

1011GN-250E/EL/EP Datasheet
250W Interrogator/Transponder GaN Power
Transistor and Amplifier



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Revision History

1.1 **Revision 1.0**

Revision 1.0 was the first publication of this document.

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2 Product Overview

The 1011GN-250E/EL/EP is an internally matched, common source, Class AB, GaN on SiC HEMT transistor/pallet amplifier capable of providing over 20.5 dB typical gain, 250 W of pulsed RF output power under several pulse formats including mode-S ELM across the 1030 to 1090 MHz band. The transistor has internal pre-match for optimal performance and is hermetically sealed. Available in two package types, both the bolt-down flange 55-QQ package and the solder-down earless flange 55-QQP package, as well as mounted in a 50 Ω IN/OUT pallet, the transistor is designed specifically for IFF, Mode-S, TCAS, and avionics secondary radar applications, and 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" × 0.550")



Figure 2 Case Outline 55-QQP Common Source (0.160" × 0.230")

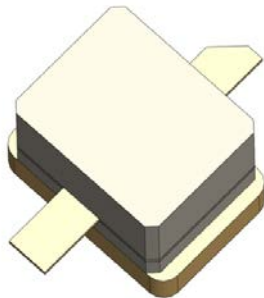
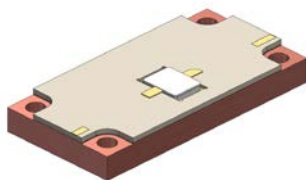


Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")



2.1 Applications

The 1011GN-250E and 1011GN-250EL transistors and the 1011GN-250EP pallet are specifically designed for IFF, Mode-S, TCAS, and avionics secondary radar applications.

2.1.1 Key Features

The following are the key features of the 1011GN-250E/EL E-Class Earless/Eared GaN transistor:

- 1030–1090 MHz, 250 W pulsed output power, 32 μ S 2% pulsing
- Common source , Class AB, 50 V_{DD} bias voltage
- High efficiency: >70% typical across the frequency band
- Extremely compact size
- High power gain: 20.5 dB typical
- Excellent gain flatness: 0.1 dB typical
- Ideal for IFF, Mode-S, TCAS, and avionics secondary radar applications
- Utilizes all-gold metallization and eutectic die attach for highest reliability
- 50 Ω 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	460	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 = 1030, 1090 MHz	250	280		W
G_P	Power gain	$P_{IN} = 2.5$ W, Freq = 1030, 1090 MHz	20	20.5		dB
η_D	Drain efficiency	$P_{IN} = 2.5$ W, Freq = 1030, 1090 MHz	60	75		%
Dr	Droop	$P_{IN} = 2.5$ W, Freq = 1030, 1090 MHz		0.14	0.5	dB
VSWR-T	Load mismatch tolerance	$P_{OUT} = 250$ W, Freq = 1030 MHz, 32 μ S-2%			5:1	
Θ_{JC}	Thermal resistance	32 μ S, 2% duty cycle			0.68	°C/W

Bias Condition: $V_{DD} = +50$ V, $I_{DQ} = 60$ 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

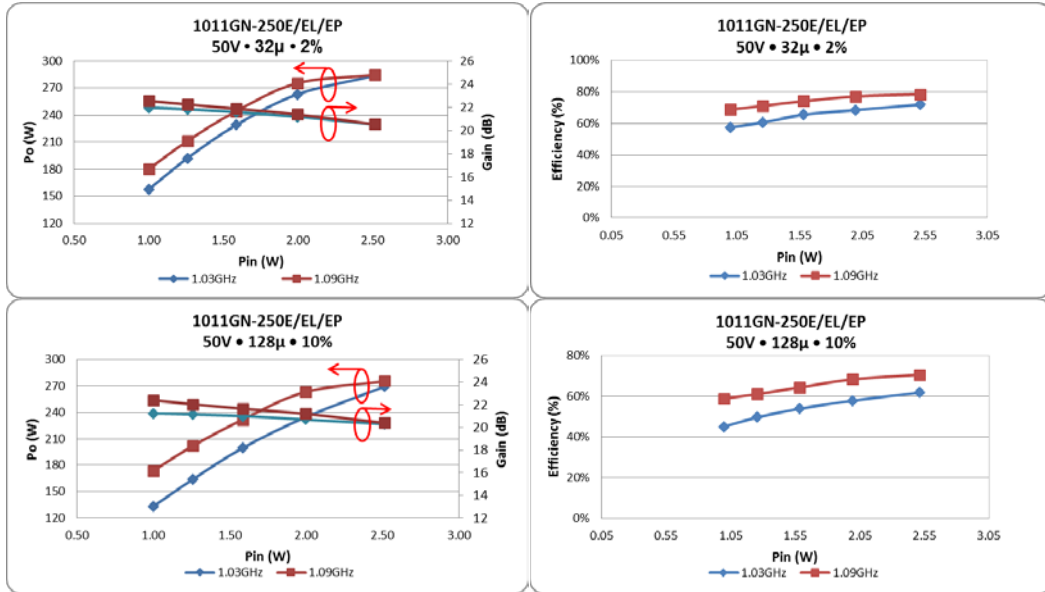
Symbol	Characteristic	Test Conditions	Min	Typ	Max	Units
$I_{D(off)}$	Drain leakage current	$V_{GS} = -8$ V, $V_D = 125$ V			24	mA
$I_{G(off)}$	Gate leakage current	$V_{GS} = -8$ V, $V_D = 0$ V			8	mA

3.4 Typical Broadband Performance Data (32 μ S, 2% Pulsing)

Table 4 Typical Broadband Performance Data (32 μ S, 2% Pulsing)

Frequency	P _{IN} (W)	P _{OUT} (W)	I _D (mA)	IRL (dB)	η_D (%)	G _P (dB)	Droop (dB)
1030 MHz	2.5	284	0.20	-8.0	72	20.5	0.12
1090 MHz	2.5	283	0.18	-12.0	78	20.5	0.12

Figure 4 Typical Broadband Performance Data Graphs



3.5 Critical Performance at P_{IN} = 2.5 W (34 dBm)

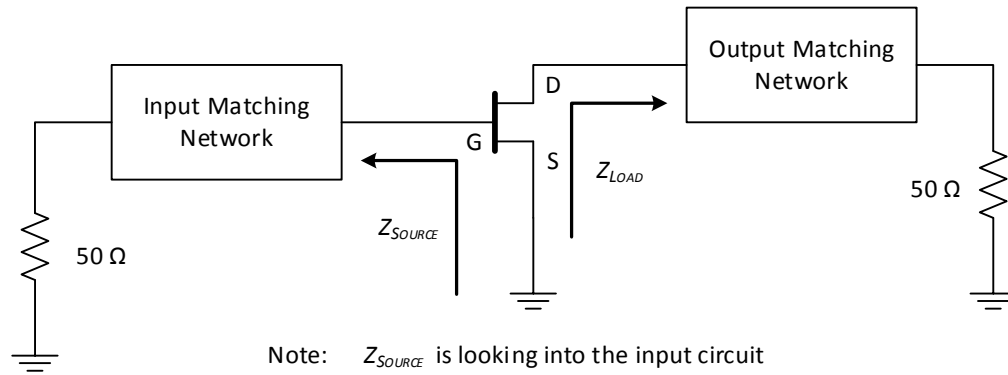
Table 5 Critical Performance at P_{IN} = 2.5 W (34 dBm)

Freq (GHz)	Test Condition	P _O (W)	Gain (dB)	Eff (%)	Droop (dB)
1.030	32 μ S – 2%	283	20.5	72	0.12
1.030	128 μ S – 10%	269	20.3	62	0.30
1.090	32 μ S – 2%	284	20.5	78	0.12
1.090	128 μ S – 10%	275	20.7	71	0.30

4 Transistor Impedance Information

The following diagram shows the transistor impedance information for 1011GN-250E/EL/EP.

Figure 5 Impedance Definition



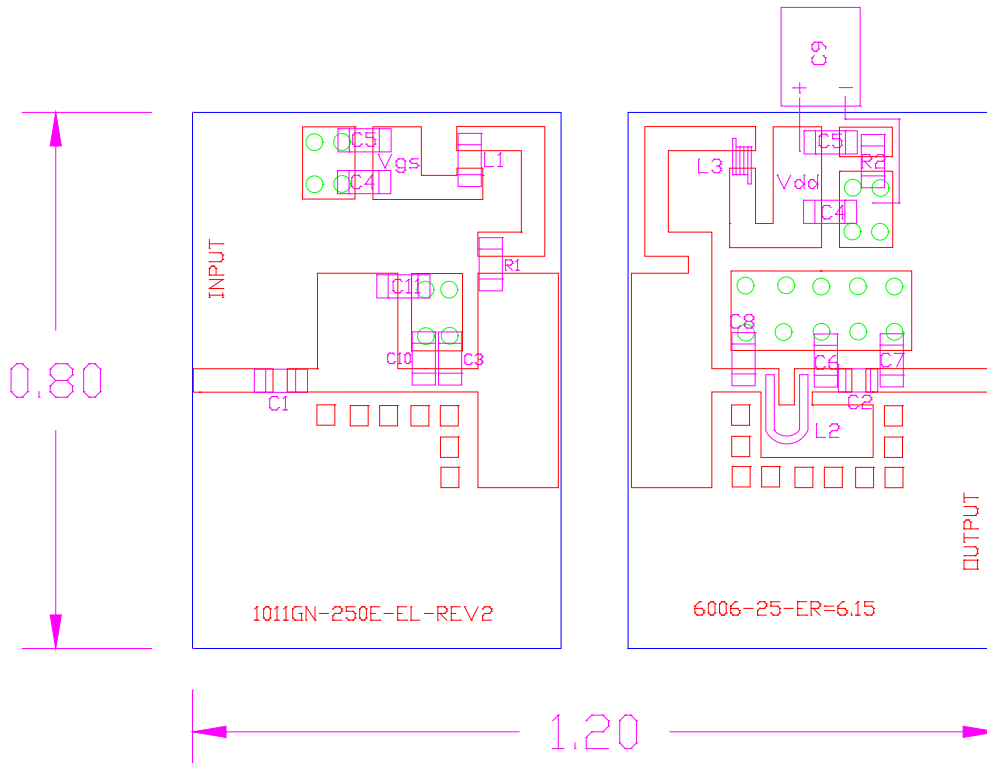
Note: Z_{SOURCE} is looking into the input circuit
 Z_{LOAD} is looking into the output circuit

For information about source and load impedances for 1011GN-250E/EL/EP, contact your Microsemi representative.

5 Transistor Test Information

5.1 Transistor Test Circuit Diagram

Figure 6 Transistor Test Circuit



The board material is Rogers Duroid 6006, 0.250" thickness, and $\epsilon_r = 6.15$.

The following table lists the components for 1011GN-250E/EL.

Table 6 Component List 1011GN-250E/EL

Item	Description	Value
C1	Chip capacitor A size – ATC 600S series	68 pF
C2	Chip capacitor A size – ATC 600S series	68 pF
C3	Chip capacitor A size – ATC 600S series	9.1 pF
C4	Chip capacitor A size	470 pF
C5	Chip capacitor B size	4.7 uF
C6	Chip capacitor A size – ATC 600S series	5.6 pF
C7	Chip capacitor A size	2 to 2.5 pF
C8	Chip capacitor A size – ATC 600S series	1.2 pF
C9	Electrolytic capacitor (63 V)	470 uF
C10	Chip capacitor A size – ATC 600S series	6.8 pF
C11	Chip capacitor A size – ATC 600S series	1.2 pF

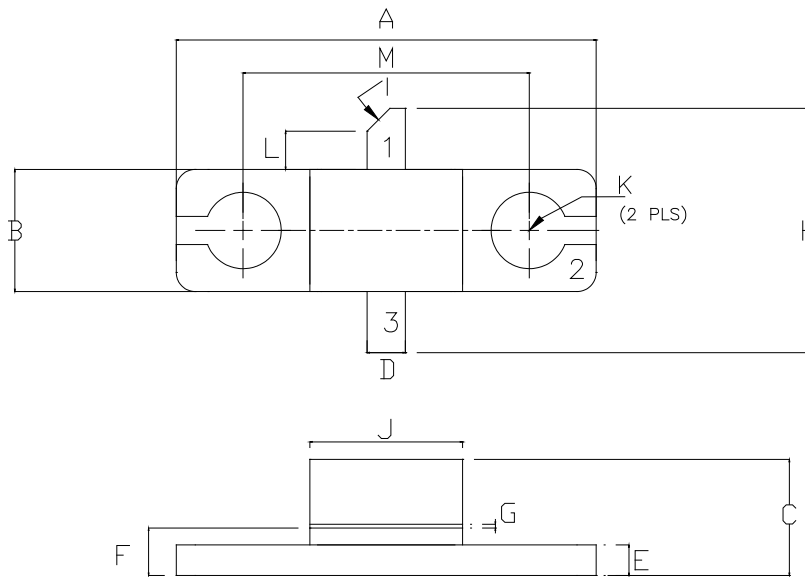
Item	Description	Value
R1	Chip resistor size 0805	40.2 Ω
R2	Chip resistor size 0805	5.1 Ω
L1	Chip inductor size 0805	47 nH
L2	24 AWG Cu wire, Diameter = 0.07"	1 Turn
L3	24 AWG Cu wire, Length = 0.280"	U Shape

6 Product Outline and Terminal Information

The 1011GN-250E transistor is available in the 55-QQP case outline and the 1011GN-250EL transistor is available in the 55-QQP case outline. The 1011GN-250EP is available in the 90-1011GN-250EP pallet outline. All three products are configured for common source operation.

6.1 55-QQ Common Source Package Dimensions and Terminal Information

Figure 7 55-QQ Package Dimensions and Terminal Information



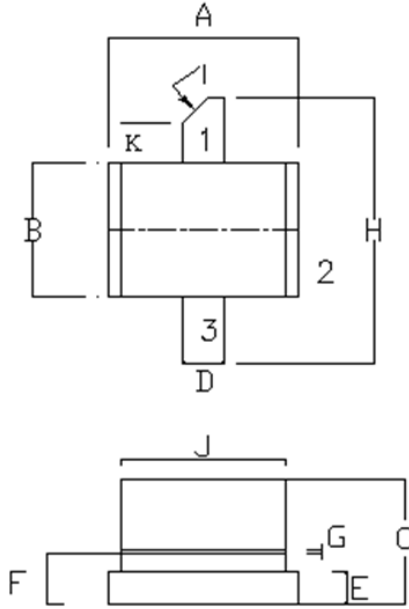
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

Table 7 55-QQ Package Dimensions

Dim	Millimeters	Tol	Inches	Tol
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 Terminal Information

Figure 8 55-QQP Package Dimensions and Terminal Information



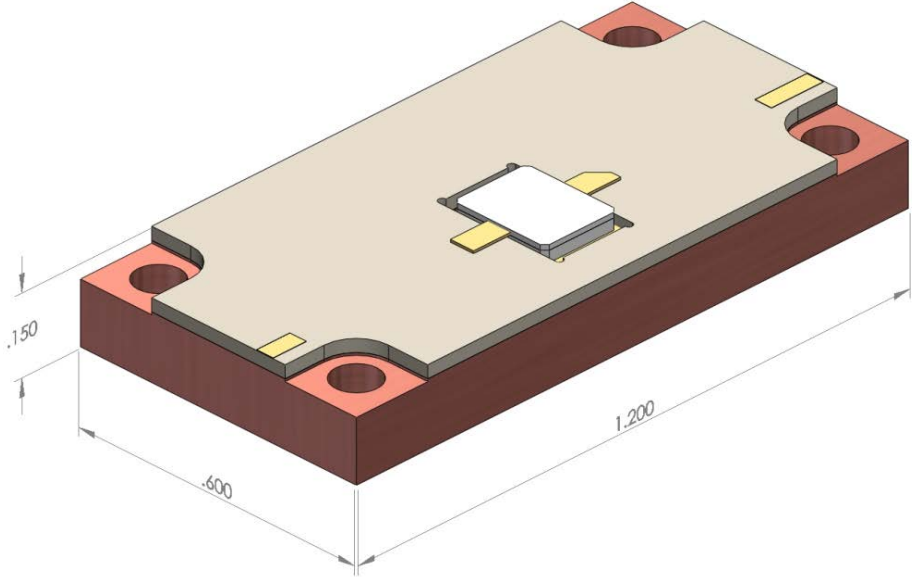
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

Table 8 55-QQP Package Dimensions

Dim	Millimeters	Tol	Inches	Tol
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 9 Pallet Package Dimensions



Dimensions 1.200" × 0.600" × 0.150"