

T1P2701012-SP

10 W, 12V, 500 MHz-3 GHz, Powerband™ pHEMT RF Power Transistor

Introduction

The T1P2701012-SP is a POWERBAND™ discrete pHEMT, depletion mode RF Power Transistor designed to operate from 500MHz to 3GHz in wide-band circuits. The device has an instantaneous band-width P1dB output power of 10watts across the entire band when operated in the TriQuint wide-band test fixture. The T1P2701012-SP can also be used in narrow band applications and is rated at 15Watts P1dB at 3GHz.

Figure 1. Available Packages



Table 1. Maximum Ratings

Sym	Parameter	Value	Notes
V ⁺	Positive Supply Voltage	12.5 V	2/
V ⁻	Negative Supply Voltage Range	-5V to 0V	
I ⁺	Positive Supply Current	5.6A	2/
I _G	Gate Supply Current	70 mA	
P _D	Power Dissipation	See note 3	2/ 3/
T _{CH}	Operating Channel Temperature	150° C	4/

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

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

3/ For a median life time of 1E+6 hrs, Power dissipation is limited to: P_D(max) = (150 °C – T_{BASE} °C) / 8.3 (°C/W)

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.

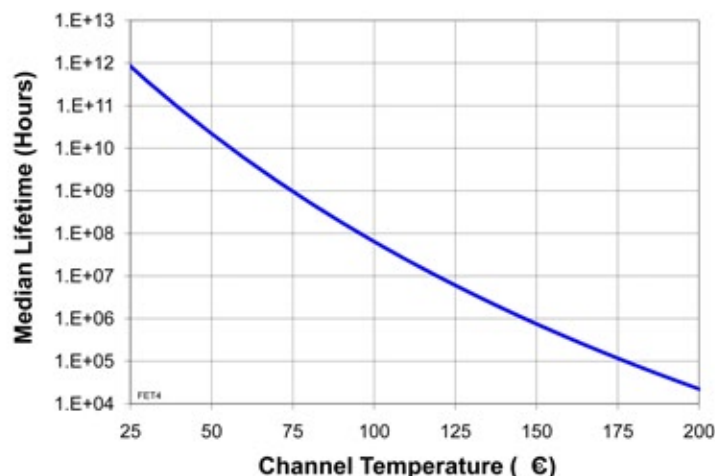
Table 2. Thermal Information

Parameter	Test Conditions	T _{CH} (°C)	θ _{JC} (°C/W)	T _M (HRS)
θ _{JC} Thermal Resistance (channel to backside of carrier)	V _d = 10 V I _{dq} = 900 mA P _{diss} = 9 W	145	8.3	1.6E+6

Features

- Exceptional Instantaneous band-width performance from 500MHz - 3GHz
- Increased efficiency results in significant advantages
 - Smaller and lighter systems
 - Reduced system component costs
 - Reduced energy consumption
- Typical Performance ratings
 - Wide-Band 500MHz - 3GHz (as tested in TriQuint Wideband Fixture)
 - 10dB Gain
 - 50% Efficiency
 - 10Watt P1dB
 - Narrow Band up to 3GHz
 - 12dB Gain
 - 60% Efficiency
 - 15Watt P1dB

Figure 2. Lifetime Median Curve



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Electrical Characteristics

Recommended operating conditions apply unless otherwise specified: $T_A = 25^\circ\text{C}$.

Table 3. dc Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Saturated Drain Current	I_{dss}	—	3000	—	mA
Transconductance	G_m	—	4000	—	mS
Pinch-off Voltage	V_p	-1.35	-1	-0.65	V
Breakdown Voltage Gate-Source	V_{BGS}	-30	—	-8	V
Breakdown Voltage Gate-Drain	V_{BGD}	-30	—	-15	V

Table 4. RF Characteristics

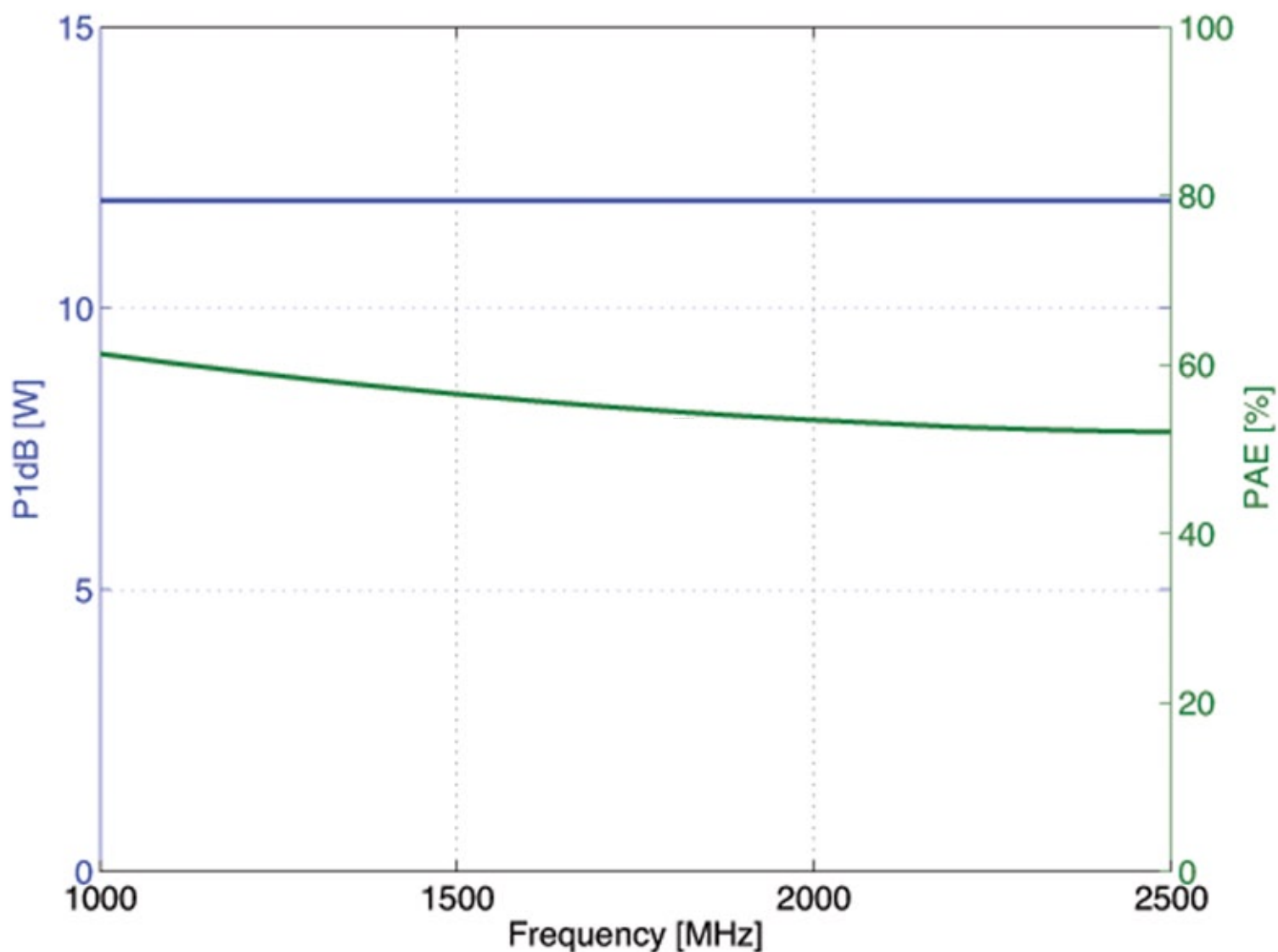
Parameter	Symbol	Min	Typ	Max	Unit
Functional Tests, Instantaneous Band-Width (Tested in TriQuint's Wide-Band Test Fixture)					
Gain @ P1dB, 500MHz-3GHz ($V_{DS} = 12\text{ V}$, $P_{OUT} = 10\text{ W}$, $I_{DD} = 200\text{ mA}$)	G	—	10	—	dB
P1dB, 500MHz-3GHz ($V_{DS} = 12\text{ V}$, $P_{OUT} = 10\text{ W}$, $I_{DD} = 200\text{ mA}$)	P1dB	—	10	—	W
Power Added Efficiency, 500MHz-3GHz ($V_{DS} = 12\text{ V}$, $P_{OUT} = 10\text{ W}$, $I_{DD} = 200\text{ mA}$)	—	—	45	—	%
Functional Tests, Narrow Band RF Performance (1GHz)					
Gain ($V_{DS} = 12\text{ V}$, $P_{OUT} = 15\text{ W}$, $I_{DQ} = 200\text{ mA}$)	G	—	17	—	dB
Output Power ($V_{DS} = 12\text{ V}$, 1 dB compression, $I_{DQ} = 200\text{ mA}$)	P1dB	—	15	—	W
Drain Efficiency ($V_{DS} = 12\text{ V}$, $P_{OUT} = \text{P1dB}$, $I_{DQ} = 200\text{ mA}$)	—	—	59	—	%
Ruggedness ($V_{DS} = 12\text{ V}$, $P_{OUT} = 15\text{ W}$, $I_{DQ} = 200\text{ mA}$, $f = 500\text{ MHz}$, $V_{SWR} = 3:1$, all angles)	—	No degradation in output power.			

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Figure 3.

P1dB and Efficiency (Narrow Band Performance Plotted Over Frequency)

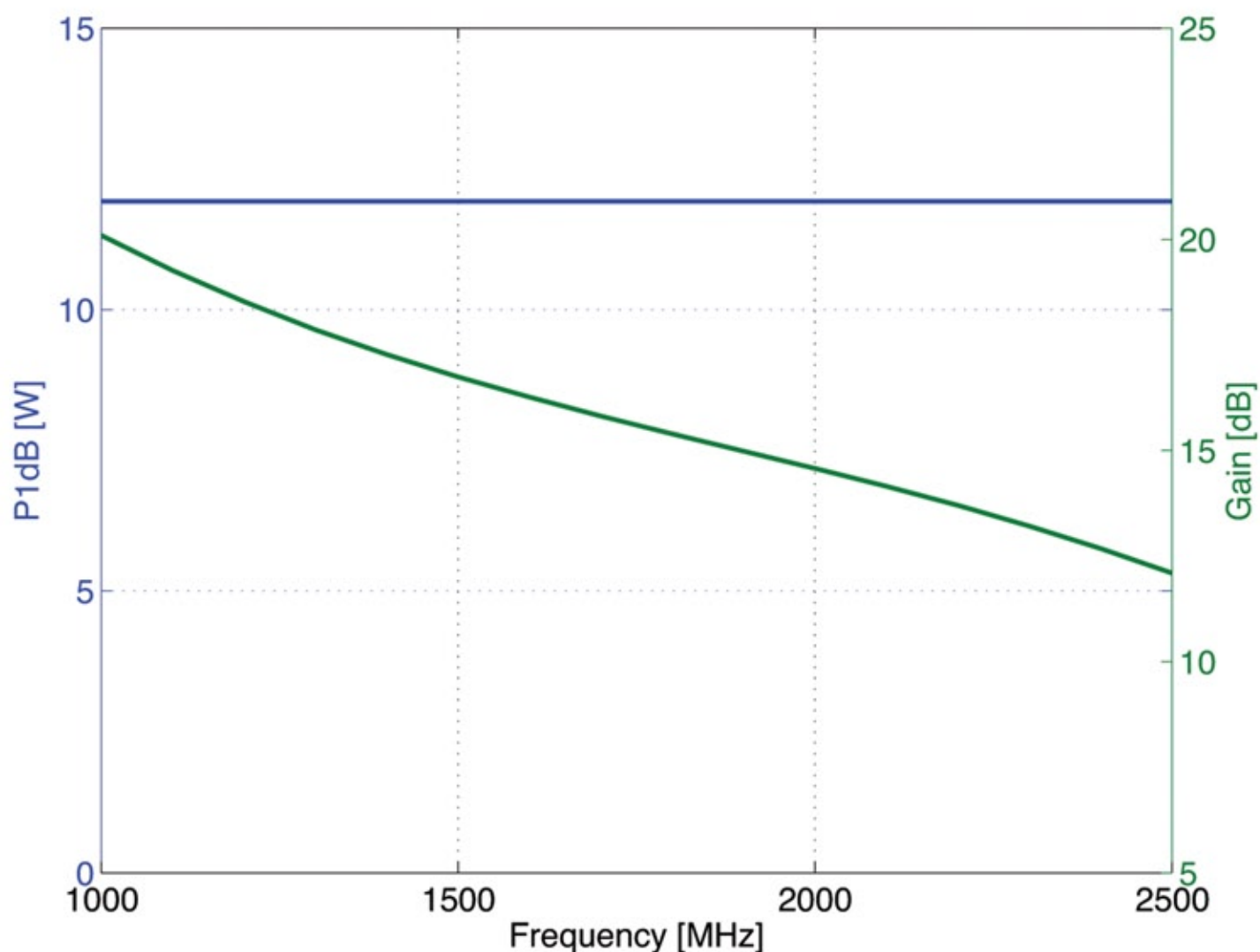


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Figure 4.

P1dB and Gain (Narrow Band Performance Plotted Over Frequency)

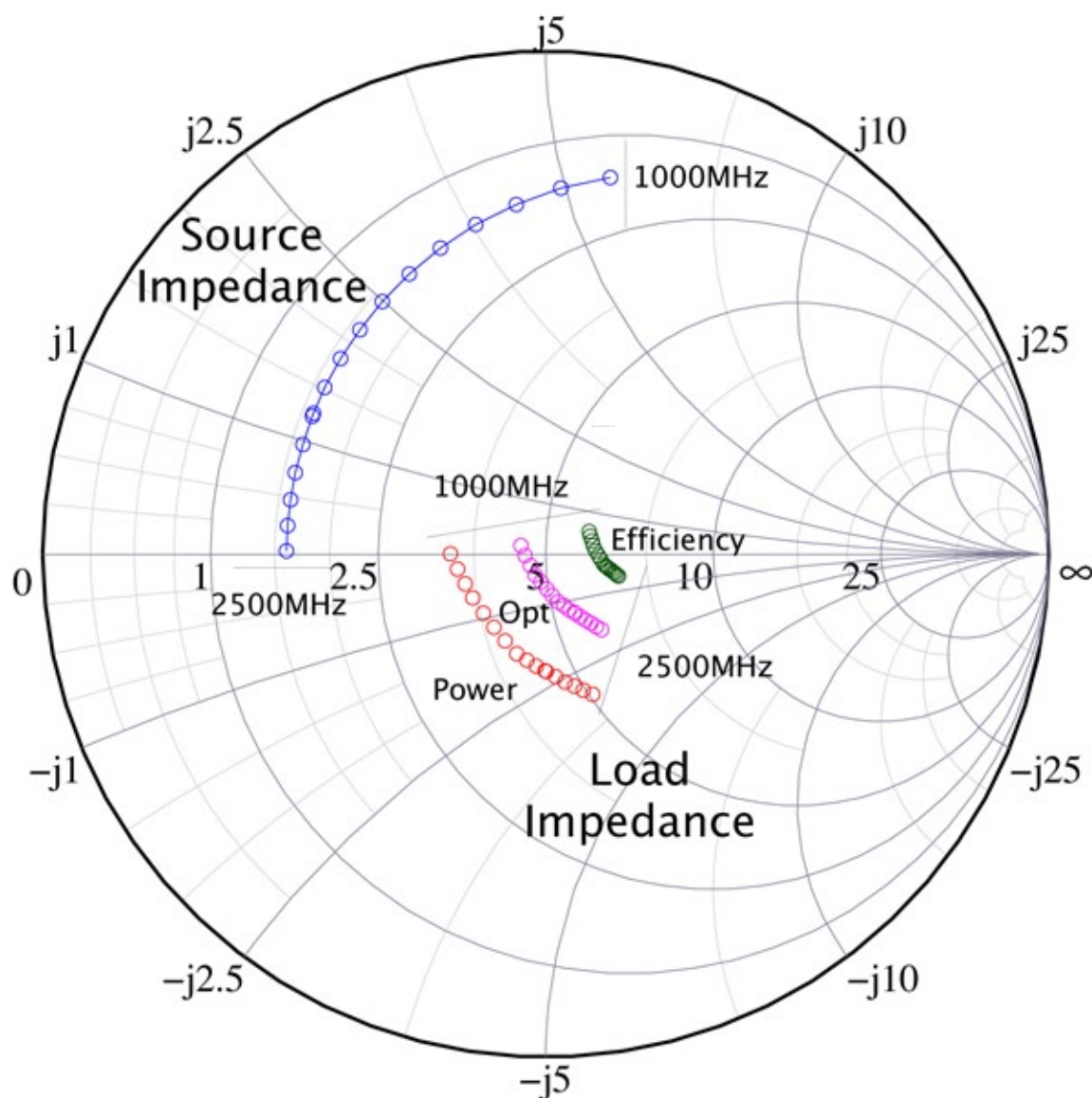


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Figure 5.

Plot of impedances to be presented to the source and load of the device for optimal RF performance.

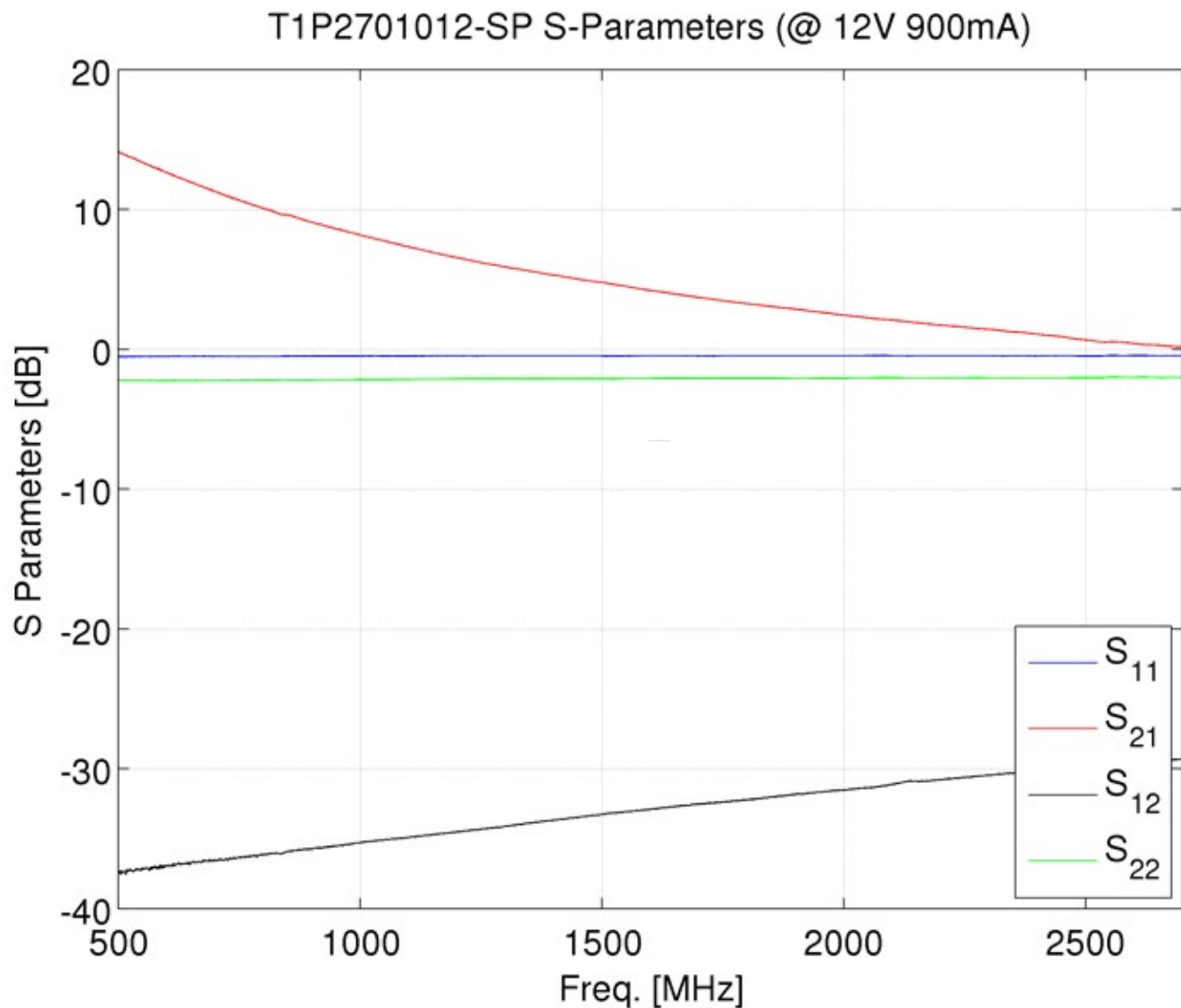


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Figure 6.

S Parameters 900mA, 12 Volts



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Table 5.

S Parameters 900mA, 12 Volts

Freq. (MHz)	Real(S11)	Imag(S11)	Real(S21)	Imag(S21)	Real(S12)	Imag(S12)	Real(S22)	Imag(S22)
500	-0.9307	-0.1207	-0.0665	5.10135	0.01135	0.00708	-0.7757	-0.0124
600	-0.939	-0.0893	0.12622	4.26706	0.01151	0.00838	-0.7729	-0.0055
700	-0.9423	-0.0652	0.26221	3.65341	0.01145	0.00948	-0.7751	0.00013
800	-0.9431	-0.0457	0.34405	3.17545	0.01145	0.0106	-0.7765	0.00428
900	-0.9448	-0.0303	0.39014	2.8255	0.01143	0.0117	-0.7764	0.00767
1000	-0.9473	-0.0164	0.4278	2.52434	0.0115	0.01286	-0.78	0.01299
1100	-0.9468	-0.0039	0.45361	2.28046	0.01141	0.01376	-0.7807	0.01654
1200	-0.9468	0.0079	0.47155	2.07291	0.01169	0.01472	-0.7822	0.01987
1300	-0.9479	0.01842	0.4925	1.9043	0.01174	0.0159	-0.7837	0.02157
1400	-0.9482	0.02885	0.51175	1.76969	0.01192	0.01696	-0.7842	0.02303
1500	-0.9463	0.04065	0.53656	1.64687	0.01242	0.0181	-0.7843	0.02466
1600	-0.9469	0.04868	0.53226	1.5342	0.01228	0.01907	-0.7857	0.02895
1700	-0.9455	0.05745	0.54947	1.42777	0.01257	0.01997	-0.7872	0.02933
1800	-0.9462	0.06551	0.56079	1.34202	0.01268	0.02086	-0.787	0.03124
1900	-0.9457	0.07494	0.57121	1.26916	0.01304	0.02209	-0.7855	0.03541
2000	-0.9453	0.08315	0.56887	1.19705	0.01292	0.02307	-0.787	0.03937
2100	-0.9446	0.09464	0.57385	1.13478	0.01307	0.02465	-0.7899	0.04435
2200	-0.9429	0.10118	0.57936	1.07323	0.01376	0.02537	-0.7886	0.04469
2300	-0.941	0.11071	0.59207	1.02035	0.01425	0.02642	-0.788	0.04657
2400	-0.9398	0.11908	0.58831	0.96607	0.01441	0.02742	-0.7877	0.05118
2500	-0.9386	0.12642	0.57374	0.91549	0.01422	0.02781	-0.7896	0.05774
2600	-0.9404	0.13279	0.57921	0.87297	0.01435	0.02993	-0.7916	0.05971
2700	-0.9386	0.14154	0.5826	0.83629	0.01494	0.03072	-0.7895	0.06451
2800	-0.9378	0.15298	0.57891	0.80993	0.01472	0.03278	-0.7919	0.07347
2900	-0.934	0.16049	0.58357	0.76239	0.01577	0.0332	-0.7927	0.07262
3000	-0.9338	0.16637	0.58289	0.72742	0.01593	0.03402	-0.7938	0.07587



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Table 6. Table of 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. The data is representative of typical device performance for both 100uSecond pulse width, 10% duty cycle conditions and 1000uSecond pulse width, 10% duty cycle conditions.

Frequency [MHz]	real(Γ_{in})	imag(Γ_{in})	real(Z_{in})	imag(Z_{in})	real(Γ_{out})	imag(Γ_{out})	real(Z_{out})	imag(Z_{out})	Gain [dB]	P1dB [W]	P1dB [dBm]	PAE [%]
1000	-0.915	0.21	1.6	5.67	-0.834	0.005	4.53	0.15	20.1	11.9	40.8	61.3
1100	-0.92	0.184	1.6	4.95	-0.831	-0.001	4.61	-0.03	19.3	11.9	40.8	60.2
1200	-0.924	0.162	1.6	4.33	-0.828	-0.007	4.7	-0.21	18.5	11.9	40.8	59.2
1300	-0.928	0.142	1.6	3.8	-0.825	-0.013	4.78	-0.4	17.9	11.9	40.8	58.2
1400	-0.93	0.124	1.6	3.32	-0.822	-0.018	4.88	-0.54	17.3	11.9	40.8	57.3
1500	-0.932	0.108	1.6	2.89	-0.819	-0.023	4.97	-0.69	16.7	11.9	40.8	56.5
1600	-0.933	0.094	1.6	2.5	-0.816	-0.028	5.06	-0.84	16.3	11.9	40.8	55.8
1700	-0.935	0.081	1.6	2.15	-0.812	-0.033	5.16	-0.99	15.8	11.9	40.8	55.1
1800	-0.936	0.068	1.6	1.82	-0.809	-0.036	5.26	-1.09	15.4	11.9	40.8	54.5
1900	-0.936	0.057	1.6	1.52	-0.806	-0.039	5.35	-1.2	15	11.9	40.8	53.9
2000	-0.937	0.046	1.6	1.23	-0.802	-0.042	5.45	-1.3	14.6	11.9	40.8	53.4
2100	-0.937	0.036	1.6	0.97	-0.799	-0.046	5.55	-1.41	14.1	11.9	40.8	53
2200	-0.938	0.027	1.6	0.71	-0.796	-0.049	5.65	-1.52	13.7	11.9	40.8	52.7
2300	-0.938	0.018	1.6	0.48	-0.792	-0.052	5.75	-1.63	13.2	11.9	40.8	52.4
2400	-0.938	0.009	1.6	0.25	-0.789	-0.056	5.84	-1.73	12.7	11.9	40.8	52.1
2500	-0.938	0.001	1.6	0.03	-0.786	-0.059	5.94	-1.84	12.1	11.9	40.8	52

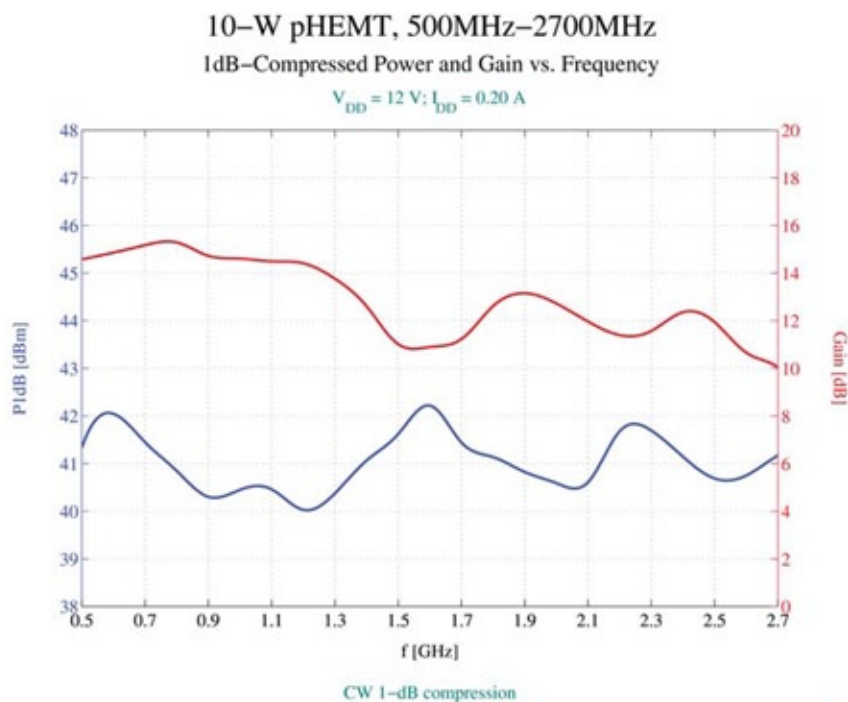
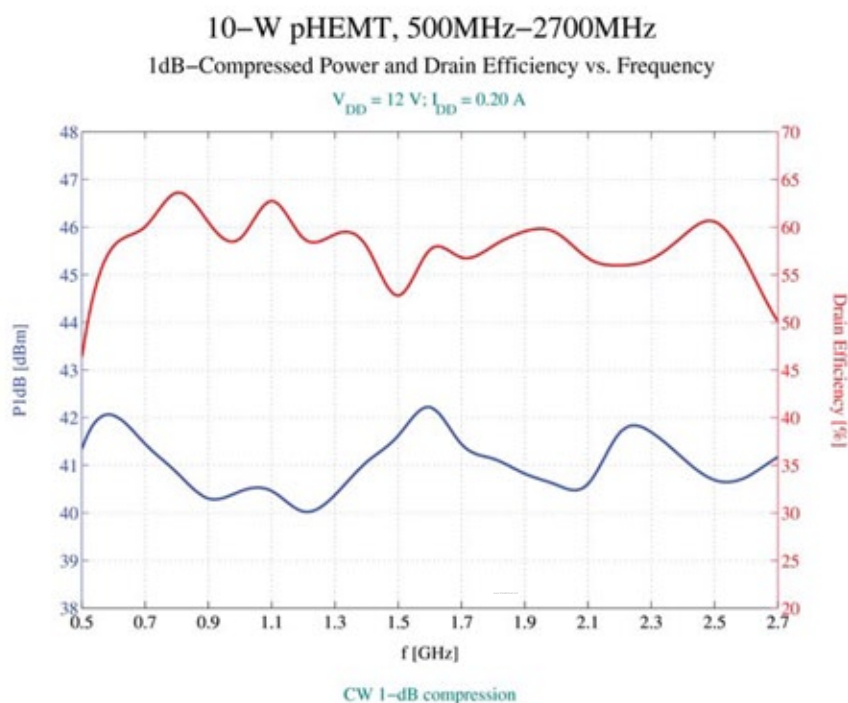


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Figure 7.

Typical Instantaneous Wideband Performance Data, 500MHz-2.7GHz
(tested in TriQuint Wideband Fixture)



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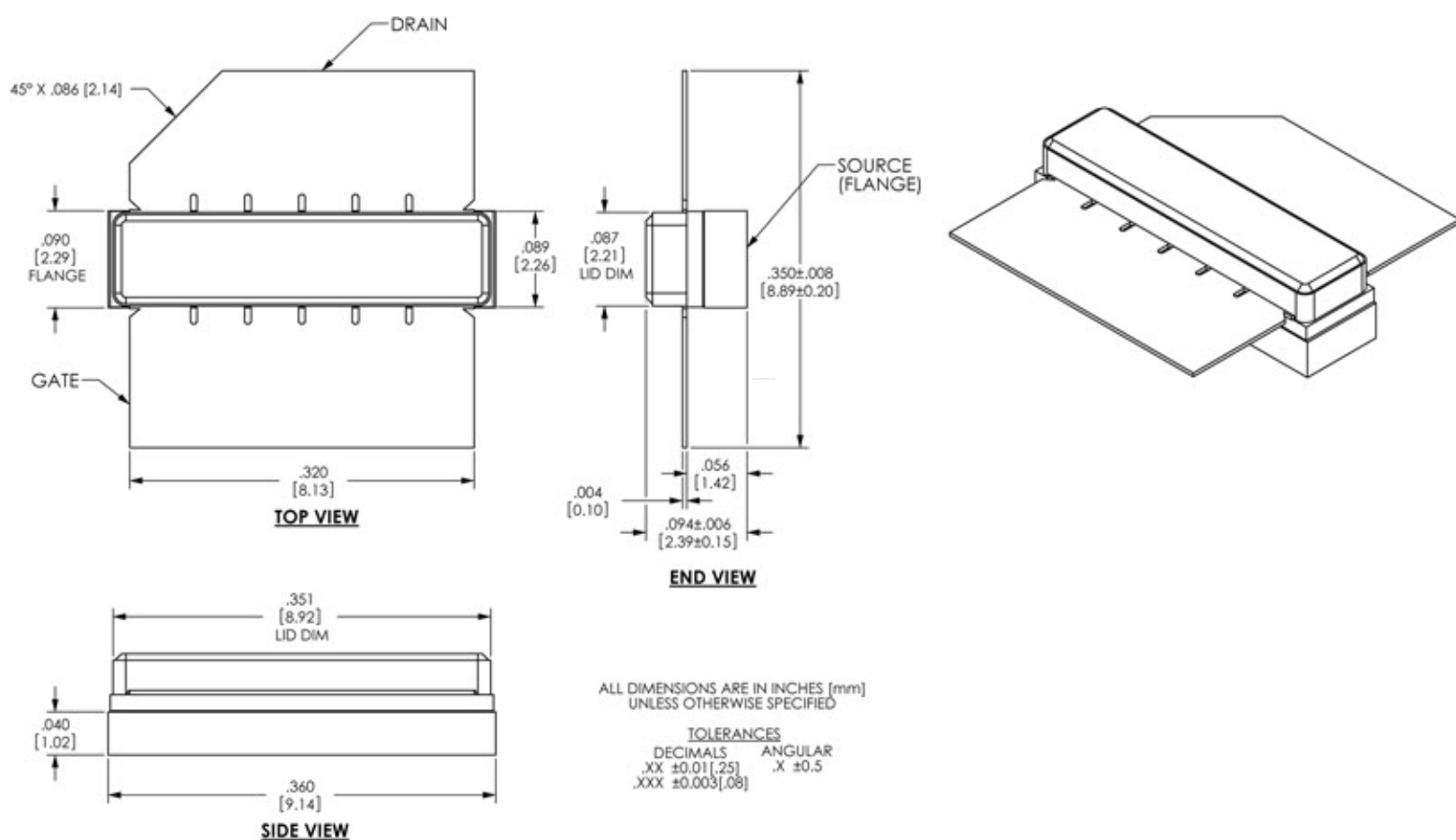


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Package Dimensions

Note: All dimensions in inches. Scale 8:1



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