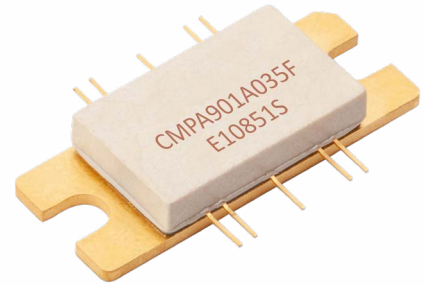


CMPA901A035F

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



Description

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.

Package Types: 440213
PN's: CMPA901A035F

Features

- 35 W typical P_{SAT}
- >33% typical power added efficiency
- 22.5 dB large signal gain
- High temperature operation

Applications

- Military radar
- Marine radar
- Weather radar
- Medical applications

Note:

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

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

Parameter	9.0 GHz	9.5 GHz	10.0 GHz	10.5 GHz	11.0 GHz	Units
Small Signal Gain ^{1,2}	34.8	32.4	32.7	33.2	32.6	dB
Output Power ^{1,3}	45.9	45.8	45.6	45.6	45.4	dBm
Power Gain ^{1,3}	22.9	22.8	22.6	22.6	22.4	dB
Power Added Efficiency ^{1,3}	37	34	33	33	34	%

Notes:

¹ $V_{DD} = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$.

² Measured at $P_{IN} = -20\text{ dBm}$.

³ Measured at $P_{IN} = 23\text{ dBm}$ and 300 μs ; duty cycle = 20%.



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}	-40, +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 11.0 GHz Unless Otherwise Stated; $T_c = 25 °C$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-2.8	-2.3	V	$V_{DS} = 10 V, I_D = 19.8 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V_{DC}	$V_{DD} = 28 V, I_{DQ} = 1500 mA$
Saturated Drain Current ¹	I_{DS}	14.3	19.8	-	A	$V_{DS} = 6.0 V, V_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	V_{BD}	84	-	-	V	$V_{GS} = -8 V, I_D = 19.8 mA$
RF Characteristics²						
Small Signal Gain	S21	-	34	-	dB	$P_{IN} = -23 dBm, Freq = 9.0 - 10.0 GHz$
Output Power	P_{OUT1}	-	45.7	-	dBm	$V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.0 GHz$
Output Power	P_{OUT2}	-	44.7	-	dBm	$V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 10.0 GHz$
Power Added Efficiency	PAE_1	-	40	-	%	$V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 9.0 GHz$
Power Added Efficiency	PAE_2	-	37	-	%	$V_{DD} = 28 V, I_{DQ} = 1500 mA, P_{IN} = 23 dBm, Freq = 10.0 GHz$
Input Return Loss	S11	-	-6.4	-	dB	$P_{IN} = -23 dBm, 9.0 - 10.0 GHz$
Output Return Loss	S22	-	-6.8	-	dB	$P_{IN} = -23 dBm, 9.0 - 10.0 GHz$
Output Mismatch Stress	VSWR	-	5:1	-	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	159	°C	Pulse Width = 300 μs , Duty Cycle = 20% $P_{DISS} = 80 W, T_{CASE} = 85 °C$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.93	°C/W	
Operating Junction Temperature	T_J	217	°C	$P_{DISS} = 80 W, T_{CASE} = 85 °C$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.66	°C/W	

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\ \mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

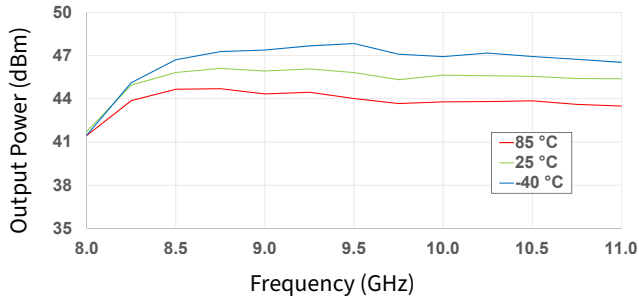


Figure 1. Output Power vs Frequency as a Function of Temperature

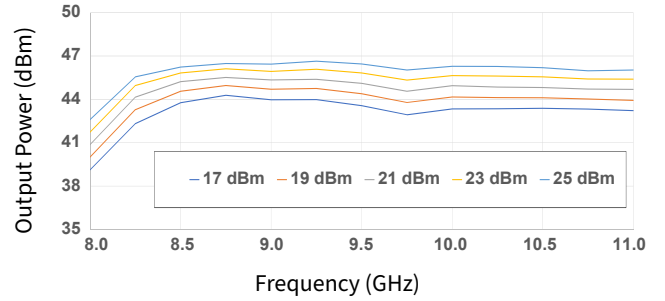


Figure 2. Output Power vs Frequency as a Function of Input Power

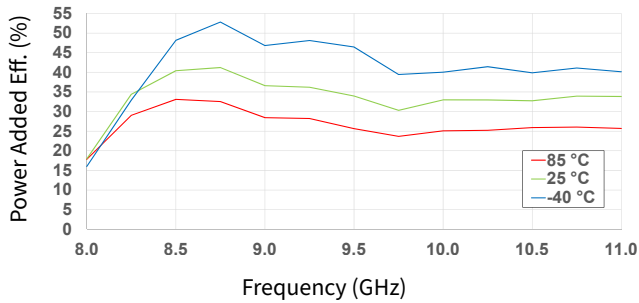


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

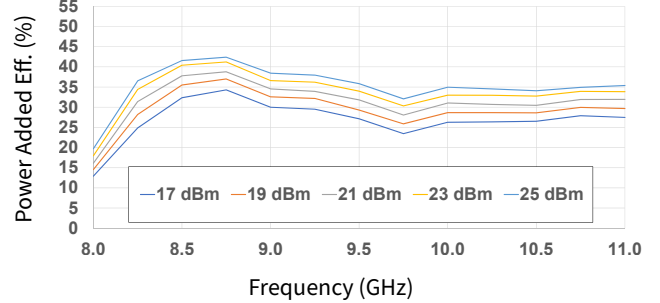


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

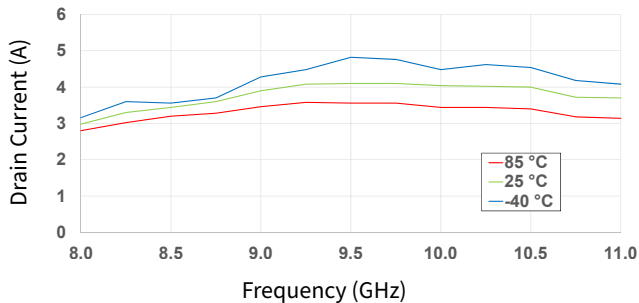


Figure 5. Drain Current vs Frequency as a Function of Temperature

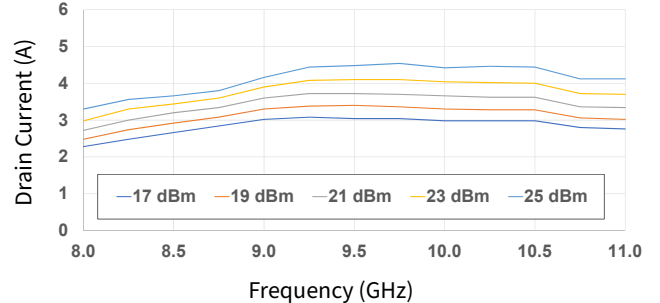


Figure 6. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\text{ }\mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

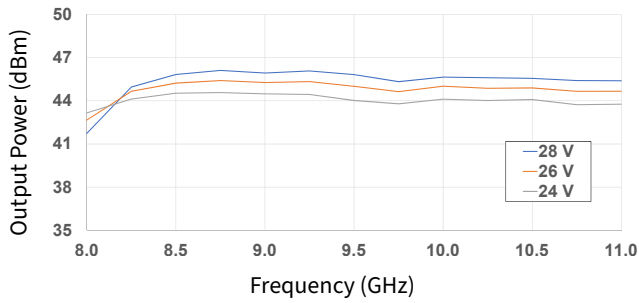


Figure 7. Output Power vs Frequency as a Function of V_D

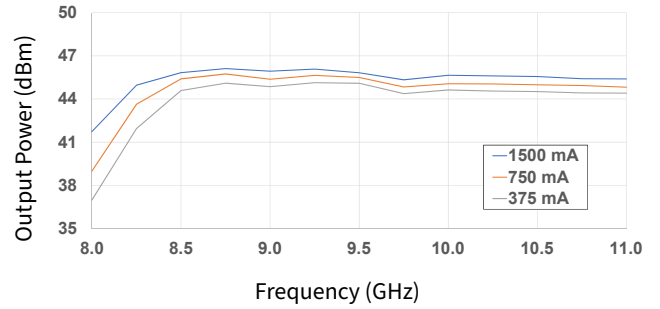


Figure 8. Output Power vs Frequency as a Function of I_{DQ}

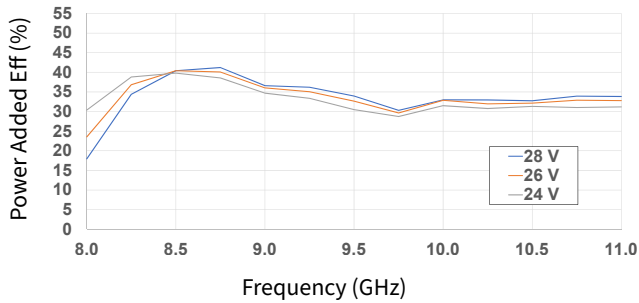


Figure 9. Power Added Eff. vs Frequency as a Function of V_D

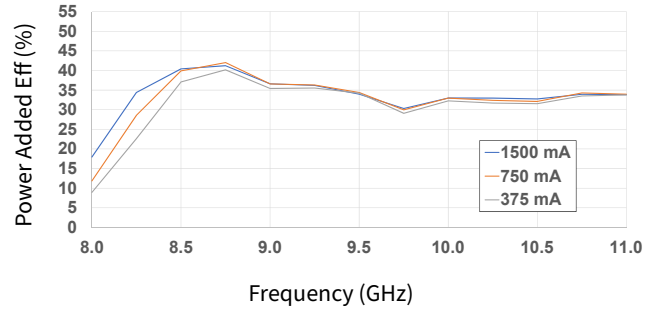


Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

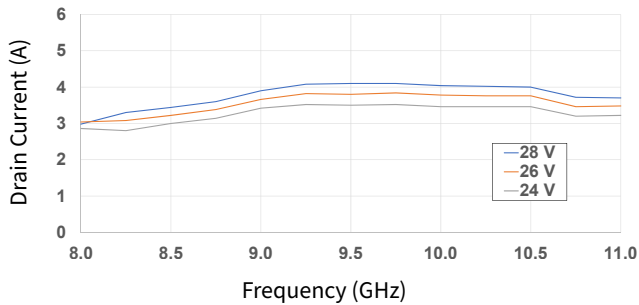


Figure 11. Drain Current vs Frequency as a Function of V_D

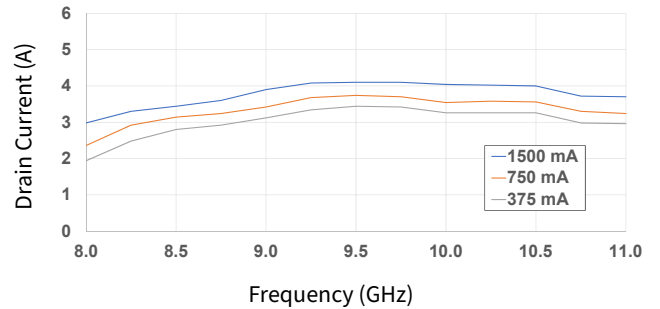


Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

Typical Performance of the CPMA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\text{ }\mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

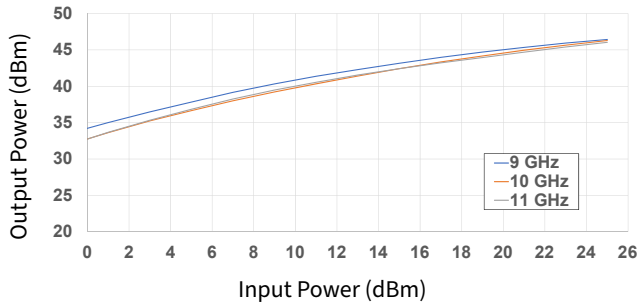


Figure 13. Output Power vs Input Power as a Function of Frequency

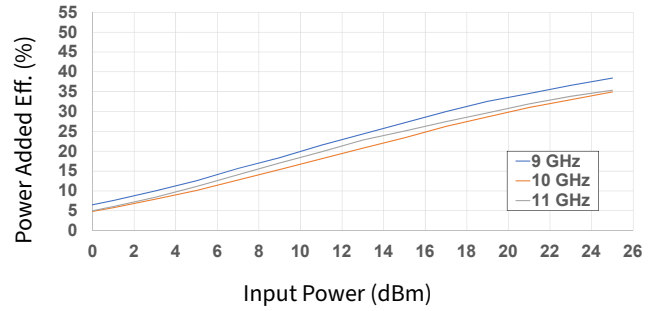


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

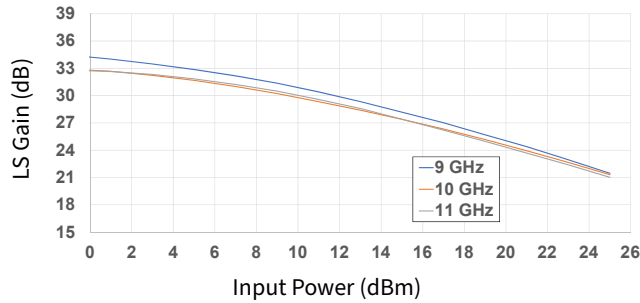


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

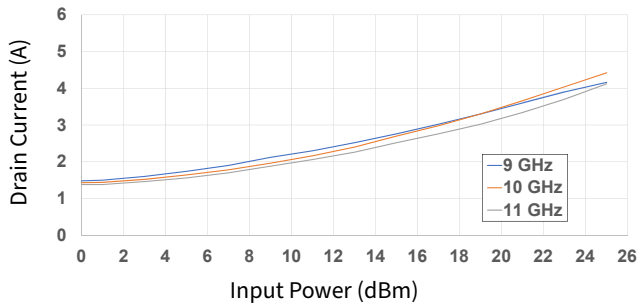


Figure 16. Drain Current vs Input Power as a Function of Frequency

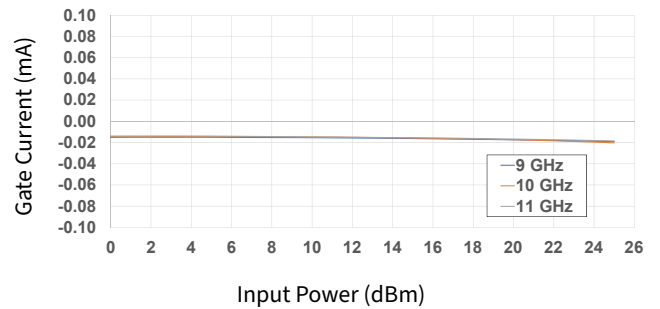


Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\text{ }\mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

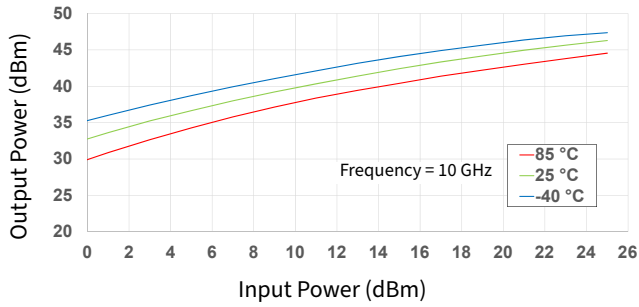


Figure 18. Output Power vs Input Power as a Function of Temperature

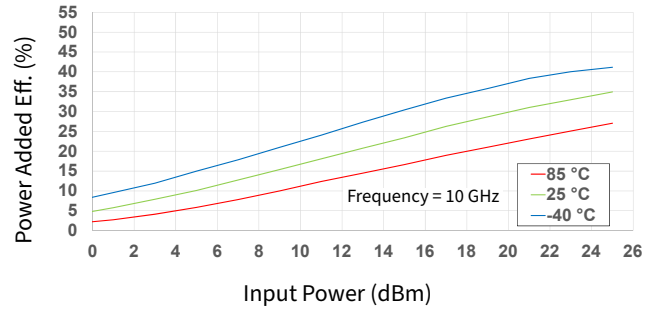


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

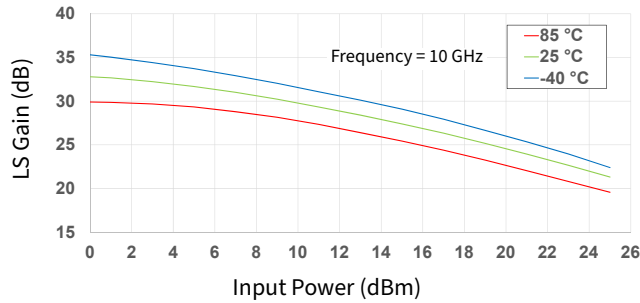


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

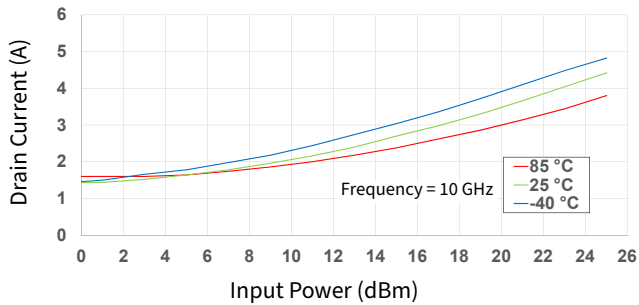


Figure 21. Drain Current vs Input Power as a Function of Temperature

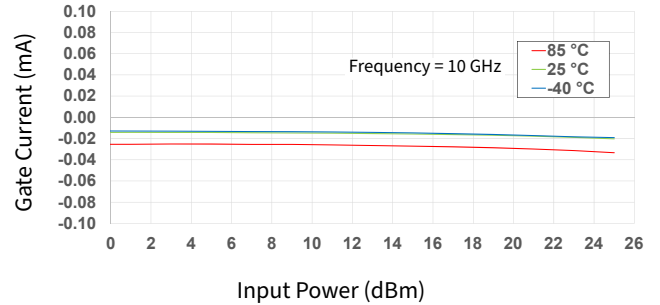


Figure 22. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\text{ }\mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

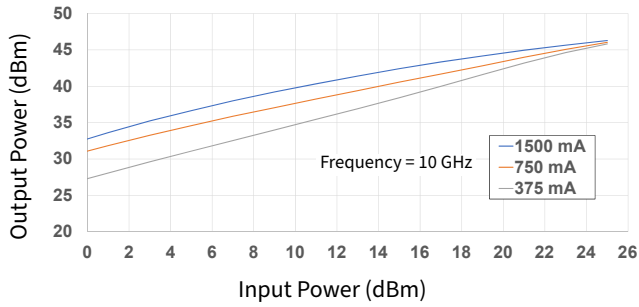


Figure 23. Output Power vs Input Power as a Function of I_{DQ}

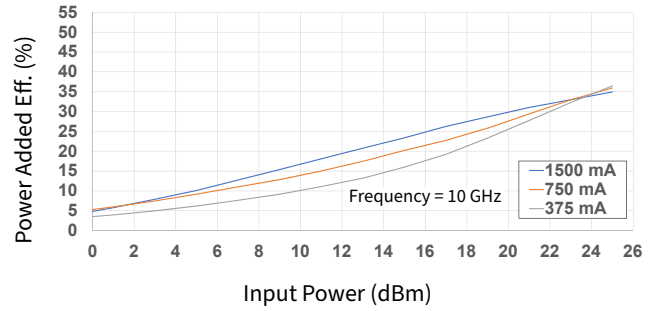


Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

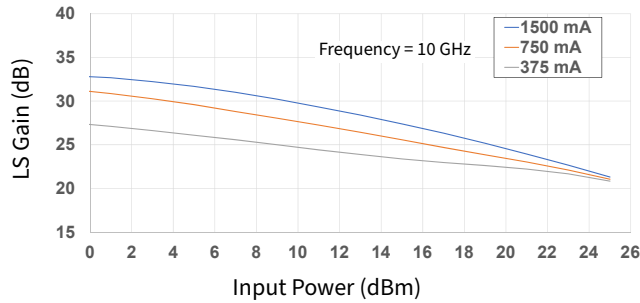


Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

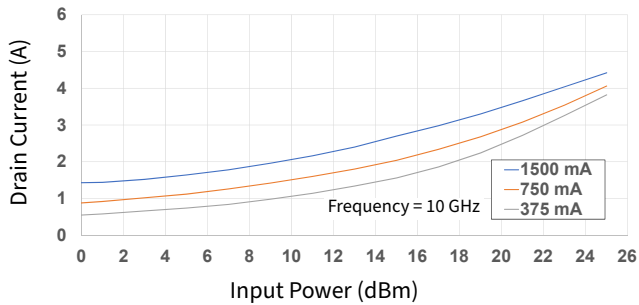


Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

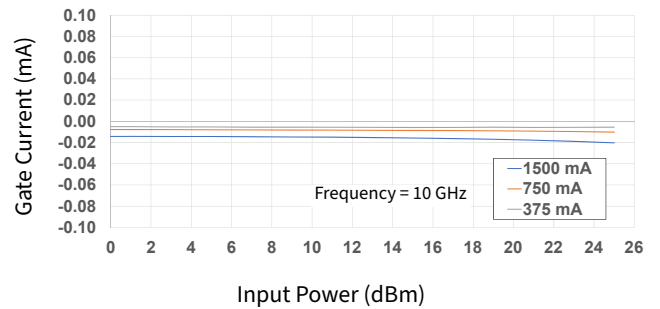


Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, pulse width = $300\text{ }\mu\text{s}$, duty cycle = 20%, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

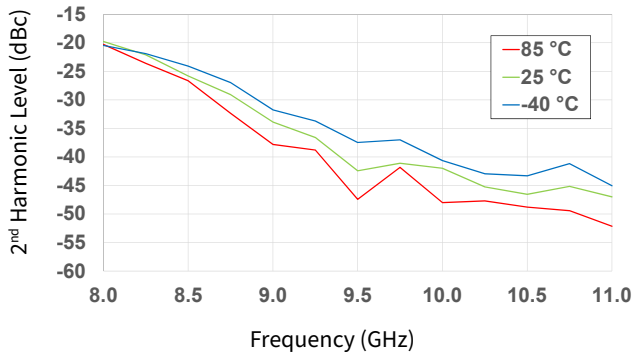


Figure 28. 2nd Harmonic vs Frequency as a Function of Temperature

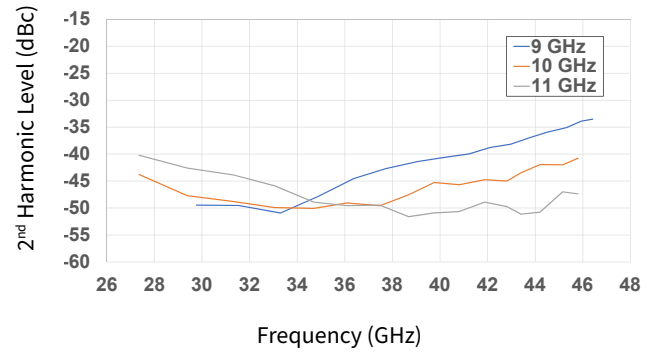


Figure 29. 2nd Harmonic vs Output Power as a Function of Frequency

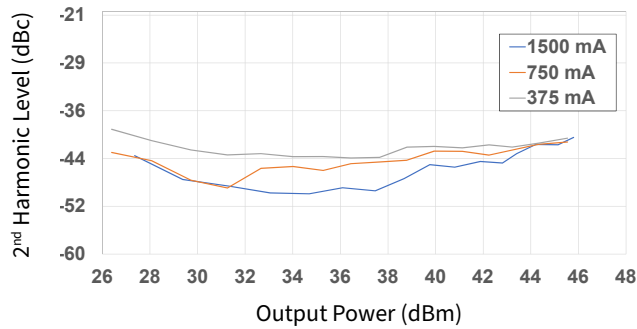


Figure 30. 2nd Harmonic vs Output Power as a Function of I_{DQ}

Typical Performance of the CMPA901A035F

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

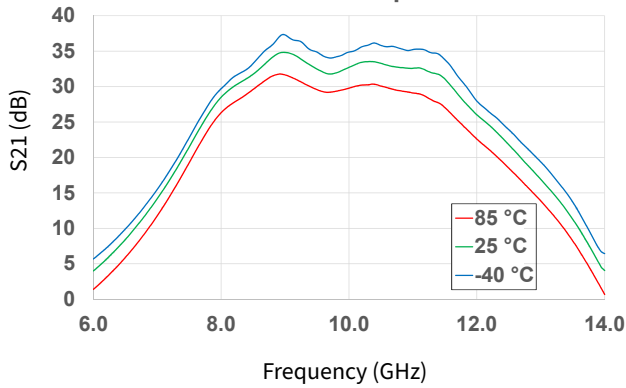


Figure 31. Gain vs Frequency as a Function of Temperature

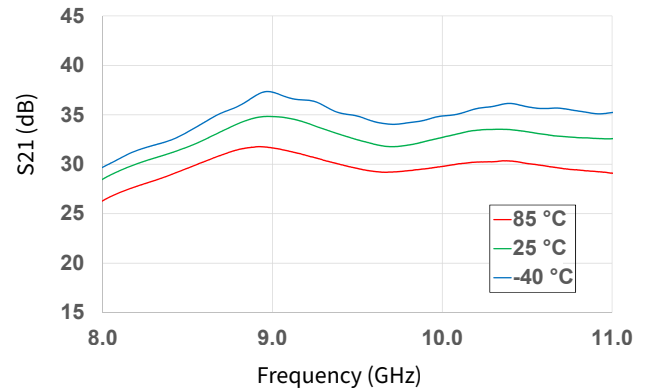


Figure 32. Gain vs Frequency as a Function of Temperature

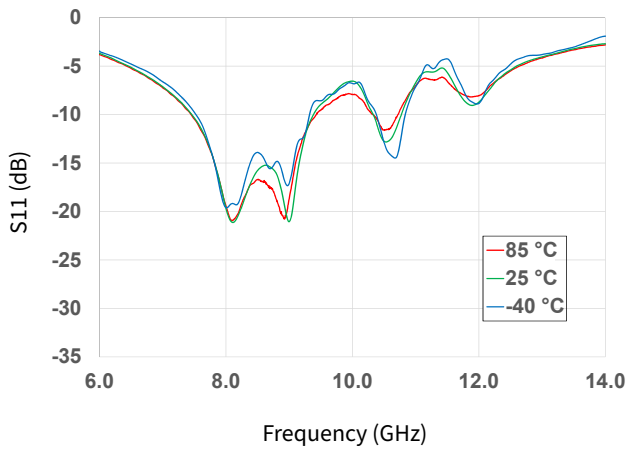


Figure 33. Input RL vs Frequency as a Function of Temperature

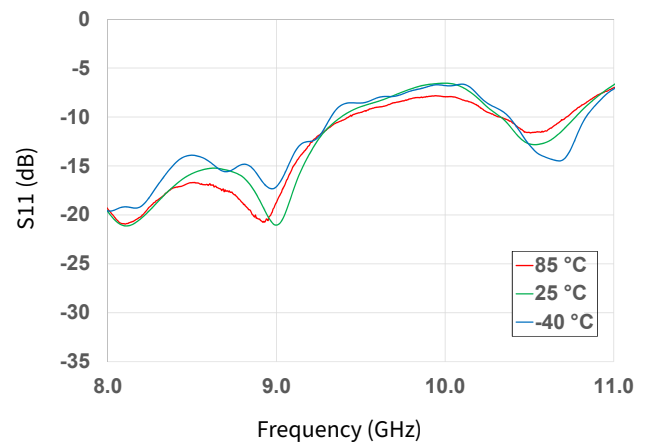


Figure 34. Input RL vs Frequency as a Function of Temperature

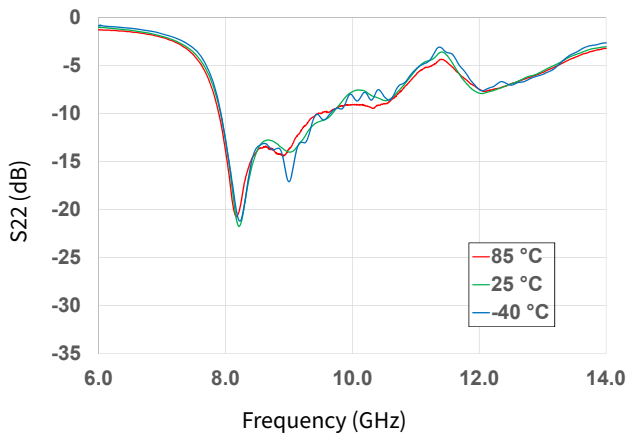


Figure 35. Output RL vs Frequency as a Function of Temperature

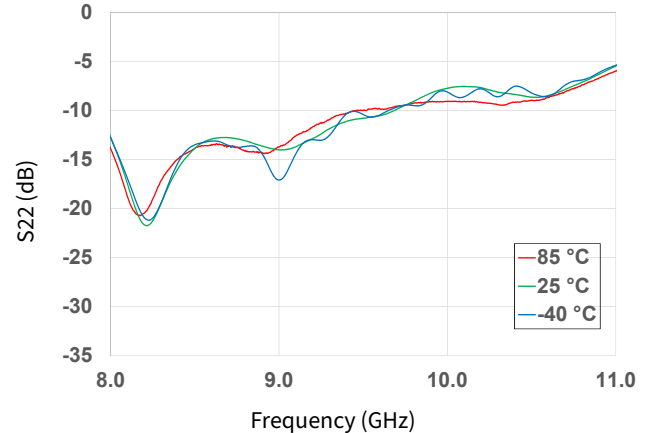


Figure 36. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CMPA901A035F

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

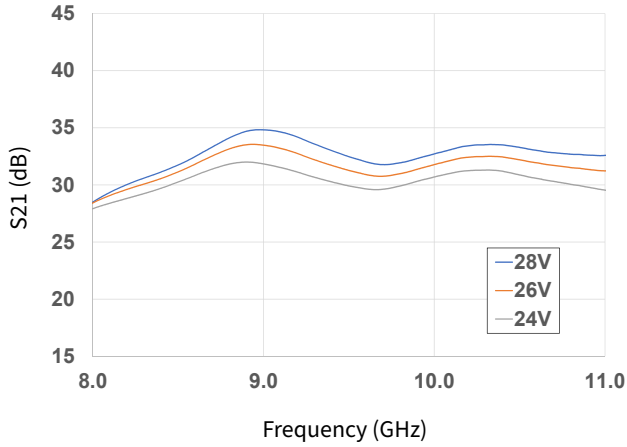


Figure 37. Gain vs Frequency as a Function of Voltage

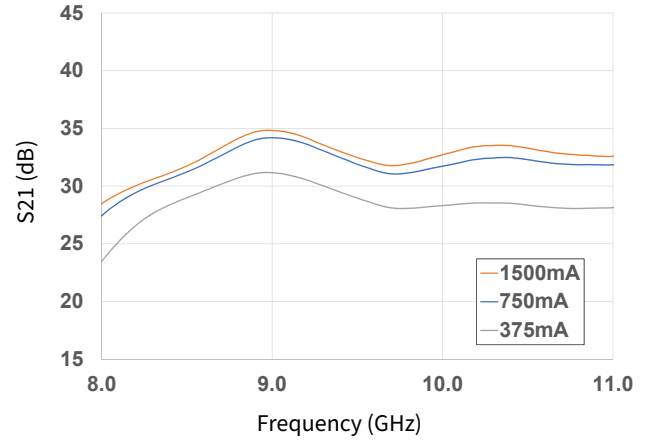


Figure 38. Gain vs Frequency as a Function of I_{DQ}

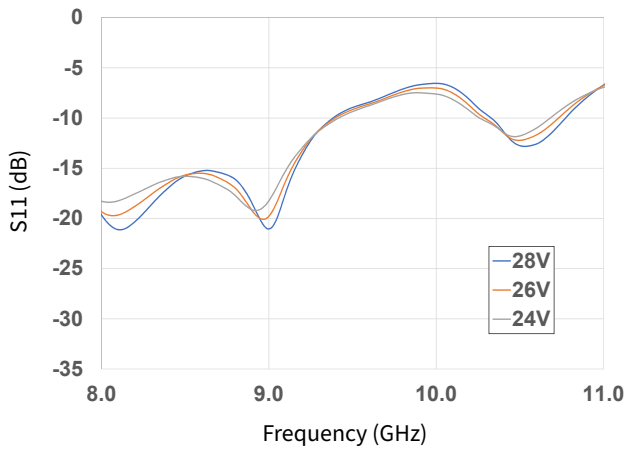


Figure 39. Input RL vs Frequency as a Function of Voltage

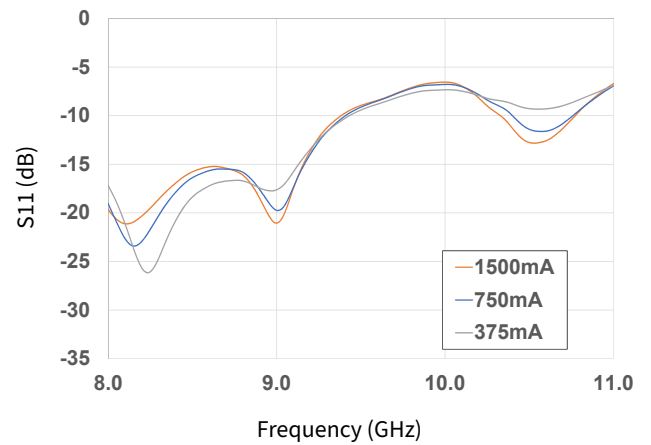


Figure 40. Input RL vs Frequency as a Function of I_{DQ}

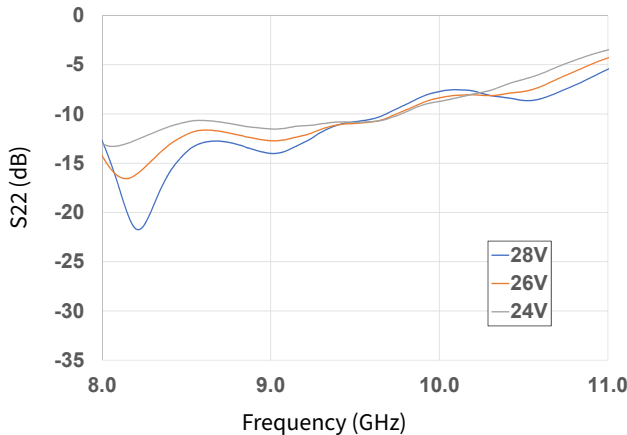


Figure 41. Output RL vs Frequency as a Function of Voltage

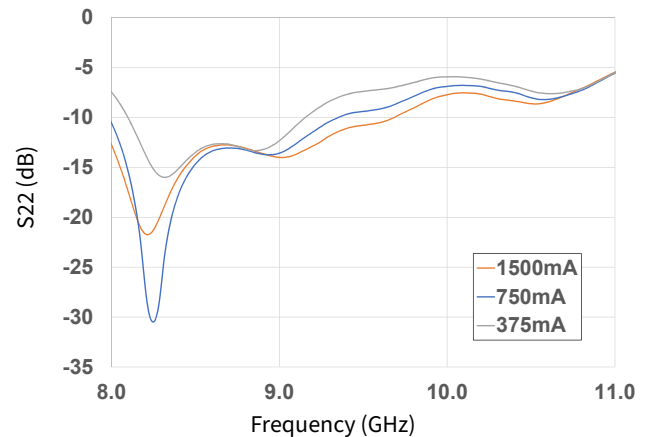


Figure 42. Output RL vs Frequency as a Function of I_{DQ}

Typical Performance of the CPMA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

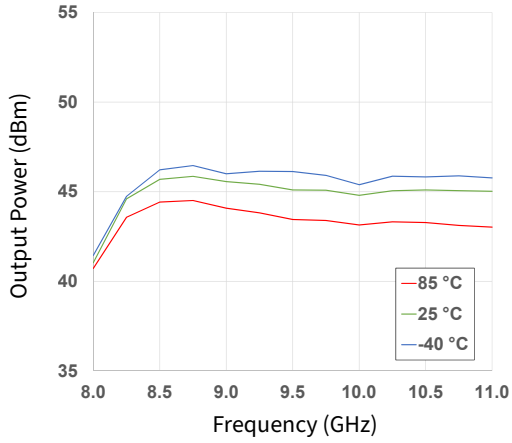


Figure 43. Output Power vs Frequency as a Function of Temperature

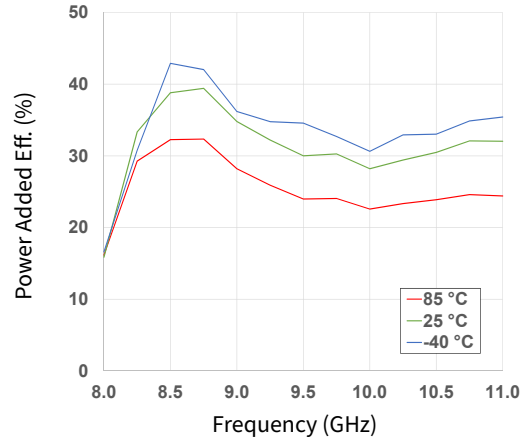


Figure 44. Power Added Eff. vs Frequency as a Function of Temperature

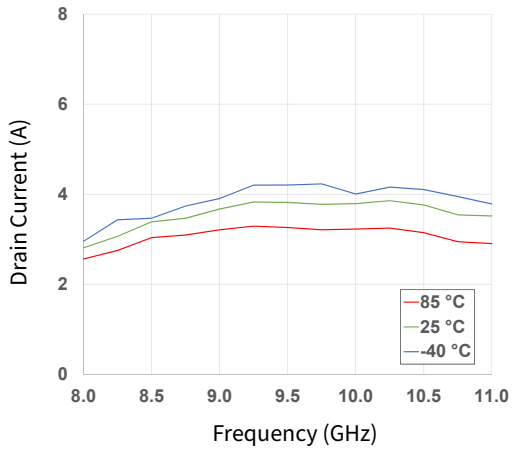


Figure 45. Drain Current vs Frequency as a Function of Temperature

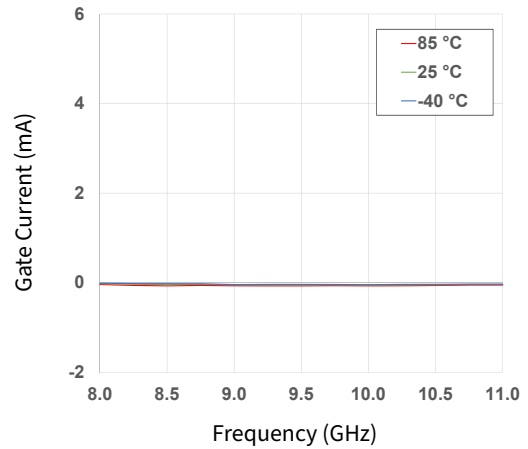


Figure 46. Gate Current vs Frequency as a Function of Temperature

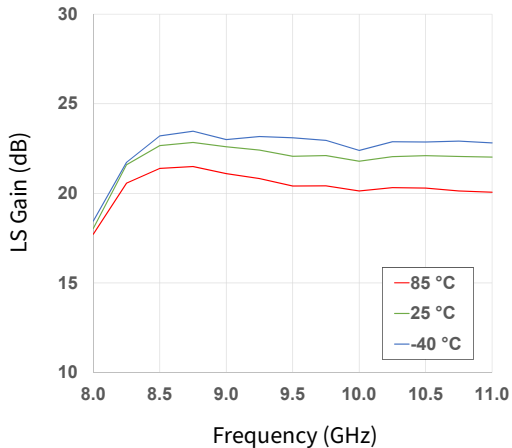


Figure 47. Large Signal Gain vs Frequency as a Function of Temperature

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

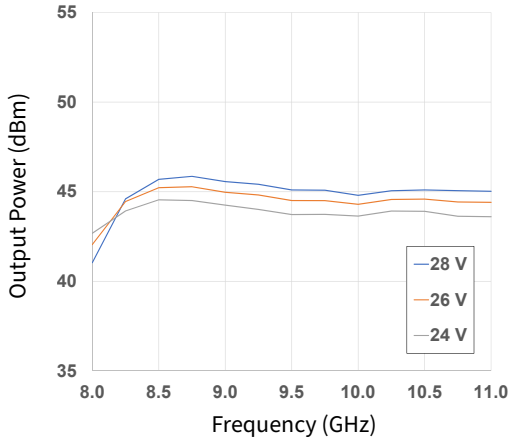


Figure 48. Output Power vs Frequency as a Function of Voltage

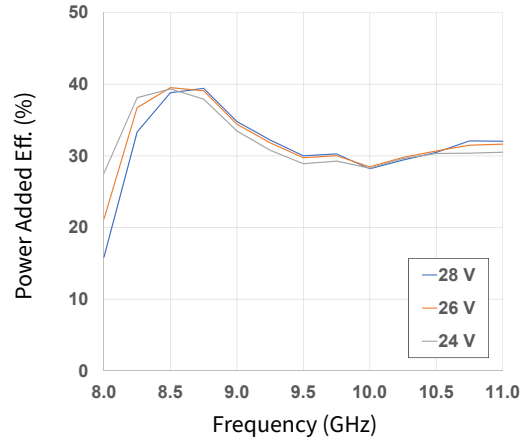


Figure 49. Power Added Eff. vs Frequency as a Function of Voltage

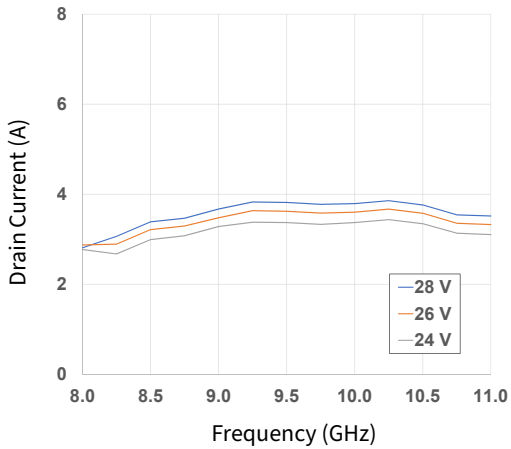


Figure 50. Drain Current vs Frequency as a Function of Voltage

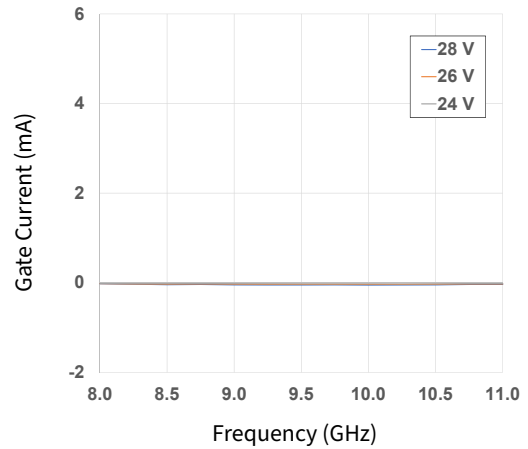


Figure 51. Gate Current vs Frequency as a Function of Voltage

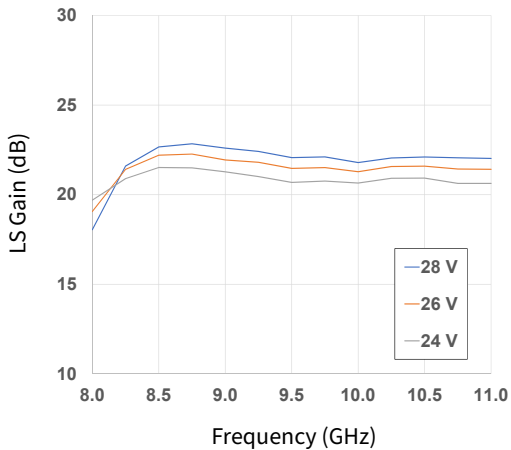


Figure 52. Large Signal Gain vs Frequency as a Function of Voltage

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

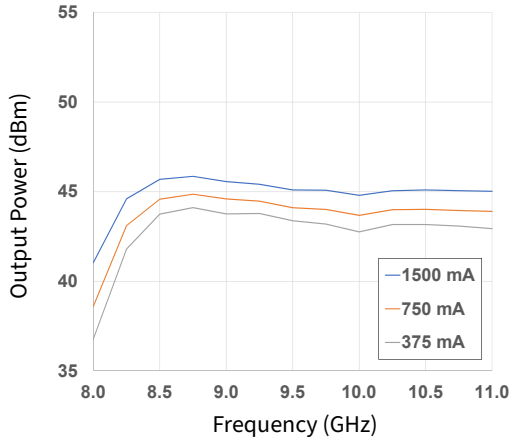


Figure 53. Output Power vs Frequency as a Function of I_{DQ}

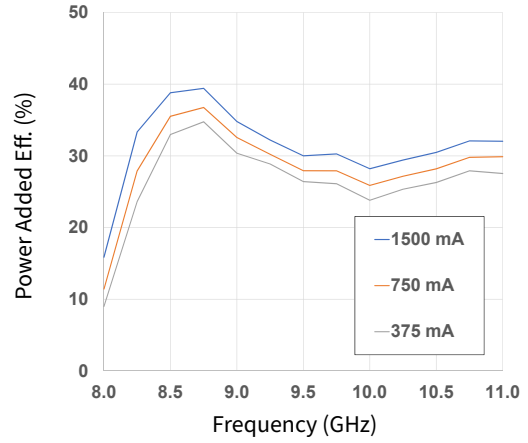


Figure 54. Power Added Eff. vs Frequency as a Function of I_{DQ}

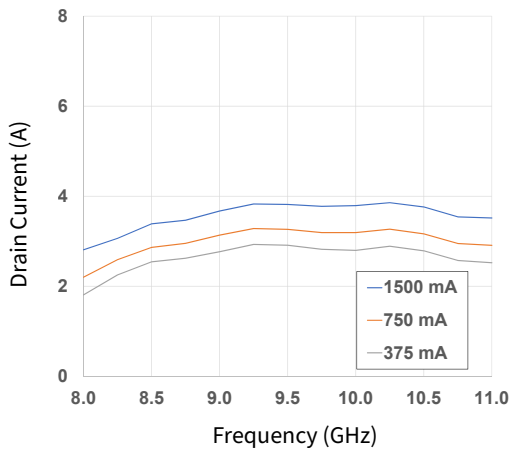


Figure 55. Drain Current vs Frequency as a Function of I_{DQ}

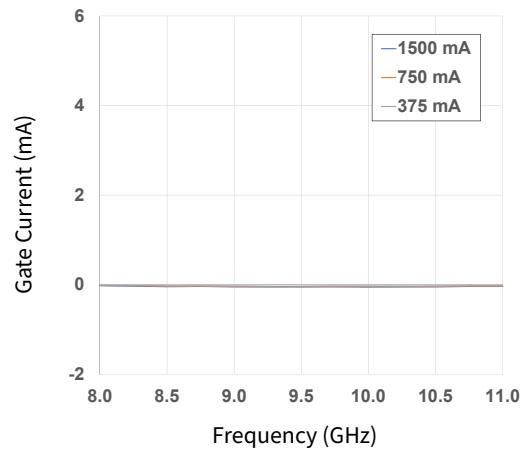


Figure 56. Gate Current vs Frequency as a Function of I_{DQ}

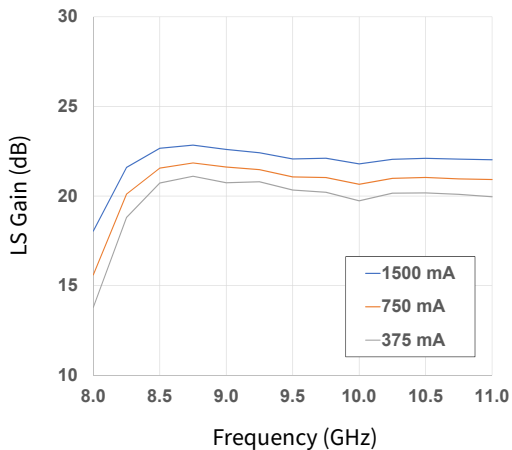


Figure 57. Large Signal Gain vs Frequency as a Function of I_{DQ}

Typical Performance of the CPMA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, Frequency = 10 GHz, $T_{BASE} = +25\text{ }^\circ\text{C}$

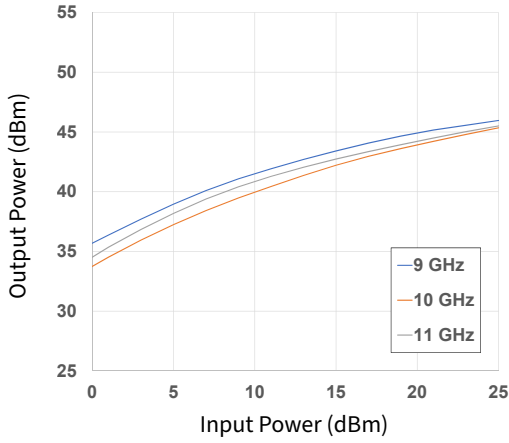


Figure 58. Output Power vs Input Power as a Function of Frequency

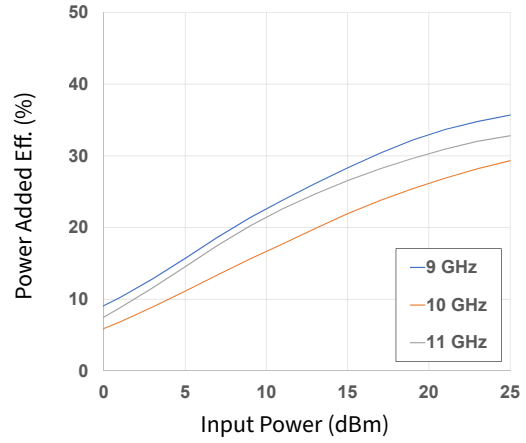


Figure 59. Power Added Eff. vs Input Power as a Function of Frequency

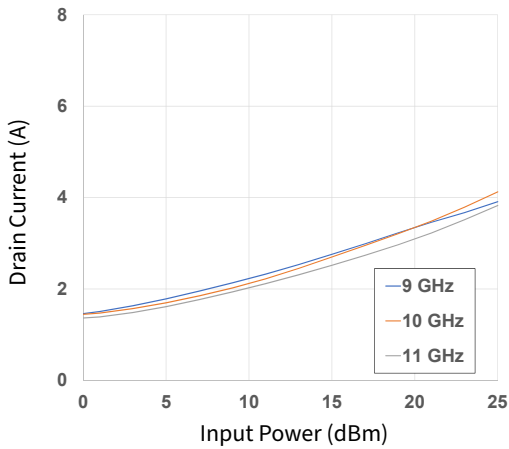


Figure 60. Drain Current vs Input Power as a Function of Frequency

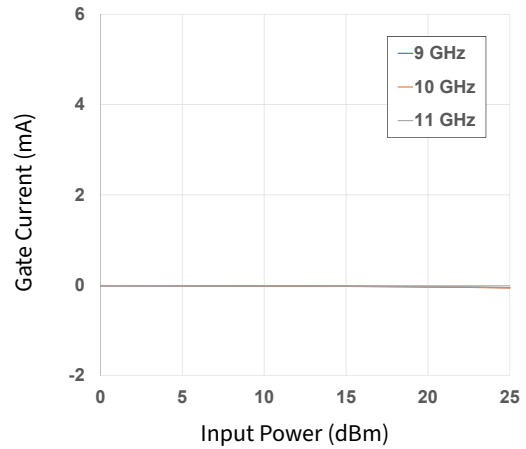


Figure 61. Gate Current vs Input Power as a Function of Frequency

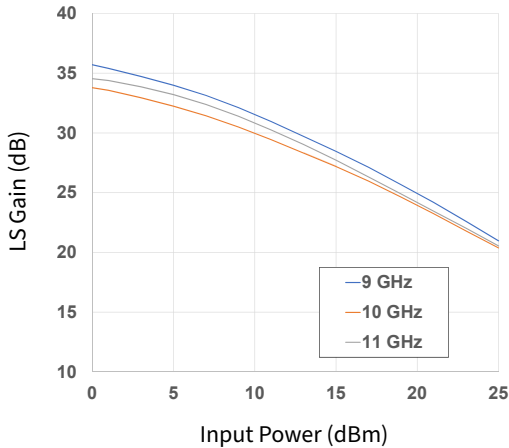


Figure 62. Large Signal Gain vs Input Power as a Function of Frequency

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, Frequency = 10 GHz, $T_{BASE} = +25\text{ }^\circ\text{C}$

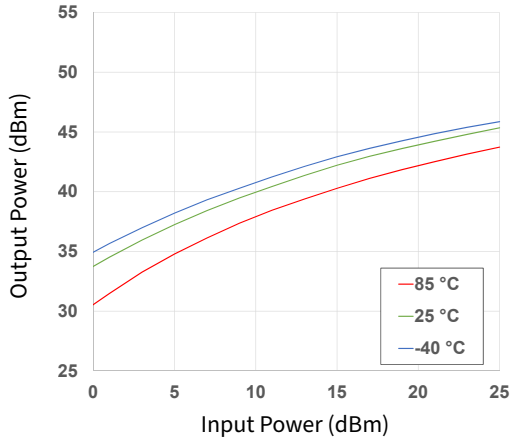


Figure 63. Output Power vs Input Power as a Function of Temperature

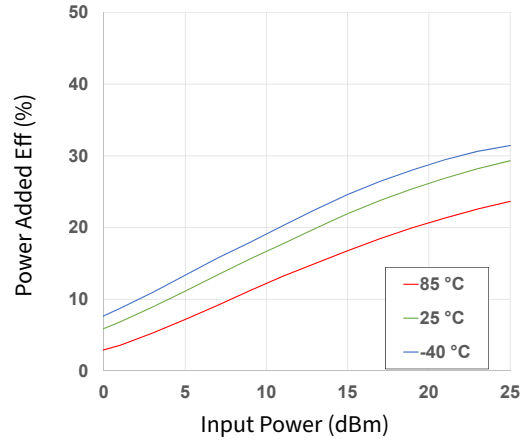


Figure 64. Power Added Eff. vs Input Power as a Function of Temperature

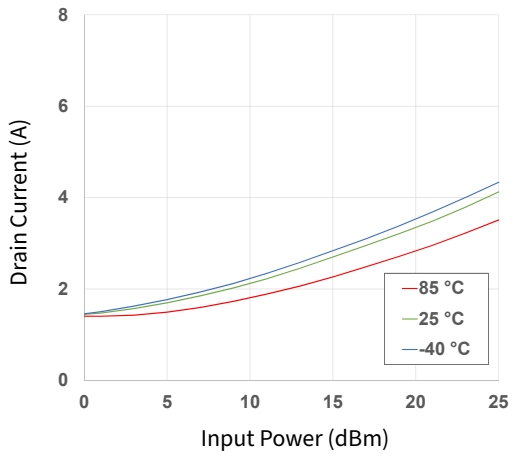


Figure 65. Drain Current vs Input Power as a Function of Temperature

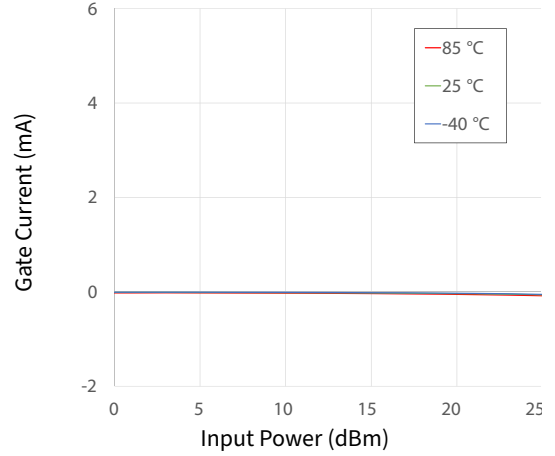


Figure 66. Gate Current vs Input Power as a Function of Temperature

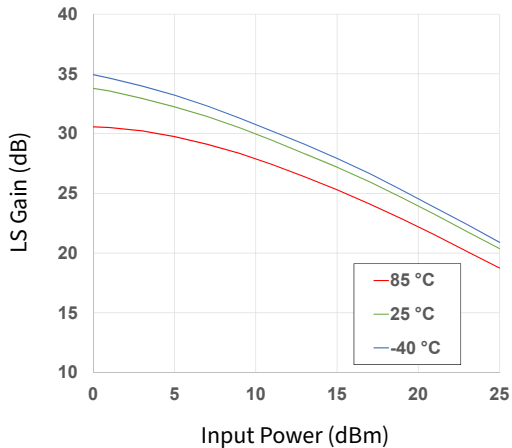


Figure 67. Large Signal Gain vs Input Power as a Function of Temperature

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, Frequency = 10 GHz, $T_{BASE} = +25\text{ }^\circ\text{C}$

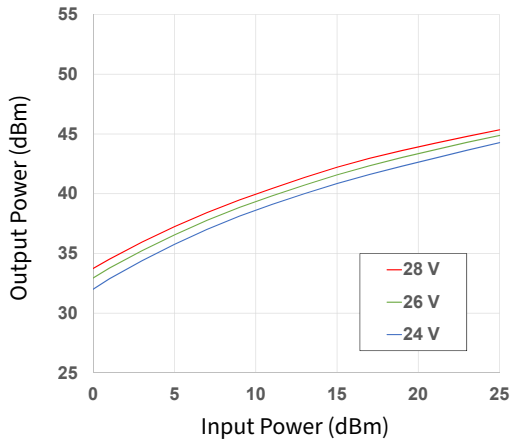


Figure 68. Output Power vs Input Power as a Function of Voltage

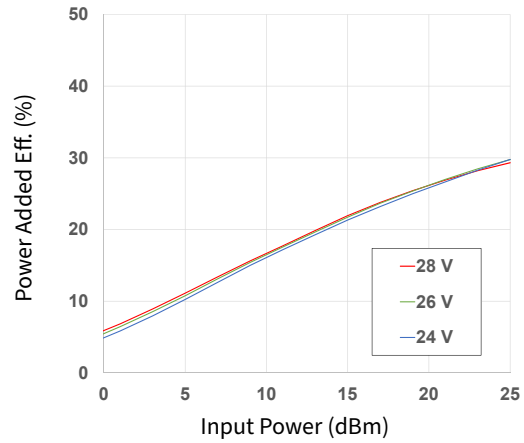


Figure 69. Power Added Eff. vs Input Power as a Function of Voltage

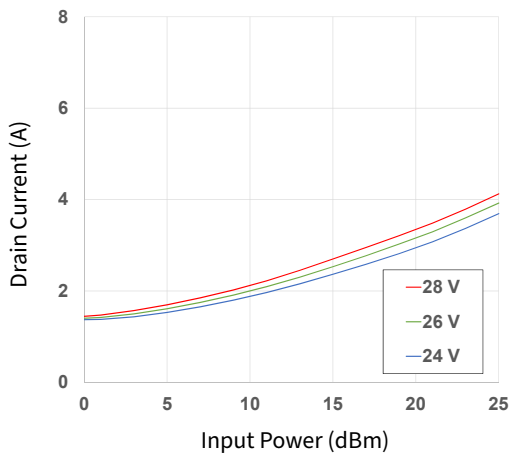


Figure 70. Drain Current vs Input Power as a Function of Voltage

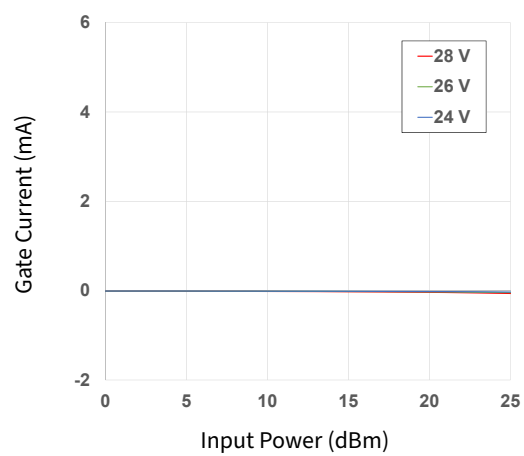


Figure 71. Gate Current vs Input Power as a Function of Voltage

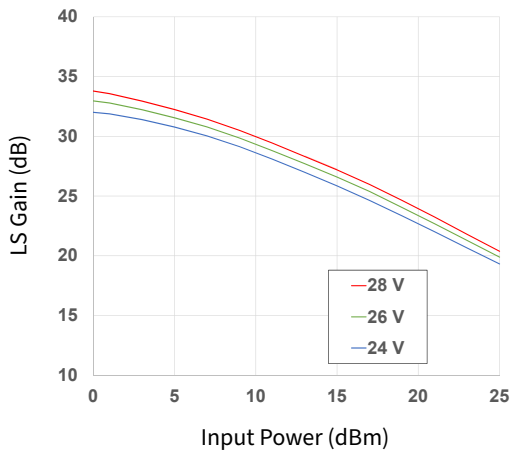


Figure 72. Large Signal Gain vs Input Power as a Function of Voltage

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: $V_D = 28\text{ V}$, $I_{DQ} = 1500\text{ mA}$, CW, $P_{IN} = 23\text{ dBm}$, $T_{BASE} = +25\text{ }^\circ\text{C}$

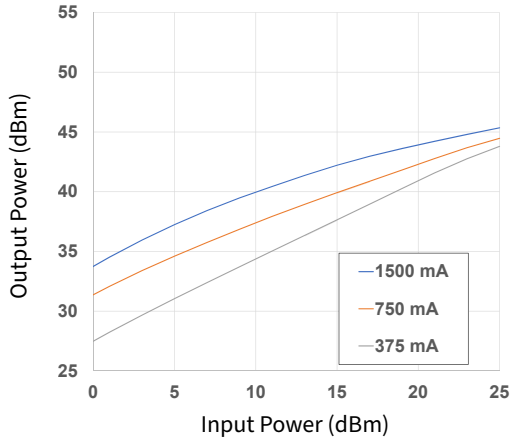


Figure 73. Output Power vs Input Power as a Function of I_{DQ}

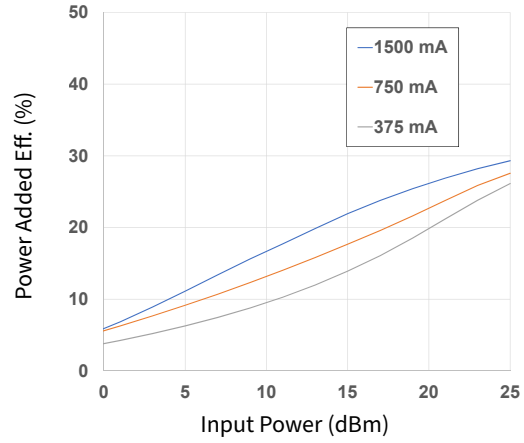


Figure 74. Power Added Eff. vs Input Power as a Function of I_{DQ}

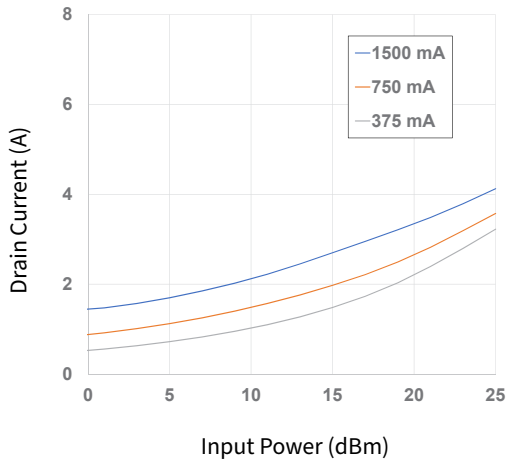


Figure 75. Drain Current vs Input Power as a Function of I_{DQ}

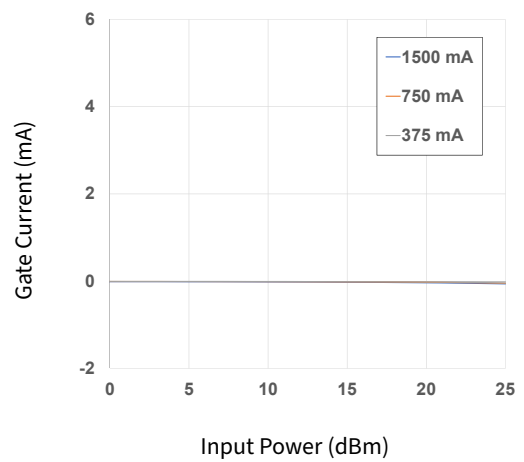


Figure 76. Gate Current vs Input Power as a Function of I_{DQ}

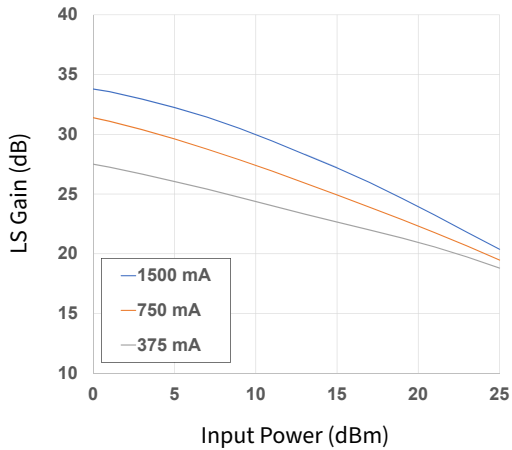
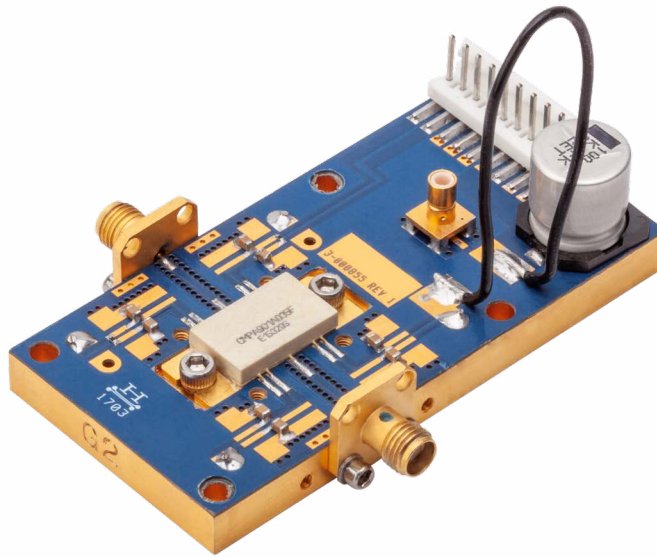


Figure 77. Large Signal Gain vs Input Power as a Function of I_{DQ}

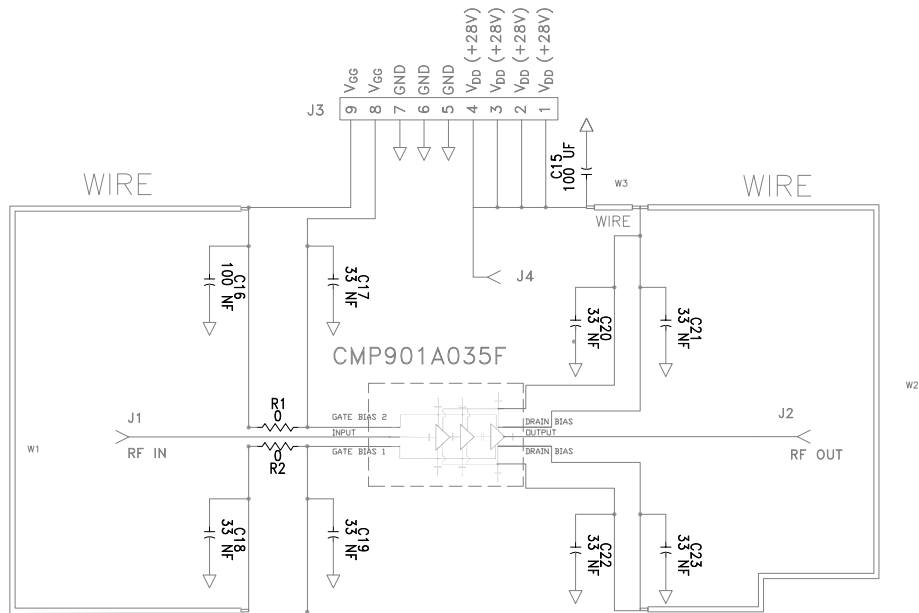
CMPA901A035F-AMP Evaluation Board Bill of Materials

Designator	Description	Qty
C15	CAP ELECT 100 UF 80 V AFK SMD	1
C16 - C23	CAP, 33000 PF, 0805, 100 V, X7R	8
R1, R2	RES 0.0 OHM 1/16 W 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

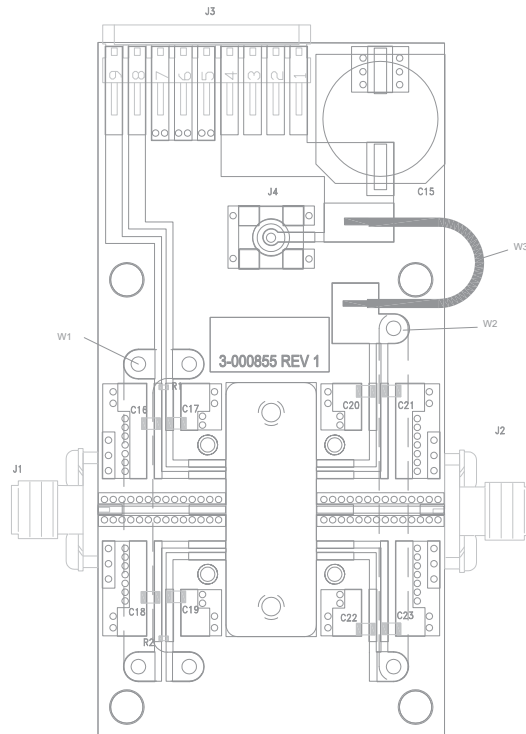
CMPA901A035F-AMP Evaluation Board Circuit



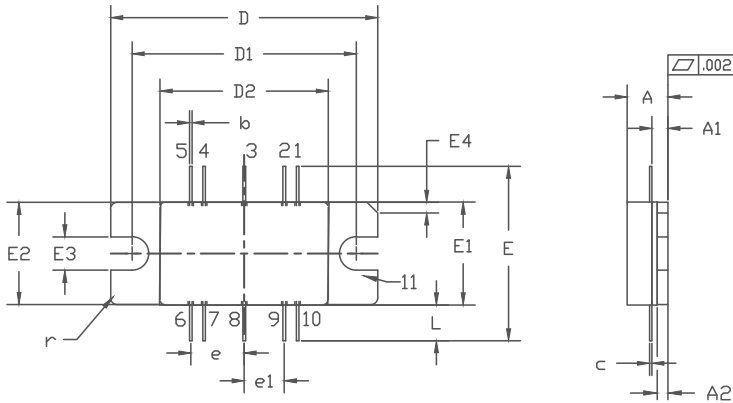
CMPA901A035F-AMP Evaluation Board Schematic



CMPA901A035F-AMP Evaluation Board Outline



Product Dimensions CMPA901A035F



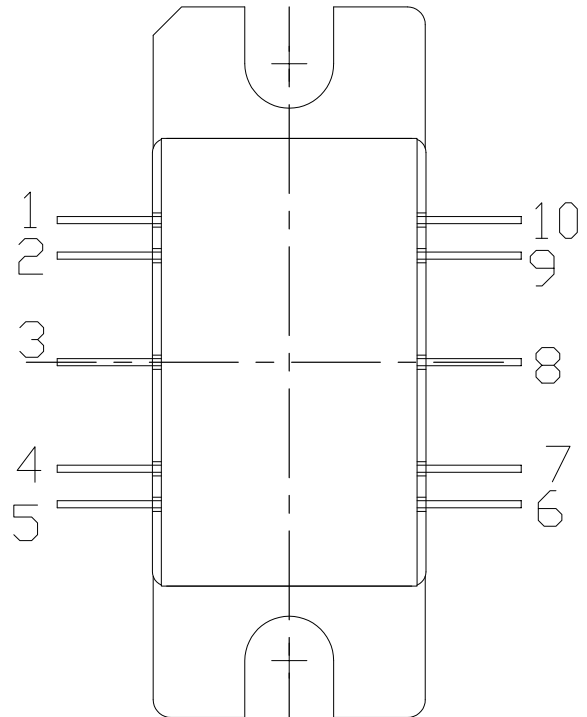
PIN 1: GATE BIAS 6: DRAIN BIAS
 2: GATE BIAS 7: DRAIN BIAS
 3: RF IN 8: RF OUT
 4: GATE BIAS 9: DRAIN BIAS
 5: GATE BIAS 10: DRAIN BIAS
 11: SOURCE

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

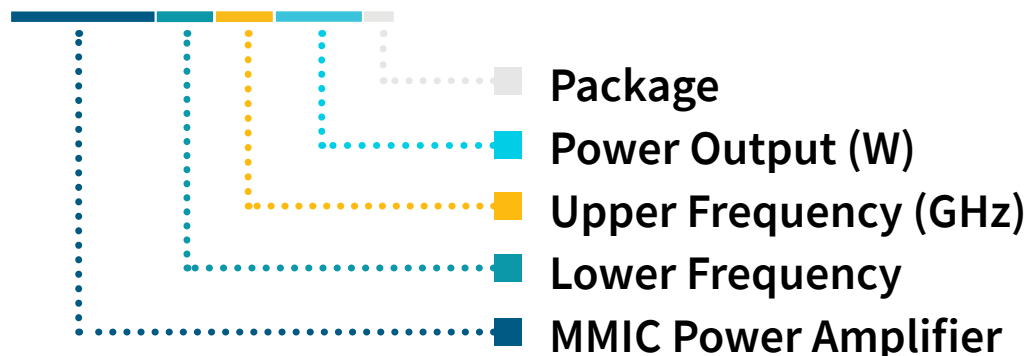


Table 1.

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

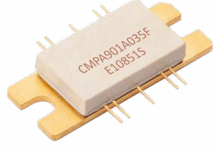

Note:

¹Alpha 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
CMPA901A035F	GaN HEMT	Each	
CMPA901A035F-AMP	Test Board with GaN MMIC Installed	Each	

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