

DATA SHEET

BFG135

NPN 7GHz wideband transistor

Product specification
File under discrete semiconductors, SC14

1995 Sep 13

NPN 7GHz wideband transistor

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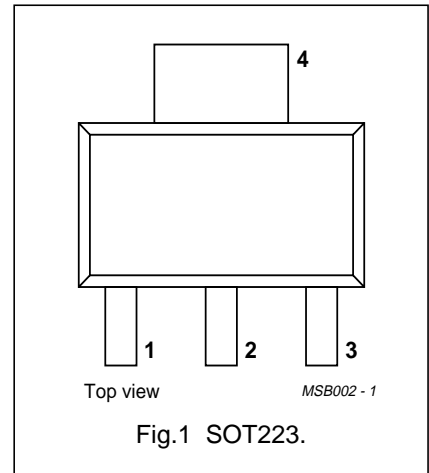
DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The small emitter structures, with integrated emitter-ballasting resistors, ensure high output voltage capabilities at a low distortion level.

The distribution of the active areas across the surface of the device gives an excellent temperature profile.

PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1 | emitter |
| 2 | base |
| 3 | emitter |
| 4 | collector |



QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------|-------------------------------|---|------|------|------|------|
| V_{CB0} | collector-base voltage | open emitter | – | – | 25 | V |
| V_{CEO} | collector-emitter voltage | open base | – | – | 15 | V |
| I_C | DC collector current | | – | – | 150 | mA |
| P_{tot} | total power dissipation | up to $T_s = 145\text{ °C}$ (note 1) | – | – | 1 | W |
| h_{FE} | DC current gain | $I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_j = 25\text{ °C}$ | 80 | 130 | – | |
| f_T | transition frequency | $I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$ | – | 7 | – | GHz |
| G_{UM} | maximum unilateral power gain | $I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | – | 16 | – | dB |
| | | $I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 800\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | – | 12 | – | dB |
| V_o | output voltage | $d_{im} = -60\text{ dB}$; $I_C = 100\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\text{ }\Omega$; $T_{amb} = 25\text{ °C}$; $f_{(p+q-r)} = 793.25\text{ MHz}$ | – | 850 | – | mV |

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|---------------------------|--------------------------------------|------|------|------|
| V_{CB0} | collector-base voltage | open emitter | – | 25 | V |
| V_{CEO} | collector-emitter voltage | open base | – | 15 | V |
| V_{EBO} | emitter-base voltage | open collector | – | 2 | V |
| I_C | DC collector current | | – | 150 | mA |
| P_{tot} | total power dissipation | up to $T_s = 145\text{ °C}$ (note 1) | – | 1 | W |
| T_{stg} | storage temperature | | –65 | 150 | °C |
| T_j | junction temperature | | – | 175 | °C |

Note

- T_s is the temperature at the soldering point of the collector tab.

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THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | THERMAL RESISTANCE |
|---------------|---|--------------------------------------|--------------------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | up to $T_s = 145\text{ °C}$ (note 1) | 30 K/W |

Note

- T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

$T_j = 25\text{ °C}$ unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------|---|--|------|------|------|---------------|
| I_{CBO} | collector cut-off current | $I_E = 0; V_{CB} = 10\text{ V}$ | – | – | 1 | μA |
| h_{FE} | DC current gain | $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}$ | 80 | 130 | – | |
| C_c | collector capacitance | $I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$ | – | 2 | – | pF |
| C_e | emitter capacitance | $I_C = i_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$ | – | 7 | – | pF |
| C_{re} | feedback capacitance | $I_C = 0; V_{CE} = 10\text{ V}; f = 1\text{ MHz}$ | – | 1.2 | – | pF |
| f_T | transition frequency | $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$ | – | 7 | – | GHz |
| G_{UM} | maximum unilateral power gain | $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$ | – | 16 | – | dB |
| | | $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ °C}$ | – | 12 | – | dB |
| V_o | output voltage | note 1 | – | 900 | – | mV |
| | | note 2 | – | 850 | – | mV |
| d_2 | second order intermodulation distortion | $I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; V_O = 50\text{ dBmV}; T_{amb} = 25\text{ °C}; f_{(p+q)} = 450\text{ MHz}; f_p = 50\text{ MHz}; f_q = 400\text{ MHz}$ | – | –58 | – | dB |
| | | $I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; V_O = 50\text{ dBmV}; T_{amb} = 25\text{ °C}; f_{(p+q)} = 810\text{ MHz}; f_p = 250\text{ MHz}; f_q = 560\text{ MHz}$ | – | –53 | – | dB |

Notes

- $d_{im} = -60\text{ dB}$ (DIN 45004B); $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C}; V_p = V_o$ at $d_{im} = -60\text{ dB}; f_p = 445.25\text{ MHz}; V_q = V_o - 6\text{ dB}; f_q = 453.25\text{ MHz}; V_r = V_o - 6\text{ dB}; f_r = 455.25\text{ MHz};$ measured at $f_{(p+q-r)} = 443.25\text{ MHz}$.
- $d_{im} = -60\text{ dB}$ (DIN 45004B); $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C}; V_p = V_o$ at $d_{im} = -60\text{ dB}; f_p = 795.25\text{ MHz}; V_q = V_o - 6\text{ dB}; f_q = 803.25\text{ MHz}; V_r = V_o - 6\text{ dB}; f_r = 805.25\text{ MHz};$ measured at $f_{(p+q-r)} = 793.25\text{ MHz}$.

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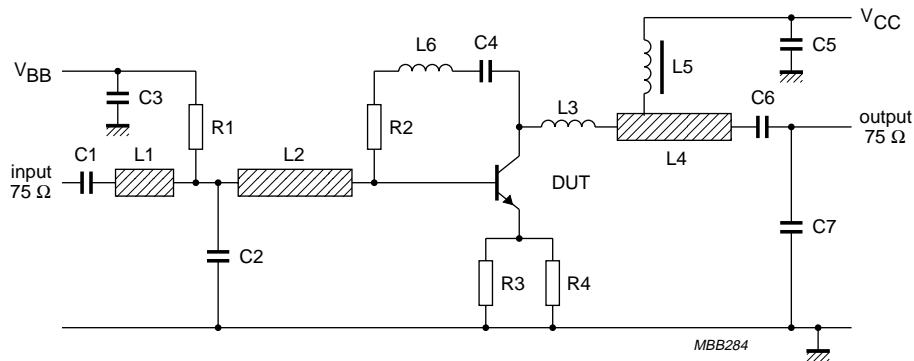


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

| DESIGNATION | DESCRIPTION | VALUE | UNIT | DIMENSIONS | CATALOGUE NO. |
|----------------|-----------------------------------|--------------|------------|---------------------------------------|----------------|
| C1, C3, C5, C6 | multilayer ceramic capacitor | 10 | nF | | 2222 590 08627 |
| C2, C7 | multilayer ceramic capacitor | 1 | pF | | 2222 851 12108 |
| C4 (note 1) | miniature ceramic plate capacitor | 10 | nF | | 2222 629 08103 |
| L1 | microstripline | 75 | Ω | length 7 mm; width 2.5 mm | |
| L2 | microstripline | 75 | Ω | length 22mm; width 2.5 mm | |
| L3 (note 1) | 1.5 turns 0.4 mm copper wire | | | int. dia. 3 mm; winding pitch 1 mm | |
| L4 | microstripline | 75 | Ω | length 19 mm; width 2.5 mm | |
| L5 | Ferrocube choke | 5 | μ H | | 3122 108 20153 |
| L6 (note 1) | 0.4 mm copper wire | ≈ 25 | nH | length 30 mm | |
| R1 | metal film resistor | 10 | k Ω | | 2322 180 73103 |
| R2 (note 1) | metal film resistor | 200 | Ω | | 2322 180 73201 |
| R3, R4 | metal film resistor | 27 | Ω | | 2322 180 73279 |

Note

- Components C4, L3, L6 and R2 are mounted on the underside of the PCB.

The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric ($\epsilon_r = 2.2$); thickness $\frac{1}{16}$ inch; thickness of copper sheet $\frac{1}{32}$ inch.

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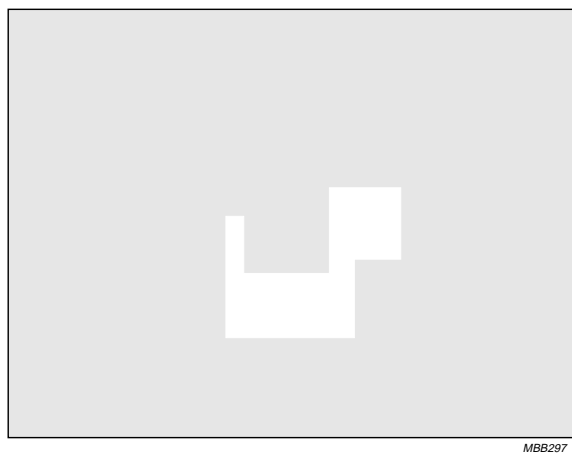
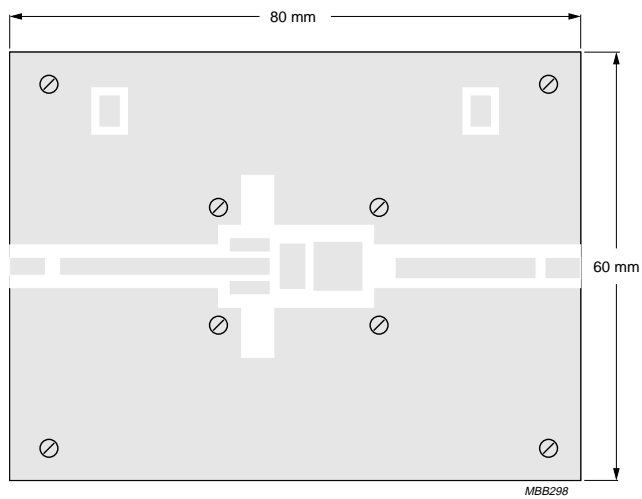
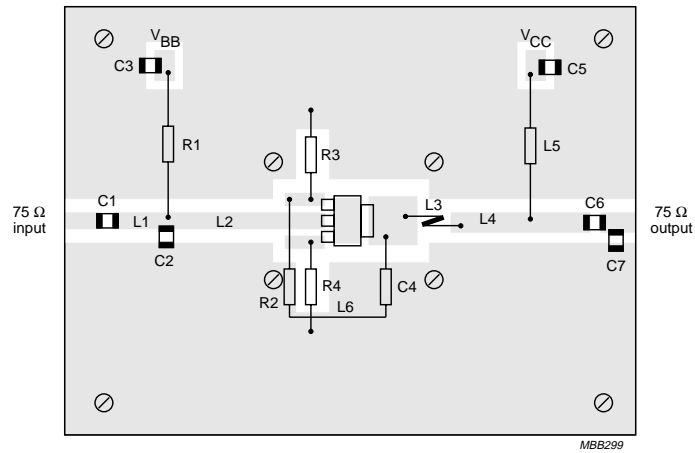
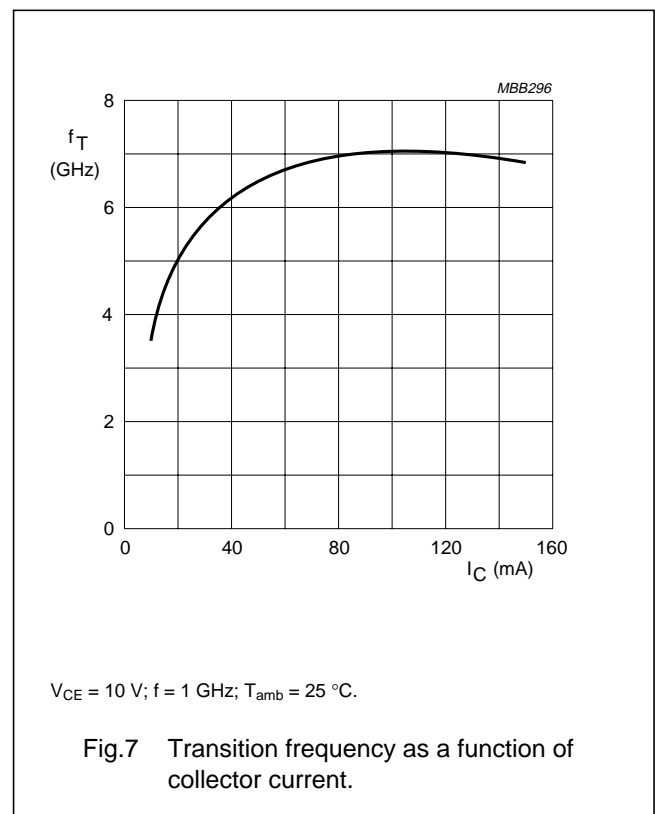
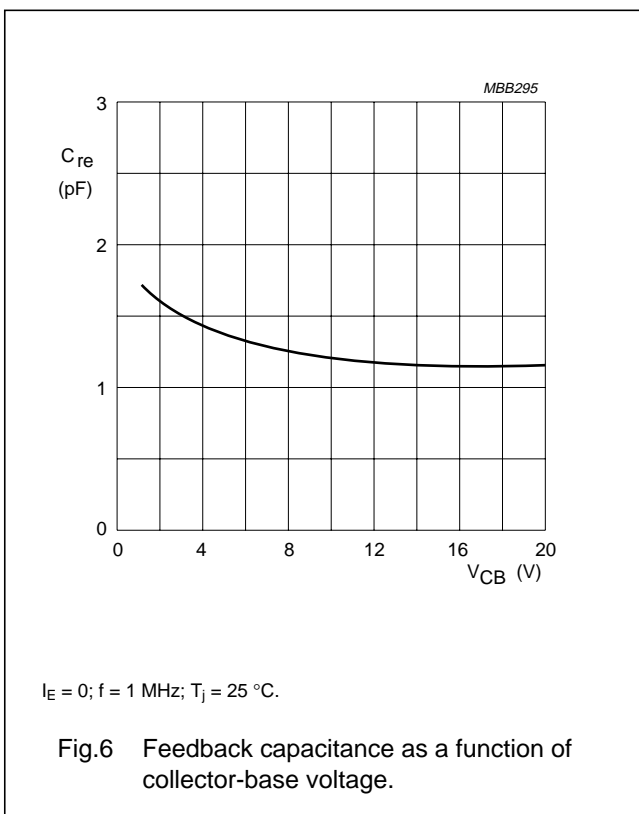
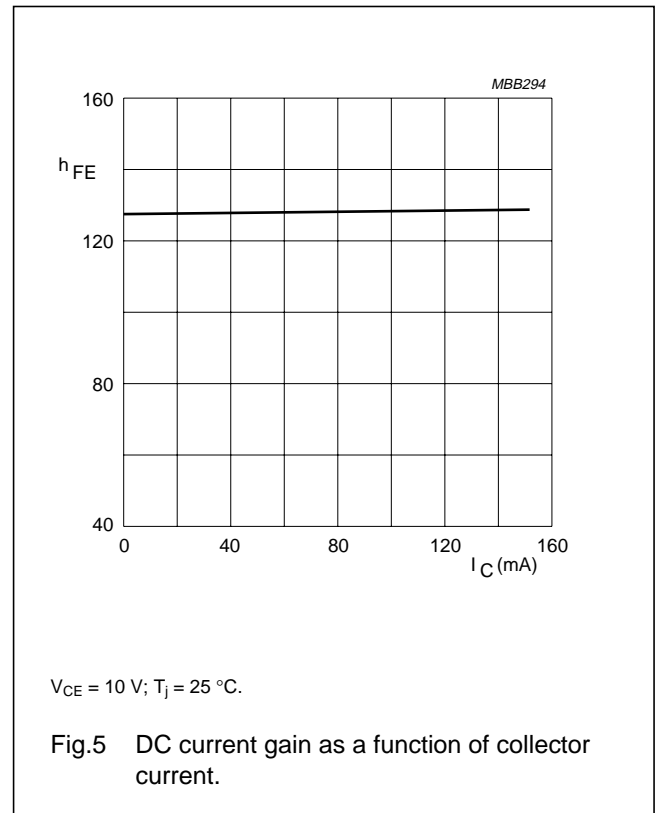
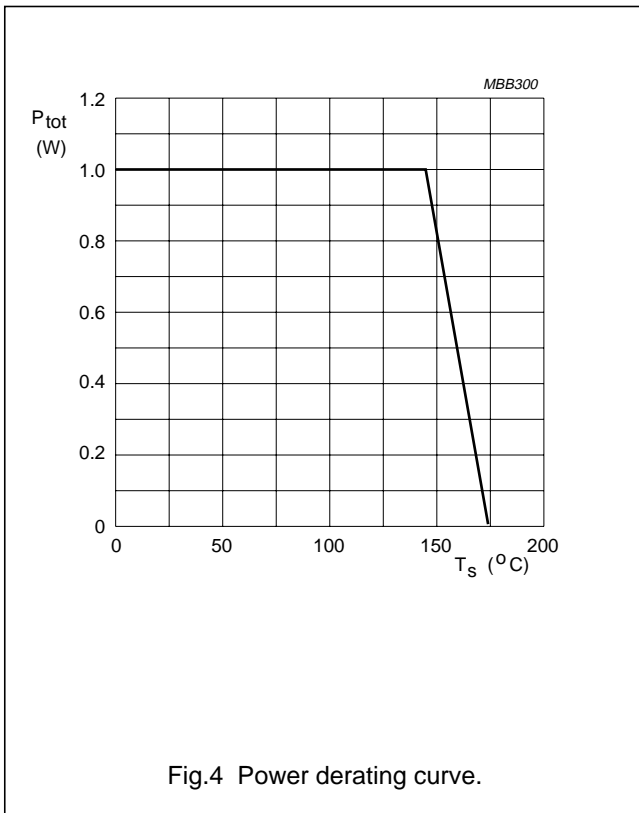


Fig.3 Intermodulation distortion test printed-circuit board.

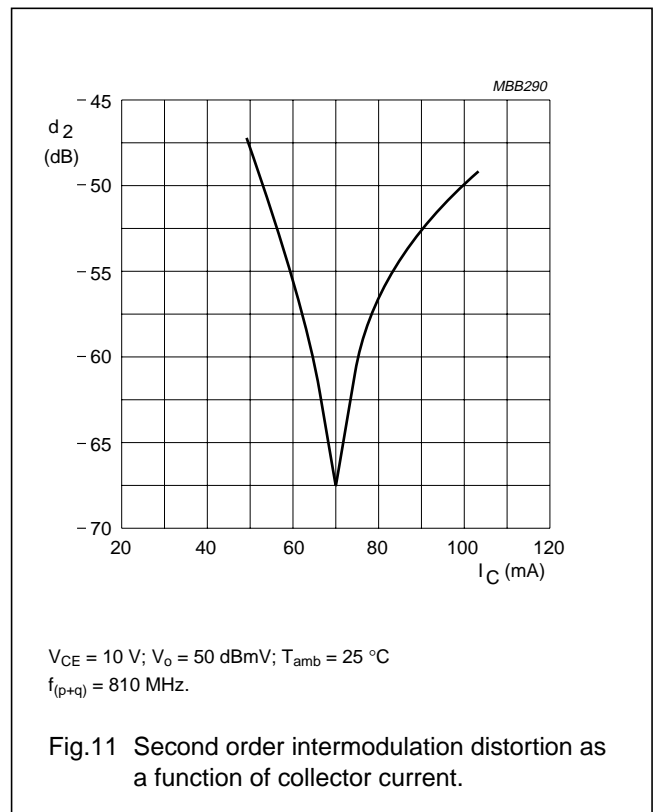
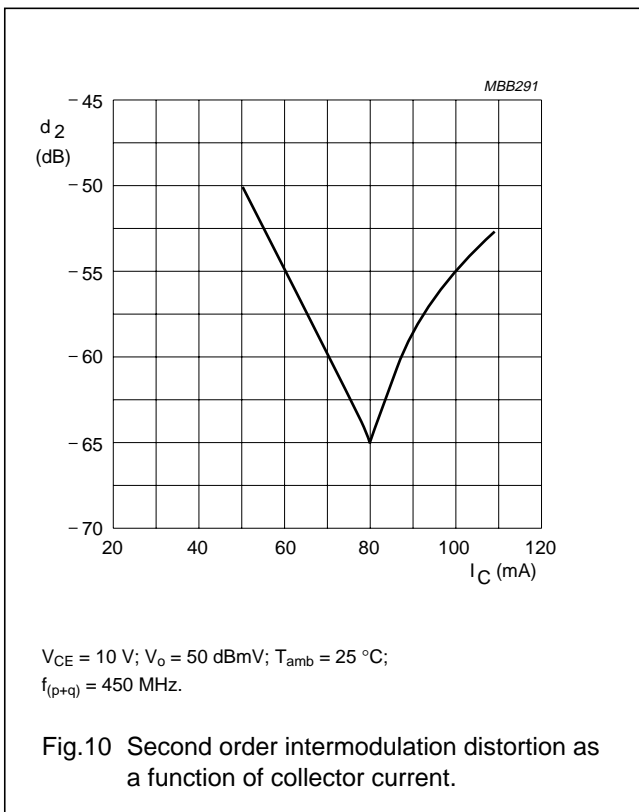
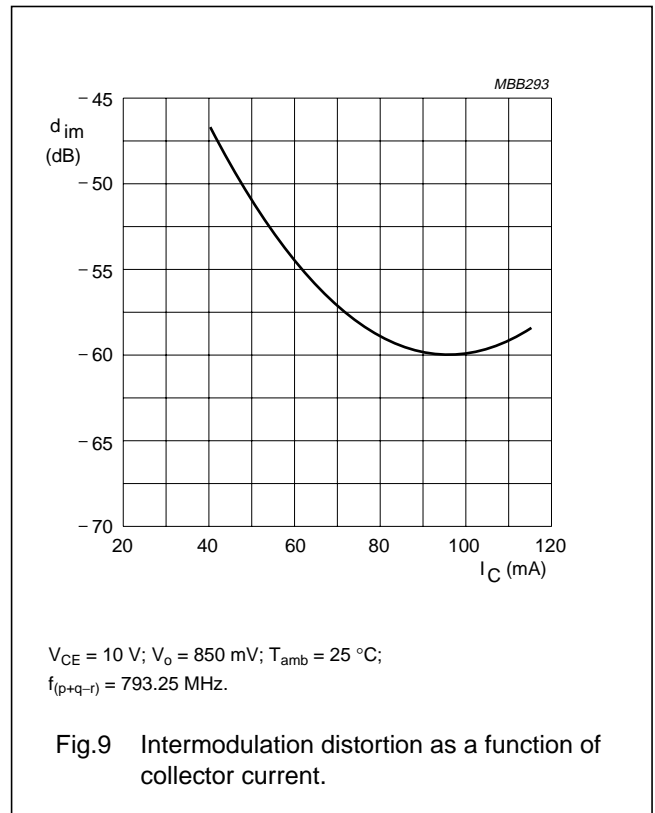
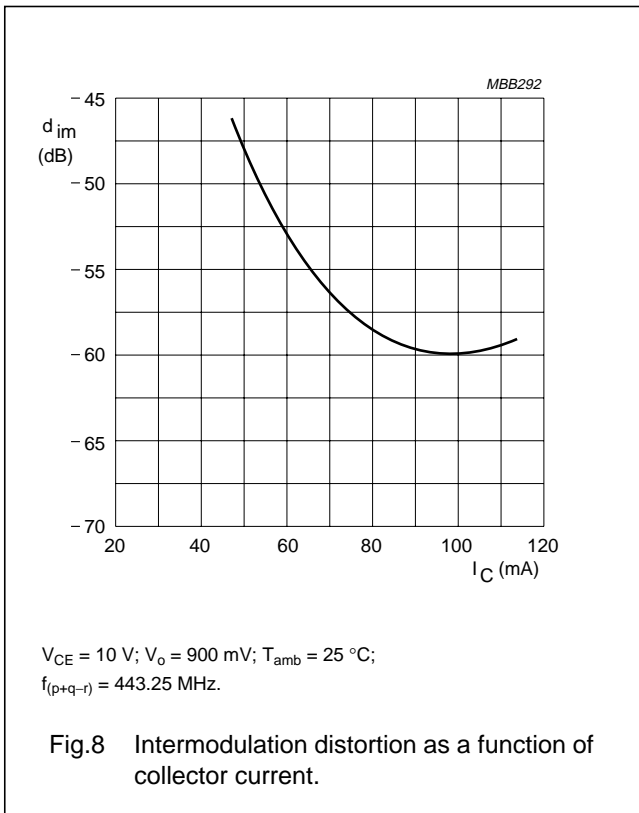
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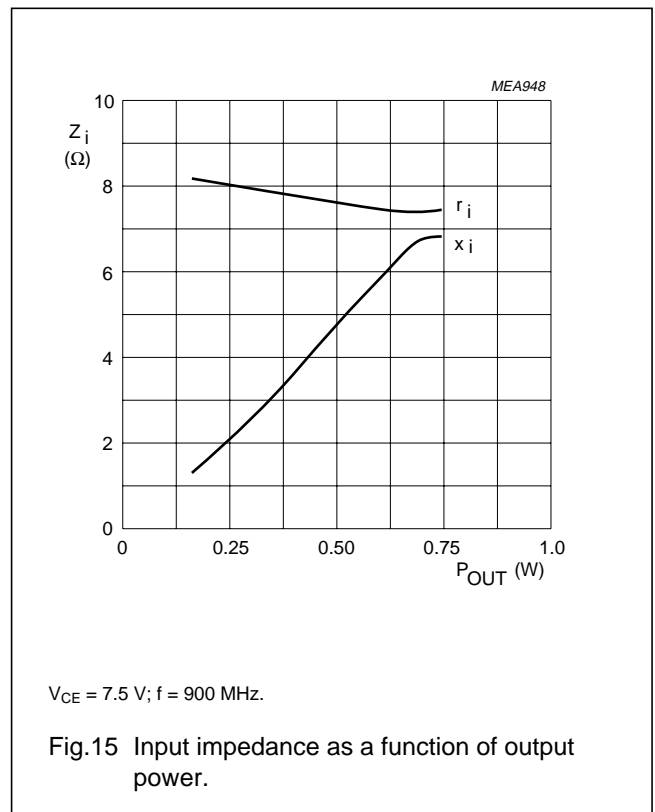
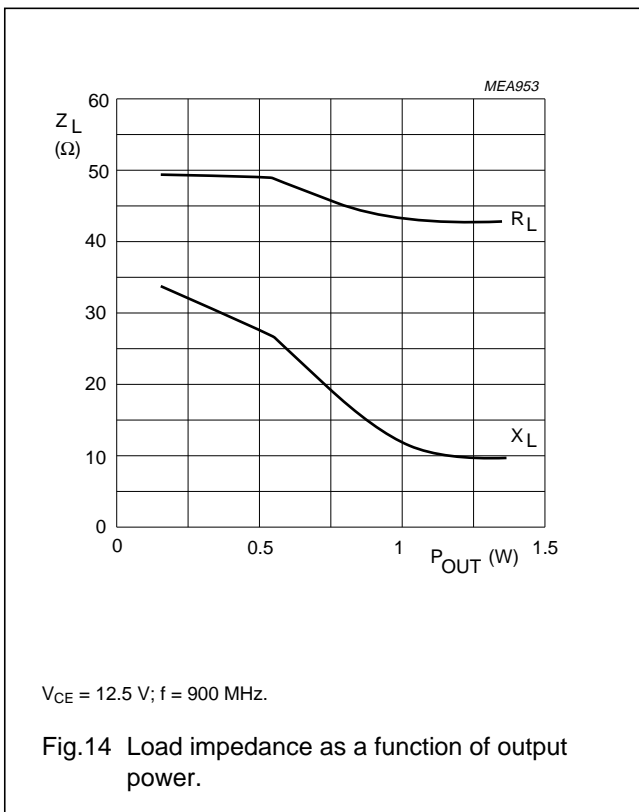
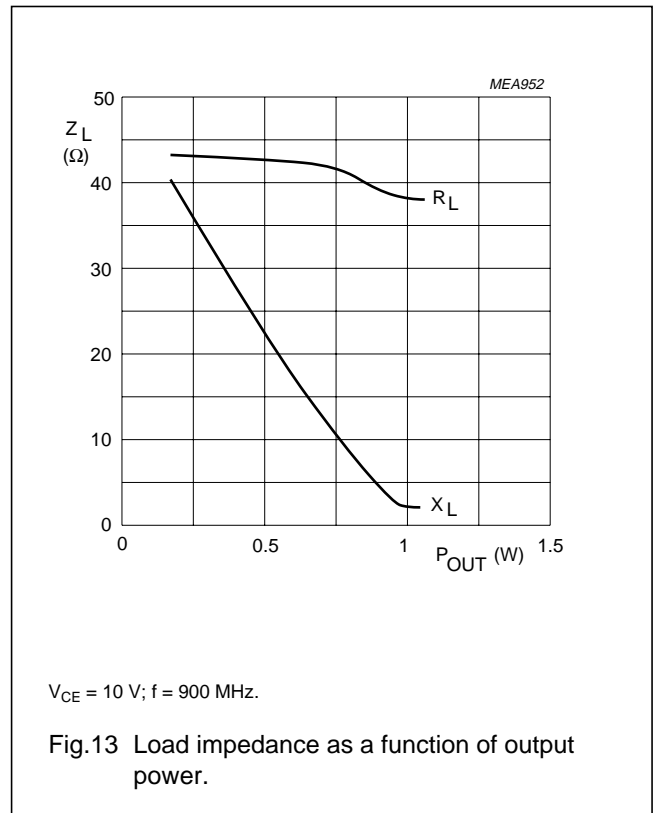
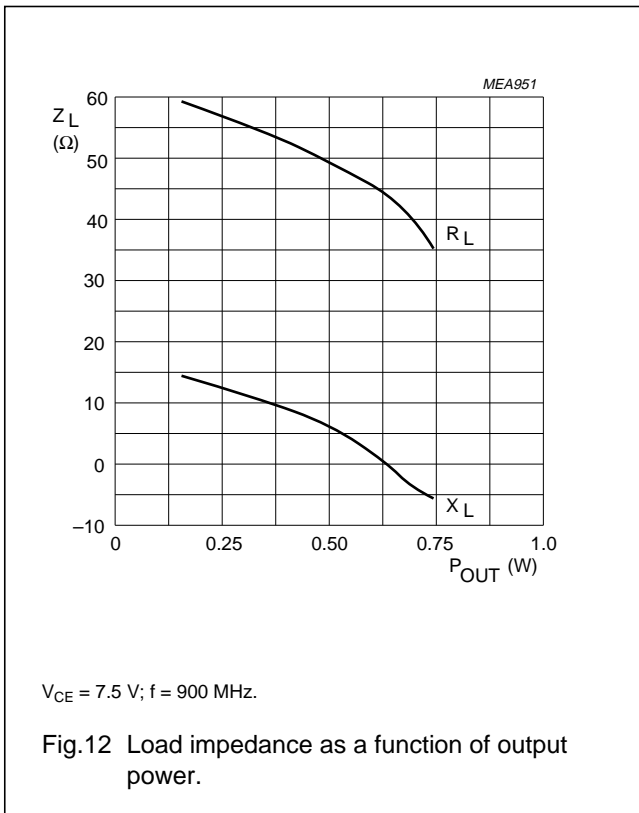
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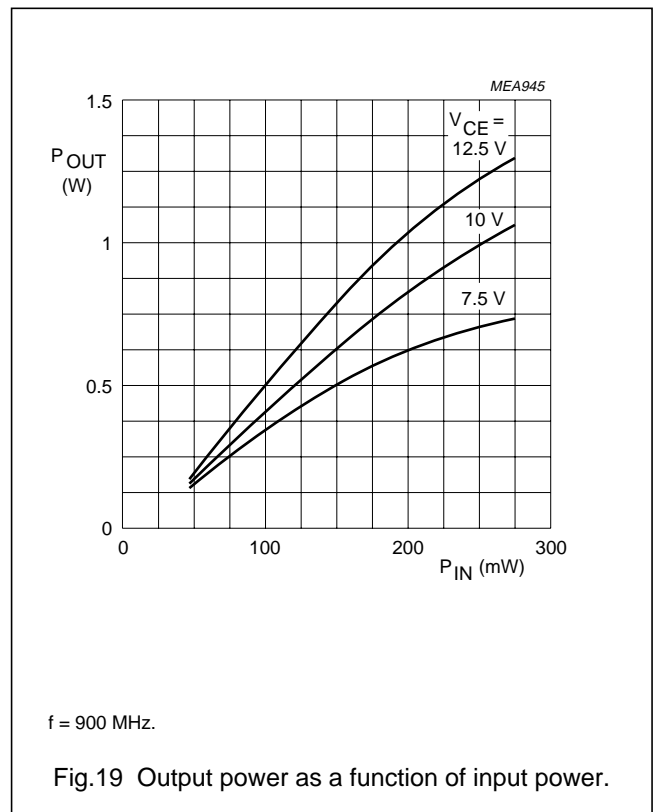
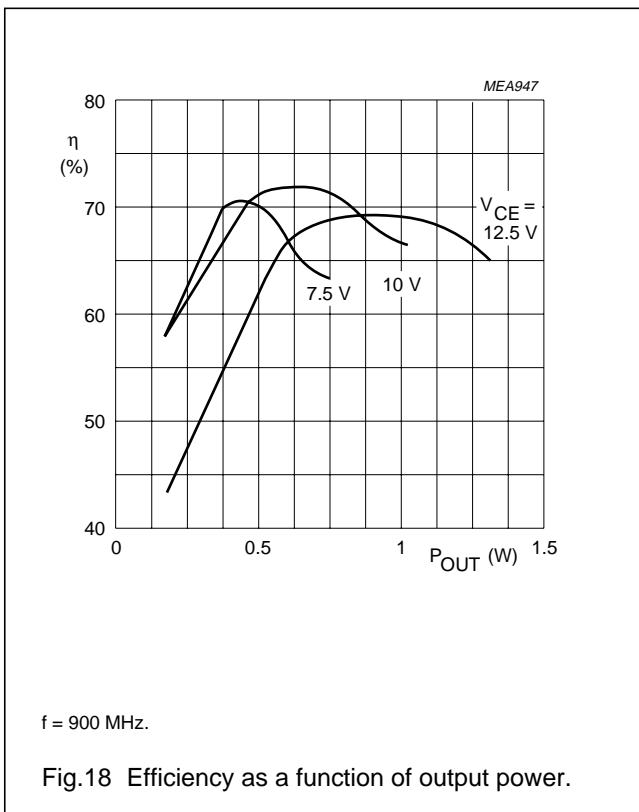
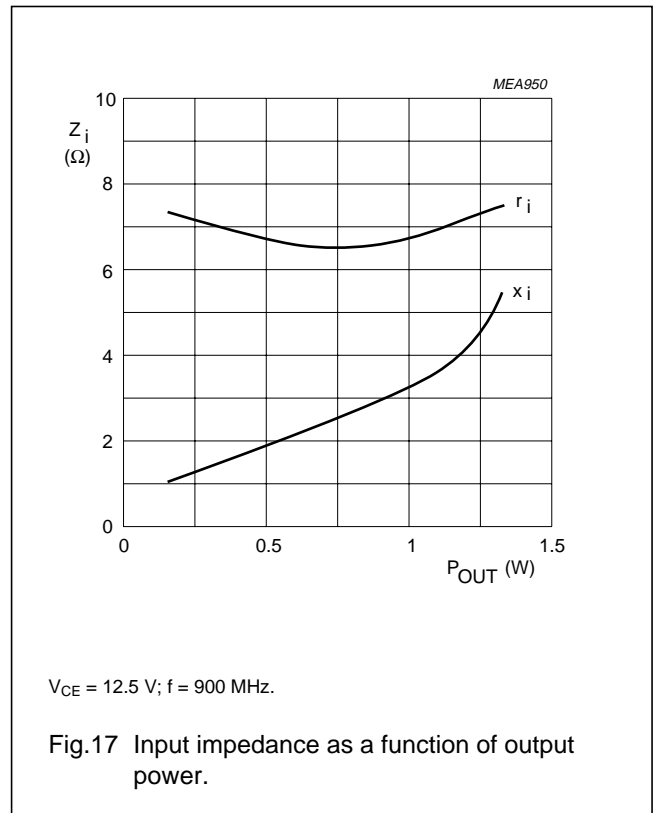
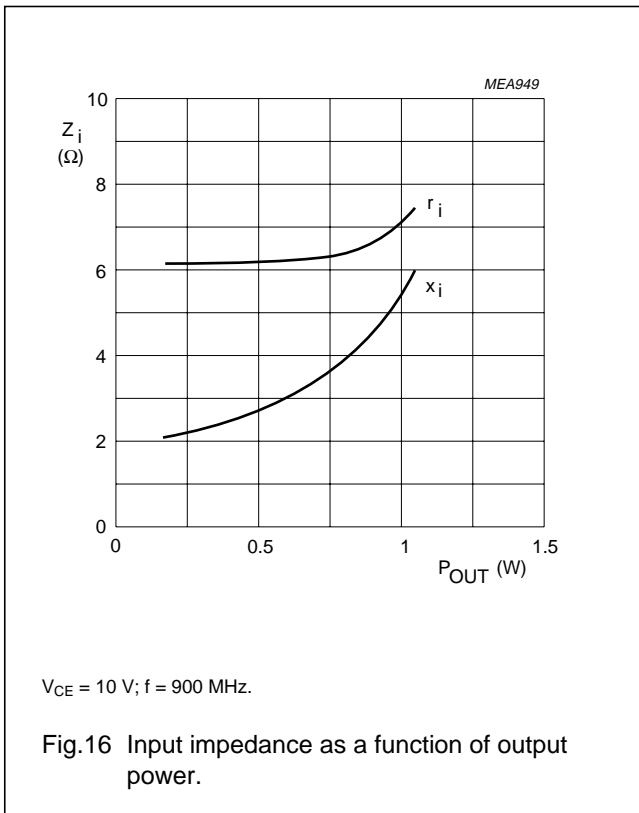
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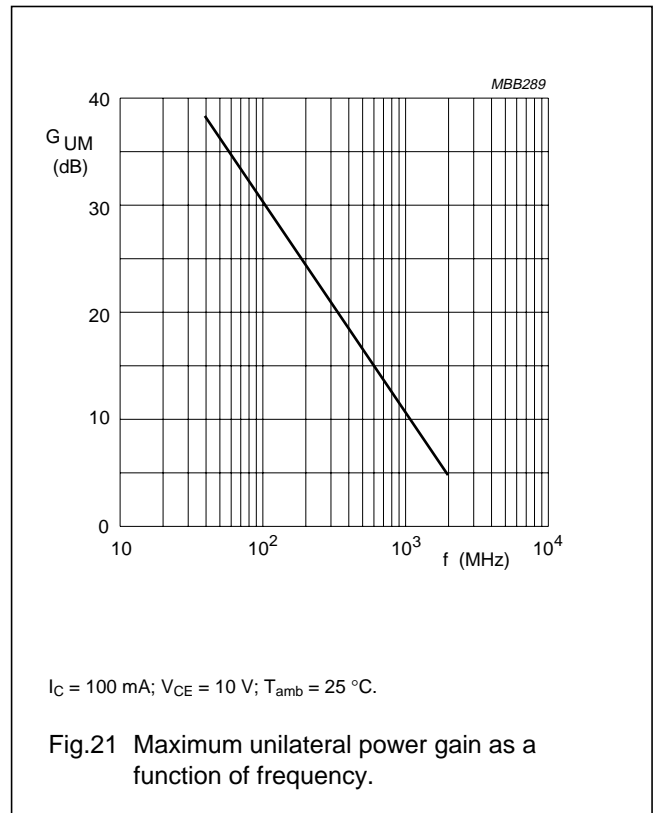
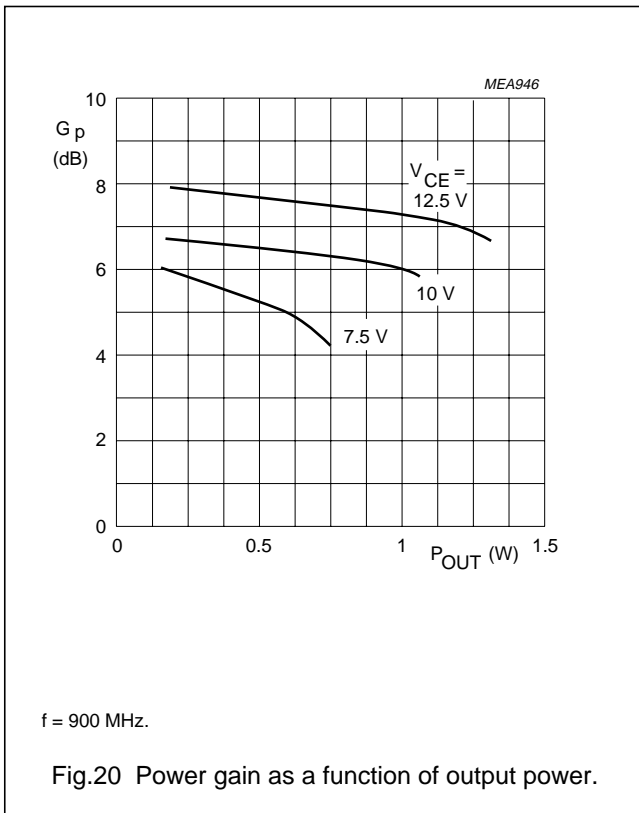
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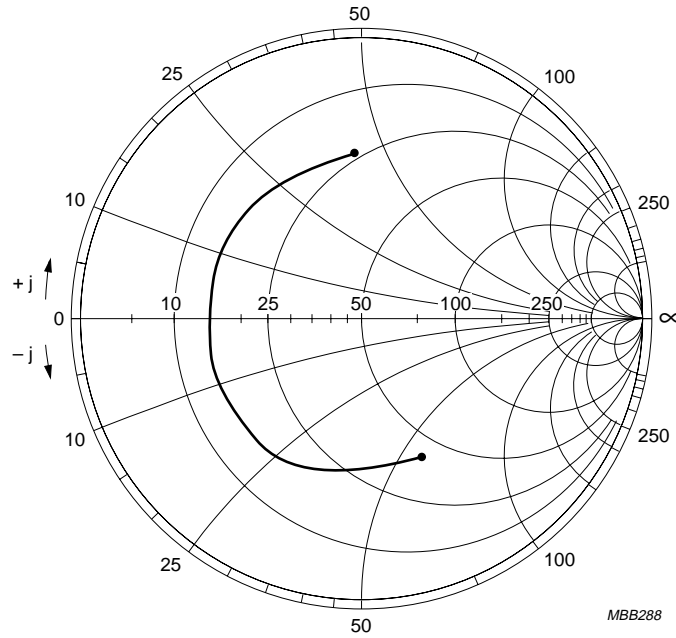
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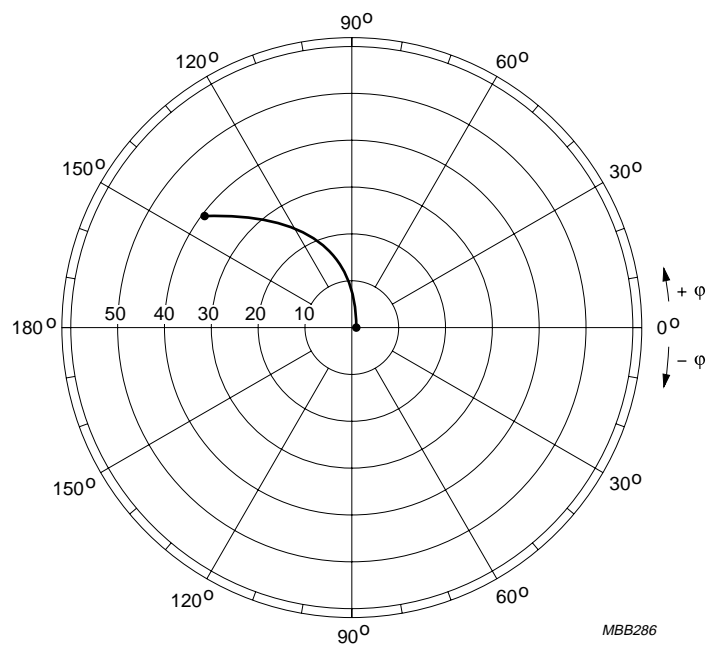
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$I_C = 100 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}; Z_o = 50 \text{ } \Omega.$

Fig.22 Common emitter input reflection coefficient (S_{11}).



$I_C = 100 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}.$

Fig.23 Common emitter forward transmission coefficient (S_{21}).

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