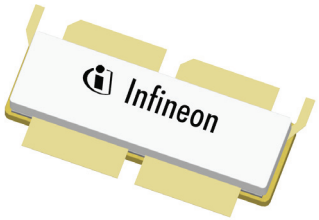
green Product

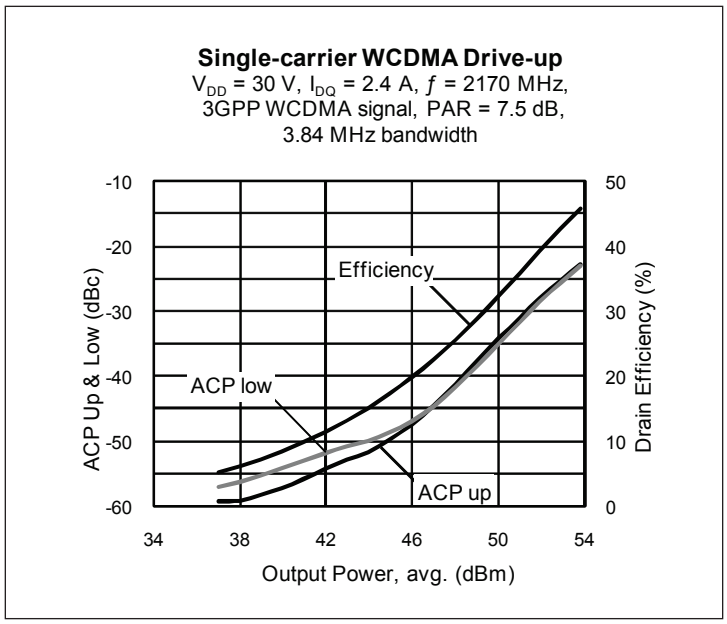
High Power RF LDMOS Field Effect Transistor
300 W, 2110 – 2170 MHz

Description

The PTFB213004F is a 300-watt LDMOS FET designed for class AB operation in cellular amplifiers covering the 2110 to 2170 MHz frequency band. Features include high peak power, input and output match, and a thermally-enhanced, open-cavity earless ceramic package.

PTFB213004F
Package H-37275-6/2





Features

- Broadband internal matching
- Enhanced for use in DPD error correction systems
- Wide video bandwidth
- Typical single-carrier WCDMA performance at 2170 MHz, 30 V
  - P_{OUT} = 49.5 dBm Avg
  - Gain = 17.5 dB
  - Efficiency = 30%
- Increased negative gate-source voltage range for improved performance in Doherty amplifiers
- Capable of handling 10:1 VSWR @ 30 V, 300 W (CW) output power
- Excellent thermal stability
- Integrated ESD protection
- Pb-free and RoHS-compliant

RF Characteristics

Two-carrier WCDMA Measurements (tested in Infineon test fixture)
V_{DD} = 30 V, I_{DQ} = 2.4 A, P_{OUT} = 60 W average,
f_1 = 2167.5 MHz, f_2 = 2172.5 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, PAR = 7.5 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17	18	—	dB
Drain Efficiency	ηD	25	26.5	—	%
Intermodulation Distortion	IMD	—	–36	–33	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 Measurements (not subject to production test—verified by design / characterization in Infineon test fixture)
V_{DD} = 30 V, I_{DQ} = 2.4 A, P_{OUT} = 250 W PEP, f = 2140 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	18	—	dB
Drain Efficiency	ηD	—	37	—	%
Intermodulation Distortion	IMD	—	–30	—	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} = 30 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 A	$R_{DS(on)}$	—	0.03	—	Ω
Operating Gate Voltage	V_{DS} = 30 V, I_{DQ} = 2.4 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

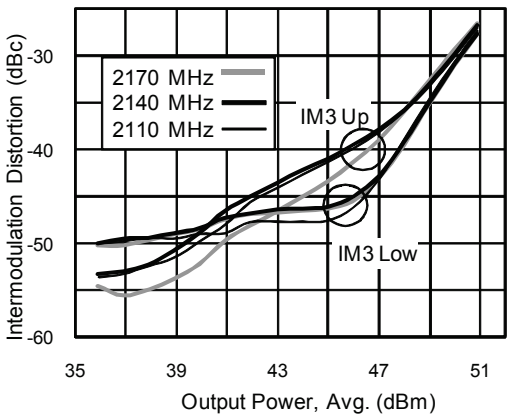
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	–0.5 to +65	V
Gate-Source Voltage	V_{GS}	–6 to +10	V
Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.23	°C/W

Ordering Information

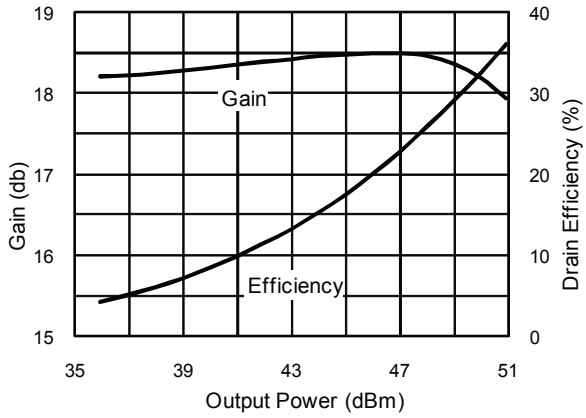
Type and Version	Order Code	Package Description	Shipping
PTFB213004F V2 R0	PTFB213004FV2R0XTMA1	H-37275-6/2, earless flange	Tape & Reel, 50 pcs
PTFB213004F V2 R250	PTFB213004FV2R250XTMA1	H-37275-6/2, earless flange	Tape & Reel, 250 pcs

Typical Performance (data taken in a production test fixture)

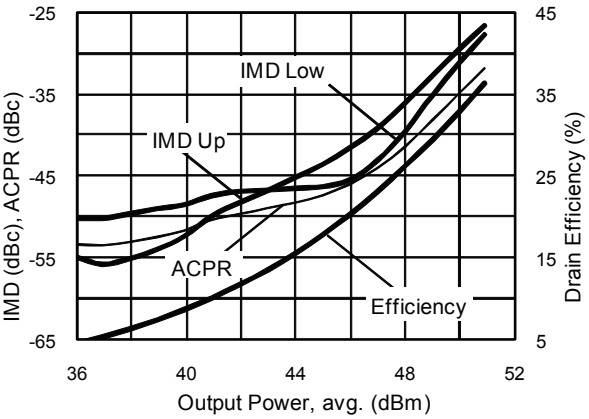
Two-carrier WCDMA Drive-up
V_{DD} = 30 V, I_{DQ} = 2.4 A, 3GPP WCDMA signal,
PAR = 8 dB, 10 MHz carrier spacing, 3.84 MHz BW



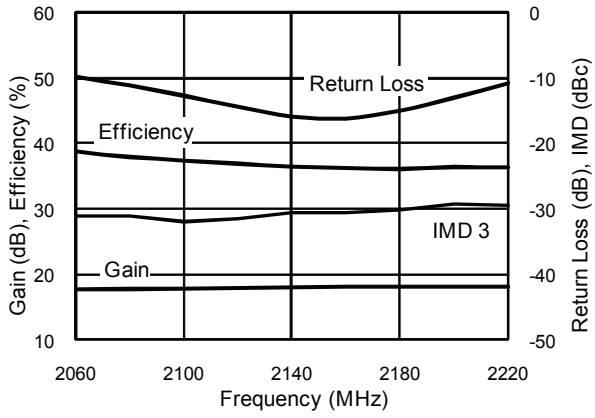
Two-carrier WCDMA Drive-up
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2170 MHz,
3GPP WCDMA signal, PAR = 8 dB,
10 MHz carrier spacing, 3.85 MHz BW



Two-carrier WCDMA Drive-up
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2170 MHz,
3GPP WCDMA signal, PAR = 8 dB,
10 MHz carrier spacing, 3.84 MHz BW

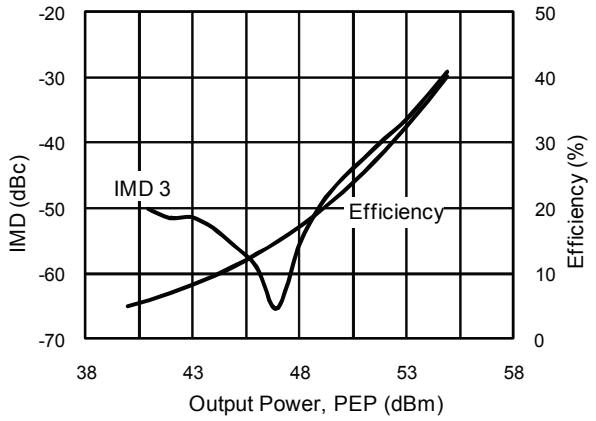


Two-tone Broadband Performance
V_{DD} = 30 V, I_{DQ} = 2.4 A, P_{OUT} = 126 W

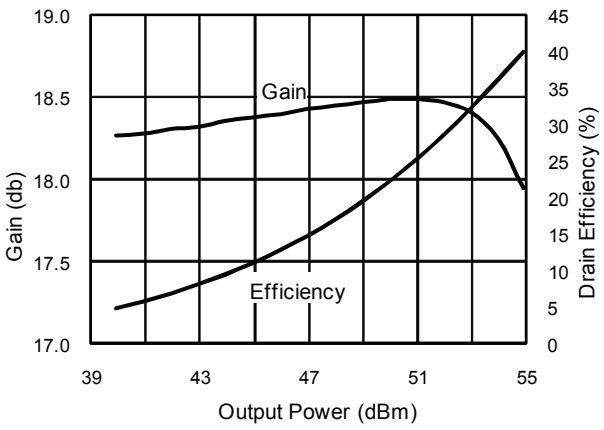


Typical Performance (cont.)

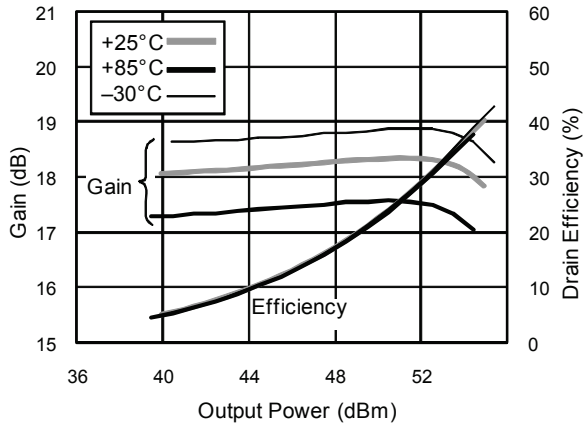
Two-tone Drive-up
V_{DD} = 30 V, I_{DQ} = 2.4 A,
f_1 = 2170 MHz, f_2 = 2169 MHz



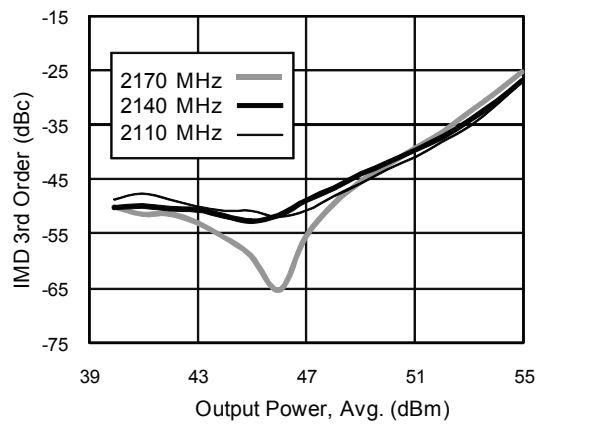
Gain & Efficiency vs. Output Power
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2170 MHz



Two-tone Drive-up (over temp)
(P_{OUT} max 3rd order IMD @ –30dBc)
V_{DD} = 30 V, I_{DQ} = 2.4 A,
f_1 = 2140.5 MHz, f_2 = 2139.5 MHz

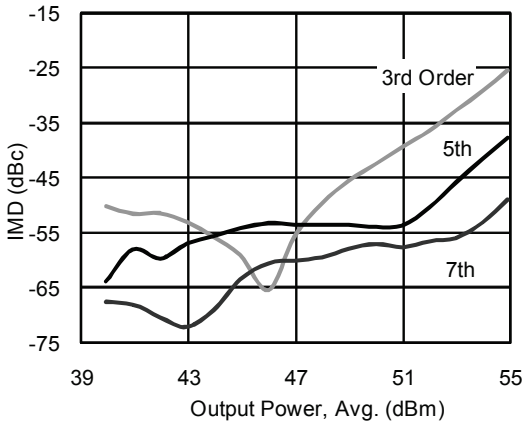


Two-tone IMD vs. Output Power
V_{DD} = 30 V, I_{DQ} = 2.4 A,
tone spacing = 1 MHz

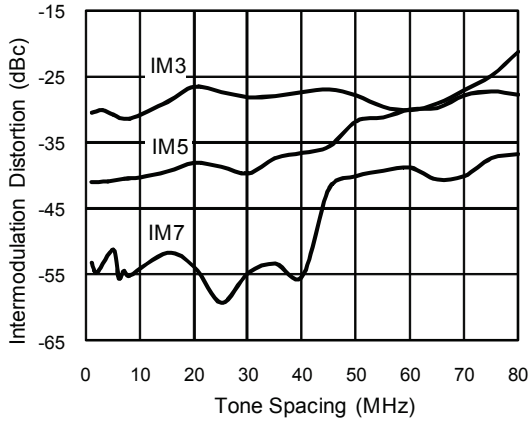


Typical Performance (cont.)

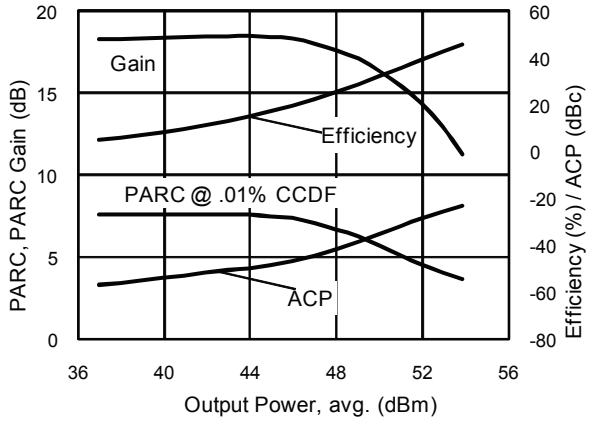
Two-tone IMD vs. Output Power
V_{DD} = 30 V, I_{DQ} = 2.4 A,
f_1 = 2170 MHz, f_2 = 2169 MHz



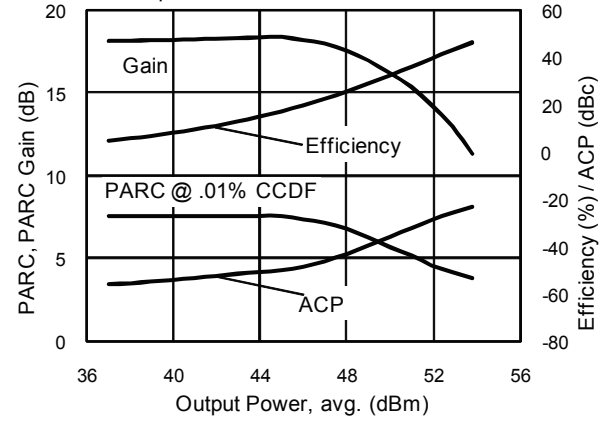
Intermodulation Distortion vs. Tone Spacing
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2140 MHz,
P_{OUT} = 251 W (PEP)



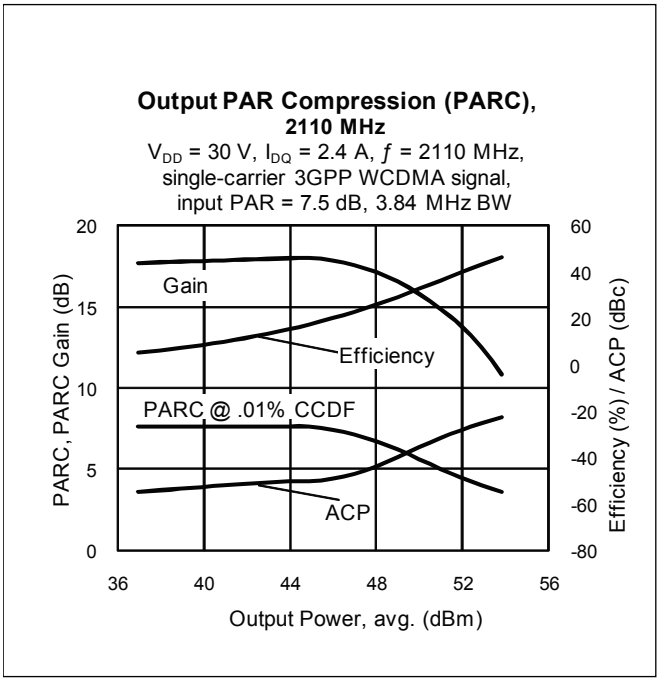
Output PAR Compression (PARC), 2170 MHz
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2170 MHz,
single-carrier 3GPP WCDMA signal,
input PAR = 7.5 dB, 3.84 MHz BW

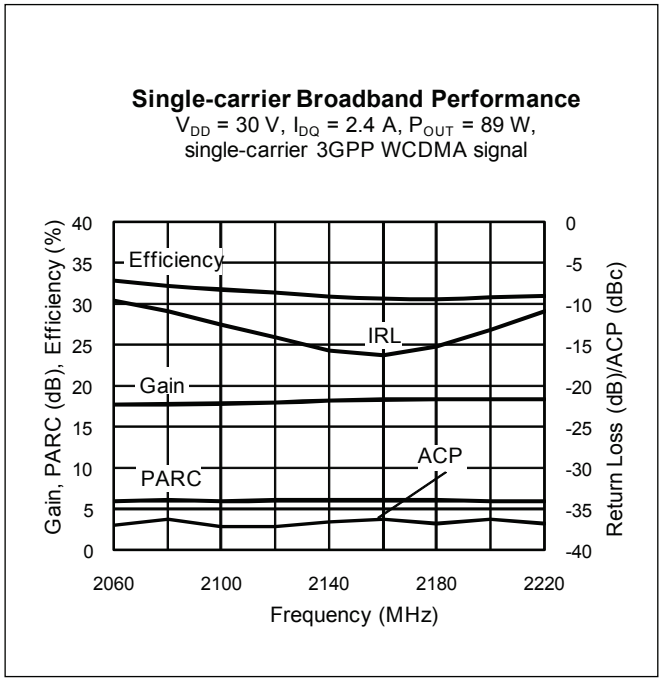


Output PAR Compression (PARC), 2140 MHz
V_{DD} = 30 V, I_{DQ} = 2.4 A, f = 2140 MHz,
single-carrier 3GPP WCDMA signal,
input PAR = 7.5 dB, 3.84 MHz BW



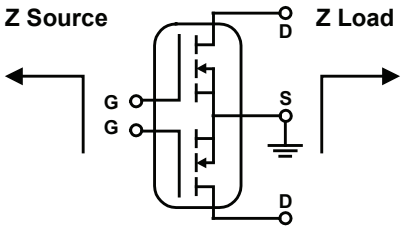
Typical Performance (cont.)

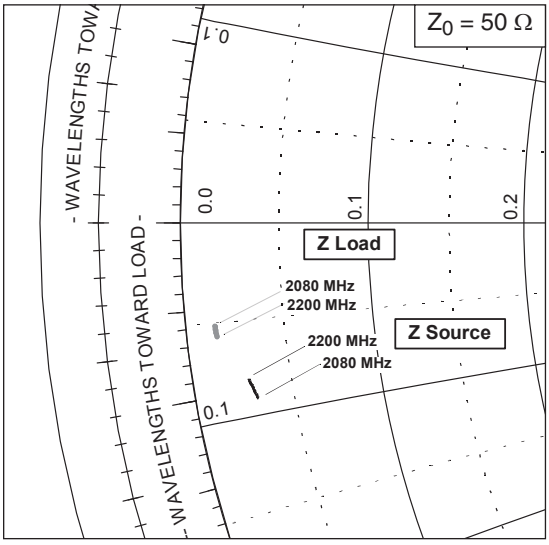




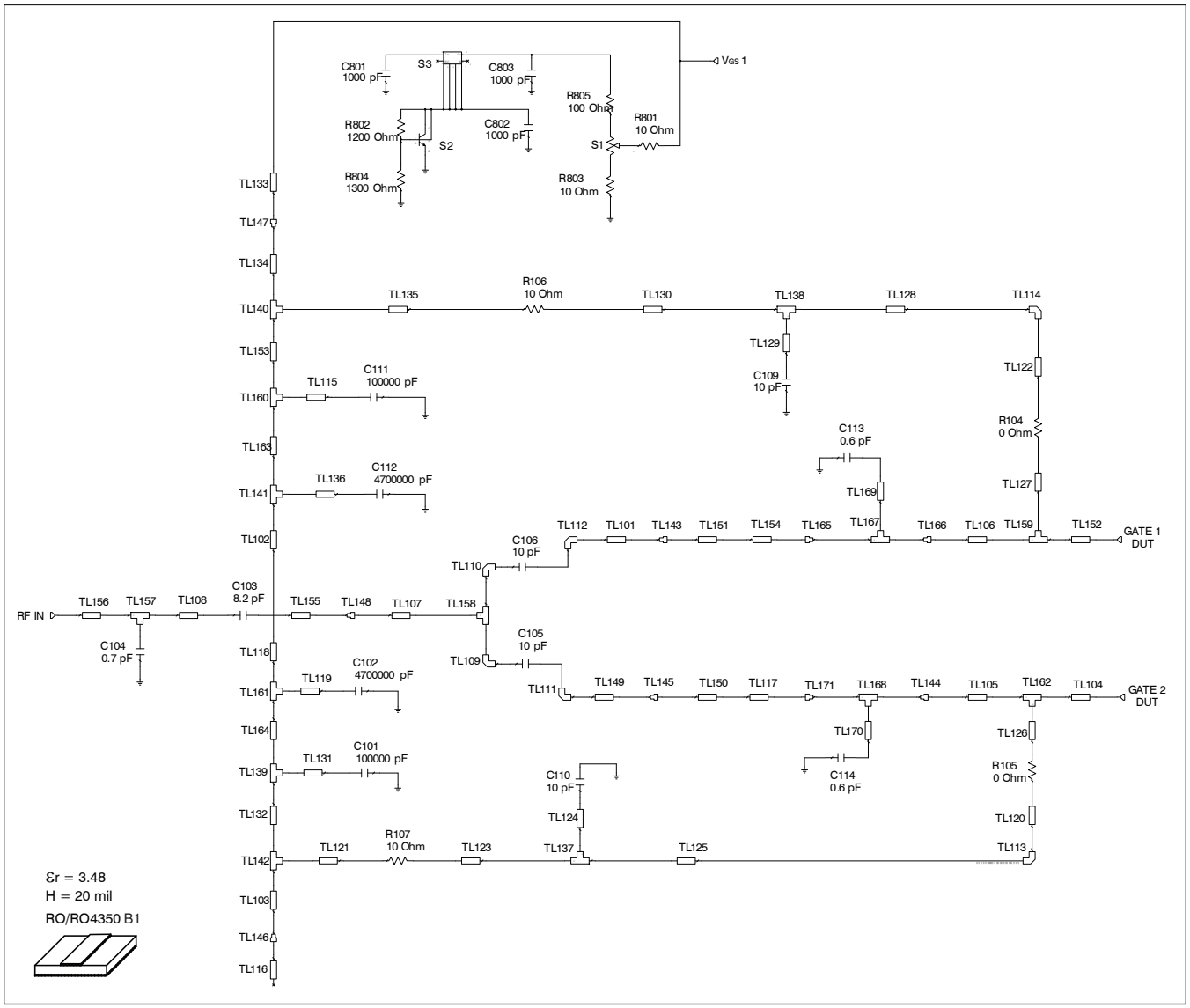
Broadband Circuit Impedance

Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
2080	1.55	–4.57	0.71	–2.91
2090	1.54	–4.52	0.71	–2.89
2100	1.52	–4.48	0.70	–2.86
2110	1.51	–4.44	0.70	–2.84
2120	1.50	–4.40	0.70	–2.81
2130	1.48	–4.36	0.70	–2.79
2140	1.47	–4.32	0.70	–2.77
2150	1.46	–4.28	0.70	–2.74
2160	1.45	–4.24	0.69	–2.72
2170	1.43	–4.20	0.69	–2.70
2180	1.42	–4.17	0.69	–2.67
2190	1.41	–4.13	0.69	–2.65
2200	1.40	–4.09	0.69	–2.63



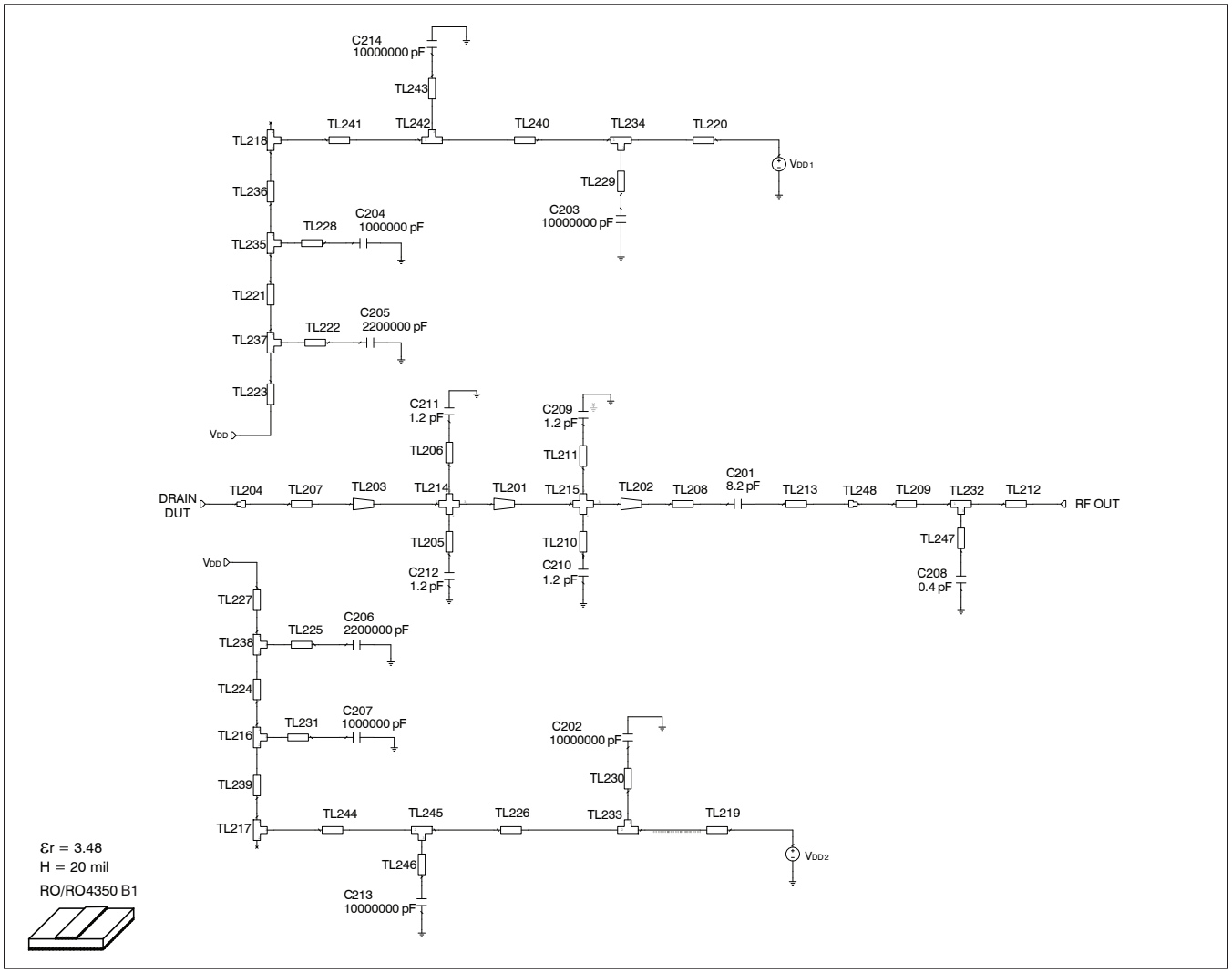


Reference Circuit (cont.)



Reference circuit input schematic for ƒ = 2170 MHz

Reference Circuit (cont.)



Reference circuit output schematic for ƒ = 2170 MHz

Reference Circuit (cont.)

Description			
DUT	PTFB213004F	LDMOS Transistor	
PCB	LTN/PTFB213004EF	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	0.004 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL101	0.010 λ, 28.85 Ω	W = 2.540, L = 0.787	W = 100, L = 31
TL102	0.207 λ, 63.89 Ω	W = 0.762, L = 17.526	W = 30, L = 690
TL103	0.006 λ, 63.89 Ω	W = 0.762, L = 0.508	W = 30, L = 20
TL104	0.070 λ, 8.03 Ω	W = 11.430, L = 5.359	W = 450, L = 211
TL105, TL106	0.017 λ, 8.03 Ω	W = 11.430, L = 1.270	W = 450, L = 50
TL107	0.025 λ, 32.60 Ω	W = 2.159, L = 2.032	W = 85, L = 80
TL108	0.015 λ, 49.69 Ω	W = 1.168, L = 1.270	W = 46, L = 50
TL109, TL110, TL111, TL112		W = 2.540	W = 100
TL113, TL114		W = 1.016	W = 40
TL115, TL131	0.000 λ, 41.75 Ω	W = 1.524, L = 0.025	W = 60, L = 1
TL116, TL133	0.016 λ, 34.08 Ω	W = 2.032, L = 1.270	W = 80, L = 50
TL117	0.016 λ, 17.20 Ω	W = 4.826, L = 1.270	W = 190, L = 50
TL118	0.041 λ, 63.89 Ω	W = 0.762, L = 3.480	W = 30, L = 137
TL119, TL136	0.000 λ, 41.75 Ω	W = 1.524, L = 0.025	W = 60, L = 1
TL120, TL122	0.015 λ, 54.17 Ω	W = 1.016, L = 1.262	W = 40, L = 50
TL121, TL135	0.020 λ, 54.17 Ω	W = 1.016, L = 1.651	W = 40, L = 65
TL123, TL130	0.017 λ, 54.17 Ω	W = 1.016, L = 1.397	W = 40, L = 55
TL124, TL129	0.000 λ, 34.08 Ω	W = 2.032, L = 0.025	W = 80, L = 1
TL125, TL128	0.091 λ, 54.17 Ω	W = 1.016, L = 7.620	W = 40, L = 300
TL126, TL127	0.009 λ, 54.17 Ω	W = 1.016, L = 0.762	W = 40, L = 30
TL132	0.018 λ, 63.89 Ω	W = 0.762, L = 1.524	W = 30, L = 60
TL134	0.006 λ, 63.89 Ω	W = 0.762, L = 0.508	W = 30, L = 20
TL137, TL138	0.024 λ, 54.17 Ω	W1 = 1.016, W2 = 1.016, W3 = 2.032	W1 = 40, W2 = 40, W3 = 80
TL139, TL141	0.018 λ, 63.89 Ω	W1 = 0.762, W2 = 0.762, W3 = 1.524	W1 = 30, W2 = 30, W3 = 60
TL140, TL142	0.012 λ, 63.89 Ω	W1 = 0.762, W2 = 0.762, W3 = 1.016	W1 = 30, W2 = 30, W3 = 40
TL143		W1 = 0.003, W2 = 0.005, Offset = 0.000	W1 = 3, W2 = 190, Offset = 10
TL144		W1 = 0.005, W2 = 0.011, Offset = –0.003	W1 = 5, W2 = 450, Offset = –130
TL145		W1 = 0.003, W2 = 0.005, Offset = 0.000	W1 = 3, W2 = 190, Offset = –10
TL146		W1 = 2.032, W2 = 0.762	W1 = 80, W2 = 30
TL147		W1 = 2.540, W2 = 0.762	W1 = 100, W2 = 30
TL148		W1 = 1.168, W2 = 2.159	W1 = 46, W2 = 85
TL149	0.009 λ, 28.85 Ω	W = 2.540, L = 0.762	W = 100, L = 30
TL150, TL151	0.006 λ, 17.20 Ω	W = 4.826, L = 0.508	W = 190, L = 20

table continued on page 10

Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL152	0.070 λ, 8.03 Ω	W = 11.430, L = 5.359	W = 450, L = 211
TL153	0.018 λ, 63.89 Ω	W = 0.762, L = 1.524	W = 30, L = 60
TL154	0.016 λ, 17.20 Ω	W = 4.826, L = 1.270	W = 190, L = 50
TL155	0.060 λ, 49.69 Ω	W = 1.168, L = 5.022	W = 46, L = 198
TL156	0.002 λ, 49.69 Ω	W = 1.168, L = 0.203	W = 46, L = 8
TL157	0.015 λ, 49.69 Ω	W1 = 1.168, W2 = 1.168, W3 = 1.270	W1 = 46, W2 = 46, W3 = 50
TL158	0.027 λ, 28.85 Ω	W1 = 2.540, W2 = 2.540, W3 = 2.159	W1 = 100, W2 = 100, W3 = 85
TL159, TL162	0.013 λ, 8.03 Ω	W1 = 11.430, W2 = 11.430, W3 = 1.016	W1 = 450, W2 = 450, W3 = 40
TL160, TL161	0.018 λ, 63.89 Ω	W1 = 0.762, W2 = 0.762, W3 = 1.524	W1 = 30, W2 = 30, W3 = 60
TL163, TL164	0.004 λ, 63.89 Ω	W = 0.762, L = 0.330	W = 30, L = 13
TL165, TL171		W1 = 0.011, W2 = 0.003, Offset = 0.005	W1 = 11, W2 = 100, Offset = 200
TL166		W1 = 0.005, W2 = 0.011, Offset = 0.003	W1 = 5, W2 = 450, Offset = 130
TL167		W1 = 0.000, W2 = 0.000, W3 = 0.000	W1 = 0, W2 = 1, W3 = 1
TL168	0.000 λ, 148.22 Ω	W1 = 0.013, W2 = 0.013, W3 = 0.013	W1 = 1, W2 = 1, W3 = 1
TL169	0.000 λ, 102.05 Ω	W = 0.254, L = 0.025	W = 10, L = 1
TL170	0.000 λ, 47.12 Ω	W = 1.270, L = 0.025	W = 50, L = 1

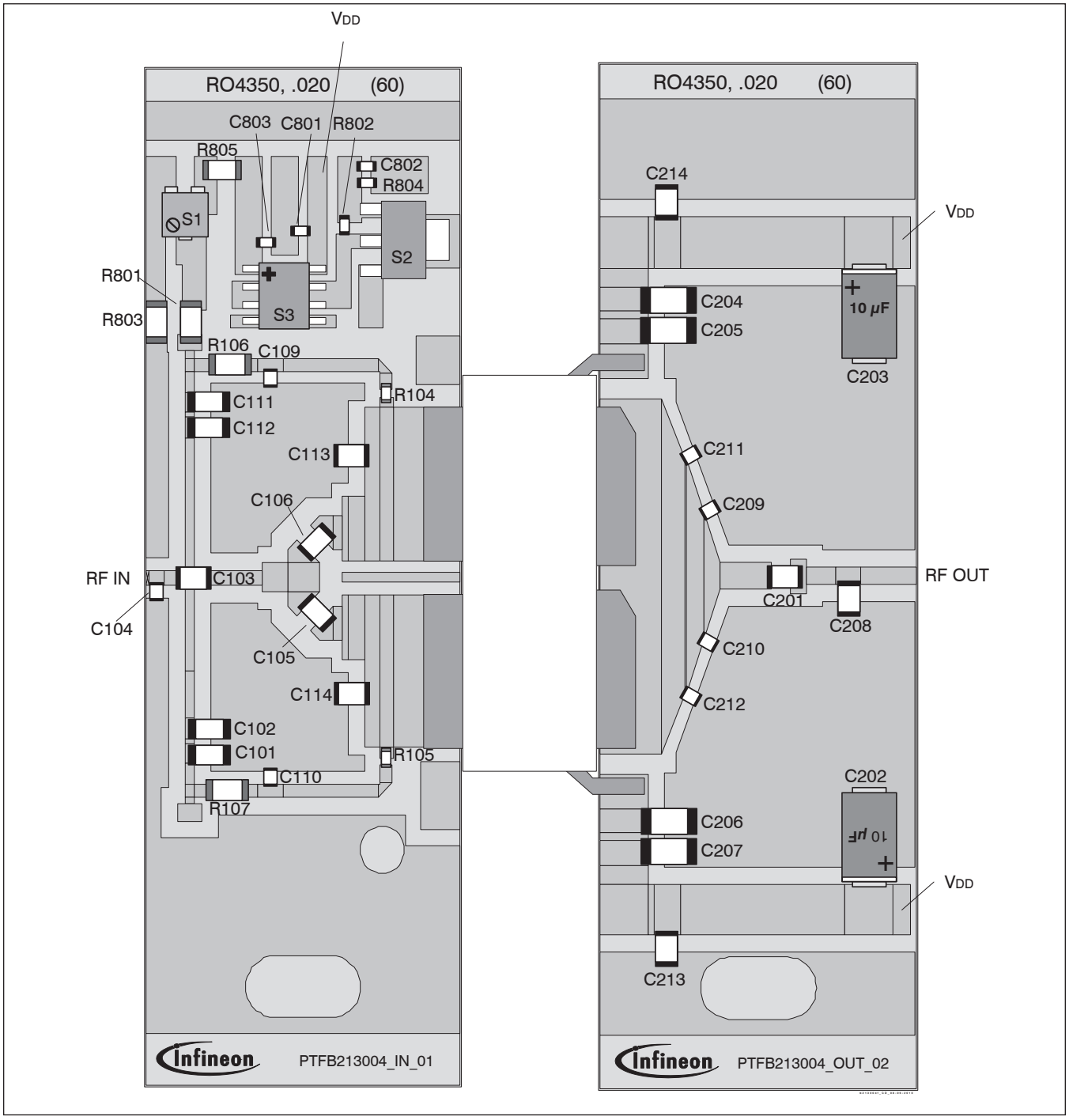
See next page for reference circuit output characteristics

Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Output			
TL201 (taper)	0.018 λ, 5.40 Ω / 9.59 Ω	W1 = 17.526, W2 = 9.398, L = 1.397	W1 = 690, W2 = 370, L = 55
TL202 (taper)	0.016 λ, 9.59 Ω / 34.72 Ω	W1 = 9.398, W2 = 1.981, L = 1.270	W1 = 370, W2 = 78, L = 50
TL203 (taper)	0.026 λ, 3.67 Ω / 5.40 Ω	W1 = 26.365, W2 = 17.526, L = 1.956	W1 = 1038, W2 = 690, L = 77
TL204		W1 = 25.400, W2 = 26.365	W1 = 1000, W2 = 1038
TL205, TL206, TL210, TL211	0.000 λ, 144.35 Ω	W = 0.025, L = 0.025	W = 1, L = 1
TL207	0.064 λ, 3.67 Ω	W = 26.365, L = 4.801	W = 1038, L = 189
TL208	0.050 λ, 34.72 Ω	W = 1.981, L = 4.115	W = 78, L = 162
TL209	0.028 λ, 47.12 Ω	W = 1.270, L = 2.337	W = 50, L = 92
TL212	0.053 λ, 47.12 Ω	W = 1.270, L = 4.394	W = 50, L = 173
TL213	0.016 λ, 28.85 Ω	W = 2.540, L = 1.270	W = 100, L = 50
TL214		W1 = 17.526, W2 = 0.025, W3 = 17.526, W4 = 0.025	W1 = 690, W2 = 1, W3 = 690, W4 = 1
TL215		W1 = 9.398, W2 = 0.025, W3 = 9.398, W4 = 0.025	W1 = 370, W2 = 1, W3 = 370, W4 = 1
TL216	0.022 λ, 20.93 Ω	W1 = 3.810, W2 = 3.810, W3 = 1.778	W1 = 150, W2 = 150, W3 = 70
TL217, TL218	0.048 λ, 20.93 Ω	W1 = 3.810, W2 = 3.810, W3 = 3.810	W1 = 150, W2 = 150, W3 = 150
TL219, TL220	0.017 λ, 20.93 Ω	W = 3.810, L = 1.372	W = 150, L = 54
TL221	0.008 λ, 20.93 Ω	W = 3.810, L = 0.635	W = 150, L = 25
TL222, TL225, TL228, TL231	0.000 λ, 37.51 Ω	W = 1.778, L = 0.025	W = 70, L = 1
TL223	0.032 λ, 20.93 Ω	W = 3.810, L = 2.540	W = 150, L = 100
TL224	0.008 λ, 20.93 Ω	W = 3.810, L = 0.635	W = 150, L = 25
TL226	0.165 λ, 20.93 Ω	W = 3.810, L = 13.106	W = 150, L = 516
TL227	0.032 λ, 20.93 Ω	W = 3.810, L = 2.540	W = 150, L = 100
TL229, TL230	0.000 λ, 20.93 Ω	W = 3.810, L = 0.025	W = 150, L = 1
TL232	0.024 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 2.032	W1 = 50, W2 = 50, W3 = 80
TL233, TL234	0.048 λ, 20.93 Ω	W1 = 3.810, W2 = 3.810, W3 = 3.810	W1 = 150, W2 = 150W3 = 150
TL235, TL237, TL238	0.022 λ, 20.93 Ω	W1 = 3.810, W2 = 3.810, W3 = 1.778	W1 = 150, W2 = 150W3 = 70
TL236, TL239	0.018 λ, 20.93 Ω	W = 3.810, L = 1.397	W = 150, L = 55
TL240	0.165 λ, 20.93 Ω	W = 3.810, L = 13.106	W = 150, L = 516
TL241	0.006 λ, 20.93 Ω	W = 3.810, L = 0.508	W = 150, L = 20
TL242, TL245	0.026 λ, 20.93 Ω	W1 = 3.810, W2 = 3.810, W3 = 2.032	W1 = 150, W2 = 150, W3 = 80
TL243, TL246, TL247	0.000 λ, 34.08 Ω	W = 2.032, L = 0.025	W = 80, L = 1
TL244	0.006 λ, 20.93 Ω	W = 3.810, L = 0.508	W = 150, L = 20
TL248		W1 = 2.540, W2 = 1.270	W1 = 100, W2 = 50

Reference Circuit (cont.)



*Reference circuit assembly diagram (not to scale)**

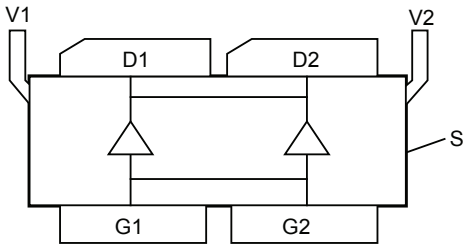
**Gerber Files for this circuit available on request*

Reference Circuit (cont.)

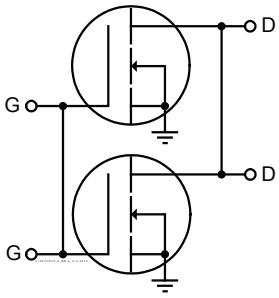
Circuit Assembly Information

Component	Description	Suggested Manufacturer	P/N
Input			
C101, C108, C111	Chip capacitor, 0.1 µF	Digi-Key	PCC104BTR-ND
C102, C112	Chip capacitor, 4.7 µF	Digi-Key	493-2372-2-ND
C103	Chip capacitor, 8.2 pF	ATC	ATC100B8R2BW500XB
C104	Chip capacitor, 0.7 pF	ATC	ATC100A0R7BW150XB
C105, C106	Chip capacitor, 10 pF	ATC	ATC100B100FW500XB
C107	Capacitor, 10 µF	Digi-Key	399-1655-2-ND
C109, C110	Chip capacitor, 10 pF	ATC	ATC100A100FW150XB
C113, C114	Chip capacitor, 0.6 pF	ATC	ATC100B0R6BW500XB
C801, C802, C803	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102	Resistor, 0 Ω	Digi-Key	P0.0ECT-ND
R103, R106, R107, R801, R803	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R104, R105	Resistor, 0 Ω	Digi-Key	P0.0GCT-ND
R802	Resistor, 1200 Ω	Digi-Key	P1.2KECT-ND
R804	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
R805	Resistor, 100 Ω	Digi-Key	P100ECT-ND
S1	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S2	Transistor	Digi-Key	BCP56
S3	Voltage Regulator	Digi-Key	LM7805
Output			
C201	Chip capacitor, 8.2 pF	ATC	ATC100B8R2BW500XB
C202, C203	Capacitor, 10 µF	Digi-Key	399-1655-2-ND
C204, C207	Chip capacitor, 1 µF	Digi-Key	445-1411-2-ND
C205, C206	Chip capacitor, 2.2 µF	Digi-Key	445-1447-2-ND
C208	Chip capacitor, 0.4 pF	ATC	ATC100B0R4BW500XB
C209, C210, C211, C212	Chip capacitor, 1.2 pF	ATC	ATC100A1R2BW150XB
C213, C214	Capacitor, 10 µF	Digi-Key	587-1818-2-ND

Pinout Diagram



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



See next page for package outline specifications

Package Outline Specifications

Package H-37275-6/2

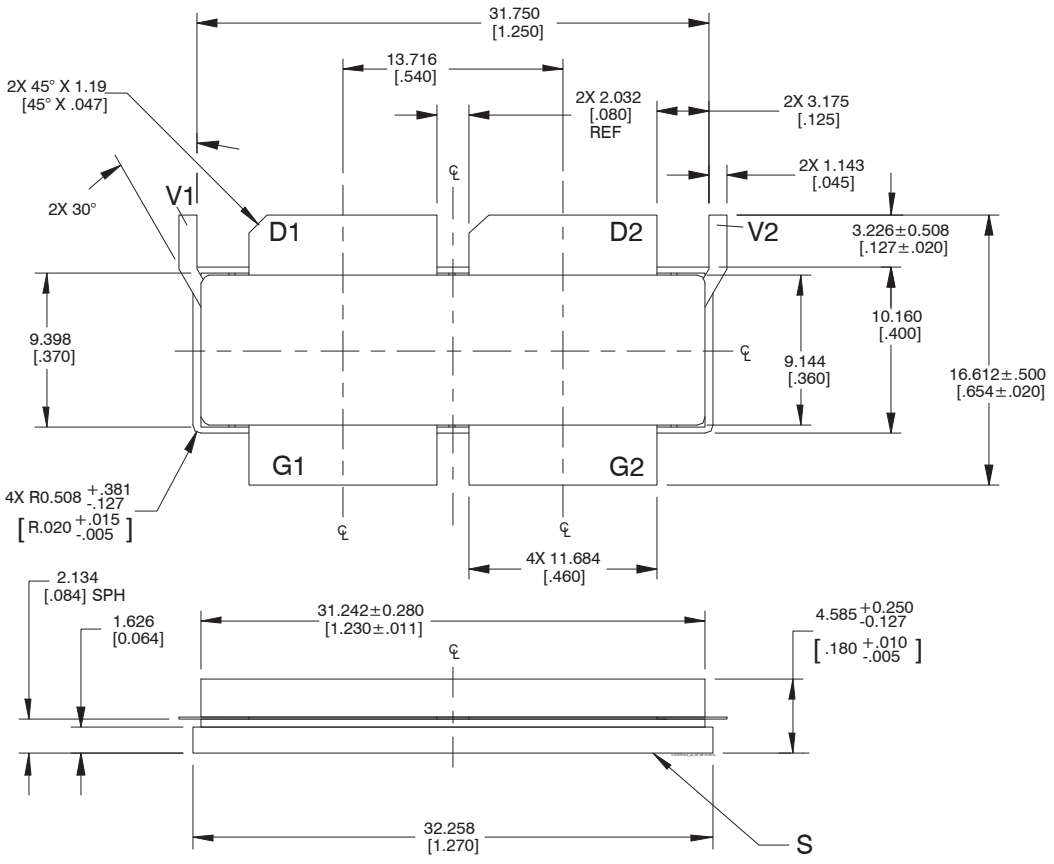


Diagram Notes—unless otherwise specified:

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] unless specified otherwise.
4. Pins: G1, G2 = gate; D1, D2 = drain; S = source; V1, V2 = V_{DD}.
5. Lead thickness: 0.127 ± 0.051 [.005 ±.002].
6. Gold plating thickness: 1.1 ± 0.38 micron [45 ± 15 microinch].

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Previous Version: 2010-12-09, Data Sheet

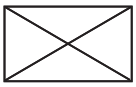
Page	Subjects (major changes since last revision)
2	Updated ordering information

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