Class A, Class AB Microwave Power Silicon NPN Transistor
0.7 W, 960–1215 MHz, 18V

Features
- Guaranteed performance @ 1090 MHz, 18 Vdc — Class A
- Output power: 0.2W
- Minimum gain: 10dB
- 100% tested for load mismatch at all phase angles with 10:1 VSWR
- Industry standard package
- Nitride passivated
- Gold metallized, emitter ballasted for long life and resistance to metal migration
- Internal input matching for broadband operation

Description and Applications
Designed for Class A and AB common emitter amplifier applications in the low-power stages of IFF, DME, TACAN, radar transmitters, and CW systems.

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>20</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Base Voltage</td>
<td>V_{CBO}</td>
<td>50</td>
<td>Vdc</td>
</tr>
<tr>
<td>Emitter–Base Voltage</td>
<td>V_{EBO}</td>
<td>3.5</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Current — Continuous</td>
<td>I_{C}</td>
<td>200</td>
<td>mAdc</td>
</tr>
<tr>
<td>Total Device Dissipation @ T_C = 25°C (1)</td>
<td>P_D</td>
<td>7.0</td>
<td>Watts</td>
</tr>
<tr>
<td>Derate above 25°C</td>
<td>40</td>
<td>mW/^°C</td>
<td></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 (2)</td>
<td>R_{jc}</td>
<td>25</td>
<td>°CW</td>
</tr>
</tbody>
</table>

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>Collector–Emitter Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_C = 5.0 mAdc, I_B = 0)</td>
<td>V_{(BR)}</td>
<td>20</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Emitter Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_C = 5.0 mAdc, V_{BE} = 0)</td>
<td>V_{(BR)}</td>
<td>50</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Base Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_C = 5.0 mAdc, I_E = 0)</td>
<td>V_{(BR)}</td>
<td>50</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Emitter–Base Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_E = 1.0 mAdc, I_C = 0)</td>
<td>V_{(BR)}</td>
<td>3.5</td>
<td>—</td>
<td>—</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Cutoff Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_{CE} = 20 Vdc, I_E = 0)</td>
<td>I_{CEO}</td>
<td>—</td>
<td>—</td>
<td>0.5</td>
<td>mAdc</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>DC Current Gain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_C = 100 mAdc, V_{CE} = 5.0 Vdc)</td>
<td>h_{FE}</td>
<td>10</td>
<td>—</td>
<td>100</td>
<td>—</td>
</tr>
</tbody>
</table>

1. These devices are designed for RF operation. The total device dissipation rating applies only when the device is operated as RF amplifiers.
2. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

For further information and support please visit:
https://www.macom.com/support
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Rev. V1

ELECTRICAL CHARACTERISTICS — continued \( (T_C = 25^\circ C \text{ unless otherwise noted.}) \)

<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>Output Capacitance ( (V_{CB} = 28 \text{ Vdc, } I_E = 0, f = 1.0 \text{ MHz}) )</td>
<td>( C_{ob} )</td>
<td>—</td>
<td>2.0</td>
<td>5.0</td>
<td>pF</td>
</tr>
</tbody>
</table>

DYNAMIC CHARACTERISTICS

FUNCTIONAL TESTS

- Common-Emitter Power Gain — Class A
  \( (V_{CE} = 18 \text{ Vdc, } I_C = 100 \text{ mA} \text{dc, } f = 1090 \text{ MHz, } P_{out} = 200 \text{ mW}) \)
  \( G_{PF} \)    10 12  —  dB

- Common-Emitter Power Gain — Class AB
  \( (V_{CE} = 18 \text{ Vdc, } I_{CB} = 10 \text{ mA} \text{dc, } f = 1090 \text{ MHz, } P_{out} = 0.7 \text{ W}) \)
  \( G_{PF} \)    — 10.7  — dB

- Load Mismatch — Class A
  \( (V_{CE} = 18 \text{ Vdc, } I_C = 100 \text{ mA} \text{dc, } f = 1090 \text{ MHz, } P_{out} = 200 \text{ mW}, V_{SWR} = 10.1 \text{ All Phase Angles}) \)
  \( \Psi \)  No Degradation in Power Output

C1, C2, C3, C7, C8, C10 — 220 pF ATC 100 mil
C4, C9 — 4.7 \( \mu \text{F, } 50 \text{ V Tantalum}
C5, C6 — 0.8–8.9 pF Johnson #7290
Z1–Z10 — Distributed Microstrip Elements
— See Figure 8
Board Material — 0.031\” Thick Teflon–Fiberglass
\( \varepsilon_r = 2.56 \)

Class AB Bias Control Circuit
18 V Output \( I_C \) 10 mA Nominal

Class A Constant Current Bias Control Circuit
\( I_C = 100 \text{ mA, } V_{CE} = 18 \text{ V} \)

Figure 1. 1090 MHz Test Circuit
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Figure 2. Output Power versus Input Power

Figure 3. Output Power versus Frequency

Figure 4. DC Safe Operating Area

Figure 5. Power Gain versus Frequency
SERIES EQUIVALENT IMPEDANCES

\[ P_{out} = 0.5 \text{ W}, \ V_{CE} = 18 \text{ Vdc}, \ I_{CO} = 10 \text{ mA}\text{dc, Class AB} \]

\[
\begin{array}{|c|c|c|}
\hline
f \ (\text{MHz}) & Z_{re} \ (\text{Ohms}) & Z_{re}^{*} \ (\text{Ohms}) \\
\hline
960 & 3.0 + 9.0 & 16 - j43 \\
1060 & 3.2 + j10 & 8.5 - j31 \\
1215 & 2.8 + j12 & 7.0 - j26 \\
\hline
\end{array}
\]

\(Z_{re}^{*}\) = Conjugate of the optimum load impedance into which the device outputs operate at a given output power, voltage, and frequency.

S–PARAMETERS — \(V_{CE} = 18 \text{ Vdc}, I_{C} = 100 \text{ mA}\text{dc, Class A}\)

\[
\begin{array}{|c|c|c|c|c|c|c|}
\hline
f \ (\text{MHz}) & |S_{11}| & \angle \phi & |S_{21}| & \angle \phi & |S_{12}| & \angle \phi & |S_{22}| & \angle \phi \\
\hline
950 & 0.77 & 166 & 2.42 & 40 & 0.016 & 42 & 0.46 & -87 \\
1000 & 0.73 & 165 & 2.36 & 36 & 0.016 & 46 & 0.50 & -90 \\
1050 & 0.77 & 183 & 2.31 & 33 & 0.016 & 46 & 0.51 & -94 \\
1100 & 0.77 & 182 & 2.31 & 28 & 0.016 & 46 & 0.54 & -97 \\
1150 & 0.78 & 161 & 2.20 & 23 & 0.015 & 46 & 0.57 & -100 \\
1200 & 0.78 & 159 & 2.20 & 19 & 0.016 & 47 & 0.59 & -103 \\
1250 & 0.78 & 158 & 2.12 & 12 & 0.016 & 42 & 0.61 & -106 \\
\hline
\end{array}
\]

Figure 6. Common–Emitter S–Parameters and Series Equivalent Input/Output Impedances

Replaces MRF1000MA/D

PACKAGE DIMENSIONS

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M 1994
2. CONTROLLING DIMENSION: INCH

CASE 332A–03
ISSUE D

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MRF1000MB

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