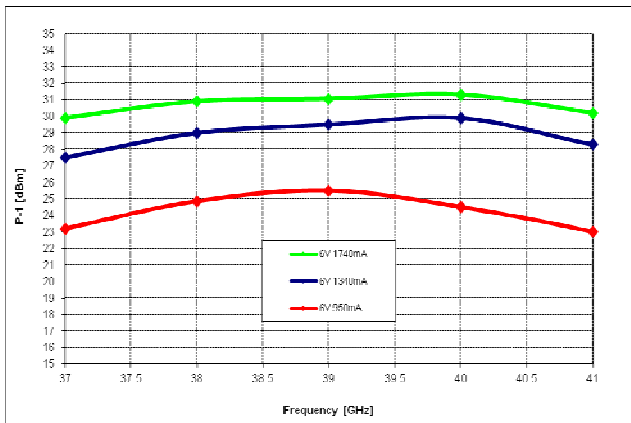
Typical Bias dependent RF Performance: $V_{ds} = 6\text{ V}$



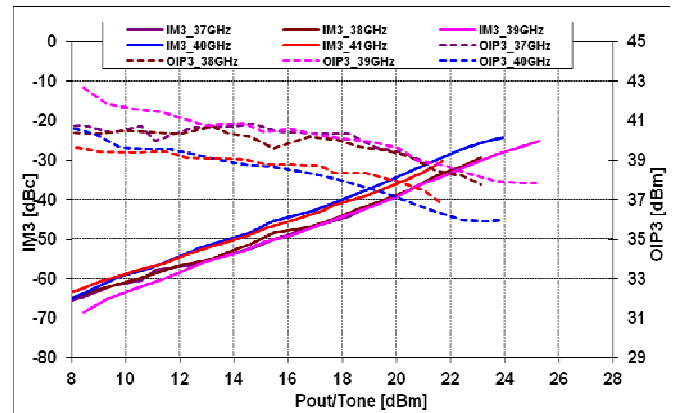
SS performance vs. Frequency ($I_{ds} = 1.1, 1.3$ and 1.5 A)



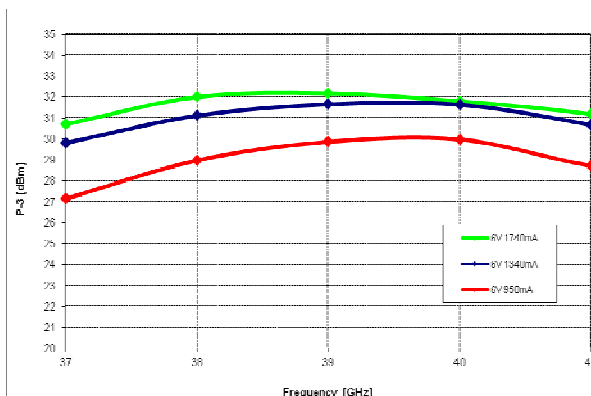
@ $V_{ds} = 6\text{ V}$, $I_{dsq} = 950\text{ mA}$



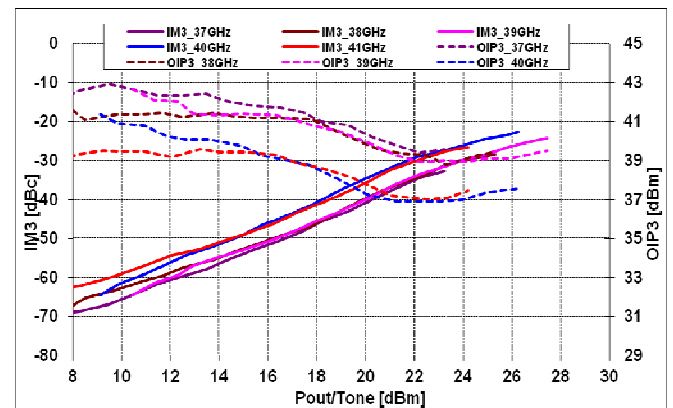
Bias dependent P-1 vs. Frequency



@ $V_{ds} = 6\text{ V}$, $I_{dsq} = 1150\text{ mA}$



Bias dependent P-3 vs. Frequency

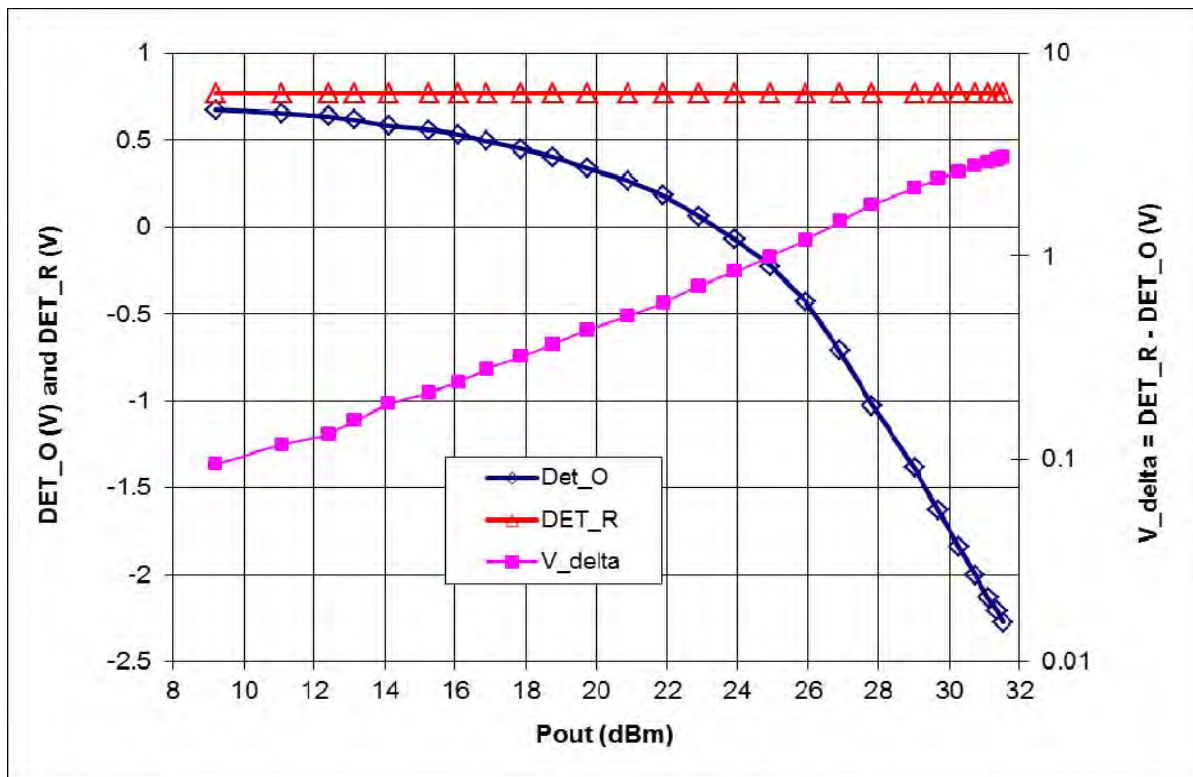


@ $V_{ds} = 6\text{ V}$, $I_{dsq} = 1500\text{ mA}$

MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Typical Power Detector Voltages: $V_{ds} = 5\text{ V}$, $I_{dsq} = 1.2\text{ A}$, $Freq. = 39\text{ GHz}$



Detector Voltages (DET_O and DET_R) vs. Output RF power

V_delta axis is Log-scale.

MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Applications

The **MMA-374030-M5** MMIC power amplifier is designed for use as a power stage amplifier in microwave transmitters. It is ideally suited for 37 to 41 GHz band point to point radio applications requiring a flat gain response and excellent linearity performance. This amplifier is provided as a 5 x 5 mm QFN package, and the packaged amplifier is fully compatible with industry standard high volume surface mount PCB assembly processes.

Biasing and Operation

The recommended bias conditions for best performance for the **MMA-374030-M5** are $V_{DD} = 5.0V$, $I_{dsq} = 1200$ mA. Performance improvements are possible depending on applications. For the best linearity performance, recommended DC bias conditions are $V_{DD} = 4.0$ V, $I_{dsq} = 1200$ mA. Drain bias voltage range is 4 to 6 V and the quiescent drain current biasing range is 1000 mA to 2000 mA. A single DC gate supply connected to V_g will bias all the amplifier stages. Muting can be accomplished by setting V_g to the pinch-off voltage ($V_p = -2$ V). The gate voltage (V_g) should be applied prior to the drain voltages (V_{d1} , V_{d2} , V_{d3} , V_{d4}) during power up and removed after the drain voltages during power down. The RF input and output ports are DC decoupled internally. Typical DC supply connection with bi-passing capacitors for the **MMA-374030-M5** is shown in following pages.

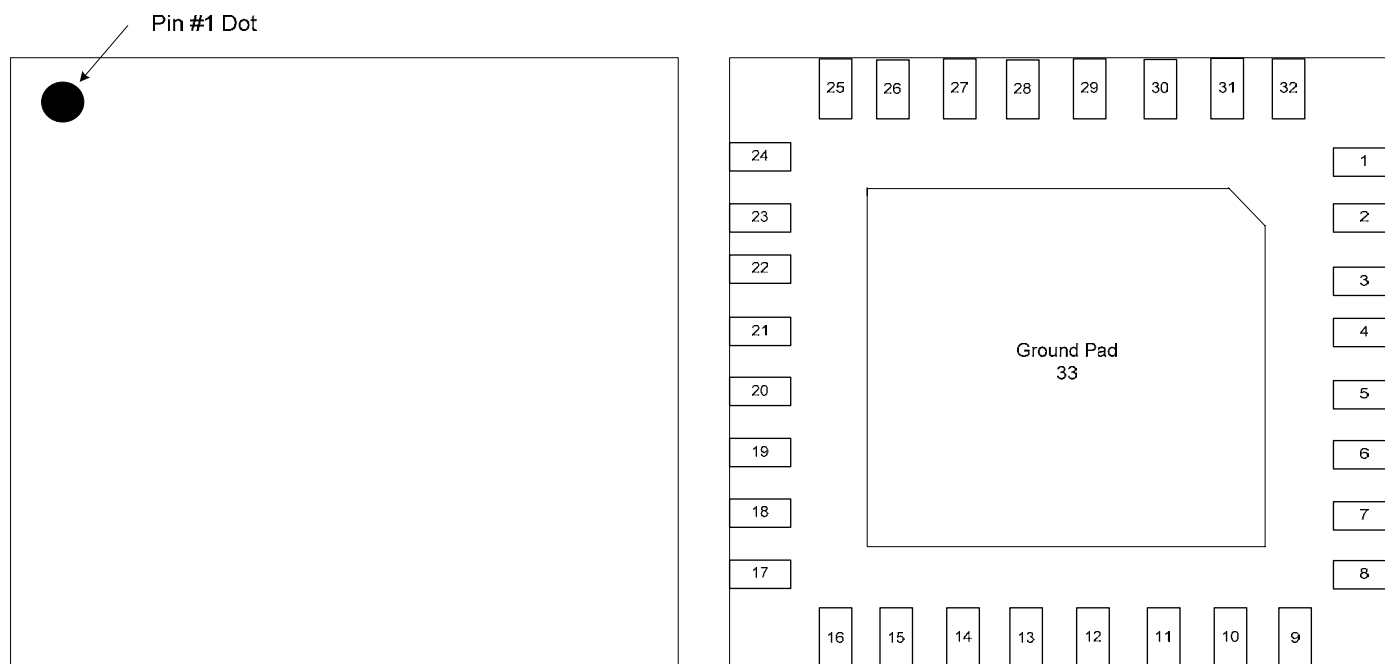
Assembly Techniques

GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Package Pin-out:

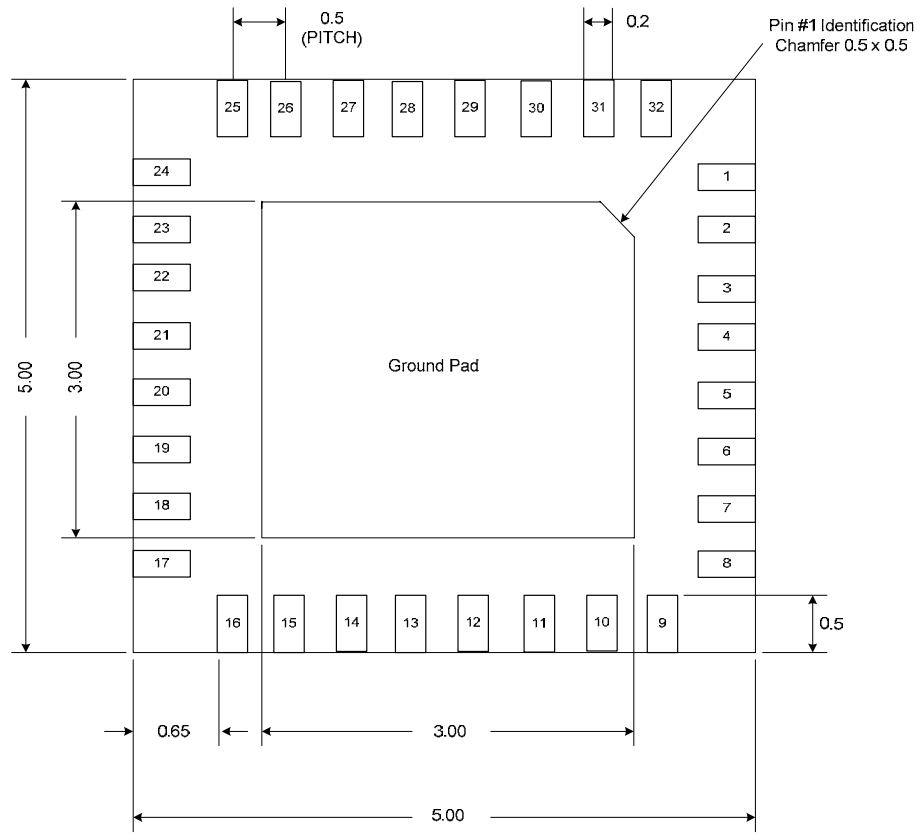


Pin	Description
4	RF Input
21	RF Output
10	Vg
30	Vd1
29	Vd2
28	Vd3
14, 27	Vd4
23	DET_Reference
26	DET_Output
1, 3, 5, 8, 9, 16, 17, 20, 22, 24, 25, 32, 33	Ground
2, 6, 7, 11, 12, 13, 15, 18, 19, 30, 31	N/C

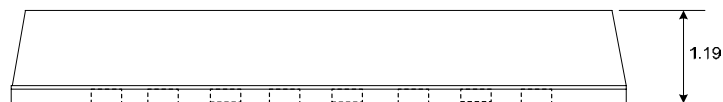
MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Mechanical Information:



BOTTOM VIEW



SIDE VIEW

The units are in [mm].

37 - 41 GHz, 1 W MMIC Power Amplifier

The diagram illustrates the AD9371 evaluation board with the following components and connections:

- RF Input:** Connected to pins 3 (GND), 4 (RF IN), and 5 (GND).
- RF Output:** Connected to pins 21 (GND), 22 (RF OUT), and 23 (GND).
- Power Supply Connections:**
 - Vd1:** Connected to pin 32.
 - Vd2:** Connected to pin 31.
 - Vd3:** Connected to pin 30.
 - Vd4:** Connected to pin 29.
 - DET_O:** Connected to pin 28.
 - Vd4:** Connected to pin 27.
 - DET_R:** Connected to pin 26.
 - Vg1:** Connected to pin 9.
 - Vd4:** Connected to pin 14.
- Component Values:**
 - Capacitors:** 1uF, 0.01uF, and 0.001uF.
 - Resistors:** 10Ω.

Note: Vd4 pins must be biased from both sides.

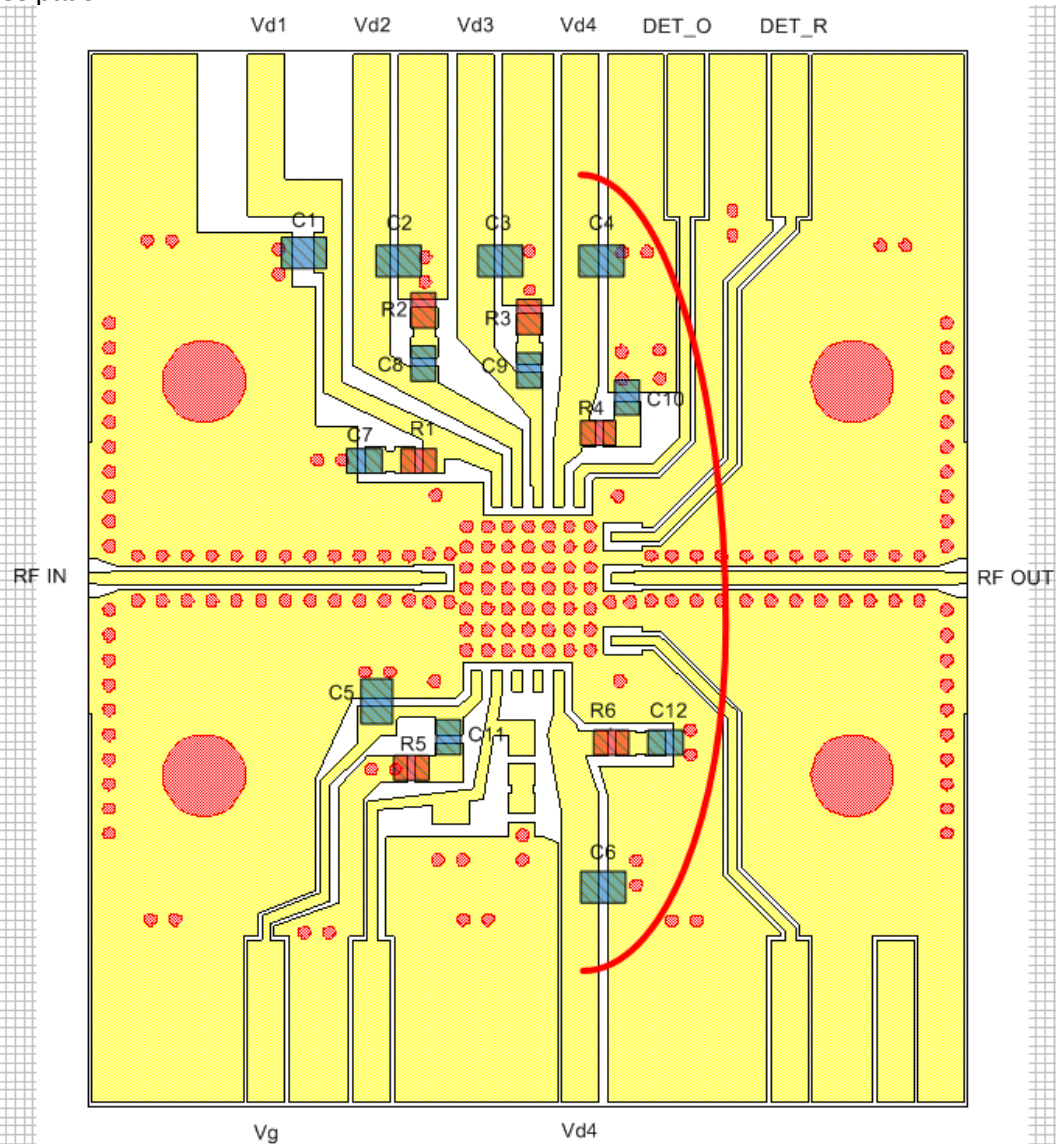
MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Recommended Application Board Design:

Board Material is 10 mil (Dielectric) thickness Rogers 4350B with 0.5 oz copper clads.

Board is soldered on a gold plated solid copper block and adequate heat-sinking is required for 16.8 W total power dissipation.



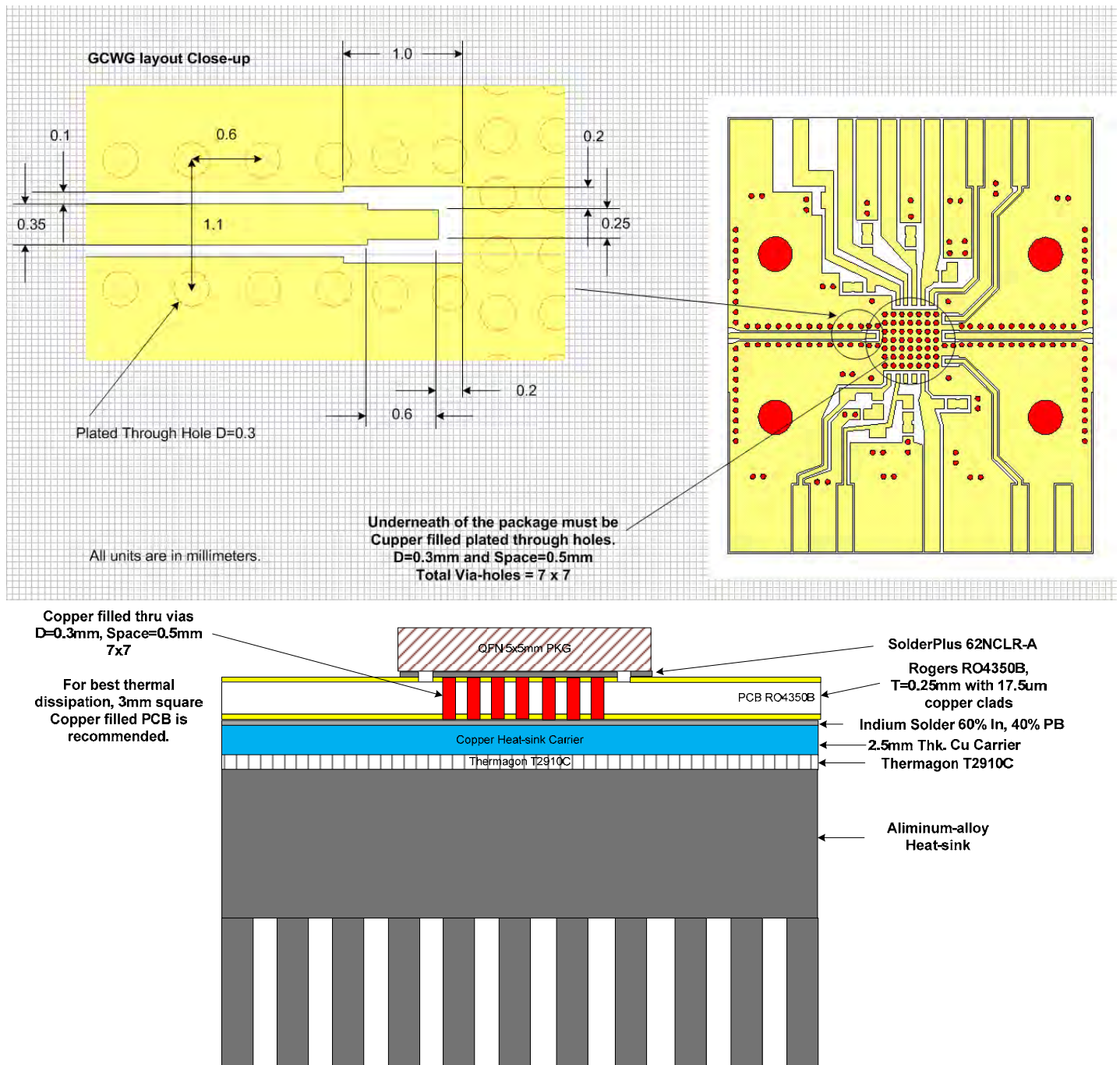
Part	Description
C1, C2, C3, C4, C5, C6	1 μ F Capacitor (0603)
C7, C8, C9, C10, C11, C12	0.01 μ F Capacitor (0402)
R1, R2, R3, R4, R5, R6	10 Ω Resistor (0402)

MMA-374030-M5

37 - 41 GHz, 1 W MMIC Power Amplifier

Recommended Application Board Design:

Board Material is 10 mil (Dielectric) thickness Rogers 4350 B with 0.5 oz copper clads. The board material and mounting pattern, as defined in the data sheet, optimizes RF performance and is strongly recommended.



RoHS Compliance



CML Micro certifies, to the best of our knowledge, that its products comply with RoHS directive (2011/65/EU), as amended by Directive (EU) 2015/863.

REACH Compliance



CML Micro certifies, to the best of our knowledge, that its products do not contain any of the banned substances specified in the SVHC list at <https://echa.europa.eu/candidate-list-table>. CML Micro are committed to ensuring the safety of products and the compliance with regulations. Publications will be updated in the event that REACH control is compromised.

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