MOTOROLA
# SEMICONDUCTOR
TECHNICAL DATA

# 2N3866
# 2N3866A

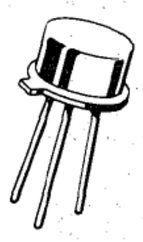
## The RF Line

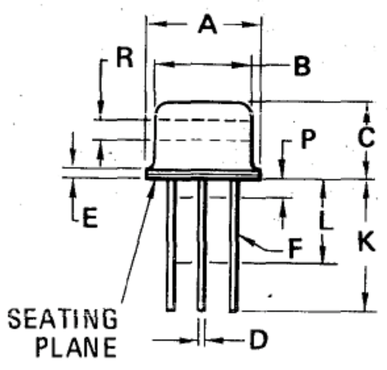
NPN SILICON HIGH FREQUENCY TRANSISTOR

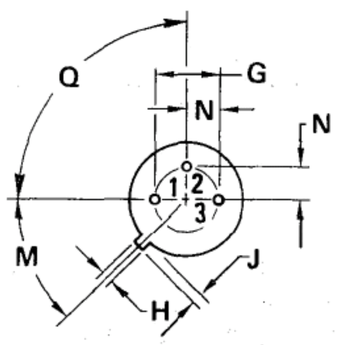
. . . designed for amplifier and oscillator applications in military and industrial equipment. Suitable for use as output, driver or pre-driver stages in VHF and UHF equipment.

- Specified 400 MHz, 28 Vdc Characteristics —
  Output Power = 1.0 Watt
  Minimum Gain = 10 dB
  Efficiency = 45%
- Large Signal Series Equivalent Impedances
- S-Parameter Characterization

1.0 W — 400 MHz
HIGH FREQUENCY
TRANSISTOR
NPN SILICON






*MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 30 | Vdc |
| Collector-Base Voltage | $V_{CBO}$ | 55 | Vdc |
| Emitter-Base Voltage | $V_{EBO}$ | 3.5 | Vdc |
| Collector Current — Continuous | $I_C$ | 0.4 | Adc |
| Total Device Dissipation @ $T_C = 25^oC$<br>Derate Above $25^oC$ | $P_D$ | 5.0<br>28.6 | Watts<br>$mW/^oC$ |
| Storage Temperature Range | $T_{stg}$ | -65 to +200 | $^oC$ |

*Indicates JEDEC Registered Data

| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 8.89 | 9.40 | 0.350 | 0.370 |
| B | 8.00 | 8.51 | 0.315 | 0.335 |
| C | 6.10 | 6.60 | 0.240 | 0.260 |
| D | 0.406 | 0.533 | 0.016 | 0.021 |
| E | 0.229 | 3.18 | 0.009 | 0.125 |
| F | 0.406 | 0.483 | 0.016 | 0.019 |
| G | 4.83 | 5.33 | 0.190 | 0.210 |
| H | 0.711 | 0.864 | 0.028 | 0.034 |
| J | 0.737 | 1.02 | 0.029 | 0.040 |
| K | 12.70 | — | 0.500 | — |
| L | 6.35 | — | 0.250 | — |
| M | $45^o$ NOM | | $45^o$ NOM | |
| P | — | 1.27 | — | 0.050 |
| Q | $90^o$ NOM | | $90^o$ NOM | |
| R | 2.54 | — | 0.100 | — |

All JEDEC dimensions and notes apply.

STYLE 1
PIN 1. EMITTER
2. BASE
3. COLLECTOR

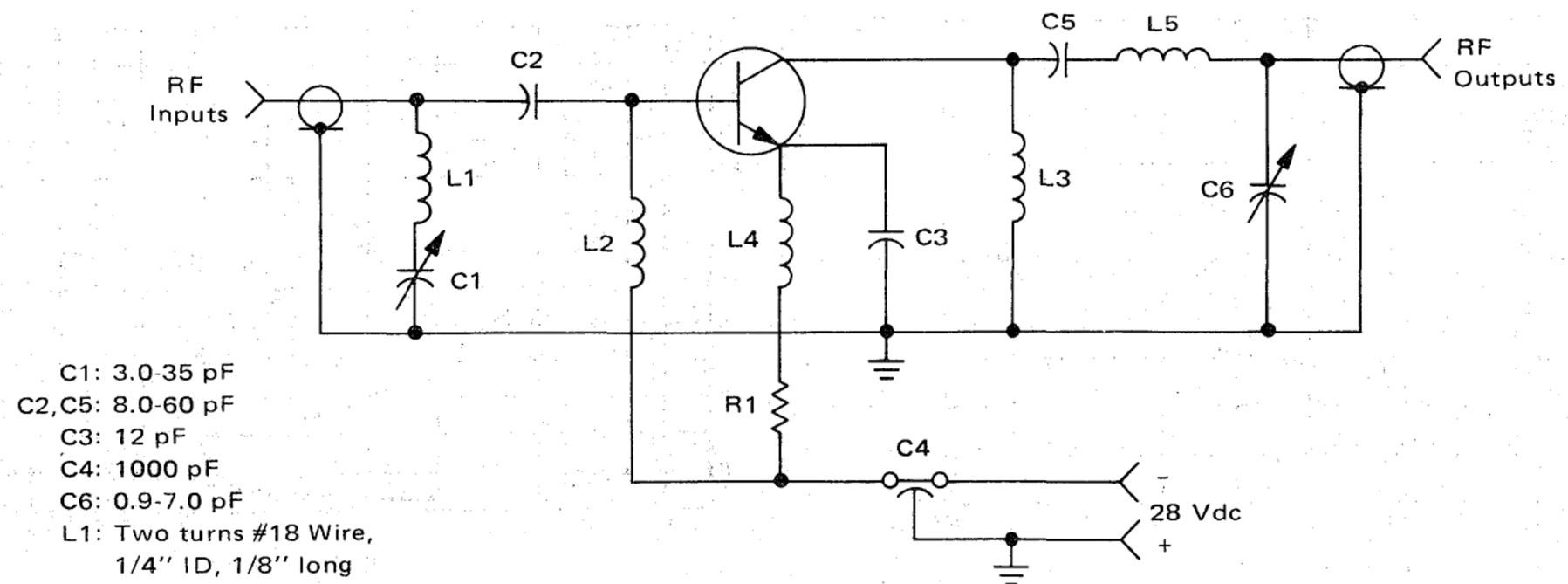
CASE 79-02
TO-39

***ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted).

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Sustaining Voltage ($I_C$ = 5.0 mAdc, $I_B$ = 0) | | $V_{CEO(sus)}$ | 30 | — | Vdc |
| Collector-Base Sustaining Voltage ($I_C$ = 5.0 mAdc, $R_{BE}$ = 10 Ω) | | $V_{CER(sus)}$ | 55 | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = 100 μAdc, $I_C$ = 0) | | $V_{(BR)EBO}$ | 3.5 | — | Vdc |
| Collector Cutoff Current ($V_{CE}$ = 28 Vdc, $I_B$ = 0) | | $I_{CEO}$ | — | 0.02 | mAdc |
| Emitter Cutoff Current ($V_{BE}$ = 3.5 Vdc, $I_C$ = 0) | | $I_{EBO}$ | — | 0.1 | mAdc |
| Collector Cutoff Current | | $I_{CEX}$ | | | mAdc |
| ($V_{CE}$ = 30 Vdc, $V_{BE}$ = −1.5 Vdc (Rev.), $T_C$ = 200°C) | | | — | 5.0 | |
| ($V_{CE}$ = 55 Vdc, $V_{BE}$ = −1.5 Vdc (Rev.) | | | — | 0.1 | |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain | | $h_{FE}$ | | | — |
| ($I_C$ = 360 mAdc, $V_{CE}$ = 5.0 Vdc) | Both | | 5.0 | — | |
| ($I_C$ = 50 mAdc, $V_{CE}$ = 5.0 Vdc) | 2N3866 | | 10 | 200 | |
| | 2N3866A | | 25 | 200 | |
| Collector-Emitter Saturation Voltage ($I_C$ = 100 mAdc, $I_B$ = 20 mAdc) | | $V_{CE(sat)}$ | — | 1.0 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current-Gain — Bandwidth Product | | $f_T$ | | | MHz |
| ($I_C$ = 50 mAdc, $V_{CE}$ = 15 Vdc, f = 200 MHz) | 2N3866 | | 500 | — | |
| | 2N3866A | | 800 | — | |
| Output Capacitance ($V_{CB}$ = 28 Vdc, $I_E$ = 0, f = 1.0 MHz) | | $C_{ob}$ | — | 3.0 | pF |
| **FUNCTIONAL TESTS** | | | | | |
| Common-Emitter Amplifier Power Gain ($V_{CC}$ = 28 Vdc, $P_{out}$ = 1.0 W, f = 400 MHz) | | $G_{PE}$ | 10 | — | dB |
| Collector Efficiency ($V_{CC}$ = 28 Vdc, $P_{out}$ = 1.0 W, f = 400 MHz) | | $\eta$ | 45 | — | % |

*Indicates JEDEC Registered Data.

**FIGURE 1 – 400 MHz TEST CIRCUIT SCHEMATIC**




C1: 3.0-35 pF
C2,C5: 8.0-60 pF
C3: 12 pF
C4: 1000 pF
C6: 0.9-7.0 pF
L1: Two turns #18 Wire, 1/4" ID, 1/8" long
L2: FERRITE RF Choke, One Turn, z = 450 Ohms
L3,L4: RF Choke, 0.1 μH
L5: 2-3/4 Turns, #18 Wire, 1/4" ID, 3/16" long
R1: 5.6 Ohms

FIGURE 2 – POWER OUTPUT versus FREQUENCY (Class C)

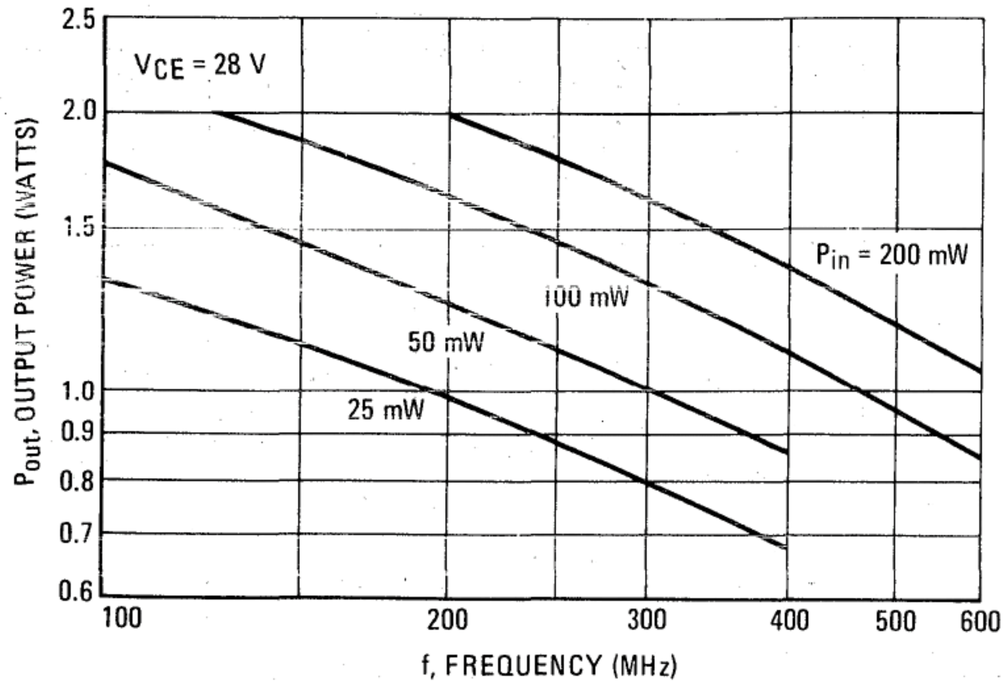



FIGURE 3 – CURRENT-GAIN – BANDWIDTH PRODUCT

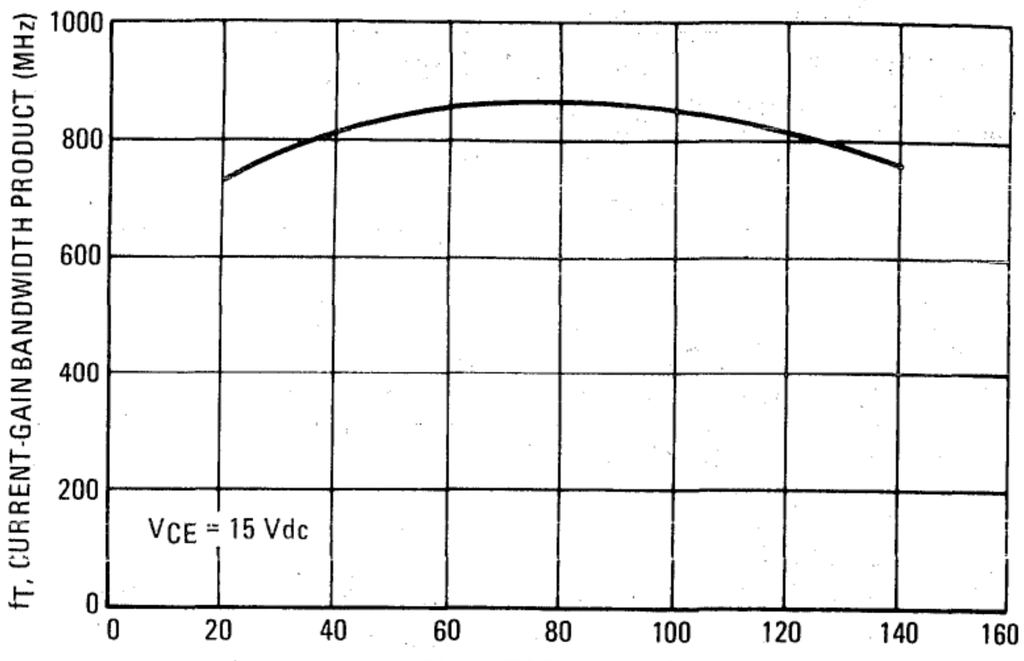



FIGURE 4 – COLLECTOR-BASE TIME CONSTANT

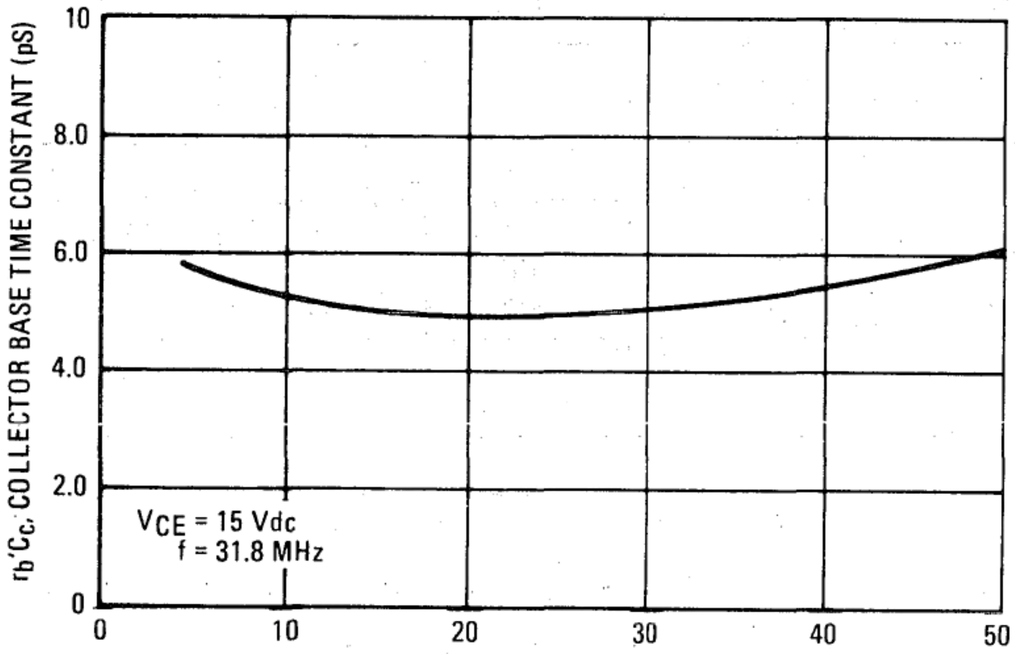



FIGURE 5 – OUTPUT CAPACITANCE

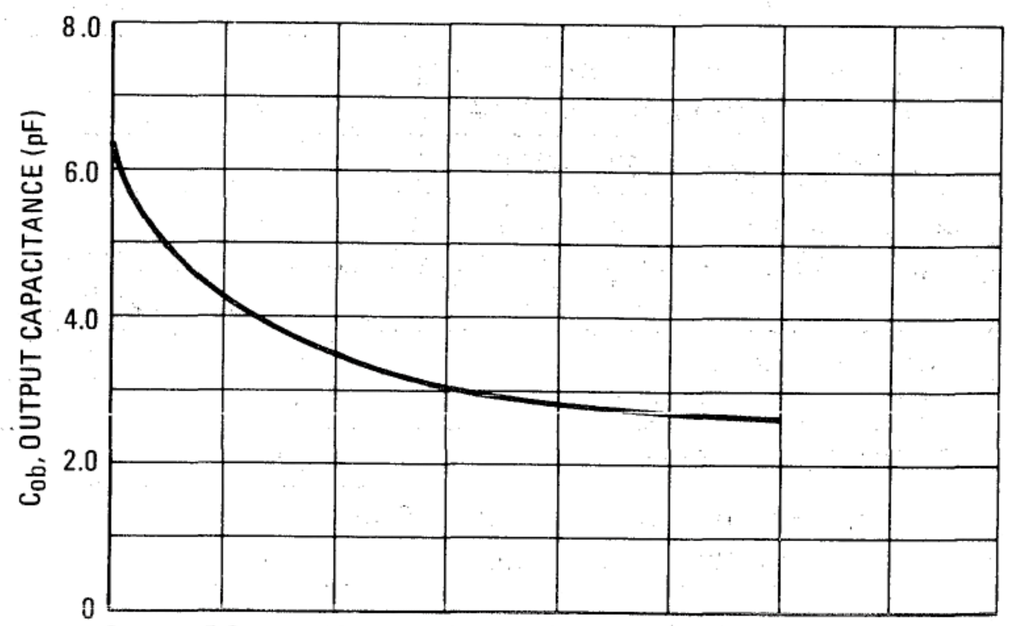



FIGURE 6 – OUTPUT POWER versus INPUT POWER (CLASS C)

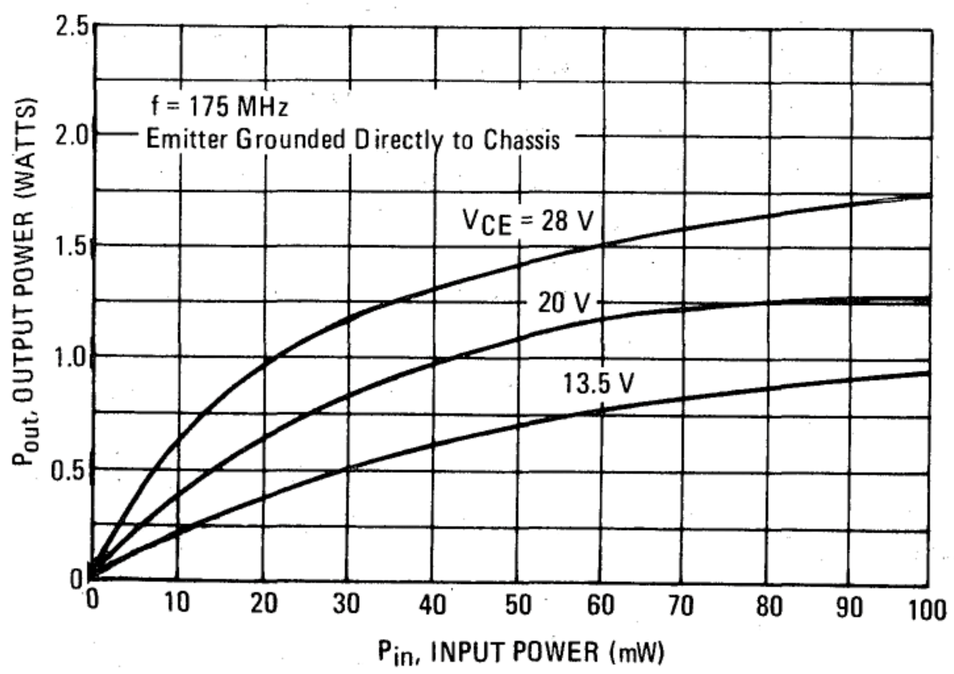



FIGURE 7 – SMALL-SIGNAL CURRENT GAIN

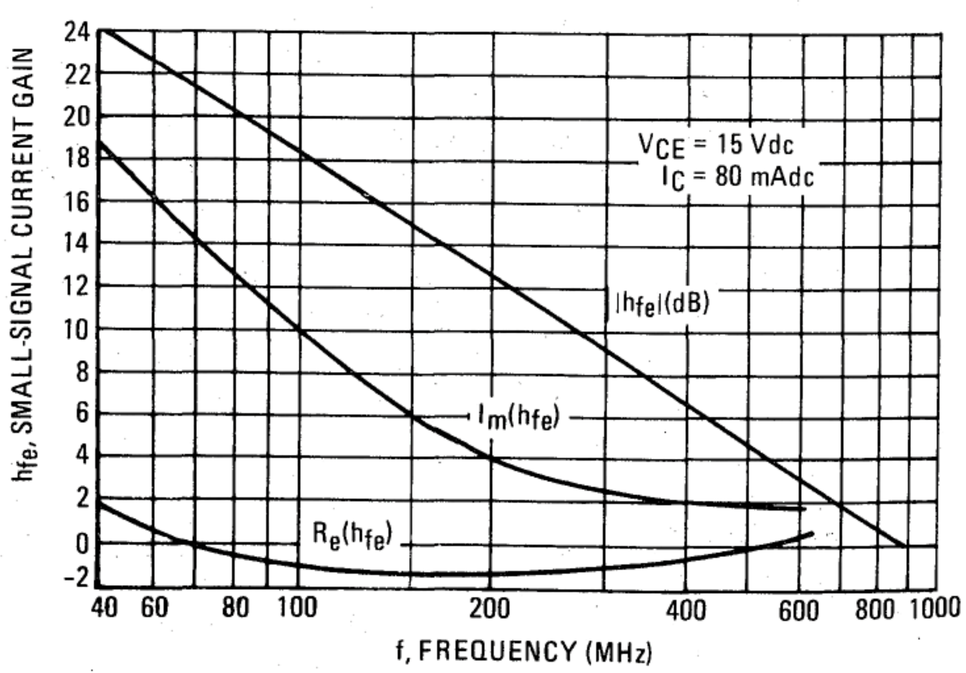


**FIGURE 8 – LARGE-SIGNAL SERIES EQUIVALENT IMPEDANCES**

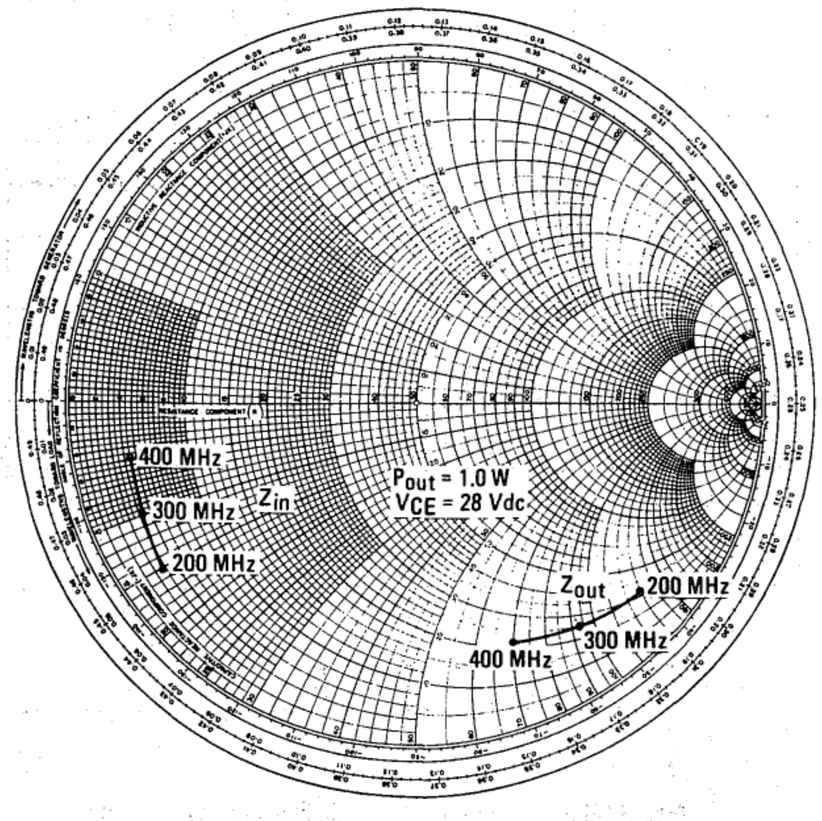



**FIGURE 9 – $S_{11}$ AND $S_{22}$ versus FREQUENCY**

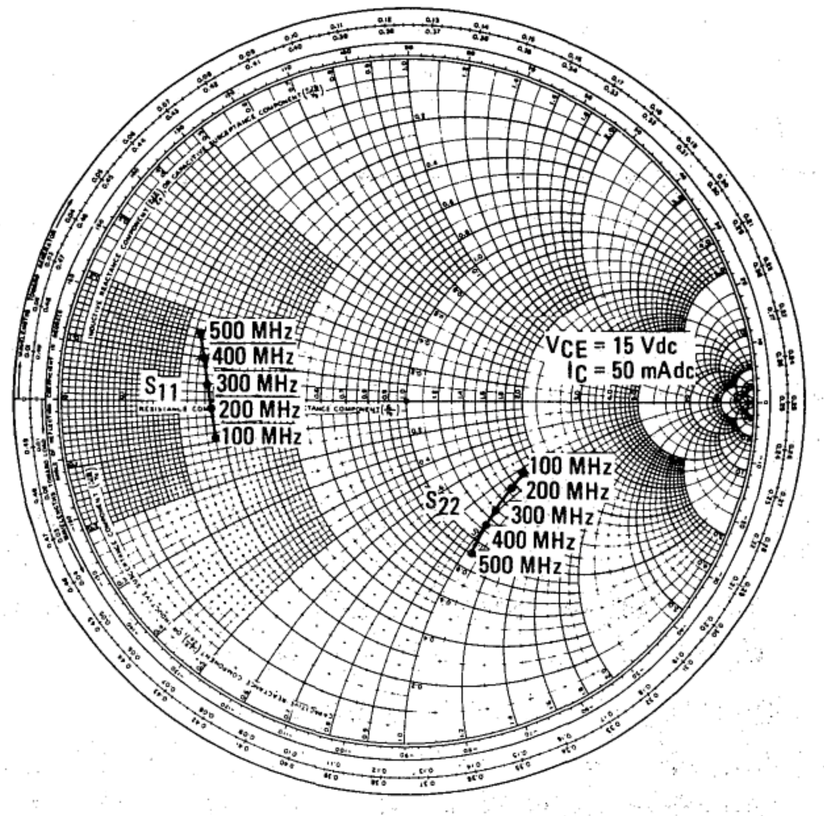



**FIGURE 10 – $S_{21}$ versus FREQUENCY**

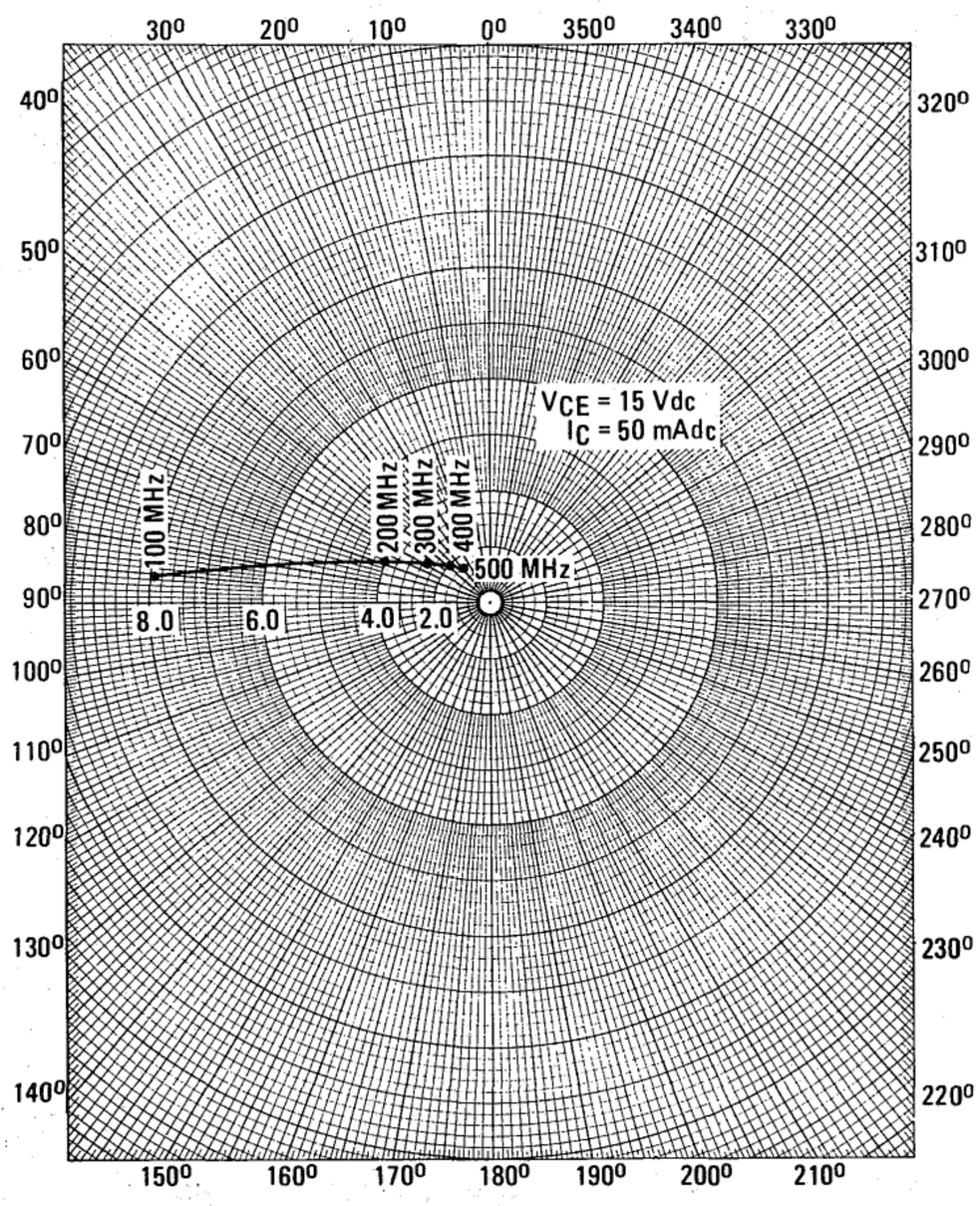



**FIGURE 11 – $S_{12}$ versus FREQUENCY**