Freescale Semiconductor
Technical Data

Document Number: MRF6S27085H
Rev. 3, 12/2008

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF6S27085HR3
MRF6S27085HSR3

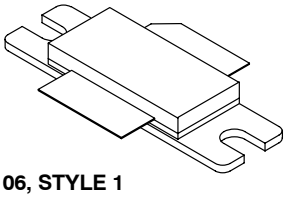
2600-2700 MHz, 20 W AVG., 28 V
SINGLE N-CDMA
LATERAL N-CHANNEL
RF POWER MOSFETs

Designed for CDMA base station applications with frequencies from 2600 to 2700 MHz. Suitable for WiMAX, WiBro and multicarrier amplifier applications. To be used in Class AB and Class C for WLL applications.

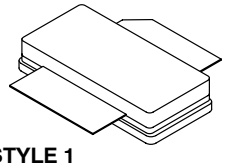
- Typical Single-Carrier N-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 900 mA, P_{out} = 20 Watts Avg., f = 2660 MHz, IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13), Channel Bandwidth = 1.2288 MHz, PAR = 9.8 dB @ 0.01% Probability on CCDF.
  Power Gain — 15.5 dB
  Drain Efficiency — 23.5%
  ACPR @ 885 kHz Offset — -48 dBc in 30 kHz Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2650 MHz, 85 Watts CW Output Power

Features

- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- Designed for Lower Memory Effects and Wide Instantaneous Bandwidth Applications
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.



CASE 465-06, STYLE 1
NI-780
MRF6S27085HR3



CASE 465A-06, STYLE 1
NI-780S
MRF6S27085HSR3

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +68	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +12	Vdc
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature (1,2)	T_J	225	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 85 W CW Case Temperature 76°C, 20 W CW	$R_{\theta JC}$	 0.50 0.56	°C/W

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

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Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	3A (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	IV (Minimum)

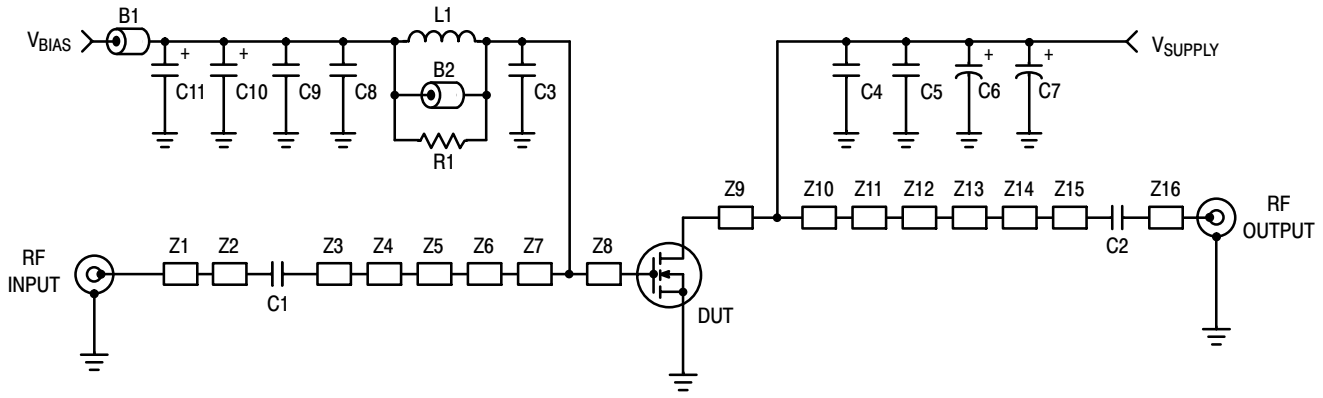
Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 68 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 250 μAdc)	$V_{GS(th)}$	1	2	3	Vdc
Gate Quiescent Voltage (V_{DD} = 28 Vdc, I_D = 900 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	2	2.8	4	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2.2 Adc)	$V_{DS(on)}$	—	0.21	0.3	Vdc
Dynamic Characteristics (1)					
Reverse Transfer Capacitance (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	2.8	—	pF

Functional Tests (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 900 mA, P_{out} = 20 W Avg. N-CDMA, f = 2660 MHz, Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier. ACPR measured in 30 kHz Channel Bandwidth @ ±885 kHz Offset. PAR = 9.8 dB @ 0.01% Probability on CCDF.

Power Gain	G_{ps}	14	15.5	17	dB
Drain Efficiency	η_D	21	23.5	—	%
Adjacent Channel Power Ratio	ACPR	—	-48	-45	dBc
Input Return Loss	IRL	—	-13	-9	dB

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

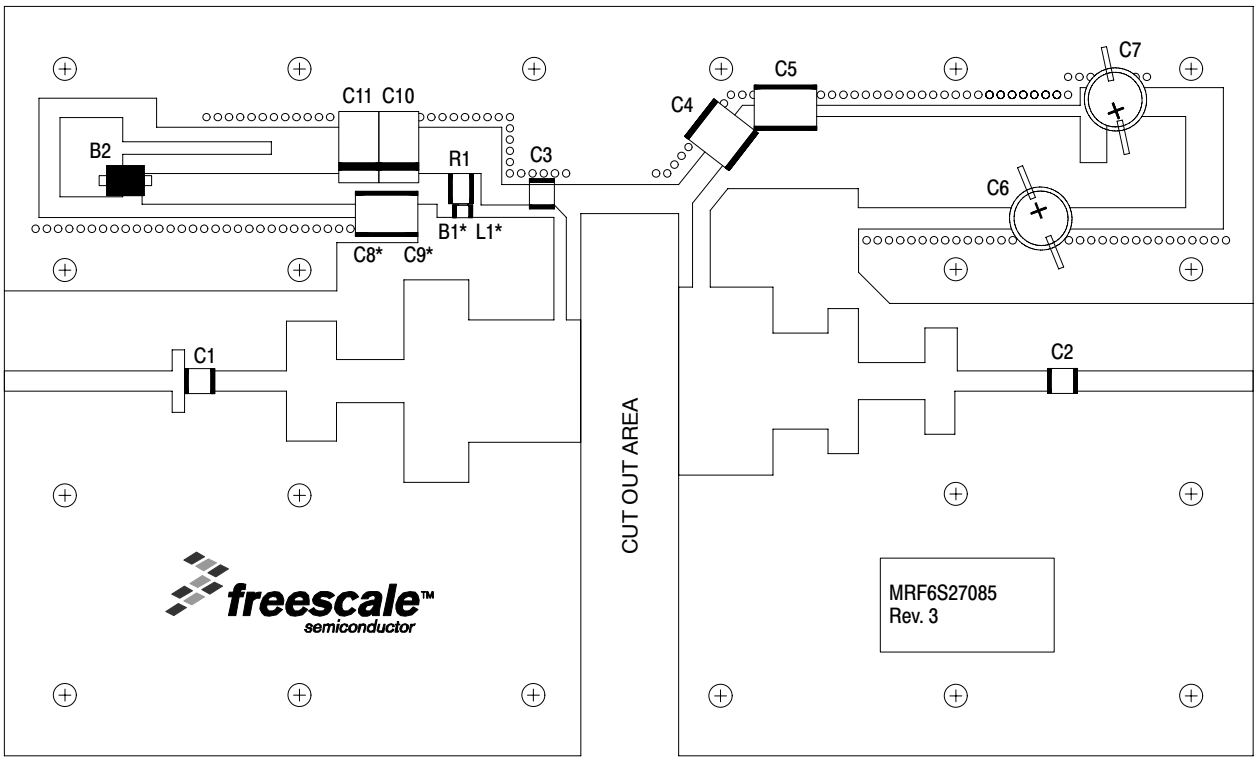


Z1	0.672″ x 0.081″ Microstrip	Z10	0.287″ x 0.753″ Microstrip
Z2	0.050″ x 0.250″ Microstrip	Z11	0.220″ x 0.384″ Microstrip
Z3	0.288″ x 0.081″ Microstrip	Z12	0.122″ x 0.580″ Microstrip
Z4	0.200″ x 0.480″ Microstrip	Z13	0.266″ x 0.148″ Microstrip
Z5	0.270″ x 0.172″ Microstrip	Z14	0.130″ x 0.425″ Microstrip
Z6	0.260″ x 0.810″ Microstrip	Z15	0.380″ x 0.081″ Microstrip
Z7	0.366″ x 0.490″ Microstrip	Z16	0.703″ x 0.081″ Microstrip
Z8	0.083″ x 0.490″ Microstrip	PCB	Arlon GX-0300-5022, 0.030″, ε_r = 2.5
Z9	0.091″ x 0.753″ Microstrip		

Figure 1. MRF6S27085HR3(SR3) Test Circuit Schematic

Table 5. MRF6S27085HR3(SR3) Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1	Ferrite Bead, Surface Mount	2508051107Y0	Fair-Rite
B2	Ferrite Bead, Surface Mount	2743019447	Fair-Rite
C1, C2	4.7 pF Chip Capacitors	ATC100B4R7CT500XT	ATC
C3	3.6 pF Chip Capacitor	ATC100B3R6CT500XT	ATC
C4	10 μF, 50 V Chip Capacitor	GRM55DR61H106KA88B	Murata
C5, C8	2.2 μF, 50 V Chip Capacitors	C1825C225J5RAC	Kemet
C6	47 μF, 50 V Electrolytic Capacitor	EMVK500ADA470MF80G	United Chemi-Con
C7	330 μF, 63 V Electrolytic Capacitor	EKMG630ELL331MJ20S	United Chemi-Con
C9	0.01 μF Chip Capacitor	C1825C103J1RAC	Kemet
C10	22 μF, 25 V Tantalum Capacitor	T491D226K025AT	Kemet
C11	47 μF, 16 V Tantalum Capacitor	T491D476K016AT	Kemet
L1	15 nH, Chip Inductor	L0603150GGW	AVX
R1	3.3 Ω, 1/3 W Chip Resistor	CRCW12103R30FKEA	Vishay



* Components stacked

Figure 2. MRF6S27085HR3(SR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

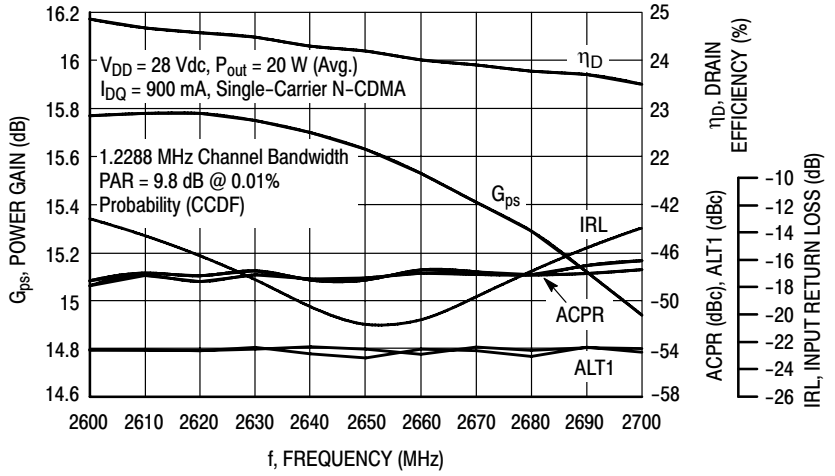


Figure 3. Single-Carrier N-CDMA Broadband Performance @ 20 Watts Avg.

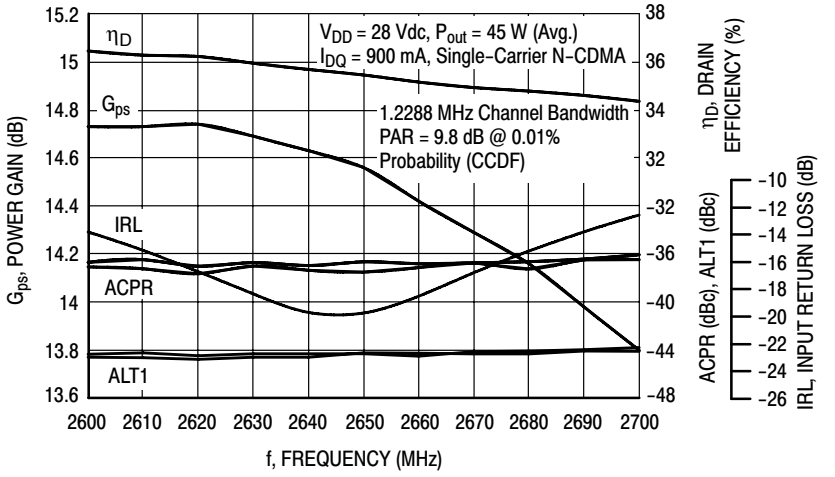


Figure 4. Single-Carrier N-CDMA Broadband Performance @ 45 Watts Avg.

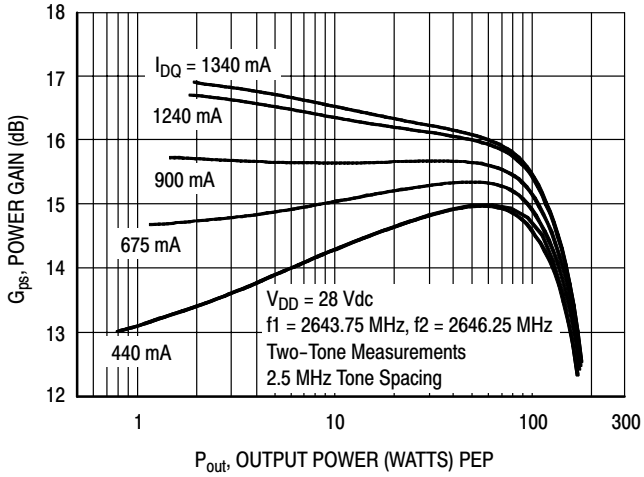


Figure 5. Two-Tone Power Gain versus Output Power

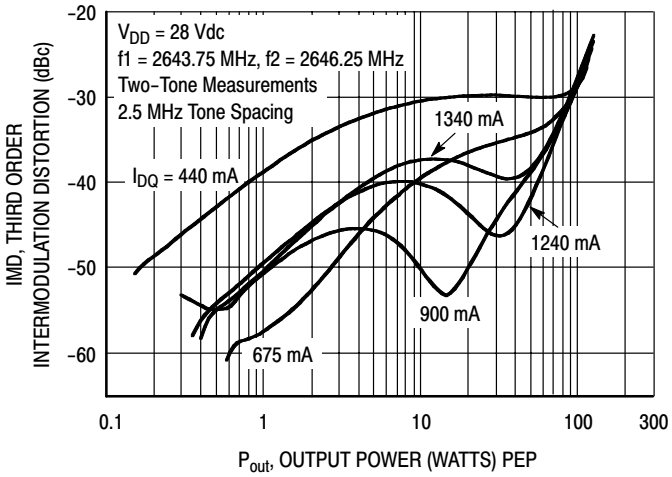


Figure 6. Third Order Intermodulation Distortion versus Output Power

TYPICAL CHARACTERISTICS

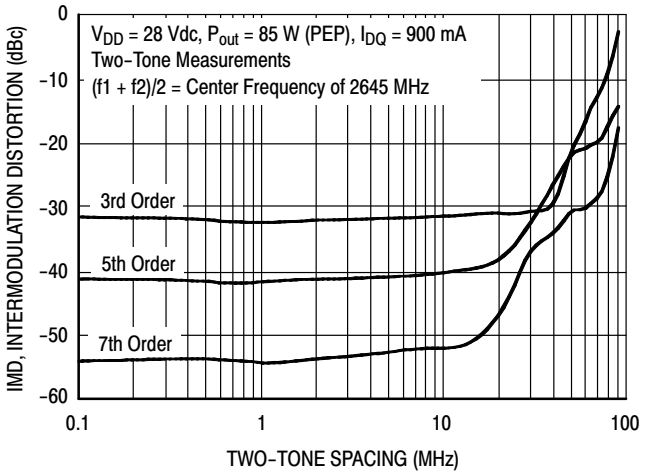


Figure 7. Intermodulation Distortion Products versus Tone Spacing

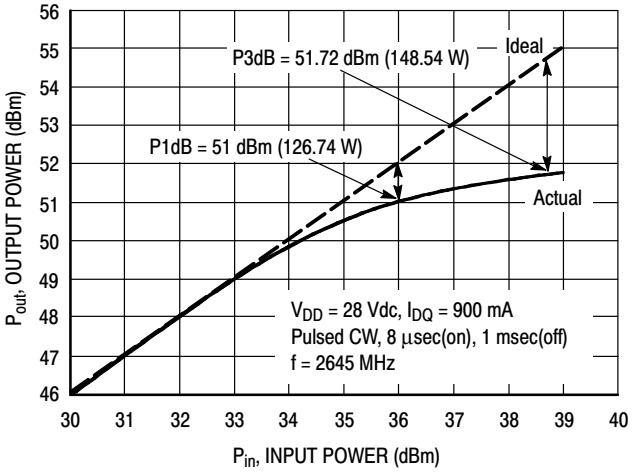


Figure 8. Pulsed CW Output Power versus Input Power

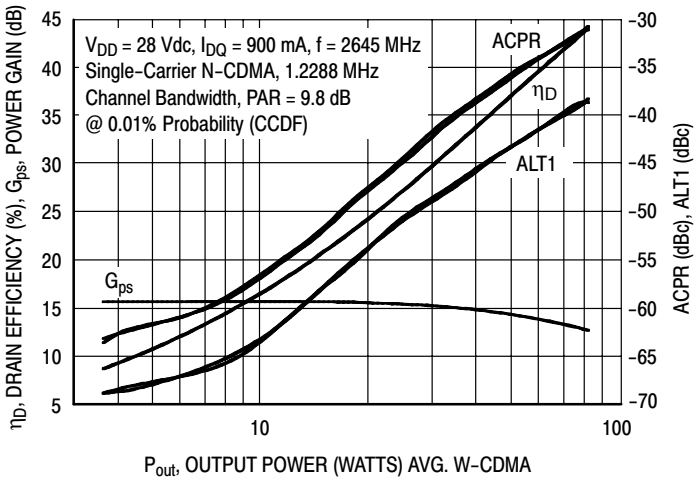


Figure 9. Single-Carrier N-CDMA ACPR, ALT1, Power Gain and Drain Efficiency versus Output Power

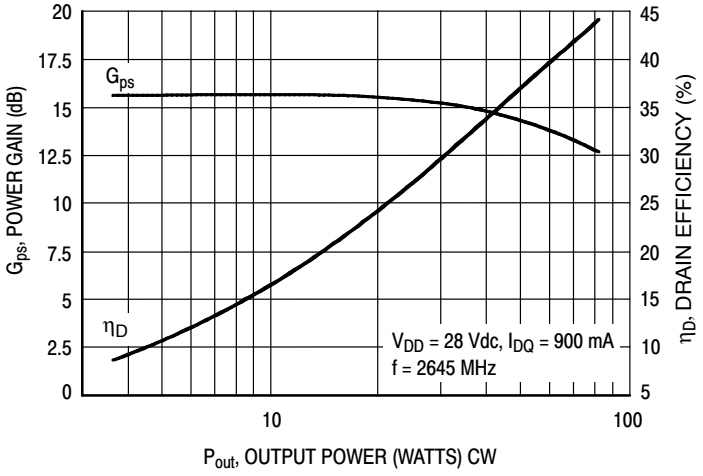


Figure 10. Power Gain and Drain Efficiency versus CW Output Power

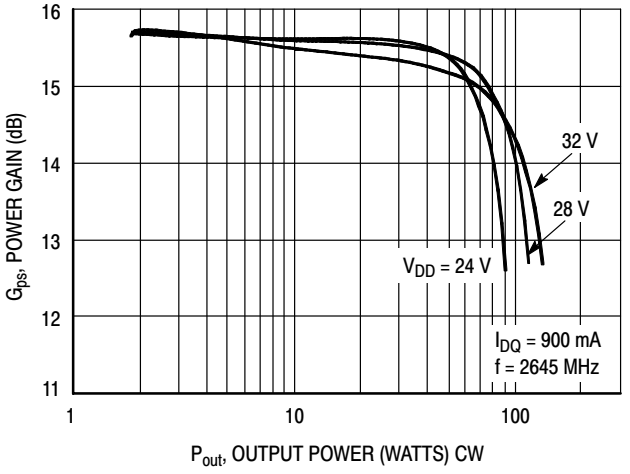
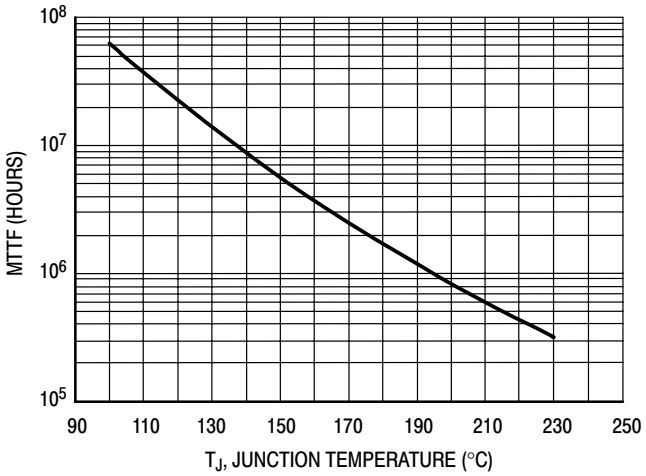


Figure 11. Power Gain versus Output Power

TYPICAL CHARACTERISTICS



This above graph displays calculated MTTF in hours when the device is operated at V_{DD} = 28 Vdc, P_{out} = 20 W Avg., and η_D = 23.5%.

MTTF calculator available at http://www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

Figure 12. MTTF versus Junction Temperature

N-CDMA TEST SIGNAL

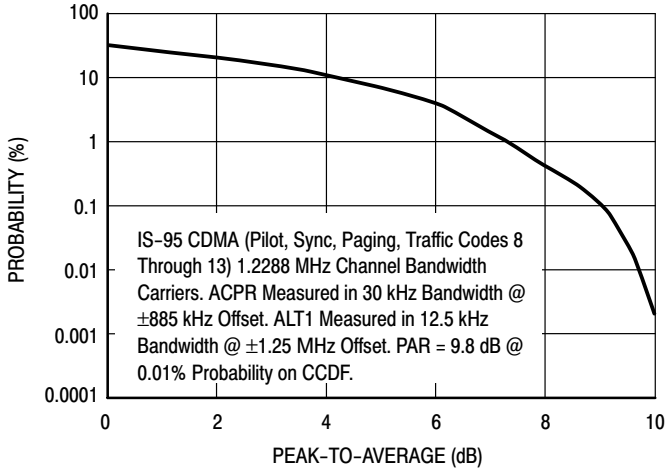


Figure 13. Single-Carrier CCDF N-CDMA

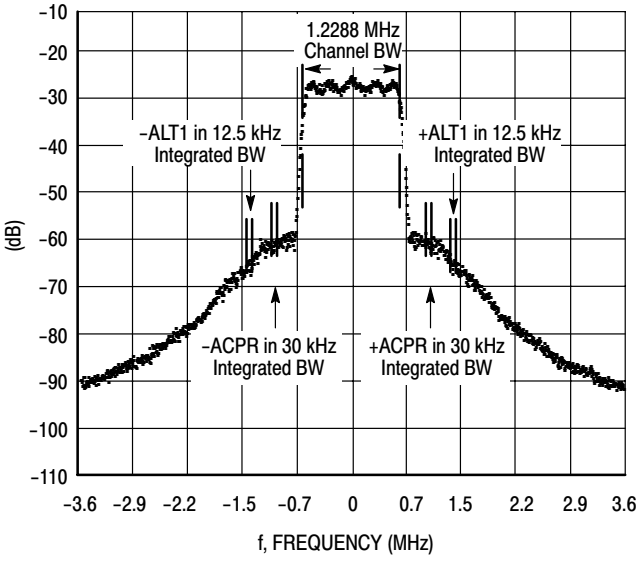
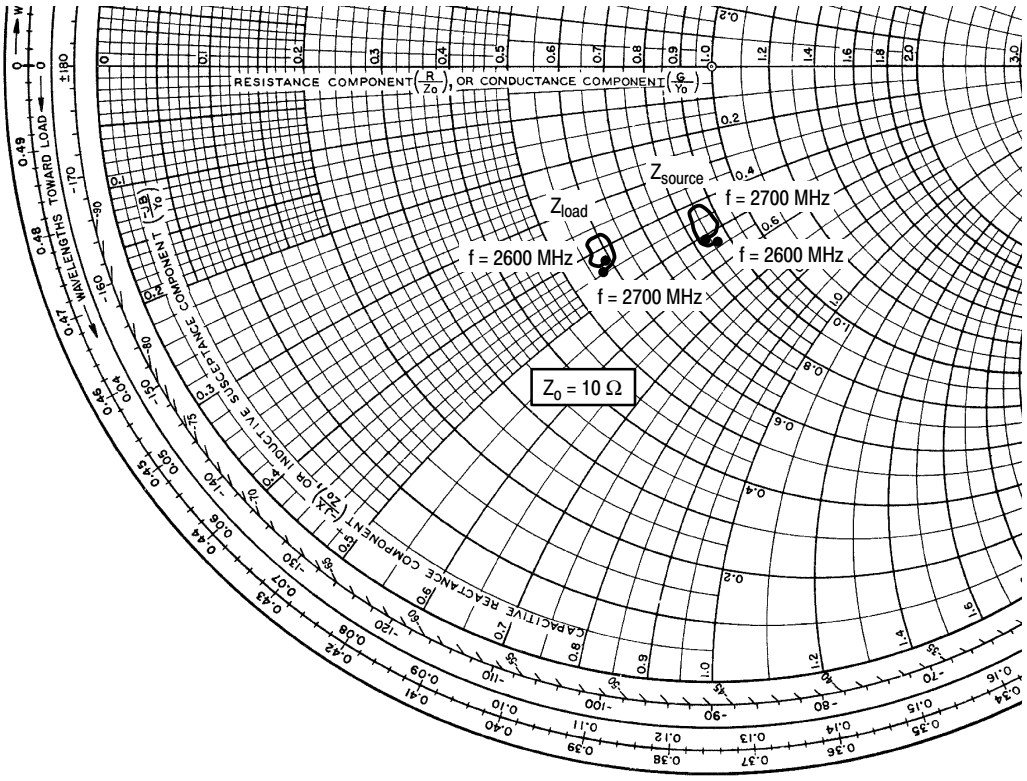


Figure 14. Single-Carrier N-CDMA Spectrum



V_{DD} = 28 Vdc, I_{DQ} = 900 mA, P_{out} = 20 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
2600	8.55 - j5.42	5.86 - j4.34
2610	8.31 - j5.30	5.69 - j4.26
2620	8.21 - j5.10	5.64 - j4.15
2630	8.21 - j4.85	5.67 - j4.00
2640	8.26 - j4.57	5.72 - j3.83
2645	8.40 - j4.43	5.80 - j3.75
2650	8.44 - j4.32	5.86 - j3.70
2660	8.78 - j4.29	6.10 - j3.72
2670	8.94 - j4.59	6.19 - j4.00
2680	8.88 - j5.01	6.07 - j4.36
2690	8.57 - j5.18	5.80 - j4.48
2700	8.36 - j5.10	5.71 - j4.47

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

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

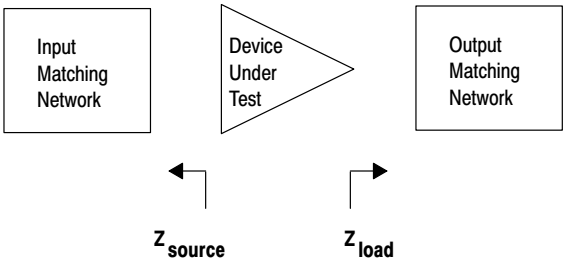
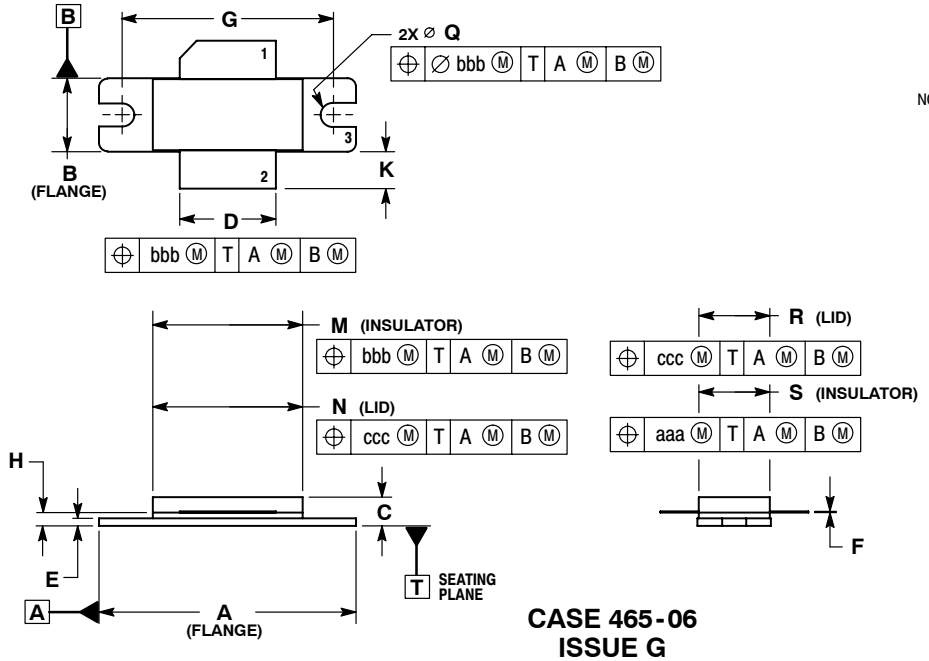


Figure 15. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

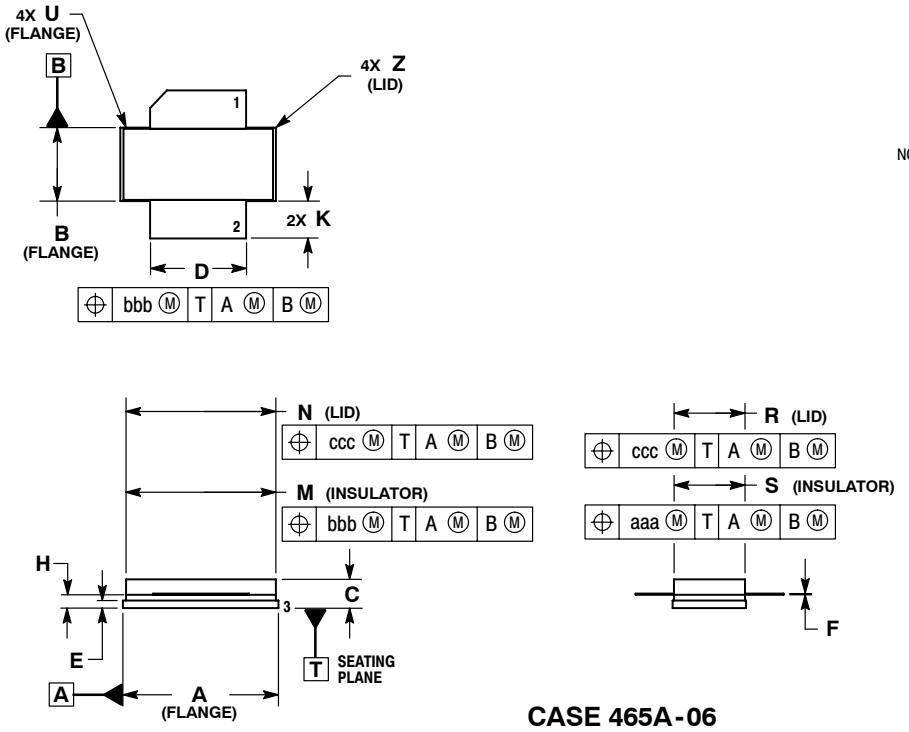


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	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 465-06
ISSUE G
NI-780
MRF6S27085HR3



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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	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
NI-780S
MRF6S27085HSR3

PRODUCT DOCUMENTATION

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
3	Dec. 2008	• Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN13232, p. 1, 2 • Removed Lower Thermal Resistance and Low Gold Plating bullets from Features section as functionality is standard, p. 1 • Removed Total Device Dissipation from Max Ratings table as data was redundant (information already provided in Thermal Characteristics table), p. 1 • Operating Junction Temperature increased from 200°C to 225°C in Maximum Ratings table and related "Continuous use at maximum temperature will affect MTTF" footnote added, p. 1 • Corrected V_{DS} to V_{DD} in the RF test condition voltage callout for $V_{GS(Q)}$, and added "Measured in Functional Test", On Characteristics table, p. 2 • Removed Forward Transconductance from On Characteristics table as it no longer provided usable information, p. 2 • Changed minimum drain efficiency specification from 22% to 21% to match production test limits, Table 4, Functional Tests, p. 2 • Updated Part Numbers in Table 5, Component Designations and Values, to RoHS compliant part numbers, p. 3 • Removed lower voltage tests from Fig. 11, Power Gain versus Output Power, due to fixed tuned fixture limitations, p. 6 • Replaced Fig. 12, MTTF versus Junction Temperature, with updated graph. Removed $Amps^2$ and listed operating characteristics and location of MTTF calculator for device, p. 7 • Added Product Documentation and Revision History, p. 10

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