

# RF Power Field Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed for GSM and GSM EDGE base station applications with frequencies from 1930 to 1990 MHz. Suitable for TDMA, CDMA, and multicarrier amplifier applications.

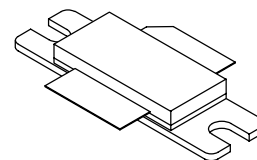
- GSM and GSM EDGE Performance, Full Frequency Band (1930 - 1990 MHz)  
Power Gain - 12.5 dB (Typ) @ 85 Watts CW  
Efficiency - 50% (Typ) @ 85 Watts CW
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1960 MHz, 85 Watts CW Output Power

### Features

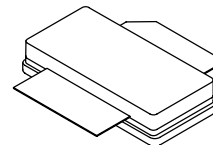
- Internally Matched for Ease of Use
- High Gain, High Efficiency, and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available with Low Gold Plating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

**MRF18085BLR3**  
**MRF18085BLSR3**

**1930-1990 MHz, 85 W, 26 V**  
**GSM/GSM EDGE**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 465-06, STYLE 1**  
**NI-780**  
**MRF18085BLR3**



**CASE 465A-06, STYLE 1**  
**NI-780S**  
**MRF18085BLSR3**

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**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	-0.5, +65	Vdc
Gate-Source Voltage	V <sub>GS</sub>	-0.5, +15	Vdc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	273 1.56	W W/°C
Storage Temperature Range	T <sub>stg</sub>	- 65 to +150	°C
Case Operating Temperature	T <sub>C</sub>	150	°C
Operating Junction Temperature	T <sub>J</sub>	200	°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value <sup>(1)</sup>	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	0.79	°C/W

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

**Table 3. ESD Protection Characteristics**

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
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**Off Characteristics**

Drain-Source Breakdown Voltage ( $V_{GS} = 0 \text{ Vdc}$ , $I_D = 100 \mu\text{Adc}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 26 \text{ Vdc}$ , $V_{GS} = 0 \text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Gate-Source Leakage Current ( $V_{GS} = 5 \text{ Vdc}$ , $V_{DS} = 0 \text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$

**On Characteristics**

Gate Threshold Voltage ( $V_{DS} = 10 \text{ Vdc}$ , $I_D = 200 \mu\text{Adc}$ )	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26 \text{ Vdc}$ , $I_D = 600 \text{ mAdc}$ )	$V_{GS(Q)}$	2.5	3.9	4.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10 \text{ Vdc}$ , $I_D = 2 \text{ Adc}$ )	$V_{DS(on)}$	—	0.18	0.21	Vdc

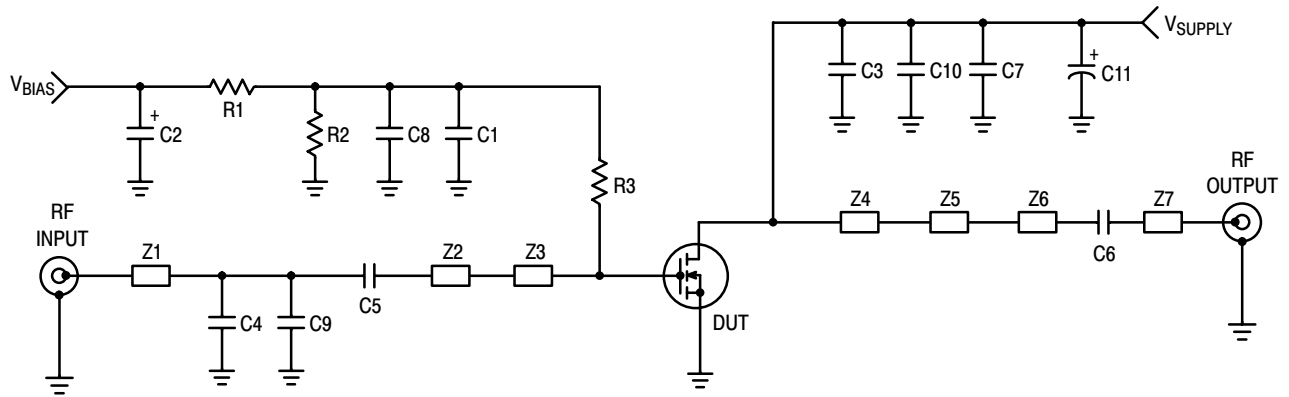
**Dynamic Characteristics**

Reverse Transfer Capacitance <sup>(1)</sup> ( $V_{DS} = 26 \text{ Vdc}$ , $V_{GS} = 0$ , $f = 1 \text{ MHz}$ )	$C_{rss}$	—	3.6	—	pF
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**Functional Tests** (In Freescale Test Fixture, 50 ohm system)

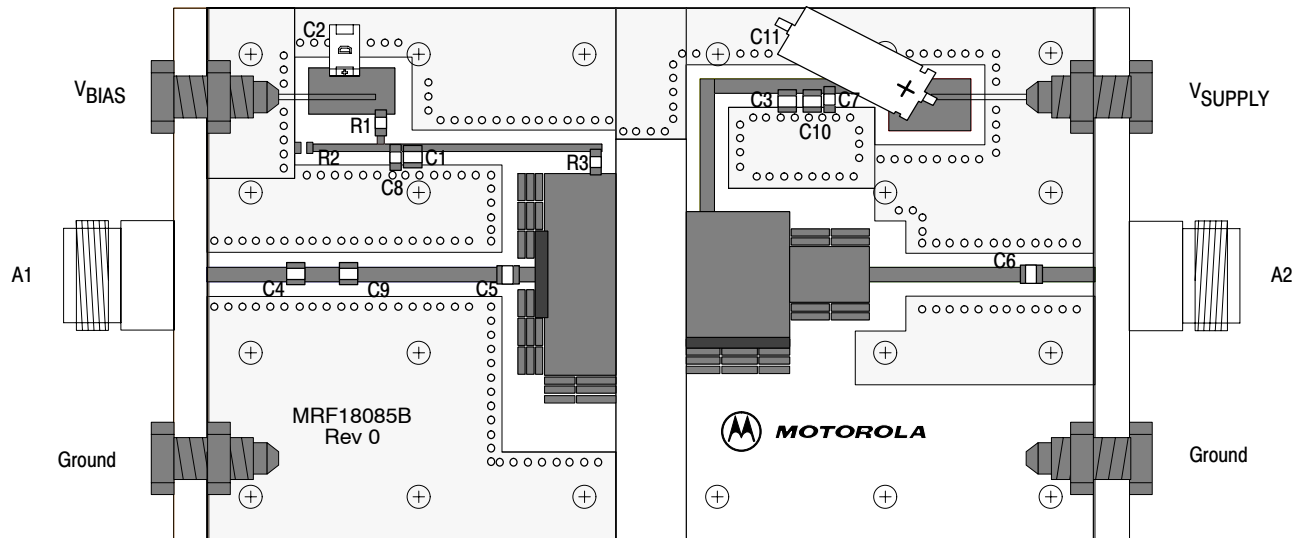
Common-Source Amplifier Power Gain @ 85 W ( $V_{DD} = 26 \text{ Vdc}$ , $I_{DQ} = 800 \text{ mA}$ , $f = 1930 - 1990 \text{ MHz}$ )	$G_{ps}$	11.5	12.5	—	dB
Drain Efficiency @ 85 W ( $V_{DD} = 26 \text{ Vdc}$ , $I_{DQ} = 800 \text{ mA}$ , $f = 1930 - 1990 \text{ MHz}$ )	$\eta$	46	50	—	%
Input Return Loss @ 85 W ( $V_{DD} = 26 \text{ Vdc}$ , $I_{DQ} = 800 \text{ mA}$ , $f = 1930 - 1990 \text{ MHz}$ )	IRL	—	-12	-9	dB
P1 dB Output Power ( $V_{DD} = 26 \text{ Vdc}$ , $I_{DQ} = 800 \text{ mA}$ , $f = 1930 - 1990 \text{ MHz}$ )	P1dB	80	90	—	W

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



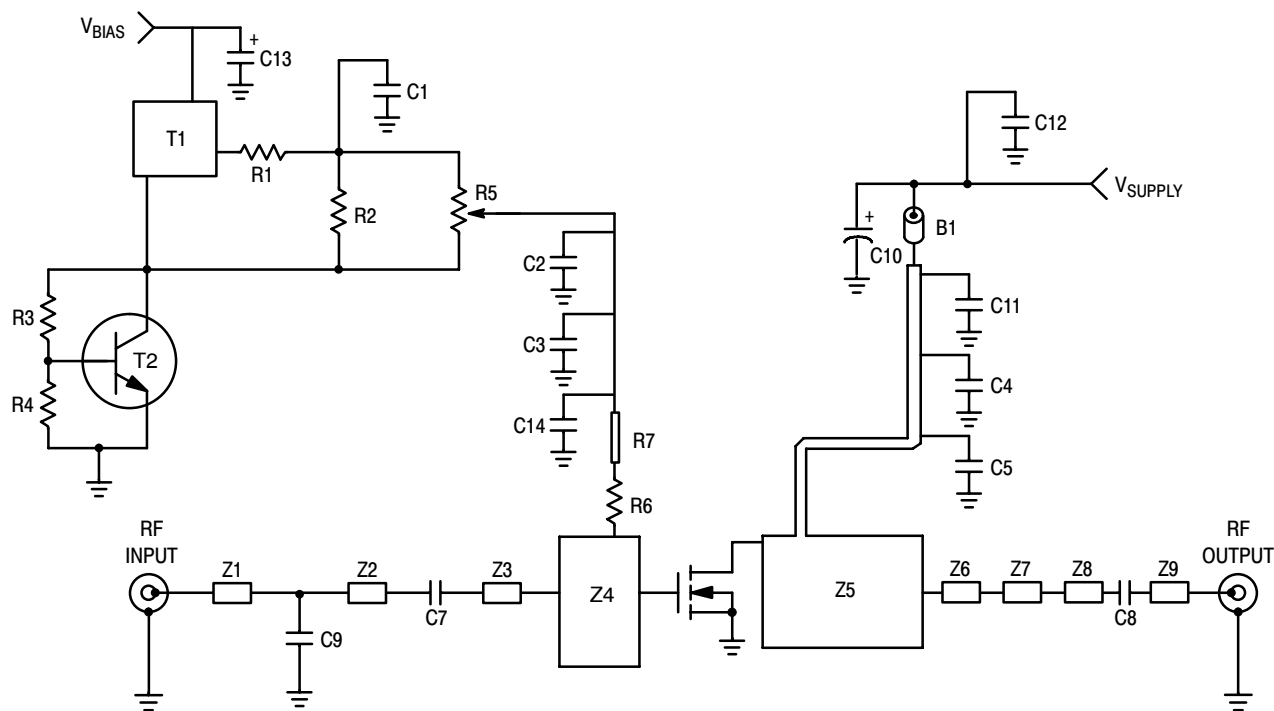
C1, C10	1.0 nF Chip Capacitors, ATC	Z1	1.654" x 0.082" Microstrip
C2	10 $\mu$ F, 35 V Tantalum Capacitor	Z2	0.207" x 0.082" Microstrip
C3, C6	10 pF Chip Capacitors, ATC	Z3	0.362" x 1.260" Microstrip
C4	3.3 pF Chip Capacitor, ATC	Z4	0.583" x 0.669" Microstrip
C5	4.7 pF Chip Capacitor, ATC	Z5	0.449" x 0.179" Microstrip
C7, C8	100 nF Chip Capacitors, ACCU-P (1206)	Z6	0.877" x 0.082" Microstrip
C9	3.9 pF Chip Capacitor, ATC	Z7	0.326" x 0.082" Microstrip
C11	470 $\mu$ F, 63 V Electrolytic Capacitor	PCB	0.030" Glass Teflon <sup>®</sup> ( $\epsilon_r = 2.55$ )
R1, R2	1.0 k $\Omega$ Chip Resistors (0805)		
R3	2 x 18 k $\Omega$ Chip Resistor (1206)		

**Figure 1. 1930 - 1990 MHz Test Fixture Schematic**



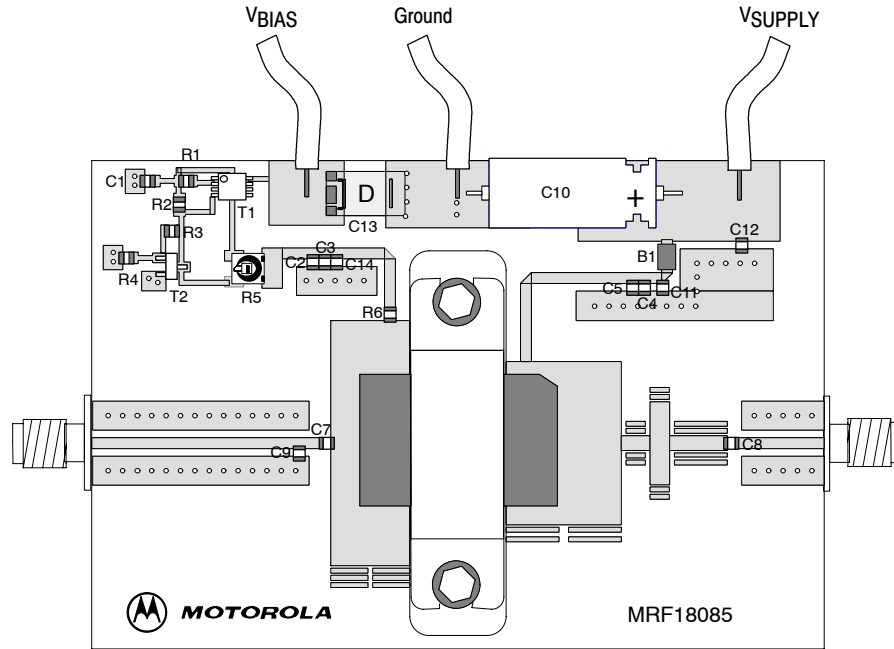
Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

**Figure 2. 1930 - 1990 MHz Test Fixture Component Layout**



B1	Short RF Ferrite Bead, #27 430119447	R1	10 $\Omega$ Chip Resistor (0805)
C1, C2	1 $\mu$ F Chip Capacitors, ACCU-P (0805)	R2	1 k $\Omega$ Chip Resistor (0805)
C3, C4	1 nF Chip Capacitors, ACCU-P (0805)	R3	1.2 k $\Omega$ Chip Resistor (0805)
C5	10 pF Chip Capacitor, ACCU-P (0805)	R4	2.2 k $\Omega$ Chip Resistor (0805)
C7	1.5 pF Chip Capacitor, ACCU-P (0805)	R5	5 k $\Omega$ Chip Resistor (0805)
C8	8.2 pF Chip Capacitor, ACCU-P (0805)	R6, R7	9 $\Omega$ Chip Resistors (1206) (18 $\Omega$ x 18 $\Omega$ )
C9	1.0 pF Chip Capacitor, ACCU-P (0805)	T1	Voltage Regulator, Micro-8, #LP2951
C10	100 $\mu$ F, 63 V Electrolytic Capacitor	T2	NPN Bipolar Transistor, SOT-23, #BC847
C11, C12	10 nF Chip Capacitors (0805)	Z1 - Z9	Printed Transmission Lines
C13	10 $\mu$ F, 35 V Tantalum Capacitor	Substrate	0.5 mm Rogers 4350 ( $\epsilon_r = 3.53$ )
C14	8.2 pF Chip Capacitor, ACCU-P (0805)		

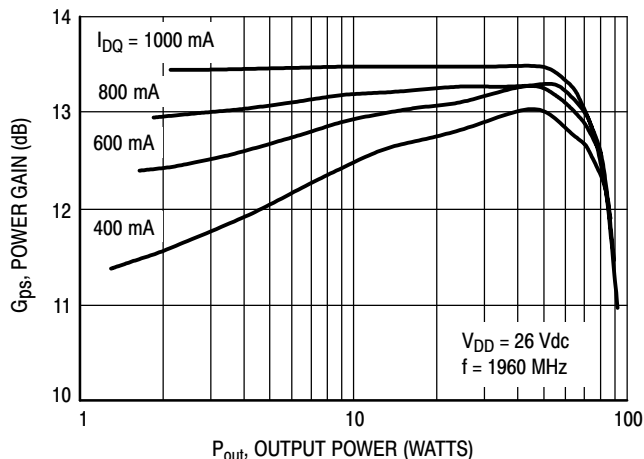
**Figure 3. 1930 - 1990 MHz GSM EDGE Optimized Demo Board Schematic**



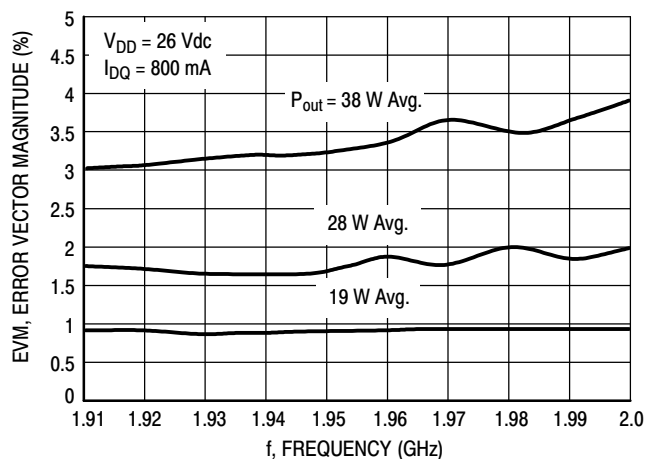
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**Figure 4. 1930 - 1990 MHz GSM EDGE Optimized Demo Board Component Layout**

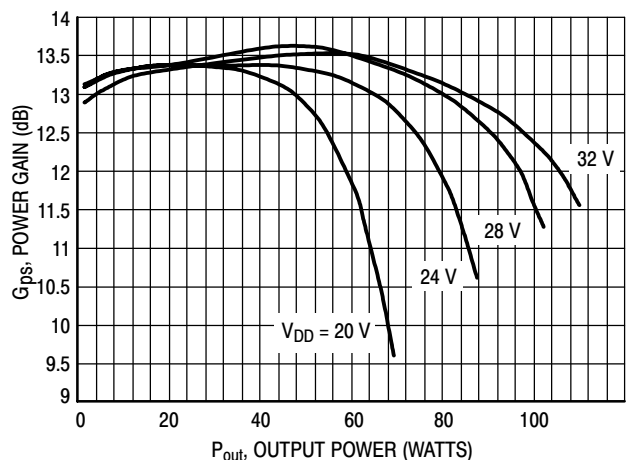
## TYPICAL CHARACTERISTICS (Performed on a GSM EDGE Optimized Demo Board)



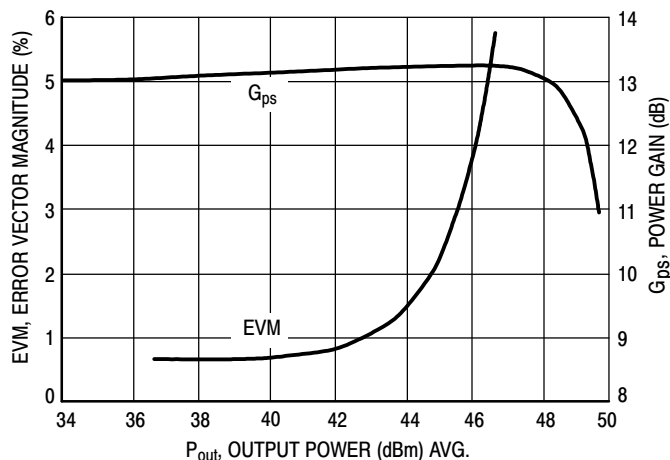
**Figure 5. Power Gain versus Output Power**



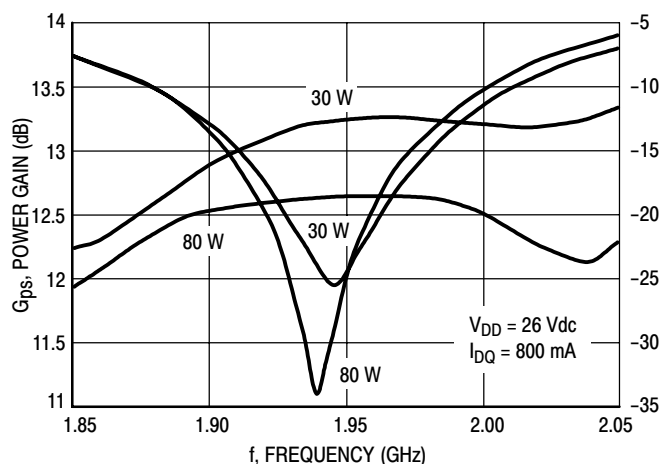
**Figure 6. Error Vector Magnitude versus Frequency**



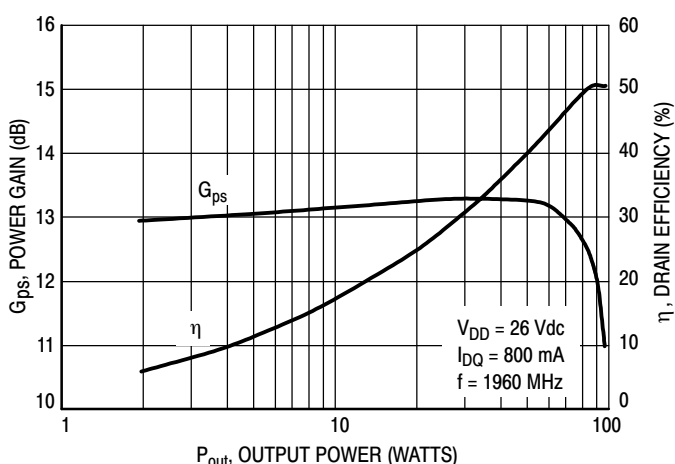
**Figure 7. Power Gain versus Output Power**



**Figure 8. EVM and Gain versus Output Power**



**Figure 9. Power Gain and IRL versus Frequency**



**Figure 10. Power Gain and Efficiency versus Output Power**

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### GSM TEST SIGNAL

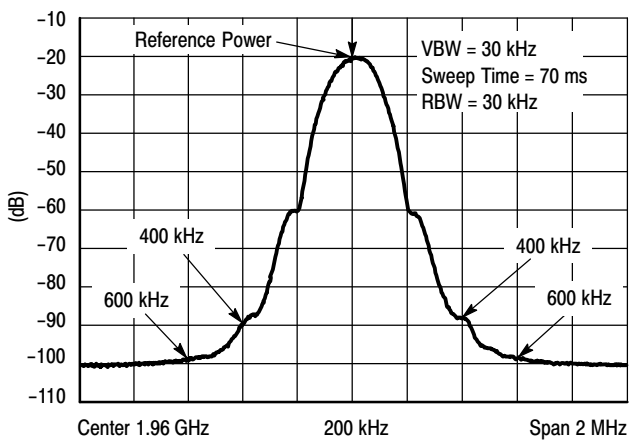
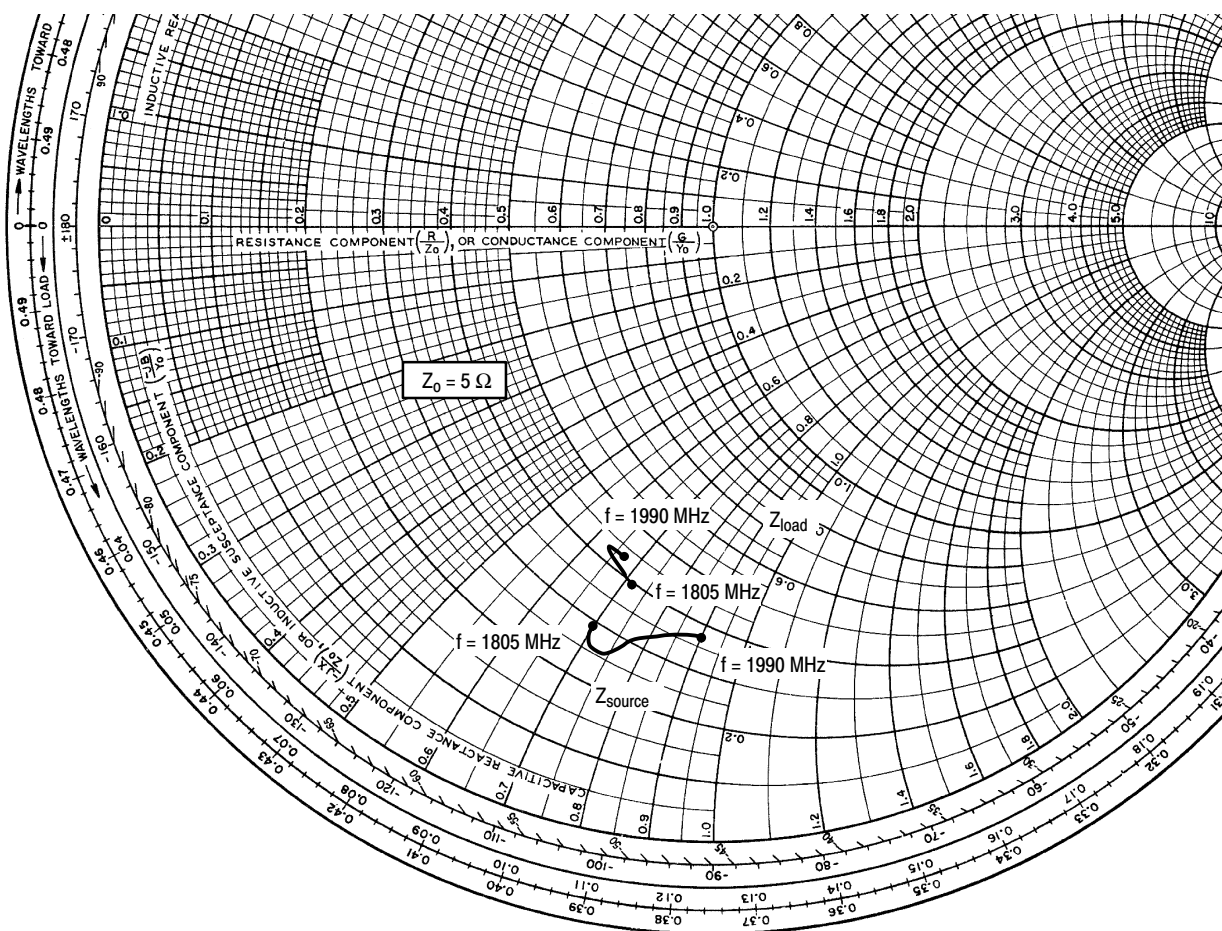


Figure 11. EDGE Spectrum

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$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $P_{out} = 85\text{ W CW}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1805	$1.43 - j3.74$	$2 - j3.60$
1880	$1.27 - j3.95$	$1.98 - j3.57$
1930	$1.5 - j4.13$	$2.13 - j3.16$
1990	$1.86 - j4.76$	$2.17 - j3.36$

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

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

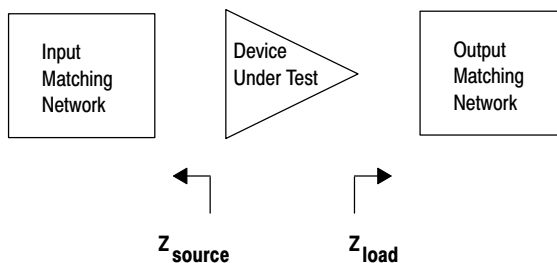


Figure 12. Series Equivalent Source and Load Impedance



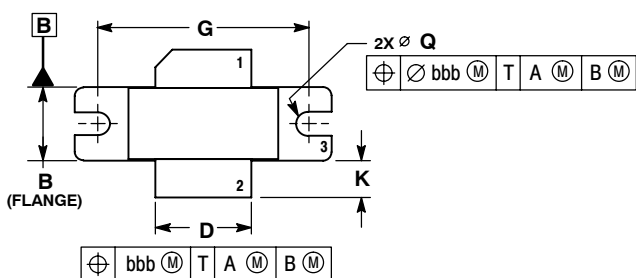
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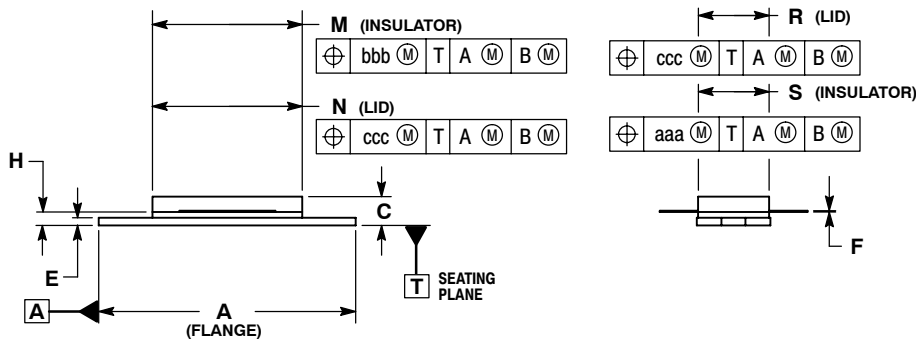
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### PACKAGE DIMENSIONS



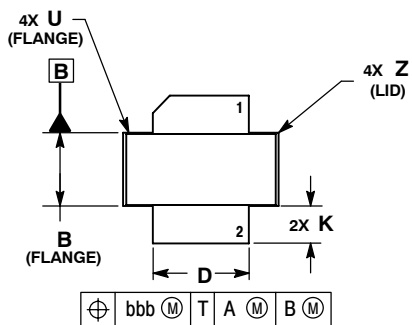
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
  2. CONTROLLING DIMENSION: INCH.
  3. DELETED
  4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	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	Ø 1.118	Ø 1.138	Ø 3.00	Ø 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	



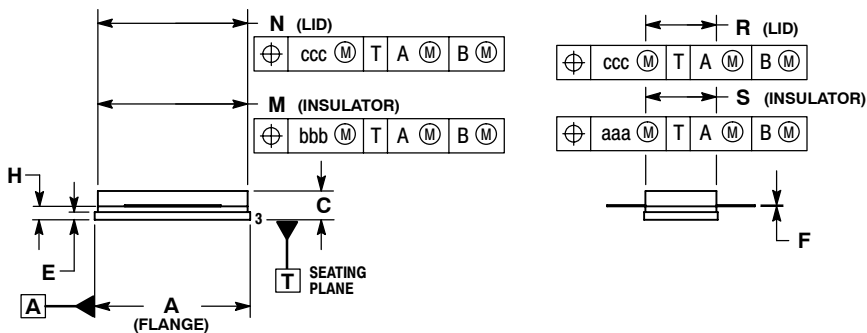
- STYLE 1:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE

**CASE 465-06  
 ISSUE G  
 NI-780  
 MRF18085BLR3**



- 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

**CASE 465A-06  
 ISSUE H  
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