

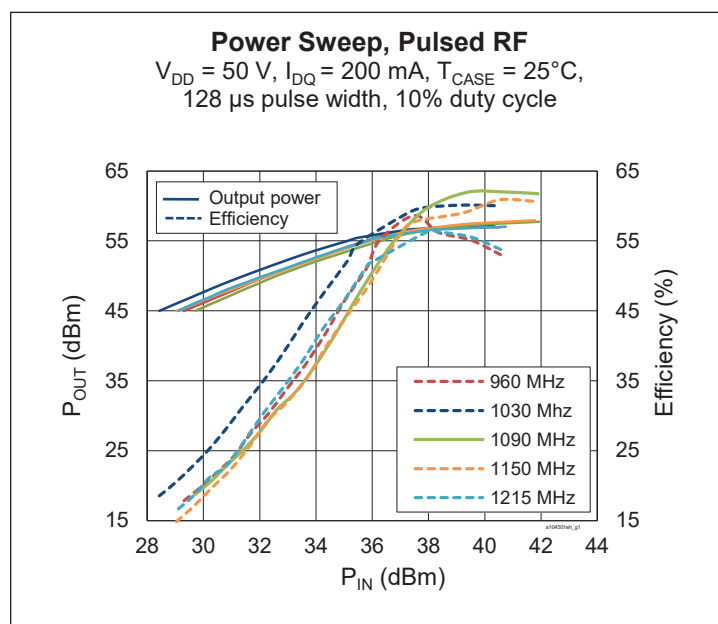
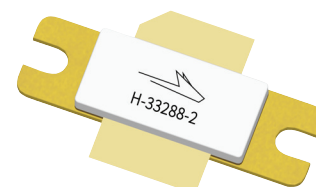
PTVA104501EH

Thermally-Enhanced High Power RF LDMOS FET 450 W, 50 V, 960 – 1215 MHz

Description

The PTVA104501EH LDMOS FET is designed for use in power amplifier applications in the 960 to 1215 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.

PTVA104501EH
Package H-33288-2



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 450 W peak under RF pulse, 128 μs , 10% duty cycle.

RF Characteristics

Pulsed RF Performance (tested in Wolfspeed test fixture)

$V_{DD} = 50\text{ V}$, $I_{DQ} = 200\text{ mA}$, $P_{OUT} = 450\text{ W}$ (peak), $f_1 = 960\text{ MHz}$, $f_2 = 1090\text{ MHz}$, $f_3 = 1215\text{ MHz}$, RF pulse 128 μs , 10% duty cycle

| Characteristic | Symbol | Min | Typ | Max | Unit |
|------------------|------------|------|------|-----|------|
| Gain | G_{ps} | 16.5 | 17.5 | — | dB |
| Drain Efficiency | η_D | 53 | 58 | — | % |
| Gain Flatness | ΔG | — | 0.85 | 1.8 | dB |
| Return Loss | IRL | — | -9.5 | -6 | dB |

All published data at $T_{CASE} = 25^\circ\text{C}$ 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)
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 200\text{ mA}$, Input signal ($t_r = 7.0\text{ ns}$, $t_f = 7.0\text{ ns}$), $128\text{ }\mu\text{s}$ pulse width, 10% duty cycle, class AB test

| Mode of Operation | f (MHz) | IRL (dB) | P _{1dB} | | | P _{3dB} | | | Max P _{droop} (pulse) @ P _{1dB} | t_r (ns) @ P _{1dB} | t_f (ns) @ P _{1dB} |
|-------------------------|-----------|----------|------------------|---------|----------------------|------------------|---------|----------------------|---|-------------------------------|-------------------------------|
| | | | Gain (dB) | Eff (%) | P _{OUT} (W) | Gain (dB) | Eff (%) | P _{OUT} (W) | | | |
| 128 μs , 10% | 960 | -7.5 | 18.0 | 56 | 460 | 16.0 | 53 | 490 | 0.15 | 5 | <2 |
| | 1030 | -13.0 | 18.5 | 59 | 470 | 16.5 | 60 | 540 | 0.15 | 5 | <2 |
| | 1090 | -8.0 | 17.8 | 61 | 510 | 15.8 | 61 | 590 | 0.20 | 5 | <2 |
| | 1150 | -15.0 | 18.1 | 59 | 540 | 16.1 | 60 | 620 | 0.20 | 5 | <2 |
| | 1215 | -9.0 | 18.3 | 56 | 460 | 16.3 | 53 | 510 | 0.20 | 5 | <2 |

DC Characteristics

| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|--------------------------------|---|---------------|-----|-----|-----|---------------|
| Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$ | $V_{(BR)DSS}$ | 105 | — | — | V |
| Drain Leakage Current | $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 1 | μA |
| | $V_{DS} = 111\text{ V}$, $V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 10 | μA |
| On-State Resistance | $V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$ | $R_{DS(on)}$ | — | 0.1 | — | Ω |
| Operating Gate Voltage | $V_{DS} = 50\text{ V}$, $I_{DQ} = 200\text{ mA}$ | V_{GS} | 3.0 | 3.5 | 4.0 | V |
| Gate Leakage Current | $V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$ | I_{GSS} | — | — | 1 | μA |

Maximum Ratings

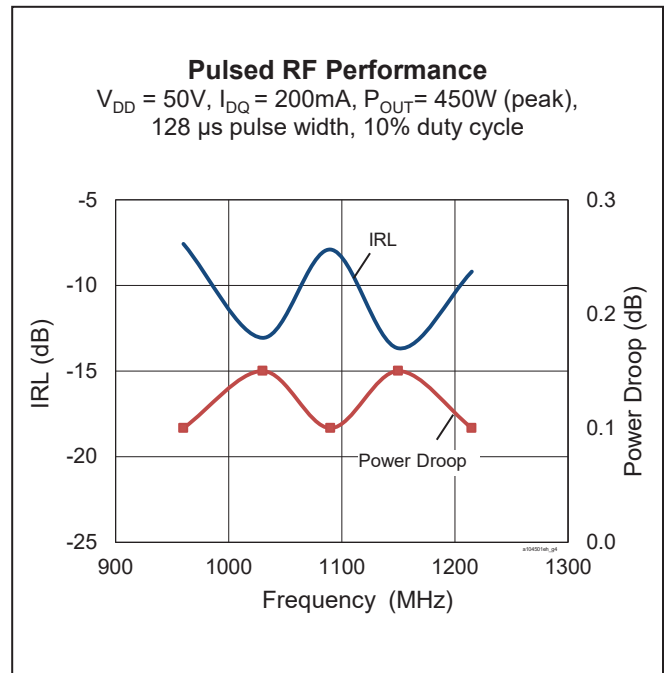
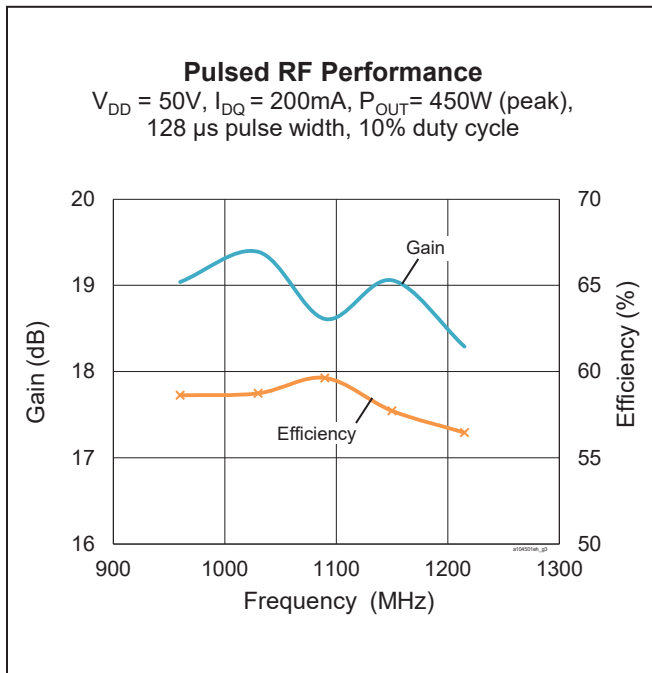
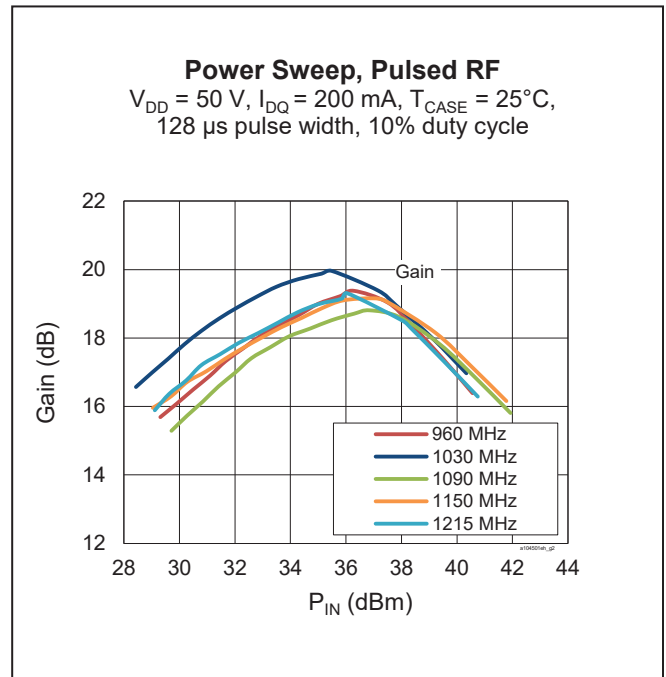
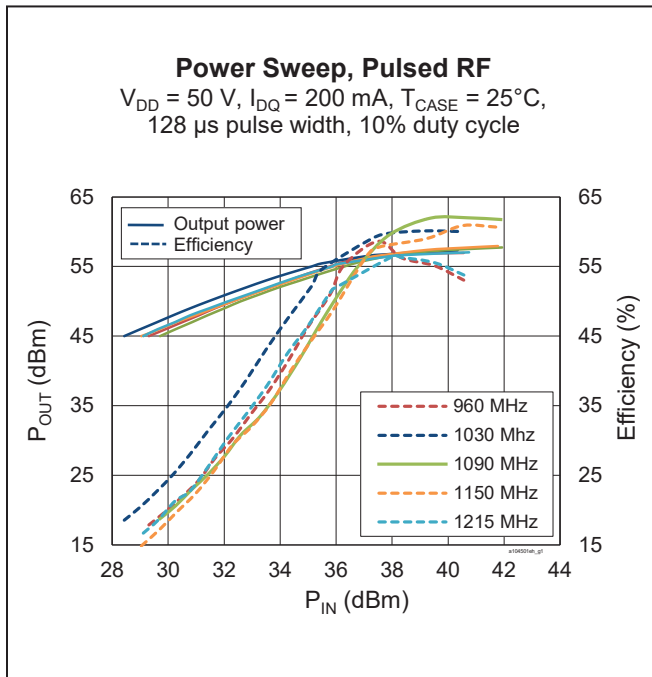
| Parameter | Symbol | Value | Unit |
|---------------------------|-----------------|-------------|----------------------|
| Drain-Source Voltage | V_{DSS} | 105 | V |
| Gate-Source Voltage | V_{GS} | -6 to +12 | V |
| Operating Voltage | V_{DD} | 0 to +55 | V |
| Junction Temperature | T_J | 225 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{STG} | -65 to +150 | $^{\circ}\text{C}$ |
| Thermal Resistance | $R_{\theta JC}$ | 0.25 | $^{\circ}\text{C/W}$ |

($T_{CASE} = 70^{\circ}\text{C}$, 430 W CW, $f = 1090\text{ MHz}$, $V_{DD} = 50\text{ V}$, $I_{DQ} = 200\text{ mA}$)

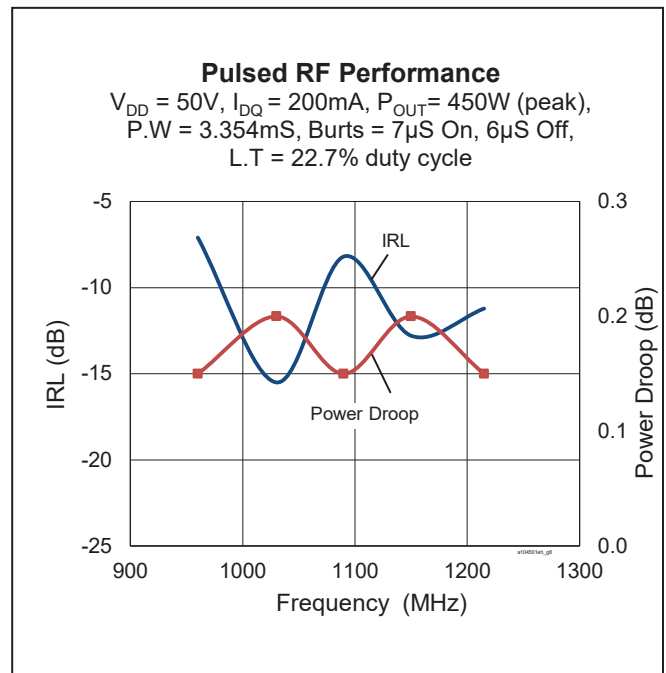
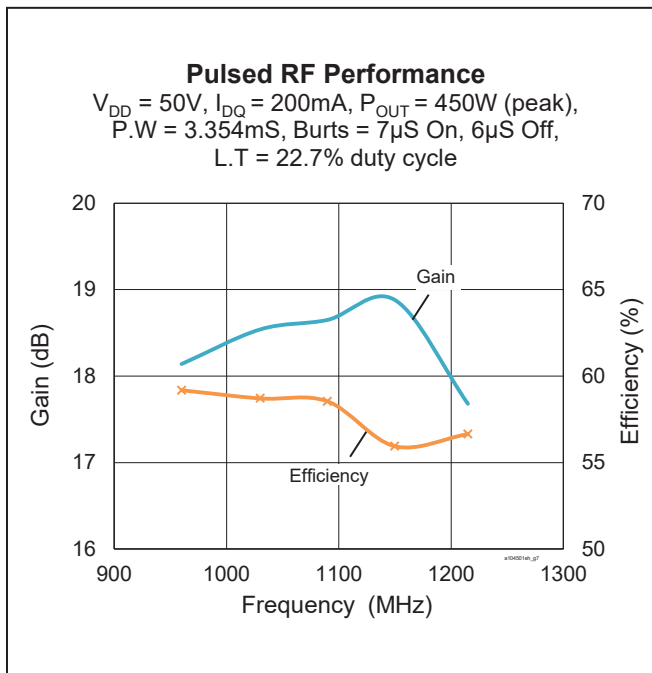
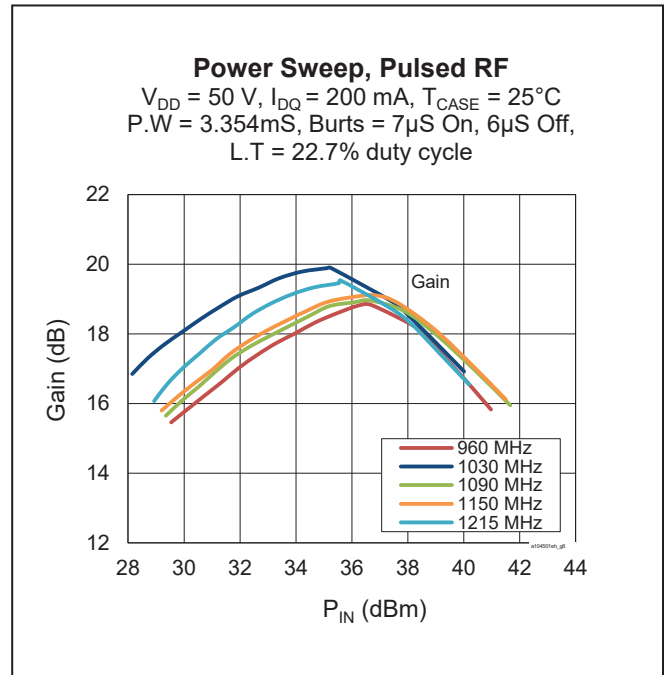
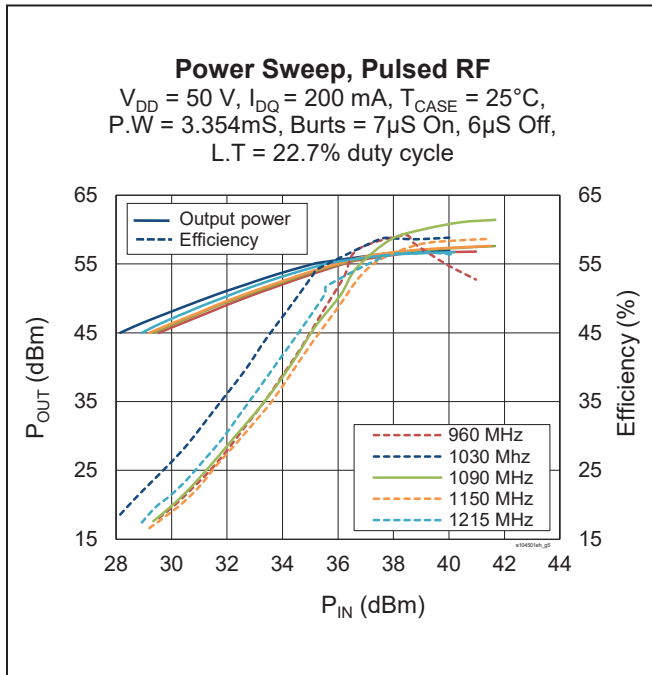
Ordering Information

| Type and Version | Order Code | Package Description | Shipping |
|----------------------|----------------------|---------------------|----------------------|
| PTVA104501EH V1 R0 | PTVA104501EH-V1-R0 | H-33288-2 | Tape & Reel, 50 pcs |
| PTVA104501EH V1 R250 | PTVA104501EH-V1-R250 | H-33288-2 | Tape & Reel, 250 pcs |

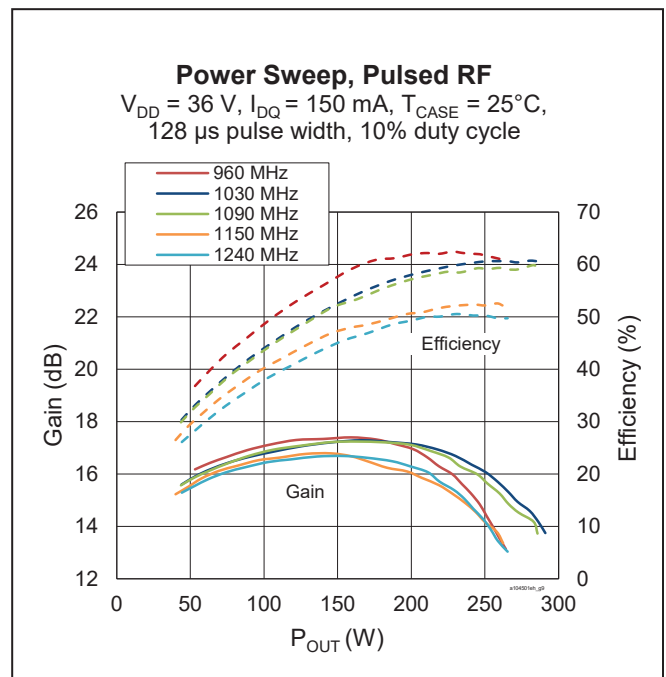
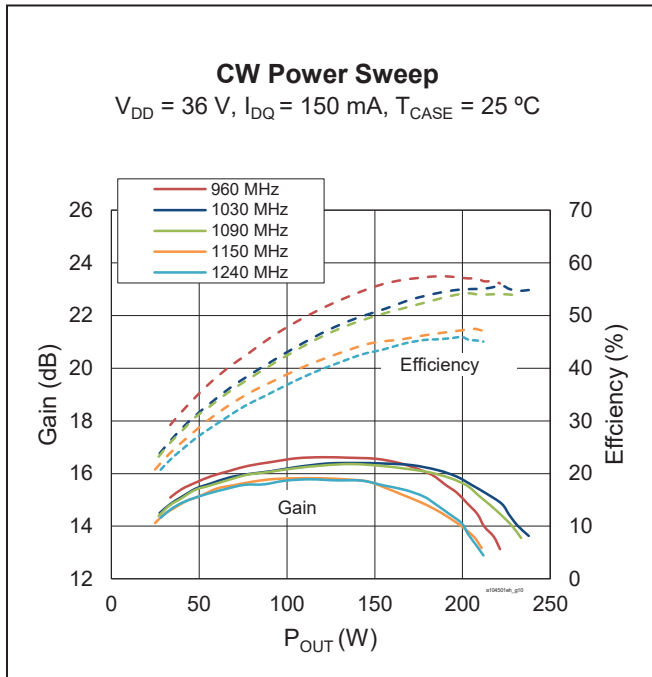
Typical RF Performance (data taken in production test fixture)



Typical RF Performance (cont.)

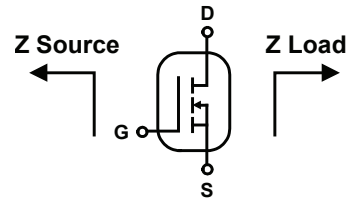


Typical RF Performance (cont.)



Broadband Circuit Impedance

| Freq [MHz] | Z Source Ω | | Z Load Ω | |
|------------|-------------------|-------|-----------------|-------|
| | R | jX | R | jX |
| 960 | 2.04 | -0.30 | 0.79 | -0.02 |
| 1030 | 1.71 | -0.18 | 0.73 | 0.64 |
| 1090 | 1.45 | 0.09 | 0.95 | 1.09 |
| 1150 | 1.23 | 0.41 | 1.26 | 0.98 |
| 1215 | 1.07 | 0.77 | 0.71 | 0.93 |



Load Pull Performance

Load Pull at Max P_{OUT} Point – 16 μ s pulse width, 10% duty cycle, class AB, V_{DD} = 50 V, 200 mA

| Freq [MHz] | ZI [Ω] | P _{IN} [dBm] | P _{OUT} [dBm] | P _{OUT} [W] | P _G [dB] | PAE Eff [%] | Z _{OUT} [Ω] |
|------------|-----------------|-----------------------|------------------------|----------------------|---------------------|-------------|-------------------------------|
| 960 | 1.35 – j0.70 | 43.30 | 57.83 | 606.74 | 14.53 | 54.90 | 1.29 – j1.37 |
| 1030 | 0.99 – j0.78 | 42.14 | 57.62 | 578.10 | 15.48 | 50.96 | 1.02 – j1.43 |
| 1090 | 1.24 – j0.84 | 41.37 | 57.40 | 549.54 | 16.03 | 50.52 | 1.06 – j1.51 |
| 1215 | 1.56 – j0.99 | 39.24 | 56.92 | 492.04 | 17.68 | 48.12 | 1.13 – j1.66 |

Load Pull at Max G_T Point – 16 μ s pulse width, 10% duty cycle, class AB, V_{DD} = 50 V, 200 mA

| Freq [MHz] | ZI [Ω] | P _{IN} [dBm] | P _{OUT} [dBm] | P _{OUT} [W] | P _G [dB] | PAE Eff [%] | Z _{OUT} [Ω] |
|------------|-----------------|-----------------------|------------------------|----------------------|---------------------|-------------|-------------------------------|
| 960 | 1.35 – j0.70 | 40.10 | 55.70 | 371.54 | 15.60 | 58.76 | 2.15 – j2.60 |
| 1030 | 0.99 – j0.78 | 38.16 | 55.33 | 341.19 | 17.17 | 59.44 | 2.73 – j2.02 |
| 1090 | 1.24 – j0.84 | 36.05 | 54.14 | 259.42 | 18.09 | 56.31 | 3.55 – j0.42 |
| 1215 | 1.56 – j0.99 | 33.38 | 53.42 | 219.79 | 20.04 | 49.44 | 1.34 – j0.08 |

Load Pull at Max Efficiency Point – 16 μ s pulse width, 10% duty cycle, class AB, V_{DD} = 50 V, 200 mA

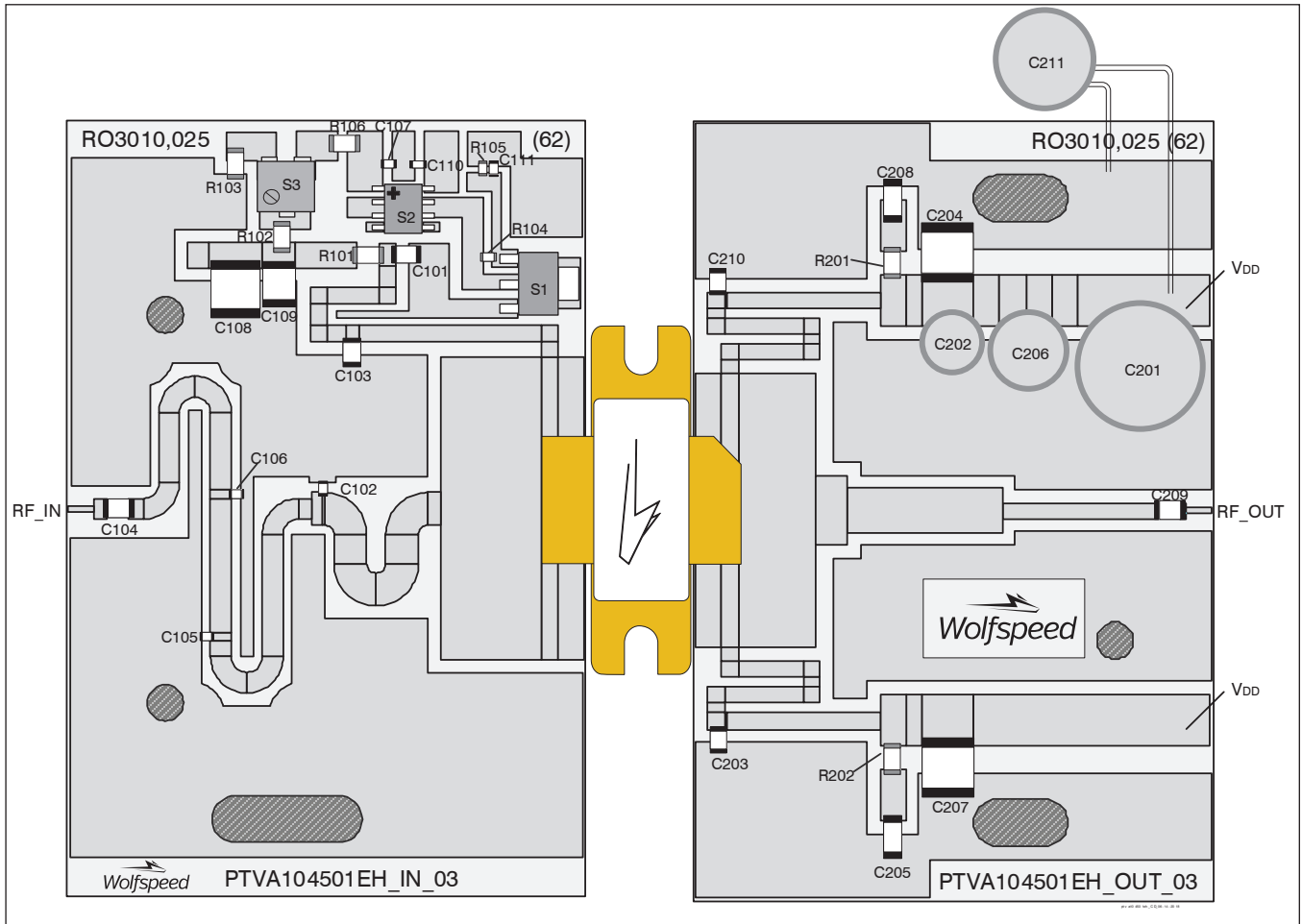
| Freq [MHz] | ZI [Ω] | P _{IN} [dBm] | P _{OUT} [dBm] | P _{OUT} [W] | P _G [dB] | PAE Eff [%] | Z _{OUT} [Ω] |
|------------|-----------------|-----------------------|------------------------|----------------------|---------------------|-------------|-------------------------------|
| 960 | 1.35 – j0.70 | 42.00 | 57.27 | 533.33 | 15.27 | 62.15 | 1.60 – j1.79 |
| 1030 | 0.99 – j0.78 | 39.44 | 56.34 | 430.53 | 16.90 | 61.78 | 2.27 – j1.50 |
| 1090 | 1.24 – j0.84 | 37.54 | 55.36 | 343.56 | 17.82 | 59.60 | 2.72 – j1.29 |
| 1215 | 1.56 – j0.99 | 36.19 | 55.58 | 361.41 | 19.39 | 56.63 | 1.65 – j0.92 |

Z Optimum – 16 μ s pulse width, 10% duty cycle, class AB, V_{DD} = 50 V, 200 mA

| Freq [MHz] | ZI [Ω] | P _{IN} [dBm] | P _{OUT} [dBm] | P _{OUT} [W] | P _G [dB] | PAE Eff [%] | Z _{OUT} [Ω] |
|------------|-----------------|-----------------------|------------------------|----------------------|---------------------|-------------|-------------------------------|
| 960 | 1.35 – j0.70 | 42.62 | 57.62 | 578.10 | 15.00 | 60.03 | 1.50 – j1.61 |
| 1030 | 0.99 – j0.78 | 39.82 | 56.62 | 459.20 | 16.80 | 61.39 | 2.03 – j1.45 |
| 1090 | 1.24 – j0.84 | 38.71 | 56.21 | 417.83 | 17.50 | 58.60 | 2.02 – j1.38 |
| 1215 | 1.56 – j0.99 | 37.79 | 56.47 | 443.61 | 18.68 | 53.43 | 1.29 – 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

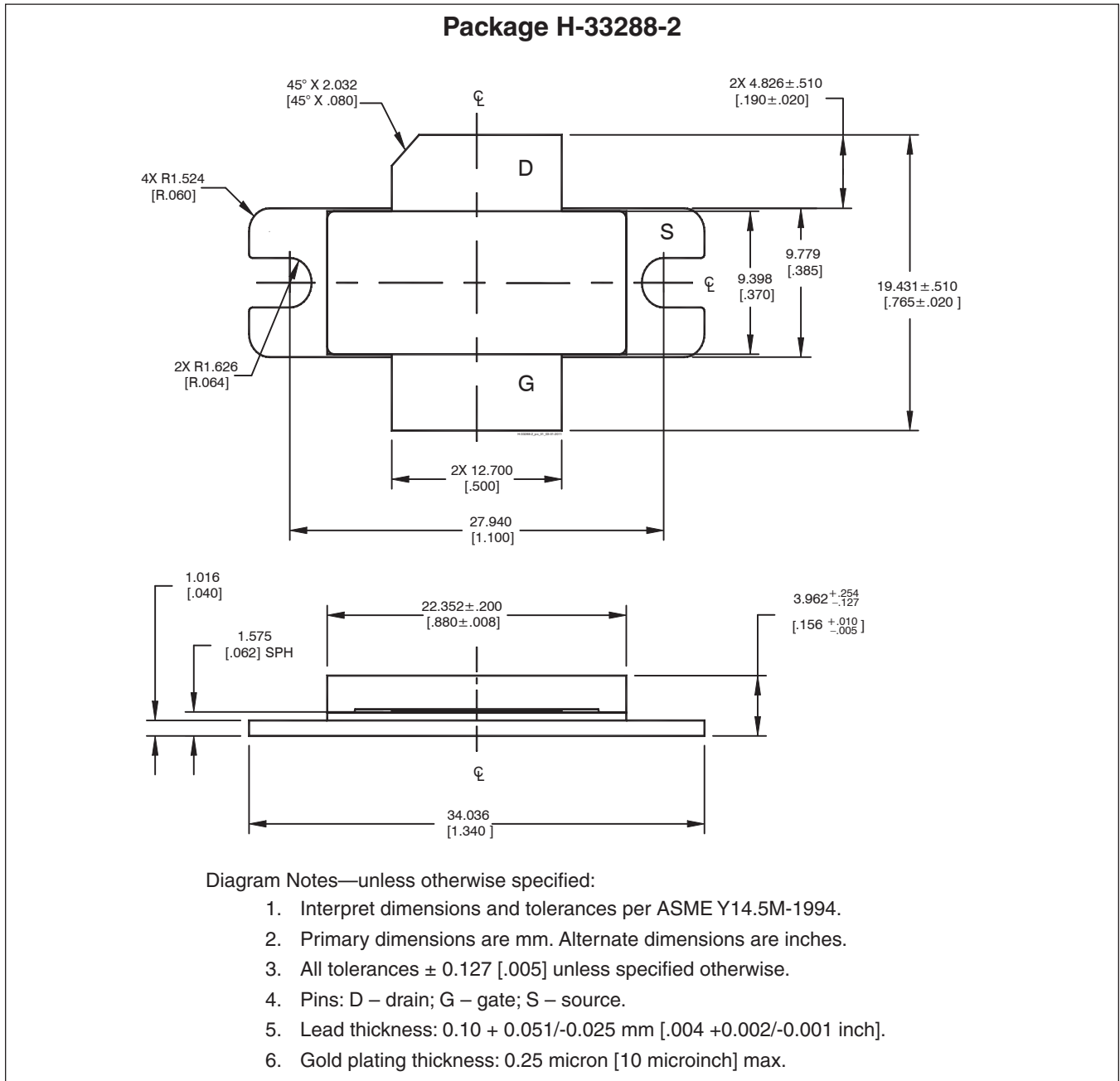
Reference Circuit (cont.)**Reference Circuit Assembly**

| | |
|-----------------------|---|
| DUT | PTVA104501EH |
| Test Fixture Part No. | LTN/PTVA104501EH V1 |
| PCB | Rogers 3010, 0.635 mm [0.025"] thick, 2 oz. copper, $\epsilon_r = 10.2$ |

Components Information

| Component | Description | Suggested Manufacturer | P/N |
|------------------|----------------------------|------------------------------------|---------------------|
| Input | | | |
| C101, C103 | Capacitor, 39 pF | ATC | 100B 390 |
| C102 | Capacitor, 3.3 pF | ATC | 800A 3R3 |
| C104 | Capacitor, 56 pF | ATC | 100B 560 |
| C105 | Capacitor, 3.9 pF | ATC | 800A 3R9 |
| C106 | Capacitor, 2.4 pF | ATC | 800A 2R4 |
| C107, C110, C111 | Capacitor, 1000 pF | Panasonic Electronic Components | ECJ-1VB1H102K |
| C108 | Capacitor, 10 μ F | TDK Corporation | C5750X5R1H106K230KA |
| C109 | Capacitor, 1 μ F | TDK Corporation | C4532X7R2A105M230KA |
| R101 | Resistor, 20 Ω | Panasonic Electronic Components | ERJ-8GEYJ200V |
| R102 | Resistor, 1k Ω | Panasonic Electronic Components | ERJ-8GEYJ102V |
| R103 | Resistor, 2k Ω | Panasonic Electronic Components | ERJ-8GEYJ202V |
| R104 | Resistor, 1.2k Ω | Panasonic Electronic Components | ERJ-3GEYJ122V |
| R105 | Resistor, 1.3k Ω | Panasonic Electronic Components | ERJ-3GEYJ132V |
| R106 | Resistor, 10 ohms | Panasonic Electronic Components | ERJ-8GEYJ100V |
| S1 | Transistor | Infineon Technologies | BCP56 |
| S2 | Voltage Regulator | Texas Instruments | LM78L05ACM |
| S3 | Potentiometer, 2k Ω | Bourns Inc. | 3224W-1-202E |
| Output | | | |
| C201 | Capacitor, 100 μ F | Cornell Dubilier Electronics (CDE) | SK101M100ST |
| C202 | Capacitor, 10 μ F | Cornell Dubilier Electronics (CDE) | SEK100M100ST |
| C203, C210 | Capacitor, 39 pF | ATC | 100B 390 |
| C204, C207 | Capacitor, 10 μ F | TDK Corporation | C5750X5R1H106K230KA |
| C205, C208 | Capacitor, 1 μ F | TDK Corporation | C4532X7R2A105M230KA |
| C206 | Capacitor, 22 μ F | Cornell Dubilier Electronics (CDE) | SEK220M100ST |
| C209 | Capacitor, 56 pF | ATC | 100B 560 |
| C211 | Capacitor, 6800 μ F | Panasonic Electronic Components | ECO-S2AP682EA |
| R201, R202 | Resistor, 5.6 Ω | Panasonic Electronic Components | ERJ-8RQJ5R6V |

Package Outline Specifications



Revision History

| Revision | Date | Data Sheet Type | Page | Subjects (major changes since last revision) |
|----------|------------|-----------------|-----------|--|
| 01 | 2013-05-21 | Advance | All | Data Sheet reflects advance specification for product development |
| 02 | 2014-07-22 | Production | All | Data Sheet reflects released product specification |
| 02.1 | 2016-04-19 | Production | 2 1, 2 | Updated conditions for drain leakage current in DC Characteristics Added ESD rating, updated ordering information |
| 02.2 | 2017-01-31 | Production | 2 | Corrected typo in package description, updated operating voltage and junction temperature |
| 02.3 | 2017-09-20 | Production | 5 | Added two new graphs ($V_{DD} = 36V$) |
| 03 | 2018-06-14 | 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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