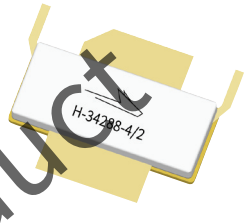
# PTFB211503FL

## Thermally-Enhanced High Power RF LDMOS FET
## 150 W, 2110 – 2170 MHz

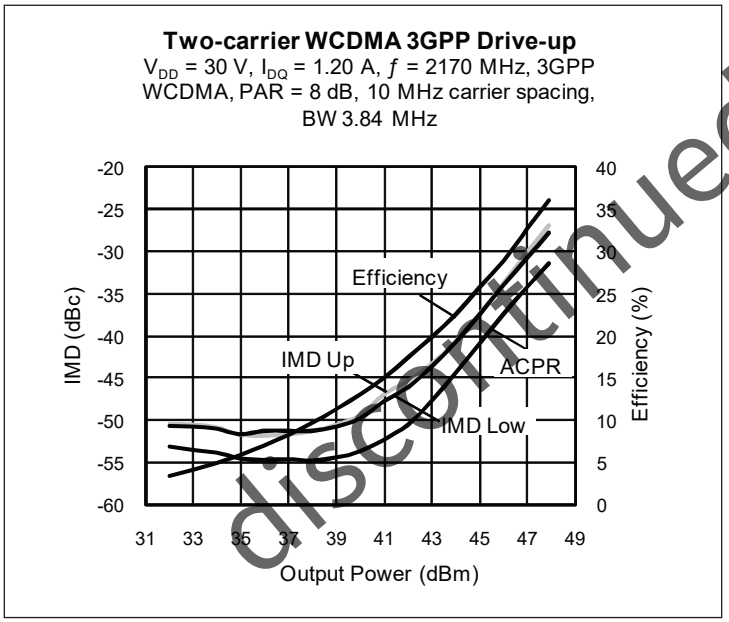
### Description

The PTFB211503FL is a thermally-enhanced, 150-watt, LDMOS FET designed for cellular power amplifier applications in the 2110 to 2170 frequency band. Features include I/O matching, high gain, and thermally-enhanced ceramic open-cavity package with earless flange. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.

PTFB211503FL
H-34288-4/2






### Features

- Broadband internal matching
- Enhanced for use in DPD error correction systems
- Typical CW performance, 2170 MHz, 30 V
  - Output power at $P_{1dB}$ = 150 W
  - Efficiency = 55%
- Increased negative gate-source voltage range for improved performance in Doherty peaking amplifiers
- Integrated ESD protection
- Capable of handling 10:1 VSWR @ 30 V, 150 W (CW) output power
- Pb-Free and RoHS compliant

### RF Characteristics

**Two-carrier WCDMA Measurements** (not subject to production test—verified by design/characterization in Wolfspeed test fixture)
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.2 A, $P_{OUT}$ = 32 W AVG, $f_1$ = 2135 MHz, $f_2$ = 2145 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8 dB @ 0.01% CCDF

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Gain | $G_{ps}$ | — | 18 | — | dB |
| Drain Efficiency | ηD | — | 29 | — | % |
| Adjacent Channel Power Ratio | ACPR | — | –36 | — | dBc |

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

ESD: Electrostatic discharge sensitive device—observe handling precautions!

## RF Characteristics (cont.)

**Two-tone Measurement** (tested in wolfspeed test fixture)
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.2 A, $P_{OUT}$ = 150 W PEP, $f$ = 2170 MHz, tone spacing = 1 MHz

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Gain | Gps | 16.5 | 18 | — | dB |
| Drain Efficiency | ηD | 39 | 40 | — | % |
| Intermodulation Distortion | IMD | — | –30 | –28 | dBc |

## DC Characteristics

| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_{DS}$ = 10 µA | $V_{(BR)DSS}$ | 65 | — | — | V |
| Drain Leakage Current | $V_{DS}$ = 28 V, $V_{GS}$ = 0 V | $I_{DSS}$ | — | — | 1.0 | µA |
| | $V_{DS}$ = 63 V, $V_{GS}$ = 0 V | $I_{DSS}$ | — | — | 10.0 | µA |
| On-State Resistance | $V_{GS}$ = 10 V, $V_{DS}$ = 0.1 V | $R_{DS(on)}$ | — | 0.08 | — | Ω |
| Operating Gate Voltage | $V_{DS}$ = 30 V, $I_{DQ}$ = 1.2 A | $V_{GS}$ | 1.6 | 2.1 | 3.0 | V |
| Gate Leakage Current | $V_{GS}$ = 10 V, $V_{DS}$ = 0 V | $I_{GSS}$ | — | — | 1.0 | µA |

## Maximum Ratings

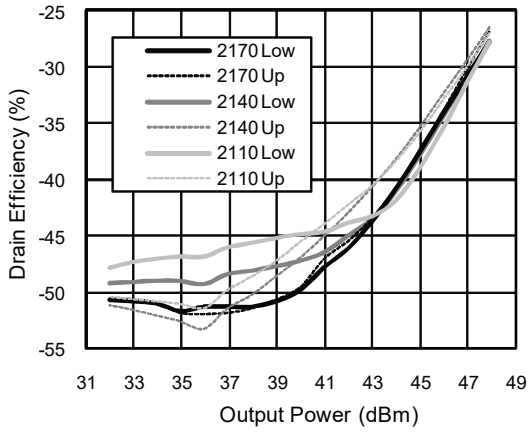
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 65 | V |
| Gate-Source Voltage | $V_{GS}$ | –6 to +10 | V |
| Junction Temperature | $T_J$ | 200 | °C |
| Storage Temperature Range | $T_{STG}$ | –40 to +150 | °C |
| Thermal Resistance ($T_{CASE}$ = 70°C, 150 W CW) | $R_{\theta JC}$ | 0.27 | °C/W |

## Ordering Information

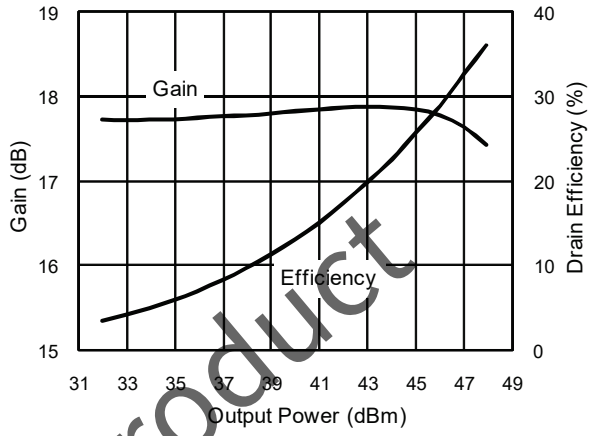
| Type and Version | Order Code | Package Description | Shipping |
|---|---|---|---|
| PTFB211503FL V2 R0 | PTFB211503FL-V2-R0 | H-34288-4/2, earless flange | Tape & Reel, 50 pcs |
| PTFB211503FL V2 R250 | PTFB211503FL-V2-R250 | H-34288-4/2, earless flange | Tape & Reel, 250 pcs |

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

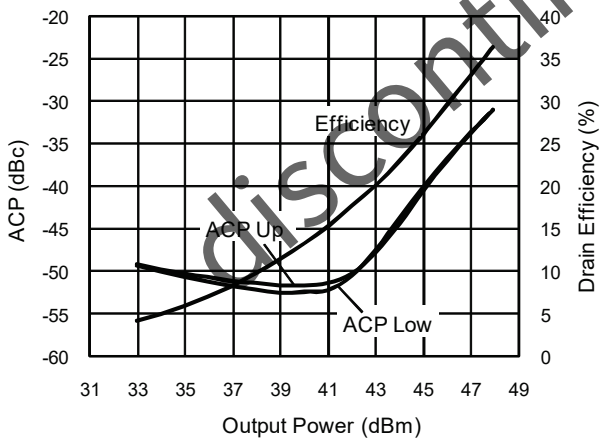
**Two-carrier WCDMA 3GPP Drive-up**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, 3GPP WCDMA, PAR = 8 dB, 10 MHz carrier spacing, BW 3.84 MHz



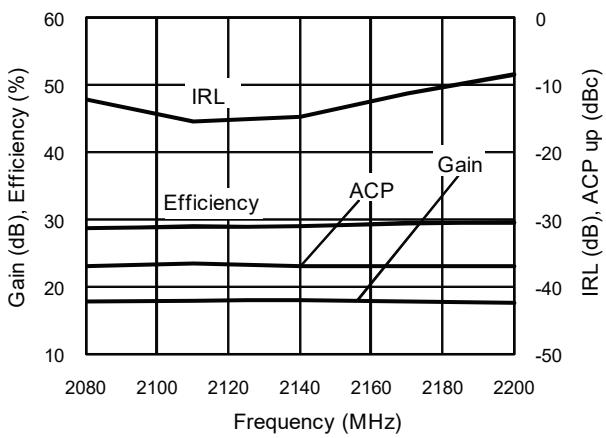

**Two-carrier WCDMA 3GPP**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, $f$ = 2170 MHz, 3GPP WCDMA, PAR = 8 dB, 10 MHz carrier spacing, BW 3.84MHz




**Single-carrier WCDMA Drive-Up**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, $f$ = 2170 MHz
3GPP WCDMA, PAR = 8 dB, BW 3.84 MHz

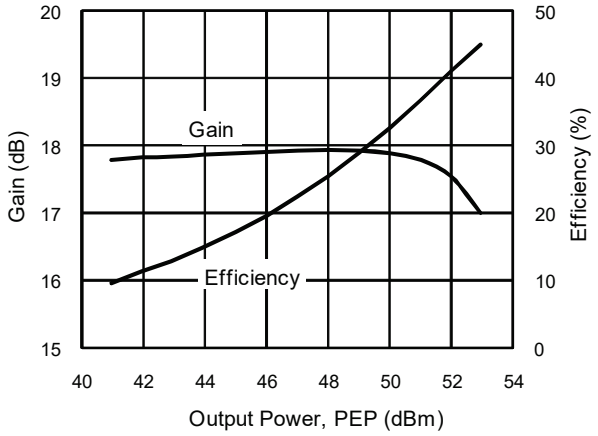



**Single-carrier WCDMA, 3GPP Broadband**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, $P_{OUT}$ = 40 W

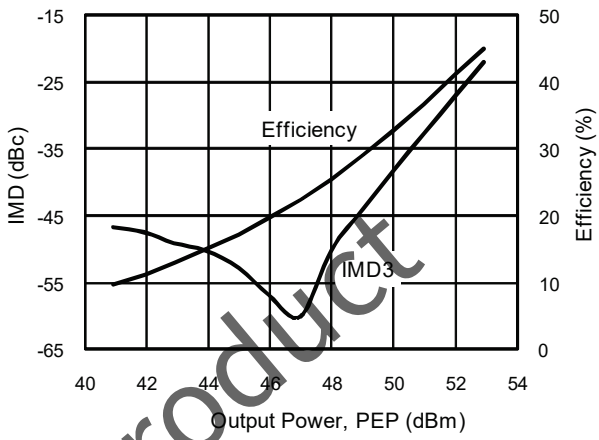


## Typical Performance (cont.)

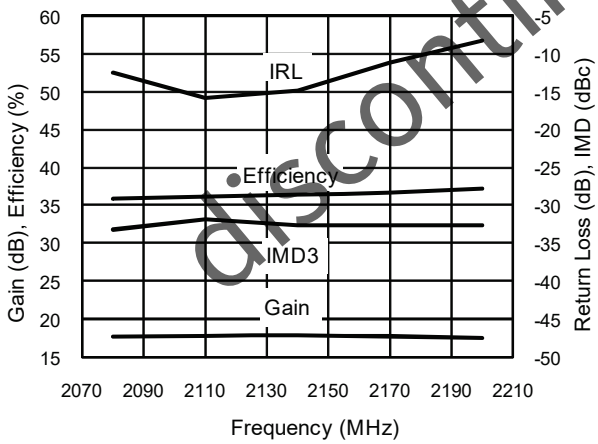
**Two-tone Drive-up**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A,
$f_1$ = 2170 MHz, $f_2$ = 2169 MHz



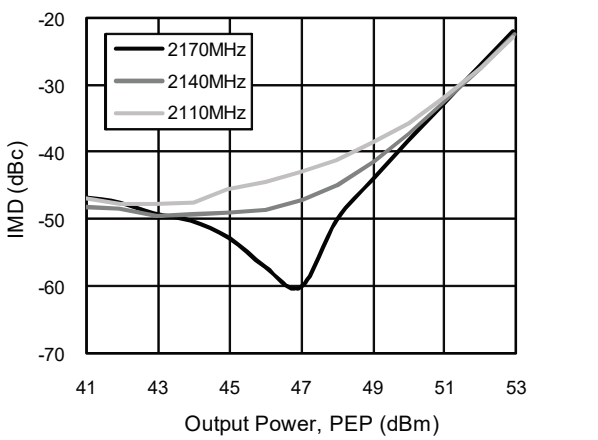

**Two-tone Drive-up**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A,
$f_1$ = 2170 MHz, $f_2$ = 2169 MHz




**Two-tone Broadband Performance**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, $P_{OUT}$ = 63 W

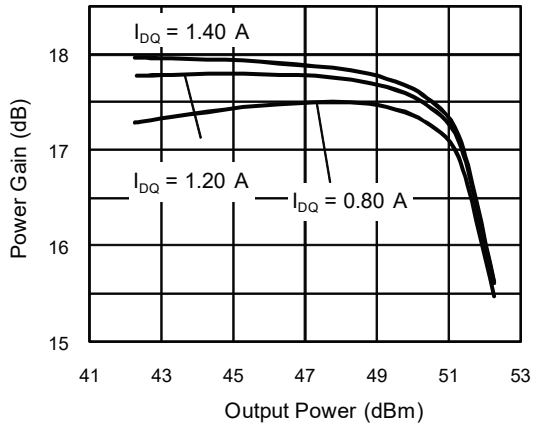



**Two-tone Drive-up at Selected Frequencies**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, tone spacing = 1 MHz

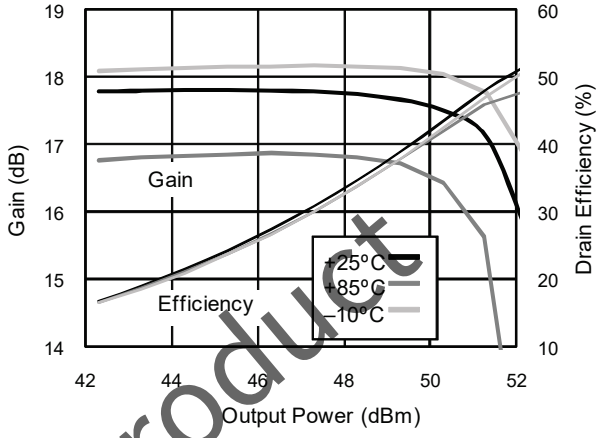


## Typical Performance (cont.)

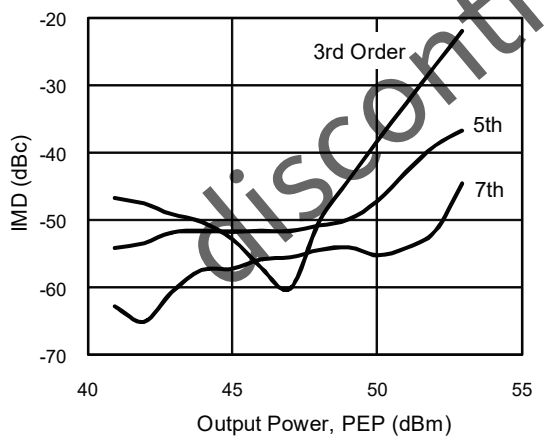
**CW Performance**
**Gain vs. Output Power**
$V_{DD}$ = 30 V, $f$ = 2170 MHz



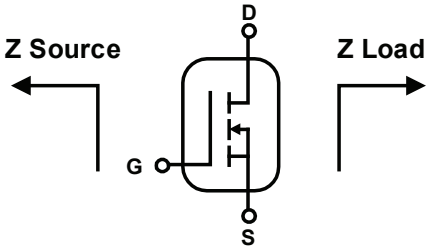

**Power Sweep, CW**
**Gain & Efficiency vs. Output Power**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A, $f$ = 2170 MHz

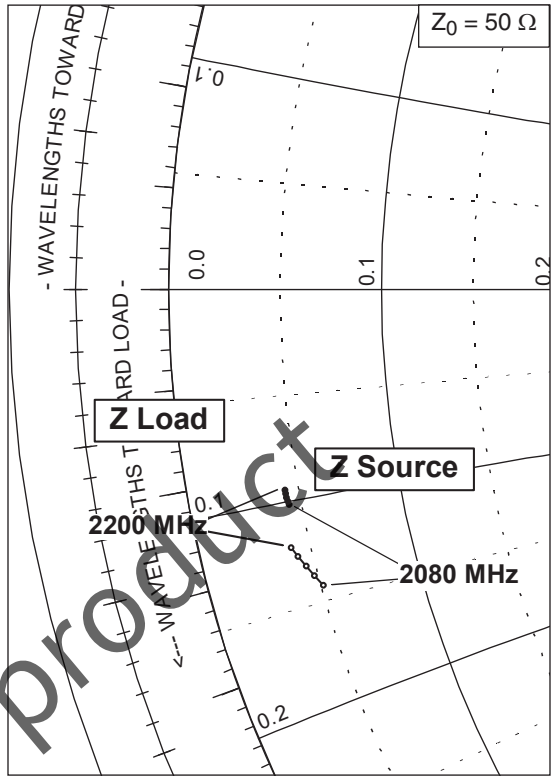



**Intermodulation Distortion**
**vs. Output Power**
$V_{DD}$ = 30 V, $I_{DQ}$ = 1.20 A,
$f_1$ = 2170 MHz, $f_2$ = 2169 MHz



## Broadband Circuit Impedance

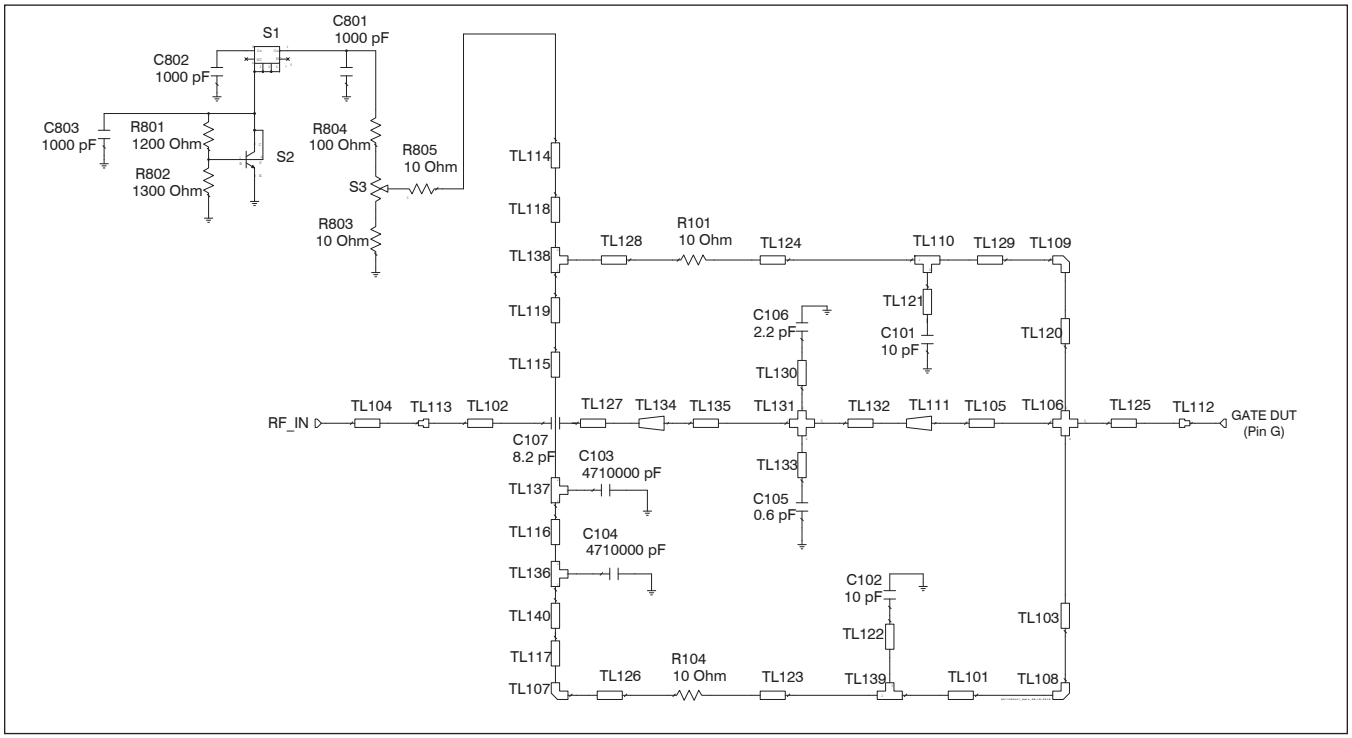


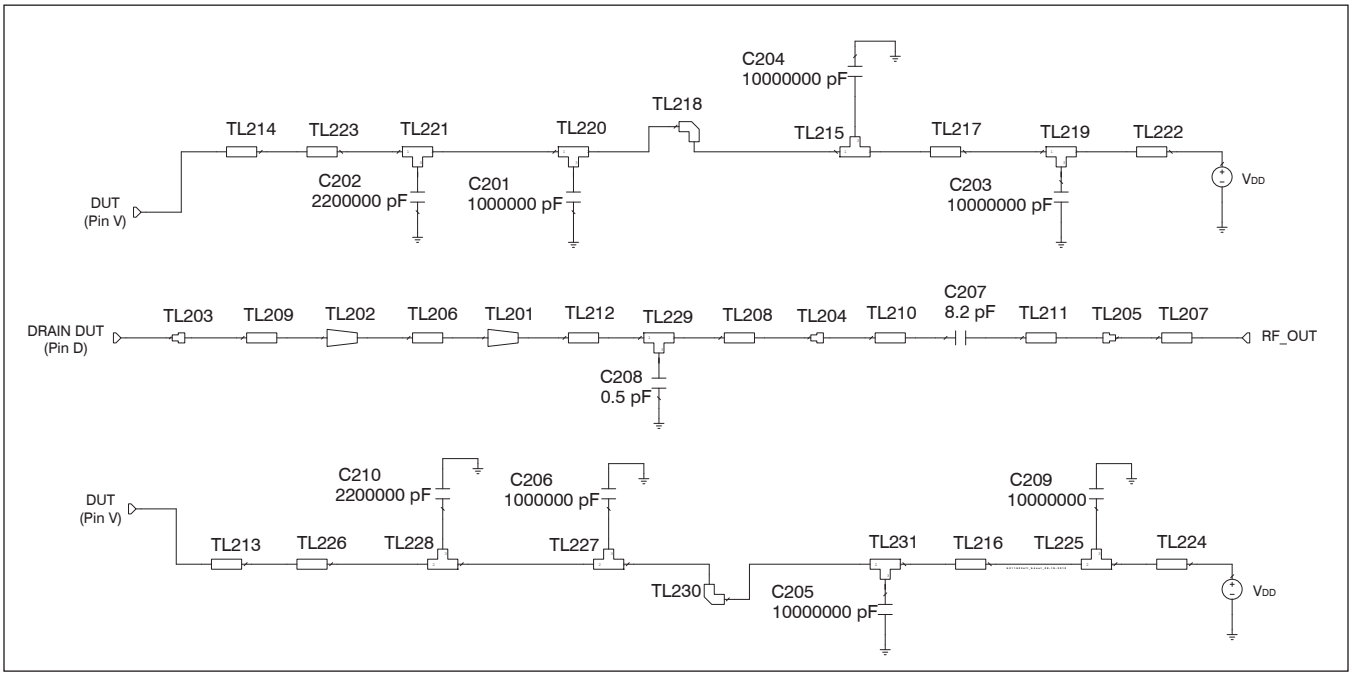

| Frequency | Z Source Ω | | Z Load Ω | |
|---|---|---|---|---|
| MHz | R | jX | R | jX |
| 2200 | 2.06 | –6.08 | 2.19 | –4.73 |
| 2170 | 2.17 | –6.33 | 2.19 | –4.82 |
| 2140 | 2.30 | –6.59 | 2.20 | –4.91 |
| 2110 | 2.43 | –6.86 | 2.21 | –5.00 |
| 2080 | 2.58 | –7.14 | 2.22 | –5.09 |

**See next page for reference circuit information**

## Reference Circuit




*Reference circuit input schematic for ƒ = 2170 MHz*




*Reference circuit output schematic for ƒ = 2170 MHz*

## Reference Circuit (cont.)

| Description | |
|---|---|
| DUT | PTFB211503FL |
| PCB | 0.508 mm [.020"] thick, εr = 3.48, Rogers 4350, 1 oz. copper |

**Electrical Characteristics at 2170 MHz**

| Transmission Line | Electrical Characteristics | Dimensions: mm | Dimensions: mils |
|---|---|---|---|
| **Input** | | | |
| TL101, TL129 | 0.095 λ, 54.17 Ω | W = 1.016, L = 8.001 | W = 40, L = 315 |
| TL102 | 0.016 λ, 31.24 Ω | W = 2.286, L = 1.270 | W = 90, L = 50 |
| TL103 | 0.026 λ, 54.17 Ω | W = 1.016, L = 2.159 | W = 40, L = 85 |
| TL104 | 0.032 λ, 47.12 Ω | W = 1.270, L = 2.692 | W = 50, L = 106 |
| TL105 | 0.005 λ, 6.67 Ω | W = 13.970, L = 0.381 | W = 550, L = 15 |
| TL106 | | W1 = 13.970, W2 = 1.016, W3 = 13.970, W4 = 1.016 | W1 = 550, W2 = 40, W3 = 550, W4 = 40 |
| TL107, TL108, TL109 | | W = 1.016 | W = 40 |
| TL110, TL139 | 0.012 λ, 54.17 Ω | W1 = 1.016, W2 = 1.016, W3 = 1.016 | W1 = 40, W2 = 40, W3 = 40 |
| TL111 (taper) | 0.006 λ, 6.67 Ω / 8.37 Ω | W1 = 13.970, W2 = 10.922, L = 0.483 | W1 = 550, W2 = 430, L = 19 |
| TL112 | | W1 = 17.780, W2 = 12.700 | W1 = 700, W2 = 500 |
| TL113 | | W1 = 1.270, W2 = 2.286 | W1 = 50, W2 = 90 |
| TL114 | 0.031 λ, 34.72 Ω | W = 1.981, L = 2.540 | W = 78, L = 100 |
| TL115 | 0.027 λ, 63.89 Ω | W = 0.762, L = 2.286 | W = 30, L = 90 |
| TL116 | 0.096 λ, 63.89 Ω | W = .762, L = 8.136 | W = 30, L = 320 |
| TL117 | 0.029 λ, 54.17 Ω | W = 1.016, L = 2.451 | W = 40, L = 97 |
| TL118 | 0.018 λ, 54.17 Ω | W = 1.016, L = 1.524 | W = 40, L = 60 |
| TL119 | 0.021 λ, 54.17 Ω | W = 1.016, L = 1.727 | W = 40, L = 68 |
| TL120 | 0.026 λ, 54.17 Ω | W = 1.016, L = 2.159 | W = 40, L = 85 |
| TL121, TL122 | 0.002 λ, 54.17 Ω | W = 1.016, L = 0.127 | W = 40, L = 5 |
| TL123, TL124 | 0.030 λ, 54.17 Ω | W = 1.016, L = 2.540 | W = 40, L = 100 |
| TL125 | 0.053 λ, 6.67 Ω | W = 13.970, L = 4.064 | W = 550, L = 160 |
| TL126 | 0.012 λ, 54.17 Ω | W = 1.016, L = 1.021 | W = 40, L = 40 |
| TL127 | 0.134 λ, 47.12 Ω | W = 1.270, L = 11.151 | W = 50, L = 439 |
| TL128 | 0.012 λ, 54.17 Ω | W = 1.016, L = 1.016 | W = 40, L = 40 |
| TL130, TL133 | 0.000 λ, 144.35 Ω | W = 0.025, L = 0.025 | W = 1, L = 1 |
| TL131 | | W1 = 10.922, W2 = 0.025, W3 = 10.922 W4 = 0.025 | W1 = 430, W2 = 1, W3 = 430, W4 = 1 |
| TL132, TL135 | 0.000 λ, 8.37 Ω | W = 10.922, L = 0.000 | W = 430, L = 0 |
| TL134 (taper) | 0.033 λ, 8.37 Ω / 47.12 Ω | W1 = 10.922, W2 = 1.270, L = 2.540 | W1 = 430, W2 = 50, L = 100 |
| TL136, TL137 | 0.012 λ, 63.89 Ω | W1 = 0.762, W2 = 0.762, W3 = 1.016 | W1 = 30, W2 = 30, W3 = 40 |
| TL138 | 0.012 λ, 54.17 Ω | W1 = 1.016, W2 = 1.270, W3 = 1.016 | W1 = 40, W2 = 50, W3 = 40 |
| TL140 | 0.021 λ, 63.89 Ω | W = 0.762, L = 1.778 | W = 30, L = 70 |

*table continued on page 9*

## Reference Circuit (cont.)

**Electrical Characteristics at 2170 MHz**

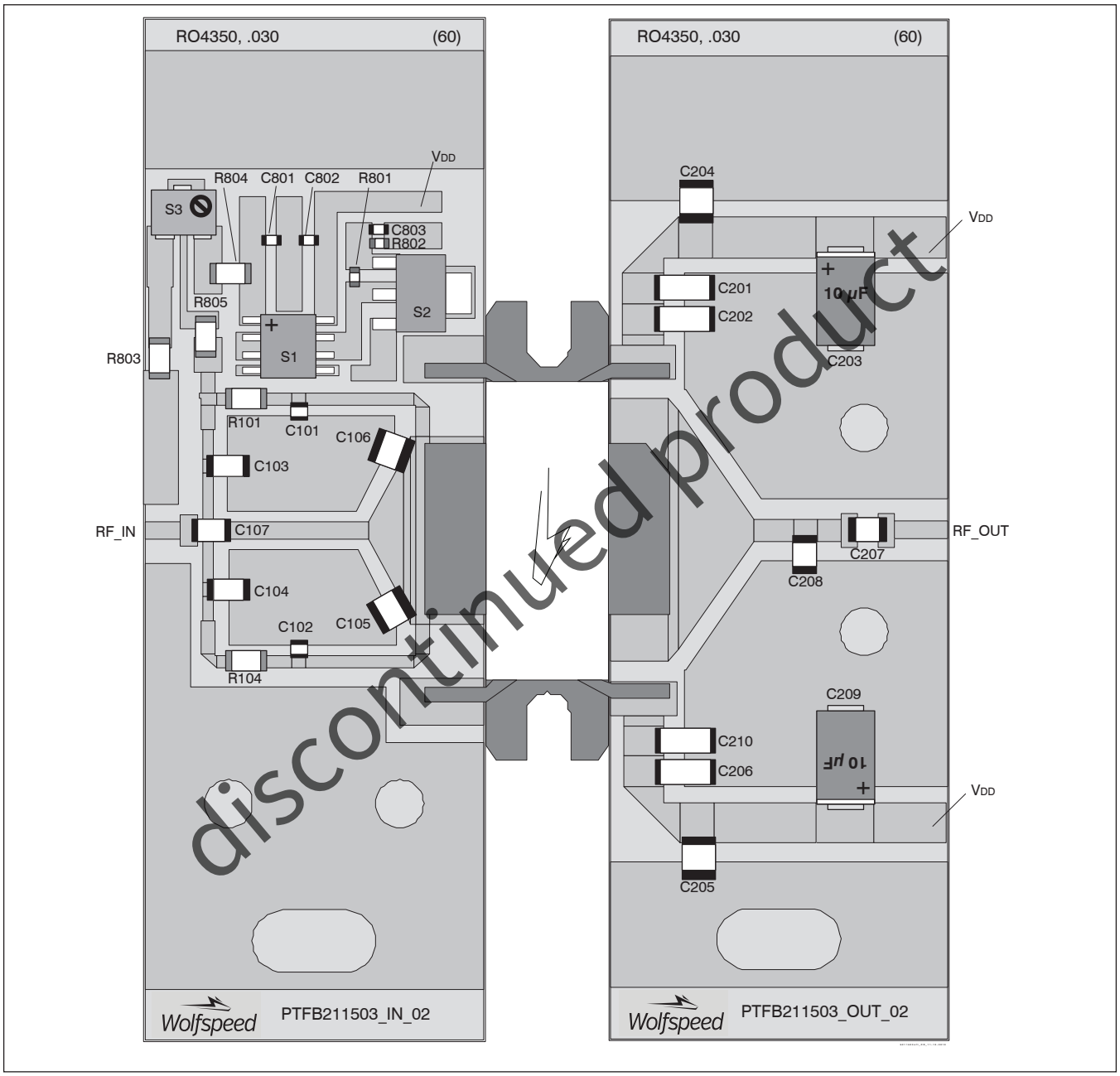
| Transmission Line | Electrical Characteristics | Dimensions: mm | Dimensions: mils |
|---|---|---|---|
| **Output** | | | |
| TL201 (taper) | 0.074 λ, 5.33 Ω / 39.51 Ω | W1 = 17.780, W2 = 1.651, L = 5.613 | W1 = 700, W2 = 65, L = 221 |
| TL202 (taper) | 0.010 λ, 4.84 Ω / 5.33 Ω | W1 = 19.685, W2 = 17.780, L = 0.787 | W1 = 775, W2 = 700, L = 31 |
| TL203 | | W1 = 12.700, W2 = 17.780 | W1 = 500, W2 = 700 |
| TL204 | | W1 = 1.651, W2 = 2.540 | W1 = 65, W2 = 100 |
| TL205 | | W1 = 1.270, W2 = 2.540 | W1 = 50, W2 = 100 |
| TL206 | 0.000 λ, 5.33 Ω | W = 17.780, L = 0.025 | W = 700, L = 1 |
| TL207 | 0.047 λ, 47.12 Ω | W = 1.270, L = 3.886 | W = 50, L = 153 |
| TL208 | 0.021 λ, 39.51 Ω | W = 1.651, L = 1.753 | W = 65, L = 69 |
| TL209 | 0.057 λ, 4.84 Ω | W = 19.685, L = 4.318 | W = 775, L = 170 |
| TL210, TL211 | 0.016 λ, 28.85 Ω | W = 2.540, L = 1.270 | W = 100, L = 50 |
| TL212 | 0.035 λ, 39.51 Ω | W = 1.651, L = 2.896 | W = 65, L = 114 |
| TL213 | 0.032 λ, 16.90 Ω | W = 4.928, L = 2.540 | W = 194, L = 100 |
| TL214 | 0.032 λ, 17.05 Ω | W = 4.877, L = 2.540 | W = 192, L = 100 |
| TL215, TL231 | 0.032 λ, 25.04 Ω | W1 = 3.048, W2 = 3.048, W3 = 2.540 | W1 = 120, W2 = 120, W3 = 100 |
| TL216, TL217 | 0.095 λ, 25.04 Ω | W = 3.048, L = 7.645 | W = 120, L = 301 |
| TL218, TL230 | | W = 3.048 | W = 120 |
| TL219, TL225 | 0.054 λ, 25.04 Ω | W1 = 3.048, W2 = 3.048, W3 = 4.318 | W1 = 120, W2 = 120, W3 = 170 |
| TL220, TL221 | 0.029 λ, 25.04 Ω | W1 = 3.048, W2 = 3.048, W3 = 2.286 | W1 = 120, W2 = 120, W3 = 90 |
| TL222, TL224 | 0.067 λ, 25.04 Ω | W = 3.048, L = 5.359 | W = 120, L = 211 |
| TL223, TL226 | 0.010 λ, 25.04 Ω | W = 3.048, L = 0.762 | W = 120, L = 30 |
| TL227, TL228 | 0.029 λ, 25.04 Ω | W1 = 3.048, W2 = 3.048, W3 = 2.286 | W1 = 120, W2 = 120, W3 =90 |
| TL229 | 0.022 λ, 39.51 Ω | W1 = 1.651, W2 = 1.651, W3 = 1.778 | W1 = 65, W2 = 65, W3 = 70 |

## Reference Circuit (cont.)

### Circuit Assembly Information

| | |
|---|---|
| Test Fixture Part No. | LTN/PTFB211503EF |

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




*Reference circuit assembly diagram (not to scale)*

## Reference Circuit (cont.)

**Component Information**

| Component | Description | Suggested Manufacturer | P/N |
|---|---|---|---|
| **Input** | | | |
| C101, C102 | Chip capacitor, 10 pF | ATC | ATC100A100FW150XB |
| C103, C104 | Chip capacitor, 4.71 µF | Digi-Key | 493-2372-2-ND |
| C105 | Chip capacitor, 0.6 pF | ATC | ATC100B0R6BW500XB |
| C106 | Chip capacitor, 2.2 pF | ATC | ATC100B2R2BW500XB |
| C107 | Chip capacitor, 8.2 pF | ATC | ATC100B8R2BW500XB |
| C801, C802, C803 | Capacitor, 1000 pF | Digi-Key | PCC1772CT-ND |
| R101, R104, R803, R805 | Resistor, 10 Ω | Digi-Key | P10ECT-ND |
| R801 | Resistor, 1200 Ω | Digi-Key | P1.2KGCT-ND |
| R802 | Resistor, 1300 Ω | Digi-Key | P1.3KGCT-ND |
| R804 | Resistor, 100 Ω | Digi-Key | P100ECT-ND |
| S1 | Voltage Regulator | Digi-Key | LM78L05ACM-LD |
| S2 | Transistor | Digi-Key | BCP5616TA-ND |
| S3 | Potentiometer, 2k Ω | Digi-Key | 3224W-202ECT-ND |
| **Output** | | | |
| C201, C206 | Chip capacitor, 1 µF | Digi-Key | 445-1411-2-ND |
| C202, C210 | Chip capacitor, 2.2 µF | Digi-Key | 445-1447-2-ND |
| C203, C209 | Capacitor, 10 µF | Digi-Key | 281M5002106K |
| C204, C205 | Capacitor, 10 µF | Digi-Key | 587-1818-2-ND |
| C207 | Chip capacitor, 8.2 pF | ATC | ATC100B8R2BW500XB |
| C208 | Chip capacitor, 0.5 pF | ATC | ATC100B0R5BW500XB |

## Package Outline Specifications

### Package H-34288-4/2

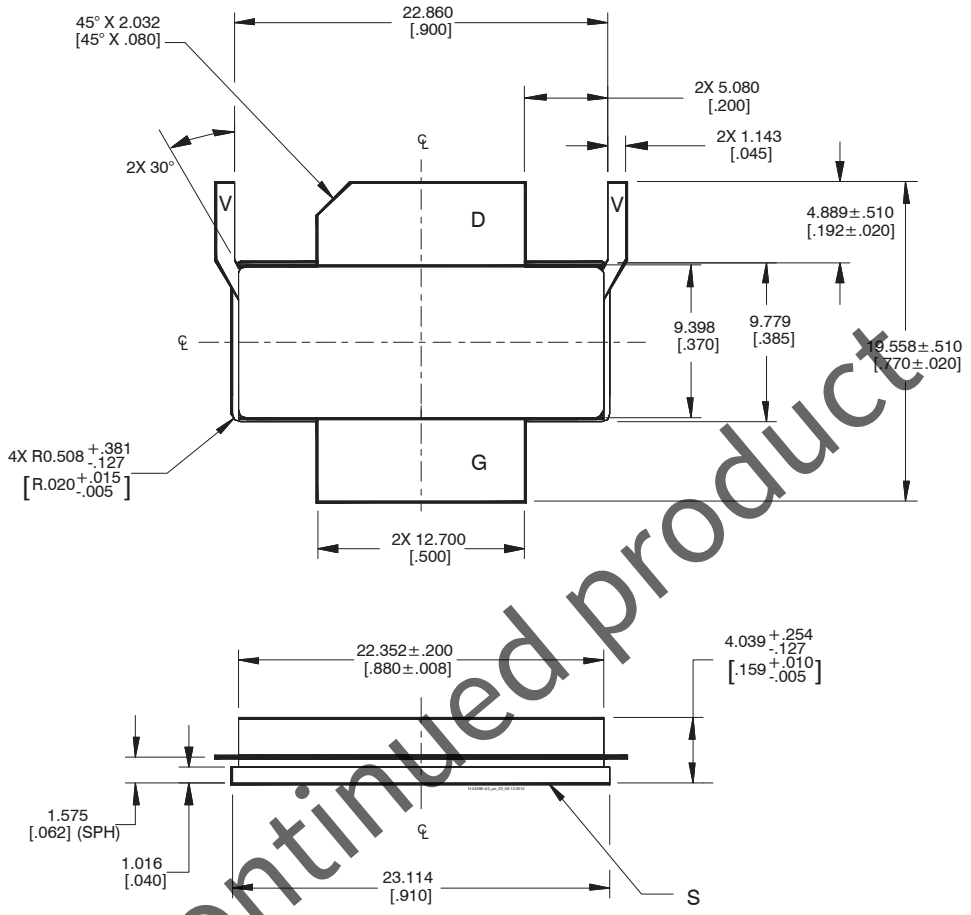





Diagram Notes—unless otherwise specified:

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; S = source; G = gate; V = $V_{DD}$.
5. Lead thickness: 0.10 + 0.051/–0.025 mm [.004 +0.002/–0.001 inch].
6. Gold plating thickness: 0.25 micron [10 microinch] max.

## Revision History

| Revision | Date | Data Sheet Type | Page | Subjects (major changes at each revision) |
|---|---|---|---|---|
| 04.1 | 2016-06-14 | Production | 2 | Updated ordering information |
| 05 | 2018-06-29 | Production | All | Converted to Wolfspeed Data Sheet |
| 06 | 2020-02-27 | Production | All | Product discontinued |



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

Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. “Typical” parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer’s technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.