Features

- Saturated Power: 40 W
- Power Added Efficiency: 40%
- Large Signal Gain: 23 dB
- Small Signal Gain: 30 dB
- Input Return Loss: <-10 dB
- Output Return Loss: <-5 dB
- CW Operation
- Small Footprint

Applications

- Electronic Warfare
- Military and Commercial Radar
- Test Instrumentation
- General Broadband Amplification

Description

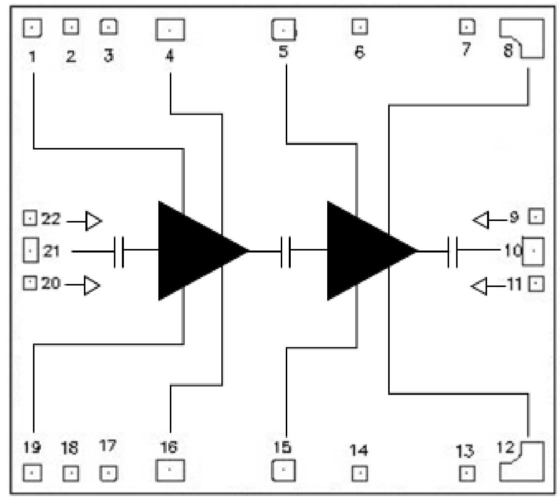
The CMPA2060040D1 is a 40 W MMIC HPA utilizing a high performance, 0.15 µm GaN-on-SiC production process. The CMPA2060040D1 operates from 2 - 6 GHz and supports electronic warfare, radar and other general broadband amplification needs. The CMPA2060040D1 achieves 40 W of saturated output power with 23 dB of large signal gain and typically 40% power-added efficiency under CW operation.

The CMPA2060040D1 provides improved RF performance over previous generations allowing customers to improve SWaP-C benchmarks in their next-generation systems.

Ordering Information

Part Number	Package (MOQ/ Mult)
CMPA2060040D1	Gel Pack (10/10)
CMPA2060040D1-AMP1	Sample Board (1/1)

Functional Schematic



Pin Configuration[1]

Pin #	Function
2, 3, 6, 7, 9, 11, 13, 14, 17, 18, 20, 22, MMIC backside	GND
1, 19	VG1
4, 16	VD1
5, 15	VG2
8, 12	VD2
10	RF_{OUT}
21	RF_{IN}

1. The backside of the MMIC must be connected to RF, DC and thermal ground.

RF Electrical Specifications: V_D = 28 V, I_{DQ} = 1 A, CW, T_C = 25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Frequency (GHz)	Units	Min.	Typ.	Max.
Output Power	P_{IN} = 23 dBm	2 4 6	dBm	44.0 45.5 44.0	45.5 46.5 45.0	-
Power Added Efficiency		2 4 6	%	45 40 30	50 45 32	-
Large Signal Gain		2 4 6	dB	21.0 22.5 21.0	22.5 23.5 22.0	-
Small Signal Gain	P_{IN} = -20 dBm	2 4 6	dB	-	30 29 27	-
Input Return Loss		2 - 6	dB	-	-10	-
Output Return Loss		2 - 6	dB	-	-5	-

DC Electrical Specifications:

Parameter	Units	Min.	Typ.	Max.
Drain Voltage	V	—	28	—
Gate Voltage	V	—	-1.9	—
Quiescent Drain Current	A	—	1	—
Saturated Drain Current	A	—	4	—

Recommended Operating Conditions

Parameter	Symbol	Unit	Min.	Typ.	Max.
Input Power	P_{IN}	dBm	—	23	—
Drain Voltage	V_D	V	—	28	—
Gate Voltage	V_G	V	—	-1.9	—
Quiescent Drain Current	I_{DQ}	A	—	1	—
Operating Temperature	T_C	°C	-40	—	+85

Absolute Maximum Ratings[2,3]

Parameter	Symbol	Unit	Min.	Max.
Input Power	P_{IN}	dBm	—	25
Drain to Source Voltage	V_{DS}	V	—	84
Drain Voltage	V_D	V	—	28
Gate Voltage	V_G	V	-8	+2
Drain Current	I_D	A	—	5.0
Gate Current	I_G	mA	—	16.32
Dissipated Power @ +85°	P_{DISS}	W	—	140
VSWR	-	Ratio	—	5:1
Junction Temperature (MTTF > 1E6 Hrs)	T_J	°C	—	+225
Storage Temperature	T_{STG}	°C	-65	+150
Mounting Temperature (30 seconds)	T_M	°C	—	+320

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

Please observe the following precautions to avoid damage:

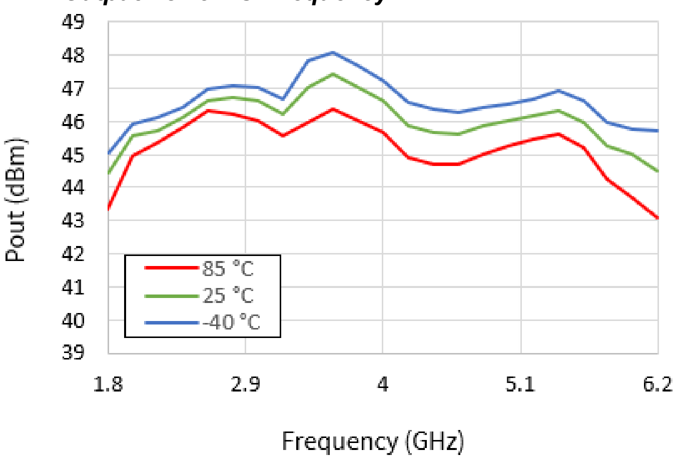
Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B devices.

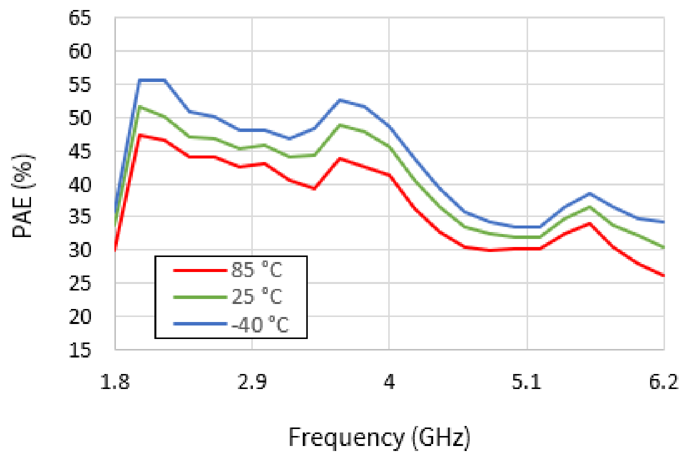
Typical Performance Curves - Large Signal over Temperature

V_D = 28 V, I_{DQ} = 1 A, CW, P_{IN} = 23 dBm

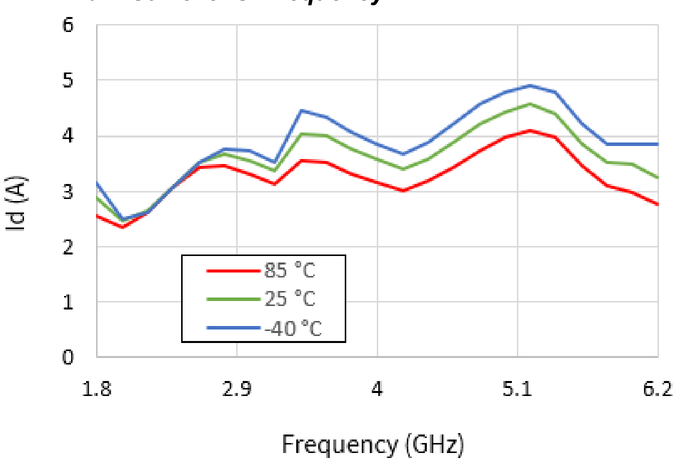
Output Power vs. Frequency



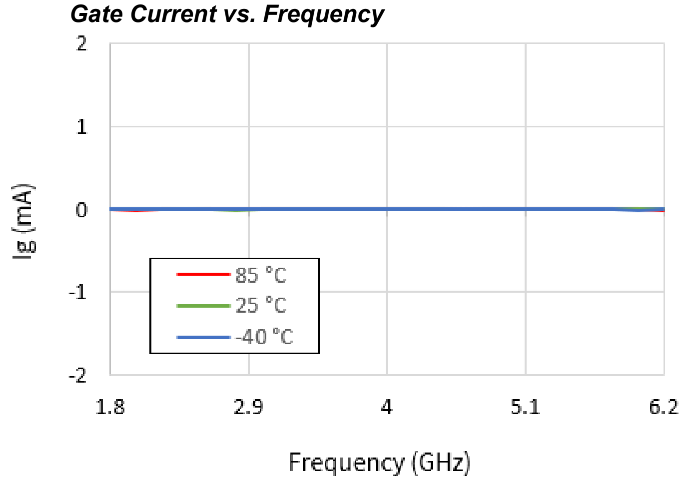
Power-Added Efficiency vs. Frequency



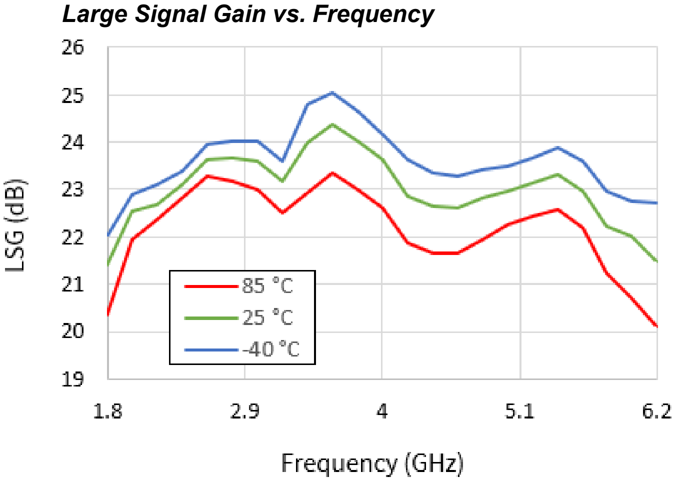
Drain Current vs. Frequency



Gate Current vs. Frequency



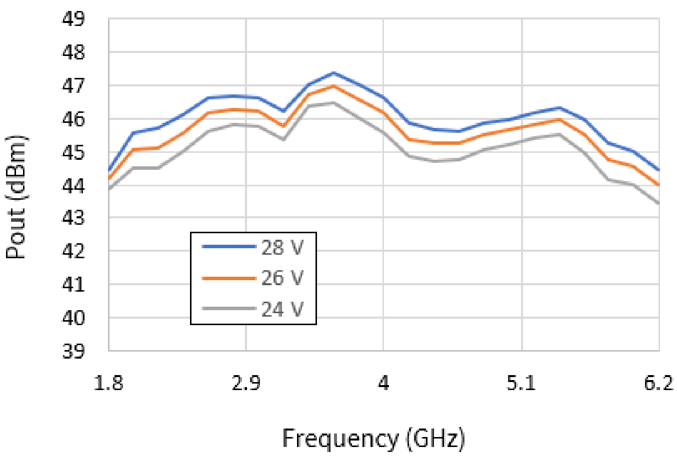
Large Signal Gain vs. Frequency



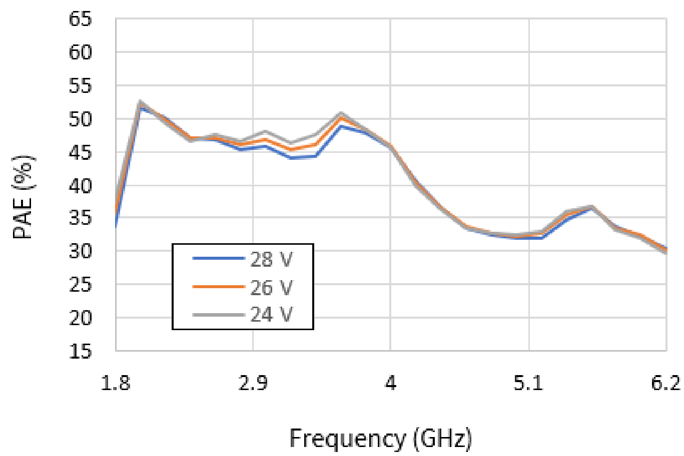
Typical Performance Curves - Large Signal over V_D

I_{DQ} = 1 A, CW, P_{IN} = 23 dBm, T_C = 25°C

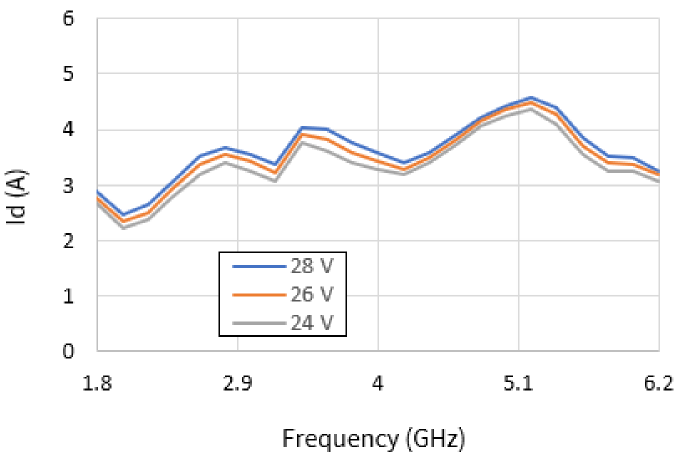
Output Power vs. Frequency



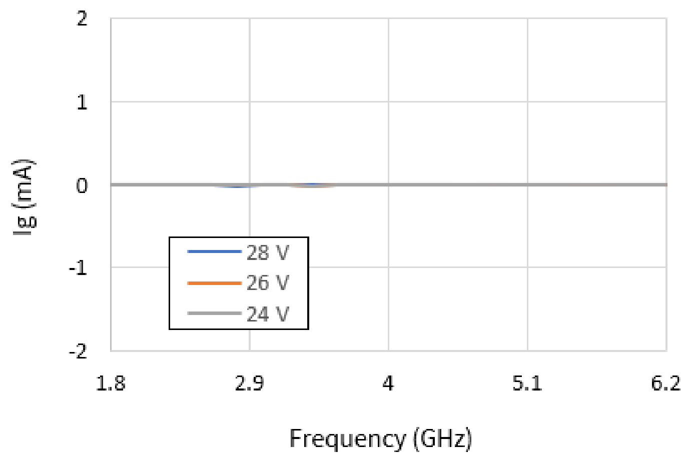
Power-Added Efficiency vs. Frequency



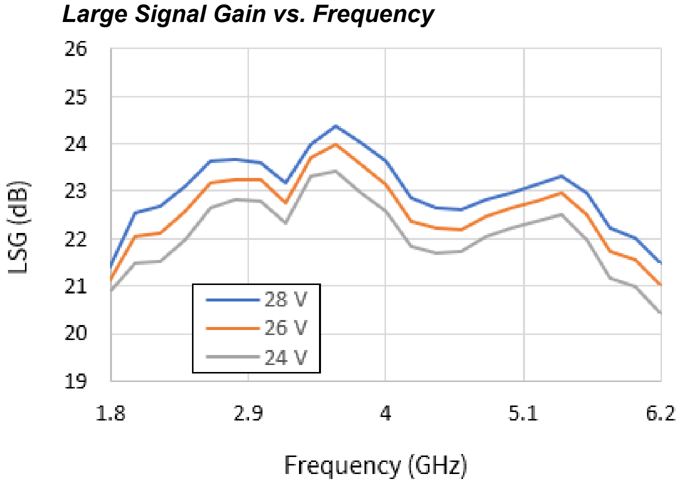
Drain Current vs. Frequency



Gate Current vs. Frequency



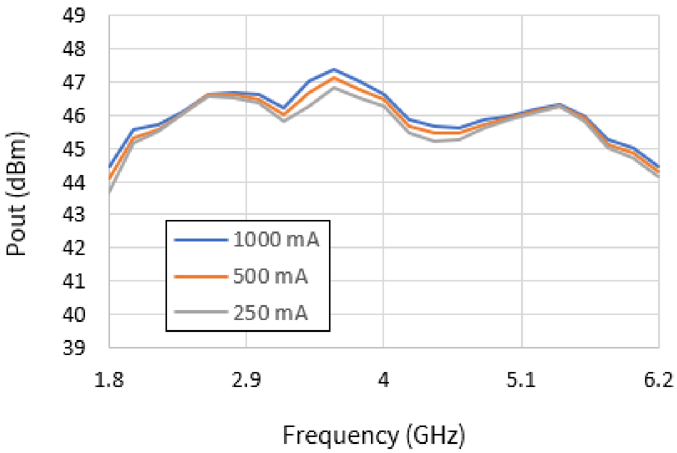
Large Signal Gain vs. Frequency



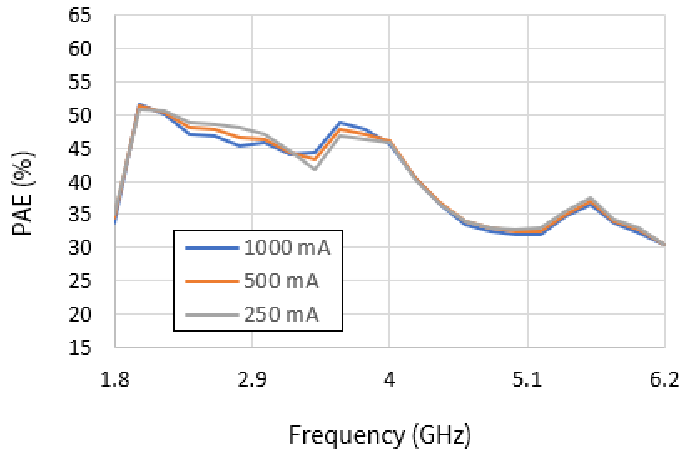
Typical Performance Curves - Large Signal over I_{DQ}

V_D = 28 V, CW, P_{IN} = 23 dBm, T_C = 25°C

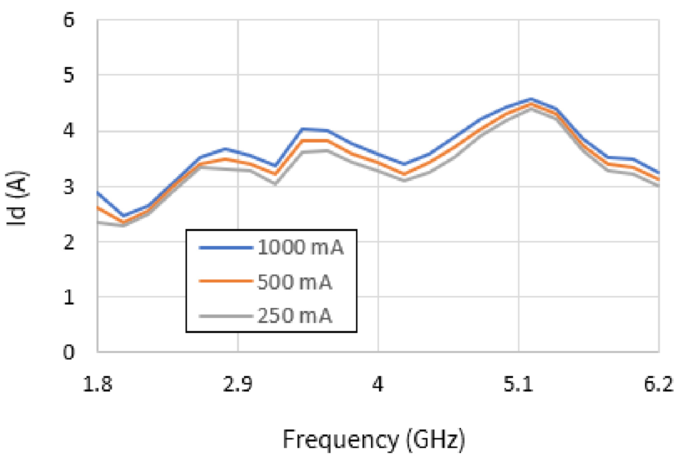
Output Power vs. Frequency



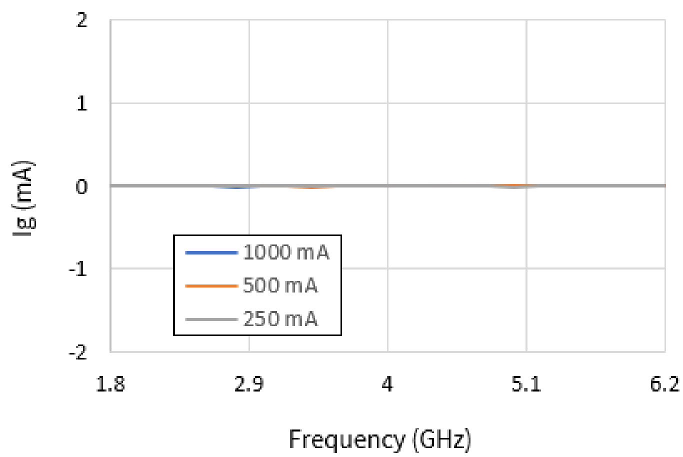
Power-Added Efficiency vs. Frequency



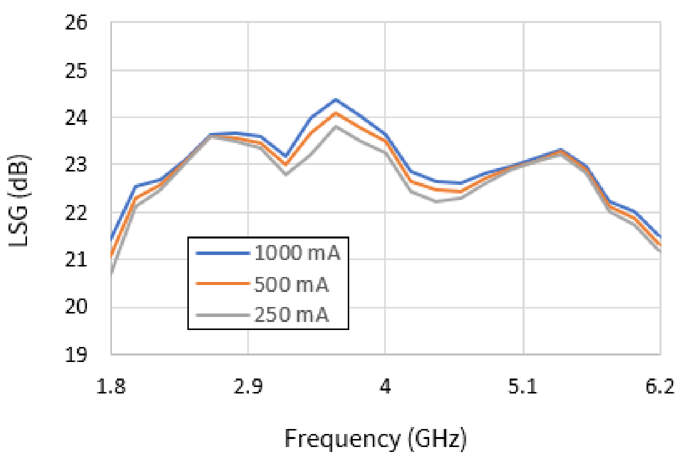
Drain Current vs. Frequency



Gate Current vs. Frequency



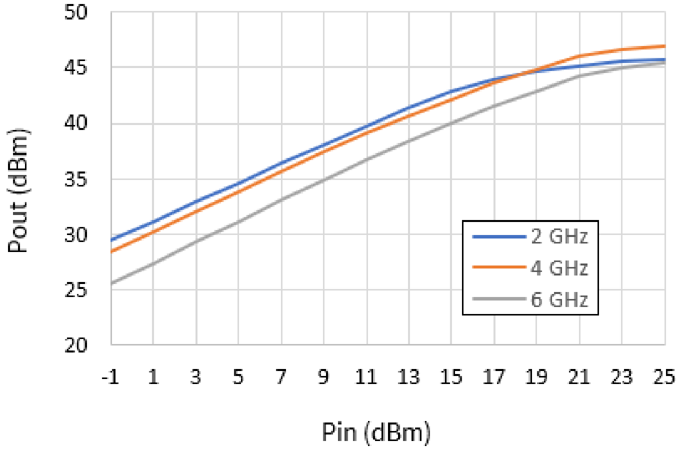
Large Signal Gain vs. Frequency



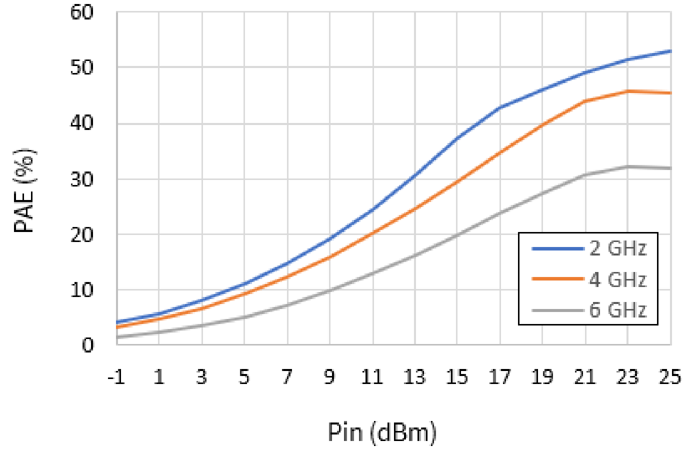
Typical Performance Curves - Drive-Up over Frequency

V_D = 28 V, I_{DQ} = 1 A, CW, T_C = 25°C

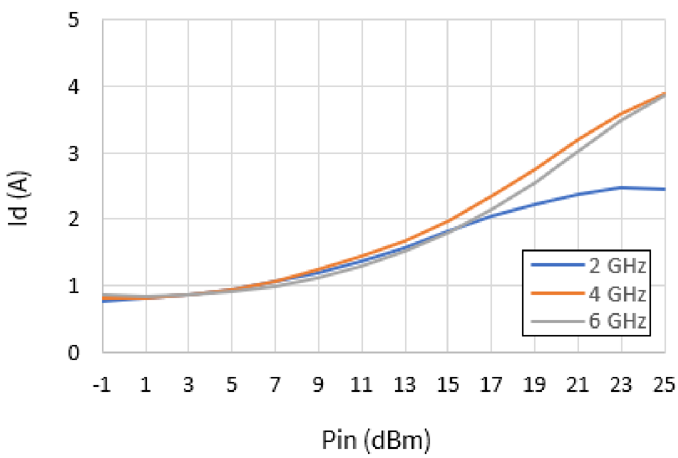
Output Power vs. Input Power



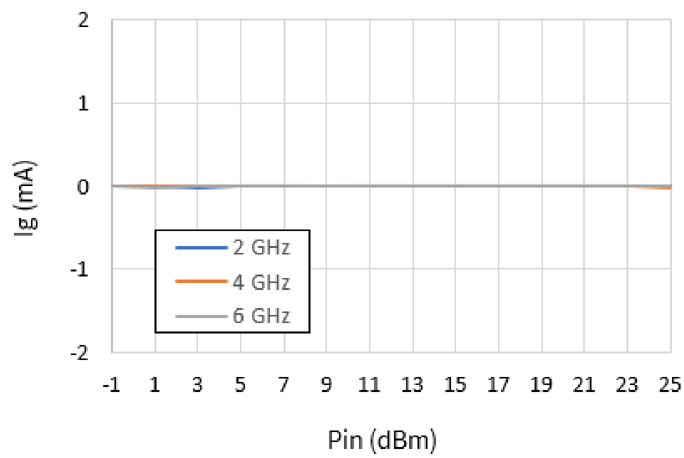
Power Added Efficiency vs. Input Power



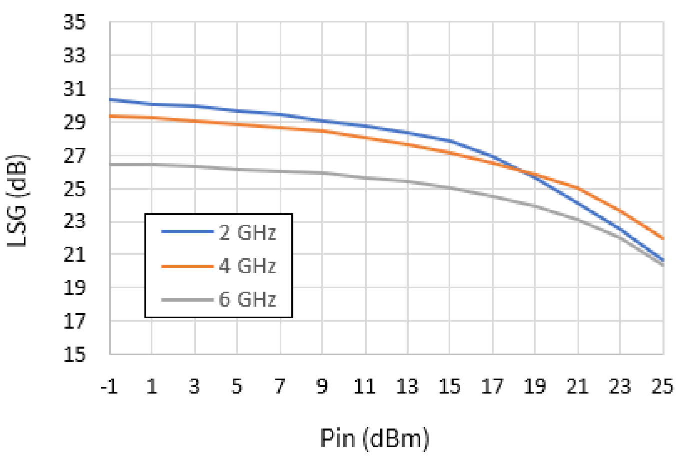
Drain Current vs. Input Power



Gate Current vs. Input Power



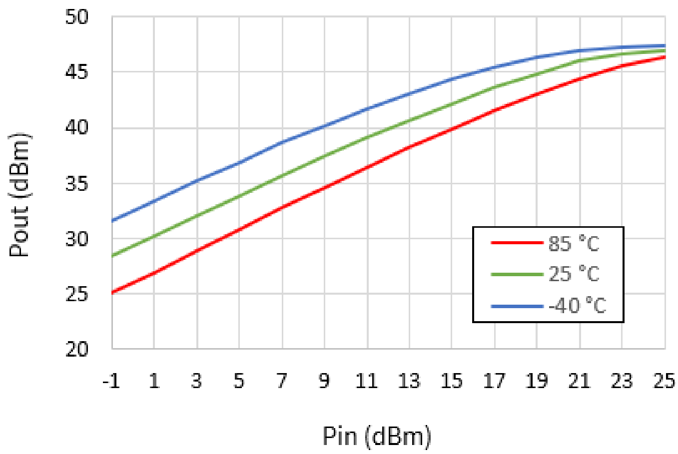
Gain vs. Input Power



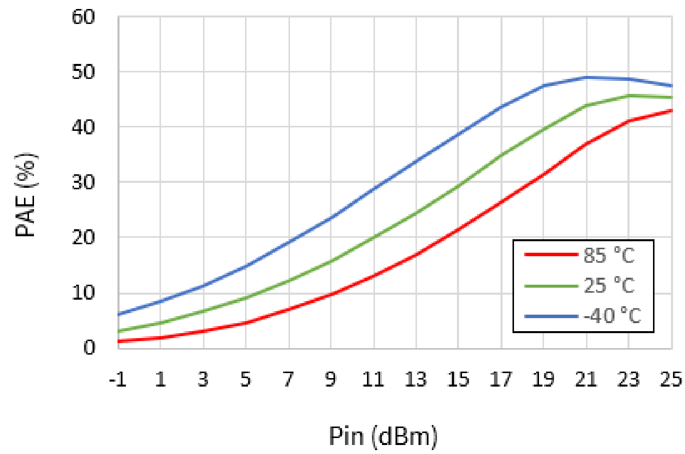
Typical Performance Curves - Drive-Up over Temperature

V_D = 28 V, I_{DQ} = 1 A, CW, Frequency: 4 GHz

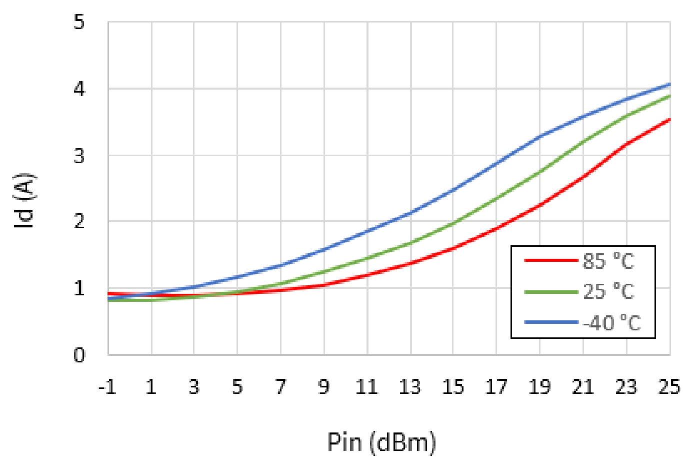
Output Power vs. Input Power



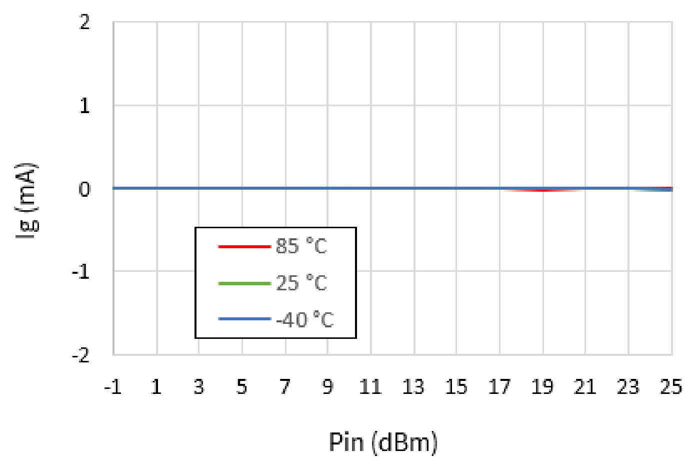
Power-Added Efficiency vs. Input Power



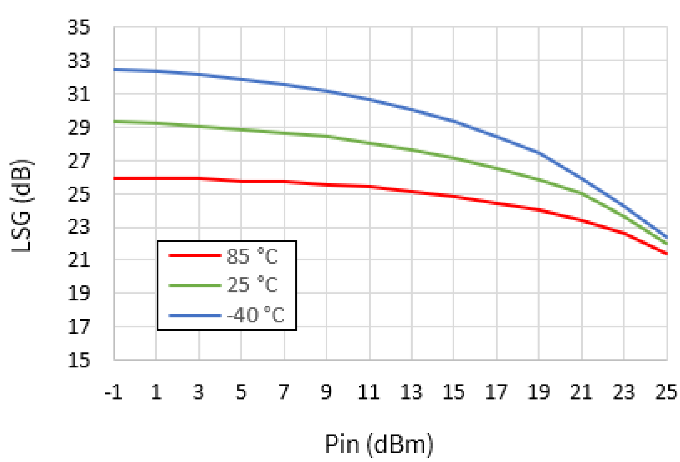
Drain Current vs. Input Power



Gate Current vs. Input Power



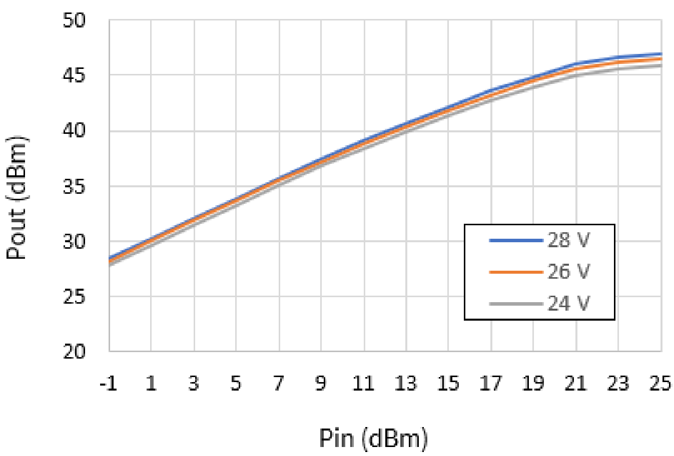
Gain vs. Input Power



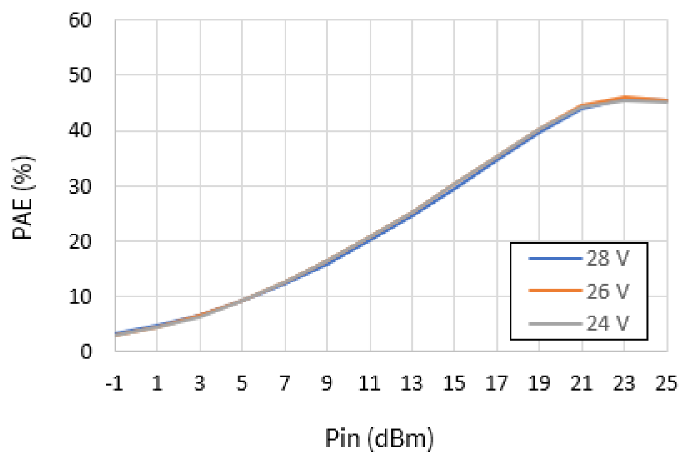
Typical Performance Curves - Drive-Up over V_D

I_{DQ} = 1 A, CW, T_C = 25°C, Frequency: 4 GHz

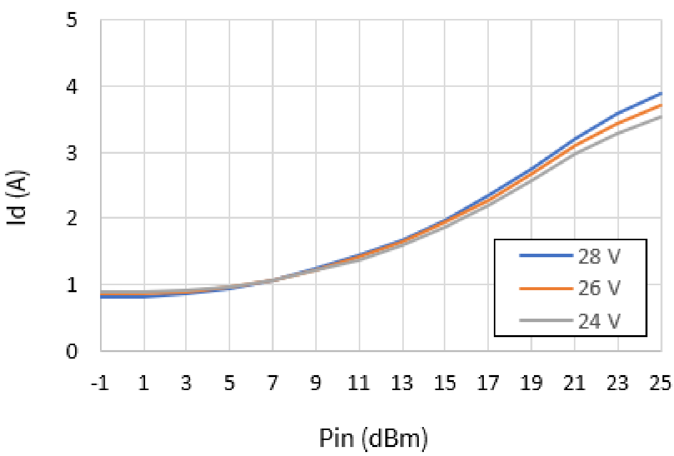
Output Power vs. Input Power



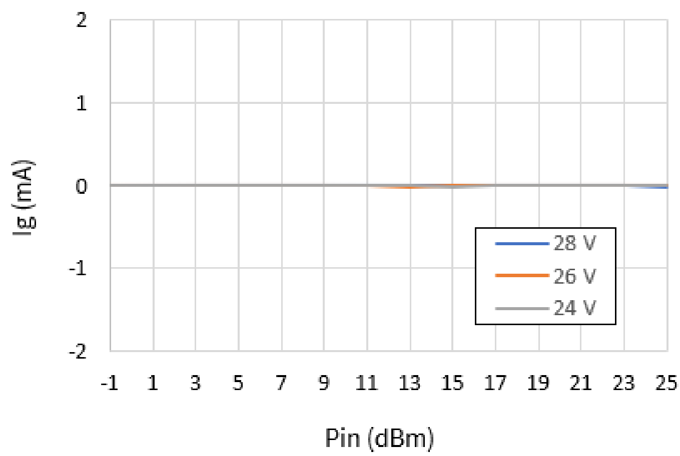
Power-Added Efficiency vs. Input Power



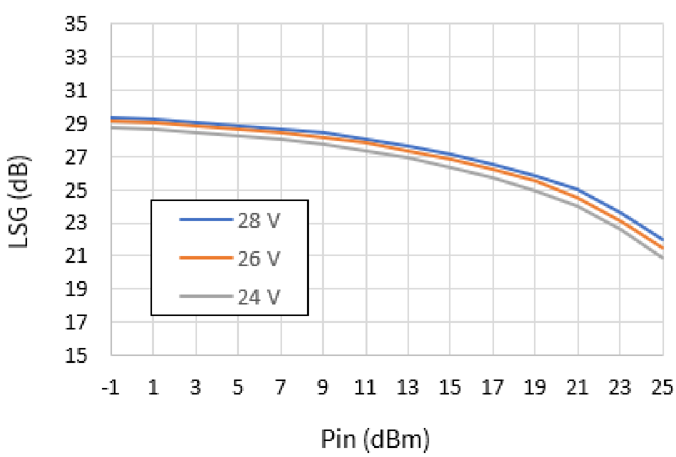
Drain Current vs. Input Power



Gate Current vs. Input Power



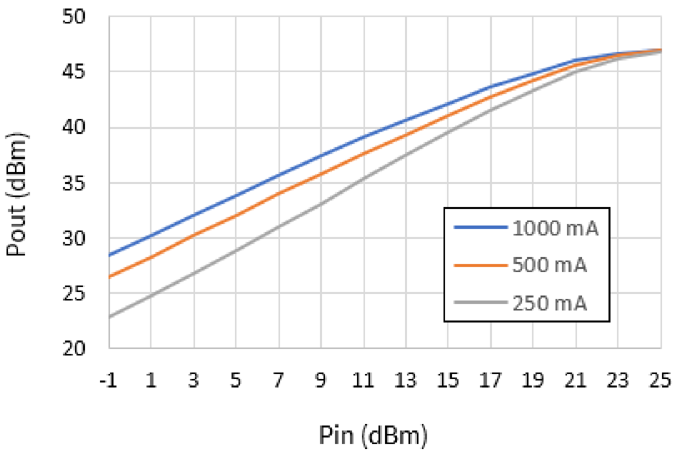
Gain vs. Input Power



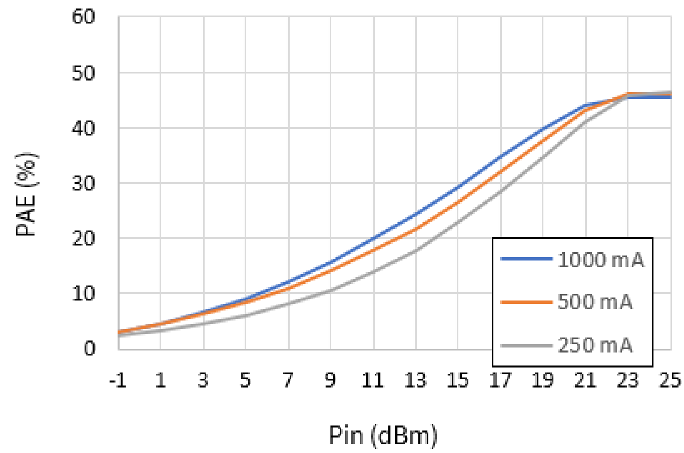
Typical Performance Curves - Drive-Up over I_{DQ}

V_D = 28 V, CW, T_C = 25°C, Frequency: 4 GHz

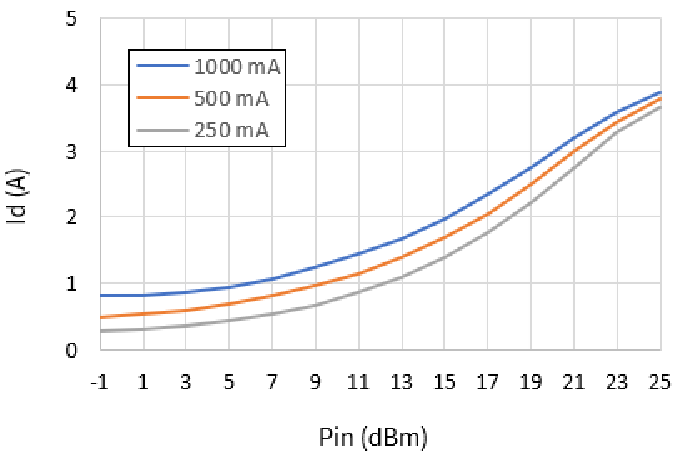
Output Power vs. Input Power



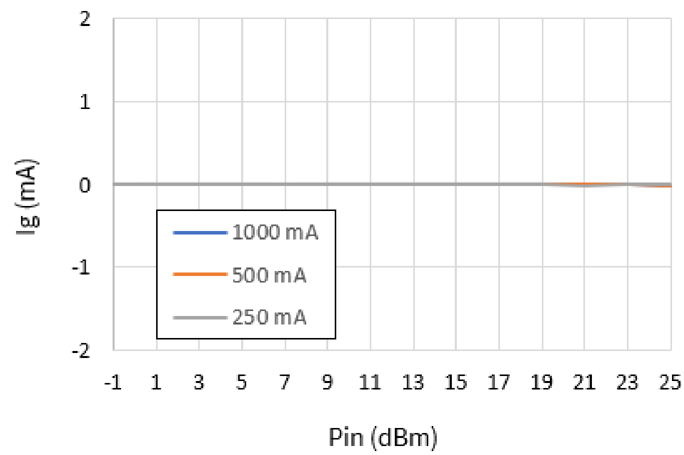
Power-Added Efficiency vs. Input Power



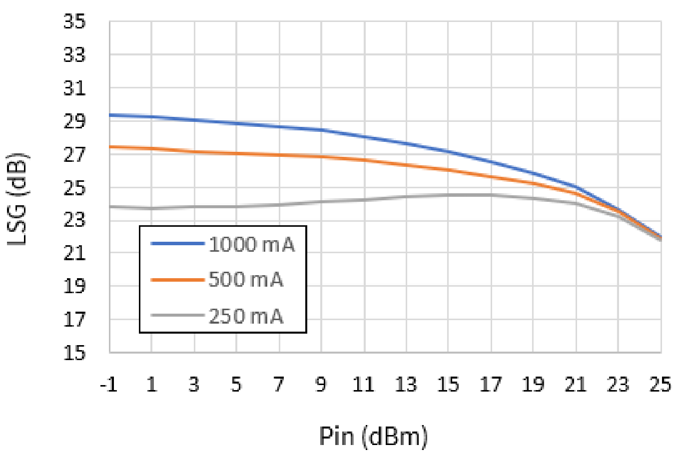
Drain Current vs. Input Power



Gate Current vs. Input Power



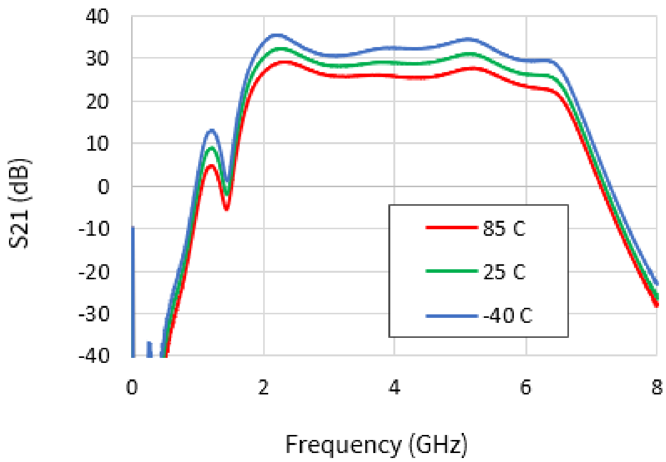
Gain vs. Input Power



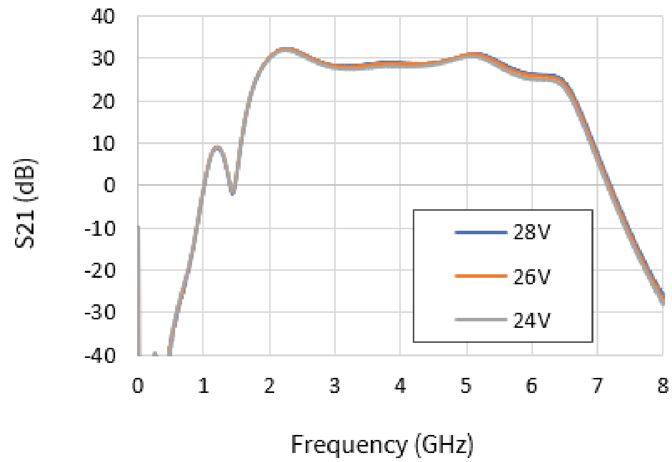
Typical Performance Curves - Small Signal over Temperature and V_D

I_{DQ} = 1 A, CW, P_{IN} = -20 dBm

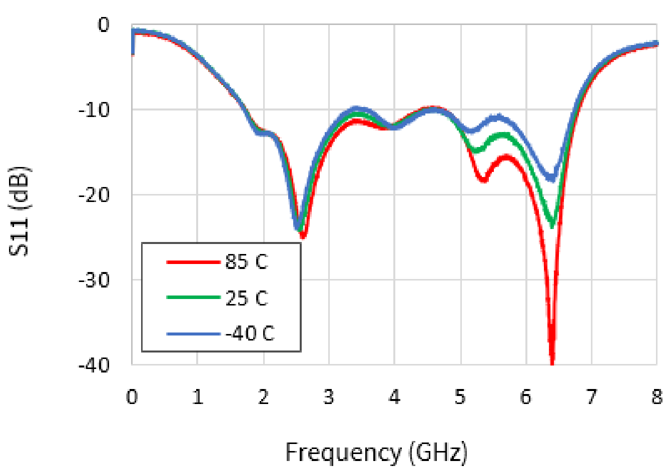
S21 vs. Frequency over Temperature @ V_D = 28 V



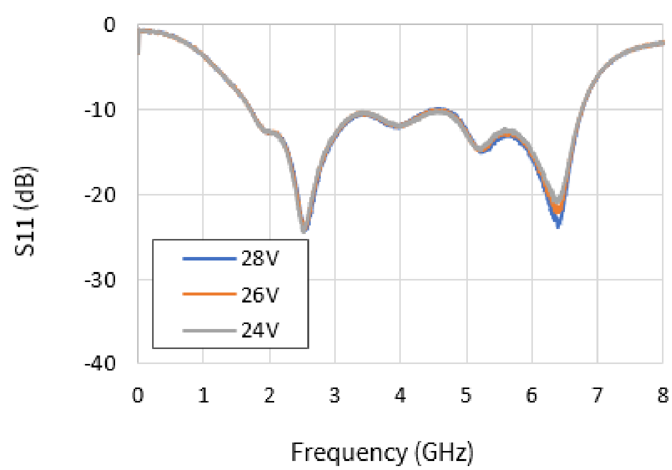
S21 vs. Frequency over V_D @ 25°C



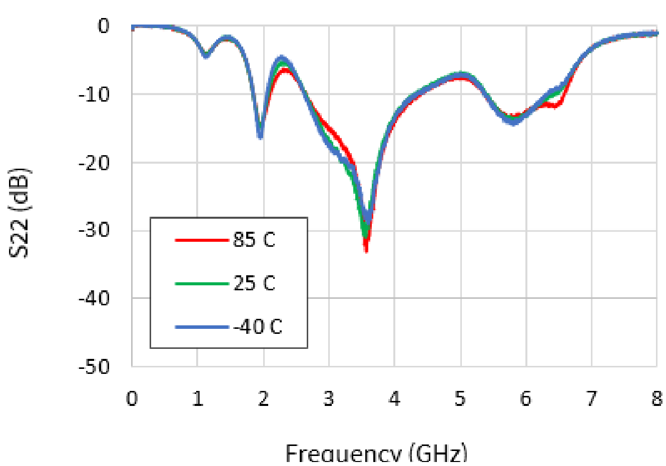
S11 vs. Frequency over Temperature @ V_D = 28 V



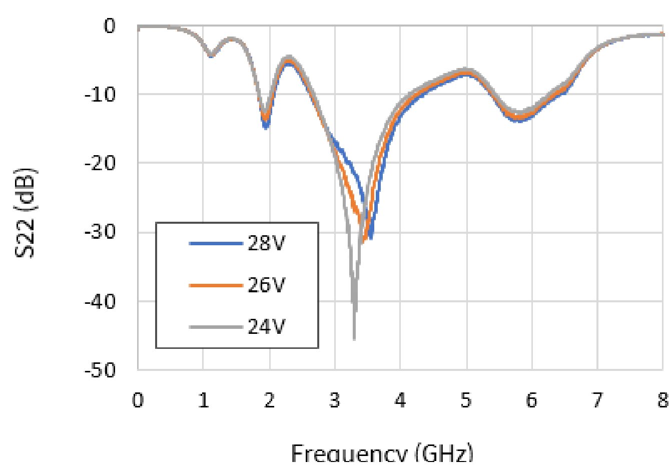
S11 vs. Frequency over V_D @ 25°C



S22 vs. Frequency over Temperature @ V_D = 28 V



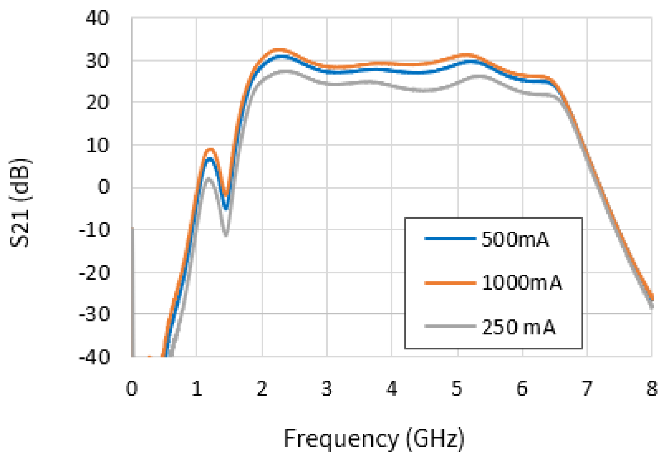
S22 vs. Frequency over V_D @ 25°C



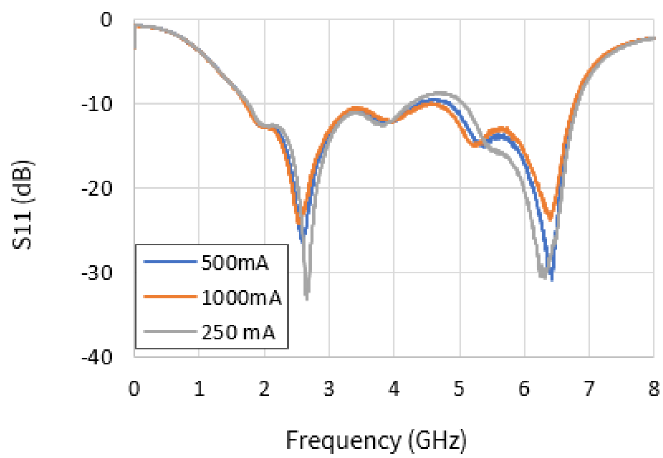
Typical Performance Curves - Small Signal over I_{DQ}

V_D = 28 V, CW, P_{IN} = -20 dBm, T_C = 25°C

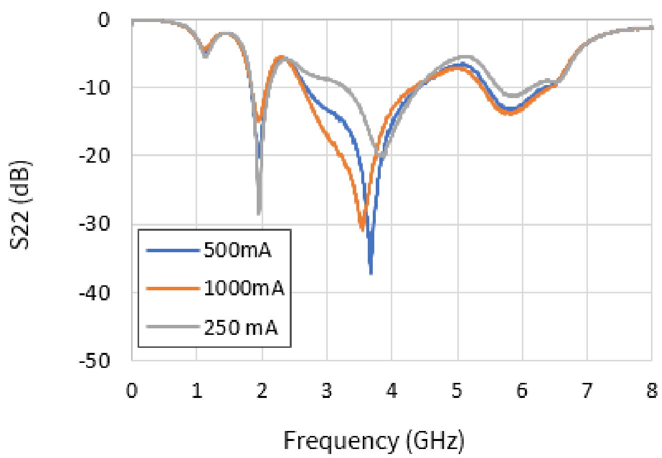
S21 vs. Frequency over I_{DQ}



S11 vs. Frequency over I_{DQ}



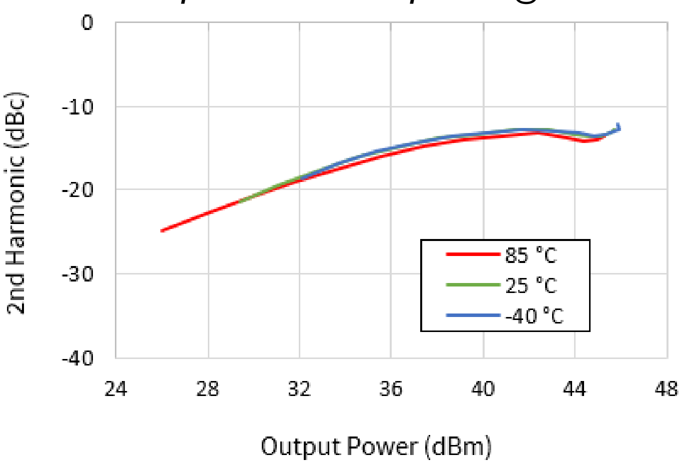
S22 vs. Frequency over I_{DQ}



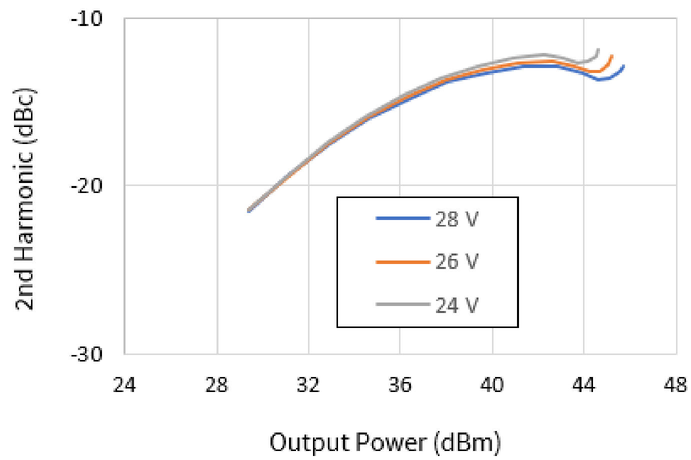
Typical Performance Curves - Harmonics over Temperature and V_D

V_D = 28 V, I_{DQ} = 1 A, CW , T_C = 25°C (unless otherwise noted)

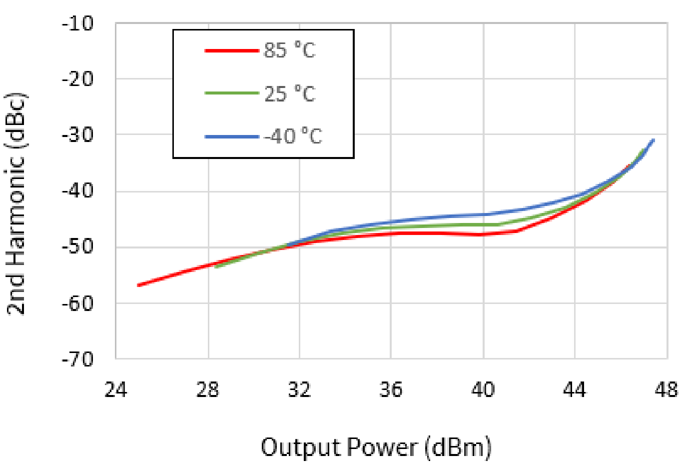
2f vs. Output Power over Temperature @ 2 GHz



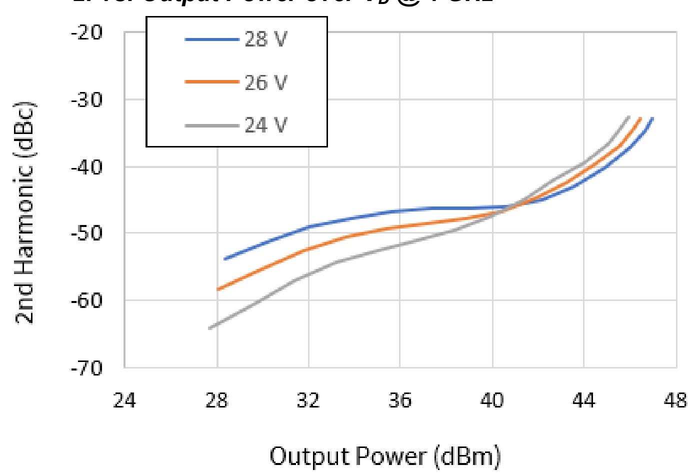
2f vs. Output Power over V_D @ 2 GHz



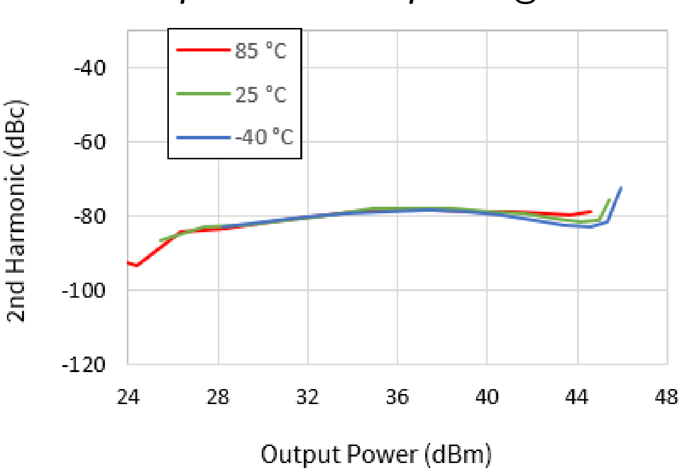
2f vs. Output Power over Temperature @ 4 GHz



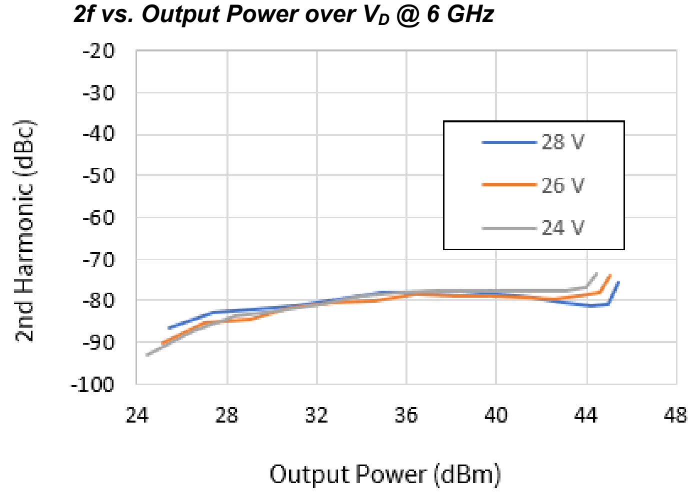
2f vs. Output Power over V_D @ 4 GHz



2f vs. Output Power over Temperature @ 6 GHz



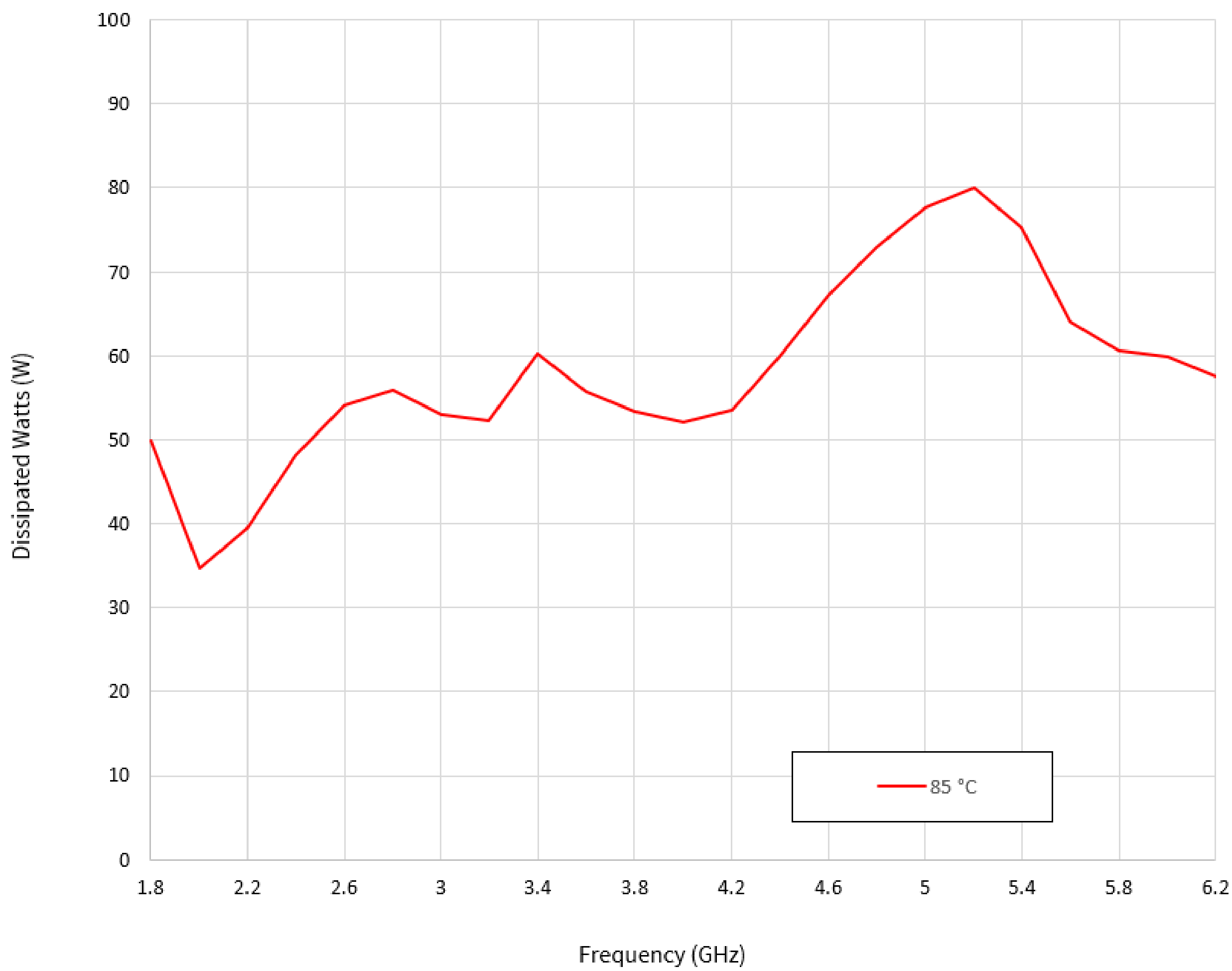
2f vs. Output Power over V_D @ 6 GHz



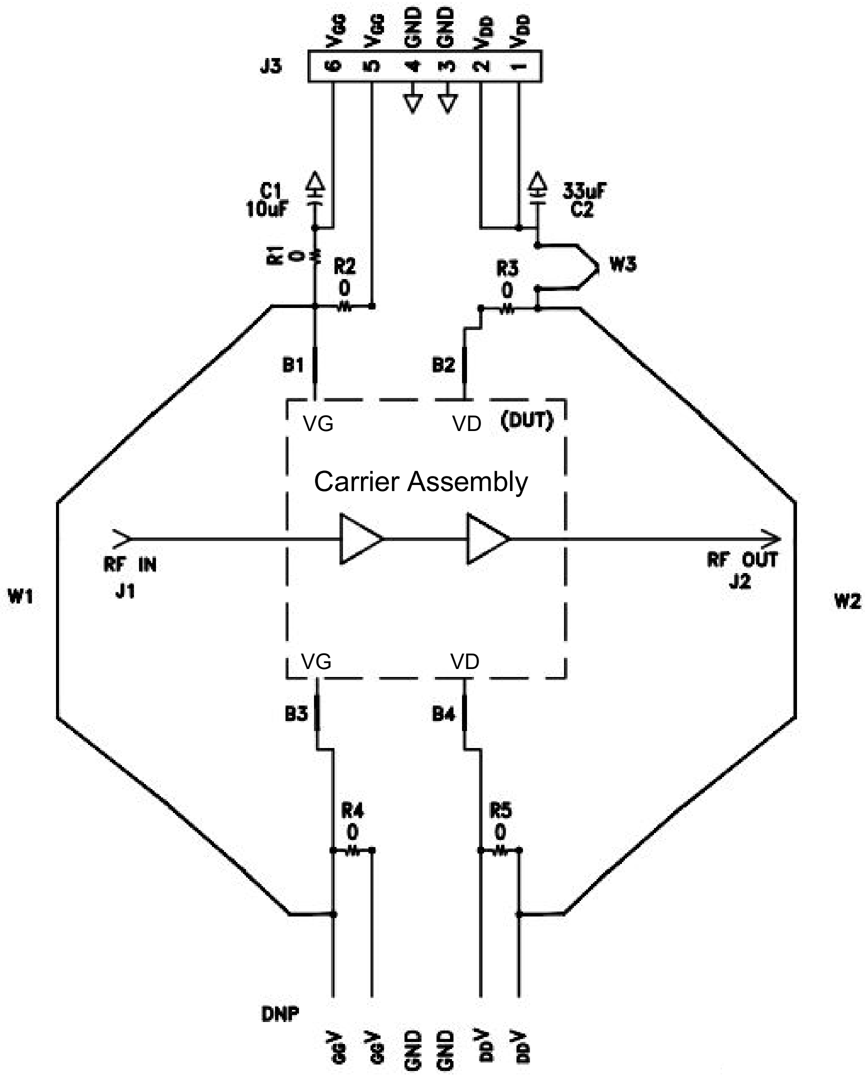
Thermal Characteristics

Parameter	Operating Conditions	Value
Operating Junction Temperature (T_J)	Freq = 4 GHz, V_D = 28 V, I_{DQ} = 1A, I_{DRIVE} = 3.16 A , P_{IN} = 23 dBm, P_{OUT} = 45.66 dBm, P_{DISS} = 52 W, T_{CASE} = 85°C, CW	137ºC
Thermal Resistance, Junction to Case ($R_{θJC}$)		1ºC/W

Power Dissipation vs. Frequency (T_C = 85°C)



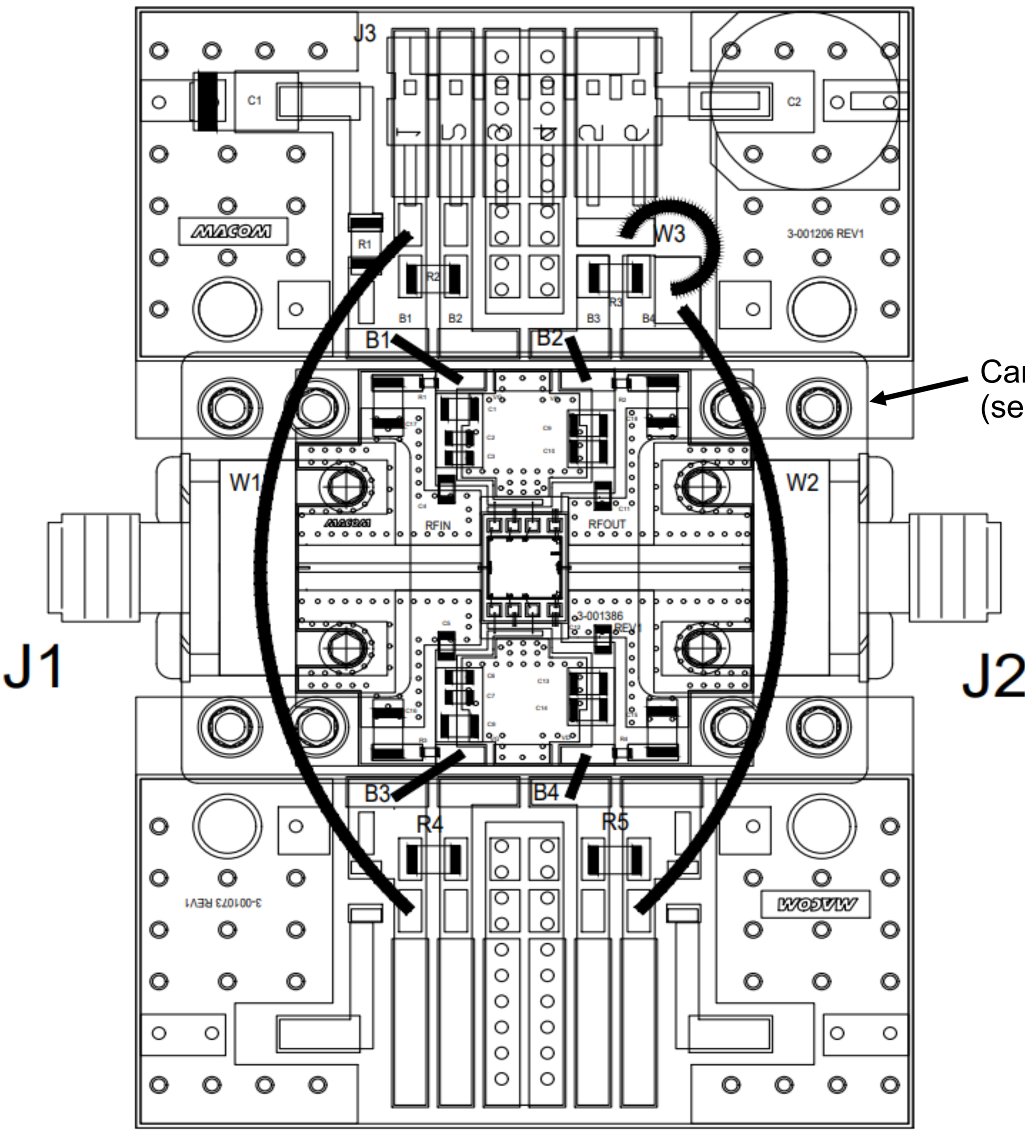
Evaluation Board Schematic (CMPA2060040D1-AMP)



Parts List

Part	Description and Value	Qty
C1	10 μF Tantalum Capacitor	1
C2	33 μF Electrolytic Capacitor	1
B1-B4	Jumper Wire	4
W1,W2, W3	Wire, BLACK 22 AWG (2")	3
J1, J2	SMA Female End Launch RF Connector, 0.007" Pin, 0.048' Coax	2
J3	6 pin DC header, Right Angle	1
R1 - R5	0 ohm Resistors, 1206	5

Evaluation Board Assembly Drawing (CMPA2060040D1-AMP)



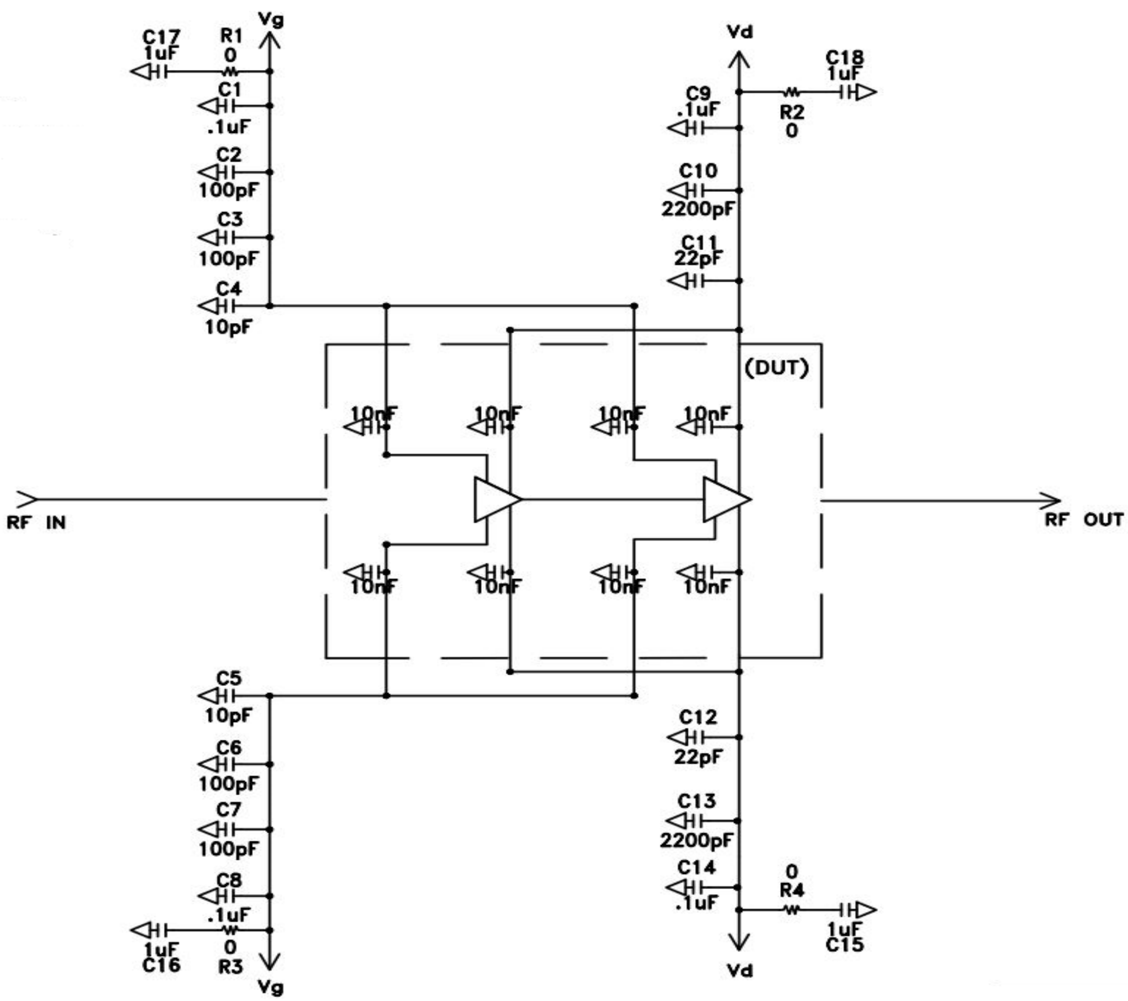
Bias On Sequence

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

Bias Off Sequence

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

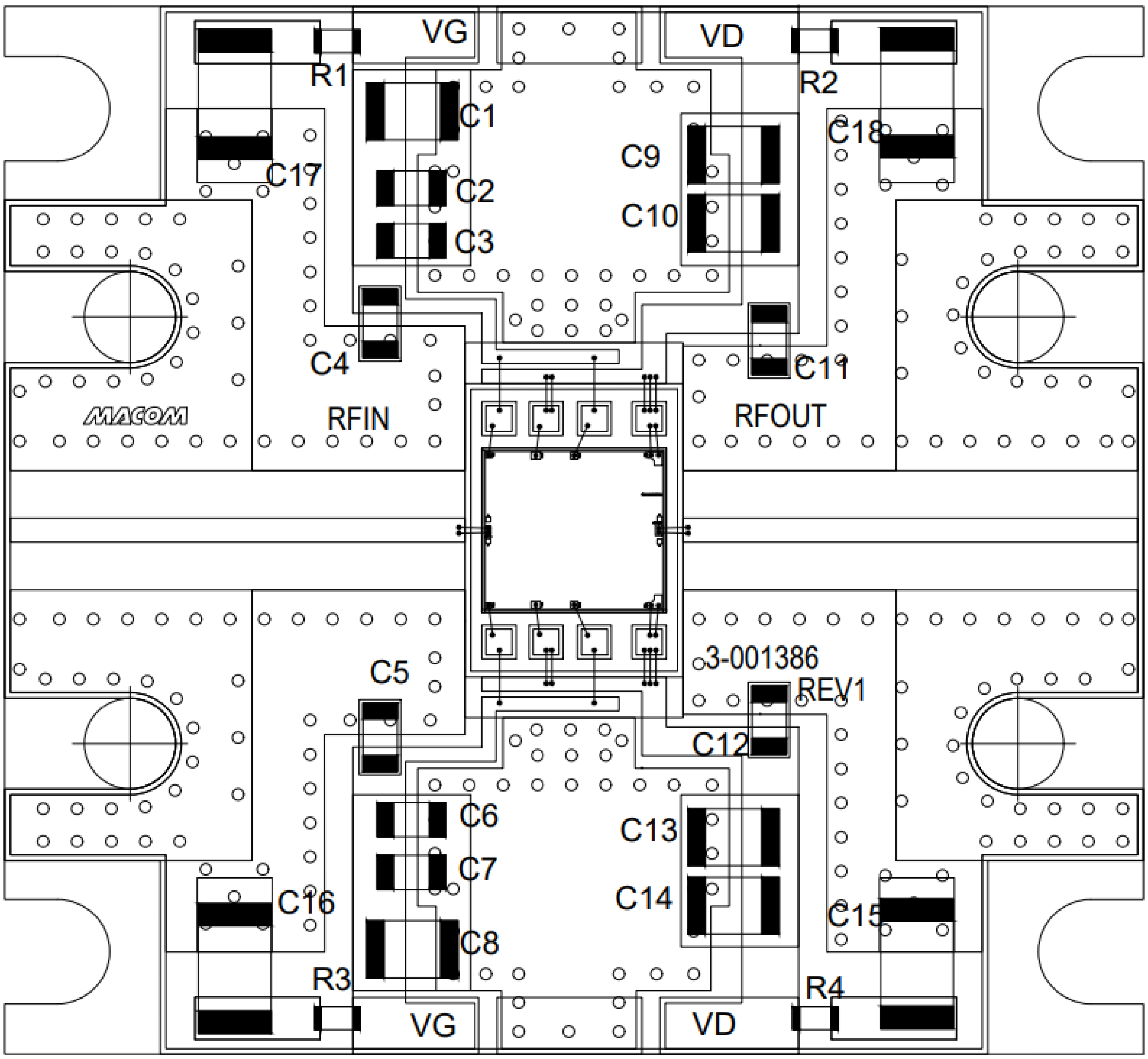
Carrier Schematic Drawing (CMPA2060040D1-AMP)



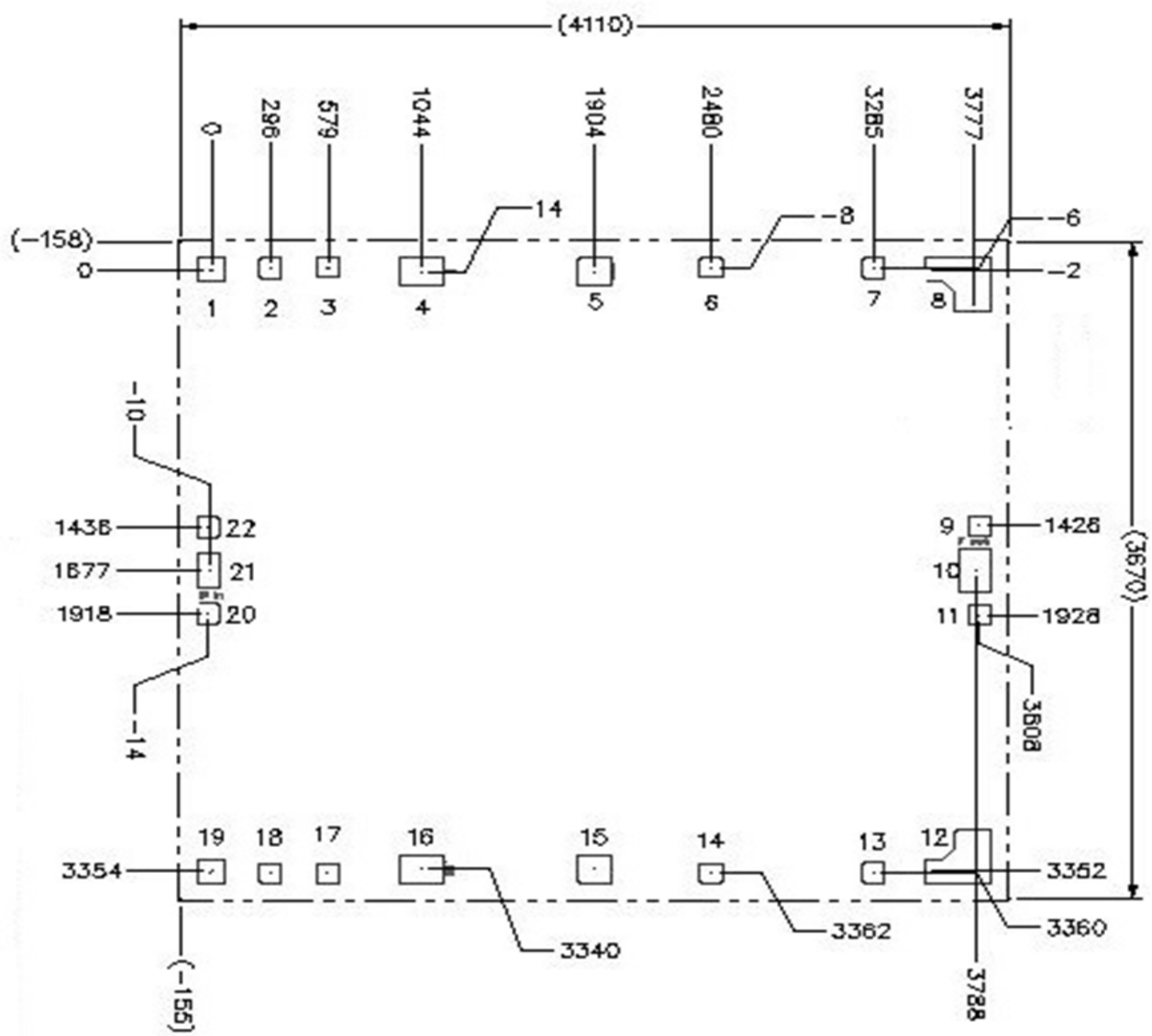
Parts List

Part	Description and Value	Qty
C1, C8, C9, C14	Capacitor, 0805, 0.1 µF, 100V, X7R	4
C2, C3, C6, C7	Capacitor, 0603, 100 pF	4
C4, C5	Capacitor, 0603, 10 pF	2
C10, C13	Capacitor, 0805, 2200 pF, 100V, X7R	2
C11, C12	Capacitor, 0603, 22 pF	2
C15 - C18	Capacitor, 1206, 1 µF, 100V	4
R1 - R4	Resistor, 0 ohm, 0402	4

Carrier Assembly Drawing (CMPA2060040D1-AMP)



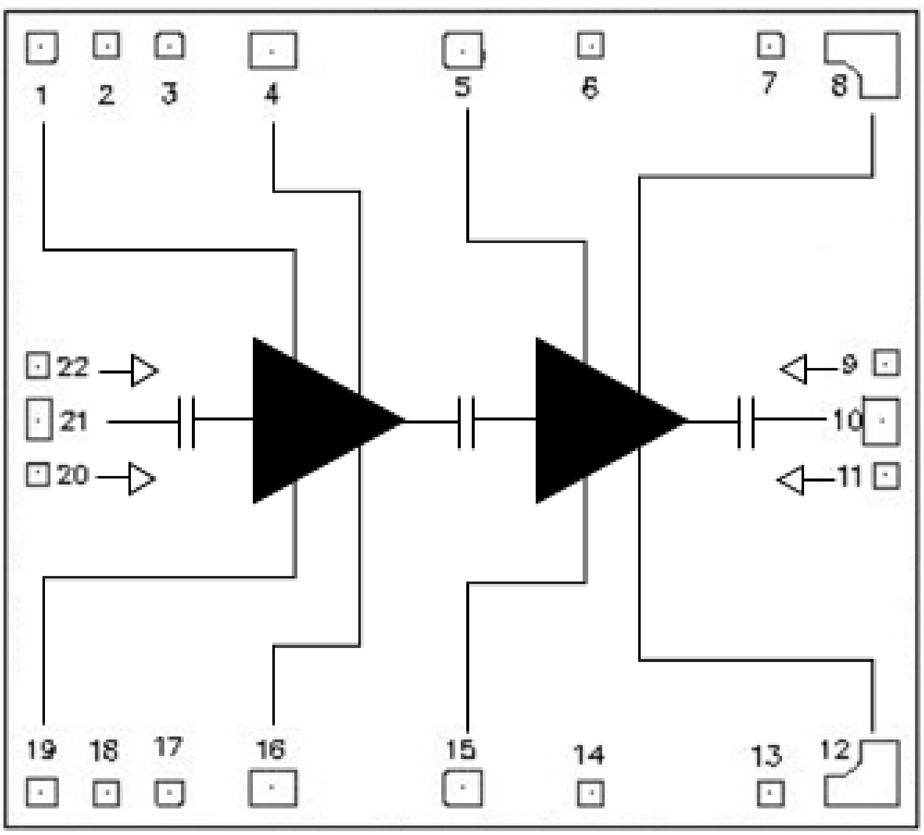
Mechanical Information



Notes
1.) Die size: 4110 µm x 3670 µm (+0/-50 µm)
2.) Die thickness: 75 µm (+/- 10 µm)
2.) Unless otherwise specified, all dimensions shown are µm with a tolerance of +/- 5 µm.

Pin Description

Pin #	Name	Description	Pad Size (µm)
2, 3, 6, 7, 9, 11, 13, 14, 17, 18, 20, 22, MMIC backside	GND	RF and DC ground.	110 x 110
1, 19	VG1	Gate bias for stage 1. Both pins must be connected.	126 x 135
4, 16	VD1	Drain bias for stage 1. Both pins must be connected.	155 x 213
5, 15	VG2	Gate bias for stage 2. Both pins must be connected.	155 x 163
8, 12	VD2	Drain bias for stage 2. Both pins must be connected.	295 x 329
10	RF_{OUT}	RF Output. 50-ohm matched. Internally DC blocked.	240 x 152
21	RF_{IN}	RF Input. 50-ohm matched. Internally DC blocked.	190 x 112



Revision History

Rev	Date	Change Description
V1	12/10/2024	Production release.