

RF Power Field Effect Transistor

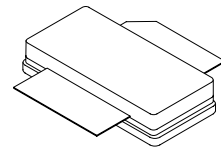
N-Channel Enhancement-Mode Lateral MOSFET

Designed for PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for $V_{DD} = 26$ Volts,
 $I_{DQ} = 850$ mA, $P_{out} = 18$ Watts Avg., $f_1 = 1930$ MHz, $f_2 = 1932.5$ MHz
 IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13)
 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured
 over a 30 kHz Bandwidth at $f_1 - 885$ KHz and $f_2 + 885$ kHz. Distortion
 Products Measured over 1.2288 MHz Bandwidth at $f_1 - 2.5$ MHz and
 $f_2 + 2.5$ MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
 Output Power — 18 Watts Avg.
 Power Gain — 13.0 dB
 Efficiency — 23%
 ACPR — -51 dB
 IM3 — -36.5 dBc
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1960 MHz, 90 Watts CW
 Output Power

Features

- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40μ" Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.

MRF19085LSR3
**1930 - 1990 MHz, 90 W, 26 V
 LATERAL N-CHANNEL
 RF POWER MOSFET**

**CASE 465A-06, STYLE 1
 NI-780S**
Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	273 1.56	W W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$
Case Operating Temperature	T_C	150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

Table 2. Thermal Characteristics

Characteristic	Symbol	Value ⁽¹⁾	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.79	$^\circ\text{C/W}$

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)

1. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>.
 Select Documentation/Application Notes - AN1955.

Table 4. Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 100\text{ }\mu\text{Adc}$)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	10	μAdc
Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	—	—	1	μAdc
On Characteristics (DC)					
Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 200\text{ }\mu\text{Adc}$)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage ($V_{DS} = 26\text{ Vdc}$, $I_D = 850\text{ mAdc}$)	$V_{GS(Q)}$	2.5	3.5	4.5	Vdc
Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 2\text{ Adc}$)	$V_{DS(on)}$	—	0.18	0.210	Vdc
Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 2\text{ Adc}$)	g_{fs}	—	6	—	S
Dynamic Characteristics					
Reverse Transfer Capacitance (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1.0\text{ MHz}$)	C_{rss}	—	3.6	—	pF
Functional Tests (In Freescale Test Fixture, 50 ohm system) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.					
Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 18\text{ W Avg.}$, $I_{DQ} = 850\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1932.5\text{ MHz}$)	G_{ps}	12	13	—	dB
Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 18\text{ W Avg.}$, $I_{DQ} = 850\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1932.5\text{ MHz}$)	η	21	23	—	%
3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 18\text{ W Avg.}$, $I_{DQ} = 850\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1932.5\text{ MHz}$; IM3 measured over 1.2288 MHz bandwidth @ $f_1 = -2.5\text{ MHz}$ and $f_2 = +2.5\text{ MHz}$)	IMD	—	-36.5	-35	dBc
Adjacent Channel Power Ratio ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 18\text{ W Avg.}$, $I_{DQ} = 850\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1932.5\text{ MHz}$; ACPR measured over 30 kHz bandwidth @ $f_1 = -885\text{ MHz}$ and $f_2 = +885\text{ MHz}$)	ACPR	—	-51	-48	dBc
Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 18\text{ W Avg.}$, $I_{DQ} = 850\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1932.5\text{ MHz}$)	IRL	—	-12	-9	dB

1. Part is internally matched both on input and output.

(continued)

Table 4. Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Test Fixture)					
Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 850\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	G_{ps}	—	13	—	dB
Two-Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 850\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	η	—	36	—	%
3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 850\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IMD	—	-31	—	dBc
Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 850\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IRL	—	-12	—	dB
P_{out} , 1 dB Compression Point ($V_{DD} = 26\text{ Vdc}$, $I_{DQ} = 850\text{ mA}$, $f = 1990\text{ MHz}$)	P1dB	—	90	—	W

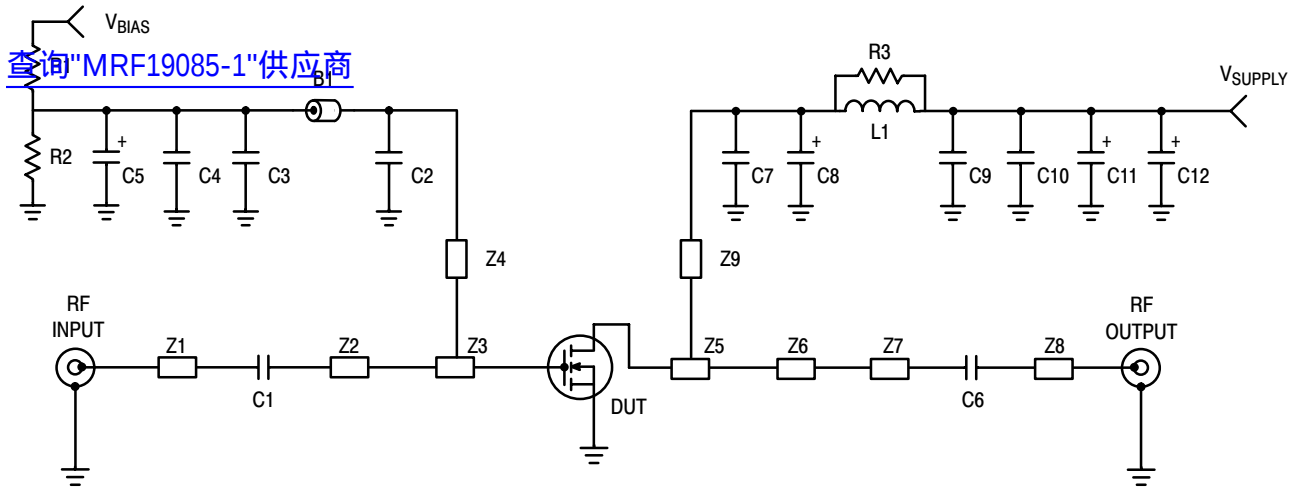
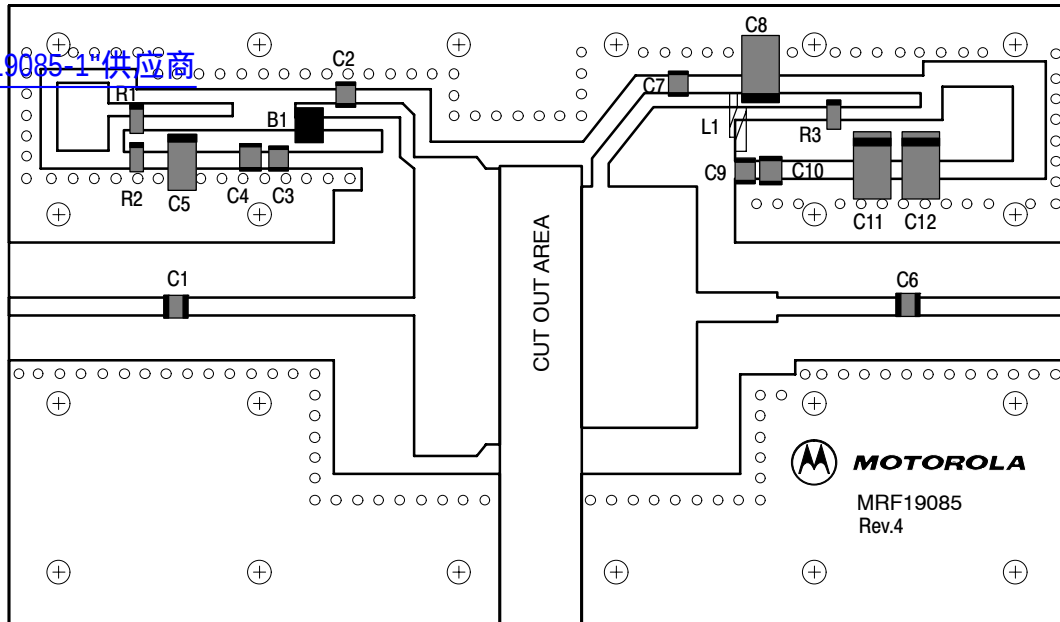


Figure 1. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Schematic

Table 5. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1	Short Ferrite Bead	2743019447	Fair Rite
C1	51 pF Chip Capacitor	ATC100B510JT500XT	ATC
C2, C7	5.1 pF Chip Capacitors	ATC100B5R1JT500XT	ATC
C3, C9	1000 pF Chip Capacitors	ATC100B102JT500XT	ATC
C4, C10	0.1 μ F Chip Capacitors	CDR33BX104AKYS	Kemet
C5	0.1 μ F Tantalum Surface Mount Capacitor	T491C105M050AT	Kemet
C6	10 pF Chip Capacitor	ATC100B100JT500XT	ATC
C8	10 μ F Tantalum Surface Mount Capacitor	T495D106K035AT	Kemet
C11, C12	22 μ F Tantalum Surface Mount Capacitors	T491D226K035AT	Kemet
L1	1 Turn, 20 AWG, 0.100" ID		
R1	1.0 k Ω , 1/4 W Chip Resistor	CRCW12061001FKEA	Vishay
R2	220 k Ω , 1/4 W Chip Resistor	CRCW12062200FKEA	Vishay
R3	10 Ω , 1/4 W Chip Resistor	CRCW120610R0FKEA	Vishay
Z1	Microstrip	0.750" x 0.0840"	
Z2	Microstrip	1.090" x 0.0840"	
Z3	Microstrip	0.400" x 1.400"	
Z4	Microstrip	0.520" x 0.050"	
Z5	Microstrip	0.540" x 1.133"	
Z6	Microstrip	0.400" x 0.140"	
Z7	Microstrip	0.555" x 0.0840"	
Z8	Microstrip	0.720" x 0.0840"	
Z9	Microstrip	0.560" x 0.070"	
Board	0.030" Glass Teflon [®]	GX-0300-55-22, $\epsilon_r = 2.55$	Arlon
PCB	Etched Circuit Boards	MRF19085 Rev. 4	CMR

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Freescall has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescall Semiconductor signature/logo. PCBs may have either Motorola or Freescall markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Component Layout

TYPICAL CHARACTERISTICS

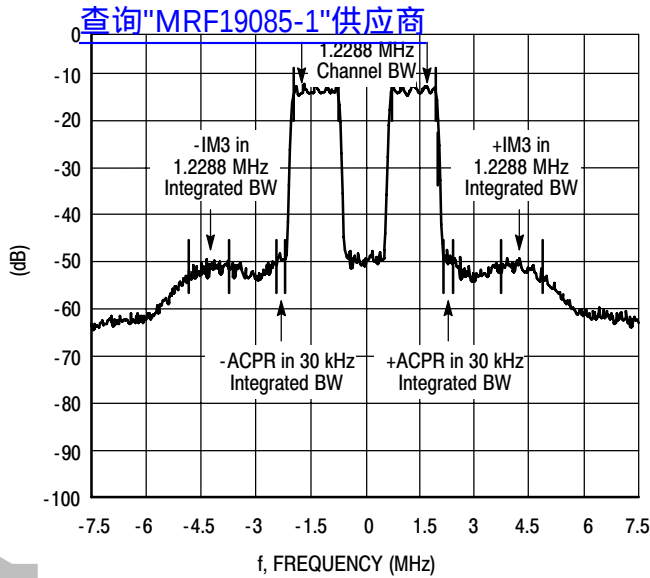


Figure 3. 2-Carrier N-CDMA Spectrum

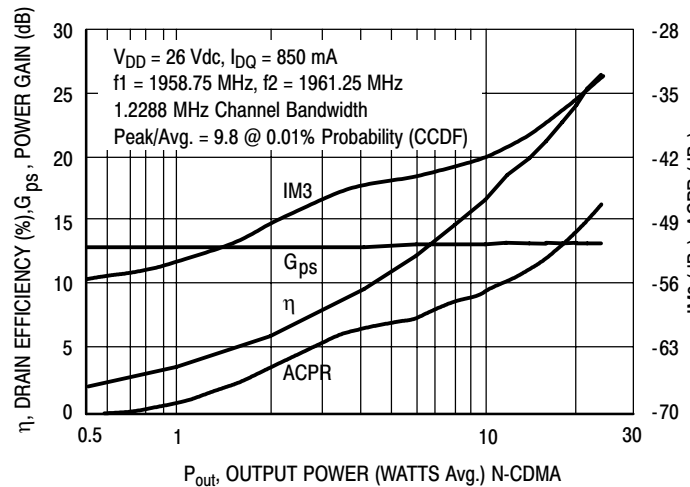


Figure 4. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

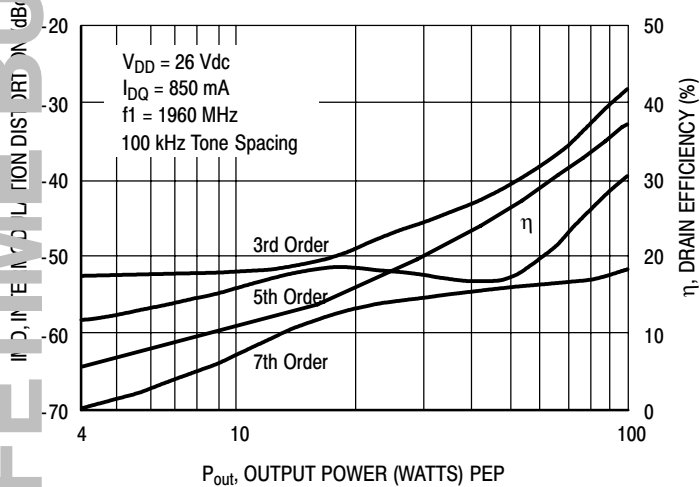


Figure 5. Intermodulation Distortion Products versus Output Power

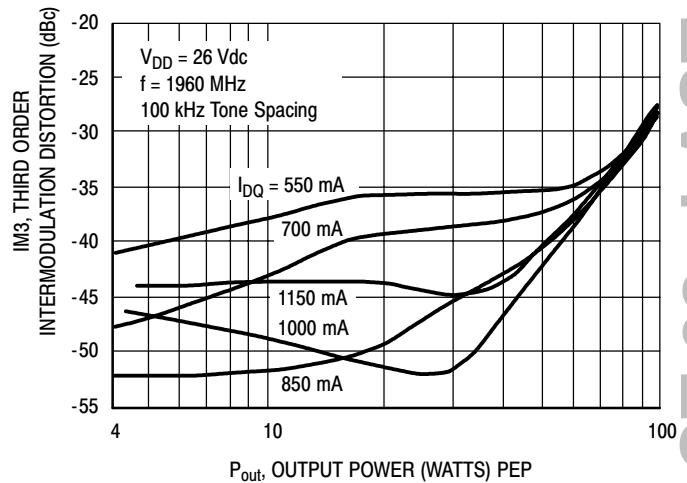


Figure 6. Third Order Intermodulation Distortion versus Output Power and I_{DQ}

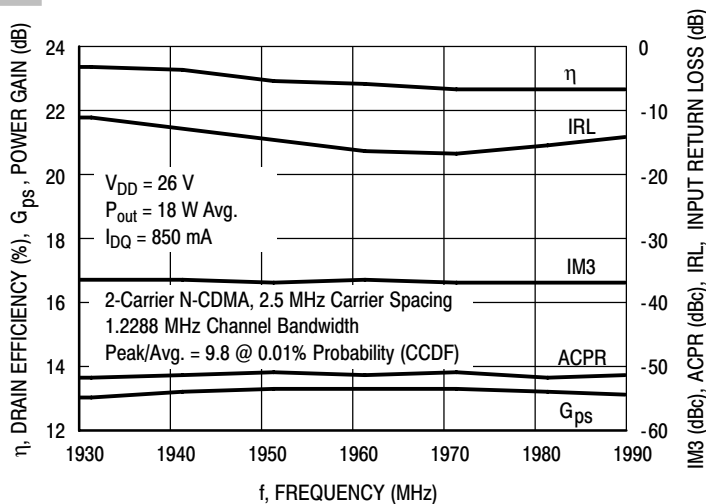


Figure 7. 2-Carrier N-CDMA Broadband Performance

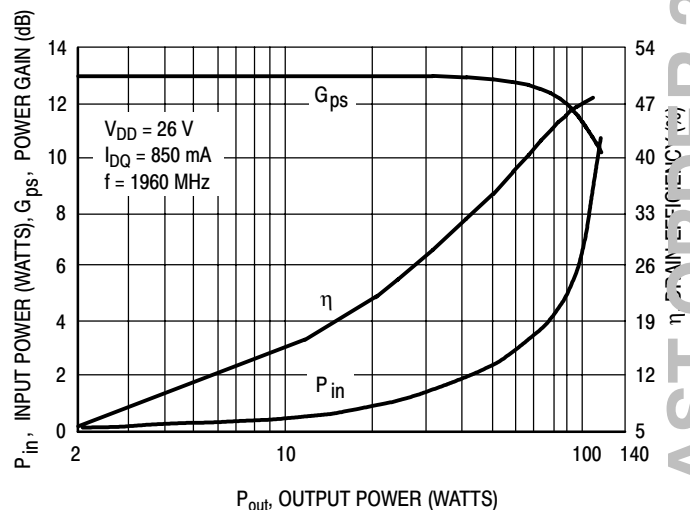


Figure 8. CW Performance

TYPICAL CHARACTERISTICS

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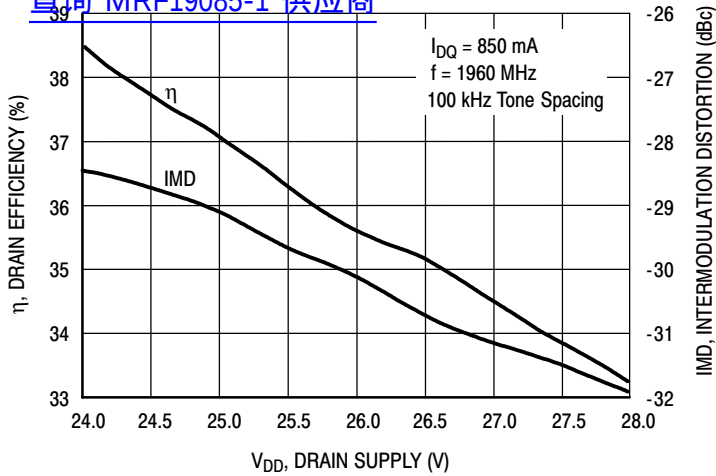


Figure 9. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

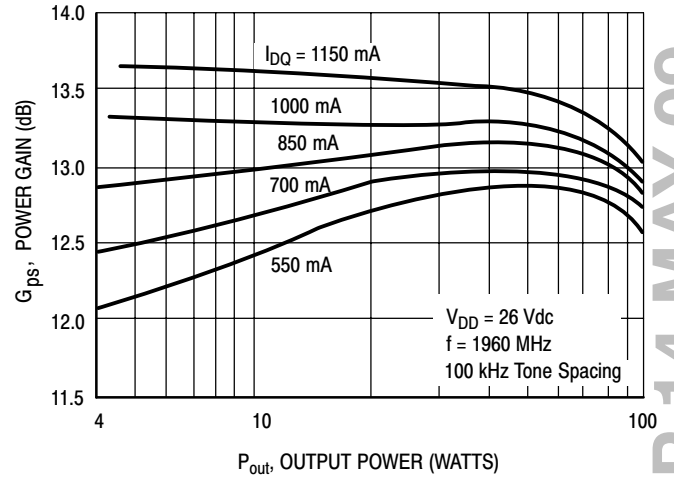


Figure 10. Two-Tone Power Gain versus Output Power

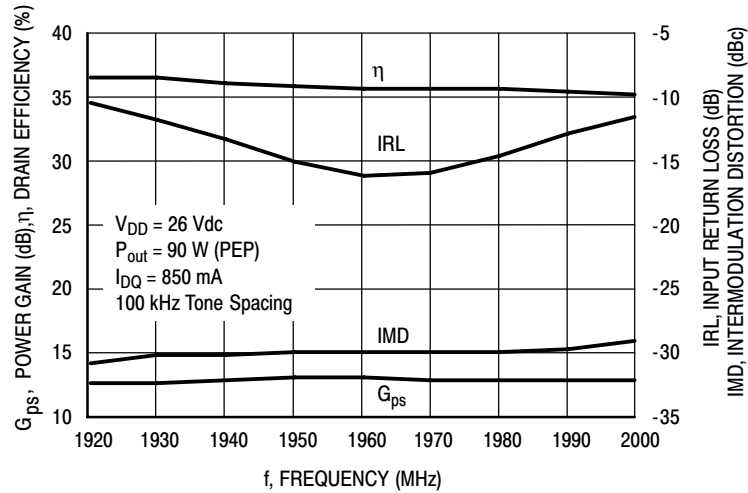
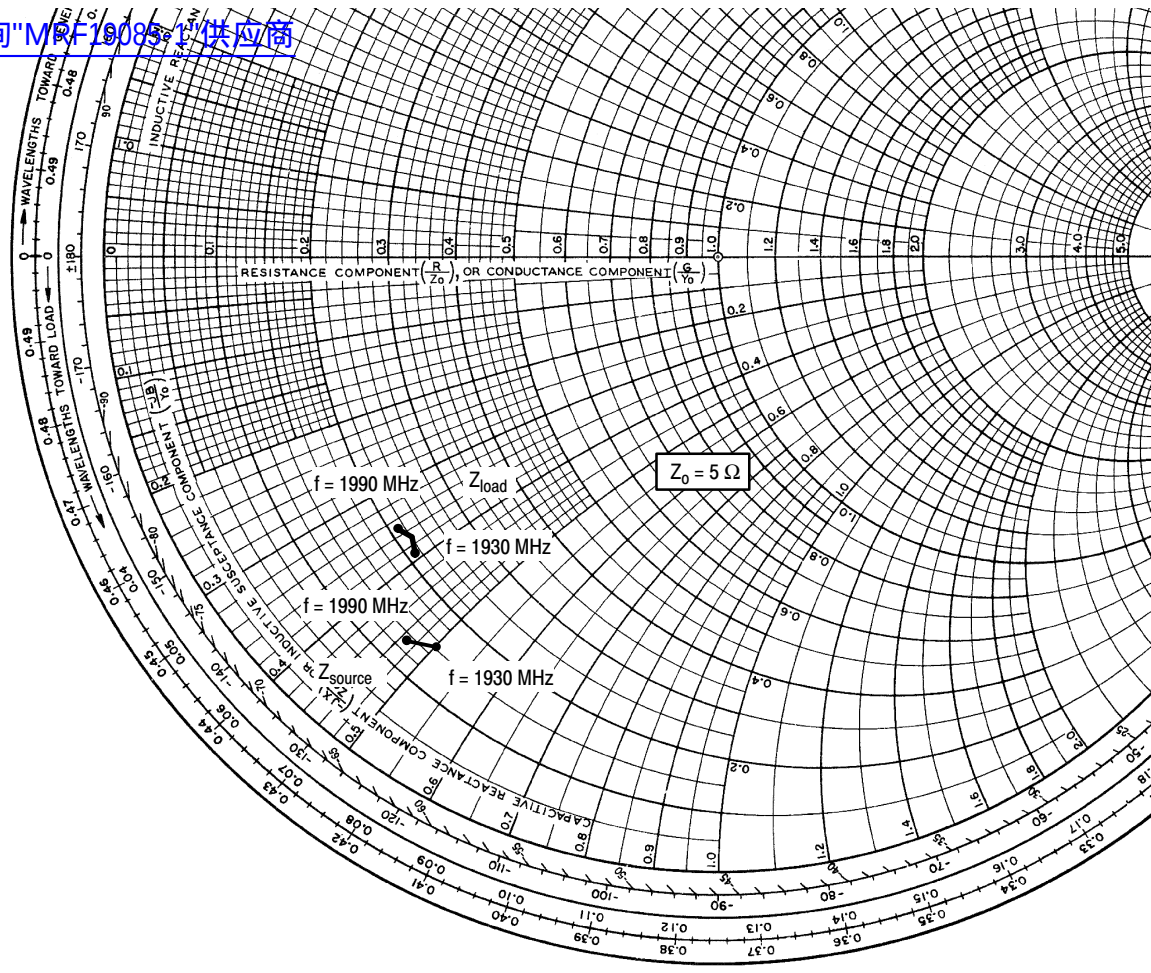


Figure 11. Two-Tone Broadband Performance

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$V_{DD} = 26\text{ V}$, $I_{DQ} = 850\text{ mA}$, $P_{out} = 18\text{ W Avg.}$

f MHz	Z_{source} Ω	Z_{load} Ω
1930	$0.75 - j2.50$	$1.05 - j1.95$
1960	$0.70 - j2.40$	$1.10 - j1.85$
1990	$0.65 - j2.35$	$1.05 - j1.75$

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

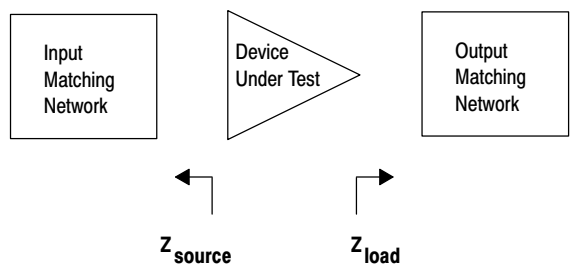
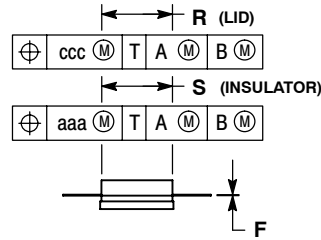
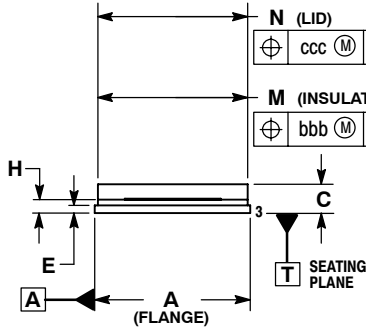
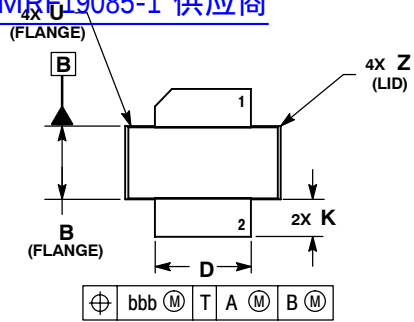


Figure 12. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

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**CASE 465A-06
ISSUE H
NI-780S
MRF19085LSR3**

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
 2. CONTROLLING DIMENSION: INCH.
 3. DELETED
 4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.61	20.02
N	0.772	0.788	19.61	20.02
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
U	---	0.040	---	1.02
Z	---	0.030	---	0.76
aaa	0.005 REF		0.127 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
5. SOURCE

PRODUCT DOCUMENTATION

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Refer to the following documents to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
9	Oct. 2008	• Data sheet revised to reflect part status change, p. 1, including use of applicable overlay. • Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN12779, p. 1, 2 • Updated Part Numbers in Table 5, Component Designations and Values, to RoHS compliant part numbers, p. 4 • Added Product Documentation and Revision History, p. 10

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