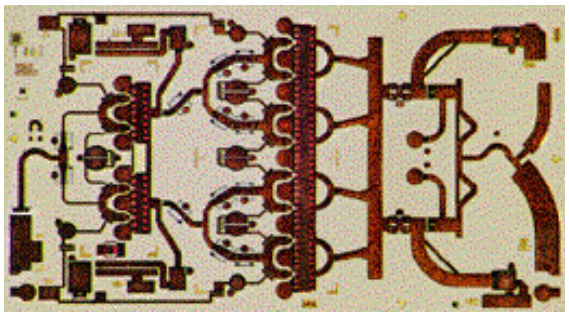
8 - 10.5 GHz Power Amplifier TGA8286-EPU



Key Features and Performance

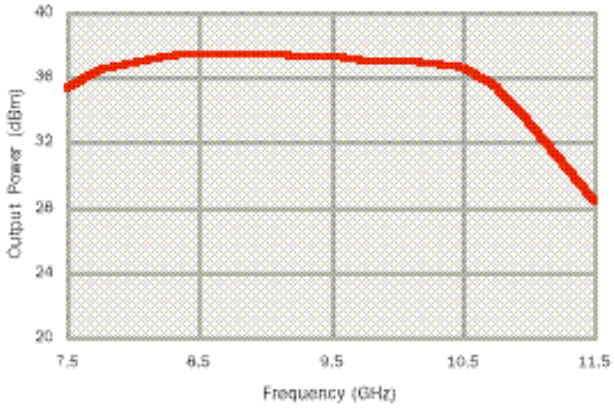
- 8 to 10.5 GHz Frequency Range, X-band
- Two Stage 5-W HFET Power Amplifier
- 37% P.A.E. at 2 to 3 dB Gain Compression
- 17 dB Small Signal Gain
- Bias can be applied from either the upper or lower edges
- 5.384 x 2.997 x 0.1016 mm (0.212 x 0.118 x 0.004 in.)

Description

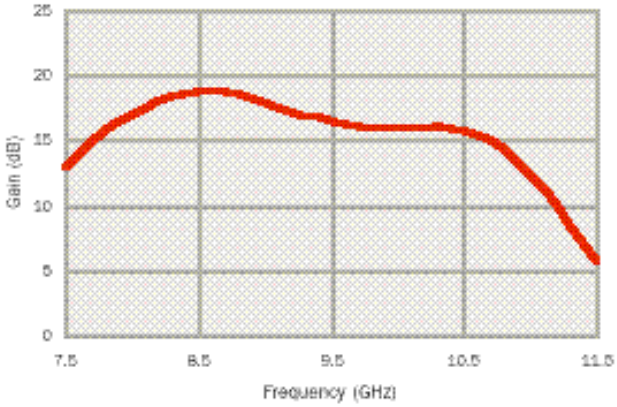
The TriQuint TGA8286-EPU is a GaAs monolithic amplifier designed for use as an X-band power amplifier. A 2.4mm and a 9.6mm HFET provide 16 dB nominal gain from 8 to 10.5 GHz with a typical 37% power-added efficiency at 2 to 3 dB gain compression. Ground is provided to the circuitry through vias to the backside metallization. The TGA8286-EPU effectively addresses applications such as an X-band radar transmitter or a microwave communication transmitter.

The TGA8286-EPU is supplied in chip form and is engineered for high volume automated assembly. All metal surfaces are gold plated to be compatiable with thermocompression and thermosonic wire bonding processes.

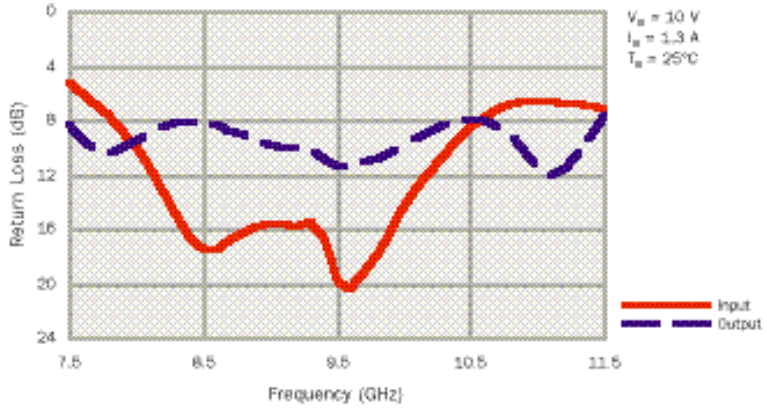
TYPICAL OUTPUT POWER P_{3dB}



TYPICAL SMALL-SIGNAL POWER GAIN



TYPICAL RETURN LOSS



ABSOLUTE MAXIMUM RATINGS

Positive supply voltage, V+	12 V
Positive supply voltage range with respect to negative supply voltage, V+ - V-	0 V to 13 V
Negative supply voltage range, V-	-5 V to 0 V
Drain supply voltage, V_D	11 V
Drain supply current, I_D	3.6 mA
Positive supply current, I+	902 mA
Power dissipation, P_D, at (or below) 25°C base-plate temperature *	28.8 W
Input continuous wave power, P_{IN}	30 dBm
Operating Channel temperature, T_{CH} **	150°C
Mounting temperature (30 sec.), T_M	320°C
Storage temperature range, T_{STG}	-65 to 150°C

Ratings over operating channel temperature range, T_{CH} (unless otherwise noted).

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "RF Characteristics" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

* For operation above 25°C base-plate temperature, derate linearly at the rate of 6.0 mW/°C.

** Operating channel temperature directly affects the device MTTF. For maximum life, it is recommended that channel temperature be maintained at the lowest possible level. These ratings apply to each individual FET.

TYPICAL S-PARAMETERS

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		GAIN
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
7.5	0.54	34	4.411	-170	0.004	88	0.38	-138	12.9
7.6	0.50	27	5.064	167	0.004	74	0.33	-149	14.1
7.7	0.45	20	5.617	144	0.005	54	0.31	-158	15.0
7.8	0.41	13	6.166	122	0.005	36	0.30	-166	15.8
7.9	0.36	7	6.615	101	0.005	16	0.31	-175	16.4
8.0	0.31	0	7.112	80	0.006	0	0.33	173	17.0
8.1	0.27	-6	7.542	59	0.006	-23	0.36	160	17.6
8.2	0.22	-10	7.980	39	0.006	-46	0.37	144	18.0
8.3	0.18	-10	8.318	18	0.006	-69	0.39	127	18.4
8.4	0.15	-5	8.600	-3	0.006	-89	0.39	108	18.7
8.5	0.13	3	8.750	-24	0.007	-114	0.39	90	18.8
8.6	0.13	11	8.760	-44	0.007	-135	0.38	70	18.9
8.7	0.14	14	8.660	-64	0.007	-157	0.36	51	18.8
8.8	0.15	14	8.453	-83	0.007	-177	0.35	31	18.5
8.9	0.16	10	8.147	-102	0.007	165	0.33	14	18.2
9.0	0.16	6	7.816	-120	0.007	148	0.32	-4	17.9
9.1	0.16	3	7.516	-137	0.007	132	0.31	-20	17.5
9.2	0.16	-1	7.211	-153	0.007	116	0.31	-34	17.2
9.3	0.17	-6	6.990	-168	0.007	103	0.31	-50	16.9
9.4	0.15	-22	6.887	176	0.007	89	0.29	-63	16.8
9.5	0.10	-16	6.676	160	0.007	74	0.27	-69	16.5
9.6	0.10	0	6.494	145	0.007	60	0.27	-73	16.3
9.7	0.11	11	6.368	130	0.007	47	0.28	-78	16.1
9.8	0.13	15	6.295	115	0.007	33	0.29	-82	16.0
9.9	0.16	16	6.266	99	0.007	19	0.30	-85	15.9
10.0	0.19	12	6.273	84	0.007	2	0.32	-89	16.0
10.1	0.22	5	6.310	68	0.008	-14	0.34	-92	16.0
10.2	0.26	-3	6.331	51	0.008	-28	0.36	-97	16.0
10.3	0.30	-14	6.353	33	0.007	-43	0.39	-102	16.1
10.4	0.33	-24	6.302	15	0.008	-59	0.40	-108	16.0
10.5	0.37	-36	6.173	-5	0.008	-73	0.40	-113	15.8
10.6	0.41	-49	5.943	-24	0.009	-90	0.40	-119	15.5
10.7	0.44	-62	5.662	-44	0.009	-110	0.38	-123	15.1
10.8	0.46	-78	5.230	-65	0.009	-132	0.35	-127	14.4
10.9	0.47	-91	4.748	-85	0.008	-152	0.31	-128	13.5
11.0	0.47	-104	4.188	-105	0.008	-169	0.27	-124	12.4
11.1	0.47	-116	3.664	-123	0.007	175	0.25	-115	11.3
11.2	0.46	-127	3.122	-141	0.006	160	0.26	-103	9.9
11.3	0.45	-137	2.670	-158	0.005	150	0.30	-96	8.5
11.4	0.45	-146	2.254	-174	0.005	142	0.35	-91	7.1
11.5	0.44	-153	1.912	172	0.004	135	0.41	-91	5.6

V_D = 10 V, I_D = 1.3 A, T_A = 25°C,

Reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram." The S-parameters are also available on floppy disk and the world wide web.

RF CHARACTERISTICS

PARAMETER		TEST CONDITIONS	TYP	UNIT
G_P	Small–signal power gain	f = 8 to 10.5 GHz	16	dB
SWR(in)	Input standing wave ratio	f = 8 to 10.5 GHz	1.4:1	-
SWR(out)	Output standing wave ratio	f = 8 to 10.5 GHz	1.9:1	-
P_{3dB}	Output power at 3–dB gain compression	f = 8 to 10.5 GHz	36	dBm
	Output second harmonic at 3–dB gain compression	f = 9 GHz	–59	dBc
IP_3	Output third–order intercept point, 30MHz signal spacing	f = 9 GHz	46	dBm
		f = 10 GHz	45	
		f = 11 GHz	44	
P.A.E.	Power added efficiency	f = 8 to 10.5 GHz	35	%

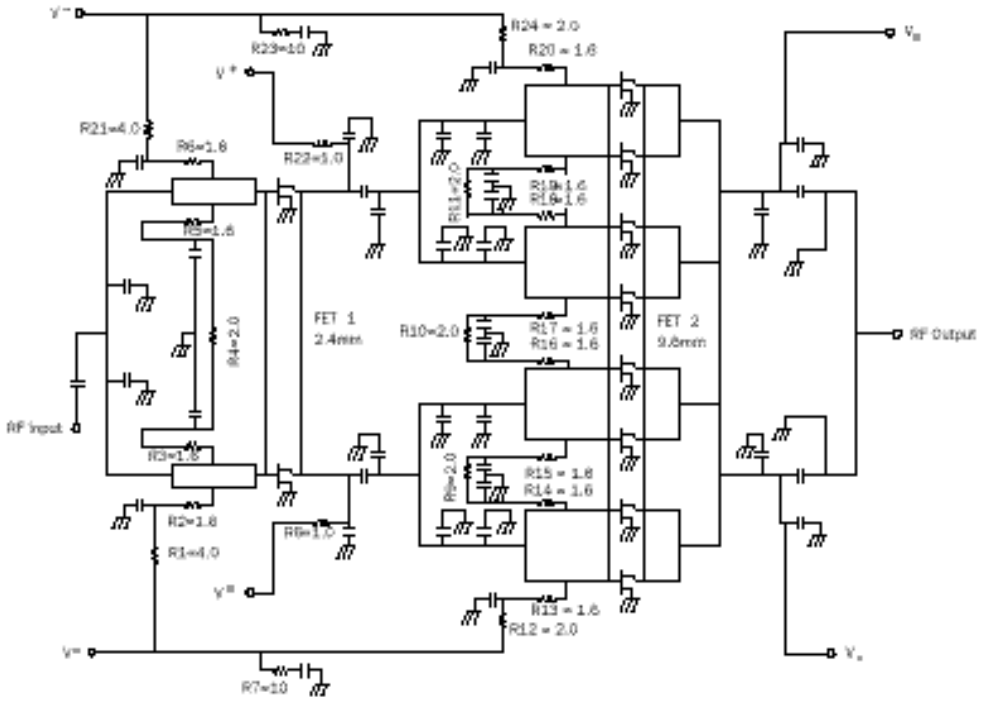
V_D = 10 V, I_D = 1.3 A, T_A = 25°C (unless otherwise noted)

THERMAL DATA

PARAMETER		TEST CONDITIONS		DGFET	MMIC	UNIT
$R_{\theta jC}$	Thermal resistance, channel–to–backside	$V_{DS(FET)}$ = 10 V, $I_{D(FET)}$ = 1.15 mA	Base = 25°C, Channel = 76°C	4.4	3.5	°C/W
			Base = 100°C, Channel = 161°C	5.3	4.2	

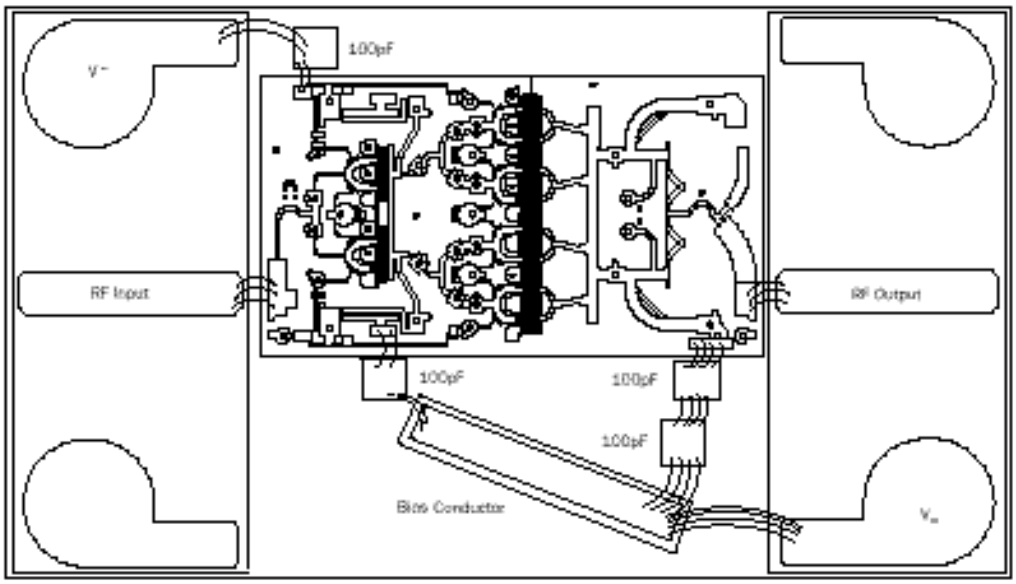
MMIC mounted with 38um AuSn solder to carrier.

EQUIVALENT SCHEMATIC



FET 1 = 2.4mm HFET, 2 x 1200um HFETs
FET 2 = 9.6mm HFET, 8 x 1200um HFETs
TaN resistors R_1 to R_{24} values are in ohms and have a tolerance of +/- 16%,

RECOMMENDED ASSEMBLY DIAGRAM



RF connections: Thermocompression bond using three 1-mil diameter, 20 to 30-mil-length gold bonds at RF Input and at RF Output for optimum RF performance.

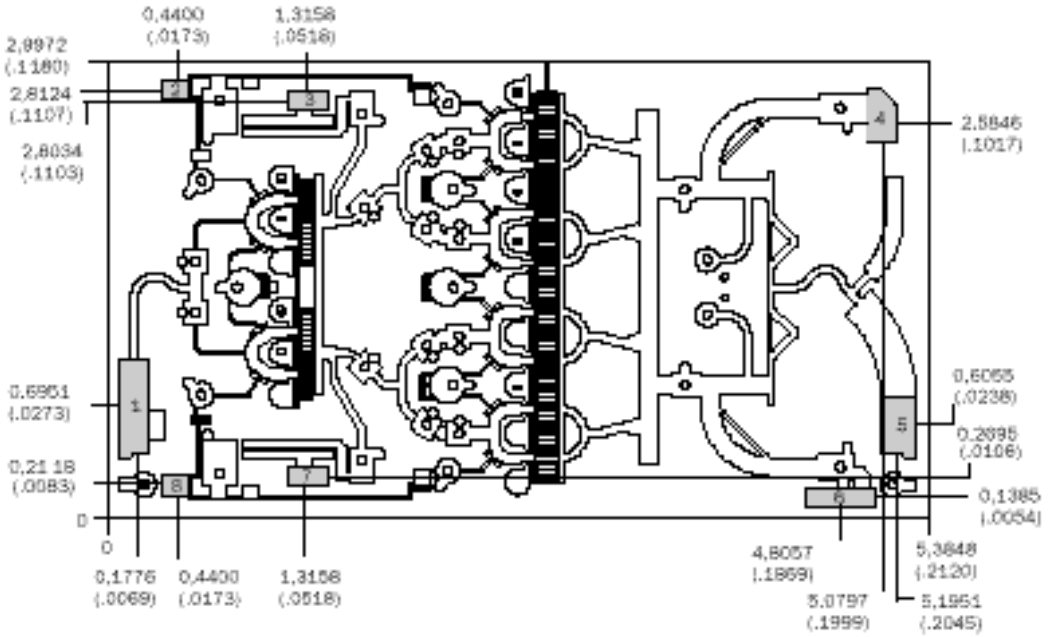
A 1uF, or greater, capacitor should be attached to the gate line within 1-2 cm of the 100pF bypass capacitor for stability.

Close placement of external components is essential to stability.

Refer to TriQuint's Recommended Assembly Instructions for GaAs Products.

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

MECHANICAL DRAWING



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 ± 0,0508 (0.002)

Bond pad #1	(RF Input)	0.200 x 0,530 (.007 x .020)
Bond pad #2	(V^-)	0,200 x 0,130 (.007 x .005)
Bond pad #3	(V^+)	0,260 x 0,120 (.010 x .004)
Bond pad #4	(V_D)	0,200 x 0,350 (.007 x .013)
Bond pad #5	(RF Output)	0,230 x 0,361 (.009 x .014)
Bond pad #6	(V_D)	0,460 x 0,116 (.018 x .004)
Bond pad #7	(V^+)	0.260 x 0,120 (.010 x .004)
Bond pad #8	(V^-)	0,200 x 0,130 (.007 x .005)

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