CMPA1D1J001S

12.7 – 18 GHz, 1 W GaN HPA

Description

The CMPA1D1J001S is a 1W package MMIC HPA utilizing the high performance, 0.15um GaN on SiC production process. The CMPA1D1J001S operates from 12.7-18 GHz and supports both radar and communication applications within both military and commercial markets. The CMPA1D1J001S achieves 1 W of saturated output power with 23 dB of large signal gain and typically 30% power-added efficiency under CW operation.

Packaged in a 4x3 mm plastic overmold QFN, the CMPA1D1J001S provides superior broadband performance and environmental robustness in a small form factor allowing customers to improve SWaP-C benchmarks in their next-generation systems.

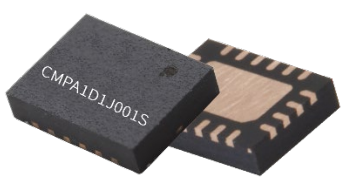


Figure 1. CMPA1D1J001S

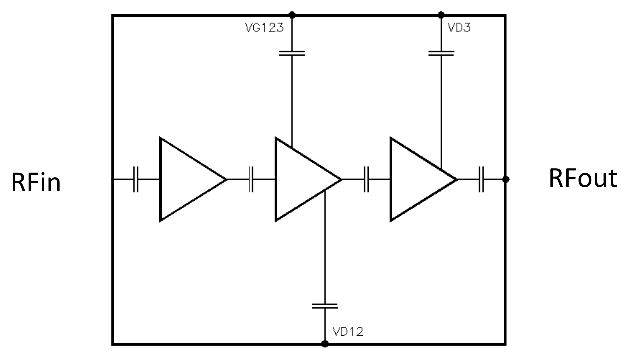


Figure 2. Functional Block Diagram

Features

- Psat: 1 W
- PAE: 30 %
- LSG: 23 dB
- S21: 27 dB
- S11: -10 dB
- S22: -8 dB
- CW operation
- Small 4 x 3 mm footprint

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

Applications

- Military and Commercial Radar and Communications
- General Purpose Broadband Amplifier

RoHS compliant

Absolute Maximum Ratings

Parameter	Symbol	Units	Value	Conditions
Drain to Source Voltage	V_{DSS}	V	84	
Drain Voltage	V_D	V	28	
Gate Voltage	V_G	V	-8, +2	
Drain Current	I_D	A	0.8	
Gate Current	I_G	mA	1.0	
Input Power	P_{in}	dBm	10	
Dissipated Power	P_{diss}	W	4.4	85 °C
Storage Temperature	T_{stg}	°C	-55, +150	
Mounting Temperature	T_J	°C	260	30 seconds
Junction Temperature	T_J	°C	225	
Output Mismatch Stress	VSWR	Ψ	5:1	

Recommended Operating Conditions

Parameter	Symbol	Units	Typical Value	Conditions
Drain Voltage	Vd	V	22	
Gate Voltage	Vg	V	-2.0	
Drain Current	Idq	mA	30	
Input Power	Pin	dBm	8	
Case Temperature	Tcase	°C	-40 to 85	

RF Specifications

Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C

Parameter	Units	Frequency	Min	Typical	Max	Conditions
Frequency	GHz		13		18	
Output Power	dBm	12.7		30.5		
		15.5		31.5		
		18		30.5		
Power-added Efficiency	%	12.7		28		
		15.5		35		
		18		34		
LSG	dB	12.7		22.5		
		15.5		23.5		
		18		22.5		
Small-Signal Gain	dB	12.7		27		Pin = -20 dBm
		15.5		30		
		18		24		
Input Return Loss	dB			-10		Pin = -20 dBm
Output Return Loss	dB			-8		Pin = -20 dBm

Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 3: Pout v. Frequency v. Temperature

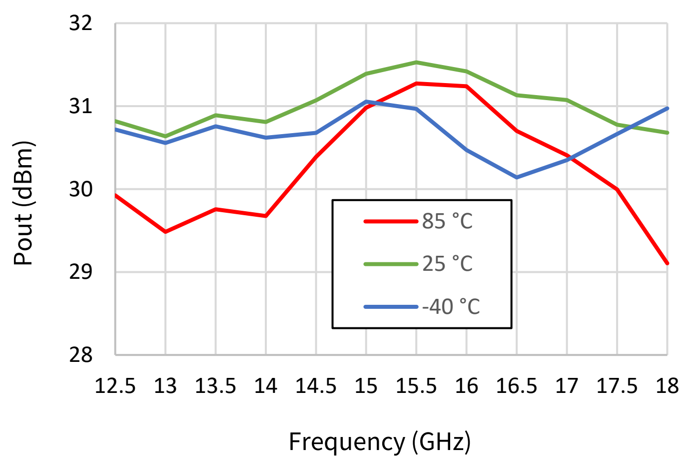


Figure 4: PAE v. Frequency v. Temperature

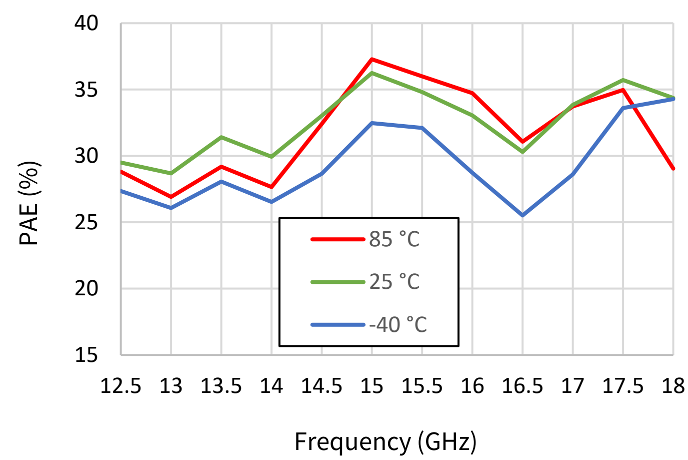


Figure 5: Id v. Frequency v. Temperature

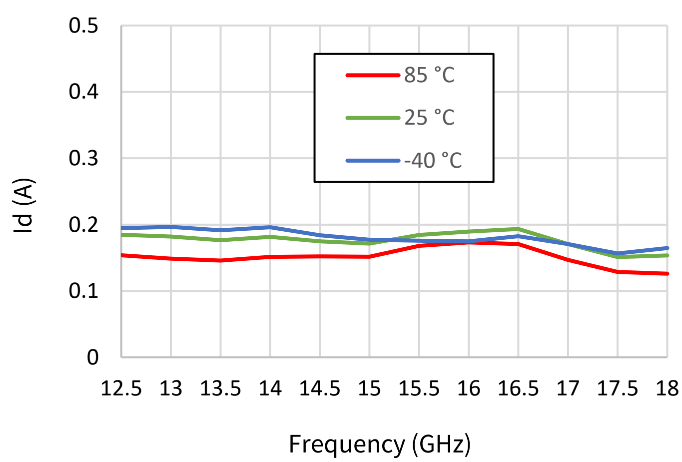


Figure 6: Ig v. Frequency v. Temperature

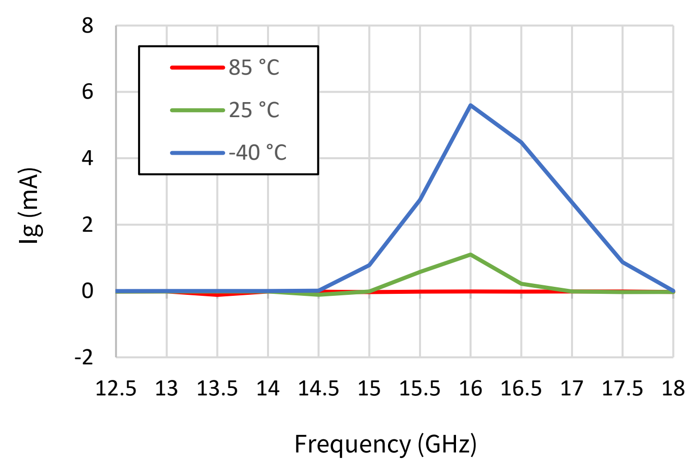
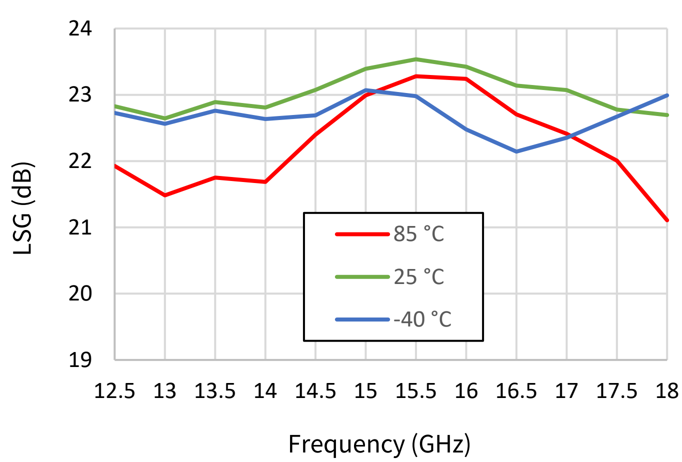


Figure 7: LSG v. Frequency v. Temperature



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 8: Pout v. Frequency v. Vd

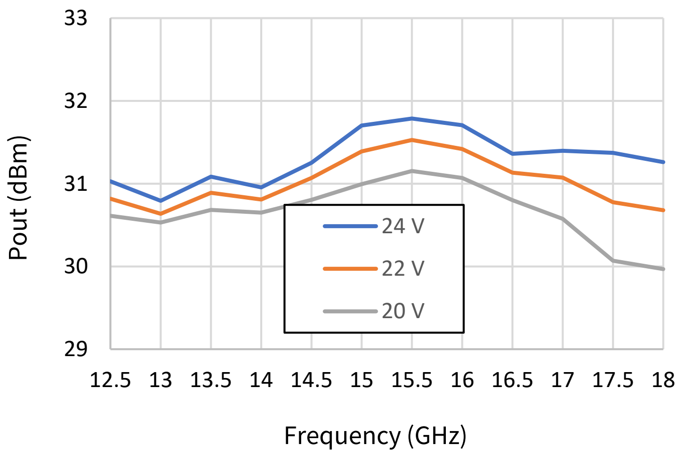


Figure 9: PAE v. Frequency v. Vd

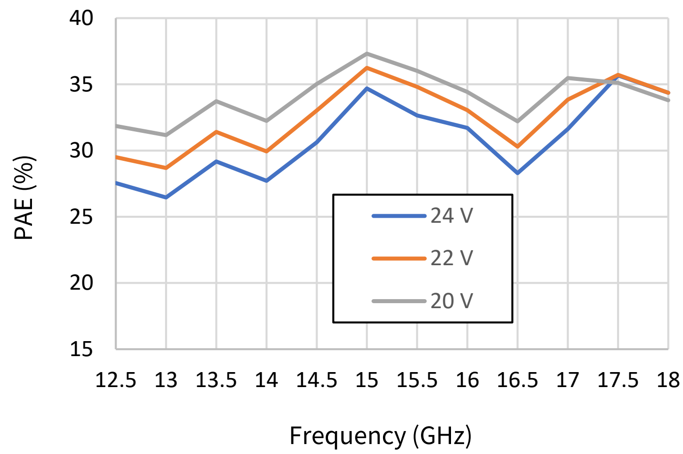


Figure 10: Id v. Frequency v. Vd

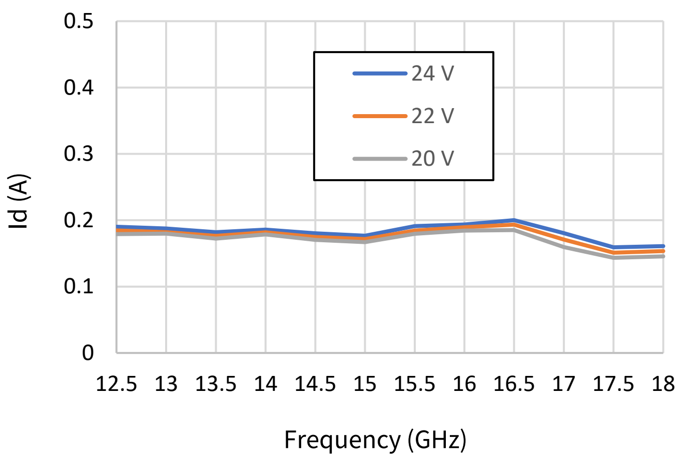


Figure 11: Ig v. Frequency v. Vd

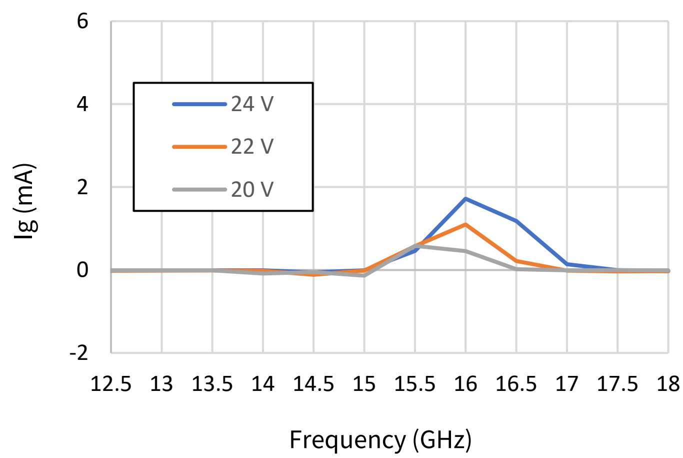
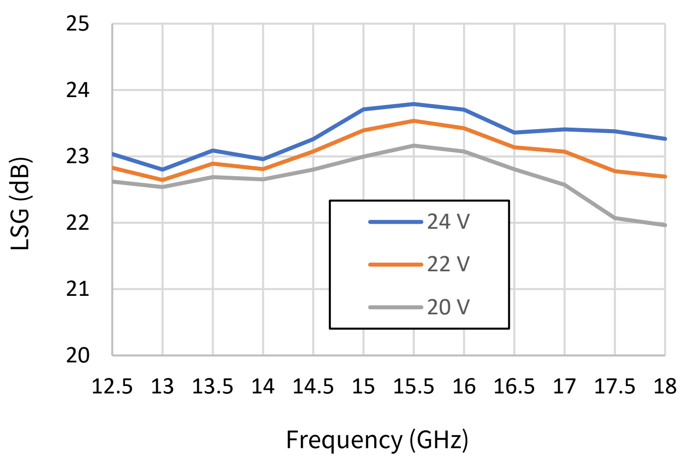


Figure 12: LSG v. Frequency v. Vd



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 13: Pout v. Frequency v. Idq

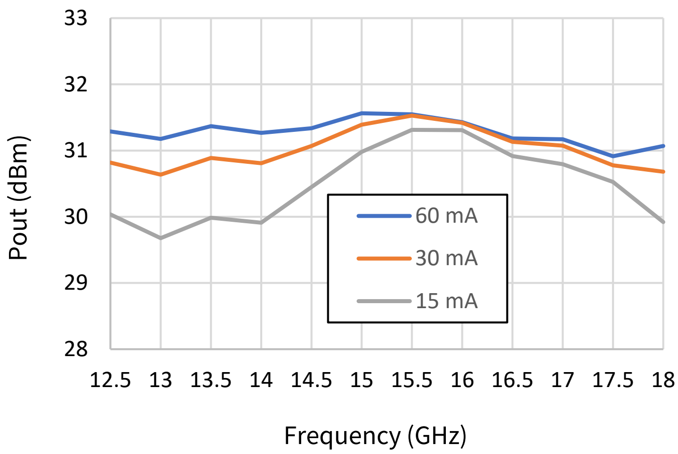


Figure 14: PAE v. Frequency v. Idq

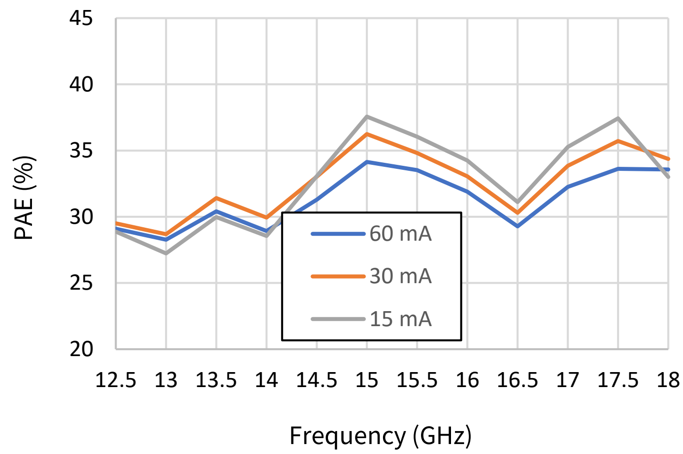


Figure 15: Id v. Frequency v. Idq

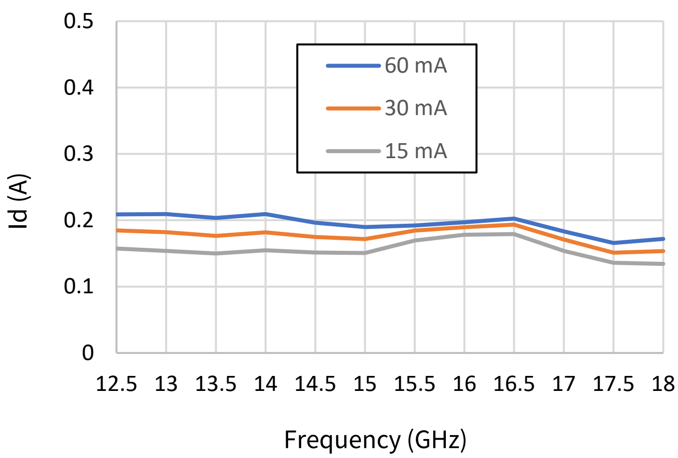


Figure 16: Ig v. Frequency v. Idq

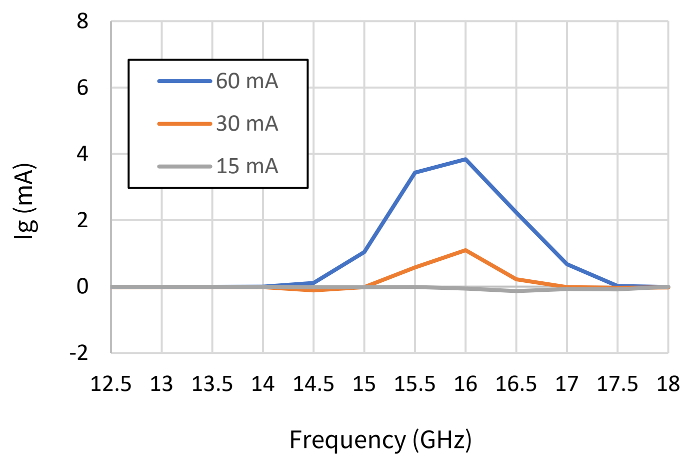
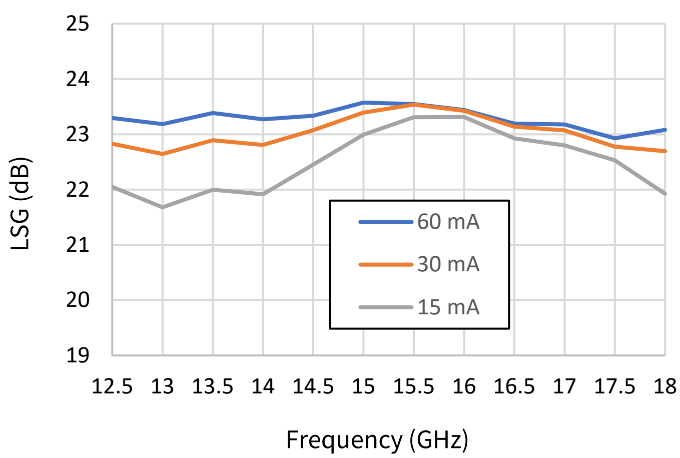


Figure 17: LSG v. Frequency v. Idq



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 18: Pout v. Pin v. Frequency

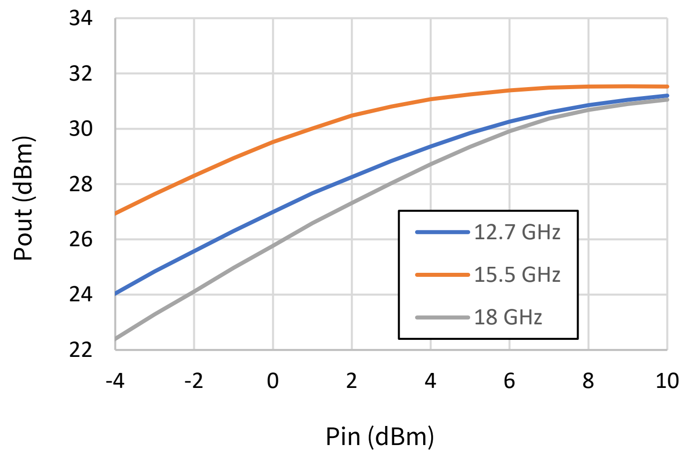


Figure 19: PAE v. Pin v. Frequency

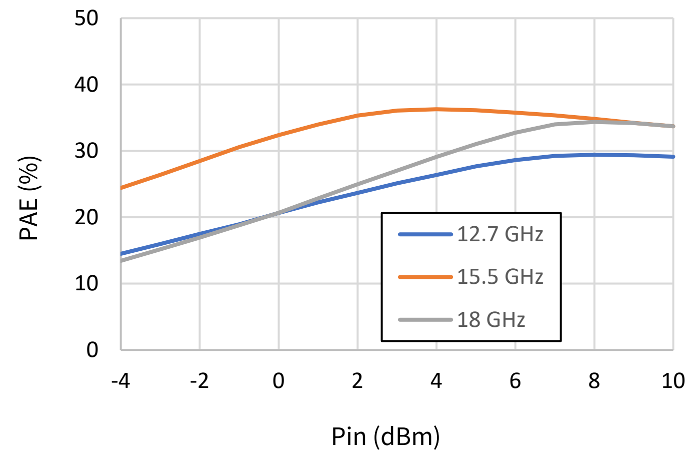


Figure 20: Id v. Pin v. Frequency

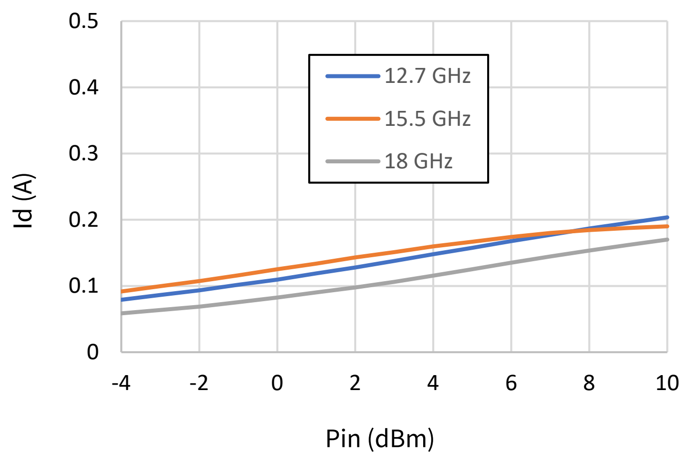


Figure 21: Ig v. Pin v. Frequency

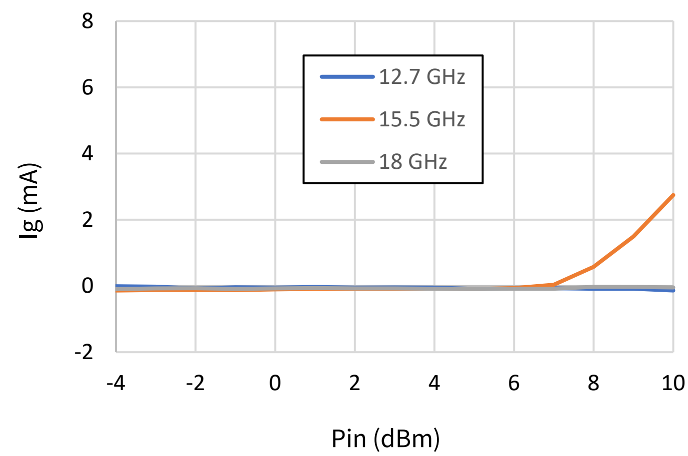
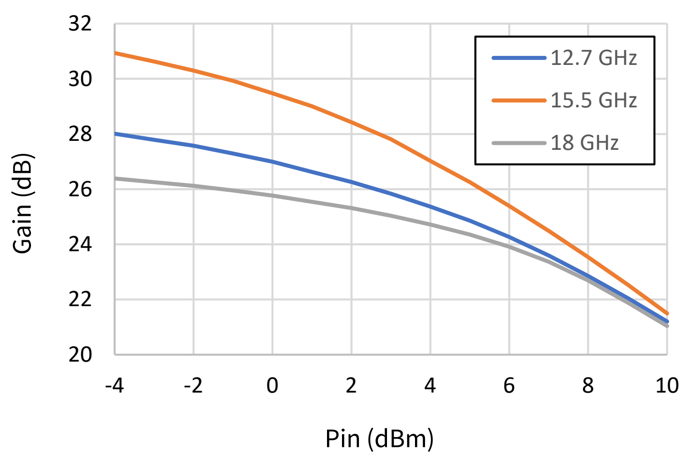


Figure 22: Gain v. Pin v. Frequency



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 23: Pout v. Pin v. Temperature

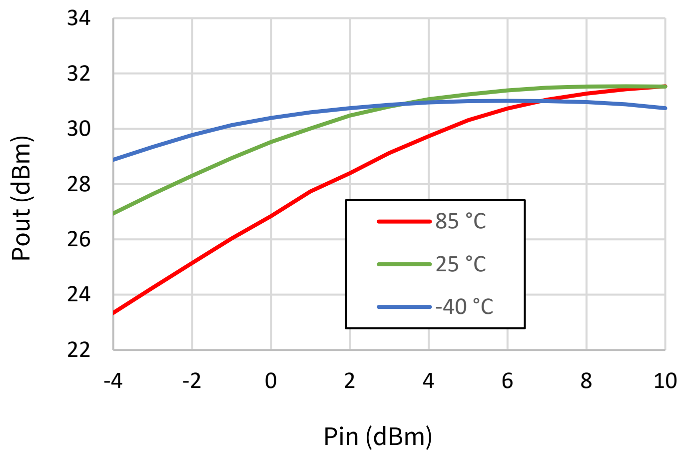


Figure 24: PAE v. Pin v. Temperature

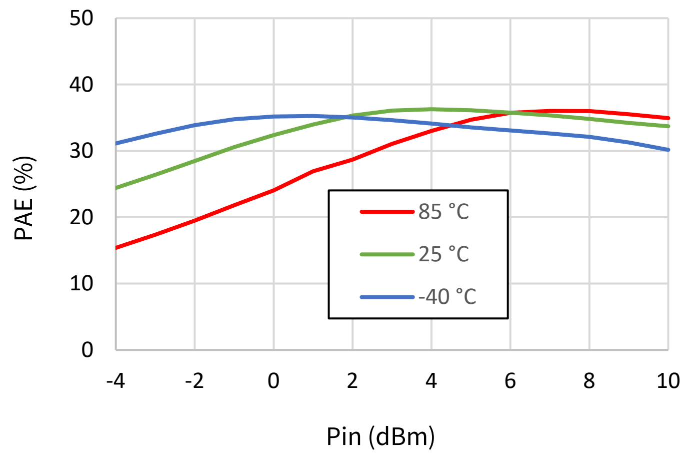


Figure 25: Id v. Pin v. Temperature

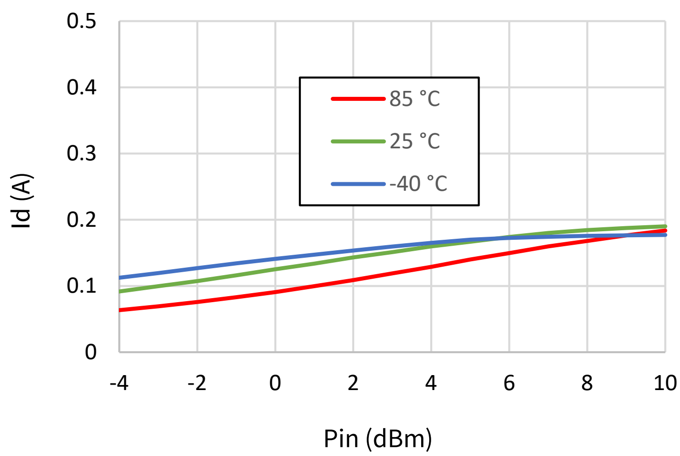


Figure 26: Ig v. Pin v. Temperature

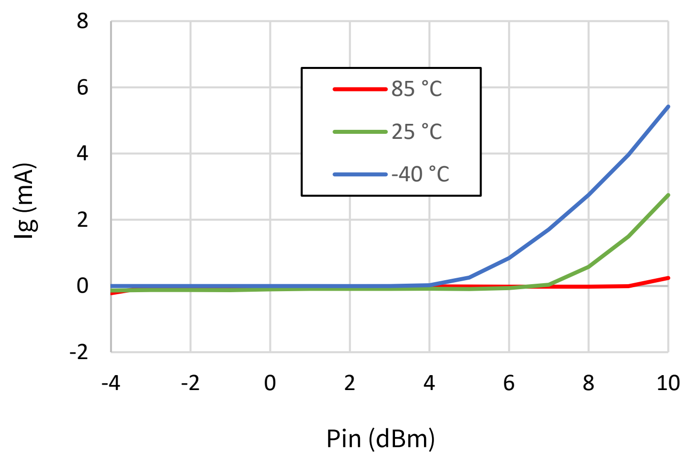
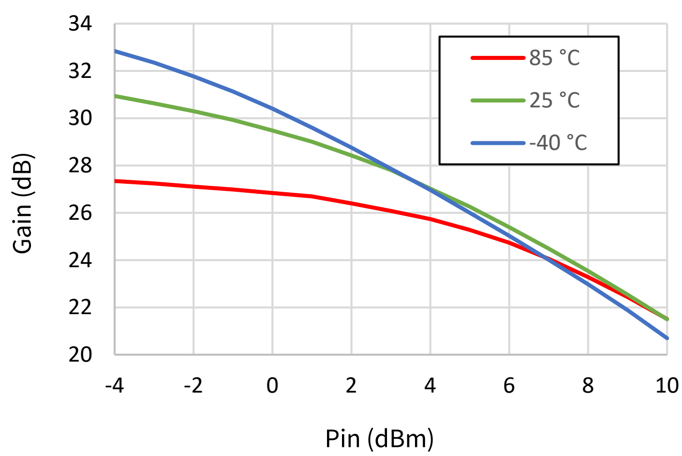


Figure 27: Gain v. Pin v. Temperature



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 28: Pout v. Pin v. Vd

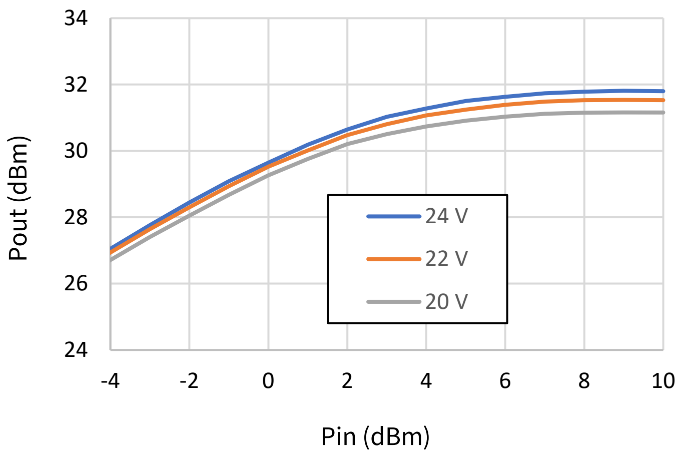


Figure 29: PAE v. Pin v. Vd

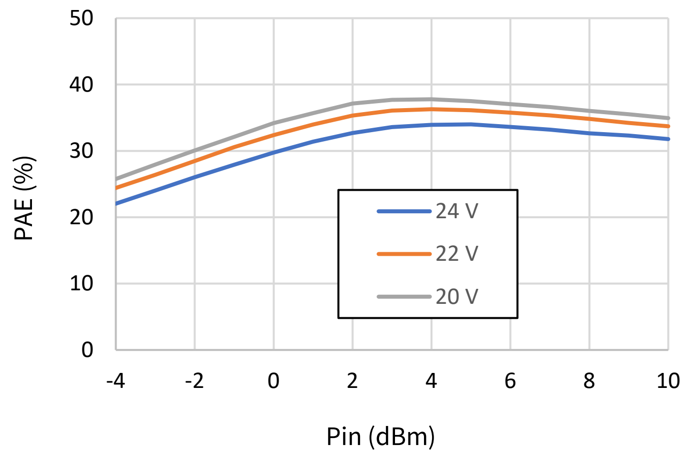


Figure 30: Id v. Pin v. Vd

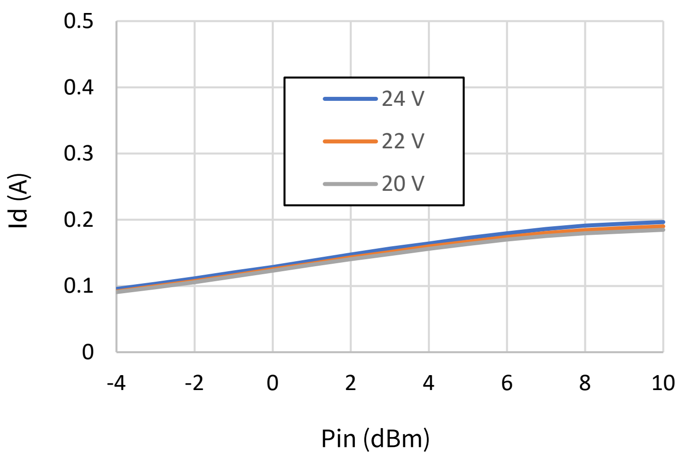


Figure 31: Ig v. Pin v. Vd

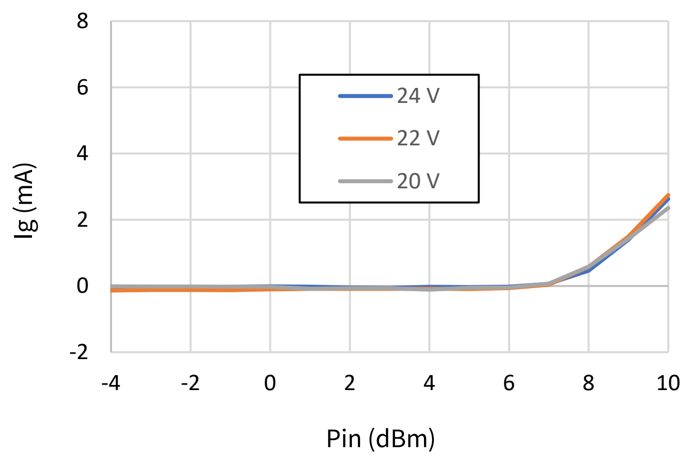
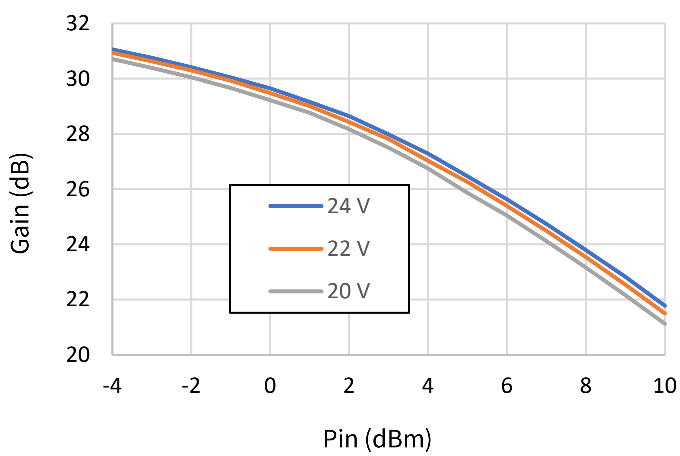


Figure 32: Gain v. Pin v. Vd



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 33: Pout v. Pin v. Idq

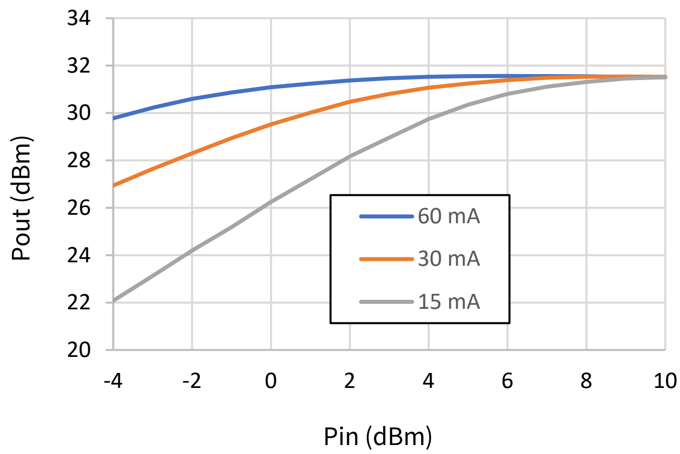


Figure 34: PAE v. Pin v. Idq

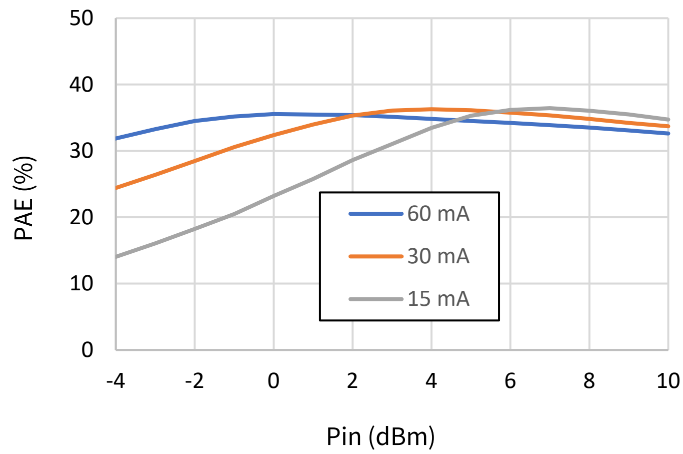


Figure 35: Id v. Pin v. Idq

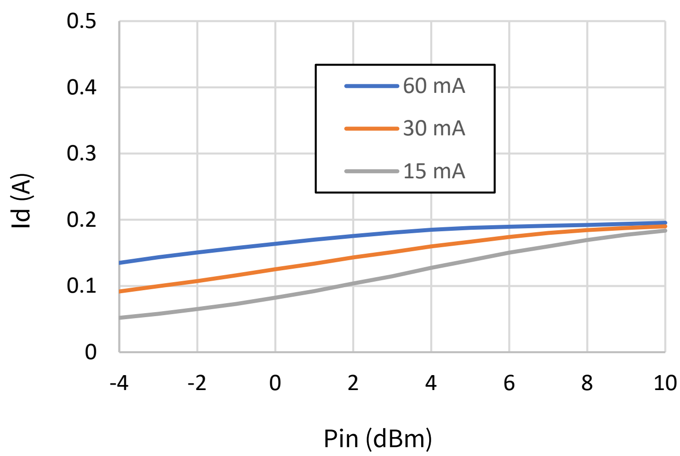


Figure 36: Ig v. Pin v. Idq

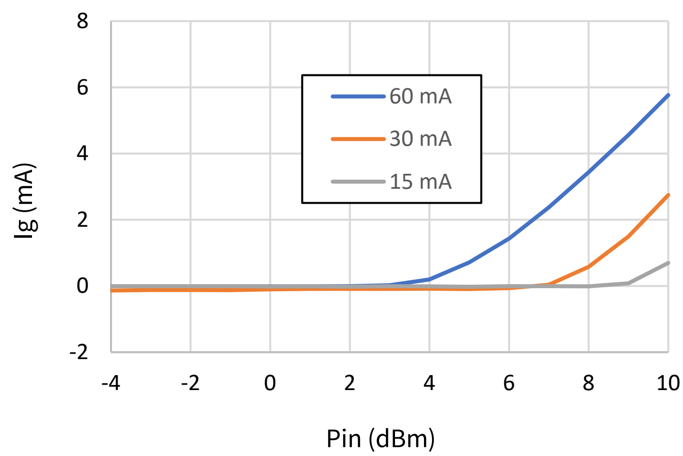
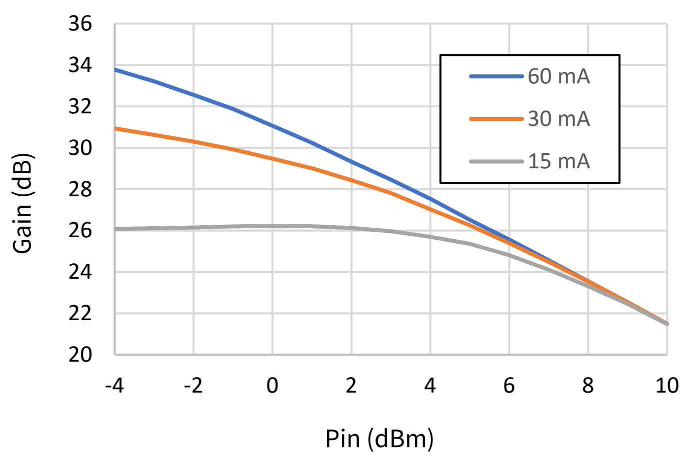


Figure 37: Gain v. Pin v. Idq



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 38: S21 v. Frequency v. Temperature

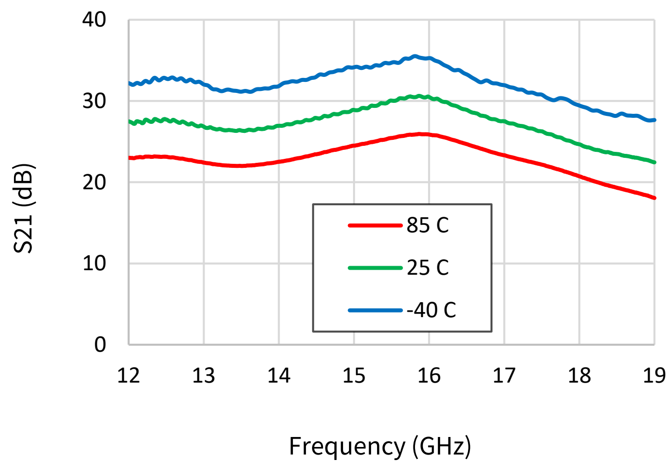


Figure 39: S21 v. Frequency v. Vd

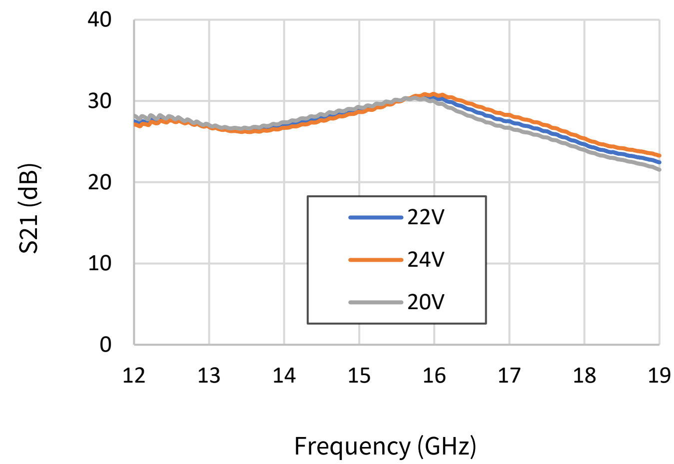


Figure 40: S11 v. Frequency v. Temperature

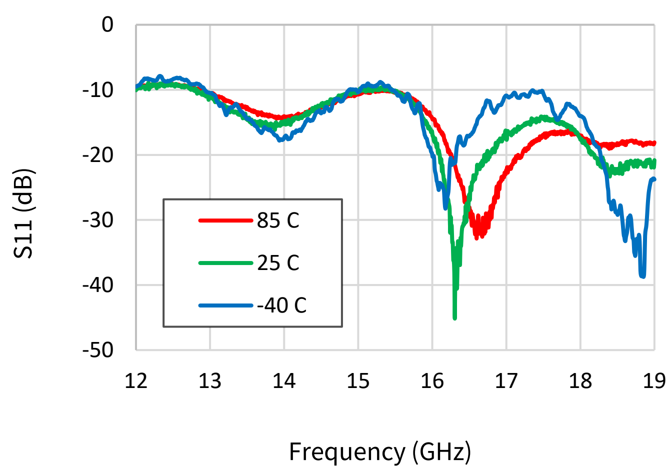


Figure 41: S11 v. Frequency v. Vd

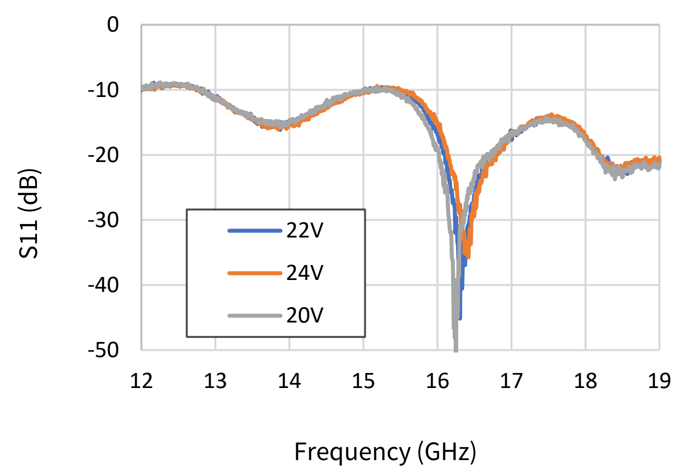


Figure 42: S22 v. Frequency v. Temperature

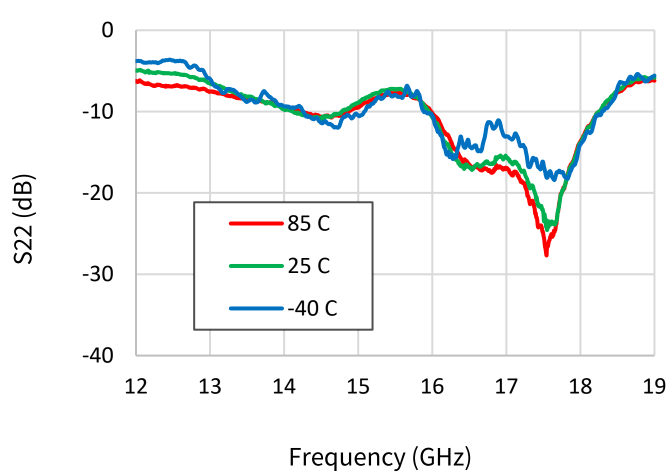
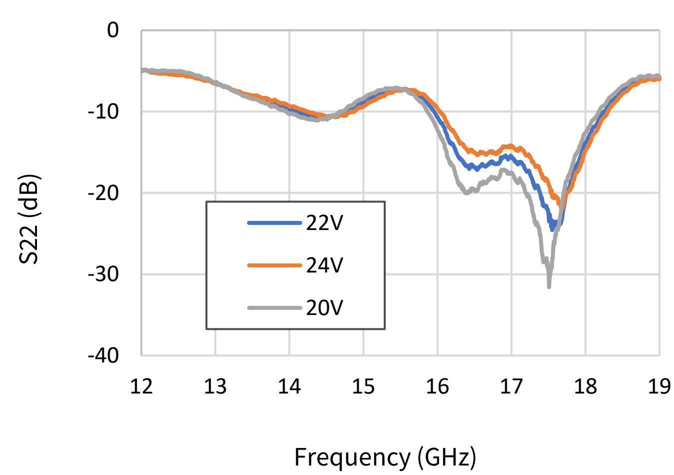


Figure 43: S22 v. Frequency v. Vd



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz

Figure 44: S21 v. Frequency v. Idq

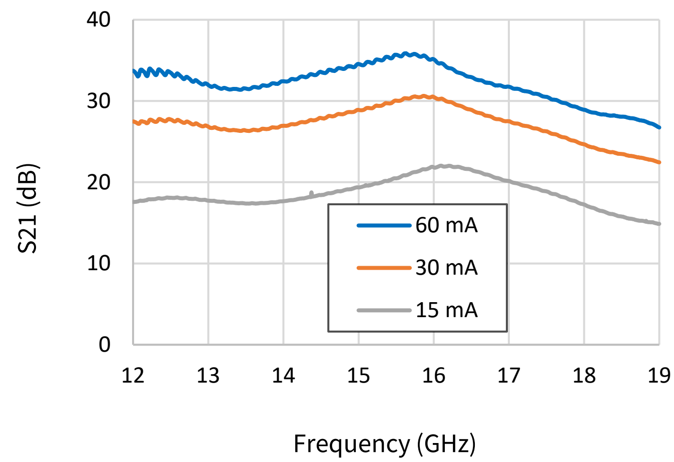


Figure 45: S11 v. Frequency v. Idq

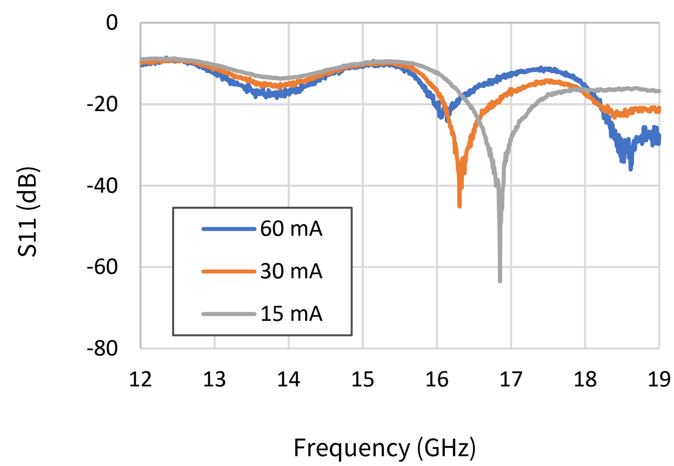
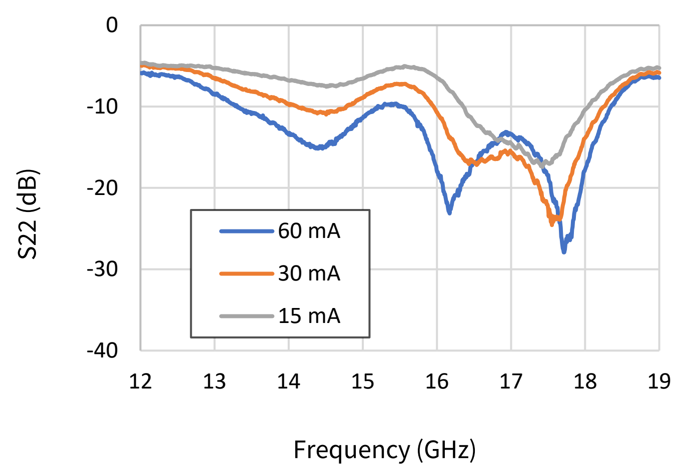


Figure 46: S22 v. Frequency v. Idq



Test conditions unless otherwise noted: Vd=22 V, Idq=30mA, CW, Pin = 8 dBm, T_{base}=25 °C, Frequency: 15.5GHz, Tone Spacing = 10 MHz, T_{base}=25 °C

Figure 47: IM3 v. Pout/tone v. Frequency

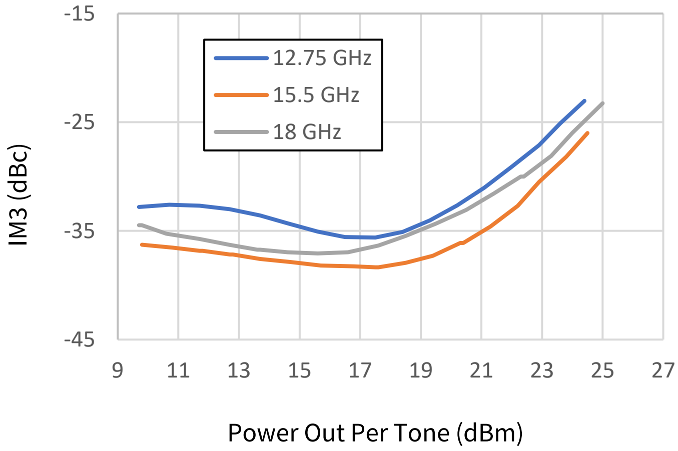


Figure 48: IM5 v. Pout/tone v. Frequency

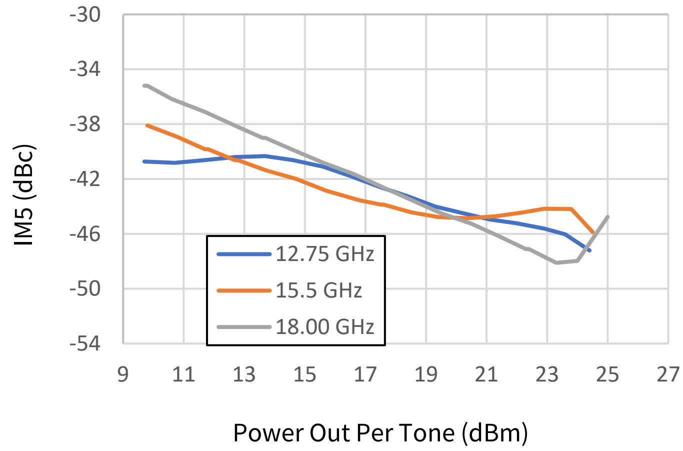


Figure 49: IM3 v. Pout/tone v. Temperature

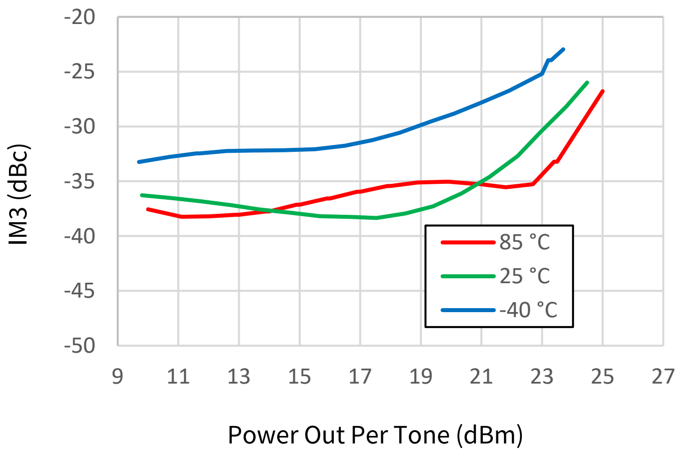


Figure 50: IM5 v. Pout/tone v. Temperature

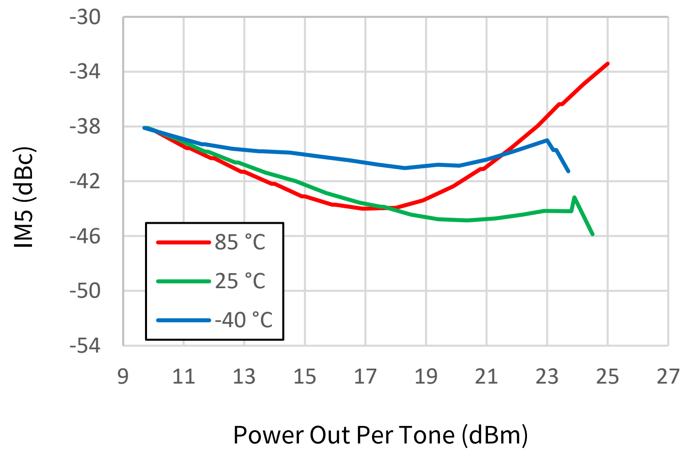


Figure 51: IM3 v. Pout/tone v. Idq

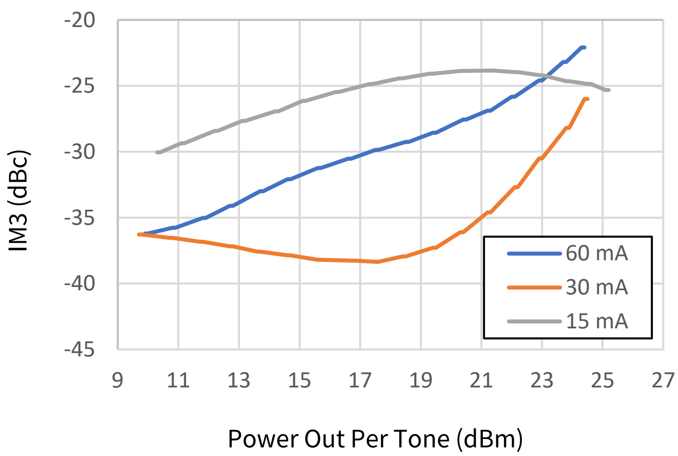
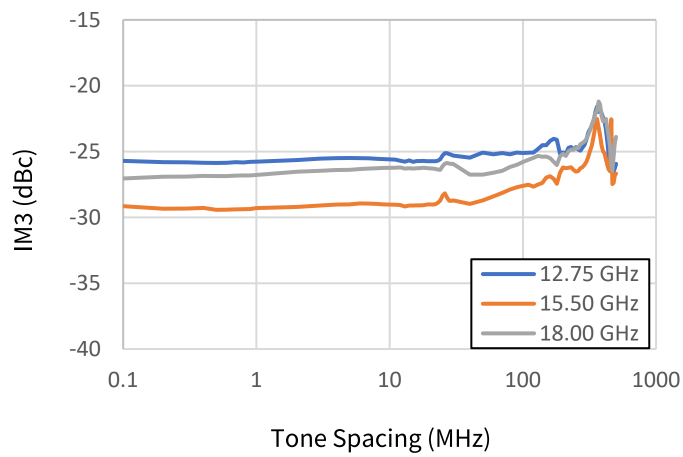


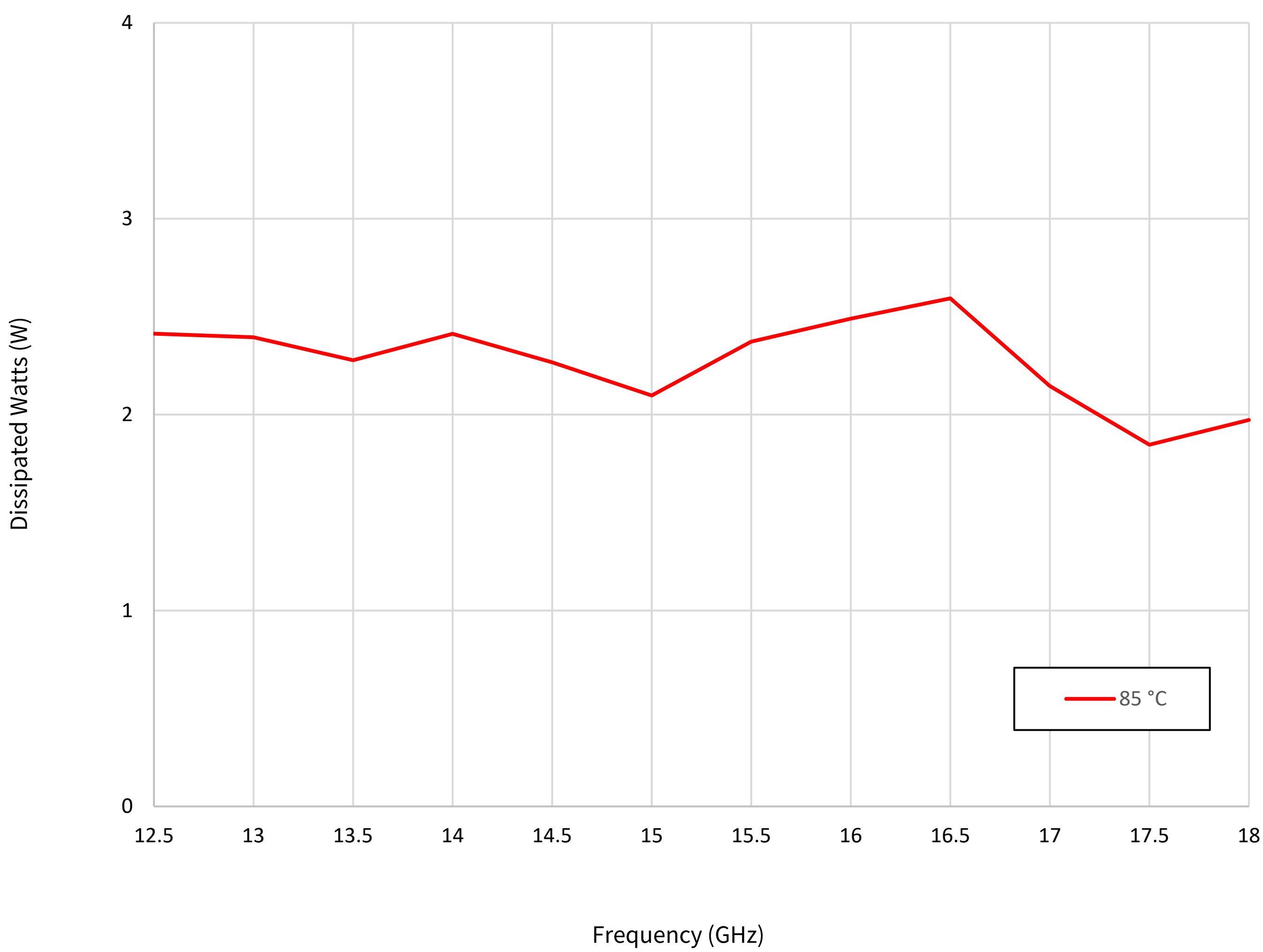
Figure 52: IM3 v. Tone Spacing v. Frequency



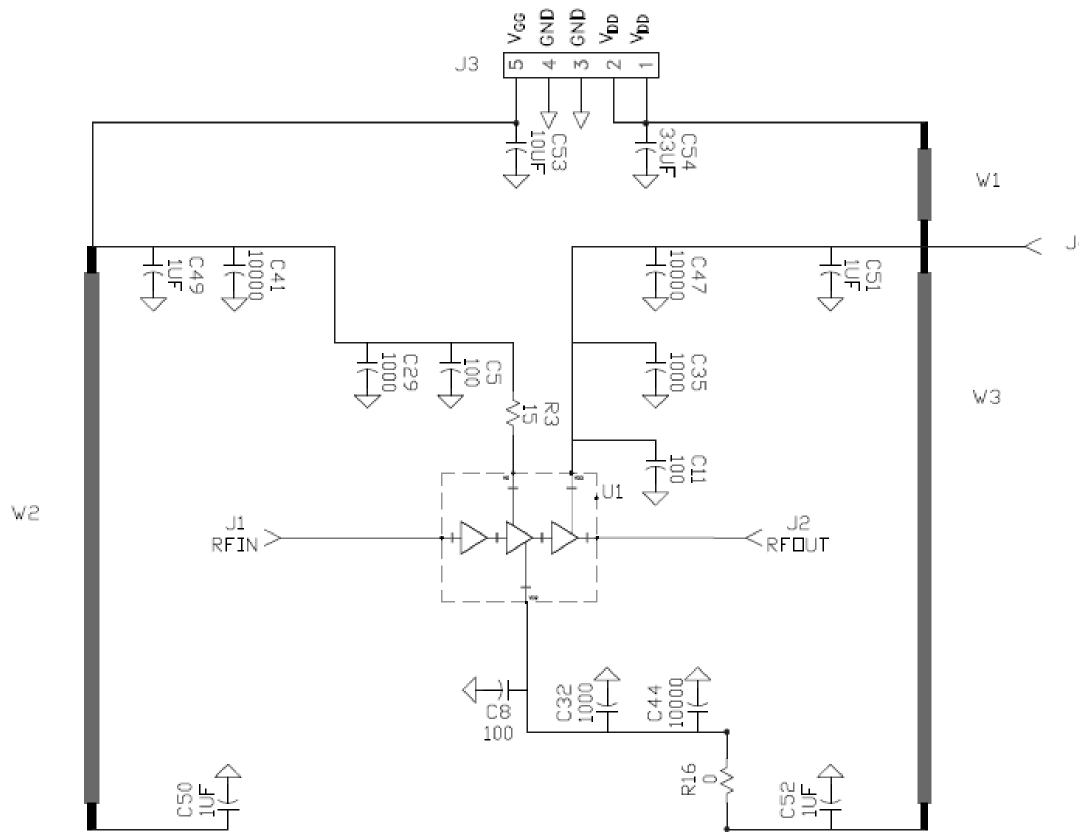
Thermal Characteristics

Parameter	Symbol	Value	Operating Conditions
Operating Junction Temperature	T_J	161.3	Freq = 15.5 GHz, V_d = 22 V, I_{dq} = 30 mA, I_{drive} = 190 mA, Pin = 8 dBm, P_{out} = 31 dBm, P_{diss} = 2.4 W, T_{case} = 85°C, CW
Thermal Resistance, Junction to Case	$R_{\theta JC}$	31.8	

Power Dissipation v. Frequency (Tcase = 85°C)



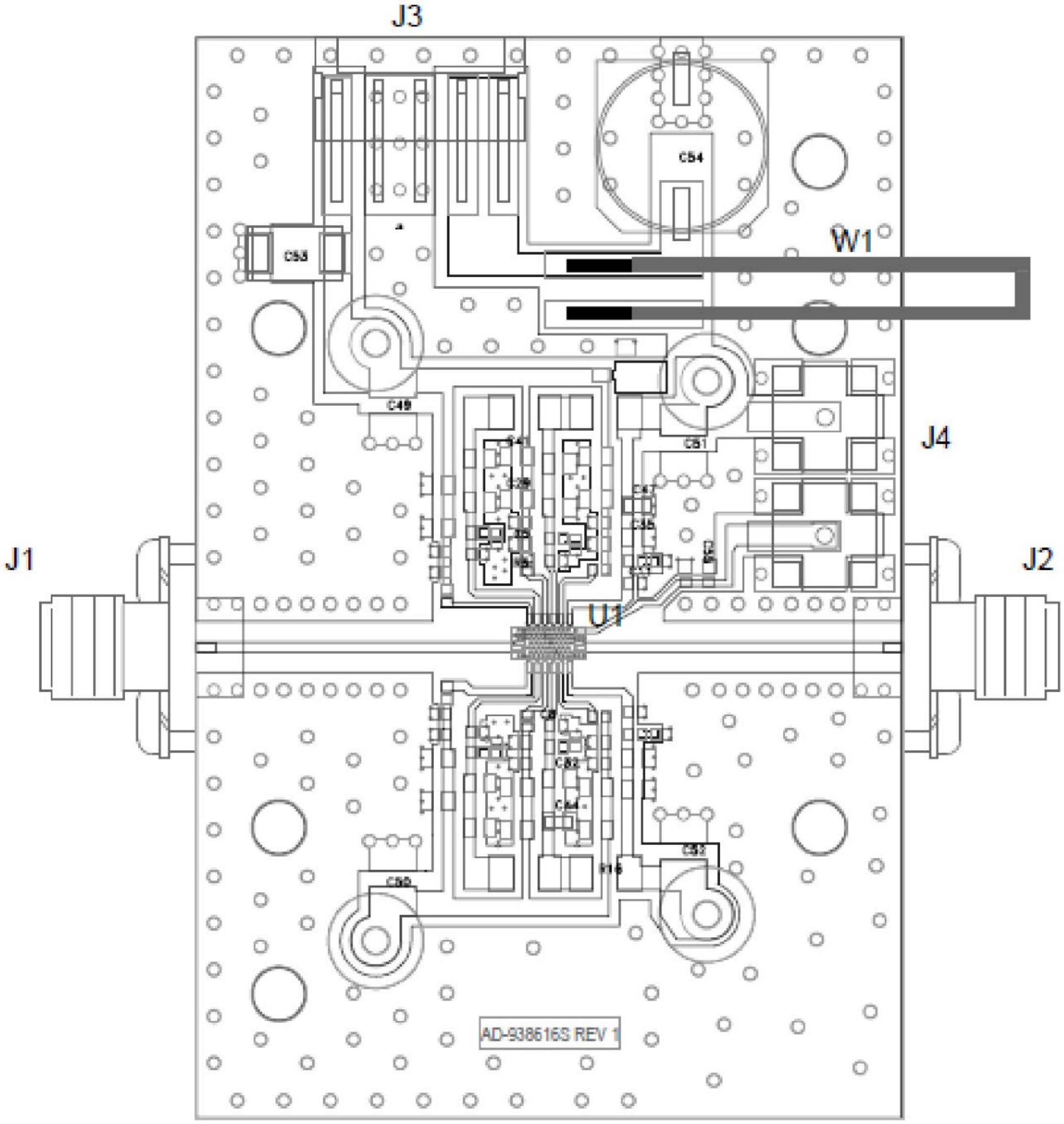
CMPA1D1J001S-AMP1 Evaluation Board Schematic Drawing



CMPA1D1J001S-AMP1 Evaluation Board Bill of Materials

Reference Designator	Description	Qty
C47, C41, C44	C0G, 10nF, +/-5%, 100V, 0603	3
C54	CAP, 33 UF, 20%, G CASE	1
C53	CAP, 10UF, 16V, TANTALUM	1
C11, C55, C5, C8	CAP, 100pF, +/-5%, 50V, 0402	4
R3	RES 15 OHM, +/-1%, 1/16W, 0402	1
C35, C29, C32	CAP, 1000PF, +/-5%, 100V, 0603	3
C49, C50, C51, C52	CAP, 1UF, 100V	4
R16	RES 0.0 OHM 1/16W 1206 SMD	1
-	PCB, RF-35, .010 THK, 3X4, 3-STAGE, QFN, CMPA1D1J001S	1
-	BASEPLATE 2.6”x1.7”x0.25” AL 3x4 QFN	1
-	2-56 SOC HD SCREW 3/16 SS	4
-	#2 SPLIT LOCKWASHER SS	4
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
J3	HEADER RT>PLZ .1CEN LK 5POS	1
W2, W3	WIRE, BLACK, 20 AWG	1
W1	WIRE, BLACK, 22 AWG	3
U1	CMPA1D1J001S	1

CMPA1D1J001S-AMP1 Evaluation Board Assembly Drawing



Note: W2 and W3 are connected on backside

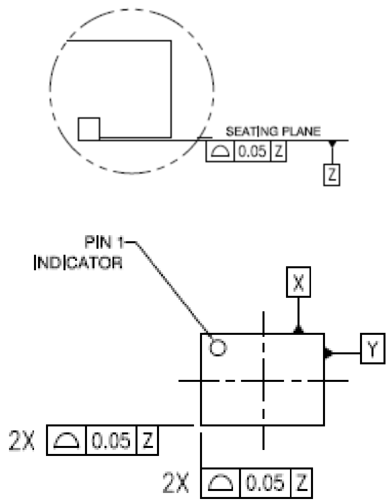
Bias On Sequence

1. Ensure RF is turned-off
2. Apply pinch-off voltage of -5 V to the gate (Vg)
3. Apply nominal drain voltage (Vd)
4. Adjust Vg to obtain desired quiescent drain current (Idq)
5. Apply RF

Bias Off Sequence

1. Turn RF off
2. Apply pinch-off to the gate (Vg=-5V)
3. Turn off drain voltage (Vd)
4. Turn off gate voltage (Vg)

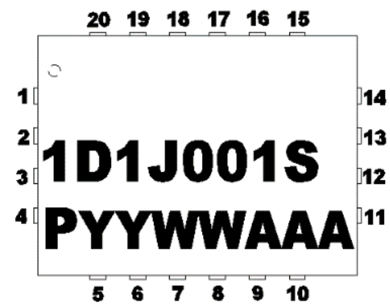
Product Dimensions

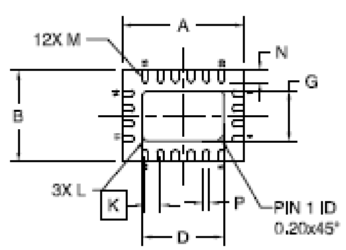


TOP VIEW

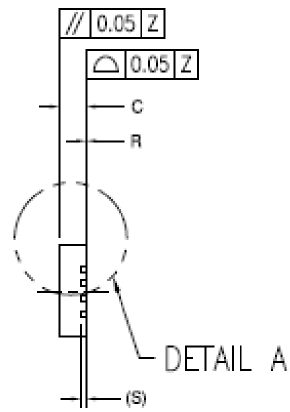
NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
2. NUMBER OF LAND PADS: 20
3. THE CONTENTS OF THIS DRAWING ARE INTENDED TO REPRESENT THE PRODUCT IN MARKETING GRAPHICS ONLY AND NOT INTENDED TO BE USED FOR ANY PRODUCTION OR INTERNAL QUALIFICATION PURPOSE.





BOTTOM VIEW



SIDE VIEW

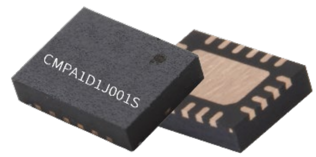
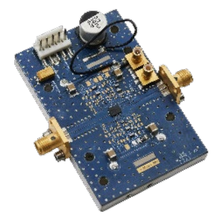
DIM	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	.156	.157	.159	3.95	4.00	4.05
B	.116	.118	.120	2.95	3.00	3.05
C	.033	.035	.037	0.85	0.90	0.95
D	.098	.104	.108	2.50	2.65	2.75
G	.059	.065	.069	1.50	1.65	1.75
K	–	.020	–	–	0.50	–
L	.004	.006	.008	0.10	0.15	0.20
M	.002	.003	.004	0.050	0.085	0.110
N	.012	.016	.020	0.30	0.40	0.50
P	.005	.008	.010	0.13	0.20	0.25
R	.000	.001	.002	0.00	0.02	0.05
S	–	.008	–	–	0.20	–

PIN	DESC	PIN	DESC
1	NC	11	RFGND
2	RFGND	12	RFOUT
3	RFIN	13	RFGND
4	RFGND	14	NC
5	NC	15	VD3
6	NC	16	NC
7	NC	17	NC
8	VD1,VD2	18	VG
9	NC	19	NC
10	NC	20	NC

Electrostatic Discharge (ESD) Classification

Parameter	Symbol	Class	Classification Level	Test Methodology
Human body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

Product Ordering Information

Part Number	Description	MOQ Increment	Image
CMPA1D1J001S	12.7 – 18 GHz, 1W GaN MMIC		
CMPA1D1J001S-AMP1	Evaluation Board w/ PA	1 Each	

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