ATF-53189

Enhancement Mode[1] Pseudomorphic HEMT in SOT 89 Package

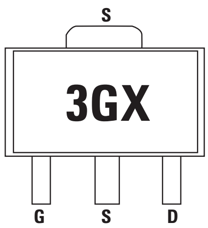
Data Sheet

Description

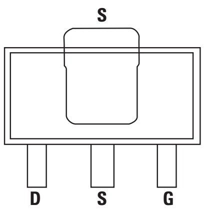
Avago Technologies's ATF-53189 is a single-voltage high linearity, low noise E-pHEMT FET packaged in a low cost surface mount SOT89 package. The device is ideal as a high-linearity, low noise, medium-power amplifier. Its operating frequency range is from 50 MHz to 6 GHz.

ATF-53189 is ideally suited for Cellular/PCS and WCDMA wireless infrastructure, WLAN, WLL and MMDS application, and general purpose discrete E-pHEMT amplifiers which require medium power and high linearity. All devices are 100% RF and DC tested.

Pin Connections and Package Marking



Top View



Bottom View

Notes:
Package marking provides orientation and identification:
"3G" = Device Code
"x" = Month code indicates the month of manufacture.
D = Drain
S = Source
G = Gate

Features

- Single voltage operation
- High Linearity and Gain
- Low Noise Figure
- Excellent uniformity in product specifications
- SOT 89 standard package
- Point MTTF > 300 years[2]
- MSL-1 and lead-free
- Tape-and-Reel packaging option available

Specifications

2 GHz, 4.0V, 135 mA (Typ.)

- 40.0 dBm Output IP3
- 23.0 dBm Output Power at 1dB gain compression
- 0.85 dB Noise Figure
- 15.5 dB Gain
- 46% PAE at P1dB
- LFOM[3] 12.7 dB

Applications

- Front-end LNA Q1 and Q2, 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

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. Linearity Figure of Merit (LFOM) is OIP3 divided by DC bias power.

ATF-53189 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 1.0
V_{gd}	Gate Drain Voltage[2]	V	-5 to 1.0
I_{ds}	Drain Current[2]	mA	300
I_{gs}	Gate Current	mA	20
P_{diss}	Total Power Dissipation[3]	W	1.0
$P_{in\ max.}$	RF Input Power	dBm	+24
T_{ch}	Channel Temperature	°C	150
T_{stg}	Storage Temperature	°C	-65 to 150

Thermal Resistance[2,4]

θ_{ch-b} = 70°C/W

Notes:
1. Operation of this device above any one of these parameters may cause permanent damage.
2. Assuming DC quiescent conditions.
3. Board (package belly) temperature T_B is 25°C. Derate 14.30 mW/°C for T_B > 80°C.
4. Channel-to-board thermal resistance measured using 150°C Liquid Crystal Measurement method.

ATF-53189 Electrical Specifications

T_A = 25°C, DC bias for RF parameters is Vds = 4.0V and Ids = 135 mA unless otherwise specified.

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
Vgs	Operational Gate Voltage	Vds = 4.0V, Ids = 135 mA	V	—	0.65	—
Vth	Threshold Voltage	Vds = 4.0V, Ids = 8 mA	V	—	0.30	—
Ids	Drain to Source Current	Vds = 4.0V, Vgs = 0V	µA	—	3.70	—
Gm	Transconductance	Vds = 4.0V, Gm = ∆Ids/∆Vgs; ∆Vgs = Vgs1 – Vgs2 Vgs1 = 0.6V, Vgs2 = 0.55V	mmho	—	650	—
Igss	Gate Leakage Current	Vds = 0V, Vgs = -4V	µA	-10.0	-0.34	—
NF	Noise Figure	f=900 MHz f=2.0 GHz f=2.4 GHz	dB dB dB	— — —	0.80 0.85 1.00	— 1.3 —
G	Gain[1]	f=900 MHz f=2.0 GHz f=2.4 GHz	dB dB dB	— 14.0 —	17.2 15.5 15.0	— 17.0 —
OIP3	Output 3rd Order Intercept Point[1]	f=900 MHz f=2.0 GHz f=2.4 GHz	dBm dBm dBm	— 36.0 —	42.0 40.0 38.6	— — —
P1dB	Output 1dB Compressed[1]	f=900 MHz f=2.0 GHz f=2.4 GHz	dBm dBm dBm	— — —	21.7 23.0 23.2	— —
PAE	Power Added Efficiency	f=900 MHz f=2.0 GHz f=2.4 GHz	% % %	— — —	33.8 46.0 49.0	— —
ACLR	Adjacent Channel Leakage Power Ratio[1,2]	Offset BW = 5 MHz Offset BW = 10 MHz	dBc dBc	— —	-54.0 -64.0	— —

Notes:
1. Measurements at 2 GHz obtained using production test board described in Figure 1.
2. 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
   - Pin = -8 dBm
   - Channel Integrate Bandwidth = 3.84 MHz

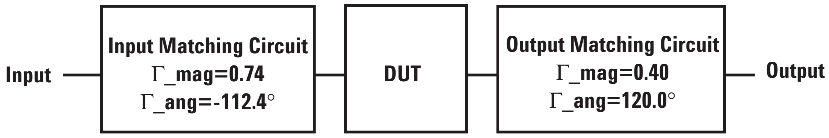


Figure 1. Block diagram of the 2 GHz production test board used for NF, Gain, OIP3 , P1dB, PAE and ACLR measurements. This circuit achieves a trade-off between optimal OIP3, P1dB and VSWR. Circuit losses have been de-embedded from actual measurements.

Product Consistency Distribution Charts [1,2]

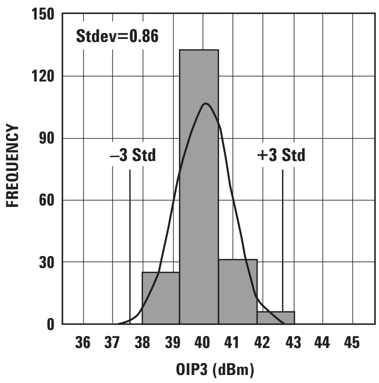


Figure 2. OIP3 @ 2 GHz, 4V, 135 mA.
LSL = 36 dBm, Nominal = 40 dBm.

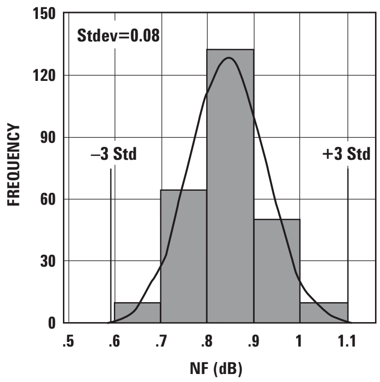


Figure 3. NF @ 2 GHz, 4V, 135 mA.
USL = 1.30 dBm, Nominal = 0.84 dBm.

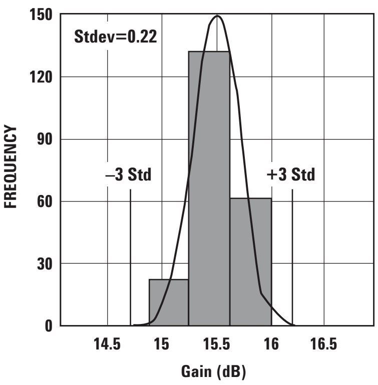


Figure 4. Gain @ 2 GHz, 4V, 135 mA.
LSL = 14 dBm, Nominal = 15.5 dBm,
USL = 17 dBm.

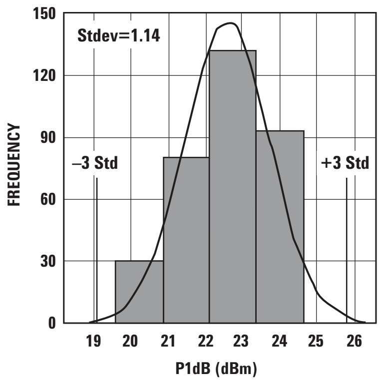


Figure 5. P1dB @ 2 GHz, 4V, 135 mA.
Nominal = 23 dBm.

Notes:

1. Distribution data sample size is 500 samples taken from 3 different wafers. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
2. 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.

Gamma Load and Source at Optimum OIP3 Tuning Conditions

The device's optimum OIP3 measurements were determined using a Maury Load Pull System at 4.0V, 135 mA quiesent bias.

Typical Gammas at Optimum OIP3 [1]

Freq	Gamma Source		Gamma Load		OIP3	Gain	P1dB	PAE
(GHz)	Mag	Ang (deg)	Mag	Ang (deg)	(dBm)	(dB)	(dBm)	(%)
0.9	0.8179	-143.28	0.0721	124.08	42.0	17.2	21.7	33.8
2.0	0.7411	-112.36	0.4080	119.91	41.6	15.6	23.4	44.2
3.9	0.6875	-94.23	0.4478	174.74	41.3	11.2	23.1	41.4
5.8	0.5204	-75.91	0.3525	-120.13	36.9	5.6	22.4	25.7

Note:
1. Typical describes additional product performance information that is not covered by the product warranty.

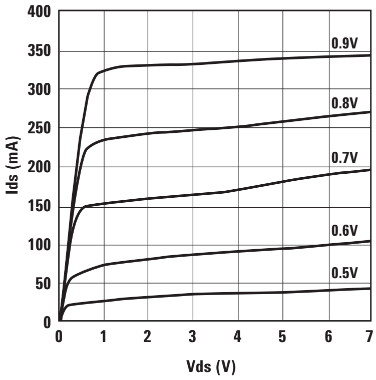


Figure 6. Typical IV Curve.

ATF-53189 Typical Performance Curves (at 25°C unless specified otherwise)
Tuned for Optimal OIP3 at Vd = 4.0V, Ids = 135 mA.

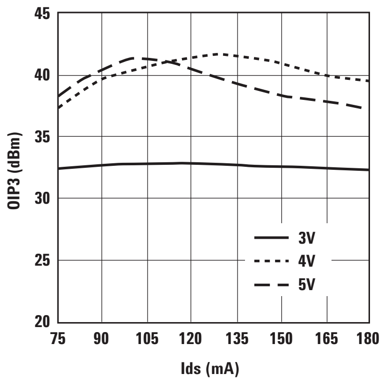


Figure 7. OIP3 vs. Ids and Vds at 900 MHz.

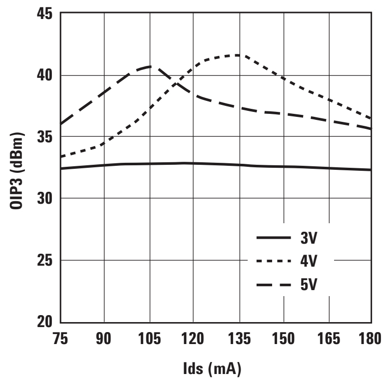


Figure 8. OIP3 vs. Ids and Vds at 2 GHz.

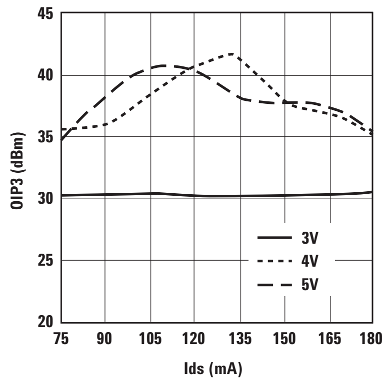


Figure 9. OIP3 vs. Ids and Vds at 3.9 GHz.

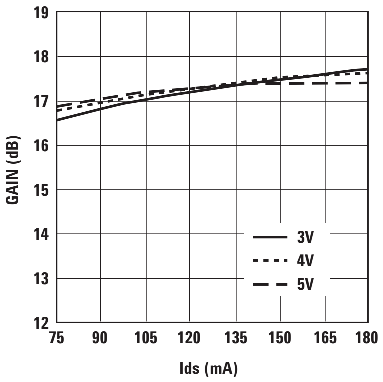


Figure 10. Small Signal Gain vs. Ids and Vds at 900 MHz.

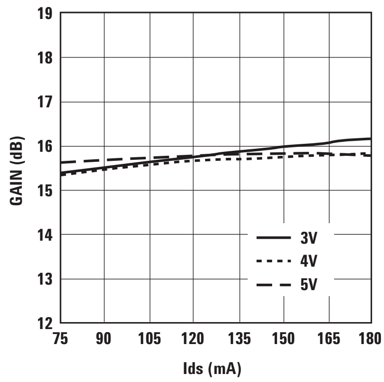


Figure 11. Small Signal Gain vs. Ids and Vds at 2 GHz.

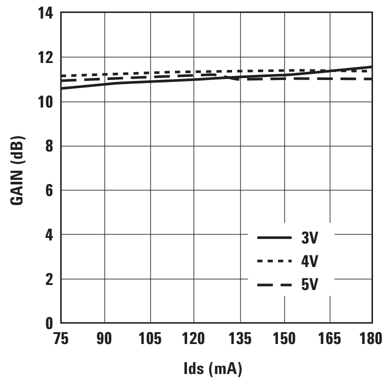


Figure 12. Small Signal Gain vs. Ids and Vds at 3.9 GHz.

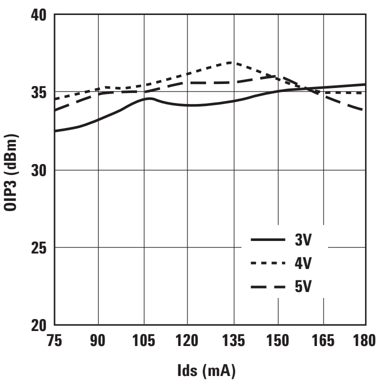


Figure 13. OIP3 vs. Ids and Vds at 5.8 GHz.

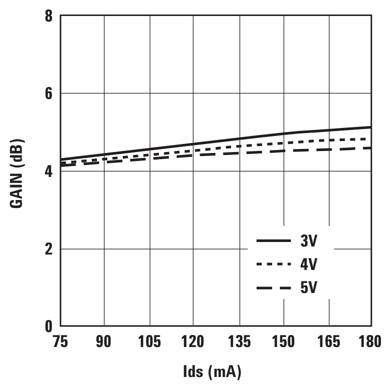


Figure 14. Small Signal Gain vs. Ids and Vds at 5.8 GHz.

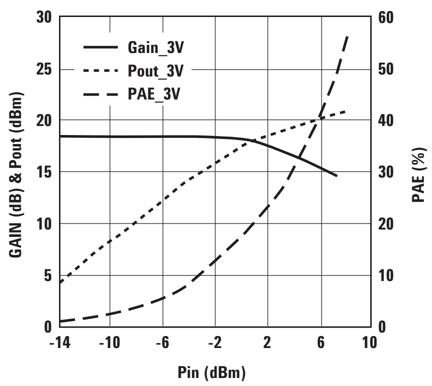


Figure 15. Small Signal Gain/Pout/PAE vs. Pin at Vds=3V and Freq = 900 MHz.

Note:
Bias current for the above charts are quiescent conditions. Actual level may increase depending on amount of RF drive.

ATF-53189 Typical Performance Curves (at 25°C unless specified otherwise), continued
Tuned for Optimal OIP3 at Vd = 4.0V, Ids = 135 mA.

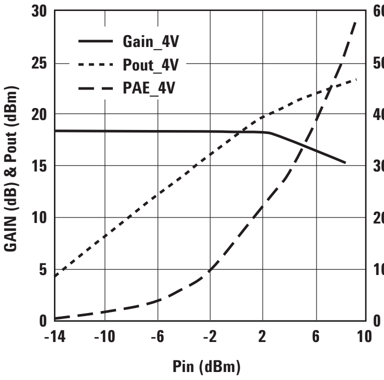


Figure 16. Small Signal Gain/Pout/PAE vs. Pin at Vds=4V and Freq = 900 MHz.

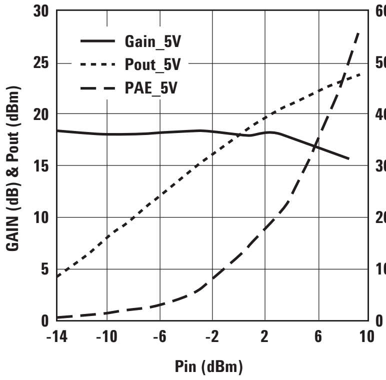


Figure 17. Small Signal Gain/Pout/PAE vs. Pin at Vds=5V and Freq = 900 MHz.

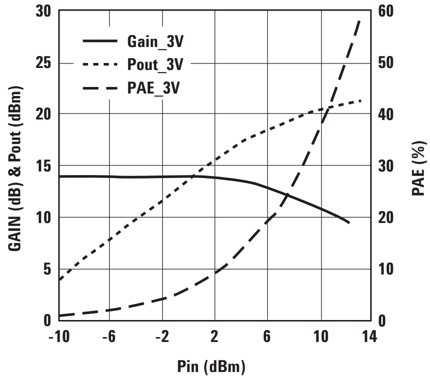


Figure 18. Small Signal Gain/Pout/PAE vs. Pin at Vds=3V and Freq = 2 GHz.

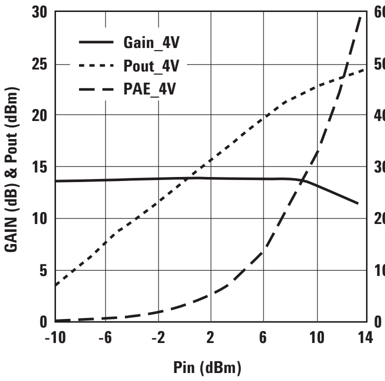


Figure 19. Small Signal Gain/Pout/PAE vs. Pin at Vds=4V and Freq = 2 GHz.

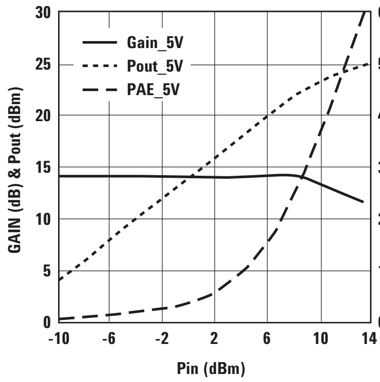


Figure 20. Small Signal Gain/Pout/PAE vs. Pin at Vds=5V and Freq = 2 GHz.

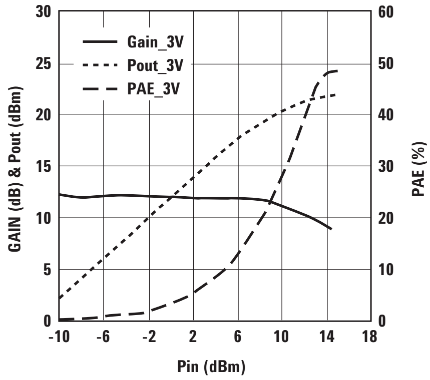


Figure 21. Small Signal Gain/Pout/PAE vs. Pin at Vds=3V and Freq = 3.9 GHz.

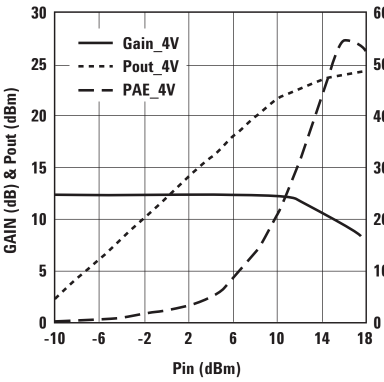


Figure 22. Small Signal Gain/Pout/PAE vs. Pin at Vds=4V and Freq = 3.9 GHz.

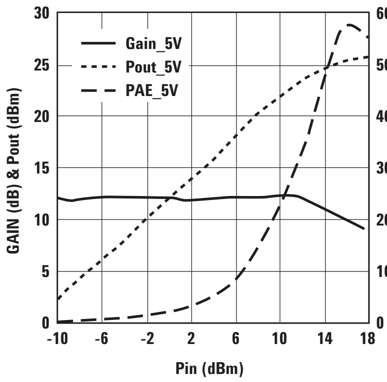


Figure 21. Small Signal Gain/Pout/PAE vs. Pin at Vds=5V and Freq = 3.9 GHz.

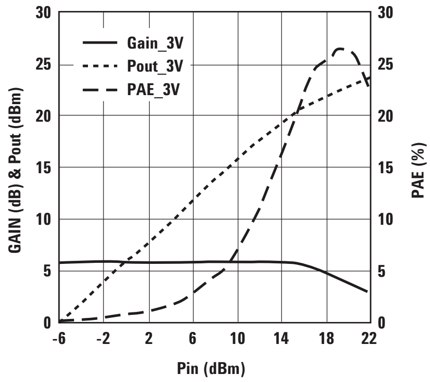


Figure 24. Small Signal Gain/Pout/PAE vs. Pin at Vds=3V and Freq = 5.8 GHz.

Note:
Bias current for the above charts are quiescent conditions. Actual level may increase depending on amount of RF drive.

ATF-53189 Typical Performance Curves (at 25°C unless specified otherwise), continued
Tuned for Optimal OIP3 at Vd = 4.0V, Ids = 135 mA.

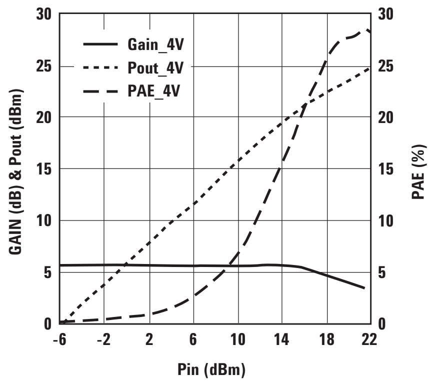


Figure 25. Small Signal Gain/Pout/PAE vs. Pin at Vds = 4V and Freq = 5.8 GHz.

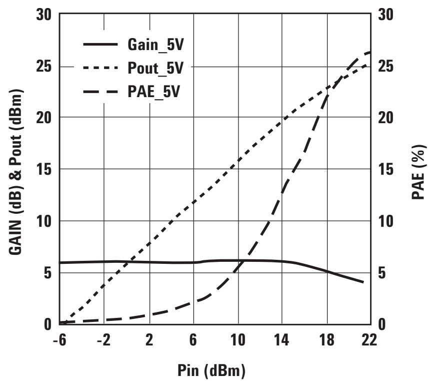


Figure 26. Small Signal Gain/Pout/PAE vs. Pin at Vds = 5V and Freq = 5.8 GHz.

ATF-53189 Typical Performance Curves, continued
Tuned for Optimal OIP3 at Vd = 4.0V, Ids = 135 mA, Over Temperature and Frequency

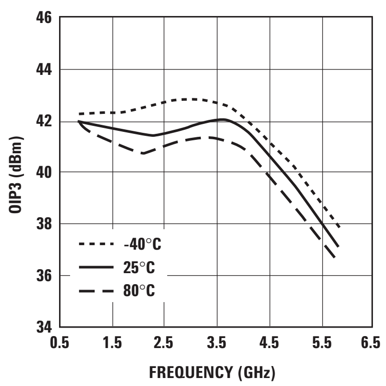


Figure 27. OIP3 vs. Temperature and Frequency at optimum OIP3.

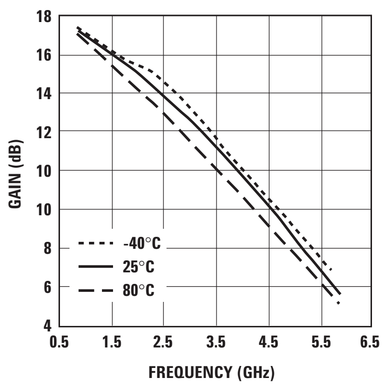


Figure 28. Gain vs. Temperature and Frequency at optimum OIP3.

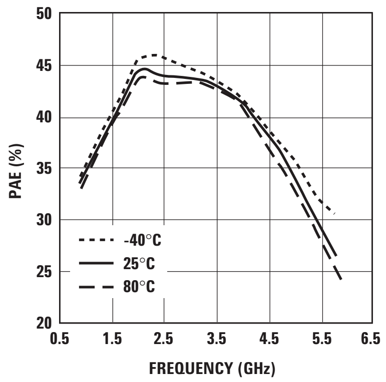


Figure 29. PAE vs. Temperature and Frequency at optimum OIP3.

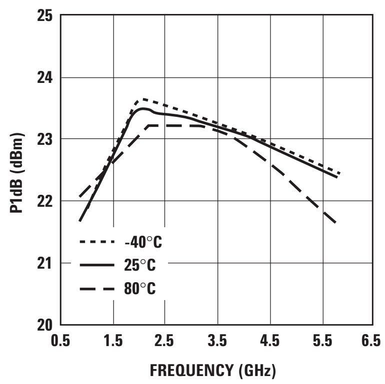


Figure 30. P1dB vs. Temperature and Frequency at optimum OIP3.

Note:
Bias current for the above charts are quiescent conditions. Actual level may increase depending on amount of RF drive.

ATF-53189 Typical Performance Curves (at 25°C unless specified otherwie), continued
Tuned for Optimal OIP3 at Vd = 4.0V, Ids = 135 mA

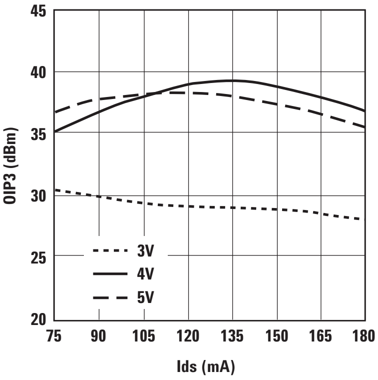


Figure 31. OIP3 vs. Ids and Vds at 2.4 GHz.

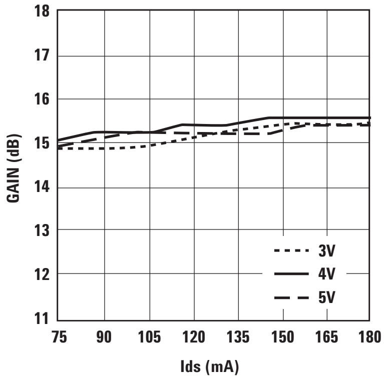


Figure 32. Small Signal Gain vs. Ids and Vds at 2.4 GHz.

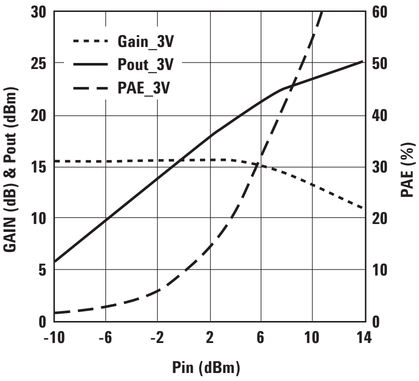


Figure 33. Small Signal Gain/Pout/PAE vs. Pin at Vds 3V and Freq = 2.4 GHz.

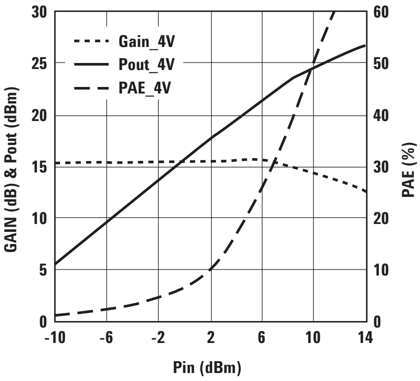


Figure 34. Small Signal Gain/Pout/PAE vs. Pin at Vds 4V and Freq = 2.4 GHz.

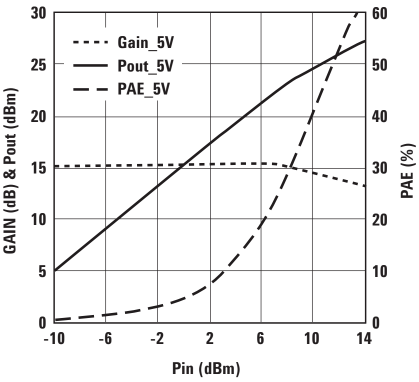


Figure 35. Small Signal Gain/Pout/PAE vs. Pin at Vds 5V and Freq = 2.4 GHz.

Note:
Bias current for the above charts are quiescent conditions. Actual level may increase depending on amount of RF drive.

ATF-53189 Typical Scattering and Noise Parameters at 25°C, V_{DS} = 4.0V, I_{DS} = 180 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		MSG/MAG
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	dB
0.1	0.544	-133.2	31.0	35.531	110.9	-37.7	0.013	31.7	0.692	-163.7	34.4
0.2	0.704	-158.7	25.6	19.023	97.1	-37.1	0.014	25.2	0.738	-173.2	31.3
0.3	0.777	-169.4	22.2	12.872	90.4	-36.5	0.015	24.9	0.749	-177.6	29.3
0.4	0.813	-176.1	19.7	9.705	85.7	-35.9	0.016	26.3	0.752	179.3	27.8
0.5	0.856	178.5	17.7	7.687	84.4	-35.4	0.017	30.4	0.756	175.7	26.6
0.6	0.866	174.5	16.2	6.438	81.7	-34.9	0.018	32.6	0.755	173.5	25.5
0.7	0.872	170.9	14.9	5.582	79.2	-34.4	0.019	34.5	0.755	171.4	24.7
0.8	0.874	167.5	13.9	4.939	76.5	-33.6	0.021	35.9	0.753	169.4	23.7
0.9	0.876	164.1	12.9	4.433	73.8	-33.2	0.022	36.8	0.755	167.5	23.0
1.0	0.880	161.0	12.1	4.026	70.9	-32.4	0.024	37.1	0.753	165.6	22.2
1.5	0.881	150.2	9.3	2.910	59.6	-30.5	0.030	35.8	0.753	158.4	19.2
2.0	0.882	137.1	6.5	2.123	45.9	-28.6	0.037	31.0	0.752	150.1	16.0
2.5	0.879	124.9	4.3	1.647	33.4	-27.3	0.043	25.0	0.768	142.3	13.4
3.0	0.874	112.7	2.3	1.304	21.1	-26.6	0.047	18.3	0.766	135.5	11.5
3.5	0.882	99.5	0.5	1.062	11.3	-26.0	0.050	12.6	0.773	131.8	10.0
4.0	0.889	92.6	-0.7	0.921	1.5	-25.8	0.051	7.1	0.779	123.3	9.4
5.0	0.903	78.2	-3.5	0.669	-19.8	-25.2	0.055	-5.3	0.793	102.9	7.0
6.0	0.918	61.3	-5.8	0.515	-41.5	-25.7	0.052	-22.4	0.806	84.7	5.2
7.0	0.948	41.2	-8.2	0.389	-59.6	-26.0	0.050	-39.5	0.809	69.9	3.2
8.0	0.960	24.3	-10.2	0.308	-79.9	-26.7	0.046	-55.9	0.844	54.6	2.1
9.0	0.941	11.8	-12.4	0.239	-100.5	-28.4	0.038	-73.5	0.882	37.0	1.4
10.0	0.946	10.8	-14.6	0.187	-109.4	-31.1	0.028	-81.6	0.896	27.1	0.1
11.0	0.937	0.3	-16.0	0.158	-124.9	-34.4	0.019	-108.3	0.872	20.3	-1.8
12.0	0.914	-8.0	-17.7	0.131	-138.0	-46.0	0.005	-147.3	0.916	7.0	-1.3
13.0	0.951	-12.1	-19.2	0.110	-153.4	-40.0	0.010	71.0	0.877	-1.1	-4.4
14.0	0.948	-20.6	-21.0	0.089	-168.9	-37.1	0.014	30.2	0.882	-7.5	-6.3
15.0	0.939	-23.6	-21.4	0.085	177.8	-39.2	0.011	-4.9	0.865	-19.2	-7.2
16.0	0.948	-23.1	-21.1	0.088	165.9	-37.7	0.013	-8.8	0.864	-26.2	-6.9
17.0	0.947	-24.3	-18.9	0.114	155.2	-41.9	0.008	-173.5	0.856	-33.6	-4.7
18.0	0.903	-32.5	-17.1	0.140	133.4	-35.4	0.017	161.7	0.835	-42.5	-3.2

Freq GHz	Fmin dB	Gamma Opt		Rn/50	Ga dB
		Mag	Ang		
0.5	0.65	0.394	163.6	0.11	25.82
0.9	0.76	0.417	172.4	0.09	21.83
1.0	0.79	0.423	175.3	0.08	21.71
1.5	0.86	0.465	-165.4	0.08	18.70
2.0	0.94	0.509	-147.7	0.06	17.63
2.4	1.00	0.545	-134.6	0.08	16.45
3.0	1.10	0.600	-116.7	0.16	14.90
3.5	1.17	0.645	-103.3	0.28	13.53
5.0	1.41	0.777	-70.0	0.35	11.35
5.8	1.53	0.840	-56.1	0.41	10.31
6.0	1.56	0.855	-52.9	0.42	10.38
7.0	1.72	0.920	-39.0	0.51	9.79
8.0	1.87	0.970	-27.5	0.97	7.91
9.0	2.03	0.993	-19.1	1.88	6.11
10.0	2.18	0.997	-7.5	2.54	4.56

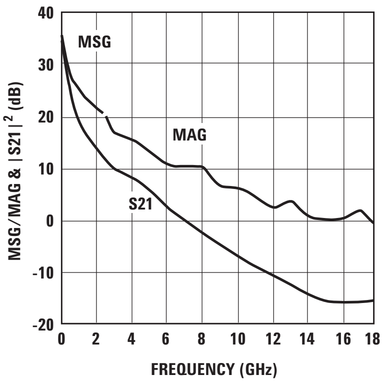


Figure 36. MSG/MAG & $|S21|^2$ vs. and Frequency at 4.0V/180 mA.

Notes:

1. F_{min} values at 2 GHz and higher are based on measurements while the F_{min} below 2 GHz have been extrapolated. The F_{min} values are based on a set of 16 noise figure measurements made at 16 different impedances using an ATN NP5 test system. From these measurements a true Fmin is calculated. Refer to the noise parameter application section for more information.
2. S and noise parameters are 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-53189 Typical Scattering and Noise Parameters at 25°C, $V_{DS} = 4.0V$, $I_{DS} = 135$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		MSG/MAG
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	dB
0.1	0.544	-133.2	31.0	35.531	110.9	-37.7	0.013	31.7	0.692	-163.7	34.4
0.2	0.704	-158.7	25.6	19.023	97.1	-37.1	0.014	25.2	0.738	-173.2	31.3
0.3	0.777	-169.4	22.2	12.872	90.4	-36.5	0.015	24.9	0.749	-177.6	29.3
0.4	0.813	-176.1	19.7	9.705	85.7	-35.9	0.016	26.3	0.752	179.3	27.8
0.5	0.856	178.5	17.7	7.687	84.4	-35.4	0.017	30.4	0.756	175.7	26.6
0.6	0.866	174.5	16.2	6.438	81.7	-34.9	0.018	32.6	0.755	173.5	25.5
0.7	0.872	170.9	14.9	5.582	79.2	-34.4	0.019	34.5	0.755	171.4	24.7
0.8	0.874	167.5	13.9	4.939	76.5	-33.6	0.021	35.9	0.753	169.4	23.7
0.9	0.876	164.1	12.9	4.433	73.8	-33.2	0.022	36.8	0.755	167.5	23.0
1.0	0.880	161.0	12.1	4.026	70.9	-32.4	0.024	37.1	0.753	165.6	22.2
1.5	0.881	150.2	9.3	2.910	59.6	-30.5	0.030	35.8	0.753	158.4	19.2
2.0	0.882	137.1	6.5	2.123	45.9	-28.6	0.037	31.0	0.752	150.1	16.0
2.5	0.879	124.9	4.3	1.647	33.4	-27.3	0.043	25.0	0.768	142.3	13.4
3.0	0.874	112.7	2.3	1.304	21.1	-26.6	0.047	18.3	0.766	135.5	11.5
3.5	0.882	99.5	0.5	1.062	11.3	-26.0	0.050	12.6	0.773	131.8	10.0
4.0	0.889	92.6	-0.7	0.921	1.5	-25.8	0.051	7.1	0.779	123.3	9.4
5.0	0.903	78.2	-3.5	0.669	-19.8	-25.2	0.055	-5.3	0.793	102.9	7.0
6.0	0.918	61.3	-5.8	0.515	-41.5	-25.7	0.052	-22.4	0.806	84.7	5.2
7.0	0.948	41.2	-8.2	0.389	-59.6	-26.0	0.050	-39.5	0.809	69.9	3.2
8.0	0.960	24.3	-10.2	0.308	-79.9	-26.7	0.046	-55.9	0.844	54.6	2.1
9.0	0.941	11.8	-12.4	0.239	-100.5	-28.4	0.038	-73.5	0.882	37.0	1.4
10.0	0.946	10.8	-14.6	0.187	-109.4	-31.1	0.028	-81.6	0.896	27.1	0.1
11.0	0.937	0.3	-16.0	0.158	-124.9	-34.4	0.019	-108.3	0.872	20.3	-1.8
12.0	0.914	-8.0	-17.7	0.131	-138.0	-46.0	0.005	-147.3	0.916	7.0	-1.3
13.0	0.951	-12.1	-19.2	0.110	-153.4	-40.0	0.010	71.0	0.877	-1.1	-4.4
14.0	0.948	-20.6	-21.0	0.089	-168.9	-37.1	0.014	30.2	0.882	-7.5	-6.3
15.0	0.939	-23.6	-21.4	0.085	177.8	-39.2	0.011	-4.9	0.865	-19.2	-7.2
16.0	0.948	-23.1	-21.1	0.088	165.9	-37.7	0.013	-8.8	0.864	-26.2	-6.9
17.0	0.947	-24.3	-18.9	0.114	155.2	-41.9	0.008	-173.5	0.856	-33.6	-4.7
18.0	0.903	-32.5	-17.1	0.140	133.4	-35.4	0.017	161.7	0.835	-42.5	-3.2

Freq GHz	Fmin dB	Gamma Opt		Rn/50	Ga dB
		Mag	Ang		
0.5	0.30	0.162	150.8	0.05	26.27
0.9	0.41	0.291	161.3	0.05	22.12
1.0	0.44	0.302	164.2	0.05	22.02
1.5	0.53	0.369	-174.2	0.04	18.95
2.0	0.62	0.433	-154.6	0.04	17.05
2.4	0.69	0.484	-140.2	0.05	15.87
3.0	0.80	0.556	-120.6	0.10	14.63
3.5	0.89	0.613	-106.1	0.19	13.21
5.0	1.16	0.764	-71.0	0.26	11.19
5.8	1.31	0.832	-56.6	0.30	10.26
6.0	1.34	0.848	-53.4	0.30	10.04
7.0	1.52	0.914	-39.3	0.39	9.64
8.0	1.71	0.963	-27.9	0.77	8.68
9.0	1.89	0.991	-18.2	0.96	6.57
10.0	2.07	0.998	-9.2	1.58	4.51

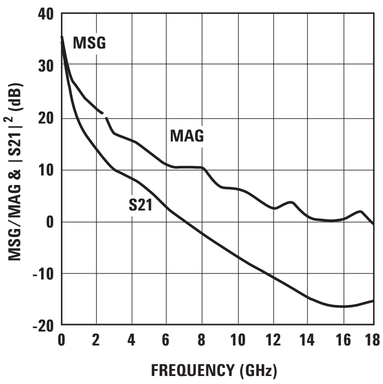


Figure 37. MSG/MAG & $|S21|^2$ vs. and Frequency at 4.0V/135 mA.

Notes:

1. F_{min} values at 2 GHz and higher are based on measurements while the F_{min} below 2 GHz have been extrapolated. The F_{min} values are based on a set of 16 noise figure measurements made at 16 different impedances using an ATN NP5 test system. From these measurements a true Fmin is calculated. Refer to the noise parameter application section for more information.
2. S and noise parameters are 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-53189 Typical Scattering and Noise Parameters at 25°C, V_{DS} = 4.0V, I_{DS} = 75 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		MSG/MAG
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	dB
0.1	0.544	-133.2	31.0	35.531	110.9	-37.7	0.013	31.7	0.692	-163.7	34.4
0.2	0.704	-158.7	25.6	19.023	97.1	-37.1	0.014	25.2	0.738	-173.2	31.3
0.3	0.777	-169.4	22.2	12.872	90.4	-36.5	0.015	24.9	0.749	-177.6	29.3
0.4	0.813	-176.1	19.7	9.705	85.7	-35.9	0.016	26.3	0.752	179.3	27.8
0.5	0.856	178.5	17.7	7.687	84.4	-35.4	0.017	30.4	0.756	175.7	26.6
0.6	0.866	174.5	16.2	6.438	81.7	-34.9	0.018	32.6	0.755	173.5	25.5
0.7	0.872	170.9	14.9	5.582	79.2	-34.4	0.019	34.5	0.755	171.4	24.7
0.8	0.874	167.5	13.9	4.939	76.5	-33.6	0.021	35.9	0.753	169.4	23.7
0.9	0.876	164.1	12.9	4.433	73.8	-33.2	0.022	36.8	0.755	167.5	23.0
1.0	0.880	161.0	12.1	4.026	70.9	-32.4	0.024	37.1	0.753	165.6	22.2
1.5	0.881	150.2	9.3	2.910	59.6	-30.5	0.030	35.8	0.753	158.4	19.2
2.0	0.882	137.1	6.5	2.123	45.9	-28.6	0.037	31.0	0.752	150.1	16.0
2.5	0.879	124.9	4.3	1.647	33.4	-27.3	0.043	25.0	0.768	142.3	13.4
3.0	0.874	112.7	2.3	1.304	21.1	-26.6	0.047	18.3	0.766	135.5	11.5
3.5	0.882	99.5	0.5	1.062	11.3	-26.0	0.050	12.6	0.773	131.8	10.0
4.0	0.889	92.6	-0.7	0.921	1.5	-25.8	0.051	7.1	0.779	123.3	9.4
5.0	0.903	78.2	-3.5	0.669	-19.8	-25.2	0.055	-5.3	0.793	102.9	7.0
6.0	0.918	61.3	-5.8	0.515	-41.5	-25.7	0.052	-22.4	0.806	84.7	5.2
7.0	0.948	41.2	-8.2	0.389	-59.6	-26.0	0.050	-39.5	0.809	69.9	3.2
8.0	0.960	24.3	-10.2	0.308	-79.9	-26.7	0.046	-55.9	0.844	54.6	2.1
9.0	0.941	11.8	-12.4	0.239	-100.5	-28.4	0.038	-73.5	0.882	37.0	1.4
10.0	0.946	10.8	-14.6	0.187	-109.4	-31.1	0.028	-81.6	0.896	27.1	0.1
11.0	0.937	0.3	-16.0	0.158	-124.9	-34.4	0.019	-108.3	0.872	20.3	-1.8
12.0	0.914	-8.0	-17.7	0.131	-138.0	-46.0	0.005	-147.3	0.916	7.0	-1.3
13.0	0.951	-12.1	-19.2	0.110	-153.4	-40.0	0.010	71.0	0.877	-1.1	-4.4
14.0	0.948	-20.6	-21.0	0.089	-168.9	-37.1	0.014	30.2	0.882	-7.5	-6.3
15.0	0.939	-23.6	-21.4	0.085	177.8	-39.2	0.011	-4.9	0.865	-19.2	-7.2
16.0	0.948	-23.1	-21.1	0.088	165.9	-37.7	0.013	-8.8	0.864	-26.2	-6.9
17.0	0.947	-24.3	-18.9	0.114	155.2	-41.9	0.008	-173.5	0.856	-33.6	-4.7
18.0	0.903	-32.5	-17.1	0.140	133.4	-35.4	0.017	161.7	0.835	-42.5	-3.2

Freq GHz	Fmin dB	Gamma Opt		Rn/50	Ga dB
		Mag	Ang		
0.5	0.32	0.175	127.6	0.05	26.45
0.9	0.41	0.224	143.8	0.04	21.98
1.0	0.43	0.235	148.3	0.03	21.50
1.5	0.49	0.306	173.6	0.03	18.55
2.0	0.56	0.375	-163.6	0.03	16.33
2.4	0.61	0.428	-147.2	0.04	15.18
3.0	0.69	0.507	-125.3	0.08	13.86
3.5	0.75	0.569	-109.3	0.14	12.68
5.0	0.95	0.738	-72.0	0.20	10.81
5.8	1.05	0.814	-57.4	0.24	10.64
6.0	1.08	0.831	-54.2	0.24	9.97
7.0	1.21	0.907	-40.5	0.30	9.25
8.0	1.34	0.961	-29.3	0.60	7.78
9.0	1.47	0.992	-19.3	0.71	6.96
10.0	1.60	0.996	-8.9	1.01	4.46

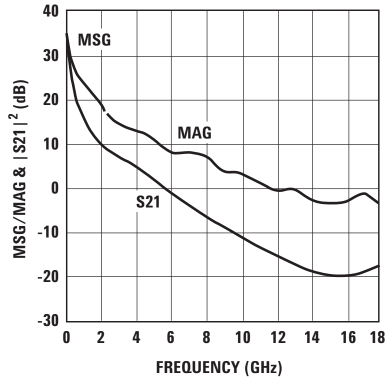


Figure 38. MSG/MAG & $|S21|^2$ vs. and Frequency at 4.0V/75 mA.

Notes:

1. F_{min} values at 2 GHz and higher are based on measurements while the F_{min} below 2 GHz have been extrapolated. The F_{min} values are based on a set of 16 noise figure measurements made at 16 different impedances using an ATN NP5 test system. From these measurements a true Fmin is calculated. Refer to the noise parameter application section for more information.
2. S and noise parameters are 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-53189 Typical Scattering and Noise Parameters at 25°C, V_{DS} = 5.0V, I_{DS} = 135 mA

Freq. GHz	S_{11} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.	MSG/MAG dB
0.1	0.544	-133.2	31.0	35.531	110.9	-37.7	0.013	31.7	0.692	-163.7	34.4
0.2	0.704	-158.7	25.6	19.023	97.1	-37.1	0.014	25.2	0.738	-173.2	31.3
0.3	0.777	-169.4	22.2	12.872	90.4	-36.5	0.015	24.9	0.749	-177.6	29.3
0.4	0.813	-176.1	19.7	9.705	85.7	-35.9	0.016	26.3	0.752	179.3	27.8
0.5	0.856	178.5	17.7	7.687	84.4	-35.4	0.017	30.4	0.756	175.7	26.6
0.6	0.866	174.5	16.2	6.438	81.7	-34.9	0.018	32.6	0.755	173.5	25.5
0.7	0.872	170.9	14.9	5.582	79.2	-34.4	0.019	34.5	0.755	171.4	24.7
0.8	0.874	167.5	13.9	4.939	76.5	-33.6	0.021	35.9	0.753	169.4	23.7
0.9	0.876	164.1	12.9	4.433	73.8	-33.2	0.022	36.8	0.755	167.5	23.0
1.0	0.880	161.0	12.1	4.026	70.9	-32.4	0.024	37.1	0.753	165.6	22.2
1.5	0.881	150.2	9.3	2.910	59.6	-30.5	0.030	35.8	0.753	158.4	19.2
2.0	0.882	137.1	6.5	2.123	45.9	-28.6	0.037	31.0	0.752	150.1	16.0
2.5	0.879	124.9	4.3	1.647	33.4	-27.3	0.043	25.0	0.768	142.3	13.4
3.0	0.874	112.7	2.3	1.304	21.1	-26.6	0.047	18.3	0.766	135.5	11.5
3.5	0.882	99.5	0.5	1.062	11.3	-26.0	0.050	12.6	0.773	131.8	10.0
4.0	0.889	92.6	-0.7	0.921	1.5	-25.8	0.051	7.1	0.779	123.3	9.4
5.0	0.903	78.2	-3.5	0.669	-19.8	-25.2	0.055	-5.3	0.793	102.9	7.0
6.0	0.918	61.3	-5.8	0.515	-41.5	-25.7	0.052	-22.4	0.806	84.7	5.2
7.0	0.948	41.2	-8.2	0.389	-59.6	-26.0	0.050	-39.5	0.809	69.9	3.2
8.0	0.960	24.3	-10.2	0.308	-79.9	-26.7	0.046	-55.9	0.844	54.6	2.1
9.0	0.941	11.8	-12.4	0.239	-100.5	-28.4	0.038	-73.5	0.882	37.0	1.4
10.0	0.946	10.8	-14.6	0.187	-109.4	-31.1	0.028	-81.6	0.896	27.1	0.1
11.0	0.937	0.3	-16.0	0.158	-124.9	-34.4	0.019	-108.3	0.872	20.3	-1.8
12.0	0.914	-8.0	-17.7	0.131	-138.0	-46.0	0.005	-147.3	0.916	7.0	-1.3
13.0	0.951	-12.1	-19.2	0.110	-153.4	-40.0	0.010	71.0	0.877	-1.1	-4.4
14.0	0.948	-20.6	-21.0	0.089	-168.9	-37.1	0.014	30.2	0.882	-7.5	-6.3
15.0	0.939	-23.6	-21.4	0.085	177.8	-39.2	0.011	-4.9	0.865	-19.2	-7.2
16.0	0.948	-23.1	-21.1	0.088	165.9	-37.7	0.013	-8.8	0.864	-26.2	-6.9
17.0	0.947	-24.3	-18.9	0.114	155.2	-41.9	0.008	-173.5	0.856	-33.6	-4.7
18.0	0.903	-32.5	-17.1	0.140	133.4	-35.4	0.017	161.7	0.835	-42.5	-3.2

Freq GHz	Fmin dB	Gamma Opt Mag	Gamma Opt Ang	Rn/50	Ga dB
0.5	0.36	0.266	149.9	0.05	26.51
0.9	0.46	0.315	162.4	0.04	22.79
1.0	0.49	0.327	165.6	0.04	22.09
1.5	0.59	0.388	-172.7	0.04	18.92
2.0	0.69	0.448	-153.0	0.04	17.04
2.4	0.77	0.495	-138.6	0.06	15.87
3.0	0.88	0.563	-116.3	0.12	14.50
3.5	0.98	0.617	-104.9	0.21	13.11
5.0	1.28	0.764	-70.5	0.31	11.19
5.8	1.44	0.830	-56.5	0.37	10.10
6.0	1.48	0.845	-53.4	0.38	10.08
7.0	1.68	0.912	-39.7	0.42	9.39
8.0	1.88	0.960	-28.3	0.84	8.78
9.0	2.08	0.988	-18.3	1.24	8.05
10.0	2.28	0.994	-8.5	1.78	4.74

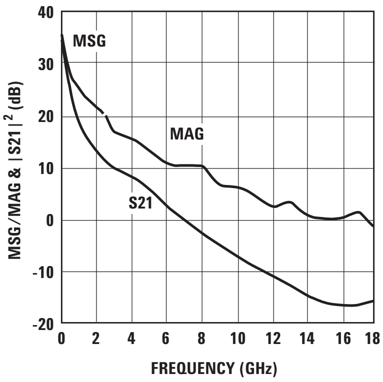


Figure 39. MSG/MAG & |S21|^2 vs. and Frequency at 5.0V/135 mA.

Notes:

1. F_{min} values at 2 GHz and higher are based on measurements while the F_{min} below 2 GHz have been extrapolated. The F_{min} values are based on a set of 16 noise figure measurements made at 16 different impedances using an ATN NP5 test system. From these measurements a true Fmin is calculated. Refer to the noise parameter application section for more information.
2. S and noise parameters are 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-53189 Typical Scattering and Noise Parameters at 25°C, V_{DS} = 3.0V, I_{DS} = 135 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		MSG/MAG
GHz	Mag.	Ang.	dB	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	dB
0.1	0.544	-133.2	31.0	35.531	110.9	-37.7	0.013	31.7	0.692	-163.7	34.4
0.2	0.704	-158.7	25.6	19.023	97.1	-37.1	0.014	25.2	0.738	-173.2	31.3
0.3	0.777	-169.4	22.2	12.872	90.4	-36.5	0.015	24.9	0.749	-177.6	29.3
0.4	0.813	-176.1	19.7	9.705	85.7	-35.9	0.016	26.3	0.752	179.3	27.8
0.5	0.856	178.5	17.7	7.687	84.4	-35.4	0.017	30.4	0.756	175.7	26.6
0.6	0.866	174.5	16.2	6.438	81.7	-34.9	0.018	32.6	0.755	173.5	25.5
0.7	0.872	170.9	14.9	5.582	79.2	-34.4	0.019	34.5	0.755	171.4	24.7
0.8	0.874	167.5	13.9	4.939	76.5	-33.6	0.021	35.9	0.753	169.4	23.7
0.9	0.876	164.1	12.9	4.433	73.8	-33.2	0.022	36.8	0.755	167.5	23.0
1.0	0.880	161.0	12.1	4.026	70.9	-32.4	0.024	37.1	0.753	165.6	22.2
1.5	0.881	150.2	9.3	2.910	59.6	-30.5	0.030	35.8	0.753	158.4	19.2
2.0	0.882	137.1	6.5	2.123	45.9	-28.6	0.037	31.0	0.752	150.1	16.0
2.5	0.879	124.9	4.3	1.647	33.4	-27.3	0.043	25.0	0.768	142.3	13.4
3.0	0.874	112.7	2.3	1.304	21.1	-26.6	0.047	18.3	0.766	135.5	11.5
3.5	0.882	99.5	0.5	1.062	11.3	-26.0	0.050	12.6	0.773	131.8	10.0
4.0	0.889	92.6	-0.7	0.921	1.5	-25.8	0.051	7.1	0.779	123.3	9.4
5.0	0.903	78.2	-3.5	0.669	-19.8	-25.2	0.055	-5.3	0.793	102.9	7.0
6.0	0.918	61.3	-5.8	0.515	-41.5	-25.7	0.052	-22.4	0.806	84.7	5.2
7.0	0.948	41.2	-8.2	0.389	-59.6	-26.0	0.050	-39.5	0.809	69.9	3.2
8.0	0.960	24.3	-10.2	0.308	-79.9	-26.7	0.046	-55.9	0.844	54.6	2.1
9.0	0.941	11.8	-12.4	0.239	-100.5	-28.4	0.038	-73.5	0.882	37.0	1.4
10.0	0.946	10.8	-14.6	0.187	-109.4	-31.1	0.028	-81.6	0.896	27.1	0.1
11.0	0.937	0.3	-16.0	0.158	-124.9	-34.4	0.019	-108.3	0.872	20.3	-1.8
12.0	0.914	-8.0	-17.7	0.131	-138.0	-46.0	0.005	-147.3	0.916	7.0	-1.3
13.0	0.951	-12.1	-19.2	0.110	-153.4	-40.0	0.010	71.0	0.877	-1.1	-4.4
14.0	0.948	-20.6	-21.0	0.089	-168.9	-37.1	0.014	30.2	0.882	-7.5	-6.3
15.0	0.939	-23.6	-21.4	0.085	177.8	-39.2	0.011	-4.9	0.865	-19.2	-7.2
16.0	0.948	-23.1	-21.1	0.088	165.9	-37.7	0.013	-8.8	0.864	-26.2	-6.9
17.0	0.947	-24.3	-18.9	0.114	155.2	-41.9	0.008	-173.5	0.856	-33.6	-4.7
18.0	0.903	-32.5	-17.1	0.140	133.4	-35.4	0.017	161.7	0.835	-42.5	-3.2

Freq GHz	Fmin dB	Gamma Opt		Rn/50	Ga dB
		Mag	Ang		
0.5	0.34	0.225	146.2	0.05	26.30
0.9	0.43	0.282	157.0	0.04	22.19
1.0	0.45	0.296	160.2	0.04	22.07
1.5	0.53	0.362	-177.0	0.03	19.00
2.0	0.61	0.427	-156.3	0.03	17.13
2.4	0.68	0.478	-141.3	0.05	15.89
3.0	0.78	0.551	-121.1	0.09	14.59
3.5	0.86	0.608	-106.2	0.17	13.17
5.0	1.10	0.763	-70.8	0.24	11.22
5.8	1.24	0.832	-56.6	0.28	10.16
6.0	1.27	0.848	-53.5	0.30	9.93
7.0	1.43	0.915	-39.7	0.38	9.57
8.0	1.60	0.964	-28.4	0.74	8.78
9.0	1.76	0.991	-18.5	0.95	7.27
10.0	1.93	0.995	-8.6	1.55	3.39

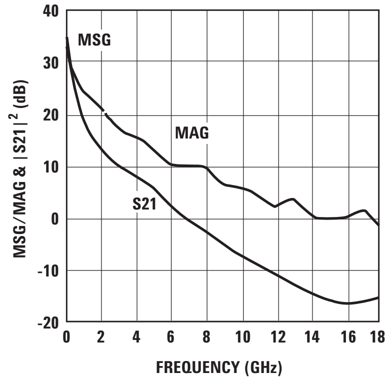


Figure 40. MSG/MAG & $|S21|^2$ vs. and Frequency at 3.0V/135 mA.

Notes:

1. F_{min} values at 2 GHz and higher are based on measurements while the F_{min} below 2 GHz have been extrapolated. The F_{min} values are based on a set of 16 noise figure measurements made at 16 different impedances using an ATN NP5 test system. From these measurements a true Fmin is calculated. Refer to the noise parameter application section for more information.
2. S and noise parameters are 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.

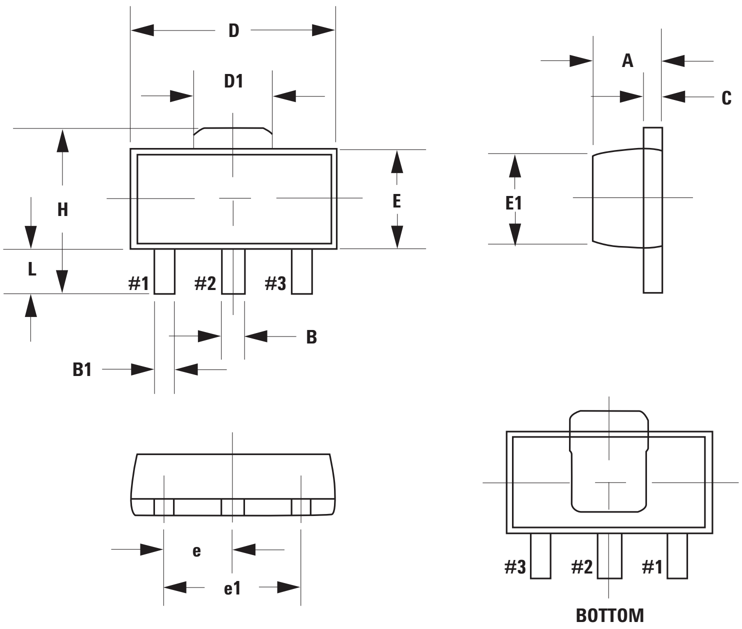
Device Models, PCB Layout and Stencil Device

Refer to Avago's Web Site: *www.avagotech.com/view/rf*

Ordering Information

Part Number	No. of Devices	Container
ATF-53189-TR1	3000	13" Reel
ATF-53189-BLK	100	Anti-static bag

SOT 89 Package Dimensions

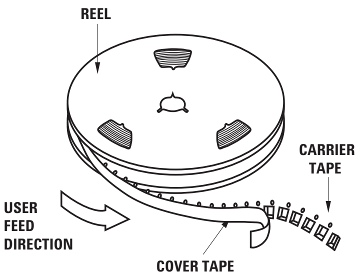


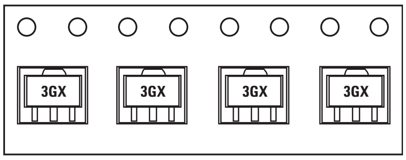
COMMON						
	DIMENSIONS Millimeters			DIMENSIONS Inches		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.40	1.50	1.60	0.055	0.059	0.063
B	0.44	0.50	0.56	0.017	0.0195	0.022
B1	0.36	0.42	0.48	0.014	0.0165	0.019
C	0.35	0.40	0.44	0.014	0.016	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.62	1.73	1.83	0.064	0.068	0.072
E	2.30	2.50	2.60	0.090	0.096	0.102
E1	2.13	2.20	2.29	0.084	0.087	0.090
e	1.50 BSC	1.50 BSC	1.50 BSC	0.059 BSC	0.059 BSC	0.059 BSC
e1	3.00 BSC	3.00 BSC	3.00 BSC	0.118 BSC	0.188 BSC	0.188 BSC
H	3.95	4.10	4.25	0.155	0.161	0.167
L	0.90	1.10	1.20	0.035	0.038	0.047

Notes:

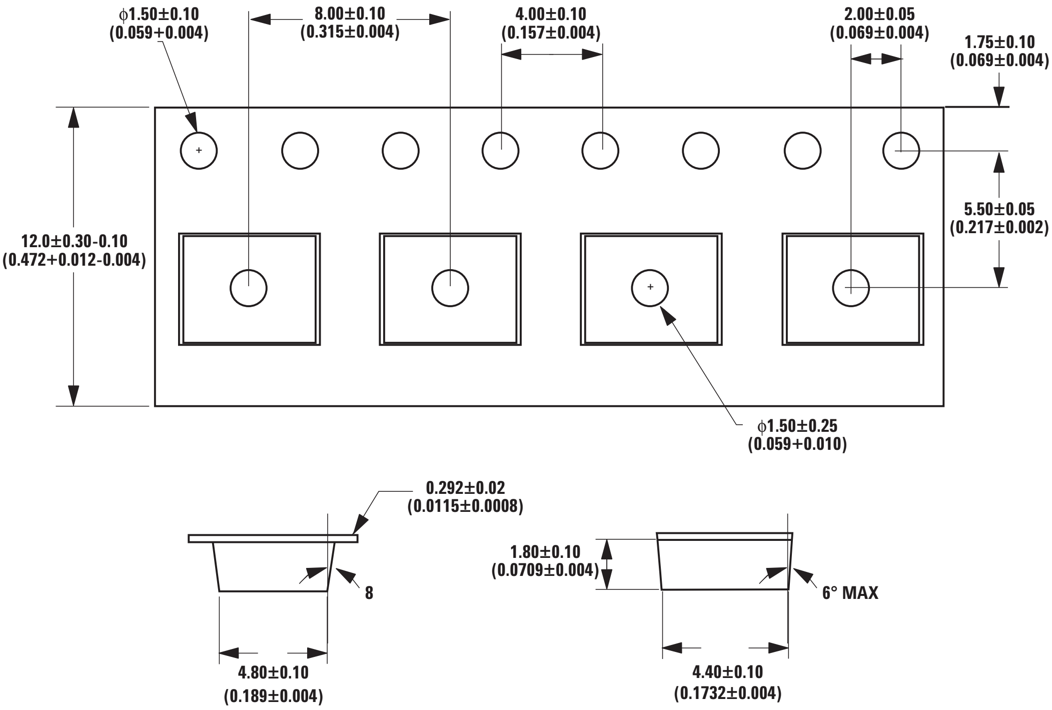
1. Dimensioning and tolerancing per ANSI.Y14.5M-1982
2. Controlling dimension: Millimeter convertions to inches are not necessarily exact.
3. Dimension B1, 2 places.

Device Orientation





Tape Dimensions



Dimensions in mm (inches)

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

AV02-0051EN - November 6, 2009

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