

### 140 W L, S-BAND PUSH-PULL POWER GaAs MES FET

#### DESCRIPTION

The NES1823P-140 is a 140 W push-pull type GaAs MES FET designed for high power transmitter applications for PCS, DCS, PHS and IMT2000 base station systems. It is capable of delivering 140 W of output power (CW) with high linear gain, high efficiency and excellent distortion under the condition of 12 V operation. Its primary band is 1.8 to 2.3 GHz, however with different matching, 60 MHz or less of instantaneous bandwidth can be achieved anywhere from 0.8 to 2.3 GHz. The device employs 0.9  $\mu\text{m}$  Tungsten Silicide gates, via holes, plated heat sink, and silicon dioxide passivation for superior performance, thermal characteristics, and reliability.

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

#### FEATURES

- Push-pull type N-channel GaAs MES FET
- $V_{DS} = 12.0$  V operation
- High output power:  $P_{out} = 140$  W TYP.
- High linear gain:  $G_L = 11$  dB TYP.
- High power added efficiency:  $\eta_{add} = 43$  % TYP. @  $V_{DS} = 12.0$  V,  $I_{Dset} = 6.0$  A (total),  $f = 2.20$  GHz

#### ORDERING INFORMATION (PLAN)

| Part Number  | Package | Supplying Form          |
|--------------|---------|-------------------------|
| NES1823P-140 | T-92    | ESD protective envelope |

**Remark** To order evaluation samples, consult your NEC sales representative.

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.  
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

**ABSOLUTE MAXIMUM RATINGS (Unless otherwise specified, 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>                  | 19          | V    |
| Gate to Source Voltage  | V <sub>GSO</sub>                 | -7          | V    |
| Gate to Drain Voltage   | V <sub>GDO</sub>                 | -22         | V    |
| Drain Current           | I <sub>D</sub>                   | 76          | A    |
| Gate Current            | I <sub>G</sub>                   | 440         | mA   |
| Total Power Dissipation | P <sub>tot</sub> <sup>Note</sup> | 270         | W    |
| Channel Temperature     | T <sub>ch</sub>                  | 175         | °C   |
| Storage Temperature     | T <sub>stg</sub>                 | -65 to +175 | °C   |

**Note** T<sub>C</sub> = +25 °C

**RECOMMENDED OPERATING CONDITIONS**

| Parameter               | Symbol                         | Test Conditions                  | MIN. | TYP. | MAX. | Unit |
|-------------------------|--------------------------------|----------------------------------|------|------|------|------|
| Drain to Source Voltage | V <sub>DS</sub>                |                                  | -    | -    | 12.0 | V    |
| Gain Compression        | G <sub>comp</sub>              |                                  | -    | -    | 3.0  | dB   |
| Channel Temperature     | T <sub>ch</sub>                |                                  | -    | -    | +150 | °C   |
| Set Drain Current       | I <sub>Dset</sub>              | V <sub>DS</sub> = 12.0 V, RF OFF | -    | 6.0  | 6.0  | A    |
| Gate Resistance         | R <sub>g</sub> <sup>Note</sup> |                                  | -    | -    | 12.5 | Ω    |

**Note** R<sub>g</sub> is the series resistance between the gate supply and the FET gate.

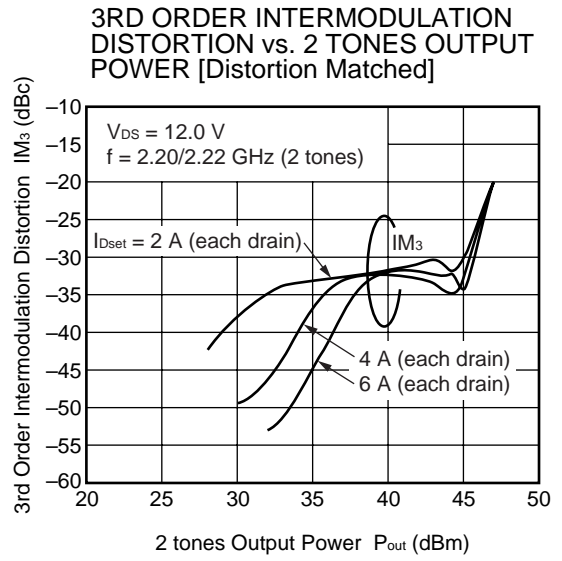
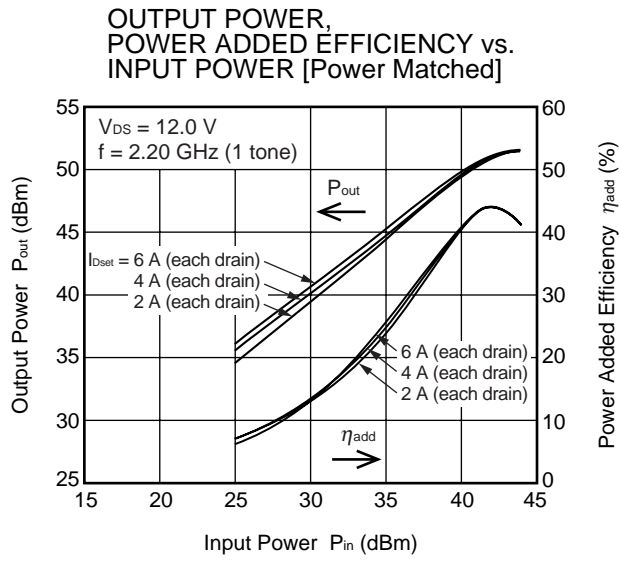
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25 °C)**

| 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            | -    | 76.0 | -    | A    |
| Pinch-off Voltage       | V <sub>p</sub>                  | V <sub>DS</sub> = 2.5 V, I <sub>D</sub> = 330 mA          | -4.0 | -2.6 | -    | V    |
| Thermal Resistance      | R <sub>th</sub>                 | Channel to Case   | -    | 0.4  | 0.55 | °C/W |
| Output Power            | P <sub>out</sub>                | f = 2.20 GHz, V <sub>DS</sub> = 12.0 V,                   | 50.5 | 51.5 | -    | dBm  |
| Drain Current           | I <sub>D</sub>                  | P <sub>in</sub> = 43.5 dBm, R <sub>g</sub> = 12.5 Ω,      | -    | 22.0 | -    | A    |
| Power Added Efficiency  | η <sub>add</sub>                | I <sub>Dset</sub> = 6.0 A Total (RF OFF) <sup>Note1</sup> | -    | 43   | -    | %    |
| Linear Gain             | G <sub>L</sub> <sup>Note2</sup> |   | 9    | 11   | -    | dB   |

**Notes 1.** I<sub>Dset</sub> = 3.0 A each drain

**2.** P<sub>in</sub> = 25 dBm

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



Remark The graphs indicate nominal characteristics.

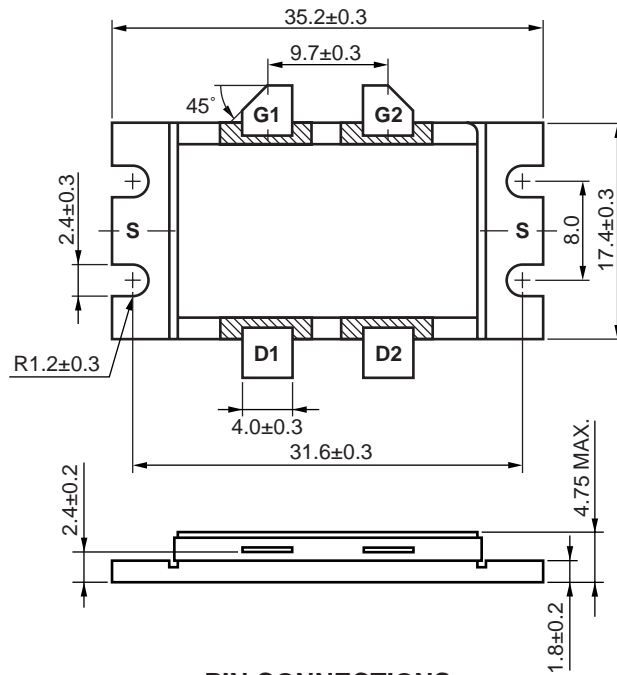
**S-PARAMETERS**

V<sub>DS</sub> = 12.0 V, I<sub>Dset</sub> = 3.0 A each drain

| FREQUENCY |       | S <sub>11</sub> |       | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |  |
|-----------|-------|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|--|
| GHz       | MAG.  | ANG. (deg.)     | MAG.  | ANG. (deg.)     | MAG.  | ANG. (deg.)     | MAG.  | ANG. (deg.)     |  |
| 1.000     | 0.954 | 168.3           | 0.440 | 91.8            | 0.005 | 63.9            | 0.901 | 162.2           |  |
| 1.050     | 0.953 | 167.5           | 0.461 | 90.7            | 0.004 | 86.8            | 0.898 | 161.7           |  |
| 1.100     | 0.958 | 166.2           | 0.481 | 85.7            | 0.006 | 64.3            | 0.884 | 160.2           |  |
| 1.150     | 0.954 | 165.2           | 0.498 | 84.1            | 0.005 | 49.6            | 0.881 | 158.2           |  |
| 1.200     | 0.947 | 164.0           | 0.545 | 80.3            | 0.006 | 51.6            | 0.866 | 156.7           |  |
| 1.250     | 0.948 | 163.0           | 0.569 | 77.3            | 0.005 | 42.8            | 0.856 | 155.3           |  |
| 1.300     | 0.943 | 161.4           | 0.592 | 74.9            | 0.006 | 79.6            | 0.849 | 153.9           |  |
| 1.350     | 0.939 | 159.6           | 0.634 | 72.3            | 0.005 | 46.6            | 0.838 | 152.2           |  |
| 1.400     | 0.936 | 158.1           | 0.704 | 66.9            | 0.009 | 49.0            | 0.831 | 150.7           |  |
| 1.450     | 0.926 | 155.8           | 0.755 | 61.9            | 0.009 | 43.1            | 0.804 | 148.3           |  |
| 1.500     | 0.921 | 153.6           | 0.855 | 58.5            | 0.007 | 28.4            | 0.793 | 146.5           |  |
| 1.550     | 0.916 | 151.8           | 0.922 | 53.0            | 0.011 | 38.9            | 0.776 | 144.9           |  |
| 1.600     | 0.902 | 149.0           | 0.988 | 48.5            | 0.009 | 39.4            | 0.761 | 143.2           |  |
| 1.650     | 0.885 | 146.8           | 1.113 | 42.6            | 0.012 | 39.1            | 0.738 | 141.3           |  |
| 1.700     | 0.860 | 142.6           | 1.324 | 34.0            | 0.012 | 14.5            | 0.707 | 138.6           |  |
| 1.750     | 0.835 | 139.1           | 1.476 | 27.0            | 0.013 | 16.5            | 0.682 | 136.5           |  |
| 1.800     | 0.806 | 136.2           | 1.641 | 20.2            | 0.014 | 6.8             | 0.657 | 134.3           |  |
| 1.850     | 0.776 | 132.6           | 1.879 | 11.9            | 0.019 | -9.9            | 0.628 | 131.9           |  |
| 1.900     | 0.746 | 129.0           | 2.145 | 1.3             | 0.022 | -15.5           | 0.609 | 129.0           |  |
| 1.950     | 0.698 | 125.2           | 2.399 | -9.1            | 0.023 | -30.1           | 0.572 | 124.5           |  |
| 2.000     | 0.609 | 119.2           | 2.897 | -26.3           | 0.028 | -54.7           | 0.522 | 115.2           |  |
| 2.050     | 0.531 | 115.8           | 3.271 | -39.5           | 0.028 | -70.2           | 0.478 | 105.7           |  |
| 2.100     | 0.446 | 113.6           | 3.596 | -55.8           | 0.033 | -89.0           | 0.407 | 89.4            |  |
| 2.150     | 0.353 | 117.4           | 3.911 | -72.3           | 0.035 | -115.4          | 0.323 | 64.8            |  |
| 2.200     | 0.290 | 131.5           | 4.080 | -91.6           | 0.037 | -128.6          | 0.254 | 21.9            |  |
| 2.250     | 0.310 | 150.5           | 3.996 | -111.3          | 0.035 | -157.9          | 0.277 | -31.8           |  |
| 2.300     | 0.427 | 156.0           | 3.544 | -138.4          | 0.030 | 169.9           | 0.439 | -82.7           |  |
| 2.350     | 0.499 | 150.9           | 3.117 | -154.6          | 0.029 | 147.2           | 0.550 | -101.3          |  |
| 2.400     | 0.549 | 144.8           | 2.790 | -166.4          | 0.028 | 126.2           | 0.631 | -114.5          |  |
| 2.450     | 0.572 | 138.0           | 2.411 | -179.1          | 0.020 | 122.6           | 0.694 | -124.1          |  |
| 2.500     | 0.584 | 130.0           | 2.074 | 171.3           | 0.023 | 92.8            | 0.743 | -131.6          |  |
| 2.550     | 0.580 | 121.2           | 1.920 | 160.8           | 0.025 | 80.7            | 0.779 | -137.9          |  |
| 2.600     | 0.559 | 106.7           | 1.608 | 147.7           | 0.022 | 62.5            | 0.824 | -144.4          |  |
| 2.650     | 0.526 | 95.2            | 1.480 | 139.9           | 0.016 | 51.4            | 0.848 | -148.3          |  |
| 2.700     | 0.498 | 81.5            | 1.374 | 132.3           | 0.020 | 32.1            | 0.860 | -151.0          |  |
| 2.750     | 0.457 | 66.8            | 1.242 | 120.6           | 0.020 | 9.6             | 0.871 | -154.0          |  |
| 2.800     | 0.414 | 47.6            | 1.071 | 112.7           | 0.020 | -5.5            | 0.883 | -156.4          |  |
| 2.850     | 0.381 | 24.7            | 1.000 | 101.2           | 0.020 | -2.8            | 0.894 | -158.9          |  |
| 2.900     | 0.418 | 3.4             | 0.901 | 92.4            | 0.020 | -16.7           | 0.905 | -160.6          |  |
| 2.950     | 0.475 | -20.5           | 0.816 | 86.3            | 0.017 | -27.5           | 0.903 | -162.6          |  |
| 3.000     | 0.530 | -41.0           | 0.753 | 75.8            | 0.023 | -40.7           | 0.908 | -163.8          |  |

PACKAGE DIMENSIONS

T-92 (UNIT: mm)



PIN CONNECTIONS

- G1, G2 : Gate
- D1, D2 : Drain
- S : Source

**RECOMMENDED MOUNTING CONDITIONS FOR CORRECT USE**

- (1) Fix to heat sink or mount surface completely with screws at the four holes of the flange.
- (2) The recommended torque strength of the screws is 30 N typical using M2.3 type screws.
- (3) The recommended flatness of the mount surface is less than  $\pm 10 \mu\text{m}$  (roughness of surface is  $\nabla\nabla\nabla$ ).

**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 NEC sales representative.

| Soldering Method | Soldering Conditions   | Recommended Condition Symbol |
|------------------|--|------------------------------|
| Partial Heating  | Pin temperature: 260 °C or below,<br>Time: 5 seconds or less (per pin row) | -                            |

For details of recommended soldering conditions, please contact your local NEC sales office.

**CAUTION**

The great care must be taken in dealing with the devices in this guide.  
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.  
Keep the law concerned and so on, especially in case of removal.

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