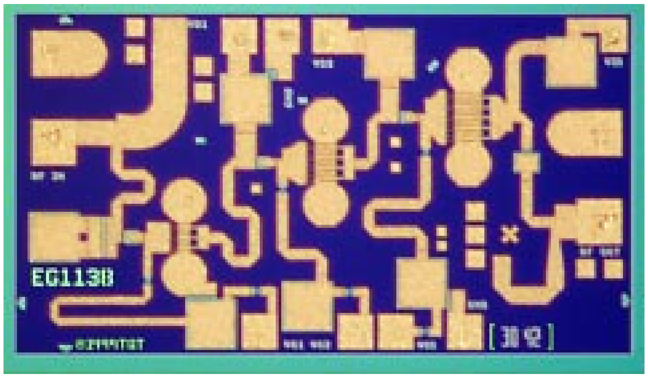
26 - 35 GHz Medium Power Amplifier TGA1073A-SCC



Key Features and Performance

- 19 dB Nominal Gain
- 25 dBm Nominal Pout @ P1dB
- -34.5 dBc IMR3 @ 15.5 dBm SCL
- Bias 5 - 7 V @ 220 mA
- 0.25-µm mmW pHEMT 2MI Technology
- Chip Dimensions 1.9 mm x 1.1 mm x 0.1 mm

Primary Applications

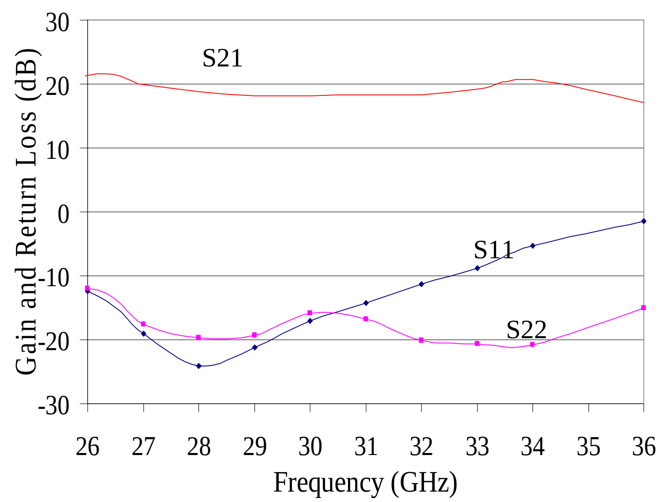
- Point-to-Point Radio
- Point-to-Multipoint Communications
- LMDS CPE PA

The TriQuint TGA1073A-SCC is a three stage MPA MMIC design using TriQuint's proven 0.25-µm mmW pHEMT 2MI process. The TGA1073A is designed to support a variety of millimeter wave applications including point-to-point digital radio and LMDS/LMCS.

The three stage design consists of a 200 µm input device driving a 480 µm interstage device followed by an 800 µm output device.

The TGA1073A provides 25 dBm nominal output power at 1dB compression across 26-35 GHz. Typical small signal gain is 19 dB.

The TGA1073A requires minimum off-chip components. Each device is 100% DC and RF tested on-wafer to ensure performance compliance. The device is available in chip form.



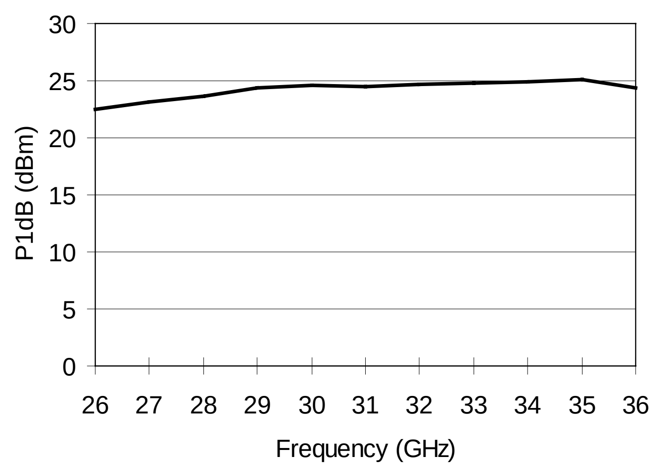


TABLE 1
MAXIMUM RATINGS 1/

SYMBOL	PARAMETER	VALUE	NOTES
V^+	POSITIVE SUPPLY VOLTAGE	8 V	6/
I^+	POSITIVE SUPPLY CURRENT	296 mA	2/, 6/
I^-	NEGATIVE SUPPLY CURRENT	8.8 mA	
P_{IN}	INPUT CONTINUOUS WAVE POWER	23 dBm	6/
P_D	POWER DISSIPATION	2.66 W	5/, 6/
T_{CH}	OPERATING CHANNEL TEMPERATURE	150 ^{0}C	3/, 4/
T_M	MOUNTING TEMPERATURE (30 SECONDS)	320 ^{0}C	
T_{STG}	STORAGE TEMPERATURE	-65 to 150 ^{0}C	

1/ These ratings represent the maximum operable values for the device.

2/ Total current for all stages.

3/ These ratings apply to each individual FET.

4/ 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.

5/ When operated at this bias condition with a base plate temperature of 55 ^{0}C, the median life is reduced from 1.3E+6 to 4.7E+2 hours.

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

TABLE II
DC SPECIFICATIONS
(T_A = 25 °C , Nominal)

NOTES	SYMBOL	LIMITS		UNITS
		MIN	MAX	
	I_{MAX3}	300	516	mA
	I_{DSS3}	80	376	mA
	G_{M3}	176	424	mS
1/	$\|V_{P1}\|$	0.5	1.5	V
1/	$\|V_{P2}\|$	0.5	1.5	V
1/	$\|V_{P3}\|$	0.5	1.5	V
1/	$\|V_{BVGD1}\|$	11	30	V
1/	$\|V_{BVGS1}\|$	11	30	V

1/ V_P, V_{BVGD}, and V_{BVGS} are negative.

TABLE III
RF SPECIFICATIONS
(T_A = 25 °C, Nominal)

NOTE	TEST	MEASUREMENT CONDITIONS 6V @ 220mA	VALUE			UNITS
			MIN	TYP	MAX	
1/	SMALL-SIGNAL GAIN MAGNITUDE	26 - 34 GHz	17	19		dB
		35 GHz		19		dB
	POWER OUTPUT AT 1 dB GAIN COMPRESSION	27 GHz	22	24.5		dBm
		>27-33 GHz	23	24.5		dBm
		35 GHz		23		dBm
1/	INPUT RETURN LOSS MAGNITUDE	26 – 35 GHz		-15		dB
		28 – 32 GHz			-10	dB
1/	OUTPUT RETURN LOSS MAGNITUDE	26 – 35 GHz		-15		dB
		28 – 32 GHz			-10	dB
2/	OUTPUT THIRD ORDER INTERCEPT			32		dBm

1/ RF probe data is taken at 1 GHz steps from 26-35 GHz.

2/ Minimum output third-order-intercept (OTOI) is generally 6dB minimum above the 1dB compression point (P1dB). Calculations are based on standard two-tone testing with each tone approximately 10dB below the nominal P1dB. Factors that may affect OTOI performance include device bias, measurement frequency, operating temperature, output interface, and output power level for each tone.

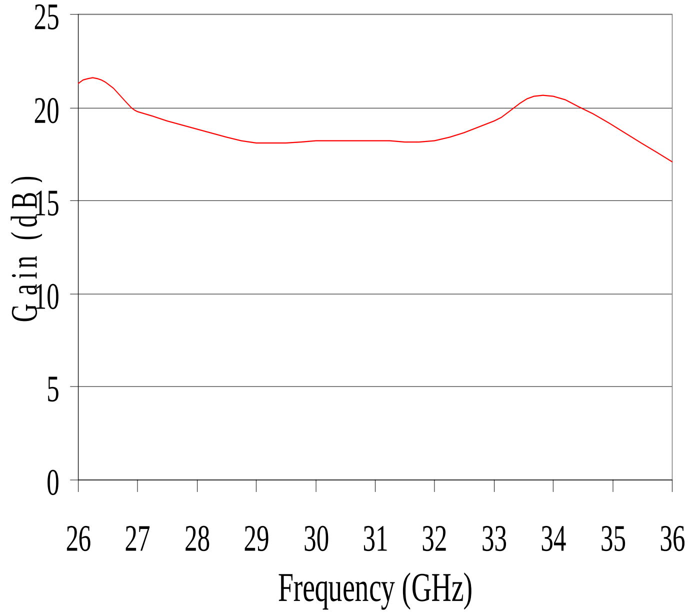
TABLE IV
RELIABILITY DATA

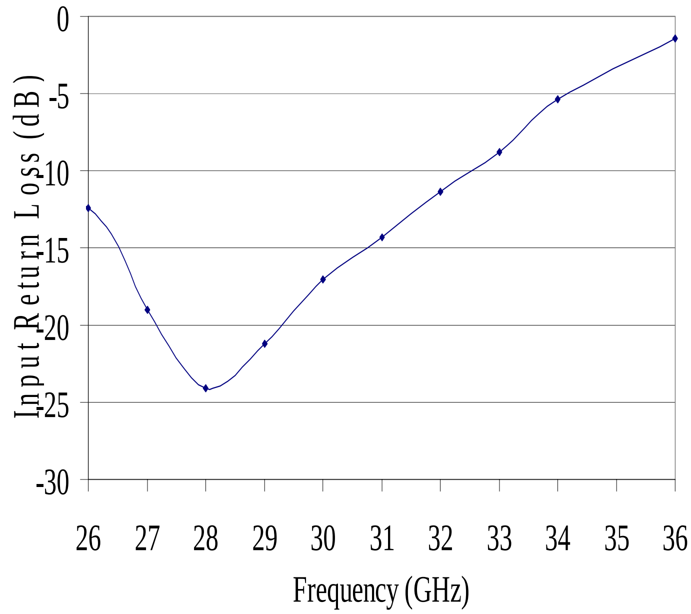
PARAMETER	BIAS CONDITIONS		P_{DISS}	$R_{\theta JC}$	T_{CH}	T_M
	V_D (V)	I_D (mA)	(W)	(C/W)	(°C)	(HRS)
$R_{\theta JC}$ Thermal resistance (channel to backside of c/p)	6	220	1.32	69.4	146.6	1.3E+6

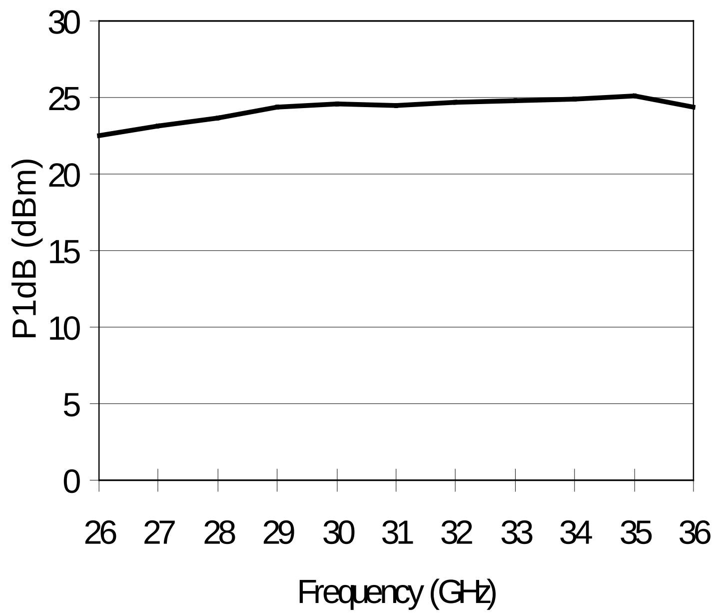
Note: Assumes eutectic attach using 1.5 mil thick 80/20 AuSn mounted to a 20 mil CuMo Carrier at 55°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

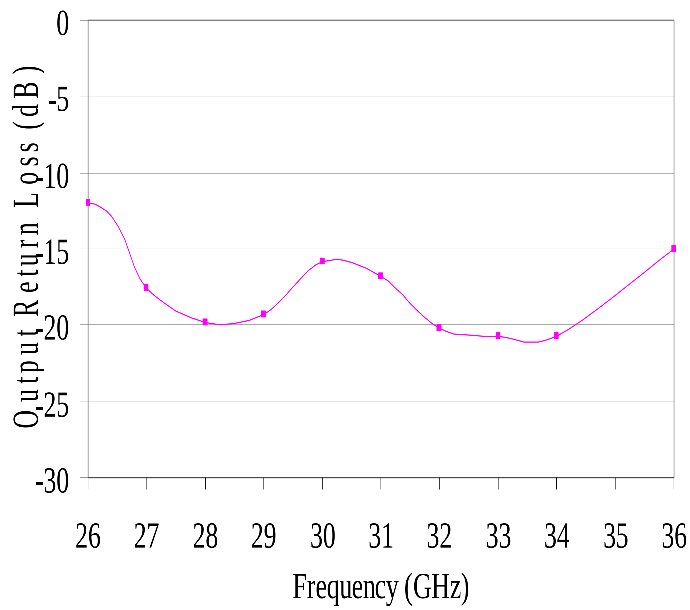
TGA1073A Typical RF-On-Wafer Probe

Vd=6 V, Id=220 mA, 25°C, Nominal

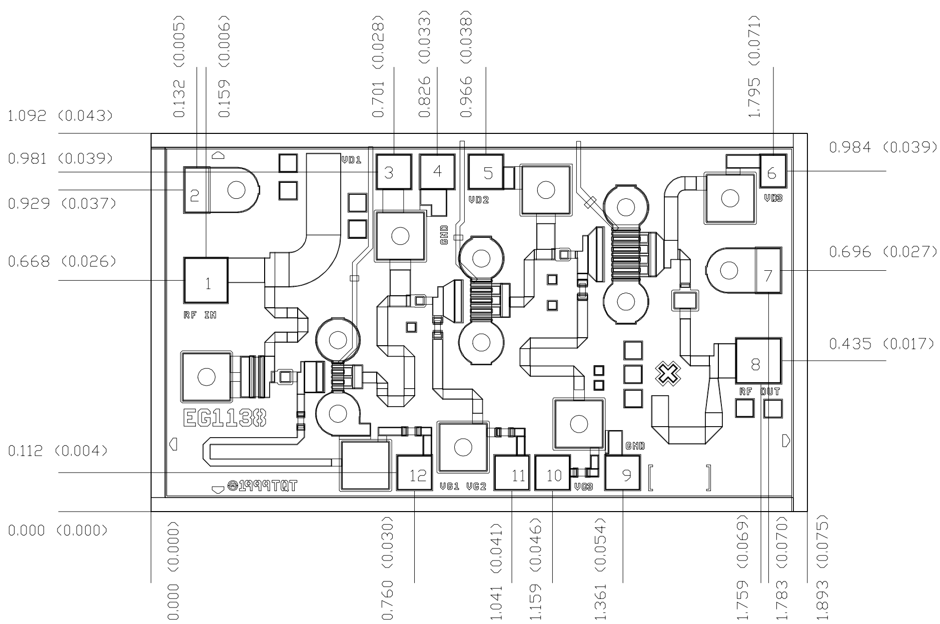








Mechanical Characteristics



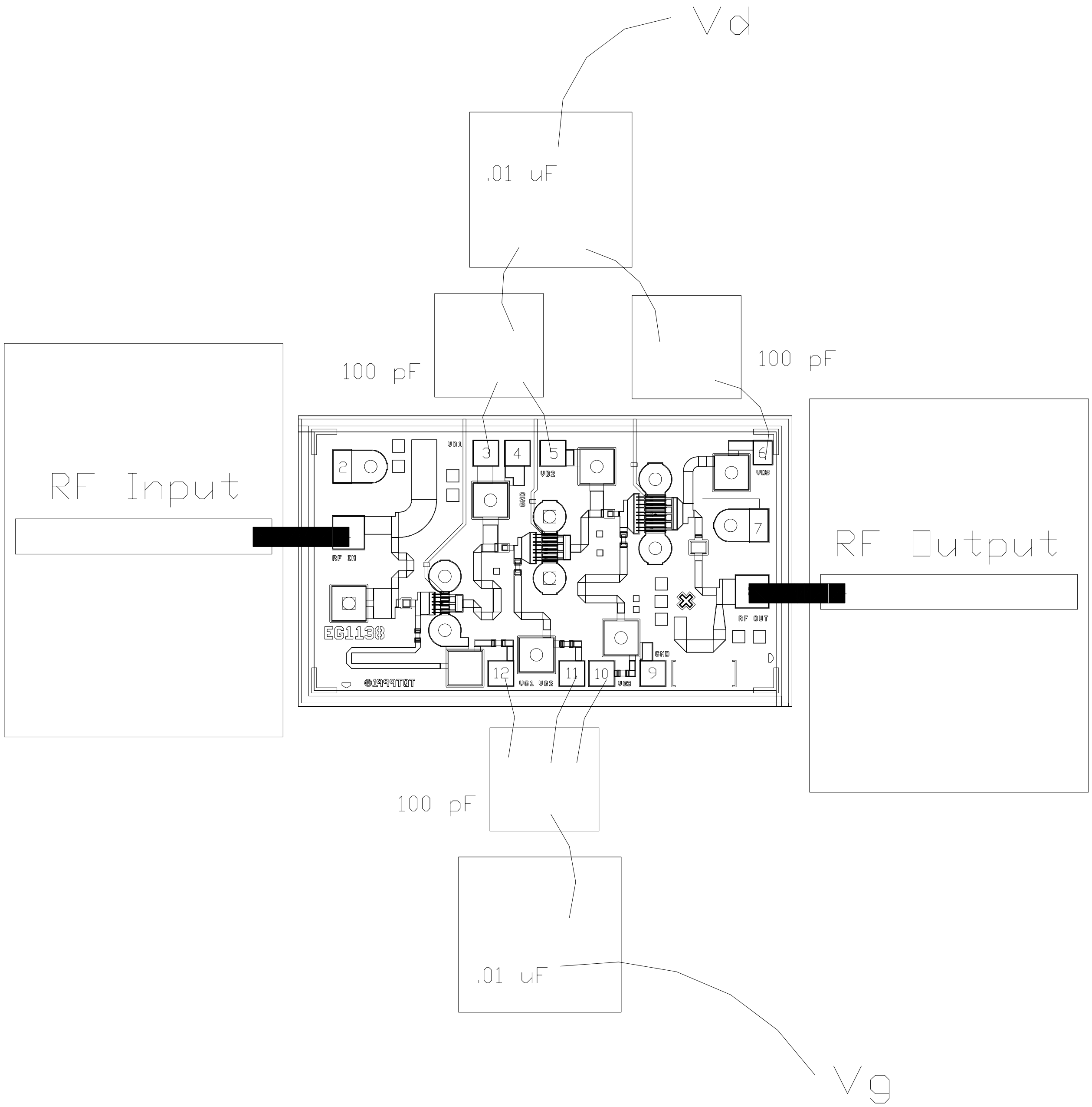
Units: millimeters (inches)
Thickness: 0.1016 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)

RF GND IS BACKSIDE OF MMIC

Bond Pad #1 (RF Input)	0.125 x 0.130 (0.005 x 0.005)
Bond Pad #2 (GND)	0.075 x 0.131 (0.003 x 0.005)
Bond Pad #3 (VD1)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #4 (GND)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #5 (VD2)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #6 (VD3)	0.075 x 0.095 (0.003 x 0.004)
Bond Pad #7 (GND)	0.075 x 0.131 (0.003 x 0.005)
Bond Pad #8 (RF Output)	0.130 x 0.130 (0.005 x 0.005)
Bond Pad #9 (GND)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #10 (VG3)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #11 (VG2)	0.100 x 0.100 (0.004 x 0.004)
Bond Pad #12 (VG3)	0.100 x 0.100 (0.004 x 0.004)

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

Chip Assembly and Bonding Diagram



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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 seconds maximum.
- 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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