

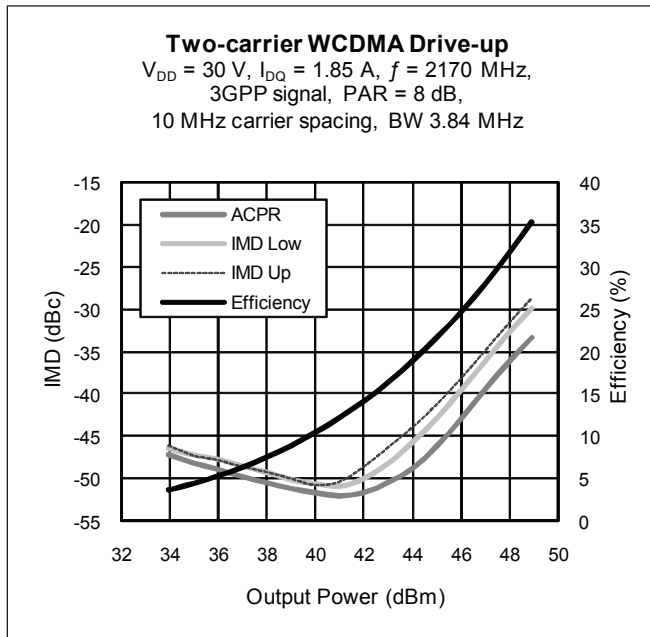
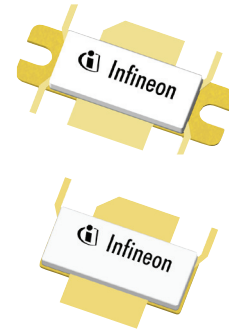
Thermally-Enhanced High Power RF LDMOS FETs 240 W, 2110 – 2170 MHz

Description

The PTFB212503EL and PTFB212503FL are 240-watt LDMOS FETs intended for use in multi-standard cellular power amplifier applications in the 2110 to 2170 MHz frequency band. Features include input and output matching, high gain, wide signal bandwidth and reduced memory effects for unparalleled DPD correctability. Manufactured with Infineon's advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

PTFB212503EL
Package H-33288-6

PTFB212503FL
Package H-34288-4/2



Features

- Broadband internal input and output matching
- Enhanced for use in DPD error correction systems
- Wide video bandwidth
- Typical single-carrier WCDMA performance at 2170 MHz, 30 V, $I_{DQ} = 1.85\text{ A}$, 3GPP signal, channel bandwidth = 3.84 MHz, PAR = 7.5 dB @ 0.01% CCDF
 - Average output power = 49.4 dBm
 - Linear gain = 18 dB
 - Efficiency = 37%
 - Intermodulation distortion = -33 dBc
- Typical CW performance, 2170 MHz, 30 V
 - Output power at P_{1dB} = 240 W
 - Efficiency = 54 %
- 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 Specifications (not subject to production test—verified by design/characterization in Infineon test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 55\text{ W}$ average, $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 8 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	18.0	—	dB
Drain Efficiency	η_D	—	31	—	%
Intermodulation Distortion	IMD	—	-33	—	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 Specifications (tested in Infineon test fixture)

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 200\text{ W PEP}$, $f = 2170\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	17	18	—	dB
Drain Efficiency	η_D	39	40	—	%
Intermodulation Distortion	IMD	—	−30	−28	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	$V_{DS} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$	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)	$R_{\theta JC}$	0.26	$^{\circ}\text{C/W}$

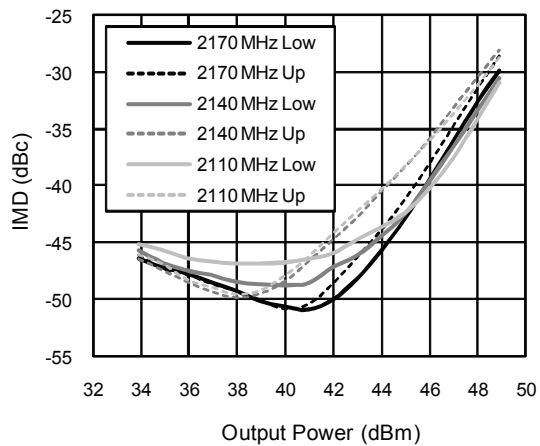
Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTFB212503EL V1 R0	PTFB212503ELV1R0XTMA1	H-33288-6, bolt-down	Tape & Reel, 50 pcs
PTFB212503EL V1 R250	PTFB212503ELV1R250XTMA1	H-33288-6, bolt-down	Tape & Reel, 250 pcs
PTFB212503FL V2 R0	PTFB212503FLV2R0XTMA1	H-34288-4/2, earless flange	Tape & Reel, 50 pcs
PTFB212503FL V2 R250	PTFB212503FLV2R250XTMA1	H-34288-4/2, earless flange	Tape & Reel, 250 pcs

Typical Performance (data taken in a production test fixture)

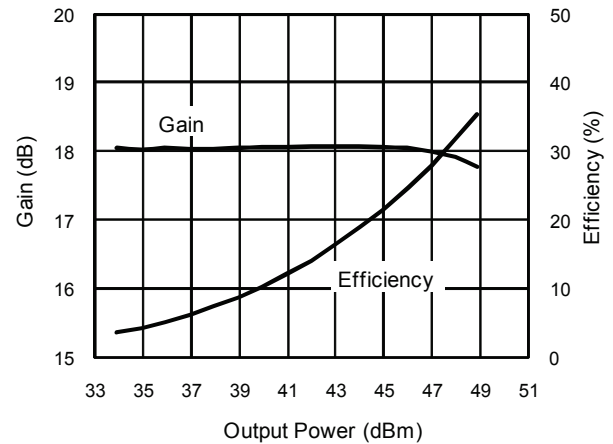
Two-carrier WCDMA Drive-up

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



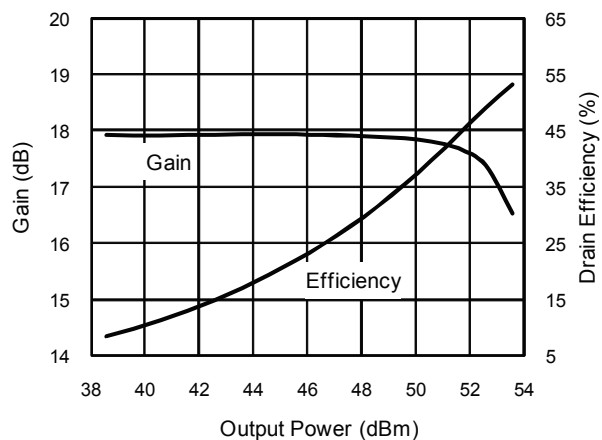
Two-carrier WCDMA Drive-up

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$, 3GPP
WCDMA, PAR = 8 dB, 10 MHz carrier spacing,
BW 3.84 MHz



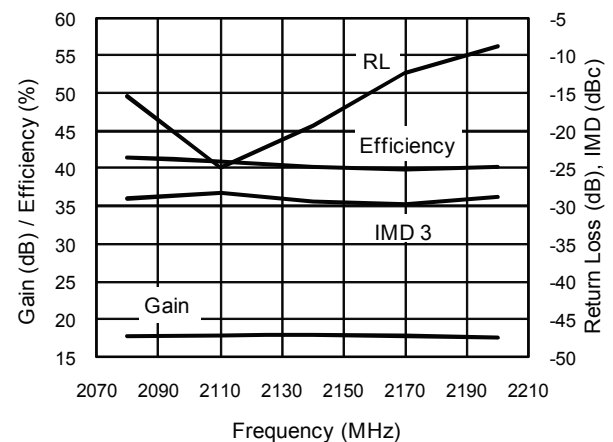
CW Power Sweep Gain & Efficiency vs. Output Power

$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $f = 2170\text{ MHz}$

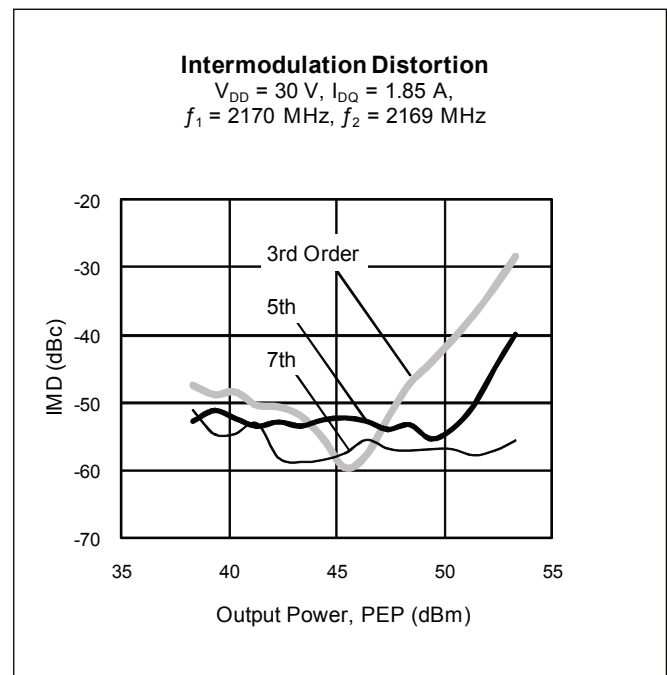
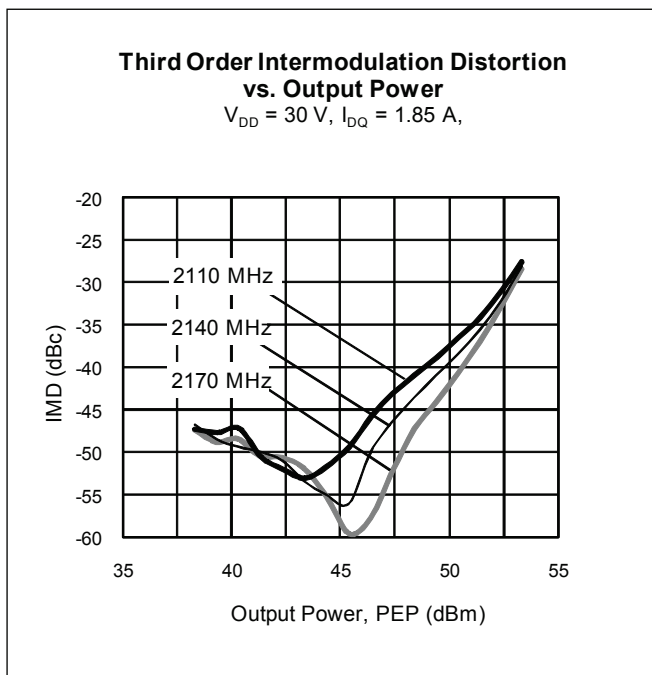
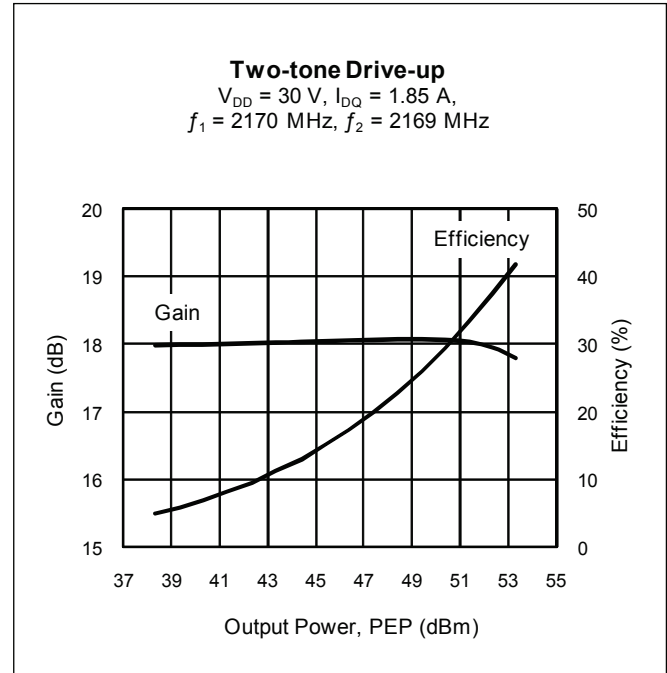
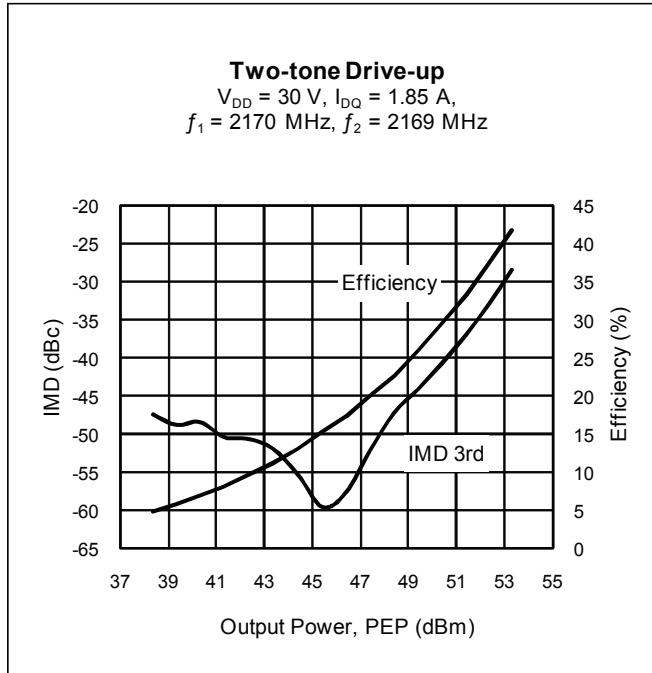


Two-tone Broadband Performance

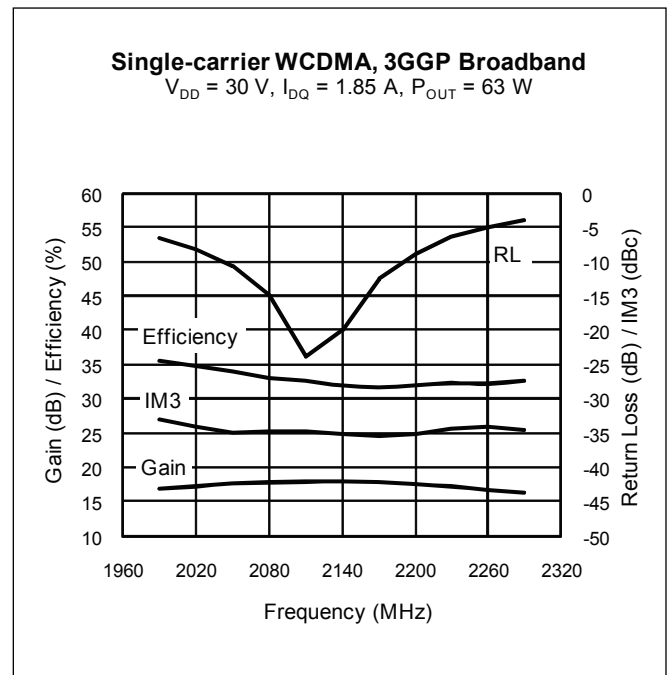
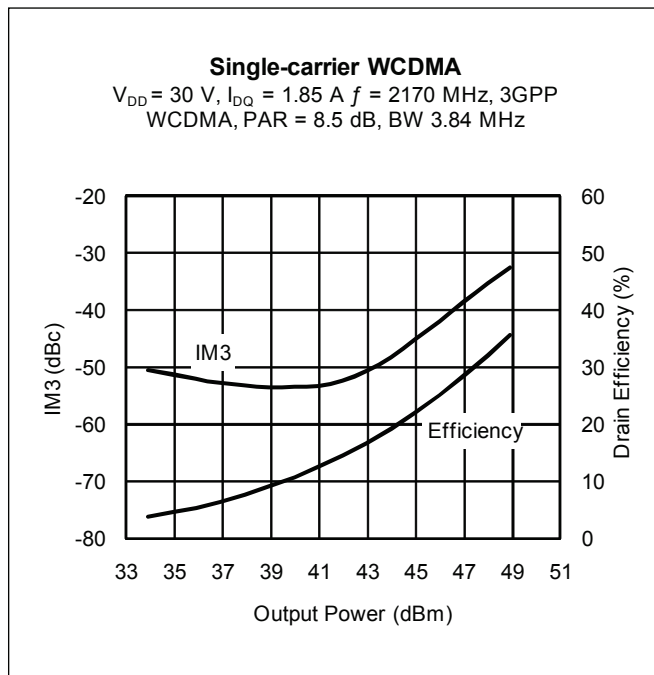
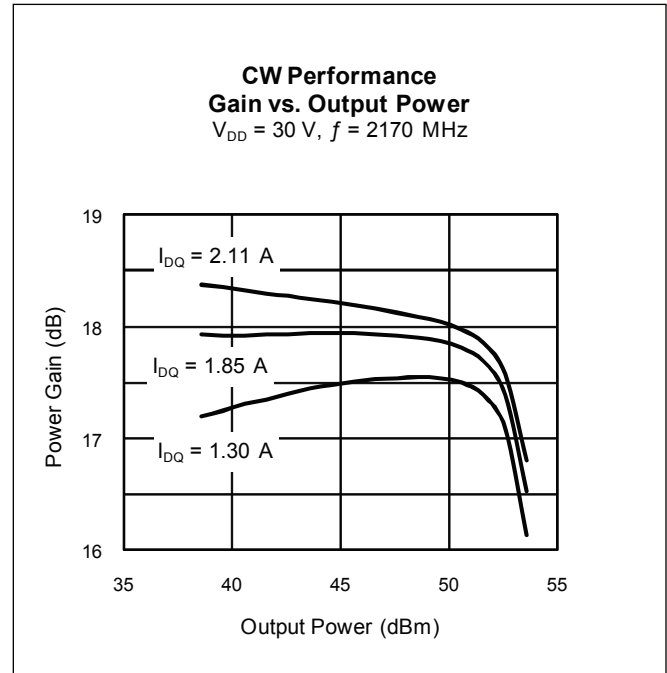
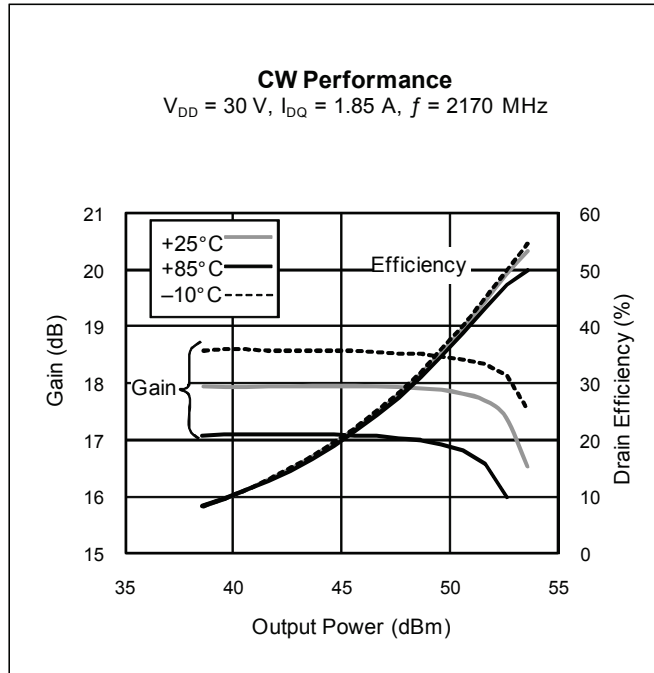
$V_{DD} = 30\text{ V}$, $I_{DQ} = 1.85\text{ A}$, $P_{OUT} = 100\text{ W}$



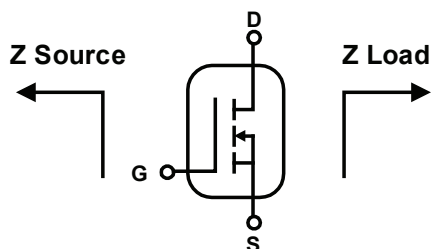
Typical Performance (cont.)



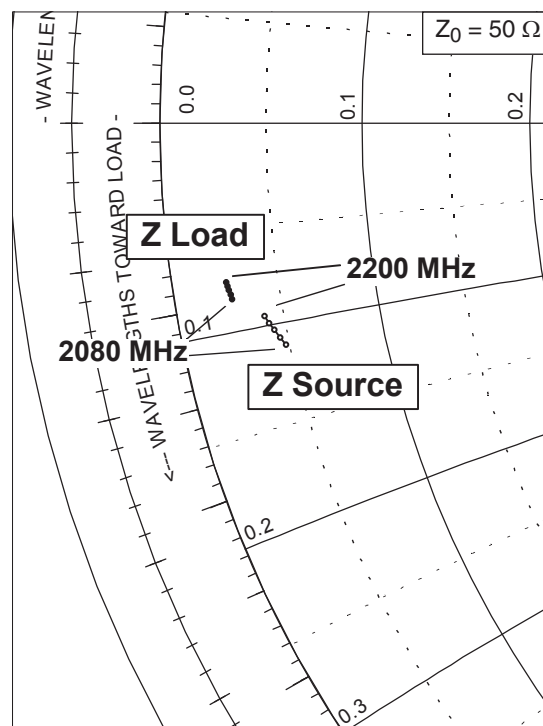
Typical Performance (cont.)



Broadband Circuit Impedance

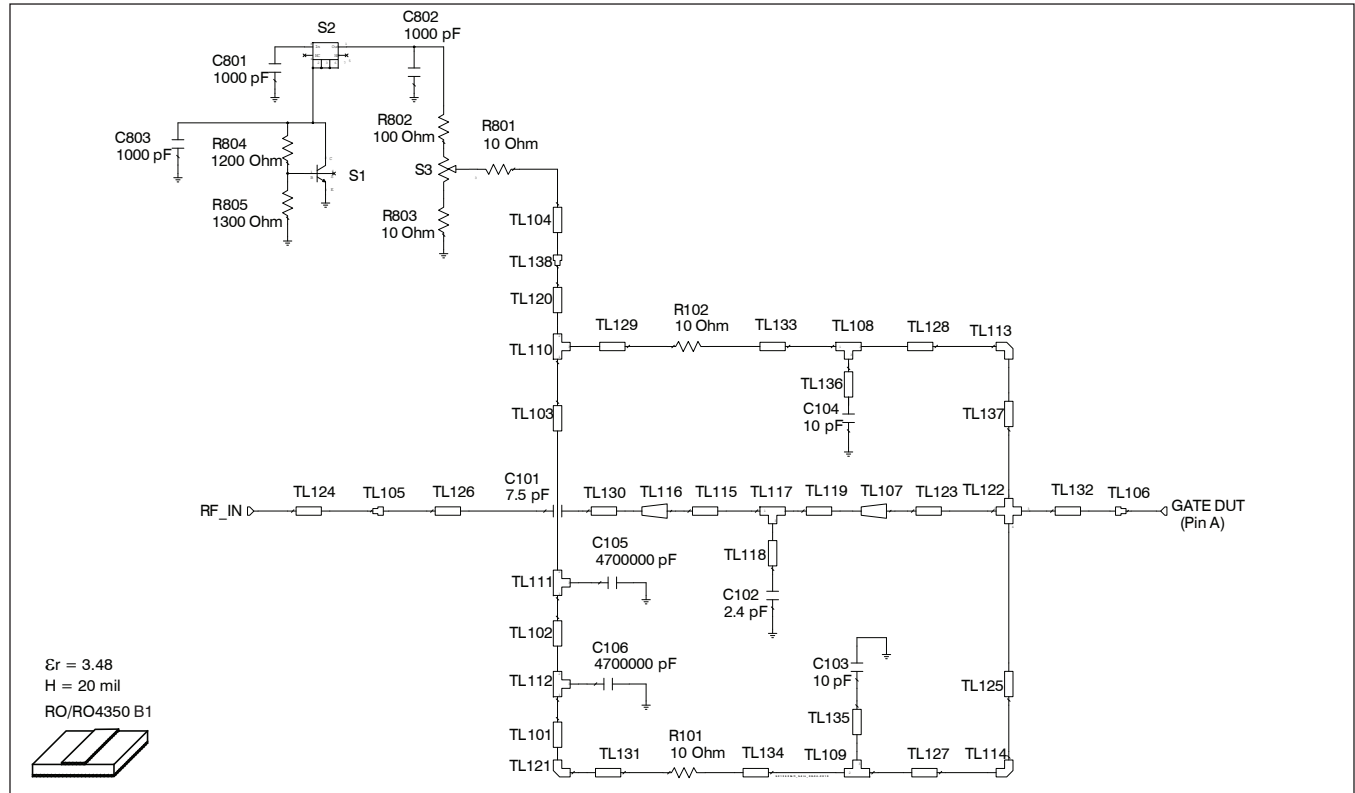


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
2080	2.42	-5.57	1.34	-4.23
2110	2.31	-5.36	1.32	-4.12
2140	2.21	-5.15	1.29	-4.01
2170	2.12	-4.96	1.27	-3.91
2200	2.04	-4.77	1.25	-3.81

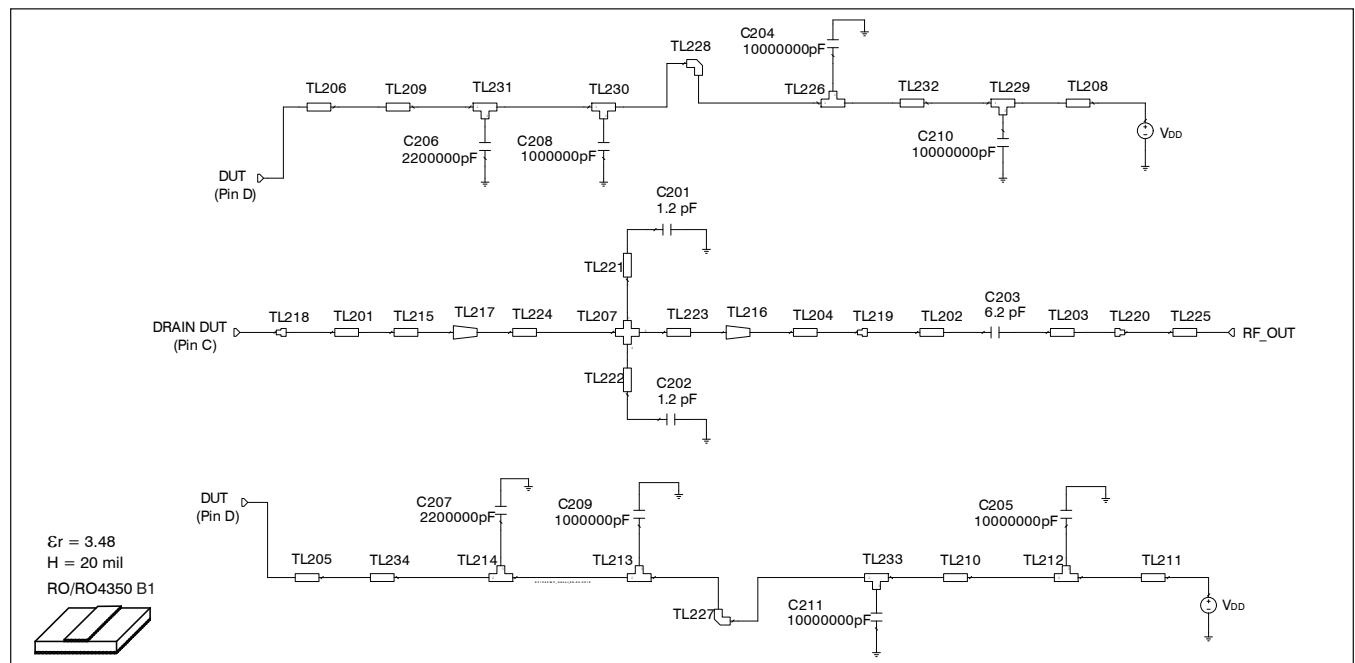


See next page for reference circuit information

Reference Circuit



Reference circuit input schematic for $f = 2170 \text{ MHz}$



Reference Circuit (cont.)

Description

DUT	PTFB212503EL or PTFB212503FL
PCB	0.508 mm [.020"] thick, $\epsilon_r = 3.48$, Rogers 4350, 1 oz. copper

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.043λ , 54.17Ω	$W = 1.016$, $L = 3.594$	$W = 40$, $L = 142$
TL102	0.107λ , 63.89Ω	$W = 0.762$, $L = 9.050$	$W = 30$, $L = 356$
TL103	0.044λ , 63.89Ω	$W = 0.762$, $L = 3.734$	$W = 30$, $L = 147$
TL104	0.031λ , 34.72Ω	$W = 1.981$, $L = 2.540$	$W = 78$, $L = 100$
TL105		$W1 = 1.270$, $W2 = 2.286$	$W1 = 50$, $W2 = 90$
TL106		$W1 = 17.780$, $W2 = 12.700$	$W1 = 700$, $W2 = 500$
TL107 (taper)	0.027λ , $6.67 \Omega / 15.80 \Omega$	$W1 = 13.970$, $W2 = 5.334$, $L = 2.032$	$W1 = 550$, $W2 = 210$, $L = 80$
TL108, TL109	0.012λ , 54.17Ω	$W1 = 1.016$, $W2 = 1.016$, $W3 = 1.016$	$W1 = 40$, $W2 = 40$, $W3 = 40$
TL110	0.012λ , 54.17Ω	$W1 = 1.016$, $W2 = 1.270$, $W3 = 1.016$	$W1 = 40$, $W2 = 50$, $W3 = 40$
TL111, TL112	0.012λ , 63.89Ω	$W1 = 0.762$, $W2 = 0.762$, $W3 = 1.016$	$W1 = 30$, $W2 = 30$, $W3 = 40$
TL113, TL114, TL121		$W = 1.016$	$W = 40$
TL115	0.000λ , 15.80Ω	$W = 5.334$, $L = 0.000$	$W = 210$, $L = 0$
TL116 (taper)	0.013λ , $15.80 \Omega / 47.12 \Omega$	$W1 = 5.334$, $W2 = 1.270$, $L = 0.991$	$W1 = 210$, $W2 = 50$, $L = 39$
TL117	0.000λ , 15.80Ω	$W1 = 5.334$, $W2 = 5.334$, $W3 = 0.025$	$W1 = 210$, $W2 = 210$, $W3 = 1$
TL118	0.000λ , 144.35Ω	$W = 0.025$, $L = 0.025$	$W = 1$, $L = 1$
TL119	0.000λ , 15.80Ω	$W = 5.334$, $L = 0.000$	$W = 210$, $L = 0$
TL120	0.018λ , 54.17Ω	$W = 1.016$, $L = 1.524$	$W = 40$, $L = 60$
TL122		$W1 = 13.970$, $W2 = 1.016$, $W3 = 13.970$ $W4 = 1.016$	$W1 = 550$, $W2 = 40$, $W3 = 550$, $W4 = 40$
TL123	0.005λ , 6.67Ω	$W = 13.970$, $L = 0.381$	$W = 550$, $L = 15$
TL124	0.032λ , 47.12Ω	$W = 1.270$, $L = 2.692$	$W = 50$, $L = 106$
TL125, TL137	0.026λ , 54.17Ω	$W = 1.016$, $L = 2.159$	$W = 40$, $L = 85$
TL126	0.016λ , 31.24Ω	$W = 2.286$, $L = 1.270$	$W = 90$, $L = 50$
TL127, TL128	0.095λ , 54.17Ω	$W = 1.016$, $L = 8.001$	$W = 40$, $L = 315$
TL129	0.012λ , 54.17Ω	$W = 1.016$, $L = 1.016$	$W = 40$, $L = 40$
TL130	0.134λ , 47.12Ω	$W = 1.270$, $L = 11.151$	$W = 50$, $L = 439$
TL131	0.012λ , 54.17Ω	$W = 1.016$, $L = 1.021$	$W = 40$, $L = 40$
TL132	0.053λ , 6.67Ω	$W = 13.970$, $L = 4.064$	$W = 550$, $L = 160$
TL133, TL134	0.030λ , 54.17Ω	$W = 1.016$, $L = 2.540$	$W = 40$, $L = 100$
TL135, TL136	0.002λ , 54.17Ω	$W = 1.016$, $L = 0.127$	$W = 40$, $L = 5$
TL138		$W1 = 1.016$, $W2 = 1.981$	$W1 = 40$, $W2 = 78$

table continued on page 9

Reference Circuit (cont.)

Electrical Characteristics at 2170 MHz

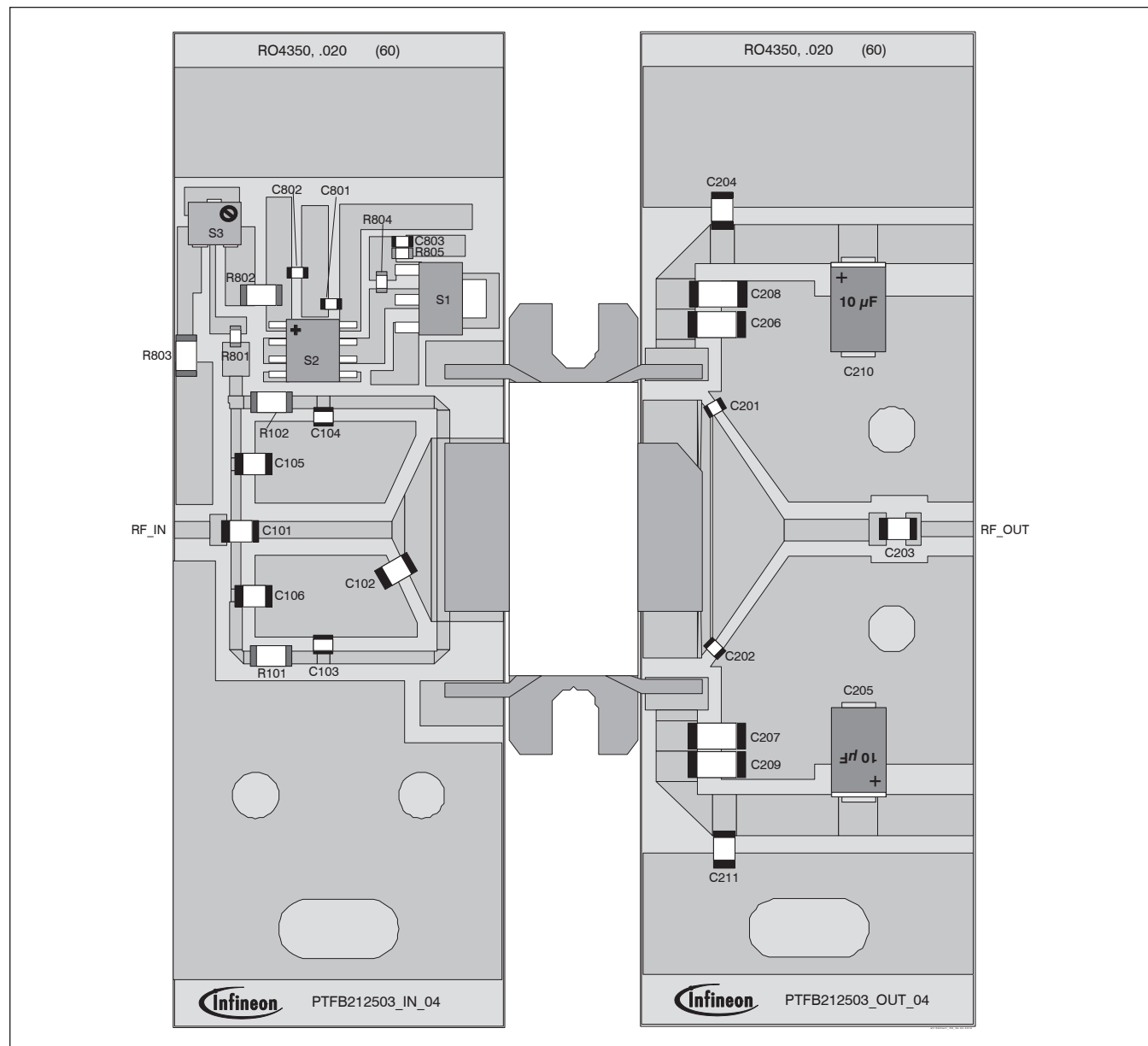
Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Output			
TL201	0.054λ , 4.84Ω	$W = 19.685$, $L = 4.064$	$W = 775$, $L = 160$
TL202, TL203	0.016λ , 28.85Ω	$W = 2.540$, $L = 1.270$	$W = 100$, $L = 50$
TL204	0.078λ , 39.51Ω	$W = 1.651$, $L = 6.426$	$W = 65$, $L = 253$
TL205	0.032λ , 16.90Ω	$W = 4.928$, $L = 2.540$	$W = 194$, $L = 100$
TL206	0.032λ , 17.05Ω	$W = 4.877$, $L = 2.540$	$W = 192$, $L = 100$
TL207		$W1 = 17.780$, $W2 = 0.025$, $W3 = 17.780$ $W4 = 0.025$	$W1 = 700$, $W2 = 1$, $W3 = 700$, $W4 = 1$
TL208, TL211	0.092λ , 25.04Ω	$W = 3.048$, $L = 7.341$	$W = 120$, $L = 289$
TL209, TL234	0.010λ , 25.04Ω	$W = 3.048$, $L = 0.762$	$W = 120$, $L = 30$
TL210, TL232	0.098λ , 25.04Ω	$W = 3.048$, $L = 7.823$	$W = 120$, $L = 308$
TL212, TL229	0.038λ , 25.04Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 3.048$	$W1 = 120$, $W2 = 120$, $W3 = 120$
TL213, TL214, TL230, TL231	0.029λ , 25.04Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 2.286$	$W1 = 120$, $W2 = 120$, $W3 = 90$
TL215	0.003λ , 4.84Ω	$W = 19.685$, $L = 0.254$	$W = 775$, $L = 10$
TL216 (taper)	0.074λ , $5.33 \Omega / 39.51 \Omega$	$W1 = 17.780$, $W2 = 1.651$, $L = 5.588$	$W1 = 700$, $W2 = 65$, $L = 220$
TL217 (taper)	0.010λ , $4.84 \Omega / 5.33 \Omega$	$W1 = 19.685$, $W2 = 17.780$, $L = 0.762$	$W1 = 775$, $W2 = 700$, $L = 30$
TL218		$W1 = 12.700$, $W2 = 17.780$	$W1 = 500$, $W2 = 700$
TL219		$W1 = 1.651$, $W2 = 2.540$	$W1 = 65$, $W2 = 100$
TL220		$W1 = 1.270$, $W2 = 2.540$	$W1 = 50$, $W2 = 100$
TL221, TL222	0.000λ , 144.35Ω	$W = 0.025$, $L = 0.025$	$W = 1$, $L = 1$
TL223, TL224	0.000λ , 5.33Ω	$W = 17.780$, $L = 0.025$	$W = 700$, $L = 1$
TL225	0.047λ , 47.12Ω	$W = 1.270$, $L = 3.912$	$W = 50$, $L = 154$
TL226, TL233	0.023λ , 25.04Ω	$W1 = 3.048$, $W2 = 3.048$, $W3 = 1.829$	$W1 = 120$, $W2 = 120$, $W3 = 72$

Reference Circuit (cont.)

Circuit Assembly Information

Test Fixture Part No. LTN/PTFB212503EF

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.)

Components Information

Component	Description	Suggested Manufacturer	P/N
Input			
C101	Chip capacitor, 7.5 pF	ATC	ATC100B7R5BW500XB
C102	Chip capacitor, 2.4 pF	ATC	ATC100B2R4BW500XB
C103, C104	Chip capacitor, 10 pF	ATC	ATC100A100JW500XB
C105, C106	Chip capacitor, 4.7 μ F	Digi-Key	493-2372-2-ND
C801, C802, C803	Capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
R101, R102, R803	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R801	Resistor, 10 Ω	Digi-Key	P10GCT-ND
R802	Resistor, 100 Ω	Digi-Key	P101ECT-ND
R804	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
R805	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
S1	Transistor	Digi-Key	BCP56
S2	Voltage Regulator	Digi-Key	LM78L05ACM-ND
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
Output			
C201, C202	Chip capacitor, 1.2 pF	ATC	ATC100A1R2BW500XB
C203	Chip capacitor, 6.2 pF	ATC	ATC100B6R2JW500XB
C204, C211	Capacitor, 10 μ F	Digi-Key	587-1818-2-ND
C205, C210	Capacitor, 10 μ F	Garrett Electronics	281M5002106K
C206, C207	Chip capacitor, 2.2 μ F	Digi-Key	445-1447-2-ND
C208, C209	Chip capacitor, 1 μ F	Digi-Key	445-1411-2-ND

Package Outline Specifications

Package H-33288-6

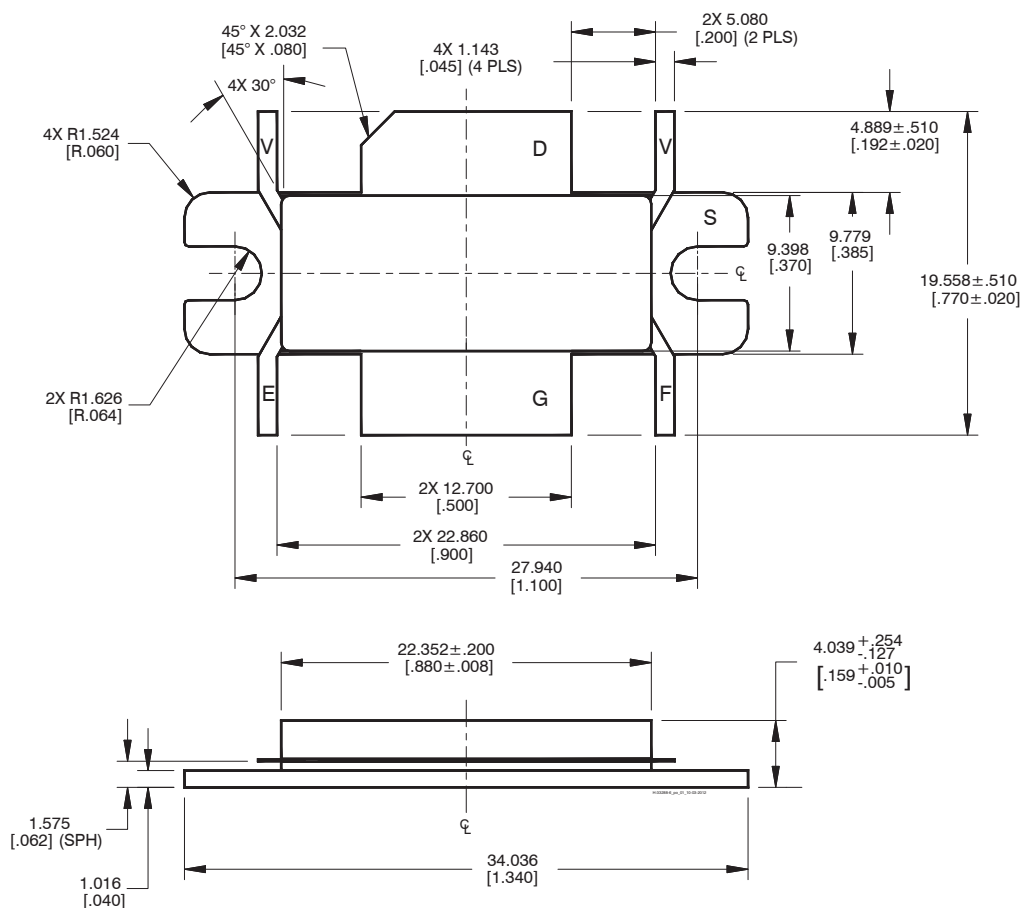


Diagram Notes—unless otherwise specified:

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].
6. Gold plating thickness: 0.25 micron [10 microinch] max.

Rev. 07.1, 2016-06-15

Revision History: 2016-06-15

Data Sheet

Previous Version: 2010-11-04, Data Sheet

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

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