

Thermally-Enhanced High Power RF LDMOS FETs 240 W, 1930 – 1990 MHz

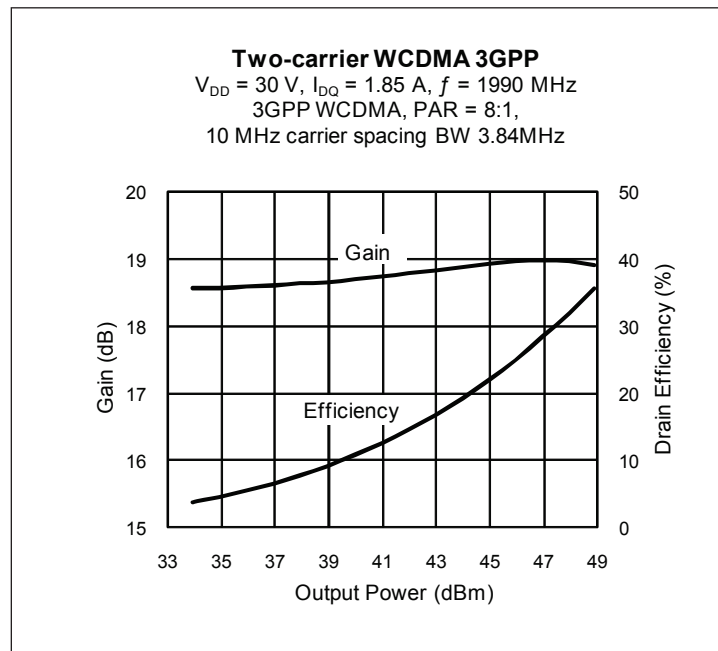
Description

The PTFB192503EL and PTFB192503FL are 240-watt LDMOS FETs 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, wide signal bandwidth and reduced memory effects for improved DPD correctability. Manufactured with Infineon's advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

PTFB192503EL
Package H-33288-6



PTFB192503FL
Package H-34288-4/2



Features

- Broadband internal input and output matching
- Enhanced for use in DPD error correction systems
- Typical two-carrier WCDMA performance, 30 V, 1990 MHz
 - Average output power = 50 W
 - Linear gain = 19 dB
 - Drain efficiency = 28 %
 - Intermodulation distortion = -35 dBc
- Typical CW performance, 1990 MHz, 30 V
 - Output power at P_{1dB} = 240 W
 - Efficiency = 55%
- Increased negative gate-source voltage range for improved performance in Doherty peaking amplifiers
- Integrated ESD protection. Human Body Model, Class 2 (minimum)
- Capable of handling 10:1 VSWR @ 30 V, 240 W (CW) output power
- Pb-free, RoHS-compliant

RF Characteristics

Two-carrier WCDMA Measurements (not subject to production test—verified by design/characterization in Infineon test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.9\text{ A}$, $P_{OUT} = 50\text{ W}$ average, $f_1 = 1980\text{ MHz}$, $f_2 = 1990\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8:1 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	19	—	dB
Drain Efficiency	η_D	—	28	—	%
Intermodulation Distortion	IMD	—	-35	—	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 Measurements (tested in Infineon test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.9\text{ A}$, $P_{OUT} = 220\text{ W PEP}$, $f = 1990\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17	18	—	dB
Drain Efficiency	η_D	40	41.5	—	%
Intermodulation Distortion	IMD	—	-29	-27	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	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.03	—	Ω
Operating Gate Voltage	$V_{DS} = 30\text{ V}$, $I_{DQ} = 1.9\text{ A}$	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 ($T_{CASE} = 70^{\circ}\text{C}$, 200 W CW)	$R_{\theta JC}$	0.262	$^{\circ}\text{C/W}$

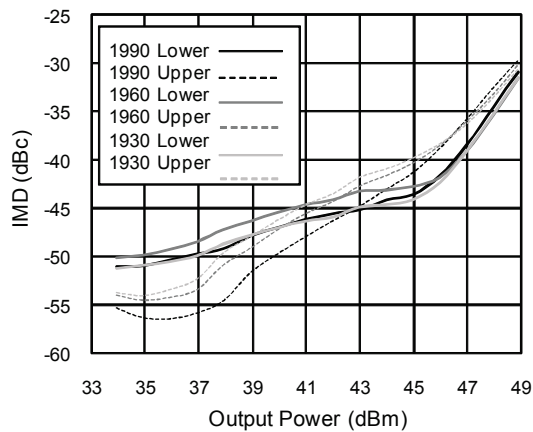
Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTFB192503EL V1 R0	PTFB192503ELV1R0XTMA1	H-33288-6, bolt-down	Tape & Reel, 50pcs
PTFB192503EL V1 R250	PTFB192503ELV1R250XTMA1	H-33288-6, bolt-down	Tape & Reel, 250pcs
PTFB192503FL V2 R0	PTFB192503FLV2R0XTMA1	H-34288-4/2, earless	Tape & Reel, 50pcs
PTFB192503FL V2 R250	PTFB192503FLV2R250XTMA1	H-34288-4/2, earless	Tape & Reel, 250pcs

Typical Performance (data taken in a production test fixture)

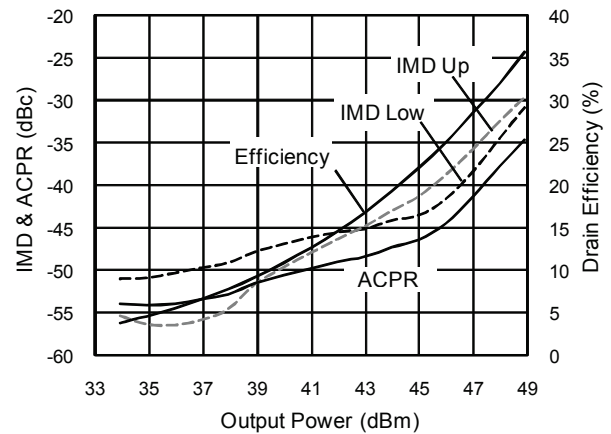
Two-carrier WCDMA 3GPP Drive-up

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, 3GPP WCDMA,
PAR = 8:1, 10 MHz carrier spacing
BW 3.84 MHz



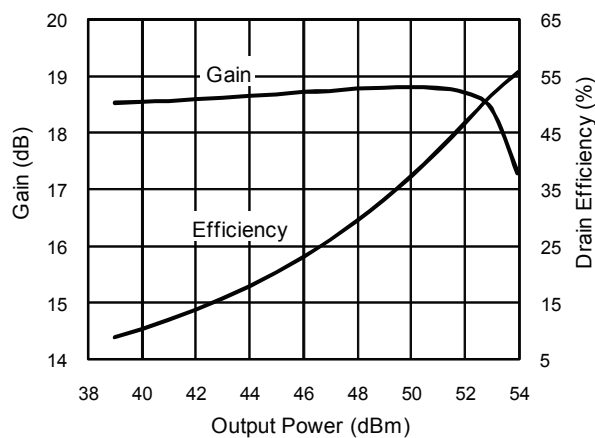
Two-carrier WCDMA 3GPP Drive-up

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 1990\text{ MHz}$
3GPP WCDMA, PAR = 8:1,
10 MHz carrier spacing, BW 3.84 MHz



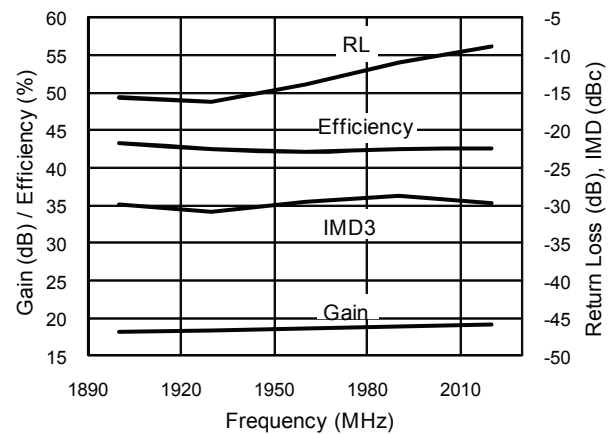
Power Sweep, CW Gain & Efficiency vs. Output Power

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 1990\text{ MHz}$



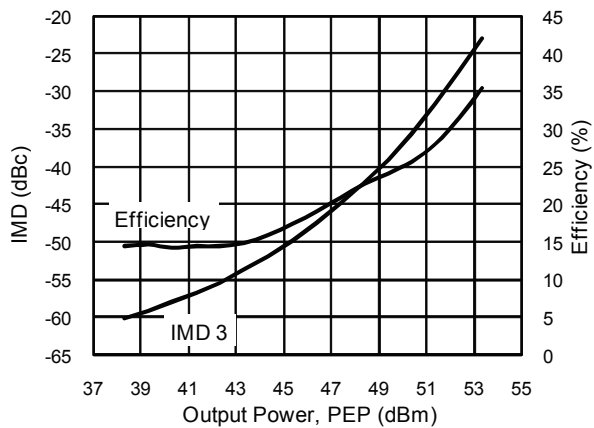
Two-tone Broadband Gain, Efficiency & Return Loss vs. Frequency

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 110\text{ W}$

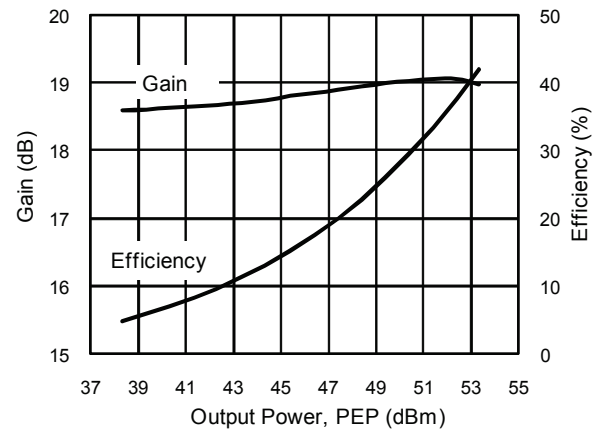


Typical Performance (cont.)

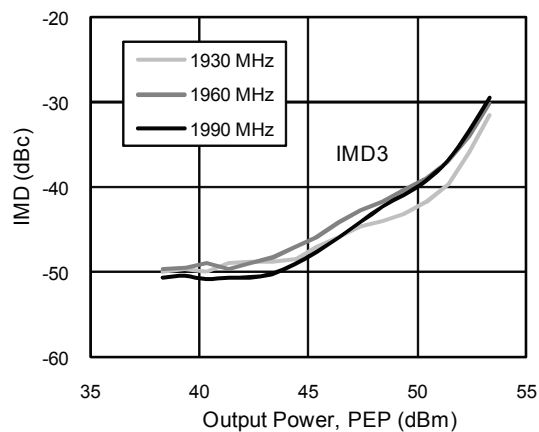
Two-tone Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,
 $f_1 = 1990\text{ MHz}$, $f_2 = 1989\text{ MHz}$



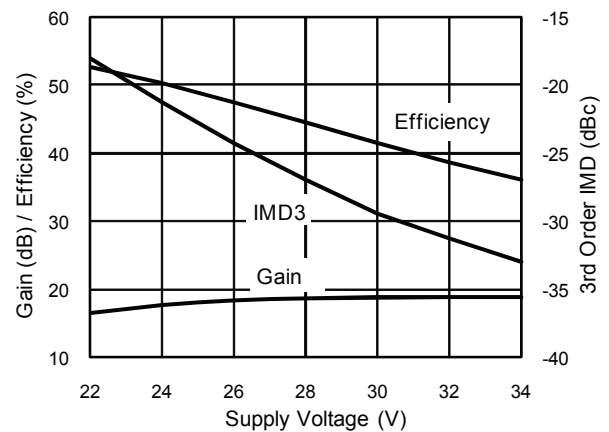
Two-tone Drive-up
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$,
 $f_1 = 1990\text{ MHz}$, $f_2 = 1989\text{ MHz}$



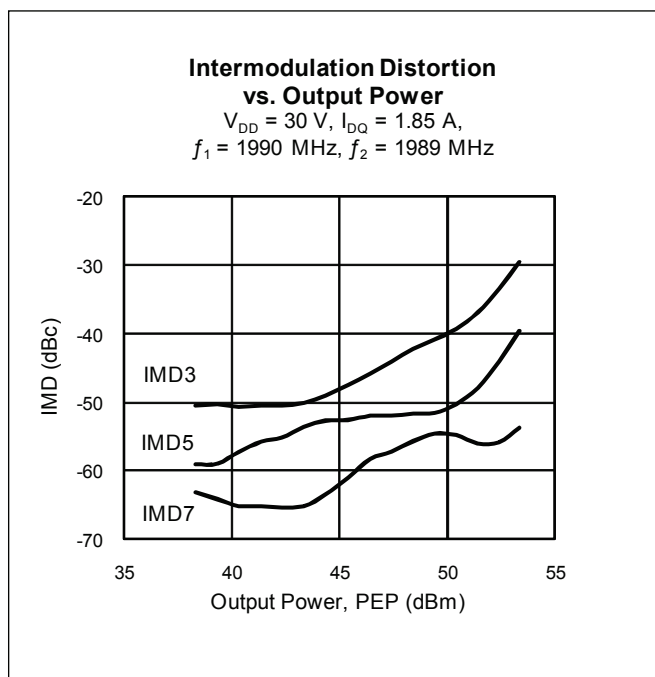
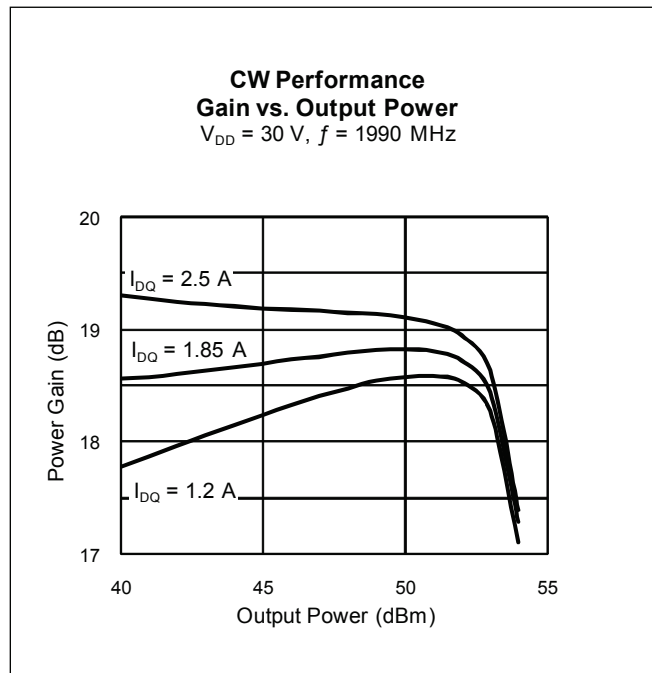
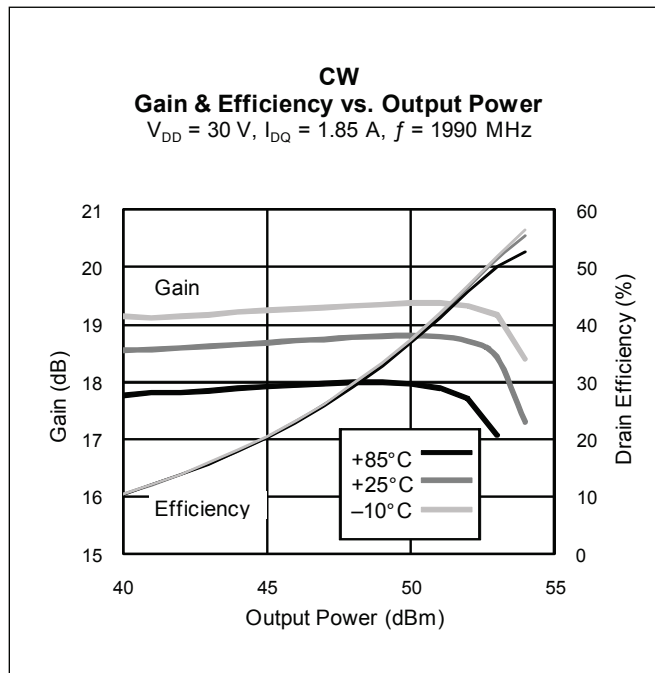
**Two-tone Drive-up
at Selected Frequencies**
 $V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, Tone Spacing = 1 MHz



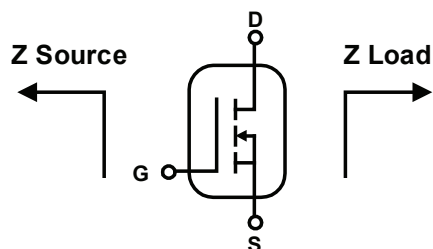
Two-tone Voltage Sweep
 $I_{DQ} = 1.85\text{ A}$, $f_1 = 1990\text{ MHz}$, $f_2 = 1989\text{ MHz}$
Output Power = 53.3 dBm



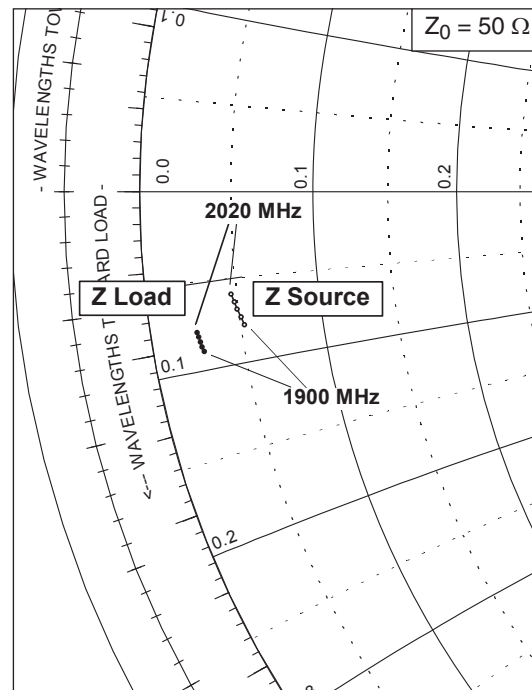
Typical Performance (cont.)



Broadband Circuit Impedance

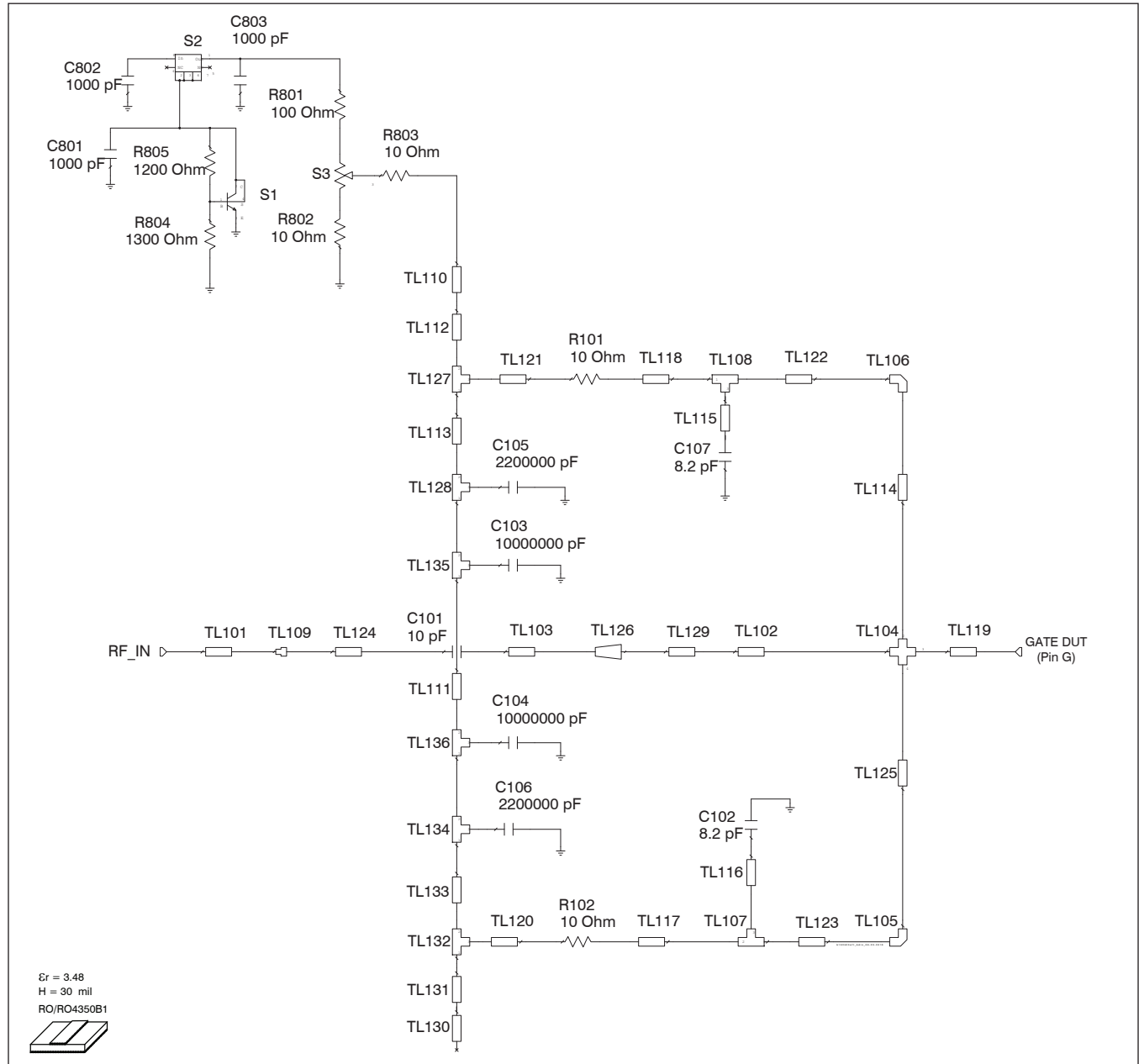


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1900	2.63	-3.92	1.36	-4.49
1930	2.56	-3.67	1.33	-4.35
1960	2.48	-3.44	1.31	-4.21
1990	2.42	-3.21	1.28	-4.07
2020	2.35	-2.98	1.26	-3.93



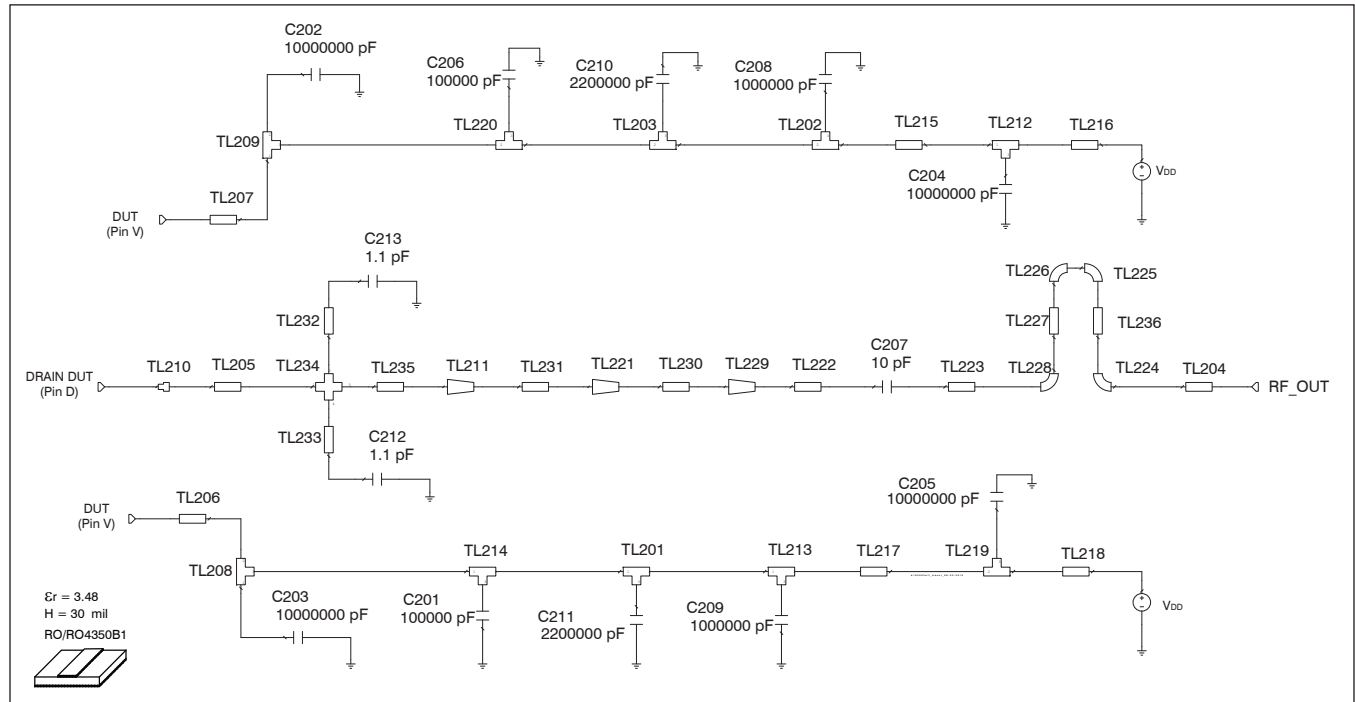
See next page for reference circuit information

Reference Circuit



Reference circuit input schematic for $f = 1990$ MHz

Reference Circuit (cont.)



Reference circuit output schematic for $f = 1990$ MHz

See next page for more reference circuit information

Reference Circuit (cont.)

Description

DUT	PTFB192503EL or PTFB192503FL
PCB	0.76 mm [.030"] thick, $\epsilon_r = 3.48$, Rogers 4350, 1 oz. copper

Electrical Characteristics at 1990 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL224	0.000λ , 144.35 Ω	$W1 = 0.025$, $W2 = 0.025$, $W3 = 0.025$	$W1 = 1$, $W2 = 1$, $W3 = 1$
TL101	0.037λ , 51.58 Ω	$W = 1.651$, $L = 3.358$	$W = 65$, $L = 132$
TL102	0.053λ , 9.67 Ω	$W = 13.970$, $L = 4.470$	$W = 550$, $L = 176$
TL103	0.033λ , 51.58 Ω	$W = 1.651$, $L = 3.018$	$W = 65$, $L = 119$
TL104		$W1 = 13.970$, $W2 = 0.762$, $W3 = 13.970$, $W4 = 0.762$	$W1 = 550$, $W2 = 30$, $W3 = 550$, $W4 = 30$
TL105, TL106		$W = 0.762$	$W = 30$
TL107, TL108	0.011λ , 78.27 Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 1.016$	$W1 = 30$, $W2 = 30$, $W3 = 40$
TL109		$W1 = 1.651$, $W2 = 2.032$	$W1 = 65$, $W2 = 80$
TL110, TL130	0.015λ , 38.82 Ω	$W = 2.540$, $L = 1.321$	$W = 100$, $L = 52$
TL111	0.071λ , 92.53 Ω	$W = 0.508$, $L = 6.756$	$W = 20$, $L = 266$
TL112	0.016λ , 68.02 Ω	$W = 1.016$, $L = 1.524$	$W = 40$, $L = 60$
TL113, TL133	0.024λ , 78.27 Ω	$W = 0.762$, $L = 2.286$	$W = 30$, $L = 90$
TL114, TL125	0.023λ , 78.27 Ω	$W = 0.762$, $L = 2.159$	$W = 30$, $L = 85$
TL115, TL116	0.001λ , 68.02 Ω	$W = 1.016$, $L = 0.127$	$W = 40$, $L = 5$
TL117, TL118	0.014λ , 78.27 Ω	$W = 0.762$, $L = 1.270$	$W = 30$, $L = 50$
TL119	0.024λ , 9.67 Ω	$W = 13.970$, $L = 1.981$	$W = 550$, $L = 78$
TL120, TL121	0.007λ , 68.02 Ω	$W = 1.016$, $L = 0.686$	$W = 40$, $L = 27$
TL122, TL123	0.125λ , 78.27 Ω	$W = 0.762$, $L = 11.684$	$W = 30$, $L = 460$
TL124	0.008λ , 45.17 Ω	$W = 2.032$, $L = 0.762$	$W = 80$, $L = 30$
TL126 (taper)	0.030λ , 9.67 Ω / 51.58 Ω	$W1 = 13.970$, $W2 = 1.651$, $L = 2.515$	$W1 = 550$, $W2 = 65$, $L = 99$
TL127, TL132	0.011λ , 68.02 Ω	$W1 = 1.016$, $W2 = 1.016$, $W3 = 1.016$	$W1 = 40$, $W2 = 40$, $W3 = 40$
TL128	0.022λ , 78.27 Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 2.032$	$W1 = 30$, $W2 = 30$, $W3 = 80$
TL129	0.077λ , 9.67 Ω	$W = 13.970$, $L = 6.502$	$W = 550$, $L = 256$
TL131	0.016λ , 68.02 Ω	$W = 1.016$, $L = 1.524$	$W = 40$, $L = 60$
TL134	0.022λ , 78.27 Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 2.032$	$W1 = 30$, $W2 = 30$, $W3 = 80$
TL135, TL136	0.016λ , 92.53 Ω	$W1 = 0.508$, $W2 = 0.508$, $W3 = 1.524$	$W1 = 20$, $W2 = 20$, $W3 = 60$

table continued on page 10

Reference Circuit (cont.)

Electrical Characteristics at 1990 MHz

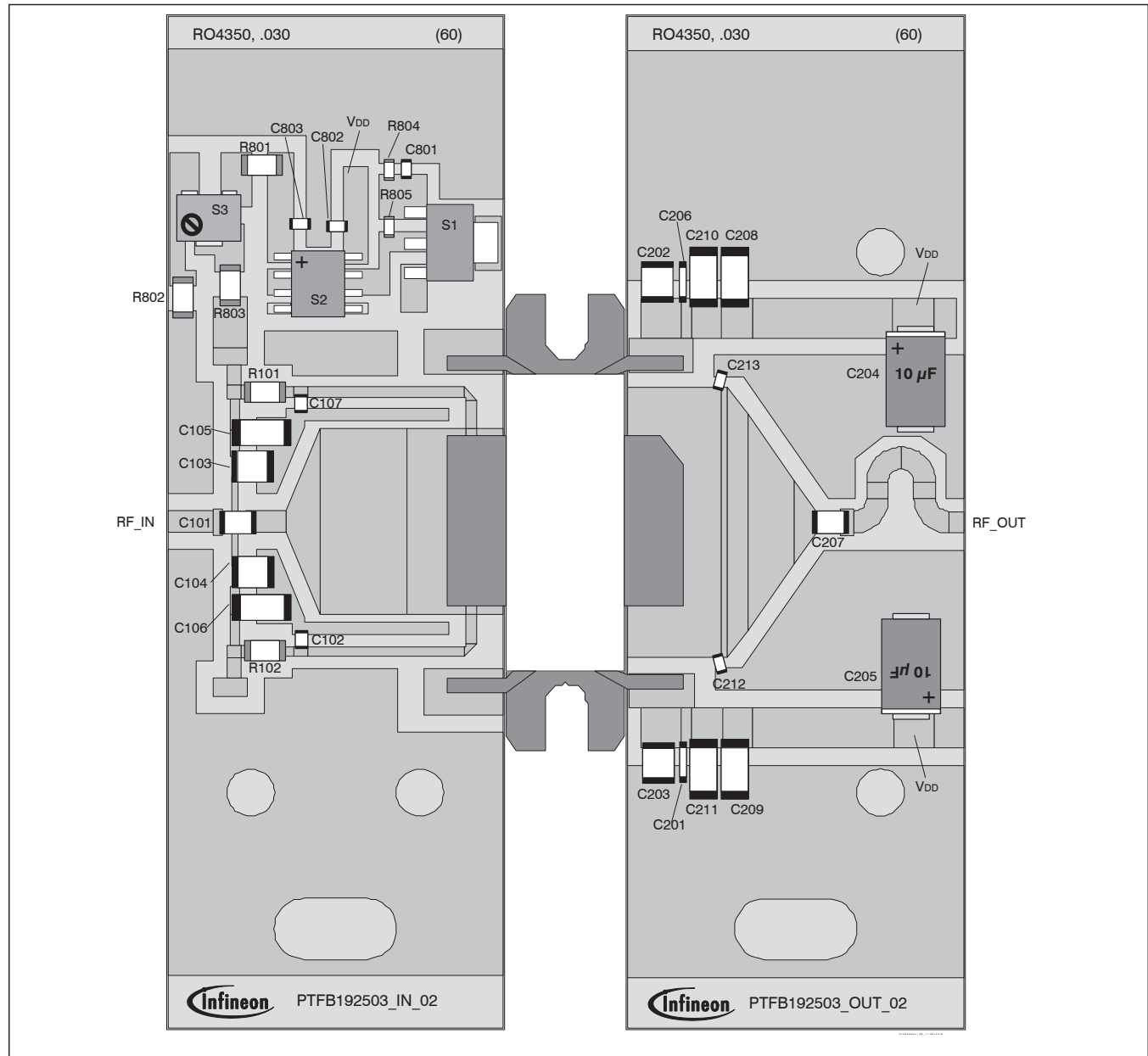
Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Output			
TL201, TL202, TL203, TL213	0.026λ , 34.08Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 2.286$	$W1 = 120$, $W2 = 120$, $W3 = 90$
TL204	0.012λ , 51.58Ω	$W = 1.651$, $L = 1.118$	$W = 65$, $L = 44$
TL205	0.084λ , 6.86Ω	$W = 20.320$, $L = 6.985$	$W = 800$, $L = 275$
TL206	0.029λ , 23.60Ω	$W = 4.928$, $L = 2.540$	$W = 194$, $L = 100$
TL207	0.029λ , 23.79Ω	$W = 4.877$, $L = 2.540$	$W = 192$, $L = 100$
TL208, TL209, TL212	0.034λ , 34.08Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 3.048$	$W1 = 120$, $W2 = 120$, $W3 = 120$
TL210		$W1 = 12.700$, $W2 = 17.780$	$W1 = 500$, $W2 = 700$
TL211 (taper)	0.019λ , 6.86Ω / 8.37Ω	$W1 = 20.320$, $W2 = 16.383$, $L = 1.575$	$W1 = 800$, $W2 = 645$, $L = 62$
TL214, TL220	0.009λ , 34.08Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 0.762$	$W1 = 120$, $W2 = 120$, $W3 = 30$
TL215, TL217	0.118λ , 34.08Ω	$W = 3.048$, $L = 10.516$	$W = 120$, $L = 414$
TL216	0.019λ , 34.08Ω	$W = 3.048$, $L = 1.702$	$W = 120$, $L = 67$
TL218	0.025λ , 34.08Ω	$W = 3.048$, $L = 2.210$	$W = 120$, $L = 87$
TL219	0.034λ , 34.08Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 3.048$	$W1 = 120$, $W2 = 120$, $W3 = 120$
TL221 (taper)	0.041λ , 8.37Ω / 19.45Ω	$W1 = 16.383$, $W2 = 6.248$, $L = 3.429$	$W1 = 645$, $W2 = 246$, $L = 135$
TL222	0.007λ , 51.58Ω	$W = 1.651$, $L = 0.635$	$W = 65$, $L = 25$
TL223	0.011λ , 45.17Ω	$W = 2.032$, $L = 1.016$	$W = 80$, $L = 40$
TL224, TL225, TL226, TL228		$W = 0.002$, $ANG = 90$, $R = 0.002$	$W = 2$, $ANG = 3543307$, $R = 70$
TL227	0.014λ , 51.58Ω	$W = 1.651$, $L = 1.270$	$W = 65$, $L = 50$
TL229 (taper)	0.019λ , 19.45Ω / 51.58Ω	$W1 = 6.248$, $W2 = 1.651$, $L = 1.651$	$W1 = 246$, $W2 = 65$, $L = 65$
TL230	0.000λ , 19.45Ω	$W = 6.248$, $L = 0.025$	$W = 246$, $L = 1$
TL231	0.000λ , 8.37Ω	$W = 16.383$, $L = 0.025$	$W = 645$, $L = 1$
TL232, TL233	0.000λ , 146.88Ω	$W = 0.025$, $L = 0.025$	$W = 1$, $L = 1$
TL234		$W1 = 20.320$, $W2 = 0.025$, $W3 = 20.320$, $W4 = 0.025$	$W1 = 800$, $W2 = 1$, $W3 = 800$, $W4 = 1$
TL235	0.005λ , 6.86Ω	$W = 20.320$, $L = 0.406$	$W = 800$, $L = 16$
TL236	0.014λ , 51.58Ω	$W = 1.651$, $L = 1.270$	$W = 65$, $L = 50$

Reference Circuit (cont.)

Circuit Assembly Information

Test Fixture Part No. LTN/PTFB192503EF

Find Gerber files for this test fixture on the Infineon Web site at <http://www.infineon.com/rfpower>



Reference circuit assembly diagram (not to scale)

Reference Circuit (cont.)

Component	Description	Suggested Manufacturer	P/N
Input			
C101	Chip capacitor, 10 pF	ATC	ATC100B100FW500XB
C102, C107	Chip capacitor, 8.2 pF	ATC	ATC100A8R2BW150XB
C103, C104	Capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C105, C106	Chip capacitor, 2.2 μ F	Digi-Key	445-1447-2-ND
C801, C802, C803	Capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102, R802, R803	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R801	Resistor, 100 Ω	Digi-Key	P100ECT-ND
R804	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
R805	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
S1	Transistor	Digi-Key	BCP5616TA-ND
S2	Voltage Regulator	Digi-Key	LM78L05ACM-ND
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
Output			
C201, C206	Chip capacitor, 0.1 μ F	Digi-Key	399-1267-2-ND
C202, C203	Chip capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C204, C205	Capacitor, 10 μ F	Digi-Key	281M5002106K
C207	Capacitor, 10 pF	ATC	ATC100B100FW500XB
C208, C209	Chip capacitor, 1 μ F	Digi-Key	445-1411-2-ND
C210, C211	Chip capacitor, 2.2 μ F	Digi-Key	445-1447-2-ND
C212, C213	Chip capacitor, 1.1 pF	ATC	ATC100A1R1BW150XB

Package Outline Specifications

Package H-33288-6

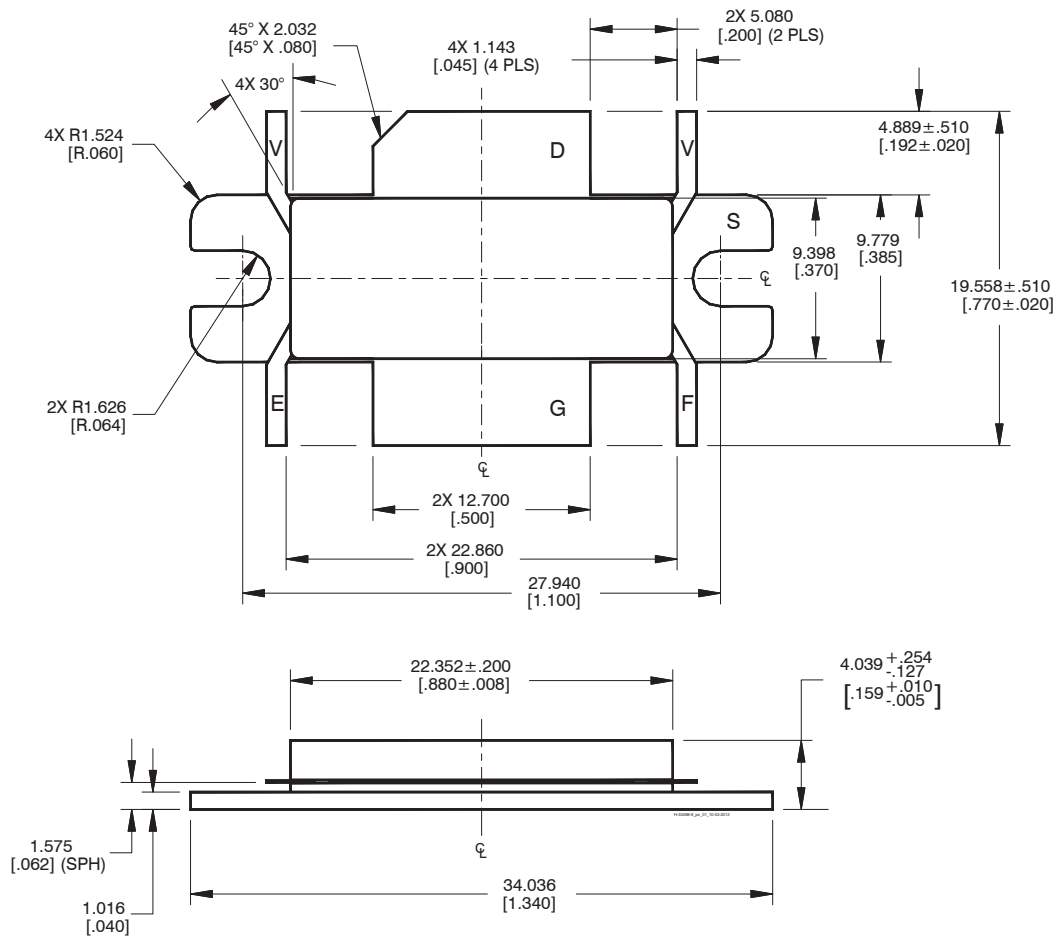
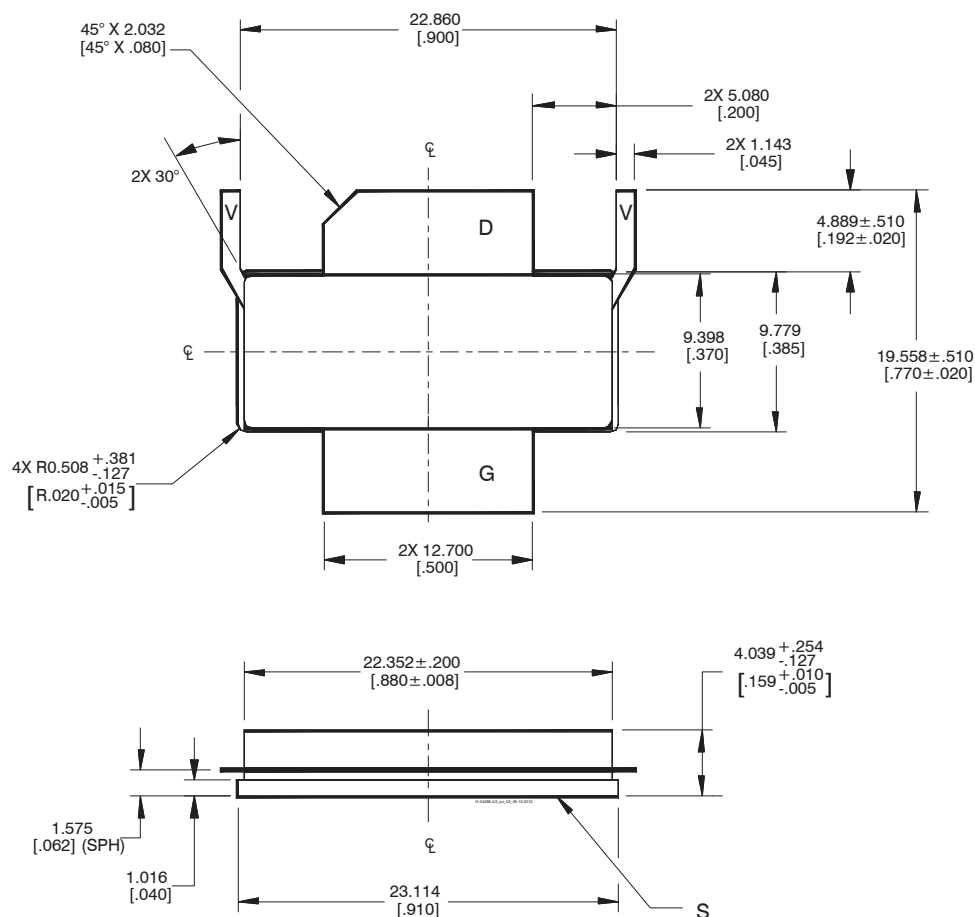


Diagram Notes—unless otherwise specified:

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: G = gate, S = source, D = drain, V = V_{DD} , E, F = N.C.
5. Lead thickness: $0.10 + 0.051/-0.025$ mm [.004 + 0.002/-0.001 inch].
6. Gold plating thickness: 0.25 micron [10 microinch] max.

Package H-34288-4/2



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: D = drain; S = source; G = gate; V = V_{DD} .
5. Lead thickness: $0.10 + 0.051/-0.025$ mm [.004 +0.002/-0.001 inch].
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Rev. 09.1, 2016-06-13

Revision History: 2016-06-13

Data Sheet

Previous Version: 2010-11-09, Data Sheet

Page	Subjects (major changes since last revision)
2	Updated ordering code to R0

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