RF Reference Design Library

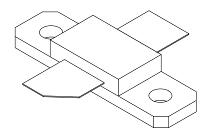
The RF Sub–Micron MOSFET Line

RF Power Field Effect Transistors

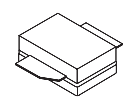
N–Channel Enhancement–Mode Lateral MOSFETs

MRF9060
MRF9060S
MRF9060SR1

NARROWBAND CDMA
865–895 MHZ



CASE 360B–04, STYLE 1
(MRF9060)



CASE 360C–04, STYLE 1
(MRF9060S)

Designed for broadband commercial and industrial applications at frequencies up to 1.0 GHz. The high gain and broadband performance of these devices makes them ideal for large–signal, common–source amplifier applications in 26 volt base station equipment.

Device Features:

- Typical Two–Tone Performance at 945 MHz, 26 Volts
  Output Power – 60 Watts PEP
  Power Gain – 16 dB
  Efficiency – 40%
  IMD – –31 dBc
- Integrated ESD Protection
- Ease of Design for Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 945 MHz, 60 Watts (CW) Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large–Signal Impedance Parameters

MRF9060 REFERENCE DESIGN

Designed by: David Runton and John Kinney, Motorola SPS

REFERENCE DESIGN

This reference design is designed to demonstrate the RF performance characteristics of the MRF9060 when applied to the 865 – 895 MHz narrowband CDMA frequency band. The reference design is tuned for performance at 60 watts average output power, V_{DS} = 26 volts, and I_{DQ} = 600 mA.

REFERENCE DESIGN LIBRARY TERMS AND CONDITIONS

Motorola is pleased to make this reference design available for your use in development and testing of your own product or products, without charge. The reference design contains easy–to–copy, fully functional amplifier designs. Where possible, it consists of “no tune” distributed element matching circuits designed to be as small as possible, includes temperature compensated bias circuitry, and is designed to be used as “building blocks” for our customers.

HEATSINKING

When operating this fixture please provide adequate heatsinking for the device. Excessive heating of the device will prevent repeating of the included measurements.

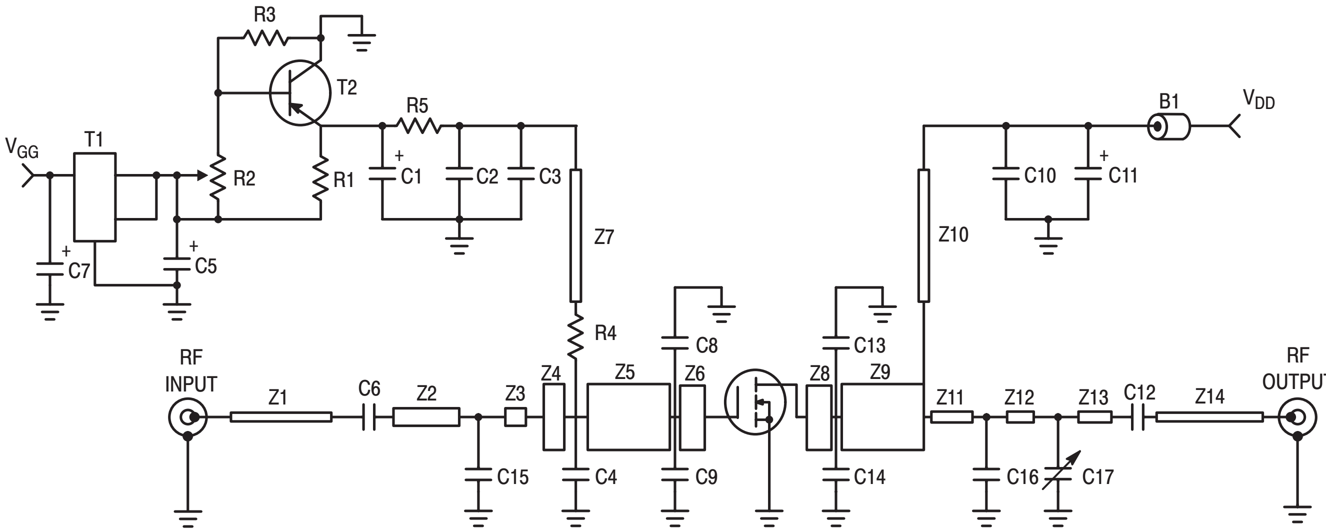


Figure 1. MRF9060 GSM EDGE and Narrowband CDMA Reference Design Schematic

Table 1. MRF9060 GSM EDGE and Narrowband CDMA Reference Design Component Designations and Values

Designation	Description
B1	Ferrite Bead, Fair Rite #2743019447
C1, C11	22 µF, 35 V Tantalum Chip Capacitors, Kemet
C2, C10	0.1 µF, 50 V Chip Capacitors (1210)
C3	27 pF, 50 V Chip Capacitor (0805)
C4, C15, C16	8.2 pF, 50 V Chip Capacitors, ACCU–P (0805)
C5, C7	1.0 µF, 35 V Tantalum Chip Capacitors, Kemet
C6, C12	47 pF, 50 V Chip Capacitors, ACCU–P (0805)
C8, C9	12 pF, 50 V Chip Capacitors, ACCU–P (0805)
C13, C14	10 pF, 50 V Chip Capacitors, ACCU–P (0805)
C17	0.4 – 2.5 pF Variable Capacitor, Gigatrim
R1, R3	2.7 kΩ Chip Resistors (0805)
R2	5.0 kΩ Trimpot
R4	10 Ω Chip Resistor (0805)
R5	3.3 kΩ Chip Resistor (0805)
T1	Voltage Regulator, Micro–8, #LP2951
T2	PNP Bipolar Transistor, SOT–23, #BC857
Z1	1.0 x 26.5 mm Microstrip
Z2	1.8 x 8.1 mm Microstrip
Z3	1.8 x 2.4 mm Microstrip
Z4	7.5 x 2.5 mm Microstrip
Z5	7.5 x 9.6 mm Microstrip
Z6	7.5 x 3.0 mm Microstrip
Z7	1.1 x 35.4 mm Microstrip
Z8	7.5 x 3.0 mm Microstrip
Z9	7.5 x 8.7 mm Microstrip
Z10	1.1 x 39.8 mm Microstrip
Z11	1.2 x 5.0 mm Microstrip
Z12	1.2 x 3.2 mm Microstrip
Z13	1.2 x 4.3 mm Microstrip
Z14	1.0 x 27.6 mm Microstrip
Bedstead	Copper Heatsink
Raw PCB	0.020″ Taconic RF–35, 65 x 110 mm, n = 3.55

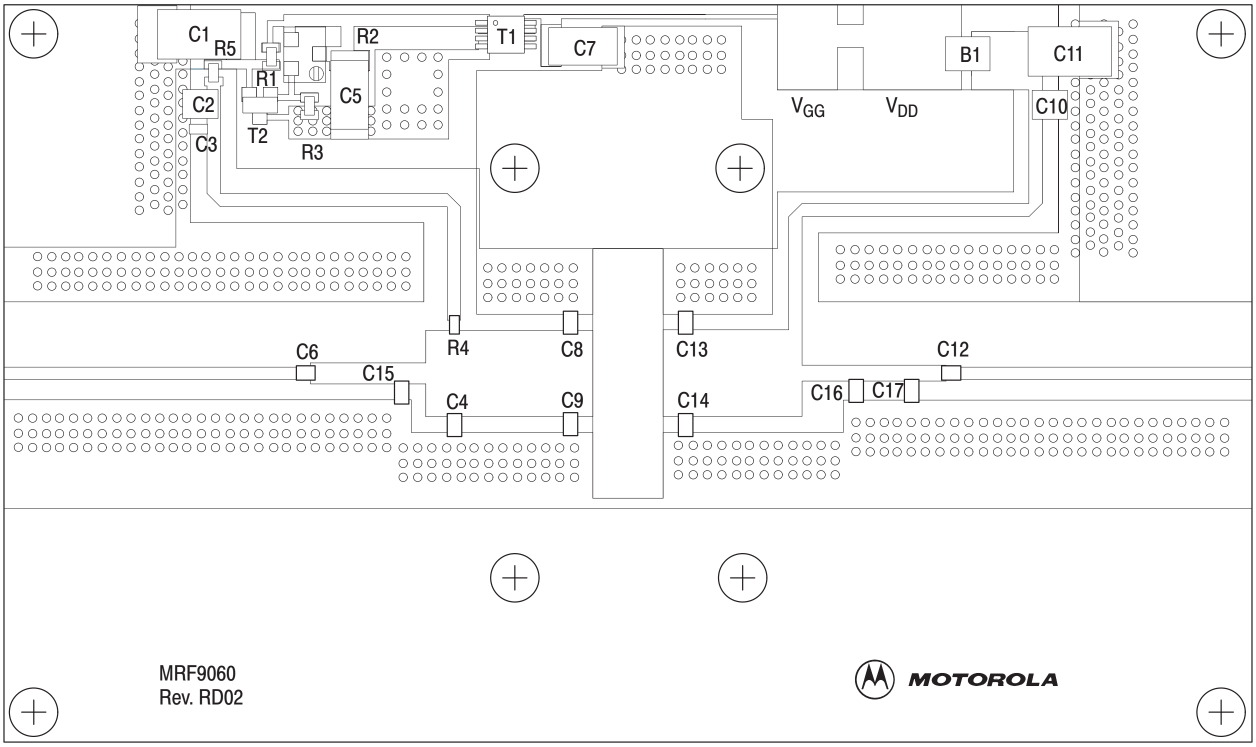


Figure 2. MRF9060 GSM EDGE and Narrowband CDMA Reference Design PC Board Layout Diagram

CHARACTERISTICS

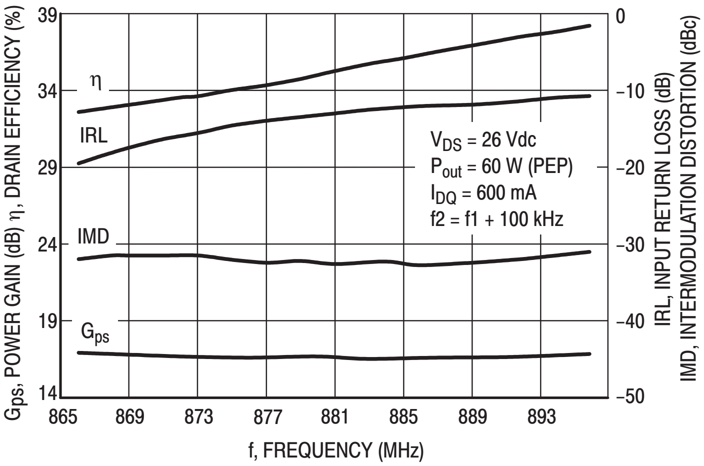


Figure 3. Class AB Broadband Circuit Performance

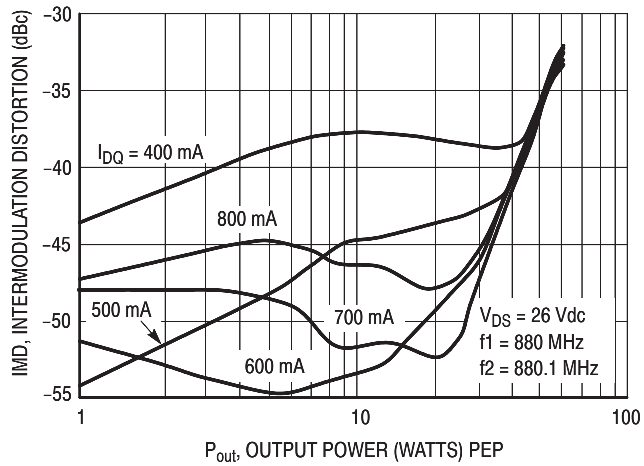


Figure 4. Intermodulation Distortion versus Output Power

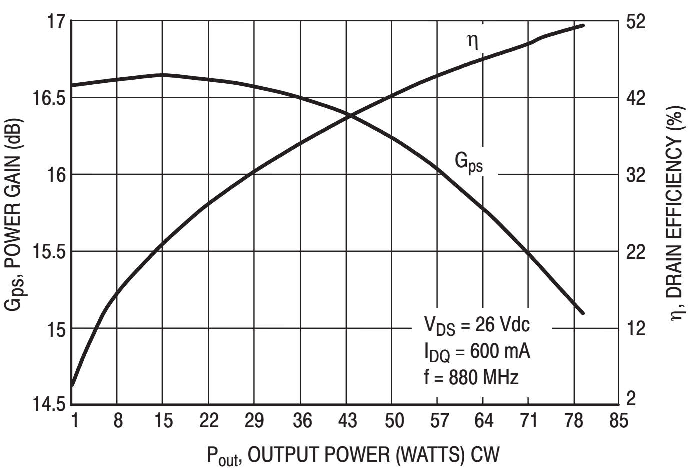


Figure 5. Power Gain, Efficiency versus Output Power

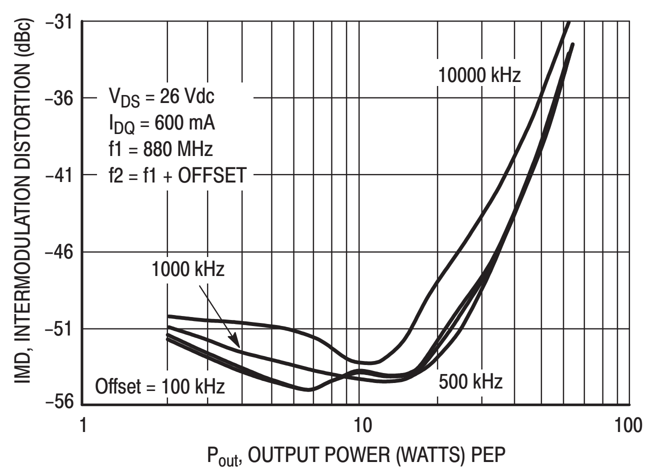


Figure 6. Intermodulation Distortion versus Output Power

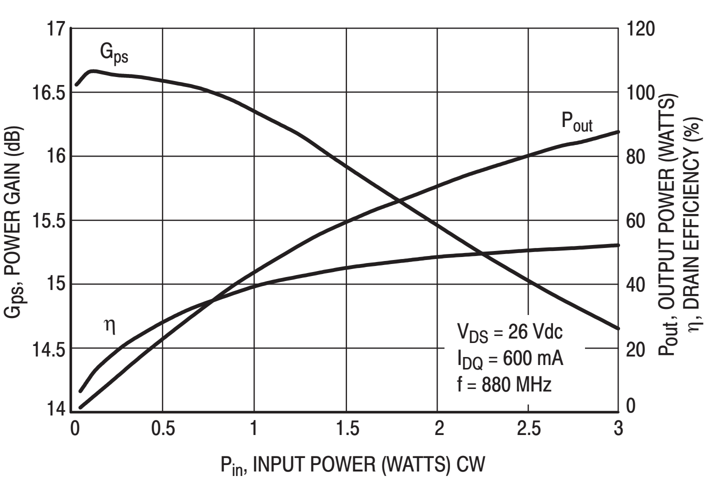


Figure 7. Power Gain, Efficiency, Output Power versus Input Power

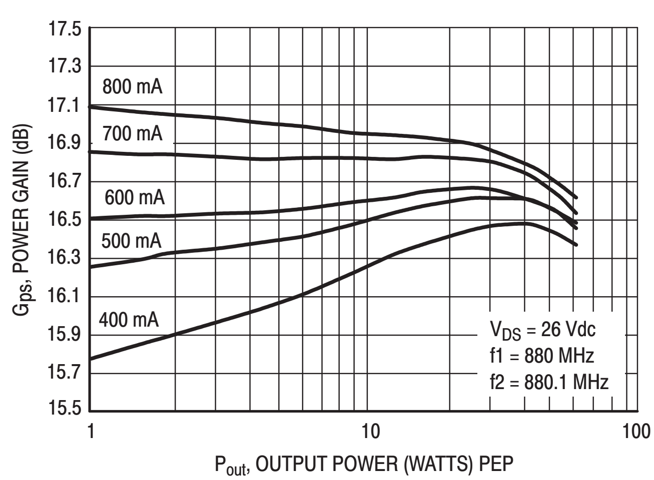


Figure 8. Power Gain versus Output Power

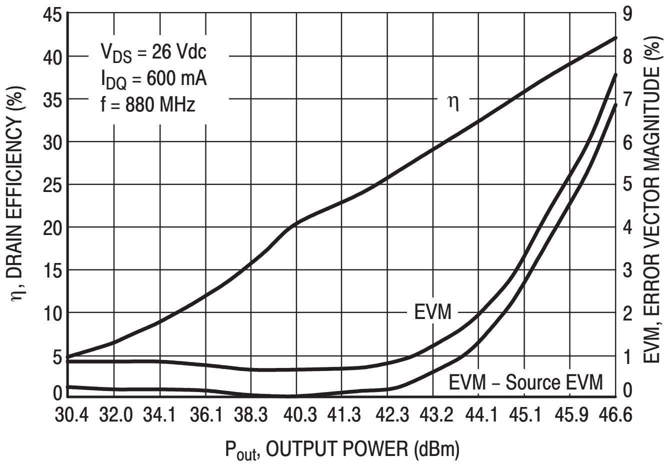


Figure 9. Drain Efficiency and Error Vector Magnitude versus Output Power

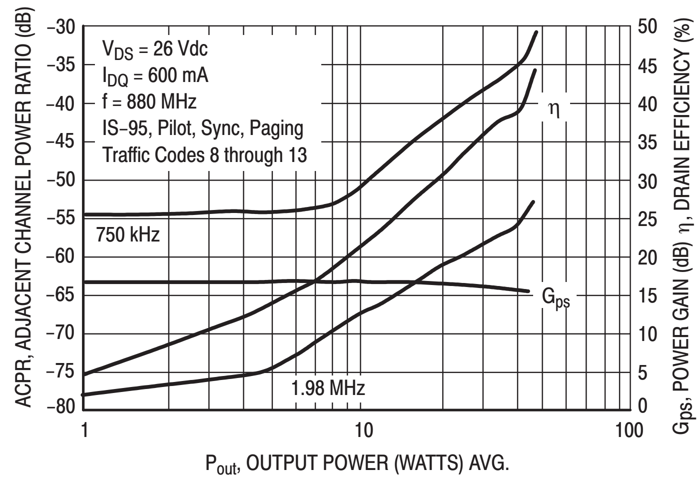
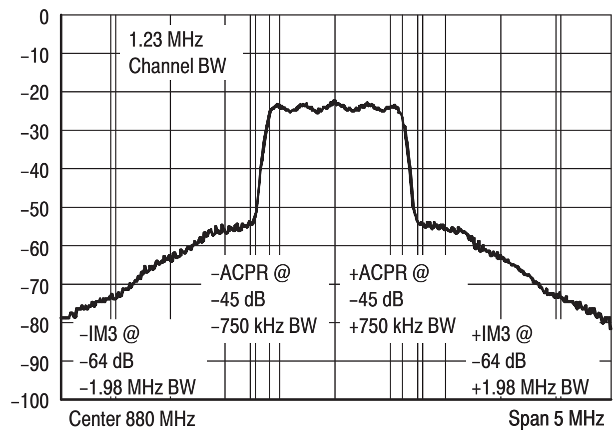


Figure 10. Power Gain, Efficiency and ACPR versus Output Power



V_{DS} = 26 Vdc, I_{DQ} = 600 mA, P_{out} (Avg.) = 15.6 W
Efficiency = 26.5%, Gain = 16.5 dB
IS−95 CDMA 1.23 MHz Channel Bandwidth
750 kHz: −45.0 dBc @ 30 kHz Bandwidth
1.98 MHz: −64.0 dBc @ 30 kHz Bandwidth

Figure 11. Single Carrier CDMA Spectrum

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