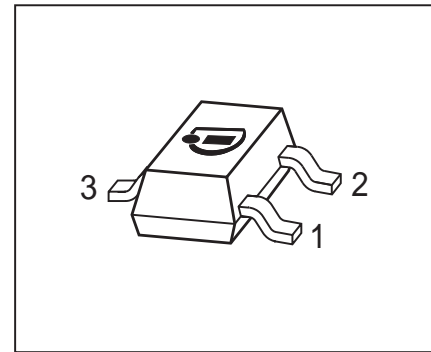


NPN Silicon RF Transistor*

- For low-noise, high gain broadband amplifiers at collector currents from 2 mA to 30 mA
- Pb-free (RoHS compliant) package¹⁾
- Qualified according AEC Q101

* Short term description



ESD (Electrostatic discharge) sensitive device, observe handling precaution!

Type	Marking	Pin Configuration			Package
BFR93A	R2s	1=B	2=E	3=C	SOT23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	90	mA
Base current	I_B	9	
Total power dissipation ²⁾ $T_S \leq 63 \text{ }^\circ\text{C}$	P_{tot}	300	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ³⁾	R_{thJS}	≤ 290	K/W

¹Pb-containing package may be available upon special request

² T_S is measured on the collector lead at the soldering point to the pcb

³For calculation of R_{thJA} please refer to Application Note Thermal Resistance

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1\text{ mA}, I_B = 0$	$V_{(BR)CEO}$	12	-	-	V
Collector-emitter cutoff current $V_{CE} = 20\text{ V}, V_{BE} = 0$	I_{CES}	-	-	100	μA
Collector-base cutoff current $V_{CB} = 10\text{ V}, I_E = 0$	I_{CBO}	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 2.5\text{ V}, I_C = 0$	I_{EBO}	-	-	10	μA
DC current gain- $I_C = 30\text{ mA}, V_{CE} = 8\text{ V}$, pulse measured	h_{FE}	70	100	140	-

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

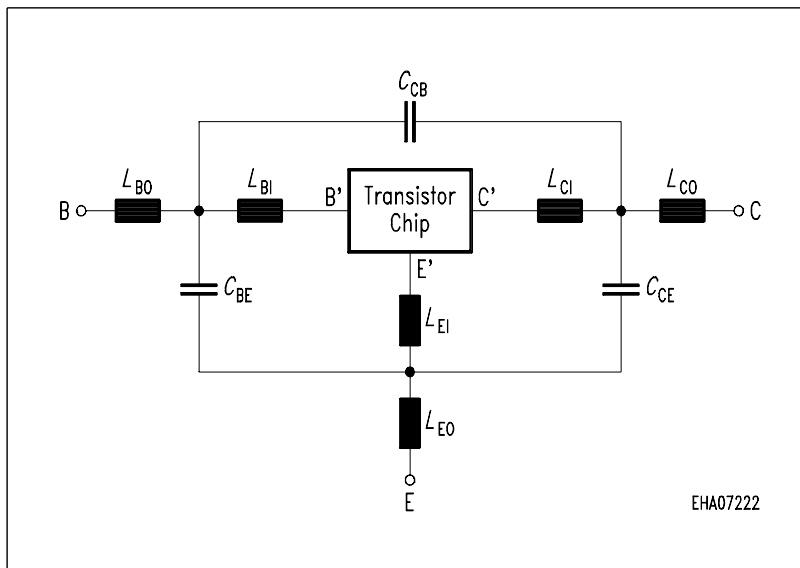
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $f = 500\text{ MHz}$	f_T	4.5	6	-	GHz
Collector-base capacitance $V_{CB} = 10\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, emitter grounded	C_{cb}	-	0.54	0.8	pF
Collector emitter capacitance $V_{CE} = 10\text{ V}$, $f = 1\text{ MHz}$, $V_{BE} = 0$, base grounded	C_{ce}	-	0.25	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$, $V_{CB} = 0$, collector grounded	C_{eb}	-	1.9	-	
Noise figure $I_C = 5\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $f = 900\text{ MHz}$ $I_C = 5\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $f = 1.8\text{ GHz}$	F	-	1.5	-	dB
		-	2.6	-	
Power gain, maximum available ¹⁾ $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 900\text{ MHz}$ $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 1.8\text{ GHz}$	G_{ma}	-	14.5	-	
		-	9.5	-	
Transducer gain $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_L = 50\ \Omega$, $f = 900\text{ MHz}$ $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_L = 50\ \Omega$, $f = 1.8\text{ MHz}$	$ S_{21e} ^2$	-	12.5	-	dB
		-	7	-	

$$^1G_{ma} = |S_{21e}| / |S_{12e}| (k - (k^2 - 1)^{1/2})$$

SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):
Transistor Chip Data:

IS =	8.6752	fA	BF =	137.63	-	NF =	0.93633	-
VAF =	20.011	V	IKF =	0.33395	A	ISE =	2619.3	fA
NE =	1.5466	-	BR =	59	-	NR =	0.88761	-
VAR =	26.834	V	IKR =	0.015129	A	ISC =	0.70823	fA
NC =	1.95	-	RB =	7.2326	Ω	IRB =	0.043806	mA
RBM =	3.4649	Ω	RE =	1.0075	-	RC =	0.13193	Ω
CJE =	3.1538	fF	VJE =	0.70393	V	MJE =	0.5071	-
TF =	33.388	ps	XTF =	0.28319	-	VTF =	0.17765	V
ITF =	2.5184	mA	PTF =	0	deg	CJC =	1039.5	fF
VJC =	0.72744	V	MJC =	0.34565	-	XCJC =	0.21442	-
TR =	1.1061	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.75935	-	TNOM	300	K

All parameters are ready to use, no scaling is necessary. Extracted on behalf of Infineon Technologies AG by: Institut für Mobil- und Satellitentechnik (IMST)

Package Equivalent Circuit:


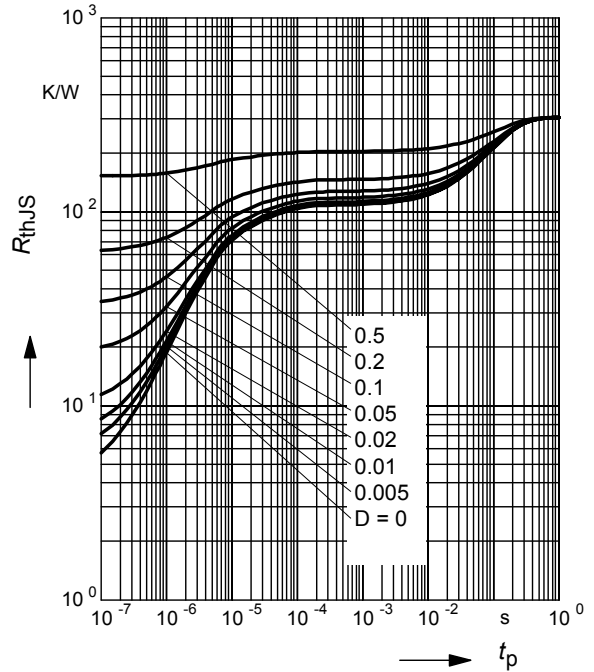
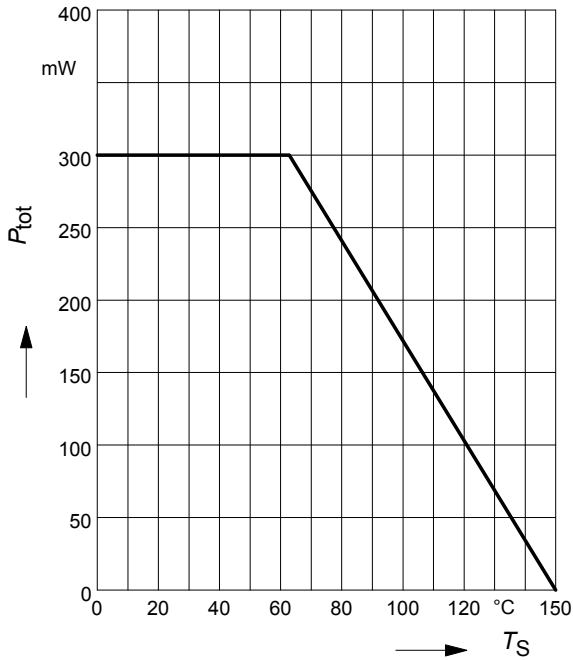
L_{BI} =	0.85	nH
L_{BO} =	0.51	nH
L_{EI} =	0.69	nH
L_{EO} =	0.61	nH
L_{CI} =	0	nH
L_{CO} =	0.49	nH
C_{BE} =	73	fF
C_{CB} =	84	fF
C_{CE} =	165	fF

Valid up to 6GHz

For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com>

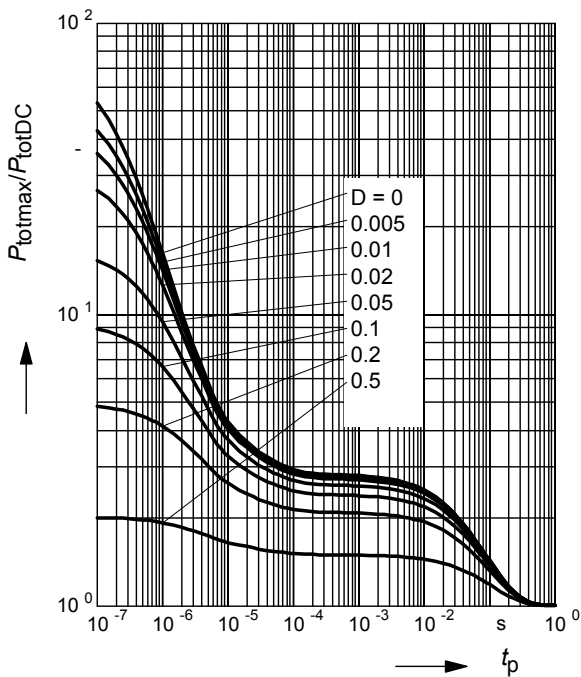
Total power dissipation $P_{tot} = f(T_S)$

Permissible Pulse Load $R_{thJS} = f(t_p)$

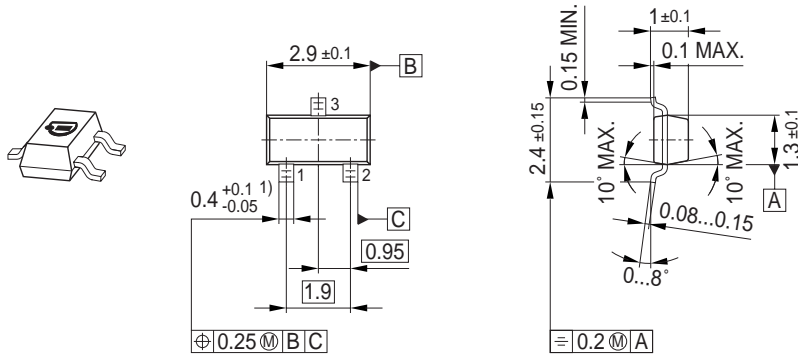


Permissible Pulse Load

$P_{totmax}/P_{totDC} = f(t_p)$

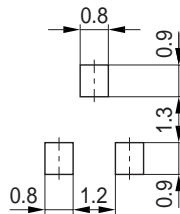


Package Outline

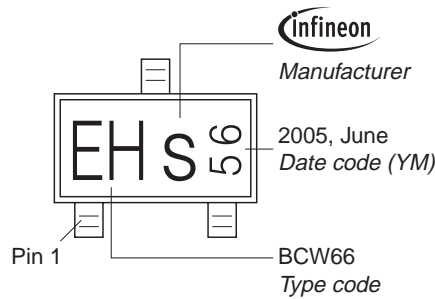


1) Lead width can be 0.6 max. in dambar area

Foot Print

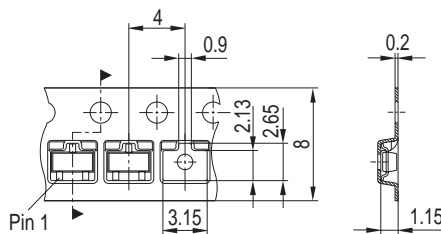


Marking Layout (Example)



Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
 Reel ø330 mm = 10.000 Pieces/Reel



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