Wide Band Low Noise Amplifier GaAs MMIC

■ GENERAL DESCRIPTION
The NJG1152KA1 is a fully matched wide band low noise amplifier GaAs MMIC for terrestrial application.

To achieve wide dynamic range, the NJG1152KA1 offers high gain mode and low gain mode. Selecting high gain mode for weak signals, the NJG1152KA1 helps improve receiver sensitivity through high gain and low noise figure. Selecting low gain mode for strong signals, it bypasses LNA circuit to offer higher linearity.

An small and ultra-thin package of FLP6-A1 is adopted.

■ APPLICATIONS
Terrestrial application like Digital TV, Set-top box

■ FEATURES
- Operating frequency: 40 to 900MHz
- Package size: FLP6-A1 (Package size: 1.6x1.6x0.55mm typ.)

[ LNA mode, 50Ω: Operating voltage 3.3V ]
- Operating current: 20mA typ.
- Small signal gain: 18.0dB typ.
- Noise figure: 1.2dB typ. @f=40 to 150MHz
  0.9dB typ. @f=150 to 900MHz

[ Bypass mode, 50Ω: Operating voltage 0V ]
- Insertion loss: 1.0dB typ.
- 2nd order intermodulation distortion: 75dB typ.
- 3rd order intermodulation distortion: 85dB typ.

■ PIN CONFIGURATION

■ TRUTH TABLE
“H”=\( V_{\text{CTL(H)}} \), “L”=\( V_{\text{CTL(L)}} \)

<table>
<thead>
<tr>
<th>( V_{\text{CTL}} )</th>
<th>LNA</th>
<th>Bypass</th>
<th>Mode select</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>ON</td>
<td>OFF</td>
<td>LNA mode</td>
</tr>
<tr>
<td>L</td>
<td>OFF</td>
<td>ON</td>
<td>Bypass mode</td>
</tr>
</tbody>
</table>

Note: Specifications and description listed in this datasheet are subject to change without notice.
## ABSOLUTE MAXIMUM RATINGS

- **PARAMETER**: CONDITIONS | **RATINGS** | **UNITS**
- Drain voltage | \( V_{DD} \) | 5.0 | V
- Control voltage | \( V_{CTL} \) | 5.0 | V
- Input power | \( P_{IN} \) | \( V_{DD}=3.3V \) | +10 | dBm
- Power dissipation | \( P_D \) | 4-layer FR4 PCB with through-hole (74.2x74.2mm), \( T_j=150^\circ C \) | 580 | mW
- Operating temperature | \( T_{opr} \) | -40 to +85 | °C
- Storage temperature | \( T_{stg} \) | -55 to +150 | °C

## ELECTRICAL CHARACTERISTICS1 (DC CHARACTERISTICS)

\[ V_{DD}=3.3V, \; T_a=+25^\circ C, \; \text{with application circuit} \]

- **PARAMETERS**: CONDITIONS | **MIN** | **TYP** | **MAX** | **UNITS**
- Operating voltage | \( V_{DD} \) | 2.3 | 3.3 | 3.6 | V
- Control voltage (High) | \( V_{CTL(H)} \) | 1.3 | 1.8 | 3.6 | V
- Control voltage (Low) | \( V_{CTL(L)} \) | 0.0 | 0.0 | 0.5 | V
- Operating current1 | \( I_{DD1} \) | RF OFF, \( V_{CTL}=1.8V \) | - | 20 | 45 | mA
- Operating current2 | \( I_{DD2} \) | RF OFF, \( V_{CTL}=0V \) | - | 17 | 35 | μA
- Control current | \( I_{CTL} \) | RF OFF, \( V_{CTL}=1.8V \) | - | 6 | 20 | μA
### ELECTRICAL CHARACTERISTICS

V<sub>DD</sub>=3.3V, V<sub>CTL</sub>=1.8V, freq=40 to 900MHz, T<sub>a</sub>=+25°C, Z<sub>S</sub>=50Ω, with application circuit

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small signal gain1</td>
<td>Gain1</td>
<td>Exclude PCB &amp; connector losses (Note1)</td>
<td>15.0</td>
<td>18.0</td>
<td>20.0</td>
<td>dB</td>
</tr>
<tr>
<td>Gain flatness1</td>
<td>Gf1</td>
<td>-</td>
<td>1.0</td>
<td>2.0</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Noise figure1_1</td>
<td>NF1_1</td>
<td>freq=40 to 150MHz, Exclude PCB &amp; connector losses (Note2)</td>
<td>-</td>
<td>1.2</td>
<td>2.0</td>
<td>dB</td>
</tr>
<tr>
<td>Noise figure1_2</td>
<td>NF1_2</td>
<td>freq=150 to 900MHz, Exclude PCB &amp; connector losses (Note2)</td>
<td>-</td>
<td>0.9</td>
<td>1.4</td>
<td>dB</td>
</tr>
<tr>
<td>Input power 1dB compression1</td>
<td>P-1dB(IN)1</td>
<td>-10.0</td>
<td>-5.0</td>
<td>-</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>Input 3rd order intercept point1</td>
<td>IIP3_1</td>
<td>f1=freq, f2=freq+100kHz, P&lt;sub&gt;IN&lt;/sub&gt;=-20dBm</td>
<td>+0.0</td>
<td>+7.0</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>2nd order intermodulation distortion1</td>
<td>IM2_1</td>
<td>f1=200MHz, f2=500MHz, fmeas=700MHz, P&lt;sub&gt;IN&lt;/sub&gt;=1=P&lt;sub&gt;IN&lt;/sub&gt;=2=-15dBm</td>
<td>18.0</td>
<td>28.0</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>3rd order intermodulation distortion1</td>
<td>IM3_1</td>
<td>f1=600MHz, f2=650MHz, fmeas=700MHz, P&lt;sub&gt;IN&lt;/sub&gt;=1=P&lt;sub&gt;IN&lt;/sub&gt;=2=-15dBm</td>
<td>35.0</td>
<td>45.0</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Isolation1</td>
<td>ISL1</td>
<td>15.0</td>
<td>19.0</td>
<td>-</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>RFIN VSWR1</td>
<td>VSWRi1</td>
<td>-</td>
<td>2.5</td>
<td>4.0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RFOUT VSWR1</td>
<td>VSWRo1</td>
<td>-</td>
<td>1.5</td>
<td>2.4</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

(Note1) Input and output PCB, connector losses: 0.014dB(40MHz), 0.088dB(620MHz), 0.121dB(900MHz)
(Note2) Input PCB and connector losses: 0.007dB(40MHz), 0.044dB(620MHz), 0.060dB(900MHz)
### ELECTRICAL CHARACTERISTICS3

(RF CHARACTERISTICS: Bypass mode, 50Ω)

\[ V_{DD}=3.3V, V_{CTL}=0V, \text{freq}=40 \text{ to } 900MHz, T_a=+25°C, Z_S=Z_L=50\Omega, \text{with application circuit} \]

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion loss</td>
<td>LOSS2</td>
<td>Exclude PCB &amp; connector losses (Note1)</td>
<td>-</td>
<td>1.0</td>
<td>3.0</td>
<td>dB</td>
</tr>
<tr>
<td>Input power 1dB compression</td>
<td>P-1dB(IN)2</td>
<td></td>
<td>+8.0</td>
<td>+15.0</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>Input 3rd order intercept point</td>
<td>IIP3_2</td>
<td>( f_1=\text{freq}, f_2=\text{freq}+100kHz, P_{IN}=-2dBm )</td>
<td>+22.0</td>
<td>+30.0</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>2nd order intermodulation distortion</td>
<td>IM2_2</td>
<td>( f_1=200MHz, f_2=500MHz, P_{fmeas}=700MHz, P_{IN1}=P_{IN2}=8dBm )</td>
<td>60.0</td>
<td>75.0</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>3rd order intermodulation distortion</td>
<td>IM3_2</td>
<td>( f_1=600MHz, f_2=650MHz, P_{fmeas}=700MHz, P_{IN1}=P_{IN2}=8dBm )</td>
<td>70.0</td>
<td>85.0</td>
<td>-</td>
<td>dB</td>
</tr>
</tbody>
</table>

(Nota1) Input and output PCB, connector losses: 0.014dB(40MHz), 0.088dB(620MHz), 0.121dB(900MHz)

### ELECTRICAL CHARACTERISTICS4

(RF CHARACTERISTICS: LNA mode, 75Ω)

\[ V_{DD}=3.3V, V_{CTL}=1.8V, \text{freq}=40 \text{ to } 900MHz, T_a=+25°C, Z_S=Z_L=75\Omega, \text{with application circuit} \]

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small signal gain</td>
<td>Gain3</td>
<td>Exclude PCB &amp; connector losses</td>
<td>-</td>
<td>18.0</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>RFIN VSWR3</td>
<td>VSWRi3</td>
<td></td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RFOUT VSWR3</td>
<td>VSWRo3</td>
<td></td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### ELECTRICAL CHARACTERISTICS5

(RF CHARACTERISTICS: Bypass mode, 75Ω)

\[ V_{DD}=3.3V, V_{CTL}=0V, \text{freq}=40 \text{ to } 900MHz, T_a=+25°C, Z_S=Z_L=75\Omega, \text{with application circuit} \]

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion loss</td>
<td>LOSS4</td>
<td>Exclude PCB &amp; connector losses</td>
<td>-</td>
<td>1.5</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Composite Second Order</td>
<td>CSO4</td>
<td>132channels, CW, ( P_{IN}=+15dBmV )</td>
<td>-</td>
<td>80</td>
<td>-</td>
<td>dBc</td>
</tr>
<tr>
<td>Composite Triple Beat</td>
<td>CTB4</td>
<td>132channels, CW, ( P_{IN}=+15dBmV )</td>
<td>-</td>
<td>80</td>
<td>-</td>
<td>dBc</td>
</tr>
<tr>
<td>RFIN VSWR4</td>
<td>VSWRi4</td>
<td></td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RFOUT VSWR4</td>
<td>VSWRo4</td>
<td></td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### TERMINAL DESCRIPTION

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RFOUT1</td>
<td>The RF output terminal of the LNA mode. This terminal doubles as the drain terminal of the LNA. Please connect this terminal to the power supply via choke inductor.</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.</td>
</tr>
<tr>
<td>3</td>
<td>RFOUT2</td>
<td>The RF output terminal of the Bypass mode. Please connect this terminal with RFOUT1 terminal through DC blocking capacitor shown in the application circuit.</td>
</tr>
<tr>
<td>4</td>
<td>RFIN</td>
<td>RF input terminal. External capacitor C1 is required to block the DC bias voltage of internal circuit.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.</td>
</tr>
<tr>
<td>6</td>
<td>VCTL</td>
<td>Control voltage terminal. At this terminal, the switching of the LNA mode and Bypass mode is possible.</td>
</tr>
</tbody>
</table>
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: $V_{DD}=3.3\,V$, $V_{CTL}=1.8\,V$, $T_a=25°C$, $Z_s=Z_l=50\,\Omega$, with application circuit
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: $V_{DD}=3.3\text{V}$, $V_{CTL}=1.8\text{V}$, $T_a=25^\circ\text{C}$, $Z_s=Z_l=50\Omega$, with application circuit
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)

Conditions: $V_{DD}=3.3\,V$, $V_{CTL}=1.8\,V$, $Ta=25^\circ C$, $Zs=Zl=50\,\Omega$, with application circuit

- $S_{11}, S_{22}$ ($50\,MHz$ to $20\,GHz$)
- $S_{21}, S_{12}$ ($50\,MHz$ to $20\,GHz$)
- $VSWR_{i}$, $VSWR_{o}$
- $Z_{in}$, $Z_{out}$
- $S_{11}, S_{22}$ ($50\,MHz$ to $20\,GHz$)
- $S_{21}, S_{12}$ ($50\,MHz$ to $20\,GHz$)
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: \( V_{\text{CTL}} = 1.8 \text{V}, \, T_a = 25^\circ \text{C}, \, Z_s = Z_l = 50\Omega, \) with application circuit

- **Gain vs. \( V_{\text{DD}} \)**
  
  \( \text{Gain (dB)} \)

- **NF vs. \( V_{\text{DD}} \)**
  
  \( \text{NF (dB)} \)

- **P-1dB(IN) vs. \( V_{\text{DD}} \)**
  
  \( \text{P-1dB(IN) (dBm)} \)

- **IIP3 vs. \( V_{\text{DD}} \)**
  
  \( \text{IIP3 (dBm)} \)

- **IM2 vs. \( V_{\text{DD}} \)**
  
  \( \text{IM2 (dB)} \)

- **IM3 vs. \( V_{\text{DD}} \)**
  
  \( \text{IM3 (dB)} \)
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: V_{CTL}=1.8V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: $V_{DD}=3.3V$, $V_{CTL}=1.8V$, $Z_s=Z_l=50\,\Omega$, with application circuit

- **Gain vs. Temperature** (freq=620MHz)
  - NF vs. Temperature
  - P-1dB(IN) vs. Temperature (freq=620MHz)
  - IIP3 vs. Temperature (f1=620MHz, f2=620.1MHz, Pin=-20dBm)
  - IM2 vs. Temperature (f1=200MHz, f2=500MHz, fmeas=700MHz, Pin1=Pin2=-15dBm)
  - IM3 vs. Temperature (f1=600MHz, f2=650MHz, fmeas=700MHz, Pin1=Pin2=-15dBm)
  - NF vs. Temperature
ELECTRICAL CHARACTERISTICS (LNA mode, 50Ω)
Conditions: \( V_{DD} = 3.3V, \ V_{CTL} = 1.8V, \ Z_s = Z_l = 50\Omega \), with application circuit
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: V_DD=3.3V, V_CTL=0V, Ta=25°C, Zs=Zl=50Ω, with application circuit

- Loss vs. frequency (freq=40~1500MHz)
- Pout vs. Pin (freq=620MHz)
- Loss, IDD vs. Pin (freq=620MHz)
- P-1dB(IN) vs. frequency (freq=40~900MHz)
- Pout, IM3 vs. Pin (f1=620MHz, f2=f1+100kHz)
- IIP3, OIP3 vs. frequency (f1=40~900MHz, f2=f1+100kHz, Pin=-2dBm)
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: $V_{DD}=3.3\,\text{V}$, $V_{CTL}=0\,\text{V}$, $Ta=25^\circ\text{C}$, $Zs=Zl=50\,\Omega$, with application circuit

RF IN Return Loss vs. frequency
(freq=40~1500MHz)

RF OUT Return Loss vs. frequency
(freq=40~1500MHz)
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: $V_{DD}=3.3V$, $V_{CTL}=0V$, $Z_s=Z_l=50\,\Omega$, with application circuit

- **S11, S22**
- **S21, S12**
- **VSWRi, VSWRo**
- **Zin, Zout**
- **S11, S22 50MHz to 20GHz**
- **S21, S12 50MHz to 20GHz**
**ELECTRICAL CHARACTERISTICS** (Bypass mode, 50Ω)
Conditions: $V_{\text{CTL}}=0\text{V}$, $T_a=25^\circ\text{C}$, $Z_s=Z_l=50\Omega$, with application circuit

![Loss vs. VDD (freq=620MHz)](image1)

![P-1dB(IN) vs. VDD (freq=620MHz)](image2)

![IIP3 vs. VDD (f1=620MHz, f2=620.1MHz, Pin=-2dBm)](image3)

![IM2 vs. VDD (f1=200MHz, f2=500MHz, fmeas=700MHz, Pin1=Pin2=-8dBm)](image4)

![IM3 vs. VDD (f1=600MHz, f2=650MHz, fmeas=700MHz, Pin1=Pin2=-8dBm)](image5)
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: $V_{\text{CTL}}=0\text{V}$, $T_a=25^\circ\text{C}$, $Z_s=Z_l=50\Omega$, with application circuit

- RF IN Return Loss vs. $V_{\text{DD}}$ (freq=620MHz)

- RF OUT Return Loss vs. $V_{\text{DD}}$ (freq=620MHz)

- $I_{\text{DD}}$ vs. $V_{\text{DD}}$ (RF OFF)
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: $V_{DD}=3.3\,\text{V}$, $V_{\text{CTL}}=0\,\text{V}$, $Z_s=Z_l=50\,\Omega$, with application circuit

- **Loss vs. Temperature**
  - Frequency: 620MHz
  - Graph showing loss (dB) vs. temperature (°C)

- **P-1dB(IN) vs. Temperature**
  - Frequency: 620MHz
  - Graph showing P-1dB(IN) (dBm) vs. temperature (°C)

- **IIP3 vs. Temperature**
  - Frequency: 620MHz, $f_2=620.1\,\text{MHz}$, $P_{in}=-2\,\text{dBm}$
  - Graph showing IIP3 (dBm) vs. temperature (°C)

- **IM2 vs. Temperature**
  - Frequency: 200MHz, $f_2=500\,\text{MHz}$, $f_{\text{meas}}=700\,\text{MHz}$, $P_{in1}=P_{in2}=-8\,\text{dBm}$
  - Graph showing IM2 (dB) vs. temperature (°C)

- **IM3 vs. Temperature**
  - Frequency: 600MHz, $f_2=650\,\text{MHz}$, $f_{\text{meas}}=700\,\text{MHz}$, $P_{in1}=P_{in2}=-8\,\text{dBm}$
  - Graph showing IM3 (dB) vs. temperature (°C)
ELECTRICAL CHARACTERISTICS (Bypass mode, 50Ω)
Conditions: $V_{DD}=3.3\, V$, $V_{CTL}=0\, V$, $Z_s=Z_l=50\, \Omega$, with application circuit

![RF IN Return Loss vs. Temperature](freq=620MHz)

![RF OUT Return Loss vs. Temperature](freq=620MHz)

![I\text{DD} vs. Temperature](RF OFF)

![I\text{DD} vs. Temperature](RF OFF)
ELECTRICAL CHARACTERISTICS (LNA mode, 75Ω)
Conditions: $V_{DD}=3.3\,\text{V}$, $V_{CTL}=1.8\,\text{V}$, $T_a=25^\circ\text{C}$, $Z_s=Z_l=75\,\Omega$, with application circuit

Gain vs. frequency
(freq=40–1500MHz, $Z_s=Z_l=75\,\Omega$)

(Exclude PCB, Connector Losses)

RF IN Return Loss vs. frequency
(freq=40–1500MHz, $Z_s=Z_l=75\,\Omega$)

RF OUT Return Loss vs. frequency
(freq=40–1500MHz, $Z_s=Z_l=75\,\Omega$)
ELECTRICAL CHARACTERISTICS (LNA mode, 75Ω)
Conditions: \(V_{\text{CTL}}=1.8\text{V}, T_a=25^\circ\text{C}, Z_s=Z_l=75\Omega\), with application circuit

Gain vs. \(V_{\text{DD}}\)  
(freq=620MHz, \(Z_s=Z_l=75\text{ohm}\))

RF IN Return Loss vs. \(V_{\text{DD}}\)  
(freq=620MHz, \(Z_s=Z_l=75\text{ohm}\))

RF OUT Return Loss vs. \(V_{\text{DD}}\)  
(freq=620MHz, \(Z_s=Z_l=75\text{ohm}\))
**ELECTRICAL CHARACTERISTICS** (LNA mode, 75Ω)
Conditions: $V_{DD}=3.3\text{V}$, $V_{CTL}=1.8\text{V}$, $Zs=Zl=75\Omega$, with application circuit

Gain vs. Temperature
(freq=620MHz, $Zs=Zl=75\text{ohm}$)

RF IN Return Loss vs. Temperature
(freq=620MHz, $Zs=Zl=75\text{ohm}$)

RF OUT Return Loss vs. Temperature
(freq=620MHz, $Zs=Zl=75\text{ohm}$)
ELECTRICAL CHARACTERISTICS (Bypass mode, 75Ω)

Conditions: $V_{DD}=3.3\,V$, $V_{CTL}=0\,V$, $Ta=25^\circ C$, $Zs=Zl=75\,\Omega$, with application circuit

**Loss vs. frequency**

(freq=40~1500MHz, $Zs=Zl=75\,\Omega$)

(Exclude PCB, Connector Losses)

**RF IN Return Loss vs. frequency**

(freq=40~1500MHz, $Zs=Zl=75\,\Omega$)

**RF OUT Return Loss vs. frequency**

(freq=40~1500MHz, $Zs=Zl=75\,\Omega$)
**ELECTRICAL CHARACTERISTICS** (Bypass mode, 75Ω)

Conditions: \( V_{\text{CTL}} = 0 \text{V}, \; T_a = 25^\circ \text{C}, \; Z_s = Z_l = 75\Omega \), with application circuit

![Graphs showing Loss vs. VDD, RF IN Return Loss vs. VDD, and RF OUT Return Loss vs. VDD.](image-url)
ELECTRICAL CHARACTERISTICS (Bypass mode, 75Ω)
Conditions: \(V_{DD}=3.3\,\text{V},\, V_{CTL}=0\,\text{V},\, Z_s=Z_l=75\,\Omega\), with application circuit

![Graph of Loss vs. Temperature (freq=620MHz, Zs=Zl=75ohm)](image)

![Graph of RF IN Return Loss vs. Temperature (freq=620MHz, Zs=Zl=75ohm)](image)

![Graph of RF OUT Return Loss vs. Temperature (freq=620MHz, Zs=Zl=75ohm)](image)
**APPLICATION CIRCUIT**

(Top view)

**TEST PCB LAYOUT**

(Top View)

PCB: FR-4, t=0.2mm  
Microstrip line width: 0.4mm  
PCB size: 16.8mm x 16.8mm

PRECAUTIONS
- C1 to C3 is DC-Blocking capacitors, and C4 is a bypass capacitor.
- L1 is RF choke inductor. (DC feed inductor)
- R1 is the resistance to adjust the operating current.
- R2 is the resistance for stability.
- L2 is the inductor to adjust the impedance matching.
- All external parts, please be placed as close to the IC.
- In order not to couple with terminal RFIN and RFOUT, please layout ground pattern under the IC.
**MEASUREMENT BLOCK DIAGRAM**

**Measuring instruments**
- NF Analyzer : Agilent 8973A
- Noise Source : Agilent 346A

**Setting the NF analyzer**
- Measurement mode form
  - Device under test : Amplifier
  - System downconverter : off
- Mode setup form
  - Sideband : LSB
  - Averages : 4
  - Average mode : Point
  - Bandwidth : 4MHz
  - Loss comp : off
  - Tcold : setting the temperature of noise source (303K)

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**Calibration Setup**

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**Measurement Setup**

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* Noise source and NF analyzer are connected directly.
* Noise source and DUT, DUT and NF analyzer are connected directly.
Caution 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.

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