

LOW NOISE AMPLIFIER GaAs MMIC

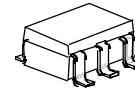
■GENERAL DESCRIPTION

NJG1102F1 is a Low Noise Amplifier GaAs MMIC designed for 800MHz band cellular phone handsets.

This amplifier provides low current consumption and low noise figure at low supply voltage of 2.5V, low noise of 1.5dB and low current consumption of 3mA at supply voltage of 2.7V.

NJG1102F1 includes internal self-bias circuit and input DC blocking capacitor with small package of MTP6-1.

■PACKAGE OUTLINE

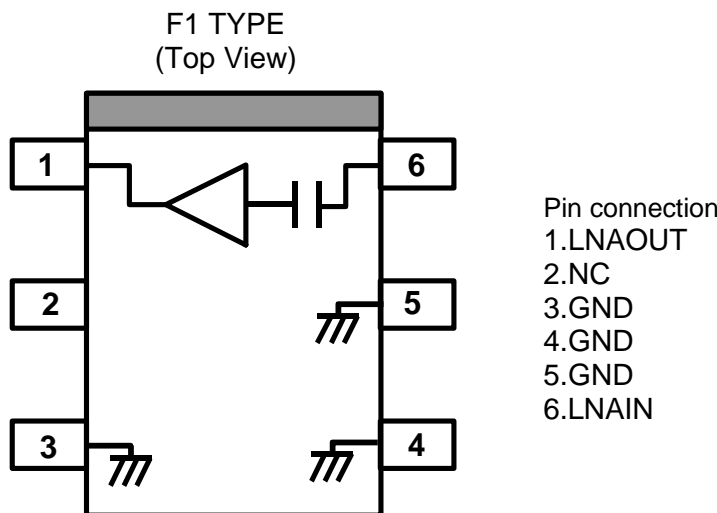


NJG1102F1

■FEATURES

- | | |
|--------------------------|--|
| ●Low voltage operation | +2.7V typ. |
| ●Low current consumption | 3mA typ. |
| ●High small signal gain | 17dB typ. @f=820MHz |
| ●Low noise figure | 1.4dB typ. @f=820MHz |
| ●High Input IP3 | -3dBm typ. @f=820.0+820.1MHz |
| ●High output IP3 | 14dBm typ. @f=820.0+820.1MHz |
| ●Package | MTP6-1 (Mount Size: 2.8 x 2.9 x 1.2mm) |

■PIN CONFIGURATION



Note: is package orientation mark.

NJG1102F1

■ABSOLUTE MAXIMUM RATINGS

($T_a=25^{\circ}\text{C}$, $Z_s=Z_i=50\Omega$)

| PARAMETER | SYMBOL | CONDITIONS | RATINGS | UNITS |
|-----------------------|-----------|----------------------|----------|--------------------|
| Drain Voltage | V_{DD} | | 5.0 | V |
| Input Power | P_{in} | $V_{DD}=2.7\text{V}$ | +10 | dBm |
| Power Dissipation | P_D | | 150 | mW |
| Operating Temperature | T_{opr} | | -40~+85 | $^{\circ}\text{C}$ |
| Storage Temperature | T_{stg} | | -55~+125 | $^{\circ}\text{C}$ |

■ELECTRICAL CHARACTERISTICS

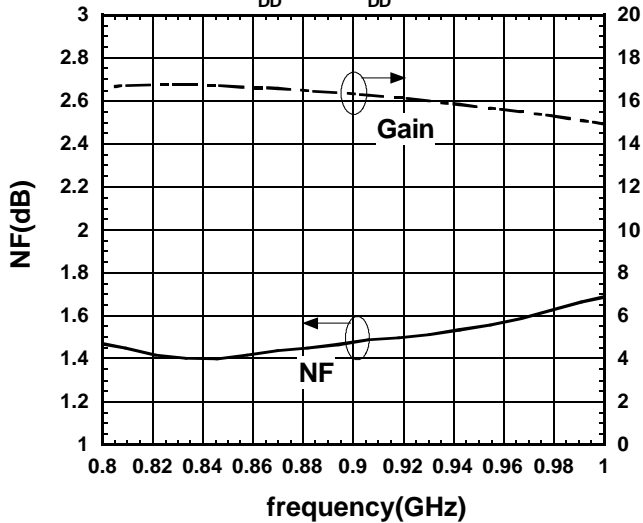
($V_{DD}=2.7\text{V}$, $f=820\text{MHz}$, $T_a=+25^{\circ}\text{C}$, $Z_s=Z_i=50\Omega$)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|------------------------------------|------------|--------------------------------|------|------|------|-------|
| Operating Frequency | freq | | 800 | 820 | 1000 | MHz |
| Drain Voltage | V_{DD} | | 2.5 | 2.7 | 4.5 | V |
| Operating Current | I_{DD} | RF OFF | - | 3.0 | 4.0 | mA |
| Small Signal Gain | Gain | | 15.0 | 17.0 | 19.0 | dB |
| Gain Flatness | G_{flat} | $f_{RF}=810\sim 885\text{MHz}$ | - | 0.5 | 1.0 | dB |
| Noise Figure | NF | | - | 1.4 | 1.6 | dB |
| Pout at 1dB Gain Compression point | P_{-1dB} | | -3.0 | +1.0 | - | dBm |
| Input 3rd Order Intercept Point | IIP3 | $f=820.0\sim 820.1\text{MHz}$ | -7.0 | -3.0 | - | dBm |
| RFIN Port VSWR | $VSWR_i$ | | - | 2.0 | 3.0 | |
| RFOUT Port VSWR | $VSWR_o$ | | - | 2.0 | 3.0 | |

TYPICAL CHARACTERISTICS

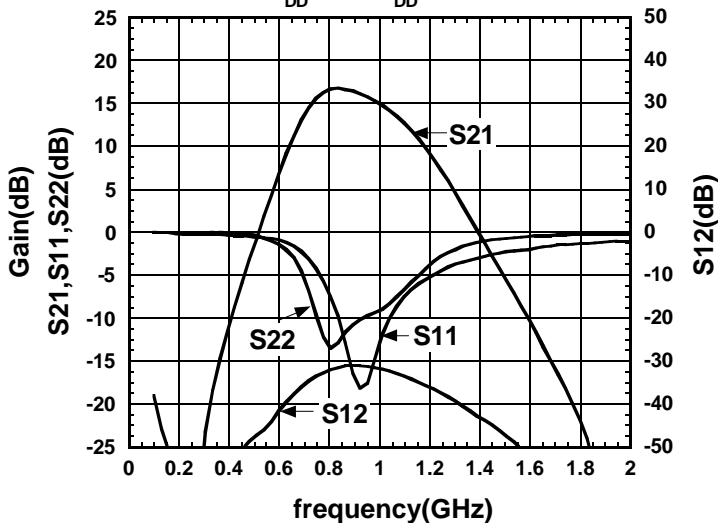
NF, Gain vs. frequency

($V_{DD}=2.7V, I_{DD}=3mA$)



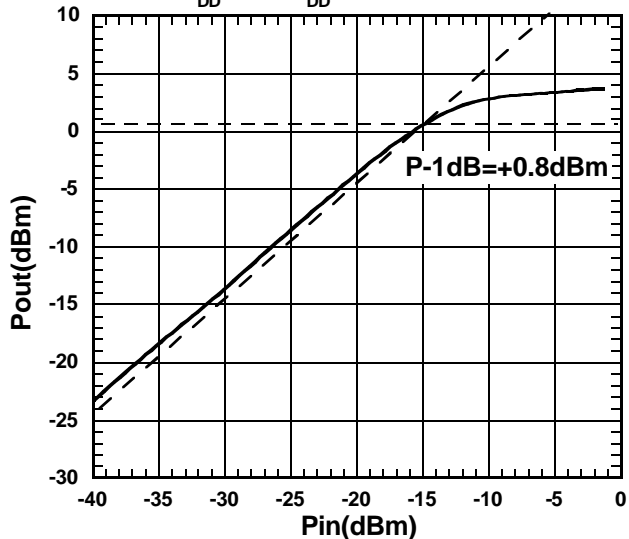
S21, S11, S22, S12 vs. frequency

($V_{DD}=2.7V, I_{DD}=3mA$)



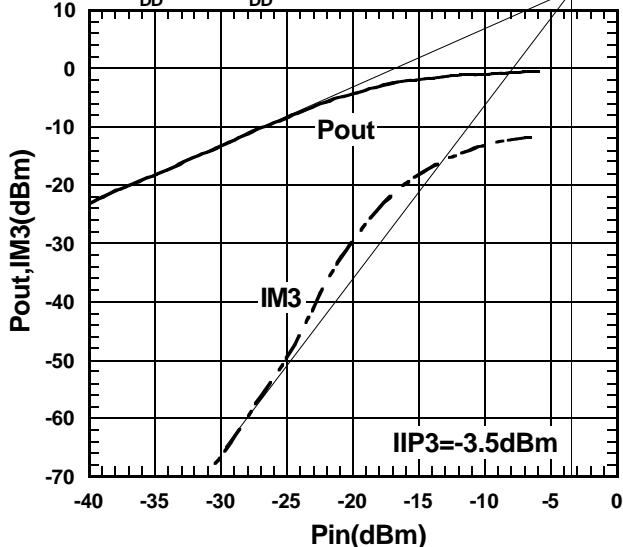
Pin vs. Pout

($V_{DD}=2.7V, I_{DD}=3mA, f=820MHz$)



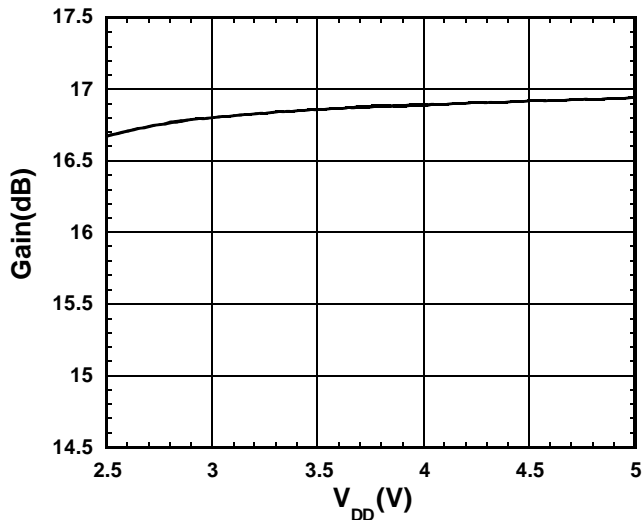
Pin vs. Pout, IM3

($V_{DD}=2.7V, I_{DD}=3mA, f=820+820.1MHz$)



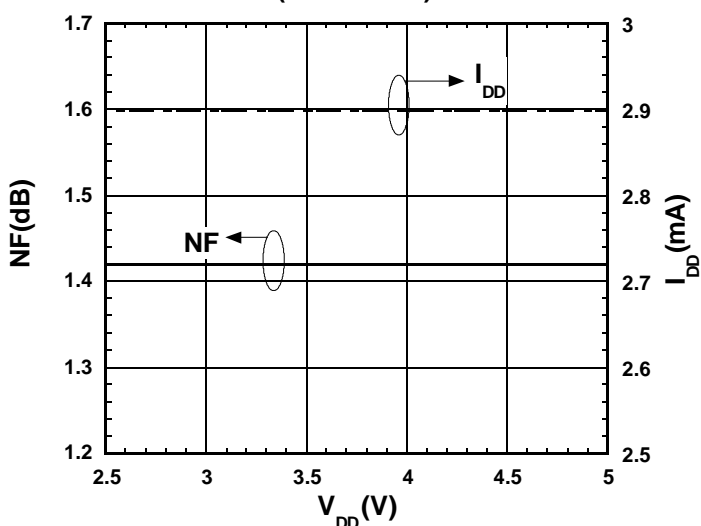
Gain vs. V_{DD}

($f=820MHz$)



NF, I_{DD} vs. V_{DD}

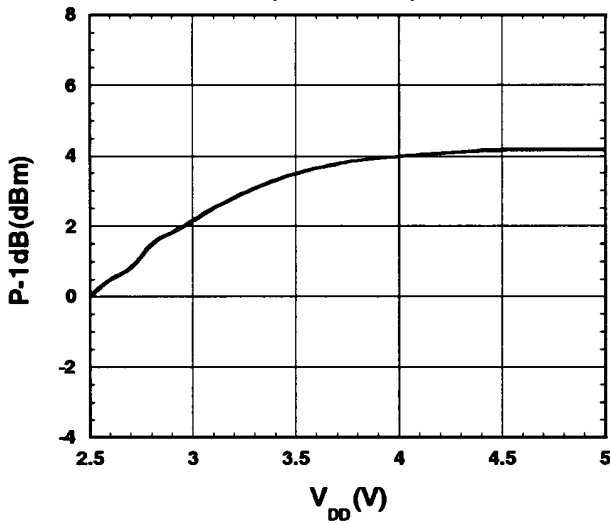
($f=820MHz$)



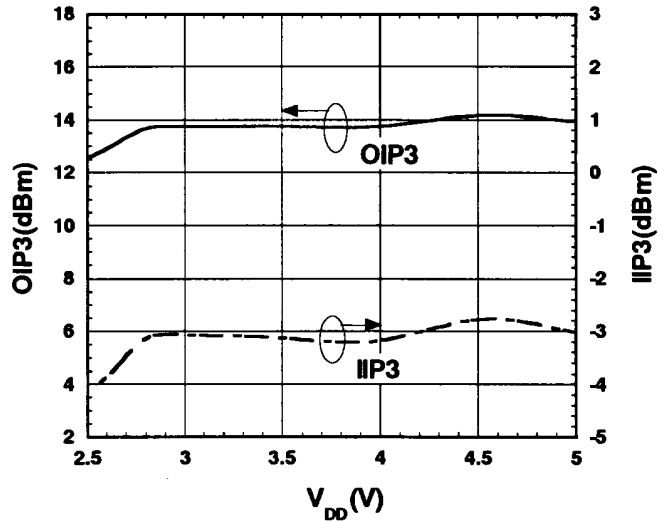
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TYPICAL CHARACTERISTICS

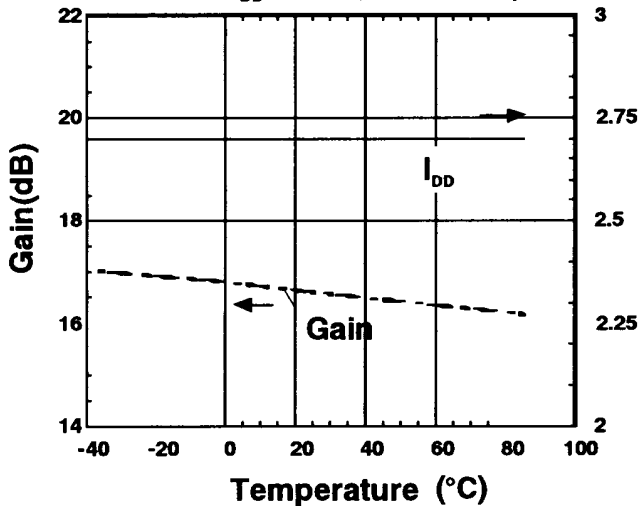
P-1dB vs. V_{DD}
(f=820MHz)



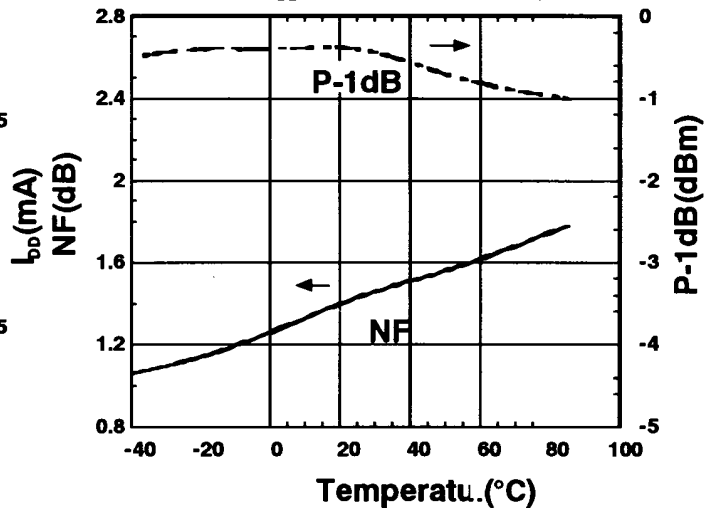
OIP3, IIP3 vs. V_{DD}
(f=820.0+820.1MHz, Pin=-30dBm)



Gain, I_{DD} vs. Temperature
($V_{DD}=2.7V, f=820MHz$)

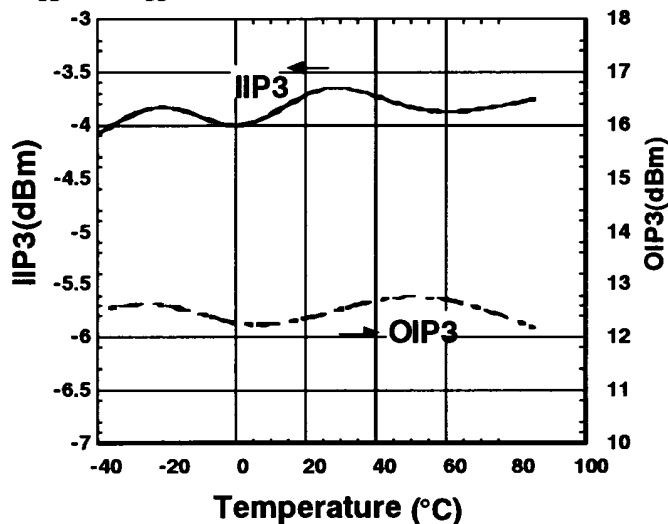


NF, P-1dB vs. Temperature
($V_{DD}=2.7V, f=820MHz$)



IIP3, OIP3 vs. Temperature

($V_{DD}=2.7V, I_{DD}=3.0mA, f=820.0+820.1MHz, Pin=-30dBm$)



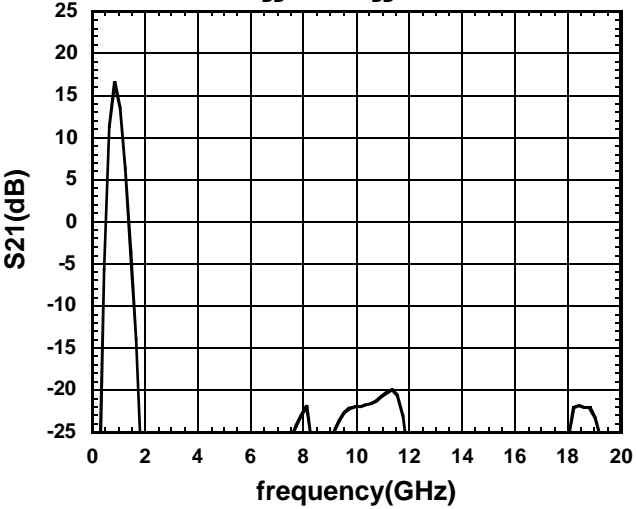
$$OIP3 = \frac{3 \times P_{out} - IM3}{2}$$

$$IIP3 = OIP3 - Gain \quad @ P_{in} = -30dBm$$

■ TYPICAL CHARACTERISTICS

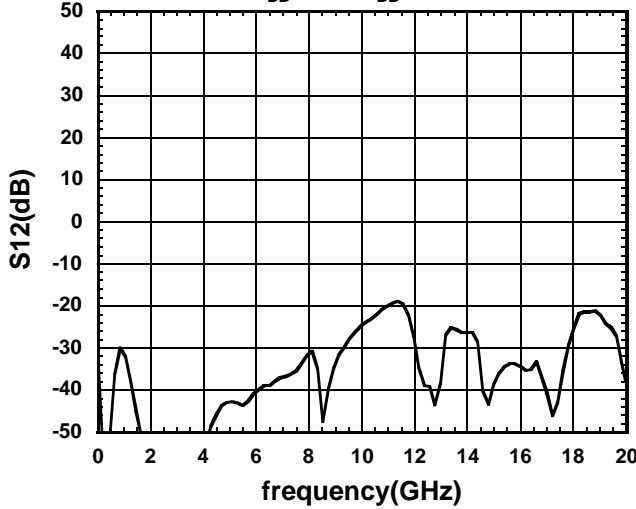
S21 vs. frequency (~20GHz)

($V_{DD}=2.7V, I_{DD}=3mA$)



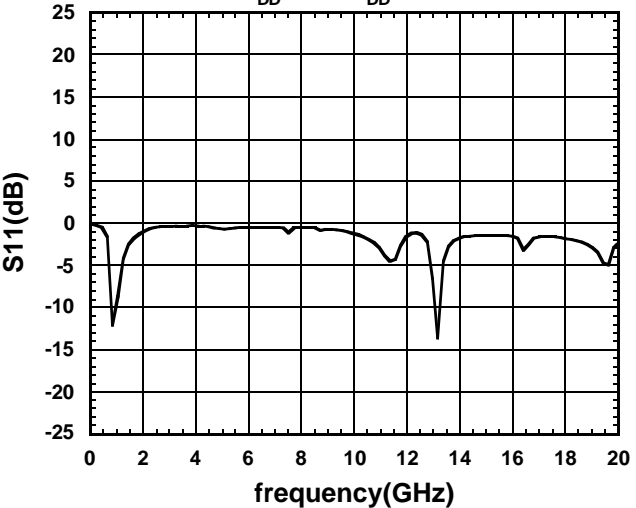
S12 vs. frequency (~20GHz)

($V_{DD}=2.7V, I_{DD}=3mA$)



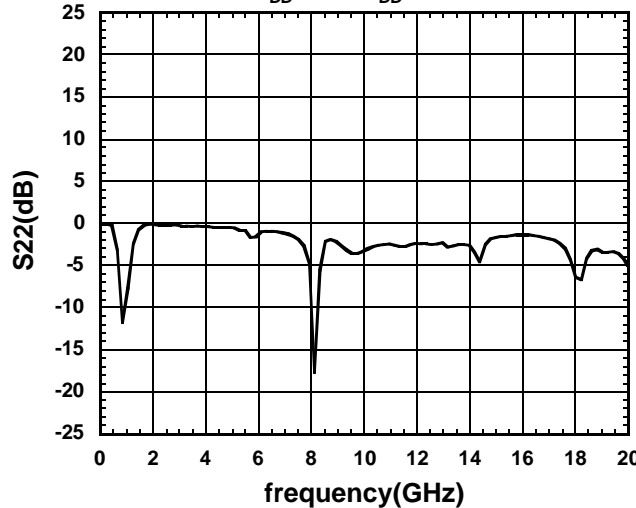
S11 vs. frequency (~20GHz)

($V_{DD}=2.7V, I_{DD}=3mA$)



S22 vs. frequency (~20GHz)

($V_{DD}=2.7V, I_{DD}=3mA$)



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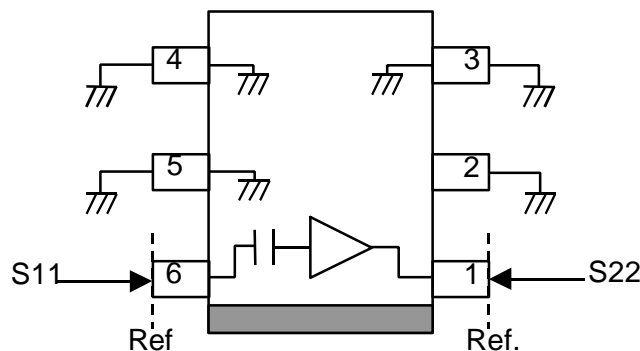
■ TYPICAL CHARACTERISTICS

Scattering Parameter Table

$V_{DD}=2.7V$, $I_{DD}=3mA$, $Z_0=50\Omega$

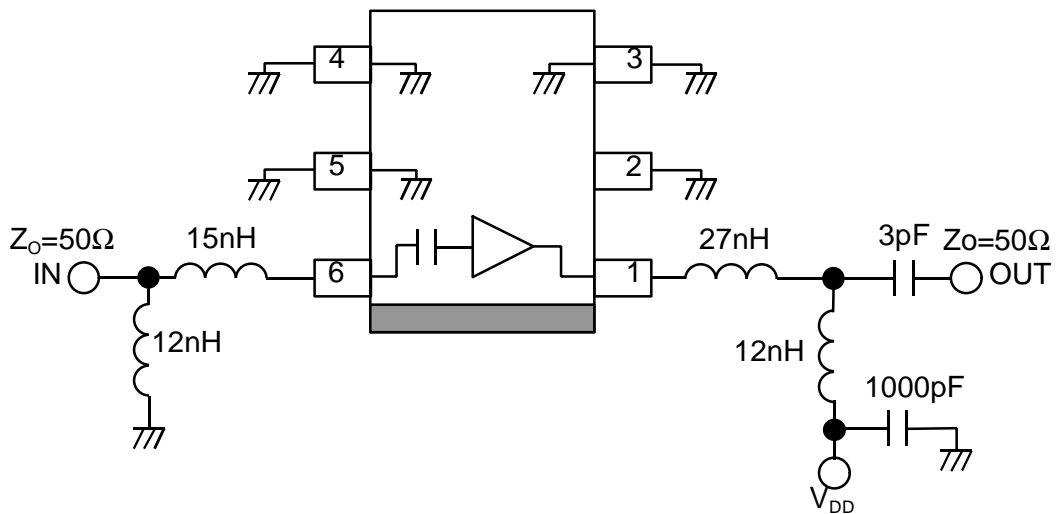
| Freq (GHz) | S11 | | S21 | | S12 | | S22 | |
|---------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| | mag (units) | ang (deg) | mag (units) | ang (deg) | mag (units) | ang (deg) | mag (units) | ang (deg) |
| 0.1 | 1.000 | -4.866 | 1.342 | -159.147 | 0.006 | 14.420 | 0.945 | -3.745 |
| 0.2 | 1.000 | -10.234 | 1.524 | -179.085 | 0.006 | 22.117 | 0.935 | -5.657 |
| 0.3 | 1.000 | -14.972 | 1.557 | 169.103 | 0.006 | 29.722 | 0.927 | -7.752 |
| 0.4 | 0.994 | -20.871 | 1.572 | 158.960 | 0.007 | 31.125 | 0.926 | -9.779 |
| 0.5 | 0.976 | -24.915 | 1.564 | 150.714 | 0.007 | 35.066 | 0.920 | -11.953 |
| 0.6 | 0.965 | -30.526 | 1.548 | 142.447 | 0.007 | 41.693 | 0.915 | -14.091 |
| 0.7 | 0.925 | -35.290 | 1.504 | 134.839 | 0.007 | 44.722 | 0.912 | -16.312 |
| 0.8 | 0.912 | -40.103 | 1.499 | 127.579 | 0.008 | 48.888 | 0.905 | -18.499 |
| 0.9 | 0.868 | -45.428 | 1.467 | 120.278 | 0.008 | 53.252 | 0.906 | -20.641 |
| 1.0 | 0.849 | -49.349 | 1.443 | 113.971 | 0.008 | 58.494 | 0.898 | -22.933 |
| 1.1 | 0.813 | -54.587 | 1.408 | 107.103 | 0.009 | 65.663 | 0.902 | -25.089 |
| 1.2 | 0.790 | -58.371 | 1.379 | 101.107 | 0.009 | 71.121 | 0.896 | -27.460 |
| 1.3 | 0.761 | -63.046 | 1.337 | 95.249 | 0.010 | 79.229 | 0.897 | -29.474 |
| 1.4 | 0.739 | -66.963 | 1.322 | 89.341 | 0.011 | 84.816 | 0.898 | -31.516 |
| 1.5 | 0.713 | -71.006 | 1.308 | 83.704 | 0.013 | 90.070 | 0.895 | -33.708 |
| 1.6 | 0.697 | -75.141 | 1.258 | 78.278 | 0.015 | 93.627 | 0.894 | -35.562 |
| 1.7 | 0.669 | -78.451 | 1.233 | 72.642 | 0.017 | 96.762 | 0.895 | -37.942 |
| 1.8 | 0.647 | -82.248 | 1.198 | 67.296 | 0.019 | 98.510 | 0.889 | -39.726 |
| 1.9 | 0.616 | -84.912 | 1.163 | 61.655 | 0.022 | 99.423 | 0.890 | -42.289 |
| 2.0 | 0.592 | -87.965 | 1.132 | 56.671 | 0.024 | 99.437 | 0.885 | -44.339 |
| 2.1 | 0.567 | -90.200 | 1.099 | 51.306 | 0.027 | 99.393 | 0.883 | -46.238 |
| 2.2 | 0.542 | -92.166 | 1.068 | 46.616 | 0.030 | 98.567 | 0.889 | -48.338 |
| 2.3 | 0.523 | -93.962 | 1.041 | 41.818 | 0.033 | 97.417 | 0.886 | -50.652 |
| 2.4 | 0.498 | -95.631 | 1.011 | 37.218 | 0.036 | 96.016 | 0.889 | -52.442 |
| 2.5 | 0.486 | -96.784 | 0.981 | 32.941 | 0.040 | 94.289 | 0.892 | -54.490 |
| 2.6 | 0.466 | -97.556 | 0.958 | 28.504 | 0.043 | 92.819 | 0.890 | -55.710 |
| 2.7 | 0.455 | -97.902 | 0.931 | 24.687 | 0.046 | 90.816 | 0.892 | -57.821 |
| 2.8 | 0.441 | -98.495 | 0.901 | 20.371 | 0.050 | 89.017 | 0.895 | -59.505 |
| 2.9 | 0.429 | -98.609 | 0.877 | 16.741 | 0.053 | 86.927 | 0.894 | -60.952 |
| 3.0 | 0.420 | -98.095 | 0.849 | 12.899 | 0.057 | 84.724 | 0.899 | -62.567 |

Note: $V_{DD}(=2.7V)$ is supplied through "BIAS CONNECT(PORT2)" of Network Analyzer.

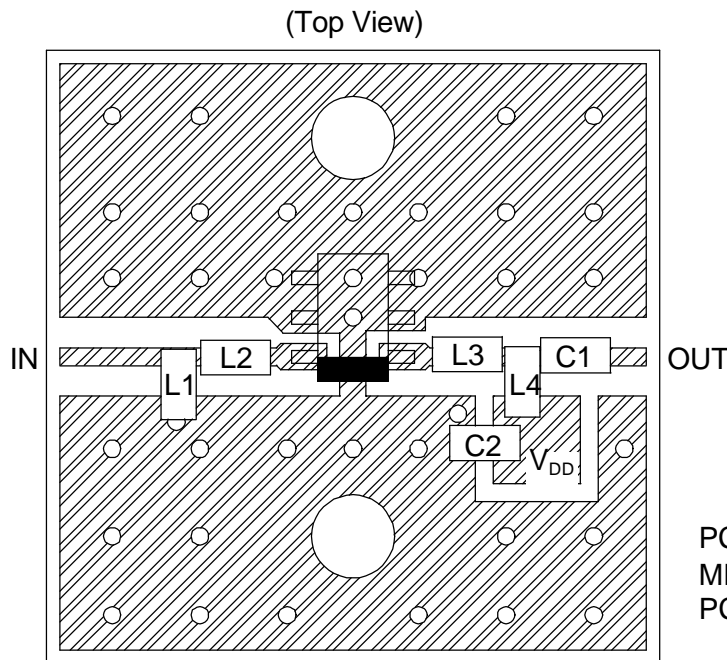


Scattering Parameter Measurement Configuration

RECOMMEND CIRCUIT (f=810~885MHz)



RECOMMENDED PCB DESIGN



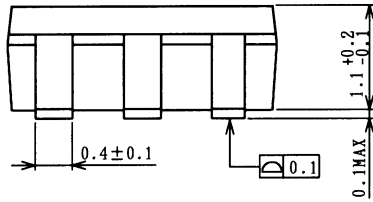
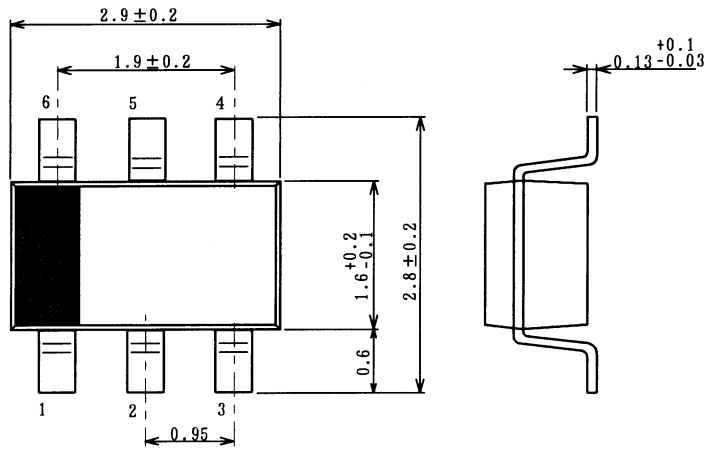
PCB : FR4, t=0.2mm
 MICROSTRIP LINE WIDTH=0.4mm(Zo=50Ω)
 PCB SIZE : 14.0x14.0mm

PARTS LIST (f=810~885MHz)

| PART ID | PARAMETER | COMMENT |
|---------|-----------|---------------------------|
| L1 | 12nH | TAIYO-YUDEN HK1608 Series |
| L2 | 15nH | TAIYO-YUDEN HK1608 Series |
| L3 | 27nH | TAIYO-YUDEN HK1608 Series |
| L4 | 12nH | TAIYO-YUDEN HK1608 Series |
| C1 | 3pF | MURATA GRM39 Series |
| C2 | 1000pF | MURATA GRM39 Series |

NJG1102F1

PACKAGE OUTLINE (MTP6-1)



Lead material : Copper
 Lead surface finish : Solder plating
 Molding material : Epoxy resin
 UNIT : mm
 Weight : 15mg

Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

[CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.