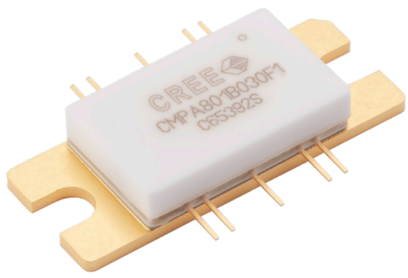
CMPA801B030F1

35 W, 8.0 - 12.0 GHz, GaN MMIC, Power Amplifier



PN: CMPA801B030F1
Package Type: 440213

Description

Cree's CMPA801B030F1 is a packaged, 35 W HPA utilizing Cree's high performance, 0.15um GaN on SiC production process. The CMPA801B030F1 operates from 8-12 GHz and targets pulsed radar systems supporting both defense and commercial applications. With 2 stages of gain, this high performance amplifier provides 19 dB of large signal gain and 35% efficiency to support lower system DC power requirements and simplify system thermal management solutions. Packaged in a bolt-down, flange package, the CMPA801B030F1 also supports superior thermal management to allow for simplified system cooling requirements.

Typical Performance Over 8.0 - 12.0 GHz (T_C = 25˚C)

Parameter	8.0 GHz	8.5 GHz	9.0 GHz	10.0 GHz	11.0 GHz	12.0 GHz	Units
Small Signal Gain[1,2]	27.2	28.0	26.2	25.0	25.0	25.4	dB
Output Power[1,3]	45.0	45.2	46.1	45.7	45.9	45.6	dBm
Power Gain[1,3]	19.0	19.2	20.1	19.7	19.9	19.6	dB
Power Added Efficiency[1,3]	40	40	44	36	37	36	%

Notes:
[1] V_{DD} = 28 V, I_{DQ} = 800 mA
[2] Measured at Pin = -20 dBm
[3] Measured at Pin = 26 dBm and 100 μs; Duty Cycle = 10%

Features

- 35 W Typical P_{SAT}
- >36% Typical Power Added Efficiency
- 19 dB Large Signal Gain
- High Temperature Operation

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

Applications

- Civil and Military Pulsed Radar Amplifiers

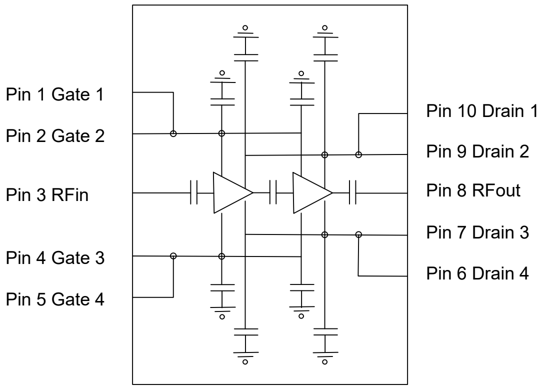


Figure 1.

RoHS COMPLIANT

Absolute Maximum Ratings (not simultaneous) at 25˚C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	84	VDC	25°C
Gate-source Voltage	V_{GS}	-10, +2	VDC	25°C
Storage Temperature	T_{STG}	-55, +150	˚C	
Maximum Forward Gate Current	I_G	12.9	mA	25°C
Maximum Drain Current	I_{DMAX}	4.0	A	
Soldering Temperature	T_S	260	˚C	
Junction Temperature	T_J	225	˚C	MTTF > 1e6 Hours

Electrical Characteristics (Frequency = 8.0 GHz to 12.0 GHz unless otherwise stated; T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(TH)}$	-2.6	-2.0	-1.6	V	V_{DS} = 10 V, I_D = 12.9 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-1.8	–	V_{DC}	V_{DD} = 28 V, I_{DQ} = 800 mA
Saturated Drain Current[1]	I_{DS}	12.9	15.48	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	84	–	–	V	V_{GS} = -8 V, I_D = 12.9 mA
RF Characteristics[2]						
Small Signal Gain	$S21_1$	–	26	–	dB	Pin = -20 dBm, Freq = 8.0 - 12.0 GHz
Output Power	P_{OUT1}	–	45.0	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.0 GHz
Output Power	P_{OUT2}	–	45.2	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.5 GHz
Output Power	P_{OUT3}	–	46.1	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 9.0 GHz
Output Power	P_{OUT4}	–	45.7	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 10.0 GHz
Output Power	P_{OUT5}	–	45.9	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 11.0 GHz
Output Power	P_{OUT6}	–	45.6	–	dBm	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 12.0 GHz
Power Added Efficiency	PAE_1	–	40	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.0 GHz
Power Added Efficiency	PAE_2	–	40	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.5 GHz
Power Added Efficiency	PAE_3	–	44	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 9.0 GHz
Power Added Efficiency	PAE_4	–	36	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 10.0 GHz
Power Added Efficiency	PAE_5	–	37	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 11.0 GHz
Power Added Efficiency	PAE_6	–	36	–	%	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 12.0 GHz
Power Gain	G_{P1}	–	19.0	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.0 GHz
Power Gain	G_{P2}	–	19.2	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 8.5 GHz
Power Gain	G_{P3}	–	20.1	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 9.0 GHz
Power Gain	G_{P4}	–	19.7	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 10.0 GHz
Power Gain	G_{P5}	–	19.9	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 11.0 GHz
Power Gain	G_{P6}	–	19.6	–	dB	V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm, Freq = 12.0 GHz

Electrical Characteristics (Frequency = 8.0 GHz to 12.0 GHz unless otherwise stated; T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[2]						
Input Return Loss	S11	–	-10	–	dB	Pin = -20 dBm, 8.0-12.0 GHz
Output Return Loss	S22	–	-7	–	dB	Pin = -20 dBm, 8.0-12.0 GHz
Output Mismatch Stress	VSWR	–	–	5 : 1	Ψ	No damage at all phase angles

Notes:
[1] Scaled from PCM data
[2] Unless otherwise noted: Pulse Width = 100 µs, Duty Cycle = 10%

Thermal Characteristics

Parameter	Symbol	Rating	Units	Conditions
Operating Junction Temperature	T_J	144	˚C	Pulse Width = 100 µs, Duty Cycle =10%, P_{DISS} = 48 W, T_{CASE} = 85 ˚C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.22	˚C/W	
Operating Junction Temperature	T_J	179	˚C	CW, P_{DISS} = 48 W, T_{CASE} = 85 ˚C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.95	˚C/W	

Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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

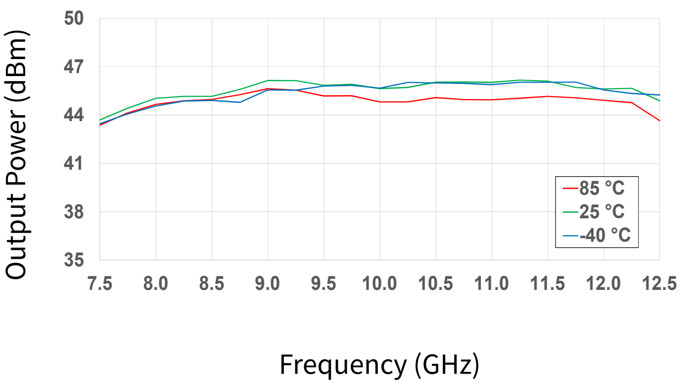


Figure 2. Output Power vs Frequency as a Function of Input Power

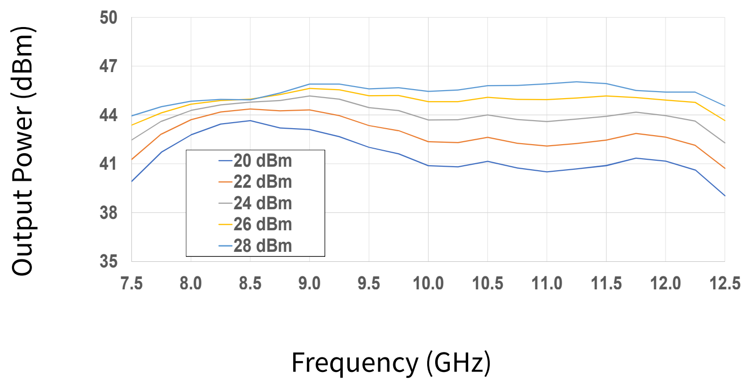


Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

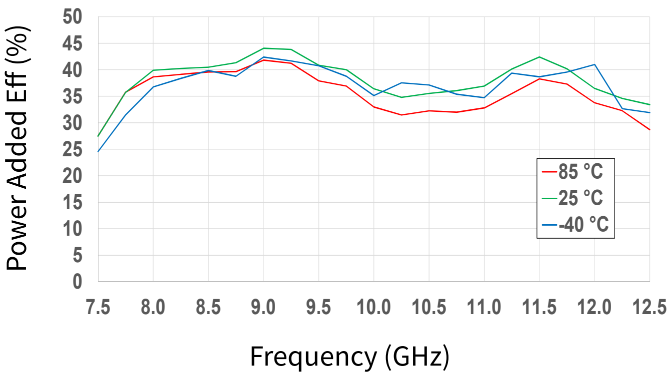


Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

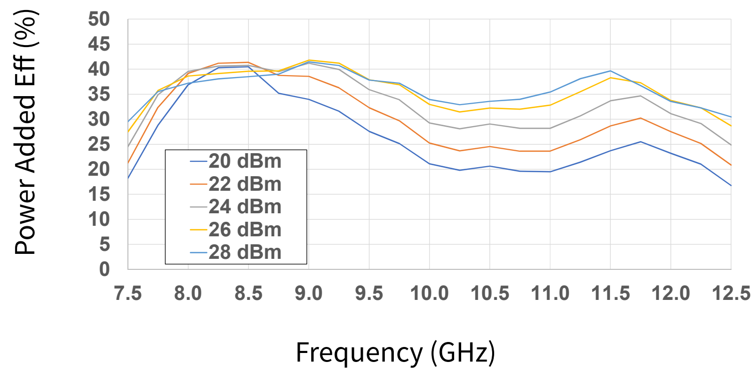


Figure 5. Drain Current vs Frequency as a Function of Temperature

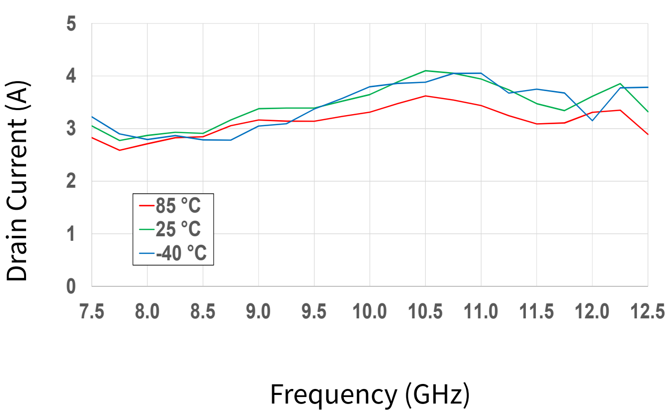
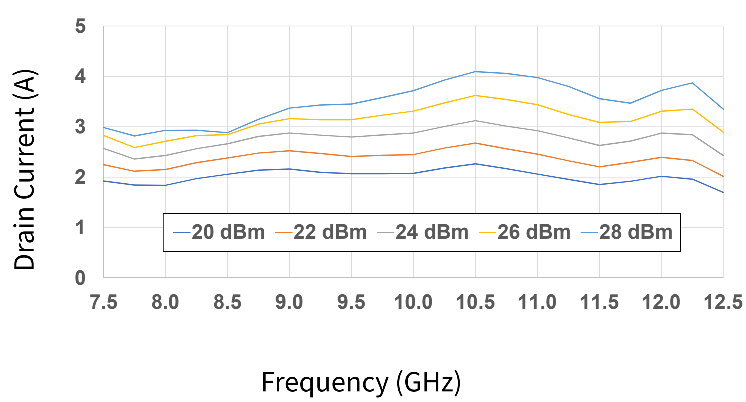


Figure 6. Drain Current vs Frequency as a Function of Input Power



Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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

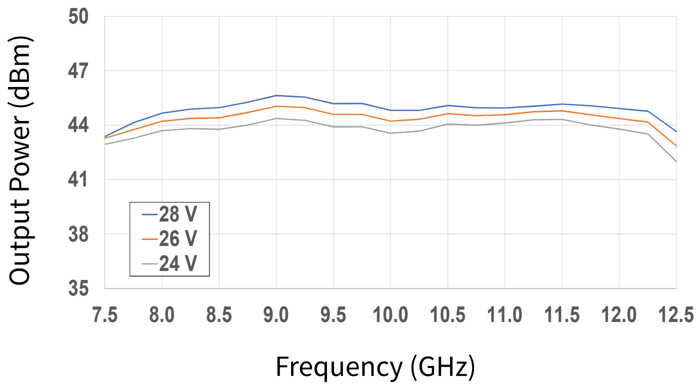


Figure 8. Output Power vs Frequency as a Function of IDQ

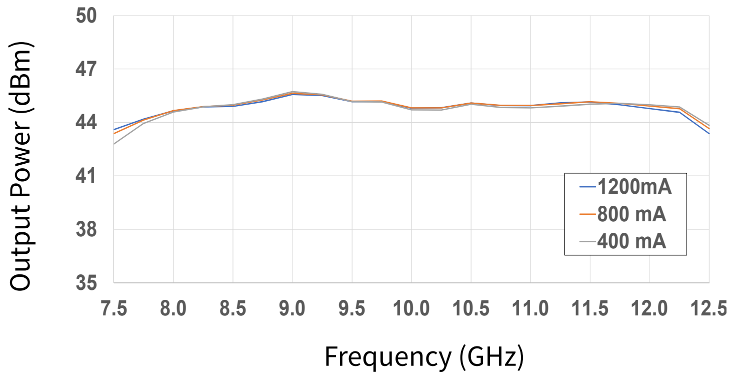


Figure 9. Power Added Eff. vs Frequency as a Function of VD

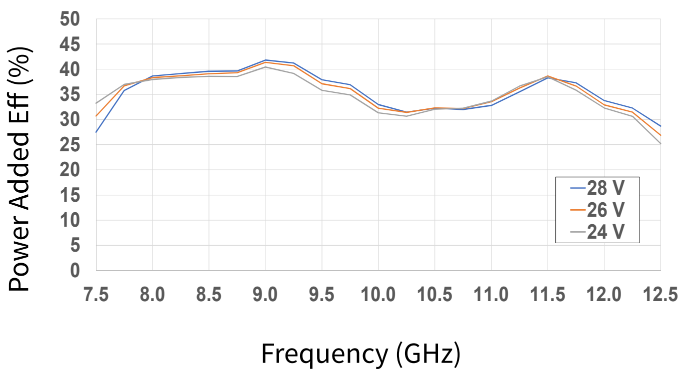


Figure 10. Power Added Eff. vs Frequency as a Function of IDQ

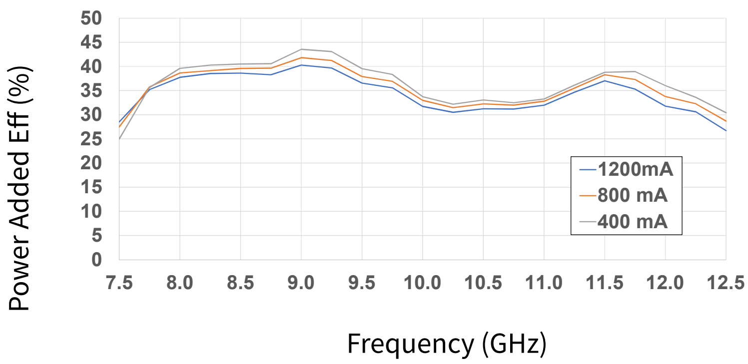


Figure 11. Drain Current vs Frequency as a Function of VD

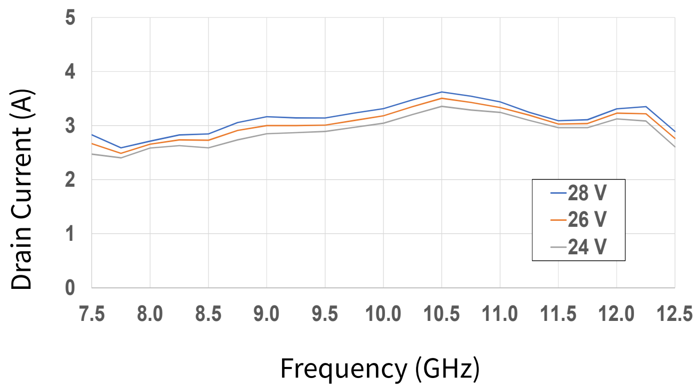
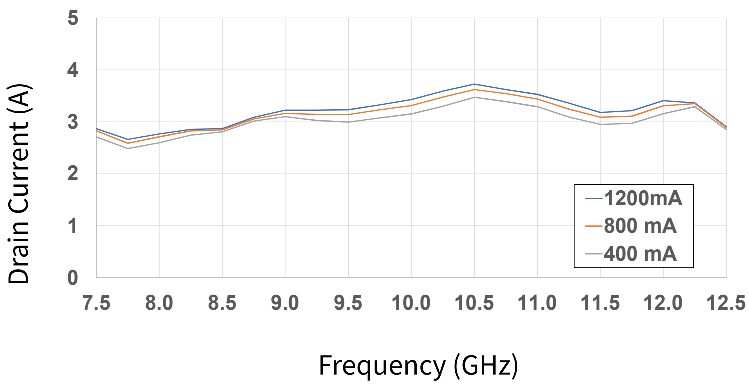


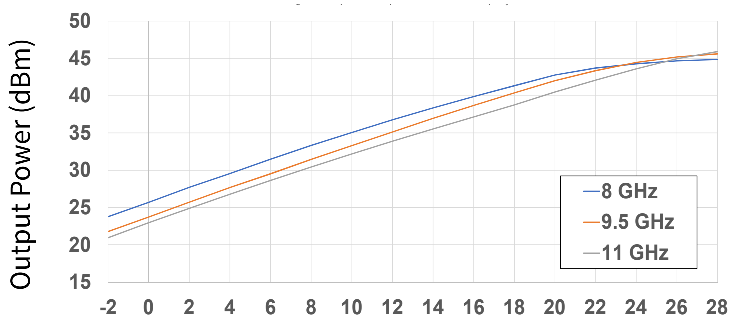
Figure 12. Drain Current vs Frequency as a Function of IDQ



Typical Performance of the CMPA801B030F1

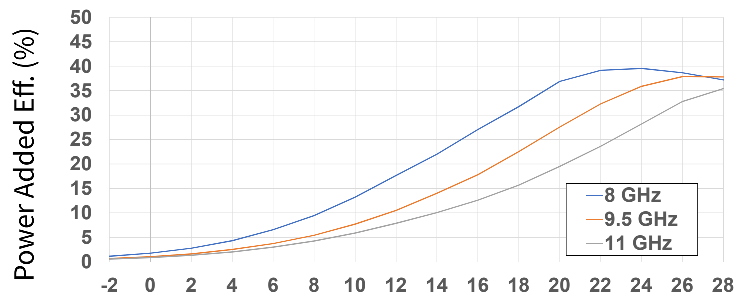
Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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



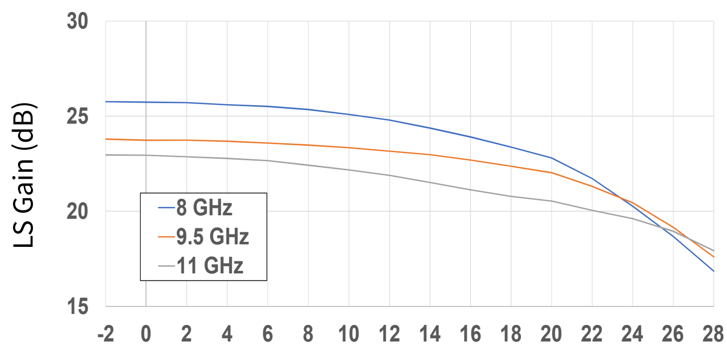
Input Power (dBm)

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



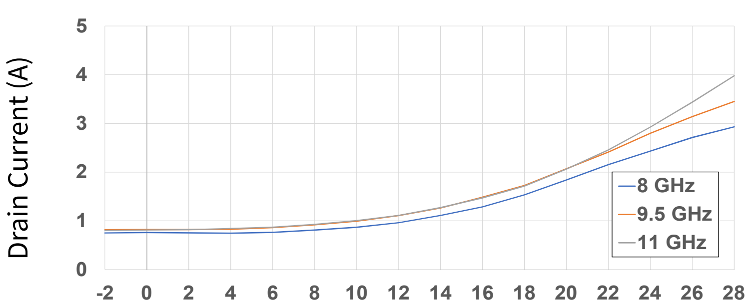
Input Power (dBm)

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



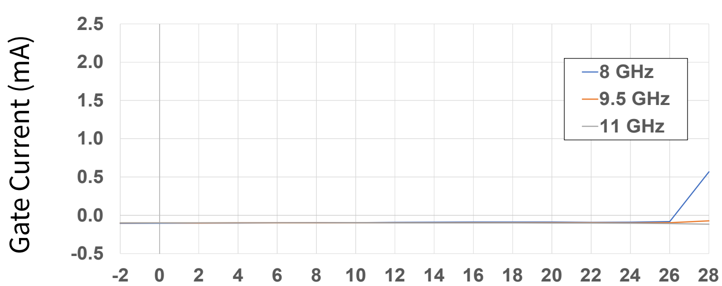
Input Power (dBm)

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



Input Power (dBm)

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



Input Power (dBm)

Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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

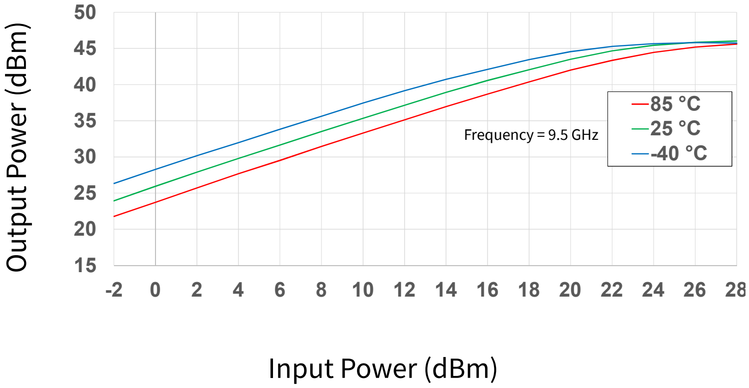


Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

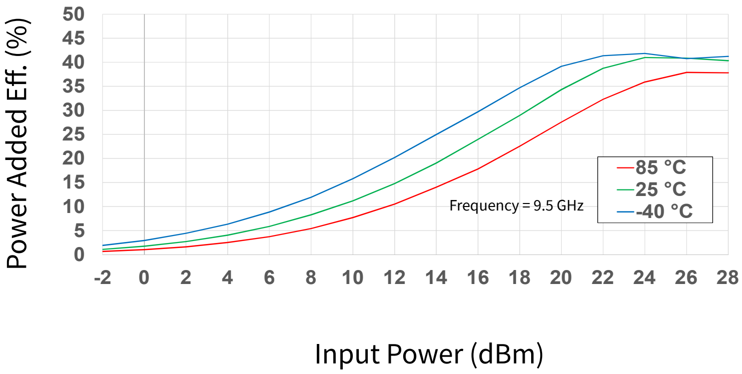


Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

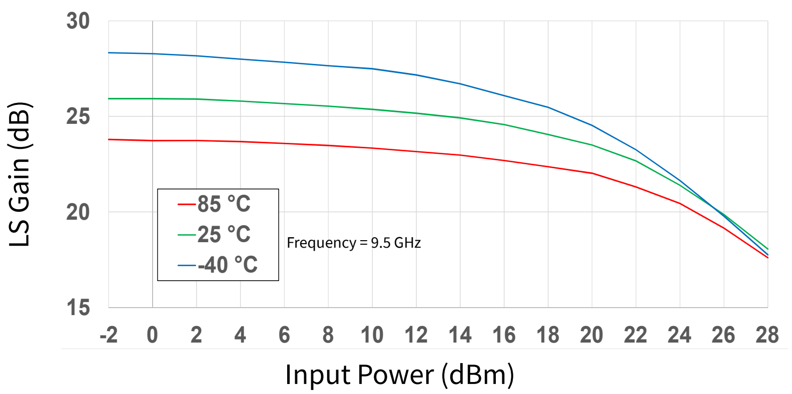


Figure 21. Drain Current vs Input Power as a Function of Temperature

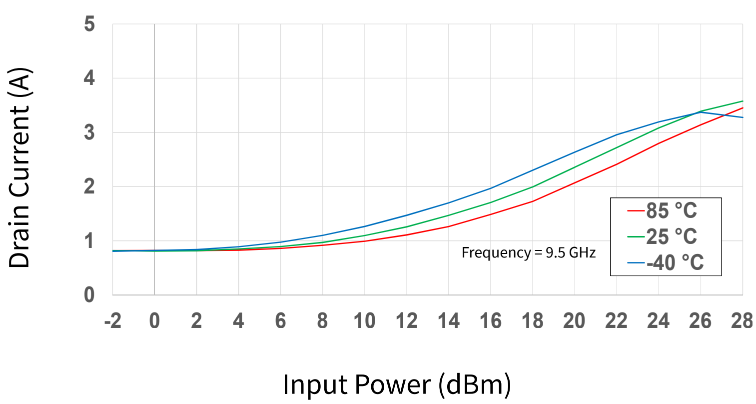
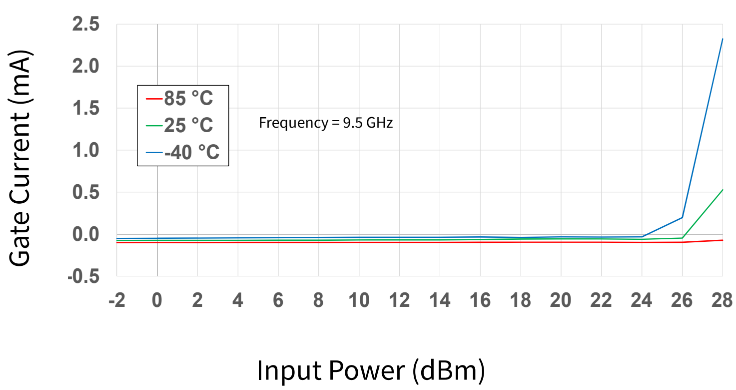


Figure 22. Gate Current vs Input Power as a Function of Temperature



Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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

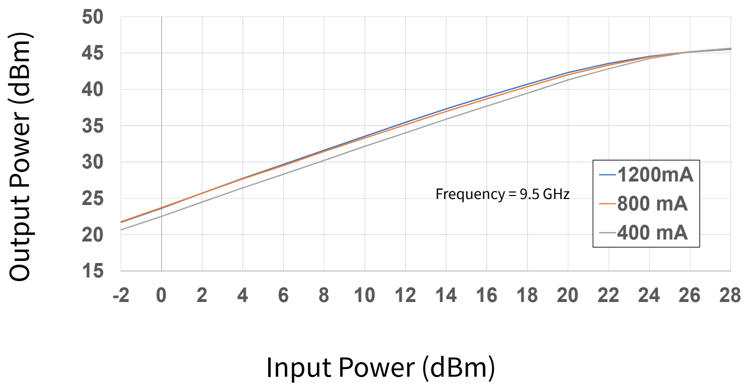


Figure 24. Power Added Eff. vs Input Power as a Function of IDQ

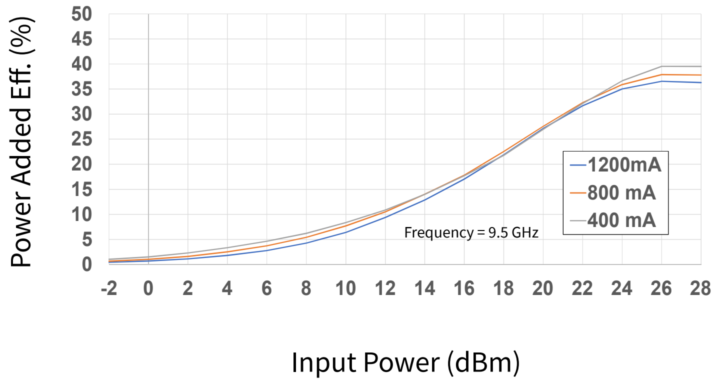


Figure 25. Large Signal Gain vs Input Power as a Function of IDQ

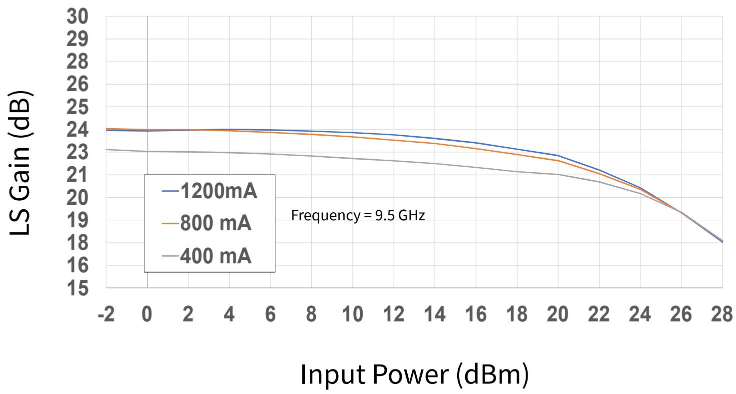


Figure 26. Drain Current vs Input Power as a Function of IDQ

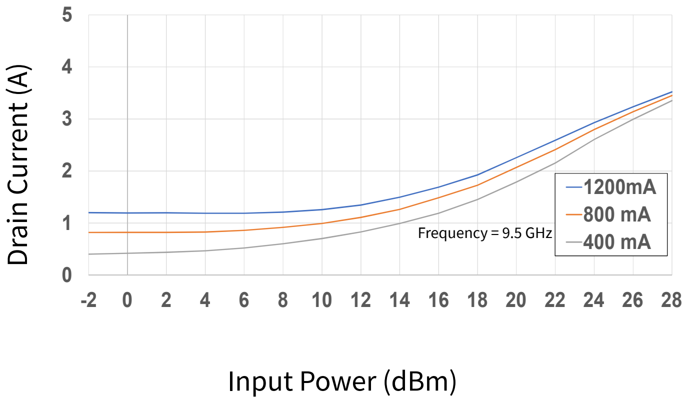
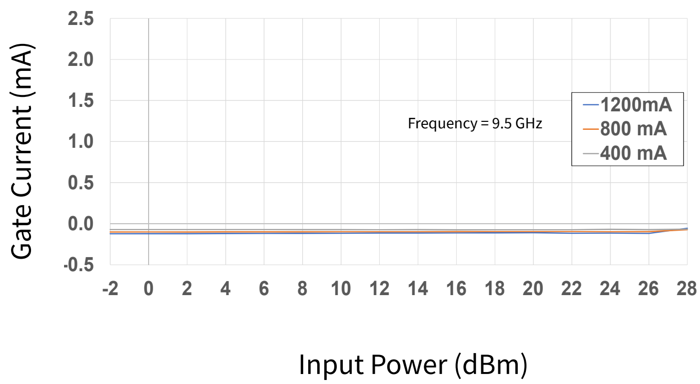


Figure 27. Gate Current vs Input Power as a Function of IDQ



Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pulse Width = 100 µs, Duty Cycle = 10%, Pin = 26 dBm, T_{BASE} = +25 °C

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

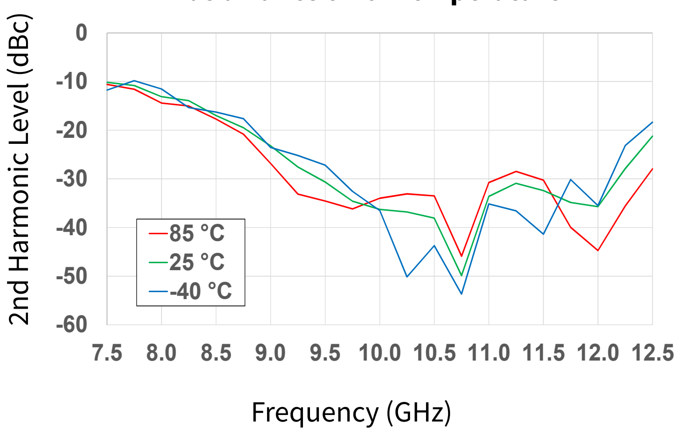


Figure 29. 2nd Harmonic vs Output Power as a Function of Frequency

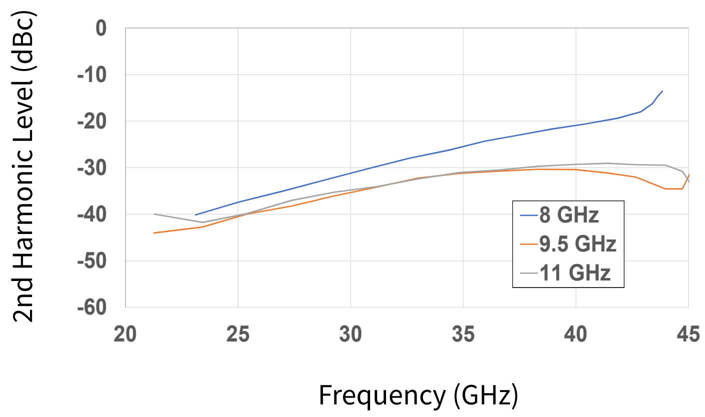
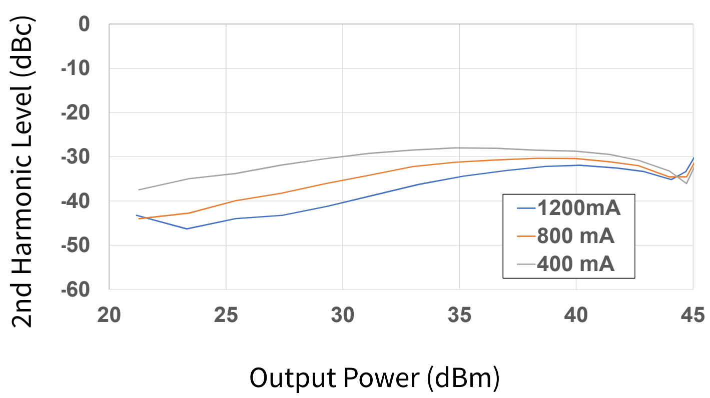


Figure 30. 2nd Harmonic vs Output Power as a Function of IDQ



Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pin = -20 dBm, T_{BASE} = +25 °C

Figure 31. Gain vs Frequency as a Function of Temperature

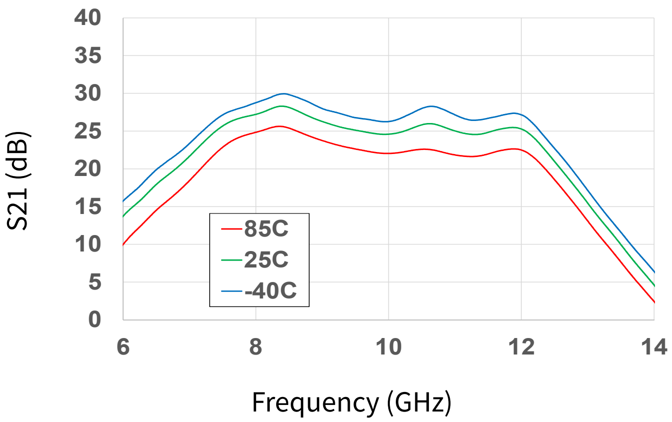


Figure 32. Gain vs Frequency as a Function of Temperature

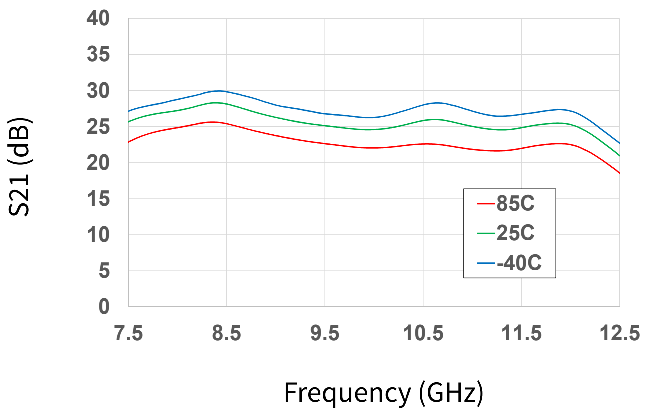


Figure 33. Input RL vs Frequency as a Function of Temperature

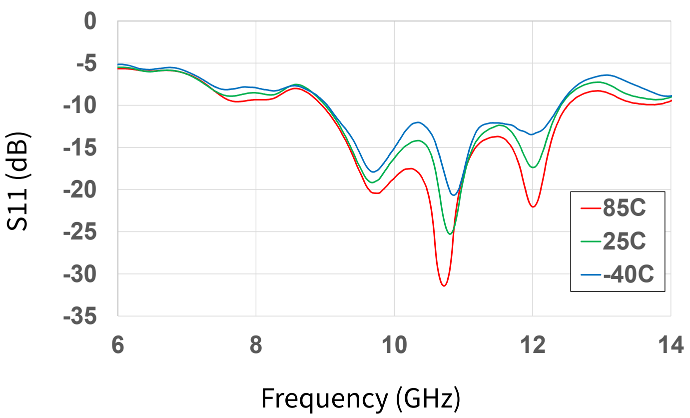


Figure 34. Input RL vs Frequency as a Function of Temperature

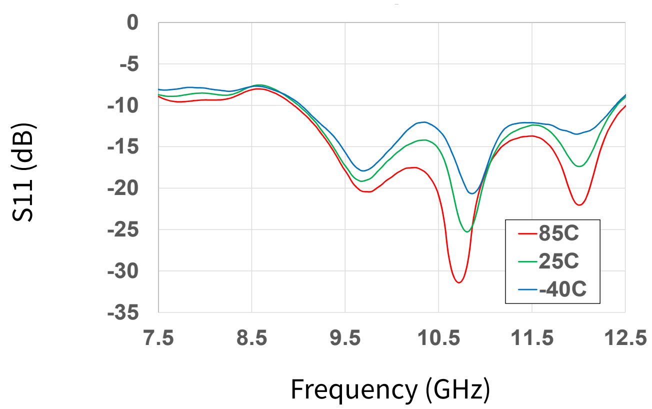


Figure 35. Output RL vs Frequency as a Function of Temperature

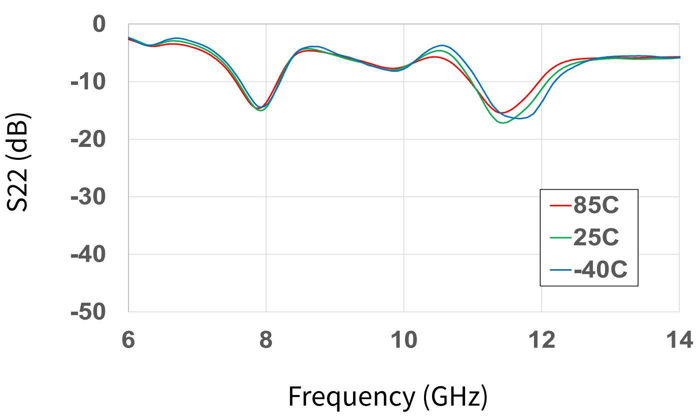
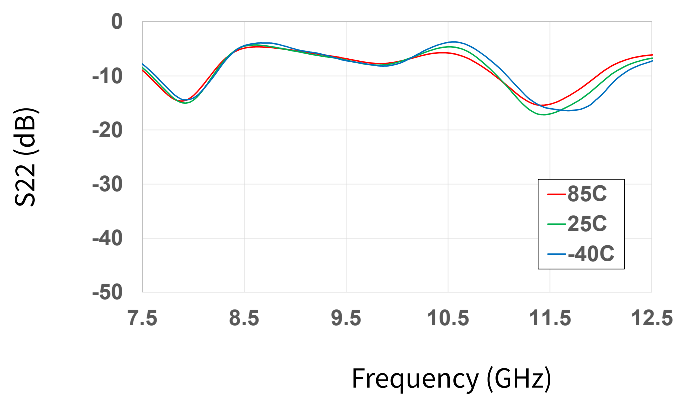


Figure 36. Output RL vs Frequency as a Function of Temperature



Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, Pin = -20 dBm, T_{BASE} = +25 °C

Figure 37. Gain vs Frequency as a Function of Voltage

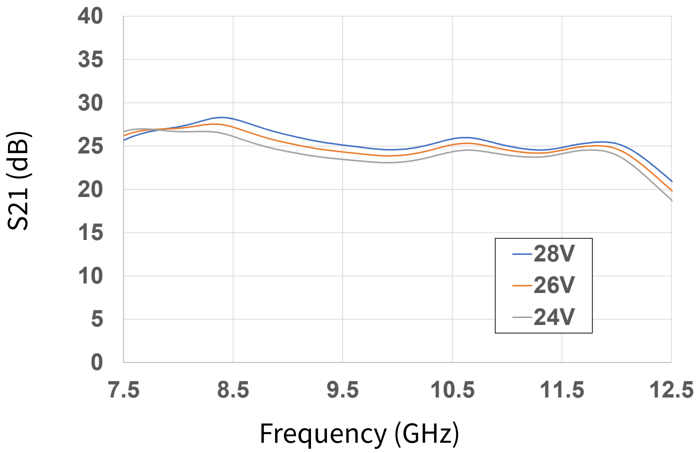


Figure 38. Gain vs Frequency as a Function of IDQ

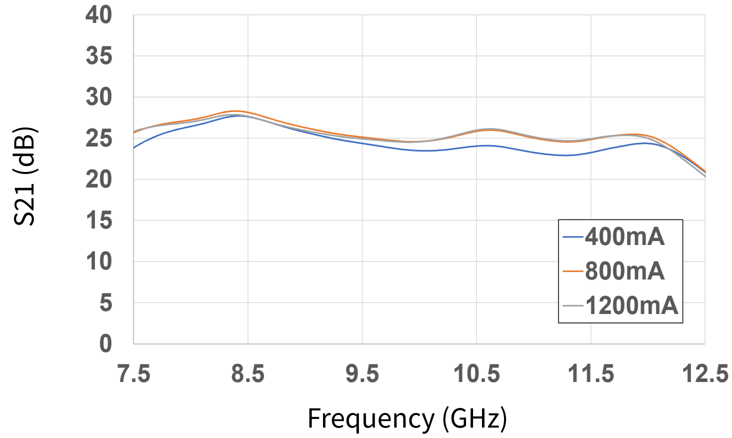


Figure 39. Input RL vs Frequency as a Function of Voltage

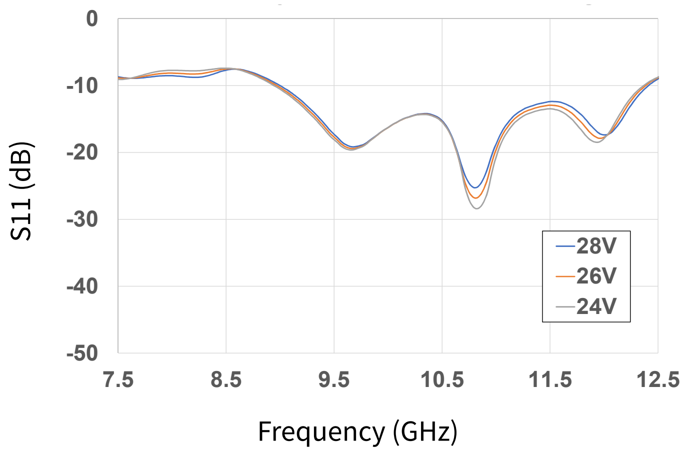


Figure 40. Input RL vs Frequency as a Function of IDQ

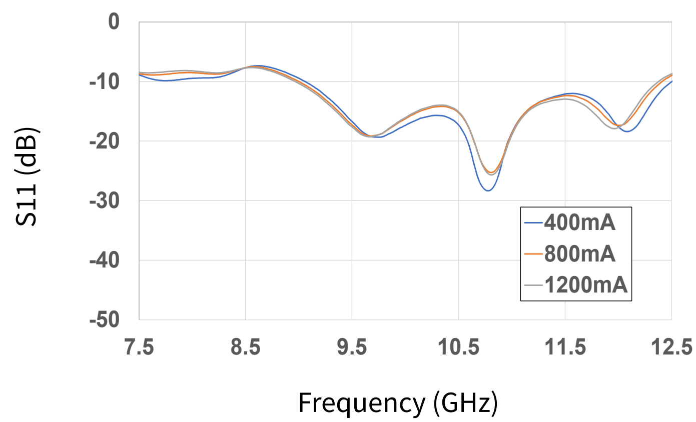


Figure 41. Output RL vs Frequency as a Function of Voltage

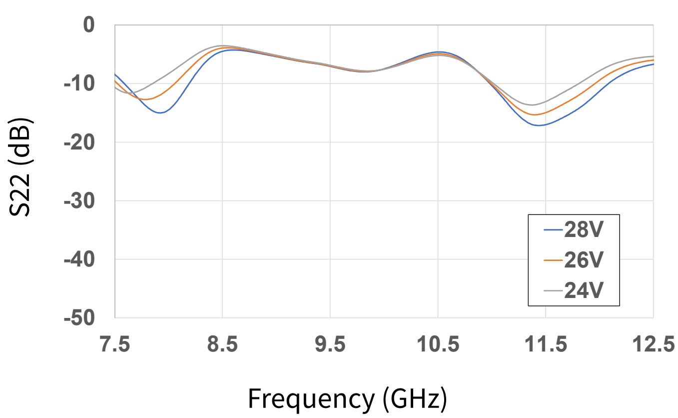
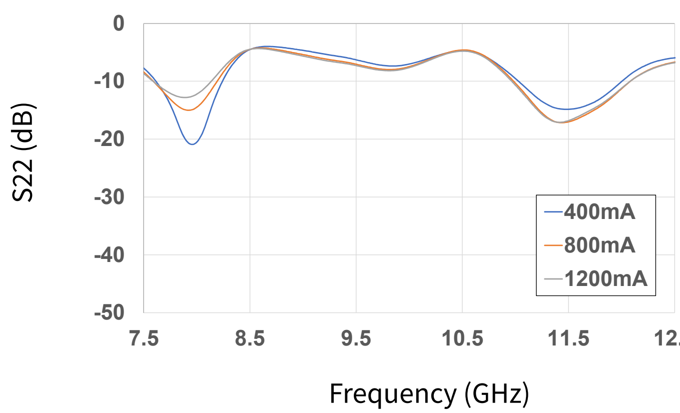
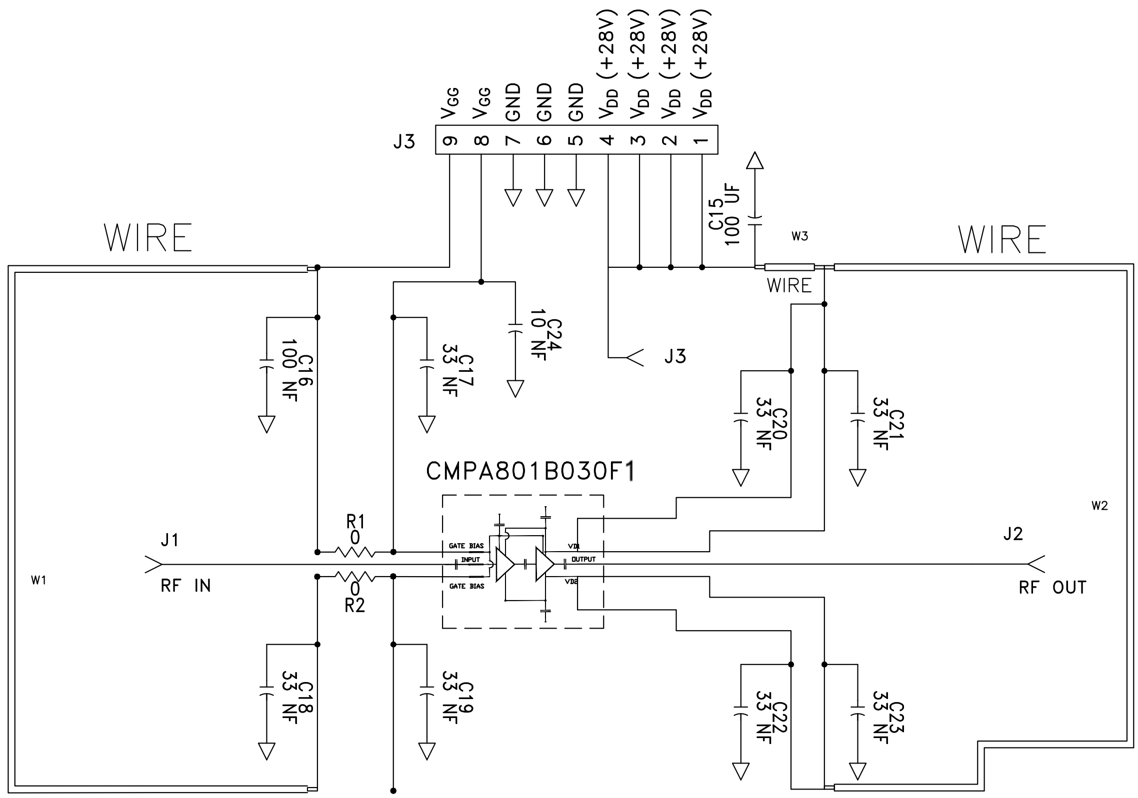


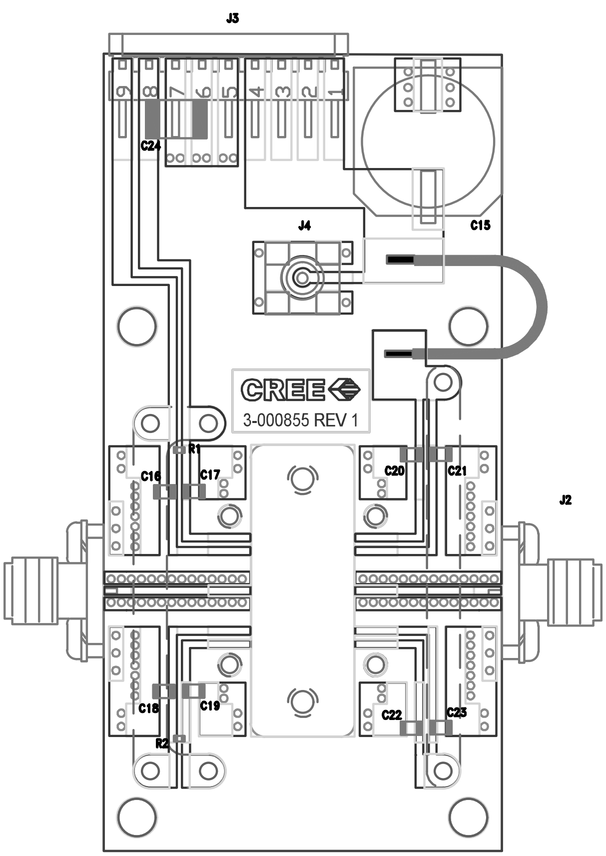
Figure 42. Output RL vs Frequency as a Function of IDQ



CMPA801B030F1-AMP Evaluation Board Schematic



CMPA801B030F1-AMP Evaluation Board Outline



CMPA801B030F1-AMP Evaluation Board Bill of Materials

Designator	Description	Qty
C15	CAP ELECT 100UF80V AFK SMD	1
C16-C23	CAP, 33000PF, 0805, 100V X7R	8
C24	CAP 10UF 16V TANT 2312	1
R1, R2	RES 0.0 OHM 1/16W 0402 SMD	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, R-HOLE, LBLUNT POST, 20MIL	2
J4	CONN, SMB, STRAIGHT JACK RECEPTICLE, SMT, 50 OHM, AU PLATED	1
J3	HEADER RT>PLZ .1CEN LK 9POS	1
W1	WIRE, BLACK, 22 AWG ~ 1.5"	1
W2	WIRE, BLACK, 22 AWG ~ 1.75"	1
W3	WIRE, BLACK, 22 AWG ~ 3.0"	1
-	PCB, TEST FIXTURE, TACONICS RF35P, 20MILS, 440208 PKG	1
-	2-56 SOC HD SCREW 1/16 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	Transistor CMPA801B030F1	1

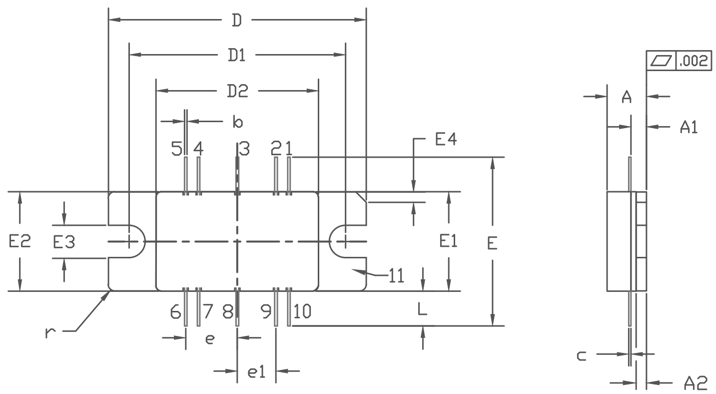
Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1B (≥ 500 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (≥ 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 CMPA801B030F1 (Package 440213)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.

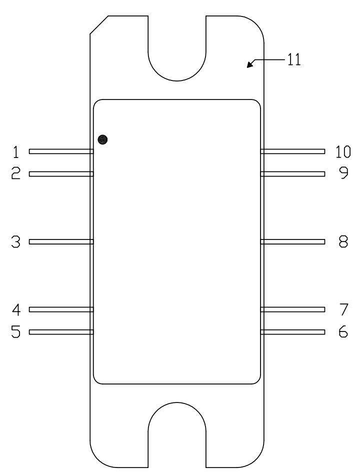
2. CONTROLLING DIMENSION: INCH.

3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

PIN 1: GATE BIAS 6: DRAIN BIAS
2: GATE BIAS 7: DRAIN BIAS
3: RF IN 8: RF OUT
4: GATE BIAS 9: DRAIN BIAS
5: GATE BIAS 10: DRAIN BIAS
11: SOURCE

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.148	0.168	3.76	4.27	
A1	0.055	0.065	1.40	1.65	
A2	0.035	0.045	0.89	1.14	
b	0.01 TYP		0.254 TYP		10x
c	0.007	0.009	0.18	0.23	
D	0.995	1.005	25.27	25.53	
D1	0.835	0.845	21.21	21.46	
D2	0.623	0.637	15.82	16.18	
E	0.653 TYP		16.59 TYP		
E1	0.380	0.390	9.65	9.91	
E2	0.380	0.390	9.65	9.91	
E3	0.120	0.130	3.05	3.30	
E4	0.035	0.045	0.89	1.14	45° CHAMFER
e	0.200 TYP		5.08 TYP		4x
e1	0.150 TYP		3.81 TYP		4x
L	0.115	0.155	2.92	3.94	10x
r	0.025 TYP		.635 TYP		3x



PIN	DESC.
1	Gate Bias for Stage 2
2	Gate Bias for Stage 2
3	RF IN
4	Gate Bias for Stage 1
5	Gate Bias for Stage 1
6	Drain Bias
7	Drain Bias
8	RF OUT
9	Drain Bias
10	Drain Bias
11	Source

Part Number System

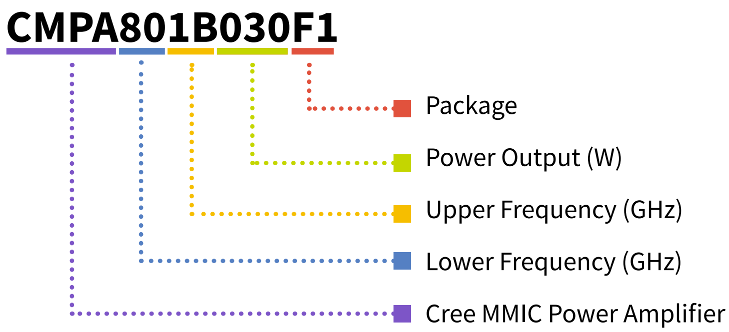


Table 1.

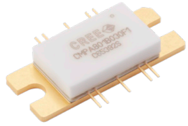
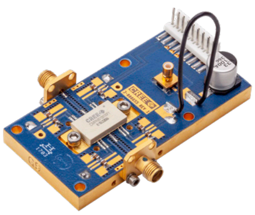
Parameter	Value	Units
Lower Frequency	8.0	GHz
Upper Frequency	11.0	GHz
Power Output	30	W
Package	Flange	-

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
CMPA801B030F1	GaN HEMT	Each	
CMPA801B030F1-AMP	Test board with GaN MMIC installed	Each	

For more information, please contact:

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

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com

Notes

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