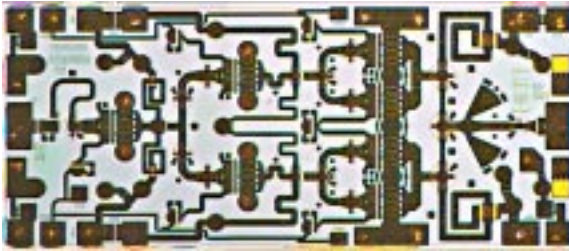


27 - 31 GHz 1W Power Amplifier

TGA4509-EPU



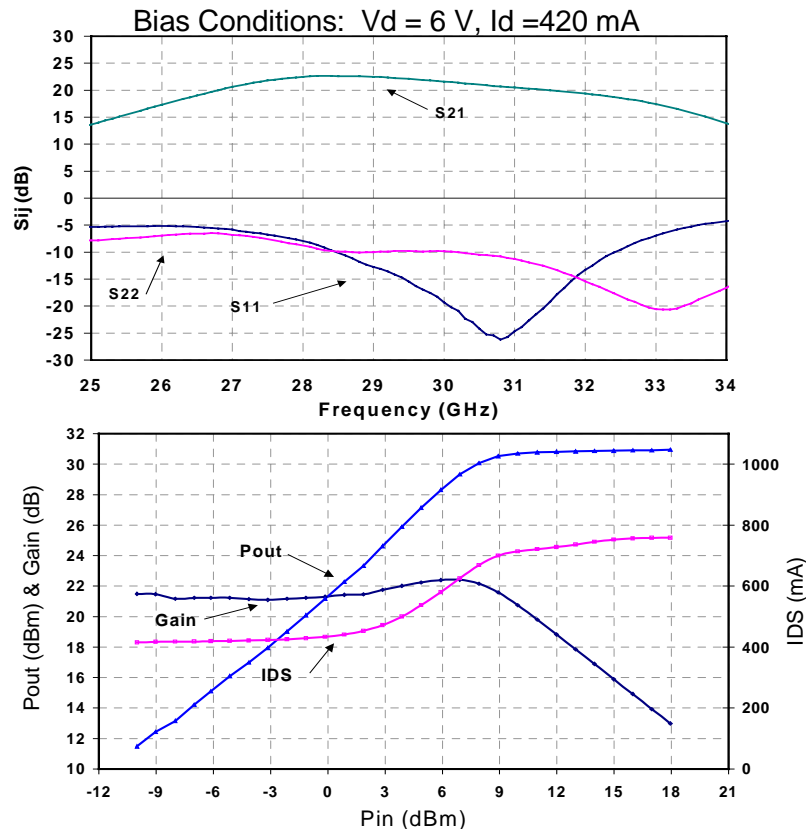
Key Features

- 22 dB Nominal Gain @ 30 GHz
- 30 dBm Nominal Pout @ P1dB
- 25% PAE @ P1dB
- -10 dB Nominal Return Loss
- Built-in Power Detector
- 0.25- μ m mmW pHEMT 3MI
- Bias Conditions: $V_d = 4 - 6$ V, $I_{dq} = 420$ mA
- Chip Dimensions 2.44 mm x 1.15 mm x 0.1 mm (0.096 x 0.045 x 0.004 in)

Primary Applications

- Point to Point Radio
- Point to Multi-point Radio
- LMDS
- Satellite Ground Terminal

Fixtured Measured Performance



Data taken
@ 30 GHz

Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

TABLE I
MAXIMUM RATINGS 1/

Symbol	Parameter	Value	Notes
V ⁺	Positive Supply Voltage	7 V	
V ⁻	Negative Supply Voltage Range	-5 V to 0 V	
I _g	Gate Current	35.2 mA	
I ⁺	Positive Supply Current	930 mA	<u>2/</u> , <u>5/</u>
P _D	Power Dissipation	TBD	
P _{IN}	Input Continuous Wave Power	22 dBm	
T _{CH}	Operating Channel Temperature	150 °C	<u>3/</u> , <u>4/</u>
T _M	Mounting Temperature (30 seconds)	320 °C	
T _{STG}	Storage Temperature	-65 °C to 150 °C	

- 1/ These values represent the maximum operable values of this device
2/ Total current for the entire MMIC
3/ These ratings apply to each individual FET
4/ Junction operating temperature will directly affect the device mean time to failure (MTTF). For maximum life it is recommended that junction temperatures be maintained at the lowest possible levels.
5/ The maximum supply current from one side is 650 mA. From both sides, the maximum supply current is 930 mA.

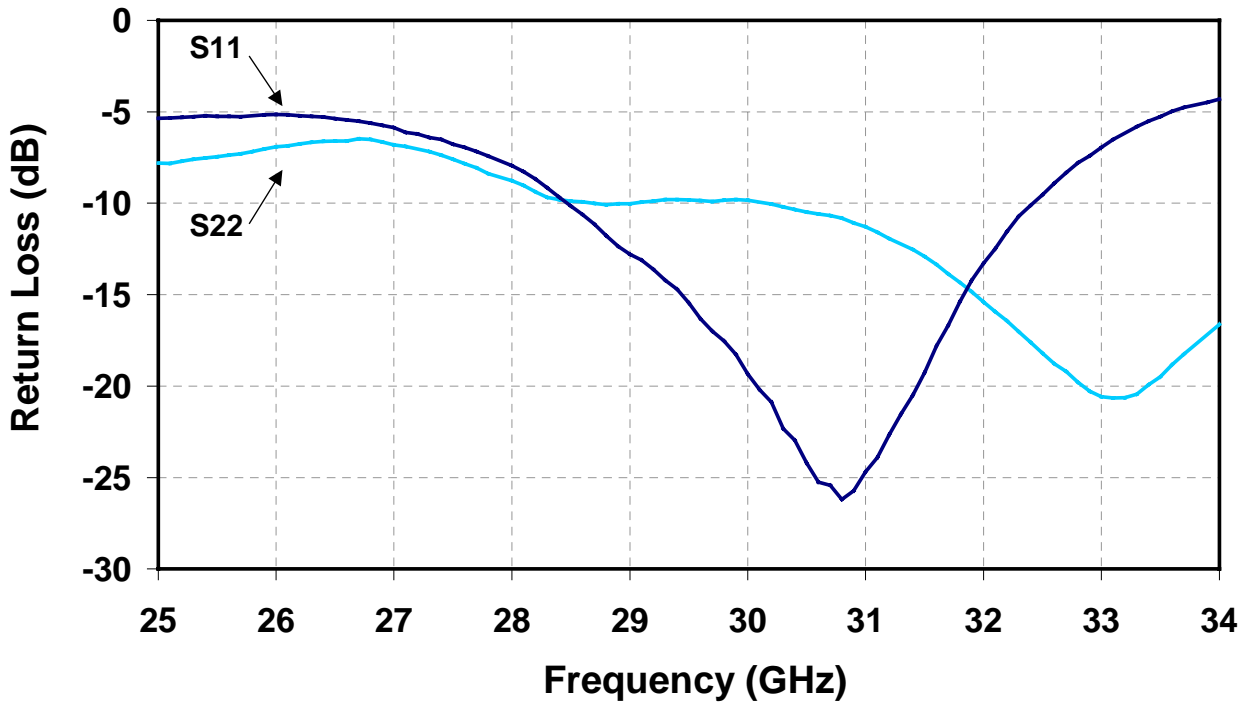
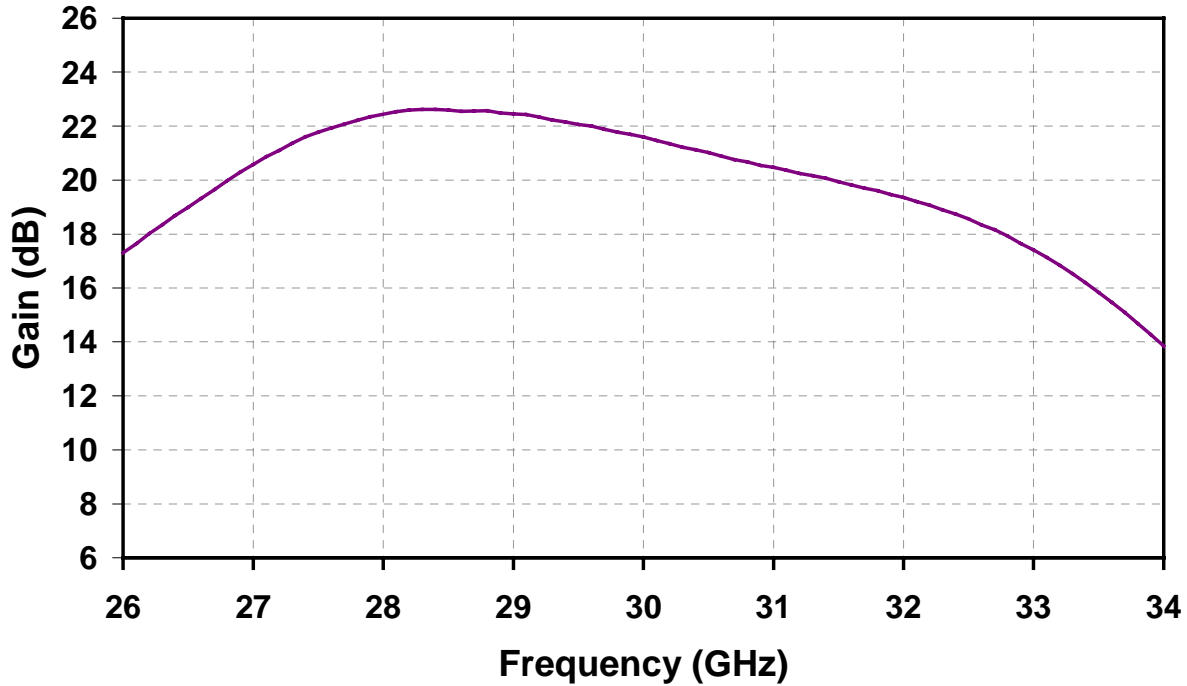
TABLE II
ELECTRICAL CHARACTERISTICS
(T_A = 25°C, Nominal)

Parameter	Units	Typical
Drain Operating Voltage	V	6
Quiescent Current	mA	420
Small Signal Gain @ 30 GHz	dB	22
Gain Flatness	dB/50MHz	0.0660
Input Return Loss (Linear Small Signal)	dB	-10
Output Return Loss (Linear Small Signal)	dB	-10
Reverse Isolation	dB	-40
CW Output Power @ P1dB	dBm	30
Power Added Efficiency @ P1dB	%	25
P1dB temperature coeff. TC (-40 to +85 °C)	dB/deg C	0.0135

Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

Measured Fixtured Data

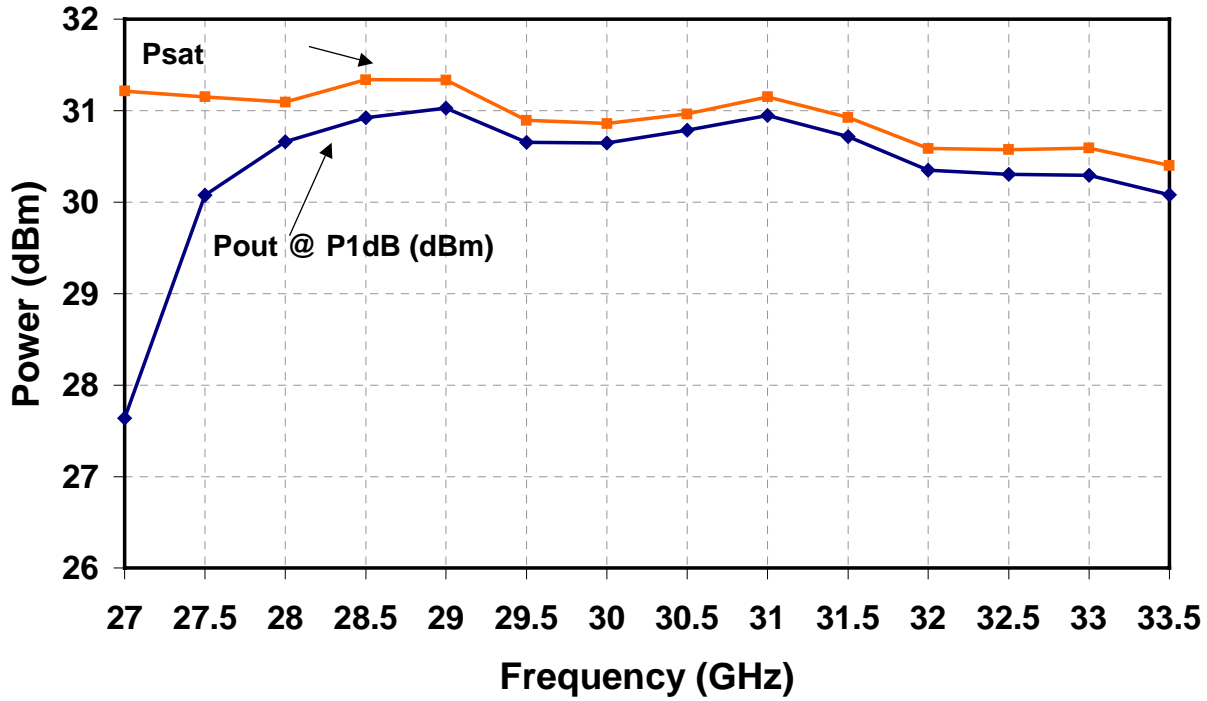
Bias Conditions: $V_d = 6\text{ V}$, $I_d = 420\text{ mA}$



Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

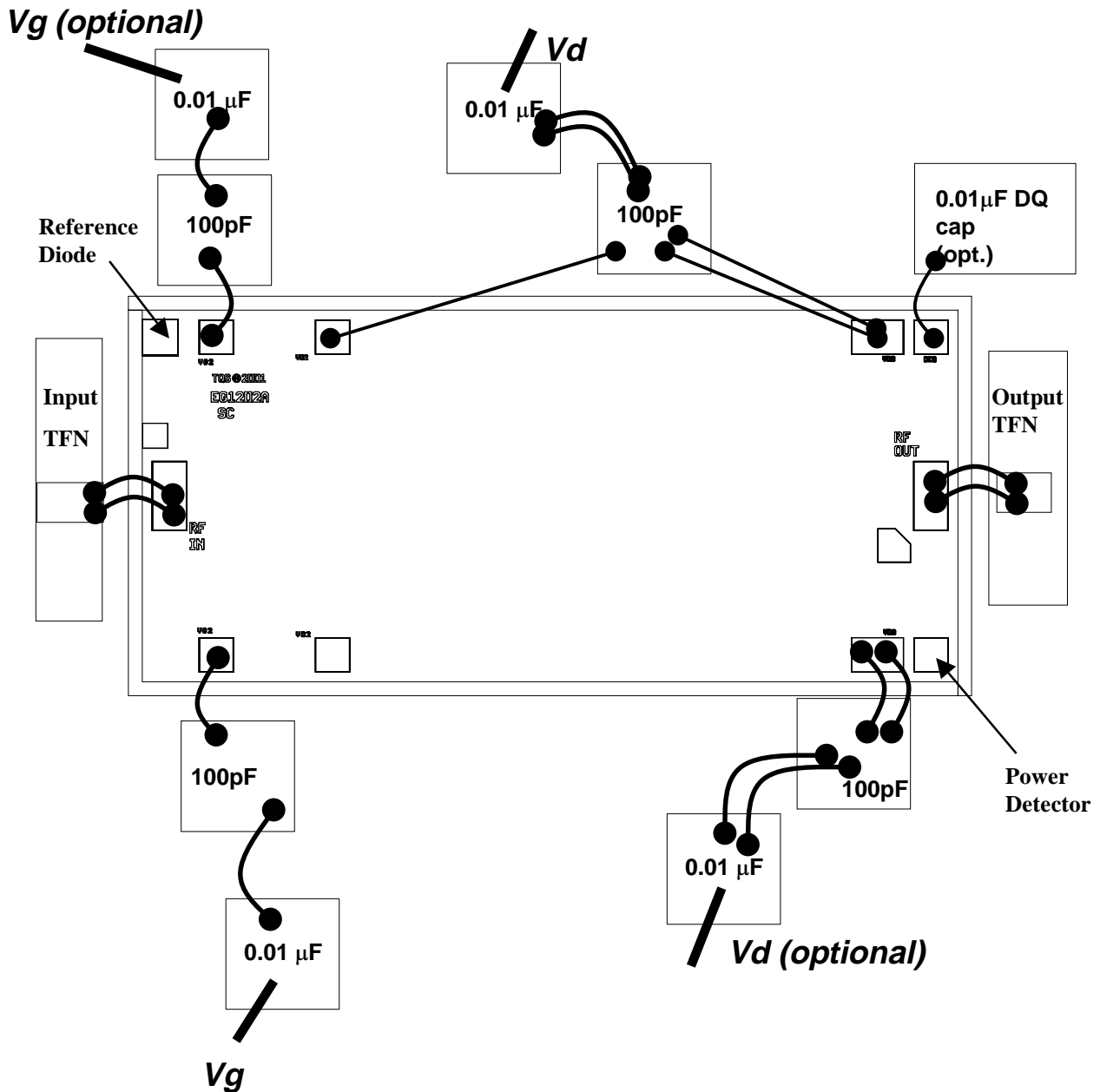
Measured Fixtured Data

Bias Conditions: $V_d = 6\text{ V}$, $I_d = 420\text{ mA}$



Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

Recommended Assembly Diagram



Notes:

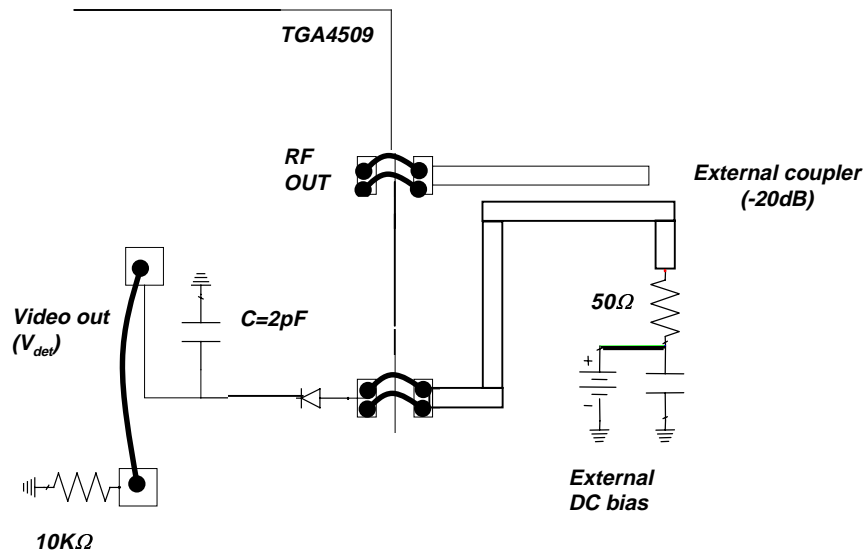
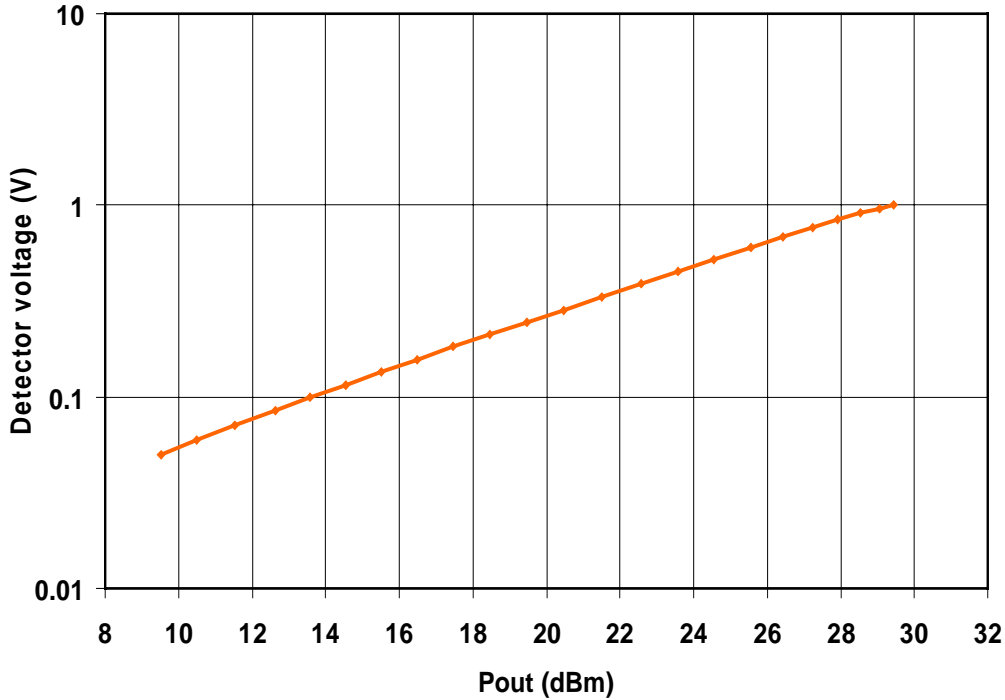
1. Connection to power det, ref diode shown.
2. 1 μF cap on gate & drain power supplies are lines required.
3. Gate voltage can either be from one side or both sides.
4. Drain voltage is required from both sides for $I_d > 650 \text{ mA}$.

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

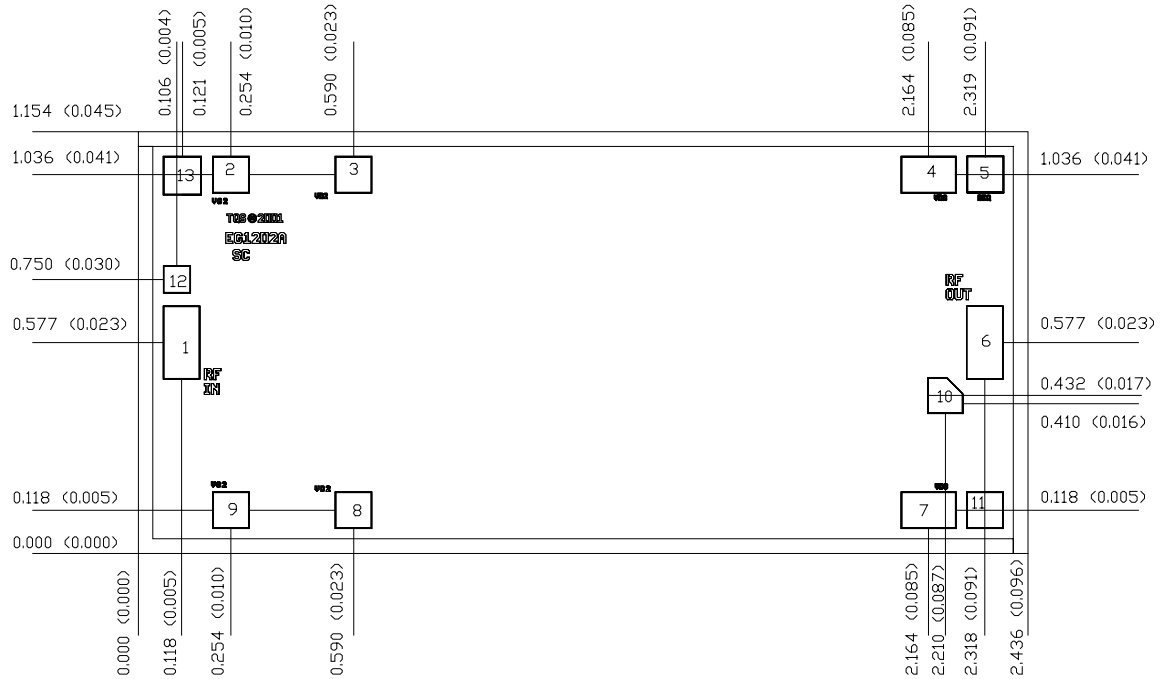
On-chip diode functions as envelope detector
External coupler and DC bias required

TGA4509 measured detector voltage offset vs output power with 20dB coupler: $V_b=0.8V$, $f = 30GHz$, Coupler loss is uncalibrated, $10K\Omega$ load



Note: Devices designated as EPU are typically early in their characterization process prior to finalizing all electrical and process specifications. Specifications are subject to change without notice.

Mechanical Drawing



Units: millimeters (inches)

Thickness: 0.100 (0.004)

Chip edge to bond pad dimensions are shown to center of bond pad

Chip size tolerance: +/- 0.051 (0.002)

GND IS BACKSIDE OF MMIC

Bond Pad #1 (RF Input)	0.098 x 0.198 (0.004 x 0.008)
Bond Pad #2 (VG1)	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #3 (VD1)	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #4 (VD1)	0.148 x 0.098 (0.006 x 0.004)
Bond Pad #5 (DEQ)	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #6 (RF Output)	0.098 x 0.198 (0.004 x 0.008)
Bond Pad #7 (VD2)	0.148 x 0.098 (0.006 x 0.004)
Bond Pad #8 (VD2) Optional	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #9 (VG2) Optional	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #10 (PWR DET)	0.095 x 0.096 (0.004 x 0.004)
Bond Pad #11 (PWR DET)	0.098 x 0.098 (0.004 x 0.004)
Bond Pad #12 (REF Diode)	0.071 x 0.071 (0.003 x 0.003)
Bond Pad #13 (REF Diode)	0.102 x 0.102 (0.004 x 0.004)

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Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300 °C for 30 sec.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- No fluxes should be utilized.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.
- Microwave or radiant curing should not be used because of differential heating.
- Coefficient of thermal expansion matching is critical.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Discrete FET devices with small pad sizes should be bonded with 0.0007-inch wire.
- Maximum stage temperature is 200 °C.

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.