Freescale Semiconductor
Technical Data

Document Number: MRF6S27085H
Rev. 1, 1/2005

RF Power Field Effect Transistors

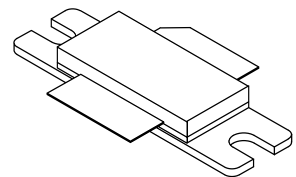
N-Channel Enhancement-Mode Lateral MOSFETs

MRF6S27085HR3
MRF6S27085HSR3

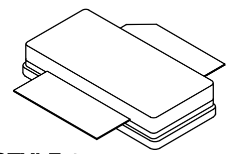
2700 MHz, 20 W AVG., 28 V
SINGLE N-CDMA
LATERAL N-CHANNEL
RF POWER MOSFETs

Designed for N-CDMA base station applications with frequencies from 2600 to 2700 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

- Typical Single-Carrier N-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 900 mA, P_{out} = 20 Watts Avg., Full Frequency Band, IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) Channel Bandwidth = 1.2288 MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
  Power Gain — 15.5 dB
  Drain Efficiency — 23.5%
  ACPR @ 885 kHz Offset — -48 dBc @ 30 kHz Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2700 MHz, 85 Watts CW Output Power
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched, Controlled Q, for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- Lower Thermal Resistance Package
- Designed for Lower Memory Effects and Wide Instantaneous Bandwidth Applications
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- 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
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	350 2	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C
CW Operation	CW	85	W

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (1,2)	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. MTTF calculator available at http://www.freescale.com/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.
2. Refer to AN1955/D, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/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.

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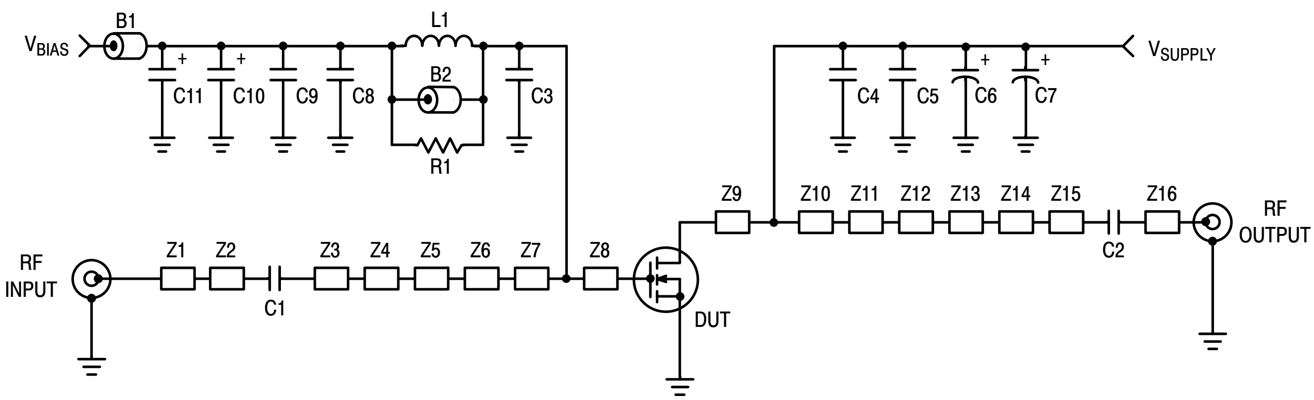
Table 3. ESD Protection Characteristics

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_{DS} = 28 Vdc, I_D = 900 mAdc)	$V_{GS(Q)}$	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
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	5.3	—	S
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 = 2630 MHz and 2660 MHz, Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier. ACPR measured in 30 kHz Channel Bandwidth @ ±885 kHz Offset. Peak/Avg. Ratio = 9.8 dB @ 0.01% Probability on CCDF					
Power Gain	G_{ps}	14	15.5	17	dB
Drain Efficiency	η_D	22	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.

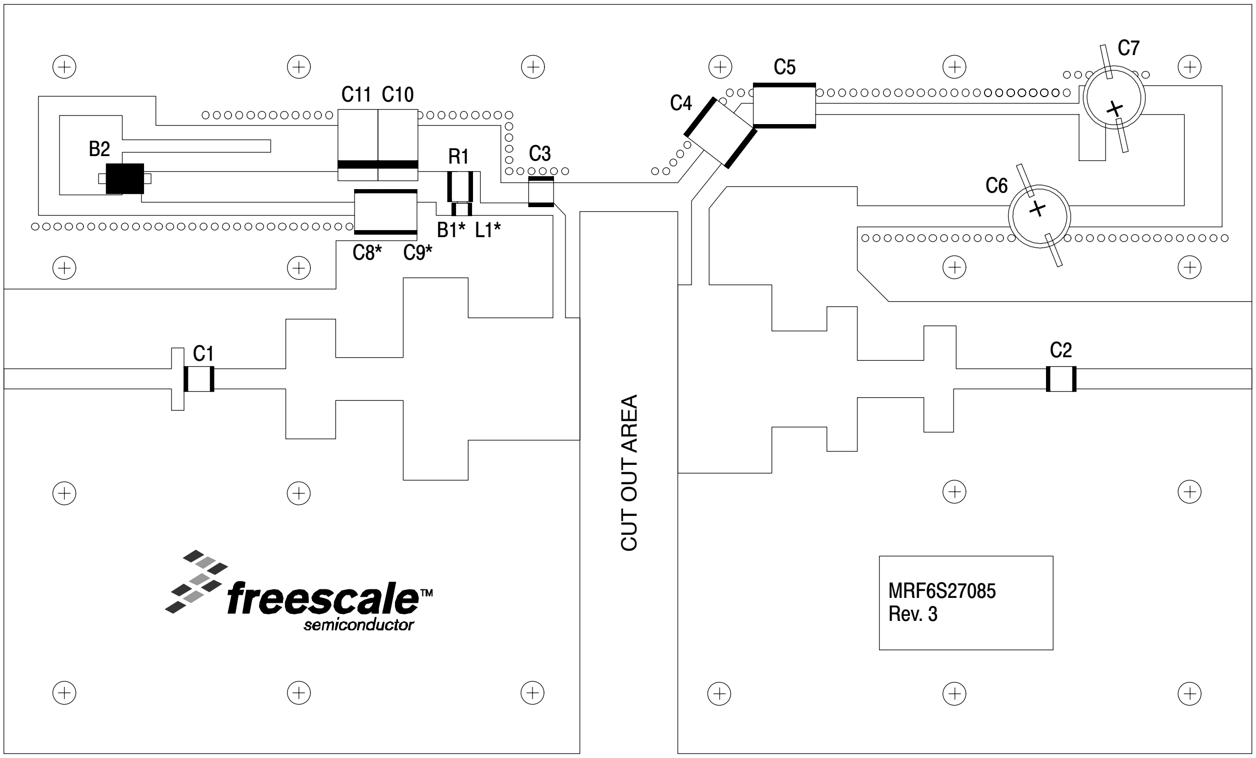


Z1	0.672″ x 0.081″ Microstrip
Z2	0.050″ x 0.250″ Microstrip
Z3	0.288″ x 0.081″ Microstrip
Z4	0.200″ x 0.480″ Microstrip
Z5	0.270″ x 0.172″ Microstrip
Z6	0.260″ x 0.810″ Microstrip
Z7	0.366″ x 0.490″ Microstrip
Z8	0.083″ x 0.490″ Microstrip
Z9	0.091″ x 0.753″ Microstrip
Z10	0.287″ x 0.753″ Microstrip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

Figure 1. MRF6S27085HR3(SR3) Test Circuit Schematic

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

Part	Description	Part Number	Manufacturer
B1	Bead (0805)	2508051107Y0	Fair-Rite
B2	Bead, Surface Mount	2743019447	Fair-Rite
C1, C2	4.7 pF Chip Capacitors, B Case	100B4R7CP500X	ATC
C3	3.6 pF Chip Capacitor, B Case	100B3R6CP500X	ATC
C4	10 μF, 50 V Chip Capacitor (2220)	GRM55DR61H106KA88B	Murata
C5, C8	2.2 μF, 50 V Chip Capacitors (1825)	C1825C225J5RAC	Kemet
C6	47 μF, 50 V Electrolytic Capacitor	MVK50VC47RM8X10TP	Nippon
C7	330 μF, 63 V Electrolytic Capacitor	NACZF331M63V	Nippon
C9	0.01 μF Chip Capacitor (1825)	C1825C103J1RAC	Kemet
C10	22 μF, 25 V Tantalum Capacitor	ECS-T1ED226R	Panasonic TE Series
C11	47 μF, 16 V Tantalum Capacitor	T491D476K016AS	Kemet
L1	15 nH, Chip Inductor	L0603150GGW	AVX
R1	3.3 Ω, 1/4 W Chip Resistor (1210)	ERJ-14YJ3R3U	Dale/Vishay



* Components stacked

Figure 2. MRF6S27085HR3(SR3) Test Circuit Component Layout

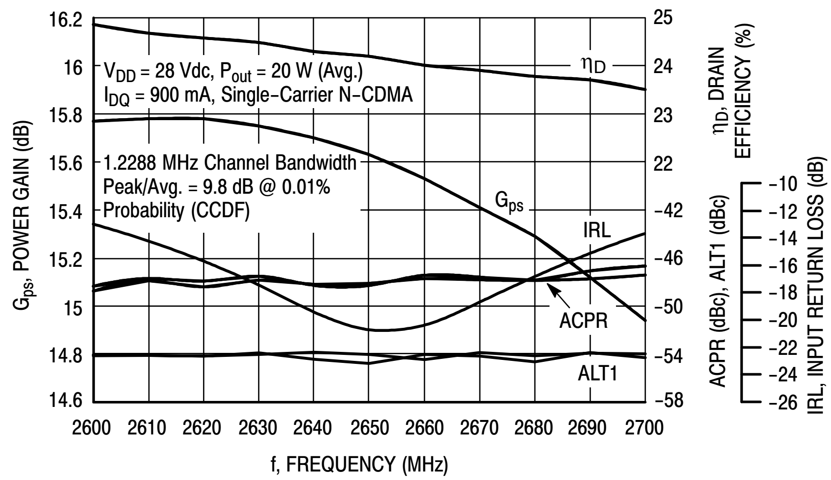


Figure 3. Single-Carrier N-CDMA Broadband Performance @ 20 Watts Avg.

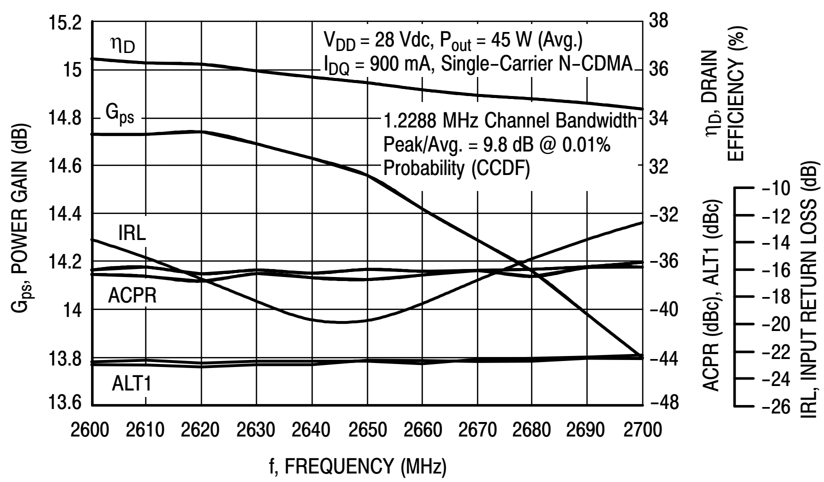


Figure 4. Single-Carrier N-CDMA Broadband Performance @ 45 Watts Avg.

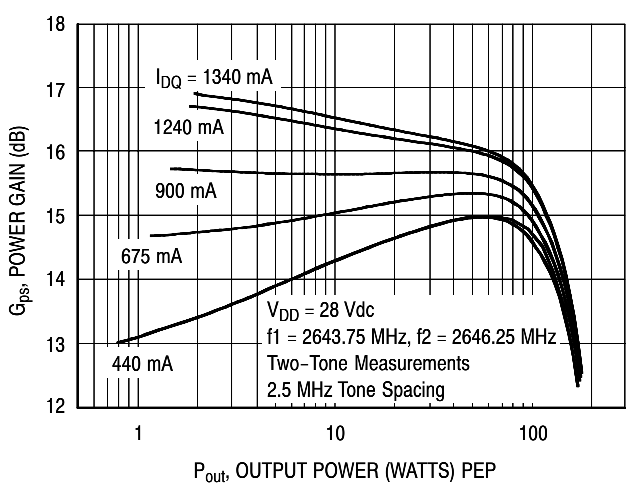


Figure 5. Two-Tone Power Gain versus Output Power

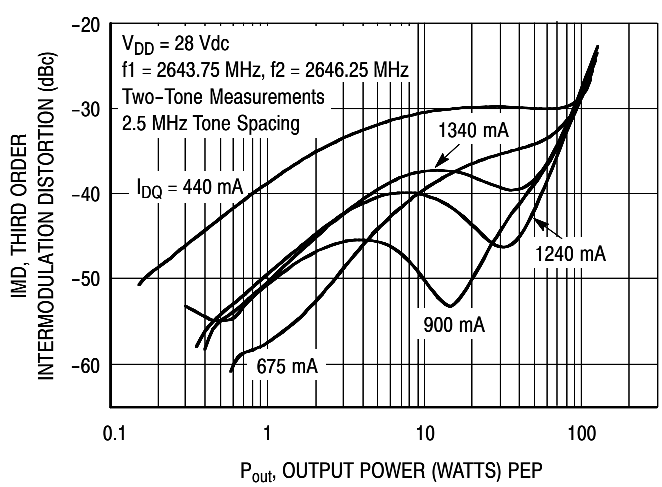


Figure 6. Third Order Intermodulation Distortion versus Output Power

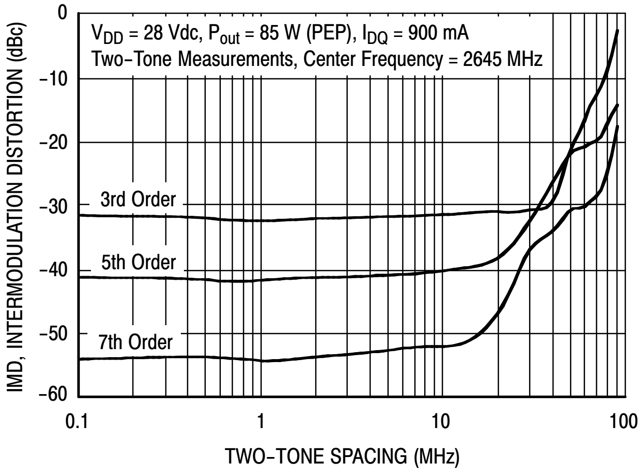


Figure 7. Intermodulation Distortion Products versus Tone Spacing

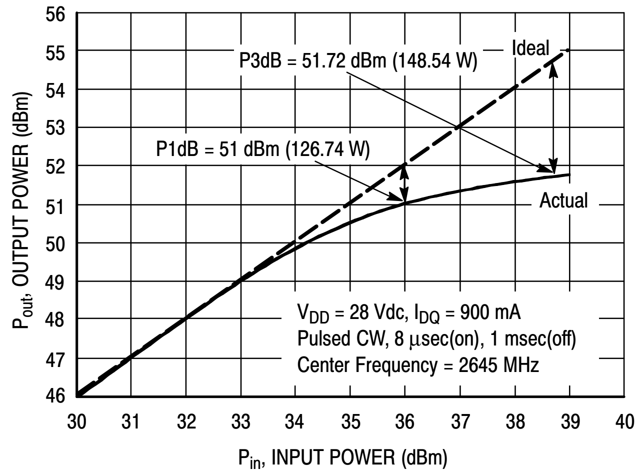


Figure 8. Pulse CW Output Power versus Input Power

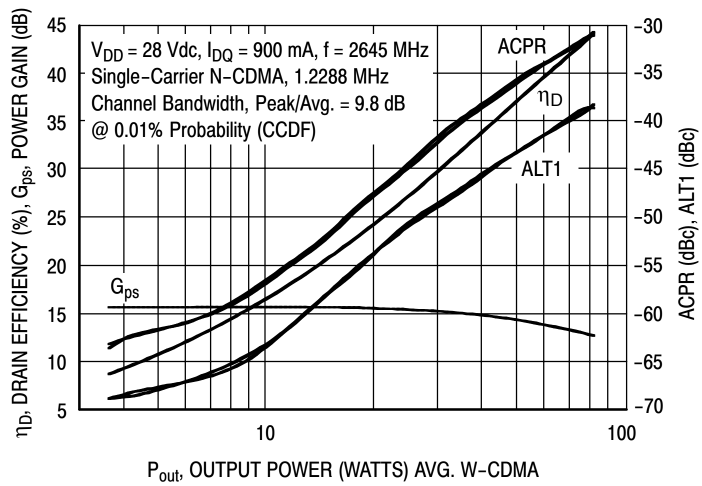


Figure 9. Single-Carrier N-CDMA ACPR, ALT1, Power Gain and Drain Efficiency versus Output Power

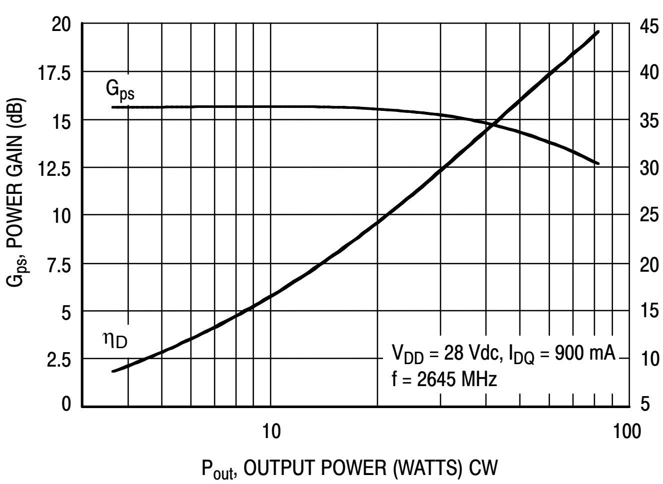


Figure 10. Power Gain and Drain Efficiency versus CW Output Power

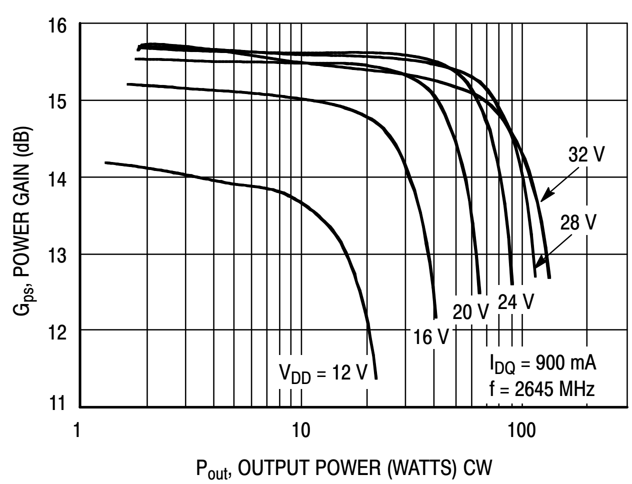
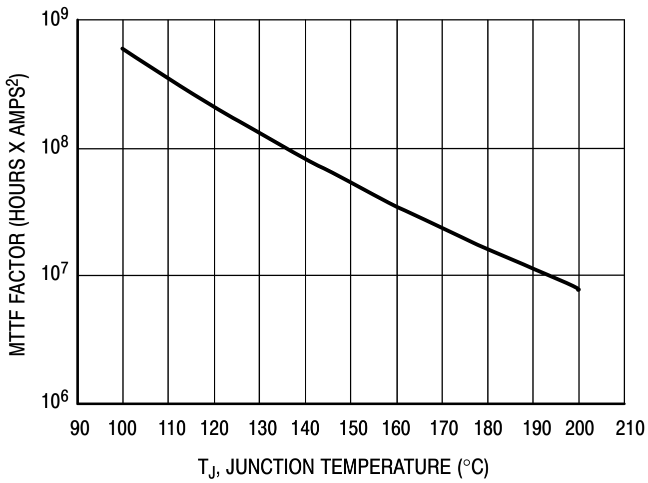


Figure 11. Power Gain versus Output Power

TYPICAL CHARACTERISTICS



This above graph displays calculated MTTF in hours x ampere^2 drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTTF factor by I_D^2 for MTTF in a particular application.

Figure 12. MTTF Factor versus Junction Temperature

TYPICAL CHARACTERISTICS
N-CDMA TEST SIGNAL

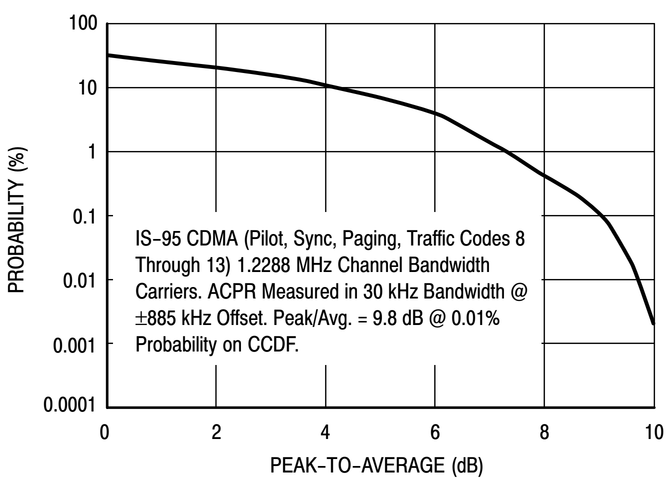


Figure 13. Single-Carrier CCDF N-CDMA

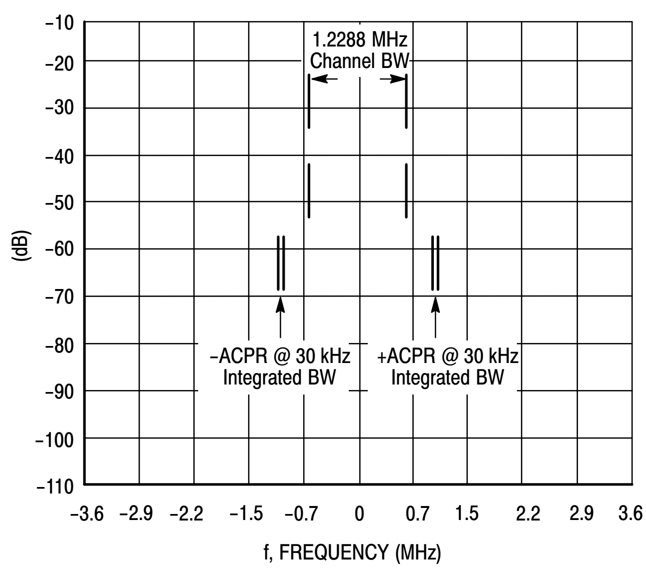
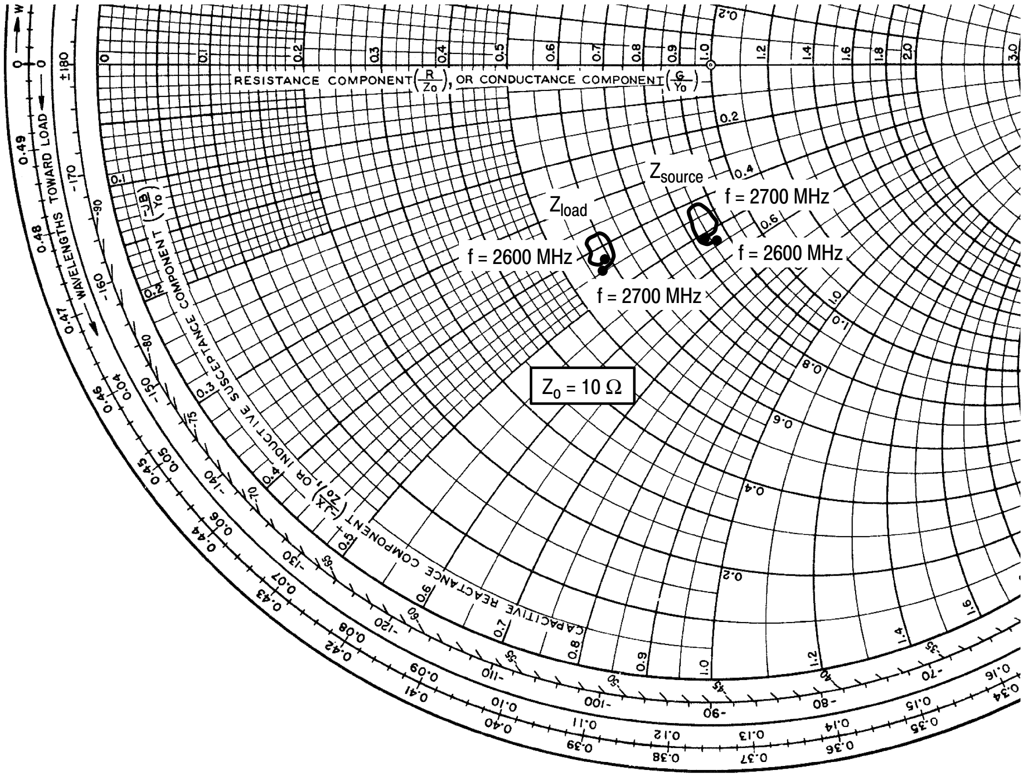


Figure 14. Single-Carrier N-CDMA Spectrum



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.

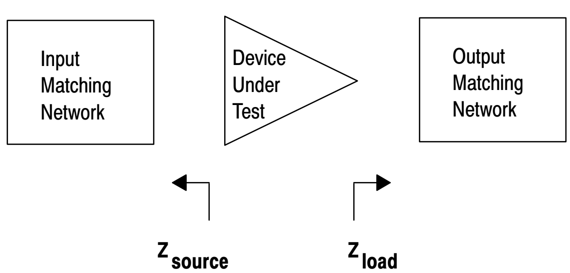
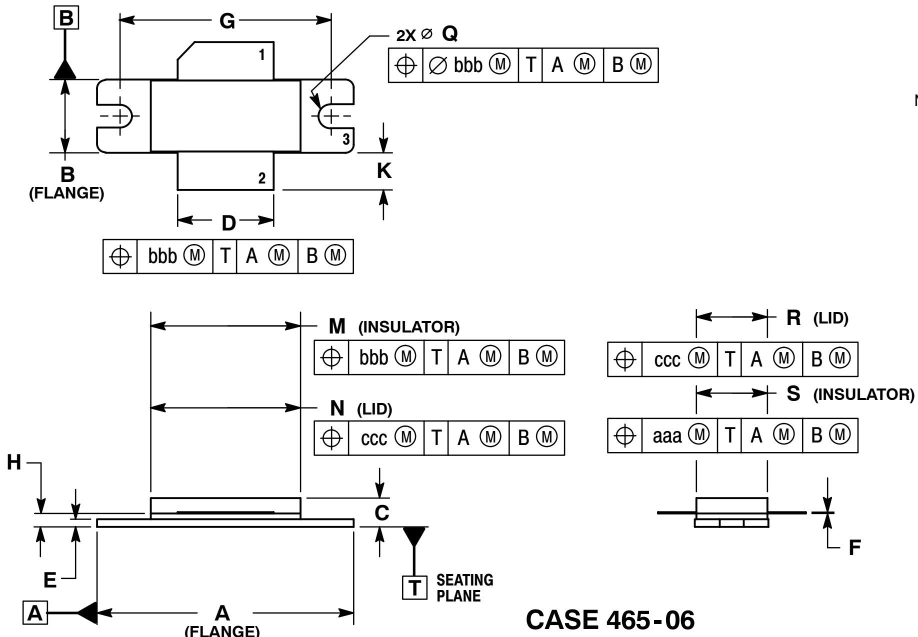


Figure 15. Series Equivalent Source and Load Impedance

NOTES

NOTES

PACKAGE DIMENSIONS

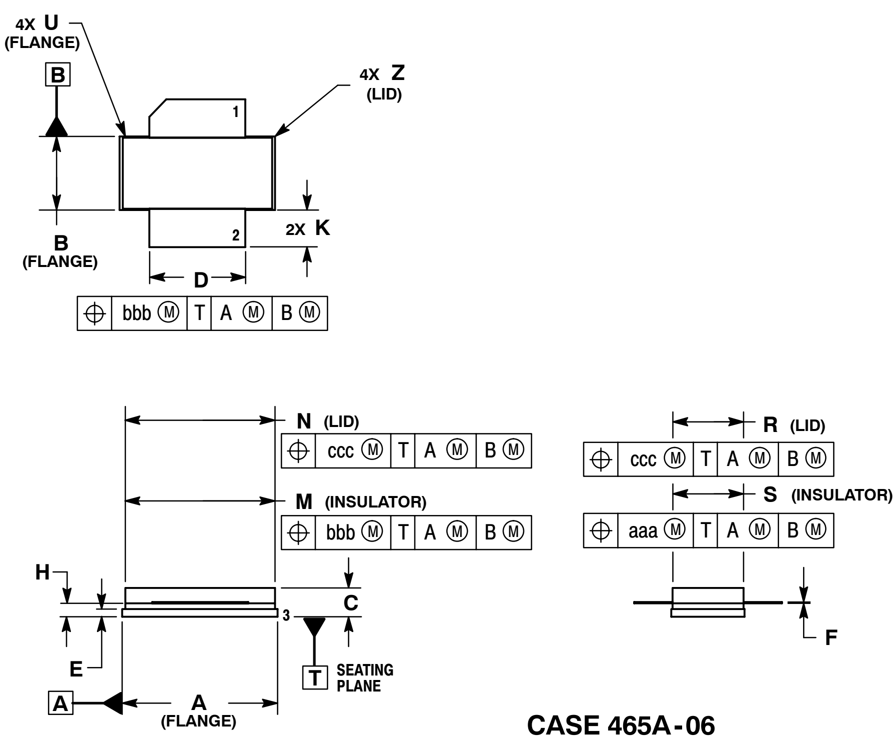


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M−1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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 F
NI-780
MRF6S27085HR3



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DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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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ISSUE F
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