

1416GN-120E/EL/EP Datasheet
120 W DME/L-Band Radar Driver GaN Power
Transistor





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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	8
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 (300 μS, 10% Pulsing)	10
4 Transistor Impedance Information.....	11
5 Transistor Test Information	12
5.1 Transistor Test Circuit Diagram	12
6 Package Outline and Pin Information	13
6.1 55-QQ Common Source Package Dimensions and Terminal Information.....	13
6.2 55-QQP Common Source Package Dimensions and Terminal Information.....	14
6.3 Overall Pallet Dimensions	15

List of Figures

Figure 1 Case Outline 55-QQ Common Source (0.160" × 0.550").....	7
Figure 2 Case Outline 55-QQP Common Source (0.160" × 0.230").....	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.....	11
Figure 6 Transistor Test Circuit	12
Figure 7 55-QQ Package Dimensions and Terminal Information.....	13
Figure 8 55-QQP Package Dimensions and Terminal Information.....	14
Figure 9 Pallet Package Dimensions	15

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 (300 μS, 10% Pulsing)	10
Table 5	Component List 1416GN-120E/EL.....	12
Table 6	55-QQ Package Dimensions	13
Table 7	55-QQP Package Dimensions	14

2 Product Overview

The 1416GN-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 μ S pulse width and 10% long term duty cycle pulsing across the 1400 MHz to 1600 MHz band. The transistor has an internal pre-match for optimal performance. The hermetically sealed transistor is available in two package types, both the bolt-down flange 55-QQ package and the solder-down earless flange 55-QQP package. It is also available mounted in a 50 Ω IN/OUT pallet. These three products are specifically designed for use as drivers in DME (Distance Measuring Equipment) and L-Band pulsed radar transmit power amplifiers, and they utilize all-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")

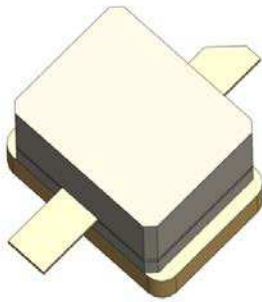
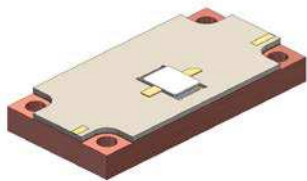


Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")



2.1 Applications

The 1416GN-120E and the 1416GN-120EL transistors and the 1416GN-120EP pallet are specifically designed for radar, L-Band avionics, and communications applications.

2.1.1 Key Features

The following are the key features of the 1416GN-120E/EL/EP E-Class Earless/Eared GaN transistor products:

- 1400 MHz–1600 MHz, 120 W pulsed output power, 300 μ S-10% pulsing
- Common source, Class AB, 50 V_{DD} bias voltage
- High efficiency: >60% typical across the frequency band
- Extremely compact size
- High power gain: 17 dB typical
- Excellent gain flatness: 0.1 dB typical
- Ideal for radar, L-Band avionics, and communications 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	265	W
Maximum voltage and current	Drain-Source voltage (V_{DSS})	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 = 1400, 1500, 1600 MHz	120	130		W
G_P	Power gain	$P_{IN} = 2.5$ W, Freq = 1400, 1500, 1600 MHz	16.8	17.2		dB
η_D	Drain efficiency	$P_{IN} = 2.5$ W, Freq = 1400, 1500, 1600 MHz	57	65		%
Dr	Droop	$P_{IN} = 2.5$ W, Freq = 1400, 1500, 1600 MHz		0.3	0.6	dB
VSWR-T	Load mismatch tolerance	$P_{OUT} = 2.5$ W, Freq = 1500 MHz, 100 μ S-10%			5:1	
Θ_{JC}	Thermal resistance	300 μ 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

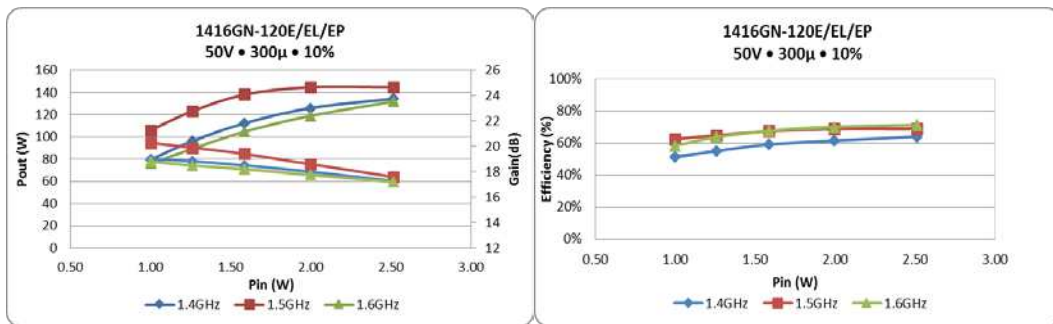
Symbol	Characteristics	Test Conditions	Min	Typ	Max	Units
$I_{D(Off)}$	Drain leakage current	$V_{GS} = -8$ V, $V_D = 125$ V			12	mA
$I_{G(Off)}$	Gate leakage current	$V_{GS} = -8$ V, $V_D = 0$ V			4	mA

3.4 Typical Broadband Performance Data (300 μS, 10% Pulsing)

Table 4 Typical Broadband Performance Data (300 μS, 10% Pulsing)

Frequency	P _{IN} (W)	P _{OUT} (W)	I _D (mA)	IRL (dB)	η _D (%)	G _P (dB)	Droop (dB)
1400 MHz	2.5	134	460	-6.0	64	17.3	0.35
1500 MHz	2.5	144	450	-12.0	69	17.6	0.30
1600 MHz	2.5	132	410	-6.0	71	17.2	0.20

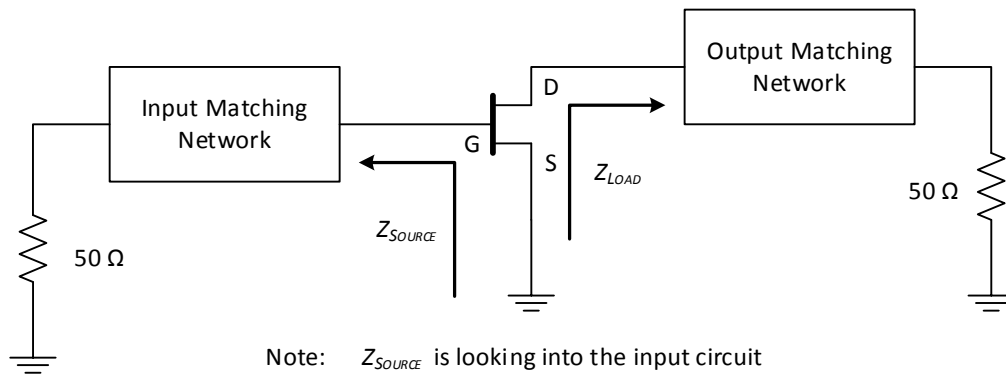
Figure 4 Typical Broadband Performance Data Graphs



4 Transistor Impedance Information

The following diagram shows the transistor impedance information for 1416GN-120E/EL/EP.

Figure 5 Impedance Definition

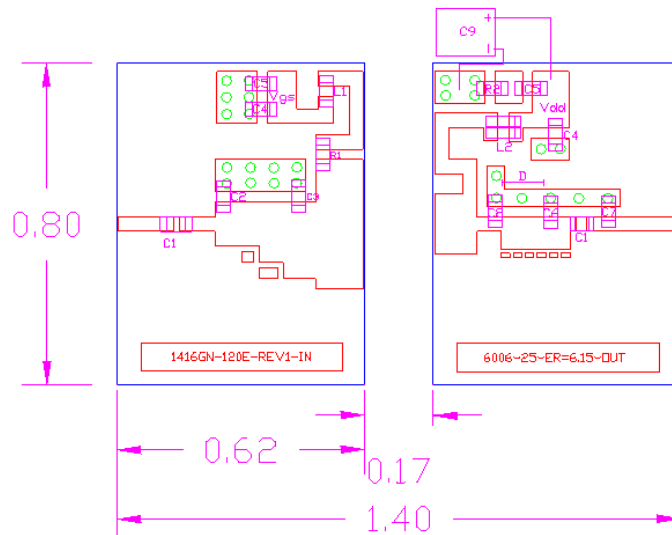


For information about source and load impedances for 1416GN-120E/EL/EP, contact your Microsemi representative.

5 Transistor Test Information

5.1 Transistor Test Circuit Diagram

Figure 6 Transistor Test Circuit



Note: Distance (D) = 0.090"–0.0950"

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

The following table lists the components for 1416GN-120E/EL.

Table 5 Component List 1416GN-120E/EL

Item	Description	Value
C1	Chip capacitor A size – ATC600S series	68 pF
C2	Chip capacitor A size – ATC600S series	4.7 pF
C3	Chip capacitor A size – ATC600S series	0.9 pF
C4 ¹	Chip capacitor A size	470 pF
C5 ¹	Chip capacitor 1210 size	4.7 uF
C6	Chip capacitor A size – ATC600S series	3 pF
C7	Chip capacitor A size – ATC600S series	0.5 pF to 0.7 pF
C8	Chip capacitor A size – ATC600S series	1 pF
C9	Electrolytic capacitor (63 V)	470 uF
C10	Chip capacitor A size – ATC600S series	82 pF
R1	Chip resistor size 0805	10 Ω
R2	Chip resistor size 0805	5.1 Ω
L1	Chip inductor size 0603	47 nH
L2 ¹	Chip inductor size 1608 (500 mA current)	1.2 nH

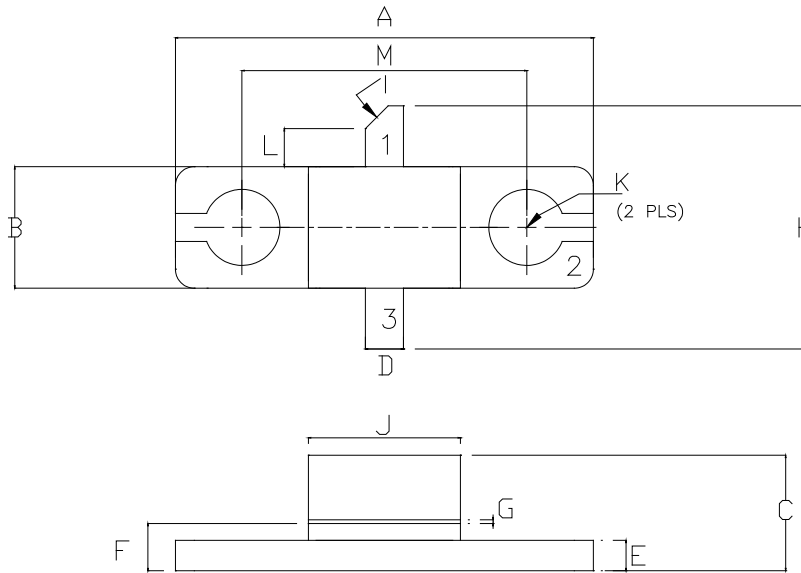
1. Two of these are needed

6 Package Outline and Pin Information

The 1416GN-125E transistor is available in the 55-QQP case outline and the 1416GN-125EL transistor is available in the 55-QQP case outline. The 1416GN-125EP is available in the 90-1416GN-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



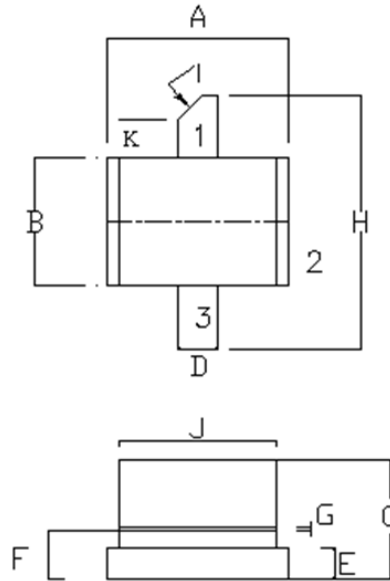
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

Table 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 Terminal Information

Figure 8 55-QQP Package Dimensions and Terminal Information



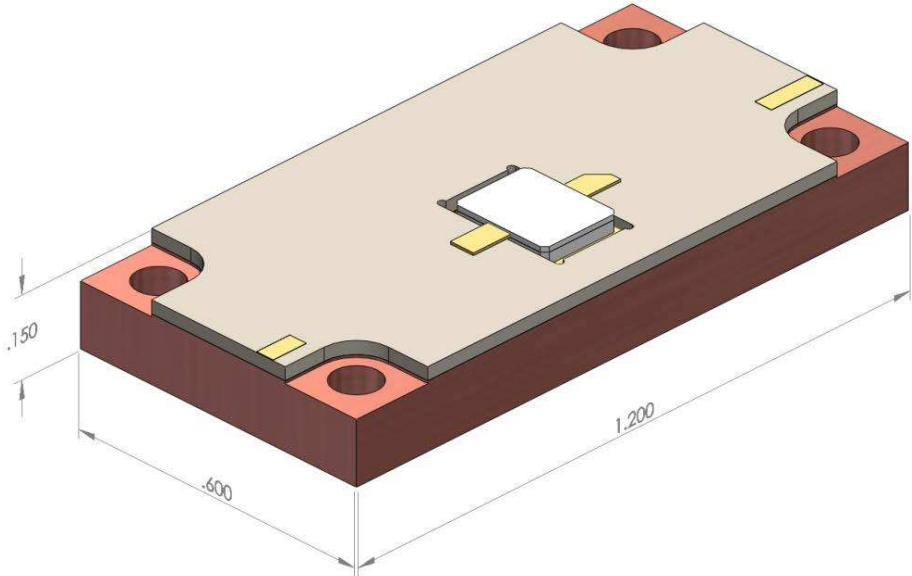
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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 9 Pallet Package Dimensions



Dimensions 1.200" × 0.600" × 0.150"