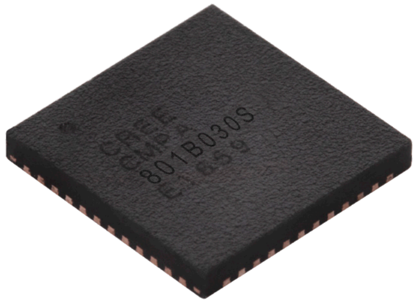
# CMPA801B030S

## 7.9 - 11.0 GHz, 40 W, Packaged GaN MMIC Power Amplifier



PN: CMPA801B030S
Package Type: 7x7 QFN

### Description

Cree's CMPA801B030S is a packaged, 40W HPA utilizing Cree's high performance, 0.15um GaN on SiC production process. The CMPA801B030S operates from 7.9-11.0 GHz and targets pulsed radar systems supporting both defense and commercial applications. With 2 stages of gain, this high performance amplifier provides 20dB of large signal gain and 40% efficiency to support lower system DC power requirements and simplify system thermal management solutions. Packaged in a 7x7 mm plastic overmold QFN, the CMPA801B030S also supports reduced board space requirements and high-throughput manufacturing lines.

### Typical Performance Over 7.9 - 11.0 GHz ($T_C$ = 25˚C)

| Parameter | 8.0 GHz | 8.5 GHz | 9.0 GHz | 10.0 GHz | 11.0 GHz | Units |
|---|---|---|---|---|---|---|
| Small Signal Gain | 28.2 | 27.5 | 27.1 | 24.6 | 24.0 | dB |
| Output Power | 39.3 | 45.9 | 48.9 | 42.3 | 40.7 | W |
| Power Gain | 19.9 | 20.6 | 21.0 | 20.3 | 20.1 | dB |
| Power Added Efficiency | 38.2 | 40.6 | 41.3 | 39.4 | 37.0 | % |

Notes: $P_{IN}$ = 26 dBm, Pulse Width = 100 µs; Duty Cycle = 10%

### Features

- Freq: 7.9 – 11.0 GHz
- Psat: 40 W
- PAE: 40%
- LS Gain: 20 dB
- 7x7 mm Overmold QFN
- Lower system costs
- Reduced board area

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

### Applications

- Military pulsed radar
- Civil pulsed radar
- Satellite Communications

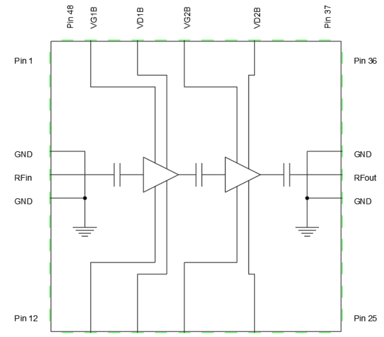



Figure 1.

RoHS COMPLIANT


4600 Silicon Drive | Durham, NC 27703 | wolfspeed.com

## Absolute Maximum Ratings (not simultaneous) at 25˚C

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DSS}$ | 84 | VDC | 25°C |
| Gate-source Voltage | $V_{GS}$ | -8, +2 | VDC | 25°C |
| Storage Temperature | $T_{STG}$ | -65, +150 | ˚C | |
| Maximum Forward Gate Current | $I_G$ | 12 | mA | 25°C |
| Maximum Drain Current | $I_{DMAX}$ | 6 | A | |
| Soldering Temperature | $T_S$ | 260 | ˚C | |

## Electrical Characteristics (Frequency = 7.9 GHz to 11.0 GHz unless otherwise stated; $T_C$ = 25˚C)

| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -2.6 | - | -1.6 | V | $V_{DS}$ = 10 V, $I_D$ = 13 mA |
| Gate Quiescent Voltage | $V_{GS(Q)}$ | – | -1.75 | – | $V_{DC}$ | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Saturated Drain Current[1] | $I_{DS}$ | – | 4 | – | A | $V_{DS}$ = 6.0 V, $V_{GS}$ = 2.0 V |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 84 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 13 mA |
| **RF Characteristics[2,3]** | | | | | | |
| Small Signal Gain | $S21_1$ | – | 28.2 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 8.0 GHz |
| Small Signal Gain | $S21_2$ | – | 27.5 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 8.5 GHz |
| Small Signal Gain | $S21_3$ | – | 27.1 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 9.0 GHz |
| Small Signal Gain | $S21_4$ | – | 24.6 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 10.0 GHz |
| Small Signal Gain | $S21_5$ | – | 24.0 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 11.0 GHz |
| Output Power | $P_{OUT1}$ | – | 39.3 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 8.0 GHz |
| Output Power | $P_{OUT2}$ | – | 45.9 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 8.5 GHz |
| Output Power | $P_{OUT3}$ | – | 48.9 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 9.0 GHz |
| Output Power | $P_{OUT4}$ | – | 42.3 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 10.0 GHz |
| Output Power | $P_{OUT5}$ | – | 40.7 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 11.0 GHz |
| Power Added Efficiency | $PAE_1$ | – | 38 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 8.0 GHz |
| Power Added Efficiency | $PAE_2$ | – | 41 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 8.5 GHz |
| Power Added Efficiency | $PAE_3$ | – | 41 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 9.0 GHz |
| Power Added Efficiency | $PAE_4$ | – | 39 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 10.0 GHz |
| Power Added Efficiency | $PAE_5$ | – | 37 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 26 dBm, Freq = 11.0 GHz |
| Power Gain | $G_P$ | – | 21.0 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Input Return Loss | S11 | – | -13 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Output Return Loss | S22 | – | -10 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Output Mismatch Stress | VSWR | – | – | 5 : 1 | Ψ | No damage at all phase angles, $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |

Notes:
[1] Scaled from PCM data
[2] All data tested in CMPA801B030S-AMP1
[3] Pulse Width = 100 µs; Duty Cycle = 10%

## Thermal Characteristics

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Operating Junction Temperature | $T_J$ | 225 | ˚C | |
| Thermal Resistance, Junction to Case (packaged)[1] | $R_{\theta JC}$ | 2.5 | ˚C/W | 100 µs, 10%, $P_{DISS}$ = 25.5 W |

Notes:
[1]Measured for the CMPA801B030S at $P_{DISS}$ = 25.5 W

## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

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

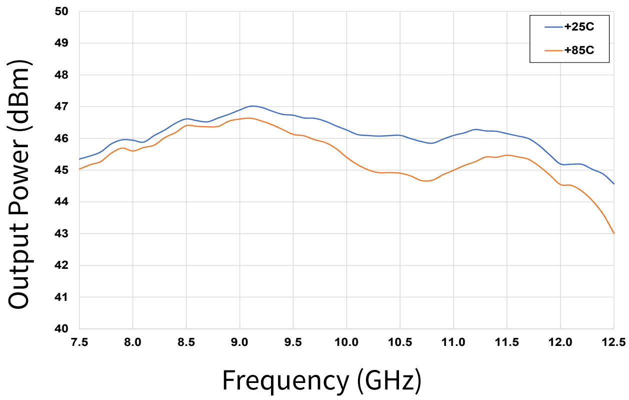



**Figure 2. Output Power vs Frequency as a Function of Input Power**

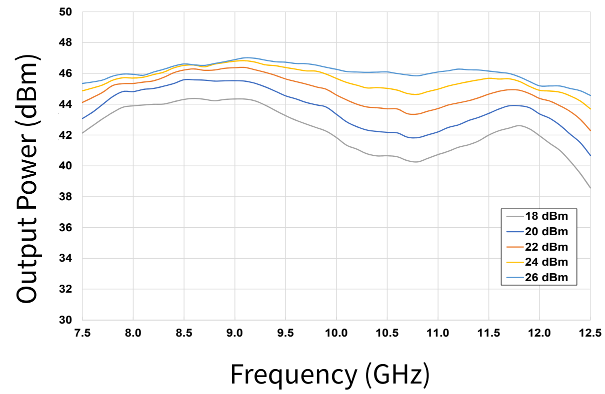



**Figure 3. Power Added Eff. vs Frequency as a Function of Temperature**

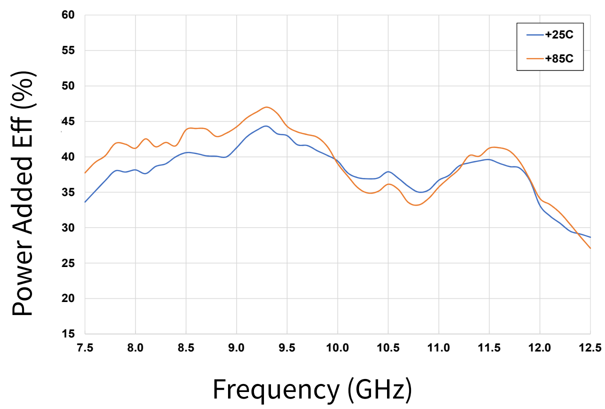



**Figure 4. Power Added Eff. vs Frequency as a Function of Input Power**

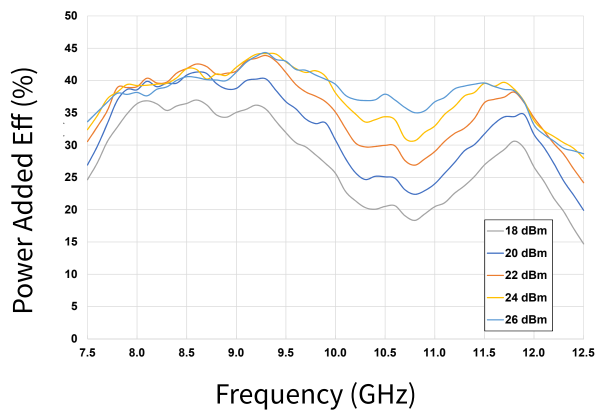



**Figure 5. Drain Current vs Frequency as a Function of Temperature**

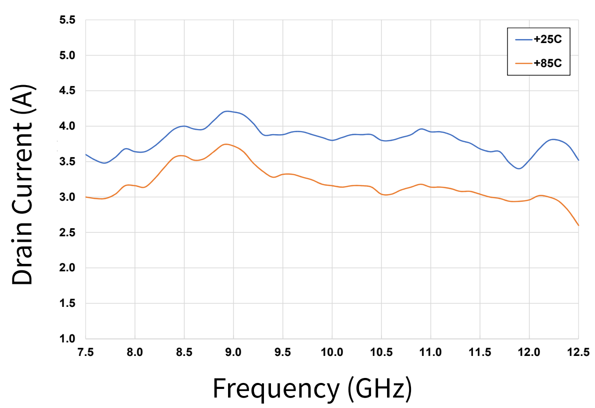
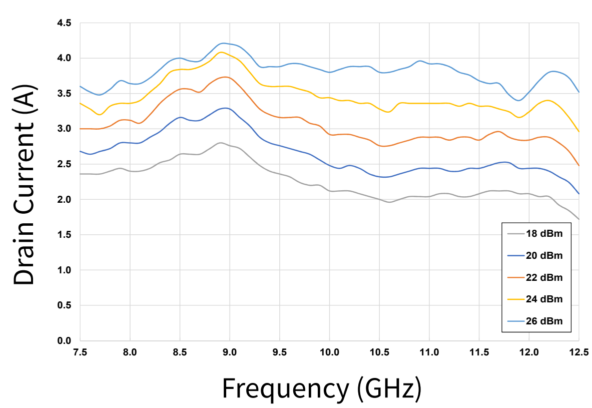



**Figure 6. Drain Current vs Frequency as a Function of Input Power**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

**Figure 7. Output Power vs Frequency as a Function of VD**

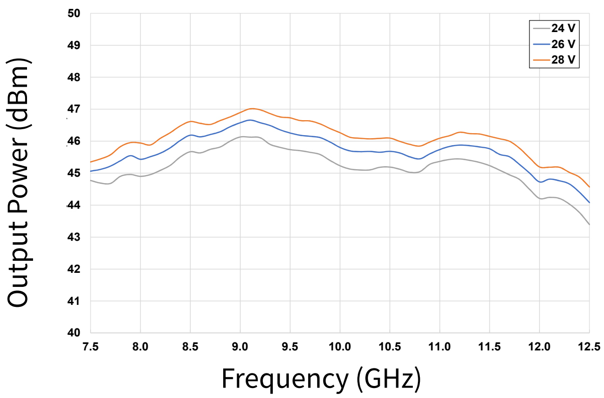



**Figure 8. Output Power vs Frequency as a Function of IDQ**

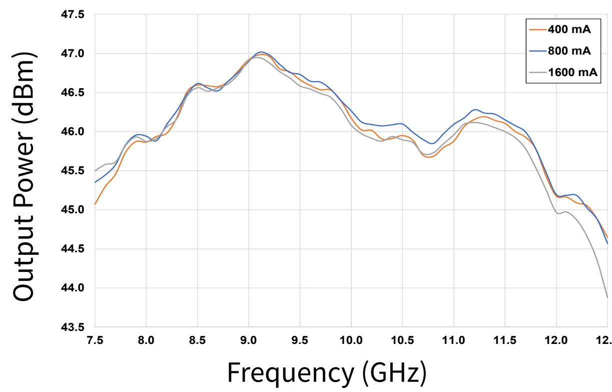



**Figure 9. Power Added Eff. vs Frequency as a Function of VD**

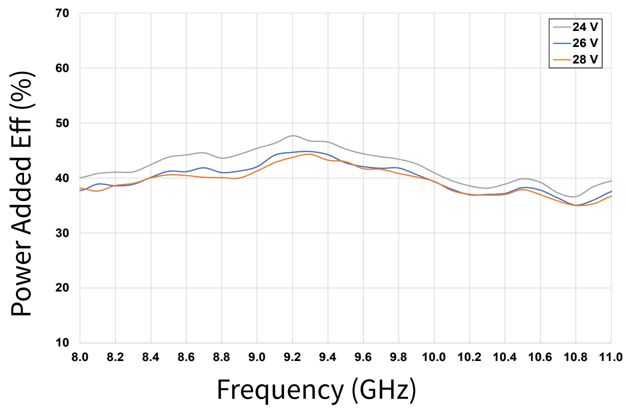



**Figure 10. Power Added Eff. vs Frequency as a Function of IDQ**

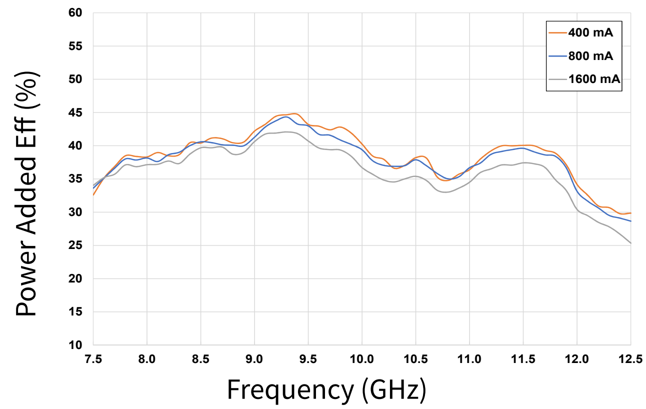



**Figure 11. Drain Current vs Frequency as a Function of VD**

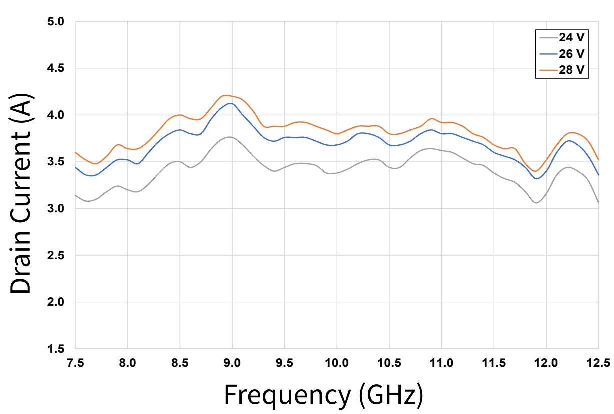
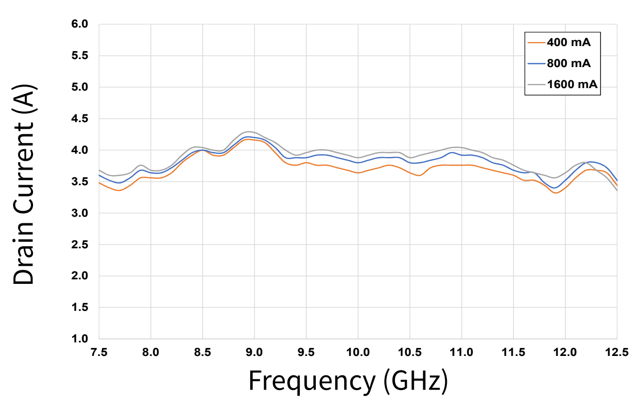



**Figure 12. Drain Current vs Frequency as a Function of IDQ**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

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

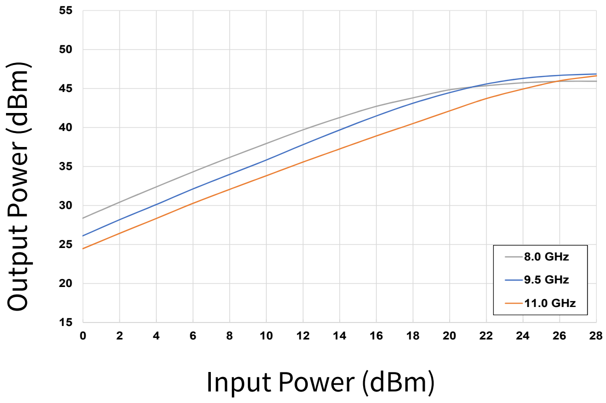



**Figure 14. Power Added Eff. vs Input Power as a Function of Frequency**

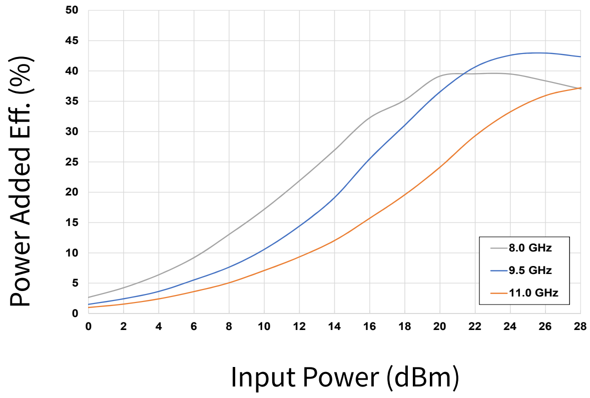



**Figure 15. Large Signal Gain vs Input Power as a Function of Frequency**

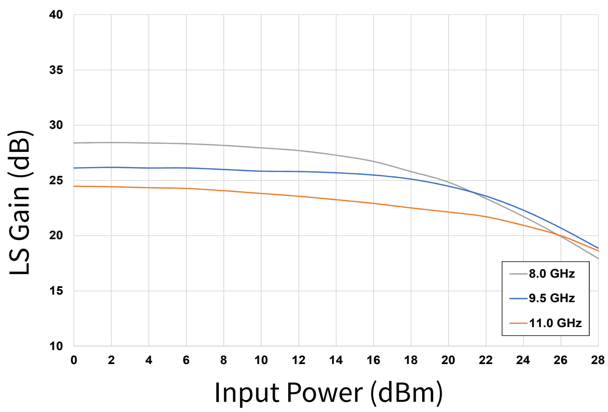



**Figure 16. Drain Current vs Input Power as a Function of Frequency**

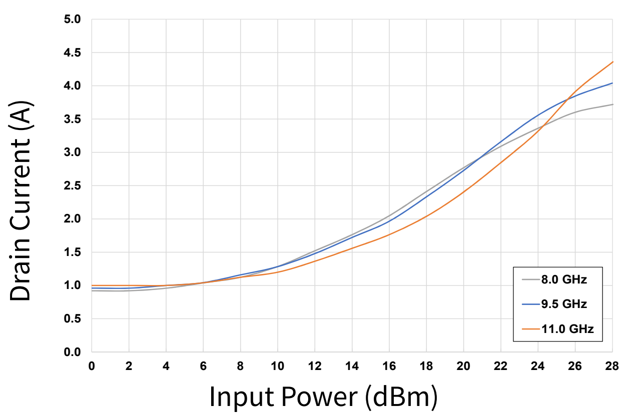
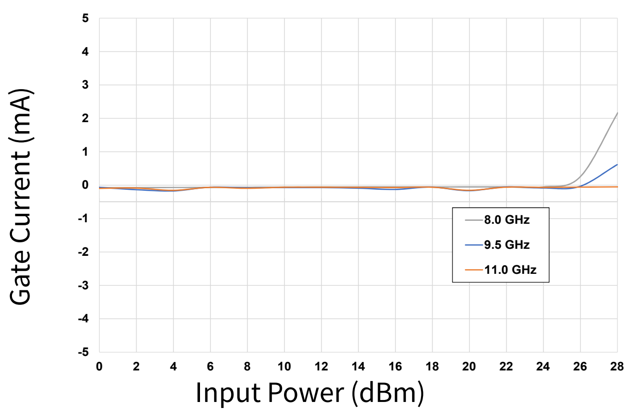



**Figure 17. Gate Current vs Input Power as a Function of Frequency**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

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

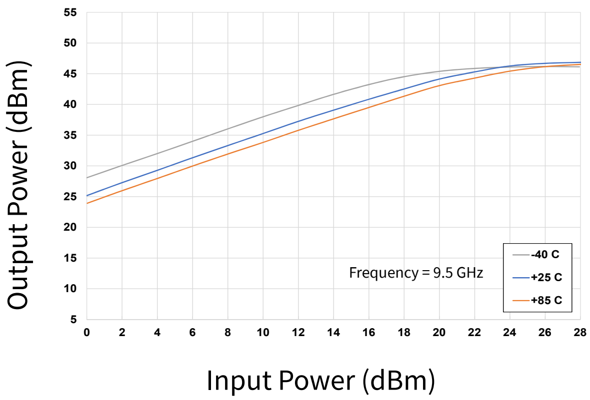



**Figure 19. Power Added Eff. vs Input Power as a Function of Temperature**

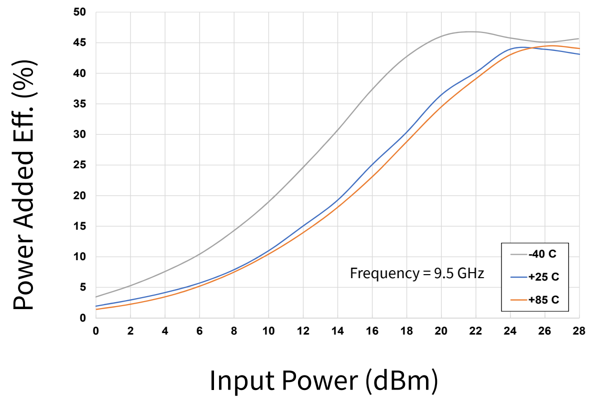



**Figure 20. Large Signal Gain vs Input Power as a Function of Temperature**

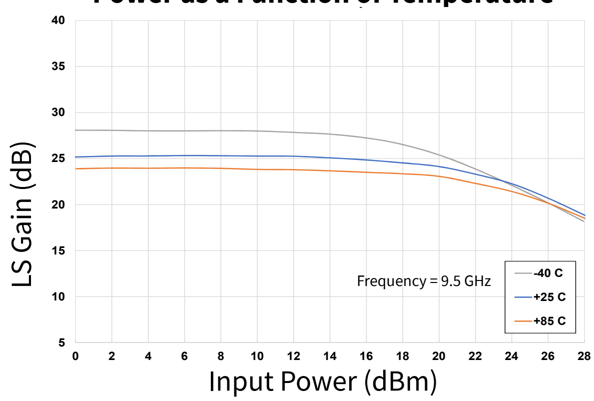



**Figure 21. Drain Current vs Input Power as a Function of Temperature**

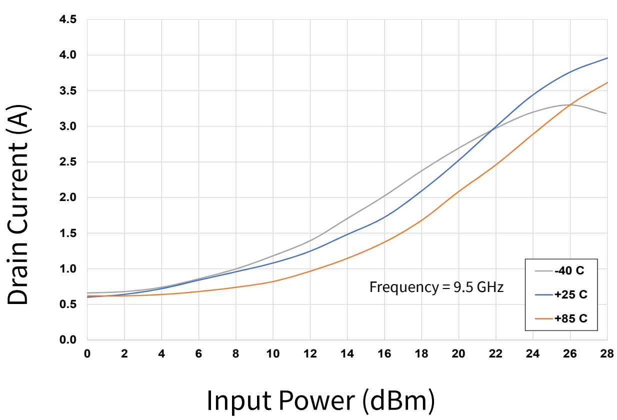
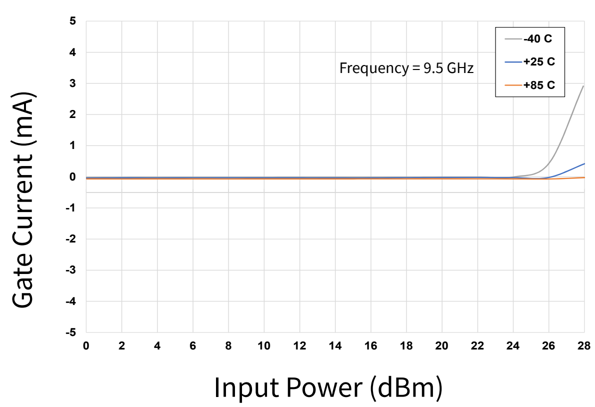



**Figure 22. Gate Current vs Input Power as a Function of Temperature**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

**Figure 23. Output Power vs Input Power as a Function of IDQ**

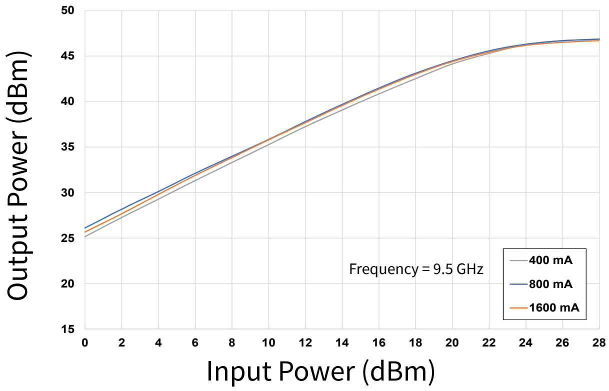



**Figure 24. Power Added Eff. vs Input Power as a Function of IDQ**

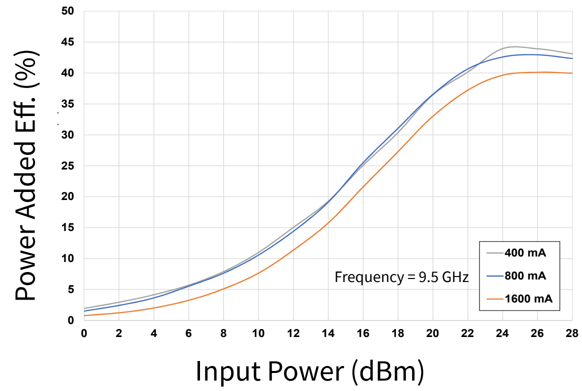



**Figure 25. Large Signal Gain vs Input Power as a Function of IDQ**

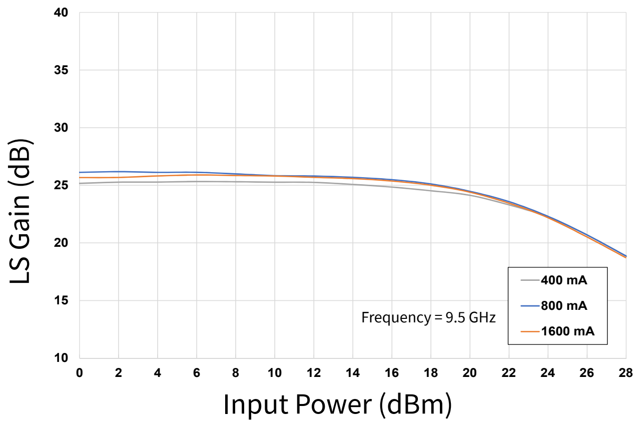



**Figure 26. Drain Current vs Input Power as a Function of IDQ**

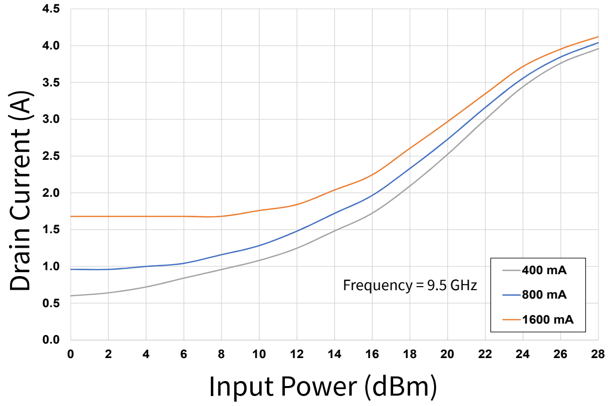
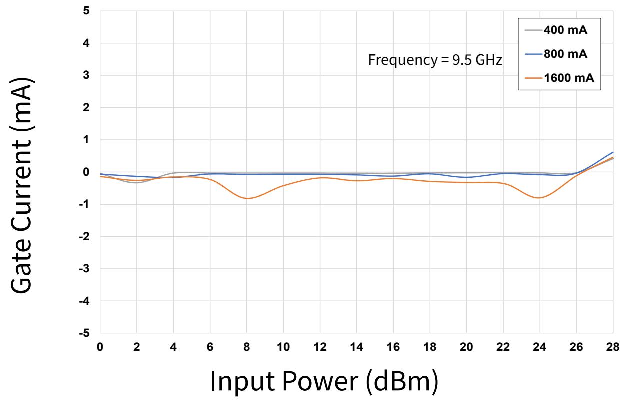



**Figure 27. Gate Current vs Input Power as a Function of IDQ**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, PW = 100 us, DC = 10%, Pin = 26 dBm, $T_{BASE}$ = +25 °C

**Figure 28. 2nd Harmonic vs Output Power as a Function of Frequency**

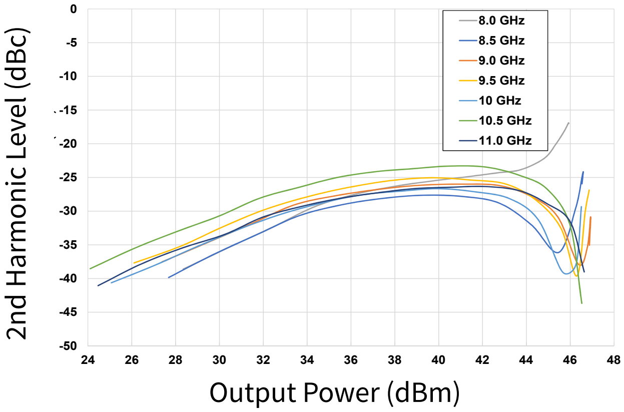



**Figure 29. 3rd Harmonic vs Output Power as a Function of Frequency**

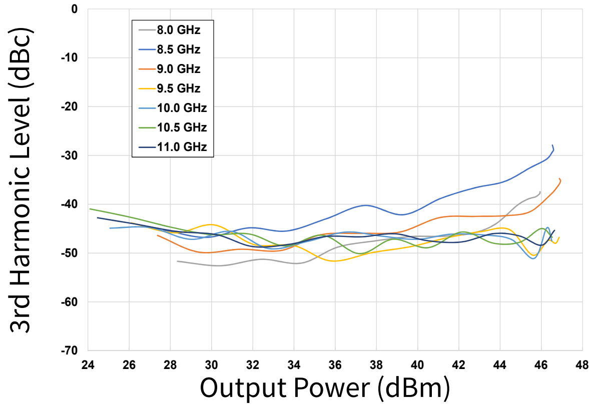



**Figure 30. 2nd Harmonic vs Output Power as a Function of IDQ**

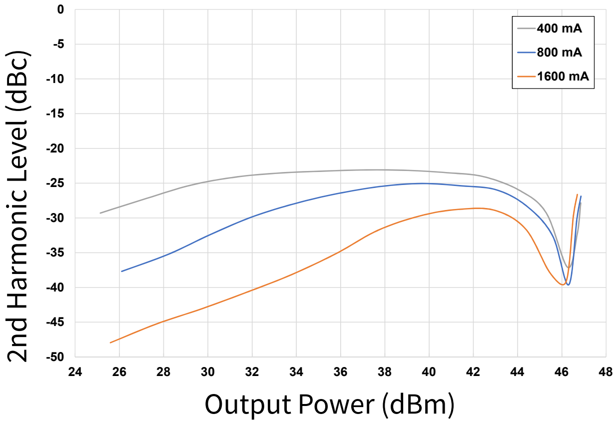
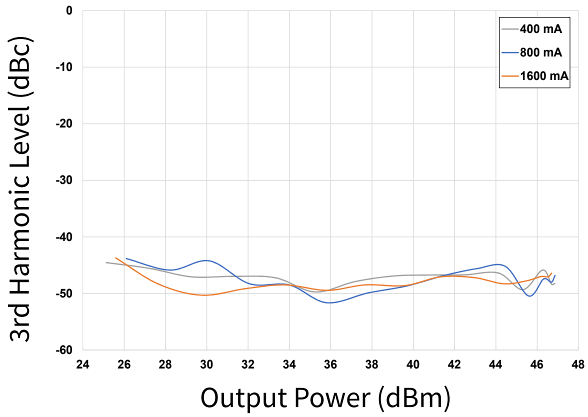



**Figure 31. 3rd Harmonic vs Output Power as a Function of IDQ**



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, Pin = -20 dBm, $T_{BASE}$ = +25 °C

Figure 32. Gain vs Frequency as a Function of Temperature

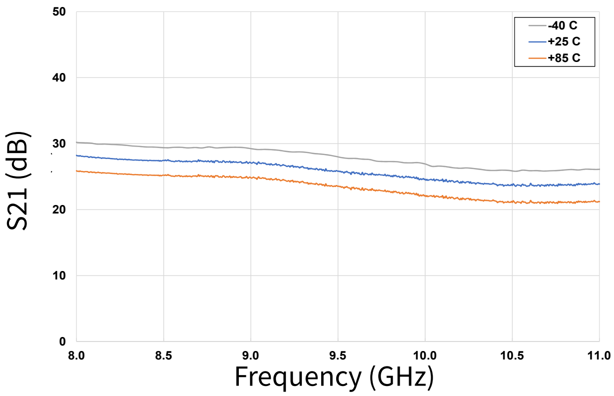



Figure 33. Gain vs Frequency as a Function of Temperature

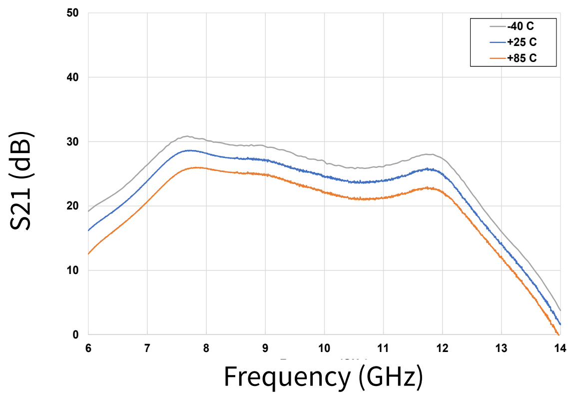



Figure 34. Input RL vs Frequency as a Function of Temperature

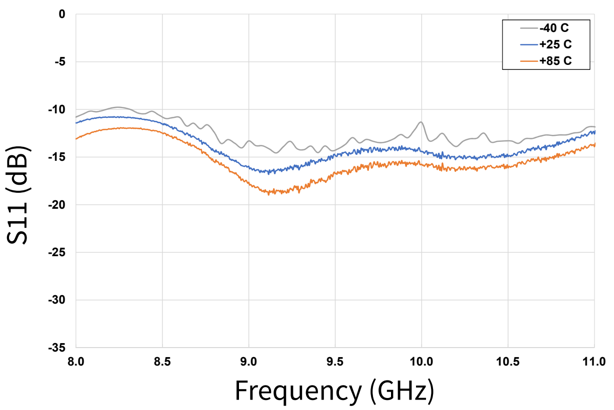



Figure 35. Input RL vs Frequency as a Function of Temperature

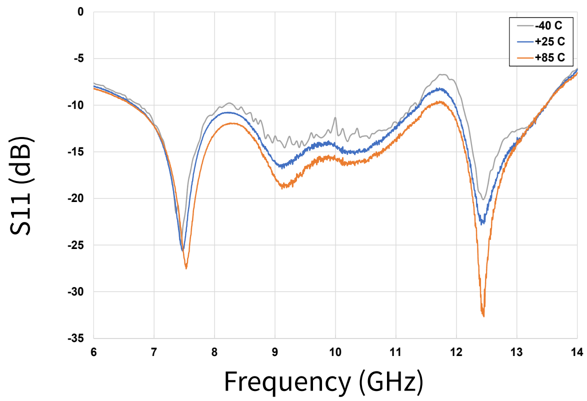



Figure 36. Output RL vs Frequency as a Function of Temperature

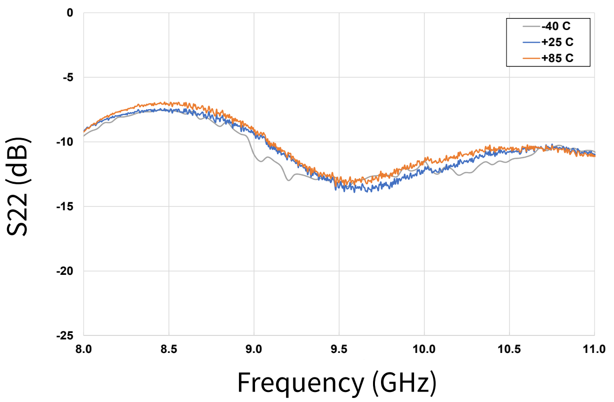
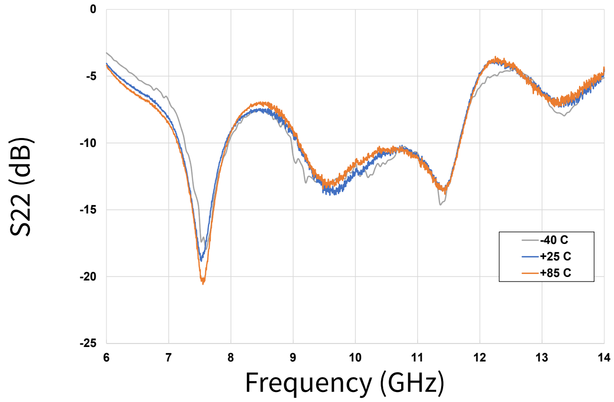



Figure 37. Output RL vs Frequency as a Function of Temperature



## Typical Performance of the CMPA801B030S

Test conditions unless otherwise noted: $V_D$ = 28 V, $I_{DQ}$ = 800 mA, Pin = -20 dBm, $T_{BASE}$ = +25 °C

**Figure 38. Gain vs Frequency as a Function of Voltage**

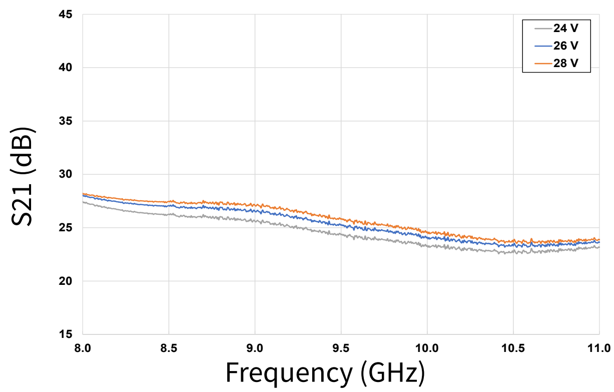



**Figure 39. Gain vs Frequency as a Function of IDQ**

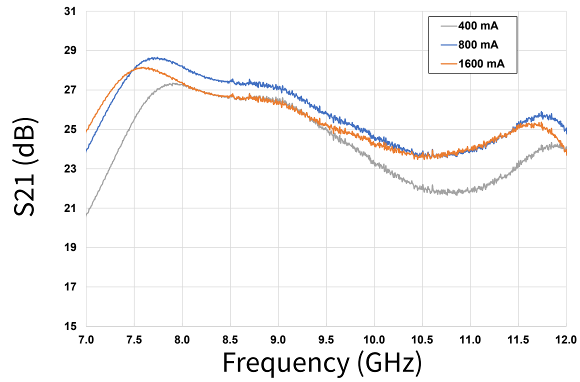



**Figure 40. Input RL vs Frequency as a Function Voltage**

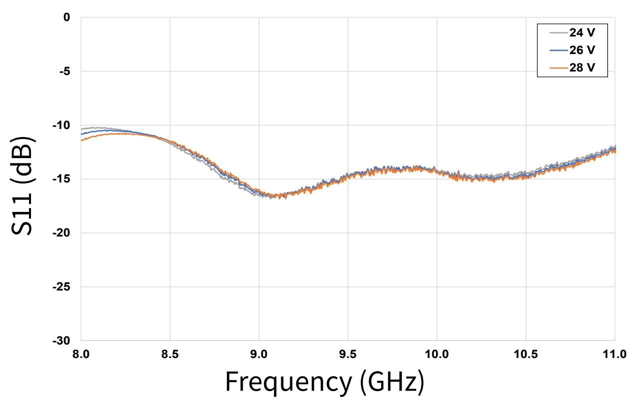



**Figure 41. Input RL vs Frequency as a Function of IDQ**

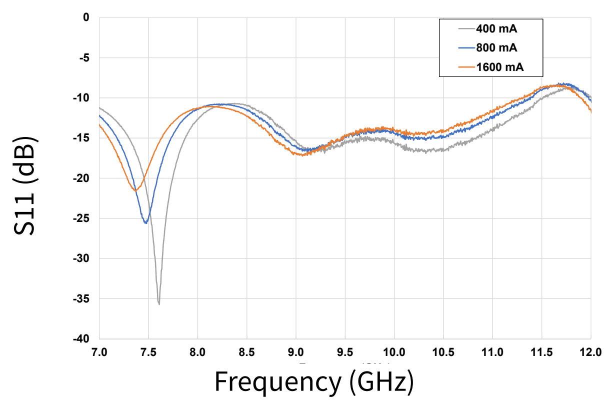



**Figure 42. Output RL vs Frequency as a Function of Voltage**

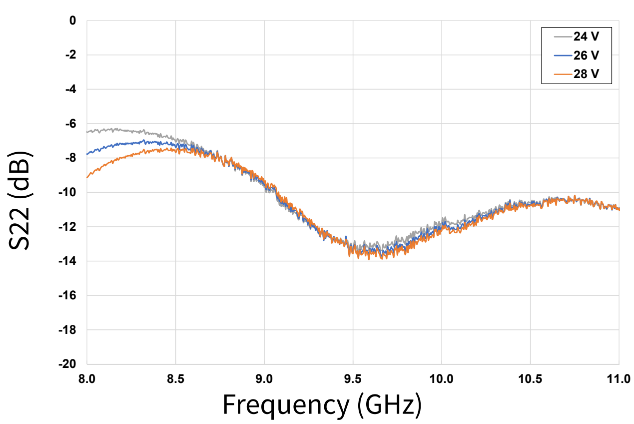
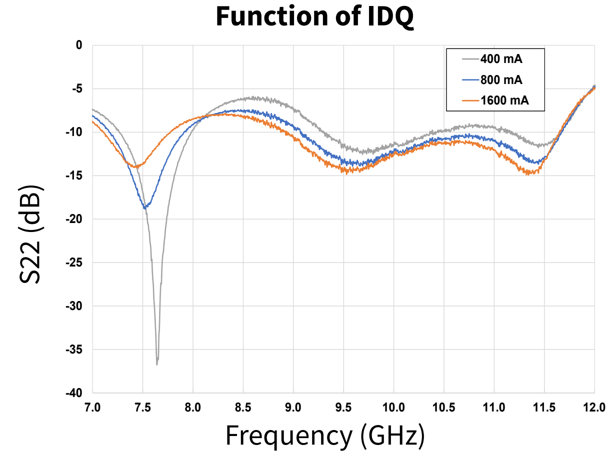
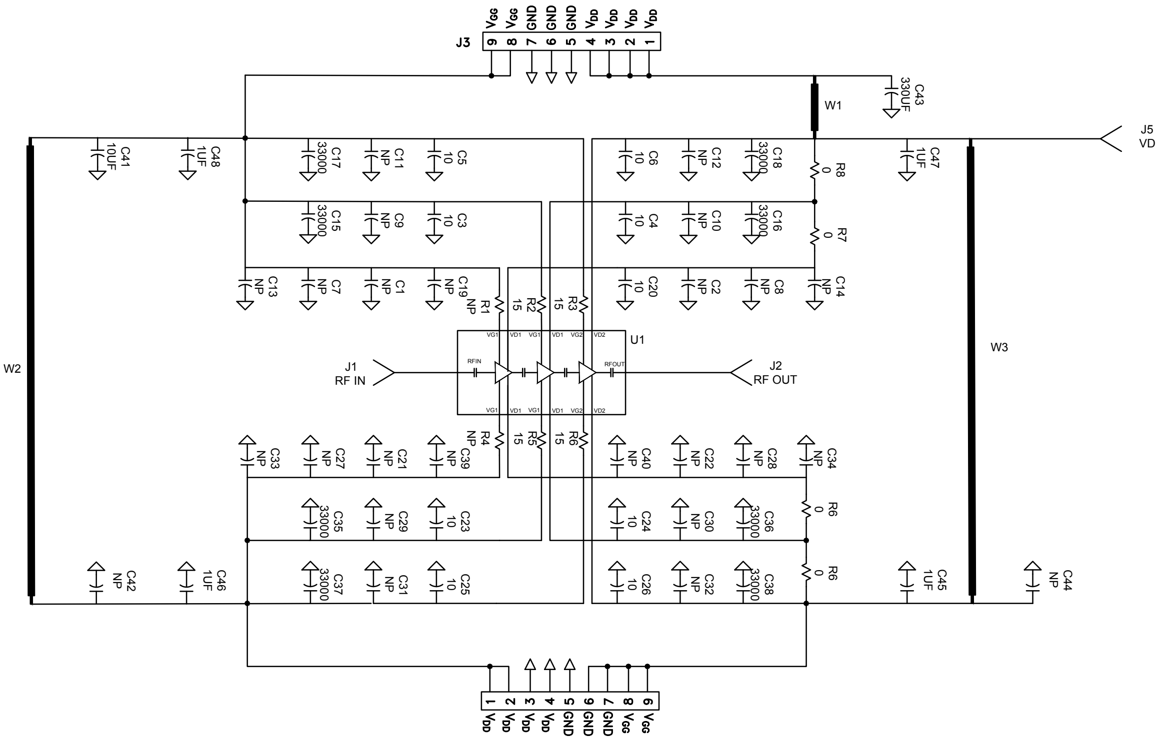


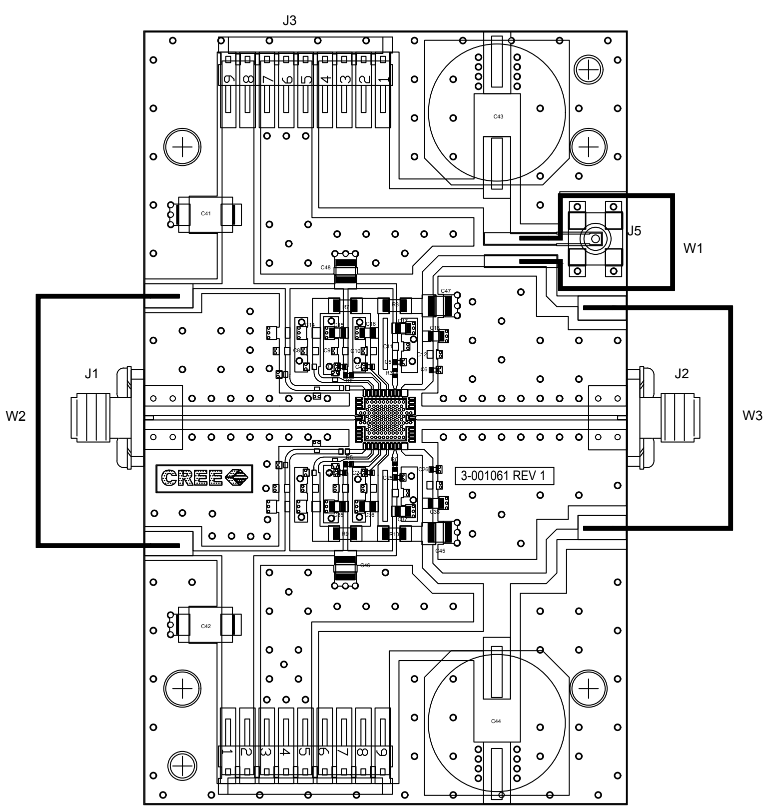

**Figure 43. Output RL vs Frequency as a Function of IDQ**



## CMPA801B030S-AMP1 Application Circuit




## CMPA801B030S-AMP1 Evaluation Board Layout



## CMPA801B030S-AMP1 Evaluation Board Bill of Materials

| Designator | Description | Qty |
|---|---|---|
| C3, C4, C5, C6, C23, C24, C25, C26 | CAP, 10pF, +/-5%, pF, 200V, 0402 | 8 |
| C15, C16, C17, C18, C35, C36, C37, C38 | CA, 330000PF, 0805,100V, X7R | 8 |
| C45, C46, C47, C48 | CAP, 1.0UF, 100V, 10%, X7R, 1210 | 4 |
| C41 | CAP 10UF 16V TANTALUM, 2312 | 1 |
| C43 | CAP, 330 UF, +/-20%, 100V, ELECTROLYTIC, CASE SIZE K16 | 1 |
| R2, R3, R5, R6 | RES 15 OHM, +/-1%, 1/16W, 0402 | 6 |
| R8, R10 | RES 0.0 OHM 1/16W 1206 SMD | 2 |
| J1, J2 | CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL | 4 |
| J5 | CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED | 1 |
| J3, J4 | HEADER RT>PLZ .1CEN LK 9POS | 1 |
| W2, W3 | WIRE, BLACK, 20 AWG ~ 2.5” | 2 |
| W1 | WIRE, BLACK, 20 AWG ~ 3.0” | 1 |
| | PCB, TEST FIXTURE, RF-35TC, 0.010 THK, 7X7 Overmold QFN SOCKET BOARD | 1 |
| | 2-56 SOC HD SCREW 3/16 SS | 4 |
| | #2 SPLIT LOCKWASHER SS | 4 |
| Q1 | CMPA801B030S | 1 |

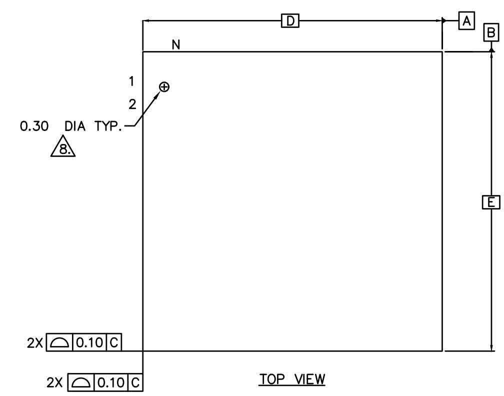
## Electrostatic Discharge (ESD) Classifications

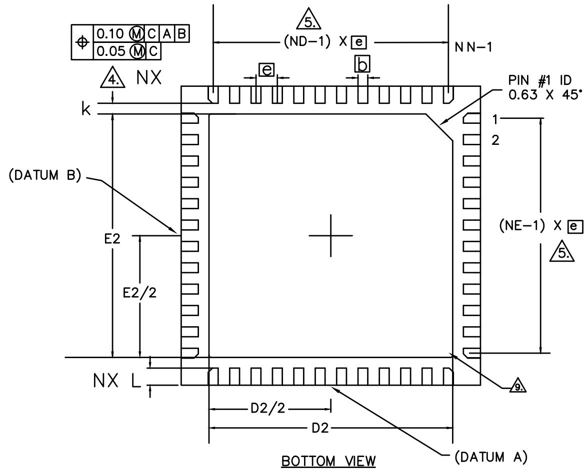
| Parameter | Symbol | Class | Test Methodology |
|---|---|---|---|
| Human Body Model | HBM | 1B (≥ 500 V) | JEDEC JESD22 A114-D |
| Charge Device Model | CDM | II (≥ 200 V) | JEDEC JESD22 C101-C |

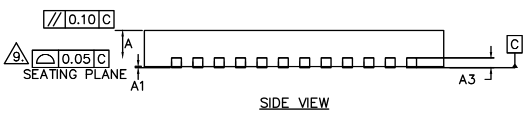
## Moisture Sensitivity Level (MSL) Classification

| Parameter | Symbol | Level | Test Methodology |
|---|---|---|---|
| Moisture Sensitivity Level | MSL | 3 (168 hours) | IPC/JEDEC J-STD-20 |

## Product Dimensions CMPA801B030S (Package 7 x 7 QFN)



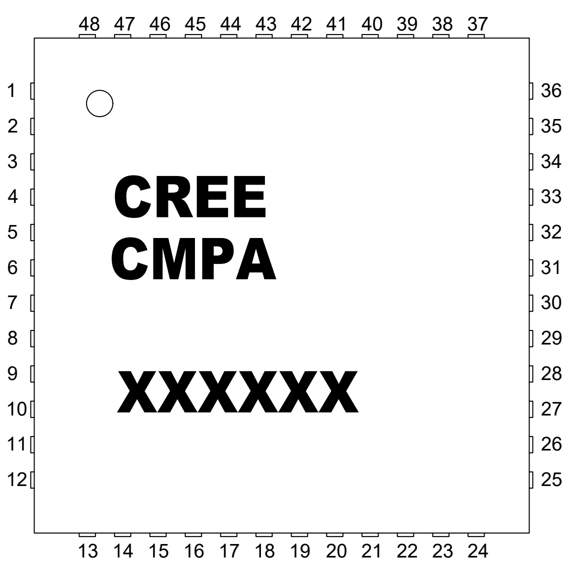




NOTES :
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M. − 1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS, θ IS IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP.
5. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
6. MAX. PACKAGE WARPAGE IS 0.05 mm.
7. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
8. PIN #1 ID ON TOP WILL BE LASER MARKED.
9. BILATERAL 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 0.010 mm +/− 0.005mm.

| SYMBOL | MIN. | NOM. | MAX. | NOTE |
|---|---|---|---|---|
| A | 0.80 | 0.86 | 0.91 | |
| A1 | 0.00 | 0.03 | 0.06 | |
| A3 | | 0.20 REF. | | |
| θ | 0 | — | 12 | 2 |
| K | | 0.20 MIN. | | |
| D | | 7.0 BSC | | |
| E | | 7.0 BSC | | |

| SYMBOL | 0.50mm LEAD PITCH | | | NOTE |
|---|---|---|---|---|
| | MIN. | NOM. | MAX. | |
| e | | 0.50 BSC. | | |
| N | | 48 | | 3 |
| ND | | 12 | | 5 |
| NE | | 12 | | 5 |
| L | 0.35 | 0.41 | 0.46 | |
| b | 0.19 | 0.25 | 0.33 | 4 |
| D2 | 5.61 | 5.72 | 5.83 | |
| E2 | 5.61 | 5.72 | 5.83 | |




| PIN | DESC. | PIN | DESC. | PIN | DESC. | PIN | DESC. |
|---|---|---|---|---|---|---|---|
| 1 | NC | 15 | NC | 29 | NC | 43 | VG2B |
| 2 | NC | 16 | VD1A | 30 | RFGND | 44 | NC |
| 3 | NC | 17 | NC | 31 | RFOUT | 45 | VD1B |
| 4 | NC | 18 | VG2A | 32 | RFGND | 46 | NC |
| 5 | RFGND | 19 | NC | 33 | NC | 47 | VG1B |
| 6 | RFIN | 20 | NC | 34 | NC | 48 | NC |
| 7 | RFGND | 21 | VD2A | 35 | NC | | |
| 8 | NC | 22 | VD2A | 36 | NC | | |
| 9 | NC | 23 | NC | 37 | NC | | |
| 10 | NC | 24 | NC | 38 | NC | | |
| 11 | NC | 25 | NC | 39 | VD2B | | |
| 12 | NC | 26 | NC | 40 | VD2B | | |
| 13 | NC | 27 | NC | 41 | NC | | |
| 14 | VG1A | 28 | NC | 42 | NC | | |

## Part Number System

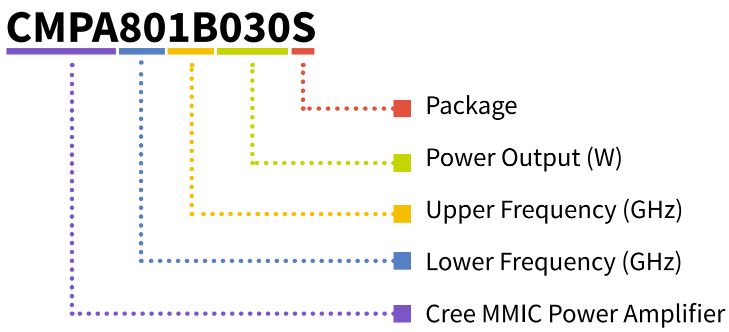



**Table 1.**

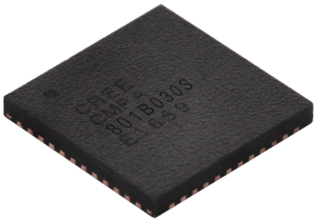
| Parameter | Value | Units |
|---|---|---|
| Lower Frequency | 7.9 | GHz |
| Upper Frequency | 11.0 | GHz |
| Power Output | 40 | W |
| Package | Surface Mount | - |

**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<br>2H = 27.0 GHz |

## Product Ordering Information

| Order Number | Description | Unit of Measure | Image |
|---|---|---|---|
| CMPA801B030S | Packaged GaN MMIC PA | Each |  |
| CMPA801B030S-AMP1 | Evaluation Board with GaN MMIC Installed | Each |  |

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RF Product Marketing Contact
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## Notes

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