# TGA2625-CP

## 10 – 11 GHz 20 W GaN Power Amplifier

## Product Description

Qorvo's TGA2625-CP is a packaged high-power X-Band amplifier fabricated on Qorvo's QGaN25 0.25 um GaN on SiC process. Operating from 10 to 11 GHz, the TGA2625-CP achieves 42.5 dBm saturated output power, a power-added efficiency of > 40 %, and power gain of 28 dB.

The TGA2625-CP is packaged in a 10-lead 15x15 mm bolt-down package with a Cu base for superior thermal management. It can support a range of bias voltages and performs well under CW and pulsed conditions. Both RF ports are internally DC blocked and matched to 50 ohms allowing for simple system integration.

The TGA2625-CP is ideally suited for both commercial and defense applications.

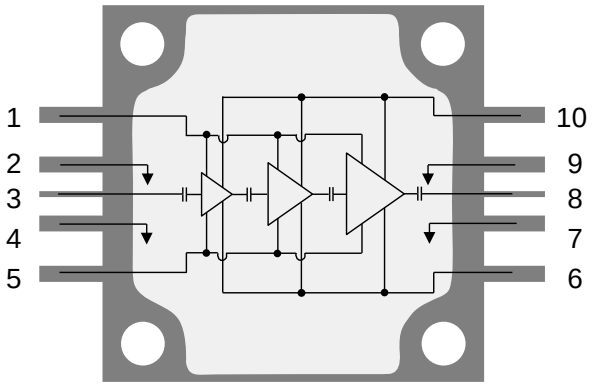
Lead free and RoHS compliant.

Evaluation Boards are available upon request.


## Product Features

- Frequency Range: 10 – 11 GHz
- Pout: 42.5 dBm (at $P_{IN}$ = 15 dBm)
- PAE: > 40 %
- Power Gain: 28 dB (at $P_{IN}$ = 15 dBm)
- Bias: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical, pulsed (PW = 100 µs, DC = 10 %)
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

## Functional Block Diagram




## Applications

- Radar
- Communications

## Ordering Information

| Part No. | Description |
|---|---|
| TGA2625-CP | 10 – 11 GHz 20 W GaN Power Amplifier |

## Absolute Maximum Ratings

| Parameter | Value / Range |
|---|---|
| Drain Voltage ($V_D$) | 40 V |
| Gate Voltage Range ($V_G$) | -8 to 0 V |
| Drain Current ($I_D$) | 3 A |
| Gate Current ($I_G$) | -6 to 14 (1) mA |
| Power Dissipation ($P_{DISS}$), 85 °C | 53 W |
| Input Power, CW, 50 Ω, ($P_{IN}$) | 21 dBm |
| Input Power, CW, VSWR 6:1, $V_D$ = 28 V, 85 °C, ($P_{IN}$) | 21 dBm |
| Mounting Temperature (30 Seconds) | 260 °C |
| 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.

(1) Max rating for IG is at Channel Temperature (TCH) of 200 °C.

## Recommended Operating Conditions

| Parameter | Value / Range |
|---|---|
| Drain Voltage ($V_D$) pulsed: PW = 100 µs, DC = 10 % | 28 V |
| Drain Current ($I_{DQ}$) | 365 mA |
| Drain Current Under RF Drive ($I_{D\_DRIVE}$) | See plots p. 6 |
| Gate Voltage ($V_G$) | −2.6 V (Typ.) |
| Gate Current Under RF Drive ($I_{G\_DRIVE}$) | See plots p. 6 |
| Temperature ($T_{BASE}$) | -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 Range | 10 | | 11 | GHz |
| Small Signal Gain | | 36 | | dB |
| Input Return Loss | | 13.5 | | dB |
| Output Return Loss | | 10 | | dB |
| Output Power (at $P_{IN}$ = 15 dBm) | | 42.5 | | dBm |
| Power Added Efficiency (at $P_{IN}$ = 15 dBm) | | 40 | | % |
| Power Gain (at $P_{IN}$ = 15 dBm) | | 28 | | dB |
| Output Power Temperature Coefficient (25 °C to 85 °C only) Pulsed / CW | | -0.003 / -0.01 | | dBm/°C |
| Recommended Operating Voltage | 25 | 28 | 32 | V |

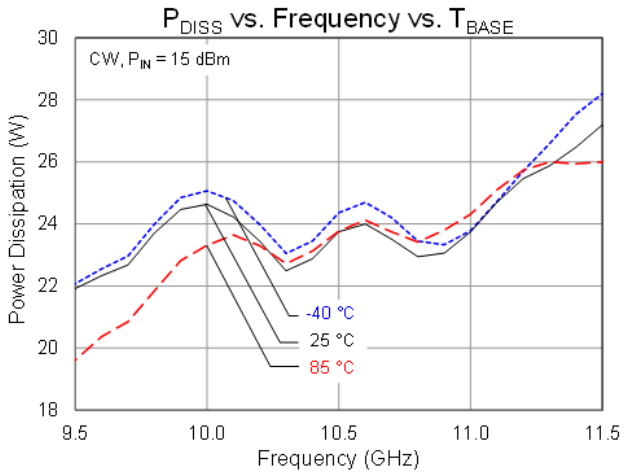
Test conditions unless otherwise noted: 25 °C, $V_D$ = 28 V (PW = 100 µs, DC = 10 %), $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

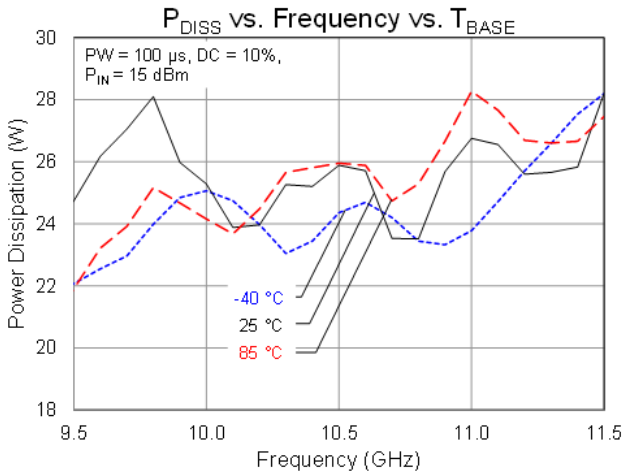
## Thermal and Reliability Information

| Parameter | Test Conditions | Value | Units |
|---|---|---|---|
| Thermal Resistance ($\theta_{JC}$) (1) | CW, $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $T_{BASE}$ = 85°C, Freq = 10.5 GHz, $P_{IN}$ = 15 dBm, $P_{OUT}$ = 42.4 dBm $P_{DISS}$ =24 W, $I_{D\_Drive}$ = 1.46 A | 2.25 | °C/W |
| Channel Temperature ($T_{CH}$) (under RF drive) | | 139 | °C |
| Thermal Resistance ($\theta_{JC}$) (1) | $V_D$ = 28 V, $I_{DQ}$ = 365 mA, (Pulsed: PW = 100 µs, DC = 10 %), $T_{BASE}$ = 85°C, Freq = 10.5 GHz, $P_{IN}$ = 15 dBm, $P_{OUT}$ = 42.8 dBm, $P_{DISS}$ =26 W, $I_{D\_Drive}$ = 1.61 A | 1.57 | °C/W |
| Channel Temperature ($T_{CH}$) (under RF drive) | | 126 | °C |

Notes:
1. Thermal resistance measured to back of package.
2. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

## Power Dissipation

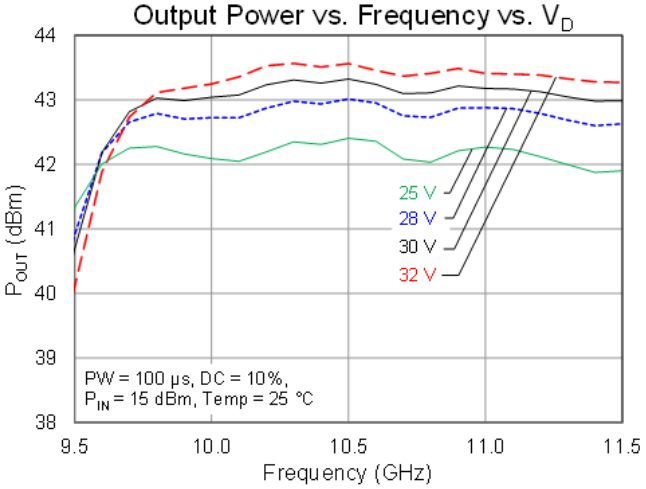


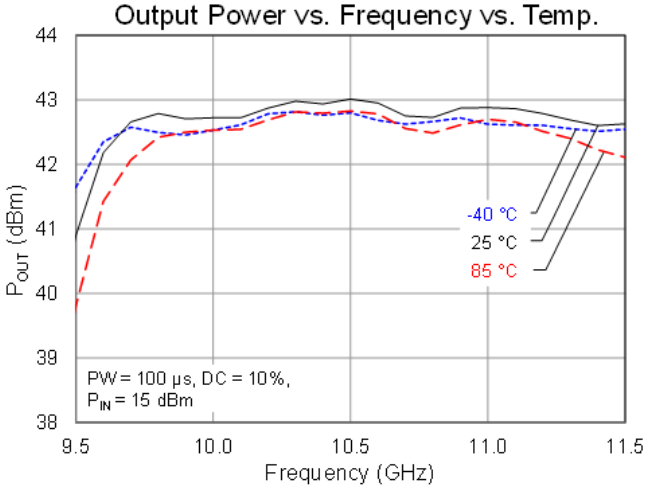
## Typical Performance – Large Signal

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

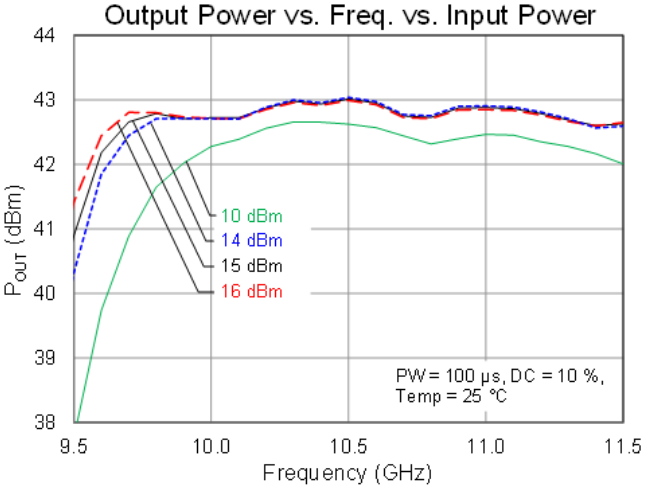
Output Power vs. Frequency vs. $V_D$



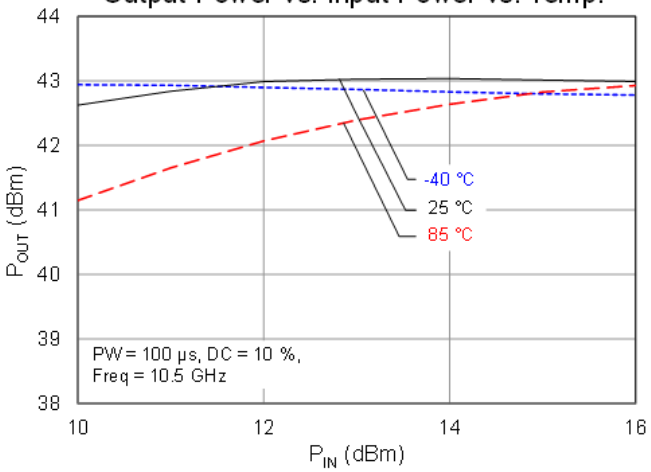

Output Power vs. Frequency vs. Temp.



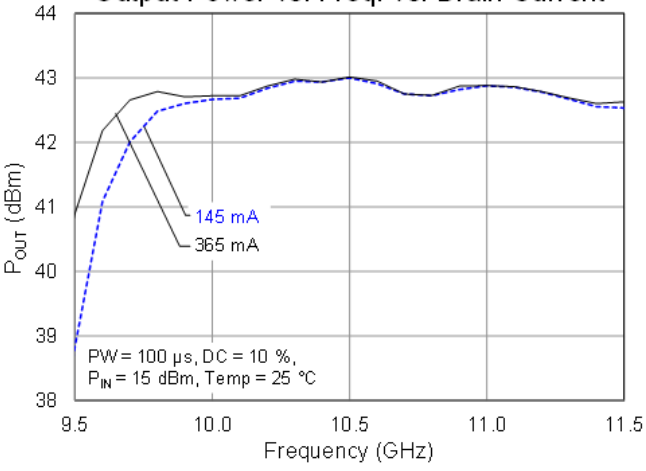

Output Power vs. Freq. vs. Input Power



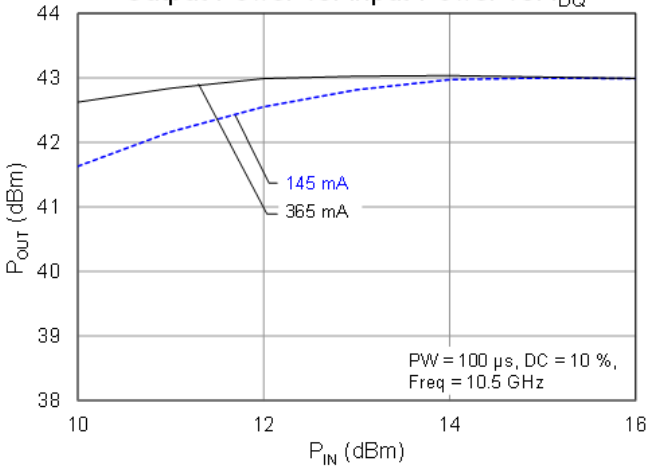

Output Power vs. Input Power vs. Temp.




Output Power vs. Freq. vs. Drain Current



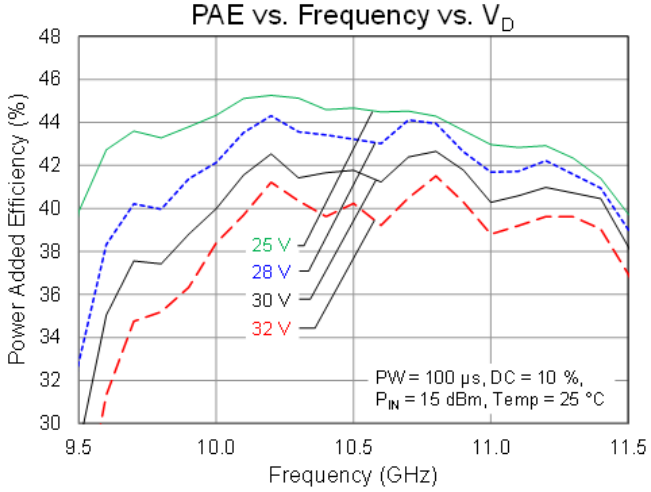

Output Power vs. Input Power vs. $I_{DQ}$



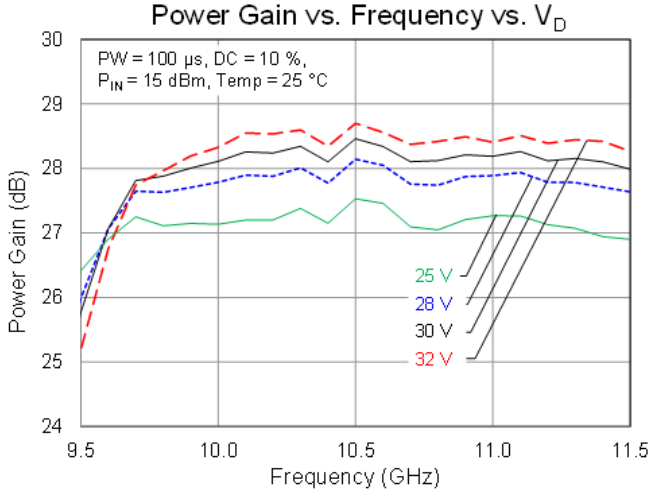
## Typical Performance – Large Signal (Pulsed)

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

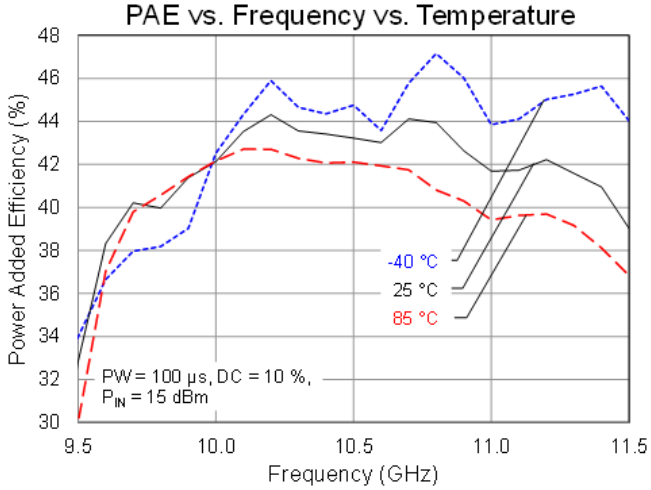
PAE vs. Frequency vs. $V_D$



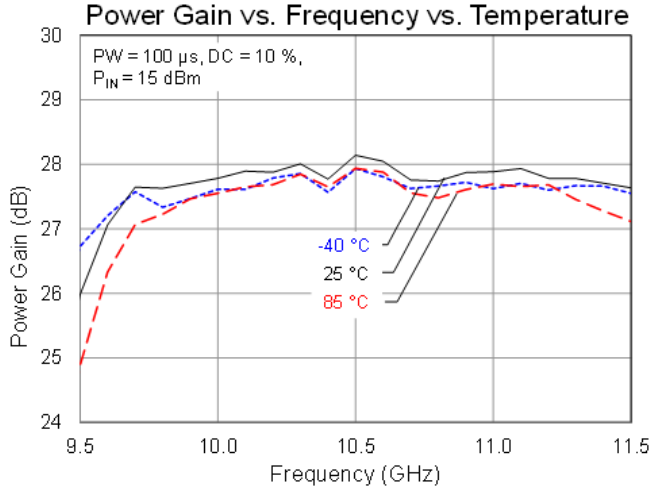

Power Gain vs. Frequency vs. $V_D$



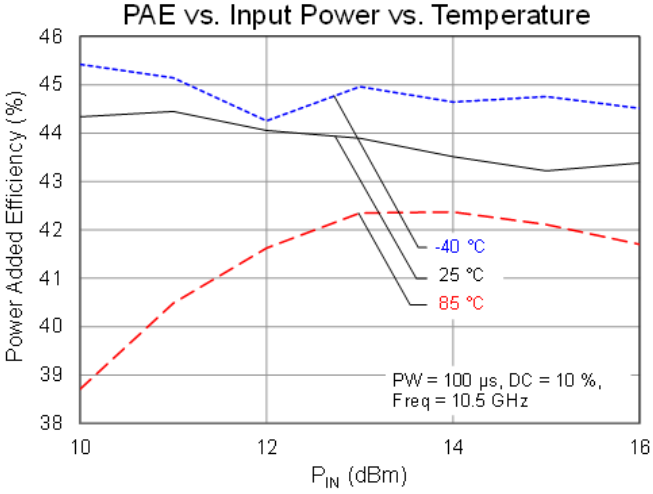

PAE vs. Frequency vs. Temperature



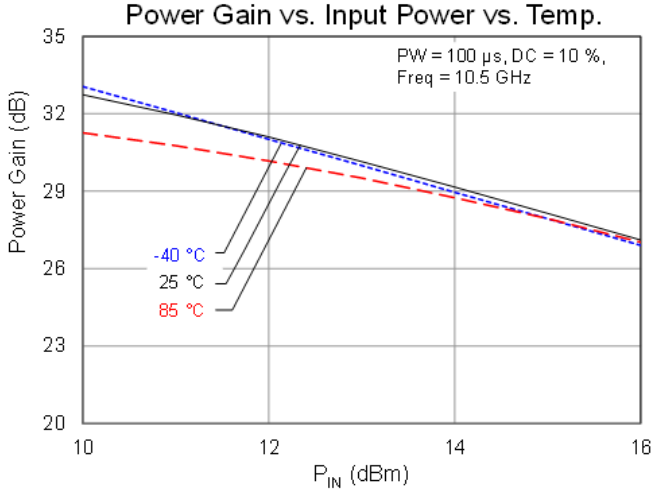

Power Gain vs. Frequency vs. Temperature




PAE vs. Input Power vs. Temperature

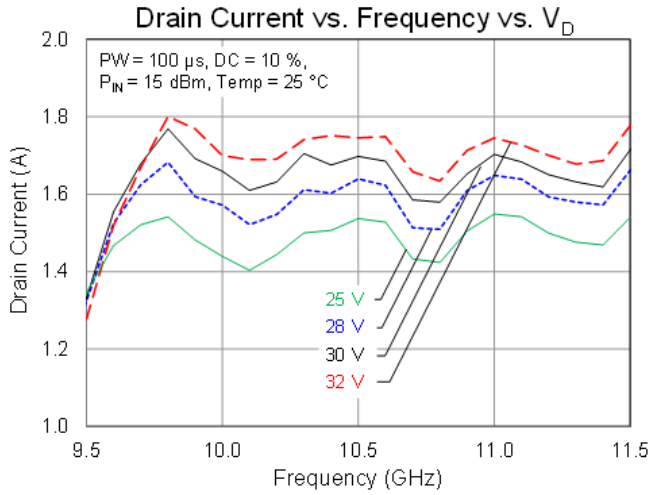


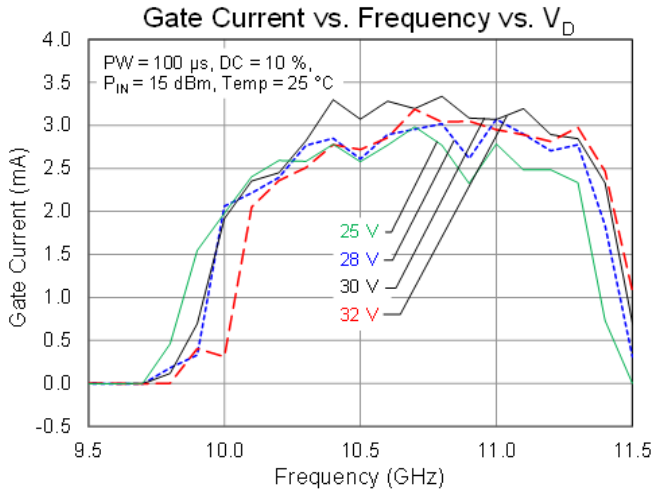

Power Gain vs. Input Power vs. Temp.

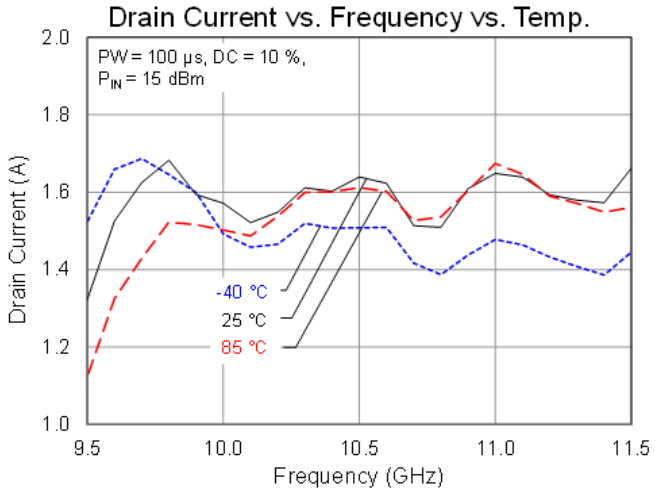


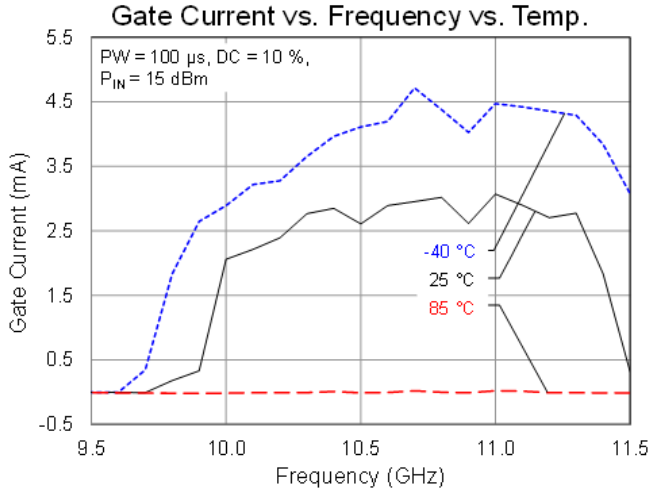
## Typical Performance – Large Signal (Pulsed)

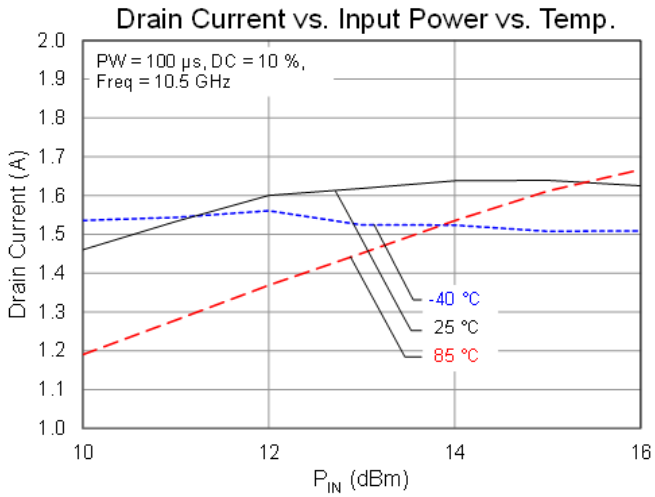
Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

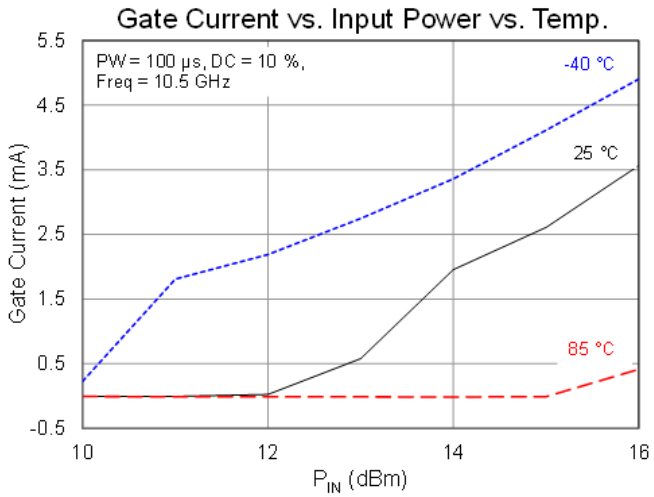


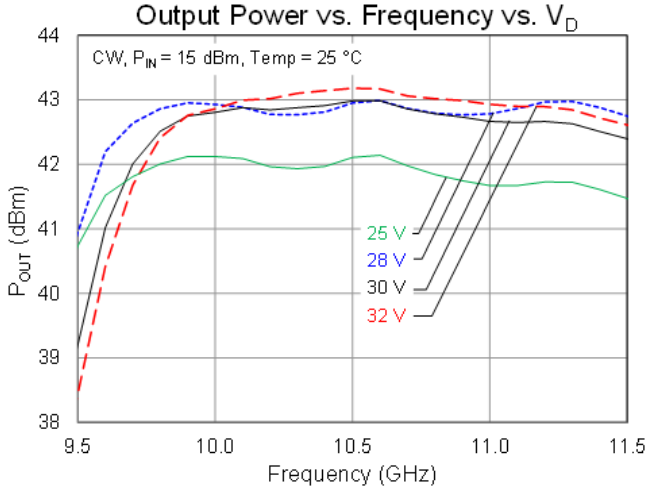



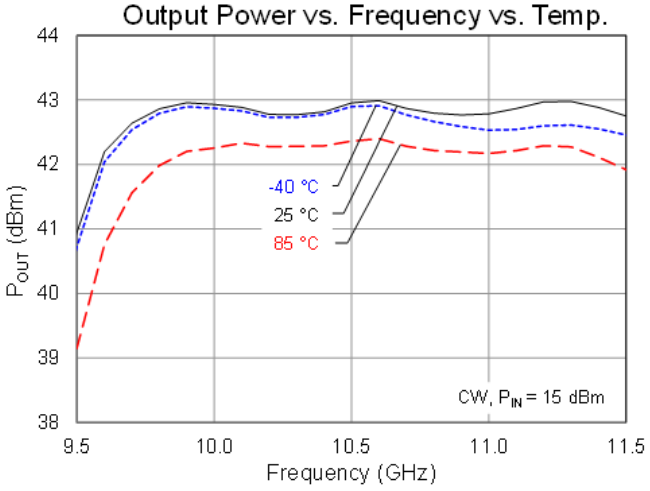
## Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

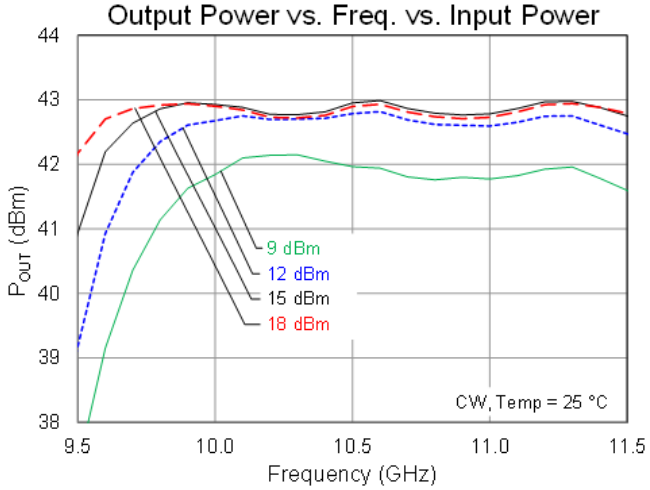
Output Power vs. Frequency vs. $V_D$



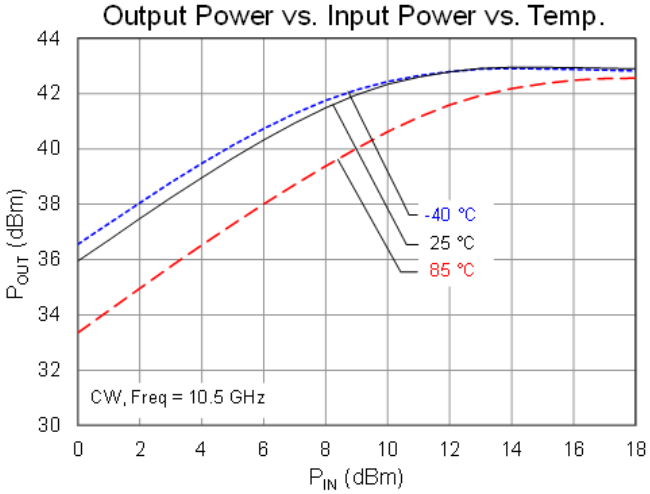

Output Power vs. Frequency vs. Temp.



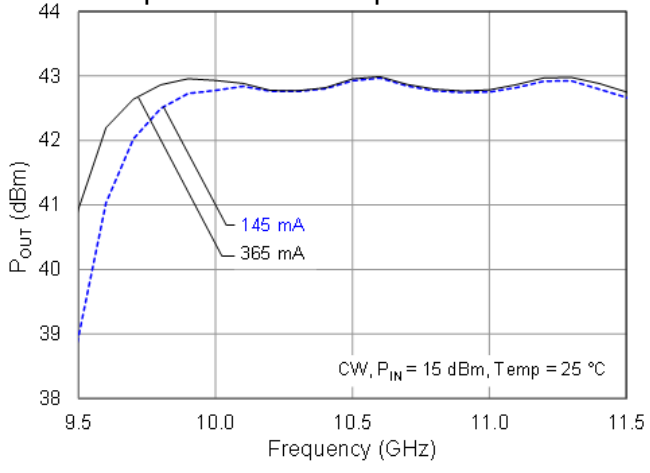

Output Power vs. Freq. vs. Input Power



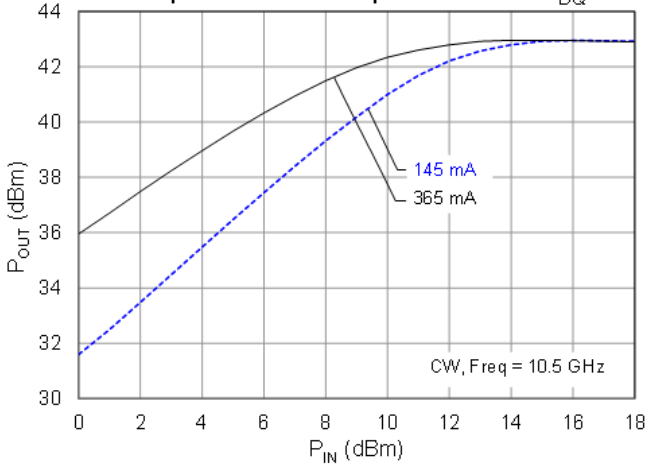

Output Power vs. Input Power vs. Temp.




Output Power vs. Freq. vs. Drain Current



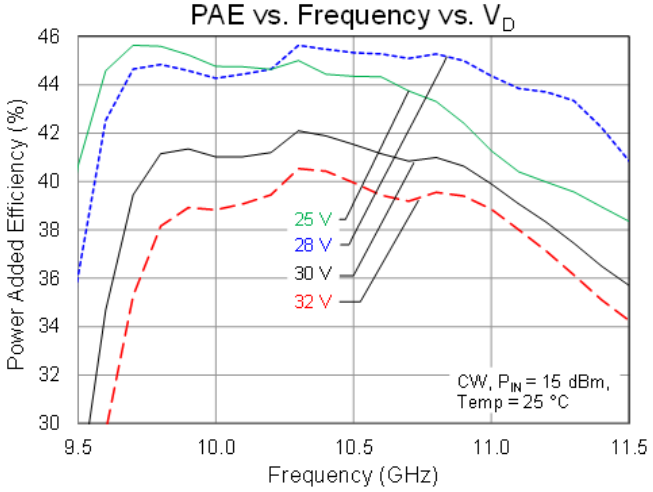

Output Power vs. Input Power vs. $I_{DQ}$



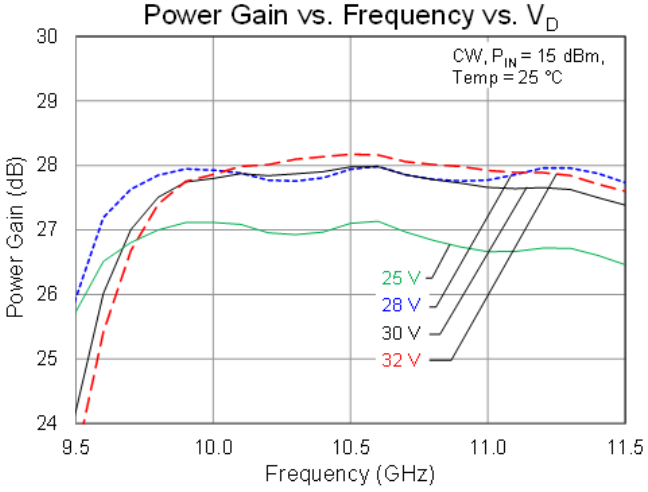
## Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

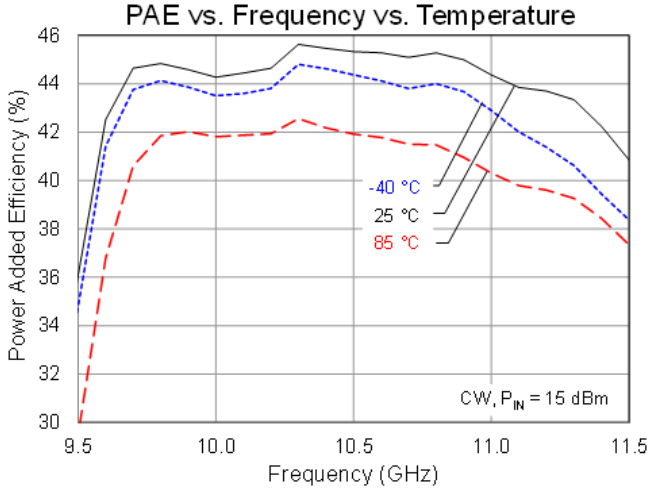
PAE vs. Frequency vs. $V_D$



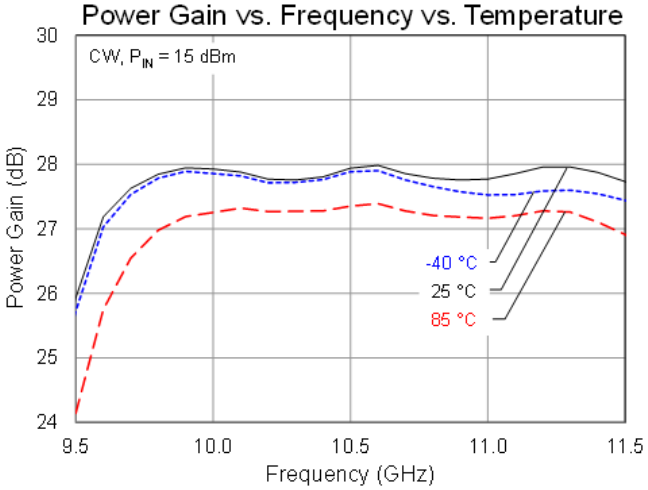

Power Gain vs. Frequency vs. $V_D$



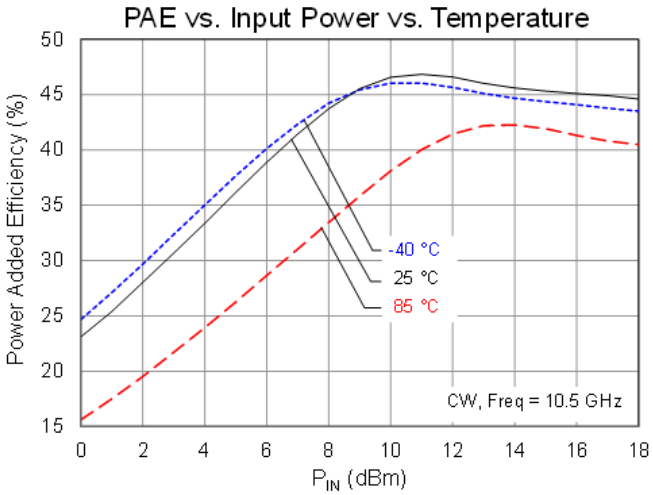

PAE vs. Frequency vs. Temperature



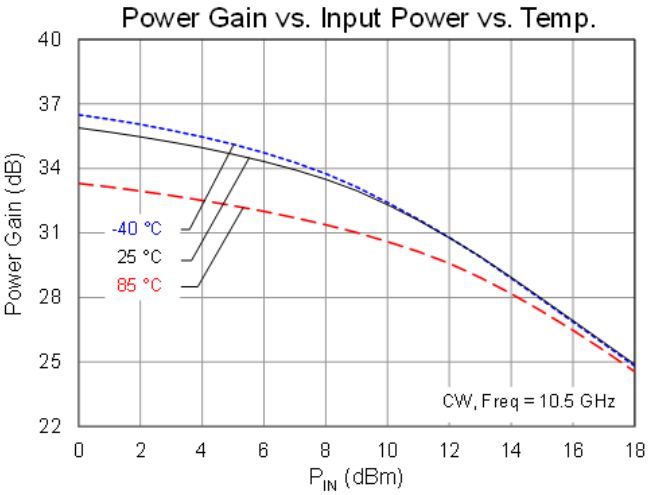

Power Gain vs. Frequency vs. Temperature




PAE vs. Input Power vs. Temperature



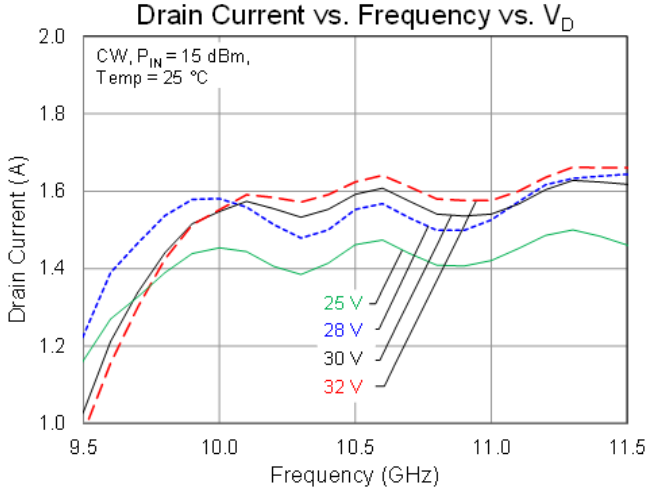

Power Gain vs. Input Power vs. Temp.



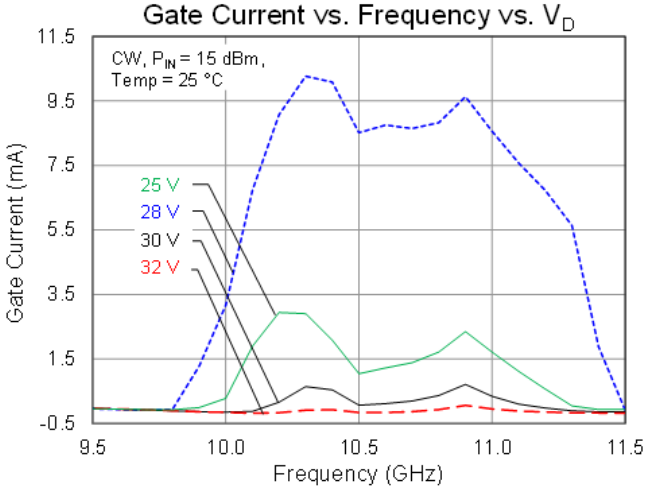
## Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

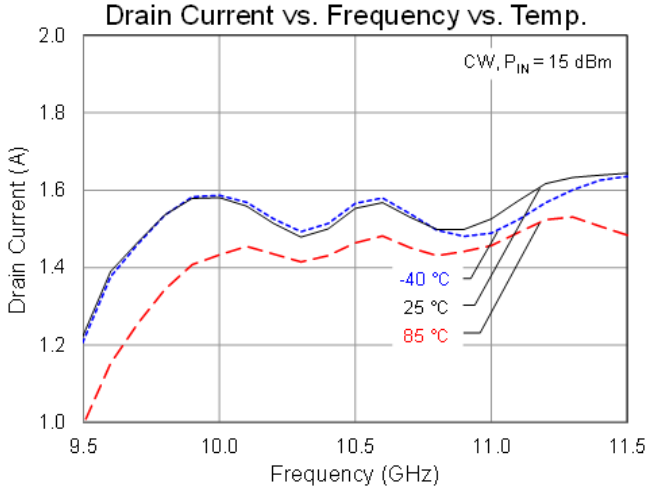
Drain Current vs. Frequency vs. $V_D$



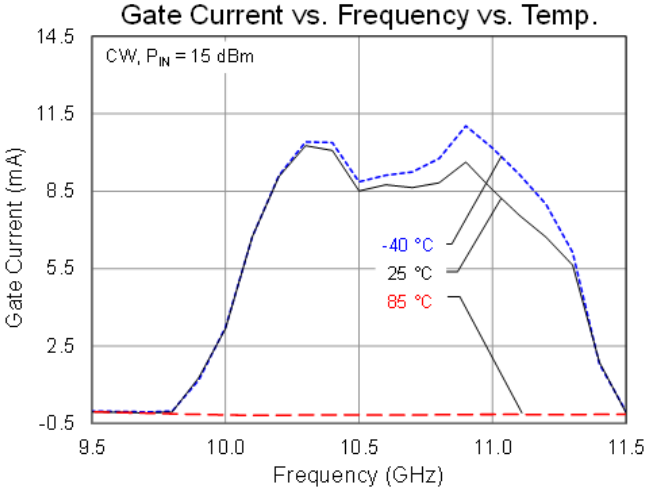

Gate Current vs. Frequency vs. $V_D$



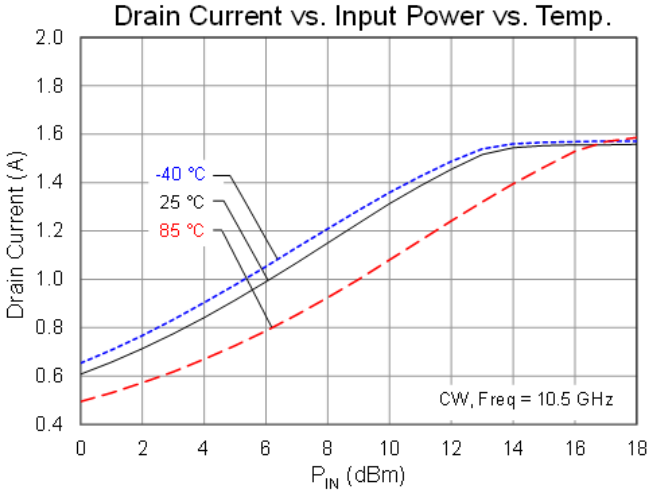

Drain Current vs. Frequency vs. Temp.



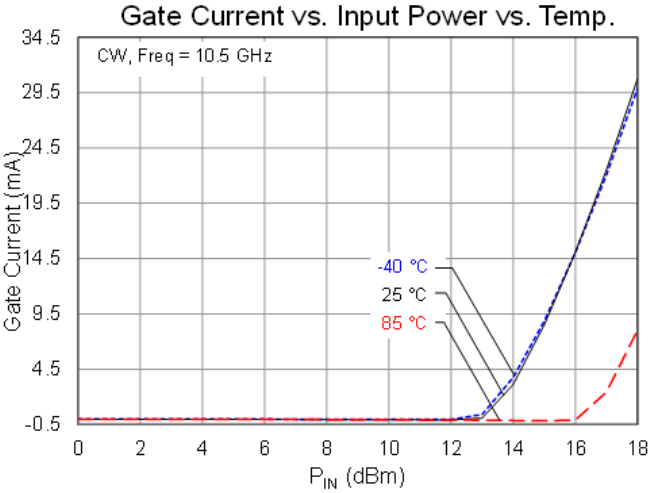

Gate Current vs. Frequency vs. Temp.




Drain Current vs. Input Power vs. Temp.

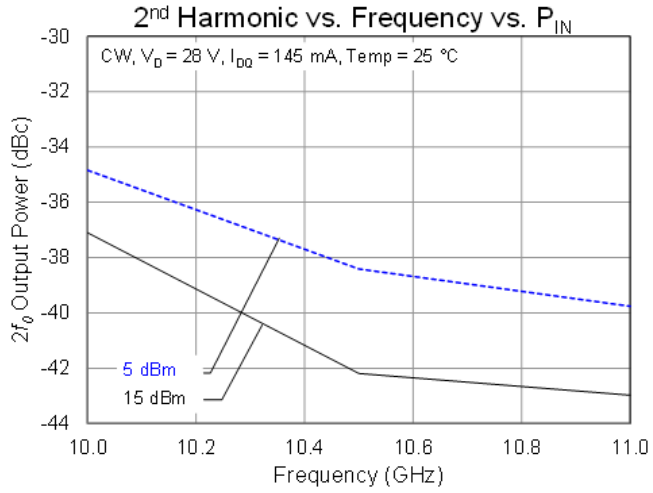


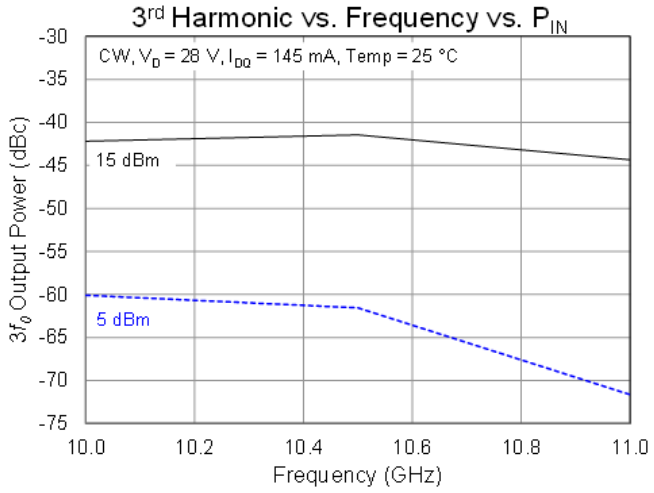

Gate Current vs. Input Power vs. Temp.

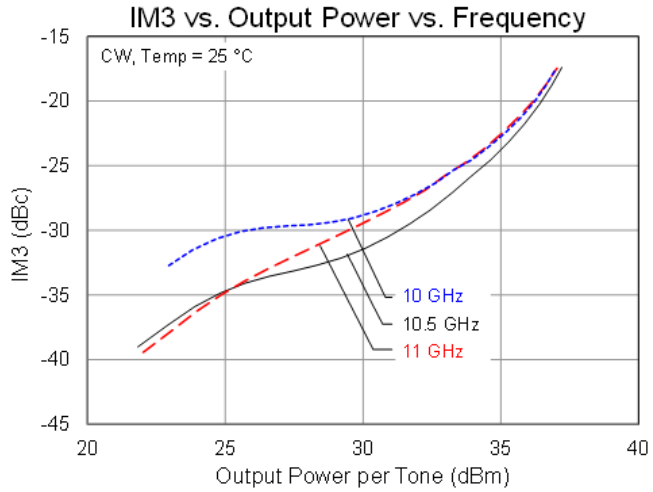


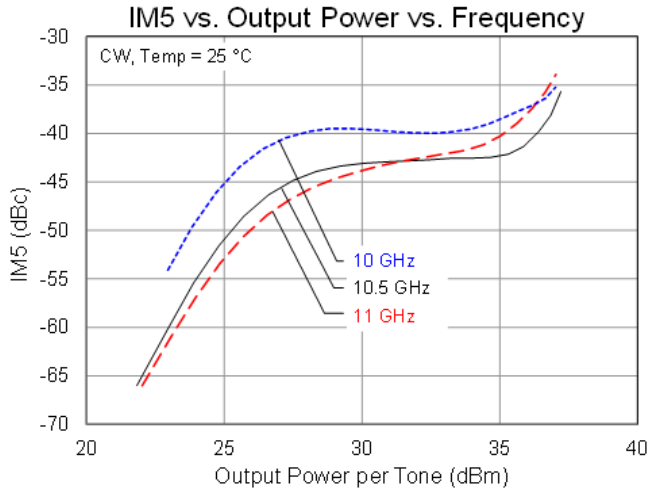
## Typical Performance – Linearity

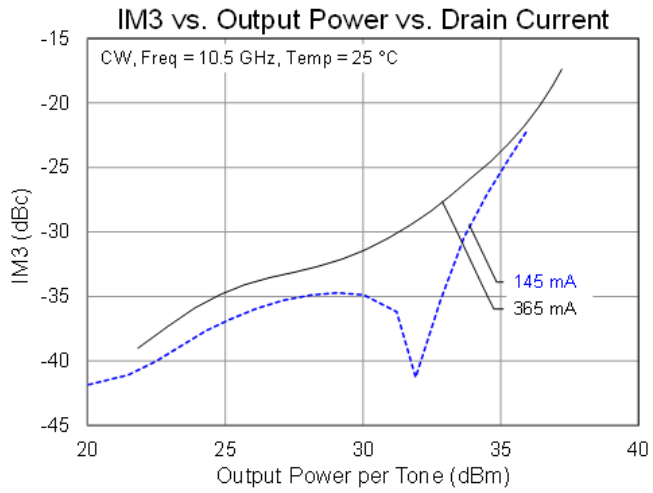
Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

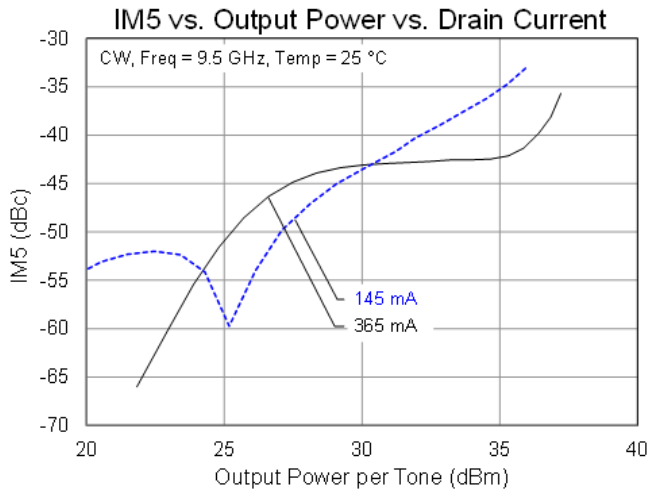


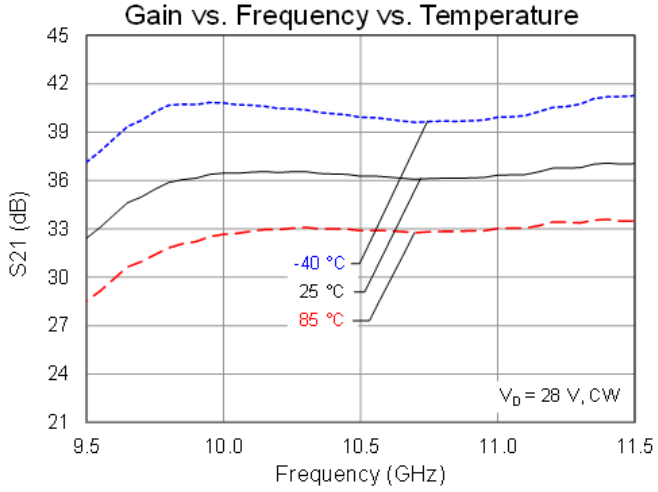



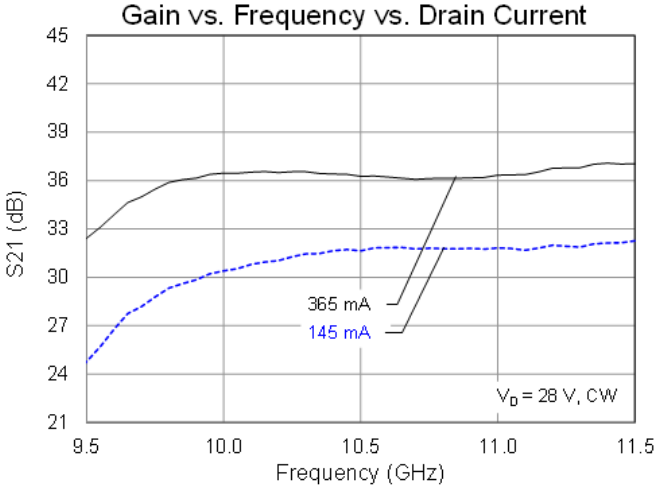
## Typical Performance – Small Signal

Conditions unless otherwise specified: $V_D$ = 28 V, $I_{DQ}$ = 365 mA, $V_G$ = -2.6 V typical.

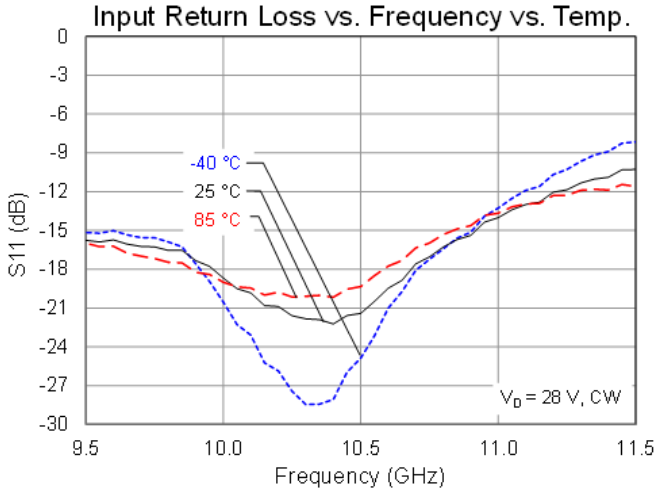
Gain vs. Frequency vs. Temperature



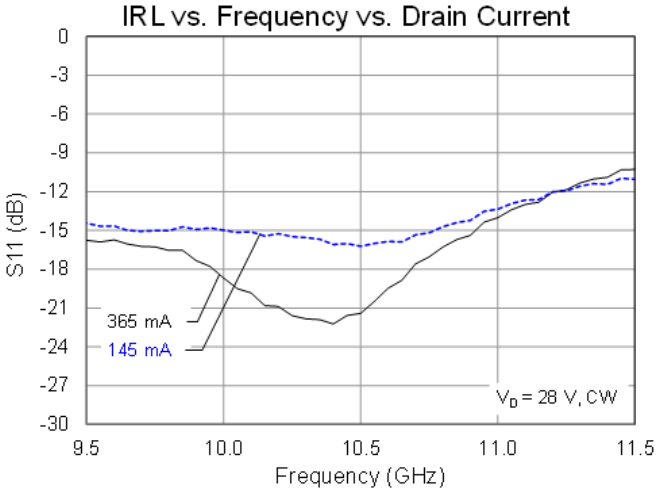

Gain vs. Frequency vs. Drain Current



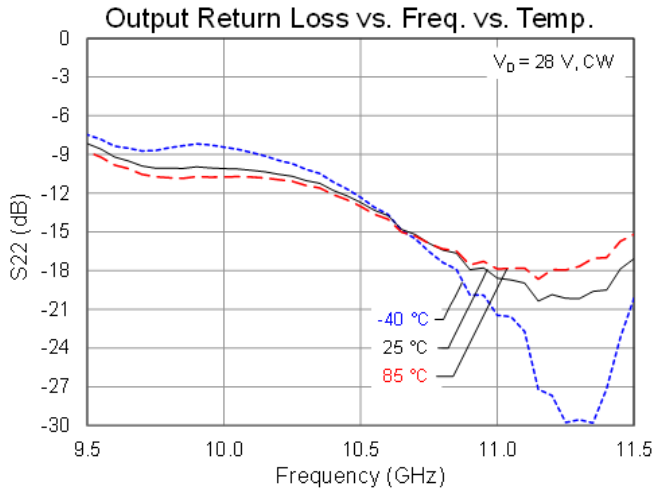

Input Return Loss vs. Frequency vs. Temp.



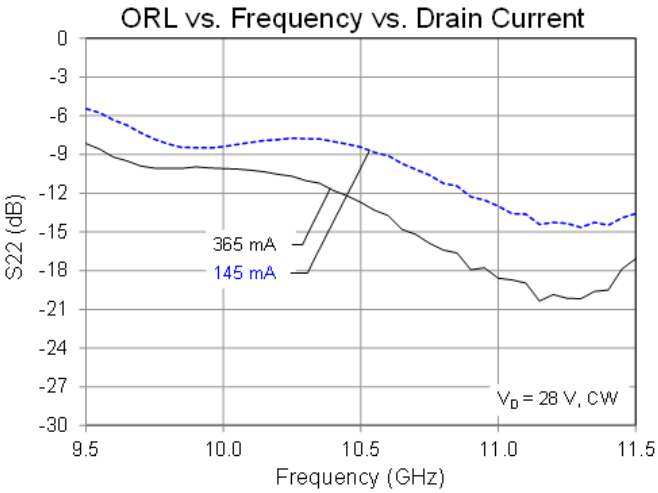

IRL vs. Frequency vs. Drain Current



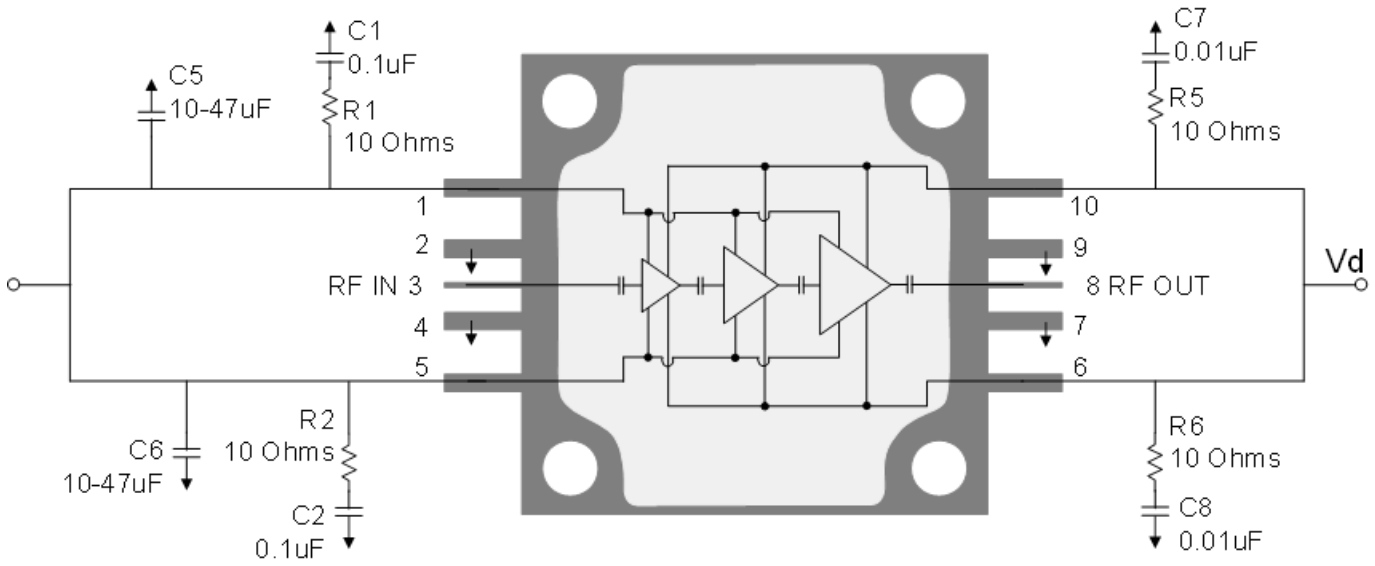

Output Return Loss vs. Freq. vs. Temp.




ORL vs. Frequency vs. Drain Current



## Applications Information and Pin Layout




## Bias Up Procedure

| |
|---|
| 1. Set $I_D$ limit to 3 A, $I_G$ limit to 14 mA |
| 2. Apply −5 V to $V_G$ |
| 3. Apply +28 V to $V_D$; ensure $I_{DQ}$ is approx. 0 mA |
| 4. Adjust $V_G$ until $I_{DQ}$ = 365 mA ($V_G$ ~ −2.6 V Typ.). |
| 5. Turn on RF supply |

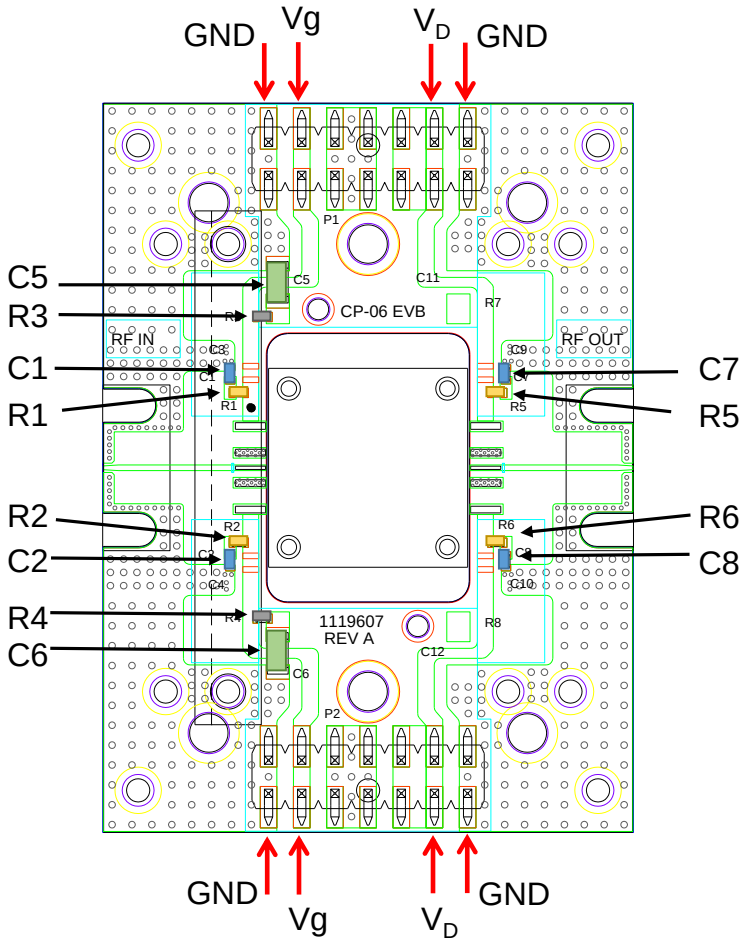
## Bias Down Procedure

| |
|---|
| 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 |

## Pin Description

| Pad No. | Symbol | Description |
|---|---|---|
| 1, 5 | $V_G$ | Gate Voltage; Bias network is required; must be biased from both sides; see recommended Application Information above. |
| 3 | $RF_{IN}$ | Output; matched to 50 Ω; DC blocked |
| 2, 4, 7, 9 | GND | Must be grounded on the PCB. |
| 6, 10 | $V_D$ | Drain voltage; Bias network is required; must be biased from both sides; see recommended Application Information above. |
| 8 | $RF_{OUT}$ | Input; matched to 50 Ω; DC blocked |

## Evaluation Board (EVB)




NOTES:

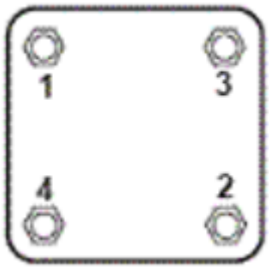
(1) Both Top and Bottom Vd and Vg must be biased.

## Bill of Materials

| Reference Des. | Value | Description | Manuf. | Part Number |
|---|---|---|---|---|
| C1, C2 | 0.1 uF | Cap, 0402, 50 V, 10%, X7R | Various | |
| C5, C6 | 10-47 uF | Cap, 1206, 50 V, 20%, X5R (10v is OK) | Various | |
| C7, C8 | 0.01 uF | Cap, 0402, 50V, 10%, X7R | Various | |
| R1, R2, R5, R6 | 10 Ohms | Res, 0402, 50V, 5% | Various | |
| R3, R4 | 0 Ohms | Res, 0402, jumper required for the above EVB design | Various | |

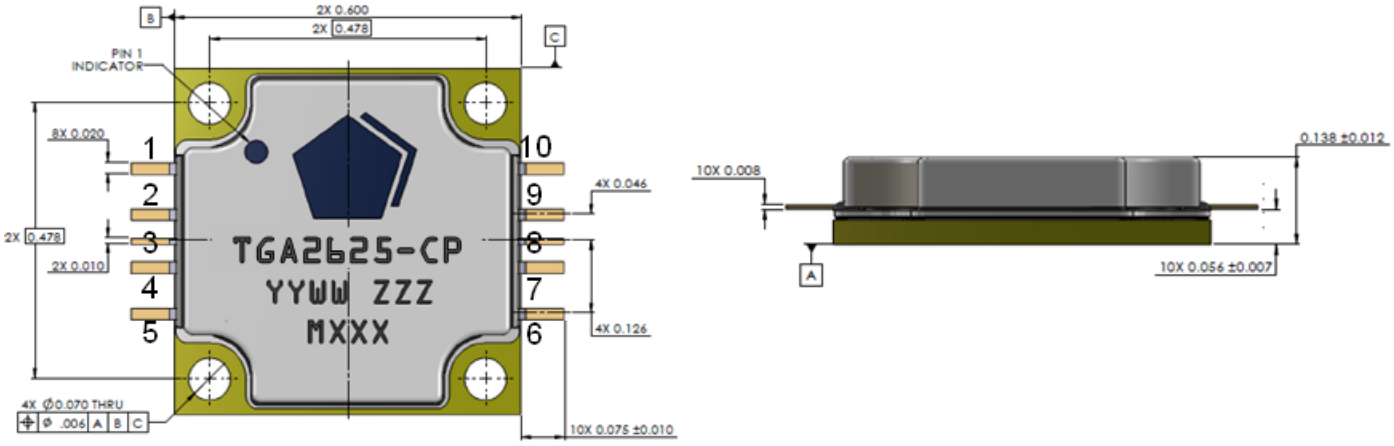
## Assembly Notes

1. Carefully clean the PC board 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 PCB and apply thermal compound (Arctic Silver 5 recommended) or 4 mil indium shim between the heat sink and the package.
3. (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 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:




4. Apply no-flux solder to each pin of the TGA2625-CP. 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.

## Mechanical Information




Units: inches
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Base: Copper
Lid: Plastic
All metalized features are gold plated
Part is epoxy sealed
Marking:
2625: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID

## Handling Precautions

| Parameter | Rating | Standard |
|---|---|---|
| ESD – Human Body Model (HBM) | 1B | ESDA / JEDEC JS-001-2014 |
| ESD – Charged Device Model (CDM) | C0B | ESDA / JEDEC JS-002-2014 |
| MSL – Moisture Sensitivity Level | N/A | |

Caution!
ESD-Sensitive Device

## Solderability

The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. Soldering of the component leads is compatible with the latest version of J-STD-020, lead-free solder, 260 °C. 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 ($C_{15}H_{12}Br_4O_2$) 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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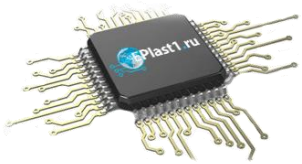
Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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