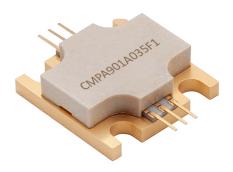


# CMPA901A035F1

## 35 W, 9.0 - 10 GHz, GaN MMIC, Power Amplifier

#### **Description**

The CMPA901A035F1 is a gallium nitride (GaN) monolithic microwave integrated circuit (MMIC) on a silicon carbide (SiC) substrate. The device provides 35 watts of output power across the band from 9 to 11 GHz. The GaN HEMT MMIC is fully matched to 50 Ohm, is housed in a compact, 6-lead metal/ceramic flanged package (Type: 440219), and offers high power, high gain, and superior efficiency. The CMPA901A035F1 is suitable for long pulse operation and capable of CW operation.



Package Type: 440219 PN's: CMPA901A035F1

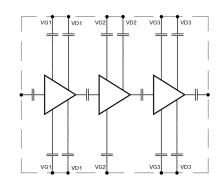
#### **Features**

- 35 W typical P<sub>SAT</sub> >38% typical power added efficiency
- 35 dB large signal gain
- High temperature operation

Note: Features are typical performance across frequency under 25 °C operation. Please reference performance charts for additional details.

#### **Applications**

Civil and military pulsed radar amplifiers



## Typical Performance Over 9.0 - 10.0 GHz ( $T_c = 25$ °C)

Parameter	9.0 GHz	9.5 GHz	10.0 GHz	Units
Small Signal Gain <sup>1,2</sup>	35.4	35.4	34.9	dB
Output Power <sup>1,3</sup>	46.6	47.0	46.6	dBm
Power Gain <sup>1,3</sup>	23.6	24.0	23.6	dB
Power Added Efficiency <sup>1,3</sup>	43	41	38	%

 $^{1}$ V $_{DD}$  = 28 V, I $_{DQ}$  = 1500 mA.



<sup>&</sup>lt;sup>2</sup> Measured at  $P_{IN}$  = -20 dBm. <sup>3</sup> Measured at  $P_{IN}$  = 23 dBm and 300 μs; duty cycle = 20%.



#### Absolute Maximum Ratings (Not Simultaneous) at 25 °C

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V <sub>DSS</sub>	84	V <sub>DC</sub>	25 °C
Gate-Source Voltage	V <sub>GS</sub>	-10, +2	V <sub>DC</sub>	25 ℃
Storage Temperature	T <sub>STG</sub>	-55, +150	°C	
Maximum Forward Gate Current	I <sub>G</sub>	19	mA	25 °C
Maximum Drain Current	I <sub>DMAX</sub>	5	Α	
Soldering Temperature	T <sub>s</sub>	260	°C	
Junction Temperature	T <sub>J</sub>	225	°C	MTTF > 1e6 Hours

## Electrical Characteristics (Frequency = 9.0 GHz to 10.0 GHz Unless Otherwise Stated; $T_c$ = 25 °C)

Characteristics	Symbol	Min.	Тур.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-3.6	-3.1	-2.4	V	$V_{DS} = 10 \text{ V, I}_{D} = 19.84 \text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V <sub>DC</sub>	V <sub>DD</sub> = 28 V, I <sub>DQ</sub> = 1500 mA
Saturated Drain Current <sup>1</sup>	I <sub>DS</sub>	14.28	19.84	-	Α	$V_{DS} = 6.0 \text{ V}, V_{GS} = 2.0 \text{ V}$
Drain-Source Breakdown Voltage	V <sub>BD</sub>	84	-	-	V	$V_{GS} = -8 \text{ V}, I_{D} = 19.84 \text{ mA}$
RF Characteristics <sup>2</sup>						
Small Signal Gain	S21 <sub>1</sub>	-	35.4	-	dB	$P_{IN} = -20 \text{ dBm}, \text{ Freq} = 9.0 - 10.0 \text{ GHz}$
Output Power	P <sub>OUT1</sub>	-	46.6	-	dBm	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, Freq = 9.0 \text{ GHz}$
Output Power	P <sub>OUT2</sub>	-	47.0	-	dBm	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, \text{ Freq} = 9.5 \text{ GHz}$
Output Power	Роитз	-	46.6	-	dBm	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, Freq = 10.0 GHz}$
Power Added Efficiency	PAE <sub>1</sub>	-	43	-	%	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, Freq = 9.0 \text{ GHz}$
Power Added Efficiency	PAE <sub>2</sub>	-	41	-	%	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, \text{ Freq} = 9.5 \text{ GHz}$
Power Added Efficiency	PAE <sub>3</sub>	-	38	-	%	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, \text{ Freq} = 10.0 \text{ GHz}$
Power Gain	G <sub>P1</sub>	-	23.6	-	dB	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, \text{Freq} = 9.0 \text{ GHz}$
Power Gain	G <sub>P2</sub>	-	24.0	-	dB	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, \text{ Freq} = 9.5 \text{ GHz}$
Power Gain	G <sub>P3</sub>	-	23.6	-	dB	$V_{DD} = 28 \text{ V}, I_{DQ} = 1500 \text{ mA}, P_{IN} = 23 \text{ dBm}, Freq = 10.0 GHz}$
Input Return Loss	S11	-		-	dB	P <sub>IN</sub> = -20 dBm, 9.0 - 10.0 GHz
Output Return Loss	S22	-		-	dB	P <sub>IN</sub> = -20 dBm, 9.0 - 10.0 GHz
Output Mismatch Stress	VSWR	-		-	Ψ	No Damage at All Phase Angles

Notes:

#### **Thermal Characteristics**

Parameter	Symbol	Rating	Units	Conditions
Operating Junction Temperature	T <sub>J</sub>	167	°C	Pulse Width = 300 μs, Duty Cycle = 20%,
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.23	°C/W	$P_{DISS} = 67 \text{ W}, T_{CASE} = 85 ^{\circ}\text{C}$

<sup>&</sup>lt;sup>1</sup> Scaled from PCM data.

 $<sup>^2</sup>$  Unless otherwise noted: Pulse width = 300  $\mu s,$  duty cycle = 20%.



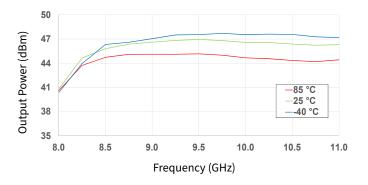


Figure 1. Output Power vs Frequency as a **Function of Temperature** 

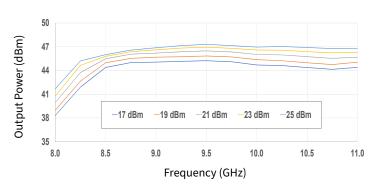


Figure 2. Output Power vs Frequency as a **Function of Input Power** 

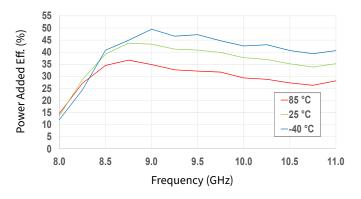


Figure 3. Power Added Eff. vs Frequency as a **Function of Temperature** 

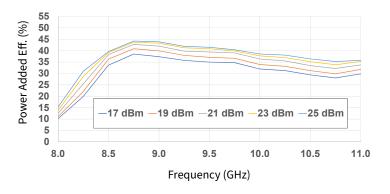


Figure 4. Power Added Eff. vs Frequency as a **Function of Input Power** 

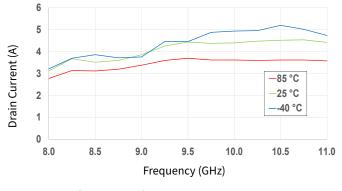


Figure 5. Drain Current vs Frequency as a **Function of Temperature** 

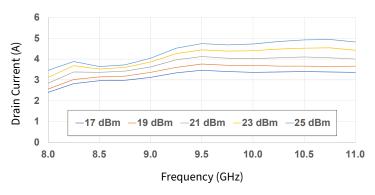
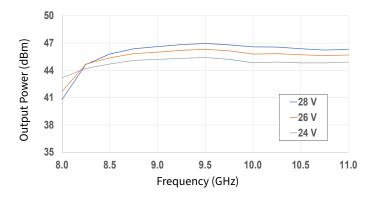


Figure 6. Drain Current vs Frequency as a **Function of Input Power** 

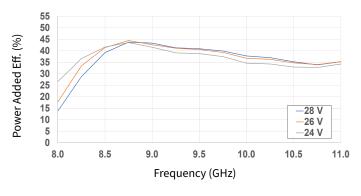




50 Output Power (dBm) 47 44 41 -1500 mA -750 mA 38 -375 mA 35 8.0 8.5 9.0 9.5 10.0 10.5 11.0 Frequency (GHz)

Figure 7. Output Power vs Frequency as a Function of V<sub>D</sub>

Figure 8. Output Power vs Frequency as a Function of I<sub>DO</sub>



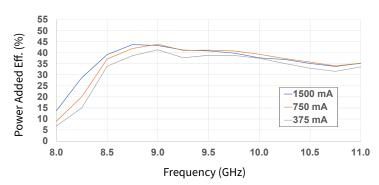
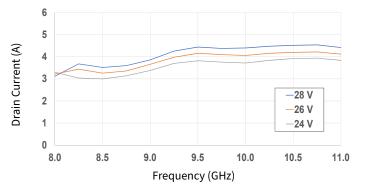


Figure 9. Power Added Eff. vs Frequency as a Function of V<sub>D</sub>

Figure 10. Power Added Eff. vs Frequency as a Function of Inc.



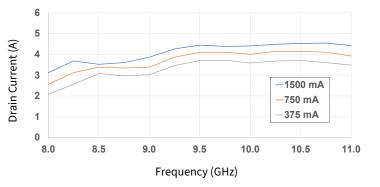


Figure 11. Drain Current vs Frequency as a Function of V<sub>D</sub>

Figure 12. Drain Current vs Frequency as a Function of I<sub>DO</sub>



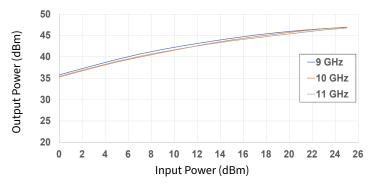


Figure 13. Output Power vs Input Power as a Function of Frequency

Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

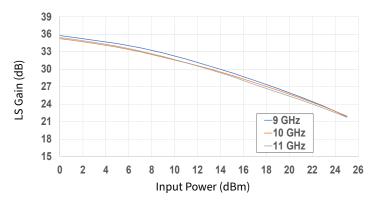
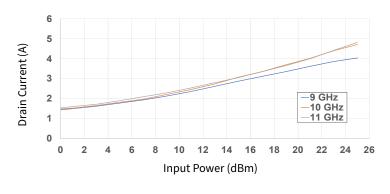


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

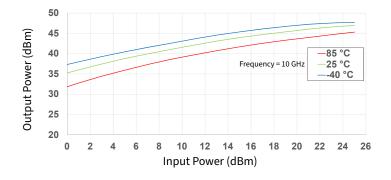


0.10 0.08 Gate Current (mA) 0.06 0.04 0.02 0.00 -0.02 -0.04 -0.06 10 GHz -0.08 11 GHz -0.10 16 20 22 Input Power (dBm)

Figure 16. Drain Current vs Input Power as a Function of Frequency

Figure 17. Gate Current vs Input Power as a Function of Frequency





50 Power Added Eff. (%) 45 40 35 30 25 20 85 °C 15 10 25 °C -40 °C 0 12 16 18 20 22 Input Power (dBm)

Figure 18. Output Power vs Input Power as a Function of Temperature

Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

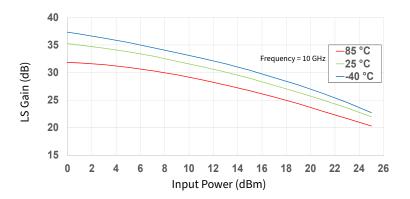


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

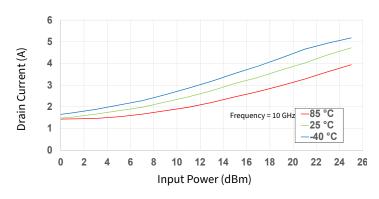


Figure 21. Drain Current vs Input Power as a Function of Temperature

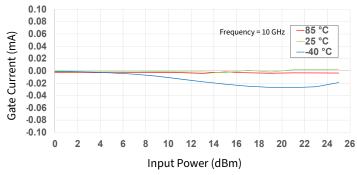
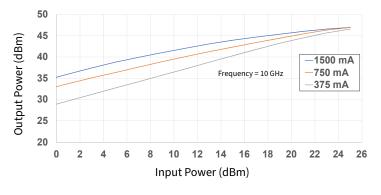


Figure 22. Gate Current vs Input Power as a Function of Temperature





55 50 Power Added Eff. (%) 45 40 35 30 25 20 1500 mA 750 mA 15 Frequency = 10 GHz 10 375 mA 0 Input Power (dBm)

Figure 23. Output Power vs Input Power as a Function of I<sub>DO</sub>

Figure 24. Power Added Eff. vs Input Power as a Function of I<sub>DO</sub>

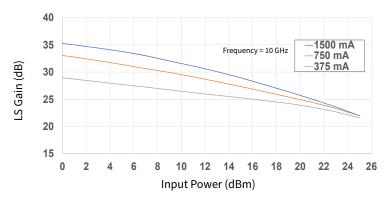


Figure 25. Large Signal Gain vs Input Power as a Function of I

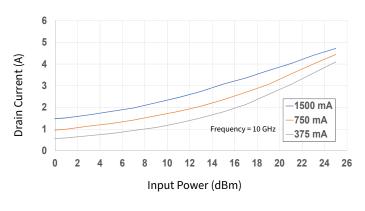


Figure 26. Drain Current vs Input Power as a Function of  $I_{DO}$ 

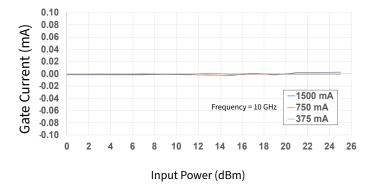


Figure 27. Gate Current vs Input Power as a Function of  $I_{DQ}$ 



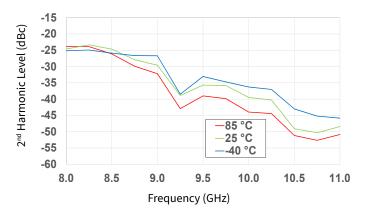


Figure 28. 2<sup>nd</sup> Harmonic vs Frequency as a Function of Temperature

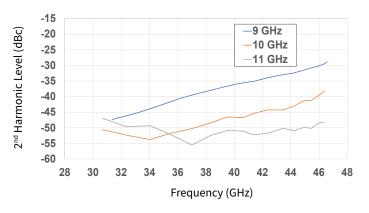


Figure 29. 2<sup>nd</sup> Harmonic vs Output Power as a Function of Frequency

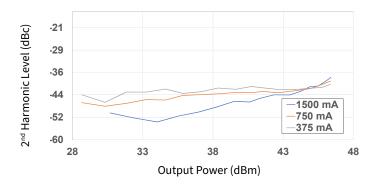


Figure 30.  $2^{nd}$  Harmonic vs Output Power as a Function of  $I_{no}$ 



Test conditions unless otherwise noted:  $V_D = 28 \text{ V}$ ,  $I_{DO} = 1500 \text{ mA}$ ,  $P_{IN} = -20 \text{ dBm}$ ,  $T_{BASE} = +25 ^{\circ}\text{C}$ 

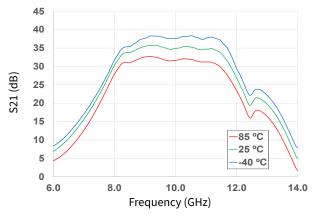


Figure 31. Gain vs Frequency as a Function of Temperature

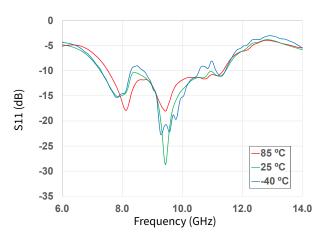


Figure 33. Input RL vs Frequency as a Function of Temperature

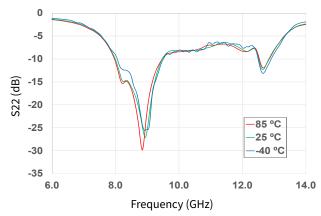


Figure 35. Output RL vs Frequency as a Function of Temperature

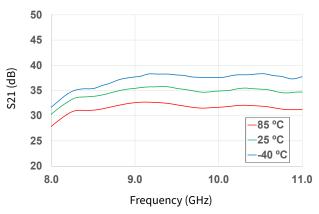


Figure 32. Gain vs Frequency as a Function of Temperature

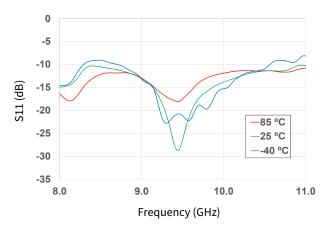


Figure 34. Input RL vs Frequency as a Function of Temperature

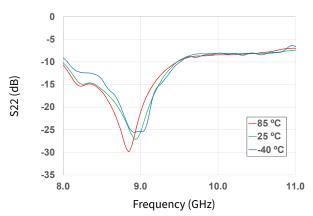


Figure 36. Output RL vs Frequency as a Function of Temperature



Test conditions unless otherwise noted:  $V_D = 28 \text{ V}$ ,  $I_{DO} = 1500 \text{ mA}$ ,  $P_{IN} = -20 \text{ dBm}$ ,  $T_{BASE} = +25 ^{\circ}\text{C}$ 

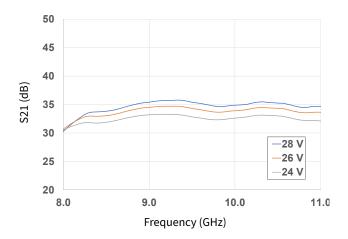


Figure 37. Gain vs Frequency as a Function of Voltage

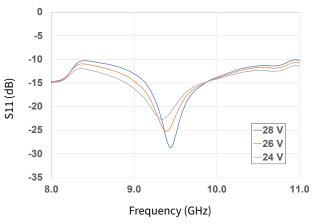


Figure 39. Input RL vs Frequency as a Function of Voltage

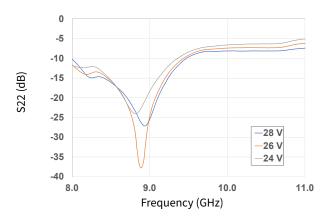


Figure 41. Output RL vs Frequency as a Function of Voltage

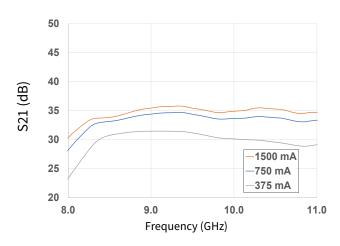


Figure 38. Gain vs Frequency as a Function of I<sub>DO</sub>

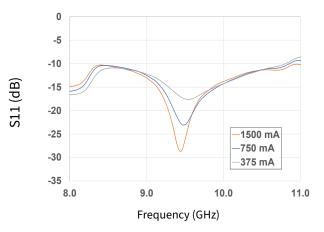


Figure 40. Input RL vs Frequency as a Function of I<sub>DO</sub>

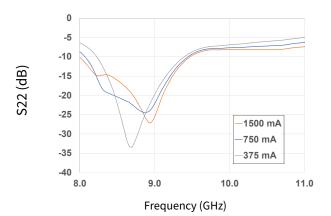
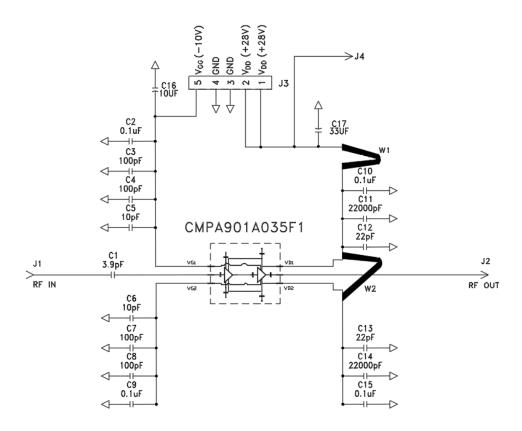


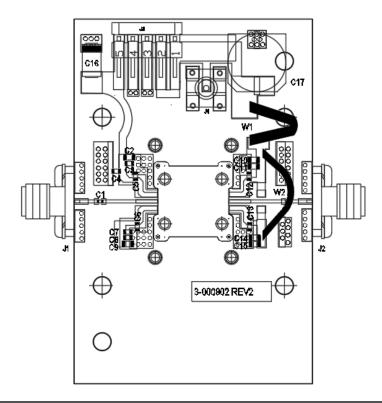
Figure 42. Output RL vs Frequency as a Function of  $I_{DO}$ 



#### CMPA901A035F1-AMP Evaluation Board Schematic



#### **CMPA901A035F1-AMP Evaluation Board Outline**





#### CMPA901A035F1-AMP Evaluation Board Bill of Materials

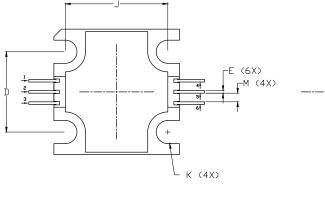
Designator	Description	Qty
C1	CAP, 3.9 pF, +/-0.1 pF, 0402, ATC	1
C2, C9, C10, C15	CAP CER 0.1 UF 100 V 10% X7R 0805	4
C3, C4, C7, C8	CAP, 100.0 pF, +/-5%, 0603, ATC	4
C5, C6	CAP, 10.0 pF, +/-5%, 0603, ATC	2
C11, C14	CAP CER 2200 pF 100 V 10% X7R 0805	2
C12, C13	CAP, 22 pF, +/-5%, 0603, ATC	2
C16	CAP 10 UF 16 V TANTALUM, 2312	1
C17	CAP, 33 UF, 20%, G CASE	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
W1, W2	WIRE, BLACK, 22 AWG	2
-	#2 SPLIT LOCKWASHER SS	4
-	PCB Board 2.6" x 1.7", TACONIC RF35, 0.01", 440219 package	1
-	BASEPLATE, AL, 2.60 x 1.70 x 2.50	1
-	2-56 SOC HD SCREW 3/16 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	MMIC CMPA901A035F1	1

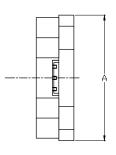
## **Electrostatic Discharge (ESD) Classifications**

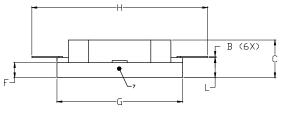
Parameter	Symbol	Class	Test Methodology
Human Body Model	НВМ	1B (≥ 500 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (≥ 200 V)	JEDEC JESD22 C101-C

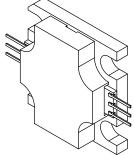


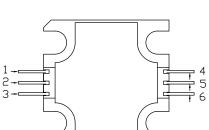
### Product Dimensions CMPA901A035F1 (Package 440219)











NOT TO SCALE

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
Α	0.495	0.505	12.57	12.82
В	0.003	0.005	0.076	0.127
С	0.140	0.160	3.56	4.06
D	0.315	0.325	8.00	8.25
Е	0.008	0.012	0.204	0.304
F	0.055	0.065	1.40	1.65
G	0.495	0.505	12.57	12.82
Н	0.695	0.705	17.65	17.91
J	0.403	0.413	10.24	10.49
K	ø.	092	2.3	34
L	0.075	0.085	1.905	2.159
М	0.032	0.040	0.82	1.02

Pin	Desc.
1	Gate 1
2	RF_IN
3	Gate 2
4	Drain 1
5	RF_OUT
6	Drain 2



#### **Part Number System**

## CMPA901A035F1

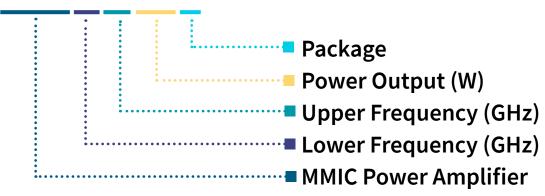


Table 1.

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

Note:

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

Table 2.

Character Code	Code Value
A	0
В	1
С	2
D	3
Е	4
F	5
G	6
Н	7
J	8
К	9
Examples:	1 A = 10.0 GHz 2 H = 27.0 GHz



### **Product Ordering Information**

Order Number	Description	Unit of Measure	Image
CMPA901A035F1	GaN HEMT	Each	CHRAGUAGIST 1
CMPA901A035F1-AMP	Test board with GaN MMIC installed	Each	



#### Notes & Disclaimer

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.