

Features

- Saturated Power: 20 W
- Power Added Efficiency: 23%
- Large Signal Gain: 18 dB
- Small Signal Gain: 24 dB
- Input Return Loss: -10 dB
- Output Return Loss: -10 dB
- IM3: -22 dBc (10 W, P_{total})
- CW operation



Applications

- Satellite Uplink

Description

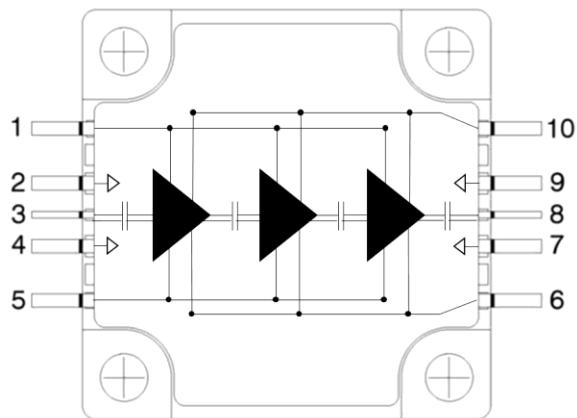
MACOM's CMPA2H3B025F is a 20 W, MMIC HPA utilizing MACOM's high performance, 0.15 μ m GaN on SiC production process. The CMPA2H3B025F operates from 27 – 31 GHz and targets Ka-band satellite uplinks. Under saturation, the CMPA2H3B025F achieves 20 W of typical output with 18 dB of large signal gain and 23% power-added efficiency. Operating at a backed-off average output power of 10W, this HPA achieves -22dBc IM3 with 25 dB of associated gain and 20% power-added efficiency.

Packaged in a 15x15 mm bolt-down, flange package, the CMPA2H3B025F provides superior RF performance and thermal management allowing customers to improve SWaP-C benchmarks in their next-generation systems.

Ordering Information

| Part Number | Package (MOQ/Mult) |
|------------------|--------------------|
| CMPA2H3B025F | Tray (10/10) |
| CMPA2H3B025F-AMP | Sample Board (1/1) |

Functional Schematic



Pin Configuration¹

| Pin # | Name |
|------------|-----------|
| 1, 5 | VG |
| 2, 4, 7, 9 | GND |
| 3 | RF Input |
| 6, 10 | VD |
| 8 | RF Output |

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

1 MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

CMPA2H3B025F
Rev. V1

RF Electrical Specifications: $V_D = 28$ V, $I_{DQ} = 300$ mA, CW, $T_C = 25^\circ\text{C}$, $Z_0 = 50$ Ω

| Parameter | Test Conditions | Frequency (GHz) | Units | Min. | Typ. | Max. |
|------------------------|---|-----------------|-------|------|-------------------|------|
| Output Power | $P_{IN} = 25$ dBm | 27 | dBm | 42.0 | 43.0 | — |
| | | 29 | | 42.0 | 43.8 | |
| | | 31 | | 42.0 | 43.2 | |
| Power Added Efficiency | $P_{IN} = 25$ dBm | 27 | % | 18 | 23 | — |
| | | 29 | | 16 | 24 | |
| | | 31 | | 16 | 23 | |
| Large Signal Gain | $P_{IN} = -30$ dBm | 27 | dB | 17.0 | 18.0 | — |
| | | 29 | | 17.0 | 18.8 | |
| | | 31 | | 17.0 | 18.2 | |
| Small Signal Gain | $P_{IN} = -30$ dBm | 27 | dB | — | 24 | — |
| | | 29 | | — | 25 | |
| | | 31 | | — | 20 | |
| Input Return Loss | $P_{IN} = -30$ dBm | 27 - 31 | dB | — | -10 | — |
| Output Return Loss | | 27 - 31 | | — | -10 | |
| IM3 | $P_{OUT/Tone} = 37$ dBm Tone/Spacing = 300 MHz | 27 29 31 | dBc | — | -22 -22 -25 | — |

DC Electrical Specifications:

| Parameter | Units | Min. | Typ. | Max. |
|-------------------------|-------|------|------|------|
| Drain Voltage | V | — | 28 | — |
| Gate Voltage | V | — | -1.8 | — |
| Quiescent Drain Current | mA | — | 300 | — |
| Saturated Drain Current | A | — | 3.4 | — |

Recommended Operating Conditions

| Parameter | Symbol | Unit | Min. | Typ. | Max. |
|-------------------------|-----------------|------|------|------|------|
| Input Power | P _{IN} | dBm | — | 25 | — |
| Drain Voltage | V _D | V | — | 28 | — |
| Gate Voltage | V _G | V | — | -1.8 | — |
| Quiescent Drain Current | I _{DQ} | mA | — | 300 | — |
| Operating Temperature | T _C | °C | -40 | — | +60 |

Absolute Maximum Ratings^{2,3}

| Parameter | Symbol | Unit | Min. | Max. |
|---------------------------------------|-------------------|-------|------|--------|
| Input Power | P _{IN} | dBm | — | 26 |
| Drain to Source Breakdown Voltage | V _{DS} | V | — | 84 |
| Drain Voltage | V _D | V | — | 28 |
| Gate Voltage | V _G | V | -8 | +2 |
| Drain Current | I _D | A | — | 4.0 |
| Gate Current | I _G | mA | — | 15 |
| Dissipated Power @ +85° | P _{DISS} | W | — | 80 |
| VSWR | — | Ratio | — | 3:1 |
| Junction Temperature (MTTF > 1E6 Hrs) | T _J | °C | — | +225°C |
| Storage Temperature | T _{STG} | °C | -55 | +150 |
| Mounting Temperature (30 seconds) | T _M | °C | — | +320 |
| Screw Torque | T | in-oz | — | 40 |

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

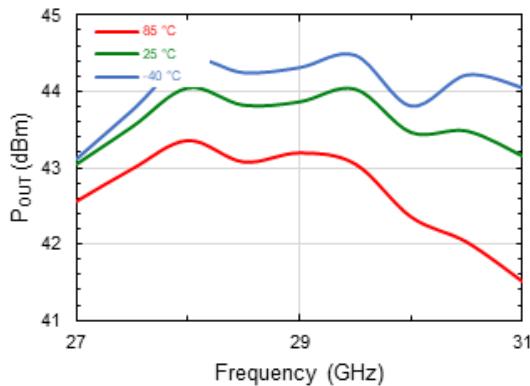
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1A and CDM class C3 devices.

3 MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

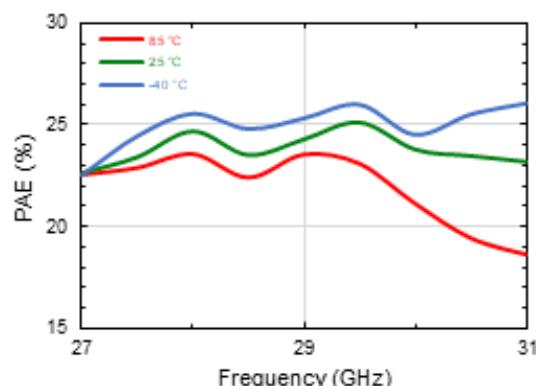
Typical Performance Curves – Large Signal over Temperature:

$V_D = 28$ V, $I_{DQ} = 300$ mA, CW, $P_{IN} = 25$ dBm

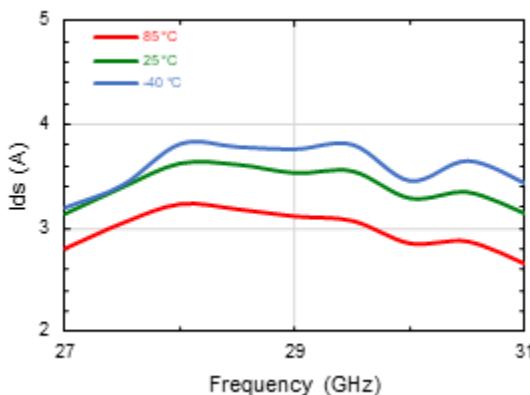
Output Power vs. Frequency



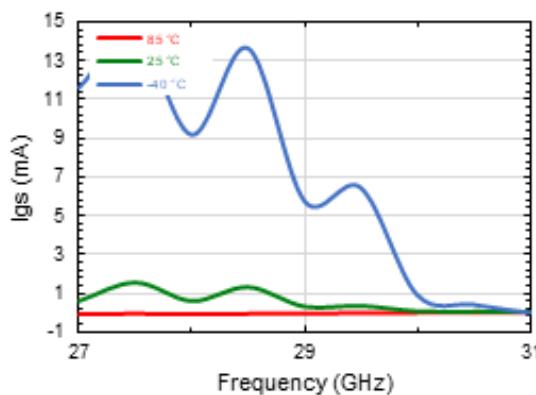
Power Added Efficiency vs. Frequency



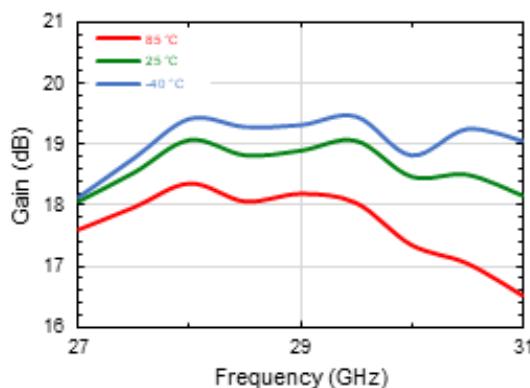
Drain Current vs. Frequency



Gate Current vs. Frequency



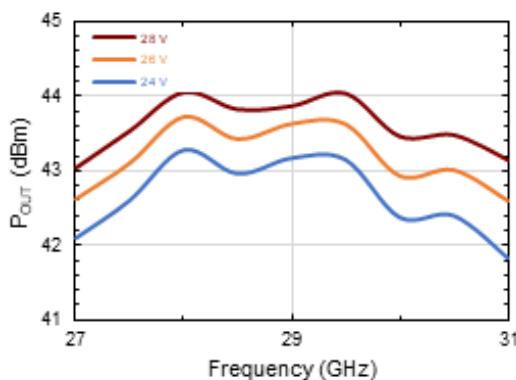
Large Signal Gain vs. Frequency



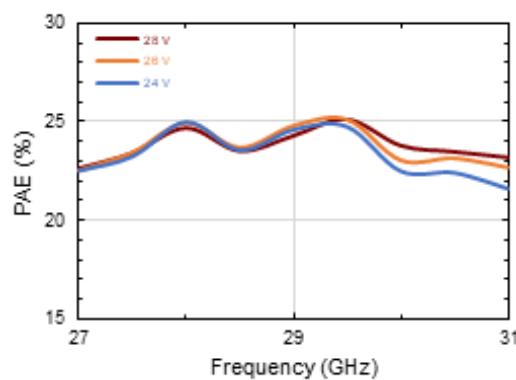
Typical Performance Curves – Large Signal over V_D :

$I_{DQ} = 300$ mA, CW, $P_{IN} = 25$ dBm, $T_c = 25^\circ\text{C}$

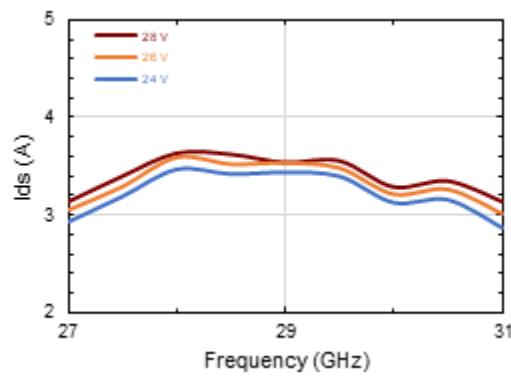
Output Power vs. Frequency



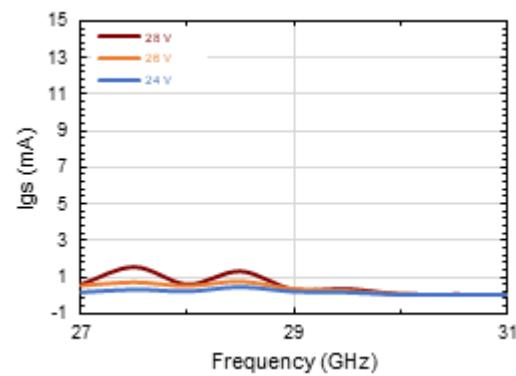
Power Added Efficiency vs. Frequency



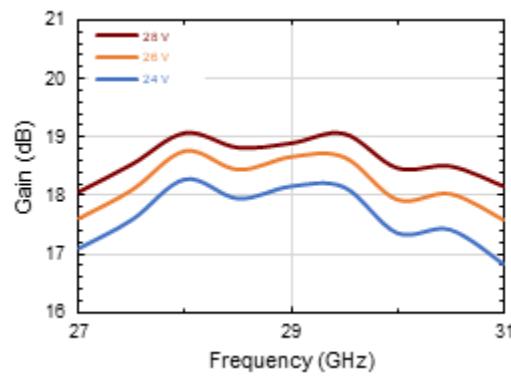
Drain Current vs. Frequency



Gate Current vs. Frequency



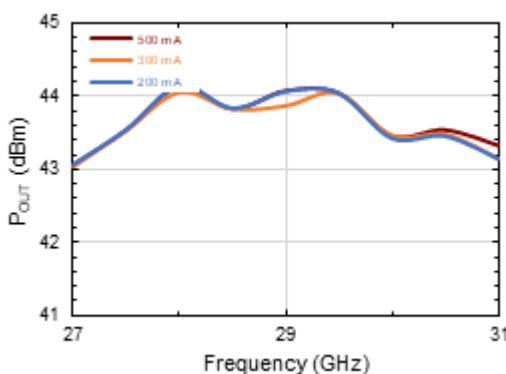
Large Signal Gain vs. Frequency



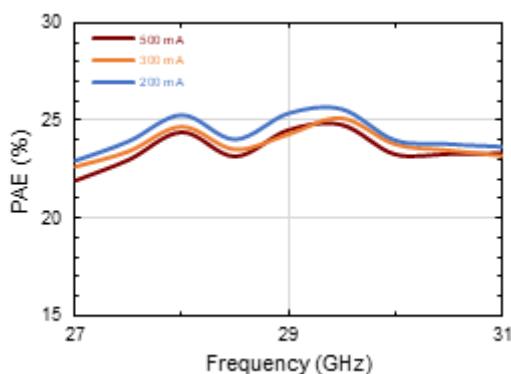
Typical Performance Curves – Large Signal over I_{DQ} :

$V_D = 28$ V, CW, $P_{IN} = 25$ dBm, $T_C = 25^\circ\text{C}$

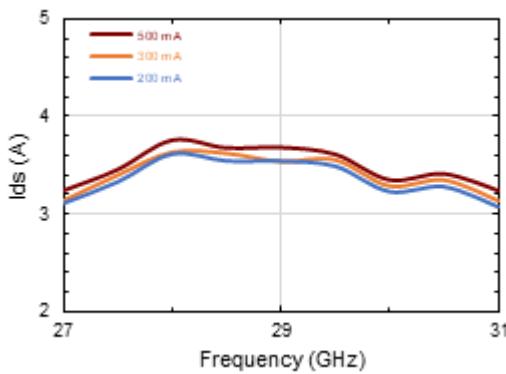
Output Power vs. Frequency



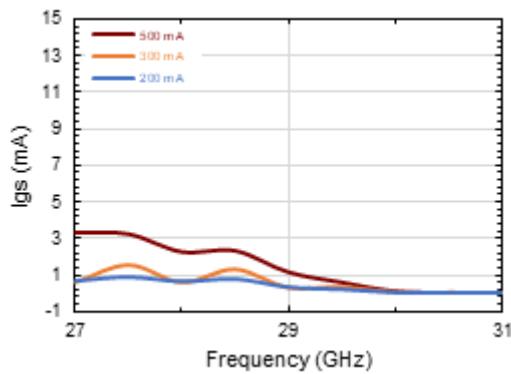
Power Added Efficiency vs. Frequency



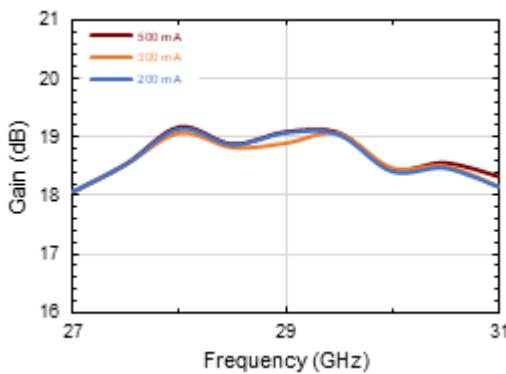
Drain Current vs. Frequency



Gate Current vs. Frequency



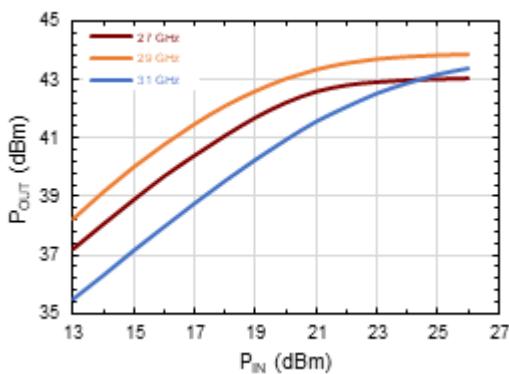
Large Signal Gain vs. Frequency



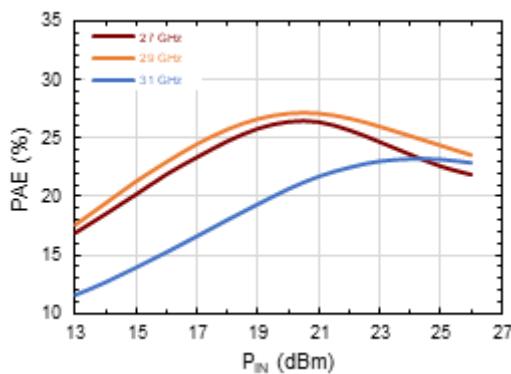
Typical Performance Curves – Drive-Up over Frequency:

$V_D = 28$ V, $I_{DQ} = 300$ mA, CW, $T_C = 25^\circ\text{C}$

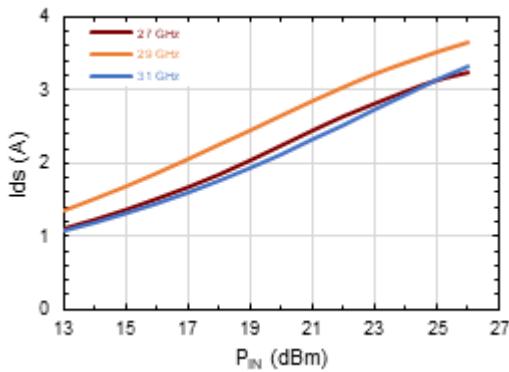
Output Power vs. Input Power



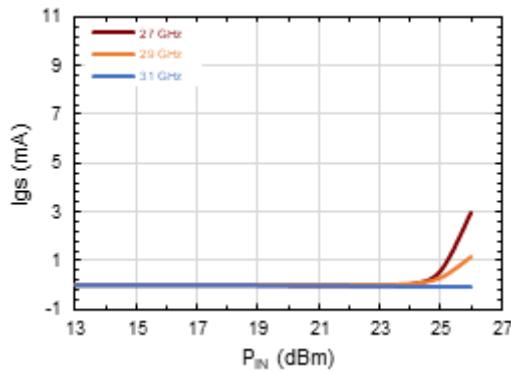
Power Added Efficiency vs. Input Power



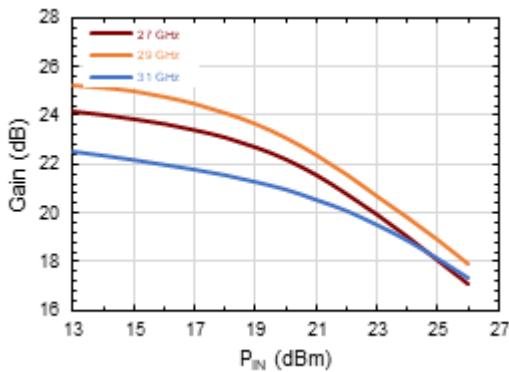
Drain Current vs. Input Power



Gate Current vs. Input Power



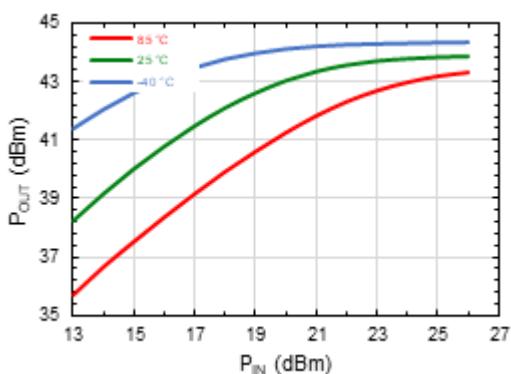
Large Signal Gain vs. Input Power



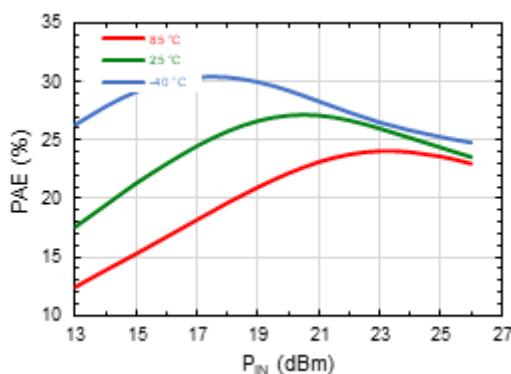
Typical Performance Curves – Drive-Up over Temperature:

$V_D = 28$ V, $I_{DQ} = 300$ mA, CW, Frequency = 29 GHz

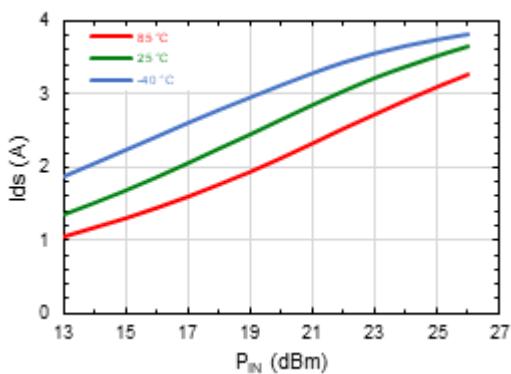
Output Power vs. Input Power



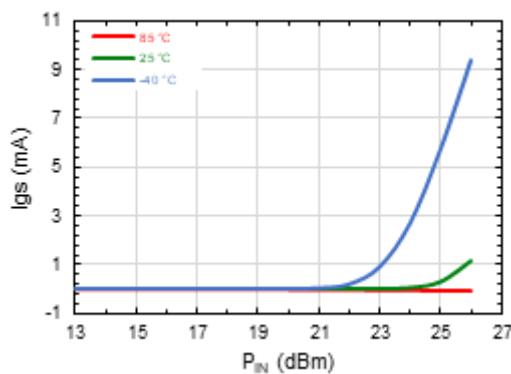
Power Added Efficiency vs. Input Power



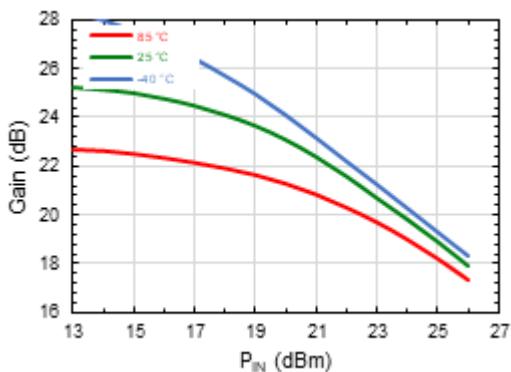
Drain Current vs. Input Power



Gate Current vs. Input Power



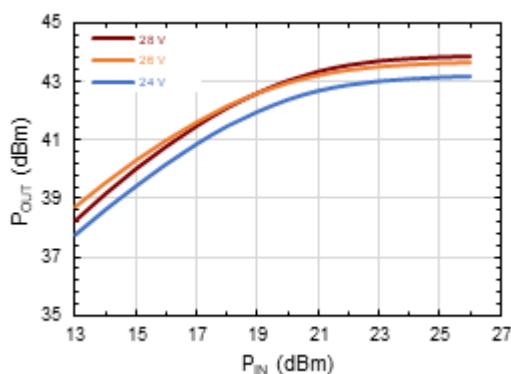
Large Signal Gain vs. Input Power



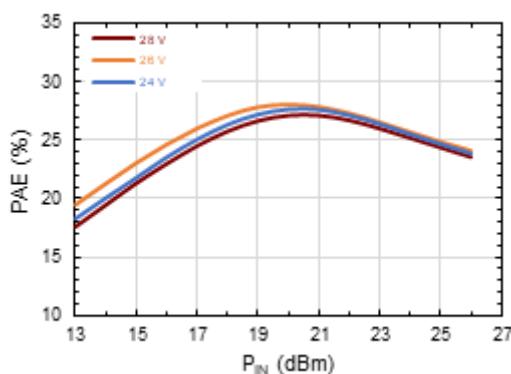
Typical Performance Curves – Drive-Up over V_D :

$I_{DQ} = 300$ mA, CW, $T_c = 25^\circ\text{C}$, Frequency = 29 GHz

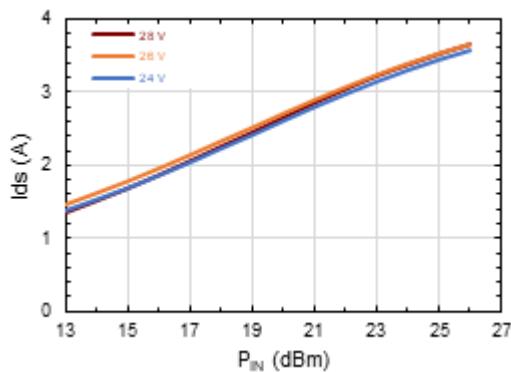
Output Power vs. Input Power



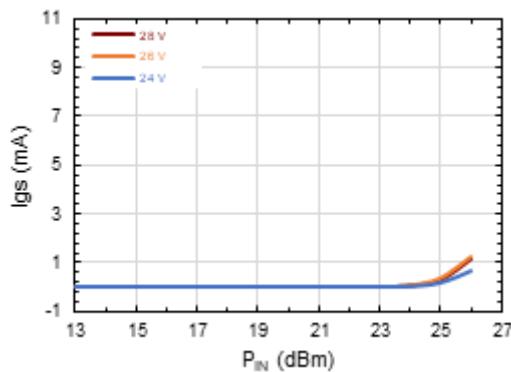
Power Added Efficiency vs. Input Power



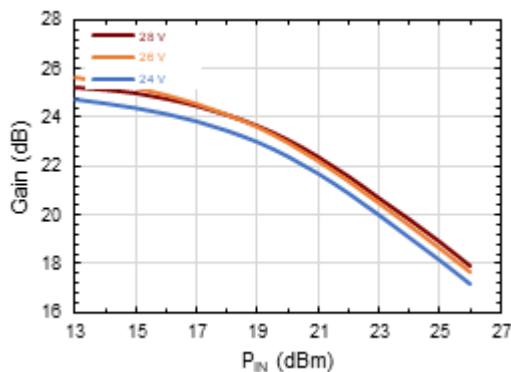
Drain Current vs. Input Power



Gate Current vs. Input Power



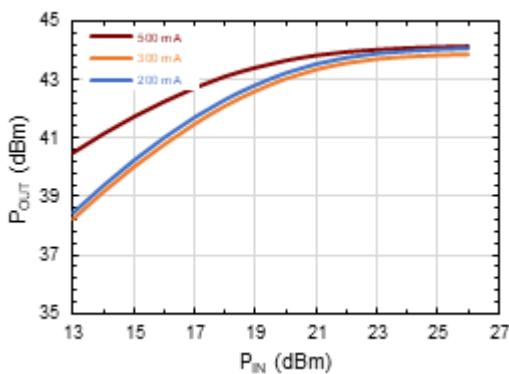
Large Signal Gain vs. Input Power



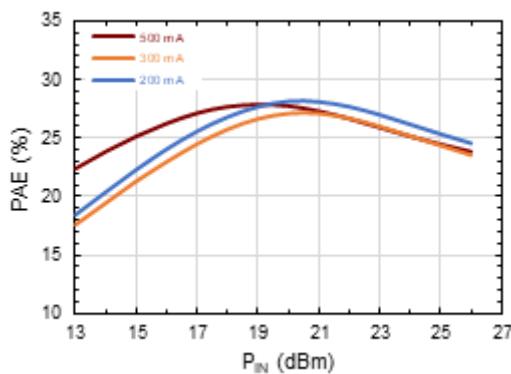
Typical Performance Curves – Drive-Up over I_{DQ} :

$V_D = 28$ V, CW, $T_c = 25^\circ\text{C}$, Frequency = 29 GHz

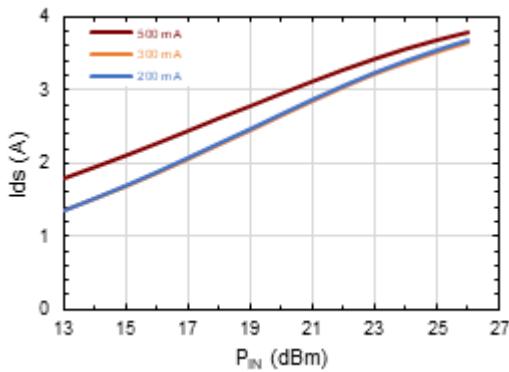
Output Power vs. Input Power



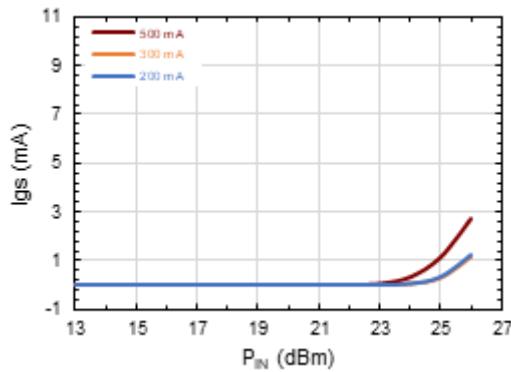
Power Added Efficiency vs. Input Power



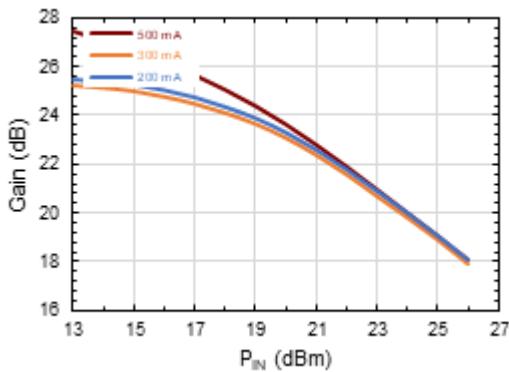
Drain Current vs. Input Power



Gate Current vs. Input Power



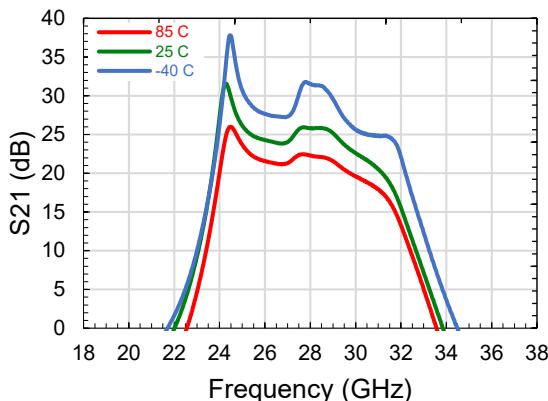
Large Signal Gain vs. Input Power



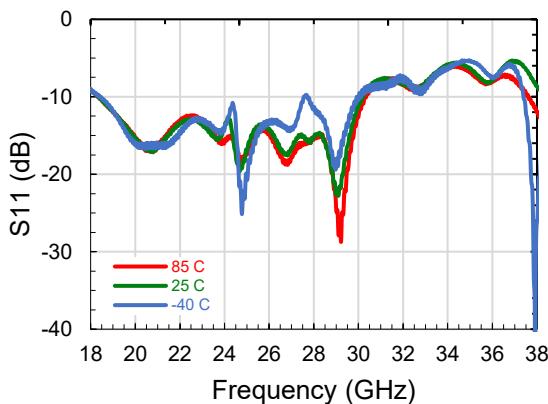
Typical Performance Curves – Small Signal over Temperature and V_D :

$I_{DQ} = 300$ mA, CW, $P_{IN} = -30$ dBm

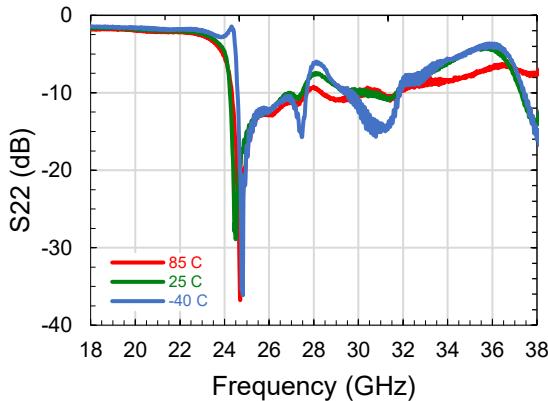
$S21$ vs. Frequency over Temperature @ $V_D = 28$ V



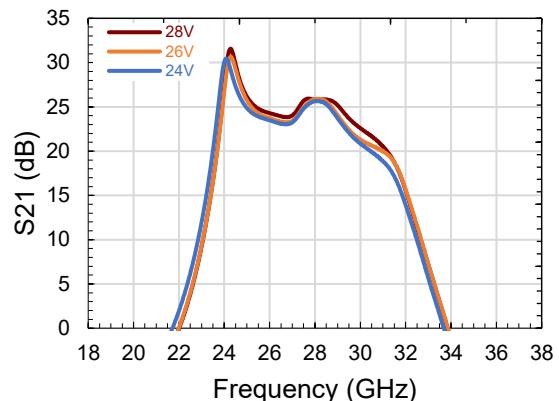
$S11$ vs. Frequency over Temperature @ $V_D = 28$ V



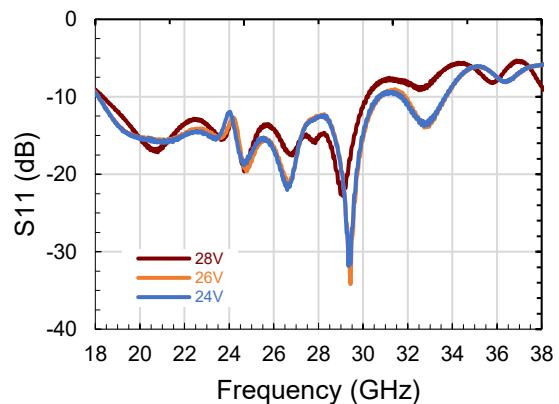
$S22$ vs. Frequency over Temperature @ $V_D = 28$ V



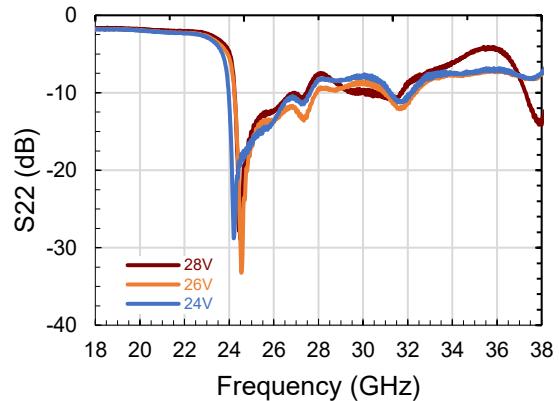
$S21$ vs. Frequency over V_D @ 25°C



$S11$ vs. Frequency over V_D @ 25°C



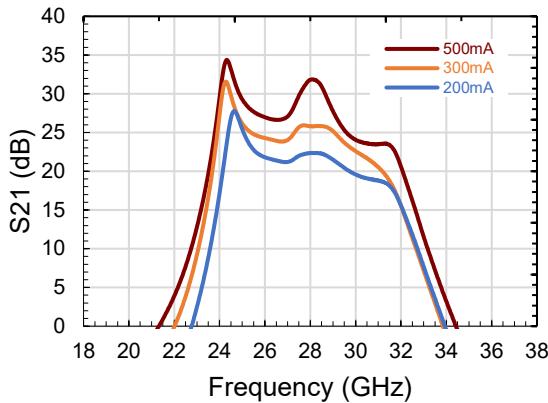
$S22$ vs. Frequency over V_D @ 25°C



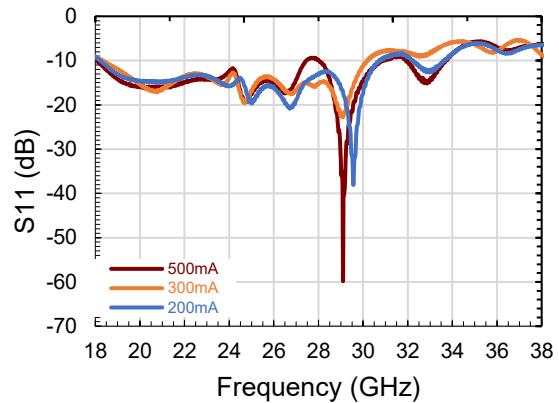
Typical Performance Curves – Small Signal over I_{DQ} :

$V_D = 28$ V, CW, $P_{IN} = -30$ dBm, $T_C = 25^\circ\text{C}$

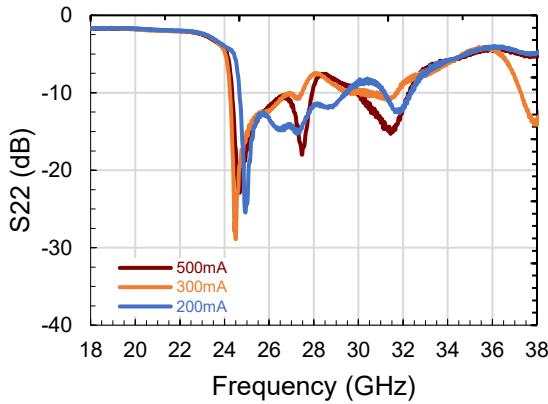
S21 vs. Frequency over I_{DQ}



S11 vs. Frequency over I_{DQ}



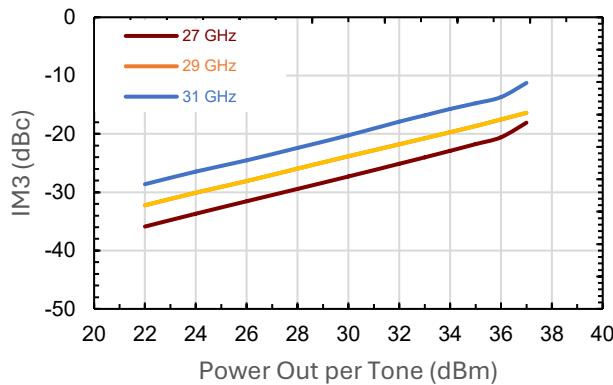
S22 vs. Frequency over I_{DQ}



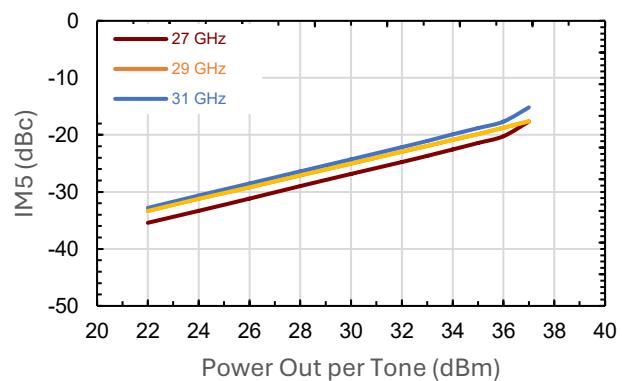
Typical Performance Curves – Linearity (IM3 and IM5):

$V_D = 28$ V, $I_{DQ} = 300$ mA, CW, Frequency = 29 GHz, Tone Spacing = 300 MHz, $T_c = 25^\circ\text{C}$ (unless otherwise stated)

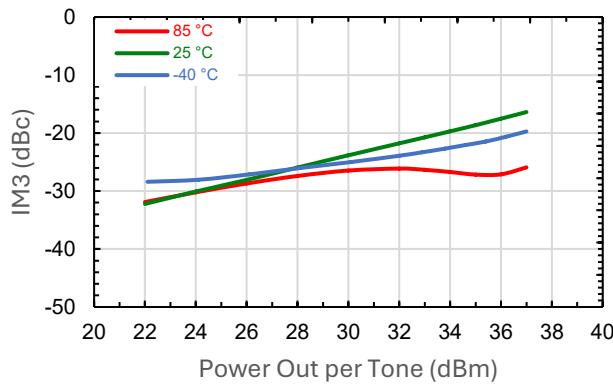
IM3 vs. P_{out} /Tone over Frequency



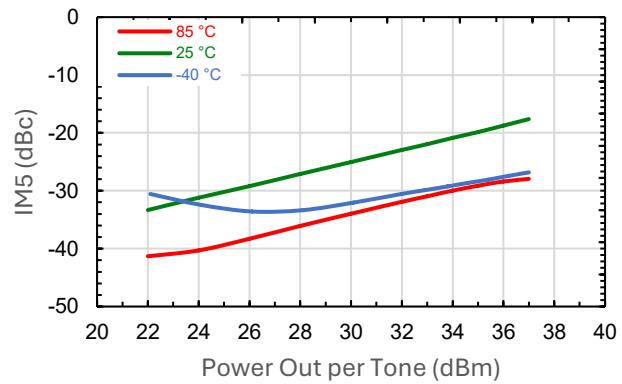
IM5 vs. P_{out} /Tone over Frequency



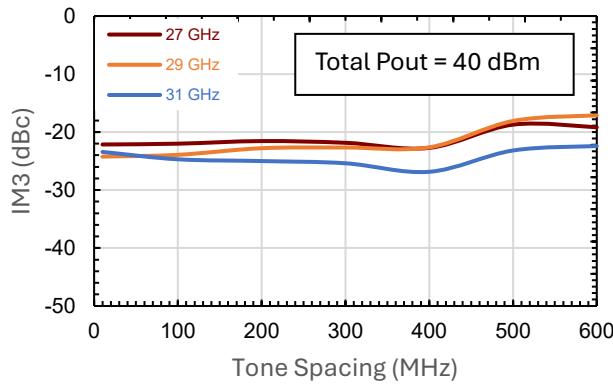
IM3 vs. P_{out} /Tone over Temperature



IM5 vs. P_{out} /Tone over Temperature



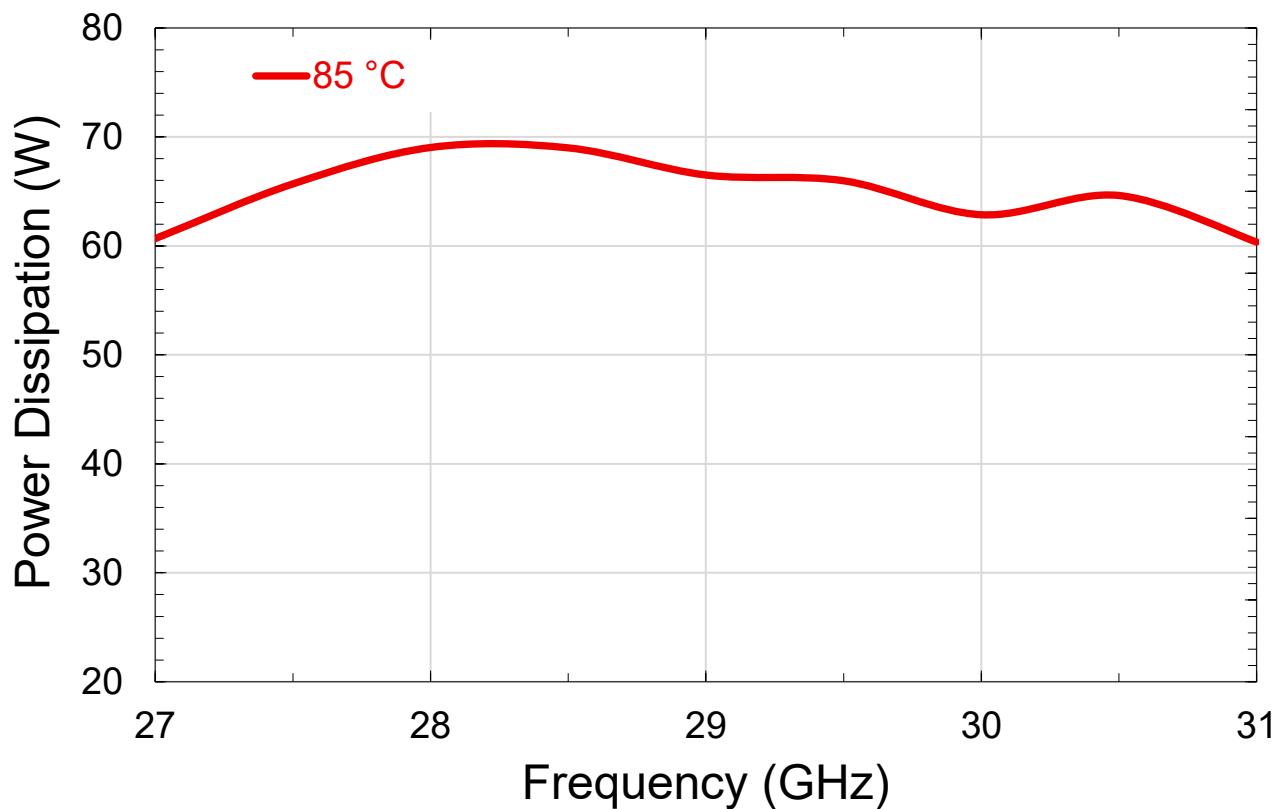
IM3 vs. Tone Spacing vs. Frequency



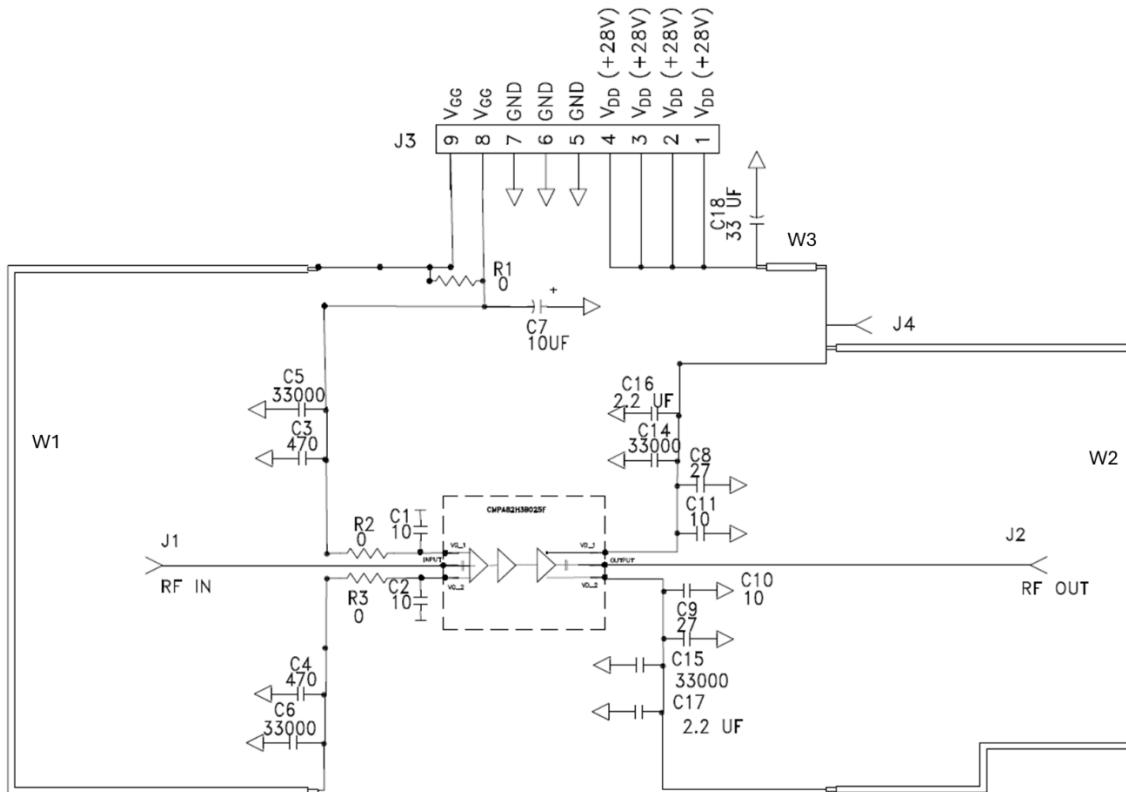
Thermal Characteristics

| Parameter | Operating Conditions | Value |
|--|---|----------|
| Operating Junction Temperature (T _J) | Freq = 29 GHz, V _D = 28 V, I _{DQ} = 300 mA, I _{DRIVE} = 3.3 A, P _{IN} = 25 dBm, P _{OUT} = 43.3 dBm, P _{DISS} = 66.5 W, T _{CASE} = 85°C, CW | 197°C |
| Thermal Resistance, Junction to Case (R _{θJC}) | | 1.68°C/W |

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



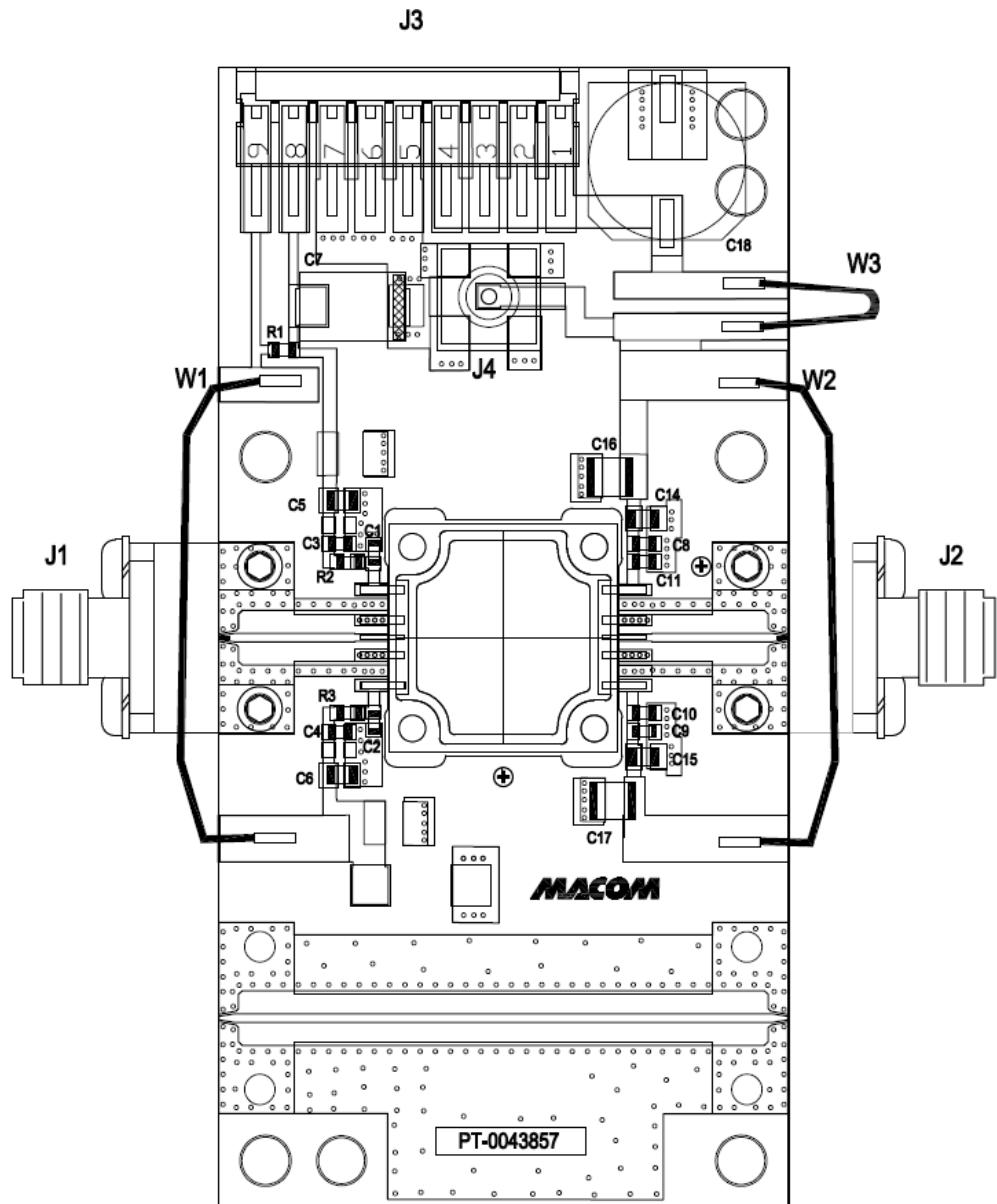
Evaluation Board Schematic (CMPA2H3B025F-AMP)



Parts List

| Part | Value | Qty |
|------------------|---|-----|
| R1, R2, R3 | RES, 0.0 OHM, 5%, 0603 SMD | 3 |
| C18 | CAP, 33uF, 20%, 50V, ELECTROLYTIC | 1 |
| C7 | CAP, 10uF, 16V, TANTALUM, 2312 | 1 |
| C16, C17 | CAP, 2.2uF, +/-10%, 100V, 1210 | 2 |
| C3, C4 | CAP, 470pF, 5%, 100V, 0603 | 2 |
| C8, C9 | CAP, 27pF, 5%, 250V, 0603 | 2 |
| C1, C2, C10, C11 | CAP, 10pF, 5%, 250V, 0603 | 4 |
| C5, C6, C14, C15 | CAP, .033uF, 50V, 0603 | 4 |
| - | PCB, RO3003, .010 THK, HPHF Package | 1 |
| - | BASEPLATE 3.0x1.5x0.25Cu | 1 |
| J1, J2 | CONN, SMA JACK (FEMALE) END LAUNCH CONNECTOR | 2 |
| J4 | CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED | 1 |
| J3 | HEADER RT>PLZ .1CEN LK 9POS | 1 |
| W1, W2, W3 | WIRE, BLACK, 22 AWG | 3 |
| U1 | CMPA2H3B025F | 1 |

Evaluation Board Assembly Drawing (CMPA2H3B025F-AMP)



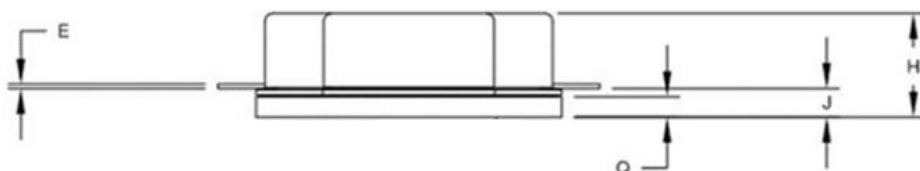
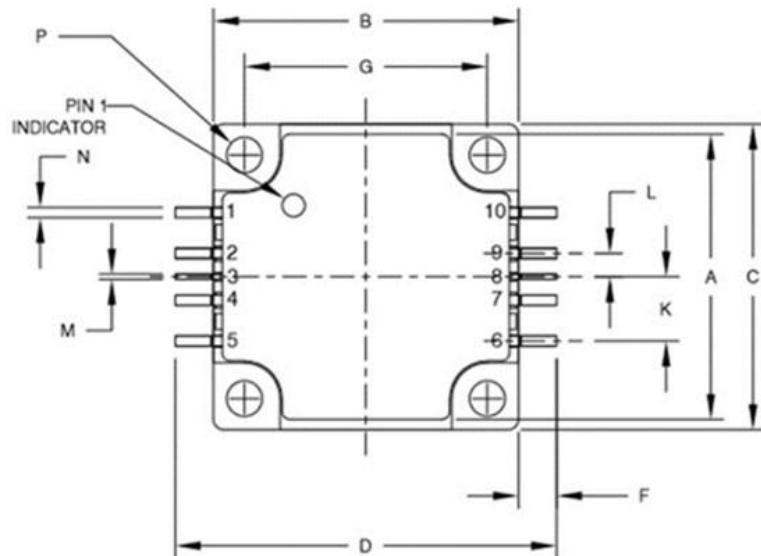
Bias On Sequence

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 V_g 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 ($V_G = -5V$)
3. Turn off drain voltage (V_D)
4. Turn off gate voltage (V_G)

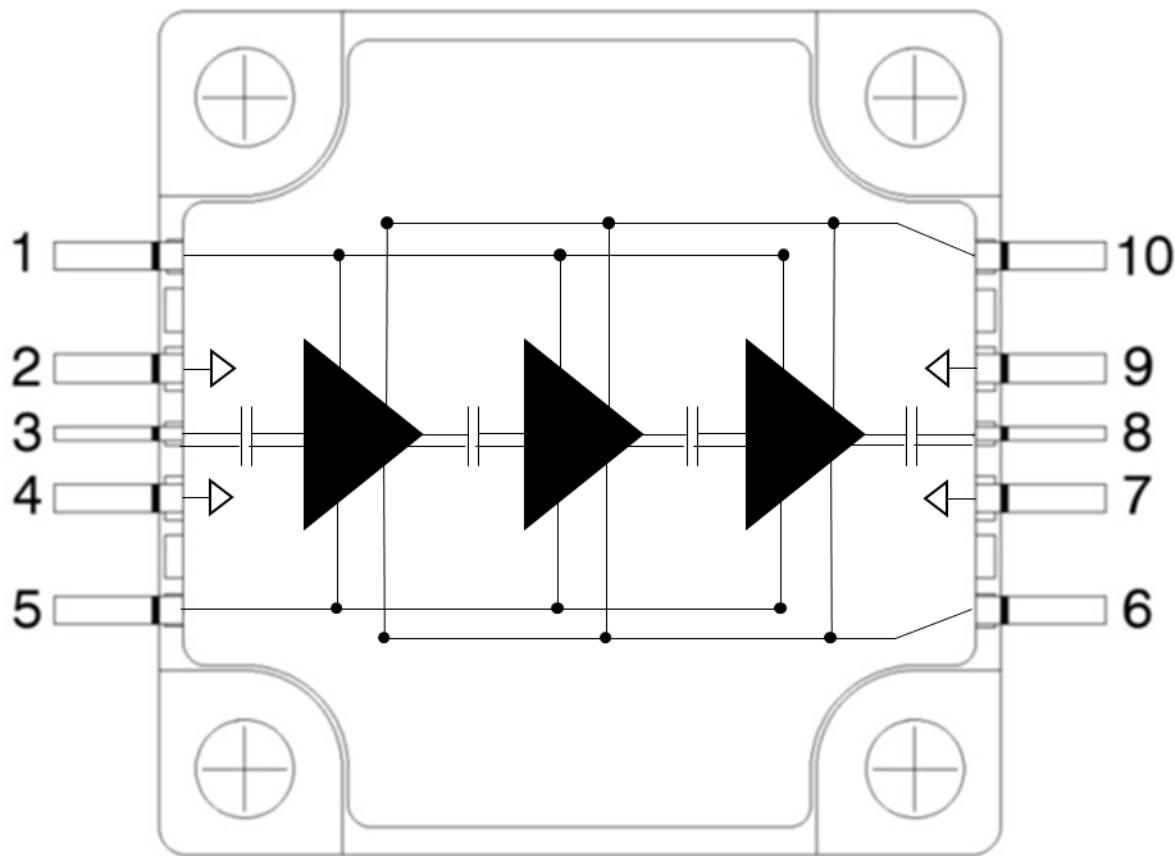
Mechanical Information



| DIM | INCHES | | | MILLIMETERS | | |
|-----|--------|--------|------|-------------|---------|-------|
| | MIN | TYP | MAX | MIN | TYP | MAX |
| A | .555 | .560 | .565 | 14.10 | 14.22 | 14.35 |
| B | .595 | .600 | .605 | 15.11 | 15.24 | 15.37 |
| C | .595 | .600 | .605 | 15.11 | 15.24 | 15.37 |
| D | - | (.750) | - | - | (19.05) | - |
| E | .006 | .008 | .010 | 0.15 | 0.20 | 0.25 |
| F | .065 | .075 | .085 | 1.66 | 1.91 | 2.16 |
| G | .473 | .478 | .483 | 12.01 | 12.14 | 12.27 |
| H | .191 | .203 | .215 | 4.86 | 5.16 | 5.46 |
| J | .049 | .056 | .063 | 1.24 | 1.42 | 1.60 |
| K | .121 | .126 | .131 | 3.07 | 3.20 | 3.33 |
| L | .041 | .046 | .051 | 1.04 | 1.17 | 1.30 |
| M | .005 | .010 | .015 | 0.13 | .25 | 0.38 |
| N | .015 | .020 | .025 | 0.38 | .51 | 0.63 |
| P | .065 | .070 | .075 | 1.65 | 1.78 | 1.90 |
| Q | .038 | .040 | .042 | 0.97 | 1.02 | 1.07 |

Pin Description

| Pin # | Name | Description |
|------------|-------|---|
| 1, 5 | VG | Pins 1 and 5 must be electrically connected to the gate bias voltage. |
| 6, 10 | VD | Pins 6 and 10 must be electrically connected to the drain bias voltage. |
| 2, 4, 7, 9 | GND | RF and DC ground. |
| 3 | RFIN | RF Input. 50-ohm matched. Internally DC blocked. |
| 8 | RFOUT | RF Output. 50-ohm matched. Internally DC blocked. |
| Base | GND | RF and DC ground. |



CMPA2H3B025F
Rev. V1

Revision History

| Rev | Date | Change Description |
|-----|------------|---------------------|
| V1P | 09/17/2024 | Preliminary release |
| V1 | 12/19/2025 | Production release |

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