NE3520S03
N-Channel GaAs HJ-FET, K Band Low Noise and High-Gain

FEATURES
• Low noise figure and high associated gain:
  \[ NF = 0.65 \text{ dB TYP.}, \quad G = 13.5 \text{ dB TYP.} \quad @ \quad f = 20 \text{ GHz}, \quad V_{DS} = 2 \text{ V}, \quad I_D = 10 \text{ mA} \]
• K band Micro-X plastic (S03) package

APPLICATIONS
• 20 GHz band DBS LNB
• Other K band communication system

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Order Number</th>
<th>Package</th>
<th>Quantity</th>
<th>Marking</th>
<th>Supplying Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE3520S03-T1C</td>
<td>NE3520S03-T1C-A</td>
<td>S03 package (Pb-Free)</td>
<td>2 kpcs/reel</td>
<td>J</td>
<td>• Embossed tape 8 mm wide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Pin 4 (Gate) face the perforation side of the tape</td>
</tr>
<tr>
<td>NE3520S03-T1D</td>
<td>NE3520S03-T1D-A</td>
<td></td>
<td>1 kpcs/reel</td>
<td>J</td>
<td></td>
</tr>
</tbody>
</table>

Remark: To order evaluation samples, please contact your nearby sales office.
Part number for sample order: NE3520S03-A

ABSOLUTE MAXIMUM RATINGS \((T_A = +25^\circ\text{C}, \text{unless otherwise specified})\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Voltage</td>
<td>(V_{DS})</td>
<td>4.0</td>
<td>V</td>
</tr>
<tr>
<td>Gate to Source Voltage</td>
<td>(V_{GS})</td>
<td>-3.0</td>
<td>V</td>
</tr>
<tr>
<td>Drain Current</td>
<td>(I_D)</td>
<td>100 mA</td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Gate Current</td>
<td>(I_G)</td>
<td>100</td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Total Power Dissipation</td>
<td>(P_{tot})</td>
<td>165</td>
<td>mW</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>(T_{ch})</td>
<td>+125</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>(T_{stg})</td>
<td>-65 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note: Mounted on 1.08 cm² x 1.0 mm (t) glass epoxy PWB

CAUTION
Observe precautions when handling because these devices are sensitive to electrostatic discharge.
### RECOMMENDED OPERATING RANGE (TA = +25°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Voltage</td>
<td>V_DS</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
<td>V</td>
</tr>
<tr>
<td>Drain Current</td>
<td>I_D</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>mA</td>
</tr>
<tr>
<td>Input Power</td>
<td>P_IN</td>
<td>–</td>
<td>–</td>
<td>0</td>
<td>dBm</td>
</tr>
</tbody>
</table>

### ELECTRICAL CHARACTERISTICS (TA = +25°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate to Source Leak Current</td>
<td>I_GSO</td>
<td>V_GS = –3.0 V</td>
<td>–</td>
<td>0.5</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>Saturated Drain Current</td>
<td>I_DSS</td>
<td>V_DS = 2 V, V_GS = 0 V</td>
<td>25</td>
<td>40</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td>Gate to Source Cut-off Voltage</td>
<td>V_GS (off)</td>
<td>V_DS = 2 V, I_D = 100 μA</td>
<td>–0.2</td>
<td>–0.7</td>
<td>–1.3</td>
<td>V</td>
</tr>
<tr>
<td>Transconductance</td>
<td>gm</td>
<td>V_DS = 2 V, I_D = 10 mA</td>
<td>50</td>
<td>65</td>
<td>–</td>
<td>mS</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>NF</td>
<td>V_DS = 2 V, I_D = 10 mA, f = 20 GHz</td>
<td>–</td>
<td>0.65</td>
<td>0.90</td>
<td>dB</td>
</tr>
<tr>
<td>Associated Gain</td>
<td>G_a</td>
<td></td>
<td>11.5</td>
<td>13.5</td>
<td>–</td>
<td>dB</td>
</tr>
</tbody>
</table>
TYPICAL CHARACTERISTICS ($T_A = +25^\circ C$, unless otherwise specified)

**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**

![Graph showing total power dissipation vs. ambient temperature.](image)

- Mounted on Glass Epoxy PCB
  - ($1.08\, \text{cm}^2 \times 1.0\, \text{mm (t)}$)

**DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE**

![Graph showing drain current vs. drain to source voltage.](image)

- $V_D = 0\, \text{V}$
- $-0.1\, \text{V}$
- $-0.2\, \text{V}$
- $-0.3\, \text{V}$
- $-0.4\, \text{V}$
- $-0.5\, \text{V}$

**DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE**

![Graph showing drain current vs. gate to source voltage.](image)

- $V_G = 0\, \text{V}$
- $-0.3\, \text{V}$
- $-0.1\, \text{V}$
- $-0.4\, \text{V}$
- $-0.5\, \text{V}$

**MINIMUM NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY**

![Graph showing minimum noise figure and associated gain vs. frequency.](image)

- $V_D = 2\, \text{V}$
- $I_D = 10\, \text{mA}$

**MINIMUM NOISE FIGURE, ASSOCIATED GAIN vs. DRAIN CURRENT**

![Graph showing minimum noise figure and associated gain vs. drain current.](image)

- $f = 20\, \text{GHz}$
- $V_D = 2\, \text{V}$

**Remark** The graphs indicate nominal characteristics.
S-PARAMETERS

S-parameters/Noise-parameters are provided on our web site in a form (S2P) that enables direct import to a microwave circuit simulator without keyboard input.

Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL http://www2.renesas.com/microwave/
RF MEASURING LAYOUT PATTERN (REFERENCE ONLY) (UNIT: mm)

- RT/duroid 5880/ROGERS
- \( t = 0.254 \text{ mm} \)
- \( \varepsilon_f = 2.20 \)
- \( \tan \delta = 0.0009 @ 10 \text{ GHz} \)
- Au-flash plate

Drop-In Replacement: CE3520K3
PACKAGE DIMENSIONS

S03 (UNIT: mm)

(Top View)

(Bottom View)

(Side View)

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

<table>
<thead>
<tr>
<th>Soldering Method</th>
<th>Soldering Conditions</th>
<th>Condition Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrared Reflow</td>
<td>Peak temperature (package surface temperature) : 260°C or below</td>
<td>IR260</td>
</tr>
<tr>
<td></td>
<td>Time at peak temperature : 10 seconds or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time at temperature of 220°C or higher : 60 seconds or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preheating time at 120 to 180°C : 120±30 seconds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum number of reflow processes : 3 times</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum chlorine content of rosin flux (% mass) : 0.2% (Wt.) or below</td>
<td></td>
</tr>
<tr>
<td>Partial Heating</td>
<td>Peak temperature (terminal temperature) : 350°C or below</td>
<td>HS350</td>
</tr>
<tr>
<td></td>
<td>Soldering time (per side of device) : 3 seconds or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum chlorine content of rosin flux (% mass) : 0.2% (Wt.) or below</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION
Do not use different soldering methods together (except for partial heating).
This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.

- Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.
  1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.
  2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.
- Do not burn, destroy, cut, crush, or chemically dissolve the product.
- Do not lick the product or in any way allow it to enter the mouth.

GaAs Products
## Revision History

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Page</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Oct 18, 2011</td>
<td>-</td>
<td>First edition issued</td>
</tr>
</tbody>
</table>

**DISCONTINUED**

Drop-In Replacement: CE3520K3
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