

**1214GN-120E/EL/EP Datasheet**

**120W L-Band Radar GaN Power Transistor and  
Pallet Amplifier**





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## Revision History

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### 1.1      **Revision 1.0**

Revision 1.0 was the first publication of this document.

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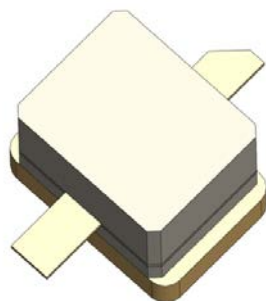
## 2 Product Overview

The 1214GN-120E/EL/EP is an internally matched, common source, Class AB, GaN on SiC HEMT transistor capable of providing over 17 dB typical power gain, 120 W of pulsed RF output power under 300  $\mu$ S pulse width and 10% long term duty cycle pulsing across the 1200 to 1400 MHz band. The transistor has internal pre-match for optimal performance. This hermetically sealed transistor is available in two package types, as well as mounted on a compact footprint 50  $\Omega$  IN/OUT pallet, and is specifically designed for L-band pulsed primary radar applications. It utilizes gold metallization and eutectic die attach to provide the highest reliability and superior ruggedness. Export Classification: EAR-99.

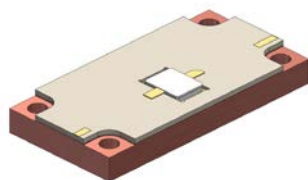
**Figure 1 Case Outline 55-QQ Common Source (0.160"  $\times$  0.550")**



**Figure 2 Case Outline 55-QQP Common Source (0.160"  $\times$  0.230")**



**Figure 3 Pallet Outline 50  $\Omega$  IN/OUT (0.600"  $\times$  1.200"  $\times$  0.150")**



### 2.1 Applications

The 1214GN-120E and 1214GN-120EL transistors and the 1214GN-120EP pallet are specifically designed for L-band pulsed primary radar applications.

### 2.1.1 Key Features

The following are the key features of the 1214GN-120E/EL/EP E-Series Earless/Eared GaN transistor products:

- 1200–1400 MHz, 120 W pulsed output power, 300  $\mu$ S 10% pulsing
- Common source, Class AB, 50 V bias voltage
- High efficiency: >60% typical across the frequency band
- Extremely compact size
- High power gain: >16.8 dB
- Excellent gain flatness
- Ideal for radar, L-Band avionics, communications, and industrial applications
- Utilizes all-gold metallization and eutectic die attach for highest reliability
- 50  $\Omega$  IN/OUT lumped element, very small footprint, plug-and-play pallets available

## 3 Electrical Specifications

### 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings at 25 °C unless otherwise specified.

**Table 1 Absolute Maximum Ratings**

| Rating                      |                                   | Value      | Units |
|-----------------------------|-----------------------------------|------------|-------|
| Maximum power dissipation   | Device dissipation at 25 °C       | 265        | W     |
| Maximum voltage and current | Drain-Source voltage ( $V_{DS}$ ) | 125        | V     |
|                             | Gate-Source voltage ( $V_{GS}$ )  | –8 to 0    | V     |
| Maximum temperatures        | Storage temperature ( $T_{STG}$ ) | –55 to 125 | °C    |
|                             | Operating junction temperature    | 200        | °C    |

### 3.2 Electrical Characteristics at 25 °C

The following table shows the typical electrical characteristics at 25 °C

**Table 2 Typical Electrical Characteristics at 25 °C**

| Symbol        | Characteristics                  | Test Conditions                                    | Min  | Typ   | Max  | Units |
|---------------|----------------------------------|----------------------------------------------------|------|-------|------|-------|
| $P_{OUT}$     | Output power                     | $P_{IN} = 2.5$ W, Freq = 1200, 1300, 1400 MHz      | 120  | 130   |      | W     |
| $G_P$         | Power gain                       | $P_{IN} = 2.5$ W, Freq = 1200, 1300, 1400 MHz      | 16.8 | 17.16 |      | dB    |
| $\eta_D$      | Drain efficiency                 | $P_{IN} = 2.5$ W, Freq = 1200, 1300, 1400 MHz      | 57   | 65    |      | %     |
| $Dr$          | Droop                            | $P_{IN} = 2.5$ W, Freq = 1200, 1300, 1400 MHz      |      | 0.15  | 0.6  | dB    |
| VSWR-T        | Load mismatch tolerance          | $P_{IN} = 2.5$ W, Freq = 1500 MHz, 100 $\mu$ S-10% |      |       | 5:1  |       |
| $\Theta_{JC}$ | Junction-Case thermal resistance | 300 $\mu$ S, 10% duty cycle                        |      |       | 1.25 | °C/W  |

**Bias Condition:**  $V_{DD} = 50$  V,  $I_{DQ} = 30$  mA constant current ( $V_{GS} = -2.0$  to  $-4.5$  V typical)

### 3.3 Functional Characteristics at 25 °C

**Table 3 Typical Functional Characteristics at 25 °C**

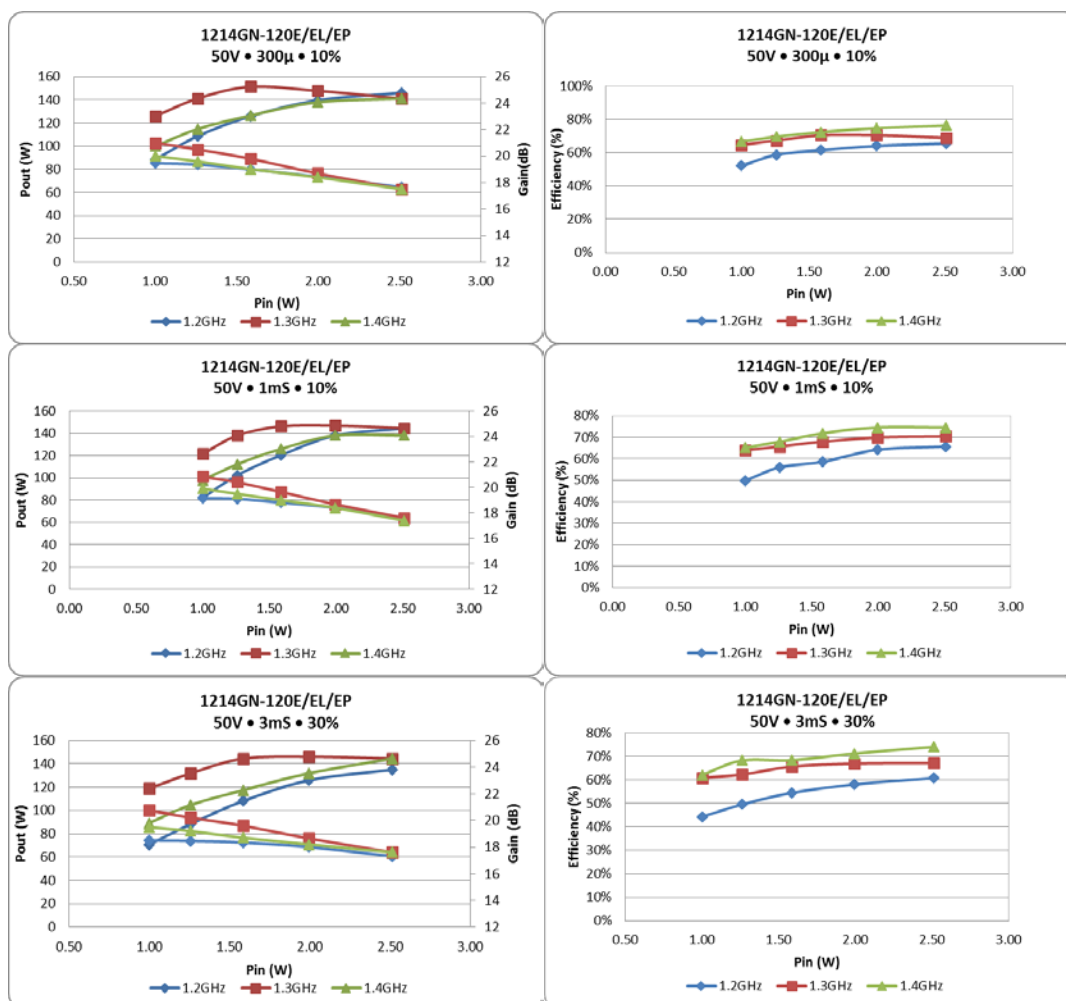
| Symbol       | Characteristic        | Test Conditions                | Min | Typ | Max | Units |
|--------------|-----------------------|--------------------------------|-----|-----|-----|-------|
| $I_{D(Off)}$ | Drain leakage current | $V_{GS} = -8$ V, $V_D = 125$ V |     |     | 12  | mA    |
| $I_{G(Off)}$ | Gate leakage current  | $V_{GS} = -8$ V, $V_D = 0$ V   |     |     | 4   | mA    |

### 3.4 Typical Broadband Performance Data (300 $\mu$ S, 10% Pulsing)

Table 4 Typical Broadband Performance Data (300  $\mu$ S, 10% Pulsing)

| Frequency | P <sub>IN</sub> (W) | P <sub>OUT</sub> (W) | I <sub>D</sub> (mA) | IRL (dB) | $\eta_D$ (%) | G <sub>P</sub> (dB) | Droop (dB) |
|-----------|---------------------|----------------------|---------------------|----------|--------------|---------------------|------------|
| 1200 MHz  | 2.5                 | 146                  | 477                 | -7.0     | 65           | 17.65               | 0.15       |
| 1300 MHz  | 2.5                 | 141                  | 440                 | -10.0    | 69           | 17.50               | 0.15       |
| 1400 MHz  | 2.5                 | 141                  | 400                 | -8.5     | 76           | 17.50               | 0.14       |

Figure 4 Typical Broadband Performance Data Graphs



### 3.5 Critical Performance at $P_{IN} = 4\text{ W}$ (34 dBm)

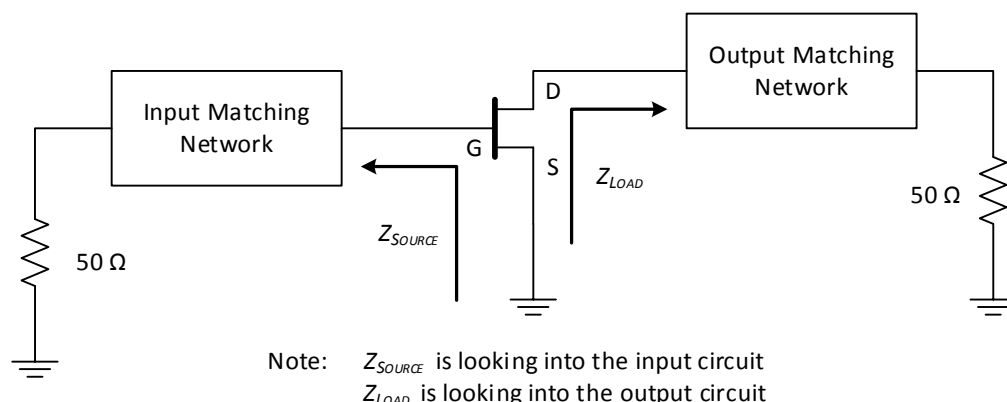
**Table 5 Critical Performance at  $P_{IN} = 4\text{ W}$  (34 dBm)**

| Freq (GHz) | Test Condition    | $P_{OUT}$ (W) | $G_P$ (dB) | $\eta_D$ (%) | Droop (dB) |
|------------|-------------------|---------------|------------|--------------|------------|
| 1.2        | 300 $\mu$ S – 10% | 146           | 17.65      | 65           | 0.15       |
| 1.2        | 1 mS – 10%        | 144           | 17.60      | 66           | 0.25       |
| 1.2        | 3 mS – 30%        | 135           | 17.30      | 61           | 0.60       |
| 1.3        | 300 $\mu$ S – 10% | 141           | 17.50      | 69           | 0.15       |
| 1.3        | 1 mS – 10%        | 144           | 17.60      | 70           | 0.25       |
| 1.3        | 3 mS – 30%        | 143           | 17.60      | 67           | 0.40       |
| 1.4        | 300 $\mu$ S – 10% | 141           | 17.50      | 76           | 0.15       |
| 1.4        | 1 mS – 10%        | 138           | 17.40      | 75           | 0.25       |
| 1.4        | 3 mS – 30%        | 144           | 17.60      | 74           | 0.40       |

## 4 Transistor Impedance Information

The following diagram shows the transistor impedance information for 1214GN-120E/EL/EP.

**Figure 5 Impedance Definition**



For information about source and load impedances for 1214GN-120E/EL/EP, contact your Microsemi representative.

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## 5 Transistor Test Information

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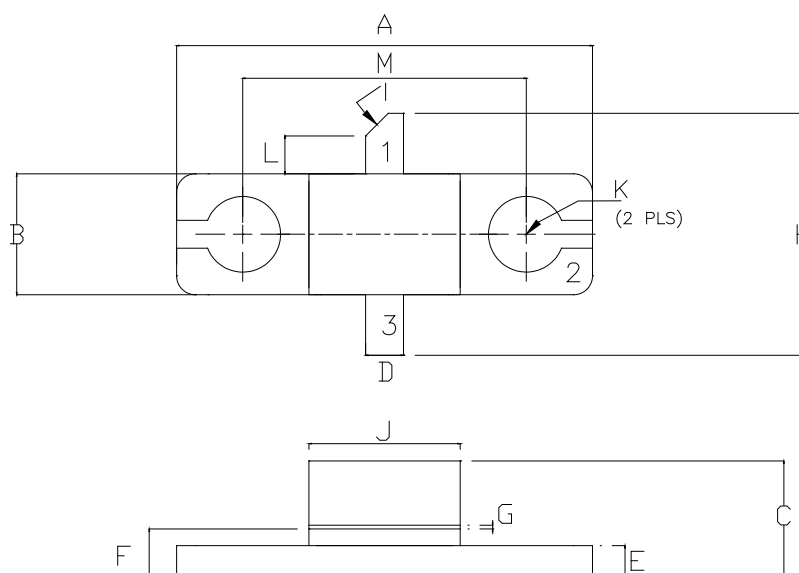
For the latest transistor test information for 1214GN-120E/EL/EP, contact your Microsemi representative.

## 6 Package Outline and Pin Information

The 1214GN-120E transistor is available in the 55-QQP case outline and the 1214GN-120EL transistor is available in the 55-QQP case outline. The 1214GN-120EP is available in the 90-1214GN-120EP pallet outline. All three products are configured for common source operation.

### 6.1 55-QQ Common Source Package Dimensions and Pin Information

**Figure 6 55-QQ Package Dimensions and Pin Information**



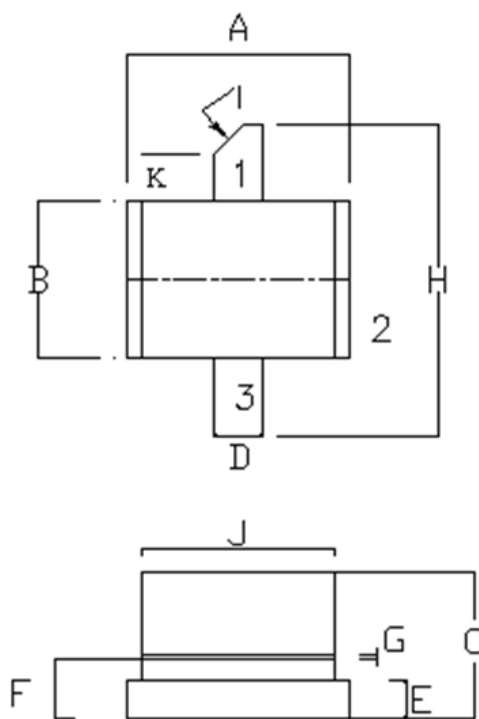
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

**Table 6 55-QQ Package Dimensions**

| Dim | Millimeters | Tol (mm) | Inches    | Tol (in.) |
|-----|-------------|----------|-----------|-----------|
| A   | 13.970      | 0.250    | 0.550     | 0.010     |
| B   | 4.570       | 0.250    | 0.160     | 0.010     |
| C   | 3.860       | 0.330    | 0.152     | 0.013     |
| D   | 1.270       | 0.130    | 0.050     | 0.005     |
| E   | 1.020       | 0.130    | 0.040     | 0.005     |
| F   | 1.700       | 0.130    | 0.067     | 0.005     |
| G   | 0.130       | 0.025    | 0.005     | 0.001     |
| H   | 8.130       | 0.250    | 0.320     | 0.010     |
| I   | 45°         | 5°       | 45°       | 5°        |
| J   | 5.080       | 0.250    | 0.200     | 0.010     |
| K   | 2.54 DIA    | 0.130    | 0.100 DIA | 0.005     |
| L   | 1.270       | 0.130    | 0.050     | 0.005     |
| M   | 9.530       | 0.130    | 0.375     | 0.005     |

## 6.2 55-QQP Common Source Package Dimensions and Pin Information

Figure 7 55-QQP Package Dimensions and Pin Information



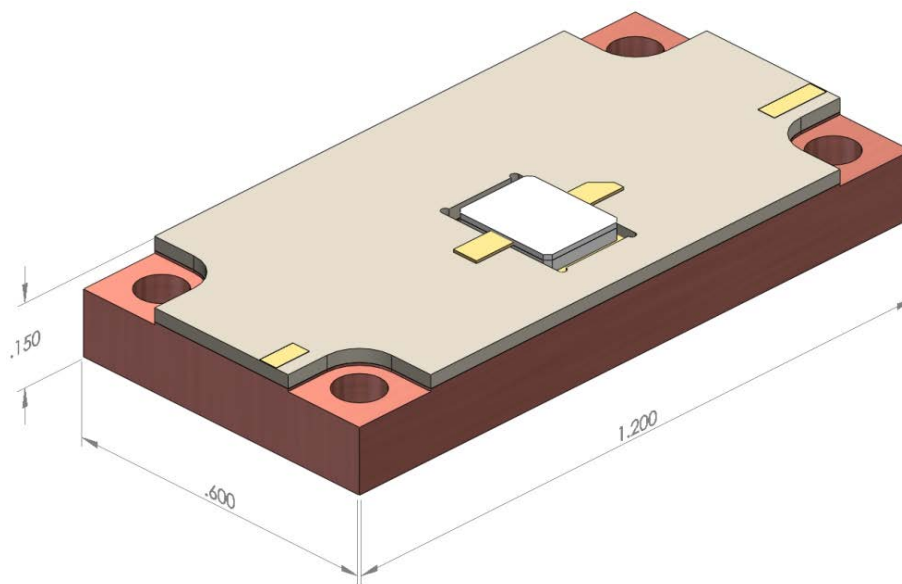
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

Table 7 55-QQP Package Dimensions

| Dim | Millimeters | Tol (mm) | Inches | Tol (in.) |
|-----|-------------|----------|--------|-----------|
| A   | 5.840       | 0.250    | 0.230  | 0.010     |
| B   | 4.060       | 0.250    | 0.160  | 0.010     |
| C   | 3.170       | 0.050    | 0.125  | 0.002     |
| D   | 1.270       | 0.130    | 0.050  | 0.005     |
| E   | 1.020       | 0.130    | 0.040  | 0.005     |
| F   | 1.570       | 0.130    | 0.062  | 0.005     |
| G   | 0.130       | 0.020    | 0.005  | 0.001     |
| H   | 8.120       | 0.250    | 0.320  | 0.010     |
| I   | 45°         | 5°       | 45°    | 5°        |
| J   | 5.080       | 0.250    | 0.200  | 0.010     |
| K   | 1.400       | 0.130    | 0.055  | 0.005     |

## 6.3 Overall Pallet Dimensions

**Figure 8** Pallet Package Dimensions



Dimensions 1.200" × 0.600" × 0.150"