

1011GN-125E/EL/EP Datasheet
125 W 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.

Contents

Revision History.....	3
1.1 Revision 1.0.....	3
2 Product Overview	7
2.1 Applications	7
2.1.1 Key Features	7
3 Electrical Specifications.....	9
3.1 Absolute Maximum Ratings	9
3.2 Electrical Characteristics at 25 °C.....	9
3.3 Functional Characteristics at 25 °C	9
3.4 Typical Broadband Performance Data (128 μ S, 10% Pulsing)	10
3.5 Critical Performance at $P_{IN} = 25$ dBm	11
4 Transistor Impedance Information.....	12
5 Transistor Test Information	13
5.1 Transistor Test Circuit Diagram	13
6 Product Outline and Pin Information.....	14
6.1 55-QQ Common Source Package Dimensions and Pin Information.....	14
6.2 55-QQP Common Source Package Dimensions and Pin Information	15
6.3 Overall Pallet Dimensions	16

List of Figures

Figure 1 Case Outlines 55-QQ Common Source (0.160" × 0.550")	7
Figure 2 Case Outlines 55-QQP Common Source (0.160" × 0.230" Flange)	7
Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")	7
Figure 4 Typical Broadband Performance Data Graphs.....	10
Figure 5 Impedance Definition.....	12
Figure 6 Transistor Test Circuit	13
Figure 7 55-QQ Package Dimensions and Pin Information	14
Figure 8 55-QQP Package Dimensions and Pin Information	15
Figure 9 Pallet Package Dimensions	16

List of Tables

Table 1	Absolute Maximum Ratings	9
Table 2	Typical Electrical Characteristics at 25 °C.....	9
Table 3	Typical Functional Characteristics at 25 °C.....	9
Table 4	Typical Broadband Performance Data (128 μ S, 10% Pulsing)	10
Table 5	Critical Performance at $P_{IN} = 25$ dBm	11
Table 6	Component List 1011GN-125E/EL.....	13
Table 7	Package Dimensions.....	15

2 Product Overview

The 1011GN-125E/EL/EP is an internally matched, common source, Class AB, GaN on SiC HEMT transmitter driver transistor capable of providing over 18.5 dB power gain and 125 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. The hermetically sealed transistor is available in both the bolt-down flange 55-QQ package and the earless solder-down flange 55-QQP package styles, as well as mounted on a compact 50 Ω IN/OUT pallet. Designed specifically for IFF, Mode-S, TCAS, and avionics secondary radar applications, the transistor devices utilize all-gold metallization and eutectic die attach to provide the highest reliability and superior ruggedness. Export Classification: EAR-99.

Figure 1 Case Outlines 55-QQ Common Source (0.160" × 0.550")

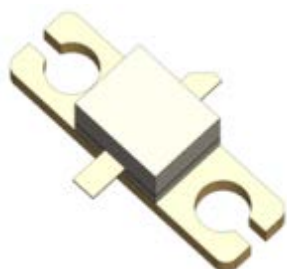


Figure 2 Case Outlines 55-QQP Common Source (0.160" × 0.230" Flange)

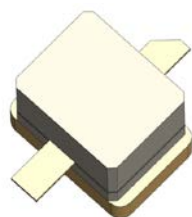
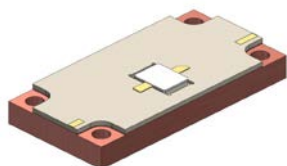


Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")



2.1 Applications

The 1011GN-125E and 1011GN-125EL transistors and the 1011GN-125EP 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-125E, 1011GN-125EL, and 1011GN-125EP products:

- 1030–1090 MHz, 125 W pulsed output power, 128 μ S 10% pulsing
- Common source, Class AB, 50 V_{DD} bias voltage
- High efficiency: >70% typical across the frequency band
- Extremely compact size
- High power gain: 18.5 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	214	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	$P_{OUT} = 2$ W, Freq = 1030, 1090 MHz	125	150		W
G_P	Power gain	$P_{IN} = 2$ W, Freq = 1030, 1090 MHz	17.96	18.75		dB
η_D	Drain efficiency	$P_{IN} = 2.5$ W, Freq = 1030, 1090 MHz	62	72		%
Dr	Droop	$P_{IN} = 2$ W, Freq = 1030, 1090 MHz		0.1	0.5	dB
VSWR-T	Load mismatch tolerance	$P_{OUT} = 125$ W, Freq = 1030 MHz, 128 μ S-10%			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

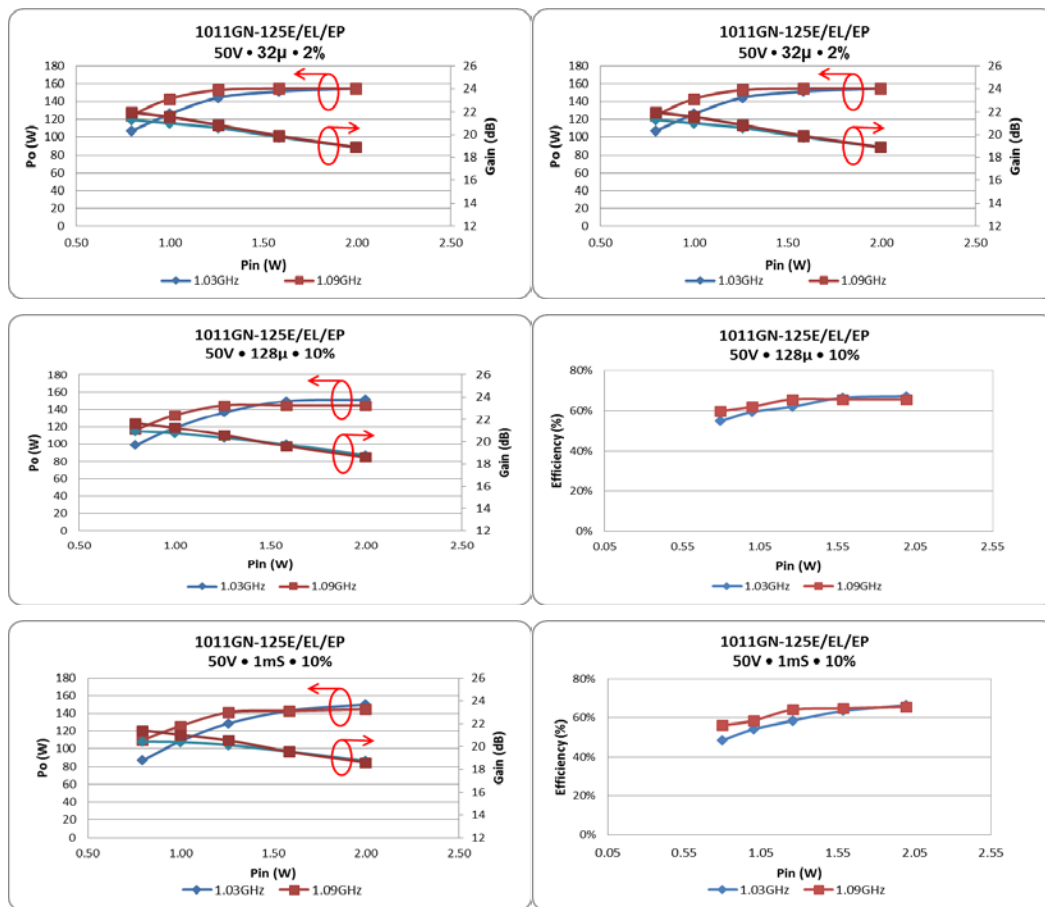
Symbol	Characteristic	Test Conditions	Min	Typ	Max	Units
$I_{D(off)}$	Drain leakage current	$V_{GS} = -8$ V, $V_D = 125$ V			12	mA
$I_{G(off)}$	Gate leakage current	$V_{GS} = -8$ V, $V_D = 0$ V			4	mA

3.4 Typical Broadband Performance Data (128 μ S, 10% Pulsing)

Table 4 Typical Broadband Performance Data (128 μ S, 10% Pulsing)

Frequency	P _{IN} (W)	P _{OUT} (W)	I _D (mA)	IRL (dB)	η_D (%)	G _P (dB)	Droop (dB)
1030 MHz	2	150	450	-8.5	71	18.75	0.1
1090 MHz	2	148	430	-16.0	74	18.70	0.1

Figure 4 Typical Broadband Performance Data Graphs



3.5 Critical Performance at $P_{IN} = 25$ dBm

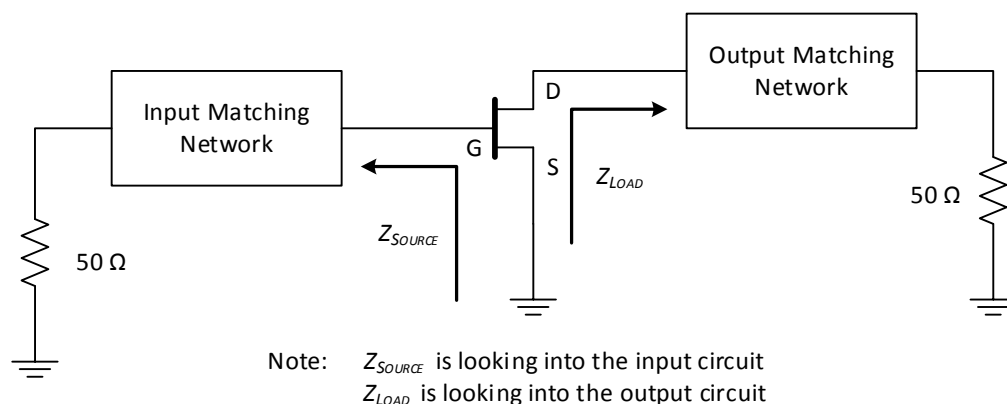
Table 5 Critical Performance at $P_{IN} = 25$ dBm

Freq (GHz)	Test Condition	P_{OUT} (W)	G_P (dB)	η_D (%)	Droop (dB)
1.03	32 μ S – 2%	158	19.00	79	0.05
1.03	128 μ S – 10%	149	18.75	71	0.10
1.03	1 mS – 10%	147	18.70	70	0.30
1.09	32 μ S – 2%	157	18.95	78	0.05
1.09	128 μ S – 10%	148	18.70	74	0.10
1.09	1 mS – 10%	146	18.65	73	0.30

4 Transistor Impedance Information

The following diagram shows the transistor impedance information for 1011GN-125E/EL/EP.

Figure 5 Impedance Definition

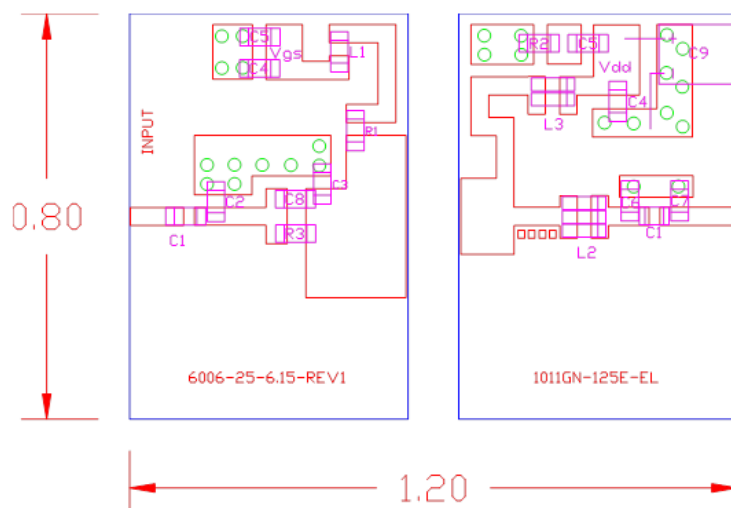


For information about source and load impedances for 1011GN-125E/EL/EP, contact your Microsemi representative.

5 Transistor Test Information

5.1 Transistor Test Circuit Diagram

Figure 6 Transistor Test Circuit



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

The following table lists the components for 1011GN-125E/EL.

Table 6 Component List 1011GN-125E/EL

Item	Description	Value
C1 ¹	Chip capacitor A size (ATC 600S)	62 pF
C2	Chip capacitor A size (ATC 600S)	8.2 pF
C3	Chip capacitor A size (ATC 600S)	10 pF
C4 ¹	Chip capacitor A size (ATC 600S)	270 pF
C5	Chip capacitor B size	4.7 uF
C6	Chip capacitor A size (ATC 600S)	3 pF
C7	Chip capacitor A size (ATC 600S)	2.7 pF
C8	Chip capacitor A size (ATC 100A)	100 pF
C9	Electrolytic capacitor (63 V)	100 uF
R1	Chip resistor size 0603/0805	10 Ω
R2	Chip resistor size 0603/0805	5.1 Ω
R3	Chip resistor size 0603/0805	10 Ω
L1	Chip resistor size 0603/0805	4.3 nH
L2 ²	Chip inductor size 1608 (Venkel: LM CI1608-1N2ST)	1.2 nH
L3 ¹	Chip inductor size 1608 (Venkel: LM CI1608-1N2ST)	1.2 nH

1. Two of these are needed.

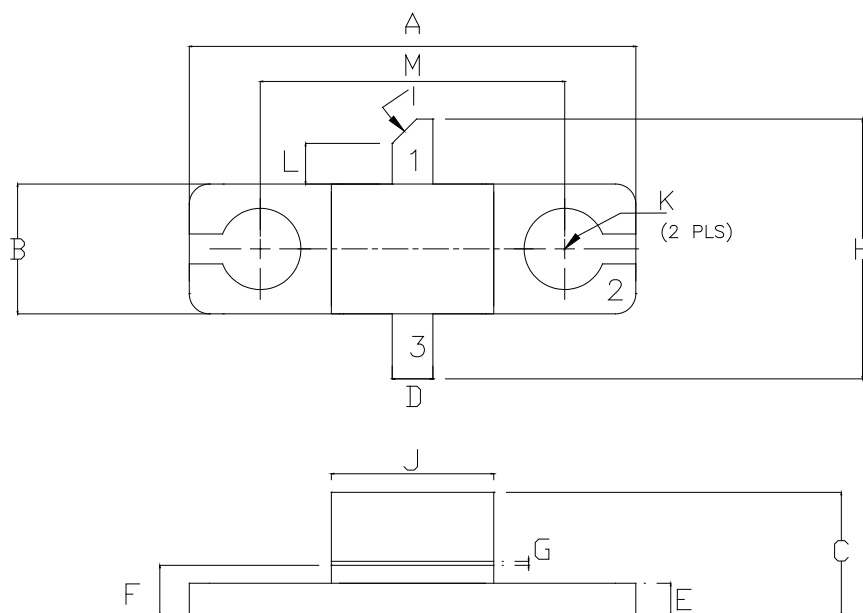
2. Three of these are needed.

6 Product Outline and Pin Information

The 1011GN-125E transistor is available in the 55-QQP case outline and the 1011GN-125EL transistor is available in the 55-QQP case outline. The 1011GN-125EP is available as a pallet. All three products are configured for common source operation.

6.1 55-QQ Common Source Package Dimensions and Pin Information

Figure 7 55-QQ Package Dimensions and Pin Information

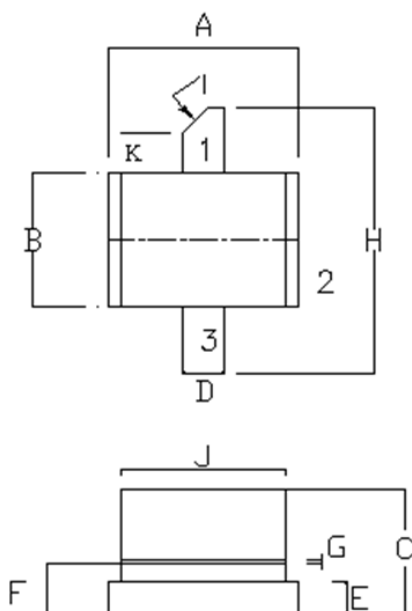


Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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 8 55-QQP Package Dimensions and Pin Information



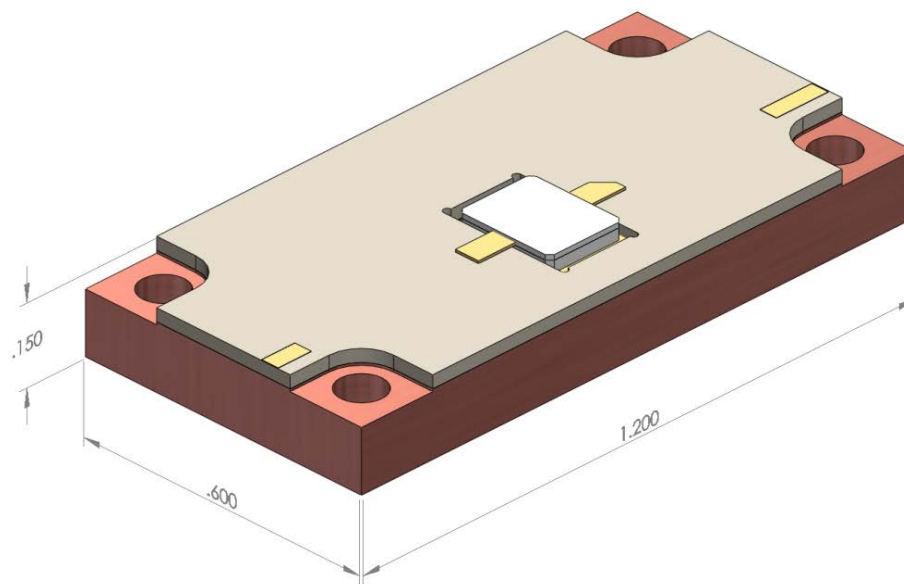
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

Table 7 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 9 Pallet Package Dimensions



Dimensions 1.200" × 0.600" × 0.150"