

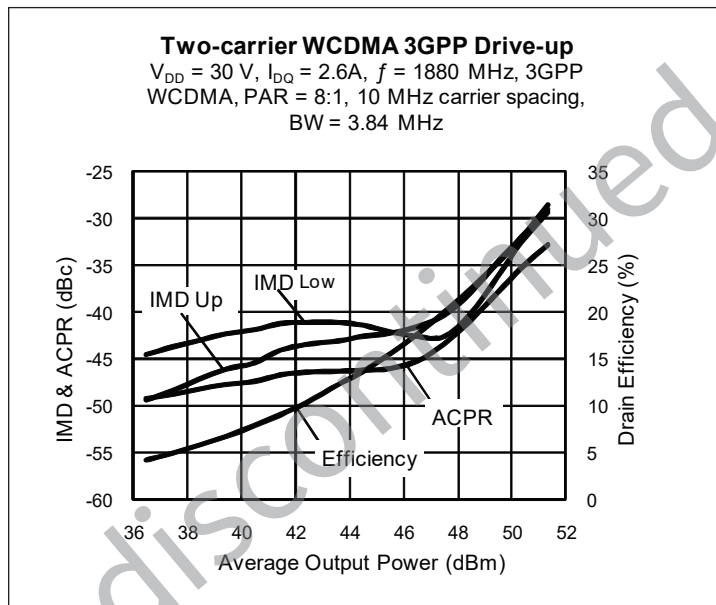
PTFB183404F

High Power RF LDMOS Field Effect Transistors 340 W, 1805 – 1880 MHz

Description

The PTFB183404F is a 340-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 and thermally-enhanced package with earless flanges. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.

PTFB183404F
Package H-37275-6/2



Features

- Broadband internal input and output matching
- Wide video bandwidth
- Typical single-carrier WCDMA performance, 1880 MHz, 30 V
 - Output power = 125 W
 - Efficiency = 31%
 - Gain = 17 dB
 - PAR = 5.5 dB @ 0.01% CCDF probability
 - ACPR @ 5 MHz = -37 dBc
- Increased negative gate-source voltage range for improved performance in Doherty amplifiers
- Capable of handling 10:1 VSWR @ 30 V, 340 W (CW) output power
- Integrated ESD protection
- Excellent thermal stability
- Pb-free and RoHS compliant

RF Characteristics

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

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 80\text{ W}$ average, $f_1 = 1870\text{ MHz}$, $f_2 = 1880\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	16	17	—	dB
Drain Efficiency	η_D	24	25.5	—	%
Intermodulation Distortion	IMD	—	-35	-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.)

Single-carrier WCDMA Performance (not subject to production test – verified by design / characterization in Wolfspeed test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, IQ clipping, channel bandwidth = 3.84 MHz, Input signal PAR = 7.5 dB @ 0.01% CCDF probability

Characteristic	Conditions	Symbol	1805 MHz (Typ)	1842 MHz (Typ)	1880 MHz (Typ)
Gain	$P_{OUT} \text{ (AVG)} = 49\text{ dBm}$	G_{ps}	17.1	17.3	17.5
	$P_{OUT} \text{ (AVG)} = 51\text{ dBm}$		17.0	17.15	17.4
Drain Efficiency	$P_{OUT} \text{ (AVG)} = 49\text{ dBm}$	η_D	25	24.5	24
	$P_{OUT} \text{ (AVG)} = 51\text{ dBm}$		31	30	30
Output PAR at 0.01%	$P_{OUT} \text{ (AVG)} = 49\text{ dBm}$	dB	6.5	6.5	6.5
	$P_{OUT} \text{ (AVG)} = 51\text{ dBm}$		5.5	5.5	5.5
Adjacent Channel Power Ratio	$P_{OUT} \text{ (AVG)} = 49\text{ dBm}$	ACPR	-43	-42.5	-41
	$P_{OUT} \text{ (AVG)} = 51\text{ dBm}$		-36	-35	-34

Two-tone Specifications (not subject to production test – verified by design / characterization in Wolfspeed test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 310\text{ W PEP}$, $f = 1880\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	17.5	—	dB
Drain Efficiency	η_D	—	35	—	%
Intermodulation Distortion	IMD	—	30	—	dBc

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$	$V_{(BR)DSS}$	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	$V_{DS} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$	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

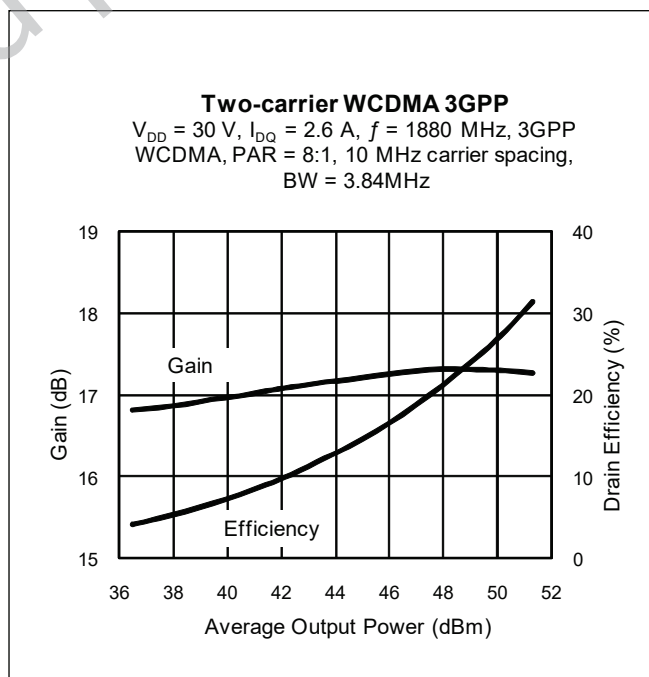
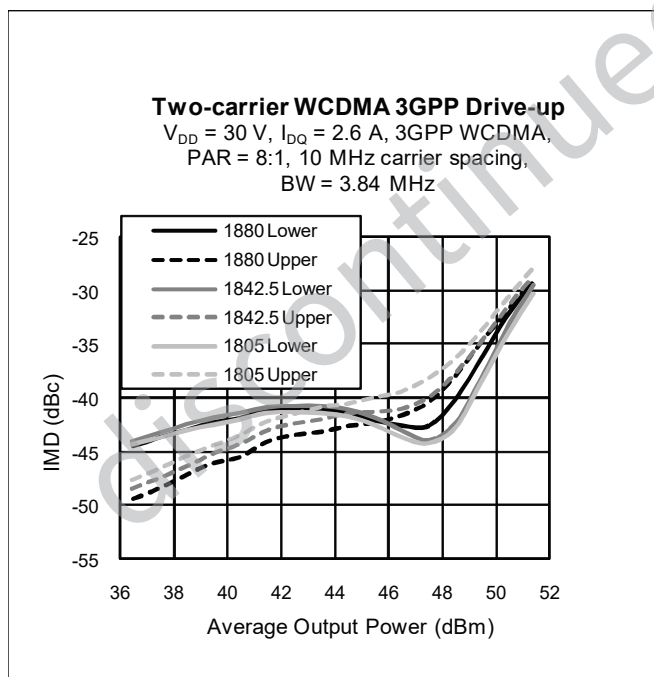
Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	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 ($T_{CASE} = 70^{\circ}\text{C}$, 340 W CW)	$R_{\theta JC}$	0.2	°C/W

Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTFB183404F V2 R0	PTFB183404F-V2-R0	Earless push-pull	Tape & Reel, 50pcs
PTFB183404F V2 R250	PTFB183404F-V2-R250	Earless push-pull	Tape & Reel, 250pcs

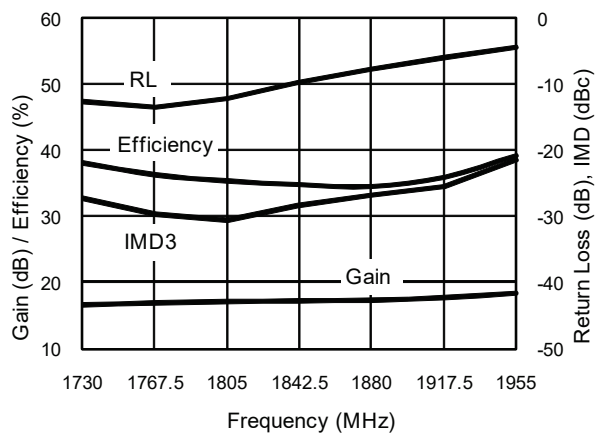
Typical Performance (data taken in a production test fixture)



Typical Performance (cont.)

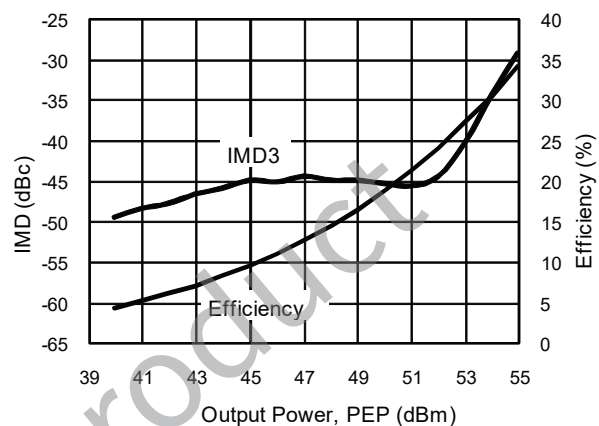
**Two-tone Broadband
Gain, Efficiency & Return Loss
vs. Frequency**

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 170\text{ W}$

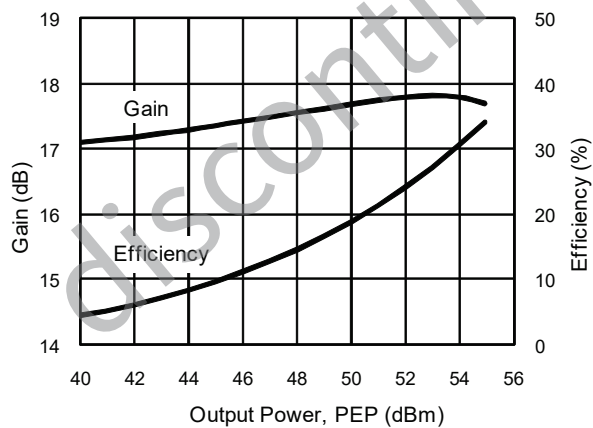


Two-tone Drive-up

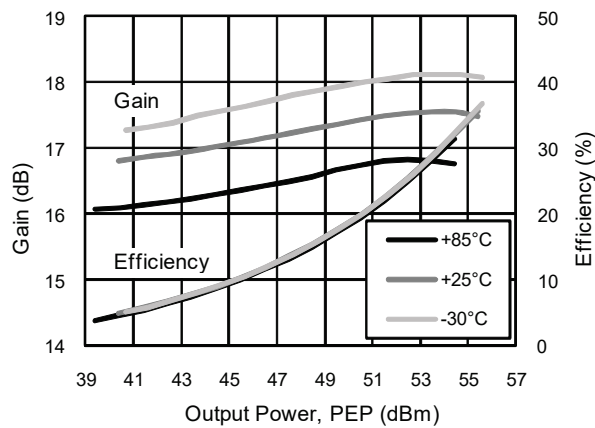
$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1880\text{ MHz}$, $f_2 = 1879\text{ MHz}$



Two-tone Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1880\text{ MHz}$, $f_2 = 1879\text{ MHz}$



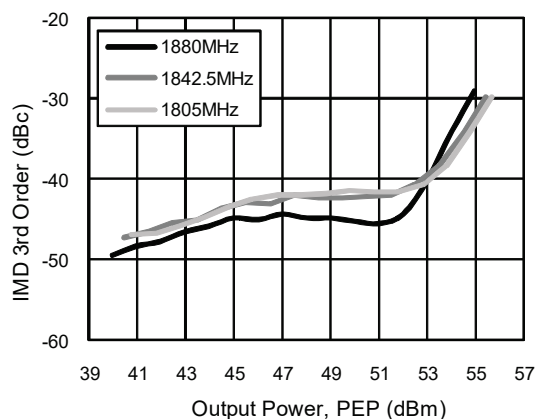
Two-tone Drive-up (over temp)
(P_{OUT} -max 3rd order IMD @ -30dBc)
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1842.5\text{ MHz}$, $f_2 = 1841.5\text{ MHz}$



Typical Performance (cont.)

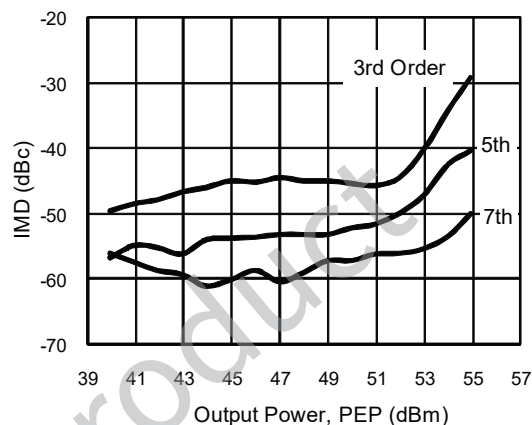
Two-tone Drive-up at Selected Frequencies

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, tone spacing = 1 MHz



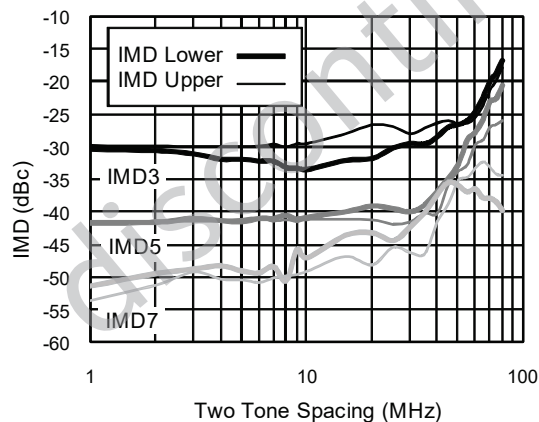
Intermodulation Distortion vs. Output Power

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1880\text{ MHz}$, $f_2 = 1879\text{ MHz}$



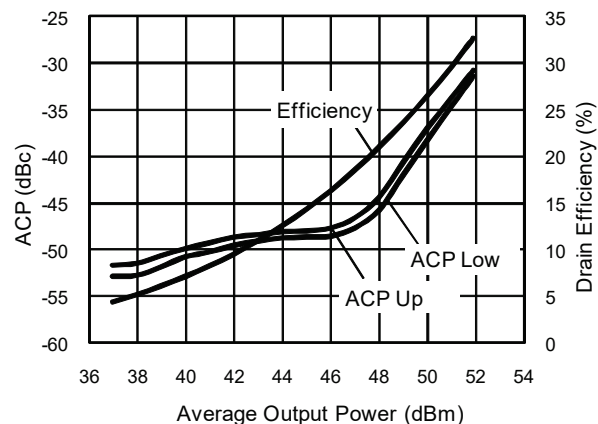
Intermodulation Distortion vs. Tone Spacing

$f = 1842.5\text{ MHz}$, $P_{OUT} = 330\text{ W (PEP)}$,
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$



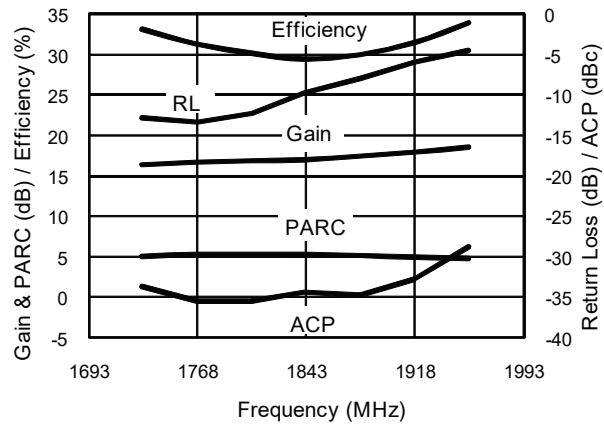
Single-carrier Drive-up, 1880 MHz

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1880\text{ MHz}$,
3GPP WCDMA signal, PAR = 7.5:1,
BW = 3.84 MHz

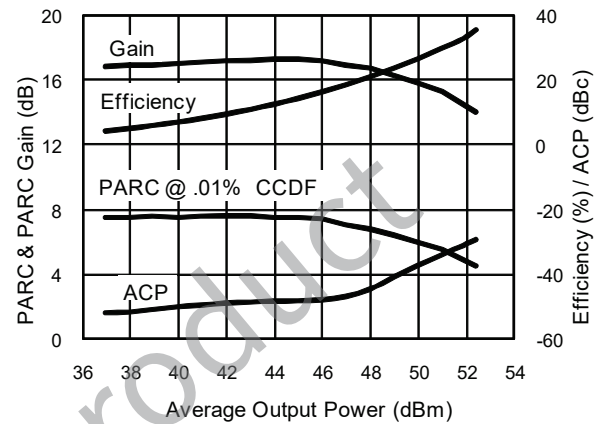


Typical Performance (cont.)

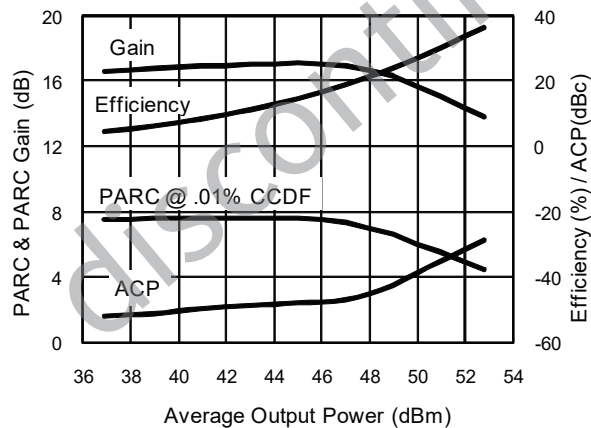
Single-carrier Broadband Performance

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 125\text{ W}$


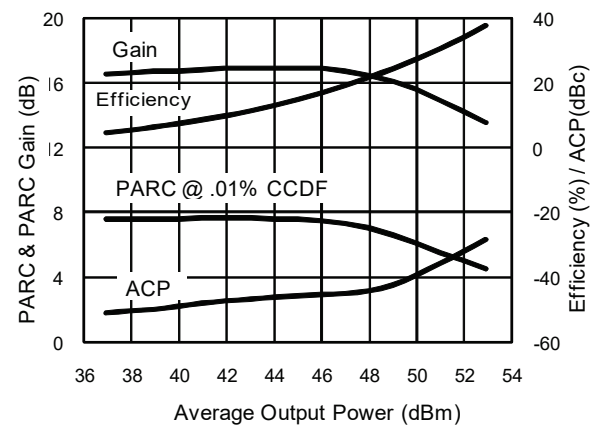
Single-carrier Drive-up, 1880 MHz

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1880\text{ MHz}$,
 3GPP WCDMA signal, PAR = 7.5:1,
 BW = 3.84 MHz


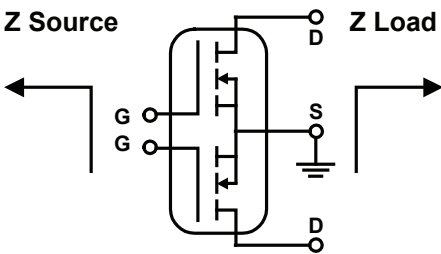
Single-carrier Drive-up, 1842 MHz

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1842\text{ MHz}$,
 3GPP WCDMA signal, PAR = 7.5:1,
 BW = 3.84 MHz


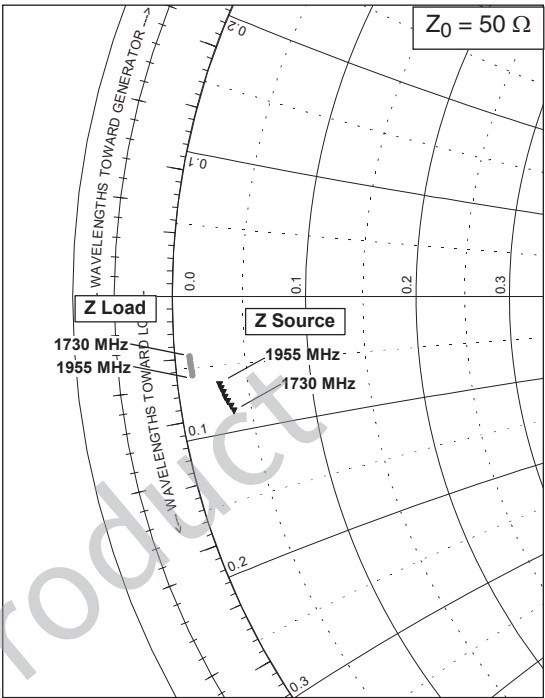
Single-carrier Drive-up, 1805 MHz

 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1805\text{ MHz}$,
 3GPP WCDMA signal, PAR = 7.5:1,
 BW = 3.84 MHz


Broadband Circuit Impedance (combined leads)



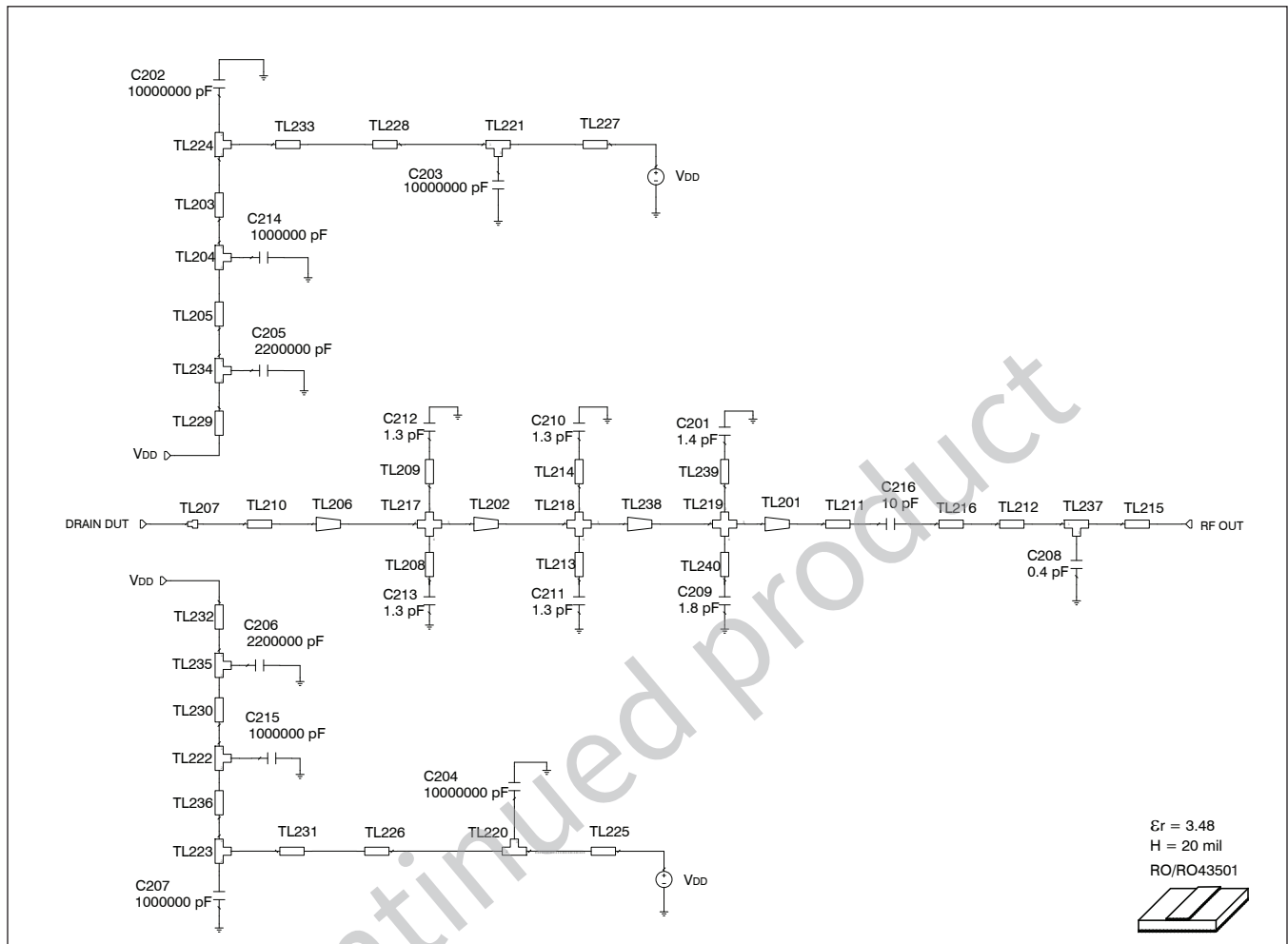
Frequency MHz	Z Source Ω		Z Load Ω	
	R	jX	R	jX
1730	1.86	-4.25	0.55	-2.78
1768	1.77	-4.06	0.54	-2.66
1805	1.68	-3.88	0.53	-2.54
1843	1.61	-3.70	0.52	-2.43
1880	1.56	-3.53	0.51	-2.32
1918	1.51	-3.37	0.51	-2.21
1955	1.47	-3.22	0.5	-2.11



See next page for reference circuit information



Reference Circuit (cont.)

Reference circuit output schematic for $f = 1880 \text{ MHz}$

Reference Circuit (cont.)

Description	
DUT	PTFB183404F
PCB	0.508 mm [.020"] 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, TL129	0.017λ , 54.17 Ω	$W = 1.016$, $L = 1.651$	$W = 40$, $L = 65$
TL102	0.002λ , 63.89 Ω	$W = 0.762$, $L = 0.203$	$W = 30$, $L = 8$
TL103, TL139	0.000λ , 41.75 Ω	$W = 1.524$, $L = 0.025$	$W = 60$, $L = 1$
TL104	0.208λ , 63.89 Ω	$W = 0.762$, $L = 20.297$	$W = 30$, $L = 799$
TL105	0.008λ , 28.85 Ω	$W = 2.540$, $L = 0.762$	$W = 100$, $L = 30$
TL106	0.005λ , 63.89 Ω	$W = 0.762$, $L = 0.508$	$W = 30$, $L = 20$
TL107, TL157	0.061λ , 8.03 Ω	$W = 11.430$, $L = 5.359$	$W = 450$, $L = 211$
TL108, TL172	0.004λ , 8.03 Ω	$W = 11.430$, $L = 0.338$	$W = 450$, $L = 13$
TL109, TL170	0.002λ , 8.03 Ω	$W = 11.430$, $L = 0.196$	$W = 450$, $L = 8$
TL110	0.022λ , 32.60 Ω	$W = 2.159$, $L = 2.032$	$W = 85$, $L = 80$
TL111	0.028λ , 49.69 Ω	$W = 1.168$, $L = 2.710$	$W = 46$, $L = 107$
TL112	0.000λ , 63.89 Ω	$W = 0.762$, $L = 0.025$	$W = 30$, $L = 1$
TL113	0.016λ , 49.69 Ω	$W = 1.168$, $L = 1.549$	$W = 46$, $L = 61$
TL114	0.029λ , 49.69 Ω	$W = 1.168$, $L = 2.743$	$W = 46$, $L = 108$
TL115, TL116, TL117, TL118		$W = 2.540$	$W = 100$
TL119, TL120		$W = 1.016$	$W = 40$
TL121, TL141	0.013λ , 34.08 Ω	$W = 2.032$, $L = 1.270$	$W = 80$, $L = 50$
TL122, TL123	0.000λ , 63.89 Ω	$W = 0.762$, $L = 0.000$	$W = 30$, $L = 0$
TL124, TL156	0.014λ , 17.20 Ω	$W = 4.826$, $L = 1.270$	$W = 190$, $L = 50$
TL125	0.013λ , 63.89 Ω	$W = 0.762$, $L = 1.270$	$W = 30$, $L = 50$
TL126, TL139, TL159	0.000λ , 41.75 Ω	$W = 1.524$, $L = 0.025$	$W = 60$, $L = 1$
TL127	0.002λ , 63.89 Ω	$W = 0.762$, $L = 0.203$	$W = 30$, $L = 8$
TL128, TL130	0.013λ , 54.17 Ω	$W = 1.016$, $L = 1.262$	$W = 40$, $L = 50$
TL131, TL138	0.014λ , 54.17 Ω	$W = 1.016$, $L = 1.397$	$W = 40$, $L = 55$
TL132, TL137	0.000λ , 34.08 Ω	$W = 2.032$, $L = 0.025$	$W = 80$, $L = 1$
TL133, TL136	0.079λ , 54.17 Ω	$W = 1.016$, $L = 7.620$	$W = 40$, $L = 300$
TL134, TL135	0.008λ , 54.17 Ω	$W = 1.016$, $L = 0.762$	$W = 40$, $L = 30$
TL140	0.015λ , 63.89 Ω	$W = 0.762$, $L = 1.422$	$W = 30$, $L = 56$
TL142, TL144	0.010λ , 63.89 Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 1.016$	$W1 = 30$, $W2 = 30$, $W3 = 40$
TL143, TL168	0.016λ , 63.89 Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 1.524$	$W1 = 30$, $W2 = 30$, $W3 = 60$
TL145	0.008λ , 49.69 Ω	$W1 = 1.168$, $W2 = 1.168$, $W3 = 0.762$	$W1 = 46$, $W2 = 46$, $W3 = 30$
TL146		$W1 = 0.003$, $W2 = 0.005$, Offset = 0.000	$W1 = 3$, $W2 = 190$, Offset = 10
TL147		$W1 = 0.005$, $W2 = 0.011$, Offset = 0.003	$W1 = 5$, $W2 = 450$, Offset = 130

table continued on page 11

Reference Circuit (cont.)**Electrical Characteristics at 1880 MHz**

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL148		W1 = 0.005, W2 = 0.011, Offset = -0.003	W1 = 5, W2 = 450, Offset = -130
TL149		W1 = 0.003, W2 = 0.005, Offset = 0.000	W1 = 3, W2 = 190, Offset = -10
TL150		W1 = 2.032, W2 = 0.762	W1 = 80, W2 = 30
TL151		W1 = 2.540, W2 = 0.762	W1 = 100, W2 = 30
TL152		W1 = 1.168, W2 = 2.159	W1 = 46, W2 = 85
TL153	0.008 λ , 28.85 Ω	W = 2.540, L = 0.762	W = 100, L = 30
TL154, TL155	0.006 λ , 17.20 Ω	W = 4.826, L = 0.508	W = 190, L = 20
TL158	0.015 λ , 63.89 Ω	W = 0.762, L = 1.422	W = 30, L = 56
TL160	0.004 λ , 63.89 Ω	W = 0.762, L = 0.404	W = 30, L = 16
TL161	0.023 λ , 28.85 Ω	W1 = 2.540, W2 = 2.540, W3 = 2.159	W1 = 100, W2 = 100, W3 = 85
TL162, TL165	0.011 λ , 8.03 Ω	W1 = 11.430, W2 = 11.430, W3 = 1.016	W1 = 450, W2 = 450, W3 = 40
TL163, TL164	0.016 λ , 63.89 Ω	W1 = 0.762, W2 = 0.762, W3 = 1.524	W1 = 30, W2 = 30, W3 = 60
TL166, TL167	0.021 λ , 54.17 Ω	W1 = 1.016, W2 = 1.016, W3 = 2.032	W1 = 40, W2 = 40, W3 = 80
TL169, TL171	0.009 λ , 8.03 Ω	W1 = 11.430, W2 = 11.430, W3 = 0.762	W1 = 450, W2 = 450, W3 = 30

See next page for more reference circuit information

Reference Circuit (cont.)

Electrical Characteristics at 1880 MHz

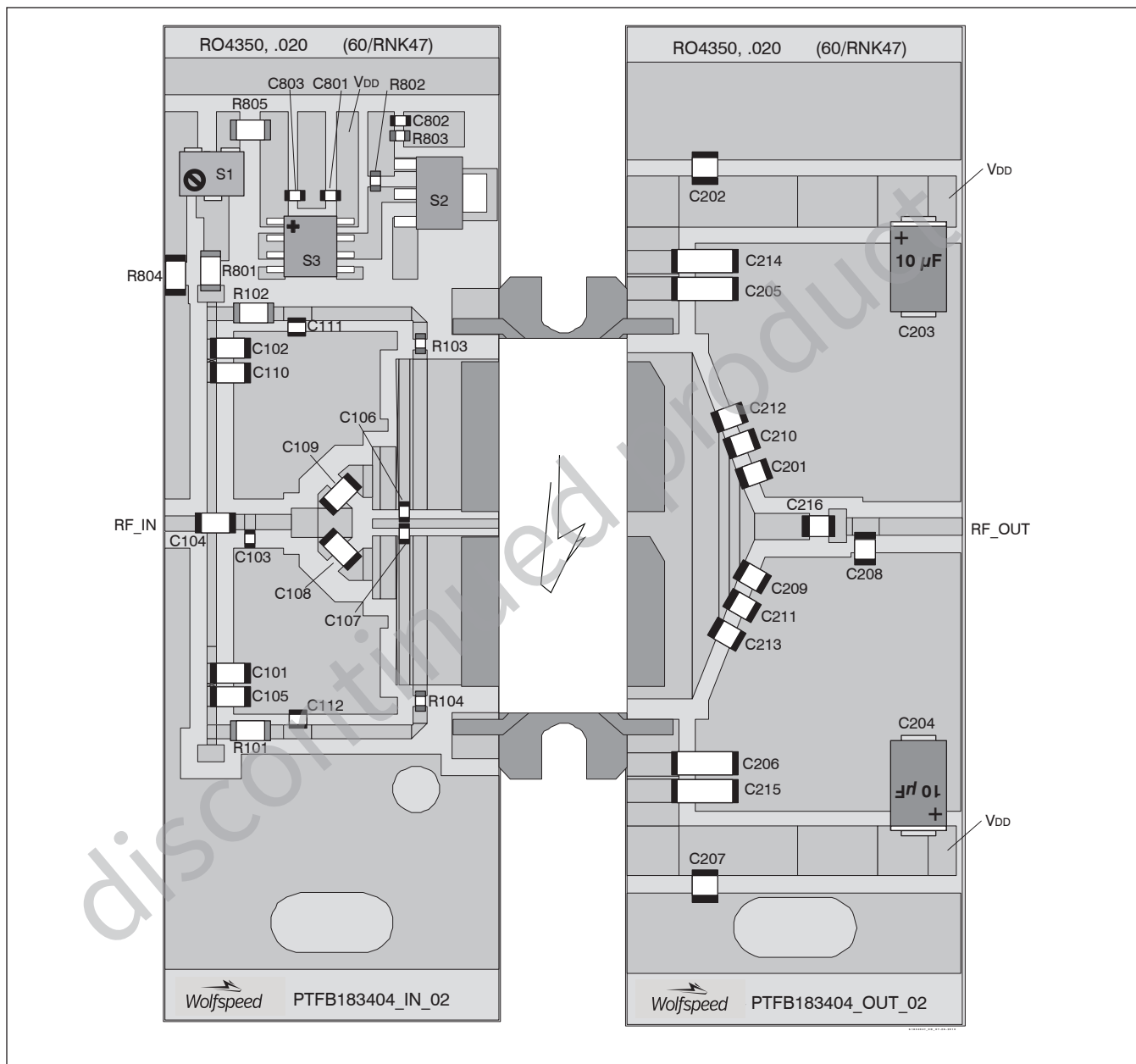
Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Output			
TL201 (taper)	0.011λ , 12.30Ω / 34.72Ω	$W1 = 7.112$, $W2 = 1.981$, $L = 1.016$	$W1 = 280$, $W2 = 78$, $L = 40$
TL202 (taper)	0.009λ , 5.88Ω / 7.95Ω	$W1 = 16.002$, $W2 = 11.557$, $L = 0.762$	$W1 = 630$, $W2 = 455$, $L = 30$
TL203	0.019λ , 20.93Ω	$W = 3.810$, $L = 1.778$	$W = 150$, $L = 70$
TL204	0.019λ , 20.93Ω	$W1 = 3.810$, $W2 = 3.810$, $W3 = 1.778$	$W1 = 150$, $W2 = 150$, $W3 = 70$
TL205, TL230	0.003λ , 20.93Ω	$W = 3.810$, $L = 0.254$	$W = 150$, $L = 10$
TL206 (taper)	0.023λ , 3.67Ω / 5.88Ω	$W1 = 26.365$, $W2 = 16.002$, $L = 2.032$	$W1 = 1038$, $W2 = 630$, $L = 80$
TL207		$W1 = 25.400$, $W2 = 26.365$	$W1 = 1000$, $W2 = 1038$
TL208, TL209	0.000λ , 144.35Ω	$W = 0.025$, $L = 0.025$	$W = 1$, $L = 1$
TL210	0.055λ , 3.67Ω	$W = 26.365$, $L = 4.801$	$W = 1038$, $L = 189$
TL211	0.044λ , 34.72Ω	$W = 1.981$, $L = 4.115$	$W = 78$, $L = 162$
TL212	0.005λ , 47.12Ω	$W = 1.270$, $L = 0.432$	$W = 50$, $L = 17$
TL213, TL214, TL239, TL240	0.000λ , 144.35Ω	$W = 0.025$, $L = 0.025$	$W = 1$, $L = 1$
TL215	0.066λ , 47.12Ω	$W = 1.270$, $L = 6.299$	$W = 50$, $L = 248$
TL216	0.014λ , 28.85Ω	$W = 2.540$, $L = 1.270$	$W = 100$, $L = 50$
TL217		$W1 = 16.002$, $W2 = 0.025$, $W3 = 16.002$ $W4 = 0.025$	$W1 = 630$, $W2 = 1$, $W3 = 630$, $W4 = 1$
TL218		$W1 = 11.557$, $W2 = 0.025$, $W3 = 11.557$ $W4 = 0.025$	$W1 = 455$, $W2 = 1$, $W3 = 455$, $W4 = 1$
TL219		$W1 = 7.112$, $W2 = 0.025$, $W3 = 7.112$ $W4 = 0.025$	$W1 = 280$, $W2 = 1$, $W3 = 280$ $W4 = 1$
TL220, TL221, TL223, TL224	0.042λ , 20.93Ω	$W1 = 3.810$, $W2 = 3.810$, $W3 = 3.810$	$W1 = 150$, $W2 = 150$, $W3 = 150$
TL222	0.019λ , 20.93Ω	$W1 = 3.810$, $W2 = 3.810$, $W3 = 1.778$	$W1 = 150$, $W2 = 150$, $W3 = 70$
TL225, TL227	0.023λ , 20.93Ω	$W = 3.810$, $L = 2.078$	$W = 150$, $L = 82$
TL226, TL228	0.066λ , 20.93Ω	$W = 3.810$, $L = 6.020$	$W = 150$, $L = 237$
TL229, TL232	0.028λ , 20.93Ω	$W = 3.810$, $L = 2.540$	$W = 150$, $L = 100$
TL231, TL233	0.097λ , 20.93Ω	$W = 3.810$, $L = 8.915$	$W = 150$, $L = 351$
TL234, TL235	0.019λ , 20.93Ω	$W1 = 3.810$, $W2 = 3.810$, $W3 = 1.778$	$W1 = 150$, $W2 = 150$, $W3 = 70$,
TL236	0.019λ , 20.93Ω	$W = 3.810$, $L = 1.778$	$W = 150$, $L = 70$
TL237	0.021λ , 47.12Ω	$W1 = 1.270$, $W2 = 1.270$, $W3 = 2.032$	$W1 = 50$, $W2 = 50$, $W3 = 80$
TL238 (taper)	0.009λ , 7.95Ω / 12.30Ω	$W1 = 11.557$, $W2 = 7.112$, $L = 0.787$	$W1 = 455$, $W2 = 280$, $L = 31$

Reference Circuit (cont.)

Circuit Assembly Information

Test Fixture Part No. LTN/PTFB183404EF

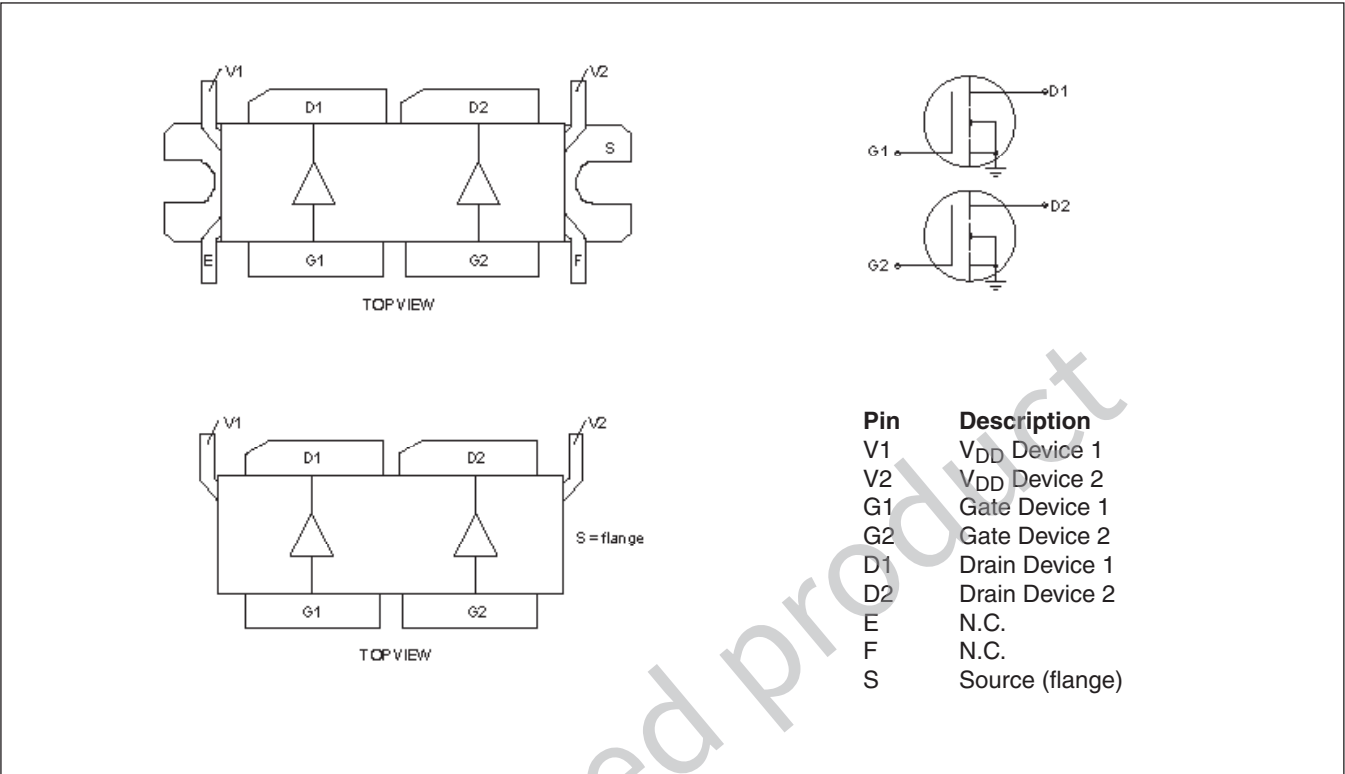
Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF



Reference Circuit (cont.)

Component	Description	Suggested Manufacturer	P/N
Input			
C101, C110	Chip capacitor, 4.7 μ F	Digi-Key	PCS3475CT-ND
C102, C105	Chip capacitor, 0.1 μ F	Digi-Key	PCC104BCT-ND
C103	Chip capacitor, 0.7 pF	ATC	ATC100B0R7BW500XB
C104, C108, C109	Chip capacitor, 10 pF	ATC	ATC100B100JW500XB
C106, C107	Chip capacitor, 1.7 pF	ATC	ATC100A1R7BW150XB
C111, C112	Chip capacitor, 10 pF	ATC	ATC100A100JW500XB
C801, C802, C803	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102, R801, R804, R805	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R103, R104	Resistor, 10 Ω	Digi-Key	P10GCT-ND
R802	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
R803	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
S1	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S2	Transistor	Digi-Key	BCP5616TA-ND
S3	Voltage Regulator	Digi-Key	LM7805
Output			
C201	Chip capacitor, 1.4 pF	ATC	ATC100B1R4BW500XB
C202, C207	Chip capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C203, C204	Tantalum capacitor, 10 μ F	Digi-Key	TPSE106K050R0400
C205, C206	Chip capacitor, 2.2 μ F	Digi-Key	445-1447-2-ND
C208	Chip capacitor, 0.4 pF	ATC	ATC100B0R4BW500XB
C209	Chip capacitor, 1.8 pF	ATC	ATC100B1R8BW500XB
C210, C211, C212, C213	Chip capacitor, 1.3 pF	ATC	ATC100B1R3BW500XB
C214, C215	Chip capacitor, 1 μ F	Digi-Key	445-1411-2-ND
C216	Chip capacitor, 10 pF	ATC	ATC100B100JW500XB

Pinout Diagram



Package Outline Specifications (cont.)

Package H-37275-6/2

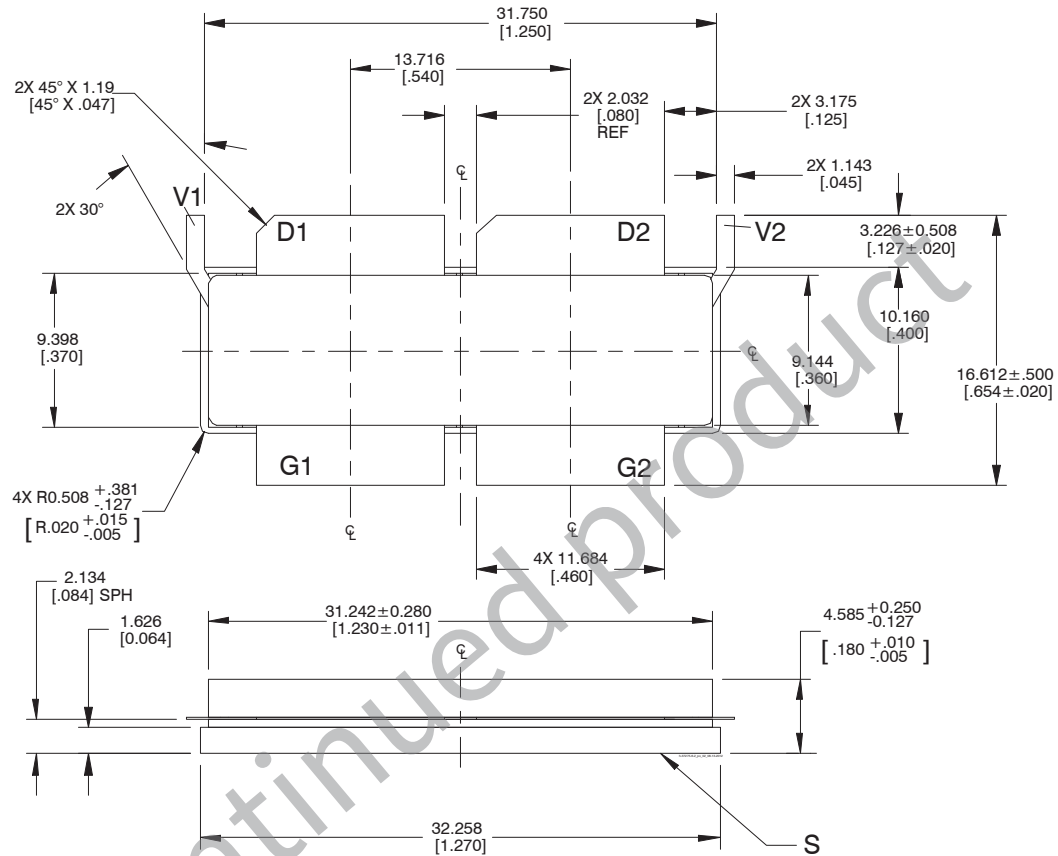


Diagram Notes—unless otherwise specified:

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; V1, V2 = V_{DD} ; S = source.
5. Lead thickness: 0.127 ± 0.051 [.005 $\pm$.002].
6. Gold plating thickness: $1.1 \pm .38$ micron [45 ± 15 microinch].

Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
4.1	2016-06-10	Data Sheet	3	Updated ordering code
05	2018-06-25	Production	All	Converted to Wolfspeed Data Sheet
06	2019-06-11	Production	All	Removed E version.
07	2020-02-27	Production	All	Not recommended for new design
08	2020-06-02	End of life	All	Product discontinued

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

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