

NPN EPITAXIAL SILICON TRANSISTOR IN MINI-MOLD PACKAGE
FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low Current Consumption and High Gain
 $|S_{21e}|^2 = 9.0 \text{ dB TYP. @ } V_{CE} = 2 \text{ V, } I_c = 7 \text{ mA, } f = 2 \text{ GHz}$
 $|S_{21e}|^2 = 8.5 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_c = 5 \text{ mA, } f = 2 \text{ GHz}$
- Mini-Mold package
 EIAJ: SC-59

ORDERING INFORMATION

PART NUMBER	QUANTITY	ARRANGEMENT
2SC5177-T1	3 000 units/reel	Embossed tape, 8 mm wide, pin No. 3 (collector) facing the perforations
2SC5177-T2	3 000 units/reel	Embossed tape, 8 mm wide, pins No. 1 (emitter) and No. 2 (base) facing the perforations

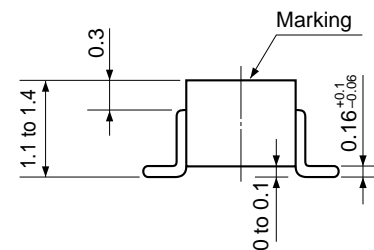
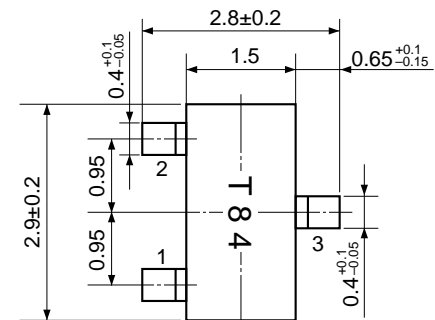
Remark Contact your NEC sales representatives to order samples for evaluation (available in batches of 50).

ABSOLUTE MAXIMUM RATINGS ($T_A = 25 \text{ }^\circ\text{C}$)

Collector to Base Voltage	V_{CBO}	5	V
Collector to Emitter Voltage	V_{CEO}	3	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_c	10	mA
Total Power Dissipation	P_T	30	mW
Junction Temperature	T_j	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

PACKAGE DIMENSIONS

(Units: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

CAUTION; This transistor uses high-frequency technology. Be careful not to allow excessive current to flow through the transistor, including static electricity.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I _{CBO}			100	nA	V _{CB} = 5 V, I _E = 0
Emitter Cutoff Current	I _{EBO}			100	nA	V _{EB} = 1 V, I _C = 0
DC Current Gain	h _{FE}	70		140		V _{CE} = 2 V, I _C = 7 mA* ¹
Insertion Power Gain (1)	S _{21e} ²	7.5	9		dB	V _{CE} = 2 V, I _C = 7 mA, f = 2 GHz
Insertion Power Gain (2)	S _{21e} ²	7	8.5		dB	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz
Noise Figure (1)	NF		1.5	2.0	dB	V _{CE} = 2 V, I _C = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.5	2.0	dB	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	f _T	10	13		GHz	V _{CE} = 2 V, I _C = 7 mA, f = 2 GHz
Gain Bandwidth Product (2)	f _T	8.5	12		GHz	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz
Feedback Capacitance	C _{re}		0.5	0.6	pF	V _{CB} = 2 V, I _E = 0 mA, f = 1 MHz* ²

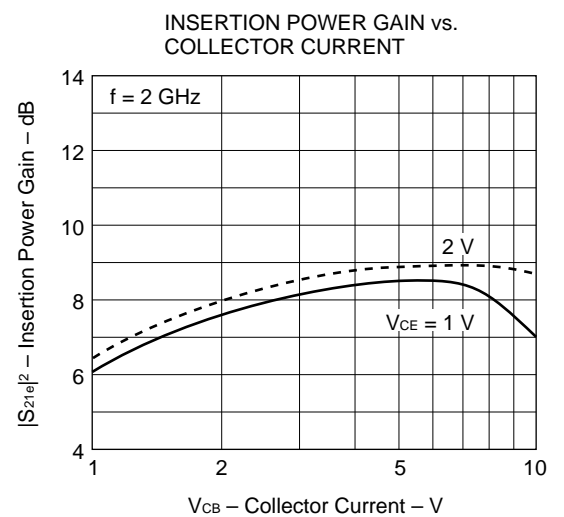
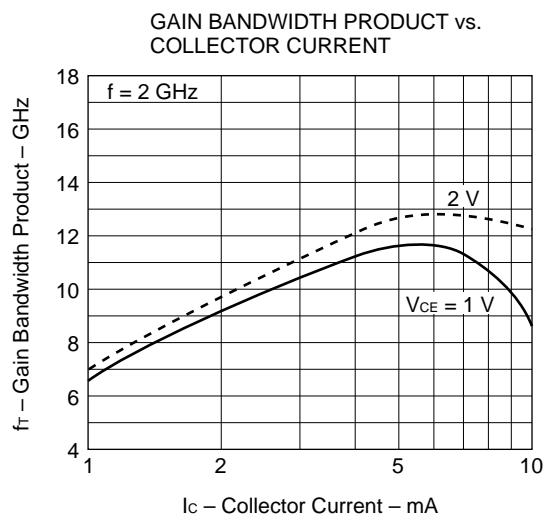
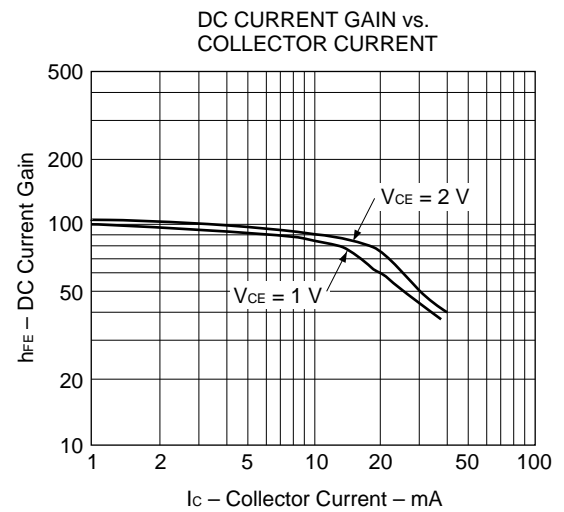
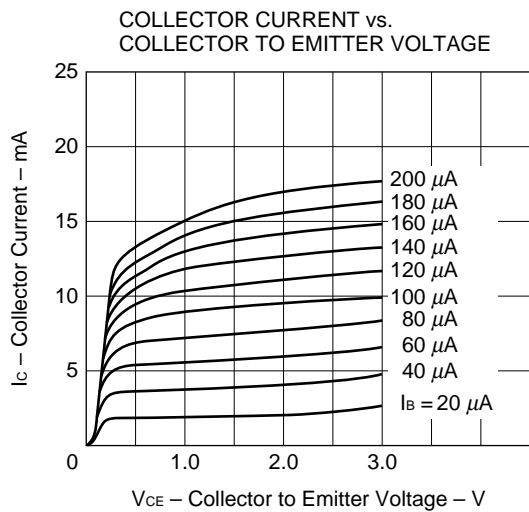
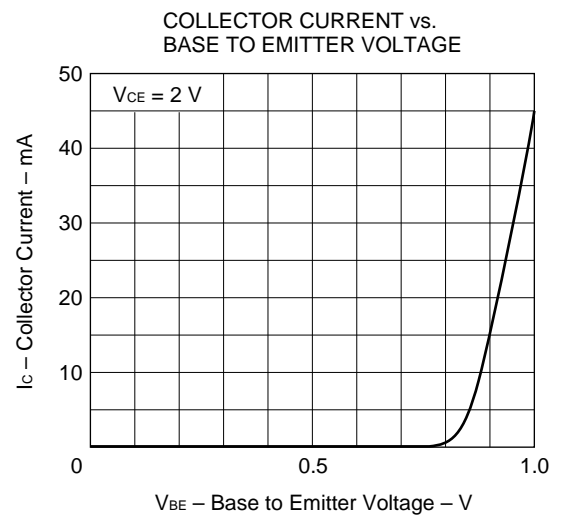
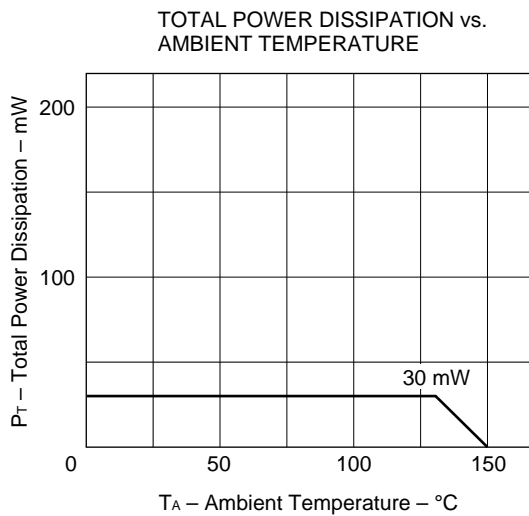
*1: Measured with pulses: Pulse width ≤ 350 μs, duty cycle ≤ 2 %, pulsed.

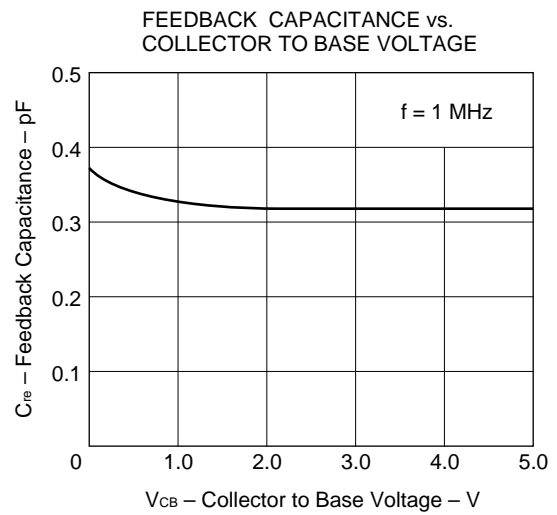
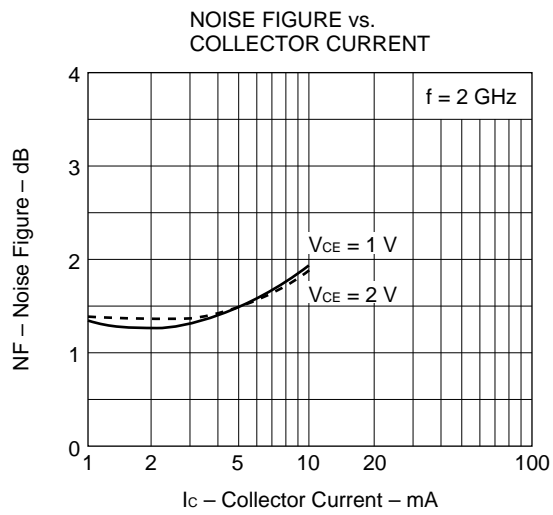
*2: Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

h_{FE} Class

Class	FB
Marking	T84
h _{FE}	70 to 140

CHARACTERISTICS CURVES (T_A = 25 °C)





S-PARAMETER

V_{CE} = 1 V, I_c = 1 mA, Z_o = 50 Ω

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.967	-7.9	2.211	173.0	0.047	87.2	0.999	-6.2
400.00	0.966	-16.2	2.243	165.3	0.085	82.9	1.000	-12.6
600.00	0.954	-24.5	2.306	157.4	0.120	72.1	0.980	-19.4
800.00	0.924	-33.4	2.399	147.7	0.158	65.6	0.962	-27.4
1000.00	0.392	-43.7	2.444	137.3	0.193	59.3	0.929	-34.2
1200.00	0.312	-53.9	2.446	126.1	0.222	52.8	0.890	-41.0
1400.00	0.756	-62.4	2.389	116.2	0.247	47.4	0.822	-48.2
1600.00	0.673	-71.9	2.251	105.6	0.260	42.2	0.753	-52.8
1800.00	0.590	-79.0	2.210	97.2	0.267	37.4	0.688	-59.5
2000.00	0.543	-87.9	2.085	89.2	0.283	36.0	0.645	-63.9
2200.00	0.460	-92.7	1.978	81.7	0.231	32.8	0.596	-67.5
2400.00	0.410	-101.7	1.917	74.6	0.293	30.6	0.548	-71.3
2600.00	0.347	-105.9	1.860	68.4	0.281	28.6	0.518	-74.7
2800.00	0.277	-115.6	1.740	62.4	0.309	29.9	0.475	-76.9
3000.00	0.224	-127.1	1.725	56.4	0.312	26.6	0.465	-80.4

V_{CE} = 1 V, I_c = 3 mA, Z_o = 50 Ω

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.951	-10.3	3.773	171.8	0.043	85.3	0.993	-8.0
400.00	0.942	-20.9	3.848	163.1	0.081	78.7	0.981	-16.7
600.00	0.918	-32.2	3.961	153.6	0.123	64.6	0.951	-26.1
800.00	0.858	-44.8	4.054	142.0	0.146	58.8	0.904	-35.4
1000.00	0.794	-58.7	4.047	129.6	0.182	54.4	0.844	-45.0
1200.00	0.682	-71.1	3.898	117.2	0.198	49.9	0.762	-52.8
1400.00	0.579	-83.1	3.645	106.5	0.209	44.8	0.672	-59.4
1600.00	0.466	-92.7	3.335	95.7	0.221	43.3	0.586	-63.9
1800.00	0.381	-102.8	3.118	87.5	0.240	41.5	0.518	-69.5
2000.00	0.324	-108.9	2.843	80.0	0.211	41.6	0.471	-70.8
2200.00	0.258	-114.7	2.620	73.4	0.249	40.9	0.426	-72.8
2400.00	0.211	-123.8	2.463	67.3	0.255	40.8	0.398	-73.7
2600.00	0.154	-125.2	2.294	61.9	0.276	39.2	0.367	-75.4
2800.00	0.106	-142.8	2.148	56.8	0.289	41.1	0.336	-77.6
3000.00	0.090	-176.6	2.075	51.3	0.298	36.0	0.313	-79.4

$V_{CE} = 1\text{ V}$, $I_c = 5\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.918	-12.7	5.022	168.4	0.042	89.0	0.977	-10.1
400.00	0.894	-25.1	4.958	156.8	0.086	77.0	0.958	-19.7
600.00	0.839	-38.5	4.883	145.2	0.112	70.4	0.898	-30.0
800.00	0.761	-51.4	4.751	132.9	0.148	59.8	0.831	-39.3
1000.00	0.673	-65.4	4.510	120.6	0.164	54.7	0.746	-48.4
1200.00	0.554	-78.5	4.205	109.2	0.187	46.4	0.668	-55.7
1400.00	0.462	-89.4	3.840	99.5	0.196	45.5	0.585	-61.2
1600.00	0.377	-98.4	3.467	90.0	0.202	48.7	0.507	-64.1
1800.00	0.297	-106.9	3.209	82.7	0.215	46.7	0.457	-67.7
2000.00	0.239	-114.7	2.928	75.9	0.218	42.5	0.418	-69.0
2200.00	0.199	-121.0	2.670	69.9	0.230	47.0	0.383	-71.5
2400.00	0.157	-135.0	2.518	64.1	0.252	45.9	0.354	-72.7
2600.00	0.090	-147.9	2.357	59.5	0.262	41.8	0.310	-73.5
2800.00	0.076	-175.4	2.197	54.3	0.287	42.4	0.288	-79.4
3000.00	0.082	141.5	2.113	49.4	0.312	43.6	0.317	-78.3

$V_{CE} = 1\text{ V}$, $I_c = 7\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.820	-20.3	8.814	155.7	0.042	81.2	0.926	-15.3
400.00	0.698	-37.1	7.520	136.2	0.076	72.4	0.814	-27.1
600.00	0.576	-48.6	6.310	121.8	0.097	64.5	0.699	-34.5
800.00	0.463	-57.4	5.368	109.9	0.120	63.5	0.618	-39.9
1000.00	0.380	-66.0	4.606	100.3	0.135	62.2	0.558	-43.5
1200.00	0.299	-73.4	4.049	92.5	0.160	58.3	0.502	-46.4
1400.00	0.255	-77.0	3.575	85.9	0.185	56.5	0.463	-49.6
1600.00	0.207	-83.0	3.193	79.0	0.195	55.5	0.421	-51.0
1800.00	0.165	-88.7	2.942	74.1	0.220	56.4	0.400	-54.4
2000.00	0.131	-95.4	2.692	68.9	0.230	55.1	0.370	-57.1
2200.00	0.087	-98.6	2.474	64.0	0.248	52.1	0.367	-59.5
2400.00	0.074	-101.7	2.316	59.4	0.264	50.7	0.319	-63.8
2600.00	0.029	-119.5	2.220	54.9	0.287	49.1	0.314	-67.5
2800.00	0.030	155.8	2.061	50.7	0.310	45.8	0.285	-70.4
3000.00	0.070	129.1	2.014	46.9	0.337	44.0	0.303	-72.3

$V_{CE} = 2\text{ V}$, $I_c = 1\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.972	-7.7	2.454	171.2	0.036	77.4	0.993	-6.5
400.00	0.947	-15.5	2.452	162.4	0.079	79.0	0.991	-12.6
600.00	0.937	-23.1	2.454	154.1	0.116	74.3	0.962	-19.1
800.00	0.897	-31.7	2.469	144.6	0.147	65.5	0.936	-25.4
1000.00	0.863	-40.4	2.479	135.1	0.173	60.9	0.913	-32.3
1200.00	0.797	-49.9	2.430	125.2	0.202	55.8	0.871	-38.6
1400.00	0.741	-57.6	2.352	116.2	0.227	50.6	0.811	-43.9
1600.00	0.669	-64.0	2.245	106.6	0.242	47.8	0.751	-49.2
1800.00	0.601	-72.1	2.221	99.1	0.260	45.7	0.713	-53.7
2000.00	0.543	-79.5	2.104	91.6	0.263	41.7	0.664	-37.1
2200.00	0.488	-85.9	1.997	84.4	0.285	36.7	0.631	-62.3
2400.00	0.432	-92.6	1.955	77.4	0.274	35.1	0.577	-67.1
2600.00	0.361	-96.4	1.868	71.6	0.281	34.7	0.553	-68.5
2800.00	0.308	-105.7	1.756	65.8	0.296	34.4	0.528	-70.2
3000.00	0.252	-114.0	1.766	60.0	0.318	31.0	0.507	-74.8

$V_{CE} = 2\text{ V}$, $I_c = 3\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.942	-11.2	4.553	168.8	0.037	77.6	0.990	-8.3
400.00	0.907	-21.4	4.474	157.7	0.068	72.3	0.957	-16.8
600.00	0.866	-31.7	4.378	147.2	0.112	69.4	0.922	-25.2
800.00	0.793	-42.7	4.286	136.1	0.139	61.5	0.863	-33.0
1000.00	0.728	-52.8	4.104	125.0	0.158	58.4	0.805	-40.2
1200.00	0.631	-63.2	3.878	114.6	0.178	54.2	0.737	-47.1
1400.00	0.546	-71.4	3.604	105.4	0.194	52.0	0.673	-42.3
1600.00	0.461	-79.9	3.310	96.3	0.214	48.1	0.597	-55.3
1800.00	0.380	-86.3	3.119	88.7	0.214	46.2	0.537	-60.7
2000.00	0.324	-91.6	2.889	82.2	0.237	45.4	0.518	-62.5
2200.00	0.269	-96.8	2.651	75.7	0.237	45.1	0.481	-65.5
2400.00	0.224	-102.1	2.506	70.0	0.249	44.3	0.435	-67.0
2600.00	0.167	-103.3	2.377	64.6	0.271	42.8	0.398	-70.2
2800.00	0.114	-113.2	2.212	59.6	0.249	40.3	0.382	-71.4
3000.00	0.089	-137.8	2.183	54.2	0.295	37.0	0.367	-71.3

$V_{CE} = 2\text{ V}$, $I_c = 5\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.900	-13.9	6.328	164.5	0.034	76.0	0.971	-10.9
400.00	0.845	-26.5	5.951	150.3	0.071	77.4	0.928	-20.4
600.00	0.755	-38.0	5.522	137.7	0.104	71.5	0.847	-27.9
800.00	0.671	-48.1	5.092	126.0	0.131	60.9	0.786	-36.3
1000.00	0.580	-57.1	4.654	115.2	0.147	58.7	0.707	-42.7
1200.00	0.501	-66.9	4.234	105.6	0.159	55.4	0.644	-46.6
1400.00	0.418	-73.5	3.826	97.8	0.172	55.4	0.575	-51.2
1600.00	0.347	-79.9	3.476	89.9	0.189	54.7	0.528	-53.3
1800.00	0.289	-85.8	3.230	83.5	0.215	52.0	0.488	-57.2
2000.00	0.253	-89.0	2.979	77.9	0.222	50.3	0.438	-61.4
2200.00	0.200	-98.0	2.740	72.1	0.226	51.4	0.432	-59.5
2400.00	0.159	-92.3	2.586	66.7	0.255	48.4	0.393	-63.7
2600.00	0.121	-94.3	2.450	62.0	0.269	44.1	0.365	-64.5
2800.00	0.063	-119.9	2.277	56.8	0.293	45.8	0.345	-67.6
3000.00	0.026	-159.8	2.219	52.6	0.299	43.6	0.345	-69.4

$V_{CE} = 2\text{ V}$, $I_c = 7\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.815	-19.5	9.516	155.6	0.035	78.4	0.934	-14.8
400.00	0.696	-34.3	8.064	136.1	0.064	70.8	0.828	-25.2
600.00	0.575	-44.5	6.741	121.9	0.082	63.5	0.709	-32.0
800.00	0.463	-50.8	5.714	110.5	0.111	63.6	0.641	-36.7
1000.00	0.391	-57.4	4.896	101.2	0.130	63.3	0.576	-39.8
1200.00	0.310	-62.1	4.297	93.6	0.151	61.9	0.524	-42.0
1400.00	0.270	-65.4	3.798	87.3	0.172	61.0	0.487	-43.6
1600.00	0.228	-65.7	3.392	81.0	0.193	59.4	0.464	-46.2
1800.00	0.188	-71.0	3.107	76.1	0.213	56.1	0.435	-48.7
2000.00	0.172	-68.4	2.852	71.0	0.227	56.6	0.415	-52.7
2200.00	0.139	-69.7	2.631	66.8	0.234	54.3	0.400	-52.3
2400.00	0.107	-71.3	2.485	62.0	0.266	52.9	0.365	-58.1
2600.00	0.077	-58.0	2.343	58.0	0.277	50.9	0.368	-59.4
2800.00	0.029	-46.1	2.174	54.0	0.292	50.0	0.327	-64.3
3000.00	0.020	82.9	2.124	50.3	0.315	48.8	0.331	-63.4

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.