

PNP Germanium RF Transistor

AF 109 R

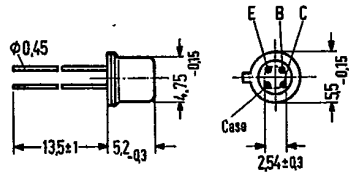
SIEMENS AKTIENGESELLSCHAFT 04053 D

T-31-07

for AGC input stages up to 260 MHz

AF 109 R is a germanium PNP RF mesa transistor in TO 72 case (18 A 4 DIN 41876). The terminals are electrically insulated from the case.

Type	Ordering code
AF 109 R	Q60106-X109-R1



Approx. weight 0.36 g Dimensions in mm

Maximum ratings

Collector-emitter voltage	$-V_{CEO}$	15	V
Collector-base voltage	$-V_{CBO}$	20	V
Emitter-base voltage	$-V_{EBO}$	0.3	V
Collector current	$-I_C$	10	mA
Emitter current	I_E	11	mA
Base current	$-I_B$	1	mA
Junction temperature	T_j	90	°C
Storage temperature range	T_{stg}	-30 to +75	°C
Total power dissipation ($T_{amb} = 45^\circ\text{C}$)	P_{tot}	60	mW

Thermal resistance

Junction to ambient air	R_{thJA}	≤ 750	K/W
Junction to case	R_{thJC}	≤ 400	K/W

Static characteristics ($T_{amb} = 25^\circ\text{C}$)

$-V_{CE}$ V	$-I_C$ mA	$-I_B$ μA	h_{FE} I_C/I_B	$-V_{BE}$ mV
12	1.5	30	50 (> 20)	380 (320 to 430)
6	2	36	55	380 (320 to 430)
6	5	66	75	405 (360 to 450)

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Static characteristics ($T_{amb} = 25^{\circ}\text{C}$)

Collector cutoff current ($-V_{CBO} = 20\text{ V}$)	$-I_{CBO}$	0.5 (<8)	μA
Emitter cutoff current ($-V_{EBO} = 0.3\text{ V}$)	$-I_{EBO}$	0.5 (<100)	μA
Collector cutoff current ($-V_{CEO} = 15\text{ V}$)	$-I_{CEO}$	<500	μA

Dynamic characteristics ($T_{amb} = 25^{\circ}\text{C}$)

Reverse transfer capacitance ($-I_C = 1\text{ mA}$; $-V_{CE} = 12\text{ V}$; $f = 450\text{ kHz}$)	$-C_{12e}$	0.25	pF
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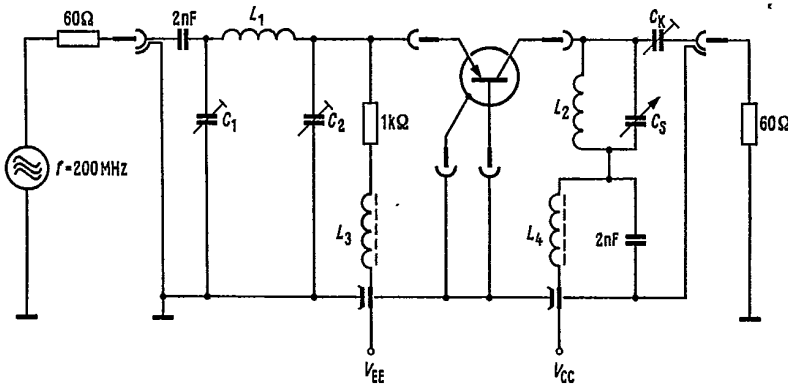
Operating point:

$-V_{CC} = 12\text{ V}$; $R_{EE} = 1\text{ k}\Omega$; $f = 200\text{ MHz}$			
Power gain ($-I_C = 2\text{ mA}$; $R_L = 920\ \Omega$)	G_{pb}	16.5 (>13)	dB
Noise figure ($-I_C = 2\text{ mA}$; $R_g = 60\ \Omega$)	NF	4 (<4.8)	dB
Adjustable amplification range ($I_E \leq 9\text{ mA}$)	G_{pb}	36	dB
Interference voltage at operating point of minimum cross modulation stability	$V_{int}\ 1\%$	22	mW

$V_{int} = 1\%$ is the rms value of half the EMF (terminal voltage under matching condition) of a 100% sine-wave modulated TV carrier with a generator impedance of $240\ \Omega$, which causes 1% amplitude modulation on the signal carrier.

$g_{11b} = 24\text{ mS}$	$g_{12b} = -0.2\text{ mS}$	$g_{21b} = -12\text{ mS}$	$g_{22b} = 0.2\text{ mS}$
$b_{11b} = -32\text{ mS}$	$b_{12b} = -0.16\text{ mS}$	$b_{21b} = 35\text{ mS}$	$b_{22b} = 1.6\text{ mS}$

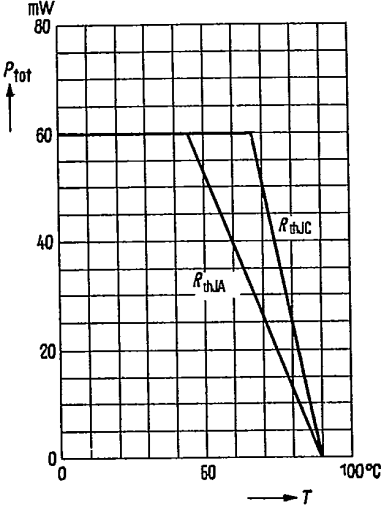
Test circuit for power gain at $f = 200\text{ MHz}$



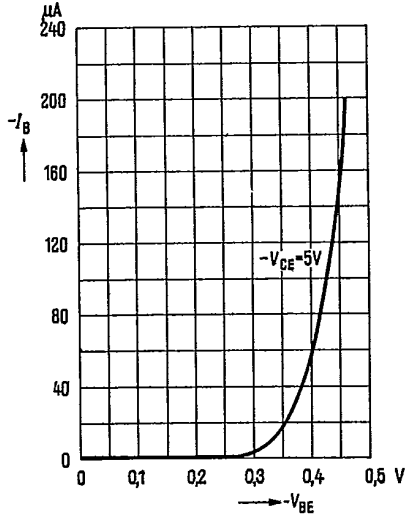
- $L_1 = 3\text{ turns}$; $d = 1\text{ mm}$; $\text{dia} = 6.5\text{ mm}$
- $L_2 = 2\text{ turns}$; $d = 1\text{ mm}$; $\text{dia} = 6.5\text{ mm}$
- $L_3 = L_4 = 20\text{ turns}$; 0.5 CuLs
on core B63310-K-1A12,3
- $C_K = 1.5\text{ to }5\text{ pF}$, so that $R_L = 920\ \Omega$
- $C_1 = 6.5\text{ to }18\text{ pF}$
- $C_2 = 9.5\text{ to }20\text{ pF}$
- $C_s = 3\text{ to }10\text{ pF}$

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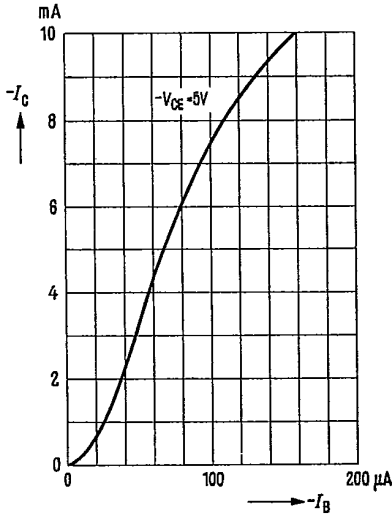
Total perm. power dissipation versus temperature
 $P_{tot} = f(T)$; R_{th} = parameter



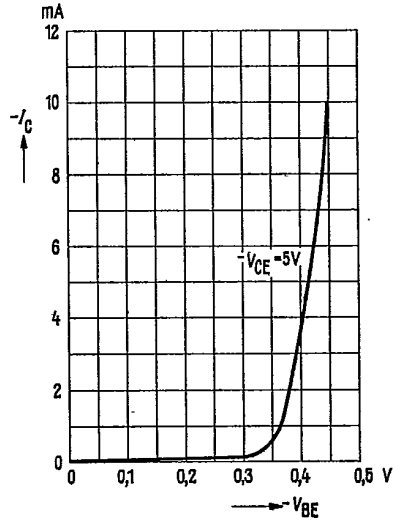
Input characteristic $I_B = f(V_{BE})$
 $-V_{CE} = 5V$
 (common emitter configuration)



Collector current $I_C = f(I_B)$
 $-V_{CE} = 5V$
 (common emitter configuration)

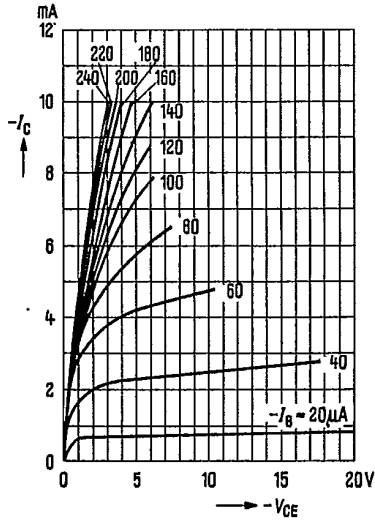


Collector current $I_C = f(V_{BE})$
 $-V_{CE} = 5V$
 (common emitter configuration)

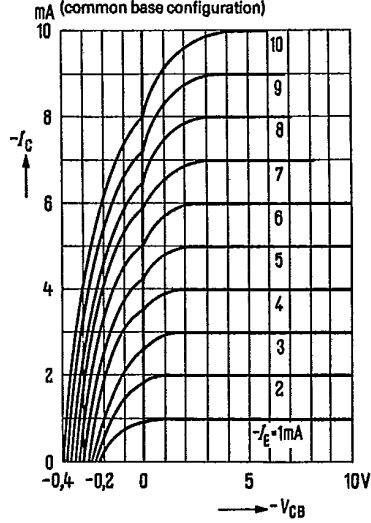


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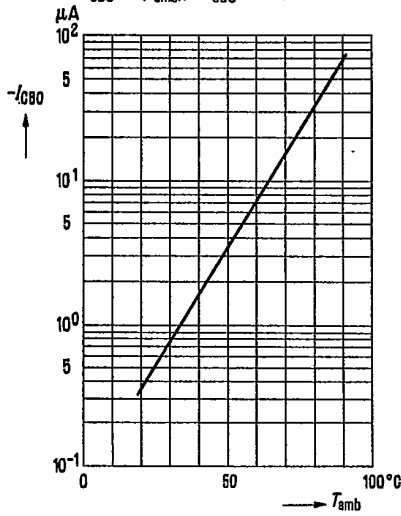
Output characteristics $I_C = f(V_{CE})$;
 (common emitter configuration)



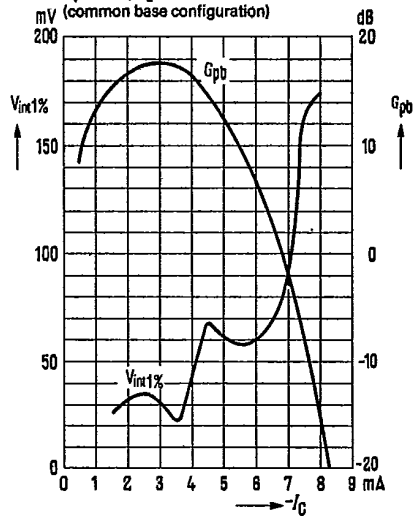
Output characteristics $I_C = f(V_{CB})$;
 $I_E = \text{parameter}$
 (common base configuration)



Collector cutoff current
 versus temperature
 $I_{CBO} = f(T_{amb})$; $-V_{CBO} = 20V$

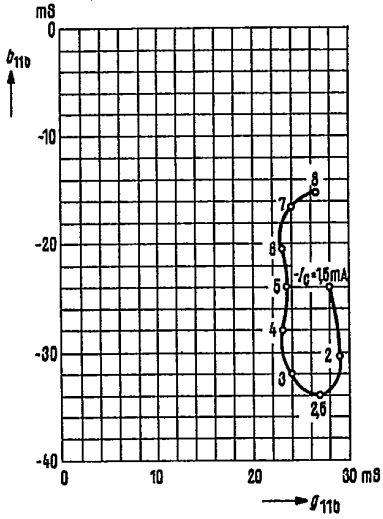


Interference voltage $V_{int 1\%} = f(I_C)$
 Power gain $G_{pb} = f(I_C)$
 $f = 200 \text{ MHz}$; $-V_{beatt} = 12V$
 $R_{sr} = 1 \text{ k}\Omega$; $R_L = 0.9 \text{ k}\Omega$
 (common base configuration)

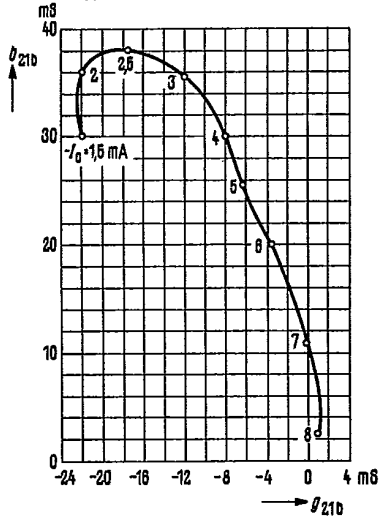


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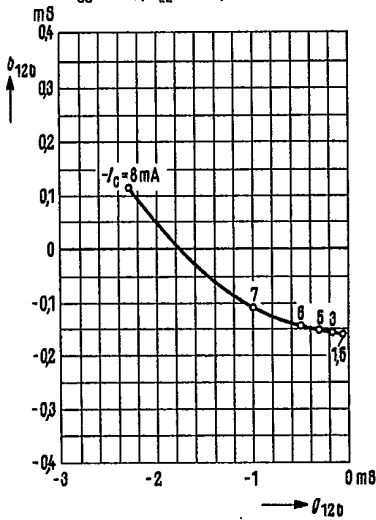
Small signal short circuit input admittance y_{11b} (common base configuration)
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit forward transfer admittance y_{21b} (common base configuration)
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit reverse transfer admittance y_{12b} (common base configuration)
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$



Small signal short circuit output admittance y_{22b} (common base configuration)
 $-V_{CC} = 12\text{ V}; R_{EE} = 1\text{ k}\Omega; f = 200\text{ MHz}$

