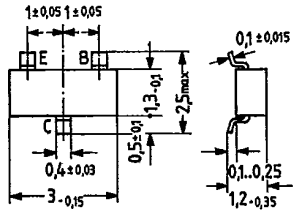
NPN Silicon Transistor for Low-Noise RF Broadband Amplifiers and High-Speed Switching Applications

BFR 35 A
BFR 35 AR
2 N 6619

SIEMENS AKTIENGESELLSCHAF '4 D T-31-15

BFR 35 A is an epitaxial NPN silicon planar RF transistor in TO 236 plastic package (23 A 3 DIN 41869), intended for use in film circuits up to the GHz range, e. g. for broadband amplifiers and ultrafast, unsaturated logic circuits. The transistor BFR 35 A is marked with the code letters "GB". The transistor is also available upon request with changed terminal sequence ("E" and "B" interchanged) under the designation BFR 35 AR (mark "GZ"). The BFR 35 A is also available upon request as JEDEC type, designated 2N6619,

Type	Mark	Ordering code
BFR 35 A	GB	Q62702-F347-S1
BFR 35 AR	GZ	Q62702-F500
2 N 6619	GB	Q68000-A4667



Approx. weight 0.02 g Dimensions in mm

Maximum ratings		BFR 35 A 2 N 6619	
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$)	V_{CER}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 to +125	°C
Total power dissipation ($T_{amb} \leq 50$°C)	P_{tot}	200	mW
Thermal resistance			
Junction to ambient air	R_{thJA}	<500	K/W
Junction to substrate back (ceramic substrate 0.7 mm; 2.5 cm² area)	R_{thJSB}	<400	K/W

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BFR 35 A
BFR 35 AR
2 N 6619

Static characteristics (T_{amb} = 25 °C)		**BFR 35 A 2 N 6619**	
Collector-emitter breakdown voltage (I_{CEO} = 500 µA)	$V_{(BR)CEO}$	>12	V
Collector-emitter breakdown voltage (I_{CER} = 10 mA; R_{BE} = 50 Ω)	$V_{(BR)CER}$	>20	V
Emitter-base breakdown voltage (I_{EBO} = 100 µA)	$V_{(BR)EBO}$	>2.5	V
Collector cutoff current (V_{CBO} = 10 V)	I_{CBO}	<50	nA
DC current gain (I_C = 5 to 20 mA; V_{CE} = 6 V)	h_{FE}	>25	–
Dynamic characteristics (T_{amb} = 25 °C)			
Small-signal current gain (I_C = 5 mA; V_{CE} = 6 V; f = 1 kHz)	h_{fe}	70	–
Transition frequency (I_C = 20 mA; V_{CE} = 10 V; f = 200 MHz)	f_T	5	GHz
Reverse transfer capacitance (I_C = 1 mA; V_{CE} = 6 V; f = 1 MHz)	C_{12e}	0.4	pF
Collector-base capacitance (V_{CBO} = 10 V; f = 1 MHz)	C_{CBO}	0.7	pF
Noise figure (I_C = 2 mA; V_{CE} = 6 V; f = 200 MHz; R_g = 75 Ω)	NF	2	dB
(I_C = 2 mA; V_{CE} = 6 V; f = 800 MHz; R_g = 60 Ω)	NF	2	dB
(I_C = 3 mA; V_{CE} = 10 V; f = 2 GHz; R_g = $R_{g\ opt}$)	NF	4	dB
Power gain (I_C = 15 mA; V_{CE} = 6 V; f = 800 MHz; R_g = 60 Ω)	G_{pe}	14	dB
Output voltage: (three tone modulation f approx. 800 MHz) (I_C = 15 mA; V_{CE} = 6 V; d_{IM} = 60 dB; R_g = R_L = 75 Ω)	V_0	140	mV

S parameter
Operating point: V_{CE} =6 V, I_C = 5 mA, Z_o = 50 Ω

f (GHz)	S_{11}	φ	S_{21}	φ	S_{12}	φ	S_{22}	φ
0,1	0,771	– 29	12,75	150	0,025	73	0,971	–14
0,2	0,639	– 55	10,70	130	0,041	63	0,807	–21
0,3	0,486	– 72	8,34	115	0,052	57	0,697	–27
0,4	0,400	– 87	6,92	104	0,063	57	0,650	–26
0,5	0,326	– 97	5,78	97	0,071	57	0,582	–29
0,6	0,289	–105	4,88	91	0,079	57	0,591	–31
0,7	0,232	–112	4,30	85	0,089	56	0,585	–25
0,8	0,206	–123	3,79	80	0,098	56	0,501	–27
0,9	0,180	–129	3,47	76	0,109	57	0,527	–34
1,0	0,168	–142	3,12	73	0,116	57	0,560	–31
1,1	0,151	–146	2,88	68	0,125	56	0,505	–29
1,2	0,124	–163	2,65	64	0,136	55	0,512	–39
1,3	0,131	–174	2,50	60	0,147	54	0,541	–35
1,4	0,124	173	2,34	57	0,157	54	0,474	–36
1,5	0,128	164	2,20	53	0,167	53	0,521	–45
1,6	0,132	148	2,08	49	0,174	51	0,539	–38
1,7	0,160	142	1,98	47	0,188	51	0,425	–40
1,8	0,158	140	1,83	43	0,192	49	0,460	–60
1,9	0,160	131	1,81	40	0,207	47	0,586	–51
2,0	0,180	123	1,73	37	0,216	47	0,480	–43

BFR 35 A
BFR 35 AR
2 N 6619

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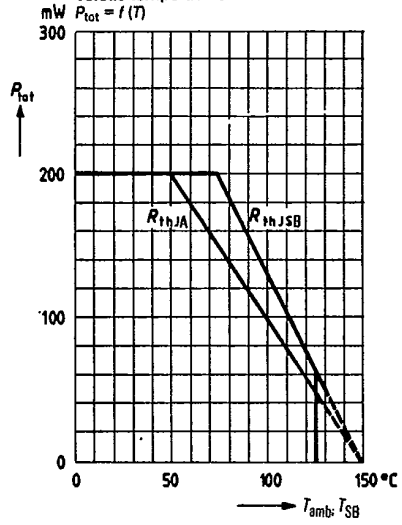
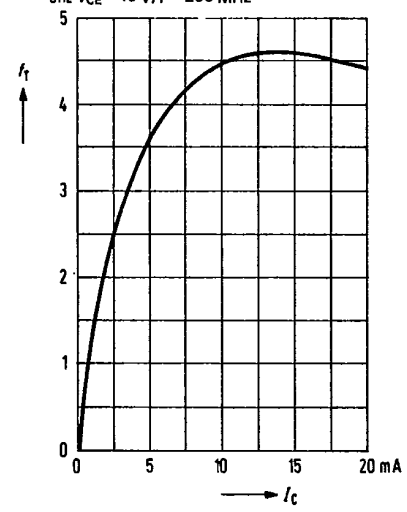
Total perm. power dissipation versus temperature
$P_{tot} = f(T)$



Transition frequency $f_T = f(I_C)$
GHz $V_{CE} = 10$ V; $f = 200$ MHz



Noise figure $NF = f(I_C)$
dB $R_g = 60\ \Omega$; $V_{CE} = 6$ V; $f = 800$ MHz