

1011GN-125E/EL/EP Datasheet
125 W Interrogator/Transponder GaN Power
Transistor and Amplifier



Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

About Microsemi

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

©2016 Microsemi Corporation. All rights reserved. Microsemi and the Microsemi logo are registered trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.



Microsemi Corporate Headquarters
One Enterprise, Aliso Viejo,
CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Sales: +1 (949) 380-6136
Fax: +1 (949) 215-4996
E-mail: sales.support@microsemi.com
www.microsemi.com

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 μS, 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 μS, 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)

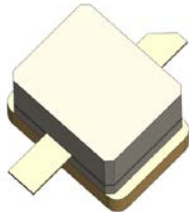
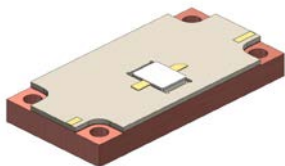


Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")



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		%
D_r	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

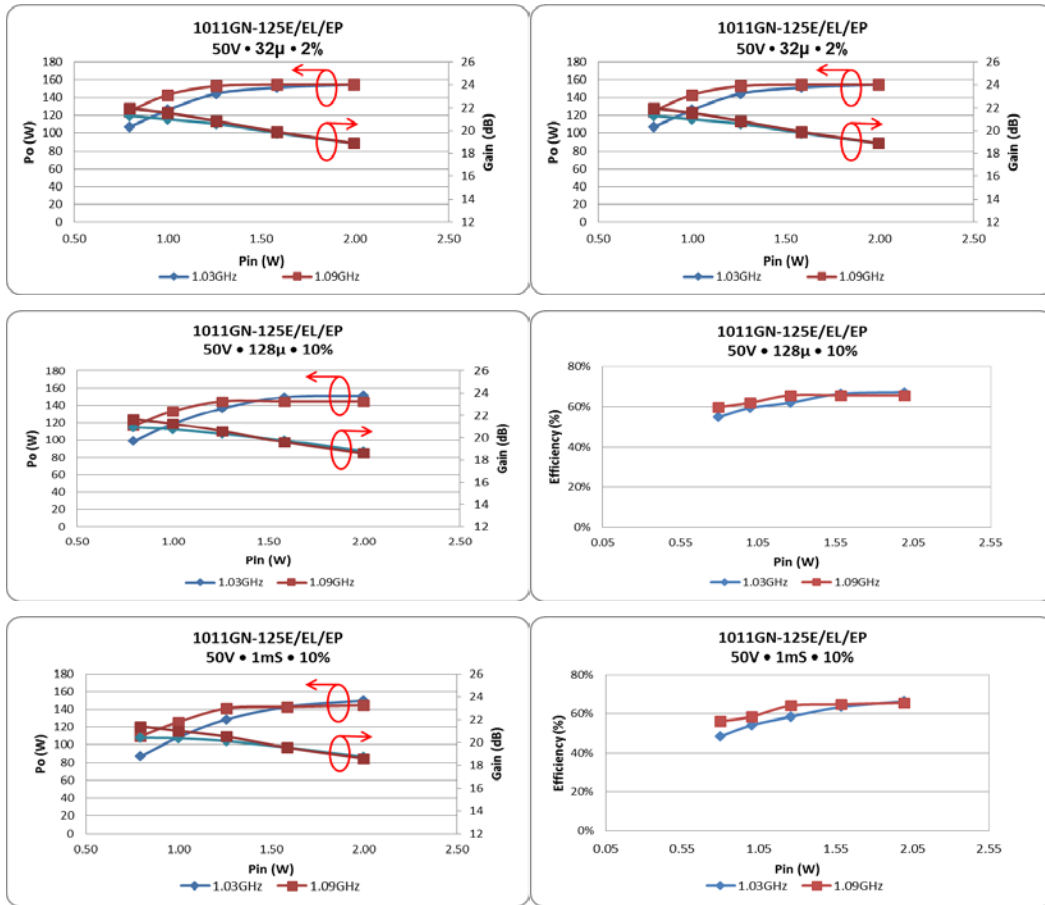
Symbol	Characteristic	Test Conditions	Min	Typ	Max	Units
$I_{D(off)}$	Drain leakage current	$V_{GS} = -8$ V, $V_D = 125$ V			12	mA
$I_{G(off)}$	Gate leakage current	$V_{GS} = -8$ V, $V_D = 0$ V			4	mA

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

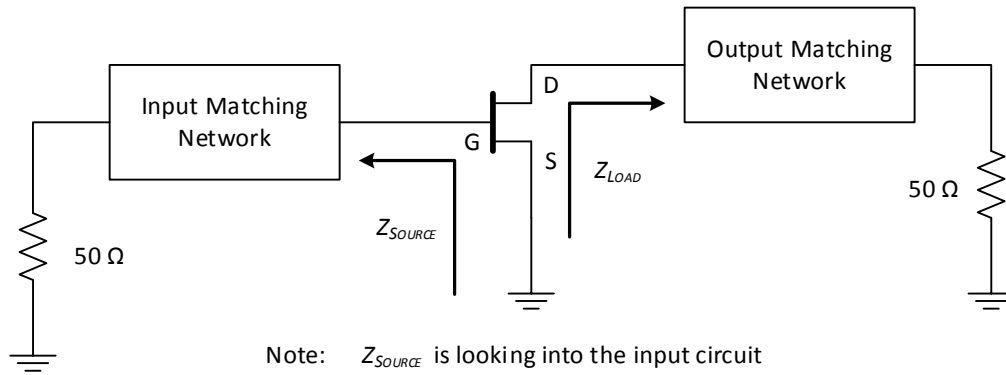
Table 5 Critical Performance at $P_{IN} = 25$ dBm

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



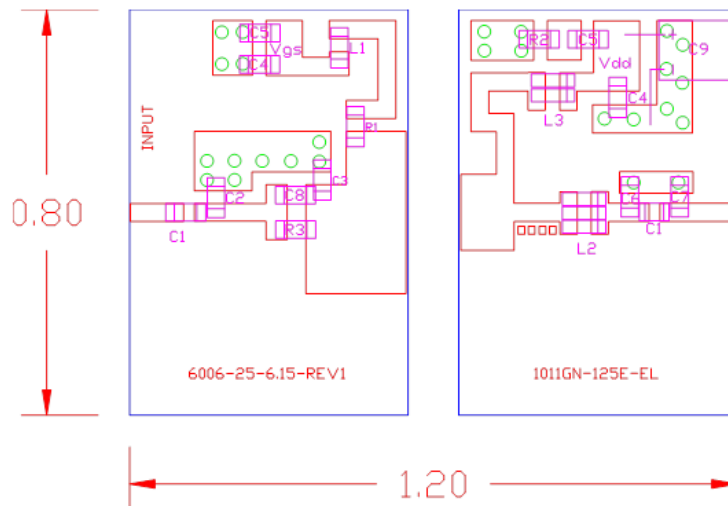
Note: Z_{SOURCE} is looking into the input circuit
 Z_{LOAD} is looking into the output circuit

For information about source and load impedances for 1011GN-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

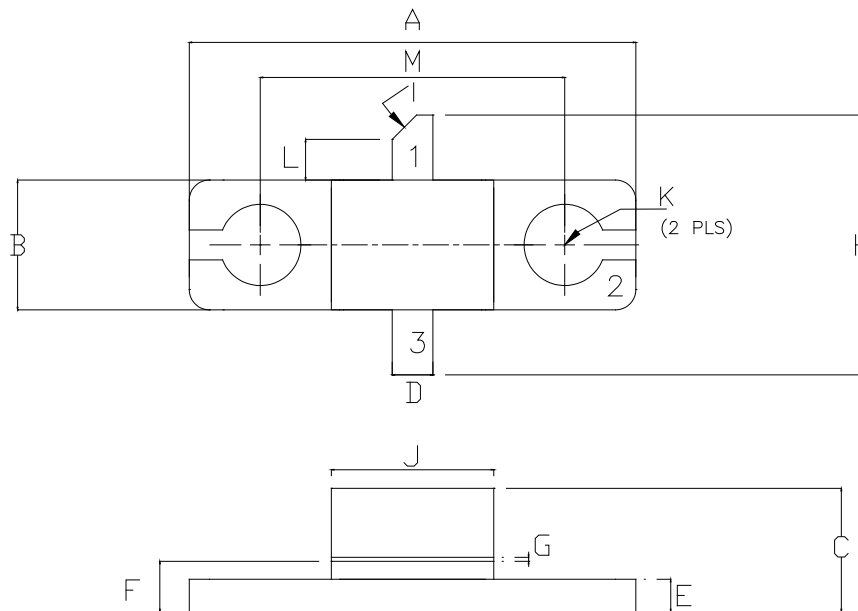
1. Two of these are needed.
2. Three of these are needed.

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

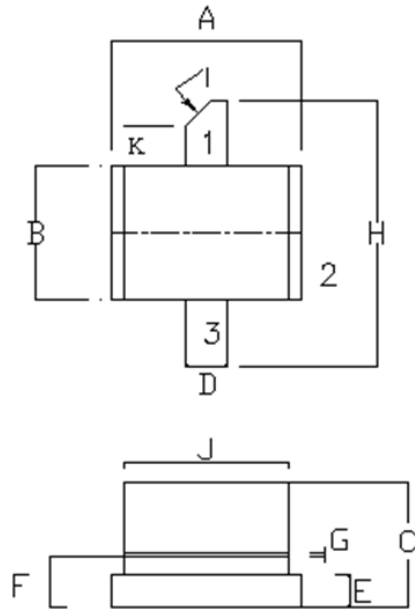


Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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



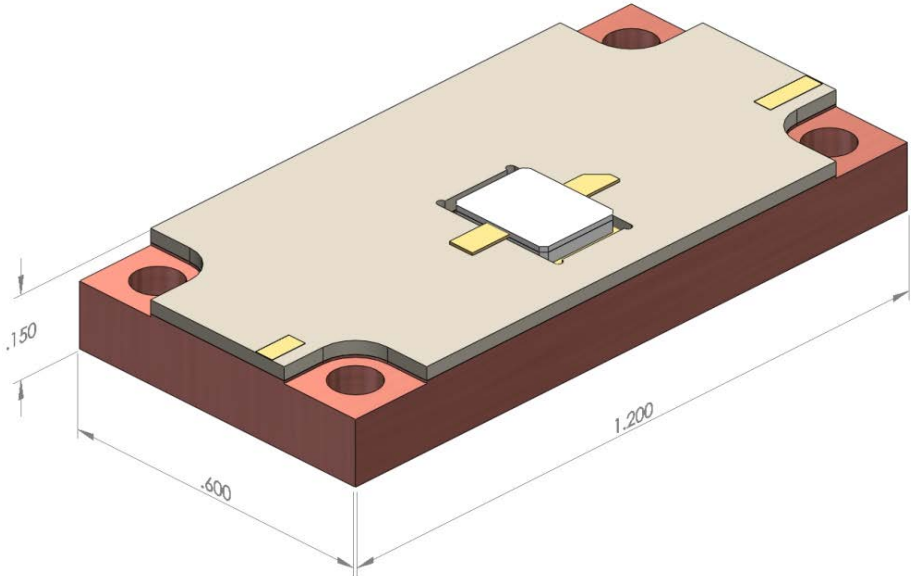
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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"