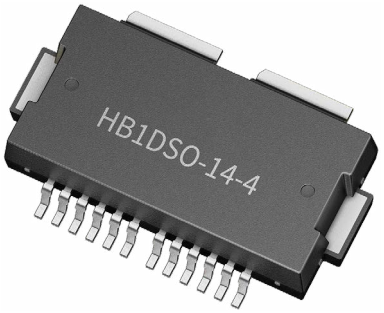
PTNC210604MD

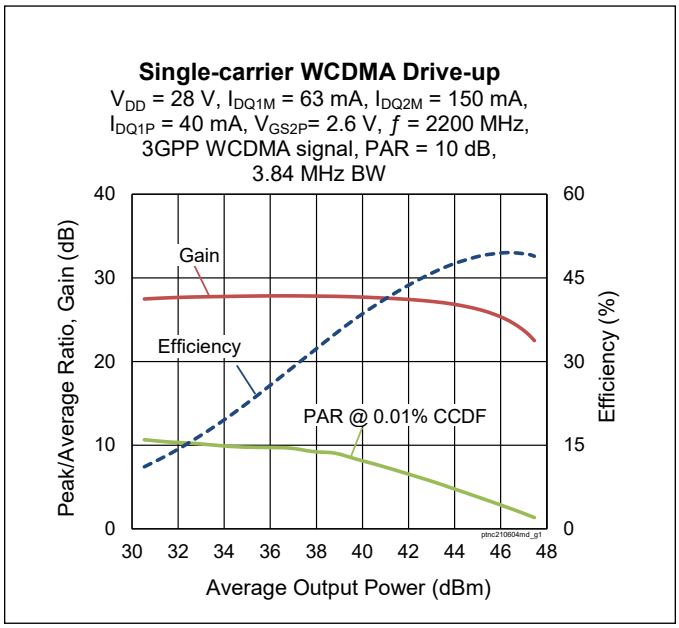
Wideband LDMOS Two-stage Integrated Power Amplifier
20 W + 40 W, 28 V, 1805 – 2200 MHz



Package Types: PG-HB1DSO-14-4

Description

The PTNC210604MD is a wideband, two-stage, LDMOS integrated power amplifier. It incorporates internal matching for operation from 1805 MHz to 2200 MHz, and dual independent outputs with 20 W and 40 W of output power each. It is available in a 14-lead plastic overmold package with gull wing leads.



Features

- On-chip matching for broadband operation
- Typical CW performance, 2200 MHz, 28 V, combined outputs
  - Output power at P_{3dB} = 63 W
  - Linear Gain = 28 dB
  - Efficiency = 50.5%
- Capable of handling 10:1 VSWR @28 V, 10 W mod avg output power
- Integrated ESD protection
- Human Body Model Class 1A (per ANSI/ESDA/JEDEC JS-001)
- Integrated temperature compensation
- Pb-free and RoHS compliant

RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty test fixture)
V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA, I_{DQ1P} = 40 mA, V_{GS2P} = 2.6 V, P_{OUT} = 10 W avg, ƒ = 2200 MHz, 3GPP WCDMA signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	26	27	—	dB
Drain Efficiency	η_D	34.5	37	—	%
Adjacent Channel Power Ratio	ACPR	—	–33	–28	dBc
Output PAR @ 0.01% probability on CCDF	OPAR	7.5	8.1	—	dB

Note:
All published data at T_{CASE} = 25°C unless otherwise indicated
ESD: Electrostatic discharge sensitive device—observe handling precautions!

RoHS compliant

DC Characteristics

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Conditions
Drain-Source Breakdown Voltage	$V_{BR(DSS)}$	64	—	—	V	V_{GS} = 0 V, I_{DS} = 51.7 µA
Drain Leakage Current – Stage 1	I_{DSS}	—	—	0.1	µA	V_{DS} = 28 V, V_{GS} = 0 V
		—	—	1.0		V_{DS} = 60 V, V_{GS} = 0 V
Drain Leakage Current – Stage 2		—	—	0.1		V_{DS} = 28 V, V_{GS} = 0 V
		—	—	1.0		V_{DS} = 60 V, V_{GS} = 0 V
Gate Leakage Current – Stage 1	I_{GSS}	—	—	0.1		V_{GS} = 1 V, V_{DS} = 0 V
Gate Leakage Current – Stage 2		—	—			
On-State Resistance – Stage 1 (Main)	$R_{DS(on)}$	—	5.8	—	Ω	V_{GS} = 10 V, V_{DS} = 0.1 V
On-State Resistance – Stage 1 (Peak)		—	3.7	—		
On-State Resistance – Stage 2 (Main)		—	0.66	—		
On-State Resistance – Stage 2 (Peak)		—	0.33	—		
Operating Gate Voltage	V_{GS2}	—	2.90	—	V	V_{DS} = 28 V, I_{DQ1M} = 63 mA
		—	2.76	—		V_{DS} = 28 V, I_{DQ2M} = 150 mA
		—	2.72	—		V_{DS} = 28 V, I_{DQ1P} = 40 mA
		—	2.11	—		V_{DS} = 28 V
Fixture Operating Gate Voltage		—	5.40	—		V_{DS} = 28 V, I_{DQ1M} = 63 mA
		—	4.37	—		V_{DS} = 28 V, I_{DQ2M} = 150 mA
		—	3.95	—		V_{DS} = 28 V, I_{DQ1P} = 40 mA
		—	2.60	—		V_{DS} = 28 V

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source Voltage	V_{DSS}	65	V
Gate-source Voltage	V_{GS}	–6 to +10	
Operating Voltage	V_{DD}	0 to +32	
Junction Temperature	T_J	225	°C
Storage Temperature Range	T_{STG}	–65 to +150	

Thermal Characteristics

Parameter	Symbol	Value	Unit	Conditions
Thermal Resistance Stage 1	$R_{\theta JC}$	4.6	°C/W	T_{CASE} = 70°C, 12 W CW
Thermal Resistance Stage 2		1.5		T_{CASE} = 70°C, 12 W CW

Moisture Sensitivity Level

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

Ordering Information

Type and Version	Order Code	Package	Shipping
PTNC210604MD V2 R5	PTNC210604MD-V2-R5	PG-HB1DSO-14-4	Tape & Reel, 500 pcs

Typical Performance (data taken in test fixture, 2100 MHz to 2200 MHz)

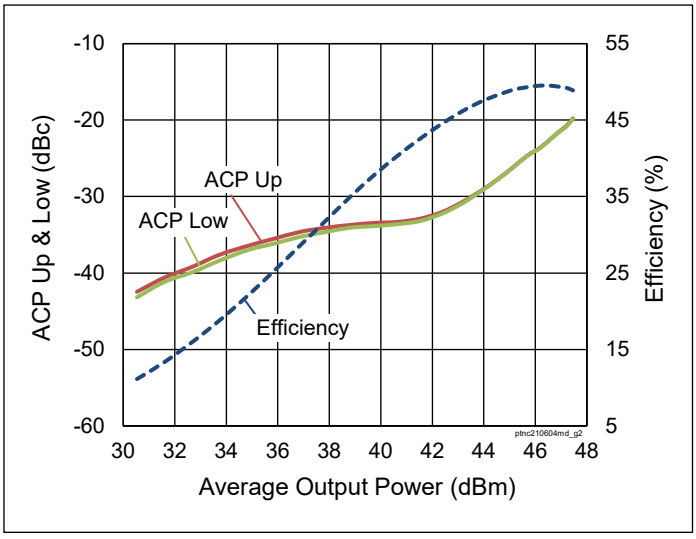


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA,
I_{DQ1P} = 40 mA, V_{GS2P} = 2.6 V, f = 2200 MHz,
3GPP WCDMA signal, PAR = 10 dB,
3.84 MHz BW

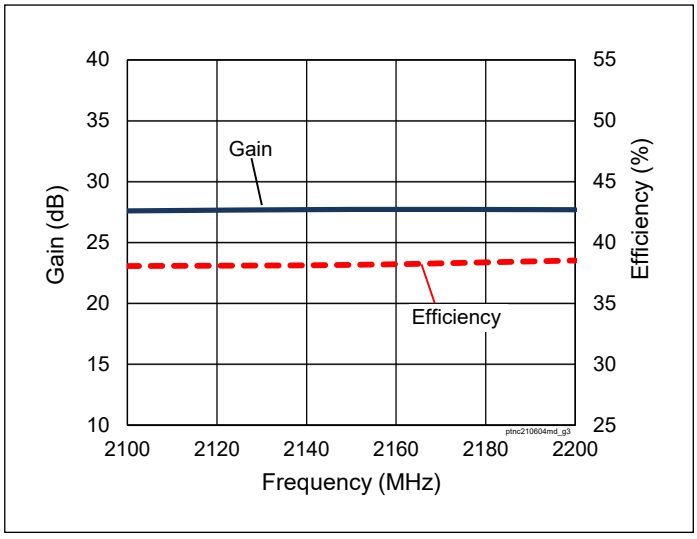


Figure 2. Single-carrier WCDMA Broadband Performance

V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA,
I_{DQ1P} = 40 mA, V_{GS2P} = 2.6 V, P_{OUT} = 40 dBm,
3GPP WCDMA signal, PAR = 10 dB

Typical Performance (data taken in test fixture, 2100 MHz to 2200 MHz)

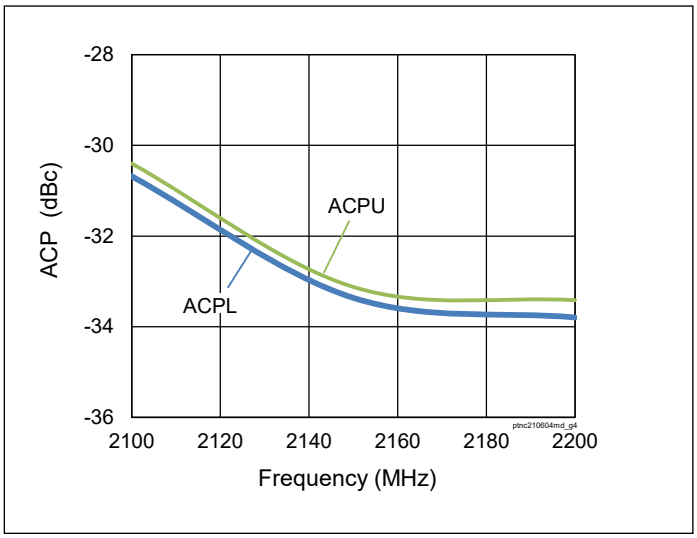


Figure 3. Single-carrier WCDMA Broadband Performance

V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA,
I_{DQ1P} = 40 mA, V_{GS2P} = 2.6 V, P_{OUT} = 40 dBm,
3GPP WCDMA signal, PAR = 10 dB

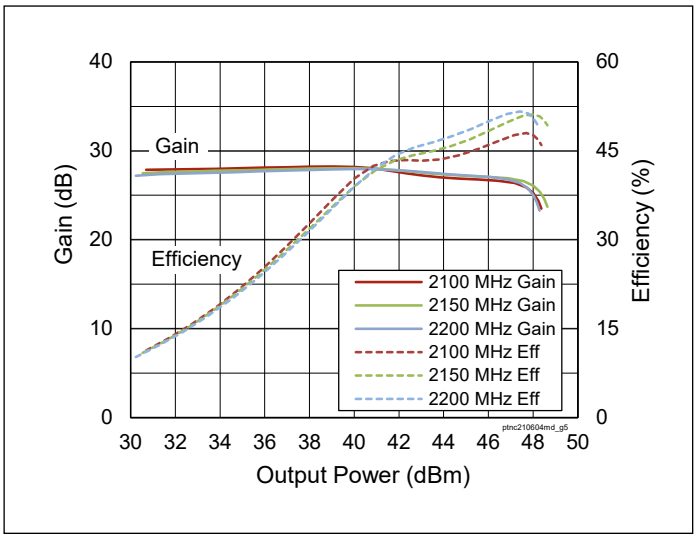


Figure 4. CW Performance

V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA,
I_{DQ1P} = 40 mA, V_{GS2P} = 2.6 V

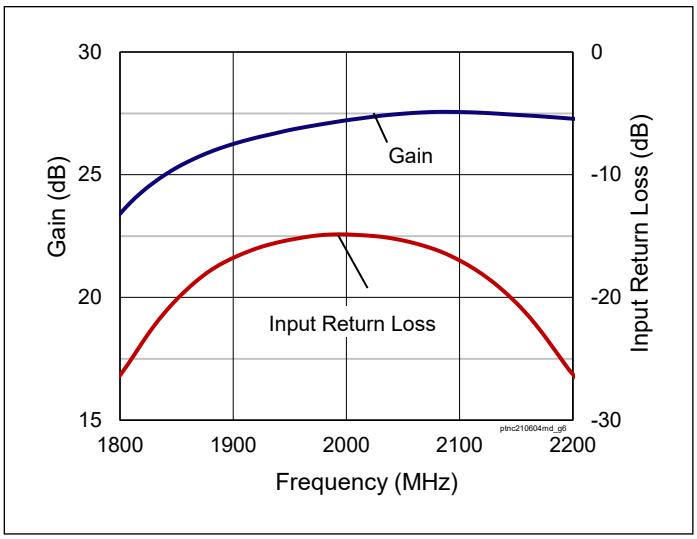


Figure 5. Small Signal CW Gain & Input Return Loss

V_{DD} = 28 V, I_{DQ1} = 34 mA, I_{DQ2} = 148 mA

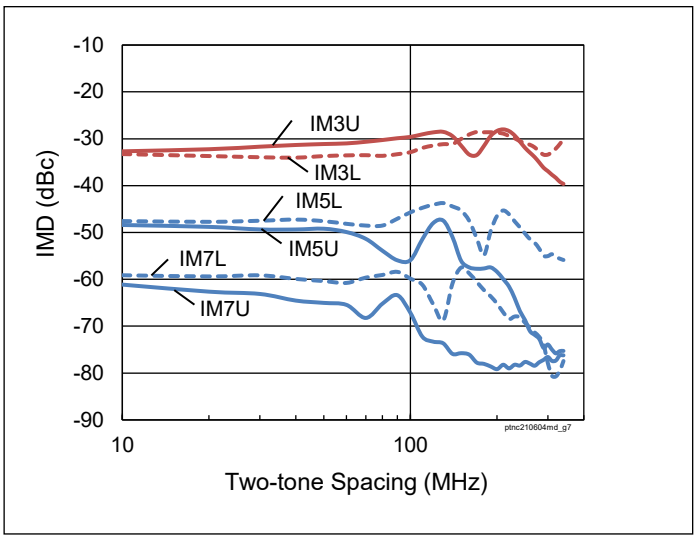


Figure 6. IMD versus two-tone spacing

V_{DD} = 28 V, I_{DQ1M} = 63 mA, I_{DQ2M} = 150 mA,
I_{DQ1P} = 40 mA, V_{GS2P}= 2.6 V,
($f1$+$f2$)/2 = Center Frequency of 2155 MHz

Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal: 1 ms, 10% duty cycle, 28 V, I_{DQ} =63 mA, 150 mA

		P_{1dB}									
		Max Output Power					Max PAE				
Freq [MHz]	Zs [W]	Zl [W]	Gain [dB]	P_{1dB} [dBm]	P_{3dB} [W]	PAE [%]	Zl [W]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	PAE [%]
1805	50+j0.00	10.1-j12.9	31.6	43.8	24.0	51.4	22.1-j13.9	32.8	42.2	16.5	58.4
1880	50+j0.00	9.5-j11.9	31.6	43.8	24.3	51.5	19.9-j5.9	32.8	42.1	16.2	58.9
1930	50+j0.00	9.5-j12.2	31.5	43.9	24.8	53.0	18.8-j5.6	32.7	42.1	16.2	59.0
1995	50+j0.00	8.9-j12.6	31.3	44.0	25.1	52.3	15.1-j5.6	32.5	42.4	17.6	59.2
2110	50+j0.00	7.8-j12.8	31.0	44.1	25.9	51.7	10.2-j7.4	32.2	43.2	20.7	59.7
2200	50+j0.00	7.1-j11.9	31.2	44.2	26.0	52.8	8.4-j7.4	32.4	43.1	20.6	60.0

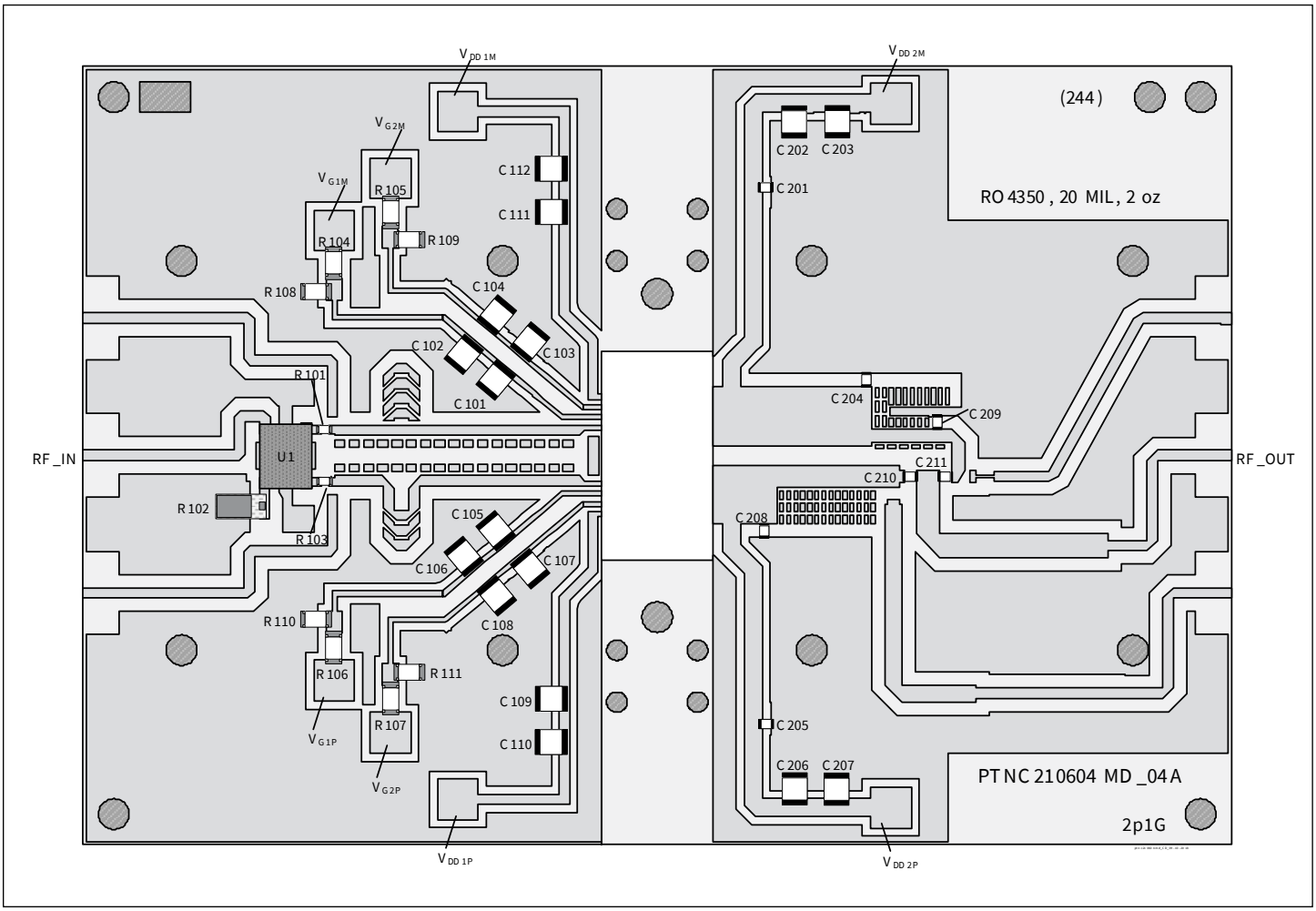
		P_{3dB}									
		Max Output Power					Max PAE				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	PAE [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	PAE [%]
1805	50+j0.00	9.4-j13.6	29.4	44.8	29.9	53.0	20.1-j12.4	30.7	43.3	21.6	60.2
1880	50+j0.00	9.2-j12.3	29.5	44.7	29.5	52.8	18.4-j8.9	30.7	43.3	21.4	60.1
1930	50+j0.00	8.8-j13.3	29.3	44.8	30.2	52.5	16.1-j7.4	30.6	43.4	22.0	59.9
1995	50+j0.00	8.5-j13.5	29.1	44.8	30.3	52.0	13.9-j6.1	30.5	43.4	21.7	59.9
2110	50+j0.00	7.6-j13.2	28.9	44.9	30.9	51.6	10.2-j6.5	30.3	43.6	22.8	59.5
2200	50+j0.00	6.9-j12.6	29.0	44.9	30.8	51.7	7.9-j6.5	30.5	43.4	22.1	59.5

Peak Side Load Pull Performance – Pulsed CW signal: 1 ms, 10% duty cycle, 28 V, I_{DQ} = 40 mA, V_{GS2P} = 2.6 V

		P_{1dB}									
		Max Output Power					Max PAE				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{3dB} [W]	PAE [%]	Zl [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	PAE [%]
1805	50+j0.00	3.4-j10.1	26.3	47.7	58.5	52.5	6.2-j8.4	26.9	46.6	45.7	62.0
1880	50+j0.00	3.2-j10.5	26.3	47.6	58.1	51.7	5.2-j8.1	26.9	46.4	43.9	60.6
1930	50+j0.00	3.0-j10.7	26.2	47.6	57.5	50.7	5.0-j8.6	26.8	46.5	44.5	60.0
1995	50+j0.00	3.1-j10.9	26.4	47.5	56.8	51.6	4.8-j8.5	26.8	46.3	42.6	59.0
2110	50+j0.00	2.6-j10.3	26.4	47.5	56.4	50.3	3.2-j8.4	27.0	46.4	43.5	58.6
2200	50+j0.00	2.5-j10.0	26.4	47.4	54.5	52.0	2.7-j8.4	26.9	46.3	43.0	59.2

		P_{3dB}									
		Max Output Power					Max PAE				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	PAE [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	PAE [%]
1805	50+j0.00	3.5-j10.2	24.3	48.2	66.6	52.4	6.2-j8.3	24.9	47.2	52.3	60.4
1880	50+j0.00	3.3-j10.6	24.3	48.2	65.7	51.2	5.2-j8.5	24.9	47.2	52.1	58.9
1930	50+j0.00	3.0-j11.0	24.1	48.1	64.8	49.3	4.8-j8.6	24.8	47.2	52.0	57.9
1995	50+j0.00	2.9-j10.9	24.3	48.1	64.1	49.3	4.7-j8.8	24.8	47.1	50.8	56.5
2110	50+j0.00	2.7-j10.4	24.4	48.0	63.1	49.8	3.3-j8.6	25.0	47.1	51.7	56.4
2200	50+j0.00	2.5-j10.1	24.3	47.8	60.5	51.3	2.7-j8.6	24.9	47.0	50.2	57.1

Evaluation Board, 2100 – 2200 MHz



Reference circuit assembly diagram (not to scale)

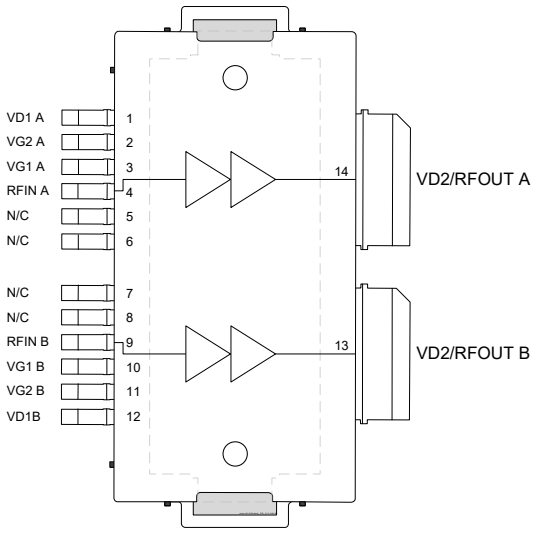
Evaluation Board Part Number	LTA/PTNC210604MD-V2
PCB Information	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66, ƒ = 2100 – 2200 MHz

Evaluation Board, 2100 – 2200 MHz (cont.)

Components Information

Component	Description	Manufacturer	P/N
C101, C103, C105, C107, C109, C111, C202, C206	Capacitor, 4.7 µF	Murata Electronics North America	GRM32ER71H475KA88L
C102, C104, C106, C108, C110, C112, C203, C207	Capacitor, 10 µF	Taiyo Yuden	UMK325C7106MM-T
C201, C205	Capacitor, 10 pF	ATC	ATC800A100JT250T
C204	Capacitor, 1.8 pF	ATC	ATC600F1R8BT250XT
C208	Capacitor, 2.0 pF	ATC	ATC600F2R0BT250XT
C209	Capacitor, 2.7 pF	ATC	ATC600F2R7BT250XT
C210, C211	Capacitor, 8.2 pF	ATC	ATC600F8R2BT250XT
R101, R103	Resistor, 0 ohms	Panasonic Electronic Components	ERJ-3GEY0R00V
R102	Resistor, 50 ohms	Anaren	C16A50Z4
R104, R105, R106, R107	Resistor, 1K ohms	Panasonic Electronic Components	ERJ-8GEYJ102V
R108, R109, R110, R111	Resistor, 4.3K ohms	Panasonic Electronic Components	ERJ-8GEYJ432V
U1	Hybrid Coupler	Anaren	X3C21P1-04S

Pinout Diagram (top view)



Source: plated copper heat slug on backside of package

Lead connections for PTNC210604MD

Package Outline Specifications – Package PG-HB1DSO-14-4

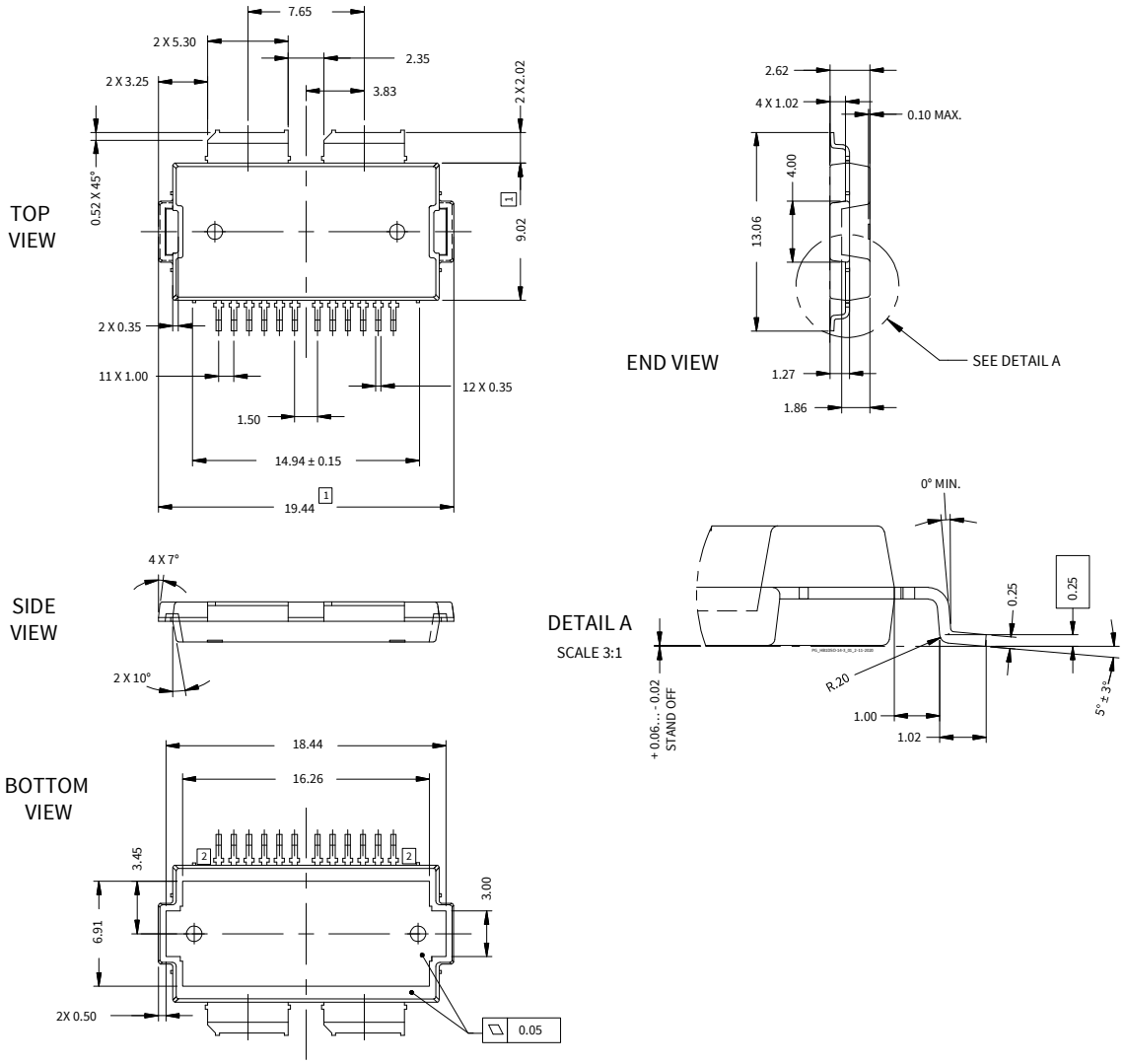


Diagram Notes–unless otherwise specified:

1. Mold/Dam Bar/Metal protrusion of 0.30 mm max per side not included.
2. Metal protrusion are connected to source and shall not exceed 0.10 mm max.
3. Fillets and radii: all radii are 0.3 mm max.
4. Interpret dimensions and tolerances per ISO 8015.
5. Dimensions are mm.
6. All tolerances ± 0.1 mm unless specified otherwise.
7. All metal surfaces are tin-plated, except area of cut.
8. Lead thickness: 0.25 mm.

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