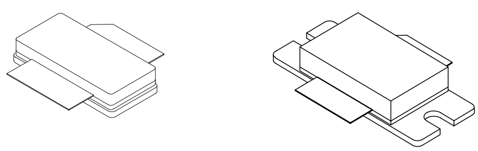
AGR19125E
125 W, 1930 MHz—1990 MHz, PCS LDMOS RF Power Transistor

Introduction

The AGR19125E is a 125 W, 28 V N-channel laterally diffused metal oxide semiconductor (LDMOS) RF power field effect transistor (FET) suitable for personal communication service (PCS) (1930 MHz—1990 MHz), time-division multiple access (TDMA), and single-carrier or multicarrier class AB power amplifier applications.



AGR19125EU (unflanged) **AGR19125EF (flanged)**

Figure 1. Available Packages

Features

- Typical 2 carrier, N-CDMA performance for V_{DD} = 28 V, I_{DQ} = 1250 mA, F1 = 1958.75 MHz, F2 = 1961.25 MHz, IS-95 (pilot, paging, sync, traffic channels 8—13) 1.2288 MHz channel bandwidth (BW). Adjacent channels measured over a 30 kHz BW at F1 – 0.885 MHz and F2 + 0.885 MHz. Intermodulation distortion products measured over a 1.2288 MHz BW at F1 – 2.5 MHz and F2 + 2.5 MHz. Peak/Average (P/A) = 9.72 dB at 0.01% probability on CCDF:
  — Output power: 24 W.
  — Power gain: 15 dB.
  — Efficiency: 24%.
  — ACPR: –48 dBc.
  — IMD3: –34 dBc.
  — Return loss: –10 dB.
- High-reliability, gold-metalization process.
- Low hot carrier injection (HCI) induced bias drift over 20 years.
- Internally matched.
- High gain, efficiency, and linearity.
- Integrated ESD protection.
- Device can withstand a 10:1 voltage standing wave ratio (VSWR) at 28 Vdc, 1960 MHz, 125 W continuous wave (CW) output power.
- Large signal impedance parameters available.

Table 1. Thermal Characteristics

Parameter	Sym	Value	Unit
Thermal Resistance, Junction to Case:			
AGR19125EU	$R_{\theta JC}$	0.5	°C/W
AGR19125EF	$R_{\theta JC}$	0.5	°C/W

Table 2. Absolute Maximum Ratings*

Parameter	Sym	Value	Unit
Drain-source Voltage	V_{DSS}	65	Vdc
Gate-source Voltage	V_{GS}	–0.5, +15	Vdc
Total Dissipation at T_C = 25 °C:			
AGR19125EU	P_D	350	W
AGR19125EF	P_D	350	W
Derate Above 25 °C:			
AGR19125EU	—	2.0	W/°C
AGR19125EF	—	2.0	W/°C
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{STG}	–65, +150	°C

* Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Table 3. ESD Rating*

AGR19125E	Minimum (V)	Class
HBM	500	1B
MM	50	A
CDM	1500	4

* Although electrostatic discharge (ESD) protection circuitry has been designed into this device, proper precautions must be taken to avoid exposure to ESD and electrical overstress (EOS) during all handling, assembly, and test operations. PEAK Devices employs a human-body model (HBM), a machine model (MM), and a charged-device model (CDM) qualification requirement in order to determine ESD-susceptibility limits and protection design evaluation. ESD voltage thresholds are dependent on the circuit parameters used in each of the models, as defined by JEDEC's JESD22-A114B (HBM), JESD22-A115A (MM), and JESD22-C101A (CDM) standards.

Caution: MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

Electrical Characteristics

Recommended operating conditions apply unless otherwise specified: T_C = 30 °C.

Table 4. dc Characteristics

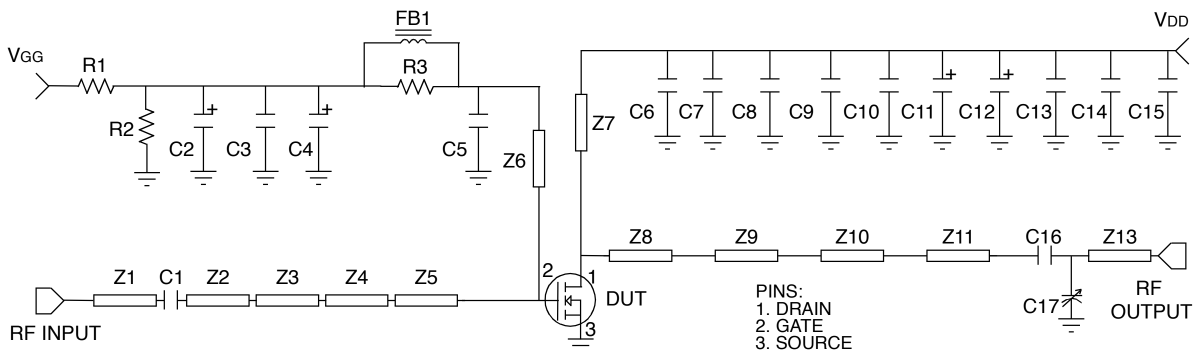
Parameter	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-source Breakdown Voltage (V_{GS} = 0, I_D = 400 μA)	$V_{(BR)DSS}$	65	—	—	Vdc
Gate-source Leakage Current (V_{GS} = 5 V, V_{DS} = 0 V)	I_{GSS}	—	—	4	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 V, V_{GS} = 0 V)	I_{DSS}	—	—	200	μAdc
On Characteristics					
Forward Transconductance (V_{DS} = 10 V, I_D = 1 A)	G_{FS}	—	9	—	S
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 400 μA)	$V_{GS(TH)}$	—	—	4.8	Vdc
Gate Quiescent Voltage (V_{DS} = 28 V, I_D = 1200 mA)	$V_{GS(Q)}$	—	3.8	—	Vdc
Drain-source On-voltage (V_{GS} = 10 V, I_D = 1 A)	$V_{DS(ON)}$	—	0.08	—	Vdc

Table 5. RF Characteristics

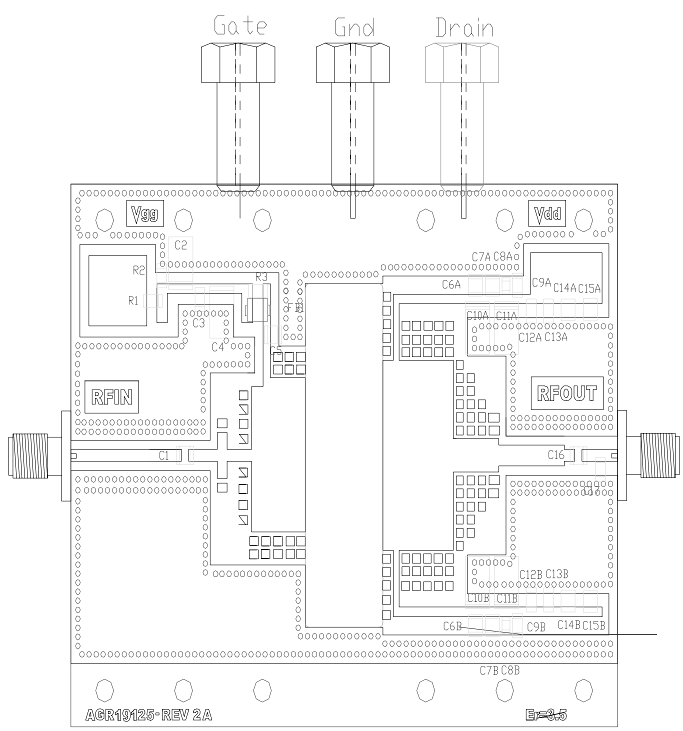
Parameter	Symbol	Min	Typ	Max	Unit
Dynamic Characteristics					
Reverse Transfer Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1.0 MHz) (This part is internally matched on both the input and output.)	C_{RSS}	—	3.0	—	pF
Functional Tests (in Supplied Test Fixture)					
Common-source Amplifier Power Gain*	G_{PS}	14	15	—	dB
Drain Efficiency*	η	—	24	—	%
Third-order Intermodulation Distortion* (IMD3 measured over 1.2288 MHz BW @ f1 – 2.5 MHz and f2 + 2.5 MHz)	IM3	—	–34	—	dBc
Adjacent Channel Power Ratio* (ACPR measured over BW of 30 kHz @ f1 – 0.885 MHz and f2 + 0.885 MHz)	ACPR	—	–48	—	dBc
Input Return Loss*	IRL	—	–10	—	dB
Power Output, 1 dB Compression Point (V_{DD} = 28 V, f_C = 1960.0 MHz)	P1dB	—	125	—	W
Output Mismatch Stress (V_{DD} = 28 V, P_{OUT} = 125 W (CW), I_{DQ} = 1250 mA, f_C = 1960.0 MHz VSWR = 10:1; [all phase angles])	ψ	No degradation in output power.			

* IS-95 N-CDMA P/A = 9.72 dB at 0.01% CCDF, f1 = 1958.75 MHz, and f2 = 1961.25 MHz.
V_{DD} = 28 Vdc, I_{DQ} = 1250 mA, and P_{OUT} = 24 W avg.

Test Circuit Illustrations for AGR19125E



A. Schematic



Parts List:

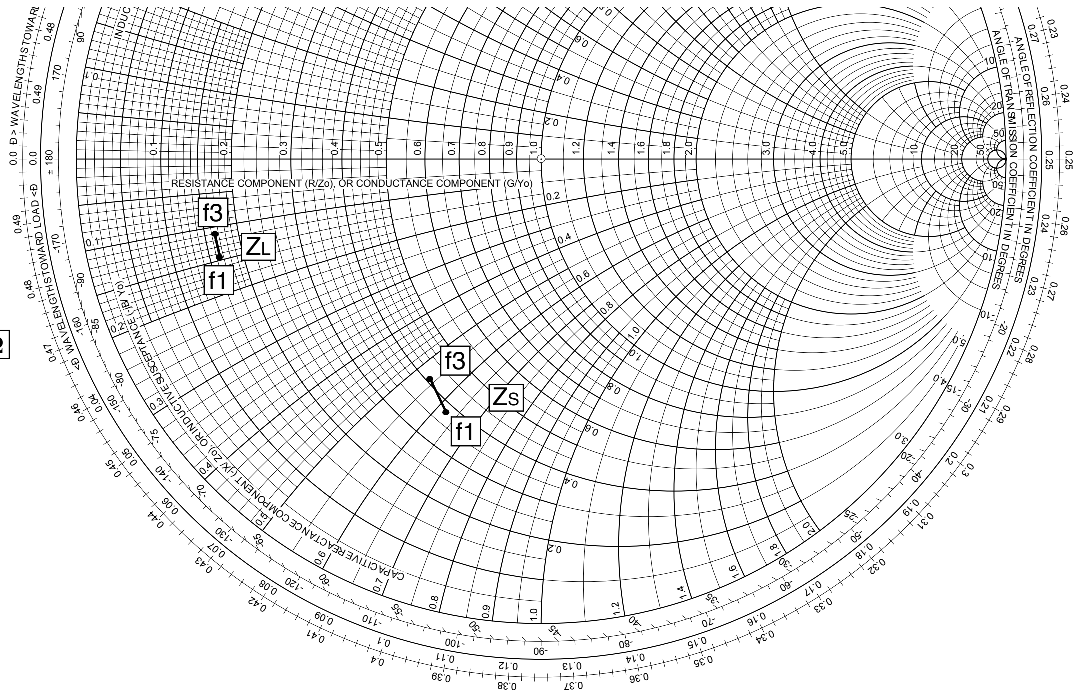
- Microstrip Line:
  Z1 0.785 in. x 0.065 in.
  Z2 0.205 in. x 0.065 in.
  Z3 0.070 in. x 0.255 in.
  Z4 0.378 in. x 0.065 in.
  Z5 0.177 in. x 0.860 in.
  Z6 0.050 in. x 0.247 in.
  Z7 0.050 in. x 0.593 in.
  Z8 0.500 in. x 1.030 in.
  Z9 0.323 in. x 0.185 in.
  Z10 0.465 in. x 0.115 in.
  Z11 0.075 in. x 0.065 in.
  Z12 0.252 in. x 0.065 in.
- *ATC*® chip capacitor:
  C1 10 pF 100B100JW500X
  C5, C14, C15: 5.6 pF100B5R6BW500X
  C9 6.8 pF 100B6R8JW500X
  C10 1.2 pF 100B1R2BW500X
  C16: 15 pF 100B150JW500X.
- *Sprague*® tantalum surface-mount chip capacitor:
  C2, C4, C11, C12: 22 μF, 35 V.
- *Kemet*® 1206 size chip capacitor:
  C6, C13: 0.1 μF C1206104K5RAC7800.
- *Murata*® 0805 size chip capacitor:
  C8 0.01 μF GRM40X7R103K100AL.
- *Johanson Giga-Trim*® variable capacitor:
  C17 0.6 pF to 4.5 pF 27271SL.
- 1206 size chip capacitor: C3, C7: 22000 pF.
- 1206 size chip resistor: R1 1 kΩ; R2 560 kΩ; R3 4.7 Ω.
- *Fair-Rite*® ferrite bead: FB1 2743019447.
- *Taconic*® ORCER RF-35: board material, 1 oz. copper, 30 mil thickness, εr = 3.5.

B. Component Layout

Figure 2. AGR19125E Test Circuit

Typical Performance Characteristics

Z0 = 10 Ω



MHz (f)	ZS Ω (Complex Source Impedance)	ZL Ω (Complex Optimum Load Impedance)
1930 (f1)	4.22 – j6.13	1.63 – j1.42
1960 (f2)	4.02 – j5.80	1.60 – j1.19
1990 (f3)	3.91 – j5.55	1.74 – j1.18

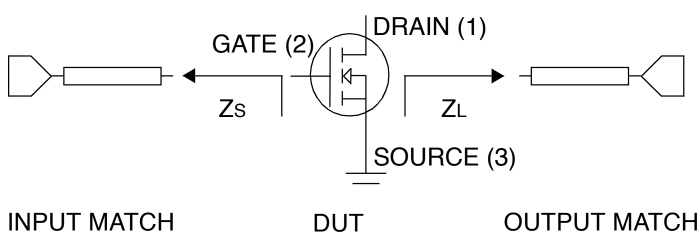
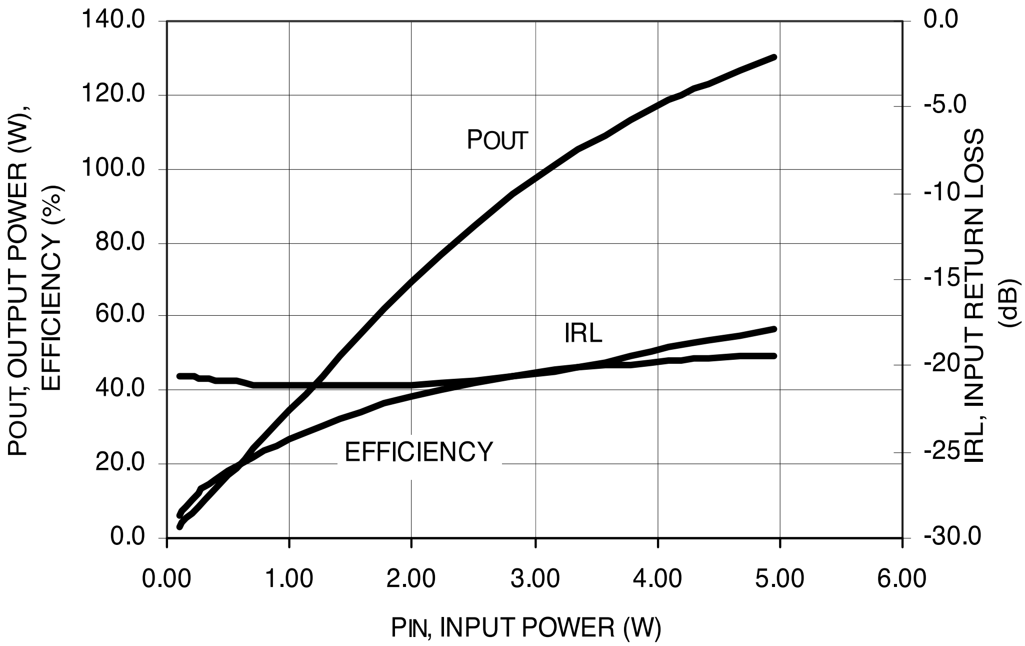


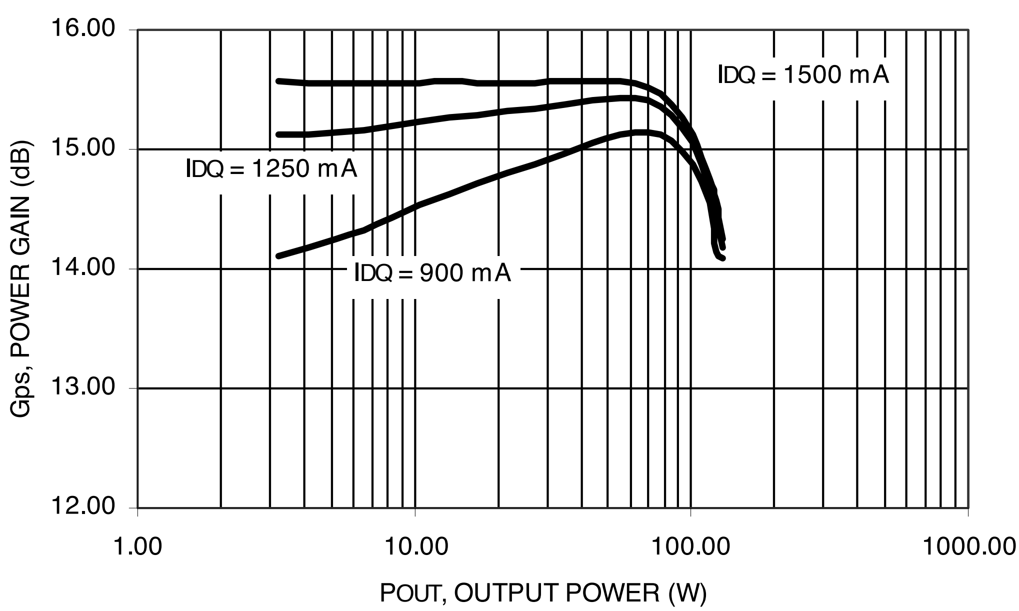
Figure 3. Series Equivalent Input and Output Impedances

Typical Performance Characteristics (continued)



TEST CONDITIONS:
V_{DD} = 28 V, I_{DQ} = 1250 mA, F = 1960 MHz.

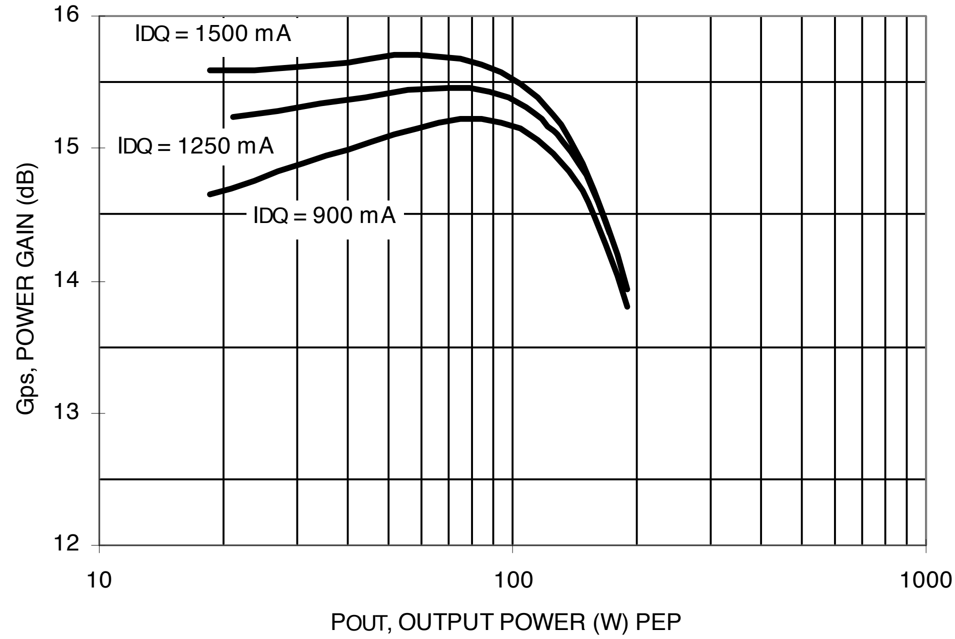
Figure 4. Output Power and Efficiency vs. Input Power



TEST CONDITIONS:
V_{DD} = 28 V, F = 1960 MHz, CW MEASUREMENT.

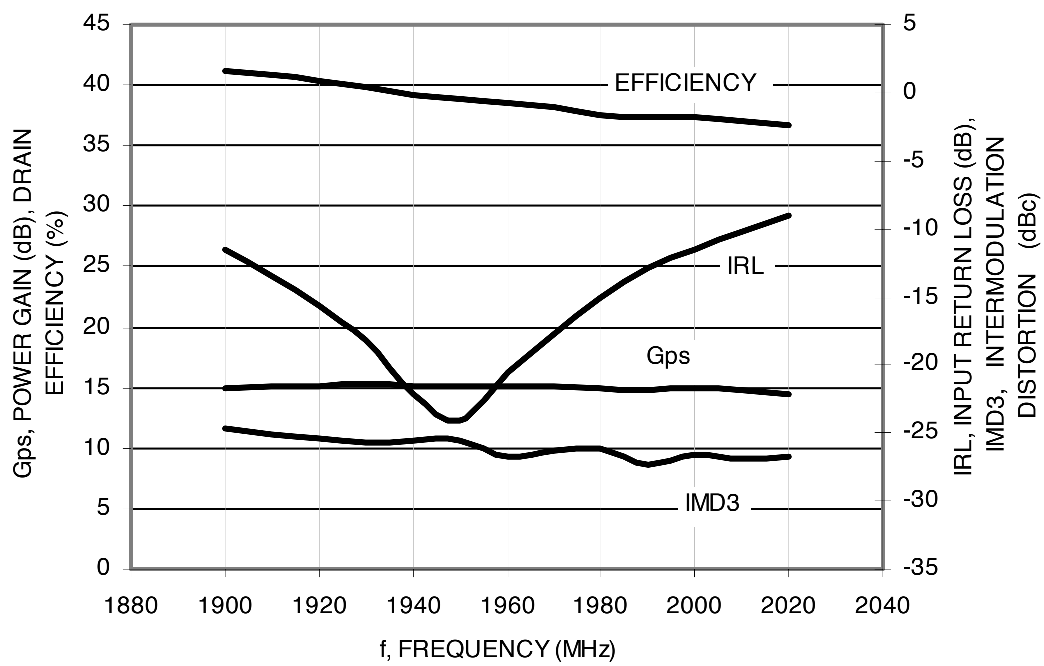
Figure 5. Power Gain vs. Output Power

Typical Performance Characteristics (continued)



TEST CONDITIONS:
V_{DD} = 28 V, F = 1960 MHz, 100 kHz TONE SPACING.

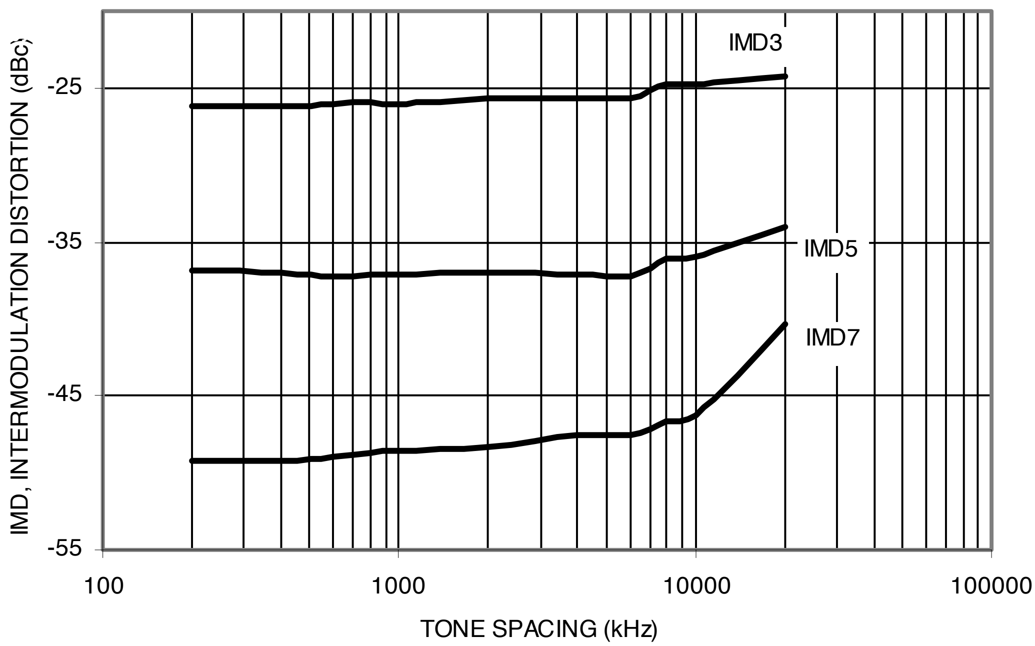
Figure 6. Two-Tone Gain vs. Output Power



TEST CONDITIONS:
V_{DD} = 28 V, I_{DQ} = 1250 mA, P_{OUT} = 125 W (PEP), 100 kHz TONE SPACING.

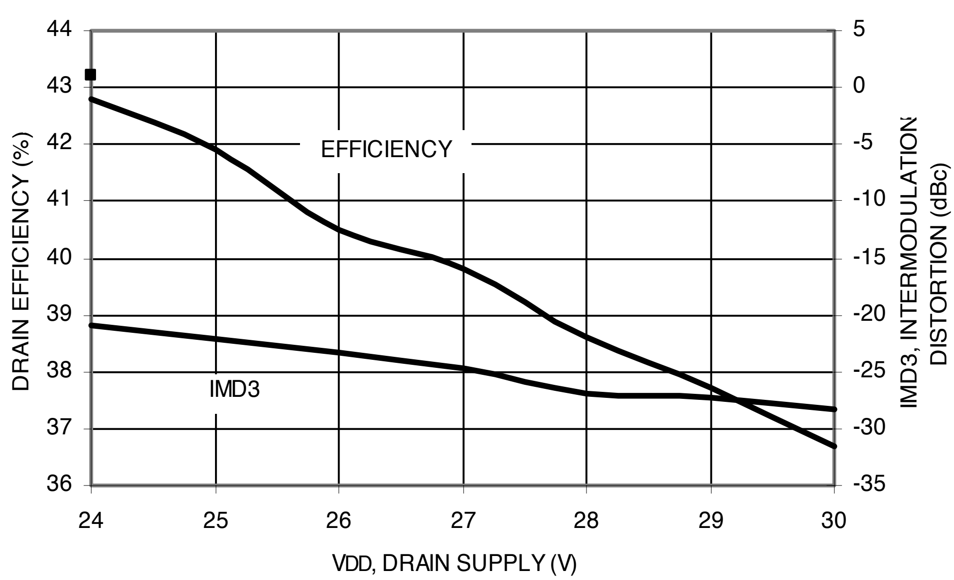
Figure 7. Two-Tone Broadband Performance

Typical Performance Characteristics (continued)



TEST CONDITIONS:
V_{DD} = 28 V, F = 1960 MHz, I_{DQ} = 1250 mA, P_{OUT} = 125 W (PEP).

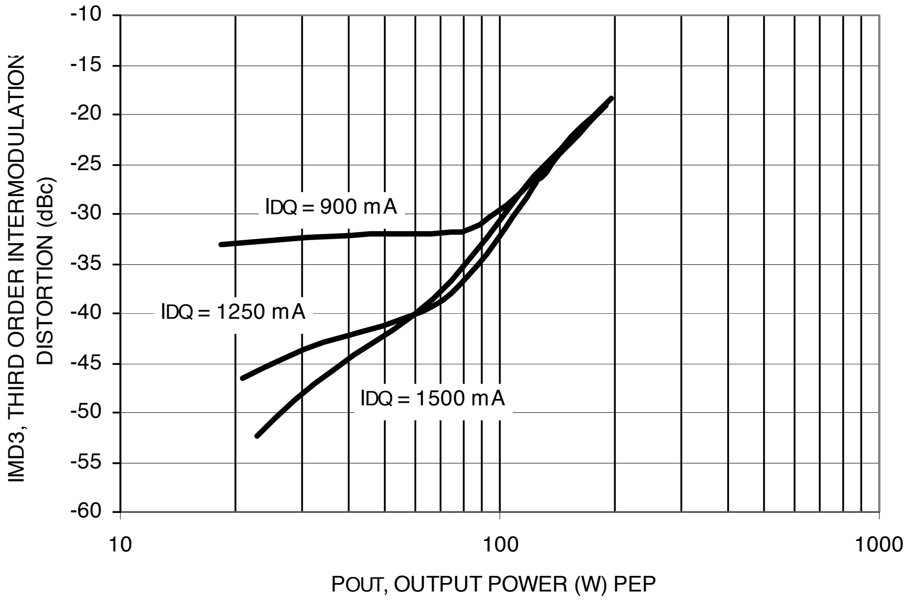
Figure 8. Two-Tone Intermodulation Products vs. Tone Spacing



TEST CONDITIONS:
F = 1960 MHz, I_{DQ} = 1250 mA, P_{OUT} = 125 W (PEP), 100 kHz TONE SPACING.

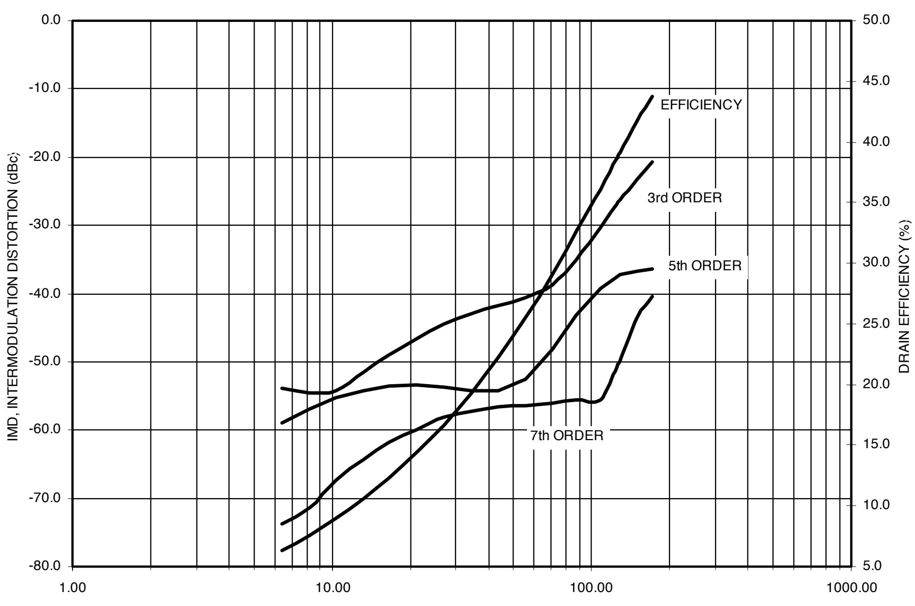
Figure 9. Two-Tone Intermodulation Distortion and Efficiency vs. Drain Supply

Typical Performance Characteristics (continued)



TEST CONDITIONS:
V_{DD} = 28 V, F = 1960 MHz, 100 kHz TONE SPACING.

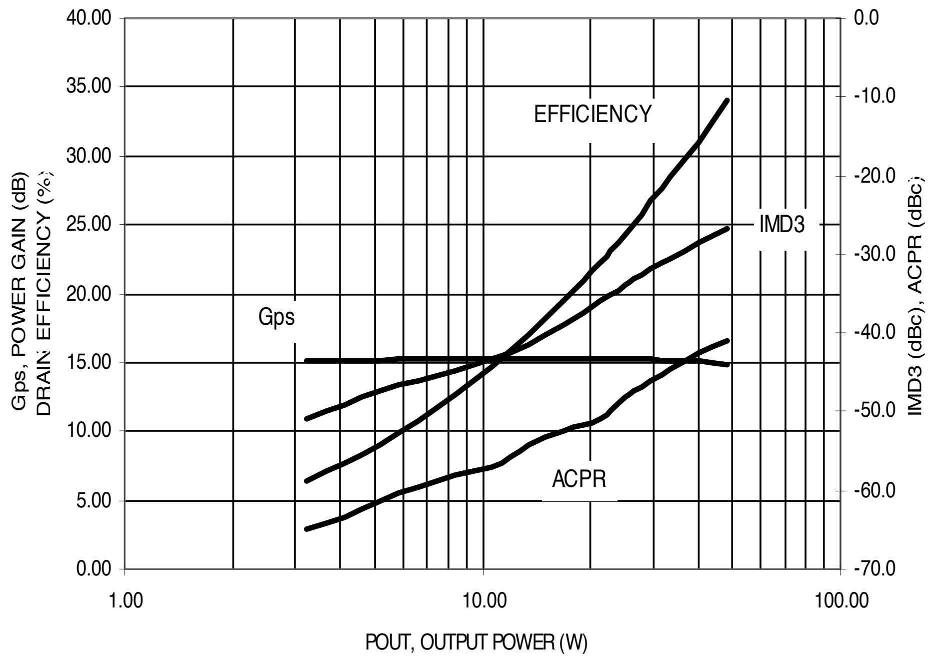
Figure 10. Third Order Intermodulation Distortion vs. Output Power



TEST CONDITIONS:
V_{DD} = 28 V, I_{DQ} = 1250 mA, F = 1960 MHz, 100 kHz TONE SPACING.

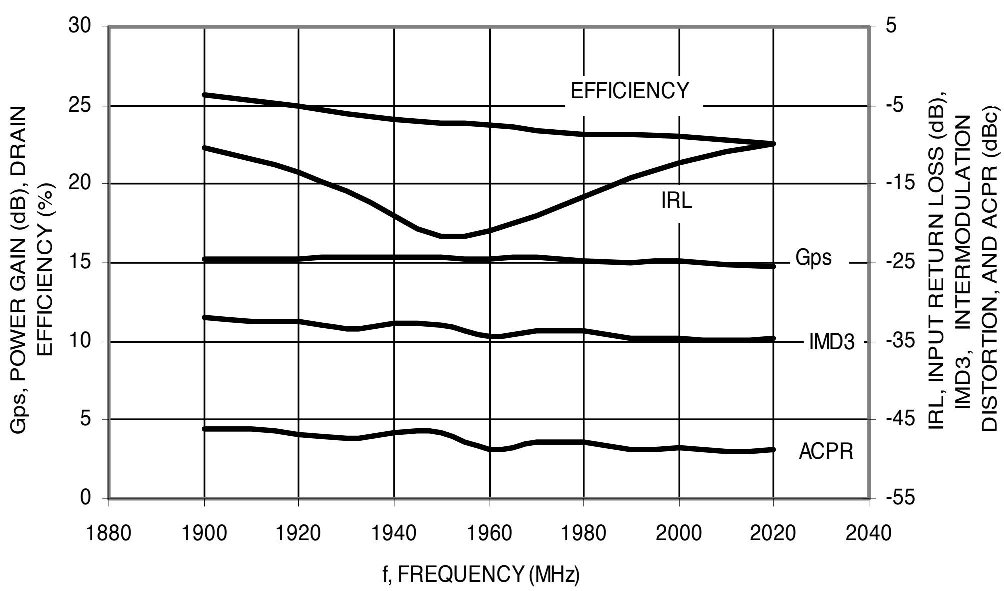
Figure 11. Intermodulation Distortion Products vs. Output Power

Typical Performance Characteristics (continued)



TEST CONDITIONS:
V_{DD} = 28 V, I_{DQ} = 1250 mA, F1 = 1960 MHz, F2 = 1962.5 MHz.
9 IS-95 CHANNELS/CARRIER, P/A RATIO = 9.72 dB AT 0.01% PROBABILITY.

Figure 12. Two Carrier IS-95 CDMA Performance vs. Output Power



TEST CONDITIONS:
V_{DD} = 28 V, I_{DQ} = 1250 mA, P_{OUT} = 24 W, 2 CARRIERS.
2.5 MHz SPACING, P/A RATIO = 9.72 dB AT 0.01%.

Figure 13. Two Carrier CDMA (IS-95) Broadband Performance

Package Dimensions

All dimensions are in inches. Tolerances are ±0.005 in. unless specified. Cut lead indicates drain.

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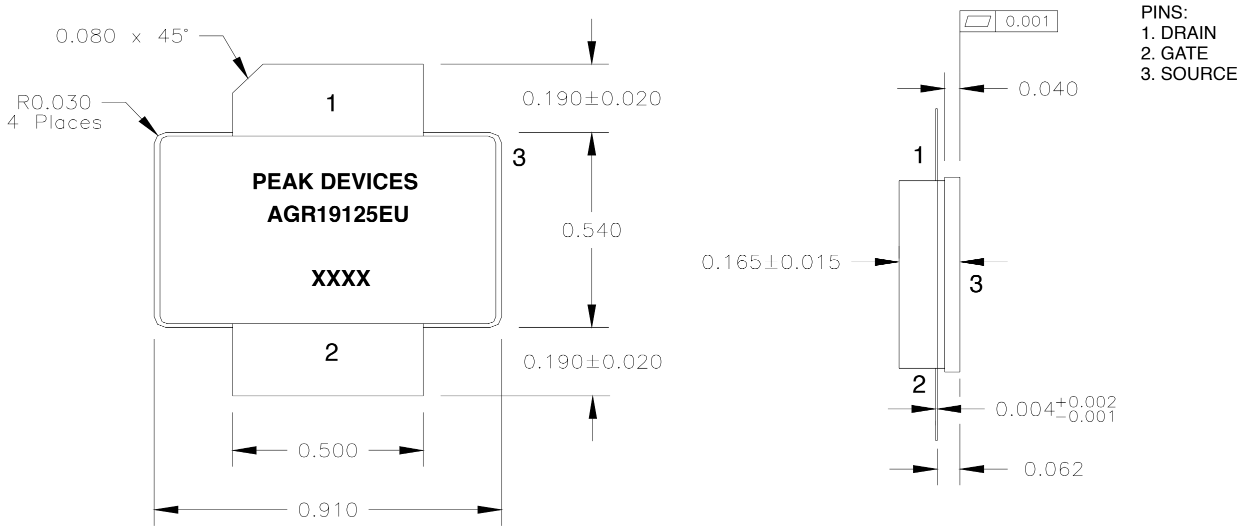

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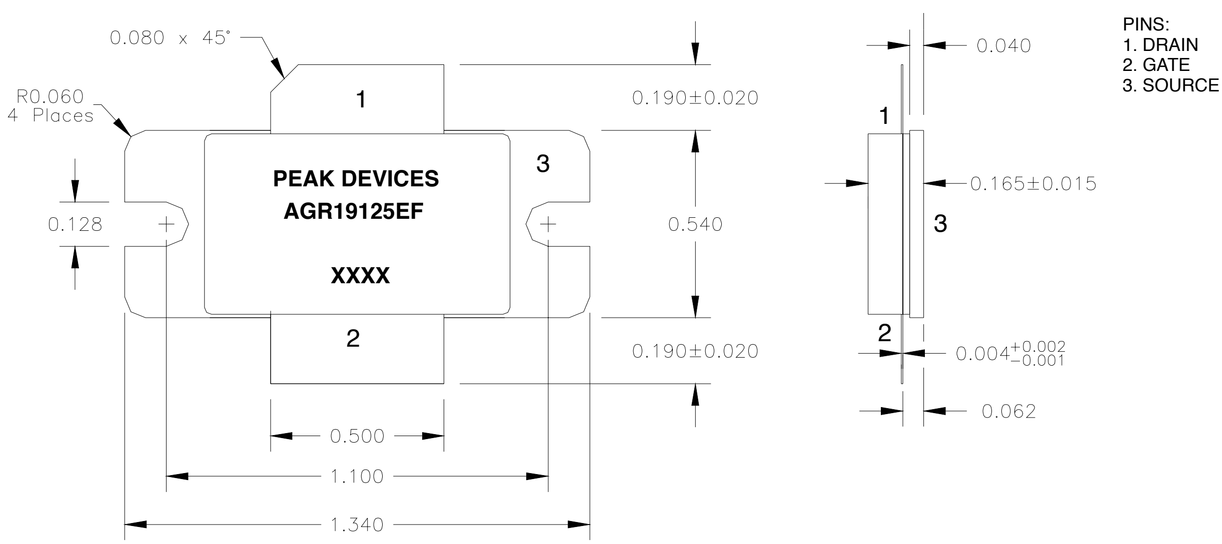

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