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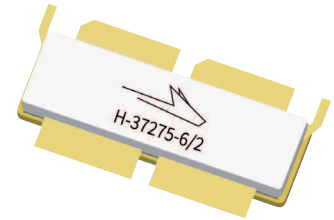


PTFB193404F

Thermally-Enhanced High Power RF LDMOS FET 340 W, 30 V, 1930 – 1990 MHz

Description

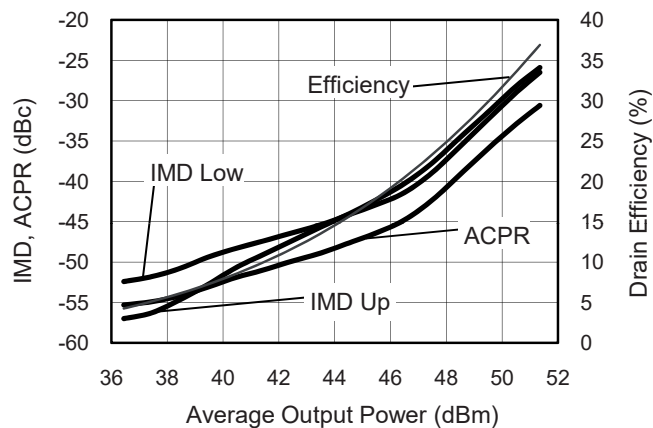
The PTFB193404F is a 340-watt LDMOS FET intended for use in multi-standard cellular power amplifier applications in the 1930 to 1990 MHz frequency band. Features include input and output matching, high gain and thermally-enhanced package with earless flange. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.



PTFB193404F
Package H-37275-6/2

Two-carrier WCDMA 3GPP Drive-up

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1990\text{ MHz}$,
3GPP WCDMA signal, PAR = 8 dB,
10 MHz carrier spacing, BW = 3.84 MHz



Features

- Broadband internal matching
- Wide video bandwidth
- Typical single-carrier WCDMA performance, 1990 MHz, 30 V
 - Output power = 100 W
 - Efficiency = 33%
 - Gain = 19 dB
 - PAR = 7.5 dB @ 0.01% CCDF
 - ACPR @ 5 MHz = -35 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

Single-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, $f = 1990\text{ MHz}$,
3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10.0 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17.5	19	—	dB
Drain Efficiency	η_D	29	33	—	%
Adjacent Channel Power Ratio	ACPR	—	-34.5	-32.5	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-carrier WCDMA Characteristics (not subject to production test—verified by design/characterization in Wolfspeed test fixture)
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 80\text{ W}$ average, $f_1 = 1980\text{ MHz}$, $f_2 = 1990\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8.0 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	19	—	dB
Drain Efficiency	η_D	—	29	—	%
Intermodulation Distortion	IMD	—	−33	—	dBc

Two-tone Characteristics (not subject to production test—verified by design/characterization in Wolfspeed test fixture)
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 265\text{ W}$ PEP, $f = 1990\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	19	—	dB
Drain Efficiency	η_D	—	36	—	%
Intermodulation Distortion	IMD	—	30	—	dBc

DC Characteristics (both sides)

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
	$V_{DS} = 63\text{ V}$, $V_{GS} = 0\text{ V}$	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

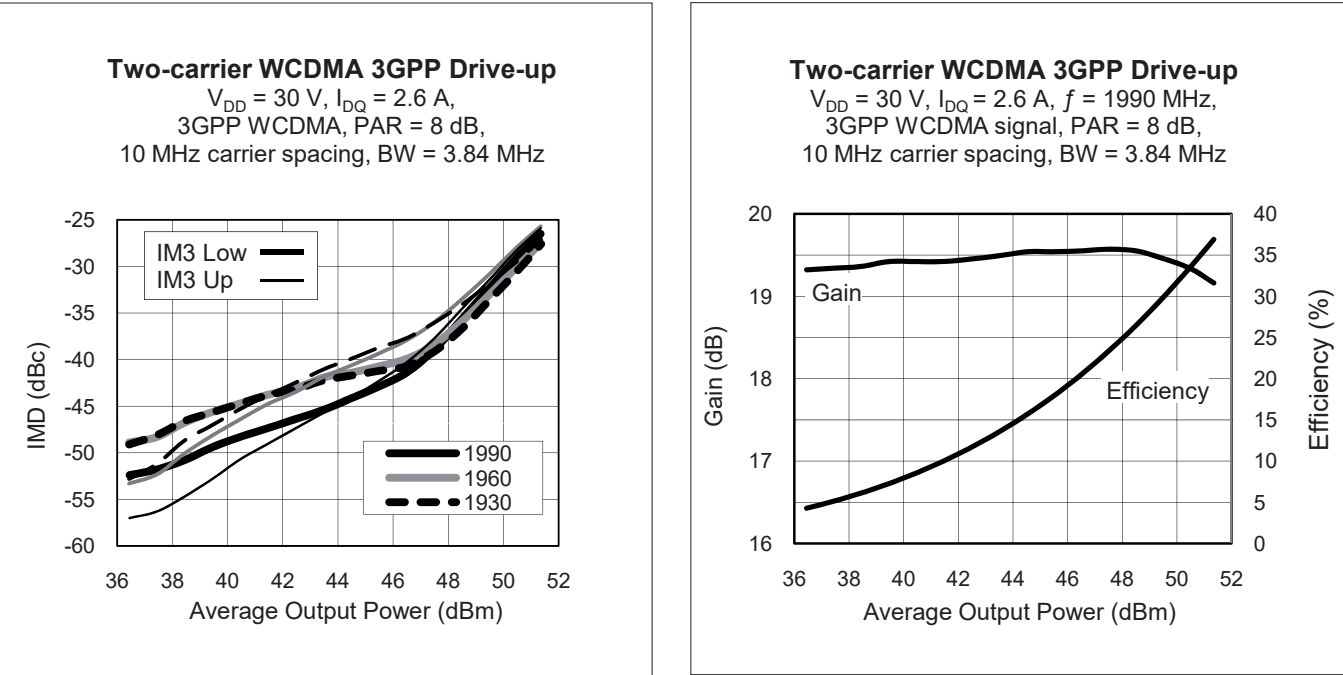
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	V
Gate-Source Voltage	V_{GS}	−6 to +10	V
Junction Temperature	T_J	200	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	−40 to +150	$^{\circ}\text{C}$
Thermal Resistance ($T_{CASE} = 70^{\circ}\text{C}$)	$R_{\theta JC}$	0.2	$^{\circ}\text{C/W}$



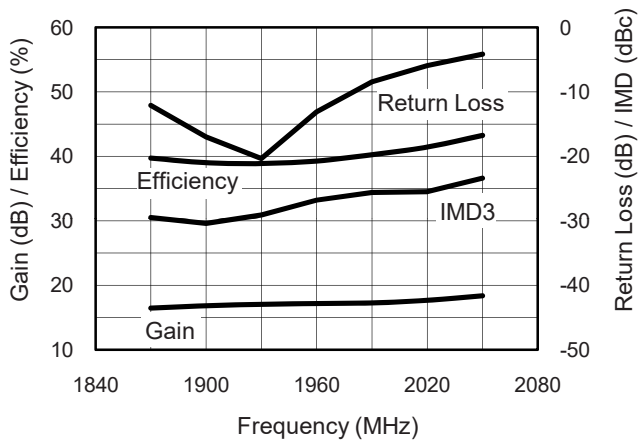
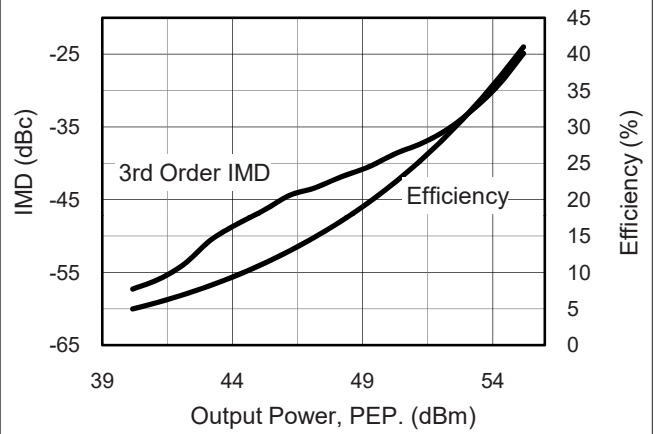
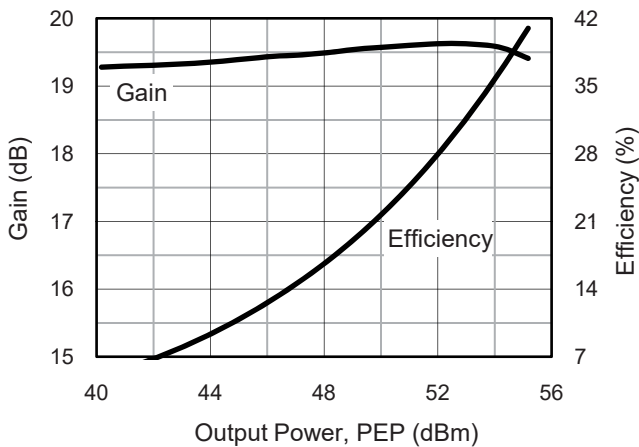
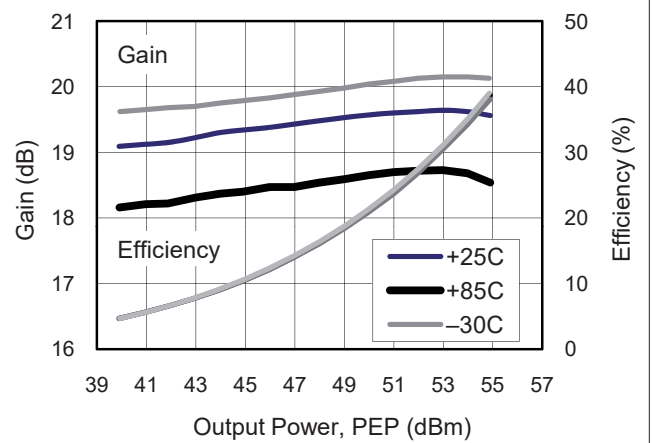
Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTFB193404F V1 R0	PTFB193404F-V1-R0	H-37275-6/2, earless flange	Tape & reel, 50 pcs
PTFB193404F V1 R250	PTFB193404F-V1-R250	H-37275-6/2, earless flange	Tape & reel, 250 pcs

Typical Performance (data taken in production test fixture)

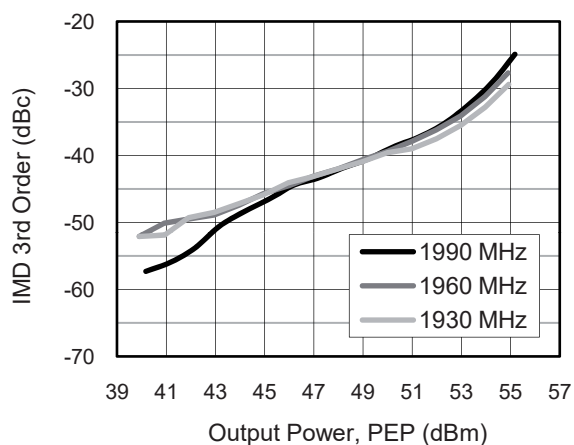


Typical Performance (cont.)

Two-tone Broadband Performance
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 52\text{ dBm}$
**Two-tone Drive-up**
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1989\text{ MHz}$, $f_2 = 1990\text{ MHz}$
**Two-tone Drive-up**
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1989\text{ MHz}$, $f_2 = 1990\text{ MHz}$
**Two-tone Drive-up (over temperature)**
 $(P_{OUT-max}\text{ 3rd order IMD @ } -30\text{ dBc})$
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1959\text{ MHz}$, $f_2 = 1960\text{ MHz}$


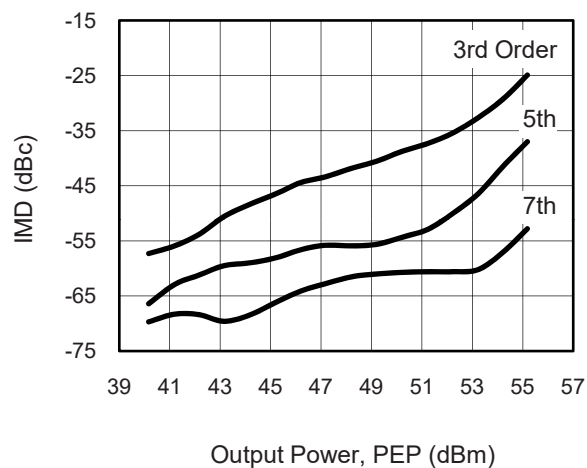
Typical Performance (cont.)

**Two-tone Drive-up
at Selected Frequencies**
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, tone spacing = 1 MHz

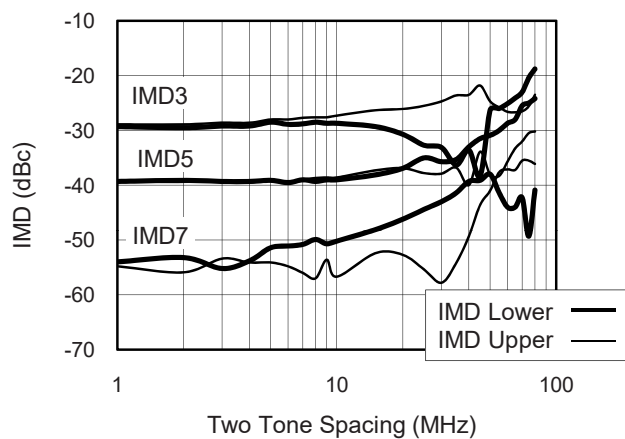


**Intermodulation Distortion
vs. Output Power**

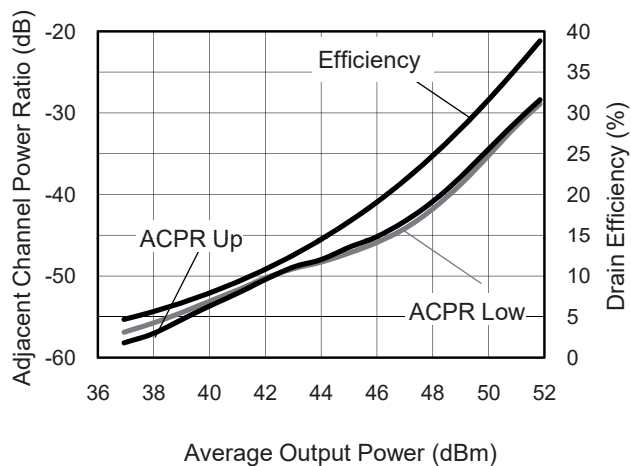
$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f_1 = 1989\text{ MHz}$, $f_2 = 1990\text{ MHz}$



**Intermodulation Distortion
vs. Tone Spacing**
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$,
 $f = 1930\text{ MHz}$, $P_{OUT} = 317\text{ W (PEP)}$



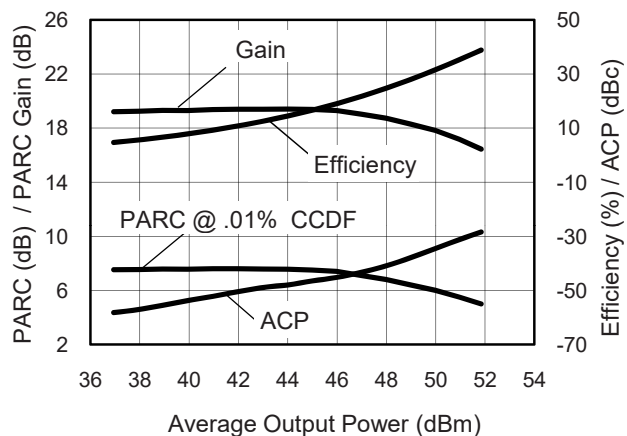
Single-carrier WCDMA Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1990\text{ MHz}$,
 3GPP WCDMA signal, TM1 w/16 DPCH,
 43% clipping, PAR = 7.5 dB, 3.84 MHz BW



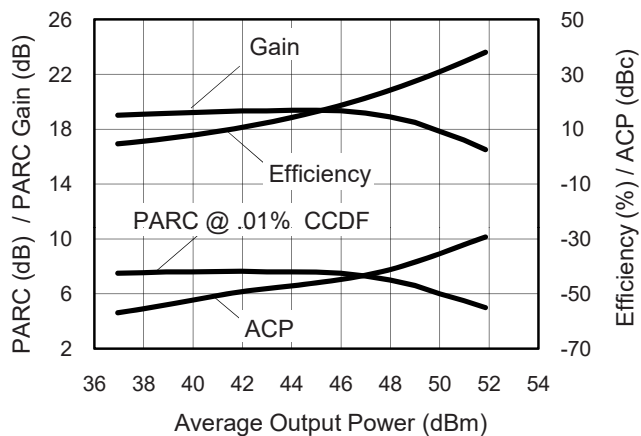
Typical Performance (cont.)

Single-carrier WCDMA Drive-up

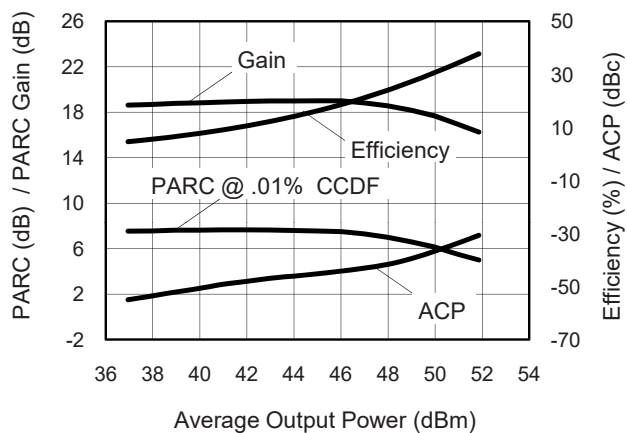
$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1990\text{ MHz}$,
3GPP WCDMA signal,
PAR = 7.5 dB, BW = 3.84 MHz

**Single-carrier WCDMA Drive-up**

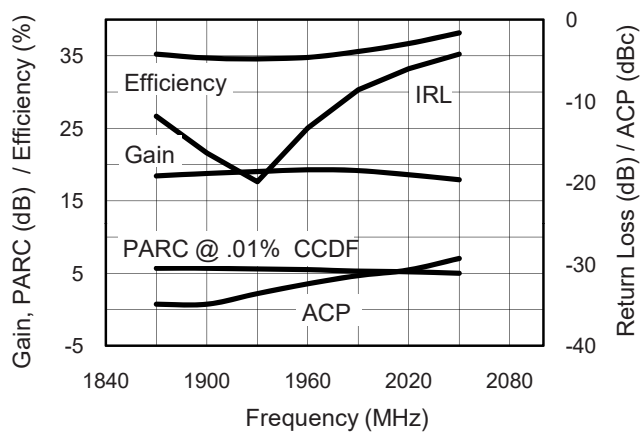
$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1960\text{ MHz}$,
3GPP WCDMA signal,
PAR = 7.5 dB, BW = 3.84 MHz

**Single-carrier WCDMA Drive-up**

$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $f = 1930\text{ MHz}$,
3GPP WCDMA signal,
PAR = 7.5 dB, BW = 3.84 MHz

**Single-carrier WCDMA Broadband**

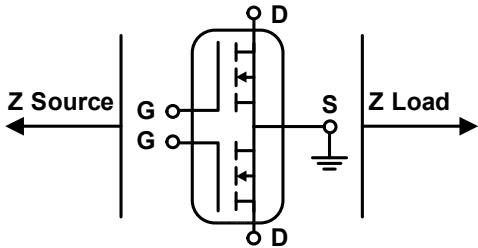
$V_{DD} = 30\text{ V}$, $I_{DQ} = 2.6\text{ A}$, $P_{OUT} = 125\text{ W}$,
3GPP WCDMA signal





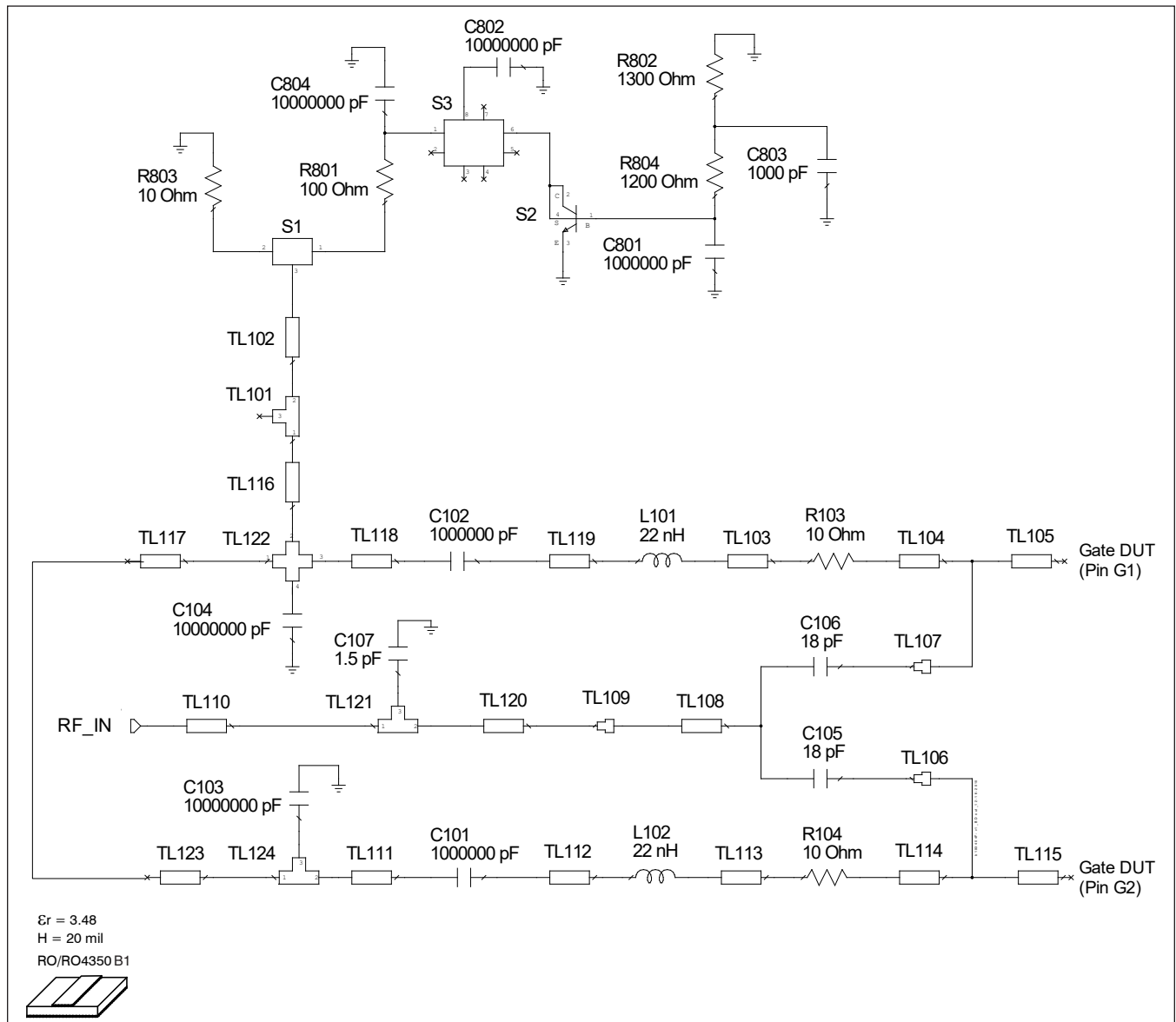
Broadband Circuit Impedance (measurements taken on full part, both sides)

Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1900	1.21	−3.60	0.73	−2.08
1930	1.21	−3.53	0.72	−2.01
1960	1.20	−3.47	0.72	−1.94
1990	1.20	−3.41	0.72	−1.87
2020	1.19	−3.35	0.72	−1.81

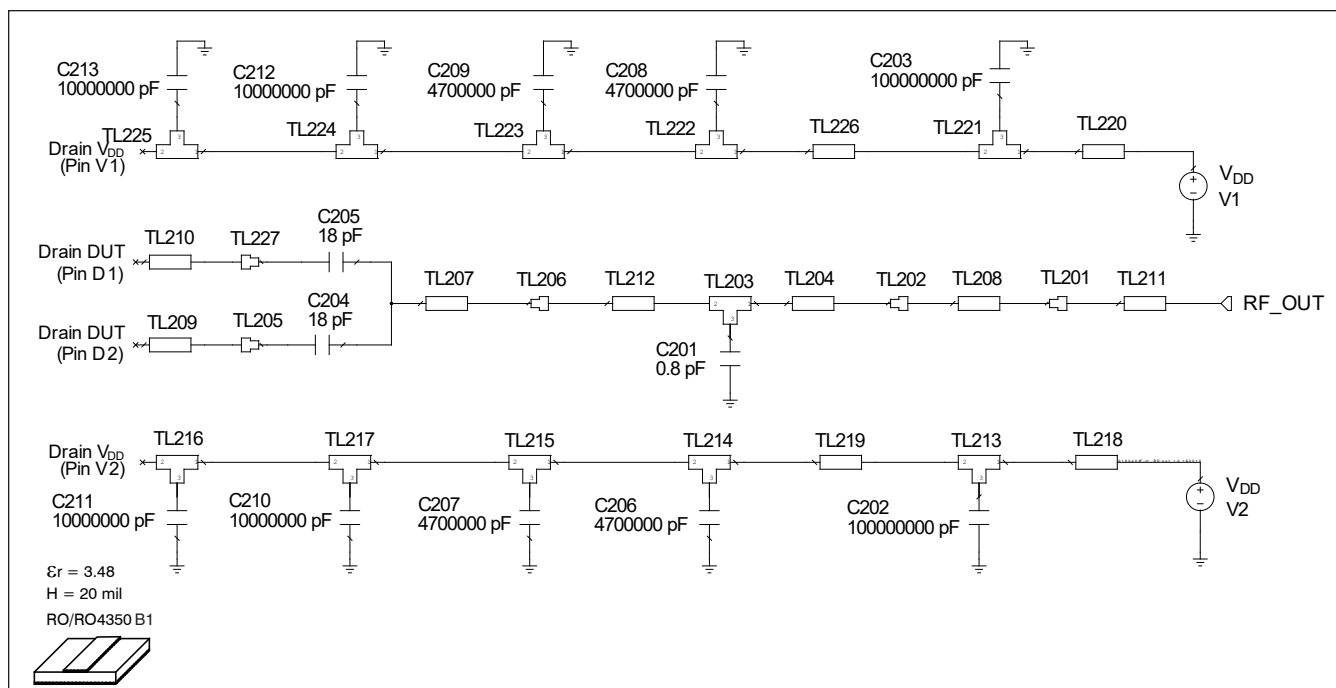


See next page for circuit information

Reference Circuit



Reference Circuit (cont.)

Reference circuit output schematic for $f = 1990$ MHz

Reference Circuit Assembly

DUT PTFB193404F

Test Fixture Part No. LTN/PTFB193404EF

PCB Rogers RO4350, 0.508 mm [0.020"] thick, 1 oz. copper, $\epsilon_r = 3.48$ Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF

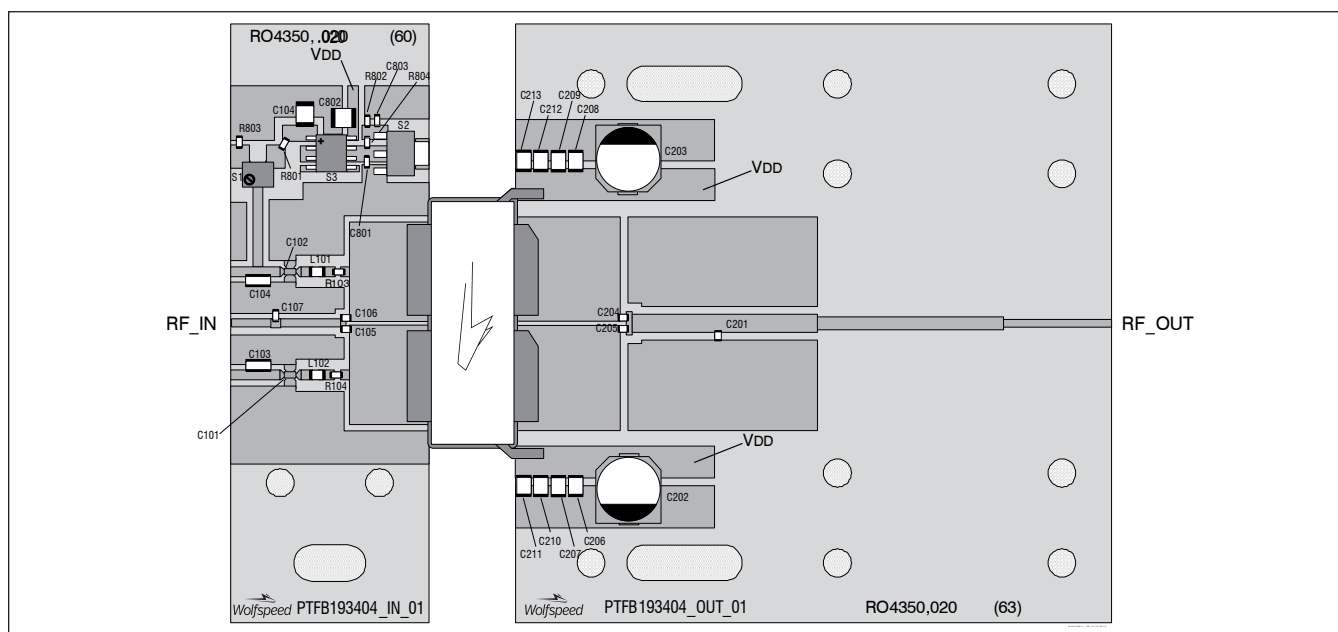
Transmission Line	Electrical Characteristics	Dimensions: W, L (mm)	Dimensions: W, L (mils)
Input			
TL101	0.017λ , 47.12Ω	$W1 = 1.270$, $W2 = 1.270$, $W3 = 1.524$	$W1 = 50$, $W2 = 50$, $W3 = 60$
TL102	0.039λ , 47.12Ω	$W = 1.270$, $L = 3.553$	$W = 50$, $L = 140$
TL103	0.023λ , 47.12Ω	$W = 1.270$, $L = 2.055$	$W = 50$, $L = 81$
TL104	0.013λ , 47.12Ω	$W = 1.270$, $L = 1.168$	$W = 50$, $L = 46$
TL105	0.122λ , 7.29Ω	$W = 12.700$, $L = 10.160$	$W = 500$, $L = 400$
TL106		$W1 = 0.010$, $W2 = 1.168$, Offset = 5.893	$W1 = 10$, $W2 = 46$, Offset = 232
TL107		$W1 = 0.010$, $W2 = 1.168$, Offset = -5.893	$W1 = 10$, $W2 = 46$, Offset = -232
TL108	0.007λ , 34.08Ω	$W = 2.032$, $L = 0.635$	$W = 80$, $L = 25$
TL109	0.012λ , 34.08Ω	$W1 = 2.032$, $W2 = 1.034$	$W1 = 80$, $W2 = 41$
TL110	0.055λ , 53.60Ω	$W = 1.034$, $L = 5.029$	$W = 41$, $L = 198$
TL111	0.023λ , 47.12Ω	$W = 1.270$, $L = 2.111$	$W = 50$, $L = 83$
TL112	0.017λ , 47.12Ω	$W = 1.270$, $L = 1.524$	$W = 50$, $L = 60$
TL113	0.023λ , 47.12Ω	$W = 1.270$, $L = 2.055$	$W = 50$, $L = 81$

table continued on next page

Reference Circuit (cont.)

Transmission Line	Electrical Characteristics	Dimensions: W, L (mm)	Dimensions: W, L (mils)
Input (cont.)			
TL114	0.013λ , 47.12 Ω	W = 1.270, L = 1.168	W = 50, L = 46
TL115	0.122λ , 7.29 Ω	W = 12.700, L = 10.160	W = 500, L = 400
TL116	0.068λ , 47.12 Ω	W = 1.270, L = 6.170	W = 50, L = 243
TL117	0.032λ , 47.12 Ω	W = 1.270, L = 2.875	W = 50, L = 113
TL118	0.024λ , 47.12 Ω	W = 1.270, L = 2.131	W = 50, L = 84
TL119	0.017λ , 47.12 Ω	W = 1.270, L = 1.524	W = 50, L = 60
TL120	0.084λ , 53.60 Ω	W = 1.034, L = 7.671	W = 41, L = 302
TL121	0.014λ , 53.60 Ω	W1 = 1.034, W2 = 1.034, W3 = 1.27	W1 = 41, W2 = 41, W3 = 50
TL122	0.014λ , 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.270, W4 = 1.270	W1 = 50, W2 = 50, W3 = 50, W4 = 50
TL123	0.032λ , 47.12 Ω	W = 1.270, L = 2.896	W = 50, L = 114
TL124	0.014λ , 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.27	W1 = 50, W2 = 50, W3 = 50
Output			
TL201		W1 = 1.577, W2 = 1.046	W1 = 62, W2 = 41
TL202		W1 = 2.263, W2 = 1.577	W1 = 89, W2 = 62
TL203	0.009λ , 31.48 Ω	W1 = 2.263, W2 = 2.263, W3 = 0.762	W1 = 89, W2 = 89, W3 = 30
TL204	0.139λ , 31.48 Ω	W = 2.263, L = 12.299	W = 89, L = 484
TL205		W1 = 0.001, W2 = 13.335, Offset = -6.223	W1 = 1, W2 = 525, Offset = -245
TL206		W1 = 3.048, W2 = 2.263	W1 = 120, W2 = 89
TL207	0.009λ , 25.04 Ω	W = 3.048, L = 0.762	W = 120, L = 30
TL208	0.266λ , 40.78 Ω	W = 1.577, L = 23.889	W = 62, L = 941
TL209	0.160λ , 6.97 Ω	W = 13.335, L = 13.335	W = 525, L = 525
TL210	0.160λ , 6.97 Ω	W = 13.335, L = 13.335	W = 525, L = 525
TL211	0.151λ , 53.21 Ω	W = 1.046, L = 13.774	W = 41, L = 542
TL212	0.120λ , 31.48 Ω	W = 2.263, L = 10.617	W = 89, L = 418
TL213	0.024λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.032	W1 = 160, W2 = 160, W3 = 80
TL214	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL215	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL216	0.024λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.032	W1 = 160, W2 = 160, W3 = 80
TL217	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL218	0.116λ , 19.85 Ω	W = 4.064, L = 10.008	W = 160, L = 394
TL219	0.052λ , 19.85 Ω	W = 4.064, L = 4.470	W = 160, L = 176
TL220	0.116λ , 19.85 Ω	W = 4.064, L = 10.008	W = 160, L = 394
TL221	0.024λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.032	W1 = 160, W2 = 160, W3 = 80
TL222	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL223	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL224	0.026λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.286	W1 = 160, W2 = 160, W3 = 90
TL225	0.024λ , 19.85 Ω	W1 = 4.064, W2 = 4.064, W3 = 2.032	W1 = 160, W2 = 160, W3 = 80
TL226	0.052λ , 19.85 Ω	W = 4.064, L = 4.470	W = 160, L = 176
TL227		W1 = 0.001, W2 = 13.335, Offset = 6.223	W1 = 1, W2 = 525, Offset = 245

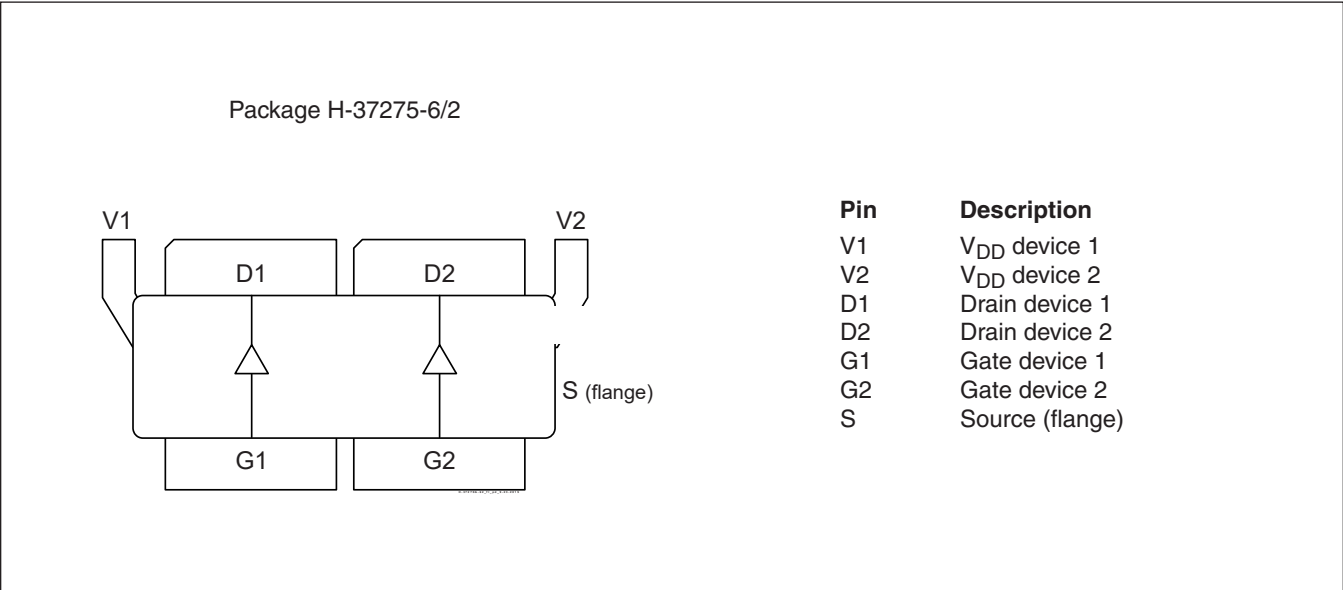
Reference Circuit (cont.)



Reference circuit assembly diagram (not to scale)

Component ID	Description	Suggested Manufacturer	P/N
C101, C102	Chip capacitor, 1 μ F	ATC	NFM18PS105R0J30
C103, C104	Capacitor, 10 μ F	Digi-Key	490-4393-2-ND
C105, C106, C204, C205	Capacitor, 18 pF	ATC	800A180JT
C107	Capacitor, 1.5 pF	ATC	800A1R5BT
C801	Capacitor, 1 μ F	Digi-Key	490-4736-2-ND
C802, C804	Capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C803	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
L101, L102	Inductor, 22 nH	Digi-Key	0805W220JT
R101, R102	Resistor, 1000 Ω	Digi-Key	P1.0KECT-ND
R103, R104	Resistor, 10 Ω	Digi-Key	P10GTR-ND
R801	Resistor, 100 Ω	Digi-Key	P100GTR-ND
R802	Resistor, 1300 Ω	Digi-Key	P1.3KGTR-ND
R803	Resistor, 10 Ω	Digi-Key	P101GTR-ND
R804	Resistor, 1200 Ω	Digi-Key	P1.2KGTR-ND
S1	Potentiometer	Digi-Key	3224W-202ECT-ND
S2	Transistor	Digi-Key	BCP56-ND, BCP56
S3	Voltage regulator	Digi-Key	LM780L05ACM-ND, 7805
C201	Capacitor, 0.8 pF	ATC	800A0R8BT
C202, C203	Capacitor, 100 μ F	Digi-Key	PCE4442TR-ND
C206, C207, C208, C209	Capacitor, 4.7 μ F	Digi-Key	490-1864-2-ND
C210, C211, C212, C213	Capacitor, 10 μ F	Digi-Key	587-1818-2-ND

Pinout Diagram



See next page for package outline specifications

Package Outline Specifications

Package H-37275-6/2

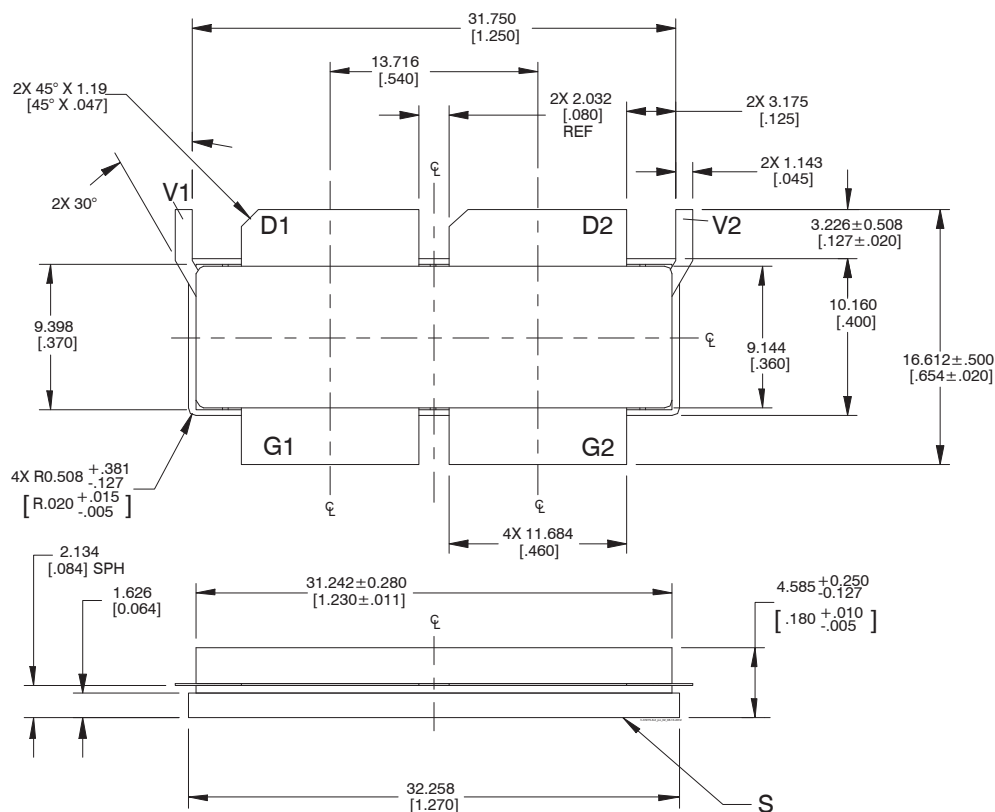


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ±0.127 [0.005] unless specified otherwise.

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: D1, D2 - drain, devices 1 & 2; G1, G2 - gate, devices 1 & 2; V1, V2 - V_{DD} , devices 1 & 2; S - source (flange).
5. Lead thickness: 0.127 ± 0.051 [.005 ± .002].
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch].

Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
05.2	2016-06-04	Advance	3	Updated ordering information to include R0
06	2018-06-25	Production	All	Converted to Wolfspeed Data Sheet

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Notes

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