NEC

NPN SILICON RF TRANSISTOR
2SC5668

NPN SILICON RF TRANSISTOR FOR LOW NOISE · HIGH-GAIN AMPLIFICATION FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- Ideal for low noise · high-gain amplification and oscillation at 3 GHz or over
  NF = 1.1 dB TYP., G_a = 11 dB @ f = 2 GHz, V_{CE} = 2 V, I_C = 5 mA
- Maximum available power gain: MAG. = 12.5 dB TYP. @ f = 2 GHz, V_{CE} = 2 V, I_C = 20 mA
- High f_T: f_T = 21 GHz TYP. @ f = 2 GHz, V_{CE} = 2 V, I_C = 20 mA
- f_T = 25 GHz "UHS0" (Ultra High Speed Process) technology adopted
- Flat-lead 3-pin thin-type ultra super minimold (t = 0.59 mm)

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5668	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5668-T1	3 kpcs/reel	• Pin 3 (collector) face the perforation side of the tape

Remark To order evaluation samples, consult your NEC sales representative (Unit sample quantity is 50 pcs).

ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V_{CBO}	15	V
Collector to Emitter Voltage	V_{CEO}	3.3	V
Emitter to Base Voltage	V_{EBO}	1.5	V
Collector Current	I_C	35	mA
Total Power Dissipation	P_{tot} Note	115	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65 to +150	°C

Note Mounted on 1.08 $cm^2 \times$ 1.0 mm (t) glass epoxy substrate

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

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ELECTRICAL CHARACTERISTICS (T_A = +25 °C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I_{CBO}	V_{CB} = 5 V, I_E = 0 mA	–	–	100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0 mA	–	–	100	nA
DC Current Gain	h_{FE} Note 1	V_{CE} = 2 V, I_C = 5 mA	50	70	100	–
RF Characteristics						
Gain Bandwidth Product	f_T	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	18	21	–	GHz
Insertion Power Gain (1)	$\lvert S_{21e} \rvert^2$	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz	9.0	11.0	–	dB
Insertion Power Gain (2)	$\lvert S_{21e} \rvert^2$	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	9.5	11.5	–	dB
Noise Figure	NF	V_{CE} = 2 V, I_C = 5 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.1	1.5	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 2 V, I_E = 0 mA, f = 1 MHz	–	0.24	0.30	pF
Maximum Available Power Gain	MAG. Note 3	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	–	12.5	–	dB
Maximum Stable Power Gain	MSG. Note 4	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	–	13.5	–	dB

Note 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2 %

2. Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

3. MAG. $= \left| \dfrac{S_{21}}{S_{12}} \right| (k - \sqrt{(k^2 - 1)})$

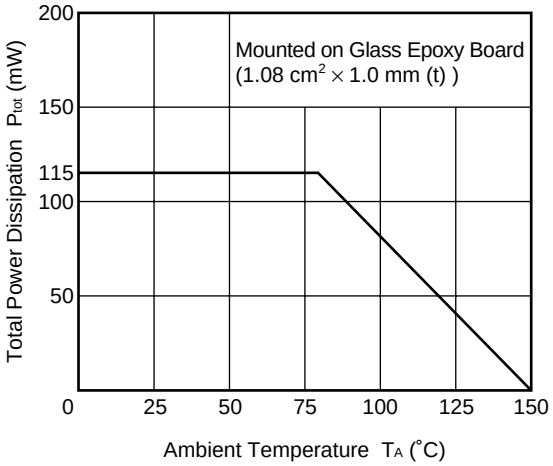
4. MSG. $= \left| \dfrac{S_{21}}{S_{12}} \right|$

h_{FE} CLASSIFICATION

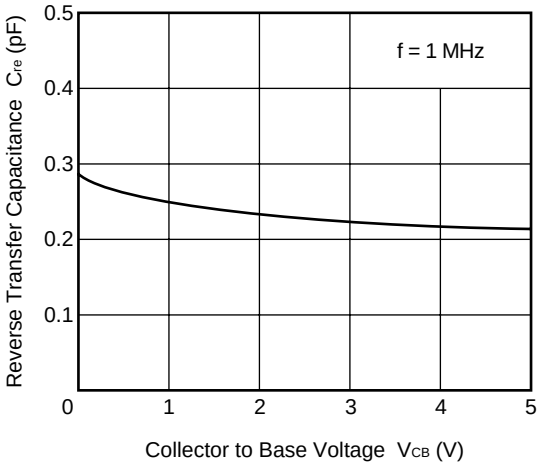
Rank	FB
Marking	UB
h_{FE} Value	50 to 100

TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C)

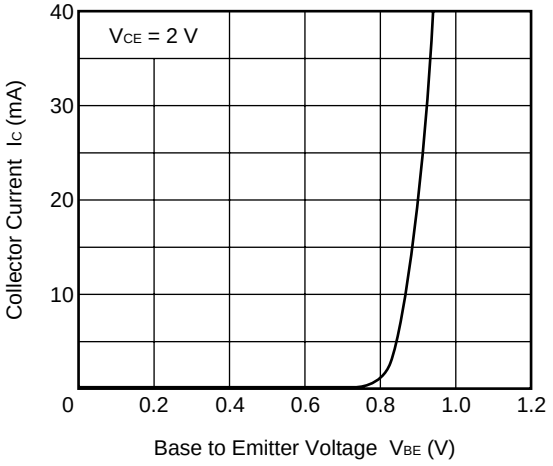
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



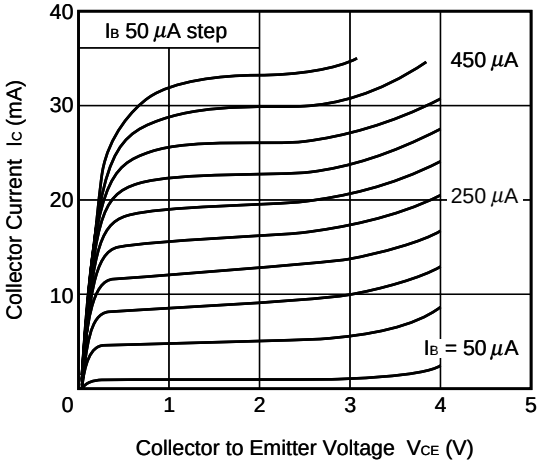
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



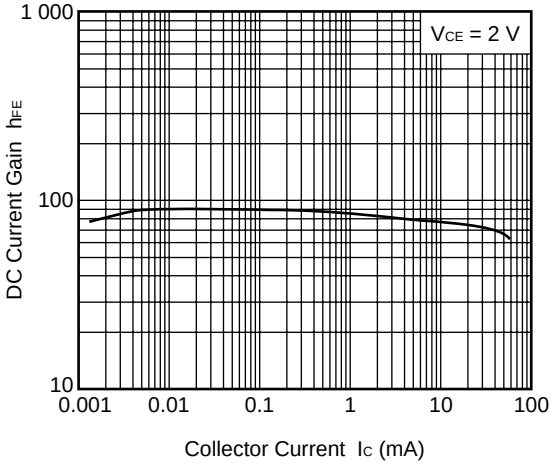
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



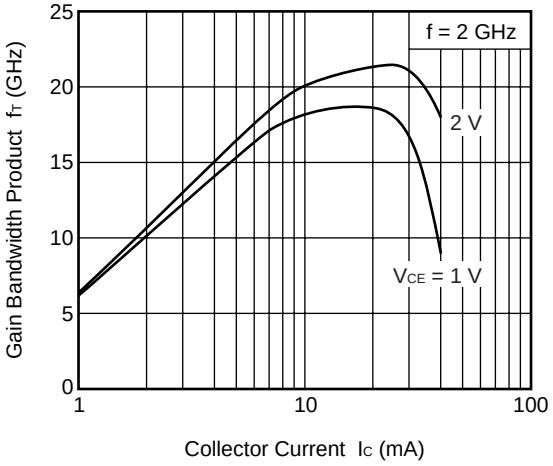
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



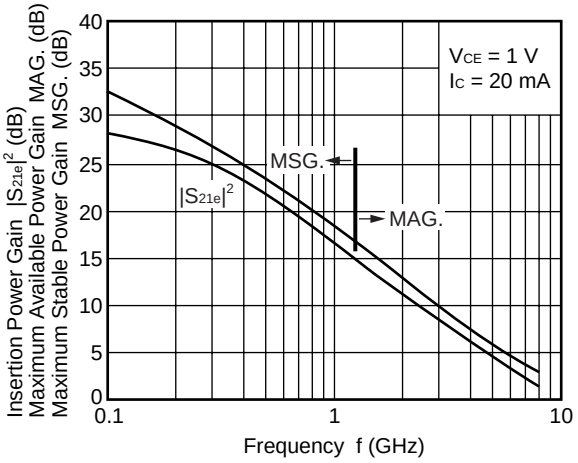
DC CURRENT GAIN vs. COLLECTOR CURRENT



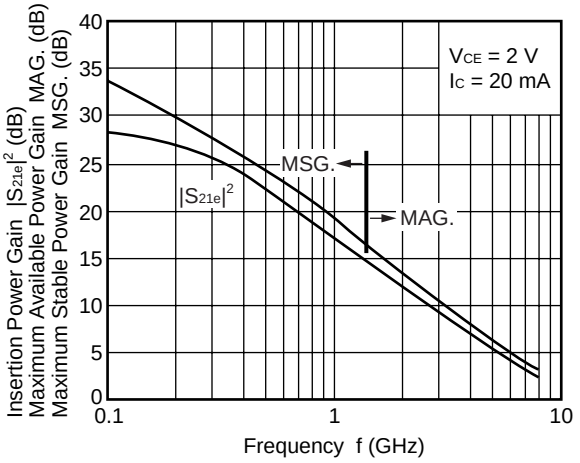
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



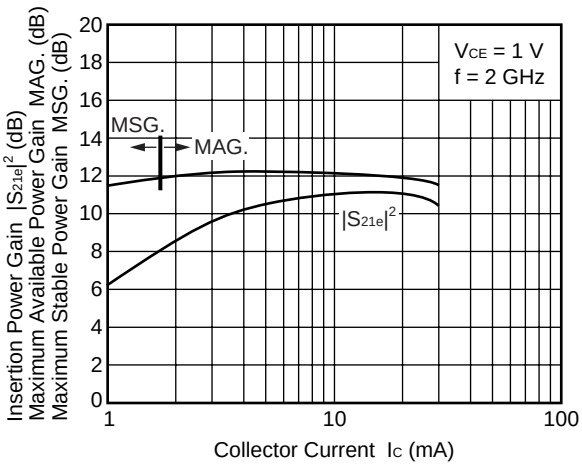
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



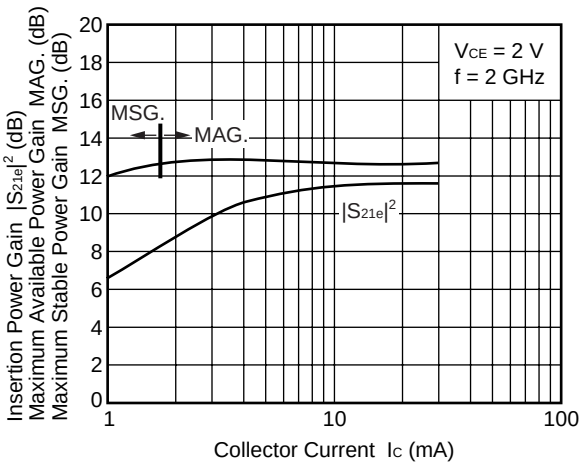
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



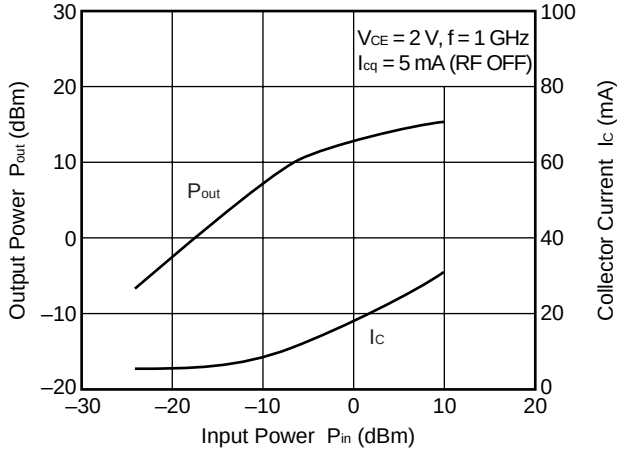
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



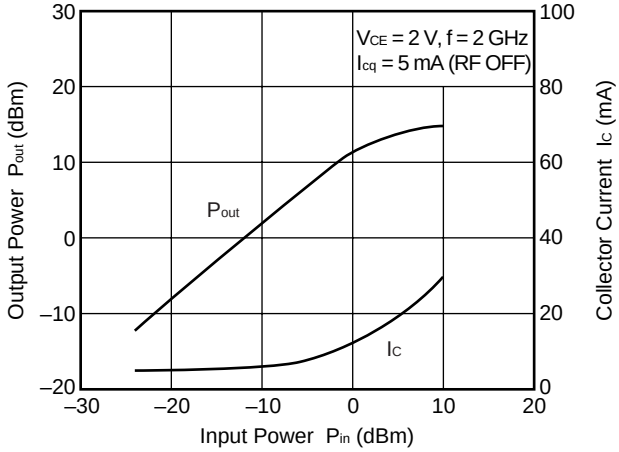
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



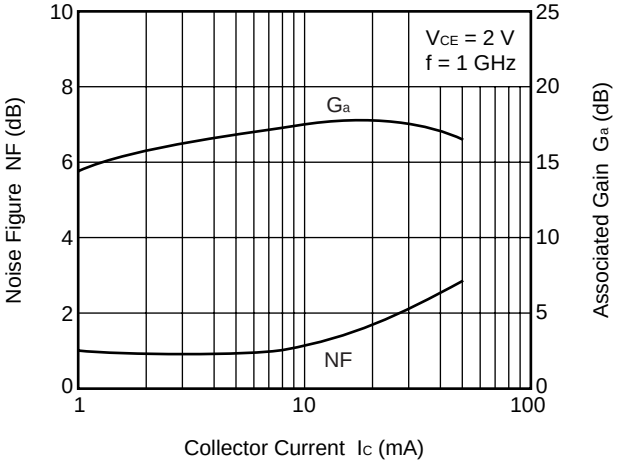
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



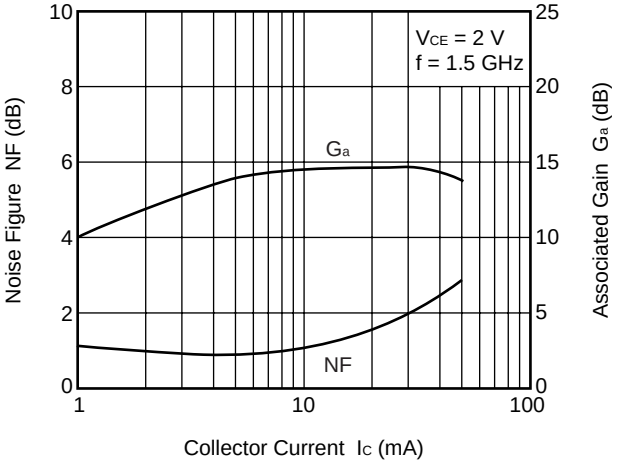
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



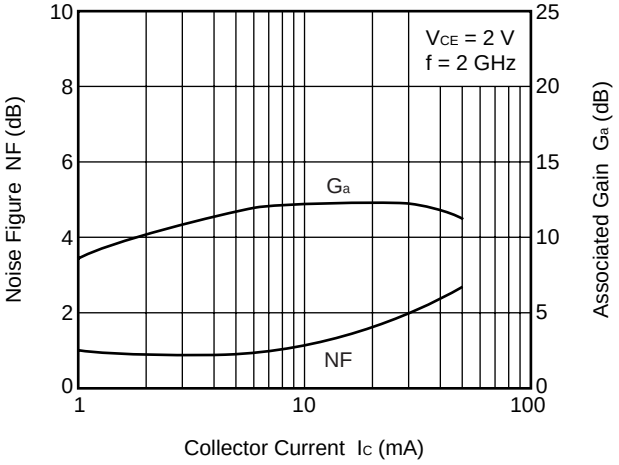
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



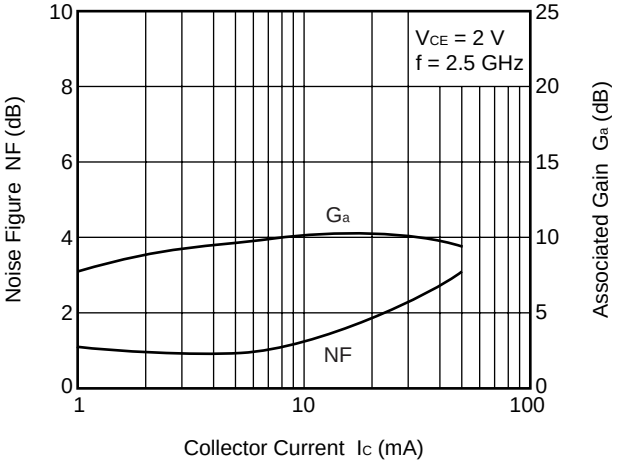
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.868	–9.2	8.975	169.4	0.018	84.6	0.981	–7.4
0.2	0.839	–19.0	8.678	159.8	0.034	78.1	0.954	–14.8
0.3	0.809	–28.0	8.211	150.9	0.049	73.2	0.910	–21.6
0.4	0.753	–35.5	7.755	142.3	0.062	69.0	0.858	–27.9
0.5	0.698	–43.6	7.246	134.8	0.073	65.3	0.802	–33.3
0.6	0.637	–50.4	6.700	127.7	0.082	62.4	0.744	–38.0
0.7	0.588	–55.9	6.209	122.0	0.090	60.5	0.690	–42.0
0.8	0.540	–61.6	5.772	116.9	0.096	59.2	0.643	–45.9
0.9	0.501	–66.5	5.386	111.8	0.102	58.2	0.600	–48.8
1.0	0.461	–71.5	5.073	107.3	0.107	57.9	0.561	–51.8
1.1	0.430	–76.1	4.773	103.2	0.112	57.8	0.525	–54.4
1.2	0.402	–80.9	4.480	99.2	0.116	57.9	0.494	–56.8
1.3	0.378	–85.9	4.254	95.8	0.121	58.2	0.466	–59.3
1.4	0.352	–90.2	4.023	92.4	0.126	58.5	0.439	–61.9
1.5	0.335	–94.6	3.805	89.3	0.131	58.9	0.419	–64.2
1.6	0.314	–99.3	3.631	86.0	0.136	59.5	0.399	–66.5
1.7	0.303	–103.8	3.466	83.2	0.141	60.3	0.379	–68.8
1.8	0.289	–108.4	3.309	80.4	0.146	60.9	0.362	–71.2
1.9	0.278	–114.2	3.167	77.5	0.152	61.4	0.347	–73.9
2.0	0.277	–120.0	3.054	74.7	0.158	62.0	0.332	–76.7
2.1	0.269	–126.3	2.945	72.2	0.163	62.5	0.316	–79.4
2.2	0.258	–133.6	2.790	69.4	0.165	62.6	0.296	–81.7
2.3	0.217	–133.8	2.632	69.0	0.169	67.5	0.302	–79.7
2.4	0.238	–133.0	2.631	67.0	0.184	67.5	0.306	–85.6
2.5	0.250	–137.4	2.565	64.8	0.193	67.4	0.297	–90.4
2.6	0.253	–140.4	2.499	62.2	0.201	67.4	0.292	–94.5
2.7	0.260	–143.6	2.433	60.5	0.209	67.7	0.288	–98.7
2.8	0.263	–147.6	2.360	58.4	0.217	67.8	0.284	–102.2
2.9	0.261	–150.6	2.302	56.7	0.227	67.7	0.281	–105.5
3.0	0.264	–154.5	2.240	54.9	0.236	67.8	0.276	–109.5
4.0	0.367	177.3	1.789	36.2	0.349	63.9	0.328	–150.9
5.0	0.503	155.9	1.425	19.8	0.452	55.0	0.443	177.7
6.0	0.545	142.8	1.226	11.0	0.540	45.5	0.527	157.5
7.0	0.616	130.4	1.038	–1.0	0.611	34.6	0.612	140.2
8.0	0.660	121.4	0.922	–2.0	0.658	26.7	0.649	128.6

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.818	–12.3	13.103	166.1	0.017	83.4	0.963	–9.6
0.2	0.754	–23.7	12.377	154.3	0.032	76.7	0.914	–18.8
0.3	0.690	–34.7	11.300	143.5	0.045	71.7	0.846	–26.7
0.4	0.624	–43.6	10.278	134.2	0.056	68.3	0.772	–33.1
0.5	0.562	–51.3	9.280	126.3	0.065	65.6	0.700	–38.2
0.6	0.500	–57.9	8.339	119.5	0.073	64.1	0.634	–42.4
0.7	0.447	–64.0	7.574	114.1	0.080	63.4	0.578	–45.6
0.8	0.402	–68.7	6.910	109.4	0.087	63.2	0.531	–48.3
0.9	0.367	–73.5	6.351	104.8	0.093	63.2	0.491	–50.6
1.0	0.334	–78.5	5.881	100.7	0.100	63.6	0.456	–52.7
1.1	0.310	–82.6	5.472	97.2	0.106	64.0	0.426	–54.6
1.2	0.288	–86.8	5.108	93.9	0.112	64.4	0.400	–56.5
1.3	0.269	–92.0	4.789	90.9	0.119	64.7	0.376	–58.4
1.4	0.251	–96.4	4.496	87.9	0.125	65.1	0.354	–60.4
1.5	0.237	–101.2	4.244	85.2	0.132	65.5	0.336	–62.4
1.6	0.224	–106.4	4.036	82.5	0.139	65.9	0.320	–64.3
1.7	0.217	–111.7	3.838	80.1	0.147	66.2	0.303	–66.3
1.8	0.207	–117.4	3.648	77.6	0.154	66.5	0.289	–68.6
1.9	0.204	–122.7	3.487	75.2	0.161	66.4	0.275	–71.1
2.0	0.202	–130.5	3.350	72.8	0.169	66.5	0.262	–73.7
2.1	0.205	–136.6	3.218	70.3	0.175	66.5	0.248	–76.3
2.2	0.202	–145.3	3.045	68.1	0.179	66.2	0.229	–77.9
2.3	0.160	–146.4	2.869	67.8	0.185	69.8	0.240	–74.8
2.4	0.183	–142.9	2.855	66.3	0.201	69.3	0.245	–82.2
2.5	0.195	–146.8	2.781	64.3	0.211	68.6	0.236	–87.5
2.6	0.203	–149.8	2.710	61.9	0.219	68.3	0.231	–92.0
2.7	0.207	–152.5	2.633	60.2	0.228	68.0	0.225	–96.6
2.8	0.211	–155.5	2.552	58.4	0.236	67.7	0.222	–100.3
2.9	0.214	–158.9	2.493	56.6	0.246	67.2	0.219	–104.0
3.0	0.218	–163.7	2.426	55.1	0.255	67.0	0.215	–108.4
4.0	0.330	172.3	1.945	38.4	0.358	61.2	0.266	–153.1
5.0	0.465	153.3	1.572	22.8	0.449	52.7	0.379	176.7
6.0	0.510	142.8	1.377	13.5	0.529	44.4	0.466	158.5
7.0	0.592	131.3	1.178	0.7	0.600	34.5	0.563	142.5
8.0	0.646	122.6	1.046	–2.5	0.649	27.1	0.613	131.5

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.662	–18.4	19.756	161.2	0.015	84.2	0.927	–13.4
0.2	0.593	–31.8	17.580	145.6	0.029	74.6	0.836	–24.8
0.3	0.512	–43.7	15.184	133.8	0.040	72.1	0.732	–33.0
0.4	0.440	–52.7	13.074	123.7	0.050	70.1	0.641	–38.8
0.5	0.377	–61.0	11.314	116.5	0.058	69.3	0.564	–42.5
0.6	0.328	–66.4	9.892	110.2	0.066	69.1	0.502	–45.2
0.7	0.283	–71.2	8.754	105.5	0.073	69.3	0.452	–47.0
0.8	0.254	–76.8	7.859	101.8	0.081	69.7	0.413	–48.6
0.9	0.229	–81.5	7.115	97.9	0.089	70.1	0.381	–49.8
1.0	0.206	–85.9	6.533	94.4	0.097	70.5	0.354	–51.0
1.1	0.190	–90.1	6.022	91.5	0.105	70.8	0.331	–52.3
1.2	0.176	–95.4	5.573	88.8	0.113	70.9	0.311	–53.6
1.3	0.167	–100.7	5.198	86.3	0.121	70.9	0.293	–55.0
1.4	0.157	–106.5	4.877	83.9	0.129	70.9	0.276	–56.6
1.5	0.149	–111.8	4.583	81.6	0.138	70.9	0.263	–58.3
1.6	0.144	–118.5	4.330	79.3	0.146	70.8	0.249	–60.1
1.7	0.142	–124.6	4.113	77.2	0.155	70.6	0.236	–62.0
1.8	0.141	–131.3	3.912	75.0	0.163	70.4	0.223	–64.1
1.9	0.142	–139.1	3.723	73.0	0.172	69.9	0.212	–66.7
2.0	0.152	–146.8	3.569	70.7	0.181	69.5	0.200	–69.4
2.1	0.157	–152.6	3.421	68.6	0.188	69.1	0.187	–72.0
2.2	0.163	–161.7	3.232	66.5	0.193	68.6	0.170	–72.7
2.3	0.129	–167.3	3.049	66.7	0.201	71.3	0.188	–68.6
2.4	0.144	–160.0	3.031	65.2	0.217	70.4	0.190	–78.2
2.5	0.160	–161.5	2.956	63.3	0.227	69.4	0.180	–84.7
2.6	0.165	–163.6	2.863	61.2	0.236	68.6	0.175	–89.9
2.7	0.179	–166.6	2.784	59.8	0.245	68.0	0.170	–95.2
2.8	0.183	–169.9	2.702	58.1	0.254	67.4	0.167	–99.7
2.9	0.185	–172.6	2.633	56.6	0.263	66.7	0.164	–104.2
3.0	0.192	–175.5	2.559	55.2	0.273	66.2	0.160	–109.0
4.0	0.312	165.3	2.043	40.0	0.369	58.9	0.217	–159.2
5.0	0.444	149.1	1.676	25.6	0.449	50.6	0.328	172.7
6.0	0.479	139.9	1.485	16.4	0.522	42.9	0.411	157.0
7.0	0.567	130.9	1.296	3.3	0.588	33.8	0.512	142.9
8.0	0.632	122.7	1.164	–1.1	0.639	27.0	0.568	133.2

V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.480	–24.2	25.645	155.8	0.014	82.7	0.868	–17.0
0.2	0.416	–41.5	21.445	137.7	0.027	75.1	0.739	–29.8
0.3	0.341	–54.6	17.381	125.2	0.036	74.1	0.618	–37.4
0.4	0.284	–63.7	14.383	115.8	0.046	73.0	0.525	–41.8
0.5	0.235	–72.6	12.148	109.3	0.055	73.5	0.457	–44.0
0.6	0.201	–78.5	10.401	104.0	0.063	73.9	0.404	–45.4
0.7	0.173	–84.7	9.125	99.7	0.072	74.1	0.364	–46.3
0.8	0.153	–90.3	8.112	96.4	0.080	74.3	0.334	–47.0
0.9	0.141	–97.3	7.315	93.1	0.089	74.5	0.310	–47.7
1.0	0.130	–104.5	6.664	90.1	0.098	74.7	0.290	–48.5
1.1	0.123	–110.9	6.119	87.8	0.107	74.6	0.271	–49.5
1.2	0.115	–117.2	5.656	85.2	0.116	74.4	0.256	–50.6
1.3	0.118	–124.5	5.251	83.1	0.125	74.0	0.242	–51.9
1.4	0.112	–131.4	4.918	80.8	0.134	73.8	0.227	–53.6
1.5	0.115	–138.7	4.614	78.8	0.144	73.4	0.217	–55.5
1.6	0.114	–145.0	4.358	76.5	0.153	73.1	0.205	–57.4
1.7	0.121	–151.0	4.131	74.7	0.162	72.8	0.194	–59.4
1.8	0.128	–156.7	3.923	72.7	0.171	72.1	0.183	–61.7
1.9	0.135	–162.3	3.735	70.8	0.180	71.4	0.173	–64.7
2.0	0.151	–167.5	3.578	68.6	0.190	70.8	0.163	–67.7
2.1	0.162	–173.0	3.423	66.8	0.198	70.3	0.151	–70.5
2.2	0.176	179.9	3.236	64.8	0.203	69.5	0.135	–70.8
2.3	0.142	173.7	3.051	65.0	0.212	71.8	0.155	–66.5
2.4	0.153	–178.7	3.027	63.6	0.228	70.6	0.156	–78.3
2.5	0.169	–178.9	2.945	61.9	0.238	69.5	0.146	–86.1
2.6	0.175	179.7	2.858	59.7	0.248	68.5	0.143	–92.2
2.7	0.188	178.9	2.777	58.5	0.257	67.8	0.138	–98.7
2.8	0.196	176.2	2.697	56.6	0.266	67.0	0.135	–104.0
2.9	0.202	175.0	2.626	55.2	0.276	66.2	0.135	–109.3
3.0	0.207	170.5	2.557	53.9	0.285	65.6	0.132	–115.0
4.0	0.329	157.5	2.040	39.6	0.379	57.3	0.203	–167.2
5.0	0.459	144.5	1.666	25.7	0.457	48.9	0.316	167.4
6.0	0.491	136.0	1.485	16.9	0.524	41.3	0.395	153.6
7.0	0.571	127.9	1.300	4.1	0.585	32.5	0.493	140.8
8.0	0.630	120.5	1.186	–0.3	0.635	26.1	0.549	132.3

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.893	–8.4	8.993	169.7	0.015	84.6	0.986	–6.8
0.2	0.848	–16.8	8.720	160.6	0.031	78.9	0.960	–13.5
0.3	0.818	–25.5	8.278	152.1	0.044	74.4	0.920	–19.8
0.4	0.769	–33.2	7.873	143.8	0.057	70.2	0.873	–25.6
0.5	0.712	–40.3	7.376	136.3	0.066	67.2	0.821	–30.7
0.6	0.658	–46.4	6.851	129.5	0.075	64.1	0.766	–35.0
0.7	0.607	–52.0	6.386	123.9	0.082	62.3	0.715	–38.8
0.8	0.561	–56.8	5.934	118.8	0.088	61.2	0.669	–42.3
0.9	0.521	–61.3	5.567	113.8	0.094	60.2	0.628	–45.1
1.0	0.482	–66.0	5.248	109.3	0.099	59.9	0.588	–47.8
1.1	0.447	–69.8	4.938	105.2	0.103	59.9	0.553	–50.2
1.2	0.422	–74.2	4.660	101.4	0.108	60.1	0.523	–52.4
1.3	0.394	–77.9	4.408	97.9	0.112	60.4	0.495	–54.6
1.4	0.370	–81.8	4.184	94.5	0.117	60.9	0.469	–56.9
1.5	0.346	–86.1	3.961	91.3	0.122	61.5	0.448	–58.9
1.6	0.325	–90.4	3.796	88.1	0.126	62.3	0.428	–61.1
1.7	0.311	–94.1	3.621	85.3	0.132	63.0	0.409	–63.0
1.8	0.294	–98.9	3.457	82.5	0.137	63.8	0.392	–65.1
1.9	0.286	–103.5	3.308	79.6	0.142	64.4	0.376	–67.5
2.0	0.278	–109.7	3.198	76.8	0.148	65.1	0.361	–69.8
2.1	0.265	–115.4	3.080	74.3	0.153	65.8	0.344	–72.2
2.2	0.249	–123.8	2.916	71.4	0.155	66.0	0.324	–73.8
2.3	0.212	–119.0	2.764	71.3	0.160	71.0	0.335	–72.5
2.4	0.235	–120.2	2.760	69.2	0.175	71.1	0.335	–77.9
2.5	0.244	–125.6	2.688	66.9	0.183	71.0	0.324	–82.1
2.6	0.249	–128.6	2.629	64.5	0.191	71.3	0.318	–85.7
2.7	0.249	–131.9	2.556	62.8	0.200	71.5	0.312	–89.5
2.8	0.252	–135.4	2.487	60.7	0.208	71.7	0.308	–92.6
2.9	0.246	–138.7	2.415	58.9	0.217	71.6	0.303	–95.6
3.0	0.248	–143.6	2.348	57.0	0.227	71.8	0.296	–99.3
4.0	0.346	–174.7	1.894	38.3	0.344	68.0	0.335	–140.6
5.0	0.487	161.5	1.520	21.1	0.455	58.3	0.442	–174.9
6.0	0.535	147.3	1.296	12.0	0.550	48.2	0.528	162.8
7.0	0.617	133.5	1.090	–0.7	0.625	36.5	0.615	143.9
8.0	0.665	124.2	0.957	–2.4	0.673	28.2	0.652	131.3

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.805	–12.7	13.195	166.8	0.015	85.8	0.970	–8.7
0.2	0.775	–21.4	12.438	155.4	0.029	77.4	0.925	–17.1
0.3	0.711	–31.3	11.458	145.1	0.041	73.1	0.863	–24.3
0.4	0.647	–39.5	10.528	135.9	0.052	69.8	0.794	–30.2
0.5	0.585	–46.6	9.535	128.0	0.060	67.3	0.726	–35.0
0.6	0.522	–52.6	8.603	121.5	0.068	66.0	0.663	–38.7
0.7	0.472	–57.7	7.834	115.9	0.074	65.2	0.609	–41.7
0.8	0.429	–62.0	7.156	111.1	0.080	65.1	0.563	–44.1
0.9	0.389	–65.9	6.592	106.6	0.087	65.2	0.524	–46.1
1.0	0.356	–70.0	6.140	102.7	0.092	65.7	0.490	–47.9
1.1	0.330	–73.5	5.699	99.4	0.098	65.9	0.460	–49.7
1.2	0.306	–77.5	5.316	95.8	0.104	66.5	0.433	–51.1
1.3	0.285	–81.4	5.021	92.8	0.111	66.9	0.411	–52.7
1.4	0.266	–85.1	4.711	89.9	0.117	67.4	0.388	–54.3
1.5	0.247	–89.2	4.441	87.2	0.124	67.9	0.371	–56.0
1.6	0.232	–93.1	4.234	84.6	0.130	68.3	0.354	–57.6
1.7	0.222	–97.4	4.020	82.1	0.137	68.7	0.338	–59.2
1.8	0.207	–102.6	3.833	79.7	0.144	69.0	0.323	–61.0
1.9	0.204	–108.7	3.668	77.3	0.151	69.1	0.310	–63.1
2.0	0.199	–113.3	3.524	74.7	0.159	69.3	0.296	–65.3
2.1	0.198	–121.7	3.381	72.4	0.165	69.3	0.281	–67.2
2.2	0.187	–131.8	3.197	70.0	0.168	69.2	0.262	–68.0
2.3	0.144	–125.4	3.027	70.2	0.176	73.0	0.280	–66.3
2.4	0.173	–125.8	3.018	68.4	0.190	72.4	0.278	–72.6
2.5	0.182	–130.4	2.938	66.3	0.200	71.9	0.267	–77.0
2.6	0.186	–133.7	2.855	64.1	0.208	71.6	0.260	–80.8
2.7	0.191	–138.2	2.786	62.6	0.217	71.3	0.254	–84.7
2.8	0.192	–141.5	2.699	60.7	0.225	71.0	0.250	–87.9
2.9	0.192	–144.3	2.628	59.0	0.235	70.6	0.245	–90.9
3.0	0.193	–150.0	2.557	57.3	0.244	70.4	0.238	–94.7
4.0	0.300	–178.5	2.068	40.6	0.350	65.0	0.268	–139.4
5.0	0.446	159.6	1.687	24.1	0.448	56.3	0.371	–173.9
6.0	0.491	147.6	1.464	14.5	0.536	47.3	0.462	165.5
7.0	0.586	135.7	1.258	0.9	0.611	36.7	0.564	147.4
8.0	0.644	125.8	1.102	–2.7	0.664	28.8	0.617	135.2

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.677	–15.9	20.016	161.8	0.013	79.1	0.938	–11.8
0.2	0.619	–29.0	17.980	147.3	0.026	76.6	0.857	–22.1
0.3	0.540	–39.1	15.632	135.3	0.036	73.0	0.761	–29.6
0.4	0.469	–46.3	13.575	125.7	0.045	71.7	0.674	–34.8
0.5	0.403	–52.9	11.807	118.1	0.053	71.0	0.600	–38.3
0.6	0.351	–57.5	10.342	112.1	0.061	70.8	0.539	–40.4
0.7	0.314	–61.4	9.173	107.5	0.068	71.0	0.491	–42.0
0.8	0.282	–64.9	8.239	103.4	0.075	71.5	0.453	–43.2
0.9	0.253	–67.2	7.503	99.5	0.083	72.0	0.422	–44.2
1.0	0.227	–70.7	6.894	96.2	0.090	72.4	0.395	–45.1
1.1	0.208	–75.4	6.345	93.5	0.097	72.6	0.373	–46.0
1.2	0.193	–77.1	5.896	90.7	0.105	72.9	0.354	–46.9
1.3	0.180	–81.9	5.515	88.2	0.113	73.0	0.336	–47.9
1.4	0.166	–84.9	5.163	85.7	0.120	73.0	0.319	–49.2
1.5	0.156	–90.3	4.851	83.6	0.129	73.1	0.305	–50.5
1.6	0.145	–94.4	4.605	81.3	0.137	73.0	0.292	–51.8
1.7	0.136	–99.1	4.346	79.3	0.145	73.0	0.279	–53.2
1.8	0.135	–107.3	4.147	77.1	0.153	72.9	0.267	–54.7
1.9	0.131	–114.2	3.949	75.0	0.161	72.4	0.255	–56.6
2.0	0.131	–122.6	3.791	72.8	0.170	72.1	0.243	–58.5
2.1	0.133	–130.5	3.643	70.8	0.177	71.8	0.230	–60.3
2.2	0.132	–144.7	3.438	68.7	0.181	71.4	0.213	–59.9
2.3	0.092	–140.5	3.244	69.0	0.190	74.2	0.236	–58.4
2.4	0.114	–137.0	3.227	67.5	0.205	73.2	0.231	–65.9
2.5	0.128	–139.5	3.144	65.7	0.214	72.3	0.219	–70.6
2.6	0.138	–143.9	3.051	63.5	0.223	71.6	0.212	–74.6
2.7	0.143	–147.4	2.972	62.2	0.232	71.1	0.206	–78.8
2.8	0.145	–149.6	2.875	60.6	0.241	70.5	0.200	–82.2
2.9	0.147	–153.2	2.805	58.9	0.250	69.9	0.194	–85.4
3.0	0.151	–160.6	2.724	57.6	0.260	69.4	0.188	–89.6
4.0	0.266	175.6	2.197	42.4	0.359	62.6	0.212	–140.3
5.0	0.408	156.5	1.819	27.6	0.446	54.2	0.310	–175.4
6.0	0.454	146.2	1.603	17.9	0.525	46.2	0.397	166.1
7.0	0.552	136.5	1.404	4.1	0.598	36.5	0.505	149.5
8.0	0.621	127.1	1.249	–0.9	0.652	29.2	0.566	138.5

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.537	–21.6	26.333	157.0	0.011	81.8	0.896	–14.8
0.2	0.449	–33.4	22.331	139.6	0.024	76.8	0.778	–26.0
0.3	0.377	–43.2	18.329	127.3	0.033	75.8	0.665	–32.7
0.4	0.318	–50.7	15.323	118.0	0.042	75.0	0.575	–36.4
0.5	0.267	–55.3	12.985	111.4	0.050	75.4	0.509	–38.2
0.6	0.227	–60.2	11.175	105.8	0.058	75.6	0.457	–39.1
0.7	0.198	–61.9	9.790	101.8	0.066	75.8	0.418	–39.6
0.8	0.177	–66.1	8.715	98.5	0.073	76.2	0.389	–40.0
0.9	0.158	–68.3	7.883	95.0	0.082	76.4	0.365	–40.3
1.0	0.140	–72.5	7.197	92.2	0.090	76.7	0.345	–40.8
1.1	0.129	–74.6	6.601	89.8	0.098	76.8	0.328	–41.4
1.2	0.122	–79.8	6.108	87.3	0.106	76.6	0.313	–42.1
1.3	0.114	–85.9	5.686	85.3	0.115	76.3	0.299	–42.9
1.4	0.109	–90.2	5.328	83.0	0.124	76.1	0.285	–44.0
1.5	0.099	–95.8	4.999	81.0	0.132	76.0	0.274	–45.4
1.6	0.096	–102.1	4.726	78.8	0.141	75.6	0.263	–46.6
1.7	0.092	–110.5	4.481	76.9	0.150	75.3	0.252	–47.9
1.8	0.090	–119.9	4.260	75.3	0.159	74.9	0.241	–49.5
1.9	0.093	–127.0	4.053	73.2	0.167	74.2	0.231	–51.3
2.0	0.100	–141.9	3.882	71.2	0.177	73.7	0.220	–53.3
2.1	0.108	–147.0	3.733	69.5	0.184	73.2	0.208	–54.7
2.2	0.115	–162.0	3.520	67.3	0.189	72.5	0.192	–53.7
2.3	0.078	–163.8	3.317	67.8	0.198	75.0	0.218	–53.1
2.4	0.094	–153.4	3.299	66.4	0.213	73.9	0.211	–61.2
2.5	0.108	–155.8	3.214	64.7	0.223	72.8	0.198	–66.2
2.6	0.117	–156.7	3.117	62.9	0.232	71.9	0.191	–70.3
2.7	0.128	–160.3	3.032	61.5	0.241	71.3	0.184	–74.8
2.8	0.132	–163.9	2.937	59.9	0.250	70.6	0.178	–78.2
2.9	0.135	–166.9	2.871	58.3	0.260	69.8	0.173	–81.9
3.0	0.142	–172.7	2.791	57.1	0.269	69.2	0.166	–86.4
4.0	0.265	169.8	2.248	42.7	0.367	61.6	0.188	–141.7
5.0	0.411	153.5	1.860	28.6	0.451	53.1	0.286	–177.2
6.0	0.451	143.3	1.655	18.9	0.524	45.2	0.371	165.3
7.0	0.548	135.1	1.455	5.5	0.595	35.9	0.478	149.6
8.0	0.618	125.7	1.306	0.1	0.649	28.8	0.541	139.3

NOISE PARAMETERS

V_{CE} = 2 V, I_C = 3 mA

Frequency	$NF_{min.}$	G_a	Γopt		Rn/50
(GHz)	(dB)	(dB)	MAG.	ANG. (deg.)	
0.8	0.80	18.0	0.39	21.3	0.22
1.0	0.83	16.2	0.38	27.2	0.21
1.5	0.90	13.1	0.33	45.8	0.19
1.8	0.95	11.8	0.29	59.6	0.17
2.0	0.98	11.0	0.27	70.1	0.16
2.5	1.05	9.5	0.22	101.2	0.12

V_{CE} = 2 V, I_C = 5 mA

Frequency	$NF_{min.}$	G_a	Γopt		Rn/50
(GHz)	(dB)	(dB)	MAG.	ANG. (deg.)	
0.8	0.86	18.7	0.24	19.1	0.18
1.0	0.89	16.9	0.24	24.6	0.18
1.5	0.95	13.6	0.19	42.7	0.16
1.8	0.99	12.3	0.15	59.2	0.15
2.0	1.02	11.5	0.13	73.5	0.14
2.5	1.09	9.9	0.11	124.3	0.12

V_{CE} = 2 V, I_C = 7 mA

Frequency	$NF_{min.}$	G_a	Γopt		Rn/50
(GHz)	(dB)	(dB)	MAG.	ANG. (deg.)	
0.8	0.99	19.0	0.16	19.0	0.17
1.0	1.01	17.1	0.15	19.0	0.17
1.5	1.07	13.9	0.10	42.6	0.16
1.8	1.10	12.5	0.07	70.2	0.14
2.0	1.12	11.7	0.06	93.3	0.14
2.5	1.17	10.1	0.07	163.7	0.12

V_{CE} = 2 V, I_C = 10 mA

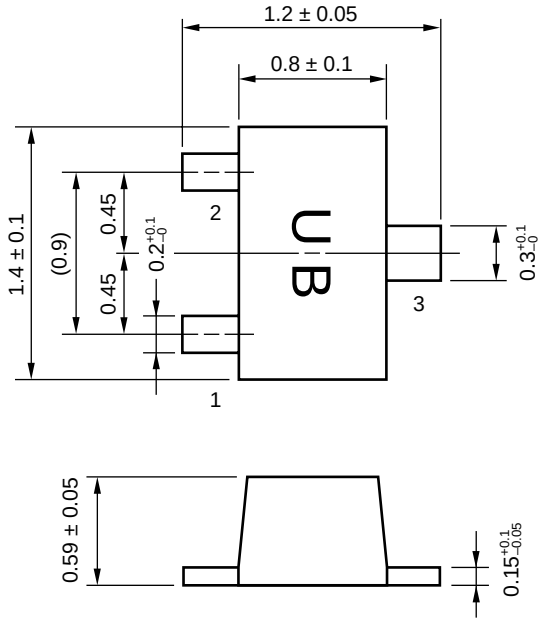
Frequency (GHz)	$NF_{min.}$ (dB)	G_a (dB)	Γopt		Rn/50
			MAG.	ANG. (deg.)	
0.8	1.16	19.1	0.06	–93.2	0.15
1.0	1.18	17.4	0.03	14.2	0.16
1.5	1.23	14.2	0.02	–2.5	0.16
1.8	1.27	12.6	0.04	179.0	0.14
2.0	1.29	11.7	0.06	–102.0	0.15
2.5	1.34	10.2	0.12	–161.8	0.13

V_{CE} = 2 V, I_C = 20 mA

Frequency (GHz)	$NF_{min.}$ (dB)	G_a (dB)	Γopt		Rn/50
			MAG.	ANG. (deg.)	
0.8	1.59	19.4	0.16	–151.7	0.15
1.0	1.62	17.5	0.16	–148.3	0.15
1.5	1.67	14.2	0.19	–138.8	0.16
1.8	1.70	12.8	0.22	–133.6	0.16
2.0	1.73	11.9	0.24	–130.9	0.16
2.5	1.78	10.2	0.28	–128.1	0.17

PACKAGE DIMENSIONS

FLAT-LEAD 3 PIN THIN-TYPE ULTRA SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

[MEMO]

[MEMO]

[MEMO]

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