**FEATURES**

High Output Power: P1dB=36.0dBm (Typ.)
High Gain: G1dB=11.5dB (Typ.)
High PAE: \( \eta_{\text{add}} = 37\% \) (Typ.)
Frequency Band: 5.9 to 6.4GHz
Internally matched
Plastic Package for SMT applications

**DESCRIPTION**

The ELM5964-4PS is a power GaAs FET that is internally matched for standard communication bands to provide optimum power and gain.

**ABSOLUTE MAXIMUM RATING (Case Temperature Tc=25 deg.C)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>( V_{DS} )</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>( V_{GS} )</td>
<td>-5</td>
<td>V</td>
</tr>
<tr>
<td>Total Power Dissipation</td>
<td>( P_T )</td>
<td>27.3</td>
<td>W</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>( T_{STG} )</td>
<td>-40 to +125</td>
<td>deg.C</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>( T_{CH} )</td>
<td>175</td>
<td>deg.C</td>
</tr>
</tbody>
</table>

**RECOMMENDED OPERATING CONDITION (Case Temperature Tc=25 deg.C)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Input Voltage</td>
<td>( V_{DS} )</td>
<td></td>
<td>&lt;10</td>
<td>V</td>
</tr>
<tr>
<td>Forward Gate Current</td>
<td>( I_{GF} )</td>
<td>( R_G=100 ) ohm</td>
<td>&lt;+16</td>
<td>mA</td>
</tr>
<tr>
<td>Reverse Gate Current</td>
<td>( I_{GR} )</td>
<td>( R_G=100 ) ohm</td>
<td>&gt;-2.2</td>
<td>mA</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>( T_{CH} )</td>
<td></td>
<td>155</td>
<td>deg.C</td>
</tr>
</tbody>
</table>

**ELECTRICAL CHARACTERISTICS (Case Temperature Tc=25 deg.C)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Current</td>
<td>( I_{DSS} )</td>
<td>( V_{DS}=5V, \ V_{GS}=0V )</td>
<td>-</td>
<td>1700</td>
</tr>
<tr>
<td>Trans conductance</td>
<td>( g_m )</td>
<td>( V_{DS}=5V, \ I_{DS}=1100mA )</td>
<td>-</td>
<td>1700</td>
</tr>
<tr>
<td>Pinch-off Voltage</td>
<td>( V_P )</td>
<td>( V_{DS}=5V, \ I_{DS}=85mA )</td>
<td>-0.5</td>
<td>-1.5</td>
</tr>
<tr>
<td>Gate-Source Breakdown Voltage</td>
<td>( V_{BSS} )</td>
<td>( I_{GS}=85uA )</td>
<td>-5.0</td>
<td>-</td>
</tr>
<tr>
<td>Output Power at 1dB G.C.P.</td>
<td>( P_{1dB} )</td>
<td>( V_{DS}=10V )</td>
<td>35.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Power Gain at 1dB G.C.P.</td>
<td>( G_{1dB} )</td>
<td>( V_{DS}=10V )</td>
<td>10.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Drain Current</td>
<td>( I_{dsr} )</td>
<td>( I_{ds(OC)}=0.65I_{DSS} ) (typ.)</td>
<td>-</td>
<td>1100</td>
</tr>
<tr>
<td>Power Added Efficiency</td>
<td>( \eta_{\text{add}} )</td>
<td>( f=5.9 ) to ( 6.4 ) GHz</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>( \Delta G )</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3rd Order Inter Modulation Distortion</td>
<td>( IM_3 )</td>
<td>( f=6.4GHz )</td>
<td>-40</td>
<td>-43</td>
</tr>
<tr>
<td>Channel to Case</td>
<td>( R_{th} )</td>
<td>Channel to Case</td>
<td>-</td>
<td>4.5</td>
</tr>
<tr>
<td>( \Delta T_{th} )</td>
<td>( \Delta T_{ch} )</td>
<td>10V ( \times ) ( I_{dsr} ) ( \times ) ( R_{th} )</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
ELM5964-4PS
C-Band Internally Matched FET

CASE STYLE: I2C

<table>
<thead>
<tr>
<th>ESD</th>
<th>Class 3 A</th>
<th>4000 to 8000V</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSL</td>
<td>2A</td>
<td>4 weeks after open the package</td>
</tr>
</tbody>
</table>

RoHS COMPLIANCE | Yes

Ordering Information

<table>
<thead>
<tr>
<th>Model Type</th>
<th>MOQ</th>
<th>MOU</th>
<th>Packing Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELM5964-4PS</td>
<td>15pcs</td>
<td>15pcs</td>
<td>15pcs Tray</td>
</tr>
<tr>
<td>ELM5964-4PST</td>
<td>500pcs</td>
<td>500pcs</td>
<td>24mm width Tape (500pcs/Reel)</td>
</tr>
</tbody>
</table>

*MOQ stands for Minimum Order Quantity.
*MOU stands for Minimum Order Unit size.

**Note**

- This device will not be delivered with test data but tested pass/fail 100% against DC and RF specifications.
- NO liquid cleaning process is suitable for this device. (including de-ionized water or solvent)
RF Characteristics

Power Derating Curve

Input Power vs. Output Power, Power Added Efficiency

IMD vs. Output Power

Output Power vs. Frequency

IMD vs. Output Power

Output Power vs. Frequency

IMD vs. Output Power

IMD vs. Output Power
Input Power vs. Output Power, Power Added Efficiency by Drain Voltage

- $I_{DS(DC)}=1100\,mA$ @5.9GHz
- $I_{DS(DC)}=1100\,mA$ @6.15GHz
- $I_{DS(DC)}=1100\,mA$ @6.4GHz
**ELM5964-4PS**

*C-Band Internally Matched FET*

Input Power vs. Output Power, Power Added Efficiency by Quiescent Drain Current

\( V_{DS} = 10V @ 5.9GHz \)

Input Power vs. Output Power, Power Added Efficiency by Quiescent Drain Current

\( V_{DS} = 10V @ 6.15GHz \)

Input Power vs. Output Power, Power Added Efficiency by Quiescent Drain Current

\( V_{DS} = 10V @ 6.4GHz \)

---

**Edition 1.8a**

**Jul. 2010**
Input Power vs. Output Power, Power Added Efficiency by Temperature

$V_{DS}=10V$ @5.9GHz

- $Tc=-40\text{deg. C}$
- $Tc=20\text{deg. C}$
- $Tc=80\text{deg. C}$

Input Power vs. Output Power, Power Added Efficiency by Temperature

$V_{DS}=10V$ @6.15GHz

- $Tc=-40\text{deg. C}$
- $Tc=20\text{deg. C}$
- $Tc=80\text{deg. C}$

Input Power vs. Output Power, Power Added Efficiency by Temperature

$V_{DS}=10V$ @6.4GHz

- $Tc=-40\text{deg. C}$
- $Tc=20\text{deg. C}$
- $Tc=80\text{deg. C}$
IMD Performance vs. Output Power by Drain Voltage

- \( I_{DS(DC)} = 1100 \text{mA @ 5.9GHz} \)
- \( I_{DS(DC)} = 1100 \text{mA @ 6.15GHz} \)
- \( I_{DS(DC)} = 1100 \text{mA @ 6.4GHz} \)

Output Power [dBm] S.C.L.

IMD [dBc]

IMD Performance vs. Output Power by Drain Voltage

- 8V
- 9V
- 10V
IMD Performance vs. Output Power by Quiescent Drain Current

V_{DS} = 10V @ 6.15GHz

V_{DS} = 10V @ 5.9GHz

V_{DS} = 10V @ 6.4GHz

C-Band Internally Matched FET
IMD Performance vs. Output Power by Temperature

\( V_{DS} = 10\text{V} @ 5.9\text{GHz} \)

\( V_{DS} = 10\text{V} @ 6.15\text{GHz} \)

\( V_{DS} = 10\text{V} @ 6.4\text{GHz} \)
• S-Parameter

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>S11 MAG</th>
<th>S11 ANG</th>
<th>S21 MAG</th>
<th>S21 ANG</th>
<th>S12 MAG</th>
<th>S12 ANG</th>
<th>S22 MAG</th>
<th>S22 ANG</th>
</tr>
</thead>
<tbody>
<tr>
<td>5700</td>
<td>0.567</td>
<td>-121.1</td>
<td>4.260</td>
<td>20.5</td>
<td>0.046</td>
<td>106.0</td>
<td>0.574</td>
<td>-124.0</td>
</tr>
<tr>
<td>5800</td>
<td>0.555</td>
<td>-146.1</td>
<td>4.318</td>
<td>2.2</td>
<td>0.043</td>
<td>86.3</td>
<td>0.581</td>
<td>-144.0</td>
</tr>
<tr>
<td>5900</td>
<td>0.552</td>
<td>-169.8</td>
<td>4.269</td>
<td>-15.4</td>
<td>0.039</td>
<td>66.7</td>
<td>0.593</td>
<td>-162.5</td>
</tr>
<tr>
<td>6000</td>
<td>0.556</td>
<td>168.9</td>
<td>4.155</td>
<td>-32.1</td>
<td>0.035</td>
<td>47.1</td>
<td>0.605</td>
<td>-178.6</td>
</tr>
<tr>
<td>6100</td>
<td>0.562</td>
<td>150.0</td>
<td>4.018</td>
<td>-47.4</td>
<td>0.031</td>
<td>27.1</td>
<td>0.610</td>
<td>167.5</td>
</tr>
<tr>
<td>6200</td>
<td>0.567</td>
<td>132.1</td>
<td>3.894</td>
<td>-62.7</td>
<td>0.026</td>
<td>5.8</td>
<td>0.613</td>
<td>155.2</td>
</tr>
<tr>
<td>6300</td>
<td>0.569</td>
<td>116.3</td>
<td>3.816</td>
<td>-76.9</td>
<td>0.023</td>
<td>-15.3</td>
<td>0.614</td>
<td>144.7</td>
</tr>
<tr>
<td>6400</td>
<td>0.567</td>
<td>100.8</td>
<td>3.775</td>
<td>-90.9</td>
<td>0.020</td>
<td>-38.5</td>
<td>0.602</td>
<td>135.4</td>
</tr>
<tr>
<td>6500</td>
<td>0.560</td>
<td>84.8</td>
<td>3.792</td>
<td>-104.9</td>
<td>0.019</td>
<td>-62.4</td>
<td>0.580</td>
<td>127.0</td>
</tr>
<tr>
<td>6600</td>
<td>0.551</td>
<td>66.6</td>
<td>3.833</td>
<td>-120.0</td>
<td>0.018</td>
<td>-90.4</td>
<td>0.542</td>
<td>118.7</td>
</tr>
</tbody>
</table>

S-Parameter Reference Plane
ELM5964-4PS
C-Band Internally Matched FET

- Package Outline

Pin Assignments
1: NC
2: Gate
3: NC
4: NC
5: Drain
6: NC
7: Source

Co Planarity

Pin Assignments
1: NC
2: Gate
3: NC
4: NC
5: Drain
6: NC
7: Source
- PCB Pads and Solder-Resist Pattern

Notes:
1. Laminate: Rogers Corporation RO4003, Thickness t=0.508mm, Cu Foil 18µm.
   Finish to copper foil: Ni 0.1µm min. / Au 0.1µm (Both side).
2. : Resist
- Marking and Tape/Reel Configuration

Quantity: 500pcs/tape  
Tape Material: Conductive PS  
(unit in mm)
**Mounting Instructions for Package for Lead-free solder**

**Mounting Condition**

For soldering, Lead-free solder (Sn-3.0Ag-0.5Cu)*1 or equivalent shall be used.

1. The example solder is a tin-rich alloy with 3.0% silver and 0.5% copper, often called Sn 96 for its approximate Tin content.
2. A rosin type flux with chlorine content of 0.2% or less shall be used. The rosin flux with low halogen content is recommended. When soldering, use the following time/temperature profile with any of the methods listed for acceptable solder joints.
3. Make sure the devices have been properly prepared with flux prior soldering.

*Reflow soldering method (Infrared reflow / Heat circulation reflow / Hot plate reflow);*

Limit solder to 3 reflow cycles because resin is used in the modules manufacturing process. Excessive reflow will effect the resin resulting in a potential failure or latent defect. The recommended reflow temperature profile is shown below. The temperature of the reflow profile must be measured at the device lead.

**Reflow temperature profile and condition:**

![Reflow temperature profile](image)

2. Preheating: 150 to 200 deg.C, 60 to 180 seconds.

*Measurement point: Device Heat-sink (Source Pin).*

1. The above-recommended conditions were confirmed using the manufacturer’s equipment and materials. However, when soldering these products, the soldering condition should be verified by customer using their own particular equipment and materials.

**Cleaning**

Avoid washing of the device after soldering by reflow method due to the risk of liquid absorption by the resin used in this part.
Humidity Lifetime for ELMxxxx-4PST

The following graph shows the effect of moisture on lifetime (moisture resistance) for the ELMxxxx-4PST. Each graph indicates the MTTF and failure rate prediction (Confidential Level = 90 %) which calculated from the results of highly accelerated temperature and humidity stress test (HAST).

Representative of device type : ELM7179-4PST
Subject of device type : ELMxxxx-4PST

Field environmental conditions for operation

If the ELMxxxx-4PST is installed in a non-hermetic environment, please refer to the following recommendations and notes for design with, and assembly and use of our products.

Note 1. When drain current cuts off, it should be cut off by drain bias, and not cut off by gate bias only. The humidity lifetime becomes shorter in case of the gate-only cut off operation due to electric field strength interacting with humidity.

Note 2. ELMxxxx-4PST should be used under the environment conditions of no dew condensation. These plots do not apply in the case of liquid absorbed into the resin, whether applied to the part in assembly or as condensate in the application.
CAUTION

This product contains gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

・Do not put these products into the mouth.

・Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.

・Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.