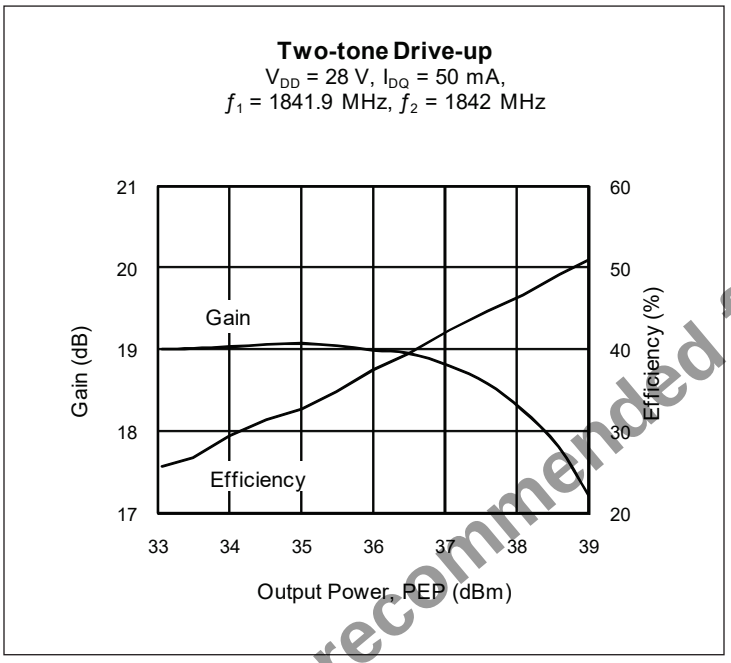
green Product

High Power RF LDMOS Field Effect Transistor
4 W, 28 V, 700 – 2200 MHz

Description

The PTFA220041M is an unmatched 4-watt LDMOS FET intended for power amplifier applications in the 700 MHz to 2200 MHz operating range. This LDMOS device offers excellent gain, efficiency and linearity performance in a small, overmolded plastic package.

PTFA220041M
Package PG-SON-10



Features

- Typical two-carrier WCDMA performance, 1842 MHz, 8 dB PAR
  - P_{OUT} = 27 dBm Avg
  - ACPR = –44 dBc
- Typical CW performance, 1842 MHz, 28 V
  - P_{OUT} = 37 dBm
  - Efficiency = 53.5%
  - Gain = 17.9 dB
- Typical CW performance, 940 MHz, 28 V
  - P_{OUT} = 37.5 dBm
  - Efficiency = 57%
  - Gain = 19.7 dB
- Capable of handling 10:1 VSWR @ 28 V, 5 W (CW) output power
- Integrated ESD protection
- Excellent thermal stability
- Pb-free and RoHS compliant

RF Characteristics

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

V_{DD} = 28 V, I_{DQ} = 50 mA, P_{OUT} = 4 W PEP, f = 1842 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	18.5	19	—	dB
Drain Efficiency	η_D	35	37.5	—	%
Intermodulation Distortion	IMD	—	–29	–28	dBc
Input Return Loss	IRL	—	–8	–7	dB

All published data at T_{CASE} = 25°C unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

RF Characteristics (cont.)

Two-tone Measurements (not subject to production test - verified by design / characterization in Infineon test fixture)
V_{DD} = 28 V, I_{DQ} = 50 mA, P_{OUT} = 5 W PEP, f = 940 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	18.5	—	dB
Drain Efficiency	η_D	—	37	—	%
Intermodulation Distortion	IMD	—	–30	—	dBc
Input Return Loss	IRL	—	–10	—	dB

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = 10 µA	$V_{(BR)DSS}$	65	—	—	V
Drain Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	µA
On-State Resistance	V_{GS} = 10 V, V_{DS} = 0.1 A	$R_{DS(on)}$	—	2.01	—	Ω
Operating Gate Voltage	V_{DS} = 28 V, I_{DQ} = 50 mA	V_{GS}	2.1	2.7	3.1	V
Gate Leakage Current	V_{GS} = 10 V, V_{DS} = 0 V	I_{GSS}	—	—	1.0	µA

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	V
Gate-Source Voltage	V_{GS}	–0.5 to +12	V
Junction Temperature	T_J	175	°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C, 5 W CW)	$R_{\theta JC}$	5.5	°C/W

Moisture Sensitivity Level

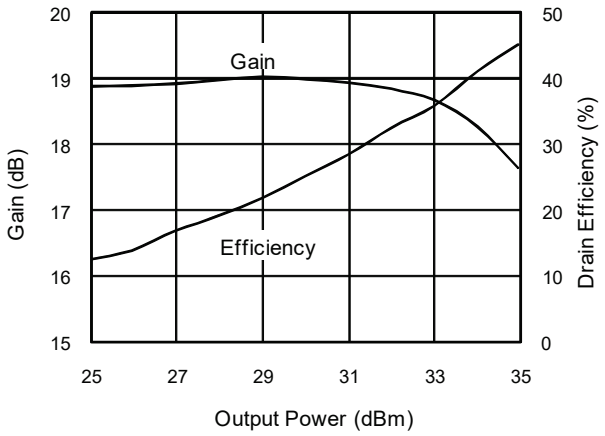
Level	Test Standard	Package Temperature	Temperature Unit
3	IPC/JEDEC J-STD-020	260	°C

Ordering Information

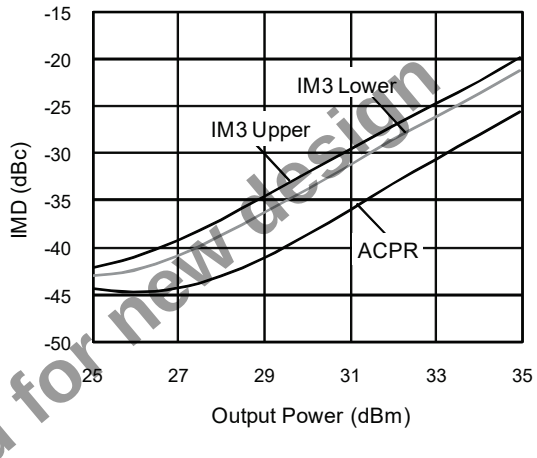
Type and Version	Order Code	Package and Description	Shipping
PTFA220041M V4 R1K	PTFA220041MV4R1KXUMA1	PG-SON-10, molded plastic, SMD	Tape & Reel, 1,000 pcs

Typical Performance, 1842 MHz (data taken in Infineon test fixture)

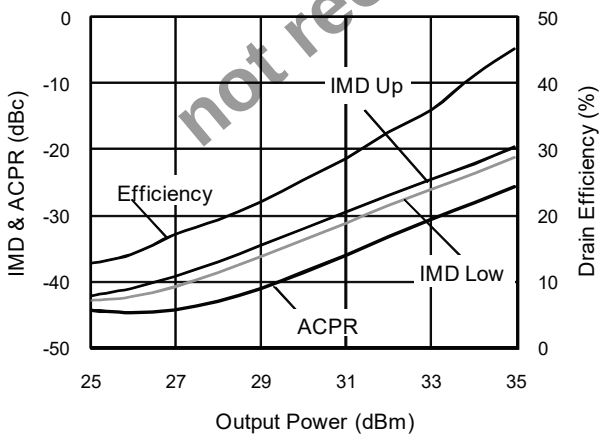
Two-carrier WCDMA 3GPP
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 1842 MHz, 3GPP WCDMA, PAR = 8.0 dB, 10 MHz carrier spacing, BW 3.84 MHz



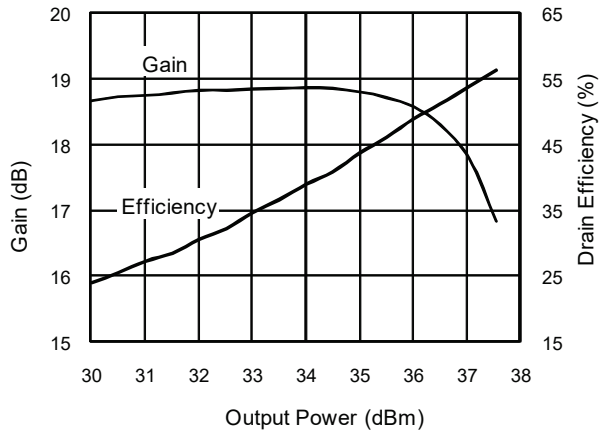
Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 28 V, I_{DQ} = 50 mA, 3GPP WCDMA, PAR = 8.0 dB, 10 MHz carrier spacing, BW 3.84 MHz



Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 1842 MHz, 3GPP WCDMA, PAR = 8.0 dB, 10 MHz carrier spacing, BW 3.84 MHz

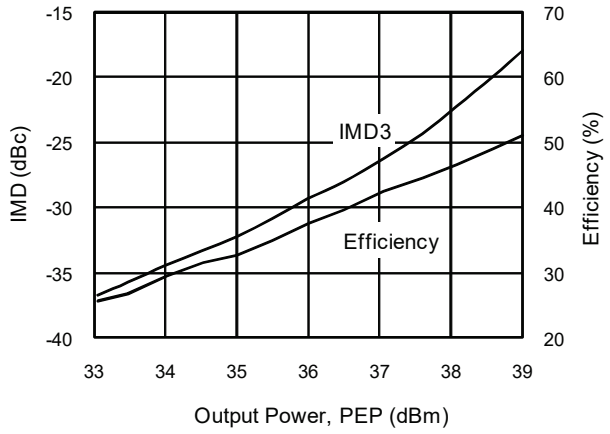


Power Sweep, CW
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 1842 MHz

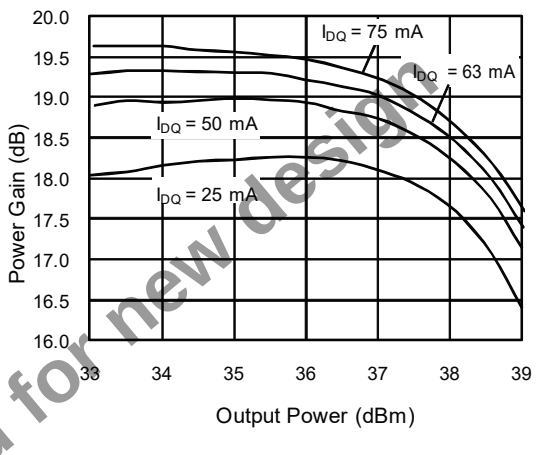


Typical Performance, 1842 MHz (cont.)

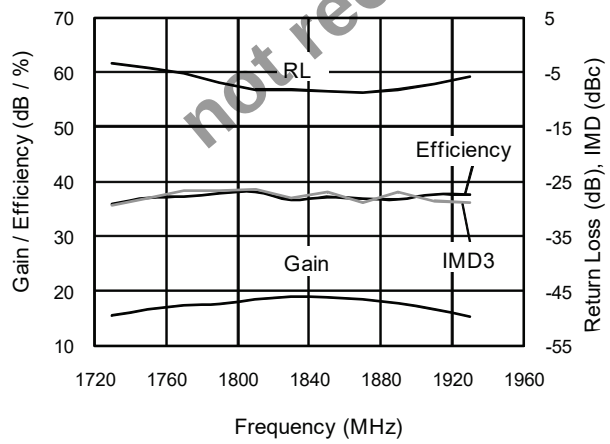
Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 50 mA,
f_1 = 1841.9 MHz, f_2 = 1842 MHz



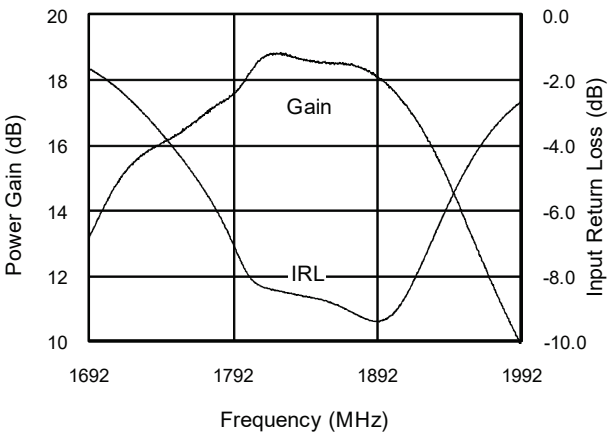
Two-tone Gain vs. Output Power
V_{DD} = 28 V, f_1 = 1841.9 MHz, f_2 = 1842 MHz



Two-tone Broadband
Gain, Efficiency & RL vs. Frequency
V_{DD} = 28V, I_{DQ} = 50 mA, avg P_{OUT} = 2 W,
tone spacing = 100 kHz

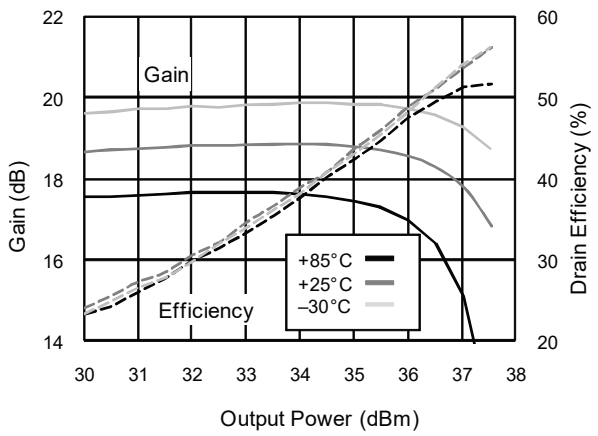


Small Signal CW
Gain & Input Return Loss
V_{DD} = 28 V, I_{DQ} = 50 mA

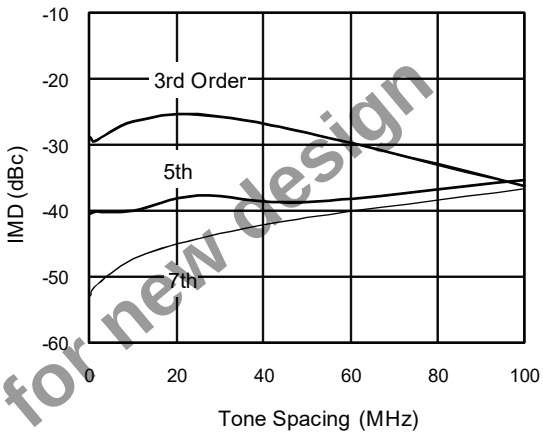


Typical Performance, 1842 MHz (cont.)

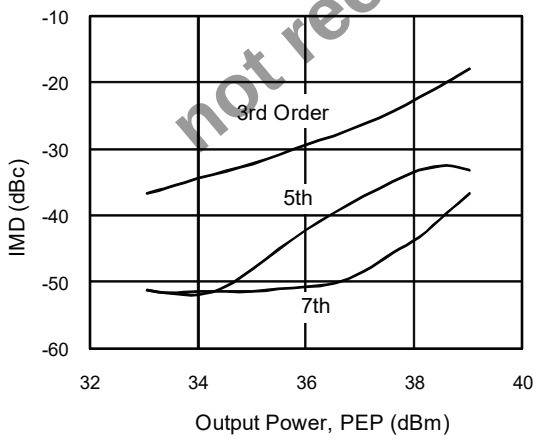
CW Performance
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 1842 MHz



Intermodulation Distortion
vs. Tone Spacing
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 1842 MHz,
P_{OUT} (PEP) = 4 W

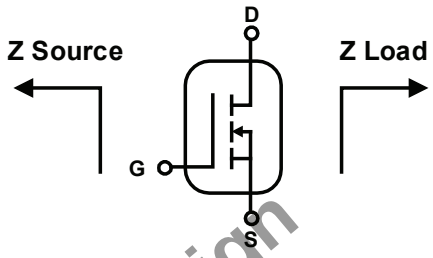


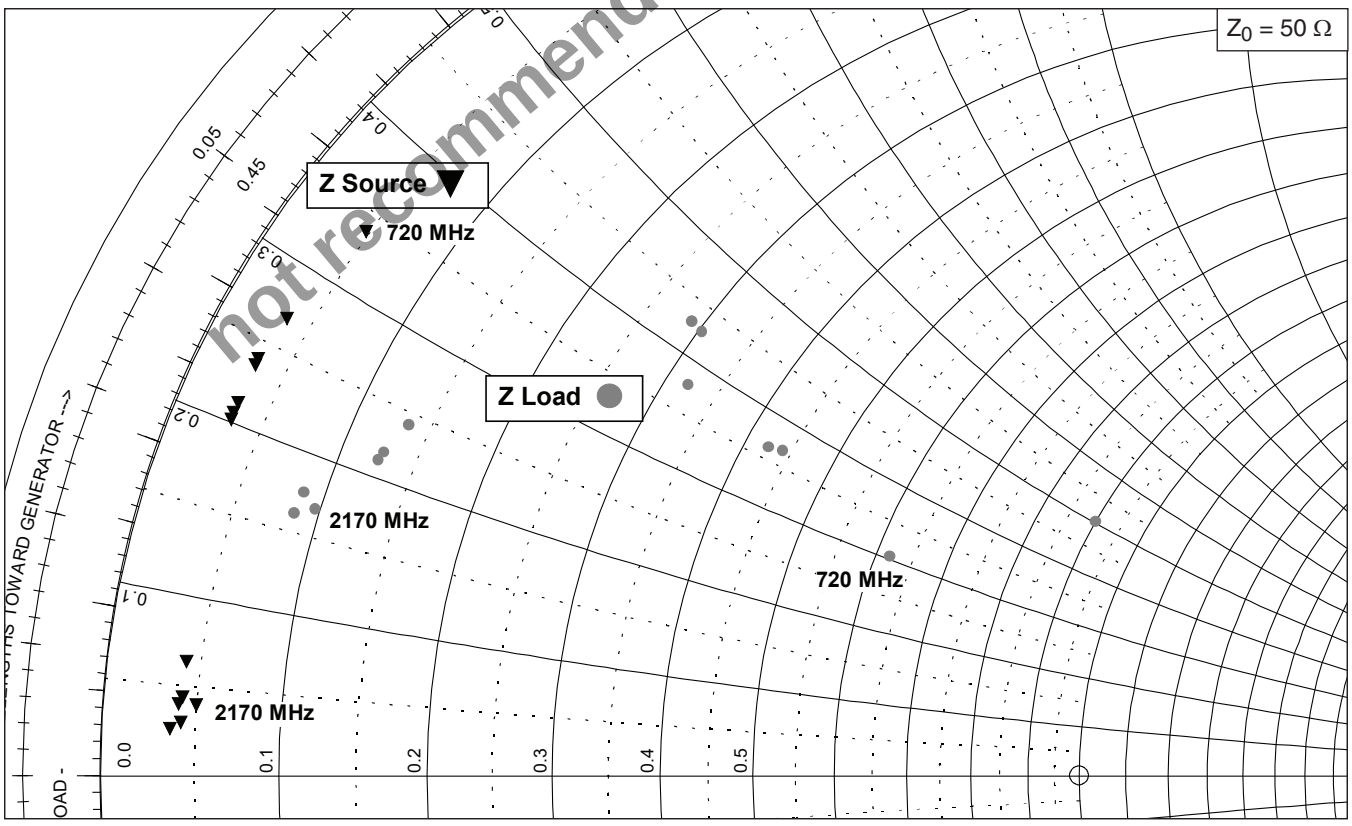
Intermodulation Distortion
vs. Output Power
V_{DD} = 28 V, I_{DQ} = 50 mA,
f_1 = 1841.9 MHz, f_2 = 1842 MHz



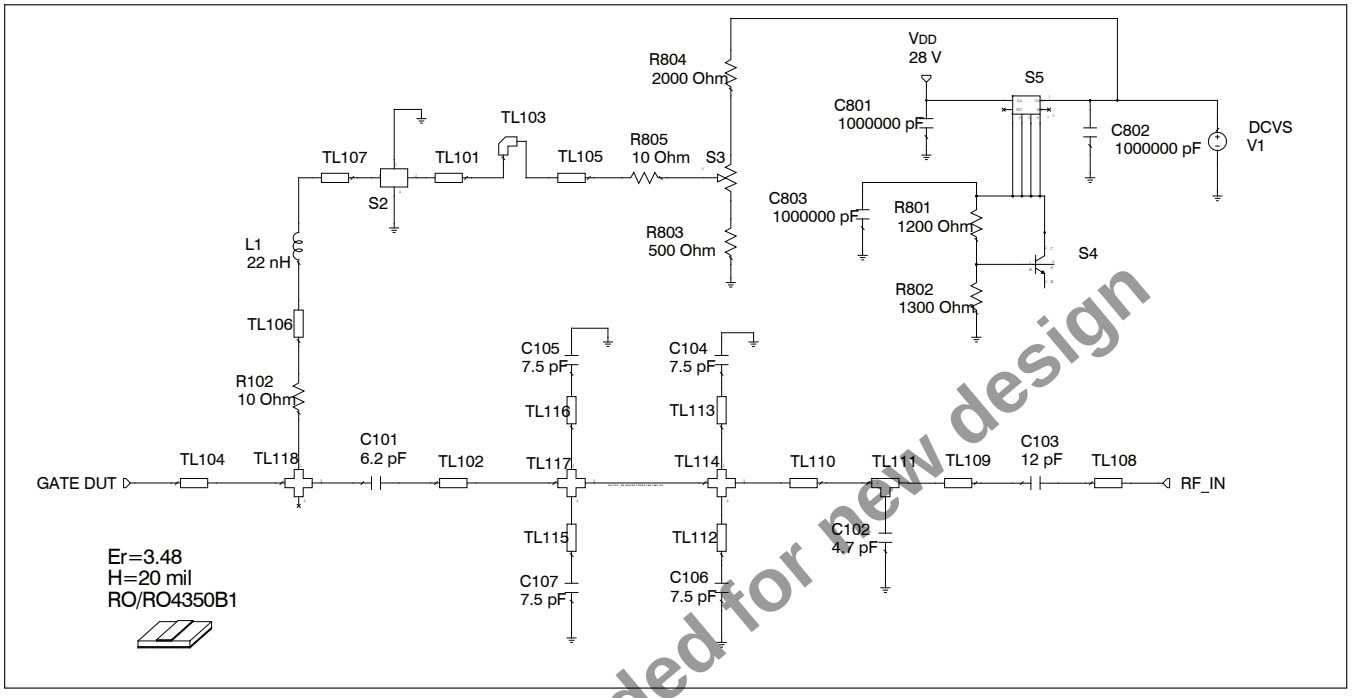
Broadband Circuit Impedance, 1842 MHz

Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
720	2.4	16.9	45.2	25.2
820	1.8	13.4	31.0	15.2
869	1.6	11.8	21.3	18.2
894	1.6	12.0	22.1	18.4
920	1.6	10.6	14.5	21.5
940	1.6	10.1	15.2	21.4
960	1.6	10.3	16.1	18.9
1805	2.1	3.2	6.8	12.1
1880	2.1	2.2	6.4	10.9
1930	1.8	1.3	6.3	10.6
1990	2.1	1.5	4.3	8.1
2110	2.5	2.0	4.9	8.4
2170	2.0	2.0	4.4	8.8

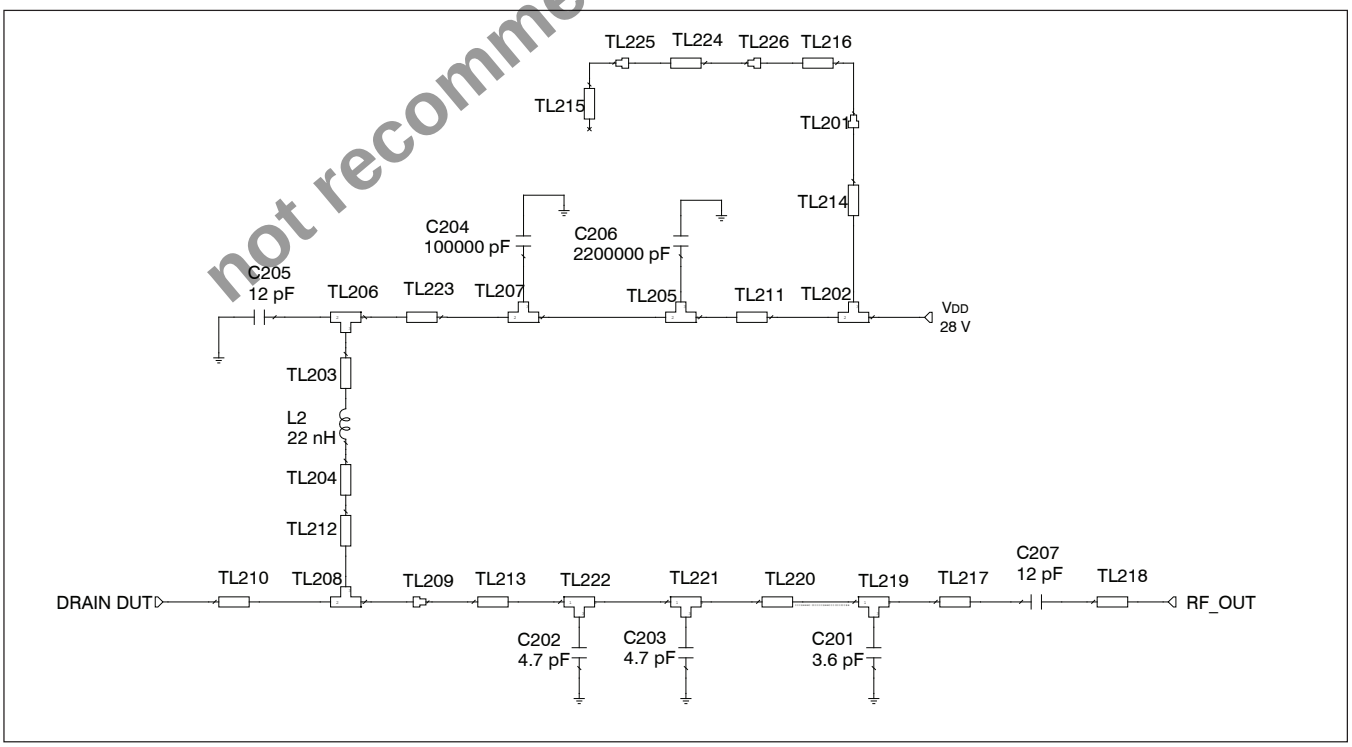




Reference Circuit, 1842 MHz



Reference circuit input schematic for ƒ = 1842 MHz



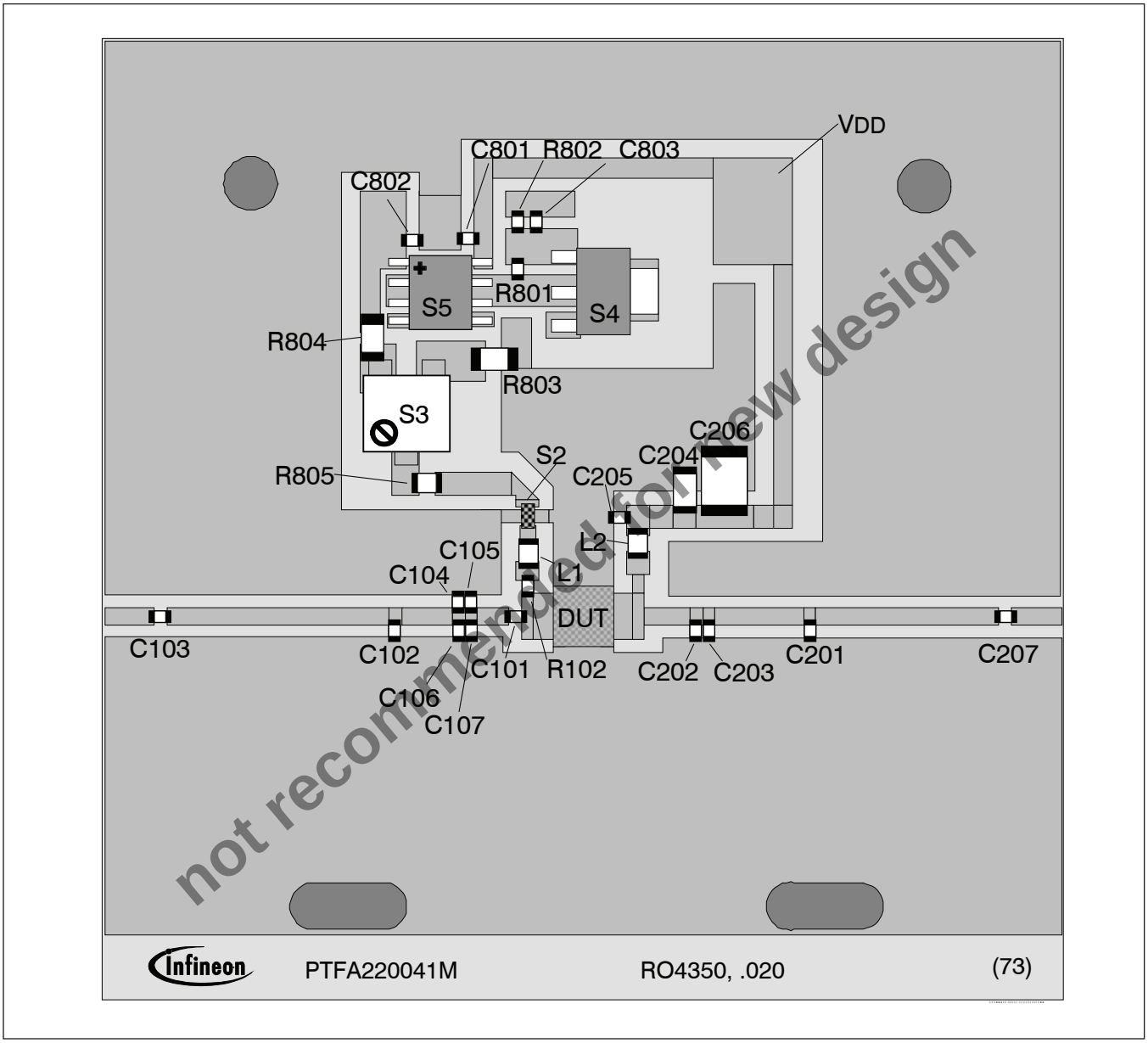
Reference circuit output schematic for ƒ = 1842 MHz

Reference Circuit, 1842 MHz (cont.)

Electrical Characteristics at 1842 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.005 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL102	0.021 λ, 51.98 Ω	W = 1.087, L = 2.108	W = 43, L = 83
TL103		W = 1.524	W = 60
TL104	0.019 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL105	0.052 λ, 41.75 Ω	W = 1.524, L = 5.08	W = 60, L = 200
TL106	0.013 λ, 41.75 Ω	W = 1.524, L = 1.27	W = 60, L = 50
TL107	0.015 λ, 54.17 Ω	W = 1.016, L = 1.524	W = 40, L = 60
TL108	0.033 λ, 51.98 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL109	0.149 λ, 51.98 Ω	W = 1.087, L = 14.681	W = 43, L = 578
TL110	0.034 λ, 51.98 Ω	W = 1.087, L = 3.378	W = 43, L = 133
TL111	0.008 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL112, TL113, TL115, TL116		W = 0, L = 0	W = 0, L = 0
TL114, TL 117		W1 = 1.087, W2 = 0.813, W3 = 1.087 W4 = 0.813	W1 = 43, W2 = 32, W3 = 43, W4 = 32
TL118		W1 = 3.048, W2 = 0.762, W3 = 3.048, W4 = 0.762	W1 = 120, W2 = 30, W3 = 120, W4 = 30
Output			
TL201, TL225, TL226		W1 = 0.025, W2 = 0.025	W1 = 1, W2 = 1
TL202	0.013 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.27	W1 = 60, W2 = 60, W3 = 50
TL203	0.005 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL204	0.016 λ, 41.75 Ω	W = 1.524, L = 1.524	W = 60, L = 60
TL205	0.039 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 3.81	W1 = 60, W2 = 60, W3 = 150
TL206, TL207	0.016 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.524	W1 = 60, W2 = 60, W3 = 60
TL208	0.008 λ, 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 0.762	W1 = 120, W2 = 120, W3 = 30
TL209		W = 1.087, W2 = 3.048	W = 43, W2 = 120
TL210	0.019 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL211	0.014 λ, 41.75 Ω	W = 1.524, L = 1.346	W = 60, L = 53
TL212	0.013 λ, 63.89 Ω	W = 0.762, L = 1.27	W = 30, L = 50
TL213	0.031 λ, 51.98 Ω	W = 1.087, L = 3.073	W = 43, L = 121
TL214	0.163 λ, 47.12 Ω	W = 1.27, L = 15.926	W = 50, L = 627
TL215	0.074 λ, 47.12 Ω	W = 1.27, L = 7.29	W = 50, L = 287
TL216	0.076 λ, 15.92 Ω	W = 5.283, L = 6.986	W = 208, L = 275
TL217	0.123 λ, 51.98 Ω	W = 1.087, L = 12.103	W = 43, L = 477
TL218	0.033 λ, 51.98 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL219, TL221, TL222	0.008 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL220	0.060 λ, 51.98 Ω	W = 1.087, L = 5.867	W = 43, L = 231
TL223	0.016 λ, 41.75 Ω	W = 1.524, L = 1.524	W = 60, L = 60
TL224	0.149 λ, 47.12 Ω	W = 1.27, L = 14.554	W = 50, L = 573

Reference Circuit, 1842 MHz (cont.)



Reference circuit assembly diagram (not to scale)

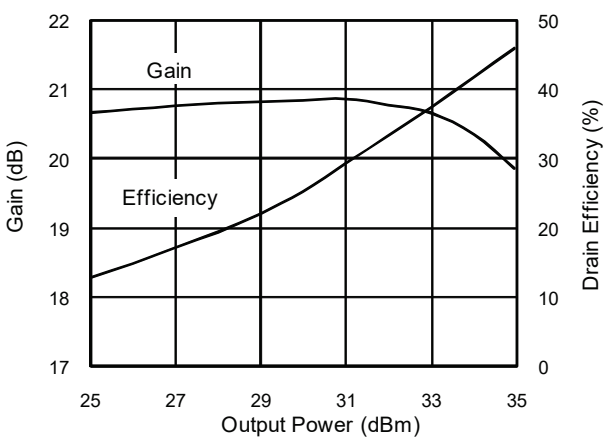
Reference Circuit, 1842 MHz (cont.)

Circuit Assembly Information			
DUT	PTFA220041M	LDMOS Transistor	
PCB	LTN/PTFA220041M	0.508 mm [.020"] thick, εr = 3.48	Rogers 4350, 1 oz. copper
Find Gerber files for this test fixture on the Infineon Web site at **www.infineon.com/rfpower**			

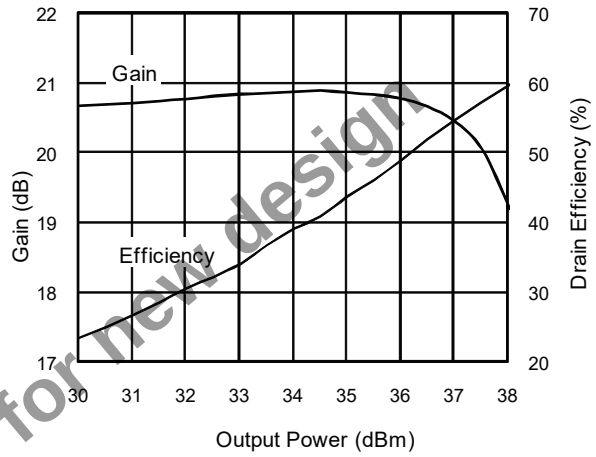
Component	Description	Manufacturer	P/N
Input			
C101	Chip capacitor, 6.2 pF	ATC	100A6R2CW150X
C102	Chip capacitor, 4.7 pF	ATC	100A4R7CW150X
C103	Chip capacitor, 12 pF	ATC	100A120JW150X
C104, C105, C106, C107	Chip capacitor, 7.5 pF	ATC	100A7R5CW150X
C801, C802, C803	Chip capacitor, 1.0 µF	Digi-Key	445-1411-2-ND
L1	Inductor, 22 nH	Coilcraft	0805HT-22NX_BG
R102, R805	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R801	Resistor, 1200 Ω	Digi-Key	P1.2KECT-ND
R802	Resistor, 1300 Ω	Digi-Key	P1.3KECT-ND
R803	Resistor, 500 Ω	Digi-Key	P500ECT-ND
R804	Resistor, 2000 Ω	Digi-Key	P2.0KECT-ND
S2	EMI Suppression Capacitor	Murata	NFM18PS105R0J3
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S4	Transistor	Infineon Technologies	BCP56
S5	Voltage regulator	National Semiconductor	LM7805
Output			
C201	Chip capacitor, 3.6 pF	ATC	100A3R6CW150X
C202, C203	Chip capacitor, 4.7 pF	ATC	100A4R7CW150X
C204	Chip capacitor, 0.1 µF	Digi-Key	PCC104BCT-ND
C205, C207	Chip capacitor, 12 pF	ATC	100A120JW150X
C206	Chip capacitor, 2.2 µF	Digi-Key	445-1447-2-ND
L2	Inductor, 22 nH	Coilcraft	0805HT-22NX_BG

Typical Performance, 940 MHz

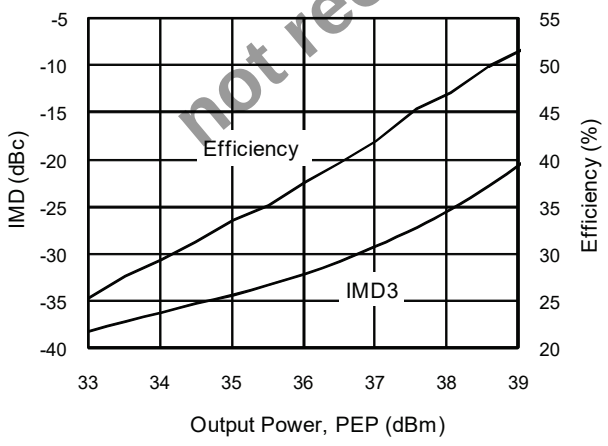
Two-carrier WCDMA 3GPP
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 940 MHz, 3GPP WCDMA, P/AR = 8:1, 10 MHz carrier spacing BW 3.84 MHz



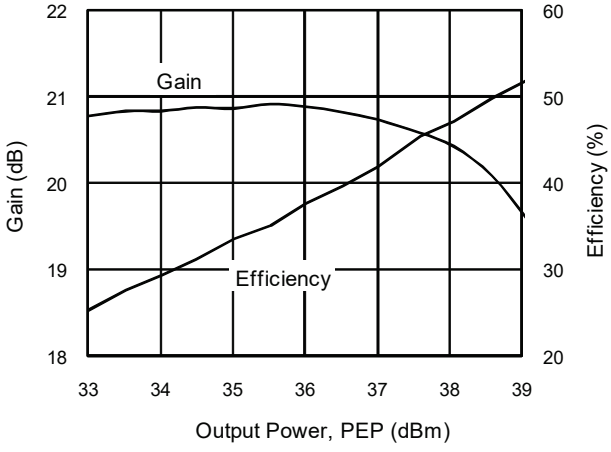
Power Sweep, CW
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 50 mA, f = 940 MHz



Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 50 mA,
f_1 = 939.9 MHz, f_2 = 940 MHz

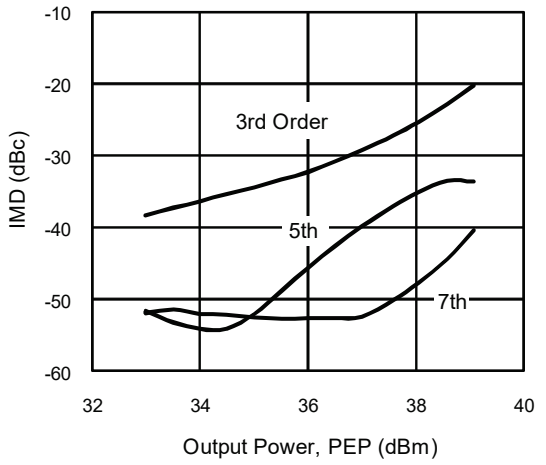


Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 50 mA,
f_1 = 939.9 MHz, f_2 = 940 MHz

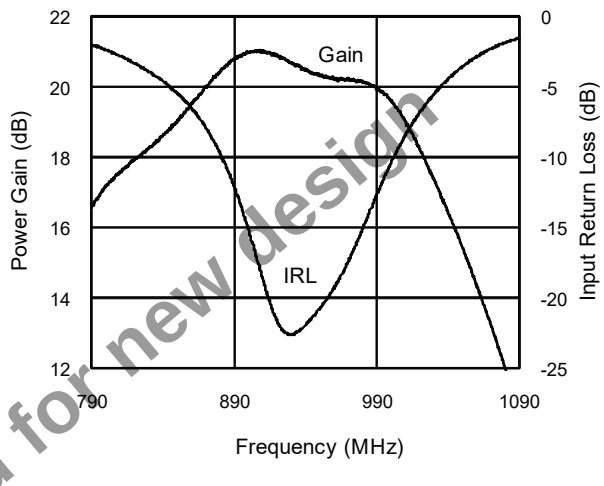


Typical Performance, 940 MHz (cont.)

Intermodulation Distortion vs. Output Power
V_{DD} = 28 V, I_{DQ} = 50 mA,
f_1 = 939.9 MHz, f_2 = 940 MHz

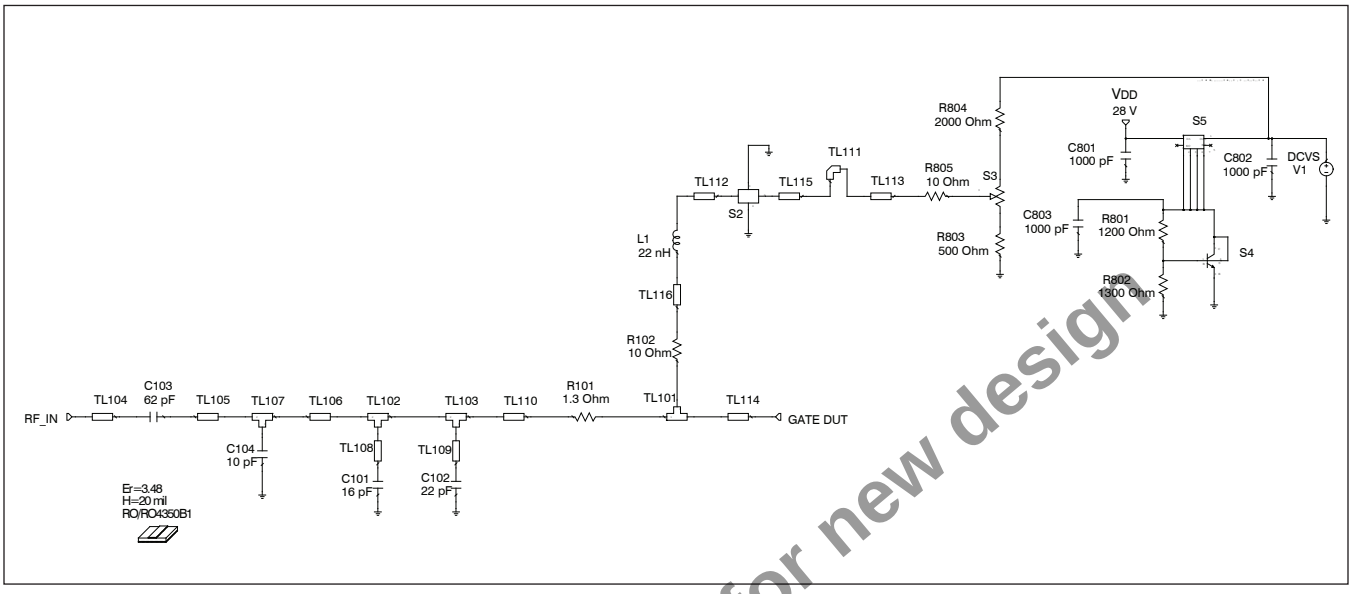


Small Signal CW Gain & Input Return Loss
V_{DD} = 28 V, I_{DQ} = 50 mA

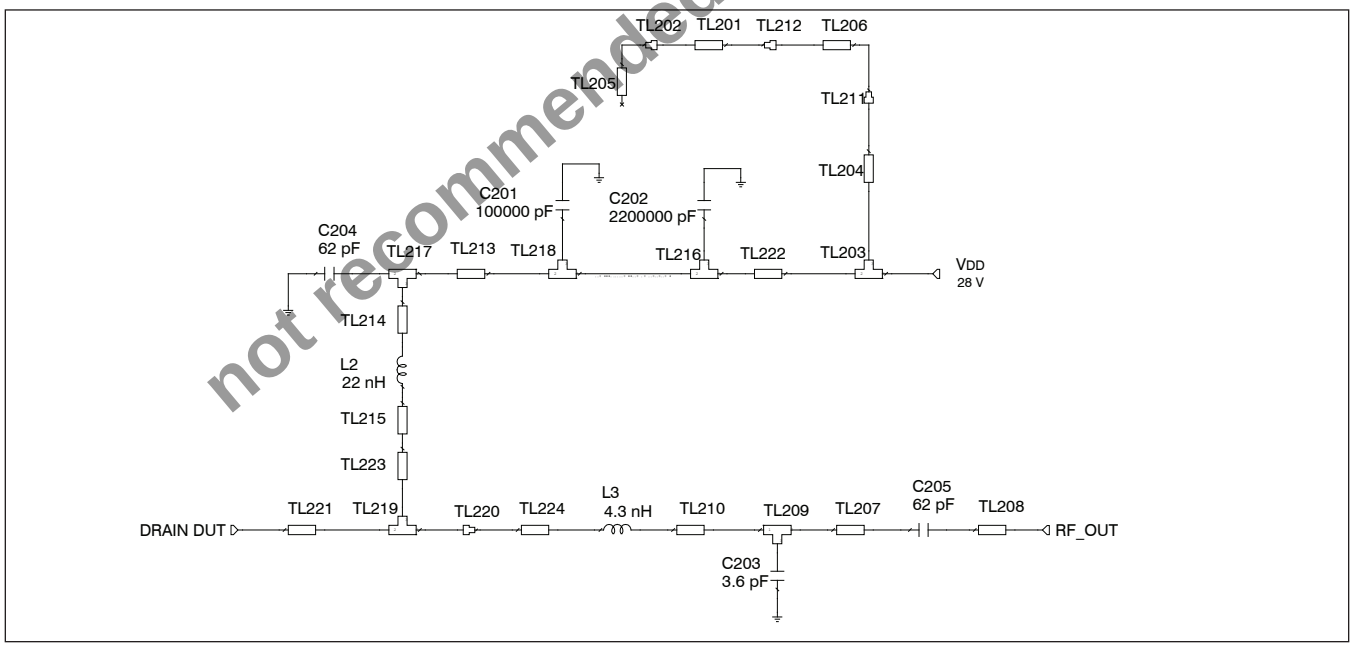


See reference circuit for 940 MHz, next page

Reference Circuit, 940 MHz



Reference circuit input schematic for ƒ = 940 MHz



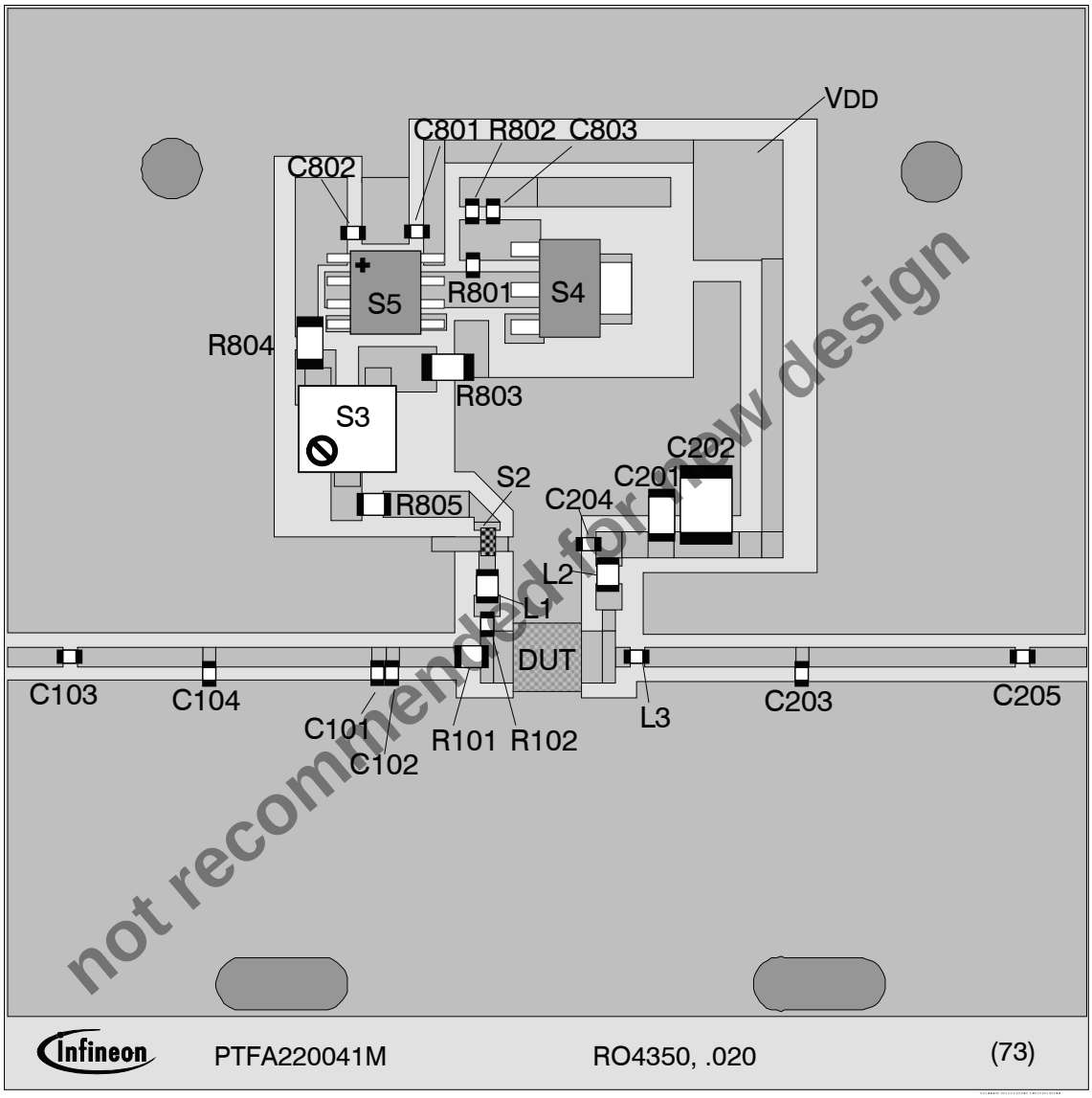
Reference circuit output schematic for ƒ = 940 MHz

Reference Circuit, 940 MHz (cont.)

Electrical Characteristics at 940 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.004 λ, 24.85 Ω	W1 = 3.048, W2 = 3.048, W3 =0.762	W1 = 120, W2 = 120, W3 = 30
TL102, TL103	0.004 λ, 51.66 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL104	0.017 λ, 51.66 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL105	0.038 λ, 51.66 Ω	W = 1.087, L = 7.341	W = 43, L = 289
TL106	0.047 λ, 51.66 Ω	W = 1.087, L = 9.144	W = 43, L = 360
TL107	0.004 λ, 51.66 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.762,	W1 = 43, W2 = 43, W3 = 30
TL108, TL109	0.000 λ, 144.28 Ω	W = 0.025, L = 0.000	W = 1, L = 0
TL110	0.019 λ, 51.66 Ω	W = 1.087, L = 3.734	W = 43, L = 147
TL111		W = 1.524	W = 60
TL112	0.008 λ, 53.85 Ω	W = 1.016, L = 1.524	W = 40, L = 60
TL113	0.027 λ, 41.47 Ω	W = 1.524, L = 5.080	W = 60, L = 200
TL114	0.010 λ, 24.85 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL115	0.003 λ, 41.47 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL116	0.007 λ, 41.47 Ω	W = 1.524, L = 1.270	W = 60, L = 50
Output			
TL201	0.076 λ, 46.82 Ω	W = 1.270, L = 14.554	W = 50, L = 573
TL202		W1 = 0.025, W2 = 0.025	W1 = 1, W2 = 1
TL203	0.007 λ, 41.47 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.270	W1 = 60, W2 = 60, W3 = 50
TL204	0.083 λ, 46.82 Ω	W = 1.270, L = 15.927	W = 50, L = 627
TL205	0.038 λ, 46.82 Ω	W = 1.270, L = 7.290	W = 50, L = 287
TL206	0.039 λ, 15.79 Ω	W = 5.283, L = 6.986	W = 208, L = 275
TL207	0.063 λ, 51.66 Ω	W = 1.087, L = 12.103	W = 43, L = 477
TL208	0.017 λ, 51.66 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL209	0.004 λ, 51.66 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL210	0.046 λ, 51.66 Ω	W =1.087, L = 8.852	W = 43, L = 349
TL211, TL212		W1 = 0.025, W2 = 0.025	W1 = 1, W2 = 1
TL213, TL215	0.008 λ, 41.47 Ω	W = 1.524, L = 1.524	W = 60, L = 60
TL214	0.003 λ, 41.47 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL216	0.020 λ, 41.47 Ω	W1 = 1.524, W2 = 1.524, W3 = 3.810	W1 = 60, W2 = 60, W3 = 150
TL217, TL218	0.008 λ, 41.47 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.524	W1 = 60, W2 = 60, W3 = 60
TL219	0.004 λ, 24.85 Ω	W1 = 3.048, W2 = 3.048, W3 = 0.762	W1 = 120, W2 = 120, W3 = 30
TL220		W1 = 1.087, W2 = 3.048	W1 = 43, W2 = 120
TL221	0.010 λ, 24.85 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL222	0.007 λ, 41.47 Ω	W = 1.524, L = 1.346	W = 60, L = 53
TL223	0.007 λ, 63.55 Ω	W = 0.762, L = 1.270	W = 30, L = 50
TL224	0.004 λ, 51.66 Ω	W = 1.087, L = 0.851	W = 43, L = 33

Reference Circuit, 940 MHz (cont.)



Reference circuit assembly diagram (not to scale)

Reference Circuit, 940 MHz (cont.)

Circuit Assembly Information

DUT	PTFA220041M	LDMOS Transistor	
PCB	LTN/PTFA220041M–9	0.508 mm [.020"] thick, εr = 3.48	Rogers 4350, 1 oz. copper

Find Gerber files for this test fixture on the Infineon Web site at **www.infineon.com/rfpower**

Component	Description	Supplier	P/N
Input			
C101	Chip capacitor, 16 pF	ATC	100A160JW150X
C102	Chip capacitor, 22 pF	ATC	100A220JW150X
C103	Chip capacitor, 62 pF	ATC	100A620JW150X
C104	Chip capacitor, 10 pF	ATC	100A100JW150X
C801, C802, C803	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
L1	Inductor, 22 nH	Coilcraft	0805HT-22NX_BG
R101	Resistor, 1.3 Ω	Digi-Key	P1.3ECT-ND
R102, R805	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R801	Resistor, 1200 Ω	Digi-Key	P1.2KECT-ND
R802	Resistor, 1300 Ω	Digi-Key	P1.3KECT-ND
R803	Resistor, 500 Ω	Digi-Key	P5.0KECT-ND
R804	Resistor, 2000 Ω	Digi-Key	P2.0KECT-ND
S2	EMI Suppression Capacitor	Murata	NFM18PS105R0J3
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S4	Transistor	Infineon Technologies	BCP56
S5	Voltage Regulator	National Semiconductor	LM7805
Output			
C201	Chip capacitor, 0.1 µF	Digi-Key	PCC104BCT-ND
C202	Chip capacitor, 2.2 µF	Digi-Key	445-1447-2-ND
C203	Chip capacitor, 3.6 pF	ATC	100A3R6CW150X
C204, C205	Chip capacitor, 62 pF	ATC	100A620JW150X
L2	Inductor, 22 nH	Coilcraft	0805HT-22NX_BG
L3	Inductor, 4.3 nH	Coilcraft	0603CS-4N3X_BG

Package Outline Specifications

Package PG-SON-10

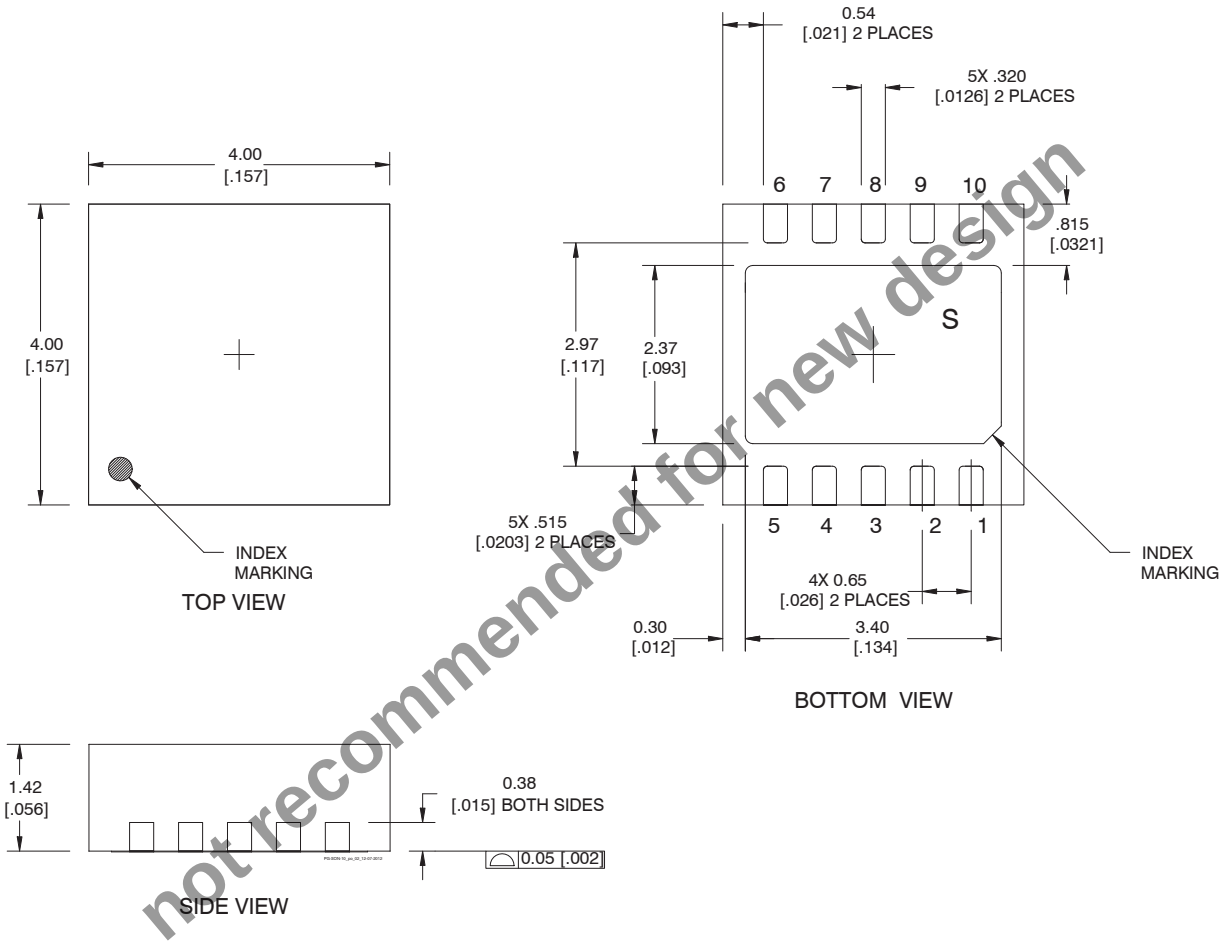


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994
2. Primary dimensions are mm; alternate dimensions are inches
3. All tolerances ± 0.1 [.004]
4. Package dimension: 4.00 mm x 4.00 mm x 1.42 mm
5. Pins: S source; 1 – 5 gate, 6 - 10 = drain
6. NiPdAu plating (gold top layer): 0.025 – 0.127 micron [1 – 5 microinch]

Find the latest and most complete information about products and packaging at the Infineon Internet page
http://www.infineon.com/rfpower

Revision History

Revision	Date	Data Sheet	Page	Subjects (major changes at each revision)
01	2008-12-16	Advance	all	Advance Specifications for product in development.
02	2009-06-19	Advance	1, 2, 3	Refine RF characteristics. Add package information (still preliminary).
03	2009-08-03	Advance	1 – 3	Update package information.
04	2009-11-03	Production	all	Firm specifications for this released product, including reference circuit and complete package outline information.
05	2009-18-18	Production	11 – 16	Add 940 MHz performance and reference circuit information.
06	2010-01-19	Production	2	Review and update specifications.
07	2010-04-15	Production	2	Add moisture sensitivity table.
08	2010-06-07	Production	6	Revise broadband circuit impedance.
09	2011-04-01	Production	1 5, 12	Update ESD information Remove CW performance graphs
10	2016-03-17	Production	2	Add current shipping and ordering information. Operating gate voltage adjusted.
10.1	2016-06-01	Production	all, 18	Add revision state to footer, Correct product version to V4
11	2018-02-23	Production	All	Not recommended for new design

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