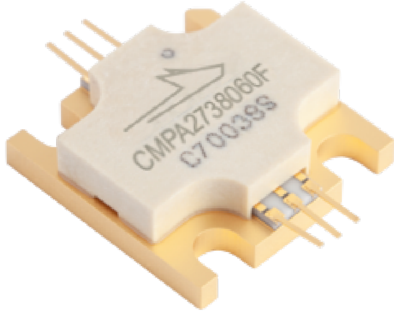
CMPA2738060F

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



Package Type: 440219
PN: CMPA2738060F

Description

Wolfspeed's 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.

Typical Performance Over 2.7 - 3.8 GHz (T_C = 25°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	%

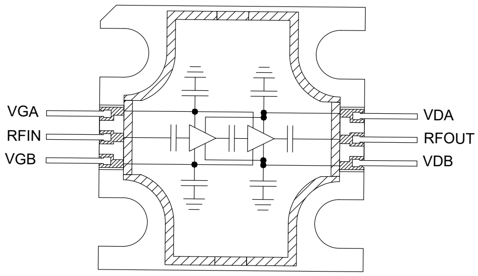
Note:
[1] P_{IN} = 20 dBm

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



RoHS compliant

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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	ºC	
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 W

Electrical Characteristics (Frequency = 2.7 GHz to 3.8 GHz unless otherwise stated; T_C = 25ºC)

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 V, I_D = 15.2 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DD} = 50 V, I_{DQ} = 280 mA
Saturated Drain Current[1]	I_{DS}	9.9	14.1	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	100	–	–	V	V_{GS} = -8 V, I_D = 15.2 mA
RF Characteristics[2,3]						
Small Signal Gain at 2.7 GHz	S21	–	36.1	–	dB	V_{DD} = 50 V, I_{DQ} = 280 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 V, I_{DQ} = 280 mA, P_{IN} = 20 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	–	%	V_{DD} = 50 V, I_{DQ} = 280 mA
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	
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	–		
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 V, I_{DQ} = 280 mA, P_{OUT} = 60 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 V, I_{DQ} = 280 mA, PW = 300µs, DC = 20%, P_{IN} = 20 dBm, -40°C at P_{IN} = 18 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

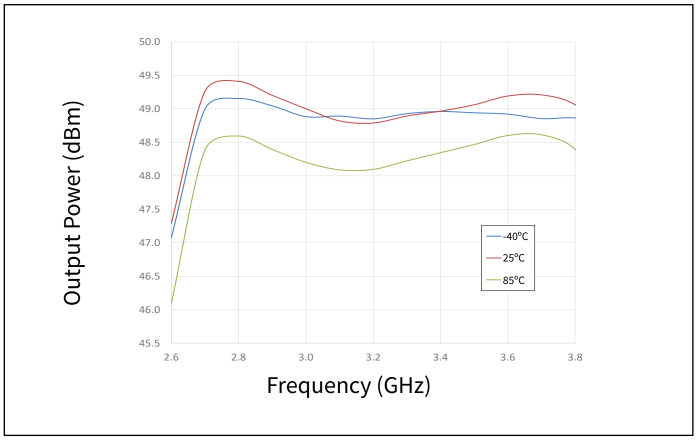


Figure 1. Output Power vs Frequency as a Function of Temperature

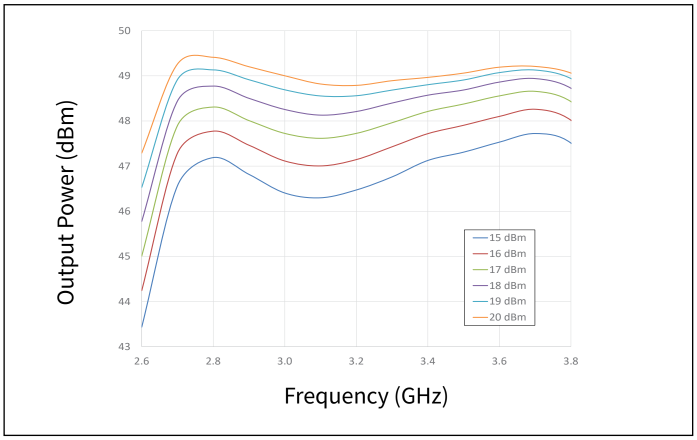


Figure 2. Output Power vs Frequency as a Function of Input Power

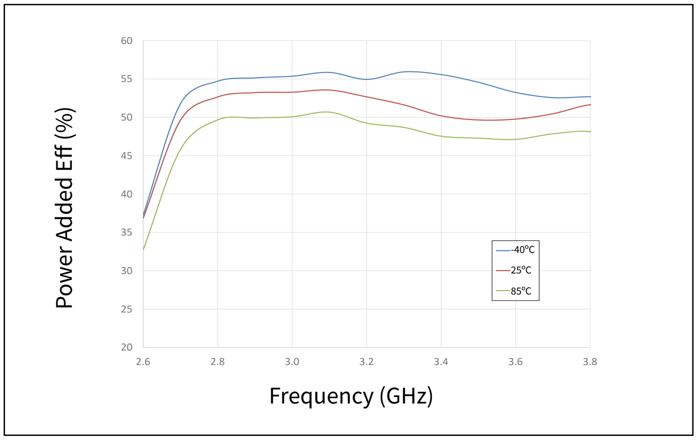


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

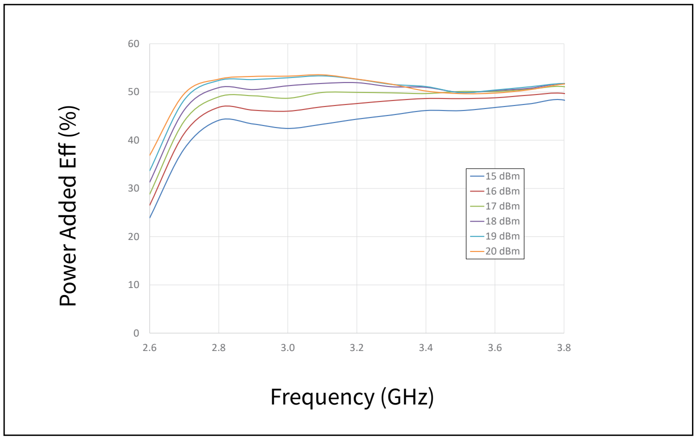


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

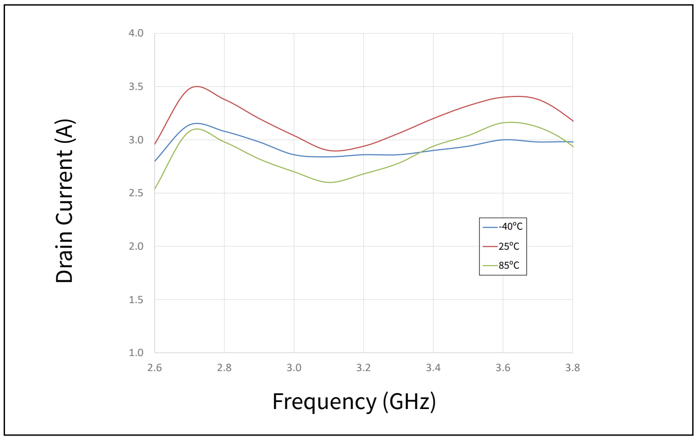


Figure 5. Drain Current vs Frequency as a Function of Temperature

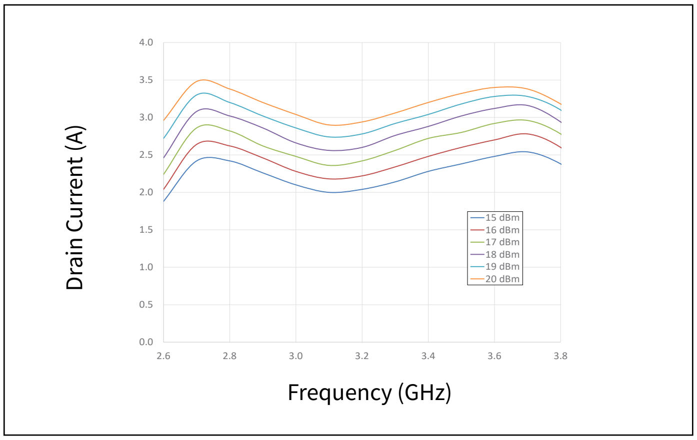


Figure 6. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: V_D = 50 V, I_{DQ} = 280 mA, PW = 300µs, DC = 20%, P_{IN} = 20 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

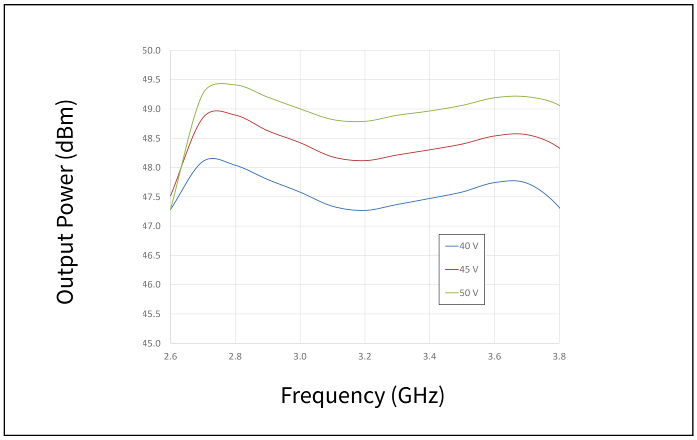


Figure 7. Output Power vs Frequency as a Function of V_D

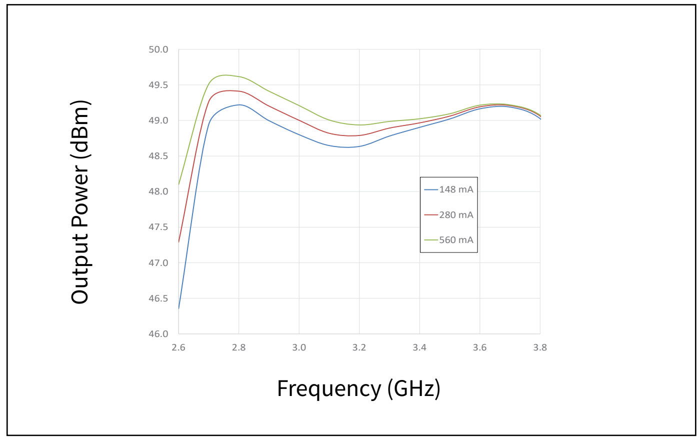


Figure 8. Output Power vs Frequency as a Function of I_{DQ}

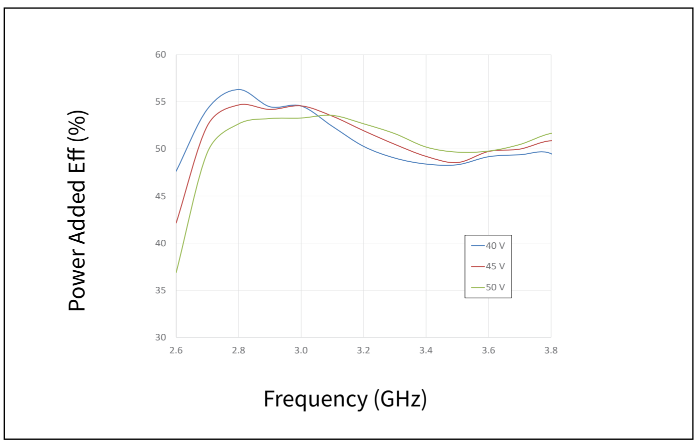


Figure 9. Power Added Eff. vs Frequency as a Function of V_D

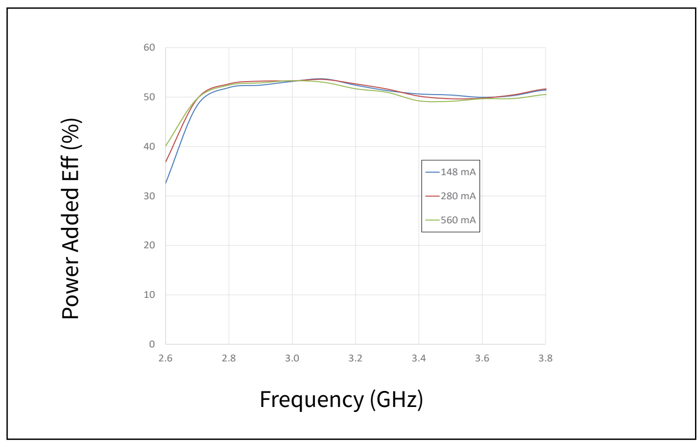


Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

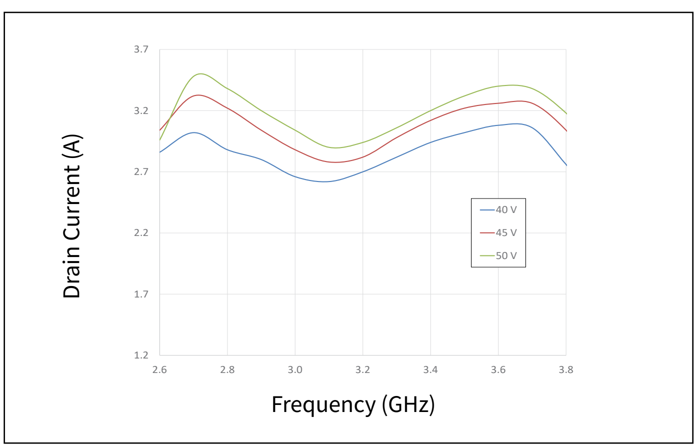


Figure 11. Drain Current vs Frequency as a Function of V_D

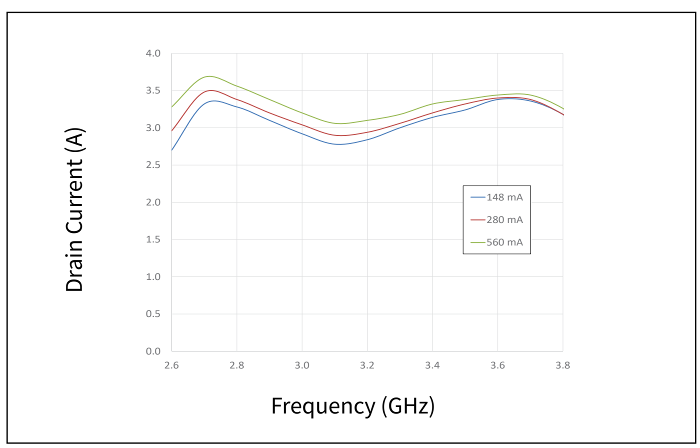


Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: V_D = 50 V, I_{DQ} = 280 mA, PW = 300μs, DC = 20%, P_{IN} = 20 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

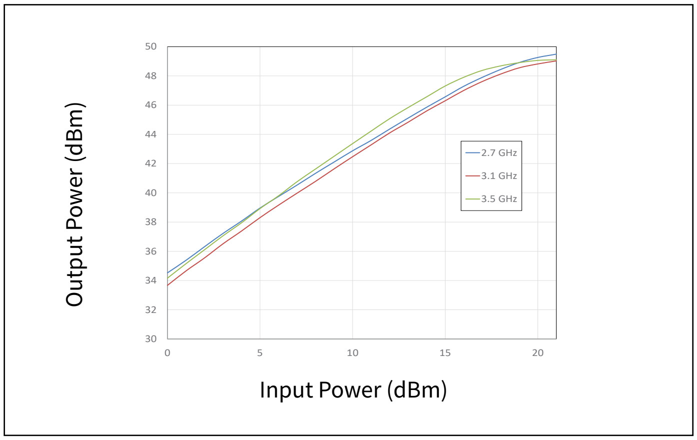


Figure 13. Output Power vs Input Power as a Function of Frequency

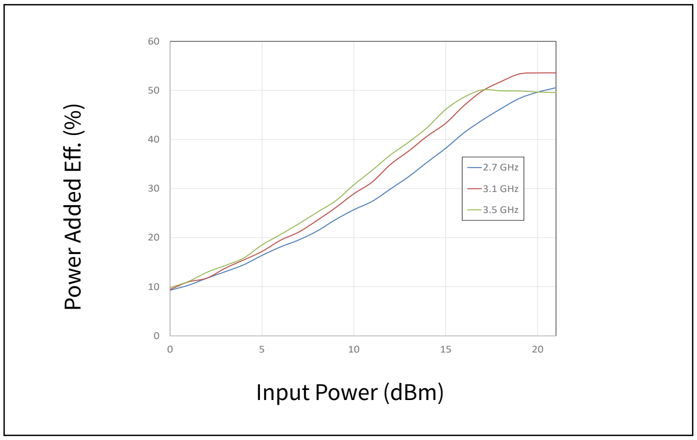


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

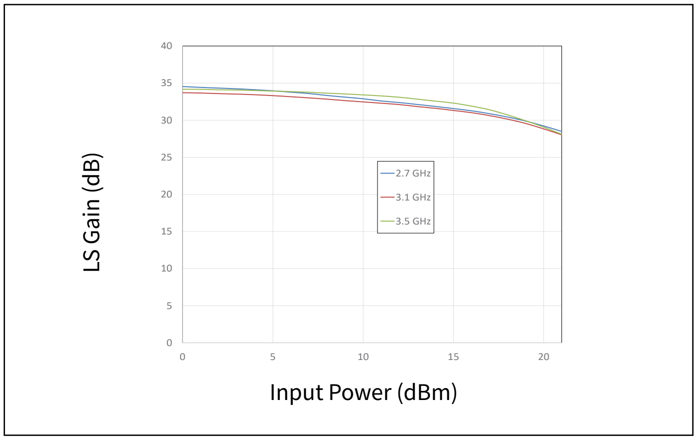


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

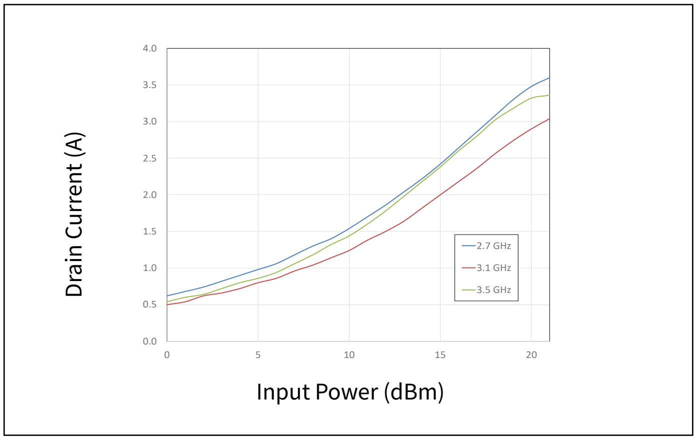


Figure 16. Drain Current vs Input Power as a Function of Frequency

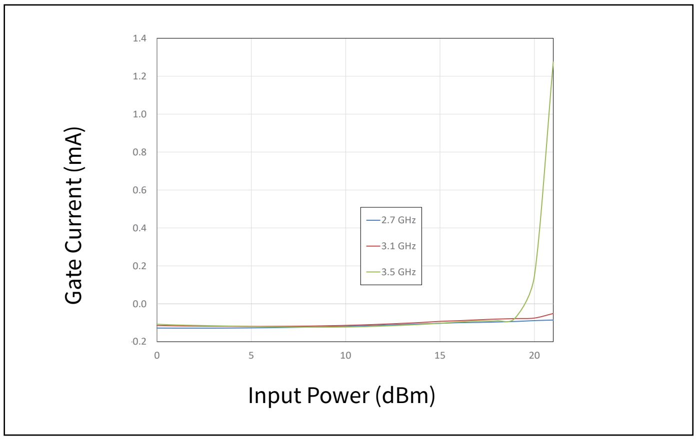


Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: V_D = 50 V, I_{DQ} = 280 mA, PW = 300µs, DC = 20%, P_{IN} = 20 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

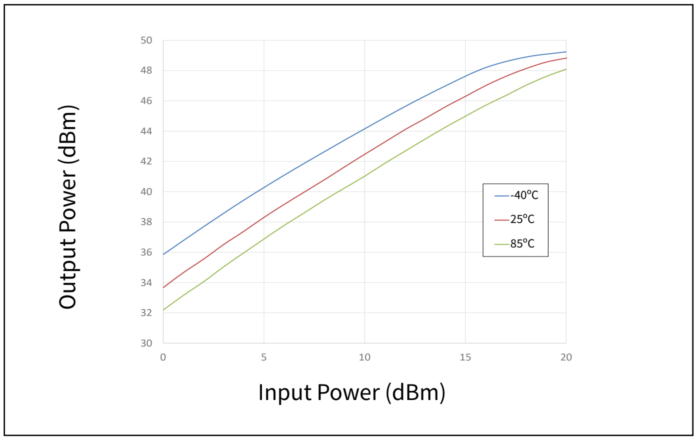


Figure 18. Output Power vs Input Power as a Function of Temperature

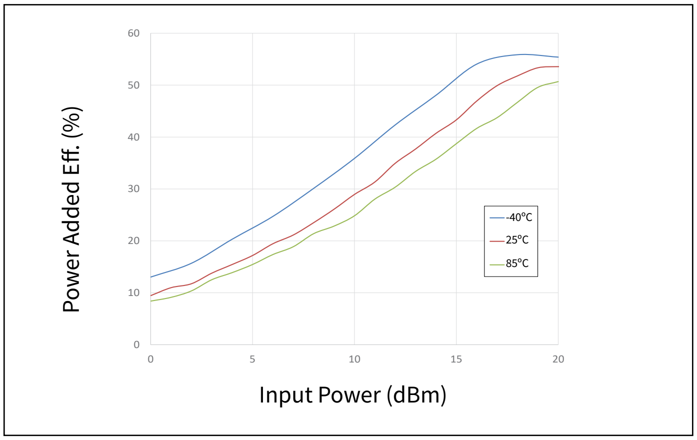


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

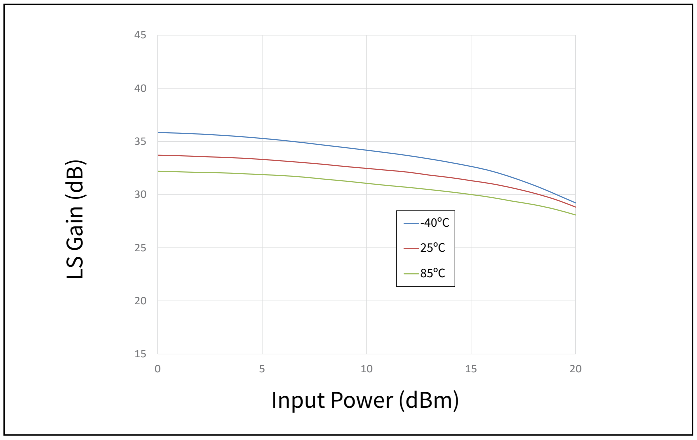


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

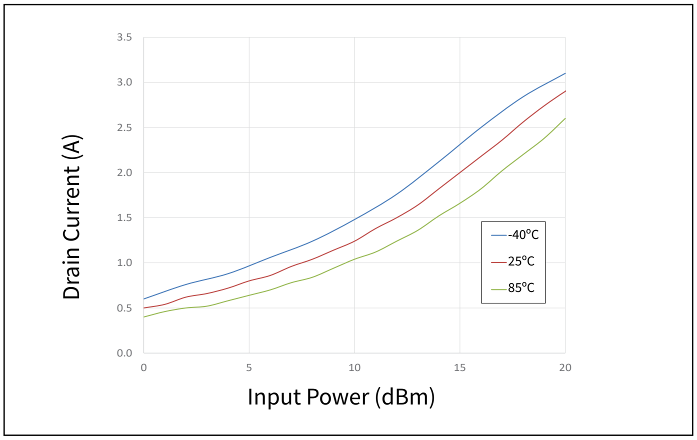


Figure 21. Drain Current vs Input Power as a Function of Temperature

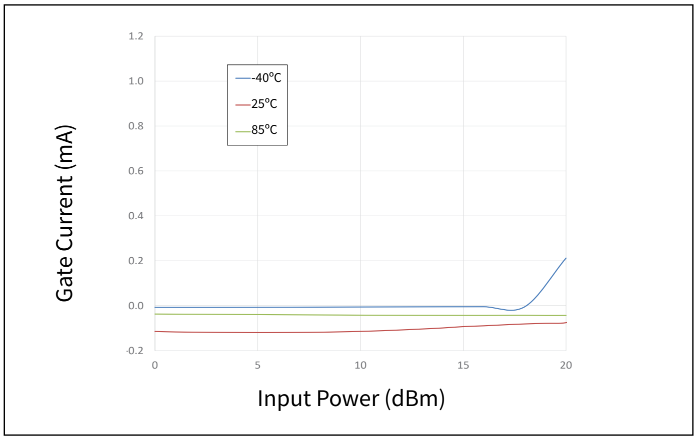


Figure 22. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: V_D = 50 V, I_{DQ} = 280 mA, PW = 300µs, DC = 20%, P_{IN} = 20 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

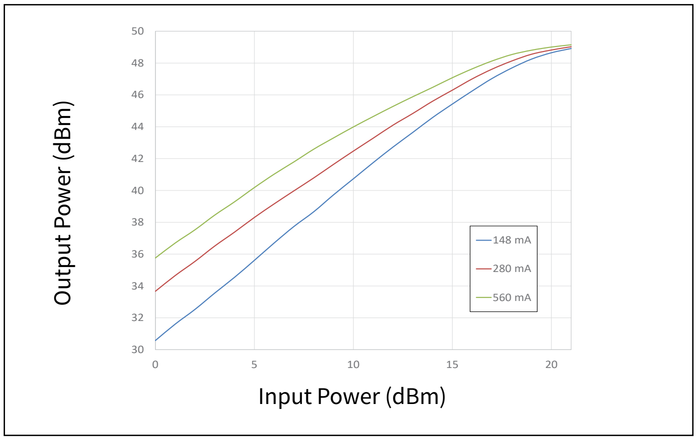


Figure 23. Output Power vs Input Power as a Function of I_{DQ}

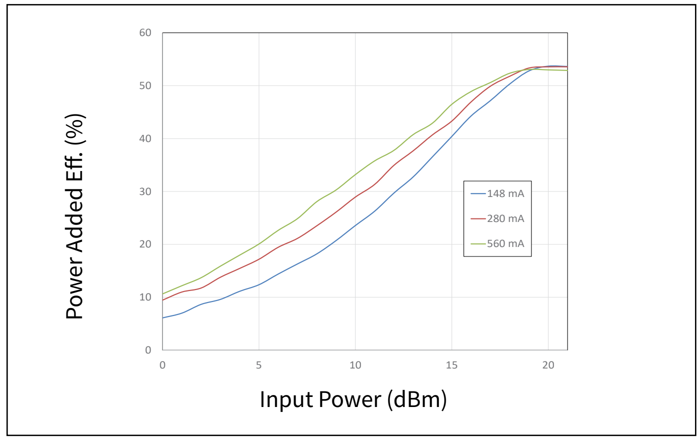


Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

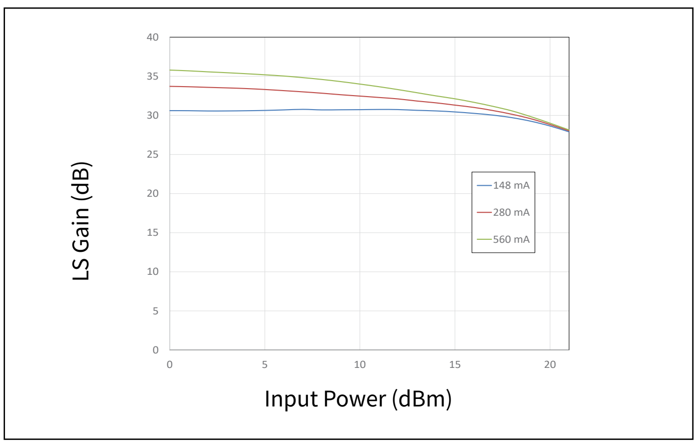


Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

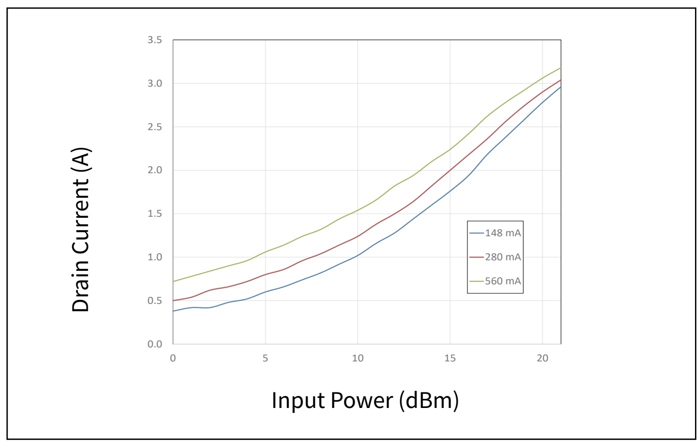


Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

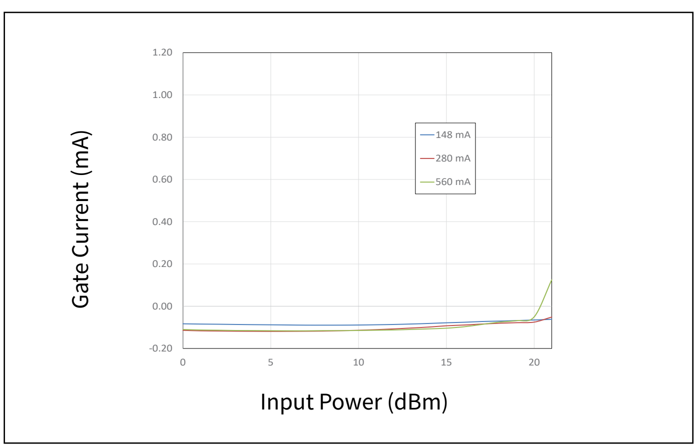


Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

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

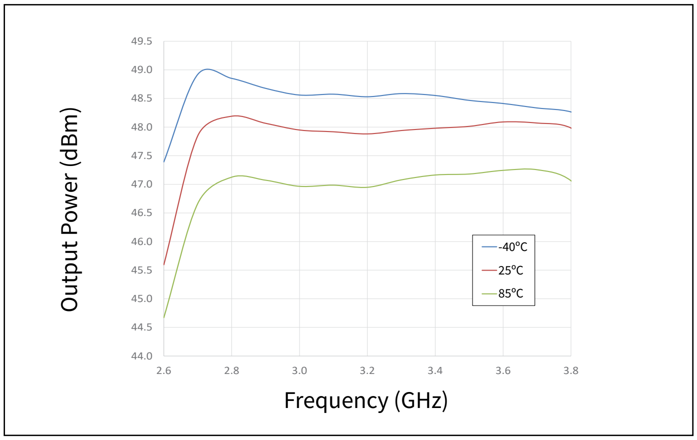


Figure 28. Output Power vs Frequency as a Function of Temperaturee

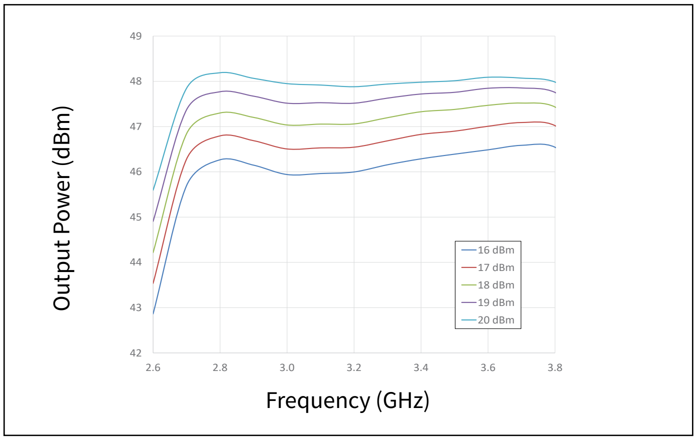


Figure 29. Output Power vs Frequency as a Function of Input Power

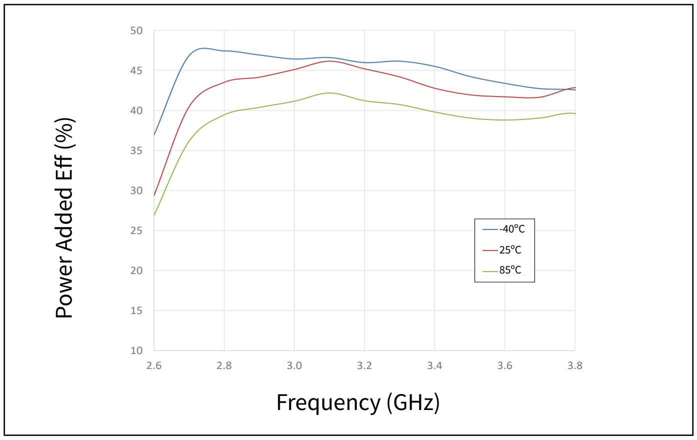


Figure 30. Power Added Eff. vs Frequency as a Function of Temperature

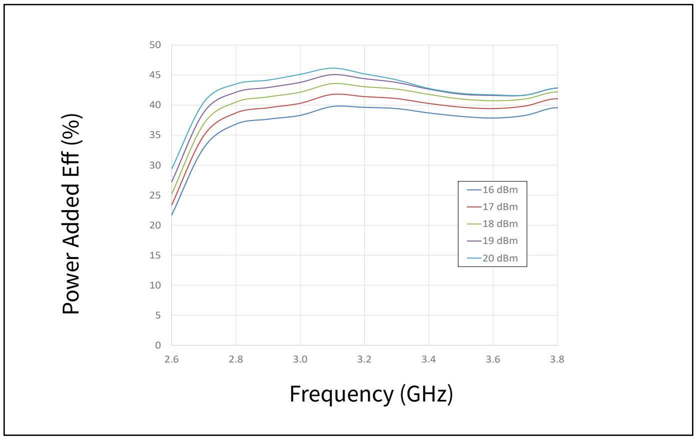


Figure 31. Power Added Eff. vs Frequency as a Function of Input Power

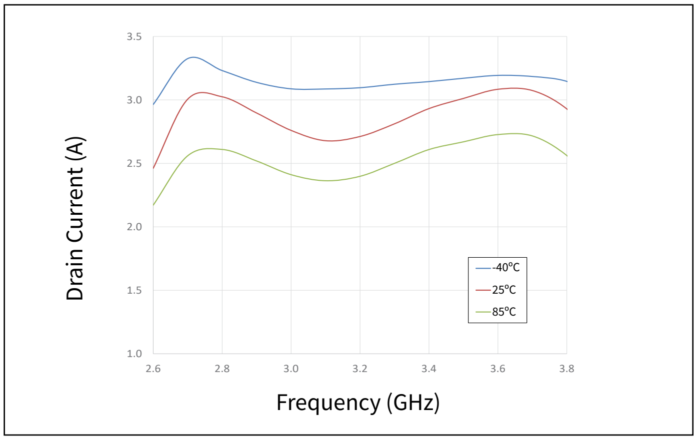


Figure 32. Drain Current vs Frequency as a Function of Temperature

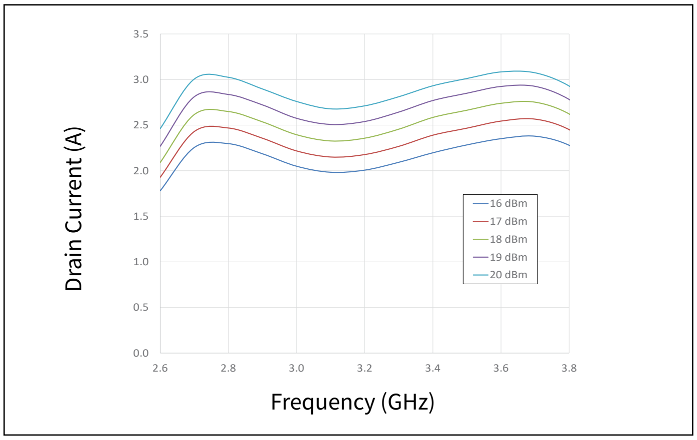


Figure 33. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CMPA2738060F

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

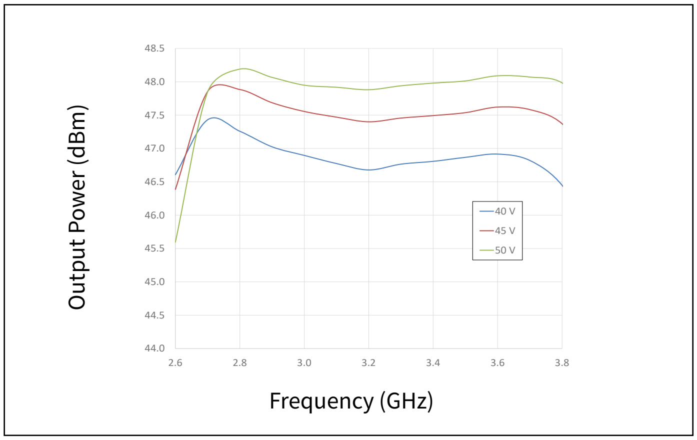


Figure 34. Output Power vs Frequency as a Function of Voltage

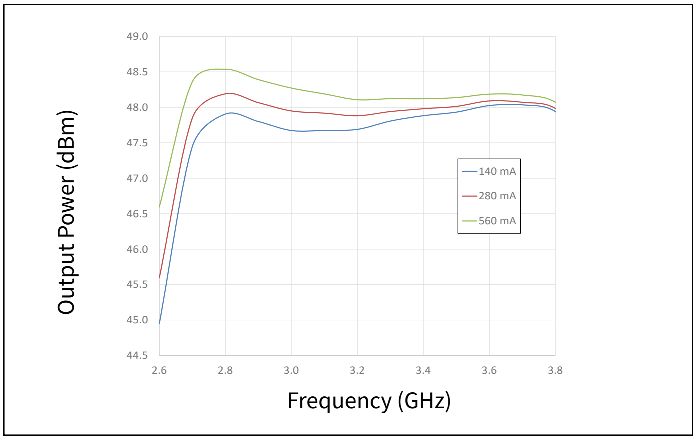


Figure 35. Drain Current vs Frequency as a Function of Input Power

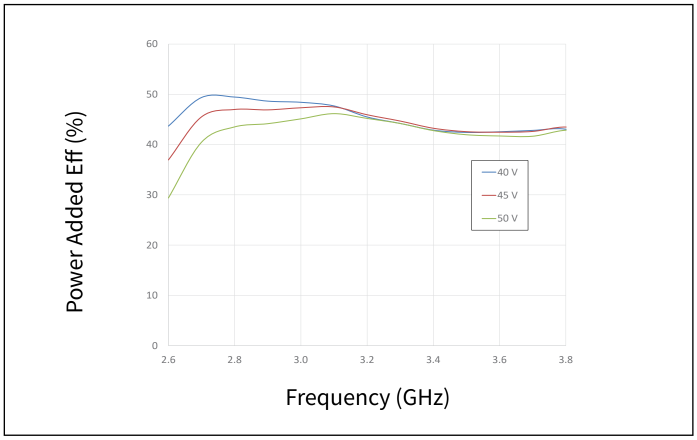


Figure 36. Power Added Eff. vs Frequency as a Function of Voltage

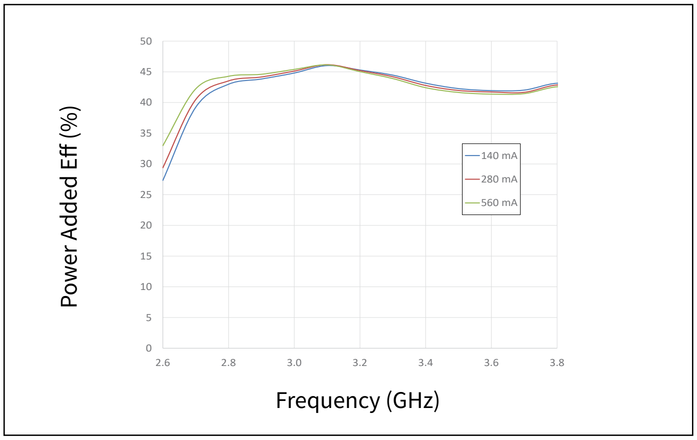


Figure 37. Power Added Eff. vs Frequency as a Function of Input Power

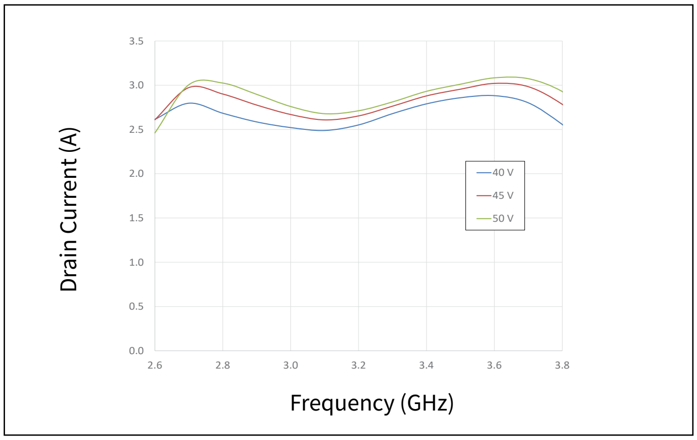


Figure 38. Drain Current vs Frequency as a Function of Voltage

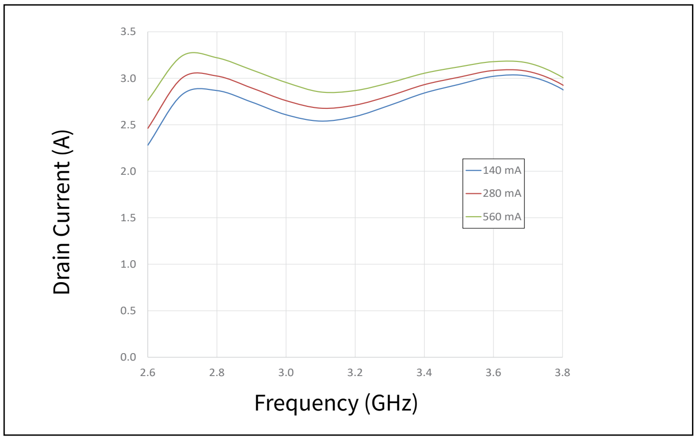


Figure 39. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CMPA2738060F

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

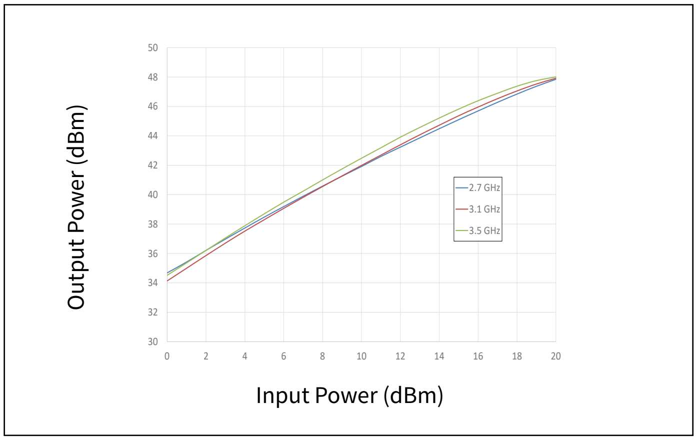


Figure 40. Output Power vs Input Power as a Function of Frequency

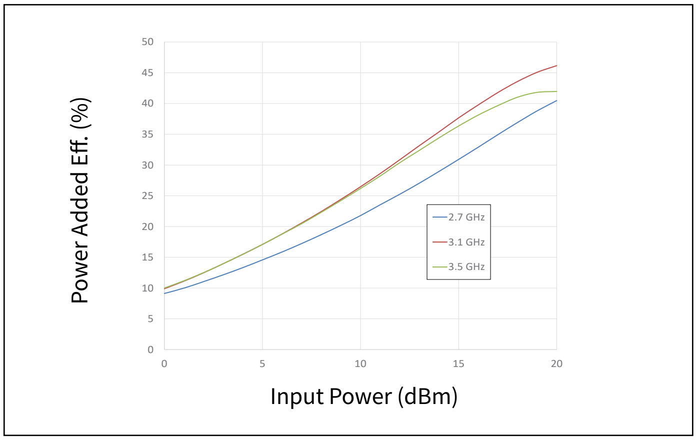


Figure 41. Power Added Eff. vs Input Power as a Function of Frequency

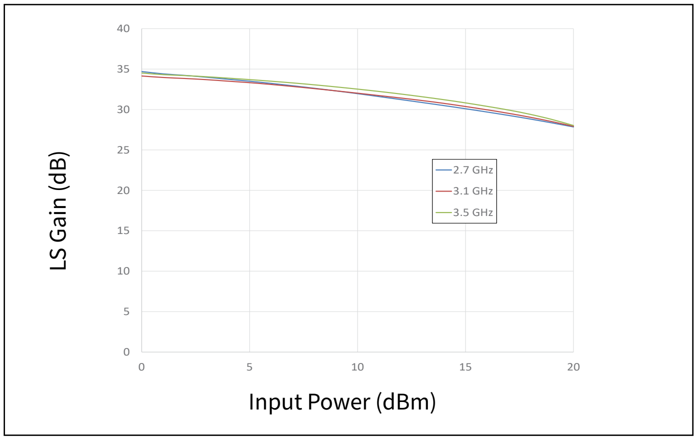


Figure 42. Large Signal Gain vs Input Power as a Function of Frequency

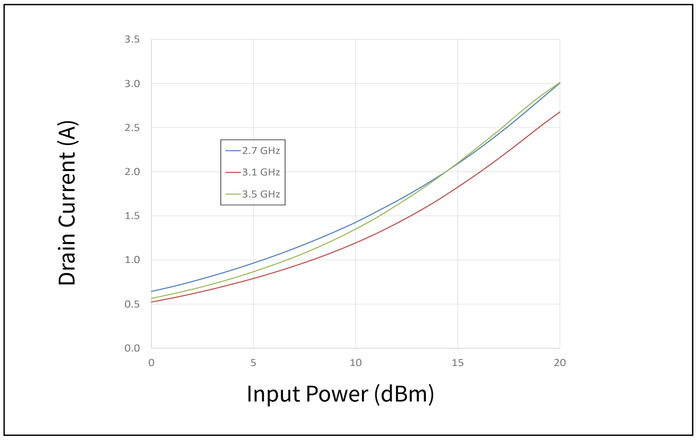


Figure 43. Drain Current vs Input Power as a Function of Frequency

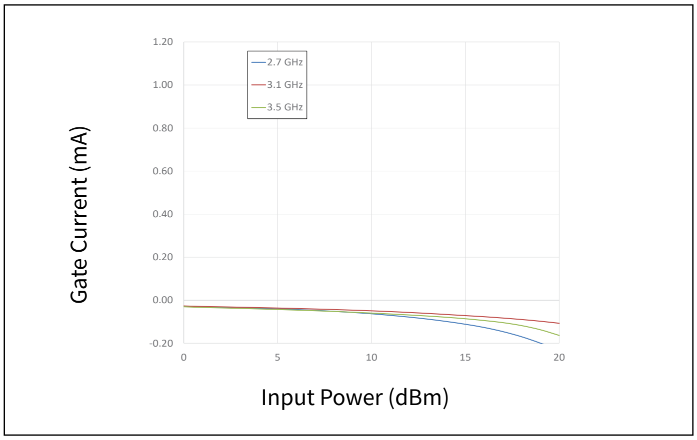


Figure 44. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA2738060F

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

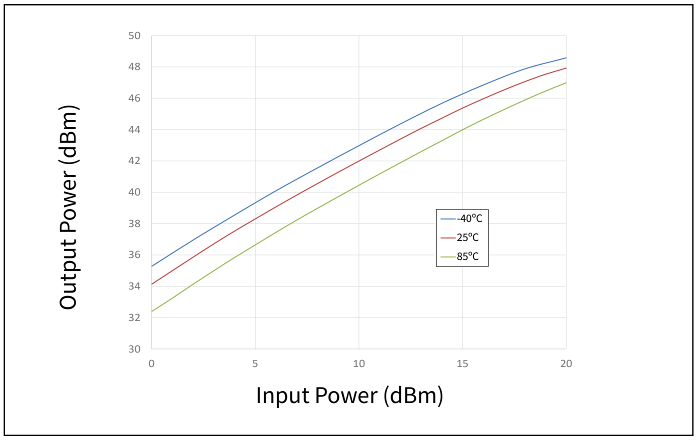


Figure 45. Output Power vs Input Power as a Function of Temperature

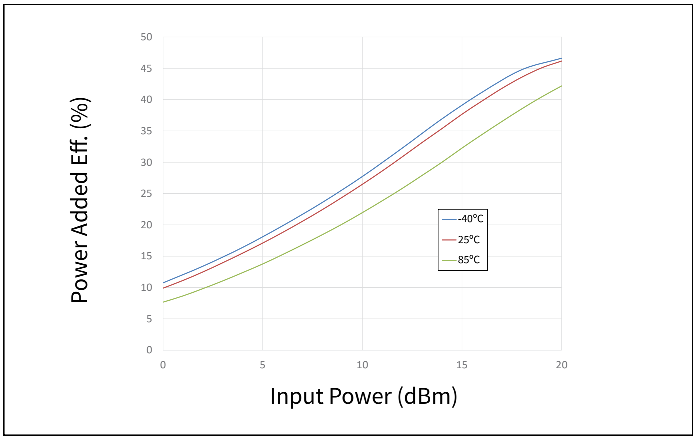


Figure 46. Power Added Eff. vs Input Power as a Function of Temperature

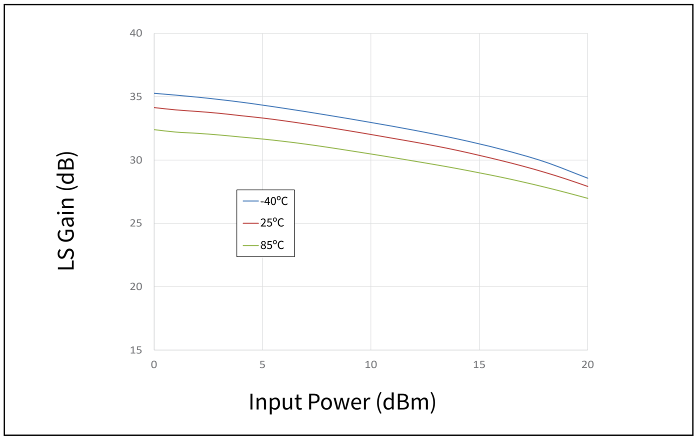


Figure 47. Large Signal Gain vs Input Power as a Function of Temperature

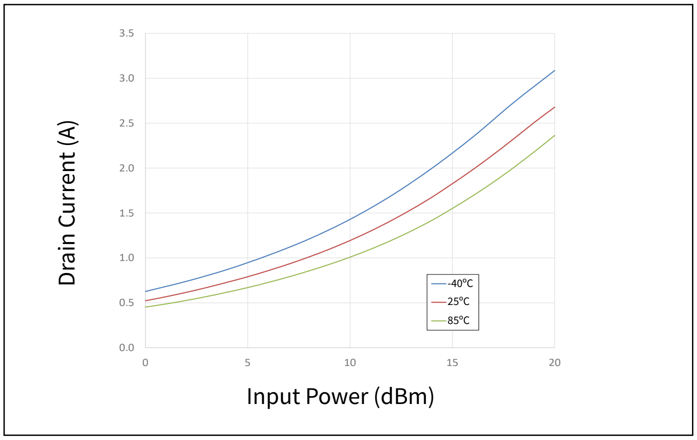


Figure 48. Drain Current vs Input Power as a Function of Temperature

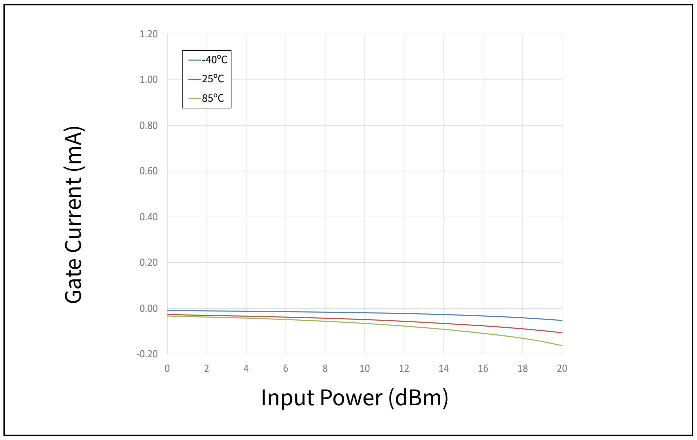


Figure 49. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA2738060F

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

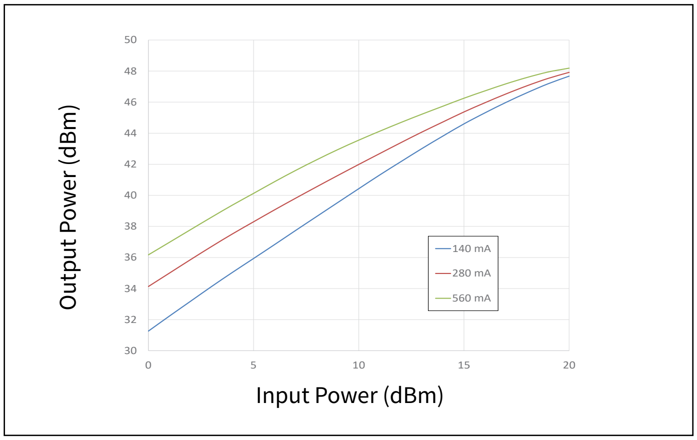


Figure 50. Output Power vs Input Power as a Function of I_{DQ}

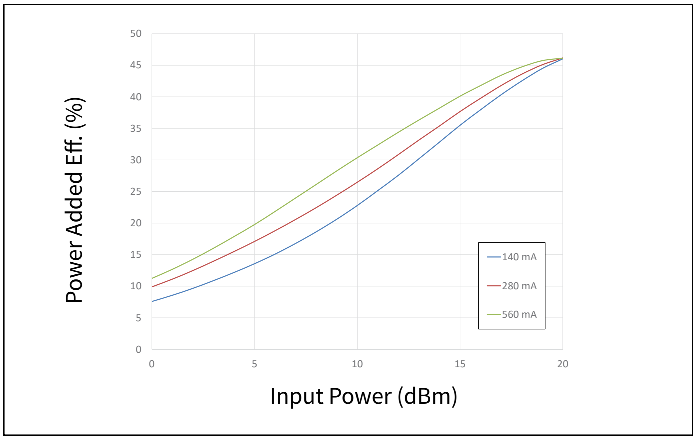


Figure 51. Power Added Eff. vs Input Power as a Function of I_{DQ}

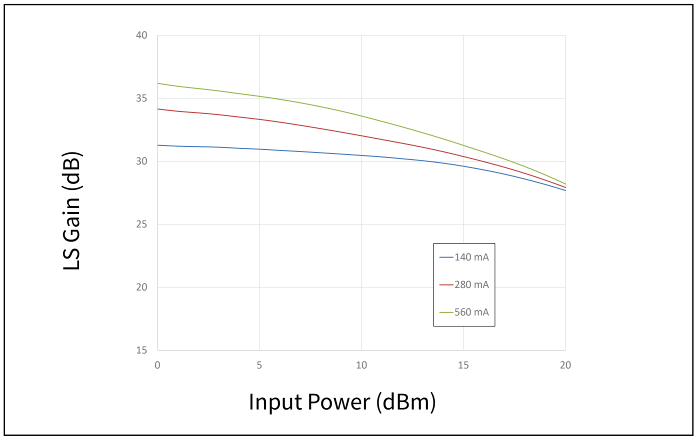


Figure 52. Large Signal Gain vs Input Power as a Function of I_{DQ}

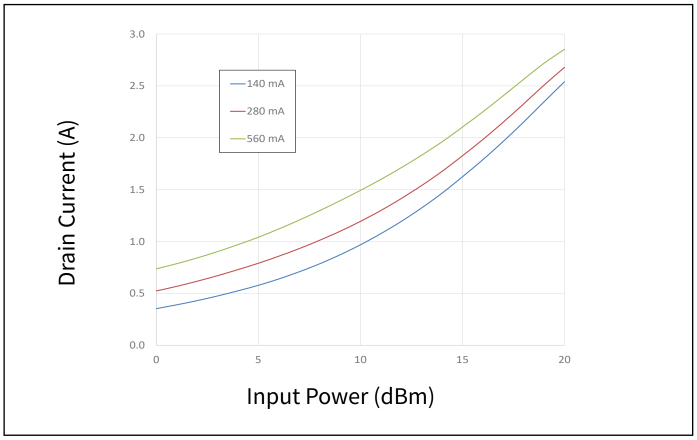


Figure 53. Drain Current vs Input Power as a Function of I_{DQ}

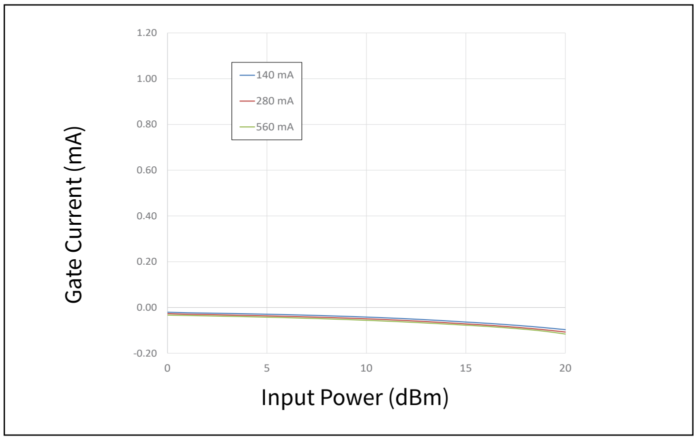


Figure 54. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

Test conditions unless otherwise noted: V_D = 50 V, I_{DQ} = 280 mA, PW = 300µs, DC = 20%, P_{IN} = 20 dBm, Frequency = 3.1 GHz, T_{BASE} = +25°C

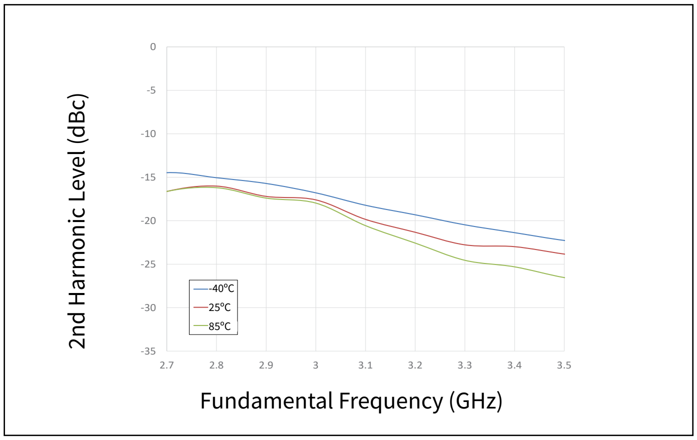


Figure 55. 2nd Harmonic vs Frequency as a Function of Temperature

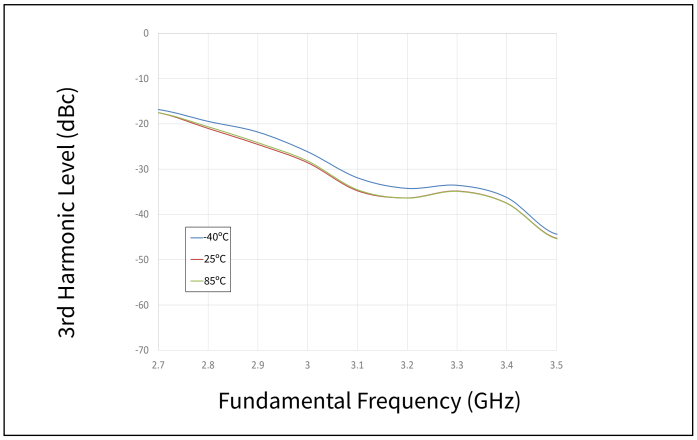


Figure 56. 3rd Harmonic vs Frequency as a Function of Temperature

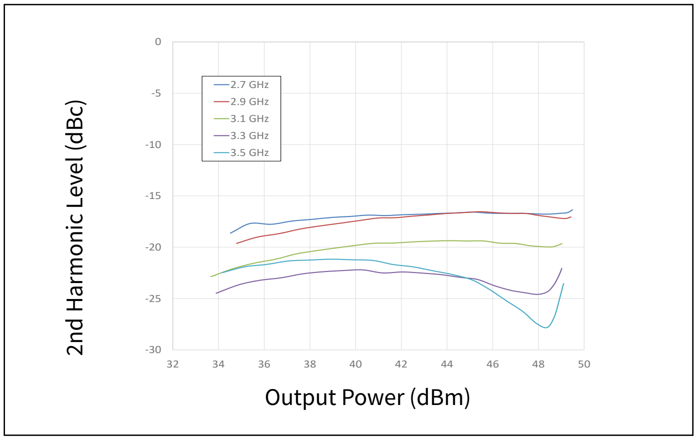


Figure 57. 2nd Harmonic vs Output Power as a Function of Frequency

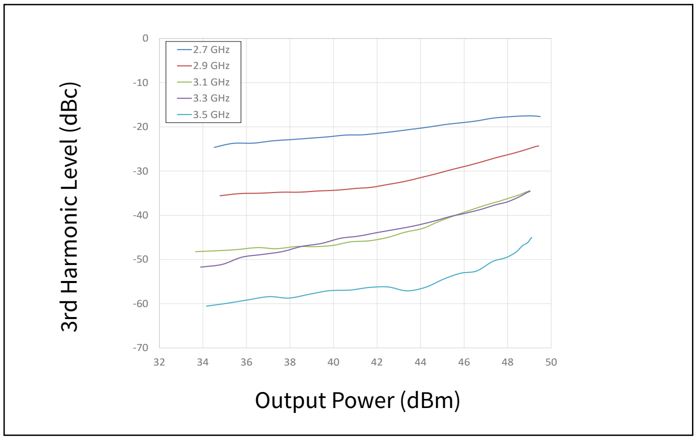


Figure 58. 3rd Harmonic vs Output Power as a Function of Frequency

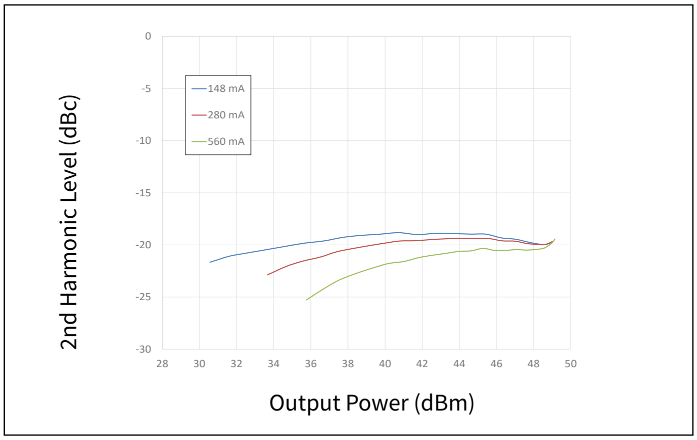


Figure 59. 2nd Harmonic vs Output Power as a Function of I_{DQ}

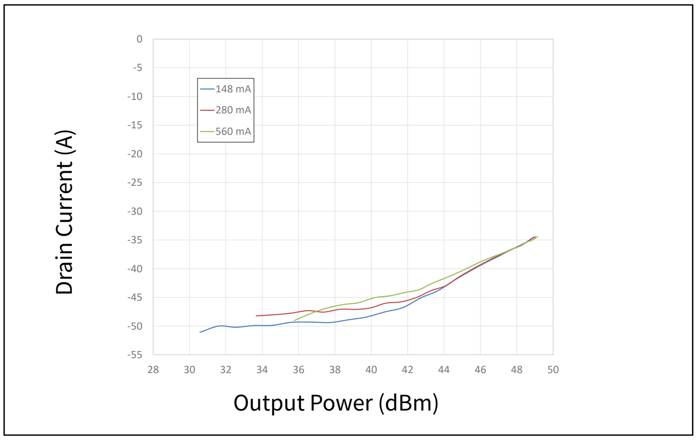


Figure 60. 3rd Harmonic vs Output Power as a Function of I_{DQ}

Typical Performance of the CMPA2738060F

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

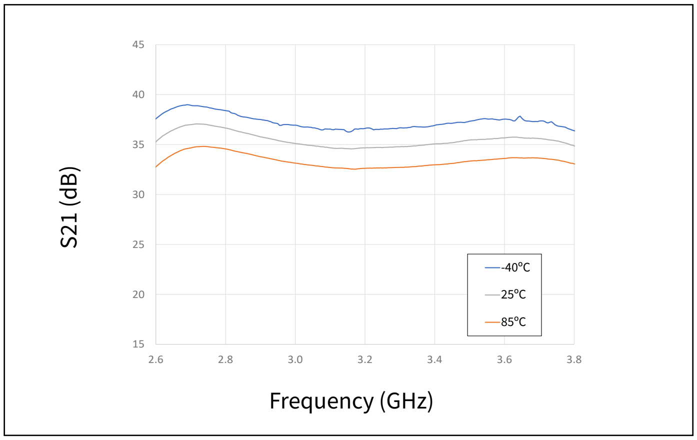


Figure 61. Gain vs Frequency as a Function of Temperature

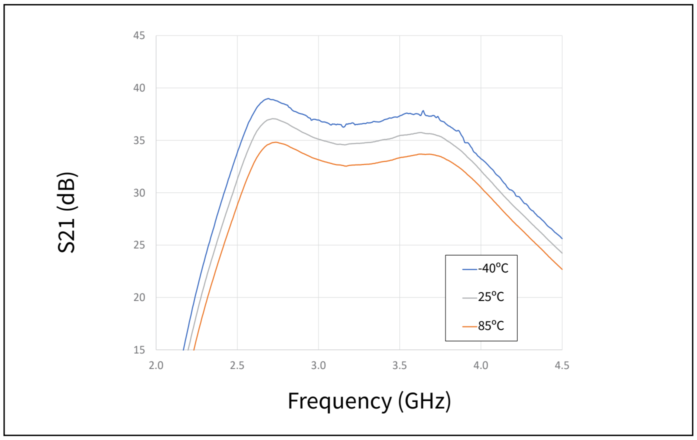


Figure 62. Gain vs Frequency as a Function of Temperature

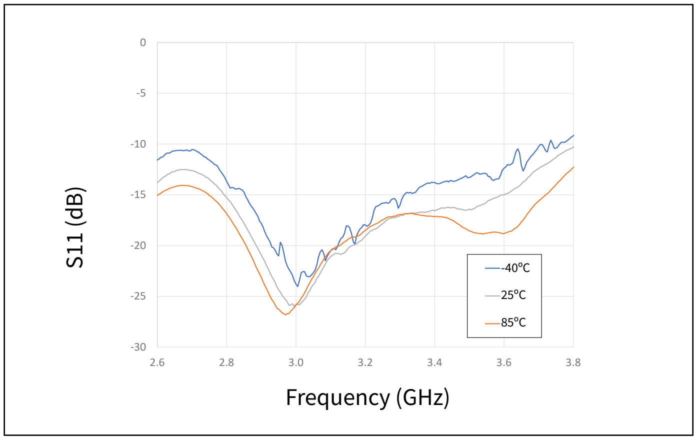


Figure 63. Input RL vs Frequency as a Function of Temperature

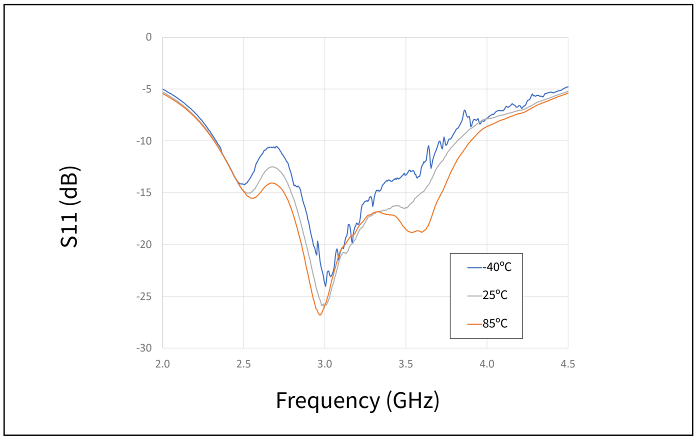


Figure 64. Input RL vs Frequency as a Function of Temperature

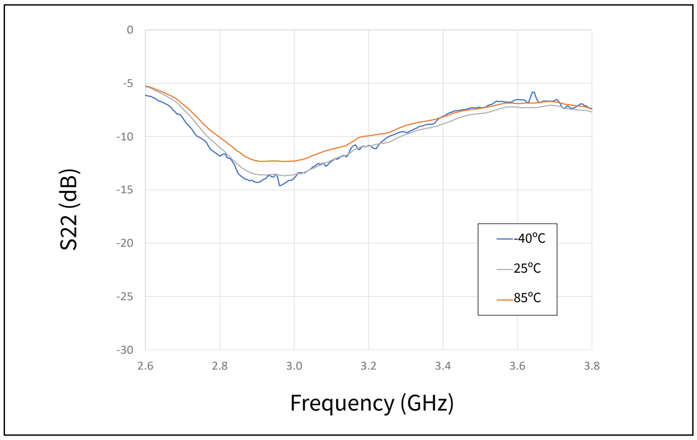


Figure 65. Output RL vs Frequency as a Function of Temperature

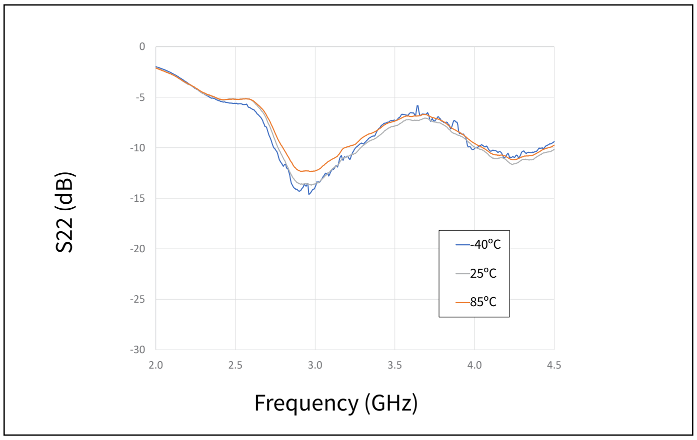


Figure 66. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CMPA2738060F

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

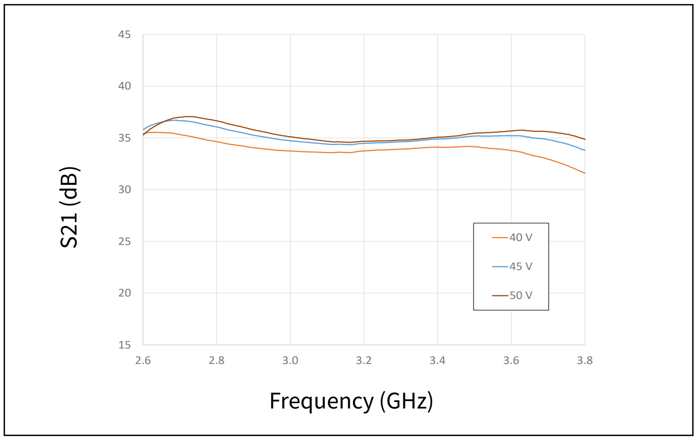


Figure 67. Gain vs Frequency as a Function of Voltage

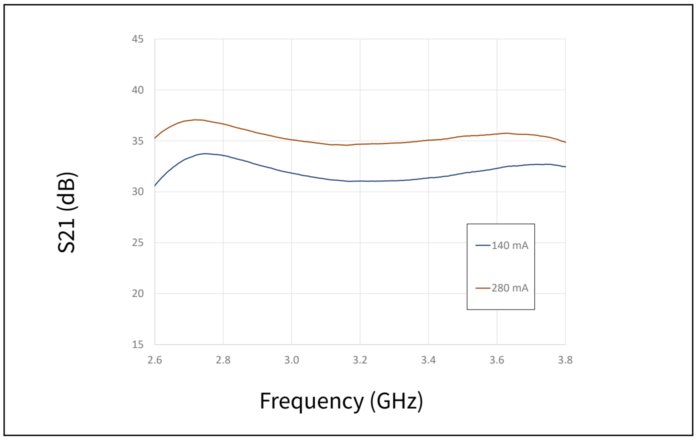


Figure 68. Gain vs Frequency as a Function of I_{DQ}

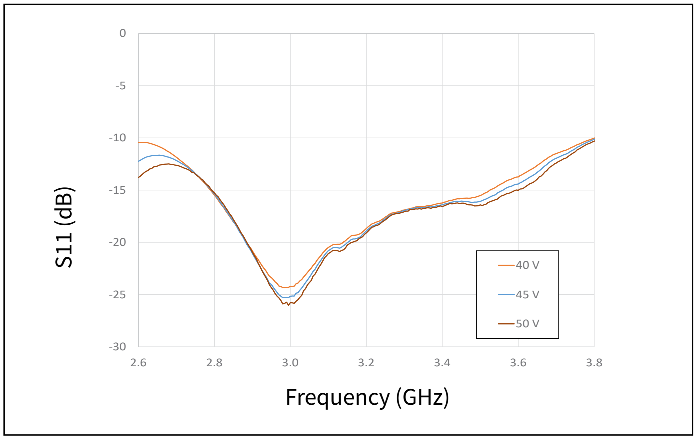


Figure 69. Input RL vs Frequency as a Function Voltage

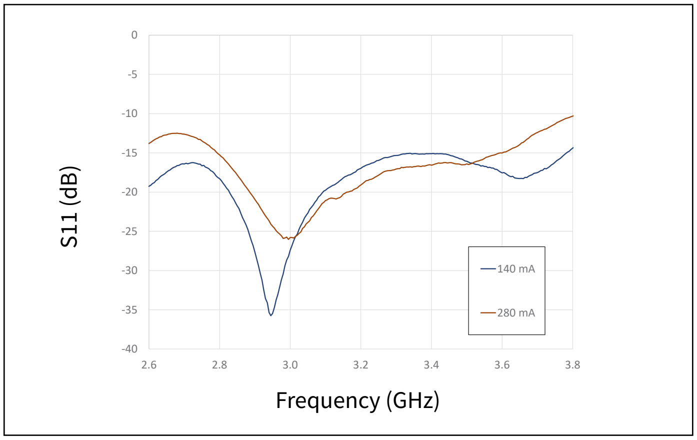


Figure 70. Input RL vs Frequency as a Function of I_{DQ}

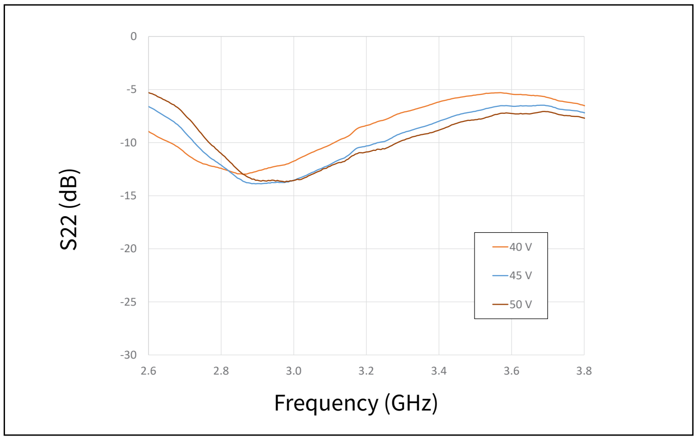


Figure 71. Output RL vs Frequency as a Function of Voltage

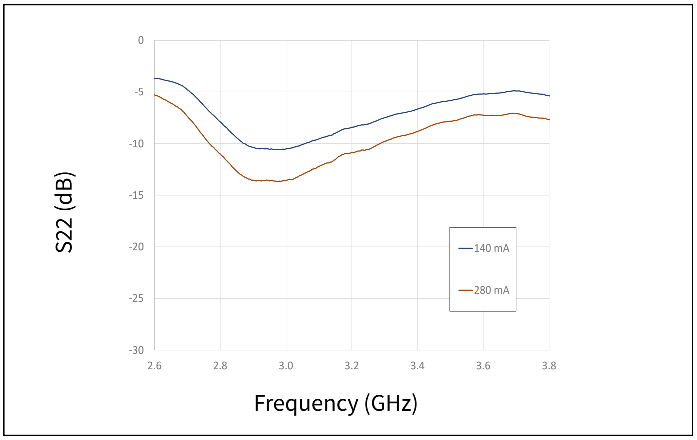
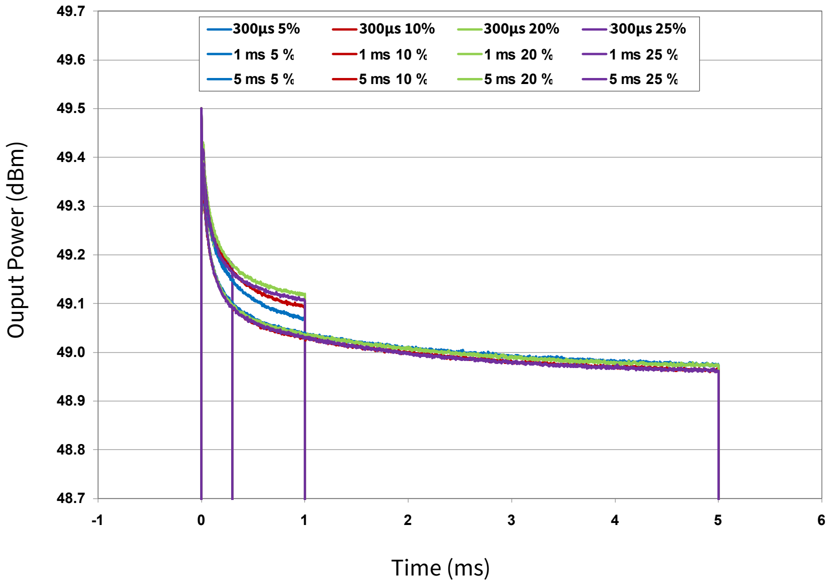


Figure 72. Output RL vs Frequency as a Function of I_{DQ}

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

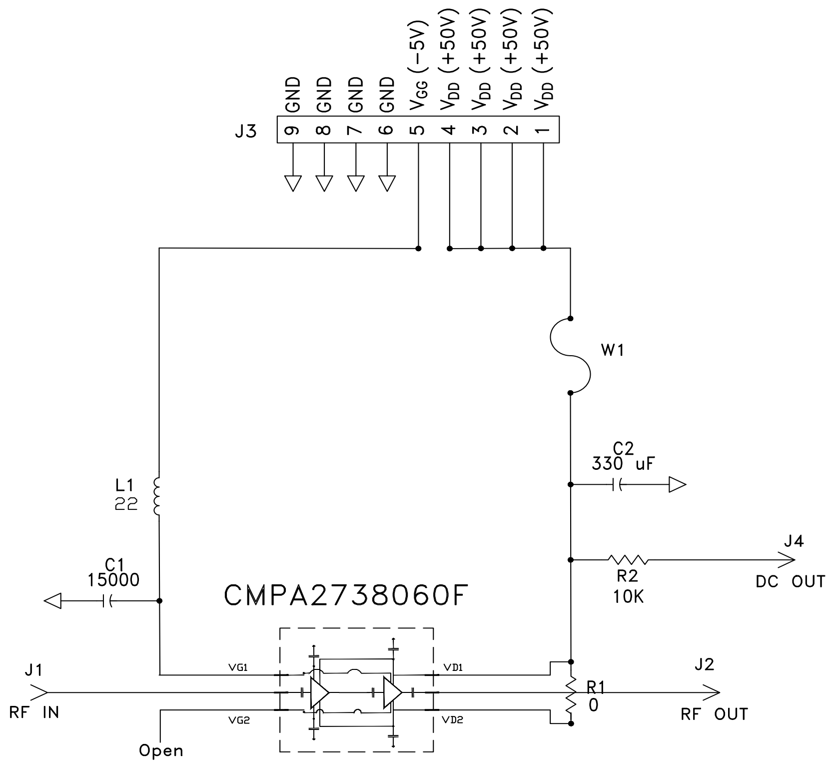
Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

CMPA2738060F-AMP Evaluation Board Bill of Materials

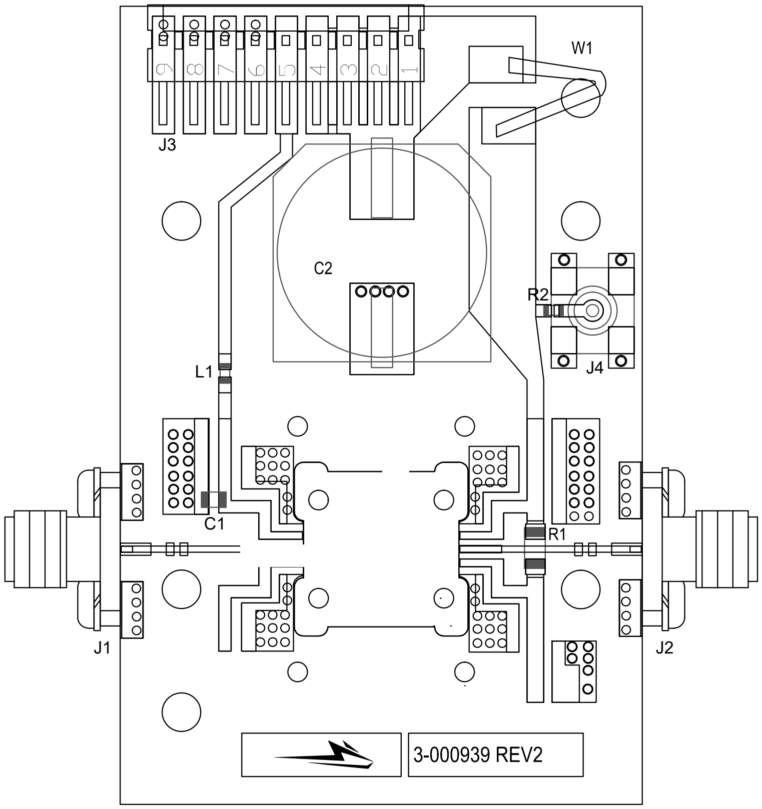
Designator	Description	Qty
C1	CAP, 15000pF, 100V, 0805, X7R	1
C2	CAP, 330µF, 20%, 100V, ELECT, MVY, SMD	1
R1	RES, 1/8W, 1206, +/-5%, 0 OHMS	1
R2	RES, 1/16W, 0603, +/-5%, 10K OHMS	1
L1	FERRITE, 22 OHM, 0805, BLM21PG220SN1	1
J1,J2	CONNECTOR, N-TYPE, FEMALE, W/0.500 SMA FLNG	2
J3	CONNECTOR, HEADER, RT>PLZ .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

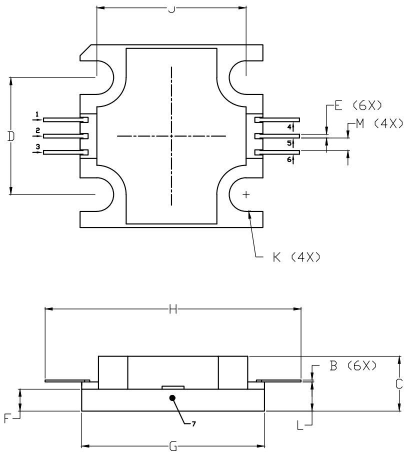
CMPA2738060F-AMP Demonstration Amplifier Circuit Schematic

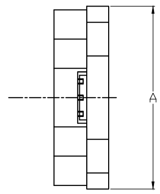


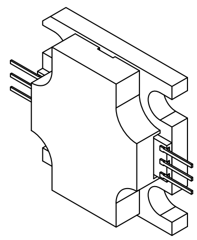
CMPA2738060F-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CMPA2738060F (Package Type — 440219)





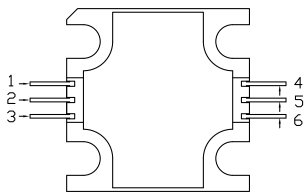


NOT TO SCALE

NOTES:

1. DIMENSIONING AND TOLERANICING 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	ø .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

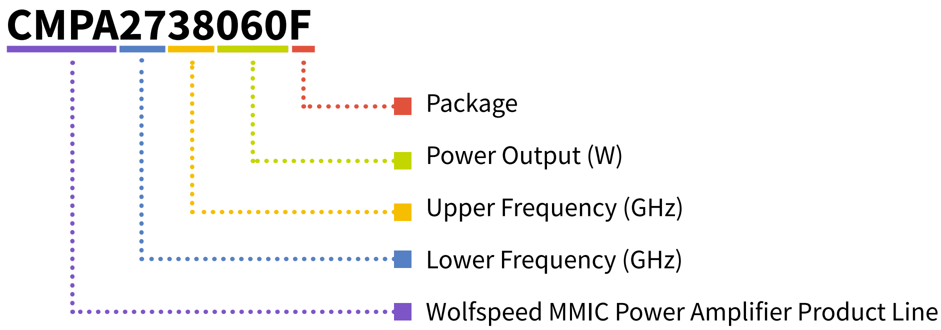


Table 1.

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	

For more information, please contact:

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Durham, NC 27703 USA
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