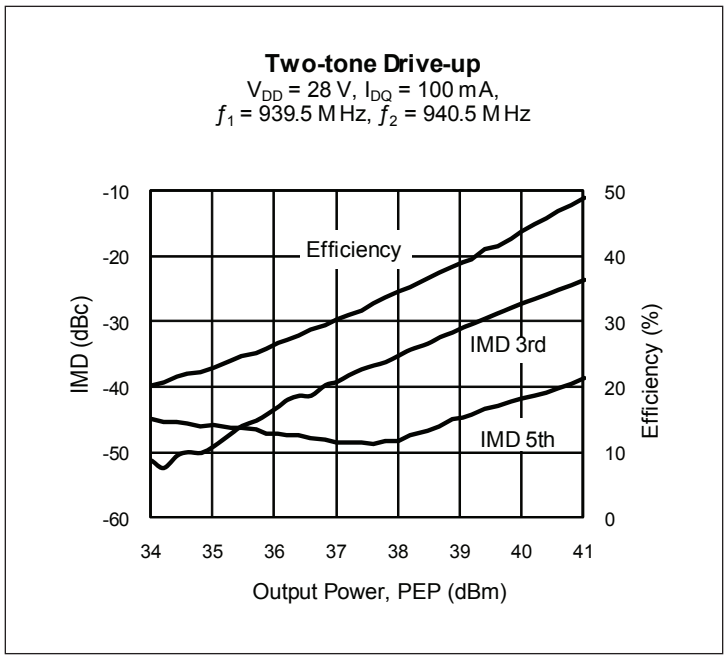
High Power RF LDMOS Field Effect Transistor
8 W, 700 – 2200 MHz

Description

The PTFA220081M an unmatched 8-watt LDMOS FET suitable for power amplifiers applications with frequencies from 700 MHz to 2200 MHz. This LDMOS transistor offers excellent gain, efficiency and linearity performance in a small overmolded plastic package.

PTFA220081M
Package PG-SON-10



Features

- Typical two-carrier WCDMA performance, 8 dB PAR
  - P_{OUT} = 33 dBm Avg
  - ACPR = –40 dBc
- Typical CW performance, 940 MHz, 28 V
  - P_{OUT} = 40 dBm
  - Efficiency = 59%
  - Gain = 20 dB
- Typical CW performance, 2140 MHz, 28 V
  - P_{OUT} = 40 dBm
  - Efficiency = 50%
  - Gain = 15 dB
- Capable of handling 10:1 VSWR @ 28 V, 8 W (CW) output power
- Integrated ESD protection : Human Body Model, Class 2 (minimum)
- 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} = 100 mA, P_{OUT} = 8 W PEP, f = 2140 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	17	—	dB
Drain Efficiency	ηD	—	38	—	%
Intermodulation Distortion	IMD	—	–31	—	dBc

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} = 100 mA, P_{OUT} = 8 W PEP, f = 940 MHz, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	20.7	—	dB
Drain Efficiency	ηD	—	39	—	%
Intermodulation Distortion	IMD	—	–30	—	dBc
Input Return Loss	IRL	—	20	—	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	$R_{DS(on)}$	—	1.10	—	Ω
Operating Gate Voltage	V_{DS} = 28 V, I_{DQ} = 100 mA	V_{GS}	2.0	2.5	3.0	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}	–65 to +150	°C
Thermal Resistance (TCASE = 70°C, 8 W DC)	$R_{\theta JC}$	4.2	°C/W

Moisture Sensitivity Level

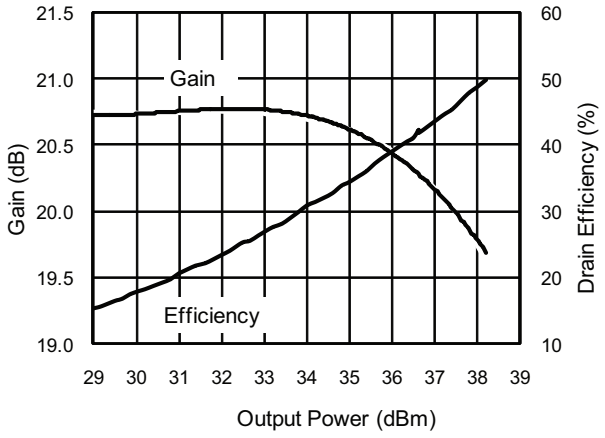
Level	Test Standard	Package Temperature	Unit
3	IPC/JEDEC J-STD-020	260	°C

Ordering Information

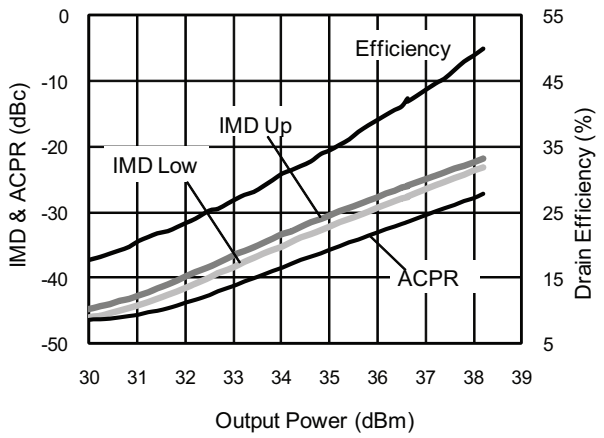
Type	Package Outline	Package Description	Shipping
PTFA220081M V4	PG-SON-10	Molded plastic, SMD	Tape & Reel, 500 pcs

Typical Performance, 940 MHz

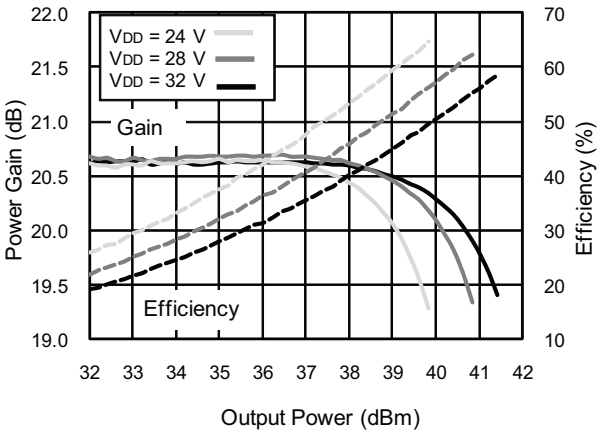
Two-carrier WCDMA 3GPP
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 940 MHz
3GPP WCDMA, P/AR = 8:1, 10 MHz carrier spacing, BW 3.84 MHz



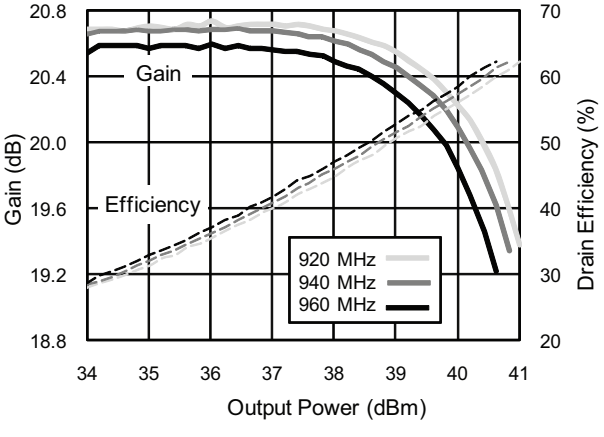
Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 940 MHz
3GPP WCDMA, P/AR = 8:1, 10 MHz carrier spacing, BW 3.84 MHz



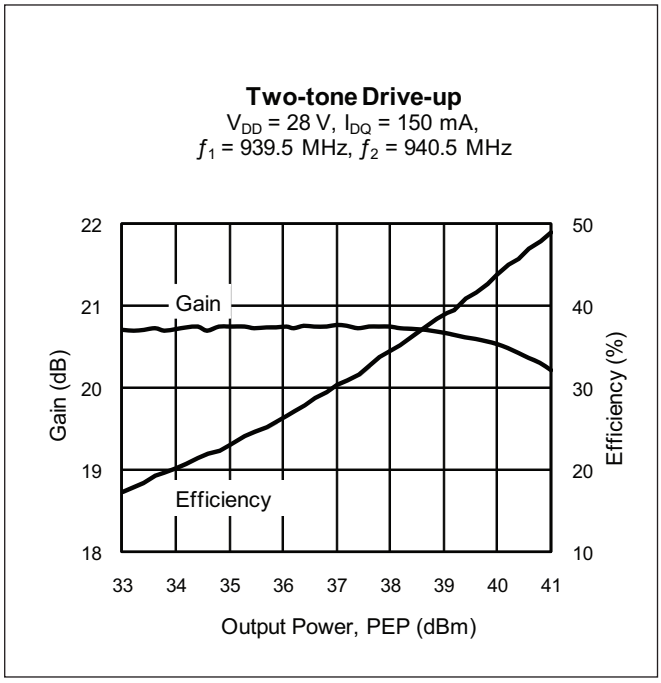
CW
Gain & Efficiency vs. Output Power & V_{DD}
I_{DQ} = 100 mA, f = 940 MHz

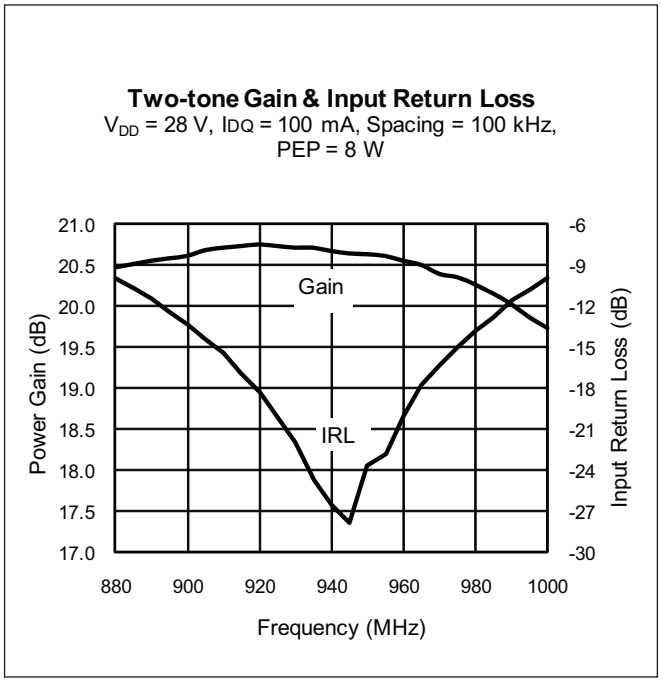


Power Sweep, CW
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 100 mA

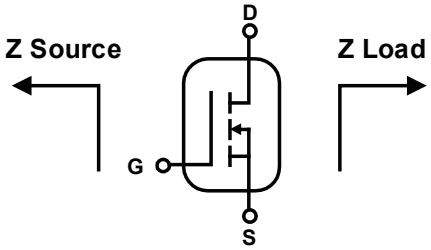


Typical Performance, 940 MHz (cont.)

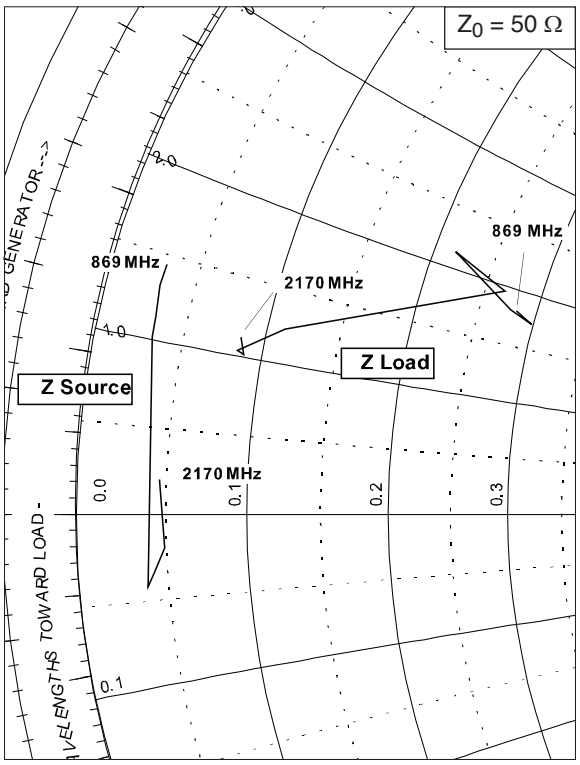




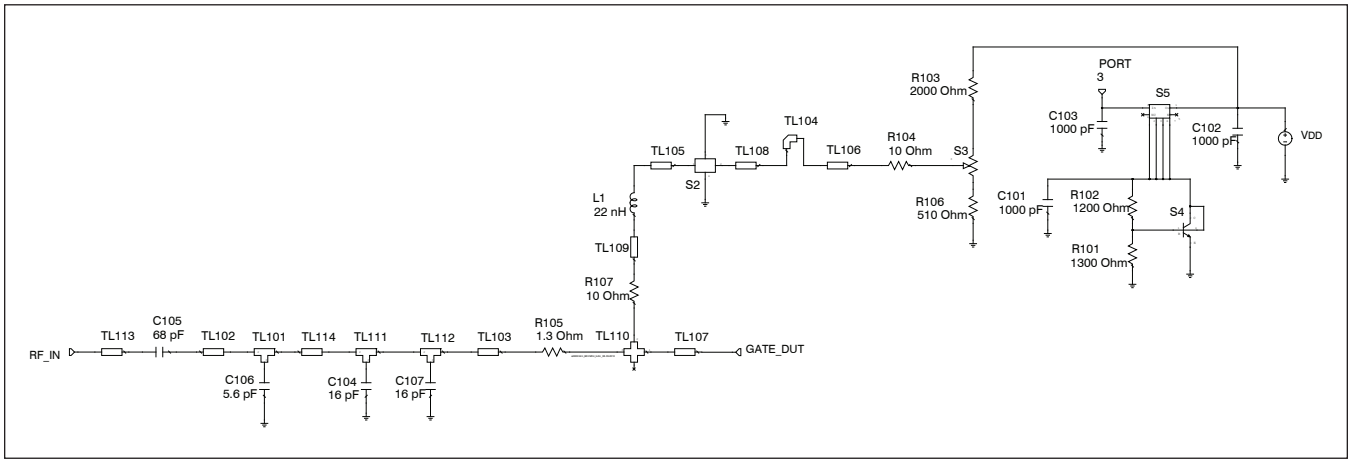
Broadband Circuit Impedance



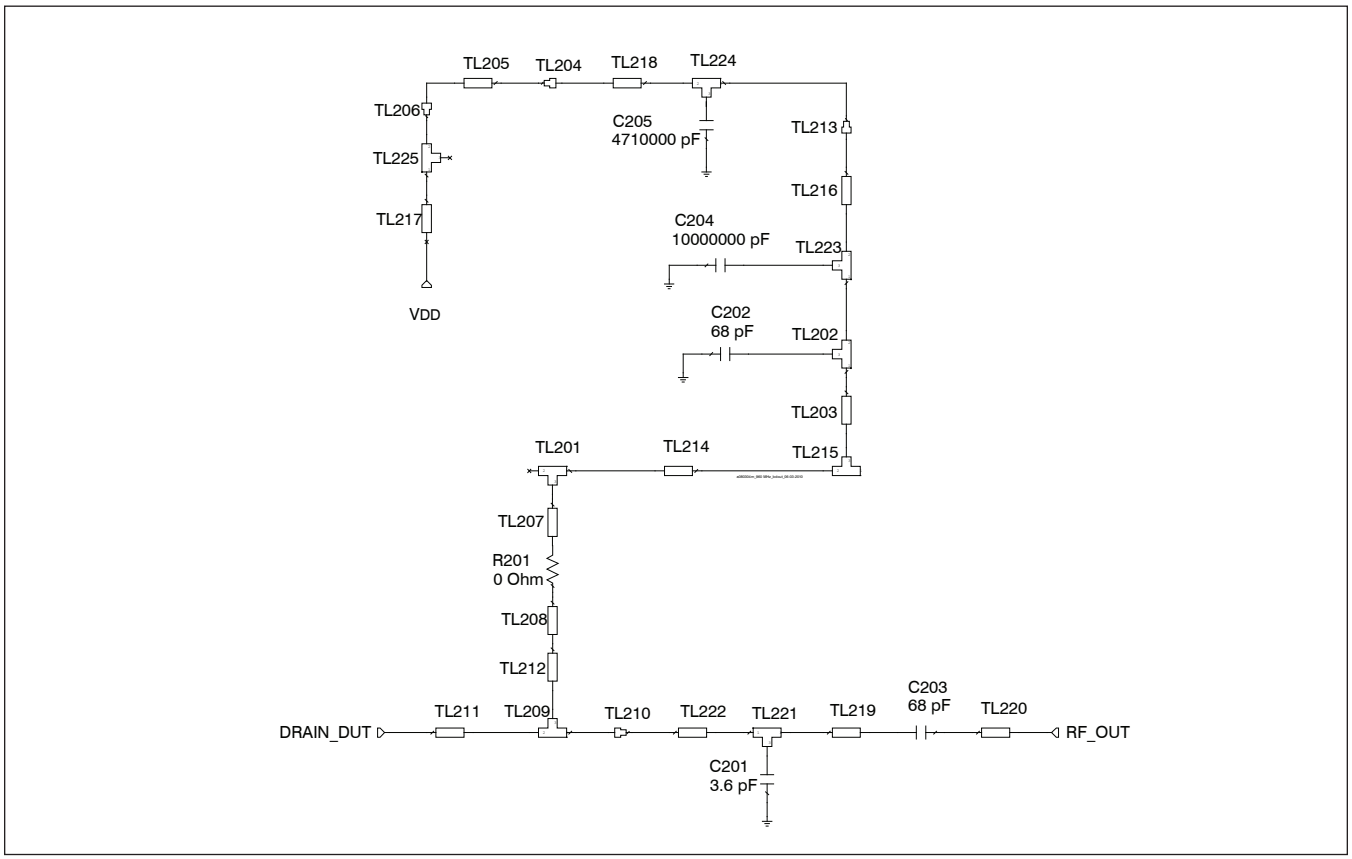
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
869	1.54	7.20	14.11	9.10
894	1.49	6.60	14.91	8.70
920	1.59	5.70	13.83	9.10
940	1.61	5.10	10.83	10.70
960	1.61	5.10	13.34	9.80
1930	1.91	–2.10	5.59	6.20
1990	2.11	–1.70	4.21	5.20
2110	2.45	–1.00	4.43	5.10
2170	2.30	–1.00	4.25	5.60



Reference Circuit, 920 – 960 MHz



Reference circuit input schematic for ƒ = 920 – 960 MHz



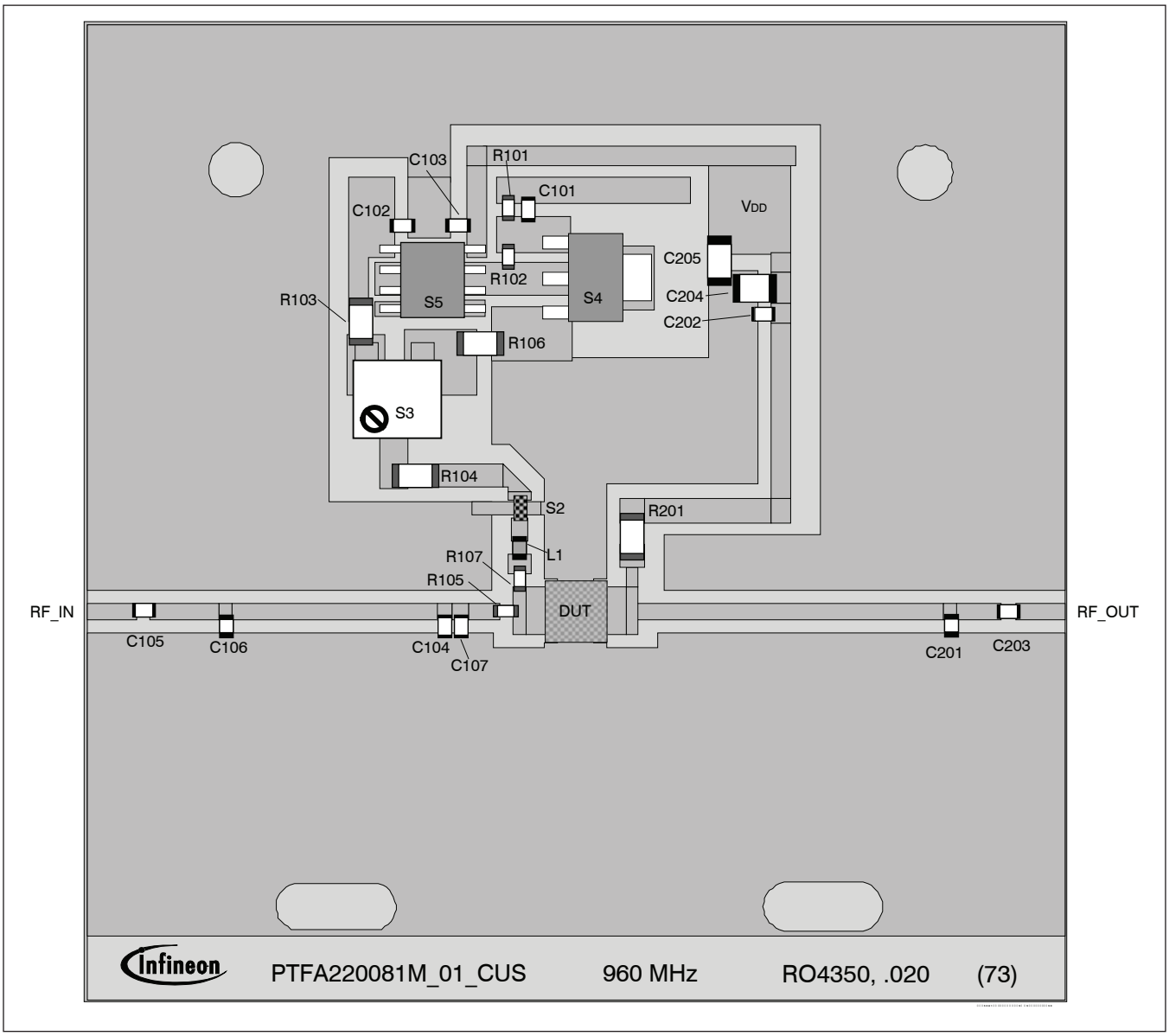
Reference circuit output schematic for ƒ = 920 – 960 MHz

Reference Circuit, 920 – 960 MHz (cont.)

Electrical Characteristics at 960 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.004 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL102	0.024 λ, 51.98 Ω	W = 1.087, L = 4.445	W = 43, L = 175
TL103	0.011 λ, 51.98 Ω	W = 1.087, L = 2.057	W = 43 L = 81
TL104		W = 1.524	W = 60
TL105	0.008 λ, 54.17 Ω	W = 1.016, L = 1.524	W = 40, L = 60
TL106	0.027 λ, 41.75 Ω	W = 1.524, L = 5.080	W = 60, L = 200
TL107	0.010 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL108	0.003 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL109	0.007 λ, 41.75 Ω	W = 1.524, L = 1.270	W = 60, L = 50
TL110		W1 = 3.048, W2 = 0.762, W3 = 3.048, W4 = 0.762	W1 = 120, W2 = 30, W3 = 120, W4 = 30
TL111, TL112	0.005 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 1.016	W1 = 43, W2 = 43, W3 = 40
TL113	0.017 λ, 51.98 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL114	0.070 λ, 51.98 Ω	W = 1.087, L = 13.259	W = 43, L = 522
Output			
TL201	0.008 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.524	W1 = 60, W2 = 60, W3 = 60
TL202, TL225	0.007 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.270	W1 = 50, W2 = 50, W3 = 50
TL203	0.060 λ, 47.12 Ω	W = 1.270, L = 11.361	W = 50, L = 447
TL204		W1 = 0.020, W2 = 0.020, Offset = 0.007	W1 = 20, W2 = 780, Offset = 280
TL205	0.007 λ, 4.74 Ω	W = 20.119, L = 1.270	W = 792, L = 50
TL206		W1 = 0.001, W2 = 0.001, Offset = 0.011	W1 = 1, W2 = 50, Offset = 416
TL207	0.003 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL208	0.008 λ, 41.75 Ω	W = 1.524, L = 1.524	W = 60, L = 60
TL209	0.004 λ, 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 0.762	W1 = 120, W2 = 120, W3 = 30
TL210		W1 = 1.087, W2 = 3.048	W1 = 43, W2 = 120
TL211	0.010 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL212	0.007 λ, 63.89 Ω	W = 0.762, L = 1.270	W = 30, L = 50
TL213		W1 = 0.001, W2 = 0.005, Offset = -0.002	W1 = 1, W2 = 208, Offset = -79
TL214	0.044 λ, 41.75 Ω	W = 1.524, L = 8.204	W = 60, L = 323
TL215	0.007 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.270	W1 = 60, W2 = 60, W3 = 50
TL216	0.007 λ, 47.12 Ω	W = 1.270, L = 1.267	W = 50, L = 50
TL217	0.032 λ, 47.12 Ω	W = 1.270, L = 5.918	W = 50, L = 233
TL218	0.032 λ, 15.92 Ω	W = 5.283, L = 5.687	W = 208, L = 224
TL219	0.016 λ, 51.98 Ω	W = 1.087, L = 2.946	W = 43, L = 116
TL220	0.017 λ, 51.98 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL221	0.004 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.813	W1 = 43, W2 = 43, W3 = 32
TL222	0.104 λ, 51.98 Ω	W = 1.087, L = 19.736	W = 43, L = 777
TL223	0.011 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 2.032	W1 = 50, W2 = 50, W3 = 80
TL224	0.000 λ, 144.35 Ω	W1 = 0.025, W2 = 0.025, W3 = 0.025	W1 = 1, W2 = 1, W3 = 1

Reference Circuit, 920 – 960 MHz (cont.)



*Reference circuit assembly diagram (not to scale)**

** Gerber Files for this circuit available on request*

Reference Circuit, 920 – 960 MHz (cont.)

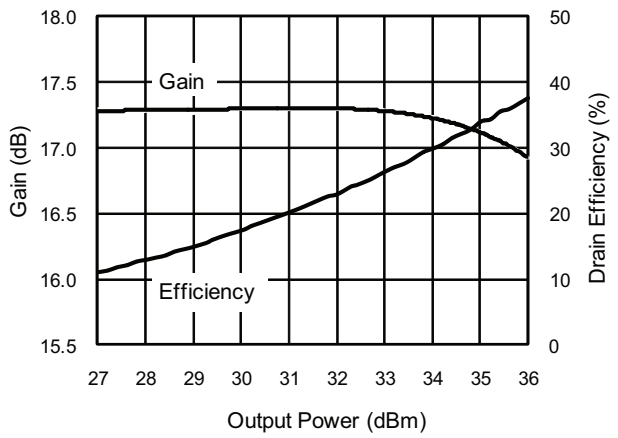
Circuit Assembly Information

DUT	PTFA220081M	LDMOS Transistor	
PCB	LTN/PTFA220081M–9	0.508 mm [.020"] thick, εr = 3.48	Rogers 4350, 1 oz. copper

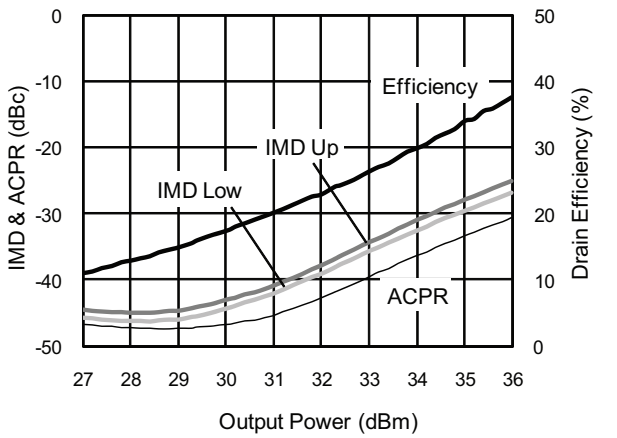
Component	Description	Suggested Manufacturer	P/N
Input			
C101, C102, C103	Chip capacitor, 1000 pF	Digi-Key	PCC1772CT-ND
C104, C107	Chip capacitor, 16 pF	ATC	ATC100A160JW150X
C105	Chip capacitor, 68 pF	ATC	ATC100A680JW150X
C106	Chip capacitor, 5.6 pF	ATC	ATC100A5R6CW150X
L1	Inductor, 22 nH	ATC	ATC0805WL22JT
R101	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
R102	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
R103	Resistor, 2000 Ω	Digi-Key	P2.0KECT-ND
R104	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R105	Resistor, 1.3 Ω	Digi-Key	P1.3GET-ND
R106	Resistor, 510 Ω	Digi-Key	P510ECT-ND
R107	Resistor, 10 Ω	Digi-Key	P10GCT-ND
S2	EMI filter, 2 - 4 A, 0.1 - 2.2 μF	Murata	NFM18PS105R0J3
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S4	Transistor	Digi-Key	BCP56
S5	Voltage Regulator	National Semiconductor	LM7805
Output			
C201	Chip capacitor, 3.6 pF	ATC	ATC100A3R6CW150X
C202, C203	Chip capacitor, 68 pF	ATC	ATC100A680JW150X
C204	Capacitor, 10 μF	Digi-Key	587-1352-1-ND
C205	Chip capacitor, 4.71 μF	Digi-Key	PCS3475CT-ND
R201	Resistor, 0 Ω	Digi-Key	P0.0ECT-ND

Typical Performance, 2140 MHz

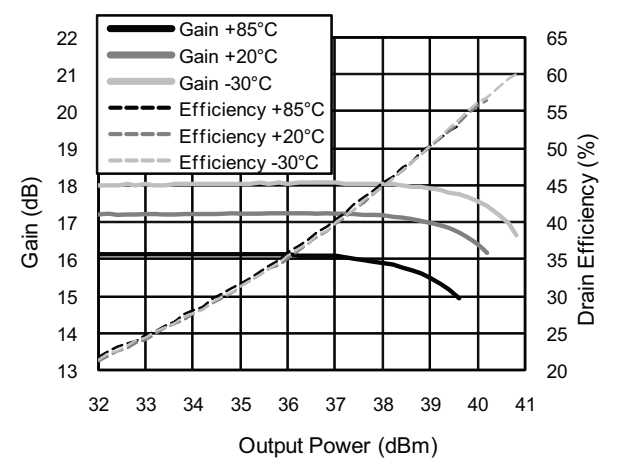
Two-carrier WCDMA 3GPP
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 2140 MHz,
3GPP WCDMA, P/AR = 8:1,
10 MHz carrier spacing, BW 3.84 MHz



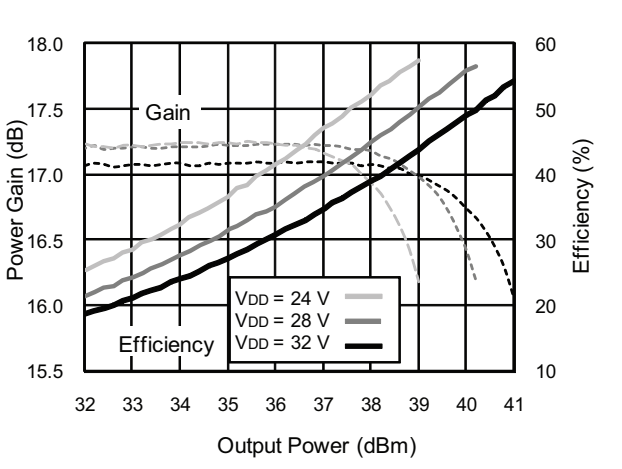
Two-carrier WCDMA 3GPP Drive-up
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 2140 MHz
3GPP WCDMA, P/AR = 8:1,
10 MHz carrier spacing, BW 3.84 MHz



CW
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 2140 MHz

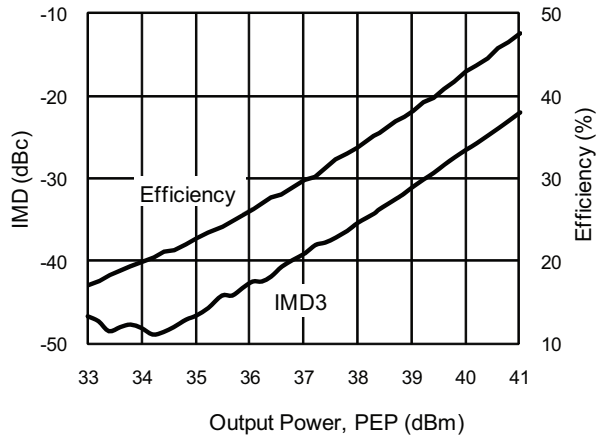


CW
Gain & Effciency vs. Output Power & V_{DD}
I_{DQ} = 100 mA, f = 2140 MHz

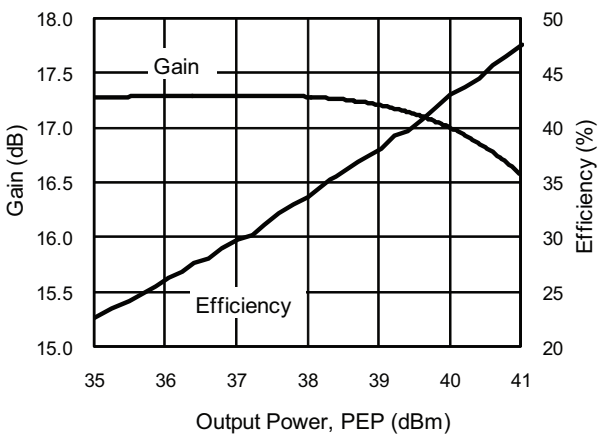


Typical Performance, 2140 MHz (cont.)

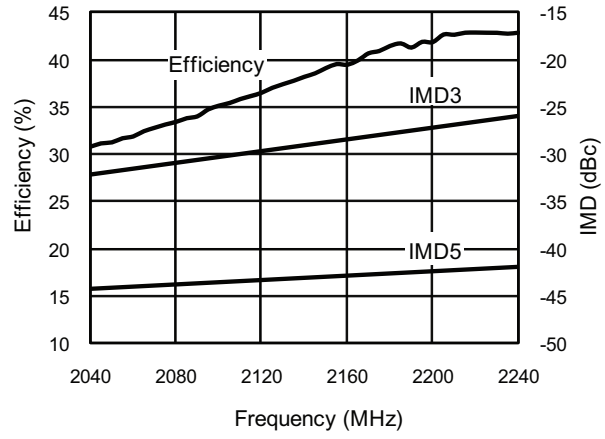
Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 100 mA,
f_1 = 2139.5 MHz, f_2 = 2140.5 MHz



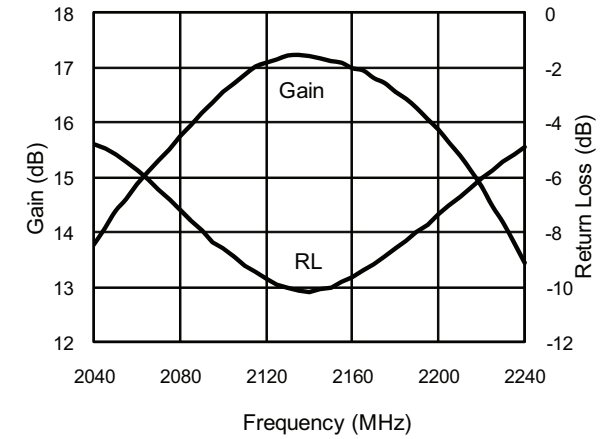
Two-tone Drive-up
V_{DD} = 28 V, I_{DQ} = 100 mA,
f_1 = 2139.5 MHz, f_2 = 2140.5 MHz



Two-tone Broadband
Efficiency & IMD vs. Frequency
V_{DD} = 28 V, I_{DQ} = 100 mA, Average PEP = 8 W,
Spacing = 100 kHz

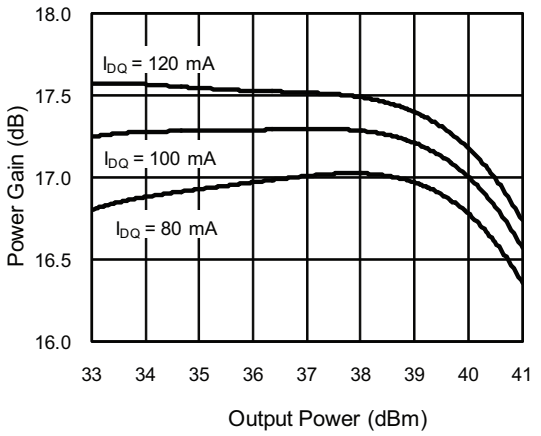


Two-tone Broadband
Gain & Return Loss vs. Frequency
V_{DD} = 28 V, I_{DQ} = 100 mA, Average PEP = 8 W,
Spacing = 100 kHz

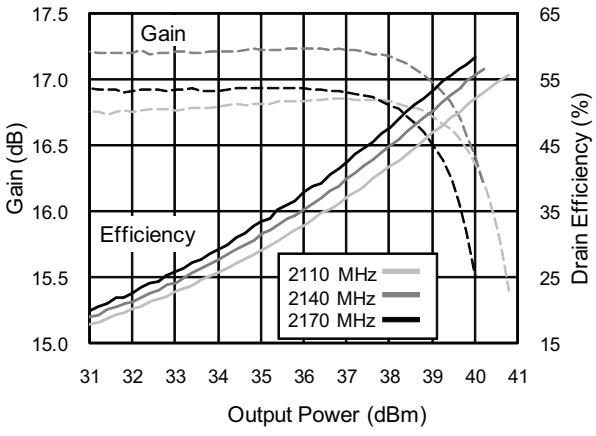


Typical Performance, 2140 MHz (cont.)

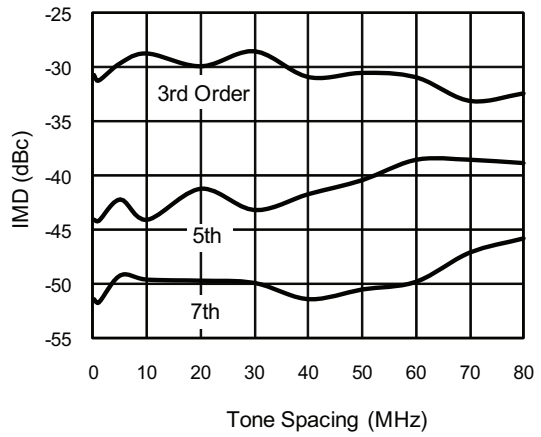
Two-tone Gain vs. Output Power
V_{DD} = 28 V, f_1 = 2139.5 MHz, f_2 = 2140.5 MHz



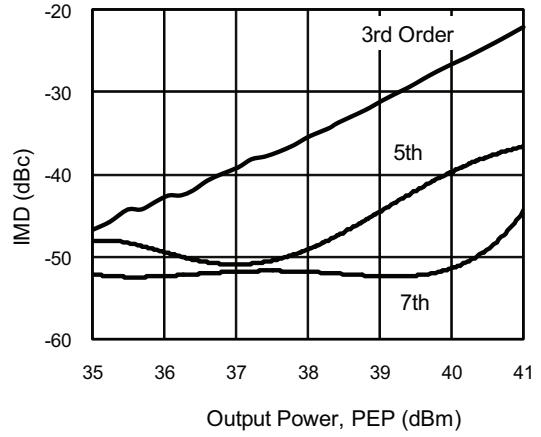
Power Sweep, CW
Gain & Efficiency vs. Output Power
V_{DD} = 28 V, I_{DQ} = 100 mA



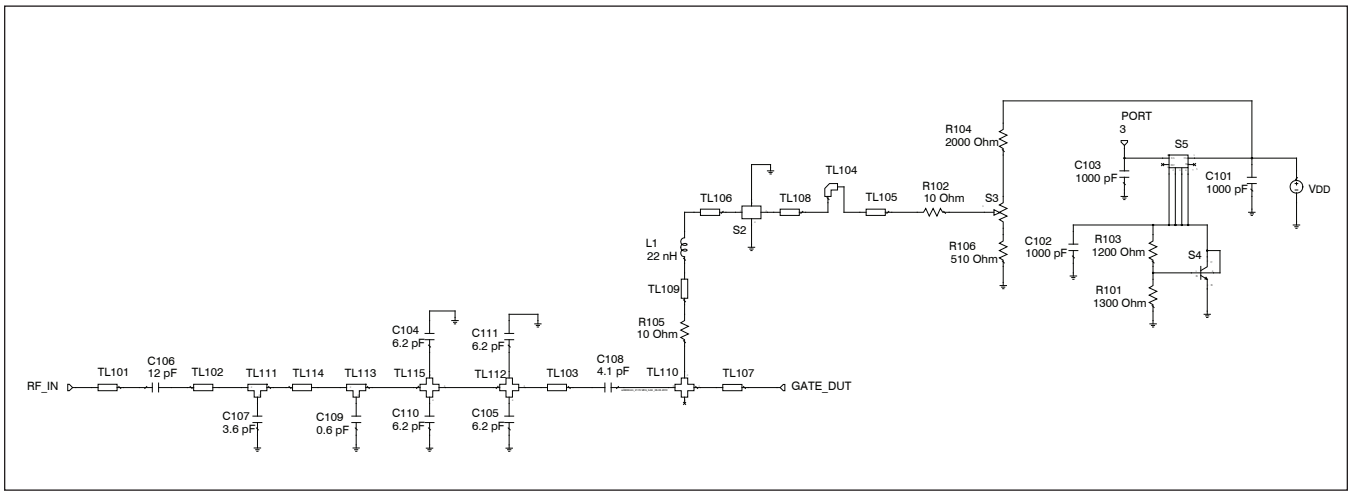
Intermodulation Distortion vs.
Tone Spacing
V_{DD} = 28 V, I_{DQ} = 100 mA, f = 2140 MHz,
PEP = 8 W



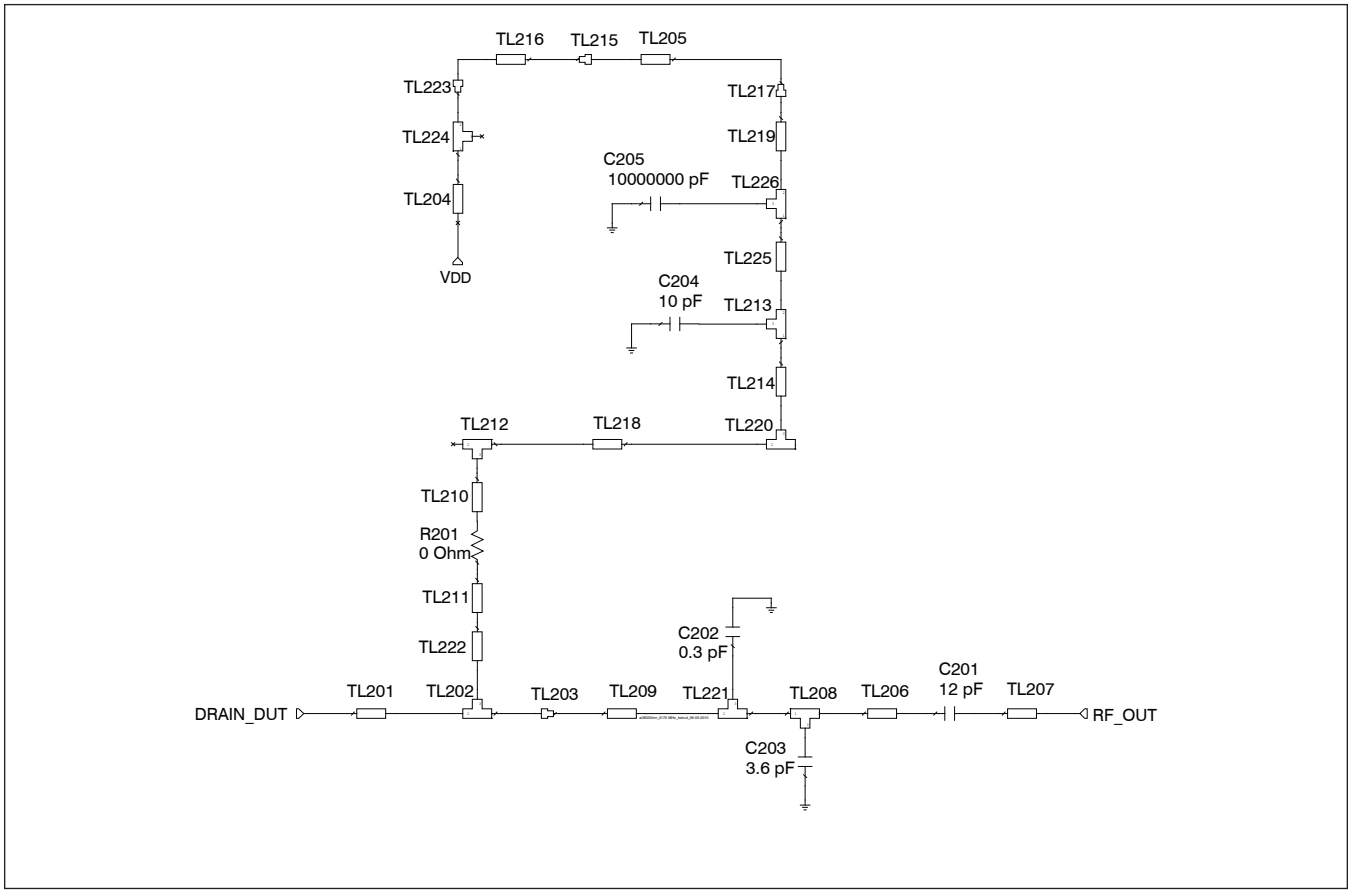
Intermodulation Distortion vs.
Output Power
V_{DD} = 28 V, I_{DQ} = 100 mA,
f_1 = 2139.5 MHz, f_2 = 2140.5 MHz



Reference Circuit, 2110 – 2170 MHz



Reference circuit input schematic for ƒ = 2110 – 2170 MHz



Reference circuit output schematic for ƒ = 2110 – 2170 MHz

Reference Circuit, 2110 – 2170 MHz (cont.)

Electrical Characteristics at 2170 MHz

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
Input			
TL101	0.054 λ, 51.98 Ω	W = 1.087, L = 4.509	W = 43, L = 178
TL102	0.150 λ, 51.98 Ω	W = 1.087, L = 12.548	W = 43, L = 494
TL103	0.027 λ, 51.98 Ω	W = 1.087, L = 2.261	W = 43, L = 89
TL104		W = 1.524	W = 60
TL105	0.062 λ, 41.75 Ω	W = 1.524, L = 5.080	W = 60, L = 200
TL106	0.018 λ, 54.17 Ω	W = 1.016, L = 1.524	W = 40, L = 60
TL107	0.022 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL108	0.006 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL109	0.015 λ, 41.75 Ω	W = 1.524, L = 1.270	W = 60, L = 50
TL110		W1 = 3.048, W2 = 0.762, W3 = 3.048, W4 = 0.762	W1 = 120, W2 = 30, W3 = 120, W4 = 30
TL111, TL113	0.012 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 1.016	W1 = 43, W2 = 43, W3 = 40
TL112		W1 = 1.087, W2 = 1.016, W3 = 1.087, W4 = 1.016	W1 = 43, W2 = 40, W3 = 43, W4 = 40
TL114	0.028 λ, 51.98 Ω	W = 1.087, L = 2.311	W = 43, L = 91
TL115		W1 = 1.087, W2 = 1.016, W3 = 1.087, W4 = 1.016	W1 = 43, W2 = 40, W3 = 43, W4 = 40
Output			
TL201	0.022 λ, 25.04 Ω	W = 3.048, L = 1.778	W = 120, L = 70
TL202	0.010 λ, 25.04 Ω	W1 = 3.048, W2 = 3.048, W3 = 0.762	W1 = 120, W2 = 120, W3 = 30
TL203		W1 = 1.087, W2 = 3.048	W1 = 43, W2 = 120
TL204	0.071 λ, 47.12 Ω	W = 1.270, L = 5.918	W = 50, L = 233
TL205	0.072 λ, 15.92 Ω	W = 5.283, L = 5.687	W = 208, L = 224
TL206	0.230 λ, 51.98 Ω	W = 1.087, L = 19.202	W = 43, L = 756
TL207	0.039 λ, 51.98 Ω	W = 1.087, L = 3.264	W = 43, L = 129
TL208	0.012 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 1.016	W1 = 43, W2 = 43, W3 = 40
TL209	0.032 λ, 51.98 Ω	W = 1.087, L = 2.642	W = 43, L = 104
TL210	0.006 λ, 41.75 Ω	W = 1.524, L = 0.508	W = 60, L = 20
TL211	0.018 λ, 41.75 Ω	W = 1.524, L = 1.524	W = 60, L = 60
TL212	0.018 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.524	W1 = 60, W2 = 60, W3 = 60
TL213	0.015 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.270	W1 = 50, W2 = 50, W3 = 50
TL214	0.035 λ, 47.12 Ω	W = 1.270, L = 2.896	W = 50, L = 114
TL215		W1 = 0.020, W2 = 0.020, Offset = 0.007	W1 = 20, W2 = 780, Offset = 280
TL216	0.017 λ, 4.74 Ω	W = 20.119, L = 1.270	W = 792, L = 50
TL217		W1 = 0.001, W2 = 0.005, Offset = -0.002	W1 = 1, W2 = 208, Offset = -79
TL218	0.099 λ, 41.75 Ω	W = 1.524, L = 8.204	W = 60, L = 323
TL219	0.015 λ, 47.12 Ω	W = 1.270, L = 1.267	W = 50, L = 50
TL220	0.015 λ, 41.75 Ω	W1 = 1.524, W2 = 1.524, W3 = 1.270	W1 = 60, W2 = 60, W3 = 50
TL221	0.008 λ, 51.98 Ω	W1 = 1.087, W2 = 1.087, W3 = 0.635	W1 = 43, W2 = 43, W3 = 25
TL222	0.015 λ, 63.89 Ω	W = 0.762, L = 1.270	W = 30, L = 50
TL223		W1 = 0.001, W2 = 0.001, Offset = 0.011	W1 = 1, W2 = 50, Offset = 416

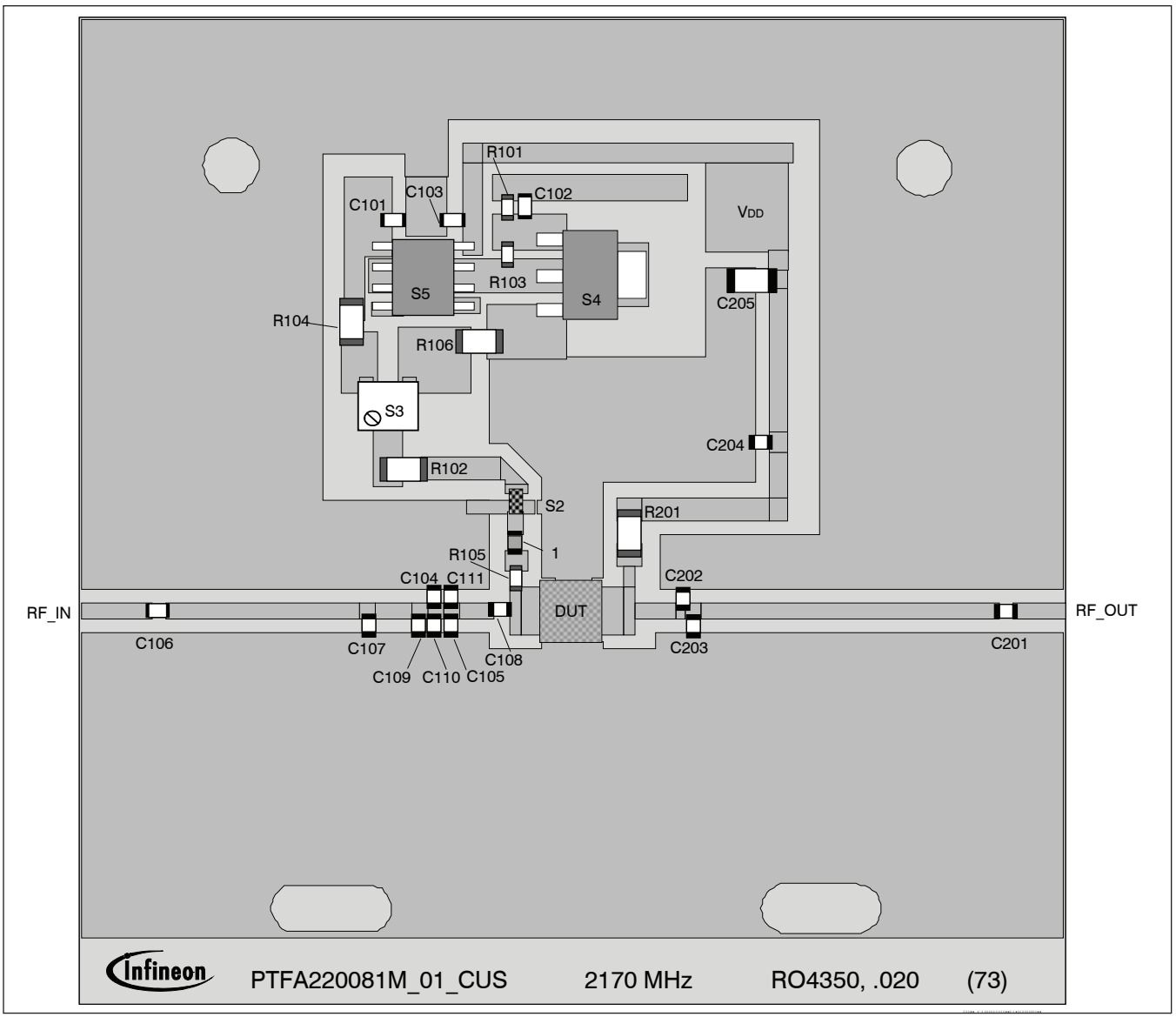
Table continued next page

Reference Circuit, 2110 – 2170 MHz (cont.)

Electrical Characteristics at 2170 MHz (cont.)

Transmission Line	Electrical Characteristics	Dimensions: mm	Dimensions: mils
TL224	0.015 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.270	W1 = 50, W2 = 50, W3 = 50
TL225	0.111 λ, 47.12 Ω	W = 1.270, L = 9.225	W = 50, L = 363
TL226	0.015 λ, 47.12 Ω	W1 = 1.270, W2 = 1.270, W3 = 1.270	W1 = 50, W2 = 50, W3 = 50

Reference Circuit, 2110 – 2170 MHz (cont.)



*Reference circuit assembly diagram (not to scale)**

** Gerber Files for this circuit available on request*

Reference Circuit, 2110 – 2170 MHz (cont.)

Circuit Assembly Information

DUT	PTFA220081M	LDMOS Transistor	
PCB	LTN/PTFA220081M	0.508 mm [.020"] thick, εr = 3.48	Rogers 4350, 1 oz. copper

Component	Description	Suggested Manufacturer	P/N
Input			
C101, C102, C103	Chip capacitor, 1000 pF	ATC	PCC1772CT-ND
C104, C105, C110, C111	Chip capacitor, 6.2 pF	ATC	ATC100A6R2CW150X
C106	Chip capacitor, 12 pF	ATC	ATC100A120FJW150X
C107	Chip capacitor, 3.6 pF	ATC	ATC100A3R6CW150X
C108	Chip capacitor, 4.1 pF	ATC	ATC100A4R1CW150X
C109	Chip capacitor, 0.6 pF	ATC	ATC100A0R6CW150X
L1	Inductor, 22 nH	ATC	ATC0805WL22JT
R101	Resistor, 1300 Ω	Digi-Key	P1.3KGCT-ND
R102	Resistor, 10 Ω	Digi-Key	P10ECT-ND
R103	Resistor, 1200 Ω	Digi-Key	P1.2KGCT-ND
R104	Resistor, 2000 Ω	Digi-Key	P2.0KECT-ND
R105	Resistor, 10 Ω	Digi-Key	P10GCT-ND
R106	Resistor, 510 Ω	Digi-Key	P510ECT-ND
S2	EMI filter, 2 - 4 A, 0.1 - 2.2 μF	Digi-Key	NFM18PS105R0J3
S3	Potentiometer, 2k Ω	Digi-Key	3224W-202ECT-ND
S4	Transistor	Digi-Key	BCP56
S5	Voltage Regulator	National Semiconductor	LM7805
Output			
C201	Chip capacitor, 12 pF	ATC	ATC100A120CW150X
C202	Chip capacitor, 0.3 pF	ATC	ATC100A0R3CW150X
C203	Chip capacitor, 3.6 pF	ATC	ATC100A3R6CW150X
C204	Chip capacitor, 10 pF	ATC	ATC100A100CW150X
C205	Capacitor, 10 μF	Digi-Key	587-1352-1-ND
R201	Resistor, 0 Ω	Digi-Key	P0.0ECT-ND

Package Outline Specifications

Package PG-SON-10

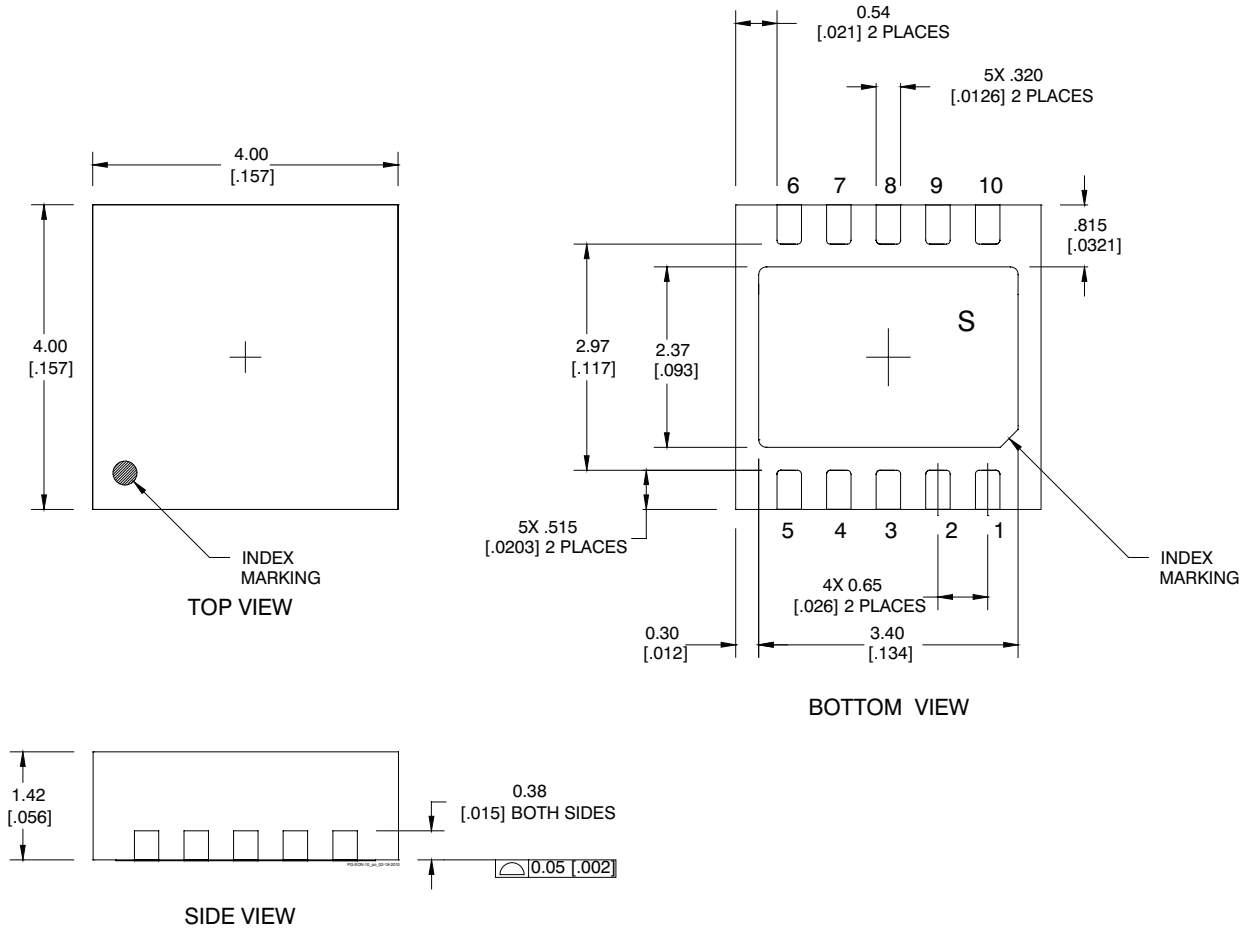


Diagram Notes—unless otherwise specified:

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] unless specified otherwise.
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].

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Revision History:	2010-06-09	Data Sheet
Previous Version:	2010-04-19, Advance Specification	
Page	Subjects (major changes since last revision)	
All	Data Sheet reflects released product specifications	

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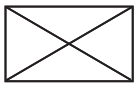

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