

阅读申明

- 1.本站收集的数据手册和产品资料都来自互联网，版权归原作者所有。如读者和版权方有任何异议请及时告之，我们将妥善解决。
- 2.本站提供的中文数据手册是英文数据手册的中文翻译，其目的是协助用户阅读，该译文无法自动跟随原稿更新，同时也可能存在翻译上的不当。建议读者以英文原稿为参考以便获得更精准的信息。
- 3.本站提供的产品资料，来自厂商的技术支持或者使用者的心得体会等，其内容可能存在描述上的差异，建议读者做出适当判断。
- 4.如需与我们联系，请发邮件到marketing@iczoom.com，主题请标有“数据手册”字样。

Read Statement

1. The datasheets and other product information on the site are all from network reference or other public materials, and the copyright belongs to the original author and original published source. If readers and copyright owners have any objections, please contact us and we will deal with it in a timely manner.
2. The Chinese datasheets provided on the website is a Chinese translation of the English datasheets. Its purpose is for reader's learning exchange only and do not involve commercial purposes. The translation cannot be automatically updated with the original manuscript, and there may also be improper translations. Readers are advised to use the English manuscript as a reference for more accurate information.
3. All product information provided on the website refer to solutions from manufacturers' technical support or users the contents may have differences in description, and readers are advised to take the original article as the standard.
4. If you have any questions, please contact us at marketing@iczoom.com and mark the subject with "Datasheets" .

ATF-50189

Enhancement Mode^[1] Pseudomorphic HEMT in SOT 89 Package



Data Sheet

Description

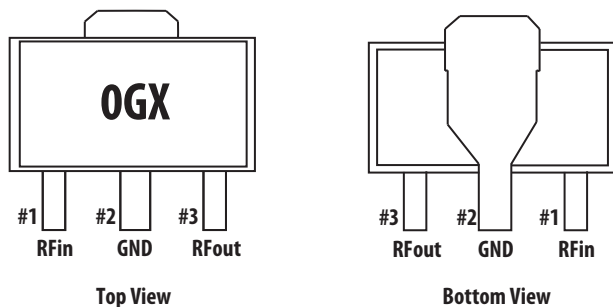
Avago Technologies's ATF-50189 is a high linearity, medium power, low noise E-pHEMT FET packaged in a low cost surface mount SOT89^[3] package. The combination of low noise figure and high output IP3 at the same bias point makes it ideal for receiver and transmitter application. Its operating frequency range is from 400 MHz to 3.9 GHz.

The ATF-50189 is ideally suited for Cellular/PCS and WCDMA wireless infrastructure, WLAN, WLL and MMDS application, and general purpose discrete E-pHEMT amplifiers which require high linearity and power. All devices are 100% RF and DC tested.

Notes:

1. Enhancement mode technology employs a single positive Vgs, eliminating the need of negative gate voltage associated with conventional depletion mode devices.
2. Refer to reliability datasheet for detailed MTTF data
3. Conform to JEDEC reference outline MO229 for DRP-N
4. Linearity Figure of Merit (LFOM) is OIP3 divided by DC bias power

Pin Connections and Package Marking



Notes:

Package marking provides orientation and identification:
 "OG" = Device Code
 "x" = Month code indicates the month of manufacture.

Features

- High Linearity and P1dB
- Low Noise Figure
- Excellent uniformity in product specifications
- SOT 89 standard package
- Point MTTF > 300 years^[2]
- MSL-2 and lead-free
- Tape-and-Reel packaging option available

Specifications

2 GH, 4.5V, 280 mA (Typ.)

- 45 dBm Output IP3
- 29 dBm Output Power at 1dB gain compression
- 1.1 dB Noise Figure
- 15.5 dB Gain
- 62% PAE at P1dB
- LFOM^[4] 14 dB

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



Attention: Observe precautions for handling electrostatic sensitive devices.
 ESD Machine Model (Class A)
 ESD Human Body Model (Class 1C)
 Refer to Avago Application Note A004R:
 Electrostatic Discharge Damage and Control.

ATF-50189 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 | 2.25 |
| P _{in} | RF Input Power | dBm | 30 |
| T _{CH} | Channel Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -65 to 150 |

Thermal Resistance^[2,4]

$$\theta_{ch_b} = 29^{\circ}\text{C}/\text{W}$$

Notes:

1. Operation of this device above 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 35 mW/°C for T_B > 85°C.
4. Channel-to-board thermal resistance measured using 150°C Liquid Crystal Measurement method.

ATF-50189 Electrical Specifications

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

| Symbol | Parameter and Test Condition | Units | Min. | Typ. | Max. |
|------------------|---|--|------------|---------|--------------|
| V _{gs} | Operational Gate Voltage | V _{ds} = 4.5V, I _{ds} = 280 mA | V | 0.37 | 0.72 |
| V _{th} | Threshold Voltage | V _{ds} = 4.5V, I _{ds} = 32 mA | V | — | 0.38 |
| I _{dss} | Saturated Drain Current | V _{ds} = 4.5V, V _{gs} = 0V | μA | — | 4.1 |
| G _m | Transconductance | V _{ds} = 4.5V, G _m = ΔI _{ds} /ΔV _{gs} ; ΔV _{gs} = V _{gs1} – V _{gs2} V _{gs1} = 0.55V, V _{gs2} = 0.5V | mmho | 175 | 2294 |
| I _{gss} | Gate Leakage Current | V _{ds} = 0V, V _{gs} = -4.5V | μA | — | 13.8 |
| NF | Noise Figure ^[1] | f = 2 GHz f = 900 MHz | dB dB | — — | 1.1 1.0 |
| G | Gain ^[1] | f = 2 GHz f = 900 MHz | dB dB | 14 — | 15.5 21.5 |
| OIP3 | Output 3 rd Order Intercept Point ^[1,2] | f = 2 GHz f = 900 MHz | dBm dBm | 43 — | 45 44 |
| P1dB | Output Power at 1dB Compression Point ^[1] | f = 2 GHz f = 900 MHz | dBm dBm | 27 — | 29 28.5 |
| PAE | Power Added Efficiency ^[1] at P1dB | f = 2 GHz f = 900 MHz | % % | 45 — | 62 49 |
| ACLR | Adjacent Channel Leakage Power Ratio ^[1,3] | Offset BW = 5 MHz Offset BW = 10 MHz | dBc dBc | — — | 60.0 67.8 |

Notes:

1. Measurements at 2 GHz obtained using production test board described in Figure 1 while measurement at 900 MHz obtained from double stub tuners.
2. i) 2 GHz OIP3 test condition: F1 = 2 GHz, F2 = 2.005 GHz and Pin = -5 dBm per tone.
ii) 900 MHz OIP3 test condition: F1 = 900 MHz, F2 = 905 MHz and Pin = -5 dBm per tone.
3. 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 = -5 dBm
 - Channel Integrate Bandwidth = 3.84 MHz

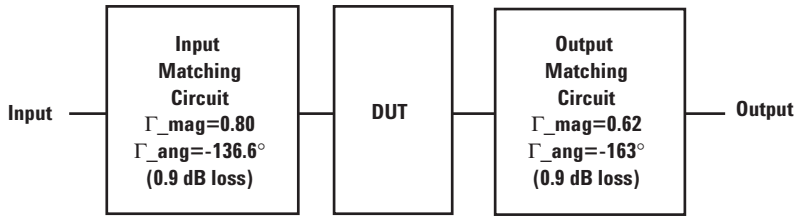


Figure 1. Block diagram of the 2 GHz production test board used for NF, Gain, OIP3, P1dB, PAE and ACLR measurements. This circuit achieves a trade-off between optimal OIP3, P1dB and PAE. Circuit losses have been de-embedded from actual measurements.

Product Consistency Distribution Charts^[1,2]

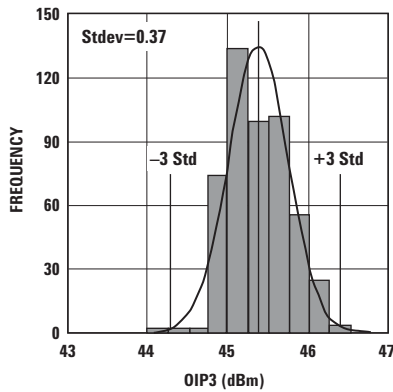


Figure 2. OIP3 @ 2 GHz, 4.5V/280 mA.
LSL = 43.0, Nominal = 45.4

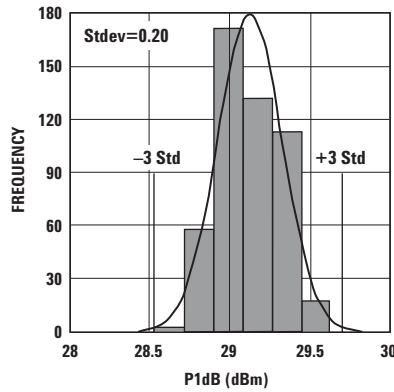


Figure 3. P1dB @ 2 GHz, 4.5V/280 mA.
LSL = 27.0, Nominal = 29.0

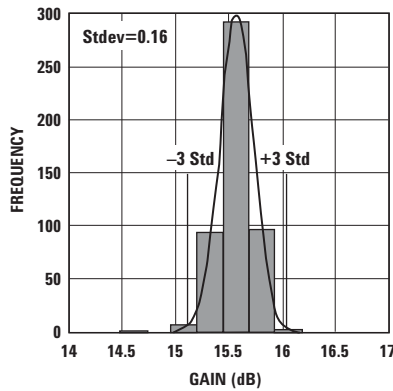


Figure 4. Gain @ 2 GHz, 4.5V/200 mA.
LSL = 14.0, Nominal = 15.5, USL = 17.0

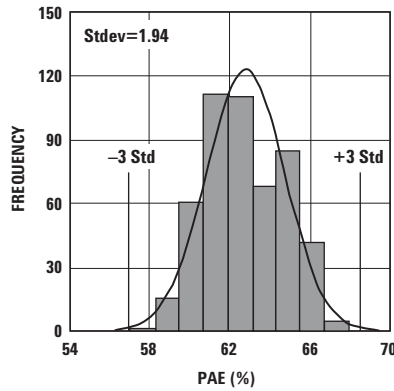


Figure 5. PAE at P1dB @ 2 GHz, 4.5V/200 mA.
LSL = 45.0, Nominal = 62.0

Notes:

1. Distribution data sample size is 500 samples taken from 5 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 and P1dB Tuning Conditions

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

Typical Gammas at Optimum OIP3^[1]

| Freq (GHz) | Gamma Source | | Optimum OIP3 | | OIP3 (dBm) | Gain (dB) | P1dB (dBm) | PAE (%) |
|------------|--------------|-----------|----------------|-----------|------------|-----------|------------|---------|
| | Mag | Ang (deg) | Gamma Load Mag | Ang (deg) | | | | |
| 0.45 | 0.47 | 121.7 | 0.76 | -175.1 | 41.0 | 22.0 | 27.5 | 39.0 |
| 0.9 | 0.81 | -157.5 | 0.72 | -178.1 | 44.2 | 21.6 | 28.3 | 49.2 |
| 1.8 | 0.82 | -110.4 | 0.62 | -135.1 | 46.5 | 16.0 | 28.7 | 61.3 |
| 2 | 0.85 | -106.4 | 0.64 | -127.4 | 46.2 | 15.1 | 29.0 | 63.0 |
| 2.4 | 0.82 | -88.8 | 0.67 | -113.6 | 45.6 | 13.0 | 28.9 | 55.0 |
| 3.5 | 0.77 | -49.6 | 0.59 | -79.5 | 44.0 | 8.6 | 26.9 | 35.0 |

Typical Gammas at Optimum P1dB^[1]

| Freq (GHz) | Gamma Source | | Optimum P1dB | | OIP3 (dBm) | Gain (dB) | P1dB (dBm) | PAE (%) |
|------------|--------------|-----------|----------------|-----------|------------|-----------|------------|---------|
| | Mag | Ang (deg) | Gamma Load Mag | Ang (deg) | | | | |
| 0.45 | 0.52 | 151.2 | 0.71 | -177.5 | 39.8 | 23.9 | 28.5 | 44.8 |
| 0.9 | 0.79 | -160.1 | 0.67 | -158.3 | 42.8 | 20.1 | 30.4 | 56 |
| 1.8 | 0.83 | -112.5 | 0.72 | -131.2 | 44.2 | 15.9 | 30.3 | 60.3 |
| 2 | 0.82 | -102.1 | 0.69 | -117.5 | 44.8 | 14.9 | 30.2 | 58.6 |
| 2.4 | 0.78 | -91.2 | 0.77 | -105.3 | 44.44 | 12.5 | 30.2 | 54.1 |
| 3.5 | 0.78 | -49.7 | 0.72 | -74.6 | 43.7 | 8.7 | 27.3 | 32 |

Note:

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

Typical IV Curve

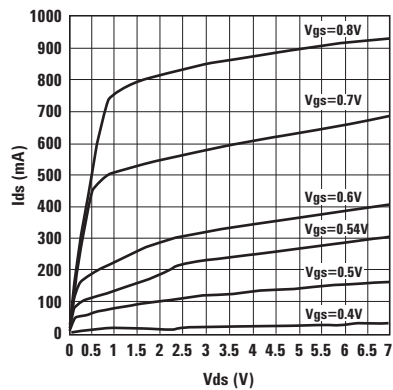


Figure 6. Typical IV curve.

**ATF-50189 Typical Performance Curves (at 25°C unless specified otherwise)
 Tuned for Optimal OIP3 at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Operating Frequency = 2 GHz.**

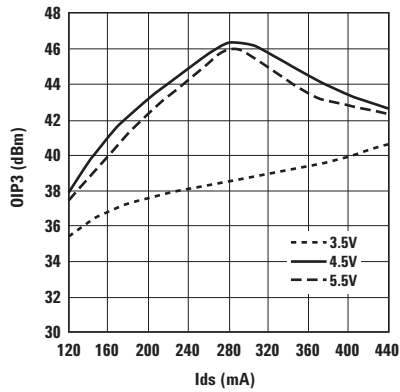


Figure 7. OIP3 vs. I_{ds} and V_{ds} at 2 GHz.

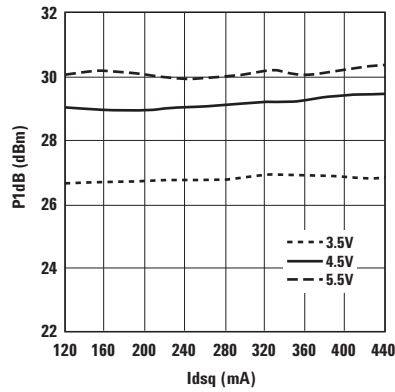


Figure 8. P1dB vs. I_{dsq} and V_{ds} at 2 GHz.

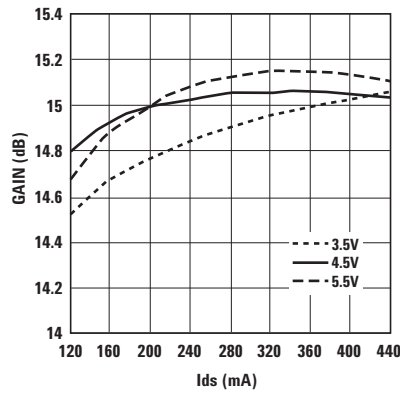


Figure 9. Gain vs. I_{ds} and V_{ds} at 2 GHz.

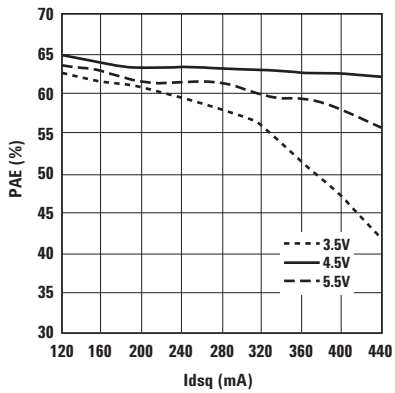


Figure 10. PAE vs. I_{dsq} and V_{ds} at 2 GHz.

ATF-50189 Typical Performance Curves, continued
Tuned for Optimal OIP3 at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Operating Frequency = 900 MHz.

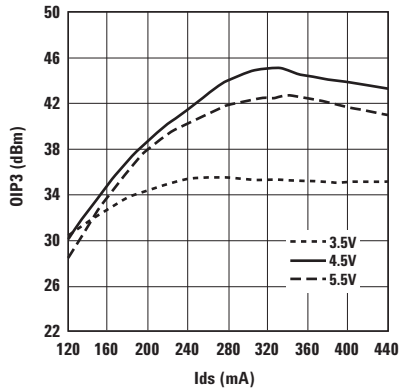


Figure 11. OIP3 vs. I_{ds} and V_{ds} at 900 MHz.

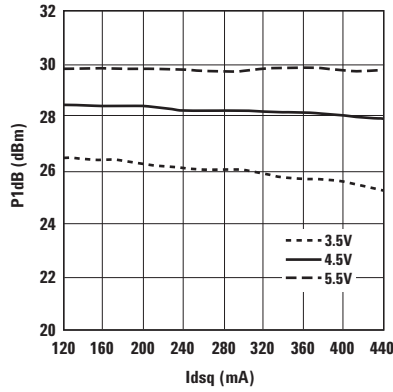


Figure 12. P1dB vs. I_{dsq} and V_{ds} at 900 MHz.

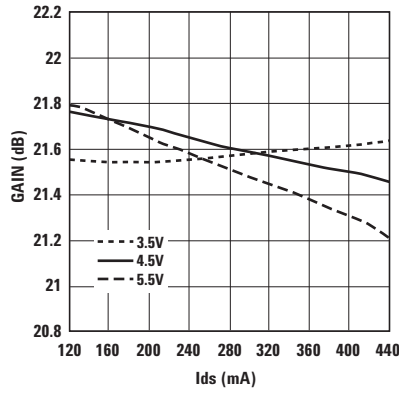


Figure 13. Gain vs. I_{ds} and V_{ds} at 900 MHz.

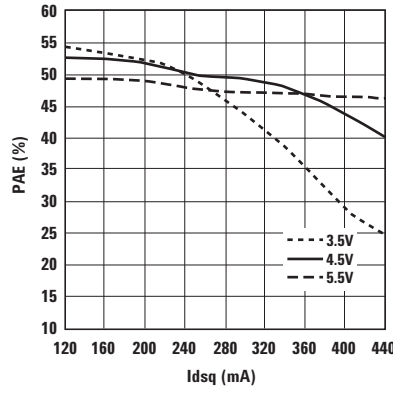


Figure 14. PAE vs. I_{dsq} and V_{ds} at 900 MHz.

ATF-50189 Typical Performance Curves, continued
Tuned for Optimal OIP3 at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Over Temperature and Frequency

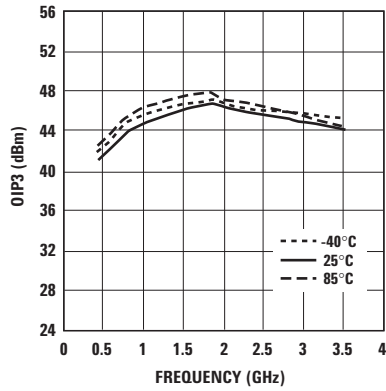


Figure 15. OIP3 vs. Temperature and Frequency at optimum OIP3.

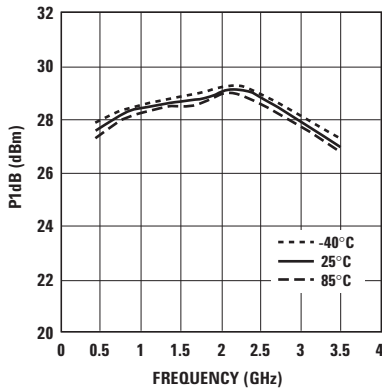


Figure 16. P1dB vs. Temperature and Frequency at optimum OIP3.

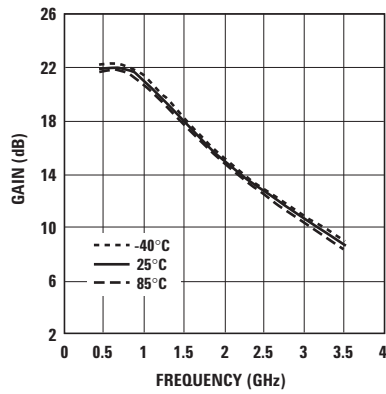


Figure 17. Gain vs. Temperature and Frequency at optimum OIP3.

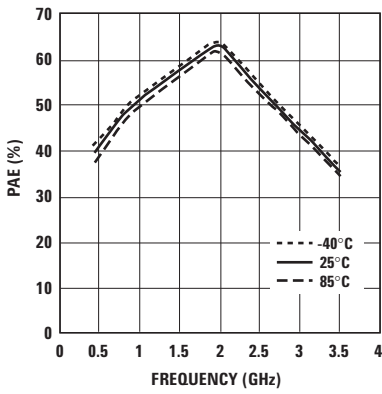


Figure 18. PAE vs. Temperature and Frequency at optimum OIP3.

ATF-50189 Typical Performance Curves, continued
Tuned for Optimal P1dB at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Operating Frequency = 2 GHz.

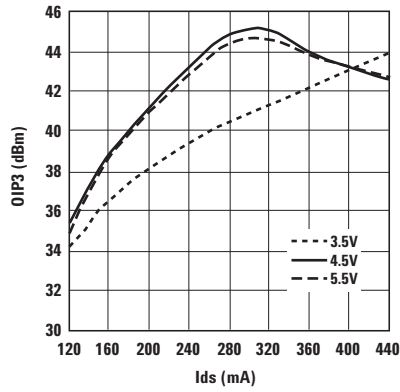


Figure 19. OIP3 vs. I_{ds} and V_{ds} at 2 GHz.

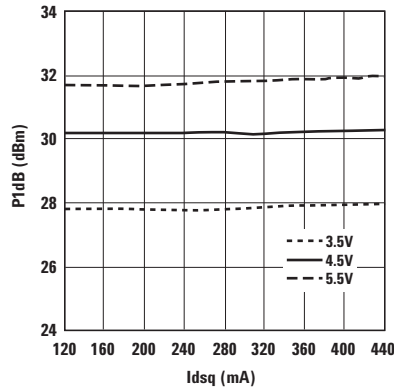


Figure 20. P1dB vs. I_{dsq} and V_{ds} at 2 GHz.

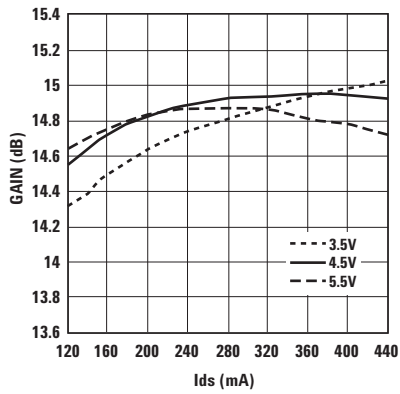


Figure 21. Gain vs. I_{ds} and V_{ds} at 2 GHz.

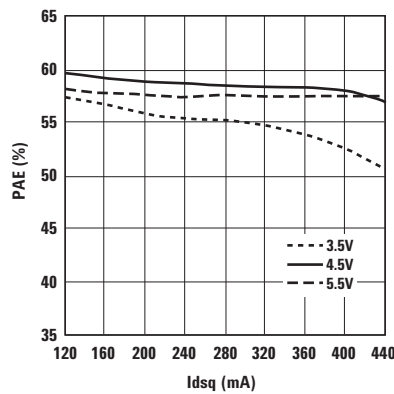


Figure 22. PAE vs. I_{dsq} and V_{ds} at 2 GHz.

ATF-50189 Typical Performance Curves, continued
Tuned for Optimal P1dB at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Operating Frequency = 900 MHz.

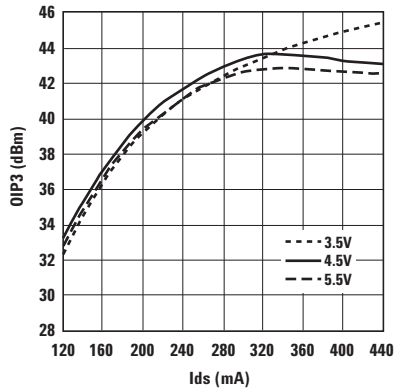


Figure 23. OIP3 vs. I_{ds} and V_{ds} at 900 MHz.

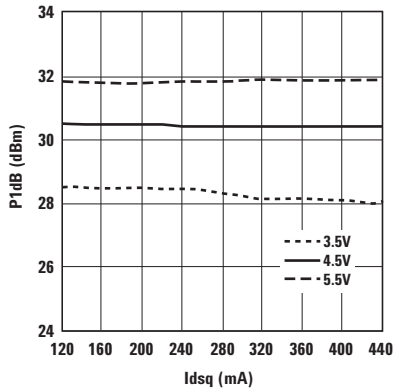


Figure 24. P1dB vs. I_{dsq} and V_{ds} at 900 MHz.

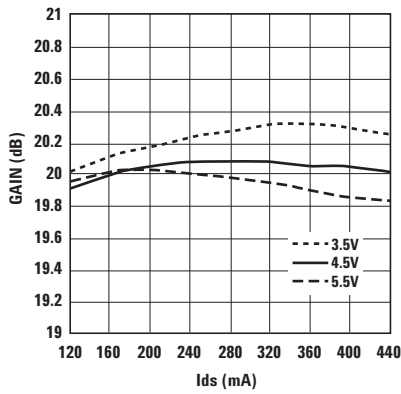


Figure 25. Gain vs. I_{ds} and V_{ds} at 900 MHz.

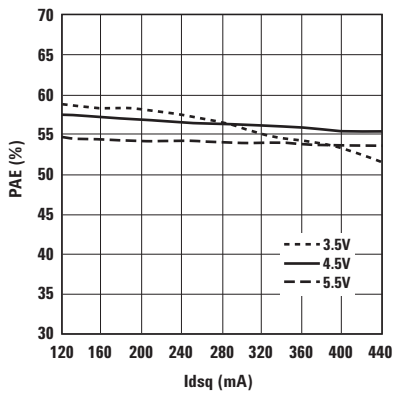


Figure 26. PAE vs. I_{dsq} and V_{ds} at 900 MHz.

ATF-50189 Typical Performance Curves, continued
Tuned for Optimal P1dB at $V_d = 4.5V$, $I_{ds} = 280\text{ mA}$, Over Temperature and Frequency

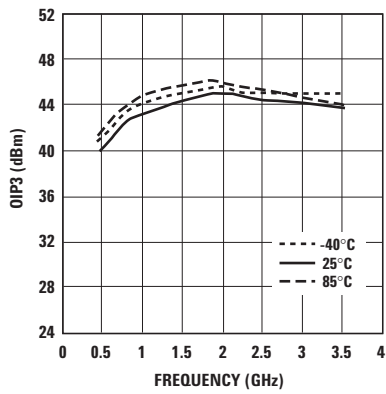


Figure 27. OIP3 vs. Temperature and Frequency at optimum P1dB.

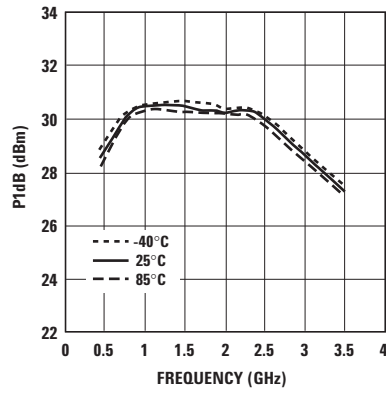


Figure 28. P1dB vs. Temperature and Frequency at optimum P1dB.

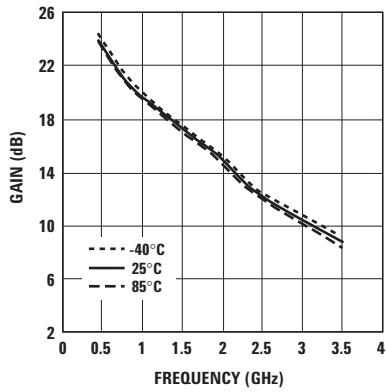


Figure 29. Gain vs. Temperature and Frequency at optimum P1dB.

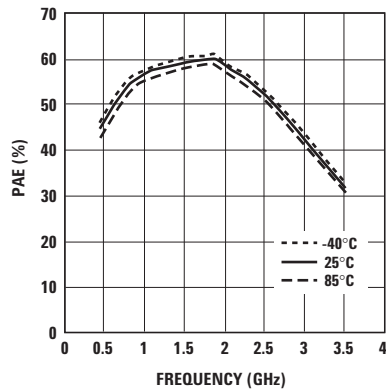
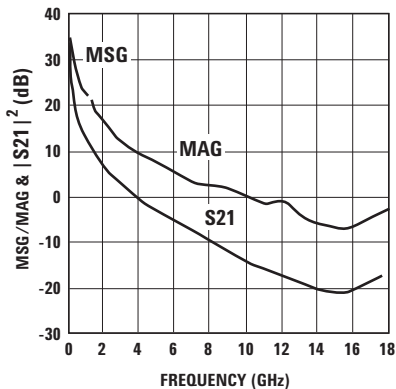


Figure 30. PAE vs. Temperature and Frequency at optimum P1dB.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 4.5V$, $I_{DS} = 280\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|-------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.923 | -133.2 | 31.0 | 35.531 | 110.9 | -37.7 | 0.013 | 31.7 | 0.692 | -163.7 | 34.4 | |
| 0.2 | 0.919 | -158.7 | 25.6 | 19.023 | 97.1 | -37.1 | 0.014 | 25.2 | 0.738 | -173.2 | 31.3 | |
| 0.3 | 0.919 | -169.4 | 22.2 | 12.872 | 90.4 | -36.5 | 0.015 | 24.9 | 0.749 | -177.6 | 29.3 | |
| 0.4 | 0.917 | -176.1 | 19.7 | 9.705 | 85.7 | -35.9 | 0.016 | 26.3 | 0.752 | 179.3 | 27.8 | |
| 0.5 | 0.916 | 178.5 | 17.7 | 7.687 | 84.4 | -35.4 | 0.017 | 30.4 | 0.756 | 175.7 | 26.6 | |
| 0.6 | 0.916 | 174.5 | 16.2 | 6.438 | 81.7 | -34.9 | 0.018 | 32.6 | 0.755 | 173.5 | 25.5 | |
| 0.7 | 0.917 | 170.9 | 14.9 | 5.582 | 79.2 | -34.4 | 0.019 | 34.5 | 0.755 | 171.4 | 24.7 | |
| 0.8 | 0.918 | 167.5 | 13.9 | 4.939 | 76.5 | -33.6 | 0.021 | 35.9 | 0.753 | 169.4 | 23.7 | |
| 0.9 | 0.920 | 164.1 | 12.9 | 4.433 | 73.8 | -33.2 | 0.022 | 36.8 | 0.755 | 167.5 | 23.0 | |
| 1.0 | 0.921 | 161.0 | 12.1 | 4.026 | 70.9 | -32.4 | 0.024 | 37.1 | 0.753 | 165.6 | 22.2 | |
| 1.1 | 0.922 | 159.6 | 11.7 | 3.853 | 69.5 | -32.0 | 0.025 | 37.1 | 0.753 | 164.7 | 21.9 | |
| 1.2 | 0.922 | 158.1 | 11.3 | 3.679 | 68.1 | -32.0 | 0.025 | 37.1 | 0.753 | 163.7 | 21.7 | |
| 1.3 | 0.922 | 155.4 | 10.6 | 3.378 | 65.2 | -31.4 | 0.027 | 36.7 | 0.751 | 162.0 | 21.0 | |
| 1.4 | 0.919 | 152.6 | 9.9 | 3.127 | 62.3 | -31.1 | 0.028 | 36.3 | 0.753 | 160.2 | 20.3 | |
| 1.5 | 0.918 | 150.2 | 9.3 | 2.910 | 59.6 | -30.5 | 0.030 | 35.8 | 0.753 | 158.4 | 19.2 | |
| 1.6 | 0.920 | 147.5 | 8.7 | 2.717 | 56.7 | -30.2 | 0.031 | 35.0 | 0.753 | 156.7 | 18.5 | |
| 1.7 | 0.919 | 144.6 | 8.1 | 2.547 | 53.9 | -29.6 | 0.033 | 34.1 | 0.753 | 154.9 | 17.8 | |
| 1.8 | 0.920 | 142.0 | 7.6 | 2.392 | 51.2 | -29.4 | 0.034 | 33.2 | 0.753 | 153.3 | 17.2 | |
| 1.9 | 0.918 | 139.6 | 7.0 | 2.251 | 48.6 | -29.1 | 0.035 | 32.1 | 0.752 | 151.7 | 16.5 | |
| 2.0 | 0.919 | 137.1 | 6.5 | 2.123 | 45.9 | -28.6 | 0.037 | 31.0 | 0.752 | 150.1 | 16.0 | |
| 2.1 | 0.917 | 134.6 | 6.1 | 2.009 | 43.3 | -28.4 | 0.038 | 29.7 | 0.752 | 148.3 | 15.4 | |
| 2.2 | 0.918 | 132.0 | 5.6 | 1.908 | 40.6 | -28.2 | 0.039 | 28.6 | 0.752 | 146.8 | 15.0 | |
| 2.3 | 0.915 | 129.8 | 5.1 | 1.800 | 37.9 | -28.0 | 0.040 | 27.4 | 0.755 | 145.2 | 14.4 | |
| 2.4 | 0.912 | 127.1 | 4.7 | 1.721 | 35.6 | -27.7 | 0.041 | 26.0 | 0.750 | 143.9 | 13.9 | |
| 2.5 | 0.908 | 124.9 | 4.3 | 1.647 | 33.4 | -27.3 | 0.043 | 25.0 | 0.768 | 142.3 | 13.4 | |
| 3 | 0.908 | 112.7 | 2.3 | 1.304 | 21.1 | -26.6 | 0.047 | 18.3 | 0.766 | 135.5 | 11.5 | |
| 3.5 | 0.912 | 99.5 | 0.5 | 1.062 | 11.3 | -26.0 | 0.050 | 12.6 | 0.773 | 131.8 | 10.0 | |
| 4 | 0.923 | 92.6 | -0.7 | 0.921 | 1.5 | -25.8 | 0.051 | 7.1 | 0.779 | 123.3 | 9.4 | |
| 5 | 0.922 | 78.2 | -3.5 | 0.669 | -19.8 | -25.2 | 0.055 | -5.3 | 0.793 | 102.9 | 7.0 | |
| 6 | 0.921 | 61.3 | -5.8 | 0.515 | -41.5 | -25.7 | 0.052 | -22.4 | 0.806 | 84.7 | 5.2 | |
| 7 | 0.921 | 41.2 | -8.2 | 0.389 | -59.6 | -26.0 | 0.050 | -39.5 | 0.809 | 69.9 | 3.2 | |
| 8 | 0.922 | 24.3 | -10.2 | 0.308 | -79.9 | -26.7 | 0.046 | -55.9 | 0.844 | 54.6 | 2.1 | |
| 9 | 0.923 | 11.8 | -12.4 | 0.239 | -100.5 | -28.4 | 0.038 | -73.5 | 0.882 | 37.0 | 1.4 | |
| 10 | 0.922 | 10.8 | -14.6 | 0.187 | -109.4 | -31.1 | 0.028 | -81.6 | 0.896 | 27.1 | 0.1 | |
| 11 | 0.921 | 0.3 | -16.0 | 0.158 | -124.9 | -34.4 | 0.019 | -108.3 | 0.872 | 20.3 | -1.8 | |
| 12 | 0.924 | -8.0 | -17.7 | 0.131 | -138.0 | -46.0 | 0.005 | -147.3 | 0.916 | 7.0 | -1.3 | |
| 13 | 0.923 | -12.1 | -19.2 | 0.110 | -153.4 | -40.0 | 0.010 | 71.0 | 0.877 | -1.1 | -4.4 | |
| 14 | 0.922 | -20.6 | -21.0 | 0.089 | -168.9 | -37.1 | 0.014 | 30.2 | 0.882 | -7.5 | -6.3 | |
| 15 | 0.925 | -23.6 | -21.4 | 0.085 | 177.8 | -39.2 | 0.011 | -4.9 | 0.865 | -19.2 | -7.2 | |
| 16 | 0.925 | -23.1 | -21.1 | 0.088 | 165.9 | -37.7 | 0.013 | -8.8 | 0.864 | -26.2 | -6.9 | |
| 17 | 0.924 | -24.3 | -18.9 | 0.114 | 155.2 | -41.9 | 0.008 | -173.5 | 0.856 | -33.6 | -4.7 | |
| 18 | 0.924 | -32.5 | -17.1 | 0.140 | 133.4 | -35.4 | 0.017 | 161.7 | 0.835 | -42.5 | -3.2 | |



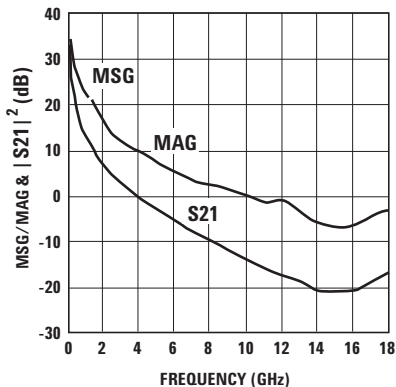
Notes:

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.

Figure 31. MSG/MAG & $|S_{21}|^2$ vs Frequency at 4.5V/280 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 4.5V$, $I_{DS} = 200\text{ mA}$

| Freq. GHz | S_{11} | | dB | S_{21} | | dB | S_{12} | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|----------|--------|---------------|
| | Mag. | Ang. | | Mag. | Ang. | | Mag. | Ang. | Mag. | Ang. | |
| 0.1 | 0.924 | -131.8 | 31.0 | 35.392 | 111.6 | -37.1 | 0.014 | 31.1 | 0.682 | -161.3 | 34.0 |
| 0.2 | 0.918 | -157.9 | 25.6 | 19.011 | 97.5 | -35.9 | 0.016 | 23.7 | 0.731 | -172.0 | 30.7 |
| 0.3 | 0.918 | -168.9 | 22.2 | 12.87 | 90.7 | -35.9 | 0.016 | 23.0 | 0.743 | -176.8 | 29.1 |
| 0.4 | 0.917 | -175.7 | 19.7 | 9.706 | 85.9 | -35.4 | 0.017 | 23.9 | 0.746 | -180.0 | 27.6 |
| 0.5 | 0.914 | 178.9 | 17.7 | 7.686 | 84.4 | -34.9 | 0.018 | 27.7 | 0.749 | 176.2 | 26.3 |
| 0.6 | 0.914 | 174.8 | 16.2 | 6.438 | 81.8 | -34.4 | 0.019 | 29.8 | 0.749 | 173.9 | 25.3 |
| 0.7 | 0.916 | 171.1 | 14.9 | 5.583 | 79.2 | -34.0 | 0.020 | 31.7 | 0.749 | 171.8 | 24.5 |
| 0.8 | 0.917 | 167.7 | 13.9 | 4.94 | 76.5 | -33.2 | 0.022 | 32.9 | 0.747 | 169.8 | 23.5 |
| 0.9 | 0.918 | 164.3 | 12.9 | 4.433 | 73.7 | -32.8 | 0.023 | 33.8 | 0.748 | 167.8 | 22.8 |
| 1 | 0.918 | 161.2 | 12.1 | 4.025 | 70.9 | -32.0 | 0.025 | 34.2 | 0.747 | 165.9 | 22.1 |
| 1.1 | 0.919 | 159.8 | 11.7 | 3.852 | 69.5 | -31.7 | 0.026 | 34.2 | 0.747 | 165.0 | 21.7 |
| 1.2 | 0.920 | 158.3 | 11.3 | 3.679 | 68.0 | -31.7 | 0.026 | 34.2 | 0.747 | 164.0 | 21.5 |
| 1.3 | 0.920 | 155.6 | 10.6 | 3.377 | 65.1 | -31.4 | 0.027 | 34.0 | 0.746 | 162.3 | 21.0 |
| 1.4 | 0.917 | 152.7 | 9.9 | 3.126 | 62.2 | -30.8 | 0.029 | 33.6 | 0.747 | 160.5 | 20.3 |
| 1.5 | 0.916 | 152.3 | 9.3 | 2.911 | 59.6 | -30.5 | 0.030 | 33.3 | 0.747 | 158.7 | 19.9 |
| 1.6 | 0.920 | 147.7 | 8.7 | 2.718 | 56.6 | -29.9 | 0.032 | 32.5 | 0.747 | 156.9 | 19.3 |
| 1.7 | 0.919 | 144.8 | 8.1 | 2.547 | 53.7 | -29.6 | 0.033 | 31.7 | 0.747 | 155.1 | 18.1 |
| 1.8 | 0.918 | 142.2 | 7.6 | 2.392 | 51.1 | -29.1 | 0.035 | 30.9 | 0.747 | 153.6 | 17.3 |
| 1.9 | 0.917 | 139.8 | 7.0 | 2.251 | 48.4 | -28.9 | 0.036 | 29.9 | 0.747 | 151.9 | 16.6 |
| 2 | 0.918 | 137.2 | 6.5 | 2.122 | 45.7 | -28.6 | 0.037 | 28.8 | 0.746 | 150.3 | 16.1 |
| 2.1 | 0.916 | 134.7 | 6.1 | 2.008 | 43.1 | -28.4 | 0.038 | 27.7 | 0.747 | 148.6 | 15.5 |
| 2.2 | 0.917 | 132.1 | 5.6 | 1.907 | 40.4 | -28.2 | 0.039 | 26.6 | 0.746 | 147.0 | 15.1 |
| 2.3 | 0.913 | 129.8 | 5.2 | 1.811 | 37.7 | -28.0 | 0.040 | 25.3 | 0.745 | 145.7 | 14.4 |
| 2.4 | 0.911 | 127.2 | 4.7 | 1.72 | 35.3 | -27.7 | 0.041 | 24.2 | 0.746 | 144.2 | 13.9 |
| 2.5 | 0.907 | 125.1 | 4.3 | 1.645 | 33.1 | -27.3 | 0.043 | 23.2 | 0.762 | 142.5 | 13.5 |
| 3 | 0.918 | 112.7 | 2.3 | 1.303 | 20.9 | -26.6 | 0.047 | 16.8 | 0.761 | 135.8 | 11.9 |
| 3.5 | 0.912 | 99.5 | 0.7 | 1.08 | 10.7 | -26.0 | 0.050 | 12.6 | 0.798 | 131.8 | 10.4 |
| 4 | 0.923 | 92.6 | -0.6 | 0.93 | 0.5 | -26.0 | 0.050 | 6.2 | 0.799 | 122.0 | 9.7 |
| 5 | 0.922 | 78.2 | -3.5 | 0.67 | -20.4 | -25.8 | 0.051 | -6.7 | 0.800 | 102.3 | 7.2 |
| 6 | 0.921 | 61.3 | -5.8 | 0.513 | -42.1 | -26.5 | 0.053 | -26.9 | 0.808 | 84.7 | 5.3 |
| 7 | 0.921 | 41.2 | -8.3 | 0.386 | -60.0 | -26.0 | 0.050 | -40.1 | 0.809 | 69.9 | 3.1 |
| 8 | 0.922 | 24.3 | -10.3 | 0.305 | -80.4 | -26.7 | 0.046 | -56.8 | 0.843 | 54.8 | 2.1 |
| 9 | 0.923 | 11.8 | -12.5 | 0.238 | -101.3 | -28.4 | 0.038 | -74.6 | 0.881 | 37.1 | 1.3 |
| 10 | 0.922 | 10.8 | -14.8 | 0.183 | -108.5 | -31.1 | 0.028 | -82.9 | 0.895 | 27.3 | -0.1 |
| 11 | 0.921 | 0.3 | -16.0 | 0.158 | -126.0 | -34.4 | 0.019 | -110.5 | 0.872 | 20.5 | -1.7 |
| 12 | 0.924 | -8.0 | -17.8 | 0.129 | -138.1 | -46.0 | 0.005 | -155.4 | 0.917 | 7.3 | -1.4 |
| 13 | 0.923 | -12.1 | -19.3 | 0.109 | -152.2 | -40.0 | 0.010 | 73.6 | 0.878 | -0.8 | -4.5 |
| 14 | 0.922 | -20.6 | -21.3 | 0.086 | -168.0 | -37.1 | 0.014 | 33.1 | 0.883 | -7.3 | -6.6 |
| 15 | 0.925 | -23.6 | -21.3 | 0.086 | 177.1 | -39.2 | 0.011 | -0.7 | 0.865 | -19.0 | -7.1 |
| 16 | 0.925 | -23.1 | -21.1 | 0.088 | 166.0 | -37.1 | 0.014 | -7.2 | 0.865 | -26.0 | -6.9 |
| 17 | 0.924 | -24.3 | -19.1 | 0.111 | 154.3 | -43.1 | 0.007 | -179.9 | 0.857 | -33.4 | -4.9 |
| 18 | 0.924 | -32.5 | -17.0 | 0.141 | 134.0 | -35.4 | 0.017 | 159.5 | 0.837 | -42.2 | -3.0 |



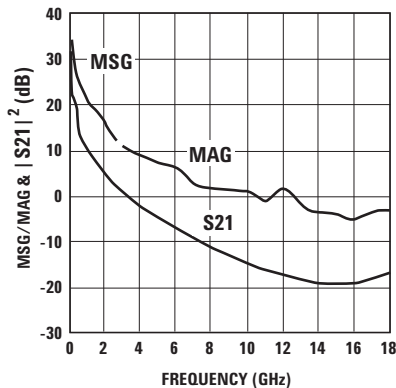
Notes:

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.

Figure 32. MSG/MAG & $|S_{21}|^2$ vs Frequency at 4.5V/200 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 4.5V$, $I_{DS} = 360\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|-------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.935 | -134.4 | 29.1 | 28.363 | 110.9 | -39.2 | 0.011 | 33.4 | 0.800 | -171.2 | 34.1 | |
| 0.2 | 0.932 | -159.5 | 23.6 | 15.134 | 97.3 | -37.7 | 0.013 | 28.3 | 0.838 | -177.3 | 30.7 | |
| 0.3 | 0.932 | -170.1 | 20.2 | 10.222 | 90.8 | -37.1 | 0.014 | 29.1 | 0.847 | 179.4 | 28.6 | |
| 0.4 | 0.930 | -176.6 | 17.7 | 7.696 | 86.2 | -36.5 | 0.015 | 30.9 | 0.849 | 176.9 | 27.1 | |
| 0.5 | 0.930 | 178.1 | 15.7 | 6.096 | 85.2 | -35.9 | 0.016 | 35.4 | 0.854 | 174.0 | 25.8 | |
| 0.6 | 0.931 | 174.2 | 14.2 | 5.107 | 82.8 | -35.4 | 0.017 | 37.8 | 0.855 | 172.0 | 24.8 | |
| 0.7 | 0.933 | 170.6 | 12.9 | 4.429 | 80.4 | -34.4 | 0.019 | 39.7 | 0.855 | 170.0 | 23.7 | |
| 0.8 | 0.933 | 167.2 | 11.9 | 3.919 | 77.9 | -33.6 | 0.021 | 40.8 | 0.853 | 168.2 | 22.7 | |
| 0.9 | 0.935 | 163.9 | 10.9 | 3.526 | 75.3 | -33.2 | 0.022 | 41.5 | 0.858 | 166.3 | 22.0 | |
| 1 | 0.936 | 160.7 | 10.1 | 3.2 | 72.6 | -32.4 | 0.024 | 41.6 | 0.855 | 164.4 | 21.2 | |
| 1.1 | 0.937 | 159.3 | 9.7 | 3.063 | 71.3 | -32.0 | 0.025 | 41.5 | 0.855 | 163.4 | 20.9 | |
| 1.2 | 0.938 | 157.8 | 9.3 | 2.925 | 69.9 | -31.7 | 0.026 | 41.3 | 0.855 | 162.4 | 20.5 | |
| 1.3 | 0.936 | 155.1 | 8.6 | 2.685 | 67.2 | -31.1 | 0.028 | 40.8 | 0.852 | 160.7 | 19.8 | |
| 1.4 | 0.933 | 152.3 | 7.9 | 2.488 | 64.4 | -30.8 | 0.029 | 40.0 | 0.857 | 158.9 | 19.3 | |
| 1.5 | 0.933 | 151.1 | 7.6 | 2.401 | 63.2 | -30.5 | 0.03 | 39.7 | 0.857 | 158.0 | 19.0 | |
| 1.6 | 0.932 | 149.8 | 7.3 | 2.314 | 61.9 | -30.2 | 0.031 | 39.3 | 0.856 | 157.0 | 18.7 | |
| 1.7 | 0.934 | 147.2 | 6.7 | 2.163 | 59.1 | -29.6 | 0.033 | 38.2 | 0.854 | 155.2 | 18.1 | |
| 1.8 | 0.934 | 144.3 | 6.2 | 2.032 | 56.4 | -29.4 | 0.034 | 37.0 | 0.855 | 153.4 | 17.1 | |
| 1.9 | 0.933 | 141.7 | 5.6 | 1.906 | 53.9 | -28.9 | 0.036 | 35.8 | 0.854 | 151.8 | 16.4 | |
| 2 | 0.932 | 139.3 | 5.1 | 1.794 | 51.3 | -28.6 | 0.037 | 34.5 | 0.853 | 150.0 | 15.8 | |
| 2.1 | 0.933 | 136.7 | 4.6 | 1.69 | 48.8 | -28.4 | 0.038 | 33.2 | 0.851 | 148.4 | 15.2 | |
| 2.2 | 0.930 | 134.2 | 4.1 | 1.6 | 46.4 | -28.0 | 0.04 | 31.8 | 0.852 | 146.6 | 14.6 | |
| 2.3 | 0.931 | 131.6 | 3.7 | 1.523 | 44.0 | -27.7 | 0.041 | 30.5 | 0.851 | 145.0 | 14.2 | |
| 2.4 | 0.929 | 129.2 | 3.2 | 1.442 | 41.7 | -27.5 | 0.042 | 29.0 | 0.853 | 143.3 | 13.7 | |
| 2.5 | 0.924 | 126.7 | 2.7 | 1.371 | 39.2 | -27.1 | 0.044 | 27.5 | 0.845 | 142.1 | 13.0 | |
| 3 | 0.917 | 114.6 | 0.7 | 1.09 | 27.7 | -26.4 | 0.048 | 20.1 | 0.855 | 134.5 | 11.1 | |
| 3.5 | 0.911 | 102.2 | -1.1 | 0.886 | 18.3 | -25.7 | 0.052 | 13.6 | 0.874 | 129.8 | 9.6 | |
| 4 | 0.921 | 93.1 | -2.3 | 0.771 | 9.1 | -25.5 | 0.053 | 6.8 | 0.894 | 121.3 | 9.1 | |
| 5 | 0.922 | 79.3 | -4.9 | 0.569 | -10.0 | -24.9 | 0.057 | -7.3 | 0.912 | 101.1 | 7.2 | |
| 6 | 0.921 | 64.3 | -7.1 | 0.441 | -30.0 | -24.6 | 0.059 | -28.5 | 0.929 | 85.8 | 6.3 | |
| 7 | 0.921 | 43.0 | -9.4 | 0.337 | -46.5 | -25.8 | 0.051 | -40.6 | 0.863 | 68.4 | 2.8 | |
| 8 | 0.922 | 25.9 | -11.3 | 0.273 | -65.6 | -26.6 | 0.047 | -57.3 | 0.875 | 53.0 | 1.6 | |
| 9 | 0.922 | 13.2 | -13.0 | 0.225 | -84.2 | -28.2 | 0.039 | -76.1 | 0.914 | 35.5 | 1.5 | |
| 10 | 0.921 | 11.7 | -15.3 | 0.171 | -93.0 | -31.1 | 0.028 | -84.5 | 0.935 | 26.0 | 0.7 | |
| 11 | 0.921 | 0.8 | -16.2 | 0.155 | -106.9 | -33.6 | 0.021 | -111.9 | 0.899 | 19.0 | -1.2 | |
| 12 | 0.923 | -7.6 | -17.1 | 0.139 | -117.3 | -43.1 | 0.007 | -160.6 | 0.954 | 7.2 | 1.7 | |
| 13 | 0.923 | -10.9 | -18.3 | 0.122 | -130.6 | -39.2 | 0.011 | 77.1 | 0.901 | -1.6 | -2.4 | |
| 14 | 0.922 | -20.2 | -19.2 | 0.11 | -150.3 | -36.5 | 0.015 | 31.3 | 0.897 | -8.1 | -3.8 | |
| 15 | 0.925 | -23.6 | -19.0 | 0.112 | -172.7 | -37.7 | 0.013 | -5.0 | 0.884 | -20.3 | -4.2 | |
| 16 | 0.924 | -21.8 | -19.4 | 0.107 | 165.1 | -39.2 | 0.011 | -3.4 | 0.873 | -27.6 | -5.0 | |
| 17 | 0.924 | -24.0 | -18.1 | 0.124 | 147.9 | -39.2 | 0.011 | -175.1 | 0.865 | -35.4 | -3.6 | |
| 18 | 0.923 | -31.6 | -17.3 | 0.136 | 127.1 | -33.2 | 0.022 | 153.4 | 0.830 | -43.4 | -3.5 | |



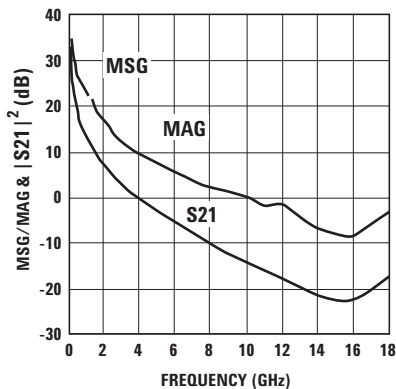
Notes:

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.

Figure 33. MSG/MAG & $|S_{21}|^2$ vs Frequency at 4.5V/360 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 5.5V$, $I_{DS} = 280\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|-------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.921 | -132.3 | 31.4 | 36.968 | 111.4 | -37.7 | 0.013 | 31.1 | 0.651 | -160.8 | 34.5 | |
| 0.2 | 0.916 | -158.2 | 26.0 | 19.86 | 97.3 | -36.5 | 0.015 | 23.9 | 0.698 | -171.7 | 31.2 | |
| 0.3 | 0.917 | -169.1 | 22.6 | 13.453 | 90.5 | -36.5 | 0.015 | 23.3 | 0.709 | -176.6 | 29.5 | |
| 0.4 | 0.915 | -175.9 | 20.1 | 10.143 | 85.6 | -35.9 | 0.016 | 24.4 | 0.712 | -179.8 | 28.0 | |
| 0.5 | 0.913 | 178.7 | 18.1 | 8.037 | 84.1 | -35.4 | 0.017 | 28.1 | 0.716 | 176.2 | 26.7 | |
| 0.6 | 0.914 | 174.5 | 16.6 | 6.733 | 81.3 | -34.9 | 0.018 | 30.2 | 0.715 | 173.8 | 25.7 | |
| 0.7 | 0.916 | 170.9 | 15.3 | 5.837 | 78.6 | -34.4 | 0.019 | 32.0 | 0.715 | 171.6 | 24.9 | |
| 0.8 | 0.916 | 167.4 | 14.3 | 5.163 | 75.8 | -33.6 | 0.021 | 33.2 | 0.713 | 169.6 | 23.9 | |
| 0.9 | 0.918 | 164.1 | 13.3 | 4.632 | 72.9 | -33.2 | 0.022 | 34.1 | 0.714 | 167.6 | 23.2 | |
| 1 | 0.919 | 160.8 | 12.5 | 4.205 | 70.0 | -32.8 | 0.023 | 34.4 | 0.712 | 165.7 | 22.6 | |
| 1.1 | 0.920 | 159.4 | 12.1 | 4.024 | 68.5 | -32.4 | 0.024 | 34.4 | 0.712 | 164.8 | 22.2 | |
| 1.2 | 0.921 | 157.9 | 11.7 | 3.842 | 67.0 | -32.0 | 0.025 | 34.4 | 0.712 | 163.8 | 21.9 | |
| 1.3 | 0.920 | 155.2 | 10.9 | 3.525 | 64.0 | -31.7 | 0.026 | 34.2 | 0.711 | 162.0 | 21.3 | |
| 1.4 | 0.917 | 152.3 | 10.3 | 3.261 | 61.0 | -31.4 | 0.027 | 33.8 | 0.713 | 160.2 | 20.4 | |
| 1.5 | 0.917 | 149.8 | 9.6 | 3.031 | 58.3 | -30.8 | 0.029 | 33.4 | 0.713 | 158.4 | 19.5 | |
| 1.6 | 0.920 | 147.2 | 9.0 | 2.832 | 55.3 | -30.5 | 0.030 | 32.7 | 0.713 | 156.6 | 18.9 | |
| 1.7 | 0.920 | 144.3 | 8.5 | 2.656 | 52.3 | -30.2 | 0.031 | 31.8 | 0.713 | 154.8 | 18.1 | |
| 1.8 | 0.919 | 141.7 | 7.9 | 2.490 | 49.6 | -29.6 | 0.033 | 31.1 | 0.714 | 153.2 | 17.4 | |
| 1.9 | 0.918 | 139.2 | 7.4 | 2.342 | 46.8 | -29.4 | 0.034 | 30.0 | 0.714 | 151.6 | 16.8 | |
| 2 | 0.919 | 136.7 | 6.9 | 2.206 | 44.1 | -29.1 | 0.035 | 29.0 | 0.714 | 150.0 | 16.3 | |
| 2.1 | 0.917 | 134.1 | 6.4 | 2.089 | 41.4 | -28.9 | 0.036 | 27.8 | 0.715 | 148.2 | 15.7 | |
| 2.2 | 0.919 | 131.5 | 5.9 | 1.982 | 38.6 | -28.6 | 0.037 | 26.8 | 0.715 | 146.6 | 15.3 | |
| 2.3 | 0.916 | 129.3 | 5.4 | 1.870 | 35.8 | -28.4 | 0.038 | 25.4 | 0.714 | 144.8 | 14.7 | |
| 2.4 | 0.912 | 126.6 | 5.0 | 1.784 | 33.4 | -28.2 | 0.039 | 24.3 | 0.715 | 143.8 | 14.1 | |
| 2.5 | 0.909 | 124.5 | 4.6 | 1.707 | 31.0 | -28.0 | 0.040 | 23.3 | 0.732 | 142.1 | 13.7 | |
| 3 | 0.909 | 112.2 | 2.6 | 1.345 | 18.4 | -27.1 | 0.044 | 16.9 | 0.734 | 135.3 | 11.7 | |
| 3.5 | 0.912 | 99.5 | 0.8 | 1.091 | 8.3 | -26.6 | 0.047 | 11.5 | 0.742 | 131.4 | 10.2 | |
| 4 | 0.923 | 92.6 | -0.5 | 0.944 | -2.0 | -26.3 | 0.048 | 6.2 | 0.752 | 122.9 | 9.5 | |
| 5 | 0.922 | 78.2 | -3.4 | 0.678 | -23.9 | -25.7 | 0.052 | -5.8 | 0.771 | 102.2 | 7.0 | |
| 6 | 0.921 | 61.3 | -5.8 | 0.514 | -46.3 | -26.2 | 0.049 | -22.8 | 0.791 | 84.0 | 5.2 | |
| 7 | 0.921 | 41.2 | -8.3 | 0.383 | -64.8 | -26.6 | 0.047 | -39.7 | 0.802 | 69.1 | 3.1 | |
| 8 | 0.922 | 24.3 | -10.5 | 0.298 | -85.4 | -27.3 | 0.043 | -55.8 | 0.841 | 54.0 | 2.0 | |
| 9 | 0.923 | 11.8 | -12.8 | 0.230 | -106.2 | -29.1 | 0.035 | -73.3 | 0.883 | 36.5 | 1.2 | |
| 10 | 0.922 | 10.8 | -14.9 | 0.179 | -114.3 | -31.7 | 0.026 | -81.6 | 0.900 | 27.0 | 0 | |
| 11 | 0.921 | 0.3 | -16.4 | 0.151 | -132.9 | -35.4 | 0.017 | -112 | 0.879 | 20.6 | -1.8 | |
| 12 | 0.924 | -8.0 | -18.3 | 0.121 | -145.5 | -48.0 | 0.004 | -174.6 | 0.924 | 8.0 | -1.5 | |
| 13 | 0.923 | -12.1 | -20.1 | 0.099 | -162.1 | -37.7 | 0.013 | 75.2 | 0.885 | 0.6 | -5.1 | |
| 14 | 0.922 | -20.6 | -22.2 | 0.078 | -177.8 | -35.9 | 0.016 | 38.6 | 0.889 | -5.1 | -7.2 | |
| 15 | 0.925 | -23.6 | -22.9 | 0.072 | 168.0 | -38.4 | 0.012 | 11.1 | 0.872 | -15.9 | -8.4 | |
| 16 | 0.925 | -23.1 | -22.9 | 0.072 | 158.3 | -37.1 | 0.014 | 5.1 | 0.873 | -21.8 | -8.4 | |
| 17 | 0.924 | -24.3 | -20.4 | 0.096 | 150.1 | -43.1 | 0.007 | 155.8 | 0.867 | -27.8 | -5.8 | |
| 18 | 0.924 | -32.5 | -18.1 | 0.125 | 133.1 | -36.5 | 0.015 | 146.2 | 0.855 | -34.7 | -3.7 | |



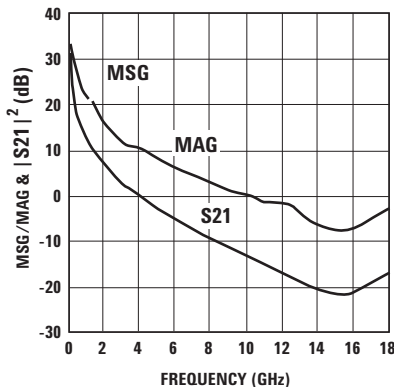
Notes:

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.

Figure 34. MSG/MAG & $|S_{21}|^2$ vs Frequency at 5.5V/280 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 5.5V$, $I_{DS} = 200\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.922 | -131.5 | 31.3 | 36.764 | 111.7 | -37.1 | 0.014 | 30.8 | 0.65 | -159.4 | 34.2 | |
| 0.2 | 0.917 | -157.7 | 25.9 | 19.783 | 97.5 | -36.5 | 0.015 | 23.2 | 0.70 | -171.0 | 31.2 | |
| 0.3 | 0.916 | -168.8 | 22.5 | 13.403 | 90.6 | -35.9 | 0.016 | 22.1 | 0.71 | -176.1 | 29.2 | |
| 0.4 | 0.914 | -175.7 | 20.1 | 10.105 | 85.7 | -35.4 | 0.017 | 22.9 | 0.71 | -179.5 | 27.7 | |
| 0.5 | 0.912 | 178.8 | 18.1 | 8.007 | 84.1 | -34.9 | 0.018 | 26.5 | 0.72 | 176.4 | 26.5 | |
| 0.6 | 0.913 | 174.7 | 16.5 | 6.708 | 81.3 | -34.4 | 0.019 | 28.6 | 0.72 | 174.1 | 25.5 | |
| 0.7 | 0.915 | 171.0 | 15.3 | 5.815 | 78.7 | -34.0 | 0.02 | 30.3 | 0.72 | 171.8 | 24.6 | |
| 0.8 | 0.916 | 167.6 | 14.2 | 5.144 | 75.9 | -33.6 | 0.021 | 31.4 | 0.71 | 169.8 | 23.9 | |
| 0.9 | 0.918 | 164.1 | 13.3 | 4.613 | 72.9 | -33.2 | 0.022 | 32.4 | 0.71 | 167.7 | 23.2 | |
| 1 | 0.918 | 161.0 | 12.4 | 4.188 | 70.1 | -32.4 | 0.024 | 32.7 | 0.71 | 165.9 | 22.4 | |
| 1.1 | 0.919 | 159.5 | 12.1 | 4.008 | 68.6 | -32.0 | 0.025 | 32.8 | 0.71 | 164.9 | 22.0 | |
| 1.2 | 0.920 | 158.0 | 11.7 | 3.827 | 67.1 | -32.0 | 0.025 | 32.8 | 0.71 | 163.9 | 21.8 | |
| 1.3 | 0.920 | 155.3 | 10.9 | 3.512 | 64.0 | -31.7 | 0.026 | 32.5 | 0.71 | 162.1 | 21.3 | |
| 1.4 | 0.917 | 152.4 | 10.2 | 3.249 | 61.1 | -31.1 | 0.028 | 32.2 | 0.71 | 160.3 | 20.6 | |
| 1.5 | 0.917 | 150.0 | 9.6 | 3.023 | 58.4 | -30.8 | 0.029 | 31.9 | 0.71 | 158.5 | 19.7 | |
| 1.6 | 0.919 | 147.3 | 9.0 | 2.821 | 55.3 | -30.5 | 0.03 | 31.2 | 0.71 | 156.7 | 19.0 | |
| 1.7 | 0.918 | 144.5 | 8.5 | 2.648 | 52.3 | -29.9 | 0.032 | 30.4 | 0.72 | 154.9 | 18.3 | |
| 1.8 | 0.919 | 141.8 | 7.9 | 2.482 | 49.6 | -29.6 | 0.033 | 29.6 | 0.72 | 153.3 | 17.6 | |
| 1.9 | 0.918 | 139.3 | 7.4 | 2.333 | 46.8 | -29.4 | 0.034 | 28.6 | 0.72 | 151.6 | 16.9 | |
| 2 | 0.918 | 136.7 | 6.8 | 2.199 | 44.1 | -29.1 | 0.035 | 27.6 | 0.72 | 150.0 | 16.3 | |
| 2.1 | 0.917 | 134.2 | 6.4 | 2.082 | 41.4 | -28.9 | 0.036 | 26.5 | 0.72 | 148.2 | 15.8 | |
| 2.2 | 0.918 | 131.6 | 5.9 | 1.973 | 38.6 | -28.6 | 0.037 | 25.4 | 0.72 | 146.7 | 15.3 | |
| 2.3 | 0.913 | 129.4 | 5.4 | 1.868 | 35.7 | -28.4 | 0.038 | 24.2 | 0.71 | 145.1 | 14.6 | |
| 2.4 | 0.912 | 126.7 | 5.0 | 1.778 | 33.4 | -28.2 | 0.039 | 23.0 | 0.72 | 143.8 | 14.1 | |
| 2.5 | 0.908 | 124.5 | 4.6 | 1.700 | 31.1 | -28.0 | 0.04 | 22.1 | 0.73 | 142.1 | 13.6 | |
| 3 | 0.907 | 112.2 | 2.5 | 1.340 | 18.4 | -27.1 | 0.044 | 15.8 | 0.74 | 135.2 | 11.7 | |
| 3.5 | 0.912 | 99.5 | 1.4 | 1.176 | 7.8 | -26.7 | 0.046 | 9.7 | 0.76 | 126.6 | 10.8 | |
| 4 | 0.923 | 92.6 | 0.1 | 1.012 | -2.9 | -26.6 | 0.047 | 3.5 | 0.78 | 117.9 | 10.3 | |
| 5 | 0.922 | 78.2 | -3.3 | 0.685 | -24.1 | -26.4 | 0.048 | -10.3 | 0.82 | 100.7 | 7.8 | |
| 6 | 0.921 | 61.3 | -5.8 | 0.512 | -46.3 | -26.6 | 0.047 | -25.6 | 0.85 | 84.1 | 6.2 | |
| 7 | 0.921 | 41.2 | -8.4 | 0.381 | -64.7 | -26.7 | 0.046 | -40.9 | 0.86 | 67.8 | 4.0 | |
| 8 | 0.922 | 24.3 | -10.5 | 0.298 | -85.4 | -27.3 | 0.043 | -56.4 | 0.87 | 51.5 | 2.5 | |
| 9 | 0.923 | 11.8 | -12.8 | 0.230 | -106.7 | -29.1 | 0.035 | -74.0 | 0.88 | 36.5 | 1.2 | |
| 10 | 0.922 | 10.8 | -14.9 | 0.179 | -114.6 | -31.7 | 0.026 | -82.1 | 0.90 | 27.1 | 0 | |
| 11 | 0.921 | 0.3 | -16.4 | 0.151 | -132.2 | -35.4 | 0.017 | -113.8 | 0.88 | 20.7 | -1.8 | |
| 12 | 0.924 | -8.0 | -18.4 | 0.120 | -145.0 | -46.0 | 0.005 | 179.4 | 0.92 | 8.1 | -1.8 | |
| 13 | 0.923 | -12.1 | -20.1 | 0.099 | -161.7 | -37.7 | 0.013 | 76.2 | 0.89 | 0.7 | -4.9 | |
| 14 | 0.922 | -20.6 | -22.2 | 0.078 | -176.9 | -35.9 | 0.016 | 39.1 | 0.89 | -5.0 | -7.2 | |
| 15 | 0.925 | -23.6 | -22.9 | 0.072 | 171.6 | -38.4 | 0.012 | 12.7 | 0.87 | -15.8 | -8.4 | |
| 16 | 0.925 | -23.1 | -22.4 | 0.076 | 160.6 | -36.5 | 0.015 | 6.4 | 0.87 | -21.7 | -8.0 | |
| 17 | 0.924 | -24.3 | -20.1 | 0.099 | 151.7 | -43.1 | 0.007 | 153.6 | 0.87 | -27.7 | -5.5 | |
| 18 | 0.924 | -32.5 | -18.1 | 0.125 | 131.4 | -36.5 | 0.015 | 145.0 | 0.86 | -34.6 | -3.5 | |



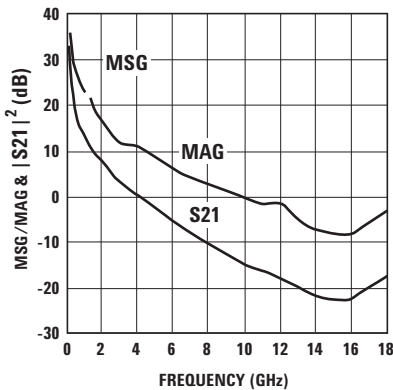
Notes:

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.

Figure 35. MSG/MAG & $|S_{21}|^2$ vs Frequency at 5.5V/200 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 5.5V$, $I_{DS} = 360\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|-------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.874 | -133.9 | 31.3 | 36.688 | 112.8 | -39.2 | 0.011 | 32.1 | 0.639 | -161.7 | 35.2 | |
| 0.2 | 0.902 | -159.0 | 26.0 | 19.973 | 98.3 | -37.7 | 0.013 | 25.5 | 0.688 | -172 | 31.9 | |
| 0.3 | 0.910 | -169.6 | 22.7 | 13.575 | 91.1 | -37.1 | 0.014 | 24.9 | 0.699 | -176.7 | 29.9 | |
| 0.4 | 0.911 | -176.2 | 20.2 | 10.251 | 86.1 | -36.5 | 0.015 | 26.2 | 0.702 | -179.9 | 28.3 | |
| 0.5 | 0.911 | 178.4 | 18.2 | 8.123 | 84.4 | -35.9 | 0.016 | 30.0 | 0.706 | 176.1 | 27.1 | |
| 0.6 | 0.912 | 174.4 | 16.7 | 6.810 | 81.6 | -35.4 | 0.017 | 32.1 | 0.706 | 173.7 | 26.0 | |
| 0.7 | 0.914 | 170.8 | 15.4 | 5.902 | 78.8 | -34.9 | 0.018 | 34.0 | 0.705 | 171.5 | 25.2 | |
| 0.8 | 0.916 | 167.4 | 14.4 | 5.218 | 76.0 | -34.4 | 0.019 | 35.3 | 0.702 | 169.6 | 24.4 | |
| 0.9 | 0.916 | 164.0 | 13.4 | 4.686 | 73.0 | -33.6 | 0.021 | 36.2 | 0.705 | 167.6 | 23.5 | |
| 1 | 0.917 | 160.9 | 12.6 | 4.247 | 70.1 | -33.2 | 0.022 | 36.6 | 0.702 | 165.7 | 22.9 | |
| 1.1 | 0.919 | 159.5 | 12.2 | 4.064 | 68.6 | -33.0 | 0.0225 | 36.6 | 0.702 | 164.7 | 22.6 | |
| 1.2 | 0.920 | 158.0 | 11.8 | 3.881 | 67.1 | -32.8 | 0.023 | 36.5 | 0.702 | 163.7 | 22.3 | |
| 1.3 | 0.919 | 155.3 | 11.0 | 3.562 | 64.1 | -32.0 | 0.025 | 36.3 | 0.700 | 162.1 | 21.2 | |
| 1.4 | 0.915 | 152.4 | 10.4 | 3.296 | 61.0 | -31.7 | 0.026 | 35.8 | 0.703 | 160.3 | 19.7 | |
| 1.5 | 0.916 | 150.0 | 9.7 | 3.064 | 58.3 | -31.4 | 0.027 | 35.5 | 0.702 | 158.5 | 19.0 | |
| 1.6 | 0.918 | 147.4 | 9.1 | 2.861 | 55.2 | -30.8 | 0.029 | 34.8 | 0.702 | 156.7 | 18.5 | |
| 1.7 | 0.918 | 144.5 | 8.6 | 2.684 | 52.2 | -30.5 | 0.03 | 33.9 | 0.702 | 155.0 | 17.9 | |
| 1.8 | 0.918 | 141.9 | 8.0 | 2.517 | 49.5 | -30.2 | 0.031 | 33.0 | 0.703 | 153.4 | 17.3 | |
| 1.9 | 0.917 | 139.4 | 7.5 | 2.368 | 46.7 | -29.6 | 0.033 | 32.0 | 0.703 | 151.8 | 16.7 | |
| 2 | 0.918 | 136.9 | 7.0 | 2.229 | 43.9 | -29.4 | 0.034 | 30.9 | 0.703 | 150.2 | 16.2 | |
| 2.1 | 0.916 | 134.4 | 6.5 | 2.110 | 41.2 | -29.1 | 0.035 | 29.7 | 0.705 | 148.5 | 15.6 | |
| 2.2 | 0.917 | 131.8 | 6.0 | 2.003 | 38.4 | -28.9 | 0.036 | 28.6 | 0.704 | 146.9 | 15.2 | |
| 2.3 | 0.913 | 129.6 | 5.5 | 1.89 | 35.6 | -28.6 | 0.037 | 27.3 | 0.702 | 145.6 | 14.5 | |
| 2.4 | 0.911 | 126.9 | 5.1 | 1.802 | 33.2 | -28.4 | 0.038 | 26.1 | 0.703 | 144.2 | 14.0 | |
| 2.5 | 0.907 | 124.8 | 4.7 | 1.724 | 30.8 | -28.2 | 0.039 | 25.1 | 0.722 | 142.6 | 13.6 | |
| 3 | 0.907 | 112.5 | 2.7 | 1.360 | 18.0 | -27.3 | 0.043 | 18.7 | 0.724 | 135.9 | 11.7 | |
| 3.5 | 0.912 | 99.5 | 1.5 | 1.192 | 7.1 | -26.9 | 0.045 | 11.0 | 0.742 | 127.8 | 10.8 | |
| 4 | 0.923 | 92.6 | 0.5 | 1.054 | -3.7 | -26.6 | 0.047 | 3.0 | 0.761 | 118.9 | 10.5 | |
| 5 | 0.922 | 78.2 | -2.2 | 0.777 | -25.4 | -26.2 | 0.049 | -11.9 | 0.799 | 101.3 | 8.6 | |
| 6 | 0.921 | 61.3 | -5.7 | 0.520 | -47.3 | -26.6 | 0.047 | -25.5 | 0.828 | 84.3 | 5.9 | |
| 7 | 0.921 | 41.2 | -8.2 | 0.388 | -66.0 | -26.7 | 0.046 | -39.2 | 0.846 | 68.3 | 3.9 | |
| 8 | 0.922 | 24.3 | -10.3 | 0.304 | -86.5 | -27.3 | 0.043 | -54.0 | 0.863 | 52.3 | 2.5 | |
| 9 | 0.923 | 11.8 | -12.7 | 0.233 | -108.9 | -29.1 | 0.035 | -71.3 | 0.877 | 37.6 | 1.2 | |
| 10 | 0.922 | 10.8 | -14.8 | 0.181 | -117.8 | -31.7 | 0.026 | -78.2 | 0.894 | 28.0 | -0.2 | |
| 11 | 0.921 | 0.3 | -16.1 | 0.156 | -134.7 | -34.9 | 0.018 | -106.9 | 0.874 | 21.3 | -1.7 | |
| 12 | 0.924 | -8.0 | -18.1 | 0.125 | -147.8 | -48.0 | 0.004 | -144.3 | 0.919 | 8.2 | -1.6 | |
| 13 | 0.923 | -12.1 | -19.7 | 0.104 | -165.7 | -40.0 | 0.01 | 74.2 | 0.878 | 0.1 | -4.9 | |
| 14 | 0.922 | -20.6 | -21.9 | 0.080 | 178.6 | -37.1 | 0.014 | 30.8 | 0.881 | -6.4 | -7.3 | |
| 15 | 0.925 | -23.6 | -22.3 | 0.077 | 167.6 | -40.0 | 0.01 | -3.8 | 0.864 | -17.9 | -8.0 | |
| 16 | 0.925 | -23.1 | -22.3 | 0.077 | 155.5 | -38.4 | 0.012 | -13.4 | 0.861 | -25.0 | -8.2 | |
| 17 | 0.924 | -24.3 | -19.5 | 0.106 | 148.1 | -39.2 | 0.011 | -177.4 | 0.854 | -32.2 | -5.3 | |
| 18 | 0.924 | -32.5 | -17.6 | 0.132 | 130.3 | -33.6 | 0.021 | 165.0 | 0.832 | -41.4 | -3.7 | |

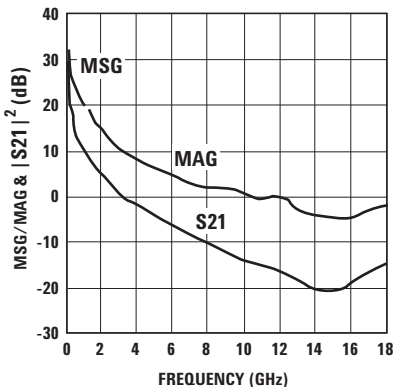


Notes:
 1. S parameter is measured on a microstrip line made on 0.025 inch thick alumina carrier. The input reference plane is at the end of the gate lead. The output reference plane is at the end of the drain lead.

Figure 36. MSG/MAG & $|S_{21}|^2$ vs Frequency at 5.5V/360 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 3.5V$, $I_{DS} = 280\text{ mA}$

| Freq. GHz | S_{11} | | dB | S_{21} | | dB | S_{12} | | S_{22} | | MSG/MAG dB |
|-----------|----------|--------|-------|----------|--------|-------|----------|--------|----------|--------|------------|
| | Mag. | Ang. | | Mag. | Ang. | | Mag. | Ang. | Mag. | Ang. | |
| 0.1 | 0.926 | -134.5 | 29.5 | 29.964 | 111.1 | -39.2 | 0.011 | 33.1 | 0.776 | -169.9 | 34.4 |
| 0.2 | 0.928 | -159.6 | 24.1 | 16.031 | 97.4 | -37.7 | 0.013 | 27.4 | 0.817 | -176.6 | 30.9 |
| 0.3 | 0.930 | -170.1 | 20.7 | 10.841 | 90.8 | -37.1 | 0.014 | 27.5 | 0.826 | -179.8 | 28.9 |
| 0.4 | 0.928 | -176.7 | 18.2 | 8.172 | 86.1 | -36.5 | 0.015 | 29.0 | 0.829 | -177.1 | 27.4 |
| 0.5 | 0.927 | 178.0 | 16.2 | 6.472 | 84.9 | -35.9 | 0.016 | 33.4 | 0.834 | -174.0 | 26.1 |
| 0.6 | 0.929 | 174.0 | 14.7 | 5.424 | 82.4 | -35.4 | 0.017 | 35.7 | 0.835 | -171.9 | 25.0 |
| 0.7 | 0.930 | 170.4 | 13.4 | 4.704 | 80.0 | -34.4 | 0.019 | 37.6 | 0.835 | -169.9 | 23.9 |
| 0.8 | 0.932 | 167.0 | 12.4 | 4.161 | 77.4 | -34.0 | 0.02 | 38.8 | 0.833 | -168.0 | 23.2 |
| 0.9 | 0.933 | 163.6 | 11.5 | 3.744 | 74.7 | -33.2 | 0.022 | 39.6 | 0.838 | -166.1 | 22.3 |
| 1 | 0.934 | 160.4 | 10.6 | 3.397 | 72.0 | -32.4 | 0.024 | 39.7 | 0.836 | -164.1 | 21.5 |
| 1.1 | 0.935 | 159.0 | 10.2 | 3.250 | 70.6 | -32.0 | 0.025 | 39.6 | 0.836 | -163.1 | 21.1 |
| 1.2 | 0.936 | 157.5 | 9.8 | 3.103 | 69.2 | -32.0 | 0.025 | 39.5 | 0.835 | -162.1 | 20.9 |
| 1.3 | 0.935 | 154.7 | 9.1 | 2.848 | 66.4 | -31.4 | 0.027 | 39.0 | 0.832 | -160.3 | 20.2 |
| 1.4 | 0.932 | 151.9 | 8.4 | 2.637 | 63.5 | -31.1 | 0.028 | 38.2 | 0.837 | -158.4 | 19.7 |
| 1.5 | 0.931 | 149.4 | 7.8 | 2.453 | 60.9 | -30.5 | 0.03 | 37.6 | 0.836 | -156.5 | 19.0 |
| 1.6 | 0.933 | 146.8 | 7.2 | 2.292 | 58.1 | -30.2 | 0.031 | 36.6 | 0.834 | -154.6 | 18.1 |
| 1.7 | 0.931 | 143.9 | 6.7 | 2.153 | 55.4 | -29.6 | 0.033 | 35.5 | 0.835 | -152.8 | 17.3 |
| 1.8 | 0.933 | 141.2 | 6.1 | 2.018 | 52.8 | -29.4 | 0.034 | 34.4 | 0.835 | -151.1 | 16.8 |
| 1.9 | 0.931 | 138.7 | 5.6 | 1.899 | 50.1 | -28.9 | 0.036 | 33.0 | 0.834 | -149.4 | 16.1 |
| 2 | 0.931 | 136.2 | 5.0 | 1.788 | 47.5 | -28.6 | 0.037 | 31.7 | 0.833 | -147.7 | 15.5 |
| 2.1 | 0.929 | 133.6 | 4.6 | 1.691 | 45.1 | -28.4 | 0.038 | 30.3 | 0.834 | -145.9 | 14.9 |
| 2.2 | 0.930 | 131.0 | 4.1 | 1.609 | 42.5 | -28.0 | 0.040 | 29.0 | 0.833 | -144.2 | 14.5 |
| 2.3 | 0.927 | 128.7 | 3.7 | 1.526 | 40.1 | -27.7 | 0.041 | 27.3 | 0.827 | -142.4 | 13.9 |
| 2.4 | 0.923 | 126.2 | 3.2 | 1.447 | 37.6 | -27.5 | 0.042 | 26.1 | 0.827 | -141.2 | 13.3 |
| 2.5 | 0.920 | 124.0 | 2.8 | 1.386 | 35.6 | -27.3 | 0.043 | 25.0 | 0.848 | -139.6 | 13.1 |
| 3 | 0.918 | 111.6 | 0.8 | 1.095 | 23.8 | -26.6 | 0.047 | 17.5 | 0.841 | -132.4 | 11.1 |
| 3.5 | 0.912 | 99.5 | -1.0 | 0.891 | 14.7 | -26.0 | 0.050 | 11.3 | 0.837 | -128.1 | 9.2 |
| 4 | 0.923 | 92.6 | -2.3 | 0.770 | 6.7 | -25.7 | 0.052 | 6.4 | 0.838 | -121.4 | 8.5 |
| 5 | 0.922 | 78.2 | -5.0 | 0.565 | -14.8 | -25.5 | 0.053 | -8.4 | 0.840 | -98.7 | 6.2 |
| 6 | 0.921 | 61.3 | -7.1 | 0.442 | -35.0 | -25.4 | 0.054 | -29.5 | 0.853 | -80.1 | 4.6 |
| 7 | 0.921 | 41.2 | -9.5 | 0.336 | -51.9 | -26.4 | 0.048 | -42.3 | 0.857 | -65.5 | 2.7 |
| 8 | 0.922 | 24.3 | -11.3 | 0.271 | -70.9 | -27.1 | 0.044 | -58.9 | 0.881 | -50.5 | 1.8 |
| 9 | 0.923 | 11.8 | -13.4 | 0.215 | -90.6 | -29.1 | 0.035 | -77 | 0.916 | -33.6 | 1.5 |
| 10 | 0.922 | 10.8 | -15.3 | 0.171 | -98.1 | -32.0 | 0.025 | -86.1 | 0.925 | -24.4 | 0.4 |
| 11 | 0.921 | 0.3 | -16.4 | 0.151 | -113.4 | -35.9 | 0.016 | -119.4 | 0.899 | -18.3 | -1.2 |
| 12 | 0.924 | -8.0 | -17.9 | 0.127 | -124.8 | -46.0 | 0.005 | 166.3 | 0.943 | -5.9 | 0.2 |
| 13 | 0.923 | -12.1 | -19.2 | 0.11 | -139.7 | -37.1 | 0.014 | 75.0 | 0.900 | -1.3 | -3.4 |
| 14 | 0.922 | -20.6 | -20.6 | 0.093 | -156.5 | -35.4 | 0.017 | 37.4 | 0.903 | -6.9 | -5.0 |
| 15 | 0.925 | -23.6 | -20.4 | 0.095 | -175.6 | -38.4 | 0.012 | 5.2 | 0.885 | -17.6 | -5.6 |
| 16 | 0.925 | -23.1 | -20.4 | 0.096 | 168.4 | -37.7 | 0.013 | -2.2 | 0.881 | -23.9 | -5.7 |
| 17 | 0.924 | -24.3 | -18.3 | 0.121 | 151.1 | -40.0 | 0.01 | 166.0 | 0.870 | -30.0 | -3.6 |
| 18 | 0.924 | -32.5 | -16.7 | 0.146 | 128.4 | -33.6 | 0.021 | 145.9 | 0.846 | -37.2 | -2.4 |



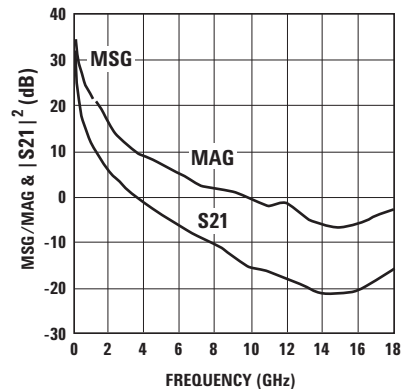
Notes:

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.

Figure 37. MSG/MAG & $|S_{21}|^2$ vs Frequency at 3.5V/280 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 3.5V$, $I_{DS} = 200\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|-------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.927 | -132.6 | 30.4 | 33.278 | 111.3 | -37.1 | 0.014 | 30.8 | 0.713 | -163.4 | 33.8 | |
| 0.2 | 0.922 | -158.4 | 25.0 | 17.839 | 97.4 | -35.9 | 0.016 | 23.7 | 0.762 | -173.1 | 30.5 | |
| 0.3 | 0.921 | -169.2 | 21.6 | 12.071 | 90.7 | -35.4 | 0.017 | 23.1 | 0.773 | -177.6 | 28.5 | |
| 0.4 | 0.919 | -176.0 | 19.2 | 9.101 | 86.0 | -34.9 | 0.018 | 24.1 | 0.776 | -179.3 | 27.0 | |
| 0.5 | 0.918 | 178.6 | 17.2 | 7.208 | 84.6 | -34.9 | 0.018 | 28.0 | 0.780 | 175.7 | 26.0 | |
| 0.6 | 0.919 | 174.6 | 15.6 | 6.036 | 82.0 | -34.4 | 0.019 | 30.1 | 0.779 | 173.5 | 25.0 | |
| 0.7 | 0.919 | 171.0 | 14.4 | 5.237 | 79.5 | -33.6 | 0.021 | 32.0 | 0.780 | 171.4 | 24.0 | |
| 0.8 | 0.920 | 167.6 | 13.3 | 4.637 | 76.9 | -33.2 | 0.022 | 33.1 | 0.778 | 169.4 | 23.2 | |
| 0.9 | 0.922 | 164.2 | 12.4 | 4.159 | 74.1 | -32.4 | 0.024 | 34.0 | 0.779 | 167.4 | 22.4 | |
| 1 | 0.923 | 161.1 | 11.5 | 3.778 | 71.4 | -32.0 | 0.025 | 34.4 | 0.778 | 165.6 | 21.8 | |
| 1.1 | 0.924 | 159.7 | 11.2 | 3.617 | 70.0 | -31.7 | 0.026 | 34.4 | 0.779 | 164.7 | 21.4 | |
| 1.2 | 0.924 | 158.2 | 10.8 | 3.455 | 68.5 | -31.4 | 0.027 | 34.4 | 0.779 | 163.7 | 21.1 | |
| 1.3 | 0.924 | 155.5 | 10.0 | 3.171 | 65.6 | -31.1 | 0.028 | 34.1 | 0.778 | 161.9 | 20.5 | |
| 1.4 | 0.921 | 152.6 | 9.4 | 2.936 | 62.8 | -30.5 | 0.030 | 33.6 | 0.779 | 160.0 | 19.9 | |
| 1.5 | 0.920 | 150.2 | 8.7 | 2.734 | 60.1 | -30.2 | 0.031 | 33.3 | 0.779 | 158.2 | 19.5 | |
| 1.6 | 0.923 | 147.6 | 8.1 | 2.554 | 57.2 | -29.9 | 0.032 | 32.5 | 0.778 | 156.5 | 19.0 | |
| 1.7 | 0.922 | 144.7 | 7.6 | 2.395 | 54.4 | -29.4 | 0.034 | 31.7 | 0.779 | 154.6 | 18.1 | |
| 1.8 | 0.922 | 142.1 | 7.0 | 2.248 | 51.8 | -29.1 | 0.035 | 30.8 | 0.778 | 153.1 | 17.2 | |
| 1.9 | 0.921 | 139.6 | 6.5 | 2.116 | 49.2 | -28.9 | 0.036 | 29.7 | 0.778 | 151.4 | 16.5 | |
| 2 | 0.921 | 137.1 | 6.0 | 1.994 | 46.5 | -28.4 | 0.038 | 28.7 | 0.777 | 149.7 | 15.9 | |
| 2.1 | 0.919 | 134.6 | 5.5 | 1.889 | 44.0 | -28.2 | 0.039 | 27.4 | 0.778 | 148.0 | 15.3 | |
| 2.2 | 0.920 | 132.0 | 5.1 | 1.792 | 41.3 | -28.0 | 0.040 | 26.3 | 0.777 | 146.4 | 14.8 | |
| 2.3 | 0.918 | 129.7 | 4.6 | 1.690 | 38.8 | -27.7 | 0.041 | 25.1 | 0.777 | 145.1 | 14.3 | |
| 2.4 | 0.914 | 127.1 | 4.2 | 1.618 | 36.4 | -27.5 | 0.042 | 23.8 | 0.775 | 143.5 | 13.7 | |
| 2.5 | 0.910 | 125.0 | 3.8 | 1.549 | 34.1 | -27.3 | 0.043 | 22.8 | 0.792 | 141.8 | 13.3 | |
| 3 | 0.909 | 112.7 | 1.8 | 1.226 | 22.1 | -26.6 | 0.047 | 16.3 | 0.790 | 135.0 | 11.3 | |
| 3.5 | 0.912 | 99.5 | 0.0 | 1.000 | 12.5 | -26.0 | 0.050 | 10.7 | 0.796 | 131.2 | 9.8 | |
| 4 | 0.923 | 92.6 | -1.2 | 0.869 | 2.9 | -25.7 | 0.052 | 5.2 | 0.801 | 122.7 | 9.1 | |
| 5 | 0.922 | 78.2 | -4.0 | 0.633 | -18.0 | -25.0 | 0.056 | -7.1 | 0.812 | 102.1 | 6.7 | |
| 6 | 0.921 | 61.3 | -6.2 | 0.488 | -39.4 | -25.5 | 0.053 | -24.3 | 0.823 | 84.0 | 5.0 | |
| 7 | 0.921 | 41.2 | -8.7 | 0.369 | -57.1 | -26.0 | 0.050 | -41.5 | 0.822 | 69.2 | 2.9 | |
| 8 | 0.922 | 24.3 | -10.6 | 0.294 | -76.8 | -26.7 | 0.046 | -58.0 | 0.854 | 53.9 | 1.9 | |
| 9 | 0.923 | 11.8 | -12.8 | 0.230 | -97.3 | -28.4 | 0.038 | -75.9 | 0.890 | 36.3 | 1.2 | |
| 10 | 0.922 | 10.8 | -15.1 | 0.176 | -105.0 | -31.1 | 0.028 | -84.6 | 0.901 | 26.6 | -0.3 | |
| 11 | 0.921 | 0.3 | -16.1 | 0.156 | -120.3 | -34.4 | 0.019 | -113.3 | 0.877 | 19.8 | -1.7 | |
| 12 | 0.924 | -8.0 | -17.9 | 0.128 | -132.2 | -44.4 | 0.006 | -164.6 | 0.921 | 6.7 | -1.2 | |
| 13 | 0.923 | -12.1 | -19.2 | 0.110 | -146.9 | -39.2 | 0.011 | 75.2 | 0.881 | -1.4 | -4.2 | |
| 14 | 0.922 | -20.6 | -20.8 | 0.091 | -161.8 | -36.5 | 0.015 | 34.4 | 0.885 | -7.8 | -6.0 | |
| 15 | 0.925 | -23.6 | -20.8 | 0.091 | -177.7 | -38.4 | 0.012 | -0.7 | 0.868 | -19.5 | -6.5 | |
| 16 | 0.925 | -23.1 | -20.6 | 0.093 | 168.1 | -37.7 | 0.013 | -7.2 | 0.867 | -26.6 | -6.4 | |
| 17 | 0.924 | -24.3 | -18.4 | 0.120 | 156.0 | -41.9 | 0.008 | -177.4 | 0.857 | -34.0 | -4.2 | |
| 18 | 0.924 | -32.5 | -16.5 | 0.150 | 132.5 | -34.9 | 0.018 | 158.2 | 0.833 | -42.9 | -2.5 | |



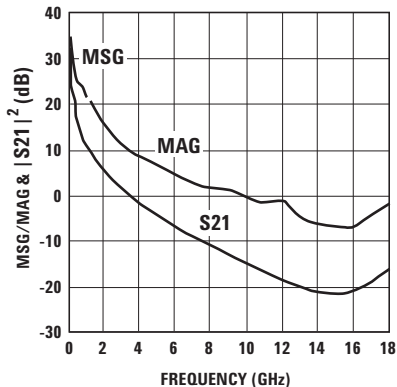
Notes:

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.

Figure 38. MSG/MAG & $|S_{21}|^2$ vs Frequency at 3.5V/200 mA.

ATF-50189 Typical Scattering Parameters at 25°C, $V_{DS} = 3.5V$, $I_{DS} = 360\text{ mA}$

| Freq. GHz | S_{11} | | | S_{21} | | | S_{12} | | | S_{22} | | MSG/MAG dB |
|--------------|----------|--------|-------|----------|--------|-------|----------|--------|------|----------|------|---------------|
| | Mag. | Ang. | dB | Mag. | Ang. | dB | Mag. | Ang. | Mag. | Ang. | | |
| 0.1 | 0.925 | -134.2 | 30.4 | 33.142 | 110.8 | -38.4 | 0.012 | 31.9 | 0.73 | -166.7 | 34.4 | |
| 0.2 | 0.923 | -159.4 | 25.0 | 17.732 | 97.1 | -37.1 | 0.014 | 25.7 | 0.77 | -174.9 | 31.0 | |
| 0.3 | 0.924 | -170.0 | 21.6 | 11.996 | 90.5 | -36.5 | 0.015 | 25.7 | 0.78 | -179.0 | 29.0 | |
| 0.4 | 0.923 | -176.6 | 19.1 | 9.042 | 85.8 | -35.9 | 0.016 | 27.1 | 0.79 | -178.1 | 27.5 | |
| 0.5 | 0.922 | 178.1 | 17.1 | 7.165 | 84.5 | -35.9 | 0.016 | 31.4 | 0.79 | -174.8 | 26.5 | |
| 0.6 | 0.923 | 174.1 | 15.6 | 6.003 | 81.9 | -34.9 | 0.018 | 33.6 | 0.79 | -172.6 | 25.2 | |
| 0.7 | 0.924 | 170.5 | 14.3 | 5.206 | 79.4 | -34.4 | 0.019 | 35.5 | 0.79 | -170.5 | 24.4 | |
| 0.8 | 0.925 | 167.1 | 13.3 | 4.608 | 76.8 | -34.0 | 0.02 | 36.6 | 0.79 | -168.5 | 23.6 | |
| 0.9 | 0.927 | 163.6 | 12.3 | 4.138 | 74.0 | -33.2 | 0.022 | 37.5 | 0.79 | -166.5 | 22.7 | |
| 1 | 0.928 | 160.5 | 11.5 | 3.757 | 71.2 | -32.4 | 0.024 | 37.7 | 0.79 | -164.6 | 21.9 | |
| 1.1 | 0.929 | 159.1 | 11.1 | 3.596 | 69.8 | -32.0 | 0.025 | 37.7 | 0.79 | -163.6 | 21.6 | |
| 1.2 | 0.929 | 157.6 | 10.7 | 3.435 | 68.3 | -32.0 | 0.025 | 37.6 | 0.79 | -162.6 | 21.4 | |
| 1.3 | 0.929 | 154.8 | 10.0 | 3.152 | 65.4 | -31.7 | 0.026 | 37.1 | 0.79 | -160.8 | 20.8 | |
| 1.4 | 0.925 | 152.0 | 9.3 | 2.918 | 62.5 | -31.1 | 0.028 | 36.6 | 0.79 | -158.9 | 20.2 | |
| 1.5 | 0.926 | 149.5 | 8.7 | 2.713 | 59.9 | -30.8 | 0.029 | 36.1 | 0.79 | -157.1 | 19.1 | |
| 1.6 | 0.927 | 146.8 | 8.1 | 2.535 | 57.0 | -30.2 | 0.031 | 35.1 | 0.79 | -155.3 | 18.5 | |
| 1.7 | 0.927 | 144.1 | 7.5 | 2.380 | 54.1 | -29.9 | 0.032 | 34.1 | 0.79 | -153.4 | 17.8 | |
| 1.8 | 0.927 | 141.3 | 7.0 | 2.231 | 51.5 | -29.4 | 0.034 | 33.0 | 0.79 | -151.8 | 17.1 | |
| 1.9 | 0.926 | 138.9 | 6.4 | 2.098 | 48.8 | -29.1 | 0.035 | 31.8 | 0.79 | -150.0 | 16.5 | |
| 2 | 0.926 | 136.4 | 5.9 | 1.977 | 46.2 | -28.9 | 0.036 | 30.6 | 0.79 | -148.4 | 15.9 | |
| 2.1 | 0.923 | 133.8 | 5.4 | 1.871 | 43.6 | -28.6 | 0.037 | 29.3 | 0.79 | -146.6 | 15.3 | |
| 2.2 | 0.926 | 131.2 | 5.0 | 1.777 | 41.0 | -28.2 | 0.039 | 28.1 | 0.79 | -144.9 | 14.9 | |
| 2.3 | 0.922 | 128.8 | 4.5 | 1.684 | 38.6 | -28.0 | 0.04 | 26.6 | 0.79 | -143.5 | 14.3 | |
| 2.4 | 0.919 | 126.3 | 4.1 | 1.600 | 36.0 | -27.7 | 0.041 | 25.3 | 0.79 | -142.0 | 13.8 | |
| 2.5 | 0.915 | 124.2 | 3.7 | 1.531 | 33.8 | -27.5 | 0.042 | 24.2 | 0.80 | -140.3 | 13.3 | |
| 3 | 0.913 | 111.9 | 1.6 | 1.208 | 21.7 | -26.7 | 0.046 | 17.2 | 0.80 | -133.2 | 11.3 | |
| 3.5 | 0.912 | 99.5 | -0.2 | 0.982 | 12.2 | -26.6 | 0.047 | 10.0 | 0.80 | -124.8 | 9.6 | |
| 4 | 0.923 | 92.6 | -1.5 | 0.846 | 3.8 | -26.4 | 0.048 | 2.8 | 0.81 | -116.4 | 9.0 | |
| 5 | 0.922 | 78.2 | -4.2 | 0.618 | -18.4 | -26.0 | 0.05 | -11.7 | 0.82 | -99.5 | 6.8 | |
| 6 | 0.921 | 61.3 | -6.4 | 0.477 | -39.3 | -25.7 | 0.052 | -26.1 | 0.83 | -82.7 | 5.0 | |
| 7 | 0.921 | 41.2 | -8.9 | 0.360 | -56.8 | -26.0 | 0.05 | -39.4 | 0.83 | -66.6 | 2.8 | |
| 8 | 0.922 | 24.3 | -10.9 | 0.286 | -76.6 | -26.7 | 0.046 | -55.9 | 0.86 | -51.6 | 1.8 | |
| 9 | 0.923 | 11.8 | -12.9 | 0.226 | -97.3 | -28.4 | 0.038 | -73.5 | 0.90 | -34.5 | 1.3 | |
| 10 | 0.922 | 10.8 | -15.0 | 0.177 | -104.9 | -31.1 | 0.028 | -81.6 | 0.91 | -25.1 | 0 | |
| 11 | 0.921 | 0.3 | -16.4 | 0.152 | -121.3 | -34.4 | 0.019 | -108.3 | 0.89 | -18.9 | -1.6 | |
| 12 | 0.924 | -8.0 | -18.1 | 0.124 | -134.4 | -46.0 | 0.005 | -147.3 | 0.93 | -6.5 | -1.0 | |
| 13 | 0.923 | -12.1 | -19.6 | 0.105 | -148.8 | -40.0 | 0.01 | -71.0 | 0.89 | -0.7 | -4.4 | |
| 14 | 0.922 | -20.6 | -21.2 | 0.087 | -163.5 | -37.1 | 0.014 | -30.2 | 0.89 | -6.3 | -6.2 | |
| 15 | 0.925 | -23.6 | -21.4 | 0.085 | -178.8 | -39.2 | 0.011 | -4.9 | 0.88 | -17.1 | -6.7 | |
| 16 | 0.925 | -23.1 | -21.2 | 0.087 | 167.6 | -37.7 | 0.013 | -8.8 | 0.87 | -23.1 | -6.9 | |
| 17 | 0.924 | -24.3 | -18.6 | 0.117 | 155.7 | -41.9 | 0.008 | -173.5 | 0.87 | -29.2 | -4.0 | |
| 18 | 0.924 | -32.5 | -16.8 | 0.145 | 133.2 | -35.4 | 0.017 | 161.7 | 0.85 | -36.3 | -2.4 | |



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.

Figure 39. MSG/MAG & $|S_{21}|^2$ vs Frequency at 3.5V/360 mA.

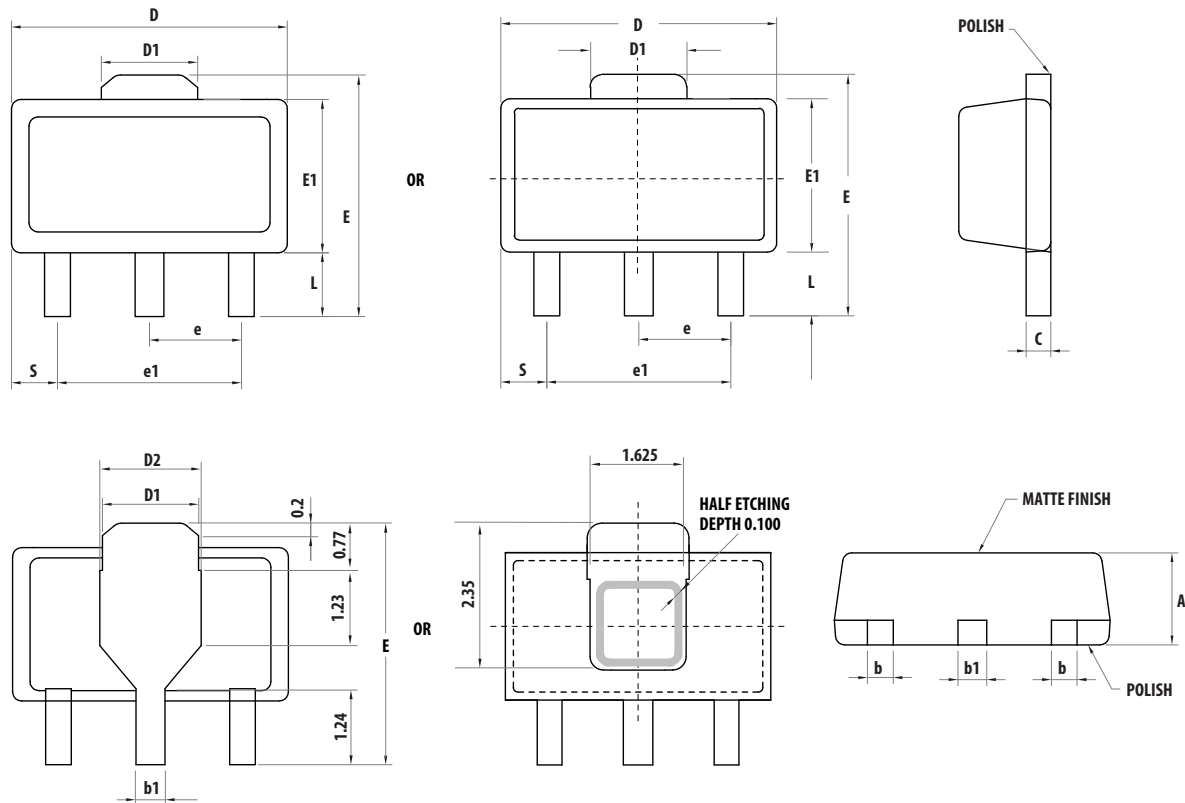
Device Models, PCB Layout and Stencil Device

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

Ordering Information

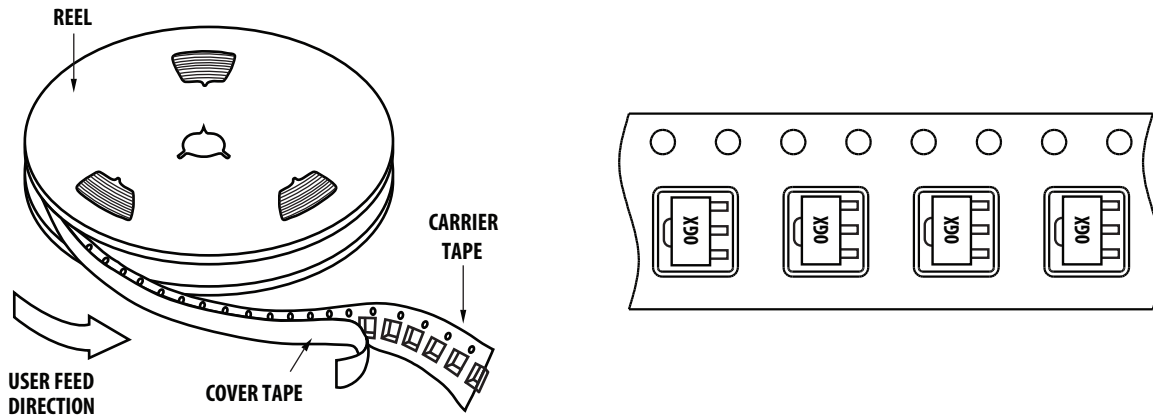
| Part Number | No. of Devices | Container |
|---------------|----------------|---------------|
| ATF-50189-BLK | 100 | 7" Tape/Reel |
| ATF-50189-TR1 | 3000 | 13" Tape/Reel |

SOT89 Package Dimensions

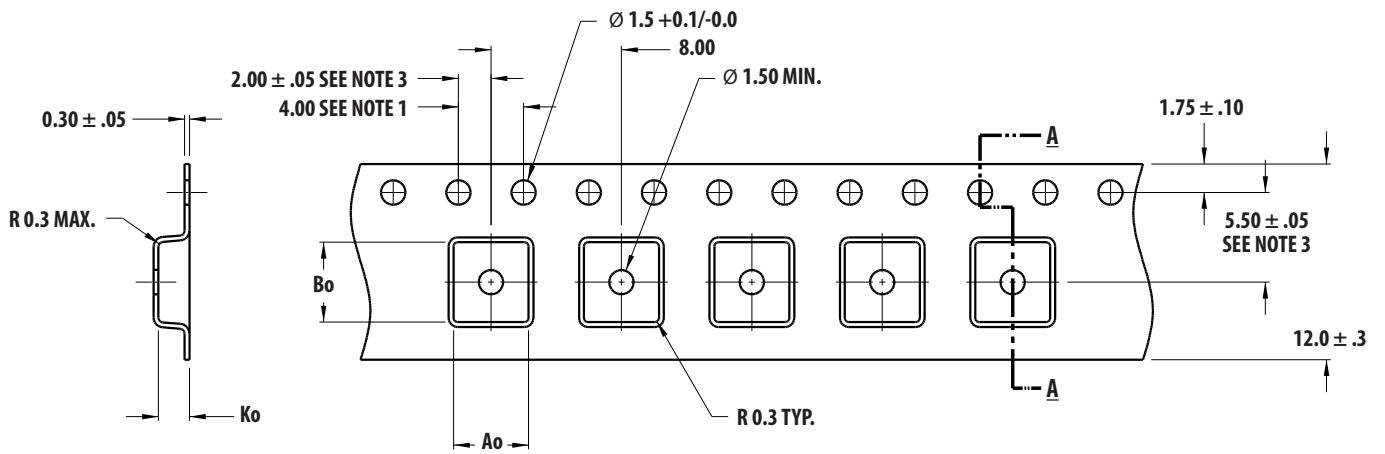


| Symbols | Dimensions in mm | | | Dimensions in inches | | |
|---------|------------------|---------|---------|----------------------|---------|---------|
| | Minimum | Nominal | Maximum | Minimum | Nominal | Maximum |
| A | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| L | 0.89 | 1.04 | 1.20 | 0.0350 | 0.041 | 0.047 |
| b | 0.36 | 0.42 | 0.48 | 0.014 | 0.016 | 0.018 |
| b1 | 0.41 | 0.47 | 0.53 | 0.016 | 0.018 | 0.030 |
| C | 0.38 | 0.40 | 0.43 | 0.014 | 0.015 | 0.017 |
| D | 4.40 | 4.50 | 4.60 | 0.173 | 0.177 | 0.181 |
| D1 | 1.40 | 1.60 | 1.75 | 0.055 | 0.062 | 0.069 |
| D2 | 1.45 | 1.65 | 1.80 | 0.055 | 0.062 | 0.069 |
| E | 3.94 | - | 4.25 | 0.155 | - | 0.167 |
| E1 | 2.40 | 2.50 | 2.60 | 0.094 | 0.098 | 0.102 |
| e1 | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| S | 0.65 | 0.75 | 0.85 | 0.026 | 0.030 | 0.034 |
| e | 1.40 | 1.50 | 1.60 | 0.054 | 0.059 | 0.063 |

Device Orientation



Tape Dimensions



SECTION A - A

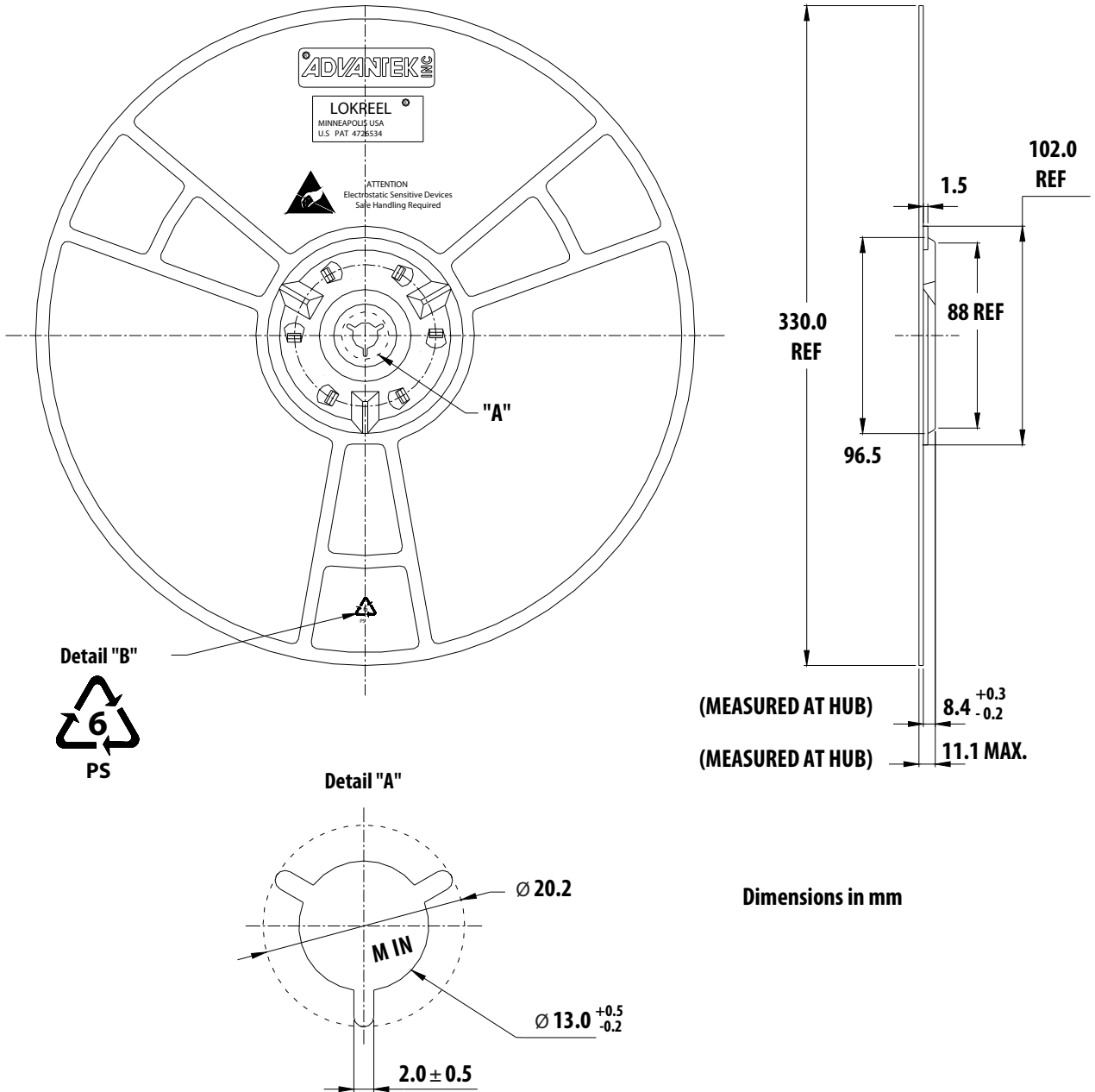
Ao = 4.60
Bo = 4.90
Ko = 1.90

DIMENSIONS IN MM

NOTES:

1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.2
2. CAMBER IN COMPLIANCE WITH EIA 481
3. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

Reel Dimensions – 13" Reel



(MEASURED AT HUB) 8.4 ^{+0.3} _{-0.2}
 (MEASURED AT HUB) 11.1 MAX.

Dimensions in mm

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

Avago, Avago Technologies, and the A logo are trademarks of Avago Technologies in the United States and other countries. Data subject to change. Copyright © 2005-2013 Avago Technologies. All rights reserved. AV02-0049EN - November 11, 2013

