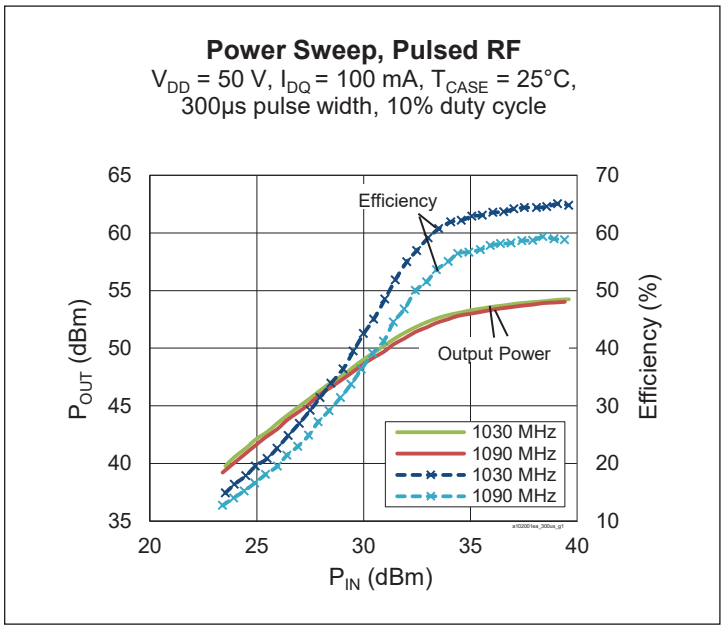
# PTVA102001EA

## Thermally-Enhanced High Power RF LDMOS FET
## 200 W, 50 V, 960 – 1600 MHz

### Description

The PTVA102001EA is a 200-watt LDMOS FET intended for use in power amplifier applications in the 960 to 1600 MHz frequency band. Features include high gain and thermally-enhanced package with bolt-down flange. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.


PTVA102001EA
Package H-36265-2




### Features

- Input matched
- Capable of handling 10:1 VSWR @50 V, 200 W (CW) output power
- Integrated ESD protection
- Low thermal resistance
- Pb-free and RoHS compliant

### RF Characteristics

**Pulsed RF Performance** (tested in Wolfspeed production test fixture)
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 200 W, $f$ = 1090 MHz, 300 µs pulse width, 10% duty cycle

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Gain | $G_{ps}$ | 17 | 18.5 | — | dB |
| Drain Efficiency | $\eta_D$ | 56 | 59.5 | — | % |

*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, $I_{DQ}$ = 100 mA, Input signal ($t_r$ = 5 ns, $t_f$ = 6.5 ns), $T_{CASE}$ = 25°C, class AB test

| Mode of Operation | *f* (MHz) | IRL (dB) | $P_{1dB}$ | | | $P_{3dB}$ | | | $P_{droop\ (pulse)}$ @ 200 W | $t_r$ (ns) | $t_f$ (ns) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | Gain (dB) | Eff (%) | $P_{OUT}$ (W) | | | |
| 300 µs, 10% Duty Cycle | 1030 | –10 | 18.5 | 60 | 204 | 16.5 | 62 | 240 | 0.10 | 6.0 | 7.9 |
| 1 ms, 10% Duty Cycle | 1030 | –10 | 18.3 | 60 | 200 | 16.3 | 62 | 235 | 0.20 | — | — |
| 20 ms, 10% Duty Cycle | 1030 | –10 | 18.2 | 59 | 195 | 16.2 | 61 | 225 | 0.25 | — | — |
| 16 ms, 50% Duty Cycle | 1030 | –10 | 18.2 | 58 | 190 | 16.2 | 60 | 215 | 0.30 | — | — |

## 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 | µA |
| | $V_{DS}$ = 111 V, $V_{GS}$ = 0 V | $I_{DSS}$ | — | — | 10 | µA |
| Gate Leakage Current | $V_{GS}$ = 10 V, $V_{DS}$ = 0 V | $I_{GSS}$ | — | — | 1 | µA |
| On-State Resistance | $V_{GS}$ = 10 V, $V_{DS}$ = 0.1 V | $R_{DS(on)}$ | — | 0.34 | — | Ω |
| Operating Gate Voltage | $V_{DS}$ = 50 V, $I_{DQ}$ = 100 mA | $V_{GS}$ | 3.1 | 3.35 | 3.5 | V |

## 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 Characteristics

$T_{CASE}$ = 70°C, 167 W (CW), 50 V, $I_{DQ}$ = 100 mA, 1030 MHz

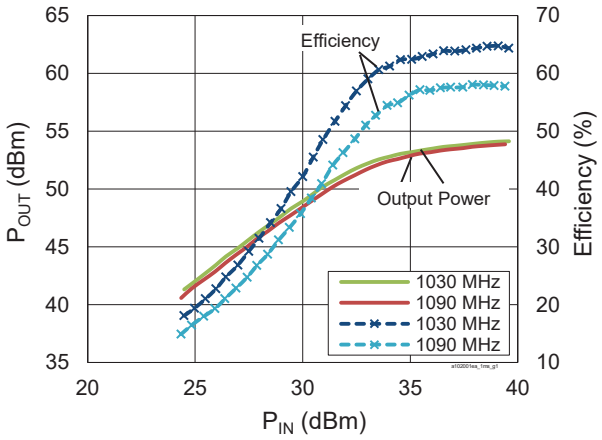
| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance | $R_{\theta JC}$ | 0.70 | °C/W |

## Ordering Information

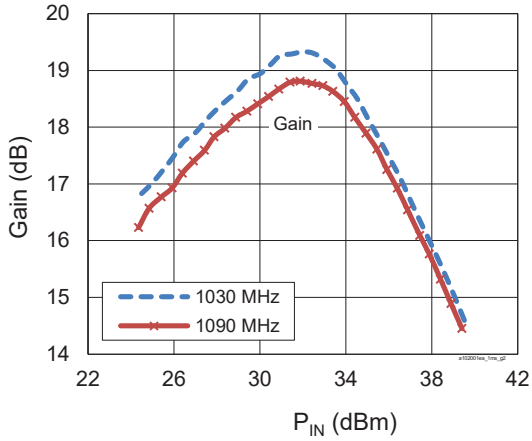
| Type and Version | Order Code | Package Description | Shipping |
|---|---|---|---|
| PTVA102001EA V1 R0 | PTVA102001EA-V1-R0 | H-36265-2, bolt-down | Tape & Reel, 50 pcs |
| PTVA102001EA V1 R2 | PTVA102001EA-V1-R2 | H-36265-2, bolt-down | Tape & Reel, 250 pcs |

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

**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
1ms pulse width, 10% duty cycle

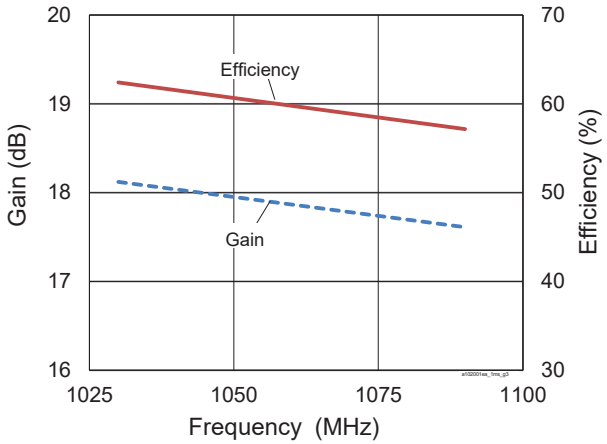



**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
1ms pulse width, 10% duty cycle

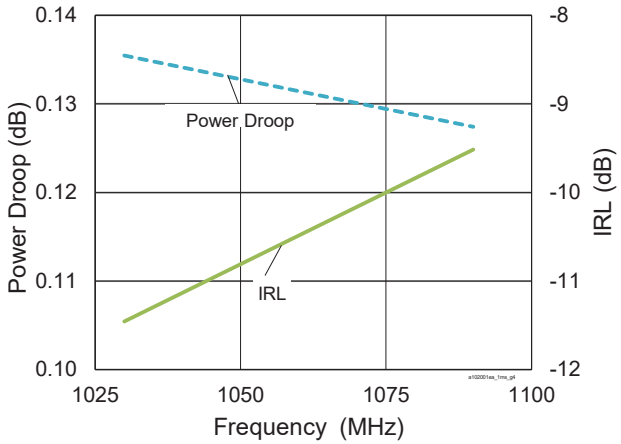


## Typical RF Performance (cont.)

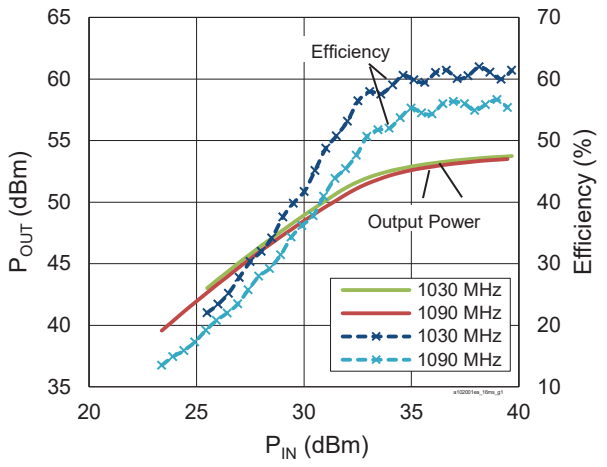
**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 200 W,
1ms pulse width, 10% duty cycle



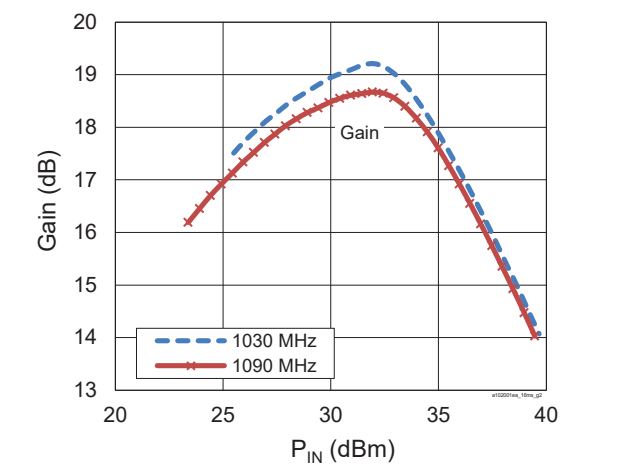

**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 200 W,
1ms pulse width, 10% duty cycle




**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
16ms pulse width, 50% duty cycle

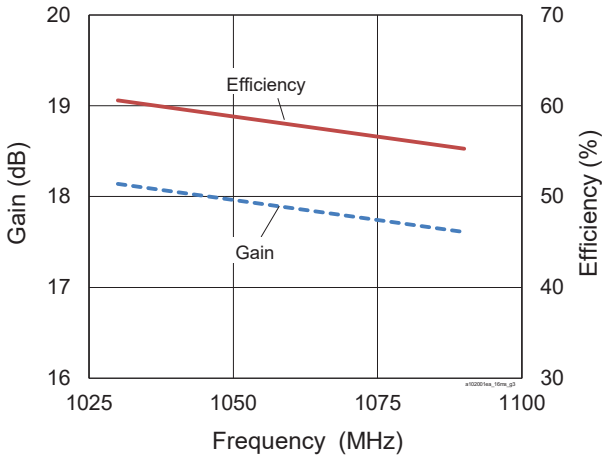



**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
16ms pulse width, 50% duty cycle

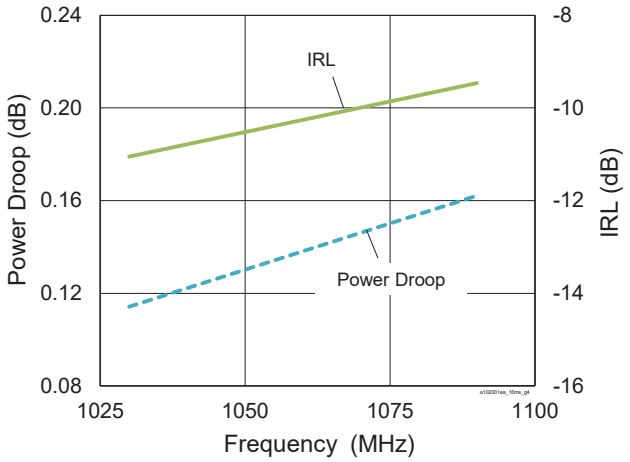


## Typical RF Performance (cont.)

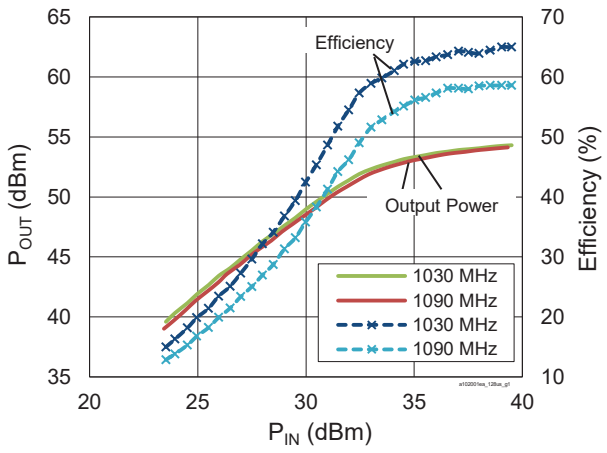
**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 190 W,
16ms pulse width, 50% duty cycle



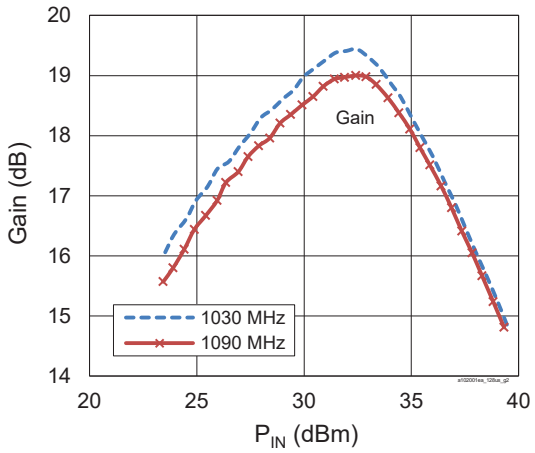

**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 190 W,
16ms pulse width, 50% duty cycle




**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
128µS pulse width, 1% duty cycle

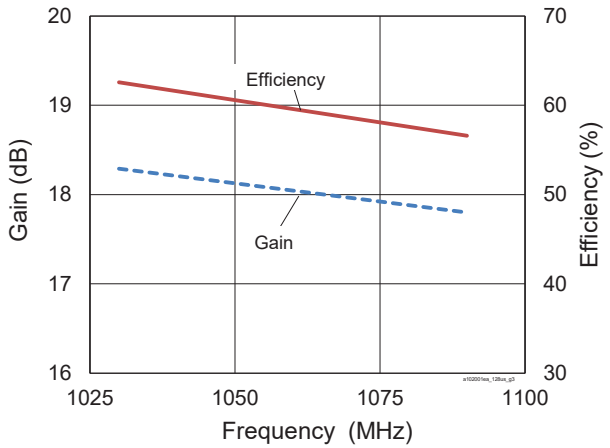



**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
128µS pulse width, 1% duty cycle

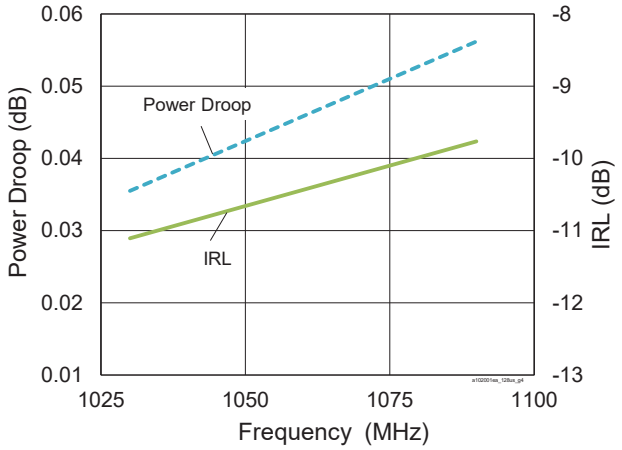


## Typical RF Performance (cont.)

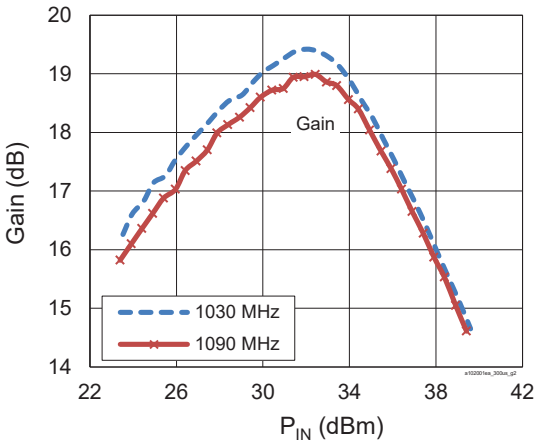
**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 210 W,
128µS pulse width, 1% duty cycle



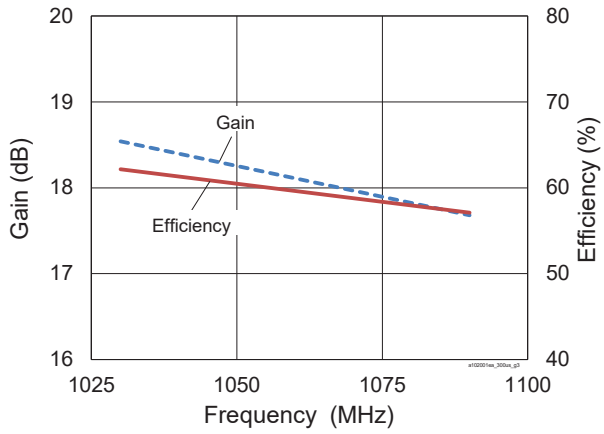

**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 210 W,
128µS pulse width, 1% duty cycle




**Power Sweep, Pulsed RF**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $T_{CASE}$ = 25°C,
300µs pulse width, 10% duty cycle

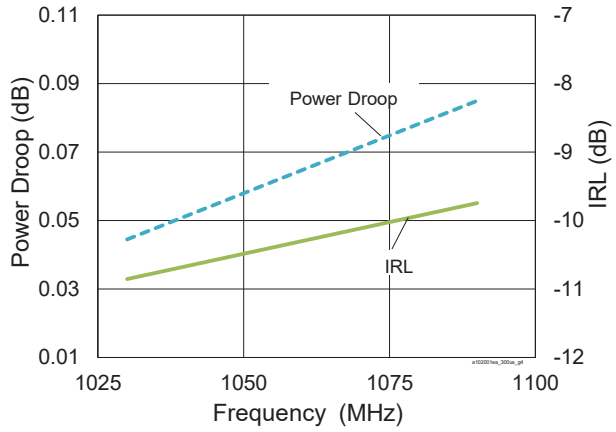



**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 205 W,
300µs pulse width, 10% duty cycle

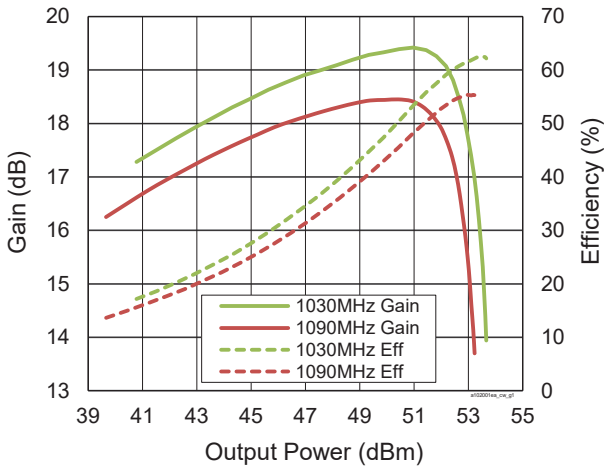


## Typical RF Performance (cont.)

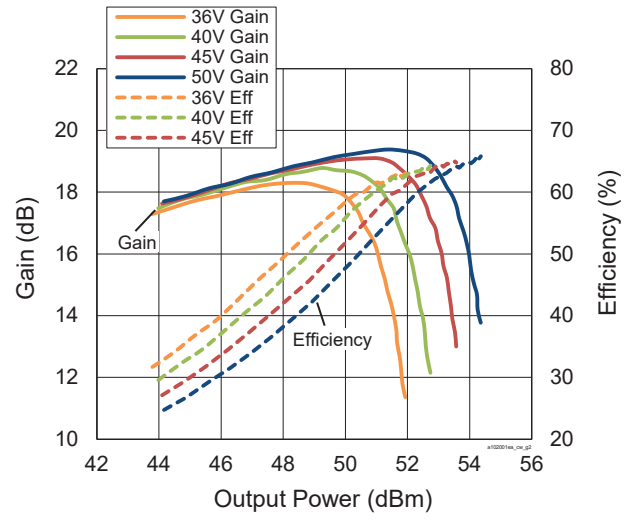
**Pulsed RF Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 205 W,
300µs pulse width, 10% duty cycle



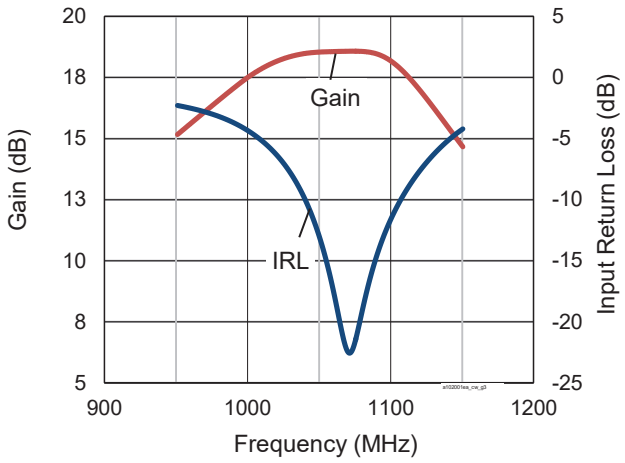

**CW Performance**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA



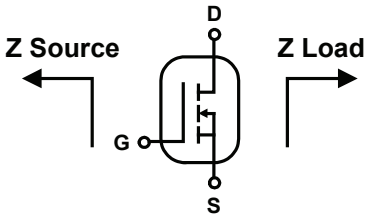

**Pulse CW Performance at Various $V_{DD}$**
300µs pulse width, 10% duty cycle,
$I_{DQ}$ = 100mA, $f$=1030 MHz




**Small Signal CW Performance**
**Gain & Input Return Loss**
$V_{DD}$ = 50 V, $I_{DQ}$ = 100 mA



## Load Pull Performance




**Pulsed CW signal:** 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, $I_{DQ}$ = 90 mA

| | | P3dB | | | | |
|---|---|---|---|---|---|---|
| | | Maximum Power | | | | |
| Freq [MHz] | $Z_{IN}$ [Ω] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
| 960 | 0.97 – j4.50 | 54.99 | 315 | 16.56 | 59.8 | 2.04 – j0.34 |
| 1030 | 1.25 – j5.26 | 54.59 | 288 | 15.63 | 57.5 | 2.26 – j0.43 |
| 1090 | 1.80 – j5.85 | 54.53 | 284 | 15.64 | 58.9 | 1.77 – j0.33 |
| 1150 | 2.37 – j7.11 | 54.53 | 284 | 15.23 | 57.0 | 2.04 – j0.65 |
| 1200 | 2.51 – j6.97 | 54.31 | 270 | 15.13 | 55.3 | 2.09 – j0.67 |
| 1300 | 4.92 – j7.48 | 54.55 | 285 | 14.70 | 56.4 | 1.80 – j0.99 |
| 1400 | 10.54 – j3.45 | 54.41 | 276 | 14.27 | 55.7 | 1.43 – j1.28 |
| 1500 | 7.87 – j0.31 | 54.36 | 273 | 13.62 | 53.1 | 1.66 – j1.93 |
| 1600 | 3.97 – j1.99 | 54.19 | 262 | 13.10 | 52.3 | 1.49 – j2.21 |

**Pulsed CW signal:** 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, $I_{DQ}$ = 90 mA

| | | P3dB | | | | |
|---|---|---|---|---|---|---|
| | | Maximum Efficiency | | | | |
| Freq [MHz] | $Z_{IN}$ [Ω] | $P_{OUT}$ [dBm] | $P_{OUT}$ [W] | $P_G$ [dB] | PAE Eff [%] | $Z_{OUT}$ [Ω] |
| 960 | 0.97 – j4.50 | 53.57 | 228 | 18.32 | 70.0 | 1.73 + j1.19 |
| 1030 | 1.25 – j5.26 | 53.42 | 220 | 17.35 | 67.2 | 1.63 + j0.98 |
| 1090 | 1.80 – j5.85 | 53.38 | 218 | 17.14 | 67.3 | 1.50 + j0.72 |
| 1150 | 2.37 – j7.11 | 53.47 | 222 | 16.82 | 65.8 | 1.41 + j0.42 |
| 1200 | 2.51 – j6.97 | 52.40 | 174 | 17.04 | 65.4 | 1.08 + j0.60 |
| 1300 | 4.92 – j7.48 | 53.17 | 207 | 16.41 | 65.5 | 1.17 – j0.02 |
| 1400 | 10.54 – j3.45 | 52.99 | 199 | 15.95 | 63.4 | 0.85 – j0.61 |
| 1500 | 7.87 – j0.31 | 53.17 | 208 | 15.20 | 60.8 | 1.01 – j1.19 |
| 1600 | 3.97 – j1.99 | 53.15 | 207 | 14.51 | 58.5 | 0.94 – j1.66 |

## Load Pull Performance (cont.)

**Pulsed CW signal:** 16 µs pulse width, 10% duty cycle, class AB, $V_{DD}$ = 50 V, $I_{DQ}$ = 90 mA

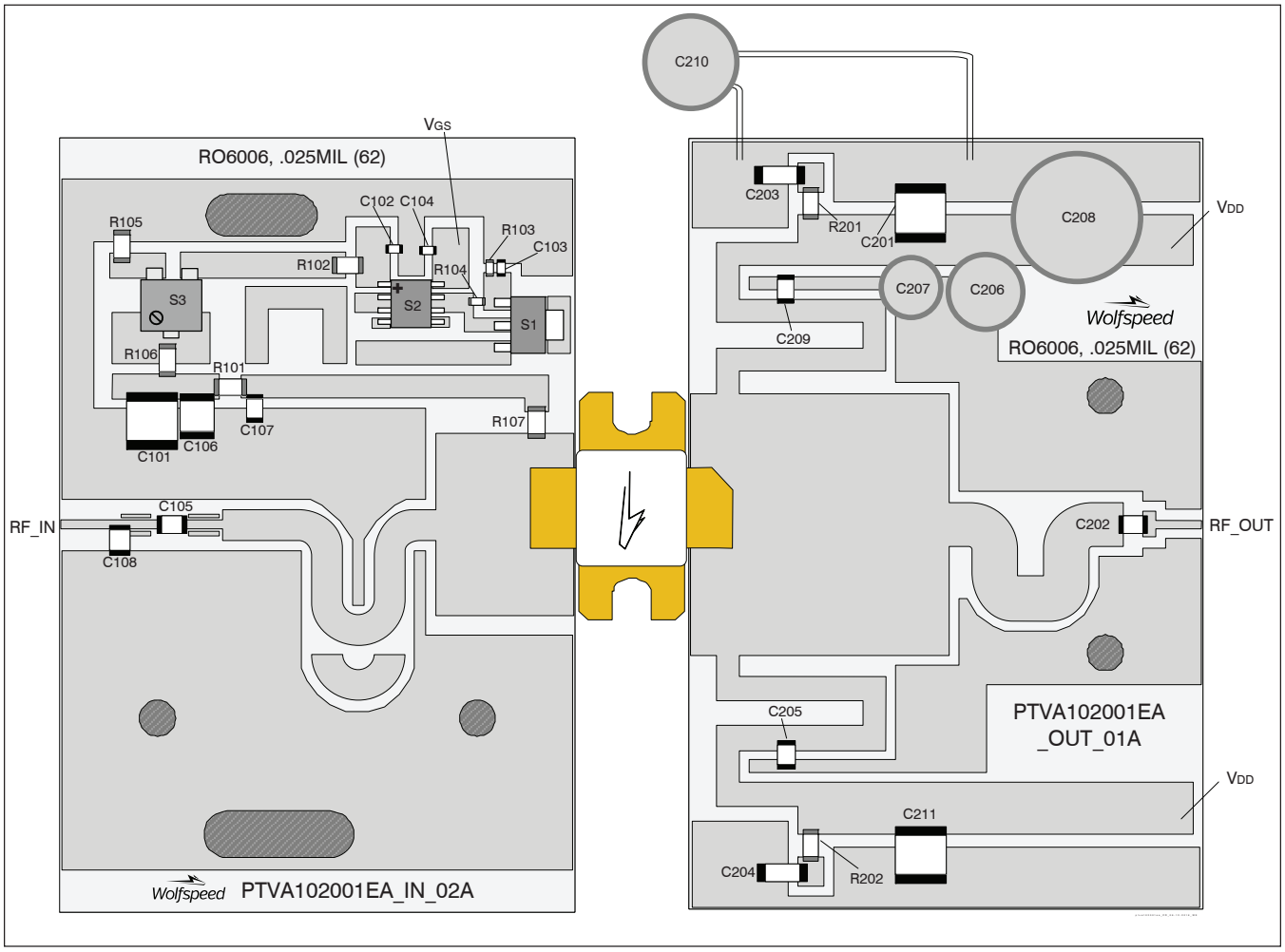
| | | P3dB | | | | |
|---|---|---|---|---|---|---|
| | | Z Optimized | | | | |
| **Freq [MHz]** | **$Z_{IN}$ [Ω]** | **$P_{OUT}$ [dBm]** | **$P_{OUT}$ [W]** | **$P_G$ [dB]** | **PAE Eff [%]** | **$Z_{OUT}$ [Ω]** |
| 960 | 0.97 – j4.50 | 54.51 | 282 | 17.55 | 67.5 | 1.94 + j0.54 |
| 1030 | 1.25 – j5.26 | 54.18 | 262 | 16.79 | 65.1 | 1.85 + j0.51 |
| 1090 | 1.80 – j5.85 | 54.17 | 261 | 16.54 | 65.3 | 1.71 + j0.28 |
| 1150 | 2.37 – j7.11 | 54.12 | 258 | 16.28 | 63.9 | 1.65 + j0.04 |
| 1200 | 2.51 – j6.97 | 53.78 | 239 | 16.23 | 62.9 | 1.48 + j0.06 |
| 1300 | 4.92 – j7.48 | 53.99 | 251 | 15.79 | 62.3 | 1.54 – j0.32 |
| 1400 | 10.54 – j3.45 | 53.89 | 245 | 15.34 | 62.0 | 1.07 – j0.84 |
| 1500 | 7.87 – j0.31 | 53.86 | 243 | 14.71 | 59.5 | 1.22 – j1.43 |
| 1600 | 3.97 – j1.99 | 53.71 | 235 | 14.09 | 57.5 | 1.05 – j1.82 |

**See next page for reference circuit information**

## Reference Circuit, 1030 – 1090 MHz

### Reference Circuit Assembly

| | |
|---|---|
| DUT | PTVA102001EA |
| Test Fixture Part No. | LTN/PTVA102001EA V1 |
| PCB | Rogers 6006, 0.635 mm [0.025"] thick, 2 oz. copper, $\varepsilon_r$ = 6.15 |




*Reference circuit assembly diagram (not to scale)*

## Reference Circuit (cont.)

### Components Information

| Component | Description | Manufacturer | P/N |
|---|---|---|---|
| **Input** | | | |
| C101 | Capacitor, 10 µF | TDK Corporation | C5750X5R1H106K230KA |
| C102, C103, C104 | Capacitor, 1000 pF | Panasonic Electronic Components | ECJ-1VB1H102K |
| C105, C107 | Capacitor, 39 pF | ATC | ATC100B390KW500XB |
| C106 | Capacitor, 1 µF | TDK Corporation | C4532X7R2A105M230KA |
| C108 | Capacitor, 3.6 pF | ATC | ATC100B3R6CW500XB |
| R101 | Resistor, 5.6 Ω | Panasonic Electronic Components | ERJ-8RQJ5R6V |
| R102, R107 | Resistor, 10 Ω | Panasonic Electronic Components | ERJ-8GEYJ100V |
| R103 | Resistor, 1.3K Ω | Panasonic Electronic Components | ERJ-3GEYJ132V |
| R104 | Resistor, 1.2K Ω | Panasonic Electronic Components | ERJ-3GEYJ122V |
| R105 | Resistor, 2000 Ω | Panasonic Electronic Components | ERJ-8GEYJ202V |
| R106 | Resistor, 1000 Ω | Panasonic Electronic Components | ERJ-8GEYJ102V |
| S1 | Transistor | Infineon Technologies | BCP56 |
| S2 | Voltage Regulator | Texas Instruments | LM78L05ACM |
| S3 | Potentiometer, 2k Ω | Bourns Inc. | 3224W-1-202E |
| **Output** | | | |
| C201, C211 | Capacitor, 10 µF | TDK Corporation | C5750X5R1H106K230KA |
| C202, C205, C209 | Capacitor, 39 pF | ATC | ATC100B390KW500XB |
| C203, C204 | Capacitor, 1 µF | TDK Corporation | C4532X7R2A105M230KA |
| C206 | Capacitor, 22 µF | Cornell Dubilier Electronics (CDE) | SEK220M100ST |
| C207 | Capacitor, 10 µF | Cornell Dubilier Electronics (CDE) | SEK100M100ST |
| C208 | Capacitor, 100 µF | Cornell Dubilier Electronics (CDE) | SK101M100ST |
| C210 | Capacitor, 6800 µF | Panasonic Electronic Components | ECO-S2AP682EA |
| R201, R202 | Resistor, 5.6 Ω | Panasonic Electronic Components | ERJ-8RQJ5R6V |

## Package Outline Specifications

### Package H-36265-2

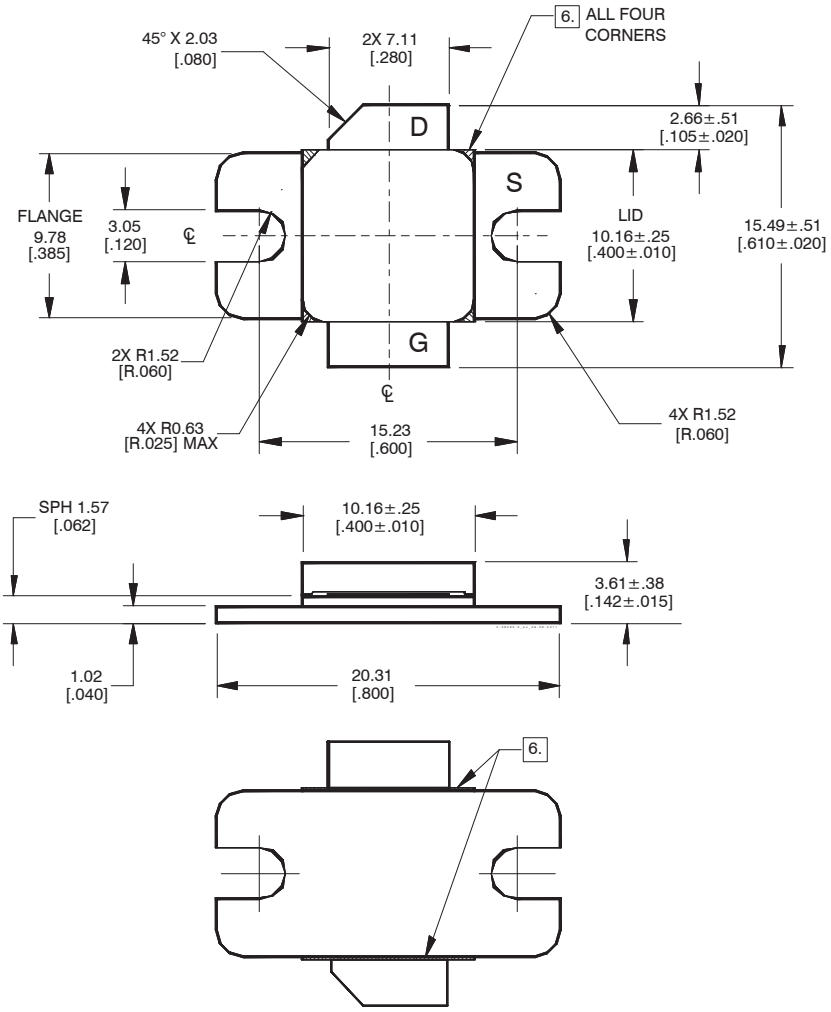



Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ±0.127 [0.005] unless specified otherwise.
4. Pins: D – drain; G – gate; S – source
5. Lead thickness: 0.10 + 0.051/–0.025 mm [0.004 + 0.002/–0.001 inch].
6. Exposed metal plane on top and bottom of ceramic insulator.
7. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch].

## Revision History

| Revision | Date | Data Sheet Type | Page | Subjects (major changes at each revision) |
|---|---|---|---|---|
| 01 | 2015-07-22 | Advance | All | Data Sheet reflects advance specification for product development |
| 02 | 2015-09-22 | Production | All | Data Sheet reflects released product specification |
| 02.1 | 2017-02-08 | Production | 2 | Updated operating voltage and junction temperature |
| 03 | 2017-08-17 | Production | 1<br>2<br>5<br>8, 9 | Extend bandwidth to 1600 MHz<br>New Thermal Characteristics table<br>Remove duplicate graph<br>Add load pull points |
| 04 | 2018-06-12 | Production | All | Converted to Wolfspeed Data Sheet |

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com
919.407.7816

## Notes

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