

# RQA0009SXAQS

## Silicon N-Channel MOS FET

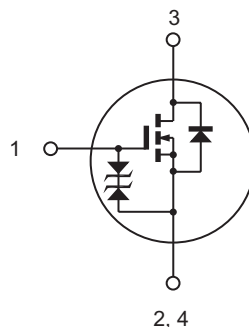
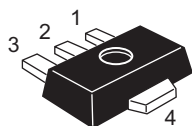
REJ03G1566-0100  
Rev.1.00  
Jul 04, 2007

### Features

- High Output Power, High Gain, High Efficiency  
Pout = +37.8 dBm, Linear Gain = 18 dB, PAE = 65%  
(V<sub>DS</sub> = 6 V, f = 520 MHz)
- Compact package capable of surface mounting
- Electrostatic Discharge Immunity Test  
(IEC Standard, 61000-4-2, Level4)

### Outline

RENESAS Package code: PLZZ0004CA-A  
(Package Name : UPAK<sup>®</sup>)



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

Note: Marking is "SX".

\*UPAK is a trademark of Renesas Technology Corp.

### Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V <sub>DSS</sub>	16	V
Gate to source voltage	V <sub>GSS</sub>	±5	V
Drain current	I <sub>D</sub>	3.2	A
Channel dissipation	P <sub>ch</sub> <sup>note</sup>	15	W
Channel temperature	T <sub>ch</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	°C

Note: Value at T<sub>c</sub> = 25°C

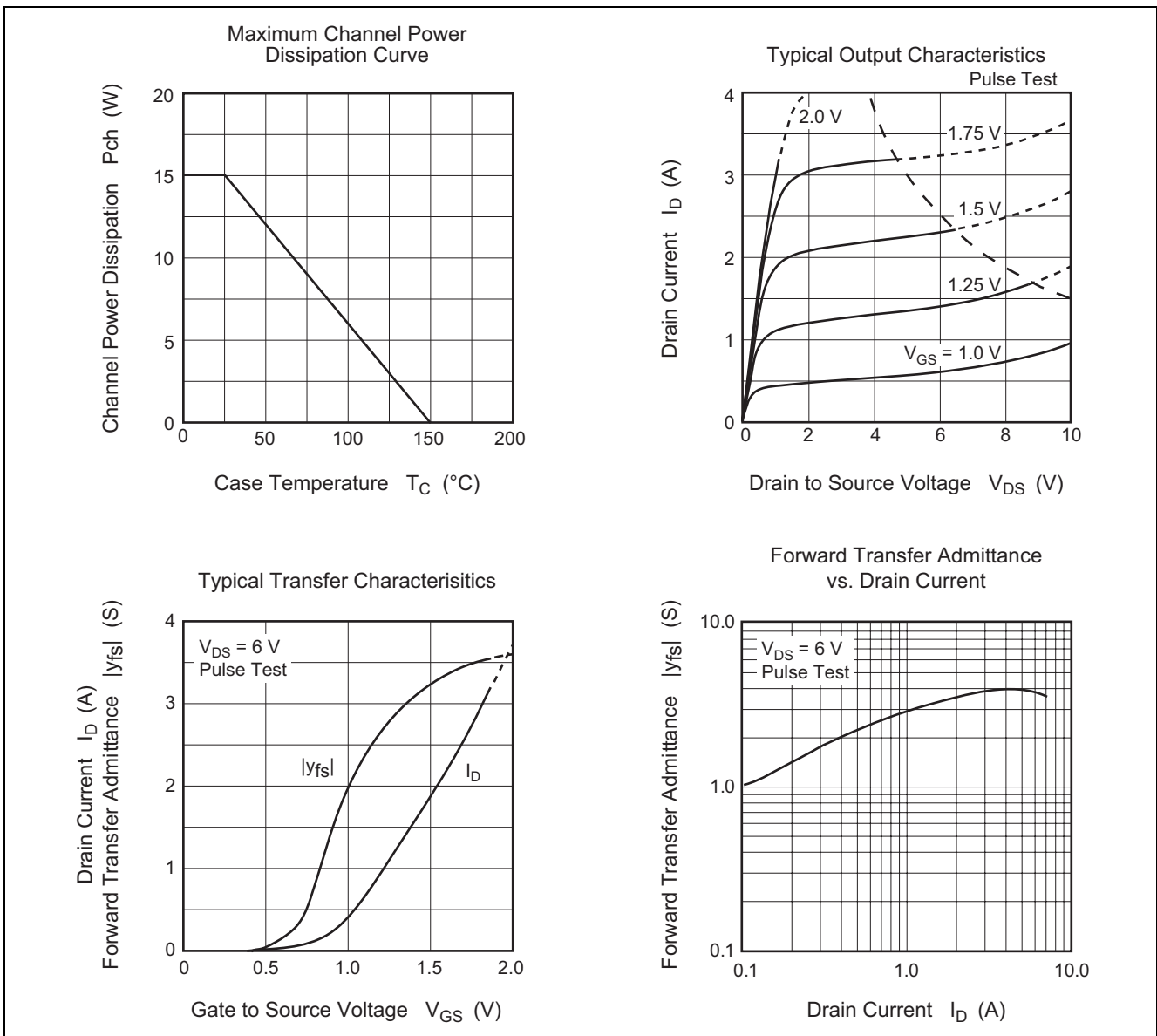
This device is sensitive to electro static discharge. An adequate careful handling procedure is requested.

### Electrical Characteristics

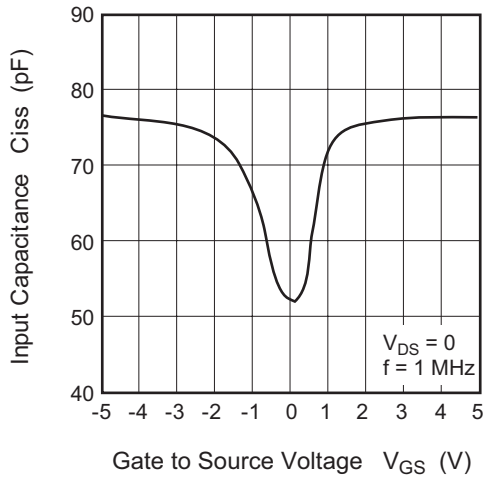
(Ta = 25°C)

Item	Symbol	Min.	Typ	Max.	Unit	Test Conditions
Zero gate voltage drain current	$I_{DSS}$	—	—	15	$\mu A$	$V_{DS} = 16 V, V_{GS} = 0$
Gate to source leak current	$I_{GSS}$	—	—	$\pm 2$	$\mu A$	$V_{GS} = \pm 5 V, V_{DS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	0.15	0.5	0.8	V	$V_{DS} = 6 V, I_D = 1 mA$
Forward Transfer Admittance	$ y_{fs} $	—	3.2	—	S	$V_{DS} = 6 V, I_D = 1.6 A$
Input capacitance	$C_{iss}$	—	76	—	pF	$V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz$
Output capacitance	$C_{oss}$	—	40	—	pF	$V_{DS} = 6 V, V_{GS} = 0, f = 1 MHz$
Reverse transfer capacitance	$C_{rss}$	—	3.5	—	pF	$V_{DG} = 6 V, V_{GS} = 0, f = 1 MHz$
Output Power	Pout	—	37.8	—	dBm	$V_{DS} = 6 V, I_{DQ} = 180 mA$
		—	6.0	—	W	$f = 520 MHz,$ $P_{in} = +25 dBm (316 mW)$
Power Added Efficiency	PAE	—	65	—	%	
Output Power	Pout	—	35.2	—	dBm	$V_{DS} = 4.8 V, I_{DQ} = 300 mA$
		—	3.3	—	W	$f = 465 MHz,$ $P_{in} = +17 dBm (50 mW)$
Power Added Efficiency	PAE	—	60	—	%	

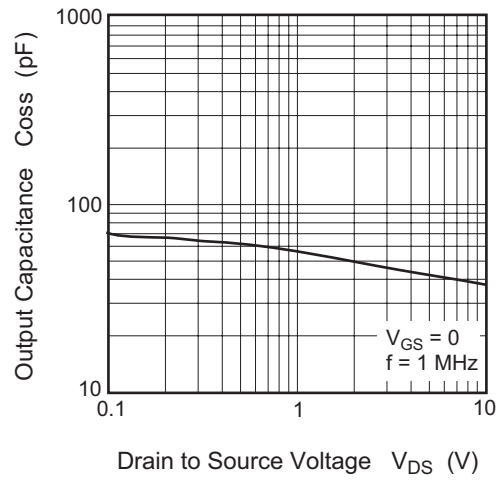
### Main Characteristics



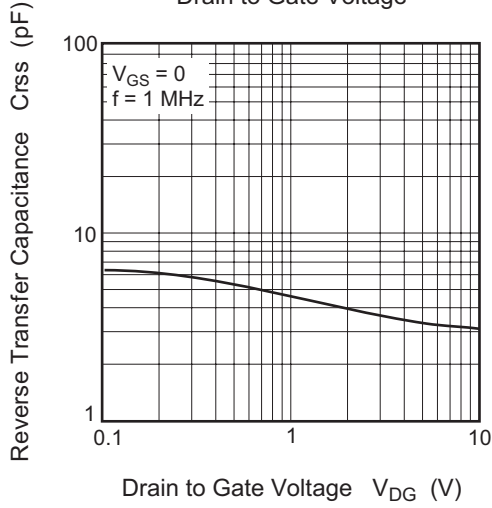
Input Capacitance vs. Gate to Source Voltage



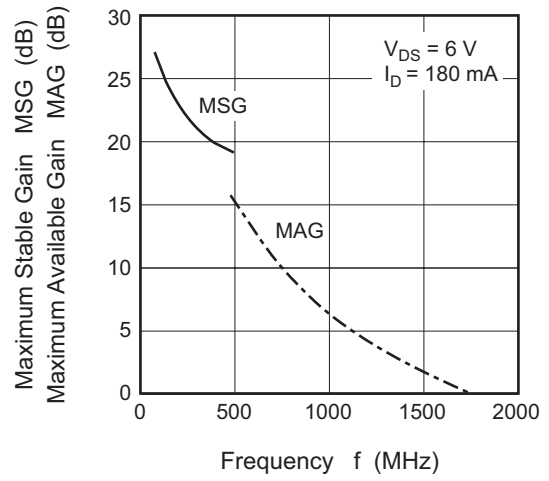
Output Capacitance vs. Drain to Source Voltage



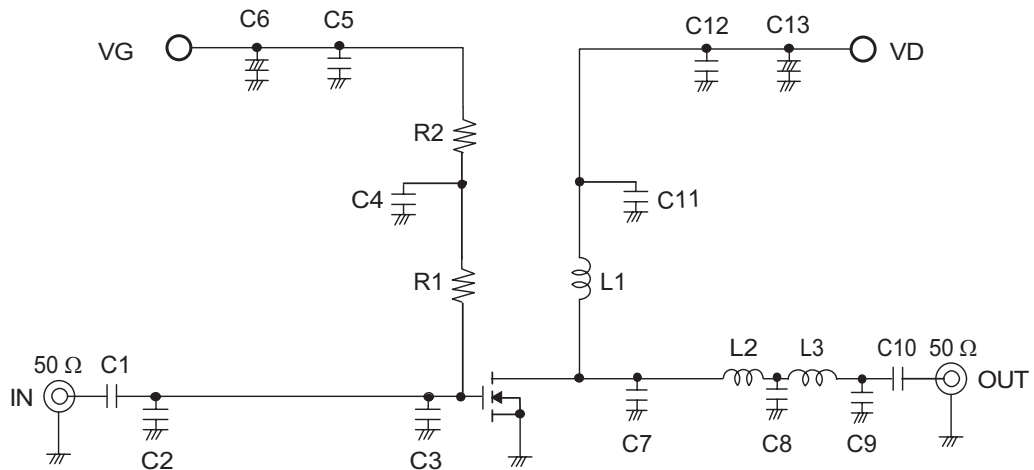
Reverse Transfer Capacitance vs. Drain to Gate Voltage



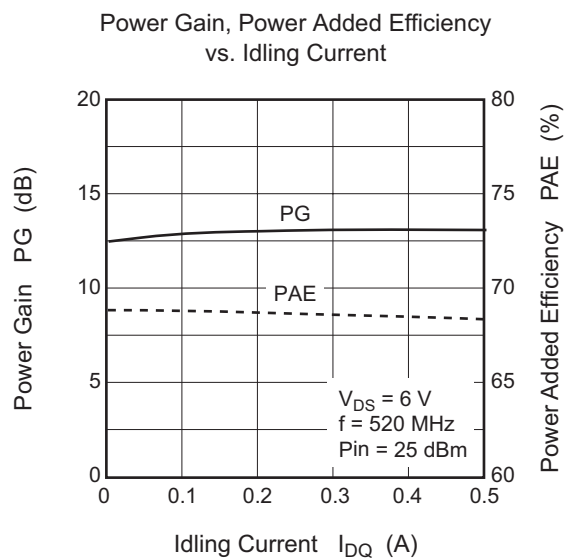
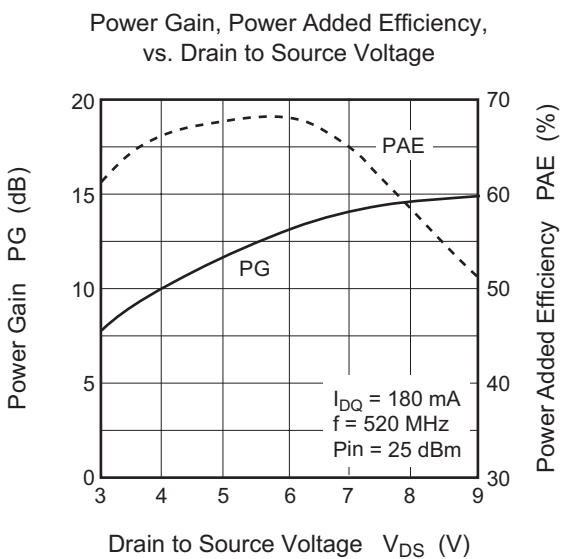
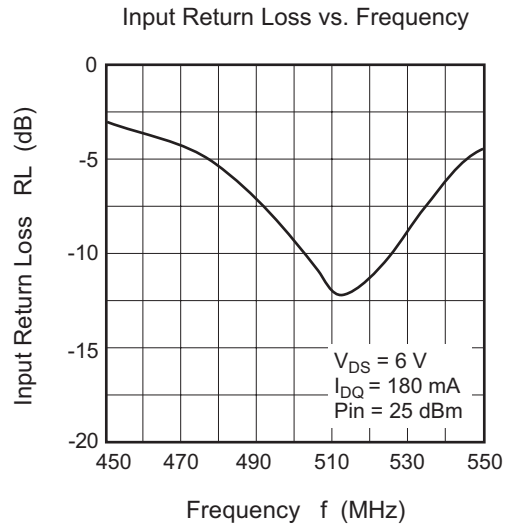
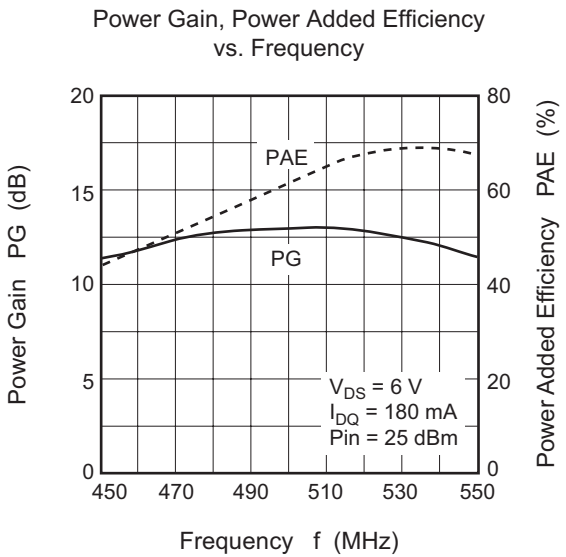
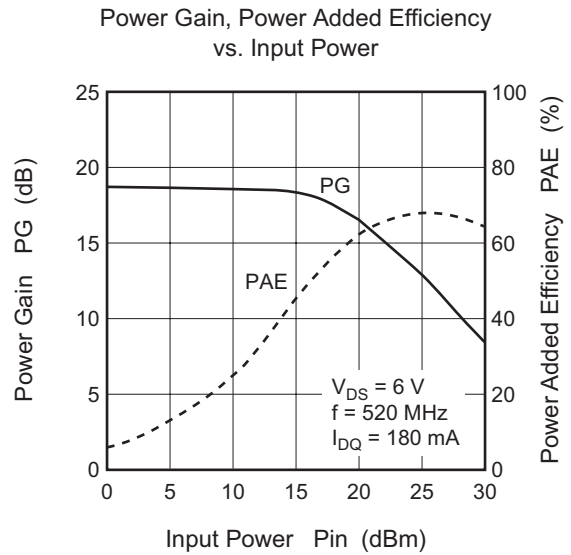
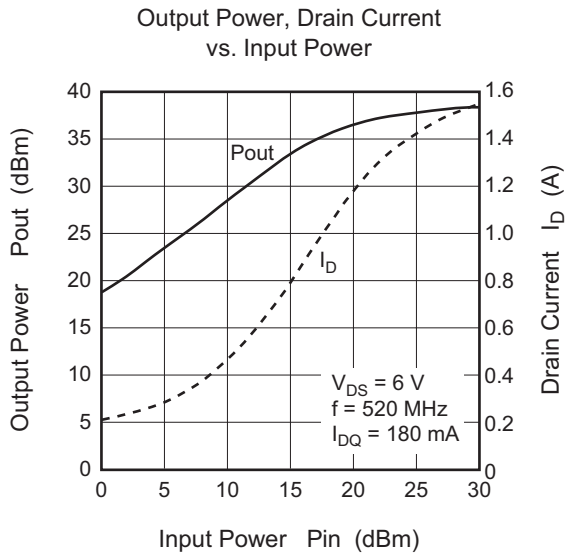
MSG, MAG vs. Frequency



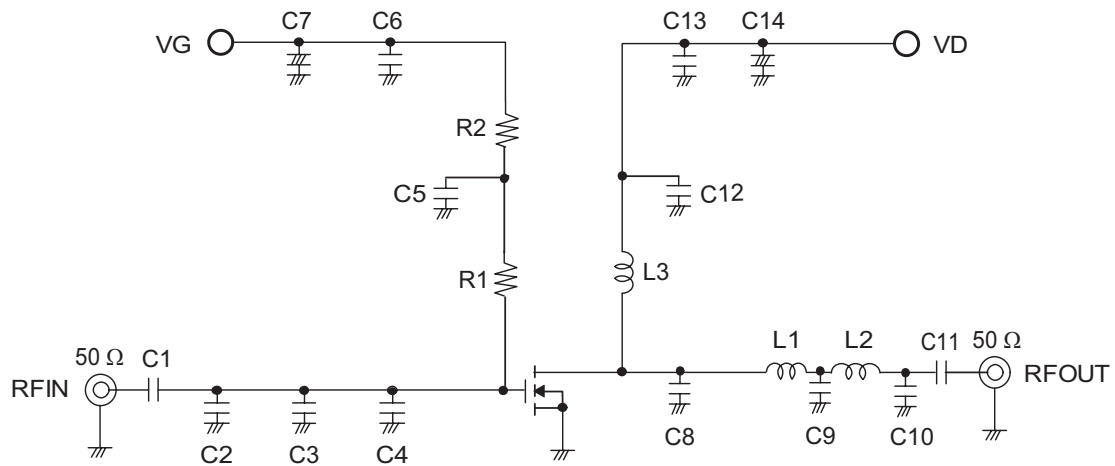
## Evaluation Circuit (f = 520 MHz)



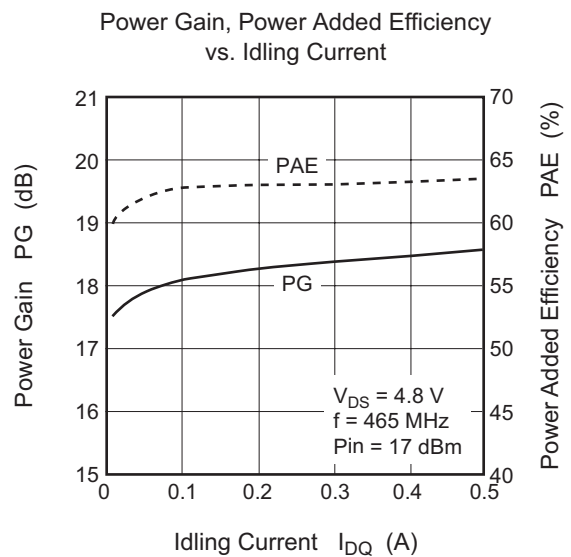
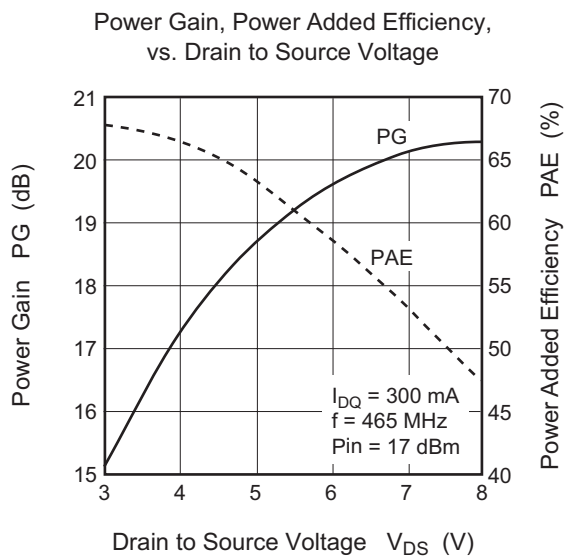
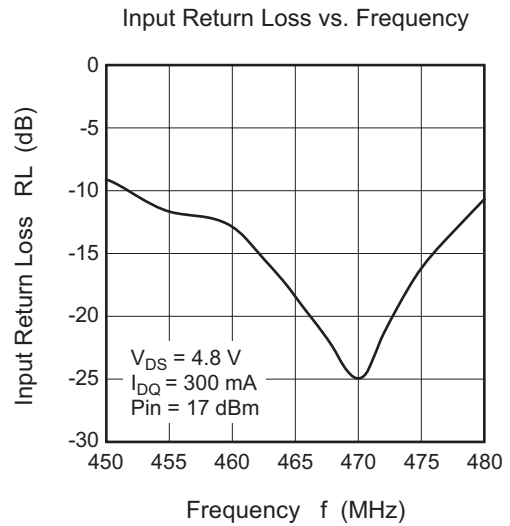
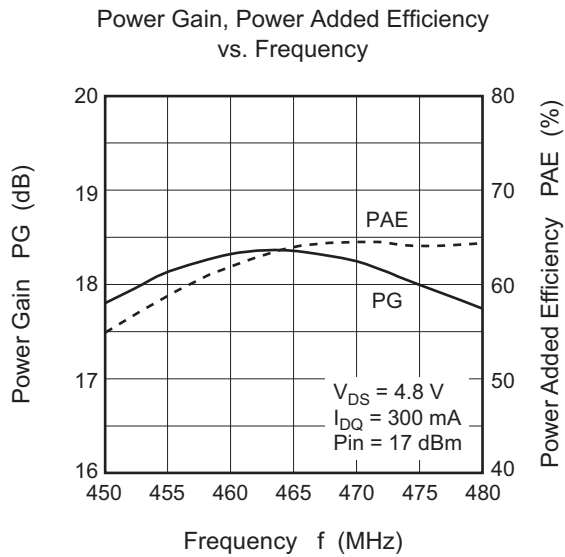
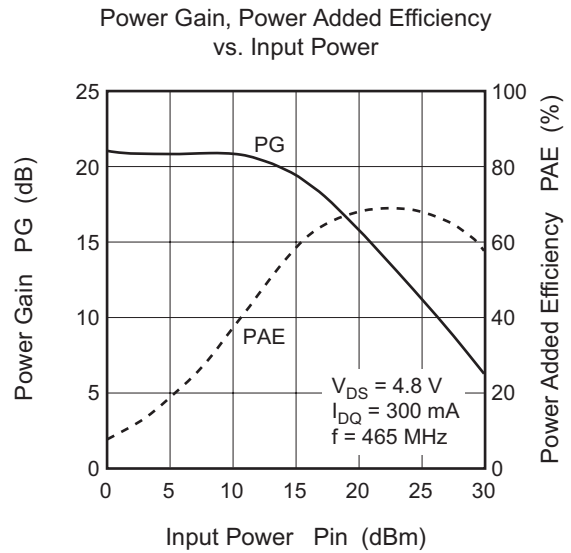
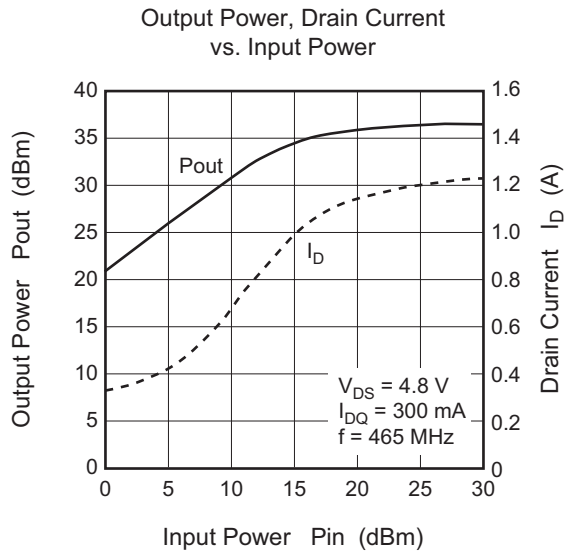
C1, C4, C10, C11	100 pF Chip Capacitor
C2	22 pF Chip Capacitor
C3	5 pF Chip Capacitor
C5, C12	1000 pF Chip Capacitor
C6, C13	1 μF Chip Tantalum Capacitor
C7	18 pF Chip Capacitor
C8	10 pF Chip Capacitor
C9	7 pF Chip Capacitor
L1	8 Turns D: 0.5 mm, φ 2.4 mm Enamel Wire
L2	1 nH Chip Inductor
L3	1.8 nH Chip Inductor
R1	670 Ω Chip Resistor
R2	6.8 kΩ Chip Resistor



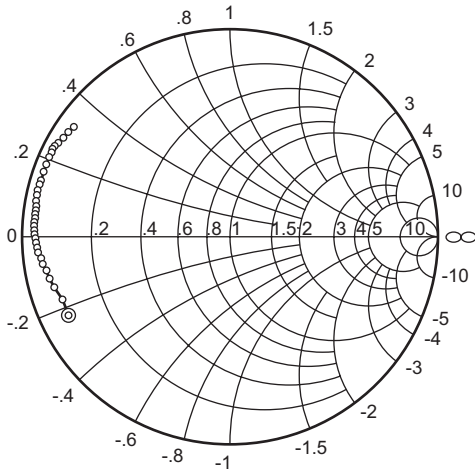
## Evaluation Circuit (f = 465 MHz)



C1, C5, C11, C12	100 pF Chip Capacitor
C2, C8	22 pF Chip Capacitor
C3	15 pF Chip Capacitor
C4, C9, C10	10 pF Chip Capacitor
C6, C13	2200 pF Chip Capacitor
C7, C14	1 $\mu$ F / 35 V Chip Tantalum Capacitor
L1	1 nH Chip Inductor
L2	1.8 nH Chip Inductor
L3	8 Turns D: 0.5 mm, $\phi$ 2.4 mm Enamel Wire
R1	670 $\Omega$ Chip Resistor
R2	6.8 k $\Omega$ Chip Resistor



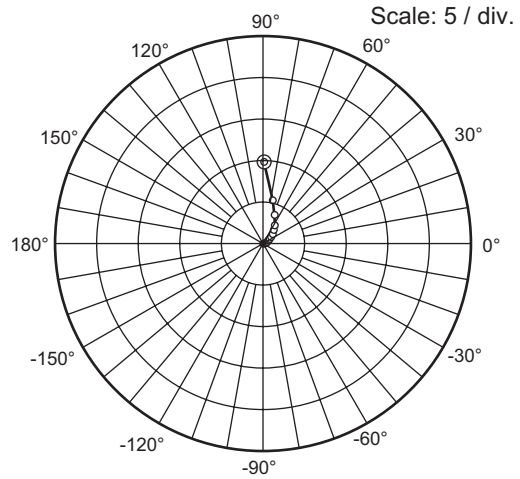
S11 Parameter vs. Frequency



Test condition:

$V_{DS} = 6\text{ V}$ ,  $I_{DQ} = 180\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

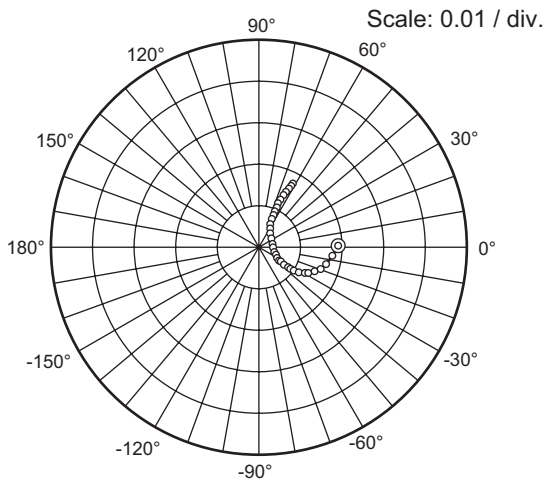
S21 Parameter vs. Frequency



Test condition:

$V_{DS} = 6\text{ V}$ ,  $I_{DQ} = 180\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

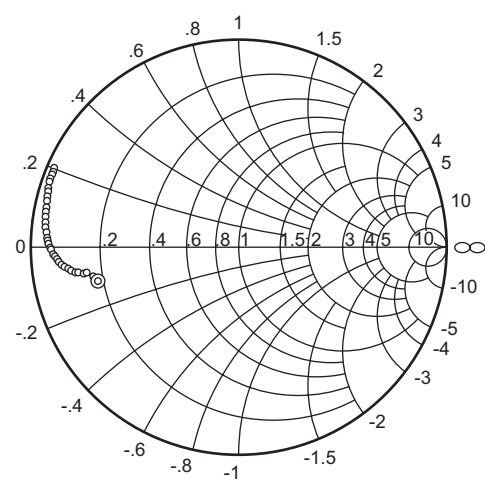
S12 Parameter vs. Frequency



Test condition:

$V_{DS} = 6\text{ V}$ ,  $I_{DQ} = 180\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

S22 Parameter vs. Frequency

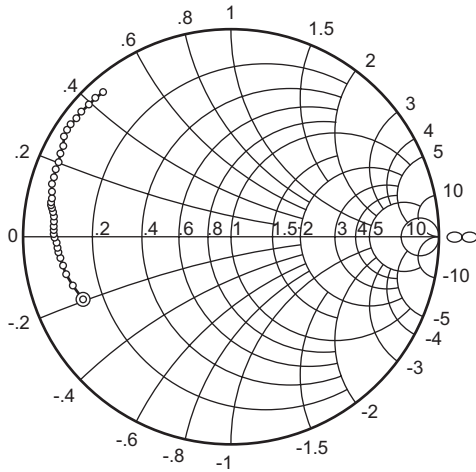


Test condition:

$V_{DS} = 6\text{ V}$ ,  $I_{DQ} = 180\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)



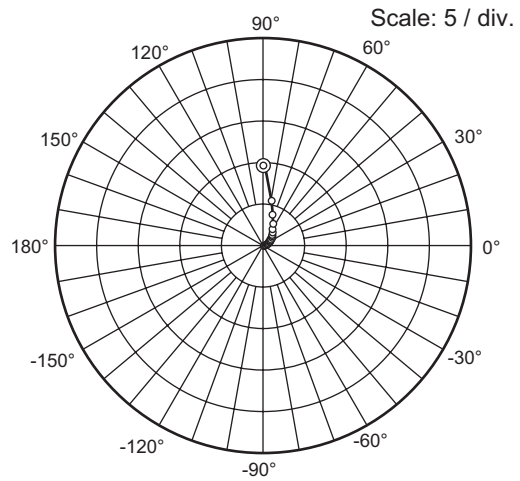
S11 Parameter vs. Frequency



Test condition:

$V_{DS} = 4.8\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

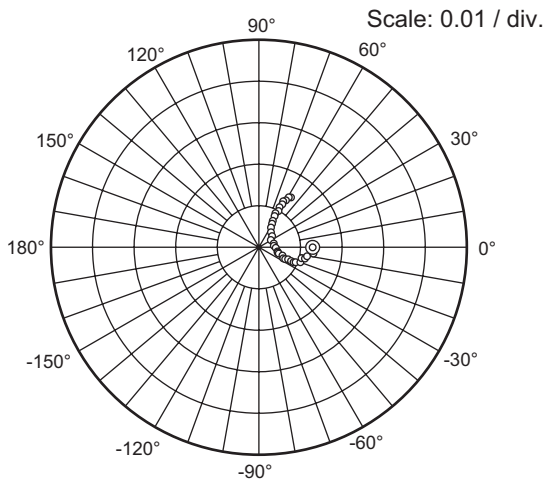
S21 Parameter vs. Frequency



Test condition:

$V_{DS} = 4.8\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

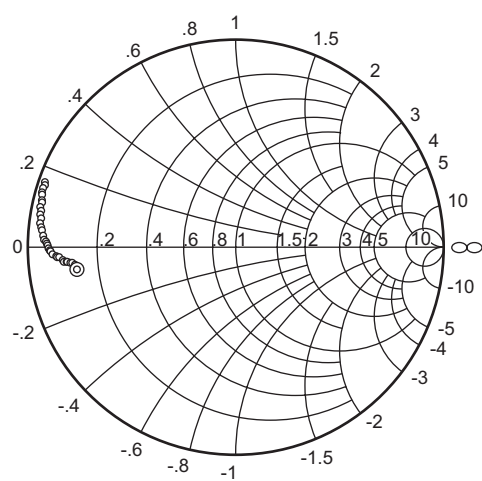
S12 Parameter vs. Frequency



Test condition:

$V_{DS} = 4.8\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

S22 Parameter vs. Frequency



Test condition:

$V_{DS} = 4.8\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $Z_O = 50\ \Omega$   
 100 to 1000 MHz (50 MHz step)  
 1000 to 2500 MHz (100 MHz step)

## S Parameter

 $(V_{DS} = 6\text{ V}, I_{DQ} = 180\text{ mA}, Z_o = 50\ \Omega)$ 

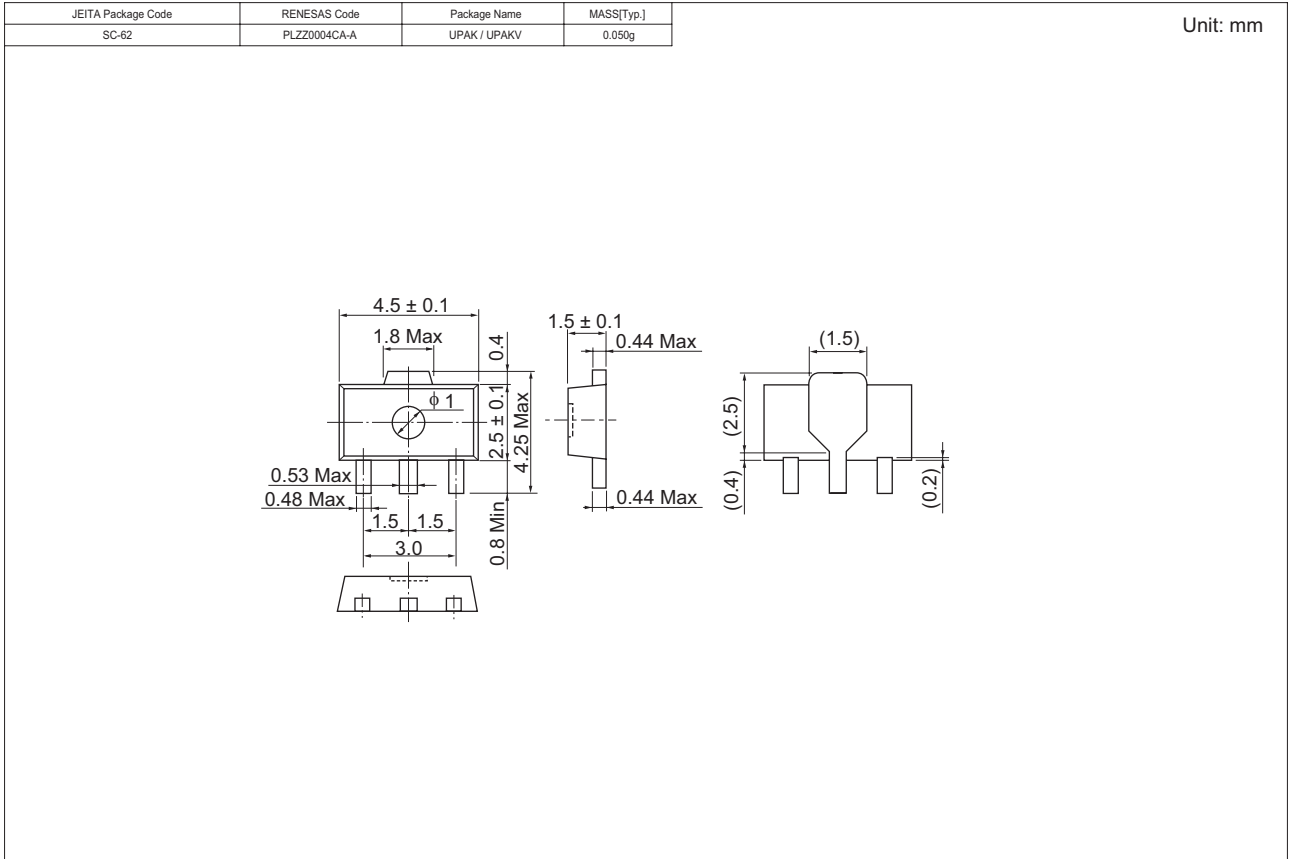
f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.868	-154.0	9.85	88.8	0.019	1.2	0.706	-166.8
150	0.861	-159.4	5.42	77.2	0.018	-6.3	0.725	-168.9
200	0.882	-163.9	3.64	68.2	0.016	-14.1	0.755	-170.6
250	0.892	-166.8	2.64	58.5	0.016	-19.2	0.768	-170.6
300	0.899	-169.5	2.06	51.8	0.014	-22.1	0.792	-171.2
350	0.910	-171.6	1.61	45.1	0.013	-27.2	0.805	-171.5
400	0.918	-173.4	1.28	40.3	0.013	-29.3	0.827	-172.2
450	0.926	-175.2	1.04	36.0	0.011	-34.1	0.840	-173.1
500	0.932	-176.8	0.84	31.8	0.010	-33.1	0.855	-173.8
550	0.936	-178.2	0.73	28.8	0.009	-34.5	0.869	-174.6
600	0.940	-179.5	0.62	26.4	0.008	-34.6	0.880	-175.6
650	0.941	179.2	0.54	23.1	0.007	-36.5	0.892	-176.5
700	0.944	178.1	0.45	20.2	0.006	-32.7	0.901	-177.3
750	0.945	176.9	0.41	18.3	0.006	-32.0	0.906	-178.0
800	0.944	175.9	0.37	16.4	0.005	-25.3	0.915	-179.4
850	0.944	174.6	0.31	13.9	0.004	-22.3	0.919	180.0
900	0.943	173.4	0.30	12.1	0.004	-15.2	0.929	178.9
950	0.943	172.3	0.26	10.6	0.003	0.3	0.930	178.1
1000	0.946	171.1	0.23	8.6	0.003	9.1	0.936	177.2
1050	0.949	170.2	0.22	7.3	0.003	20.6	0.940	176.5
1100	0.951	169.4	0.21	6.5	0.004	36.9	0.943	175.5
1150	0.952	168.7	0.18	5.3	0.004	40.3	0.944	174.7
1200	0.952	167.8	0.18	4.3	0.004	52.0	0.950	174.1
1250	0.952	167.0	0.16	3.7	0.005	53.2	0.951	173.3
1300	0.952	166.2	0.14	2.2	0.005	56.8	0.949	172.6
1350	0.952	165.4	0.14	1.3	0.006	60.9	0.956	171.7
1400	0.952	164.6	0.13	0.8	0.006	64.0	0.958	171.0
1450	0.952	164.0	0.12	0.1	0.007	62.2	0.957	170.3
1500	0.952	163.3	0.11	-0.8	0.008	65.4	0.956	169.5
1550	0.952	162.1	0.11	-1.8	0.008	65.9	0.959	168.5
1600	0.952	160.8	0.10	-2.7	0.009	65.6	0.960	168.2
1650	0.952	159.7	0.10	-3.6	0.009	65.9	0.960	167.4
1700	0.952	158.5	0.09	-4.5	0.010	66.6	0.962	166.4
1750	0.952	157.3	0.08	-4.7	0.010	66.2	0.967	165.8
1800	0.952	156.4	0.08	-5.0	0.011	66.5	0.968	165.3
1850	0.952	155.7	0.08	-4.7	0.011	66.5	0.965	164.5
1900	0.953	154.7	0.07	-4.9	0.012	67.0	0.967	163.7
1950	0.958	153.9	0.07	-5.2	0.012	67.0	0.976	163.2
2000	0.965	153.6	0.07	-4.6	0.013	65.5	0.972	162.9
2050	0.963	153.3	0.07	-4.9	0.013	65.4	0.972	161.9
2100	0.956	152.9	0.06	-4.2	0.014	65.3	0.976	161.0
2150	0.950	152.2	0.06	-3.5	0.014	65.2	0.981	160.7
2200	0.944	151.6	0.06	-3.8	0.015	63.9	0.977	160.1
2250	0.936	150.7	0.06	-3.5	0.015	63.9	0.977	159.5
2300	0.932	149.3	0.05	-3.4	0.016	63.0	0.978	158.9
2350	0.932	148.1	0.05	-3.6	0.016	62.8	0.981	158.4
2400	0.929	147.3	0.05	-3.0	0.017	63.0	0.977	158.0
2450	0.923	146.3	0.05	-3.6	0.017	61.3	0.977	157.2
2500	0.917	144.9	0.05	-3.0	0.017	61.8	0.980	156.8

## S Parameter

 $(V_{DS} = 4.8 \text{ V}, I_{DQ} = 300 \text{ mA}, Z_o = 50 \Omega)$ 

f (MHz)	S11		S21		S12		S22	
	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)	MAG	ANG (deg.)
100	0.772	-157.0	9.63	88.9	0.013	-1.0	0.776	-172.1
150	0.794	-162.8	5.54	79.0	0.013	-6.3	0.784	-173.8
200	0.812	-167.3	3.91	71.6	0.012	-11.1	0.799	-174.8
250	0.818	-170.4	2.98	64.7	0.011	-13.5	0.805	-174.8
300	0.824	-173.1	2.36	59.1	0.011	-15.2	0.818	-175.0
350	0.831	-175.0	1.92	53.6	0.011	-20.4	0.824	-175.1
400	0.836	-176.6	1.60	48.7	0.010	-21.4	0.837	-175.4
450	0.841	-178.3	1.36	44.8	0.009	-23.3	0.843	-175.8
500	0.848	-179.9	1.15	40.5	0.008	-22.9	0.859	-176.8
550	0.851	179.0	1.00	37.1	0.008	-22.2	0.868	-177.1
600	0.851	177.7	0.87	33.9	0.007	-24.8	0.874	-177.4
650	0.852	176.3	0.77	30.7	0.006	-24.2	0.887	-177.8
700	0.854	174.7	0.69	27.9	0.006	-20.5	0.896	-178.8
750	0.858	173.3	0.60	24.8	0.005	-18.2	0.901	-179.1
800	0.865	171.9	0.54	22.3	0.005	-15.1	0.905	-179.8
850	0.873	170.8	0.49	20.2	0.005	-12.2	0.911	179.5
900	0.878	169.8	0.45	17.9	0.004	-1.7	0.918	178.9
950	0.880	168.8	0.41	16.1	0.004	4.3	0.922	178.3
1000	0.882	167.7	0.37	14.2	0.004	11.2	0.932	177.8
1050	0.886	166.5	0.35	12.4	0.004	21.6	0.931	177.1
1100	0.889	165.5	0.32	10.7	0.004	29.8	0.935	176.5
1150	0.893	164.4	0.29	8.9	0.004	33.2	0.939	175.8
1200	0.898	163.3	0.27	7.5	0.004	40.9	0.944	175.1
1250	0.902	162.4	0.26	6.2	0.005	46.7	0.943	174.6
1300	0.901	161.3	0.23	4.7	0.005	50.8	0.948	174.1
1350	0.902	160.0	0.22	3.3	0.005	54.5	0.948	173.4
1400	0.904	158.7	0.21	1.8	0.006	57.8	0.954	173.1
1450	0.907	157.7	0.19	0.4	0.006	55.3	0.954	172.5
1500	0.904	156.5	0.18	-0.8	0.007	60.5	0.953	171.6
1550	0.905	155.1	0.17	-2.4	0.007	62.1	0.958	171.0
1600	0.912	153.8	0.16	-3.1	0.007	61.1	0.959	170.7
1650	0.915	152.8	0.15	-4.2	0.008	64.3	0.956	170.4
1700	0.919	151.5	0.14	-5.8	0.008	63.2	0.958	169.3
1750	0.926	149.9	0.14	-6.8	0.009	62.7	0.964	168.9
1800	0.938	148.8	0.13	-7.8	0.009	63.0	0.965	168.4
1850	0.942	147.9	0.13	-8.6	0.010	62.6	0.963	167.8
1900	0.942	146.7	0.12	-9.3	0.010	61.9	0.965	167.0
1950	0.945	145.5	0.11	-10.2	0.010	63.8	0.968	166.6
2000	0.946	144.7	0.11	-10.6	0.011	62.4	0.965	166.3
2050	0.942	143.7	0.11	-11.2	0.011	62.2	0.969	165.5
2100	0.939	142.3	0.10	-11.8	0.012	61.2	0.973	164.9
2150	0.940	140.9	0.10	-12.5	0.012	62.0	0.974	164.6
2200	0.942	139.8	0.09	-13.3	0.012	61.3	0.974	164.2
2250	0.939	138.3	0.09	-14.3	0.013	59.2	0.974	163.4
2300	0.937	136.8	0.08	-15.3	0.013	59.6	0.976	163.0
2350	0.937	135.4	0.08	-16.3	0.014	59.8	0.977	162.9
2400	0.935	134.1	0.08	-17.5	0.014	58.9	0.972	162.0
2450	0.932	132.8	0.07	-18.1	0.014	57.9	0.975	161.5
2500	0.931	131.3	0.07	-18.7	0.014	57.7	0.977	161.2

### Package Dimensions



### Ordering Information

Part Name	Quantity	Shipping Container
RQA0009SXTL-E	1000 pcs.	$\phi 178$ mm reel, 12 mm emboss taping

Notes:

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
  - (1) artificial life support devices or systems
  - (2) surgical implantations
  - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
  - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



**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