

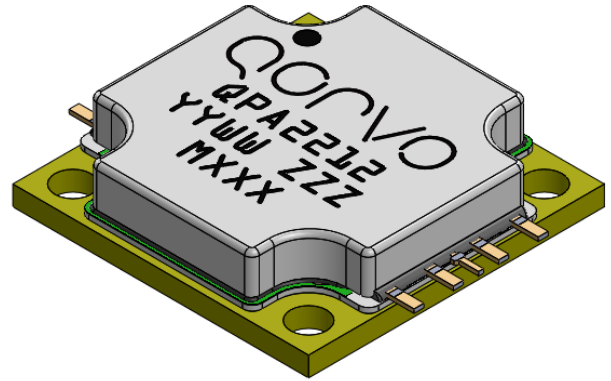
Product Description

Qorvo's QPA2212 is a Ka-band power amplifier fabricated on Qorvo's 0.15um GaN on SiC process (QGaN15). Operating from 27.5 to 31 GHz, it achieves 10 W linear power with lower than -25 dBc intermodulation distortion products and 22 dB small signal gain. Saturated output power is greater than 20 W with and associated power-added efficiency of 22%.

QPA2212 is packaged in a 10-lead 15 x 15 mm bolt-down package with a Cu base for superior thermal management. To simplify system integration, the QPA2212 is fully matched to 50 ohms with integrated DC blocking caps on both I/O ports.

QPA2212 is ideally suited to support satellite communications and 5G infrastructure.

Lead-free and RoHS compliant.

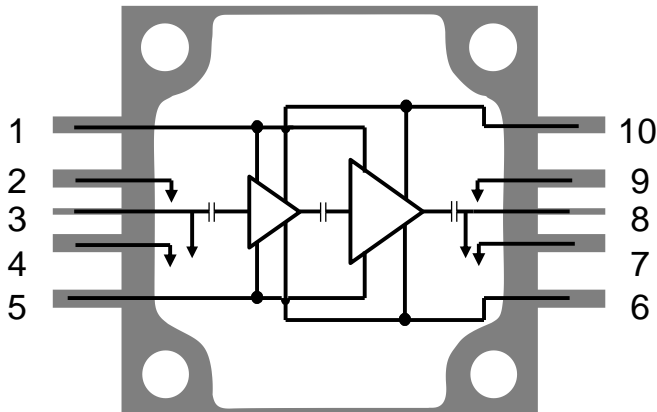


Product Features

- Frequency Range: 27.5–31 GHz
- P_{SAT} ($P_{IN} = 25$ dBm): 43 dBm
- PAE ($P_{IN} = 25$ dBm): 22%
- Power Gain ($P_{IN} = 25$ dBm): 18 dB
- Small Signal Gain: 22 dB
- IMD3 ($P_{OUT} = 36$ dBm/line): -28 dBc
- Bias: $V_D = 22$ V, $I_{DQ} = 460$ mA
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

Performance is typical across frequency. Please reference electrical specification table and data plots for more details

Functional Block Diagram



Applications

- 5G Infrastructure
- Satellite Communications

Ordering Information

Part No.	Description
QPA2212	27.5 – 31 GHz 20 W GaN Power Amplifier
QPA2212EVB	Evaluation Board

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	29.5 V
Gate Voltage Range (V_G)	-5 to 0 V
Drain Current (I_D)	5660 mA
Gate Current (I_G)	See plot page 17
Power Dissipation (P_{DISS}), 85°C	80.3 W
Input Power (P_{IN}), 50 Ω , $V_D=22$ V, $I_{DQ}=460$ mA, 85 °C	34 dBm
Input Power (P_{IN}), 3:1 VSWR, $V_D=22$ V, $I_{DQ}=460$ mA, 85 °C	34 dBm
Mounting Temperature	Refer to Assembly Notes, page 20
Storage Temperature	-55 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Recommended Operating Conditions

Parameter	Value / Range
Drain Voltage (V_D)	22 V
Drain Current (I_{DQ})	460 mA
Temperature Range	-40 to +85 °C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

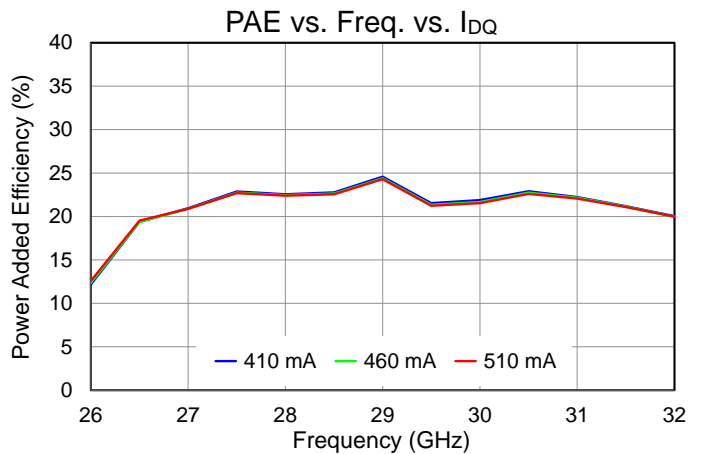
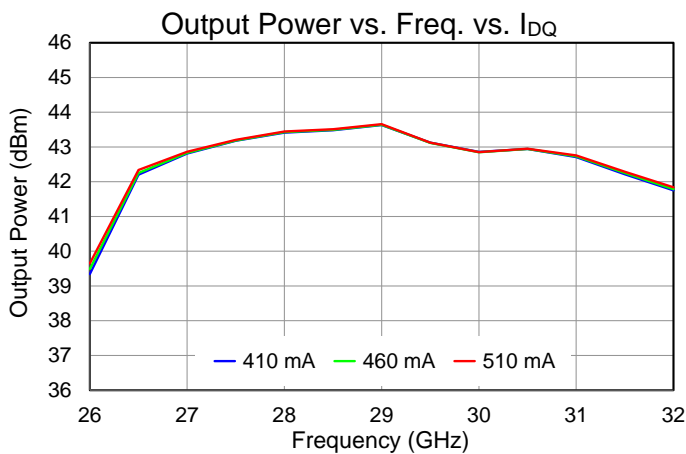
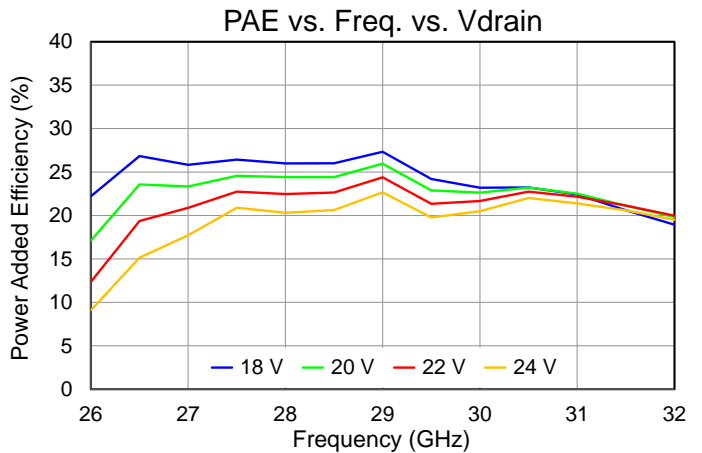
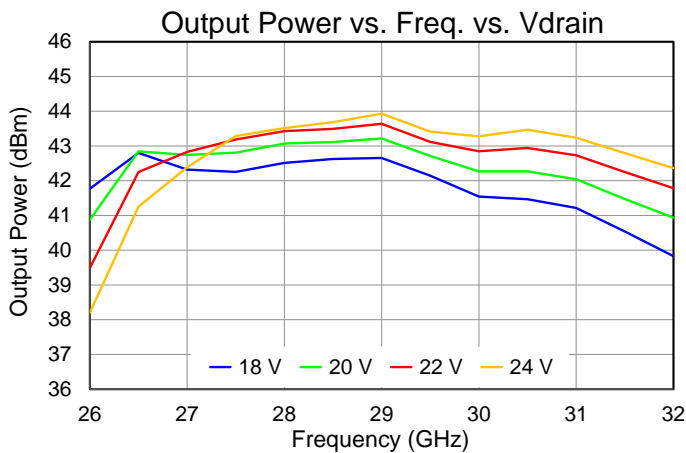
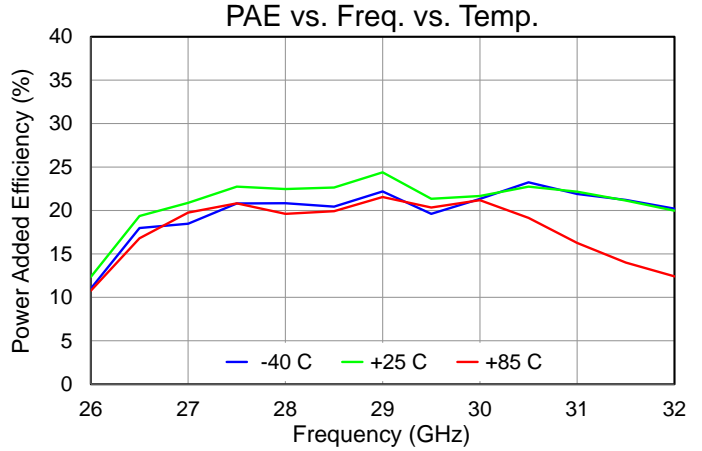
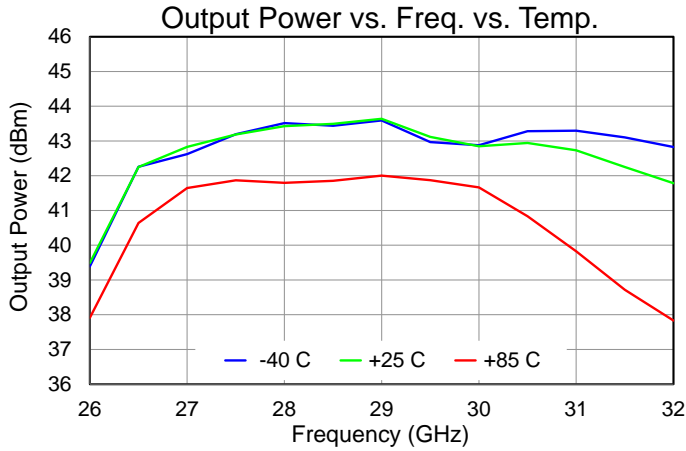
Electrical Specifications

Parameter		Min	Typ	Max	Units
Operational Frequency		27.5		31	GHz
Output Power ($P_{IN}=25$ dBm)	27.5 GHz 29 GHz 31 GHz		43.2 43.6 42.7		dBm dBm dBm
Power Added Efficiency ($P_{IN}=25$ dBm)	27.5 GHz 29 GHz 31 GHz		22.4 24.0 21.8		% % %
Small Signal Gain	27.5 GHz 29 GHz 31 GHz		24.1 24.6 22.1		dB dB dB
Input Return Loss	27.5 GHz 29 GHz 31 GHz		13 8 9		dB dB dB
Output Return Loss	27.5 GHz 29 GHz 31 GHz		6 15 10		dB dB dB
IMD3 ($P_{OUT}/\text{Tone} = 36$ dBm, 10 MHz tone spacing)	27.5 GHz 29 GHz 31 GHz		-28 -31 -29		dBc dBc dBc
P_{OUT} Temp. Coeff. (85 °C to 25 °C, $P_{IN} = 25$ dBm))			-0.0028		dB/°C
Sm. Sig. Gain Temp. Coefficient (85 °C to -40 °C)			-0.109		dB/°C
Gate Leakage ($V_D = 10$ V, $V_G = -3.7$)		-18.5			mA

Test conditions, unless otherwise noted: T = 25 °C, $V_D = 22$ V, $I_{DQ} = 460$ mA

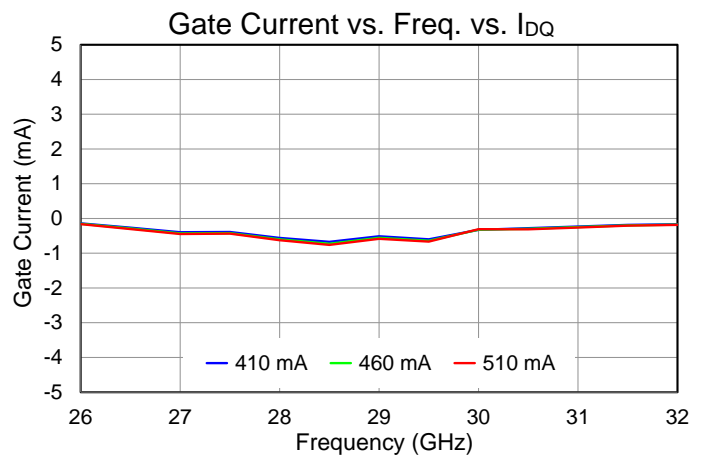
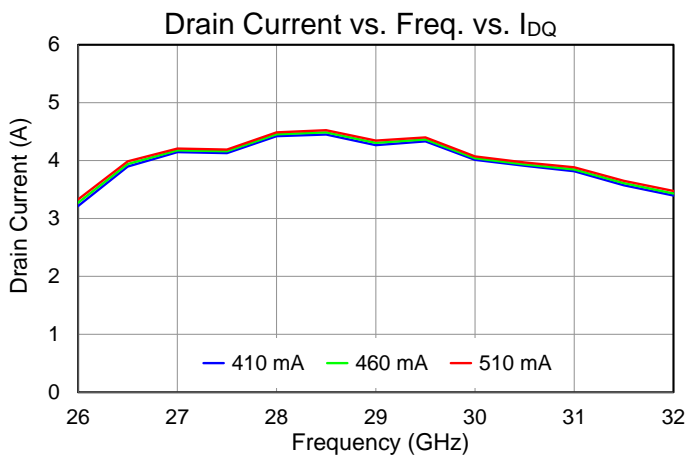
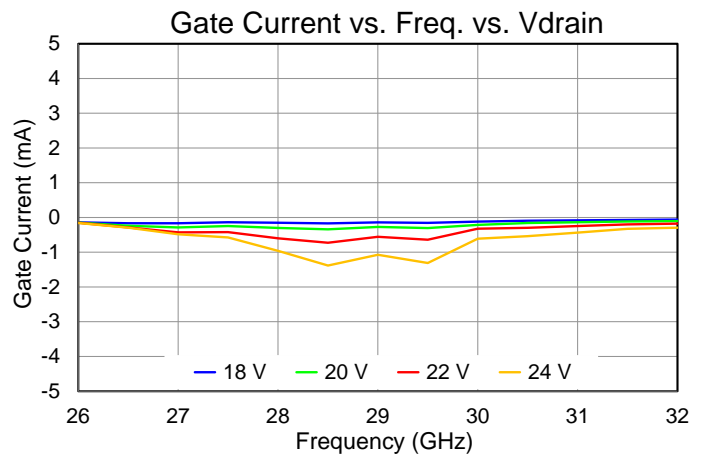
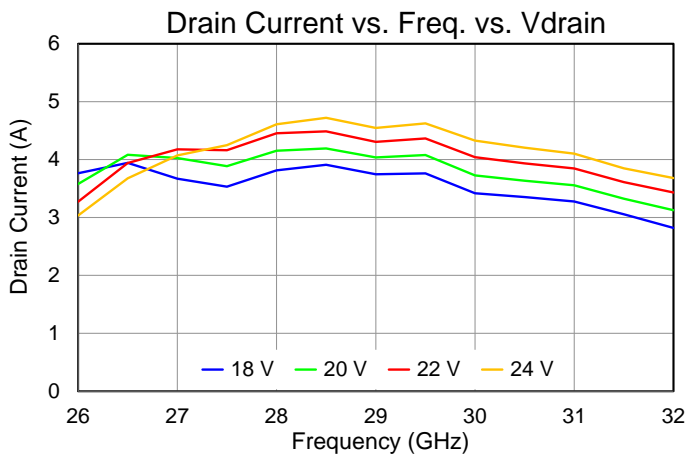
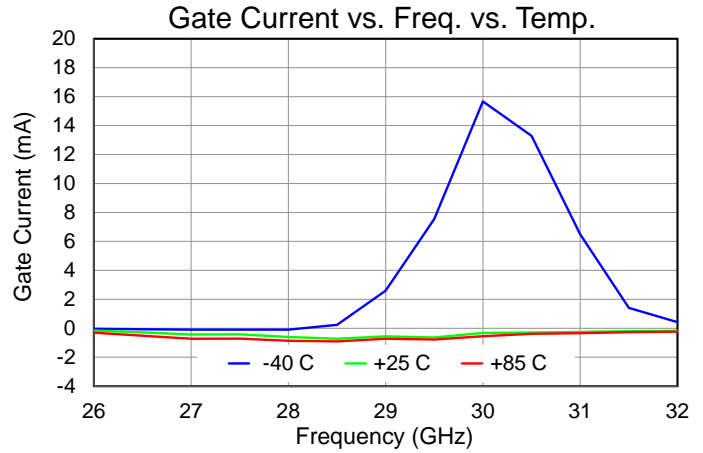
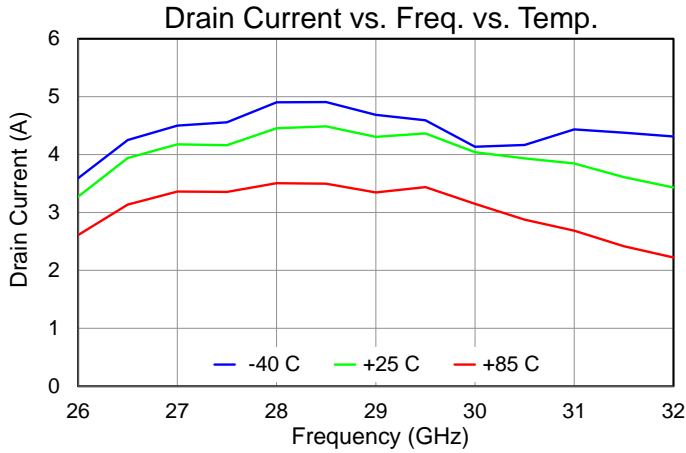
Performance Plots – Large Signal

Test conditions, unless otherwise noted: $V_D = 22\text{ V}$, $I_{DQ} = 460\text{ mA}$, $T = 25\text{ }^{\circ}\text{C}$, $P_{IN} = 25\text{ dBm}$



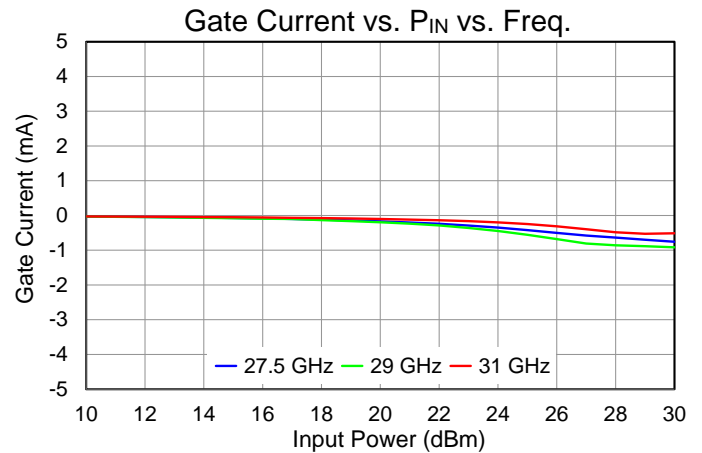
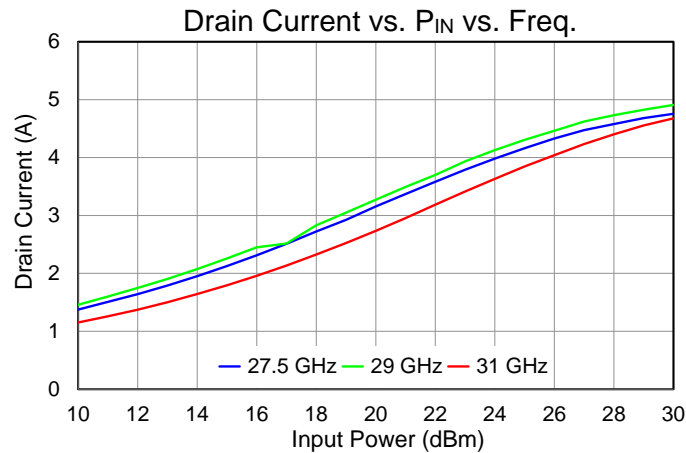
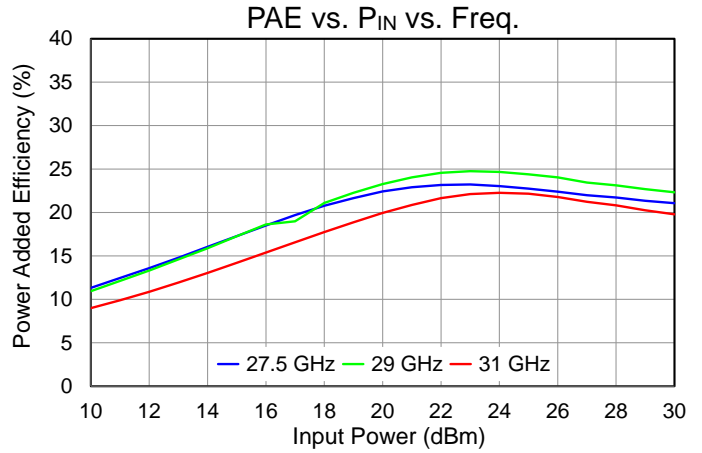
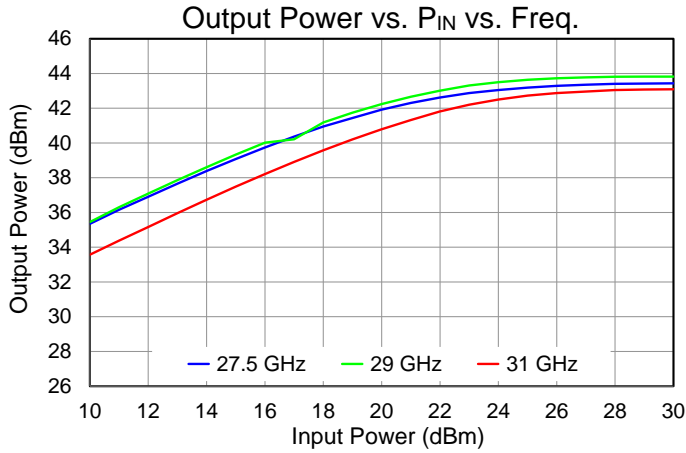
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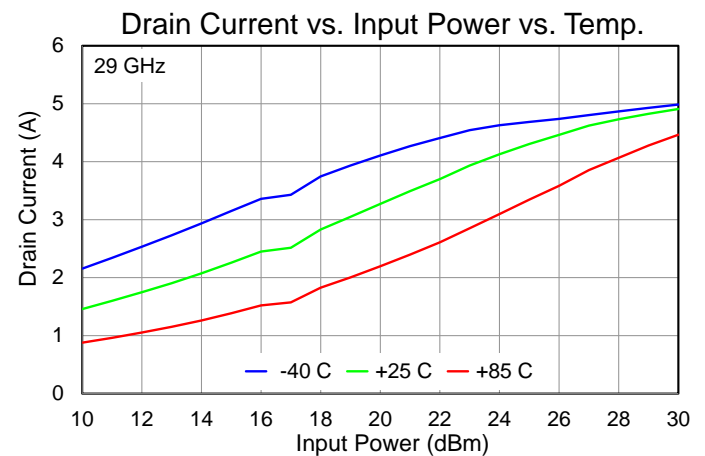
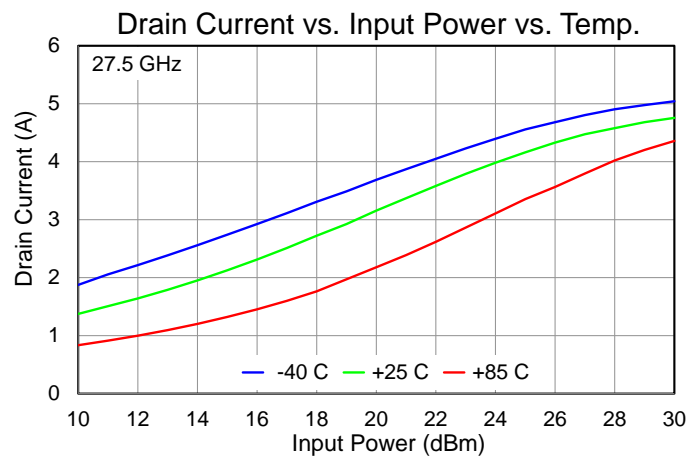
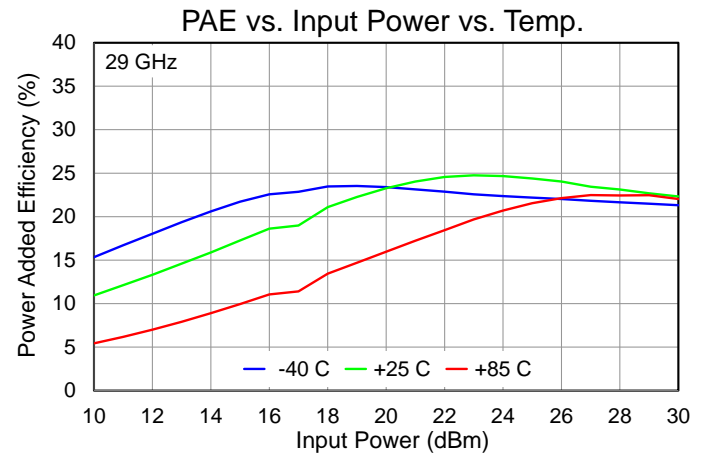
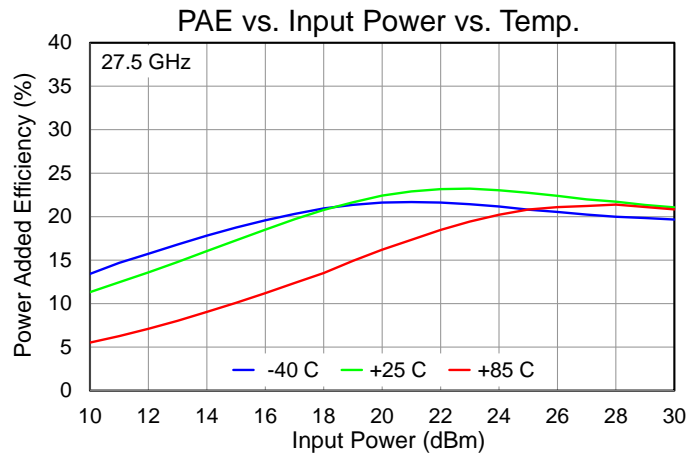
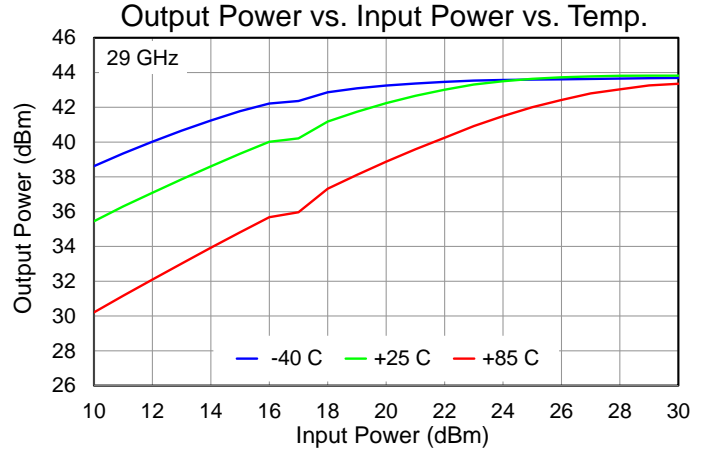
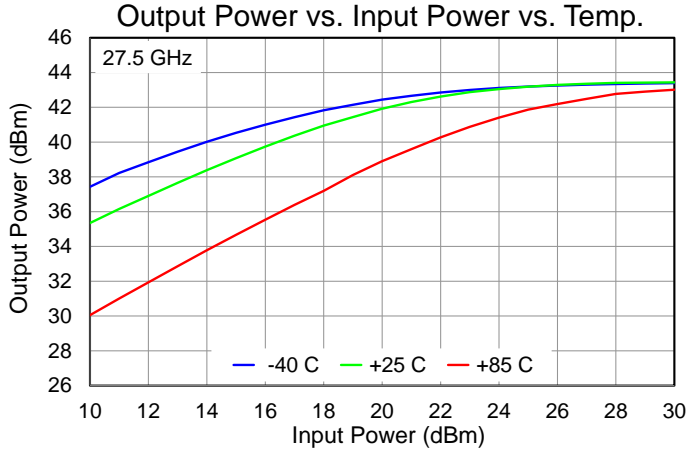
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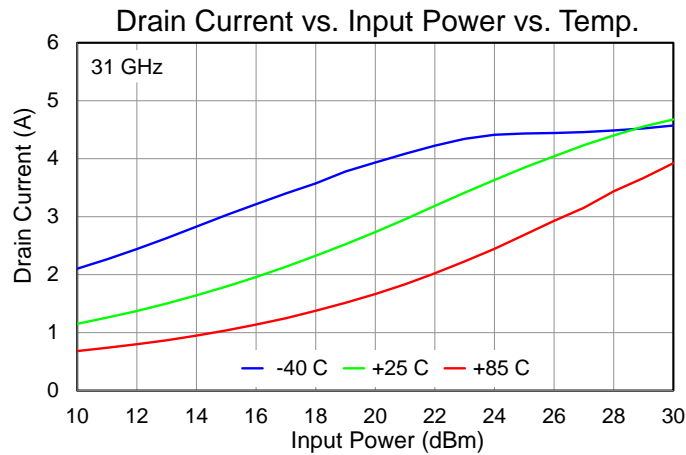
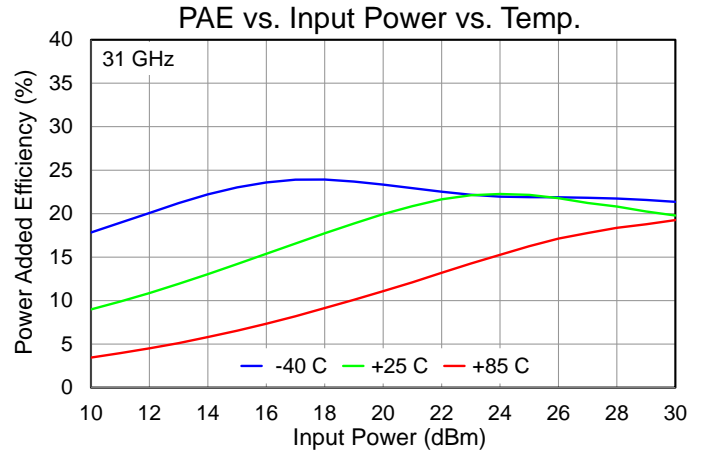
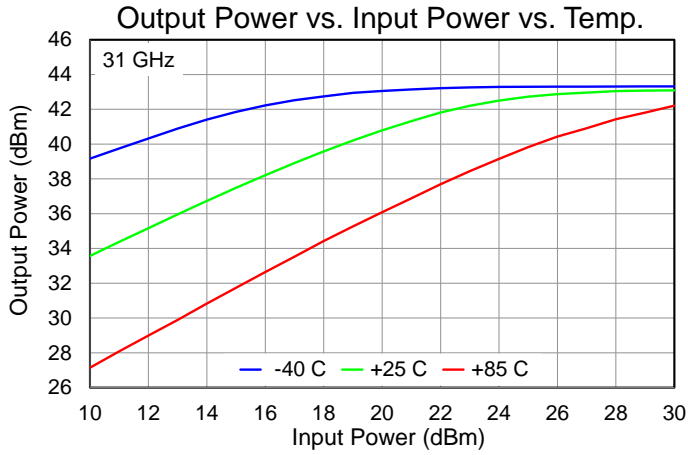
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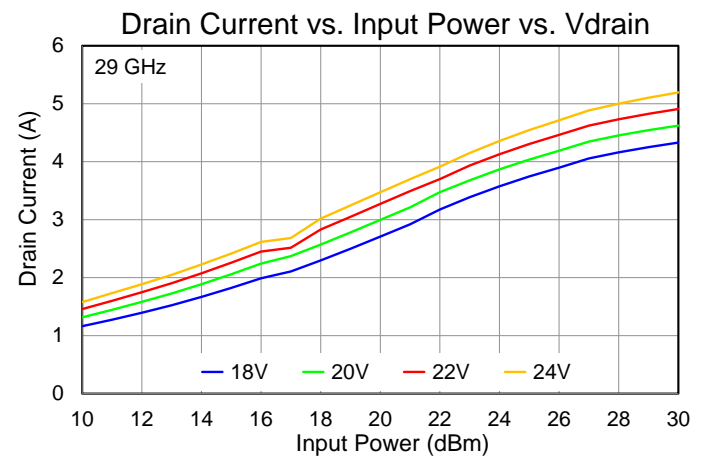
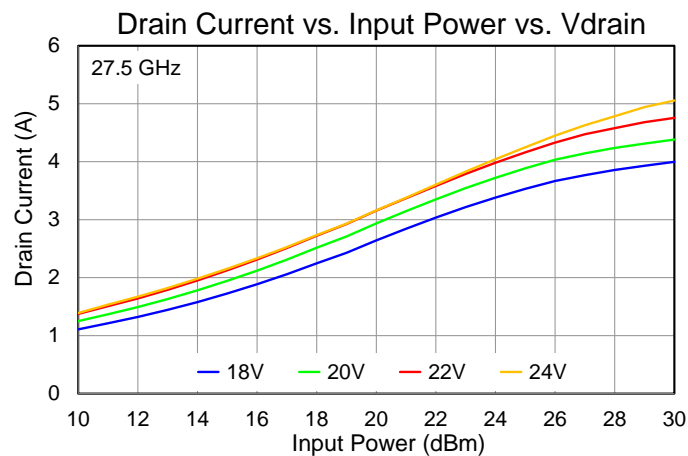
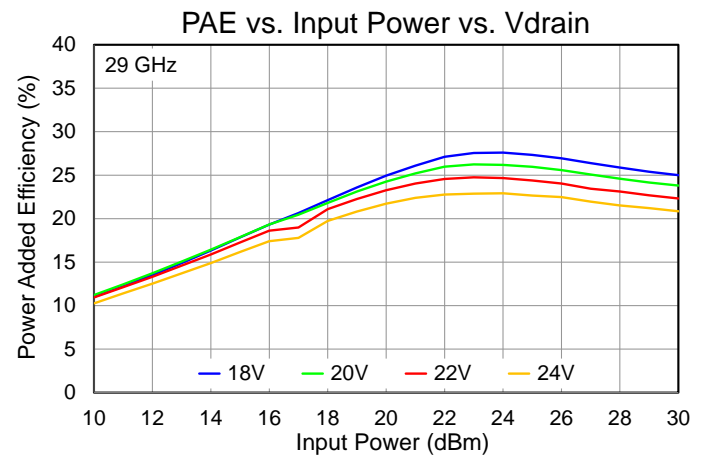
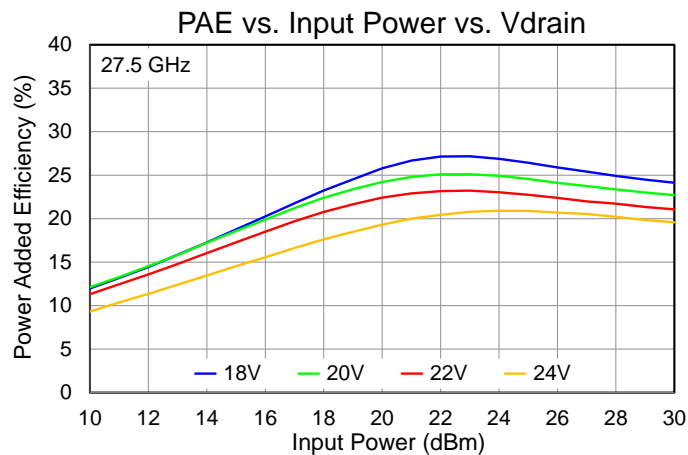
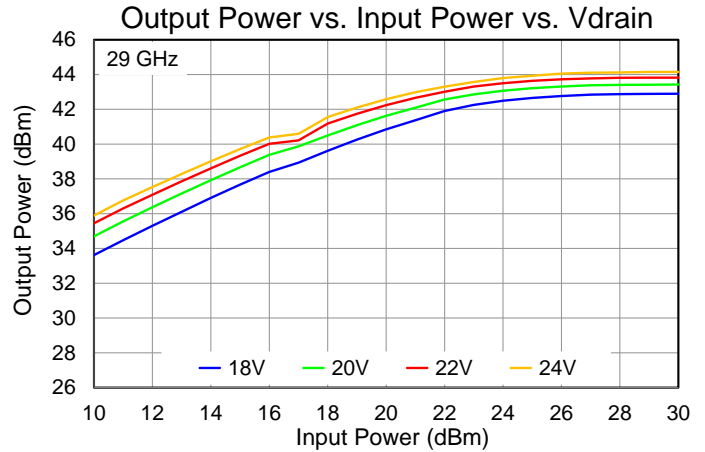
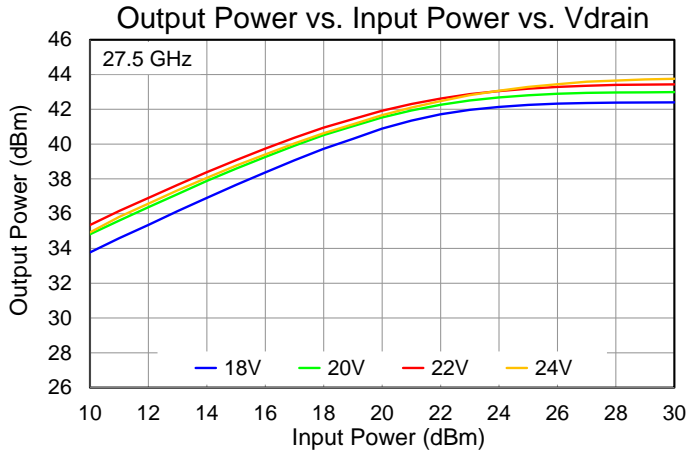
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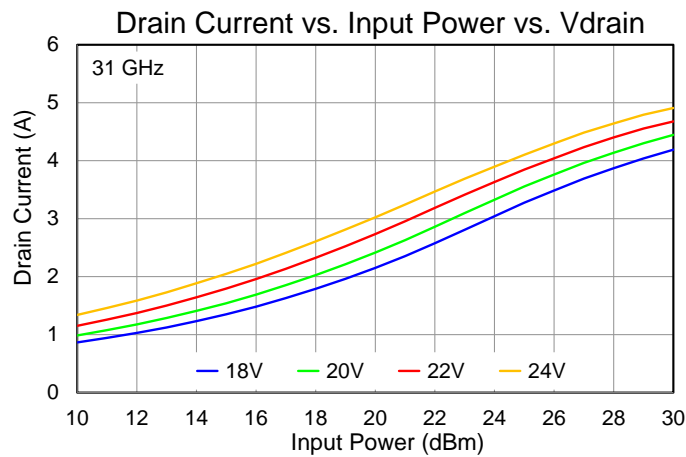
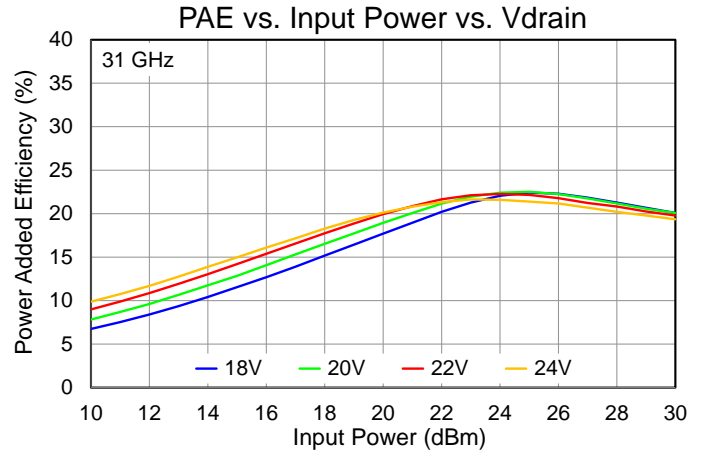
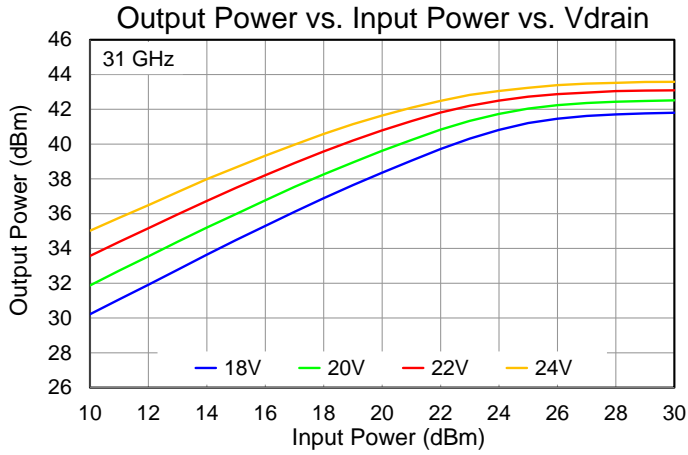
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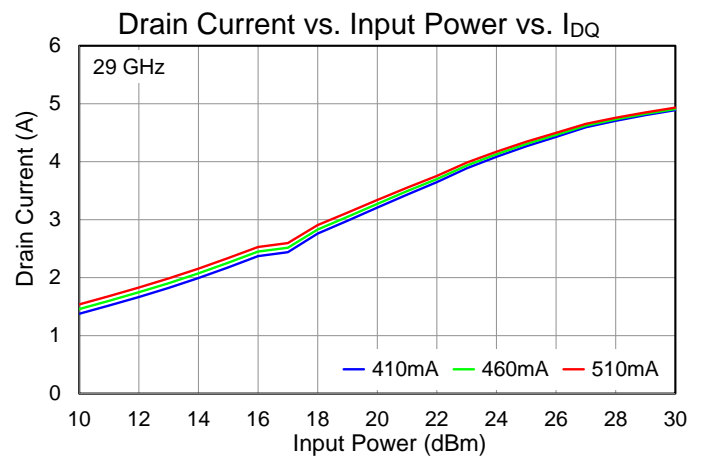
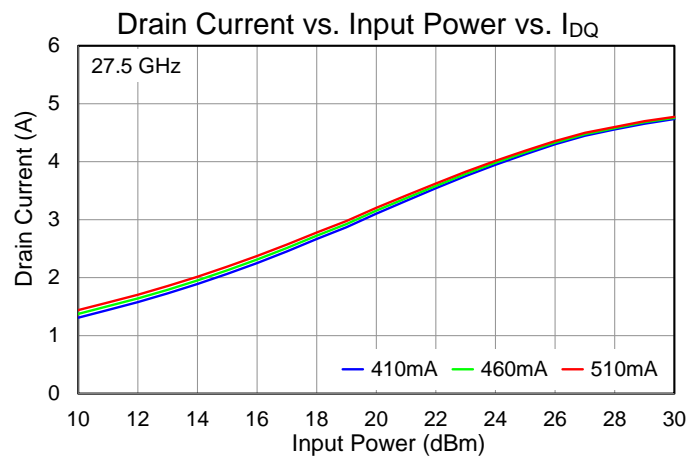
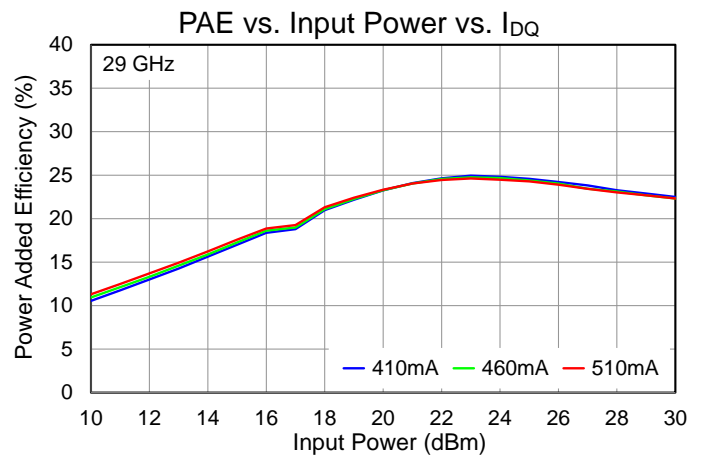
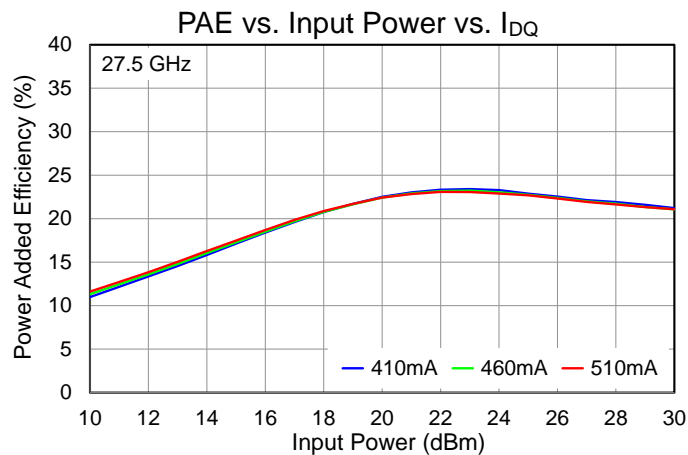
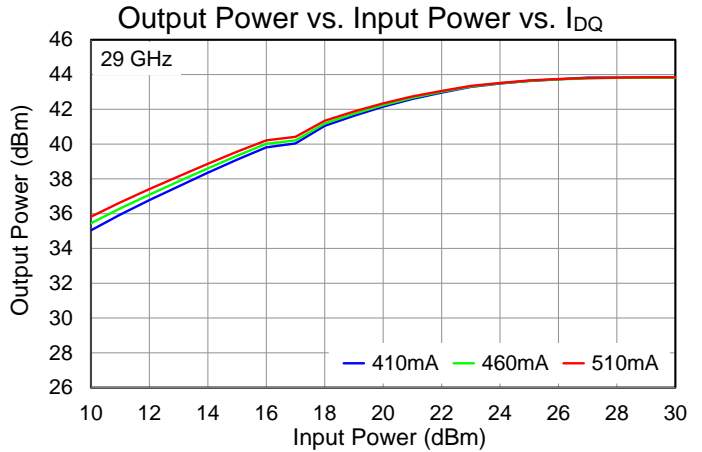
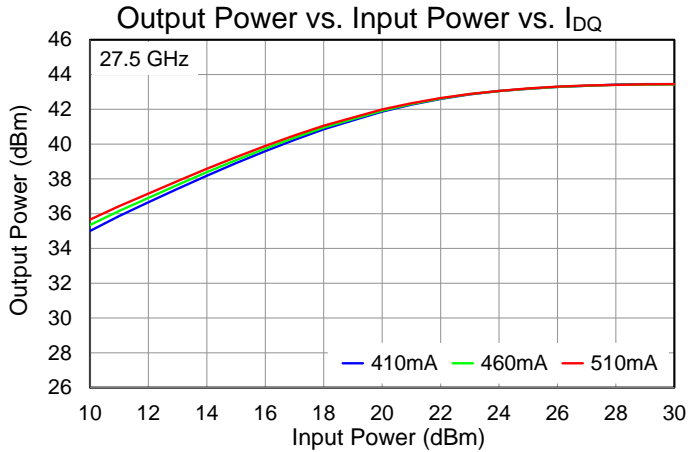
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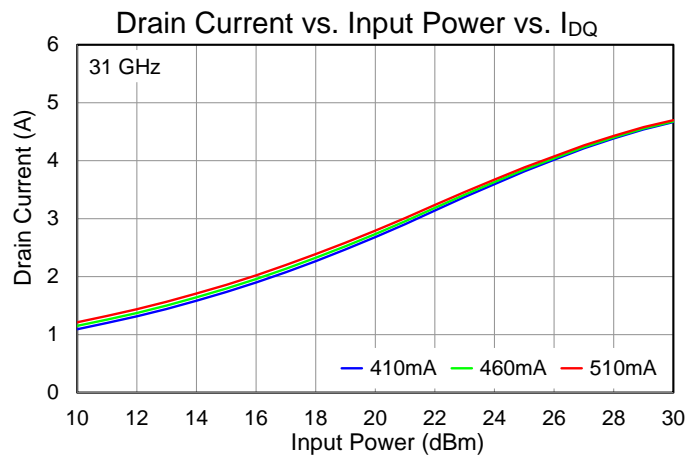
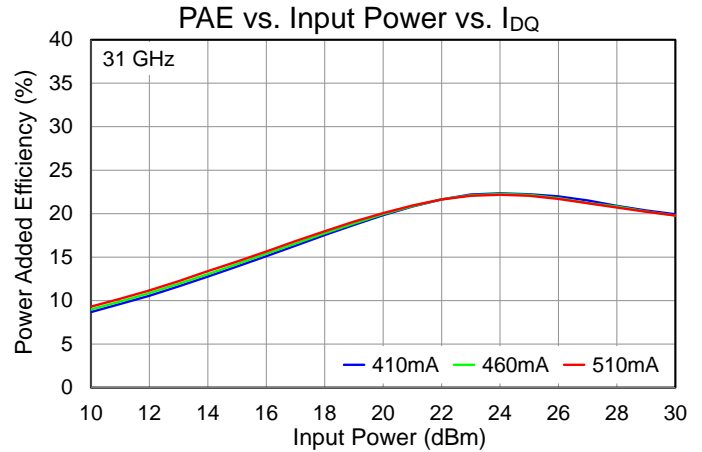
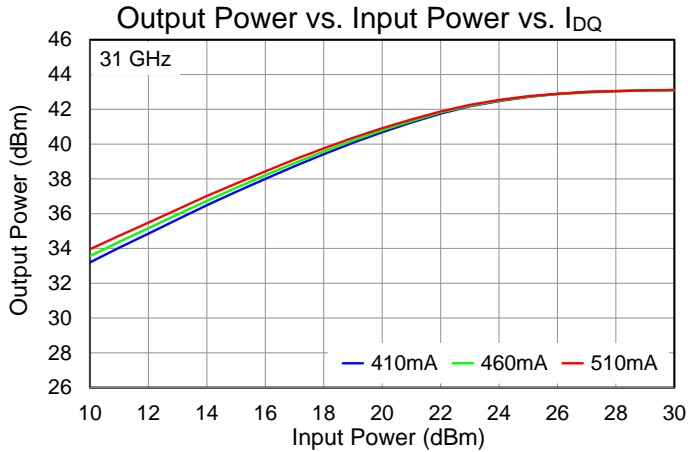
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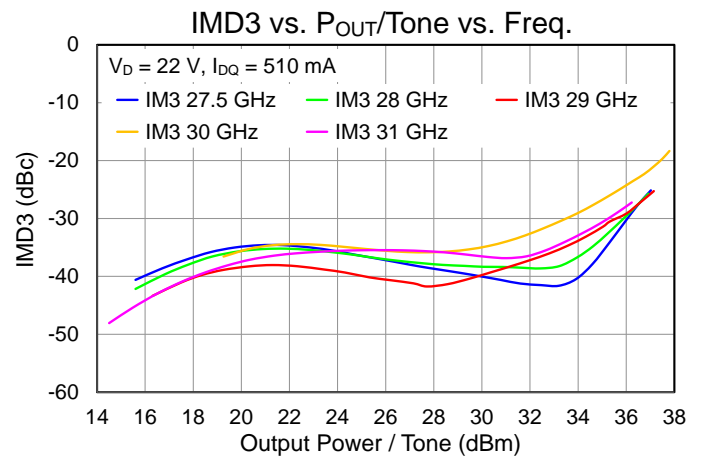
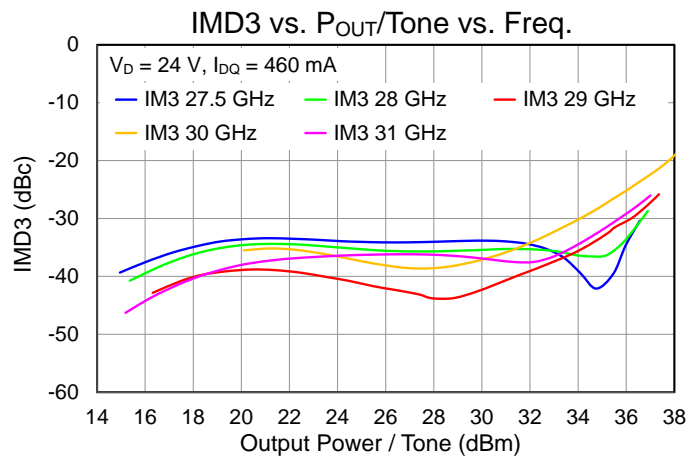
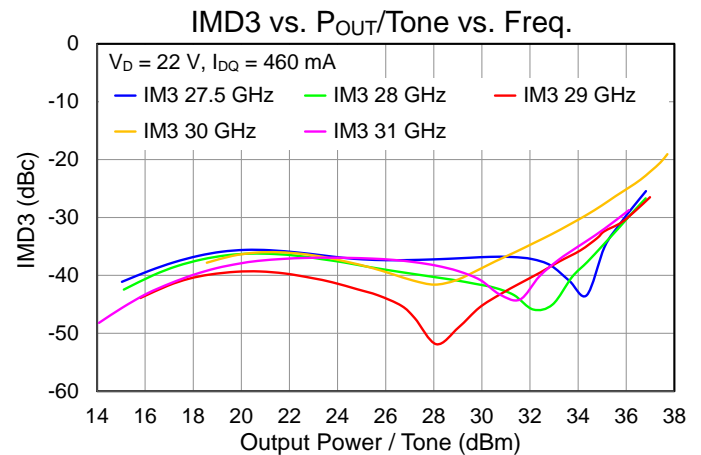
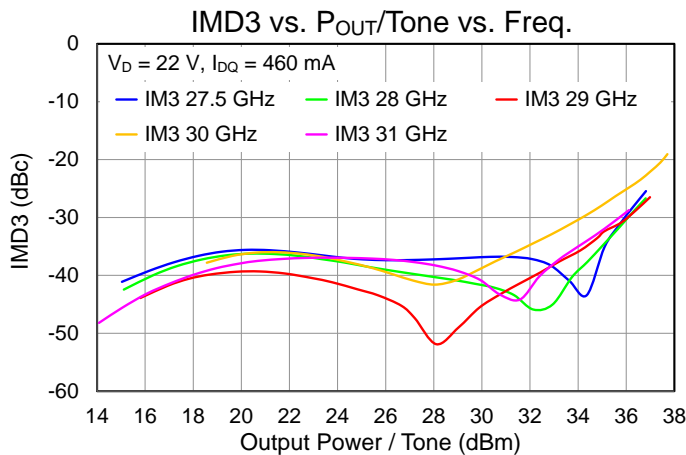
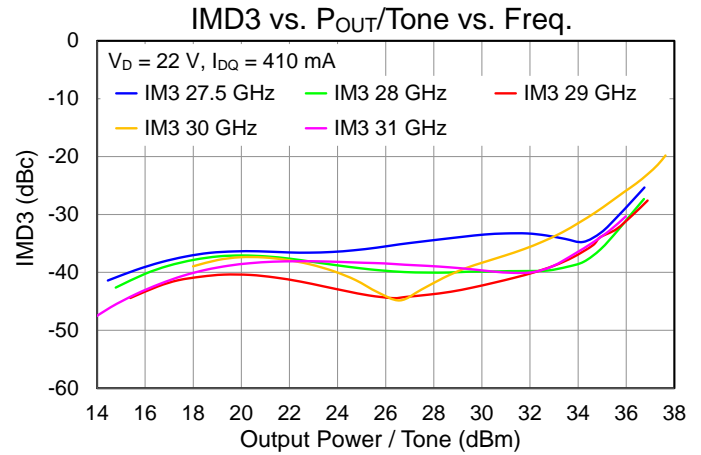
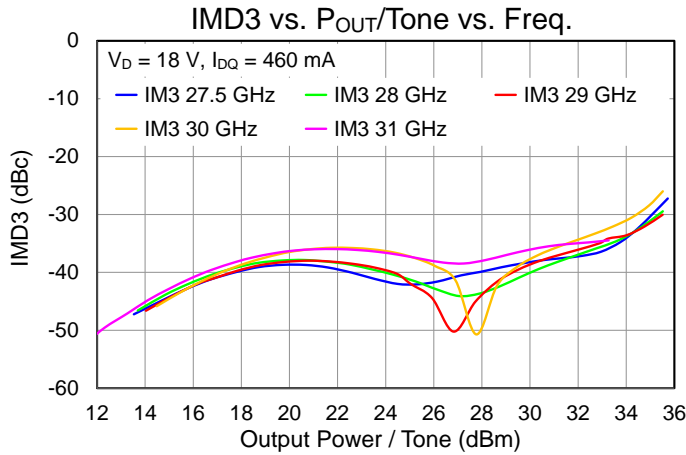
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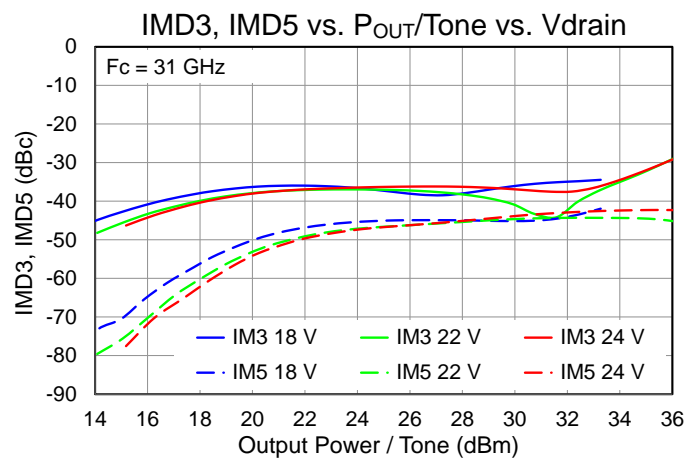
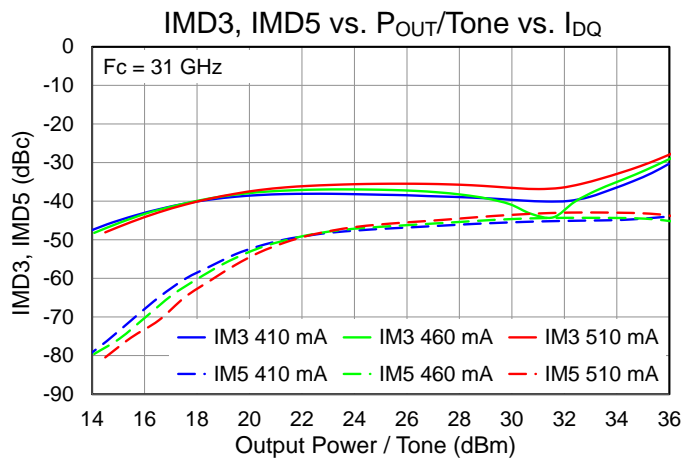
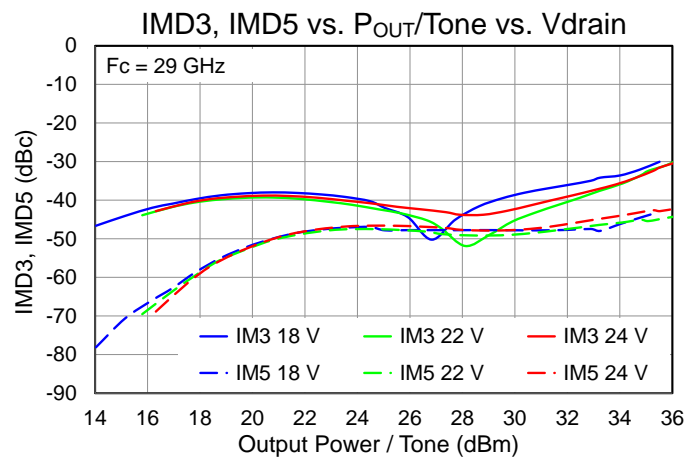
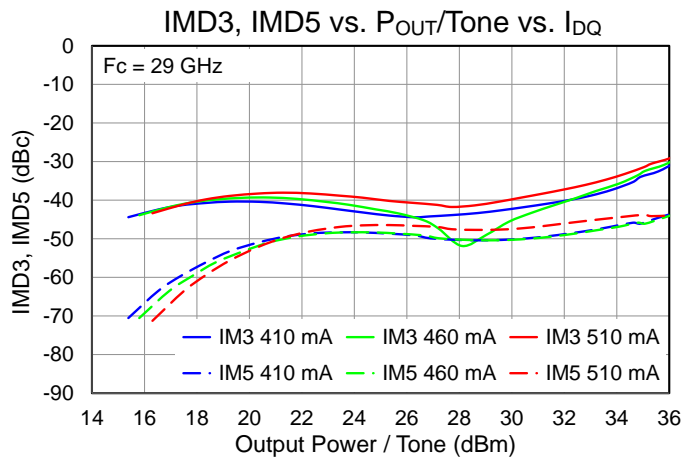
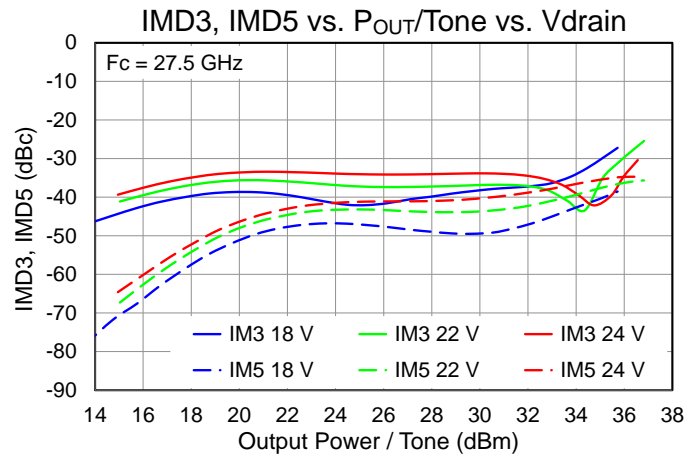
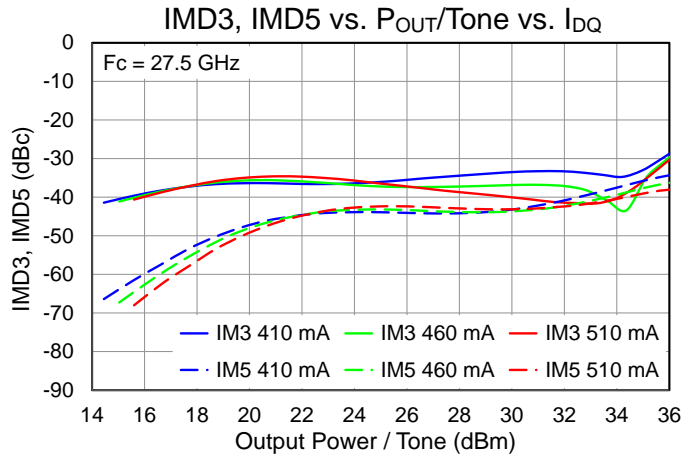
Performance Plots – Linearity

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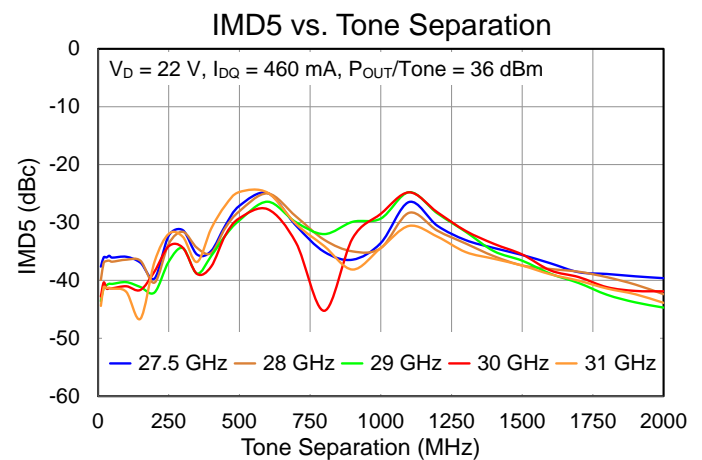
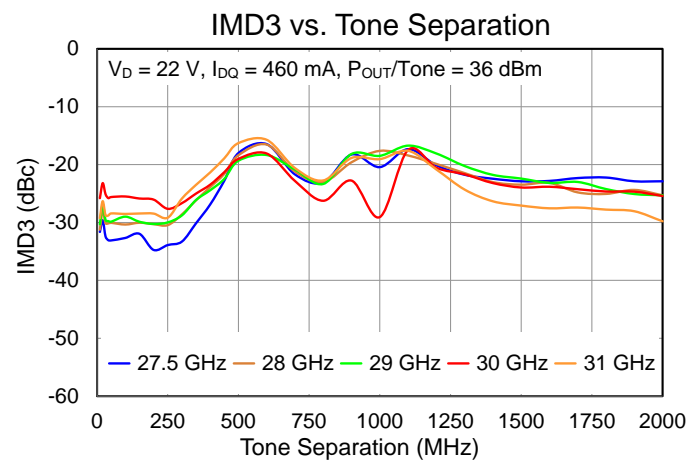
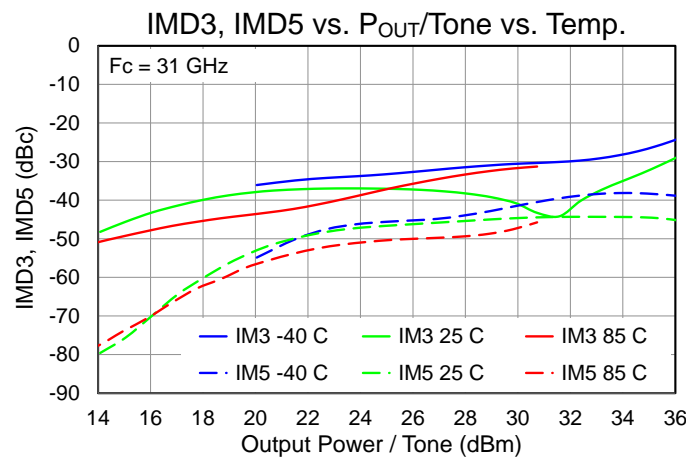
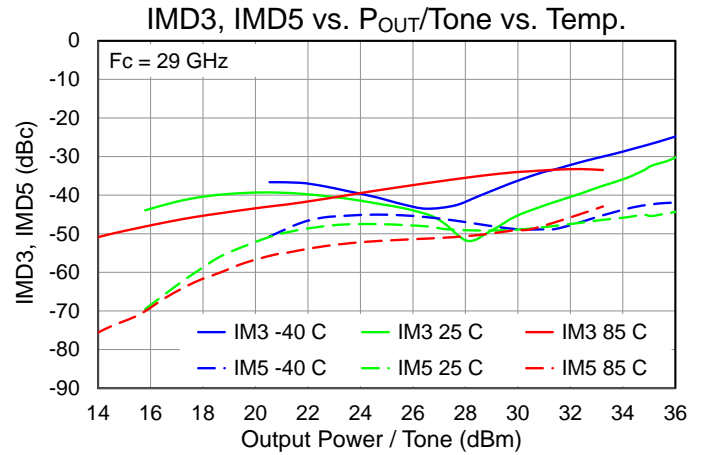
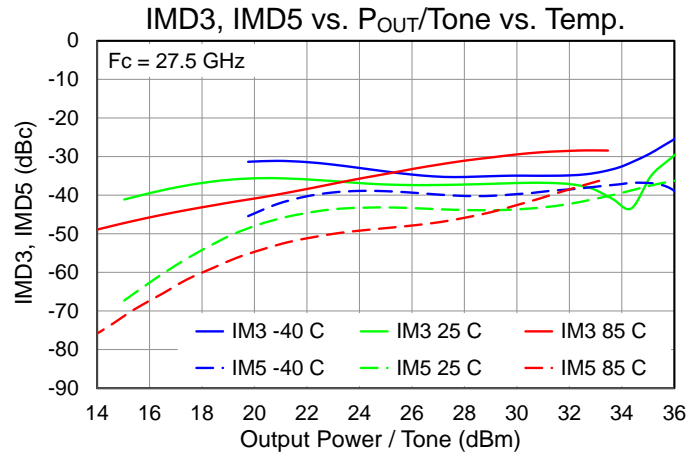
Performance Plots – Linearity

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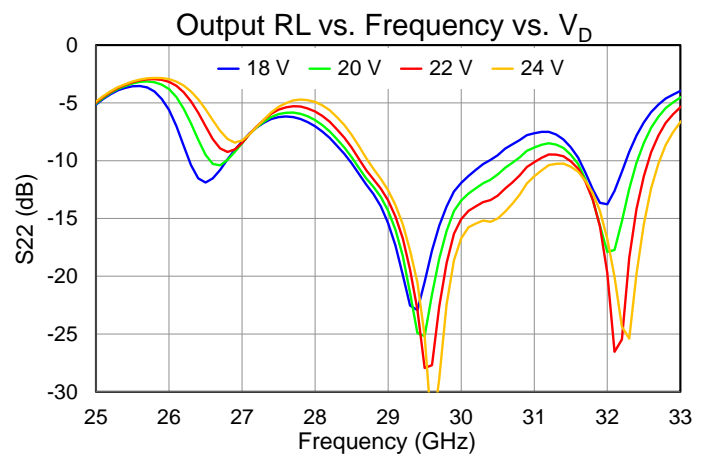
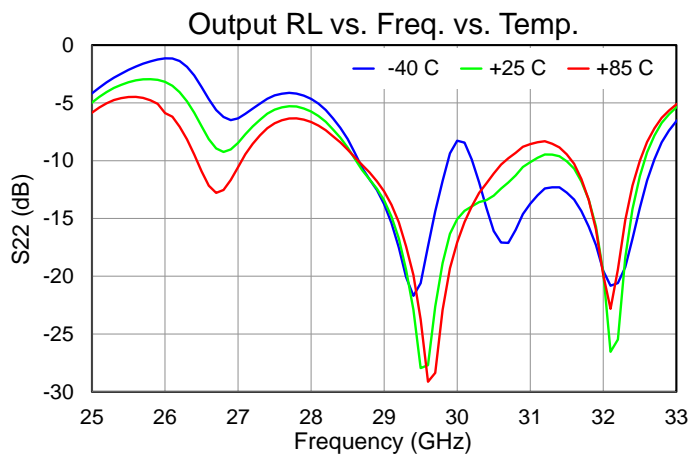
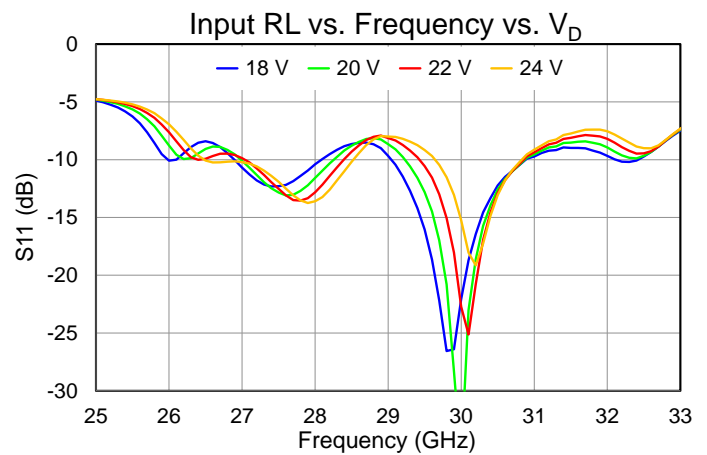
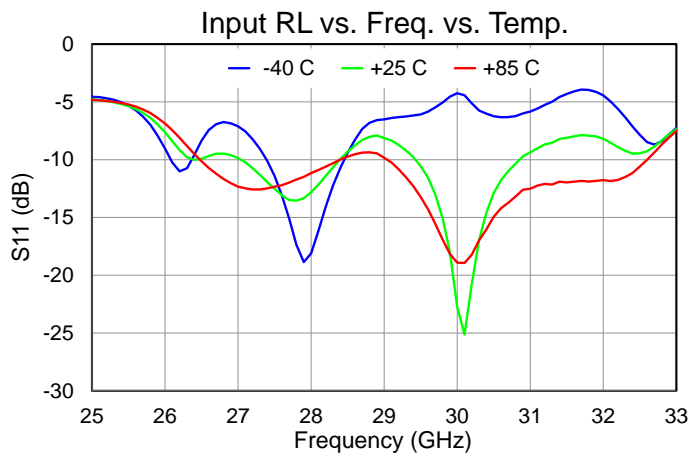
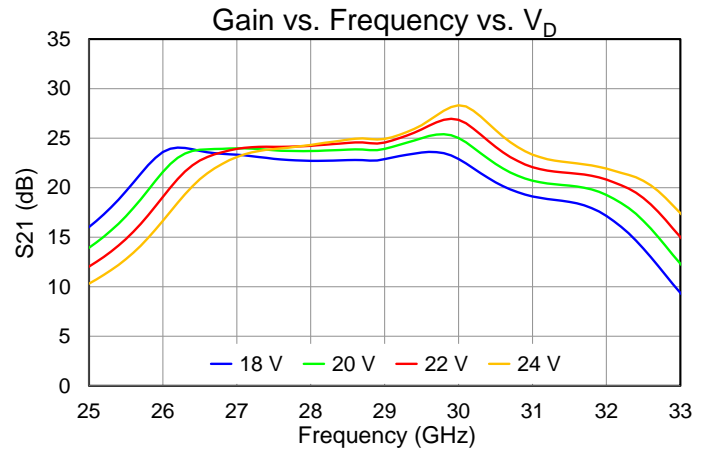
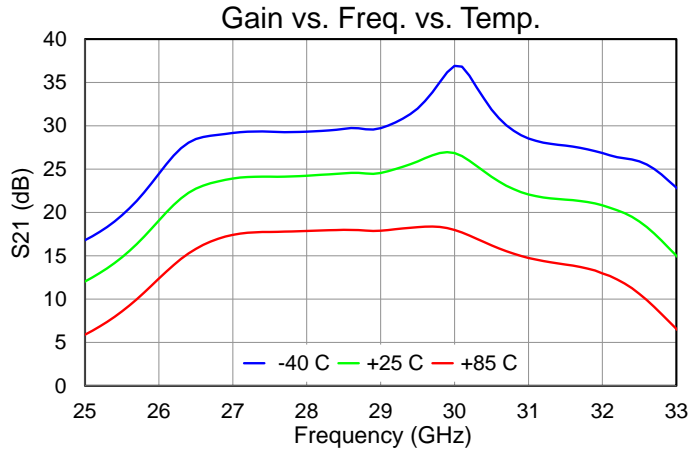
Performance Plots – Linearity

Test conditions, unless otherwise noted: $V_D = 22\text{ V}$, $I_{DQ} = 460\text{ mA}$, $T = 25\text{ }^{\circ}\text{C}$



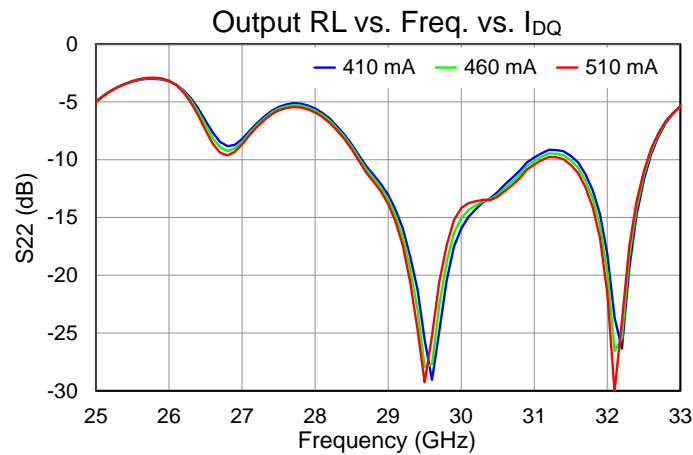
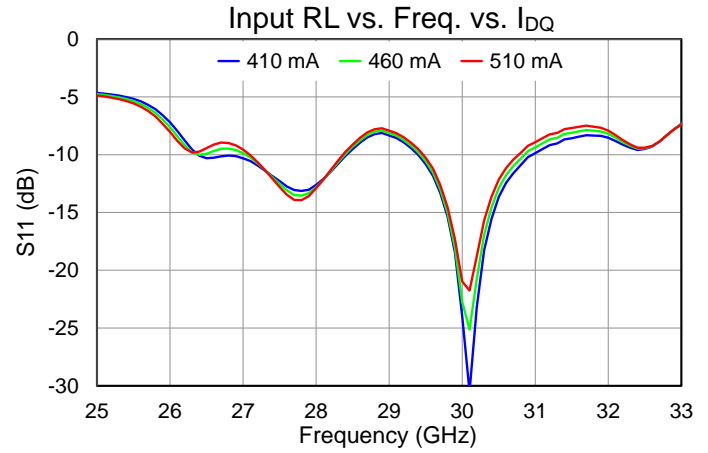
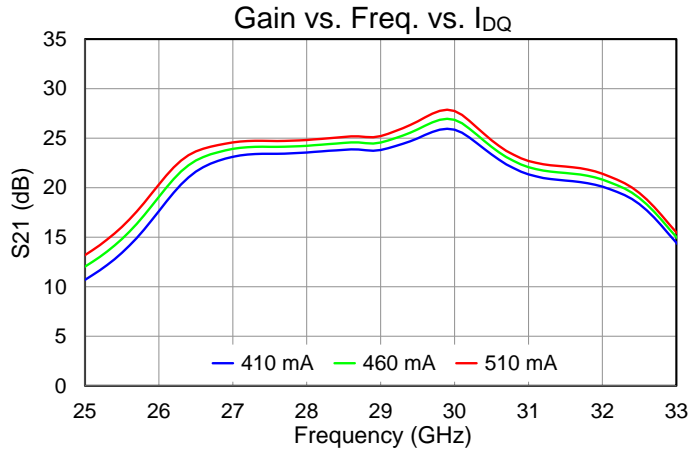
Performance Plots – Small Signal

Test conditions, unless otherwise noted: $V_D = 22\text{ V}$, $I_{DQ} = 460\text{ mA}$, $T = 25\text{ }^{\circ}\text{C}$



Performance Plots – Small Signal

Test conditions, unless otherwise noted: $V_D = 22$ V, $I_{DQ} = 460$ mA, $T = 25$ °C



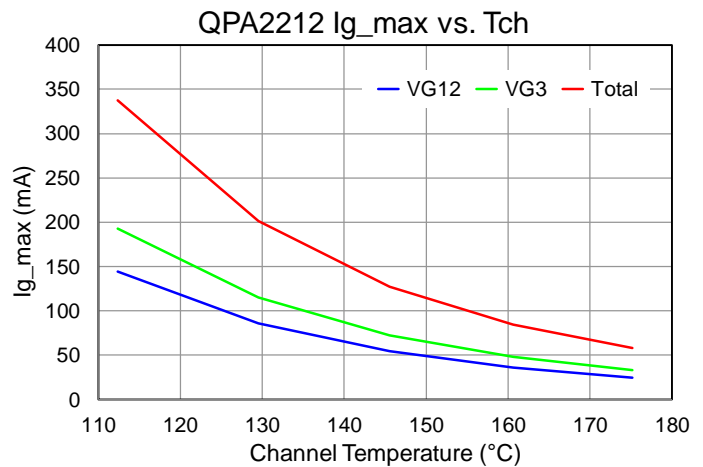
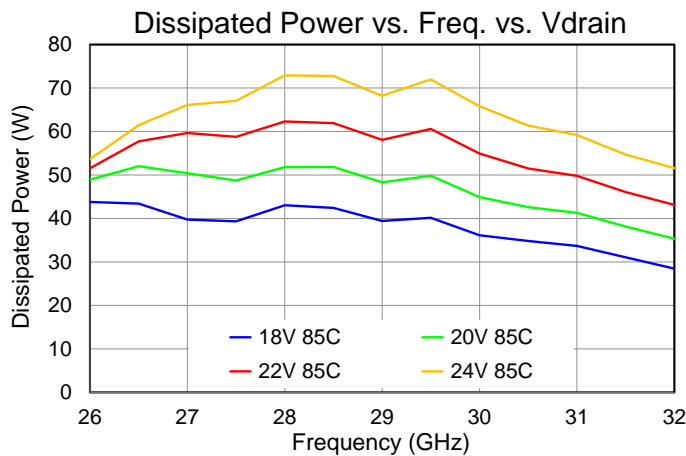
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{base} = 85\text{ }^{\circ}\text{C}$, $V_D = 22\text{ V}$, $I_{DQ} = 460\text{ mA}$, $P_{DISS} = 10.12\text{ W}$, No RF (quiescent DC operation)	1.084	$^{\circ}\text{C/W}$
Channel Temperature, T_{CH} (No RF) ⁽²⁾		96.0	$^{\circ}\text{C}$
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{base} = 85\text{ }^{\circ}\text{C}$, $V_D = 22\text{ V}$, $I_{DQ} = 460\text{ mA}$, Freq = 28 GHz, $I_{D_Drive} = 3.50\text{ A}$, $P_{IN} = 25\text{ dBm}$, $P_{OUT} = 41.8\text{ dBm}$, $P_{DISS} = 62.3\text{ W}$	1.439	$^{\circ}\text{C/W}$
Channel Temperature, T_{CH} (Under RF) ⁽²⁾		174.6	$^{\circ}\text{C}$
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{base} = 85\text{ }^{\circ}\text{C}$, $V_D = 24\text{ V}$, $I_{DQ} = 460\text{ mA}$, Freq = 28 GHz, $I_{D_Drive} = 3.70\text{ A}$, $P_{IN} = 25\text{ dBm}$, $P_{OUT} = 42.1\text{ dBm}$, $P_{DISS} = 72.9\text{ W}$	1.483	$^{\circ}\text{C/W}$
Channel Temperature, T_{CH} (Under RF) ⁽²⁾		193.1	$^{\circ}\text{C}$

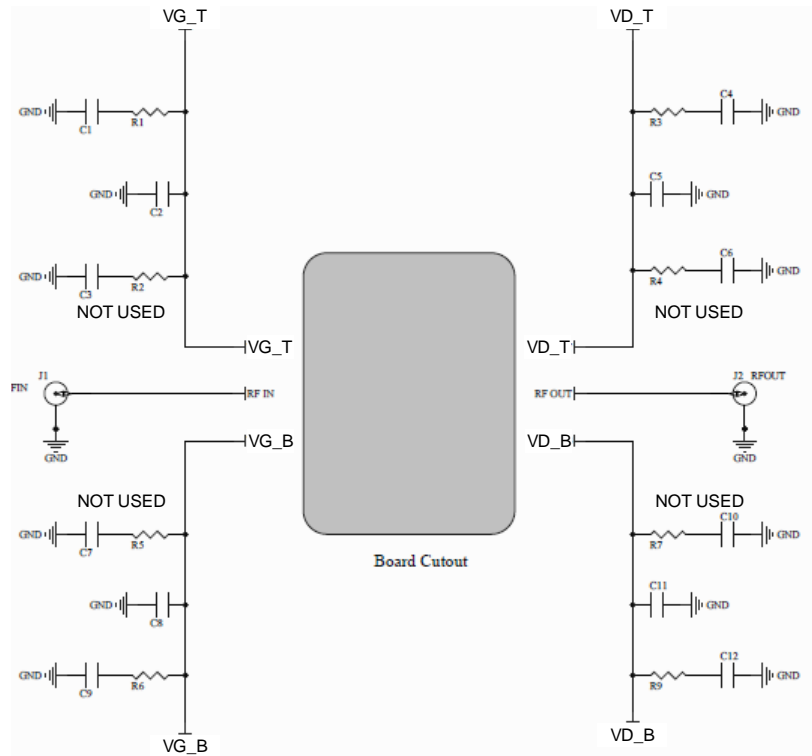
Notes:

- Thermal resistance is referenced to the back of package (85 $^{\circ}\text{C}$)
- IR Scan equivalent temperature. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

Dissipated Power and Maximum Gate Current



Applications Information and Pin Layout



Notes:

1. V_G must be biased from both sides (Pins 1 and 5)
2. V_D must be biased from both sides (Pins 6 and 10)

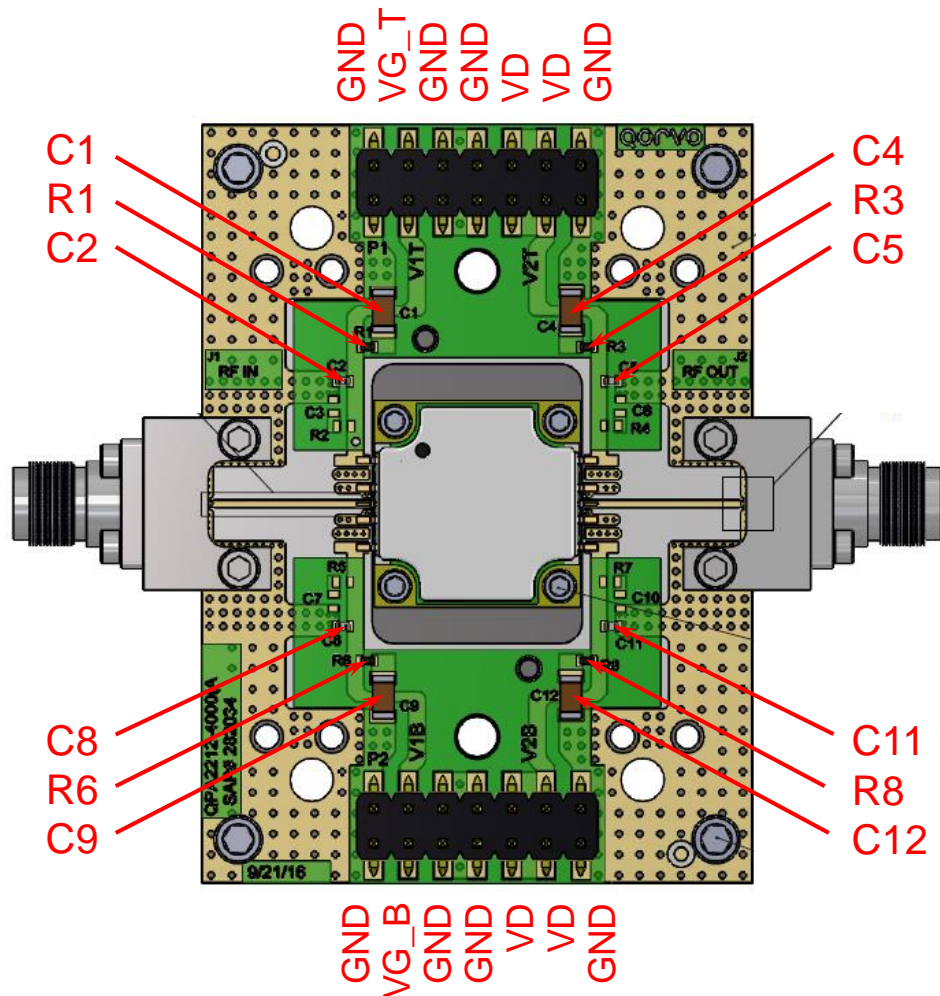
Bias Up Procedure

1. Set I_D limit to 5500 mA, I_G limit to 40 mA
2. Apply -5 V to V_G
3. Apply 22 V to V_D ; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until $I_{DQ} = 460$ mA
5. Turn on RF supply

Bias Down Procedure

1. Turn off RF supply
2. Reduce V_G to -5 V; ensure I_{DQ} is approx. 0 mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

Evaluation Board (EVB) Assembly Drawing



PCB NOTES:

1. PCB is made from Rogers 6035HTC dielectric, 0.010 inch thick, 0.5 oz. copper both sides.
2. Both Top and Bottom V_D and V_G must be biased.

Bill of Materials

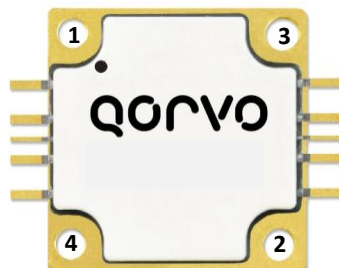
Reference Des.	Value	Description	Manufacturer	Part Number
C2,C5,C8,C11	0.01 uF	CAP, 0402, 50 V, 10%, X7R	Various	–
C1,C4,C9,C12	10 uF	CAP, 1206, 50 V, 20%, X5R	Various	–
R1,R6	5.1 Ω	RES, 5.1 OHM, 5%, 50V, 0402	Various	–
R3,R8	0 Ω	RES, 0 OHM, JMPR, 0402	Various	–
J1, J2	2.4 mm	CONNECTOR RF 2.4MM	Southwest Microwave	1492-04A-5

Assembly Notes

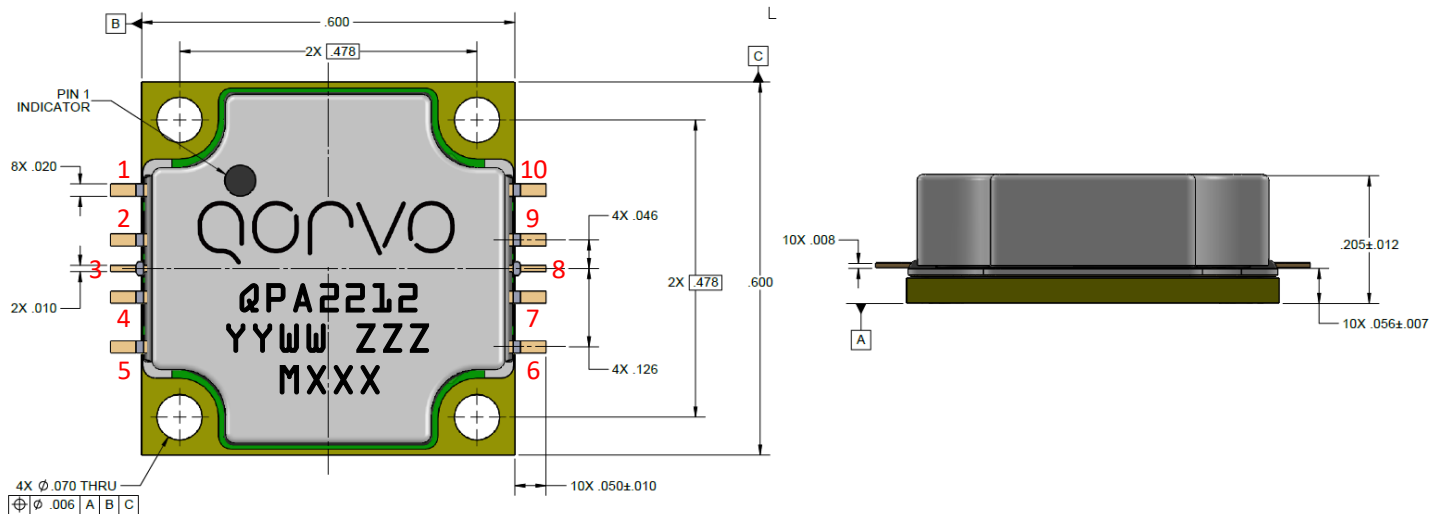
1. Carefully clean the PC board, base plate, and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the package and apply either a thermal compound (Arctic Silver 5 recommended) or a .004 inch (maximum thickness) Indium shim between the heat sink and the package. Refer to the applications note [Application of Arctic Silver 5 Thermal Compound and Indium Shims for Qorvo CP-style Packaged Components](#) for more information.
3. The component leads should be manually soldered. Apply a low residue solder alloy meeting J-STD-001 (ROL0, ROL1 or equivalent) with a liquidus temperature below 220 °C to each pin of the QPA2212. The use of low residue/no-clean flux (ROL0, ROL1) is recommended. The package lead temperature should not exceed 260 deg C. Each solder connection should be completed within 2 to 5 seconds. Adding flux during hand soldering of the component leads with localized spot cleaning is acceptable. Soldering irons meeting the requirements of J-STD-001, Appendix A are acceptable.
4. The leads should be soldered in a staggered or star pattern from side to side, and never solder two adjacent leads. This allows the heat to dissipate on each lead, and not cause the adjacent leads to become de-soldered and damaged or displaced.



5. The packaged part should not be subjected to conventional SMT automated solder reflow processes.
6. (The following is for information only. There are many variables in a second level assembly that Qorvo does not control, so Qorvo does not recommend an absolute torque value.) Use screws to attach the component to the heat sink. A suggested final torque value is 16 in-oz. for a 0-80 screw. Start with screws finger tight, then torque to 8 in-oz., then torque to final value. Use the following tightening pattern:



Mechanical Information



Units: inches

Tolerances: (unless specified)

x.xx = ± 0.01

x.xxx = ± 0.005

Materials:

Base: Copper

Leads: Alloy 194

Lid: Plastic

All metalized features are gold plated

Part is epoxy sealed

Marking:

QPA2212: Part number

YY: Part Assembly year

WW: Part Assembly week

ZZZ: Serial Number (unique for all parts within one assembly lot)

MXXX: Batch ID

Pin Description

Package Pin	Symbol	Description
1, 5	VG	Gate voltage. Bypass network required; refer to page 18.
2, 4, 7, 9	GND	Must be grounded to the PCB.
3	RF IN	RF input. 50 Ohms. DC blocked, DC grounded.
6, 10	VD	Drain voltage. Bypass network required; refer to page 18.
8	RF OUT	RF output. 50 Ohms. DC blocked, DC grounded.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	2	JEDEC Standard JESD22 A114
ESD – Charge Device Model (CDM)	C3	JEDEC Standard JESD22-C101F
MSL – Moisture Sensitivity Level	NA	



Caution!
ESD-Sensitive Device

Solderability

The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. The use of no-clean solder to avoid washing after soldering is recommended.

RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU. This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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