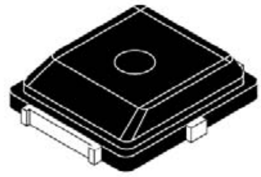
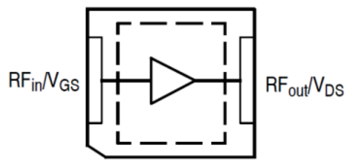
RoHS

LDMOS RF Power Transistor

HTN7G27S010P



Package: PQFN6*5



(Top View)

Pin Connections

1. Features

- High Efficiency
- High Power Gain
- Integrated ESD Protection
- Excellent Ruggedness
- Excellent Thermal Stability

2. Applications

- CDMA
- W-CDMA
- GSM EDGE
- MC-GSM
- LTE
- WiMAX

3. Typical Performances

This RF LDMOS transistor is designed for base station applications covering the frequency range of 700MHz to 2700MHz.

Table 1. ***V_{DD}=28Vdc, I_{DQ}=140mA, CW, in Huatai Test Fixture.***

Frequency	Gain(dB)	P1dB(dBm)	P3dB(dBm)	η_D(%)
2110 MHz	18.8	41.8	42.7	58.0
2140 MHz	19.1	41.4	42.4	59.0
2170 MHz	19.0	40.9	41.9	57.7

Table 2. ***V_{DD}=28Vdc, I_{DQ}=140mA, Pout=31.0dBm (1.26W) Avg. Single-Carrier W-CDMA, Input Signal PAR=9.9 dB @0.01%Probability on CCDF, in Huatai Test Fixture.***

Frequency	Gain(dB)	P1dB(dBm)	ACPR(dBc)	IRL(dB)
2110 MHz	18.8	17.3	-47.0	-13.6
2140 MHz	19.1	18.1	-48.0	-14.7
2170 MHz	19.0	18.8	-48.0	-15.6

Table 3. ***V_{DD}=12Vdc, I_{DQ}=145mA, CW, ACPR: Pout=27dBm (0.5W) Avg. Single-Carrier W-CDMA, Input Signal PAR=9.9 dB @0.01%Probability on CCDF, in Huatai Test Fixture.***

Frequency(MHz)	Gain(dB)	P1dB(dBm)	η_D(%)	ACPR(dBc)
2320	12.8	36.6	40.8	-46.5
2345	12.8	36.5	41.6	-46.5
2370	12.5	36.5	43.1	-46.5

4. Maximum Ratings

Table 4. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-5.0, +10	Vdc
Operating Voltage	V_{DD}	28, +0	Vdc
Storage Temperature Range	T_{stg}	-55 to +150	℃
Case Operating Temperature Range	Tc	-40 to +150	℃
Operating Junction Temperature Range	T_J	-40 to +225	℃

5. Thermal Characteristics

Table 5. Thermal Characteristics

Characteristic	Symbol	Conditions	Value	Unit
Thermal Resistance (Junction to Case)	$R_{\theta JC}$	Case Temperature: 50℃ CW Output Power: 10W	3.5	℃/W

6. Electrical Characteristics

Table 6. DC Characteristics

Characteristic	Symbol	Conditions	Min	Typ	Max	Unit
Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V; I_D=33.6uA	65	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}= V_{GS}; I_D=33.6uA	-	1.4	-	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=65V; V_{GS}=0V	-	-	1.4	uA
Gate-Source Leakage Current	I_{GSS}	V_{DS}=0V; V_{GS}= 5V	-	-	140	nA
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS}=6V; I_D=900mA	-	1.1	-	Ω

Table 7. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1B
Machine Model (per EIA/JESD22-A115)	A
Charge Device Model (per JESD22-C101)	III

Table 8. Load Mismatch（*in Huatai Test Fixture*）

Test Methodology	Results
VSWR=10:1 at all Phase Angles CW: V_{DD}=28Vdc, I_{DQ}=140mA, f=2140MHz, Pout=43.0dBm(3dB input Overdrive from P3dB)	No Device Degradation

Table 9. Typical Performances（*in Huatai Test Fixture*）

Characteristic	Symbol	Min	Typ	Max	Unit
V_{DD}=28Vdc, I_{DQ}=140mA, Pout=31.0dBm (1.26W), Avg. f=2140MHz, Single-Carrier W-CDMA, Input Signal PAR=9.9dB @0.01% Probability on CCDF. ACPR measured in 3.84MHz Channel Bandwidth @ ±5MHz Offset.					
Power Gain	G_{ps}	-	19.1	-	dB
Drain Efficiency	η_D	-	18.1	-	%
Adjacent Channel Power Ratio	ACPR	-	-48.0	-	dBc
V_{DD}=28Vdc, I_{DQ}=140mA, CW.					
Pout @ 1dB Compression Point	P1dB	-	41.4	-	dBm
AM/PM (Maximum value measured at the P3dB compression point across the 2110-2170MHz frequency range)	Φ	-	18.1	-	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	-	90	-	MHz
Gain Flatness in 60MHz Bandwidth @ P1dB (2110-2170MHz)	G_F	-	0.3	-	dB

7. Load Pull Performance

Load Pull Performance — Maximum Power Tuning

V_{DD}=28Vdc, I_{DQ}=140mA, Pulsed CW, 40us Pulse Width, 4% Duty

f (MHz)	Z_{source} (Ω)	Max Output Power				
		P1dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
940	0.79+j3.77	14.13+j1.11	25.63	43.48	22.28	64.90
1400	0.88+j0.15	12.08+j2.86	22.36	42.75	18.84	58.91
1840	0.88+j0.45	8.53+j2.50	19.32	42.56	18.03	54.47
2170	1.44-j2.25	4.73+j0.43	19.41	42.45	17.58	56.25
2300	1.26-j2.34	4.54+j0.34	19.10	42.51	17.82	56.90
2450	1.28-j5.38	4.49+j0.56	17.56	42.52	17.86	57.56
2600	1.04-j3.53	3.99+j1.00	17.38	42.22	16.67	55.88

f (MHz)	Z_{source} (Ω)	Max Output Power				
		P3dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
940	0.79+j3.77	13.97+j1.29	25.70	44.42	27.67	71.25
1400	0.88+j0.15	13.00+j3.20	22.23	43.63	23.07	64.04
1840	0.88+j0.45	12.42+j2.69	22.29	43.67	23.28	62.81
2170	1.44-j2.25	8.63+j2.51	19.29	43.44	22.08	57.68
2300	1.26-j2.34	6.15+j0.12	19.17	43.31	21.43	56.92
2450	1.28-j5.38	5.79+j0.45	17.32	43.32	21.48	56.96
2600	1.04-j3.53	5.61+j0.13	17.11	43.32	21.48	57.17

V_{DD}=12Vdc, I_{DQ}=140mA, Pulsed CW, 40us Pulse Width, 4% Duty

f (MHz)	Z_{source} (Ω)	Max Output Power				
		P1dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
2110	1.12-j4.12	3.00-j3.33	16.1	37.89	6.15	49.79

f (MHz)	Z_{source} (Ω)	Max Output Power				
		P3dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
2110	1.12-j4.12	3.32-j3.51	16.1	39.05	8.04	54.47

Load Pull Performance — Maximum Drain Efficiency Tuning

V_{DD}=28Vdc, I_{DQ}=140mA, Pulsed CW, 40us Pulse Width, 4% Duty

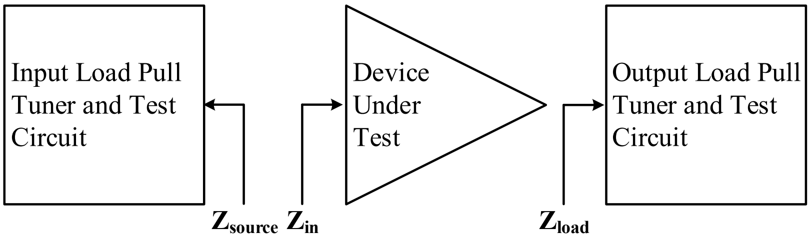
f (MHz)	Z_{source} (Ω)	Max Drain Efficiency				
		P1dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
940	0.79+j3.77	15.64+j10.22	27.30	42.32	17.06	75.05
1400	0.88+j0.15	8.25+j10.23	24.34	41.15	13.03	70.22
1840	0.88+j0.45	3.08+j7.71	22.00	41.05	12.74	68.39
2170	1.44-j2.25	2.85+j2.87	20.88	40.96	12.47	64.59
2300	1.26-j2.34	2.78+j2.35	20.55	41.24	13.30	65.87
2450	1.28-j5.38	2.73+j2.38	18.92	41.08	12.82	64.56
2600	1.04-j3.53	2.50+j2.50	18.42	41.00	12.59	61.32

f (MHz)	Z_{source} (Ω)	Max Drain Efficiency				
		P3dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
940	1.04+j3.12	14.08+j12.60	27.95	42.95	19.72	82.84
1400	0.88+j0.15	8.20+j10.78	24.36	42.10	16.22	75.58
1840	0.88+j0.45	3.19+j7.63	21.96	42.08	16.14	70.21
2170	1.44-j2.25	3.32+j2.47	20.63	42.15	16.41	65.03
2300	1.26-j2.34	2.86+j2.22	20.47	41.97	15.74	65.88
2450	1.28-j5.38	2.87+j2.26	18.83	41.92	15.56	65.01
2600	1.04-j3.53	3.25+j2.39	18.32	41.71	14.83	61.42

V_{DD}=12Vdc, I_{DQ}=140mA, Pulsed CW, 40us Pulse Width, 4% Duty

f (MHz)	Z_{source} (Ω)	Max Drain Efficiency				
		P1dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
2110	1.12-j4.12	3.02-j0.65	18.5	36.39	4.36	60.78

f (MHz)	Z_{source} (Ω)	Max Drain Efficiency				
		P3dB				
		Z_{load} (Ω)	Gain (dB)	(dBm)	(W)	η_D (%)
2110	1.12-j4.12	2.95-j0.65	18.5	37.36	5.45	64.93



8. Reference Design

8.1 2110-2170MHz

8.1.1 Test Circuit Component Layout

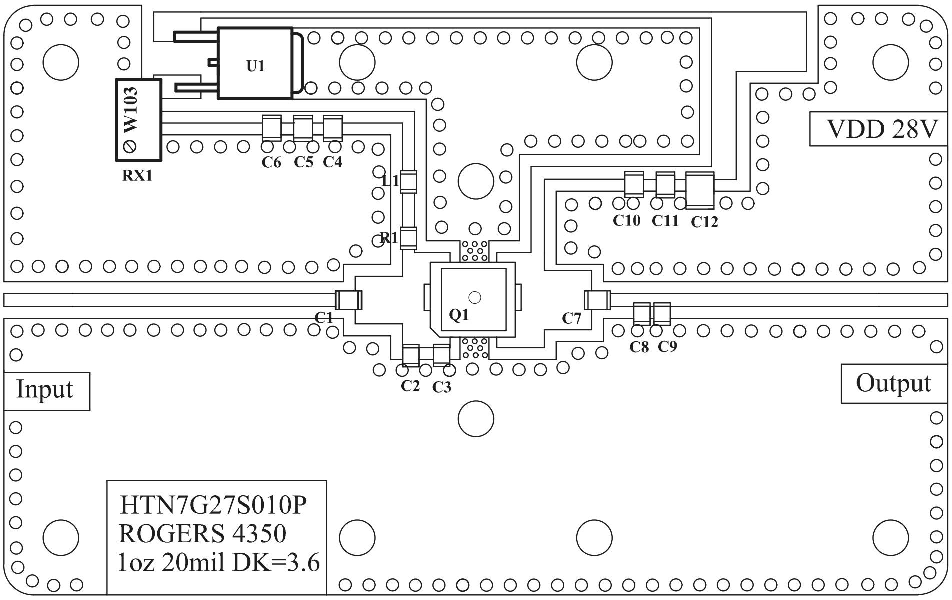


Figure1. HTN7G27S010P Test Circuit Component Layout — 2110-2170MHz

Table 10. Test Circuit Component Designations and Values — 2110-2170MHz

Part	Description	Part Number	Manufacturer
C1, C4, C7, C10	8.2pF Chip Capacitors	GQM2195C2E8R2BB12	Murata
C2	2.4pF Chip Capacitors	GQM2195C2E2R4BB12	Murata
C3	2.2pF Chip Capacitors	GQM2195C2E2R2CB12	Murata
C8, C9	2.0pF Chip Capacitors	GQM2195C2E2R0CB12	Murata
C5, C11	10nF Chip Capacitors	GRM31MR72A103KA01L	Murata
C6	1uF Chip Capacitors	1206	Arbitrary
C12	10uF, 50 V Electrolytic Capacitor	MCGPR50V107M13X26	Multicomp
R1	30ohm Chip Resistor	0603	Arbitrary
L1	22nH Chip Inductor	0603	Arbitrary
PCB	Rogers RO4350B, 20mil, $\varepsilon_r = 3.6$	-	Arbitrary

8.1.2 Test Results

CW Signal

V_{DD}=28Vdc, I_{DQ}=140mA, CW.

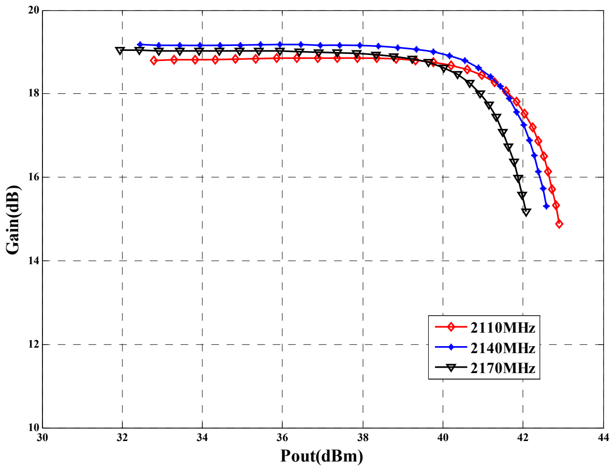


Figure 2. Gain vs Pout

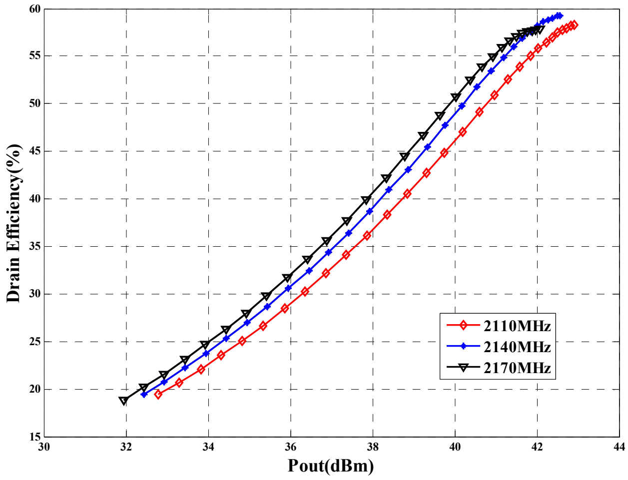


Figure 3. Drain Efficiency vs Pout

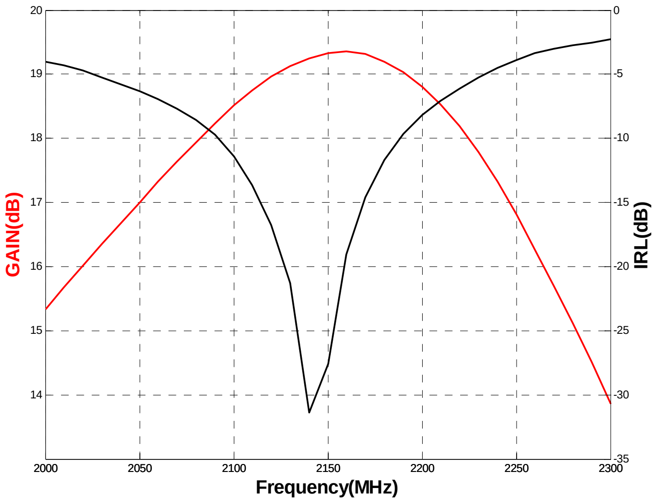


Figure 4. Broadband Frequency Response

Single-Carrier W-CDMA

V_{DD}=28Vdc, I_{DQ}=140mA, Single-Carrier W-CDMA, Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

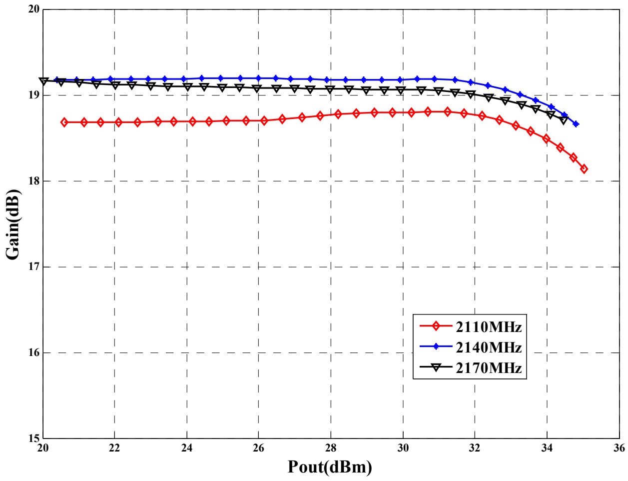


Figure 5. Gain vs Pout

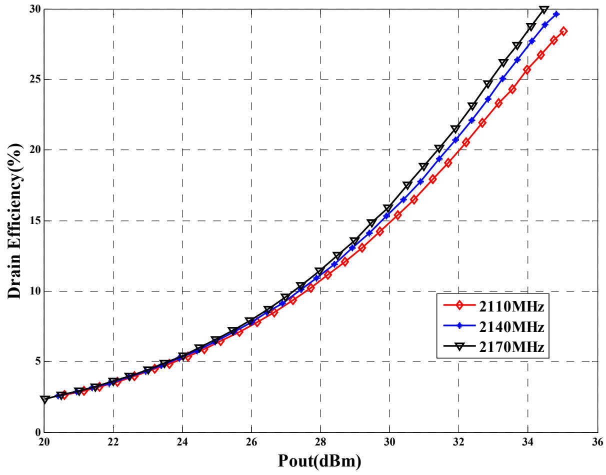


Figure 6. Drain Efficiency vs Pout

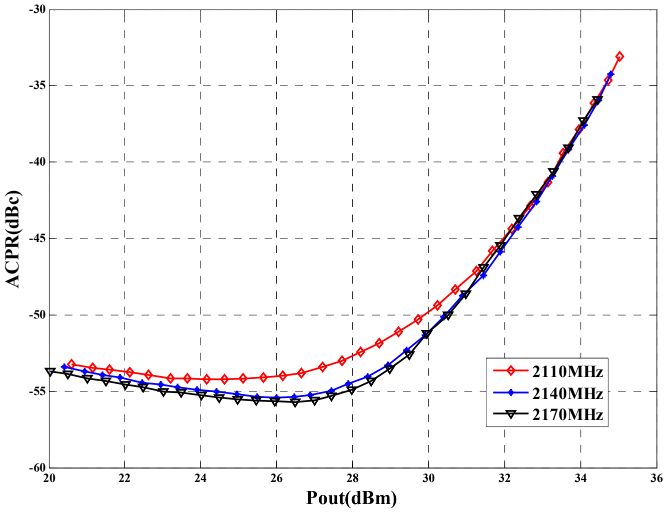


Figure 7. ACPR vs Pout

Intermodulation Distortion Products

V_{DD}=28Vdc, I_{DQ}=140mA, Pout=7.6W (PEP), Two-Tone Measurements, (f1 + f2)/2=Center Frequency of 2140MHz

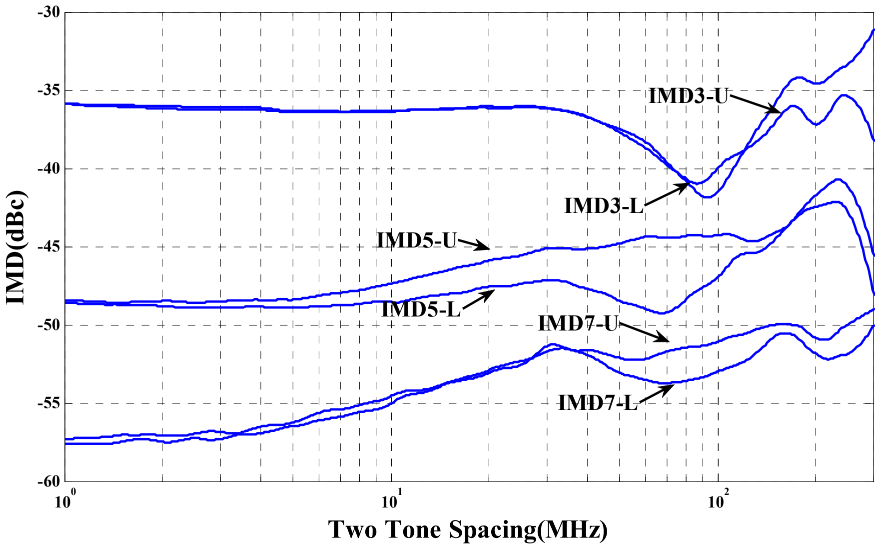


Figure 8. Intermodulation Distortion Products vs Two Tone Spacing

Under Different Temperatures

V_{DD}=28Vdc, I_{DQ}=140mA, f=2140MHz, CW.

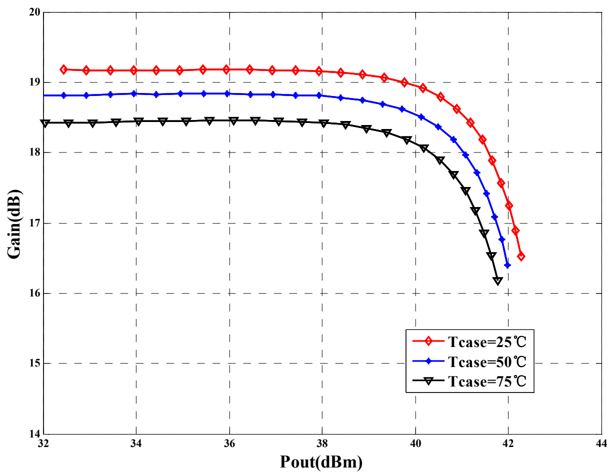


Figure 9. Gain vs Pout

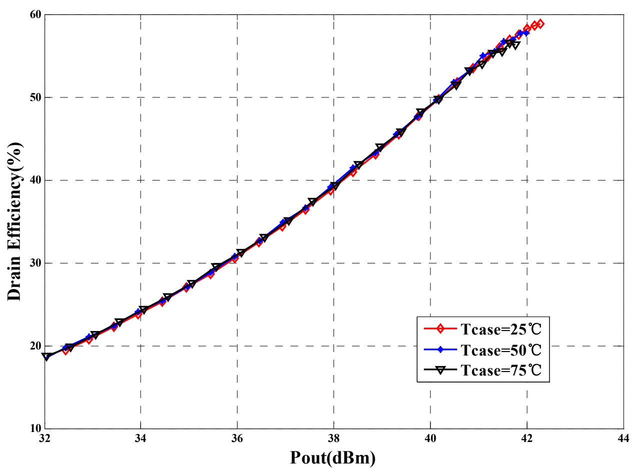


Figure 10. Drain Efficiency vs Pout

****NOTE：Tcase represents the temperature of the heat sink。***

8.2 920-960MHz

8.2.1 Test Circuit Component Layout

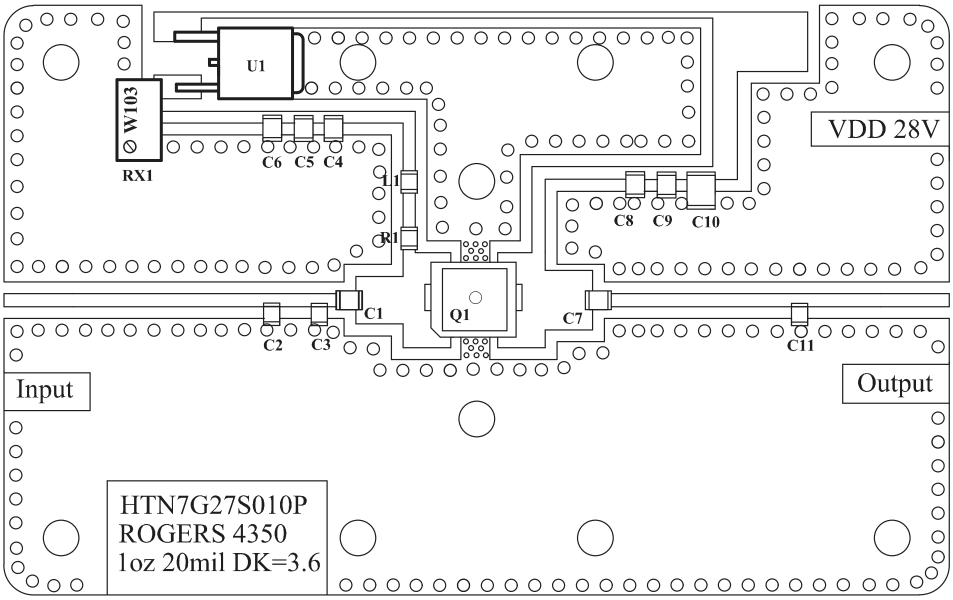


Figure 11. HTN7G27S010P Test Circuit Component Layout — 920-960MHz

Table 11. Test Circuit Component Designations and Values — 920-960MHz

Part	Description	Part Number	Manufacturer
C1, C4, C7, C8	68pF Chip Capacitors	GQM2195C2E680JB12	Murata
C2, C3	8.0pF Chip Capacitors	GQM2195C2E8R0BB12	Murata
C11	4.7pF Chip Capacitors	GQM2195C2E4R7BB12	Murata
C5, C9	10nF Chip Capacitors	GRM31MR72A103KA01L	Murata
C6	1uF Chip Capacitors	1206	Arbitrary
C10	10uF, 50 V Electrolytic Capacitor	MCGPR50V107M13X26	Multicomp
R1	30ohm Chip Resistor	0603	Arbitrary
L1	47nH Chip Inductor	0603	Arbitrary
PCB	Rogers RO4350B, 20mil, εr = 3.6	-	Arbitrary

8.2.2 Test Result

CW Signal

V_{DD}=28Vdc, I_{DQ}=140mA, CW.

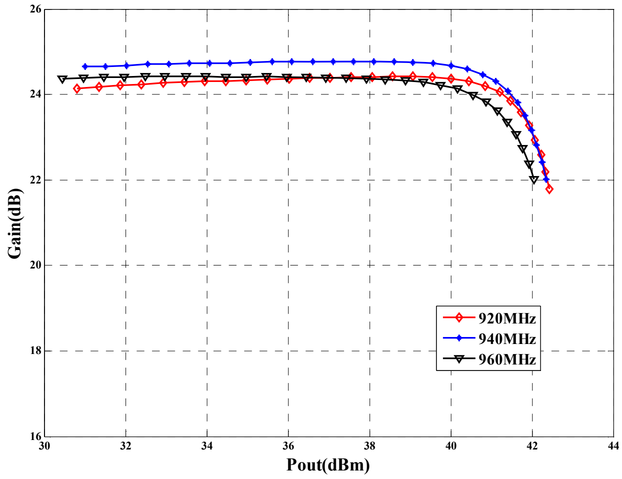


Figure 12. Gain vs Pout

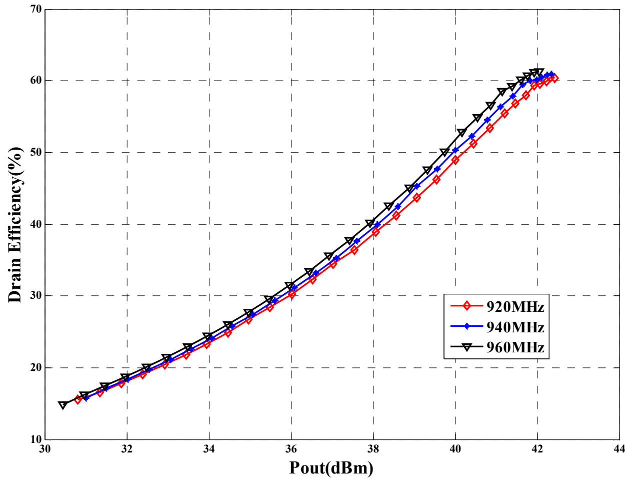


Figure 13. Drain Efficiency vs Pout

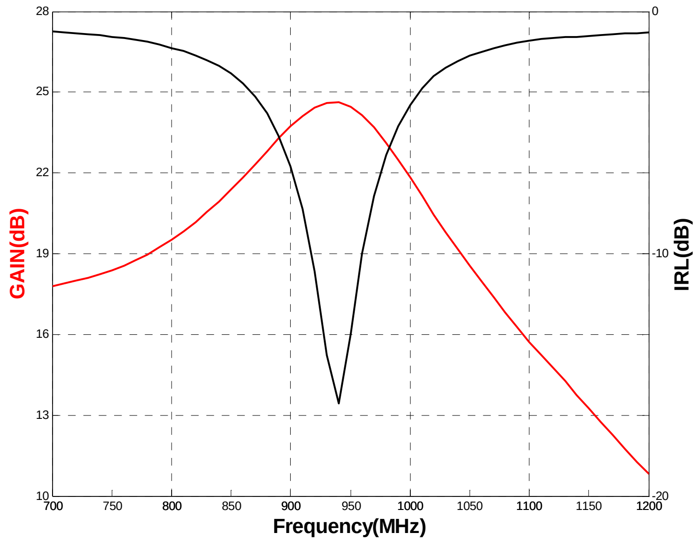


Figure 14. Broadband Frequency Response

Single-Carrier W-CDMA

V_{DD}=28Vdc, I_{DQ}=140mA, Single Carrier W-CDMA, Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

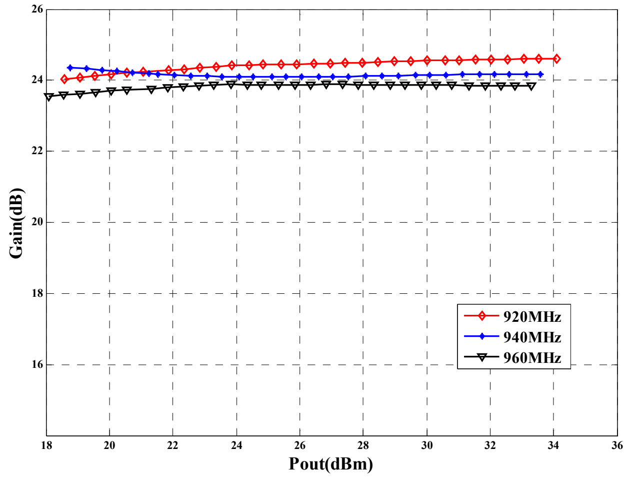


Figure 15. Gain vs Pout

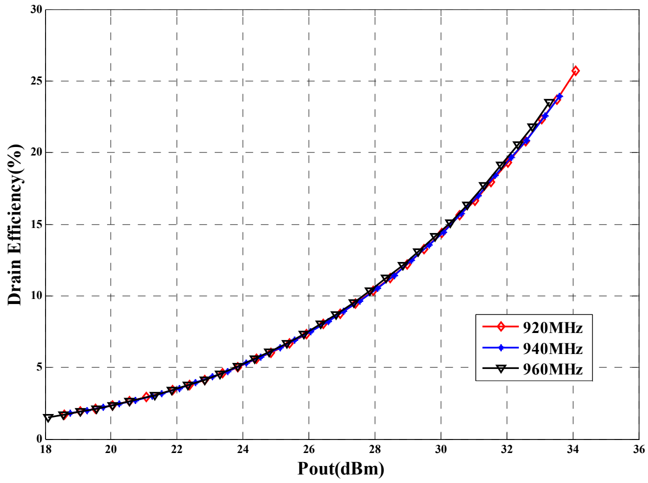


Figure 16. Drain Efficiency vs Pout

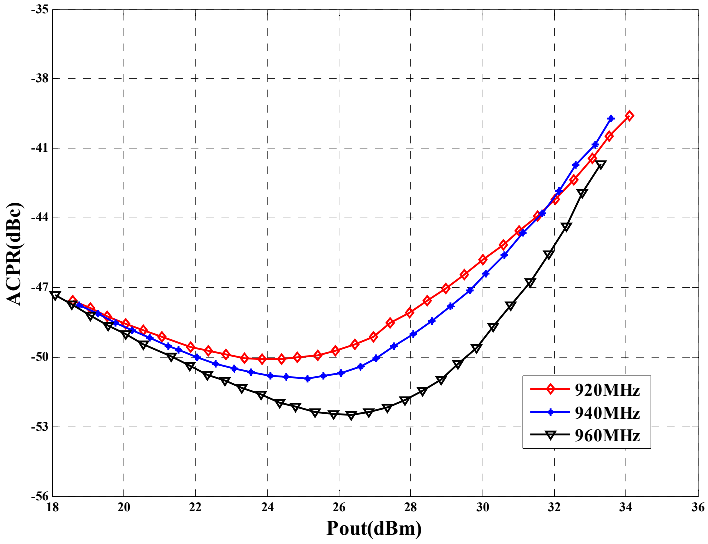


Figure 17. ACPR vs Pout

8.3 2400-2500MHz

8.3.1 Test Circuit Component Layout

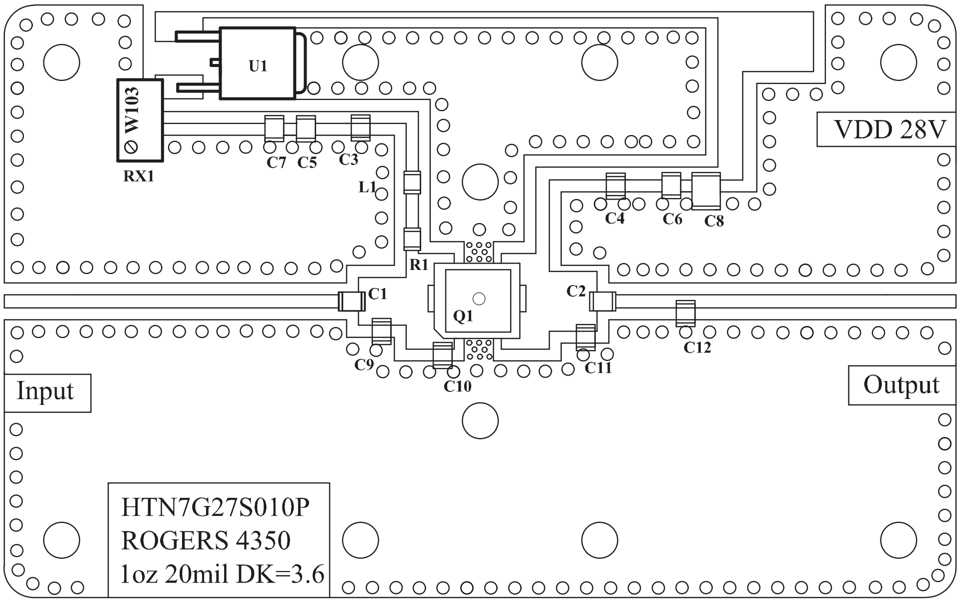


Figure 18. HTN7G27S010P Test Circuit Component Layout — 2400-2500MHz

Table 12. Test Circuit Component Designations and Values — 2400-2500MHz

Part	Description	Part Number	Manufacturer
C2, C3, C4	6.2pF Chip Capacitors	ATC100B6R2JT500XT	ATC
C1	2.0pF Chip Capacitors	ATC100B2R0JT500XT	ATC
C9	0.3pF	ATC100B0R3JT500XT	ATC
C10	1.8pF Chip Capacitors	ATC100B1R8JT500XT	ATC
C11	2.2pF Chip Capacitors	GQM2195C2E2R2CB12	Murata
C12	1.2	GQM2195C2E1R2CB12	Murata
C5, C6	10nF Chip Capacitors	GRM31MR72A103KA01L	Murata
C7	1uF Chip Capacitors	1206	Arbitrary
C8	10uF, 50 V Electrolytic Capacitor	MCGPR50V107M13X26	Multicomp
R1	10ohm Chip Resistor	0603	Arbitrary
L1	6.8nH Chip Inductor	0603	Arbitrary
PCB	Rogers RO4350B, 20mil, εr = 3.6	-	Arbitrary

8.3.2 Test Result

CW Signal

V_{DD}=28Vdc, I_{DQ}=140mA, CW.

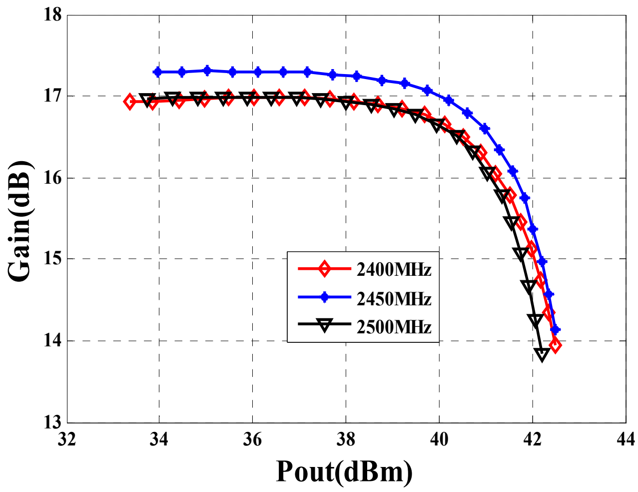


Figure 19. Gain vs Pout

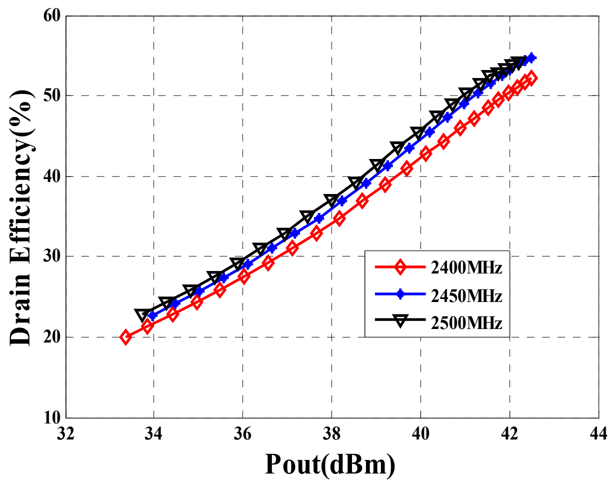


Figure 20. Drain Efficiency vs Pout

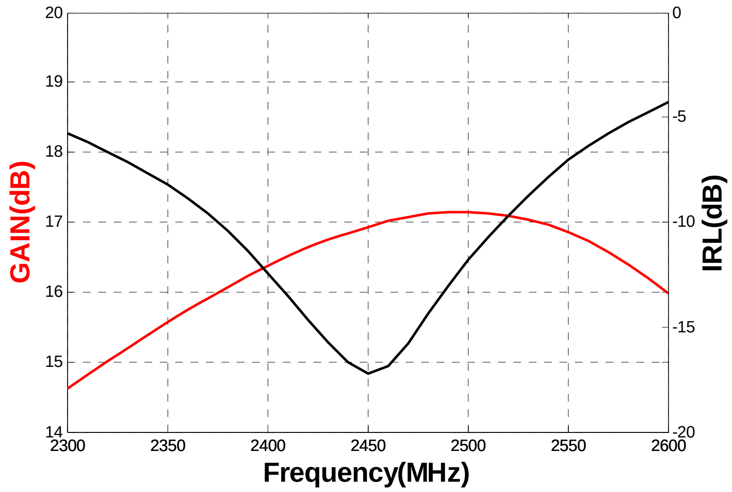


Figure 21. Broadband Frequency Response

8.4 2620-2690MHz

8.4.1 Test Circuit Component Layout

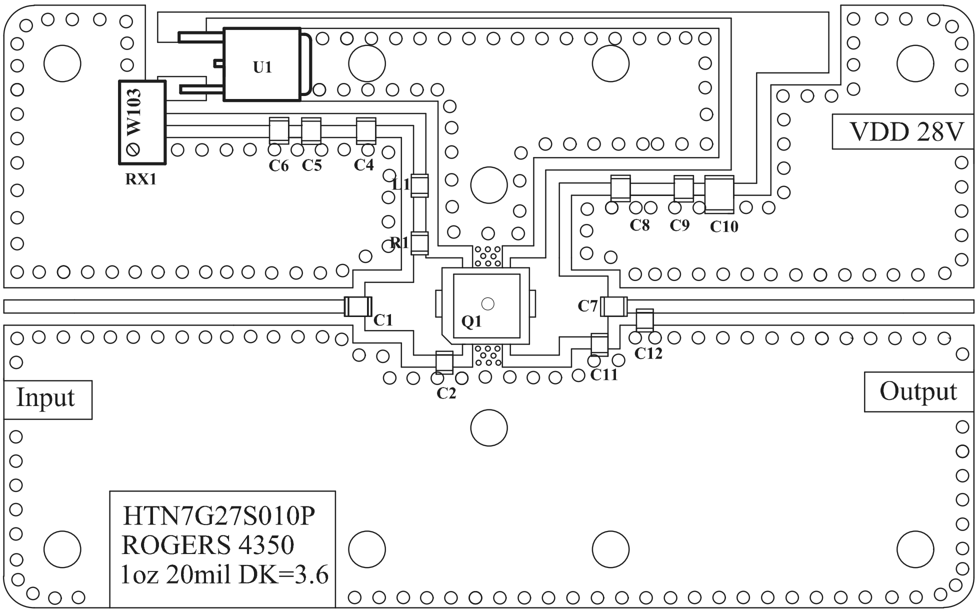


Figure 22. HTN7G27S010P Test Circuit Component Layout — 2620-2690MHz

Table 13. Test Circuit Component Designations and Values — 2620-2690MHz

Part	Description	Part Number	Manufacturer
C1, C4, C7, C8	6.8pF Chip Capacitors	GQM2195C2E6R8BB12	Murata
C2	1.6pF Chip Capacitors	GQM2195C2E1R6CB12	Murata
C11, C12	1.5pF Chip Capacitors	GQM2195C2E1R5CB12	Murata
C5, C9	10nF Chip Capacitors	GRM31MR72A103KA01L	Murata
C6	1uF Chip Capacitors	1206	Arbitrary
C10	10uF, 50 V Electrolytic Capacitor	MCGPR50V107M13X26	Multicomp
R1	30ohm Chip Resistor	0603	Arbitrary
L1	10nH Chip Inductor	0603	Arbitrary
PCB	Rogers RO4350B, 20mil, εr = 3.6	-	Arbitrary

8.4.2 Test Result

CW Signal

V_{DD}=28Vdc, I_{DQ}=140mA, CW.

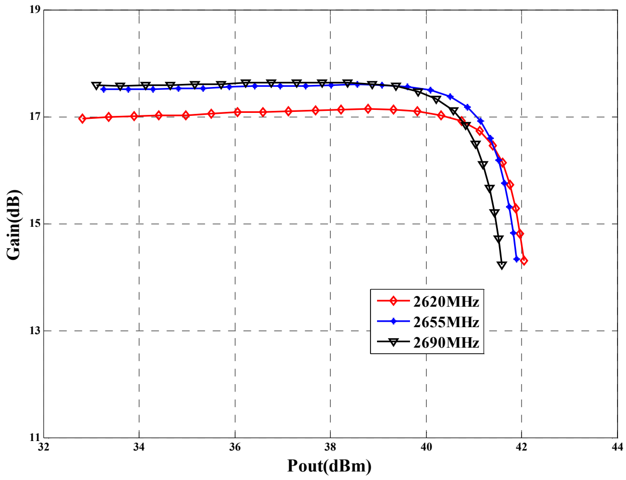


Figure 23. Gain vs Pout

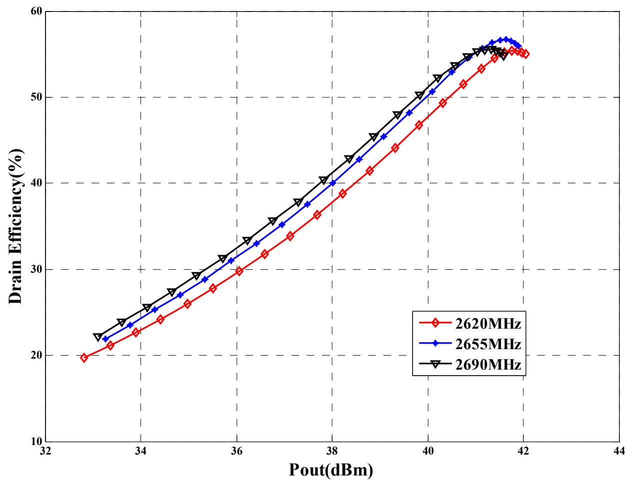


Figure 24. Drain Efficiency vs Pout

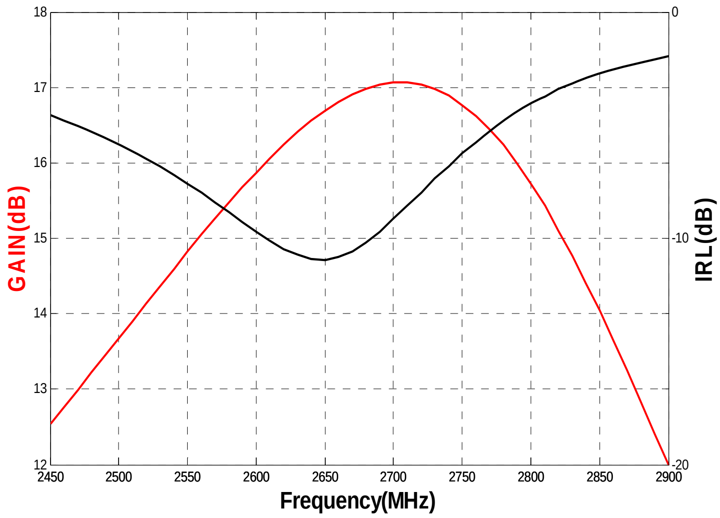


Figure 25. Broadband Frequency Response

Single-Carrier W-CDMA

V_{DD}=28Vdc, I_{DQ}=140mA, Single-Carrier W-CDMA, Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

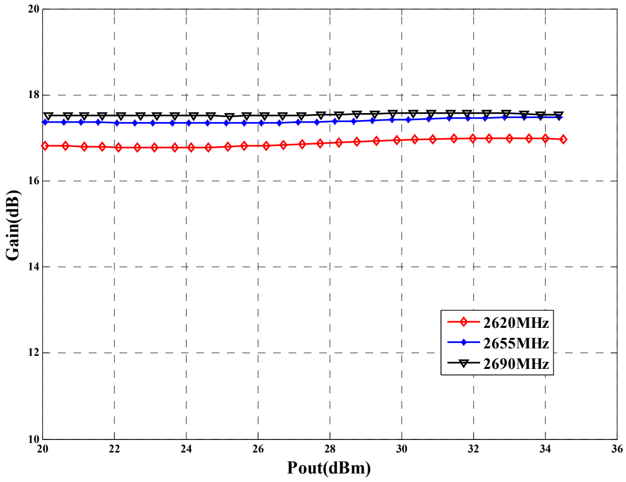


Figure 26. Gain vs Pout

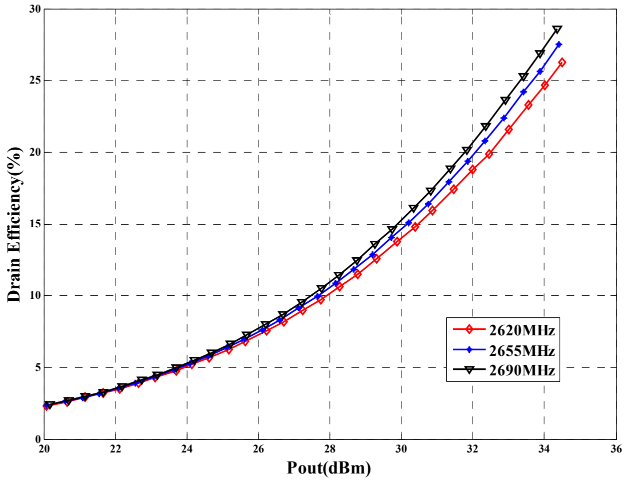


Figure 27. Drain Efficiency vs Pout

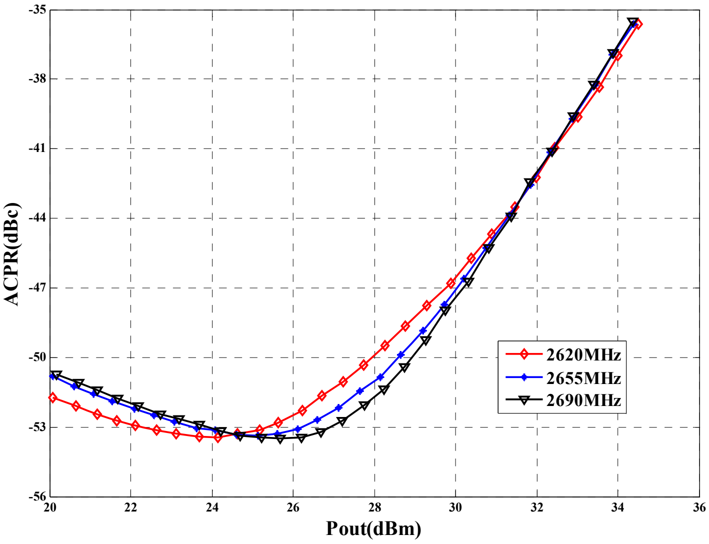


Figure 28. ACPR vs Pout

8.5 3000-3100MHz

8.5.1 Test Circuit Component Layout

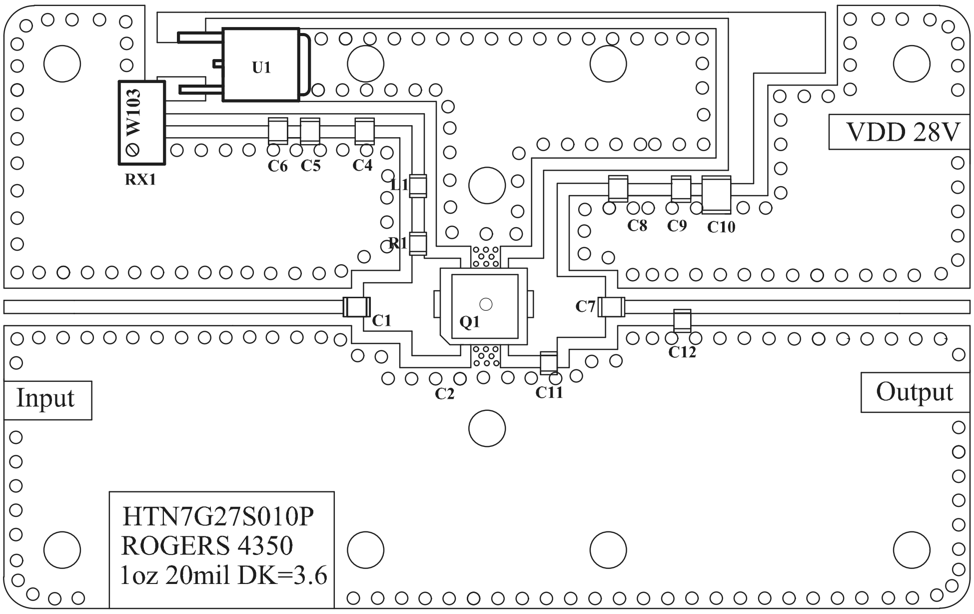


Figure 29. HTN7G27S010P Test Circuit Component Layout — 3000-3100MHz

Table 14. Test Circuit Component Designations and Values — 3000-3100MHz

Part	Description	Part Number	Manufacturer
C4, C7, C8	5.6pF Chip Capacitors	GQM2195C2E5R6BB12	Murata
C1	4.3pF Chip Capacitors	GQM2195C2E4R3BB12	Murata
C11	1.5pF Chip Capacitors	GQM2195C2E1R5CB12	Murata
C12	0.5pF Chip Capacitors	GQM2195C2E0R5CB12	Murata
C5, C9	10nF Chip Capacitors	GRM31MR72A103KA01L	Murata
C6	1uF Chip Capacitors	1206	Arbitrary
C10	10uF, 50 V Electrolytic Capacitor	MCGPR50V107M13X26	Multicomp
R1	10ohm Chip Resistor	0603	Arbitrary
L1	6.8nH Chip Inductor	0603	Arbitrary
PCB	Rogers RO4350B, 20mil, εr = 3.6	-	Arbitrary

8.5.2 Test Result

Pulsed CW Signal

V_{DD}=28Vdc, I_{DQ}=140mA, Pulsed CW，100us Pulse Width，10% Duty.

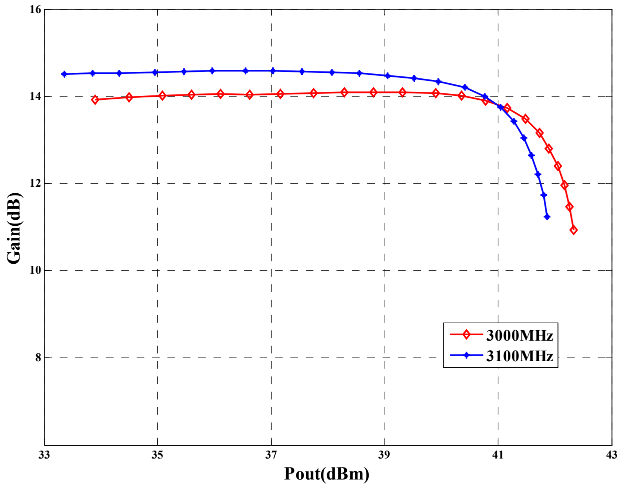


Figure 30. Gain vs Pout

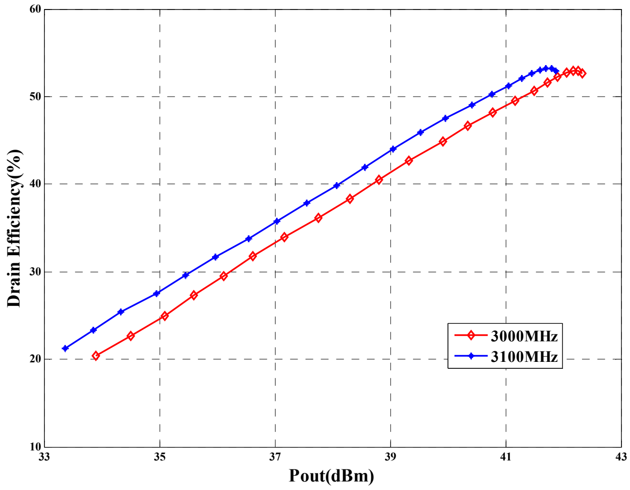
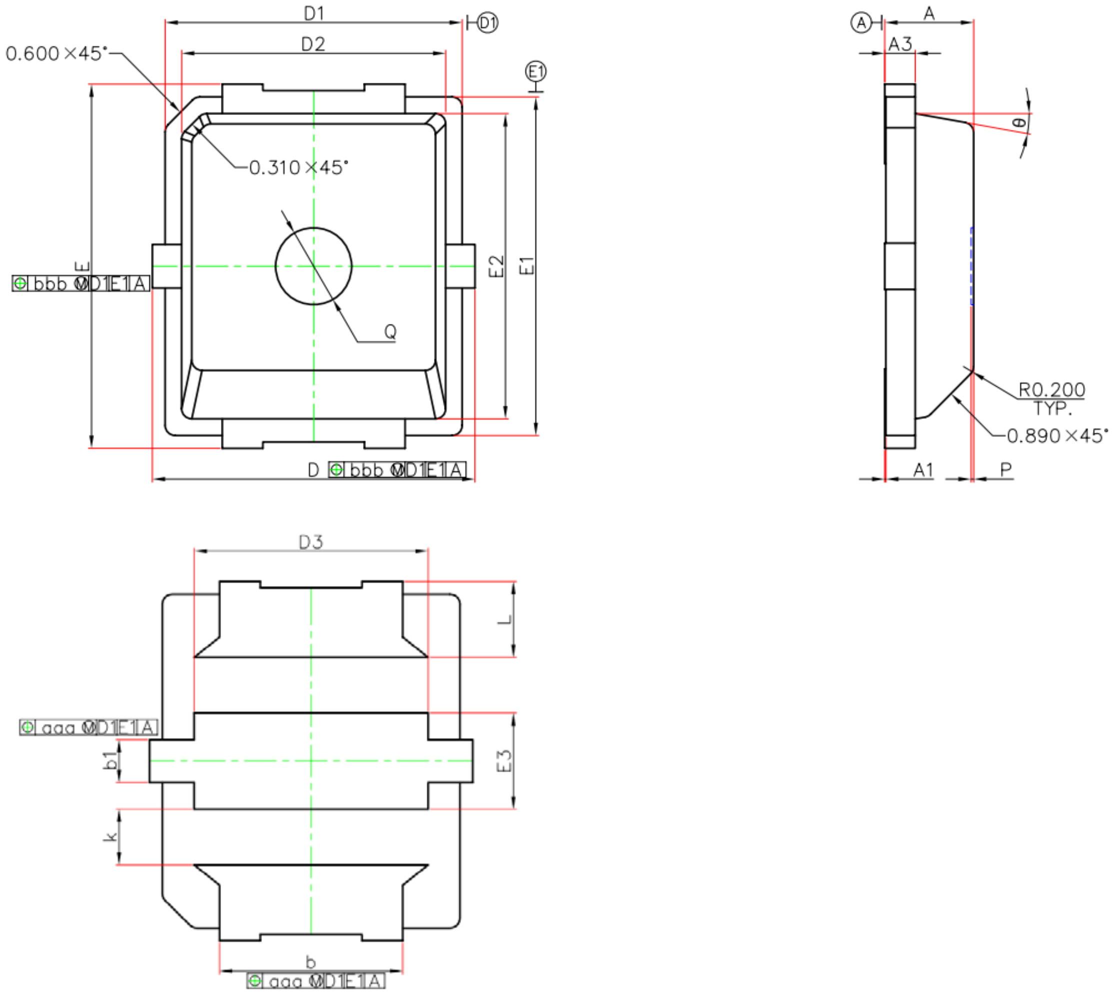


Figure 31. Drain Efficiency vs Pout

9. Package Dimensions

PDFN5.85×6.60-2L(PLD) PACKAGE OUTLINE DIMENSIONS



Symbol	Dimesions in Milimeters		Dimesions in Inches			Symbol	Dimesions in Milimeters		Dimesions in Inches	
	Min.	Max.	Min.	Max.			Min.	Max.	Min.	Max.
A	1.650	1.850	0.065	0.073		E	7.000	7.200	0.276	0283
A1	0.000	0.050	0.000	0.002		E1	6.500	6.700	0.256	0.264
A3	0.600 REF.		0.024 REF.			E2	5.850	6.050	0.230	0.238
b	3.500	3.700	0.138	0.146		E3	1.750	2.050	0.069	0.081
b1	0.700	1.000	0.028	0.039		k	1.100 REF.		0.034 ERF.	
D	6.250	6.450	0.256	0.254		L	1.400	1.600	0.055	0.063
D1	5.750	5.950	0.226	0.234		P	0.000	0.100	0.000	0.004
D2	5.100	5.300	0.201	0.209		Q	1.400	1.600	0.055	0.063
D3	4.450	4.750	0.175	0.187		θ	5°	15°	5°	15°
aaa	0.100 REF.		0.004 REF.			bbb	0.130 REF.		0.005 REF.	

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