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

Designed for CDMA base station applications with frequencies from 1930 to 1990 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

- CDMA Performance @ 1990 MHz, 26 Volts
  IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13
  885 kHz — -47 dBc @ 30 kHz BW
  1.25 MHz — -55 dBc @ 12.5 kHz BW
  2.25 MHz — -55 dBc @ 1 MHz BW
  Output Power — 15 Watts (Avg.)
  Power Gain — 11.7 dB
  Efficiency — 16%

- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency, High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1990 MHz, 120 Watts (CW)
- Output Power
- S-Parameter Characterization at High Bias Levels
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters

MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>V_{DSS}</td>
<td>65</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>V_{GS}</td>
<td>-0.5, +15</td>
<td>Vdc</td>
</tr>
<tr>
<td>Total Device Dissipation @ T_{C} = 25°C</td>
<td>P_{D}</td>
<td>389</td>
<td>Watts</td>
</tr>
<tr>
<td>Derate above 25°C</td>
<td></td>
<td>2.22</td>
<td>W/°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>T_{stg}</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>T_{J}</td>
<td>200</td>
<td>°C</td>
</tr>
</tbody>
</table>

THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Resistance, Junction to Case</td>
<td>R_{JUC}</td>
<td>0.45</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

ESD PROTECTION CHARACTERISTICS

<table>
<thead>
<tr>
<th>Test Conditions</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Body Model</td>
<td>1 (Minimum)</td>
</tr>
<tr>
<td>Machine Model</td>
<td>M3 (Minimum)</td>
</tr>
</tbody>
</table>

NOTE - CAUTION - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.
## Electrical Characteristics

### Off Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Breakdown Voltage (VGS = 0 Vdc, ID = 10 µAdc)</td>
<td>V(BR)DSS</td>
<td>65</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate-Source Leakage Current (VGS = 5 Vdc, VDS = 0 Vdc)</td>
<td>IGS</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>µAdc</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Leakage Current (VDS = 26 Vdc, VGS = 0 Vdc)</td>
<td>IDSS</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>µAdc</td>
</tr>
</tbody>
</table>

### On Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Transconductance (VDS = 10 Vdc, ID = 2 Adc)</td>
<td>gfs</td>
<td>—</td>
<td>4.8</td>
<td>—</td>
<td>S</td>
</tr>
<tr>
<td>Gate Threshold Voltage (VDS = 10 V, ID = 200 µA)</td>
<td>VGS(th)</td>
<td>2.5</td>
<td>3</td>
<td>3.8</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate Quiescent Voltage (VDS = 26 V, ID = 500 mA)</td>
<td>VGS(Q)</td>
<td>3</td>
<td>3.9</td>
<td>5</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain-Source On-Voltage (VGS = 10 V, ID = 2 A)</td>
<td>VDS(on)</td>
<td>—</td>
<td>0.38</td>
<td>0.5</td>
<td>Vdc</td>
</tr>
</tbody>
</table>

### Dynamic Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Transfer Capacitance (VDS = 26 Vdc, VGS = 0, f = 1 MHz)</td>
<td>Crss</td>
<td>—</td>
<td>2.8</td>
<td>—</td>
<td>pF</td>
</tr>
<tr>
<td>Common-Source Amplifier Power Gain (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)</td>
<td>Gps</td>
<td>10.7</td>
<td>11.7</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Drain Efficiency (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)</td>
<td>η</td>
<td>30</td>
<td>34</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>Intermodulation Distortion (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)</td>
<td>IMD</td>
<td>—</td>
<td>-31</td>
<td>-28</td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)</td>
<td>IRL</td>
<td>—</td>
<td>-12</td>
<td>-9</td>
<td>dB</td>
</tr>
<tr>
<td>Common-Source Amplifier Power Gain (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)</td>
<td>Gps</td>
<td>—</td>
<td>11.7</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Drain Efficiency (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)</td>
<td>η</td>
<td>—</td>
<td>34</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>Intermodulation Distortion (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)</td>
<td>IMD</td>
<td>—</td>
<td>-31</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Input Return Loss (VDD = 26 Vdc, Pout = 120 W PEP, IDQ = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)</td>
<td>IRL</td>
<td>—</td>
<td>-14</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Power Output, 1 dB Compression Point (VDD = 26 Vdc, CW, IDQ = 2 × 500 mA, f1 = 1990.0 MHz)</td>
<td>P1dB</td>
<td>—</td>
<td>120</td>
<td>—</td>
<td>Watts</td>
</tr>
<tr>
<td>Common-Source Amplifier Power Gain (VDD = 26 Vdc, Pout = 120 W CW, IDQ = 2 × 500 mA, f1 = 1990.0 MHz)</td>
<td>Gps</td>
<td>—</td>
<td>11</td>
<td>—</td>
<td>dB</td>
</tr>
</tbody>
</table>

(1) Each side of device measured separately.
(2) Device measured in push-pull configuration.

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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNCTIONAL TESTS</strong> (In Motorola Test Fixture, 50 ohm system) (2) (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain Efficiency</td>
<td>( \eta )</td>
<td>—</td>
<td>45</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>( V_{DD} = 26 \text{ Vdc}, P_{out} = 120 \text{ W CW}, I_{DQ} = 2 \times 500 \text{ mA}, f_1 = 1990.0 \text{ MHz} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Mismatch Stress</td>
<td>( \Psi )</td>
<td>No Degradation In Output Power Before and After Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{DD} = 26 \text{ Vdc}, P_{out} = 120 \text{ W CW}, I_{DQ} = 2 \times 500 \text{ mA}, f = 1990 \text{ MHz}, \text{VSWR} = 10:1, \text{All Phase Angles at Frequency of Tests} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2) Device measured in push-pull configuration.
Figure 1. 1.93 - 1.99 GHz Broadband Test Circuit Schematic

B1, B2
Ferrite Beads, Fair Rite

C1, C2
0.06 - 4.5 pF Variable Capacitors, Johanson Gigatrim

C3, C4, C9, C10
10 pF Chip Capacitors, B Case, ATC

C5, C12
0.4 - 2.5 pF Variable Capacitors, Johanson Gigatrim

C6, C7
2.0 pF Chip Capacitors, B Case, ATC

C8
1.1 pF Chip Capacitor, B Case, ATC

C11
0.1 pF Chip Capacitor, B Case, ATC

C13, C20, C29, C37
5.1 pF Chip Capacitors, B Case, ATC

C14, C21, C28, C38
91 pF Chip Capacitors, B Case, ATC

C15, C22, C31, C40
100 µF, 50 V Electrolytic Capacitors, Sprague

C16, C23, C33, C43
0.039 µF Chip Capacitors, B Case, ATC

C17, C24, C32, C41
1000 pF Chip Capacitors, B Case, ATC

C19, C25
0.020 µF Chip Capacitors, B Case, ATC

C27, C34, C36, C42
22 µF, 35 V Tantalum Surface Mount Chip Capacitors, Kemet

C30, C39
1.0 µF, 35 V Tantalum Surface Mount Chip Capacitors, Kemet

C35, C44
470 µF, 63 V Electrolytic Capacitors, Sprague

Coax1, Coax2
25 Ω, Semi Rigid Coax, 70 mil OD, 1.05" Long

Coax3, Coax4
50 Ω, Semi Rigid Coax, 85 mil OD, 1.05" Long

L1
5.0 nH, Minispring Inductor, Coilcraft

L2
8.0 nH, Minispring Inductor, Coilcraft

L3, L4
5.60 nH, Microspring Inductors, Coilcraft

R1, R2
1 kΩ, 1/2 W Fixed Metal Film Resistors, Dale

R3, R4
270 Ω, 1/8 W Fixed Film Chip Resistors, Dale

R5, R6
1.0 kΩ, 1/8 W Fixed Film Chip Resistors, Dale

Z1
0.150” x 0.080” Microstrip

Z2
0.320” x 0.080” Microstrip

Z4, Z5
1.050” x 0.080” Microstrip

Z6, Z7
0.120” x 0.080” Microstrip

Z8, Z9
0.140” x 0.080” Microstrip

Z10, Z11
0.610” x 0.080” Microstrip

Z12, Z13
0.135” x 0.080” Microstrip

Z14, Z15
0.130” x 0.080” Microstrip

Z16, Z17
0.300” x 0.350” Microstrip

Z18, Z19
0.150” x 0.500” Microstrip

Z20, Z21
0.075” x 0.500” Microstrip

Z22, Z23
0.330” x 0.500” Microstrip

Z24, Z25
0.100” x 0.550” Microstrip

Z26, Z27
0.175” x 0.550” Microstrip

Z28, Z29
0.045” x 0.550” Microstrip

Z30, Z31
0.190” x 0.325” Microstrip

Z32, Z33
0.080” x 0.325” Microstrip

Z34, Z35
0.515” x 0.080” Microstrip

Z36, Z37
0.020” x 0.080” Microstrip

Z38, Z39
0.565” x 0.080” Microstrip

Z40
0.100” x 0.080” Microstrip

Z41
0.470” x 0.080” Microstrip

Z42
0.100” x 0.080” Microstrip

Board Material
0.03” Teflon®, εr = 2.55 Copper Clad, 2 oz. Cu

Connectors
N-Type Panel Mount, Stripline

For More Information On This Product, Go to: www.freescale.com

MRF19120

MOTOROLA RF DEVICE DATA
Figure 2. MRF19120 Test Circuit Component Layout
Freescale Semiconductor, Inc.

TYPICAL CHARACTERISTICS

Figure 3. Power Gain versus Output Power

Figure 4. Class AB Broadband Circuit Performance

Figure 5. Intermodulation Distortion versus Output Power

Figure 6. Intermodulation Distortion Products versus Output Power

Figure 7. Power Gain, Efficiency, and IMD versus Output Power

Figure 8. Power Gain, Efficiency, and ACPR versus Output Power
V_{DD} = 26 \text{ V, } I_{DQ} = 2 \times 500 \text{ mA, } P_{out} = 120 \text{ W PEP}

<table>
<thead>
<tr>
<th>f MHz</th>
<th>Z_{source} \Omega</th>
<th>Z_{load} \Omega</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>1.64 - j2.6</td>
<td>3.9 - j1.7</td>
</tr>
<tr>
<td>1960</td>
<td>2.10 - j2.8</td>
<td>4.8 - j0.8</td>
</tr>
<tr>
<td>1990</td>
<td>2.10 - j1.4</td>
<td>4.9 - j0.3</td>
</tr>
</tbody>
</table>

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

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

Figure 9. Series Equivalent Input and Output Impedance
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ASIA/PACIFIC: Motorola Semiconductors H.K.Ltd.; Silicon Harbour Centre,
2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong
852-26668334

HOME PAGE: http://motorola.com/semiconductors

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