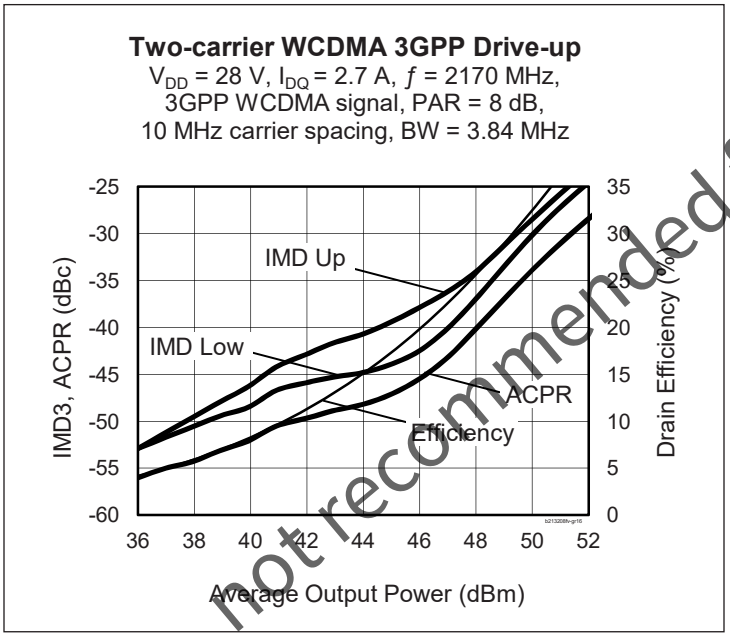
PTFB213208FV

Thermally-Enhanced High Power RF LDMOS FET
320 W, 28 V, 2110 – 2170 MHz

Description

The PTFB213208FV is a 320-watt LDMOS FET 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 and thermally-enhanced package with earless flange. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.



PTFB213208FV
Package H-37275G-6/2

Features

- Broadband internal matching
- Wide video bandwidth
- Typical pulsed CW performance, 2140 MHz, 28 V (combined outputs)
  - Output power @ P_{1dB} = 343 W
  - Efficiency = 54%
  - Gain = 16.5 dB
- Typical single-carrier WCDMA performance, 2140 MHz, 28 V
  - Output power = 50 dBm avg
  - Gain = 17 dB
  - Efficiency = 32%
- Capable of handling 10:1 VSWR @ 28 V, 320 W (CW) output power
- Integrated ESD protection
- Low thermal resistance
- Pb-free and RoHS compliant

RF Characteristics

Single-carrier WCDMA Measurements (tested in Wolfspeed test fixture)
V_{DD} = 28 V, I_{DQ} = 2.6 A, P_{OUT} = 85 W average, f = 2170 MHz
3GPP WCDMA signal, 3.84 MHz channel bandwidth, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	Gps	15.75	17.0	—	dB
Drain Efficiency	ηD	29	31	—	%
Adjacent Channel Power Ratio	ACPR	—	–33	–29.5	dBc

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

ESD: Electrostatic discharge sensitive device—observe handling precautions!

DC Characteristics (both sides)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = 10 mA	$V_{(BR)DSS}$	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	$R_{DS(on)}$	—	0.05	—	Ω
Operating Gate Voltage	V_{DS} = 28 V, I_{DQ} = 2.6 A	V_{GS}	2.3	2.8	3.3	V
Gate Leakage Current	V_{GS} = 10 V, V_{DS} = 0 V	I_{GSS}	—	—	1.0	µA

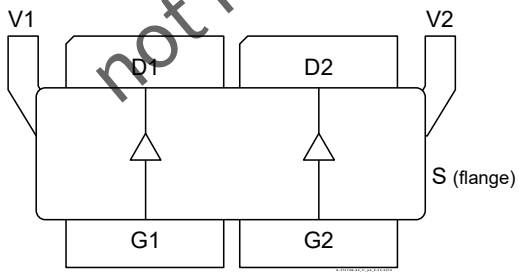
Maximum Ratings

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, 28 V, 200 W CW)	$R_{\theta JC}$	0.20	°C/W

Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTFB213208FV V2 R0	PTFB213208FV-V2-R0	H-37275G-6/2, ceramic open-cavity, push-pull earless	Tape & Reel, 50 pcs
PTFB213208FV V2 R2	PTFB213208FV-V2-R2	H-37275G-6/2, ceramic open-cavity, push-pull earless	Tape & Reel, 250 pcs

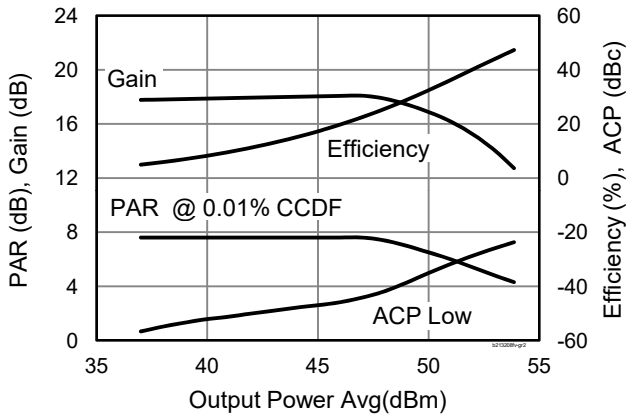
Pinout Diagram (top view)



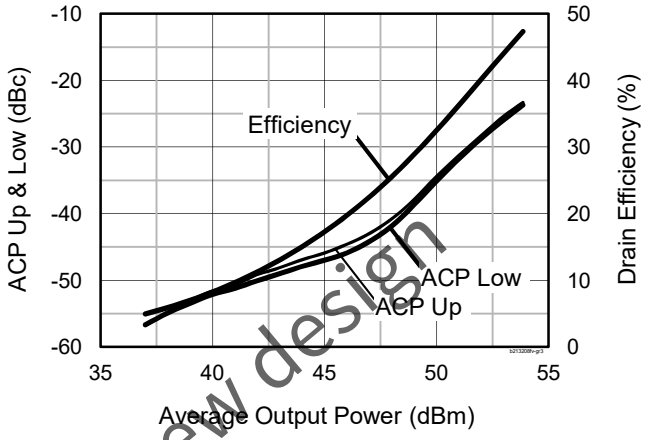
Pin	Description
D1	Drain device 1
D2	Drain device 2
G1	Gate device 1
G2	Gate device 2
V1	V_{DD} device 1
V2	V_{DD} device 2
S	Source (flange)

Typical Performance (data taken in an Wolfspeed production test fixture)

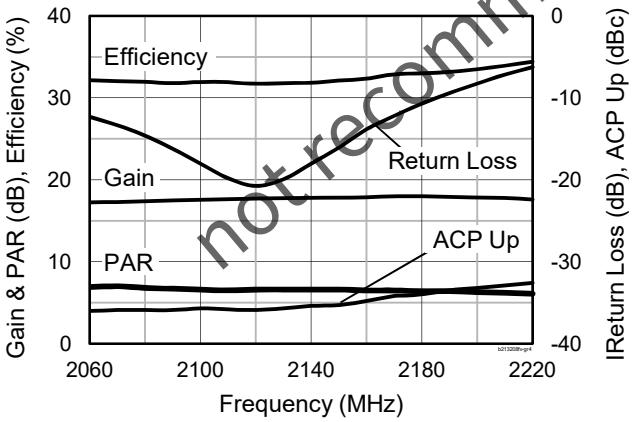
Single-carrier WCDMA 3GPP Drive-up
V_{DD} = 28V, I_{DQ} = 2.7 A, f = 2170 MHz
3GPP WCDMA signal,
PAR = 7.5 dB, 3.84 MHz BW



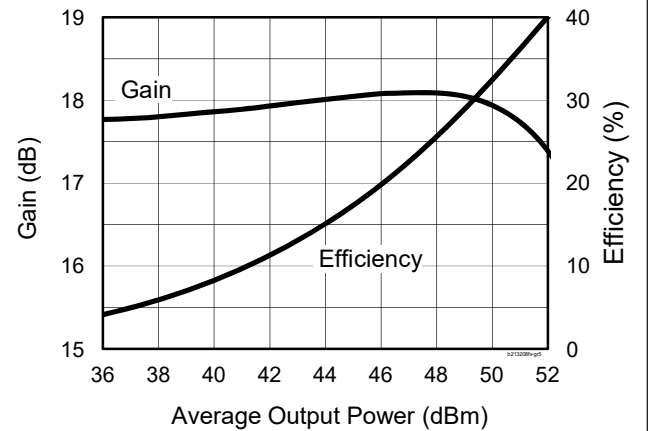
Single-carrier WCDMA Drive-up
V_{DD} = 28 V, I_{DQ} = 2.7 A, f = 2170 MHz,
3GPP WCDMA signal, PAR = 7.5,
BW = 3.84 MHz



Single-carrier WCDMA 3GPP Broadband Performance
V_{DD} = 28 V, I_{DQ} = 2.7 A, P_{OUT} = 100 W

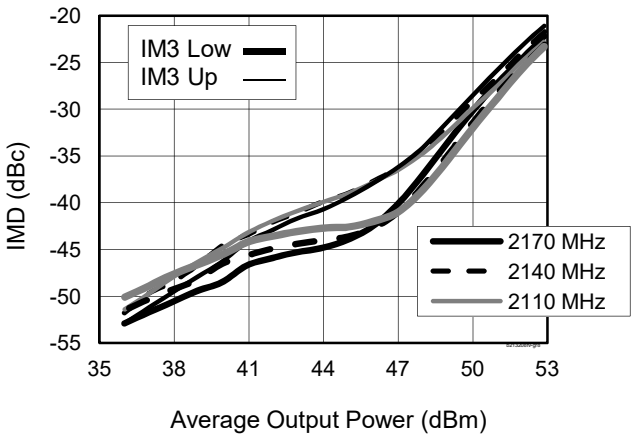


Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 28 V, I_{DQ} = 2.7 A, f = 2170 MHz,
3GPP WCDMA signal, PAR = 8 dB,
10 MHz carrier spacing, BW = 3.84 MHz

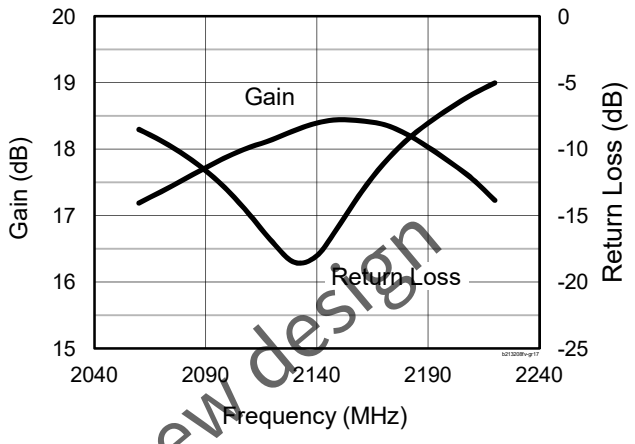


Typical Performance (cont.)

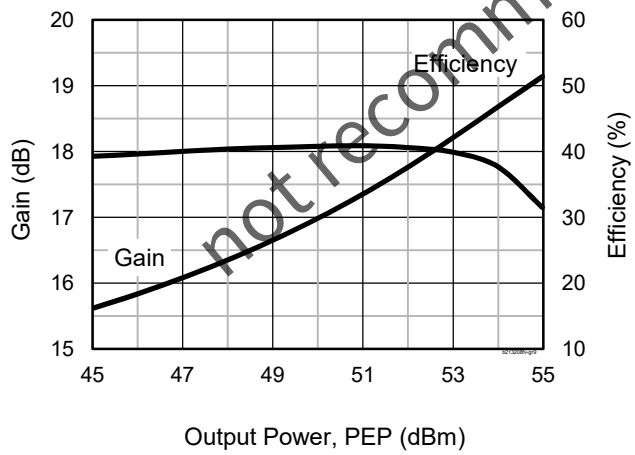
Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 30 V, I_{DQ} = 2.7 A,
3GPP WCDMA, PAR = 8 dB,
10 MHz carrier spacing, BW = 3.84 MHz



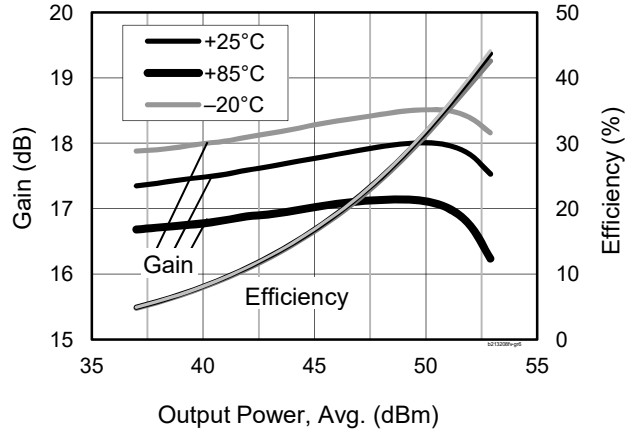
Single Carrier WCDMA
Broadband Performance
V_{DD} = 28 V, I_{DQ} = 2.7 A, P_{OUT} = 80 W



CW Drive-up
V_{DD} = 28 V, I_{DQ} = 2.7 A, f = 2170

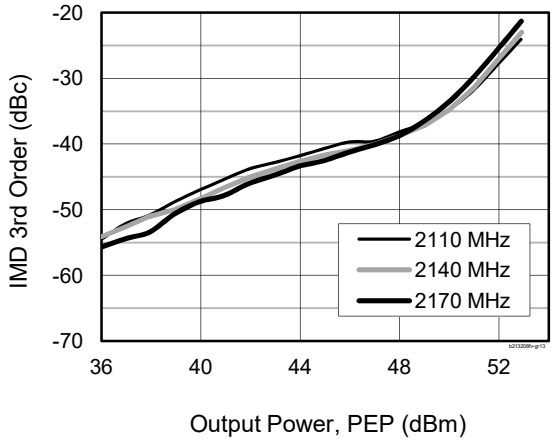


Two-tone Drive-up (over temperature)
V_{DD} = 28 V, I_{DQ} = 2.7 A,
f_1 = 2139.5 MHz, f_2 = 2140.5 MHz

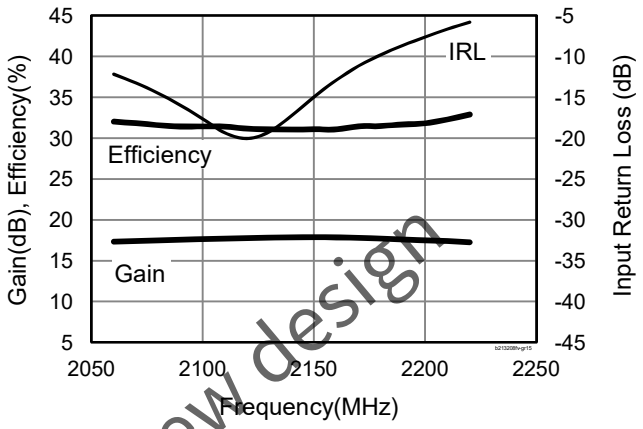


Typical Performance (cont.)

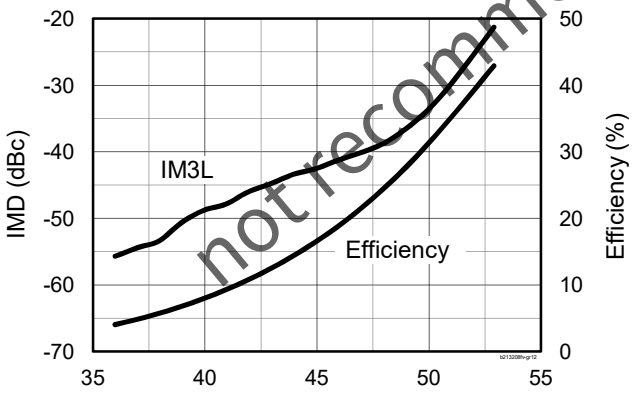
Two-tone Drive-up
at selected frequencies
V_{DD} = 28 V, I_{DQ} = 2.7 A, tone spacing = 1 MHz



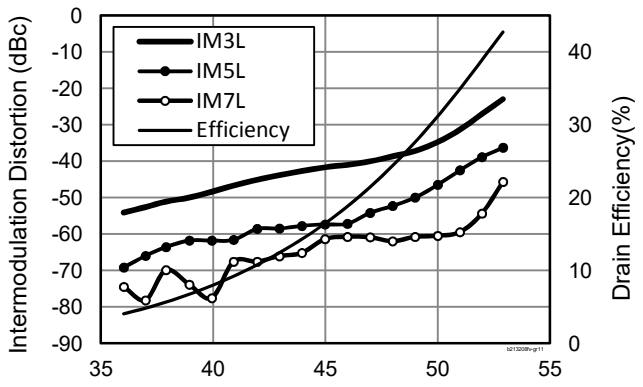
Two-tone Broadband Performance
V_{DD} = 28 V, I_{DQ} = 2.7 A, P_{OUT} = 126 W



Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 2.7 A, f = 2170 MHz

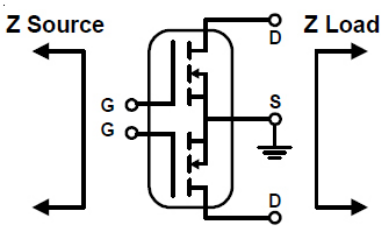


Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 2.7 A, f = 2140 MHz,
tone spacing = 1 MHz



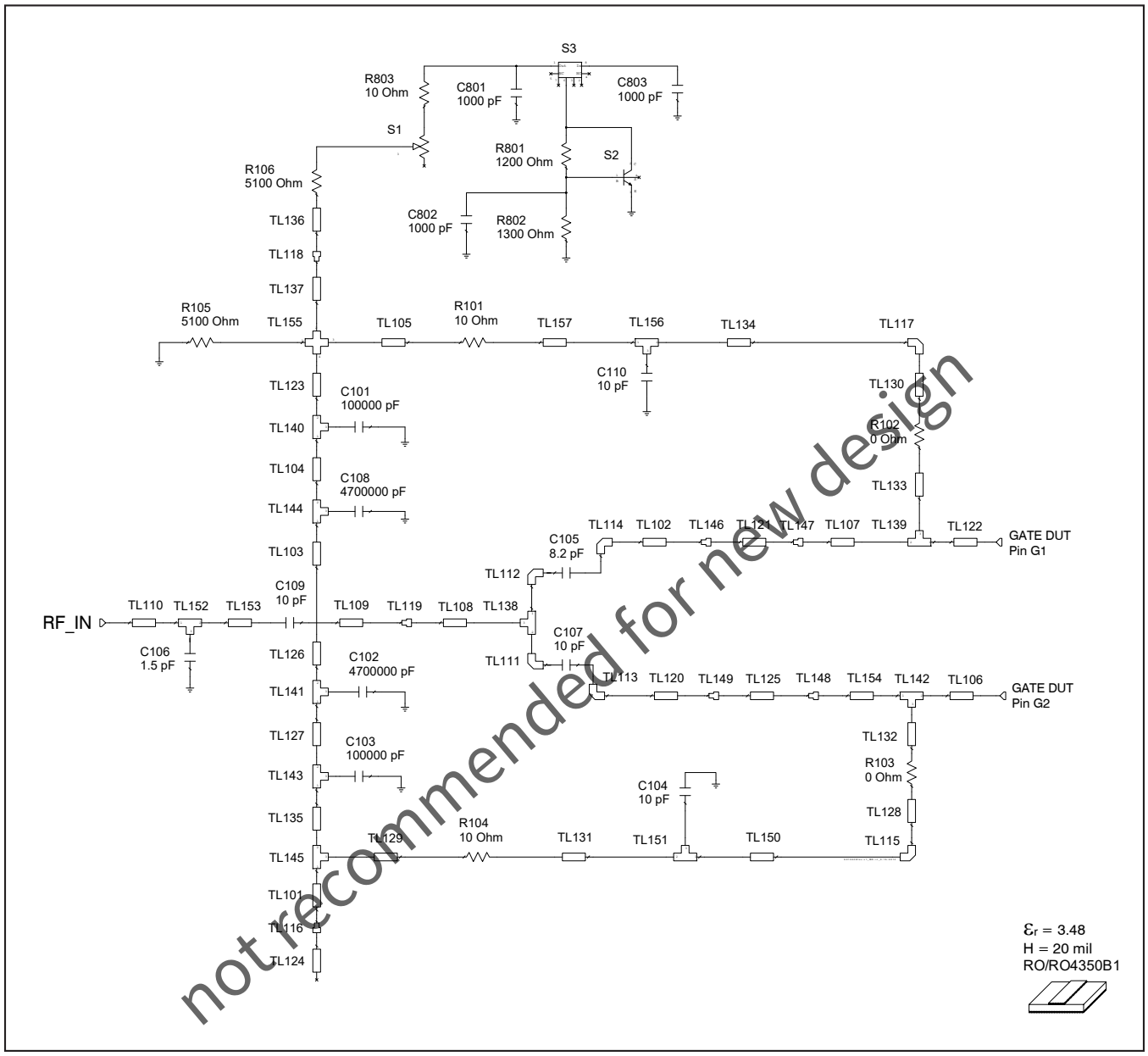
Broadband Circuit Impedance

Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
2100	3.34	–5.60	0.55	–1.99
2110	3.32	–5.61	0.55	–1.96
2120	3.30	–5.62	0.55	–1.94
2130	3.27	–5.63	0.54	–1.92
2140	3.24	–5.64	0.54	–1.89
2150	3.21	–5.65	0.54	–1.87
2160	3.18	–5.66	0.54	–1.85
2170	3.15	–5.67	0.54	–1.82
2180	3.11	–5.68	0.54	–1.80
2190	3.07	–5.69	0.54	–1.78
2200	3.03	–5.70	0.54	–1.75



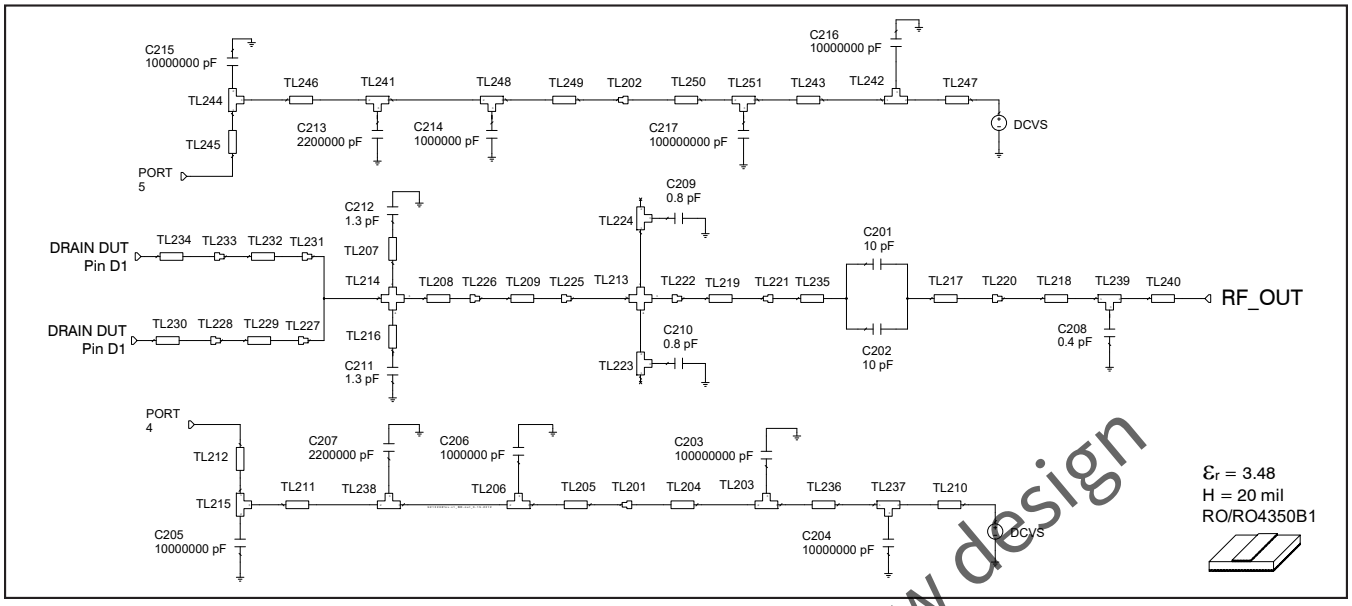
See next page for reference circuit information

Reference Circuit



Reference circuit input schematic for ƒ = 2170 MHz

Reference Circuit (cont.)



Reference circuit output schematic for ƒ = 2170 MHz

Reference Circuit Assembly

DUT	PTFB213208FV
Test Fixture Part No.	LTN/PTFB213208FV
PCB	Rogers RO4350, 0.508 mm [0.020"] thick, 2 oz. copper, ε_r = 3.48
Find Gerber files for this test fixture on the Wolfspeed Web site at **www.wolfspeed.com/RF**	

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.006 λ, 63.89 Ω	W = 0.76, L = 0.51	W = 30, L = 20
TL102, TL120	0.009 λ, 28.85 Ω	W = 2.54, L = 0.76	W = 100, L = 30
TL103	0.156 λ, 63.89 Ω	W = 0.76, L = 13.19	W = 30, L = 519
TL104	0.010 λ, 63.89 Ω	W = 0.76, L = 0.81	W = 30, L = 32
TL105	0.020 λ, 54.17 Ω	W = 1.02, L = 1.65	W = 40, L = 65
TL106, TL122	0.070 λ, 7.29 Ω	W = 12.7, L = 5.36	W = 500, L = 211
TL107	0.017 λ, 7.29 Ω	W = 12.7, L = 1.3	W = 500, L = 51
TL108	0.025 λ, 32.6 Ω	W = 2.16, L = 2.03	W = 85, L = 80
TL109	0.060 λ, 49.69 Ω	W = 1.17, L = 5.02	W = 46, L = 197
TL110	0.006 λ, 49.69 Ω	W = 1.17, L = 0.51	W = 46, L = 20
TL121	0.023 λ, 17.05 Ω	W = 4.88, L = 1.78	W = 192, L = 70
TL123	0.054 λ, 63.89 Ω	W = 0.76, L = 4.57	W = 30, L = 180
TL124	0.016 λ, 34.08 Ω	W = 2.03, L = 1.27	W = 80, L = 50
TL125	0.023 λ, 17.05 Ω	W = 4.88, L = 1.78	W = 192, L = 70

table continued on next page

Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz (Input cont.)

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
TL126	0.018 λ, 63.89 Ω	W = 0.76, L = 1.52	W = 30, L = 6
TL126	0.018 λ, 63.89 Ω	W = 0.76, L = 1.52	W = 30, L = 60
TL127	0.011 λ, 63.89 Ω	W = 0.76, L = 0.89	W = 30, L = 35
TL128, TL130	0.006 λ, 54.17 Ω	W = 1.02, L = 0.51	W = 40, L = 20
TL129	0.018 λ, 54.17 Ω	W = 1.02, L = 1.53	W = 40, L = 60
TL131	0.017 λ, 54.17 Ω	W = 1.02, L = 1.42	W = 40, L = 56
TL132, TL133	0.009 λ, 54.17 Ω	W = 1.02, L = 0.76	W = 40, L = 30
TL134	0.098 λ, 54.17 Ω	W = 1.02, L = 8.2	W = 40, L = 323
TL135	0.056 λ, 63.89 Ω	W = 0.76, L = 4.72	W = 30, L = 186
TL136	0.016 λ, 34.08 Ω	W = 2.03, L = 1.27	W = 80, L = 50
TL137	0.003 λ, 63.89 Ω	W = 0.76, L = 0.28	W = 30, L = 10
TL138	0.027 λ, 28.85 Ω	W1 = 2.54, W2 = 2.54, W3 = 2.16	W1 = 100, W2 = 100, W3 = 85
TL139, TL142	0.013 λ, 7.29 Ω	W1 = 12.7, W2 = 12.7, W3 = 1.02	W1 = 500, W2 = 500, W3 = 40
TL140, TL141, TL143, TL144	0.015 λ, 63.89 Ω	W1 = 0.76, W2 = 0.76, W3 = 1.27	W1 = 30, W2 = 30, W3 = 50
TL145	0.012 λ, 63.89 Ω	W1 = 0.76, W2 = 0.76, W3 = 1.02	W1 = 30, W2 = 30, W3 = 40
TL150	0.100 λ, 54.17 Ω	W = 1.02, L = 8.36	W = 40, L = 329
TL151, TL156	0.015 λ, 54.17 Ω	W1 = 1.02, W2 = 1.02, W3 = 1.27	W1 = 40, W2 = 40, W3 = 50
TL152	0.015 λ, 49.69 Ω	W1 = 1.17, W2 = 1.17, W3 = 1.27	W1 = 46, W2 = 46, W3 = 50
TL153	0.012 λ, 49.69 Ω	W = 1.17, L = 0.97	W = 46, L = 38
TL154	0.017 λ, 7.29 Ω	W = 12.7, L = 1.3	W = 500, L = 51
TL155	0.090 λ, 47.12 Ω	W1 = 1.27, W2 = 0.767, W3 = 1.27, W4 = 0.72	W1 = 50, W2 = 30, W3 = 50, W4 = 30
TL157	0.017 λ, 54.17 Ω	W = 1.02, L = 1.42	W = 40, L = 56
Output			
TL203	0.026 λ, 11.57 Ω	W1 = 7.62, W2 = 7.62, W3 = 2.03	W1 = 300, W2 = 300, W3 = 80
TL204	0.028 λ, 11.57 Ω	W = 7.62, L = 2.18	W = 300, L = 86
TL205	0.089 λ, 20.93 Ω	W = 3.81, L = 7.11	W = 150, L = 280
TL206	0.029 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 2.29	W1 = 150, W2 = 150, W3 = 90
TL207, TL216	0 λ, 144.35 Ω	W = 0.03, L = 0.03	W = 1, L = 1
TL208	0.009 λ, 4.29 Ω	W = 22.35, L = 0.65	W = 880, L = 25
TL209	0.021 λ, 7.92 Ω	W = 11.61, L = 1.6	W = 457, L = 63
TL210	0.013 λ, 11.57 Ω	W = 7.62, L = 1.02	W = 300, L = 40
TL211	0.016 λ, 20.93 Ω	W = 3.81, L = 1.3	W = 150, L = 51
TL212	0.098 λ, 20.93 Ω	W = 3.81, L = 7.8	W = 150, L = 307
TL213	0.003 λ, 10.43 Ω	W1 = 8.56, W2 = 0.25, W3 = 8.56, W4 = 0.25	W1 = 337, W2 = 10, W3 = 337, W4 = 10
TL214	0.020 λ, 4.29 Ω	W1 = 22.35, W2 = 1.52, W3 = 22.35, W4 = 1.52	W1 = 880, W2 = 60, W3 = 880, W4 = 60
TL215	0.048 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 3.81	W1 = 150, W2 = 150, W3 = 150
TL217	0.016 λ, 20.93 Ω	W = 3.81, L = 1.27	W = 150, L = 50

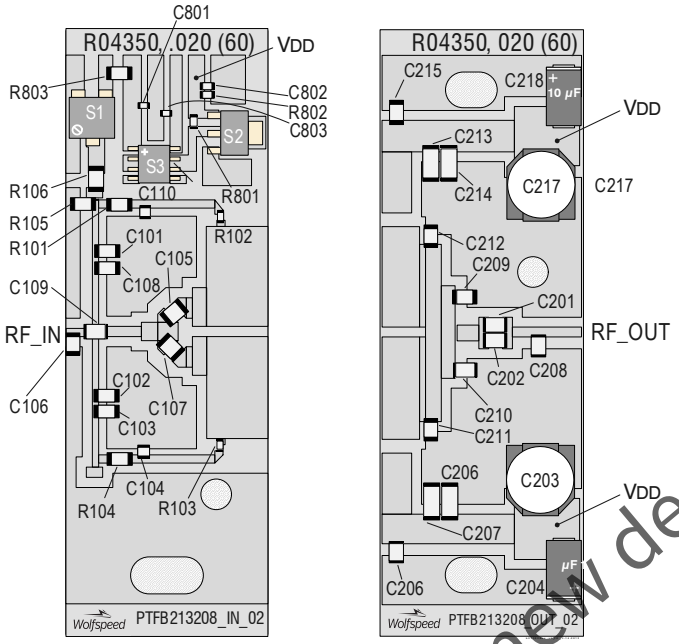
table continued on next page

Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz (Output cont.)

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
TL218	0.033 λ, 47.12 Ω	W = 1.27, L = 2.74	W = 50, L = 108
TL219	0.035 λ, 34.72 Ω	W = 1.98, L = 2.84	W = 78, L = 112
TL223, TL224	0.017 λ, 102.05 Ω	W1 = 0.25, W2 = 0.25, W3 = 1.52	W1 = 10, W2 = 10, W3 = 60
TL229	0.008 λ, 8.64 Ω	W = 10.54, L = 0.65	W = 415, L = 25
TL230, TL234	0.063 λ, 7.29 Ω	W = 12.7, L = 4.8	W = 500, L = 189
TL232	0.008 λ, 8.64 Ω	W = 10.54, L = 0.65	W = 415, L = 25
TL235	0.016 λ, 20.93 Ω	W = 3.81, L = 1.27	W = 150, L = 50
TL236, TL243	0.012 λ, 11.57 Ω	W = 7.62, L = 0.94	W = 300, L = 37
TL237, TL242, TL251	0.026 λ, 11.57 Ω	W1 = 7.62, W2 = 7.62, W3 = 2.03	W1 = 300, W2 = 300, W3 = 80
TL238	0.029 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 2.29	W1 = 150, W2 = 150, W3 = 90
TL239	0.018 λ, 47.12 Ω	W1 = 1.27, W2 = 1.27, W3 = 1.52	W1 = 50, W2 = 50, W3 = 60
TL240	0.054 λ, 47.12 Ω	W = 1.27, L = 4.5	W = 50, L = 177
TL241	0.029 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 2.29	W1 = 150, W2 = 150, W3 = 90
TL244	0.048 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 3.81	W1 = 150, W2 = 150, W3 = 150
TL245	0.098 λ, 20.93 Ω	W = 3.81, L = 7.8	W = 150, L = 307
TL246	0.016 λ, 20.93 Ω	W = 3.81, L = 1.3	W = 150, L = 51
TL247	0.013 λ, 11.57 Ω	W = 7.62, L = 1.02	W = 300, L = 40
TL248	0.029 λ, 20.93 Ω	W1 = 3.81, W2 = 3.81, W3 = 2.29	W1 = 150, W2 = 150, W3 = 90
TL249	0.089 λ, 20.93 Ω	W = 3.81, L = 7.11	W = 150, L = 280
TL250	0.028 λ, 11.57 Ω	W = 7.62, L = 2.18	W = 300, L = 86

Reference Circuit (cont.)



Reference circuit assembly diagram (not to scale)

Component ID	Description	Supplier	P/N
Input			
C101, C102, C104	Chip capacitor, 300 pF	ATC	ATC100B301KW200X
C103, C108	Chip capacitor, 20 pF	ATC	ATC100B200KW500X
C105	Capacitor, 1 nF	Digi-Key	PCC1772CT-ND
C106	Capacitor, 1 nF	Digi-Key	PCC1772CT-ND
C107	Chip capacitor, 6.2 pF	ATC	ATC100B6R2CT500X
C109	Chip capacitor, 6.2 pF	ATC	ATC100B6R2CT500X
C801, C802, C803	Capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102, R103	Resistor, 5.6 Ω	Digi-Key	P5.6ECT-ND
R104, R105, R106	Resistor, 5.6 Ω	Digi-Key	P5.6ECT-ND
R107	Resistor, 1k Ω	Digi-Key	P1.0KECT-ND
Output			
C201	Chip capacitor, 10 pF	ATC	ATC100B100FW500XB
C202	Chip capacitor, 10 pF	ATC	ATC100B100FW500XB
C203	Capacitor, 100 nF	Digi-Key	PCE3718CT-ND
C204, C216	Capacitor, 10 nF	Digi-Key	TPSE106K050R0400
C205	Capacitor, 10 nF	Digi-Key	587-1818-2-ND
C206, C214	Chip capacitor, 1 nF	Digi-Key	445-1411-2-ND
C207, C213	Chip capacitor, 2.2 nF	Digi-Key	445-1447-2-ND
C208	Chip capacitor, 0.4 pF	ATC	ATC100B0R4BW500XB
C209, C210	Chip capacitor, 0.8 pF	ATC	ATC100B0R8BW500XB
C211, C212	Chip capacitor, 1.3 pF	ATC	ATC100B1R3BW500XB
C217	Capacitor, 100 nF	Digi-Key	PCE3718CT-ND

Package Outline Specifications

Package H-37275G-6/2

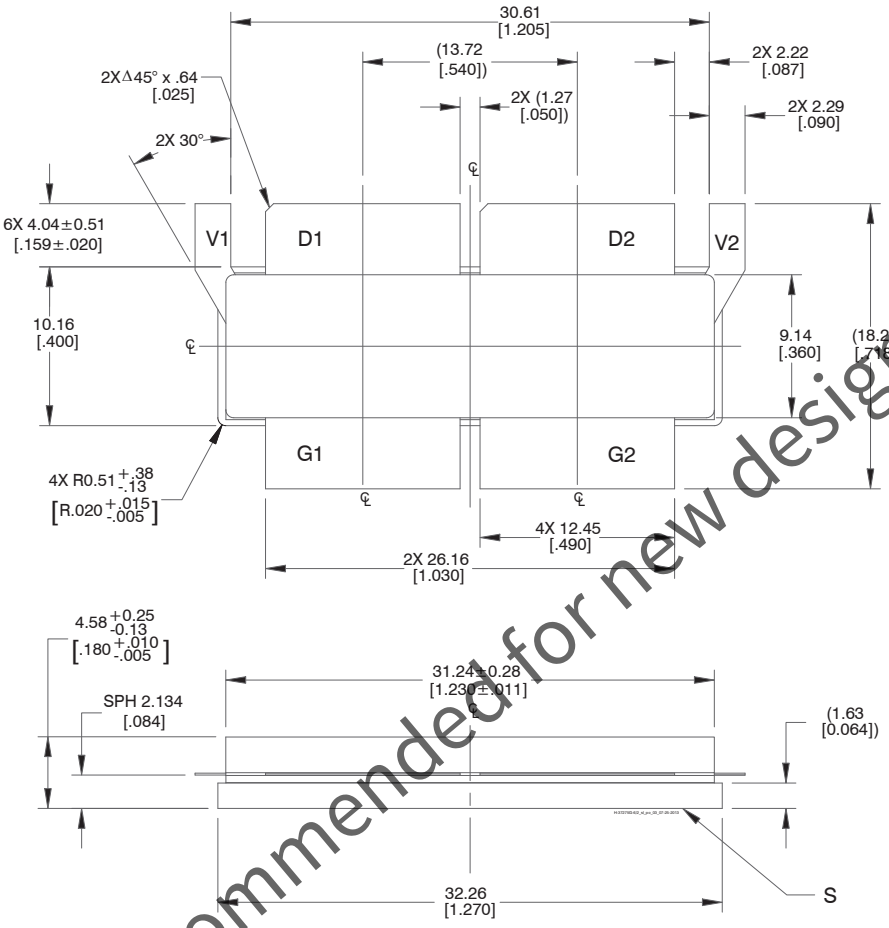


Diagram Notes—unless otherwise specified:

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].
4. Pins: D1, D2 - drain; G1, G2 - gate; S - source; V1, V2 - supply voltage (V_{DD}).
5. Lead thickness: 0.13 +0.051/–0.025 [.005 +.002/–.001].
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch] max.

Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes at each revision)
01	2011-04-29	Advance	All	Advance information for proposed product.
02	2012-07-03	Data Sheet	All	Product released: Specifications updated, set; circuit and other information added.
03	2015-11-11	Data Sheet	1, 2, 12 2 13	Package changed to H-37275G-6/2. Shipping options: tray shipping no longer available, tape & reel only. Typo corrected.
04	2018-06-29	Production	All	Converted to Wolfspeed Data Sheet
05	2019-05-29	Not for new design	All	Not recommended for new design

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.