

MMA-005022-M4 30 kHz - 50 GHz Traveling Wave Amplifier

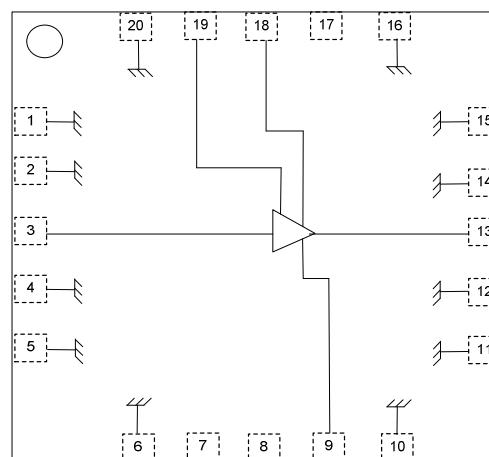
Features:

- Frequency Range: 30 kHz – 50 GHz *
- P1dB: +22 dBm
- Vout: 7 V p-p @ 50 Ω
- Gain: 13.5 dB
- Vdd = 7 V
- Ids = 200 mA
- Input and Output Fully Matched to 50 Ω
- Surface Mount, RoHs Compliant QFN 4 x 4 mm package

* NOTE: Performance degradation over 40 GHz

Applications:

- Fiber optics communication systems
- Microwave and wireless communication systems
- Microwave and optical instrumentations



Functional block diagram

Description:

The MMA-005022-M4 is a broadband GaAs MMIC Traveling Wave Amplifier (TWA) with medium output power and high gain over full 30 kHz to 50 GHz frequency range. This amplifier is optimally designed for broadband applications requiring flat gain and group delay with excellent input and output matches over a 30 kHz to 50 GHz frequency range.

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

SYMBOL	PARAMETERS	UNITS	Min.	Max.
Vds	Drain-Source Voltage	V		10
Vg1	First Gate-Source Voltage	V	-8	0
Ig1	First Gate Current	mA	-38	1
Vg2	Second Gate-Source Voltage	V	-3.5	4
Ig2	Second Gate-Source Current	mA	-20	
Ids	Drain Current	mA		340
Pin max	RF Input Power	dBm		17
Toper	Operating Temperature	°C		-40 to +85
Tch	Channel Temperature	°C		+150
Tstg	Storage Temperature	°C		-55 to +165
Tmax	Max. Assembly Temp (60 sec max)	°C		+300

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

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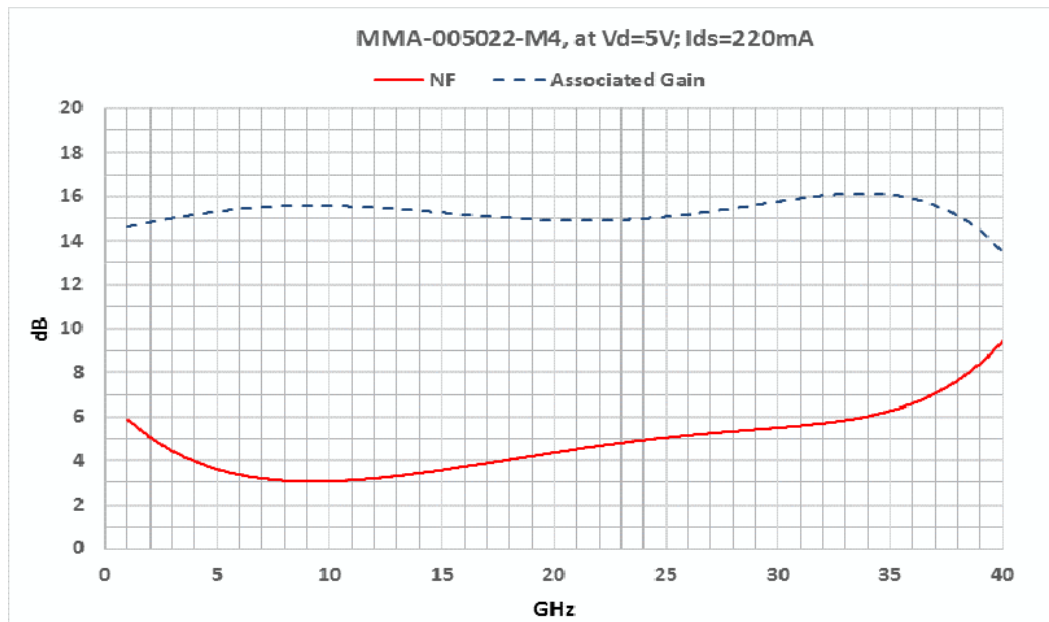
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Electrical Specifications: $V_{ds} = 7\text{ V}$, $V_{g1} = -2.7\text{ V}$, $V_{g2} = \text{open}$, $I_{ds} = 200\text{ mA}$, $T_a = 25\text{ }^{\circ}\text{C}$, $Z_0 = 50\text{ }\Omega$

Parameter	Units	Min.	Typ.	Max.
Frequency Range	MHz	0.03		40,000
Gain	dB	12	13.5	
Gain Flatness	$\pm$ dB		2.0	2.5
Input RL	dB		10	
Output RL	dB		10	
Output P1dB	dBm		22	
Output IP3 ⁽¹⁾	dBm		30	
Output Psat	dBm		25	
Operating Current at P1dB	mA		210	230
Thermal Resistance	$^{\circ}\text{C} / \text{W}$		16	

(1) Output IP3 is measured with two tones at output power of 10 dBm / tone separated by 20 MHz.

Typical RF Performance: $V_{ds} = 7\text{ V}$, $V_{g1} = -2.7\text{ V}$, $V_{g2} = \text{open}$, $I_{ds} = 200\text{ mA}$, $Z_0 = 50\text{ }\Omega$, $T_a = 25\text{ }^{\circ}\text{C}$

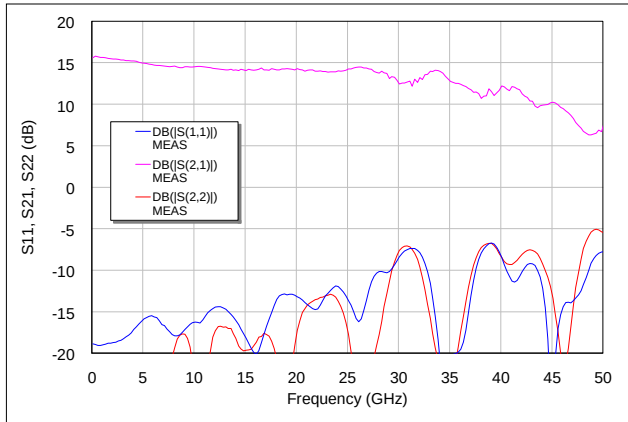


NF vs. Associated Gain

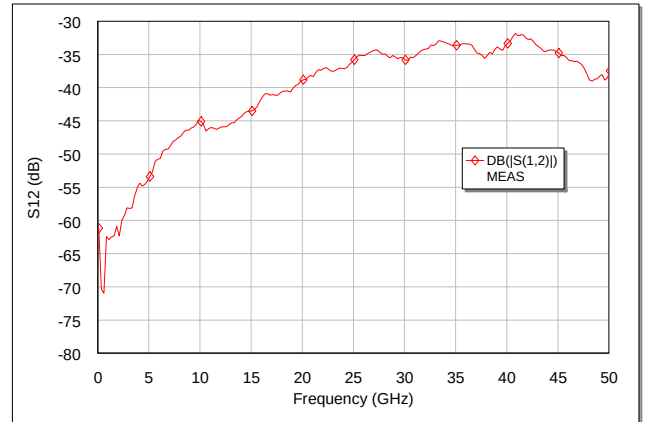
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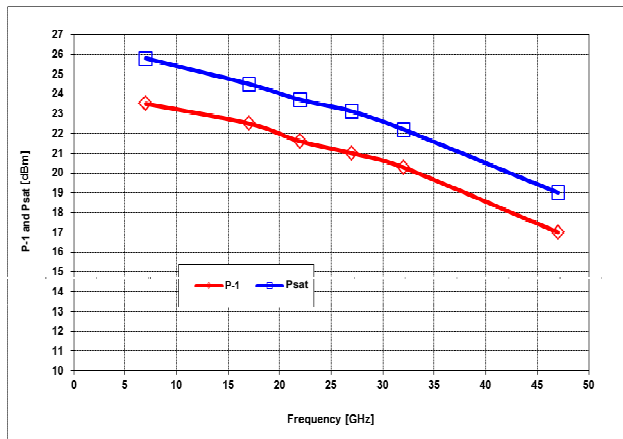
Typical RF Performance cont.: $V_{ds} = 7\text{ V}$, $V_{g1} = -2.7\text{ V}$, $V_{g2} = \text{open}$, $I_{ds} = 200\text{ mA}$, $Z_0 = 50\ \Omega$, $T_a = 25\text{ }^\circ\text{C}$



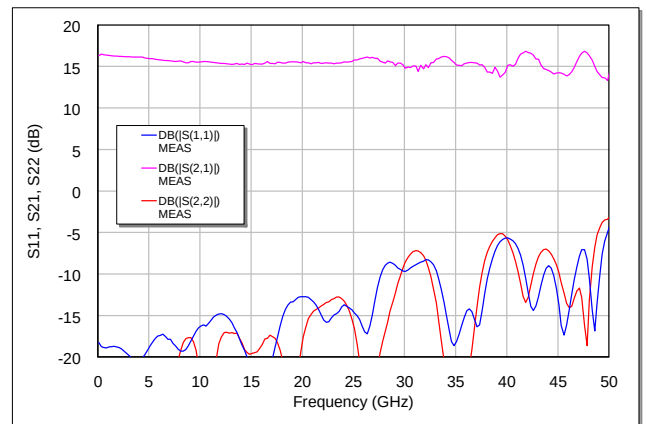
S11, S21, and S22 vs. Frequency



S12 (dB) vs. Frequency



P-1 and Psat vs. Frequency



S11, S21, and S22 vs. Frequency
@ $V_{ds} = 5\text{ V}$, $I_{ds} = 220\text{ mA}$

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.

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Applications

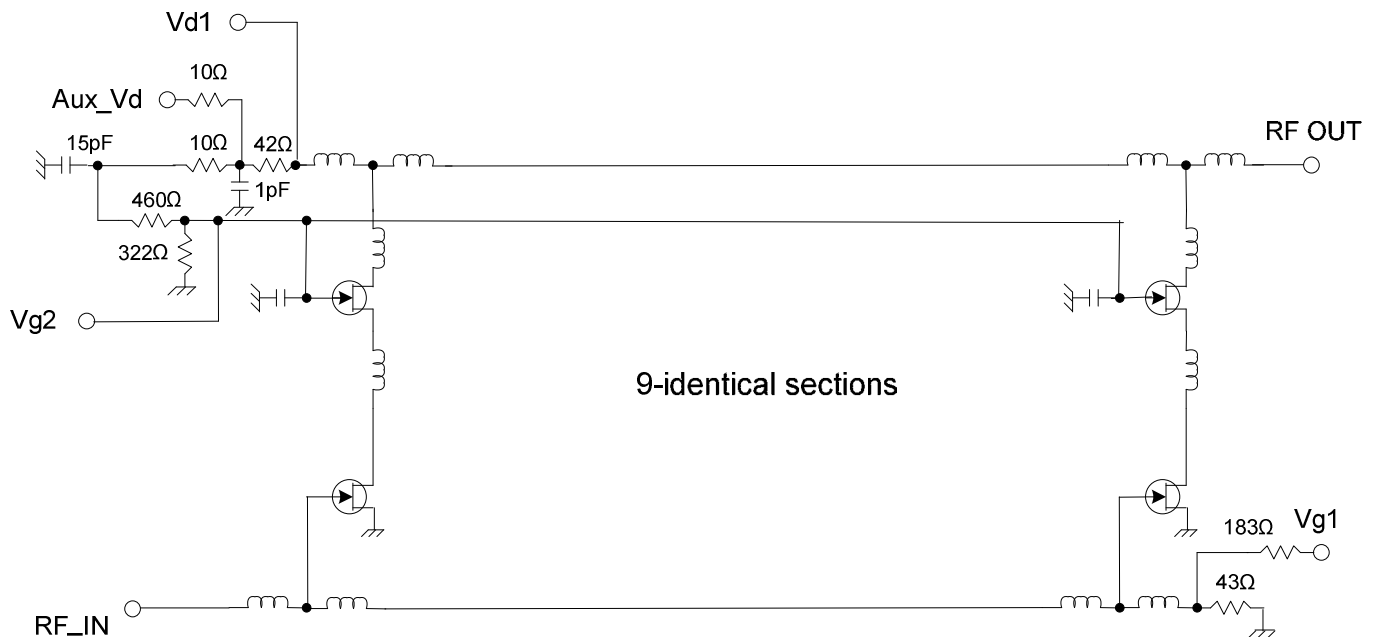
The MMA-005022-M4 traveling wave amplifier is designed for use as a general purpose wideband power stage in microwave and optical communication systems, and test fiber optic/microwave test equipments. It is ideally suited for broadband applications requiring a flat gain response and excellent port matches over a 30 kHz to 50 GHz frequency range. Dynamic gain control and low-frequency extension capabilities are designed into these devices.

Biassing and Operation

The recommended bias conditions for best performance for the MMA-005022-M4 are $V_{DD} = 7.0$ V, $I_{DD} = 200$ mA. To achieve these drain current levels, V_{g1} is typically biased between -2.7 V with approximately 10 mA. No other bias supplies or connections to the device are required for 30 kHz to 50 GHz operation. Performance improvements are possible depending on applications. For high gain requirement at higher frequency, recommended bias conditions are $V_{dd} = 5$ V, $I_{dsq} = 220$ mA. The drain bias voltage range is 3 to 7 V and the quiescent drain current biasing range is 120 mA to 250 mA. The gate voltage (V_{g1}) should be applied prior to the drain voltage (V_{dd}) during power up and removed after the drain voltage during power down. The MMA-005022-M4 is a DC coupled amplifier. External coupling capacitors are needed on RFIN and RFOUT ports. The drain bias pad is connected to RF and must be decoupled to the lowest operating frequency. An auxiliary drain contacts is provided when performance below 1 GHz is required. Connect external capacitors to ground to maintain input and output VSWR at low frequencies (see additional application note). Do not apply bias to these pads. The second gate (V_{g2}) can be used to obtain 30 dB (typical) dynamic gain control. For normal operation, no external bias is required on this contact.

Assembly Techniques

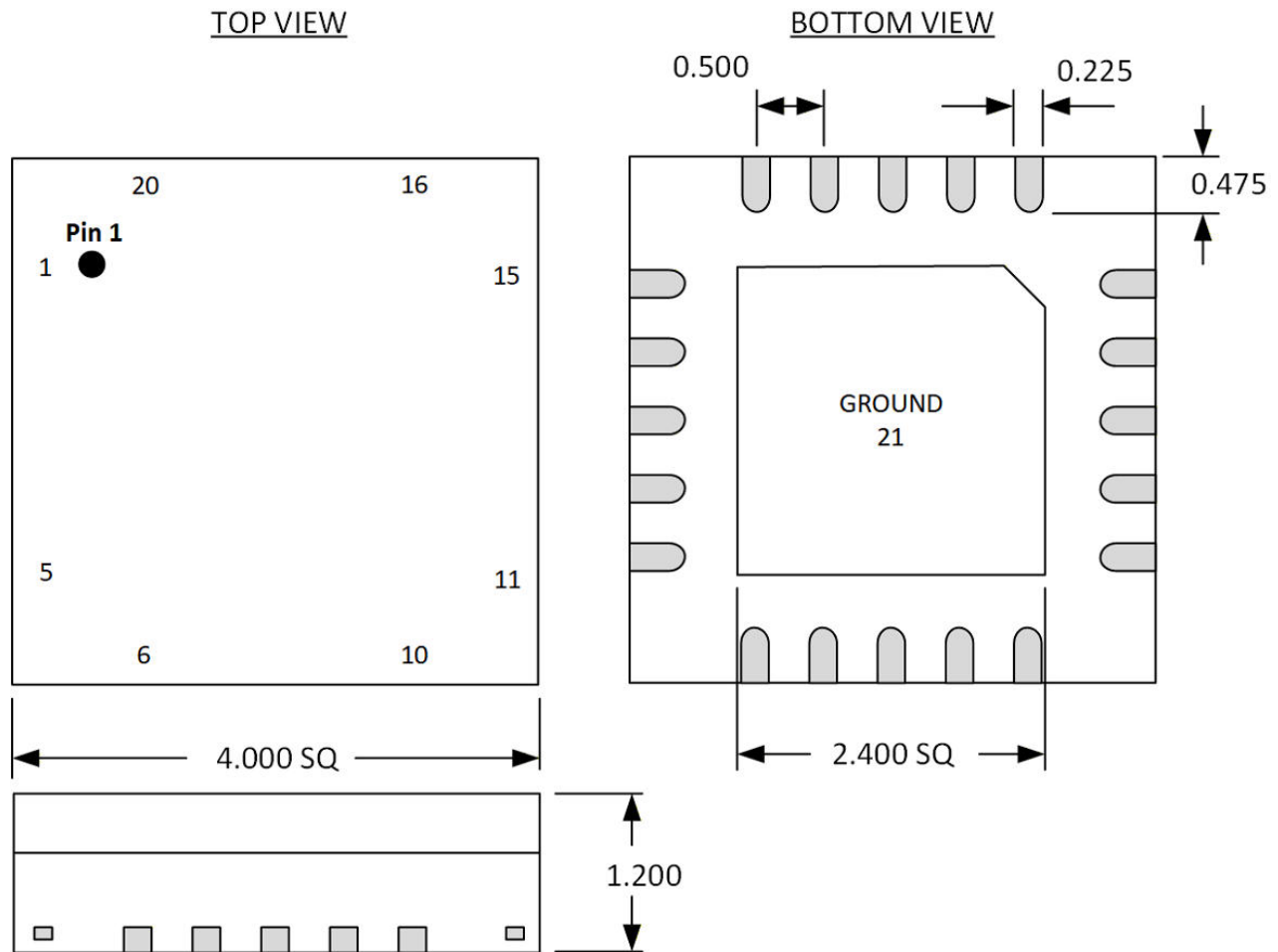
GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.



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Package Mechanical information and Pin-out:



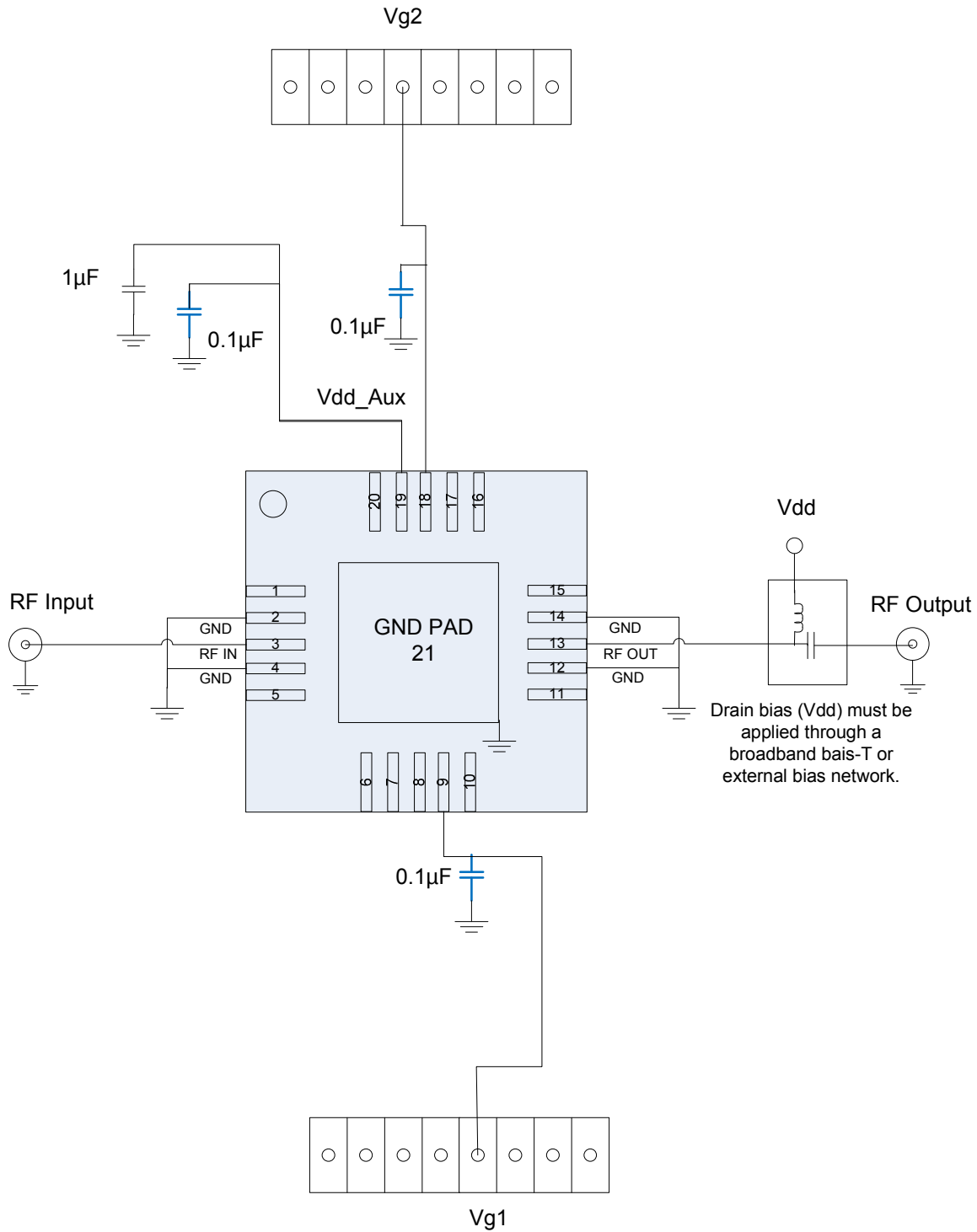
The units are in [mm].

Pin	Description
3	RF Input
13	RF Output / Vdd
9	Vg1
18	Vg2
19	Vdd_Aux
1, 2, 3, 4, 5, 6, 10, 12, 14, 15, 16, 20, 21	Ground
7.8.17	N/C

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Application Circuit:

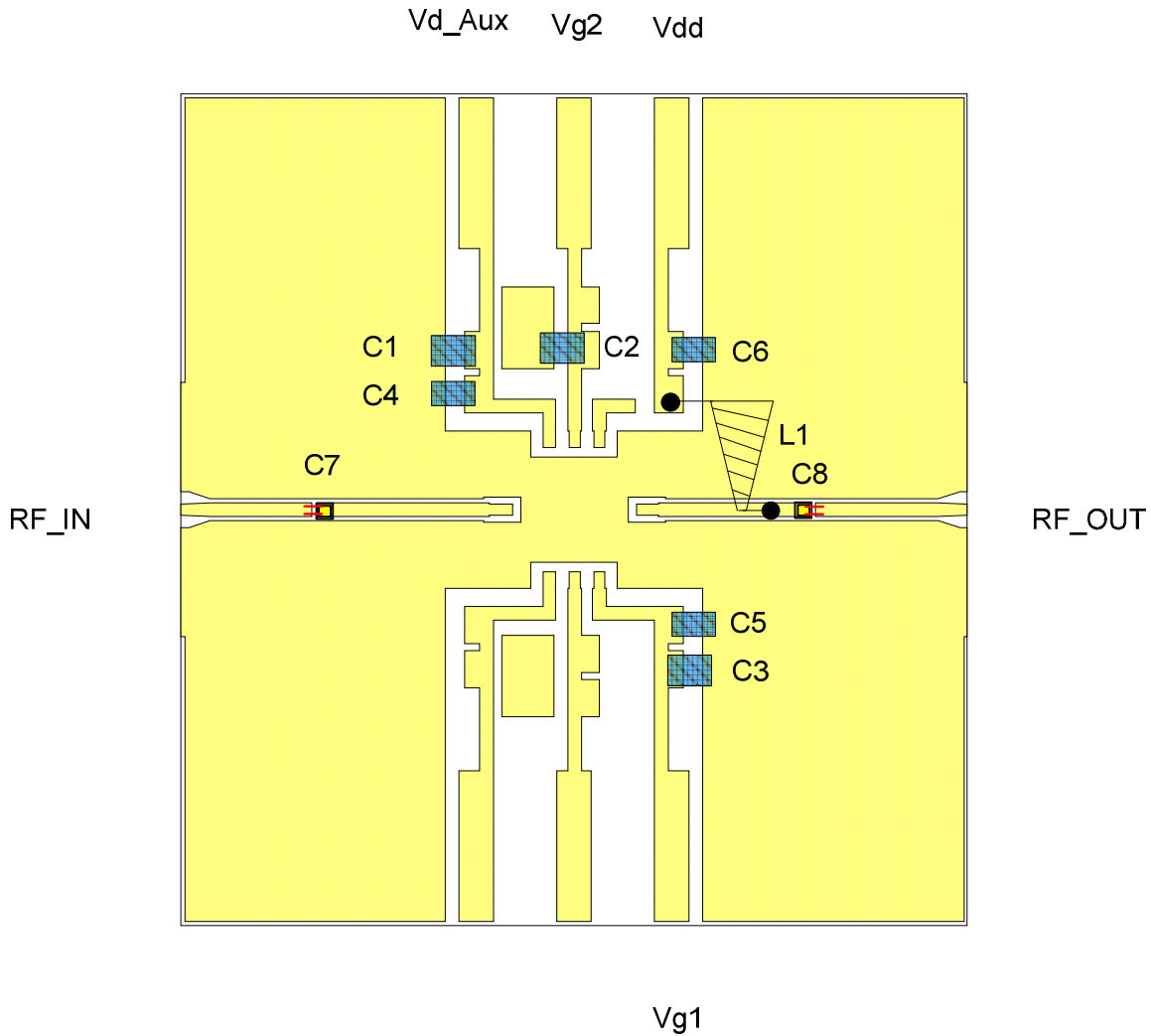


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Recommended Application Board Design:

Board Material is 10mil (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 3.4 W total maximum power dissipation.



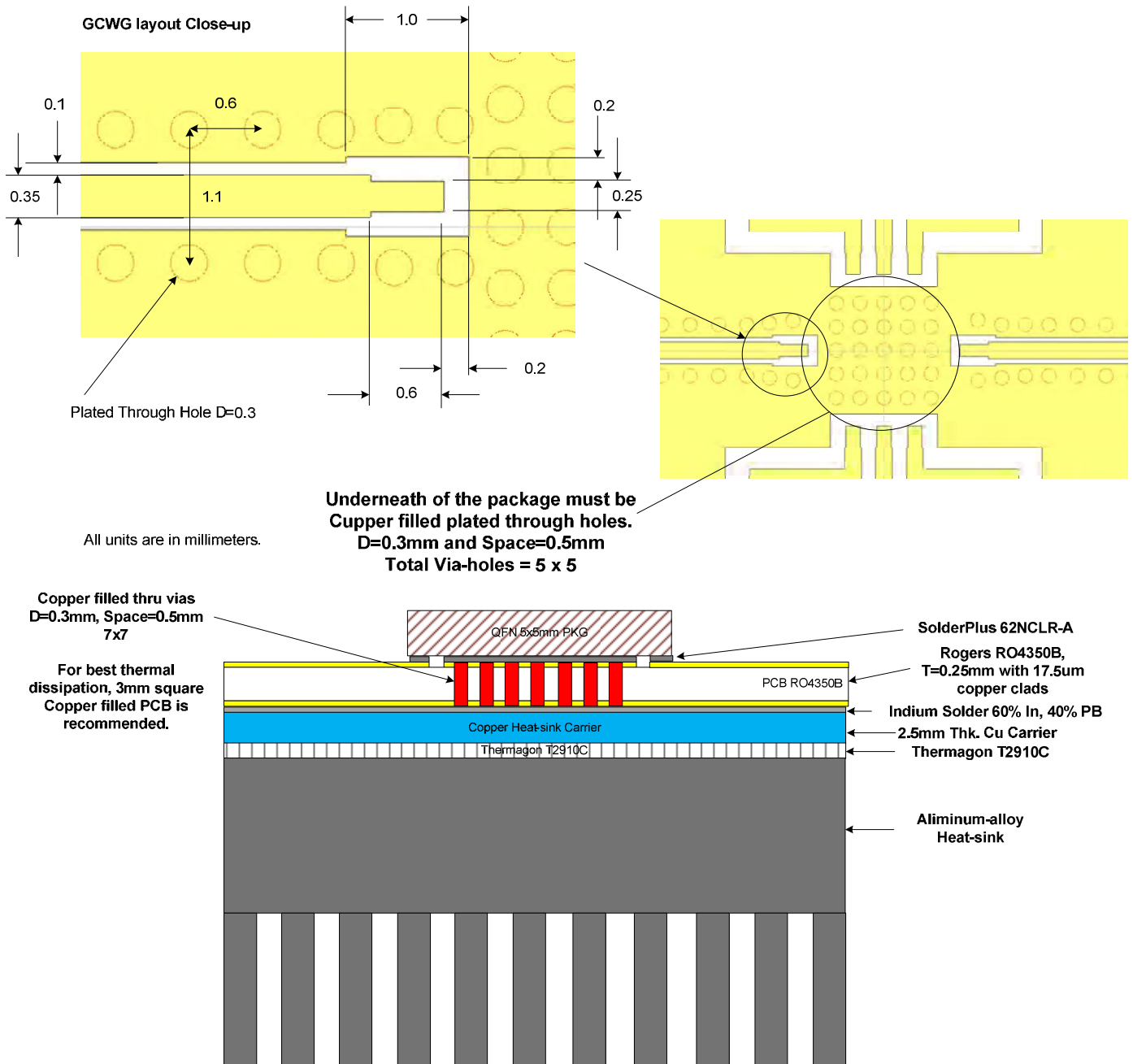
Part	Value	Description
C1, C3	1 μ F	0603
C2, C4, C5, C6	0.1 μ F	0402
C7, C8	100 pF	Presidio LSB1515B101M2H5R-B
L1	1 μ H	GOWANDA C100FL3944G6

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Recommended Application Board Design:

Board Material is 10 mil (Dielectric) thickness Rogers 4350B 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. An electronic drawing of the land pattern is available from CML Micro, upon request.



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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Contact details can be found at www.cmlmicro.com.

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