CMPA801B030D1

8 – 11 GHz, 40 W GaN HPA

Description

The CMPA801B030D1 is a 40 W MMIC HPA utilizing the high performance, 0.15 um GaN on SiC production process. The CMPA801B030D1 operates from 8 - 11 GHz and supports both defence and commercial-related radar applications. The CMPA801B030D1 achieves 40 W of saturated output power with 20 dB of large signal gain and typically 40% power-added efficiency under pulsed operation. CW operation is also an option.

The CMPA801B030D1 provides improved RF performance over previous generations allowing customers to improve SWaP-C benchmarks in their next-generation systems.

Figure 1. CMPA801B030D1

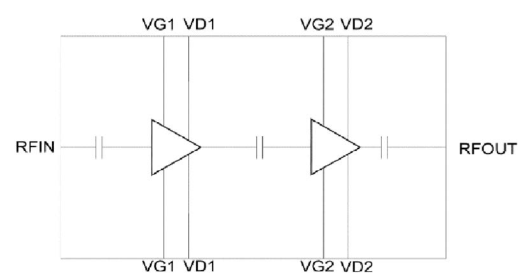


Figure 2. Functional Block Diagram

Features

- P_{SAT}: 40 W
- PAE: 40 %
- LSG: 20 dB
- S21: 27 dB
- S11: -10 dB
- S22: -6 dB
- Pulsed/CW operation

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

Applications

- Military and commercial radar

RoHS compliant

MACOM®

Absolute Maximum Ratings

Parameter	Symbol	Units	Value	Conditions
Drain Voltage	V_D	V	28	
Gate Voltage	V_G	V	-10, +2	
Drain Current	I_D	A	4	
Gate Current	I_G	mA	12.9	
Input Power	P_{IN}	dBm	29	
Dissipated Power	P_{DISS}	W	98	85 °C
Storage Temperature	T_{STG}	°C	-55, +150	
Mounting Temperature	T_J	°C	260	30 Seconds
Junction Temperature	T_J	°C	225	MTTF > 1E6
Output Mismatch Stress	VSWR	Ψ	5:1	

Recommended Operating Conditions

Parameter	Symbol	Units	Typical Value	Conditions
Drain Voltage	V_D	V	28	
Gate Voltage	V_G	V	-1.8	
Drain Current	I_{DQ}	mA	800	
Input Power	P_{IN}	dBm	26	
Case Temperature	T_{CASE}	°C	-40 to 85	

RF Specifications

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, T_{BASE} = 25 °C

Parameter	Units	Frequency	Min.	Typical	Max.	Conditions
Frequency	GHz		8		11	
Output Power	dBm	8		45.5		P_{IN} = 26 dBm
		10		46.5		
		11		46.5		
Power-Added Efficiency	%	8		40		P_{IN} = 26 dBm
		10		39		
		11		36		
LSG	dB	8		19.5		P_{IN} = 26 dBm
		10		20.5		
		11		20.5		
Small-Signal Gain (S21)	dB	8		28.5		
		10		26		
		11		25		
Input Return Loss	dB			-10		
Output Return Loss	dB			-6		

Large Signal Performance versus Temperature

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

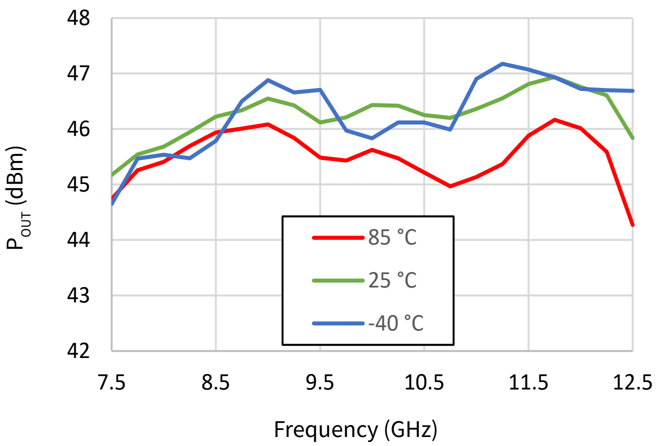


Figure 3. P_{OUT} v. Frequency v. Temperature

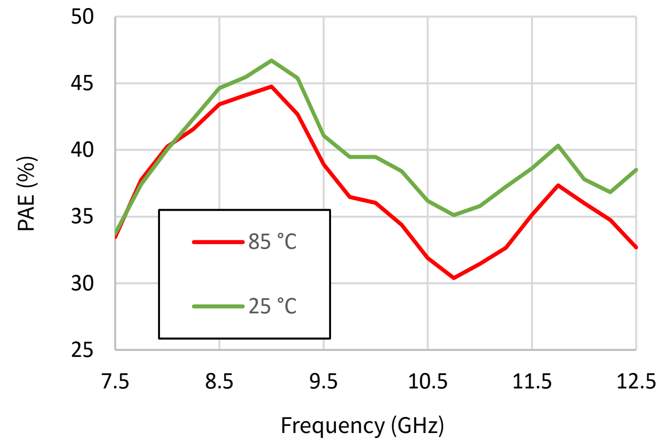


Figure 4. PAE v. Frequency v. Temperature

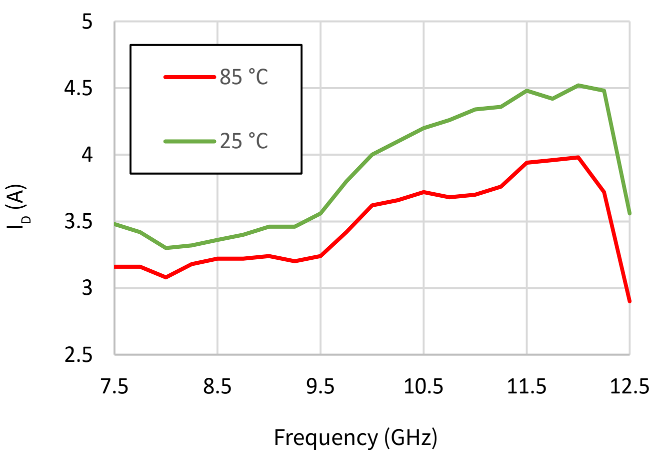


Figure 5. I_D v. Frequency v. Temperature

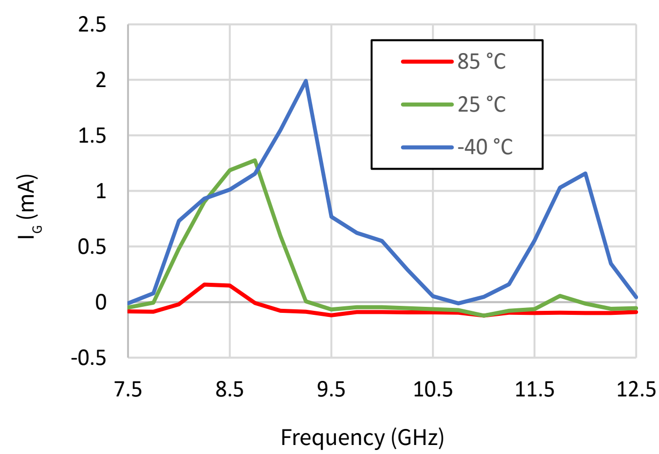


Figure 6. I_G v. Frequency v. Temperature

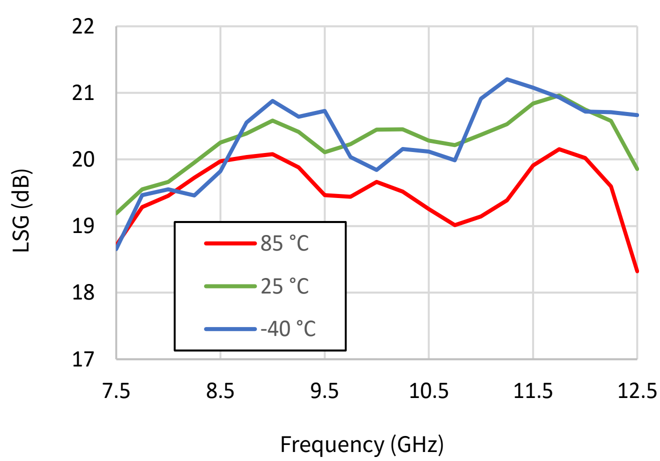


Figure 7. LSG v. Frequency v. Temperature

Large Signal Performance versus Temperature

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

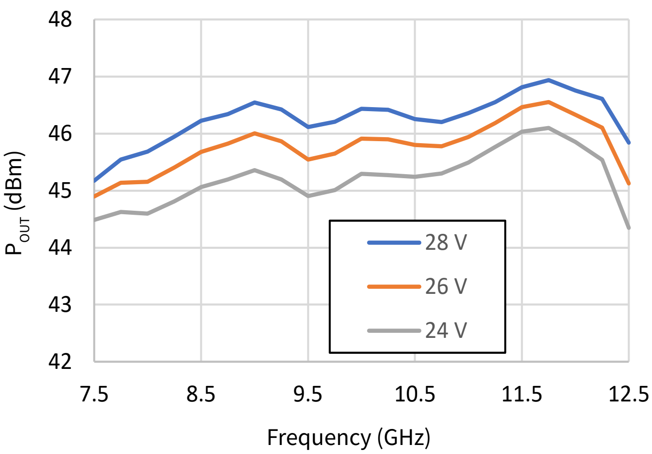


Figure 8. P_{OUT} v. Frequency v. V_D

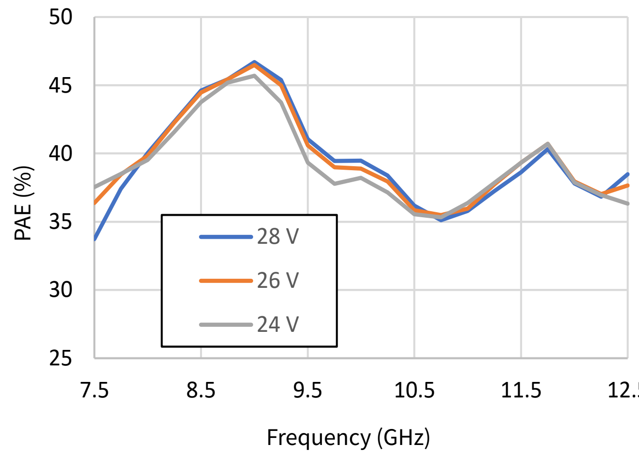


Figure 9. PAE v. Frequency v. V_D

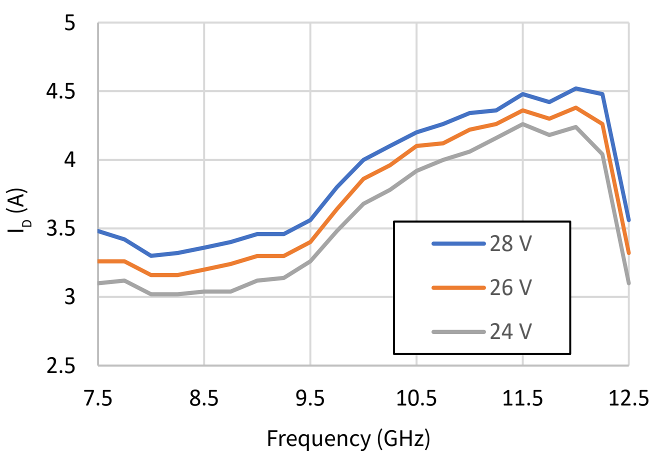


Figure 10. I_D v. Frequency v. V_D

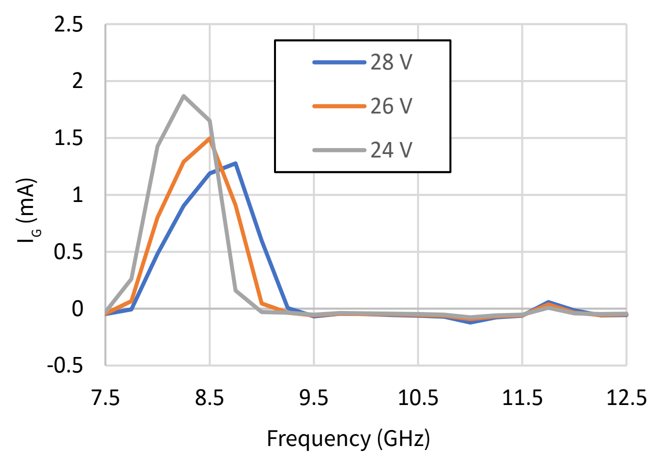


Figure 11. I_G v. Frequency v. V_D

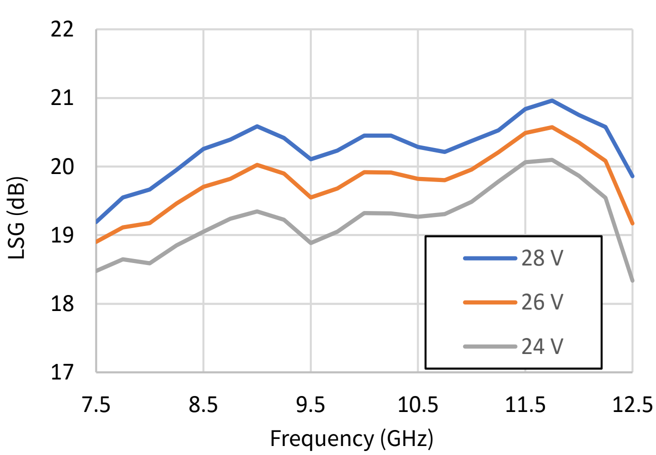


Figure 12. LSG v. Frequency v. V_D

Large Signal Performance versus I_{DQ}

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

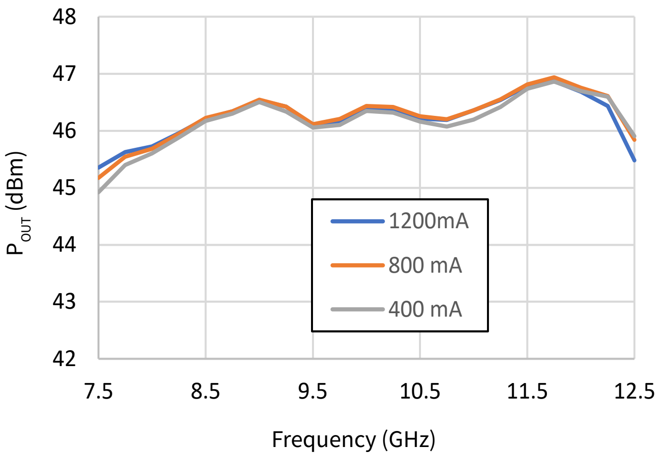


Figure 13. P_{OUT} v. Frequency v. I_{DQ}

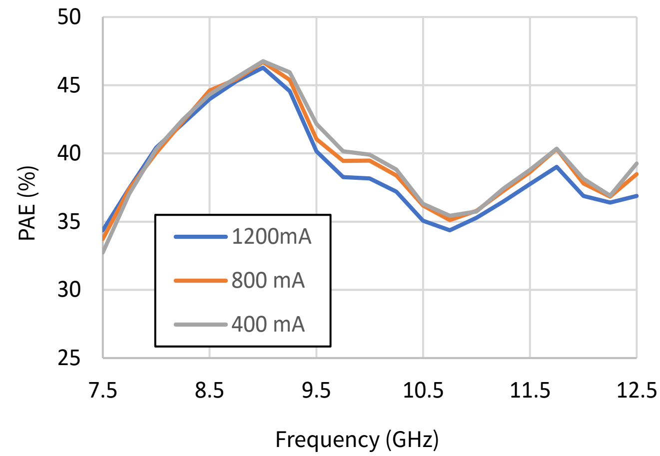


Figure 14. PAE v. Frequency v. I_{DQ}

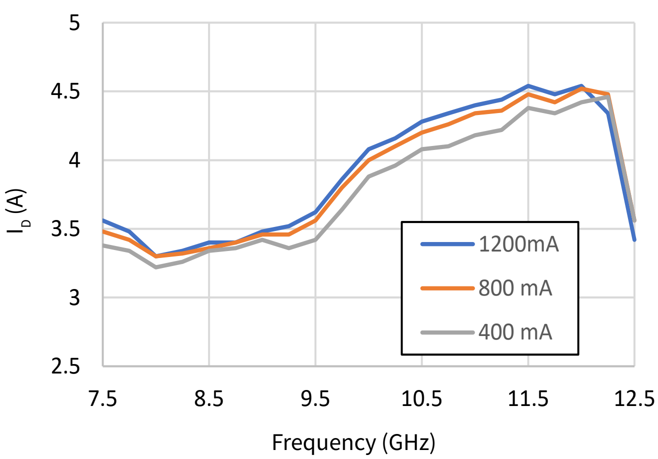


Figure 15. I_D v. Frequency v. I_{DQ}

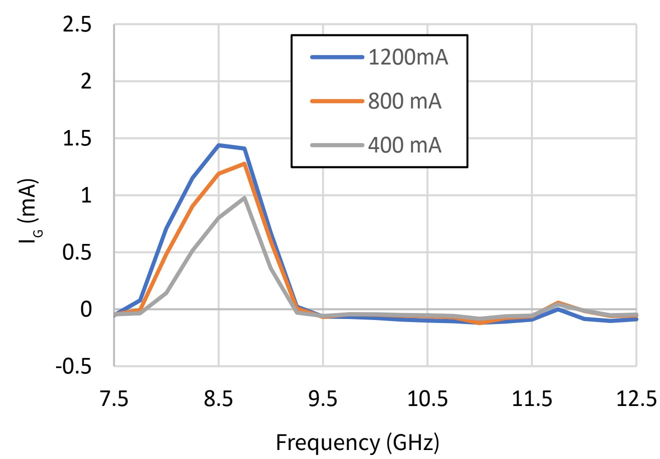


Figure 16. I_G v. Frequency v. I_{DQ}

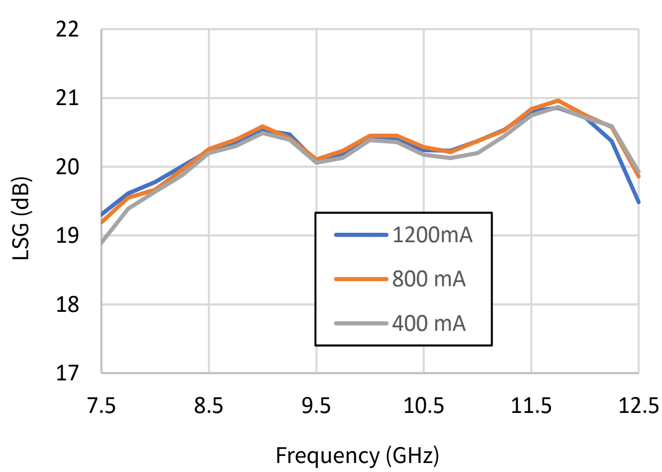


Figure 17. LSG v. Frequency v. I_{DQ}

Drive-Up versus Frequency

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

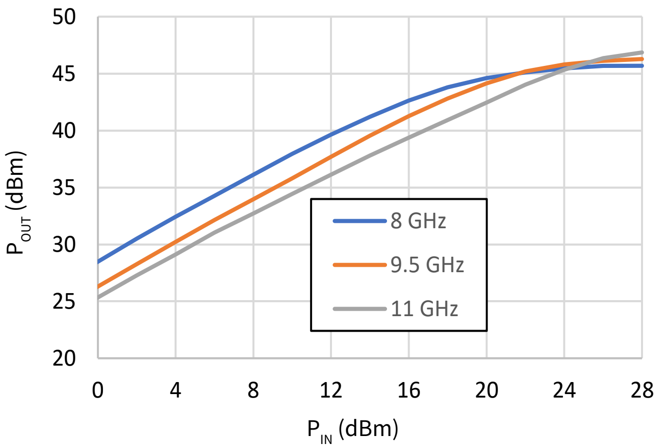


Figure 18. P_{OUT} v. P_{IN} v. Frequency

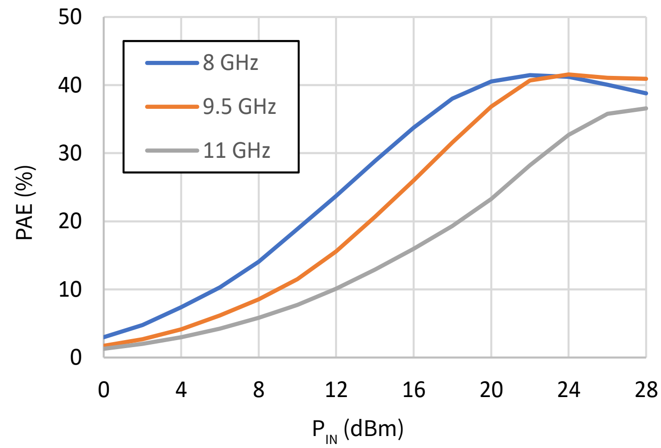


Figure 19. PAE v. P_{IN} v. Frequency

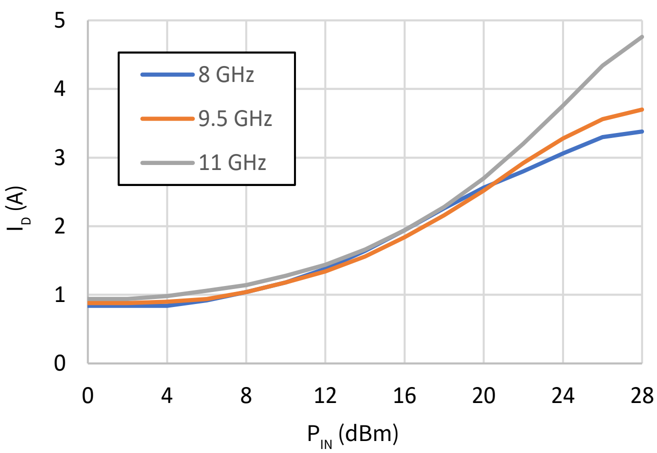


Figure 20. I_D v. P_{IN} v. Frequency

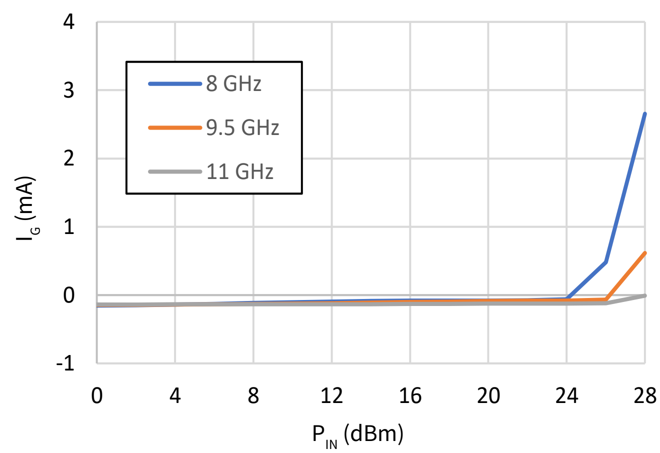


Figure 21. I_G v. P_{IN} v. Frequency

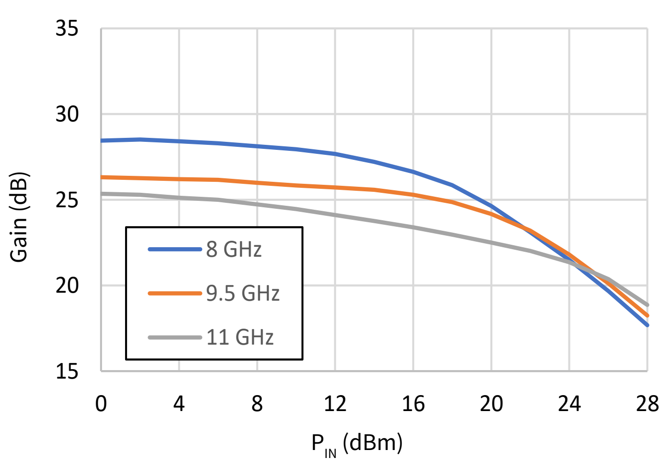


Figure 22. Gain v. P_{IN} v. Frequency

Drive-Up versus Temperature

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

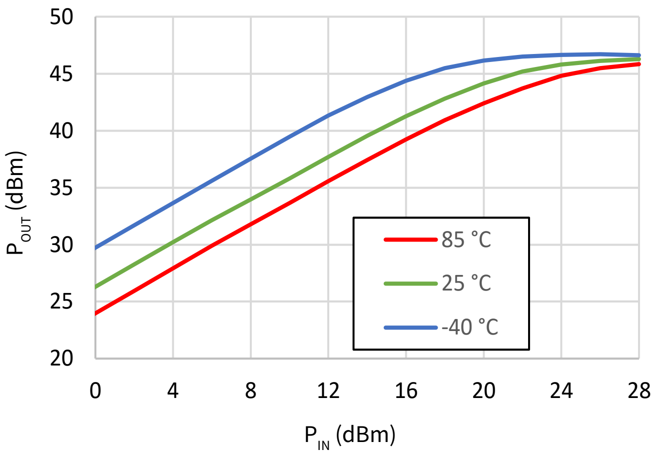


Figure 23. P_{OUT} v. P_{IN} v. Temperature

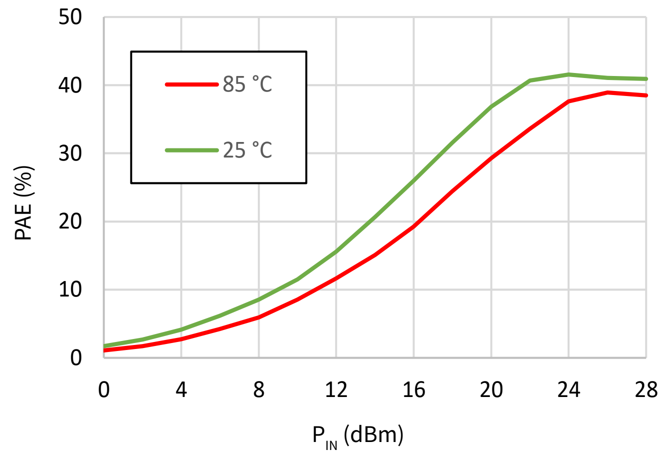


Figure 24. PAE v. P_{IN} v. Temperature

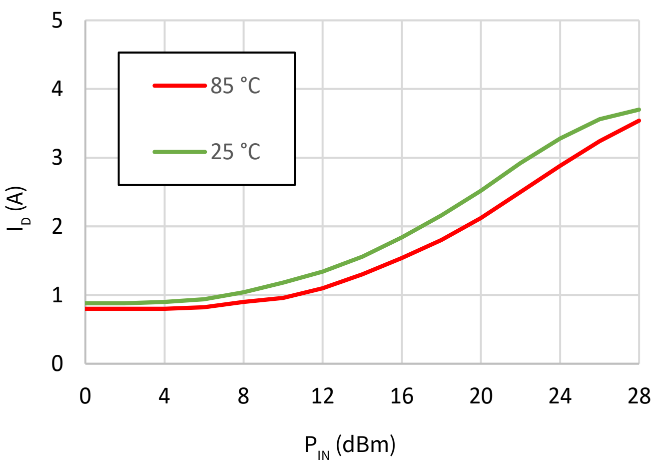


Figure 25. I_D v. P_{IN} v. Temperature

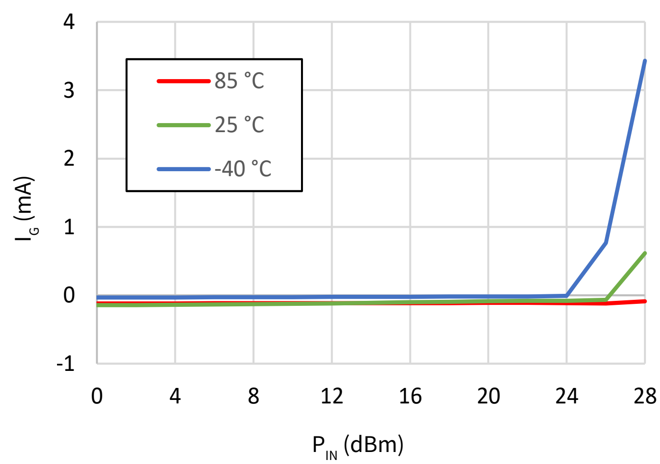


Figure 26. I_G v. P_{IN} v. Temperature

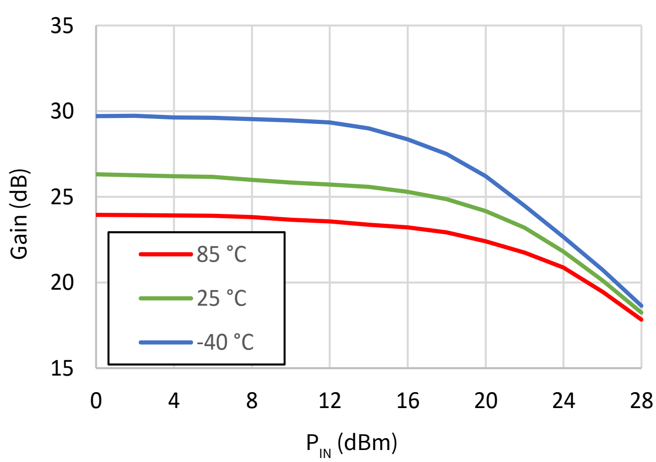


Figure 27. Gain v. P_{IN} v. Temperature

Drive-Up versus V_D

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

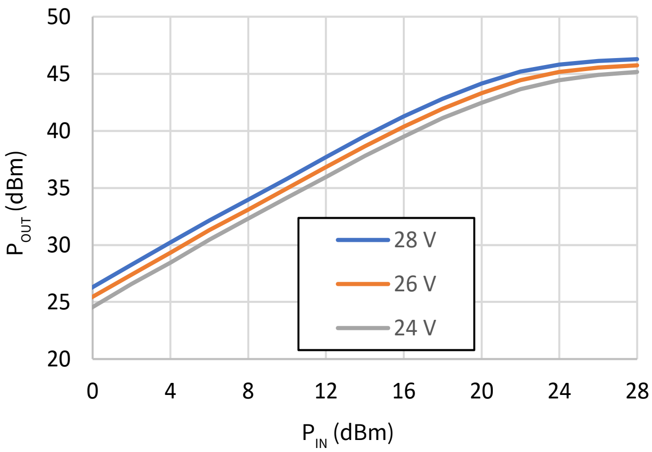


Figure 28. P_{OUT} v. P_{IN} v. V_D

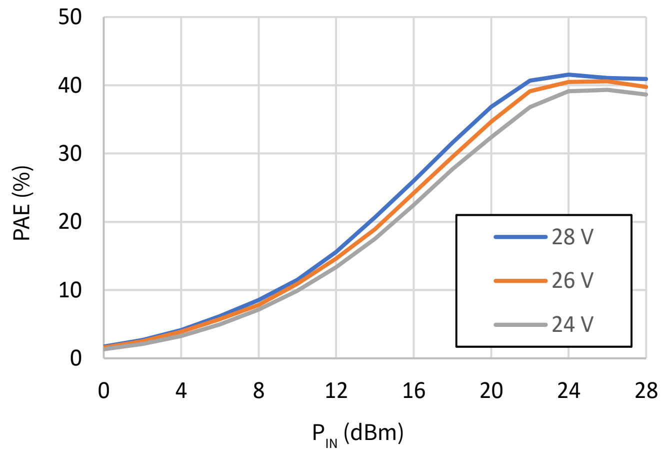


Figure 29. PAE v. P_{IN} v. V_D

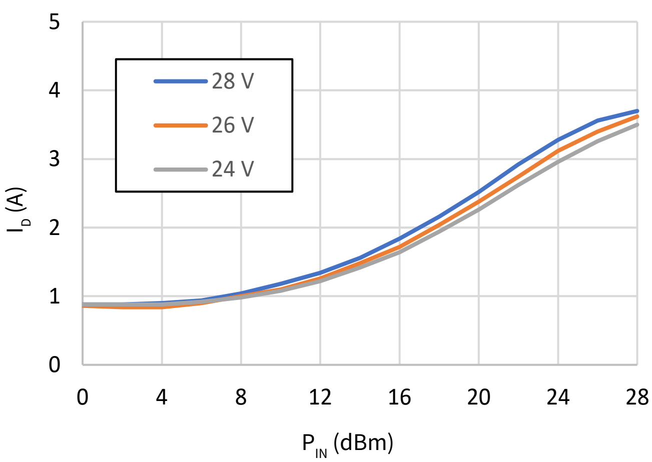


Figure 30. I_D v. P_{IN} v. V_D

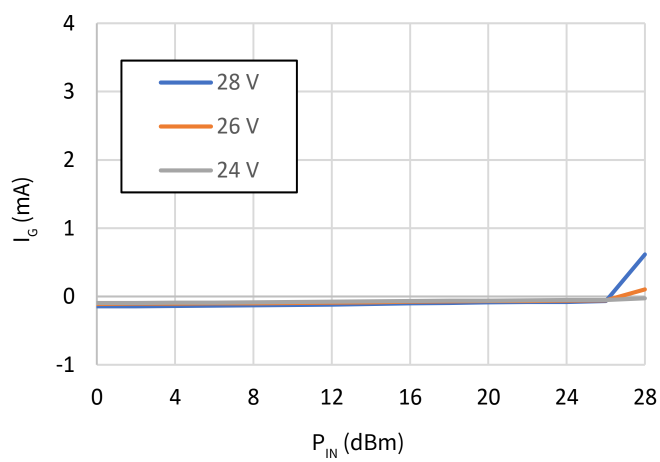


Figure 31. I_G v. P_{IN} v. V_D

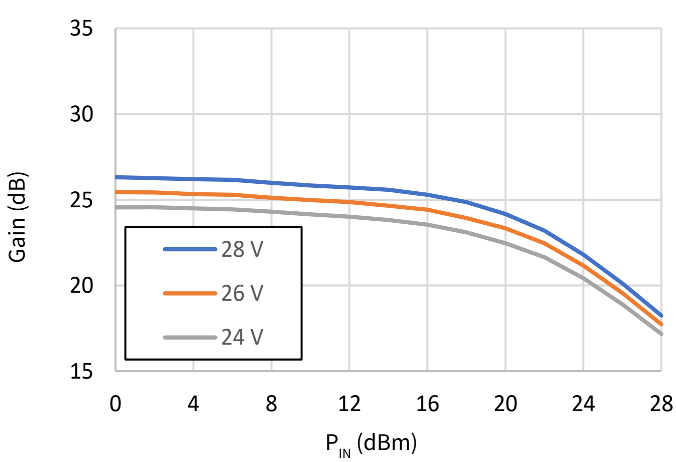


Figure 32. Gain v. P_{IN} v. V_D

Drive-Up versus I_{DQ}

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C, frequency = 9.5 GHz

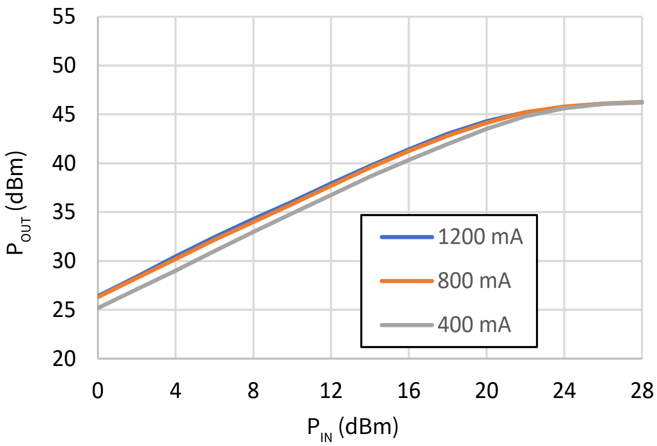


Figure 33. P_{OUT} v. P_{IN} v. I_{DQ}

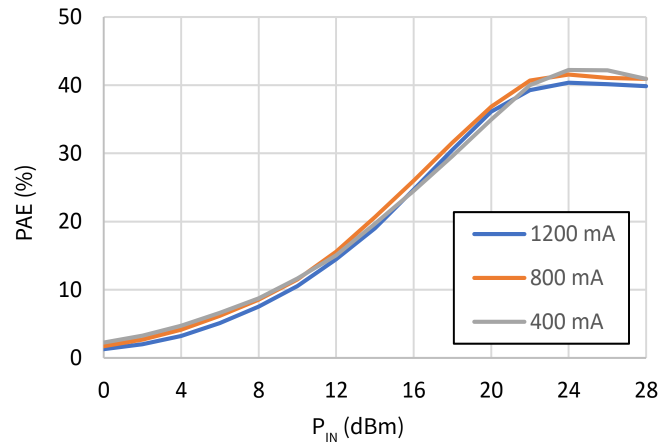


Figure 34. PAE v. P_{IN} v. I_{DQ}

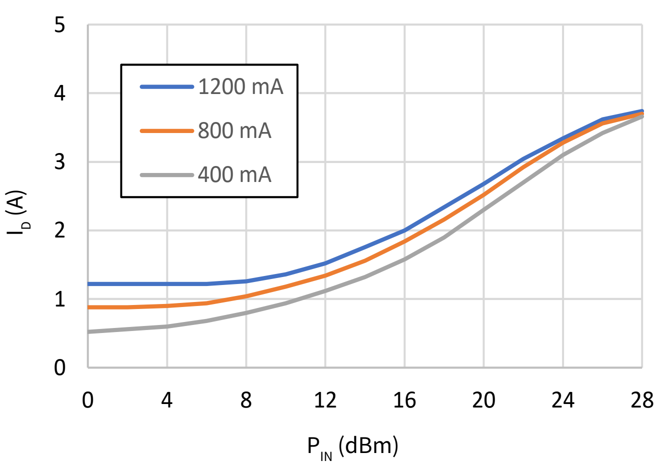


Figure 35. I_D v. P_{IN} v. I_{DQ}

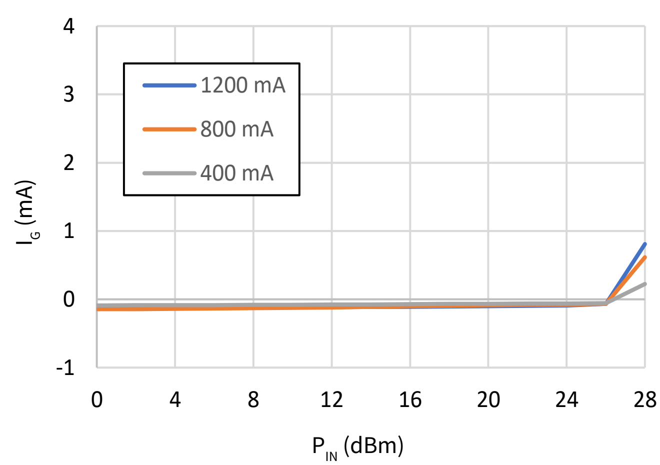


Figure 36. I_G v. P_{IN} v. I_{DQ}

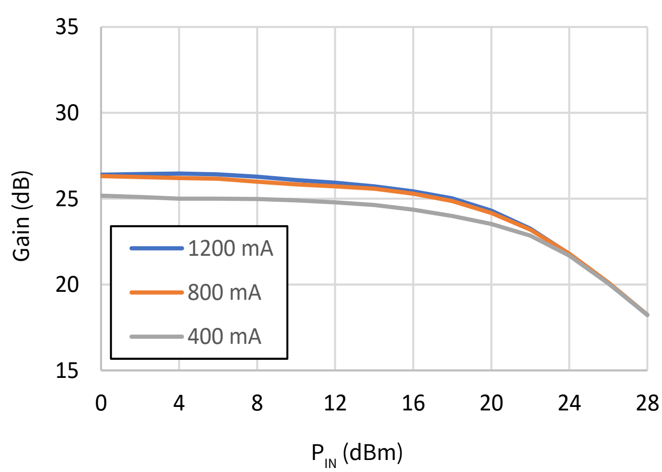


Figure 37. Gain v. P_{IN} v. I_{DQ}

Small Signal v. Temperature and V_D

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

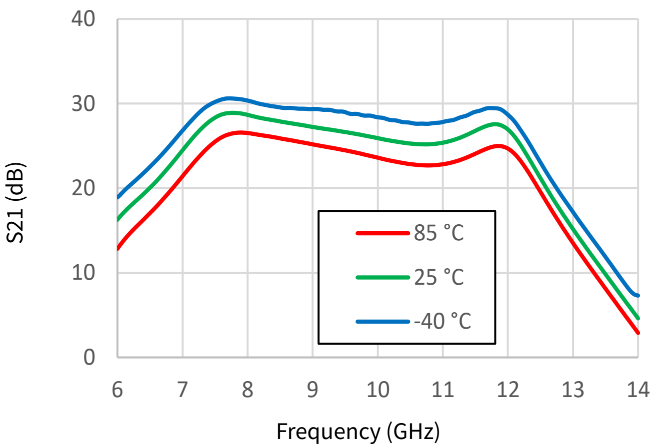


Figure 38. S21 v. Frequency v. Temperature

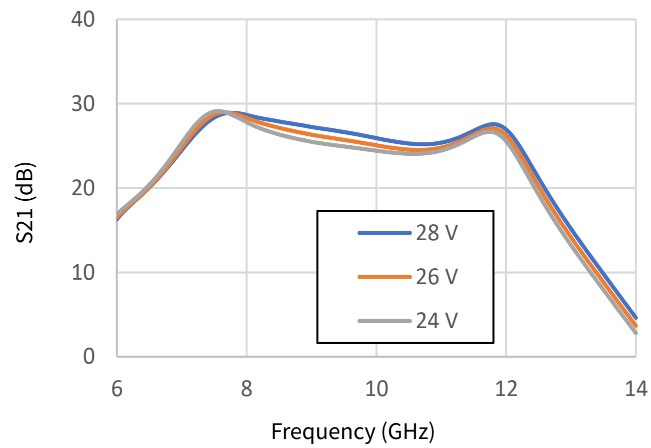


Figure 39. S21 v. Frequency v. V_D

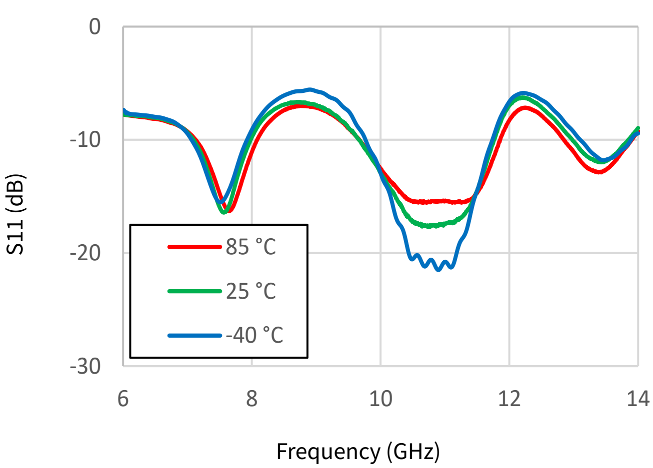


Figure 40. S11 v. Frequency v. Temperature

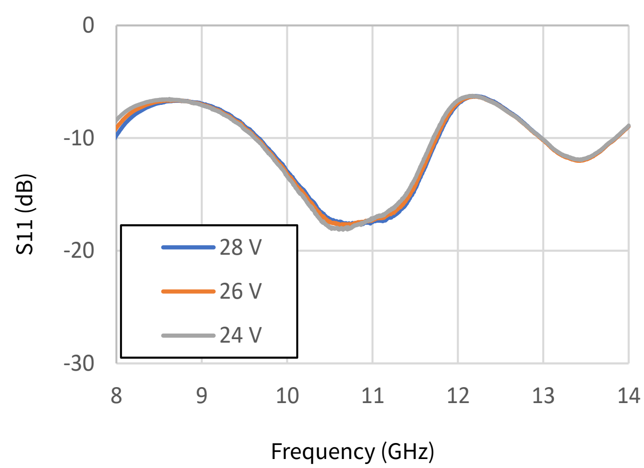


Figure 41. S11 v. Frequency v. V_D

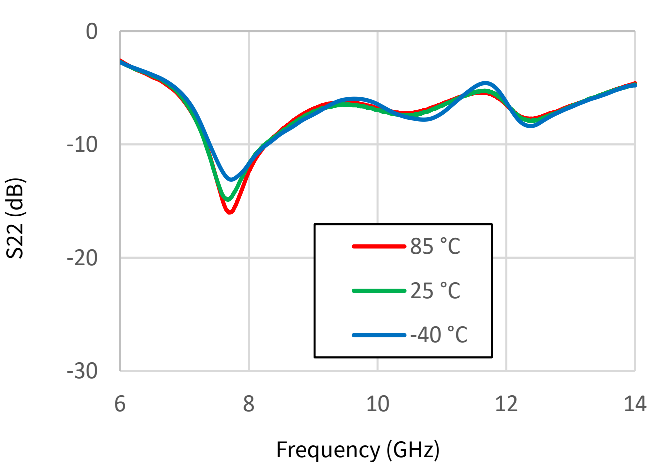


Figure 42. S22 v. Frequency v. Temperature

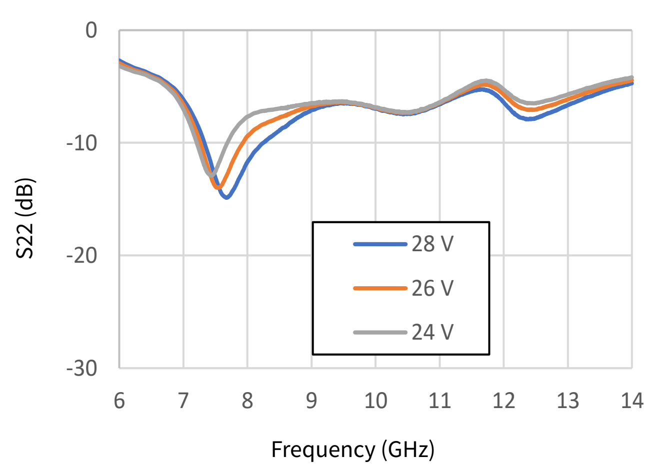


Figure 43. S22 v. Frequency v. V_D

Rev 1.1, SEPTEMBER 2023

Small Signal v. I_{DQ}

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

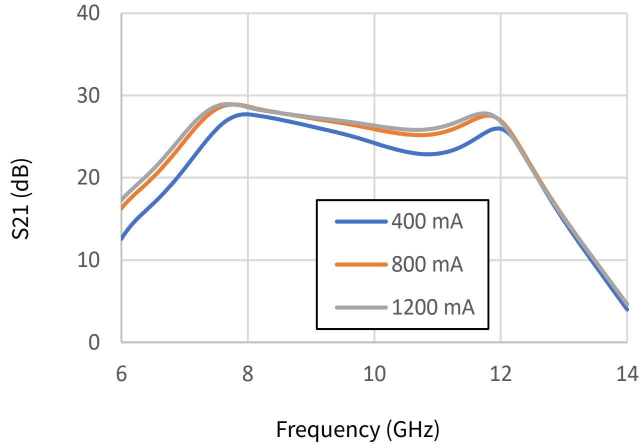


Figure 44. S21 v. Frequency v. I_{DQ}

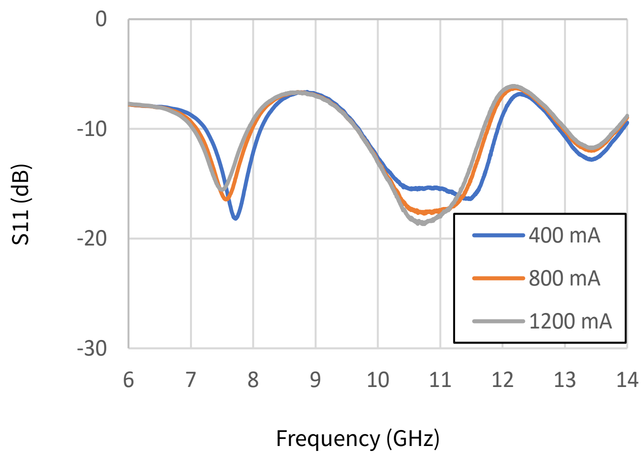


Figure 45. S11 v. Frequency v. I_{DQ}

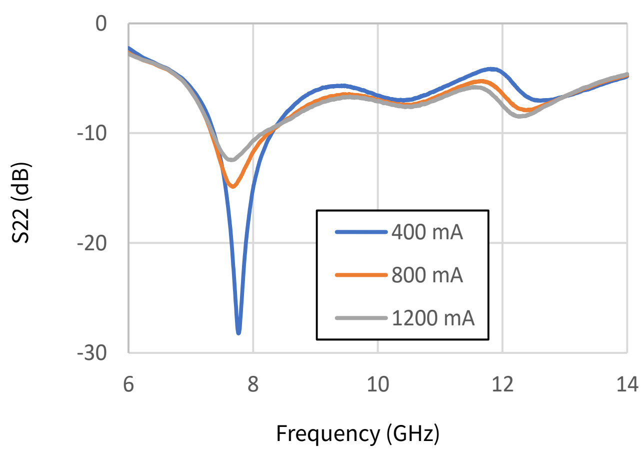


Figure 46. S22 v. Frequency v. I_{DQ}

Harmonics

Test conditions unless otherwise noted: V_D = 28 V, I_{DQ} = 800 mA, PW = 100 uS, DC = 10%, P_{IN} = 26 dBm, T_{BASE} = 25 °C

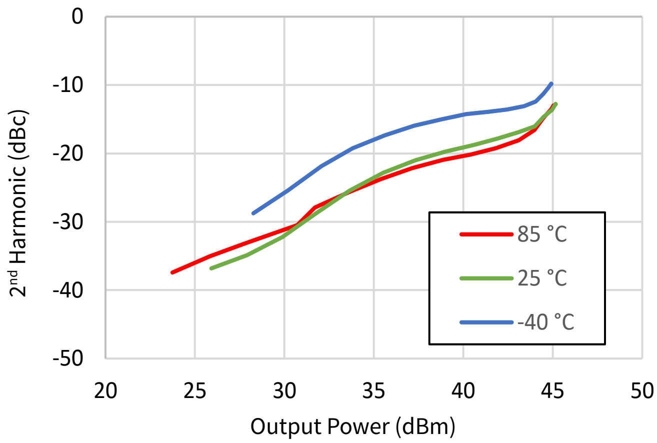


Figure 47. 2f v. P_{OUT} v. Temperature, 8 GHz

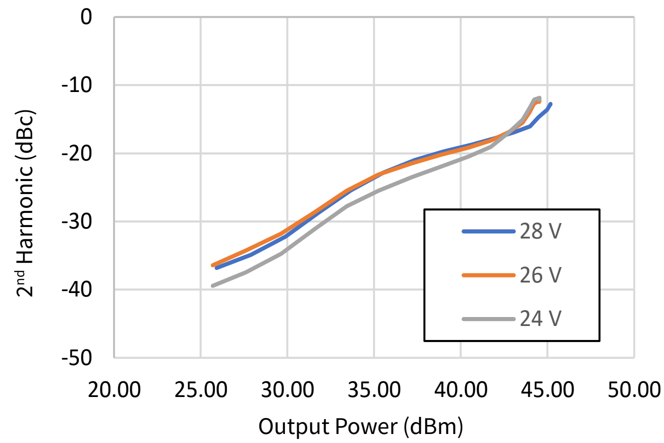


Figure 48. 2f v. P_{OUT} v. V_D, 8 GHz

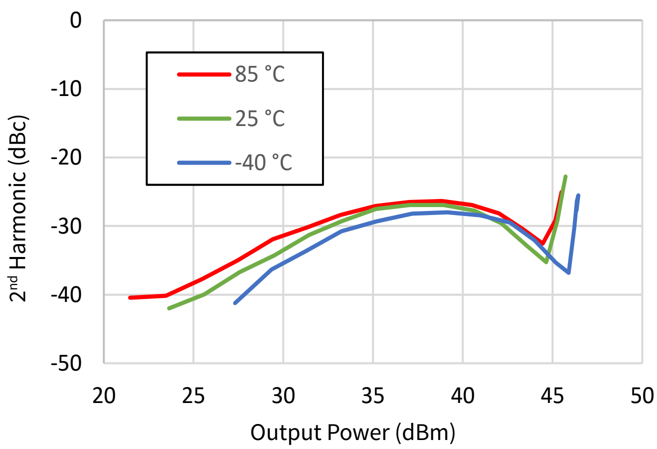


Figure 49. 2f v. P_{OUT} v. Temperature, 9.5 GHz

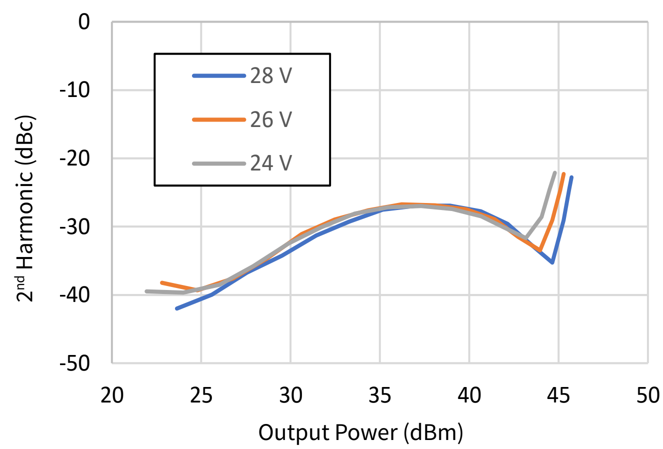


Figure 50. 2f v. P_{OUT} v. V_D, 9.5 GHz

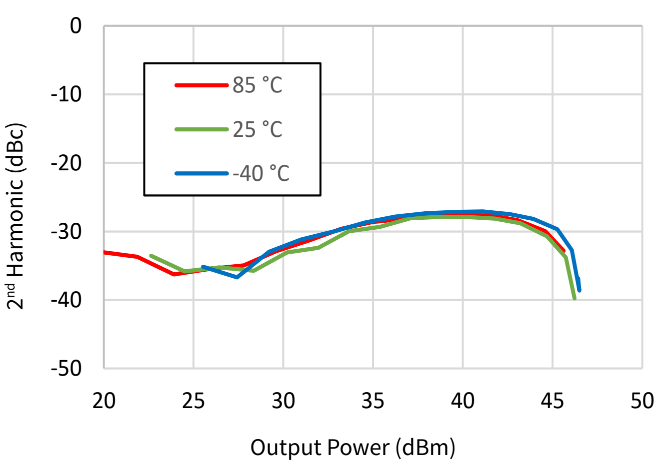


Figure 51. 2f v. P_{OUT} v. Temperature, 11 GHz

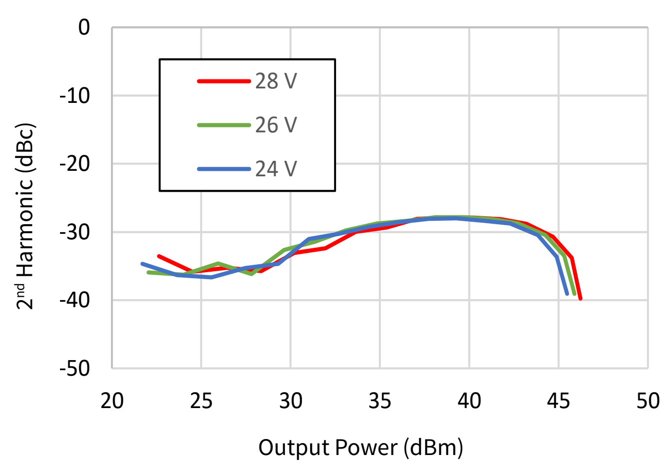
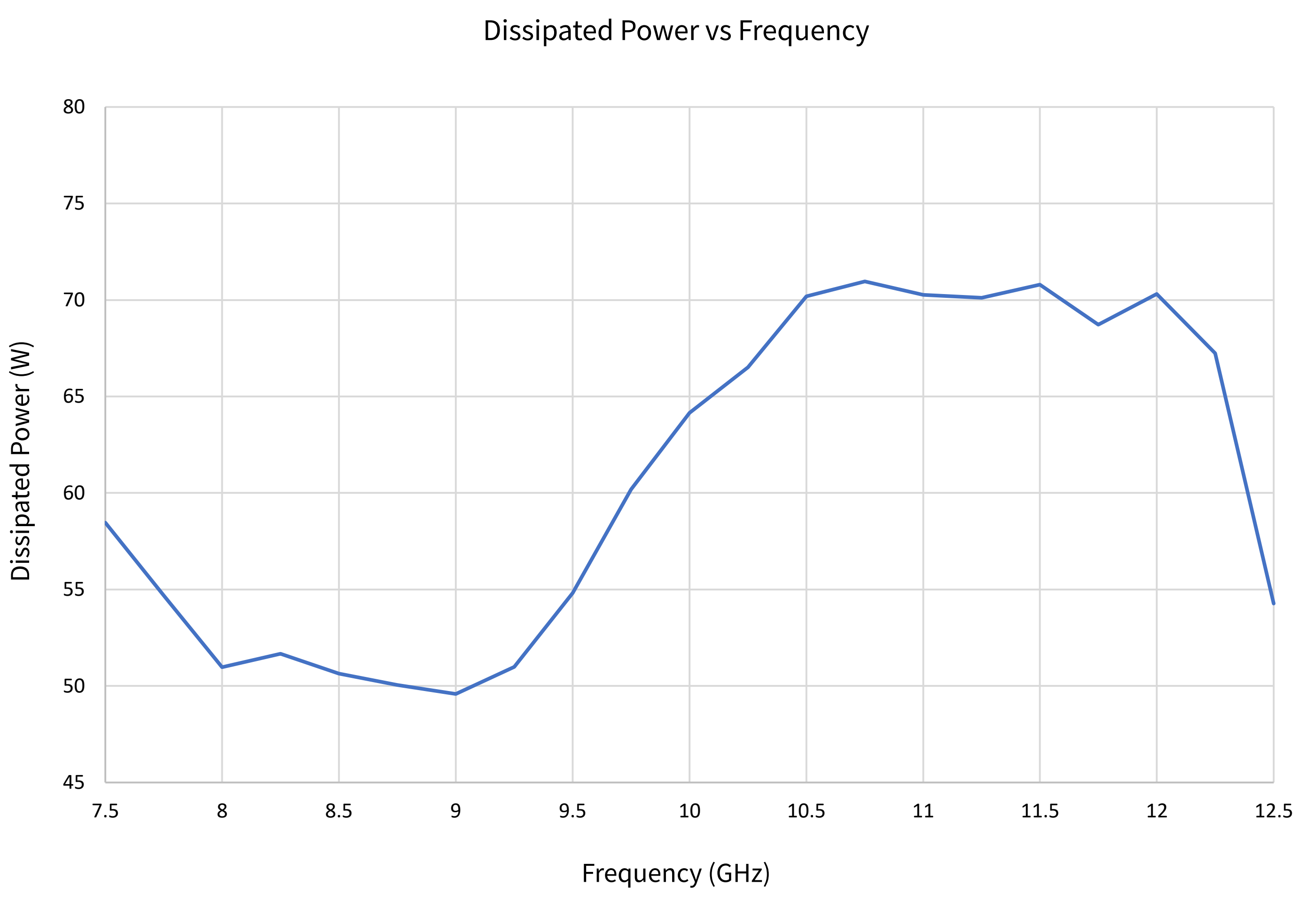


Figure 52. 2f v. P_{OUT} v. V_D, 11 GHz

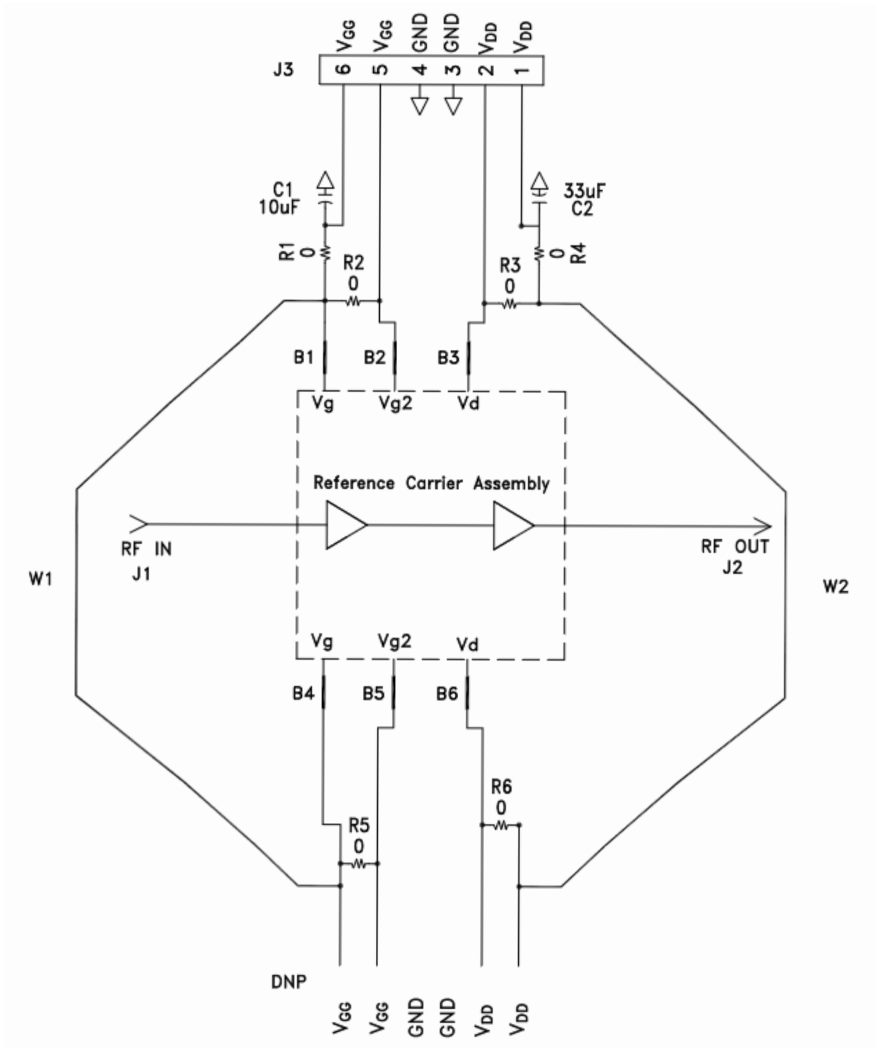
Thermal Characteristics

Parameter	Symbol	Rating	Operating Conditions
Operating Junction Temperature	T_J	186 °C	Pulse Width = 100 uS, Duty Cycle = 10%, P_{Diss} = 71 W, T_{BASE} = 85 °C
Thermal Resistance, Junction to Back of Die	$R_{\theta JC}$	1.42 °C/W	

Power Dissipation v. Frequency (T_{CASE} = 85 °C)



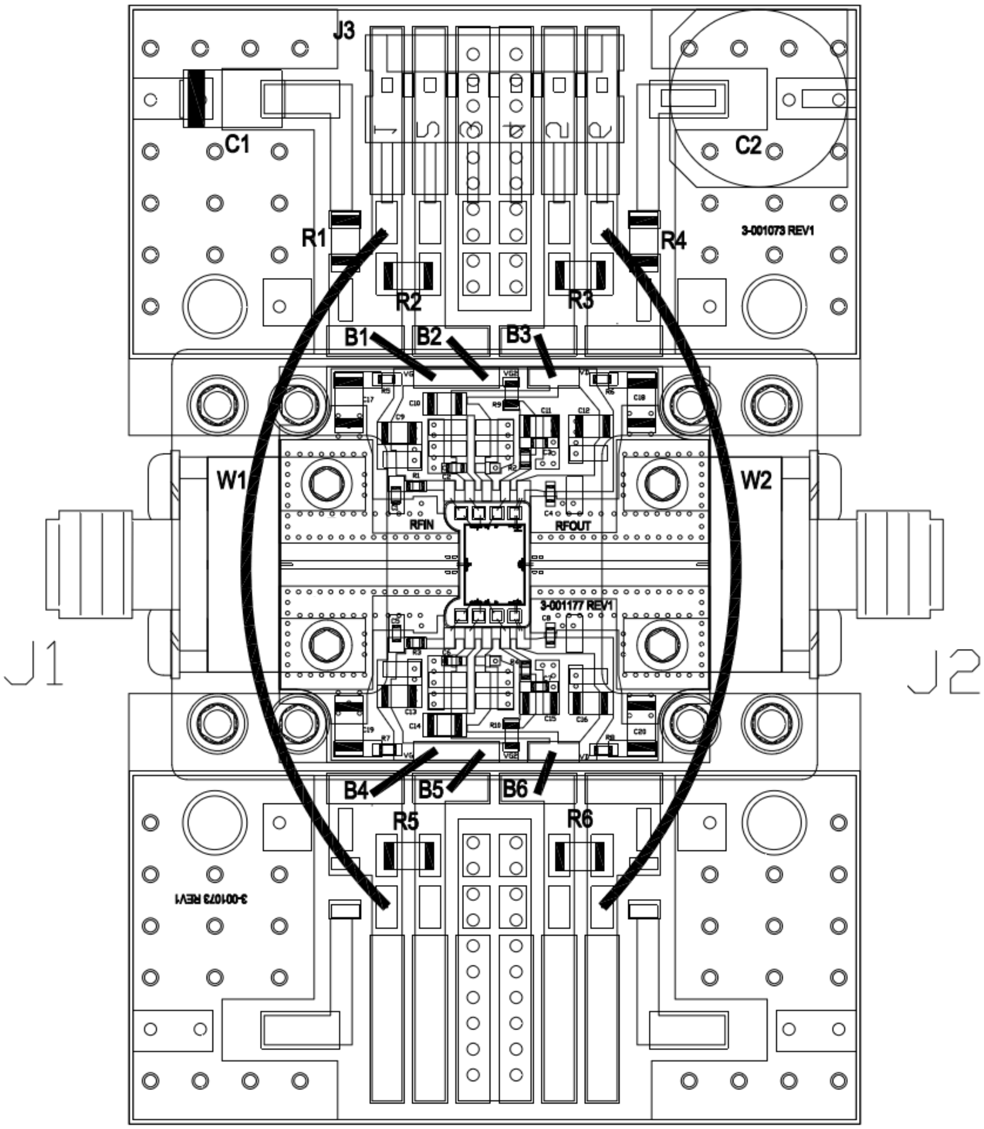
CMPA801B030D1-AMP Evaluation Board Schematic Drawing



CMPA801B030D1-AMP Evaluation Board Bill of Materials

Reference Designator	Description	Qty
J1, J2	CONNECTOR SMA JACK (FEMALE) END LAUNCH	2
J3	6-PIN DC HEADER, RIGHT ANGLE	1
R1 - R6	RESISTOR, 0 OHMS, 1206	6
C1	CAPACITOR, 10 UF, TANTALUM	1
C2	CAPACITOR, 33 UF, ELECTROLYTIC	1
B1 - B6	JUMPER WIRE	6
W1 - W2	WIRE, BLACK, 22 AWG (~2”)	2

CMPA801B030D1-AMP Evaluation Board Assembly Drawing



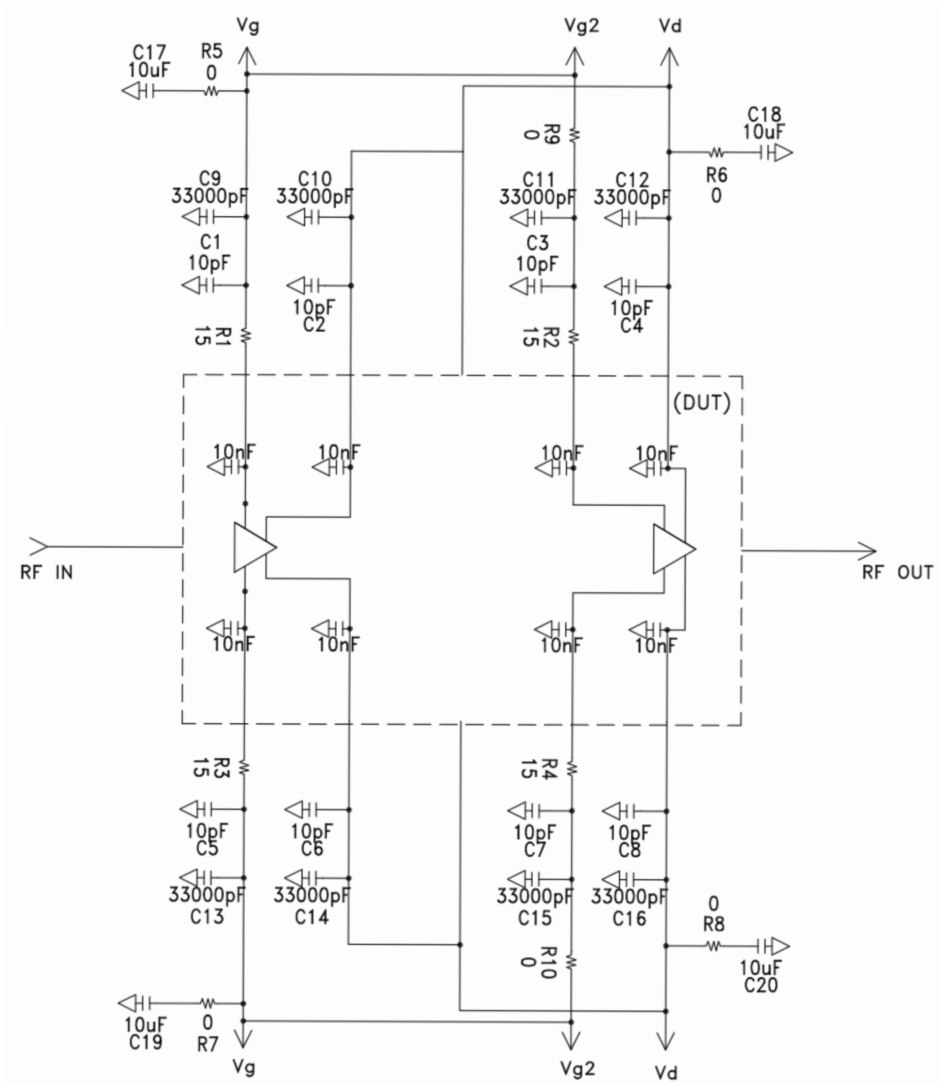
Bias On Sequence

- Ensure RF is turned-off
- Apply pinch-off voltage of -5 V to the gate (V_G)
- Apply nominal drain voltage (V_D)
- Adjust V_G to obtain desired quiescent drain current (I_{DQ})
- Apply RF

Bias Off Sequence

- Turn RF off
- Apply pinch-off to the gate (V_G = -5 V)
- Turn off drain voltage (V_D)
- Turn off gate voltage (V_G)

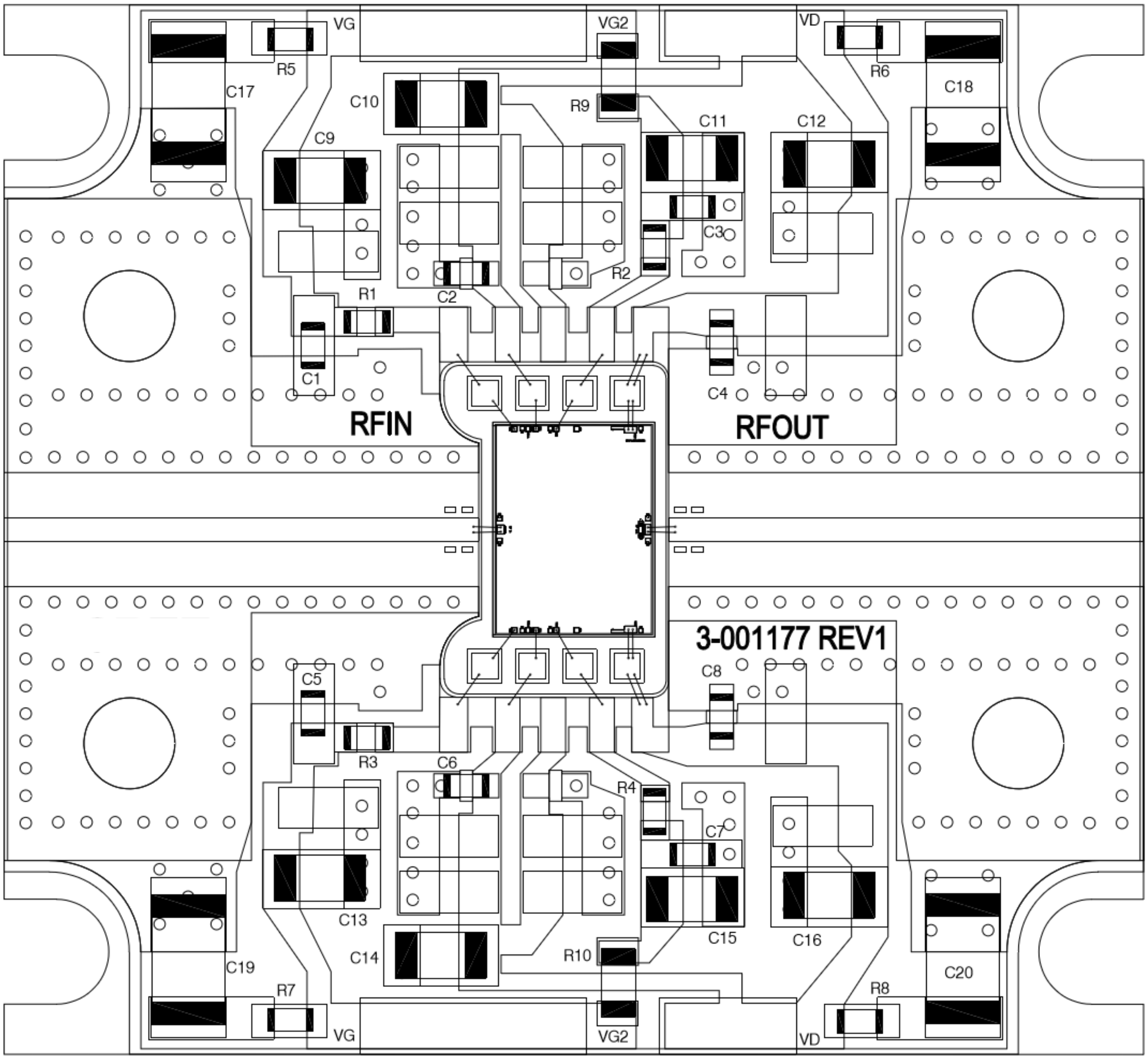
CMPA801B030D1-AMP Carrier Schematic Drawing



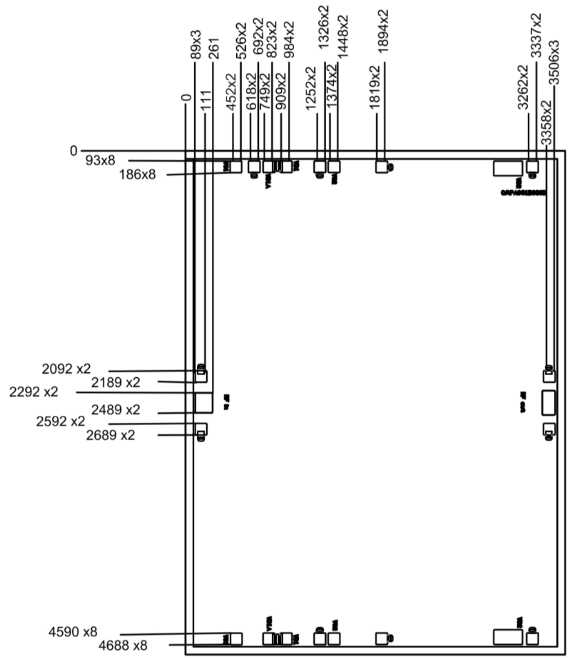
CMPA801B030D1-AMP Carrier Bill of Materials

Reference Designator	Description	Qty
R1 - R4	RESISTOR, 0402, 15 Ohms	4
R5 - R8	RESISTOR, 0402, 0 Ohms	4
R9 - R10	RESISTOR, 0603, 0 Ohms	2
C1 - C8	CAPACITOR, 10 pF, 5%, 0402, ATC	8
C9 - C16	CAPACITOR, 33000 pF, 0805, X7R	8
C17 - C20	CAPACITOR, 10 uF, 1206	4

CMPA801B030D1-AMP Carrier Assembly Drawing



Product Dimensions



Overall Die Size 4780 x 3610 (+0/-50) microns, Die Thickness 100 (+/-10) microns.
All Gate and Drain Pads Must be Wire Bonded for Electrical Connection.

Pad	Function	Description	Pad Size (um)	Note
1	RF-IN	RF-Input Pad. Matched to 50 ohms	190 x 165	4
2	VG1_A	Gate Control for Stage 1. V_G ~ 2.0 - 3.5 V	110 x 110	1, 2
3	VG1_B	Gate Control for Stage 1. V_G ~ 2.0 - 3.5 V	110 x 110	1, 2
4	VD1_A	Drain Supply for Stage 1. V_D = 28 V	110 x 110	1
5	VD1_B	Drain Supply for Stage 1. V_D = 28 V	110 x 110	1
6	VG2_A	Gate Control for Stage 2A. V_G ~ 2.0 - 3.5 V	110 x 110	1, 3
7	VG2_B	Gate Control for Stage 2A. V_G ~ 2.0 - 3.5 V	110 x 110	1, 3
8	VD2_A	Drain Supply for Stage 2A. V_D = 28 V	274 x 140	1
9	VD2_B	Drain Supply for Stage 2B. V_D = 28 V	274 x 140	1
10	RF-OUT	RF-Output Pad. Matched to 50 ohms	150 x 150	4

Notes:
[1] Attach bypass capacitor to pads 2 - 9 per application circuit.
[2] VG1_A and VG1_B are connected internally so it would be enough to connect either one for proper orientation.
[3] VG2_A and VG2_B are connected internally so it would be enough to connect either one for proper orientation.
[4] The RF input and output pad have a ground-signal-ground with a nominal pitch of 1 mil (25 um). The RF ground pads are 110 x 110 microns.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	TBD	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	JEDEC JESD22 C101-C

Product Ordering Information

Part Number	Description	MOQ Increment	Image
CMPA801B030D1	8 - 11 GHz, 40 W GaN MMIC	1 Each	
CMPA801B030D1-AMP	Evaluation Board W/PA	1 Each	

Notes & Disclaimer