CMPA9396025S

9.3 - 9.6 GHz, 25 W, Packaged GaN MMIC Power Amplifier

Package Type: 6 x 6 QFN
PN: CMPA9396025S

Description

Wolfspeed's CMPA9396025S is a GaN MMIC designed specifically from 9.3 - 9.6 GHz to be compact and provide high-efficiency, which makes it ideal for marine radar amplifier applications. The MMIC delivers 25W at 100µsec pulse width and 10% duty cycle. The 50-ohm, 3-stage MMIC is available in a plastic surface-mount package.

Typical Performance Over 9.3 - 9.6 GHz (T_C = 25°C)

Parameter	9.3 GHz	9.4 GHz	9.5 GHz	9.6 GHz	Units
Small Signal Gain	36.0	35.9	35.9	36.2	dB
Output Power[1]	37.0	37.5	37.5	37.0	W
Power Gain[1]	26.7	26.7	26.7	26.7	dB
Power Added Efficiency[1]	41	42	42	41	%

Note:
[1] P_{IN} = 19 dBm, Pulse Width = 100µs; Duty Cycle = 10%, V_D = 40 V, I_{DQ} = 260 mA

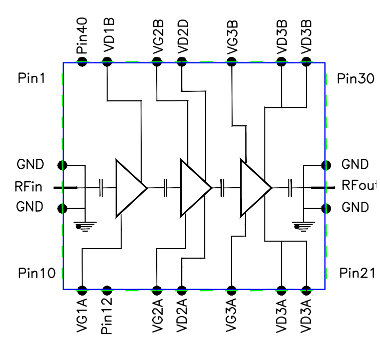
Features

- 9.3 - 9.6 GHz Operation
- 30 W Typical Output Power
- 27 dB Power Gain
- 50-ohm Matched for Ease of Use
- Plastic Surface-Mount Package, 6x6 mm QFN

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

Applications

- Marine radar
- Military radar



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Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	120	V_{DC}	25˚C
Gate-source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	ºC	
Maximum Forward Gate Current	I_G	8.6	mA	25˚C
Maximum Drain Current	I_{DMAX}		A	
Soldering Temperature	T_S	260	ºC	

Electrical Characteristics (Frequency = 9.3 GHz to 9.6 GHz unless otherwise stated; T_C = 25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	–	-2.4	V	V_{DS} = 10 V, I_D = 8.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.65	–	V_{DC}	V_{DD} = 40 V, I_{DQ} = 260 mA
Saturated Drain Current[2]	I_{DS}	6.2	8.6	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	100	–	–	V	V_{GS} = -8 V, I_D = 8.6 mA
RF Characteristics[3,4]						
Small Signal Gain at 9.3 GHz	$S21_1$	–	36.0	–	dB	V_{DD} = 40 V, I_{DQ} = 260 mA
Small Signal Gain at 9.6 GHz	$S21_2$	–	36.2	–		
Output Power at 9.3 GHz	P_{OUT1}	–	37.0	–	W	
Output Power at 9.6 GHz	P_{OUT2}	–		–		
Power Added Efficiency at 9.3 GHz	PAE_1	–	41	–	%	
Power Added Efficiency at 9.6 GHz	PAE_2	–		–		
Power Gain	G_P	–	26.0	–	dB	V_{DD} = 40 V, I_{DQ} = 260 mA, P_{IN} = 19 dBm
Input Return Loss	S11	–	-11.4	–		V_{DD} = 40 V, I_{DQ} = 260 mA
Output Return Loss	S22	–	-8.2	–		
Output Mismatch Stress	VSWR	–	–	3:1	Ψ	No damage at all phase angles, V_{DD} = 40 V, I_{DQ} = 260 mA, P_{IN} = 19 dBm

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CMPA9396025S high volume test fixture at 9.3 and 9.6 GHz and may not show the full capability of the device due to source inductance and thermal performance.
[4] P_{IN} = 19 dBm, Pulse Width = 25µs; Duty Cycle = 1%

Thermal Characteristics

Parameter	Symbol	Rating	Units	Conditions
Operating Junction Temperature	T_J	225	ºC	
Thermal Resistance, Junction to Case (packaged)[1]	$R_{θJC}$	1.94	ºC/W	Pulse Width = 100µs, Duty Cycle =10%

Notes:
[1] Measured for the CMPA9396025S at P_{DISS} = 28.6 W

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Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

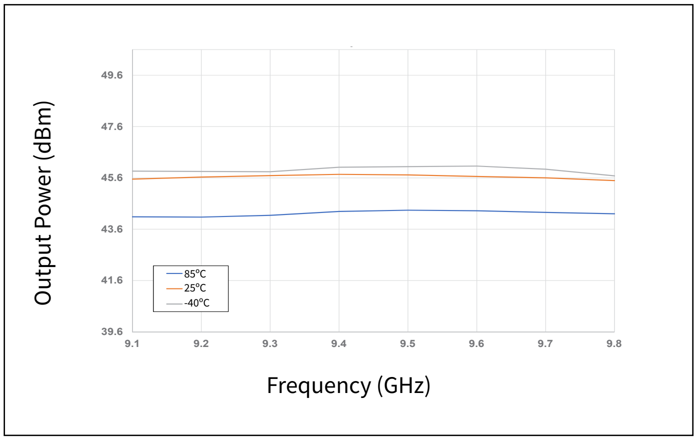

Figure 1. Output Power vs Frequency as a Function of Temperature

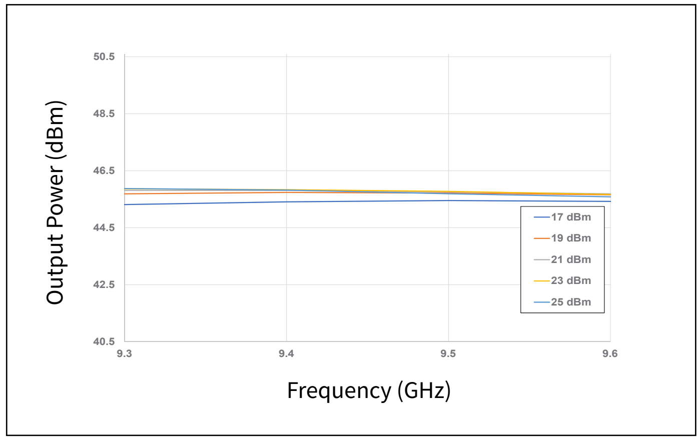

Figure 2. Output Power vs Frequency as a Function of Input Power

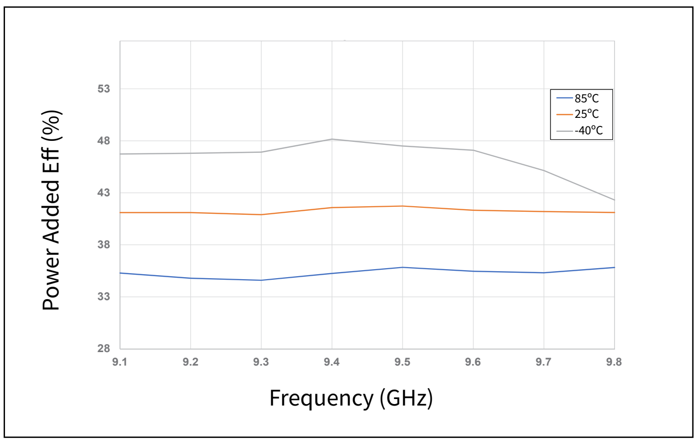

Figure 3. Power Added Eff. vs Frequency as a Function of Temperature

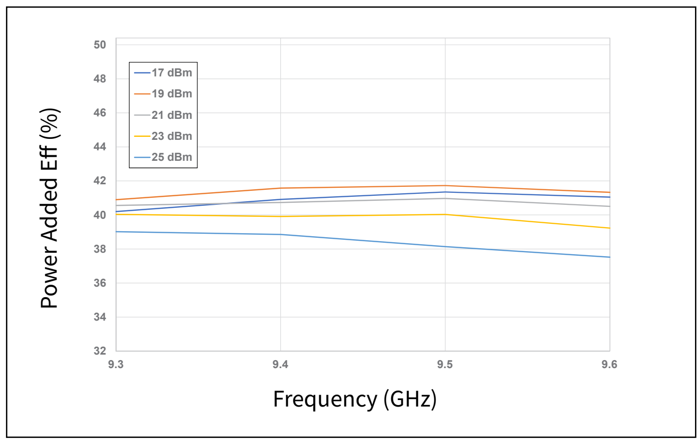

Figure 4. Power Added Eff. vs Frequency as a Function of Input Power

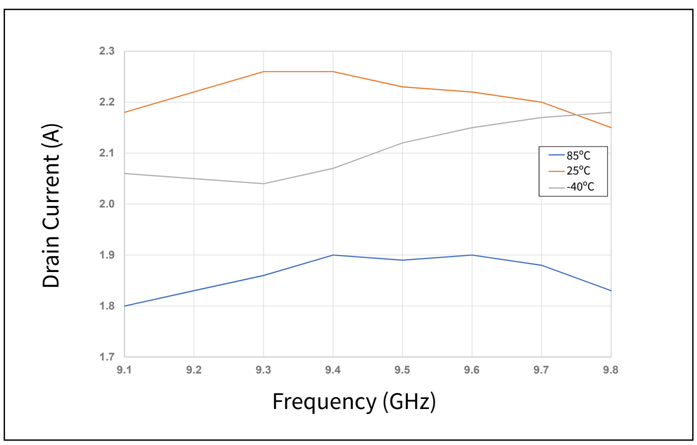

Figure 5. Drain Current vs Frequency as a Function of Temperature

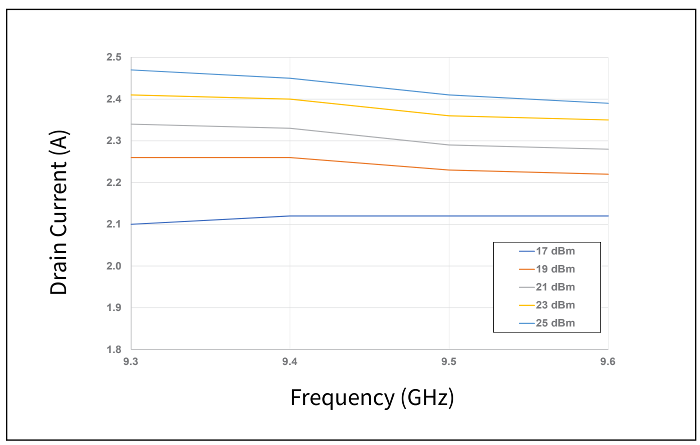

Figure 6. Drain Current vs Frequency as a Function of Input Power

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

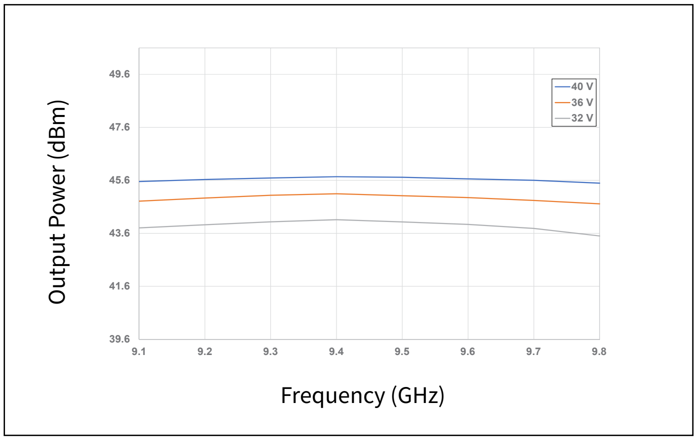

Figure 7. Output Power vs Frequency as a Function of V_D

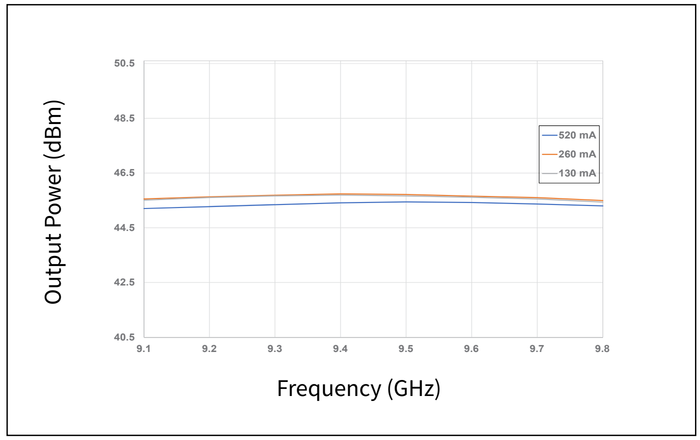

Figure 8. Output Power vs Frequency as a Function of I_{DQ}

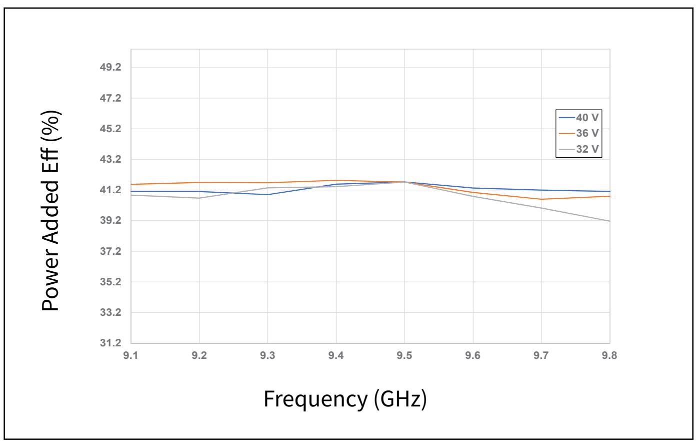

Figure 9. Power Added Eff. vs Frequency as a Function of V_D

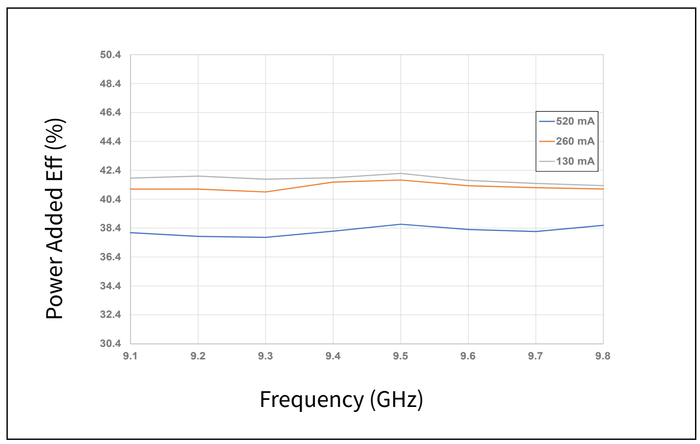

Figure 10. Power Added Eff. vs Frequency as a Function of I_{DQ}

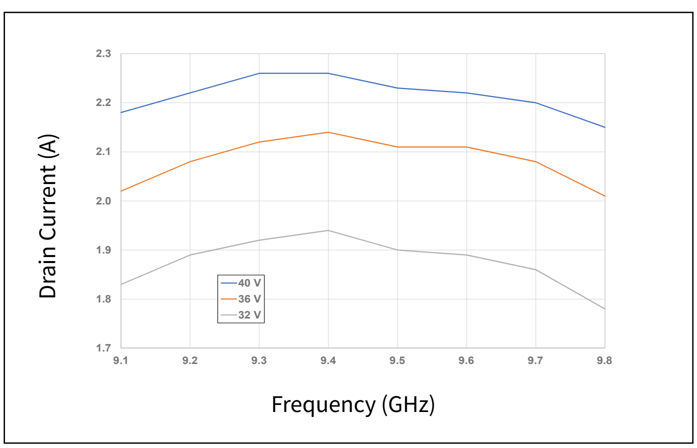

Figure 11. Drain Current vs Frequency as a Function of V_D

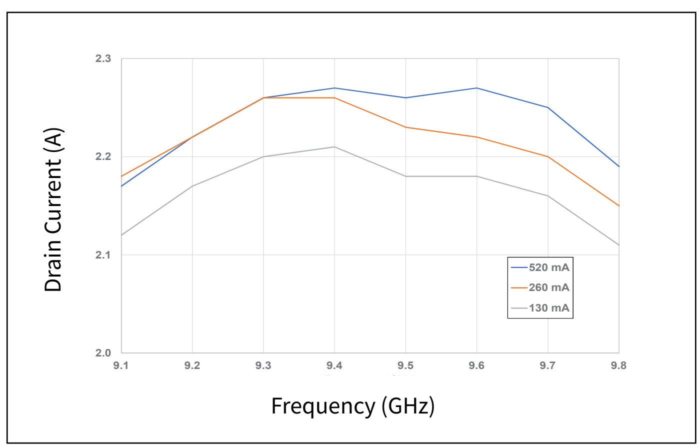

Figure 12. Drain Current vs Frequency as a Function of I_{DQ}

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

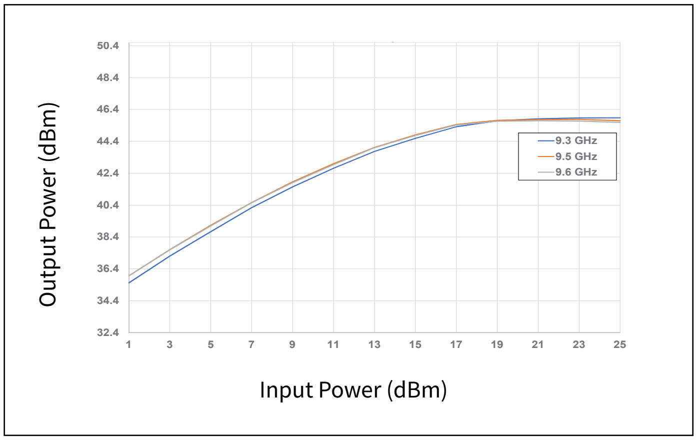

Figure 13. Output Power vs Input Power as a Function of Frequency

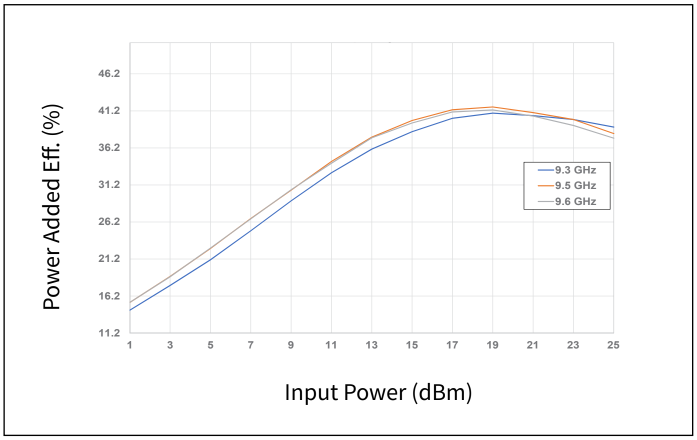

Figure 14. Power Added Eff. vs Input Power as a Function of Frequency

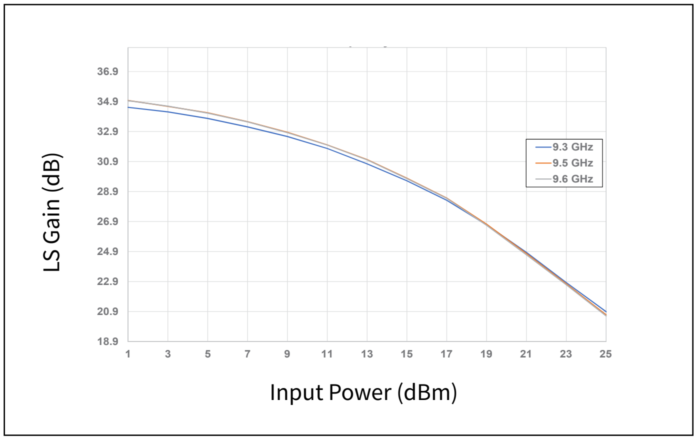

Figure 15. Large Signal Gain vs Input Power as a Function of Frequency

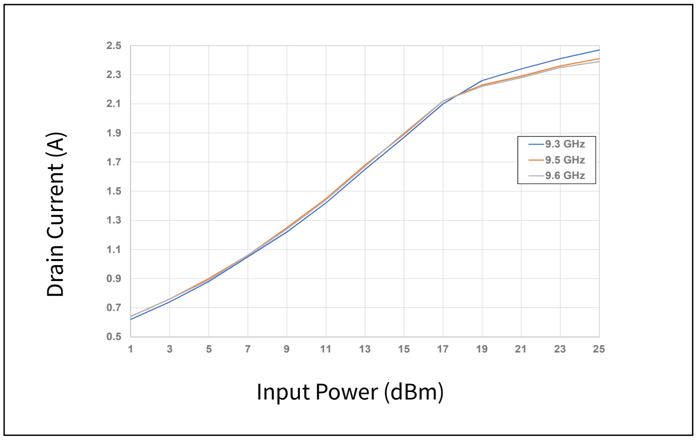

Figure 16. Drain Current vs Input Power as a Function of Frequency

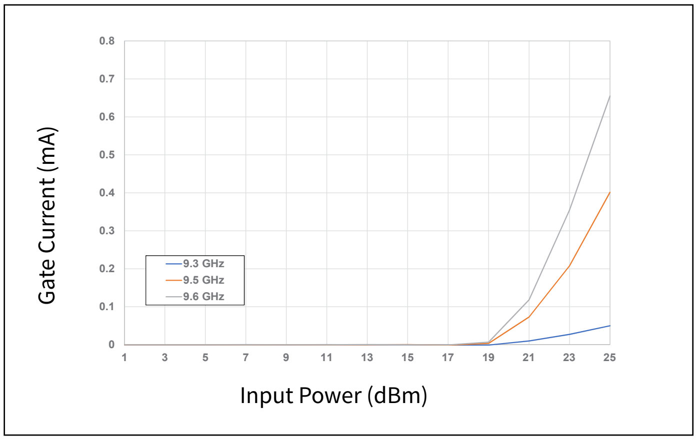

Figure 17. Gate Current vs Input Power as a Function of Frequency

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

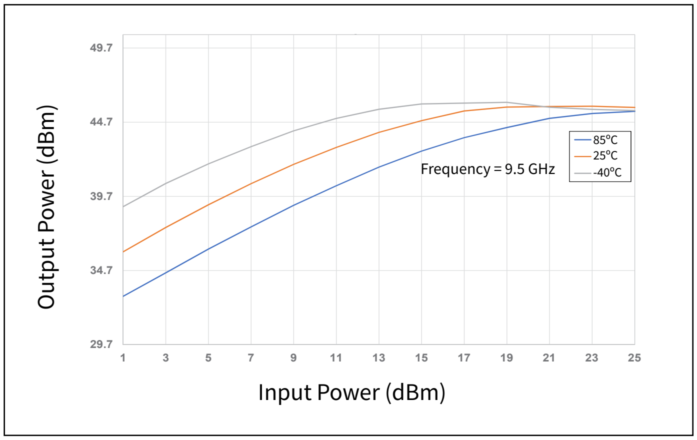

Figure 18. Output Power vs Input Power as a Function of Temperature

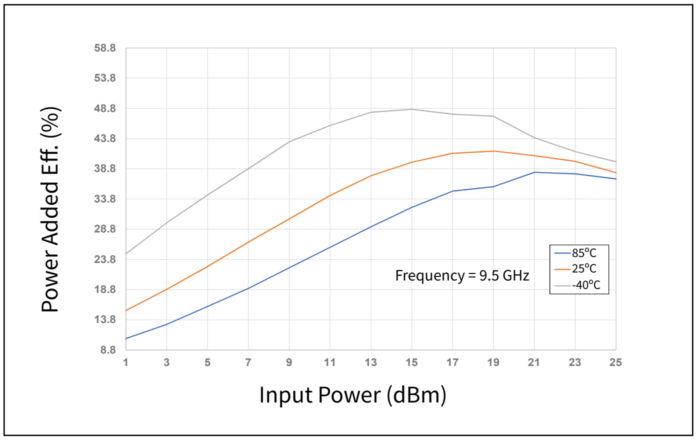

Figure 19. Power Added Eff. vs Input Power as a Function of Temperature

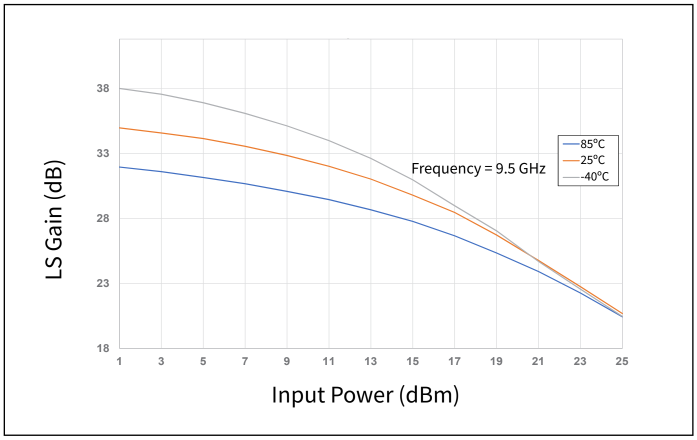

Figure 20. Large Signal Gain vs Input Power as a Function of Temperature

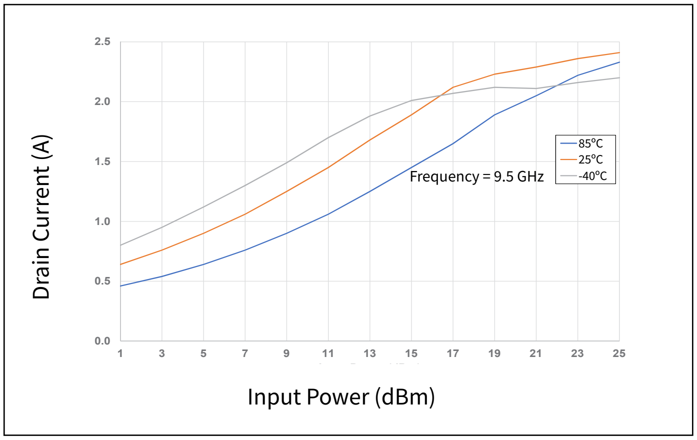

Figure 21. Drain Current vs Input Power as a Function of Temperature

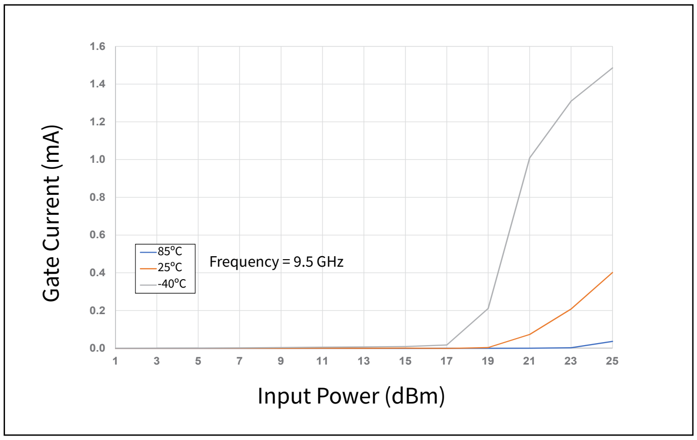

Figure 22. Gate Current vs Input Power as a Function of Temperature

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

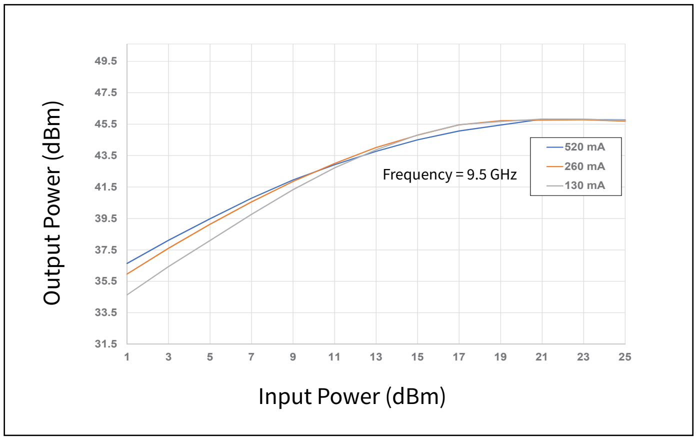

Figure 23. Output Power vs Input Power as a Function of I_{DQ}

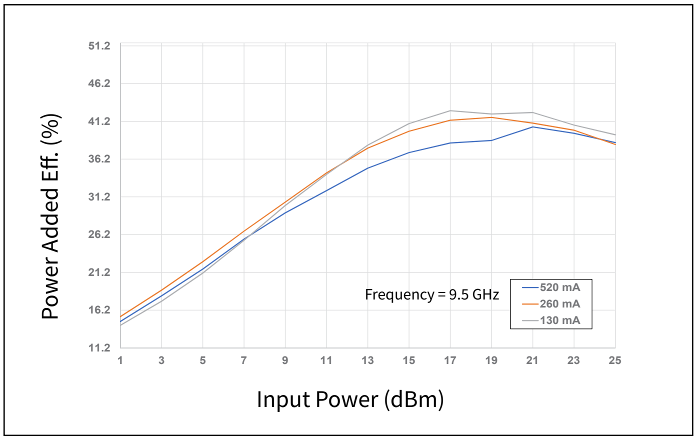

Figure 24. Power Added Eff. vs Input Power as a Function of I_{DQ}

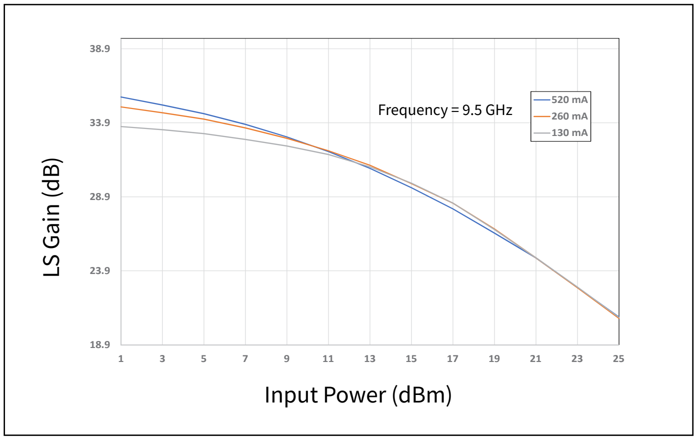

Figure 25. Large Signal Gain vs Input Power as a Function of I_{DQ}

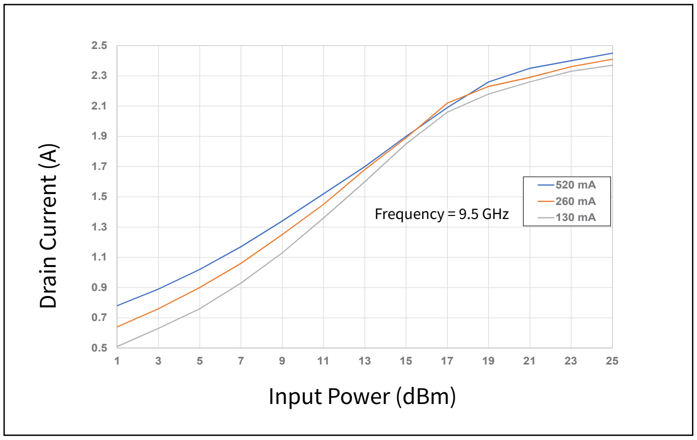

Figure 26. Drain Current vs Input Power as a Function of I_{DQ}

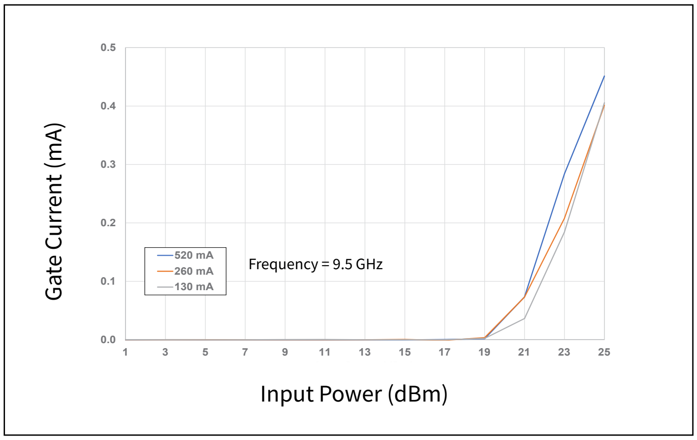

Figure 27. Gate Current vs Input Power as a Function of I_{DQ}

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, PW = 100µs, DC = 10%, P_{IN} = 19 dBm, T_{BASE} = +25°C

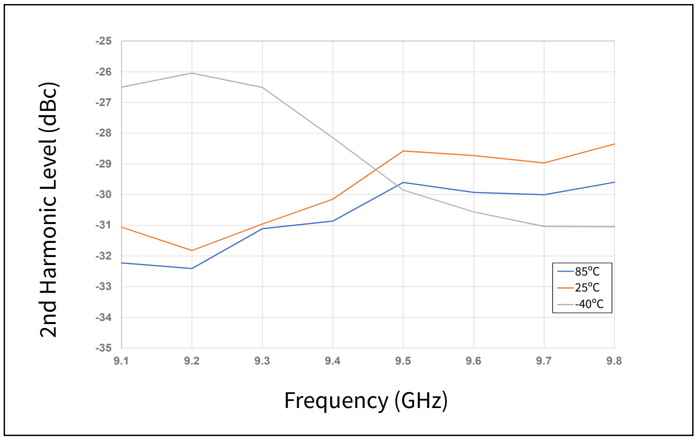

Figure 28. 2nd Harmonic vs Frequency as a Function of Temperature

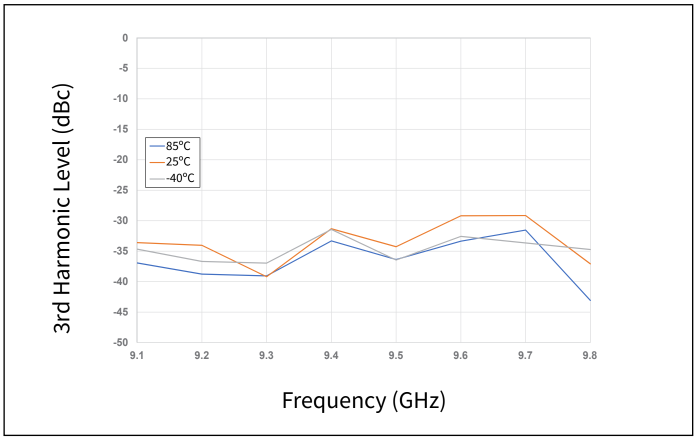

Figure 29. 3rd Harmonic vs Frequency as a Function of Temperature

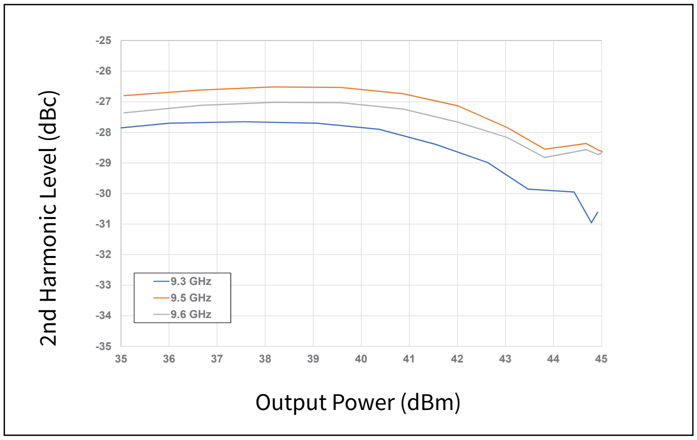

Figure 30. 2nd Harmonic vs Output Power as a Function of Frequency

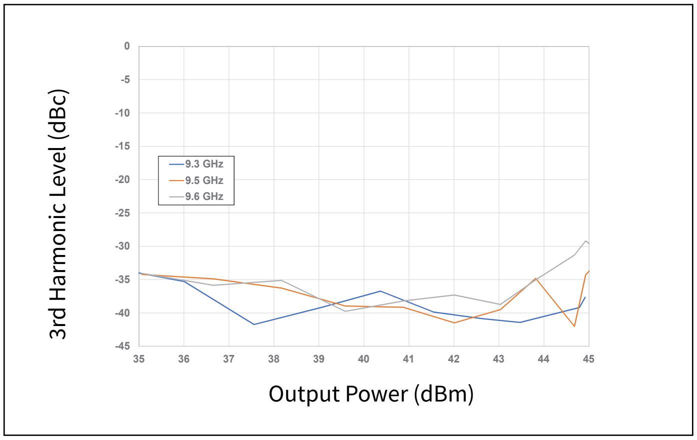

Figure 31. 3rd Harmonic vs Output Power as a Function of Frequency

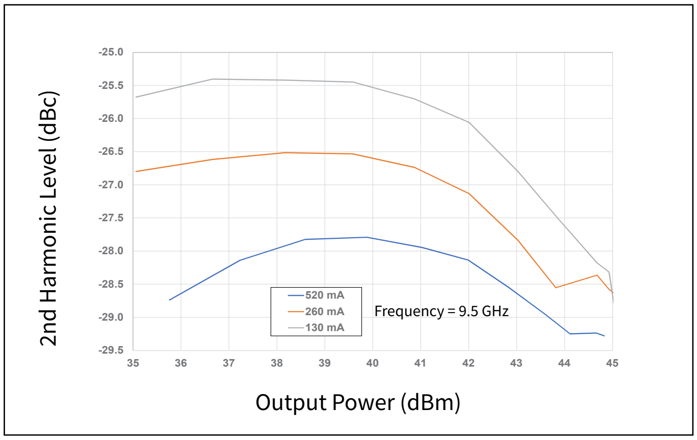

Figure 32. 2nd Harmonic vs Output Power as a Function of I_{DQ}

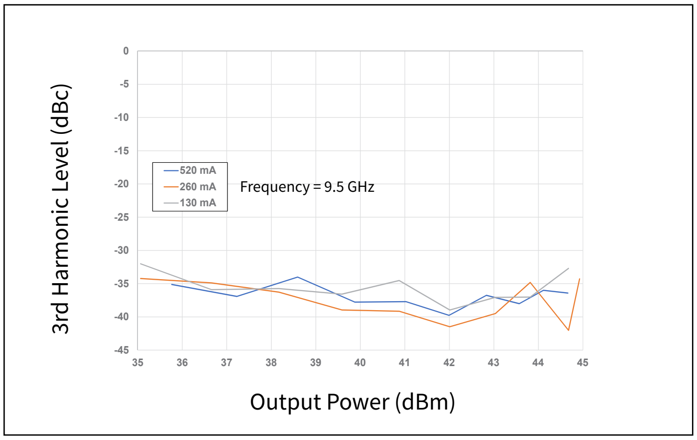

Figure 33. 3rd Harmonic vs Output Power as a Function of I_{DQ}

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Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, P_{IN} = -30 dBm, T_{BASE} = +25°C

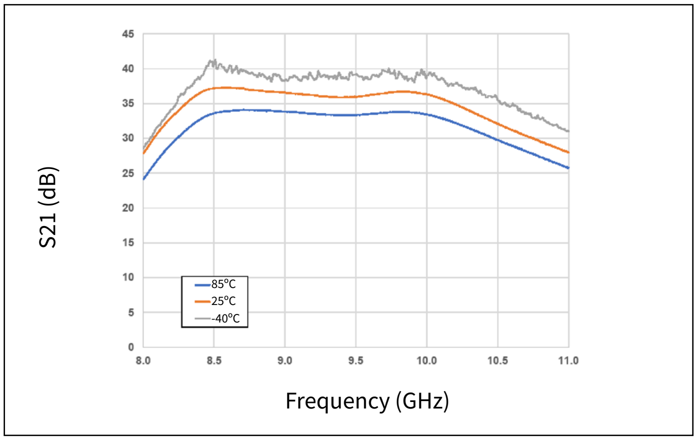


Figure 34. Gain vs Frequency as a Function of Temperature

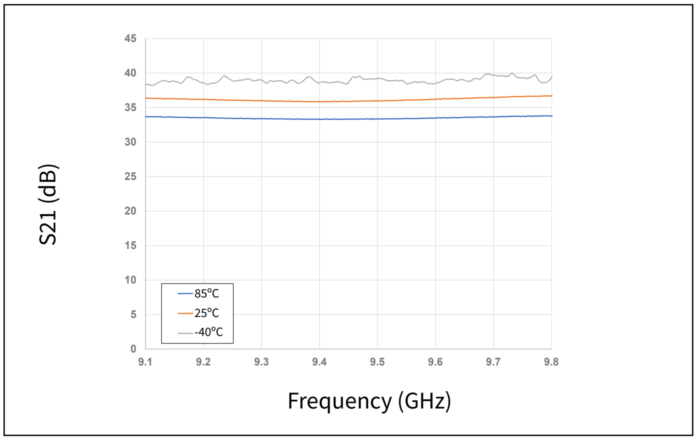


Figure 35. Gain vs Frequency as a Function of Temperature

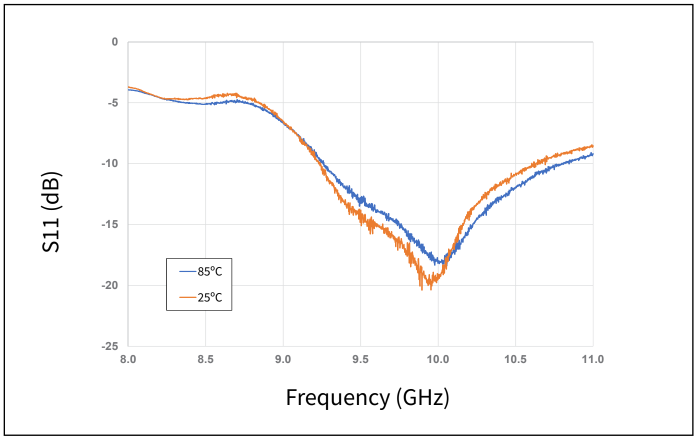


Figure 36. Input RL vs Frequency as a Function of Temperature

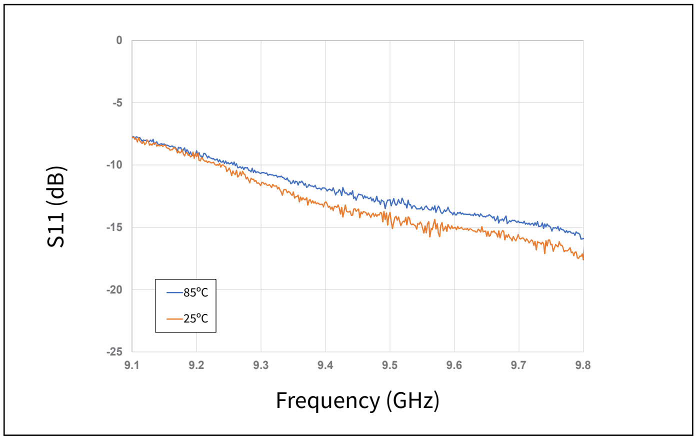


Figure 37. Input RL vs Frequency as a Function of Temperature

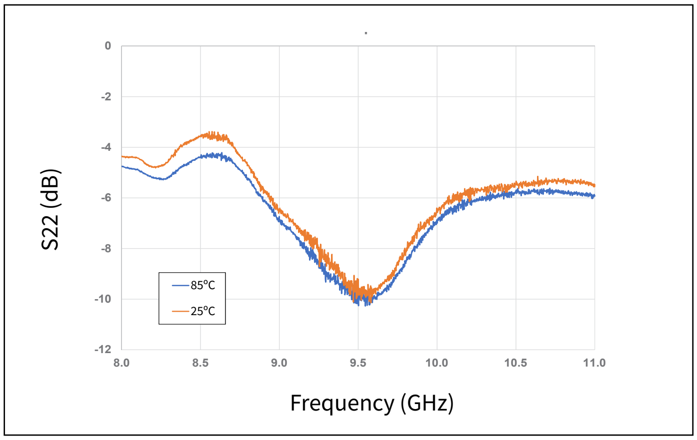


Figure 38. Output RL vs Frequency as a Function of Temperature

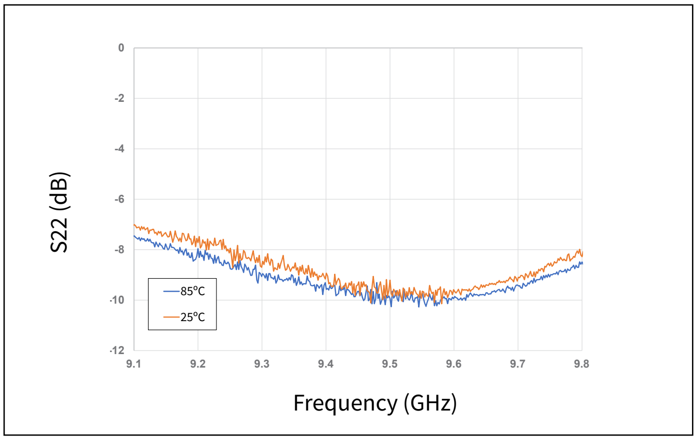


Figure 39. Output RL vs Frequency as a Function of Temperature

Typical Performance of the CMPA9396025S

Test conditions unless otherwise noted: V_D = 40 V, I_{DQ} = 260 mA, P_{IN} = -30 dBm, T_{BASE} = +25°C

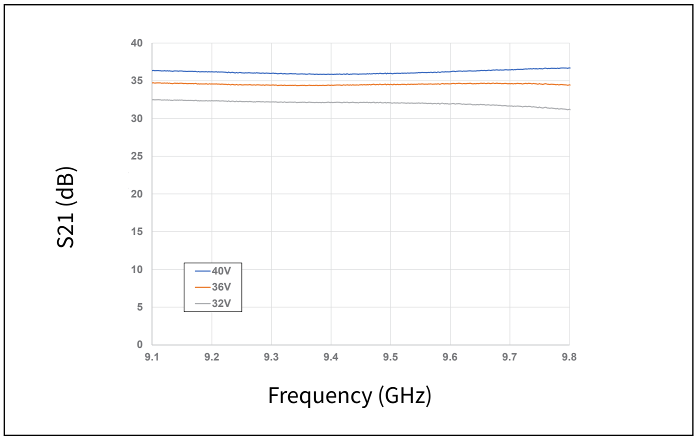


Figure 40. Gain vs Frequency as a Function of Voltage

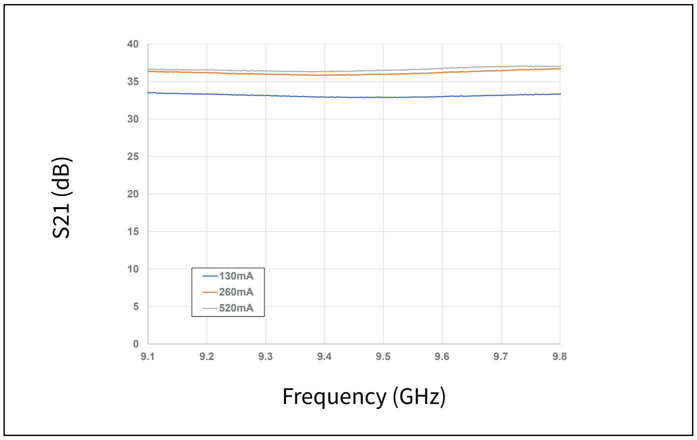


Figure 41. Gain vs Frequency as a Function of I_{DQ}

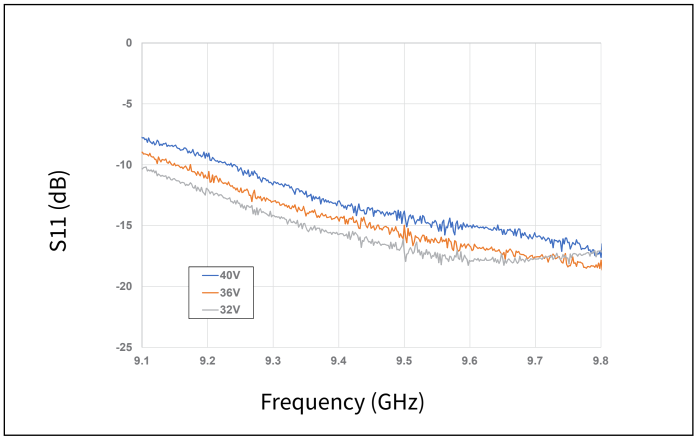


Figure 42. Input RL vs Frequency as a Function Voltage

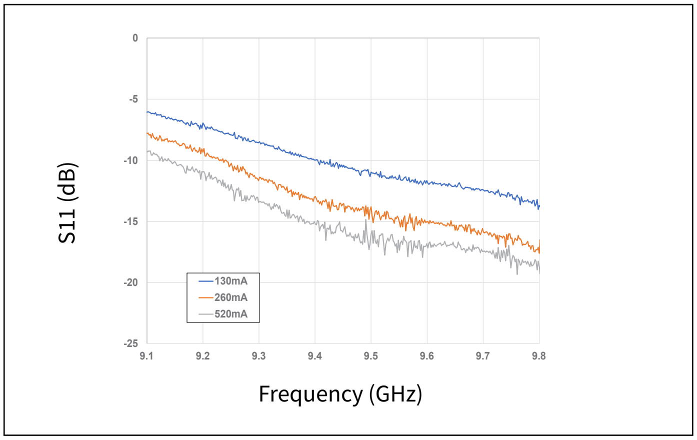


Figure 43. Input RL vs Frequency as a Function of I_{DQ}

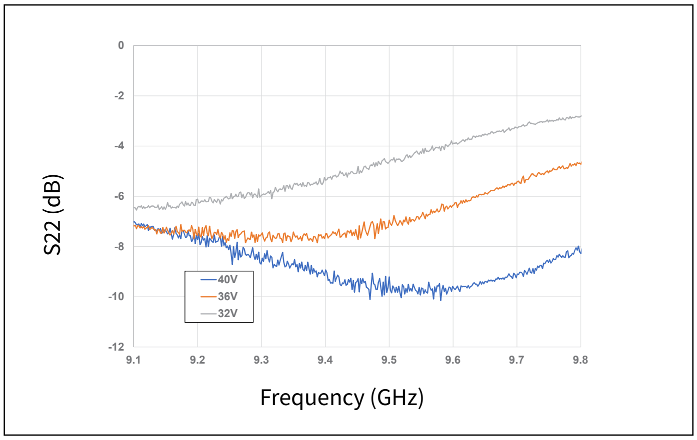


Figure 44. Output RL vs Frequency as a Function of Voltage

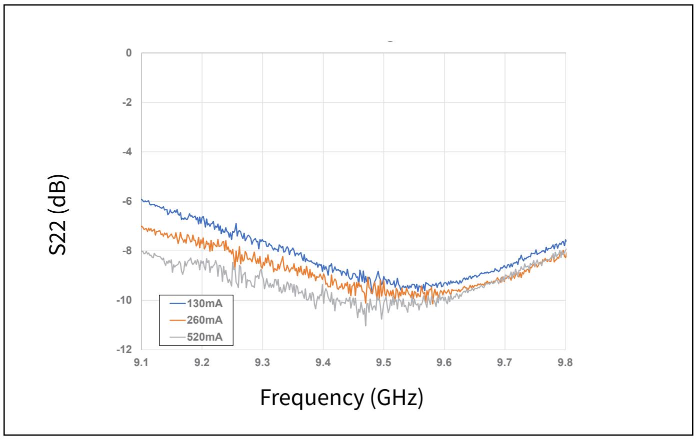
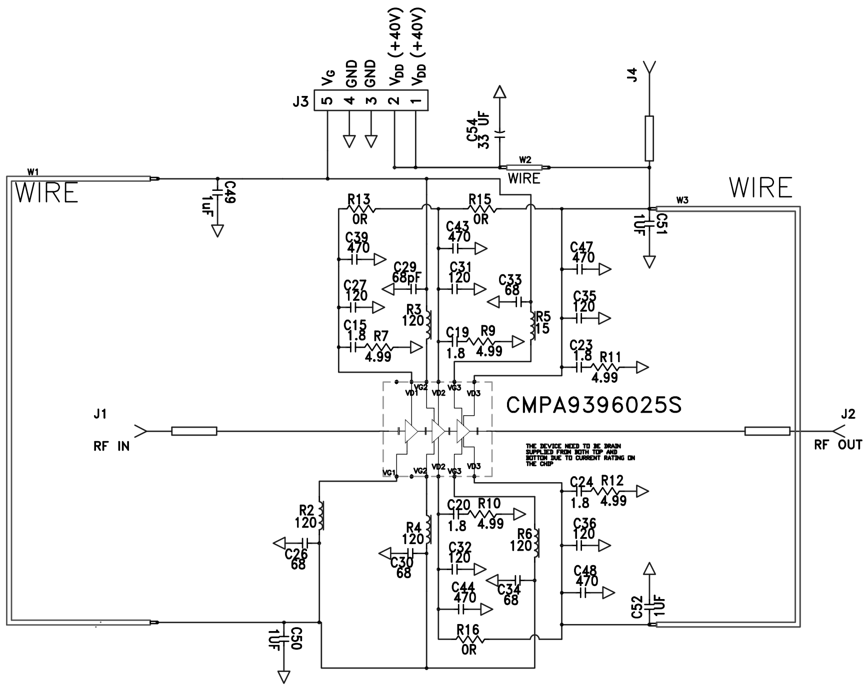
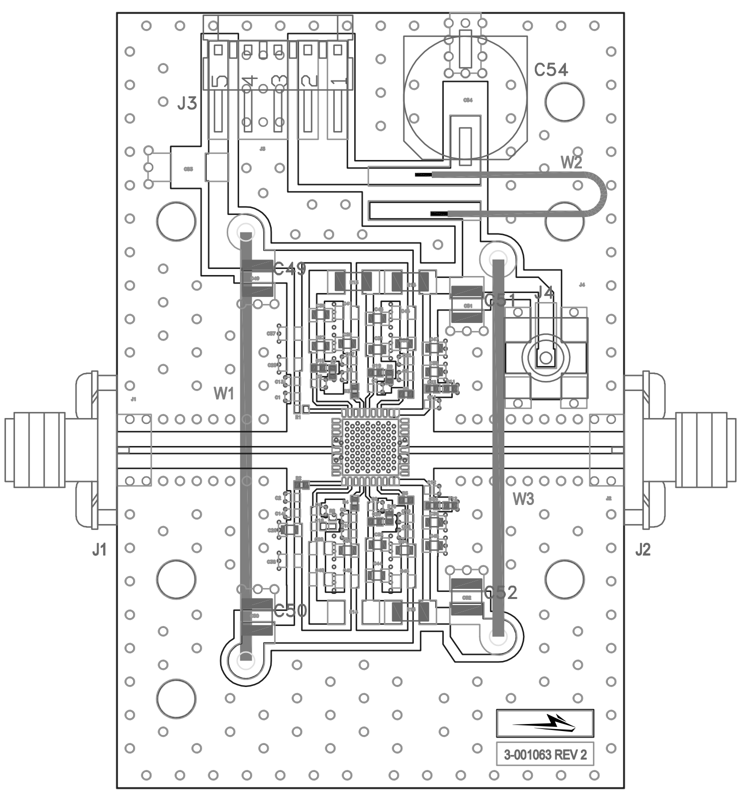


Figure 45. Output RL vs Frequency as a Function of I_{DQ}

CMPA9396025S-AMP1 Application Circuit



CMPA9396025S-AMP1 Evaluation Board Layout



CMPA9396025S-AMP1 Evaluation Board Bill of Materials

Designator	Description	Qty
C54	CAP, 33µF, 20%, G_{CASE}	1
C49, C50, C51, C52	CAP, 1.0µF, 100V, 10%, X7R, 1210	4
C39, C43, C44, C47, C48	CAP, 470pF, 5%, 100V, 0603, X7R	5
C26, C29, C30, C33, C34	CAP, 68pF, +/-5%pF, 0603, ATC	5
C27, C31, C32, C35, C36	CAP, 120pF, +/-5%, C0G, 0603, 100V	5
C15, C19, C20, C23, C24	CAP, 1.8pF, +/-0.05pF, ATC 600L, 0402	5
R2-R6	Ferrite bead, 120 OHM, 600mA, 0402	5
R7, R9-R12	RES 4.99 OHM, +/-1%, 1/16W, 0402	5
R13, R15, R16	RES 0.0 OHM, 1/16W, 1206 SMD	3
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
W1	WIRE, BLACK, 20 AWG ~ 1.5”	1
W2	WIRE, BLACK, 20 AWG ~ 1.3”	1
W3	WIRE, BLACK, 20 AWG ~ 1.5”	1
	PCB, TEST FIXTURE, RF35, 0.010", 6X6 3-STAGE, QFN	1
	HEATSINK, 6X6 QFN, 3-STAGE 2.600 X 1.700 X 0.250	1
	2-56 SOC HD SCREW 3/16 SS	4
	#2 SPLIT LOCKWASHER SS	4
Q1	CMPA9396025S	1

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	1A	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C0b	ANSI/ESDA/JEDEC JS-002 Table 3	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

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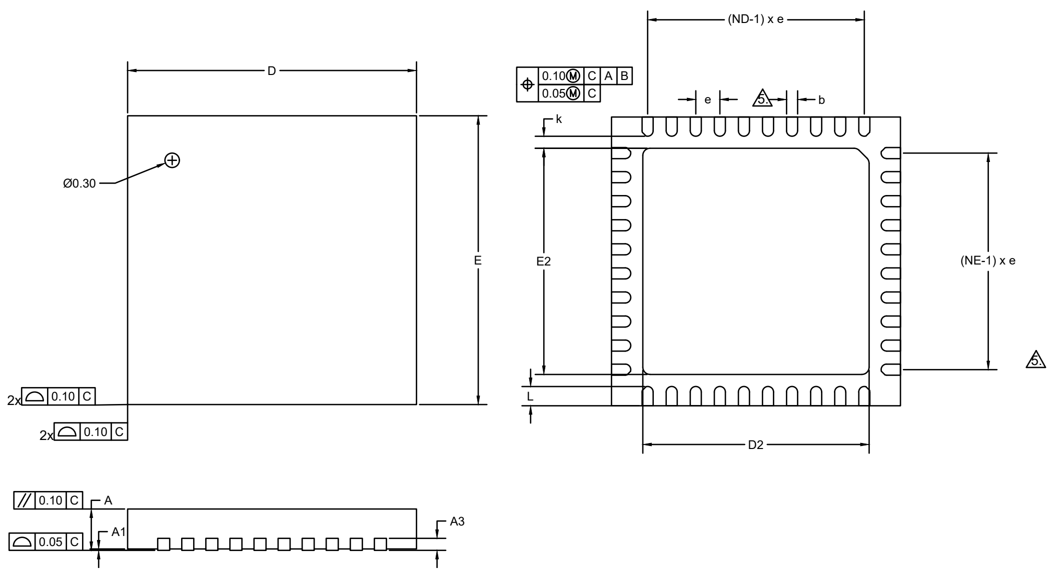
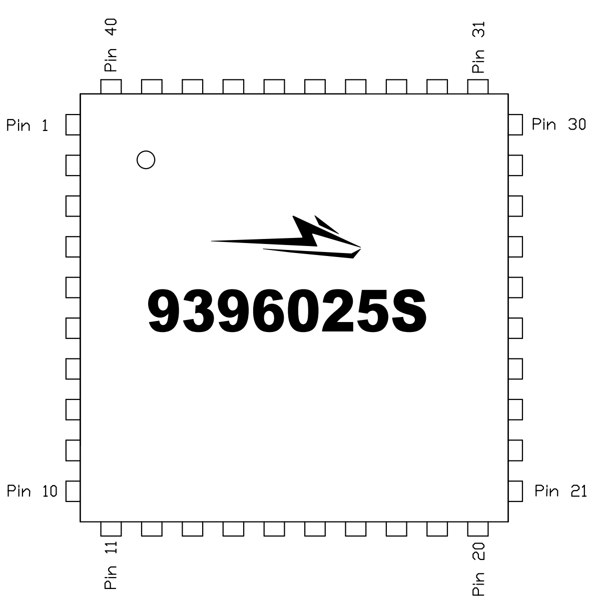
Product Dimensions CMPA9396025S (Package 6 x 6 QFN)

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M. - 1994
2. ALL DIMENSIONS ARE IN MILLIMETERS, 0 IS IN DEGREES
3. N IS THE TOTAL NUMBER OF TEMRINALS
4. DIMENSION b APPLIES TO THE METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP
5. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY
6. MAX. PACKAGE WARPAGE IS 0.05mm
7. MAXIMUM ALLOWABLE BURRS IS 0.076mm IN ALL DIRECTIONS
8. PIN #1 ID ON TOP WILL BE LASER MARKED
9. B ILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS
10. THIS DRAWING CONFORMS TO JEDEC REGISTERED OUTLINE MO-220
11. ALL PLATED SURFACES ARE TIN 0.010mm +/- 0.005mm



SYM	MIN	NOM	MAX	NOTE
A	0.80	0.86	0.91	
A1	0.00	0.03	0.06	
A3		0.25 REF		
k		0.15 MIN		
D		6.0 BSC		
E		6.0 BSC		
e		0.50 BSC		
N		40		3
ND		10		5.
NE		10		5.
L	0.35	0.40	0.46	
b	0.20	0.23	0.28	5.
D2	4.60	4.70	4.80	
E2	4.60	4.70	4.80	



PIN	DESC.	PIN	DESC.	PIN	DESC.
1	NC	15	VD2A	29	NC
2	NC	16	NC	30	NC
3	NC	17	VG3A	31	VD3B
4	NC	18	NC	32	VD3B
5	RFGND	19	VD3A	33	NC
6	RFIN	20	VD3A	34	VG3B
7	RFGND	21	NC	35	NC
8	NC	22	NC	36	VD2B
9	NC	23	NC	37	VG2B
10	NC	24	RFGND	38	NC
11	VG1A	25	RFOUT	39	VD1B
12	NC	26	RFGND	40	NC
13	NC	27	NC		
14	VG2A	28	NC		

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Part Number System

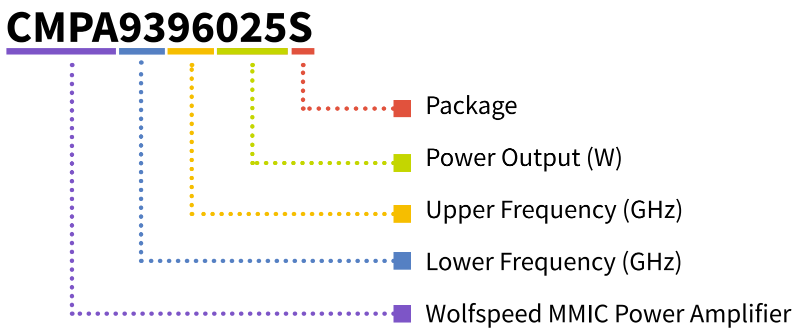

Table 1.

Parameter	Value	Units
Lower Frequency	9.3	GHz
Upper Frequency	9.6	
Power Output	25	W
Package	Surface Mount	–

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
CMPA9396025S	Packaged GaN MMIC PA	Each	
CMPA9396025S-AMP1	Evaluation Board with GaN MMIC Installed	Each	

For more information, please contact:

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Notes & Disclaimer

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