

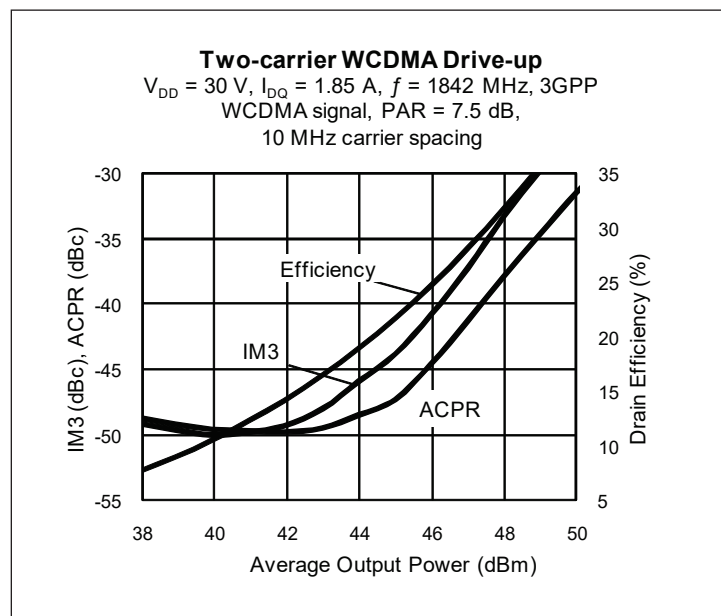
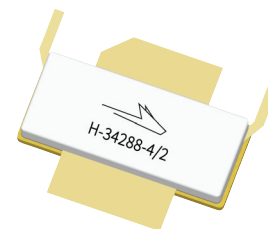
PTFB182503FL

Thermally-Enhanced High Power RF LDMOS FET 240 W, 1805 – 1880 MHz

Description

The PTFB182503FL is a 240-watt LDMOS FET intended for use in multi-standard cellular power amplifier applications in the 1805 to 1880 MHz frequency band. Features include input and output matching, high gain, wide signal bandwidth and reduced memory effects for improved DPD correctability. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.

PTFB182503FL
H-34288-4/2



Features

- Broadband internal input and output matching
- Enhanced for use in DPD error correction systems
- Typical two-carrier WCDMA performance, 1880 MHz, 30 V
 - Average output power = 50 W
 - Linear gain = 19 dB
 - Drain efficiency = 28 %
 - Intermodulation distortion = -35 dBc
- Typical CW performance, 1880 MHz, 30 V
 - Output power at P_{1dB} = 240 W
 - Efficiency = 55%
- Increased negative gate-source voltage range for improved performance in Doherty peaking amplifiers
- Integrated ESD protection. Human Body Model, Class 2 (minimum)
- Capable of handling 10:1 VSWR @ 30 V, 240 W (CW) output power
- Pb-free, RoHS compliant

RF Characteristics

Two-carrier WCDMA Specifications (tested in Wolfspeed test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 50\text{ W}$ average

$f_1 = 1840\text{ MHz}$, $f_2 = 1845\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 7.5 dB @ 0.01% CCDF

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------------------|----------|-----|-----|-----|------|
| Gain | G_{ps} | 18 | 19 | — | dB |
| Drain Efficiency | η_D | 27 | 28 | — | % |
| Intermodulation Distortion | IMD | — | -35 | -31 | dBc |

All published data at $T_{CASE} = 25^\circ\text{C}$ unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

RF Characteristics (cont.)

Two-tone Specifications (not subject to production test—verified by design/characterization in WolfSpeed test fixture)
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 220\text{ W PEP}$, $f = 1840\text{ MHz}$, tone spacing = 1 MHz

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------------------|----------|-----|-----|-----|------|
| Gain | G_{ps} | — | 18 | — | dB |
| Drain Efficiency | η_D | — | 40 | — | % |
| Intermodulation Distortion | IMD | — | -28 | — | dBc |

DC Characteristics

| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|--------------------------------|---|---------------|-----|------|------|---------------|
| Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$ | $V_{(BR)DSS}$ | 65 | — | — | V |
| Drain Leakage Current | $V_{DS} = 28\text{ V}$, $V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 1.0 | μA |
| Drain Leakage Current | $V_{DS} = 63\text{ V}$, $V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 10.0 | μA |
| On-State Resistance | $V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$ | $R_{DS(on)}$ | — | 0.03 | — | Ω |
| Operating Gate Voltage | $V_{DS} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$ | V_{GS} | 2.3 | 2.8 | 3.3 | V |
| Gate Leakage Current | $V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$ | 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 |
| Operating Voltage | V_{DD} | 24 to 30 | V |
| Junction Temperature | T_J | 200 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{STG} | -40 to +150 | $^{\circ}\text{C}$ |
| Thermal Resistance ($T_{CASE} = 70^{\circ}\text{C}$, 50 W WCDMA) | $R_{\theta JC}$ | 0.262 | $^{\circ}\text{C/W}$ |

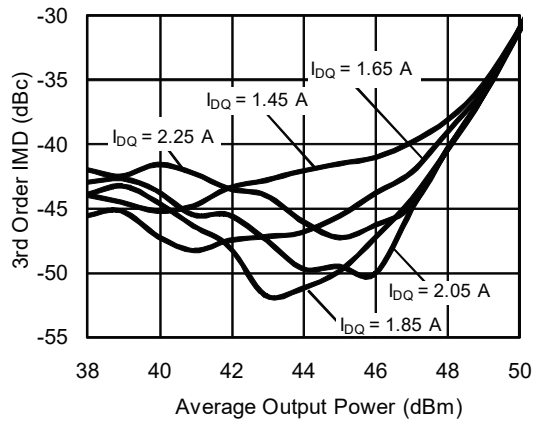
Ordering Information

| Type and Version | Order Code | Package Description | Shipping |
|----------------------|----------------------|-----------------------------|----------------------|
| PTFB182503FL V2 R0 | PTFB182503FL-V2-R0 | H-34288-4/2, earless flange | Tape & Reel, 50 pcs |
| PTFB182503FL V2 R250 | PTFB182503FL-V2-R250 | H-34288-4/2, earless flange | Tape & Reel, 250 pcs |

Typical Performance (data taken in a production test fixture)

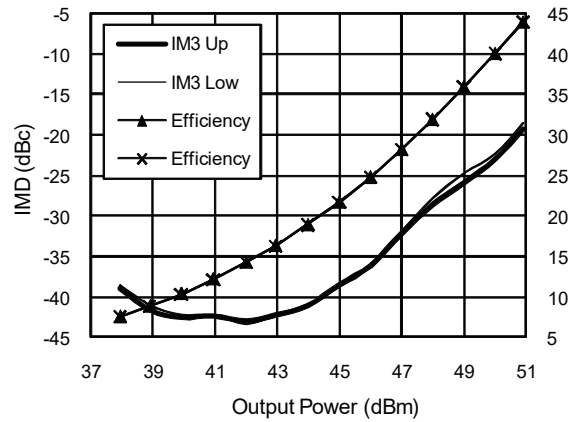
Two-Carrier WCDMA at Various Biases

$V_{DD} = 30\text{ V}$, $f = 1842\text{ MHz}$, 3GPP WCDMA signal, PAR = 7.5 dB, 5 MHz carrier spacing



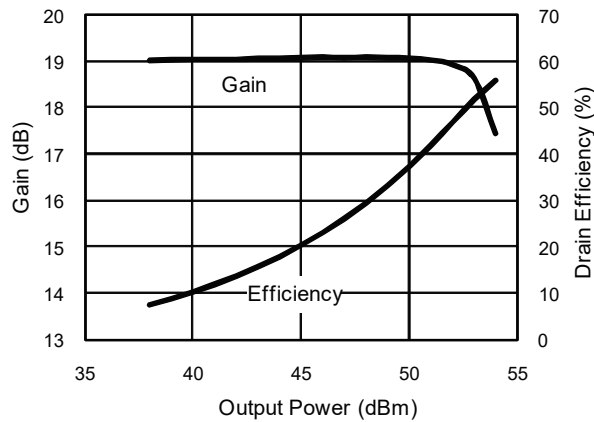
Six-Carrier GSM vs Power Out

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 1842\text{ MHz}$, PAR = 7.1 dB



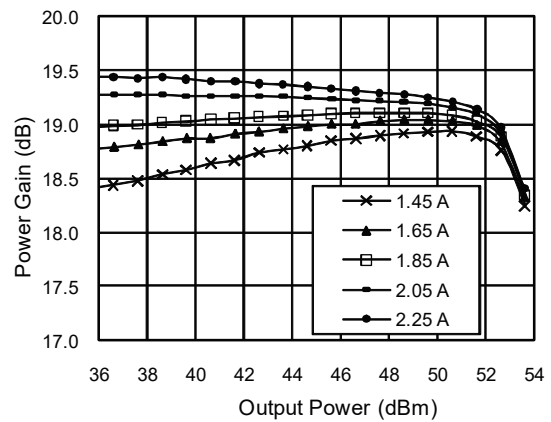
CW Performance Gain & Efficiency vs. Output Power

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 1842\text{ MHz}$

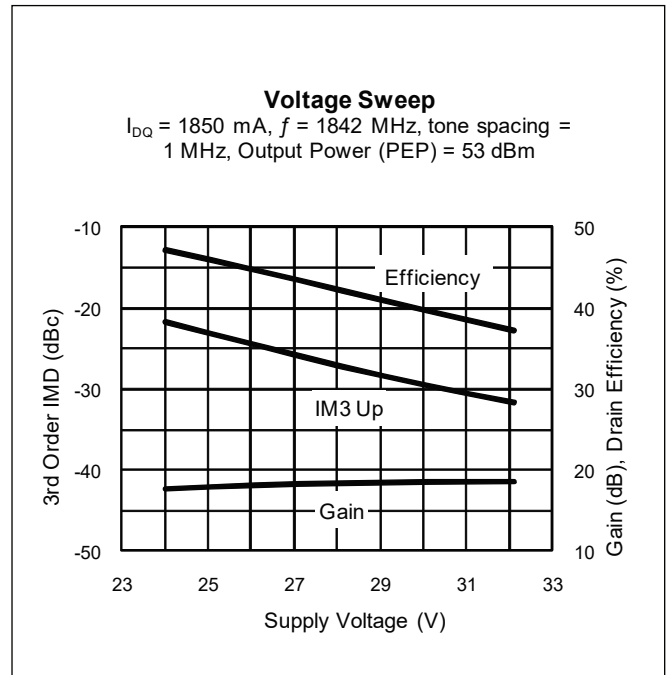
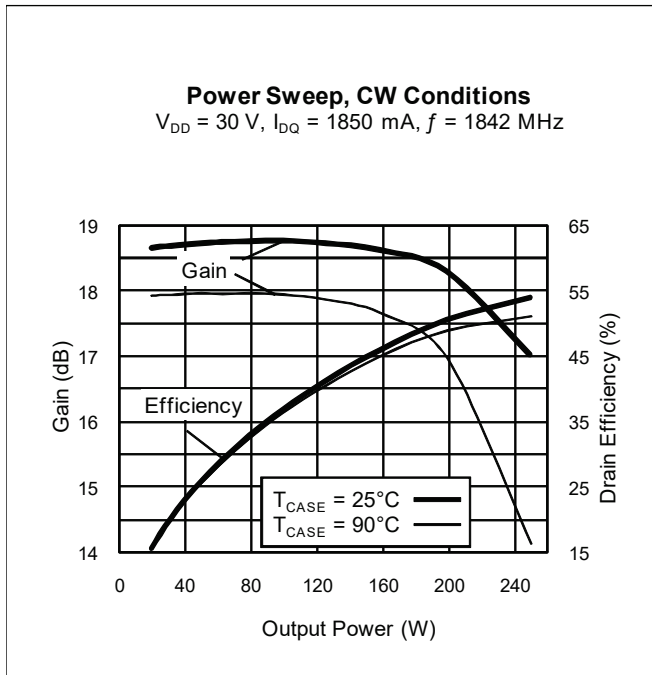


Power Sweep

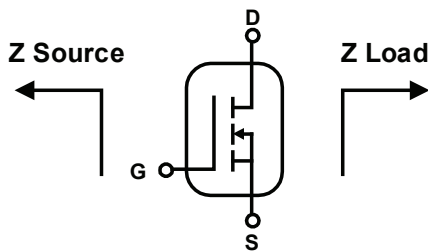
$V_{DD} = 30\text{ V}$, $f = 1842\text{ MHz}$



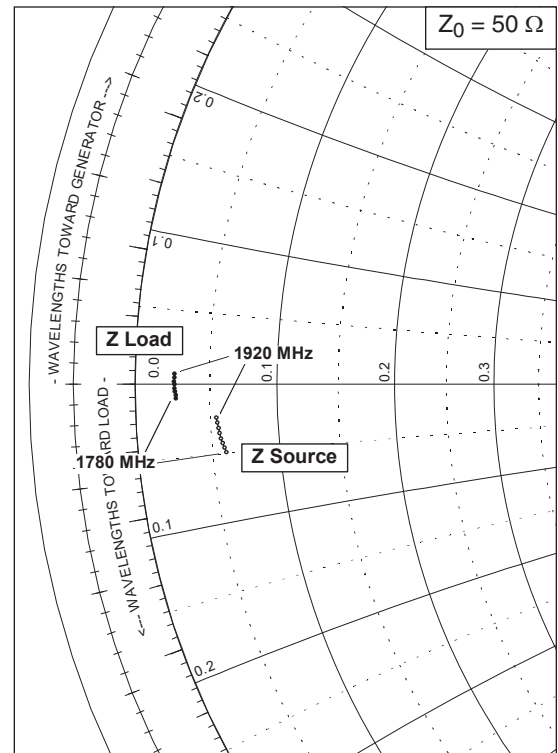
Typical Performance (cont.)



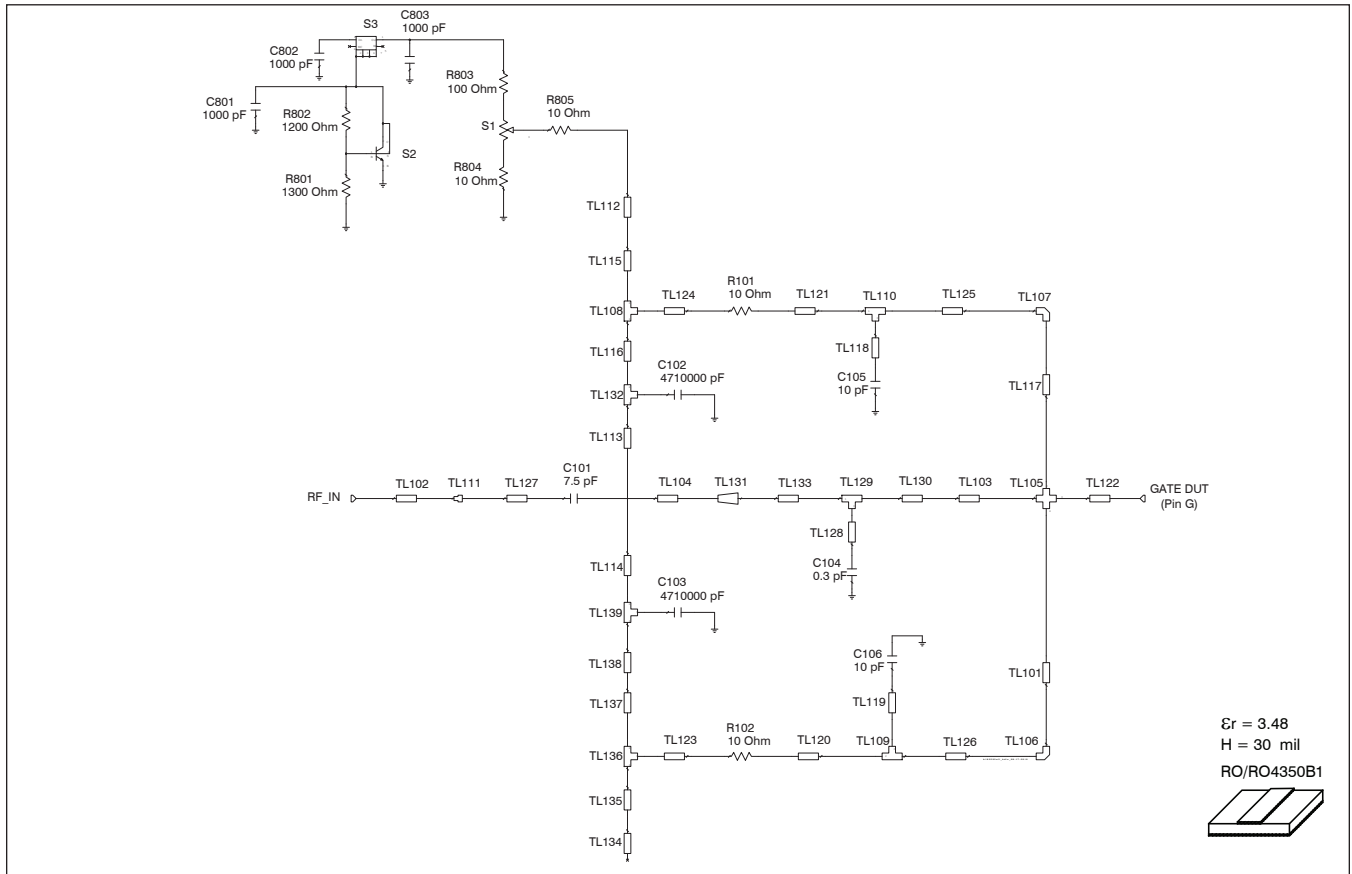
Broadband Circuit Impedance



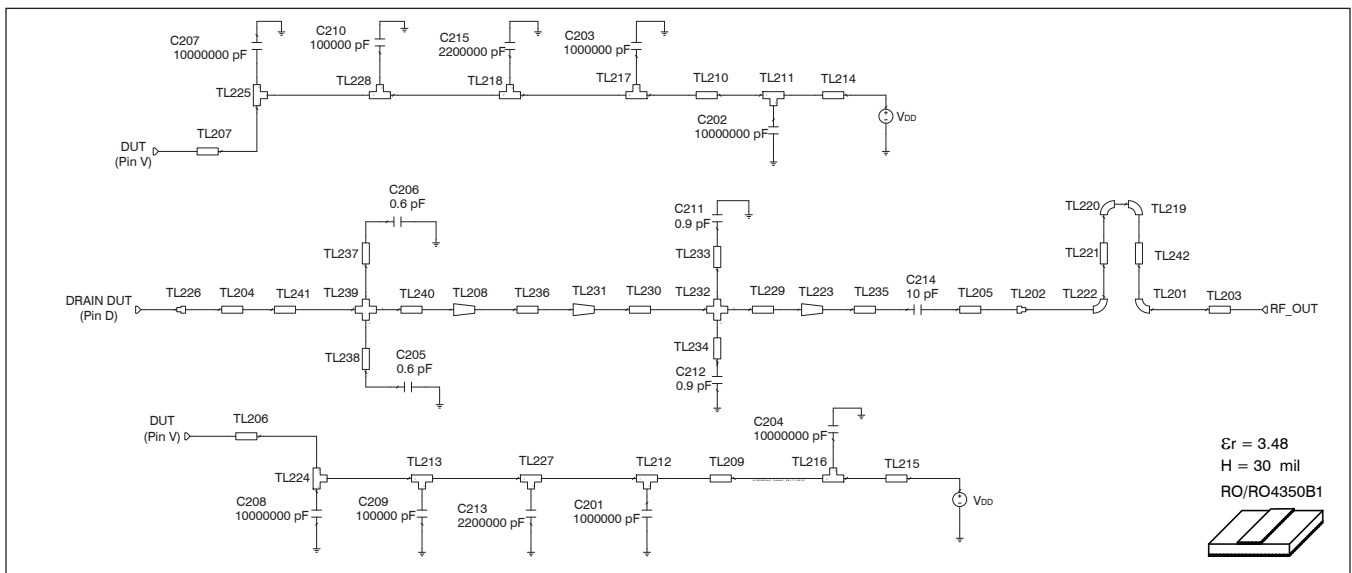
| Frequency MHz | Z Source Ω | | Z Load Ω | |
|------------------|-------------------|-------|-----------------|-------|
| | R | jX | R | jX |
| 1780 | 2.99 | -2.48 | 1.33 | -0.49 |
| 1800 | 2.95 | -2.30 | 1.33 | -0.38 |
| 1820 | 2.89 | -2.13 | 1.31 | -0.27 |
| 1840 | 2.84 | -1.96 | 1.29 | -0.16 |
| 1860 | 2.80 | -1.76 | 1.29 | -0.02 |
| 1880 | 2.78 | -1.58 | 1.28 | 0.10 |
| 1900 | 2.74 | -1.39 | 1.29 | 0.23 |
| 1920 | 2.72 | -1.21 | 1.29 | 0.36 |



Reference Circuit



Reference circuit input schematic for $f = 1880$ MHz



Reference circuit output schematic for $f = 1880$ MHz

Reference Circuit (cont.)

| Description | |
|-------------|--|
| DUT | PTFB182503FL |
| PCB | 0.76 mm [.030"] thick, $\epsilon_r = 3.48$, Rogers 4350, 1 oz. copper |

Electrical Characteristics at 1880 MHz

| Transmission Line | Electrical Characteristics | Dimensions: mm | Dimensions: mils |
|----------------------------|--|--|--------------------------------------|
| Input | | | |
| TL101, TL117 | 0.022 λ , 78.27 Ω | W = 0.762, L = 2.159 | W = 30, L = 85 |
| TL102 | 0.035 λ , 51.58 Ω | W = 1.651, L = 3.358 | W = 65, L = 132 |
| TL103 | 0.050 λ , 9.67 Ω | W = 13.970, L = 4.445 | W = 550, L = 175 |
| TL104 | 0.031 λ , 51.58 Ω | W = 1.651, L = 3.018 | W = 65, L = 119 |
| TL105 | | W1 = 13.970, W2 = 0.762, W3 = 13.970, W4 = 0.762 | W1 = 550, W2 = 30, W3 = 550, W4 = 30 |
| TL106, TL107 | | W = 0.762 | W = 30 |
| TL108, TL136 | 0.010 λ , 68.02 Ω | W1 = 1.016, W2 = 1.016, W3 = 1.016 | W1 = 40, W2 = 40, W3 = 40 |
| TL109, TL110, TL132, TL139 | 0.010 λ , 78.27 Ω | W1 = 0.762, W2 = 0.762, W3 = 1.016 | W1 = 30, W2 = 30, W3 = 40 |
| TL111 | | W1 = 1.651, W2 = 2.032 | W1 = 65, W2 = 80 |
| TL112, TL134 | 0.014 λ , 38.82 Ω | W = 2.540, L = 1.321 | W = 100, L = 52 |
| TL113 | 0.020 λ , 78.27 Ω | W = 0.762, L = 2.007 | W = 30, L = 79 |
| TL114 | 0.099 λ , 92.53 Ω | W = 0.508, L = 9.957 | W = 20, L = 392 |
| TL115 | 0.016 λ , 68.02 Ω | W = 1.016, L = 1.524 | W = 40, L = 60 |
| TL116, TL137 | 0.017 λ , 78.27 Ω | W = 0.762, L = 1.727 | W = 30, L = 68 |
| TL118, TL119 | 0.001 λ , 68.02 Ω | W = 1.016, L = 0.127 | W = 40, L = 5 |
| TL120, TL121 | 0.013 λ , 78.27 Ω | W = 0.762, L = 1.270 | W = 30, L = 50 |
| TL122 | 0.022 λ , 9.67 Ω | W = 13.970, L = 1.981 | W = 550, L = 78 |
| TL123, TL124 | 0.007 λ , 68.02 Ω | W = 1.016, L = 0.686 | W = 40, L = 27 |
| TL125, TL126 | 0.118 λ , 78.27 Ω | W = 0.762, L = 11.684 | W = 30, L = 460 |
| TL127 | 0.008 λ , 45.17 Ω | W = 2.032, L = 0.762 | W = 80, L = 30 |
| TL128 | 0.000 λ , 45.17 Ω | W = 2.032, L = 0.025 | W = 80, L = 1 |
| TL129 | 0.023 λ , 9.67 Ω | W1 = 13.970, W2 = 13.970, W3 = 2.032 | W1 = 550, W2 = 550, W3 = 80 |
| TL130 | 0.000 λ , 9.67 Ω | W = 13.970, L = 0.025 | W = 550, L = 1 |
| TL131 (taper) | 0.028 λ , 9.67 Ω / 51.58 Ω | W1 = 13.970, W2 = 1.651, L = 2.515 | W1 = 550, W2 = 65, L = 99 |
| TL133 | 0.050 λ , 9.67 Ω | W = 13.970, L = 4.470 | W = 550, L = 176 |
| TL135 | 0.015 λ , 68.02 Ω | W = 1.016, L = 1.514 | W = 40, L = 60 |
| TL138 | 0.010 λ , 78.27 Ω | W = 0.762, L = 0.991 | W = 30, L = 39 |

table continued on page 7

Reference Circuit (cont.)

Electrical Characteristics at 1880 MHz

| Transmission Line | Electrical Characteristics | Dimensions: mm | Dimensions: mils |
|-----------------------------------|---|--|------------------------------------|
| Output | | | |
| TL201, TL219, TL220, TL222 | | W = 0.002, ANG = 90.000, R = 0.002 | W = 2, ANG = 3543307, R = 70 |
| TL202 | | W1 = 1.651, W2 = 2.032 | W1 = 65, W2 = 80 |
| TL203 | 0.012 λ , 51.58 Ω | W = 1.651, L = 1.118 | W = 65, L = 44 |
| TL204 | 0.084 λ , 6.86 Ω | W = 20.320, L = 7.366 | W = 800, L = 290 |
| TL205 | 0.011 λ , 45.17 Ω | W = 2.032, L = 1.016 | W = 80, L = 40 |
| TL206 | 0.028 λ , 23.60 Ω | W = 4.928, L = 2.540 | W = 194, L = 100 |
| TL207 | 0.028 λ , 23.79 Ω | W = 4.877, L = 2.540 | W = 192, L = 100 |
| TL208 (taper) | 0.018 λ , 6.86 Ω / 8.31 Ω | W1 = 20.320, W2 = 16.510, L = 1.575 | W1 = 800, W2 = 650, L = 62 |
| TL209, TL210 | 0.076 λ , 34.08 Ω | W = 3.048, L = 7.112 | W = 120, L = 280 |
| TL211, TL216, TL224, TL225 | 0.032 λ , 34.08 Ω | W1 = 3.048, W2 = 3.048, W3 = 3.048 | W1 = 120, W2 = 120, W3 = 120 |
| TL212, TL228, TL217, TL218, TL227 | 0.024 λ , 34.08 Ω | W1 = 3.048, W2 = 3.048, W3 = 2.286 | W1 = 120, W2 = 120, W3 = 90 |
| TL213 | 0.008 λ , 34.08 Ω | W1 = 3.048, W2 = 3.048, W3 = 0.762 | W1 = 120, W2 = 120, W3 = 30 |
| TL214, TL215 | 0.051 λ , 34.08 Ω | W = 3.048, L = 4.826 | W = 120, L = 190 |
| TL221, TL242 | 0.013 λ , 51.58 Ω | W = 1.651, L = 1.270 | W = 65, L = 50 |
| TL223 (taper) | 0.018 λ , 19.45 Ω / 51.58 Ω | W1 = 6.248, W2 = 1.651, L = 1.651 | W1 = 246, W2 = 65, L = 65 |
| TL226 | | W1 = 12.700, W2 = 17.780 | W1 = 500, W2 = 700 |
| TL229, TL230 | 0.000 λ , 19.45 Ω | W = 6.248, L = 0.025 | W = 246, L = 1 |
| TL231 (taper) | 0.038 λ , 8.31 Ω / 19.45 Ω | W1 = 16.510, W2 = 6.248, L = 3.378 | W1 = 650, W2 = 246, L = 133 |
| TL232 | | W1 = 6.248, W2 = 0.025, W3 = 6.248, W4 = 0.025 | W1 = 246, W2 = 1, W3 = 246, W4 = 1 |
| TL233, TL234, TL237, TL238 | 0.000 λ , 146.88 Ω | W = 0.025, L = 0.025 | W = 1, L = 1 |
| TL235 | 0.005 λ , 51.58 Ω | W = 1.651, L = 0.508 | W = 65, L = 20 |
| TL236 | 0.000 λ , 8.31 Ω | W = 16.510, L = 0.025 | W = 650, L = 1 |
| TL239 | | W1 = 20.320, W2 = 0.025, W3 = 20.320, W4 = 0.025 | W1 = 800, W2 = 1, W3 = 800, W4 = 1 |
| TL240, TL241 | 0.000 λ , 6.86 Ω | W = 20.320, L = 0.025 | W = 800, L = 1 |

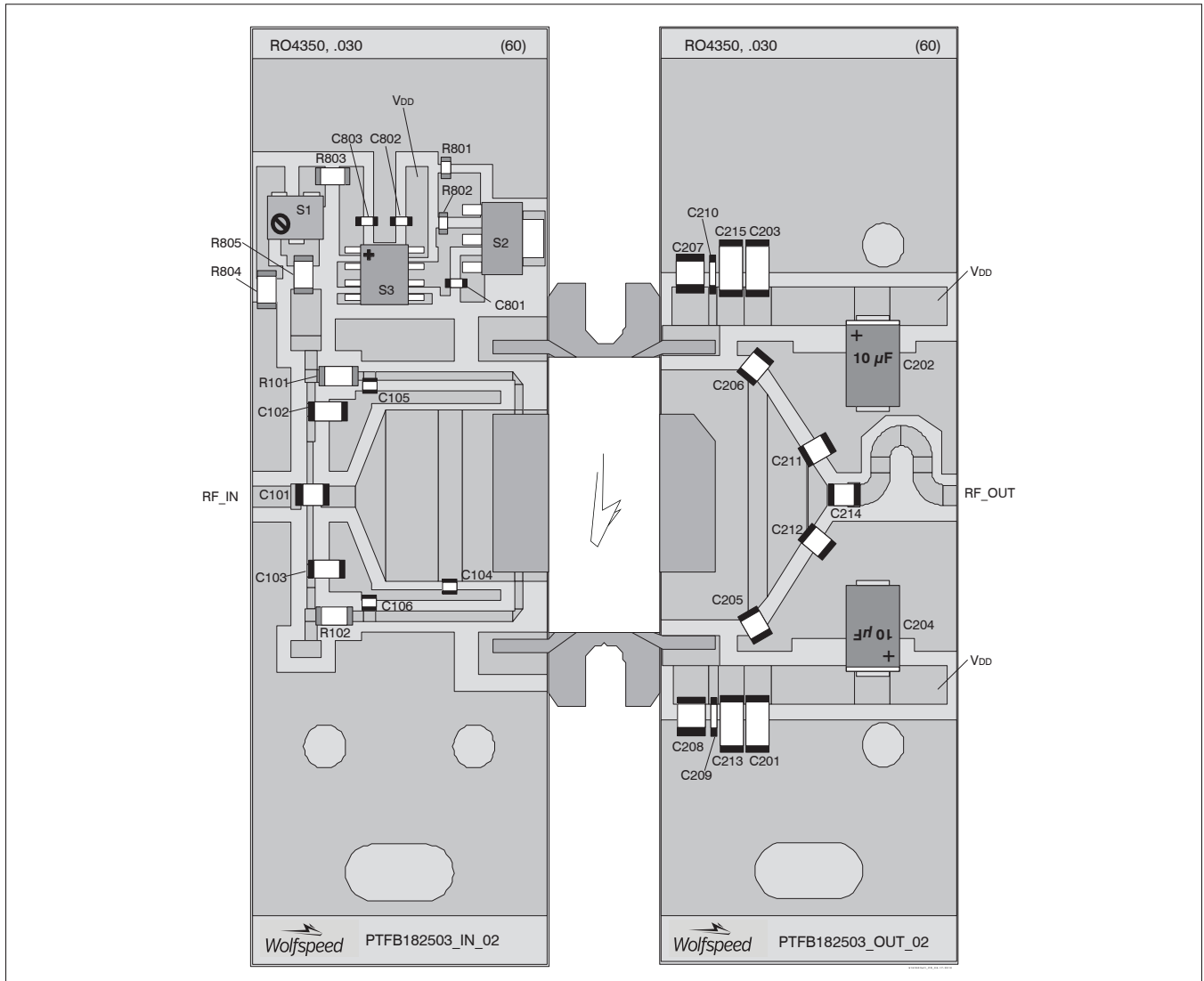


Reference Circuit (cont.)

Circuit Assembly Information

Test Fixture Part No. LTN/PTFB182503FL

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

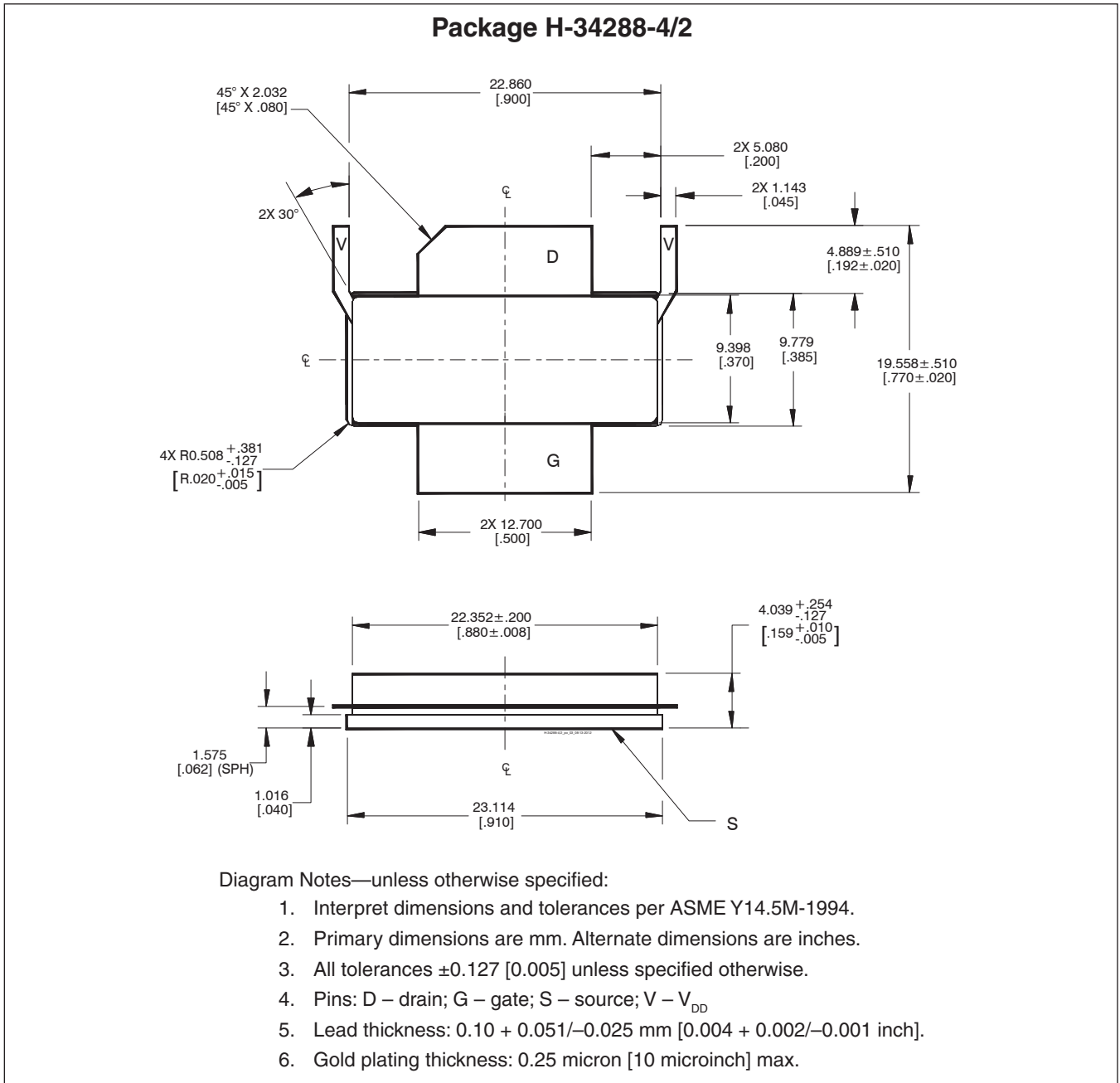


Reference circuit assembly diagram (not to scale)

Reference Circuit (cont.)

| Component | Description | Suggested Manufacturer | P/N |
|------------------------|------------------------------|------------------------|-------------------|
| Input | | | |
| C101 | Chip capacitor, 7.5 pF | ATC | ATC100B7R5BW500XB |
| C102, C103 | Chip capacitor, 4.71 μ F | ATC | 493-2372-2-ND |
| C104 | Chip capacitor, 0.3 pF | ATC | ATC100A0R3BW150XB |
| C105, C106 | Chip capacitor, 10 pF | ATC | ATC100A100FW150XB |
| C801, C802, C803 | Capacitor, 1000 pF | Digi-Key | PCC1772CT-ND |
| R101, R102, R804, R805 | Resistor, 10 Ω | Digi-Key | P10ECT-ND |
| R801 | Resistor, 1300 Ω | Digi-Key | P1.3KGCT-ND |
| R802 | Resistor, 1200 Ω | Digi-Key | P1.2KGCT-ND |
| R803 | Resistor, 100 Ω | Digi-Key | P100ECT-ND |
| S1 | Potentiometer, 2k Ω | Digi-Key | 3224W-202ECT-ND |
| S2 | Transistor | Digi-Key | BCP5616TA-ND |
| S3 | Voltage Regulator | Digi-Key | LM78L05ACM-ND |
| Output | | | |
| C201, C203 | Chip capacitor, 0.1 μ F | Digi-Key | 445-1411-2-ND |
| C202, C204 | Capacitor, 10 μ F | Garrett Electronics | 281M5002106K |
| C205, C206 | Chip capacitor, 0.6 pF | ATC | ATC100B0R6BW500XB |
| C207, C208 | Chip capacitor, 10 μ F | Digi-Key | 587-1818-2-ND |
| C209, C210 | Chip capacitor, 0.1 μ F | Digi-Key | 399-1267-2-ND |
| C211, C212 | Chip capacitor, 0.9 pF | ATC | ATC100B0R9BW500XB |
| C213, C215 | Chip capacitor, 2.2 μ F | Digi-Key | 445-1447-2-ND |
| C214 | Chip capacitor, 10 pF | ATC | ATC100B100FW500XB |

Package Outline Specifications



Revision History

| | | | | |
|------|------------|------------|-----|------------------------------------|
| 07.2 | 2016-06-10 | Production | 2 | Updated ordering code to R0 |
| 08 | 2018-07-18 | Production | All | Converted to Wolfspeed data sheet. |

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Notes

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