

# CMPA801B030D1

8 – 11 GHz, 40 W GaN HPA

## Description

The CMPA801B030D1 is a 40 W MMIC HPA utilizing the high performance, 0.15  $\mu\text{m}$  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

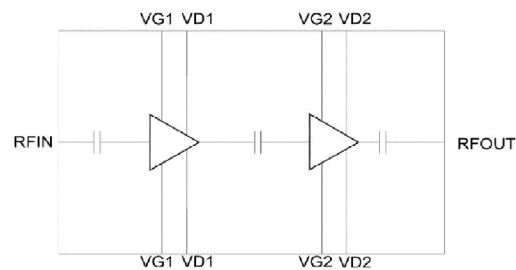


Figure 2. Functional Block Diagram

## 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



## 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	$\Psi$	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,  $PW = 100$   $\mu$ S,  $DC = 10\%$ ,  $T_{BASE} = 25$  °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:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{S}$ ,  $DC = 10\%$ ,  $P_{IN} = 26\text{ dBm}$ ,  $T_{BASE} = 25\text{ }^\circ\text{C}$ , frequency =  $9.5\text{ GHz}$

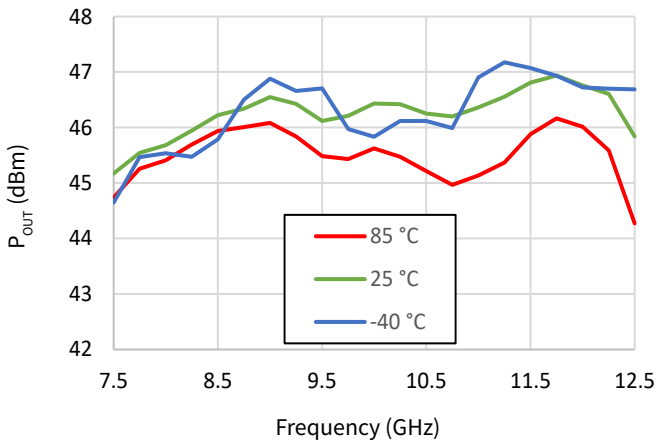


Figure 3.  $P_{OUT}$  v. Frequency v. Temperature

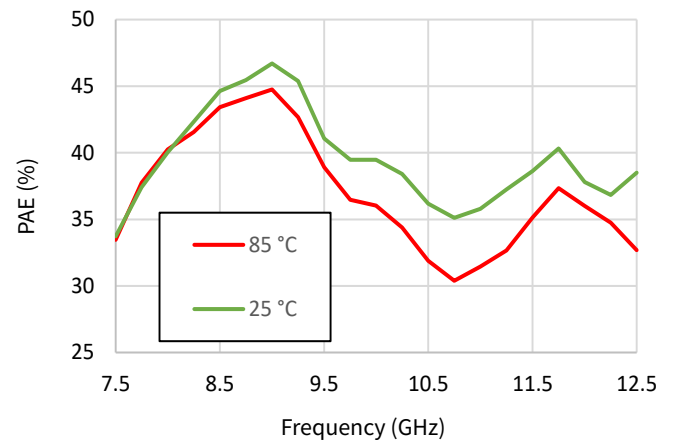


Figure 4. PAE v. Frequency v. Temperature

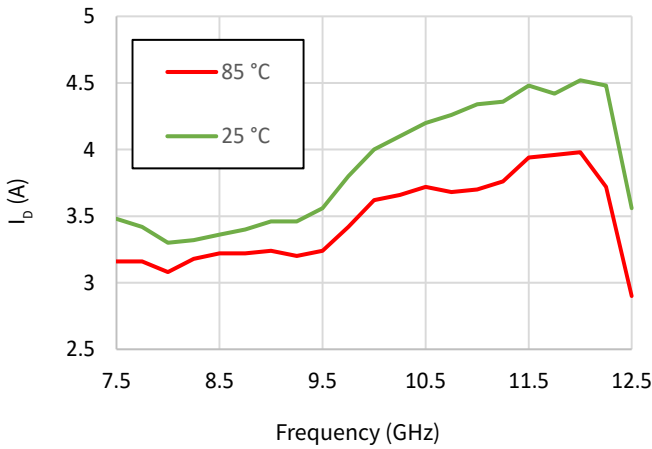


Figure 5.  $I_D$  v. Frequency v. Temperature

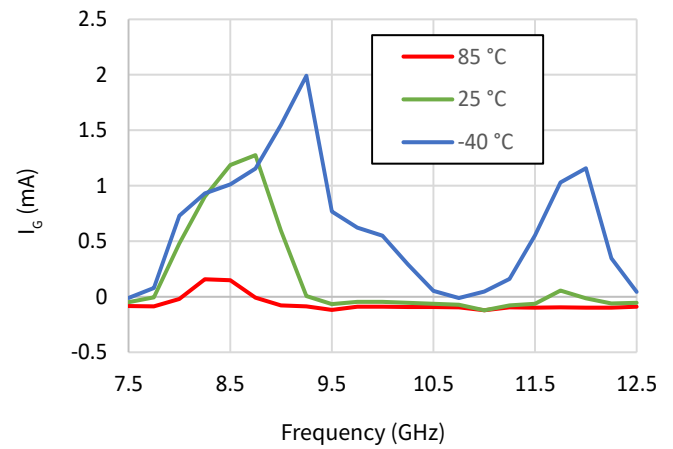


Figure 6.  $I_G$  v. Frequency v. Temperature

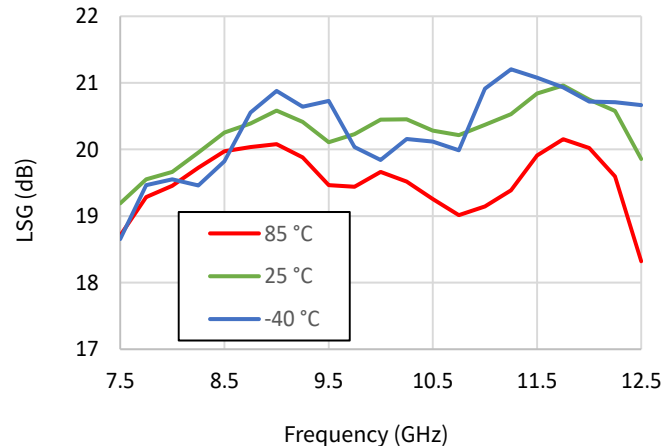


Figure 7. LSG v. Frequency v. Temperature

## Large Signal Performance versus Temperature

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{S}$ ,  $DC = 10\%$ ,  $P_{IN} = 26\text{ dBm}$ ,  $T_{BASE} = 25\text{ }^\circ\text{C}$ , frequency =  $9.5\text{ GHz}$

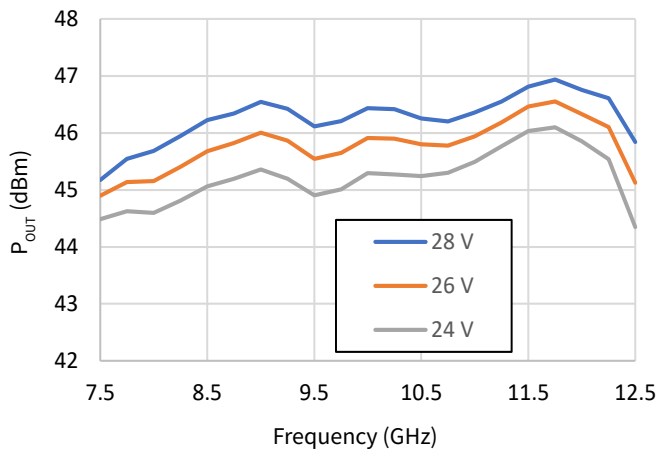


Figure 8.  $P_{OUT}$  v. Frequency v.  $V_D$

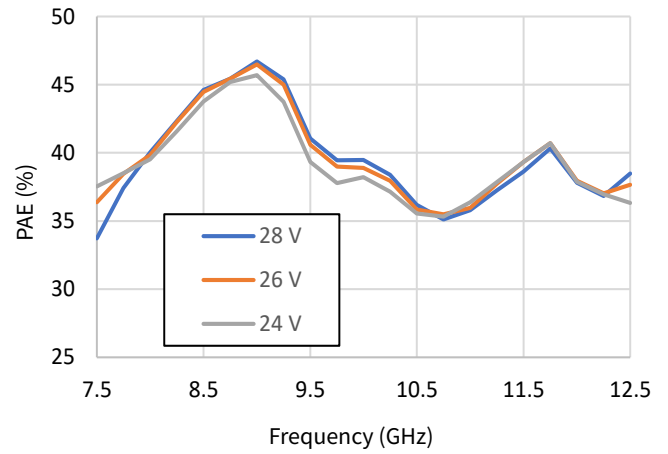


Figure 9. PAE v. Frequency v.  $V_D$

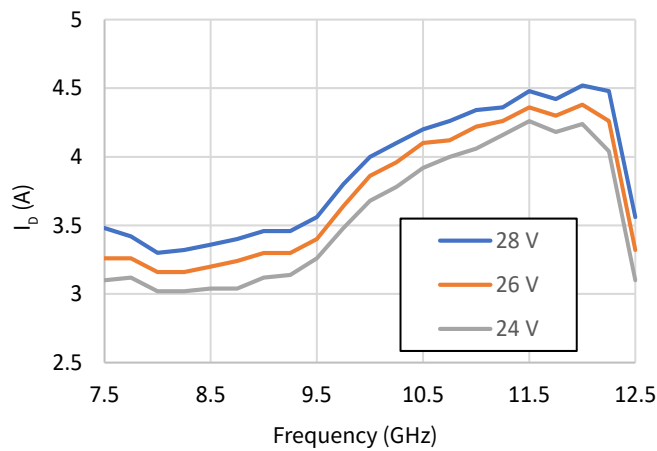


Figure 10.  $I_D$  v. Frequency v.  $V_D$

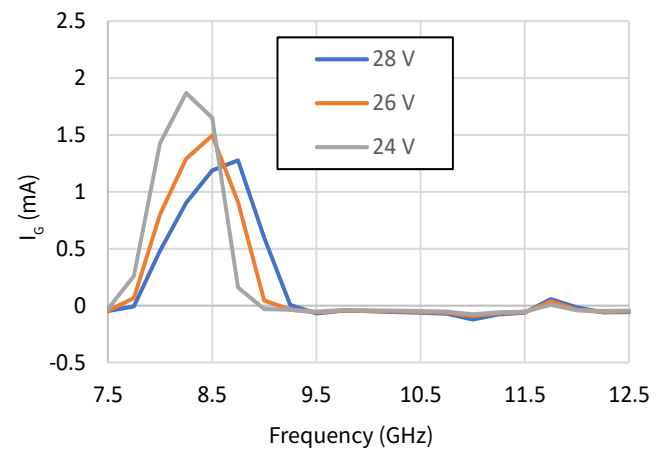


Figure 11.  $I_G$  v. Frequency v.  $V_D$

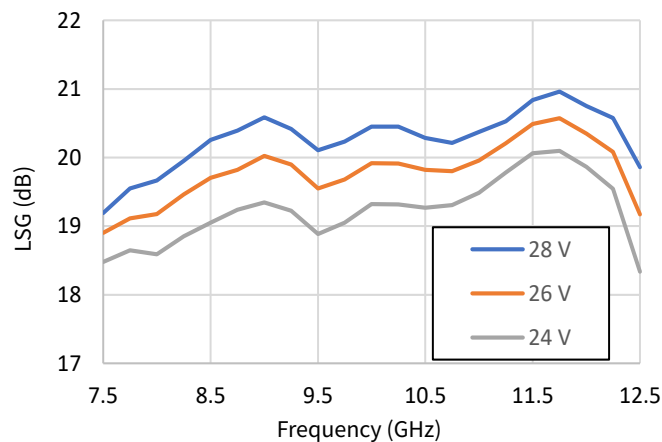


Figure 12. LSG v. Frequency v.  $V_D$

## Large Signal Performance versus $I_{DQ}$

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

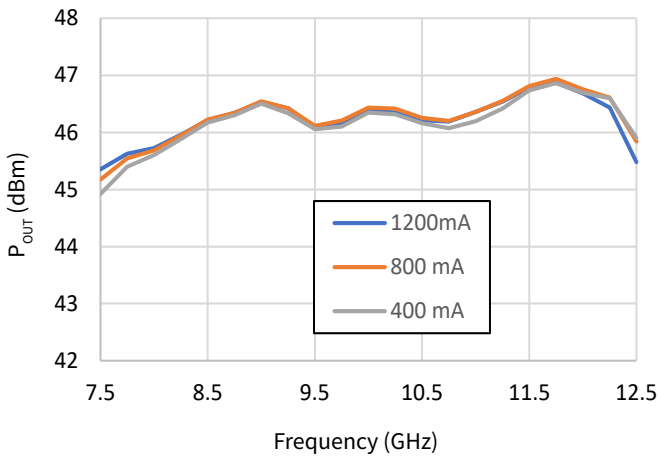


Figure 13.  $P_{OUT}$  v. Frequency v.  $I_{DQ}$

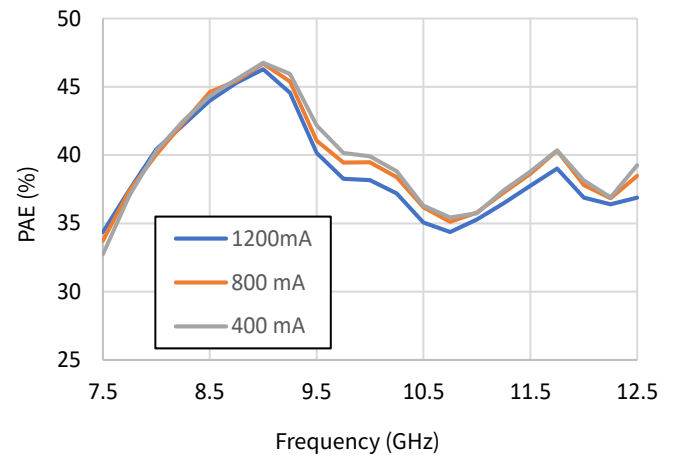


Figure 14. PAE v. Frequency v.  $I_{DQ}$

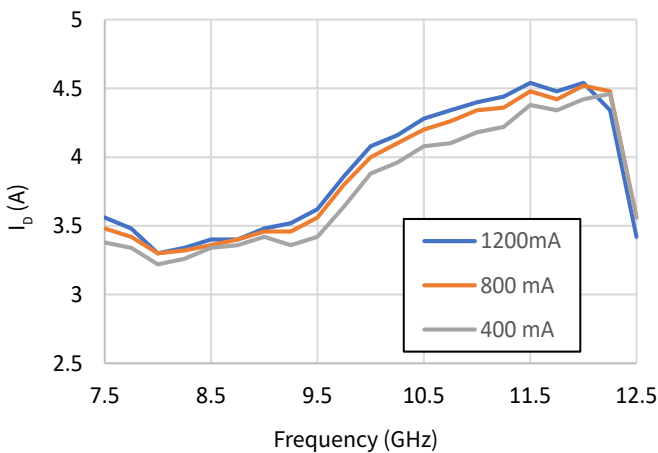


Figure 15.  $I_D$  v. Frequency v.  $I_{DQ}$

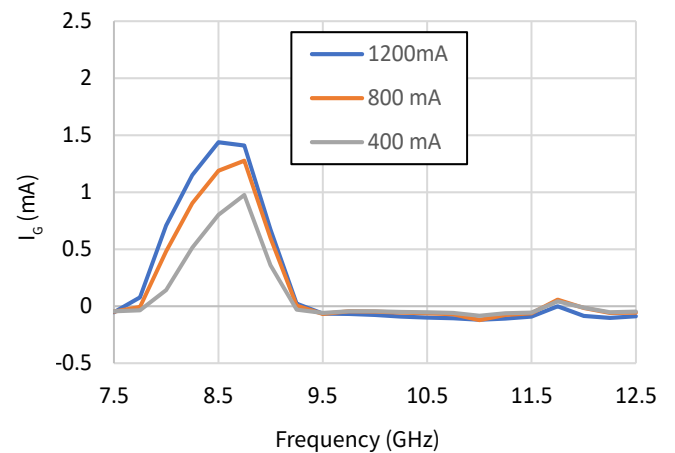


Figure 16.  $I_G$  v. Frequency v.  $I_{DQ}$

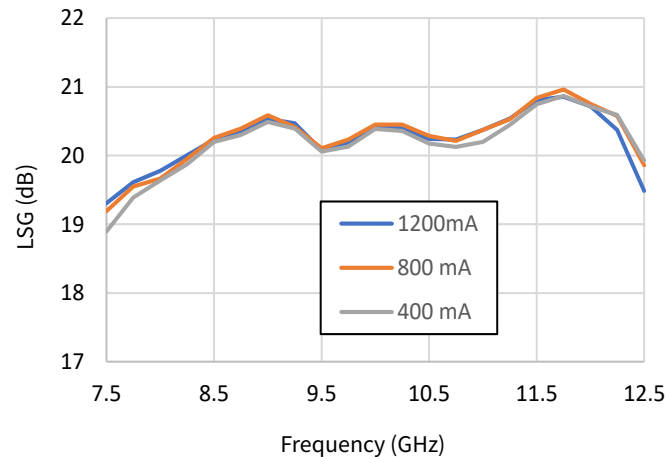


Figure 17. LSG v. Frequency v.  $I_{DQ}$

## Drive-Up versus Frequency

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

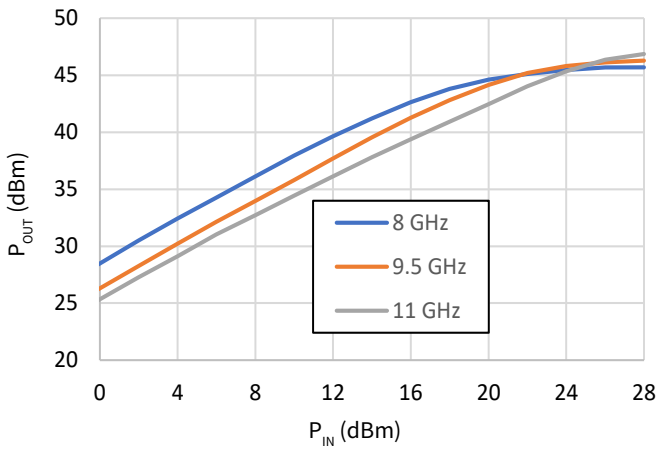


Figure 18.  $P_{OUT}$  v.  $P_{IN}$  v. Frequency

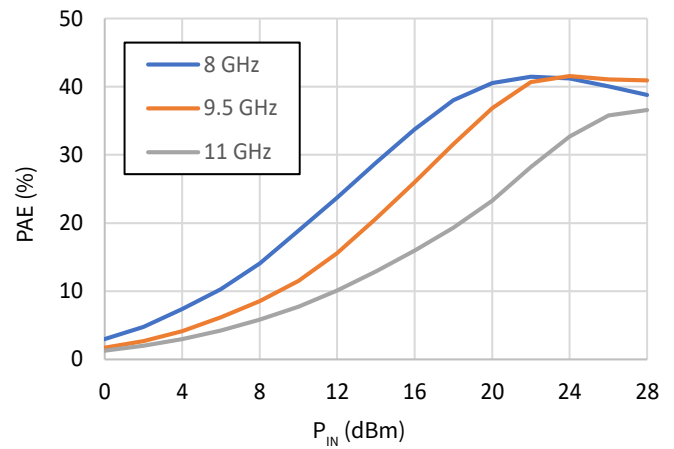


Figure 19. PAE v.  $P_{IN}$  v. Frequency

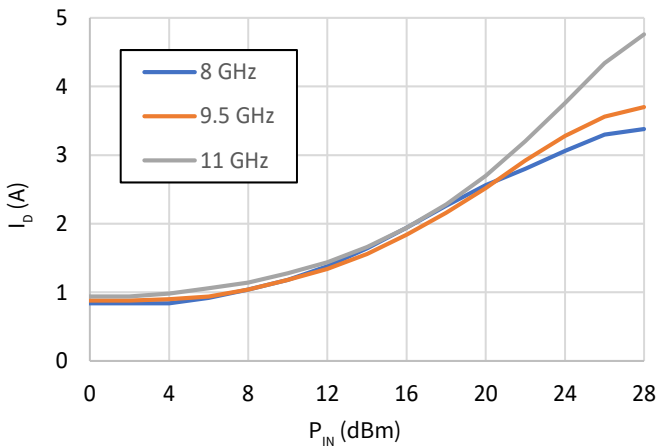


Figure 20.  $I_D$  v.  $P_{IN}$  v. Frequency

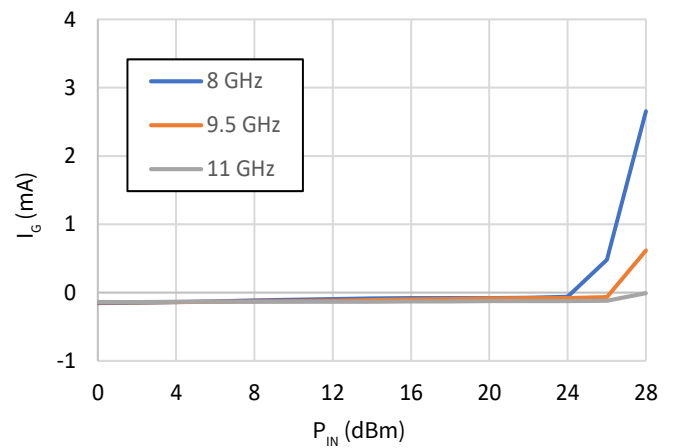


Figure 21.  $I_G$  v.  $P_{IN}$  v. Frequency

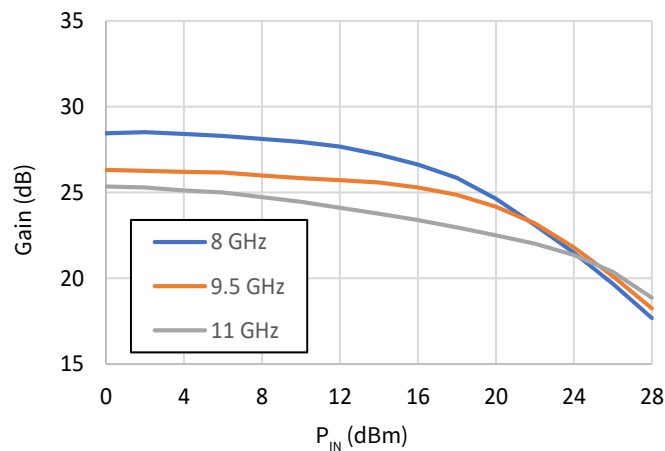


Figure 22. Gain v.  $P_{IN}$  v. Frequency

## Drive-Up versus Temperature

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 26\text{ dBm}$ ,  $T_{BASE} = 25\text{ }^\circ\text{C}$ , frequency =  $9.5\text{ GHz}$

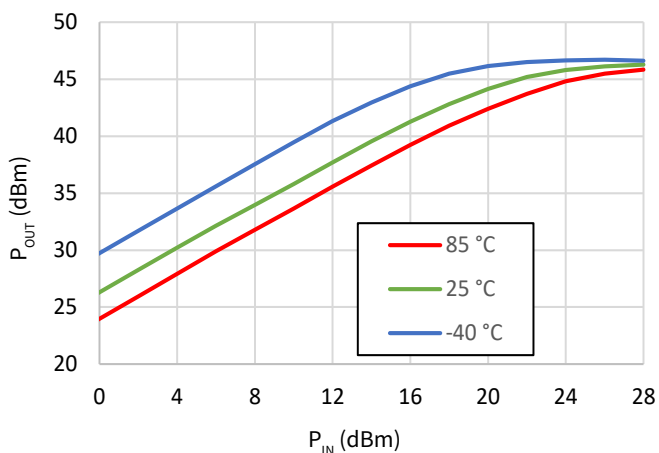


Figure 23.  $P_{OUT}$  v.  $P_{IN}$  v. Temperature

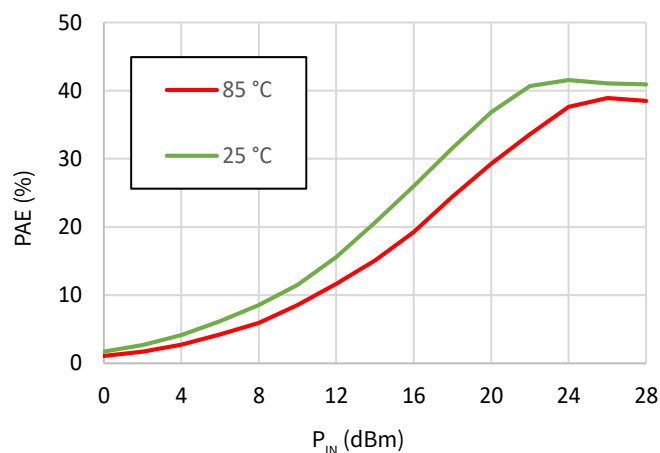


Figure 24. PAE v.  $P_{IN}$  v. Temperature

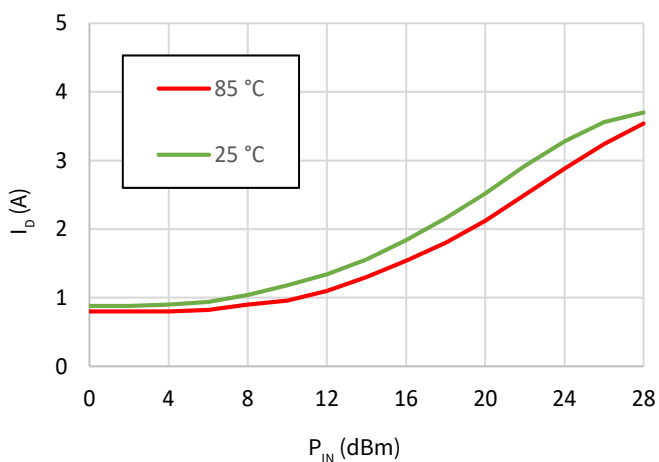


Figure 25.  $I_D$  v.  $P_{IN}$  v. Temperature

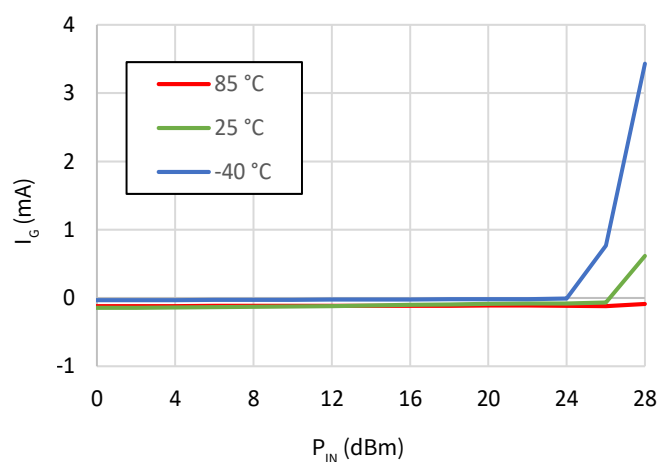


Figure 26.  $I_G$  v.  $P_{IN}$  v. Temperature

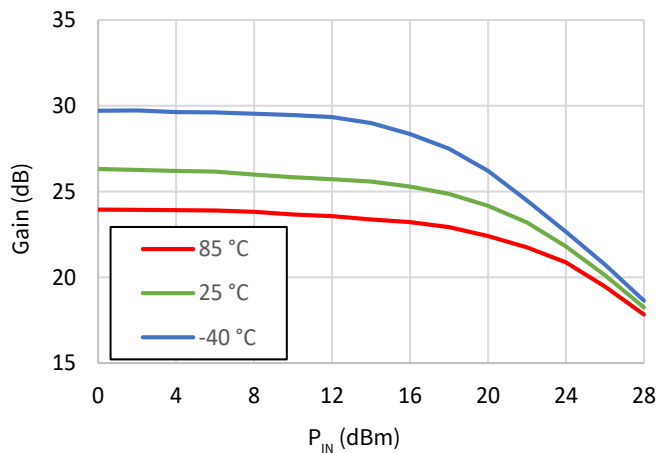


Figure 27. Gain v.  $P_{IN}$  v. Temperature

## Drive-Up versus $V_D$

Test conditions unless otherwise noted:  $V_D = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{IN} = 26\text{ dBm}$ ,  $T_{BASE} = 25\text{ }^\circ\text{C}$ , frequency =  $9.5\text{ GHz}$

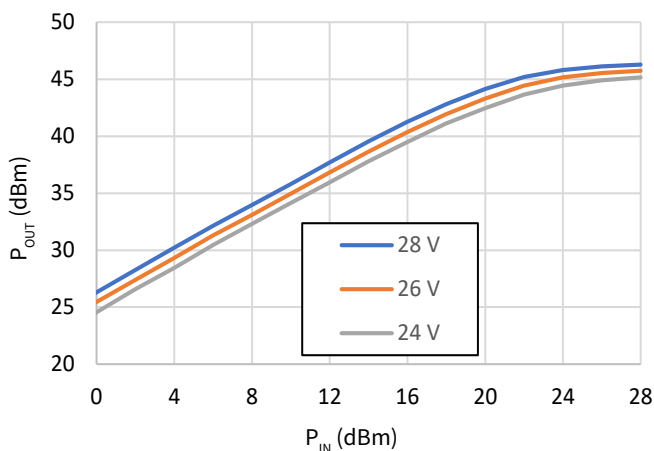


Figure 28.  $P_{OUT}$  v.  $P_{IN}$  v.  $V_D$

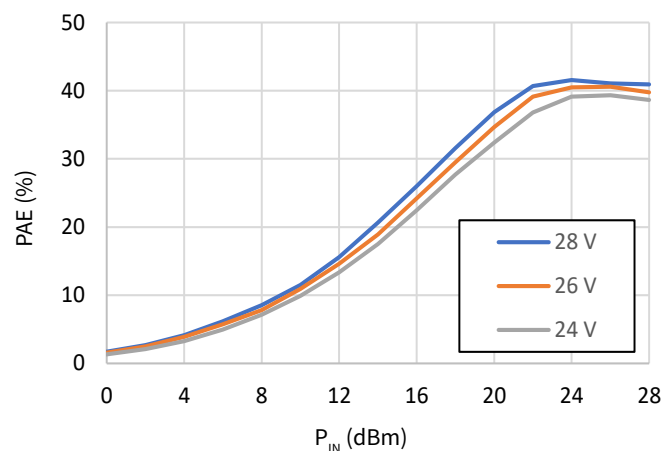


Figure 29. PAE v.  $P_{IN}$  v.  $V_D$

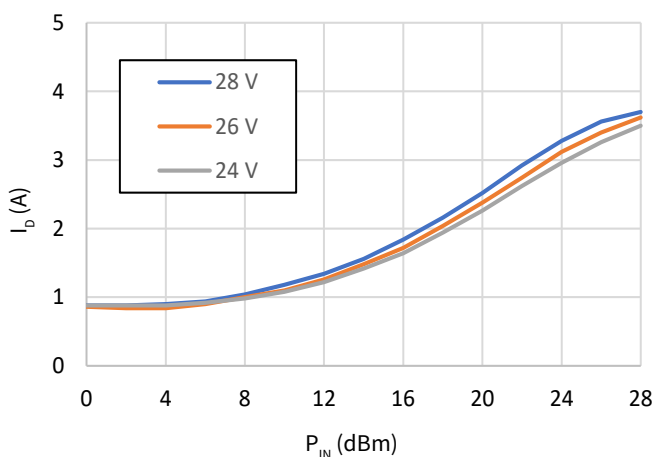


Figure 30.  $I_D$  v.  $P_{IN}$  v.  $V_D$

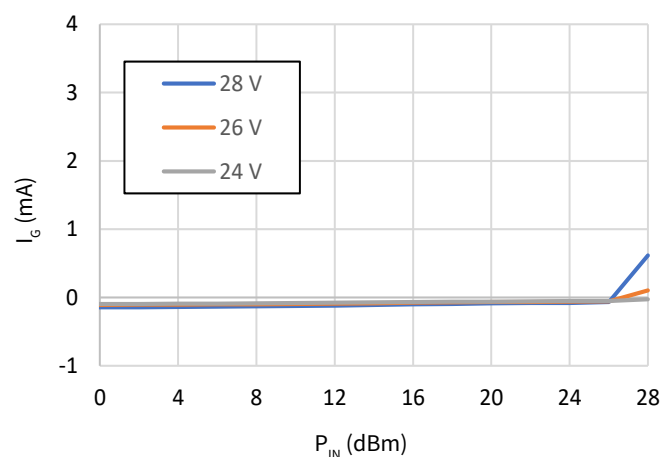


Figure 31.  $I_G$  v.  $P_{IN}$  v.  $V_D$

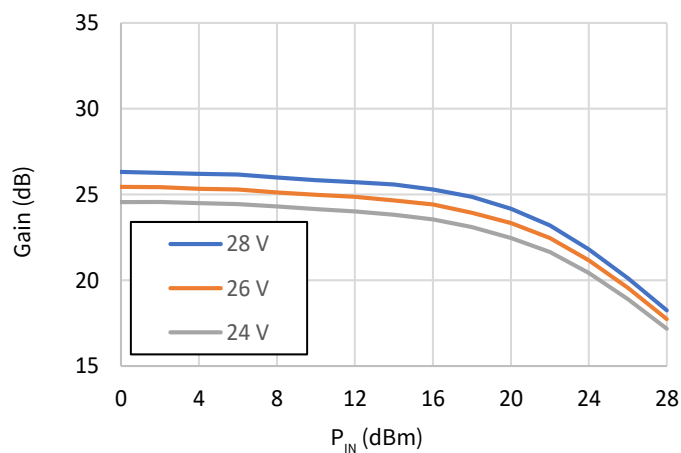


Figure 32. Gain v.  $P_{IN}$  v.  $V_D$



## Drive-Up versus $I_{DQ}$

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

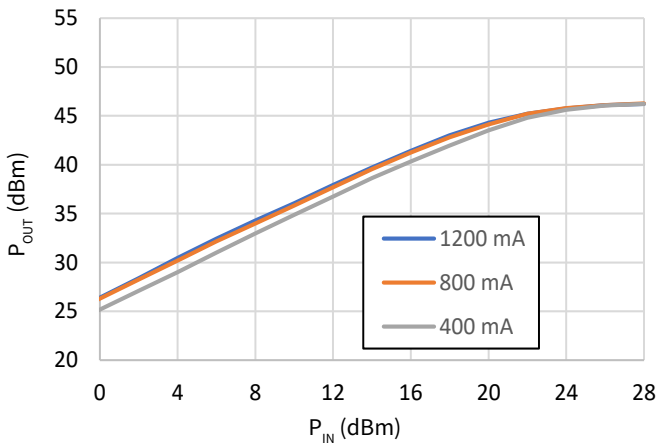


Figure 33.  $P_{OUT}$  v.  $P_{IN}$  v.  $I_{DQ}$

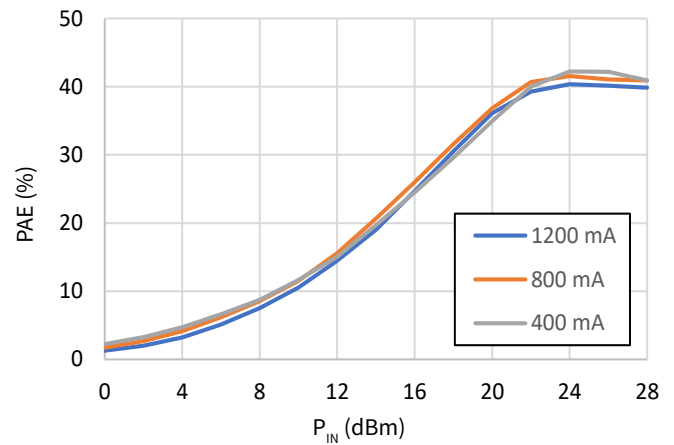


Figure 34. PAE v.  $P_{IN}$  v.  $I_{DQ}$

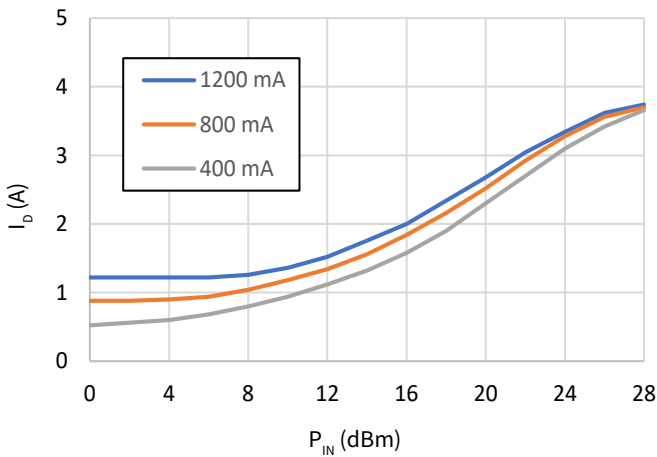


Figure 35.  $I_D$  v.  $P_{IN}$  v.  $I_{DQ}$

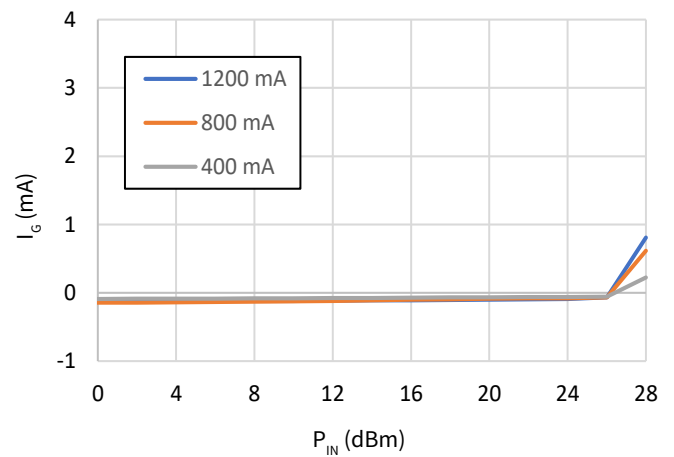


Figure 36.  $I_G$  v.  $P_{IN}$  v.  $I_{DQ}$

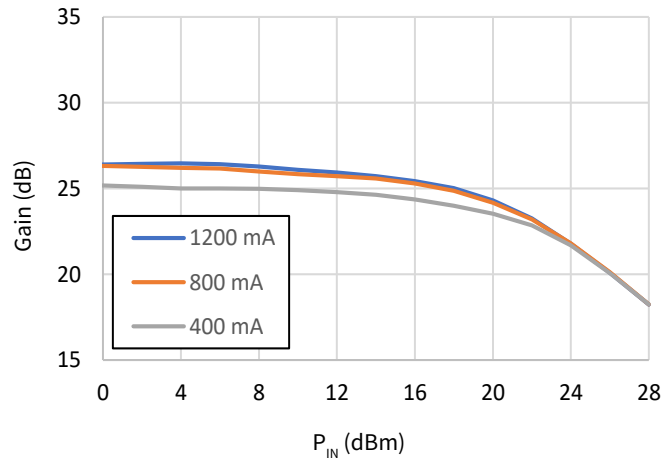


Figure 37. Gain v.  $P_{IN}$  v.  $I_{DQ}$

## 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

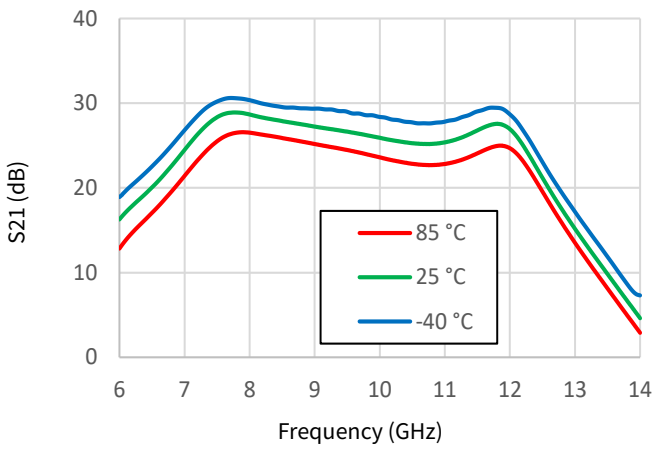


Figure 38. S21 v. Frequency v. Temperature

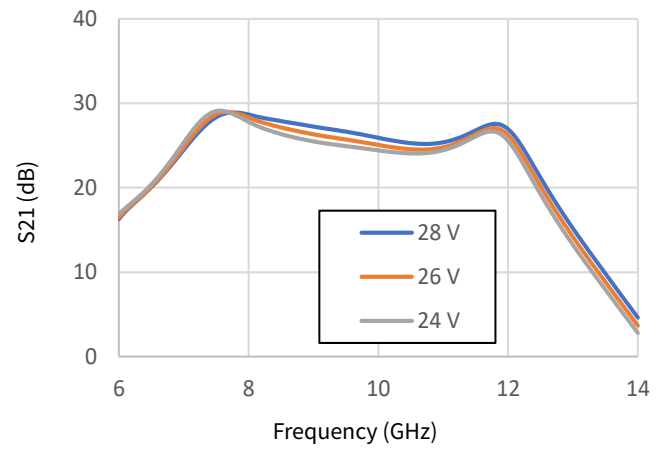


Figure 39. S21 v. Frequency v.  $V_D$

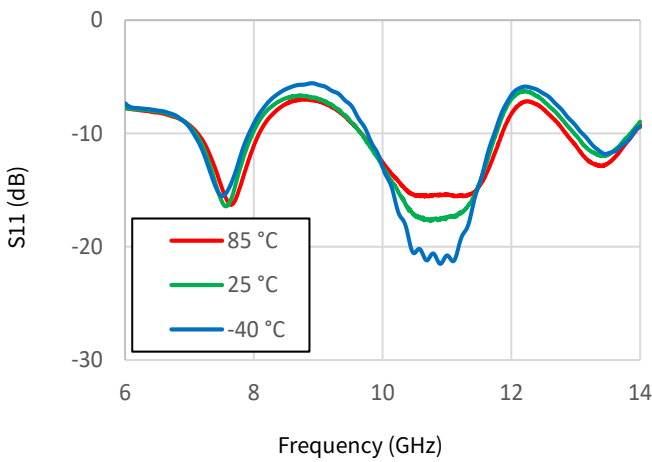


Figure 40. S11 v. Frequency v. Temperature

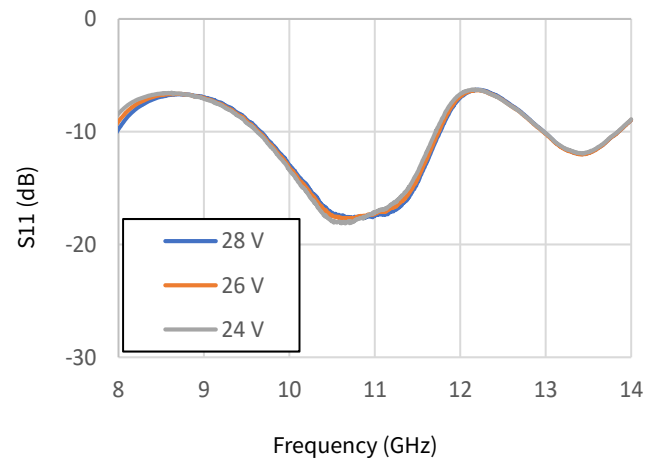


Figure 41. S11 v. Frequency v.  $V_D$

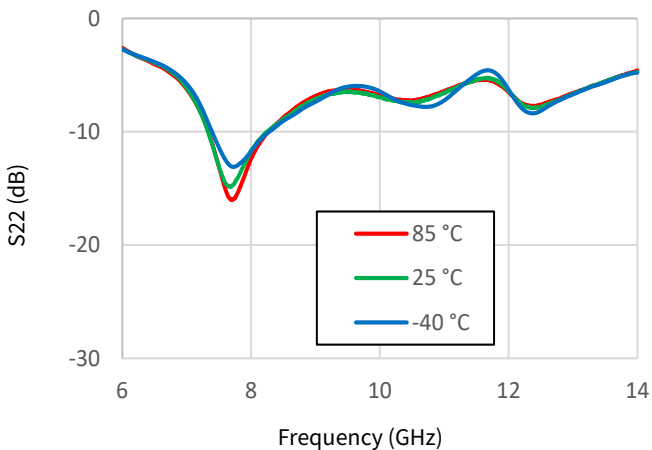


Figure 42. S22 v. Frequency v. Temperature

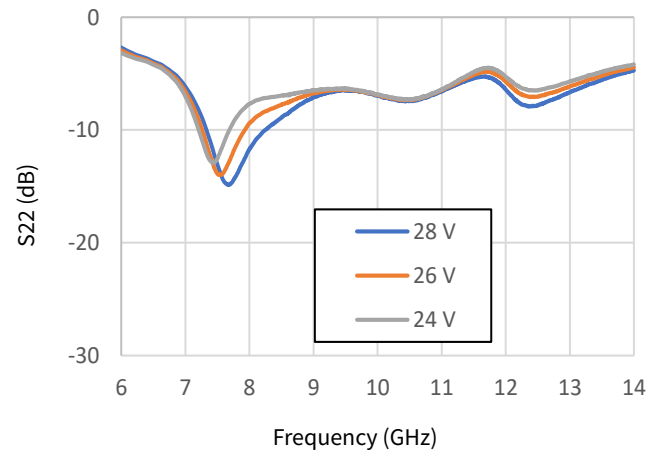


Figure 43. S22 v. Frequency v.  $V_D$

## 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

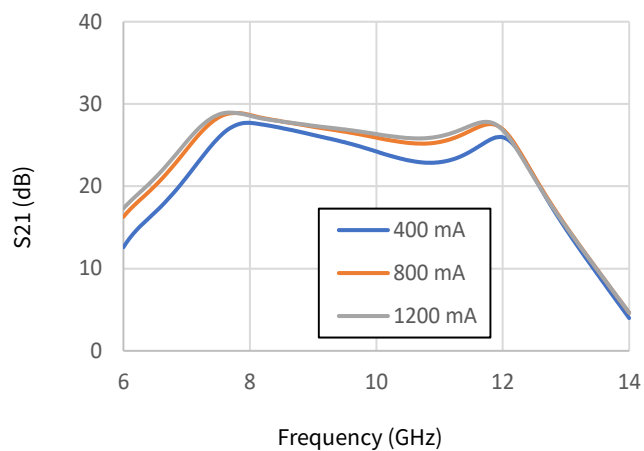


Figure 44. S21 v. Frequency v.  $I_{DQ}$

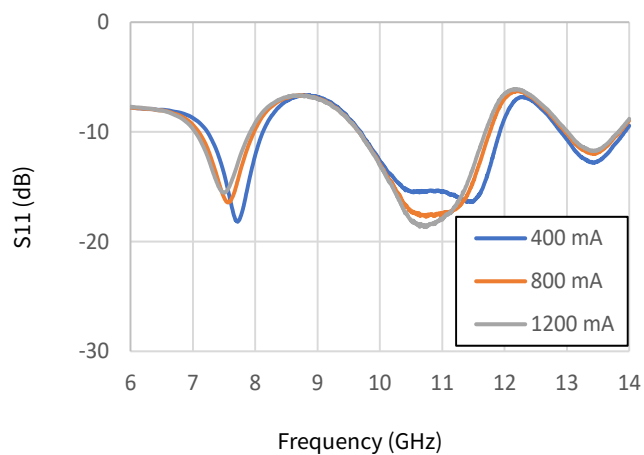


Figure 45. S11 v. Frequency v.  $I_{DQ}$

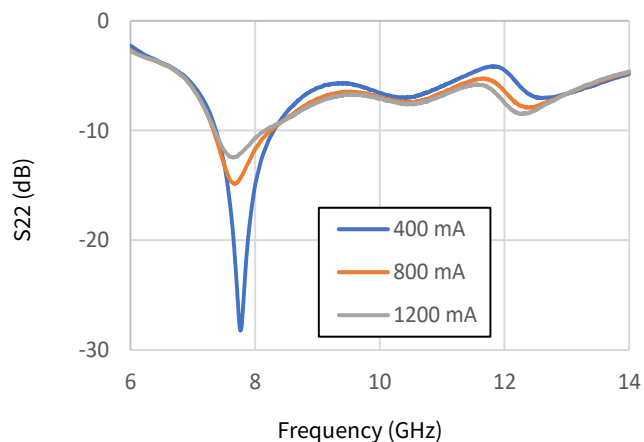


Figure 46. S22 v. Frequency v.  $I_{DQ}$

## Harmonics

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

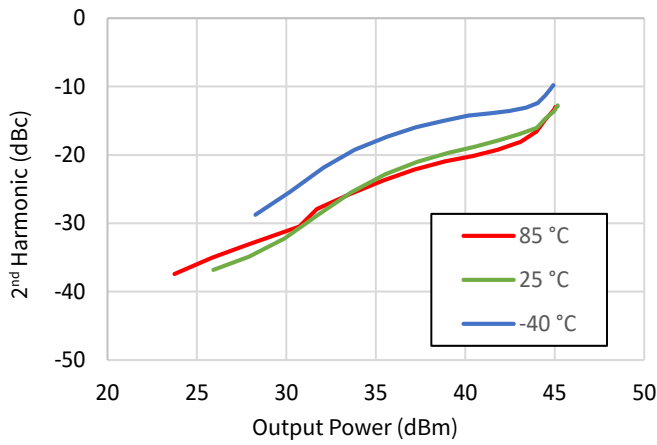


Figure 47. 2f v.  $P_{OUT}$  v. Temperature, 8 GHz

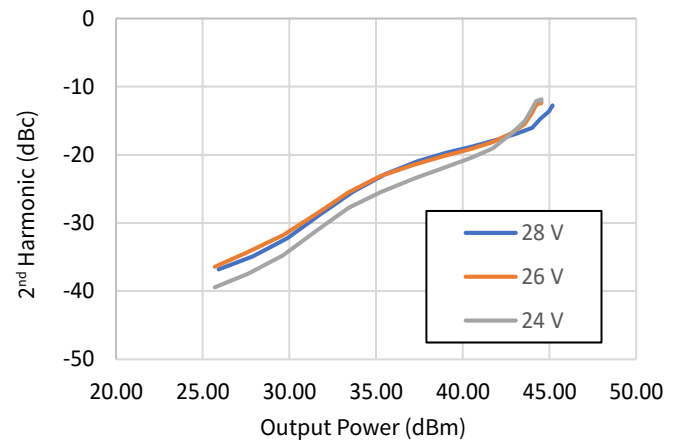


Figure 48. 2f v.  $P_{OUT}$  v.  $V_D$ , 8 GHz

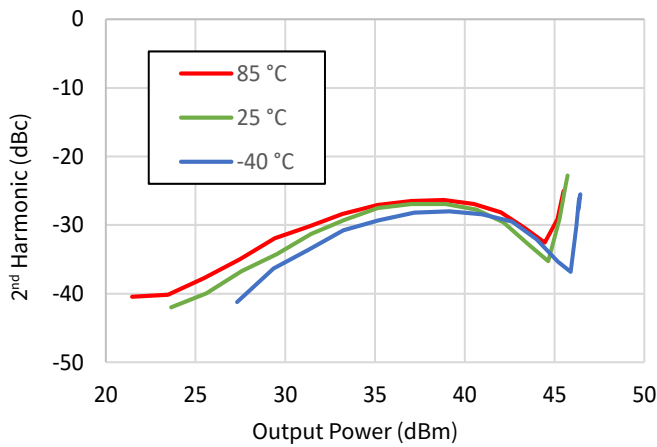


Figure 49. 2f v.  $P_{OUT}$  v. Temperature, 9.5 GHz

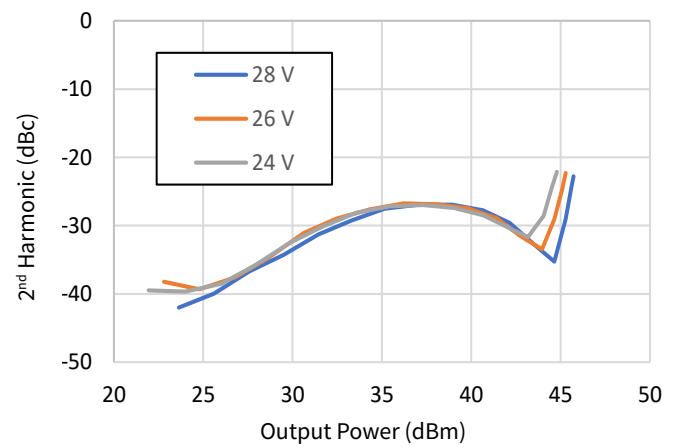


Figure 50. 2f v.  $P_{OUT}$  v.  $V_D$ , 9.5 GHz

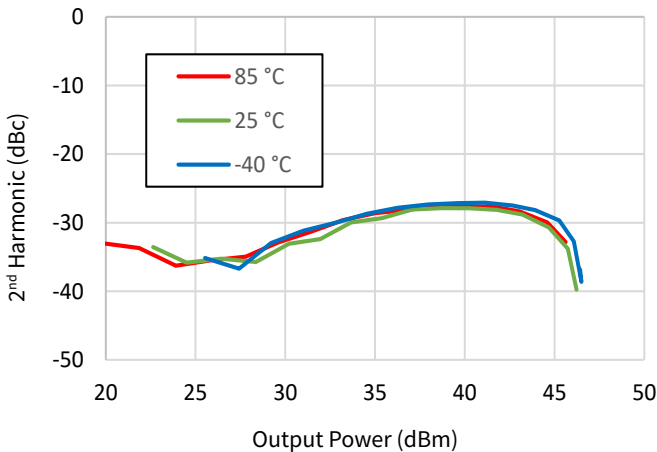


Figure 51. 2f v.  $P_{OUT}$  v. Temperature, 11 GHz

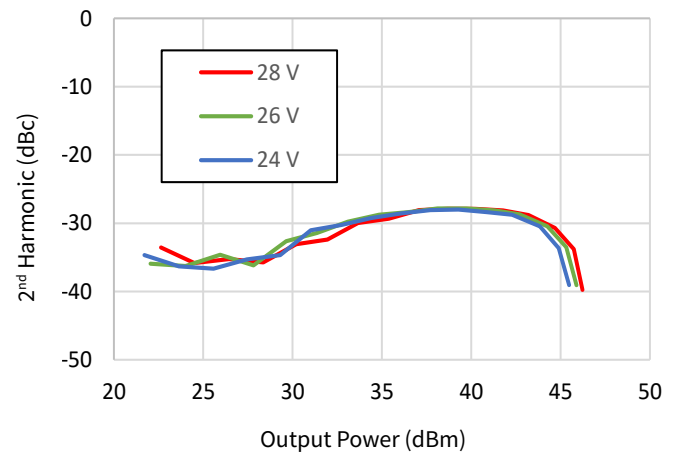
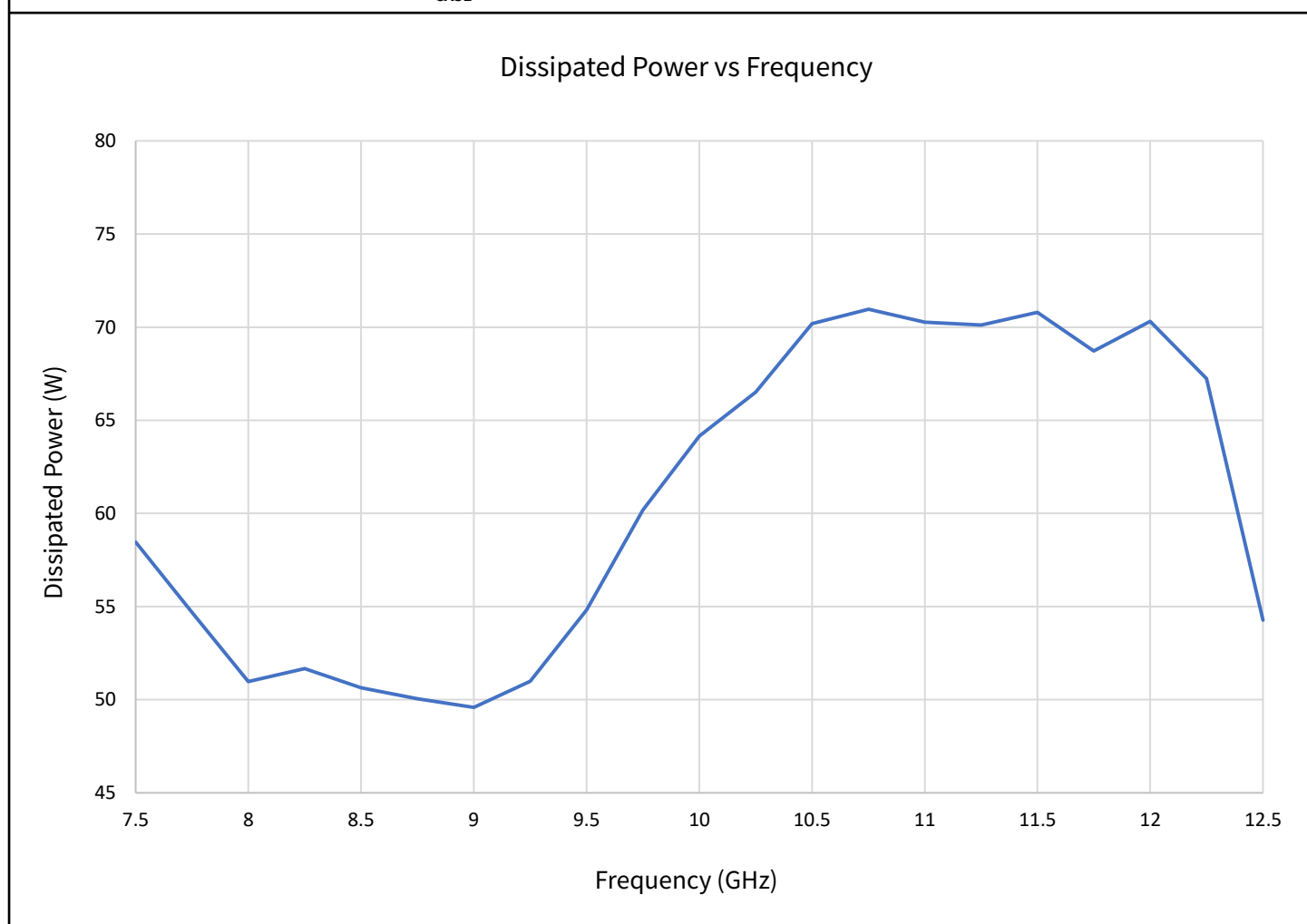


Figure 52. 2f v.  $P_{OUT}$  v.  $V_D$ , 11 GHz

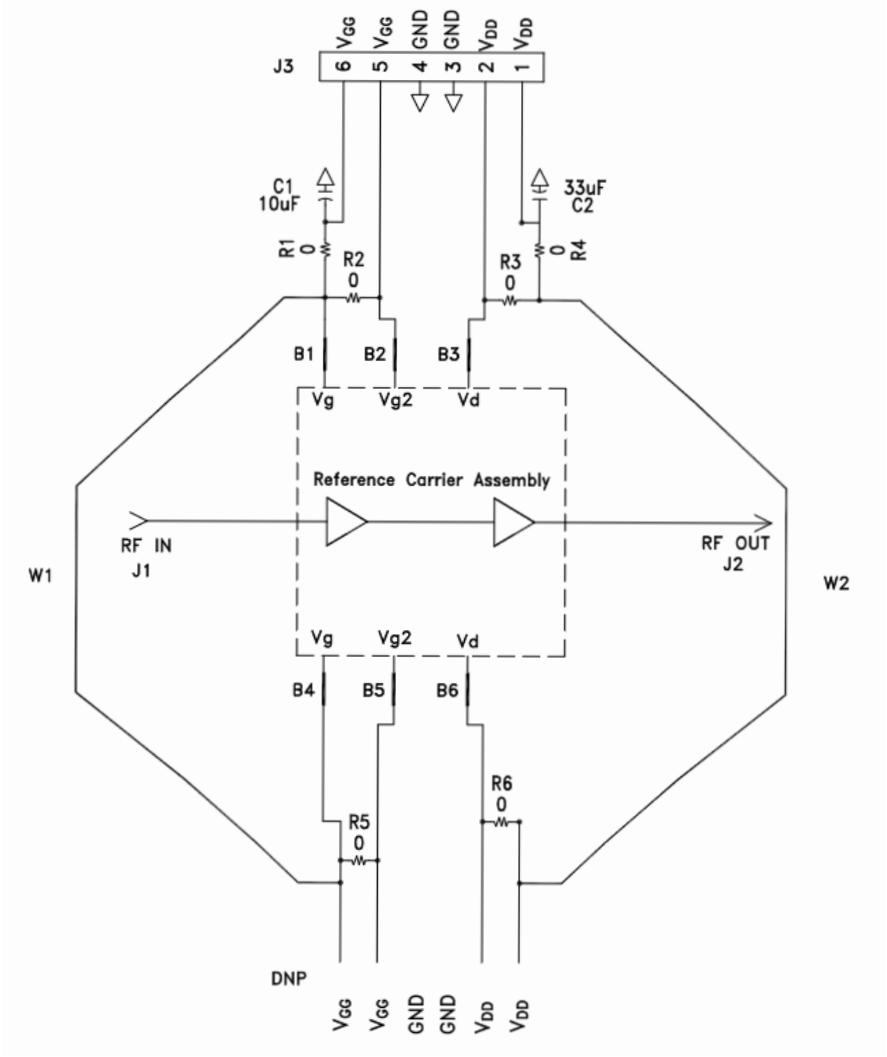
## Thermal Characteristics

Parameter	Symbol	Rating	Operating Conditions
Operating Junction Temperature	$T_J$	186 °C	Pulse Width = 100 $\mu$ S, 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)



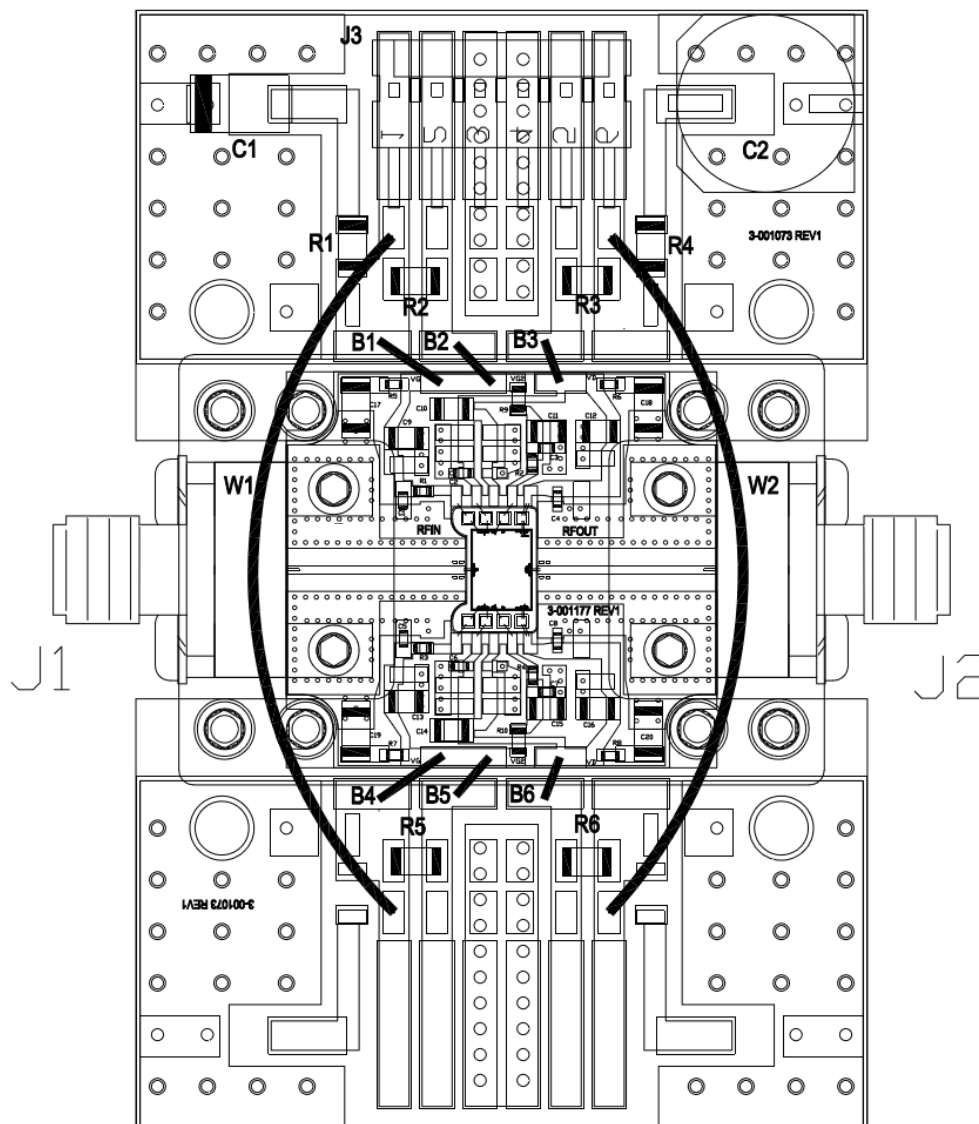
CMPA801B030D1-AMP Evaluation Board Schematic Drawing



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



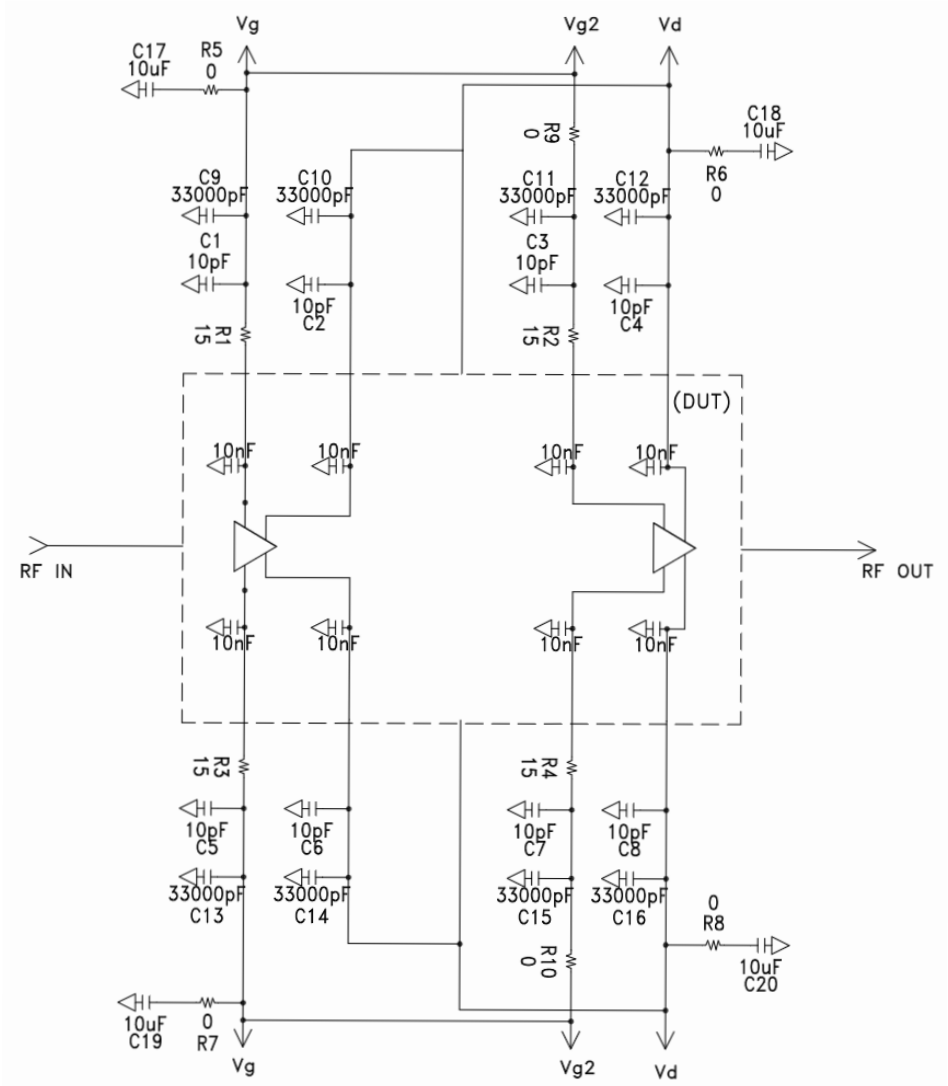
### Bias On Sequence

- 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

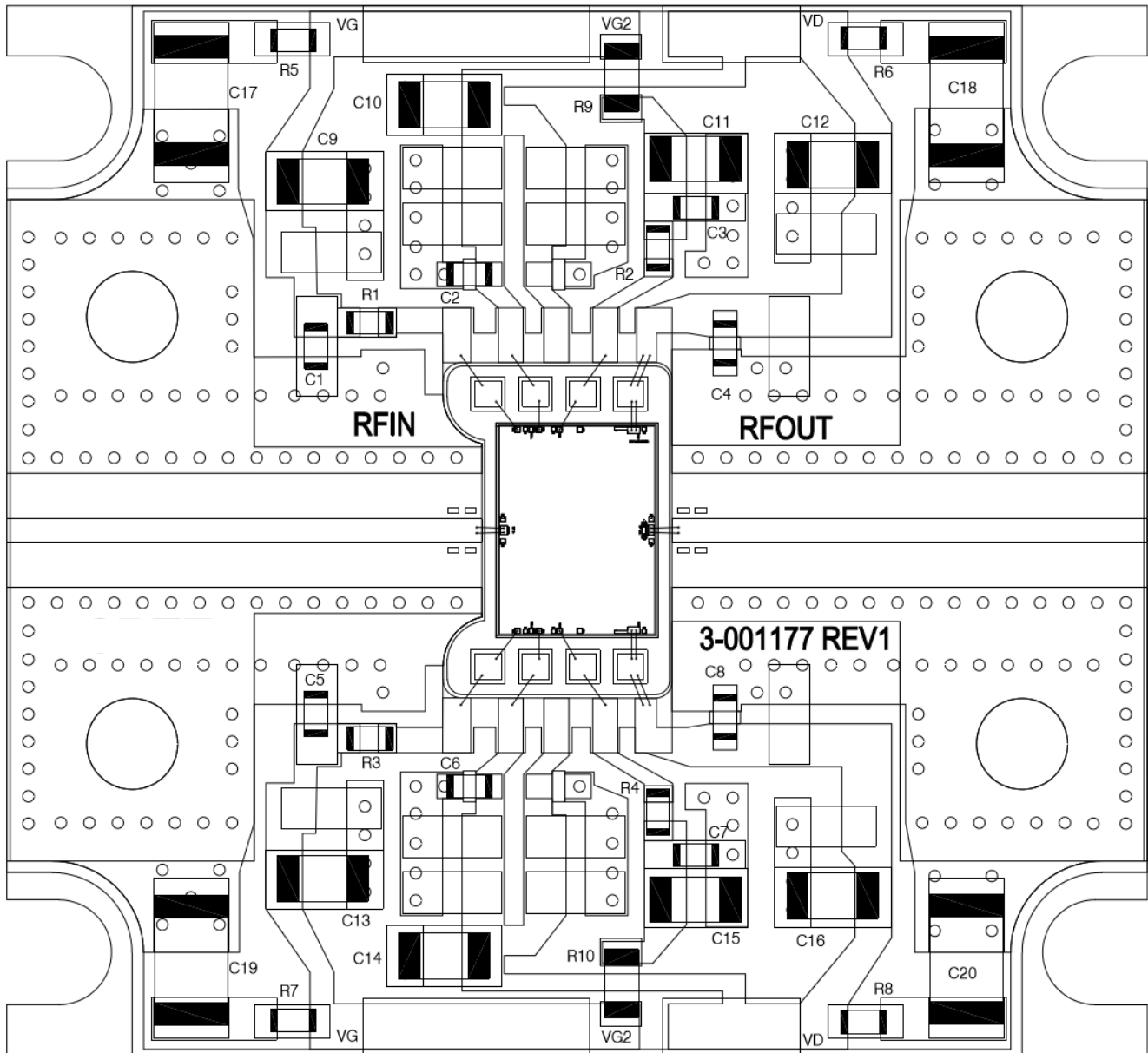


CMPA801B030D1-AMP Carrier Bill of Materials

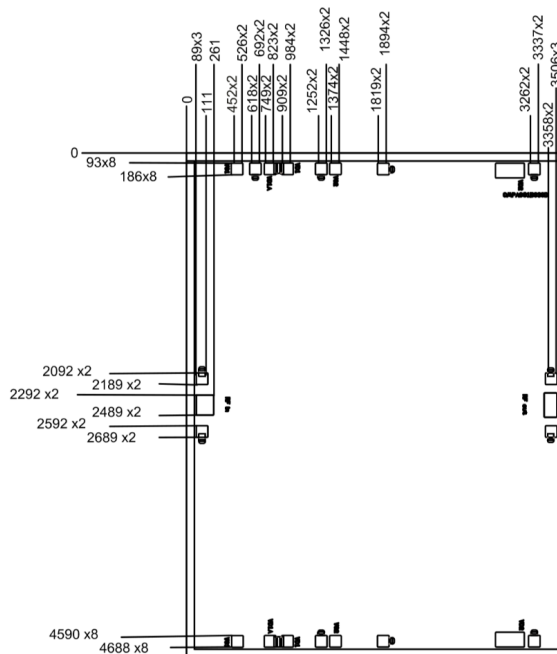
Reference Designator	Description	Qty
R1 - R4	RESISTOR, 0402, 15 Ohms	4
R5 - R8	RESISTOR, 0402, 0 Ohms	4
R9 - R10	RESISTOR, 0603, 0 Ohms	2
C1 - C8	CAPACITOR, 10 pF, 5%, 0402, ATC	8
C9 - C16	CAPACITOR, 33000 pF, 0805, X7R	8
C17 - C20	CAPACITOR, 10 uF, 1206	4



# **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. $V_G \sim 2.0 - 3.5$ V	110 x 110	1, 2
3	VG1_B	Gate Control for Stage 1. $V_G \sim 2.0 - 3.5$ 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. $V_G \sim 2.0 - 3.5$ V	110 x 110	1, 3
7	VG2_B	Gate Control for Stage 2A. $V_G \sim 2.0 - 3.5$ 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:

<sup>1</sup> Attach bypass capacitor to pads 2 - 9 per application circuit.

<sup>2</sup> VG1\_A and VG1\_B are connected internally so it would be enough to connect either one for proper orientation.


<sup>3</sup> VG2\_A and VG2\_B are connected internally so it would be enough to connect either one for proper orientation.

<sup>4</sup> 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

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