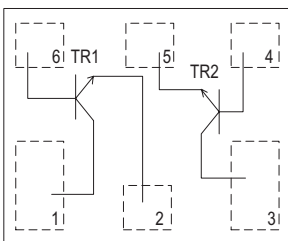
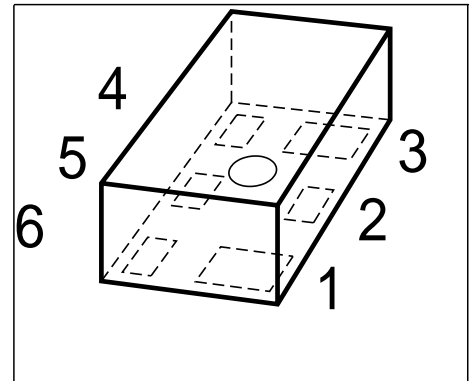


**NPN Silicon RF TWIN Transistor**

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

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>2)</sup>	$R_{thJS}$		K/W
TR1		$\leq 230$	
TR2		$\leq 200$	

<sup>1)</sup> $T_S$  is measured on the collector lead at the soldering point to the pcb

<sup>2)</sup>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.	
<b>DC Characteristics</b>					
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	$\mu\text{A}$
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	$\mu\text{A}$
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.	
<b>AC Characteristics</b> (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.	
<b>AC Characteristics (verified by random sampling)</b>					
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 <sup>1)</sup>	$G_{\text{ms}}$				
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 <sup>1)</sup>	$G_{\text{ma}}$	-	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 <sup>2)</sup>	$IP_3$				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	-	

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

<sup>2</sup>IP3 value depends on termination of all intermodulation frequency components.

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

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