PRELIMINARY DATA SHEET

NEC

NPN SILICON RF TRANSISTOR
2SC5606

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

FEATURES

- Suitable for high-frequency oscillation
- f_T = 25 GHz technology adopted
- 3-pin ultra super minimold

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5606	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5606-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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The mark ★ shows major revised points.

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	–	–	200	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0 mA	–	–	200	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	–	21	–	GHz
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	10	12.5	–	dB
Noise Figure	NF	V_{CE} = 2 V, I_C = 5 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.2	1.5	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 2 V, I_E = 0 mA, f = 1 MHz	–	0.21	0.3	pF
Maximum Available Gain	MAG. Note 3	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	–	14	–	dB
Maximum Stable Power Gain	MSG. Note 4	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	–	15	–	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. = $\left|\frac{S_{21}}{S_{12}}\right| (k - \sqrt{(k^2 - 1)})$

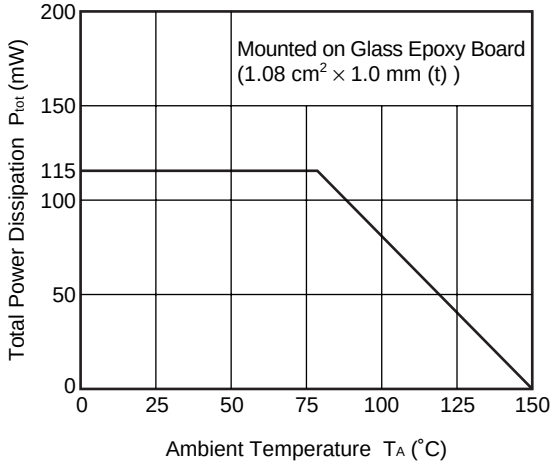
4. MSG. = $\left|\frac{S_{21}}{S_{12}}\right|$

h_{FE} CLASSIFICATION

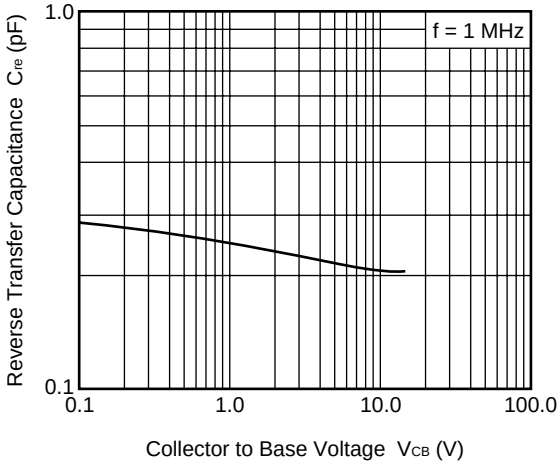
Rank	FB
Marking	UA
h_{FE}	50 to 100

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

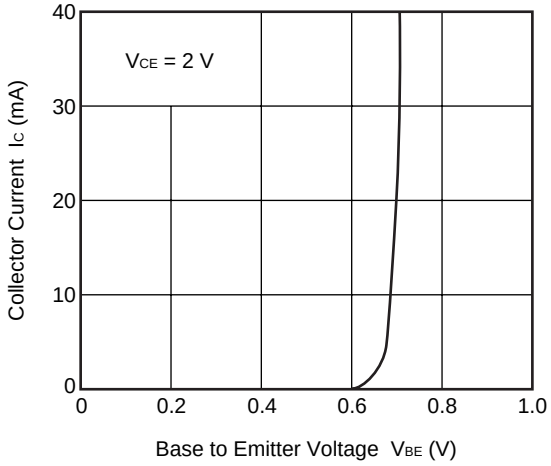
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



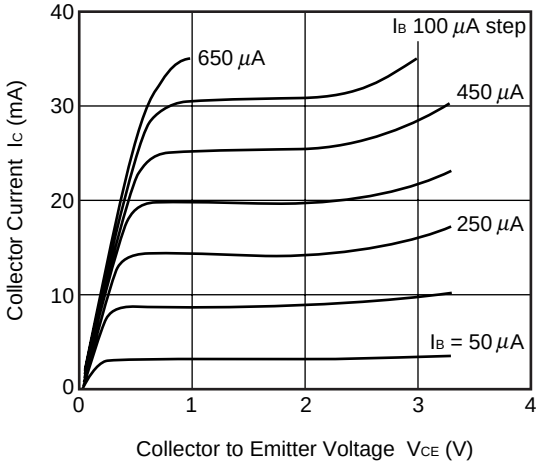
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



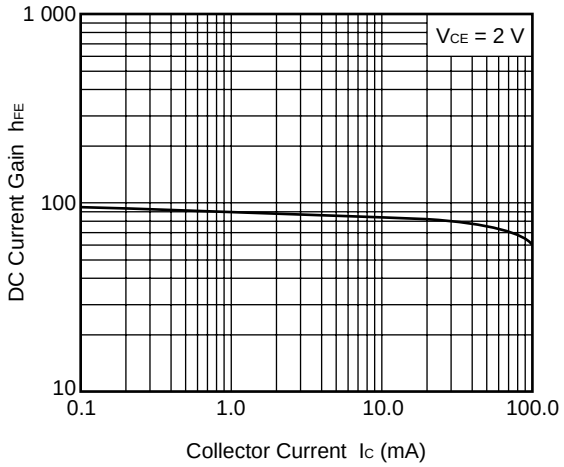
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



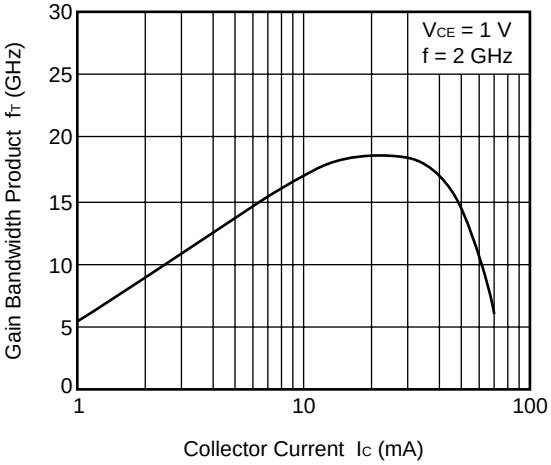
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



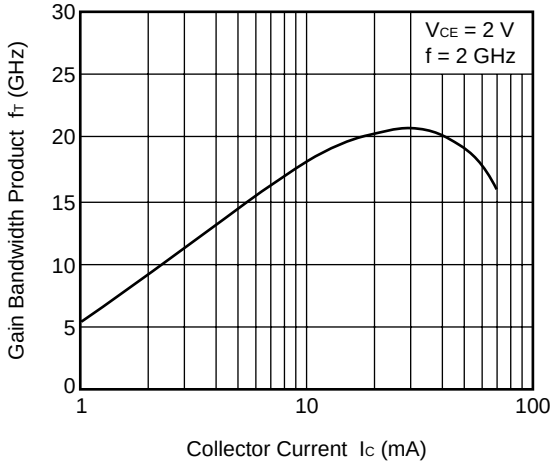
DC CURRENT GAIN vs. COLLECTOR CURRENT



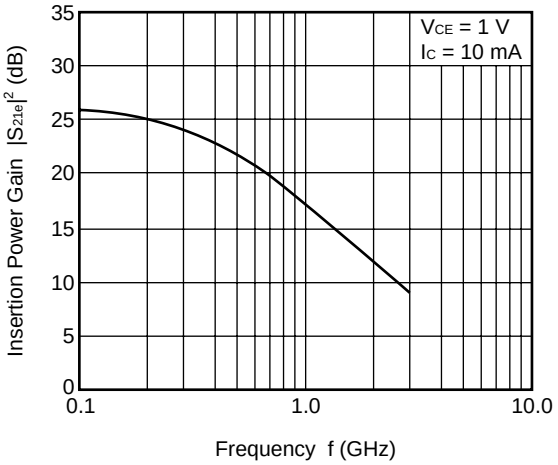
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



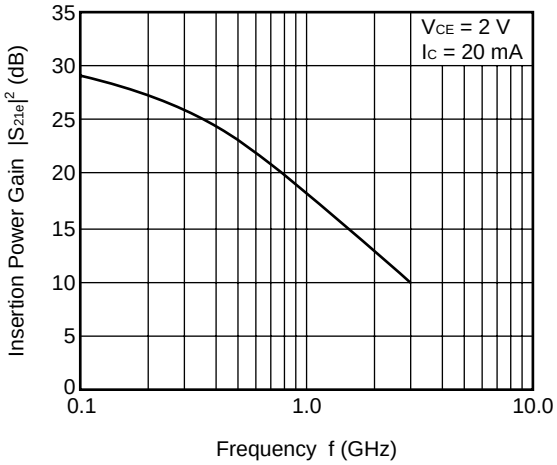
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



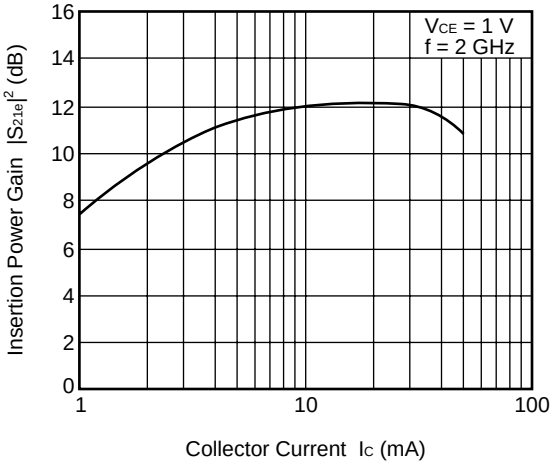
INSERTION POWER GAIN vs. FREQUENCY



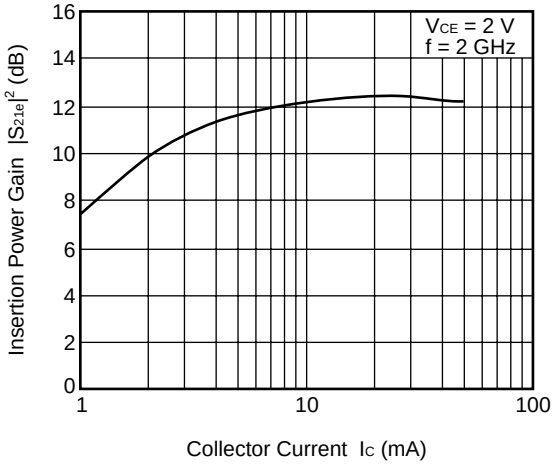
INSERTION POWER GAIN vs. FREQUENCY



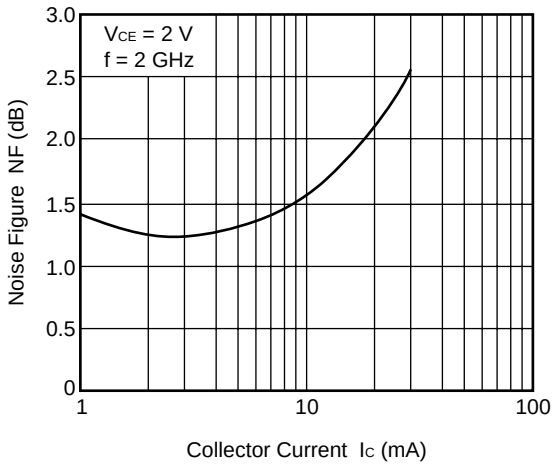
INSERTION POWER GAIN vs. COLLECTOR CURRENT



INSERTION POWER GAIN vs. COLLECTOR CURRENT



NOISE FIGURE vs.
COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

V_{CE} = 3 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.938	–7.9	3.872	174.6	0.010	121.9	0.996	–3.2
200	0.894	–11.5	3.499	166.9	0.019	53.1	0.976	–8.3
300	0.871	–17.9	3.458	162.4	0.041	81.7	0.958	–11.3
400	0.881	–22.6	3.292	156.6	0.049	78.6	0.918	–13.4
500	0.855	–29.1	3.270	151.8	0.054	73.4	0.888	–15.6
600	0.837	–34.1	3.189	147.3	0.071	67.7	0.887	–18.2
700	0.825	–40.0	3.106	142.4	0.078	58.5	0.884	–20.7
800	0.789	–44.5	3.023	137.3	0.078	62.0	0.852	–22.5
900	0.768	–48.9	2.956	134.2	0.086	53.0	0.832	–25.6
1000	0.745	–54.0	2.895	129.4	0.098	56.8	0.816	–27.0
1100	0.726	–59.4	2.827	124.9	0.105	59.1	0.790	–28.8
1200	0.699	–63.1	2.773	121.8	0.109	55.4	0.777	–30.8
1300	0.673	–67.8	2.705	117.8	0.114	51.3	0.765	–31.7
1400	0.652	–72.3	2.630	113.7	0.125	51.9	0.747	–33.0
1500	0.622	–76.6	2.555	110.5	0.123	49.8	0.723	–34.3
1600	0.602	–80.9	2.519	106.5	0.124	49.8	0.714	–36.0
1700	0.568	–86.7	2.455	103.3	0.130	47.1	0.687	–37.6
1800	0.542	–90.5	2.367	100.4	0.128	46.5	0.676	–37.8
1900	0.523	–96.0	2.368	97.2	0.136	46.4	0.656	–39.1
2000	0.502	–100.9	2.334	93.2	0.137	44.3	0.646	–40.1
2100	0.477	–106.3	2.268	89.6	0.142	44.2	0.632	–41.7
2200	0.455	–112.8	2.217	86.6	0.143	44.2	0.616	–41.6
2300	0.438	–118.0	2.178	83.9	0.151	45.7	0.602	–43.3
2400	0.412	–123.2	2.154	80.0	0.158	44.7	0.586	–44.4
2500	0.401	–130.9	2.122	77.5	0.157	43.6	0.571	–46.2
2600	0.390	–137.7	2.058	74.4	0.159	42.9	0.554	–46.8
2700	0.375	–143.1	2.007	71.2	0.161	41.4	0.536	–47.9
2800	0.372	–151.4	2.017	68.5	0.167	44.3	0.530	–48.9
2900	0.361	–159.1	1.952	66.2	0.162	43.3	0.507	–49.6
3000	0.365	–166.1	1.927	62.4	0.167	43.7	0.488	–51.0

V_{CE} = 3 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.842	–9.3	9.149	170.1	0.024	38.9	0.990	–7.2
200	0.808	–17.2	8.180	161.7	0.027	36.6	0.951	–11.0
300	0.766	–25.1	8.015	154.8	0.040	71.0	0.903	–15.8
400	0.731	–30.1	7.427	146.9	0.044	69.5	0.853	–19.7
500	0.688	–38.6	7.174	140.4	0.043	76.1	0.811	–21.9
600	0.653	–44.3	6.752	135.2	0.054	64.8	0.789	–25.0
700	0.618	–51.0	6.404	128.7	0.062	66.1	0.766	–27.7
800	0.584	–55.0	6.103	124.1	0.071	61.0	0.734	–29.0
900	0.550	–61.0	5.845	119.1	0.073	52.8	0.685	–32.5
1000	0.514	–65.1	5.453	115.3	0.080	62.1	0.681	–33.2
1100	0.479	–70.2	5.197	110.6	0.088	60.6	0.638	–34.0
1200	0.442	–72.7	4.944	107.5	0.090	57.9	0.612	–34.6
1300	0.418	–76.7	4.713	103.9	0.090	58.9	0.599	–36.4
1400	0.386	–80.6	4.497	100.0	0.104	58.9	0.582	–37.1
1500	0.359	–84.7	4.241	97.3	0.106	55.3	0.561	–37.9
1600	0.338	–88.0	4.091	93.8	0.107	58.4	0.548	–38.5
1700	0.310	–93.1	3.946	91.1	0.113	57.4	0.534	–39.4
1800	0.287	–95.5	3.727	88.4	0.114	56.0	0.524	–38.8
1900	0.261	–102.1	3.649	85.9	0.124	56.3	0.504	–40.6
2000	0.243	–106.8	3.524	82.4	0.127	53.9	0.493	–40.7
2100	0.224	–110.0	3.371	80.2	0.137	56.3	0.481	–41.6
2200	0.211	–116.8	3.257	77.9	0.142	54.1	0.466	–41.8
2300	0.194	–123.0	3.178	75.0	0.143	55.2	0.456	–42.8
2400	0.177	–129.9	3.092	72.1	0.158	56.7	0.447	–43.8
2500	0.168	–135.7	2.991	70.4	0.160	53.5	0.438	–45.5
2600	0.180	–143.5	2.904	68.7	0.166	52.2	0.424	–46.9
2700	0.173	–154.5	2.829	65.0	0.168	52.4	0.399	–47.8
2800	0.179	–167.1	2.815	63.5	0.169	52.8	0.391	–49.1
2900	0.168	–178.0	2.718	61.1	0.175	52.7	0.370	–48.5
3000	0.182	174.3	2.635	58.3	0.185	50.2	0.358	–50.2

V_{CE} = 3 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.774	–15.1	13.426	167.1	0.006	–177.2	0.957	–8.5
200	0.725	–20.9	11.729	157.4	0.025	41.0	0.911	–15.1
300	0.670	–29.3	11.161	148.8	0.036	76.9	0.865	–20.2
400	0.618	–36.0	10.162	139.9	0.048	77.3	0.796	–23.0
500	0.579	–43.0	9.497	133.4	0.045	70.8	0.754	–25.2
600	0.518	–49.2	8.711	127.0	0.051	75.4	0.719	–28.2
700	0.491	–54.8	8.150	121.3	0.059	64.2	0.687	–30.4
800	0.445	–58.5	7.525	115.7	0.060	65.0	0.639	–31.1
900	0.408	–64.4	6.989	111.6	0.065	59.3	0.613	–32.3
1000	0.379	–66.6	6.548	107.7	0.080	63.7	0.591	–34.3
1100	0.352	–70.3	6.108	103.6	0.085	66.7	0.556	–35.0
1200	0.319	–72.9	5.794	100.4	0.093	62.9	0.543	–35.4
1300	0.297	–76.6	5.459	97.2	0.093	65.6	0.530	–35.6
1400	0.274	–78.4	5.182	93.6	0.105	66.0	0.511	–36.4
1500	0.248	–81.5	4.892	91.2	0.102	62.3	0.499	–36.3
1600	0.231	–84.3	4.645	88.1	0.110	64.6	0.491	–37.1
1700	0.208	–88.1	4.446	85.4	0.116	63.2	0.477	–38.1
1800	0.188	–91.3	4.217	82.7	0.117	63.1	0.463	–38.0
1900	0.168	–97.0	4.095	81.2	0.124	59.8	0.453	–38.4
2000	0.152	–99.5	3.920	78.0	0.136	58.5	0.441	–39.2
2100	0.140	–103.0	3.797	76.0	0.138	60.7	0.425	–39.7
2200	0.122	–112.9	3.601	74.2	0.148	58.1	0.416	–40.4
2300	0.106	–118.8	3.504	71.4	0.151	58.8	0.405	–41.0
2400	0.091	–125.5	3.404	68.7	0.160	59.1	0.395	–41.1
2500	0.087	–142.5	3.283	67.1	0.166	56.8	0.382	–43.8
2600	0.084	–157.0	3.157	65.1	0.174	57.1	0.371	–44.4
2700	0.074	–166.8	3.046	61.9	0.182	54.6	0.351	–44.1
2800	0.090	179.9	3.015	60.6	0.183	57.2	0.346	–45.7
2900	0.099	166.2	2.902	59.3	0.187	56.1	0.327	–44.6
3000	0.107	158.2	2.810	56.4	0.193	54.1	0.312	–46.3

V_{CE} = 5 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.840	–7.0	3.680	174.5	0.020	–166.8	0.975	–4.4
200	0.859	–11.8	3.333	167.8	0.026	30.5	0.970	–7.7
300	0.808	–16.2	3.310	163.1	0.048	75.0	0.946	–10.1
400	0.798	–22.2	3.155	157.2	0.049	73.5	0.920	–13.2
500	0.800	–28.0	3.143	152.8	0.058	73.2	0.901	–14.5
600	0.771	–33.0	3.052	148.0	0.056	69.9	0.895	–17.5
700	0.767	–38.8	3.008	143.7	0.069	61.7	0.880	–20.4
800	0.736	–42.9	2.923	138.9	0.074	63.2	0.852	–21.6
900	0.721	–47.1	2.889	135.5	0.080	55.4	0.831	–23.7
1000	0.697	–51.8	2.788	131.2	0.093	57.3	0.831	–26.0
1100	0.680	–57.8	2.740	126.3	0.095	58.0	0.798	–26.9
1200	0.648	–60.1	2.700	123.8	0.102	54.0	0.780	–29.2
1300	0.630	–65.4	2.629	120.0	0.103	53.7	0.764	–29.2
1400	0.602	–70.2	2.581	115.7	0.112	53.6	0.754	–31.5
1500	0.584	–74.7	2.498	113.0	0.111	51.2	0.737	–31.9
1600	0.565	–79.1	2.467	108.5	0.118	51.7	0.729	–34.1
1700	0.535	–84.5	2.422	105.3	0.120	48.1	0.705	–35.8
1800	0.510	–88.9	2.350	102.1	0.124	47.2	0.695	–36.4
1900	0.483	–94.5	2.342	98.9	0.126	47.7	0.670	–38.0
2000	0.471	–99.3	2.323	95.5	0.136	45.1	0.665	–38.7
2100	0.444	–104.5	2.259	91.8	0.133	46.7	0.650	–40.8
2200	0.425	–111.2	2.198	89.3	0.139	45.4	0.636	–40.6
2300	0.402	–116.8	2.165	85.3	0.141	47.4	0.618	–41.4
2400	0.379	–122.6	2.139	82.0	0.144	46.8	0.605	–42.9
2500	0.365	–130.3	2.092	79.4	0.149	44.1	0.590	–44.5
2600	0.351	–138.5	2.039	76.1	0.151	45.1	0.581	–45.0
2700	0.327	–143.3	1.981	72.8	0.153	42.3	0.559	–45.8
2800	0.322	–151.8	1.984	70.5	0.155	46.6	0.550	–47.1
2900	0.321	–159.6	1.917	67.8	0.161	45.9	0.535	–46.8
3000	0.323	–167.5	1.895	64.0	0.158	45.4	0.513	–49.0

V_{CE} = 5 V, I_C = 3 mA, Z_O = 50 Ω

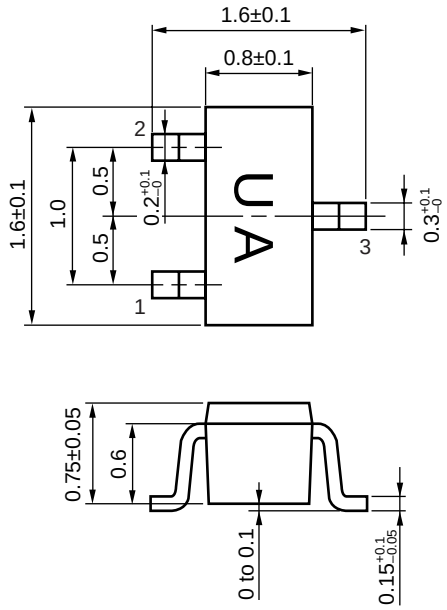
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.869	–12.7	13.849	166.7	0.025	–49.9	0.873	–10.9
200	0.865	–19.3	11.812	157.2	0.040	30.8	0.842	–13.4
300	0.785	–28.6	11.249	148.6	0.031	66.5	0.781	–17.7
400	0.744	–34.8	10.234	140.1	0.051	61.9	0.726	–20.9
500	0.684	–43.5	9.666	133.3	0.053	63.6	0.699	–22.5
600	0.627	–49.2	8.956	126.6	0.053	58.4	0.665	–25.7
700	0.582	–55.1	8.293	120.7	0.061	58.3	0.638	–27.1
800	0.532	–58.9	7.698	115.7	0.061	48.9	0.607	–28.2
900	0.491	–63.4	7.156	111.8	0.067	52.5	0.578	–28.6
1000	0.452	–66.7	6.659	107.6	0.074	60.6	0.554	–30.1
1100	0.410	–71.6	6.219	103.2	0.079	58.9	0.534	–30.4
1200	0.378	–73.4	5.879	100.2	0.086	54.8	0.518	–30.6
1300	0.345	–76.0	5.545	97.0	0.088	57.6	0.509	–31.5
1400	0.326	–77.3	5.236	93.6	0.095	61.4	0.491	–31.2
1500	0.297	–81.3	4.917	91.2	0.093	58.5	0.480	–30.7
1600	0.278	–82.3	4.722	88.1	0.103	61.5	0.480	–32.7
1700	0.249	–86.1	4.476	85.8	0.107	60.6	0.467	–32.2
1800	0.229	–88.0	4.226	83.3	0.110	58.3	0.462	–32.4
1900	0.205	–92.7	4.128	81.6	0.118	58.5	0.451	–33.1
2000	0.187	–95.0	4.031	78.2	0.125	57.4	0.441	–33.7
2100	0.175	–97.9	3.816	76.3	0.137	59.3	0.433	–33.9
2200	0.157	–103.5	3.652	74.8	0.141	57.6	0.430	–34.6
2300	0.136	–108.6	3.538	71.9	0.141	58.3	0.417	–35.0
2400	0.121	–112.0	3.416	69.4	0.154	57.8	0.410	–36.5
2500	0.114	–119.8	3.310	68.4	0.163	55.6	0.402	–37.5
2600	0.117	–127.8	3.195	66.6	0.163	55.4	0.390	–39.9
2700	0.116	–143.7	3.143	63.8	0.166	52.7	0.365	–40.3
2800	0.115	–161.0	3.119	62.0	0.171	54.4	0.357	–40.5
2900	0.110	–175.8	3.009	60.0	0.177	53.5	0.341	–39.6
3000	0.116	174.7	2.907	57.6	0.184	52.6	0.324	–41.5

V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.930	–9.5	9.751	169.6	0.010	–62.7	0.926	–7.1
200	0.923	–16.8	8.571	160.7	0.032	44.7	0.906	–11.5
300	0.865	–23.9	8.239	153.5	0.037	74.8	0.870	–15.2
400	0.835	–31.3	7.706	145.8	0.047	70.1	0.819	–18.7
500	0.798	–37.4	7.390	139.8	0.046	56.3	0.769	–21.1
600	0.751	–43.8	6.954	134.2	0.056	64.6	0.754	–22.9
700	0.706	–50.1	6.506	127.6	0.065	60.6	0.742	–26.1
800	0.660	–54.5	6.228	122.8	0.067	59.0	0.695	–26.7
900	0.624	–59.8	5.913	118.6	0.073	51.6	0.673	–29.5
1000	0.576	–63.4	5.522	114.1	0.083	59.0	0.646	–31.3
1100	0.545	–68.1	5.199	109.6	0.085	60.0	0.620	–30.9
1200	0.504	–71.8	5.006	106.6	0.092	54.2	0.602	–32.0
1300	0.471	–74.9	4.762	103.0	0.088	54.8	0.587	–33.1
1400	0.439	–78.5	4.528	99.2	0.102	56.6	0.573	–33.7
1500	0.408	–82.7	4.286	96.7	0.099	54.3	0.558	–33.5
1600	0.385	–85.6	4.086	92.6	0.110	57.8	0.550	–35.0
1700	0.349	–89.6	3.942	90.4	0.109	53.1	0.530	–35.3
1800	0.326	–93.3	3.755	87.6	0.112	54.4	0.522	–35.6
1900	0.299	–96.9	3.644	84.9	0.124	55.2	0.507	–36.5
2000	0.280	–101.1	3.561	82.3	0.129	54.2	0.502	–37.0
2100	0.257	–105.0	3.391	78.9	0.131	55.6	0.488	–37.0
2200	0.234	–110.7	3.272	77.2	0.139	53.1	0.471	–37.3
2300	0.217	–115.8	3.183	74.3	0.142	53.8	0.468	–38.6
2400	0.196	–119.2	3.086	71.8	0.151	54.3	0.461	–40.1
2500	0.183	–127.2	3.002	70.2	0.159	51.5	0.448	–40.8
2600	0.176	–132.1	2.874	67.9	0.163	52.2	0.438	–42.2
2700	0.176	–137.8	2.809	65.7	0.160	51.5	0.410	–43.0
2800	0.187	–152.3	2.827	63.7	0.165	53.0	0.405	–43.6
2900	0.177	–164.7	2.746	61.3	0.166	53.7	0.383	–42.4
3000	0.177	–173.7	2.663	58.6	0.176	52.4	0.367	–43.8

PACKAGE DIMENSIONS

3 PIN ULTRA SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

[MEMO]

[MEMO]

[MEMO]

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