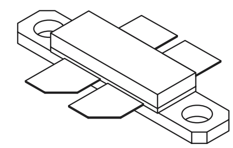
The RF MOSFET Line
RF Power Field-Effect Transistor
N–Channel Enhancement–Mode Lateral MOSFET

MRF374A

Designed for broadband commercial and industrial applications with frequencies from 470 to 860 MHz. The high gain and broadband performance of this device make it ideal for large–signal, common source amplifier applications in 28/32 volt transmitter equipment.

- Typical Two–Tone Performance @ 860 MHz, 32 Volts, Narrowband Fixture
  Output Power — 130 Watts PEP
  Power Gain — 17.3 dB
  Efficiency — 41%
  IMD — –32.5 dBc
- 100% Tested for Load Mismatch Stress at All Phase Angles with 10:1 VSWR @ 32 Vdc, 860 MHz, 130 Watts, f1 = 857 MHz, f2 = 863 MHz
- Integrated ESD Protection
- Excellent Thermal Stability
- Characterized with Differential Large–Signal Impedance Parameters

**470 – 860 MHz, 130 W, 32 V
LATERAL N–CHANNEL
BROADBAND
RF POWER MOSFET**



**CASE 375F–04, STYLE 1
NI–650**

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	70	Vdc
Gate–Source Voltage	V_{GS}	– 0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	302 1.72	Watts W/°C
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M2 (Minimum)

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.58	°C/W

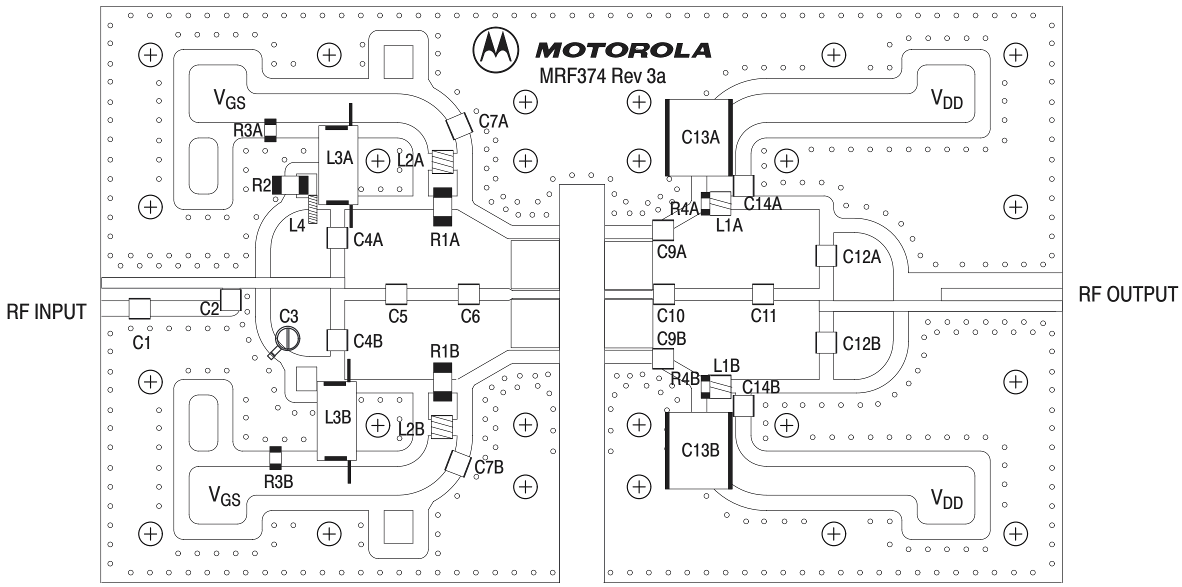
NOTE – **CAUTION** – MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

REV 3

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Drain–Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D =10 μA)	$V_{(BR)DSS}$	70	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 32 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 (1)					
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 200 μA)	$V_{GS(th)}$	2	2.9	4	Vdc
Gate Quiescent Voltage (V_{DS} = 32 V, I_D = 100 mA)	$V_{GS(Q)}$	2.5	3.3	4.5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 V, I_D = 3 A)	$V_{DS(on)}$	—	0.41	0.45	Vdc
DYNAMIC CHARACTERISTICS (1)					
Input Capacitance (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{iss}	—	97.3	—	pF
Output Capacitance (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{oss}	—	49	—	pF
Reverse Transfer Capacitance (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{rss}	—	1.91	—	pF
FUNCTIONAL CHARACTERISTICS, NARROWBAND OPERATION (In Motorola MRF374A Narrowband Circuit, 50 ohm system) (2)					
Common Source Power Gain (V_{DD} = 32 Vdc, P_{out} = 130 W PEP, I_{DQ} = 2 x 200 mA, f1 = 857 MHz, f2 = 863 MHz)	G_{ps}	16	17.3	—	dB
Drain Efficiency (V_{DD} = 32 Vdc, P_{out} = 130 W PEP, I_{DQ} = 2 x 200 mA, f1 = 857 MHz, f2 = 863 MHz)	η	36	41.2	—	%
Intermodulation Distortion (V_{DD} = 32 Vdc, P_{out} = 130 W PEP, I_{DQ} = 2 x 200 mA, f1 = 857 MHz, f2 = 863 MHz)	IMD	—	–32.5	–28	dB
Load Mismatch (V_{DD} = 32 Vdc, P_{out} = 130 W Two–Tone, I_{DQ} = 2 x 200 mA, f1 = 857 MHz, f2 = 863 MHz, VSWR 10:1 at All Phase Angles of Test)		No Degradation in Output Power			
TYPICAL CHARACTERISTICS, BROADBAND OPERATION (In Motorola MRF374 Broadband Circuit, 50 ohm system)					
Common Source Power Gain (V_{DD} = 32 Vdc, P_{out} = 100 W PEP, I_{DQ} = 750 mA, f1 = 857 MHz, f2 = 863 MHz)	G_{ps}	—	15.8	—	dB
Drain Efficiency (V_{DD} = 32 Vdc, P_{out} = 100 W PEP, I_{DQ} = 750 mA, f1 = 857 MHz, f2 = 863 MHz)	η	—	35	—	%
Intermodulation Distortion (V_{DD} = 32 Vdc, P_{out} = 100 W PEP, I_{DQ} = 750 mA, f1 = 857 MHz, f2 = 863 MHz)	IMD	—	34.5	—	dB

(1) Each side of device measured separately.
(2) Measured in push–pull configuration.



Vertical Balun Mounting Detail

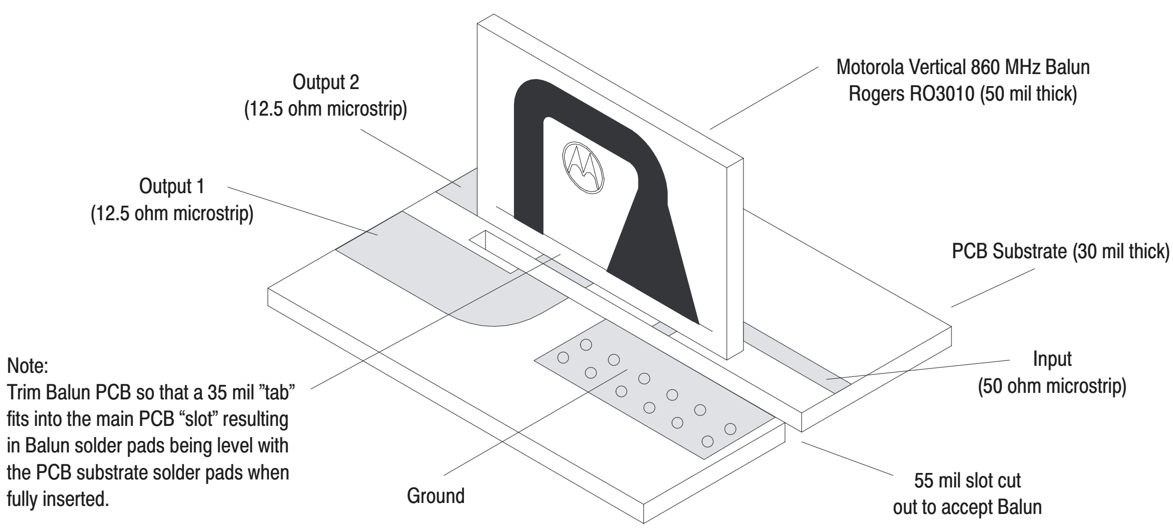
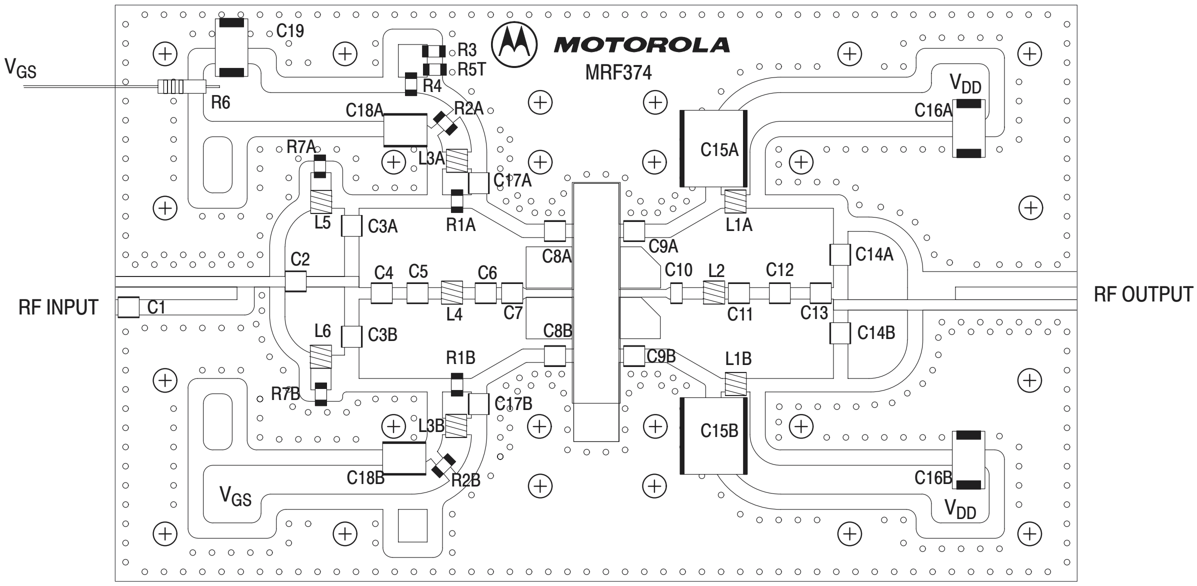


Figure 1. MRF374A Narrowband Test Circuit Component Layout

Table 1. MRF374A Narrowband Test Circuit Component Layout Designations and Values

Designation	Description
C1	0.8 pF Chip Capacitor, B Case, ATC
C2	2.2 pF Chip Capacitor, B Case, ATC
C3	0.5 – 5.0 pF Variable Capacitor, Johanson Gigatrim
C4A, B, C12A, B	47 pF Chip Capacitors, B Case, ATC
C5	1.0 pF Chip Capacitor, B Case, ATC
C6	10 pF Chip Capacitor, B Case, ATC
C7A, B, C14A, B	100,000 pF Chip Capacitors, B Case, ATC
C9A, B	15 pF Chip Capacitors, B Case, ATC
C10	3.9 pF Chip Capacitor, B Case, ATC
C11	5.1 pF Chip Capacitor, B Case, ATC
C13A, B	2.2 μF, 100 V Chip Capacitors, Vishay #VJ3640Y225KXBAT
L1A, B	5.0 nH, Coilcraft #A02T
L2A, B	8.0 nH, Coilcraft #A03T
L3A, B	130.0 nH, Coilcraft #132–11SMJ
L4	8.8 nH, Coilcraft #1606–8
R1A, B	51 Ω, 1/4 W Chip Resistors, Vishay Dale (1210)
R2	10 Ω, 1/2 W Chip Resistor, Vishay Dale (2010)
R3A, B	3.3 kΩ, 1/8 W Chip Resistors, Vishay Dale (1206)
R4A, B	180 Ω, 1/4 W Chip Resistors, Vishay Dale (1210)
PCB	MRF374 Printed Circuit Board Rev 03, Rogers RO4350, Height 30 mils, ε_r = 3.48
Balun B1A, B	Vertical 860 MHz Narrowband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, ε_r = 10.2



Vertical Balun Mounting Detail

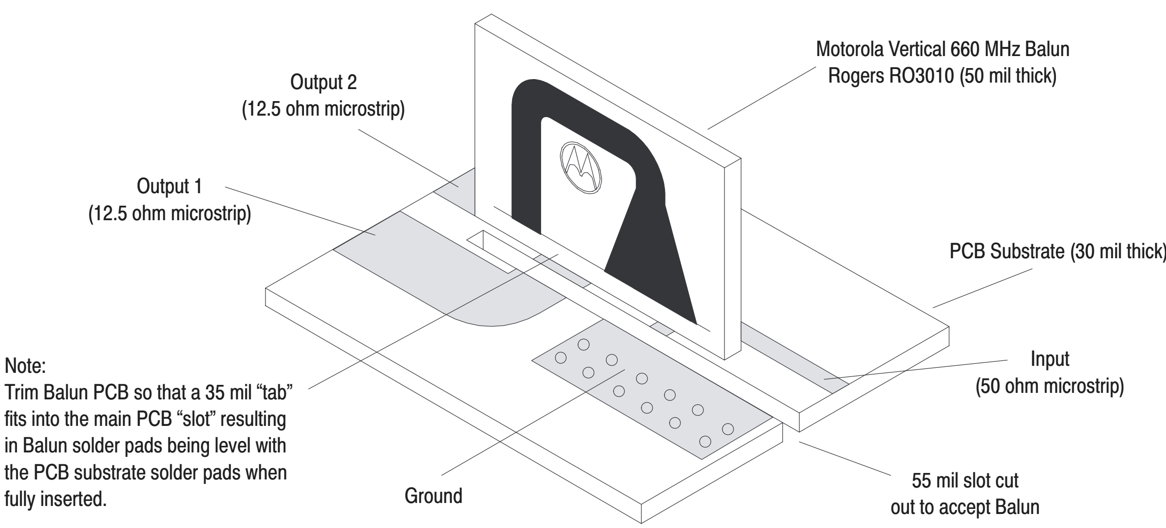


Figure 2. MRF374 Broadband Test Circuit Component Layout

Table 2. MRF374 Broadband Test Circuit Component Designations and Values

Designation	Description
C1	0.8 pF Chip Capacitor, B Case, ATC
C2	8.2 pF Chip Capacitor, B Case, ATC
C3A, B, C14A, B	100 pF Chip Capacitors, B Case, ATC
C4	7.5 pF Chip Capacitor, B Case, ATC
C5	3.0 pF Chip Capacitor, B Case, ATC
C6	9.1 pF Chip Capacitor, B Case, ATC
C7	15 pF Chip Capacitor, B Case, ATC
C8A, B	12 pF Chip Capacitors, B Case, ATC
C9A, B	4.7 pF Chip Capacitors, B Case, ATC
C10	10 pF Chip Capacitor, B Case, ATC
C11	3.6 pF Chip Capacitor, B Case, ATC
C12	3.0 pF Chip Capacitor, B Case, ATC
C13	2.7 pF Chip Capacitor, B Case, ATC
C15A, B	3.3 μF, 100 V Chip Capacitors, Vitramon #VJ3640Y335KXBAT
C16A, B	22 μF, 35 V Chip Capacitors, Kemet #491D226K035AS
C17A, B	3.9 pF Chip Capacitors, B Case, ATC
C18A, B	2.2 μF, 50 V Chip Capacitors, Vitramon #VJ2225Y225KXAAT
C19	10 μF, 35 V Chip Capacitor, Kemet #T491D106K035AS
L1A, B, L3A, B, L4, L5	8.0 nH, Coilcraft #A03T
L2, L6	12.5 nH, Coilcraft #A04T
R1A, B	22 Ω, 1/8 W Chip Resistor, Vishay Dale (1206)
R2A, B, R7A, B	10 Ω, 1/8 W Chip Resistor, Vishay Dale (1206)
R3	390 Ω, 1/8 W Chip Resistor, Vishay Dale (1206)
R4	2.4 kΩ, 1/8 W Chip Resistor, Vishay Dale (1206)
R5T	470 Ω Thermistor, KOA SPEER MOT #0680149M01
R6	6.8 kΩ, 1/2 W Resistor (Axial Lead), Vishay Dale (2010)
PCB	MRF374 Printed Circuit Board Rev 03, Rogers RO4350, Height 30 mils, $\varepsilon_r = 3.48$
Balun B1, B2	Vertical 660 MHz Broadband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, $\varepsilon_r = 10.2$

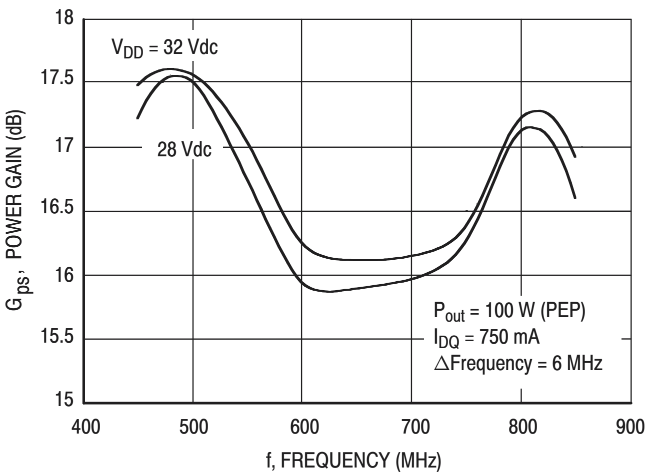


Figure 3. Gain versus Frequency in Broadband Circuit

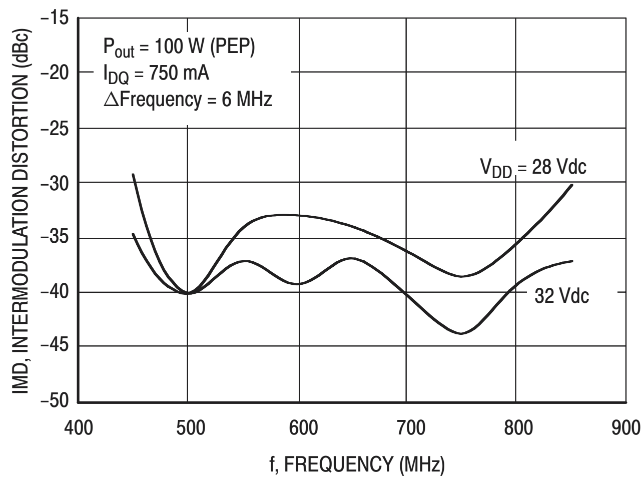


Figure 4. Intermodulation Distortion versus Frequency in Broadband Circuit

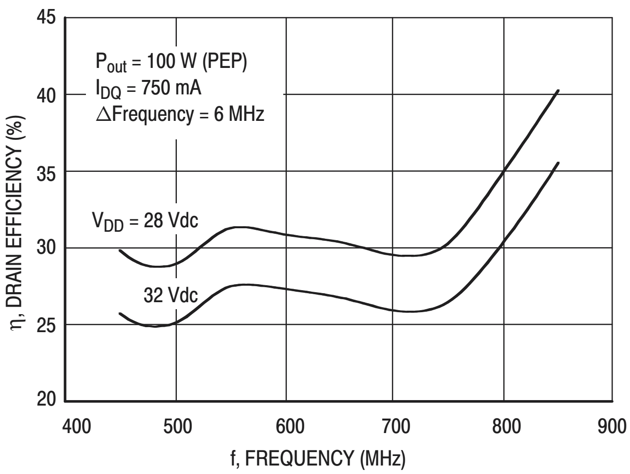


Figure 5. Drain Efficiency versus Frequency in Broadband Circuit

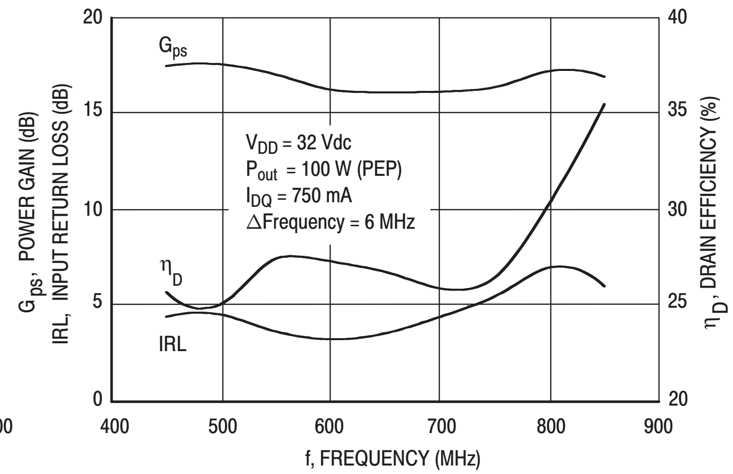


Figure 6. Performance in Broadband Circuit

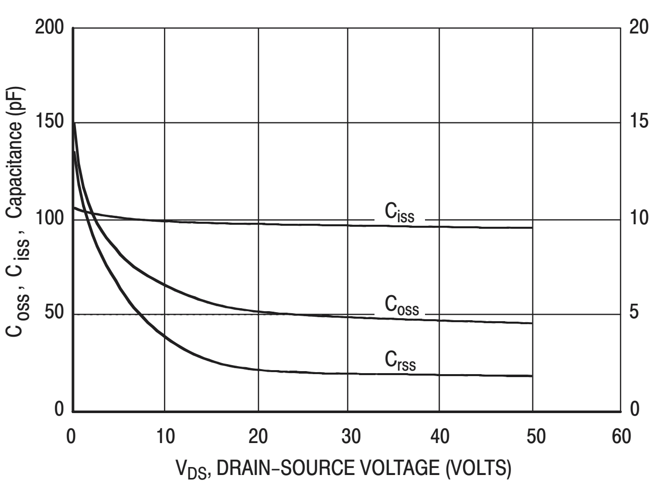


Figure 7. Capacitance versus Voltage

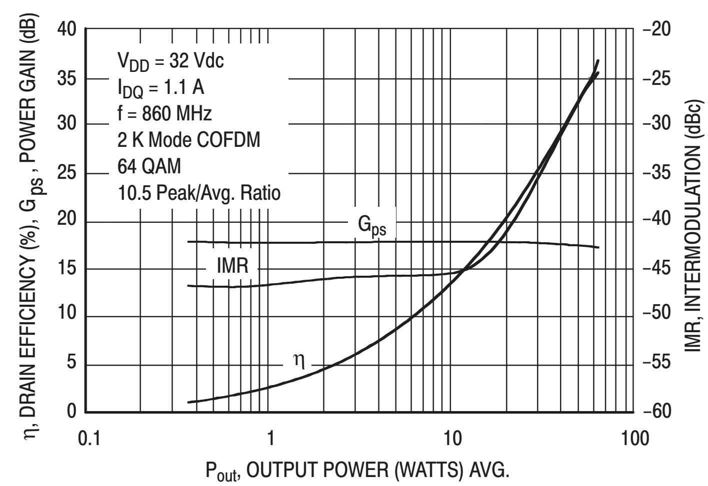


Figure 8. COFDM Intermodulation, Gain and Efficiency versus Output Power in Broadband Circuit

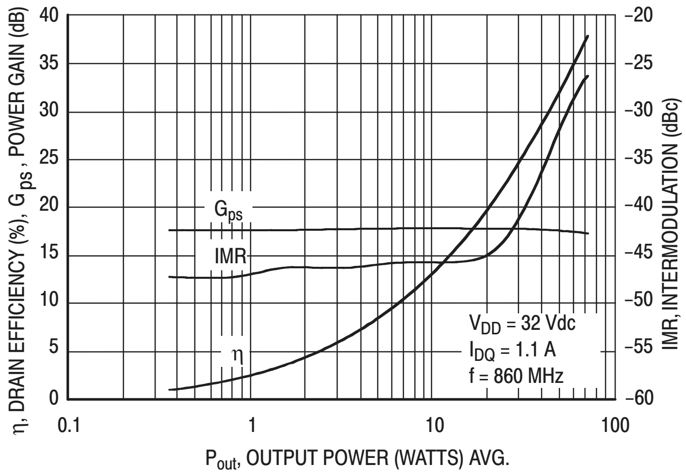


Figure 9. 8–VSB Intermodulation, Gain and Efficiency versus Output Power in Broadband Circuit

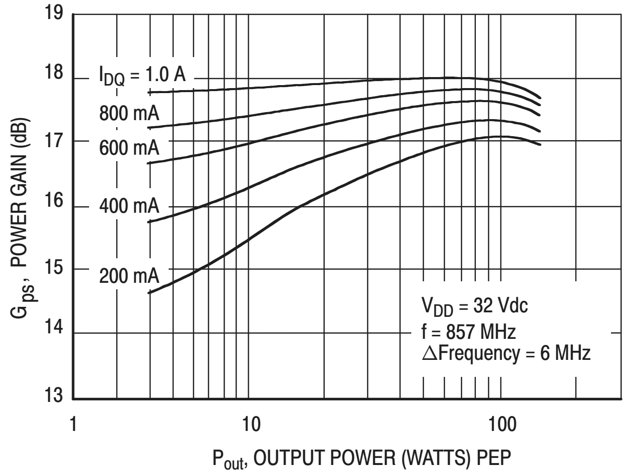


Figure 10. Power Gain versus Peak Output Power in Narrowband Circuit

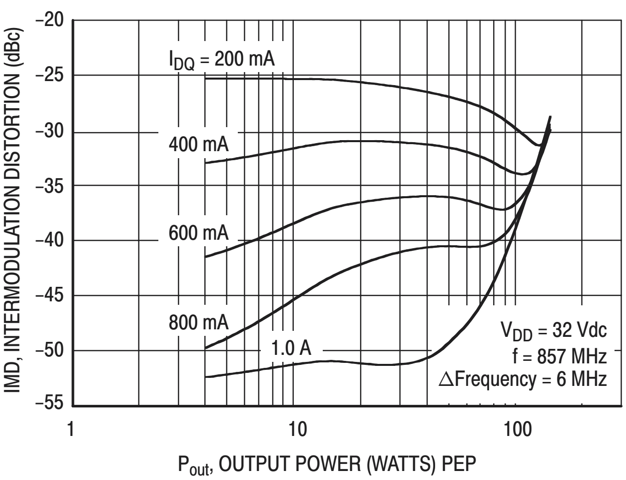


Figure 11. Intermodulation Distortion versus Peak Output Power in Narrowband Circuit

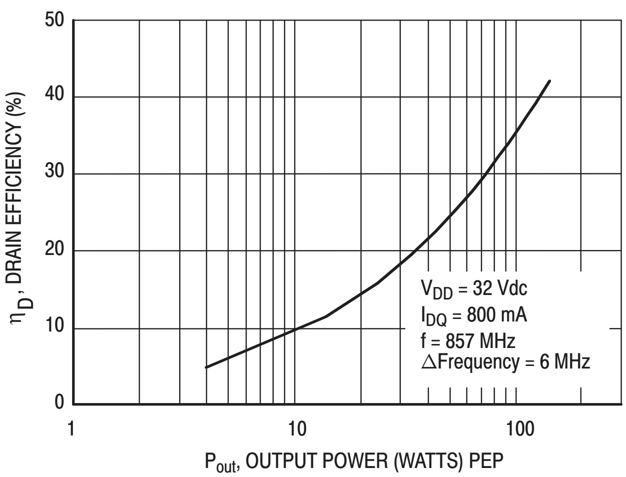


Figure 12. Drain Efficiency versus Peak Output Power in Narrowband Circuit

V_{DD} = 28 Vdc

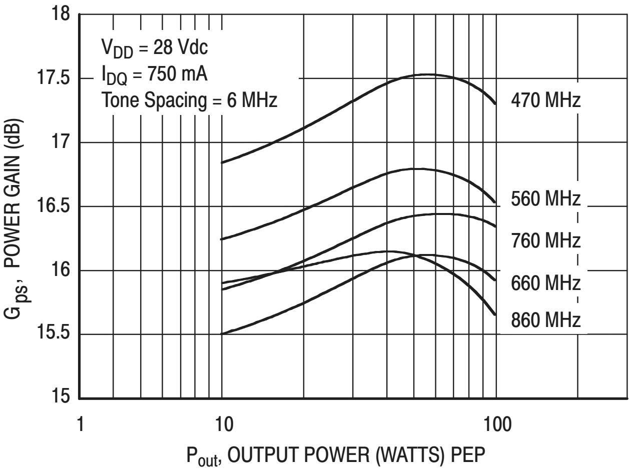


Figure 13. Power Gain versus Peak Output Power in Broadband Circuit

V_{DD} = 32 Vdc

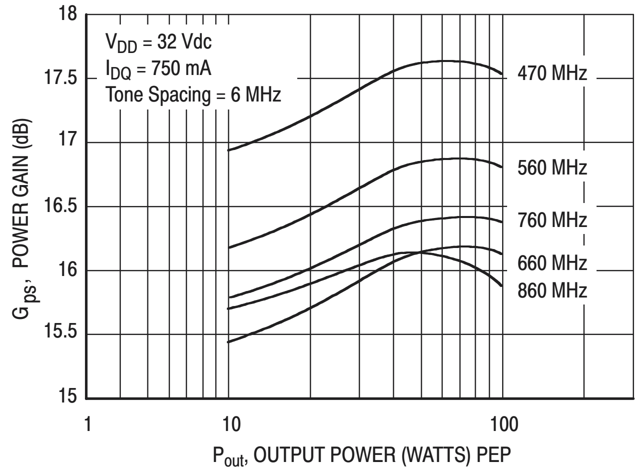


Figure 14. Power Gain versus Peak Output Power in Broadband Circuit

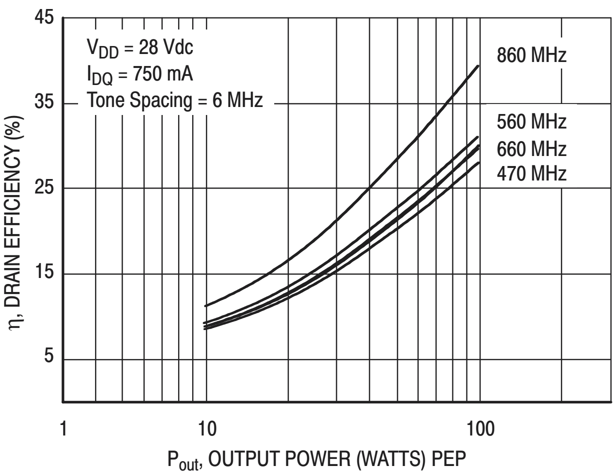


Figure 15. Drain Efficiency versus Peak Output Power in Broadband Circuit

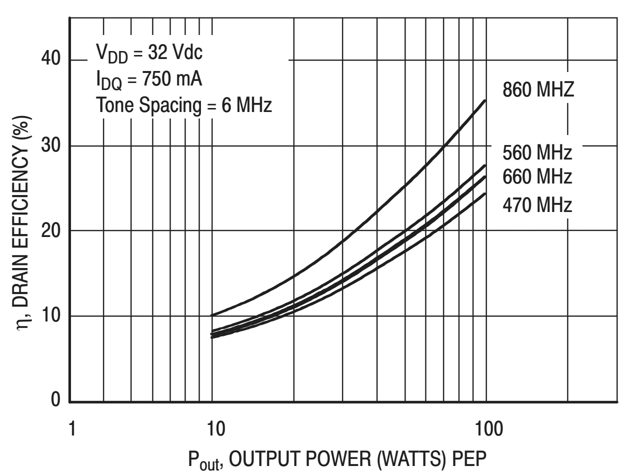


Figure 16. Drain Efficiency versus Peak Output Power in Broadband Circuit

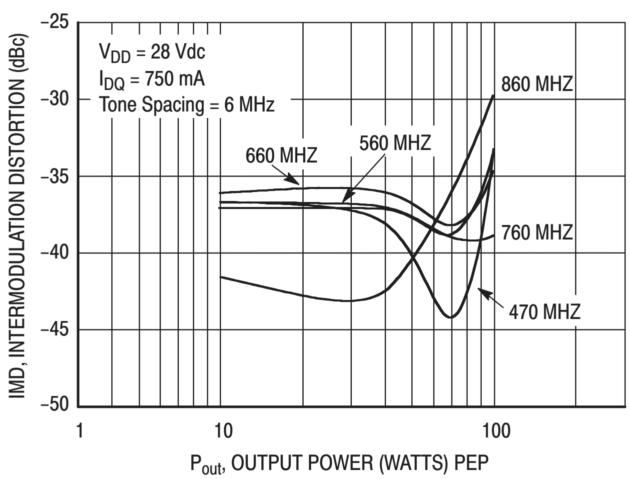


Figure 17. Intermodulation Distortion versus Peak Output Power in Broadband Circuit

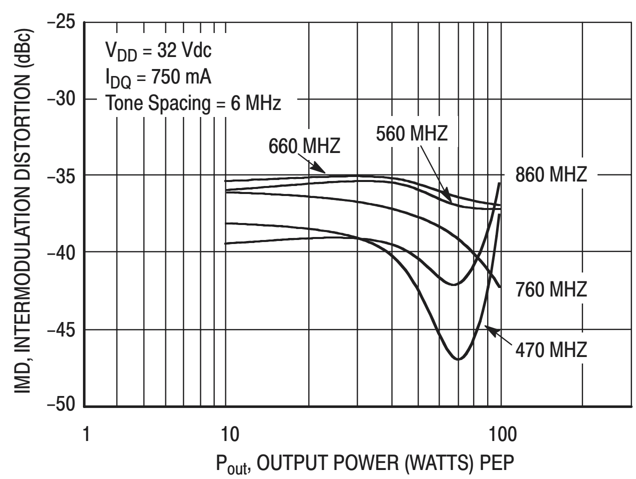
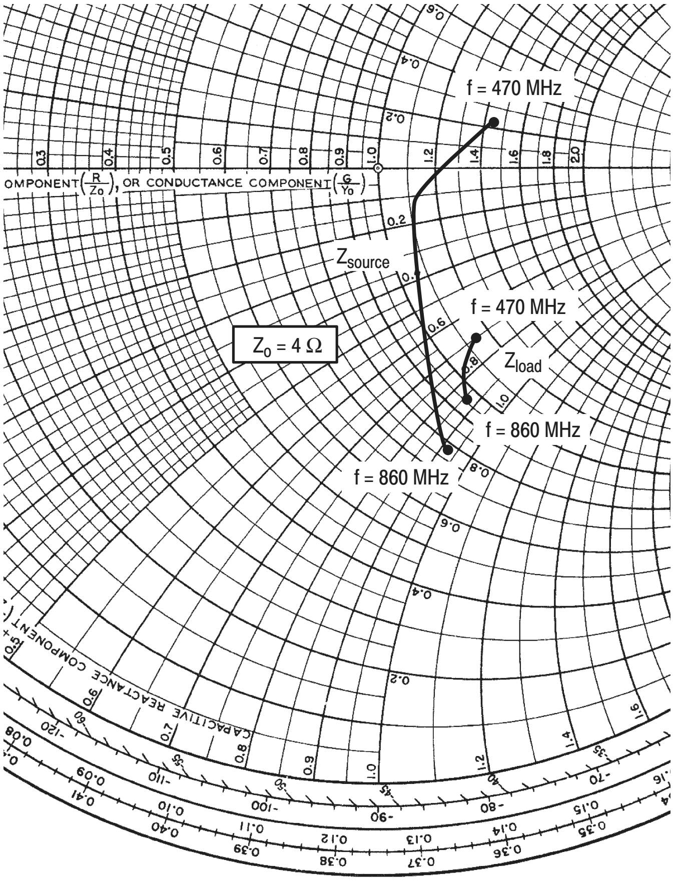


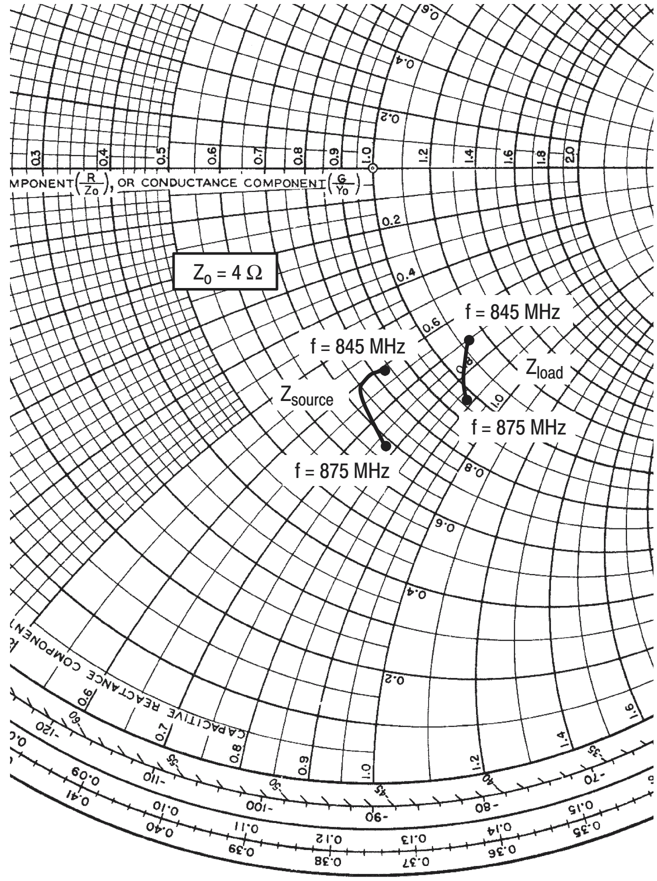
Figure 18. Intermodulation Distortion versus Peak Output Power in Broadband Circuit



MRF374

V_{DD} = 28 V, I_{DQ} = 400 mA, P_{out} = 100 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
470	5.79 + j0.97	4.54 – j2.82
660	4.52 – j0.50	4.21 – j3.04
860	3.16 – j3.73	3.86 – j3.44



MRF374A

V_{DD} = 32 V, I_{DQ} = 400 mA, P_{out} = 130 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
845	3.33 – j2.42	4.56 – j2.86
860	3.03 – j2.39	4.22 – j3.16
875	2.73 – j3.10	3.87 – j3.52

Z_{source} = Test circuit impedance as measured from gate to gate, balanced configuration.

Z_{load} = Test circuit impedance as measured from drain to drain, balanced configuration.

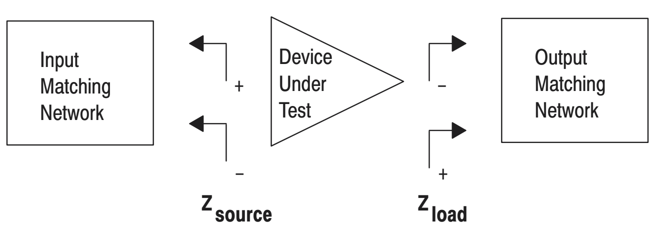
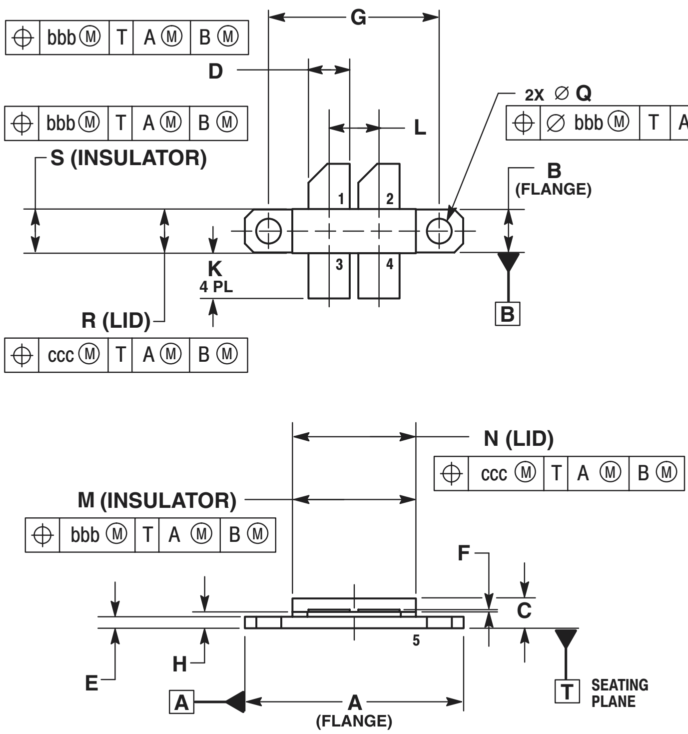


Figure 19. Series Equivalent Input and Output Impedance

NOTES

PACKAGE DIMENSIONS



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.135	1.145	28.80	29.10
B	0.225	0.235	5.72	5.97
C	0.135	0.178	3.43	4.52
D	0.210	0.220	5.33	5.59
E	0.055	0.065	1.40	1.65
F	0.004	0.006	0.11	0.15
G	0.900 BSC		22.86 BSC	
H	0.077	0.087	1.96	2.21
K	0.220	0.250	5.59	6.35
L	0.260 BSC		6.60 BSC	
M	0.643	0.657	16.33	16.69
N	0.638	0.650	16.20	16.50
Q	∅.125	∅.135	∅3.175	∅3.43
R	0.227	0.233	5.77	5.92
S	0.225	0.235	5.715	5.97
bbb	0.010 BSC		0.254 BSC	
ccc	0.015 BSC		0.381 BSC	

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

CASE 375F–04
ISSUE D
NI–650

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