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Freescale Semiconductor
Technical Data

Document Number: MRF19085
Rev. 8, 5/2006

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF19085LR3
MRF19085LSR3

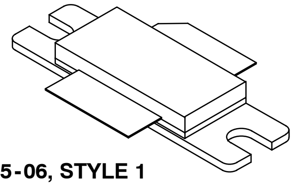
1930-1990 MHz, 90 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFETs

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

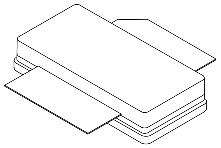
- Typical 2-Carrier N-CDMA Performance for V_{DD} = 26 Volts, I_{DQ} = 850 mA, P_{out} = 18 Watts Avg., f1 = 1960 MHz, f2 = 1962.5 MHz IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured over a 30 kHz Bandwidth at f1 -885 Khz and f2 +885 kHz. Distortion Products Measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +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.



CASE 465-06, STYLE 1
NI-780
MRF19085LR3



CASE 465A-06, STYLE 1
NI-780S
MRF19085LSR3

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°C Derate above 25°C	P_D	273 1.56	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (1)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.79	°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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 100 μAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics (DC)					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 200 μAdc)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 850 mAdc)	$V_{GS(Q)}$	2.5	3.5	4.5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2 Adc)	$V_{DS(on)}$	—	0.18	0.210	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	6	—	S
Dynamic Characteristics					
Reverse Transfer Capacitance [1] (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 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 Vdc, P_{out} = 18 W Avg., I_{DQ} = 850 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz)	G_{ps}	12	13	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 18 W Avg., I_{DQ} = 850 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz)	η	21	23	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 18 W Avg., I_{DQ} = 850 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz); IM3 measured over 1.2288 MHz bandwidth @ f1 -2.5 MHz and f2 = +2.5 MHz)	IMD	—	-36.5	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 26 Vdc, P_{out} = 18 W Avg., I_{DQ} = 850 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz); ACPR measured over 30 kHz bandwidth @ f1 -885 MHz and f2 =+885 MHz)	ACPR	—	-51	-48	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 18 W Avg., I_{DQ} = 850 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz)	IRL	—	-12	-9	dB

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

(continued)

Table 4. Electrical Characteristics (T_C = 25°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 Vdc, P_{out} = 90 W PEP, I_{DQ} = 850 mA, f = 1930 MHz and 1990 MHz, Tone Spacing = 100 kHz)	G_{ps}	—	13	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 850 mA, f = 1930 MHz and 1990 MHz, Tone Spacing = 100 kHz)	η	—	36	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 850 mA, f = 1930 MHz and 1990 MHz, Tone Spacing = 100 kHz)	IMD	—	-31	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 850 mA, f = 1930 MHz and 1990 MHz, Tone Spacing = 100 kHz)	IRL	—	-12	—	dB
P_{out}, 1 dB Compression Point (V_{DD} = 26 Vdc, I_{DQ} = 850 mA, f = 1990 MHz)	P1dB	—	90	—	W

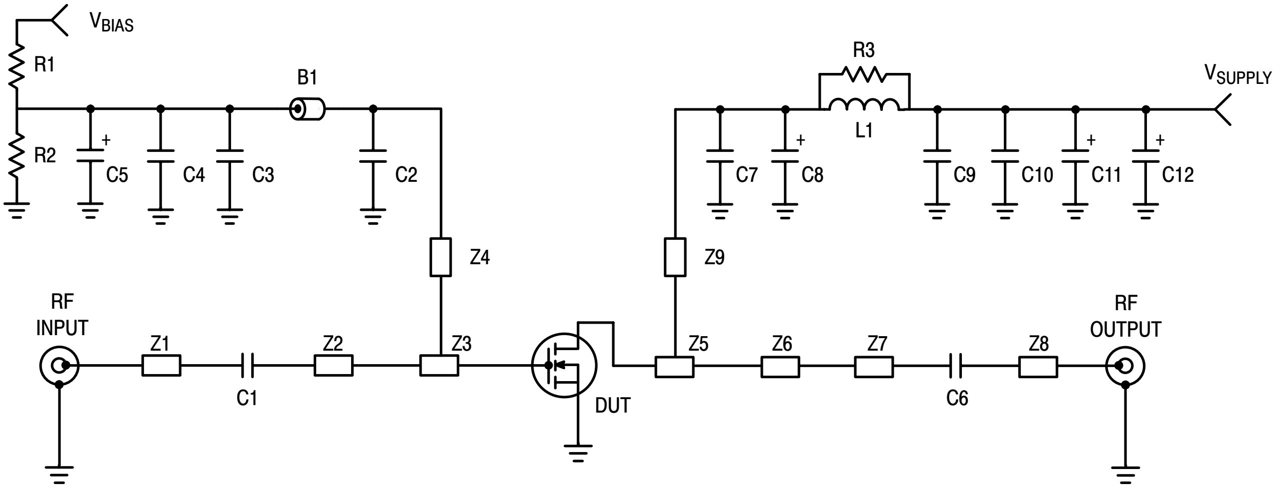
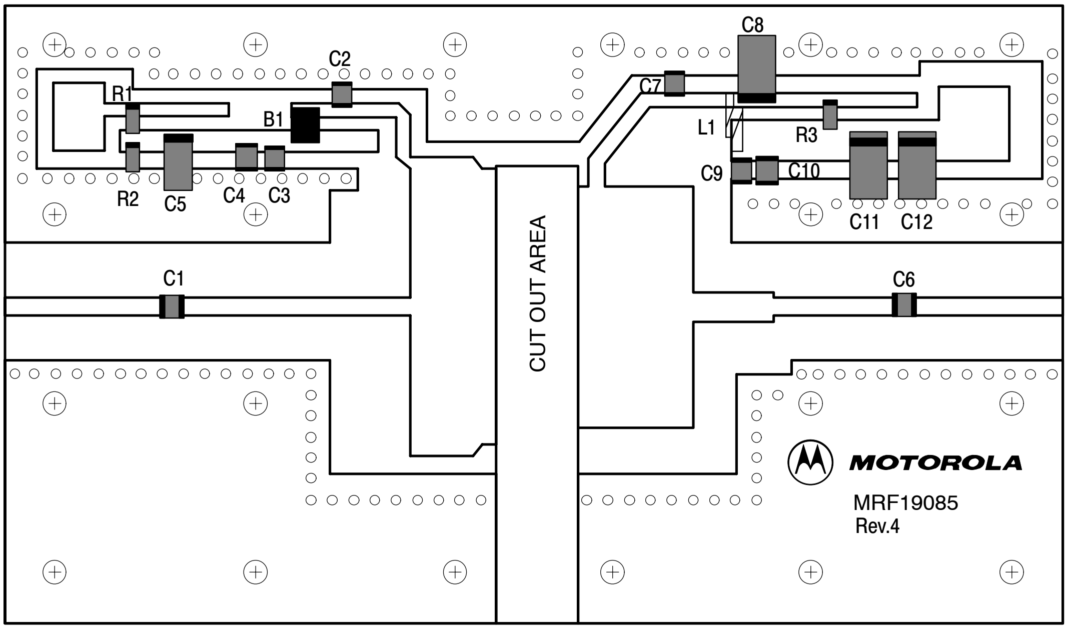


Figure 1. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Schematic

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	100B510JCA500X	ATC
C2, C7	5.1 pF Chip Capacitors	100B5R1JCA500X	ATC
C3, C9	1000 pF Chip Capacitors	100B102JCA500X	ATC
C4, C10	0.1 μF Chip Capacitors	CDR33BX104AKWS	Kemet
C5	0.1 μF Tantalum Surface Mount Capacitor	T491C105M050	Kemet
C6	10 pF Chip Capacitor	100B100JCA500X	ATC
C8	10 μF Tantalum Surface Mount Capacitor	T495X106K035AS4394	Kemet
C11, C12	22 μF Tantalum Surface Mount Capacitors	T491X226K035AS4394	Kemet
L1	1 Turn, 20 AWG, 0.100″ ID		
N1, N2	Type N Flange Mounts	3052-1648-10	Omni Spectra
R1	1.0 kΩ, 1/8 W Chip Resistor		
R2	220 kΩ, 1/8 W Chip Resistor		
R3	10 Ω, 1/8 W Chip Resistor		
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, ε_r = 2.55	Keene
PCB	Etched Circuit Boards	MRF19085 Rev. 4	CMR



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale 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

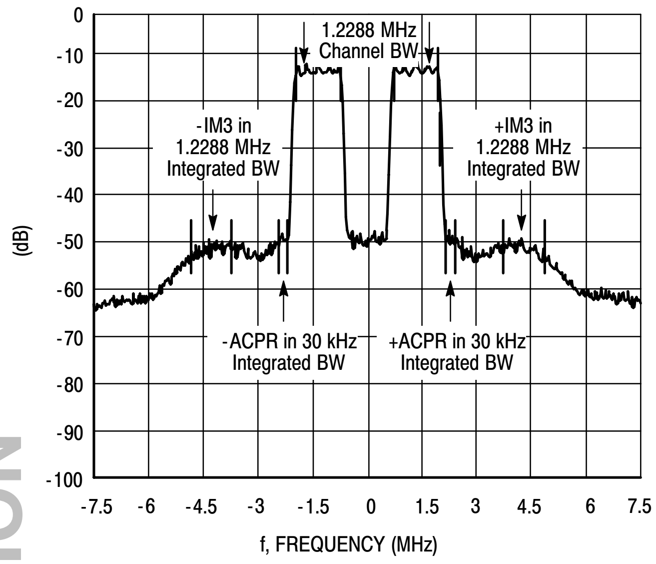


Figure 3. 2-Carrier N-CDMA Spectrum

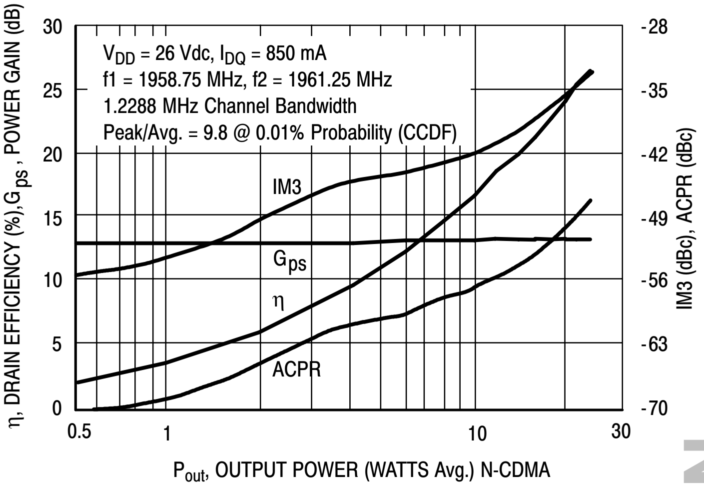


Figure 4. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

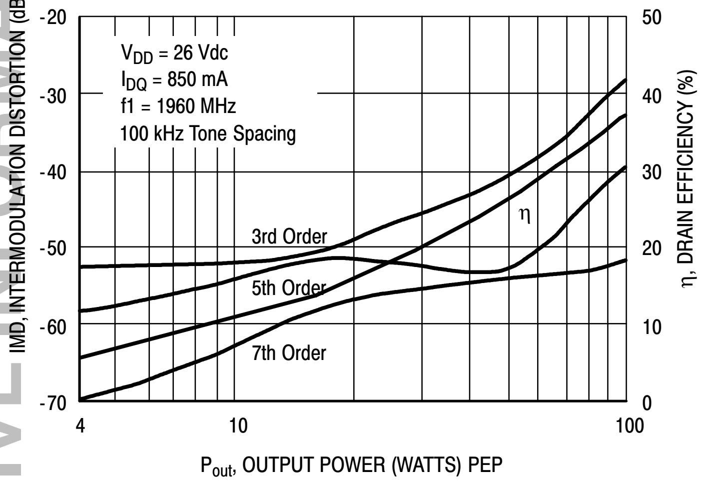


Figure 5. Intermodulation Distortion Products versus Output Power

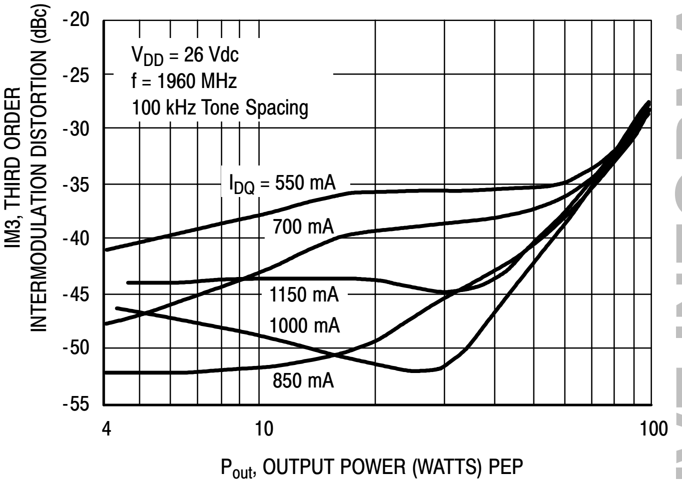


Figure 6. Third Order Intermodulation Distortion versus Output Power and I_{DQ}

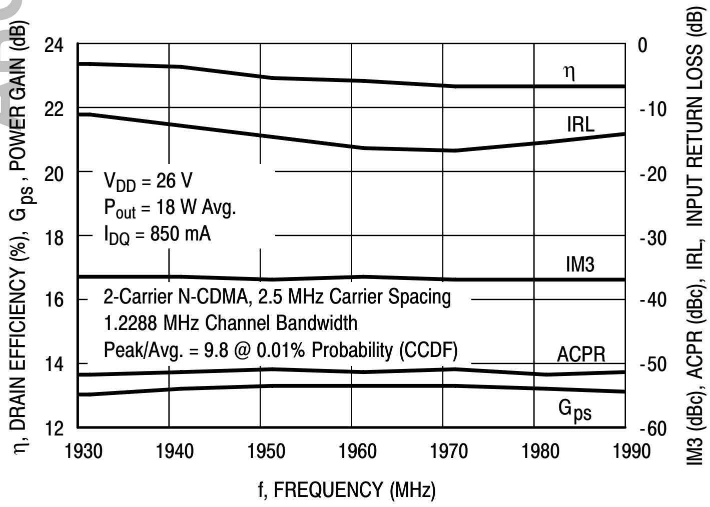


Figure 7. 2-Carrier N-CDMA Broadband Performance

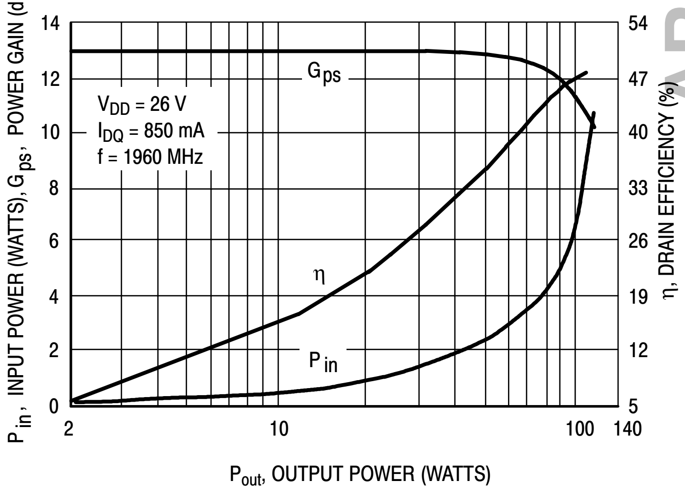


Figure 8. CW Performance

TYPICAL CHARACTERISTICS

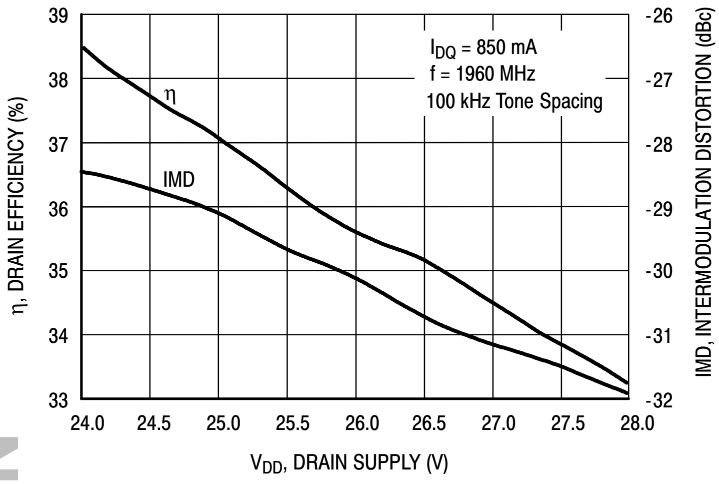


Figure 9. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

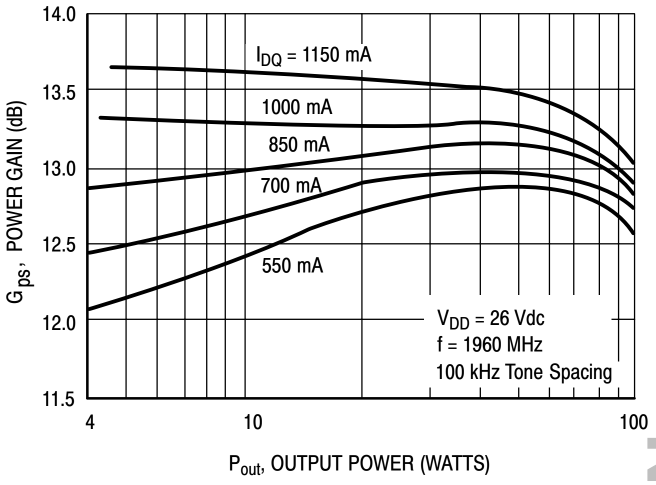


Figure 10. Two-Tone Power Gain versus Output Power

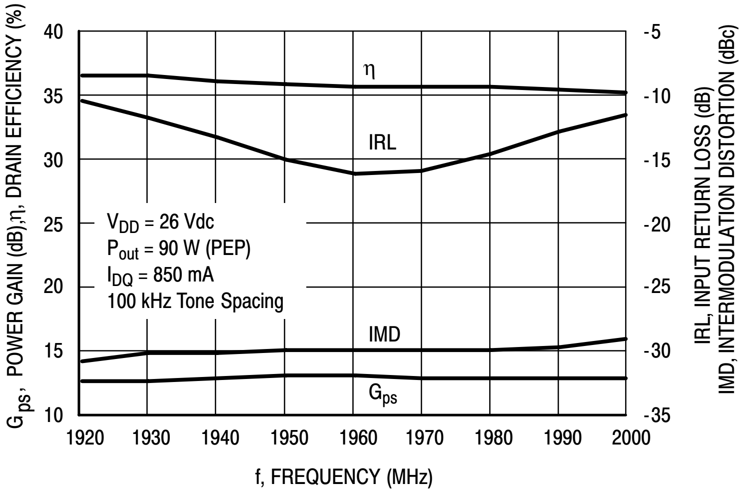
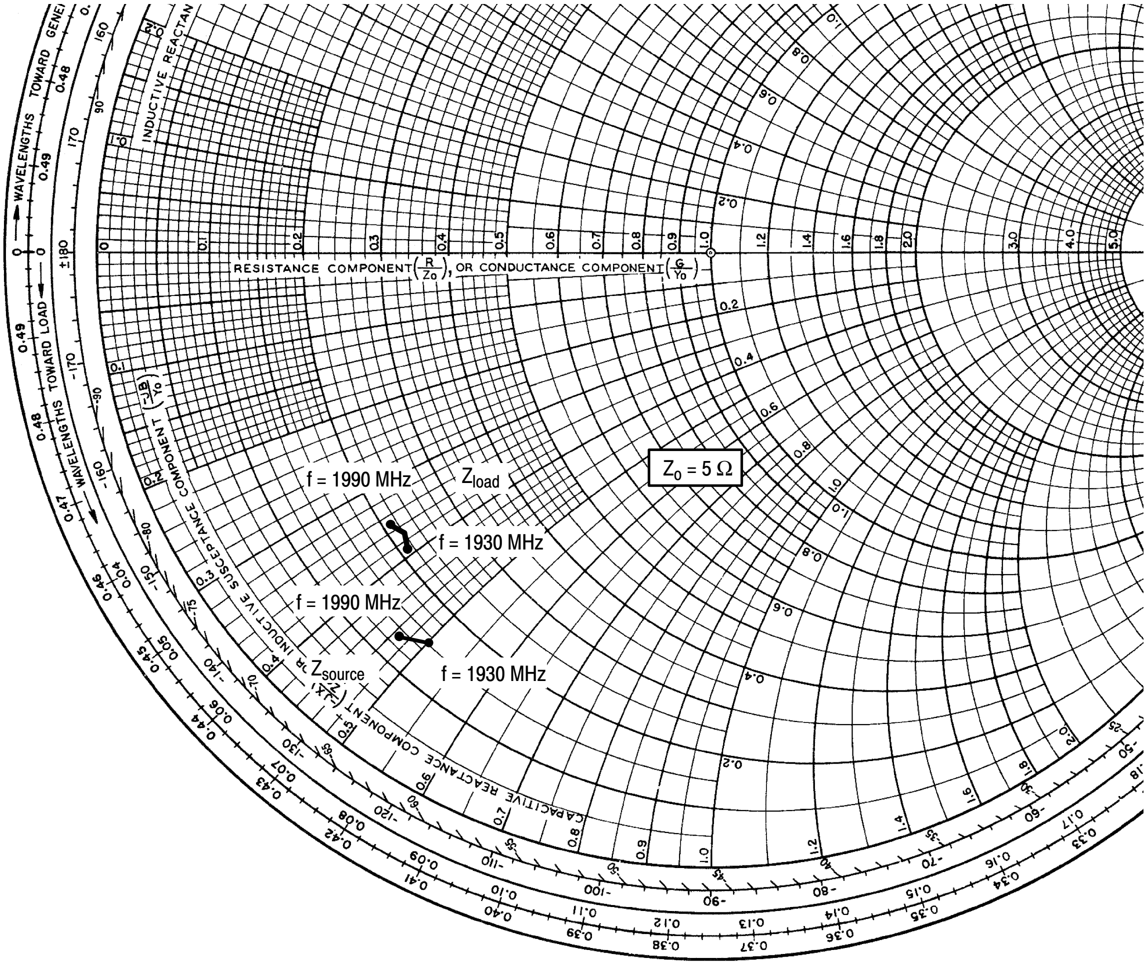


Figure 11. Two-Tone Broadband Performance



V_{DD} = 26 V, I_{DQ} = 850 mA, P_{out} = 18 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.

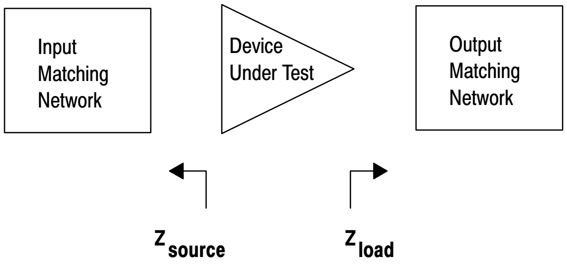
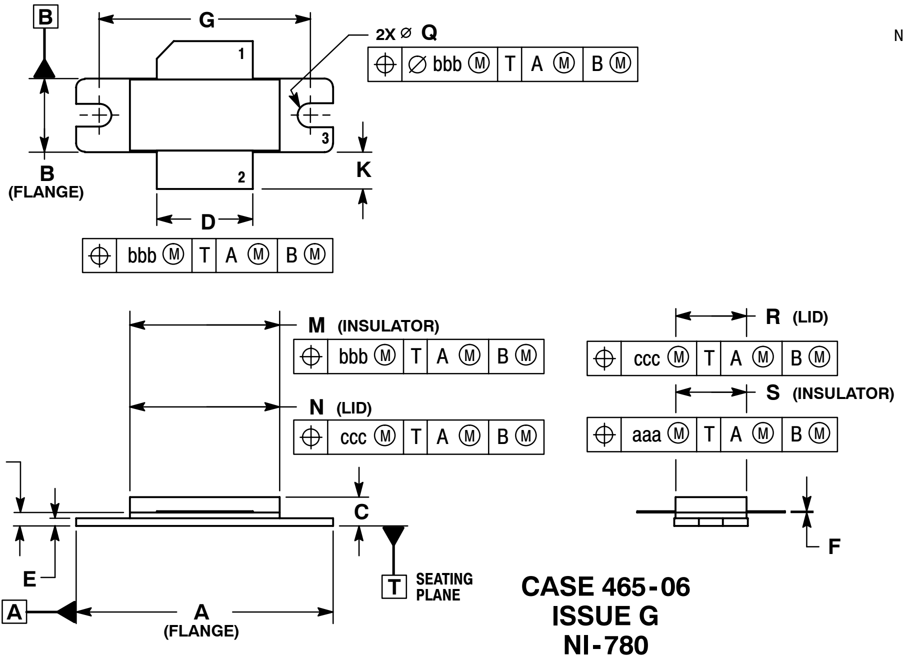


Figure 12. Series Equivalent Source and Load Impedance

NOTES

NOTES

PACKAGE DIMENSIONS

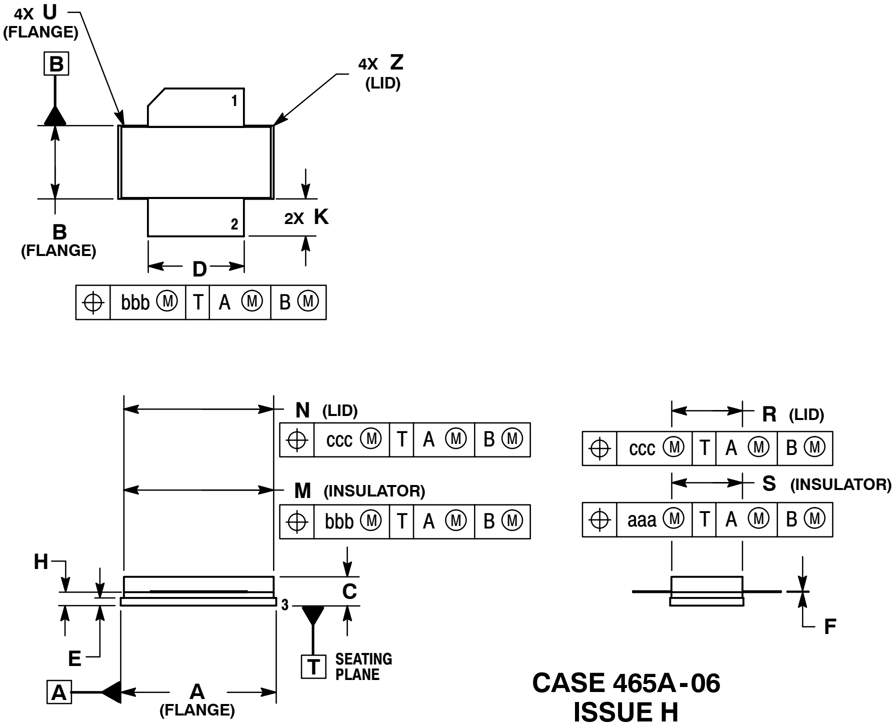


CASE 465-06
ISSUE G
NI-780
MRF19085LR3

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.

	INCHES		**MILLIMETERS**	
DIM	**MIN**	**MAX**	**MIN**	**MAX**
A	1.335	1.345	33.91	34.16
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
G	1.100 BSC		27.94 BSC	
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	⌀.118	⌀.138	⌀3.00	⌀3.51
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
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
3. SOURCE



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

NOTES:
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	INCHES		**MILLIMETERS**	
DIM	**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

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