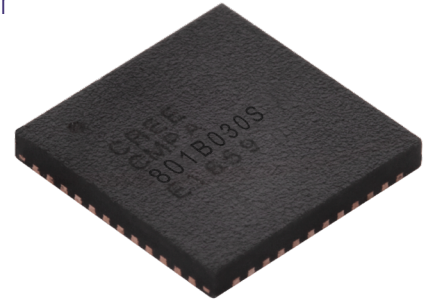


# CMPA801B030S

7.9 - 11.0 GHz, 40 W, Packaged GaN MMIC Power Amplifier

## Description

Cree's CMPA801B030S is a packaged, 40W HPA utilizing Cree's high performance, 0.15um GaN on SiC production process. The CMPA801B030S operates from 7.9-11.0 GHz and targets pulsed radar systems supporting both defense and commercial applications. With 2 stages of gain, this high performance amplifier provides 20dB of large signal gain and 40% efficiency to support lower system DC power requirements and simplify system thermal management solutions. Packaged in a 7x7 mm plastic overmold QFN, the CMPA801B030S also supports reduced board space requirements and high-throughput manufacturing lines.



PN: CMPA801B030S  
Package Type: 7x7 QFN

## Typical Performance Over 7.9 - 11.0 GHz ( $T_c = 25^\circ\text{C}$ )

Parameter	8.0 GHz	8.5 GHz	9.0 GHz	10.0 GHz	11.0 GHz	Units
Small Signal Gain	28.2	27.5	27.1	24.6	24.0	dB
Output Power	39.3	45.9	48.9	42.3	40.7	W
Power Gain	19.9	20.6	21.0	20.3	20.1	dB
Power Added Efficiency	38.2	40.6	41.3	39.4	37.0	%

Notes:  $P_{in} = 26\text{ dBm}$ , Pulse Width = 100  $\mu\text{s}$ ; Duty Cycle = 10%

### Features

- Freq: 7.9 – 11.0 GHz
- Psat: 40 W
- PAE: 40%
- LS Gain: 20 dB
- 7x7 mm Overmold QFN
- Lower system costs
- Reduced board area

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

### Applications

- Military pulsed radar
- Civil pulsed radar
- Satellite Communications

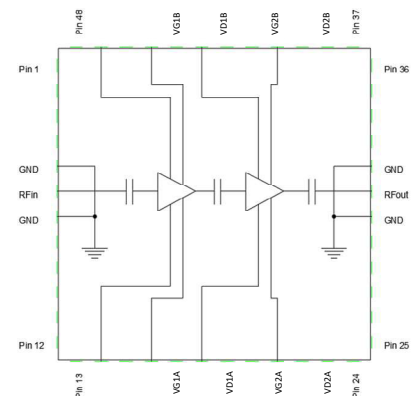


Figure 1.



**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	$V_{GS}$	-8, +2	VDC	25°C
Storage Temperature	$T_{STG}$	-65, +150	°C	
Maximum Forward Gate Current	$I_G$	12	mA	25°C
Maximum Drain Current	$I_{DMAX}$	6	A	
Soldering Temperature	$T_S$	260	°C	

**Electrical Characteristics (Frequency = 7.9 GHz to 11.0 GHz unless otherwise stated;  $T_c = 25^\circ\text{C}$ )**

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-2.6	-	-1.6	V	$V_{DS} = 10\text{ V}, I_D = 13\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-1.75	-	V <sub>DC</sub>	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}$
Saturated Drain Current <sup>1</sup>	$I_{DS}$	-	4	-	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	$V_{BD}$	84	-	-	V	$V_{GS} = -8\text{ V}, I_D = 13\text{ mA}$
<b>RF Characteristics<sup>2,3</sup></b>						
Small Signal Gain	$S21_1$	-	28.2	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, \text{Freq} = 8.0\text{ GHz}$
Small Signal Gain	$S21_2$	-	27.5	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, \text{Freq} = 8.5\text{ GHz}$
Small Signal Gain	$S21_3$	-	27.1	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, \text{Freq} = 9.0\text{ GHz}$
Small Signal Gain	$S21_4$	-	24.6	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, \text{Freq} = 10.0\text{ GHz}$
Small Signal Gain	$S21_5$	-	24.0	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, \text{Freq} = 11.0\text{ GHz}$
Output Power	$P_{OUT1}$	-	39.3	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 8.0\text{ GHz}$
Output Power	$P_{OUT2}$	-	45.9	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 8.5\text{ GHz}$
Output Power	$P_{OUT3}$	-	48.9	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 9.0\text{ GHz}$
Output Power	$P_{OUT4}$	-	42.3	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 10.0\text{ GHz}$
Output Power	$P_{OUT5}$	-	40.7	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 11.0\text{ GHz}$
Power Added Efficiency	$PAE_1$	-	38	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 8.0\text{ GHz}$
Power Added Efficiency	$PAE_2$	-	41	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 8.5\text{ GHz}$
Power Added Efficiency	$PAE_3$	-	41	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 9.0\text{ GHz}$
Power Added Efficiency	$PAE_4$	-	39	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 10.0\text{ GHz}$
Power Added Efficiency	$PAE_5$	-	37	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 11.0\text{ GHz}$
Power Gain	$G_p$	-	21.0	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}$
Input Return Loss	$S11$	-	-13	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}$
Output Return Loss	$S22$	-	-10	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}$
Output Mismatch Stress	VSWR	-	-	5 : 1	Ψ	No damage at all phase angles, $V_{DD} = 28\text{ V}, I_{DQ} = 800\text{ mA}$

Notes:

<sup>1</sup> Scaled from PCM data<sup>2</sup> All data tested in CMPA801B030S-AMP1<sup>3</sup> Pulse Width = 100 μs; Duty Cycle = 10%



## Thermal Characteristics

Parameter	Symbol	Rating	Units	Conditions
Operating Junction Temperature	$T_J$	225	°C	
Thermal Resistance, Junction to Case (packaged) <sup>1</sup>	$R_{\theta JC}$	2.5	°C/W	100 $\mu$ s, 10%, $P_{DISS} = 25.5$ W

Notes:

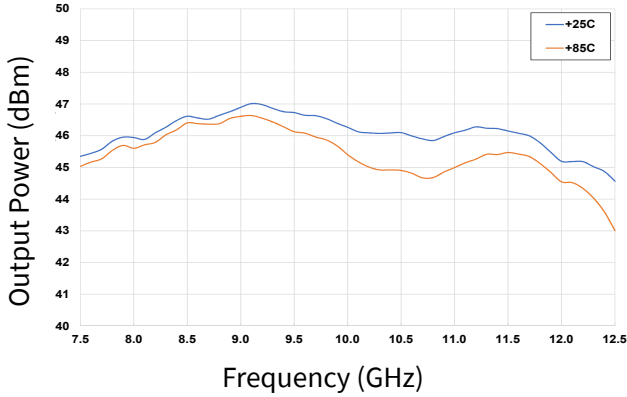
<sup>1</sup>Measured for the CMPA801B030S at  $P_{DISS} = 25.5$  W



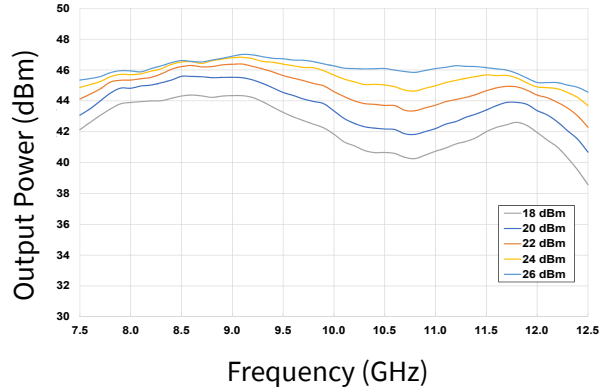
**Typical Performance of the CMPA801B030S**

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

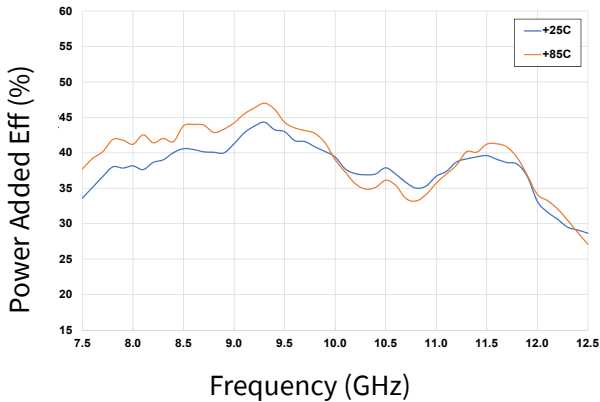
**Figure 1. Output Power vs Frequency as a Function of Temperature**



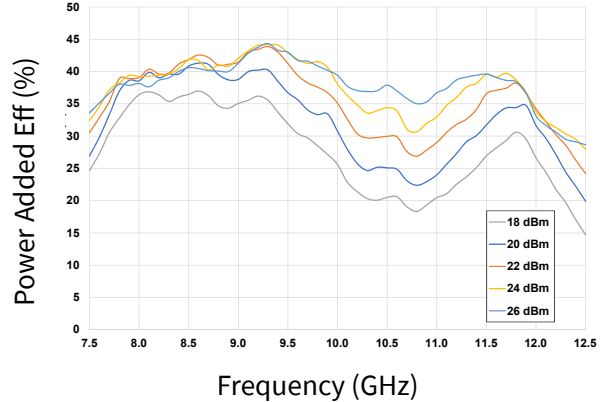
**Figure 2. Output Power vs Frequency as a Function of Input Power**



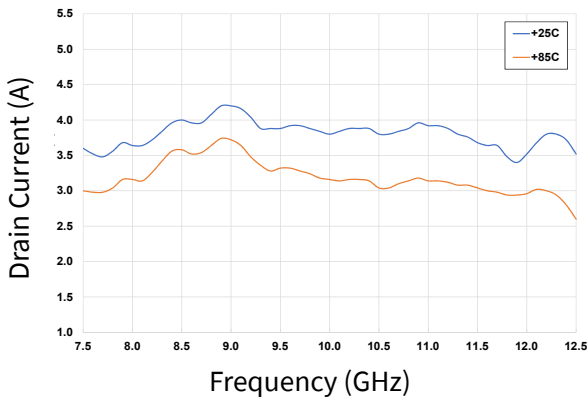
**Figure 3. Power Added Eff. vs Frequency as a Function of Temperature**



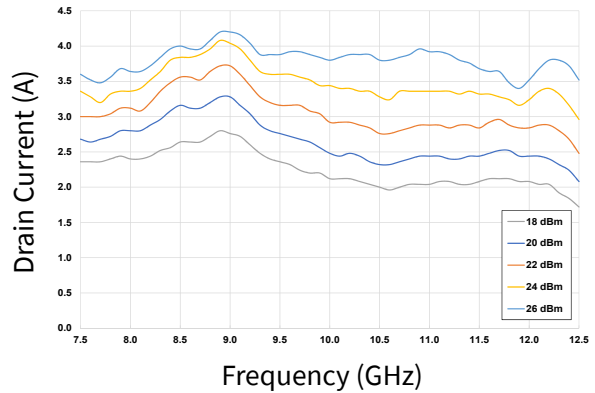
**Figure 4. Power Added Eff. vs Frequency as a Function of Input Power**



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



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

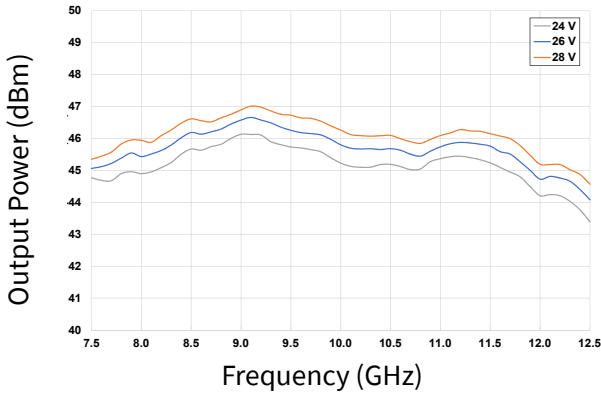




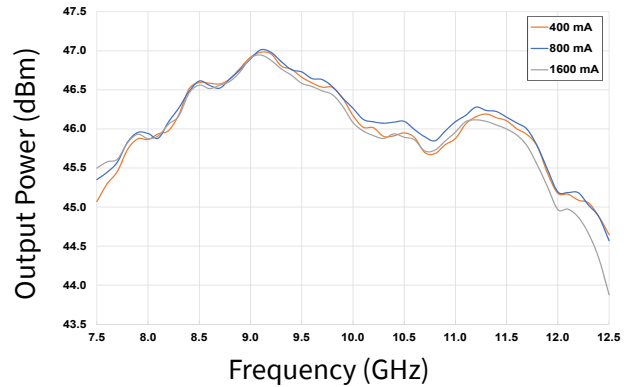
### Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

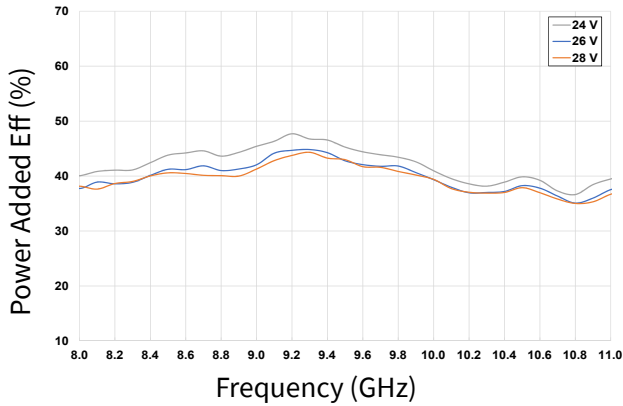
**Figure 7. Output Power vs Frequency as a Function of  $V_D$**



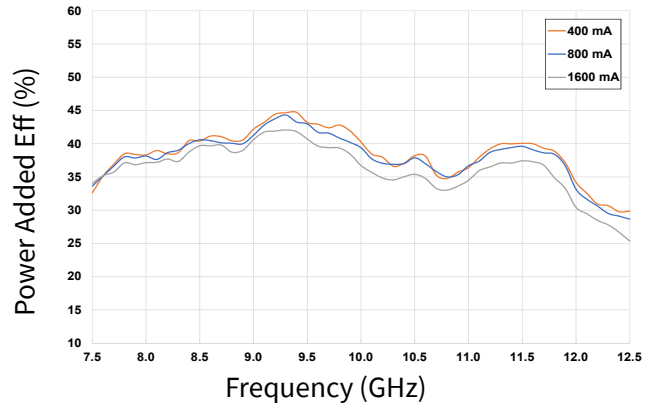
**Figure 8. Output Power vs Frequency as a Function of  $I_{DQ}$**



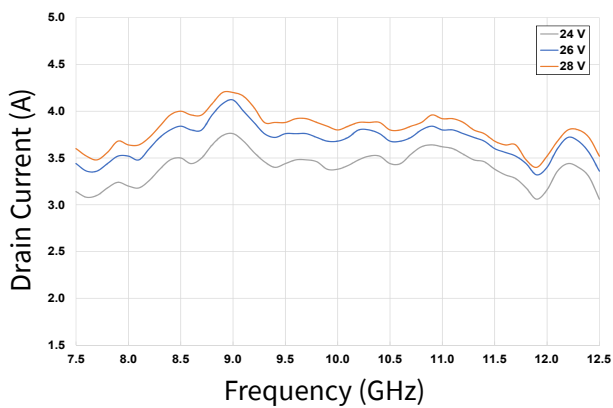
**Figure 9. Power Added Eff. vs Frequency as a Function of  $V_D$**



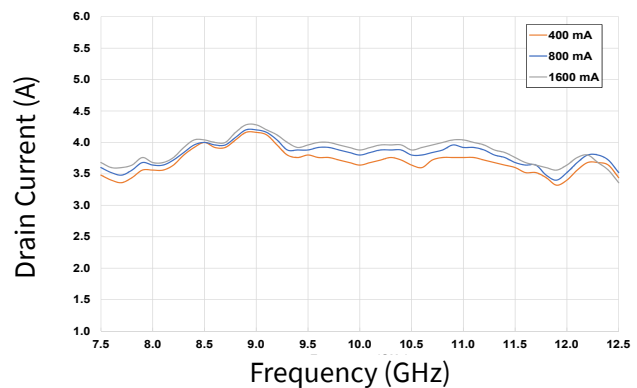
**Figure 10. Power Added Eff. vs Frequency as a Function of  $I_{DQ}$**



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



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

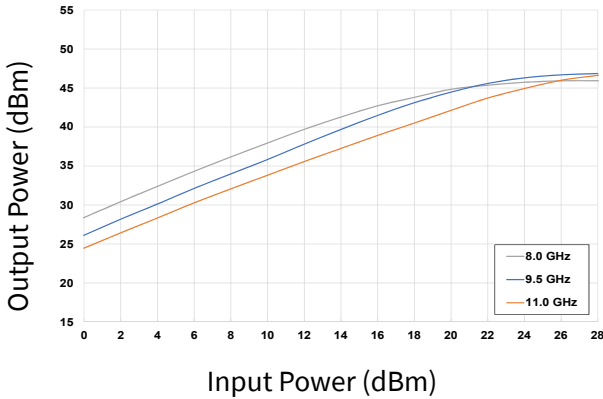




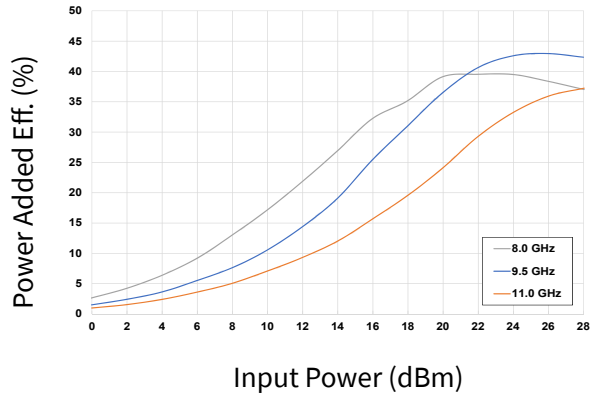
**Typical Performance of the CMPA801B030S**

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

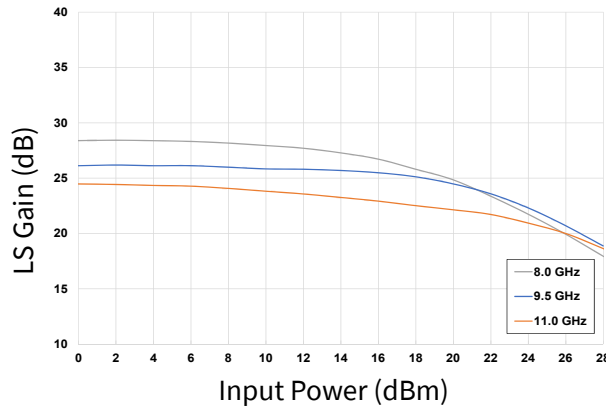
**Figure 13. Output Power vs Input Power as a Function of Frequency**



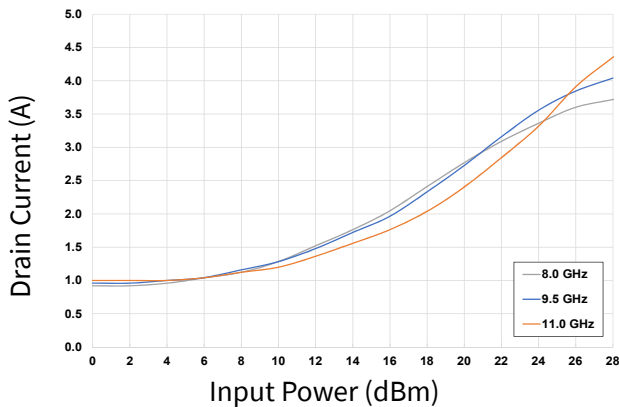
**Figure 14. Power Added Eff. vs Input Power as a Function of Frequency**



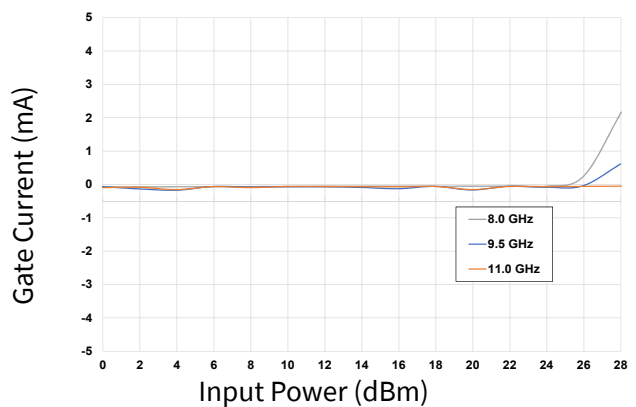
**Figure 15. Large Signal Gain vs Input Power as a Function of Frequency**



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



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

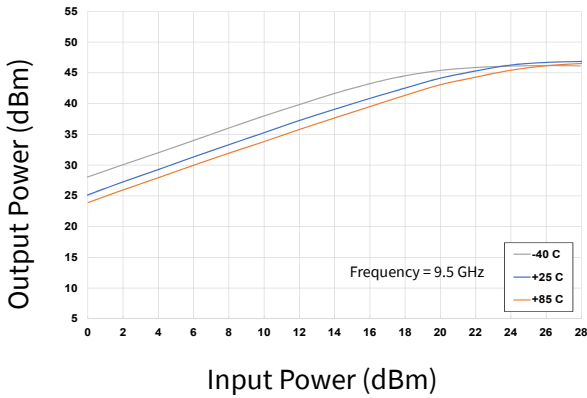




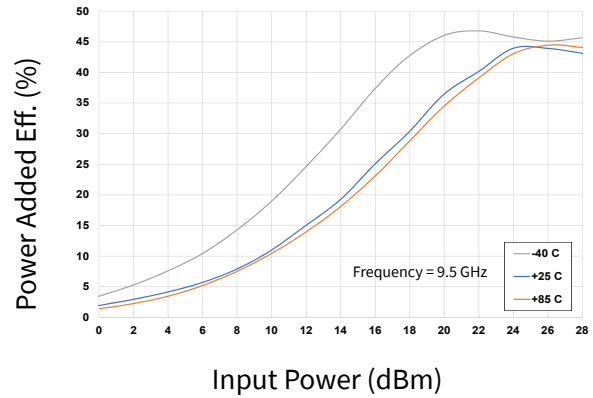
### Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ us}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

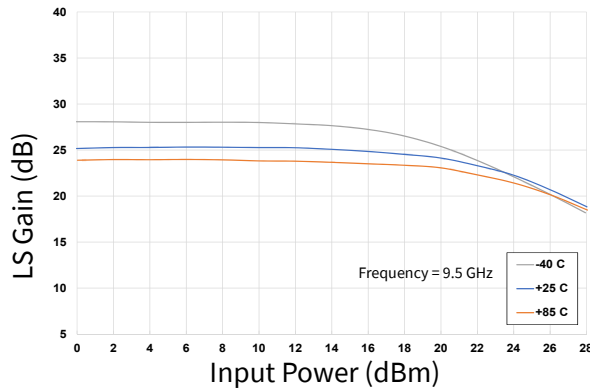
**Figure 18. Output Power vs Input Power as a Function of Temperature**



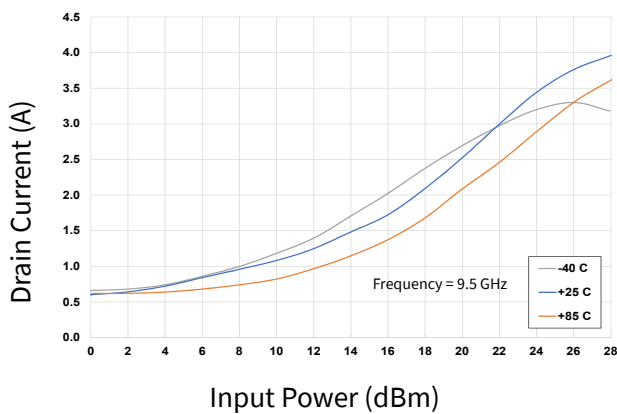
**Figure 19. Power Added Eff. vs Input Power as a Function of Temperature**



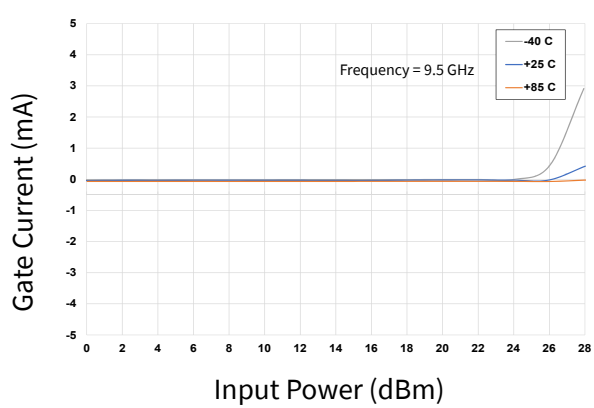
**Figure 20. Large Signal Gain vs Input Power as a Function of Temperature**



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



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

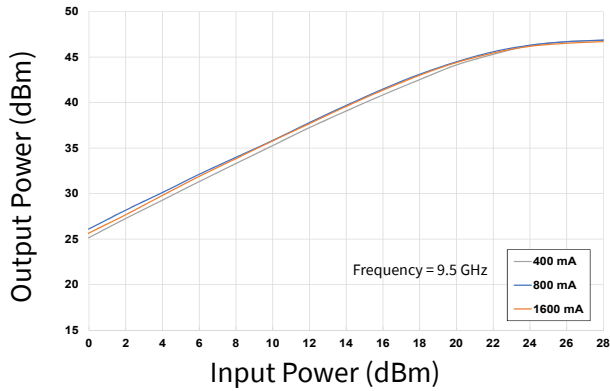




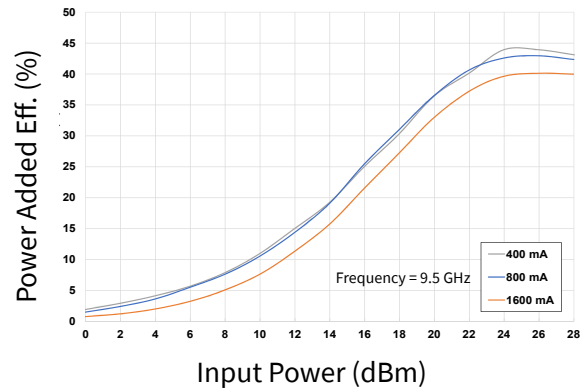
### Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

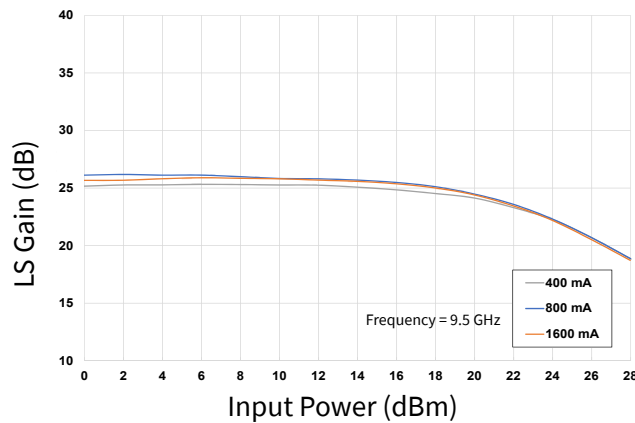
**Figure 23. Output Power vs Input Power as a Function of IDQ**



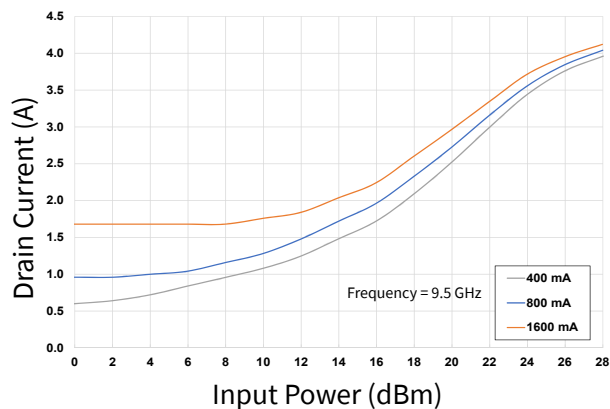
**Figure 24. Power Added Eff. vs Input Power as a Function of IDQ**



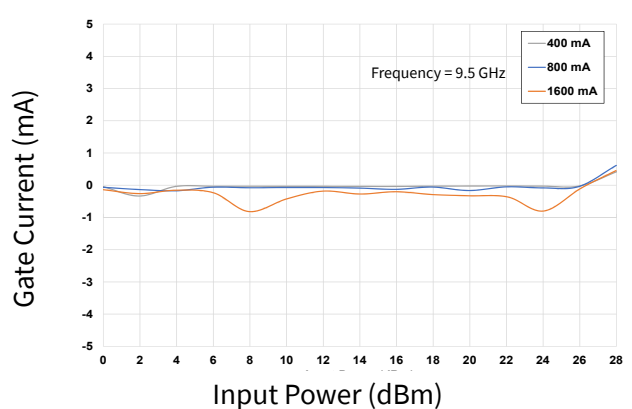
**Figure 25. Large Signal Gain vs Input Power as a Function of IDQ**



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



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



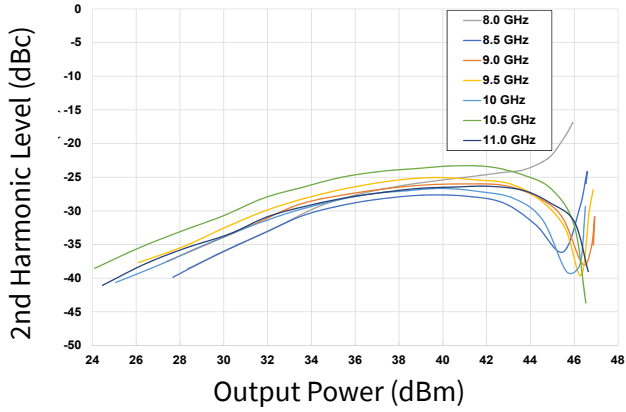




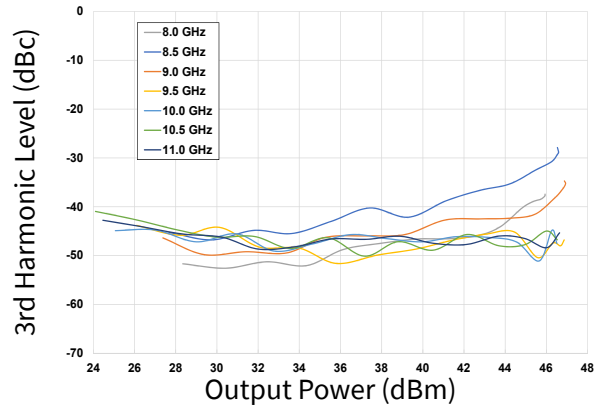
**Typical Performance of the CMPA801B030S**

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = 26\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

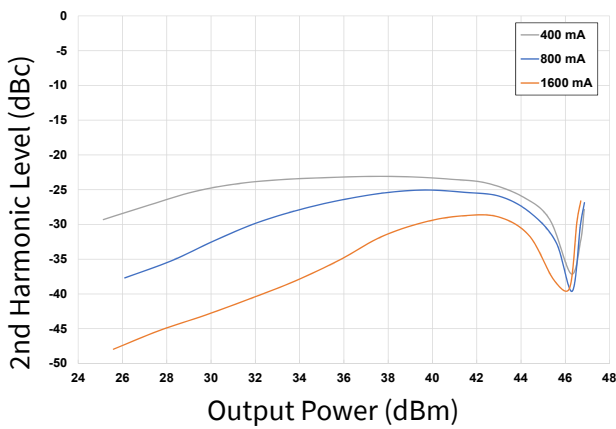
**Figure 28. 2nd Harmonic vs Output Power as a Function of Frequency**



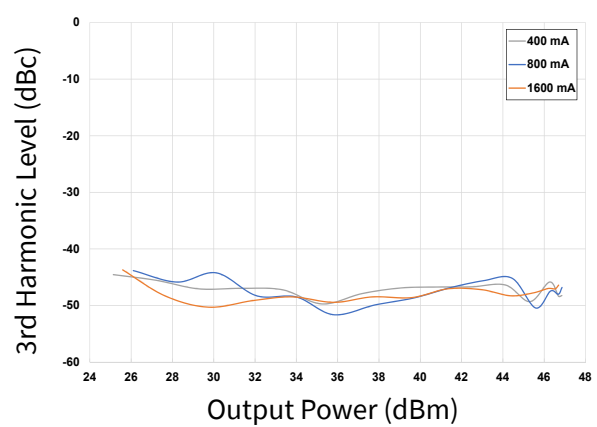
**Figure 29. 3rd Harmonic vs Output Power as a Function of Frequency**



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



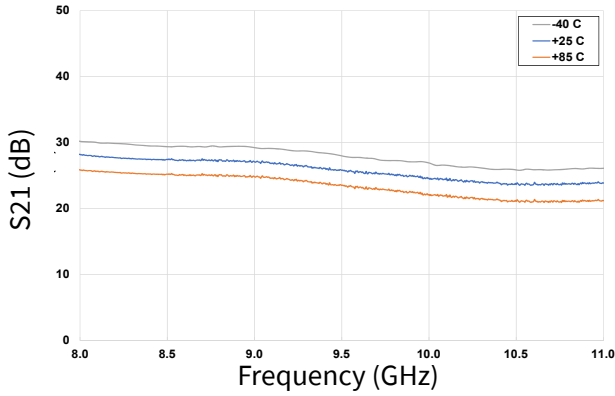
**Figure 31. 3rd Harmonic vs Output Power as a Function of IDQ**



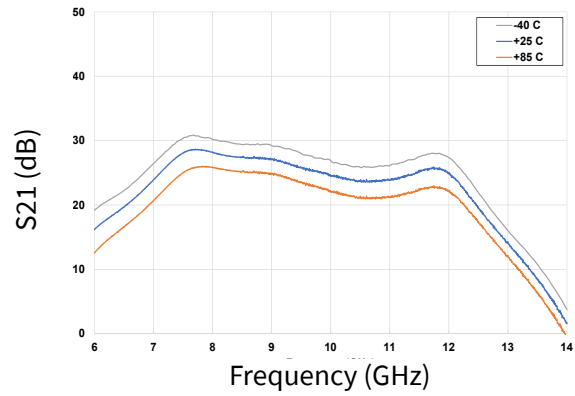
### Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $P_{in} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

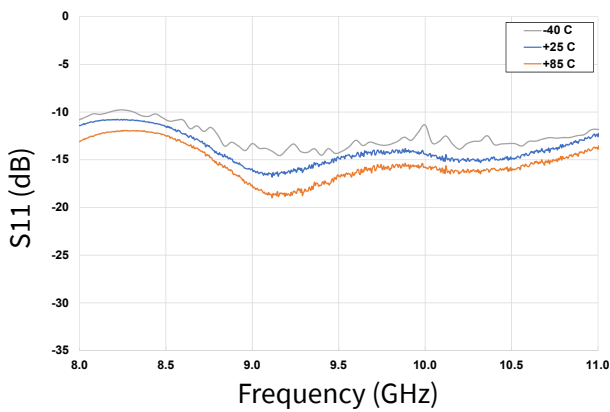
**Figure 32. Gain vs Frequency as a Function of Temperature**



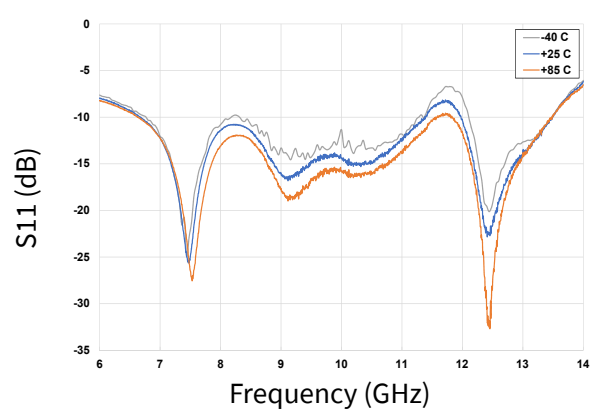
**Figure 33. Gain vs Frequency as a Function of Temperature**



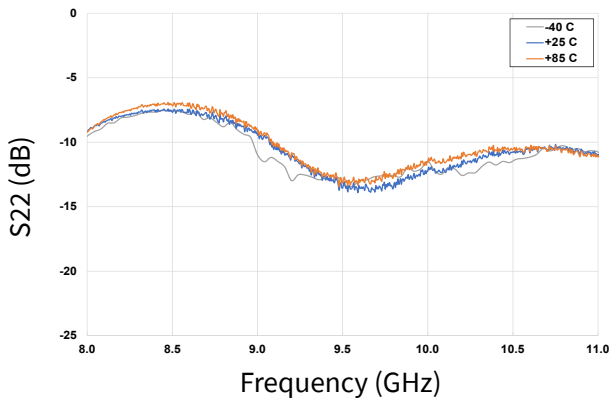
**Figure 34. Input RL vs Frequency as a Function of Temperature**



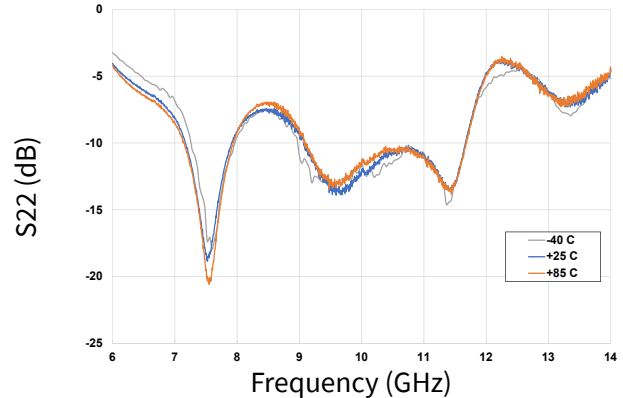
**Figure 35. Input RL vs Frequency as a Function of Temperature**



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



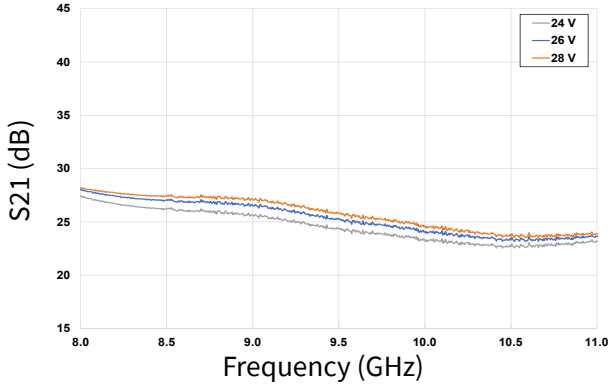
**Figure 37. Output RL vs Frequency as a Function of Temperature**



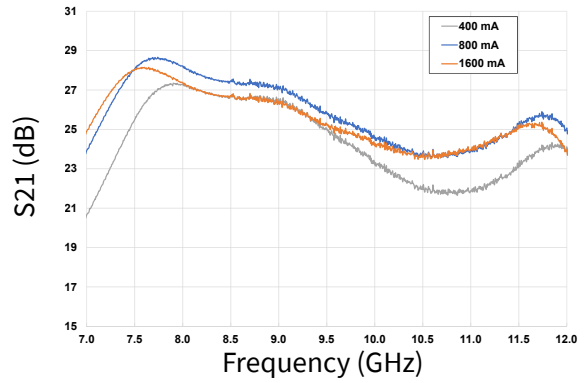
**Typical Performance of the CMPA801B030S**

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $P_{in} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

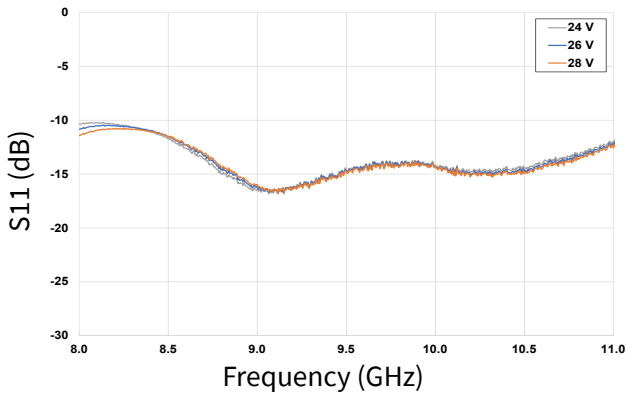
**Figure 38. Gain vs Frequency as a Function of Voltage**



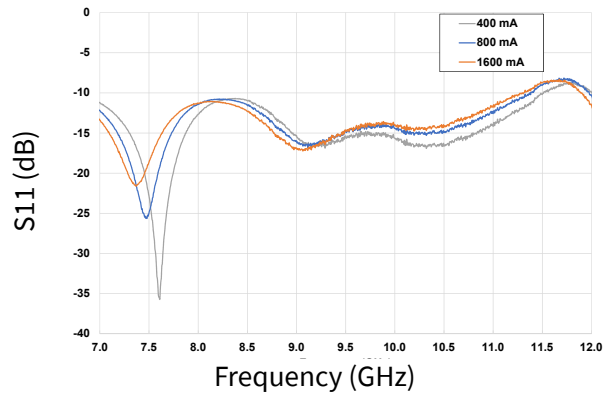
**Figure 39. Gain vs Frequency as a Function of IDQ**



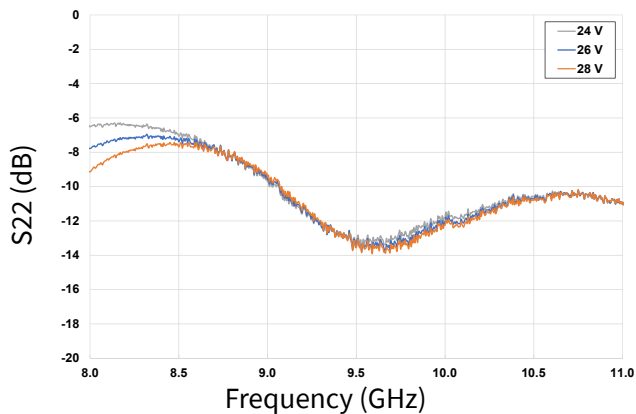
**Figure 40. Input RL vs Frequency as a Function Voltage**



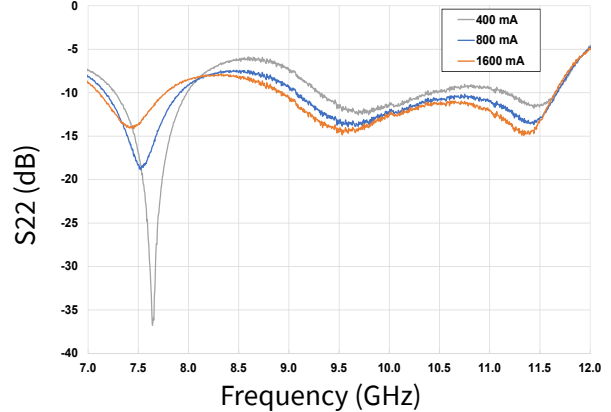
**Figure 41. Input RL vs Frequency as a Function of IDQ**



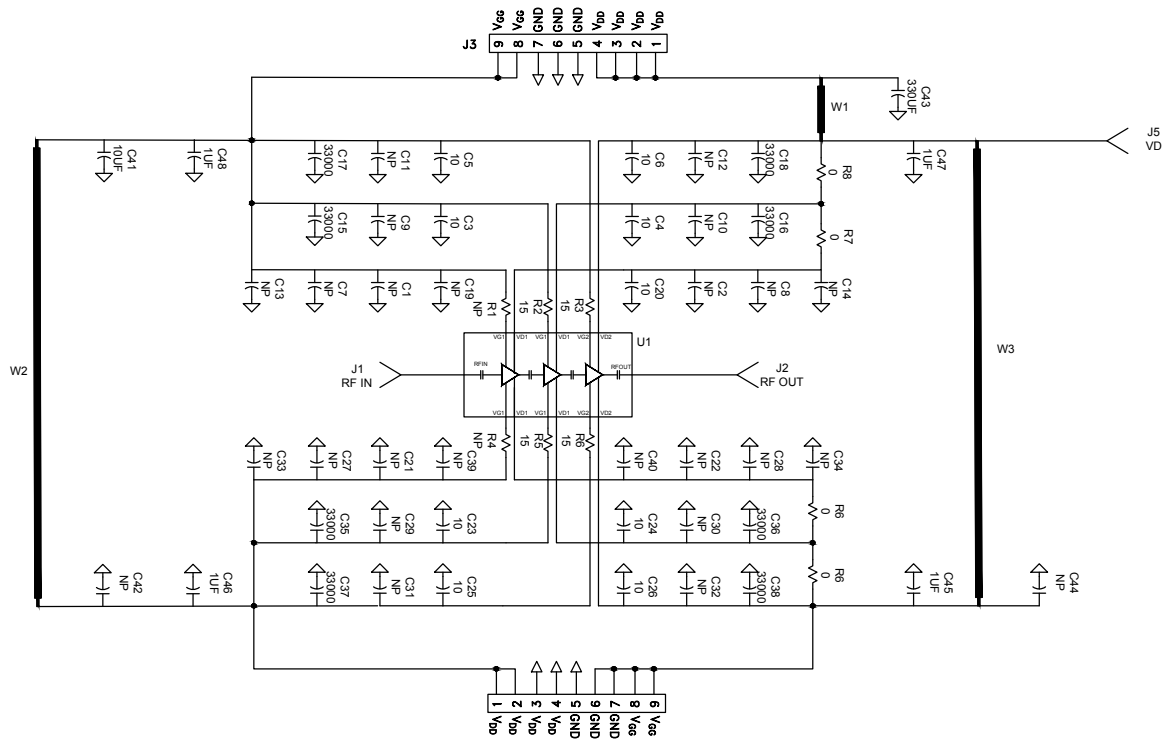
**Figure 42. Output RL vs Frequency as a Function of Voltage**



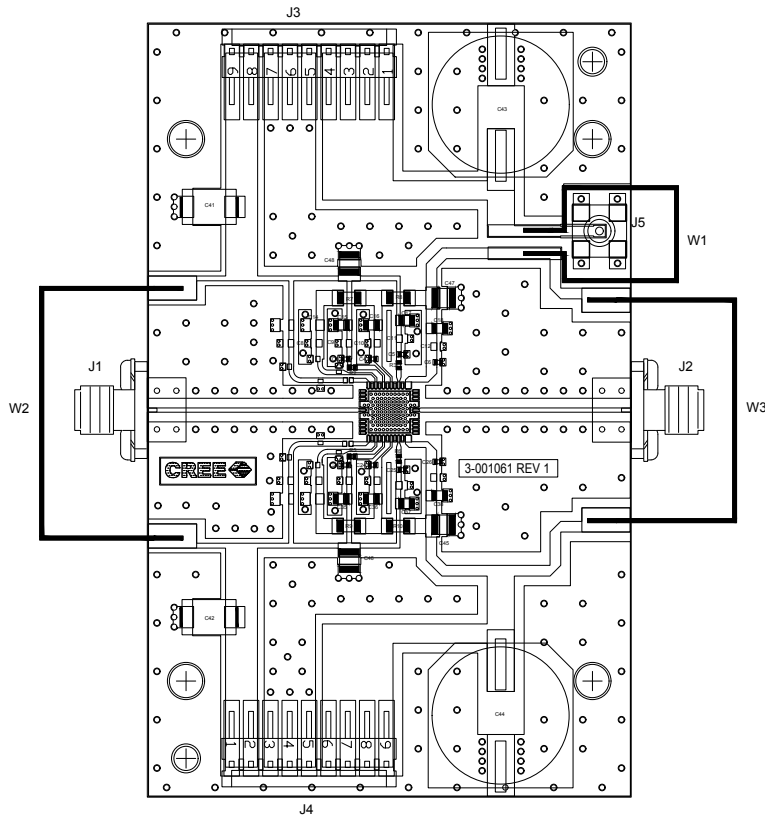
**Figure 43. Output RL vs Frequency as a Function of IDQ**



**CMPA801B030S-AMP1 Application Circuit**



**CMPA801B030S-AMP1 Evaluation Board Layout**



**CMPA801B030S-AMP1 Evaluation Board Bill of Materials**

Designator	Description	Qty
C3, C4, C5, C6, C23, C24, C25, C26	CAP, 10pF, +/-5%, pF, 200V, 0402	8
C15, C16, C17, C18, C35, C36, C37, C38	CA, 330000PF, 0805,100V, X7R	8
C45, C46, C47, C48	CAP, 1.0UF, 100V, 10%, X7R, 1210	4
C41	CAP 10UF 16V TANTALUM, 2312	1
C43	CAP, 330 UF, +/-20%, 100V, ELECTROLYTIC, CASE SIZE K16	1
R2, R3, R5, R6	RES 15 OHM, +/-1%, 1/16W, 0402	6
R8, R10	RES 0.0 OHM 1/16W 1206 SMD	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	4
J5	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
J3, J4	HEADER RT>PLZ .1CEN LK 9POS	1
W2, W3	WIRE, BLACK, 20 AWG ~ 2.5"	2
W1	WIRE, BLACK, 20 AWG ~ 3.0"	1
	PCB, TEST FIXTURE, RF-35TC, 0.010 THK, 7X7 Overmold QFN SOCKET BOARD	1
	2-56 SOC HD SCREW 3/16 SS	4
	#2 SPLIT LOCKWASHER SS	4
Q1	CMPA801B030S	1

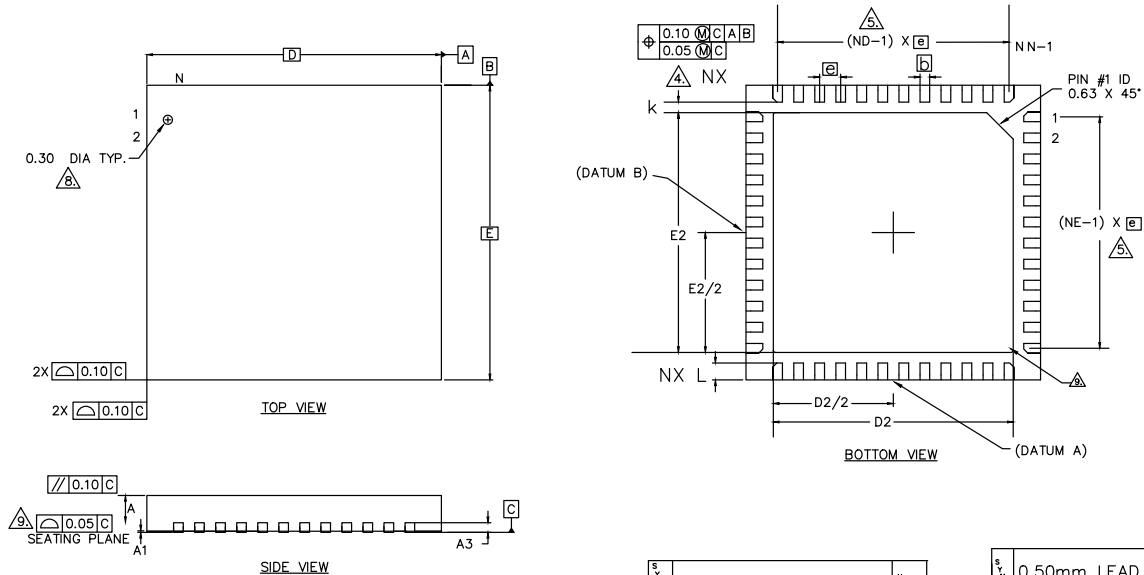
**Electrostatic Discharge (ESD) Classifications**

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1B ( $\geq 500$ V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II ( $\geq 200$ V)	JEDEC JESD22 C101-C

**Moisture Sensitivity Level (MSL) Classification**

Parameter	Symbol	Level	Test Methodology
Moisture Sensitivity Level	MSL	3 (168 hours)	IPC/JEDEC J-STD-20

**Product Dimensions CPMA801B030S (Package 7 x 7 QFN)**

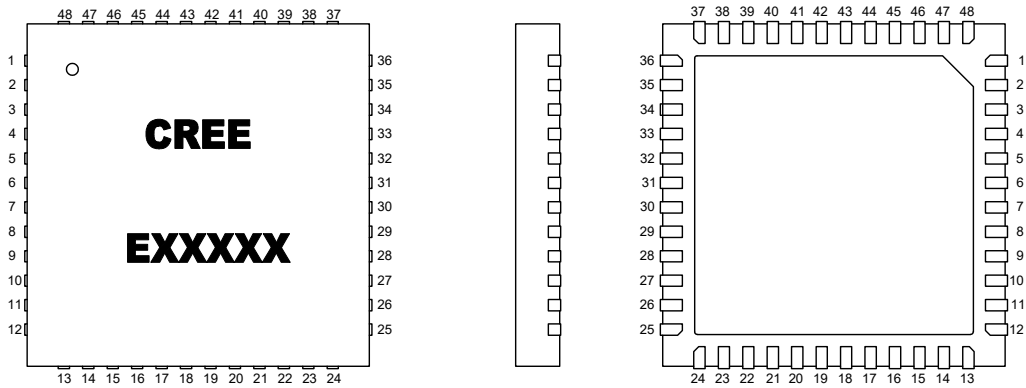


**NOTES :**

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M. - 1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS, 0 IS IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP.
5. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
6. MAX. PACKAGE WARPAGE IS 0.05 mm.
7. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
8. PIN #1 ID ON TOP WILL BE LASER MARKED.
9. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
10. THIS DRAWING CONFORMS TO JEDEC REGISTERED OUTLINE MO-220
11. ALL PLATED SURFACES ARE TIN 0.010 mm +/- 0.005mm.

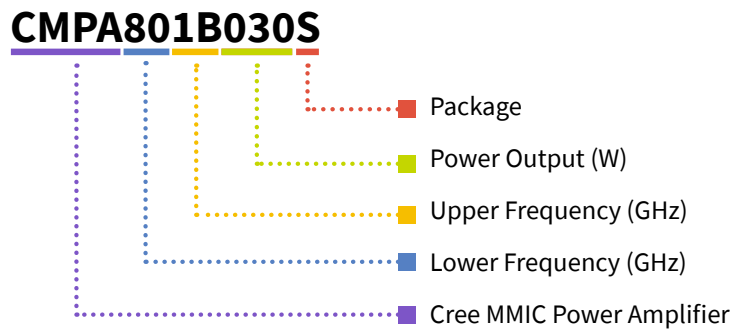
S W O L	MIN.	NOM.	MAX.	N <sub>O</sub> E
	A	0.80	0.9	
A1	0.00	0.03	0.06	
A3	0.20 REF.			
C	0		12	2
K	0.20 MIN.			
D	7.0 BSC			
E	7.0 BSC			

S W O L	0.50mm LEAD PITCH			N <sub>O</sub> E
	MIN.	NOM.	MAX.	
E	0.50 BSC.			
N		48		3
ND		12		2
NE		12		2
L	0.35	0.41	0.46	
b	0.19	0.25	0.33	
D2	5.61	5.72	5.83	
E2	5.61	5.72	5.83	



PIN	DESC.	PIN	DESC.	PIN	DESC.	PIN	DESC.
1	NC	15	NC	29	NC	43	NC
2	NC	16	NC	30	RFGND	44	VG1B
3	NC	17	VG1A	31	RFOUT	45	NC
4	NC	18	NC	32	RFGND	46	NC
5	RFGND	19	VD1A	33	NC	47	NC
6	RFIN	20	NC	34	NC	48	NC
7	RFGND	21	VG2A	35	NC		
8	NC	22	NC	36	NC		
9	NC	23	VD2A	37	NC		
10	NC	24	NC	38	VD2B		
11	NC	25	NC	39	NC		
12	NC	26	NC	40	VG2B		
13	NC	27	NC	41	NC		
14	NC	28	NC	42	VD1B		

**Part Number System**



**Table 1.**

Parameter	Value	Units
Lower Frequency	7.9	GHz
Upper Frequency	11.0	GHz
Power Output	40	W
Package	Surface Mount	-

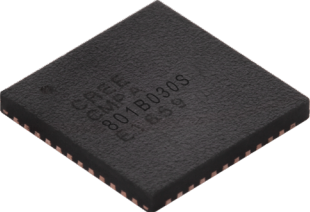

**Note<sup>1</sup>:** Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

**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
CMPA801B030S	Packaged GaN MMIC PA	Each	
CMPA801B030S-AMP1	Evaluation Board with GaN MMIC Installed	Each	





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## Notes & Disclaimer

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