Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010 Renesas Electronics Corporation

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2SC5812

Silicon NPN Epitaxial VHF/UHF wide band amplifier

REJ03G0757-0100 (Previous ADE-208-1468) Rev.1.00 Aug.10.2005

*MFPAK is a trademark of Renesas Technology Corp.

Application

• High power gain, Low noise figure at low power operation: $|S_{21}|^2 = 17 \text{ dB typ}, \text{NF} = 1.0 \text{ dB typ} (V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, f = 900 \text{ MHz})$

Outline



Absolute Maximum Ratings

			$(Ta = 25^{\circ}C)$
Item	Symbol	Ratings	Unit
Collector to base voltage	V _{CBO}	15	V
Collector to emitter voltage	V _{CEO}	4	V
Emitter to base voltage	V _{EBO}	1.5	V
Collector current	I _C	50	mA
Collector power dissipation	Pc	80	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	-55 to +150	°C



Electrical Characteristics

temSymbolMinTypMaxUnitTest conditionsCollector to base breakdown voltage $V_{(BR)CBO}$ 15V $l_c = 10 \ \muA, l_E = 0$ Collector cutoff current l_{CBO} 0.1 μA $V_{CB} = 15 \ V, l_E = 0$ Collector cutoff current l_{CBO} 0.1 μA $V_{CB} = 15 \ V, l_E = 0$ Emitter cutoff current l_{EBO} 0.1 μA $V_{CB} = 10 \ V, l_E = 0$ DC current transfer ratio h_{FE} 100120150 $V_{CE} = 1 \ V, l_C = 5 \ mA$ Reverse transfer capacitance C_{re} 0.2pF $V_{CE} = 1 \ V, l_E = 0$ Collector output capacitance C_{re} 0.40.7pF $V_{CB} = 1 \ V, l_E = 0$ Gain bandwidth product $f_T(1)$ 811GHz $V_{CE} = 1 \ V, l_C = 5 \ mA$ Gain bandwidth product $f_T(2)$ 15GHz $V_{CE} = 1 \ V, l_C = 5 \ mA$ Forward transmission coefficient $ S_{21} ^2$ 1417dB $V_{CE} = 1 \ V, l_C = 5 \ mA$ Noise figureNF1.01.7dB $V_{CE} = 1 \ V, l_C = 5 \ mA$ f = 900 MHz, $Z_S = Z_L = 50 \ \Omega$ SSSS		1		1	1		$(Ta = 25^{\circ}C)$
Collector to base breakdown voltage $V_{(BR)CBO}$ 15V $I_C = 10 \ \mu A, I_E = 0$ Collector cutoff current I_{CBO} 0.1 μA $V_{CB} = 15 \ V, I_E = 0$ Collector cutoff current I_{CEO} 1 μA $V_{CE} = 4 \ V, R_B = \infty$ Emitter cutoff current I_{EBO} 0.1 μA $V_{CE} = 4 \ V, R_B = \infty$ DC current transfer ratio h_{FE} 100120150 $V_{CE} = 1 \ V, I_C = 5 \ m A$ Reverse transfer capacitance C_{re} 0.2 pF $V_{CE} = 1 \ V, I_C = 5 \ m A$ Collector output capacitance C_{cob} 0.40.7 pF $V_{CE} = 1 \ V, I_C = 5 \ m A$ Gain bandwidth product $f_T(1)$ 811 GHz $V_{CE} = 1 \ V, I_C = 5 \ m A$ Forward transmission coefficient $ S_{21} ^2 $ 1417 GHz $V_{CE} = 1 \ V, I_C = 5 \ m A, f = 900 \ MHz$ Noise figureNF1.01.7 dB $V_{CE} = 1 \ V, I_C = 5 \ m A, f = 900 \ MHz, Z_S = Z_L = 50 \ \Omega$	ltem	Symbol	Min	Тур	Max	Unit	Test conditions
Collector cutoff current I_{CBO} 0.1 μA $V_{CB} = 15 \text{ V}, I_E = 0$ Collector cutoff current I_{CEO} 1 μA $V_{CE} = 4 \text{ V}, R_{BE} = \infty$ Emitter cutoff current I_{EBO} 0.1 μA $V_{CE} = 4 \text{ V}, R_{BE} = \infty$ DC current transfer ratio h_{FE} 100120150 $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$ Reverse transfer capacitance C_{re} 0.2 pF $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$ Collector output capacitance C_{ob} 0.40.7 pF $V_{CE} = 1 \text{ V}, I_E = 0,$ f = 1 MHzCollector output capacitance $fr(1)$ 811 GHz $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$ Gain bandwidth product $fr(2)$ 15 GHz $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$ Gain bandwidth product $fr(2)$ 15 GHz $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$ Forward transmission coefficient $ S_{21} ^2$ 1417 dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA},$ Noise figureNF1.01.7 dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA},$ $f = 900 \text{ MHz},$ 1.01.7 dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA},$ $f = 900 \text{ MHz},$ 1.01.7 dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA},$ $f = 50 \Omega$ 1.01.0- $f = 1 = 10 \text{ M}, I_C = 10$	Collector to base breakdown voltage	V _{(BR)CBO}	15	—	—	V	$I_{\rm C} = 10 \ \mu {\rm A}, \ I_{\rm E} = 0$
Collector cutoff current I_{CEO} 1 μA $V_{CE} = 4 V, R_{BE} = \infty$ Emitter cutoff current I_{EBO} 0.1 μA $V_{EB} = 0.8 V, I_C = 0$ DC current transfer ratiohFE100120150 $V_{CE} = 1 V, I_C = 5 mA$ Reverse transfer capacitance C_{re} 0.2 pF $V_{CE} = 1 V, I_C = 5 mA$ Collector output capacitance C_{ob} 0.40.7 pF $V_{CE} = 1 V, I_E = 0,$ f = 1 MHzCollector output capacitance $f_{T}(1)$ 811GHz $V_{CE} = 1 V, I_C = 5 mA$ Gain bandwidth product $f_{T}(2)$ 15GHz $V_{CE} = 1 V, I_C = 5 mA$ Gain bandwidth product $f_{T}(2)$ 15GHz $V_{CE} = 1 V, I_C = 5 mA$, f = 900 MHzForward transmission coefficient $ S_{21} ^2$ 1417dB $V_{CE} = 1 V, I_C = 5 mA$, f = 900 MHz, Zs = ZL = 50 Ω Noise figureNF1.01.7dB $V_{CE} = 1 V, I_C = 5 mA$, f = 900 MHz, Zs = ZL = 50 Ω	Collector cutoff current	I _{CBO}	—	—	0.1	μΑ	$V_{CB} = 15 \text{ V}, \text{ I}_{E} = 0$
Emitter cutoff currentII <t< td=""><td>Collector cutoff current</td><td>ICEO</td><td>—</td><td></td><td>1</td><td>μΑ</td><td>$V_{CE} = 4 V, R_{BE} = \infty$</td></t<>	Collector cutoff current	ICEO	—		1	μΑ	$V_{CE} = 4 V, R_{BE} = \infty$
DC current transfer ratio h_{FE} 100120150 $V_{CE} = 1 \text{ V}, \text{ lc} = 5 \text{ mA}$ Reverse transfer capacitance C_{re} 0.2 pF $V_{CE} = 1 \text{ V}, \text{ Ic} = 5 \text{ mA}$ Collector output capacitance C_{ob} 0.40.7 pF $V_{CB} = 1 \text{ V}, \text{ le} = 0, f = 1 \text{ MHz}$ Gain bandwidth product $fr(1)$ 811GHz $V_{CE} = 1 \text{ V}, \text{ le} = 0, f = 1 \text{ MHz}$ Gain bandwidth product $fr(2)$ 15GHz $V_{CE} = 1 \text{ V}, \text{ lc} = 5 \text{ mA}$ Forward transmission coefficient $ S_{21} ^2$ 1417dB $V_{CE} = 1 \text{ V}, \text{ lc} = 5 \text{ mA}, f = 900 \text{ MHz}$ Noise figureNF1.01.7dB $V_{CE} = 1 \text{ V}, \text{ lc} = 5 \text{ mA}, f = 900 \text{ MHz}, Zs = Zt = 50 \Omega$	Emitter cutoff current	I _{EBO}	—	—	0.1	μΑ	$V_{EB} = 0.8 V, I_C = 0$
Reverse transfer capacitance C_{re} $ 0.2$ $ pF$ $V_{CE} = 1 \text{ V}$, Emitter ground, f = 1 MHzCollector output capacitance C_{ob} $ 0.4$ 0.7 pF $V_{CB} = 1 \text{ V}$, $I_E = 0$, f = 1 MHzGain bandwidth product $f_T(1)$ 8 11 $ GHz$ $V_{CE} = 1V$, $I_C = 5 \text{ mA}$ Gain bandwidth product $f_T(2)$ $ 15$ $ GHz$ $V_{CE} = 1V$, $I_C = 20 \text{ mA}$ Forward transmission coefficient $ S_{21} ^2$ 14 17 $ dB$ $V_{CE} = 1 \text{ V}$, $I_C = 5 \text{ mA}$, f = 900 MHzNoise figure NF $ 1.0$ 1.7 dB $V_{CE} = 1 \text{ V}$, $I_C = 5 \text{ mA}$, f = 900 MHz, Z = $Z_5 = Z_L = 50 \Omega$	DC current transfer ratio	h _{FE}	100	120	150		$V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}$
Collector output capacitance C_{ob} $ 0.4$ 0.7 pF $V_{CB} = 1 V, I_E = 0, f = 1 MHz$ Gain bandwidth product $f_T(1)$ 811 $ GHz$ $V_{CE} = 1 V, I_C = 5 mA$ Gain bandwidth product $f_T(2)$ $-$ 15 $ GHz$ $V_{CE} = 1 V, I_C = 20 mA$ Forward transmission coefficient $ S_{21} ^2$ 1417 $ dB$ $V_{CE} = 1 V, I_C = 5 mA, f = 900 MHz$ Noise figureNF $ 1.0$ 1.7 dB $V_{CE} = 1 V, I_C = 5 mA, f = 900 MHz$	Reverse transfer capacitance	C _{re}		0.2		pF	$V_{CE} = 1 V$, Emitter ground, f = 1 MHz
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Collector output capacitance	C _{ob}	—	0.4	0.7	pF	$V_{CB} = 1 V, I_E = 0,$ f = 1 MHz
Gain bandwidth product $f_T(2)$ 15GHz $V_{CE} = 1V, I_C = 20 \text{ mA}$ Forward transmission coefficient $ S_{21} ^2$ 1417dB $V_{CE} = 1 V, I_C = 5 \text{ mA}, f = 900 \text{ MHz}$ Noise figureNF1.01.7dB $V_{CE} = 1 V, I_C = 5 \text{ mA}, f = 900 \text{ MHz}, Zs = ZL = 50 \Omega$	Gain bandwidth product	f⊤(1)	8	11	—	GHz	$V_{CE} = 1V, I_{C} = 5 \text{ mA}$
Forward transmission coefficient $ S_{21} ^2$ 1417dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, f = 900 \text{ MHz}$ Noise figureNF1.01.7dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, f = 900 \text{ MHz}, Z_S = Z_L = 50 \Omega$	Gain bandwidth product	f⊤(2)	_	15	—	GHz	$V_{CE} = 1V, I_C = 20 \text{ mA}$
Noise figure NF - 1.0 1.7 dB $V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, f = 900 \text{ MHz}, Z_3 = Z_L = 50 \Omega$	Forward transmission coefficient	S ₂₁ ²	14	17		dB	$V_{CE} = 1 V, I_C = 5 mA,$ f = 900 MHz
	Noise figure	NF		1.0	1.7	dB	$V_{CE} = 1 V, I_C = 5 mA,$ f = 900 MHz, Z _S = Z _L = 50 Ω
			5,	0	9	2	



Main Characteristics













S Parameter

 $(V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, Z_O = 50 \Omega)$

	S11 S21		S12 5			322		
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.842	-16.3	15.23	164.9	0.015	80.2	0.963	-10.1
200	0.783	-31.7	14.17	152.2	0.027	72.9	0.904	-18.4
300	0.719	-44.6	12.84	141.4	0.037	66.8	0.826	-24.9
400	0.637	-55.4	11.41	131.8	0.045	62.9	0.754	-29.4
500	0.582	-65.9	10.25	124.8	0.051	60.8	0.691	-32.9
600	0.531	-73.2	9.16	118.6	0.056	60.1	0.638	-35.0
700	0.472	-80.9	8.22	113.1	0.061	59.7	0.595	-36.7
800	0.443	-87.0	7.49	108.9	0.065	60.0	0.561	-37.7
900	0.404	-92.3	6.80	104.6	0.069	60.7	0.530	-38.5
1000	0.377	-99.2	6.26	101.0	0.073	61.5	0.508	-39.1
1100	0.355	-103.4	5.80	98.1	0.077	62 <mark>.8</mark>	0.490	-39.7
1200	0.337	-108.0	5.38	94.8	0.081	64.1	0.474	-40.4
1300	0.327	-112.6	5.04	92.4	0.085	65.0	0.461	-40.8
1400	0.305	-116.3	4.71	90.1	0.090 🧹	66.4	0.452	-41.7
1500	0.299	-120.3	4.45	87.7	0.094	67.5	0.440	-42.0
1600	0.297	-123.8	4.20	86.0	0.099	68.5	0.437	-42.8
1700	0.284	-127.7	3.98	83.6	0.104	70.0	0.428	-43.4
1800	0.282	-132.2	3.80	81.7	0.109	71.1	0.423	-44.3
1900	0.272	-134.3	3.62	79.8	0.114	72.0	0.418	-45.3
2000	0.268	-138.4	3.47	77.9	0.120	73.0	0.414	-46.0

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			1		r	$(\cdot CE = 1$	1, 10 = 20 m	1, 20 = 50 =
	S	11	S	21	S	12	S	22
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.502	-40.3	36.64	147.5	0.013	76.3	0.824	-21.8
200	0.388	-66.7	27.85	127.8	0.021	70.3	0.653	-32.0
300	0.317	-84.6	21.13	116.2	0.027	69.3	0.531	-35.4
400	0.257	-99.2	16.75	108.5	0.034	72.2	0.460	-35.8
500	0.237	-109.6	13.87	103.5	0.040	73.6	0.416	-35.2
600	0.216	-115.5	11.77	99.5	0.047	75.0	0.387	-34.8
700	0.195	-125.0	10.19	96.1	0.054	75.6	0.367	-34.1
800	0.193	-129.2	9.00	93.5	0.060	76.3	0.352	-33.7
900	0.181	-135.9	8.03	90.8	0.068	77.1	0.340	-33.2
1000	0.179	-141.0	7.26	88.8	0.074	77.7	0.333	-33.3
1100	0.178	-142.4	6.66	86.8	0.081	78.1	0.326	-33.7
1200	0.176	-147.8	6.12	84.7	0.088	78.2	0.321	-34.0
1300	0.176	-150.0	5.68	83.2	0.094	78.4	0.317	-34.5
1400	0.166	-154.2	5.32	81.7	0.102	78.5	0.314	-35.1
1500	0.175	-158.0	4.97	80.0	0.109	78.6	0.311	-36.0
1600	0.172	-159.7	4.70	78.7	0.116	79.0	0.309	-36.8
1700	0.172	-162.4	4.43	77.0	0.123	78.9	0.307	-37.6
1800	0.179	-164.9	4.21	75.7	0.131	78.8	0.305	-38.6
1900	0.177	-166.8	4.01	74.3	0.138	78.7	0.304	-39.7
2000	0.183	-169.9	3.83	72.8	0.145	78.5	0.303	-40.8

 $(V_{CE} = 1 \text{ V}, I_C = 20 \text{ mA}, Z_O = 50 \Omega)$



Package Dimensions



Ordering Information

Part Name	Quantity	\leq	Shipping Container
2SC5812WG-TR-E	9000		φ 178 mm Reel, 8 mm Emboss Taping

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