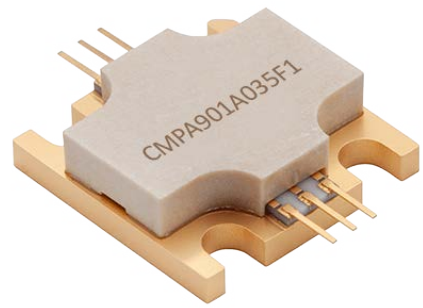
CMPA901A035F1

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

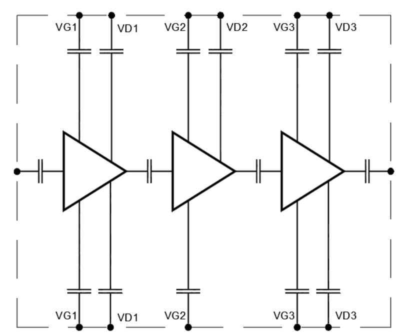
Features

- 35 W typical P_{SAT}
- >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[1,2]	35.4	35.4	34.9	dB
Output Power[1,3]	46.6	47.0	46.6	dBm
Power Gain[1,3]	23.6	24.0	23.6	dB
Power Added Efficiency[1,3]	43	41	38	%

Notes:
[1] V_{DD} = 28 V, I_{DQ} = 1500 mA.
[2] Measured at P_{IN} = -20 dBm.
[3] Measured at P_{IN} = 23 dBm and 300 µs; duty cycle = 20%.

RoHS compliant

Rev. 0.1, SEPTEMBER 2023

Absolute Maximum Ratings (Not Simultaneous) at 25 °C

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	84	V_{DC}	25 °C
Gate-Source Voltage	V_{GS}	-10, +2	V_{DC}	25 °C
Storage Temperature	T_{STG}	-55, +150	°C	
Maximum Forward Gate Current	I_G	19	mA	25 °C
Maximum Drain Current	I_{DMAX}	5	A	
Soldering Temperature	T_S	260	°C	
Junction Temperature	T_J	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.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(TH)}$	-3.6	-3.1	-2.4	V	V_{DS} = 10 V, I_D = 19.84 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DD} = 28 V, I_{DQ} = 1500 mA
Saturated Drain Current[1]	I_{DS}	14.28	19.84	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	84	–	–	V	V_{GS} = -8 V, I_D = 19.84 mA
RF Characteristics[2]						
Small Signal Gain	$S21_1$	–	35.4	–	dB	P_{IN} = -20 dBm, Freq = 9.0 - 10.0 GHz
Output Power	P_{OUT1}	–	46.6	–	dBm	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.0 GHz
Output Power	P_{OUT2}	–	47.0	–	dBm	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.5 GHz
Output Power	P_{OUT3}	–	46.6	–	dBm	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 10.0 GHz
Power Added Efficiency	PAE_1	–	43	–	%	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.0 GHz
Power Added Efficiency	PAE_2	–	41	–	%	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.5 GHz
Power Added Efficiency	PAE_3	–	38	–	%	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 10.0 GHz
Power Gain	G_{P1}	–	23.6	–	dB	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.0 GHz
Power Gain	G_{P2}	–	24.0	–	dB	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.5 GHz
Power Gain	G_{P3}	–	23.6	–	dB	V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 10.0 GHz
Input Return Loss	S11	–		–	dB	P_{IN} = -20 dBm, 9.0 - 10.0 GHz
Output Return Loss	S22	–		–	dB	P_{IN} = -20 dBm, 9.0 - 10.0 GHz
Output Mismatch Stress	VSWR	–		–	Ψ	No Damage at All Phase Angles

Notes:
[1] Scaled from PCM data.
[2] Unless otherwise noted: Pulse width = 300 µs, duty cycle = 20%.

Thermal Characteristics

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

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

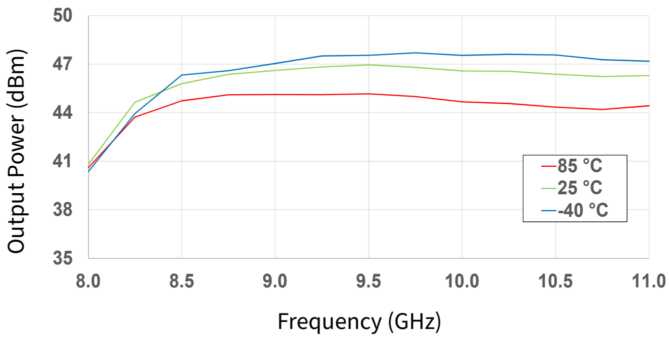


Figure 1. Output Power vs Frequency as a Function of Temperature

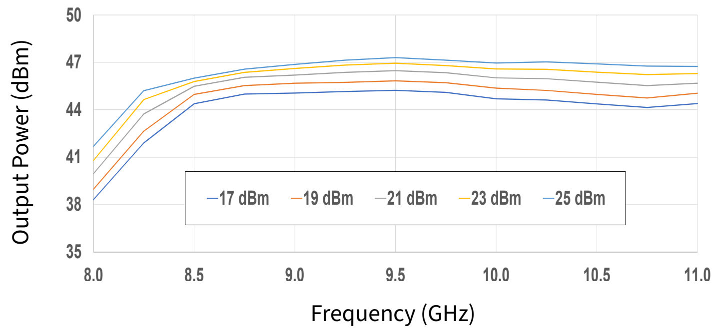


Figure 2. Output Power vs Frequency as a Function of Input Power

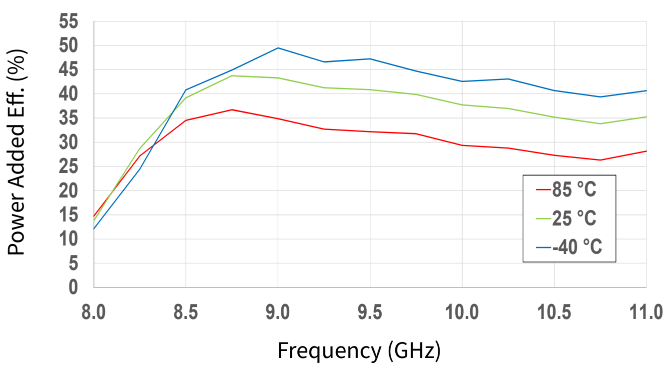


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

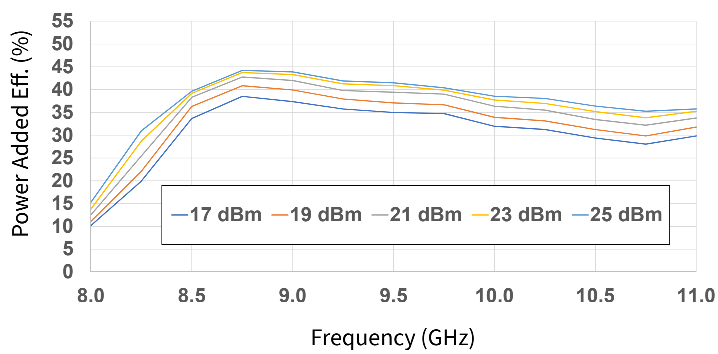


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

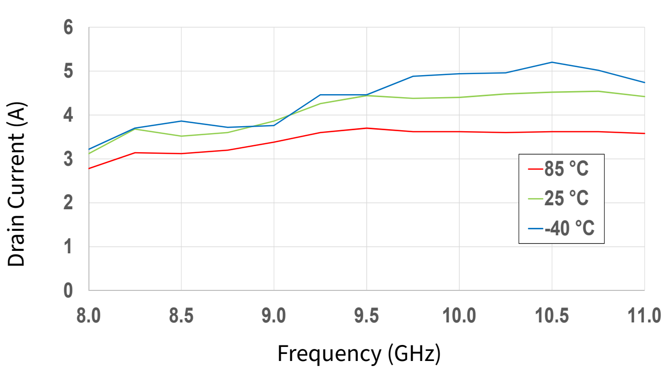


Figure 5. Drain Current vs Frequency as a Function of Temperature

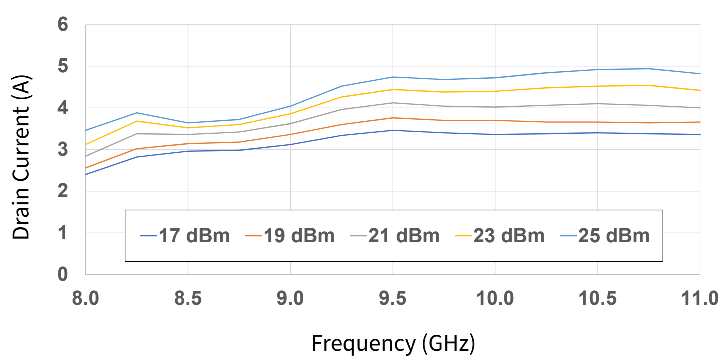


Figure 6. Drain Current vs Frequency as a Function of Input Power

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Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

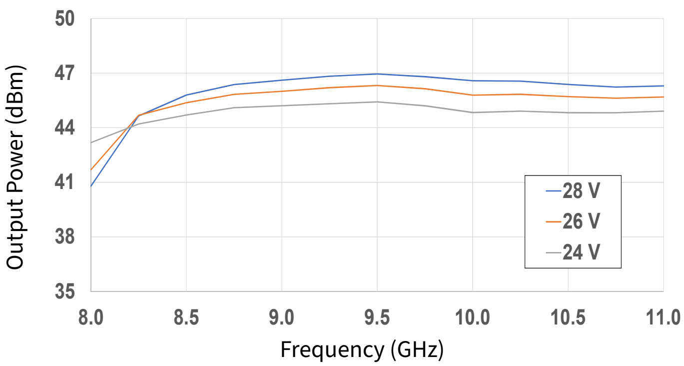


Figure 7. Output Power vs Frequency as a Function of V_D

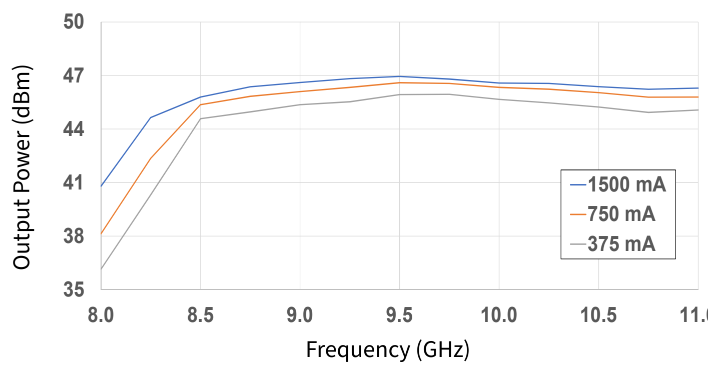


Figure 8. Output Power vs Frequency as a Function of I_{DQ}

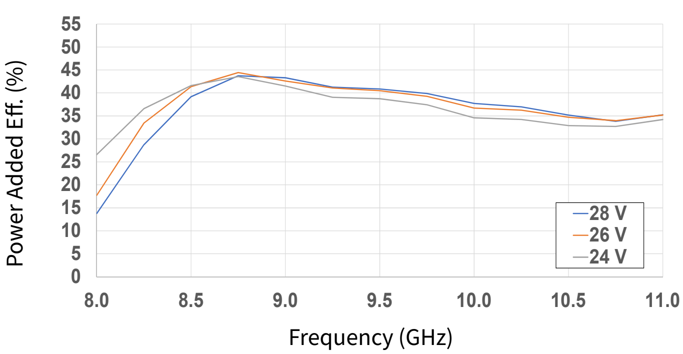


Figure 9. Power Added Eff. vs Frequency as a Function of V_D

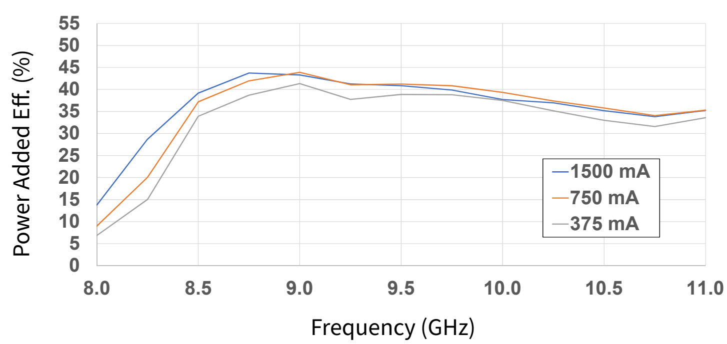


Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

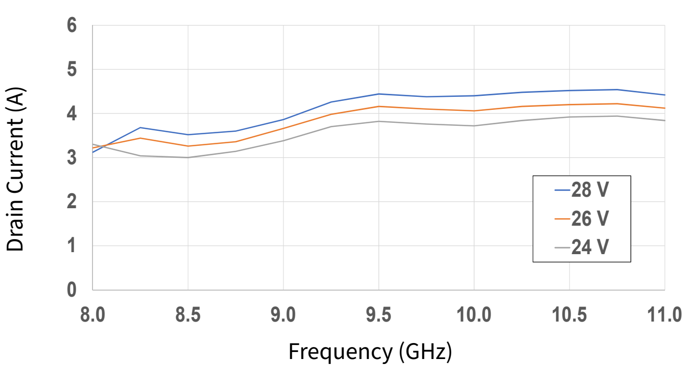


Figure 11. Drain Current vs Frequency as a Function of V_D

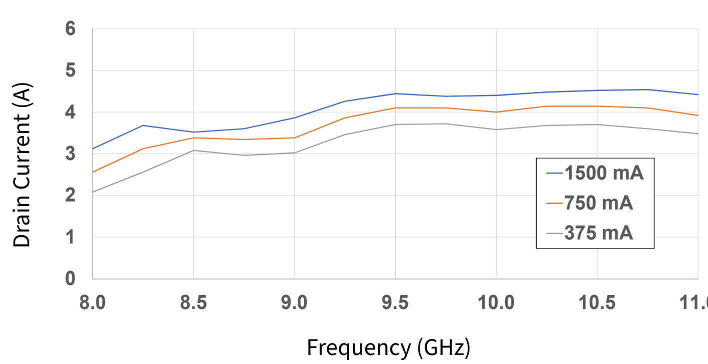


Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

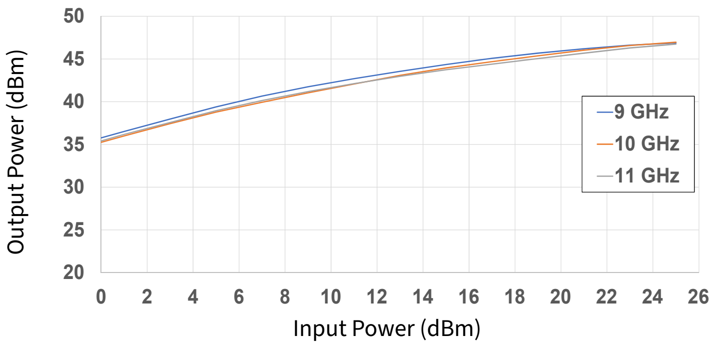


Figure 13. Output Power vs Input Power as a Function of Frequency

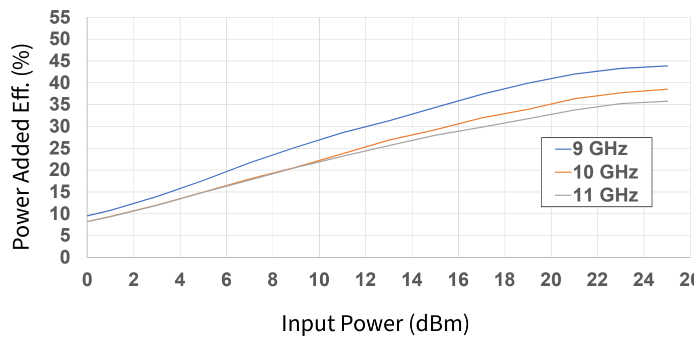


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

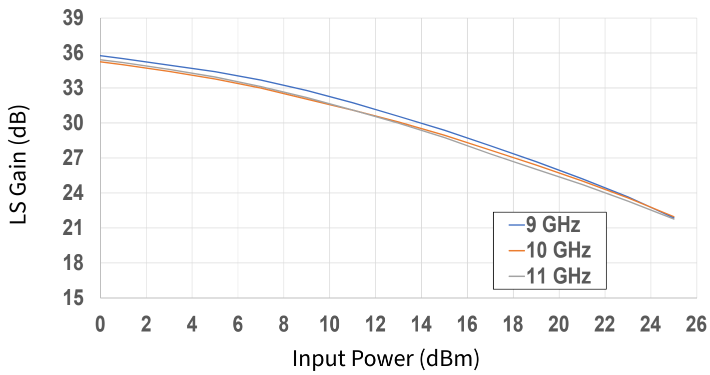


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

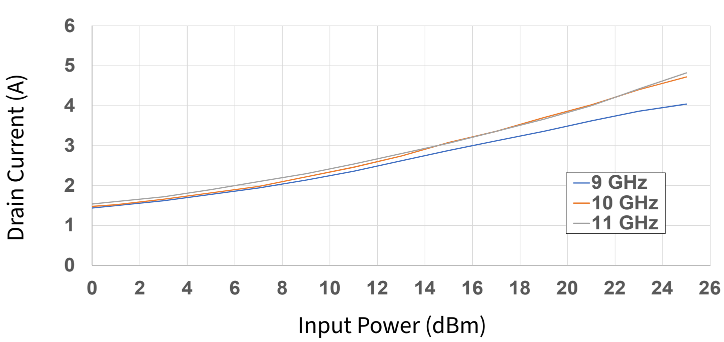


Figure 16. Drain Current vs Input Power as a Function of Frequency

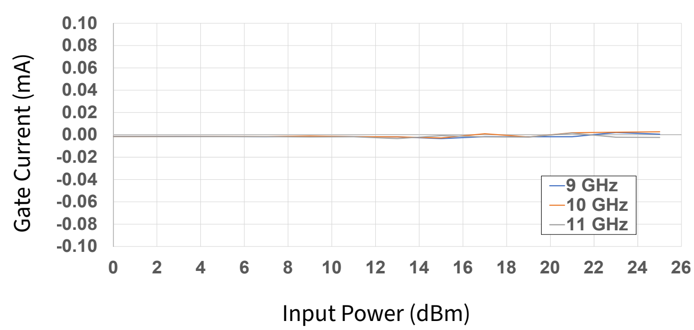


Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

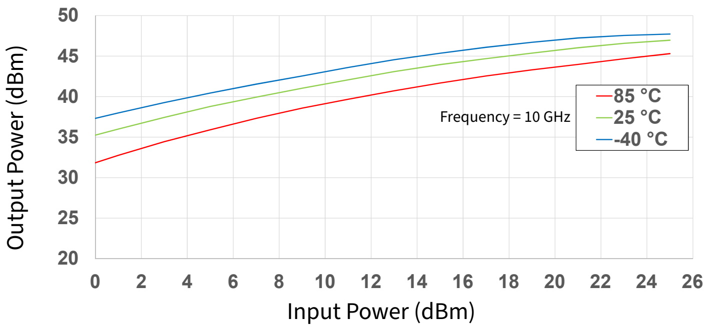


Figure 18. Output Power vs Input Power as a Function of Temperature

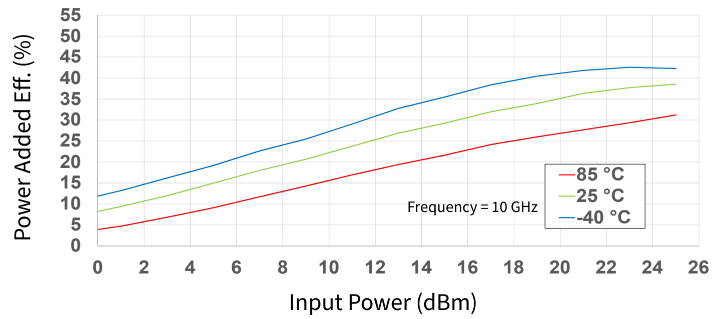


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

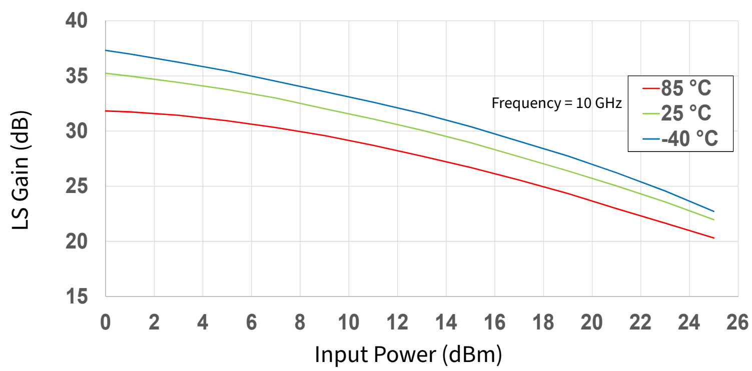


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

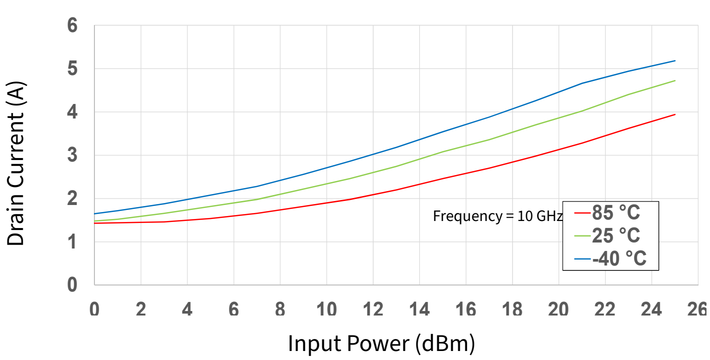


Figure 21. Drain Current vs Input Power as a Function of Temperature

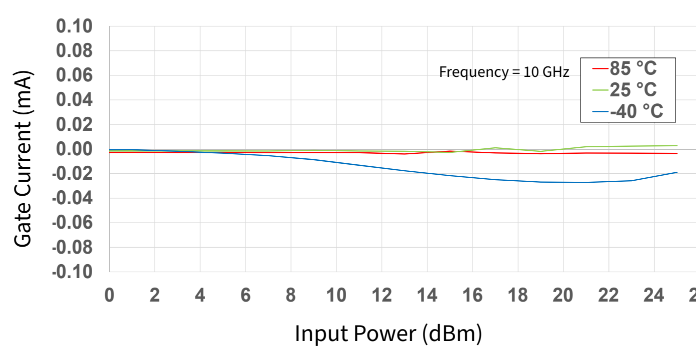


Figure 22. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

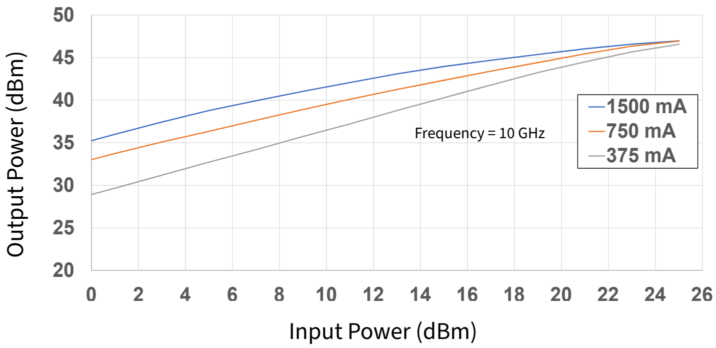


Figure 23. Output Power vs Input Power as a Function of I_{DQ}

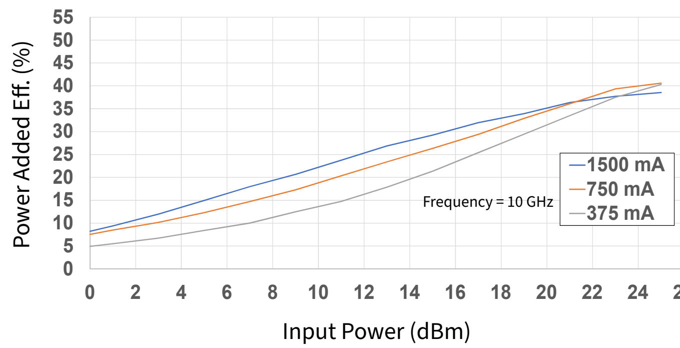


Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

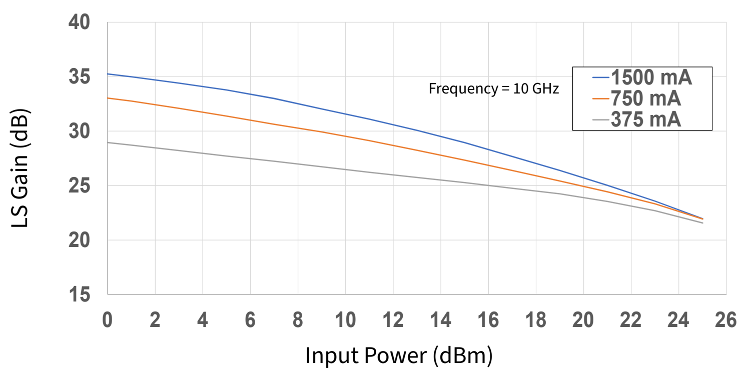


Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

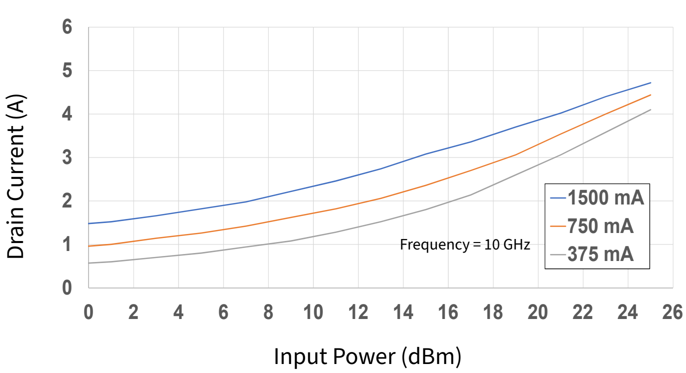


Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

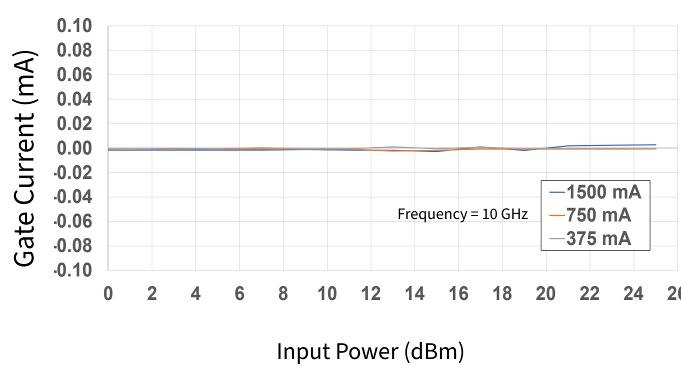


Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, pulse width = 300 µs, duty cycle = 20%, P_{IN} = 23 dBm, T_{BASE} = +25 °C

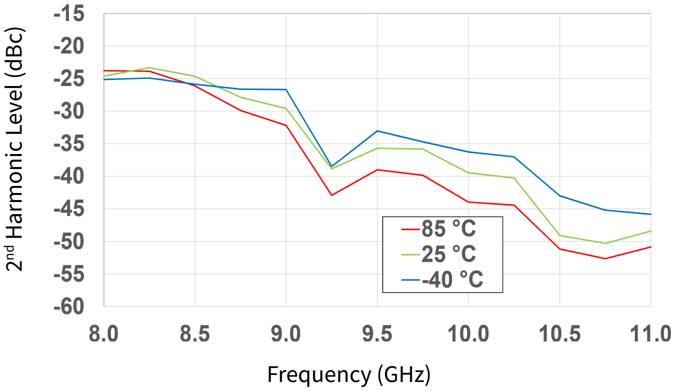


Figure 28. 2nd Harmonic vs Frequency as a Function of Temperature

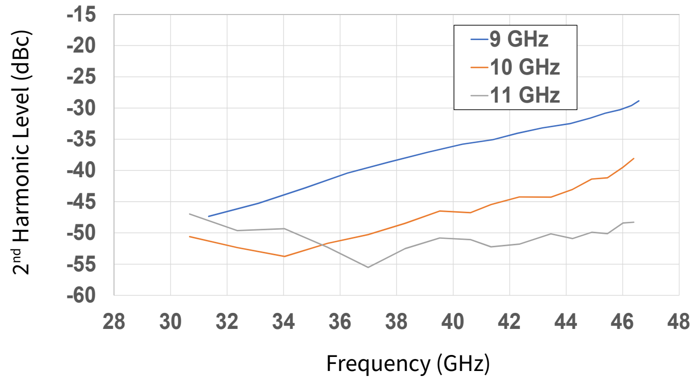


Figure 29. 2nd Harmonic vs Output Power as a Function of Frequency

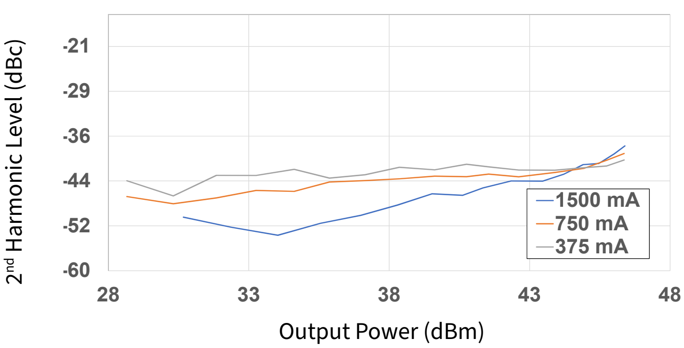


Figure 30. 2nd Harmonic vs Output Power as a Function of I_{DQ}

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, P_{IN} = -20 dBm, T_{BASE} = +25 °C

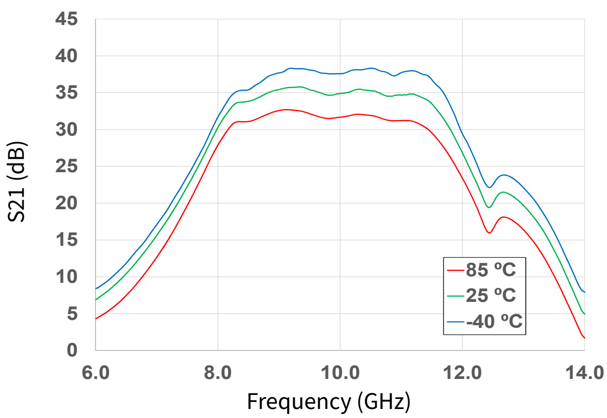


Figure 31. Gain vs Frequency as a Function of Temperature

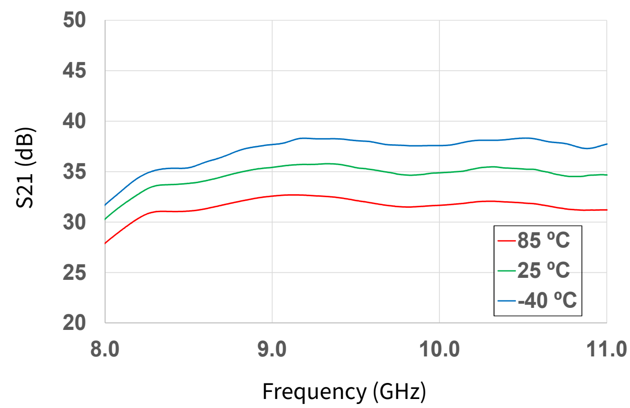


Figure 32. Gain vs Frequency as a Function of Temperature

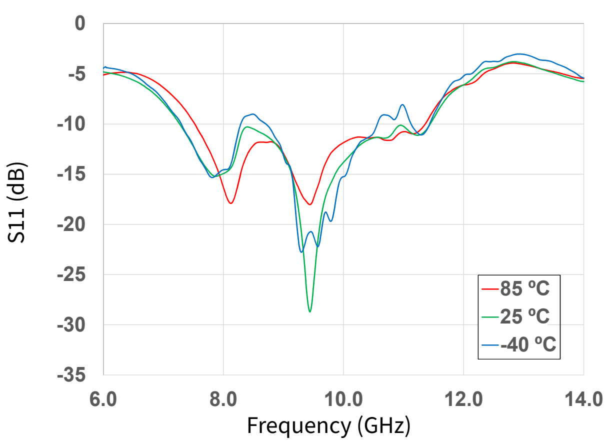


Figure 33. Input RL vs Frequency as a Function of Temperature

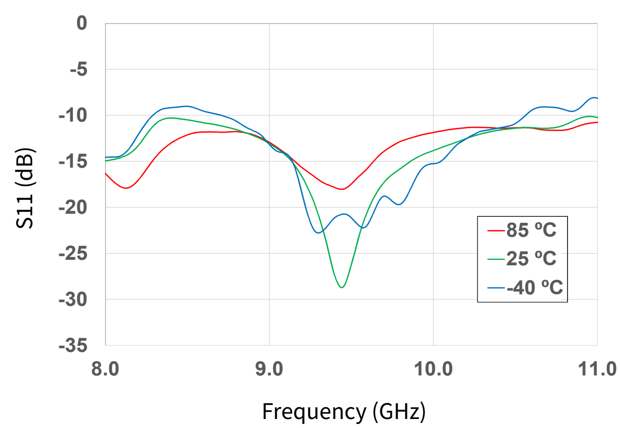


Figure 34. Input RL vs Frequency as a Function of Temperature

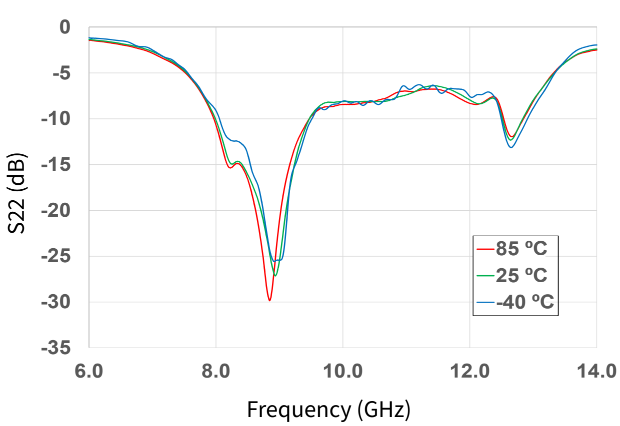


Figure 35. Output RL vs Frequency as a Function of Temperature

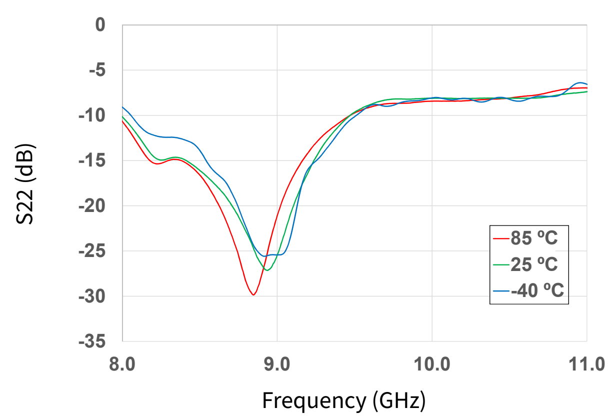


Figure 36. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CMPA901A035F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, P_{IN} = -20 dBm, T_{BASE} = +25 °C

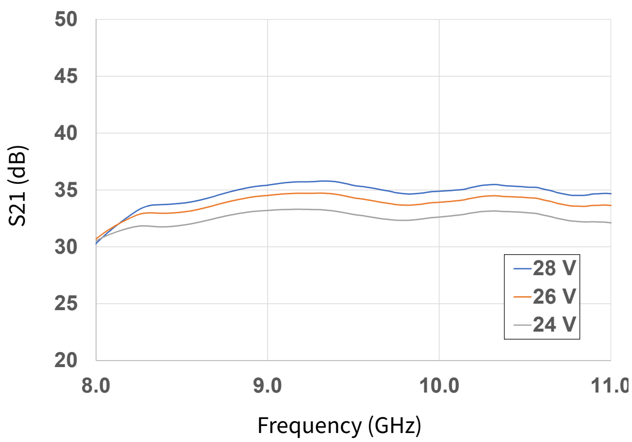


Figure 37. Gain vs Frequency as a Function of Voltage

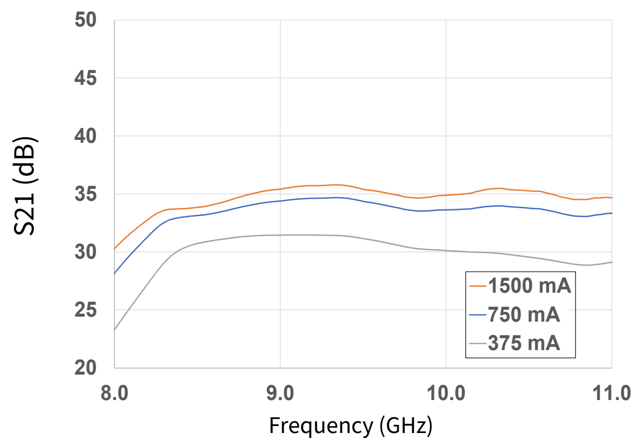


Figure 38. Gain vs Frequency as a Function of I_{DQ}

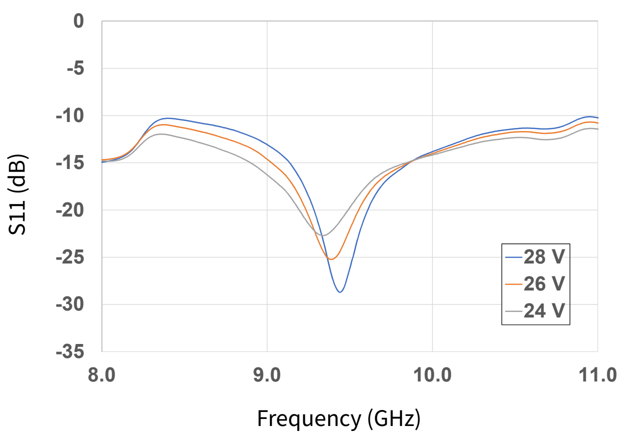


Figure 39. Input RL vs Frequency as a Function of Voltage

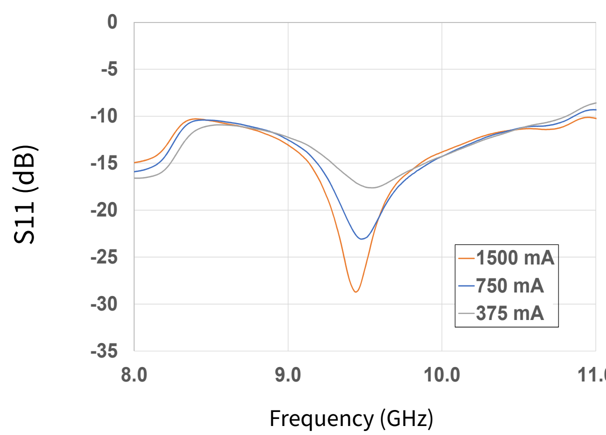


Figure 40. Input RL vs Frequency as a Function of I_{DQ}

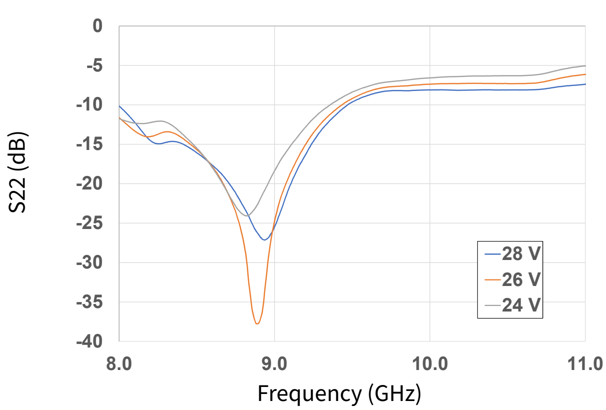


Figure 41. Output RL vs Frequency as a Function of Voltage

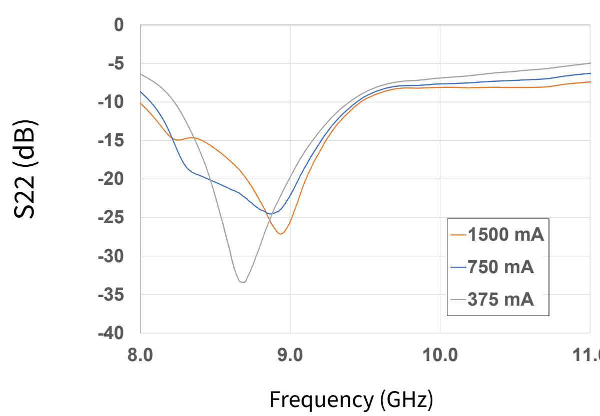
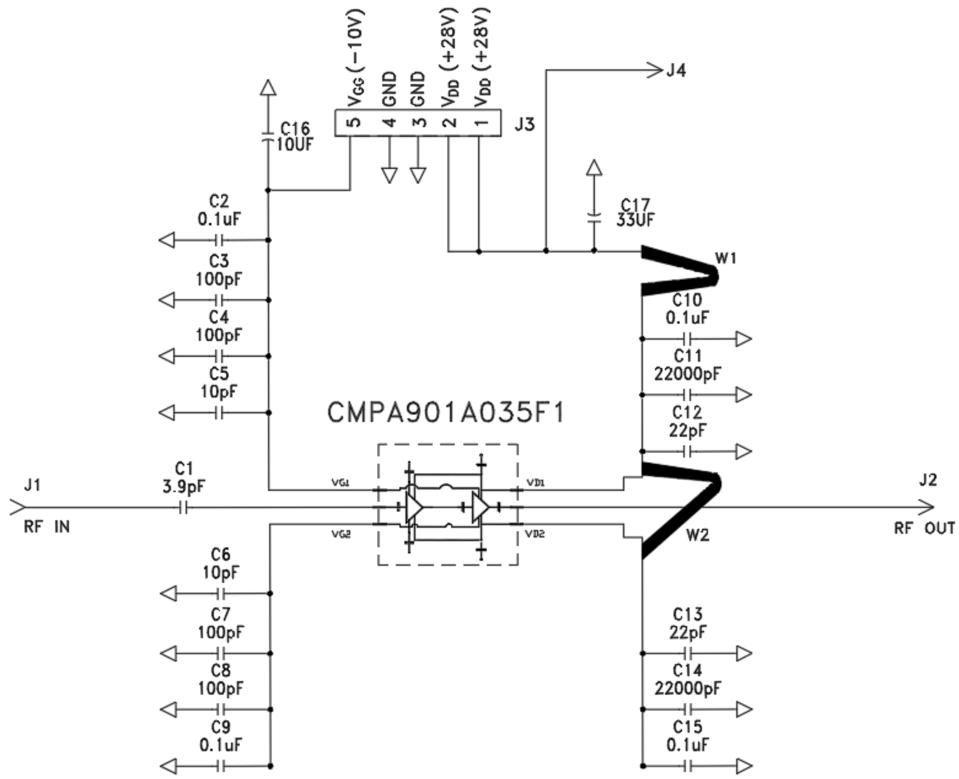
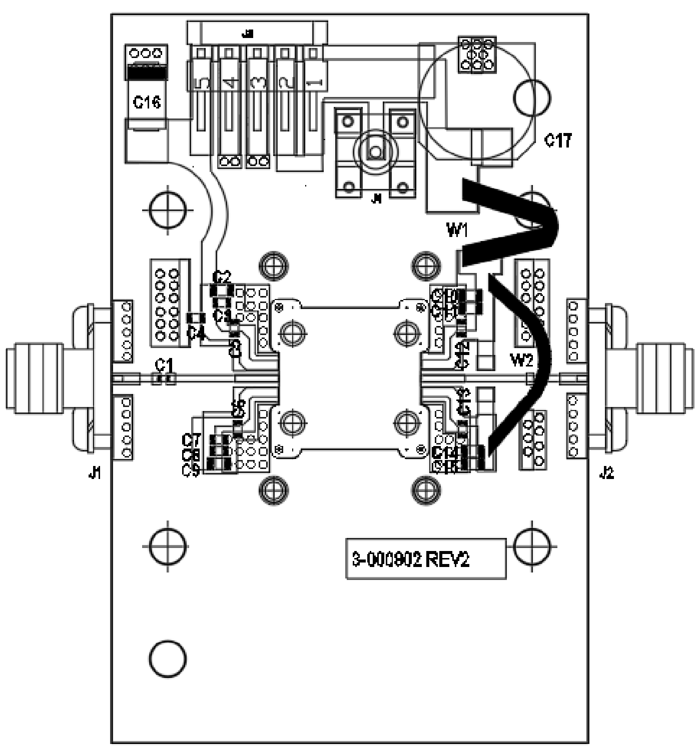


Figure 42. Output RL vs Frequency as a Function of I_{DQ}

CMPA901A035F1-AMP Evaluation Board Schematic



CMPA901A035F1-AMP Evaluation Board Outline



CMPA901A035F1-AMP Evaluation Board Bill of Materials

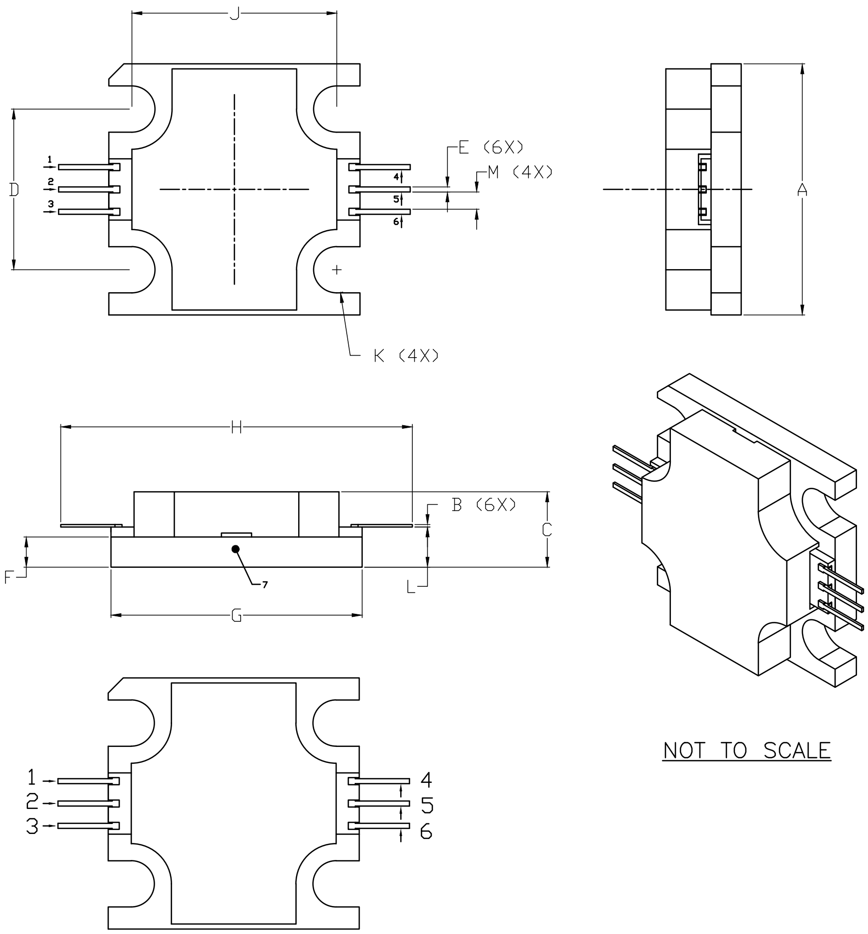
Designator	Description	Qty
C1	CAP, 3.9 pF, +/-0.1 pF, 0402, ATC	1
C2, C9, C10, C15	CAP CER 0.1 UF 100 V 10% X7R 0805	4
C3, C4, C7, C8	CAP, 100.0 pF, +/-5%, 0603, ATC	4
C5, C6	CAP, 10.0 pF, +/-5%, 0603, ATC	2
C11, C14	CAP CER 2200 pF 100 V 10% X7R 0805	2
C12, C13	CAP, 22 pF, +/-5%, 0603, ATC	2
C16	CAP 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	HBM	1B (≥ 500 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (≥ 200 V)	JEDEC JESD22 C101-C

Rev. 0.1, SEPTEMBER 2023

Product Dimensions CMPA901A035F1 (Package 440219)



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.495	0.505	12.57	12.82
B	0.003	0.005	0.076	0.127
C	0.140	0.160	3.56	4.06
D	0.315	0.325	8.00	8.25
E	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
H	0.695	0.705	17.65	17.91
J	0.403	0.413	10.24	10.49
K	ø .092		2.34	
L	0.075	0.085	1.905	2.159
M	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

MACOM

Part Number System

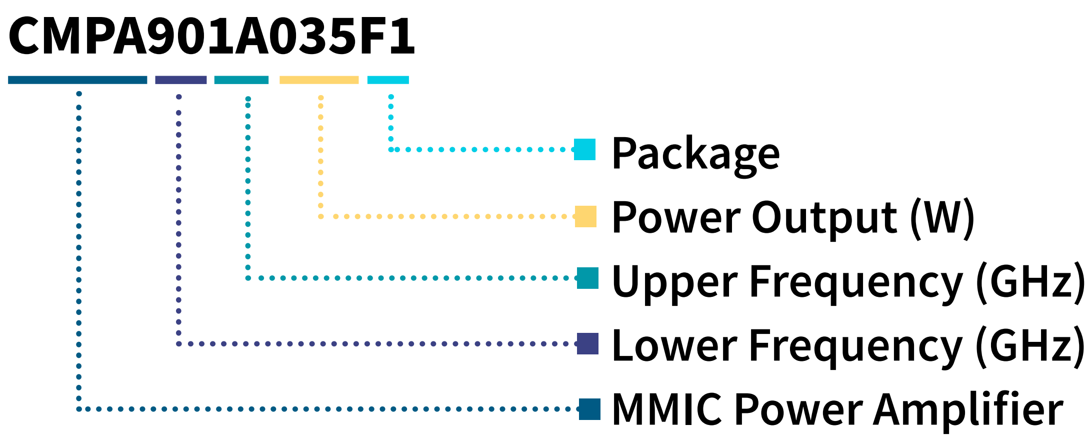


Table 1.

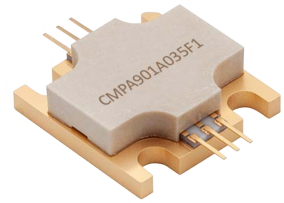
Parameter	Value	Units
Lower Frequency	9.0	GHz
Upper Frequency	10.0	GHz
Power Output	35	W
Package	Flange	-

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
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	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	
CMPA901A035F1-AMP	Test board with GaN MMIC installed	Each	

Notes & Disclaimer