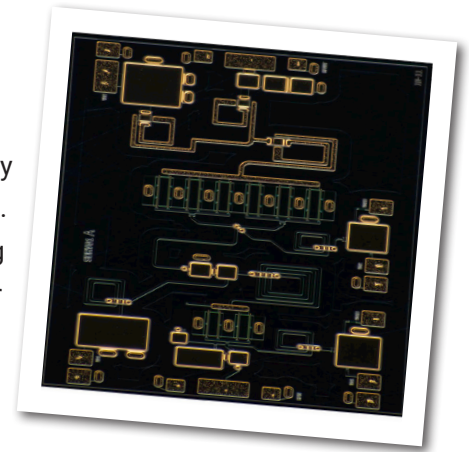


CMPA2735015D

15 W, 2.7 - 3.5 GHz, GaN MMIC, Power Amplifier

Cree's CMPA2735015D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC contains a two-stage reactively matched amplifier design approach enabling very wide bandwidths to be achieved.



Typical Performance Over 2.7-3.5 GHz ($T_c = 25^\circ\text{C}$)

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	3.3 GHz	3.5 GHz	Units
Small Signal Gain	36	35	35	35	35	dB
Output Power ¹	20	22	26	27	26	W
Power Gain ¹	27	27	28	28	28	dB
PAE ¹	51	57	54	52	52	%

Note¹: $P_{IN} = 16\text{ dBm}$, Pulse Width = 500 μs ; Duty Cycle = 10%

Features

- 35 dB Small Signal Gain
- 20 W Typical P_{SAT}
- Operation up to 50 V
- High Breakdown Voltage
- High Temperature Operation
- Size 0.118 x 0.071 x 0.004 inches

Applications

- Civil and Military Pulsed Radar Amplifiers



Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units
Drain-source Voltage	V_{DS}	150	VDC
Gate-source Voltage	V_{GS}	-10, +2	VDC
Storage Temperature	T_{STG}	-65, +150	°C
Operating Junction Temperature	T_J	225	°C
Thermal Resistance, Junction to Case (packaged)	$R_{\theta JC}$	-	°C/W
Mounting Temperature (30 seconds)	T_s	260	°C

Electrical Characteristics (Frequency = 2.7 GHz to 3.5 GHz unless otherwise stated; $T_c = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(TH)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10\text{ V}, I_D = 3\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V _{DC}	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$,
Saturated Drain Current ¹	I_{DS}	-	3.0	-	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	V_{BD}	-	150	-	V	$V_{GS} = -8\text{ V}, I_D = 3\text{ mA}$
RF Characteristics²						
Small Signal Gain ₁	S21	-	36	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 2.7 GHz
Small Signal Gain ₂	S21	-	35	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 3.1 GHz
Small Signal Gain ₃	S21	-	35	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 3.5 GHz
Power Output ₁	P_{OUT}	-	21	-	W	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}, P_{IN} = 16\text{ dBm}$, Frequency = 2.7 GHz
Power Output ₂	P_{OUT}	-	28	-	W	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}, P_{IN} = 16\text{ dBm}$, Frequency = 3.1 GHz
Power Output ₃	P_{OUT}	-	27	-	W	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}, P_{IN} = 16\text{ dBm}$, Frequency = 3.5 GHz
Power Added Efficiency ₁	PAE	-	54	-	%	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 2.7 GHz
Power Added Efficiency ₂	PAE	-	57	-	%	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 3.1 GHz
Power Added Efficiency ₃	PAE	-	55	-	%	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$, Frequency = 3.5 GHz
Power Gain	G_p	-	27	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$
Input Return Loss	S11	-	8	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$
Output Return Loss	S22	-	8	-	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}$
Output Mismatch Stress	VSWR	-	-	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 50\text{ V}, I_{DQ} = 80\text{ mA}, P_{OUT} = 15\text{ W Pulsed}$

Notes:

¹ Scaled from PCM data.

² All data pulse tested on-wafer with Pulse Width = 10 μs, Duty Cycle = 1%.

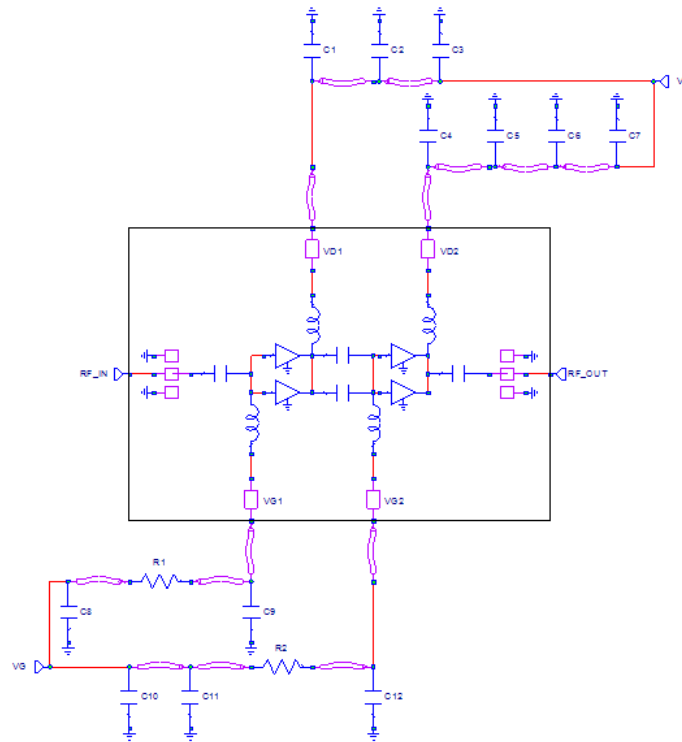


Die Dimensions (units in microns)

Die Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at <http://www.cree.com/RF/Document-Library>
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.
- Use the die label (XX-YY) for correct orientation.

Block Diagram Showing Additional Capacitors & Output Matching Section for Operation Over 2.7 to 3.5 GHz



Designator	Description	Quantity
C1,C4,C9,C12	CAP, 10pF, 100V, 0402	4
C2,C5	CAP, 100pF, 100V, 0603	2
C3,C6,C8,C11	CAP, 470pF, 100V, 0603	4
C7	CAP, 33uF, 50V, ELECT, MVY, SMD	1
C12	CAP, 10uF, 16V, TANTALUM, SMD	1
R1,R2	RES, 1000hm, 1/16W, 0603	2

Notes:

- 1 The input, output and decoupling capacitors should be attached as close as possible to the die- typical distance is 40 to 50 mils.
- 2 The MMIC die and capacitors should be connected with 1 mil gold bond wires.

Typical Performance

Figure 1. - Gain and Input Return Loss vs Frequency
 $V_{DD} = 50\text{ V}, I_{DQ} = 0.08\text{ A}$

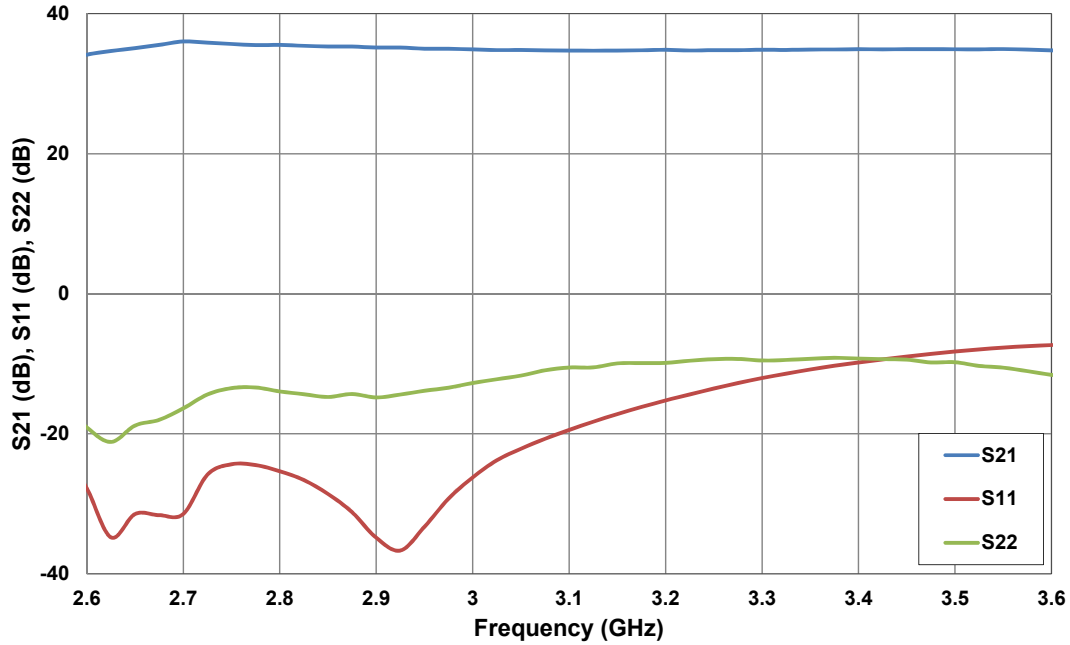
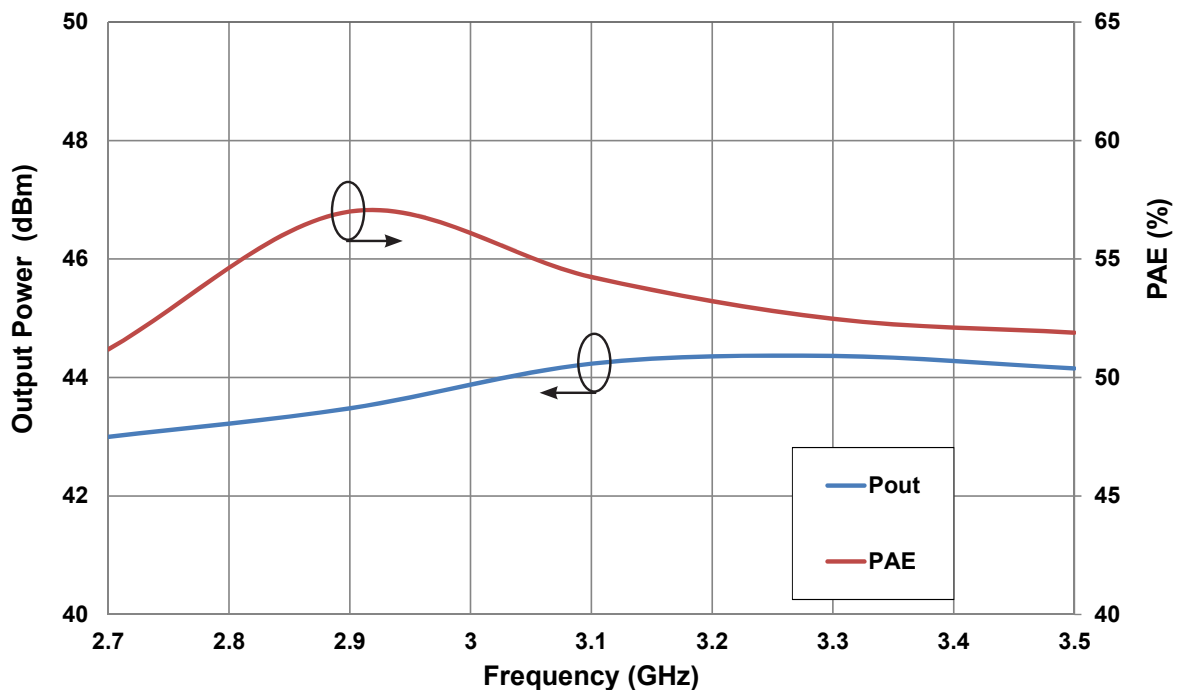


Figure 2. - Output Power and PAE vs Frequency
 $V_{DD} = 50\text{ V}, I_{DQ} = 0.08\text{ A}, P_{IN} = 16\text{ dBm}, \text{Pulse Width} = 500\text{ }\mu\text{s}, \text{Duty Cycle} = 10\%$



Typical Performance

Figure 3. - Associated Gain vs Frequency

$V_{DD} = 50\text{ V}$, $I_{DQ} = 0.08\text{ A}$, $P_{IN} = 16\text{ dBm}$
 Pulse Width = 500 μs , Duty Cycle = 10%

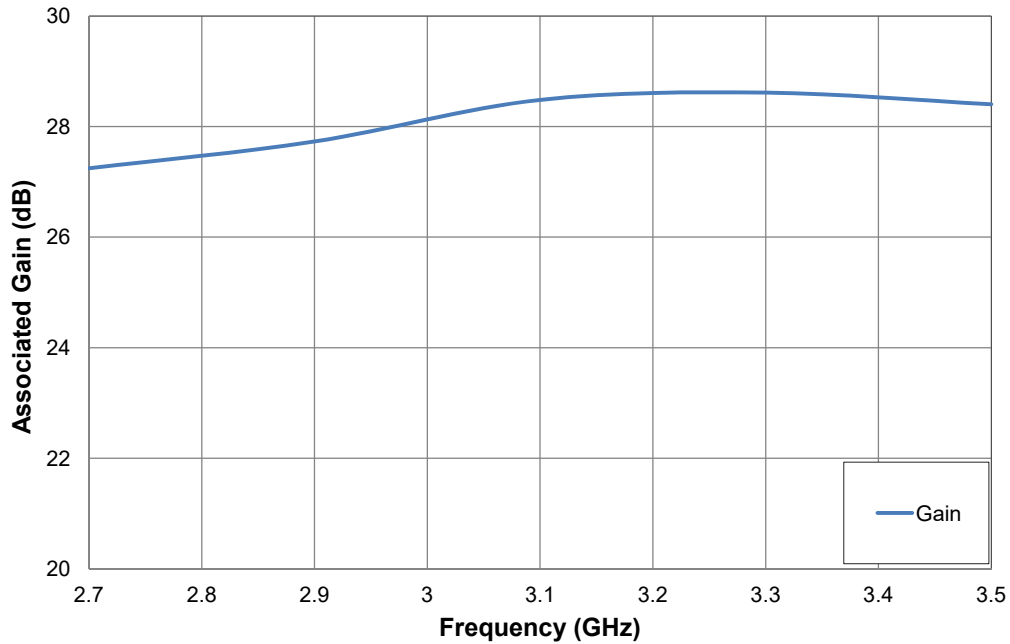
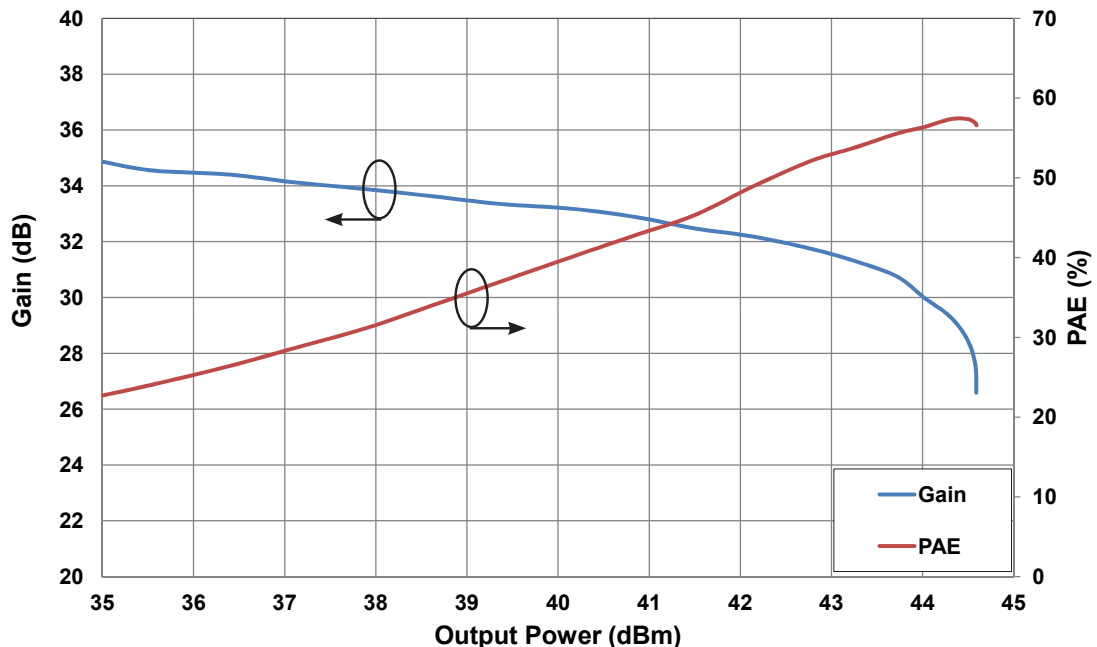
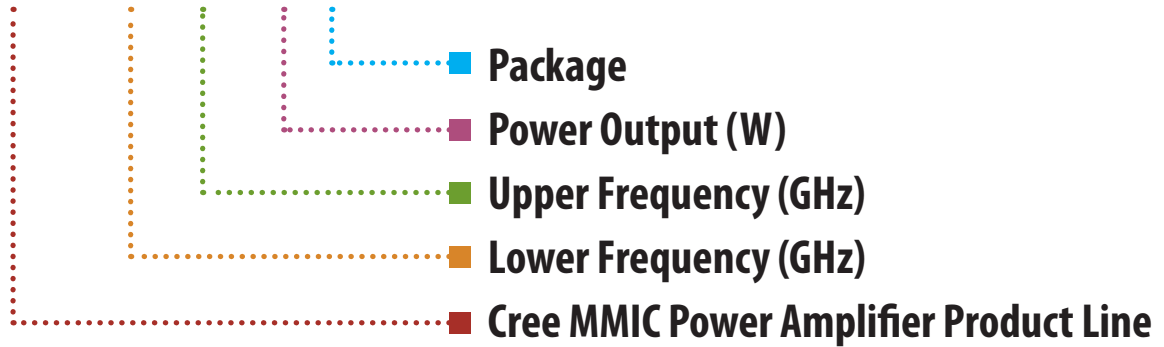


Figure 4. - Gain and Power Added Efficiency vs Output Power

$V_{DD} = 50\text{ V}$, $I_{DQ} = 0.08\text{ A}$, Frequency = 3.1 GHz
 Pulse Width = 500 μs , Duty Cycle = 10%



CMPA2735015D



Parameter	Value	Units
Lower Frequency	2.7	GHz
Upper Frequency	3.5	GHz
Power Output	15	W
Package	Bare Die	-

Table 1.

Note: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

Table 2.



Product Ordering Information

Order Number	Description	Unit of Measure
CMPA2735015D	GaN MMIC	Each



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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/RF

Sarah Miller
Marketing
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639