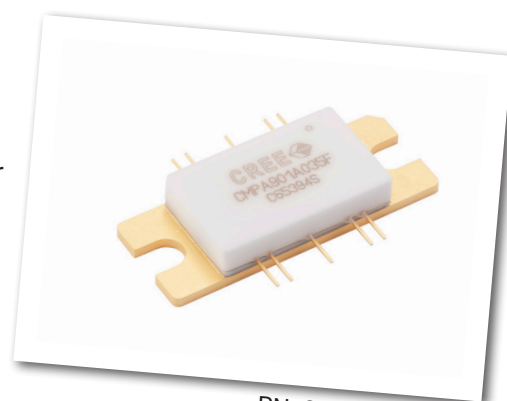


CMPA901A035F

35 W, 9.0 - 11.0 GHz, GaN MMIC, Power Amplifier

The CMPA901A035F is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC) on a silicon carbide (SiC) substrate. The semiconductor offers 35 Watts of power from 9 to 11 GHz of instantaneous bandwidth. The GaN HEMT MMIC is housed in a thermally-enhanced, 10-lead 25 mm x 9.9 mm metal/ceramic flanged package. It offers high gain and superior efficiency in a small footprint package at 50 ohms.



PN: CMPA901A035F
Package Type: 440213

Typical Performance Over 9.0-11.0 GHz ($T_c = 25^\circ\text{C}$)

Parameter	9.0 GHz	9.5 GHz	10.0 GHz	10.5 GHz	11.0 GHz	Units
Small Signal Gain	35	34	34	37	31	dB

CW Performance	9.0 GHz	9.5 GHz	10.0 GHz	10.5 GHz	11.0 GHz	Units
$P_{OUT} @ P_{IN} = 23 \text{ dBm}$	46	45	43	42	37	W
Power Gain @ $P_{IN} = 23 \text{ dBm}$	23.7	23.5	23.3	23.2	22.7	dB
PAE @ $P_{IN} = 23 \text{ dBm}$	40	36	34	34	35	%

Pulsed Performance (100 μsec , 10%)	9.0 GHz	9.5 GHz	10.0 GHz	10.5 GHz	11.0 GHz	Units
$P_{OUT} @ P_{IN} = 23 \text{ dBm}$	51	52	50	48	40	W
Power Gain @ $P_{IN} = 23 \text{ dBm}$	24.1	24.2	24.0	23.8	23.0	dB
PAE @ $P_{IN} = 23 \text{ dBm}$	41.7	38.03	36.5	36.4	35.3	%

Features

- 9.0 - 11.0 GHz Operation
- Typical Output Power 40 W
- Typical Power Gain 23 dB
- Typical PAE 35%
- Operation up to 28 V

Applications

- Military Radar
- Marine Radar
- Weather Radar
- Medical Applications

Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DS}	84	V_{DC}	25°C
Gate-source Voltage	V_{GS}	-10, +2	V_{DC}	25°C
Storage Temperature	T_{STG}	-40, +150	°C	
Operating Junction Temperature	T_J	225	°C	
Maximum Forward Gate Current	I_{GMAX}	19	mA	25°C
Soldering Temperature ¹	T_{STG}	245	°C	
Screw Torque	T	40	in-oz	
Thermal Resistance, Junction to Case, CW	$R_{\theta JC}$	1.3	°C/W	85°C @ $P_{DISS} = 80$ W
Thermal Resistance, Junction to Case, Pulsed	$R_{\theta JC}$	0.93	°C/W	85°C @ $P_{DISS} = 80$ W
Case Operating Temperature ²	T_C	-40, +150	°C	

Note¹ Refer to the Application Note on soldering at <http://www.cree.com/rf/document-library>

Note² See also, the Power Dissipation De-rating Curve on page 10

Electrical Characteristics (Frequency = 9.0 GHz to 11.0 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics^{1,2}						
Gate Threshold	V_{TH}	-3.8	-2.8	-2.3	V	$V_{DS} = 10$ V, $I_{DS} = 19.8$ mA
Saturated Drain Current	I_{DS}	14.3	19.8	—	A	$V_{DS} = 6$ V, $V_{GS} = 2$ V
Drain-Source Breakdown Voltage	V_{BD}	84	100	—	V	$V_{GS} = -8$ V, $I_{DS} = 19.8$ mA
RF Characteristics³						
Small Signal Gain	S21	—	35	—	dB	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = -30$ dBm
Input Return Loss	S11	—	-5	—	dB	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = -30$ dBm
Output Return Loss	S22	—	-5	—	dB	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = -30$ dBm
Output Power ^{3,4,5}	P_{OUT1}	—	47.1	—	dBm	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = 23$ dBm, Freq = 9 GHz
Output Power ^{3,4,5}	P_{OUT2}	—	47.0	—	dBm	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = 23$ dBm, Freq = 10 GHz
Power Added Efficiency ^{3,4,5}	PAE_1	—	42	—	%	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = 23$ dBm, Freq = 9 GHz
Power Added Efficiency ^{3,4,5}	PAE_2	—	36	—	%	$V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = 23$ dBm, Freq = 10 GHz
Output Mismatch Stress	VSWR	—	5:1	VSWR	Ψ	No damage at all phase angles, $V_{DS} = 28$ V, $I_{DQ} = 1.5$ A, $P_{IN} = 23$ dBm, CW

Notes:

¹ Measured on-wafer prior to packaging.

² Scaled from PCM data.

³ Measured in the CMPA901A035F-TB fixture

⁴ Fixture loss de-embedded using the following offsets. The offset is subtracted from the input offset value and added to the output offset value.

- a) 9.0 GHz - 0.20 dB
- b) 10.0 GHz - 0.25 dB

⁵ Pulse performance, with pulse width 100 μsec , duty cycle 10%

CMPA901A035F Typical Performance

Figure 1. - Small Signal Gain and Return Loss vs. Frequency of the CMPA901A035F as Measured in Circuit CMPA901A035F-AMP Demonstration Amplifier

$$V_{DD} = 28 \text{ V}, I_{DQ} = 1.5 \text{ A}$$

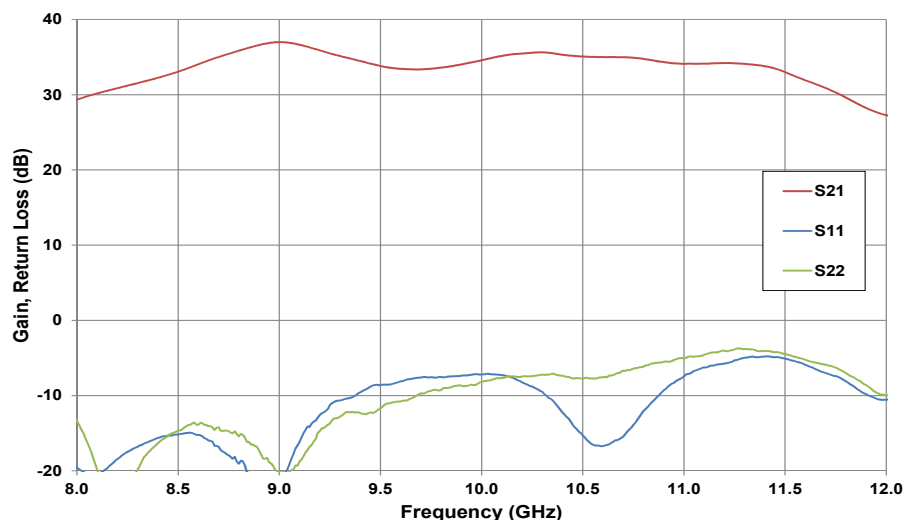
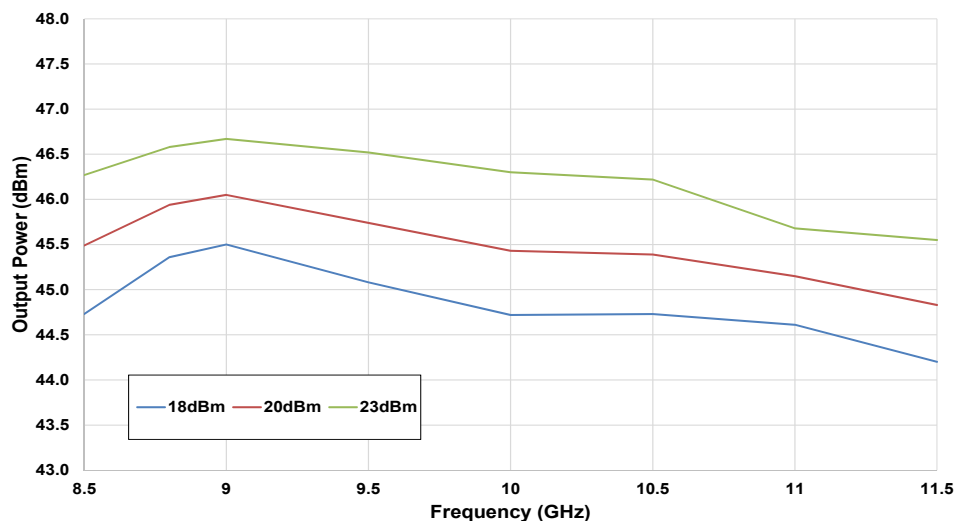


Figure 2. - CW Output Power vs. Frequency as a Function of Input Power of the CMPA901A035F as Measured in Demonstration Amplifier Circuit CMPA901A035F-AMP

$$V_{DD} = 28 \text{ V}, I_{DQ} = 1.5 \text{ A}$$



CMPA901A035F Typical Performance

Figure 3. - CW Power Gain vs. Frequency
as a Function of Input Power

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$

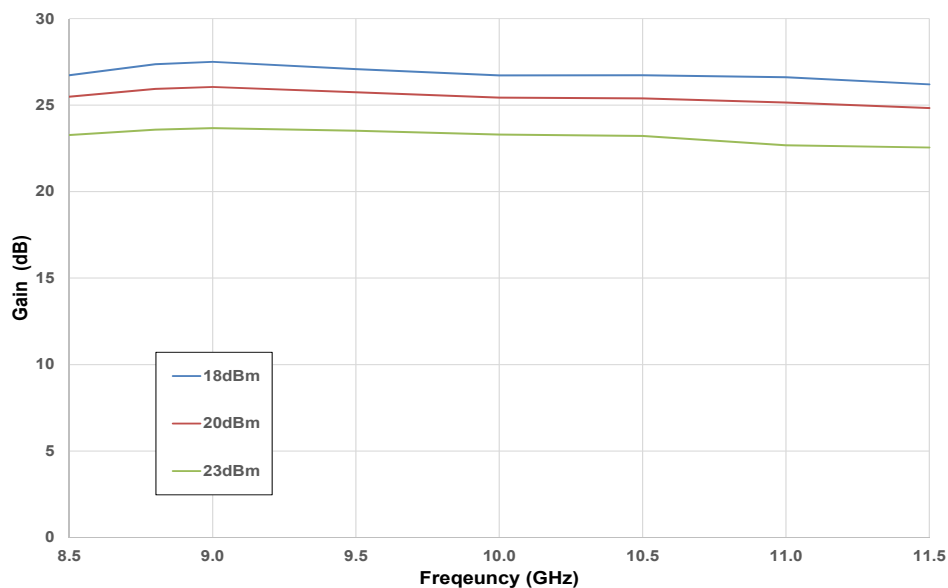
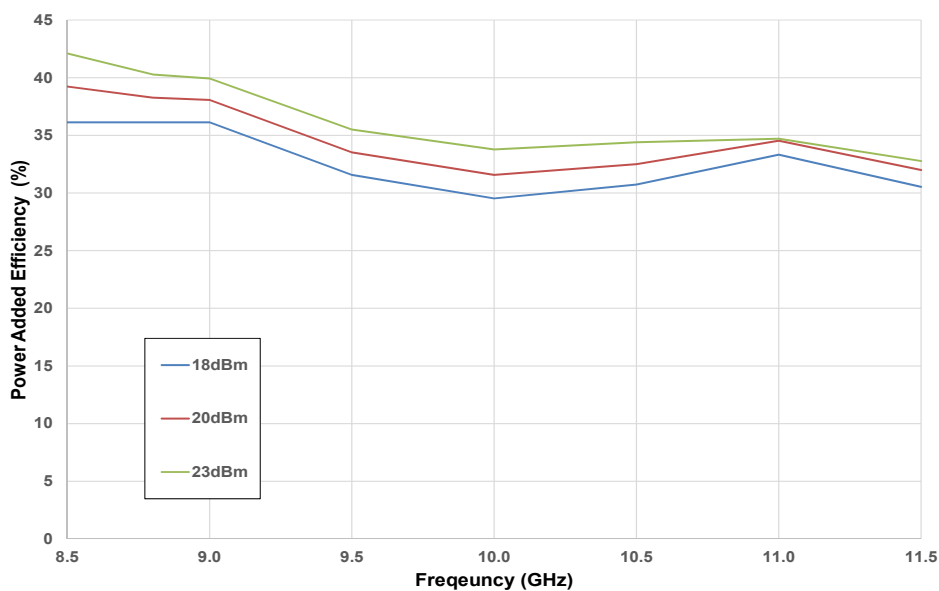


Figure 4. - CW Power Added Efficiency vs. Frequency
as a Function of Input Power

$V_{DD} = 28\text{ V}$, $I_{DQ} = 2.5\text{ A}$



CMPA901A035F Typical Performance

Figure 5. - CW Output Power vs. Input Power
as a Function of Frequency

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$

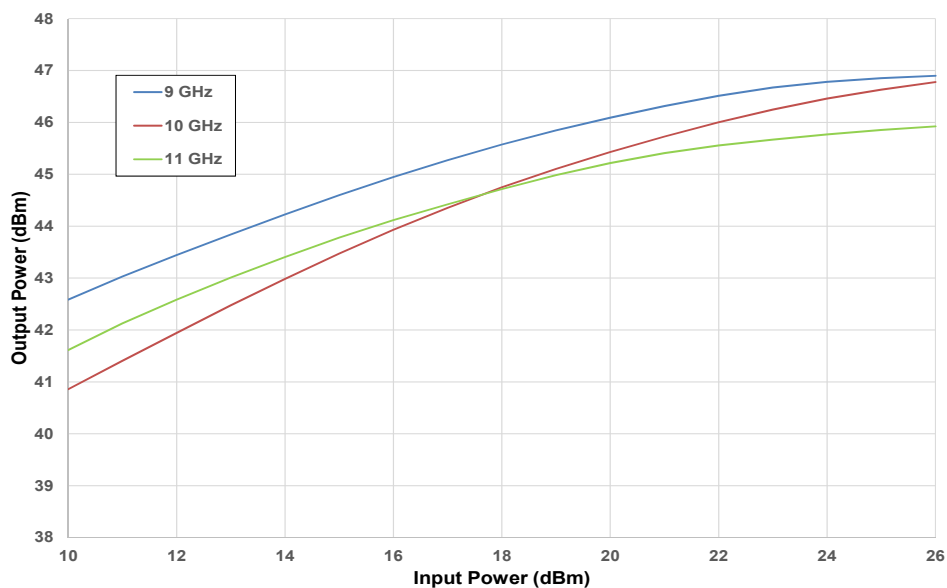
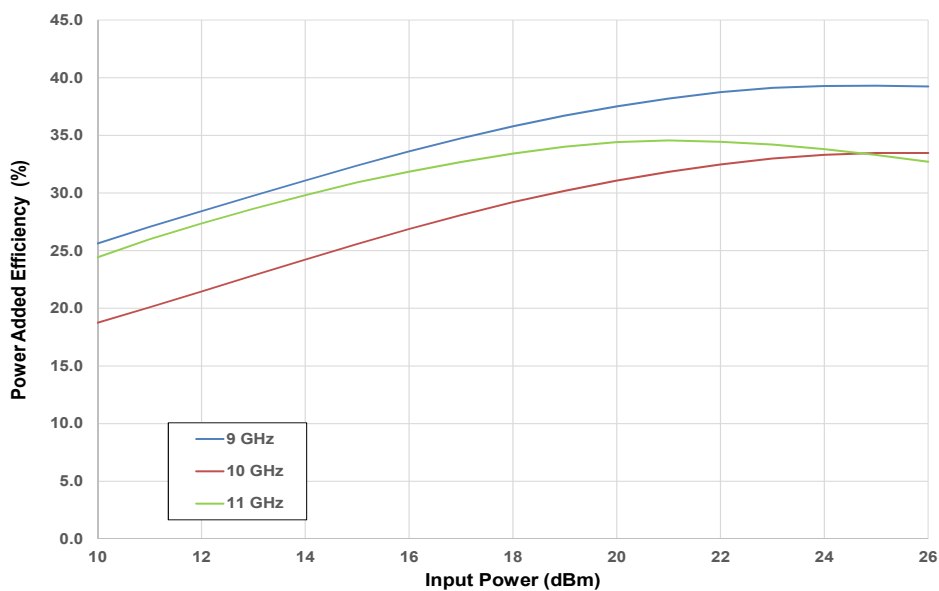


Figure 6. - CW Power Added Efficiency vs. Input Power
as a Function of Frequency

$V_{DD} = 28\text{ V}$, $I_{DQ} = 2.5\text{ A}$



CMPA901A035F Typical Performance

Figure 7. - CW Gain vs. Input Power
as a Function of Frequency

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$

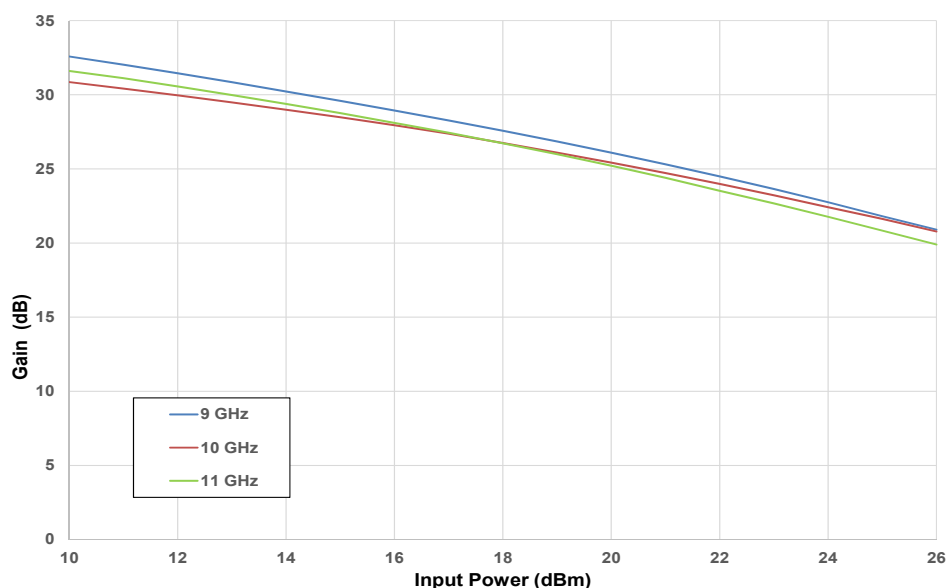
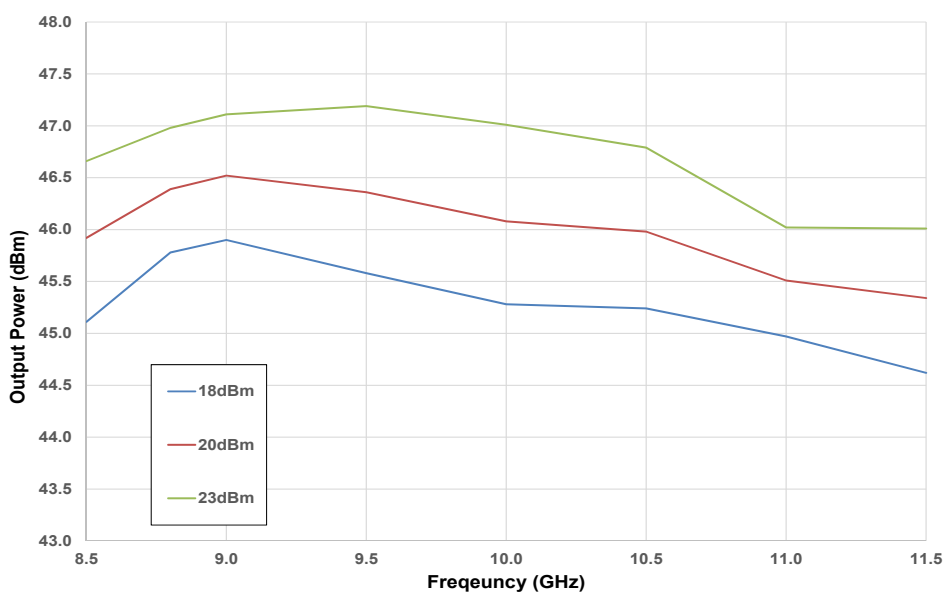
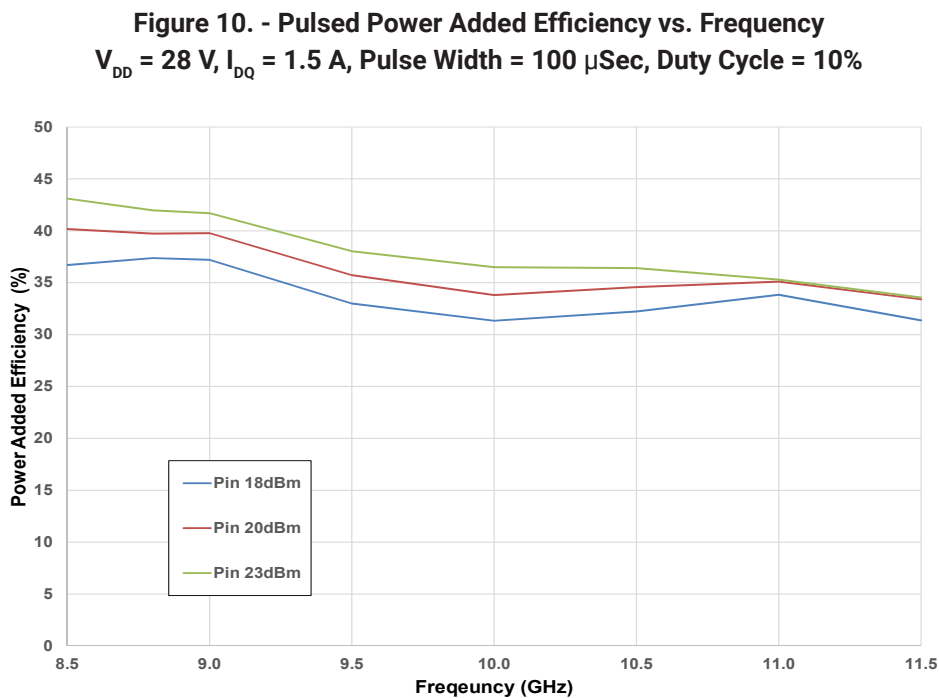
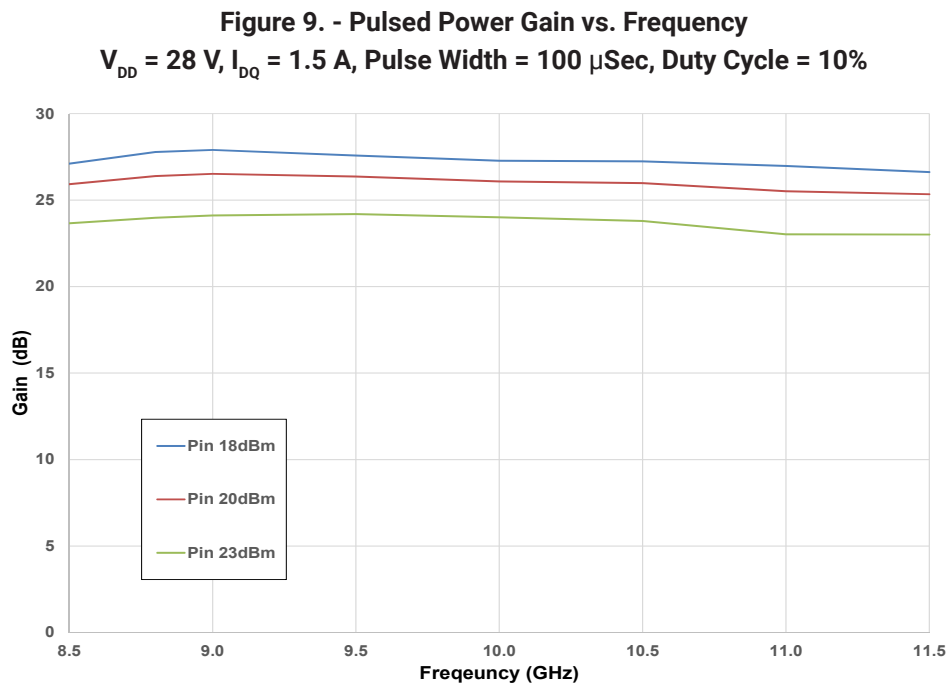


Figure 8. - Pulsed Output Power vs. Frequency
as a Function of Input Power

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$, Pulse Width = 100 μSec , Duty Cycle = 10%



CMPA901A035F Typical Performance



CMPA901A035F Typical Performance

Figure 11. - Pulsed Output Power vs. Input Power
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$, Pulse Width = 100 μSec , Duty Cycle = 10%

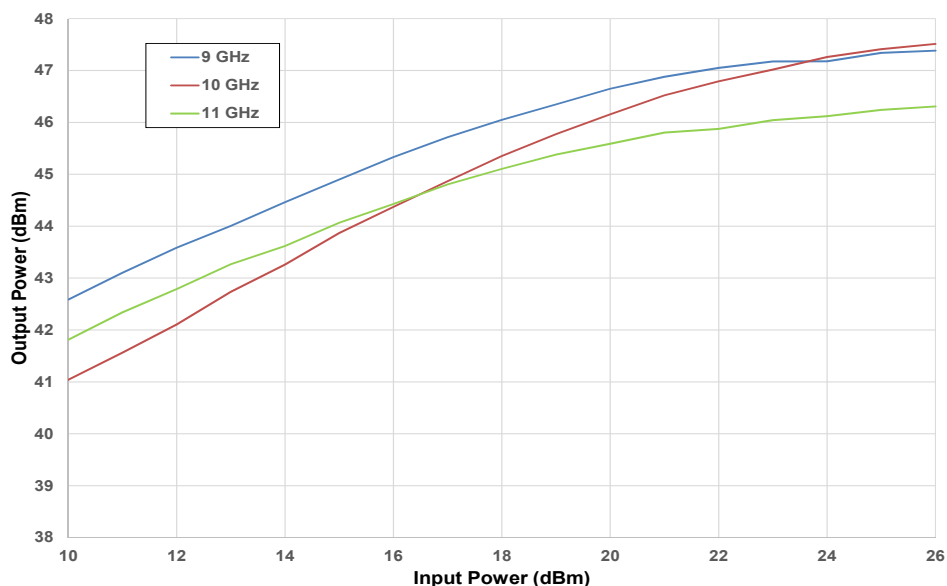
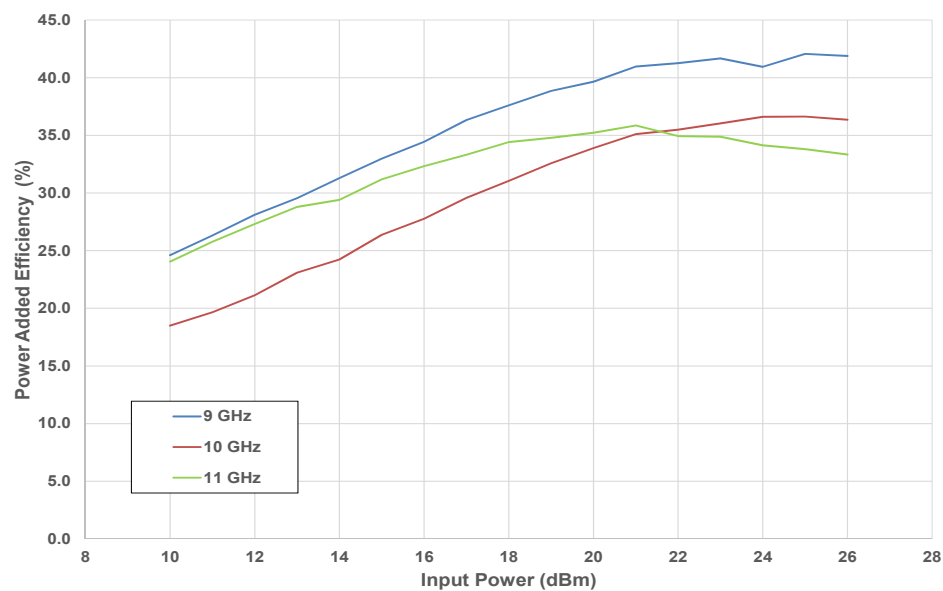


Figure 12. - Pulsed Power Added Efficiency vs. Input Power
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$, Pulse Width = 100 μSec , Duty Cycle = 10%



CMPA901A035F Typical Performance

Figure 13. - Pulsed Gain vs. Input Power

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$, Pulse Width = 100 μSec , Duty Cycle = 10%

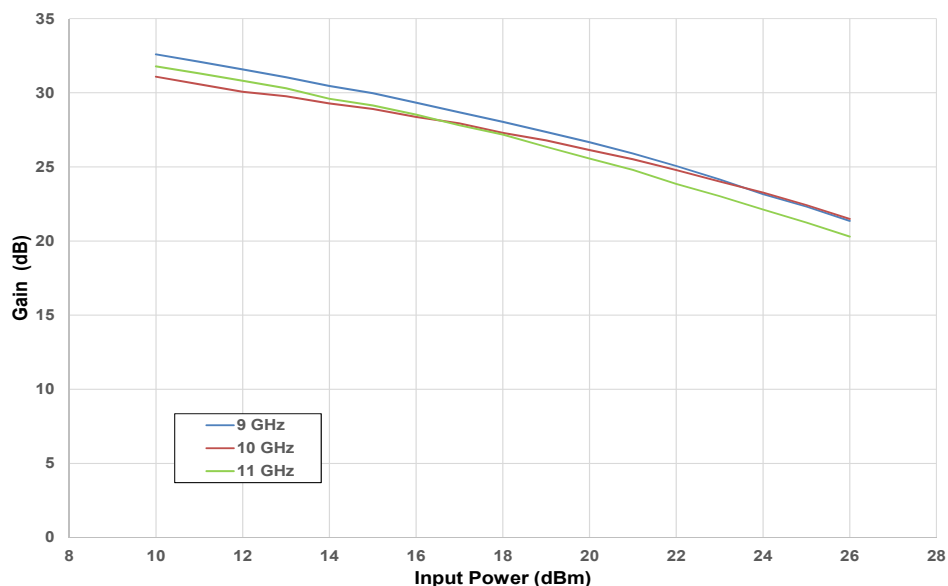


Figure 14. - Pulse Droop

$V_{DD} = 28\text{ V}$, $I_{DQ} = 1.5\text{ A}$, Frequency = 9.5 GHz, $P_{IN} = 26\text{ dBm}$

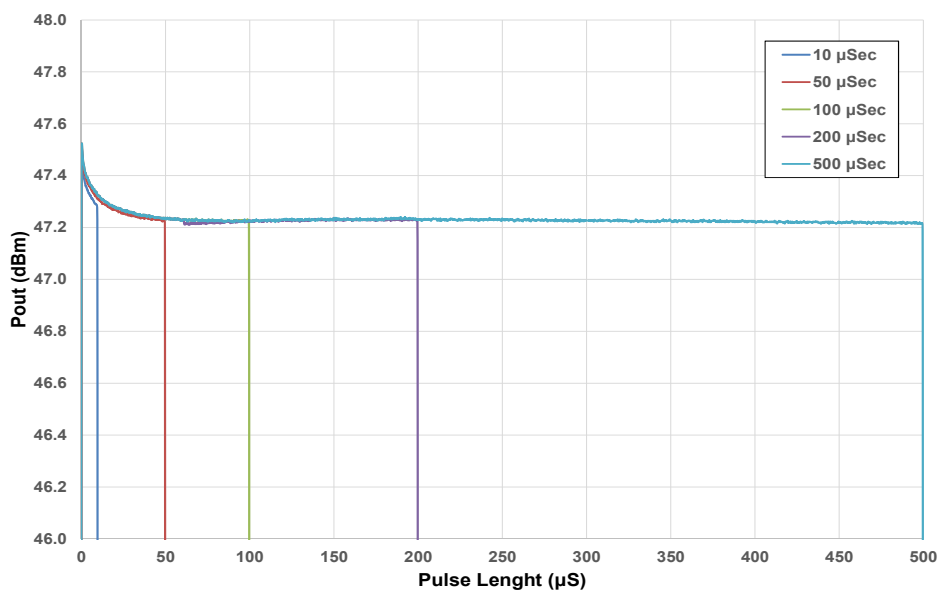
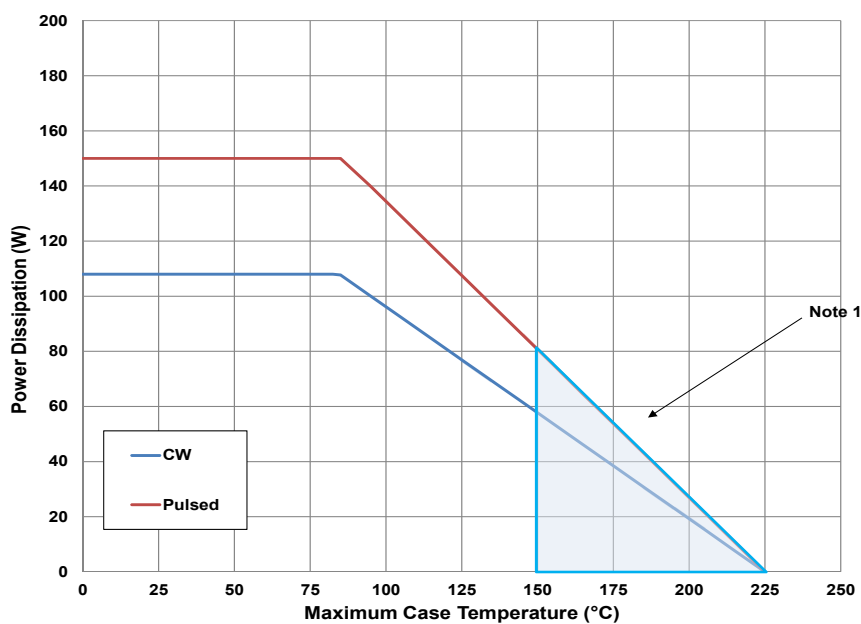


Figure 15. - Power Dissipation De-Rating Curve



Note 1. Area exceed Maximum Case Operating Temperature (See Page 2).

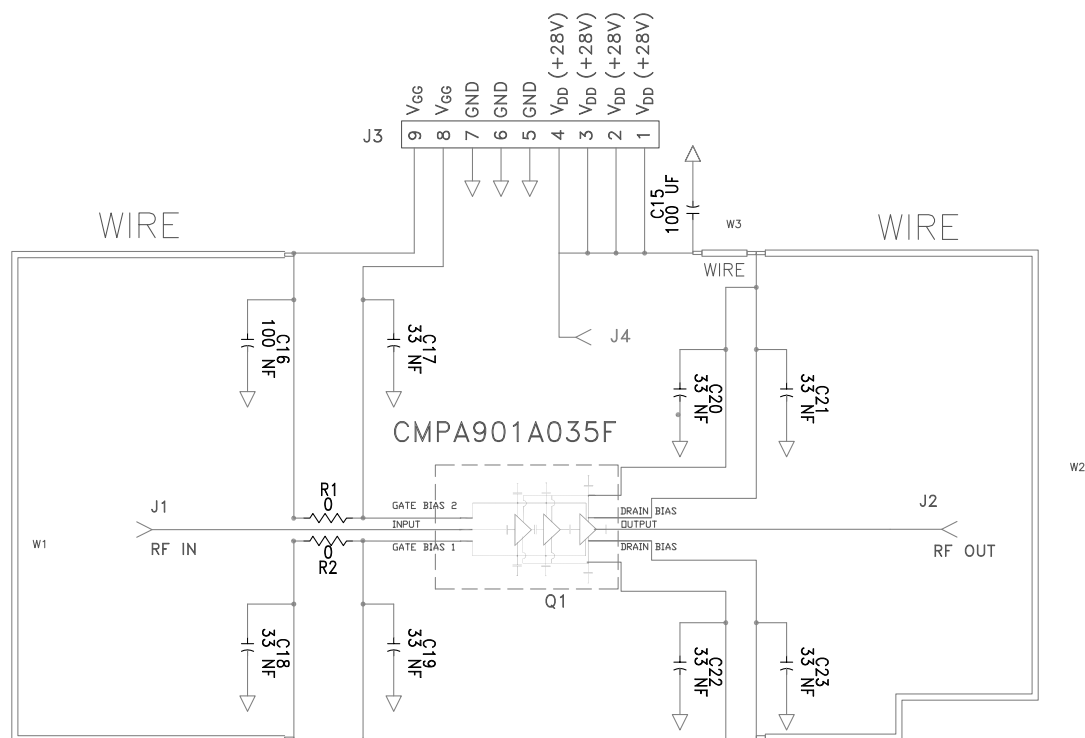
CMPA901A035F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C15	CAP ELECT 100UF 80V AFK SMD	1
C16-C23	CAP,33000PF, 0805,100V, X7R	8
R1,R2	RES 0.0 OHM 1/16W 0402 SMD	2
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
J3	HEADER RT>PLZ .1CEN LK 9POS	1
W1	WIRE, BLACK, 22 AWG ~ 1.50"	1
W2	WIRE, BLACK, 22 AWG ~ 1.75"	1
W3	WIRE, BLACK, 22 AWG ~ 3.0"	1
Q1	CMQA901A035F	1

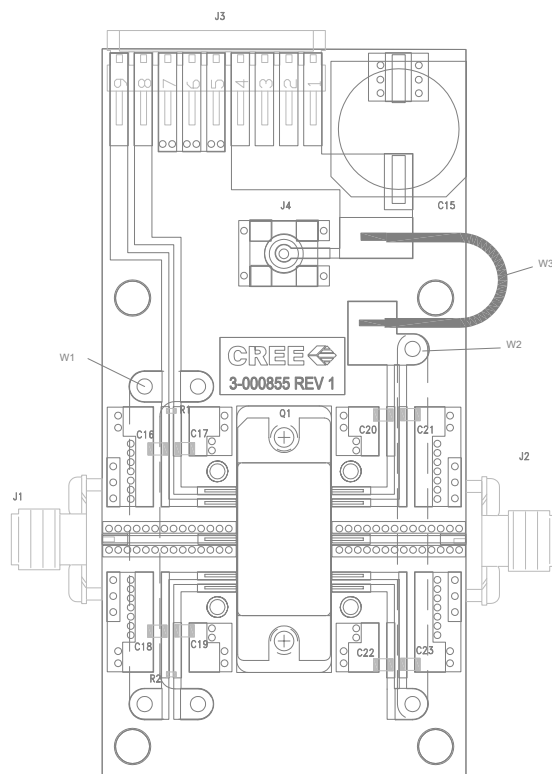
CMQA901A035F-AMP Demonstration Amplifier Circuit



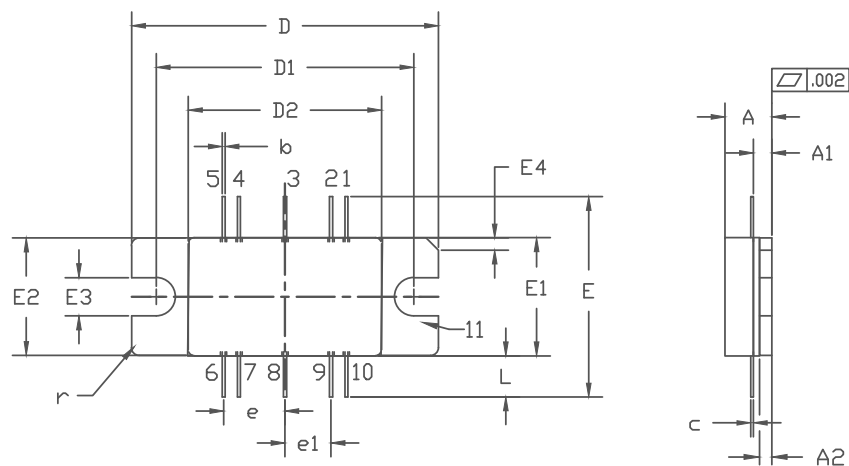
CMPA901A035F-AMP Demonstration Amplifier Circuit Schematic



CMPA901A035F-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CMPA901A035F



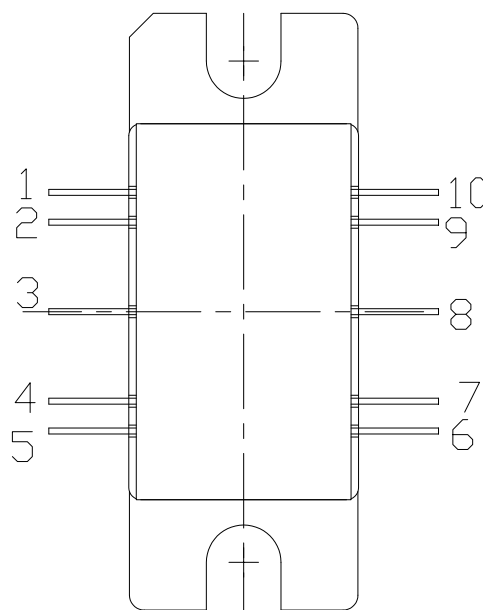
PIN 1: GATE BIAS 6: DRAIN BIAS
 2: GATE BIAS 7: DRAIN BIAS
 3: RF IN 8: RF OUT
 4: GATE BIAS 9: DRAIN BIAS
 5: GATE BIAS 10: DRAIN BIAS
 11: SOURCE

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

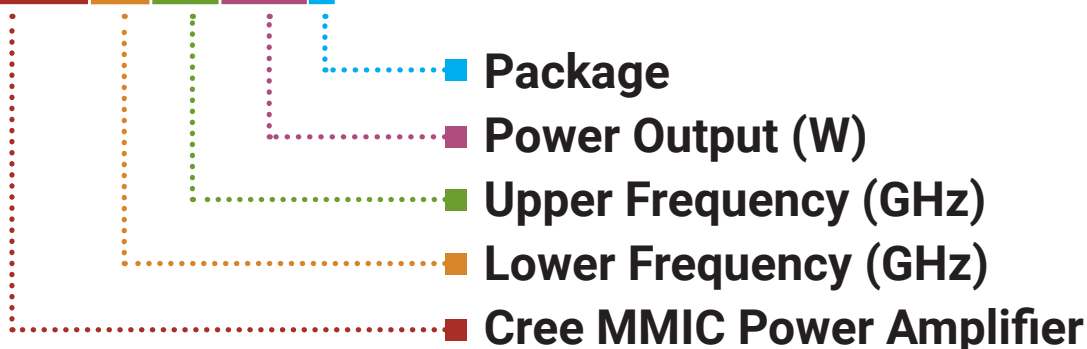
DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.148	0.168	3.76	4.27	
A1	0.055	0.065	1.40	1.65	
A2	0.035	0.045	0.89	1.14	
b	0.01	TYP	0.254	TYP	10x
c	0.007	0.009	0.18	0.23	
D	0.995	1.005	25.27	25.53	
D1	0.835	0.845	21.21	21.46	
D2	0.623	0.637	15.82	16.18	
E	0.653	TYP	16.59	TYP	
E1	0.380	0.390	9.65	9.91	
E2	0.380	0.390	9.65	9.91	
E3	0.120	0.130	3.05	3.30	
E4	0.035	0.045	0.89	1.14	45° CHAMFER
e	0.200	TYP	5.08	TYP	4x
e1	0.150	TYP	3.81	TYP	4x
L	0.115	0.155	2.92	3.94	10x
r	0.025	TYP	.635	TYP	3x

Pin Number	Qty
1	Gate Bias for Stage 1, 2 & 3
2	Gate Bias for Stage 1, 2 & 3
3	RF IN
4	Gate Bias for Stage 1, 2 & 3
5	Gate Bias for Stage 1, 2 & 3
6	Drain Bias
7	Drain Bias
8	RF OUT
9	Drain Bias
10	Drain Bias



Part Number System

CMPA901A035F



Parameter	Value	Units
Lower Frequency	9.0	GHz
Upper Frequency ¹	10.0	GHz
Power Output	35	W
Package	Flanged	-

Table 1.

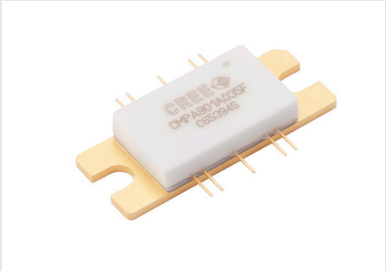
Note¹: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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	Image
CMPA901A035F	GaN HEMT	Each	
CMPA901A035F-AMP	Test board with GaN HEMT installed	Each	

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