CMPA601J025D

6.0 – 18.0 GHz, 25 W GaN HPA

Description

The CMPA601J025D is a 25 W, MMIC HPA utilizing the high performance, 0.15 um GaN on SiC production process. The CMPA601J025D operates from 6 – 18 GHz and supports a variety of end applications such as electronic warfare, test instrumentation, radar, and general amplification. The CMPA601J025D achieves 25 W of saturated output power with 20 dB of large signal gain and 20% power-added efficiency under CW operation.

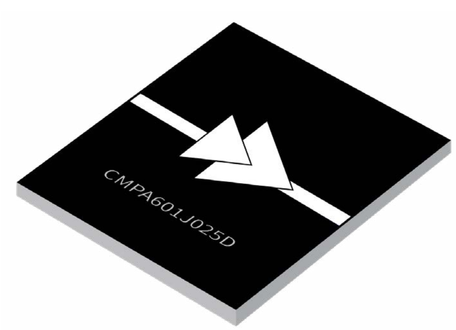

Figure 1. CMPA601J025D

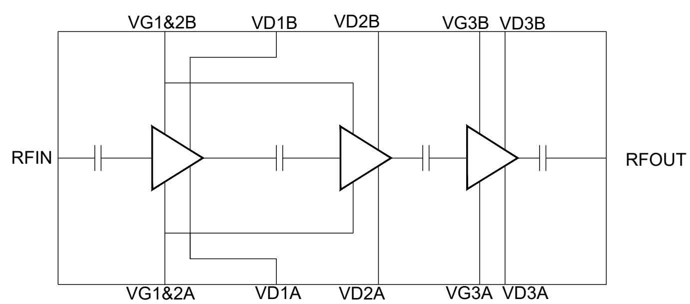

Figure 2. Functional Block Diagram

Features

- P_{sat}: 25 W
- PAE: 20 %
- LSG: 20 dB
- S21: 30 dB
- S11: <-11 dB
- S22: <-7 dB
- CW operation

Applications

- Electronic warfare
- Test instrumentation
- Radar
- Broadband amplifiers

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

RoHS compliant

Absolute Maximum Ratings

Parameter	Symbol	Units	Value	Conditions
Drain Voltage	V_D	V	22	25 °C
Gate Voltage	V_G	V	-10, +2	25 °C
Drain Current	I_D	A	5.9	25 °C
Gate Current	I_G	mA	11	25 °C
Input Power	P_{IN}	dBm	24	CW Operation Only
Dissipated Power	P_{DISS}	W	130	85 °C
Storage Temperature	T_{STG}	°C	-55, +150	
Mounting Temperature	T_J	°C	320	30 Seconds
Junction Temperature	T_J	°C	225	MTTF >=1E6 Hours
Output Mismatch Stress	VSWR	Ψ	3:1	

Recommended Operating Conditions

Parameter	Symbol	Units	Typical Value	Conditions
Drain Voltage	V_D	V	22	
Gate Voltage	V_G	V	-1.7	
Drain Current	I_{DQ}	A	>1.2	
Input Power	P_{IN}	dBm	24	CW Operation Only
Case Temperature	T_{CASE}	°C	-40 to 85	

RF Specifications

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, CW, T_{BASE} = 25 °C

Parameter	Units	Frequency	Min.	Typical	Max.	Conditions
Frequency	GHz		6		18	
Output Power	dBm	6.0 GHz		43.6		P_{IN} = 24 dBm
		9.5 GHz		45.7		
		14.0 GHz		43.7		
		18.0 GHz		43.9		
Power-Added Efficiency	%	6.0 GHz		32		P_{IN} = 24 dBm
		9.5 GHz		30		
		14.0 GHz		18		
		18.0 GHz		23		
LSG	dB	6.0 GHz		19.6		P_{IN} = 24 dBm
		9.5 GHz		21.7		
		14.0 GHz		19.7		
		18.0 GHz		19.9		
Small-Signal Gain (S21)	dB	6-11 GHz		32.0		P_{IN} = -25 dBm
		11-18 GHz		29.5		
Input Return Loss (S11)	dB	6-11 GHz		-13.5		P_{IN} = -25 dBm
		11-18 GHz		-11.4		
Output Return Loss (S22)	dB	6-11 GHz		-7.6		P_{IN} = -25 dBm
		11-18 GHz		-7.5		

Large Signal Performance versus Temperature

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, CW, P_{IN} = 24 dBm, T_{BASE} = 25 °C

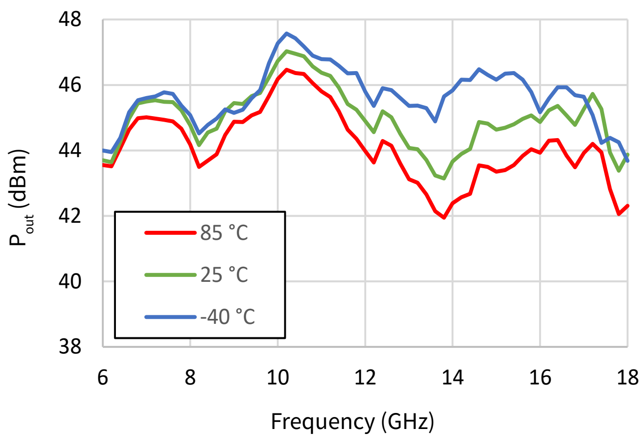

Figure 3. P_{out} v. Frequency v. Temperature

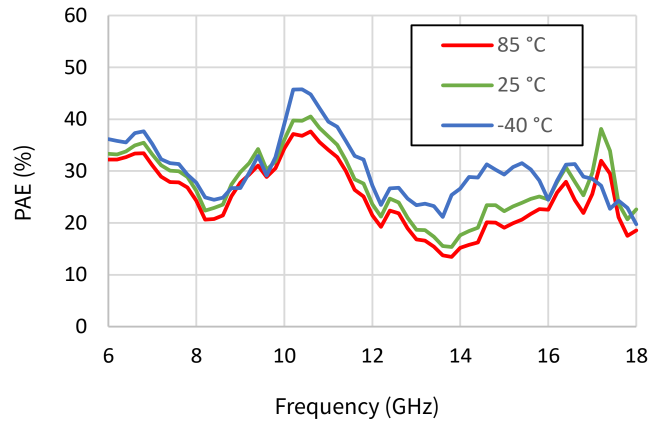

Figure 4. PAE v. Frequency v. Temperature

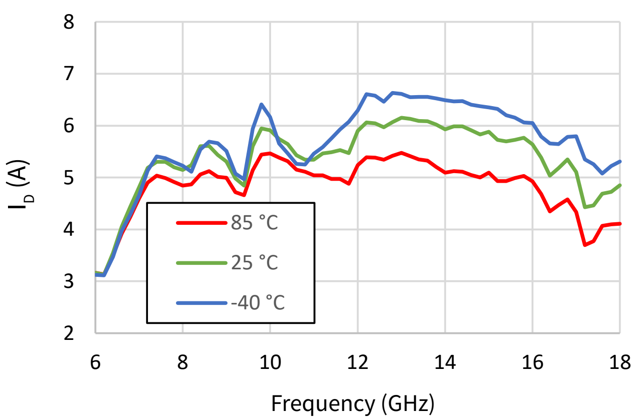

Figure 5. I_D v. Frequency v. Temperature

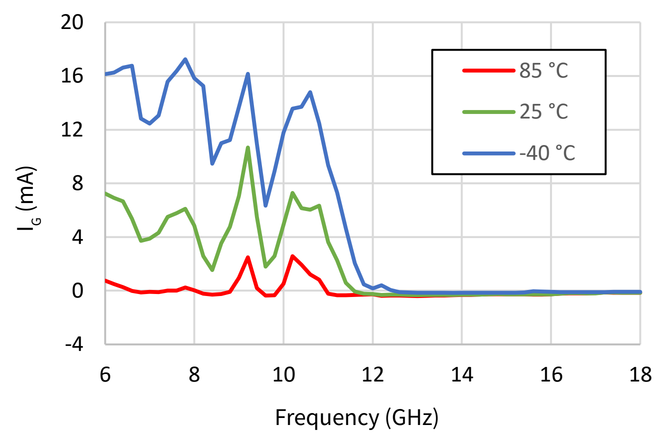

Figure 6. I_G v. Frequency v. Temperature

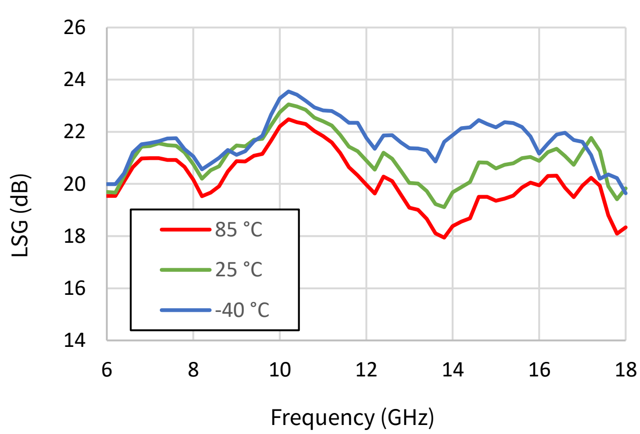

Figure 7. LSG v. Frequency v. Temperature

Drive-Up versus Frequency

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, CW, P_{IN} = 24 dBm, T_{BASE} = 25 °C

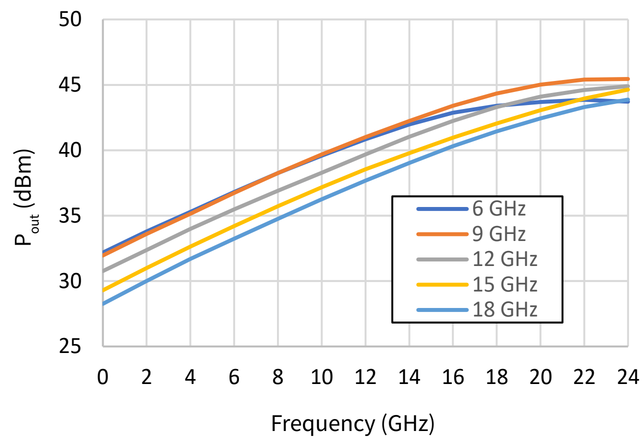

Figure 8. P_{out} v. P_{in} v. Frequency

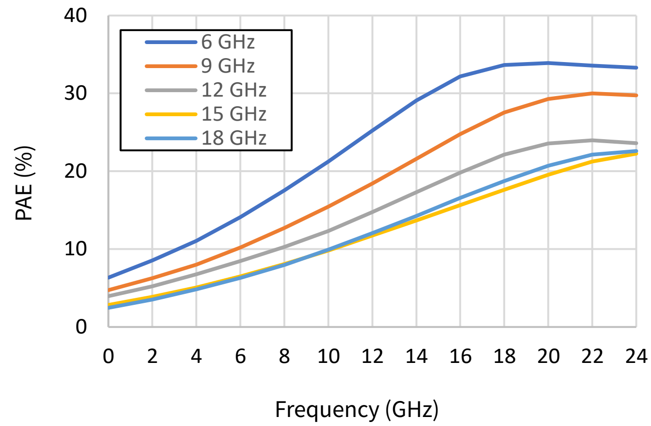

Figure 9. PAE v. P_{in} v. Frequency

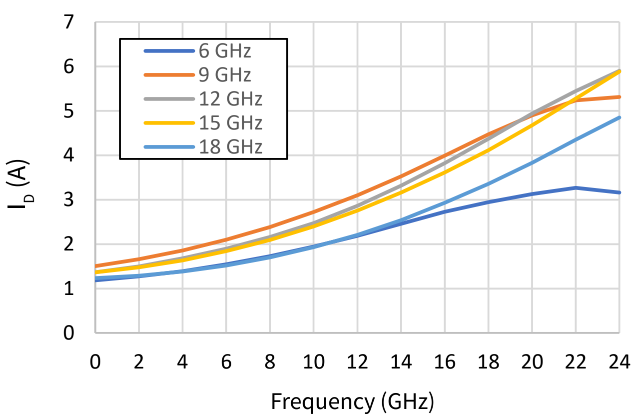

Figure 10. I_D v. P_{in} v. Frequency

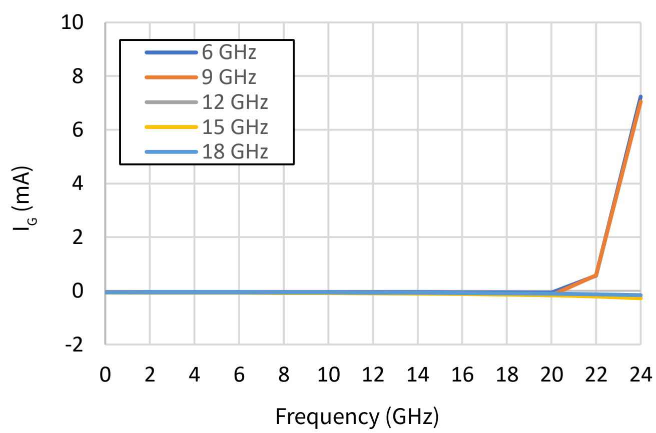

Figure 11. I_G v. P_{in} v. Frequency

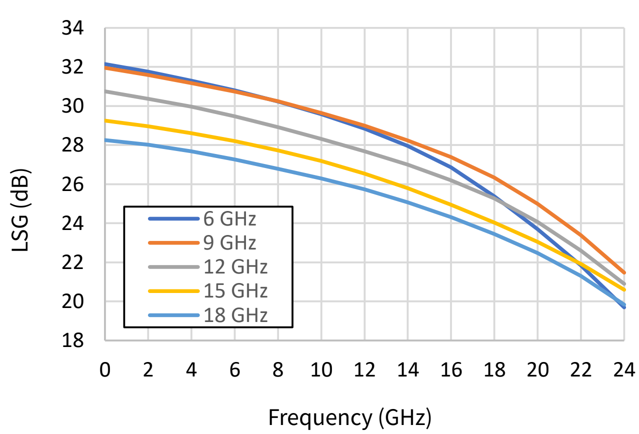

Figure 12. Gain v. P_{in} v. Frequency

Drive-Up versus Temperature

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, CW, P_{IN} = 24 dBm, frequency = 12 GHz, T_{BASE} = 25 °C

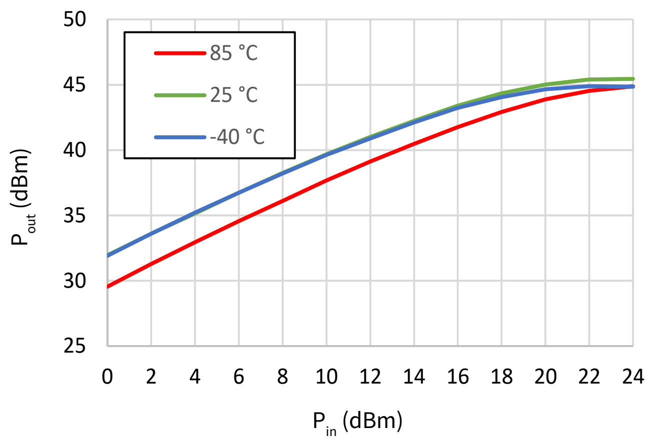

Figure 13. P_{out} v. P_{in} v. Temperature

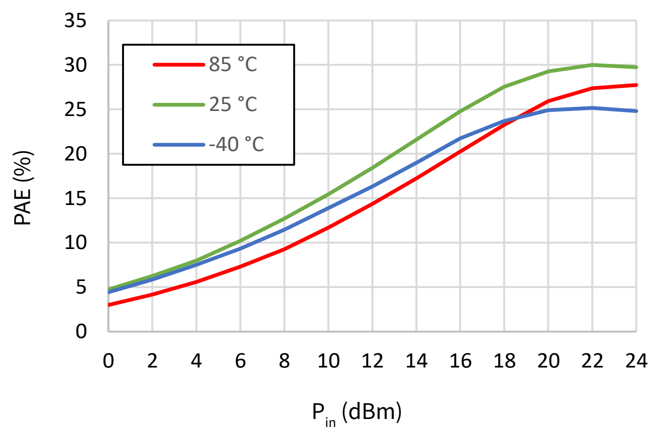

Figure 14. PAE v. P_{in} v. Temperature

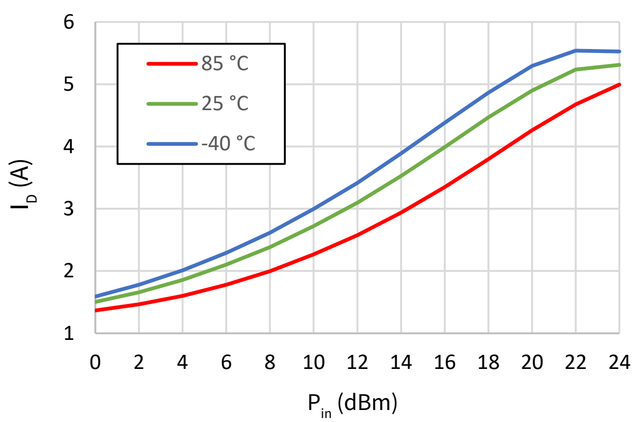

Figure 15. I_D v. P_{in} v. Temperature

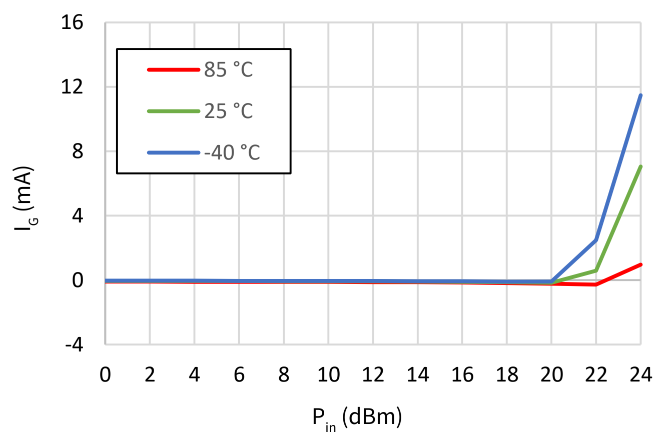

Figure 16. I_G v. P_{in} v. Temperature

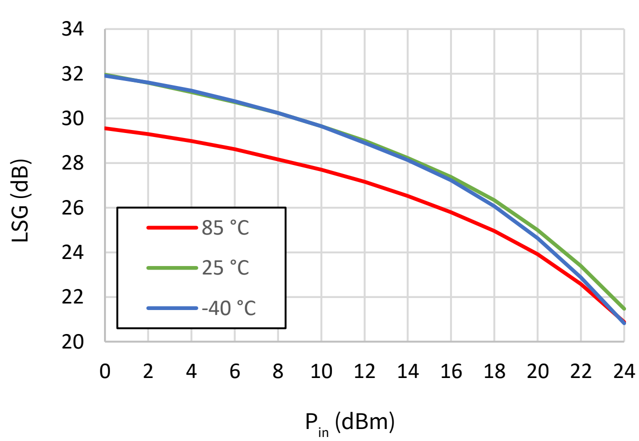

Figure 17. Gain v. P_{in} v. Temperature

Small Signal v. Temperature

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, PW = CW, P_{IN} = -25 dBm, T_{BASE} = 25 °C

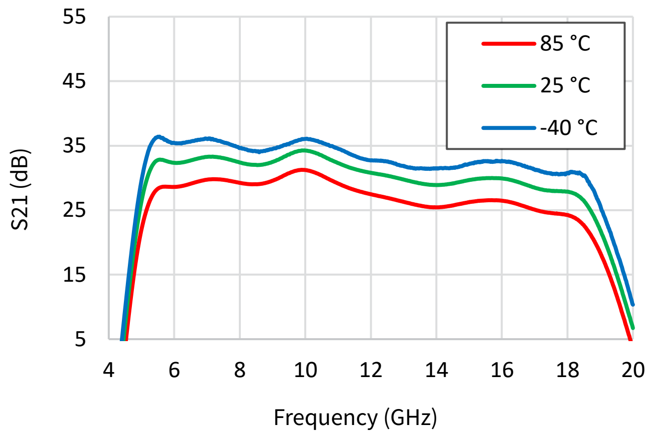

Figure 18. S21 v. Frequency v. Temperature

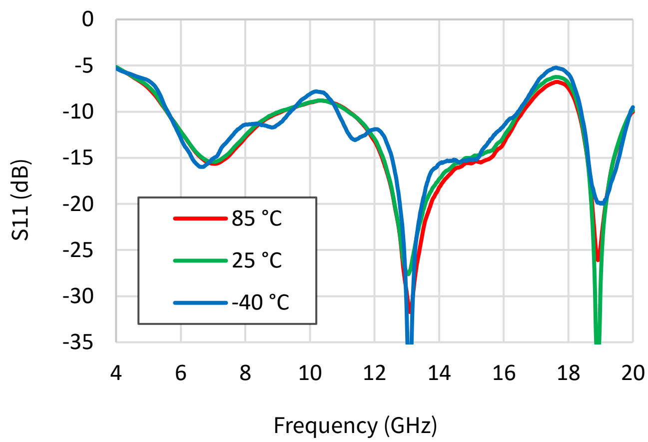

Figure 19. S11 v. Frequency v. Temperature

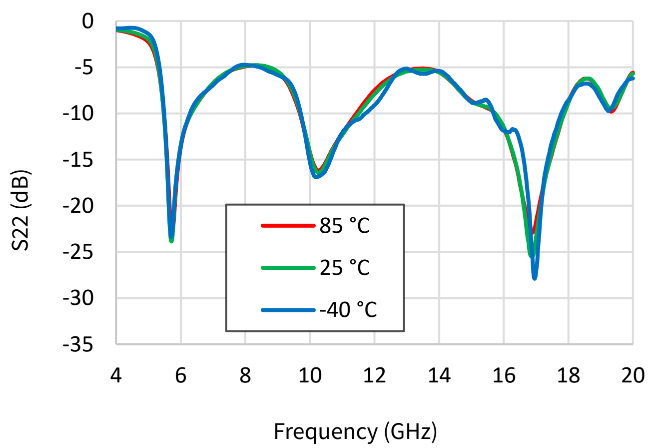

Figure 20. S22 v. Frequency v. Temperature

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Harmonics

Test conditions unless otherwise noted: V_D = 22 V, I_{DQ} = 1.2 A, CW, P_{IN} = 24 dBm

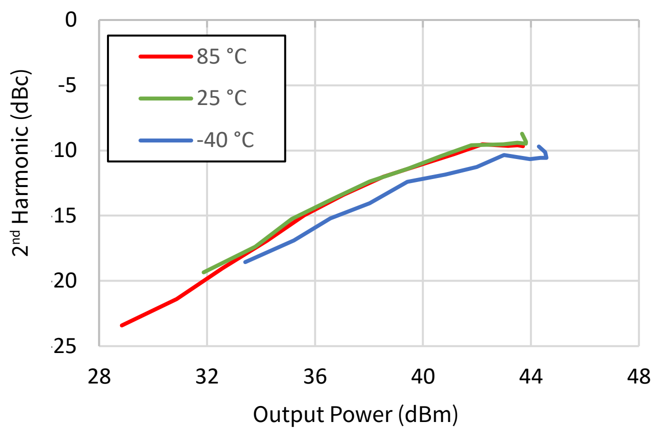


Figure 21. 2f v. P_{out} v. Temperature, 6 GHz

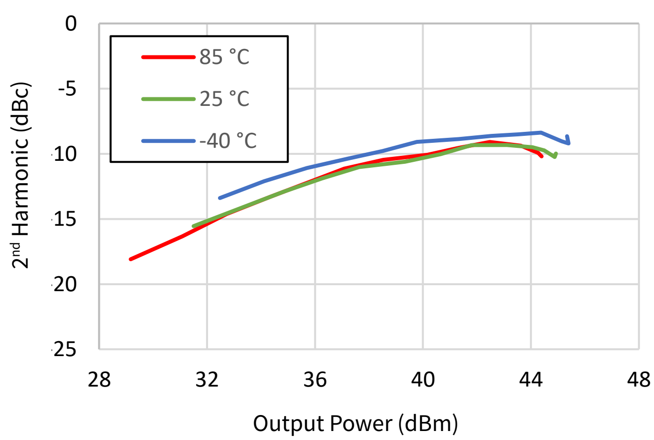


Figure 22. 2f v. P_{out} v. Temperature, 9 GHz

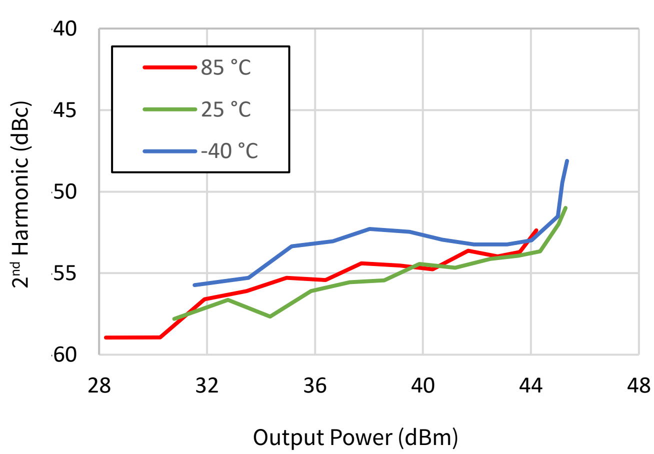
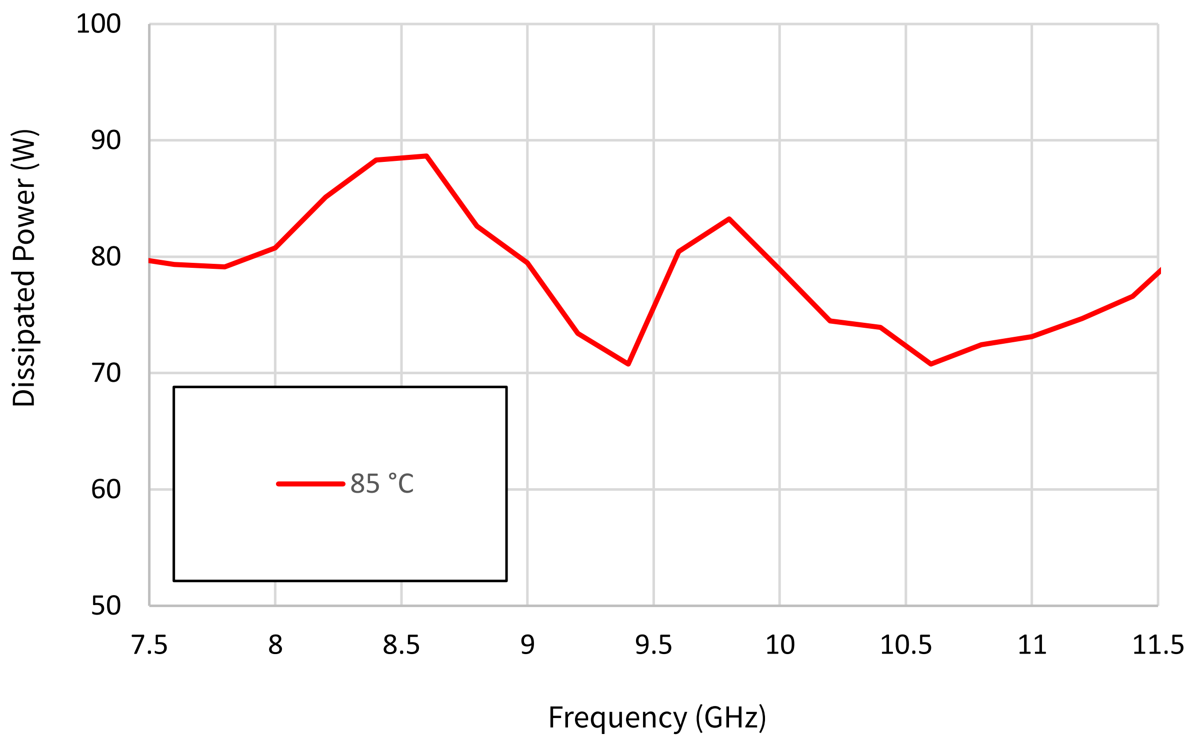


Figure 23. 2f v. P_{out} v. Temperature, 12 GHz

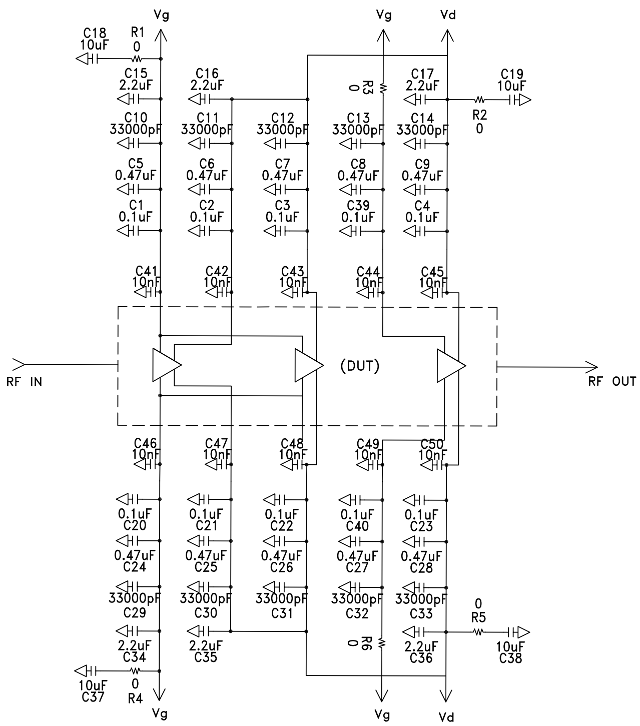
Thermal Characteristics

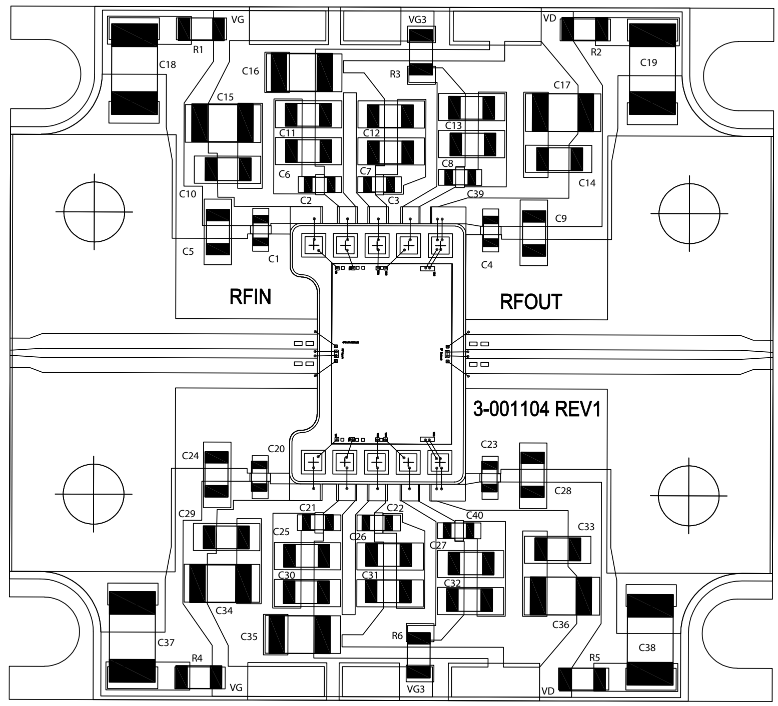
Parameter	Symbol	Value	Operating Conditions
Operating Junction Temperature	T_J	171	Freq = 9.0 GHz, V_D = 22 V, I_{DQ} = 1.2 A, I_{DRIVE} = 5.3 A, P_{IN} = 24 dBm, P_{OUT} = 44.9 dBm, P_{DISS} = 80 W, T_{BASE} = 85 °C, CW
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.08	

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



CMPA601J025D-AMP Carrier Schematic and Assembly Drawing





CMPA601J025D-AMP Carrier Bill of Materials

Reference Designator	Description	Qty
C1-C4, C20-C23, C39, C40	CAPACITOR, 0402, 0.1 uF, 50 V	10
C5-C9, C24-C28	CAPACITOR, 0603, 0.47 uF, 50 V	10
C10-C14, C29-C33	CAPACITOR, 0603, 33000 pF, 50 V	10
C15-C17, C34-C36	CAPACITOR, 0805, 2.2 uF, 50 V	6
C18, C19, C37, C38	CAPACITOR, 1206, 10 uF, 50 V	4
R1-R6	RESISTOR, 0603, 0 Ohm	6

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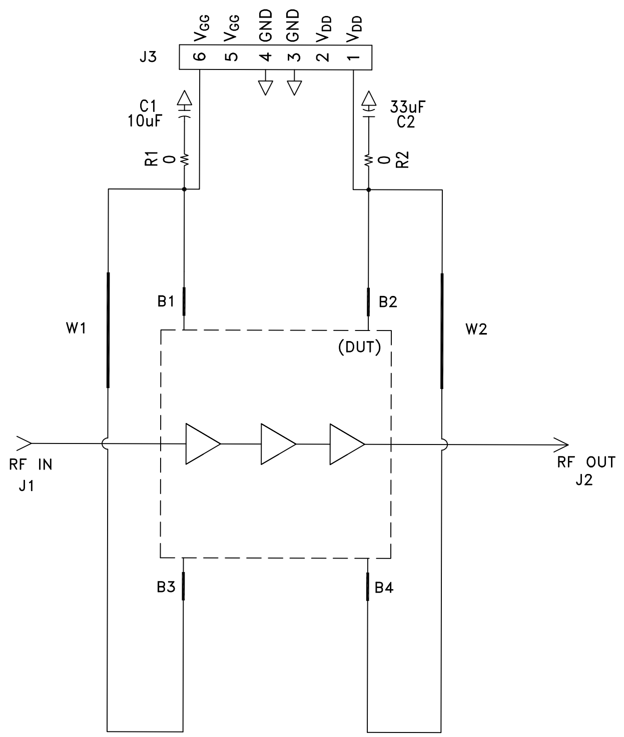
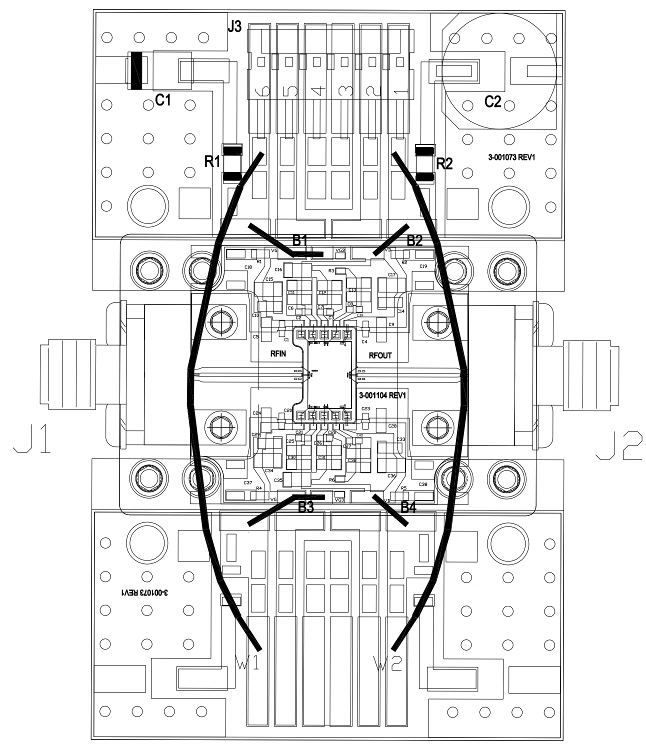
CMPA601J025D-AMP Evaluation Board Schematic and Drawing





Note: Gate and drain should be biased on both sides of the die, as shown above.

CMPA601C025D-AMP Evaluation Board Bill of Materials

Reference Designator	Description	Qty
J1, J2	2.92 mm Female End Launch RF Connector, .007" Pin, .048" Coax	2
J3	6-Pin DC Header, Right Angle	1
R1 - R2	0 Ohm Resistors, 1206	2
C1	10 uF Tantalum Capacitor	1
C2	33 uF Electrolytic Capactitor	1
B1 - B4	Jumper Wire	4
W1 - W2	WIRE, BLACK, 22 AWG (~2")	2

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)

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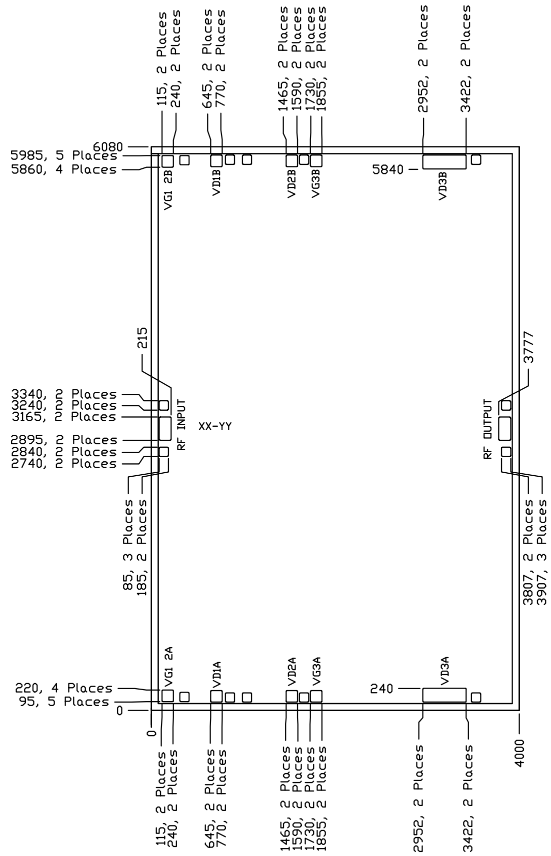
Product Dimensions



Overall Die Size 4000 x 6080 (+0/-50) microns, Die Thickness 100 (+/-10) microns.

Pad Number	Function	Description	Pad Size (um)	Note
1	RF IN	RF Input Pad. Matched to 50 ohms. The DC Impedance ~ 0 ohm Due to Matching Circuit	130 x 250	4
2	VG1 & 2_A	Gate Control for Stage 1 & 2A. V_G = -1.5 to -2.5 V	125 x 125	1, 2
3	VG1 & 2_B	Gate Control for Stage 1 & 2B. V_G = -1.5 to -2.5 V	125 x 125	1, 2
4	VD1_A	Drain Supply for Stage 1A. V_D = 22 V	125 x 125	1
5	VD1_B	Drain Supply for Stage 1B. V_D = 22 V	125 x 125	1
6	VD2_A	Drain Supply for Stage 2A. V_D = 22 V	125 x 125	1
7	VD2_B	Drain Supply for Stage 2B. V_D = 22 V	125 x 125	1
8	VG3_A	Gate Control for Stage 3A. V_G = -1.5 to -2.5 V	125 x 125	1, 3
9	VG3_B	Gate Control for Stage 3B. V_G = -1.5 to -2.5 V	125 x 125	1, 3
10	VD3_A	Drain Supply for Stage 3A. V_D = 22 V	470 x 150	1
11	VD3_B	Drain Supply for Stage 3B. V_D = 22 V	470 x 150	1
12	RF OUT	RF Output Pad. Matched to 50 ohms	130 x 250	4

Notes:
[1] Attach bypass capacitor to pads 2 - 11 per application circuit.
[2] VG1 & 2_A and VG1 & 2_B are connected internally so it would be enough to connect either one for proper operation.
[3] VG3_A and VG3_B are connected internally so it would be enough to connect either one for proper operation.
[4] The RF input and output pad have a ground-signal-ground with a nominal pitch of 10 mil (250 um). The RF ground pads are 100 x 100 microns.

Electrostatic Discharge (ESD) Classifications

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

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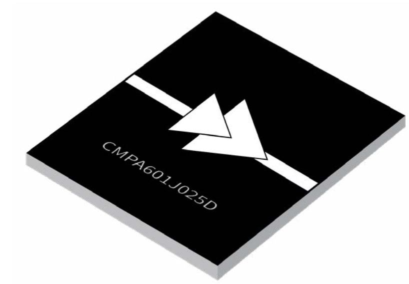
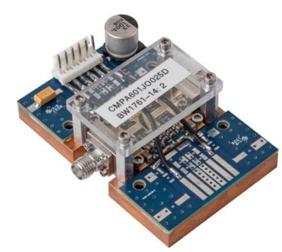
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA601J025D	MMIC Die	1 Each	
CMPA601J025D-AMP	Evaluation Board w/PA	1 Each	

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