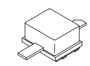
The RF Sub–Micron MOSFET Line
RF Power Field Effect Transistors
N–Channel Enhancement–Mode Lateral MOSFETs

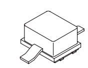
MRF282SR1*
MRF282ZR1*

*To be introduced 1Q00.

10 W, 2000 MHz, 26 V
LATERAL N–CHANNEL
BROADBAND
RF POWER MOSFETs



CASE 458–05, STYLE 1
(MRF282SR1)



CASE 458A–02, STYLE 1
(MRF282ZR1)

Designed for class A and class AB PCN and PCS base station applications at frequencies up to 2600 MHz. Suitable for FM, TDMA, CDMA, and multicarrier amplifier applications.

- Specified Two–Tone Performance @ 2000 MHz, 26 Volts
  Output Power = 10 Watts (PEP)
  Power Gain = 11 dB
  Efficiency = 30%
  Intermodulation Distortion = –28 dBc
- Specified Single–Tone Performance @ 2000 MHz, 26 Volts
  Output Power = 10 Watts (CW)
  Power Gain = 11 dB
  Efficiency = 40%
- Characterized with Series Equivalent Large–Signal Impedance Parameters
- S–Parameter Characterization at High Bias Levels
- Excellent Thermal Stability
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 2000 MHz, 10 Watts (CW) Output Power
- Gold Metallization for Improved Reliability
- Available in Tape and Reel. R1 Suffix = 500 Units per 12 mm, 7 inch Reel.
- LDMOS Models and Circuit Board Artwork Available at: http://motorola.com/sps/rf/designtds/

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	65	Vdc
Gate–Source Voltage	V_{GS}	±20	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	60 0.34	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.9	°C/W

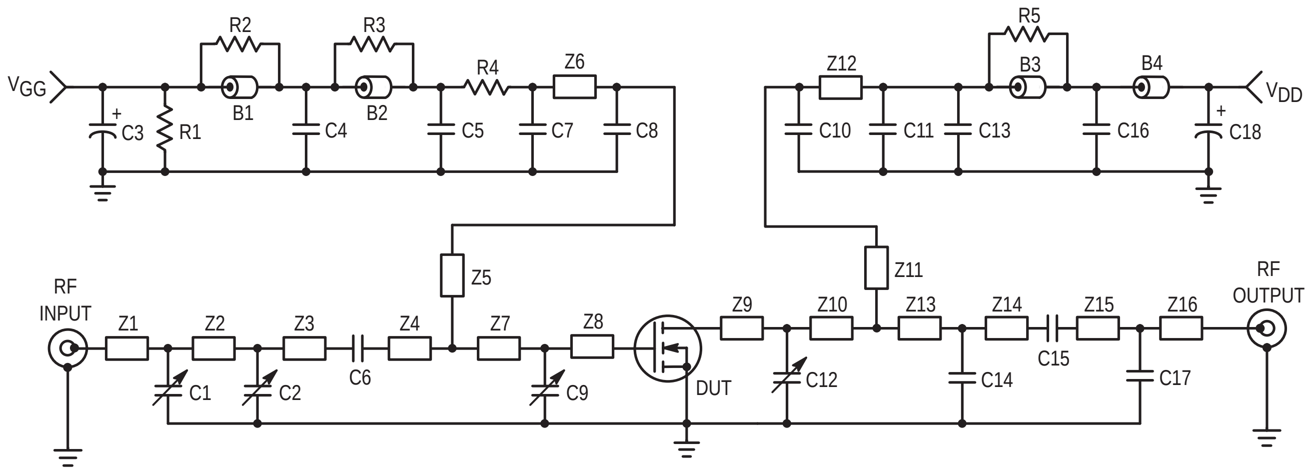
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{GS} = 0, I_D = 10 μAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0)	I_{DSS}	—	—	1.0	μAdc
Gate–Source Leakage Current (V_{GS} = 20 Vdc, V_{DS} = 0)	I_{GSS}	—	—	1.0	μAdc

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 50 μAdc)	$V_{GS(th)}$	2.0	3.0	4.0	Vdc
Drain–Source On–Voltage (V_{GS} = 10 Vdc, I_D = 0.5 Adc)	$V_{DS(on)}$	—	0.4	0.6	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 0.5 Adc)	g_{fs}	—	0.7	—	S
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 75 mAdc)	$V_{GS(q)}$	3.0	4.0	5.0	Vdc
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{iss}	—	15	—	pF
Output Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{oss}	—	8.0	—	pF
Reverse Transfer Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{rss}	—	0.45	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture)					
Common–Source Power Gain (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	G_{ps}	11	12.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	η	30	34	—	%
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	IMD	—	–32.5	–28	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	IRL	10	14	—	dB
Common–Source Power Gain (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	G_{ps}	11	12.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	η	—	30	—	%
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IMD	—	–32.5	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 10 W (PEP), I_{DQ} = 75 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IRL	10	14	—	dB
Common–Source Power Gain (V_{DD} = 26 Vdc, P_{out} = 10 W CW, I_{DQ} = 75 mA, f = 2000.0 MHz)	G_{ps}	11	12.3	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 10 W CW, I_{DQ} = 75 mA, f = 2000.0 MHz)	η	40	45	—	%
Output Mismatch Stress (V_{DD} = 26 Vdc, P_{out} = 10 W CW, I_{DQ} = 75 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz, Load VSWR = 10:1, All Phase Angles at Frequency of Test)	Ψ	No Degradation In Output Power			



Z1	0.491″ x 0.080″ Microstrip	Z11	0.636″ x 0.055″ Microstrip
Z2	0.253″ x 0.080″ Microstrip	Z12	0.303″ x 0.055″ Microstrip
Z3	0.632″ x 0.080″ Microstrip	Z13	0.463″ x 0.080″ Microstrip
Z4	0.567″ x 0.080″ Microstrip	Z14	0.105″ x 0.080″ Microstrip
Z5	1.139″ x 0.055″ Microstrip	Z15	0.452″ ± 0.085″ x 0.080″ Microstrip
Z6	0.236″ x 0.055″ Microstrip	Z16	0.910″ ± 0.085″ x 0.080″ Microstrip
Z7	0.180″ x 0.325″ Microstrip	Raw Board Material	0.030″ Glass Teflon®, 2 oz Copper, 3″ x 5″ Dimensions, Arlon GX0300–55–22, ε_r = 2.55
Z8	0.301″ x 0.325″ Microstrip		
Z9	0.439″ x 0.325″ Microstrip		
Z10	0.055″ x 0.325″ Microstrip		

Figure 1. 1.93 – 2.0 GHz Broadband Test Circuit Schematic

Table 1. 1.93 – 2.0 GHz Broadband Component Designations and Values

Designators	Description
B1, B4	0.120″ x 0.333″ x 0.100″, Surface Mount Ferrite Beads, Fair Rite # 2743019446
B2, B3	0.120″ x 0.170″ x 0.100″, Surface Mount Ferrite Beads, Fair Rite # 2743029446
C1, C2, C9	0.8–8.0 pF Gigatrim Variable Capacitors, Johanson # 27291SL
C3	10 μF, 35 V Tantalum Surface Mount Chip Capacitor, Kemet # T495X106K035AS4394
C4, C5, C13, C16	0.1 μF Chip Capacitor, Kemet # CDR33BX104AKWS
C6	200 pF, B Case RF Chip Capacitors, ATC # 100B201JCA500X
C7	18 pF, B Case RF Chip Capacitors, ATC # 100B180KP500X
C8	39 pF, B Case RF Chip Capacitors, ATC # 100B390JCA500X
C10	27 pF, B Case RF Chip Capacitors, ATC # 100B270JCA500X
C11	1.2 pF, B Case RF Chip Capacitors, ATC # 100B1R2CCA500X
C12	0.6–4.5 pF, Gigatrim Variable Capacitor, Johanson # 27271SL
C14	0.5 pF, B Case RF Chip Capacitors, ATC # 100B0R5BCA500X
C15	15 pF, B Case RF Chip Capacitors, ATC # 100B150JCA500X
C17	0.1 pF, B Case RF Chip Capacitors, ATC # 100B0R1BCA500X
C18	22 μF, 35 V Tantalum Surface Mount Chip Capacitor, Kemet # T491X226K035AS4394
R1	560 kΩ, 1/4 W Chip Resistor 0.08″ x 0.13″
R2, R5	12 Ω, 1/4 W Chip Resistor 0.08″ x 0.13″, Garrett Instruments # RM73B2B120JT
R3, R4	91 Ω, 1/4 W Chip Resistor 0.08″ x 0.13″, Garrett Instruments # RM73B2B910JT
WS1, WS2	Berrylium Copper Wear Blocks 0.010″ x 0.235″ x 0.135″ NOM
	Brass Banana Jack and Nut
	Red Banana Jack and Nut
	Green Banana Jack and Nut
	Type “N” Jack Connectors, Omni–Spectra # 3052–1648–10
	4–40 Ph Head Screws, 0.125″ Long
	4–40 Ph Head Screws, 0.188″ Long
	4–40 Ph Head Screws, 0.312″ Long
	4–40 Ph Rec. Hd. Screws, 0.438″ Long
RF Circuit Board	3″ x 5″ Copper Clad PCB, Glass Teflon®

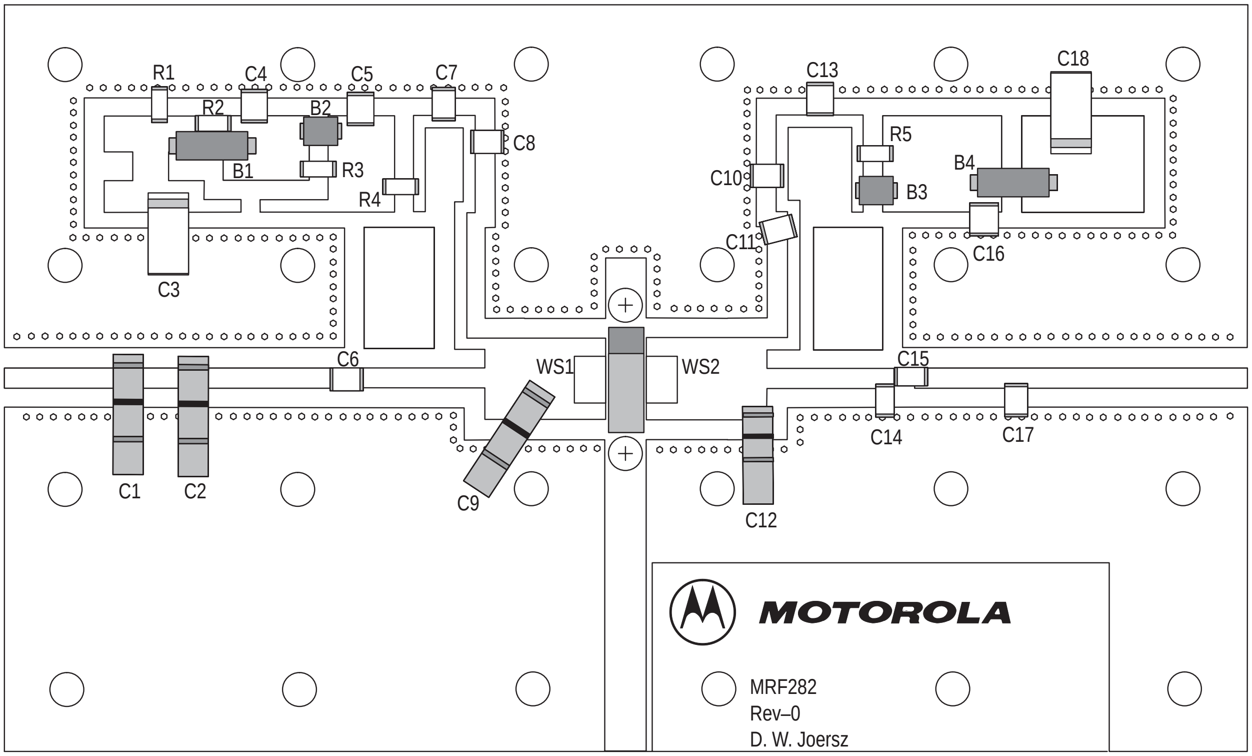
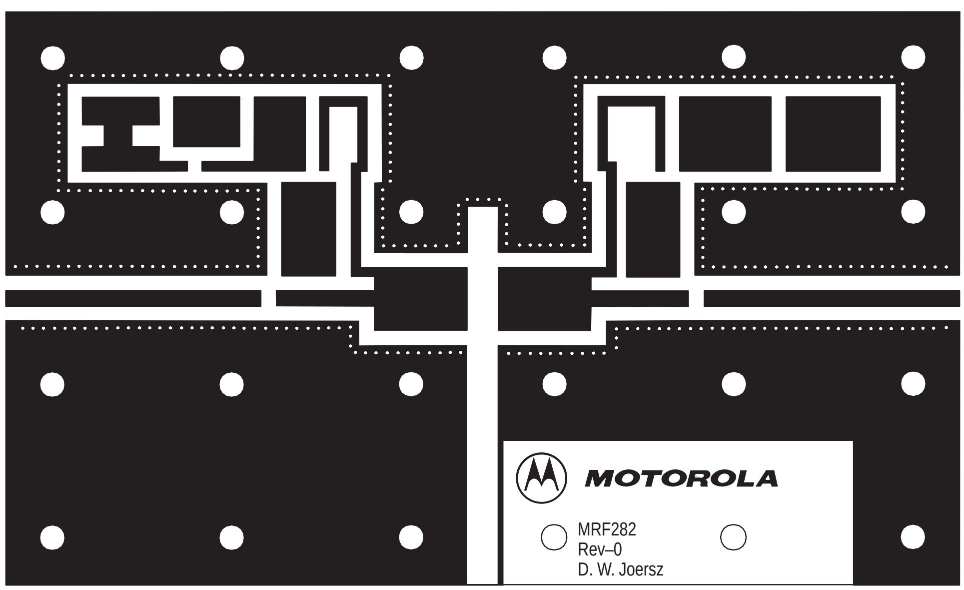
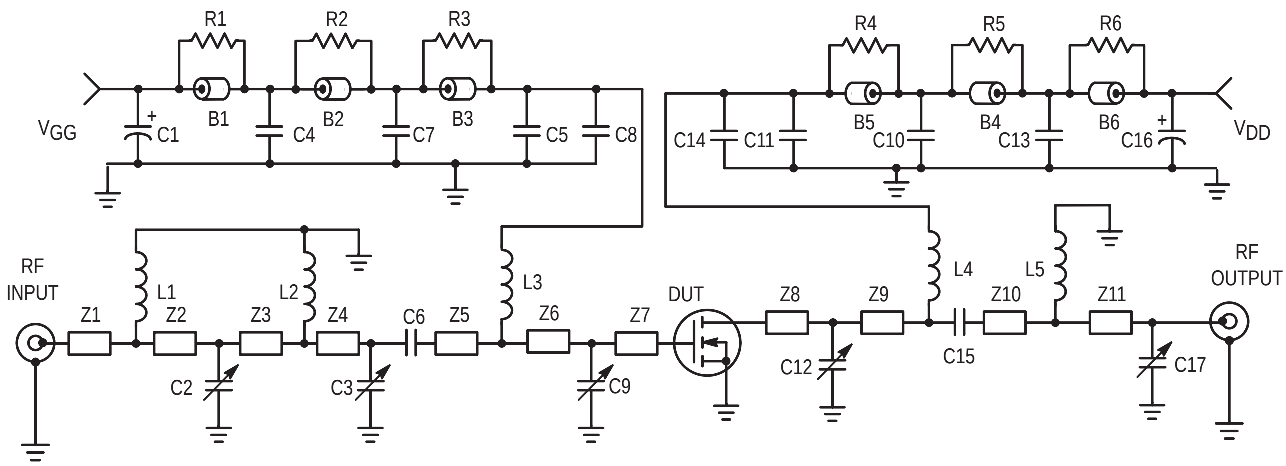


Figure 2. 1.93–2.0 GHz Broadband Test Circuit Component Layout



(Scale 1:1)

Figure 3. MRF282 Test Circuit Photomaster
(Reduced 18% in printed data book, DL110/D)

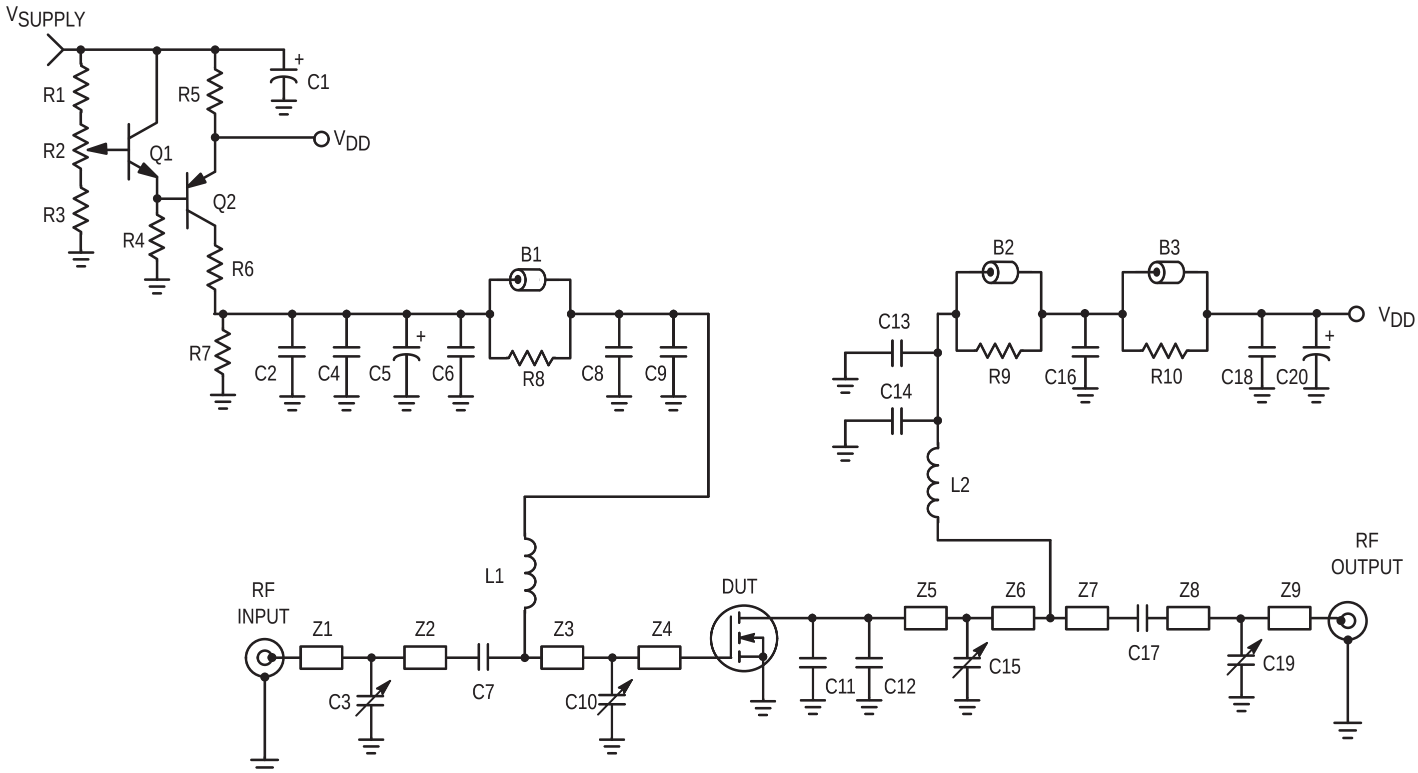


Z1	0.122″ x 0.08″ Microstrip	Z8	0.414″ x 0.330″ Microstrip
Z2	0.650″ x 0.08″ Microstrip	Z9	0.392″ x 0.08″ Microstrip
Z3	0.160″ x 0.08″ Microstrip	Z10	0.070″ x 0.08″ Microstrip
Z4	0.030″ x 0.08″ Microstrip	Z11	1.110″ x 0.08″ Microstrip
Z5	0.045″ x 0.08″ Microstrip	Raw Board Material	0.030″ Glass Teflon®, 2 oz Copper, 3″ x 5″ Dimensions, Arlon GX0300–55–22, ε_r = 2.55
Z6	0.291″ x 0.08″ Microstrip		
Z7	0.483″ x 0.330″ Microstrip		

Figure 4. 1.81 – 1.88 GHz Broadband Test Circuit Schematic

Table 2. 1.81 – 1.88 GHz Broadband Component Designations and Values

Designators	Description
B1, B2, B3, B4, B5, B6	0.120″ x 0.170″ x 0.100″, Surface Mount Ferrite Beads, Fair Rite # 2743029446
C1, C16	470 µF, 63 V, Electrolytic Capacitor, Mallory # SME63UB471M12X25L
C2, C9, C12, C17	0.6–4.5 pF, Variable Capacitor, Johanson Gigatrim # 27271SL
C3	0.8–8.0 pF, Variable Capacitor, Johanson Gigatrim # 27291SL
C4, C13	0.1 µF, Chip Capacitor, Kemet # CDR33BX104AKWS
C5, C14	100 pF, B Case Chip Capacitor, ATC # 100B101JCA500X
C6, C8, C11, C15	12 pF, B Case Chip Capacitor, ATC # 100B120JCA500X
C7, C10	1000 pF, B Case Chip Capacitor, ATC # 100B102JCA50X
L1	3 Turns, 27 AWG, 0.087″ OD, 0.050″ ID, 0.053″ Long, 6.0 nH
L2	5 Turns, 27 AWG, 0.087″ OD, 0.050″ ID, 0.091″ Long, 15 nH
L3, L4	9 Turns, 26 AWG, 0.080″ OD, 0.046″ ID, 0.170″ Long, 30.8 nH
L5	4 Turns, 27 AWG, 0.087″ OD, 0.050″ ID, 0.078″ Long, 10 nH
R1, R2, R3	12 Ω, 1/8 W Fixed Film Chip Resistor. Garrett Instruments # RM73B2B120JT
R4, R5, R6	0.08″ x 0.13″. Garrett Instruments # RM73B2B120JT
W1, W2	Berrylium Copper 0.010″ x 0.110″ x 0.210″



Z1	0.624″ x 0.08″ Microstrip	Z7	0.408″ x 0.08″ Microstrip
Z2	0.725″ x 0.08″ Microstrip	Z8	0.990″ x 0.08″ Microstrip
Z3	0.455″ x 0.08″ Microstrip	Z9	0.295″ x 0.08″ Microstrip
Z4	0.530″ x 0.330″ Microstrip	Raw Board Material	0.030″ Glass Teflon®, 2 oz Copper, 3″ x 5″ Dimensions, Arlon GX0300–55–22, ε_r = 2.55
Z5	0.280″ x 0.330″ Microstrip		
Z6	0.212″ x 0.330″ Microstrip		

Figure 5. Class A Test Circuit Schematic

Table 3. Class A Broadband Component Designations and Values

Designators	Description
B1, B2, B3	Ferrite Bead, Ferroxcube, 56–590–65–3B
C1, C20	470 µF, 63 V, Electrolytic Capacitor, Mallory # SME63V471M12X25L
C2	0.01 µF, B Case Chip Capacitor, ATC # 100B103JCA50X
C3, C10, C15	0.6–4.5 pF, Variable Capacitor, Johanson # 27271SL
C4, C16	0.02 µF, B Case Chip Capacitor, ATC # 100B203JCA50X
C5	100 µF, 50 V, Electrolytic Capacitor, Mallory # SME50VB101M12X256
C6, C7, C9, C14, C17	12 pF, B Case Chip Capacitor, ATC # 100B120JCA500X
C8, C13	51 pF, B Case Chip Capacitor, ATC # 100B510JCA500X
C11, C12	0.3 pF, B Case Chip Capacitor, ATC # 100B0R3CCA500X
C18	0.1 µF, Chip Capacitor, Kemet # CDR33BX104AKWS
C19	0.4–2.5 pF, Variable Capacitor, Johanson # 27285
L1	8 Turns, 0.042″ ID, 24 AWG, Enamel
L2	9 Turns, 0.046″ ID, 26 AWG, Enamel
Q1	NPN, 15 W, Bipolar Transistor, MJD310
Q2	PNP, 15 W, Bipolar Transistor, MJD320
R1	200 Ω, Axial, 1/4 W Resistor
R2	1.0 kΩ, 1/2 W Potentiometer, Bourns
R3	13 kΩ, Axial, 1/4 W Resistor
R4, R6, R7	390 Ω, 1/8 W Chip Resistor, Garrett Instruments # RM73B2B391JT
R5	1.0 Ω, 10 W 1% Resistor, DALE # RE65G1R00
R8, R9, R10	12 Ω, 1/8 W Chip Resistor, Garrett Instruments # RM73B2B120JT
Input/Output	Type N Flange Mount RF55–22, Connectors, Omni–Spectra

TYPICAL CHARACTERISTICS

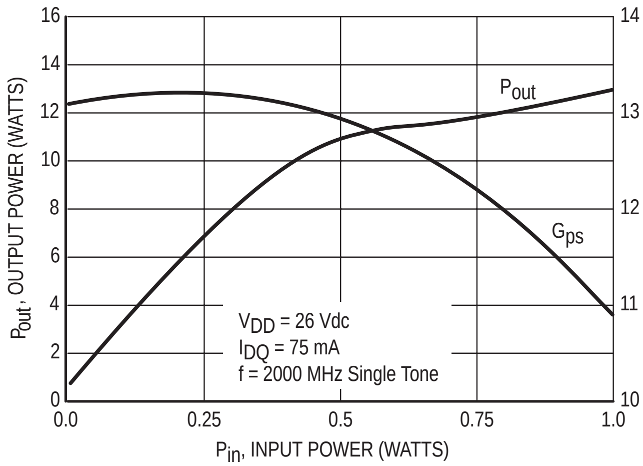


Figure 6. Output Power & Power Gain versus Input Power

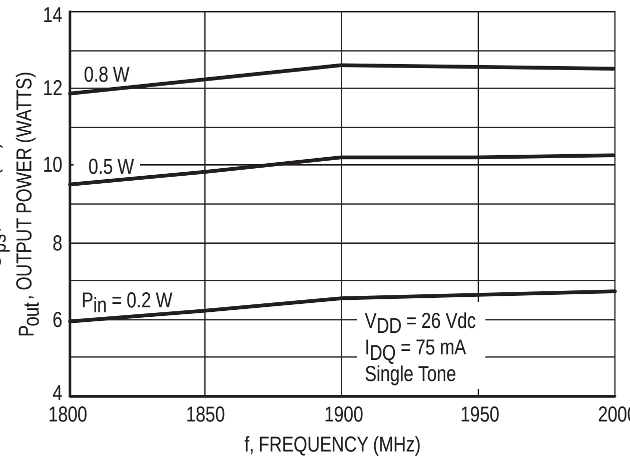


Figure 7. Output Power versus Frequency

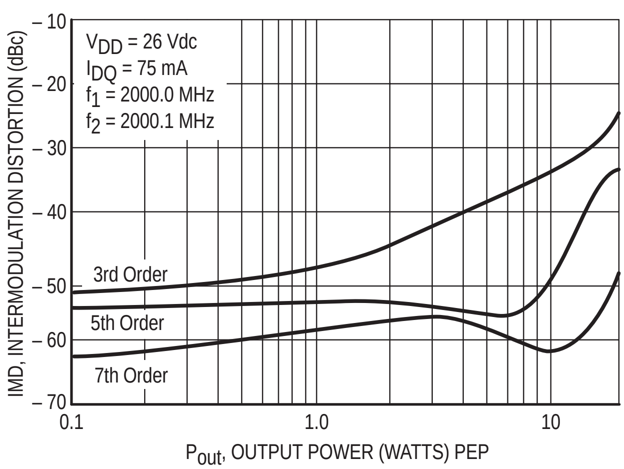


Figure 8. Intermodulation Distortion Products versus Output Power

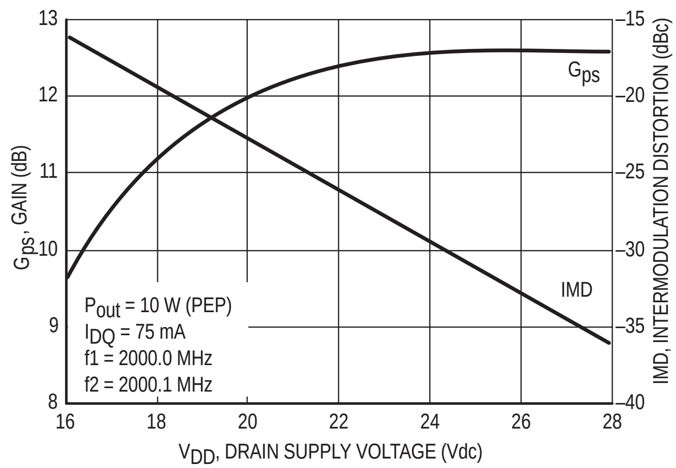


Figure 9. Power Gain and Intermodulation Distortion versus Supply Voltage

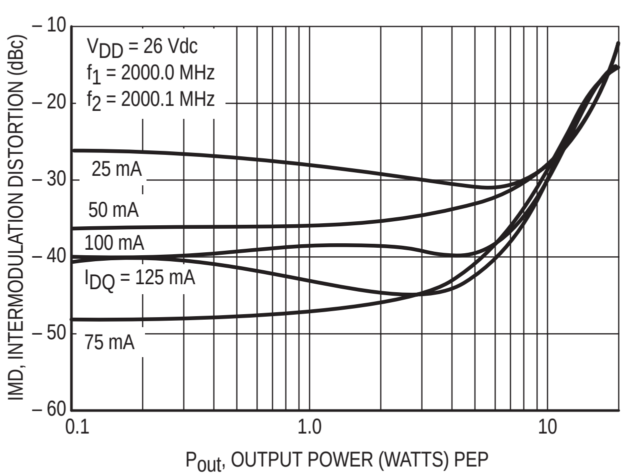


Figure 10. Intermodulation Distortion versus Output Power

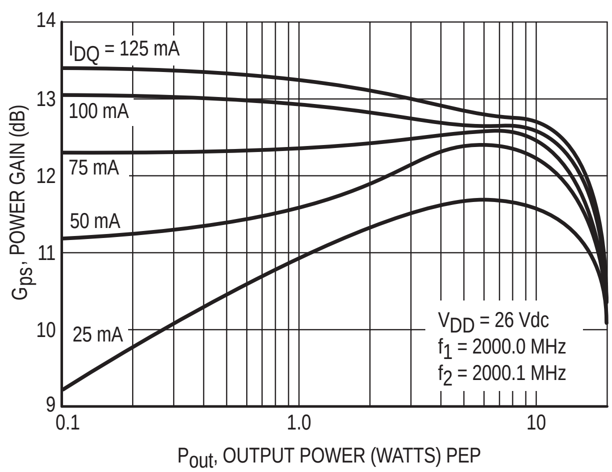


Figure 11. Power Gain versus Output Power

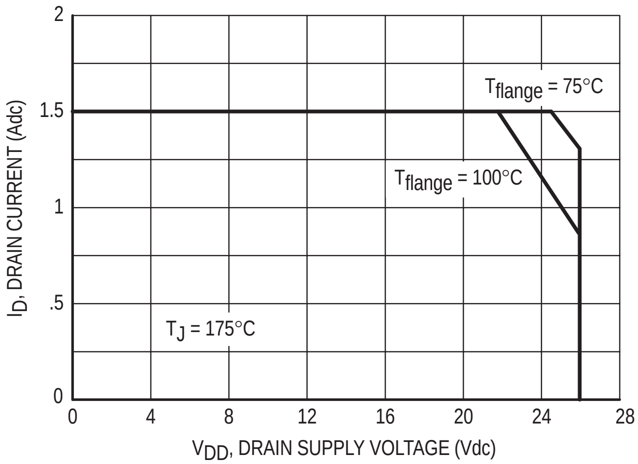


Figure 12. Class A DC Safe Operating Area

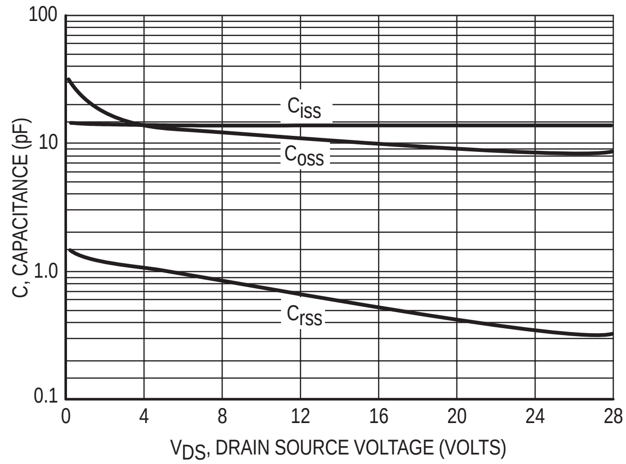


Figure 13. Capacitance versus Drain Source Voltage

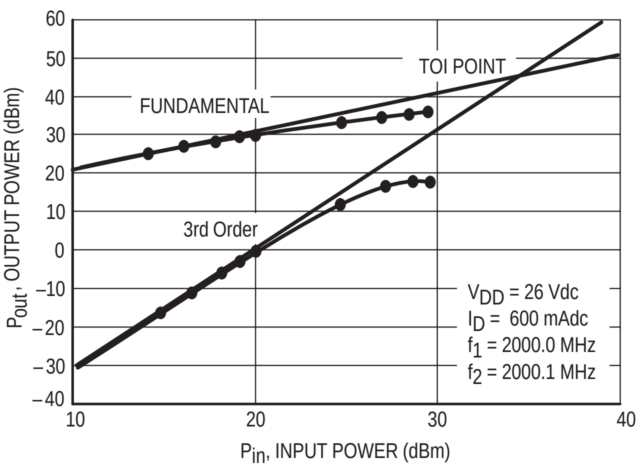


Figure 14. Class A Third Order Intercept Point

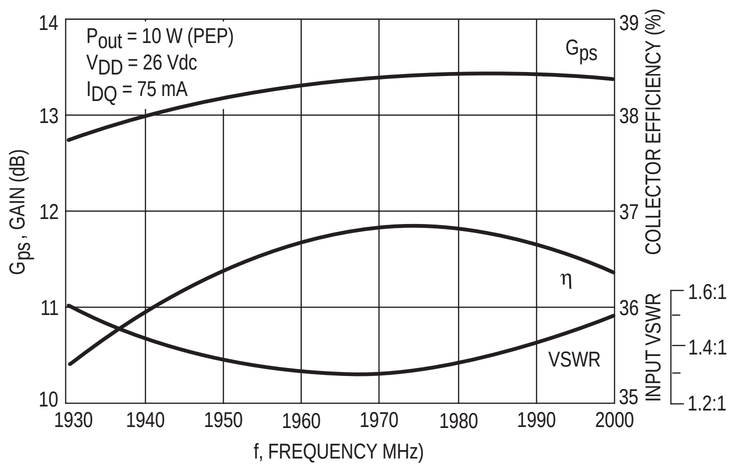
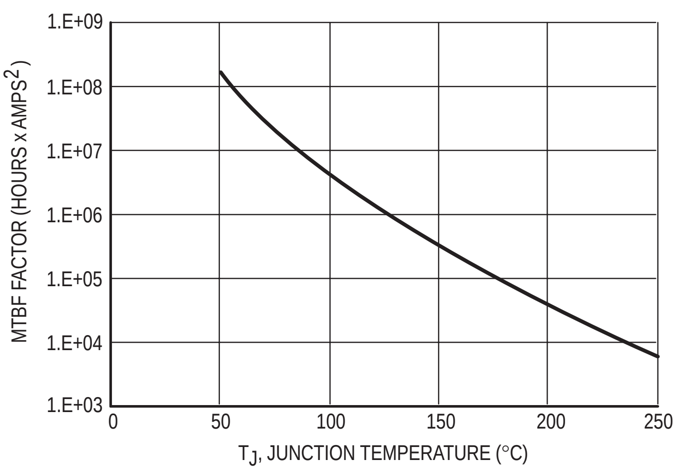
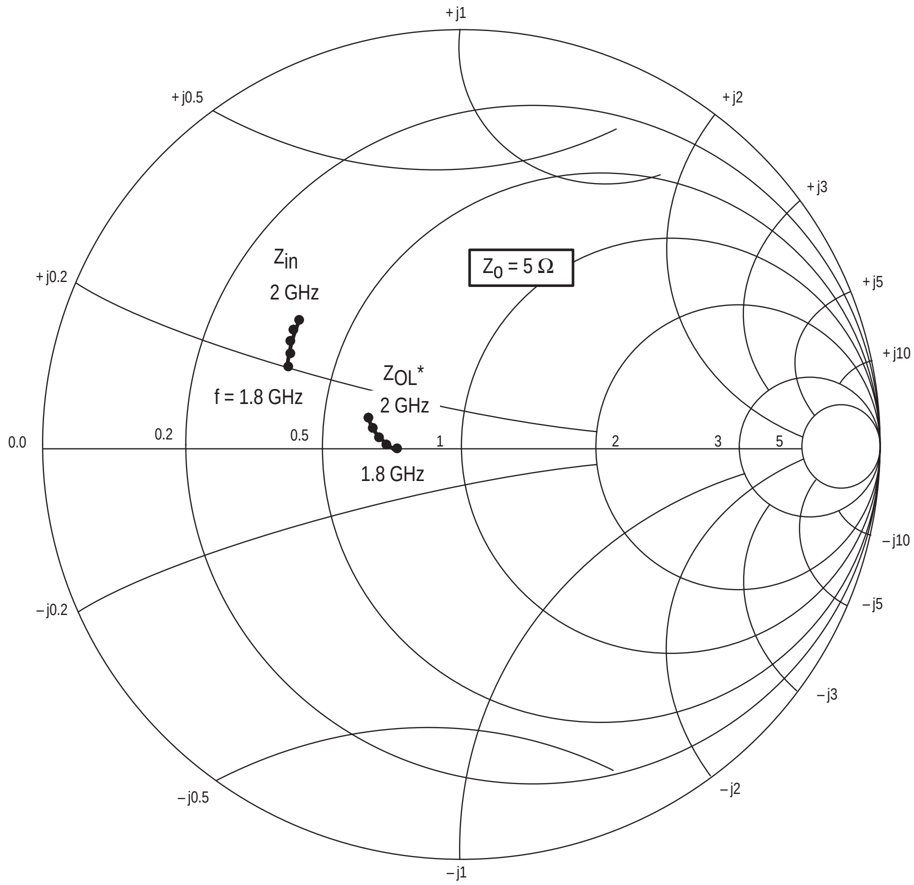


Figure 15. Performance in Broadband Circuit



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

Figure 16. MTBF Factor versus Junction Temperature



V_{CC} = 26 V, I_{CQ} = 75 mA, P_{out} = 10 W (PEP)

f MHz	**Z_{in}(1) Ω**	**Z_{OL}* Ω**
1800	2.1 + j1.0	3.8 – j0.15
1860	2.05 + j1.15	3.77 – j0.13
1900	2.0 + j1.2	3.75 – j0.1
1960	1.9 + j1.4	3.65 + j0.1
2000	1.85 + j1.6	3.55 + j0.2

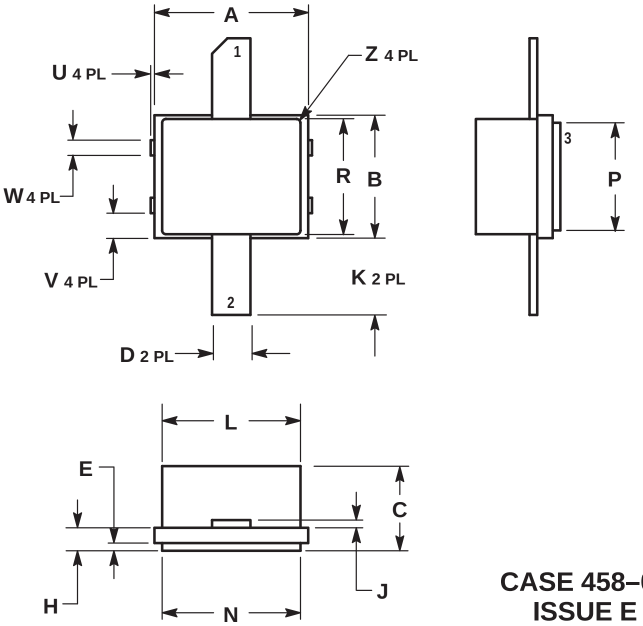
Z_{in}(1) = Complex conjugate of source impedance.

Z_{OL}* = Conjugate of the optimum load impedance at given output power, voltage, IMD, bias current and frequency.

Figure 17. Series Equivalent Input and Output Impedence

NOTES

PACKAGE DIMENSIONS

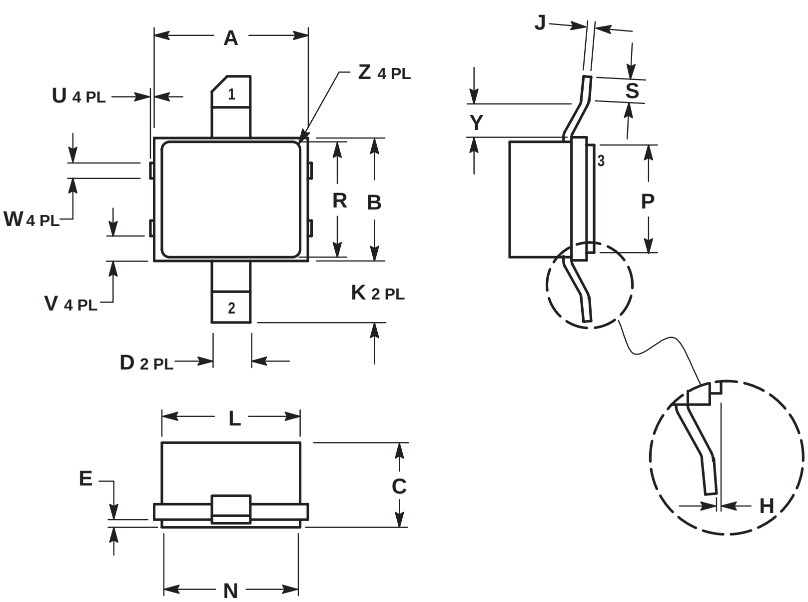


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030" AWAY FROM THE BODY OF THE PACKAGE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.197	0.203	5.00	5.16
B	0.157	0.163	3.99	4.14
C	0.085	0.110	2.16	2.79
D	0.047	0.053	1.19	1.35
E	0.006	0.010	0.15	0.25
H	0.025	0.031	0.64	0.79
J	0.006	0.010	0.15	0.25
K	0.060	0.100	1.52	2.54
L	0.177	0.183	4.50	4.65
N	0.175	0.183	4.45	4.65
P	0.135	0.143	3.43	3.63
R	0.147	0.153	3.73	3.89
U	0.000	0.005	0.00	0.13
V	0.030	0.040	0.76	1.02
W	0.017	0.023	0.43	0.58
Z	—	0.020	—	0.508

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

CASE 458–05
ISSUE E
(MRF282SR1)



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION –H– (PACKAGE COPLANARITY): THE BOTTOM OF THE LEADS AND REFERENCE PLANE –T– MUST BE COPLANAR WITHIN DIMENSION –H–.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.197	0.203	5.00	5.16
B	0.157	0.163	3.99	4.14
C	0.085	0.110	2.16	2.79
D	0.047	0.053	1.19	1.35
E	0.006	0.010	0.15	0.25
H	0.000	0.004	0.00	0.10
J	0.006	0.010	0.15	0.25
K	0.050	0.080	1.27	2.03
L	0.177	0.183	4.50	4.65
N	0.175	0.183	4.45	4.65
P	0.135	0.143	3.43	3.63
R	0.147	0.153	3.73	3.89
S	0.020	0.040	0.51	1.02
U	0.000	0.005	0.00	0.13
V	0.030	0.040	0.76	1.02
W	0.017	0.023	0.43	0.58
Y	0.030	0.040	0.76	1.02
Z	—	0.020	—	0.508

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

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