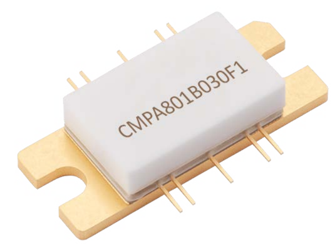
CMPA801B030F1

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

Description

The CMPA801B030F1 is a packaged, 35 W HPA utilizing the high performance, 0.15 um 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.



Package Types: 440213
PN's: CMPA801B030F1

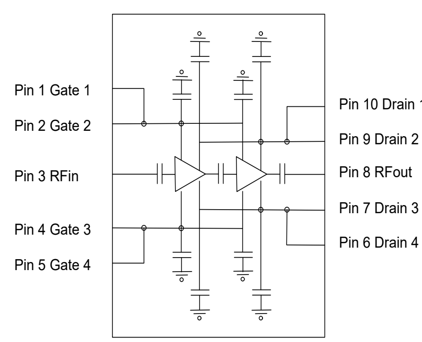
Features

- 35 W typical P_{SAT}
- >36% typical power added efficiency
- 19 dB large signal gain
- High temperature operation

Applications

- Civil and military pulsed radar amplifiers

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



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 P_{IN} = -20 dBm.
[3] Measured at P_{IN} = 26 dBm and 100 µs; duty cycle = 10%.

RoHS compliant

Rev 0.1, SEPTEMBER 2023

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Absolute Maximum Ratings (Not Simultaneous) at 25 °C

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	84	V_{DC}	25 °C
Gate-Source Voltage	V_{GS}	-10, +2	V_{DC}	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

Note:
[1] Scaled from PCM data.

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]						
Small Signal Gain	$S21_1$	–	26	–	dB	P_{IN} = -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
Input Return Loss	S11	–	-10	–	dB	P_{IN} = -20 dBm, 8.0 - 12.0 GHz
Output Return Loss	S22	–	-7	–	dB	P_{IN} = -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	

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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%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

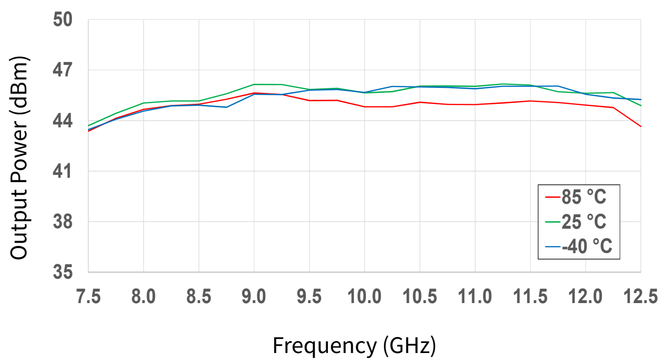

Figure 1. Output Power vs Frequency as a Function of Temperature

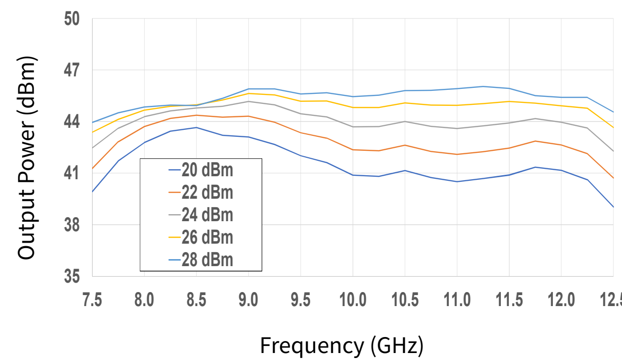

Figure 2. Output Power vs Frequency as a Function of Input Power

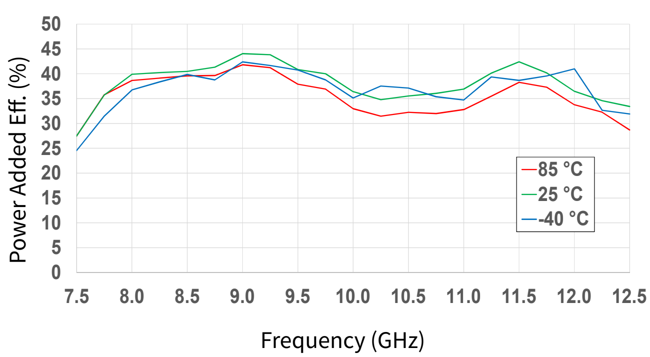

Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

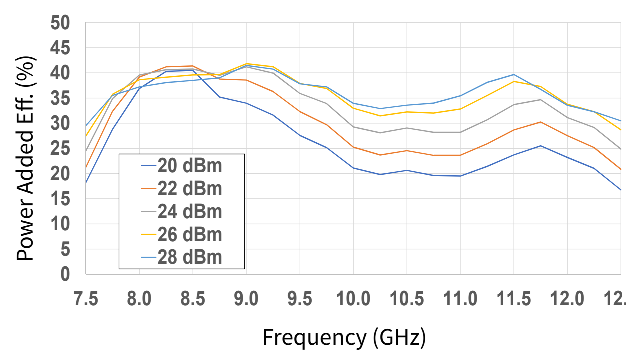

Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

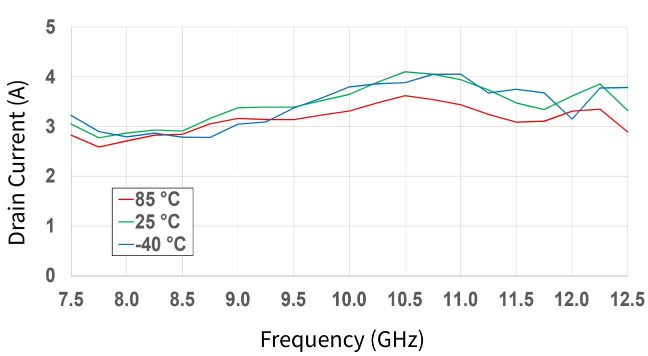

Figure 5. Drain Current vs Frequency as a Function of Temperature

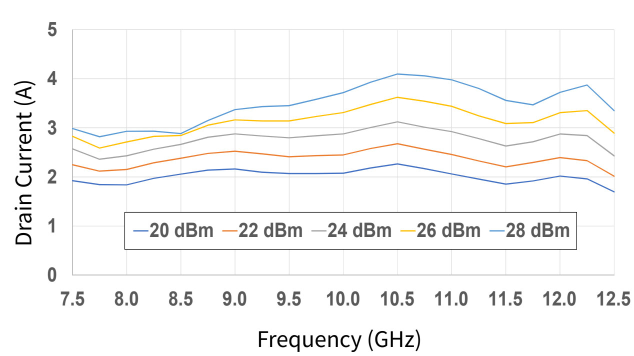

Figure 6. Drain Current vs Frequency as a Function of Input Power

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%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

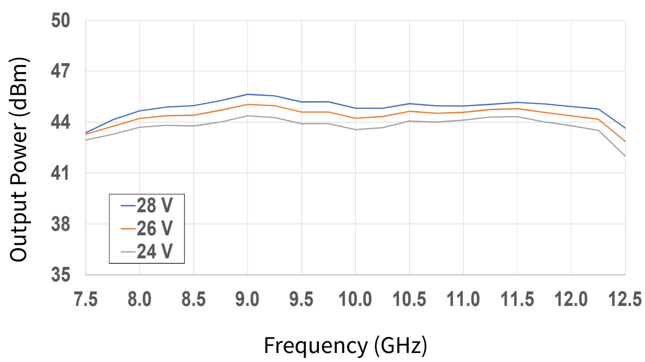

Figure 7. Output Power vs Frequency as a Function of V_D

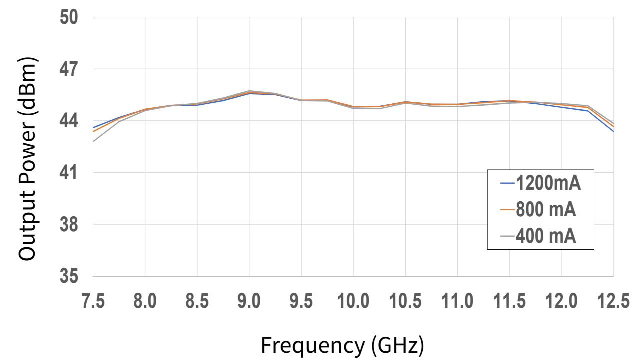

Figure 8. Output Power vs Frequency as a Function of I_{DQ}

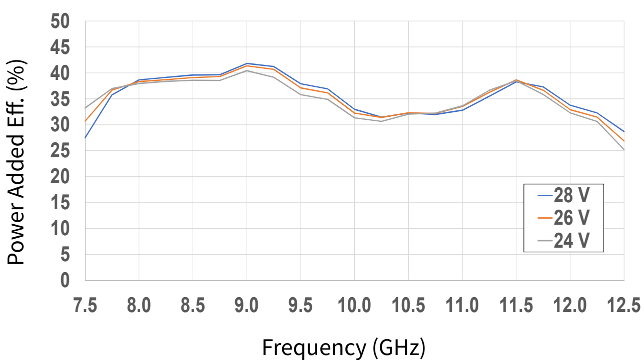

Figure 9. Power Added Eff. vs Frequency as a Function of V_D

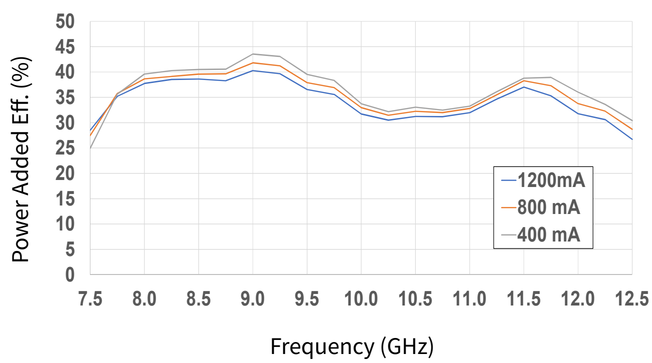

Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

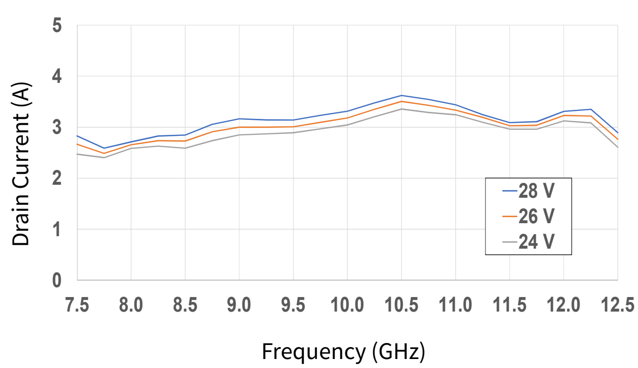

Figure 11. Drain Current vs Frequency as a Function of V_D

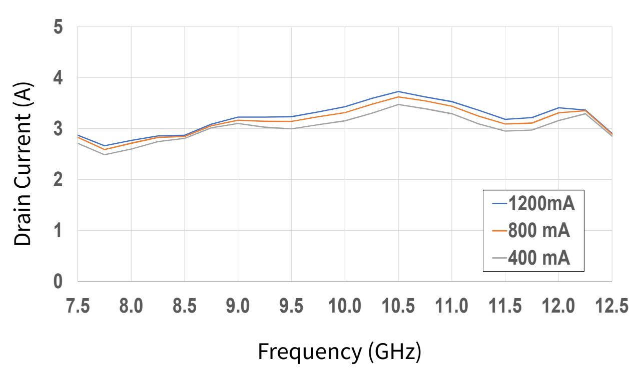

Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

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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%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

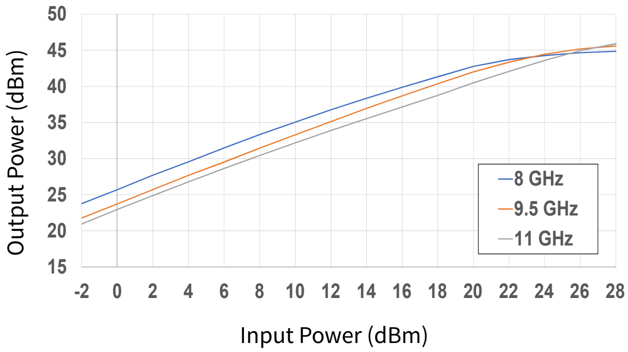

Figure 13. Output Power vs Input Power as a Function of Frequency

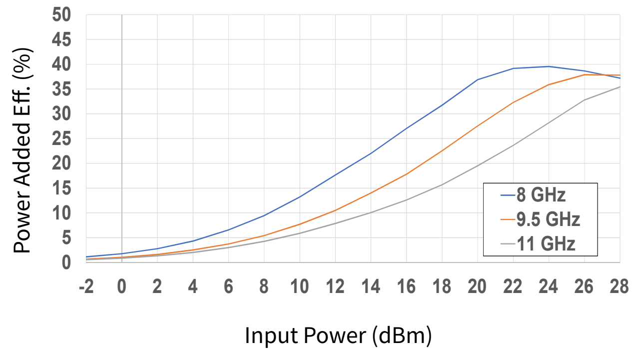

Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

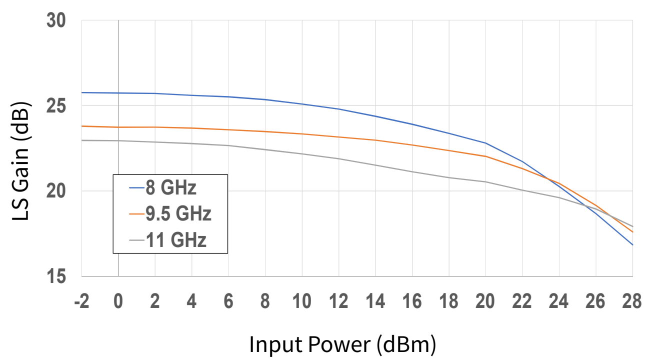

Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

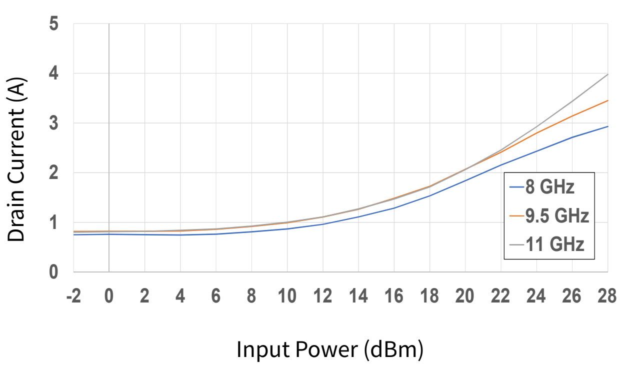

Figure 16. Drain Current vs Input Power as a Function of Frequency

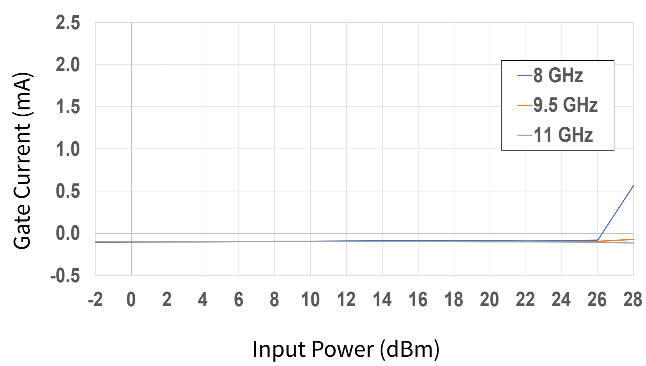

Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA801B030F1

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, pulse width = 100 µs, duty cycle = 10%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

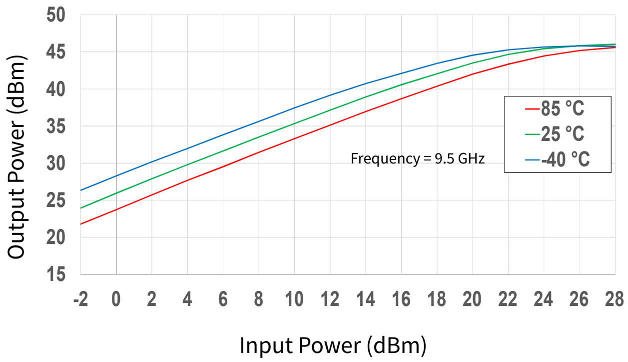

Figure 18. Output Power vs Input Power as a Function of Temperature

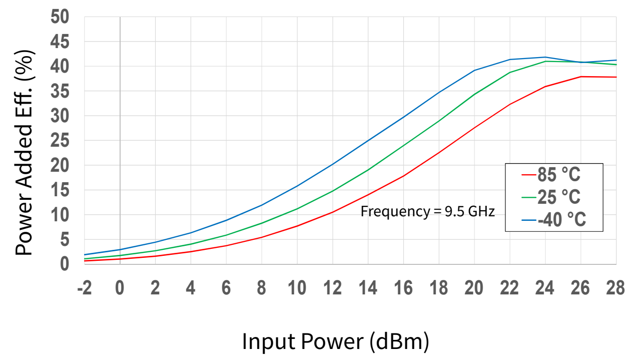

Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

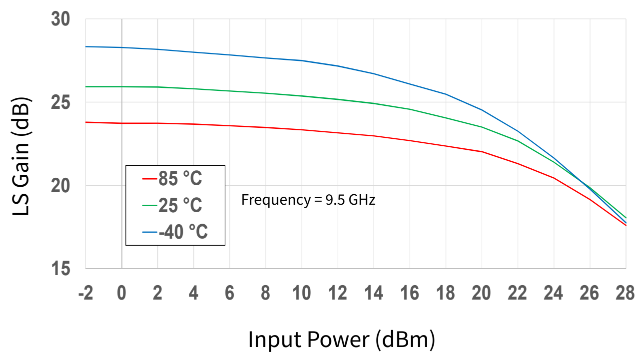

Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

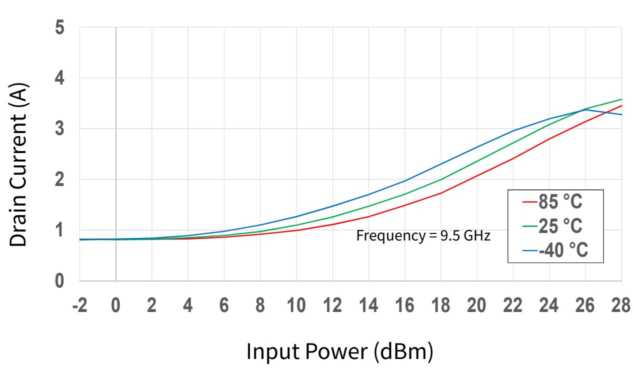

Figure 21. Drain Current vs Input Power as a Function of Temperature

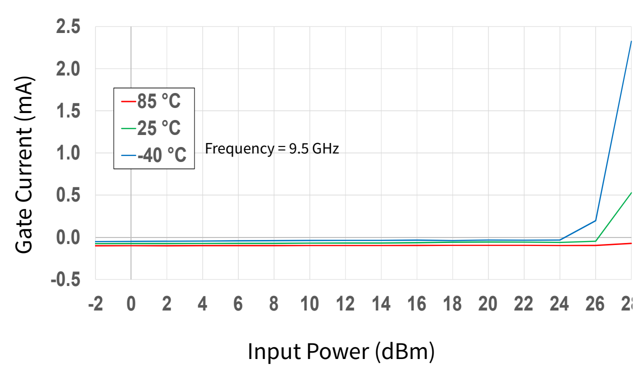

Figure 22. Gate Current vs Input Power as a Function of Temperature

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%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

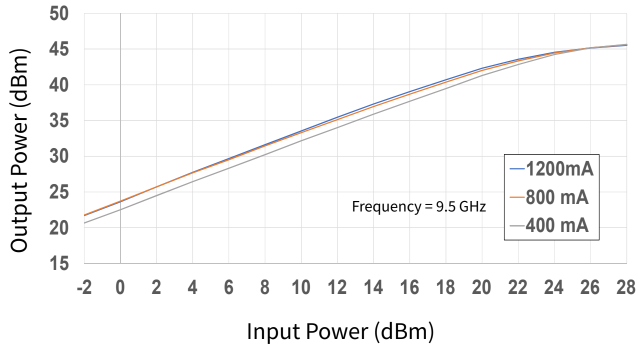

Figure 23. Output Power vs Input Power as a Function of I_{DQ}

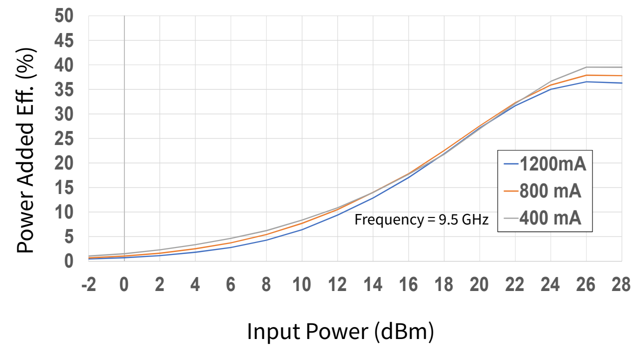

Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

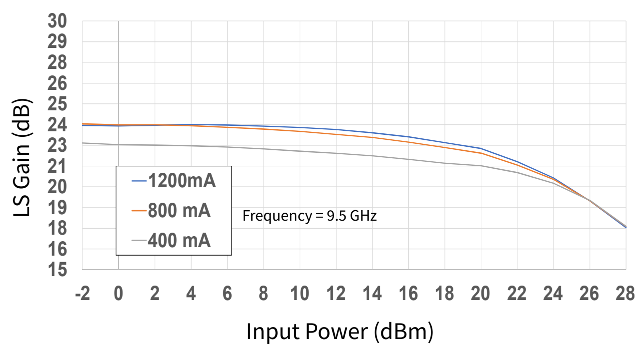

Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

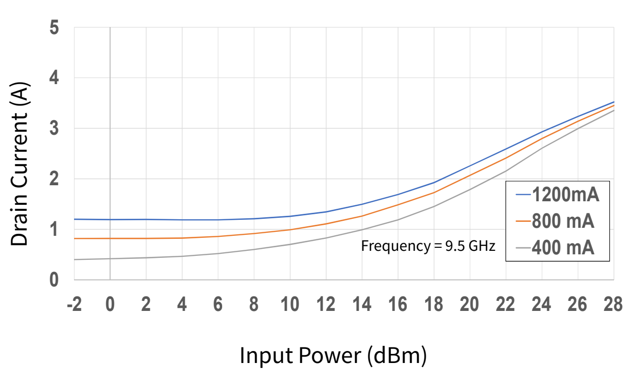

Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

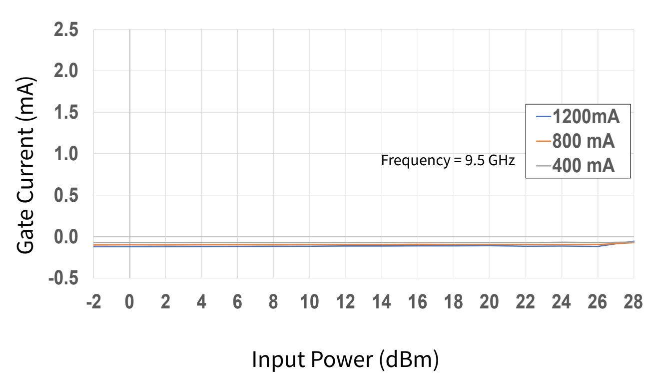

Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

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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%, P_{IN} = 26 dBm, T_{BASE} = +25 °C

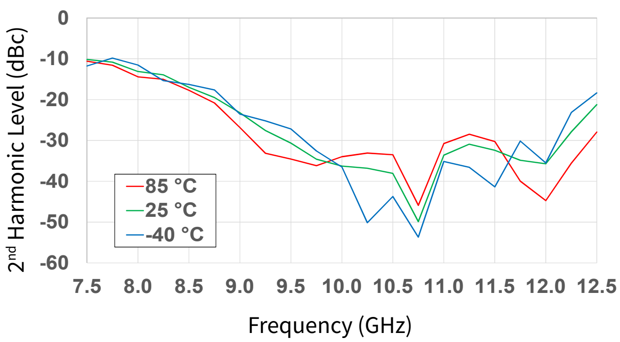


Figure 28. 2nd Harmonic vs Frequency as a Function of Temperature

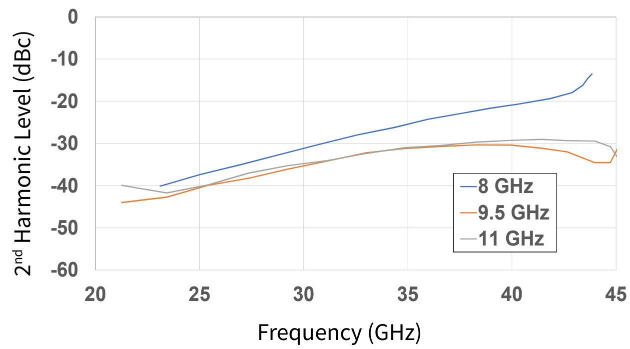


Figure 29. 2nd Harmonic vs Output Power as a Function of Frequency

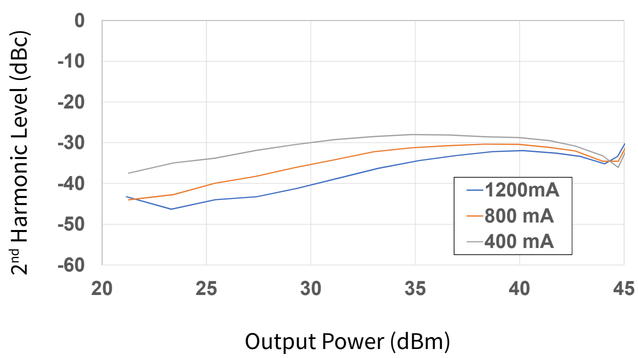


Figure 30. 2nd Harmonic vs Output Power as a Function of I_{DQ}

Typical Performance of the CMPA801B030F1

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

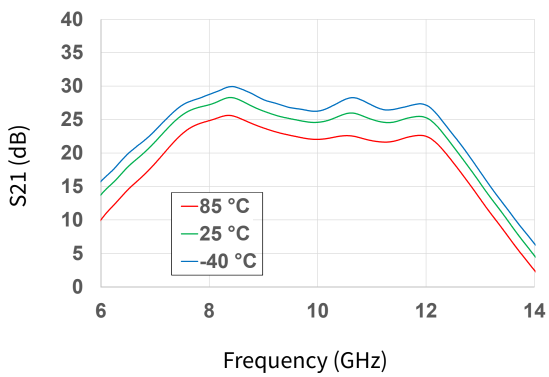


Figure 31. Gain vs Frequency as a Function of Temperature

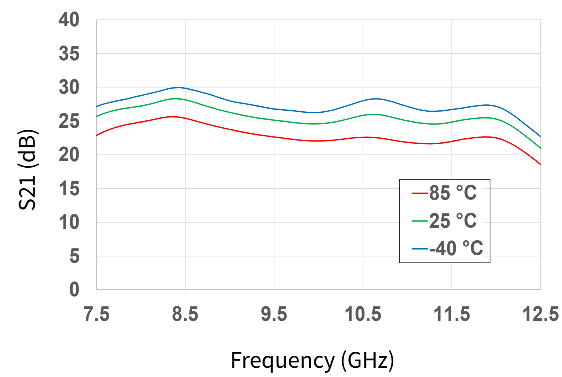


Figure 32. Gain vs Frequency as a Function of Temperature

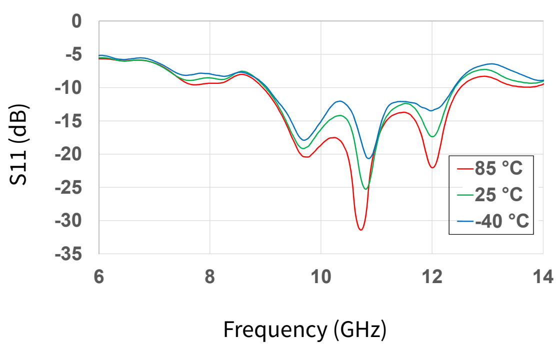


Figure 33. Input RL vs Frequency as a Function of Temperature

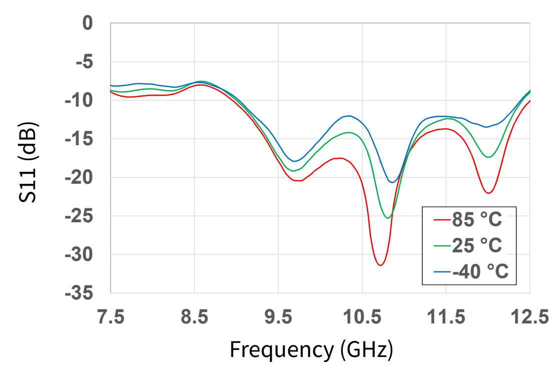


Figure 34. Input RL vs Frequency as a Function of Temperature

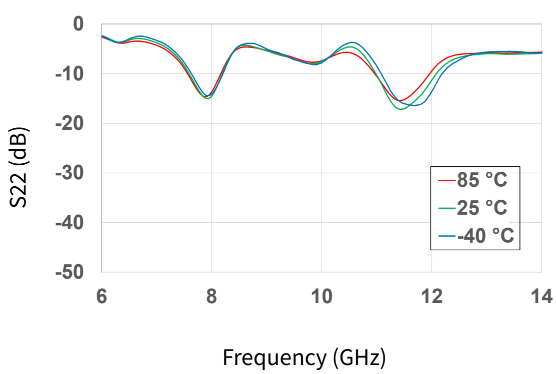


Figure 35. Output RL vs Frequency as a Function of Temperature

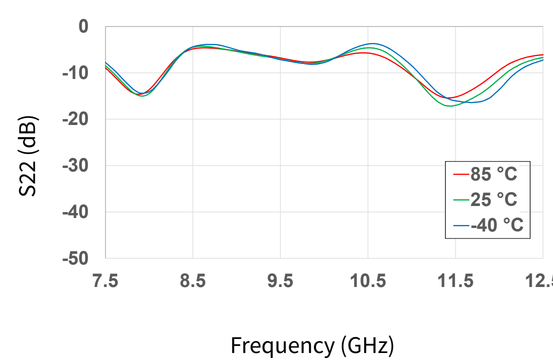


Figure 36. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CMPA801B030F1

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

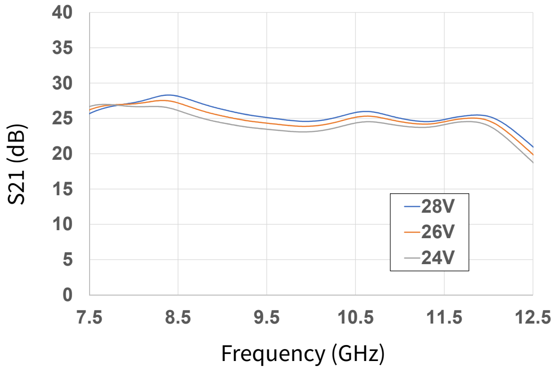


Figure 37. Gain vs Frequency as a Function of Voltage

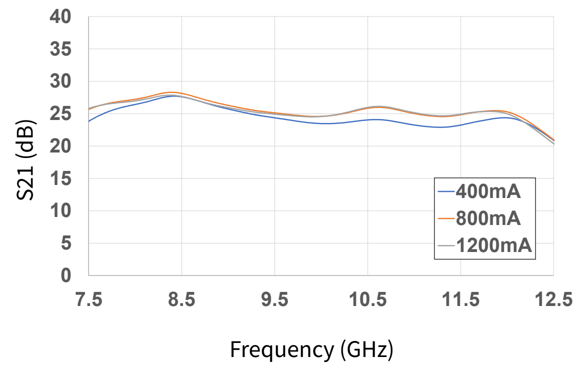


Figure 38. Gain vs Frequency as a Function of I_{DQ}

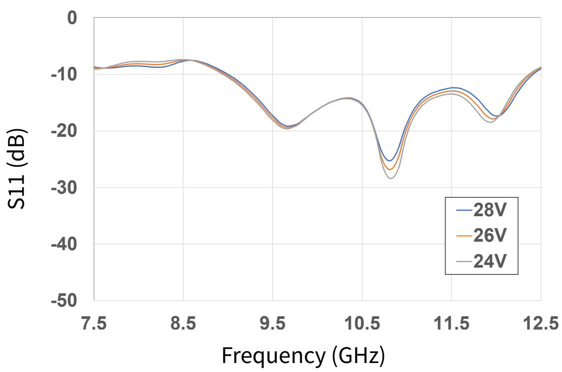


Figure 39. Input RL vs Frequency as a Function of Voltage

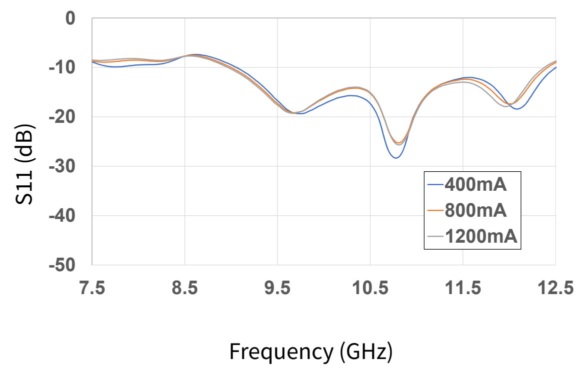


Figure 40. Input RL vs Frequency as a Function of I_{DQ}

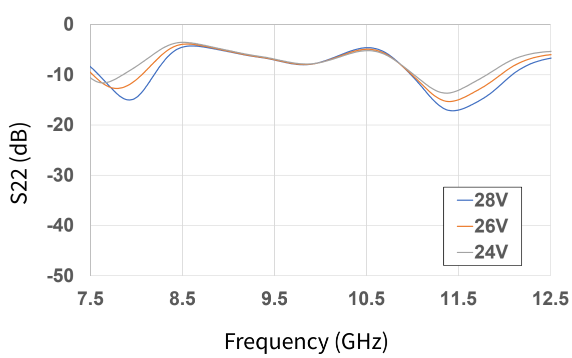


Figure 41. Output RL vs Frequency as a Function of Voltage

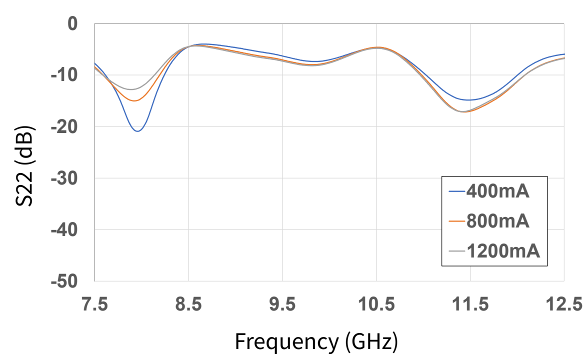
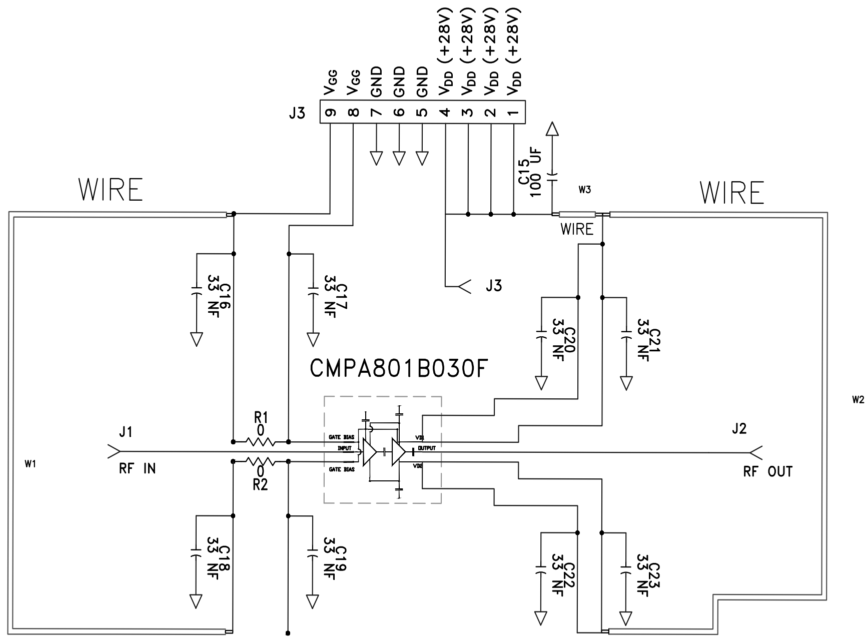
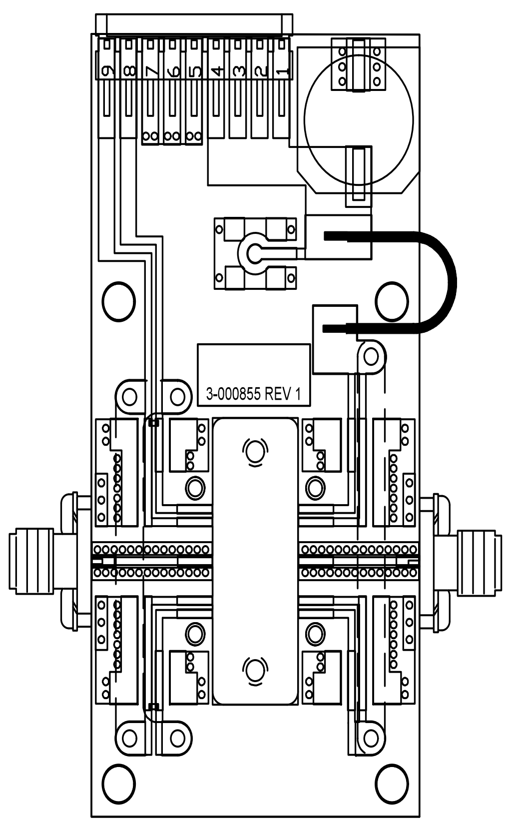


Figure 42. Output RL vs Frequency as a Function of I_{DQ}

CMPA801B030F1-AMP Evaluation Board Schematic



CMPA801B030F1-AMP Evaluation Board Outline



CMPA801B030F1-AMP Evaluation Board Bill of Materials

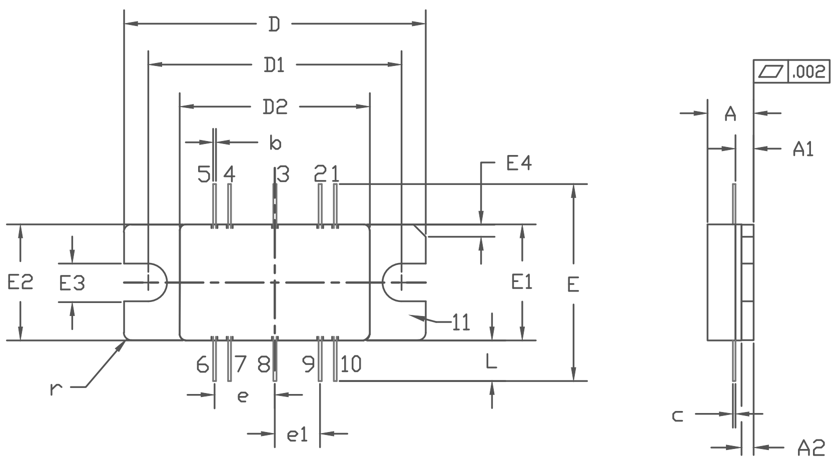
Designator	Description	Qty
C15	CAP ELECT 100 UF 80 V AFK SMD	1
C16 - C23	CAP, 33000 PF, 0805, 100 V X7R	8
C24	CAP 10 UF 16 V TANT 2312	1
R1, R2	RES 0.0 OHM 1/16 W 0402 SMD	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, R-HOLE, LBLUNT POST, 20 MIL	2
J4	CONN, SMB, STRAIGHT JACK RECEPTICLE, SMT, 50 OHM, 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, 20 MILS, 440208 PKG	1
–	2 - 56 SOC HD SCREW 1/16 SS	4
–	#2 SPLIT LOCKWASHER SS	4
Q1	MMIC CMPA801B030F1	1

Electrostatic Discharge (ESD) Classifications

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

Rev 0.1, SEPTEMBER 2023

Product Dimensions CMPA801B030F1 (Package 440213)



NOTES:

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

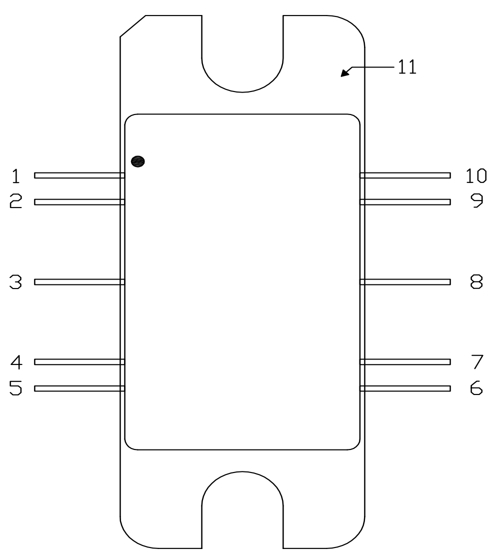
2. CONTROLLING DIMENSION: INCH.

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

	INCHES		MILLIMETERS		NOTES
DIM	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

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Part Number System

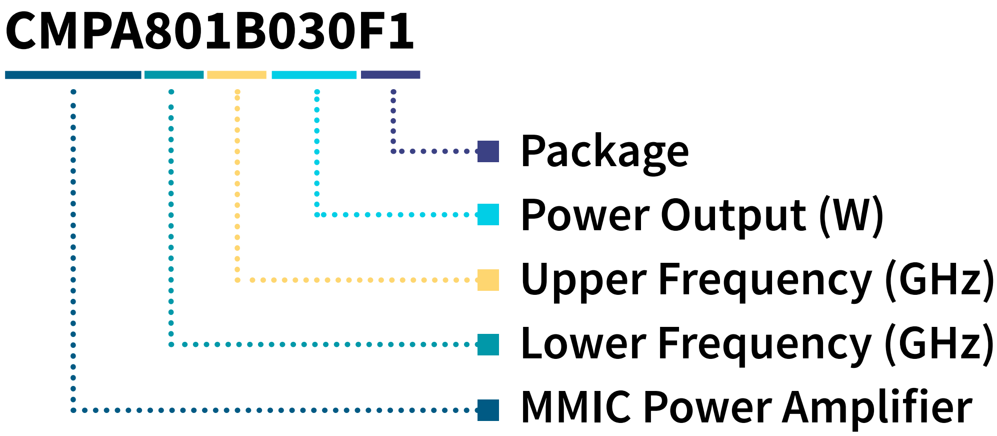


Table 1.

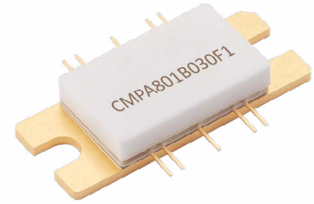
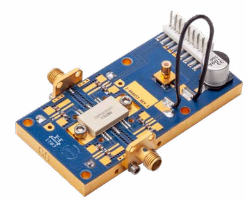
Parameter	Value	Units
Lower Frequency	8.0	GHz
Upper Frequency	11.0	GHz
Power Output	30	W
Package	Flange	–

Note:
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
CMPA801B030F1	GaN HEMT	Each	
CMPA801B030F1-AMP	Test Board with GaN MMIC Installed	Each	

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