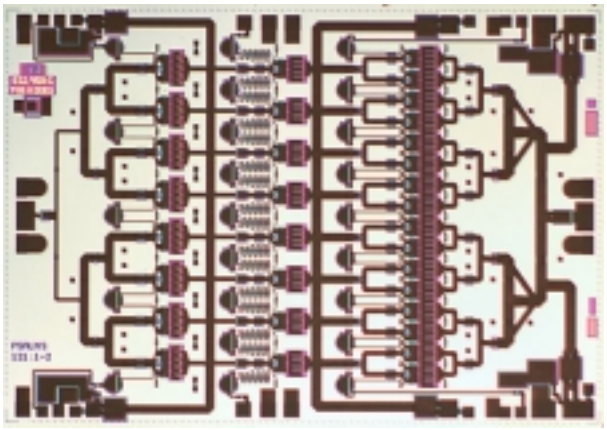
TriQuint SEMICONDUCTOR

Advanced Product Information
December 14, 2001
TGA4501-EPU

28-31 GHz Ka Band HPA



Chip Dimensions 4.290 mm x 3.019 mm

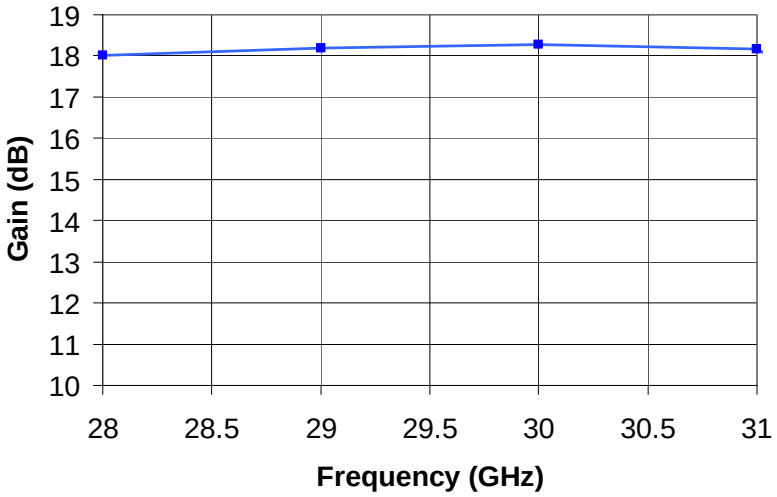
Key Features

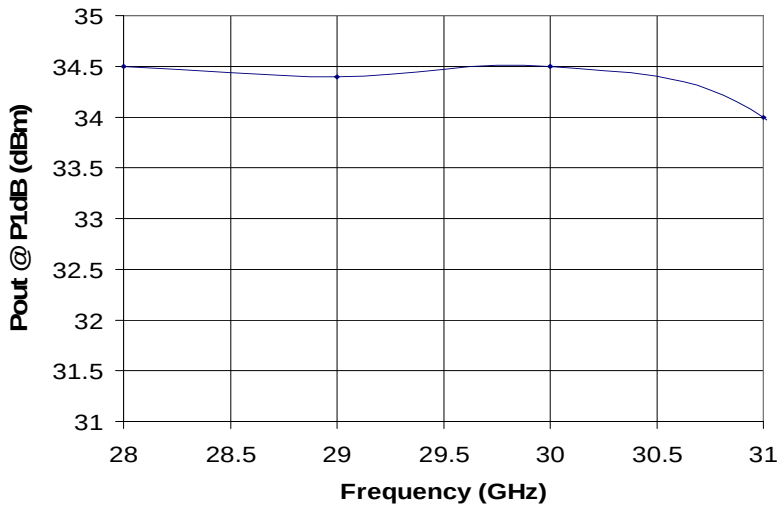
- 0.25 um pHEMT Technology
- 18 dB Nominal Gain
- 34.5 dBm Nominal P1dB
- 40 dBm OTOI Typical
- Bias 6 V @ 2.1 A

Primary Applications

- Satellite Ground Terminal
- Point-to-Point Radio

Bias Conditions: Vd = 6 V, Id = 2..1 A





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

Symbol	Parameter 5/	Value	Notes
V^+	Positive Supply Voltage	8 V	4/
V^-	Negative Supply Voltage Range	-5V TO 0V	
I^+	Positive Supply Current (Quiescent)	3.0 A	4/
$\| I_G \|$	Gate Supply Current	62 mA	
P_{IN}	Input Continuous Wave Power	24 dBm	
P_D	Power Dissipation	18.4 W	3/ 4/
T_{CH}	Operating Channel Temperature	150 ^{0}C	1/ 2/
T_M	Mounting Temperature (30 Seconds)	320 ^{0}C	
T_{STG}	Storage Temperature	-65 to 150 ^{0}C	

1/ These ratings apply to each individual FET.

2/ Junction operating temperature will directly affect the device median time to failure (T_M). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

3/ When operated at this bias condition with a base plate temperature of 70 ^{0}C, the median life is reduced from 7.4 E+6 to 4.6 E+5 hours.

4/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.

5/ These ratings represent the maximum operable values for this device.

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TABLE II
DC PROBE TEST
(TA = 25 °C ± 5 °C)

Symbol	Parameter	Minimum	Maximum	Unit
Idss $_{(Q35)*}$	Saturated Drain Current	15	70.5	mA
$Gm_{(Q35)*}$	Transconductance	33	79.5	mS
V_P	Pinch-off Voltage	-1.5	-0.5	V
$BVGS_{(Q35)*}$	Breakdown Voltage Gate-Source	-30	-11	V
$BVGD_{(Q35)*}$	Breakdown Voltage Gate-Drain	-30	-11	V

* Q35 is a 150 um Test FET

TABLE III
AUTOPROBE FET PARAMETER MEASUREMENT CONDITIONS

FET Parameters	Test Conditions
I_{DSS} : Maximum drain current (I_{DS}) with gate voltage (V_{GS}) at zero volts.	V_{GS} = 0.0 V, drain voltage (V_{DS}) is swept from 0.5 V up to a maximum of 3.5 V in search of the maximum value of I_{DS}; voltage for I_{DSS} is recorded as VDSP.
G_m : Transconductance; $\frac{(I_{DSS} - IDS1)}{VG1}$	For all material types, V_{DS} is swept between 0.5 V and VDSP in search of the maximum value of I_{ds}. This maximum I_{DS} is recorded as IDS1. For Intermediate and Power material, IDS1 is measured at V_{GS} = VG1 = -0.5 V. For Low Noise, HFET and pHEMT material, V_{GS} = VG1 = -0.25 V. For LNBECOLC, use V_{GS} = VG1 = -0.10 V.
V_P : Pinch-Off Voltage; V_{GS} for I_{DS} = 0.5 mA/mm of gate width.	V_{DS} fixed at 2.0 V, V_{GS} is swept to bring I_{DS} to 0.5 mA/mm.
V_{BVGD} : Breakdown Voltage, Gate-to-Drain; gate-to-drain breakdown current (I_{BD}) = 1.0 mA/mm of gate width.	Drain fixed at ground, source not connected (floating), 1.0 mA/mm forced into gate, gate-to-drain voltage (V_{GD}) measured is V_{BVGD} and recorded as BVGD; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.
V_{BVGS} : Breakdown Voltage, Gate-to-Source; gate-to-source breakdown current (I_{BS}) = 1.0 mA/mm of gate width.	Source fixed at ground, drain not connected (floating), 1.0 mA/mm forced into gate, gate-to-source voltage (V_{GS}) measured is V_{BVGS} and recorded as BVGS; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.

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TABLE IV
RF WAFER CHARACTERIZATION TEST
(T_A = 25°C ± 5°C)
(Vd = 6V, Id = 2.048A ±5%)

Parameter	Unit	Min	Typical	Max
Frequency	GHz	28		31
Output P1dB	dBm	33.5	34.5	
Small Signal Gain	dB	16	18	
Input Return Loss	dB		-6	
Output Return Loss	dB		-6	
Output TOI	dBm		40	

TABLE V
THERMAL INFORMATION*

Parameter	Test Conditions	T_{CH} (°C)	$R_{\theta JC}$ (°C/W)	T_M (HRS)
$R_{\theta JC}$ Thermal Resistance (channel to backside of carrier)	Vd = 6V I_D = 2.048 A Pdiss = 12.288 W	127.65	4.69	7.4E+6

Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

* This information is a result of a thermal model analysis.

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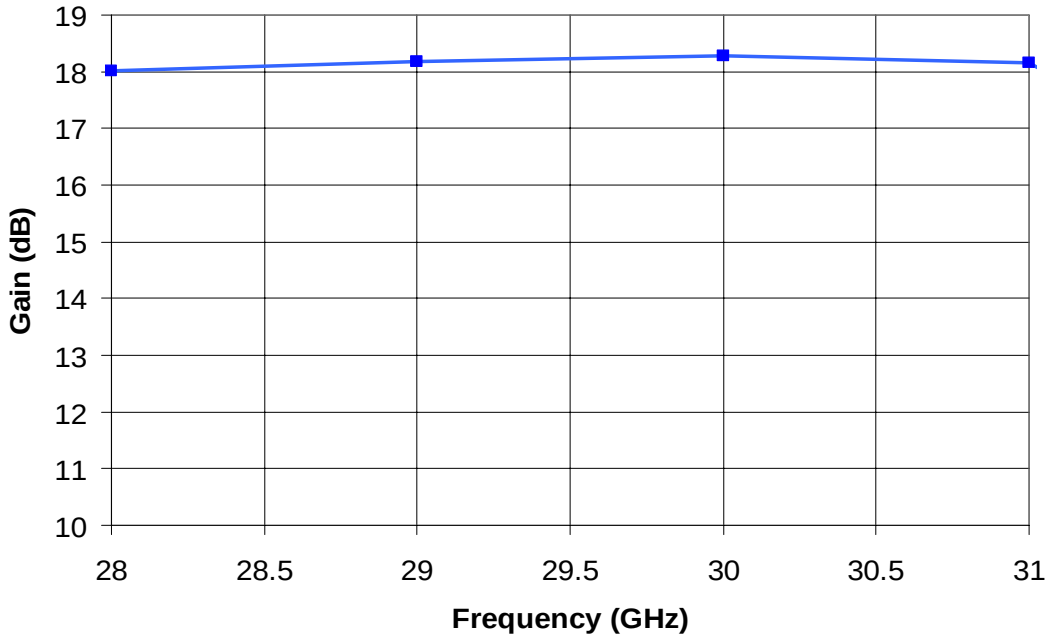
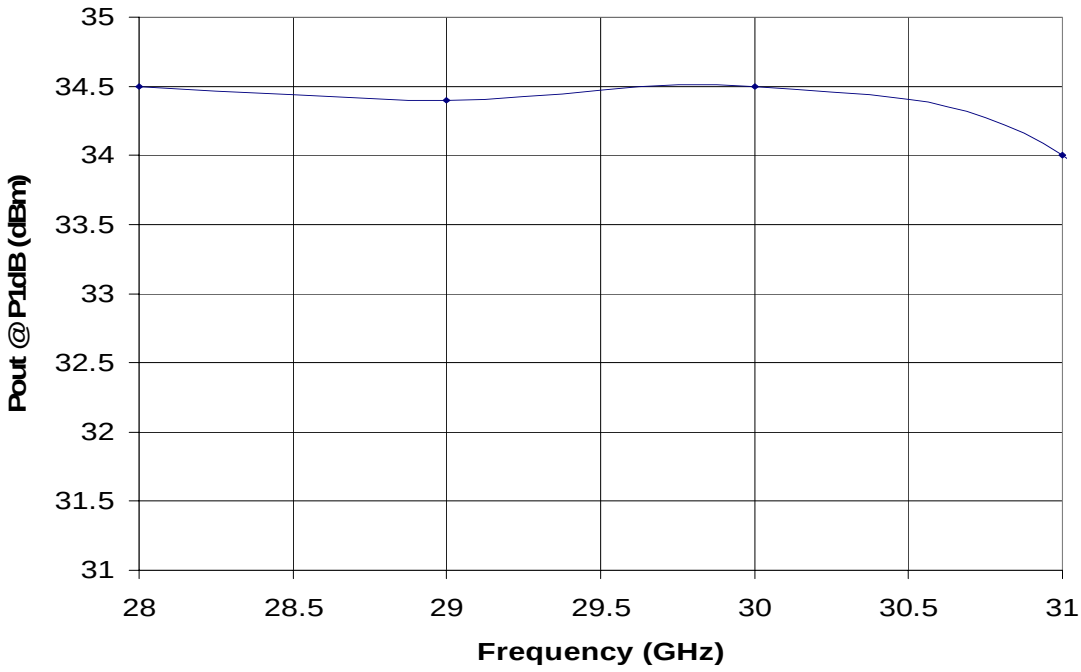
Preliminary Measured Data

Bias Conditions: Vd = 6 V, Id = 2.1 A





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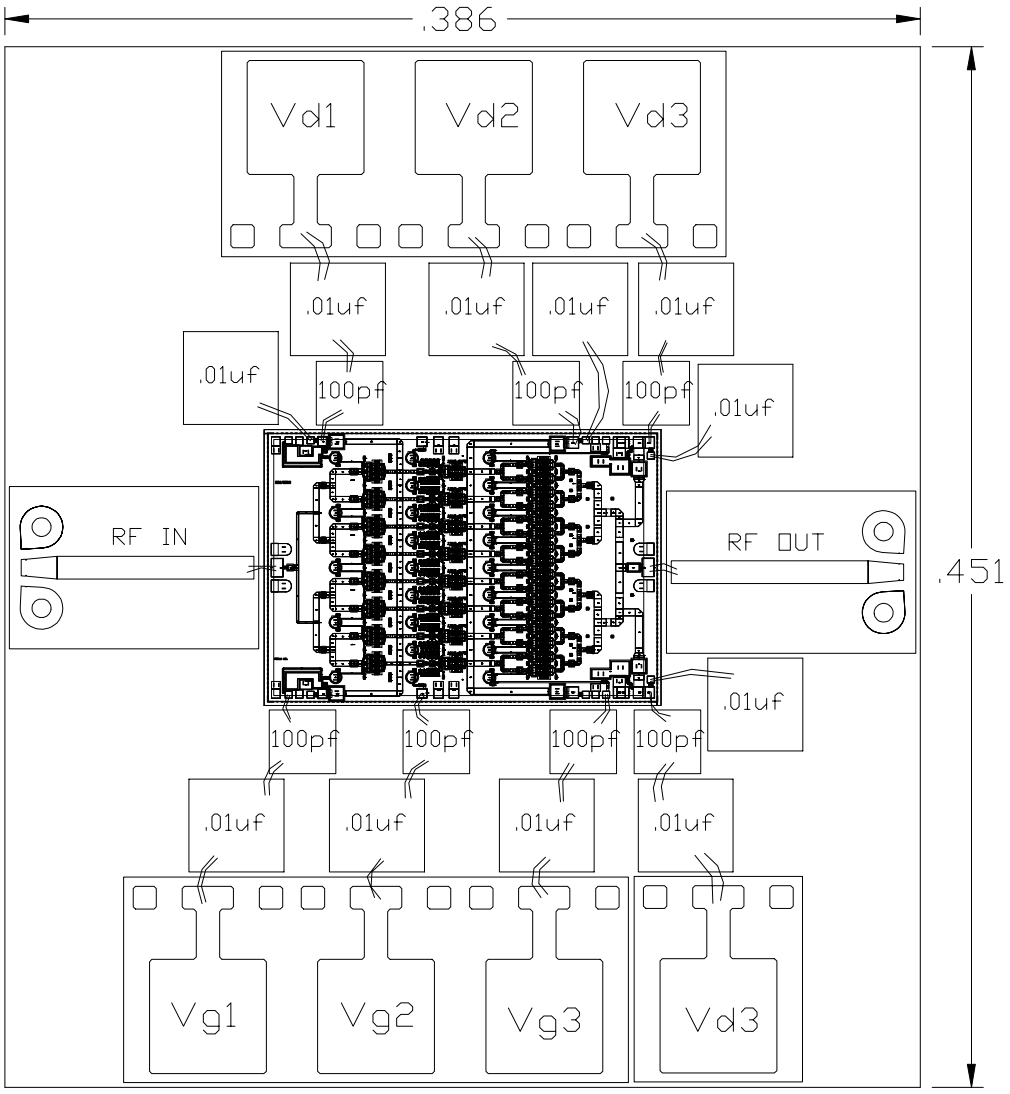
Chip Assembly & Bonding Diagram



Note: Please refer to page 8 for a magnified view of the chip assembly and bonding diagram

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

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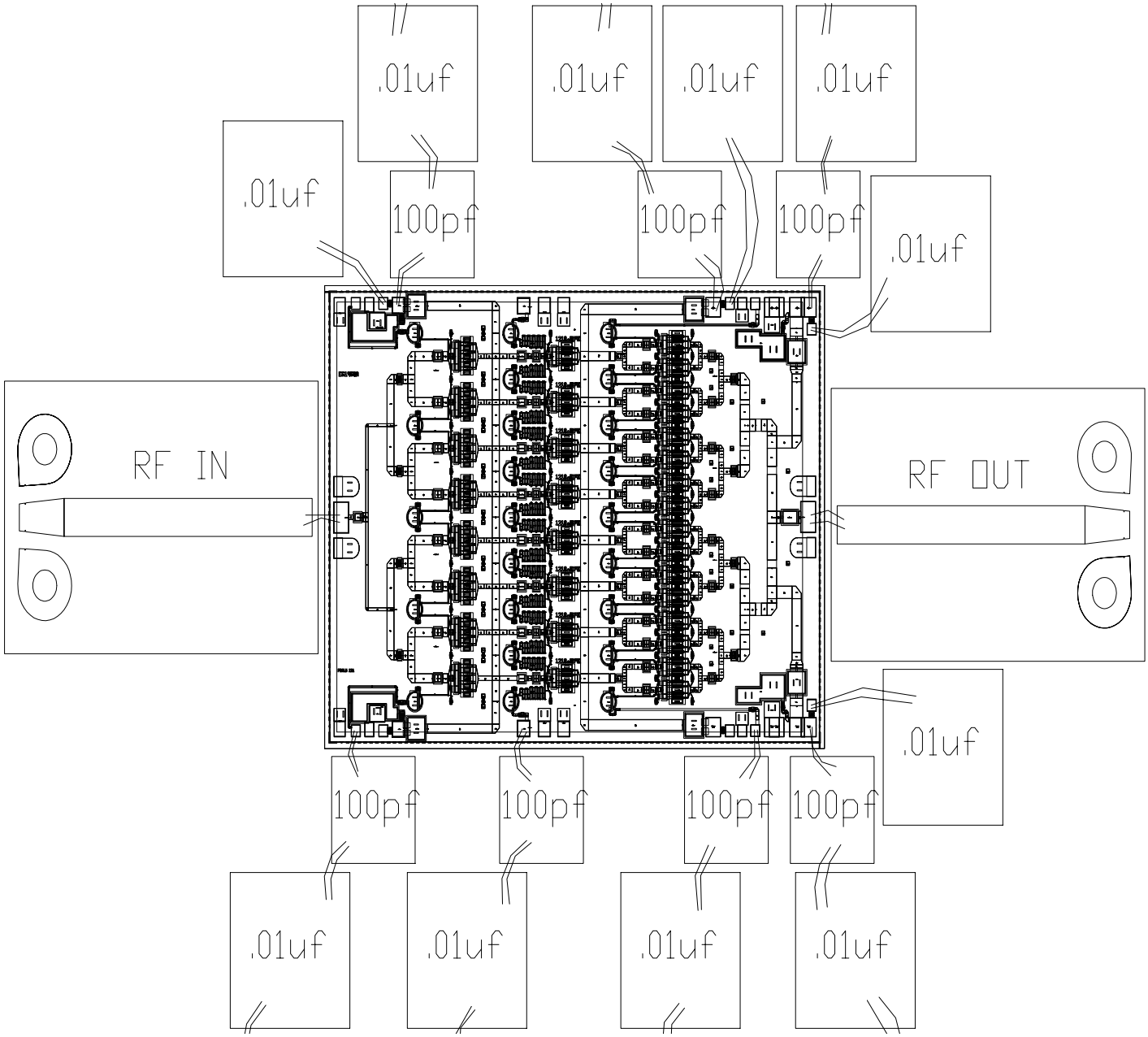
Chip Assembly and Bonding Diagram



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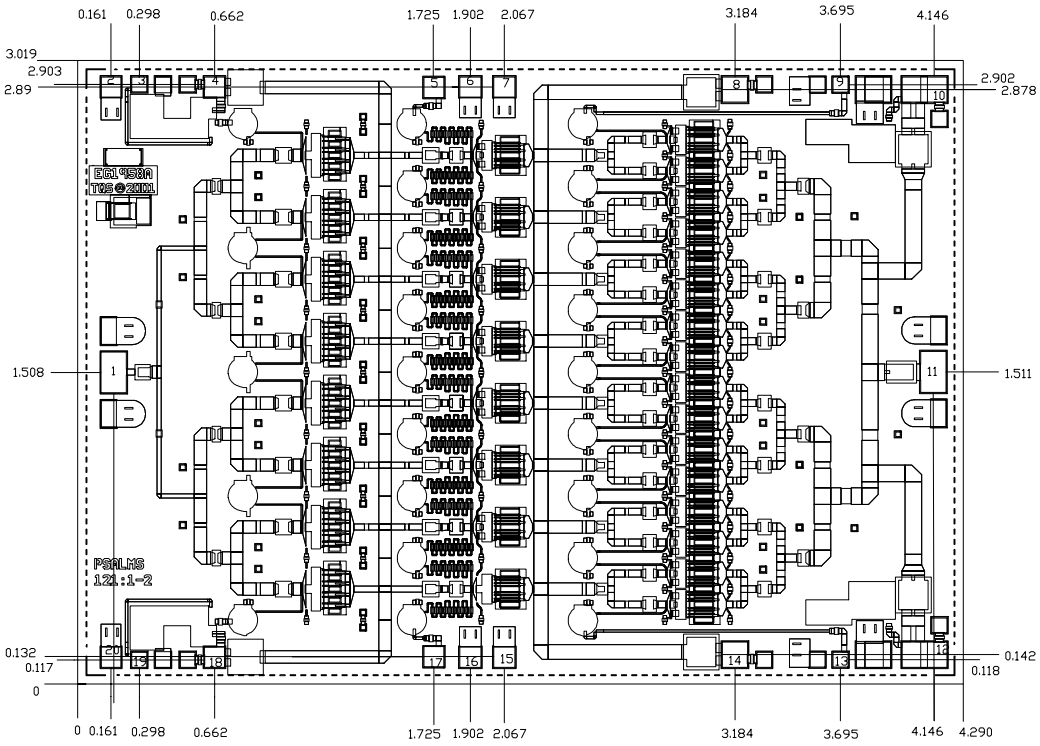
Mechanical Drawing



Units: Millimeters (inches)
Thickness: 0.0508 (0.002) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size +/- 0.0508 (0.002)

Bond pad #1	(RF Input):	0.130 x 0.205 (0.0051 x 0.0081)
Bond pad #11	(RF Output)	0.130 x 0.205 (0.0051 x 0.0081)
Bond pad #2, 20	(GND)	0.102 x 0.105 (0.004 x 0.0041)
Bond pad #3, 19	(VG1)	0.085 x 0.085 (0.0033 x 0.0033)
Bond pad #4, 18	(VD1)	0.105 x 0.105 (0.0041 x 0.0042)
Bond pad #5, 17	(VG2)	0.110 x 0.110 (0.0043 x 0.0043
Bond pad #6, 7, 15, 16	(GND)	0.110 x 0.105 (0.0043 x 0.0042)
Bond pad #8, 14	(VD2)	0.130 x 0.130 (0.0051 x 0.0051)
Bond pad #9, 13	(VG3)	0.085 x 0.085 (0.0033 x 0.0033)
Bond pad #10, 12	(VD3)	0.130 x 0.130 (0.0051 x 0.0051)

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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.
- 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.

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