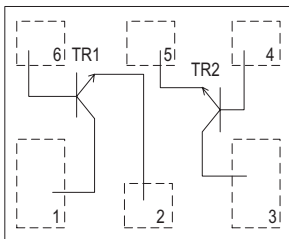
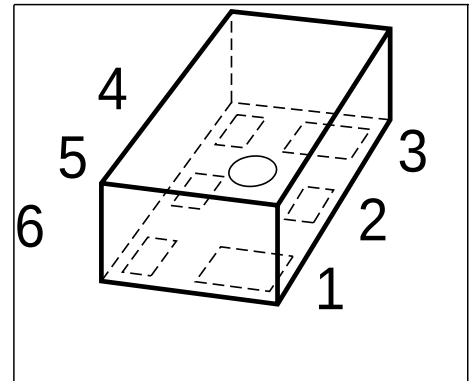


NPN Silicon RF TWIN Transistor

Preliminary data

- Low voltage/ low current applications
- Ideal for VCO modules and low noise amplifiers
- Low noise figure: TR1: 1.1dB at 1.8 GHz
TR2: 1.5 dB at 1.8 GHz
- World's smallest SMD 6-pin leadless package
- Built in 2 transistors (TR1: die as BFR460L3,
TR2: die as BFR949L3)



ESD: Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Pin Configuration						Package
BFS469L6	AD	1=C1	2=E1	3=C2	4=B2	5=E2	6=B1	TSLP-6-1

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}		V
TR1		4.5	
TR2		10	
Collector-emitter voltage	V_{CES}		
TR1		15	
TR2		20	
Collector-base voltage	V_{CBO}		
TR1		15	
TR2		20	
Emitter-base voltage	V_{EBO}		
TR1		1.5	
TR2		1.5	
Collector current	I_C		mA
TR1		50	
TR2		70	

Maximum Ratings

Parameter	Symbol	Value	Unit
Base current TR1 TR2	I_B	5 7	mA
Total power dissipation ¹⁾ TR1, $T_S \leq 104^\circ\text{C}$ TR2, $T_S \leq 100^\circ\text{C}$	P_{tot}	200 250	mW
Junction temperature TR1 TR2	T_j	150 150	$^\circ\text{C}$
Ambient temperature TR1 TR2	T_A	-65 ... 150 -65 ... 150	
Storage temperature TR1 TR2	T_{stg}	-65 ... 150 -65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ²⁾ TR1 TR2	R_{thJS}	≤ 230 ≤ 200	K/W

¹⁾ T_S is measured on the collector lead at the soldering point to the pcb

²⁾ For 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 TR1, $I_C = 1\text{ mA}$, $I_B = 0$ TR2, $I_C = 1\text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	4.5 10	5 -	- -	V
Collector-emitter cutoff current TR1, $V_{CE} = 15\text{ V}$, $V_{BE} = 0$ TR1, $V_{CE} = 20\text{ V}$, $V_{BE} = 0$	I_{CES}	- -	- -	10 10	μA
Collector-base cutoff current TR1, $V_{CB} = 5\text{ V}$, $I_E = 0$ TR2, $V_{CB} = 10\text{ V}$, $I_E = 0$	I_{CBO}	- -	- -	100 100	nA
Emitter-base cutoff current TR1, $V_{EB} = 0,5\text{ V}$, $I_C = 0$ TR2, $V_{EB} = 1\text{ V}$, $I_C = 0$	I_{EBO}	- -	- -	1 0.1	μA
DC current gain- TR1, $I_C = 20\text{ mA}$, $V_{CE} = 3\text{ V}$ TR2, $I_C = 5\text{ mA}$, $V_{CE} = 3\text{ V}$	h_{FE}	- 100	130 140	- 200	-

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 TR1, $I_C = 30\text{ mA}$, $V_{CE} = 3\text{ V}$, $f = 1\text{ GHz}$ TR2, $I_C = 15\text{ mA}$, $V_{CE} = 6\text{ V}$, $f = 1\text{ GHz}$	f_T	16 tbd	22 9	- -	GHz
Collector-base capacitance TR1, $V_{CB} = 3\text{ V}$, $f = 1\text{ MHz}$, emitter grounded TR2, $V_{CB} = 10\text{ V}$, $f = 1\text{ MHz}$, emitter grounded	C_{cb}	- -	0.33 0.3	0.5 0.45	pF
Collector emitter capacitance TR1, $V_{CE} = 3\text{ V}$, $f = 1\text{ MHz}$, base grounded TR1, $V_{CE} = 10\text{ V}$, $f = 1\text{ MHz}$, base grounded	C_{ce}	- -	0.17 0.17	- -	
Emitter-base capacitance TR1, $V_{EB} = 0,5\text{ V}$, $f = 1\text{ MHz}$, collector grounded TR2, $V_{EB} = 0,5\text{ V}$, $f = 1\text{ MHz}$, collector grounded	C_{eb}	- -	0.57 0.75	- -	

Electrical Characteristics at TA = 25°C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Noise figure	F				dB
TR1, $I_C=5\text{mA}$, $V_{CE} = 3\text{ V}$, $f = 1.8\text{ GHz}$, $Z_S = Z_{\text{Sopt}}$		-	1.1	-	
TR1, $I_C=5\text{mA}$, $V_{CE} = 3\text{ V}$, $f = 3\text{ GHz}$, $Z_S = Z_{\text{Sopt}}$		-	1.4	-	
TR2, $I_C=3\text{mA}$, $V_{CE} = 6\text{ V}$, $f = 1\text{ GHz}$, $Z_S = Z_{\text{Sopt}}$		-	1	-	
TR2, $I_C=3\text{mA}$, $V_{CE} = 8\text{ V}$, $f = 1.8\text{ GHz}$, $Z_S = Z_{\text{Sopt}}$		-	1.3	-	
Power gain, maximum stable ¹⁾	G_{ms}				
TR1, $I_C = 20\text{ mA}$, $V_{CE} = 3\text{ V}$, $Z_S=Z_{\text{Sopt}}$, $Z_L=Z_{\text{Lopt}}$, $f = 1.8\text{ GHz}$		-	14.5	-	
TR2, $I_C = 10\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S=Z_{\text{Sopt}}$, $Z_L=Z_{\text{Lopt}}$, $f = 0.9\text{ GHz}$		-	20	-	
TR2, $I_C = 10\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S=Z_{\text{Sopt}}$, $Z_L=Z_{\text{Lopt}}$, $f = 1.8\text{ GHz}$		-	14	-	
Power gain, maximum available ¹⁾	G_{ma}	-	10	-	
TR1, $I_C = 20\text{mA}$, $V_{CE} = 3\text{ V}$, $Z_S = Z_{\text{Sopt}}$, $Z_L = Z_{\text{Lopt}}$, $f = 1,8\text{ GHz}$					
Transducer gain	$ S_{21e} ^2$				
TR1, $I_C=20\text{mA}$, $V_{CE} = 3\text{ V}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	12.5	-	
TR1, $I_C=20\text{mA}$, $V_{CE} = 3\text{ V}$, $Z_S=Z_L=50\Omega$, $f=3\text{GHz}$		-	9	-	
TR2, $I_C=15\text{mA}$, $V_{CE} = 6\text{ V}$, $Z_S=Z_L=50\Omega$, $f=1\text{GHz}$		-	15,5	-	
TR2, $I_C=10\text{mA}$, $V_{CE} = 8\text{ V}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	11	-	
Third order intercept point at output ²⁾	IP_3				dBm
TR1, $V_{CE}=3\text{V}$, $I_C=20\text{mA}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	28	-	
TR2, $V_{CE}=8\text{V}$, $I_C=10\text{mA}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	24.5	-	
1dB Compression point at output	$P_{-1\text{dB}}$				
TR1, $I_C=20\text{mA}$, $V_{CE}=3\text{V}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	12	-	
TR1, $I_C=10\text{mA}$, $V_{CE}=8\text{V}$, $Z_S=Z_L=50\Omega$, $f=1.8\text{GHz}$		-	6	-	

¹⁾ $G_{\text{ma}} = |S_{21e}| / |S_{12e}| (k - (k^2 - 1)^{1/2})$, $G_{\text{ms}} = |S_{21e}| / |S_{12e}|$
²⁾ IP_3 value depends on termination of all intermodulation frequency components.

Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

**Published by Infineon Technologies AG,
St.-Martin-Strasse 53,
81669 München**

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