

The RF MOSFET Line

RF Power Field Effect Transistors

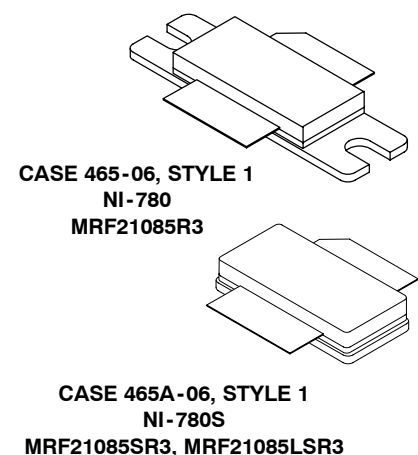
N-Channel Enhancement-Mode Lateral MOSFETs

Designed for W-CDMA base station applications with frequencies from 2110 to 2170 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN - PCS/cellular radio and WLL applications.

- Typical 2-carrier W-CDMA Performance for $V_{DD} = 28$ Volts, $I_{DQ} = 1000$ mA, $f_1 = 2135$ MHz, $f_2 = 2145$ MHz, Channel Bandwidth = 3.84 MHz, Adjacent Channels Measured over 3.84 MHz BW @ $f_1 - 5$ MHz and $f_2 + 5$ MHz, Distortion Products Measured over a 3.84 MHz BW @ $f_1 - 10$ MHz and $f_2 + 10$ MHz, Peak/Avg. = 8.3 dB @ 0.01% Probability on CCDF.
 - Output Power — 19 Watts Avg.
 - Power Gain — 13.6 dB
 - Efficiency — 23%
 - IM3 — -37.5 dBc
 - ACPR — -41 dBc
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 5:1 VSWR, @ 28 Vdc, 2170 MHz, 90 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40 μ Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

MRF21085R3
MRF21085SR3
MRF21085LSR3

2170 MHz, 90 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	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	224 1.28	Watts W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value (1)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.78	$^\circ\text{C/W}$

ESD PROTECTION CHARACTERISTICS

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

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

NOTE - CAUTION - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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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} = 28 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} = 28 Vdc, I _D = 1000 mAdc)	V _{GS(Q)}	3	3.9	5	Vdc
Drain-Source On-Voltage (V _{GS} = 10 Vdc, I _D = 2 Adc)	V _{DS(on)}	—	0.18	0.21	Vdc
Forward Transconductance (V _{DS} = 10 Vdc, I _D = 2 Adc)	g _{fs}	—	6	—	S

DYNAMIC CHARACTERISTICS (1)

Reverse Transfer Capacitance (V _{DS} = 28 Vdc, V _{GS} = 0, f = 1.0 MHz)	C _{rss}	—	3.6	—	pF
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FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) 2-carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers, ACPR and IM3 measured in 3.84 MHz Bandwidth. Peak/Avg. = 8.3 dB @ 0.01% Probability on CCDF.

Common-Source Amplifier Power Gain (V _{DD} = 28 Vdc, P _{out} = 19 W Avg., I _{DQ} = 1000 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz)	G _{ps}	12	13.6	—	dB
Drain Efficiency (V _{DD} = 28 Vdc, P _{out} = 19 W Avg., I _{DQ} = 1000 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz)	η	20	23	—	%
Third Order Intermodulation Distortion (V _{DD} = 28 Vdc, P _{out} = 19 W Avg., I _{DQ} = 1000 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz; IM3 measured over 3.84 MHz BW at f ₁ -10 MHz and f ₂ +10 MHz referenced to carrier channel power.)	IM3	—	-37.5	-35	dBc
Adjacent Channel Power Ratio (V _{DD} = 28 Vdc, P _{out} = 19 W Avg., I _{DQ} = 1000 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz; ACPR measured over 3.84 MHz at f ₁ -5 MHz and f ₂ +5 MHz.)	ACPR	—	-41	-38	dBc
Input Return Loss (V _{DD} = 28 Vdc, P _{out} = 19 W Avg., I _{DQ} = 1000 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz)	IRL	—	-12	-9	dB
Output Mismatch Stress (V _{DD} = 28 Vdc, P _{out} = 90 W CW, I _{DQ} = 1000 mA, f = 2170 MHz VSWR = 5:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power Before and After Test			

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

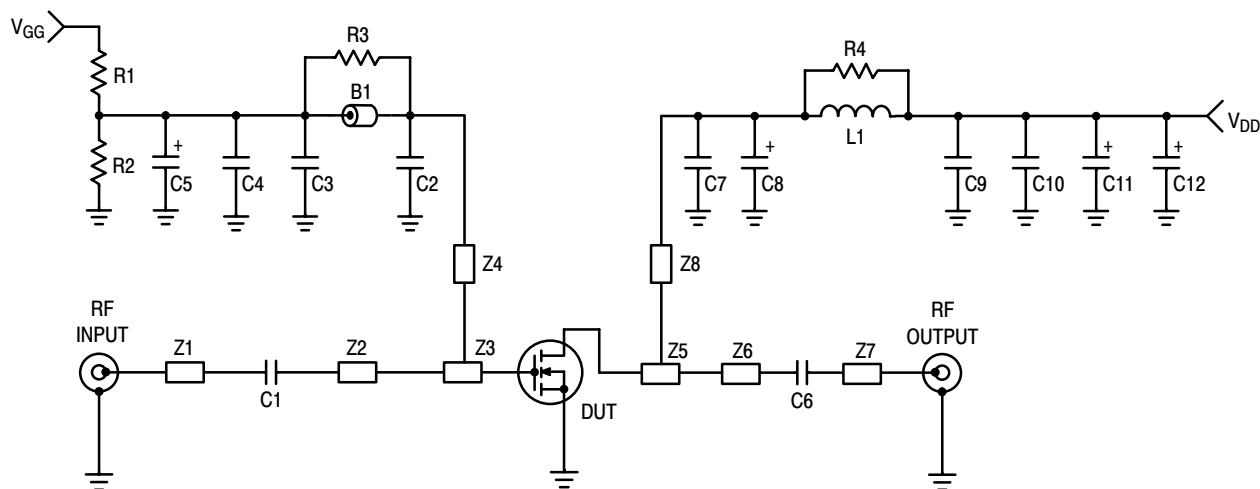
(continued)

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ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) (continued)					
Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 1000\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	G_{ps}	—	13.6	—	dB
Two-Tone Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 1000\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	η	—	36	—	%
Two-Tone Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 1000\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	IMD	—	-31	—	dBc
Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 1000\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	IRL	—	-12	—	dB
P_{out} , 1 dB Compression Point ($V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 1000\text{ mA}$, $f = 2170\text{ MHz}$)	P1dB	—	100	—	W

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Z1	0.750" x 0.084" Microstrip
Z2	1.015" x 0.084" Microstrip
Z3	0.480" x 0.800" Microstrip
Z4	0.750" x 0.050" Microstrip
Z5	0.610" x 0.800" Microstrip
Z6	0.885" x 0.084" Microstrip
Z7	0.720" x 0.084" Microstrip
Z8	0.800" x 0.070" Microstrip

Board	0.030" Glass Teflon®, Keene GX-0300-55-22, $\epsilon_r = 2.55$
PCB	Etched Circuit Boards MRF21085 Rev. 3, CMR

Figure 1. MRF21085 Test Circuit Schematic

Table 1. MRF21085 Test Circuit Component Designations and Values

Designators	Description
B1	Short Ferrite Bead, Fair Rite, #2743019447
C1, C6	43 pF Chip Capacitors, ATC #100B430JCA500X
C2	10 pF Chip Capacitor, ATC #100B100JCA500X
C3, C9	1000 pF Chip Capacitors, ATC #100B102JCA500X
C4, C10	0.1 μ F Chip Capacitors, Kemet #CDR33BX104AKWS
C5	1.0 μ F Tantalum Chip Capacitor, Kemet #T491C105M050
C7	2.7 pF Chip Capacitor, ATC #100B2R7JCA500X
C8	10 μ F Tantalum Chip Capacitor, Kemet #T495X106K035AS4394
C11, C12	22 μ F Tantalum Chip Capacitors, Kemet #T491X226K035AS4394
L1	1 Turn, #20 AWG, 0.100" ID, Motorola
N1, N2	Type N Flange Mounts, Omni Spectra #3052-1648-10
R1	1.0 k Ω , 1/8 W Chip Resistor
R2	180 k Ω , 1/8 W Chip Resistor
R3, R4	10 Ω , 1/8 W Chip Resistors

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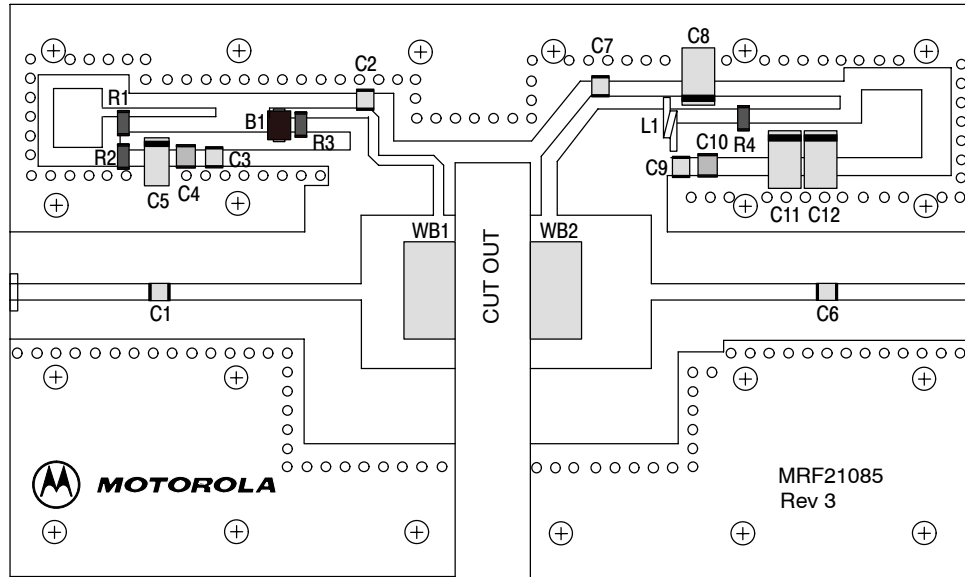


Figure 2. MRF21085 Test Circuit Component Layout

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TYPICAL CHARACTERISTICS

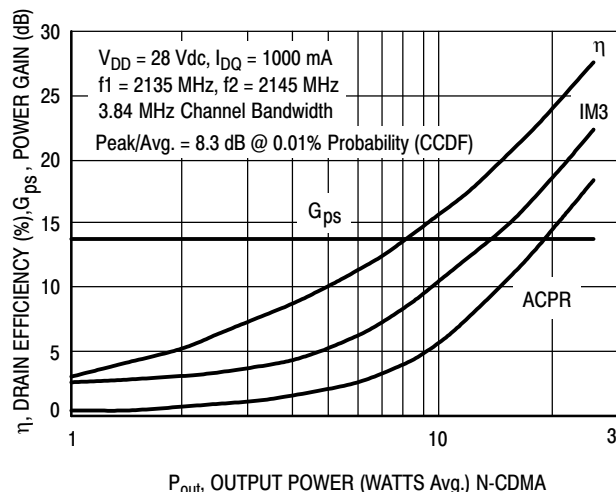


Figure 3. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

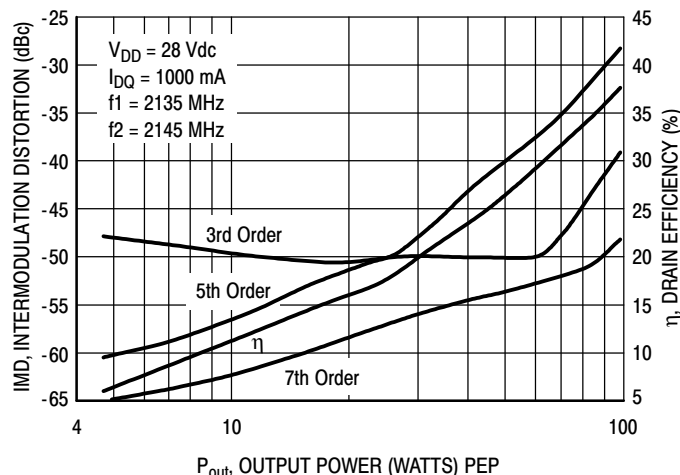


Figure 4. Intermodulation Distortion Products versus Output Power

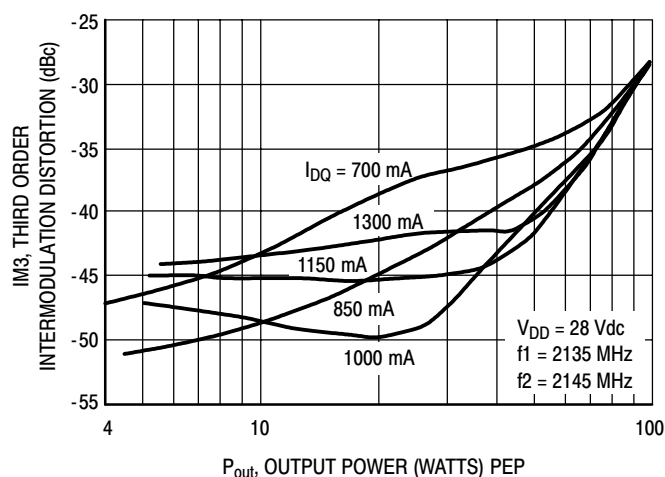


Figure 5. Third Order Intermodulation Distortion versus Output Power

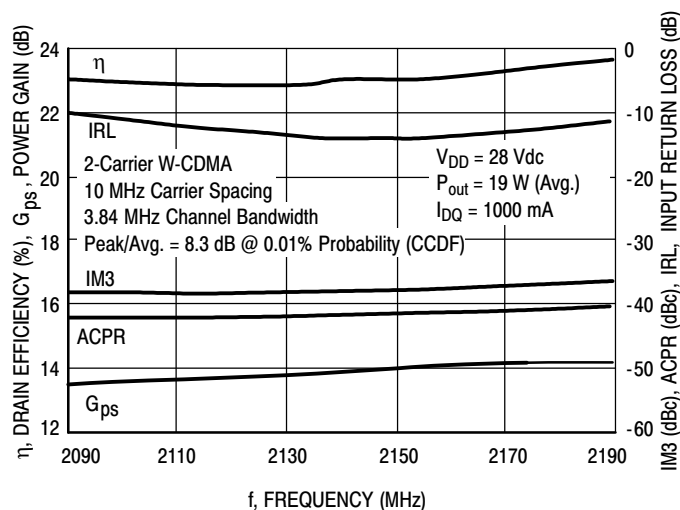


Figure 6. 2-Carrier W-CDMA Broadband Performance

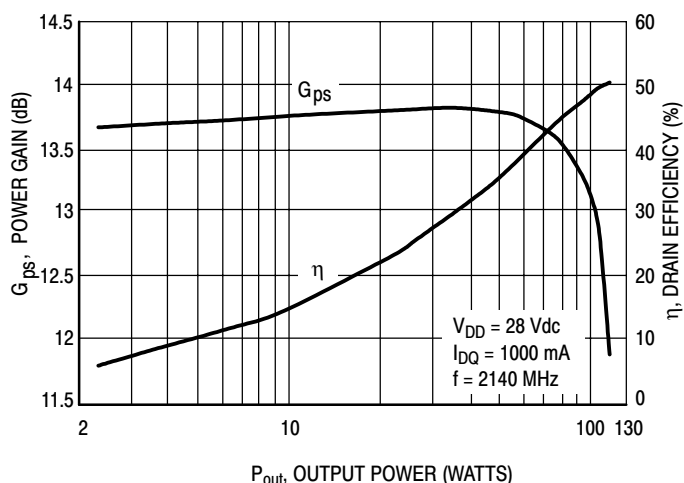


Figure 7. CW Performance

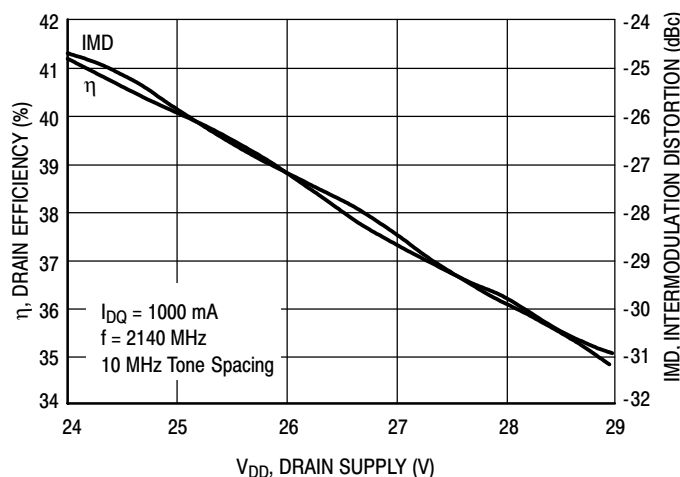


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

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TYPICAL CHARACTERISTICS

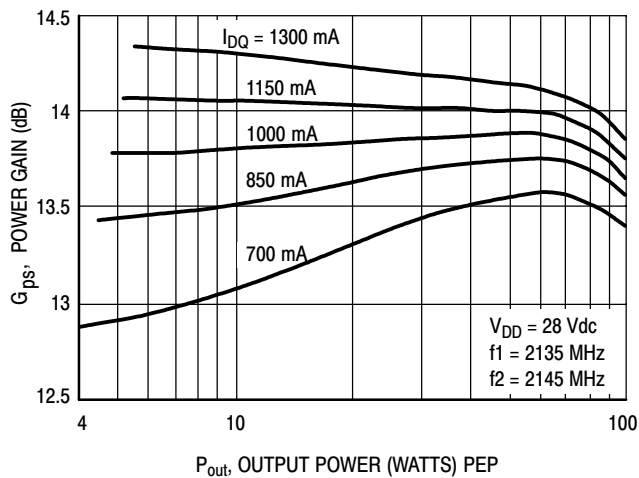


Figure 9. Two-Tone Power Gain versus Output Power

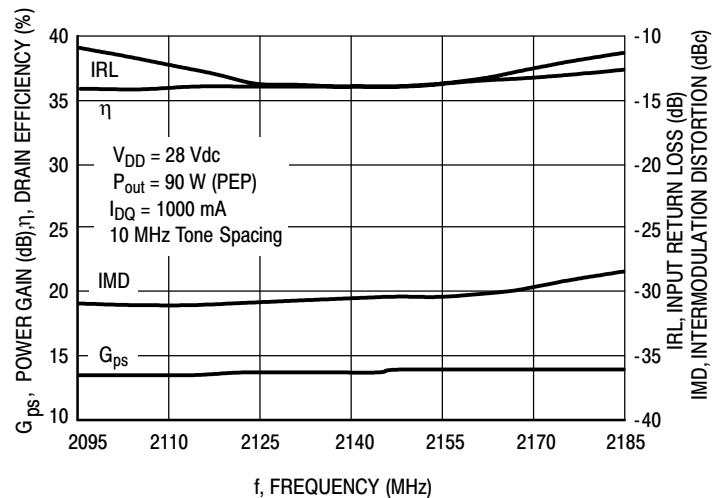


Figure 10. Two-Tone Broadband Performance

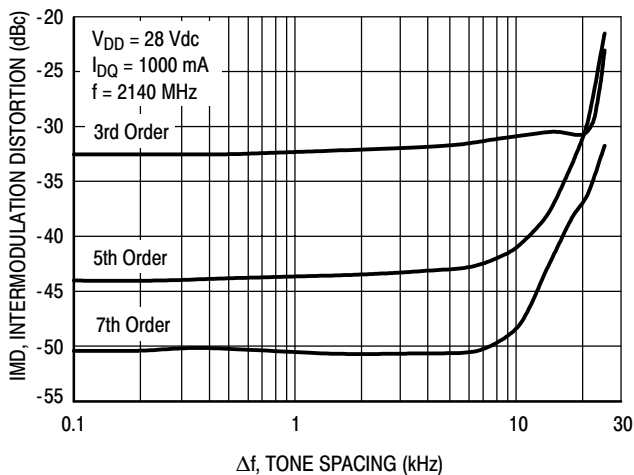


Figure 11. Intermodulation Distortion Products versus Two-Tone Spacing

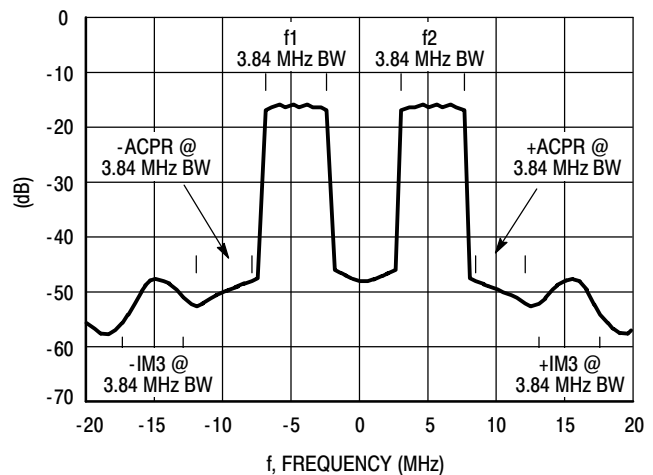
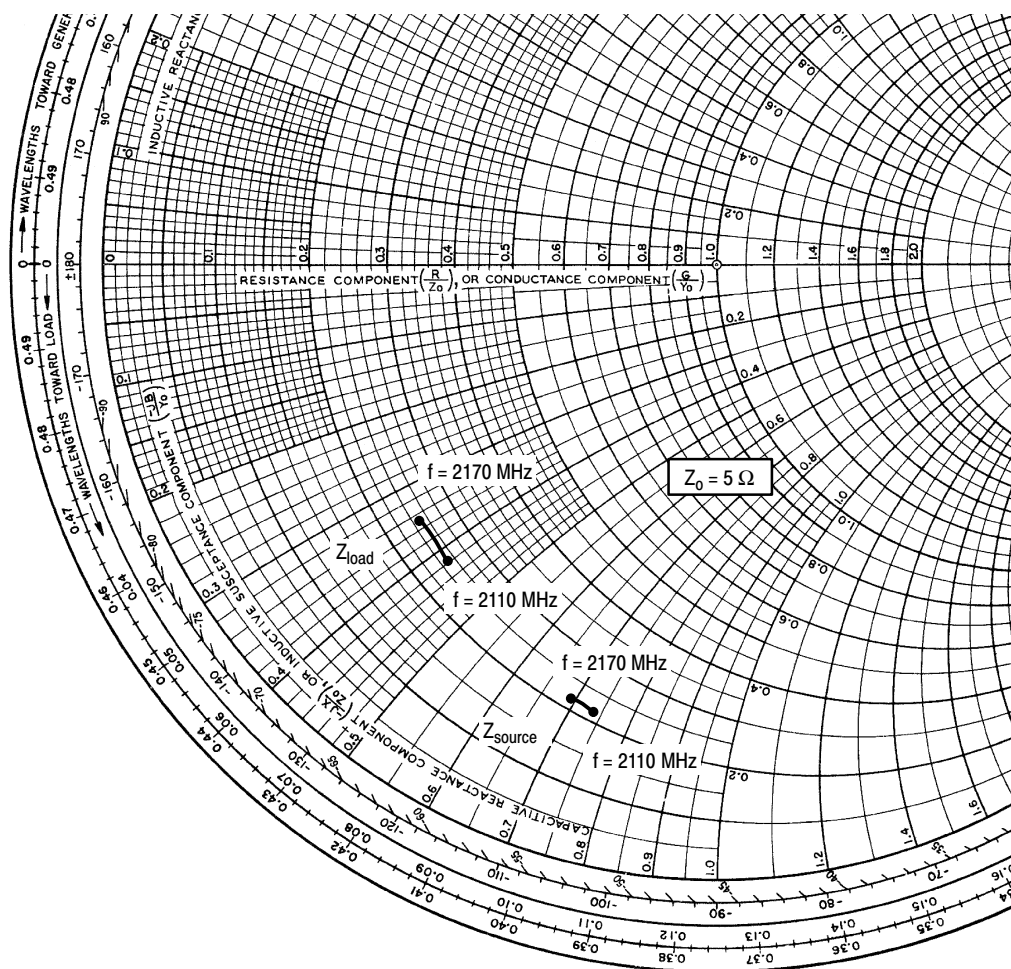


Figure 12. 2-Carrier W-CDMA Spectrum



$V_{DD} = 28 \text{ V}$, $I_{DQ} = 1000 \text{ mA}$, $P_{out} = 19 \text{ W Avg.}$

f MHz	Z_{source} Ω	Z_{load} Ω
2110	$1.10 - j3.71$	$1.23 - j2.10$
2140	$1.11 - j3.57$	$1.26 - j1.92$
2170	$1.12 - j3.40$	$1.25 - j1.76$

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

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

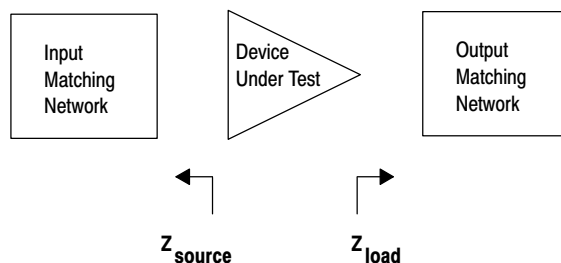


Figure 13. Series Equivalent Input and Output Impedance

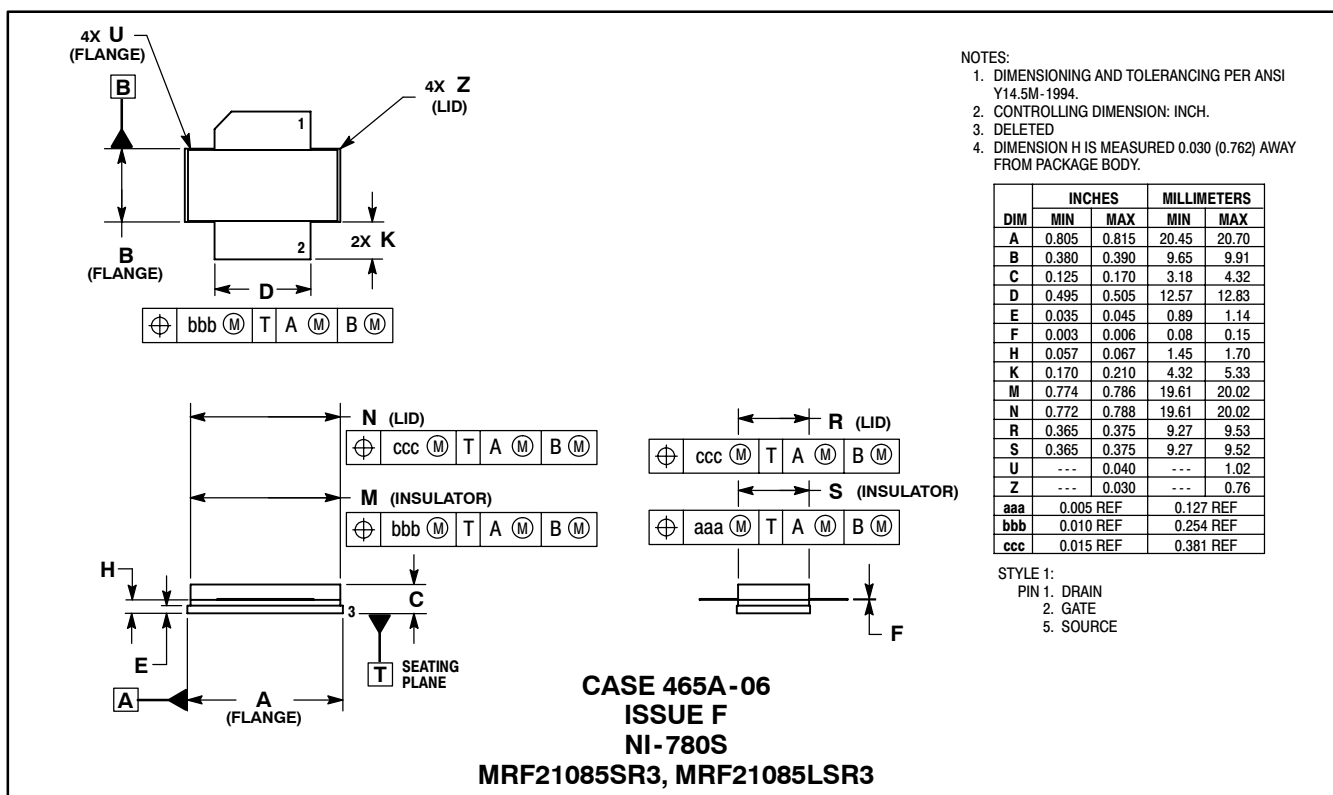
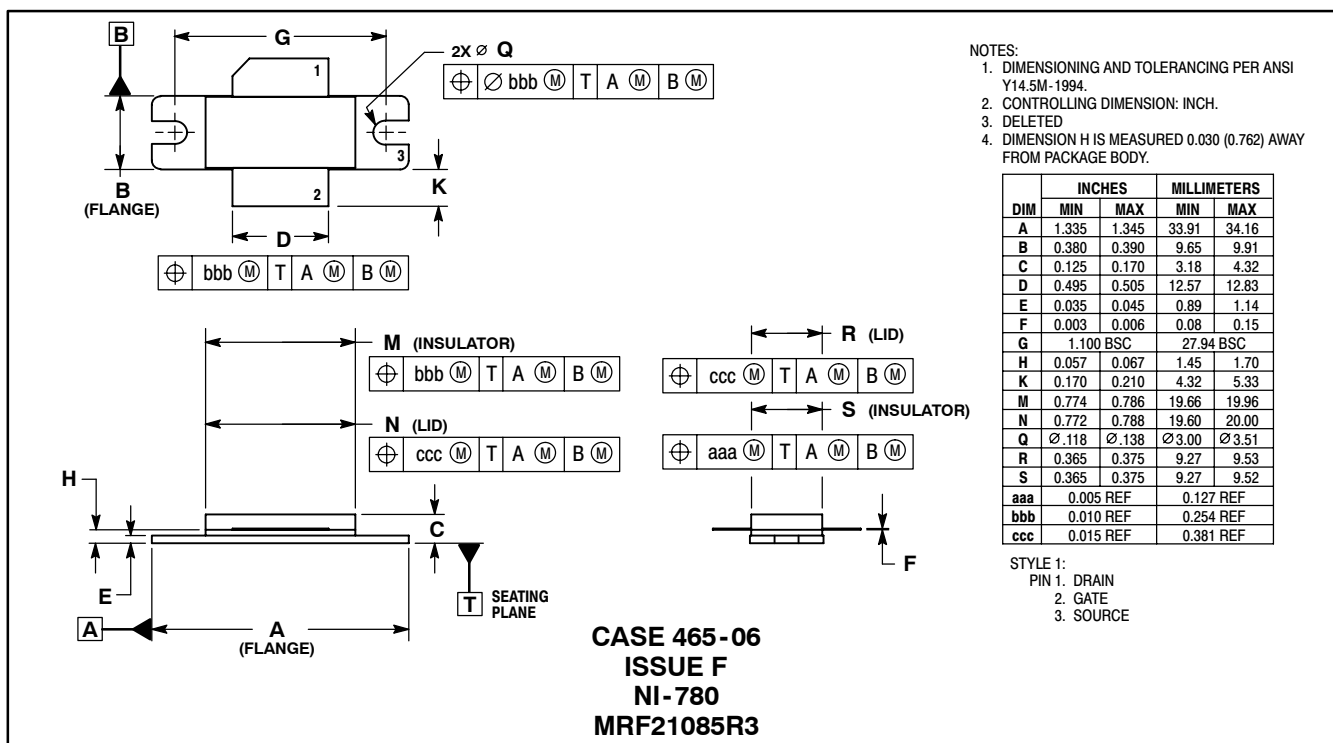
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