

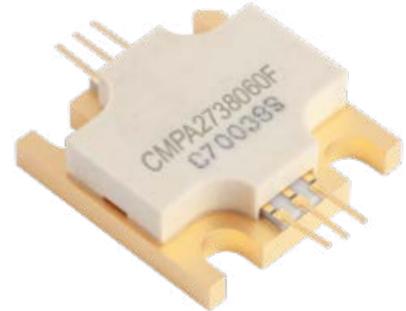
CMPA2738060F

60 W, 2.7 - 3.8 GHz, GaN MMIC,
Power Amplifier

Description

The CMPA2738060F is a packaged, high-power MMIC amplifier producing 85W of saturated output power over the 2.7 - 3.8 GHz frequency range. With 27dB of large signal gain and achieving 50% power-added efficiency or higher, the CMPA2738060F is ideally suited to support a variety of S-Band radar applications.

The CMPA2738060F also supports ease of use and straight-forward system integration. Matched to 50 ohms at both RF ports along with DC blocking capacitors, thermal-management is further enhanced in a bolt-down, flanged package allowing for long-pulse operation.



Package Type: 440219
PN: CMPA2738060F

Typical Performance Over 2.7 - 3.8 GHz ($T_c = 25^\circ\text{C}$)

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	3.5 GHz	3.8 GHz	Units
Small Signal Gain	36.1	36.0	34.5	35.7	35.0	dB
Output Power ¹	88.0	86.5	74.0	81.0	81.2	W
Power Gain ¹	29.4	29.4	28.7	29.1	29.1	dB
PAE ¹	52.5	55.5	50.4	53.0	51.0	%

Note:

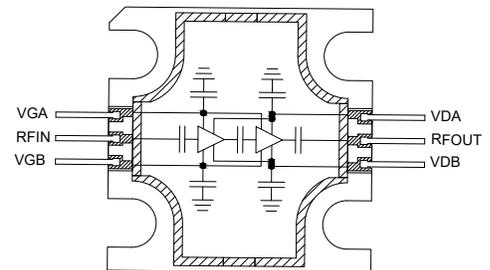
¹ $P_{IN} = 20 \text{ dBm}$

Features

- 35 dB Small Signal Gain
- 80 W Typical P_{SAT}
- Operation up to 50 V
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" Total Product Size

Applications

- Civil and Military Pulsed Radar Amplifiers



Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	150	V_{DC}	25°C
Gate-source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	12	mA	25°C
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case (packaged) ¹	$R_{\theta JC}$	0.77	°C/W	300µsec, 20%, 85°C
		1.44		CW, 85°C

Note:

¹ Measured for the CMPA2738050F at $P_{DISS} = 64\text{ W}$

Electrical Characteristics (Frequency = 2.7 GHz to 3.8 GHz unless otherwise stated; $T_c = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10\text{ V}, I_D = 15.2\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—	V_{DC}	$V_{DD} = 50\text{ V}, I_{DQ} = 280\text{ mA}$
Saturated Drain Current ¹	I_{DS}	9.9	14.1	—	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	V_{BD}	100	—	—	V	$V_{GS} = -8\text{ V}, I_D = 15.2\text{ mA}$
RF Characteristics^{2,3}						
Small Signal Gain at 2.7 GHz	S21	—	36.1	—	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 280\text{ mA}$
Small Signal Gain at 3.1 GHz		—	34.5	—		
Small Signal Gain at 3.8 GHz		—	35.0	—		
Output Power at 2.7 GHz	P_{OUT}	—	88.0	—	W	$V_{DD} = 50\text{ V}, I_{DQ} = 280\text{ mA}, P_{IN} = 20\text{ dBm}$
Output Power at 3.1 GHz		—	86.5	—		
Output Power at 3.8 GHz		—	81.2	—		
Power Added Efficiency at 2.7 GHz	PAE	—	52.5	—	%	
Power Added Efficiency at 3.1 GHz		—	55.5	—		
Power Added Efficiency at 3.8 GHz		—	51.0	—		
Input Return Loss at 2.7 GHz	S11	—	-11.3	—	dB	$V_{DD} = 50\text{ V}, I_{DQ} = 280\text{ mA}$
Input Return Loss at 3.1 GHz		—	-25.0	—		
Input Return Loss at 3.8 GHz		—	-11.5	—		
Output Return Loss at 2.7 GHz	S22	—	-8.5	—	dB	
Output Return Loss at 3.1 GHz		—	-11.0	—		
Output Return Loss at 3.8 GHz		—	-8.0	—		
Output Mismatch Stress	VSWR	—	—	5:1	Ψ	No damage at all phase angles, $V_{DD} = 50\text{ V}, I_{DQ} = 280\text{ mA}, P_{OUT} = 60\text{ W}$

Notes:

¹ Scaled from PCM data

² All data pulse tested in CMPA2738060F-AMP

³ Pulse Width = 300µs, Duty Cycle = 20%

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, -40°C at $P_{IN} = 18\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

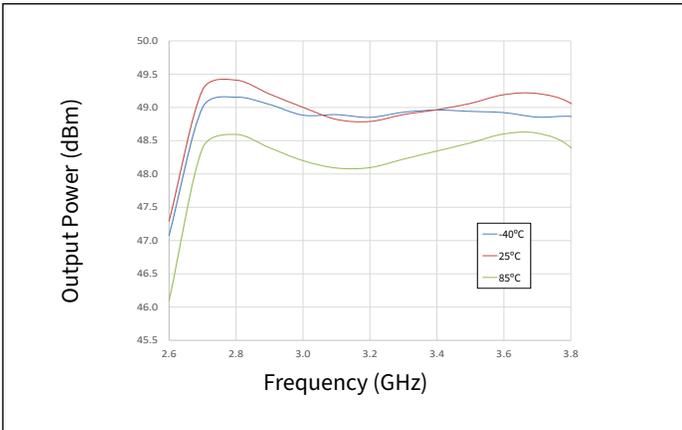


Figure 1. Output Power vs Frequency as a Function of Temperature

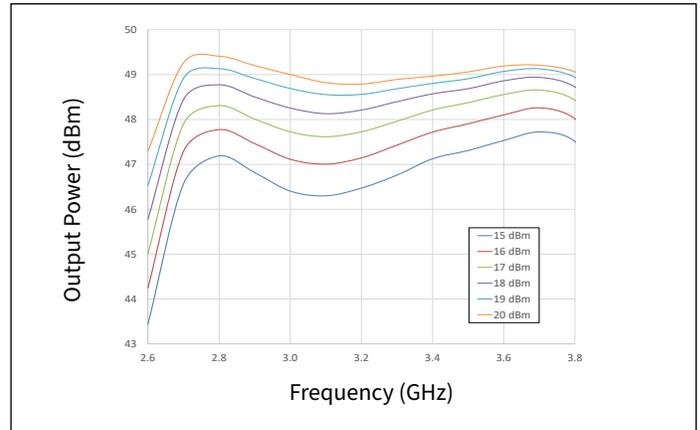


Figure 2. Output Power vs Frequency as a Function of Input Power

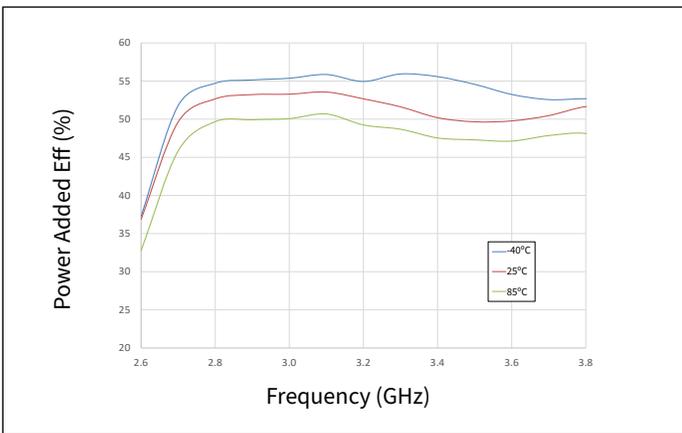


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

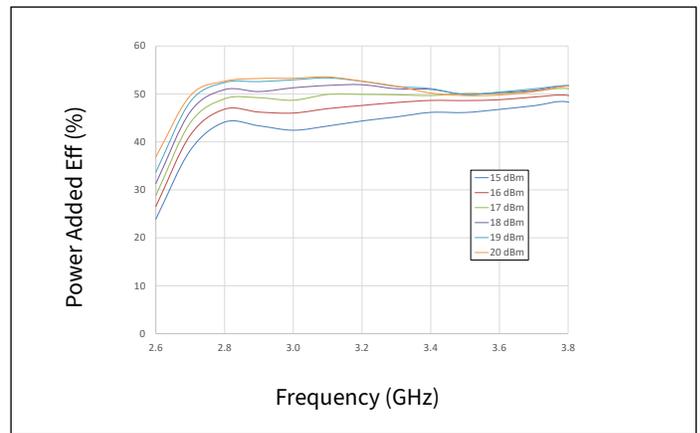


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

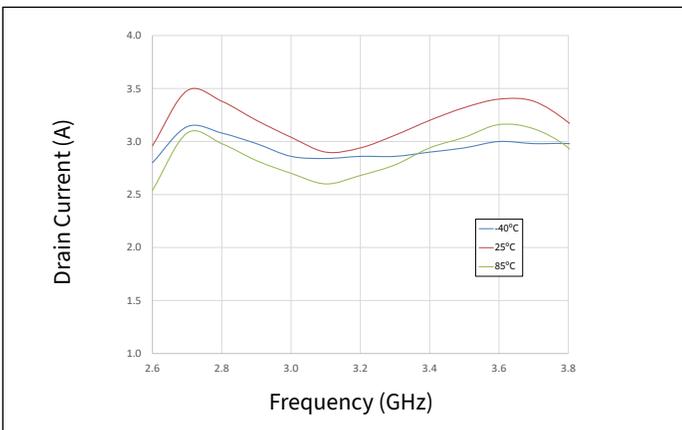


Figure 5. Drain Current vs Frequency as a Function of Temperature

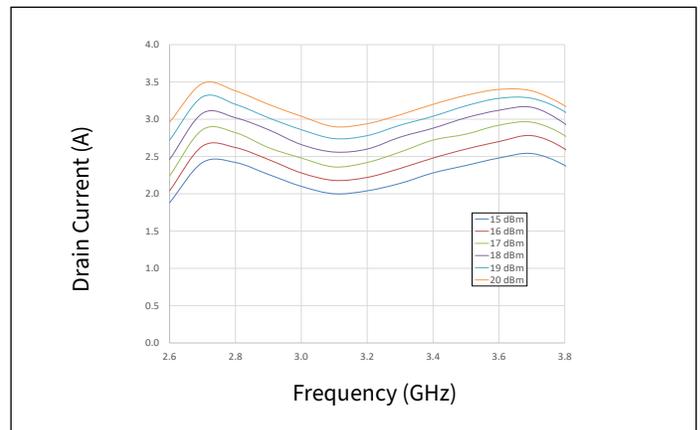


Figure 6. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

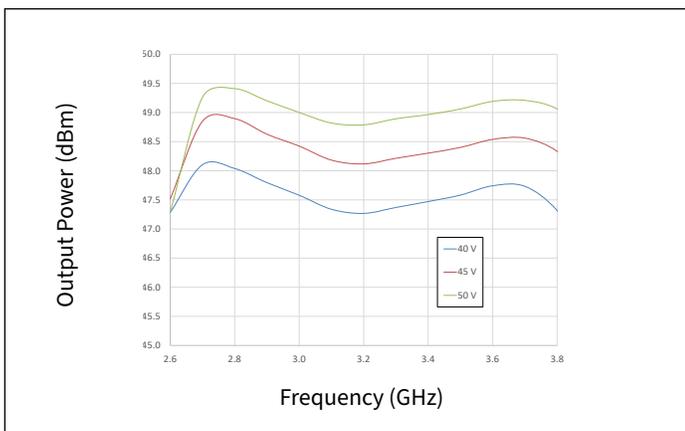


Figure 7. Output Power vs Frequency as a Function of V_D

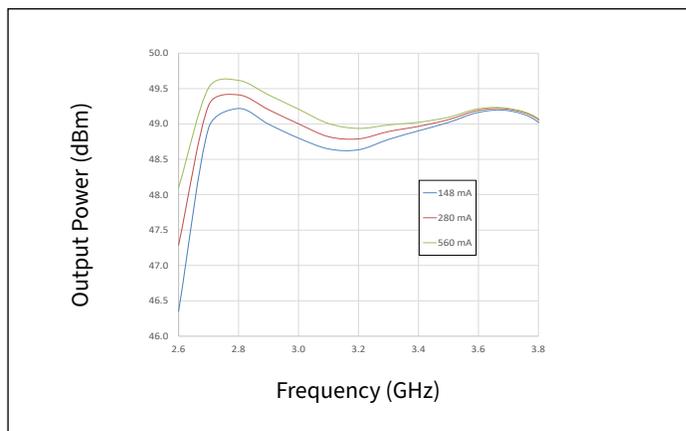


Figure 8. Output Power vs Frequency as a Function of I_{DQ}

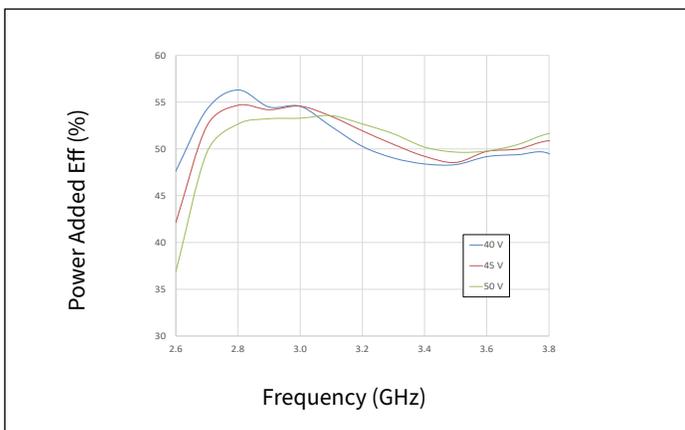


Figure 9. Power Added Eff. vs Frequency as a Function of V_D

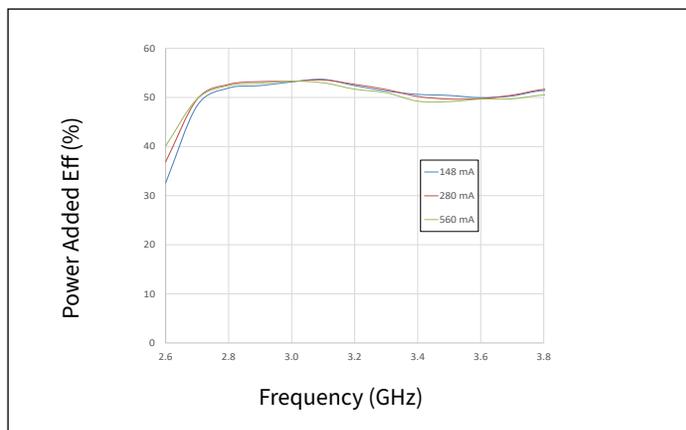


Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

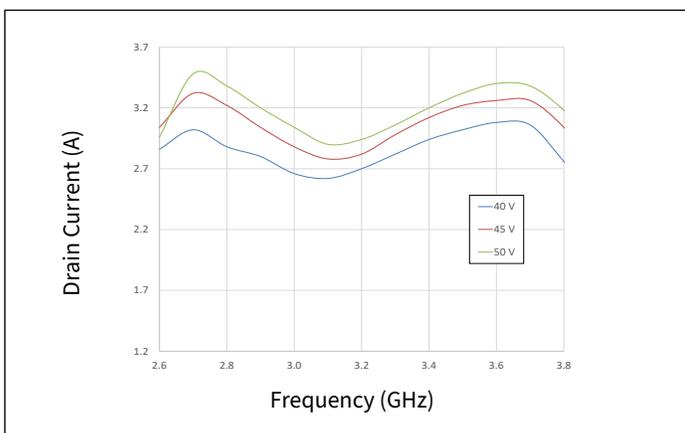


Figure 11. Drain Current vs Frequency as a Function of V_D

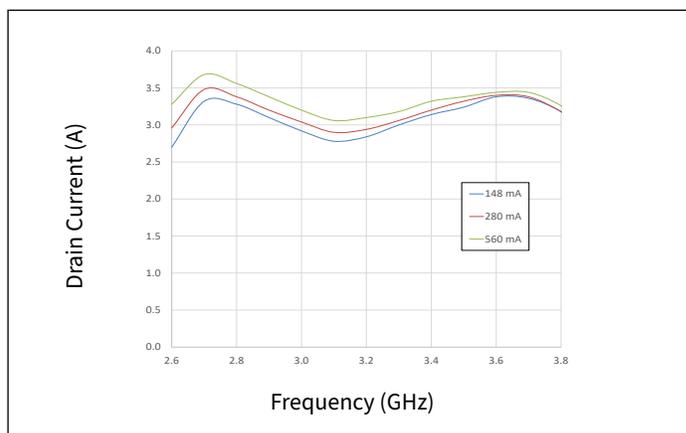


Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

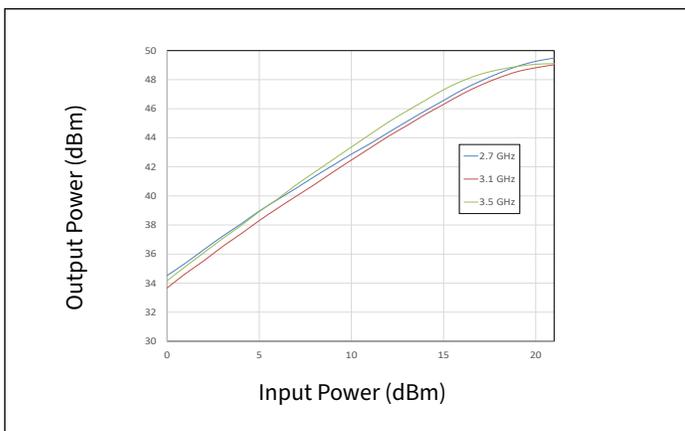


Figure 13. Output Power vs Input Power as a Function of Frequency

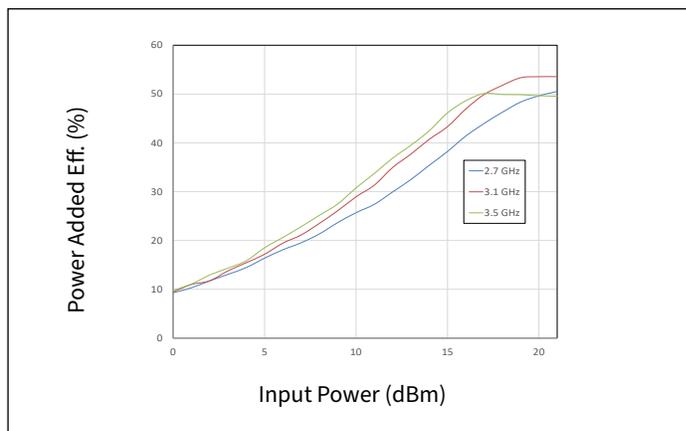


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

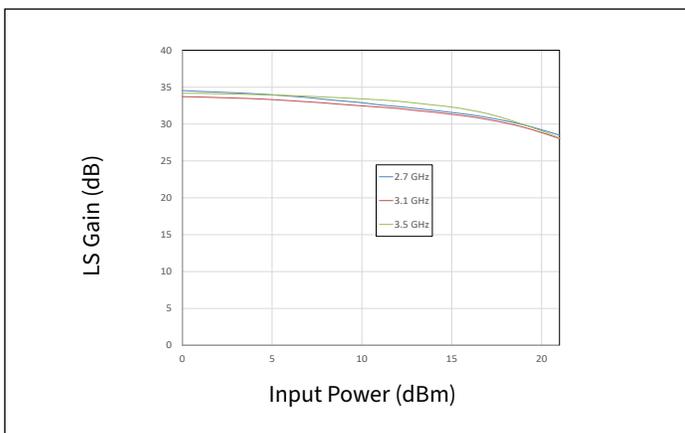


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

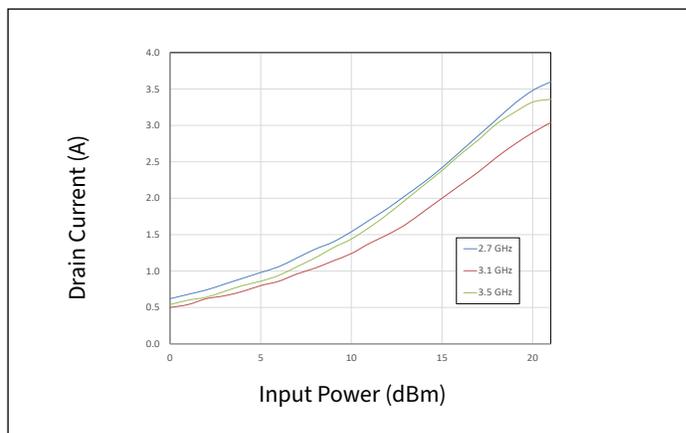


Figure 16. Drain Current vs Input Power as a Function of Frequency

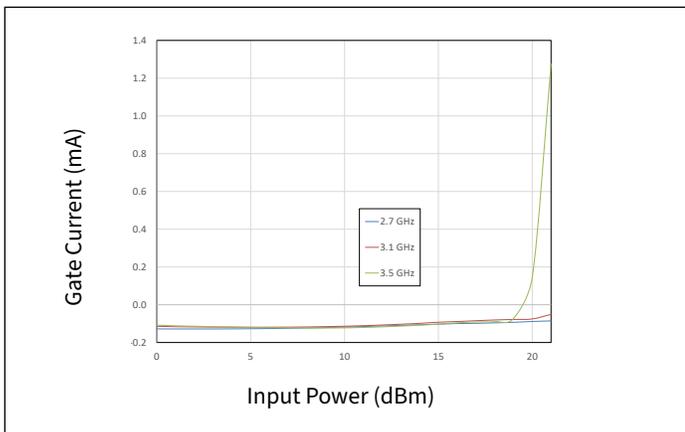


Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

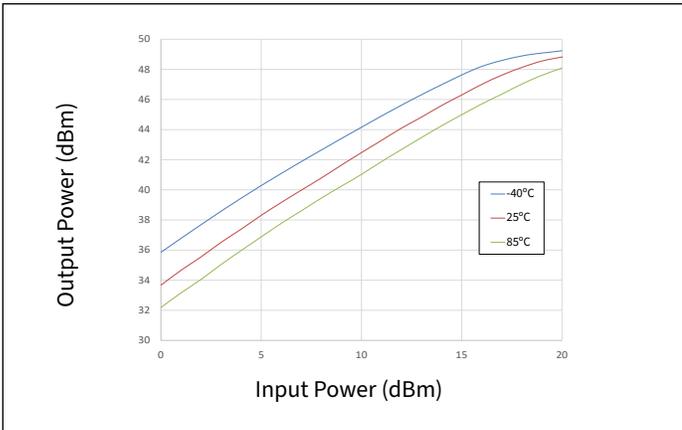


Figure 18. Output Power vs Input Power as a Function of Temperature

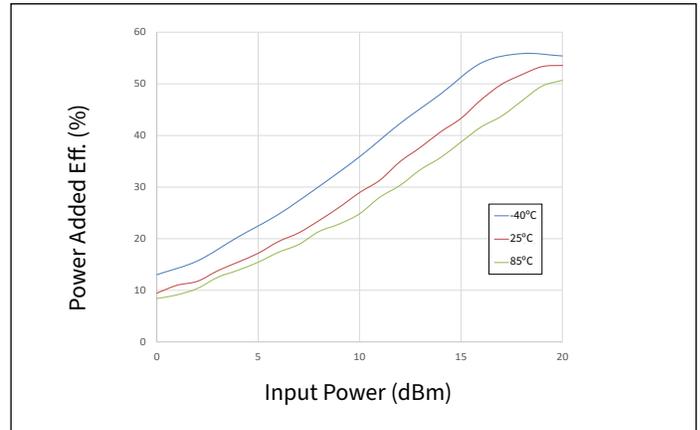


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

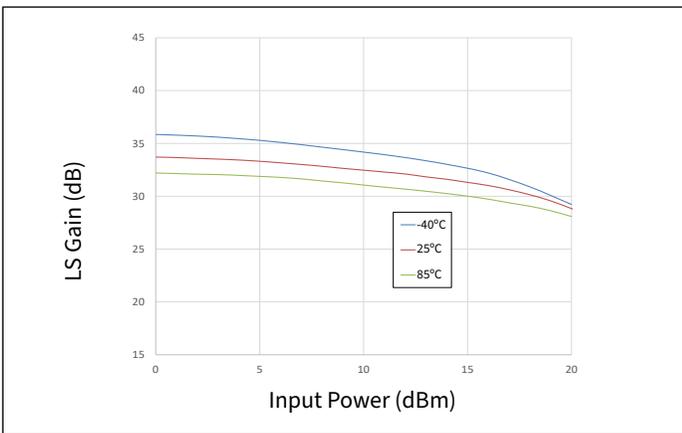


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

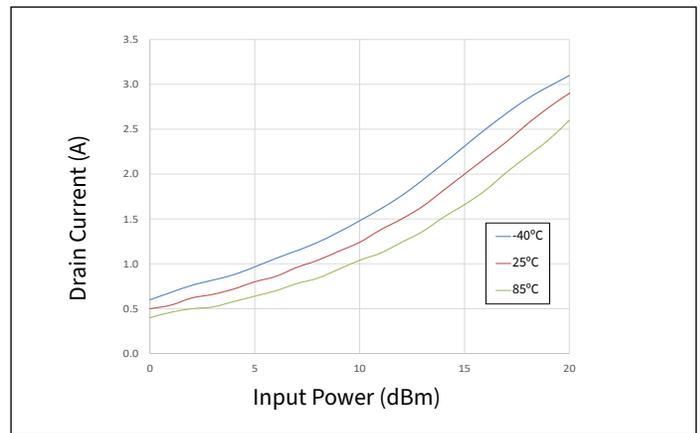


Figure 21. Drain Current vs Input Power as a Function of Temperature

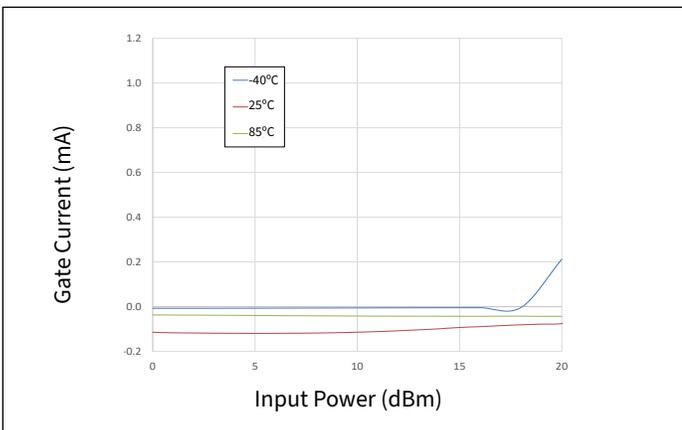


Figure 22. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

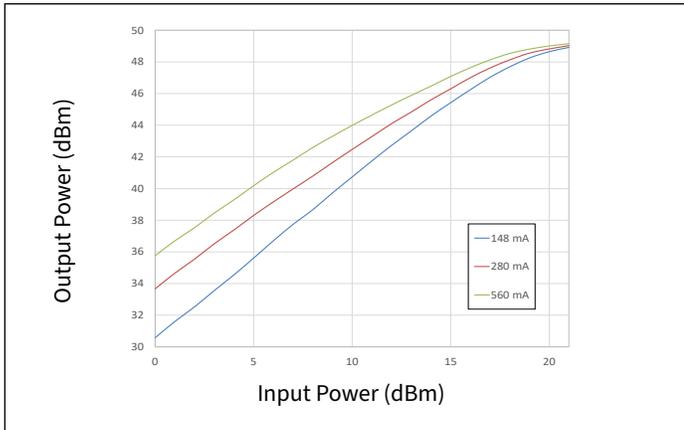


Figure 23. Output Power vs Input Power as a Function of I_{DQ}

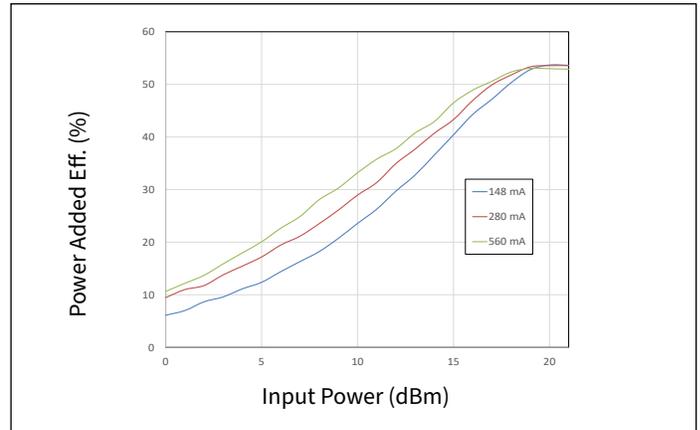


Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

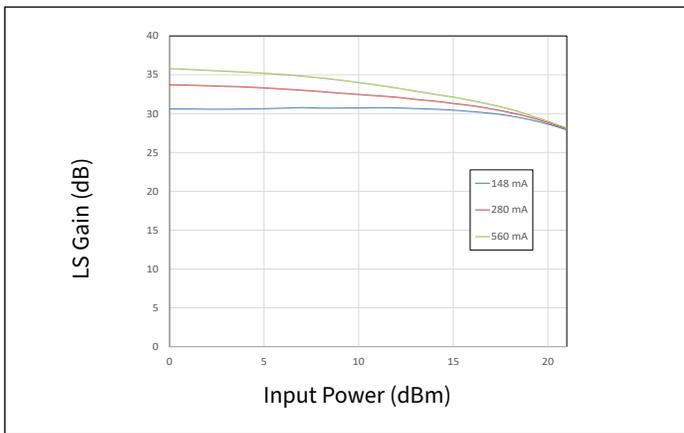


Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

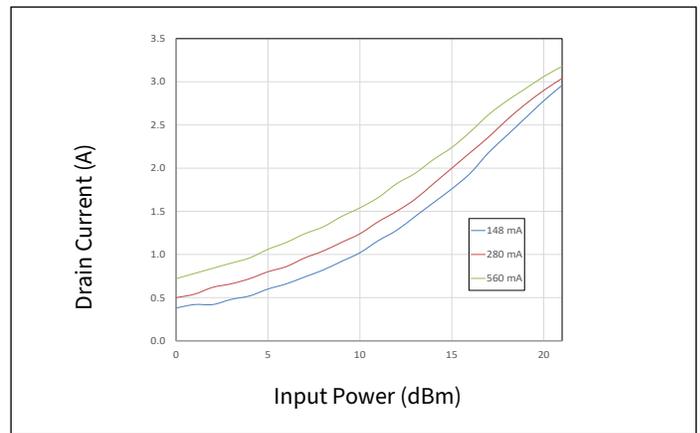


Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

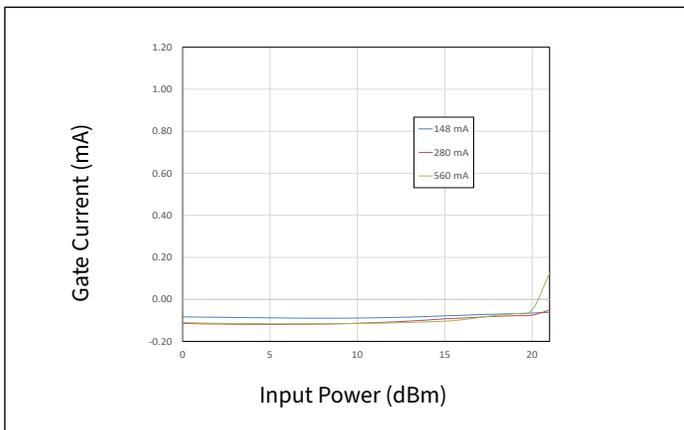


Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, CW, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

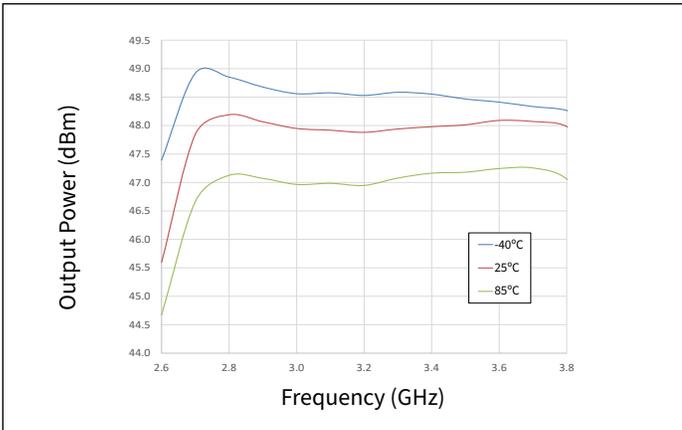


Figure 28. Output Power vs Frequency as a Function of Temperature

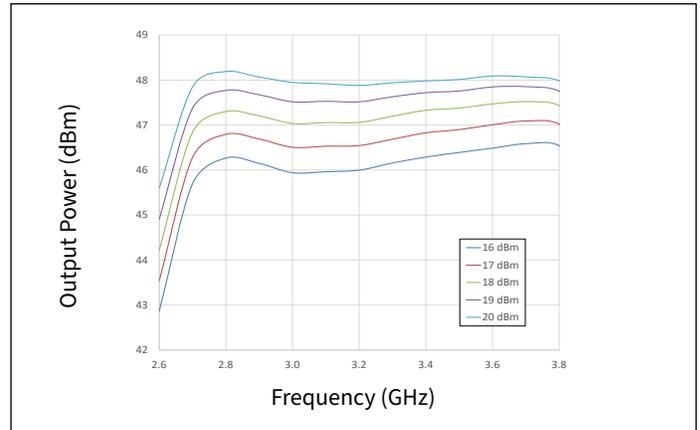


Figure 29. Output Power vs Frequency as a Function of Input Power

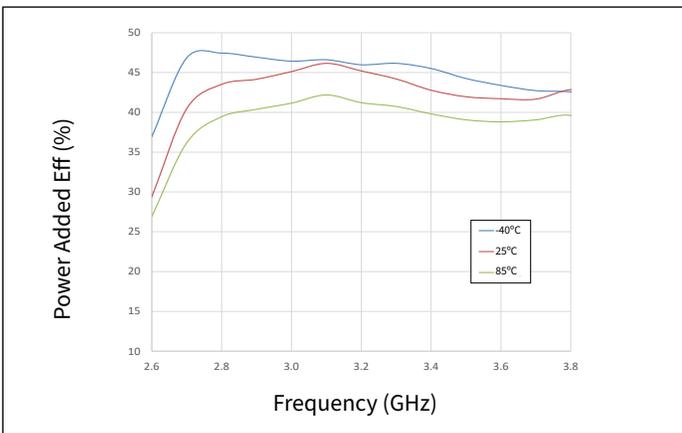


Figure 30. Power Added Eff. vs Frequency as a Function of Temperature

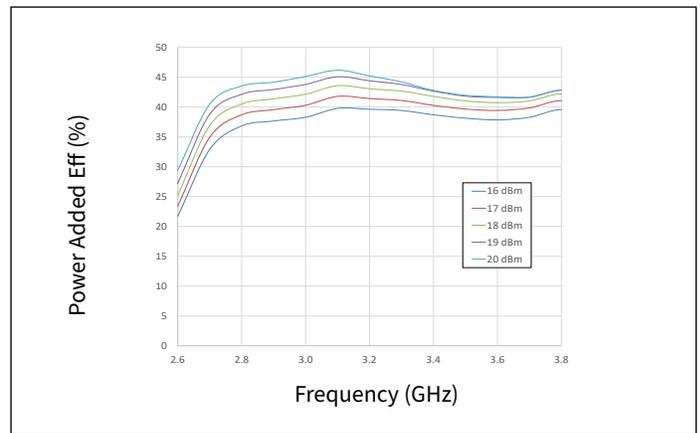


Figure 31. Power Added Eff. vs Frequency as a Function of Input Power

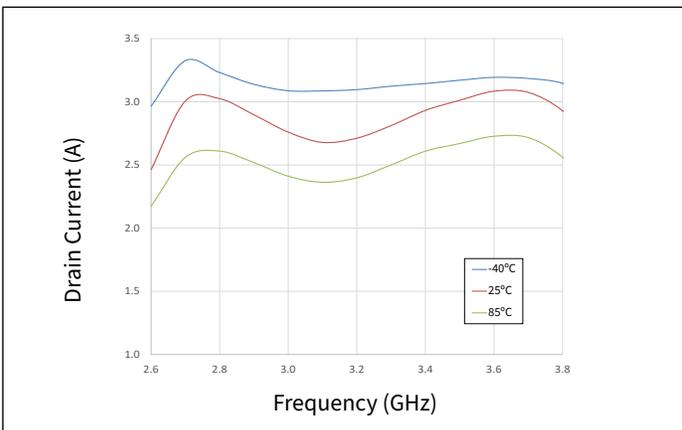


Figure 32. Drain Current vs Frequency as a Function of Temperature

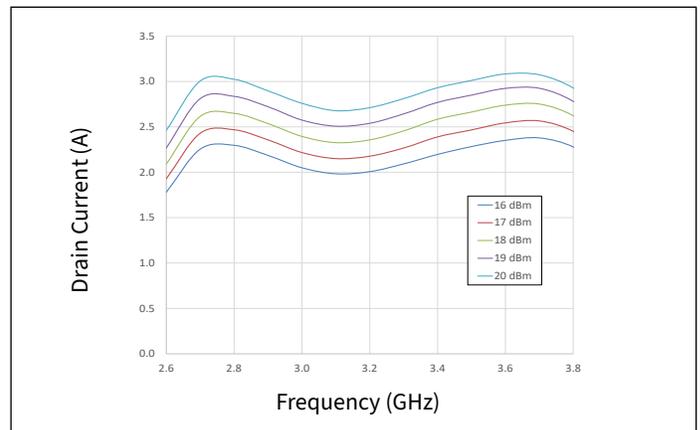


Figure 33. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, CW, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

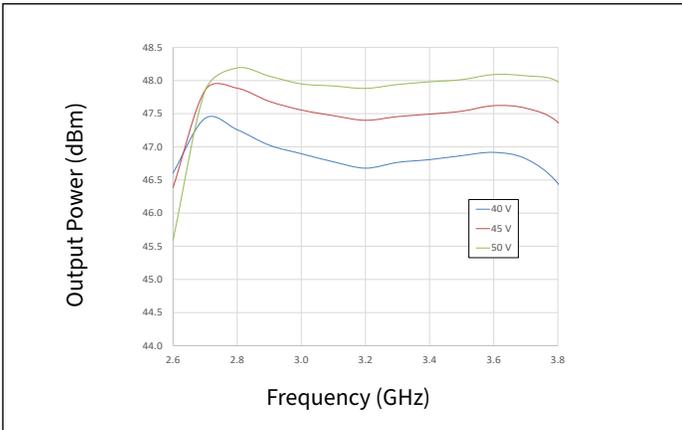


Figure 34. Output Power vs Frequency as a Function of Voltage

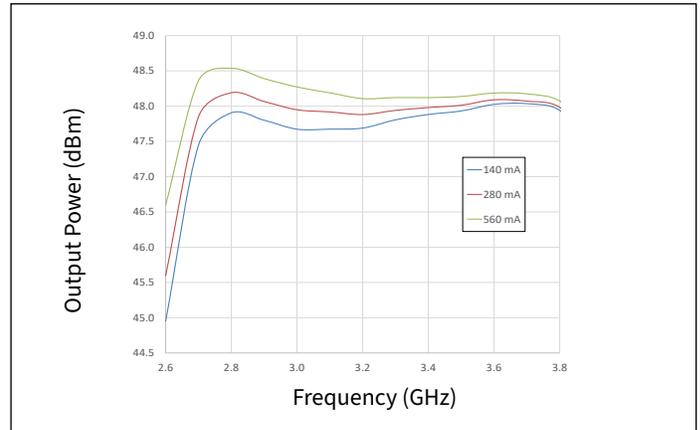


Figure 35. Drain Current vs Frequency as a Function of Input Power

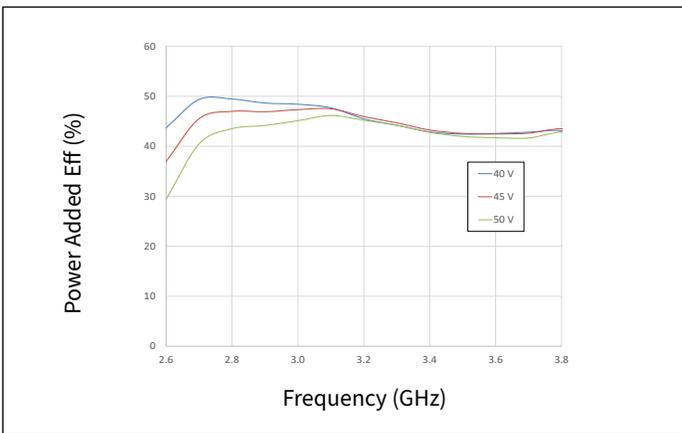


Figure 36. Power Added Eff. vs Frequency as a Function of Voltage

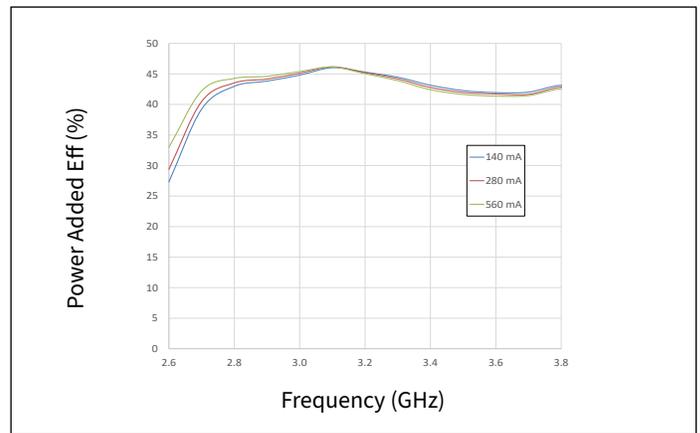


Figure 37. Power Added Eff. vs Frequency as a Function of Input Power

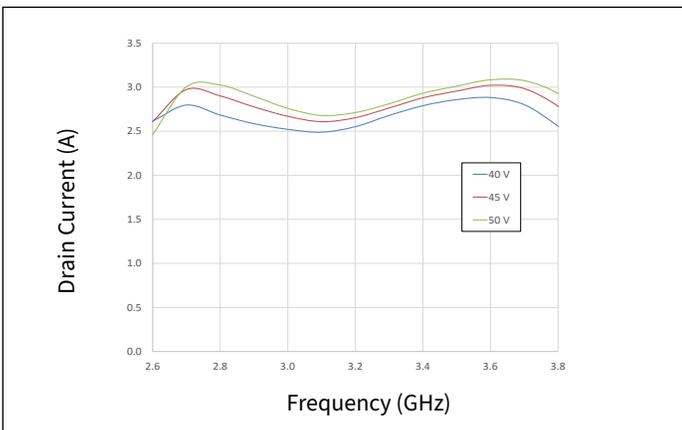


Figure 38. Drain Current vs Frequency as a Function of Voltage

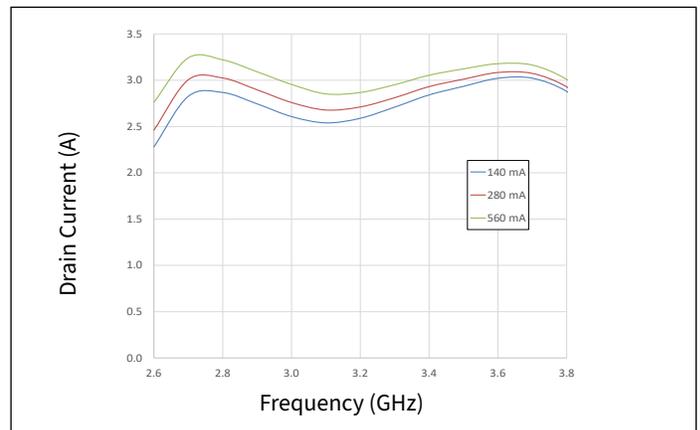


Figure 39. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, CW, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

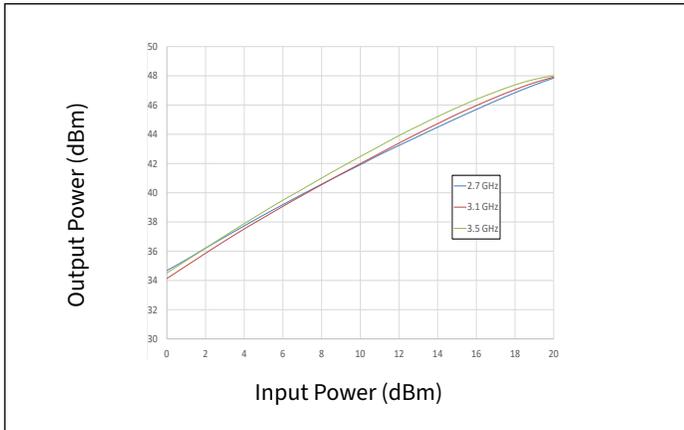


Figure 40. Output Power vs Input Power as a Function of Frequency

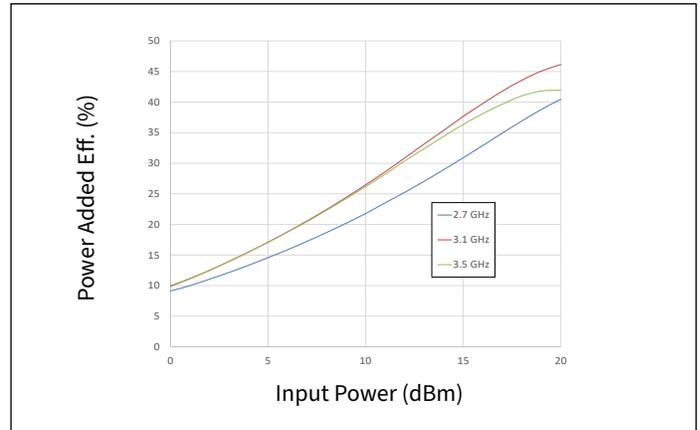


Figure 41. Power Added Eff. vs Input Power as a Function of Frequency

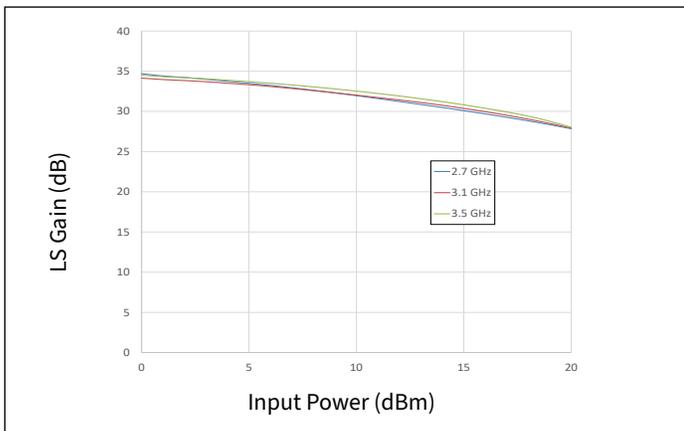


Figure 42. Large Signal Gain vs Input Power as a Function of Frequency

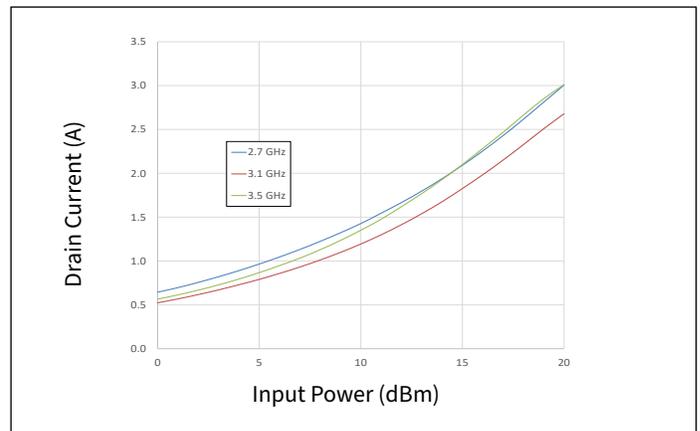


Figure 43. Drain Current vs Input Power as a Function of Frequency

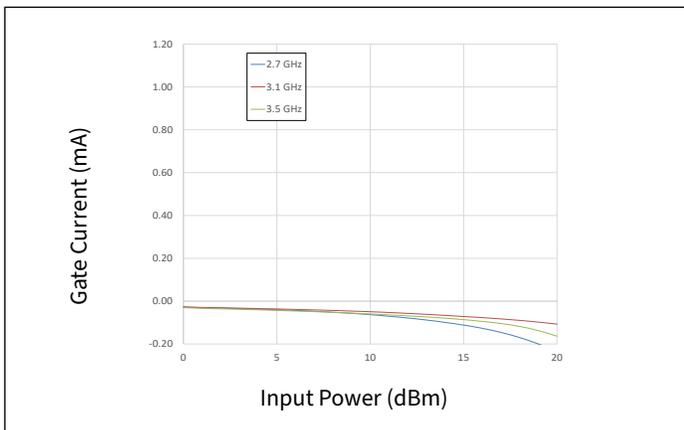


Figure 44. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, CW, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

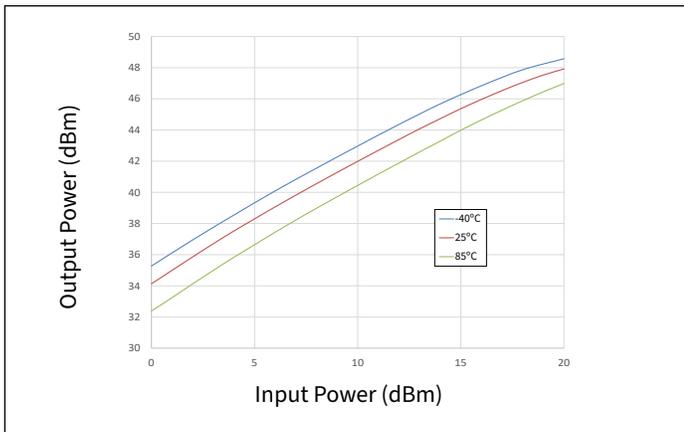


Figure 45. Output Power vs Input Power as a Function of Temperature

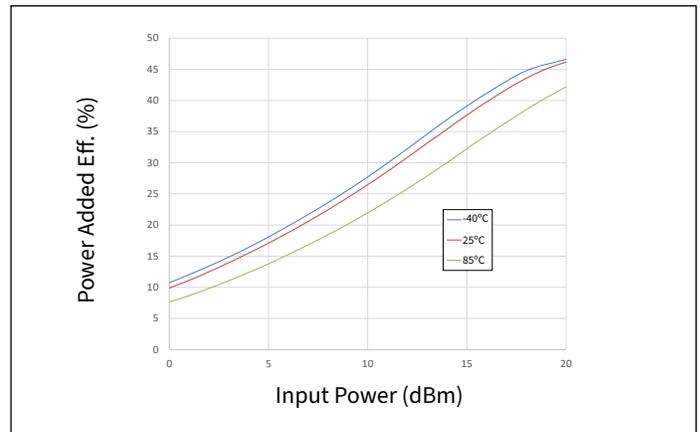


Figure 46. Power Added Eff. vs Input Power as a Function of Temperature

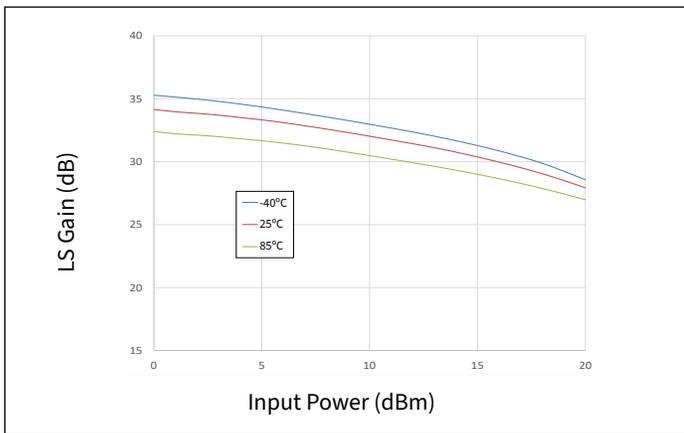


Figure 47. Large Signal Gain vs Input Power as a Function of Temperature

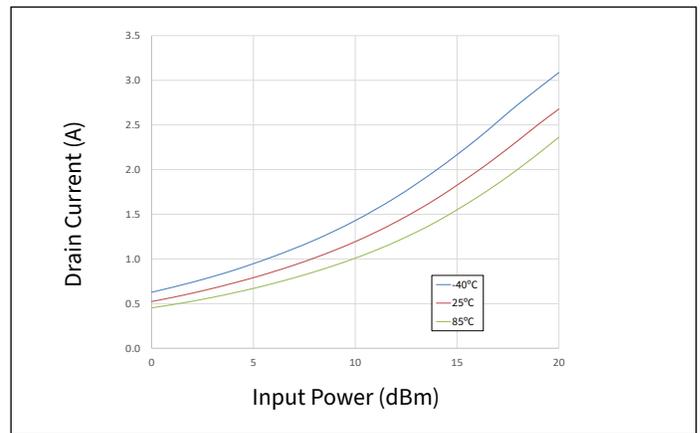


Figure 48. Drain Current vs Input Power as a Function of Temperature

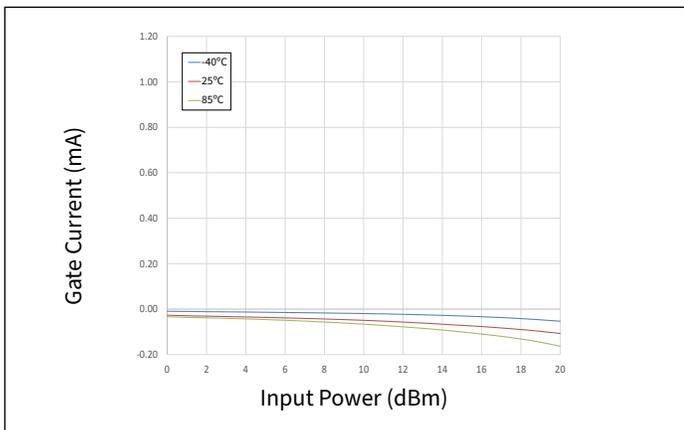


Figure 49. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, CW, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

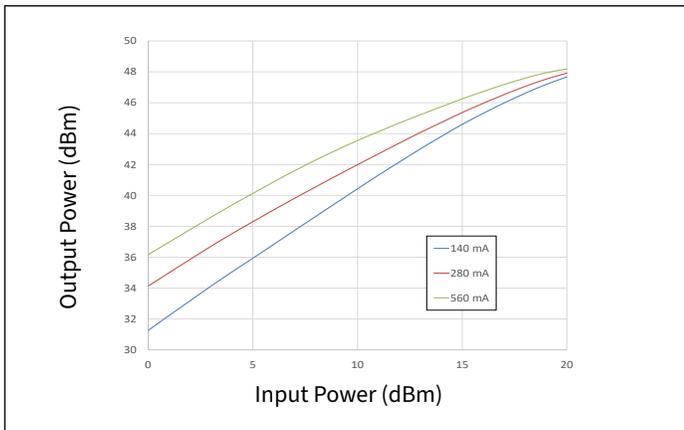


Figure 50. Output Power vs Input Power as a Function of I_{DQ}

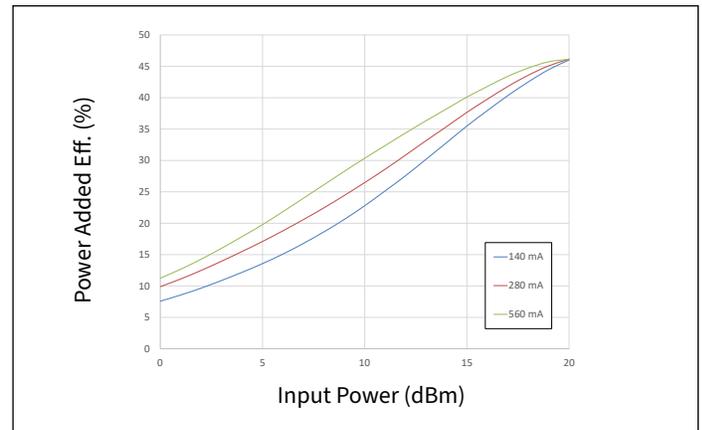


Figure 51. Power Added Eff. vs Input Power as a Function of I_{DQ}

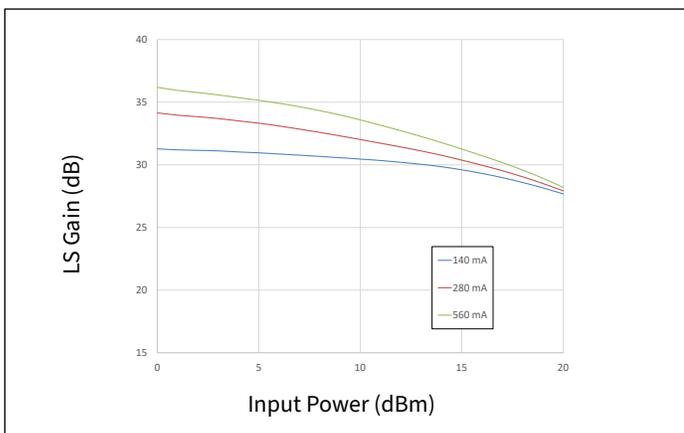


Figure 52. Large Signal Gain vs Input Power as a Function of I_{DQ}

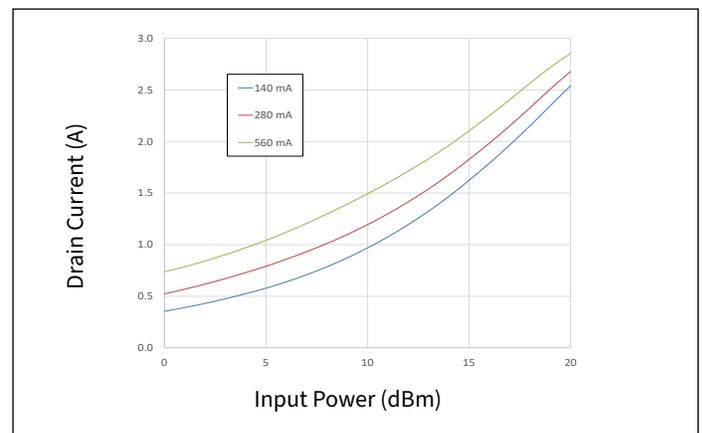


Figure 53. Drain Current vs Input Power as a Function of I_{DQ}

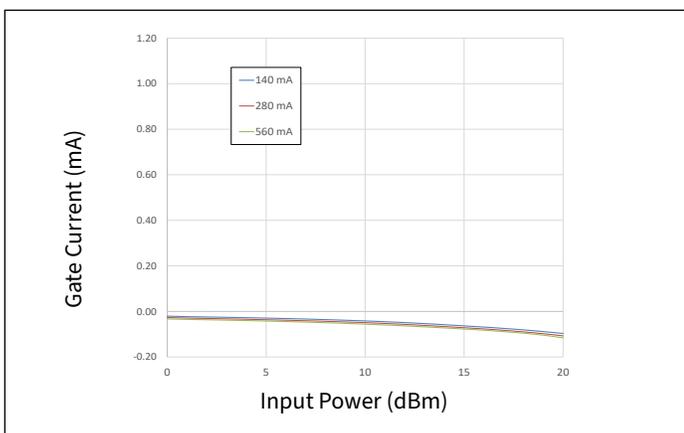


Figure 54. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $PW = 300\mu\text{s}$, $DC = 20\%$, $P_{IN} = 20\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

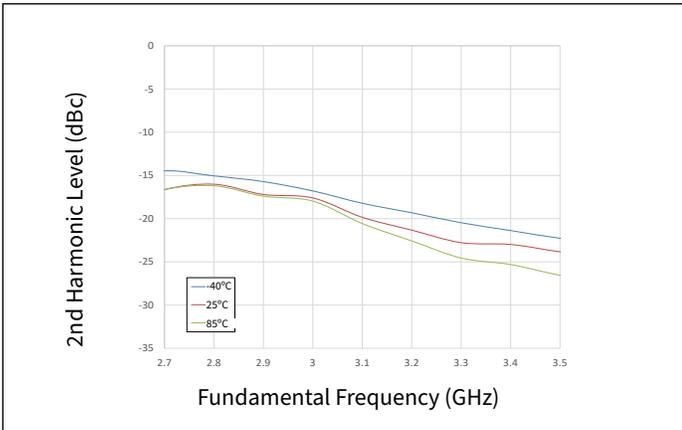


Figure 55. 2nd Harmonic vs Frequency as a Function of Temperature

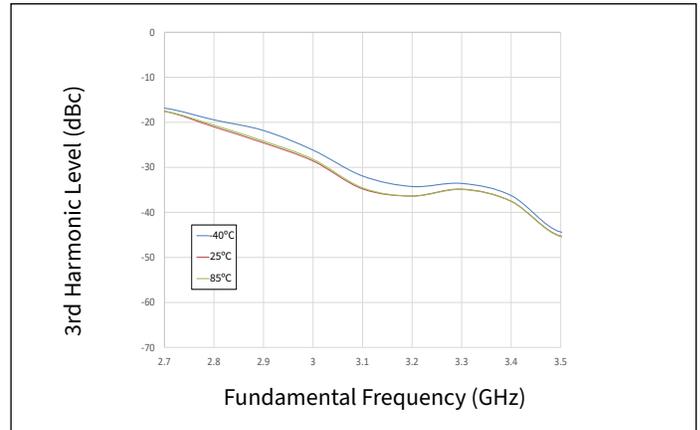


Figure 56. 3rd Harmonic vs Frequency as a Function of Temperature

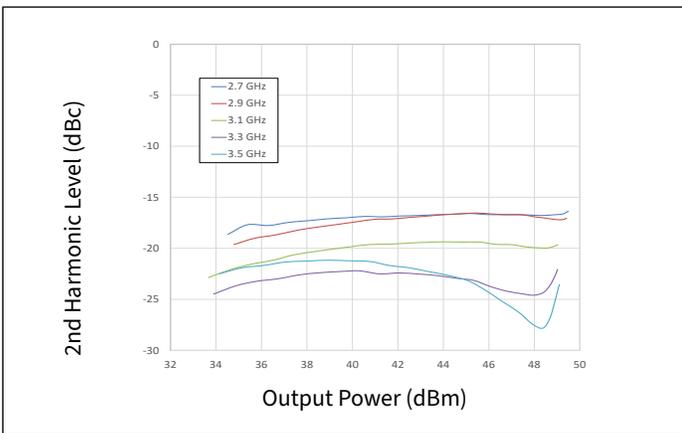


Figure 57. 2nd Harmonic vs Output Power as a Function of Frequency

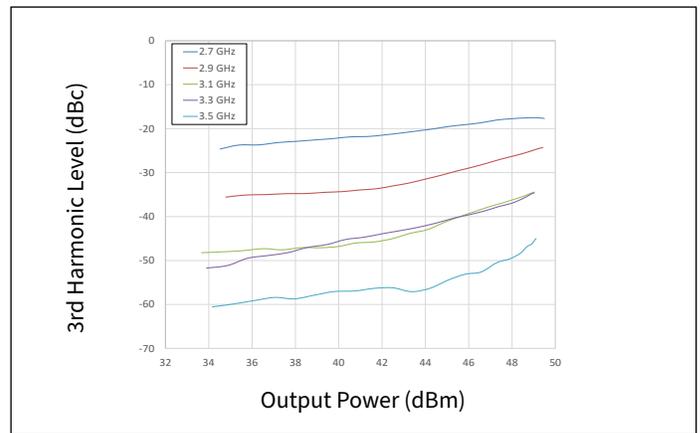


Figure 58. 3rd Harmonic vs Output Power as a Function of Frequency

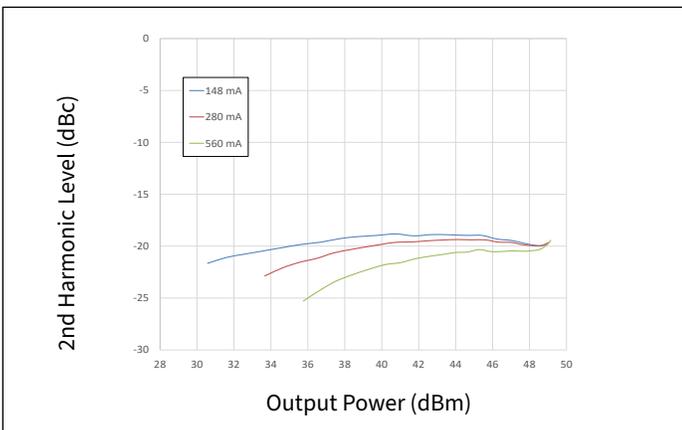


Figure 59. 2nd Harmonic vs Output Power as a Function of I_{DQ}

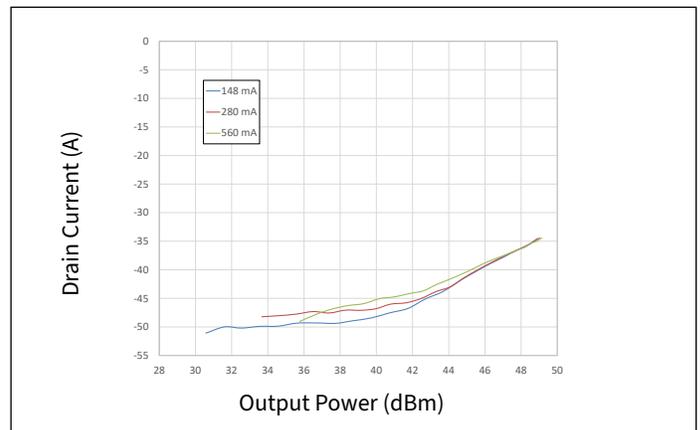


Figure 60. 3rd Harmonic vs Output Power as a Function of I_{DQ}

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $P_{IN} = -20\text{ dBm}$, Frequency = 3.1 GHz, $T_{BASE} = +25^\circ\text{C}$

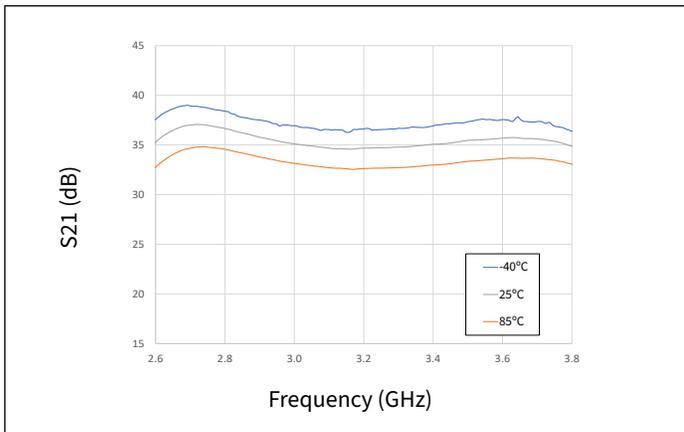


Figure 61. Gain vs Frequency as a Function of Temperature

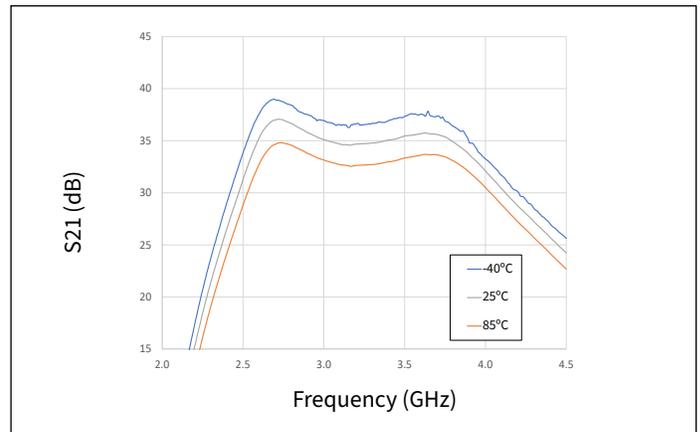


Figure 62. Gain vs Frequency as a Function of Temperature

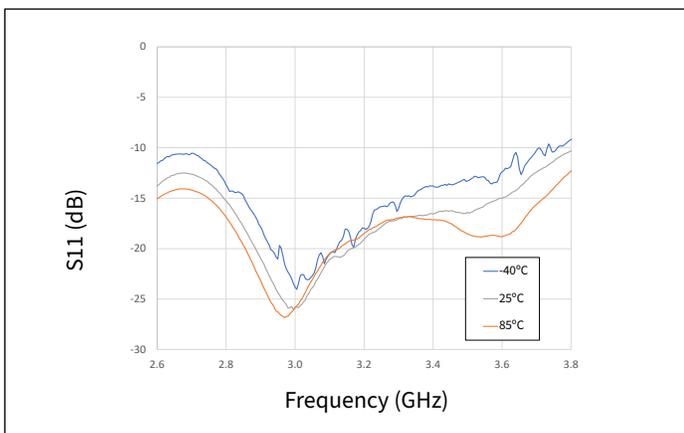


Figure 63. Input RL vs Frequency as a Function of Temperature

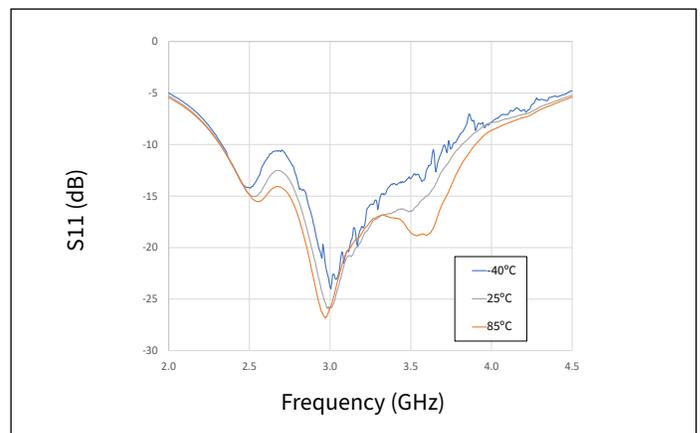


Figure 64. Input RL vs Frequency as a Function of Temperature

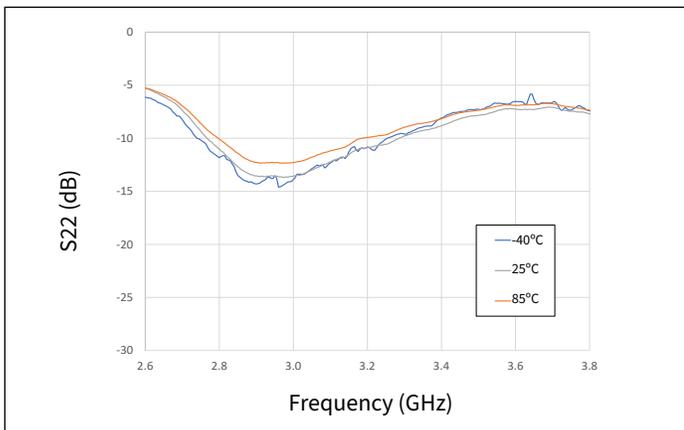


Figure 65. Output RL vs Frequency as a Function of Temperature

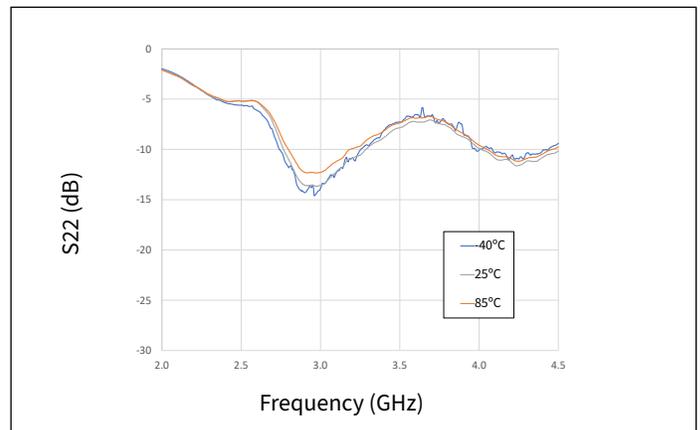


Figure 66. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CPMA2738060F

Test conditions unless otherwise noted: $V_D = 50\text{ V}$, $I_{DQ} = 280\text{ mA}$, $P_{IN} = -20\text{ dBm}$, Frequency = 3.1 GHz , $T_{BASE} = +25^\circ\text{C}$

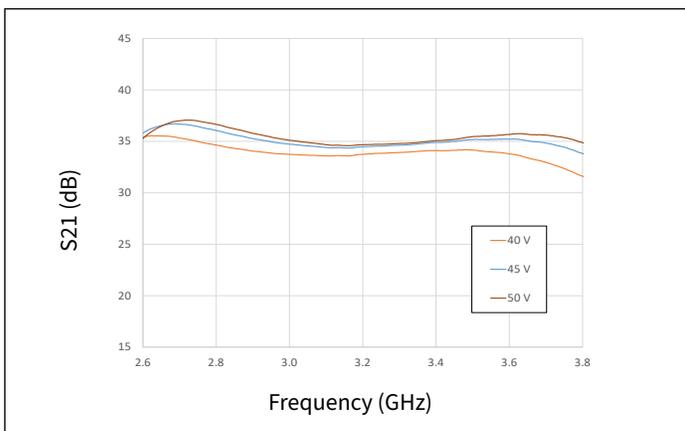


Figure 67. Gain vs Frequency as a Function of Voltage

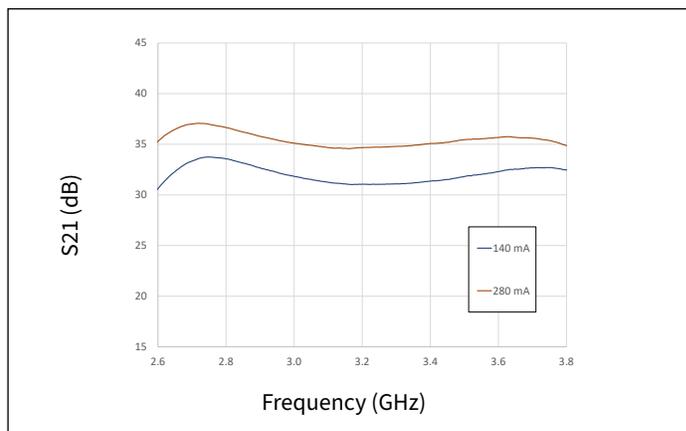


Figure 68. Gain vs Frequency as a Function of I_{DQ}

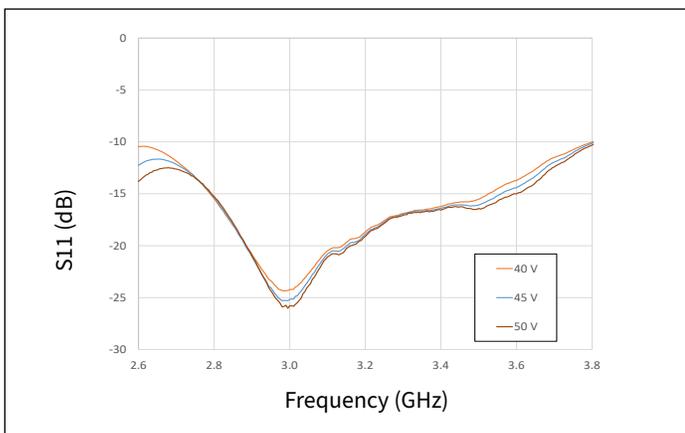


Figure 69. Input RL vs Frequency as a Function of Voltage

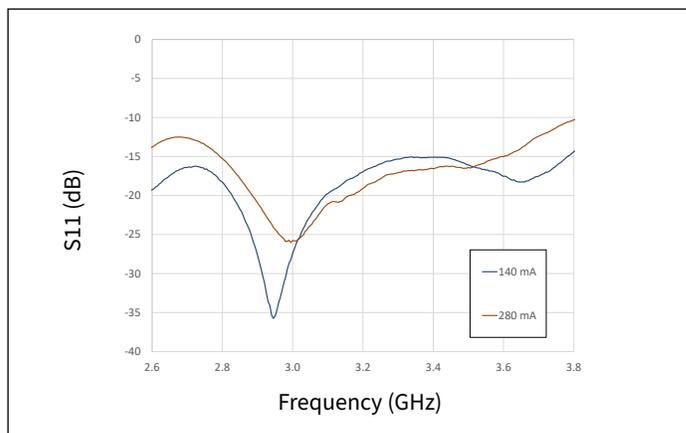


Figure 70. Input RL vs Frequency as a Function of I_{DQ}

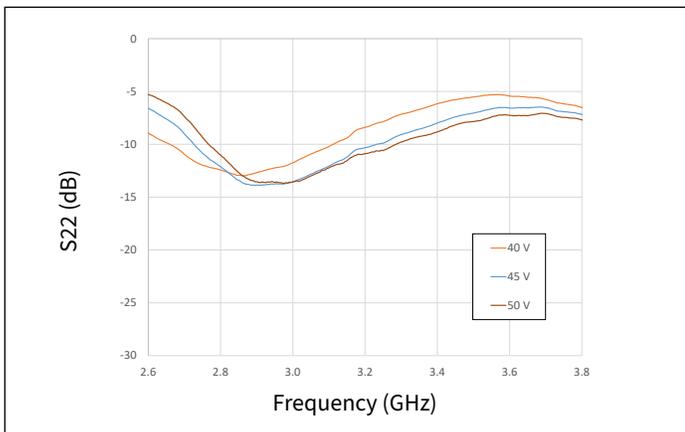


Figure 71. Output RL vs Frequency as a Function of Voltage

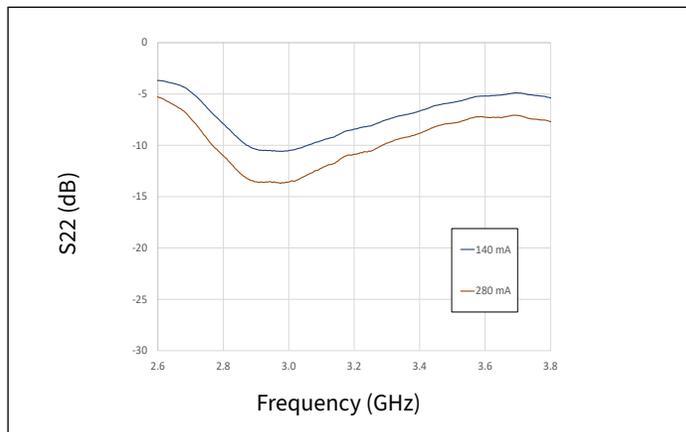
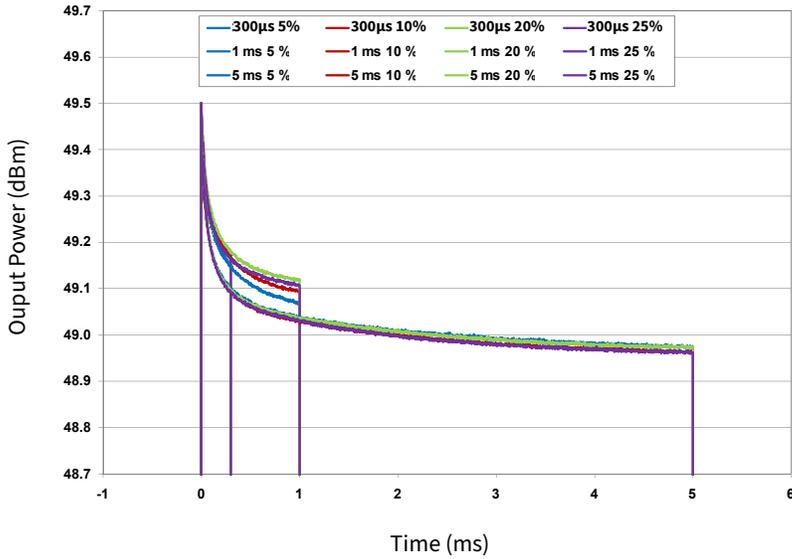


Figure 72. Output RL vs Frequency as a Function of I_{DQ}

Typical Pulse Droop Performance



Pulse Width	Duty Cycle (%)	Droop (dB)
10µs	5-25	0.30
50µs	5-25	0.30
100µs	5-25	0.30
300µs	5-25	0.35
1ms	5-25	0.40
5ms	5-25	0.55

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

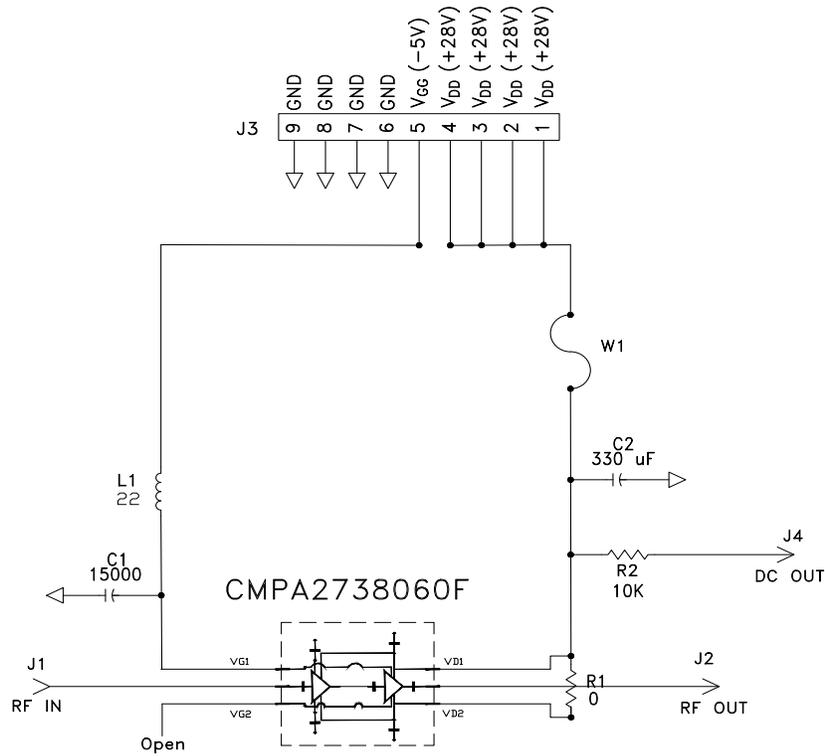
CMPA2738060F-AMP Evaluation Board Bill of Materials

Designator	Description	Qty
C1	CAP, 15000pF, 100V, 0805, X7R	1
C2	CAP, 330µF, 20%, 100V, ELECT, MVY, SMD	1
R1	RES, 1/8W, 1206, +/-5%, 0 OHMS	1
R2	RES, 1/16W, 0603, +/-5%, 10K OHMS	1
L1	FERRITE, 22 OHM, 0805, BLM21PG220SN1	1
J1,J2	CONNECTOR, N-TYPE, FEMALE, W/0.500 SMA FLNG	2
J3	CONNECTOR, HEADER, RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR, SMB, STRAIGHT JACK, SMD	1
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA2738060F	1

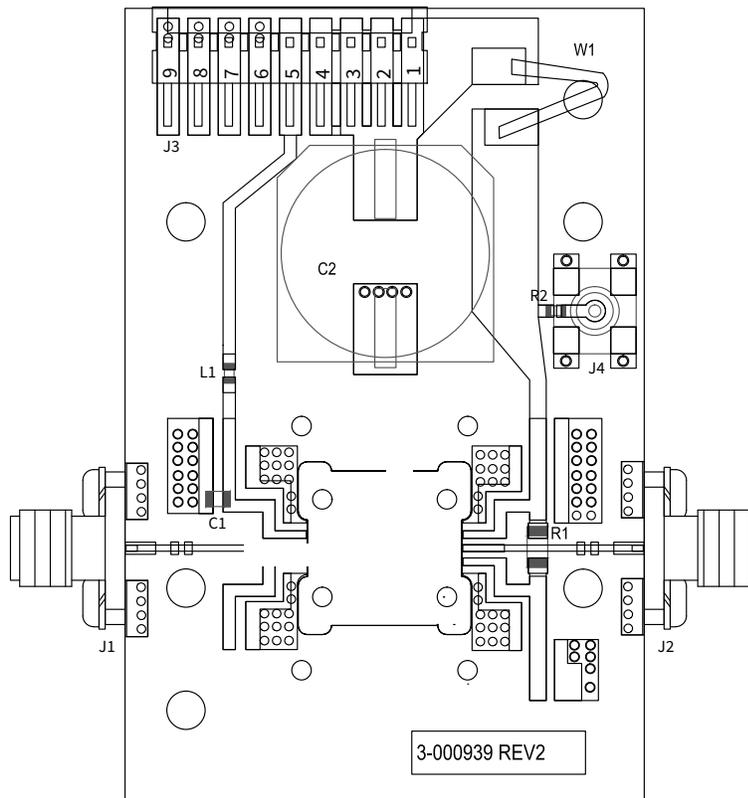
CMPA2738060F-AMP Demonstration Amplifier Circuit



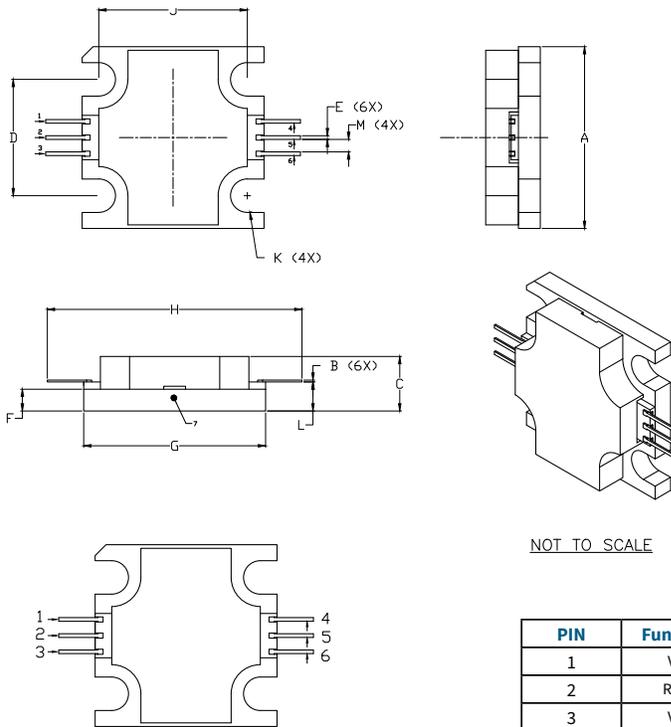
CMPA2738060F-AMP Demonstration Amplifier Circuit Schematic



CMPA2738060F-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CMPA2738060F (Package Type – 440219)



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 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 THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
 5. ALL PLATED SURFACES ARE Ni/AU

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	∅ .092		2.34	
L	0.075	0.085	1.905	2.159
M	0.032	0.040	0.82	1.02

PIN	Function
1	V _{GG}
2	RFin
3	V _{GG}
4	V _{DD}
5	RFout
6	V _{DD}
7	Source

Part Number System

CMPA2738060F

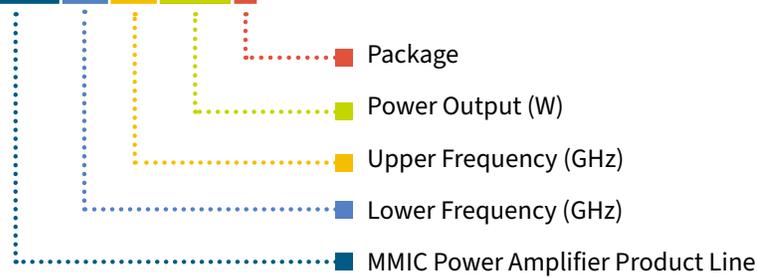


Table 1.

Parameter	Value	Units
Lower Frequency	2.7	GHz
Upper Frequency	3.8	
Power Output	60	W
Package	Flange	–

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
CMPA2738060F	GaN MMIC	Each	
CMPA2738060F-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.