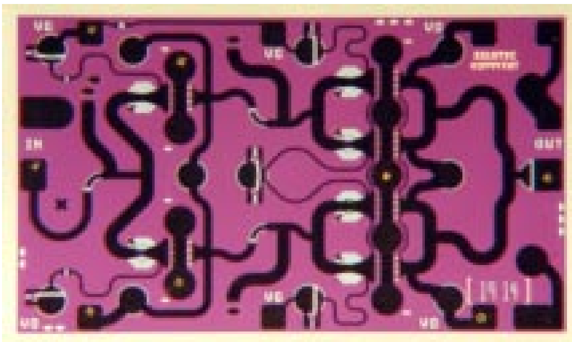
36 - 40 GHz Power Amplifier

TGA1073C-SCC



Key Features and Performance

- 0.25um pHEMT Technology
- 36-40 GHz Frequency Range
- 26 dBm Nominal Pout @ P1dB, 38GHz
- 15 dB Nominal Gain
- Bias 5-7V @ 240 mA
- Chip Dimensions 2.4 mm x 1.45 mm

Primary Applications

- Point-to-Point Radio
- Point-to-Multipoint Radio

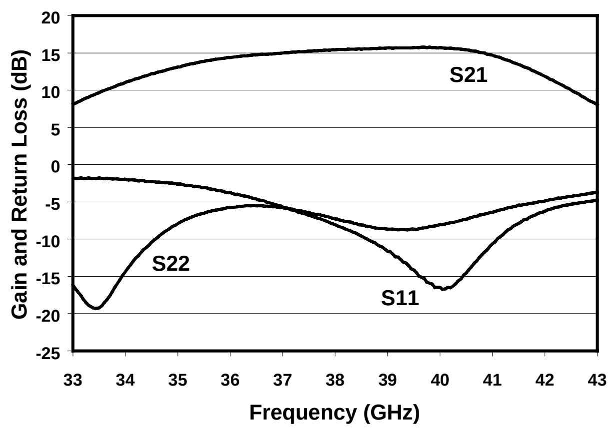
The TriQuint TGA1073C-SCC is a two stage PA MMIC design using TriQuint's proven 0.25 µm Power pHEMT process to support a variety of millimeter wave applications including point-to-point digital radio and point-to-multipoint systems.

The two-stage design consists of two 400 µm input devices driving four 400 µm output devices.

The TGA1073C provides 24 dBm of output power at 1dB gain compression and 26 dBm saturated output power across the 36-40 GHz with a typical small signal gain of 15 dB.

The TGA1073C requires a minimum of off-chip components. Each device is 100% DC and RF tested on-wafer to ensure performance compliance. The device is available in chip form.

TGA1073C Typical RF Performance (Fixtured)



Typical Performance, 36-40 GHz

Parameter	Unit	+5V Supply	+6V Supply	+7V Supply
Small Signal Gain	dB		15	
Gain Flatness	dBpp		1	
Output P1dB	dBm	24	25	26
Saturated Output Power	dBm	26	27	28
Saturated PAE	%	23	22	20
Output OTOI	dBm		34	
IMR3 @ SCL = P1dB - 10dB	dBc		34	
Input Return Loss	dB		-10	
Output Return Loss	dB		-8	
Reverse Isolation	dB		-35	
Quiescent Current	mA	225	240	260

TGA1073C Typical RF Performance (Fixtured)

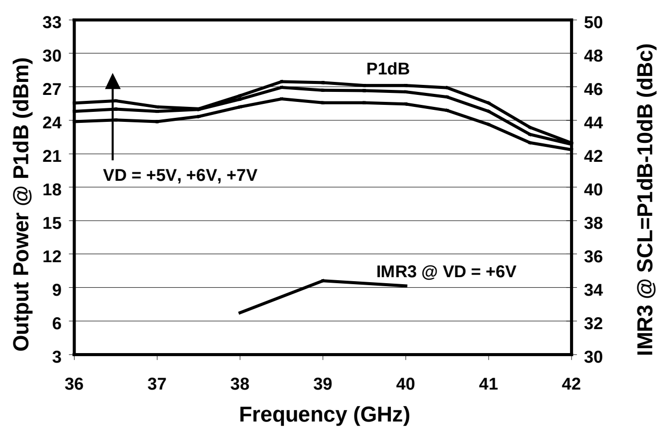


TABLE I

MAXIMUM RATINGS **6**/

SYMBOL	PARAMETER	VALUE	NOTES
V^+	POSITIVE SUPPLY VOLTAGE	8 V	5/
I^+	POSITIVE SUPPLY CURRENT	480 mA	1/, 5/
I^-	NEGATIVE GATE CURRENT	28.16 mA	
P_{IN}	INPUT CONTINUOUS WAVE POWER	21.2 dBm	5/
P_D	POWER DISSIPATION	2.16 W	3/, 5/
T_{CH}	OPERATING CHANNEL TEMPERATURE	150 ^{0}C	2/, 3/, 4/
T_M	MOUNTING TEMPERATURE (30 SECONDS)	320 ^{0}C	
T_{STG}	STORAGE TEMPERATURE	-65 to 150 ^{0}C	

1/ Total current for all stages.

2/ These ratings apply to each individual FET

3/ When operated at this bias condition with a base plate temperature of 70 ^{0}C, the median life is reduced from 2.1 E+7 to 1.9E+6 hours.

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

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

TABLE II

DC SPECIFICATIONS (100%)
(T_A = 25 °C $\pm$ 5 °C)

NOTES	SYMBOL	LIMITS		UNITS
		MIN	MAX	
	I_{DSS1}	40	188	mA
	G_{M1}	88	212	mS
1/	$\lvert V_{P1}\rvert$	0.5	1.5	V
1/	$\lvert V_{P2}\rvert$	0.5	1.5	V
1/	$\lvert V_{P3-6}\rvert$	0.5	1.5	V
1/	$\lvert V_{BVGD1,2}\rvert$	11	30	V
1/	$\lvert V_{BVGS1}\rvert$	11	30	V

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

TABLE III
RF SPECIFICATIONS
(T_A = 25°C ± 5°C)

NOTE	TEST	MEASUREMENT CONDITIONS 6V @ 240mA	VALUE			UNITS
			MIN	TYP	MAX	
1/	SMALL-SIGNAL GAIN MAGNITUDE	36 – 39 GHz	12	15		dB
		40 GHz	9	14		dB
	POWER OUTPUT AT 1 dB GAIN COMPRESSION	37 GHz	23	26		dBm
		38.5 GHz	23	26		dBm
		40 GHz	21	25		dBm
1/	INPUT RETURN LOSS MAGNITUDE	36 – 40 GHz		-10		dB
1/	OUTPUT RETURN LOSS MAGNITUDE	36 – 40 GHz		-8		dB
2/	OUTPUT THIRD ORDER INTERCEPT			33		dBm

1/ RF probe data is taken at 1 GHz steps.

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.

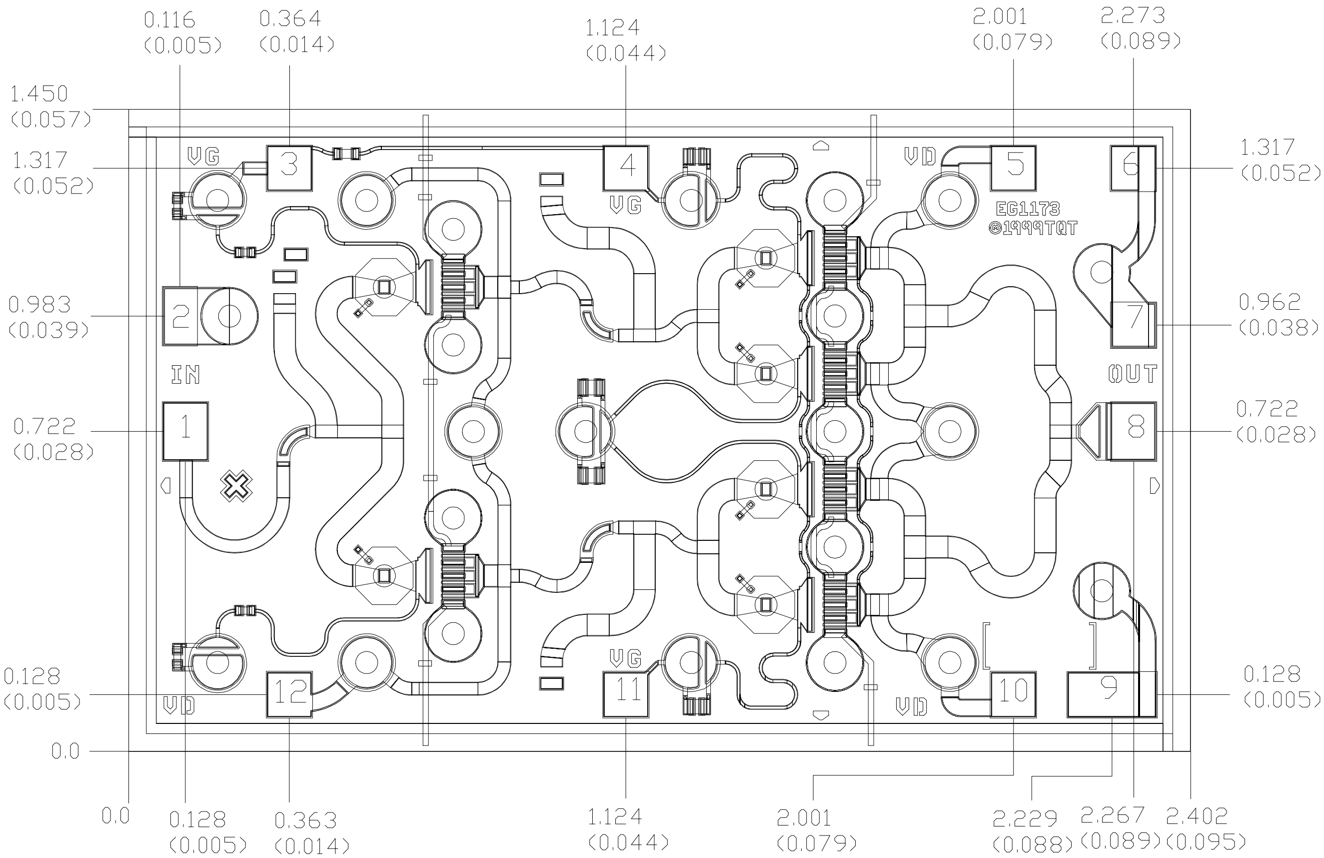
TABLE IV
RELIABILITY DATA*

PARAMETER	BIAS CONDITIONS		P_{DISS} (W)	T_{CH} (°C)	$R_{\theta JC}$ (°C/W)	T_M (HRS)
	V_D (V)	I_D (mA)				
$R_{\theta JC}$ Thermal Resistance (channel to backside of carrier plate)	6	240	1.44	116.7	32.43	2.1E+7

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.

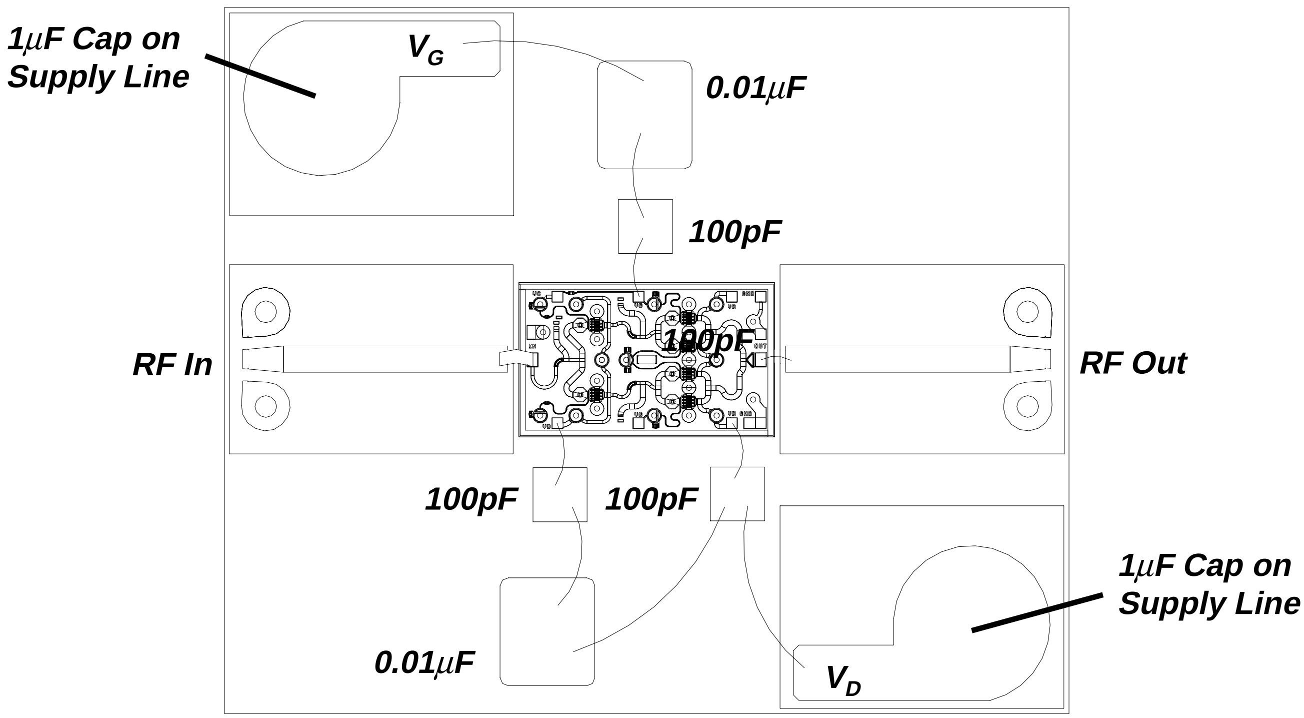
Mechanical Characteristics



Unit: 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)

Bond Pad #1 (RF Input)	0.105 x 0.135	(0.004 x 0.005)
Bond Pad #2 (GND)	0.080 x 0.135	(0.003 x 0.005)
Bond Pad #3 (VG)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #4 (VG)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #5 (VD)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #6 (GND)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #7 (GND)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #8 (RF Output)	0.105 x 0.135	(0.004 x 0.005)
Bond Pad #9 (GND)	0.105 x 0.205	(0.004 x 0.008)
Bond Pad #10 (VD)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #11 (VG)	0.105 x 0.105	(0.004 x 0.004)
Bond Pad #12 (VD)	0.105 x 0.105	(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.
- 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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