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.

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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 µS 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")

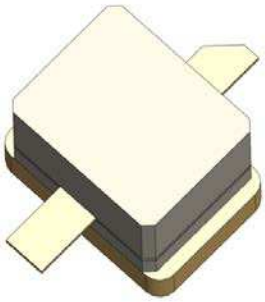
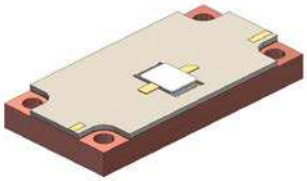


Figure 3 Pallet Outline 50 Ω IN/OUT (0.600" × 1.200" × 0.150")



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 µS-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 µS-10%			5:1	
Θ_{JC}	Thermal resistance	300 µS, 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

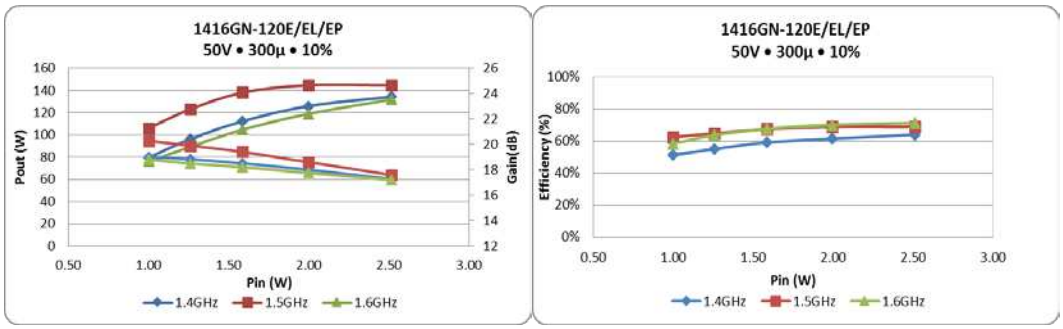
Symbol	Characteristics	Test Conditions	Min	Typ	Max	Units
$I_{D(Off)}$	Drain leakage current	V_{GS} = –8 V, V_D = 125 V			12	mA
$I_{G(Off)}$	Gate leakage current	V_{GS} = –8 V, V_D = 0 V			4	mA

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

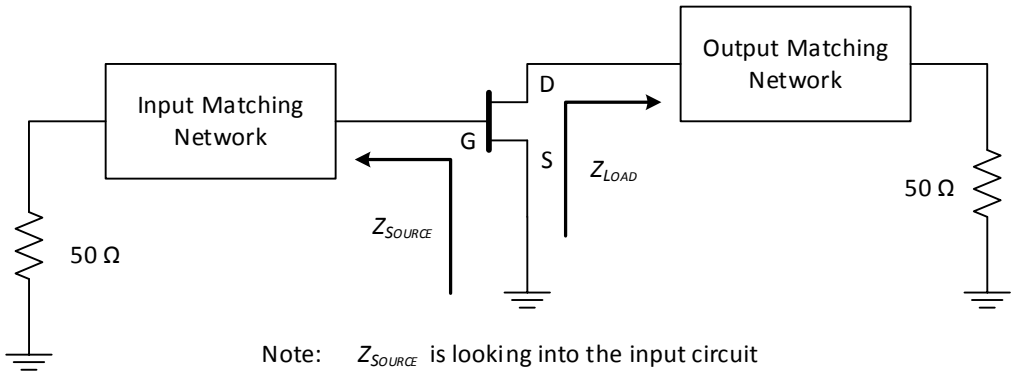
Figure 4 Typical Broadband Performance Data Graphs



4 Transistor Impedance Information

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

Figure 5 Impedance Definition



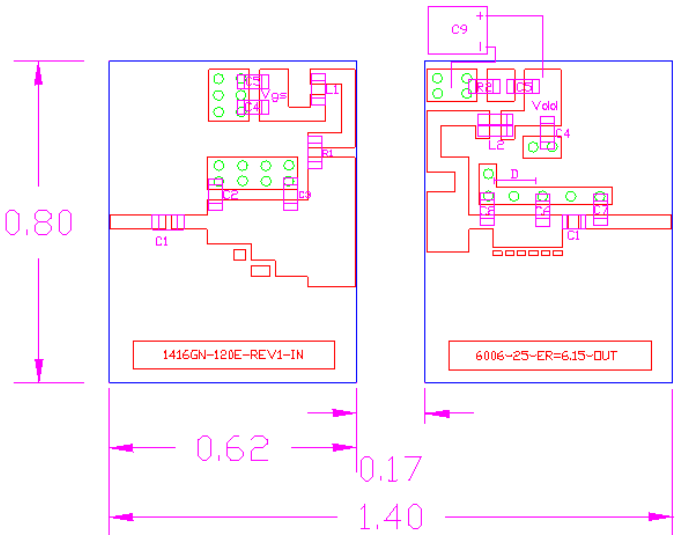
Note: Z_{SOURCE} is looking into the input circuit
Z_{LOAD} is looking into the output circuit

For information about source and load impedances for 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 εr = 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

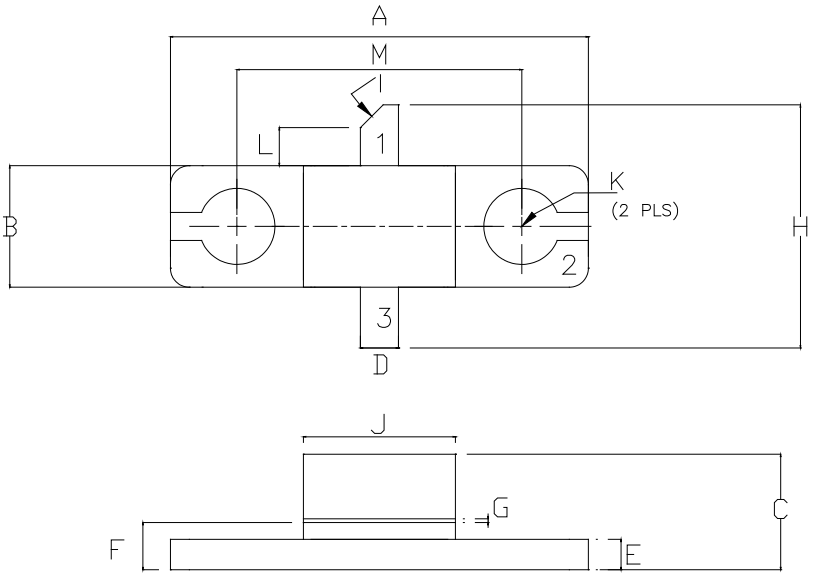
1. Two of these are needed

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



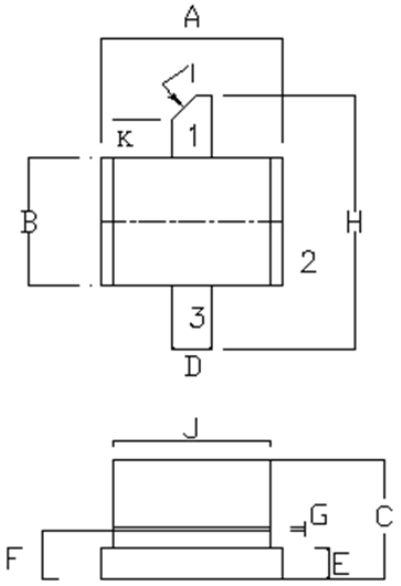
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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



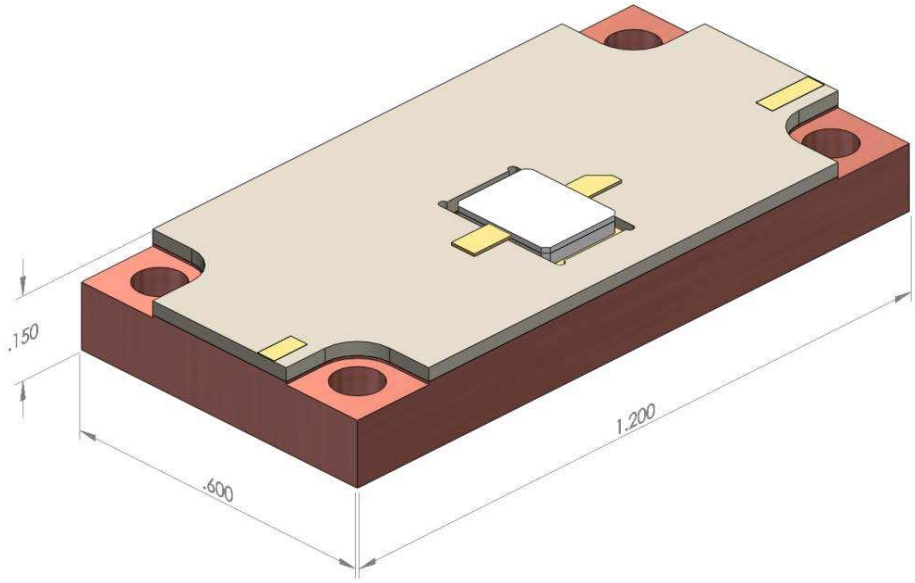
Pin 1: Drain, Pin 2: Source, Pin 3: Gate

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"