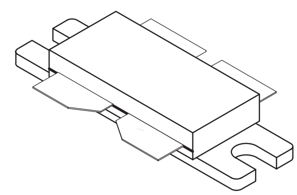
The RF MOSFET Line
RF Power Field-Effect Transistor
N–Channel Enhancement–Mode Lateral MOSFET

MRF372

470 – 860 MHz, 180 W, 32 V
LATERAL N–CHANNEL
BROADBAND
RF POWER MOSFET



CASE 375G–03, STYLE 2

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

- Typical Narrowband Two–Tone Performance @ f1 = 857 MHz, f2 = 863 MHz, 32 Volts
  Output Power – 180 Watts PEP
  Power Gain – 17 dB
  Efficiency – 36%
  IMD – –35 dBc
- Typical Broadband Two–Tone Performance @ f1 = 857 MHz, f2 = 863 MHz, 32 Volts
  Output Power – 180 Watts PEP
  Power Gain – 14.5 dB
  Efficiency – 37%
  IMD – –31 dBc
- Internally Matched
- Integrated ESD Protection
- 100% Tested for Load Mismatch Stress at All Phase Angles with 3:1 VSWR @ 32 Vdc, f1 = 857 MHz, f2 = 863 MHz, 180 Watts PEP
- Excellent Thermal Stability

MAXIMUM RATINGS (1)

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	68	Vdc
Gate–Source Voltage	V_{GS}	+15, – 0.5	Vdc
Drain Current – Continuous	I_D	17	Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	350 2.0	W 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 (Typical)
Machine Model	M3 (Typical)

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.5	°C/W

(1) Each side of device measured separately.

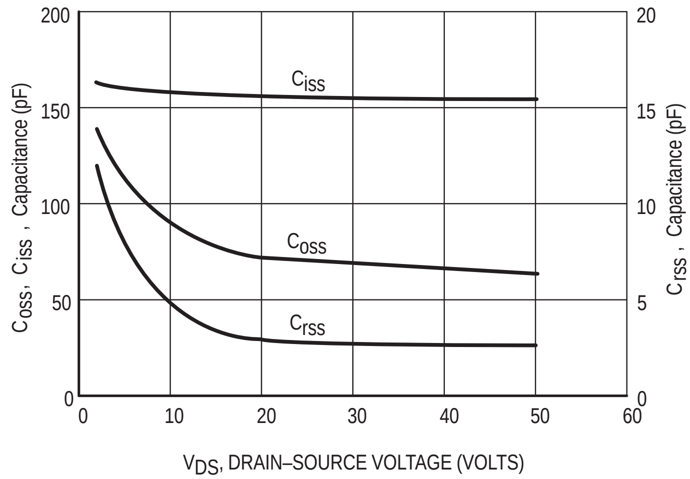
NOTE – **CAUTION** – MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Drain–Source Breakdown Voltage (V_{GS} = 0 V, I_D =10 µA)	$V_{(BR)DSS}$	68	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 32 V, V_{GS} = 0 V)	I_{DSS}	—	—	10	µAdc
Gate–Source Leakage Current (V_{GS} = 5 V, V_{DS} = 0 V)	I_{GSS}	—	—	1	µAdc
ON CHARACTERISTICS (1)					
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 200 µA)	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage (V_{DS} = 32 V, I_D = 100 mA)	$V_{GS(Q)}$	2.5	3.5	4.5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 V, I_D = 3 A)	$V_{DS(on)}$	—	0.28	0.45	Vdc
Forward Transconductance (V_{DS} = 10 V, I_D = 3 A)	g_{fs}	—	2.6	—	S
DYNAMIC CHARACTERISTICS (1)					
Input Capacitance (Includes Input Matching Capacitance) (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{iss}	—	260	—	pF
Output Capacitance (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{oss}	—	69	—	pF
Reverse Transfer Capacitance (V_{DS} = 32 V, V_{GS} = 0 V, f = 1 MHz)	C_{rss}	—	2.5	—	pF
FUNCTIONAL CHARACTERISTICS, TWO–TONE TESTING, NARROWBAND FIXTURE (2)					
Common Source Power Gain (V_{DD} = 32 V, P_{out} = 180 W PEP, I_{DQ} = 2 x 400 mA, f1 = 857 MHz, f2 = 863 MHz)	G_{ps}	16	17	—	dB
Drain Efficiency (V_{DD} = 32 V, P_{out} = 180 W PEP, I_{DQ} = 2 x 400 mA, f1 = 857 MHz, f2 = 863 MHz)	η	33	36	—	%
Intermodulation Distortion (V_{DD} = 32 Vdc, P_{out} = 180 W PEP, I_{DQ} = 2 x 400 mA, f1 = 857 MHz, f2 = 863 MHz)	IMD	—	–35	–31	dBc
Output Mismatch Stress (V_{DD} = 32 Vdc, P_{out} = 180 W PEP, I_{DQ} = 2 x 400 mA, f1 = 857 MHz, f2 = 863 MHz, V_{SWR} = 3:1 at all phase angles of test)	ψ	No Degradation in Output Power			
TYPICAL CHARACTERISTICS, TWO–TONE OPERATION, BROADBAND FIXTURE (2)					
Common Source Power Gain (V_{DD} = 32 Vdc, P_{out} = 180 W PEP, I_{DQ} = 2 x 500 mA, f1 = 857 MHz, f2 = 863 MHz)	G_{ps}	—	14.5	—	dB
Drain Efficiency (V_{DD} = 32 Vdc, P_{out} = 180 W PEP, I_{DQ} = 2 x 500 mA, f1 = 857 MHz, f2 = 863 MHz)	η	—	37	—	%
Intermodulation Distortion (V_{DD} = 32 Vdc, P_{out} = 180 W PEP, I_{DQ} = 2 x 500 mA, f1 = 857 MHz, f2 = 863 MHz)	IMD	—	–31	—	dBc

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

TYPICAL CHARACTERISTICS



Note: C_{iss} does not include input matching capacitance.

Figure 1. Capacitance versus Voltage

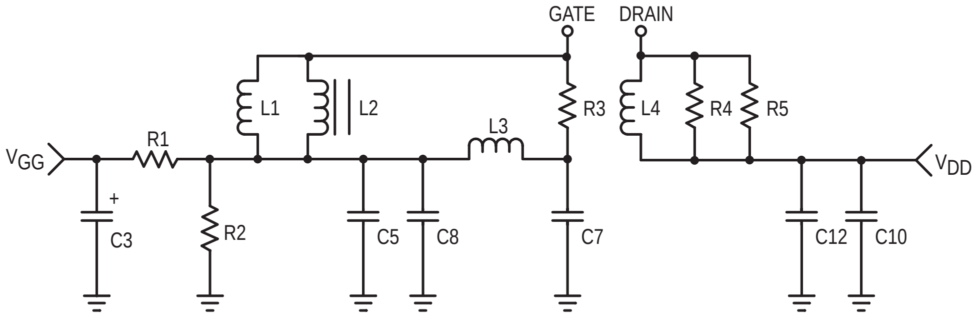
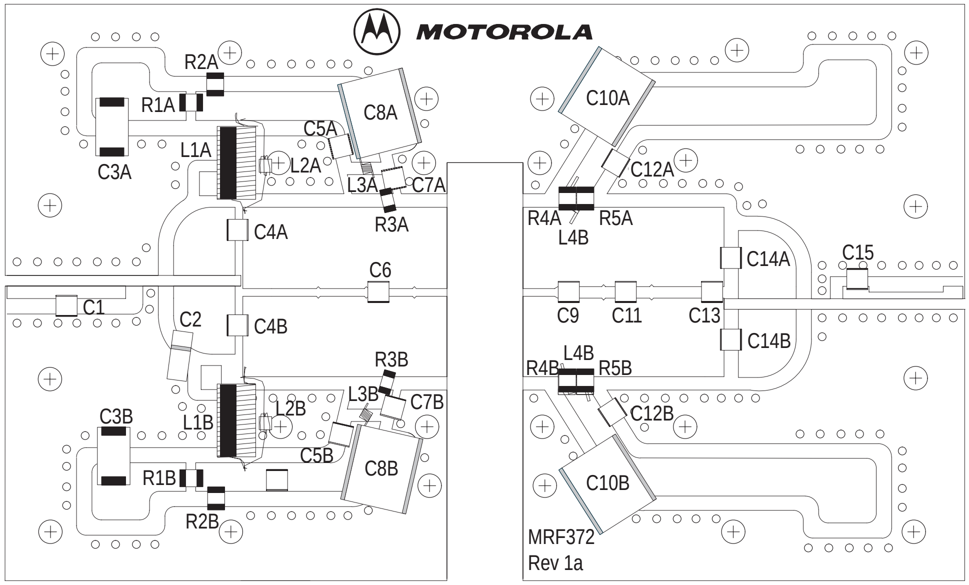


Figure 2. 860 MHz Narrowband DC Bias Networks

Table 1. 860 MHz Narrowband DC Bias Networks Component Designations and Values

Designation	Description
C1	2.2 pF, Chip Capacitor, B Case, ATC
C2	0.5 — 5.0 pF, Variable Capacitor, B Case, Johansen Gigatrim
C3A, B	22 μF, 22 V, Tantalum Chip Capacitors, Kemet #T491D226K22AS
C4A, B, C14A, B	47.0 pF, Chip Capacitors, B Case, ATC
C5A, B	100 pF, Chip Capacitors, B Case, ATC
C6	10.0 pF, Chip Capacitor, B Case, ATC
C7A, B	2.7 pF, Chip Capacitors, A Case, ATC
C8A, B	1.0 μF, 100 V, Chip Capacitors, Vitramon #VJ3640Y105KXBAT
C9	10.0 pF, Chip Capacitor, B Case, ATC
C10A, B	2.2 μF, 100 V, Chip Capacitors, Vitramon #VJ3640Y225KXBAT
C11	5.1 pF, Chip Capacitor, B Case, ATC
C12A, B	0.01 μF, 100 V, Chip Capacitors, Kemet #VJ1210Y103KXBAT
C15	1.2 pF, Chip Capacitor, B Case, ATC
L1A, B	130 nH, Coilcraft #132–11SM
L2A, B	#24 AWG, 3 Turns Loose, Fair Rite #2643706001
L3A, B	3.85 nH, Coilcraft #0906–4
L4A, B	5.0 nH, Coilcraft #A02T
R1A, B, R2A, B R4A, B, R5A, B	180 Ω, 1/4 W, Chip Resistors, Vishay Dale (1210)
R3A, B	12 Ω, 1/8 W Chip Resistors, Vishay Dale (1206)
PCB	MRF372 Printed Circuit Board Rev 1a, Rogers RO4350, Height 30 mils, ε_r = 3.48
Balun A, B	Vertical 860 MHz Broadband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, ε_r = 10.2



Vertical Balun Mounting Detail

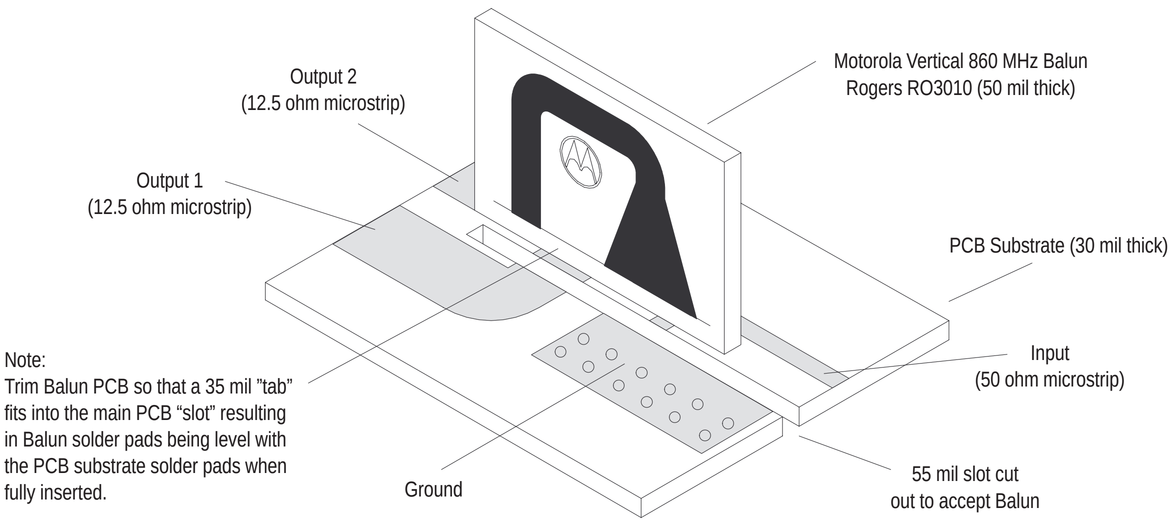
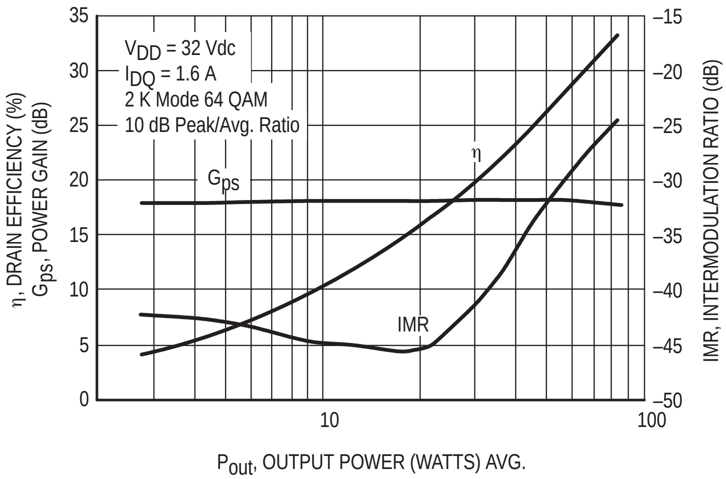


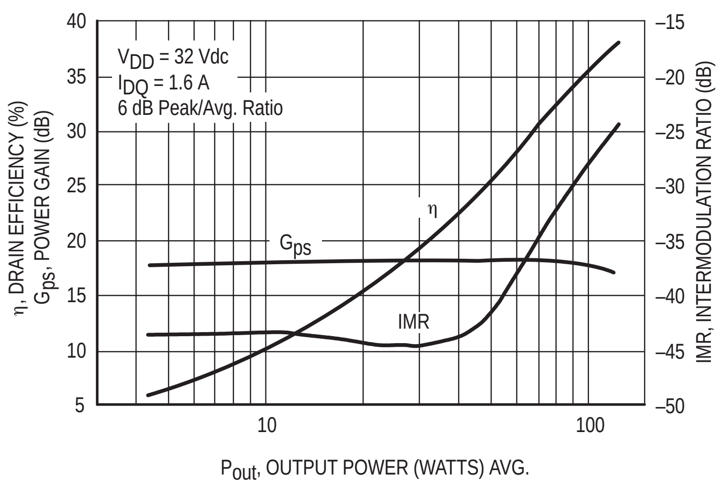
Figure 3. 860 MHz Narrowband Component Layout

TYPICAL TWO–TONE NARROWBAND CHARACTERISTICS



Note: IMR measured using Delta Marker Method.

Figure 4. COFDM Performance (860 MHz)



Note: IMR measured using Delta Marker Method.

Figure 5. 8–VSB Performance (860 MHz)

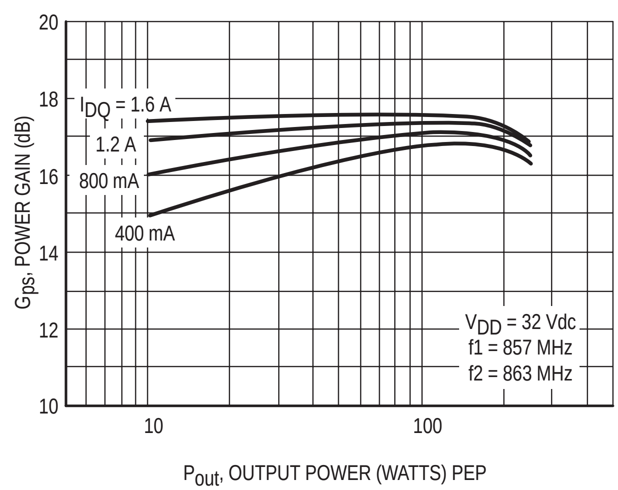


Figure 6. Power Gain versus Output Power

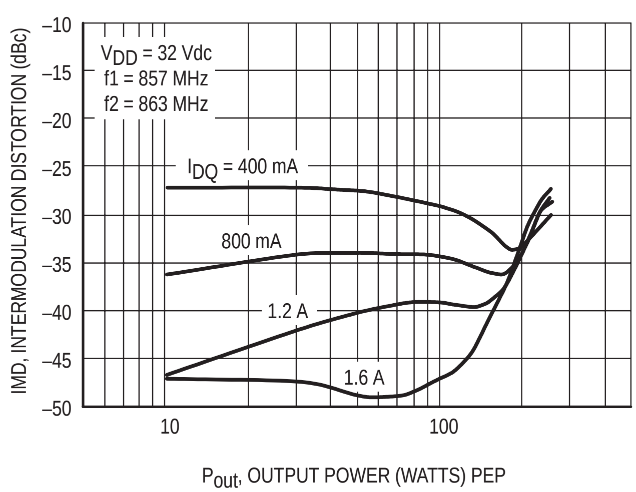


Figure 7. Intermodulation Distortion versus Output Power

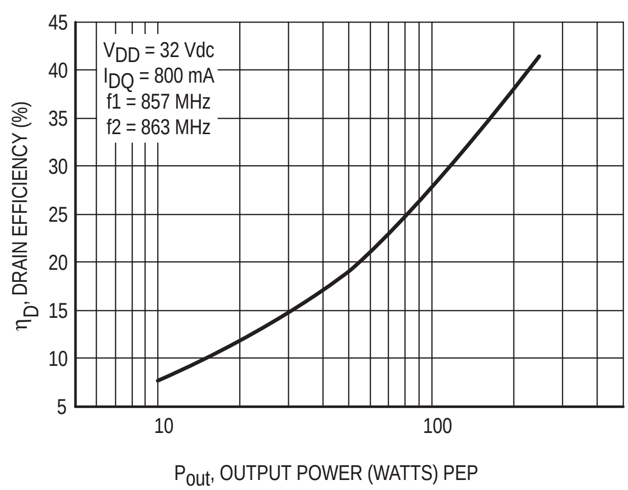
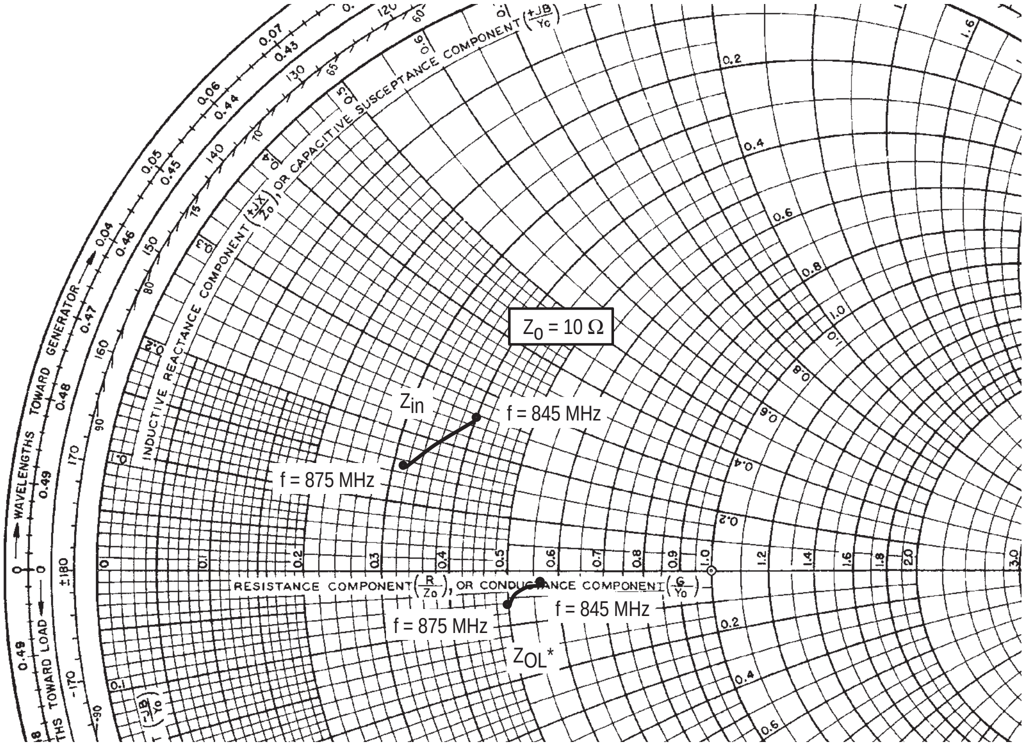


Figure 8. Drain Efficiency versus Output Power



V_{DD} = 32 V, I_{DQ} = 800 mA, P_{out} = 180 W (PEP)

f MHz	Z_{in} Ω	Z_{OL}* Ω
845	3.99 + j2.50	5.63 – j0.38
860	3.56 + j1.98	5.28 – j0.43
875	3.18 + j1.46	4.94 – j0.56
Harmonics		
f **GHz**	Z_{in} Ω	Z_{OL}* Ω
1.69	2.85 – j14.30	1.23 – j9.37
1.72	3.27 – j14.32	1.54 – j9.60
1.75	3.35 – j14.36	1.73 – j9.62

Z_{in} = Complex conjugate of source impedance.

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

Note: Z_{in} and Z_{OL}* were chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

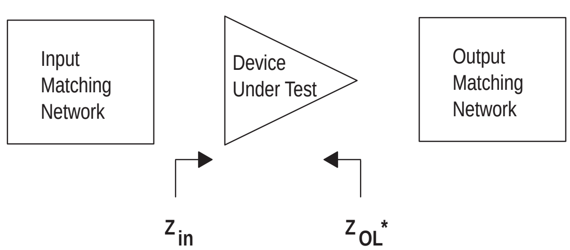


Figure 9. Narrowband Series Equivalent Input and Output Impedance

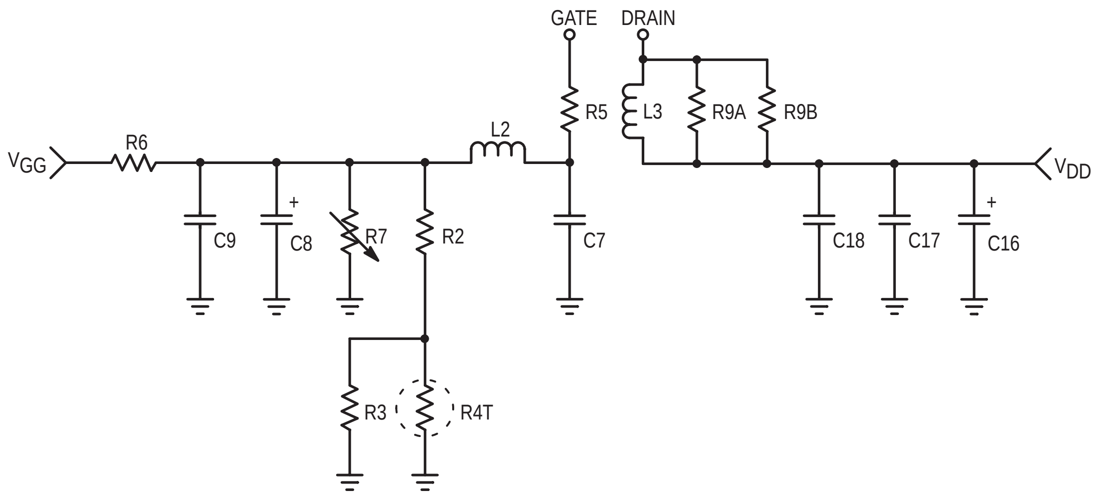
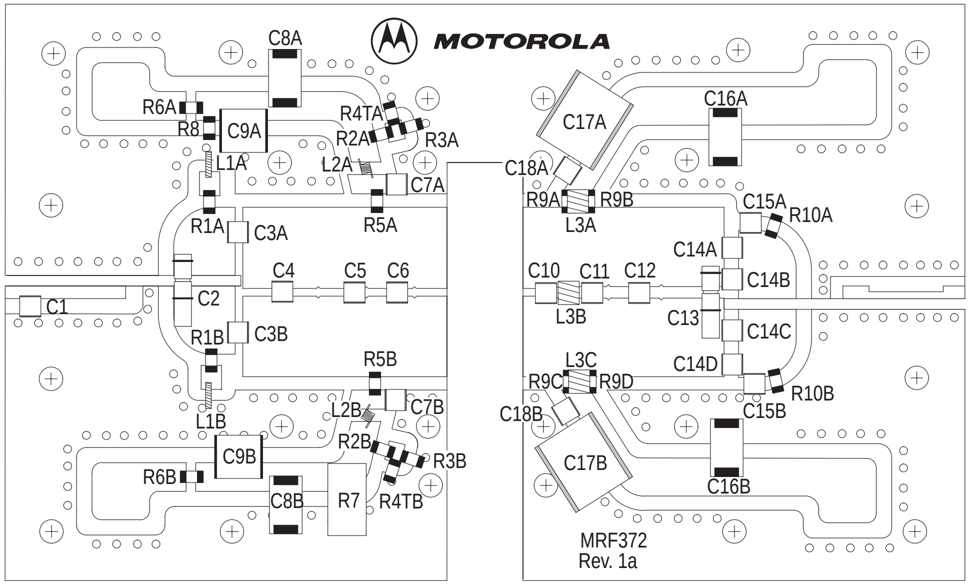


Figure 10. 470–860 MHz Broadband DC Bias Networks

Table 2. 470–860 MHz Broadband DC Bias Networks Component Designations and Values

Designation	Description
C1	0.7 pF, Chip Capacitor, B Case, ATC
C2, C13	0.8 — 8.0 pF, Variable Capacitors, Johansen Gigatrim
C3A, B, C14A, B, C, D	100 pF, Chip Capacitors, B Case, ATC
C4	4.7 pF, Chip Capacitor, B Case, ATC
C5	7.5 pF, Chip Capacitor, B Case, ATC
C6	10.0 pF, Chip Capacitor, B Case, ATC
C7A, B	6.2 pF, Chip Capacitors, A Case, ATC
C8A, B	22 μF, 22 V, Tantalum Chip Capacitors, Kemet #T491D226K22AS
C9A, B	0.1 μF, 100 V, Chip Capacitors, Vitramon #VJ3640Y104KXBAT
C10	13 pF, Chip Capacitor, B Case, ATC
C11	6.8 pF, Chip Capacitor, B Case, ATC
C12	3.9 pF, Chip Capacitor, B Case, ATC
C15A, B	3.3 pF, Chip Capacitors, B Case, ATC
C16A, B	10 μF, 35 V, Tantalum Chip Capacitors, Kemet #T491D106K35AS
C17A, B	3.3 μF, 100 V, Chip Capacitors, Vitramon #VJ3640Y335KXBAT
C18A, B	0.01 μF, Chip Capacitors, B Case, ATC
L1A, B	12.55 nH, Coilcraft #1606–10
L2A, B	5.45 nH, Coilcraft #0906–5
L3A, B, C	12.5 nH, Coilcraft #A04T
R1A, B	10 Ω, 1/4 W, Chip Resistors, Vishay Dale (1210)
R2A, B	2.2 kΩ, 1/4 W, Chip Resistors, Vishay Dale (1210)
R3A, B, R10A, B	390 Ω, 1/8 W Chip Resistors, Vishay Dale (1206)
R4TA, B	520 Ω, Thermistor, Vishay #NTHS—1206J14520R5%
R5A, B	6.2 Ω, 1/4 W, Chip Resistors, Vishay Dale (1210)
R6A, B	6.8 kΩ, 1/4 W, Chip Resistors, Vishay Dale (1210)
R7	100 kΩ, Potentiometer, Bourns
R8	47.3 kΩ, 1/8 W Chip Resistor, Vishay Dale (1206)
R9A, B, C, D	180 Ω, 1/4 W, Chip Resistors, Vishay Dale (1210)
PCB	MRF372 Printed Circuit Board Rev 1a, Rogers RO4350, Height 30 mils, ε_r = 3.48
Balun A, B	Vertical 660 MHz Broadband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, ε_r = 10.2



Vertical Balun Mounting Detail

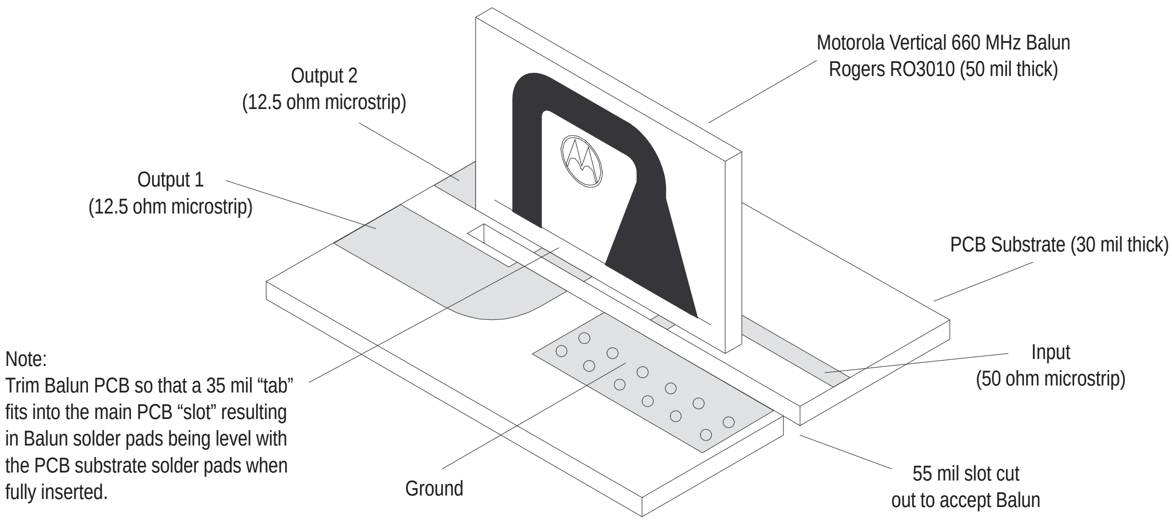


Figure 11. 470–860 MHz Broadband Component Layout

TYPICAL TWO–TONE BROADBAND CHARACTERISTICS

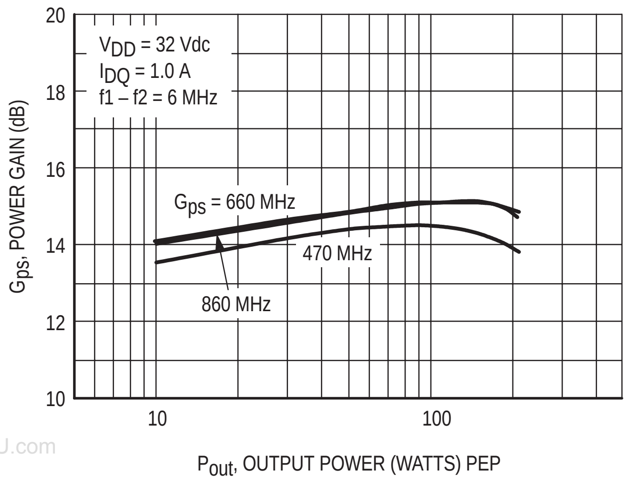


Figure 12. Power Gain versus Output Power

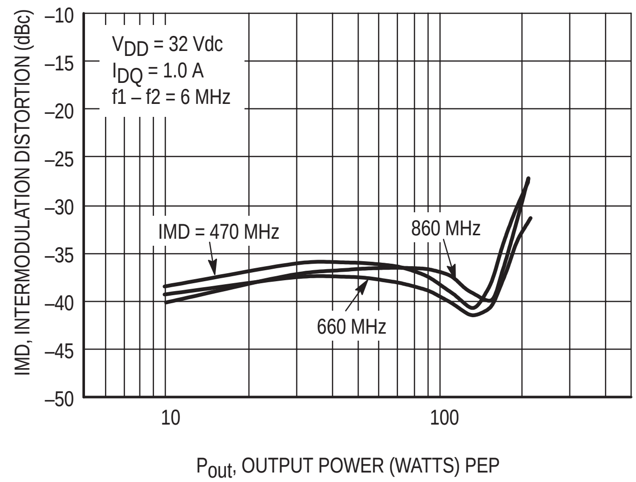


Figure 13. Intermodulation Distortion versus Output Power

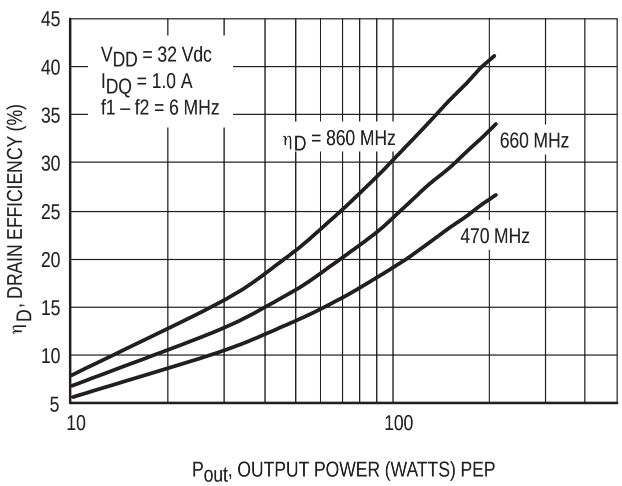
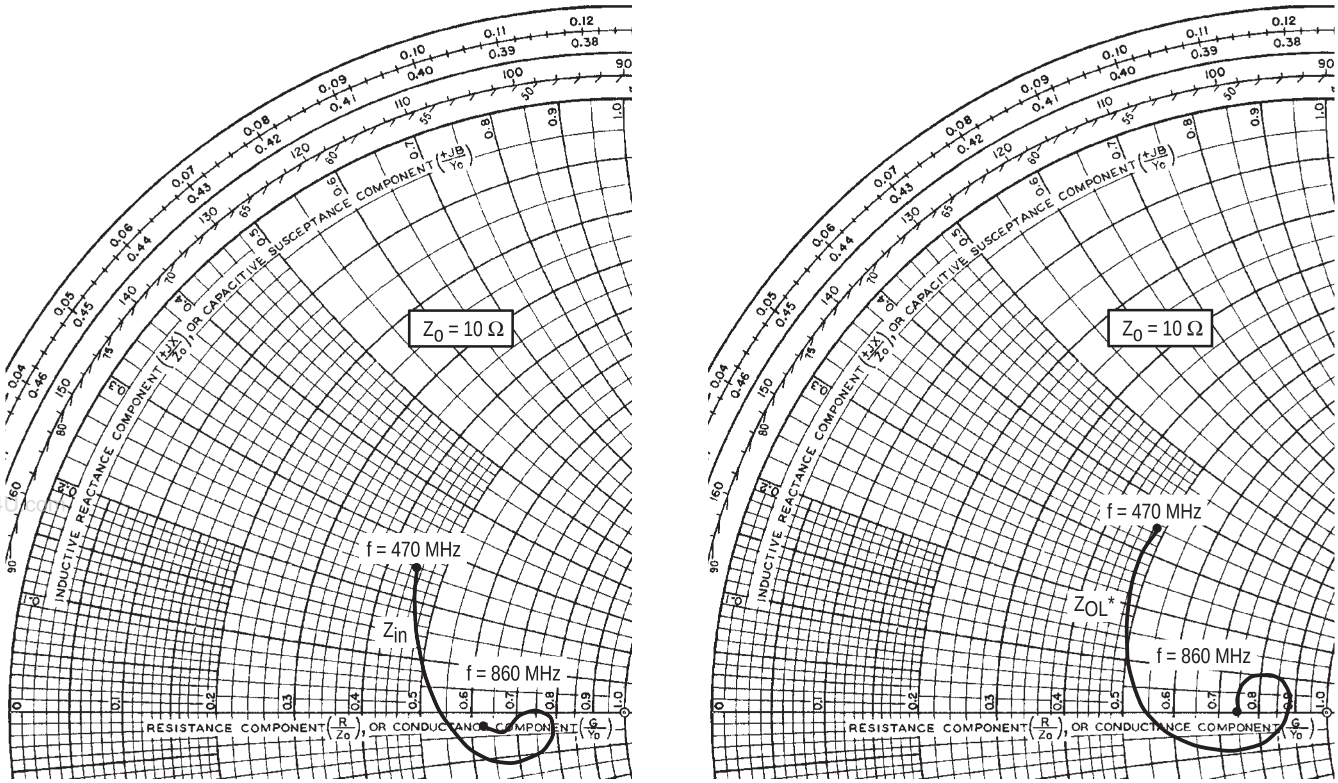


Figure 14. Drain Efficiency versus Output Power



V_{DD} = 32 V, I_{DQ} = 1.0 mA, P_{out} = 180 W (PEP)

f MHz	Z_{in} Ω	Z_{OL}* Ω
470	4.46 + j2.57	4.88 + j3.50
560	6.40 – j1.06	5.45 + j0.07
660	7.84 – j0.14	8.13 – j0.73
760	6.67 – j0.46	8.27 + j1.00
860	6.25 – j0.31	7.52 – j0.02

Z_{in} = Complex conjugate of source impedance.

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

Note: Z_{in} and Z_{OL}* were chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

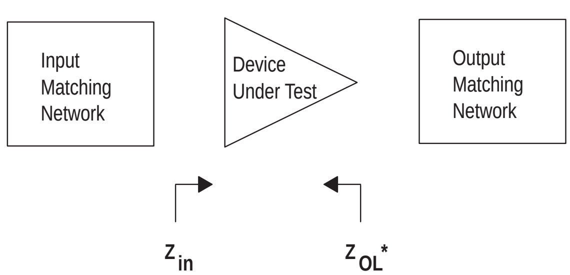
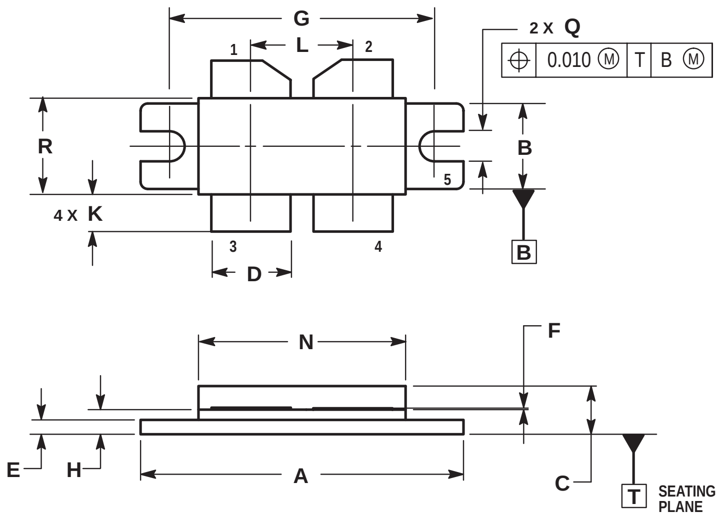


Figure 15. Broadband Series Equivalent Input and Output Impedance

PACKAGE DIMENSIONS



NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.330	1.350	33.78	34.29
B	0.375	0.395	9.52	10.03
C	0.180	0.210	4.57	5.33
D	0.320	0.340	8.13	8.64
E	0.060	0.070	1.52	1.78
F	0.004	0.006	0.1	0.15
G	1.100 BSC		27.94 BSC	
H	0.093	0.108	2.36	2.74
K	0.135	0.165	3.43	4.19
L	0.425 BSC		10.8 BSC	
N	0.845	0.875	21.46	22.22
Q	0.118	0.130	3	3.3
R	0.390	0.410	9.91	10.41

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

CASE 375G–03
ISSUE B

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