

# RQA0011DNS

## Silicon N-Channel MOS FET

REJ03G1600-0100

Rev.1.00

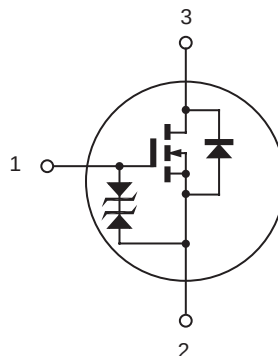
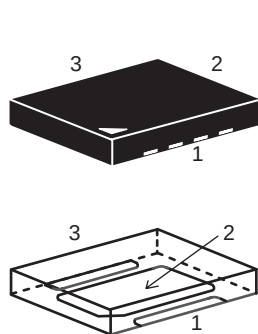
Nov 08, 2007

### Features

- High output power, High gain, High efficiency  
Pout = +39.6 dBm, Linear gain = 20 dB, PAE = 68% (f = 520 MHz)
- Small outline package (WSN0504-2: 5.0 × 4.0 × 0.8 mm)
- Electrostatic Discharge Immunity Test  
(IEC Standard, 61000-4-2, Level4)

### Outline

RENESAS Package code: PWSN0002ZA-B  
(Package name: HWSN-2 <WSN0504-2>)



1. Gate
2. Source
3. Drain

Note: Marking is "RQA0011".

### Absolute Maximum Ratings

(Ta = 25°C)

| Item                    | Symbol          | Ratings     | Unit |
|-------------------------|-----------------|-------------|------|
| Drain to source voltage | $V_{DSS}$       | 16          | V    |
| Gate to source voltage  | $V_{GSS}$       | ±5          | V    |
| Drain current           | $I_D$           | 3.8         | A    |
| Channel dissipation     | $P_{ch}^{note}$ | 15          | W    |
| Channel temperature     | $T_{ch}$        | 150         | °C   |
| Storage temperature     | $T_{stg}$       | -55 to +150 | °C   |

Note: Value at Tc = 25°C

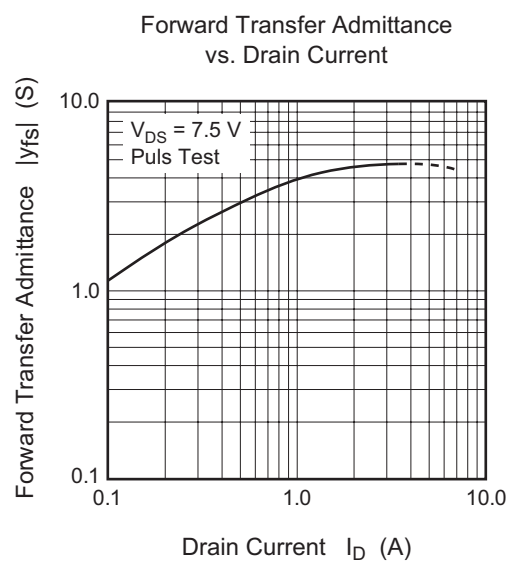
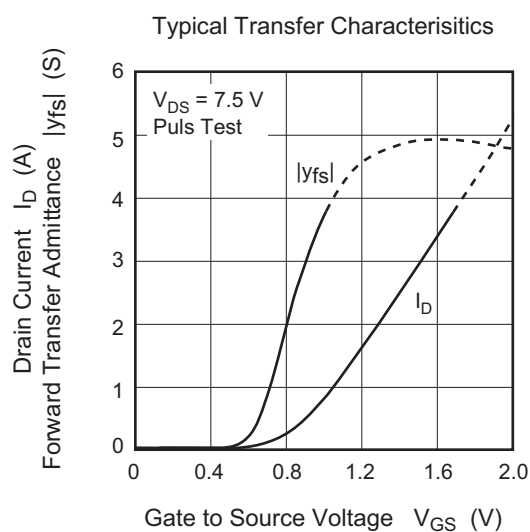
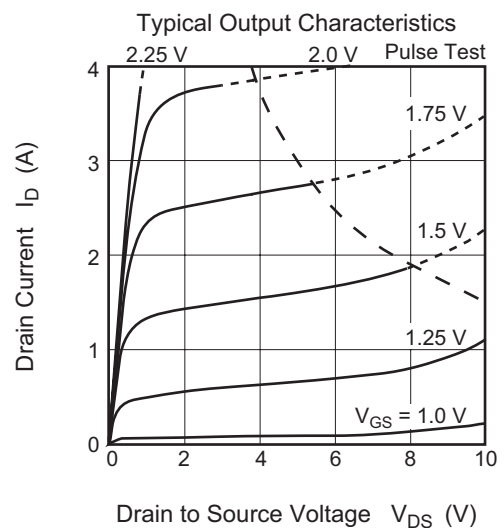
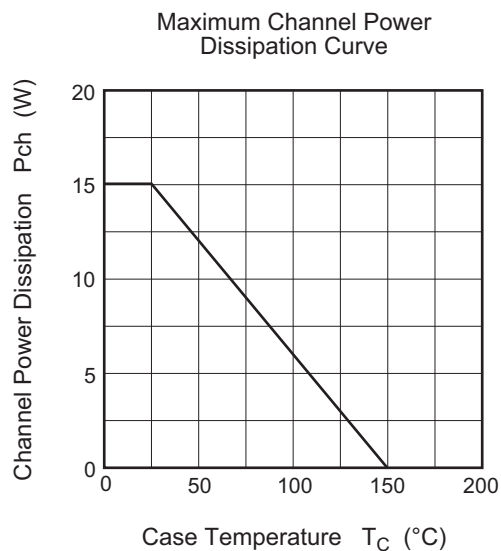
This device is sensitive to electro static discharge. An adequate careful handling procedure is requested.

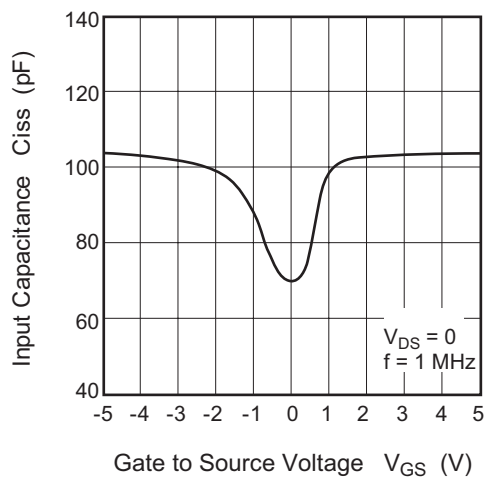
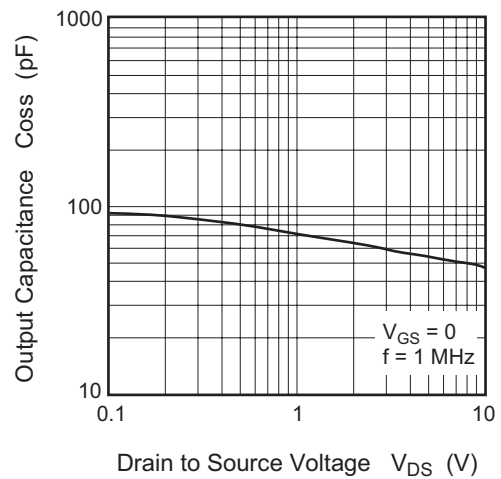
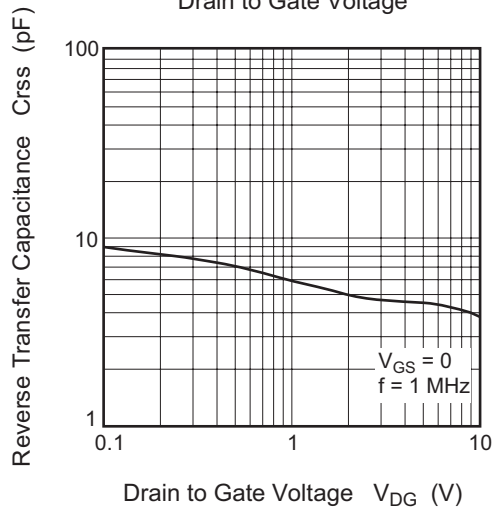
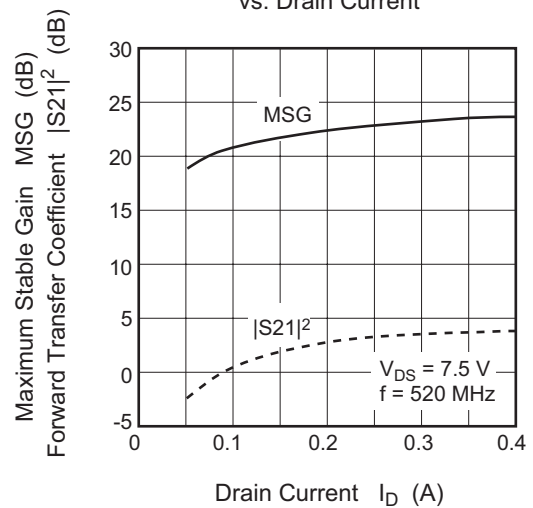
## Electrical Characteristics

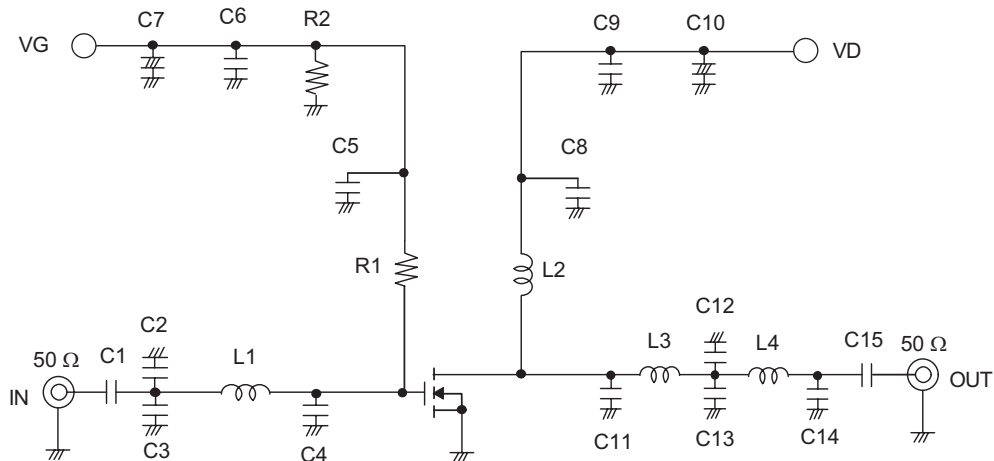
(Ta = 25°C)

| Item                            | Symbol        | Min. | Typ  | Max.    | Unit    | Test Conditions                                                                     |
|---------------------------------|---------------|------|------|---------|---------|-------------------------------------------------------------------------------------|
| Zero gate voltage drain current | $I_{DSS}$     | —    | —    | 20      | $\mu A$ | $V_{DS} = 16 V, V_{GS} = 0$                                                         |
| Gate to source leak current     | $I_{GSS}$     | —    | —    | $\pm 3$ | $\mu A$ | $V_{GS} = \pm 5 V, V_{DS} = 0$                                                      |
| Gate to source cutoff voltage   | $V_{GS(off)}$ | 0.25 | 0.4  | 0.75    | V       | $I_D = 1 mA, V_{DS} = 7.5 V$                                                        |
| Forward transfer admittance     | $ y_{fs} $    | 3.8  | 4.8  | 5.8     | S       | $V_{DS} = 7.5 V, I_D = 2 A$                                                         |
| Input capacitance               | $C_{iss}$     | —    | 102  | —       | pF      | $V_{GS} = 5 V, V_{DS} = 0, f = 1 MHz$                                               |
| Output capacitance              | $C_{oss}$     | —    | 50   | —       | pF      | $V_{DS} = 7.5 V, V_{GS} = 0, f = 1 MHz$                                             |
| Reverse transfer capacitance    | $C_{rss}$     | —    | 4.5  | —       | pF      | $V_{DG} = 7.5 V, V_{GS} = 0, f = 1 MHz$                                             |
| Output power                    | $P_{out}$     | 38.7 | 39.6 | —       | dBm     | $V_{DS} = 7.5 V, I_{DQ} = 200 mA,$<br>$f = 520 MHz,$<br>$P_{in} = +25 dBm (316 mW)$ |
|                                 |               | 7.41 | 9.12 | —       | W       |                                                                                     |
| Power added efficiency          | PAE           | 60   | 68   | —       | %       | $V_{DS} = 7.5 V, I_{DQ} = 200 mA,$<br>$f = 520 MHz,$<br>$P_{in} = +25 dBm (316 mW)$ |
| Output power                    | $P_{out}$     | —    | 35.8 | —       | dBm     |                                                                                     |
|                                 |               | —    | 3.8  | —       | W       | $V_{DS} = 3.6 V, I_{DQ} = 200 mA,$<br>$f = 520 MHz,$<br>$P_{in} = +25 dBm (316 mW)$ |
| Power added efficiency          | PAE           | —    | 60   | —       | %       |                                                                                     |

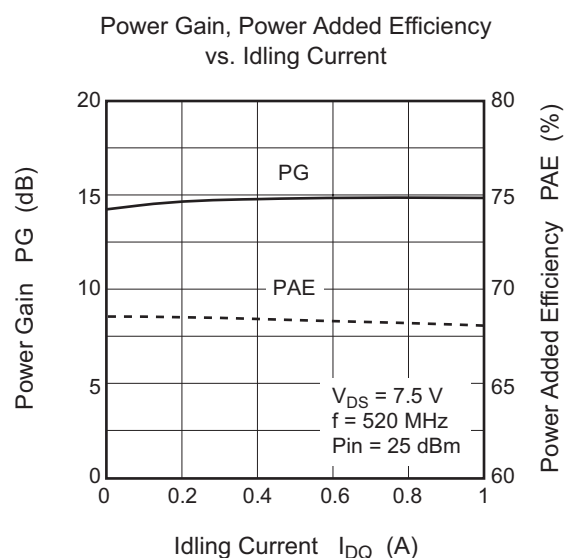
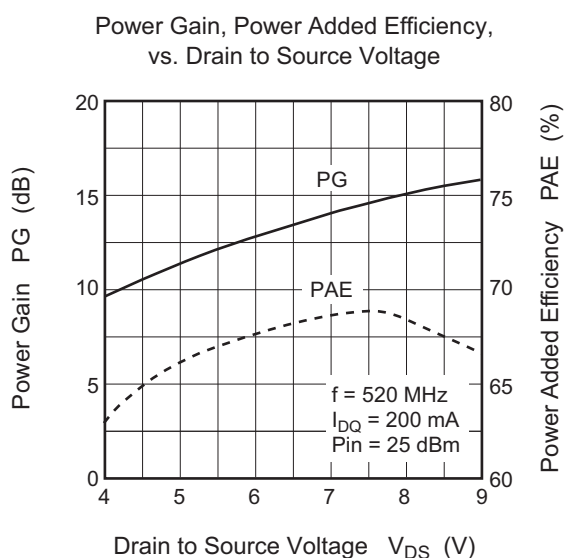
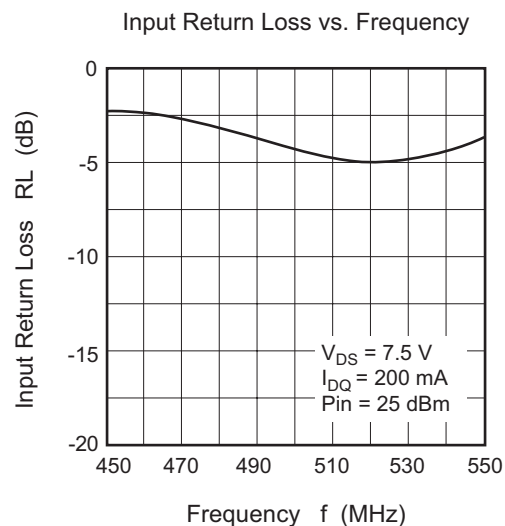
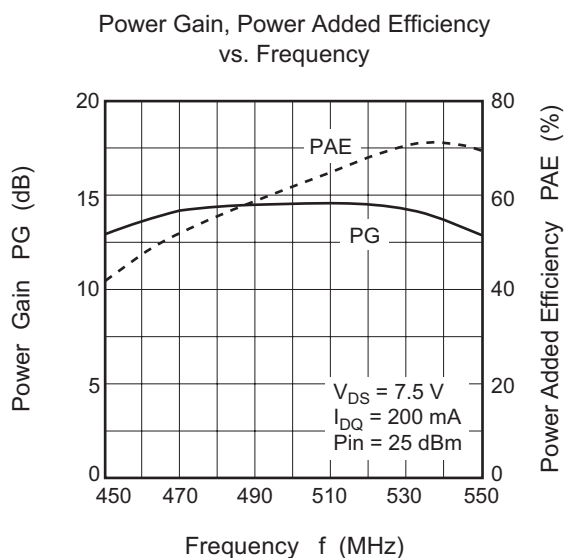
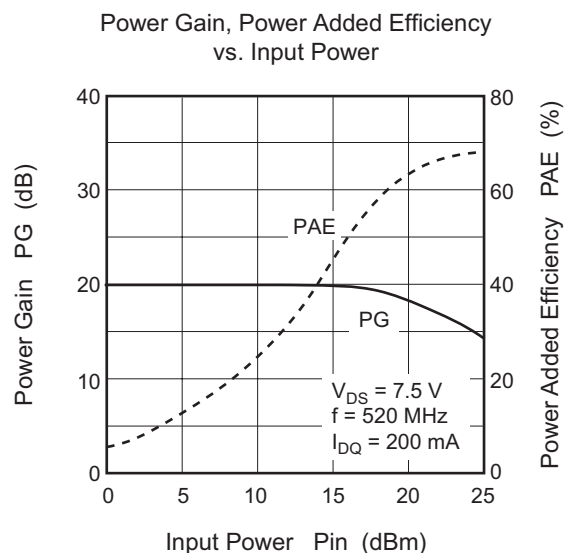
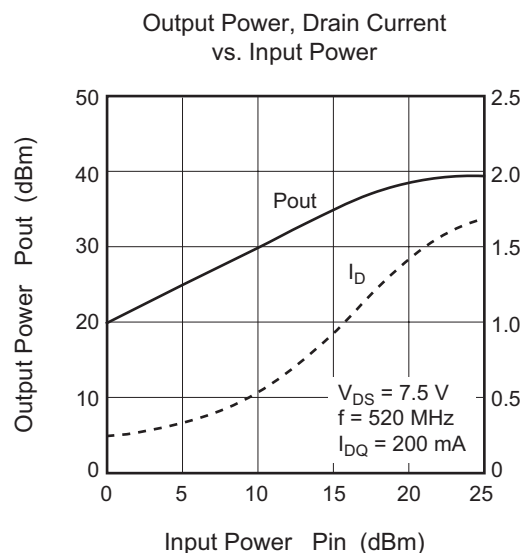
## Main Characteristics

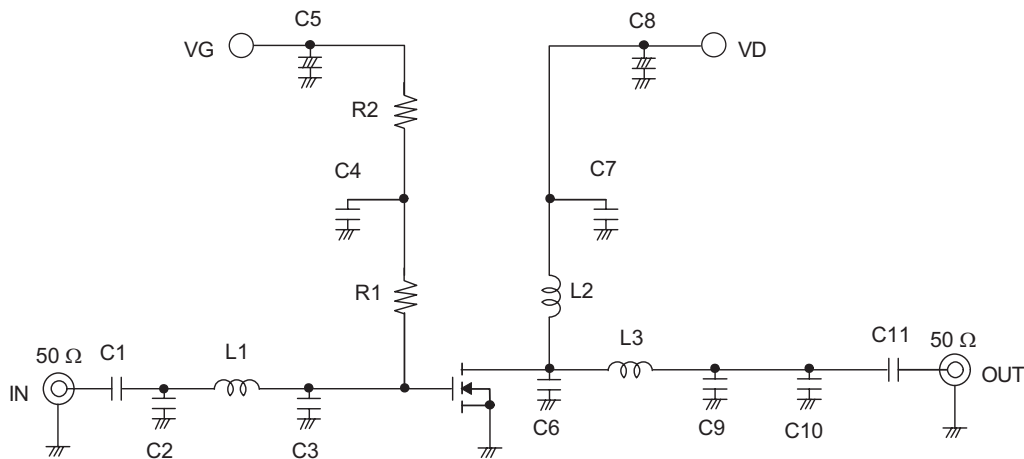


Input Capacitance vs.  
Gate to Source VoltageOutput Capacitance vs.  
Drain to Source VoltageReverse Transfer Capacitance vs.  
Drain to Gate VoltageMaximum Stable Gain,  $|S_{21}|^2$   
vs. Drain Current

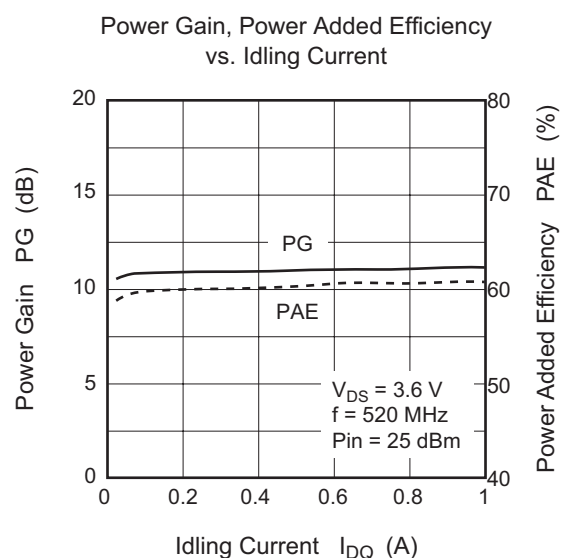
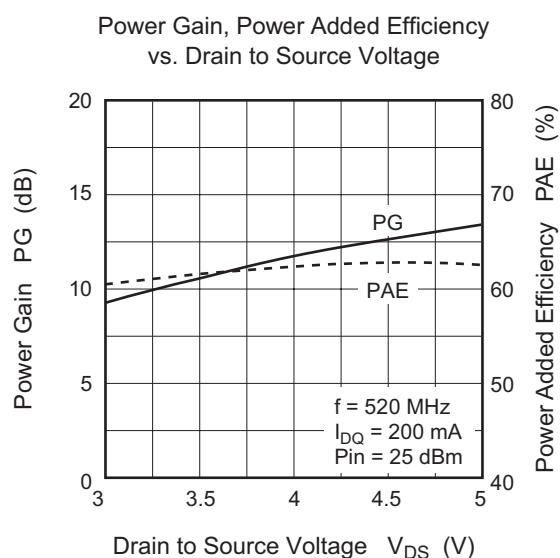
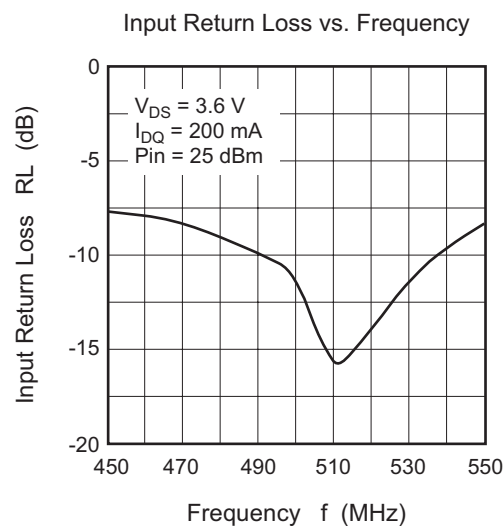
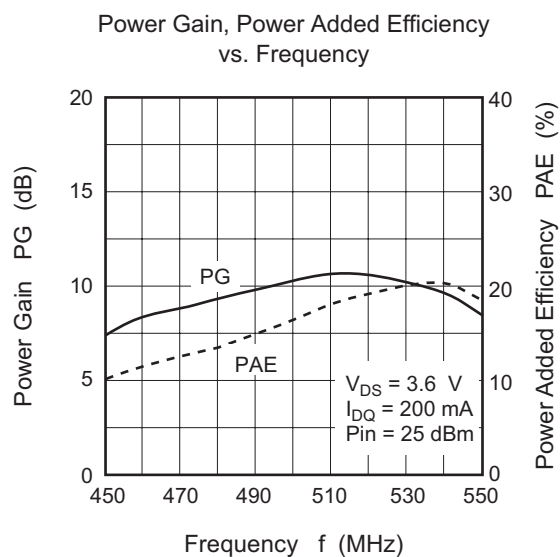
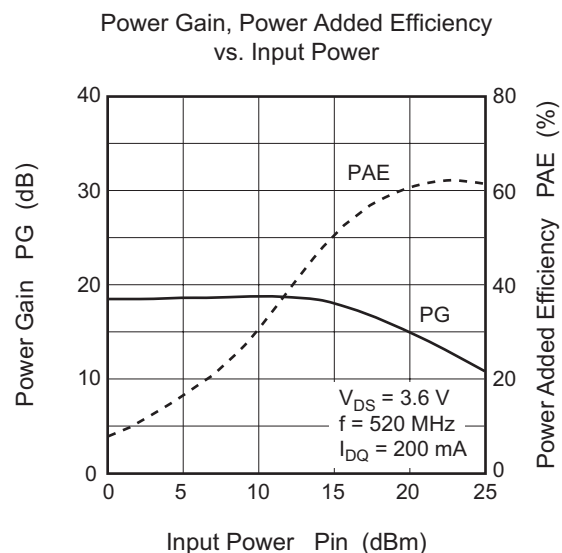
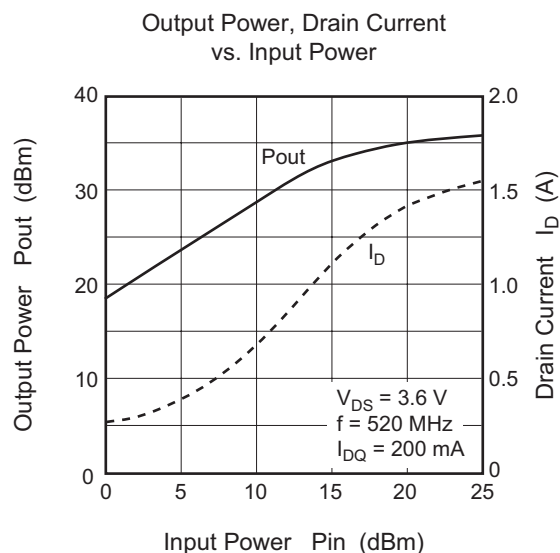
**Evaluation Circuit (@ $V_{DD} = 7.5\text{ V}$  Tuning,  $f = 520\text{ MHz}$ )**


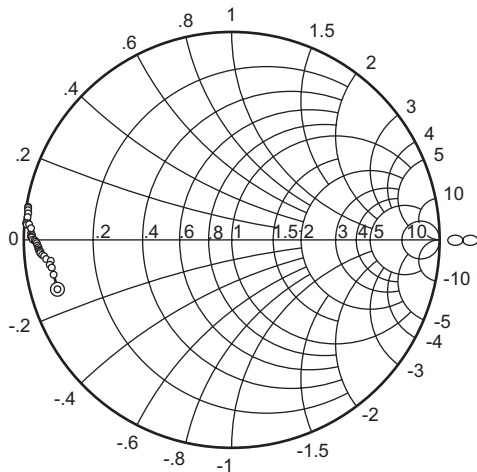
- C1, C6, C9, C15: 1000 pF Chip Capacitor  
 C2: 4 pF Chip Capacitor  
 C3: 15 pF Chip Capacitor  
 C4, C11: 5 pF Chip Capacitor  
 C5, C8: 100pF Chip Capacitor  
 C7, C10: 1  $\mu$ F Electrolysis Capacitor  
 C12, C14: 10 pF Chip Capacitor  
 C13: 7 pF Chip Capacitor  
 L1: 1.8 nH Chip Inductor  
 L2: 8 Turns D : 0.5 mm,  $\phi$ 2.4 mm Enamel Wire  
 L3: 1.0 nH Chip Inductor  
 L4: 1.5 nH Chip Inductor  
 R1: 6.8 k $\Omega$  Chip Resistor  
 R2: 40 k $\Omega$  Chip Resistor



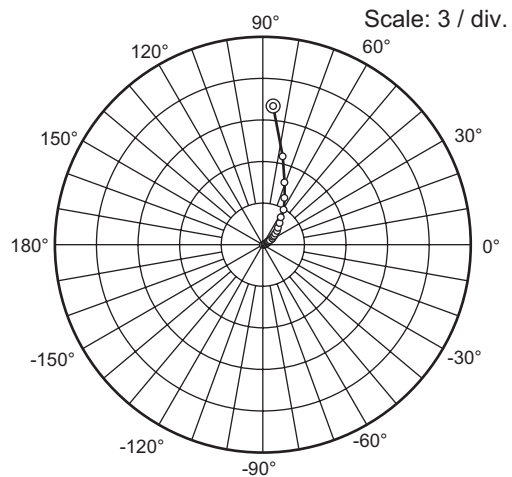
**Evaluation Circuit 2 ( @ $V_{DD} = 3.6$  V Tuning,  $f = 520$  MHz )**


- C1, C11: 1000 pF Chip Capacitor  
 C2: 20 pF Chip Capacitor  
 C3, C10: 10 pF Chip Capacitor  
 C4, C7: 100 pF Chip Capacitor  
 C5, C8: 1  $\mu$ F Electrolysis Capacitor  
 C6: 5 pF Chip Capacitor  
 C9: 27 pF Chip Capacitor  
 L1: 1.5 nH Chip Inductor  
 L2: 8 Turns D : 0.5 mm ,  $\phi$ 2.4 mm Enamel Wire  
 L3: 1.2 nH Chip Inductor  
 R1: 200  $\Omega$  Chip Resistor  
 R2: 3 k $\Omega$  Chip Resistor

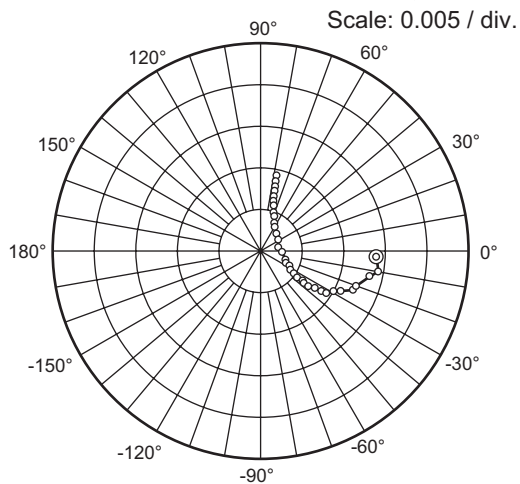


$S_{11}$  Parameter vs. Frequency

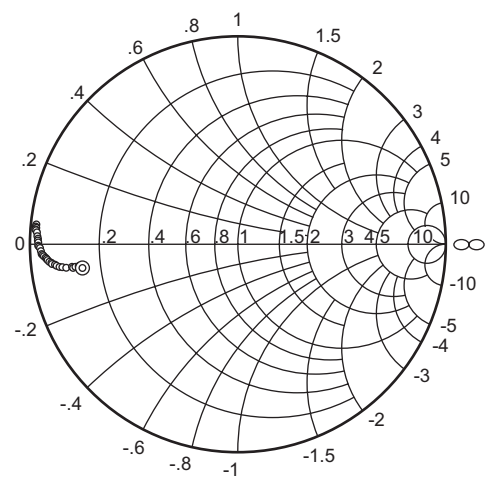
Condition:  $V_{DS} = 7.5 \text{ V}$ ,  $I_{DQ} = 200 \text{ mA}$ ,  $Z_o = 50 \Omega$   
 100 to 1000 MHz (50 MHz Step)  
 1000 to 2500 MHz (100 MHz Step)

 $S_{21}$  Parameter vs. Frequency

Condition:  $V_{DS} = 7.5 \text{ V}$ ,  $I_{DQ} = 200 \text{ mA}$ ,  $Z_o = 50 \Omega$   
 100 to 1000 MHz (50 MHz Step)  
 1000 to 2500 MHz (100 MHz Step)

 $S_{12}$  Parameter vs. Frequency

Condition:  $V_{DS} = 7.5 \text{ V}$ ,  $I_{DQ} = 200 \text{ mA}$ ,  $Z_o = 50 \Omega$   
 100 to 1000 MHz (50 MHz Step)  
 1000 to 2500 MHz (100 MHz Step)

 $S_{22}$  Parameter vs. Frequency

Condition:  $V_{DS} = 7.5 \text{ V}$ ,  $I_{DQ} = 200 \text{ mA}$ ,  $Z_o = 50 \Omega$   
 100 to 1000 MHz (50 MHz Step)  
 1000 to 2500 MHz (100 MHz Step)



## S Parameter

(V<sub>DS</sub> = 3.6 V, I<sub>D</sub> = 200 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21  |            | S12   |            | S22   |            |
|---------|-------|------------|------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG  | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.861 | -166.1     | 9.02 | 82.8       | 0.016 | -1.9       | 0.774 | -171.0     |
| 150     | 0.865 | -169.7     | 5.92 | 74.0       | 0.016 | -13.1      | 0.788 | -171.9     |
| 200     | 0.876 | -171.3     | 4.30 | 67.4       | 0.014 | -18.3      | 0.805 | -171.8     |
| 250     | 0.883 | -172.3     | 3.29 | 61.4       | 0.013 | -23.9      | 0.823 | -171.9     |
| 300     | 0.880 | -173.1     | 2.62 | 56.0       | 0.013 | -27.2      | 0.824 | -172.1     |
| 350     | 0.903 | -174.0     | 2.09 | 51.4       | 0.011 | -31.8      | 0.855 | -172.4     |
| 400     | 0.915 | -174.5     | 1.72 | 47.2       | 0.011 | -33.5      | 0.872 | -172.6     |
| 450     | 0.920 | -175.0     | 1.45 | 43.3       | 0.010 | -38.2      | 0.886 | -172.9     |
| 500     | 0.930 | -175.5     | 1.24 | 39.8       | 0.009 | -38.5      | 0.895 | -173.4     |
| 550     | 0.935 | -176.0     | 1.06 | 36.7       | 0.008 | -40.6      | 0.906 | -173.9     |
| 600     | 0.937 | -176.4     | 0.92 | 33.8       | 0.007 | -41.7      | 0.914 | -174.4     |
| 650     | 0.941 | -176.9     | 0.81 | 31.2       | 0.007 | -40.9      | 0.920 | -174.7     |
| 700     | 0.941 | -177.5     | 0.71 | 28.7       | 0.006 | -41.0      | 0.928 | -175.1     |
| 750     | 0.944 | -177.9     | 0.64 | 26.4       | 0.005 | -41.0      | 0.934 | -175.6     |
| 800     | 0.951 | -178.6     | 0.57 | 24.4       | 0.005 | -40.3      | 0.937 | -176.0     |
| 850     | 0.952 | -179.2     | 0.51 | 22.4       | 0.004 | -40.1      | 0.942 | -176.5     |
| 900     | 0.959 | -179.6     | 0.46 | 21.2       | 0.004 | -33.9      | 0.945 | -177.0     |
| 950     | 0.966 | -179.9     | 0.42 | 19.8       | 0.003 | -31.0      | 0.951 | -177.3     |
| 1000    | 0.968 | -179.8     | 0.38 | 18.7       | 0.003 | -25.8      | 0.954 | -177.7     |
| 1050    | 0.969 | 179.8      | 0.34 | 17.5       | 0.003 | -16.0      | 0.956 | -178.0     |
| 1100    | 0.972 | 179.8      | 0.32 | 16.3       | 0.002 | -9.2       | 0.957 | -178.5     |
| 1150    | 0.972 | 179.7      | 0.29 | 15.2       | 0.002 | 2.2        | 0.962 | -178.8     |
| 1200    | 0.974 | 179.4      | 0.27 | 14.3       | 0.002 | 9.9        | 0.962 | -179.2     |
| 1250    | 0.974 | 179.2      | 0.25 | 13.2       | 0.002 | 24.6       | 0.963 | -179.6     |
| 1300    | 0.975 | 178.9      | 0.23 | 12.1       | 0.002 | 33.5       | 0.965 | -179.7     |
| 1350    | 0.973 | 178.6      | 0.21 | 11.1       | 0.002 | 43.3       | 0.966 | -180.0     |
| 1400    | 0.971 | 178.2      | 0.20 | 9.9        | 0.003 | 48.3       | 0.967 | 179.8      |
| 1450    | 0.968 | 177.5      | 0.19 | 9.0        | 0.003 | 55.8       | 0.968 | 179.4      |
| 1500    | 0.970 | 176.8      | 0.17 | 8.0        | 0.003 | 62.8       | 0.967 | 179.1      |
| 1550    | 0.979 | 176.5      | 0.17 | 7.4        | 0.004 | 65.0       | 0.967 | 178.9      |
| 1600    | 0.990 | 175.9      | 0.16 | 7.0        | 0.004 | 67.1       | 0.968 | 178.4      |
| 1650    | 0.995 | 175.9      | 0.15 | 6.9        | 0.004 | 68.7       | 0.968 | 178.3      |
| 1700    | 0.999 | 175.8      | 0.14 | 6.6        | 0.004 | 71.0       | 0.969 | 177.9      |
| 1750    | 0.999 | 175.8      | 0.13 | 6.2        | 0.005 | 72.3       | 0.969 | 177.6      |
| 1800    | 0.999 | 175.7      | 0.13 | 6.2        | 0.005 | 74.8       | 0.972 | 177.3      |
| 1850    | 0.999 | 175.7      | 0.12 | 6.3        | 0.005 | 75.0       | 0.970 | 177.0      |
| 1900    | 0.999 | 175.6      | 0.12 | 6.4        | 0.006 | 75.5       | 0.971 | 176.7      |
| 1950    | 0.999 | 175.3      | 0.11 | 6.4        | 0.006 | 75.2       | 0.972 | 176.4      |
| 2000    | 0.999 | 174.9      | 0.10 | 6.4        | 0.006 | 75.4       | 0.974 | 176.2      |
| 2050    | 0.999 | 174.4      | 0.10 | 6.3        | 0.006 | 78.5       | 0.975 | 175.9      |
| 2100    | 0.999 | 173.7      | 0.09 | 5.9        | 0.007 | 78.0       | 0.975 | 175.7      |
| 2150    | 0.999 | 173.0      | 0.09 | 5.2        | 0.007 | 78.0       | 0.979 | 175.5      |
| 2200    | 0.999 | 172.4      | 0.09 | 4.9        | 0.007 | 77.6       | 0.980 | 175.4      |
| 2250    | 0.999 | 172.2      | 0.08 | 4.2        | 0.008 | 78.2       | 0.979 | 175.1      |
| 2300    | 0.999 | 171.5      | 0.08 | 4.0        | 0.008 | 78.6       | 0.978 | 174.9      |
| 2350    | 0.999 | 171.2      | 0.08 | 3.2        | 0.008 | 78.8       | 0.983 | 174.7      |
| 2400    | 0.999 | 171.0      | 0.08 | 3.3        | 0.009 | 79.3       | 0.979 | 174.6      |
| 2450    | 0.999 | 171.2      | 0.07 | 2.7        | 0.009 | 78.9       | 0.978 | 174.4      |
| 2500    | 0.999 | 170.8      | 0.07 | 3.3        | 0.009 | 78.7       | 0.980 | 174.1      |

## S parameter

(V<sub>DS</sub> = 6 V, I<sub>D</sub> = 200 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21  |            | S12   |            | S22   |            |
|---------|-------|------------|------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG  | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.869 | -165.2     | 9.86 | 83.9       | 0.016 | -1.6       | 0.758 | -170.4     |
| 150     | 0.872 | -169.3     | 6.45 | 75.2       | 0.015 | -10.6      | 0.773 | -171.4     |
| 200     | 0.878 | -171.1     | 4.68 | 68.4       | 0.014 | -17.0      | 0.791 | -171.3     |
| 250     | 0.887 | -172.2     | 3.59 | 62.7       | 0.013 | -23.2      | 0.808 | -171.2     |
| 300     | 0.882 | -173.2     | 2.87 | 57.1       | 0.012 | -26.0      | 0.811 | -171.6     |
| 350     | 0.907 | -173.9     | 2.29 | 52.6       | 0.011 | -30.3      | 0.843 | -171.7     |
| 400     | 0.915 | -174.6     | 1.90 | 48.4       | 0.010 | -32.0      | 0.861 | -172.0     |
| 450     | 0.922 | -174.9     | 1.60 | 44.4       | 0.009 | -36.7      | 0.874 | -172.3     |
| 500     | 0.932 | -175.2     | 1.37 | 41.1       | 0.009 | -37.5      | 0.885 | -172.9     |
| 550     | 0.933 | -175.9     | 1.18 | 37.8       | 0.008 | -39.5      | 0.897 | -173.3     |
| 600     | 0.937 | -176.4     | 1.02 | 35.2       | 0.007 | -40.4      | 0.905 | -173.6     |
| 650     | 0.940 | -176.8     | 0.90 | 32.5       | 0.007 | -39.4      | 0.912 | -174.0     |
| 700     | 0.941 | -177.4     | 0.79 | 29.8       | 0.006 | -38.9      | 0.922 | -174.5     |
| 750     | 0.946 | -178.0     | 0.71 | 27.4       | 0.005 | -40.1      | 0.927 | -174.9     |
| 800     | 0.947 | -178.4     | 0.63 | 25.1       | 0.005 | -38.9      | 0.931 | -175.4     |
| 850     | 0.955 | -179.2     | 0.57 | 23.7       | 0.004 | -37.9      | 0.936 | -175.9     |
| 900     | 0.961 | -179.8     | 0.52 | 21.9       | 0.004 | -32.8      | 0.941 | -176.3     |
| 950     | 0.967 | -180.0     | 0.47 | 20.6       | 0.003 | -29.5      | 0.946 | -176.7     |
| 1000    | 0.968 | -179.9     | 0.42 | 19.7       | 0.003 | -26.7      | 0.949 | -177.2     |
| 1050    | 0.969 | 179.6      | 0.38 | 18.3       | 0.003 | -17.2      | 0.951 | -177.6     |
| 1100    | 0.972 | 179.8      | 0.35 | 17.1       | 0.002 | -10.4      | 0.954 | -178.0     |
| 1150    | 0.971 | 179.7      | 0.33 | 15.9       | 0.002 | 4.4        | 0.956 | -178.3     |
| 1200    | 0.975 | 179.5      | 0.30 | 15.0       | 0.002 | 9.0        | 0.959 | -178.6     |
| 1250    | 0.973 | 179.3      | 0.28 | 14.0       | 0.002 | 19.7       | 0.959 | -179.0     |
| 1300    | 0.974 | 178.9      | 0.26 | 12.8       | 0.002 | 34.9       | 0.962 | -179.2     |
| 1350    | 0.973 | 178.8      | 0.24 | 11.8       | 0.002 | 41.8       | 0.965 | -179.5     |
| 1400    | 0.971 | 178.3      | 0.22 | 10.5       | 0.003 | 48.9       | 0.963 | -179.8     |
| 1450    | 0.968 | 177.7      | 0.21 | 9.5        | 0.003 | 55.0       | 0.965 | 179.9      |
| 1500    | 0.971 | 177.2      | 0.20 | 8.4        | 0.003 | 60.4       | 0.964 | 179.6      |
| 1550    | 0.975 | 176.6      | 0.19 | 7.8        | 0.003 | 63.0       | 0.966 | 179.4      |
| 1600    | 0.993 | 176.1      | 0.18 | 7.3        | 0.004 | 63.7       | 0.966 | 178.9      |
| 1650    | 0.997 | 175.8      | 0.17 | 7.1        | 0.004 | 67.9       | 0.966 | 178.8      |
| 1700    | 0.999 | 175.9      | 0.16 | 6.7        | 0.004 | 69.2       | 0.967 | 178.4      |
| 1750    | 0.999 | 175.8      | 0.15 | 6.6        | 0.004 | 70.5       | 0.967 | 178.0      |
| 1800    | 0.999 | 175.8      | 0.14 | 6.5        | 0.005 | 72.7       | 0.970 | 177.7      |
| 1850    | 0.999 | 175.9      | 0.14 | 6.4        | 0.005 | 74.6       | 0.969 | 177.3      |
| 1900    | 0.999 | 175.9      | 0.13 | 6.9        | 0.006 | 75.6       | 0.969 | 177.1      |
| 1950    | 0.999 | 175.4      | 0.12 | 6.5        | 0.006 | 75.6       | 0.971 | 176.8      |
| 2000    | 0.999 | 174.9      | 0.12 | 6.3        | 0.006 | 76.7       | 0.972 | 176.5      |
| 2050    | 0.999 | 174.6      | 0.11 | 6.5        | 0.006 | 78.5       | 0.973 | 176.3      |
| 2100    | 0.999 | 173.8      | 0.11 | 5.9        | 0.007 | 78.2       | 0.974 | 176.0      |
| 2150    | 0.999 | 173.1      | 0.10 | 5.0        | 0.007 | 77.7       | 0.978 | 175.8      |
| 2200    | 0.999 | 172.6      | 0.10 | 4.8        | 0.007 | 77.4       | 0.979 | 175.8      |
| 2250    | 0.999 | 172.1      | 0.09 | 3.8        | 0.008 | 78.2       | 0.977 | 175.5      |
| 2300    | 0.999 | 171.7      | 0.09 | 3.4        | 0.008 | 77.3       | 0.978 | 175.1      |
| 2350    | 0.999 | 171.2      | 0.09 | 2.9        | 0.008 | 78.4       | 0.982 | 175.1      |
| 2400    | 0.999 | 171.1      | 0.08 | 2.9        | 0.008 | 78.9       | 0.978 | 174.9      |
| 2450    | 0.999 | 171.1      | 0.08 | 2.5        | 0.009 | 78.5       | 0.978 | 174.7      |
| 2500    | 0.999 | 171.1      | 0.08 | 2.7        | 0.009 | 78.4       | 0.979 | 174.4      |

## S parameter

(V<sub>DS</sub> = 7.2 V, I<sub>D</sub> = 200 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21   |            | S12   |            | S22   |            |
|---------|-------|------------|-------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.875 | -164.1     | 10.08 | 85.2       | 0.015 | -0.6       | 0.757 | -170.9     |
| 150     | 0.877 | -168.9     | 6.59  | 76.3       | 0.014 | -9.4       | 0.771 | -171.7     |
| 200     | 0.884 | -170.8     | 4.78  | 69.7       | 0.013 | -16.3      | 0.787 | -171.5     |
| 250     | 0.892 | -172.0     | 3.69  | 63.7       | 0.012 | -20.8      | 0.804 | -171.5     |
| 300     | 0.887 | -173.0     | 2.95  | 58.3       | 0.012 | -23.6      | 0.807 | -171.7     |
| 350     | 0.908 | -173.9     | 2.35  | 53.8       | 0.011 | -28.4      | 0.838 | -171.7     |
| 400     | 0.917 | -174.4     | 1.96  | 49.4       | 0.010 | -30.7      | 0.854 | -172.0     |
| 450     | 0.922 | -174.8     | 1.66  | 45.8       | 0.010 | -34.6      | 0.869 | -172.3     |
| 500     | 0.931 | -175.3     | 1.42  | 42.4       | 0.009 | -35.9      | 0.880 | -172.7     |
| 550     | 0.934 | -176.0     | 1.23  | 39.3       | 0.008 | -38.4      | 0.893 | -173.2     |
| 600     | 0.939 | -176.2     | 1.06  | 36.3       | 0.007 | -38.5      | 0.902 | -173.6     |
| 650     | 0.943 | -176.8     | 0.93  | 33.4       | 0.007 | -38.9      | 0.908 | -173.9     |
| 700     | 0.944 | -177.4     | 0.83  | 31.0       | 0.006 | -36.6      | 0.917 | -174.4     |
| 750     | 0.948 | -177.8     | 0.74  | 28.4       | 0.005 | -38.0      | 0.925 | -174.8     |
| 800     | 0.949 | -178.5     | 0.66  | 26.5       | 0.005 | -37.0      | 0.928 | -175.3     |
| 850     | 0.953 | -179.1     | 0.60  | 24.7       | 0.004 | -36.2      | 0.933 | -175.7     |
| 900     | 0.963 | -179.6     | 0.54  | 23.3       | 0.004 | -30.7      | 0.938 | -176.2     |
| 950     | 0.972 | -179.8     | 0.50  | 21.7       | 0.003 | -29.5      | 0.944 | -176.6     |
| 1000    | 0.968 | -179.9     | 0.45  | 20.3       | 0.003 | -25.6      | 0.947 | -176.9     |
| 1050    | 0.969 | 180.0      | 0.41  | 19.4       | 0.003 | -13.4      | 0.949 | -177.4     |
| 1100    | 0.970 | 179.8      | 0.37  | 18.0       | 0.002 | -7.9       | 0.953 | -177.8     |
| 1150    | 0.972 | 179.6      | 0.34  | 16.8       | 0.002 | 3.2        | 0.955 | -178.2     |
| 1200    | 0.975 | 179.6      | 0.32  | 15.8       | 0.002 | 8.7        | 0.958 | -178.5     |
| 1250    | 0.975 | 179.4      | 0.29  | 14.8       | 0.002 | 24.7       | 0.958 | -178.9     |
| 1300    | 0.977 | 179.0      | 0.27  | 13.5       | 0.002 | 33.6       | 0.960 | -179.1     |
| 1350    | 0.972 | 178.7      | 0.25  | 12.4       | 0.002 | 43.9       | 0.962 | -179.3     |
| 1400    | 0.972 | 178.3      | 0.23  | 11.2       | 0.003 | 45.9       | 0.963 | -179.6     |
| 1450    | 0.967 | 177.6      | 0.22  | 10.0       | 0.003 | 53.6       | 0.963 | -180.0     |
| 1500    | 0.971 | 177.1      | 0.21  | 9.0        | 0.003 | 61.2       | 0.963 | 179.8      |
| 1550    | 0.979 | 176.6      | 0.20  | 8.4        | 0.003 | 63.4       | 0.964 | 179.5      |
| 1600    | 0.988 | 176.2      | 0.19  | 7.8        | 0.004 | 65.1       | 0.964 | 179.0      |
| 1650    | 0.996 | 176.0      | 0.18  | 7.6        | 0.004 | 68.0       | 0.965 | 178.9      |
| 1700    | 0.998 | 175.7      | 0.17  | 7.1        | 0.004 | 69.1       | 0.965 | 178.5      |
| 1750    | 0.999 | 175.8      | 0.16  | 6.9        | 0.005 | 72.3       | 0.965 | 178.2      |
| 1800    | 0.999 | 175.8      | 0.15  | 6.8        | 0.005 | 72.6       | 0.969 | 177.8      |
| 1850    | 0.999 | 175.9      | 0.14  | 6.6        | 0.005 | 74.8       | 0.968 | 177.5      |
| 1900    | 0.999 | 175.9      | 0.14  | 6.9        | 0.006 | 74.8       | 0.968 | 177.2      |
| 1950    | 0.999 | 175.3      | 0.13  | 6.6        | 0.006 | 76.7       | 0.970 | 176.9      |
| 2000    | 0.999 | 175.0      | 0.12  | 6.7        | 0.006 | 76.3       | 0.972 | 176.7      |
| 2050    | 0.999 | 174.5      | 0.12  | 6.6        | 0.006 | 77.7       | 0.973 | 176.5      |
| 2100    | 0.999 | 173.7      | 0.11  | 6.2        | 0.007 | 76.2       | 0.974 | 176.1      |
| 2150    | 0.999 | 173.1      | 0.11  | 5.4        | 0.007 | 78.1       | 0.978 | 175.9      |
| 2200    | 0.999 | 172.5      | 0.10  | 4.7        | 0.007 | 76.9       | 0.977 | 175.9      |
| 2250    | 0.999 | 172.2      | 0.10  | 3.9        | 0.008 | 78.0       | 0.977 | 175.5      |
| 2300    | 0.999 | 171.7      | 0.10  | 3.3        | 0.008 | 76.4       | 0.977 | 175.2      |
| 2350    | 0.999 | 171.2      | 0.09  | 2.7        | 0.008 | 78.6       | 0.981 | 175.2      |
| 2400    | 0.999 | 171.0      | 0.09  | 2.7        | 0.008 | 79.3       | 0.978 | 175.1      |
| 2450    | 0.999 | 171.1      | 0.09  | 2.3        | 0.009 | 78.2       | 0.977 | 174.8      |
| 2500    | 0.999 | 170.9      | 0.08  | 2.5        | 0.009 | 78.6       | 0.978 | 174.5      |

## S parameter

(V<sub>DS</sub> = 7.5 V, I<sub>D</sub> = 50 mA, Z<sub>0</sub> = 50 Ω)

| f (MHz) | S11   |            | S21  |            | S12   |            | S22   |            |
|---------|-------|------------|------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG  | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.823 | -154.9     | 7.70 | 78.6       | 0.029 | -10.5      | 0.659 | -153.1     |
| 150     | 0.844 | -160.8     | 4.82 | 66.1       | 0.027 | -23.3      | 0.715 | -156.5     |
| 200     | 0.865 | -163.9     | 3.33 | 56.7       | 0.023 | -31.6      | 0.767 | -158.5     |
| 250     | 0.887 | -166.2     | 2.44 | 49.1       | 0.021 | -39.6      | 0.809 | -160.5     |
| 300     | 0.891 | -168.1     | 1.86 | 42.6       | 0.019 | -44.9      | 0.829 | -162.7     |
| 350     | 0.922 | -169.6     | 1.42 | 37.5       | 0.016 | -49.4      | 0.869 | -164.4     |
| 400     | 0.932 | -171.0     | 1.14 | 33.1       | 0.015 | -52.4      | 0.893 | -165.9     |
| 450     | 0.941 | -172.0     | 0.93 | 29.4       | 0.013 | -56.4      | 0.908 | -167.3     |
| 500     | 0.949 | -173.1     | 0.77 | 26.1       | 0.012 | -58.1      | 0.920 | -168.6     |
| 550     | 0.953 | -173.8     | 0.65 | 23.5       | 0.011 | -59.9      | 0.931 | -169.7     |
| 600     | 0.955 | -174.4     | 0.54 | 21.0       | 0.009 | -61.1      | 0.939 | -170.7     |
| 650     | 0.955 | -175.4     | 0.47 | 18.8       | 0.008 | -62.3      | 0.944 | -171.6     |
| 700     | 0.957 | -176.2     | 0.41 | 16.6       | 0.007 | -61.7      | 0.950 | -172.3     |
| 750     | 0.965 | -176.8     | 0.36 | 14.7       | 0.007 | -62.9      | 0.955 | -173.1     |
| 800     | 0.962 | -177.6     | 0.32 | 13.1       | 0.006 | -62.2      | 0.958 | -173.8     |
| 850     | 0.969 | -178.3     | 0.28 | 11.5       | 0.005 | -63.0      | 0.961 | -174.5     |
| 900     | 0.973 | -178.8     | 0.26 | 10.9       | 0.004 | -60.5      | 0.963 | -175.1     |
| 950     | 0.979 | -179.3     | 0.23 | 9.6        | 0.004 | -58.6      | 0.967 | -175.6     |
| 1000    | 0.977 | -179.2     | 0.21 | 8.9        | 0.003 | -57.6      | 0.969 | -176.2     |
| 1050    | 0.982 | -179.7     | 0.19 | 7.9        | 0.002 | -53.5      | 0.969 | -176.7     |
| 1100    | 0.984 | 180.0      | 0.17 | 7.2        | 0.002 | -46.6      | 0.971 | -177.2     |
| 1150    | 0.982 | 179.7      | 0.16 | 6.3        | 0.002 | -38.0      | 0.973 | -177.5     |
| 1200    | 0.982 | 179.6      | 0.15 | 5.8        | 0.001 | -27.7      | 0.975 | -177.9     |
| 1250    | 0.983 | 179.5      | 0.13 | 5.1        | 0.001 | -1.9       | 0.975 | -178.4     |
| 1300    | 0.984 | 179.1      | 0.12 | 4.2        | 0.001 | 21.6       | 0.976 | -178.6     |
| 1350    | 0.986 | 178.9      | 0.12 | 3.5        | 0.001 | 37.7       | 0.977 | -178.9     |
| 1400    | 0.987 | 178.6      | 0.11 | 2.9        | 0.002 | 47.3       | 0.978 | -179.2     |
| 1450    | 0.987 | 177.9      | 0.10 | 2.2        | 0.002 | 56.0       | 0.977 | -179.6     |
| 1500    | 0.989 | 177.1      | 0.09 | 1.4        | 0.002 | 64.7       | 0.976 | 180.0      |
| 1550    | 0.989 | 176.5      | 0.09 | 0.8        | 0.003 | 69.3       | 0.977 | 179.7      |
| 1600    | 0.989 | 175.9      | 0.08 | 0.9        | 0.003 | 71.4       | 0.977 | 179.3      |
| 1650    | 0.999 | 175.8      | 0.08 | 1.3        | 0.003 | 73.5       | 0.976 | 179.2      |
| 1700    | 0.999 | 175.8      | 0.08 | 1.0        | 0.004 | 74.6       | 0.976 | 178.7      |
| 1750    | 0.999 | 176.0      | 0.07 | 1.2        | 0.004 | 75.2       | 0.976 | 178.4      |
| 1800    | 0.999 | 175.9      | 0.07 | 1.9        | 0.004 | 76.6       | 0.978 | 178.1      |
| 1850    | 0.999 | 175.8      | 0.06 | 1.9        | 0.005 | 78.8       | 0.978 | 177.7      |
| 1900    | 0.999 | 175.7      | 0.06 | 3.0        | 0.005 | 78.7       | 0.977 | 177.3      |
| 1950    | 0.999 | 175.4      | 0.06 | 3.1        | 0.005 | 79.7       | 0.980 | 177.1      |
| 2000    | 0.999 | 174.9      | 0.06 | 3.4        | 0.006 | 79.1       | 0.981 | 176.8      |
| 2050    | 0.999 | 174.6      | 0.05 | 3.5        | 0.006 | 81.0       | 0.982 | 176.6      |
| 2100    | 0.999 | 174.2      | 0.05 | 3.6        | 0.006 | 80.3       | 0.982 | 176.3      |
| 2150    | 0.999 | 173.6      | 0.05 | 3.2        | 0.007 | 80.9       | 0.986 | 176.1      |
| 2200    | 0.999 | 173.0      | 0.05 | 3.0        | 0.007 | 80.5       | 0.985 | 176.0      |
| 2250    | 0.999 | 172.8      | 0.04 | 3.0        | 0.007 | 80.7       | 0.985 | 175.7      |
| 2300    | 0.999 | 172.1      | 0.04 | 3.0        | 0.007 | 80.5       | 0.984 | 175.4      |
| 2350    | 0.999 | 171.6      | 0.04 | 3.4        | 0.008 | 81.6       | 0.988 | 175.2      |
| 2400    | 0.999 | 171.6      | 0.04 | 3.7        | 0.008 | 81.2       | 0.985 | 175.2      |
| 2450    | 0.999 | 171.6      | 0.04 | 3.8        | 0.008 | 80.7       | 0.984 | 174.9      |
| 2500    | 0.999 | 171.4      | 0.04 | 4.6        | 0.009 | 80.5       | 0.985 | 174.6      |

## S parameter

(V<sub>DS</sub> = 7.5 V, I<sub>D</sub> = 100 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21  |            | S12   |            | S22   |            |
|---------|-------|------------|------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG  | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.844 | -161.0     | 9.17 | 82.5       | 0.020 | -3.8       | 0.702 | -165.1     |
| 150     | 0.855 | -165.9     | 5.87 | 72.1       | 0.019 | -16.1      | 0.731 | -166.4     |
| 200     | 0.867 | -168.1     | 4.19 | 64.4       | 0.017 | -22.8      | 0.760 | -166.6     |
| 250     | 0.880 | -169.6     | 3.17 | 57.7       | 0.017 | -29.0      | 0.789 | -166.9     |
| 300     | 0.880 | -170.8     | 2.49 | 51.8       | 0.015 | -31.9      | 0.802 | -167.7     |
| 350     | 0.906 | -172.0     | 1.96 | 46.7       | 0.014 | -37.6      | 0.840 | -168.3     |
| 400     | 0.913 | -172.7     | 1.60 | 42.2       | 0.012 | -40.1      | 0.862 | -169.1     |
| 450     | 0.925 | -173.5     | 1.33 | 38.4       | 0.011 | -44.6      | 0.878 | -169.8     |
| 500     | 0.932 | -174.4     | 1.12 | 35.1       | 0.010 | -45.7      | 0.892 | -170.5     |
| 550     | 0.939 | -175.0     | 0.96 | 31.9       | 0.009 | -49.7      | 0.903 | -171.4     |
| 600     | 0.944 | -175.4     | 0.83 | 29.3       | 0.008 | -50.1      | 0.912 | -172.1     |
| 650     | 0.944 | -176.1     | 0.72 | 26.6       | 0.007 | -50.3      | 0.919 | -172.7     |
| 700     | 0.946 | -176.9     | 0.63 | 24.2       | 0.007 | -50.0      | 0.928 | -173.3     |
| 750     | 0.951 | -177.4     | 0.56 | 22.0       | 0.006 | -50.8      | 0.934 | -173.8     |
| 800     | 0.952 | -178.1     | 0.49 | 20.0       | 0.005 | -50.0      | 0.937 | -174.4     |
| 850     | 0.958 | -178.9     | 0.44 | 18.5       | 0.004 | -50.1      | 0.941 | -174.9     |
| 900     | 0.961 | -179.2     | 0.40 | 17.3       | 0.004 | -44.7      | 0.947 | -175.5     |
| 950     | 0.967 | -179.3     | 0.36 | 16.0       | 0.003 | -44.2      | 0.951 | -175.9     |
| 1000    | 0.971 | -179.7     | 0.33 | 15.0       | 0.003 | -42.4      | 0.954 | -176.5     |
| 1050    | 0.969 | -180.0     | 0.30 | 13.9       | 0.002 | -35.6      | 0.957 | -177.0     |
| 1100    | 0.972 | 179.7      | 0.27 | 12.7       | 0.002 | -27.0      | 0.959 | -177.5     |
| 1150    | 0.976 | 179.7      | 0.25 | 11.6       | 0.002 | -15.0      | 0.961 | -177.7     |
| 1200    | 0.976 | 179.5      | 0.23 | 11.0       | 0.002 | -6.4       | 0.963 | -178.2     |
| 1250    | 0.978 | 179.1      | 0.21 | 9.7        | 0.002 | 10.7       | 0.963 | -178.6     |
| 1300    | 0.976 | 179.1      | 0.20 | 9.0        | 0.002 | 21.9       | 0.965 | -178.8     |
| 1350    | 0.979 | 178.7      | 0.18 | 8.0        | 0.002 | 37.1       | 0.966 | -179.1     |
| 1400    | 0.980 | 178.3      | 0.17 | 7.0        | 0.002 | 45.3       | 0.966 | -179.3     |
| 1450    | 0.982 | 177.7      | 0.16 | 5.9        | 0.002 | 53.3       | 0.967 | -179.8     |
| 1500    | 0.983 | 177.0      | 0.15 | 4.9        | 0.003 | 61.1       | 0.967 | 180.0      |
| 1550    | 0.984 | 176.4      | 0.14 | 4.3        | 0.003 | 64.9       | 0.968 | 179.7      |
| 1600    | 0.985 | 175.8      | 0.13 | 4.1        | 0.003 | 66.4       | 0.969 | 179.2      |
| 1650    | 0.999 | 175.9      | 0.13 | 4.2        | 0.004 | 67.9       | 0.969 | 179.1      |
| 1700    | 0.999 | 175.6      | 0.12 | 3.7        | 0.004 | 69.8       | 0.969 | 178.7      |
| 1750    | 0.999 | 175.9      | 0.12 | 3.9        | 0.004 | 73.2       | 0.970 | 178.3      |
| 1800    | 0.999 | 175.7      | 0.11 | 3.8        | 0.004 | 72.8       | 0.972 | 178.0      |
| 1850    | 0.999 | 175.7      | 0.10 | 4.0        | 0.005 | 75.9       | 0.970 | 177.7      |
| 1900    | 0.999 | 175.8      | 0.10 | 4.5        | 0.005 | 76.8       | 0.971 | 177.2      |
| 1950    | 0.999 | 175.3      | 0.09 | 4.5        | 0.006 | 76.8       | 0.973 | 177.0      |
| 2000    | 0.999 | 174.9      | 0.09 | 4.2        | 0.006 | 77.5       | 0.974 | 176.8      |
| 2050    | 0.999 | 174.6      | 0.08 | 4.7        | 0.006 | 79.9       | 0.973 | 176.6      |
| 2100    | 0.999 | 174.0      | 0.08 | 4.2        | 0.007 | 77.7       | 0.975 | 176.3      |
| 2150    | 0.999 | 173.4      | 0.08 | 3.6        | 0.007 | 79.2       | 0.979 | 176.0      |
| 2200    | 0.999 | 172.8      | 0.07 | 2.8        | 0.007 | 79.7       | 0.979 | 176.0      |
| 2250    | 0.999 | 172.6      | 0.07 | 2.6        | 0.007 | 79.0       | 0.979 | 175.7      |
| 2300    | 0.999 | 172.0      | 0.07 | 2.4        | 0.008 | 79.0       | 0.979 | 175.4      |
| 2350    | 0.999 | 171.4      | 0.07 | 2.0        | 0.008 | 79.9       | 0.983 | 175.3      |
| 2400    | 0.999 | 171.3      | 0.06 | 1.9        | 0.008 | 80.2       | 0.978 | 175.1      |
| 2450    | 0.999 | 171.3      | 0.06 | 1.8        | 0.008 | 79.5       | 0.979 | 174.8      |
| 2500    | 0.999 | 171.3      | 0.06 | 2.3        | 0.009 | 79.2       | 0.980 | 174.6      |

## S parameter

(V<sub>DS</sub> = 7.5 V, I<sub>D</sub> = 200 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21   |            | S12   |            | S22   |            |
|---------|-------|------------|-------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.879 | -164.2     | 10.01 | 85.5       | 0.014 | -3.4       | 0.758 | -171.4     |
| 150     | 0.880 | -168.9     | 6.55  | 77.0       | 0.014 | -10.6      | 0.773 | -172.1     |
| 200     | 0.884 | -170.9     | 4.75  | 70.5       | 0.013 | -13.8      | 0.787 | -172.0     |
| 250     | 0.893 | -172.1     | 3.69  | 64.7       | 0.012 | -20.8      | 0.803 | -171.8     |
| 300     | 0.884 | -173.3     | 2.95  | 59.3       | 0.012 | -23.7      | 0.805 | -172.0     |
| 350     | 0.906 | -173.9     | 2.37  | 54.9       | 0.011 | -27.5      | 0.835 | -172.1     |
| 400     | 0.913 | -174.8     | 1.97  | 50.7       | 0.010 | -29.4      | 0.852 | -172.4     |
| 450     | 0.922 | -175.3     | 1.67  | 46.9       | 0.009 | -33.1      | 0.866 | -172.6     |
| 500     | 0.931 | -175.7     | 1.43  | 43.5       | 0.009 | -34.6      | 0.878 | -173.0     |
| 550     | 0.932 | -176.0     | 1.24  | 40.3       | 0.008 | -35.6      | 0.887 | -173.4     |
| 600     | 0.935 | -176.4     | 1.08  | 37.4       | 0.007 | -37.2      | 0.897 | -173.7     |
| 650     | 0.938 | -177.0     | 0.95  | 34.6       | 0.007 | -38.0      | 0.903 | -174.1     |
| 700     | 0.939 | -177.7     | 0.84  | 32.1       | 0.006 | -36.3      | 0.913 | -174.5     |
| 750     | 0.944 | -178.2     | 0.75  | 29.5       | 0.005 | -37.3      | 0.919 | -175.0     |
| 800     | 0.946 | -178.6     | 0.67  | 27.7       | 0.005 | -35.8      | 0.923 | -175.4     |
| 850     | 0.953 | -179.3     | 0.61  | 25.8       | 0.004 | -34.3      | 0.929 | -175.7     |
| 900     | 0.957 | -179.7     | 0.55  | 24.0       | 0.004 | -28.9      | 0.934 | -176.2     |
| 950     | 0.964 | -180.0     | 0.50  | 22.6       | 0.003 | -27.9      | 0.939 | -176.6     |
| 1000    | 0.965 | -180.0     | 0.46  | 21.5       | 0.003 | -22.4      | 0.943 | -176.9     |
| 1050    | 0.969 | 179.5      | 0.42  | 20.0       | 0.003 | -14.2      | 0.945 | -177.4     |
| 1100    | 0.969 | 179.6      | 0.38  | 18.6       | 0.002 | -7.2       | 0.949 | -177.9     |
| 1150    | 0.968 | 179.3      | 0.35  | 17.4       | 0.002 | 5.2        | 0.951 | -178.2     |
| 1200    | 0.973 | 179.3      | 0.32  | 16.6       | 0.002 | 8.9        | 0.954 | -178.6     |
| 1250    | 0.972 | 178.7      | 0.30  | 15.0       | 0.002 | 24.2       | 0.954 | -179.0     |
| 1300    | 0.972 | 178.8      | 0.28  | 14.1       | 0.002 | 31.9       | 0.957 | -179.1     |
| 1350    | 0.971 | 178.7      | 0.26  | 13.1       | 0.002 | 41.1       | 0.959 | -179.4     |
| 1400    | 0.975 | 178.1      | 0.24  | 11.9       | 0.003 | 46.9       | 0.959 | -179.6     |
| 1450    | 0.974 | 177.7      | 0.22  | 10.6       | 0.003 | 51.3       | 0.959 | -180.0     |
| 1500    | 0.975 | 177.0      | 0.21  | 9.4        | 0.003 | 59.2       | 0.961 | 179.7      |
| 1550    | 0.978 | 176.5      | 0.20  | 9.0        | 0.003 | 61.8       | 0.961 | 179.5      |
| 1600    | 0.984 | 175.8      | 0.19  | 8.4        | 0.004 | 63.3       | 0.962 | 179.1      |
| 1650    | 0.990 | 175.8      | 0.18  | 8.1        | 0.004 | 67.9       | 0.962 | 178.9      |
| 1700    | 0.995 | 175.5      | 0.17  | 7.6        | 0.004 | 68.4       | 0.963 | 178.5      |
| 1750    | 0.998 | 175.8      | 0.16  | 7.4        | 0.005 | 71.3       | 0.964 | 178.2      |
| 1800    | 0.999 | 176.0      | 0.16  | 7.3        | 0.005 | 71.6       | 0.967 | 177.8      |
| 1850    | 0.999 | 175.7      | 0.15  | 7.1        | 0.005 | 74.7       | 0.966 | 177.5      |
| 1900    | 0.999 | 175.6      | 0.14  | 7.3        | 0.005 | 74.8       | 0.965 | 177.2      |
| 1950    | 0.999 | 175.3      | 0.13  | 7.2        | 0.006 | 75.1       | 0.967 | 176.9      |
| 2000    | 0.999 | 174.8      | 0.13  | 7.0        | 0.006 | 75.7       | 0.969 | 176.7      |
| 2050    | 0.999 | 174.3      | 0.12  | 7.0        | 0.006 | 78.5       | 0.969 | 176.5      |
| 2100    | 0.999 | 173.8      | 0.12  | 6.4        | 0.007 | 76.6       | 0.971 | 176.2      |
| 2150    | 0.999 | 173.3      | 0.11  | 5.6        | 0.007 | 77.1       | 0.974 | 176.0      |
| 2200    | 0.999 | 172.6      | 0.11  | 4.9        | 0.007 | 77.0       | 0.975 | 175.9      |
| 2250    | 0.999 | 172.2      | 0.10  | 4.1        | 0.008 | 77.6       | 0.974 | 175.6      |
| 2300    | 0.999 | 171.8      | 0.10  | 3.4        | 0.008 | 77.3       | 0.976 | 175.3      |
| 2350    | 0.999 | 171.3      | 0.09  | 3.0        | 0.008 | 78.4       | 0.980 | 175.2      |
| 2400    | 0.999 | 171.4      | 0.09  | 3.1        | 0.008 | 78.5       | 0.977 | 175.1      |
| 2450    | 0.999 | 171.3      | 0.09  | 2.9        | 0.009 | 78.4       | 0.977 | 174.8      |
| 2500    | 0.999 | 171.2      | 0.09  | 2.9        | 0.009 | 78.8       | 0.977 | 174.5      |

## S parameter

(V<sub>DS</sub> = 7.5 V, I<sub>D</sub> = 300 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21   |            | S12   |            | S22   |            |
|---------|-------|------------|-------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.896 | -165.0     | 10.25 | 87.2       | 0.013 | 3.4        | 0.785 | -173.3     |
| 150     | 0.892 | -169.8     | 6.73  | 79.1       | 0.012 | -4.6       | 0.795 | -174.1     |
| 200     | 0.895 | -171.6     | 4.94  | 73.2       | 0.011 | -10.3      | 0.805 | -173.9     |
| 250     | 0.901 | -173.1     | 3.85  | 67.9       | 0.011 | -16.0      | 0.816 | -173.7     |
| 300     | 0.891 | -174.1     | 3.11  | 62.9       | 0.011 | -18.7      | 0.814 | -173.8     |
| 350     | 0.912 | -175.0     | 2.51  | 58.5       | 0.010 | -22.0      | 0.840 | -173.7     |
| 400     | 0.918 | -175.1     | 2.11  | 54.8       | 0.009 | -23.4      | 0.855 | -173.9     |
| 450     | 0.924 | -175.8     | 1.80  | 50.9       | 0.009 | -27.0      | 0.865 | -174.0     |
| 500     | 0.933 | -176.3     | 1.56  | 47.5       | 0.008 | -28.2      | 0.875 | -174.2     |
| 550     | 0.931 | -176.7     | 1.35  | 44.3       | 0.007 | -29.4      | 0.885 | -174.5     |
| 600     | 0.932 | -176.9     | 1.19  | 41.5       | 0.007 | -30.5      | 0.893 | -174.7     |
| 650     | 0.937 | -177.5     | 1.05  | 38.8       | 0.006 | -29.9      | 0.899 | -175.0     |
| 700     | 0.936 | -178.0     | 0.93  | 35.8       | 0.006 | -27.9      | 0.907 | -175.3     |
| 750     | 0.938 | -178.4     | 0.84  | 33.6       | 0.005 | -28.5      | 0.914 | -175.7     |
| 800     | 0.945 | -179.0     | 0.75  | 31.4       | 0.005 | -26.9      | 0.918 | -175.9     |
| 850     | 0.948 | -179.7     | 0.69  | 29.3       | 0.004 | -26.6      | 0.924 | -176.4     |
| 900     | 0.953 | -180.0     | 0.63  | 27.5       | 0.004 | -20.4      | 0.929 | -176.6     |
| 950     | 0.961 | -179.8     | 0.57  | 26.0       | 0.003 | -16.5      | 0.935 | -177.0     |
| 1000    | 0.963 | -179.9     | 0.52  | 25.0       | 0.003 | -14.1      | 0.938 | -177.4     |
| 1050    | 0.966 | -179.6     | 0.48  | 23.1       | 0.003 | -5.8       | 0.940 | -177.8     |
| 1100    | 0.966 | -179.3     | 0.44  | 21.9       | 0.003 | 3.2        | 0.944 | -178.2     |
| 1150    | 0.966 | -179.3     | 0.41  | 20.8       | 0.003 | 11.0       | 0.948 | -178.4     |
| 1200    | 0.967 | -179.2     | 0.37  | 19.6       | 0.002 | 15.9       | 0.949 | -178.8     |
| 1250    | 0.969 | -179.0     | 0.34  | 18.3       | 0.003 | 26.3       | 0.950 | -179.2     |
| 1300    | 0.970 | -178.7     | 0.32  | 17.1       | 0.003 | 33.7       | 0.953 | -179.3     |
| 1350    | 0.972 | -178.4     | 0.30  | 15.8       | 0.003 | 44.4       | 0.954 | -179.6     |
| 1400    | 0.976 | -178.2     | 0.28  | 14.5       | 0.003 | 49.3       | 0.955 | -179.8     |
| 1450    | 0.974 | -177.4     | 0.26  | 13.4       | 0.003 | 52.7       | 0.956 | -179.9     |
| 1500    | 0.974 | -176.8     | 0.24  | 12.1       | 0.004 | 59.3       | 0.956 | -179.6     |
| 1550    | 0.980 | -176.3     | 0.23  | 11.5       | 0.004 | 62.8       | 0.959 | -179.4     |
| 1600    | 0.985 | -175.8     | 0.22  | 10.8       | 0.004 | 63.8       | 0.959 | -178.9     |
| 1650    | 0.997 | -175.7     | 0.21  | 10.3       | 0.004 | 66.1       | 0.959 | -178.8     |
| 1700    | 0.999 | -175.7     | 0.20  | 10.0       | 0.005 | 68.4       | 0.960 | -178.4     |
| 1750    | 0.999 | -175.7     | 0.19  | 9.7        | 0.005 | 69.6       | 0.961 | -178.1     |
| 1800    | 0.999 | -175.6     | 0.18  | 9.3        | 0.005 | 69.4       | 0.964 | -177.7     |
| 1850    | 0.999 | -175.7     | 0.17  | 9.0        | 0.005 | 70.8       | 0.962 | -177.4     |
| 1900    | 0.999 | -175.5     | 0.16  | 9.2        | 0.006 | 72.8       | 0.963 | -177.1     |
| 1950    | 0.999 | -175.2     | 0.16  | 9.0        | 0.006 | 74.1       | 0.965 | -176.8     |
| 2000    | 0.999 | -174.7     | 0.15  | 8.8        | 0.006 | 74.9       | 0.966 | -176.6     |
| 2050    | 0.999 | -174.3     | 0.14  | 8.6        | 0.007 | 76.4       | 0.967 | -176.4     |
| 2100    | 0.999 | -173.7     | 0.13  | 8.0        | 0.007 | 75.7       | 0.969 | -176.1     |
| 2150    | 0.999 | -173.1     | 0.13  | 7.2        | 0.007 | 77.2       | 0.972 | -175.9     |
| 2200    | 0.999 | -172.5     | 0.12  | 6.4        | 0.007 | 77.1       | 0.972 | -175.8     |
| 2250    | 0.999 | -172.1     | 0.12  | 5.5        | 0.008 | 77.9       | 0.972 | -175.5     |
| 2300    | 0.999 | -171.6     | 0.11  | 5.0        | 0.008 | 76.4       | 0.973 | -175.3     |
| 2350    | 0.999 | -171.2     | 0.11  | 4.1        | 0.008 | 78.3       | 0.977 | -175.1     |
| 2400    | 0.999 | -171.1     | 0.11  | 4.1        | 0.009 | 78.1       | 0.974 | -175.0     |
| 2450    | 0.999 | -171.1     | 0.10  | 3.6        | 0.009 | 78.3       | 0.974 | -174.7     |
| 2500    | 0.999 | -171.0     | 0.10  | 3.7        | 0.009 | 78.3       | 0.974 | -174.4     |

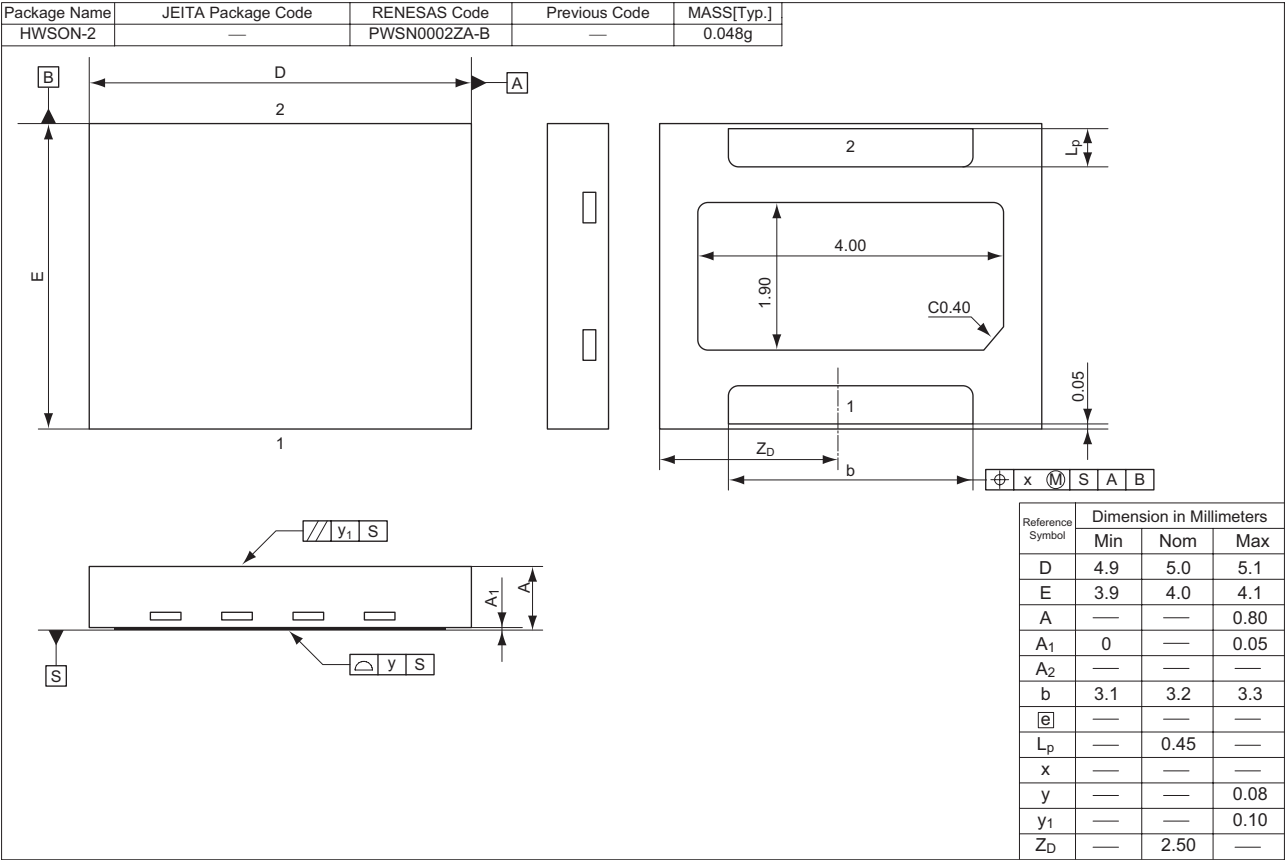
## S parameter

(V<sub>DS</sub> = 7.5 V, I<sub>D</sub> = 400 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |            | S21   |            | S12   |            | S22   |            |
|---------|-------|------------|-------|------------|-------|------------|-------|------------|
|         | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) | MAG   | ANG (deg.) |
| 100     | 0.903 | -165.5     | 10.28 | 88.0       | 0.013 | 4.2        | 0.799 | -174.4     |
| 150     | 0.903 | -170.2     | 6.78  | 80.2       | 0.011 | -6.6       | 0.808 | -175.1     |
| 200     | 0.901 | -172.3     | 4.99  | 74.6       | 0.010 | -9.4       | 0.816 | -174.9     |
| 250     | 0.907 | -173.5     | 3.91  | 69.6       | 0.010 | -13.8      | 0.826 | -174.7     |
| 300     | 0.895 | -174.7     | 3.17  | 64.6       | 0.010 | -15.9      | 0.821 | -174.8     |
| 350     | 0.916 | -175.4     | 2.58  | 60.6       | 0.009 | -20.6      | 0.847 | -174.9     |
| 400     | 0.922 | -175.8     | 2.17  | 56.7       | 0.008 | -20.5      | 0.859 | -174.7     |
| 450     | 0.927 | -176.2     | 1.86  | 53.1       | 0.008 | -23.5      | 0.868 | -174.8     |
| 500     | 0.932 | -176.7     | 1.62  | 49.6       | 0.007 | -24.4      | 0.876 | -175.0     |
| 550     | 0.936 | -177.0     | 1.42  | 46.7       | 0.007 | -25.3      | 0.884 | -175.1     |
| 600     | 0.937 | -177.3     | 1.25  | 43.7       | 0.006 | -26.5      | 0.892 | -175.3     |
| 650     | 0.938 | -177.7     | 1.10  | 40.9       | 0.006 | -26.1      | 0.898 | -175.5     |
| 700     | 0.939 | -178.4     | 0.98  | 38.3       | 0.006 | -25.0      | 0.907 | -175.8     |
| 750     | 0.943 | -178.8     | 0.88  | 35.6       | 0.005 | -23.6      | 0.912 | -176.0     |
| 800     | 0.946 | -179.3     | 0.80  | 33.5       | 0.004 | -19.9      | 0.915 | -176.3     |
| 850     | 0.948 | -179.9     | 0.73  | 31.5       | 0.004 | -18.5      | 0.922 | -176.7     |
| 900     | 0.956 | 179.7      | 0.67  | 29.8       | 0.004 | -15.7      | 0.927 | -177.0     |
| 950     | 0.960 | 179.6      | 0.61  | 28.1       | 0.003 | -12.0      | 0.933 | -177.3     |
| 1000    | 0.964 | 179.7      | 0.56  | 26.9       | 0.003 | -7.7       | 0.937 | -177.7     |
| 1050    | 0.963 | 179.3      | 0.51  | 25.5       | 0.003 | -0.5       | 0.939 | -178.0     |
| 1100    | 0.966 | 179.3      | 0.47  | 23.8       | 0.003 | 7.8        | 0.942 | -178.4     |
| 1150    | 0.966 | 179.3      | 0.43  | 22.6       | 0.003 | 15.4       | 0.945 | -178.6     |
| 1200    | 0.969 | 179.1      | 0.40  | 21.4       | 0.003 | 22.3       | 0.947 | -179.0     |
| 1250    | 0.970 | 178.7      | 0.37  | 20.1       | 0.003 | 31.2       | 0.948 | -179.4     |
| 1300    | 0.972 | 178.5      | 0.34  | 18.8       | 0.003 | 39.9       | 0.951 | -179.5     |
| 1350    | 0.970 | 178.4      | 0.32  | 17.5       | 0.003 | 44.3       | 0.953 | -179.7     |
| 1400    | 0.973 | 177.9      | 0.30  | 16.1       | 0.003 | 47.7       | 0.954 | -179.9     |
| 1450    | 0.975 | 177.4      | 0.28  | 14.7       | 0.003 | 51.8       | 0.954 | 179.7      |
| 1500    | 0.974 | 176.6      | 0.26  | 13.6       | 0.004 | 60.0       | 0.955 | 179.4      |
| 1550    | 0.980 | 176.3      | 0.25  | 12.9       | 0.004 | 60.3       | 0.957 | 179.2      |
| 1600    | 0.983 | 175.7      | 0.24  | 12.0       | 0.004 | 62.3       | 0.958 | 178.8      |
| 1650    | 0.990 | 175.5      | 0.23  | 11.8       | 0.004 | 65.9       | 0.958 | 178.6      |
| 1700    | 0.996 | 175.6      | 0.21  | 11.2       | 0.005 | 66.9       | 0.959 | 178.3      |
| 1750    | 0.999 | 175.6      | 0.20  | 10.9       | 0.005 | 68.5       | 0.959 | 178.0      |
| 1800    | 0.999 | 175.6      | 0.20  | 10.4       | 0.005 | 69.5       | 0.961 | 177.7      |
| 1850    | 0.999 | 175.5      | 0.19  | 10.3       | 0.005 | 72.5       | 0.960 | 177.3      |
| 1900    | 0.999 | 175.4      | 0.18  | 10.4       | 0.006 | 72.6       | 0.962 | 177.0      |
| 1950    | 0.999 | 175.1      | 0.17  | 10.1       | 0.006 | 74.0       | 0.963 | 176.7      |
| 2000    | 0.999 | 174.6      | 0.16  | 10.0       | 0.006 | 75.7       | 0.965 | 176.5      |
| 2050    | 0.999 | 174.3      | 0.15  | 9.5        | 0.007 | 76.3       | 0.966 | 176.3      |
| 2100    | 0.999 | 173.6      | 0.14  | 9.0        | 0.007 | 74.3       | 0.968 | 176.0      |
| 2150    | 0.999 | 172.9      | 0.14  | 8.0        | 0.007 | 76.1       | 0.970 | 175.8      |
| 2200    | 0.999 | 172.2      | 0.13  | 7.1        | 0.008 | 77.1       | 0.972 | 175.7      |
| 2250    | 0.999 | 171.9      | 0.13  | 6.4        | 0.008 | 77.6       | 0.971 | 175.4      |
| 2300    | 0.999 | 171.6      | 0.12  | 5.8        | 0.008 | 77.0       | 0.972 | 175.2      |
| 2350    | 0.999 | 171.2      | 0.12  | 5.0        | 0.008 | 78.5       | 0.975 | 175.0      |
| 2400    | 0.999 | 170.9      | 0.11  | 4.5        | 0.009 | 78.2       | 0.973 | 174.9      |
| 2450    | 0.999 | 171.0      | 0.11  | 4.4        | 0.009 | 77.2       | 0.973 | 174.6      |
| 2500    | 0.999 | 170.8      | 0.11  | 4.4        | 0.009 | 77.7       | 0.974 | 174.4      |



Package Dimensions



Ordering Information

| Part Name      | Quantity  | Shipping Container                |
|----------------|-----------|-----------------------------------|
| RQA0011DNSTB-E | 2000 pcs. | φ178 mm Reel, 12 mm Emboss Taping |

Notes:

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