The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

Designed primarily for wideband large–signal output and driver amplifier stages in the 30 to 500 MHz frequency range.

- Specified 28 V, 500 MHz characteristics —
  - Output power = 100 W
  - Typical gain = 9.5 dB (Class AB); 8.5 dB (Class C)
  - Efficiency = 55% (typ.)
- Built–in input impedance matching networks for broadband operation
- Push–pull configuration reduces even numbered harmonics
- Gold metallization system for high reliability
- 100% tested for load mismatch

The MRF393 is two transistors in a single package with separate base and collector leads and emitters common. This arrangement provides the designer with a space saving device capable of operation in a push–pull configuration.

### PUSH–PULL TRANSISTORS

#### MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector–Emitter Voltage</td>
<td>( V_{CEO} )</td>
<td>30</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Base Voltage</td>
<td>( V_{CEO} )</td>
<td>60</td>
<td>Vdc</td>
</tr>
<tr>
<td>Emitter–Base Voltage</td>
<td>( V_{EBO} )</td>
<td>4.0</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Current — Continuous</td>
<td>( I_{C} )</td>
<td>16</td>
<td>Adc</td>
</tr>
<tr>
<td>Total Device Dissipation @ ( T_C = 25^\circ C ) (1)</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>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_{thJC} )</td>
<td>0.65</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

**NOTE:**

1. This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF push–pull amplifier.
The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

**ELECTRICAL CHARACTERISTICS** (T_{\text{J}} = 25^\circ\text{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>Collector-Emitter Breakdown Voltage (I_{C} = 50 mA dc, I_{B} = 0)</td>
<td>V_{\text{BRCEO}}</td>
<td>30</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector−Emitter Breakdown Voltage (I_{C} = 50 mA dc, V_{BE} = 0)</td>
<td>V_{\text{BRICES}}</td>
<td>60</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Emitter−Base Breakdown Voltage (I_{E} = 5.0 mA dc, I_{C} = 0)</td>
<td>V_{\text{BRIEBO}}</td>
<td>4.0</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Cutoff Current (V_{CB} = 30 Vdc, I_{E} = 0)</td>
<td>I_{CBO}</td>
<td>—</td>
<td>—</td>
<td>5.0</td>
<td>mA dc</td>
</tr>
</tbody>
</table>

**OFF CHARACTERISTICS** (1)

**ON CHARACTERISTICS** (1)

| DC Current Gain (I_{C} = 1.0 A dc, V_{CE} = 5.0 Vdc) | hFE | 20  | —   | 100 | — |

**DYNAMIC CHARACTERISTICS** (1)

| Output Capacitance (V_{CB} = 28 Vdc, I_{E} = 0, f = 1.0 MHz) | C_{OB} | 40  | 75  | 96  | pF |

**FUNCTIONAL TESTS** (2) — See Figure 1

| Common−Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 500 MHz) | Q_{pe} | 7.5 | 6.5 | —   | dB |

| Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 500 MHz) | \eta | 50  | 55  | —   | %  |

| Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 500 MHz, Y_{S\text{WR}} = 30:1, all phase angles) | \psi | No Degradation in Output Power |

**NOTES:**

1. Each transistor chip measured separately.
2. Both transistor chips operating in push−pull amplifier.
The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

---

C1, C2, C7, C8 — 240 pF 100 mil Chip Cap
C3 — 15 pF 100 mil Chip Cap
C4 — 24 pF 100 mil Chip Cap
C5 — 33 pF 100 mil Chip Cap
C6 — 12 pF 100 mil Chip Cap
C9, C13 — 1000 pF 100 mil Chip Cap
C10, C14 — 680 pF Feedthru Cap
C11, C15 — 0.1 μF Ceramic Disc Cap
C12, C16 — 50 μF 50 V

L1, L2 — 0.15 μH Molded Choke with Ferrite Bead
L3, L4 — 2-1/2 Turns #20 AWG 0.200” ID
L5, L6 — 3-1/2 Turns #18 AWG 0.200” ID
B1, B2 — Balun 50 Ω Semi Rigid Coax, 86 mil OD, 4” Long
Z1, Z2 — 860 mil Long x 125 mil W. Microstrip
Z3, Z4 — 200 mil Long x 125 mil W. Microstrip
Z5, Z6 — 800 mil Long x 125 mil W. Microstrip
Board Material — 0.0325” Teflon—Fiberglass, εr = 2.56,
1 oz. Copper Clad both sides.

Figure 1. 600 MHz Test Fixture
The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

Class C

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
The RF Line Controlled “Q” Broadband Power Transistor

100W, 30 to 500MHz, 28V

<table>
<thead>
<tr>
<th>f (MHz)</th>
<th>Z_o^* (Ω)</th>
<th>Z_in (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.85 + j0</td>
<td>7.8 + j5.6</td>
</tr>
<tr>
<td>225</td>
<td>0.58 + j2.6</td>
<td>5.0 + j3.2</td>
</tr>
<tr>
<td>400</td>
<td>3.00 + j5.9</td>
<td>3.2 + j0.6</td>
</tr>
<tr>
<td>500</td>
<td>4.80 + j3.0</td>
<td>2.9 + j1.2</td>
</tr>
</tbody>
</table>

NOTE: Z_in & Z_o^* are given from base-to-base and collector-to-collector respectively.

Figure 6. Series Equivalent Input/Output Impedance

Figure 7. Class AB Output Power versus Input Power
The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

REV. V1

MRF393

CASE 744A-01
ISSUE C
MRF393

The RF Line Controlled “Q” Broadband Power Transistor
100W, 30 to 500MHz, 28V

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 estoppeles 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 DAMAGES RESULTING 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.