

# CMPA2735030S

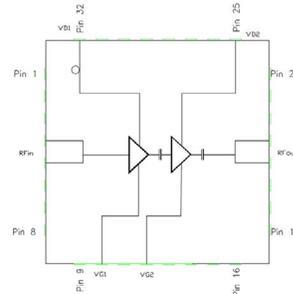
30 W, 2.7 - 3.5 GHz, GaN MMIC, Power Amplifier



## Description

The CMPA2735030S is a gallium nitride (GaN) high electron mobility transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC contains a two-stage reactively matched amplifier design approach enabling high power and power added efficiency to be achieved in a 5 mm x 5 mm, surface mount (QFN package).

Package Types: 5x5 mm  
PN's: CMPA2735030S



## Features

- 32 dB small signal gain
- Operation up to 50 V
- High breakdown voltage
- High temperature operation
- 5 mm x 5 mm total product size

## Applications

- Civil and military pulsed radar amplifiers

## Typical Performance Over 2.7 - 3.5 GHz ( $T_c = 25^\circ\text{C}$ )

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	3.3 GHz	3.5 GHz	Units
Small Signal Gain	33.8	32.9	32.9	33.5	33.4	dB
Output Power <sup>1</sup>	36.5	39.7	40.6	36.0	27.8	W
Power Gain <sup>1</sup>	27.6	28.0	28.1	27.6	26.4	dB
PAE <sup>1</sup>	57	53	51	51	45	%

Note:

<sup>1</sup>  $P_{IN} = 18\text{ dBm}$ , pulse width = 100  $\mu\text{s}$ ; duty cycle = 10%.



### 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	$V_{DC}$	25 °C
Storage Temperature	$T_{STG}$	-65, +150	°C	
Maximum Forward Gate Current	$I_G$	15.5	mA	25 °C
Soldering Temperature	$T_s$	260	°C	

### Electrical Characteristics (Frequency = 2.7 GHz to 3.5 GHz Unless Otherwise Stated; $T_c = 25 °C$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10 V, I_D = 7.6 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 50 V, V_{DQ} = 135 mA$
Saturated Drain Current <sup>1</sup>	$I_{DS}$	-	4.6	-	A	$V_{DS} = 6.0 V, V_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	$V_{BD}$	-	150	-	V	$V_{GS} = -8 V, I_D = 7.6 mA$
<b>RF Characteristics<sup>2,3</sup></b>						
Small Signal Gain	$S21_1$	-	33.8	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 2.7 GHz
Small Signal Gain	$S21_2$	-	32.9	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.1 GHz
Small Signal Gain	$S21_3$	-	33.4	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.5 GHz
Power Output	$P_{OUT1}$	-	36.5	-	W	$V_{DD} = 50 V, I_{DQ} = 135 mA, P_{IN} = 21 dBm$ , Frequency = 2.7 GHz
Power Output	$P_{OUT2}$	-	40.6	-	W	$V_{DD} = 50 V, I_{DQ} = 135 mA, P_{IN} = 21 dBm$ , Frequency = 3.1 GHz
Power Output	$P_{OUT3}$	-	27.8	-	W	$V_{DD} = 50 V, I_{DQ} = 135 mA, P_{IN} = 21 dBm$ , Frequency = 3.5 GHz
Power Added Efficiency	$PAE_1$	-	57	-	%	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 2.7 GHz
Power Added Efficiency	$PAE_2$	-	51	-	%	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.1 GHz
Power Added Efficiency	$PAE_3$	-	45	-	%	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.5 GHz
Input Return Loss	$S11_1$	-	-18.2	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 2.7 GHz
Input Return Loss	$S11_2$	-	-13.4	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.1 GHz
Input Return Loss	$S11_3$	-	-27.0	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.5 GHz
Output Return Loss	$S22_1$	-	-14.9	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 2.7 GHz
Output Return Loss	$S22_2$	-	-9.5	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.1 GHz
Output Return Loss	$S22_3$	-	-16.5	-	dB	$V_{DD} = 50 V, I_{DQ} = 135 mA$ , Frequency = 3.5 GHz
Output Mismatch Stress	VSWR	-	5:1	-	$\Psi$	No Damage at All Phase Angles, $V_{DD} = 50 V, I_{DQ} = 135 mA, P_{IN} = 18 dBm$

Notes:

<sup>1</sup> Scaled from PCM data.

<sup>2</sup> Measured in CMPA2735030S high volume test fixture at 2.7, 3.1, and 3.5 GHz and may not show the full capability of the device due to source inductance and thermal performance.

<sup>3</sup> Pulse width = 25  $\mu s$ ; duty cycle = 1%.

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### Thermal Characteristics

Parameter	Symbol	Rating	Units	Conditions
Operating Junction Temperature	$T_J$	225	°C	
Thermal Resistance, Junction to Case (Packaged) <sup>1</sup>	$R_{\theta JC}$	2.62	°C/W	Pulse Width = 500 $\mu$ s, Duty Cycle = 10%

Notes:

<sup>1</sup> Measured for the CMPA2735030S at  $P_{DISS} = 32$  W.

### Typical Performance of the CMPA2735030S

Test conditions unless otherwise noted:  $V_D = 50$  V,  $I_{DQ} = 130$  mA, PW = 100  $\mu$ s, DC = 10%,  $P_{IN} = 18$  dBm,  $T_{BASE} = +25$  °C

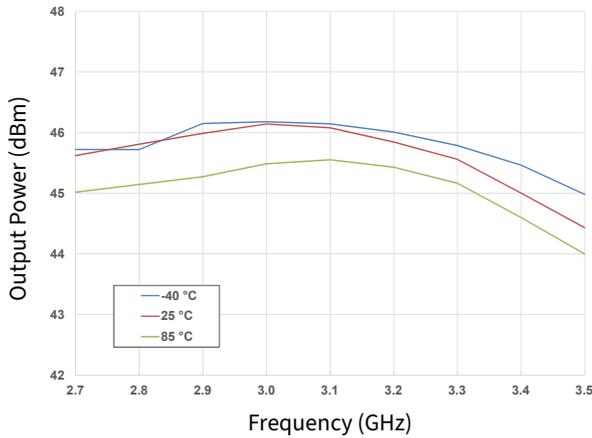


Figure 1. Output Power vs Frequency as a Function of Temperature

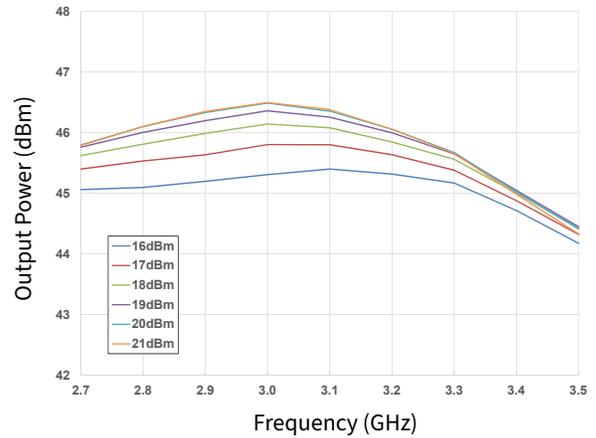


Figure 2. Output Power vs Frequency as a Function of Input Power

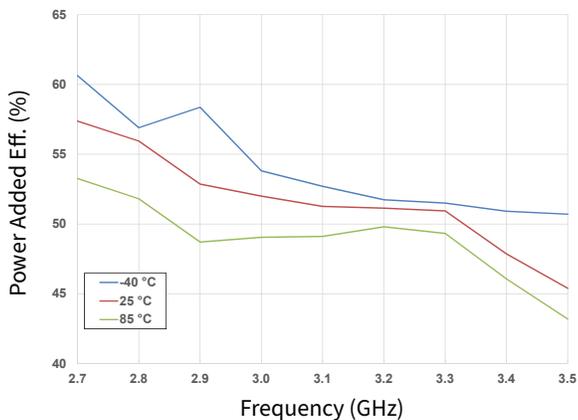


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

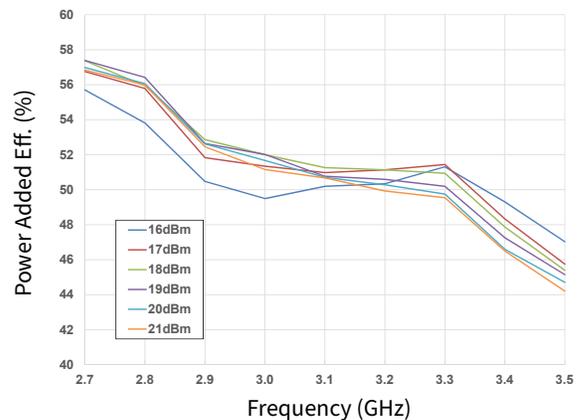


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

### Typical Performance of the CMPA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $PW = 100\ \mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 18\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

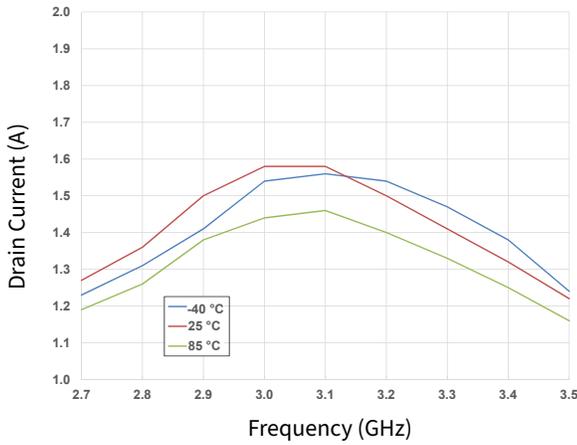


Figure 5. Drain Current vs Frequency as a Function of Temperature

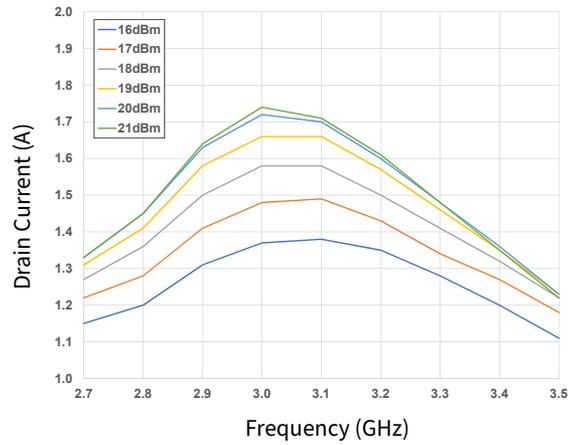


Figure 6. Drain Current vs Frequency as a Function of Input Power

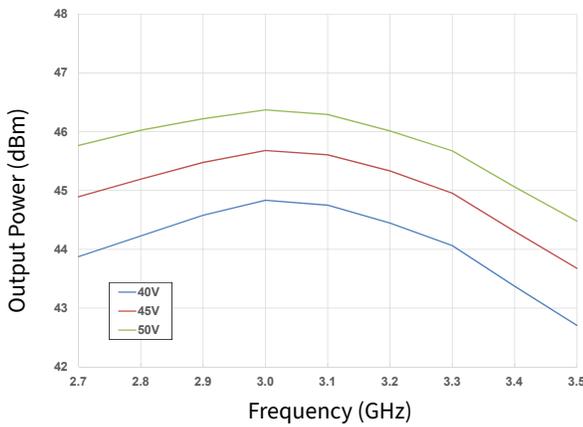


Figure 7. Output Power vs Frequency as a Function of  $V_D$

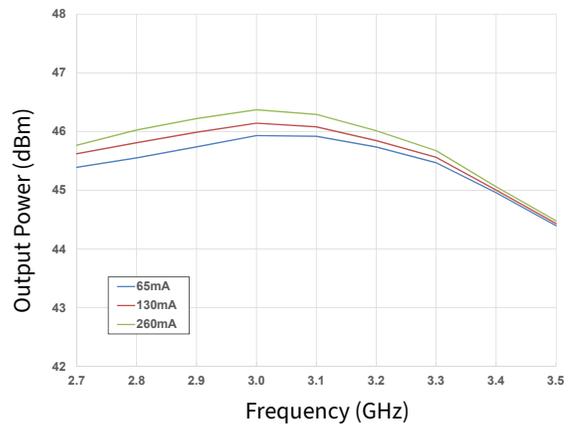


Figure 8. Output Power vs Frequency as a Function of  $I_{DQ}$

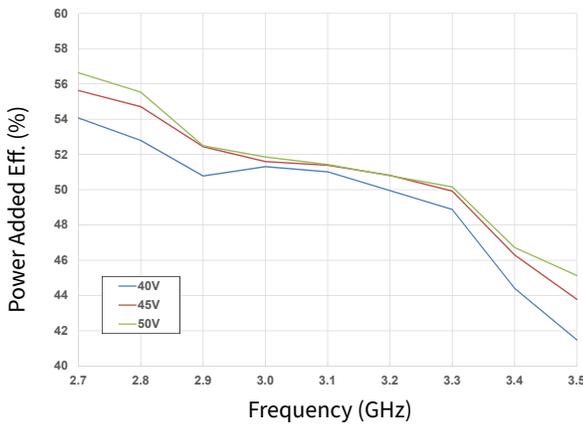


Figure 9. Power Added Eff. vs Frequency as a Function of  $V_D$

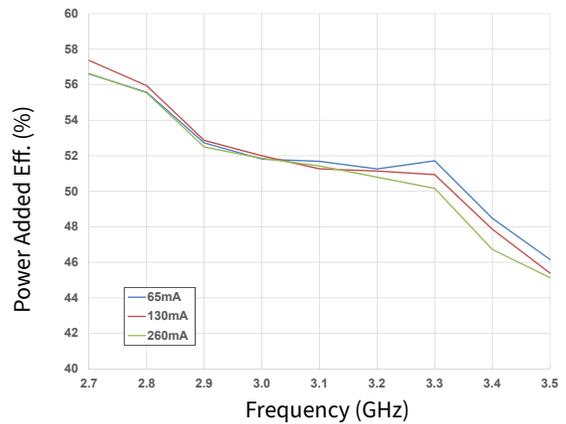


Figure 10. Power Added Eff. vs Frequency as a Function of  $I_{DQ}$

### Typical Performance of the CPM2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 18\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

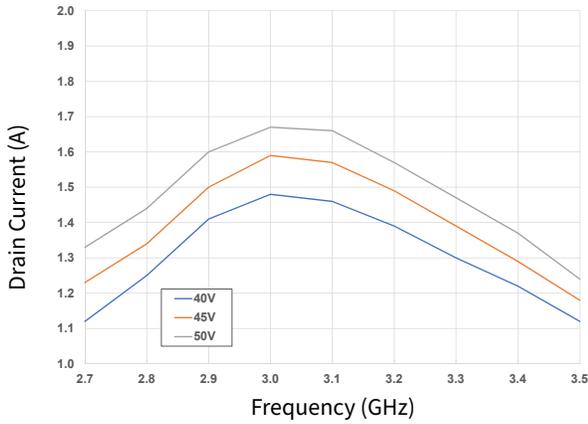


Figure 11. Drain Current vs Frequency as a Function of  $V_D$

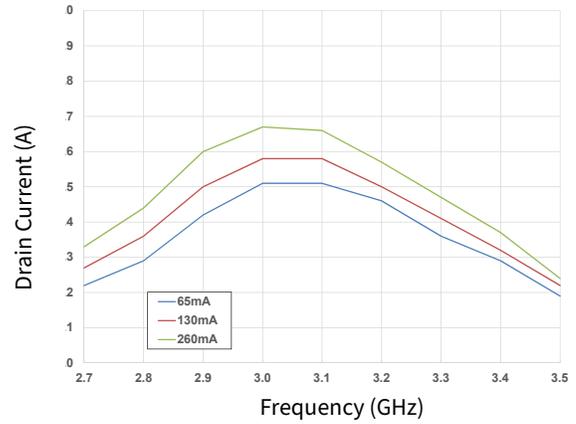


Figure 12. Drain Current vs Frequency as a Function of  $I_{DQ}$

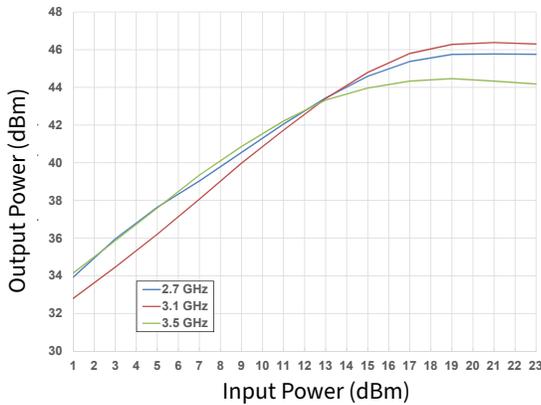


Figure 13. Output Power vs Input Power as a Function of Frequency

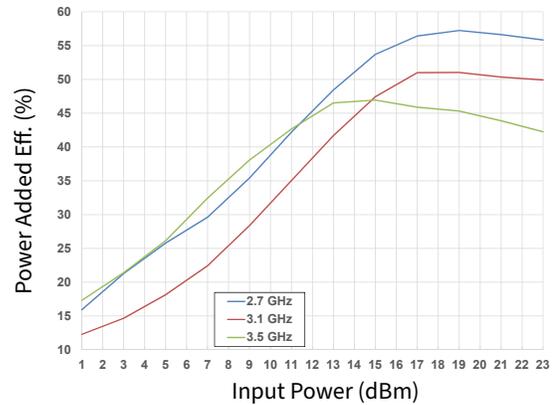


Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

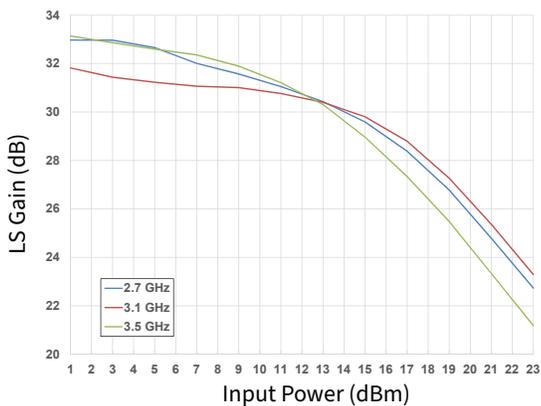


Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

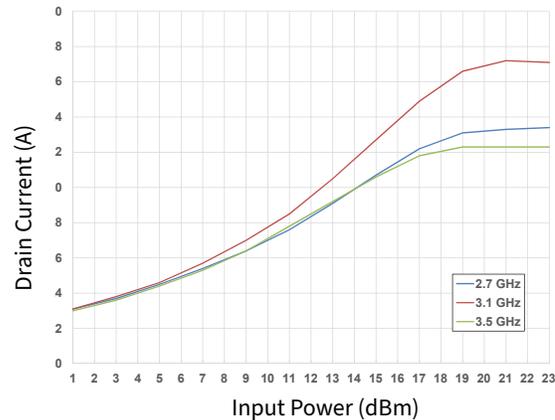


Figure 16. Drain Current vs Input Power as a Function of Frequency

### Typical Performance of the CMPA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 18\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

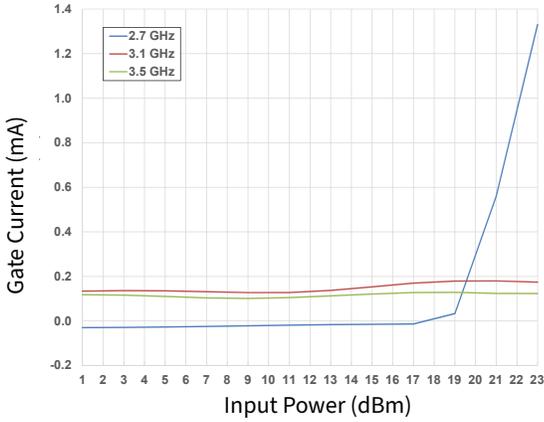


Figure 17. Gate Current vs Input Power as a Function of Frequency

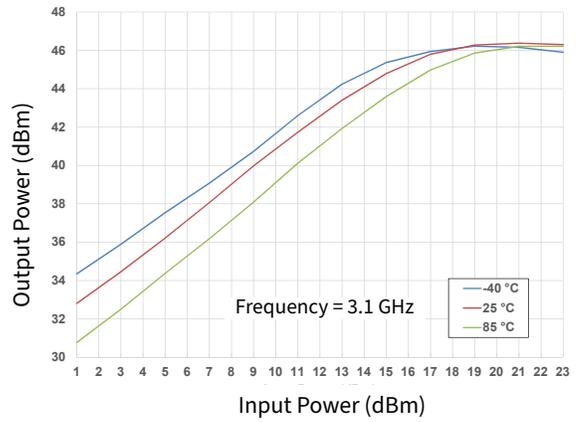


Figure 18. Output Power vs Input Power as a Function of Temperature

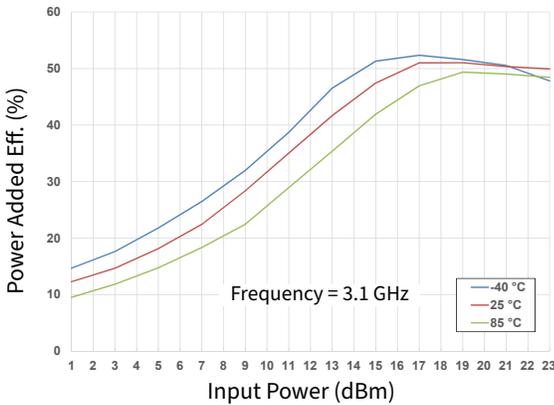


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

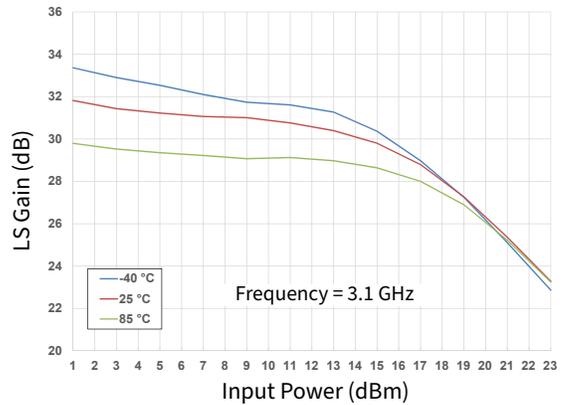


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

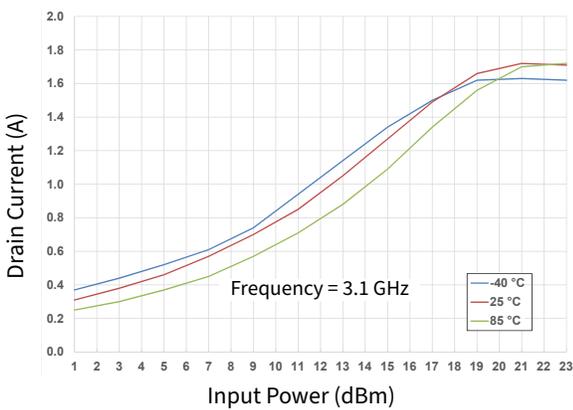


Figure 21. Drain Current vs Input Power as a Function of Temperature

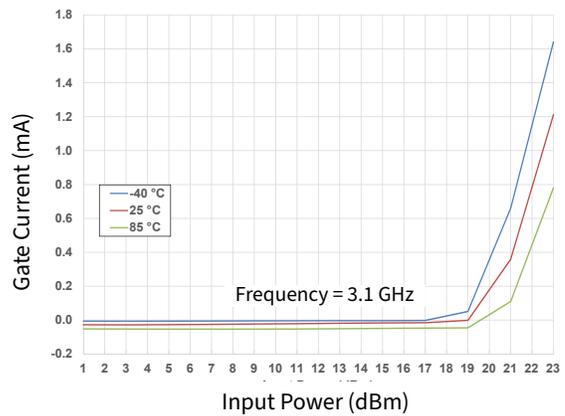


Figure 22. Gate Current vs Input Power as a Function of Temperature

### Typical Performance of the CMPA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $PW = 100\ \mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 18\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

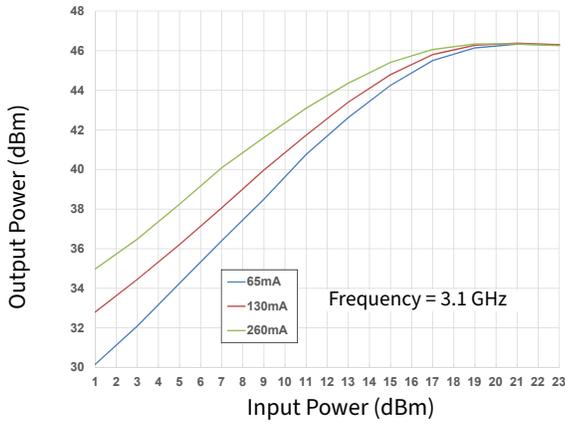


Figure 23. Output Power vs Input Power as a Function of  $I_{DQ}$

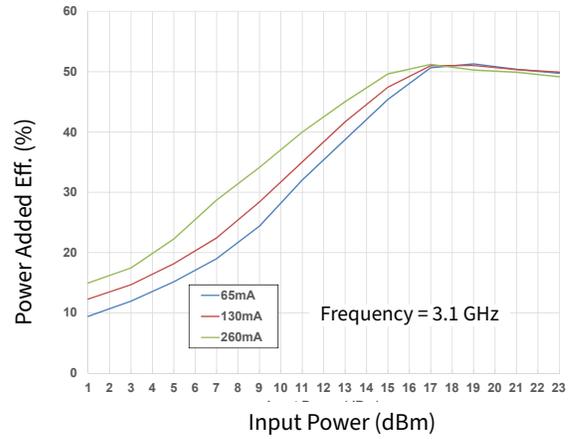


Figure 24. Power Added Eff. vs Input Power as a Function of  $I_{DQ}$

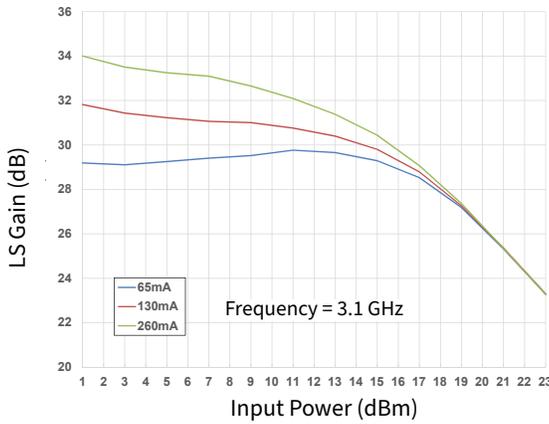


Figure 25. Large Signal Gain vs Input Power as a Function of  $I_{DQ}$

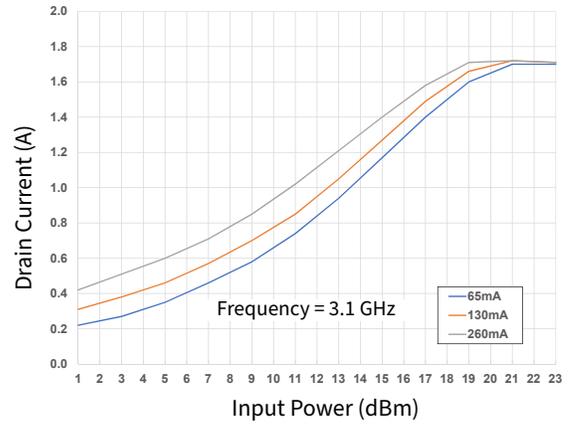


Figure 26. Drain Current vs Input Power as a Function of  $I_{DQ}$

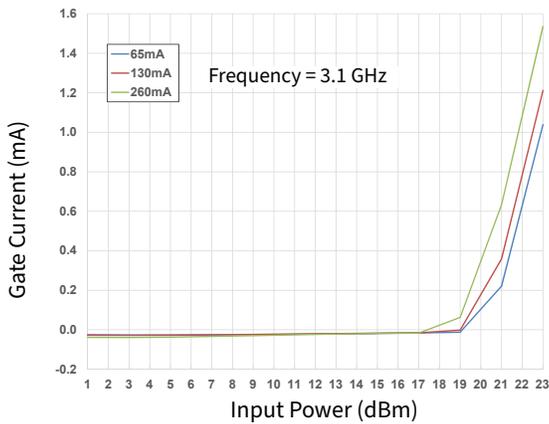


Figure 27. Gate Current vs Input Power as a Function of  $I_{DQ}$

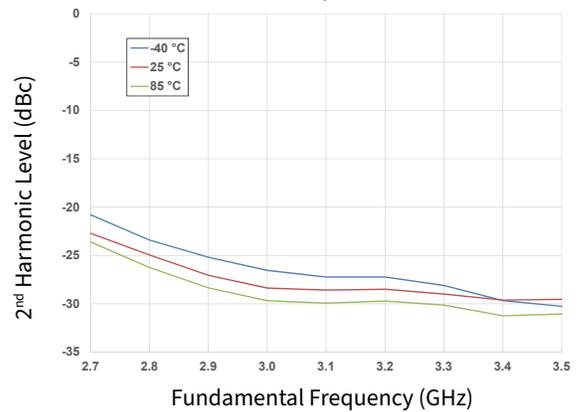


Figure 28. 2<sup>nd</sup> Harmonic vs Frequency as a Function of Temperature

### Typical Performance of the CPMA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $PW = 100\ \mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 18\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

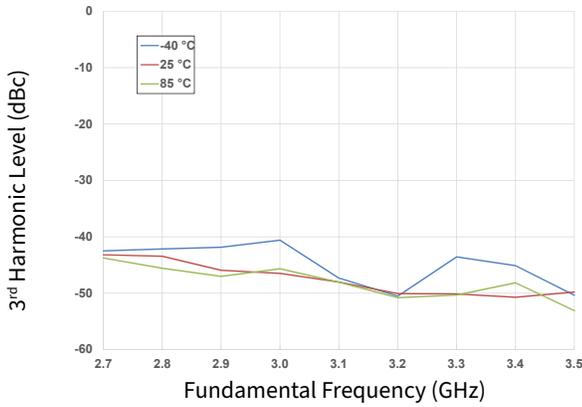


Figure 29. 3<sup>rd</sup> Harmonic vs Frequency as a Function of Temperature

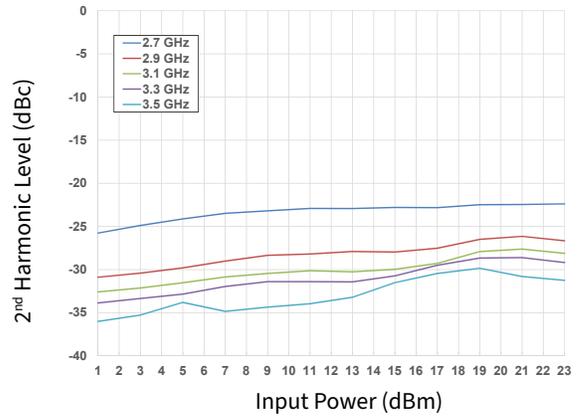


Figure 30. 2<sup>nd</sup> Harmonic vs Input Power as a Function of Frequency

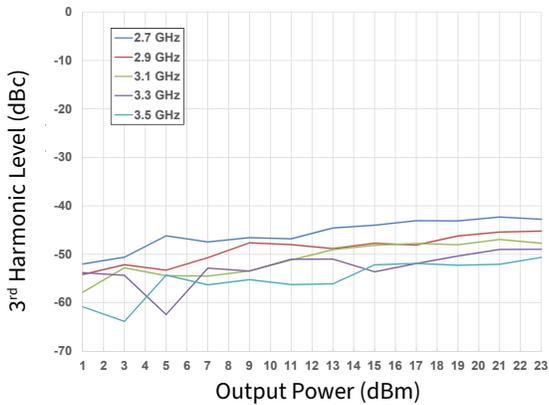


Figure 31. 3<sup>rd</sup> Harmonic vs Input Power as a Function of Frequency

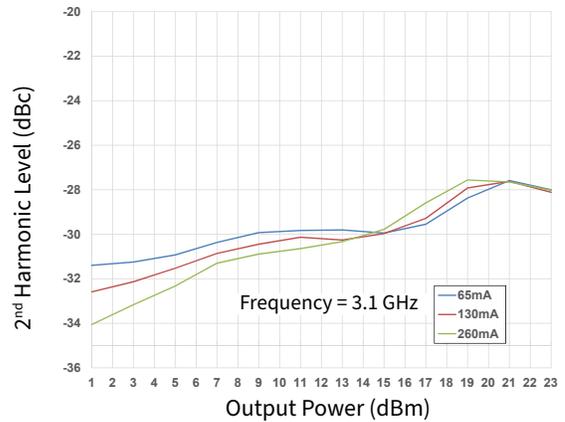


Figure 32. 2<sup>nd</sup> Harmonic vs Output Power as a Function of  $I_{DQ}$

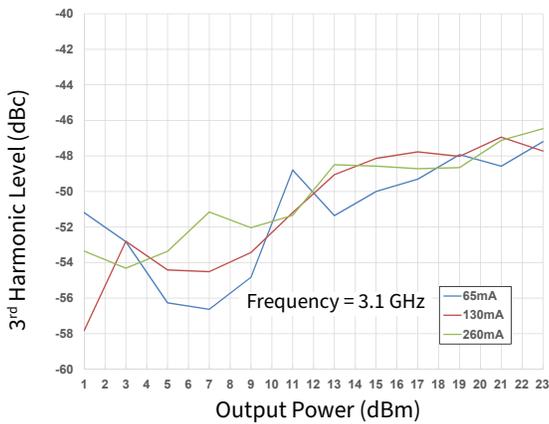


Figure 33. 3<sup>rd</sup> Harmonic vs Output Power as a Function of  $I_{DQ}$

### Typical Performance of the CMPA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $P_{IN} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

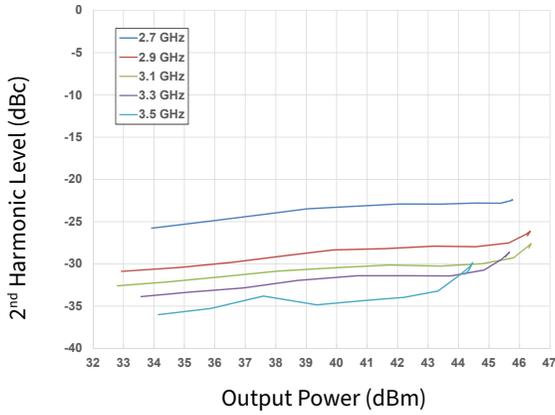


Figure 34. 2<sup>nd</sup> Harmonic vs Output Power as a Function of Frequency

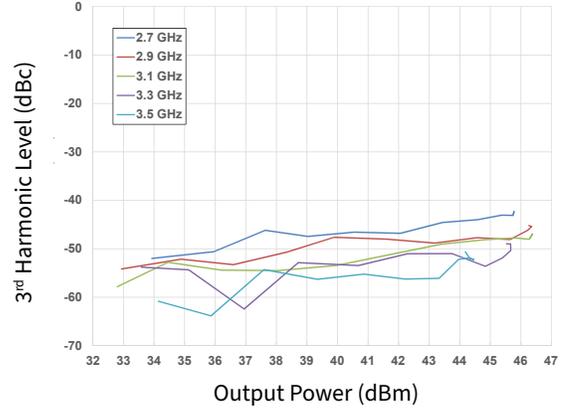


Figure 35. 3<sup>rd</sup> Harmonic vs Output Power as a Function of Frequency

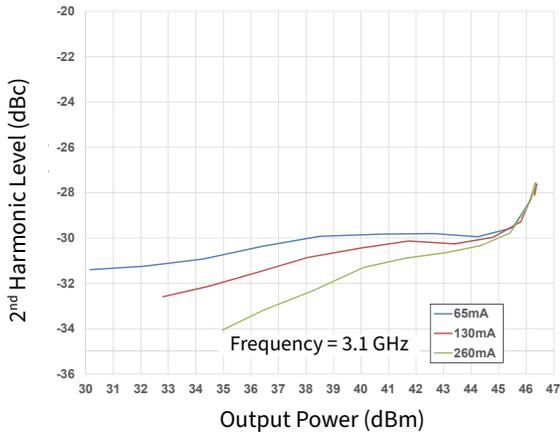


Figure 36. 2<sup>nd</sup> Harmonic vs Output Power as a Function of  $I_{DQ}$

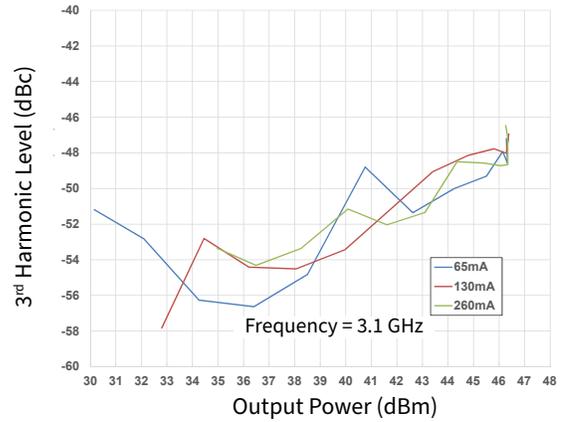


Figure 37. 3<sup>rd</sup> Harmonic vs Output Power as a Function of  $I_{DQ}$

### Typical Performance of the CPMA2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $P_{IN} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

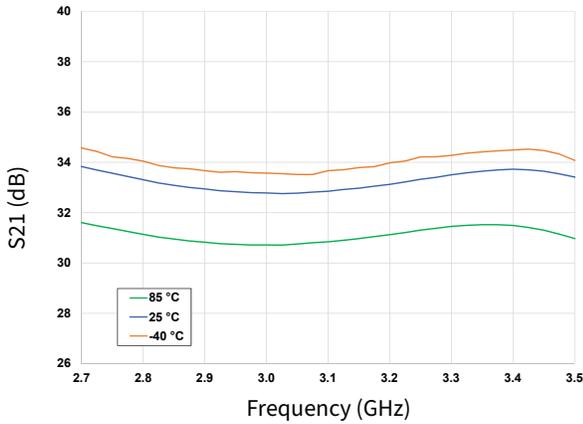


Figure 38. Gain vs Frequency as a Function of Temperature

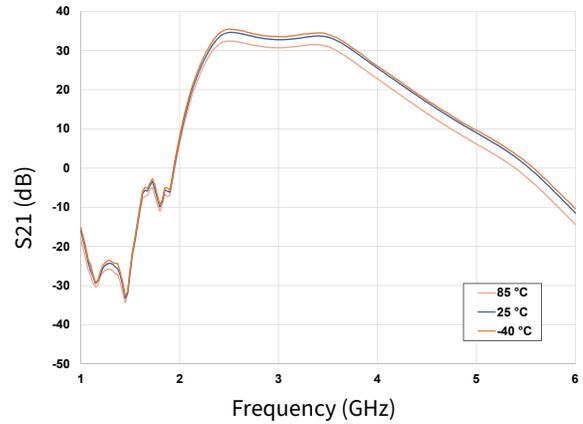


Figure 39. Gain vs Frequency as a Function of Temperature

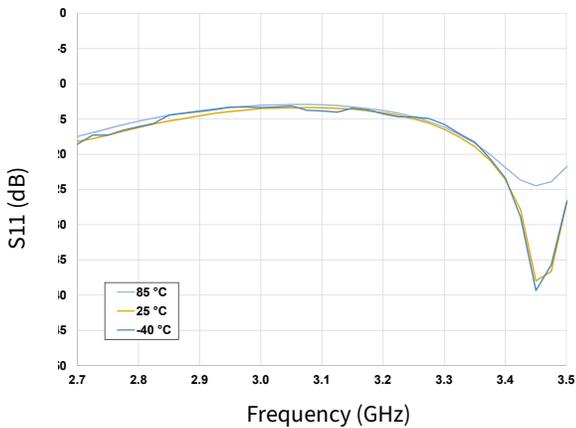


Figure 40. Input RL vs Frequency as a Function of Temperature

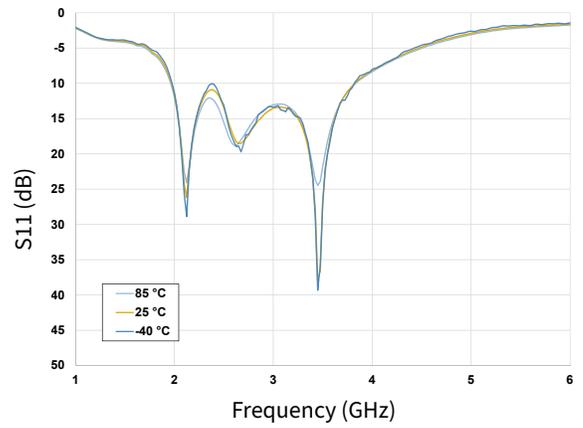


Figure 41. Input RL vs Frequency as a Function of Temperature

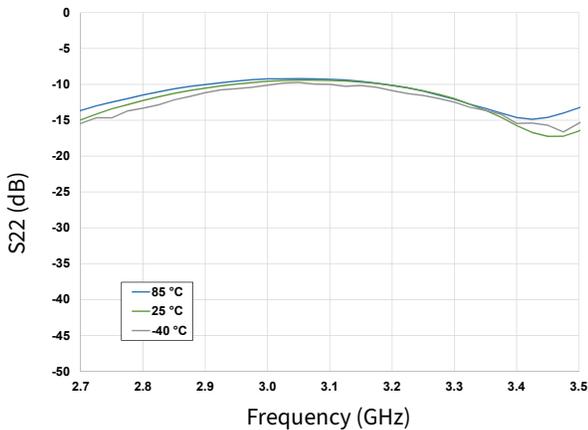


Figure 42. Output RL vs Frequency as a Function of Temperature

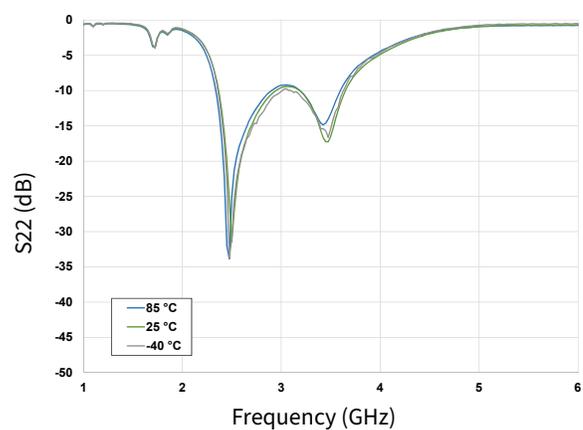


Figure 43. Output RL vs Frequency as a Function of Temperature

### Typical Performance of the CPM2735030S

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 130\text{ mA}$ ,  $P_{IN} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

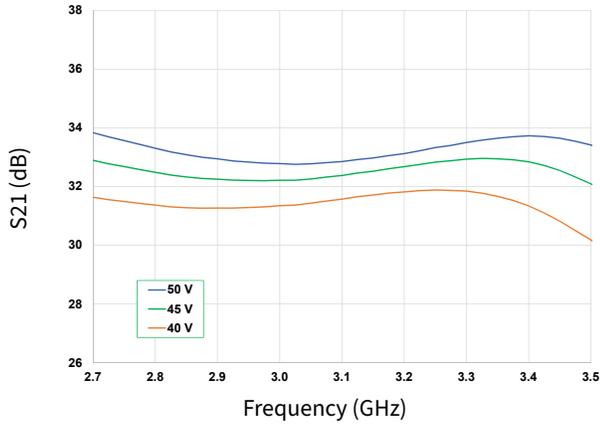


Figure 44. Gain vs Frequency as a Function of Voltage

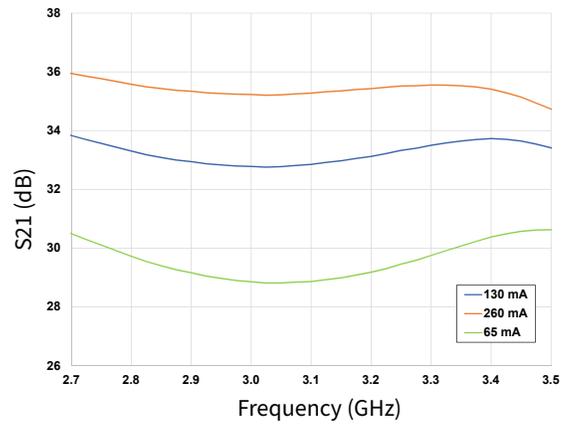


Figure 45. Gain vs Frequency as a Function of  $I_{DQ}$

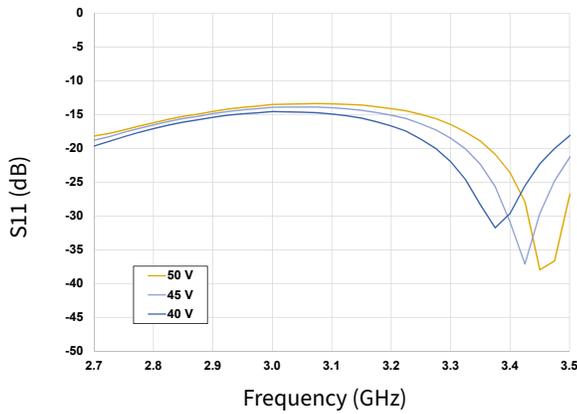


Figure 46. Input RL vs Frequency as a Function Voltage

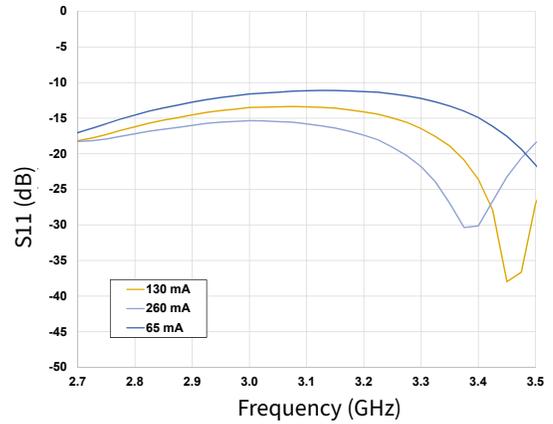


Figure 47. Input RL vs Frequency as a Function of  $I_{DQ}$

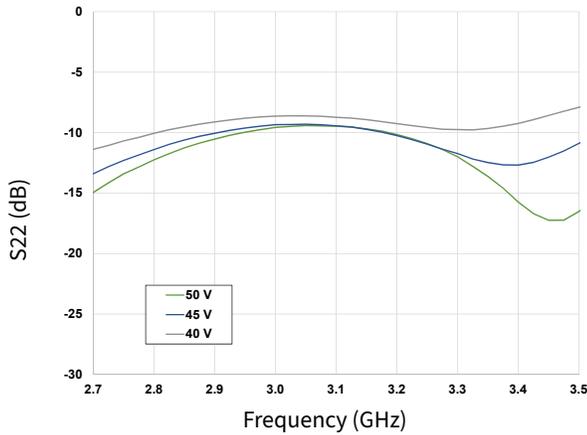


Figure 48. Output RL vs Frequency as a Function of Voltage

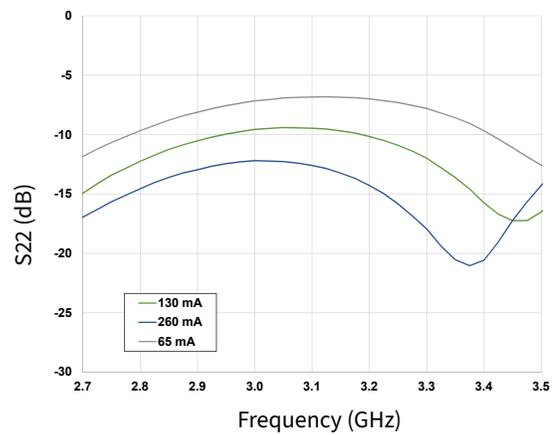
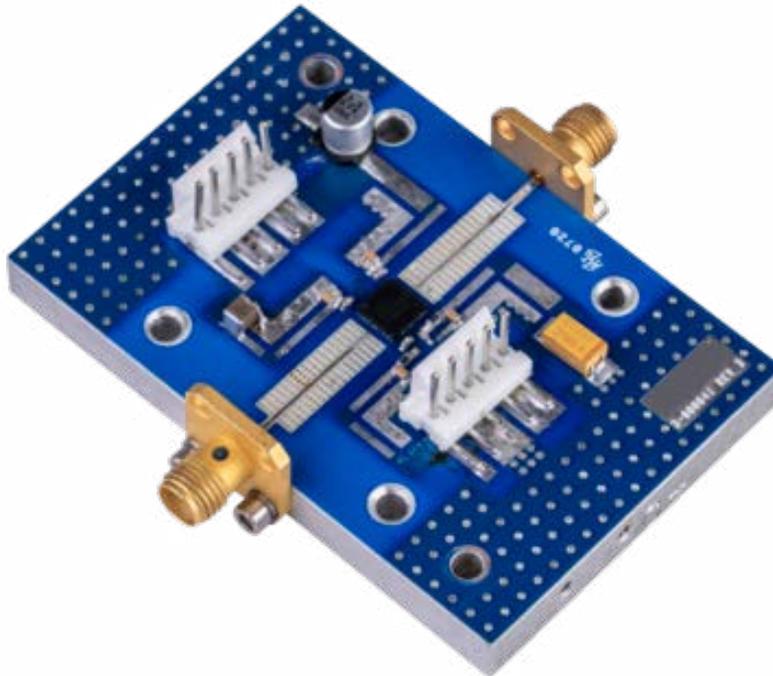


Figure 49. Output RL vs Frequency as a Function of  $I_{DQ}$

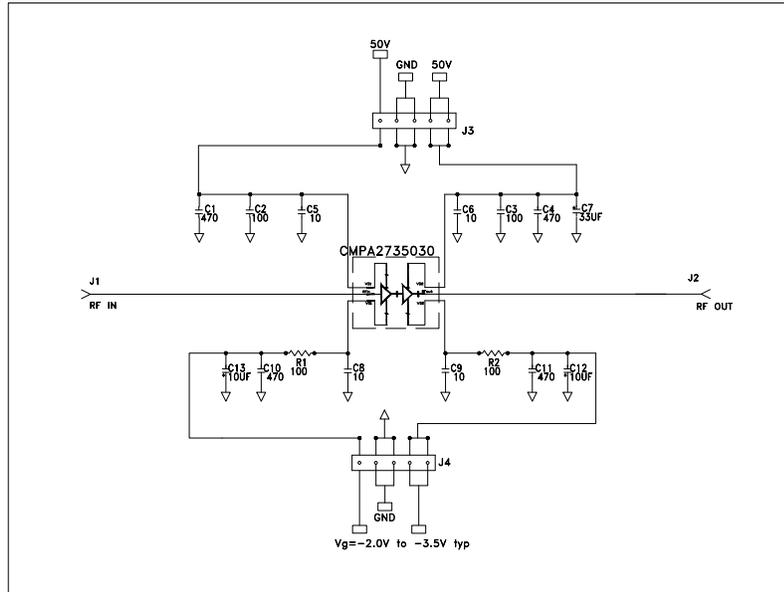
### CMPA2735030S-AMP1 Evaluation Board Bill of Materials

Designator	Description	Qty
C1, C4, C10, C11	CAP, 470 pF, 100 V, 0603	4
C2, C3	CAP, 100 pF, 100 V, 0603	2
C5, C6, C8, C9	CAP, 10 pF, 100 V, 0402	4
C7	CAP, 33 uF, 50 V, ELECT, MVY, SMD	1
C12, C13	CAP, 10 uF, 16 V, TANTALUM, SMD	2
R1, R2	RES, 100 Ohm, 1/16 W, 0603	2
J1, J2	CONNECTOR, N-TYPE, FEMALE, W/0.500 SMA FLNG	2
J3, J4	CONNECTOR, HEADER, RT>PLZ .1CEN LK 5POS	2
-	PCB, RO4350B, $E_r = 3.48$ , h = 10 mil	1
Q1	CMPA2735030S	1

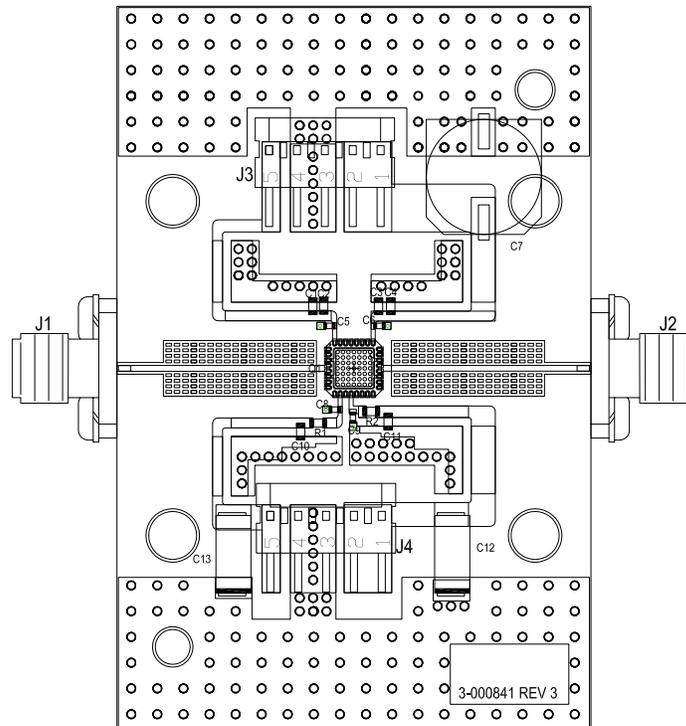
### CMPA2735030S-AMP1 Evaluation Board



### CMPA2735030S-AMP1 Application Circuit



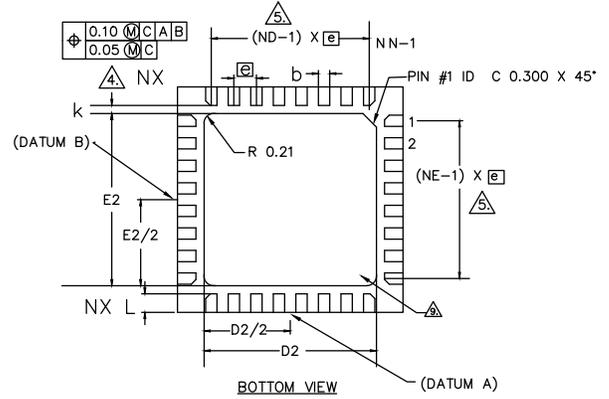
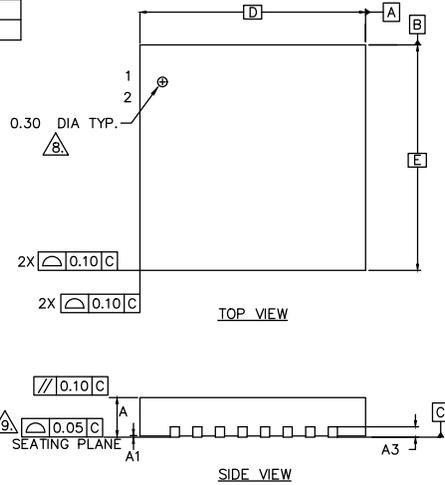
### CMPA2735030S-AMP1 Evaluation Board Layout



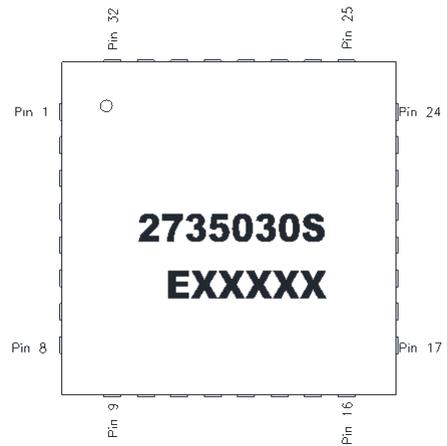
**Product Dimensions CPM2735030S (Package)**

Symbol	MIN.	NOM.	MAX.	Note
A	0.80	0.86	0.91	
A1	0.00	0.03	0.06	
A3	0.20 REF.			
⌀	0		12	2
K	0.17 MIN.			
D	5.0 BSC			
E	5.0 BSC			

Symbol	0.50mm LEAD PITCH			Note
	MIN.	NOM.	MAX.	
⌀	0.50 BSC.			
N	32			3
ND	8			▲
NE	8			▲
L	0.35	0.41	0.46	
b	0.21	0.25	0.29	▲
D2	3.76	3.82	3.88	
E2	3.76	3.82	3.88	

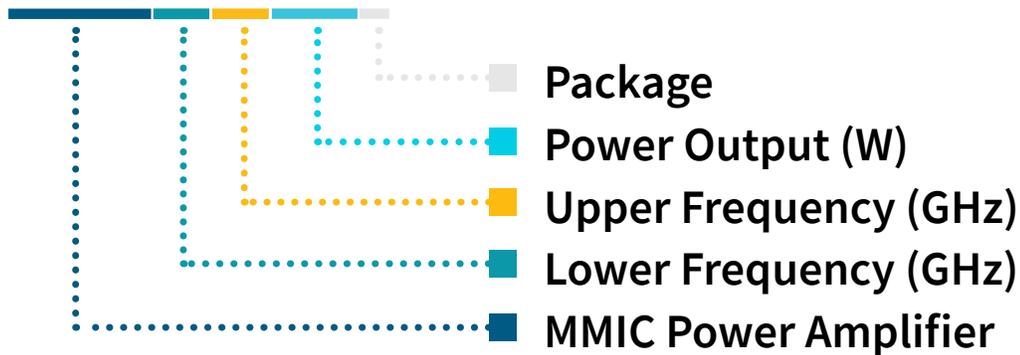


PIN	DESC.	PIN	DESC.	PIN	DESC.
1	NC	15	NC	29	NC
2	NC	16	NC	30	NC
3	NC	17	NC	31	NC
4	RFIN	18	NC	32	VD1
5	RFIN	19	NC		
6	NC	20	RFOUT		
7	NC	21	RFOUT		
8	NC	22	NC		
9	NC	23	NC		
10	VG1	24	NC		
11	NC	25	VD2		
12	VG2	26	NC		
13	NC	27	NC		
14	NC	28	NC		



**Part Number System**

**CMPA2735030S**



**Table 1.**

Parameter	Value	Units
Lower Frequency	2.7	GHz
Upper Frequency	3.5	GHz
Power Output	30	W
Package	Surface Mount	-

Note:  
Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

**Table 2.**

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1 A = 10.0 GHz 2 H = 27.0 GHz

**Product Ordering Information**

Order Number	Description	Unit of Measure	Image
CMPA2735030S	GaN HEMT	Each	
CMPA2735030S-AMP1	Test Board with GaN MMIC Installed	Each	

## Notes & Disclaimer

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