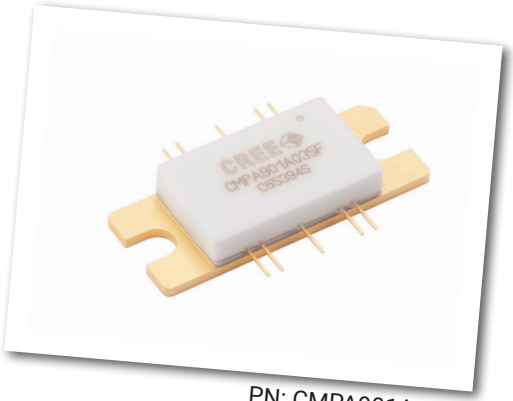
CMPA901A035F

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



PN: CMPA901A035F
Package Type: 440213

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.

Typical Performance Over 9.0-11.0 GHz (T_c = 25°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 dBm	46	45	43	42	37	W
Power Gain @ P_{IN} = 23 dBm	23.7	23.5	23.3	23.2	22.7	dB
PAE @ P_{IN} = 23 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 dBm	51	52	50	48	40	W
Power Gain @ P_{IN} = 23 dBm	24.1	24.2	24.0	23.8	23.0	dB
PAE @ P_{IN} = 23 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

Rev 0.0 –May 2019-PRELIMINARY

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	

Note[1] Refer to the Application Note on soldering at http://www.cree.com/rf/document-library
Note[2] 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˚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} = 6V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V	V_{GS} = -8 V, I_{DS} = 19.8 mA
RF Characteristics[3]						
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_{DD} = 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%

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Figure 1. - Small Signal Gain and Return Loss vs. Frequency of the CMPA901A035F as Measured in Circuit CMPA901A035F-AMP Demonstration Amplifier
V_{DD} = 28 V, I_{DQ} = 1.5 A

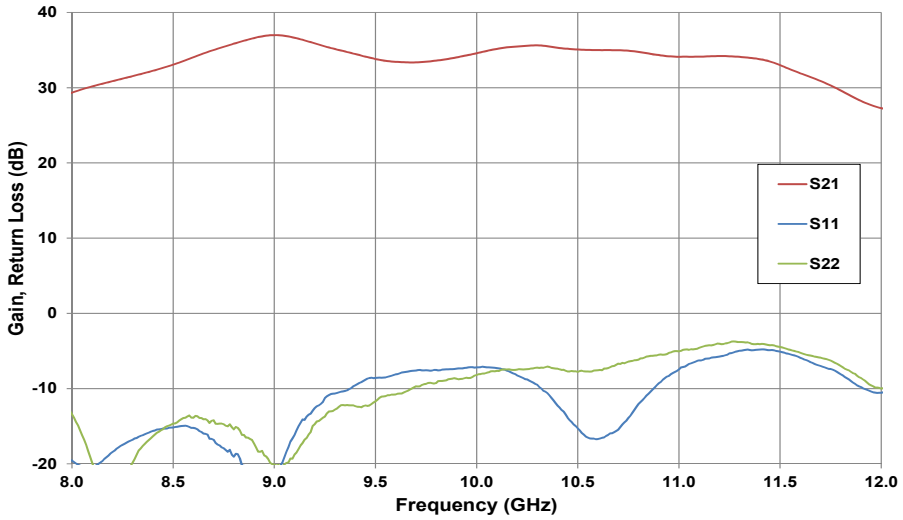

Figure 2. - CW Output Power vs. Frequency as a Function of Input Power of the CMPA901A035F as Measured in Demonstration Amplifier Circuit CMPA901A035F-AMP
V_{DD} = 28 V, I_{DQ} = 1.5 A

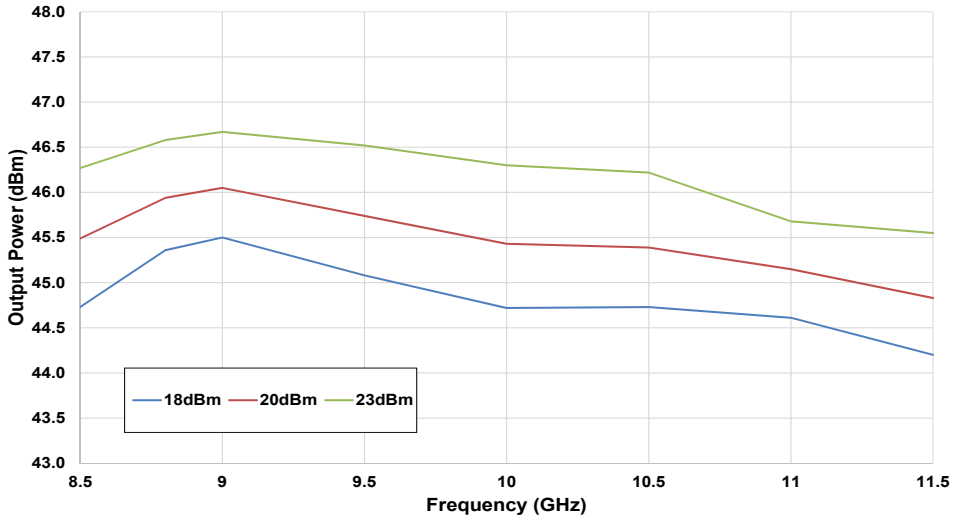

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Figure 3. - CW Power Gain vs. Frequency as a Function of Input Power
V_{DD} = 28 V, I_{DQ} = 1.5 A

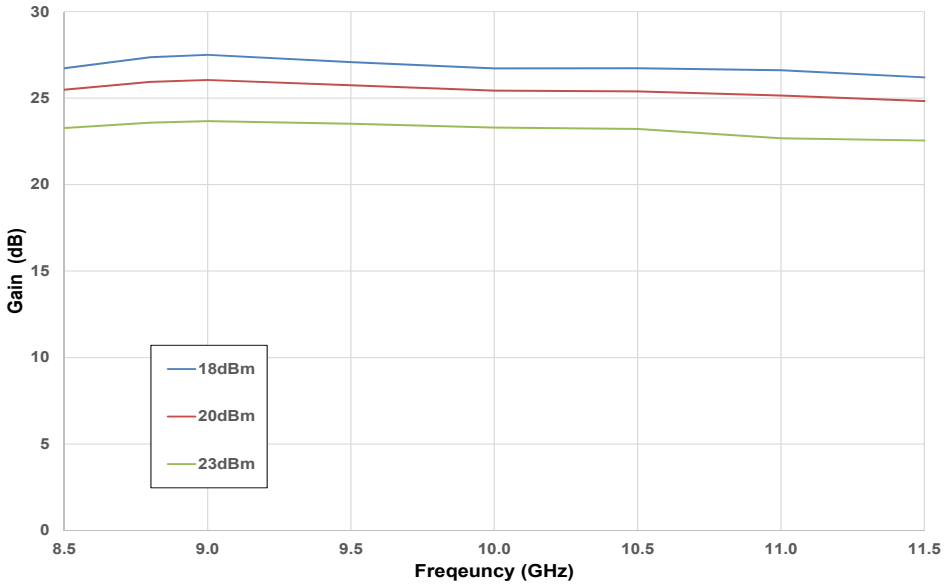

Figure 4. - CW Power Added Efficiency vs. Frequnecy as a Function of Input Power
V_{DD} = 28 V, I_{DQ} = 2.5 A

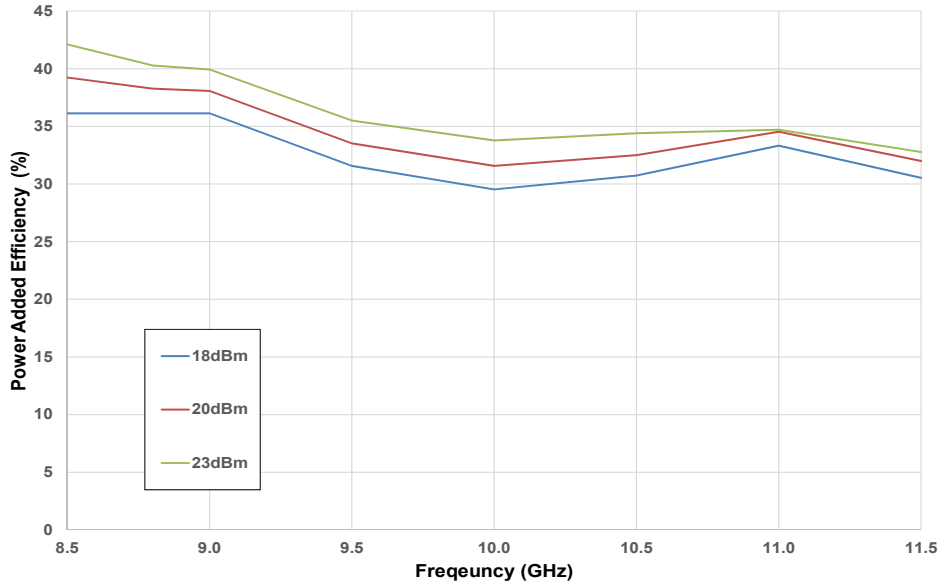

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Figure 5. - CW Output Power vs. Input Power as a Function of Frequency
V_{DD} = 28 V, I_{DQ} = 1.5 A

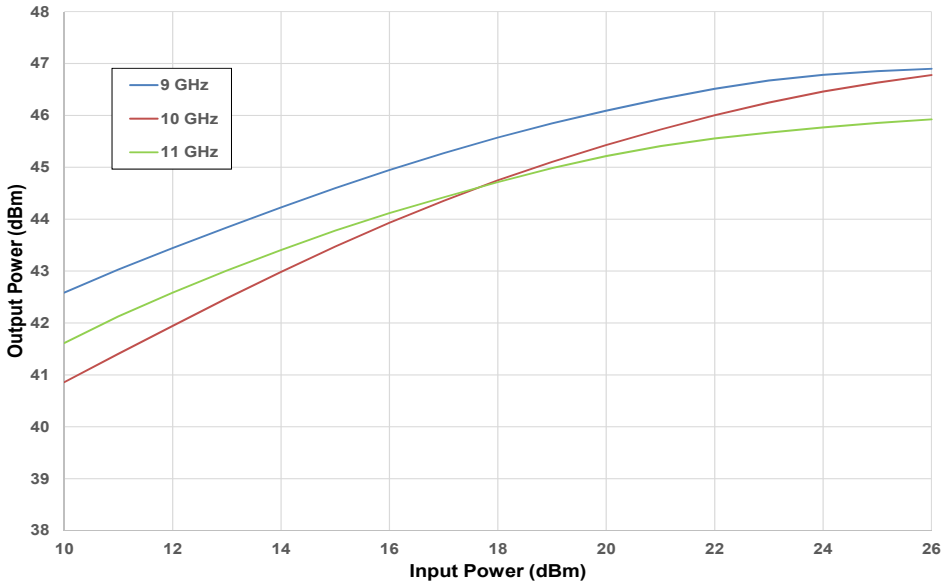

Figure 6. - CW Power Added Efficiency vs. Input Power as a Function of Frequency
V_{DD} = 28 V, I_{DQ} = 2.5 A

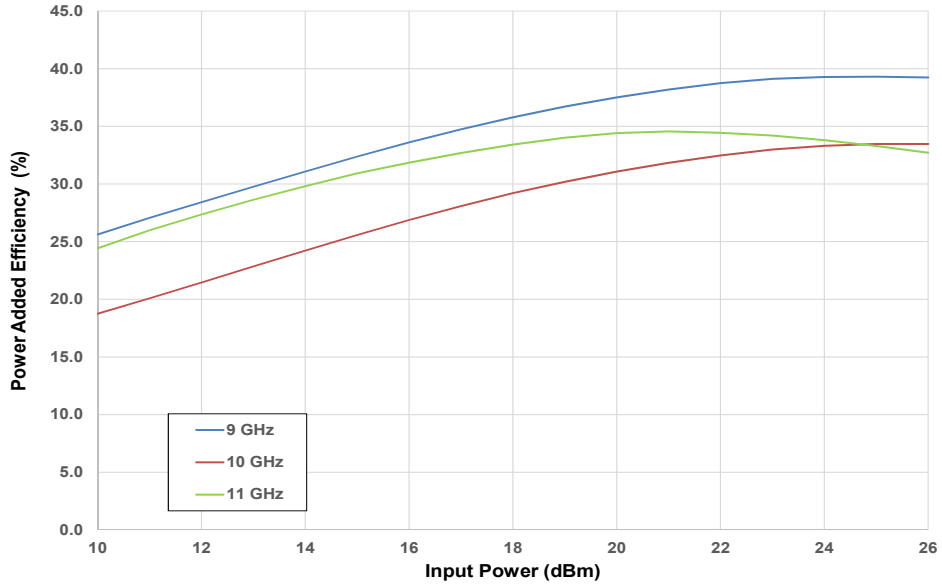

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Figure 7. - CW Gain vs. Input Power as a Function of Frequency
V_{DD} = 28 V, I_{DQ} = 1.5 A

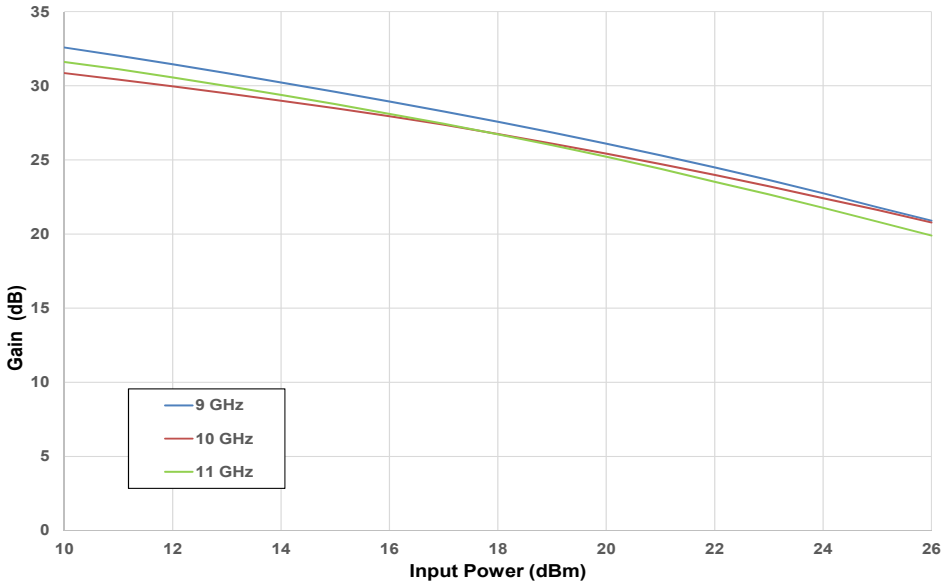

Figure 8. - Pulsed Output Power vs. Frequency as a Function of Input Power
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

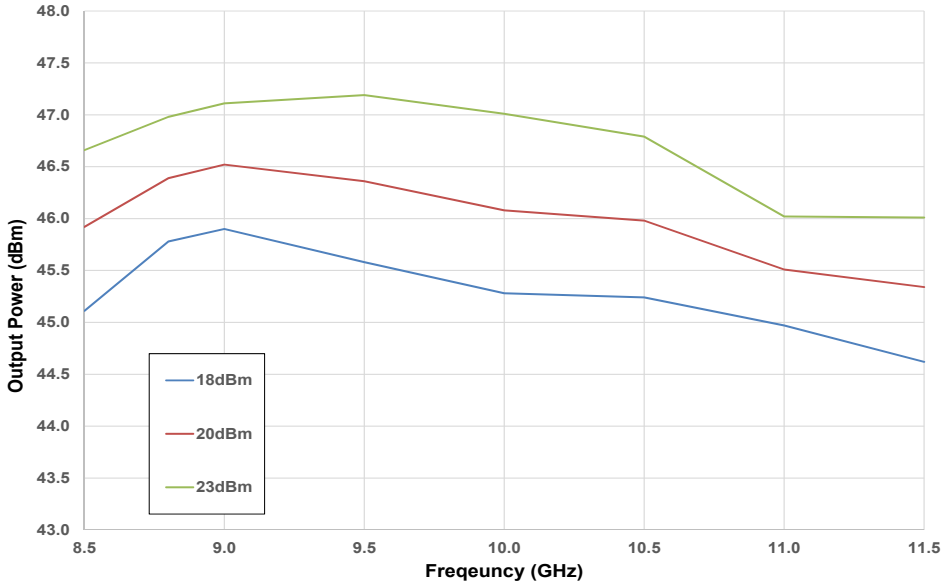

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Figure 9. - Pulsed Power Gain vs. Frequency
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

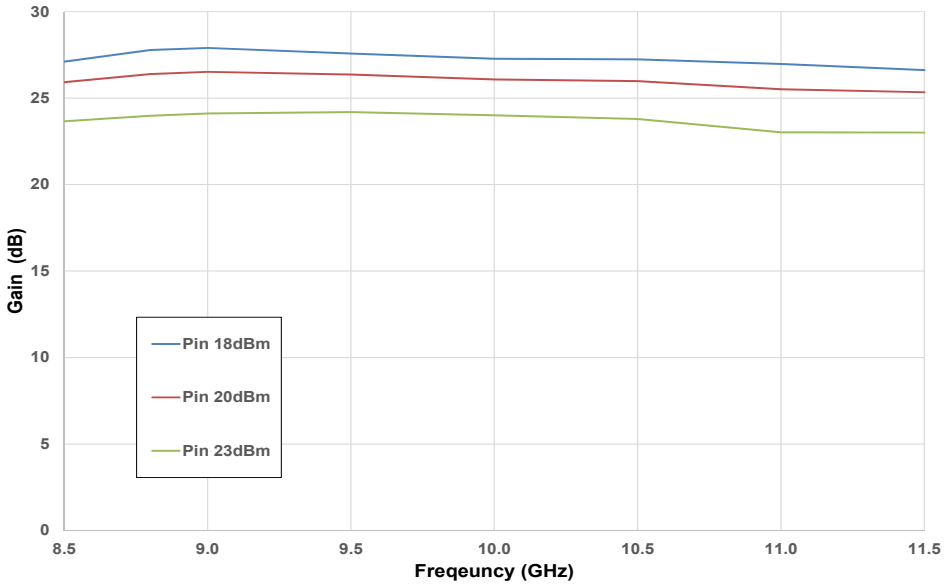

Figure 10. - Pulsed Power Added Efficiency vs. Frequency
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

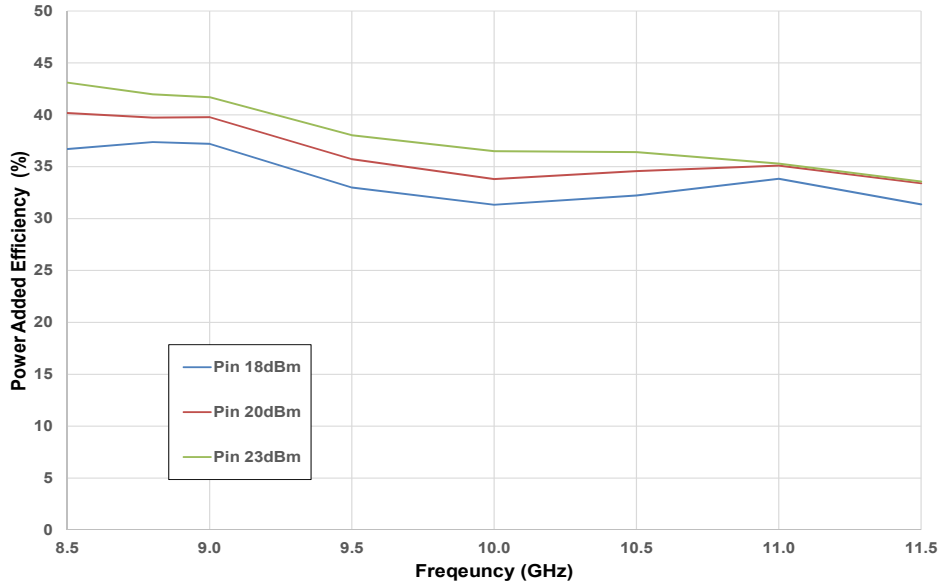

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Figure 11. - Pulsed Output Power vs. Input Power
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

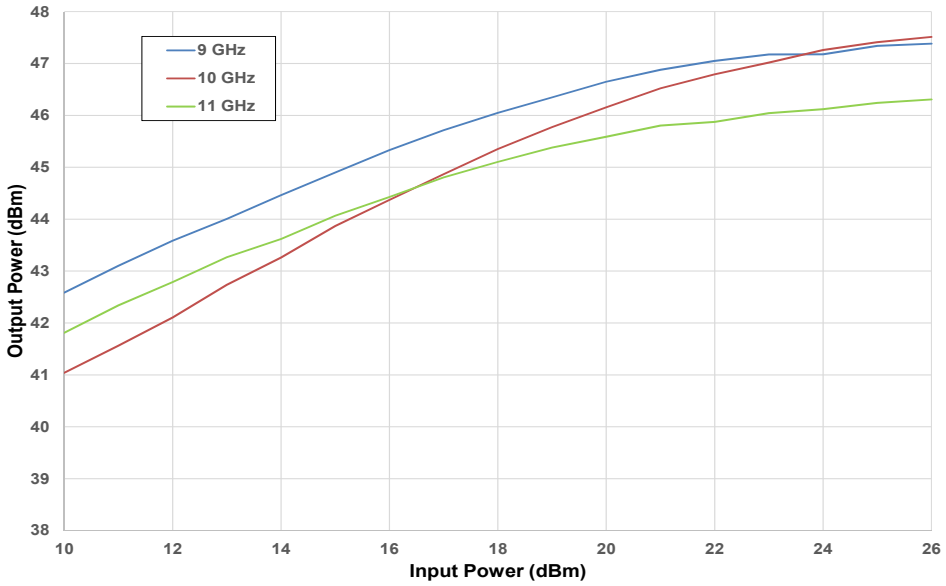

Figure 12. - Pulsed Power Added Efficiency vs. Input Power
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

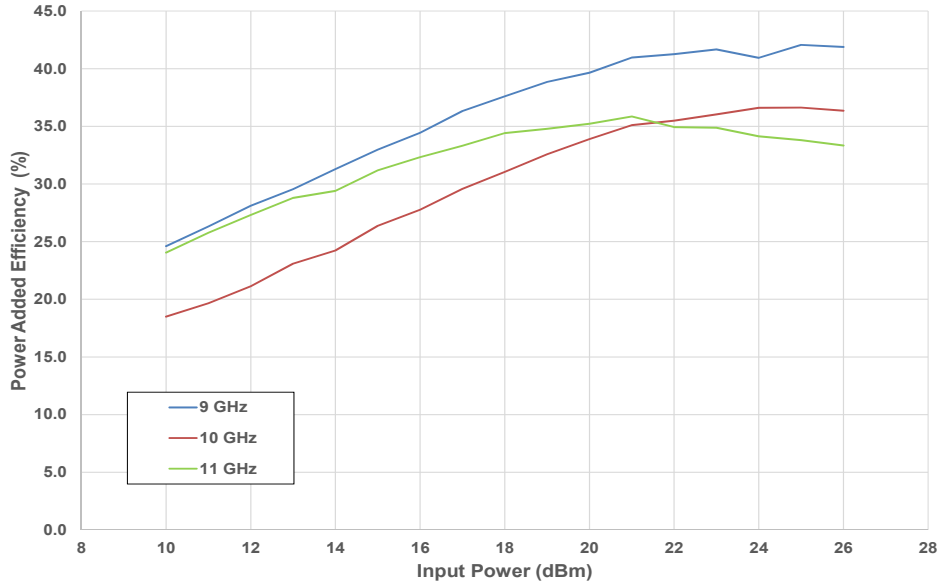

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Figure 13. - Pulsed Gain vs. Input Power
V_{DD} = 28 V, I_{DQ} = 1.5 A, Pulse Width = 100 µSec, Duty Cycle = 10%

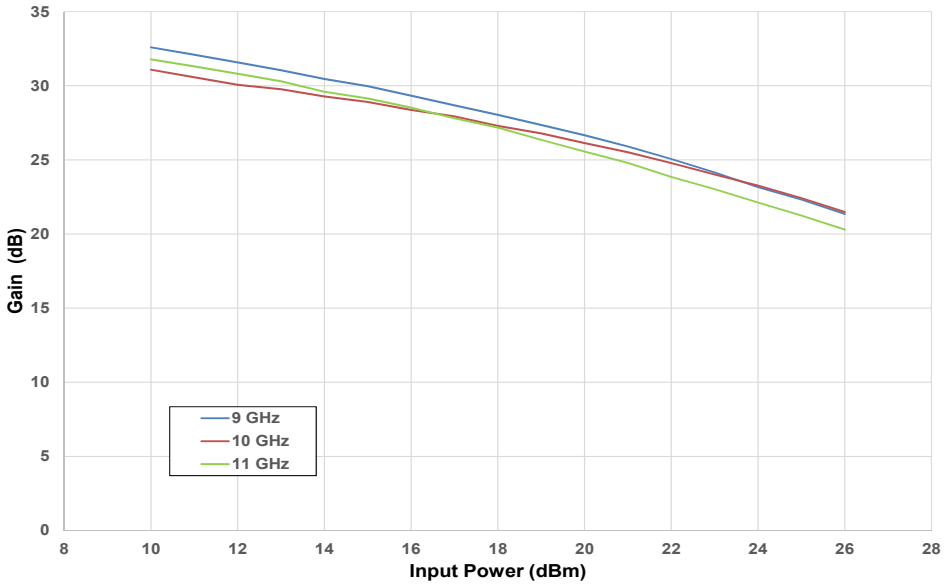

Figure 14. - Pulse Droop
V_{DD} = 28 V, I_{DQ} = 1.5 A, Frequency = 9.5 GHz, P_{IN} = 26 dBm

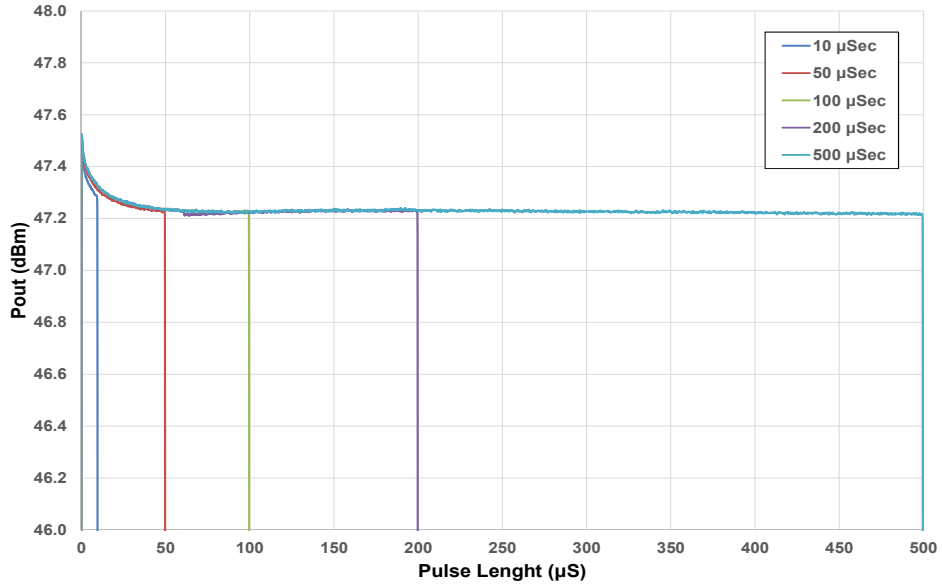

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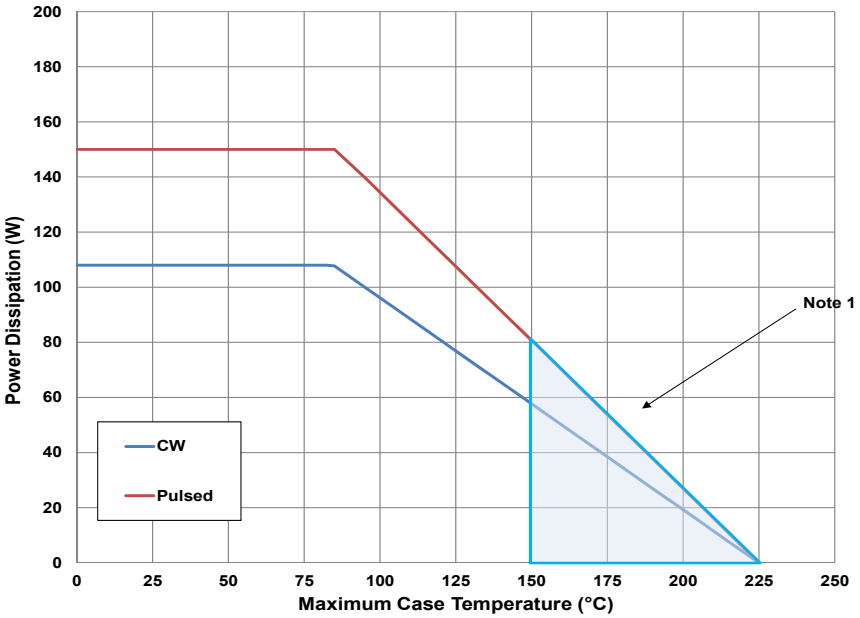
Figure 15. - Power Dissipation De-Rating Curve



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

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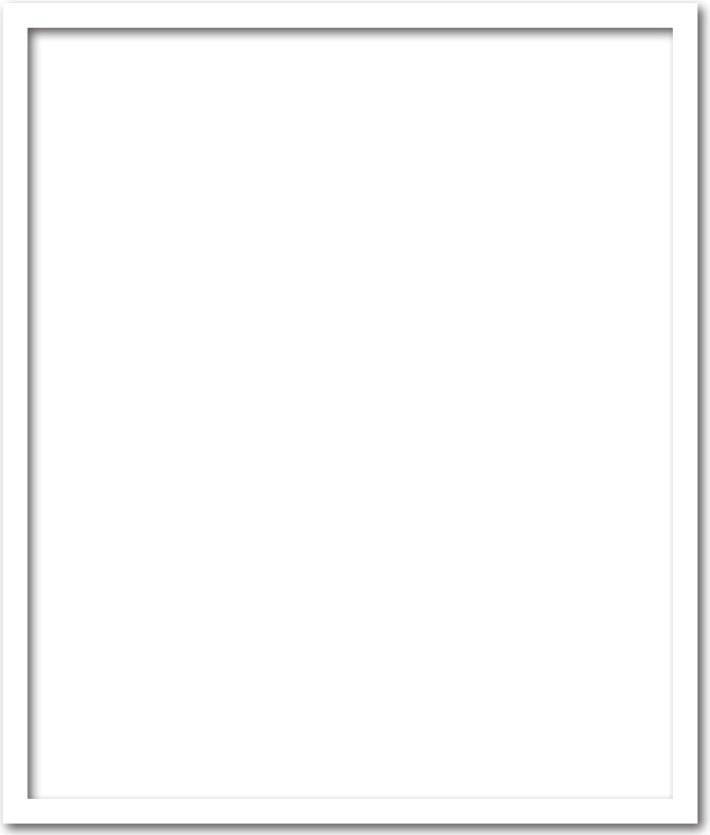
CMPA901A035F-AMP Demonstration Amplifier Circuit Bill of Materials

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	CMPA901A035F	1

CMPA901A035F-AMP Demonstration Amplifier Circuit



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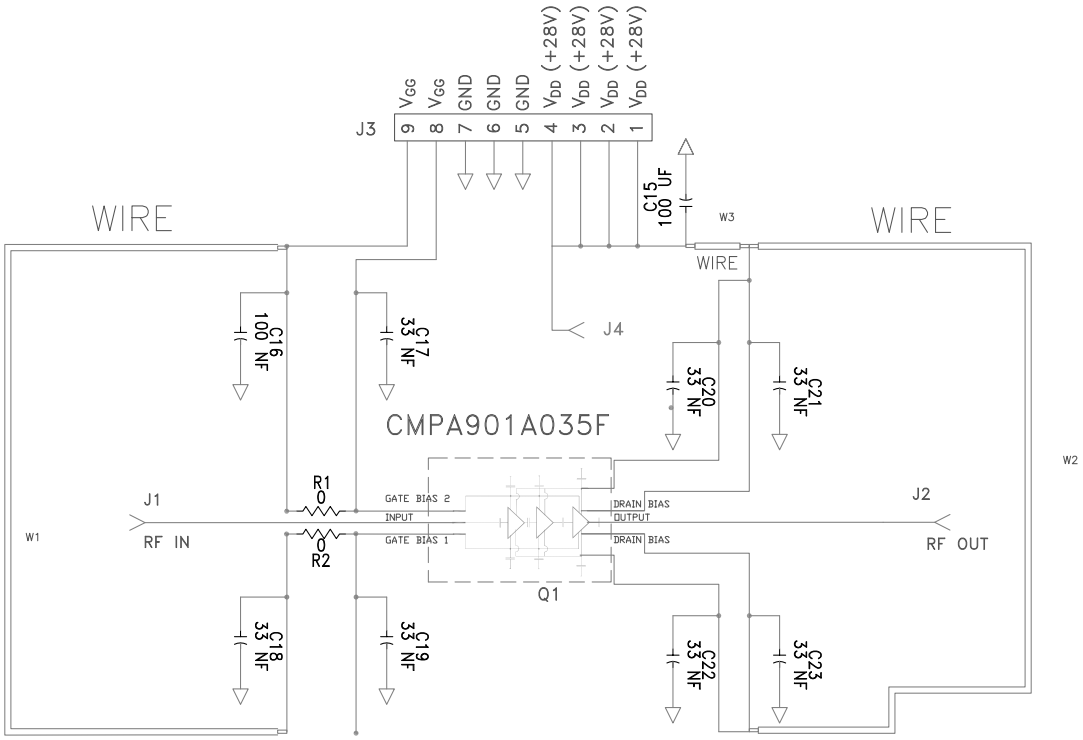
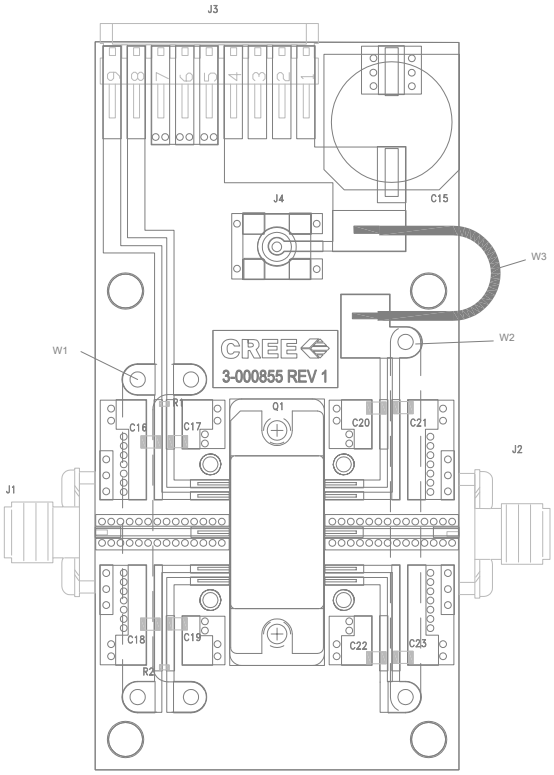
CMPA901A035F-AMP Demonstration Amplifier Circuit Schematic



CMPA901A035F-AMP Demonstration Amplifier Circuit Outline



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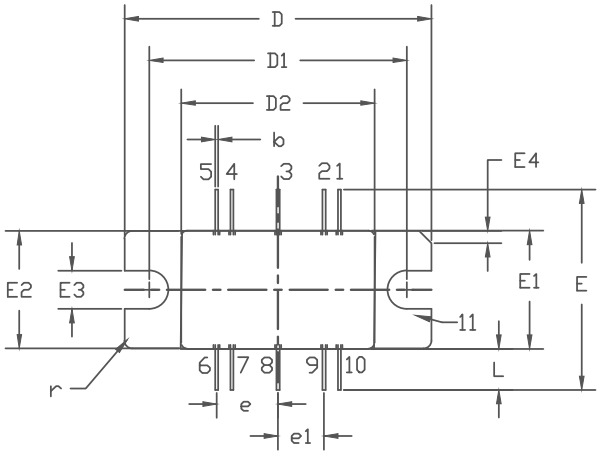
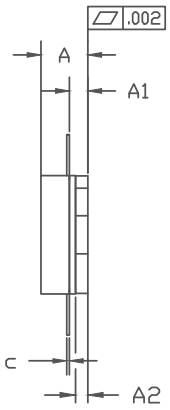
Product Dimensions CMPA901A035F





NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.

2. CONTROLLING DIMENSION: INCH.

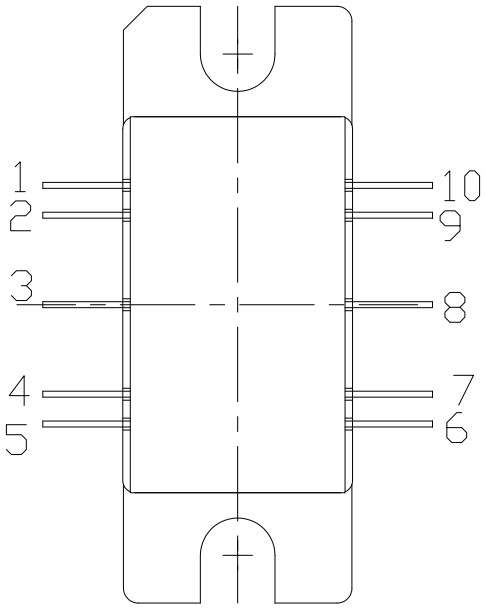
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

	INCHES		MILLIMETERS		NOTES
DIM	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 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

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



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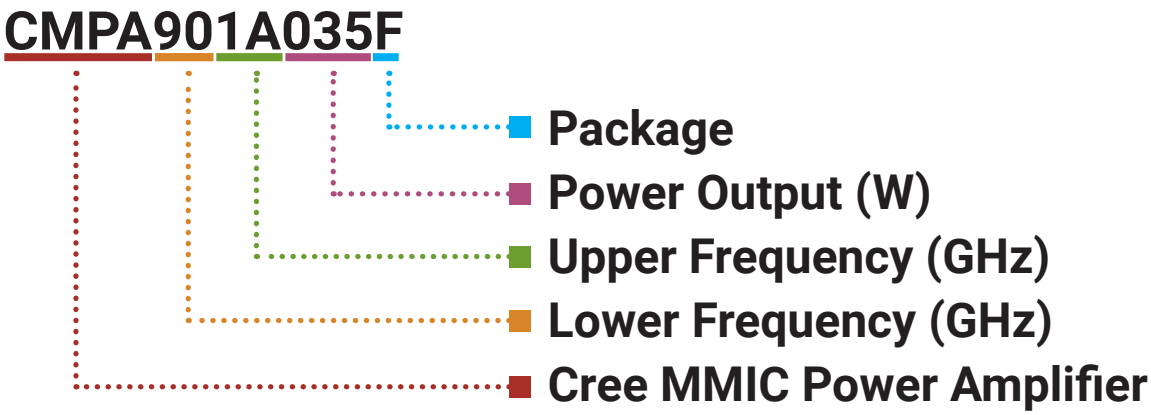
Part Number System



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

Table 1.

Note[1]: 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.

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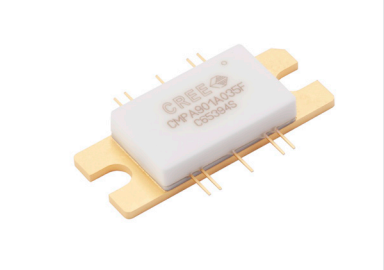
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA901A035F	GaN HEMT	Each	
CMPA901A035F-AMP	Test board with GaN HEMT installed	Each	

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