PNP Germanium RF Transistor

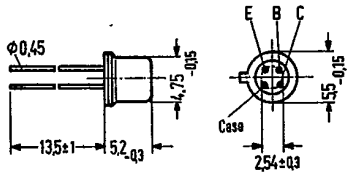
AF 109 R

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 °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 °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)

Static characteristics (T_{amb} = 25 °C)

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

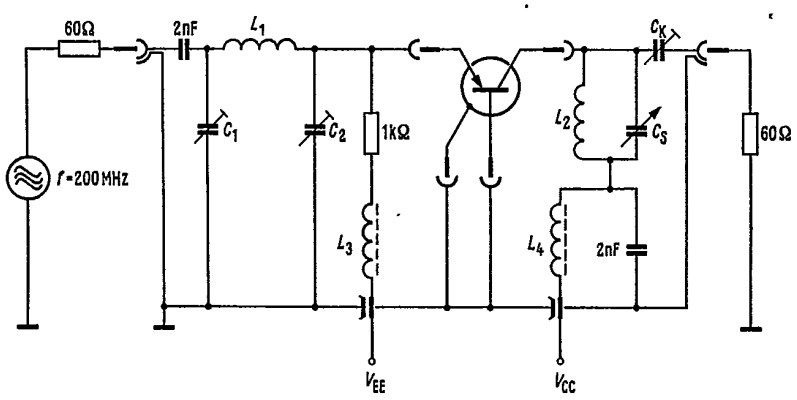
Dynamic characteristics (T_{amb} = 25 °C)

Reverse transfer capacitance ($-I_C$ = 1 mA; $-V_{CE}$ = 12 V; f = 450 kHz)	$-C_{12e}$	0.25	pF
Operating point: $-V_{CC}$ = 12 V; R_{EE} = 1 kΩ; f = 200 MHz			
Power gain ($-I_C$ = 2 mA; R_L = 920 Ω)	G_{pb}	16.5 (>13)	dB
Noise figure ($-I_C$ = 2 mA; R_g = 60 Ω)	NF	4 (<4.8)	dB
Adjustable amplification range ($I_E \leq 9$ 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 Ω, which causes 1% amplitude modulation on the signal carrier.

g_{11b} = 24 mS	g_{12b} = −0.2 mS	g_{21b} = −12 mS	g_{22b} = 0.2 mS
b_{11b} = −32 mS	b_{12b} = −0.16 mS	b_{21b} = 35 mS	b_{22b} = 1.6 mS

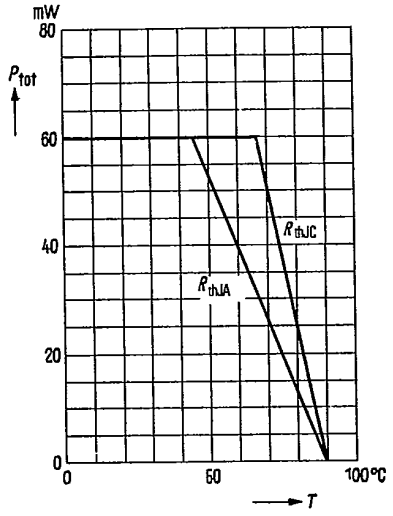
Test circuit for power gain at f = 200 MHz



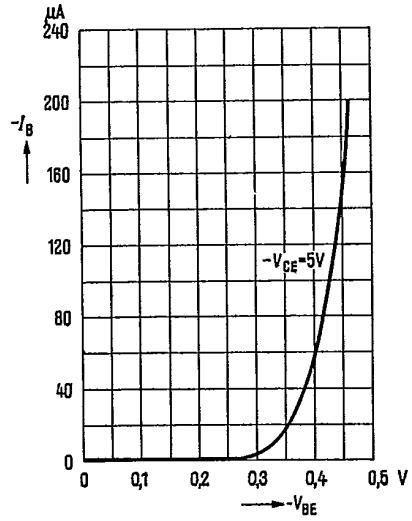
L_1 = 3 turns; d = 1 mm; dia = 6.5 mm
L_2 = 2 turns; d = 1 mm; dia = 6.5 mm
$L_3 = L_4$ = 20 turns; 0.5 CuLs
on core B63310-K-1A12,3

C_K = 1.5 to 5 pF, so that R_L = 920 Ω
C_1 = 6.5 to 18 pF
C_2 = 9.5 to 20 pF
C_s = 3 to 10 pF

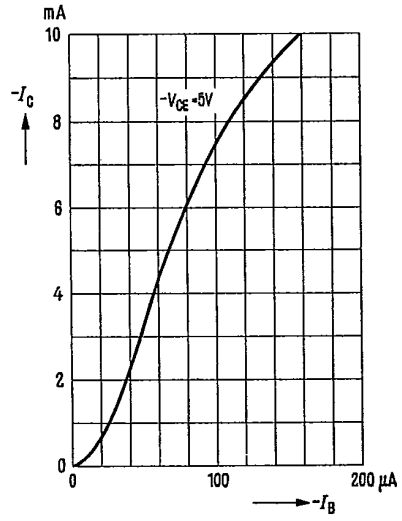
Total perm. power dissipation versus temperature
$P_{tot} = f(T)$; R_{th} = parameter



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



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



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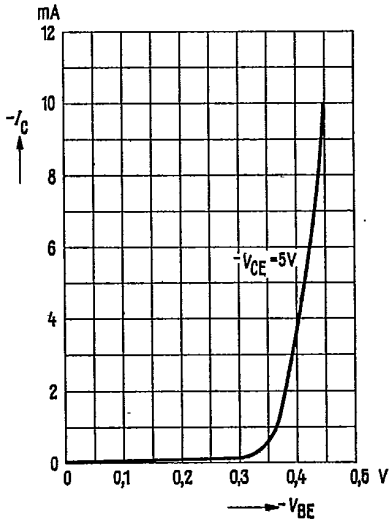
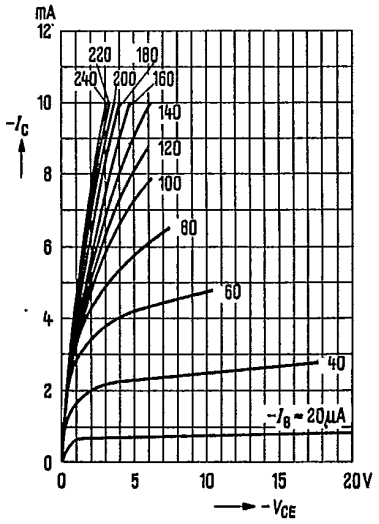
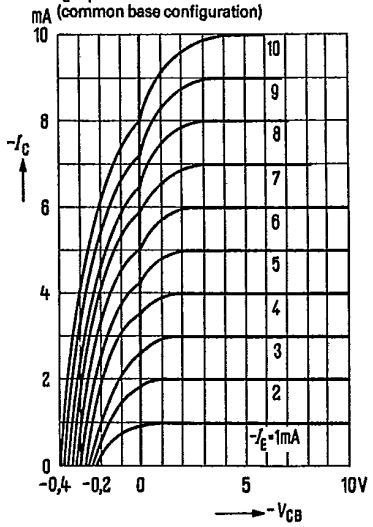


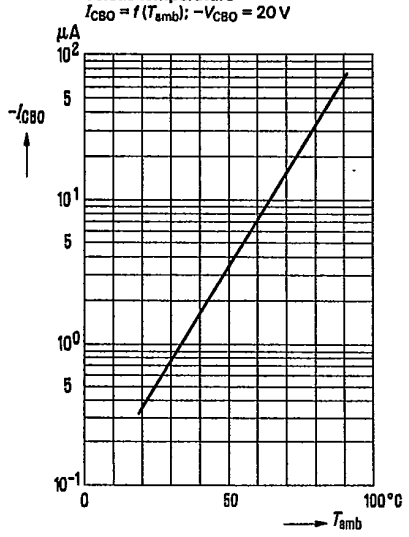
Output characteristics $I_C = f(V_{CE})$;
(common emitter configuration)



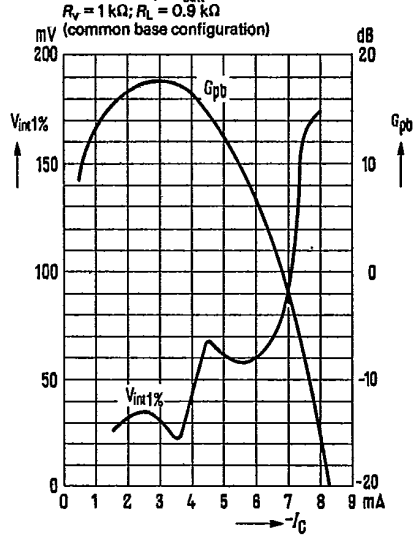
Output characteristics $I_C = f(V_{CB})$;
I_E = parameter
(common base configuration)



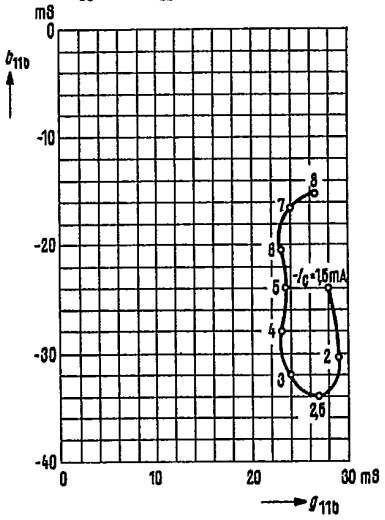
Collector cutoff current
versus temperature
$I_{CBO} = f(T_{amb})$; $-V_{CBO} = 20\,V$



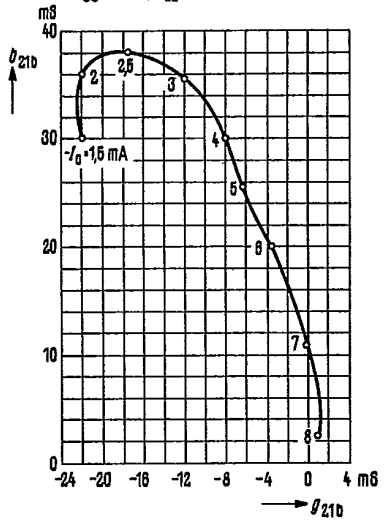
Interference voltage V_{int} 1% = $f(I_C)$
Power gain $G_{pb} = f(I_C)$
f = 200 MHz; $-V_{batt}$ = 12 V
R_y = 1 kΩ; R_L = 0.9 kΩ
(common base configuration)



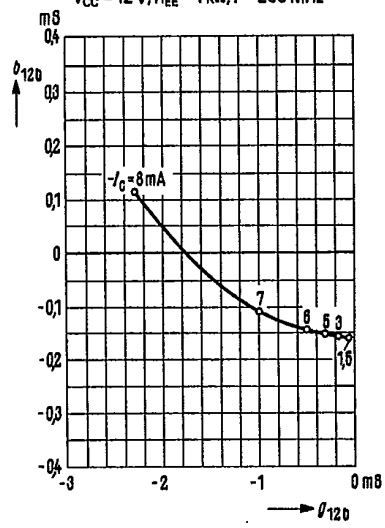
Small signal short circuit input admittance y_{11b}
(common base configuration)
$-V_{CC} = 12$ V; $R_{EE} = 1$ kΩ; $f = 200$ MHz



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



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



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

