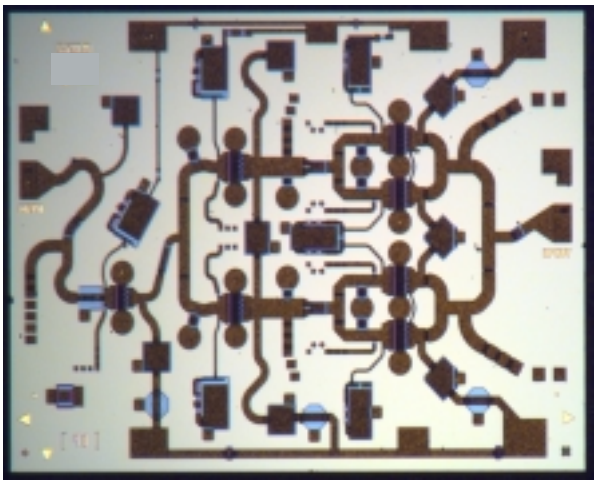
23 - 29 GHz High Power Amplifier TGA9070-SCC



Key Features and Performance

- 0.25um pHEMT Technology
- 23 GHz - 29 GHz Frequency Range
- Nominal 1 Watt (28GHz) @ P1dB
- Nominal Gain of 23 dB
- Bias 7V @ 400 mA
- Chip Dimensions 4.1mm x 3.0mm

Primary Applications

- LMDS
- Point-to-Point Radio

Description

The TriQuint TGA9070-SCC is a three stage HPA MMIC design using TriQuint's proven 0.25 um Power pHEMT process to support a variety of millimeter wave applications including point-to-point digital radio, LMDS/LMCS and Ka-band satellite spacecraft and ground terminals.

The three stage design consists of a 400 um input device driving a pair of 600 um interstage devices followed by four 600 um output devices.

The TGA9070 provides greater than 1W of output power across 23-29 GHz with a typical PAE of 35%. Typical small signal gain is 23 dB.

The TGA9070 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 I
RECOMMENDED MAXIMUM RATINGS

SYMBOL	PARAMETER	VALUE	NOTES
V^+	POSITIVE SUPPLY VOLTAGE	8 V	
I^+	POSITIVE SUPPLY CURRENT	1 A	1/
P_D	POWER DISSIPATION	8 W	
P_{IN}	INPUT CONTINUOUS WAVE POWER	20dBm	
T_{CH}	OPERATING CHANNEL TEMPERATURE	150 ^{0}C	2/ 3/
T_M	MOUNTING TEMPERATURE (30 SECONDS)	320 ^{0}C	
T_{STG}	STORAGE TEMPERATURE	-65 to 150 ^{0}C	

1/ Total current for all 3 stages

2/ 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.

3/ These ratings apply to each individual FET

TABLE II
DC PROBE TESTS (100%)
(T_A = 25 °C ± 5 °C)

NOTES	SYMBOL 2/	TEST CONDITIONS 3/	LIMITS		UNITS
			MIN	MAX	
	I_{DSS1}	STD	40	188	mA
1/	$\|V_{P1}\|$	STD	0.5	1.5	V
1/	$\|V_{P2}\|$	STD	0.5	1.5	V
1/	$\|V_{P3}\|$	STD	0.5	1.5	V
1/	$\|V_{P4}\|$	STD	0.5	1.5	V
1/	$\|V_{P5}\|$	STD	0.5	1.5	V
1/	$\|V_{BVGD1-5}\|$	STD	12	30	V
1/	$\|V_{BVGS1}\|$	STD	12	30	V

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

2/ Subscripts are referred to Q1, Q2, Q3, Q4, Q5 accordingly.

3/ The measurement conditions are subject to change at the manufacture's discretion (with appropriate notification to the buyer).

STD – Standard Test Conditions (see Table III for definitions)

TABLE IV
ELECTRICAL CHARACTERISTICS
(T_A = 25°C ± 5°C)
V_d = 6V, I_d = 400 mA

NOTE	TEST	MEASUREMENT CONDITIONS 1/	VALUE			UNITS
			MIN	TYP	MAX	
2/	POWER OUTPUT AT 1 dB GAIN COMPRESSION	F = 23 - 27 GHz	28.5	30		dBm
		F = 28 GHz	29	30.5		dBm
		F = 29 GHz	28.5	30		dBm
	POWER ADDED EFFICIENCY	F = 23 – 29 GHz		35		%
	SMALL-SIGNAL GAIN MAGNITUDE	F = 23 GHz	19	21	26	dB
		F = 24 – 28 GHz	20	23	28	dB
		F = 29 GHz	19	21	26	dB
	INPUT RETURN LOSS MAGNITUDE	F = 23 - 29 GHz		-10		dB
	OUTPUT RETURN LOSS MAGNITUDE	F = 23 – 29 GHz		-10		dB

1/ RF Probe data is taken at 1 GHz steps

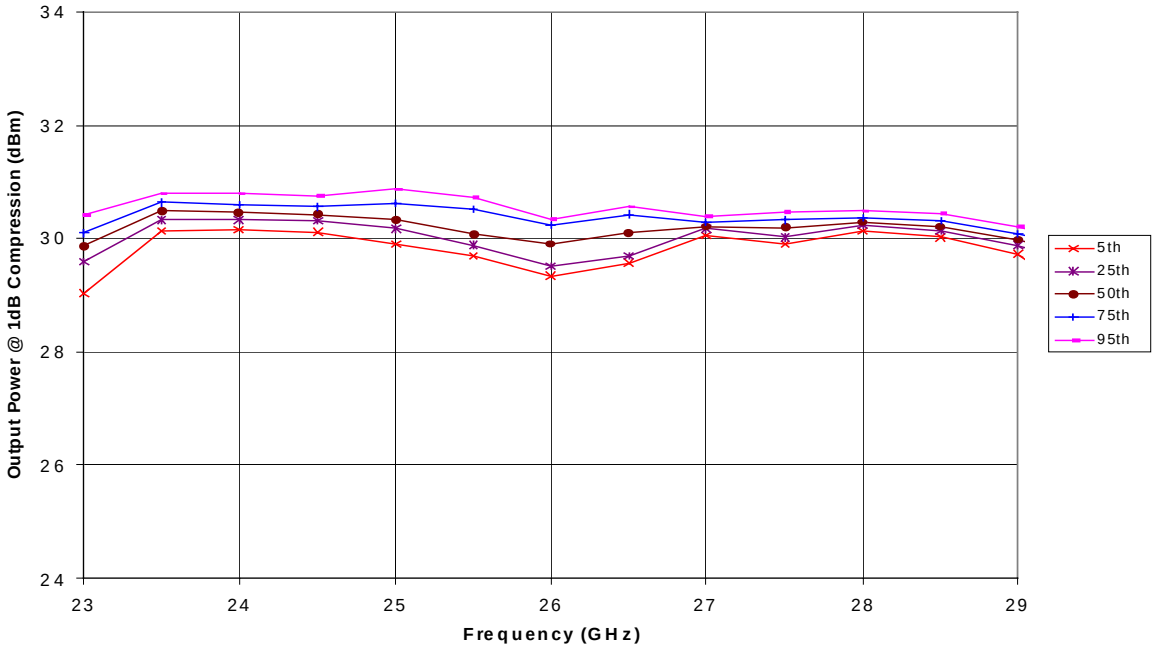
2/ $\Delta P/\Delta T$ typically –0.02dB/°C

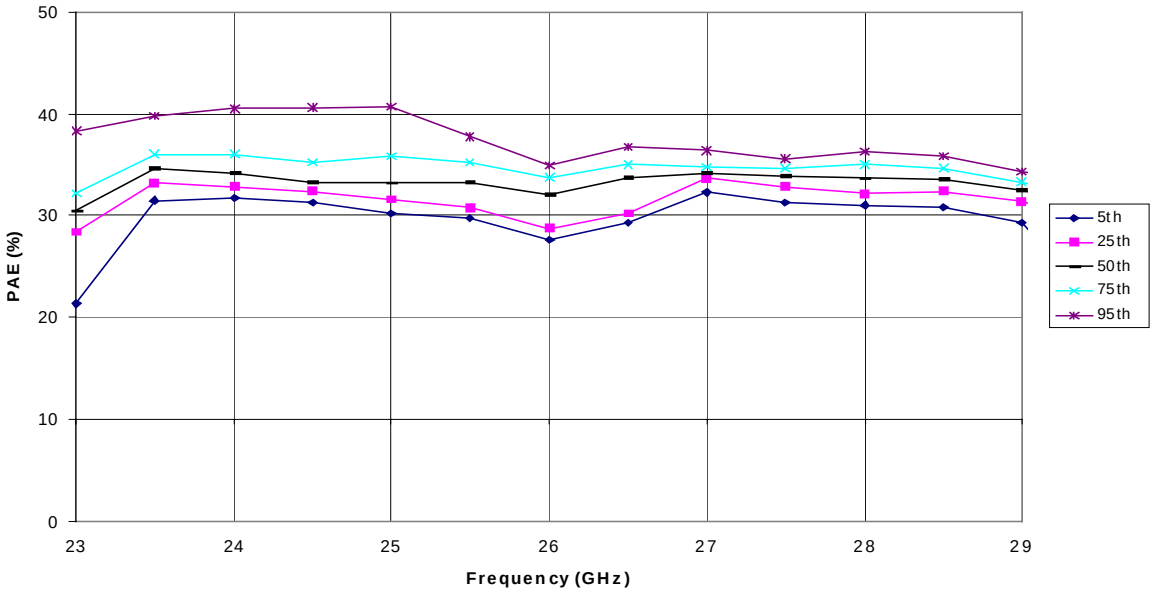
TABLE V
RELIABILITY DATA

PARAMETER	BIAS CONDITIONS		P_{DISS}	$R_{\theta JC}$	T_{CH}	MTTF
	V_D (V)	I_D (mA)	(W)	(C/W)	(°C)	(HRS)
$R_{\theta JC}$ Thermal resistance (channel to backside)	6	400	2.4	22.08	123	> 2 E6
	7	400	2.8	22.5	133	> 1 E6

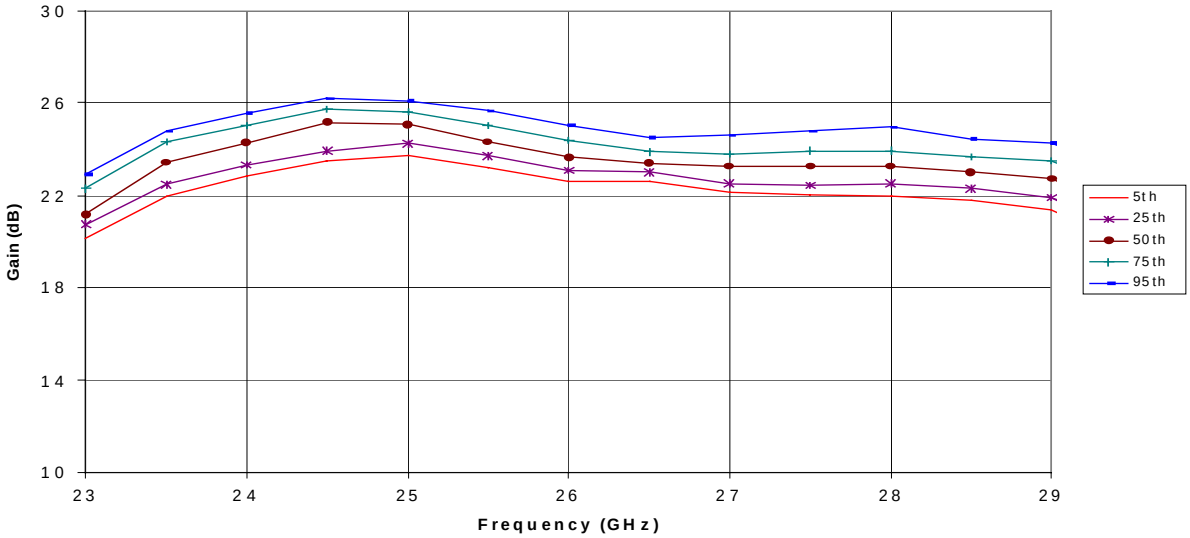
Note: Assumes eutectic attach using 80/20 AuSn mounted to a 10mil CuMo Carrier at 70°C baseplate temperature. Worst case condition with no RF applied, 100% of DC power is dissipated.

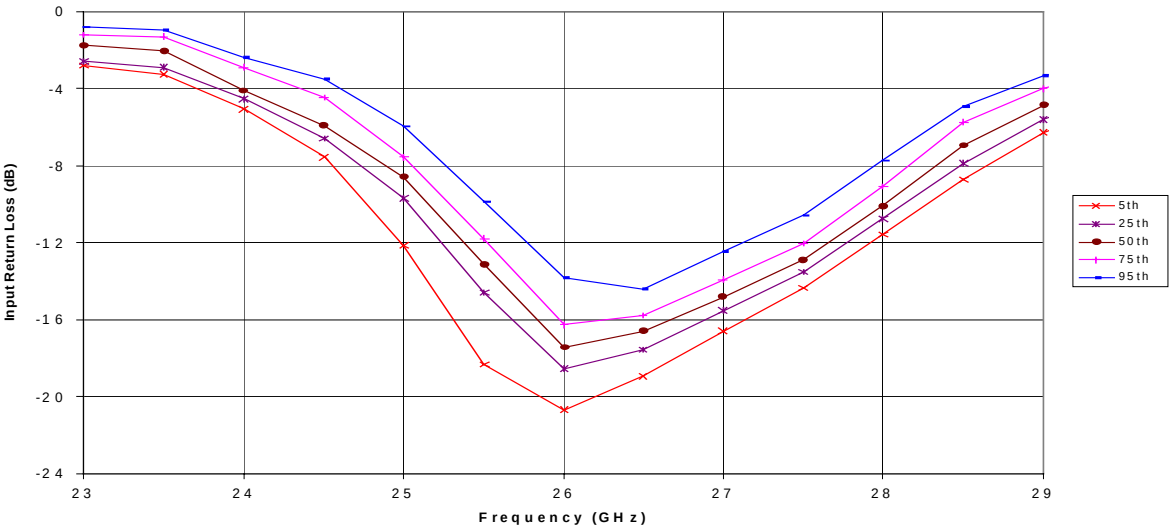
Statistical Performance Summary

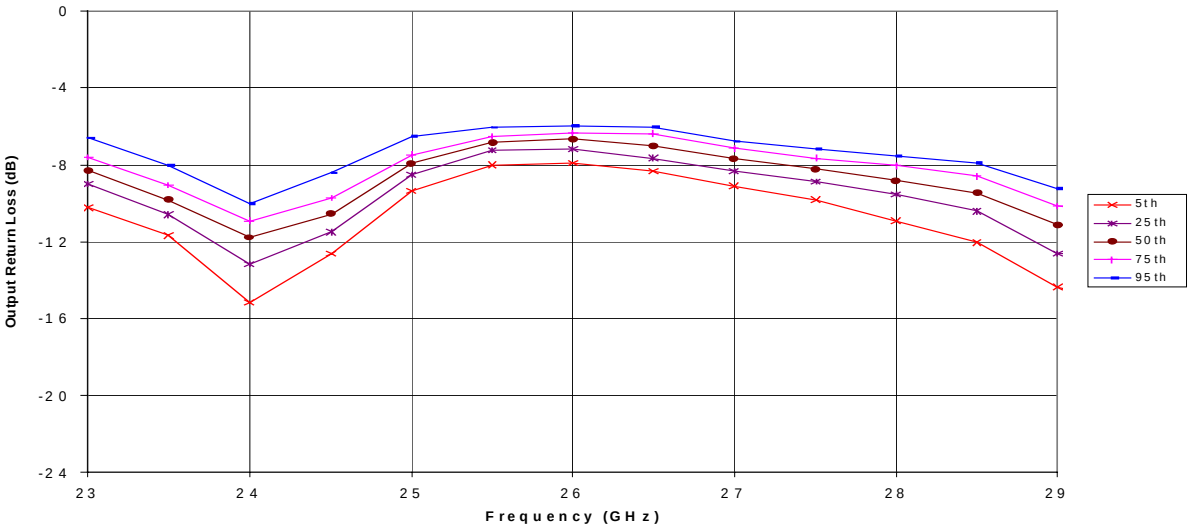




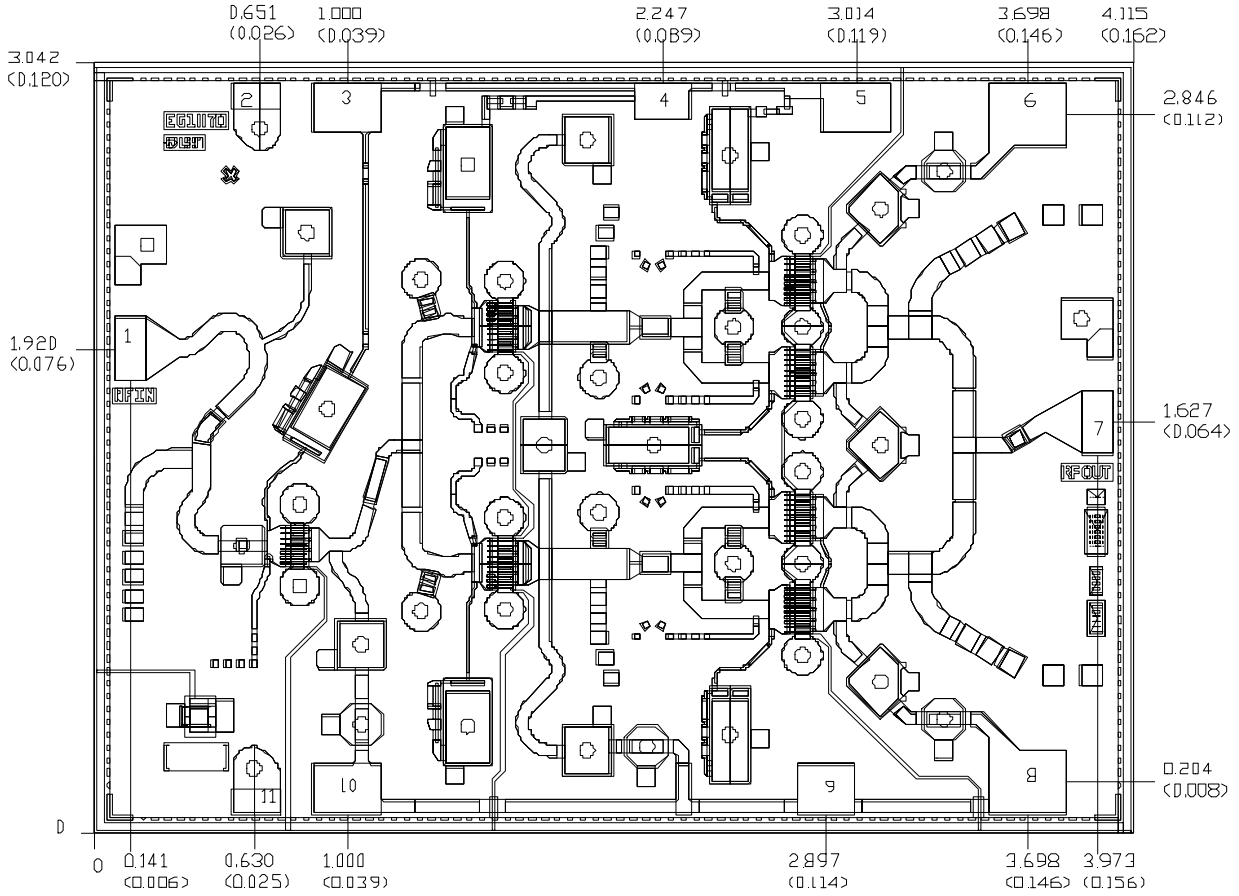
Statistical Performance Summary





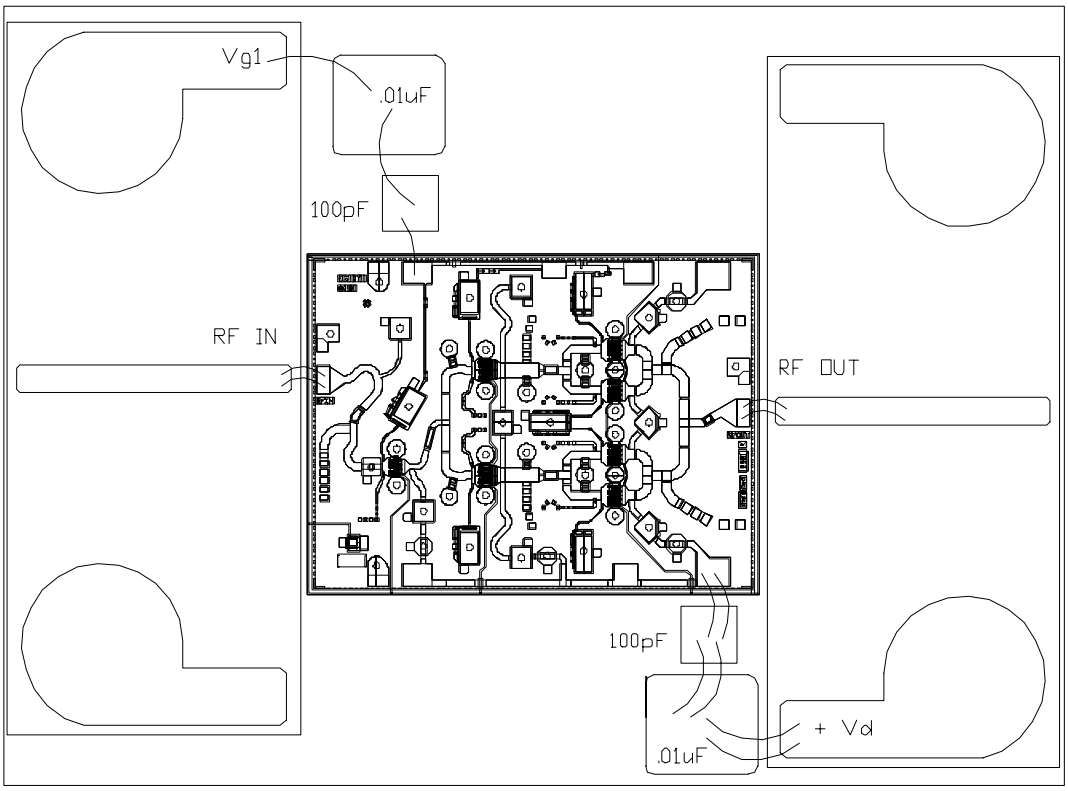


Mechanical Characteristics



Units: millimeters (inches)
Thickness: 0.1016 (0.004) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad.
Chip size tolerance: +/- 0.050B (0.002)

Bond Pad #1 (RF Input)	0.120 x 0.249	(0.005 x 0.010)
Bond Pad #2 (Gnd)	0.190 x 0.100	(0.008 x 0.004)
Bond Pad #3 (Vg1)	0.270 x 0.195	(0.011 x 0.008)
Bond Pad #4 (Vg2)	0.220 x 0.144	(0.009 x 0.006)
Bond Pad #5 (Vg3)	0.270 x 0.195	(0.011 x 0.008)
Bond Pad #6 & #8 (Vd3)	0.306 x 0.250	(0.012 x 0.010)
Bond Pad #7 (RF Output)	0.120 x 0.249	(0.005 x 0.010)
Bond Pad #9 (Vd2)	0.220 x 0.195	(0.009 x 0.008)
Bond Pad #10 (Vd1)	0.270 x 0.195	(0.011 x 0.008)
Bond Pad #11 (Gnd)	0.190 x 0.100	(0.008 x 0.004)



Chip Assembly and Bonding Diagram

Reflow process assembly notes:

- AuSn (80/20) solder with limited exposure to temperatures at or above 300°C
- alloy station or conveyor furnace with reducing atmosphere
- no fluxes should be utilized
- coefficient of thermal expansion matching is critical for long-term reliability
- storage in dry nitrogen atmosphere

Component placement and adhesive attachment assembly notes:

- vacuum pencils and/or vacuum collets preferred method of pick up
- avoidance of air bridges during placement
- force impact 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: 200°C

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