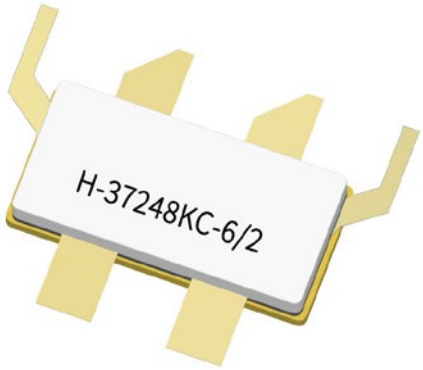
GTRB424908FC/1

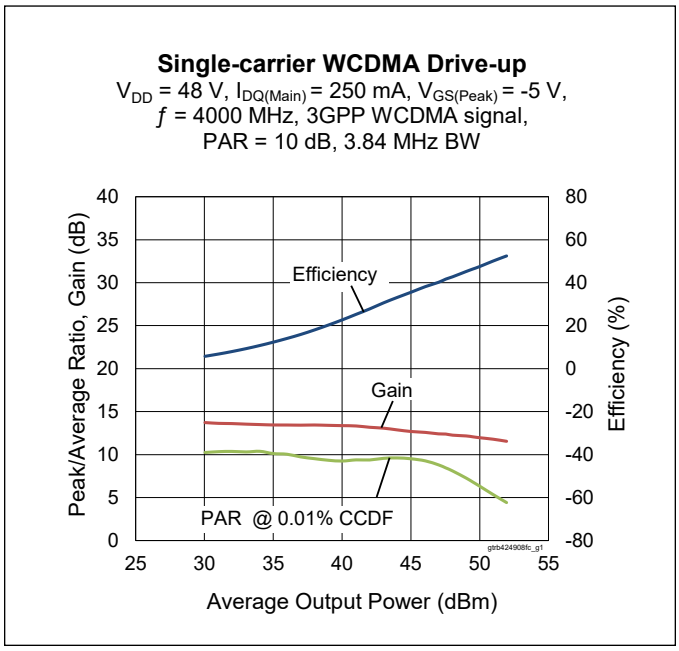
Thermally-Enhanced High Power RF GaN on SiC Amplifier, 450 W, 48 V, 3700 – 4000 MHz



Package Types: H-37248KC-6/2

Description

The GTRB424908FC/1 is a 450-watt (P_{3dB}) GaN on SiC HEMT D-mode amplifier designed for use in multi-standard cellular power amplifier applications. It features high efficiency, and a thermally-enhanced package with earless flange.



Features

- GaN on SiC HEMT technology
- Typical Pulsed CW performance, 3800 MHz, 48 V, 100 µs pulse width, 10% duty cycle, combined outputs
  - Output power at P3dB = 450 W
  - Efficiency at P_{3dB} = 61%
- Human Body Model Class 1C (per ANSI/ESDA/JEDEC JS-001)
- Pb-free and RoHS compliant

Typical RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty evaluation board for 3700 – 4000 MHz)
V_{DD} = 48 V, I_{DQ} = 250 mA, P_{OUT} = 56.2 W, $V_{GS(PEAK)}$ = –5 V, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

	P_{OUT} (dBM)	Gain (dB)	Efficiency (%)	ACPR + (dBc)	ACPR – (dBc)	OPAR (dB)
3700 MHz	47.5	12.4	42.4	–33.7	–33.8	8.2
3800 MHz	47.5	12.7	40.4	–38.0	–38.2	8.5
3900 MHz	47.5	12.8	40.7	–35.8	–35.7	8.6
4000 MHz	47.5	12.4	41.7	–32.5	–35.5	8.5

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

RoHS compliant

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DC Characteristics

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Conditions
Drain-source Breakdown Voltage (main)	$V_{BR(DSS)}$	150	—	—	V	V_{GS} = -8 V, I_D = 10 mA
Drain-source Breakdown Voltage (peak)						
Drain-source Leakage Current (main)	I_{DSS}	—	—	4.4	mA	V_{GS} = -8 V, V_{DS} = 10 V
Drain-source Leakage Current (peak)				6.3		
Gate-source Leakage Current (main)	I_{GSX}	—	—	-6.9		V_{GS} = -8 V, V_{DD} = 50 V
Gate-source Leakage Current (peak)				-9.9		
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.1	–2.3	V	V_{DS} = 10 V, I_D = 25 mA
Gate Threshold Voltage (peak)						V_{DS} = 10 V, I_D = 36 mA

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating Voltage	V_{DD}	0	—	50	V	
Gate Quiescent Voltage	$V_{GS(Q)}$	-3.6	–2.9	-2.1		V_{DS} =48 V, I_D = 250 mA

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source Voltage	V_{DSS}	125	V
Gate-source Voltage	V_{GS}	–10 to +2	
Operating Voltage	V_{DD}	55	
Gate Current (main)	I_G	25.2	mA
Gate Current (peak)		36	
Drain Current (main)	I_D	9.45	A
Drain Current (peak)		13.5	
Junction Temperature	T_J	275	°C
Storage Temperature Range	T_{STG}	–65 to +150	

1. Operation above the maximum values listed here may cause permanent damage. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the component. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. For reliable continuous operation, the device should be operated within the operating voltage range (V_{DD}) specified above.
2. Product's qualification were performed at 225 °C. Operation at TJ (275 °C) reduces median time to failure.

Thermal Characteristics

Characteristic	Symbol	Value	Unit	Conditions
Thermal Resistance (main)	$R_{\theta JC}$	1.4	°C/W	T_{CASE} = 85 °C, 100 W DC
Thermal Resistance (peak)		1.05		T_{CASE} = 85 °C, 134 W DC

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RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty test fixture)
V_{DD} = 48 V, I_{DQ} = 250 mA, P_{OUT} = 56.2 W avg, $V_{GS(PEAK)}$ = –5 V, f = 4000 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	11	12	—	dB
Drain Efficiency	η_D	35	42	—	%
Adjacent Channel Power Ratio	ACPR	—	–25	–20	dBc
Output PAR @ 0.01% CCDF	OPAR	7.2	8	—	dB

Ordering Information

Type and Version	Order Code	Package	Shipping
GTRB424908FC/1 V1 R0	GTRB424908FC1V1-R0	H-37248KC-6/2	Tape & Reel, 50 pcs
GTRB424908FC/1 V1 R2	GTRB424908FC1V1-R2	H-37248KC-6/2	Tape & Reel, 250 pcs

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Typical Performance (data taken in Doherty evaluation board)

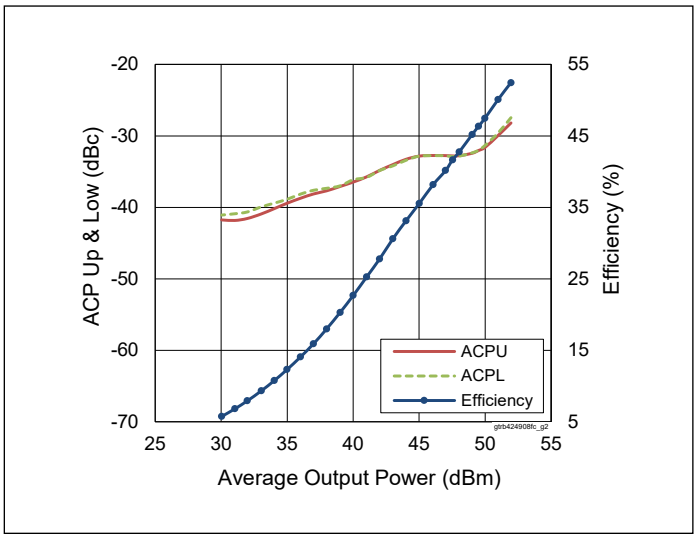

Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V,
f = 4000 MHz, 3GPP WCDMA signal,
PAR = 10 dB, BW = 3.84 MHz

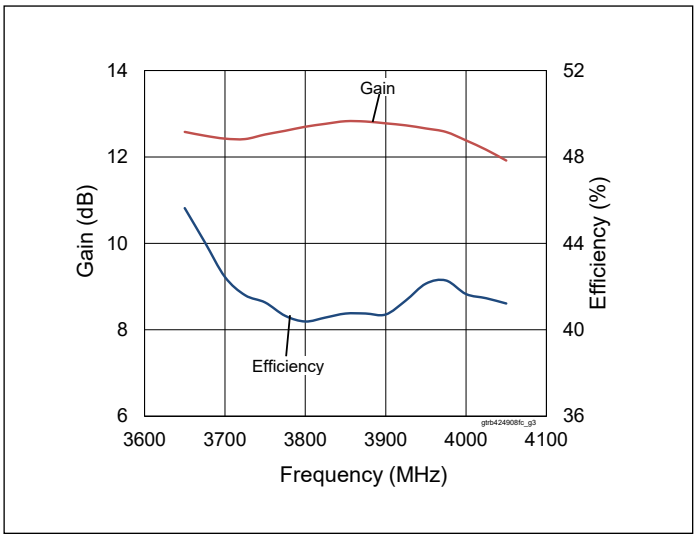

Figure 2. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V,
P_{OUT} = 47.5 dBm, 3GPP WCDMA signal,
PAR = 10 dB

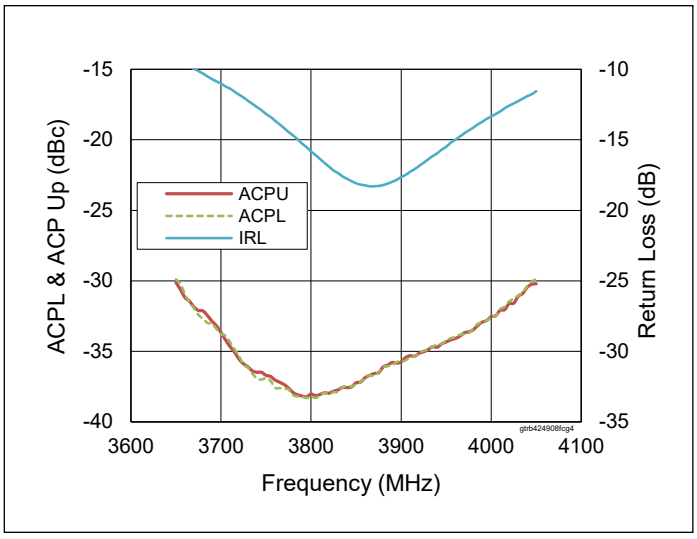

Figure 3. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V,
P_{OUT} = 47.5 dBm, 3GPP WCDMA signal,
PAR = 10 dB

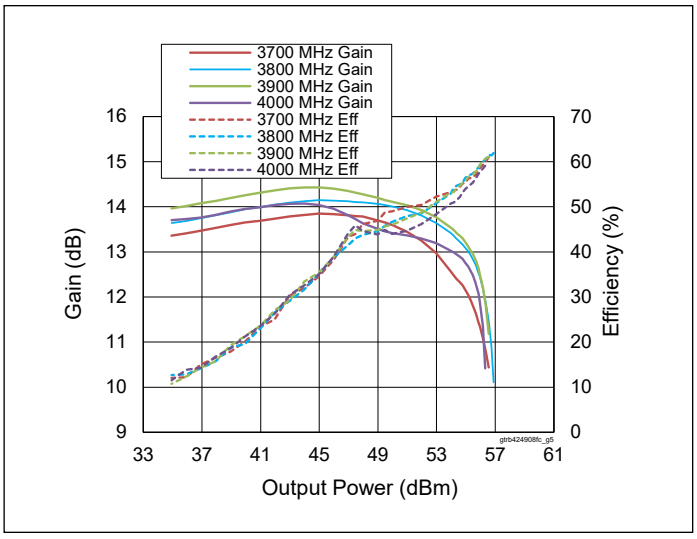

Figure 4. Pulsed CW Performance

V_{DD} = 48 V, $I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V

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Typical RF Performance(cont.)

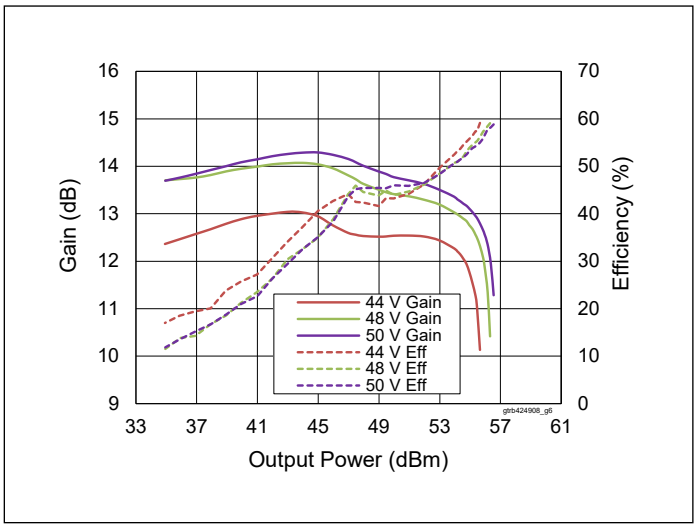

Figure 5. Pulsed CW Performance at Various V_{DD}

$I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V,
f = 4000 MHz

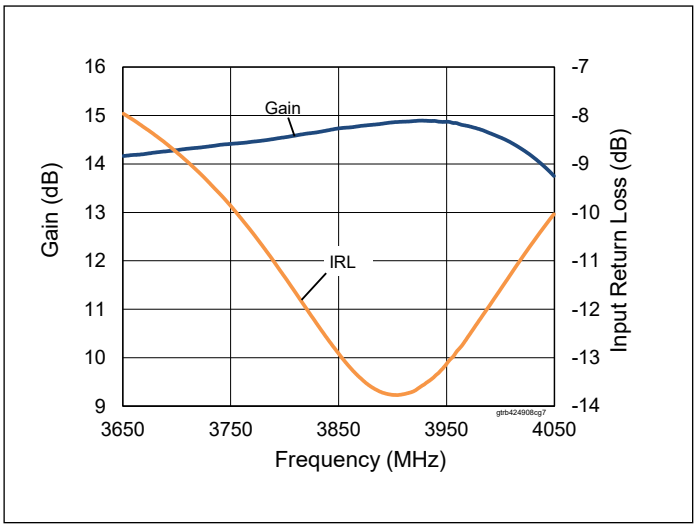

Figure 6. CW Performance Small Signal Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(Main)}$ = 250 mA, $V_{GS(Peak)}$ = -5 V

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Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal – 100 µsec, 10% duty cycle, 48 V, I_{DQ} = 250 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
3700	14-j22.8	6.7-j13.8	16.9	54	251.2	54.7	9.8-j4.9	19.1	51.7	147.9	64.4
3800	13.4-j21.2	6.9-j15.3	16.4	53.9	245.5	52.6	7.5-j7	18.9	52.1	162.2	63
3900	12.4-j22.4	7-j15.1	16.9	53.8	239.9	54	7-j8.8	18.7	52.3	169.8	62.4
4000	12.1-j26	7.5-j15.6	16.9	53.7	234.4	54.3	7.2-j9.6	18.5	52.1	162.2	62.3

Peak Side Load Pull Performance – Pulsed CW signal – 100 µsec, 10% duty cycle, 48 V, V_{GSPK} = –5 V, class C

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
3700	5.1-j21.3	3.8-j7.8	11.7	55.1	323.6	72.3	4-j7.7	11.7	55.00	316.2	72.8
3800	9.4-j21.2	2.4-j8.8	10.6	55.5	354.8	64.4	3.7-j5.7	11.7	53.80	239.9	78.1
3900	12.1-j17.5	2.7-j8.9	10.6	55.4	346.7	64.7	3.4-j5.9	11.3	53.70	234.4	73.6
4000	11.3-j13.2	2.8-j9	10.6	55.4	346.7	64.7	2.9-j6.1	11.5	53.50	223.9	73.8

Peak Side Load Pull Performance – Pulsed CW signal – 100 µsec, 10% duty cycle, 48 V, I_{DQ} = 360 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
3700	5.1-j21.3	2.6-j8.8	14.7	55.8	380.2	61.0	3.8-j6.8	16.4	54.30	269.2	67.3
3800	9.4-j21.2	2.4-j8.9	14.5	55.8	380.2	60.0	3.6-j4.1	16.9	52.20	166	68.8
3900	12.1-j17.5	2.7-j9	14.7	55.7	371.5	61.1	2.8-j6.5	16.6	54.10	257	68.4
4000	10.6-j16.8	2.7-j9.3	14.9	55.6	363.1	59.4	2.9-j6.4	17.1	53.40	218.8	67.9

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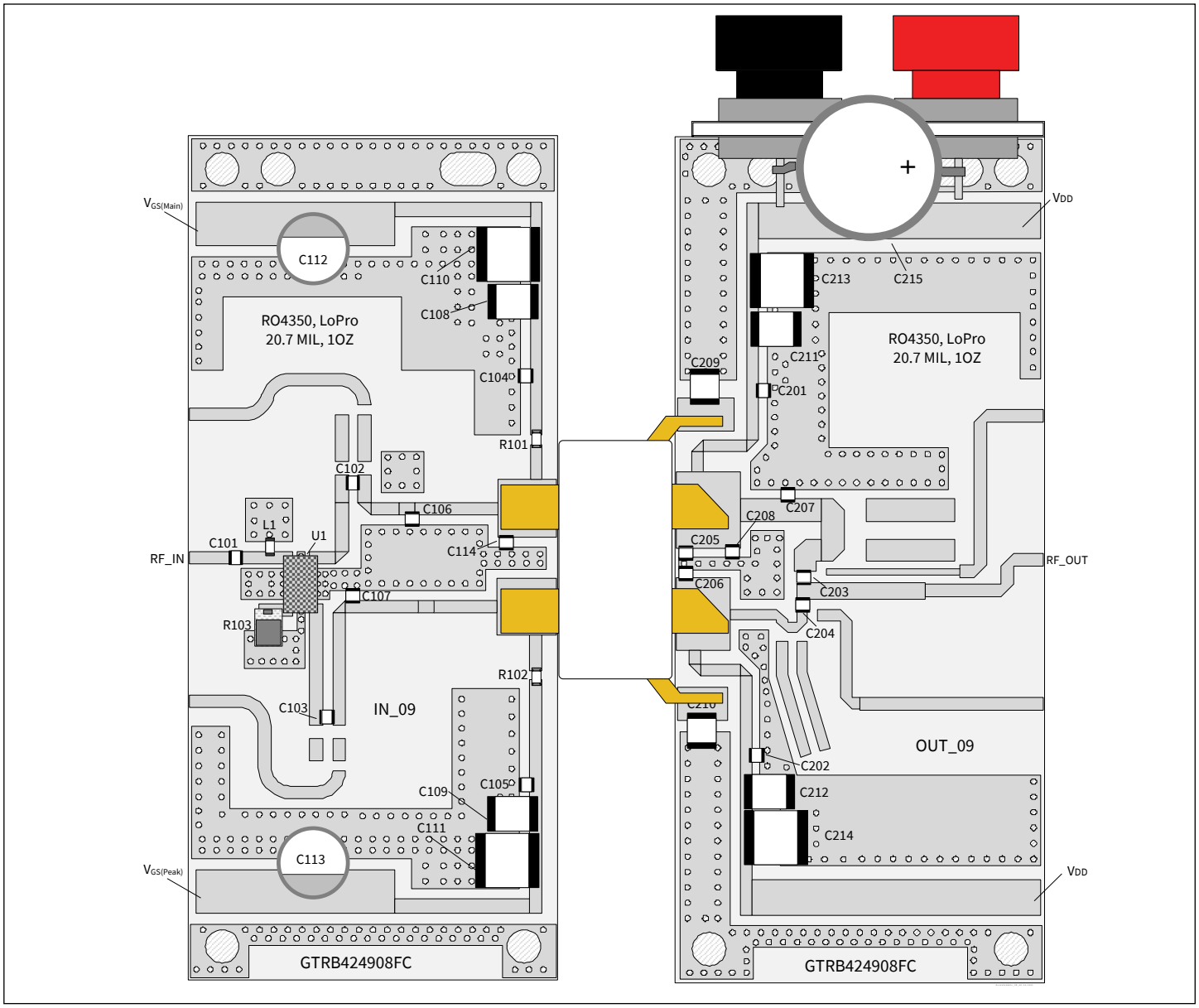
Doherty Evaluation Board, 3700 – 4000 MHz

Evaluation Board Part Number	LTAGTRB424908FC1E4
PCB Information	Rogers 4350 LoPro, 0.526 mm [0.0207”] thick, 1 oz. copper, ε_r = 3.66



Reference circuit assembly diagram (not to scale)

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Doherty Evaluation Board (cont.)

Components Information

Component	Description	Manufacturer	P/N
Input			
C101, C102, C103, C104, C105	Capacitor, 8.2 pF	ATC	ATC800A8R2JT250XT
C106	Capacitor, 0.8 pF	ATC	ATC800A0R8CT250XT
C107	Capacitor, 0.4 pF	ATC	ATC800A0R4CT250T
C108, C109	Capacitor, 100 V, 1 µF	TDK Corporation	C4532X7R2A105K230KA
C110, C111	Capacitor, 100 V, 10 µF	TDK Corporation	C5750X7S2A106M230KB
C112, C113	Capacitor, 35 V, 100 µF	Panasonic Electronic Components	EEE-FT1V101AP
C114	Capacitor, 0.1 pF	ATC	ATC800A0R1CT250T
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 50 ohms	Richardson	C8A50Z4B
L1	Inductor , 6.8 nH	EPCOS - TDK Electronics	B82496C3689J000
U1	Hybrid Coupler	Anaren	X3C35F1-03S
Output			
C201, C202, C203, C204	Capacitor, 8.2 pF	ATC	ATC800A8R2JT250XT
C205, C206	Capacitor, 0.6 pF	ATC	ATC800A0R6CT250XT
C207	Capacitor, 0.9 pF	ATC	ATC800A0R9CT250XT
C208	Capacitor, 0.2 pF	ATC	ATC800A0R2CT250XT
C209, C210	Capacitor, 100 V, 4.7 µF	TDK Corporation	C4532X7S2A475M230KB
C211, C212	Capacitor, 100 V, 1 µF	TDK Corporation	C4532X7R2A105K230KA
C213, C214	Capacitor, 100 V, 10 µF	TDK Corporation	C5750X7S2A106M230KB
C215	Capacitor, 220 µF	Panasonic Electronic Components	ECA-2AHG221

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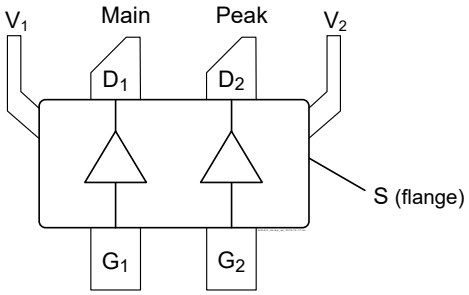
Bias Sequencing

Bias On
1. Ensure RF is turned off
2. Apply pinch-off voltage of –5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias Off
1. Turn RF off
2. Apply pinch-off voltage to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Pinout Diagram (top view)



Lead connections for GTRB424908FC/1

Pin	Description
D1	Drain Device 1
D2	Drain Device 2
G1	Gate Device 1
G2	Gate Device 2
V1	Drain video decoupling and no DC bias
V2	Drain video decoupling and no DC bias
S	Source (flange)

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Package Outline Specifications – Package H-37248KC-6/2

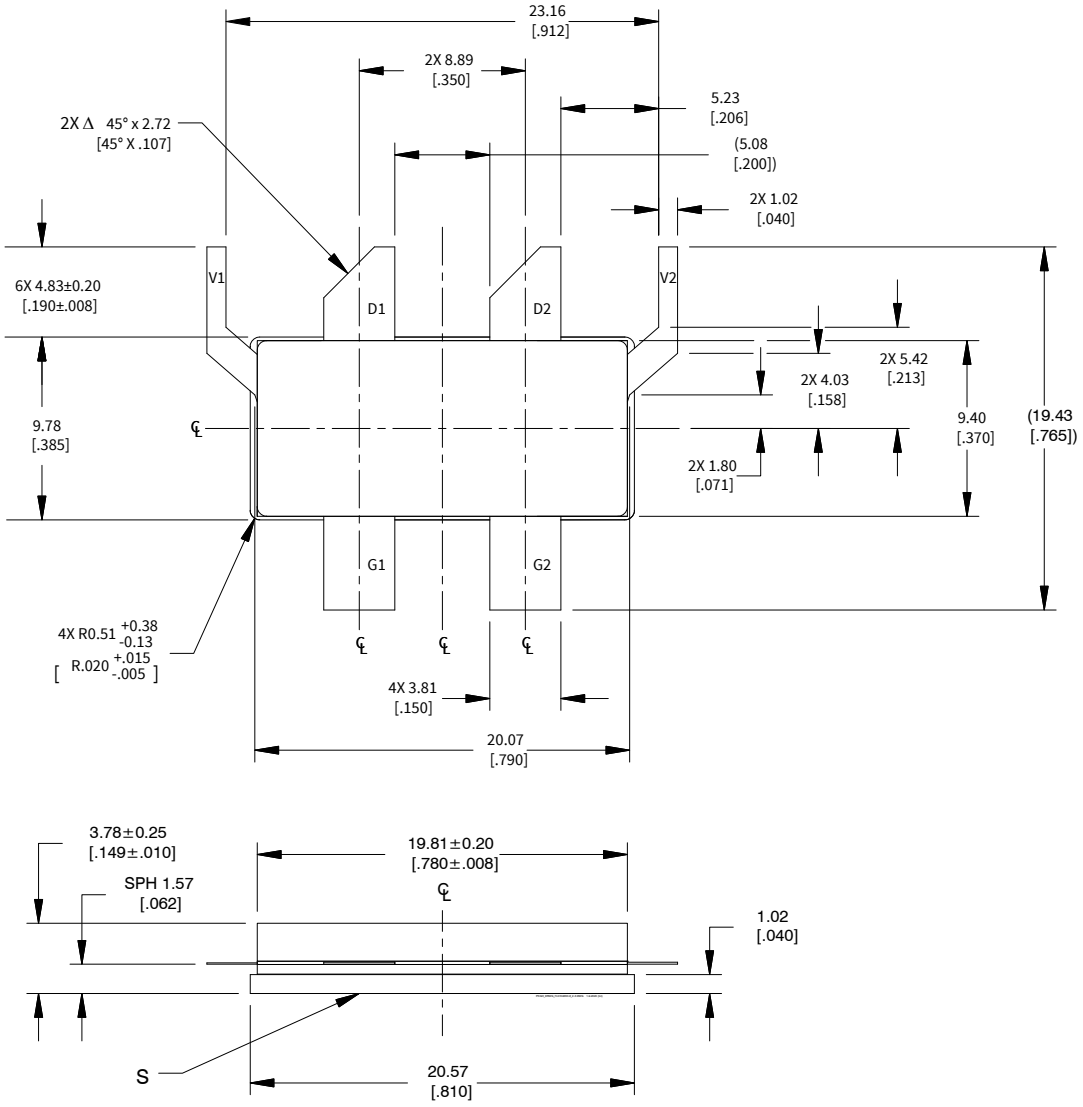

Diagram Notes—unless otherwise specified:

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]
4. Pins: D1, D2 – drain, G1, G2 – gate, V1, V2 – drain video decoupling and no DC bias, S – source (flange)
5. Lead thickness: 0.127 +0.05/–0.025 [.005 +.002/–.001]
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch]

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