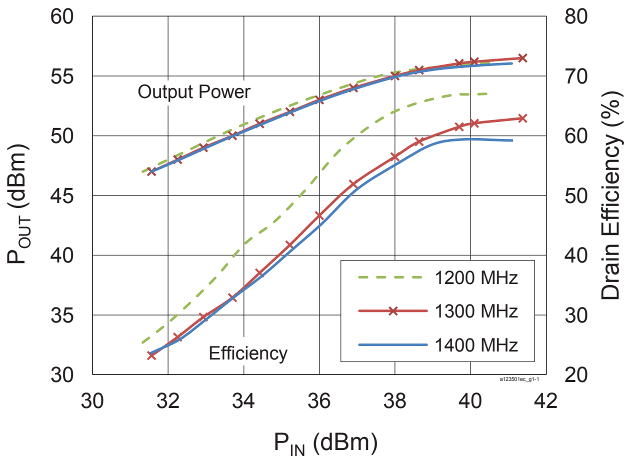
# PTVA123501EC/FC

## Thermally-Enhanced High Power RF LDMOS FETs
## 350 W, 50 V, 1200 – 1400 MHz

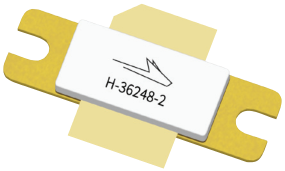
### Description

The PTVA123501EC and PTVA123501FC LDMOS FETs are designed for use in power amplifier applications in the 1200 MHz to 1400 MHz frequency band. Features include high gain and thermally-enhanced package with slotted and earless flanges. Manufactured with Wolfspeed's advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

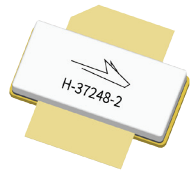
**Power Sweep, Pulsed RF**
$I_{DQ}$ = 150 mA, $V_{DD}$ = 50 V, $T_{CASE}$ = 25°C,
300 µs pulse width, 12% duty cycle




PTVA123501EC
Package H-36248-2




PTVA123501FC
Package H-37248-2




### Features

- Broadband internal input and output matching
- High gain and efficiency
- Integrated ESD protection
- Human Body Model Class 2 (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Excellent ruggedness
- Pb-free and RoHS compliant
- Capable of withstanding a 10:1 load mismatch (all phase angles) at 55.5 dBm under pulsed conditions: 300 µs pulse width, 12% duty cycle, $V_{DD}$ = 50 V

### RF Characteristics

**Pulsed RF Performance** (tested in Wolfspeed test fixture)

$V_{DD}$ = 50 V, $I_{DQ}$ = 0.15 A, $P_{OUT}$ = 350 W, $f_1$ = 1200 MHz, $f_2$ = 1300 MHz, $f_3$ = 1400 MHz, 300 µs pulse width, 12% duty cycle

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Gain | $G_{ps}$ | 16.5 | 17 | — | dB |
| Drain Efficiency | $\eta_D$ | 54 | 55 | — | % |
| Return Loss | IRL | — | –12 | –9 | dB |

*All published data at $T_{CASE}$ = 25°C unless otherwise indicated*

ESD: Electrostatic discharge sensitive device—observe handling precautions!

## RF Characteristics

**Typical RF Performance** (not subject to production test, verified by design/characterization in Wolfspeed test fixture)
$V_{DD}$ = 50 V, $I_{DQ}$ = 150 mA, Input signal ($t_r$ = 5 ns, $t_f$ = 6.5 ns), 300 µs pulse width, 12% duty cycle, class AB test

| Mode of Operation | $f$ (MHz) | IRL (dB) | $P_{1dB}$ | | | $P_{3dB}$ | | | Max $P_{droop\ (pulse)}$ dB @ 350 W | $t_{r\ (ns)}$ @ 350 W | $t_{f\ (ns)}$ @ 350 W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | | | |
| Pulsed RF | 1200 | –14 | 16.2 | 59 | 375 | 14.2 | 59 | 415 | 0.10 | 4 | 5< |
| Pulsed RF | 1300 | –14 | 16.0 | 59 | 390 | 14.0 | 59 | 435 | 0.15 | 4 | 5< |
| Pulsed RF | 1400 | –12 | 15.8 | 56 | 375 | 13.8 | 57 | 415 | 0.15 | 4 | 5< |

**Typical RF Performance** (not subject to production test, verified by design/characterization in Wolfspeed test fixture)
$V_{DD}$ = 50 V, $I_{DQ}$ = 150 mA, 30 ms pulse width, 30% duty cycle, class AB test

| Mode of Operation | $f$ (MHz) | $P_{1dB}$ | | | $P_{3dB}$ | | | $P_{droop\ (pulse)}$ dB @ 300 W |
|---|---|---|---|---|---|---|---|---|
| | | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | |
| Pulsed RF | 1200 | 16 | 47 | 316 | 14 | 48 | 350 | 0.23 |
| Pulsed RF | 1300 | 16 | 47 | 324 | 14 | 48 | 355 | 0.25 |
| Pulsed RF | 1400 | 15.5 | 45 | 315 | 13.5 | 47 | 355 | 0.29 |

## DC Characteristics

| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_{DS}$ = 10 mA | $V_{(BR)DSS}$ | 105 | — | — | V |
| Drain Leakage Current | $V_{DS}$ = 50 V, $V_{GS}$ = 0 V | $I_{DSS}$ | — | — | 1.0 | µA |
| | $V_{DS}$ = 105 V, $V_{GS}$ = 0 V | $I_{DSS}$ | — | — | 10.0 | µA |
| On-State Resistance | $V_{GS}$ = 10 V, $V_{DS}$ = 0.1 V | $R_{DS(on)}$ | — | 0.1 | — | Ω |
| Operating Gate Voltage | $V_{DS}$ = 50 V, $I_{DQ}$ = 150 mA | $V_{GS}$ | 3 | 3.35 | 4 | V |
| Gate Leakage Current | $V_{GS}$ = 10 V, $V_{DS}$ = 0 V | $I_{GSS}$ | — | — | 1.0 | µA |

## Maximum Ratings

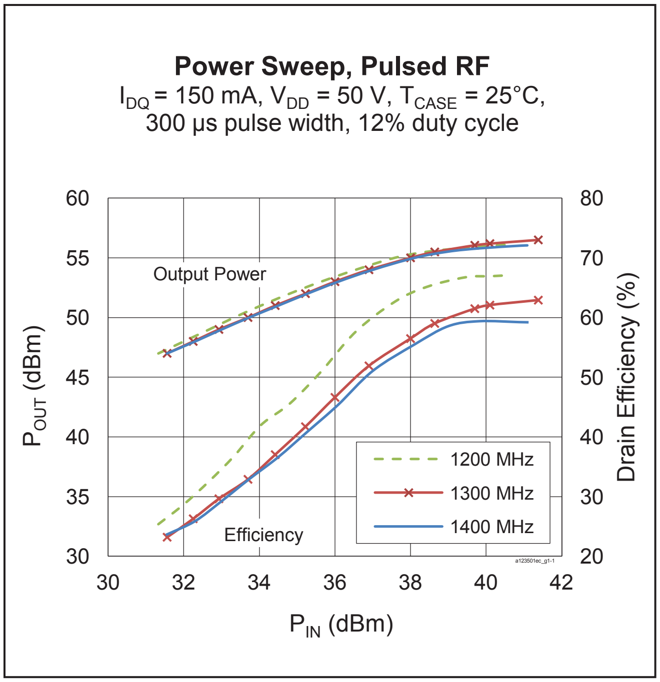
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 105 | V |
| Gate-Source Voltage | $V_{GS}$ | –6 to +12 | V |
| Operating Voltage | $V_{DD}$ | 0 to +55 | V |
| Junction Temperature | $T_J$ | 225 | °C |
| Storage Temperature Range | $T_{STG}$ | –65 to +150 | °C |
| Thermal Resistance ($T_{CASE}$ = 70°C, 300 W CW) | $R_{\theta JC}$ | 0.34 | °C/W |

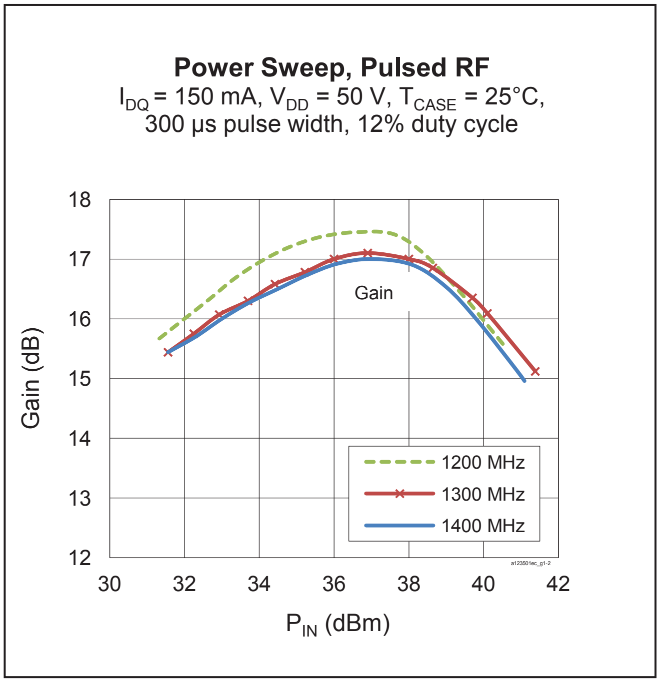
## Ordering Information

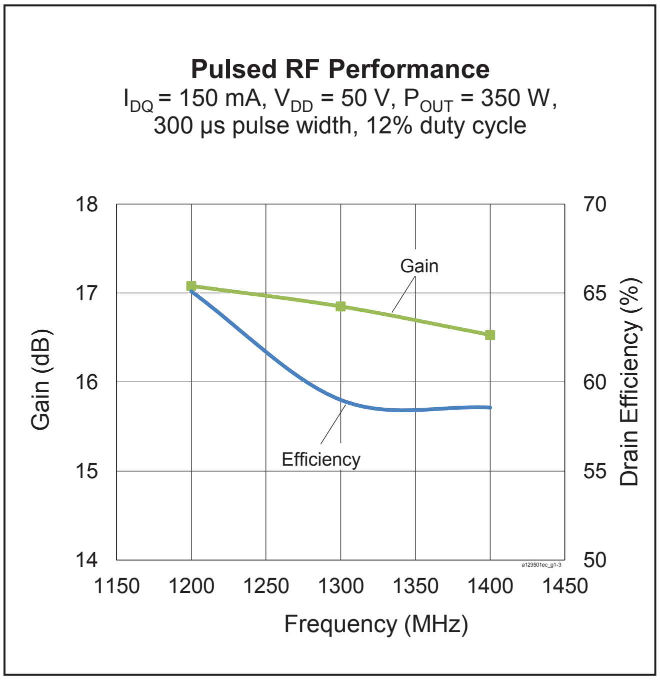
| Type and Version | Order Code | Package Description | Shipping |
|---|---|---|---|
| PTVA123501EC V2 R0 | PTVA123501EC-V2-R0 | H-36248-2, bolt-down | Tape & Reel, 50 pcs |
| PTVA123501EC V2 R250 | PTVA123501EC-V2-R250 | H-36248-2, bolt-down | Tape & Reel, 250 pcs |
| PTVA123501FC V1 R0 | PTVA123501FC-V1-R0 | H-37248-2, earless | Tape & Reel, 50 pcs |
| PTVA123501FC V1 R250 | PTVA123501FC-V1-R250 | H-37248-2, earless | Tape & Reel, 250 pcs |

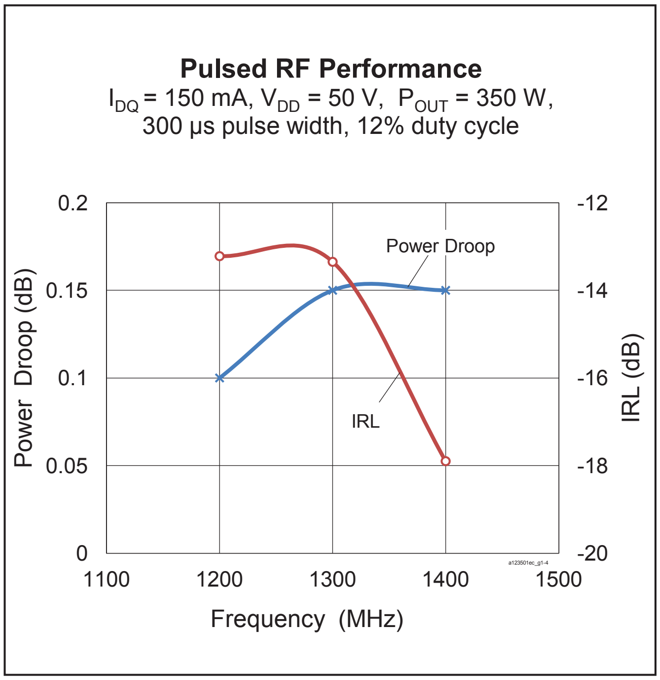
See next page for Typical RF Performance

## Typical RF Performance (data taken in production test fixture)

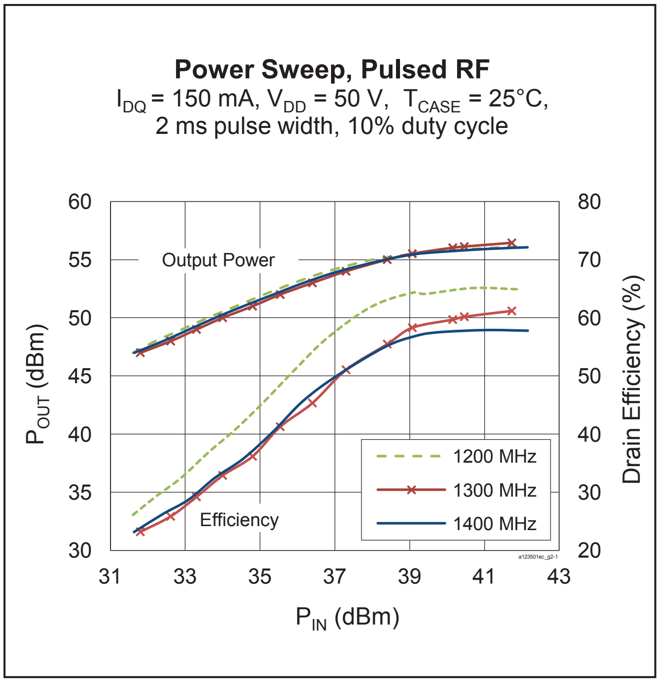


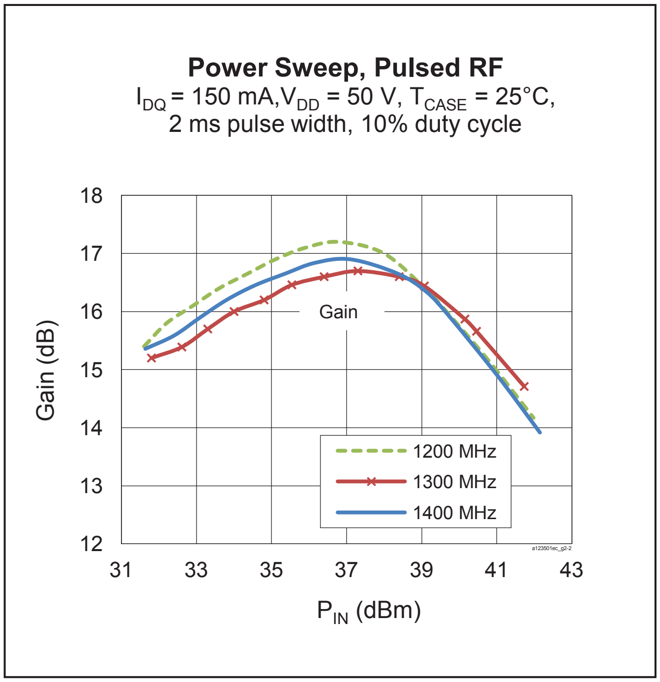



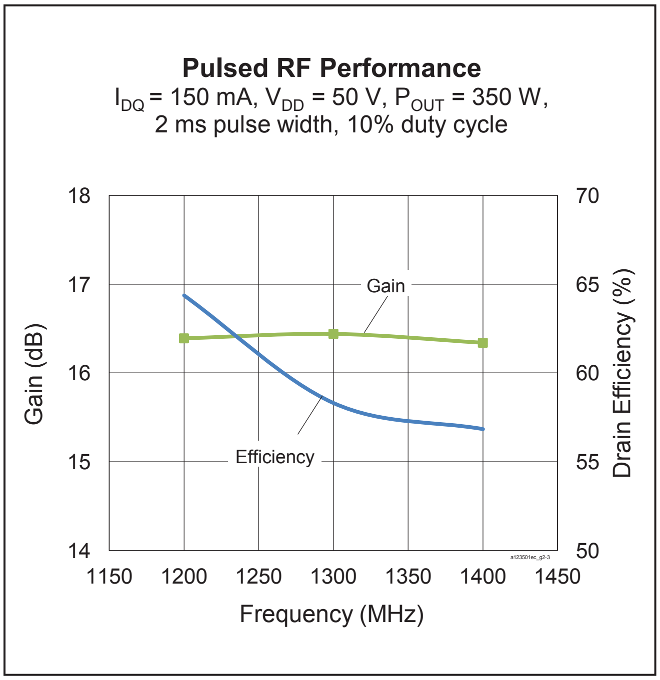



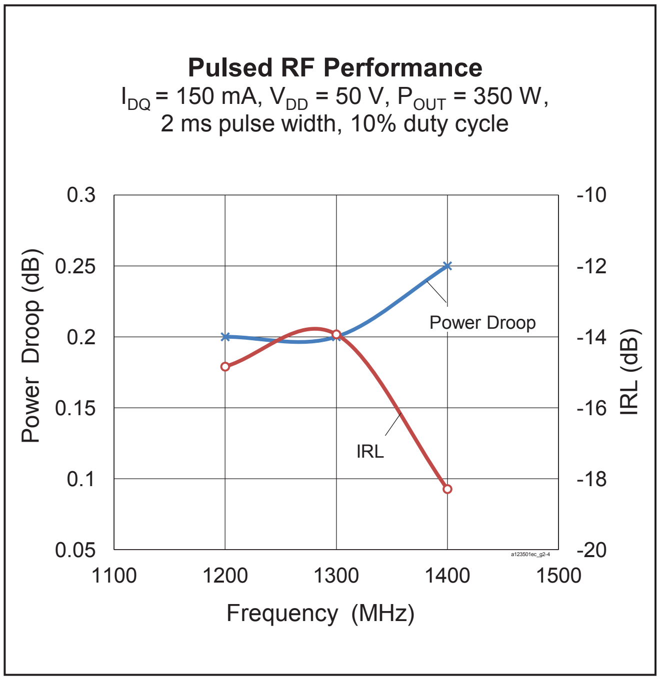



## Typical RF Performance (cont.)

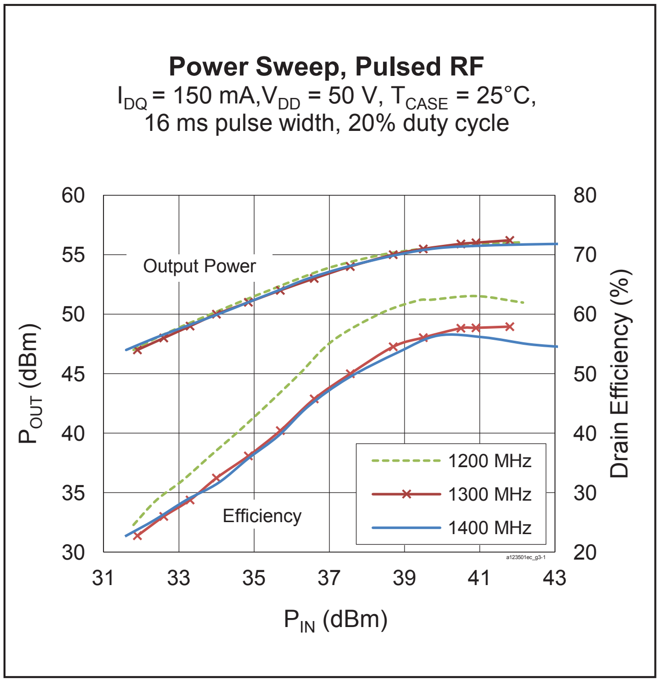


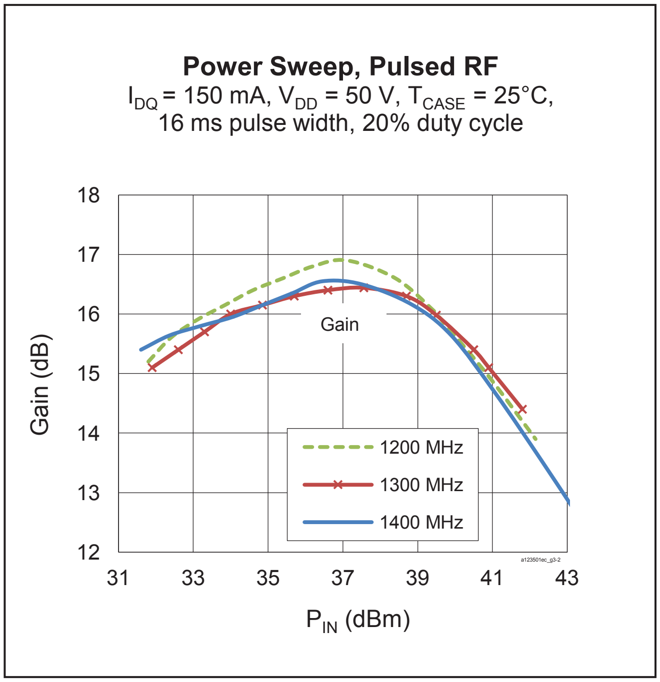



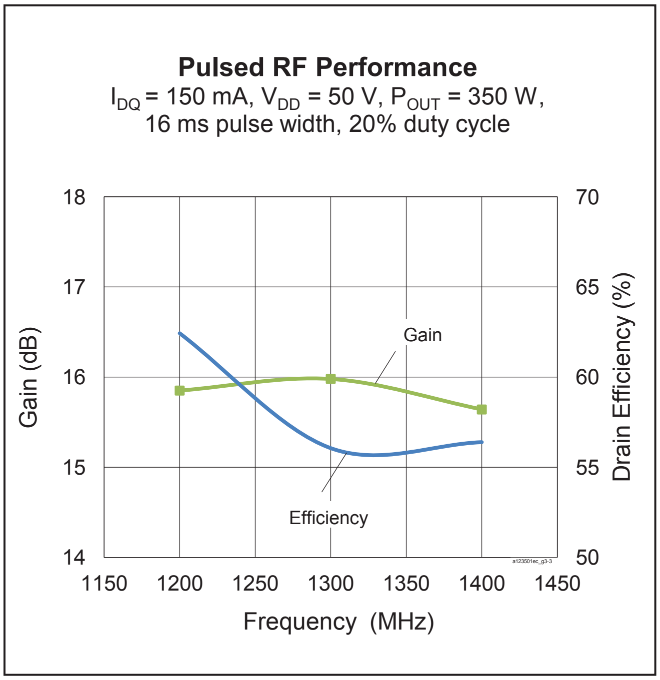



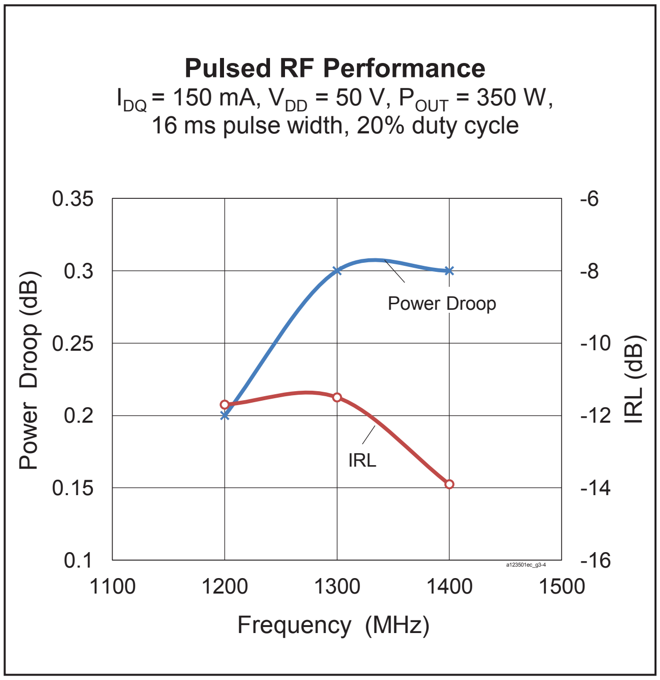



## Typical RF Performance (cont.)

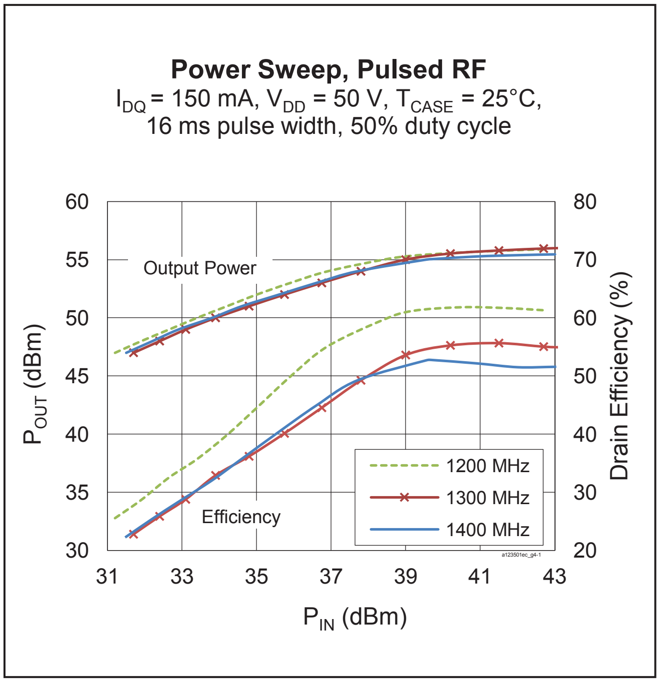


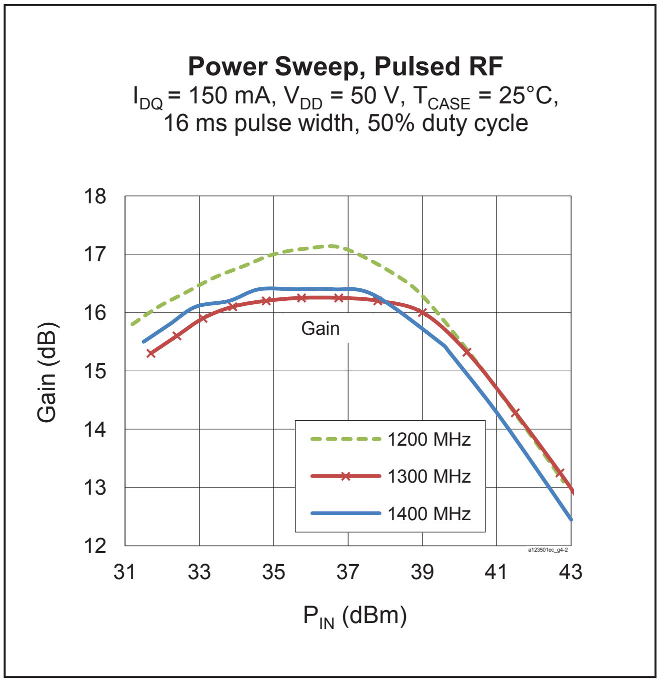



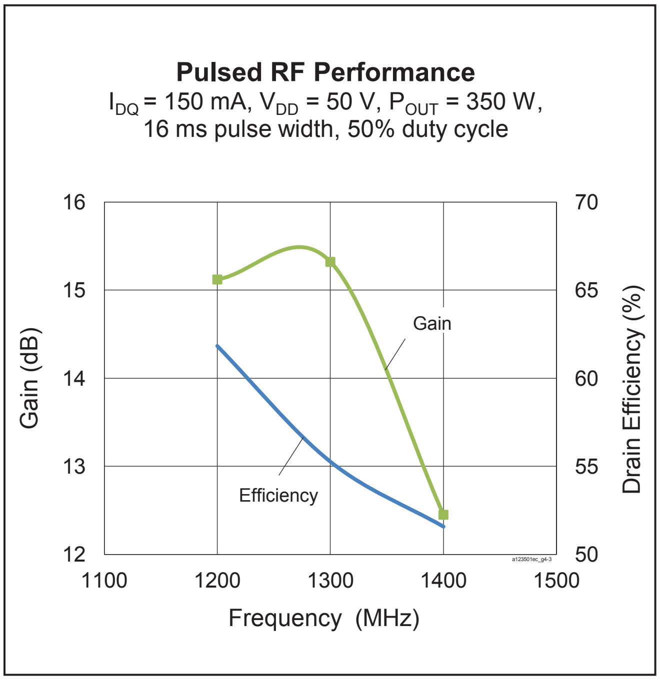



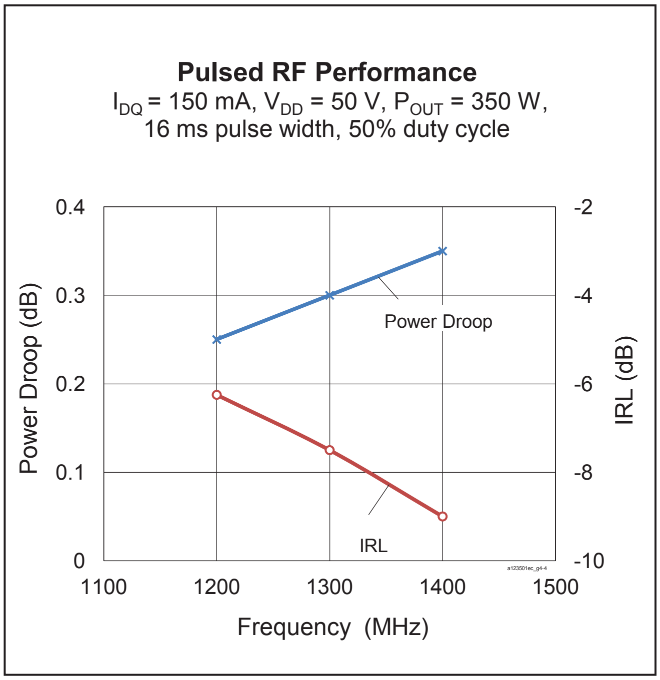



## Typical RF Performance (cont.)

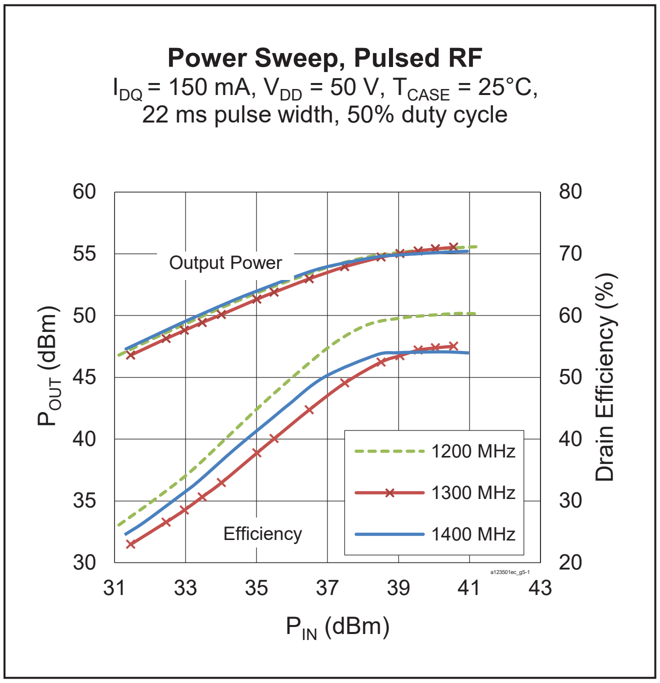


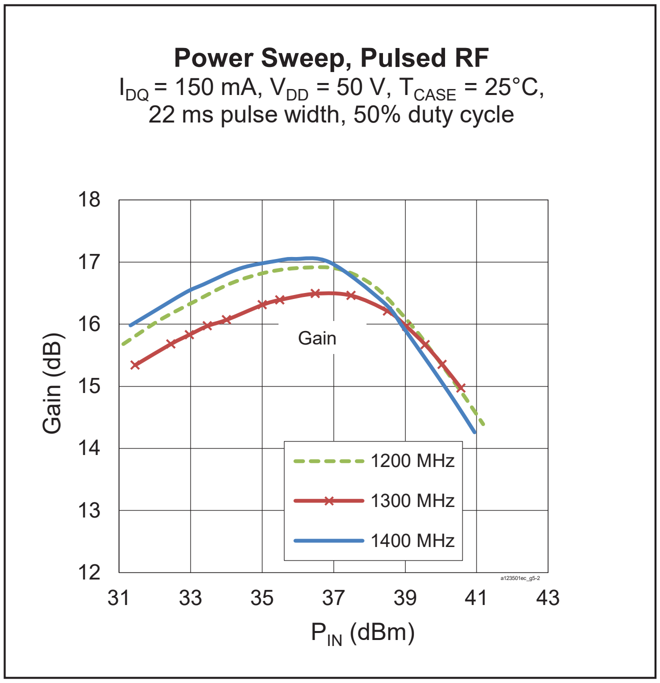



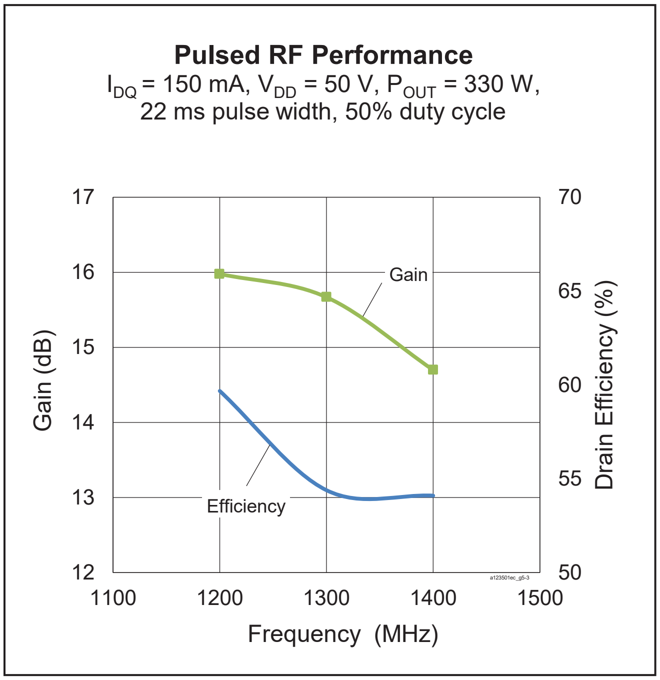



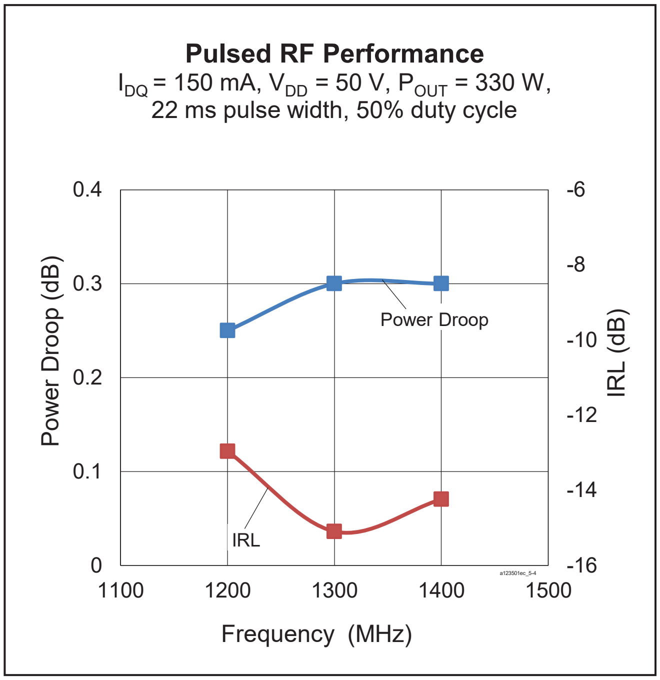



## Typical RF Performance (cont.)



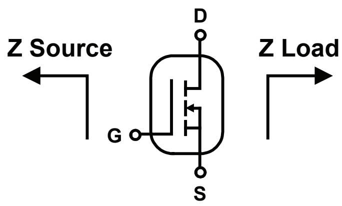



## Broadband Circuit Impedance

| Freq [MHz] | Z Source Ω | | Z Load Ω | |
|---|---|---|---|---|
| | R | jX | R | jX |
| 1200 | 1.25 | –1.99 | 1.96 | –2.23 |
| 1300 | 1.54 | –1.52 | 1.59 | –2.03 |
| 1400 | 1.66 | –1.58 | 1.26 | –1.75 |




## Load Pull Performance

**Load Pull at Max $P_{OUT}$ Point** – 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, 150 mA

| Freq [MHz] | ZI [Ω] | $P_{IN}$ [dBm] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
|---|---|---|---|---|---|---|---|
| 1200 | 1.91 – j2.04 | 41.40 | 56.40 | 436.52 | 15 | 53.80 | 1.30 – j2.03 |
| 1300 | 2.72 – j3.13 | 42.24 | 56.54 | 450.82 | 14.30 | 54.48 | 1.25 – j1.94 |
| 1400 | 4.83 – j1.46 | 41.66 | 56.31 | 427.56 | 14.65 | 53.27 | 1.03 – j1.94 |

**Load Pull at Max $G_T$ Point** – 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, 150 mA

| Freq [MHz] | ZI [Ω] | $P_{IN}$ [dBm] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
|---|---|---|---|---|---|---|---|
| 1200 | 1.91 – j2.04 | 38.10 | 54.72 | 296.48 | 16.62 | 57.89 | 3.03 – j3.11 |
| 1300 | 2.72 – j3.13 | 38.84 | 54.83 | 304.09 | 15.99 | 62.54 | 3.22 – j1.63 |
| 1400 | 4.83 – j1.46 | 37.21 | 53.42 | 219.79 | 16.21 | 57.25 | 2.30 – j0.09 |

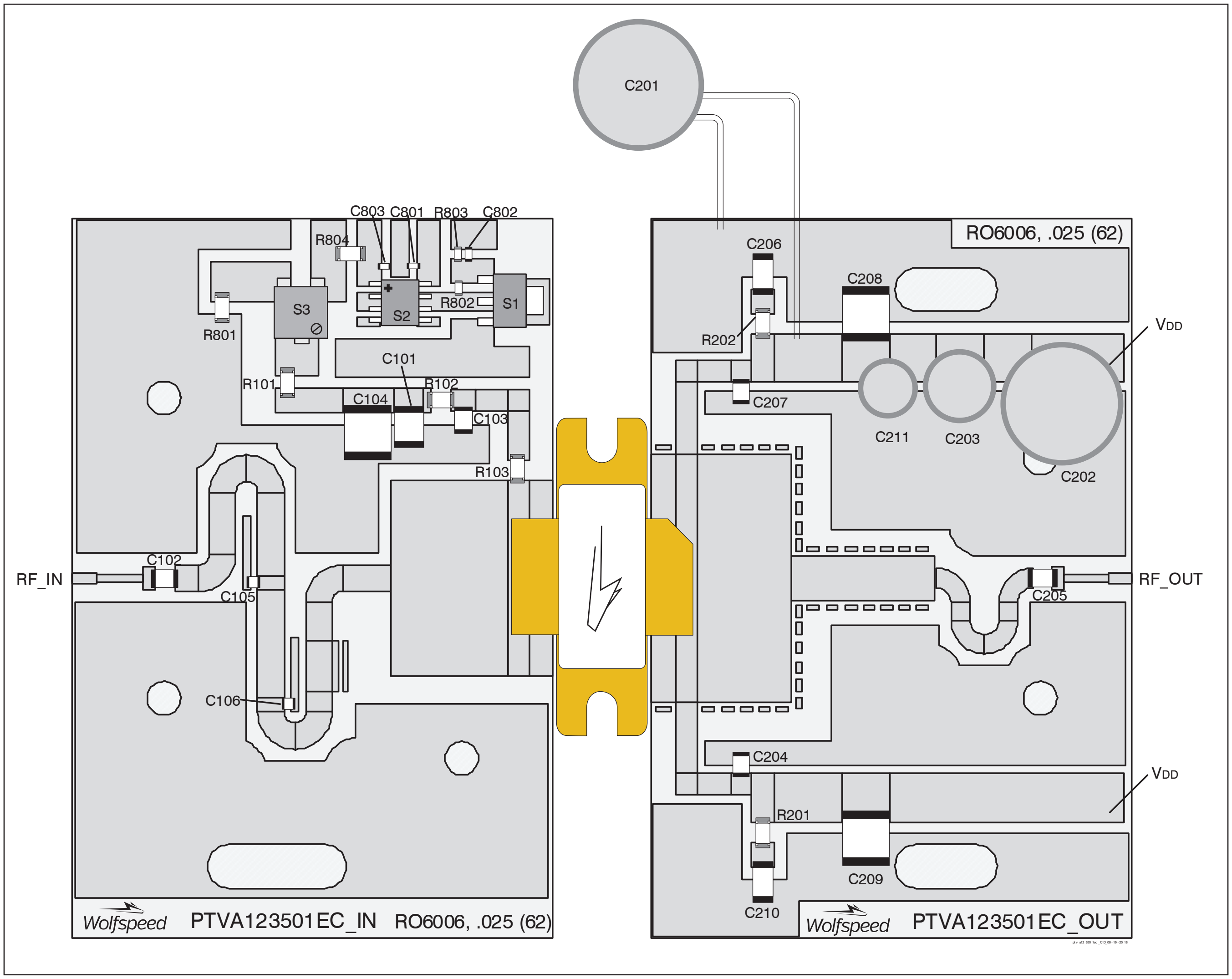
**Load Pull at Max Efficiency Point** – 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, 150 mA

| Freq [MHz] | ZI [Ω] | $P_{IN}$ [dBm] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
|---|---|---|---|---|---|---|---|
| 1200 | 1.91 – j2.04 | 39.60 | 55.80 | 380.19 | 16.20 | 60.71 | 2.22 – j2.43 |
| 1300 | 2.72 – j3.13 | 39.44 | 55.23 | 333.43 | 15.79 | 63.71 | 2.81 – j1.90 |
| 1400 | 4.83 – j1.46 | 39.39 | 55.19 | 330.37 | 15.80 | 62.26 | 2.40 – j1.45 |

**Z Optimum** – 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, 150 mA

| Freq [MHz] | ZI [Ω] | $P_{IN}$ [dBm] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
|---|---|---|---|---|---|---|---|
| 1200 | 1.91 – j2.04 | 39.18 | 55.58 | 361.41 | 16.4 | 60.5 | 2.41 – j2.50 |
| 1300 | 2.72 – j3.13 | 39.50 | 55.30 | 338.84 | 15.8 | 62.6 | 2.73 – j1.51 |
| 1400 | 4.83 – j1.46 | 40 | 55.60 | 363.08 | 15.6 | 60.7 | 1.86 – j1.37 |

## Reference Circuit




*Reference circuit assembly diagram (not to scale)**

*Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF*

## Reference Circuit (cont.)

### Reference Circuit Assembly

| | |
|---|---|
| DUT | PTVA123501EC or PTVA123501FC |
| Test Fixture Part No. | LTN/PTVA123501EC V2 or LTN/PTVA123501FC V1 |
| PCB | Rogers 6006, 0.635 mm [0.025"] thick, 2 oz. copper, $\varepsilon_r = 6.15$ |

### Components Information

| Component | Description | Suggested Manufacturer | P/N |
|---|---|---|---|
| **Input** | | | |
| C101 | Capacitor, 1 µF | TDK Corporation | C4532X7R2A105M230KA |
| C102, C103 | Capacitor, 39 pF | ATC | ATC100B390KW500XB |
| C104 | Capacitor, 10 µF | TDK Corporation | C5750X5R1H106K230KA |
| C105 | Capacitor, 3 pF | ATC | ATC100A3R0CW150XB |
| C106 | Capacitor, 0.5 pF | ATC | ATC100A0R5CW150XB |
| C801, C802, C803 | Capacitor, 1000 pF | Panasonic Electronic Components | ECJ-1VB1H102K |
| R101 | Resistor, 1000 Ω | Panasonic Electronic Components | ERJ-8GEYJ102V |
| R102 | Resistor, 5600 Ω | Panasonic Electronic Components | ERJ-8GEYJ562V |
| R103, R804 | Resistor, 10 Ω | Panasonic Electronic Components | ERJ-8GEYJ100V |
| R801 | Resistor, 2000 Ω | Panasonic Electronic Components | ERJ-8GEYJ202V |
| R802 | Resistor, 1200 Ω | Panasonic Electronic Components | ERJ-3GEYJ122V |
| R803 | Resistor, 1300 Ω | Panasonic Electronic Components | ERJ-3GEYJ132V |
| S1 | Transistor | Infineon Technologies | BCP56 |
| S2 | Voltage Regulator | Texas Instruments | LM7805 |
| S3 | Potentiometer, 2k Ω | Bourns Inc. | 3224W-1-202E |
| **Output** | | | |
| C201 | Capacitor, 6800 µF | Panasonic Electronic Components | ECO-S2AP682EA |
| C202 | Capacitor, 100 µF | Cornell Dubilier Electronics (CDE) | SK101M100ST |
| C203 | Capacitor, 22 µF | Cornell Dubilier Electronics (CDE) | SEK220M100ST |
| C204, C205, C207 | Capacitor, 39 pF | ATC | ATC100B390KW500XB |
| C206, C210 | Capacitor, 1 µF | TDK Corporation | C4532X7R2A105M230KA |
| C208, C209 | Capacitor, 10 µF | TDK Corporation | C5750X5R1H106K230KA |
| C211 | Capacitor, 10 µF | Panasonic Electronic Components | EEV-HD1H100P |
| R201, R202 | Resistor, 5600 Ω | Panasonic Electronic Components | ERJ-8GEYJ562V |

## Package Outline Specifications

### Package H-36248-2

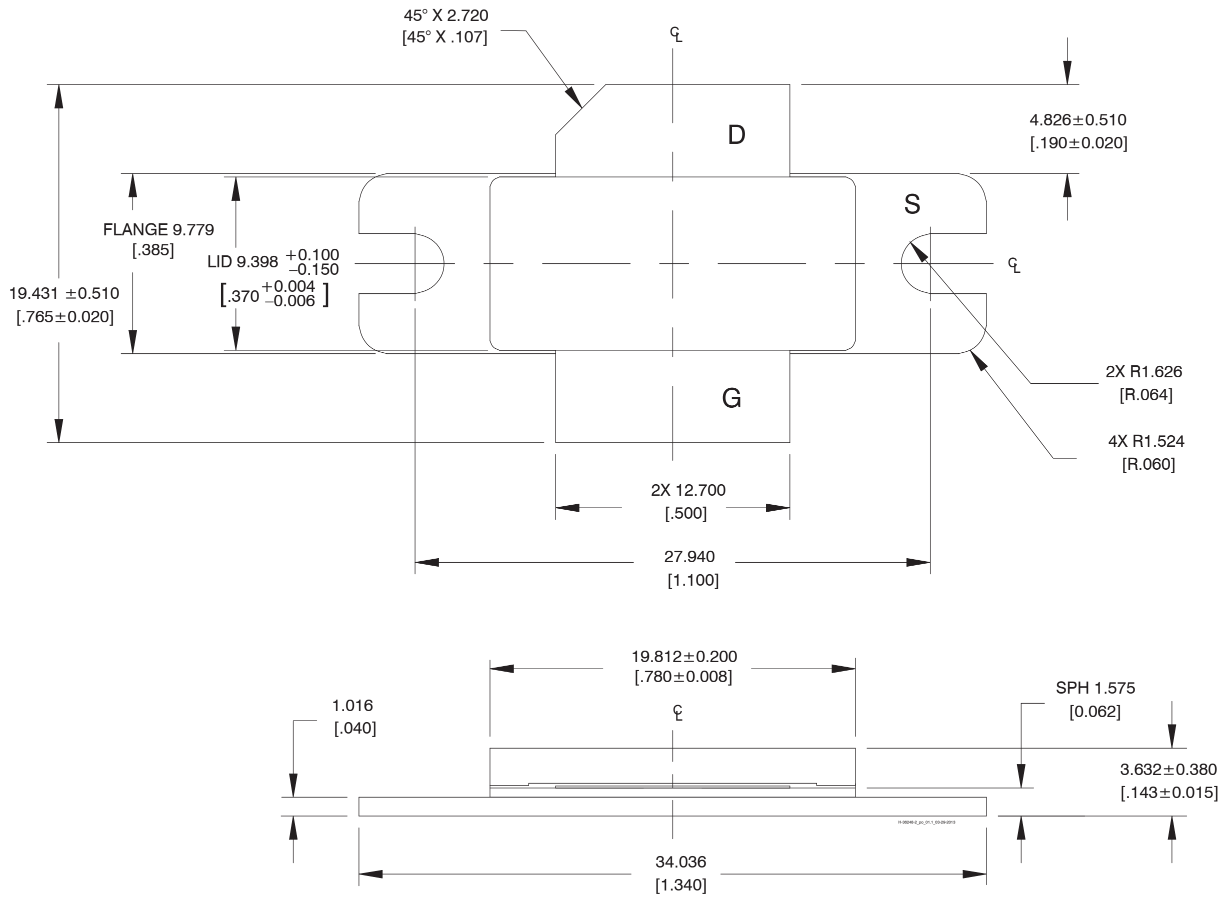
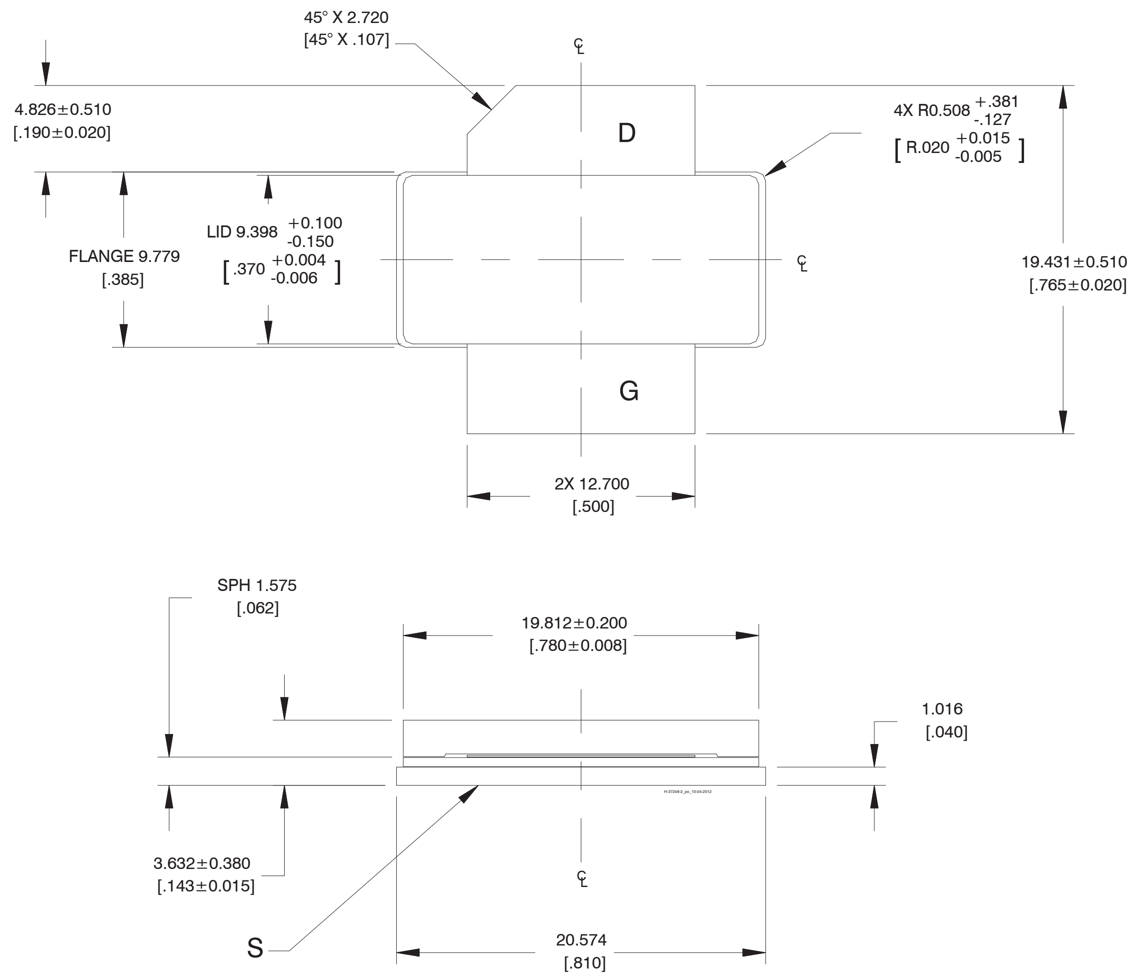



Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ± 0.127 [.005] unless specified otherwise.
4. Pins: D – drain; G – gate; S – source.
5. Lead thickness: 0.10 + 0.051/-0.025 mm [.004 +0.002/-0.001 inch].
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch].

## Package Outline Specifications (cont.)

### Package H-37248-2

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## Revision History

| Revision | Date | Data Sheet Type | Page | Subjects (major changes since last revision) |
|---|---|---|---|---|
| 01 | 2012-06-05 | Preliminary | All | Data Sheet reflects preliminary specification |
| 02 | 2013-03-06 | Production | All | Data Sheet reflects released product specification |
| 03 | 2013-07-11 | Production | All<br>1, 9, 12 | Updated to include FC version<br>Revised Pulsed RF performance table, Minor cosmetic changes only, Added package outline |
| 04 | 2014-04-29 | Production | All, 1 | Revised product from V1 to V2, Revised target RF Charateristics table |
| 04.1 | 2014-06-26 | Production | All<br>3 | Corrected FC version to V1 throughout<br>Corrected package to H-36248-2 and H-37248-2 in ordering table |
| 05 | 2015-07-07 | Production | 8 | Added typical performance at 22ms, 50% pulse |
| 05.1 | 2016-04-26 | Production | 1, 3 | Added ESD rating, updated ordering information |
| 05.2 | 2016-02-07 | Production | 2 | Updated operating voltage and junction temperature |
| 06 | 2018-06-19 | Production | All | Converted to Wolfspeed Data Sheet |

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## Notes

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**Океан Электроники**
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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения **«JONHON»**, а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов **«FORSTAR»**.

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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