

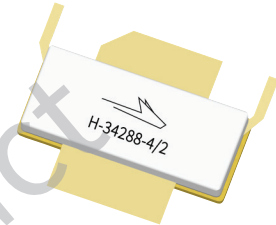
PTFB212503FL

Thermally-Enhanced High Power RF LDMOS FET 240 W, 2110 – 2170 MHz

Description

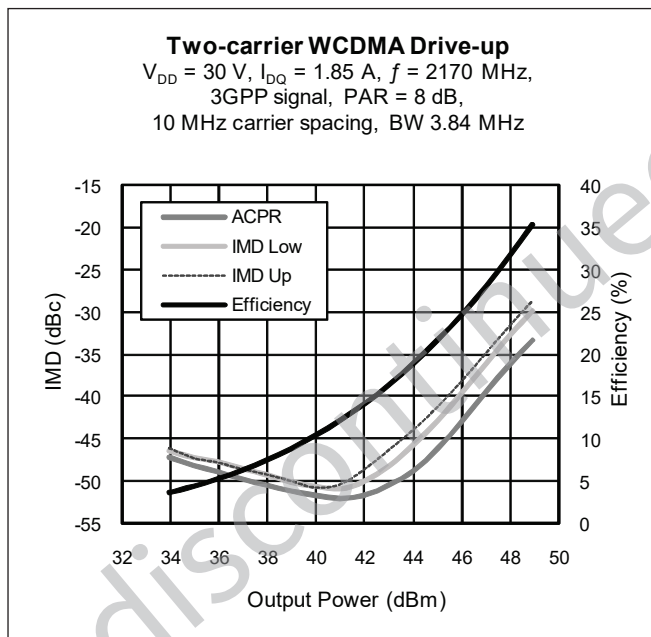
The PTFB212503FL is a 240-watt LDMOS FETs intended for use in multi-standard cellular power amplifier applications in the 2110 to 2170 MHz frequency band. Features include input and output matching, high gain, wide signal bandwidth and reduced memory effects for unparalleled DPD correctability. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.

PTFB212503FL
Package H-34288-4/2



Features

- Broadband internal input and output matching
- Enhanced for use in DPD error correction systems
- Wide video bandwidth
- Typical single-carrier WCDMA performance at 2170 MHz, 30 V, $I_{DQ} = 1.85$ A, 3GPP signal, channel bandwidth = 3.84 MHz, PAR = 7.5 dB @ 0.01% CCDF
 - Average output power = 49.4 dBm
 - Linear gain = 18 dB
 - Efficiency = 37%
 - Intermodulation distortion = -33 dBc
- Typical CW performance, 2170 MHz, 30 V
 - Output power at $P_{1dB} = 240$ W
 - Efficiency = 54 %
- 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 (not subject to production test—verified by design/characterization in Wolfspeed test fixture)
 $V_{DD} = 30$ V, $I_{DQ} = 1.85$ A, $P_{OUT} = 55$ W average, $f_1 = 2160$ MHz, $f_2 = 2170$ MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	18.0	—	dB
Drain Efficiency	η_D	—	31	—	%
Intermodulation Distortion	IMD	—	-33	—	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** (tested in Wolfspeed test fixture) $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 200\text{ W PEP}$, $f = 2170\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17	18	—	dB
Drain Efficiency	η_D	39	40	—	%
Intermodulation Distortion	IMD	—	-30	-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	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.05	—	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

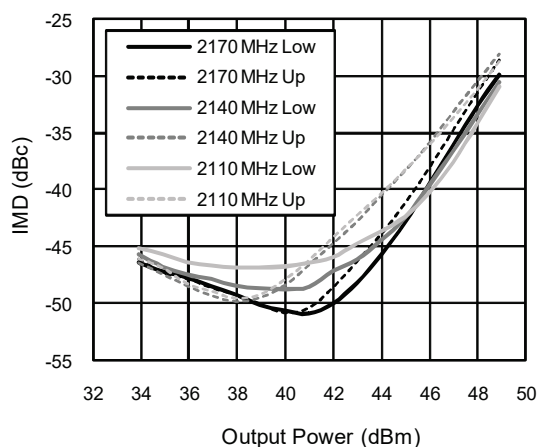
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	V
Gate-Source Voltage	V_{GS}	-6 to +10	V
Junction Temperature	T_J	200	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-40 to +150	$^{\circ}\text{C}$
Thermal Resistance ($T_{CASE} = 70^{\circ}\text{C}$, 200 W CW)	$R_{\theta JC}$	0.26	$^{\circ}\text{C/W}$

Ordering Information

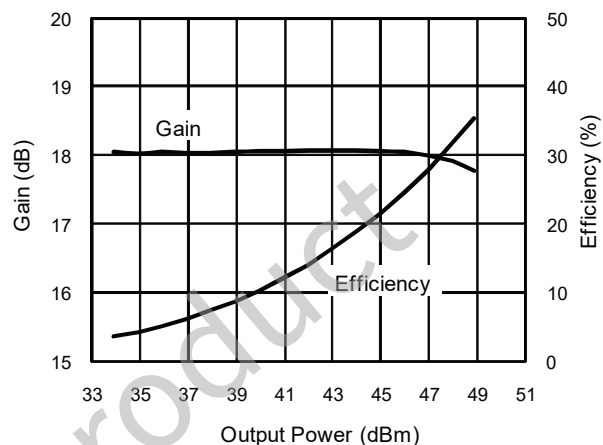
Type and Version	Order Code	Package Description	Shipping
PTFB212503FL V2 R0	PTFB212503FL-V2-R0	H-34288-4/2, earless flange	Tape & Reel, 50 pcs
PTFB212503FL V2 R250	PTFB212503FL-V2-R250	H-34288-4/2, earless flange	Tape & Reel, 250 pcs

Typical Performance (data taken in a production test fixture)**Two-carrier WCDMA Drive-up**

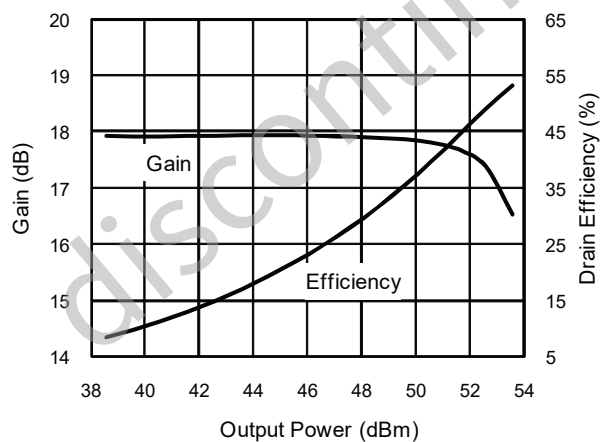
$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, 3GPP signal,
PAR = 8 dB, 10 MHz carrier spacing,
BW 3.84 MHz

**Two-carrier WCDMA Drive-up**

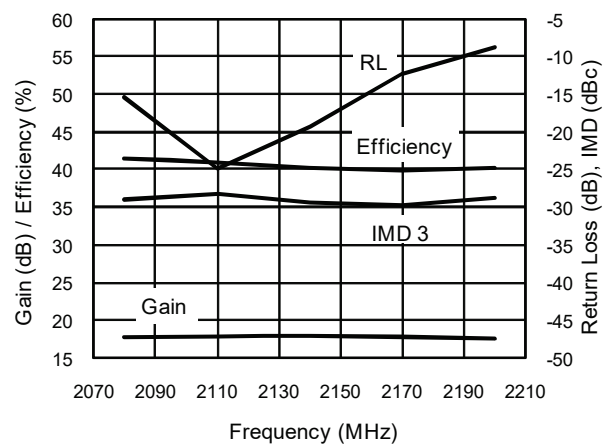
$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$, 3GPP
WCDMA, PAR = 8 dB, 10 MHz carrier spacing,
BW 3.84 MHz

**CW Power Sweep
Gain & Efficiency vs. Output Power**

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$

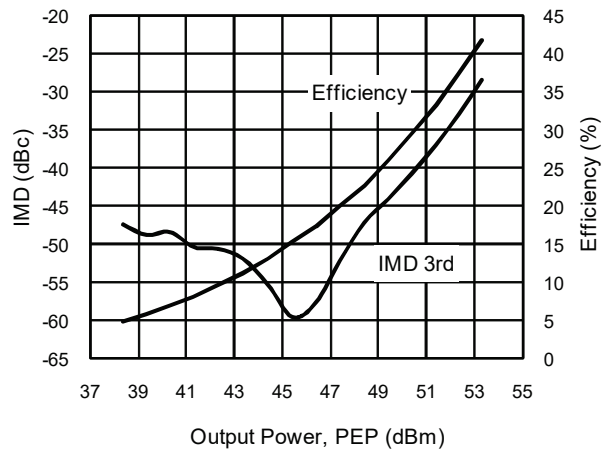
**Two-tone Broadband Performance**

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 100\text{ W}$

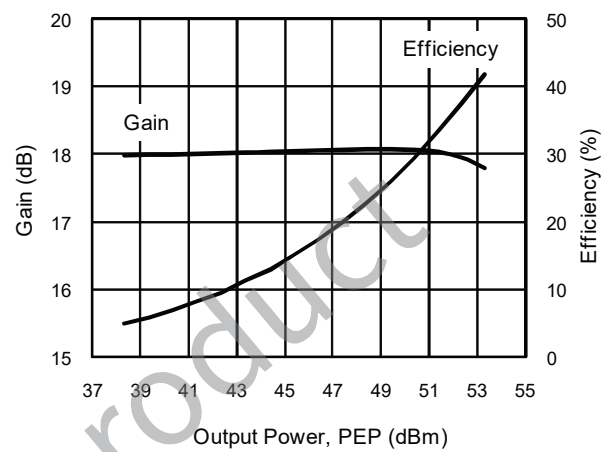


Typical Performance (cont.)

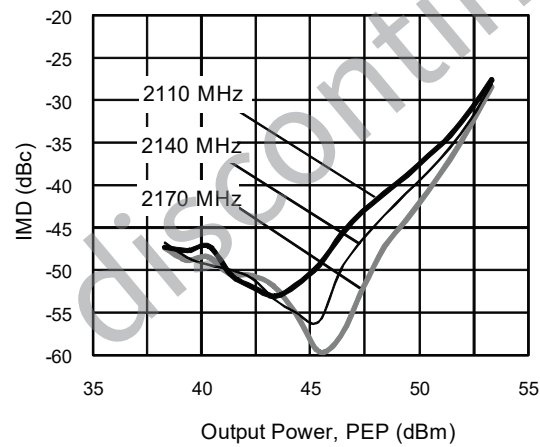
Two-tone Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,
 $f_1 = 2170\text{ MHz}$, $f_2 = 2169\text{ MHz}$



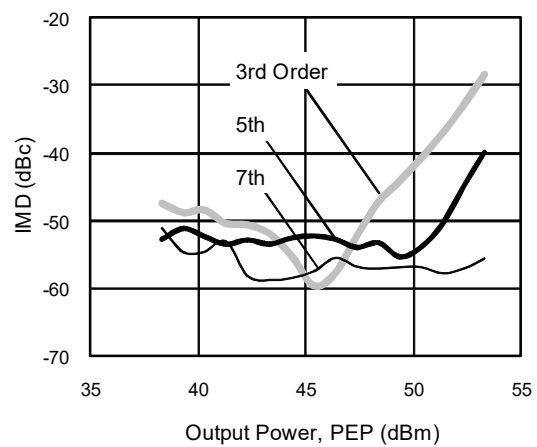
Two-tone Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,
 $f_1 = 2170\text{ MHz}$, $f_2 = 2169\text{ MHz}$



Third Order Intermodulation Distortion vs. Output Power
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,

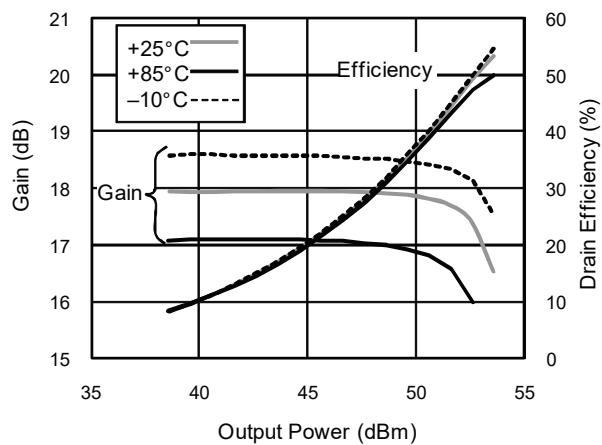
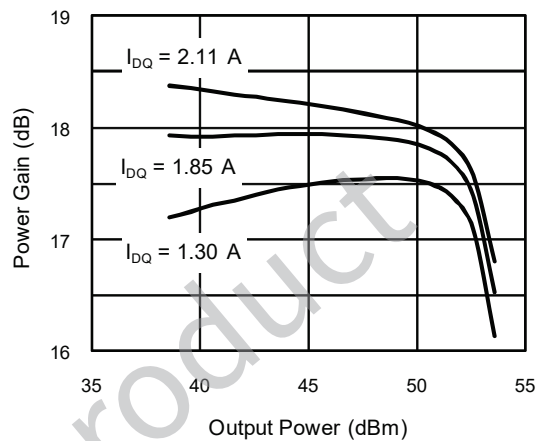


Intermodulation Distortion
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,
 $f_1 = 2170\text{ MHz}$, $f_2 = 2169\text{ MHz}$

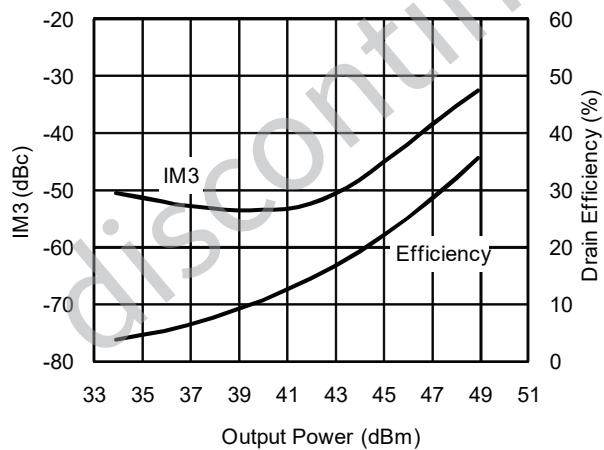


Typical Performance (cont.)

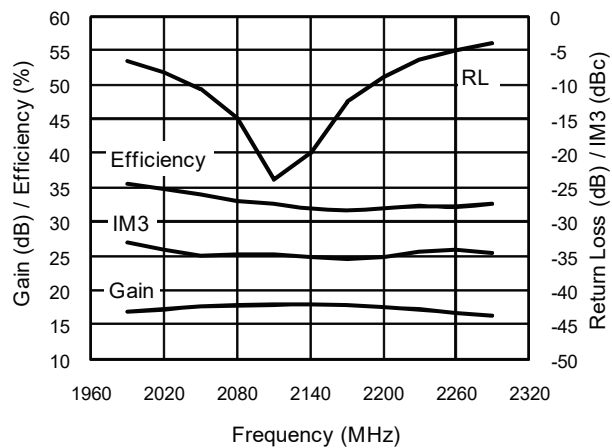
CW Performance

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$
CW Performance
Gain vs. Output Power
 $V_{DD} = 30\text{ V}$, $f = 2170\text{ MHz}$


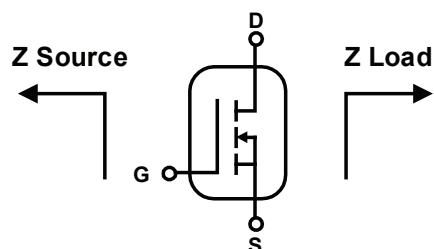
Single-carrier WCDMA

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$, 3GPP
WCDMA, PAR = 8.5 dB, BW 3.84 MHz


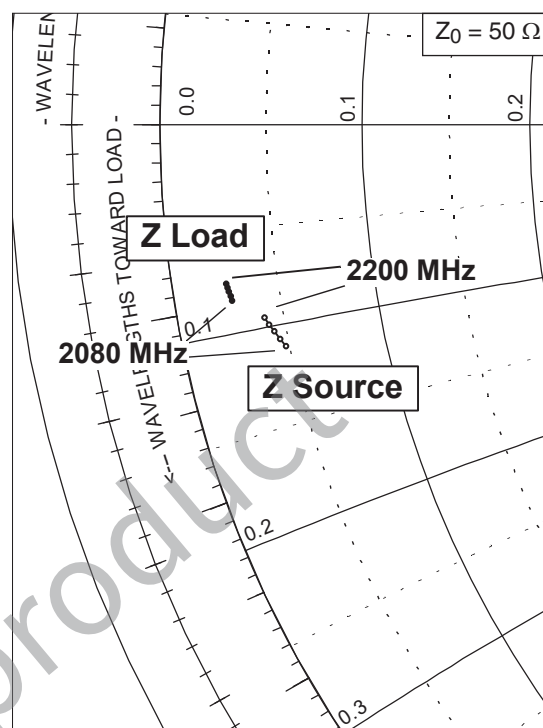
Single-carrier WCDMA, 3GPP Broadband

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 63\text{ W}$


Broadband Circuit Impedance

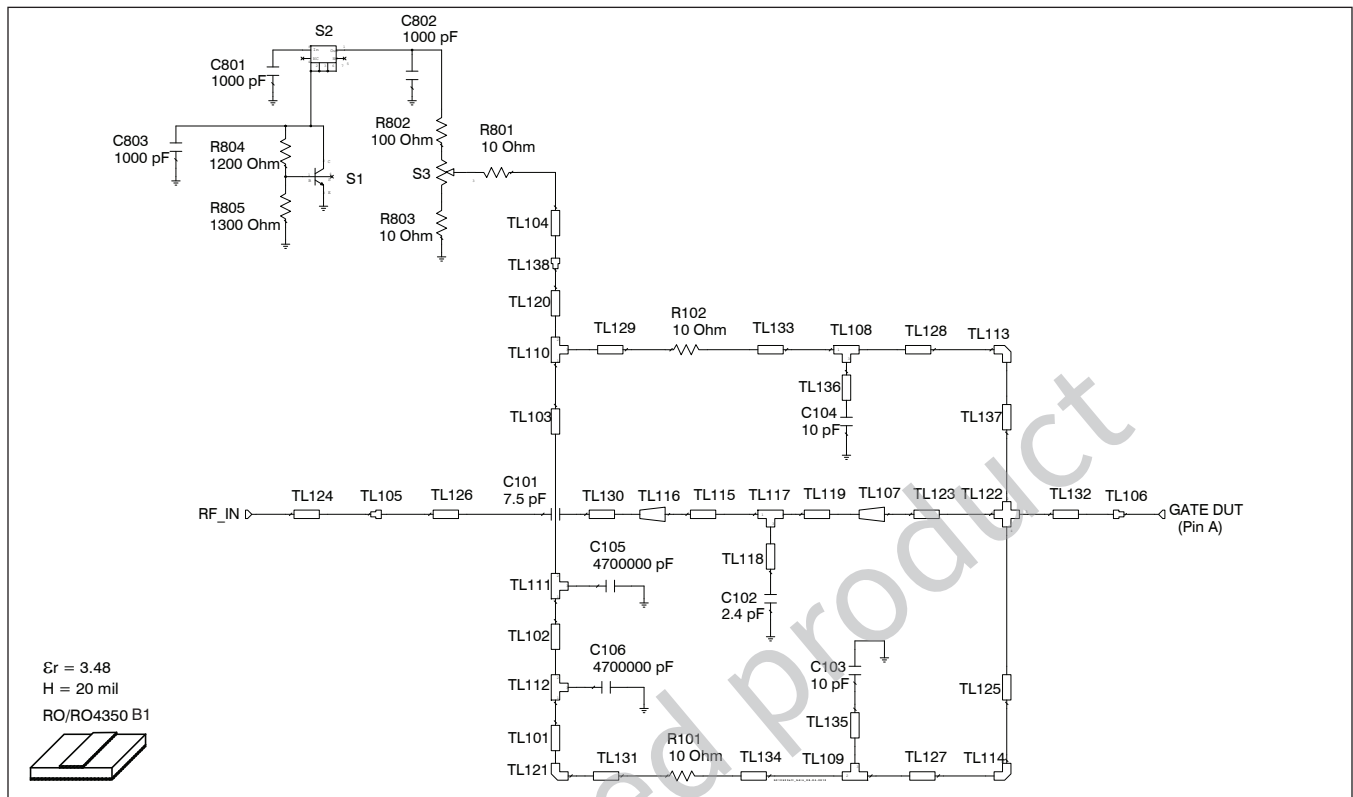
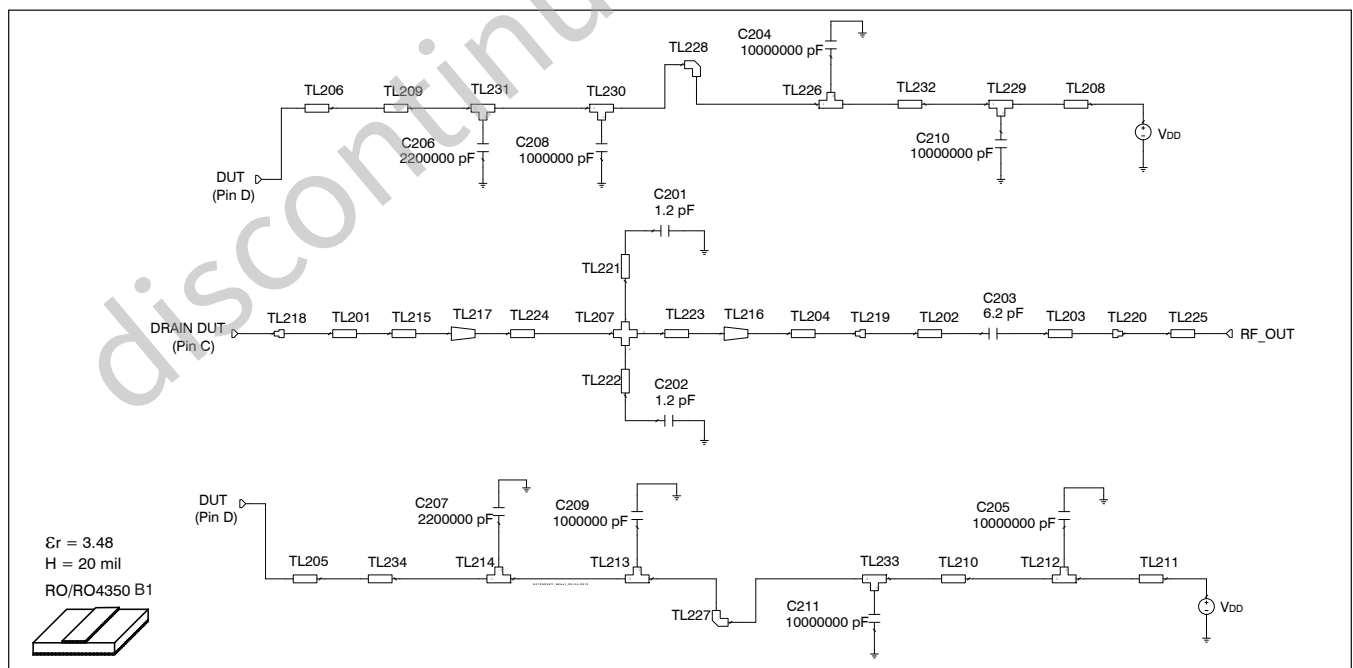


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
2080	2.42	-5.57	1.34	-4.23
2110	2.31	-5.36	1.32	-4.12
2140	2.21	-5.15	1.29	-4.01
2170	2.12	-4.96	1.27	-3.91
2200	2.04	-4.77	1.25	-3.81



See next page for reference circuit information

Reference Circuit

Reference circuit input schematic for $f = 2170 \text{ MHz}$ Reference circuit output schematic for $f = 2170 \text{ MHz}$

Reference Circuit (cont.)

Description	
DUT	PTFB212503FL
PCB	0.508 mm [.020"] thick, $\epsilon_r = 3.48$, Rogers 4350, 1 oz. copper

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.043λ , 54.17 Ω	W = 1.016, L = 3.594	W = 40, L = 142
TL102	0.107λ , 63.89 Ω	W = 0.762, L = 9.050	W = 30, L = 356
TL103	0.044λ , 63.89 Ω	W = 0.762, L = 3.734	W = 30, L = 147
TL104	0.031λ , 34.72 Ω	W = 1.981, L = 2.540	W = 78, L = 100
TL105		W1 = 1.270, W2 = 2.286	W1 = 50, W2 = 90
TL106		W1 = 17.780, W2 = 12.700	W1 = 700, W2 = 500
TL107 (taper)	0.027λ , 6.67 Ω / 15.80 Ω	W1 = 13.970, W2 = 5.334, L = 2.032	W1 = 550, W2 = 210, L = 80
TL108, TL109	0.012λ , 54.17 Ω	W1 = 1.016, W2 = 1.016, W3 = 1.016	W1 = 40, W2 = 40, W3 = 40
TL110	0.012λ , 54.17 Ω	W1 = 1.016, W2 = 1.270, W3 = 1.016	W1 = 40, W2 = 50, W3 = 40
TL111, TL112	0.012λ , 63.89 Ω	W1 = 0.762, W2 = 0.762, W3 = 1.016	W1 = 30, W2 = 30, W3 = 40
TL113, TL114, TL121		W = 1.016	W = 40
TL115	0.000λ , 15.80 Ω	W = 5.334, L = 0.000	W = 210, L = 0
TL116 (taper)	0.013λ , 15.80 Ω / 47.12 Ω	W1 = 5.334, W2 = 1.270, L = 0.991	W1 = 210, W2 = 50, L = 39
TL117	0.000λ , 15.80 Ω	W1 = 5.334, W2 = 5.334, W3 = 0.025	W1 = 210, W2 = 210, W3 = 1
TL118	0.000λ , 144.35 Ω	W = 0.025, L = 0.025	W = 1, L = 1
TL119	0.000λ , 15.80 Ω	W = 5.334, L = 0.000	W = 210, L = 0
TL120	0.018λ , 54.17 Ω	W = 1.016, L = 1.524	W = 40, L = 60
TL122		W1 = 13.970, W2 = 1.016, W3 = 13.970 W4 = 1.016	W1 = 550, W2 = 40, W3 = 550, W4 = 40
TL123	0.005λ , 6.67 Ω	W = 13.970, L = 0.381	W = 550, L = 15
TL124	0.032λ , 47.12 Ω	W = 1.270, L = 2.692	W = 50, L = 106
TL125, TL137	0.026λ , 54.17 Ω	W = 1.016, L = 2.159	W = 40, L = 85
TL126	0.016λ , 31.24 Ω	W = 2.286, L = 1.270	W = 90, L = 50
TL127, TL128	0.095λ , 54.17 Ω	W = 1.016, L = 8.001	W = 40, L = 315
TL129	0.012λ , 54.17 Ω	W = 1.016, L = 1.016	W = 40, L = 40
TL130	0.134λ , 47.12 Ω	W = 1.270, L = 11.151	W = 50, L = 439
TL131	0.012λ , 54.17 Ω	W = 1.016, L = 1.021	W = 40, L = 40
TL132	0.053λ , 6.67 Ω	W = 13.970, L = 4.064	W = 550, L = 160
TL133, TL134	0.030λ , 54.17 Ω	W = 1.016, L = 2.540	W = 40, L = 100
TL135, TL136	0.002λ , 54.17 Ω	W = 1.016, L = 0.127	W = 40, L = 5
TL138		W1 = 1.016, W2 = 1.981	W1 = 40, W2 = 78

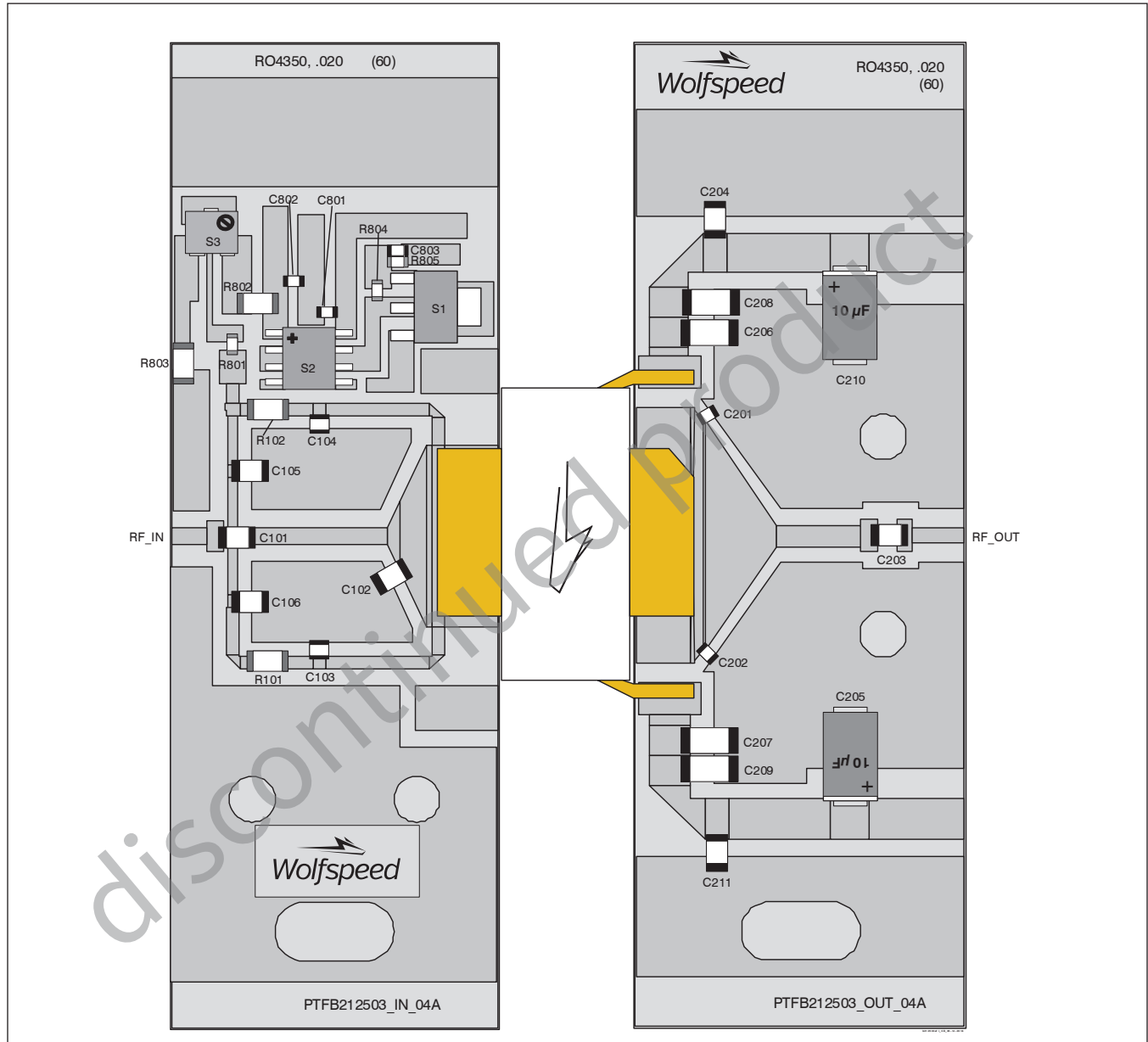
table continued on page 9

Reference Circuit (cont.)**Electrical Characteristics at 2170 MHz**

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Output			
TL201	0.054 λ , 4.84 Ω	W = 19.685, L = 4.064	W = 775, L = 160
TL202, TL203	0.016 λ , 28.85 Ω	W = 2.540, L = 1.270	W = 100, L = 50
TL204	0.078 λ , 39.51 Ω	W = 1.651, L = 6.426	W = 65, L = 253
TL205	0.032 λ , 16.90 Ω	W = 4.928, L = 2.540	W = 194, L = 100
TL206	0.032 λ , 17.05 Ω	W = 4.877, L = 2.540	W = 192, L = 100
TL207		W1 = 17.780, W2 = 0.025, W3 = 17.780 W4 = 0.025	W1 = 700, W2 = 1, W3 = 700, W4 = 1
TL208, TL211	0.092 λ , 25.04 Ω	W = 3.048, L = 7.341	W = 120, L = 289
TL209, TL234	0.010 λ , 25.04 Ω	W = 3.048, L = 0.762	W = 120, L = 30
TL210, TL232	0.098 λ , 25.04 Ω	W = 3.048, L = 7.823	W = 120, L = 308
TL212, TL229	0.038 λ , 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 3.048	W1 = 120, W2 = 120, W3 = 120
TL213, TL214, TL230, TL231	0.029 λ , 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 2.286	W1 = 120, W2 = 120, W3 = 90
TL215	0.003 λ , 4.84 Ω	W = 19.685, L = 0.254	W = 775, L = 10
TL216 (taper)	0.074 λ , 5.33 Ω / 39.51 Ω	W1 = 17.780, W2 = 1.651, L = 5.588	W1 = 700, W2 = 65, L = 220
TL217 (taper)	0.010 λ , 4.84 Ω / 5.33 Ω	W1 = 19.685, W2 = 17.780, L = 0.762	W1 = 775, W2 = 700, L = 30
TL218		W1 = 12.700, W2 = 17.780	W1 = 500, W2 = 700
TL219		W1 = 1.651, W2 = 2.540	W1 = 65, W2 = 100
TL220		W1 = 1.270, W2 = 2.540	W1 = 50, W2 = 100
TL221, TL222	0.000 λ , 144.35 Ω	W = 0.025, L = 0.025	W = 1, L = 1
TL223, TL224	0.000 λ , 5.33 Ω	W = 17.780, L = 0.025	W = 700, L = 1
TL225	0.047 λ , 47.12 Ω	W = 1.270, L = 3.912	W = 50, L = 154
TL226, TL233	0.023 λ , 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 1.829	W1 = 120, W2 = 120, W3 = 72

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

Test Fixture Part No. LTN/PTFB212503EF

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.)**Components Information**

Component	Description	Suggested Manufacturer	P/N
Input			
C101	Chip capacitor, 7.5 pF	ATC	ATC100B7R5BW500XB
C102	Chip capacitor, 2.4 pF	ATC	ATC100B2R4BW500XB
C103, C104	Chip capacitor, 10 pF	ATC	ATC100A100JW500XB
C105, C106	Chip capacitor, 4.7 μ F	Digi-Key	493-2372-2-ND
C801, C802, C803	Capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102, R803	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R801	Resistor, 10 Ω	Digi-Key	P10GCT-ND
R802	Resistor, 100 Ω	Digi-Key	P101ECT-ND
R804	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
R805	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
S1	Transistor	Digi-Key	BCP56
S2	Voltage Regulator	Digi-Key	LM78L05ACM-ND
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
Output			
C201, C202	Chip capacitor, 1.2 pF	ATC	ATC100A1R2BW500XB
C203	Chip capacitor, 6.2 pF	ATC	ATC100B6R2JW500XB
C204, C211	Capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C205, C210	Capacitor, 10 μ F	Garrett Electronics	281M5002106K
C206, C207	Chip capacitor, 2.2 μ F	Digi-Key	445-1447-2-ND
C208, C209	Chip capacitor, 1 μ F	Digi-Key	445-1411-2-ND

Package Outline Specifications

Package H-34288-4/2

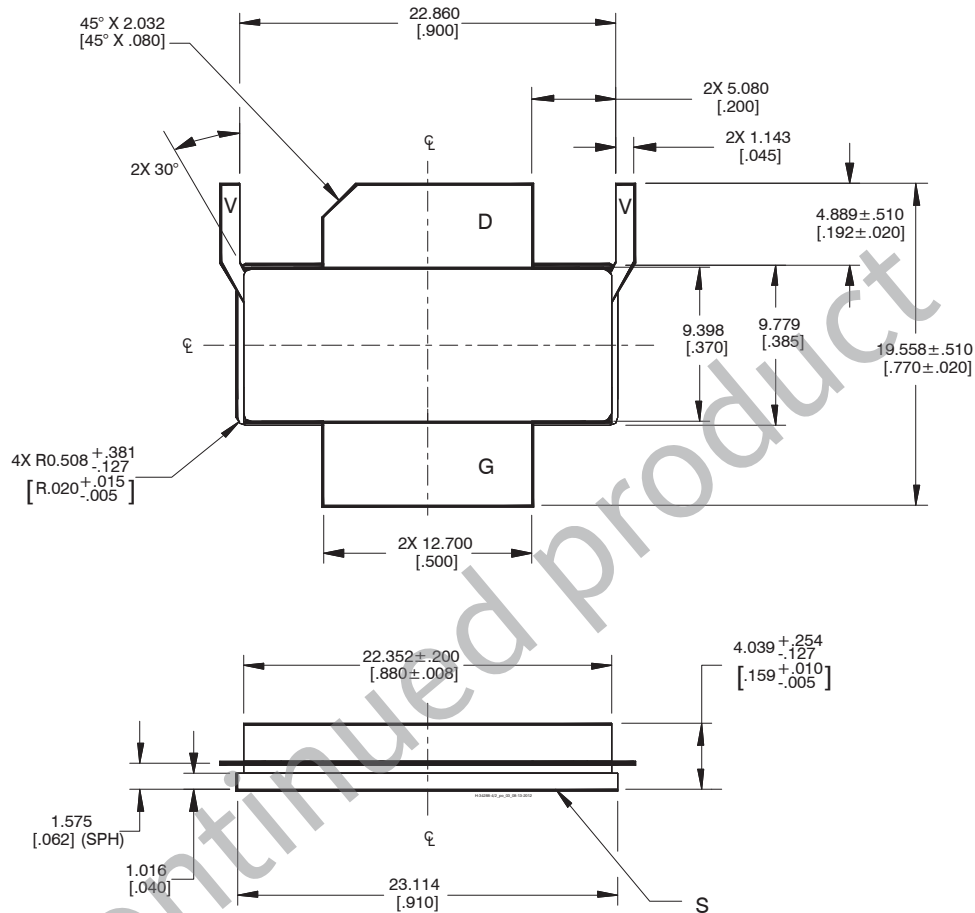


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ± 0.127 [0.005] unless specified otherwise.
4. Pins: D = drain; S = source; G = gate; V = V_{DD}.
5. Lead thickness: $0.10 + 0.051/-0.025$ mm [0.004 +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)
01	2009-03-27	Preliminary	All	Data Sheet reflects preliminary specification
02	2009-03-27	Preliminary	2	Updated gate-source voltage
03	2009-06-04	Preliminary	1 to 5	Revised operating conditions and provided updated and new performance
04	2009-08-04	Production	All 8 to 13 13, 14	Finalize specifications and remove Preliminary designation. Add circuit information Revise package notes
05	2009-10-12	Production	2	Revise Vgs and package outline information
06	2010-08-05	Production	1, 2 7 to 11 12, 13	Updated package information Revised reference circuit tables Updated package outline
07	2010-11-04	Production	1, 2, 12 1	Changed eared flange package type Updated VSWR spec to 10:1
07.1	2016-06-15	Production	2	Updated ordering information
08	2018-06-14	Production	All	Removed EL version, Converted to Wolfspeed Data Sheet
09	2020-02-17	Production	All	Not recommended for new design
10	2020-06-05	End of life	All	Product discontinued

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Notes

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