

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

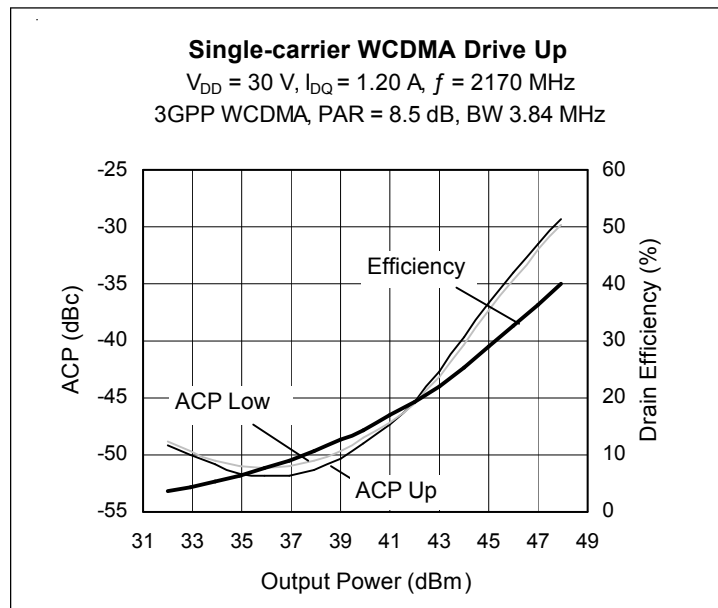
### Description

The PTFB211501E and PTFB211501F are thermally-enhanced, 150-watt, LDMOS FETs designed for cellular power amplifier applications in the 2110 – 2170 frequency band. Features include I/O matching, high gain, and thermally-enhanced ceramic open-cavity packages with slotted and earless flanges.

PTFB211501E  
 Package H-36248-2



PTFB211501F  
 Package H-37248-2



### Features

- Broadband internal matching
- Typical single-carrier WCDMA performance at 2170 MHz, 30 V,  $I_{DQ} = 1.2\text{ A}$ , 3GPP signal, channel bandwidth = 3.84 MHz, PAR = 8.5 dB @ 0.01% CCDF
  - Average output power = 40 W
  - Linear Gain = 18 dB
  - Efficiency = 32%
  - Adjacent channel power = -34 dBc
- Typical CW performance, 2170 MHz, 30 V
  - Output power at P-1dB = 150 W
  - Efficiency = 55%
- Integrated ESD protection: Human Body Model, Class 2 (minimum)
- Capable of handling 10:1 VSWR @ 30 V, 150 W (CW) output power
- Pb-Free and RoHS compliant

### RF Characteristics

#### Single-carrier WCDMA Measurements (tested in Infineon test fixture)

$V_{DD} = 30\text{ V}$ ,  $I_{DQ} = 1.2\text{ A}$ ,  $P_{OUT} = 40\text{ W AVG}$ ,  $f = 2170\text{ MHz}$ , 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8.5 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	$G_{ps}$	17	18	—	dB
Drain Efficiency	$\eta_D$	27	32	—	%
Intermodulation Distortion	IMD	—	-34	-32	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 Measurement** (not subject to production test - verified by design / characterization in Infineon test fixture)  
 $V_{DD} = 30\text{ V}$ ,  $I_{DQ} = 1.2\text{ A}$ ,  $P_{OUT} = 140\text{ W PEP}$ ,  $f = 2170\text{ MHz}$ , tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	$G_{ps}$	—	18	—	dB
Drain Efficiency	$\eta_D$	—	40	—	%
Intermodulation Distortion	IMD	—	-30	—	dBc

## DC Characteristics

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

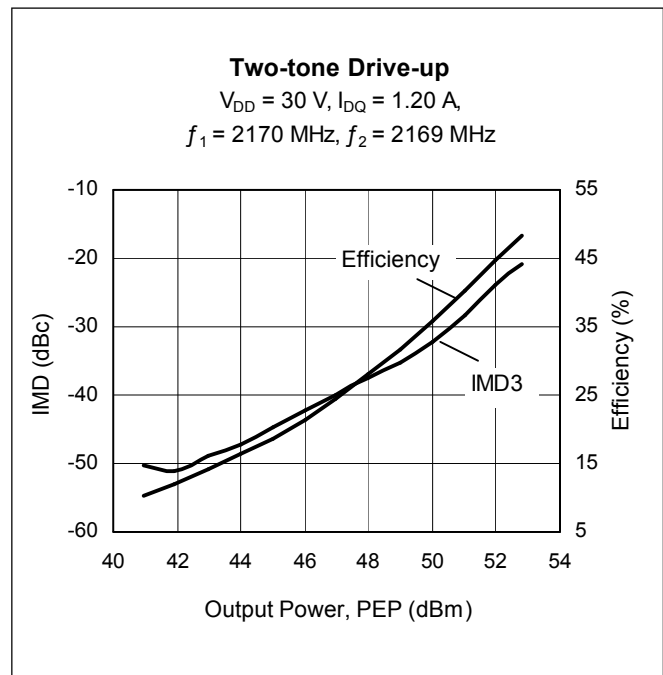
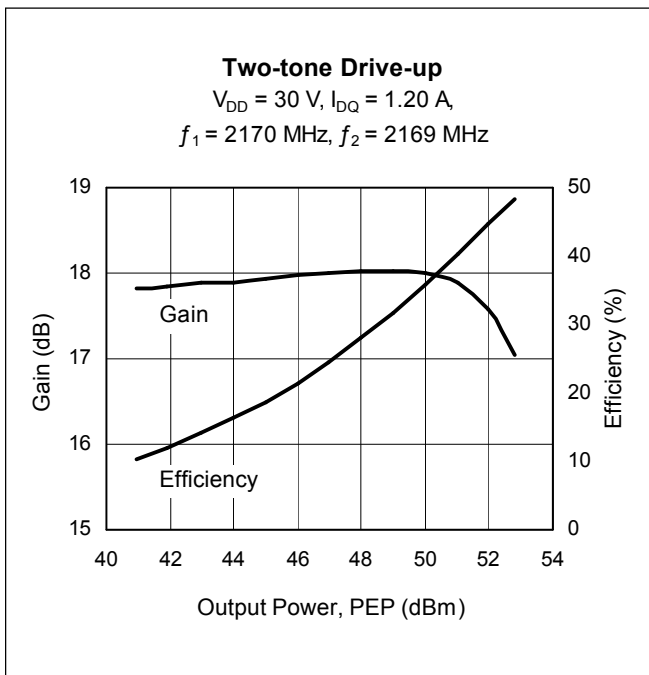
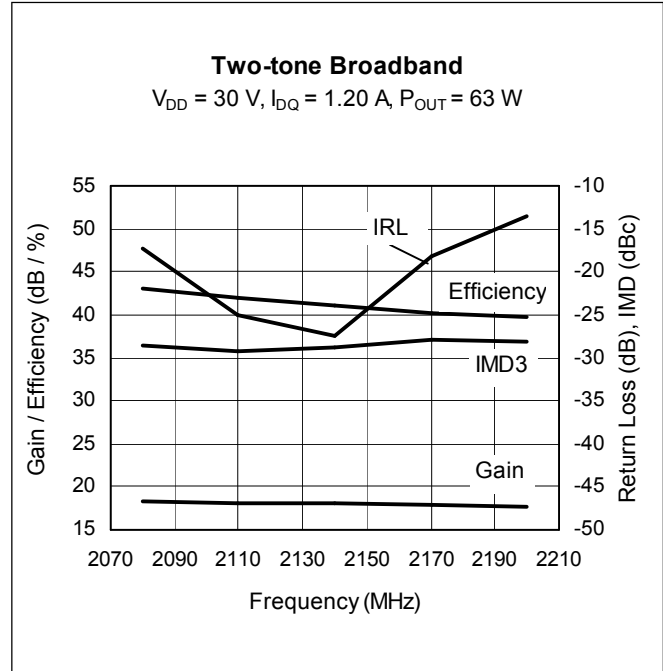
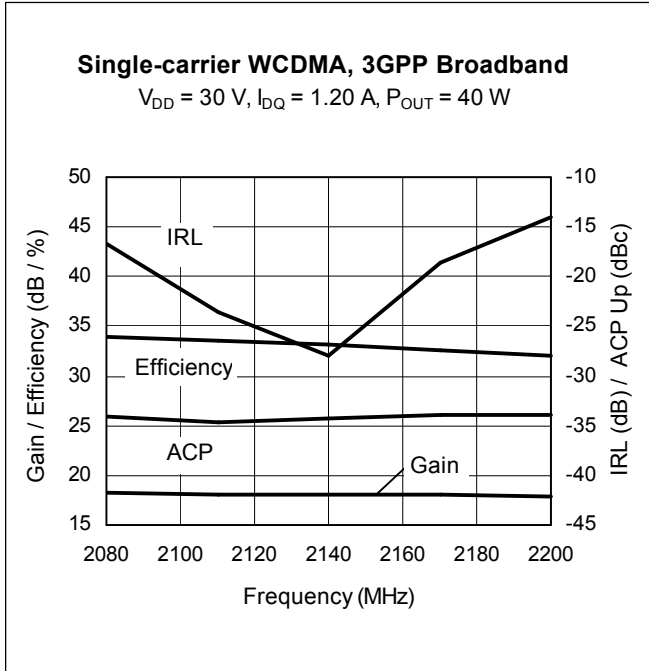
## Maximum Ratings

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 ( $T_{CASE} = 70^{\circ}\text{C}$ , 150 W CW)	$R_{\theta JC}$	0.29	$^{\circ}\text{C/W}$

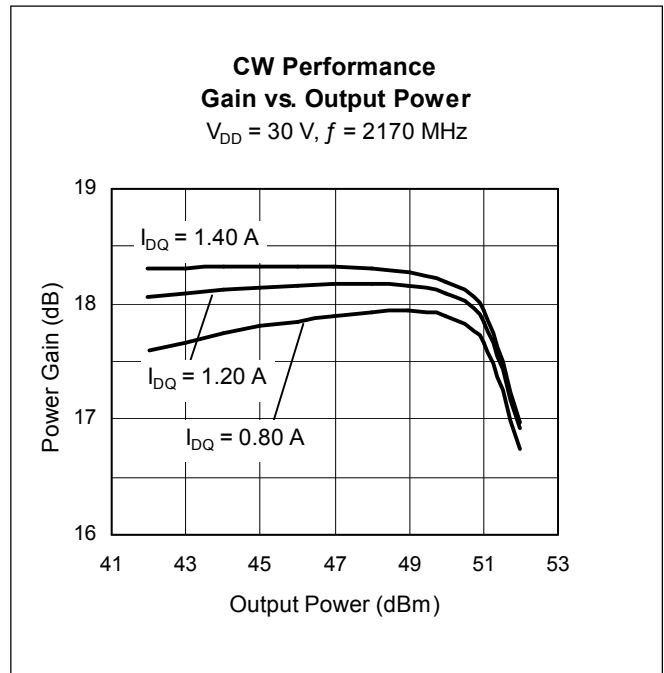
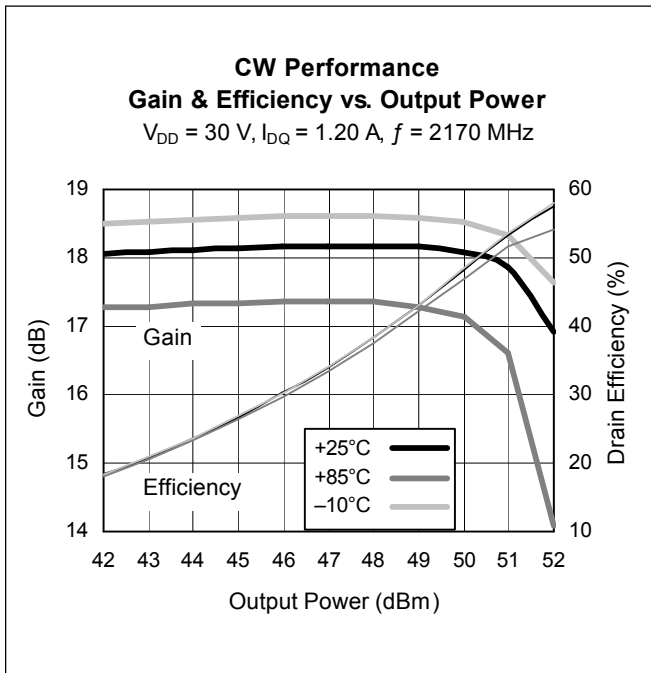
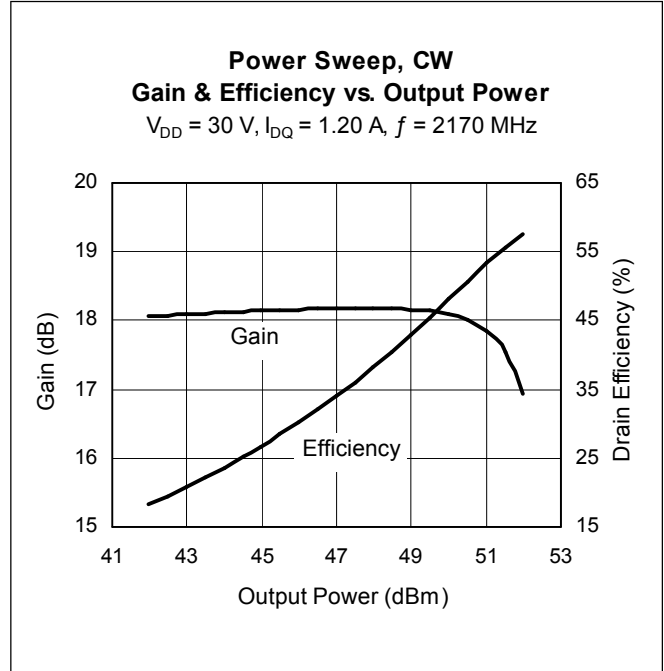
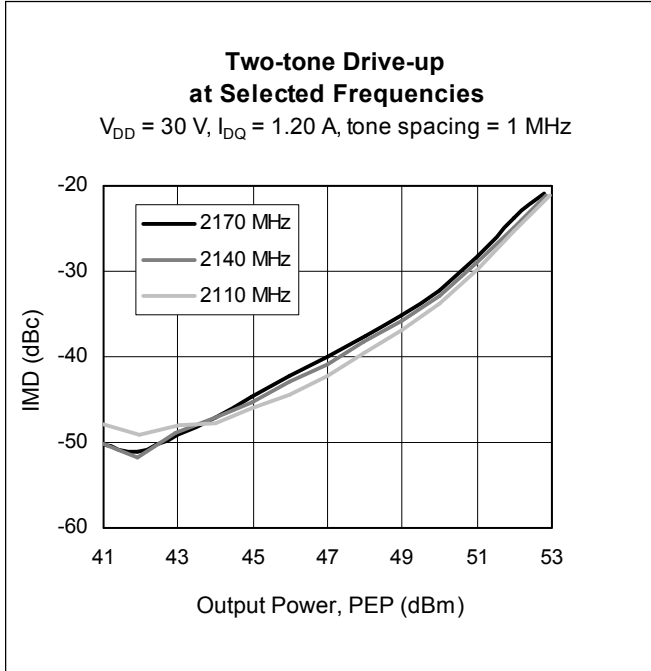
## Ordering Information

Type and Version	Package Outline	Package Description	Shipping
PTFB211501E V4	H-36248-2	Slotted flange, single-ended	Tray
PTFB211501E V4 R250	H-36248-2	Slotted flange, single-ended	Tape & Reel 250 pcs
PTFB211501F V4	H-37248-2	Earless flange, single-ended	Tray
PTFB211501F V4 R250	H-37248-2	Earless flange, single-ended	Tape & Reel 250 pcs

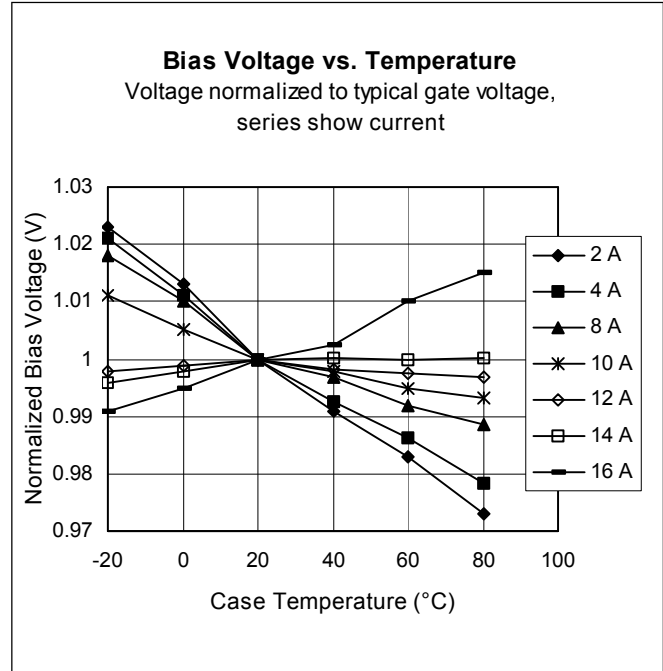
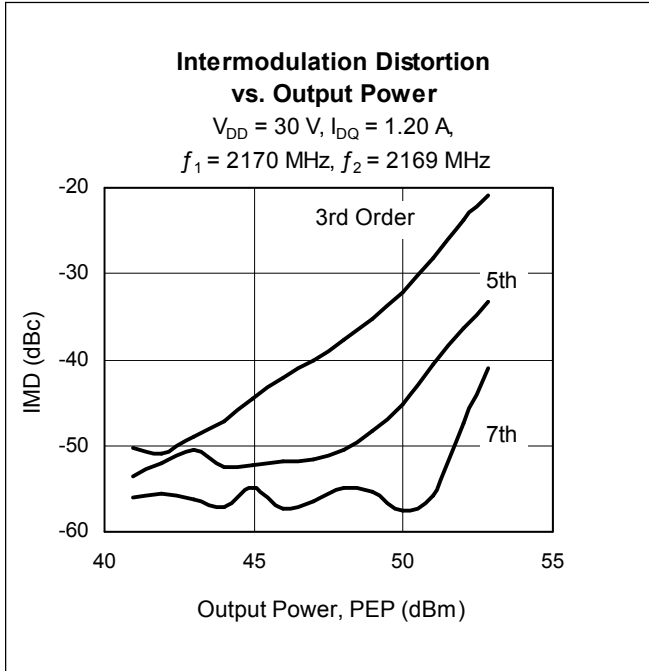
**Typical Performance** (data taken in production test fixture)



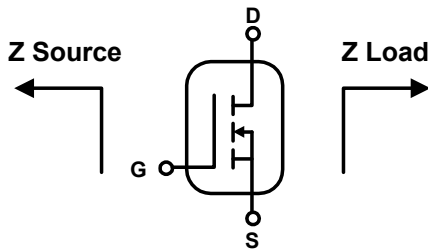
Typical Performance (cont.)



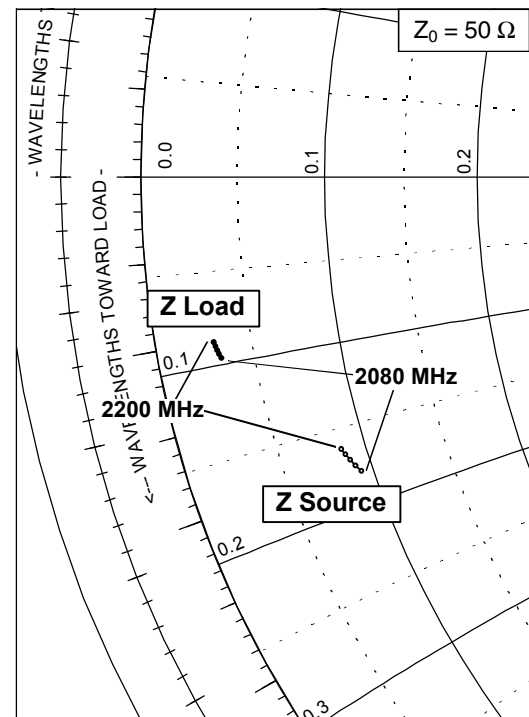
Typical Performance (cont.)



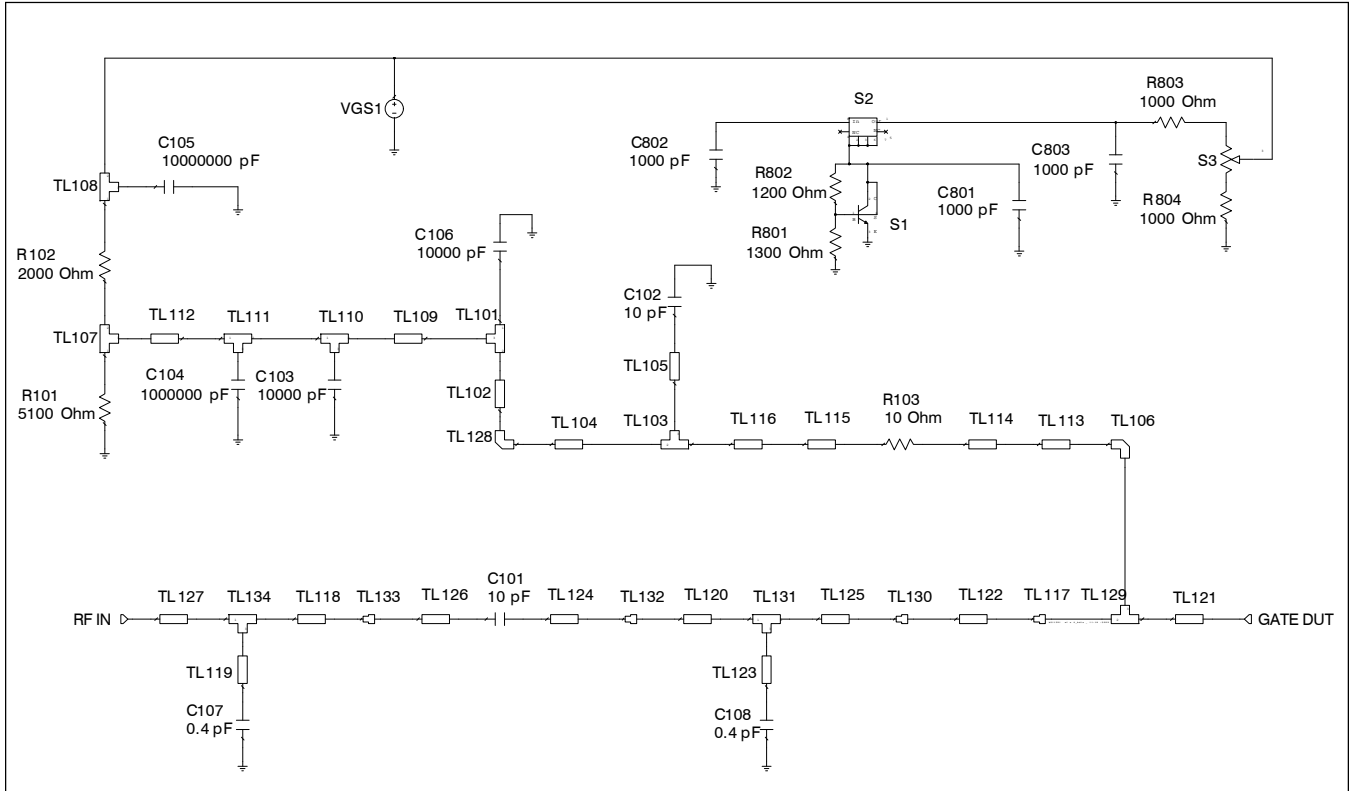
Broadband Circuit Impedance



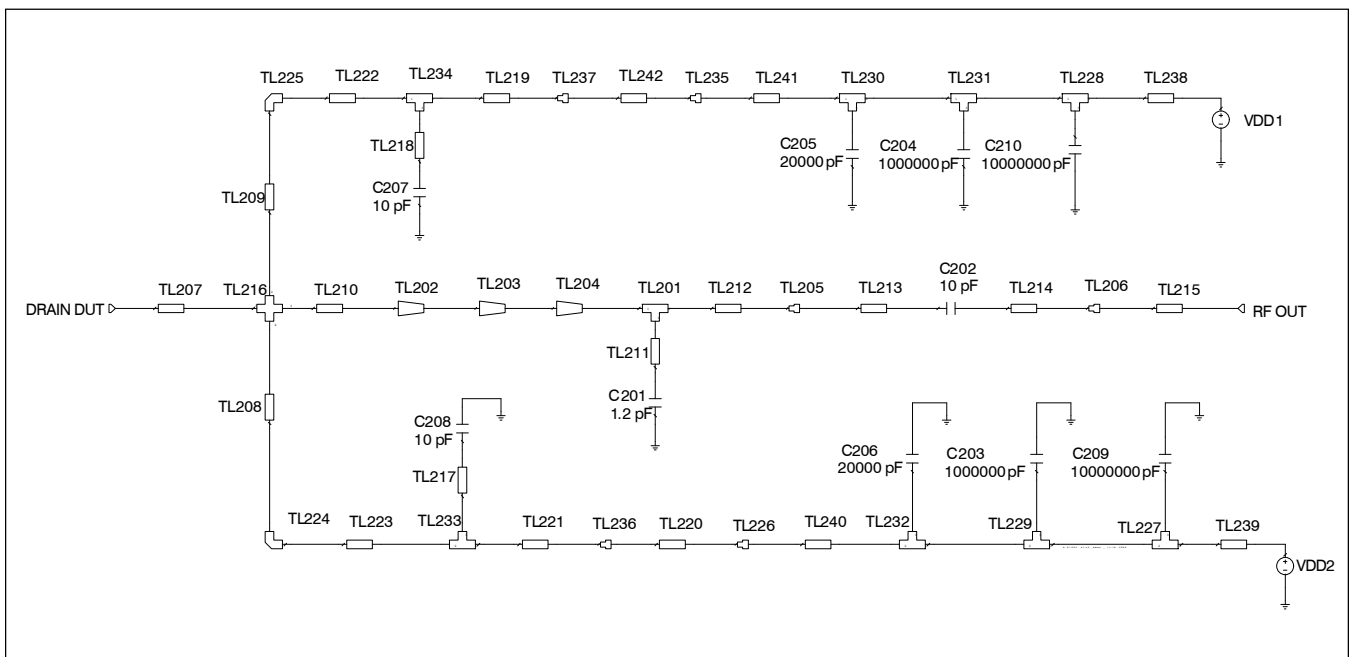
Frequency MHz	Z Source W		Z Load W	
	R	jX	R	jX
2200	4.29	-8.14	1.49	-4.39
2170	4.36	-8.34	1.52	-4.50
2140	4.45	-8.53	1.55	-4.61
2110	4.55	-8.74	1.58	-4.72
2080	4.67	-8.95	1.62	-4.84



### Reference Circuit

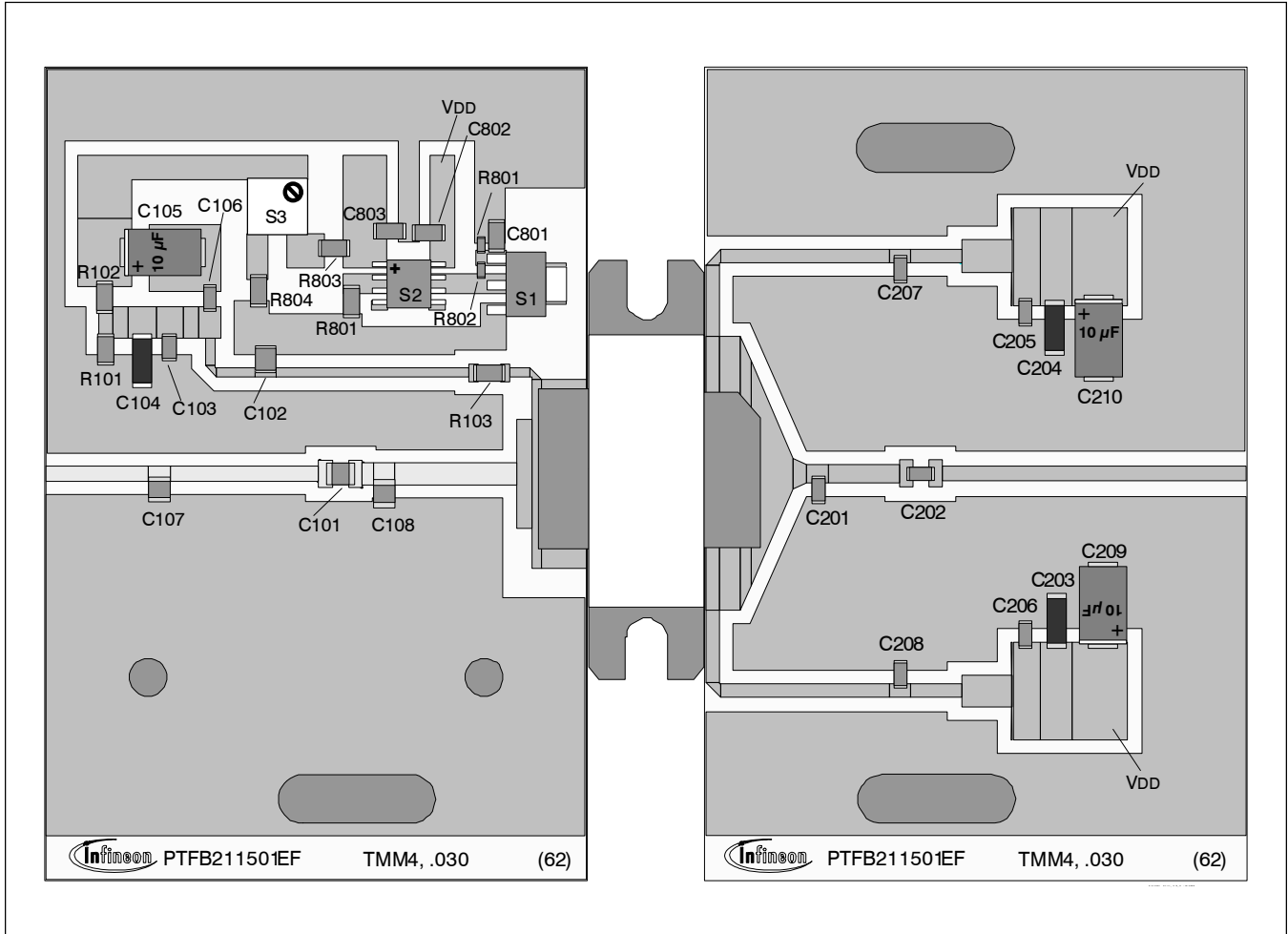


Reference circuit input schematic for  $f = 2170$  MHz



Reference circuit output schematic for  $f = 2170$  MHz

Reference Circuit (cont.)



Reference circuit assembly diagram (not to scale)\*

\* Gerber Files for this circuit available on request

## Reference Circuit (cont.)

### Circuit Assembly Information

DUT	PTFB211501E or PTFB211501F		LDMOS Transistor	
PCB	LTN/PTFB211501EF	0.76 mm [.030"] thick, $\epsilon_r = 4.5$	TMM4	2 oz. copper

Component	Description	Suggested Manufacturer	P/N
<b>Input</b>			
C101, C102	Chip capacitor, 10 pF	ATC	100B100JW500X
C103, C106	Chip capacitor, 0.01 $\mu$ F	ATC	200B103MW50X
C104	Chip capacitor, 1 $\mu$ F	Digi-Key	445-1411-2-ND
C105	Capacitor, 10 $\mu$ F	Digi-Key	399-1655-2-ND
C107, C108	Chip capacitor, 0.4 pF	ATC	100B0R4CW500X
C801, C802, C803	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101	Resistor, 5100 $\Omega$	Digi-Key	P5.1KECT-ND
R102	Resistor, 2000 $\Omega$	Digi-Key	P2.0KECT-ND
R103	Resistor, 10 $\Omega$	Digi-Key	P10ECT-ND
R801	Resistor, 1300 $\Omega$	Digi-Key	P1.3KECT-ND
R802	Resistor, 1200 $\Omega$	Digi-Key	P1.2KECT-ND
R803, R804	Resistor, 1000 $\Omega$	Digi-Key	P1.0KECT-ND
S1	Transistor	Infineon Technologies	BCP56
S2	Voltage regulator	National Semiconductor	LM7805
S3	Potentiometer, 2k $\Omega$	Digi-Key	3224W-202ECT-ND
<b>Output</b>			
C201	Chip capacitor, 1.2 pF	ATC	100B1R2CW500X
C202	Chip capacitor, 10 pF	ATC	100B100JW500X
C203, C204	Chip capacitor, 1 $\mu$ F	Digi-Key	445-1411-2-ND
C205, C206	Chip capacitor, 0.02 $\mu$ F	ATC	200B203MW50X
C207, C208	Chip capacitor, 10 pF	ATC	100B100JW500X
C209, C210	Capacitor, 10 $\mu$ F	Garrett Electronics	TPSE106K050R0400



Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz

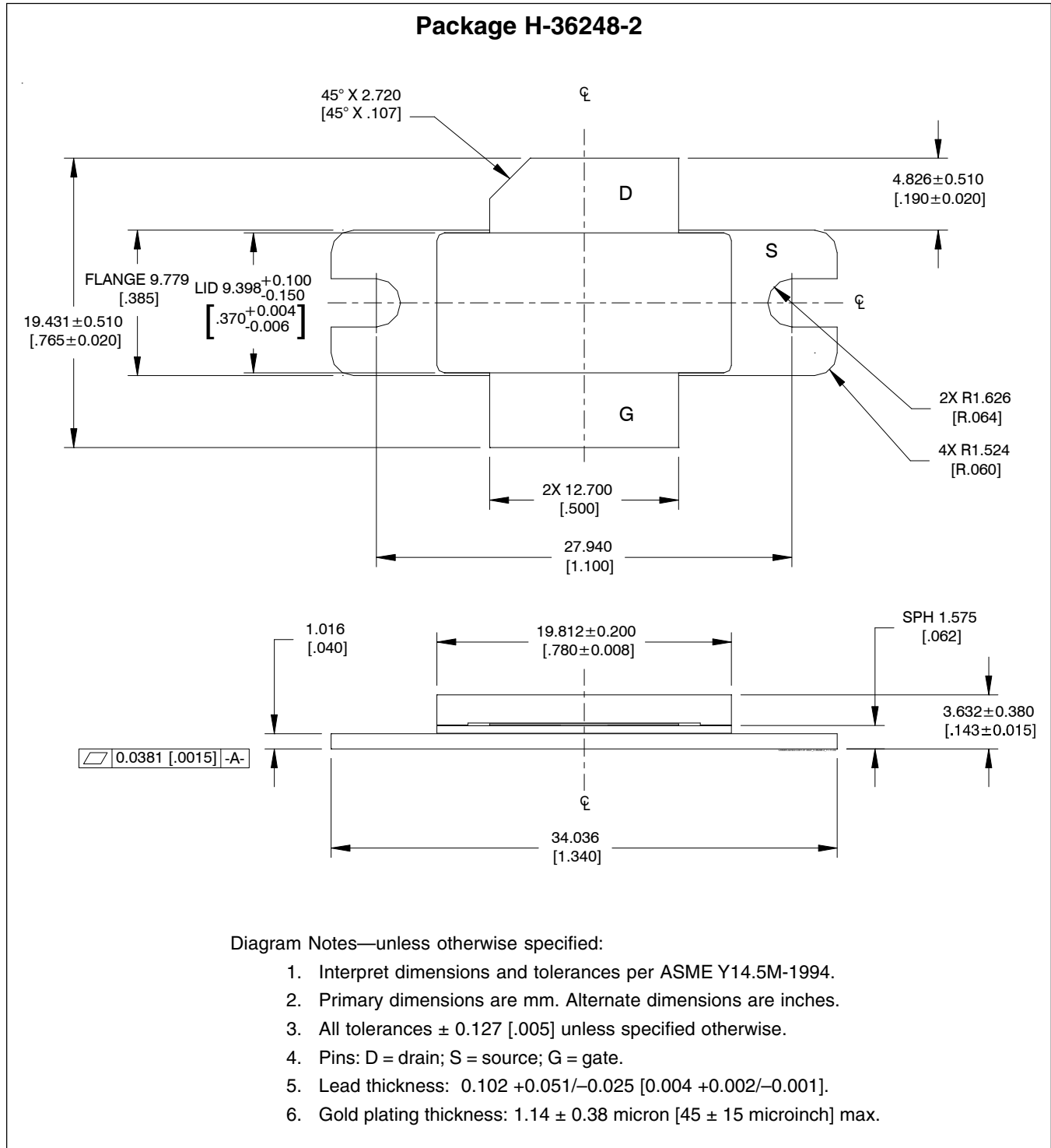
Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
<b>Input</b>			
TL101	0.041 $\lambda$ , 40.30 $\Omega$	W1 = 2.032, W2 = 2.032, W3 = 3.048	W1 = 80, W2 = 80, W3 = 120
TL102	0.033 $\lambda$ , 65.15 $\Omega$	W = 0.889, L = 2.540	W = 35, L = 100
TL103	0.027 $\lambda$ , 65.15 $\Omega$	W1 = 0.889, W2 = 0.889, W3 = 2.032	W1 = 35, W2 = 35, W3 = 80
TL104	0.047 $\lambda$ , 65.15 $\Omega$	W = 0.889, L = 3.556	W = 35, L = 140
TL105	0.000 $\lambda$ , 40.30 $\Omega$	W = 2.032, L = 0.025	W = 80, L = 1
TL106, TL128		W = 0.889	W = 35
TL107	0.040 $\lambda$ , 53.88 $\Omega$	W1 = 1.270, W2 = 1.270, W3 = 3.048	W1 = 50, W2 = 50, W3 = 120
TL108	0.089 $\lambda$ , 20.46 $\Omega$	W1 = 5.080, W2 = 5.080, W3 = 6.350	W1 = 200, W2 = 200, W3 = 50
TL109, TL112	0.021 $\lambda$ , 30.35 $\Omega$	W = 3.048, L = 1.524	W = 120, L = 60
TL110, TL111	0.035 $\lambda$ , 30.35 $\Omega$	W1 = 3.048, W2 = 3.048, W3 = 2.540	W1 = 120, W2 = 120, W3 = 100
TL113	0.025 $\lambda$ , 65.15 $\Omega$	W = 0.889, L = 1.905	W = 35, L = 75
TL114, TL115	0.012 $\lambda$ , 46.07 $\Omega$	W = 1.651, L = 0.889	W = 65, L = 35
TL116	0.236 $\lambda$ , 65.15 $\Omega$	W = 0.889, L = 18.034	W = 35, L = 710
TL117		W1 = 10.160, W2 = 17.780	W1 = 400, W2 = 700
TL118	0.186 $\lambda$ , 50.98 $\Omega$	W = 1.397, L = 13.970	W = 55, L = 550
TL119, TL123	0.000 $\lambda$ , 40.30 $\Omega$	W = 2.032, L = 0.025	W = 80, L = 1
TL120	0.014 $\lambda$ , 40.30 $\Omega$	W = 2.032, L = 1.016	W = 80, L = 40
TL121	0.062 $\lambda$ , 6.87 $\Omega$	W = 17.780, L = 4.191	W = 700, L = 165
TL122	0.020 $\lambda$ , 11.38 $\Omega$	W = 10.160, L = 1.397	W = 400, L = 55
TL124, TL126	0.017 $\lambda$ , 34.60 $\Omega$	W = 2.540, L = 1.270	W = 100, L = 50
TL125	0.155 $\lambda$ , 40.30 $\Omega$	W = 2.032, L = 11.430	W = 80, L = 450
TL127	0.127 $\lambda$ , 50.98 $\Omega$	W = 1.397, L = 9.525	W = 55, L = 375
TL129	0.013 $\lambda$ , 6.87 $\Omega$	W1 = 17.780, W2 = 17.780, W3 = 0.889	W1 = 700, W2 = 700, W3 = 35
TL130		W1 = 2.032, W2 = 10.160	W1 = 80, W2 = 400
TL131	0.027 $\lambda$ , 40.30 $\Omega$	W1 = 2.032, W2 = 2.032, W3 = 2.032	W1 = 80, W2 = 80, W3 = 80
TL132		W1 = 2.540, W2 = 2.032	W1 = 100, W2 = 80
TL133		W1 = 1.397, W2 = 2.540	W1 = 55, W2 = 100
TL134	0.027 $\lambda$ , 50.98 $\Omega$	W1 = 1.397, W2 = 1.397, W3 = 2.032	W1 = 55, W2 = 55, W3 = 80

## Reference Circuit (cont.)

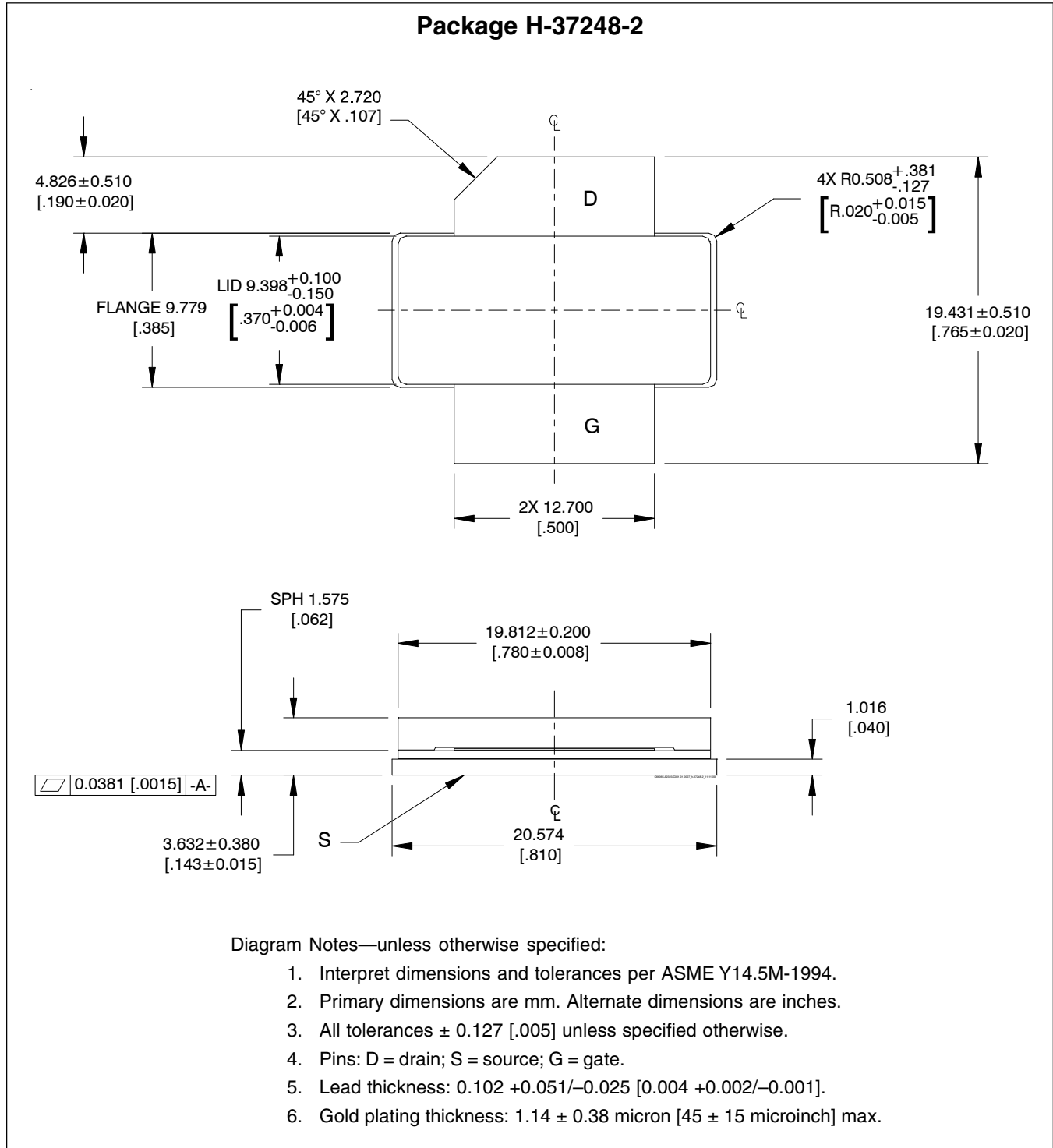
### Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
<b>Output</b>			
TL201	0.027 $\lambda$ , 43.96 $\Omega$	W1 = 1.778, W2 = 1.778, W3 = 2.032	W1 = 70, W2 = 70, W3 = 80
TL202 (taper)	0.016 $\lambda$ , 4.88 $\Omega$ / 5.86 $\Omega$	W1 = 25.654, W2 = 21.107, L = 1.041	W1 = 1010, W2 = 831, L = 41
TL203 (taper)	0.058 $\lambda$ , 5.86 $\Omega$ / 32.33 $\Omega$	W1 = 21.107, W2 = 2.794, L = 3.937	W1 = 831, W2 = 110, L = 155
TL204 (taper)	0.017 $\lambda$ , 32.33 $\Omega$ / 43.96 $\Omega$	W1 = 2.794, W2 = 1.778, L = 1.270	W1 = 110, W2 = 70, L = 50
TL205		W1 = 1.778, W2 = 2.540	W1 = 70, W2 = 100
TL206		W1 = 2.540, W2 = 1.397	W1 = 100, W2 = 55
TL207	0.000 $\lambda$ , 4.88 $\Omega$	W = 25.654, L = 0.025	W = 1010, L = 1
TL208, TL209	0.089 $\lambda$ , 53.88 $\Omega$	W = 1.270, L = 6.731	W = 50, L = 265
TL210	0.028 $\lambda$ , 4.88 $\Omega$	W = 25.654, L = 1.905	W = 1010, L = 75
TL211, TL217, TL218	0.000 $\lambda$ , 40.30 $\Omega$	W = 2.032, L = 0.025	W = 80, L = 1
TL212	0.089 $\lambda$ , 43.96 $\Omega$	W = 1.778, L = 6.604	W = 70, L = 260
TL213, TL214	0.017 $\lambda$ , 34.60 $\Omega$	W = 2.540, L = 1.270	W = 100, L = 50
TL215	0.378 $\lambda$ , 50.98 $\Omega$	W = 1.397, L = 28.423	W = 55, L = 1119
TL216		W1 = 25.654, W2 = 1.270, W3 = 25.654, W4 = 1.270	W1 = 1010, W2 = 50, W3 = 1010, W4 = 50
TL219, TL221	0.062 $\lambda$ , 53.88 $\Omega$	W = 1.270, L = 4.699	W = 50, L = 185
TL220, TL242	0.065 $\lambda$ , 30.35 $\Omega$	W = 3.048, L = 4.699	W = 120, L = 185
TL222, TL223	0.209 $\lambda$ , 53.88 $\Omega$	W = 1.270, L = 15.748	W = 50, L = 620
TL224, TL225		W = 1.270	W = 50
TL226, TL235		W1 = 3.048, W2 = 9.144	W1 = 120, W2 = 360
TL227, TL228	0.073 $\lambda$ , 12.48 $\Omega$	W1 = 9.144, W2 = 9.144, W3 = 5.080	W1 = 360, W2 = 360, W3 = 200
TL229, TL231	0.044 $\lambda$ , 12.48 $\Omega$	W1 = 9.144, W2 = 9.144, W3 = 3.048	W1 = 360, W2 = 360, W3 = 120
TL230, TL232	0.037 $\lambda$ , 12.48 $\Omega$	W1 = 9.144, W2 = 9.144, W3 = 2.540	W1 = 360, W2 = 360, W3 = 100
TL233, TL234	0.027 $\lambda$ , 53.88 $\Omega$	W1 = 1.270, W2 = 1.270, W3 = 2.032	W1 = 50, W2 = 50, W3 = 80
TL236, TL237		W1 = 1.270, W2 = 3.048,	W1 = 50, W2 = 120
TL238, TL239, TL240, TL241	0.002 $\lambda$ , 12.48 $\Omega$	W = 9.144, L = 0.127	W = 360, L = 5

### Package Outline Specifications



Package Outline Specifications (cont.)



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