

0.4 W L-BAND POWER GaAs HJ-FET

**DESCRIPTION**

The NE651R479A is a 0.4 W GaAs HJ-FET designed for middle power transmitter applications for mobile communication and wireless PC LAN systems. It is capable of delivering 0.4 W of output power (CW) with high linear gain, high efficiency and excellent distortion and as a driver amplifier for our NE6510179A and NE6510379A.

Reliability and performance uniformity are assured by NEC's stringent quality and control procedures.

**FEATURES**

- GaAs HJ-FET structure
- High output power :  $P_{out} = +27.0$  dBm TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 900$  MHz,  $P_{in} = +13$  dBm  
 $P_{out} = +27.0$  dBm TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = +15$  dBm  
 $P_{out} = +29.5$  dBm TYP. @  $V_{DS} = 5.0$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = +15$  dBm
- High linear gain :  $G_L = 14.0$  dB TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 900$  MHz,  $P_{in} = 0$  dBm  
 $G_L = 12.0$  dB TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = 0$  dBm  
 $G_L = 12.0$  dB TYP. @  $V_{DS} = 5.0$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = 0$  dBm
- High power added efficiency : 60 % TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 900$  MHz,  $P_{in} = +13$  dBm  
 60 % TYP. @  $V_{DS} = 3.5$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = +15$  dBm  
 58 % TYP. @  $V_{DS} = 5.0$  V,  $I_{Dset} = 50$  mA,  $f = 1.9$  GHz,  $P_{in} = +15$  dBm

**ORDERING INFORMATION**

| Part Number   | Package | Supplying Form  |
|---------------|---------|---|
| NE651R479A-T1 | 79A     | <ul style="list-style-type: none"> <li>• 12 mm wide embossed taping</li> <li>• Qty 1 kpcs/reel</li> </ul> |

**Remark** To order evaluation samples, contact your nearby sales office.

Part number for sample order: NE651R479A

**Caution** Please handle this device at static-free workstation, because this is an electrostatic sensitive device.

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 Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25 °C)**

Operation in excess of any one of these parameters may result in permanent damage.

| Parameter               | Symbol           | Ratings     | Unit |
|-------------------------|------------------|-------------|------|
| Drain to Source Voltage | V <sub>DS</sub>  | 8           | V    |
| Gate to Source Voltage  | V <sub>GSO</sub> | -4          | V    |
| Drain Current           | I <sub>D</sub>   | 1.0         | A    |
| Gate Forward Current    | I <sub>GF</sub>  | 10          | mA   |
| Gate Reverse Current    | I <sub>GR</sub>  | 10          | mA   |
| Total Power Dissipation | P <sub>tot</sub> | 2.5         | W    |
| Channel Temperature     | T <sub>ch</sub>  | 150         | °C   |
| Storage Temperature     | T <sub>stg</sub> | -65 to +150 | °C   |

★ **RECOMMENDED OPERATING CONDITIONS**

| Parameter               | Symbol            | Test Conditions | MIN. | TYP. | MAX. | Unit |
|-------------------------|-------------------|-----------------|------|------|------|------|
| Drain to Source Voltage | V <sub>DS</sub>   |                 | -    | 3.5  | 6.0  | V    |
| Gain Compression        | G <sub>comp</sub> |                 | -    | -    | 3.0  | dB   |
| Channel Temperature     | T <sub>ch</sub>   |                 | -    | -    | +125 | °C   |

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = +25 °C, unless otherwise specified, using NEC standard test fixture.)

| Parameter                        | Symbol           | Test Conditions                                   | MIN. | TYP. | MAX. | Unit |
|----------------------------------|------------------|---|------|------|------|------|
| Saturated Drain Current          | I <sub>DSS</sub> | V <sub>DS</sub> = 2.5 V, V <sub>GS</sub> = 0 V    | -    | 0.7  | -    | A    |
| Pinch-off Voltage                | V <sub>p</sub>   | V <sub>DS</sub> = 2.5 V, I <sub>D</sub> = 5 mA    | -2.0 | -    | -0.4 | V    |
| Gate to Drain Break Down Voltage | BV <sub>gd</sub> | I <sub>gd</sub> = 5 mA                            | 12   | -    | -    | V    |
| Thermal Resistance               | R <sub>th</sub>  | Channel to Case                                   | -    | 30   | 50   | °C/W |
| Output Power                     | P <sub>out</sub> | f = 1.9 GHz, V <sub>DS</sub> = 3.5 V,             | 26.0 | 27.0 | -    | dBm  |
| Drain Current                    | I <sub>D</sub>   | P <sub>in</sub> = +15 dBm, R <sub>g</sub> = 1 kΩ, | -    | 220  | -    | mA   |
| Power Added Efficiency           | η <sub>add</sub> | I <sub>Dset</sub> = 50 mA (RF OFF)                | 52   | 60   | -    | %    |
| Linear Gain <sup>Note 1</sup>    | G <sub>L</sub>   | <b>Note 2</b>                                     | -    | 12.0 | -    | dB   |

**Notes 1.** P<sub>in</sub> = 0 dBm

**2.** DC performance is 100 % testing. RF performance is testing several samples per wafer. Wafer rejection criteria for standard devices is 1 reject for several samples.

**TYPICAL RF PERFORMANCE FOR REFERENCE (NOT SPECIFIED)**

(T<sub>A</sub> = +25 °C, unless otherwise specified, using NEC standard test fixture.)

| Parameter                   | Symbol           | Test Conditions                                   | MIN. | TYP. | MAX. | Unit |
|-----------------------------|------------------|---|------|------|------|------|
| Output Power                | P <sub>out</sub> | f = 900 MHz, V <sub>DS</sub> = 3.5 V,             | –    | 27.0 | –    | dBm  |
| Drain Current               | I <sub>D</sub>   | P <sub>in</sub> = +13 dBm, R <sub>g</sub> = 1 kΩ, | –    | 230  | –    | mA   |
| Power Added Efficiency      | η <sub>add</sub> | I <sub>Dset</sub> = 50 mA (RF OFF)                | –    | 60   | –    | %    |
| Linear Gain <sup>Note</sup> | G <sub>L</sub>   |   | –    | 14.0 | –    | dB   |

**Note** P<sub>in</sub> = 0 dBm

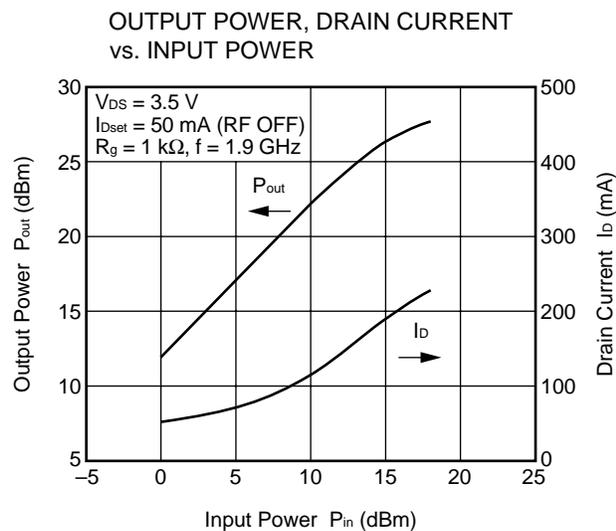
**TYPICAL RF PERFORMANCE FOR REFERENCE (NOT SPECIFIED)**

(T<sub>A</sub> = +25 °C, unless otherwise specified, using NEC standard test fixture.)

| Parameter                   | Symbol           | Test Conditions                                   | MIN. | TYP. | MAX. | Unit |
|-----------------------------|------------------|---|------|------|------|------|
| Output Power                | P <sub>out</sub> | f = 1.9 GHz, V <sub>DS</sub> = 5.0 V,             | –    | 29.5 | –    | dBm  |
| Drain Current               | I <sub>D</sub>   | P <sub>in</sub> = +15 dBm, R <sub>g</sub> = 1 kΩ, | –    | 350  | –    | mA   |
| Power Added Efficiency      | η <sub>add</sub> | I <sub>Dset</sub> = 50 mA (RF OFF)                | –    | 58   | –    | %    |
| Linear Gain <sup>Note</sup> | G <sub>L</sub>   |   | –    | 12.0 | –    | dB   |

**Note** P<sub>in</sub> = 0 dBm

**TYPICAL CHARACTERISTICS (T<sub>A</sub> = +25 °C)**



**Remark** The graph indicates nominal characteristics.

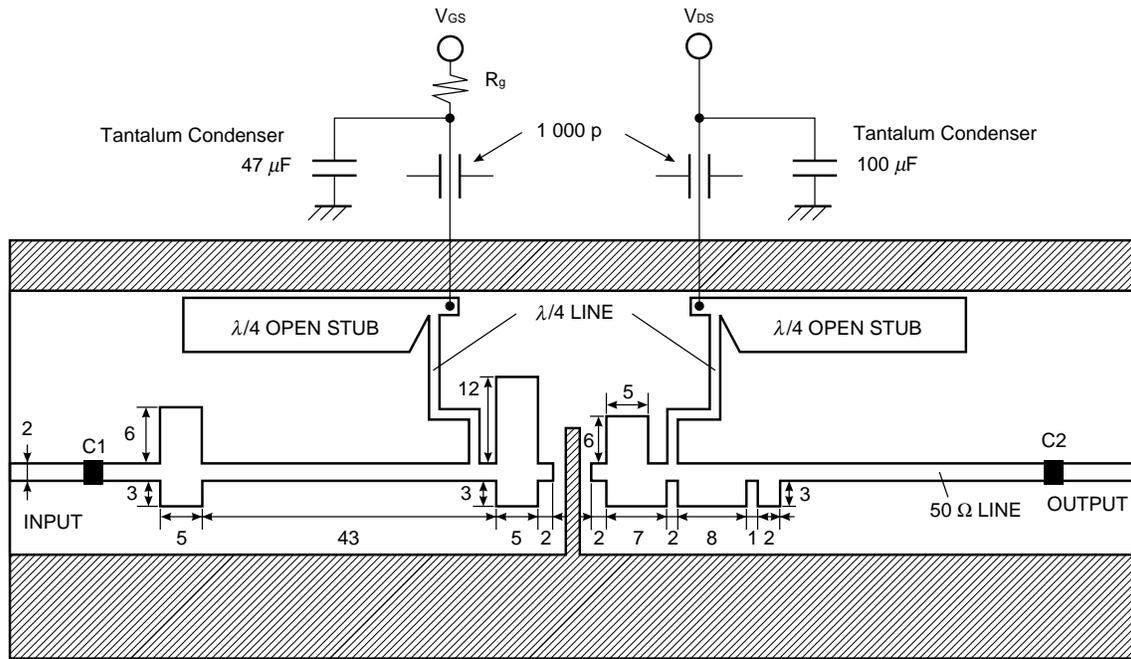
**S-PARAMETERS**

Test Conditions:  $V_{DS} = 3.5\text{ V}$ ,  $I_{Dset} = 50\text{ mA}$  (RF OFF)

| Frequency<br>GHz | S <sub>11</sub> |             | S <sub>21</sub> |             | S <sub>12</sub> |             | S <sub>22</sub> |             |
|------------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
|                  | MAG.            | ANG. (deg.) |
| 600              | 0.868           | -168.8      | 6.120           | 96.9        | 0.046           | 15.7        | 0.536           | -170.3      |
| 700              | 0.866           | -172.7      | 5.225           | 95.0        | 0.046           | 14.9        | 0.537           | -173.9      |
| 800              | 0.864           | -176.9      | 4.641           | 93.0        | 0.045           | 14.8        | 0.541           | -177.1      |
| 900              | 0.863           | -179.4      | 4.145           | 91.6        | 0.045           | 15.4        | 0.540           | -179.6      |
| 1000             | 0.868           | 176.6       | 3.730           | 89.4        | 0.045           | 15.8        | 0.541           | 178.0       |
| 1100             | 0.862           | 173.6       | 3.359           | 88.3        | 0.045           | 16.6        | 0.542           | 175.5       |
| 1200             | 0.860           | 170.8       | 3.152           | 87.5        | 0.046           | 16.6        | 0.542           | 173.4       |
| 1300             | 0.861           | 168.3       | 2.894           | 85.8        | 0.047           | 15.7        | 0.535           | 171.9       |
| 1400             | 0.859           | 165.4       | 2.695           | 85.2        | 0.047           | 15.5        | 0.533           | 170.1       |
| 1500             | 0.861           | 162.2       | 2.527           | 84.2        | 0.046           | 16.1        | 0.533           | 167.8       |
| 1600             | 0.862           | 159.3       | 2.387           | 82.9        | 0.046           | 17.0        | 0.533           | 165.9       |
| 1700             | 0.857           | 156.7       | 2.261           | 82.8        | 0.047           | 17.1        | 0.532           | 163.8       |
| 1800             | 0.855           | 153.5       | 2.229           | 80.9        | 0.046           | 17.0        | 0.537           | 161.1       |
| 1900             | 0.856           | 150.0       | 2.093           | 77.8        | 0.046           | 16.6        | 0.538           | 158.4       |
| 2000             | 0.860           | 146.7       | 1.946           | 76.9        | 0.045           | 16.3        | 0.537           | 156.0       |
| 2100             | 0.860           | 142.9       | 1.884           | 75.5        | 0.045           | 16.9        | 0.533           | 154.0       |
| 2200             | 0.863           | 140.1       | 1.785           | 73.6        | 0.045           | 18.4        | 0.533           | 149.6       |

APPLICATION CIRCUIT EXAMPLE

f = 1.9 GHz (Unit: mm)



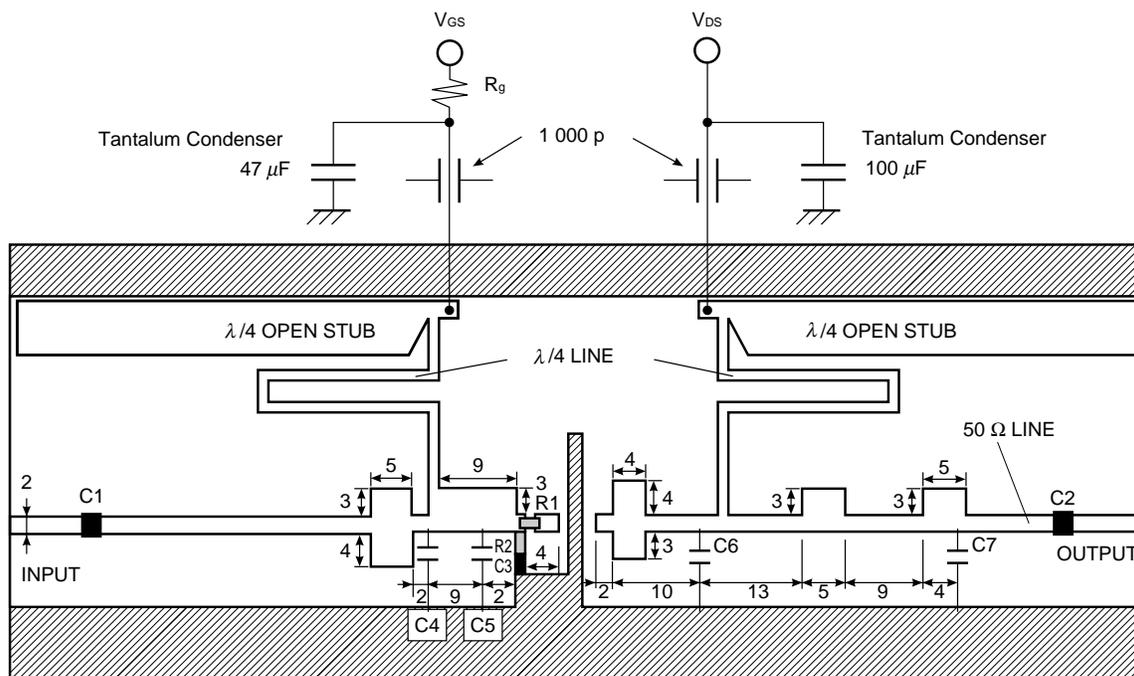
f = 1.9 GHz  
 V<sub>DS</sub> = 3.5 V  
 I<sub>Dset</sub> = 50 mA (RF OFF)

C1 = 30 pF  
 C2 = 30 pF  
 R<sub>g</sub> = 1 kΩ

Substrate: Teflon glass (ε<sub>r</sub> = 2.6)  
 t = 0.8 mm

APPLICATION CIRCUIT EXAMPLE

f = 900 MHz (Unit: mm)



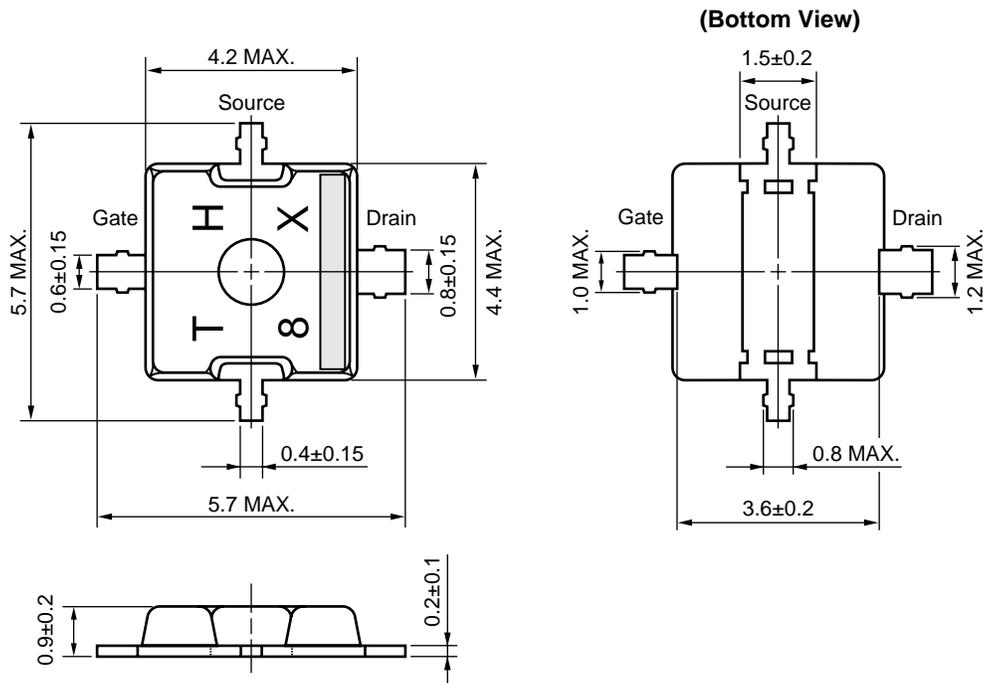
f = 900 MHz  
 V<sub>DS</sub> = 3.5 V  
 I<sub>Dset</sub> = 50 mA (RF OFF)

C1 = 30 pF  
 C2 = 30 pF  
 C3 = 1 000 pF  
 C4 = 6 pF  
 C5 = 3 pF  
 C6 = 6 pF  
 C7 = 1 pF  
 R1 = 5.1 Ω  
 R2 = 30 Ω  
 R<sub>g</sub> = 1 kΩ

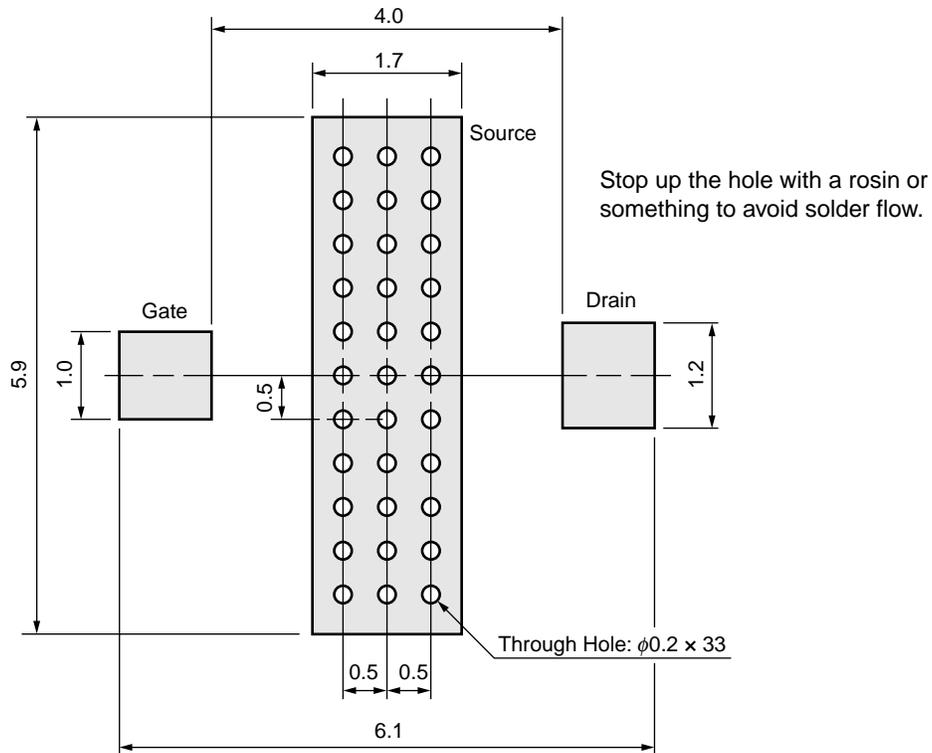
Substrate: Teflon glass (ε<sub>r</sub> = 2.6)  
 t = 0.8 mm

PACKAGE DIMENSIONS

79A (UNIT: mm)



79A PACKAGE RECOMMENDED P.C.B. LAYOUT (UNIT: mm)



**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

| Soldering Method | Soldering Conditions  | Recommended Condition Symbol |
|------------------|---|------------------------------|
| Infrared Reflow  | Package peak temperature: 235 °C or below,<br>Time: 30 seconds or less (at 210 °C or higher),<br>Count: 2 times or less,<br>Exposure: limit: None <sup>Note</sup> | IR35-00-2                    |
| Partial Heating  | Pin temperature: 260 °C or below,<br>Time: 5 seconds or less (per pin row)<br>Exposure: limit: None <sup>Note</sup>   | —                            |

**Note** After opening the dry pack, store it at 25 °C or less and 65 % RH or less for the allowable storage period.

**Caution** Do not use different soldering methods together (except for partial heating).

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M8E 00.4-0110

**SAFETY INFORMATION ON THIS PRODUCT**

|                       |                      |   |
|-----------------------|----------------------|---|
| <p><b>Caution</b></p> | <p>GaAs Products</p> | <p>The product contains gallium arsenide, GaAs.<br/>GaAs vapor and powder are hazardous to human health if inhaled or ingested.</p> <ul style="list-style-type: none"> <li>• Do not destroy or burn the product.</li> <li>• Do not cut or cleave off any part of the product.</li> <li>• Do not crush or chemically dissolve the product.</li> <li>• Do not put the product in the mouth.</li> </ul> <p>Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.</p> |
|-----------------------|----------------------|---|

► **Business issue**

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► **Technical issue**

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