2SK3391

Silicon N-Channel MOS FET
UHF Power Amplifier

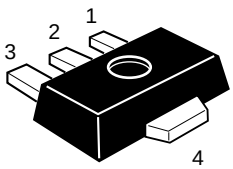
REJ03G0209-0300
Rev.3.00
Nov 08, 2007

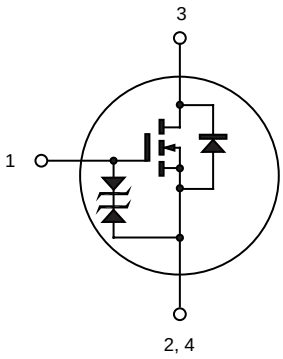
Features

- High power output, High gain, High efficiency
  PG = 18 dB, Pout = 1.6 W, ηadd = 58% min. (f = 836 MHz)
- Compact package capable of surface mounting

Outline

RENESAS Package code: PLZZ0004CA-A
(Package Name : UPAK®)





1. Gate
2. Source
3. Drain
4. Source

Note: Marking is “JX”.

*UPAK is a trademark of Renesas Technology Corp.

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	17	V
Gate to source voltage	V_{GSS}	±10	V
Drain current	I_D	0.3	A
Drain peak current	I_D(pulse) Note1	0.75	A
Channel dissipation	Pch Note2	5	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–45 to +150	°C

Notes: 1. PW < 1sec, Tch < 150°C
2. Value at Tc = 25°C

This device is sensitive to electro static discharge. An adequate careful handling procedure is requested.

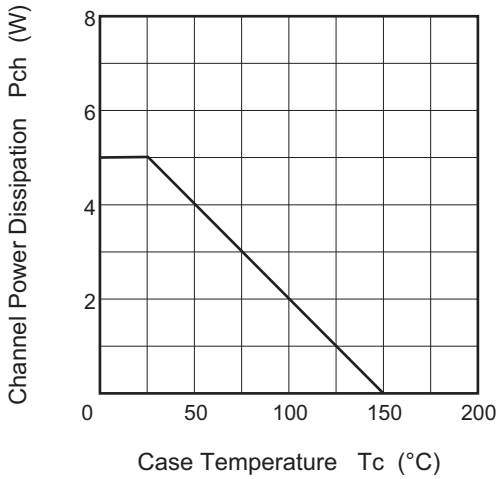
Electrical Characteristics

(Ta = 25°C)

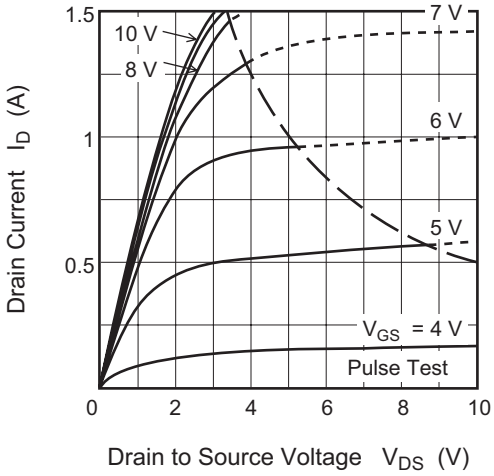
Item	Symbol	Min.	Typ	Max.	Unit	Test Conditions
Zero gate voltage drain current	I_{DSS}	—	—	10	µA	V_{DS} = 13.7 V, V_{GS} = 0
Gate to source leak current	I_{GSS}	—	—	±5	µA	V_{GS} = ±10 V, V_{DS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	2.3	—	3.1	V	V_{DS} = 13.7 V, I_D = 1 mA
Input capacitance	Ciss	—	10	—	pF	V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz
Output capacitance	Coss	—	3.5	—	pF	V_{DS} = 13.7 V, V_{GS} = 0, f = 1 MHz
Output Power	Pout	1.6	—	—	W	V_{DS} = 13.7 V, I_{DQ} = 150 mA
Added Efficiency	ηadd	58	—	—	%	f = 836 MHz, Pin = 25.1 mW

Main Characteristics

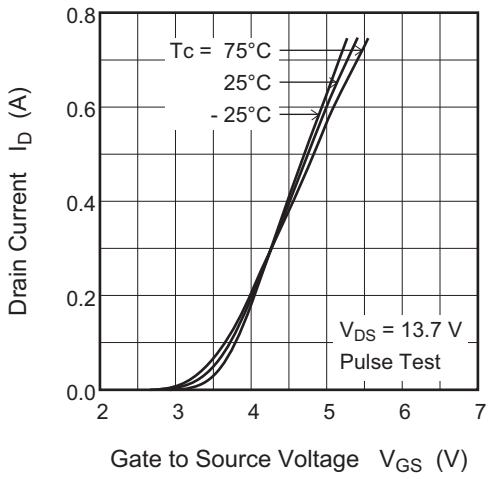
Maximum Channel Power Dissipation Curve



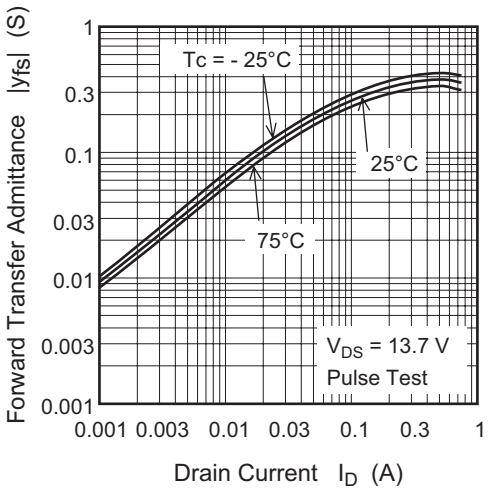
Typical Output Characteristics



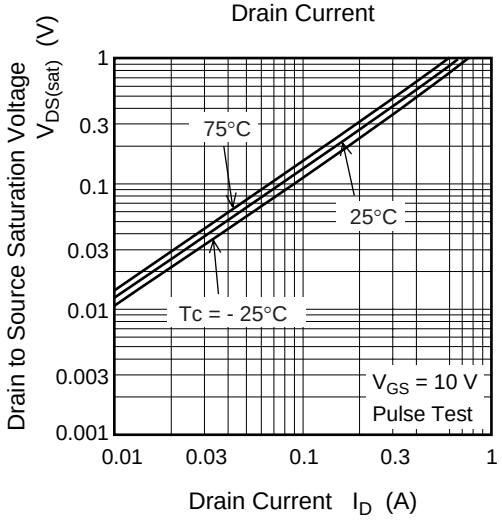
Typical Transfer Characteristics



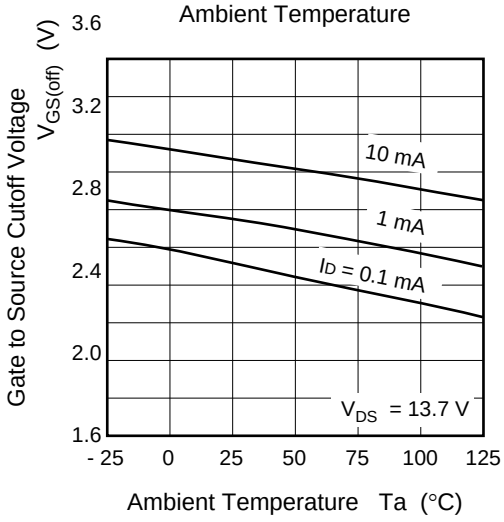
Forward Transfer Admittance vs. Drain Current



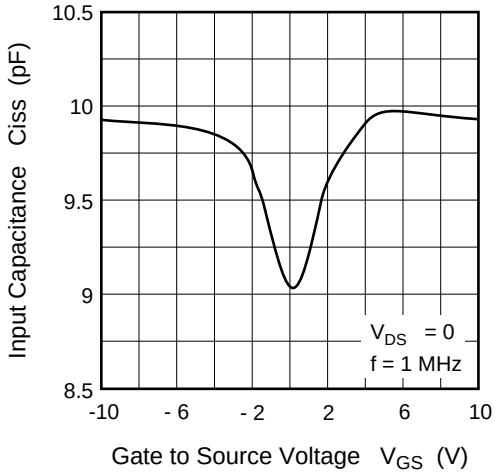
Drain to Source Saturatioin Voltage vs. Drain Current



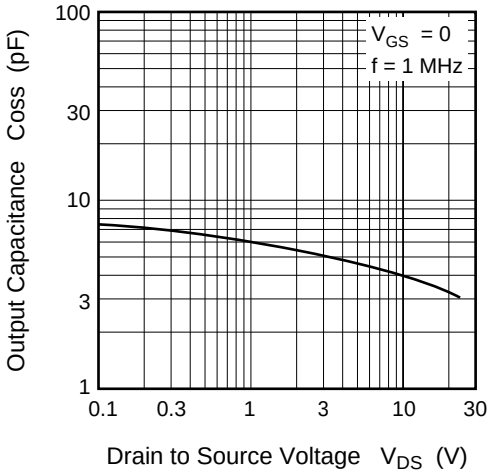
Gate to Source Cutoff Voltage vs. Ambient Temperature



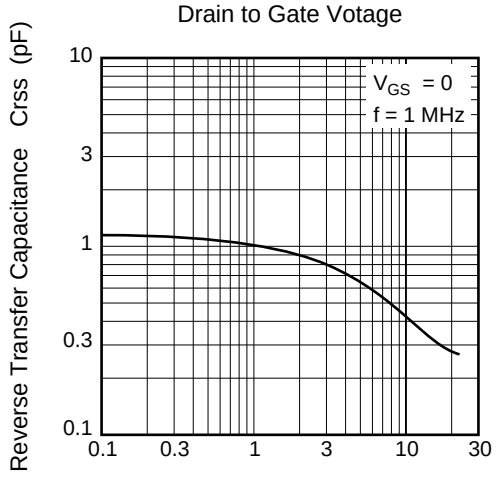
Input Capacitance vs. Gate to Source Voltage



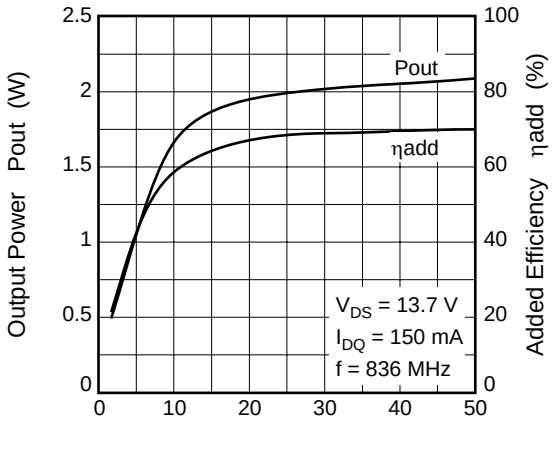
Output Capacitance vs. Drain to Source Voltage



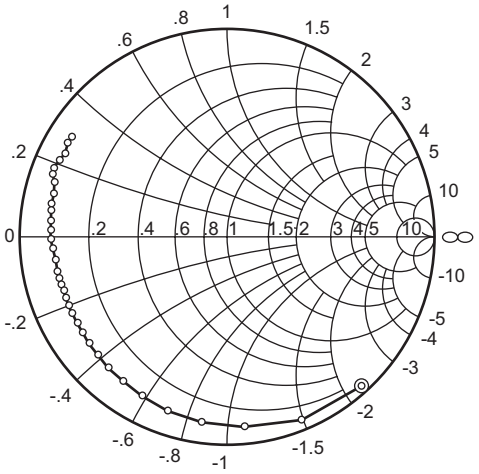
Reverse Transfer Capacitance vs. Drain to Gate Votage



Output Power, Added Efficiency vs. Input Power



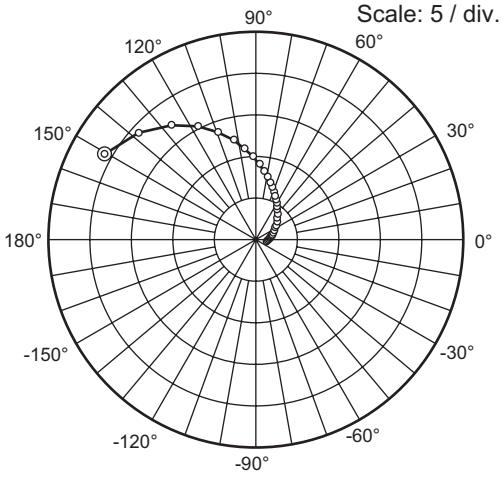
S_{11} Parameter vs. Frequency



Condition: V_{DS} = 13.7 V, I_{DQ} = 150 mA, Zo = 50 Ω
100 to 1000 MHz (50 MHz Step)
1000 to 2500 MHz (100 MHz Step)

S_{21} Parameter vs. Frequency

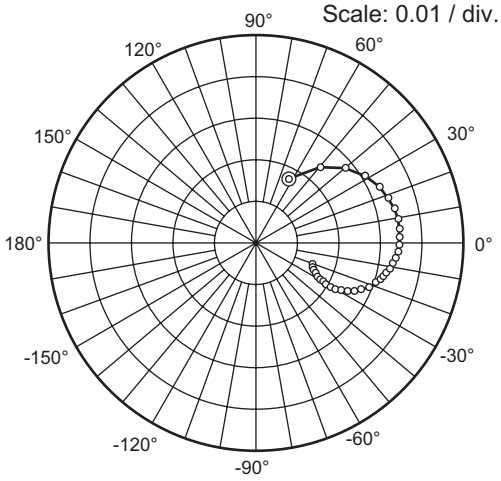
Scale: 5 / div.



Condition: V_{DS} = 13.7 V, I_{DQ} = 150 mA, Zo = 50 Ω
100 to 1000 MHz (50 MHz Step)
1000 to 2500 MHz (100 MHz Step)

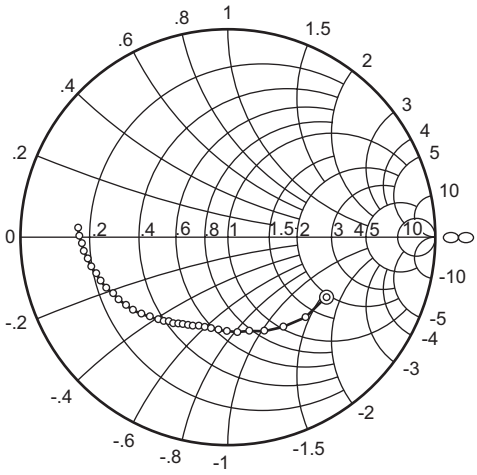
S_{12} Parameter vs. Frequency

Scale: 0.01 / div.



Condition: V_{DS} = 13.7 V, I_{DQ} = 150 mA, Zo = 50 Ω
100 to 1000 MHz (50 MHz Step)
1000 to 2500 MHz (100 MHz Step)

S_{22} Parameter vs. Frequency



Condition: V_{DS} = 13.7 V, I_{DQ} = 150 mA, Zo = 50 Ω
100 to 1000 MHz (50 MHz Step)
1000 to 2500 MHz (100 MHz Step)

S Parameter

(V_{DS} = 4.5 V, I_{DQ} = 150 mA, Zo = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.942	-62.0	12.61	141.7	0.036	52.5	0.426	-76.6
150	0.920	-85.7	11.22	128.5	0.045	38.2	0.455	-99.8
200	0.885	-105.8	10.04	116.4	0.050	28.2	0.473	-115.6
250	0.854	-120.3	9.15	107.5	0.053	20.8	0.484	-126.7
300	0.836	-130.3	8.11	100.8	0.054	15.1	0.503	-134.5
350	0.814	-138.2	7.32	95.3	0.055	10.3	0.509	-140.5
400	0.809	-144.2	6.64	90.6	0.056	6.2	0.517	-145.0
450	0.806	-148.9	6.04	86.7	0.056	2.3	0.520	-148.5
500	0.802	-152.9	5.54	82.9	0.056	-0.7	0.526	-151.5
550	0.796	-156.2	5.10	79.5	0.056	-3.6	0.530	-154.1
600	0.795	-159.2	4.71	76.4	0.055	-6.4	0.535	-156.2
650	0.795	-162.0	4.37	73.2	0.055	-8.8	0.540	-158.1
700	0.795	-164.5	4.06	70.3	0.055	-11.1	0.544	-159.8
750	0.796	-166.8	3.79	67.5	0.054	-13.1	0.550	-161.5
800	0.795	-168.7	3.53	64.6	0.053	-15.4	0.556	-162.9
850	0.796	-170.6	3.33	62.1	0.053	-17.2	0.561	-164.3
900	0.799	-172.6	3.15	59.5	0.052	-19.0	0.567	-165.6
950	0.802	-174.5	2.97	57.0	0.052	-20.7	0.574	-166.7
1000	0.802	-175.9	2.80	54.8	0.051	-22.6	0.580	-168.0
1050	0.802	-177.5	2.65	52.3	0.050	-24.4	0.586	-169.2
1100	0.803	-179.3	2.51	50.1	0.050	-26.0	0.592	-170.4
1150	0.807	179.3	2.39	47.9	0.049	-27.4	0.597	-171.4
1200	0.809	177.6	2.27	45.4	0.048	-28.8	0.602	-172.5
1250	0.813	176.3	2.16	43.1	0.047	-30.2	0.606	-173.8
1300	0.818	175.1	2.06	41.0	0.047	-31.6	0.612	-174.7
1350	0.818	173.9	1.97	38.8	0.046	-33.0	0.617	-175.7
1400	0.820	172.8	1.88	36.7	0.045	-34.1	0.620	-176.7
1450	0.817	171.6	1.80	34.8	0.044	-35.4	0.625	-177.9
1500	0.821	170.1	1.72	32.9	0.043	-36.5	0.630	-178.9
1550	0.825	168.7	1.64	30.9	0.043	-37.7	0.635	179.9
1600	0.830	167.5	1.57	28.9	0.042	-38.9	0.639	178.6
1650	0.832	166.6	1.51	26.9	0.041	-40.0	0.646	177.6
1700	0.833	165.5	1.45	24.9	0.040	-41.0	0.649	176.5
1750	0.831	164.0	1.41	22.9	0.039	-42.1	0.654	175.3
1800	0.833	162.4	1.36	21.0	0.039	-42.7	0.660	174.2
1850	0.836	160.8	1.32	19.5	0.038	-43.6	0.664	173.0
1900	0.842	159.3	1.28	17.9	0.037	-44.3	0.670	171.9
1950	0.854	157.9	1.23	16.4	0.037	-45.5	0.675	170.7
2000	0.869	156.9	1.19	14.9	0.036	-46.4	0.682	169.6
2050	0.871	156.4	1.15	13.3	0.035	-47.2	0.684	168.5
2100	0.870	155.7	1.11	11.4	0.034	-48.2	0.689	167.3
2150	0.864	154.5	1.07	9.3	0.034	-48.6	0.696	166.2
2200	0.860	153.1	1.04	7.2	0.033	-49.4	0.699	165.2
2250	0.858	151.9	1.01	5.5	0.032	-50.1	0.702	164.1
2300	0.855	150.3	0.98	3.8	0.032	-50.8	0.706	162.8
2350	0.860	149.1	0.95	2.5	0.031	-51.5	0.713	161.7
2400	0.868	147.7	0.92	0.5	0.031	-51.9	0.714	160.7
2450	0.868	146.7	0.89	-1.1	0.030	-52.4	0.716	159.6
2500	0.865	145.2	0.86	-3.2	0.029	-53.1	0.720	158.3

S Parameter

(V_{DS} = 6 V, I_{DQ} = 150 mA, Zo = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.941	-60.5	15.47	142.1	0.030	53.5	0.476	-61.7
150	0.916	-83.6	13.68	129.2	0.040	40.8	0.471	-83.8
200	0.886	-102.5	12.16	117.5	0.044	30.8	0.468	-100.1
250	0.856	-115.8	11.01	109.0	0.047	23.1	0.465	-112.0
300	0.838	-125.6	9.74	102.6	0.049	17.0	0.475	-120.8
350	0.824	-133.4	8.74	96.9	0.050	11.9	0.475	-127.9
400	0.816	-139.4	7.89	92.0	0.050	7.5	0.479	-133.1
450	0.812	-144.5	7.17	87.8	0.051	3.6	0.482	-137.2
500	0.807	-148.8	6.50	83.7	0.051	0.2	0.485	-140.7
550	0.804	-152.6	5.99	80.2	0.051	-2.6	0.489	-143.7
600	0.800	-155.8	5.50	76.9	0.050	-5.6	0.495	-146.1
650	0.797	-158.7	5.09	73.9	0.050	-8.2	0.500	-148.3
700	0.800	-161.7	4.73	70.5	0.049	-10.6	0.506	-150.3
750	0.800	-164.1	4.40	67.6	0.049	-12.6	0.513	-152.2
800	0.801	-166.2	4.11	64.7	0.048	-15.1	0.520	-153.9
850	0.802	-168.3	3.87	62.0	0.048	-16.7	0.526	-155.3
900	0.802	-170.3	3.65	59.4	0.047	-18.6	0.535	-156.9
950	0.803	-171.9	3.44	56.9	0.046	-20.4	0.543	-158.3
1000	0.807	-173.7	3.24	54.5	0.046	-22.2	0.551	-159.7
1050	0.806	-175.5	3.08	51.9	0.045	-24.0	0.559	-161.1
1100	0.808	-177.2	2.91	49.8	0.044	-25.7	0.566	-162.5
1150	0.811	-178.9	2.77	47.2	0.043	-27.1	0.574	-163.7
1200	0.815	179.6	2.63	44.9	0.043	-28.5	0.580	-165.0
1250	0.818	178.1	2.50	42.5	0.042	-29.9	0.586	-166.4
1300	0.824	176.8	2.39	40.2	0.041	-31.2	0.594	-167.6
1350	0.824	175.8	2.28	38.0	0.040	-32.6	0.600	-168.7
1400	0.827	174.4	2.17	36.1	0.040	-33.6	0.605	-169.9
1450	0.825	173.1	2.07	33.9	0.039	-34.9	0.611	-171.2
1500	0.827	171.6	1.98	31.9	0.038	-36.0	0.617	-172.5
1550	0.832	170.3	1.89	30.1	0.037	-37.1	0.622	-173.8
1600	0.838	168.9	1.81	27.9	0.036	-38.2	0.628	-175.2
1650	0.842	168.0	1.74	25.9	0.036	-39.2	0.636	-176.4
1700	0.840	166.8	1.68	23.6	0.035	-40.2	0.640	-177.6
1750	0.838	165.3	1.62	21.6	0.034	-41.1	0.646	-179.0
1800	0.840	163.7	1.57	19.9	0.033	-41.5	0.652	179.8
1850	0.843	162.0	1.51	18.1	0.033	-42.3	0.658	178.5
1900	0.852	160.4	1.47	16.7	0.032	-42.9	0.664	177.2
1950	0.860	159.1	1.41	15.2	0.031	-43.9	0.670	175.9
2000	0.873	158.1	1.36	13.6	0.031	-44.6	0.677	174.7
2050	0.879	157.4	1.31	12.0	0.030	-45.4	0.680	173.5
2100	0.877	156.7	1.26	10.1	0.029	-46.1	0.686	172.1
2150	0.871	155.4	1.22	8.0	0.029	-46.3	0.693	171.0
2200	0.869	154.2	1.19	6.0	0.028	-46.9	0.697	169.8
2250	0.865	152.8	1.15	4.1	0.027	-47.4	0.701	168.7
2300	0.863	151.2	1.12	2.4	0.027	-47.7	0.705	167.3
2350	0.868	149.6	1.08	0.8	0.026	-48.2	0.712	166.2
2400	0.875	148.6	1.05	-0.9	0.026	-48.2	0.713	165.1
2450	0.876	147.4	1.01	-2.7	0.025	-48.7	0.716	163.9
2500	0.872	146.1	0.98	-4.6	0.025	-49.0	0.720	162.4

S Parameter

(V_{DS} = 7.5 V, I_{DQ} = 150 mA, Zo = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.946	-58.3	17.64	143.8	0.027	55.8	0.500	-52.7
150	0.920	-80.2	15.56	130.9	0.036	42.9	0.483	-73.1
200	0.889	-98.1	13.78	119.7	0.040	32.7	0.470	-88.9
250	0.867	-110.4	12.44	111.4	0.043	25.1	0.460	-101.0
300	0.844	-120.8	10.97	104.3	0.045	18.8	0.453	-110.0
350	0.832	-129.0	9.80	98.4	0.046	13.5	0.458	-117.7
400	0.821	-135.6	8.80	93.3	0.047	8.9	0.461	-123.3
450	0.819	-141.1	7.96	88.8	0.047	4.8	0.463	-127.8
500	0.816	-145.8	7.25	84.6	0.047	1.2	0.466	-131.6
550	0.809	-149.8	6.64	80.7	0.047	-1.8	0.469	-135.0
600	0.807	-153.2	6.09	77.4	0.046	-4.7	0.475	-137.7
650	0.804	-156.5	5.63	74.1	0.046	-7.3	0.481	-140.0
700	0.806	-159.3	5.22	70.7	0.046	-9.8	0.488	-142.4
750	0.806	-161.9	4.86	67.7	0.045	-12.1	0.494	-144.5
800	0.806	-164.2	4.54	64.7	0.044	-14.3	0.502	-146.3
850	0.807	-166.3	4.26	62.0	0.044	-16.3	0.510	-148.2
900	0.808	-168.6	4.02	59.3	0.043	-18.0	0.519	-149.9
950	0.811	-170.4	3.79	56.8	0.043	-19.9	0.528	-151.5
1000	0.812	-172.2	3.57	54.3	0.042	-21.8	0.537	-153.1
1050	0.816	-174.0	3.38	51.8	0.041	-23.4	0.546	-154.6
1100	0.814	-175.8	3.21	49.3	0.041	-25.2	0.555	-156.1
1150	0.818	-177.5	3.05	47.0	0.040	-26.5	0.563	-157.6
1200	0.820	-179.1	2.89	44.5	0.039	-28.0	0.569	-159.1
1250	0.826	179.4	2.75	42.1	0.038	-29.3	0.578	-160.6
1300	0.829	178.0	2.62	39.8	0.037	-30.7	0.585	-161.9
1350	0.831	176.8	2.50	37.5	0.037	-31.9	0.592	-163.2
1400	0.832	175.5	2.38	35.4	0.036	-33.1	0.597	-164.6
1450	0.830	174.1	2.28	33.2	0.035	-34.0	0.605	-166.0
1500	0.835	172.6	2.17	31.3	0.034	-35.1	0.611	-167.4
1550	0.835	171.2	2.07	29.2	0.034	-36.2	0.618	-168.8
1600	0.843	169.7	1.98	27.1	0.033	-37.2	0.624	-170.4
1650	0.846	168.8	1.90	25.1	0.032	-38.1	0.632	-171.6
1700	0.845	167.4	1.83	22.9	0.031	-38.9	0.636	-173.0
1750	0.845	166.1	1.77	21.1	0.030	-39.8	0.642	-174.5
1800	0.845	164.5	1.71	19.1	0.030	-40.0	0.649	-175.9
1850	0.848	162.7	1.65	17.2	0.029	-40.8	0.656	-177.2
1900	0.855	161.2	1.60	15.7	0.028	-41.3	0.661	-178.6
1950	0.867	159.9	1.54	14.3	0.028	-42.0	0.668	-180.0
2000	0.880	158.8	1.49	12.6	0.027	-42.5	0.676	178.7
2050	0.883	158.1	1.43	10.9	0.026	-43.0	0.679	177.4
2100	0.882	157.2	1.37	9.1	0.026	-43.5	0.685	176.0
2150	0.876	156.1	1.33	7.0	0.025	-43.5	0.692	174.7
2200	0.873	154.6	1.29	4.8	0.025	-43.9	0.697	173.5
2250	0.871	153.3	1.25	3.1	0.024	-44.0	0.701	172.2
2300	0.869	151.8	1.21	1.5	0.023	-44.2	0.705	170.7
2350	0.873	150.3	1.17	-0.1	0.023	-44.5	0.712	169.7
2400	0.880	149.0	1.14	-2.2	0.022	-44.4	0.714	168.4
2450	0.881	147.7	1.10	-3.7	0.022	-44.4	0.717	167.1
2500	0.878	146.5	1.06	-5.5	0.021	-44.6	0.721	165.6

S Parameter

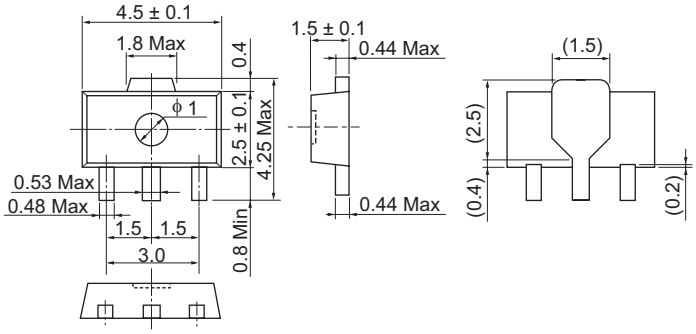
(V_{DS} = 13.7 V, I_{DQ} = 150 mA, Zo = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.968	-47.9	20.87	150.6	0.017	63.3	0.557	-31.9
150	0.951	-67.8	19.11	137.9	0.024	49.8	0.536	-46.4
200	0.918	-85.0	17.04	126.4	0.028	39.6	0.512	-58.9
250	0.897	-98.0	15.32	117.2	0.031	31.5	0.488	-69.3
300	0.882	-109.0	13.72	109.6	0.033	24.6	0.466	-77.5
350	0.870	-118.4	12.29	102.7	0.034	18.8	0.460	-85.1
400	0.855	-125.9	11.02	97.1	0.034	13.9	0.454	-91.3
450	0.852	-132.2	10.01	92.3	0.035	9.5	0.451	-96.3
500	0.846	-137.6	9.12	87.8	0.035	5.7	0.451	-100.7
550	0.841	-142.4	8.37	83.3	0.035	2.3	0.451	-104.8
600	0.835	-146.5	7.69	79.6	0.035	-0.8	0.456	-108.3
650	0.833	-150.2	7.11	75.8	0.034	-3.5	0.464	-111.6
700	0.833	-153.6	6.58	72.4	0.034	-6.4	0.469	-114.7
750	0.836	-156.5	6.14	68.9	0.033	-8.5	0.477	-117.7
800	0.833	-159.2	5.72	65.9	0.033	-11.0	0.486	-120.4
850	0.832	-161.8	5.37	62.8	0.032	-12.8	0.494	-122.9
900	0.834	-164.1	5.05	59.9	0.032	-14.7	0.503	-125.4
950	0.834	-166.1	4.75	57.1	0.031	-16.4	0.514	-127.8
1000	0.836	-168.2	4.50	54.6	0.031	-18.3	0.525	-130.2
1050	0.837	-170.3	4.24	51.8	0.030	-19.8	0.535	-132.5
1100	0.838	-172.3	4.03	49.1	0.029	-21.4	0.544	-134.7
1150	0.839	-174.5	3.83	46.3	0.029	-22.7	0.554	-136.8
1200	0.843	-176.0	3.63	44.0	0.028	-23.9	0.563	-138.8
1250	0.848	-177.7	3.46	41.6	0.027	-24.9	0.571	-140.9
1300	0.851	-179.3	3.29	39.1	0.026	-25.9	0.580	-142.8
1350	0.851	179.5	3.13	36.8	0.026	-27.0	0.588	-144.7
1400	0.852	177.9	2.98	34.4	0.025	-27.6	0.594	-146.5
1450	0.851	176.4	2.85	32.3	0.024	-28.4	0.602	-148.4
1500	0.853	175.0	2.72	30.0	0.023	-29.1	0.609	-150.3
1550	0.857	173.3	2.59	27.8	0.023	-29.5	0.616	-152.1
1600	0.861	171.8	2.48	25.6	0.022	-30.2	0.623	-154.0
1650	0.864	170.8	2.37	23.5	0.022	-30.3	0.631	-155.7
1700	0.862	169.4	2.29	21.2	0.021	-30.7	0.637	-157.5
1750	0.860	167.9	2.20	19.4	0.020	-30.7	0.643	-159.3
1800	0.861	166.2	2.13	17.3	0.020	-30.4	0.651	-161.0
1850	0.866	164.3	2.05	15.5	0.019	-30.1	0.657	-162.7
1900	0.873	162.6	1.98	13.9	0.019	-29.7	0.664	-164.5
1950	0.884	161.3	1.90	12.2	0.018	-29.7	0.671	-166.2
2000	0.895	160.4	1.83	10.6	0.018	-29.5	0.679	-167.9
2050	0.901	159.5	1.77	8.5	0.017	-28.9	0.683	-169.4
2100	0.898	158.7	1.70	6.7	0.017	-28.5	0.689	-171.1
2150	0.891	157.4	1.65	4.6	0.016	-27.4	0.697	-172.8
2200	0.887	155.9	1.60	2.5	0.016	-26.8	0.702	-174.2
2250	0.882	154.5	1.54	0.7	0.016	-26.2	0.705	-175.7
2300	0.880	153.0	1.49	-0.9	0.015	-24.9	0.709	-177.4
2350	0.887	151.4	1.45	-2.8	0.015	-24.2	0.718	-178.9
2400	0.892	149.9	1.40	-4.7	0.015	-22.7	0.720	179.7
2450	0.894	148.7	1.35	-6.4	0.015	-21.7	0.724	178.3
2500	0.890	147.5	1.31	-8.5	0.015	-20.7	0.727	176.6

Package Dimensions

Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
UPAK	SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050g

Unit: mm



Ordering Information

Part Name	Quantity	Shipping Container
2SK3391JXTL-E	1000 pcs.	φ178 mm Reel, 12 mm Emboss Taping

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Refer to "**http://www.renesas.com/en/network**" for the latest and detailed information.

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510

Colophon .7.0