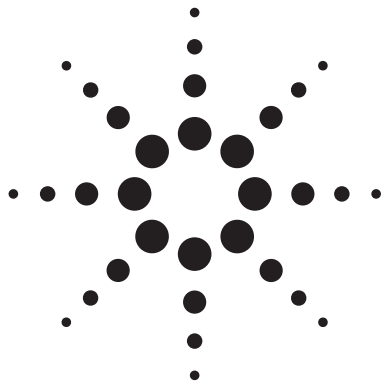




Agilent ATF-501P8 High Linearity Enhancement Mode^[1] Pseudomorphic HEMT in 2x2 mm² LPCC^[3] Package

Data Sheet

Description

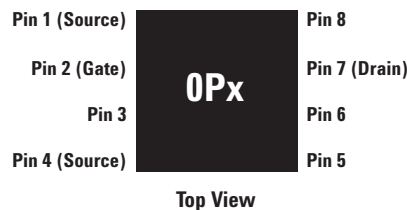
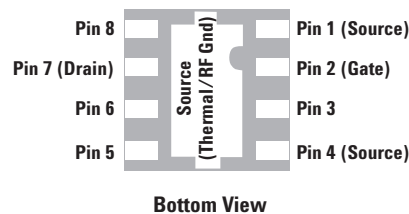
Agilent Technologies's ATF-501P8 is a single-voltage high linearity, low noise E-pHEMT housed in an 8-lead JEDEC-standard leadless plastic chip carrier (LPCC^[3]) package. The device is ideal as a medium-power amplifier. Its operating frequency range is from 400 MHz to 3.9 GHz.

The thermally efficient package measures only 2mm x 2mm x 0.75mm. Its backside metalization provides excellent thermal dissipation as well as visual evidence of solder reflow. The device has a Point MTTF of over 300 years at a mounting temperature of +85°C. All devices are 100% RF & DC tested.

Notes:

1. Enhancement mode technology employs a single positive V_{gs} , eliminating the need of negative gate voltage associated with conventional depletion mode devices.
2. Refer to reliability datasheet for detailed MTTF data.
3. Conforms to JEDEC reference outline M0229 for DRP-N.
4. Linearity Figure of Merit (LFOM) is essentially OIP3 divided by DC bias power.

Pin Connections and Package Marking



Note:

Package marking provides orientation and identification:

"0P" = Device Code

"X" = Date code indicates the month of manufacture.



Attention:
Observe precautions for handling electrostatic sensitive devices.

ESD Machine Model (Class A)

ESD Human Body Model (Class 1B)

Refer to Agilent Application Note A004R:
Electrostatic Discharge Damage and Control.

Features

- Single voltage operation
- High Linearity and P1dB
- Low Noise Figure
- Excellent uniformity in product specifications
- Small package size: 2.0 x 2.0 x 0.75 mm³
- Point MTTF > 300 years^[2]
- MSL-1 and lead-free
- Tape-and-Reel packaging option available

Specifications

- 2 GHz; 4.5V, 280 mA (Typ.)
- 45.5 dBm Output IP3
- 29 dBm Output Power at 1dB gain compression
- 1 dB Noise Figure
- 15 dB Gain
- 14.5 dB LFOM^[4]
- 65% PAE
- 23°C/W thermal resistance

Applications

- Front-end LNA Q2 and Q3, Driver or Pre-driver Amplifier for Cellular/PCS and WCDMA wireless infrastructure
- Driver Amplifier for WLAN, WLL/RLL and MMDS applications
- General purpose discrete E-pHEMT for other high linearity applications



Agilent Technologies

ATF-501P8 Absolute Maximum Ratings^[1]

Symbol	Parameter	Units	Absolute Maximum
V_{DS}	Drain–Source Voltage ^[2]	V	7
V_{GS}	Gate–Source Voltage ^[2]	V	-5 to 0.8
V_{GD}	Gate Drain Voltage ^[2]	V	-5 to 1
I_{DS}	Drain Current ^[2]	A	1
I_{GS}	Gate Current	mA	12
P_{diss}	Total Power Dissipation ^[3]	W	3.5
$P_{in\ max.}$	RF Input Power	dBm	30
T_{CH}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150
θ_{ch_b}	Thermal Resistance ^[4]	°C/W	23

Notes:

1. Operation of this device in excess of any one of these parameters may cause permanent damage.
2. Assumes DC quiescent conditions.
3. Board (package belly) temperature T_B is 25°C. Derate 43.5 mW/°C for $T_B > 69.5^\circ\text{C}$.
4. Channel-to-board thermal resistance measured using 150°C Liquid Crystal Measurement method.

Product Consistency Distribution Charts at 2 GHz, 4.5V, 200 mA^[5,6]

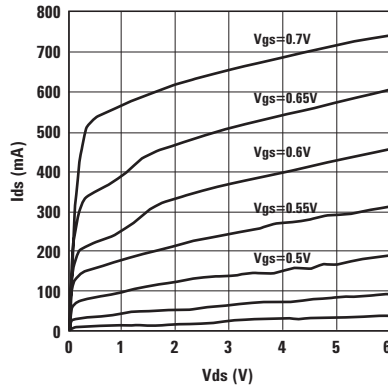


Figure 1. Typical IV curve ($V_{GS} = 0.01V$ per step).

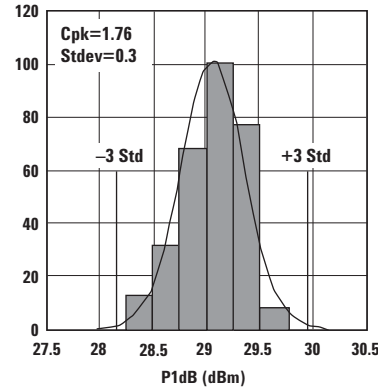


Figure 2. P1dB.

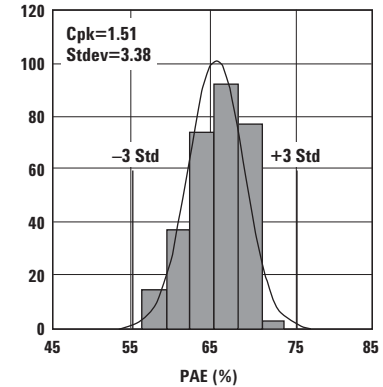


Figure 3. PAE.

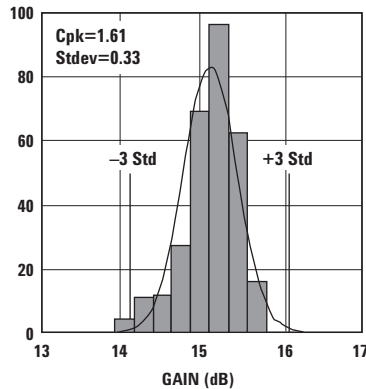


Figure 4. Gain.

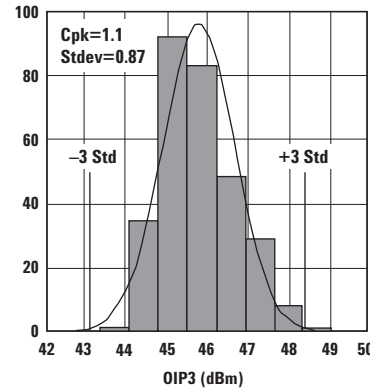


Figure 5. OIP3.

Notes:

5. Distribution data sample size is 300 samples taken from 3 different wafers and 3 different lots. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
6. Measurements are made on production test board, which represents a trade-off between optimal OIP3, P1dB and VSWR. Circuit losses have been de-embedded from actual measurements.

ATF-501P8 Electrical Specifications

$T_A = 25^\circ\text{C}$, DC bias for RF parameters is $V_{ds} = 4.5\text{V}$ and $I_{ds} = 280\text{ mA}$ unless otherwise specified.

Symbol	Parameter and Test Condition		Units	Min.	Typ.	Max.
Vgs	Operational Gate Voltage	Vds = 4.5V, Ids = 280 mA	V	0.42	0.55	0.67
Vth	Threshold Voltage	Vds = 4.5V, Ids = 32 mA	V	—	0.33	—
Idss	Saturated Drain Current	Vds = 4.5V, Vgs = 0V	μA	—	5	—
Gm	Transconductance	Vds = 4.5V, Gm = ΔIds/ΔVgs; ΔVgs = Vgs1 – Vgs2 Vgs1 = 0.55V, Vgs2 = 0.5V	mmho	—	1872	—
Igss	Gate Leakage Current	Vds = 0V, Vgs = -4.5V	μA	-30	-0.8	—
NF	Noise Figure ^[1]	f = 2 GHz f = 900 MHz	dB dB	— —	1 —	— —
G	Gain ^[1]	f = 2 GHz f = 900 MHz	dB dB	13.5 —	15 16.6	16.5 —
OIP3	Output 3 rd Order Intercept Point ^[1,2]	f = 2 GHz f = 900 MHz	dBm dBm	43 —	45.5 42	— —
P1dB	Output 1dB Compressed ^[1]	f = 2 GHz f = 900 MHz	dBm dBm	27.5 —	29 27.3	— —
PAE	Power Added Efficiency ^[1]	f = 2 GHz f = 900 MHz	% %	50 —	65 49	— —
ACLR	Adjacent Channel Leakage Power Ratio ^[1,3]	Offset BW = 5 MHz Offset BW = 10 MHz	dBc dBc	— —	63.9 64.1	— —

Notes:

- Measurements at 2 GHz obtained using production test board described in Figure 2 while measurement at 0.9GHz obtained from load pull tuner.
- i) 2 GHz OIP3 test condition: $F1 = 2.0\text{ GHz}$, $F2 = 2.01\text{ GHz}$ and $P_{in} = -5\text{ dBm}$ per tone.
ii) 900 MHz OIP3 test condition: $F1 = 900\text{ MHz}$, $F2 = 910\text{ MHz}$ and $P_{in} = -5\text{ dBm}$ per tone.
- ACLR test spec is based on 3GPP TS 25.141 V5.3.1 (2002-06)
 - Test Model 1
 - Active Channels: PCCPCH + SCH + CPICH + PICH + SCCPCH + 64 DPCH (SF=128)
 - Freq = 2140 MHz
 - $P_{in} = -5\text{ dBm}$
 - Channel Integrate Bandwidth = 3.84 MHz
- Use proper bias, board, heatsinking and derating designs to ensure max channel temperature is not exceeded.
See absolute max ratings and application note for more details.

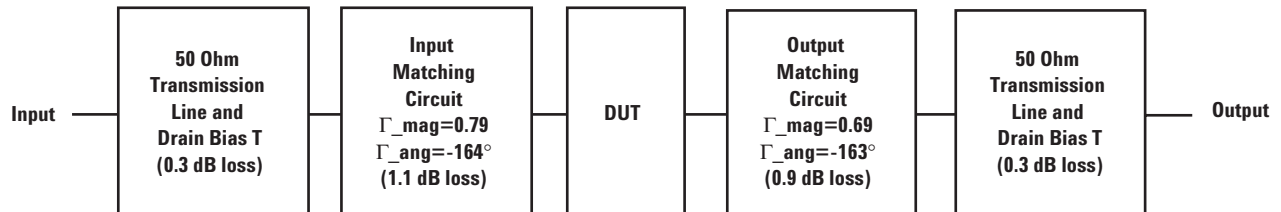


Figure 6. Block diagram of the 2 GHz production test board used for NF, Gain, OIP3, P1dB and PAE measurements at 2 GHz. This circuit achieves a trade-off between optimal OIP3, P1dB and VSWR. Circuit losses have been de-embedded from actual measurements.

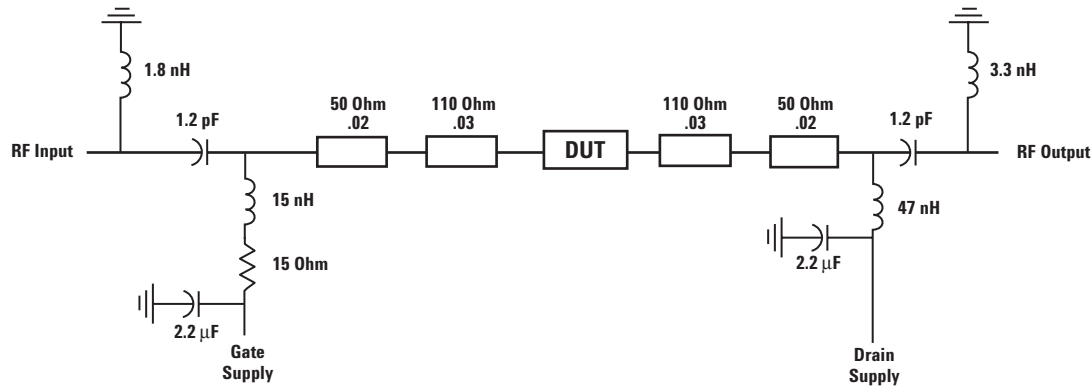


Figure 3. Simplified schematic of production test board. Primary purpose is to show 15 Ohm series resistor placement in gate supply. Transmission line tapers, tee intersections, bias lines and parasitic values are not shown.

Gamma Load and Source at Optimum OIP3 and P1dB Tuning Conditions

The device's optimum OIP3 and P1dB measurements were determined using a load pull system at 4.5V 280 mA and 4.5V 400 mA quiescent bias respectively:

Typical Gammas at Optimum OIP3 at 4.5V 280 mA

Freq (GHz)	Optimized for maximum OIP3 at 4.5V 280 mA				Gamma Source	Gamma Load
	OIP3	Gain	P1dB	PAE		
0.9	46.42	16.03	26.67	45.80	0.305 < -140	0.577 < 162
2.0	45.50	15.07	28.93	50.30	0.806 < -179.2	0.511 < 164
2.4	44.83	12.97	29.03	45.70	0.756 < -167	0.589 < -168
3.9	43.97	6.11	27.33	33.90	0.782 < -162	0.524 < -153

Typical Gammas at Optimum P1dB at 4.5V 280mA

Freq (GHz)	Optimized for maximum P1dB at 4.5V 280 mA				Gamma Source	Gamma Load
	OIP3	Gain	P1dB	PAE		
0.9	39.29	20.90	30.49	41.00	0.859 < 165	0.757 < 179
2.0	41.79	14.72	30.60	45.30	0.76 < -171	0.691 < -168
2.4	42.37	11.25	30.24	39.70	0.745 < -166	0.694 < -161
3.9	42.00	5.63	28.26	25.80	0.759 < -159	0.708 < -149

Typical Gammas at Optimum OIP3 at 4.5V 400 mA

Freq (GHz)	Optimized for maximum OIP3 at 4.5V 400 mA				Gamma Source	Gamma Load
	OIP3	Gain	P1dB	PAE		
0.9	49.15	16.85	27.86	44.20	0.5852 < -135.80	0.4785 < 177.00
2.0	48.18	14.72	29.36	48.89	0.7267 < -175.37	0.7338 < 179.56
2.4	47.54	12.47	29.10	46.83	0.6155 < -171.71	0.5411 < -172.02
3.9	45.44	8.05	28.49	37.02	0.7888 < -148.43	0.5247 < -145.84

Typical Gammas at Optimum P1dB at 4.5V 400 mA

Freq (GHz)	Optimized for maximum P1dB at 4.5V 400 mA				Gamma Source	Gamma Load
	OIP3	Gain	P1dB	PAE		
0.9	41.78	21.84	31.23	49.97	0.7765 < 168.50	0.7589 < -175.09
2.0	43.28	14.83	31.03	44.78	0.8172 < -175.74	0.8011 < -165.75
2.4	42.46	11.90	30.66	41.00	0.8149 < -163.78	0.8042 < -161.79
3.9	42.94	7.70	29.56	33.06	0.8394 < -151.21	0.7826 < -149.00

ATF-501P8 Typical Performance Curves (at 25°C unless specified otherwise)
Tuned for Optimal OIP3 at 4.5V 280 mA

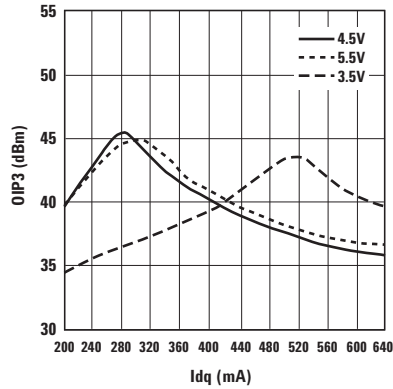


Figure 8. OIP3 vs. Idq and Vds at 2 GHz.

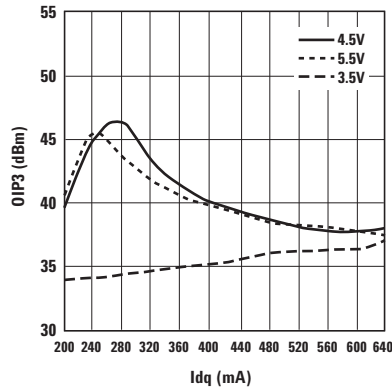


Figure 9. OIP3 vs. Idq and Vds at 0.9 GHz.

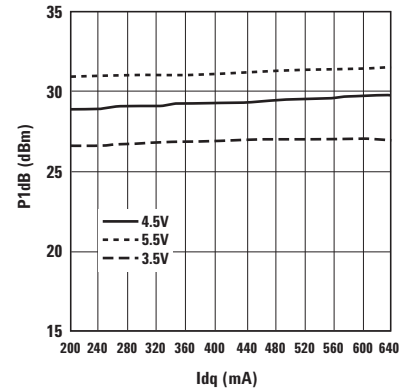


Figure 10. P1dB vs. Idq and Vds at 2 GHz.

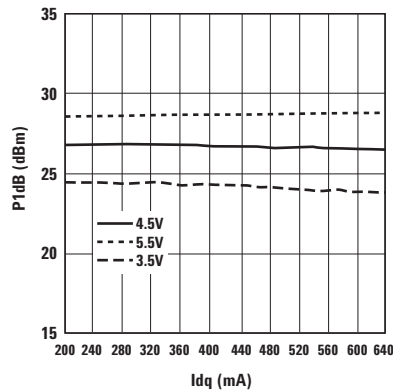


Figure 11. P1dB vs. Idq and Vds at 0.9 GHz.

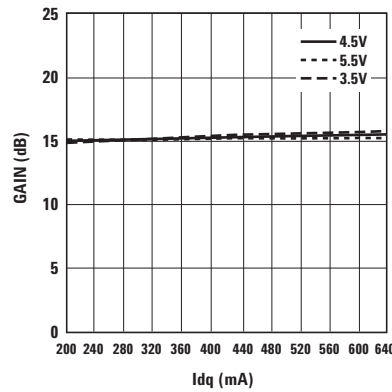


Figure 12. Gain vs. Idq and Vds at 2 GHz.

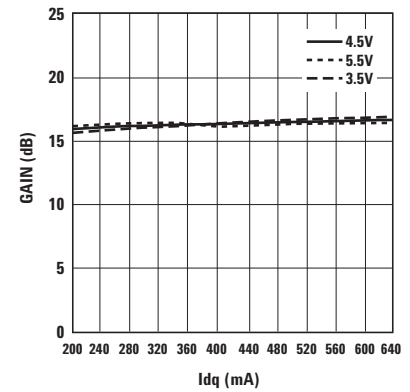


Figure 13. Gain vs. Idq and Vds at 0.9 GHz.

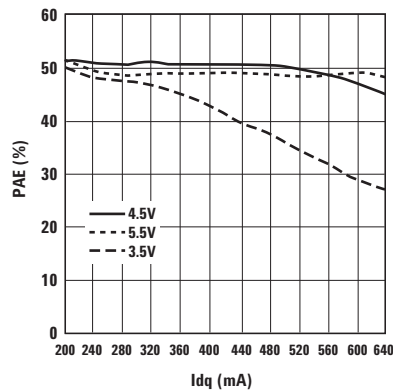


Figure 14. PAE vs. Idq and Vds at 2 GHz.

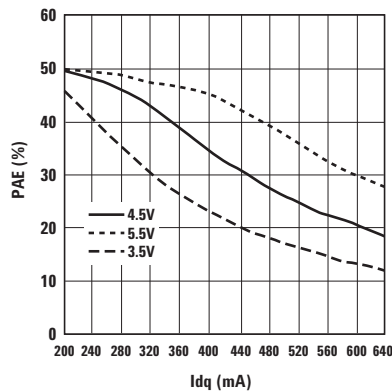


Figure 15. PAE vs. Idq and Vds at 0.9 GHz.

ATF-501P8 Typical Performance Curves (at 25°C unless specified otherwise)
Tuned for Optimal P1dB at 4.5V 280 mA

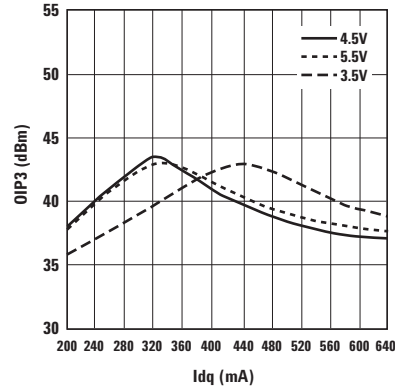


Figure 16. OIP3 vs. Idq and Vds at 2 GHz.

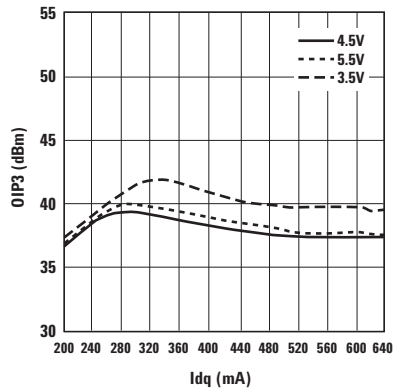


Figure 17. OIP3 vs. Idq and Vds at 0.9 GHz.

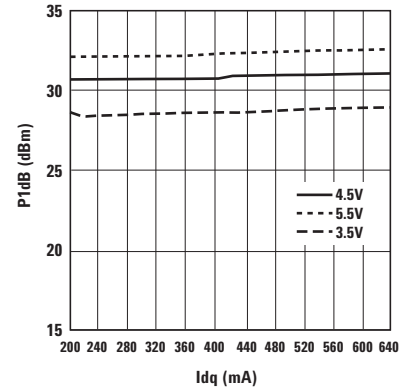


Figure 18. P1dB vs. Idq and Vds at 2 GHz.

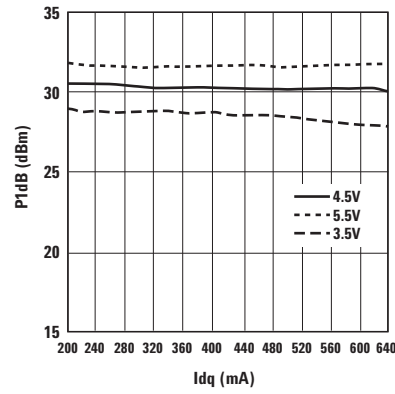


Figure 19. P1dB vs. Idq and Vds at 0.9 GHz.

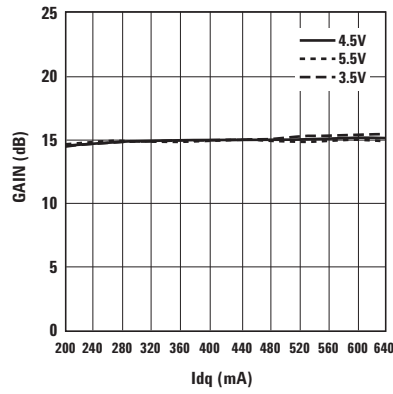


Figure 20. Gain vs. Idq and Vds at 2 GHz.

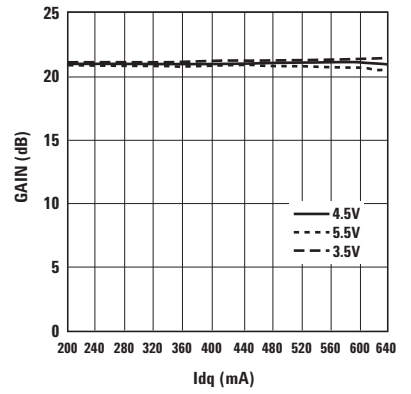


Figure 21. Gain vs. Idq and Vds at 0.9 GHz.

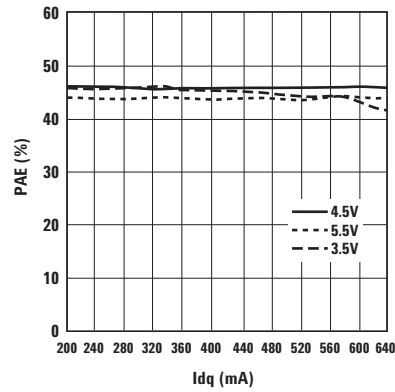


Figure 22. PAE vs. Idq and Vds at 2 GHz.

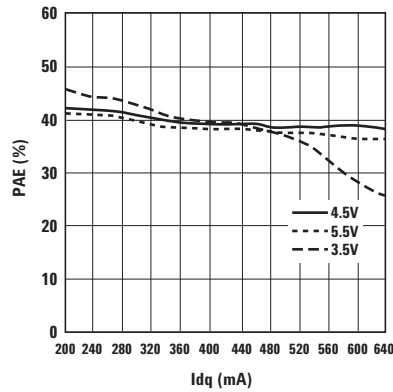


Figure 23. PAE vs. Idq and Vds at 0.9 GHz.

ATF-501P8 Typical Performance Curves (at 25°C unless specified otherwise)
Tuned for Optimum OIP3 at 4.5V 280 mA

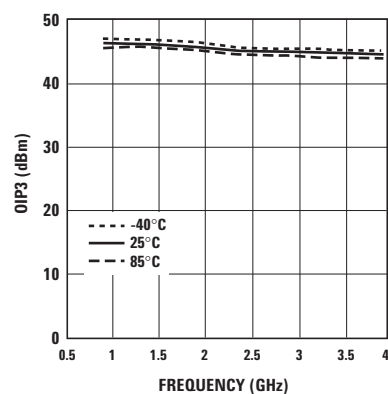


Figure 24. OIP3 vs. Temperature and Frequency at Optimal OIP3.

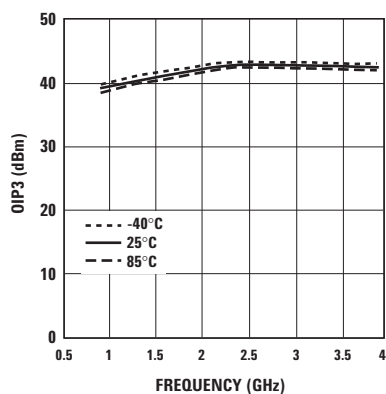


Figure 25. OIP3 vs. Temperature and Frequency at Optimal P1dB.

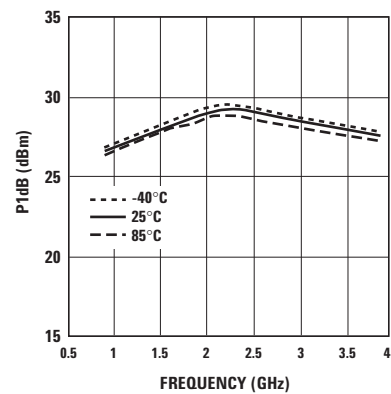


Figure 26. P1dB vs. Temperature and Frequency at Optimal OIP3.

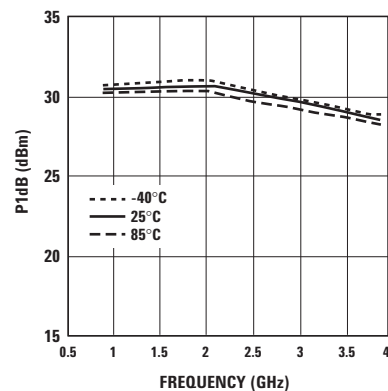


Figure 27. P1dB vs. Temperature and Frequency at Optimal P1dB.

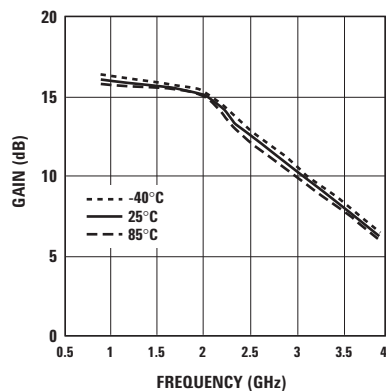


Figure 28. Gain vs. Temperature and Frequency at Optimal OIP3.

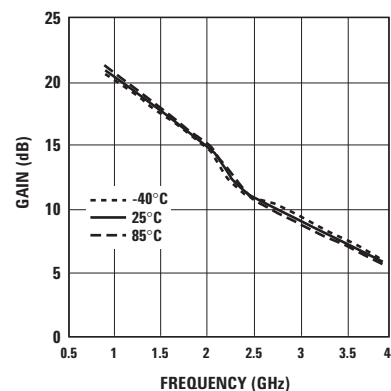


Figure 29. Gain vs. Temperature and Frequency at Optimal P1dB.

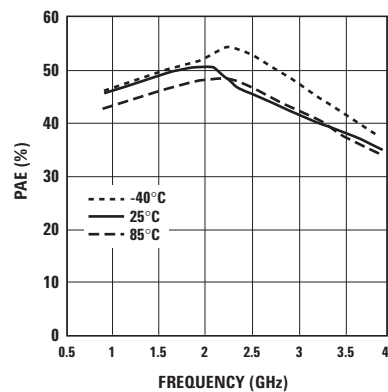


Figure 30. PAE vs. Temperature and Frequency at Optimal OIP3.

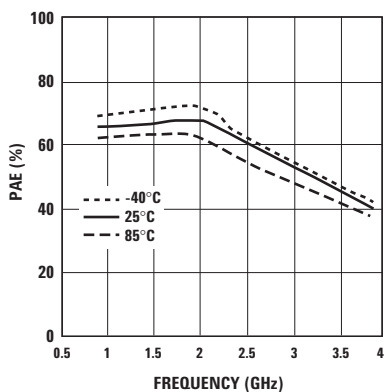


Figure 31. PAE vs. Temperature and Frequency at Optimal P1dB.

ATF-501P8 Typical Performance Curves (at 25°C unless specified otherwise)
Tuned for Optimal OIP3 at 4.5V 400 mA

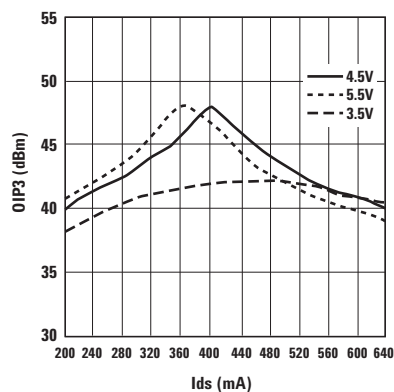


Figure 32. OIP3 vs. Ids and Vds at 2 GHz.

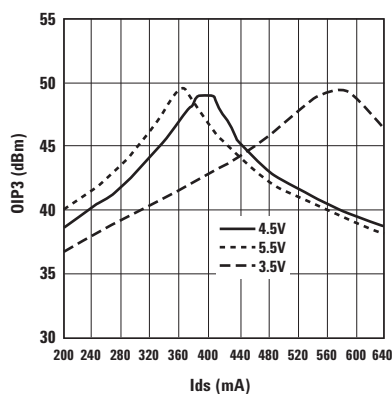


Figure 33. OIP3 vs. Ids and Vds at 900 MHz.

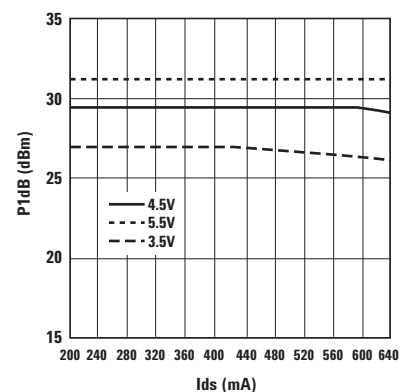


Figure 34. P1dB vs. Ids and Vds at 2 GHz.

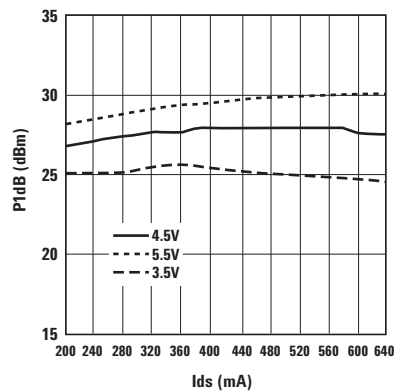


Figure 35. P1dB vs. Ids and Vds at 900 MHz.

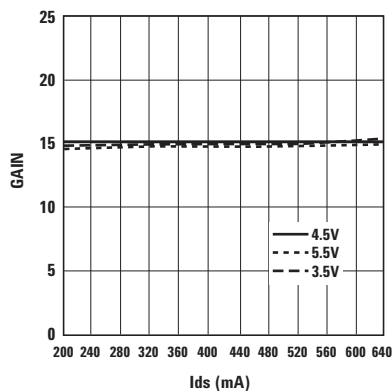


Figure 36. Gain vs. Ids and Vds at 2 GHz.

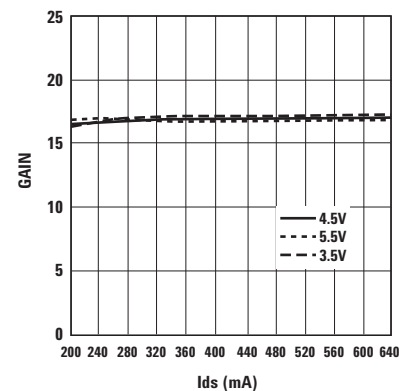


Figure 37. Gain vs. Ids and Vds at 900 MHz.

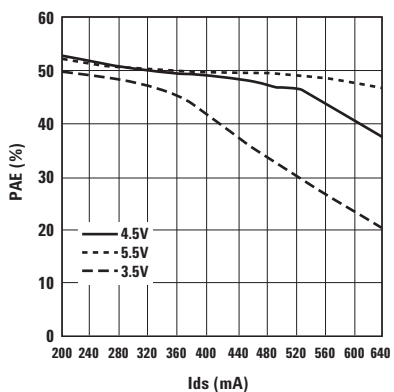


Figure 38. PAE vs. Ids and Vds at 2 GHz.

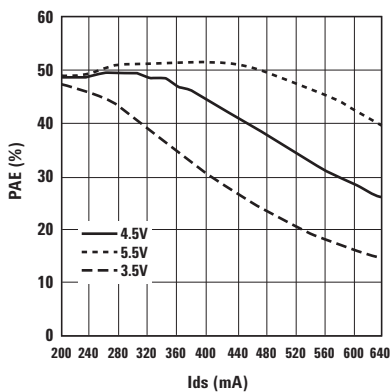


Figure 39. PAE vs. Ids and Vds at 900 MHz.

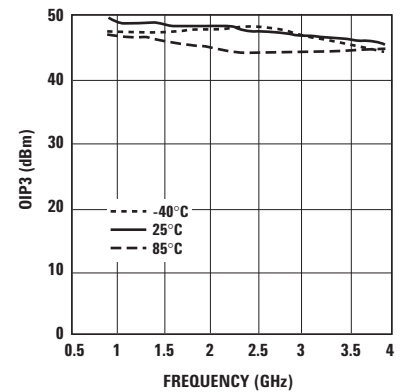


Figure 40. OIP3 vs. Temperature and Frequency at optimum OIP3.

Note:

Bias current (Ids) for the above charts are quiescent conditions. Actual level may increase or decrease depending on amount of RF drive.

ATF-501P8 Typical Performance Curves, continued (at 25°C unless specified otherwise)
Tuned for Optimal OIP3 at 4.5V 400 mA

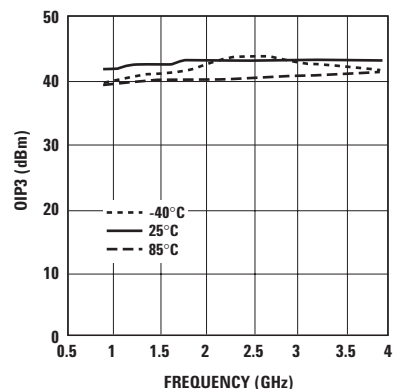


Figure 41. OIP3 vs. Temperature and Frequency at optimum P1dB.

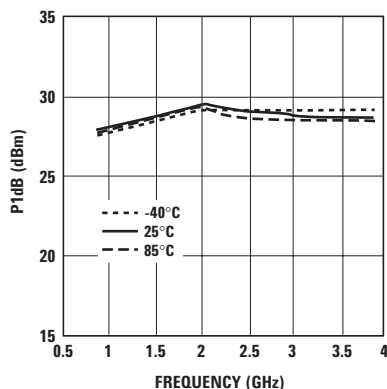


Figure 42. P1dB vs. Temperature and Frequency at optimum OIP3.

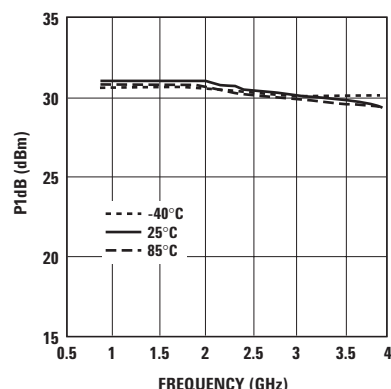


Figure 43. P1dB vs. Temperature and Frequency at optimum P1dB.

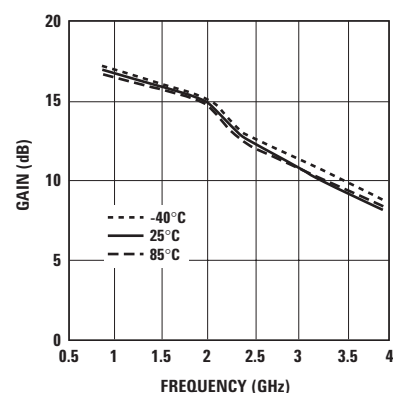


Figure 44. Gain vs. Temperature and Frequency at optimum OIP3.

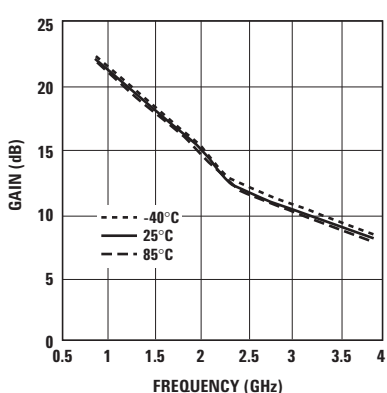


Figure 45. Gain vs. Temperature and Frequency at optimum P1dB.

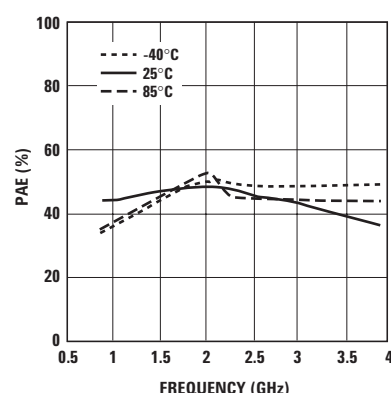


Figure 46. PAE vs. Temperature and Frequency at optimum OIP3.

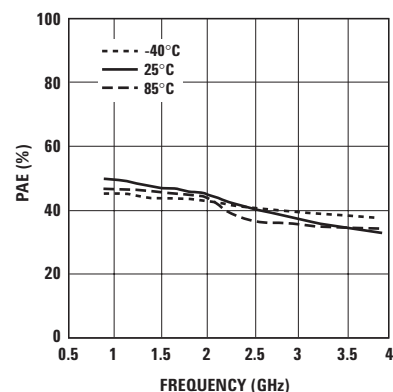


Figure 47. PAE vs. Temperature and Frequency at optimum P1dB.

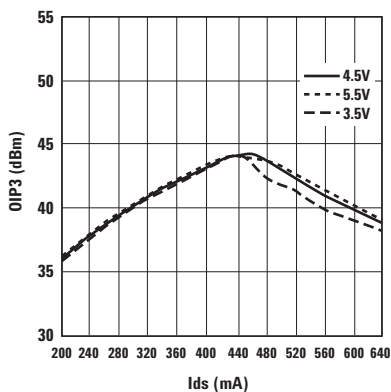


Figure 48. OIP3 vs. Ids and Vds at 2 GHz.

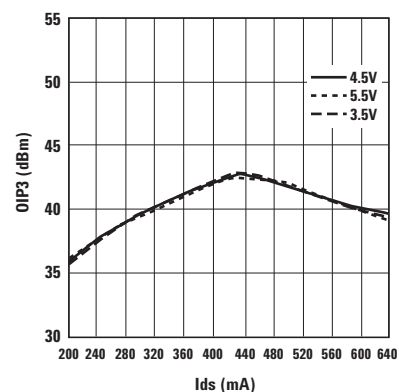


Figure 49. OIP3 vs. Ids and Vds at 900 MHz.

Note:

Bias current (Ids) for the above charts are quiescent conditions. Actual level may increase or decrease depending on amount of RF drive.

ATF-501P8 Typical Performance Curves, continued (at 25°C unless specified otherwise)
Tuned for Optimal P1dB at 4.5V 400 mA

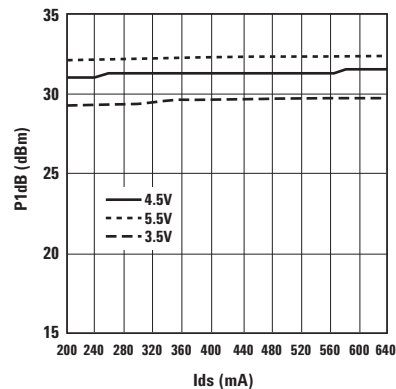


Figure 50. P1dB vs. Ids and Vds at 2 GHz.

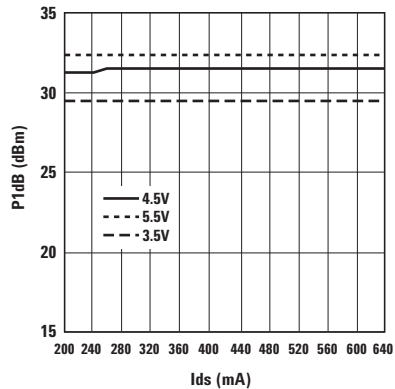


Figure 51. P1dB vs. Ids and Vds at 900 MHz.

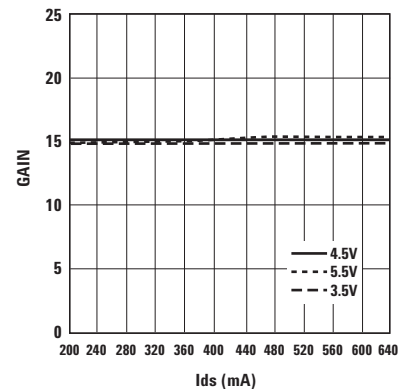


Figure 52. Gain vs. Ids and Vds at 2 GHz.

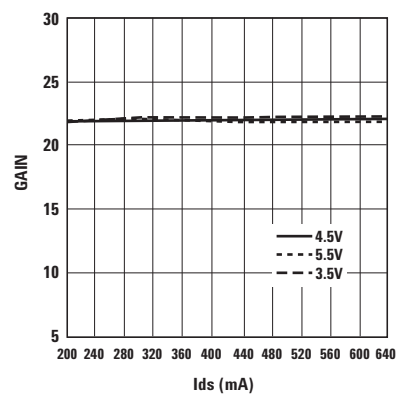


Figure 53. Gain vs. Ids and Vds at 900 MHz.

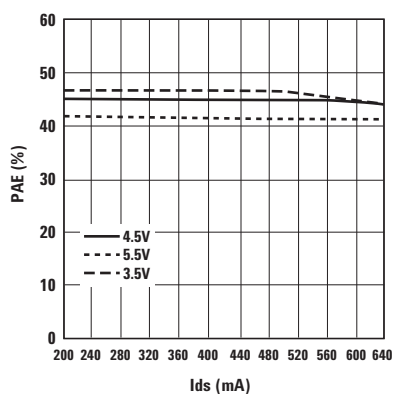


Figure 54. PAE vs. Ids and Vds at 2 GHz.

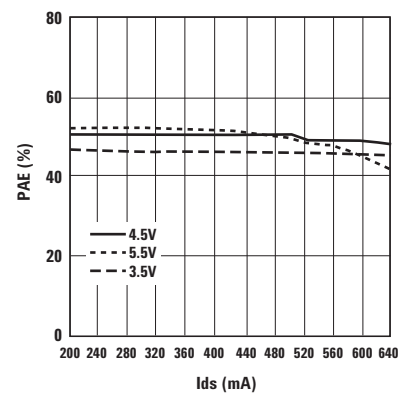


Figure 55. PAE vs. Ids and Vds at 900 MHz.

Note:

Bias current (Ids) for the above charts are quiescent conditions. Actual level may increase or decrease depending on amount of RF drive.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 4.5V$, $I_{DS} = 280\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.915	-132.3	31.6	37.990	112.2	-38.4	0.012	29.3	0.647	-160.6	35.0	0.173
0.2	0.911	-156.2	26.2	20.324	99.9	-37.7	0.013	24.0	0.689	-171.1	31.9	0.314
0.3	0.910	-165.4	22.8	13.783	94.5	-37.1	0.014	24.5	0.699	-175.7	29.9	0.436
0.4	0.910	-170.9	20.3	10.342	91.1	-37.1	0.014	27.3	0.702	-178.5	28.7	0.569
0.5	0.908	-173.4	18.7	8.604	88.4	-36.5	0.015	29.6	0.691	-179.9	27.6	0.648
0.6	0.907	-176.1	17.1	7.194	86.1	-35.9	0.016	32.4	0.691	-178.5	26.5	0.736
0.7	0.908	-178.5	15.8	6.167	84.1	-35.4	0.017	34.4	0.694	-177.2	25.6	0.800
0.8	0.905	-179.8	14.7	5.407	82.1	-34.9	0.018	36.3	0.695	-175.2	24.8	0.871
0.9	0.909	-178.2	13.6	4.799	80.3	-34.4	0.019	38.3	0.692	-175.1	24.0	0.906
1	0.909	-176.6	12.7	4.308	78.3	-34.0	0.020	39.9	0.692	-173.9	23.3	0.953
1.5	0.902	-170.5	9.1	2.859	70.3	-31.7	0.026	45.0	0.698	-169.4	18.2	1.128
2	0.902	-166.0	7.1	2.264	64.4	-30.5	0.030	46.9	0.700	-165.6	16.0	1.209
2.5	0.901	-165.0	6.6	2.134	63.1	-30.2	0.031	47.2	0.699	-163.0	15.4	1.241
3	0.901	-161.1	5.0	1.772	57.7	-28.9	0.036	47.4	0.697	-159.1	13.8	1.278
4	0.898	-155.0	3.0	1.412	49.3	-27.3	0.043	46.5	0.707	-153.7	11.7	1.326
5	0.902	-145.0	0.9	1.110	37.6	-24.7	0.058	43.5	0.699	-146.8	9.7	1.272
6	0.893	-134.9	-0.9	0.902	22.6	-22.9	0.072	35.6	0.697	-145.3	7.8	1.286
7	0.899	-125.8	-3.3	0.687	9.0	-22.2	0.078	27.3	0.652	-134.1	5.7	1.394
8	0.895	-115.6	-4.4	0.604	-1.1	-20.8	0.091	22.0	0.646	-117.4	4.2	1.463
9	0.898	-105.5	-5.3	0.542	-13.0	-19.6	0.105	12.3	0.641	-115.5	3.2	1.447
10	0.886	-95.5	-5.9	0.505	-20.2	-18.9	0.114	9.7	0.695	-104.5	2.5	1.455
11	0.868	-84.7	-6.6	0.469	-29.7	-17.6	0.132	0.5	0.742	-91.3	1.6	1.431
12	0.862	-74.0	-8.0	0.398	-40.8	-17.4	0.135	-6.3	0.735	-88.1	-0.1	1.661
13	0.847	-64.5	-7.9	0.403	-47.5	-16.0	0.159	-12.3	0.766	-78.4	-0.1	1.491
14	0.844	-55.6	-8.5	0.377	-58.4	-15.3	0.171	-21.3	0.800	-68.9	-0.3	1.397
15	0.837	-47.4	-9.0	0.354	-67.2	-14.6	0.187	-30.1	0.797	-65.6	-1.1	1.414
16	0.824	-39.9	-9.7	0.327	-72.0	-14.2	0.194	-36.8	0.763	-51.5	-2.3	1.608
17	0.821	-31.6	-9.8	0.323	-82.7	-13.4	0.215	-44.6	0.786	-38.9	-2.4	1.488
18	0.805	-24.6	-10.5	0.298	-90.1	-12.5	0.237	-51.8	0.781	-29.5	-3.5	1.575

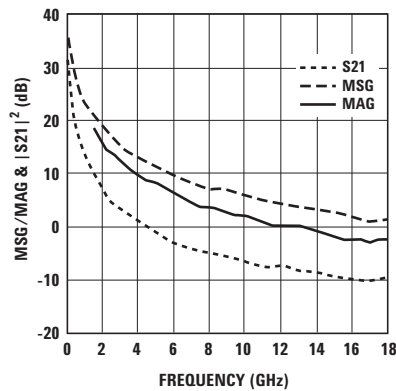


Figure 56. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 4.5V 280mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 4.5V$, $I_{DS} = 200\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.922	-131.5	31.1	35.978	112.6	-37.7	0.013	28.9	0.664	-159.8	34.4	0.142
0.2	0.914	-155.7	25.7	19.290	100.1	-36.5	0.015	22.4	0.709	-170.7	31.1	0.274
0.3	0.914	-165.2	22.3	13.088	94.7	-36.5	0.015	22.5	0.719	-175.4	29.4	0.390
0.4	0.911	-170.5	19.8	9.814	91.4	-35.9	0.016	24.9	0.722	-178.4	27.9	0.510
0.5	0.911	-173.3	18.3	8.176	88.6	-35.4	0.017	26.8	0.713	-179.9	26.8	0.577
0.6	0.912	-176.0	16.7	6.834	86.4	-34.9	0.018	29.3	0.713	-178.6	25.8	0.653
0.7	0.910	-178.3	15.4	5.861	84.3	-34.4	0.019	31.3	0.716	-177.2	24.9	0.725
0.8	0.910	-179.9	14.2	5.141	82.3	-34.4	0.019	33.0	0.718	-175.5	24.3	0.801
0.9	0.913	-178.4	13.2	4.558	80.5	-34.0	0.020	34.9	0.712	-175.0	23.6	0.840
1	0.910	-176.8	12.2	4.092	78.7	-33.6	0.021	36.6	0.714	-173.8	22.9	0.903
1.5	0.904	-170.5	8.7	2.718	70.5	-31.4	0.027	41.7	0.721	-169.0	18.3	1.077
2	0.905	-166.1	6.7	2.153	64.9	-30.2	0.031	44.2	0.721	-165.2	16.0	1.161
2.5	0.905	-165.2	6.1	2.027	63.7	-29.9	0.032	44.5	0.719	-162.5	15.4	1.188
3	0.906	-161.1	4.5	1.684	58.3	-28.6	0.037	44.9	0.715	-158.5	13.7	1.227
4	0.905	-154.9	2.6	1.354	50.3	-27.1	0.044	44.3	0.725	-152.9	11.8	1.262
5	0.904	-145.1	0.4	1.053	38.5	-24.7	0.058	41.6	0.716	-145.7	9.5	1.271
6	0.899	-134.9	-1.3	0.863	23.9	-22.9	0.072	34.1	0.712	-144.1	7.7	1.263
7	0.905	-126.0	-3.6	0.661	10.5	-22.2	0.078	26.0	0.660	-132.9	5.6	1.371
8	0.902	-115.8	-4.6	0.587	0.3	-20.8	0.091	20.8	0.654	-116.3	4.2	1.423
9	0.900	-106.4	-5.6	0.527	-11.1	-19.6	0.105	11.1	0.649	-114.4	3.0	1.451
10	0.894	-95.9	-6.1	0.498	-17.7	-18.9	0.114	8.4	0.700	-103.4	2.6	1.412
11	0.882	-84.9	-7.0	0.448	-26.8	-17.7	0.130	-0.9	0.746	-90.5	1.6	1.407
12	0.873	-74.3	-8.1	0.393	-38.8	-17.5	0.133	-7.5	0.738	-87.3	0.1	1.614
13	0.856	-64.6	-8.1	0.393	-45.4	-16.1	0.156	-13.1	0.768	-77.8	-0.1	1.492
14	0.853	-56.0	-8.4	0.380	-55.0	-15.6	0.166	-21.4	0.800	-68.4	-0.2	1.399
15	0.837	-47.4	-8.8	0.361	-64.1	-14.8	0.182	-29.6	0.799	-65.2	-1.0	1.439
16	0.829	-40.6	-9.2	0.345	-72.0	-14.4	0.190	-35.9	0.763	-51.1	-1.8	1.556
17	0.828	-32.7	-9.5	0.336	-80.5	-13.4	0.213	-43.3	0.787	-38.5	-2.0	1.449
18	0.807	-26.1	-10.2	0.310	-88.2	-12.5	0.236	-50.5	0.782	-29.1	-3.2	1.542

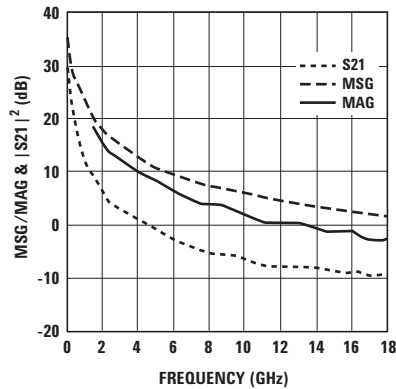


Figure 57. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 4.5V 200mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 4.5V$, $I_{DS} = 360\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.911	-132.8	31.6	38.110	112.4	-39.2	0.011	30.3	0.649	-162.1	35.4	0.200
0.2	0.910	-156.5	26.2	20.415	100.0	-38.4	0.012	24.9	0.692	-171.8	32.3	0.340
0.3	0.911	-165.8	22.8	13.848	94.6	-37.7	0.013	26.2	0.701	-176.2	30.3	0.472
0.4	0.913	-171.1	20.3	10.397	91.3	-37.7	0.013	28.9	0.704	-178.9	29.0	0.600
0.5	0.907	-173.7	18.7	8.640	88.5	-36.5	0.015	31.8	0.693	-179.7	27.6	0.679
0.6	0.910	-176.3	17.2	7.232	86.2	-35.9	0.016	34.5	0.694	-178.2	26.6	0.747
0.7	0.910	-178.6	15.8	6.200	84.2	-35.9	0.016	36.8	0.696	-176.9	25.9	0.838
0.8	0.906	-179.7	14.7	5.431	82.2	-35.4	0.017	38.8	0.697	-175.6	25.0	0.914
0.9	0.913	-178.0	13.7	4.826	80.3	-34.9	0.018	40.6	0.695	-174.8	24.3	0.930
1	0.907	-176.4	12.7	4.328	78.4	-34.0	0.020	42.3	0.694	-173.7	23.4	0.984
1.5	0.904	-170.3	9.2	2.878	70.4	-32.0	0.025	47.0	0.698	-169.4	18.2	1.154
2	0.906	-165.9	7.1	2.275	64.5	-30.5	0.030	48.7	0.702	-165.5	16.1	1.193
2.5	0.904	-164.8	6.6	2.146	63.2	-30.2	0.031	49.0	0.701	-162.8	15.5	1.231
3	0.907	-160.9	5.0	1.783	57.9	-28.9	0.036	49.0	0.699	-159.0	14.0	1.246
4	0.906	-154.7	3.1	1.424	49.4	-27.3	0.043	47.7	0.708	-153.6	12.0	1.275
5	0.903	-144.8	0.9	1.114	37.7	-24.7	0.058	44.2	0.701	-146.7	9.7	1.268
6	0.896	-134.7	-0.8	0.907	22.7	-22.7	0.073	36.2	0.699	-145.1	7.9	1.256
7	0.903	-125.6	-3.2	0.691	8.9	-22.2	0.078	27.9	0.654	-134.0	5.9	1.355
8	0.903	-115.0	-4.3	0.612	-1.0	-20.7	0.092	22.4	0.647	-117.3	4.6	1.375
9	0.891	-105.6	-5.3	0.544	-13.3	-19.5	0.106	12.8	0.642	-115.4	2.9	1.495
10	0.885	-94.9	-6.0	0.504	-20.0	-18.8	0.115	10.2	0.697	-104.4	2.4	1.462
11	0.873	-84.3	-6.7	0.465	-28.4	-17.5	0.133	0.9	0.743	-91.3	1.6	1.416
12	0.866	-74.0	-7.9	0.403	-41.1	-17.3	0.137	-5.8	0.735	-87.9	0.1	1.607
13	0.849	-64.3	-7.8	0.406	-47.3	-15.9	0.161	-12.1	0.768	-78.3	0.0	1.464
14	0.849	-55.7	-8.4	0.379	-57.9	-15.2	0.174	-21.3	0.801	-68.8	-0.2	1.361
15	0.841	-46.6	-9.0	0.353	-69.0	-14.5	0.189	-30.3	0.800	-65.5	-0.9	1.376
16	0.828	-39.0	-9.4	0.337	-73.1	-14.2	0.196	-37.1	0.763	-51.4	-2.0	1.547
17	0.817	-31.0	-9.8	0.322	-83.0	-13.2	0.218	-45.1	0.787	-38.7	-2.4	1.491
18	0.809	-23.9	-10.3	0.304	-92.7	-12.4	0.240	-52.4	0.783	-29.3	-3.2	1.513

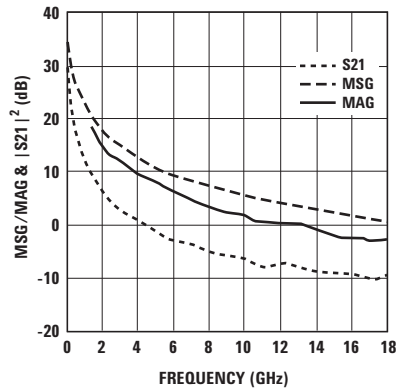


Figure 58. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 4.5V 360mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 3.5V$, $I_{DS} = 280\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.923	-133.9	30.6	34.047	111.6	-38.4	0.012	28.8	0.716	-164.7	34.5	0.166
0.2	0.922	-157.1	25.2	18.161	99.7	-37.7	0.013	23.8	0.759	-173.4	31.5	0.301
0.3	0.920	-166.1	21.8	12.313	94.5	-37.1	0.014	25.0	0.767	-177.3	29.4	0.427
0.4	0.920	-171.3	19.3	9.220	91.4	-37.1	0.014	27.5	0.770	-179.8	28.2	0.549
0.5	0.915	-173.9	17.7	7.674	88.7	-35.9	0.016	30.0	0.760	-178.8	26.8	0.622
0.6	0.917	-176.5	16.2	6.429	86.6	-35.4	0.017	32.9	0.761	-177.2	25.8	0.697
0.7	0.917	-178.9	14.8	5.511	84.6	-34.9	0.018	34.8	0.762	-175.8	24.9	0.761
0.8	0.915	-179.6	13.6	4.813	82.8	-34.9	0.018	37.2	0.760	-175.0	24.3	0.843
0.9	0.918	-177.7	12.7	4.302	81.0	-34.4	0.019	38.8	0.764	-173.7	23.5	0.877
1	0.913	-176.4	11.7	3.850	79.1	-33.6	0.021	40.5	0.759	-172.4	22.6	0.930
1.5	0.913	-170.4	8.1	2.555	72.0	-31.4	0.027	45.6	0.759	-168.1	18.1	1.070
2	0.913	-166.1	6.1	2.025	66.3	-30.2	0.031	47.1	0.763	-163.9	15.9	1.139
2.5	0.910	-164.8	5.6	1.912	65.1	-29.9	0.032	47.6	0.762	-161.0	15.2	1.181
3	0.913	-160.9	4.0	1.588	60.4	-28.6	0.037	47.5	0.758	-156.7	13.6	1.206
4	0.906	-154.6	2.1	1.276	52.2	-26.9	0.045	45.9	0.762	-150.9	11.5	1.261
5	0.910	-144.7	0.1	1.012	41.6	-24.4	0.060	42.4	0.754	-143.3	9.4	1.226
6	0.903	-134.6	-1.6	0.827	27.2	-22.5	0.075	34.3	0.742	-141.3	7.5	1.239
7	0.907	-125.4	-3.9	0.636	14.0	-22.0	0.079	25.3	0.674	-130.1	5.3	1.402
8	0.903	-115.2	-4.9	0.570	5.1	-20.6	0.093	19.8	0.669	-113.5	3.9	1.448
9	0.897	-105.5	-5.6	0.522	-7.0	-19.4	0.107	9.9	0.666	-112.0	2.8	1.484
10	0.889	-94.8	-6.0	0.499	-14.5	-18.8	0.115	7.0	0.709	-100.9	2.4	1.458
11	0.880	-84.2	-6.4	0.477	-23.6	-17.7	0.131	-2.4	0.754	-88.2	1.9	1.378
12	0.870	-73.4	-7.7	0.411	-33.8	-17.6	0.132	-9.1	0.745	-85.0	0.3	1.614
13	0.847	-63.8	-7.5	0.421	-41.1	-16.3	0.153	-14.5	0.770	-75.9	0.1	1.519
14	0.839	-55.1	-8.0	0.397	-52.2	-15.8	0.163	-22.5	0.801	-66.5	-0.1	1.458
15	0.816	-47.3	-8.2	0.390	-63.9	-15.0	0.178	-30.0	0.795	-63.4	-0.8	1.495
16	0.808	-39.8	-9.2	0.345	-70.3	-14.6	0.186	-35.9	0.755	-49.5	-2.3	1.727
17	0.794	-32.3	-9.0	0.354	-81.5	-13.5	0.211	-43.3	0.787	-36.6	-2.1	1.538
18	0.769	-26.0	-9.7	0.329	-91.7	-12.6	0.234	-50.7	0.777	-27.7	-3.2	1.632

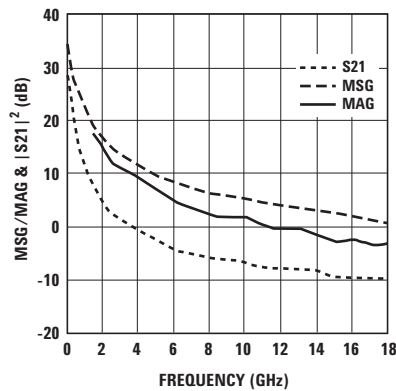


Figure 59. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 3.5V 280mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 3.5V$, $I_{DS} = 200\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.924	-132.7	30.5	33.400	112.1	-37.1	0.014	28.4	0.703	-162.3	33.8	0.150
0.2	0.919	-156.5	25.0	17.862	99.9	-36.5	0.015	22.1	0.749	-172.1	30.8	0.269
0.3	0.918	-165.7	21.7	12.118	94.6	-36.5	0.015	22.7	0.757	-176.5	29.1	0.390
0.4	0.918	-171.0	19.2	9.080	91.4	-35.9	0.016	24.6	0.760	-179.2	27.5	0.496
0.5	0.918	-173.6	17.6	7.556	88.7	-35.4	0.017	26.4	0.751	-179.4	26.5	0.559
0.6	0.915	-176.2	16.0	6.328	86.5	-34.9	0.018	29.3	0.752	-177.7	25.5	0.651
0.7	0.915	-178.5	14.7	5.422	84.5	-34.4	0.019	31.3	0.753	-176.3	24.6	0.717
0.8	0.914	-179.8	13.5	4.739	82.7	-34.0	0.020	33.2	0.752	-175.3	23.7	0.777
0.9	0.919	-178.0	12.5	4.232	80.8	-33.6	0.021	35.1	0.755	-174.1	23.0	0.806
1	0.916	-176.7	11.6	3.788	79.0	-33.2	0.022	36.7	0.750	-172.8	22.4	0.870
1.5	0.912	-170.5	8.0	2.515	71.5	-31.4	0.027	42.0	0.750	-168.3	18.2	1.057
1.9	0.911	-166.0	6.0	1.991	65.8	-29.9	0.032	44.3	0.755	-165.0	15.8	1.126
2	0.910	-164.9	5.5	1.882	64.7	-29.6	0.033	44.7	0.753	-164.2	15.2	1.157
2.4	0.911	-160.9	3.9	1.562	59.7	-28.6	0.037	45.0	0.750	-161.3	13.5	1.215
3	0.909	-154.7	2.0	1.255	51.5	-26.9	0.045	43.9	0.754	-157.0	11.5	1.244
4	0.911	-144.8	-0.1	0.988	40.4	-24.4	0.060	41.0	0.746	-151.3	9.3	1.225
5	0.902	-134.8	-1.8	0.813	25.9	-22.6	0.074	33.3	0.735	-143.7	7.4	1.255
6	0.904	-125.5	-4.1	0.624	12.7	-22.0	0.079	24.6	0.669	-141.8	5.0	1.438
7	0.904	-115.6	-5.1	0.555	3.9	-20.6	0.093	19.3	0.664	-130.6	3.8	1.455
8	0.901	-105.6	-5.9	0.509	-8.3	-19.4	0.107	9.5	0.662	-113.9	2.7	1.466
9	0.897	-95.4	-6.4	0.477	-14.5	-18.8	0.115	6.6	0.705	-112.3	2.3	1.437
10	0.880	-84.1	-6.9	0.450	-23.9	-17.7	0.130	-3.0	0.751	-101.2	1.5	1.429
11	0.872	-73.7	-8.1	0.393	-34.0	-17.6	0.132	-9.7	0.742	-88.5	0.0	1.646
12	0.849	-64.2	-7.8	0.408	-42.5	-16.4	0.152	-14.9	0.767	-85.3	0.0	1.539
13	0.841	-55.5	-8.2	0.391	-53.2	-15.8	0.162	-22.8	0.798	-76.2	-0.2	1.465
14	0.820	-47.1	-8.5	0.377	-63.5	-15.1	0.176	-29.9	0.793	-66.8	-1.0	1.527
15	0.809	-39.3	-9.0	0.354	-69.5	-14.7	0.185	-35.9	0.754	-63.6	-2.1	1.708
16	0.794	-32.7	-9.1	0.350	-84.1	-13.6	0.210	-43.1	0.785	-49.8	-2.1	1.543
17	0.770	-25.8	-9.6	0.332	-89.0	-12.6	0.234	-50.5	0.776	-36.9	-3.1	1.634
18	0.766	-21.5	-9.2	0.346	-99.8	-11.5	0.266	-60.7	0.797	-28.0	-2.6	1.394

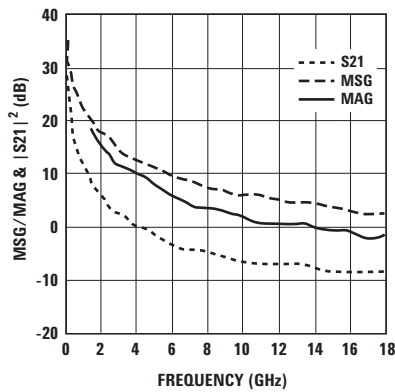


Figure 60. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 3.5V 200mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 3.5V$, $I_{DS} = 360\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.919	-134.2	30.8	34.576	111.7	-39.2	0.011	29.6	0.722	-166.1	35.0	0.191
0.2	0.920	-157.3	25.3	18.445	99.7	-38.4	0.012	25.5	0.763	-174.1	31.9	0.336
0.3	0.921	-166.4	21.9	12.499	94.6	-37.7	0.013	26.7	0.771	-177.8	29.8	0.460
0.4	0.918	-171.4	19.4	9.372	91.5	-37.7	0.013	30.0	0.773	179.8	28.6	0.599
0.5	0.915	-174.0	17.8	7.792	88.8	-36.5	0.015	32.7	0.763	178.6	27.2	0.665
0.6	0.916	-176.7	16.3	6.537	86.6	-35.9	0.016	35.7	0.765	176.9	26.1	0.744
0.7	0.916	-178.9	15.0	5.596	84.7	-35.4	0.017	37.9	0.765	175.6	25.2	0.809
0.8	0.914	179.4	13.8	4.888	83.1	-34.9	0.018	40.0	0.764	174.9	24.3	0.871
0.9	0.919	178.1	12.8	4.370	81.1	-34.4	0.019	41.8	0.768	173.4	23.6	0.892
1	0.914	176.2	11.8	3.911	79.3	-34.0	0.020	43.0	0.762	172.2	22.9	0.963
1.5	0.912	170.2	8.3	2.596	72.2	-31.7	0.026	47.8	0.761	168.1	18.0	1.103
2	0.914	165.8	6.3	2.059	66.7	-30.2	0.031	49.2	0.766	163.8	15.9	1.142
2.5	0.910	164.7	5.8	1.940	65.6	-29.9	0.032	49.3	0.765	160.9	15.2	1.185
3	0.912	160.8	4.2	1.618	60.7	-28.6	0.037	49.0	0.761	156.6	13.6	1.210
4	0.913	154.4	2.3	1.296	52.9	-26.9	0.045	47.3	0.765	150.8	11.8	1.221
5	0.908	144.7	0.2	1.023	42.0	-24.4	0.060	43.2	0.756	143.0	9.4	1.236
6	0.903	134.5	-1.5	0.844	27.9	-22.5	0.075	34.8	0.745	141.1	7.6	1.233
7	0.906	125.5	-3.8	0.647	15.0	-21.9	0.080	25.7	0.676	129.9	5.3	1.392
8	0.904	115.1	-4.7	0.582	5.9	-20.6	0.093	20.3	0.670	113.3	4.1	1.430
9	0.902	105.3	-5.5	0.532	-6.4	-19.4	0.107	10.3	0.666	111.6	3.1	1.433
10	0.893	95.0	-5.8	0.513	-13.3	-18.8	0.115	7.5	0.710	100.7	2.7	1.416
11	0.881	84.1	-6.5	0.474	-22.0	-17.7	0.131	-1.9	0.756	88.2	1.9	1.388
12	0.873	73.6	-7.6	0.417	-32.9	-17.5	0.133	-8.5	0.746	84.9	0.5	1.577
13	0.847	63.9	-7.5	0.424	-40.6	-16.2	0.154	-13.9	0.772	75.7	0.2	1.507
14	0.844	55.4	-7.8	0.407	-52.7	-15.7	0.165	-22.0	0.802	66.3	0.1	1.407
15	0.827	47.4	-8.2	0.389	-63.7	-14.9	0.180	-29.7	0.793	63.2	-0.7	1.457
16	0.818	40.2	-8.9	0.357	-67.9	-14.6	0.187	-35.8	0.759	49.4	-1.9	1.637
17	0.799	32.9	-9.0	0.353	-81.4	-13.5	0.211	-43.1	0.786	36.5	-2.0	1.526
18	0.780	26.7	-9.3	0.344	-90.7	-12.5	0.236	-50.4	0.777	27.6	-2.7	1.549

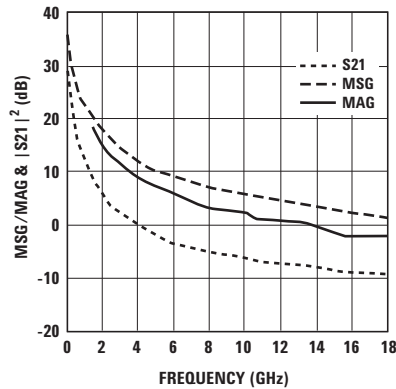


Figure 61. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 3.5V 360mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 5.5V$, $I_{DS} = 280\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.914	-131.5	31.8	39.087	112.6	-38.4	0.012	29.6	0.618	-158.7	35.1	0.172
0.2	0.912	-155.7	26.4	20.961	100.1	-37.7	0.013	23.9	0.661	-170.0	32.1	0.307
0.3	0.914	-165.2	23.1	14.228	94.5	-37.1	0.014	24.1	0.670	-174.9	30.1	0.420
0.4	0.913	-170.5	20.6	10.678	91.1	-37.1	0.014	26.7	0.674	-177.9	28.8	0.550
0.5	0.909	-173.3	19.0	8.871	88.3	-36.5	0.015	29.0	0.662	-179.3	27.7	0.638
0.6	0.910	-176.0	17.4	7.417	86.0	-35.9	0.016	31.7	0.663	-179.2	26.7	0.715
0.7	0.911	-178.2	16.1	6.365	83.9	-35.4	0.017	34.3	0.666	-177.8	25.7	0.782
0.8	0.908	-179.8	14.9	5.577	81.8	-34.9	0.018	36.0	0.667	-176.3	24.9	0.850
0.9	0.913	-178.4	13.9	4.956	79.9	-34.4	0.019	38.0	0.664	-175.7	24.2	0.878
1	0.907	-176.7	13.0	4.446	78.0	-34.0	0.020	39.4	0.664	-174.5	23.5	0.958
1.5	0.903	-170.5	9.4	2.951	69.6	-32.0	0.025	44.5	0.672	-170.1	18.4	1.141
2	0.905	-166.2	7.4	2.331	63.5	-30.5	0.030	46.4	0.674	-166.5	16.3	1.182
2.5	0.903	-165.2	6.8	2.197	62.1	-30.2	0.031	47.0	0.674	-164.0	15.7	1.222
3	0.903	-161.0	5.2	1.822	56.7	-29.1	0.035	47.3	0.672	-160.3	14.0	1.284
4	0.900	-154.7	3.3	1.455	47.9	-27.3	0.043	46.7	0.685	-155.2	12.0	1.307
5	0.902	-145.0	1.1	1.129	35.9	-24.9	0.057	43.8	0.679	-148.6	9.8	1.278
6	0.895	-134.9	-0.8	0.916	20.6	-23.0	0.071	36.2	0.681	-147.0	8.0	1.271
7	0.903	-125.8	-3.2	0.695	6.8	-22.3	0.077	28.3	0.648	-135.8	6.1	1.340
8	0.898	-115.4	-4.2	0.616	-3.5	-20.8	0.091	22.9	0.641	-119.2	4.5	1.401
9	0.898	-105.8	-5.3	0.546	-16.3	-19.6	0.105	13.3	0.636	-117.2	3.3	1.416
10	0.884	-95.4	-6.0	0.499	-23.2	-18.9	0.114	10.9	0.694	-106.2	2.4	1.459
11	0.871	-84.6	-6.8	0.458	-31.5	-17.6	0.132	1.6	0.741	-92.7	1.6	1.420
12	0.864	-74.2	-8.3	0.386	-43.6	-17.3	0.137	-5.2	0.731	-89.5	-0.2	1.655
13	0.849	-64.8	-8.3	0.385	-49.9	-15.8	0.162	-11.5	0.768	-79.6	-0.3	1.479
14	0.854	-56.1	-8.7	0.366	-60.4	-15.2	0.174	-20.9	0.804	-70.2	-0.2	1.332
15	0.841	-47.7	-9.6	0.330	-68.9	-14.4	0.191	-29.9	0.807	-66.7	-1.3	1.385
16	0.834	-40.0	-10.0	0.317	-73.5	-14.1	0.198	-37.0	0.768	-52.4	-2.3	1.536
17	0.824	-31.9	-10.2	0.310	-83.2	-13.2	0.219	-45.0	0.792	-39.7	-2.5	1.466
18	0.813	-24.7	-10.7	0.291	-88.9	-12.4	0.240	-52.2	0.788	-30.0	-3.5	1.533

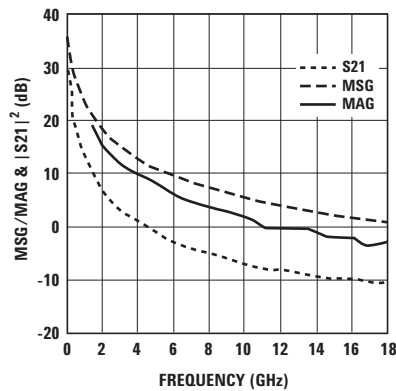


Figure 62. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 5.5V 280mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 5.5V$, $I_{DS} = 200\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.921	-130.1	31.8	38.725	113.1	-37.7	0.013	29.6	0.615	-156.5	34.7	0.145
0.2	0.914	-155.0	26.4	20.822	100.3	-37.1	0.014	22.8	0.659	-168.9	31.7	0.274
0.3	0.914	-164.6	23.0	14.136	94.7	-36.5	0.015	22.7	0.669	-174.1	29.7	0.385
0.4	0.913	-170.1	20.5	10.611	91.3	-36.5	0.015	24.9	0.673	-177.3	28.5	0.510
0.5	0.909	-172.9	18.9	8.824	88.4	-35.4	0.017	26.8	0.662	-178.9	27.2	0.576
0.6	0.909	-175.7	17.4	7.375	86.0	-35.4	0.017	29.4	0.662	-179.6	26.4	0.672
0.7	0.909	-178.1	16.0	6.329	83.9	-34.9	0.018	31.3	0.665	-178.2	25.5	0.739
0.8	0.908	-179.7	14.9	5.549	81.8	-34.4	0.019	32.9	0.667	-176.5	24.7	0.798
0.9	0.911	-178.5	13.8	4.922	80.0	-34.0	0.020	35.3	0.662	-176.0	23.9	0.843
1	0.909	-176.8	12.9	4.418	78.0	-33.6	0.021	36.4	0.664	-174.8	23.2	0.897
1.5	0.905	-170.8	9.3	2.933	69.4	-31.7	0.026	41.7	0.673	-170.3	18.8	1.079
2	0.907	-166.3	7.3	2.322	63.4	-30.5	0.030	44.3	0.674	-166.6	16.5	1.153
2.5	0.903	-165.3	6.8	2.182	62.1	-30.2	0.031	44.5	0.673	-164.1	15.7	1.208
3	0.906	-161.2	5.2	1.815	56.5	-28.9	0.036	45.1	0.671	-160.4	14.2	1.226
4	0.903	-155.0	3.2	1.447	47.8	-27.3	0.043	44.7	0.684	-155.3	12.1	1.273
5	0.904	-145.1	1.0	1.123	35.9	-24.9	0.057	42.3	0.678	-148.7	9.9	1.257
6	0.899	-135.2	-0.8	0.909	20.3	-23.0	0.071	35.1	0.681	-147.2	8.2	1.235
7	0.904	-126.2	-3.2	0.693	6.5	-22.4	0.076	27.4	0.647	-136.0	6.2	1.332
8	0.901	-115.6	-4.3	0.608	-4.0	-20.9	0.090	22.2	0.640	-119.4	4.6	1.386
9	0.896	-106.2	-5.4	0.536	-15.9	-19.7	0.104	12.6	0.634	-117.5	3.1	1.459
10	0.891	-95.4	-6.1	0.497	-23.9	-18.9	0.113	10.2	0.692	-106.3	2.6	1.408
11	0.877	-85.0	-7.0	0.446	-32.3	-17.7	0.131	1.0	0.739	-92.9	1.5	1.403
12	0.871	-74.4	-8.3	0.386	-42.5	-17.4	0.135	-5.8	0.730	-89.7	-0.1	1.625
13	0.851	-64.9	-8.2	0.387	-49.0	-15.9	0.160	-11.8	0.767	-79.8	-0.3	1.480
14	0.850	-56.2	-8.8	0.364	-60.0	-15.3	0.172	-21.0	0.803	-70.5	-0.3	1.364
15	0.839	-48.0	-9.5	0.335	-67.9	-14.5	0.188	-29.9	0.805	-66.9	-1.3	1.403
16	0.834	-39.7	-10.2	0.309	-72.5	-14.2	0.195	-36.8	0.768	-52.7	-2.5	1.585
17	0.827	-32.2	-10.2	0.309	-82.4	-13.3	0.216	-44.6	0.792	-39.9	-2.5	1.472
18	0.814	-24.4	-10.5	0.298	-89.4	-12.5	0.238	-51.8	0.790	-30.2	-3.2	1.510

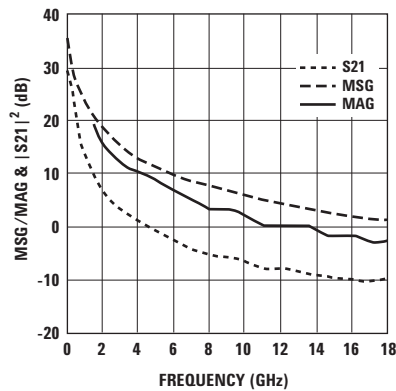


Figure 63. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 5.5V 200mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

ATF-501P8 Typical Scattering Parameters, $V_{DS} = 5.5V$, $I_{DS} = 360\text{ mA}$

Freq. GHz	S_{11}			S_{21}			S_{12}		S_{22}		MSG/MAG dB	K factor
	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.		
0.1	0.904	-132.0	31.8	38.785	113.0	-39.2	0.011	29.8	0.619	-159.9	35.5	0.198
0.2	0.910	-156.2	26.4	20.860	100.3	-38.4	0.012	24.8	0.662	-170.6	32.4	0.338
0.3	0.912	-165.4	23.0	14.161	94.7	-37.7	0.013	25.5	0.672	-175.3	30.4	0.459
0.4	0.912	-170.7	20.5	10.635	91.2	-37.1	0.014	27.8	0.675	-178.2	28.8	0.571
0.5	0.907	-173.5	18.9	8.834	88.4	-36.5	0.015	30.5	0.663	-179.5	27.7	0.666
0.6	0.909	-176.1	17.4	7.399	86.1	-35.9	0.016	33.4	0.664	-178.9	26.7	0.741
0.7	0.909	-178.3	16.0	6.337	83.9	-35.4	0.017	35.7	0.666	-177.6	25.7	0.808
0.8	0.907	-179.9	14.9	5.557	81.9	-35.4	0.017	37.6	0.668	-176.2	25.1	0.901
0.9	0.909	-178.4	13.9	4.942	80.0	-34.9	0.018	39.7	0.665	-175.5	24.4	0.943
1	0.906	-176.7	12.9	4.429	78.0	-34.4	0.019	41.2	0.665	-174.3	23.7	1.008
1.5	0.904	-170.5	9.4	2.941	69.7	-32.0	0.025	46.2	0.672	-170.1	18.4	1.150
2	0.904	-166.1	7.3	2.325	63.6	-30.8	0.029	47.9	0.676	-166.5	16.2	1.225
2.5	0.900	-165.1	6.8	2.191	62.2	-30.2	0.031	48.4	0.675	-163.9	15.5	1.254
3	0.905	-161.0	5.2	1.817	56.6	-29.1	0.035	48.6	0.674	-160.2	14.0	1.278
4	0.900	-155.0	3.3	1.456	48.2	-27.5	0.042	47.4	0.686	-155.1	12.0	1.329
5	0.904	-144.9	1.1	1.130	35.7	-24.9	0.057	44.4	0.680	-148.5	9.9	1.267
6	0.897	-134.8	-0.8	0.913	20.7	-23.0	0.071	36.8	0.683	-146.9	8.0	1.264
7	0.902	-125.7	-3.2	0.695	7.3	-22.3	0.077	28.9	0.649	-135.8	6.0	1.359
8	0.899	-115.5	-4.3	0.609	-3.7	-20.8	0.091	23.4	0.643	-119.1	4.5	1.402
9	0.893	-105.9	-5.3	0.544	-16.0	-19.6	0.105	13.8	0.636	-117.1	3.1	1.470
10	0.886	-95.4	-6.0	0.499	-23.1	-18.9	0.114	11.7	0.696	-106.1	2.4	1.447
11	0.867	-85.0	-6.8	0.455	-31.7	-17.5	0.133	2.3	0.743	-92.6	1.4	1.439
12	0.871	-75.0	-8.2	0.389	-43.4	-17.2	0.138	-4.6	0.732	-89.3	0.0	1.589
13	0.854	-65.6	-8.2	0.387	-49.9	-15.7	0.164	-11.0	0.769	-79.4	-0.2	1.436
14	0.855	-56.8	-8.9	0.360	-61.2	-15.1	0.176	-20.4	0.805	-70.0	-0.3	1.323
15	0.845	-48.1	-9.6	0.330	-68.7	-14.3	0.192	-29.6	0.806	-66.4	-1.3	1.371
16	0.842	-40.7	-10.0	0.315	-72.5	-14.0	0.199	-36.7	0.769	-52.1	-2.2	1.502
17	0.833	-32.6	-10.2	0.309	-82.1	-13.2	0.220	-44.6	0.792	-39.4	-2.4	1.436
18	0.826	-25.5	-10.5	0.299	-87.9	-12.3	0.242	-51.8	0.789	-29.7	-3.1	1.457

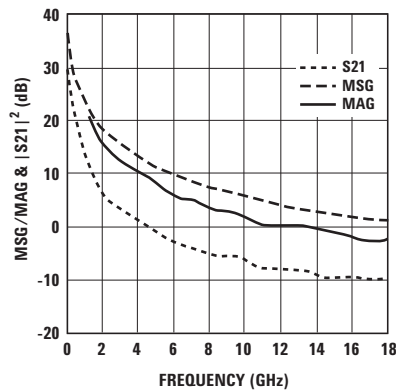


Figure 64. MSG/MAG & $|S_{21}|^2$ vs. Frequency at 5.5V 360mA.

Notes:

1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

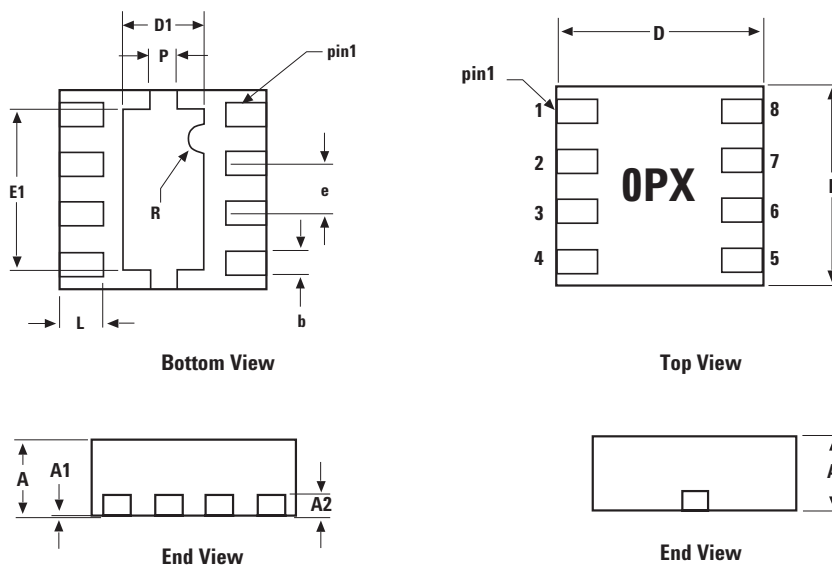
Device Models

Refer to Agilent's Web Site
www.agilent.com/view/rf

Ordering Information

Part Number	No. of Devices	Container
ATF-501P8-TR1	3000	7" Reel
ATF-501P8-TR2	10000	13" Reel
ATF-501P8-BLK	100	antistatic bag

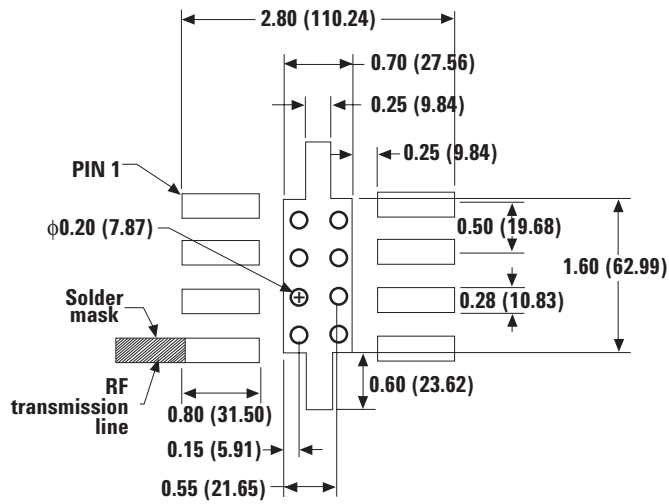
2x2 LPCC (JEDEC DFP-N) Package Dimensions



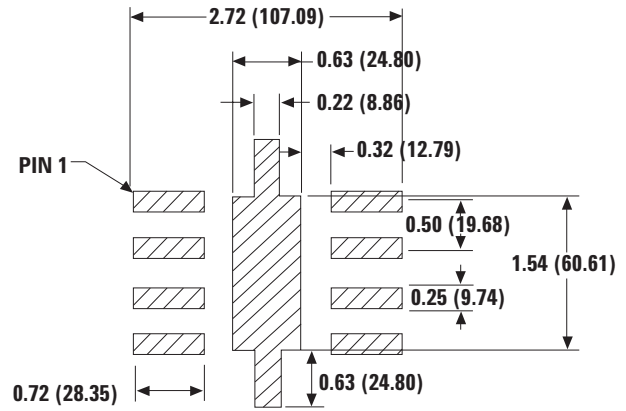
SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0	0.02	0.05
A2	0.203 REF	0.203 REF	0.203 REF
b	0.225	0.25	0.275
D	1.9	2.0	2.1
D1	0.65	0.80	0.95
E	1.9	2.0	2.1
E1	1.45	1.6	1.75
e	0.50 BSC	0.50 BSC	0.50 BSC

DIMENSIONS ARE IN MILLIMETERS

PCB Land Pattern and Stencil Design



PCB Land Pattern (top view)



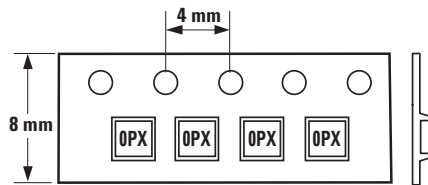
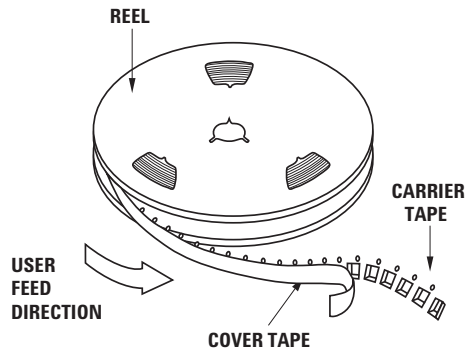
Stencil Layout (top view)

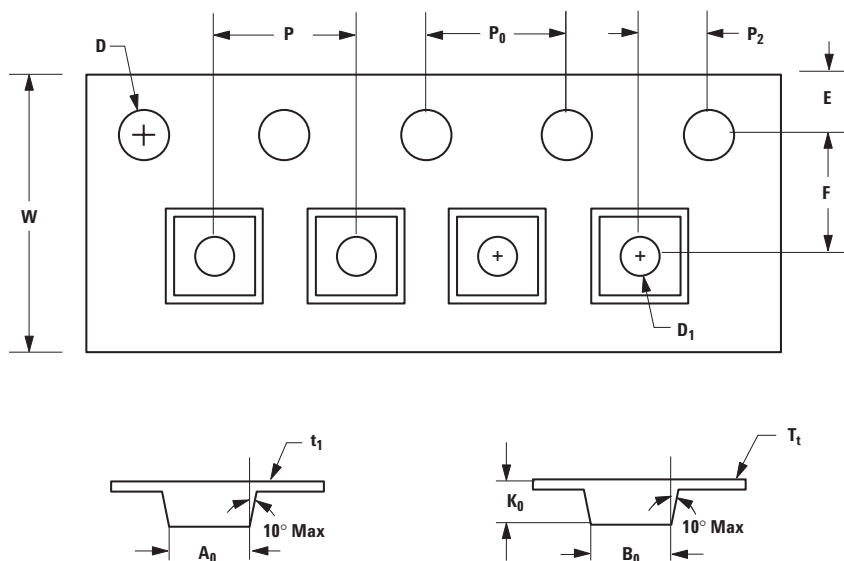
Notes:

Typical stencil thickness is 5 mils.

Measurements are in millimeters (mils).

Device Orientation





DESCRIPTION		SYMBOL	SIZE (mm)	SIZE (inches)
CAVITY	LENGTH	A_0	2.30 ± 0.05	0.091 ± 0.004
	WIDTH	B_0	2.30 ± 0.05	0.091 ± 0.004
	DEPTH	K_0	1.00 ± 0.05	0.039 ± 0.002
	PITCH	P	4.00 ± 0.10	0.157 ± 0.004
	BOTTOM HOLE DIAMETER	D_1	1.00 ± 0.25	0.039 ± 0.002
PERFORATION	DIAMETER	D	1.50 ± 0.10	0.060 ± 0.004
	PITCH	P_0	4.00 ± 0.10	0.157 ± 0.004
	POSITION	E	1.75 ± 0.10	0.069 ± 0.004
CARRIER TAPE	WIDTH	W	8.00 ± 0.30 $8.00 - 0.10$	0.315 ± 0.012 0.315 ± 0.004
	THICKNESS	t_1	0.254 ± 0.02	0.010 ± 0.0008
COVER TAPE	WIDTH	C	5.4 ± 0.10	0.205 ± 0.004
	TAPE THICKNESS	T_t	0.062 ± 0.001	0.0025 ± 0.0004
DISTANCE	CAVITY TO PERFORATION (WIDTH DIRECTION)	F	3.50 ± 0.05	0.138 ± 0.002
	CAVITY TO PERFORATION (LENGTH DIRECTION)	P_2	2.00 ± 0.05	0.079 ± 0.002

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