The RF MOSFET Line
125W, 200MHz

Designed primarily for wideband large–signal output and driver stages up to 200 MHz frequency range.

N–Channel enhancement mode MOSFET

- Guaranteed performance at 150 MHz, 28 Vdc
  - Output power = 125 W
  - Minimum gain = 9.0 dB
- Efficiency = 50% (min.)
- Excellent thermal stability, ideally suited for Class A operation
- Facilitates manual gain control, ALC and modulation techniques
- 100% tested for load mismatch at all phase angles with 30:1 VSWR
- Low noise figure — 3.0 dB typ. at 2.0 A, 150 MHz

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>Drain–Gate Voltage (RGs = 10 MΩ)</td>
<td>$V_{DG}$</td>
<td>65</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate–Source Voltage</td>
<td>$V_{GS}$</td>
<td>±40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain Current — Continuous</td>
<td>$I_{D}$</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>Total Device Dissipation @ $T_C = 25^°C$</td>
<td>$P_D$</td>
<td>270</td>
<td>Watts</td>
</tr>
<tr>
<td>Derate above 25°C</td>
<td></td>
<td>1.54</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>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Resistance, Junction to Case</td>
<td>$R_{θJC}$</td>
<td>0.65</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Handling and Packaging — 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.)

<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 (V_{GS} = 0, I_D = 50 mA)</td>
<td>V(BR)DSS</td>
<td>65</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current (V_{DS} = 28 V, V_{GS} = 0)</td>
<td>I_{DSS}</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Gate–Source Leakage Current (V_{GS} = 20 V, V_{DS} = 0)</td>
<td>I_{GS}</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td>μA</td>
</tr>
</tbody>
</table>

## OFF CHARACTERISTICS

| Gate Threshold Voltage (V_{DS} = 10 V, I_D = 100 mA)                  | V_{GS(th)} | 1.0  | 3.0  | 6.0  | Vdc    |
| Forward Transconductance (V_{DS} = 10 V, I_D = 3.0 A)                | gfs        | 1.75 | 2.5  | —    | mhos   |

## DYNAMIC CHARACTERISTICS

| Input Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1.0 MHz)            | C_{iss}    | —    | 175  | —    | pF     |
| Output Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1.0 MHz)          | C_{oss}    | —    | 190  | —    | pF     |
| Reverse Transfer Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1.0 MHz)| C_{trs}    | —    | 40   | —    | pF     |

## FUNCTIONAL CHARACTERISTICS (Figure 1)

| Noise Figure (V_{DD} = 28 Vdc, I_D = 2.0 A, f = 150 MHz)             | NF         | —    | 3.0  | —    | dB     |
| Common Source Power Gain (V_{DD} = 28 Vdc, P_{out} = 125 W, f = 150 MHz, I_{DQ} = 100 mA) | G_{ps}     | 9.0  | 11.8 | —    | dB     |
| Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 125 W, f = 150 MHz, I_{DQ} = 100 mA) | η           | 50   | 60   | —    | %      |
| Electrical Ruggedness (V_{DD} = 28 Vdc, P_{out} = 125 W, f = 150 MHz, I_{DQ} = 100 mA, VSWR 30:1 at all Phase Angles) | ν           | No Degradation in Output Power |
MRF174

The RF MOSFET Line
125W, 200MHz

Rev. V1

M/A-COM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

For further information and support please visit: https://www.macom.com/support

Figure 1. 150 MHz Test Circuit

C1 — 15 pF Unelco
C2 — Arco 462, 5.0—80 pF
C3 — 100 pF Unelco
C4 — 25 pF Unelco
C6 — 40 pF Unelco
C7 — Arco 461, 2.7–30 pF
C5, C8 — Arco 463, 9.0–180 pF
C9, C11, C14 — 0.1 µF Erie Redcap
C10 — 50 µF, 50 V
C12, C13 — 680 pF Feedthr
D1 — 1N5926A Motorola Zener
L1 — #16 AWG, 1–1/4 Turns, 0.213” ID
L2 — #16 AWG, Hairpin
L3 — #14 AWG, Hairpin
L4 — 10 Turns #16 AWG Enamed Wire on R1
RFC1 — 18 Turns #16 AWG Enamed Wire, 0.3” ID
R1 — 10 Ω, 2.0 W
R2 — 1.8 kΩ, 1/2 W
R3 — 10 kΩ, 10 Turn Bourns
R4 — 10 kΩ, 1/4 W
The RF MOSFET Line
125W, 200MHz

Figure 2. Output Power versus Input Power

Figure 3. Output Power versus Input Power

Figure 4. Output Power versus Supply Voltage

Figure 5. Output Power versus Supply Voltage

M/A-COM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

For further information and support please visit:
https://www.macom.com/support
Figure 6. Output Power versus Supply Voltage

Figure 7. Power Gain versus Frequency
The RF MOSFET Line
125W, 200MHz

Figure 8. Output Power versus Gate Voltage

Figure 9. Drain Current versus Gate Voltage
(Transfer Characteristics)

Figure 10. Gate–Source Voltage versus

Figure 11. Capacitance versus Drain Voltage
Figure 12. DC Safe Operating Area
The RF MOSFET Line
125W, 200MHz

Figure 13. $S_{11}$, Input Reflection Coefficient
versus Frequency
$V_{DS} = 28\, V, I_D = 3.0\, A$

Figure 14. $S_{12}$, Reverse Transmission Coefficient
versus Frequency
$V_{DS} = 28\, V, I_D = 3.0\, A$

Figure 15. $S_{21}$, Forward Transmission Coefficient
versus Frequency
$V_{DS} = 28\, V, I_D = 3.0\, A$

Figure 16. $S_{22}$, Output Reflection Coefficient
versus Frequency
$V_{DS} = 28\, V, I_D = 3.0\, A$
Figure 17. Series Equivalent Input/Output Impedance, $Z_{in}$, $Z_{OL}^*$
DESIGN CONSIDERATIONS

The MRF174 is a RF MOSFET power N–channel enhancement mode field–effect transistor (FET) designed for UHF power amplifier applications. M/A-COM RF MOSFETs feature a vertical structure with a planar design, thus avoiding the processing difficulties associated with V–groove power FETs.

M/A-COM Application Note AN211A, FETs in Theory and Practice, is suggested reading for those not familiar with the construction and characteristics of FETs.

The major advantages of RF power FETs include high gain, low noise, simple bias systems, relative immunity from thermal runaway, and the ability to withstand severely mismatched loads without suffering damage. Power output can be varied over a wide range with a low power dc control signal, thus facilitating manual gain control, ALC and modulation.

DC BIAS

The MRF174 is an enhancement mode FET and, therefore, does not conduct when drain voltage is applied. Drain current flows when a positive voltage is applied to the gate. See Figure 9 for a typical plot of drain current versus gate voltage. RF power FETs require forward bias for optimum performance. The value of quiescent drain current (IDQ) is not critical for many applications. The MRF174 was characterized at IDQ = 100 mA, which is the suggested minimum value of IDQ. For special applications such as linear amplification, IDQ may have to be selected to optimize the critical parameters.

The gate is a dc open circuit and draws no current. Therefore, the gate bias circuit may generally be just a simple resistive divider network. Some special applications may require a more elaborate bias system.

GAIN CONTROL

Power output of the MRF174 may be controlled from its rated value down to zero (negative gain) by varying the dc gate voltage. This feature facilitates the design of manual gain control, AGC/ALC and modulation systems. (see Figure 8.)

AMPLIFIER DESIGN

Impedance matching networks similar to those used with bipolar VHF transistors are suitable for MRF174. See M/A-COM Application Note AN721, Impedance Matching Networks Applied to RF Power Transistors. The higher input impedance of RF MOSFETs helps ease the task of broadband network design. Both small–signal scattering parameters and large–signal impedances are provided. While the s–parameters will not produce an exact design solution for high power operation, they do yield a good first approximation. This is an additional advantage of RF MOS power FETs.
The RF MOSFET Line
125W, 200MHz

MRF174

MACOM

M/A-COM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit www.macom.com for additional data sheets and product information.

For further information and support please visit:
https://www.macom.com/support

Unless otherwise noted, tolerances are inches ±0.005" [millimeters ±0.13mm].
M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.

For further information and support please visit: https://www.macom.com/support