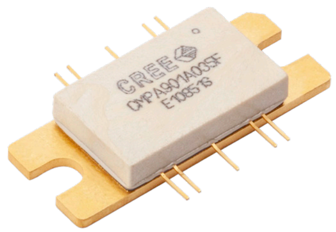
CMPA901A035F

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.



PN: CMPA901A035F
Package Type: 440213

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[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 V, I_{DQ} = 1500 mA
[2] Measured at Pin = -20 dBm
[3] Measured at Pin = 23 dBm and 300 μs; Duty Cycle = 20%

Features

- 35 W Typical P_{SAT}
- >33% Typical Power Added Efficiency
- 22.5 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

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

RoHS COMPLIANT

Absolute Maximum Ratings (not simultaneous) at 25˚C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	84	VDC	25°C
Gate-source Voltage	V_{GS}	-10, +2	VDC	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 Characteristics[2]						
Small Signal Gain	S21	–	34	–	dB	Pin = -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	Pin = -23 dBm, 9.0-10.0 GHz
Output Return Loss	S22	–	-6.8	–	dB	Pin = -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	$R_{θJC}$	0.93	˚C/W	
Operating Junction Temperature	T_J	217	˚C	P_{DISS} = 80 W, T_{CASE} = 85 ˚C
Thermal Resistance, Junction to Case	$R_{θJC}$	1.66	˚C/W	

Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

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

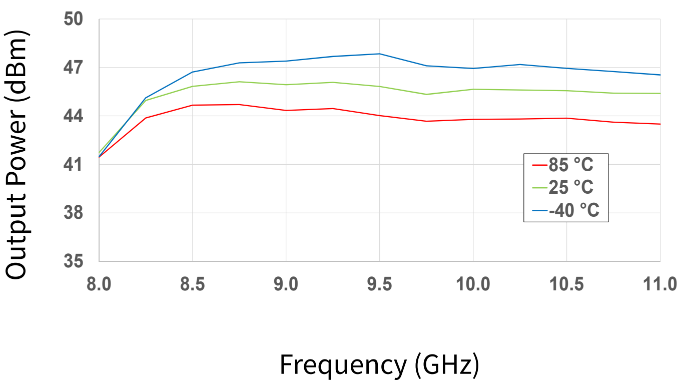


Figure 2. Output Power vs Frequency as a Function of Input Power

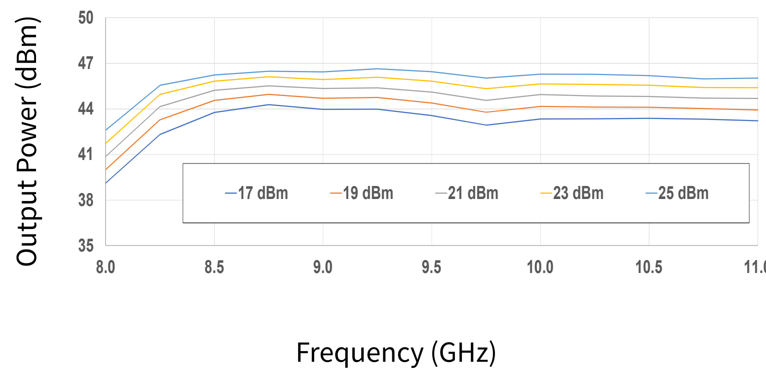


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

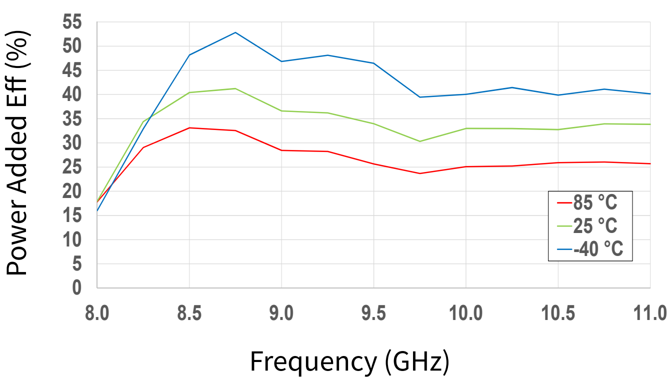


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

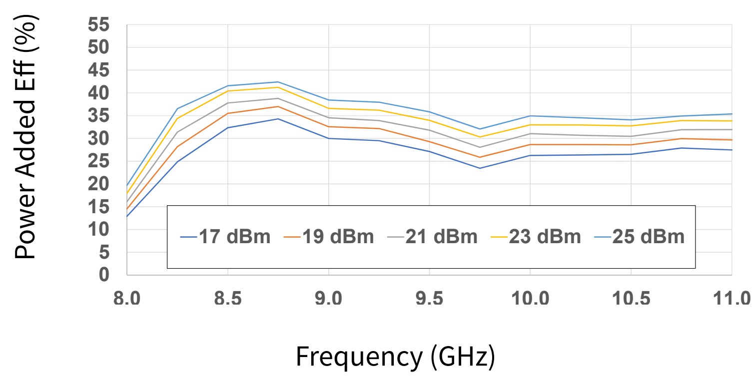


Figure 5. Drain Current vs Frequency as a Function of Temperature

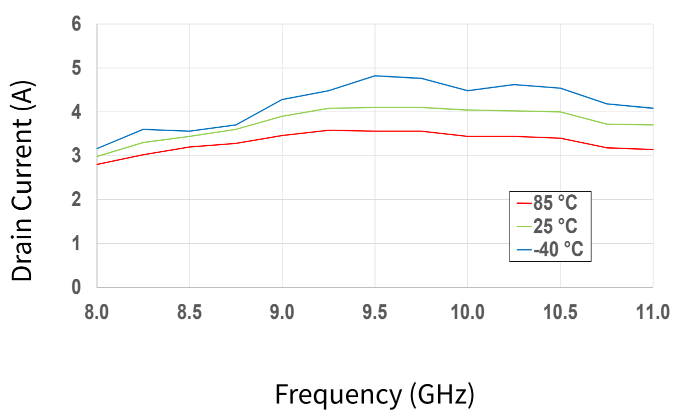
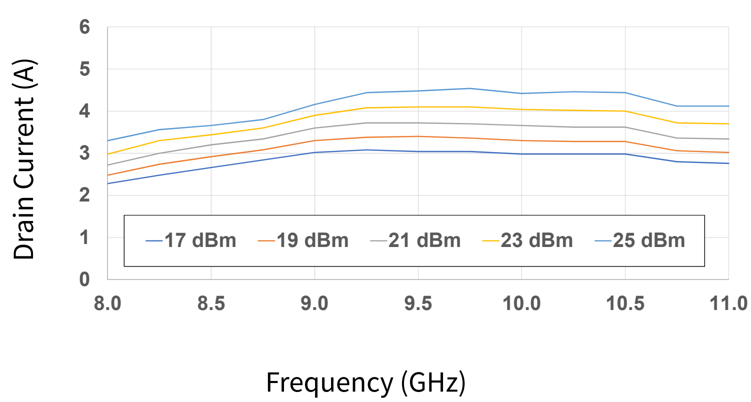


Figure 6. Drain Current vs Frequency as a Function of Input Power



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

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

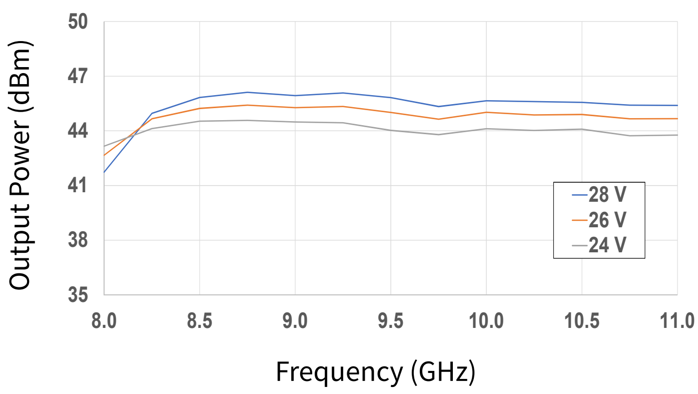


Figure 8. Output Power vs Frequency as a Function of IDQ

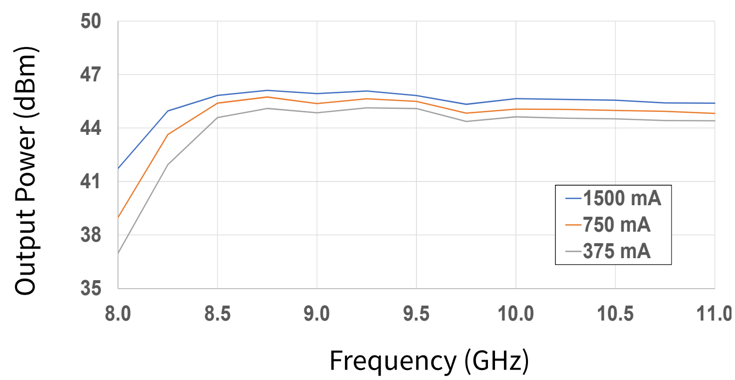


Figure 9. Power Added Eff. vs Frequency as a Function of VD

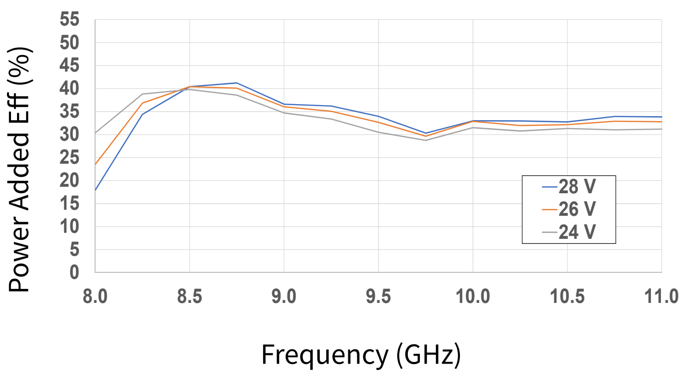


Figure 10. Power Added Eff. vs Frequency as a Function of IDQ

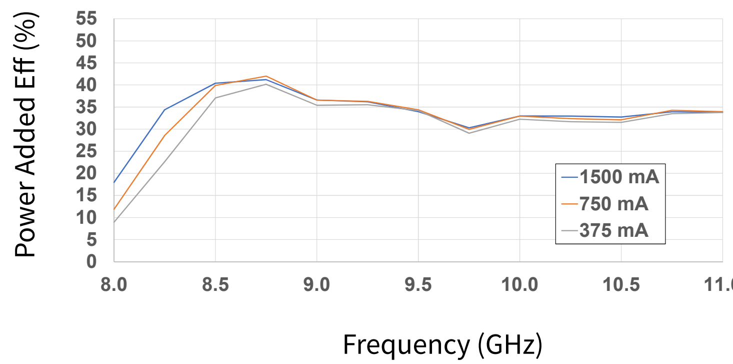


Figure 11. Drain Current vs Frequency as a Function of VD

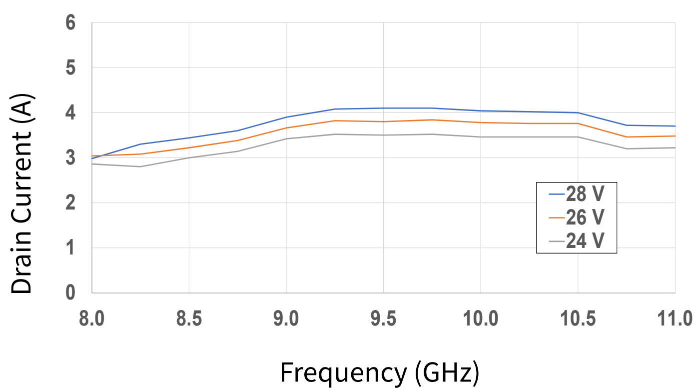
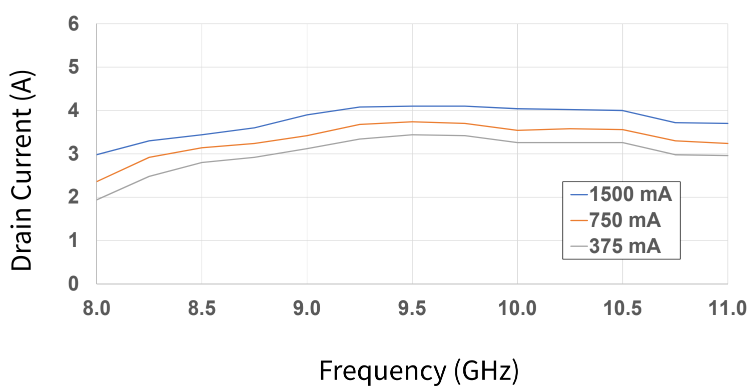


Figure 12. Drain Current vs Frequency as a Function of IDQ



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

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

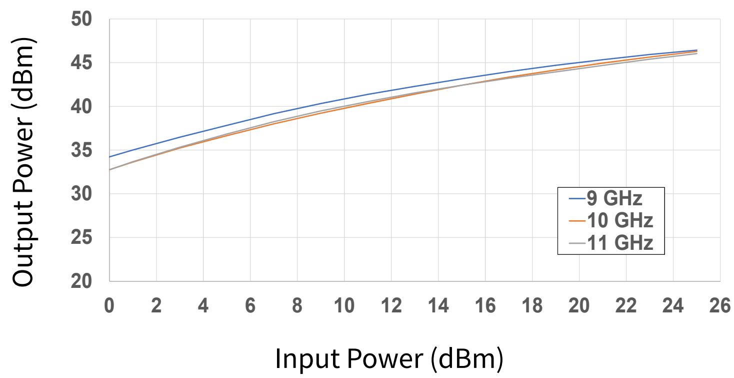


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

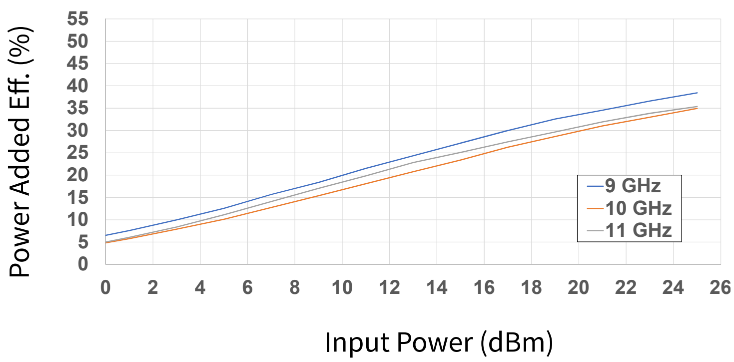


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

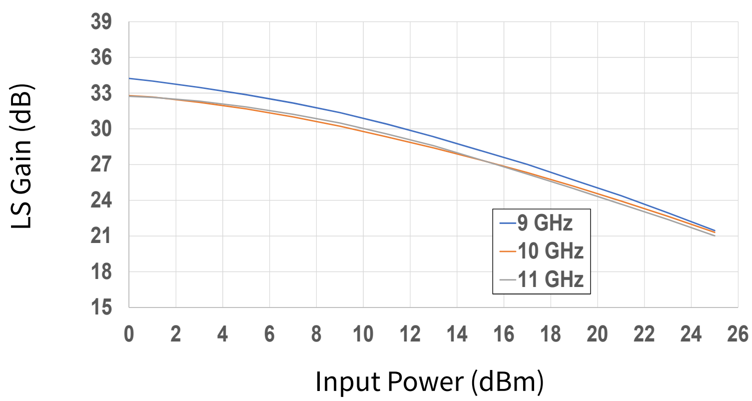


Figure 16. Drain Current vs Input Power as a Function of Frequency

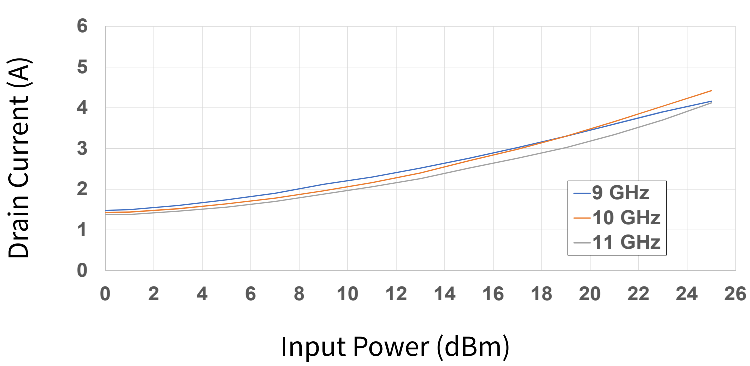
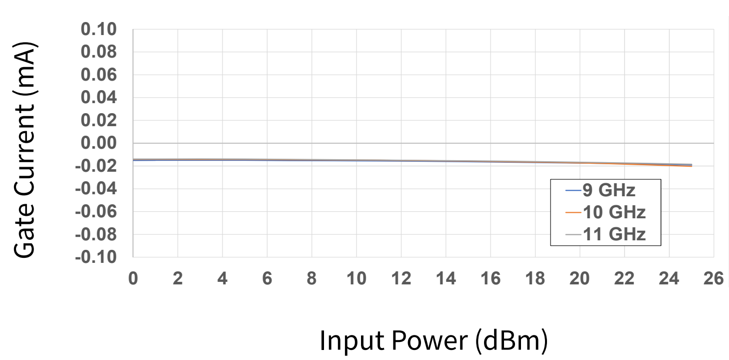


Figure 17. Gate Current vs Input Power as a Function of Frequency



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

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

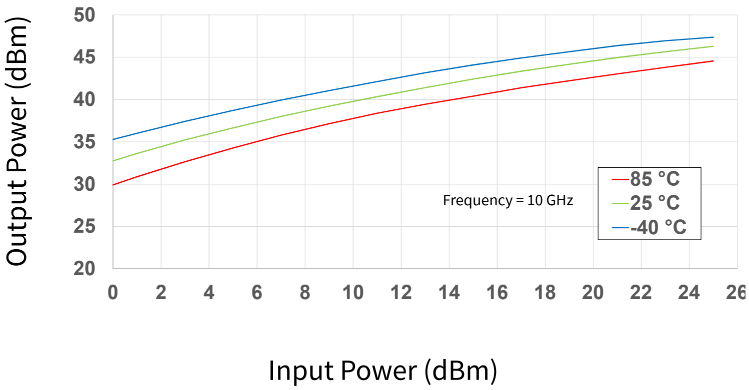


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

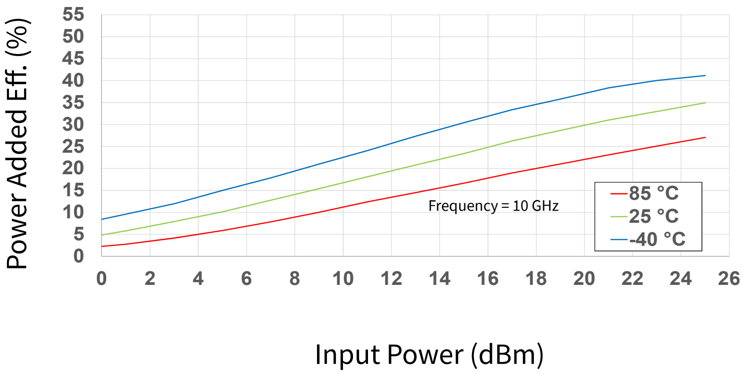


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

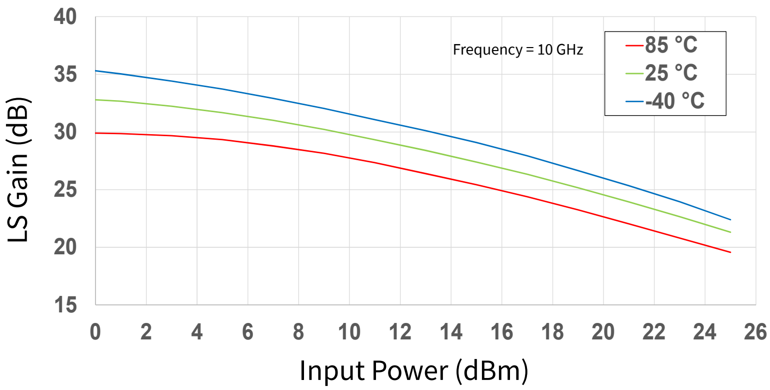


Figure 21. Drain Current vs Input Power as a Function of Temperature

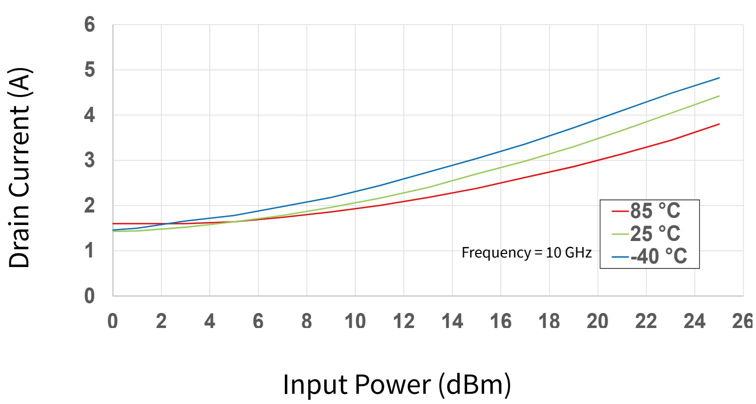
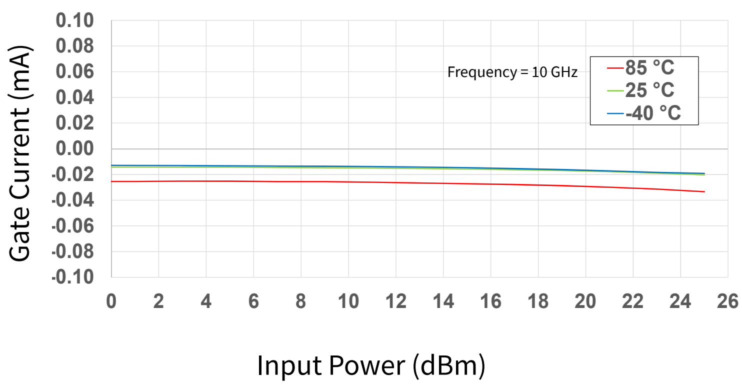


Figure 22. Gate Current vs Input Power as a Function of Temperature



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

Figure 23. Output Power vs Input Power as a Function of IDQ

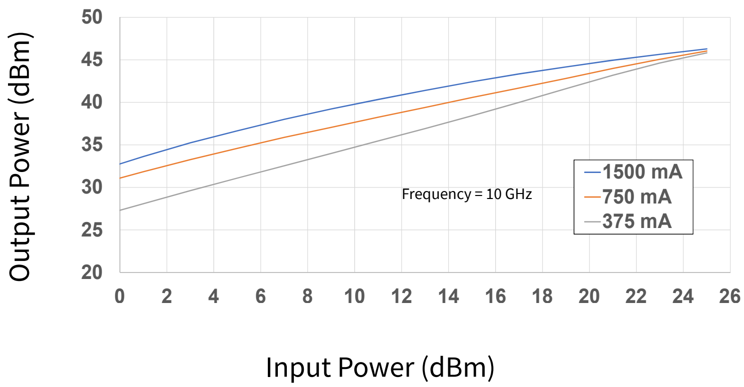


Figure 24. Power Added Eff. vs Input Power as a Function of IDQ

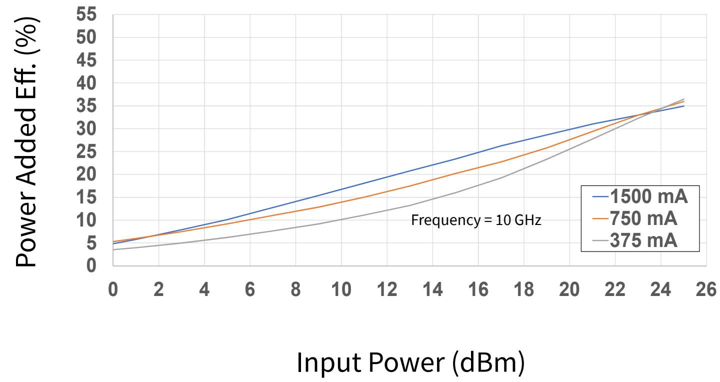


Figure 25. Large Signal Gain vs Input Power as a Function of IDQ

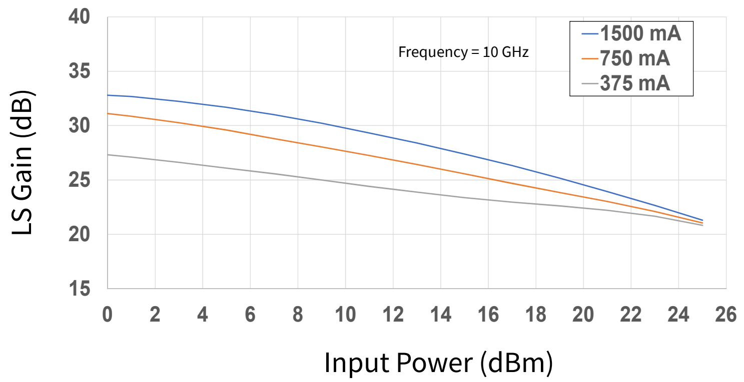


Figure 26. Drain Current vs Input Power as a Function of IDQ

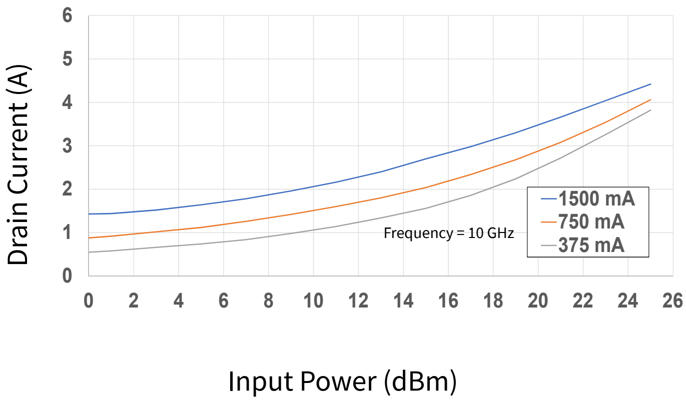
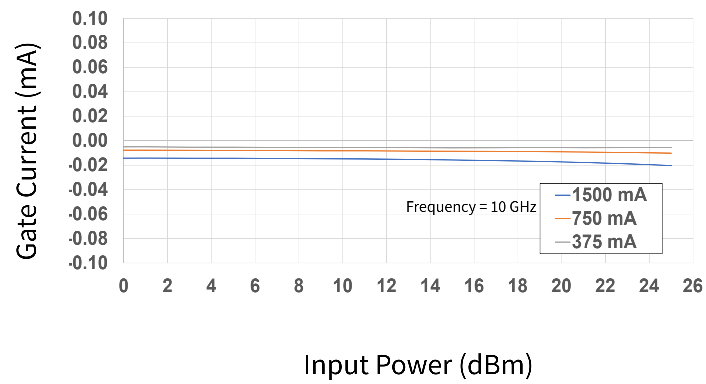


Figure 27. Gate Current vs Input Power as a Function of IDQ



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, Pulse Width = 300 µs, Duty Cycle = 20%, Pin = 23 dBm, T_{BASE} = +25 °C

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

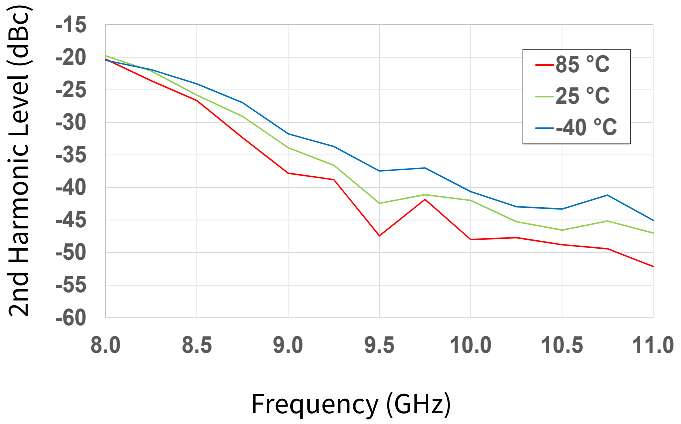


Figure 29. 2nd Harmonic vs Output Power as a Function of Frequency

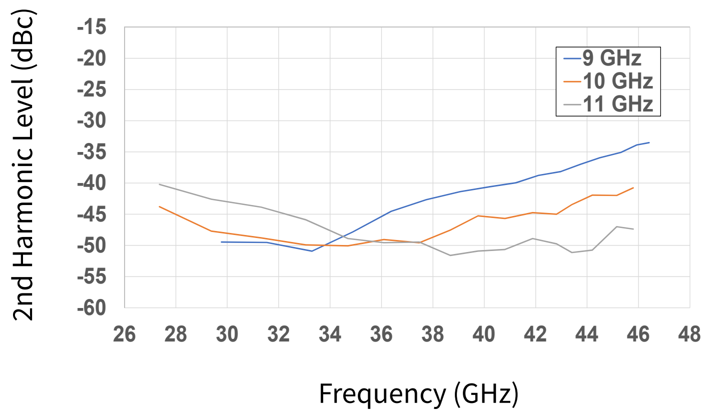
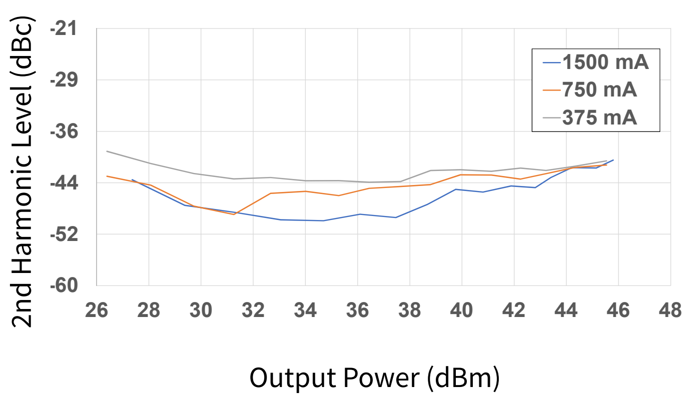


Figure 30. 2nd Harmonic vs Output Power as a Function of IDQ



Typical Performance of the CMPA901A035F

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

Figure 31. Gain vs Frequency as a Function of Temperature

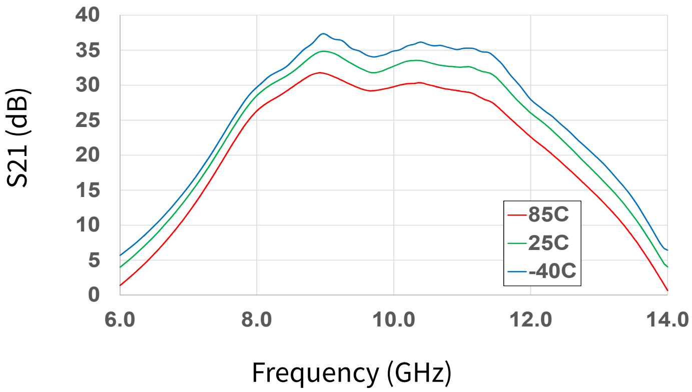


Figure 32. Gain vs Frequency as a Function of Temperature

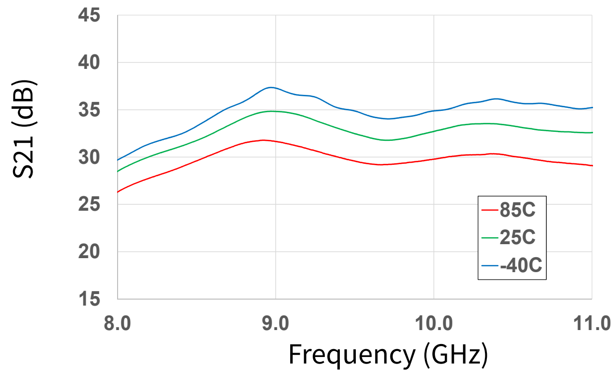


Figure 33. Input RL vs Frequency as a Function of Temperature

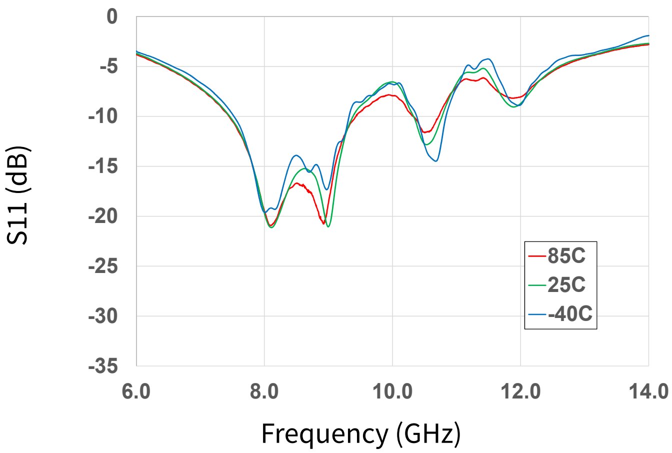


Figure 34. Input RL vs Frequency as a Function of Temperature

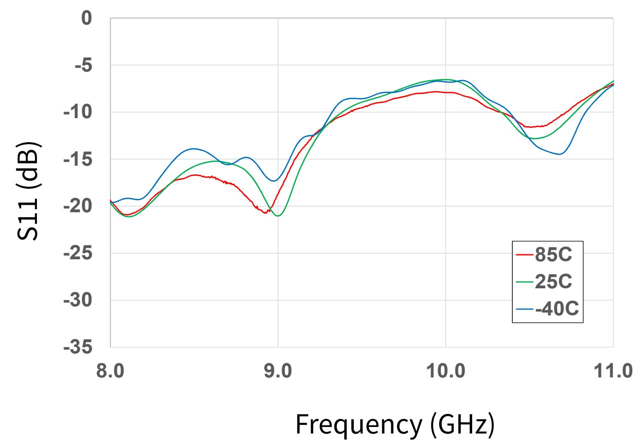


Figure 35. Output RL vs Frequency as a Function of Temperature

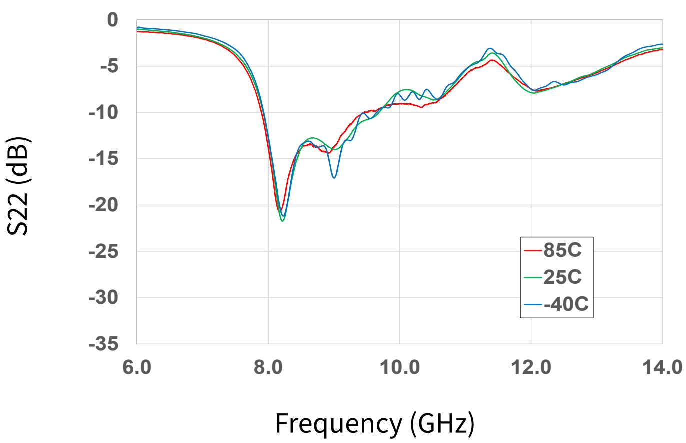
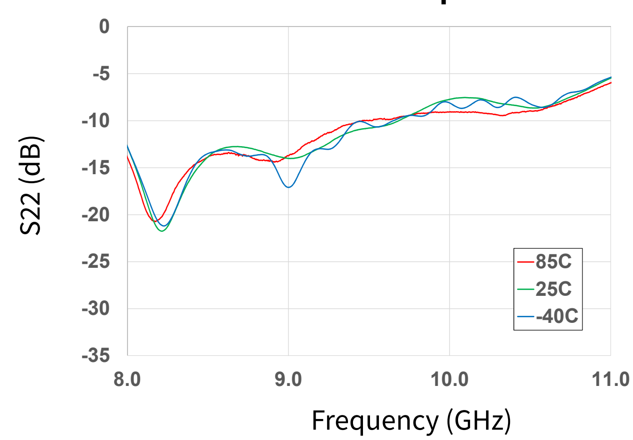


Figure 36. Output RL vs Frequency as a Function of Temperature



Typical Performance of the CMPA901A035F

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

Figure 37. Gain vs Frequency as a Function of Voltage

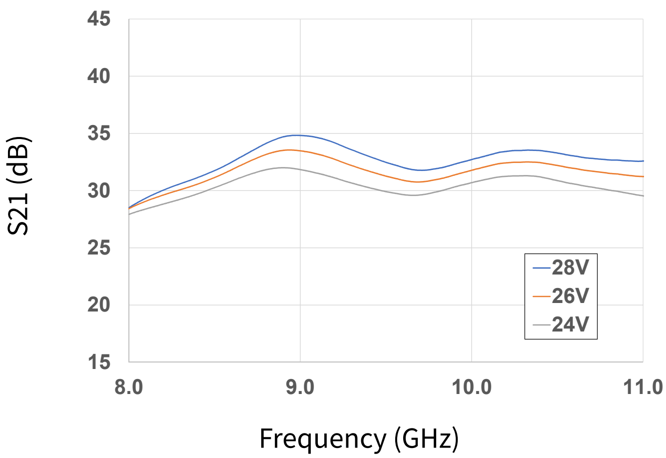


Figure 38. Gain vs Frequency as a Function of IDQ

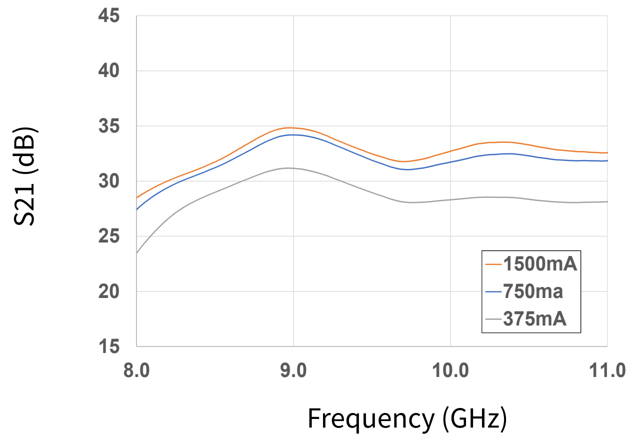


Figure 39. Input RL vs Frequency as a Function of Voltage

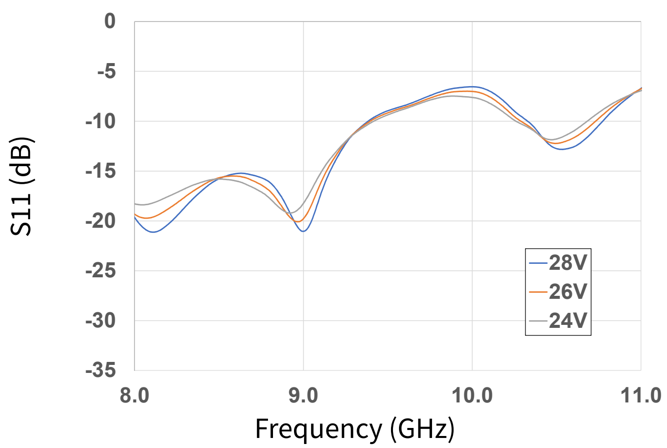


Figure 40. Input RL vs Frequency as a Function of IDQ

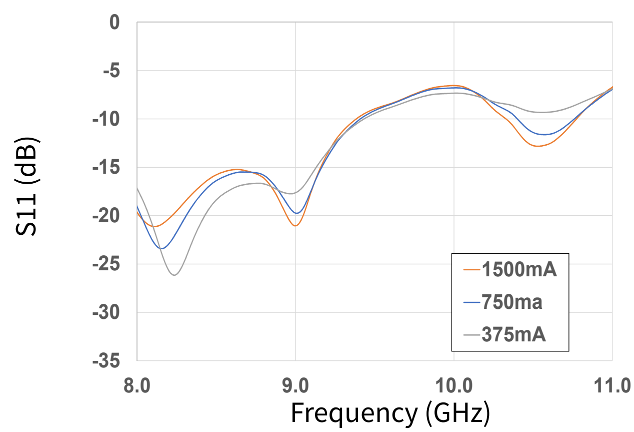


Figure 41. Output RL vs Frequency as a Function of Voltage

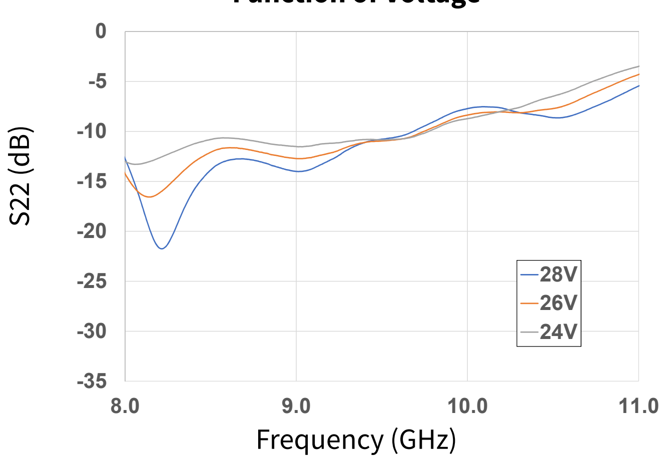
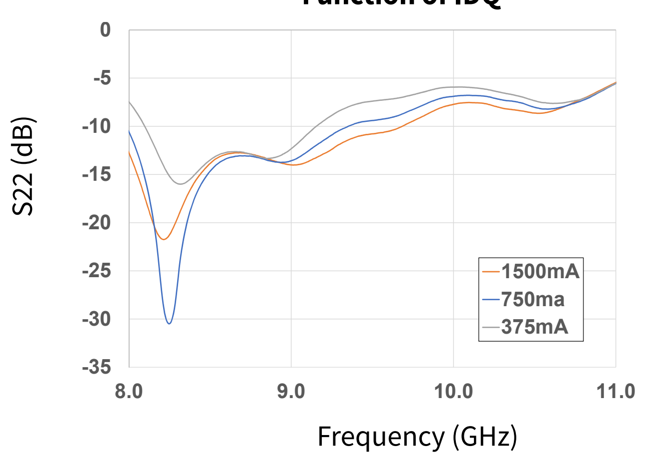


Figure 42. Output RL vs Frequency as a Function of IDQ



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, T_{BASE} = +25 °C

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

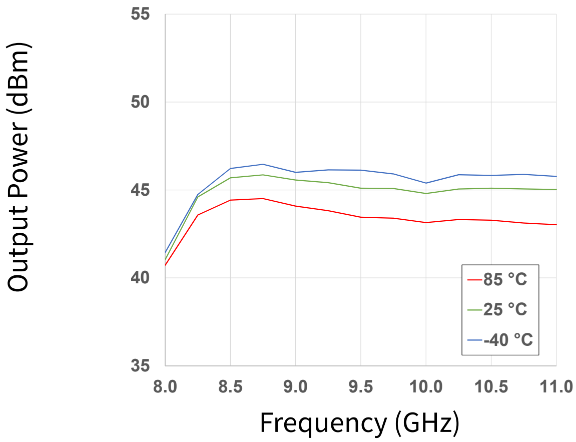


Figure 44. Power Added Eff. vs Frequency as a Function of Temperature

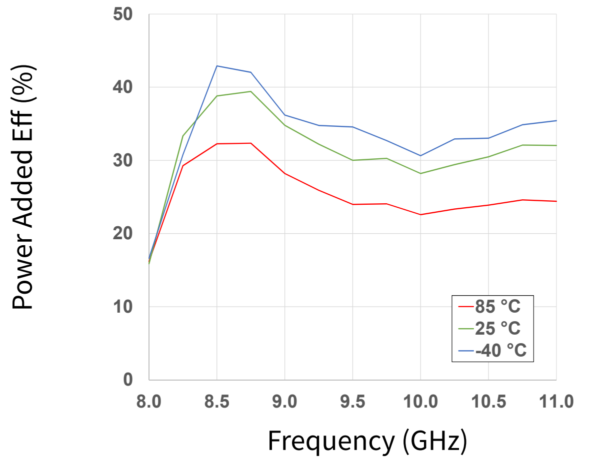


Figure 45. Drain Current vs Frequency as a Function of Temperature

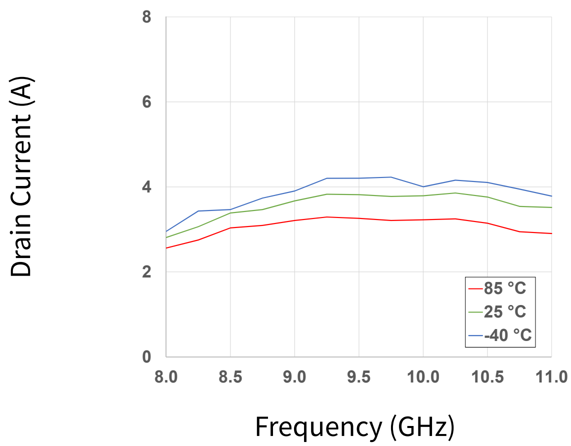


Figure 46. Gate Current vs Frequency as a Function of Temperature

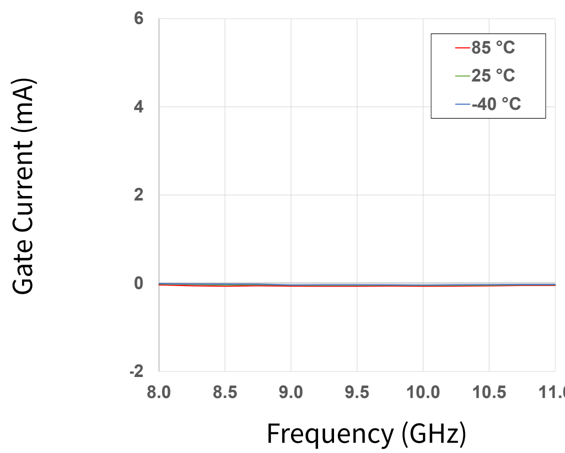
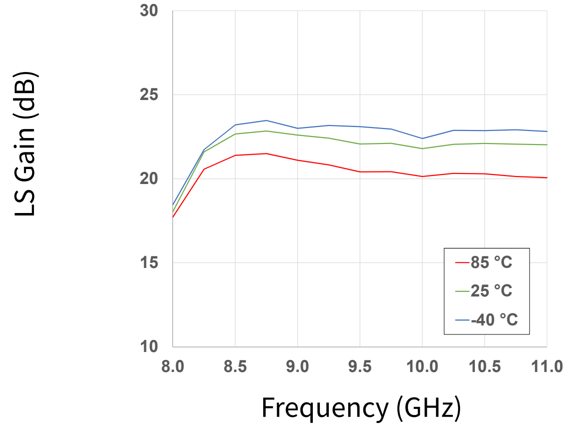


Figure 47. Large Signal Gain vs Frequency as a Function of Temperature



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, T_{BASE} = +25 °C

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

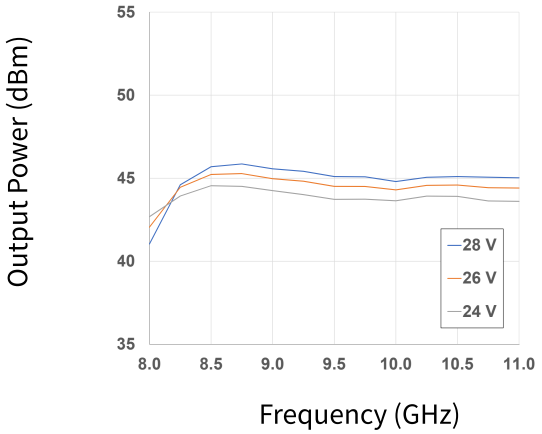


Figure 49. Power Added Eff. vs Frequency as a Function of Voltage

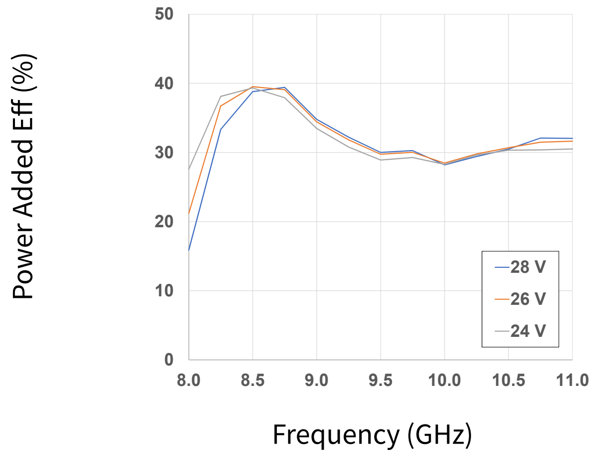


Figure 50. Drain Current vs Frequency as a Function of Voltage

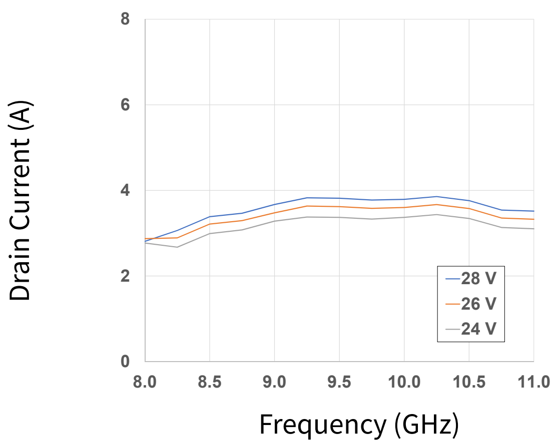


Figure 51. Gate Current vs Frequency as a Function of Voltage

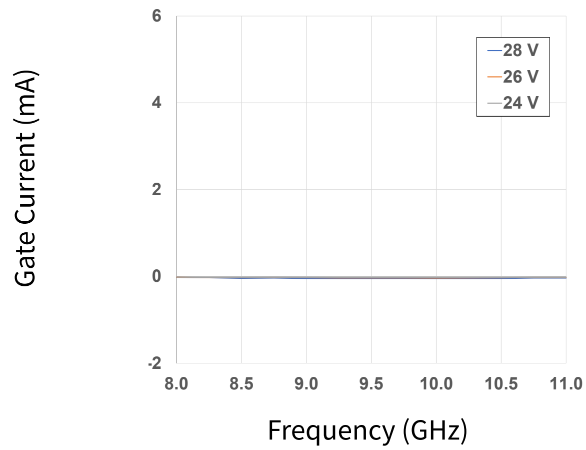
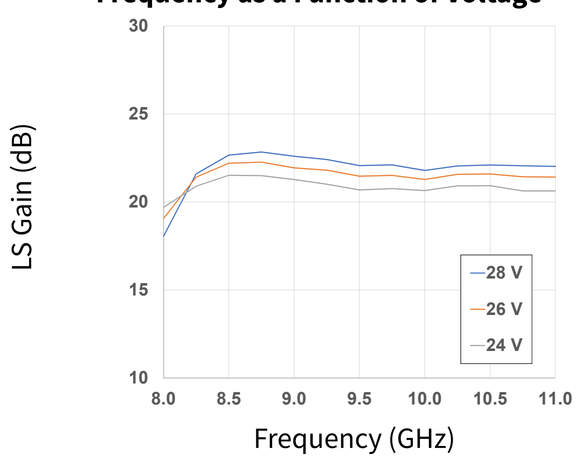


Figure 52. Large Signal Gain vs Frequency as a Function of Voltage



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, T_{BASE} = +25 °C

Figure 53. Output Power vs Frequency as a Function of IDQ

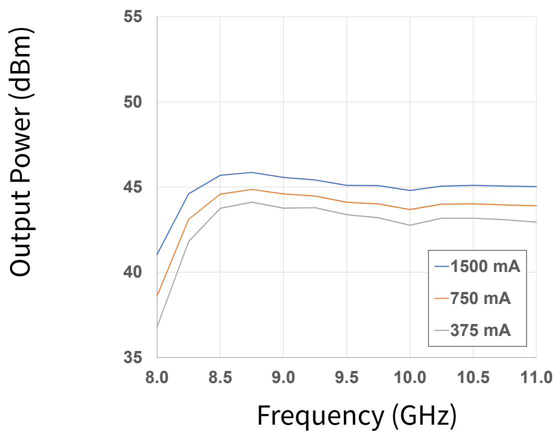


Figure 54. Power Added Eff. vs Frequency as a Function of IDQ

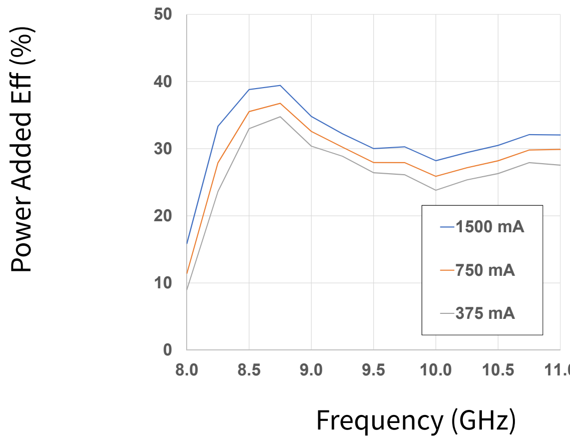


Figure 55. Drain Current vs Frequency as a Function of IDQ

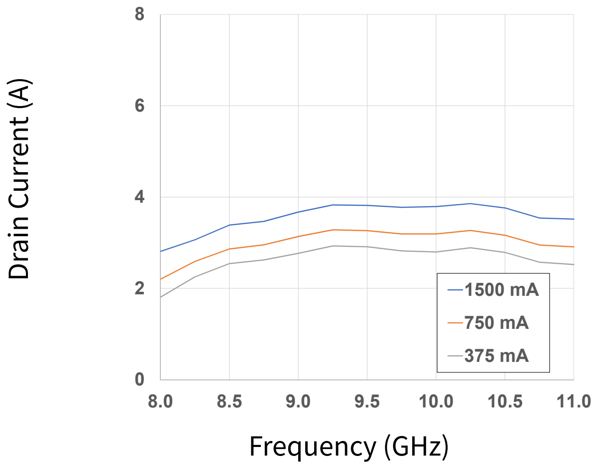


Figure 56. Gate Current vs Frequency as a Function of IDQ

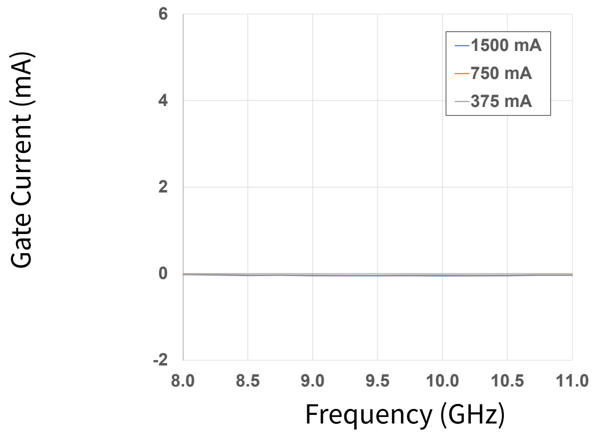
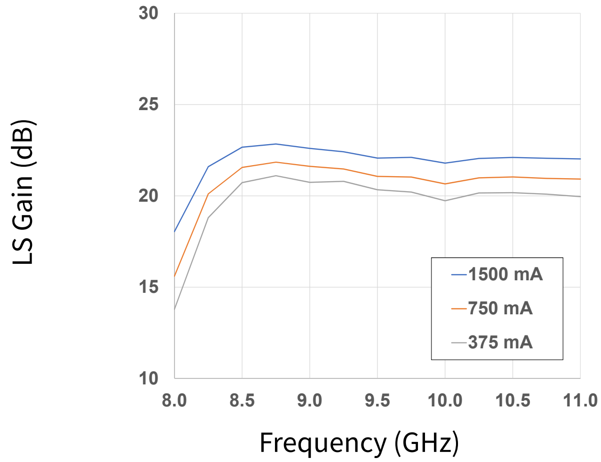


Figure 57. Large Signal Gain vs Frequency as a Function of IDQ



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, Frequency = 10 GHz, T_{BASE} = +25 °C

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

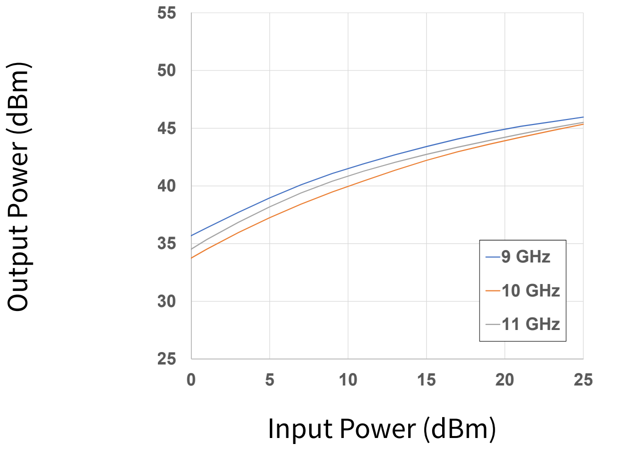


Figure 59. Power Added Eff. vs Input Power as a Function of Frequency

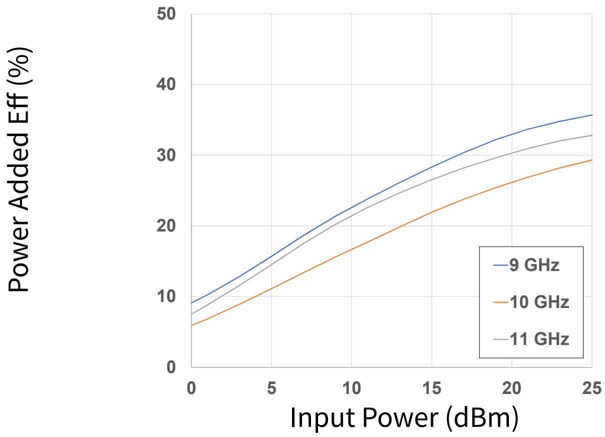


Figure 60. Drain Current vs Input Power as a Function of Frequency

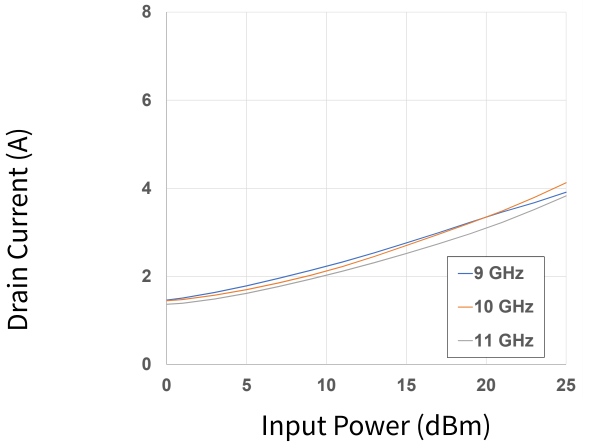


Figure 61. Gate Current vs Input Power as a Function of Frequency

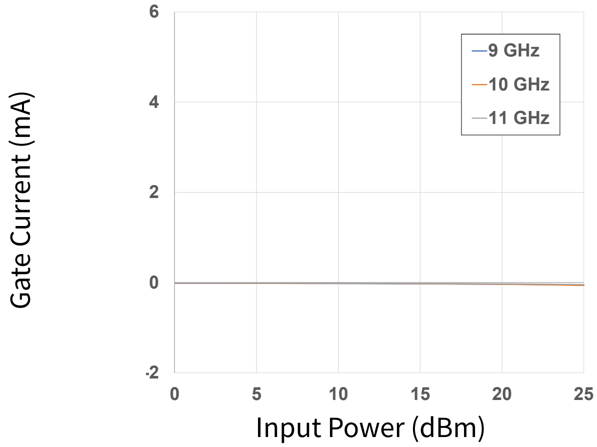
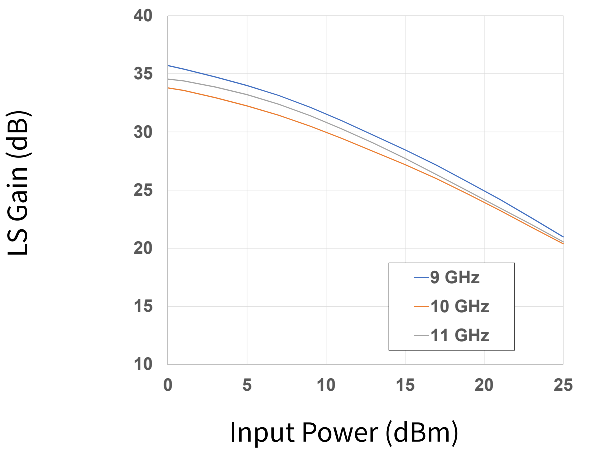


Figure 62. Large Signal Gain vs Input Power as a Function of Frequency



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, Frequency = 10 GHz, T_{BASE} = +25 °C

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

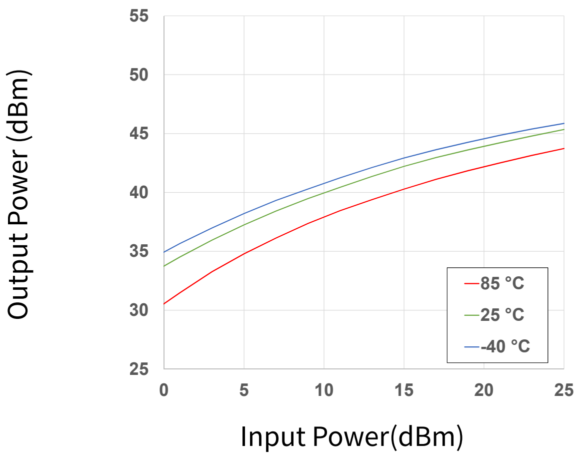


Figure 64. Power Added Eff. vs Input Power as a Function of Temperature

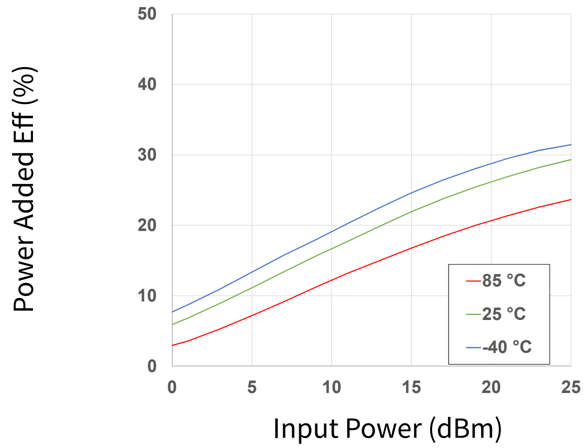


Figure 65. Drain Current vs Input Power as a Function of Temperature

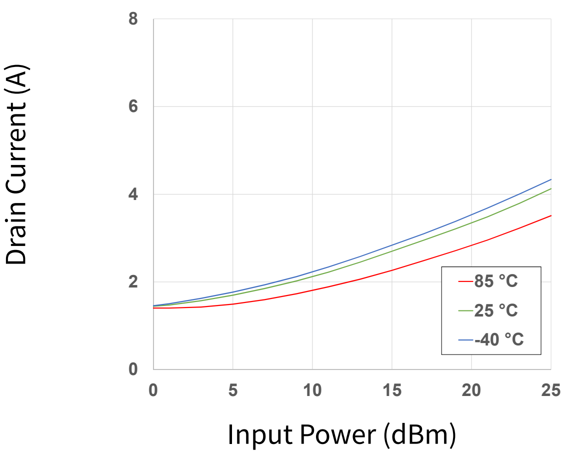


Figure 66. Gate Current vs Input Power as a Function of Temperature

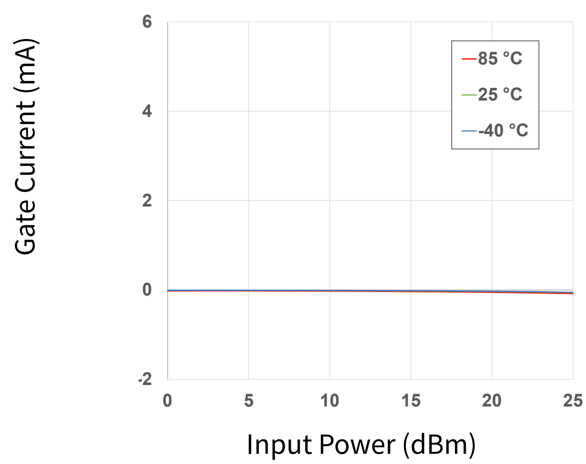
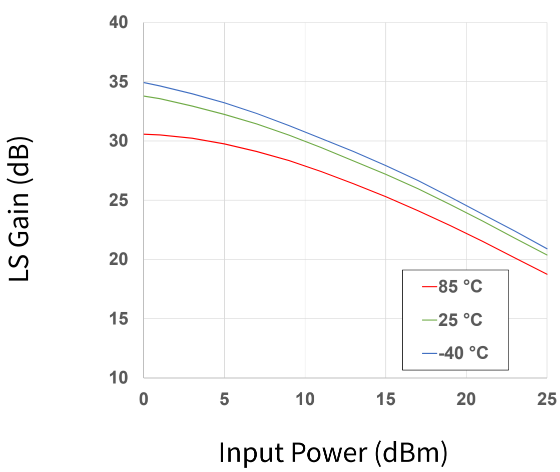


Figure 67. Large Signal Gain vs Input Power as a Function of Temperature



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, Frequency = 10 GHz, T_{BASE} = +25 °C

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

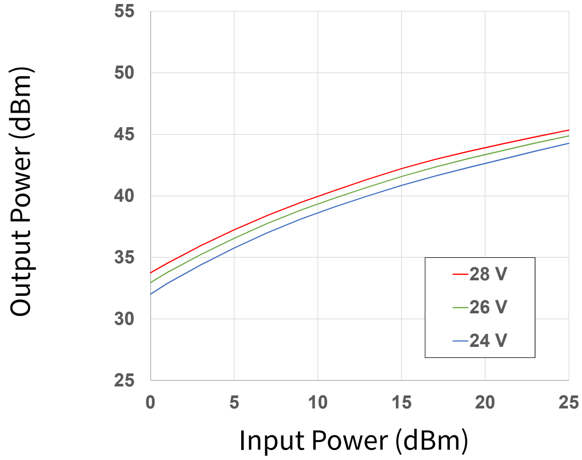


Figure 69. Power Added Eff. vs Input Power as a Function of Voltage

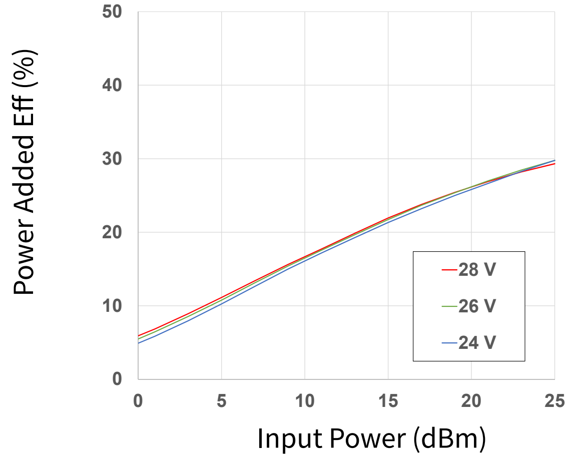


Figure 70. Drain Current vs Input Power as a Function of Voltage

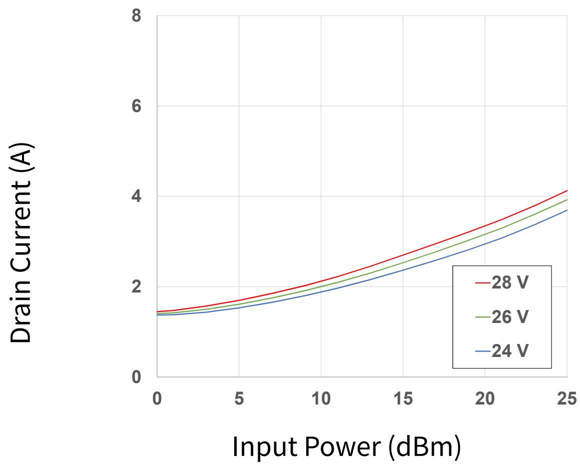


Figure 71. Gate Current vs Input Power as a Function of Voltage

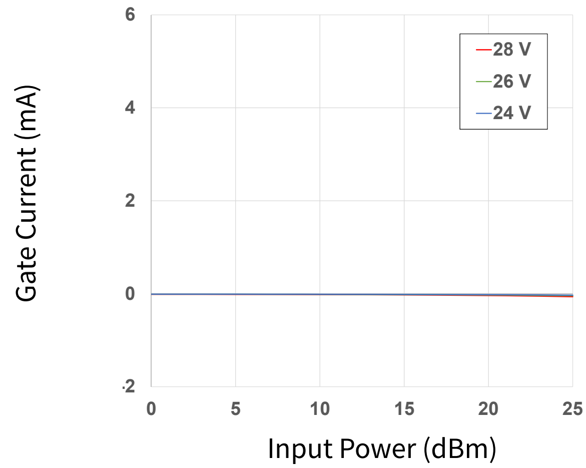
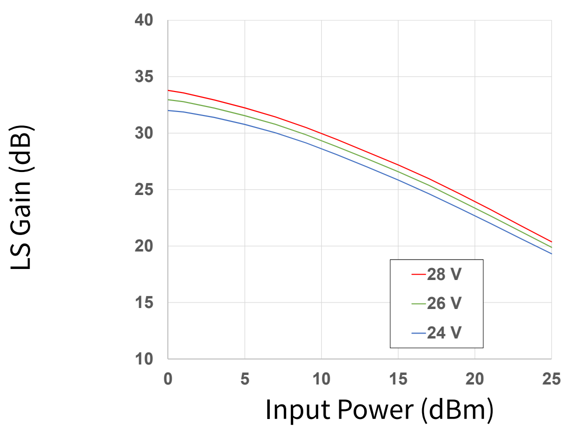


Figure 72. Large Signal Gain vs Input Power as a Function of Voltage



Typical Performance of the CMPA901A035F

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 1500 mA, CW, Pin = 23 dBm, T_{BASE} = +25 °C

Figure 73. Output Power vs Input Power as a Function of IDQ

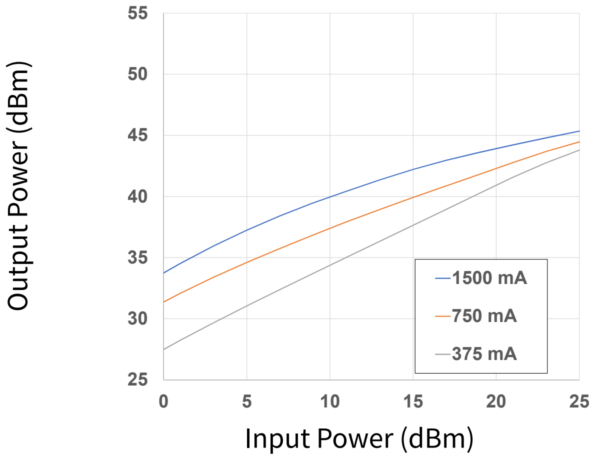


Figure 74. Power Added Eff. vs Input Power as a Function of IDQ

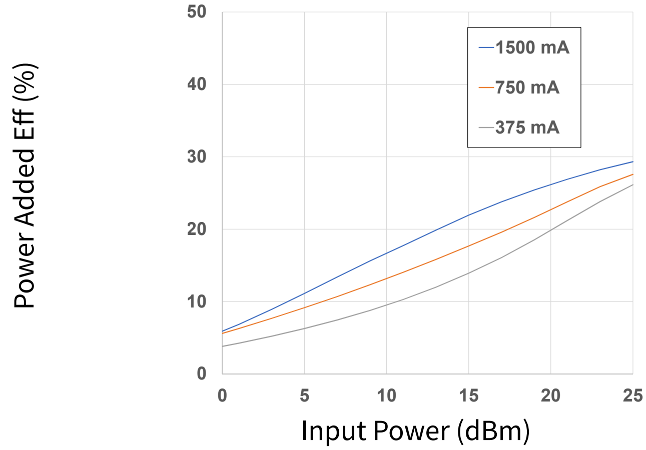


Figure 75. Drain Current vs Input Power as a Function of IDQ

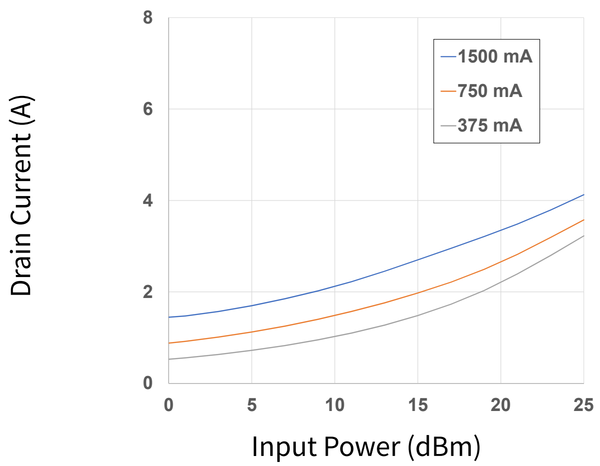


Figure 76. Gate Current vs Input Power as a Function of IDQ

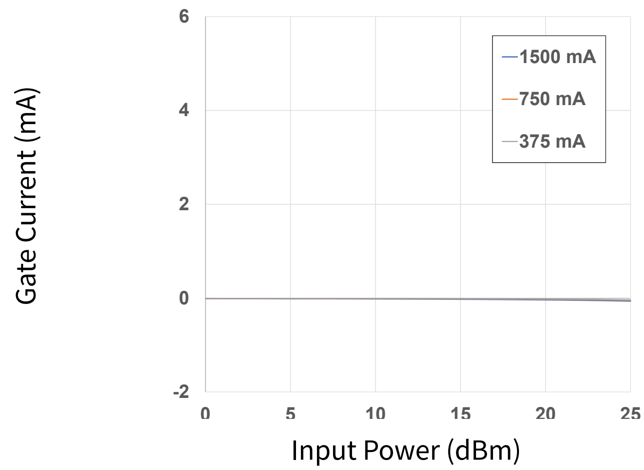
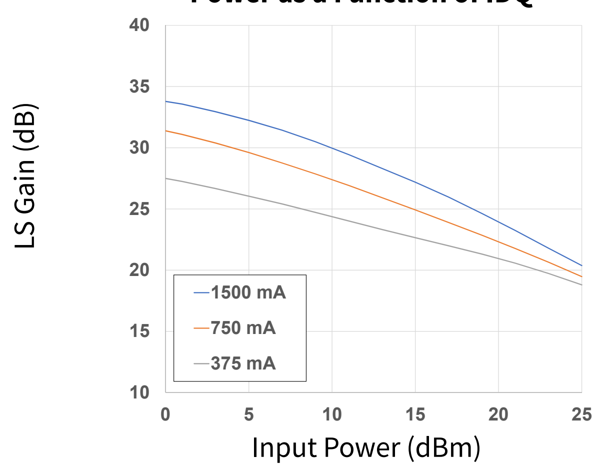


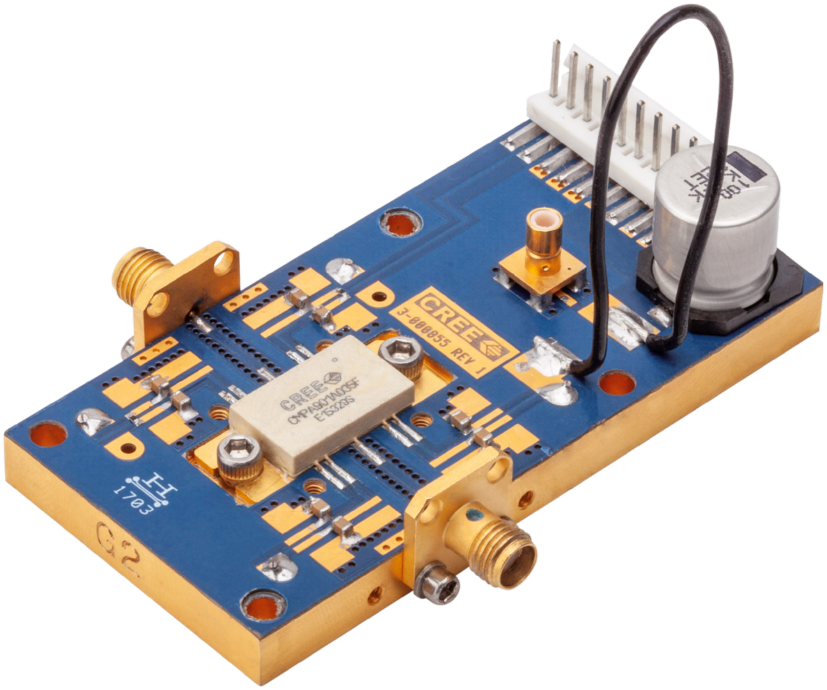
Figure 77. Large Signal Gain vs Input Power as a Function of IDQ



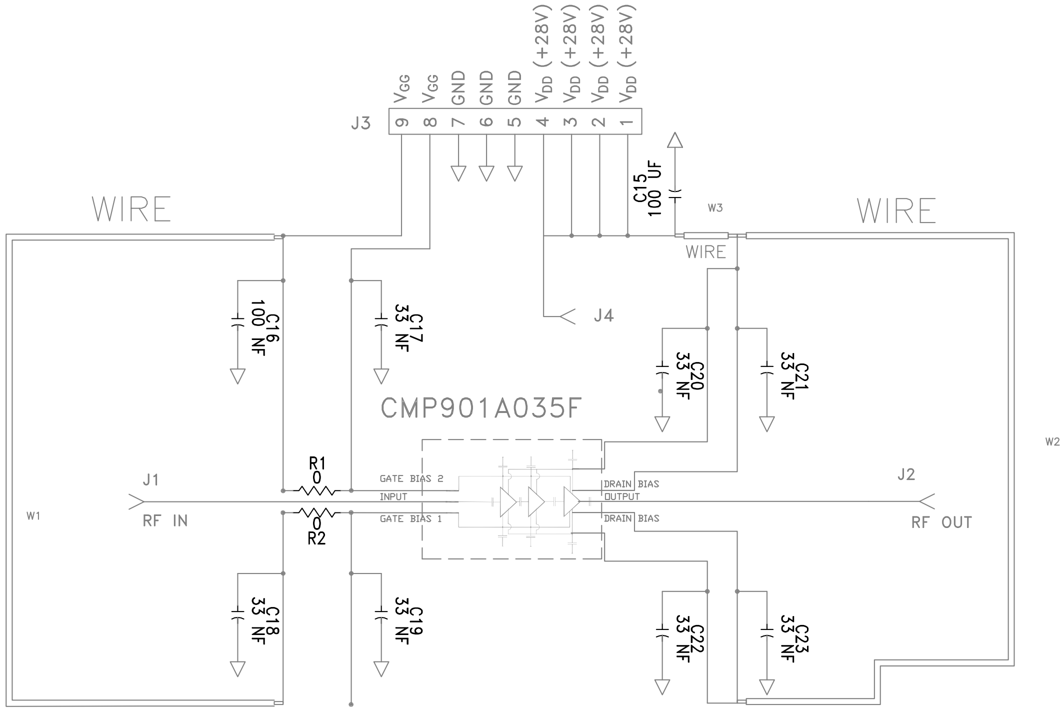
CMPA901A035F-AMP Evaluation Board Bill of Materials

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

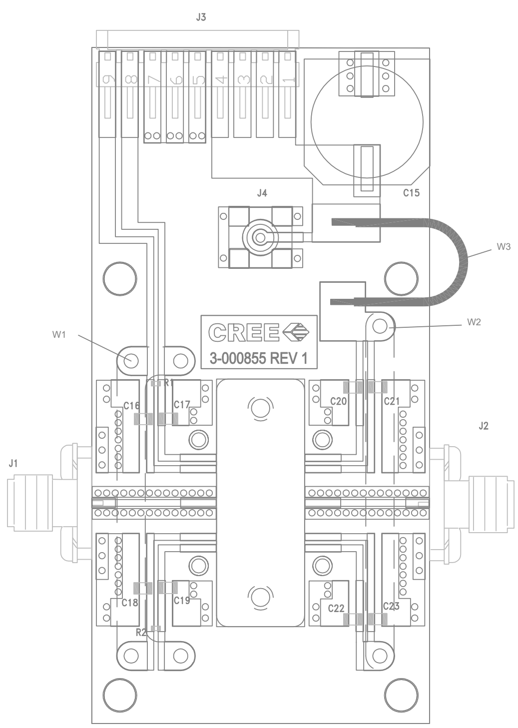
CMPA901A035F-AMP Evaluation Board Circuit



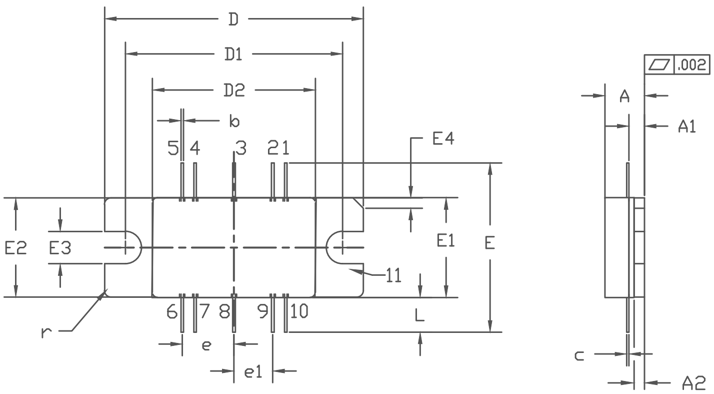
CMPA901A035F-AMP Evaluation Board Schematic



CMPA901A035F-AMP Evaluation Board Outline



Product Dimensions CMPA901A035F



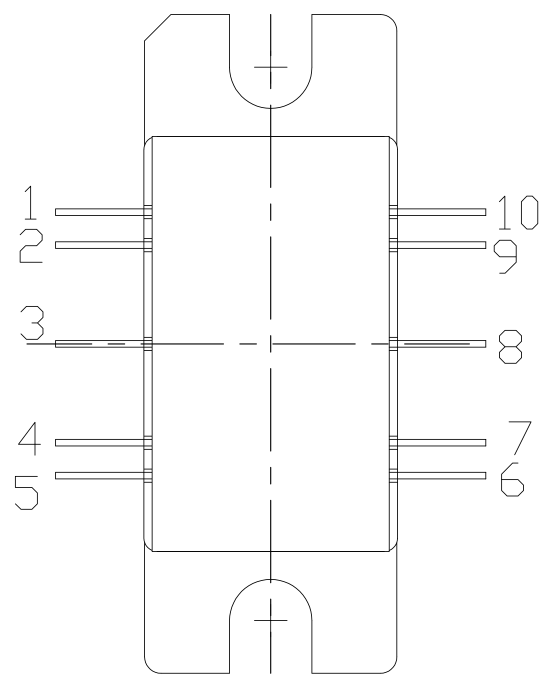
NOTES:

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.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
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



Part Number System

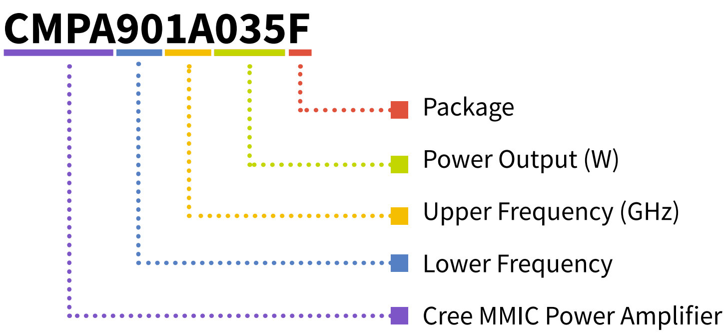


Table 1.

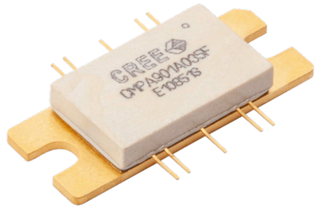
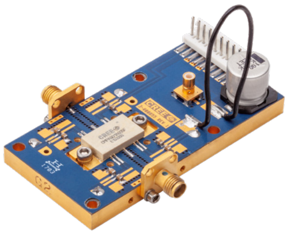
Parameter	Value	Units
Lower Frequency	9.0	GHz
Upper Frequency[1]	10.0	GHz
Power Output	35	W
Package	Flanged	-

Note[1]: 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:	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

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

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com

Notes

Disclaimer

Specifications are subject to change without notice. “Typical” parameters are the average values expected by Cree in large quantities and are provided for information purposes only. Cree products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death. No responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Cree.