T1G6003028-SP POWERBAND™

25W, 28V, 20MHz-6GHz, GaN RF Power Transistor

TriQuint SEMICONDUCTOR

Applications

- Wideband and narrowband defense and commercial communication systems
  - General Purpose RF Power
  - Jammers
  - Radar
  - Professional radio systems
  - WiMAX
  - Wideband amplifiers
  - Test instrumentation
  - Cellular infrastructure

Product Features

- Frequency: 20 MHz to 6 GHz
- Linear Gain: >10 dB at 6 GHz
- Operating Voltage: 28 V
- Output Power (P_{3dB}): 25 W at 6 GHz
- Lead-free and RoHS compliant
- Low thermal resistance package

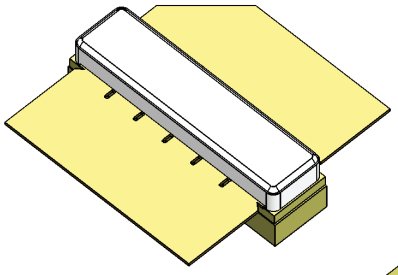
General Description

The TriQuint T1G6003028-SP is a 25 W (P_{3dB}) discrete GaN on SiC HEMT which operates from 20 MHz to 6 GHz and typically provides >10 dB gain at 6 GHz. The device is constructed with TriQuint's proven 0.25 µm production process, which features advanced field plate techniques to optimize power and efficiency at high drain bias operating conditions. This optimization can potentially lower system costs in terms of fewer amplifier line-ups and lower thermal management costs.

As part of the PowerBand™ RF transistor family of products, this device is capable of wideband and narrowband operation. The T1G6003028-SP and the other PowerBand™ devices are ideal for wideband RF circuits, but designers considering a narrowband application can take advantage of the reduced size and weight offered by PowerBand™ transistors.

Available Package

Top



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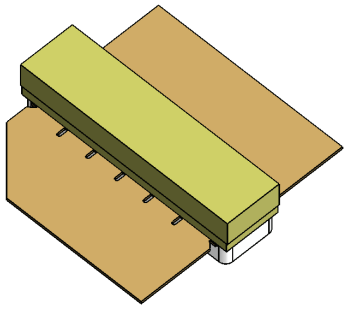


Package Information

Package Type	Description	Base
SP	9mm ceramic air cavity package	CuW

Ordering Information

Material No.	Part No.	Description
1074565	T1G6003028-SP	Packaged part
1076439	T1G6003028-SP	Standard evaluation board: 500 MHz to 3 GHz
1076612	T1G6003028-SP	Standard evaluation board: 2.5 GHz to 6 GHz

Specifications

Absolute Maximum Ratings

Sym	Parameter	Value
V^+	Positive Supply Value	32
V^-	Negative Supply Voltage Range	- 10 V to 0 V
I	Positive Supply Current	10A
$\|I_G\|$	Gate Supply Current	50 mA
P_D	Power Dissipation	41.5 W
T_{CH}	Operating Channel Temperature	225°C

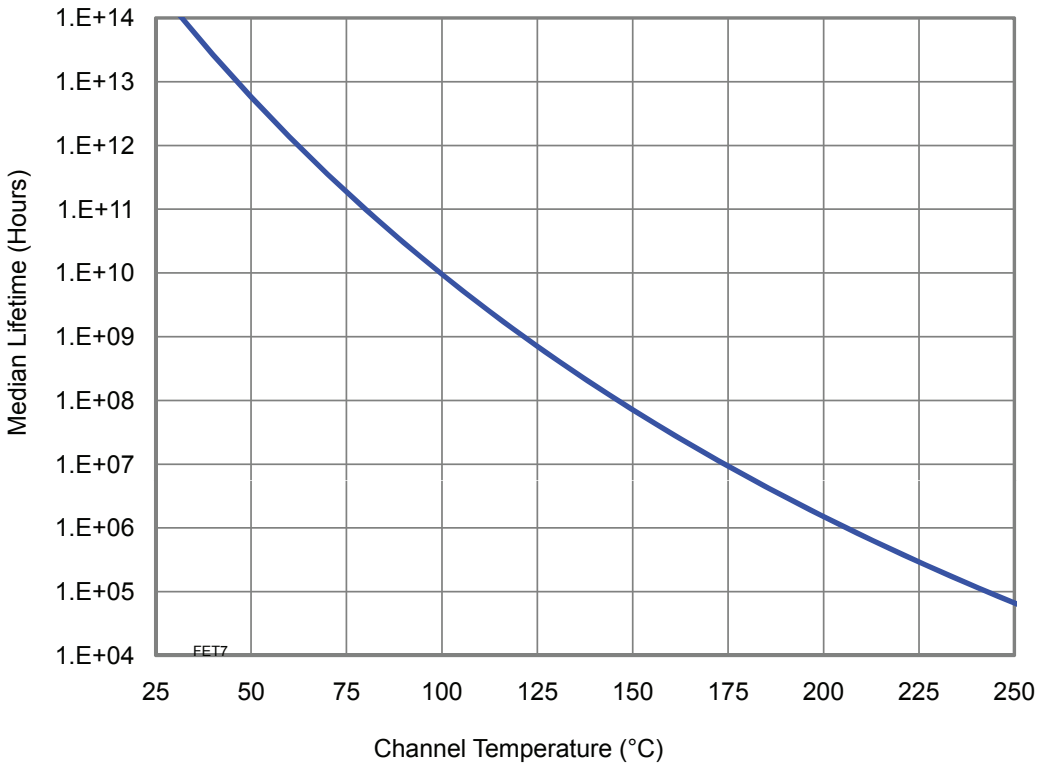
Operation of this device outside the parameter ranges given above may cause permanent damage.

Thermal Information

Test Conditions	T_{CH} (°C)	*Θ_{JC} (°C/W)
DC at 85°C Base	202	4.8

*Thermal Resistance (channel to backside of carrier)

Lifetime Median Curve



Electrical Specifications

Recommended operating conditions apply unless otherwise specified: T_A=25 °C

DC Characteristics

Characteristics	Symbol	Min	Typ	Max	Unit	Conditions
Break-Down Voltage Drain Source	B_{VDSX}	85	120		V	V_{GS}= -8 V, I_D=4 mA
Gate Quiescent Voltage	$V_{GS\ (Q)}$		-3.2		V	V_{DS}=28 V; I_{DQ}=0.4 A
Gate Threshold Voltage	$V_{GS\ (th)}$		-3.5		V	V_{DS}=10 V; I_D=20 mA
Saturated Drain Current	I_{DSX}		7		A	V_{DS}=5 V; V_{GS}=0 V

RF Characteristics

Characteristics	Symbol	Min	Typ	Max	Unit
Functional Tests, Instantaneous Bandwidth (Tested in TriQuint's Eval Board, 5.3 GHz to 5.9 GHz, 100uS, 20%)					
Gain @ P_{2dB}, 5.3 GHz to 5.9 GHz (V_{DS}=28 V, P_{out}=25 W, I_{DQ}=150 mA)		7.5	8		dB
P_{2dB}, 5.3 GHz to 5.9 GHz (V_{DS}=28 V, P_{out}=25 W, I_{DQ}=150 mA)		25	28		W
Power Added Efficiency, 5.3 GHz to 5.9 GHz (V_{DS}=28 V, P_{out}=25 W, I_{DQ}=150 mA)		47	50		%
Functional Tests, Narrow Band EVB RF Performance (6 GHz), CW					
Linear Gain (V_{DS}=28 V, G_{LIN} = G_{3dB} + 3dB, I_{DQ}=100 mA), CW	G_{LIN}	10.0	10.5		dB
Output Power at 3 dB Gain Compression (V_{DS}=28 V, G = G_{3dB}, I_{DQ}=100 mA), CW	P_{3dB}	22.5	25.0		W
Drain Efficiency at 3 dB Gain Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	DE_{3dB}	41.5	47.5		%
Power-Added Efficiency at 3 dB Gain Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	PAE_{3dB}	34.0	39.0		%
Gain at 3 dB Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	G_{3dB}	7.0	7.5		dB
Impedance Mismatch Ruggedness (V_{DS}=28 V, P_{in} for P_{out} = P_{3dB}, I_{DQ}=100 mA, VSWR=TBD, all angles)		No degradation in output power			

Electrical Specifications (continued)

Recommended operating conditions apply unless otherwise specified: T_A=25 °C

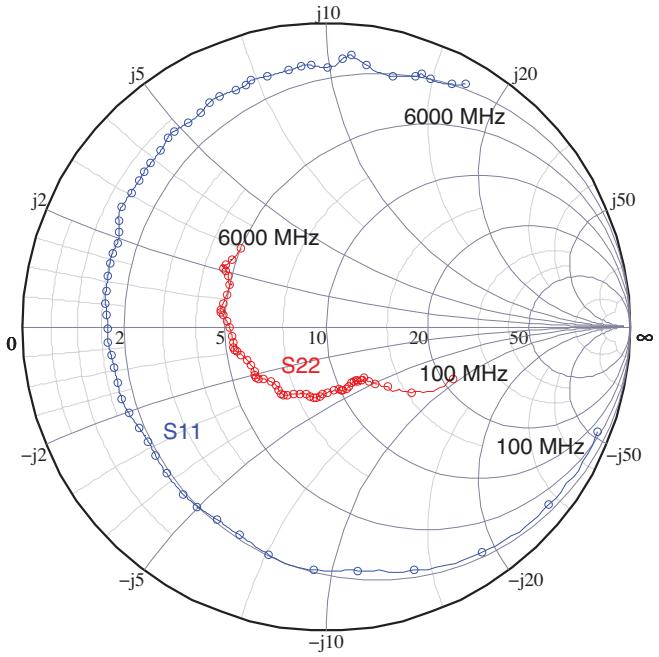
RF Characteristics

Characteristics	Symbol	Min	Typ	Max	Unit
Functional Tests, Narrow Band EVB RF Performance (3.5 GHz), CW					
Linear Gain (V_{DS}=28 V, G_{LIN} = G_{3dB} + 3dB, I_{DQ}=100 mA), CW	G_{LIN}	13.5	14.0		dB
Output Power at 3 dB Gain Compression (V_{DS}=28 V, G = G_{3dB}, I_{DQ}=100 mA), CW	P_{3dB}	28.0	33.0		W
Drain Efficiency at 3 dB Gain Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	DE_{3dB}	53.0	56.0		%
Power-Added Efficiency at 3 dB Gain Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	PAE_{3dB}	48.0	51.5		%
Gain at 3 dB Compression (V_{DS}=28 V, P_{out} = P_{3dB}, I_{DQ}=100 mA), CW	G_{3dB}	10.5	11.0		dB
Impedance Mismatch Ruggedness (V_{DS}=28 V, P_{in} for P_{out} = P_{3dB}, I_{DQ}=100 mA, VSWR=TBD, all angles)		No degradation in output power			

Device Characterization Data

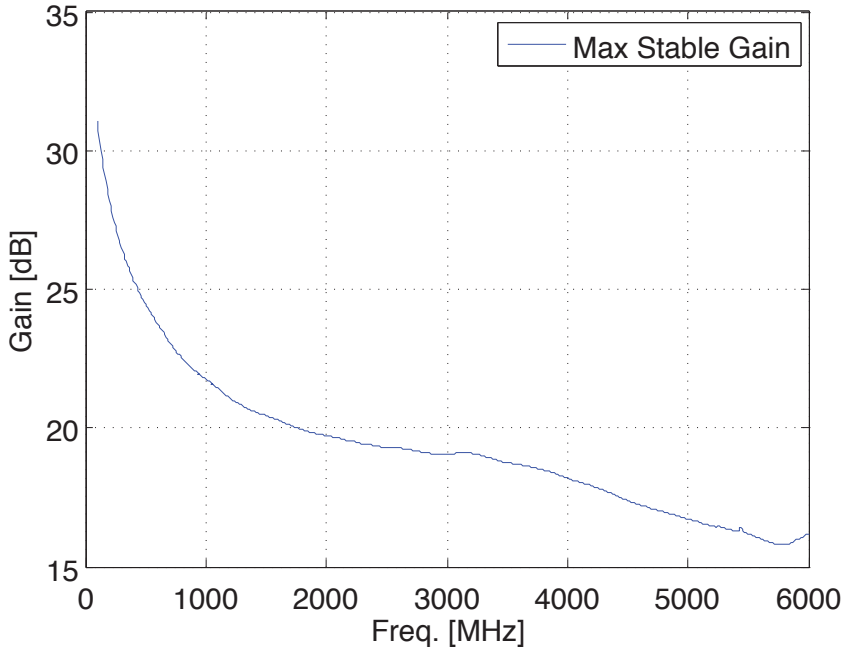
S-Parameter Smith Chart

T1G6003028-SP, 28V, 100mA



Small Signal Gain

T1G6003028-SP



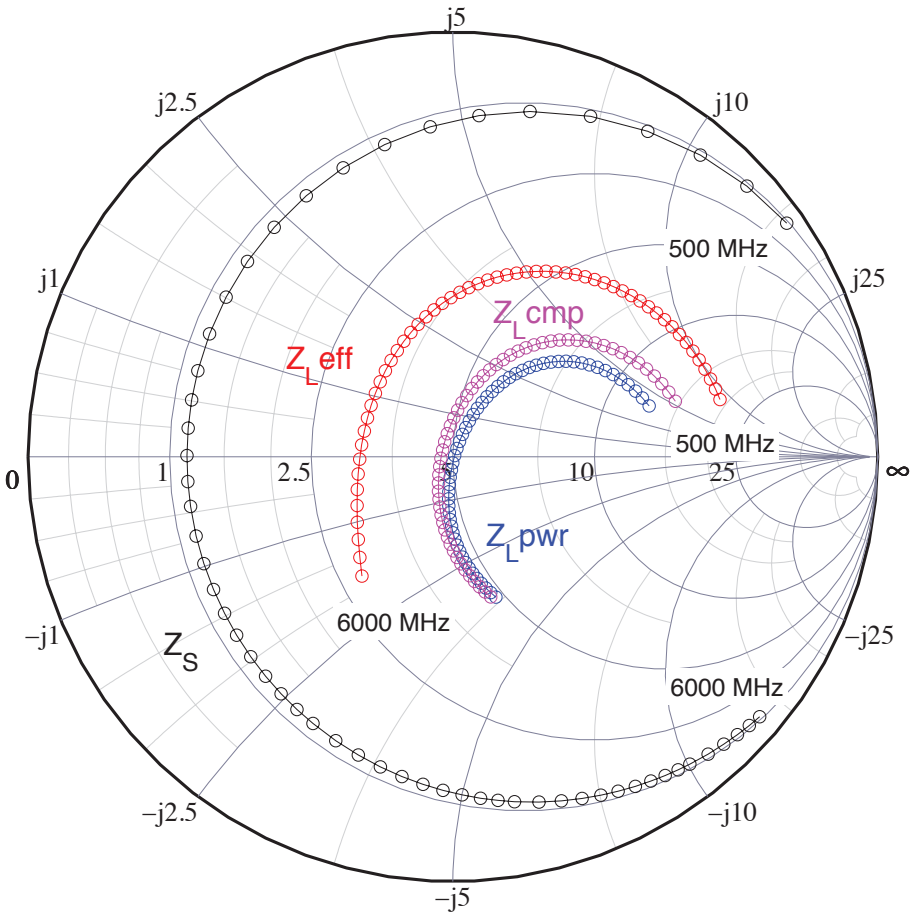
S-Parameter Data

Freq. [GHz]	Real S11	Imag S11	Real S21	Imag S21	Real S12	Imag S12	Real S22	Imag S22
0.1	0.056	-0.882	-14.601	14.243	0.011	0.012	-0.374	-0.180
0.2	-0.471	-0.786	-6.123	12.562	0.019	0.010	-0.508	-0.178
0.3	-0.692	-0.608	-2.603	9.694	0.021	0.007	-0.559	-0.142
0.4	-0.782	-0.474	-1.077	7.710	0.022	0.005	-0.584	-0.128
0.5	-0.826	-0.387	-0.303	6.323	0.022	0.004	-0.596	-0.120
0.6	-0.861	-0.331	0.186	5.294	0.022	0.003	-0.604	-0.109
0.7	-0.881	-0.274	0.417	4.520	0.022	0.003	-0.604	-0.110
0.8	-0.890	-0.235	0.564	3.945	0.022	0.002	-0.610	-0.113
0.9	-0.898	-0.205	0.673	3.474	0.022	0.001	-0.619	-0.113
1.0	-0.907	-0.183	0.766	3.090	0.021	0.001	-0.627	-0.111
1.1	-0.912	-0.164	0.818	2.847	0.021	0.001	-0.623	-0.111
1.2	-0.916	-0.139	0.848	2.557	0.021	0.001	-0.632	-0.112
1.3	-0.918	-0.120	0.877	2.321	0.021	0.000	-0.639	-0.117
1.4	-0.920	-0.105	0.905	2.129	0.020	0.000	-0.647	-0.122
1.5	-0.924	-0.090	0.924	1.957	0.020	0.000	-0.652	-0.122
1.6	-0.929	-0.075	0.930	1.798	0.019	0.000	-0.656	-0.120
1.7	-0.931	-0.062	0.925	1.655	0.019	0.000	-0.661	-0.118
1.8	-0.932	-0.048	0.924	1.528	0.018	0.000	-0.670	-0.118
1.9	-0.933	-0.034	0.916	1.412	0.018	0.000	-0.681	-0.118
2.0	-0.935	-0.024	0.915	1.303	0.017	0.000	-0.690	-0.119
2.1	-0.937	-0.014	0.921	1.209	0.017	0.000	-0.697	-0.120
2.2	-0.937	-0.001	0.923	1.117	0.016	0.000	-0.703	-0.121
2.3	-0.938	0.010	0.905	1.034	0.016	0.000	-0.707	-0.119
2.4	-0.939	0.019	0.886	0.965	0.015	0.000	-0.712	-0.116
2.5	-0.940	0.030	0.874	0.912	0.015	0.001	-0.718	-0.110
2.6	-0.940	0.042	0.871	0.854	0.014	0.001	-0.726	-0.107
2.7	-0.940	0.053	0.859	0.779	0.014	0.001	-0.737	-0.105
2.8	-0.940	0.062	0.841	0.714	0.013	0.001	-0.747	-0.103
2.9	-0.938	0.071	0.830	0.664	0.013	0.001	-0.752	-0.103
3.0	-0.938	0.081	0.812	0.630	0.013	0.002	-0.754	-0.099
3.1	-0.942	0.090	0.794	0.600	0.012	0.002	-0.757	-0.093
3.2	-0.943	0.101	0.794	0.576	0.012	0.003	-0.759	-0.085
3.3	-0.940	0.115	0.794	0.542	0.012	0.003	-0.766	-0.079
3.4	-0.938	0.128	0.777	0.500	0.011	0.004	-0.774	-0.074
3.5	-0.938	0.137	0.762	0.463	0.011	0.004	-0.781	-0.071
3.6	-0.936	0.147	0.763	0.435	0.011	0.005	-0.784	-0.069
3.7	-0.934	0.161	0.763	0.412	0.011	0.005	-0.785	-0.066
3.8	-0.935	0.173	0.755	0.390	0.010	0.006	-0.786	-0.060
3.9	-0.934	0.182	0.749	0.366	0.010	0.007	-0.788	-0.052
4.0	-0.928	0.196	0.749	0.341	0.010	0.007	-0.793	-0.043
4.1	-0.925	0.212	0.738	0.320	0.010	0.008	-0.799	-0.036
4.2	-0.925	0.224	0.727	0.298	0.010	0.008	-0.805	-0.032
4.3	-0.922	0.237	0.730	0.274	0.010	0.009	-0.808	-0.029
4.4	-0.915	0.253	0.737	0.250	0.010	0.009	-0.808	-0.026
4.5	-0.911	0.266	0.730	0.229	0.010	0.010	-0.808	-0.020
4.6	-0.911	0.273	0.718	0.211	0.010	0.010	-0.810	-0.011
4.7	-0.904	0.290	0.724	0.194	0.010	0.011	-0.812	-0.001
4.8	-0.894	0.315	0.730	0.179	0.010	0.011	-0.816	0.008
4.9	-0.889	0.331	0.719	0.160	0.010	0.012	-0.821	0.014
5.0	-0.884	0.342	0.720	0.135	0.010	0.012	-0.824	0.017
5.1	-0.870	0.360	0.733	0.110	0.010	0.013	-0.824	0.021
5.2	-0.870	0.384	0.736	0.104	0.010	0.013	-0.822	0.028
5.3	-0.869	0.398	0.734	0.087	0.010	0.014	-0.818	0.039
5.4	-0.846	0.412	0.746	0.057	0.011	0.014	-0.816	0.052
5.5	-0.811	0.443	0.767	0.016	0.011	0.015	-0.820	0.062
5.6	-0.794	0.483	0.769	0.004	0.011	0.016	-0.824	0.069
5.7	-0.794	0.496	0.759	-0.014	0.012	0.016	-0.827	0.071
5.8	-0.779	0.507	0.769	-0.049	0.013	0.016	-0.826	0.075
5.9	-0.753	0.549	0.803	-0.072	0.013	0.016	-0.820	0.083
6.0	-0.745	0.581	0.817	-0.087	0.012	0.016	-0.812	0.100

Device Characterization Data

Load-Pull Data

Test conditions: V_{DD}= 28 V, I_{DQ} = 100 mA, Test signal = CW



RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or load-pull system

Load-Pull Data

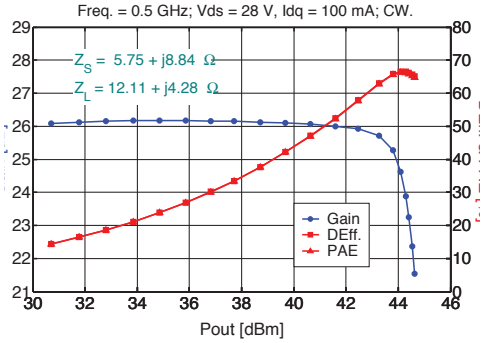
Freq. [GHz]	Real(ZS)	Imag(ZS)	Real(ZL)	Imag(ZL)	G3dB [dB]	P3dB [dBm]	P3dB [W]	PAE [%]
0.5	1.15	15.79	14.54	5.36	23.2	44.5	28.2	65.9
0.6	1.15	12.72	13.57	5.74	21.9	44.7	29.5	62.2
0.7	1.15	10.46	12.66	5.97	20.8	44.9	30.9	60.4
0.8	1.15	8.71	11.82	6.08	20.0	45.1	32.4	60.2
0.9	1.15	7.29	11.07	6.09	19.4	45.1	32.4	61.2
1.0	1.15	6.11	10.38	6.04	19.0	45.3	33.9	62.9
1.1	1.15	5.27	9.78	5.93	18.7	45.4	34.7	65.1
1.2	1.15	4.54	9.23	5.78	18.4	45.6	36.3	67.4
1.3	1.15	3.89	8.75	5.61	18.1	45.7	37.2	69.4
1.4	1.15	3.32	8.32	5.41	17.8	45.7	37.2	70.7
1.5	1.15	2.81	7.93	5.20	17.4	45.7	37.2	71.0
1.6	1.15	2.34	7.59	4.99	16.9	45.6	36.3	70.0
1.7	1.15	1.91	7.29	4.77	16.2	45.5	35.5	68.0
1.8	1.15	1.51	7.01	4.54	15.6	45.4	34.7	65.7
1.9	1.15	1.13	6.77	4.32	15.1	45.3	33.9	63.3
2.0	1.15	0.78	6.55	4.09	14.7	45.3	33.9	61.3
2.1	1.15	0.51	6.35	3.86	14.5	45.3	33.9	60.3
2.2	1.15	0.25	6.18	3.64	14.4	45.4	34.7	60.0
2.3	1.15	0.01	6.02	3.42	14.5	45.5	35.5	60.1
2.4	1.15	-0.22	5.88	3.19	14.5	45.5	35.5	60.3
2.5	1.15	-0.45	5.75	2.98	14.4	45.6	36.3	60.3
2.6	1.15	-0.72	5.63	2.76	14.2	45.6	36.3	59.9
2.7	1.15	-0.98	5.52	2.54	13.9	45.6	36.3	59.2
2.8	1.15	-1.23	5.42	2.33	13.5	45.6	36.3	58.4
2.9	1.15	-1.47	5.34	2.12	13.1	45.5	35.5	57.5
3.0	1.15	-1.71	5.25	1.92	12.7	45.5	35.5	56.8
3.1	1.15	-1.96	5.18	1.71	12.3	45.5	35.5	56.4
3.2	1.15	-2.21	5.11	1.51	12.0	45.4	34.7	56.1
3.3	1.15	-2.44	5.05	1.31	11.8	45.5	35.5	56.0
3.4	1.15	-2.68	4.99	1.11	11.6	45.5	35.5	56.0
3.5	1.15	-2.90	4.94	0.91	11.4	45.5	35.5	56.1
3.6	1.15	-3.22	4.89	0.72	11.3	45.5	35.5	56.1
3.7	1.15	-3.53	4.84	0.53	11.2	45.4	34.7	56.5
3.8	1.15	-3.84	4.80	0.34	11.2	45.3	33.9	56.7
3.9	1.15	-4.14	4.76	0.15	11.1	45.4	34.7	56.9
4.0	1.15	-4.43	4.73	-0.03	11.1	45.3	33.9	56.9
4.1	1.15	-4.72	4.69	-0.22	11.0	45.3	33.9	56.9
4.2	1.15	-5.01	4.66	-0.40	10.9	45.2	33.1	56.8
4.3	1.15	-5.29	4.64	-0.58	10.8	45.2	33.1	56.6
4.4	1.15	-5.56	4.61	-0.75	10.7	45.2	33.1	56.3
4.5	1.15	-5.84	4.59	-0.93	10.5	45.3	33.9	56.0
4.6	1.15	-6.27	4.58	-1.10	10.4	45.4	34.7	55.5
4.7	1.15	-6.69	4.56	-1.27	10.2	45.4	34.7	55.1
4.8	1.15	-7.11	4.55	-1.44	10.1	45.4	34.7	54.5
4.9	1.15	-7.52	4.54	-1.61	9.9	45.4	34.7	53.8
5.0	1.15	-7.93	4.54	-1.78	9.7	45.4	34.7	53.2
5.1	1.15	-8.36	4.54	-1.95	9.5	45.5	35.5	52.4
5.2	1.15	-8.80	4.54	-2.12	9.4	45.5	35.5	51.6
5.3	1.15	-9.22	4.55	-2.29	9.2	45.4	34.7	50.8
5.4	1.15	-9.65	4.56	-2.45	9.0	45.4	34.7	50.0
5.5	1.15	-10.07	4.58	-2.62	8.9	45.3	33.9	49.1
5.6	1.15	-10.78	4.60	-2.80	8.8	45.1	32.4	48.2
5.7	1.15	-11.48	4.62	-2.97	8.7	45.1	32.4	47.4
5.8	1.15	-12.18	4.64	-3.15	8.6	44.9	30.9	46.5
5.9	1.15	-12.87	4.67	-3.33	8.5	44.7	29.5	45.7
6.0	1.15	-13.55	4.70	-3.52	8.5	44.4	27.5	44.8

Typical Performance: Gain, Efficiency and Output Power

Performance is measured at DUT reference plane.

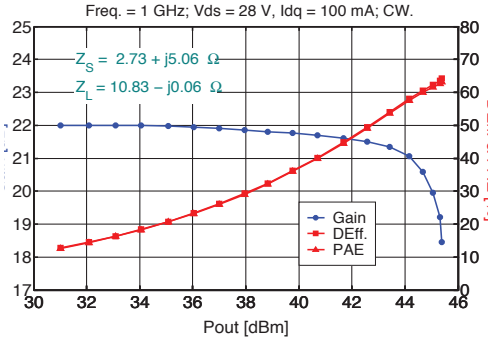
Gain, DEff., and PAE vs. Pout

Freq. = 0.5 GHz; Vds = 28 V, Idq = 100 mA; CW.



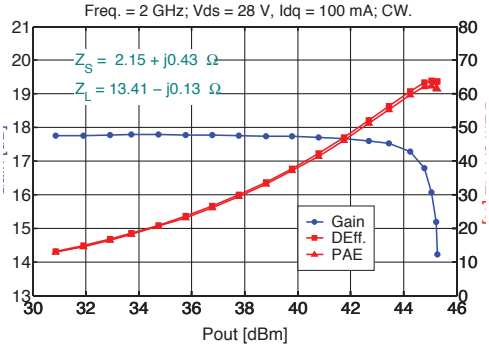
Gain, DEff., and PAE vs. Pout

Freq. = 1 GHz; Vds = 28 V, Idq = 100 mA; CW.



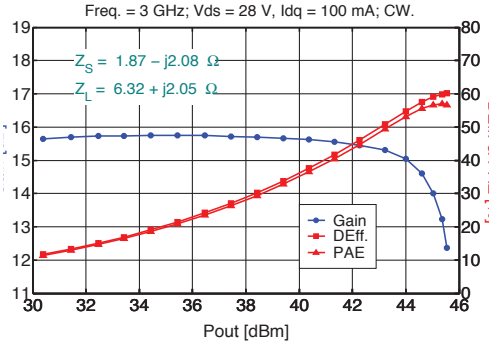
Gain, DEff., and PAE vs. Pout

Freq. = 2 GHz; Vds = 28 V, Idq = 100 mA; CW.



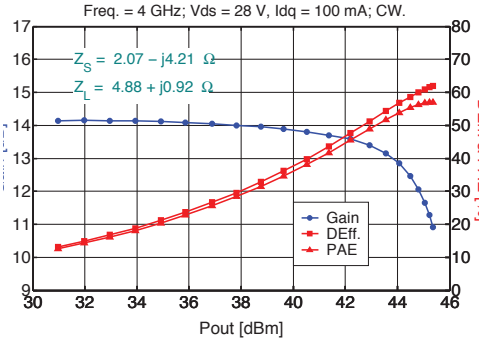
Gain, DEff., and PAE vs. Pout

Freq. = 3 GHz; Vds = 28 V, Idq = 100 mA; CW.



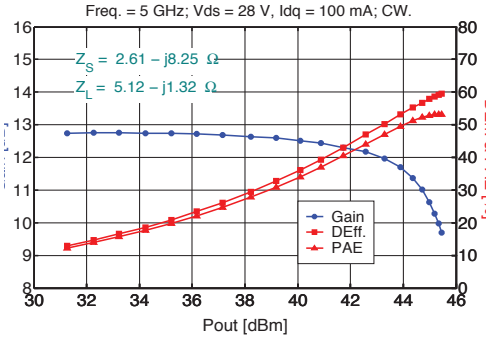
Gain, DEff., and PAE vs. Pout

Freq. = 4 GHz; Vds = 28 V, Idq = 100 mA; CW.



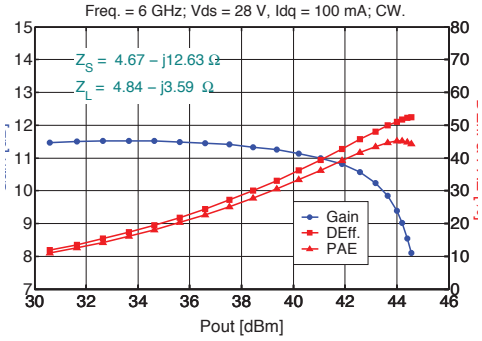
Gain, DEff., and PAE vs. Pout

Freq. = 5 GHz; Vds = 28 V, Idq = 100 mA; CW.



Gain, DEff., and PAE vs. Pout

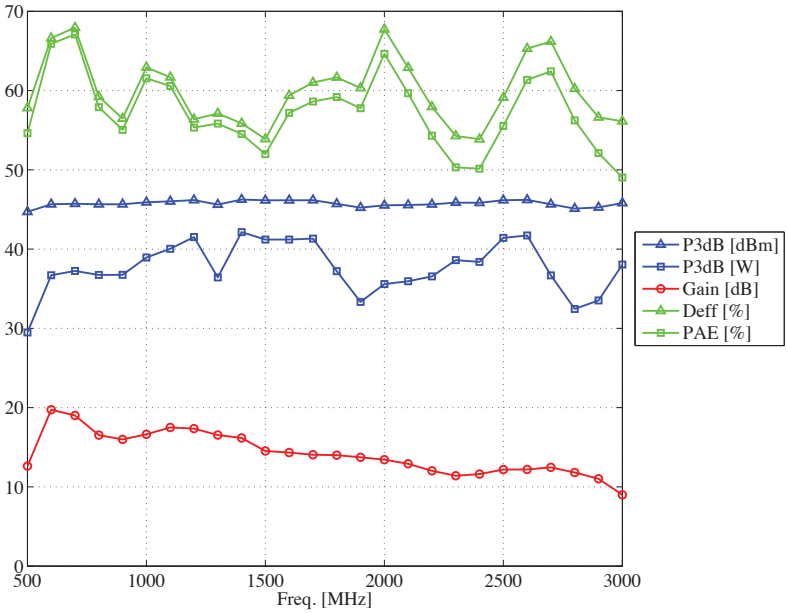
Freq. = 6 GHz; Vds = 28 V, Idq = 100 mA; CW.



Typical Instantaneous Wide-Band Performance

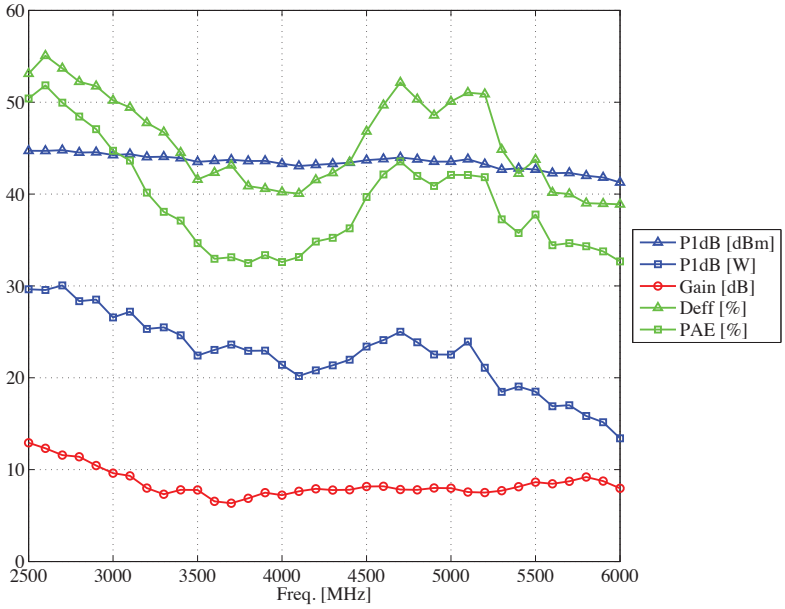
Evaluation Board Performance 500 MHz to 3 GHz

T1G6003028-SP Low Band Evaluation Board
Bias: Vd=28V, IDQ=100 mA, CW 3dB Compression



Evaluation Board Performance 2.5 GHz to 6 GHz

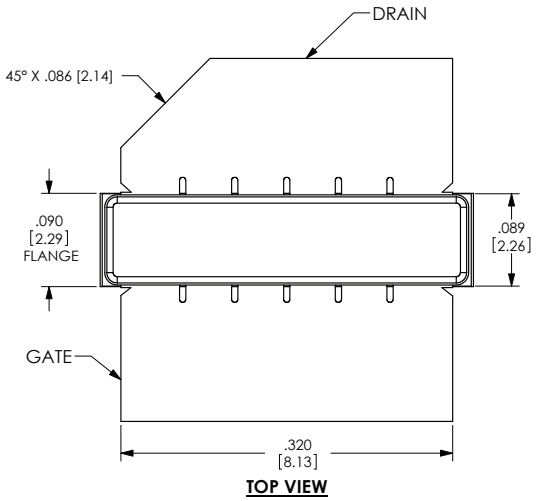
T1G6003028-SP High Band Evaluation Board
Bias: Vd=28V, IDQ=100 mA, CW 1dB Compression



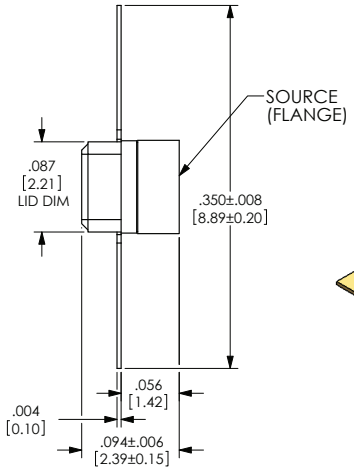
Mechanical Information

Package Information and Dimensions

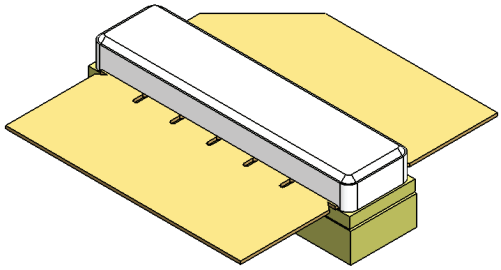
This package is lead-free/ROHS-compliant.

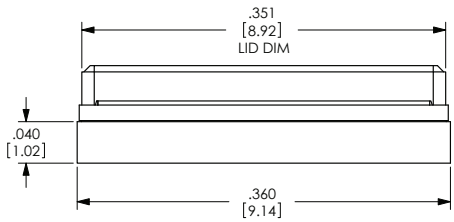


TOP VIEW



END VIEW





SIDE VIEW

ALL DIMENSIONS ARE IN INCHES [mm]
UNLESS OTHERWISE SPECIFIED

TOLERANCES

DECIMALS	ANGULAR
.XX ±0.01[.25]	.X ±0.5
.XXX ±0.003[.08]	

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: www.triquint.com

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