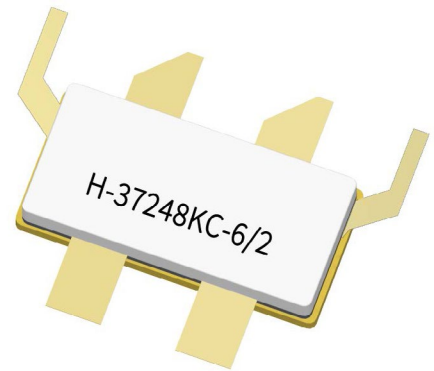


GTRB424908FC/1

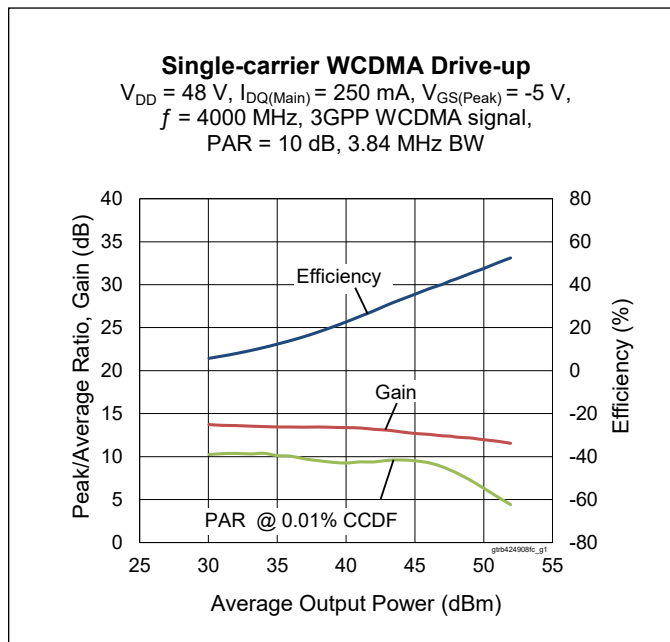
Thermally-Enhanced High Power RF GaN on SiC HEMT
450 W, 48 V, 3700 – 4000 MHz

Description

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



Package Types: H-37248KC-6/2



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 $P_{3dB} = 450\text{ W}$
 - 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)

$V_{DD} = 48\text{ V}$, $I_{DQ} = 250\text{ mA}$, $P_{OUT} = 56.2\text{ W}$, $V_{GS(PEAK)} = -5\text{ V}$, 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 $T_{CASE} = 25^\circ\text{C}$ unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!



DC Characteristics

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

Recommended Operating Conditions

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

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 T_J (275 °C) reduces median time to failure.

Thermal Characteristics

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

RF Characteristics

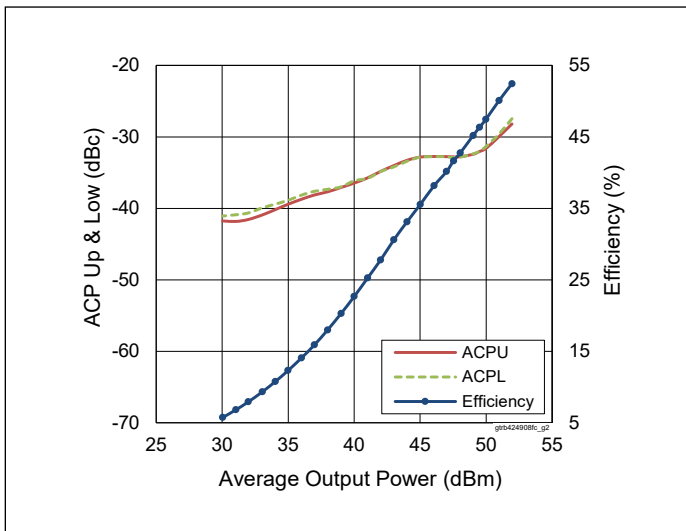
Single-carrier WCDMA Specifications (tested in the Doherty test fixture)

$V_{DD} = 48\text{ V}$, $I_{DQ} = 250\text{ mA}$, $P_{OUT} = 56.2\text{ W avg}$, $V_{GS(PEAK)} = -5\text{ V}$, $f = 4000\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

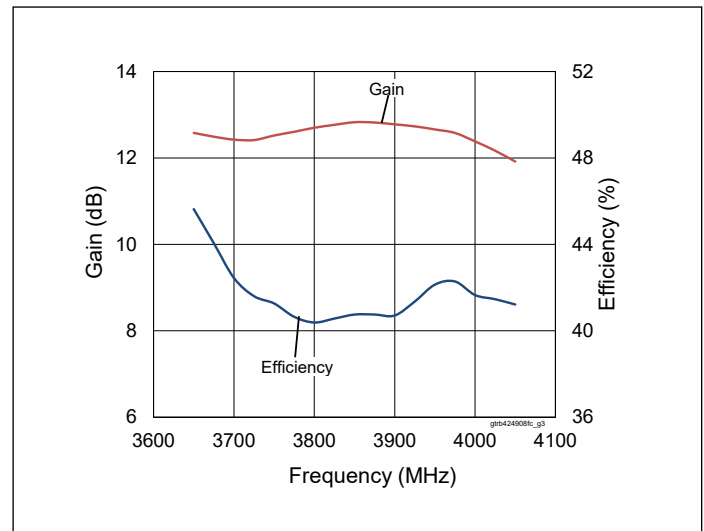
Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	11	12	—	dB
Drain Efficiency	η_D	35	42	—	%
Adjacent Channel Power Ratio	ACPR	—	-25	-20	dBc
Output PAR @ 0.01% CCDF	OPAR	7.2	8	—	dB

Ordering Information

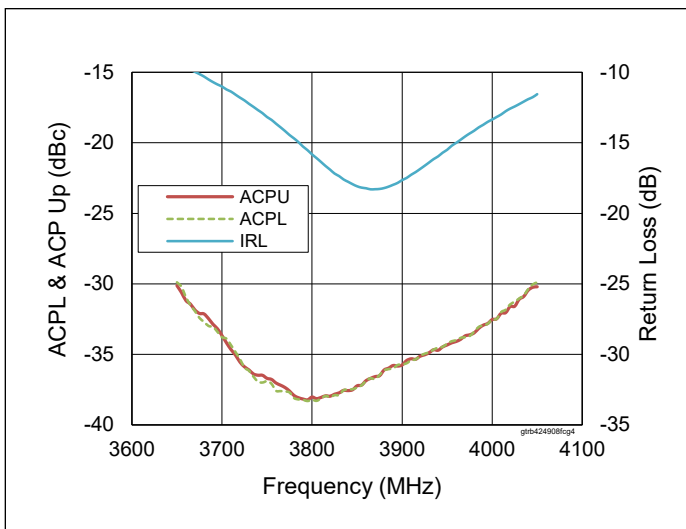
Type and Version	Order Code	Package	Shipping
GTRB424908FC/1 V1 R0	GTRB424908FC1V1-R0	H-37248KC-6/2	Tape & Reel, 50 pcs
GTRB424908FC/1 V1 R2	GTRB424908FC1V1-R2	H-37248KC-6/2	Tape & Reel, 250 pcs

Typical Performance (data taken in Doherty evaluation board)

Figure 1. Single-carrier WCDMA Drive-up

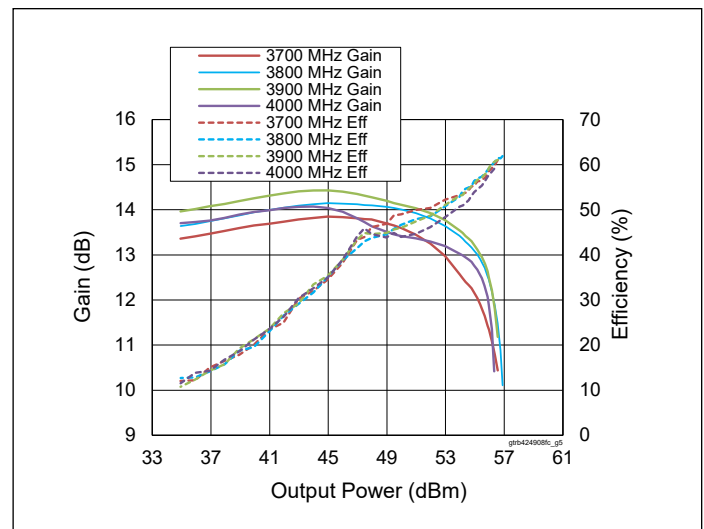
$V_{DD} = 48\text{ V}$, $I_{DQ(\text{Main})} = 250\text{ mA}$, $V_{GS(\text{Peak})} = -5\text{ V}$,
 $f = 4000\text{ MHz}$, 3GPP WCDMA signal,
 $PAR = 10\text{ dB}$, $BW = 3.84\text{ MHz}$


Figure 2. Single-carrier WCDMA Broadband Performance

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


Figure 3. Single-carrier WCDMA Broadband Performance

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


Figure 4. Pulsed CW Performance

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

Typical RF Performance(cont.)

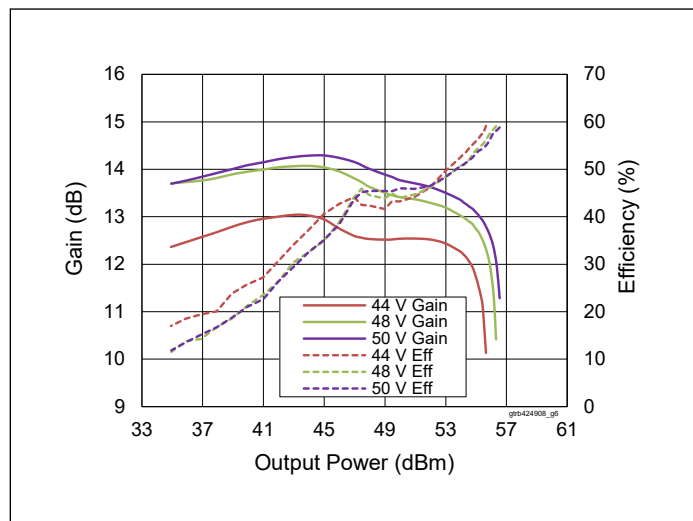


Figure 5. Pulsed CW Performance at Various V_{DD}

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

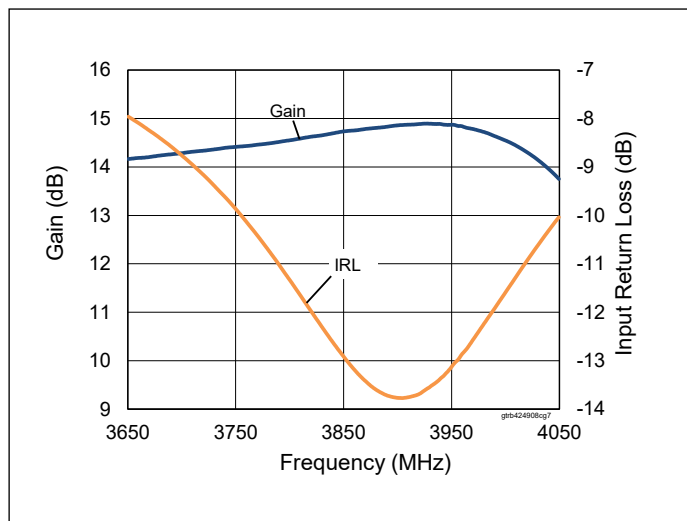


Figure 6. CW Performance Small Signal Gain & Input Return Loss

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

Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal – 100 μ sec, 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]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
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 μ sec, 10% duty cycle, 48 V, $V_{GSPK} = -5$ V, class C

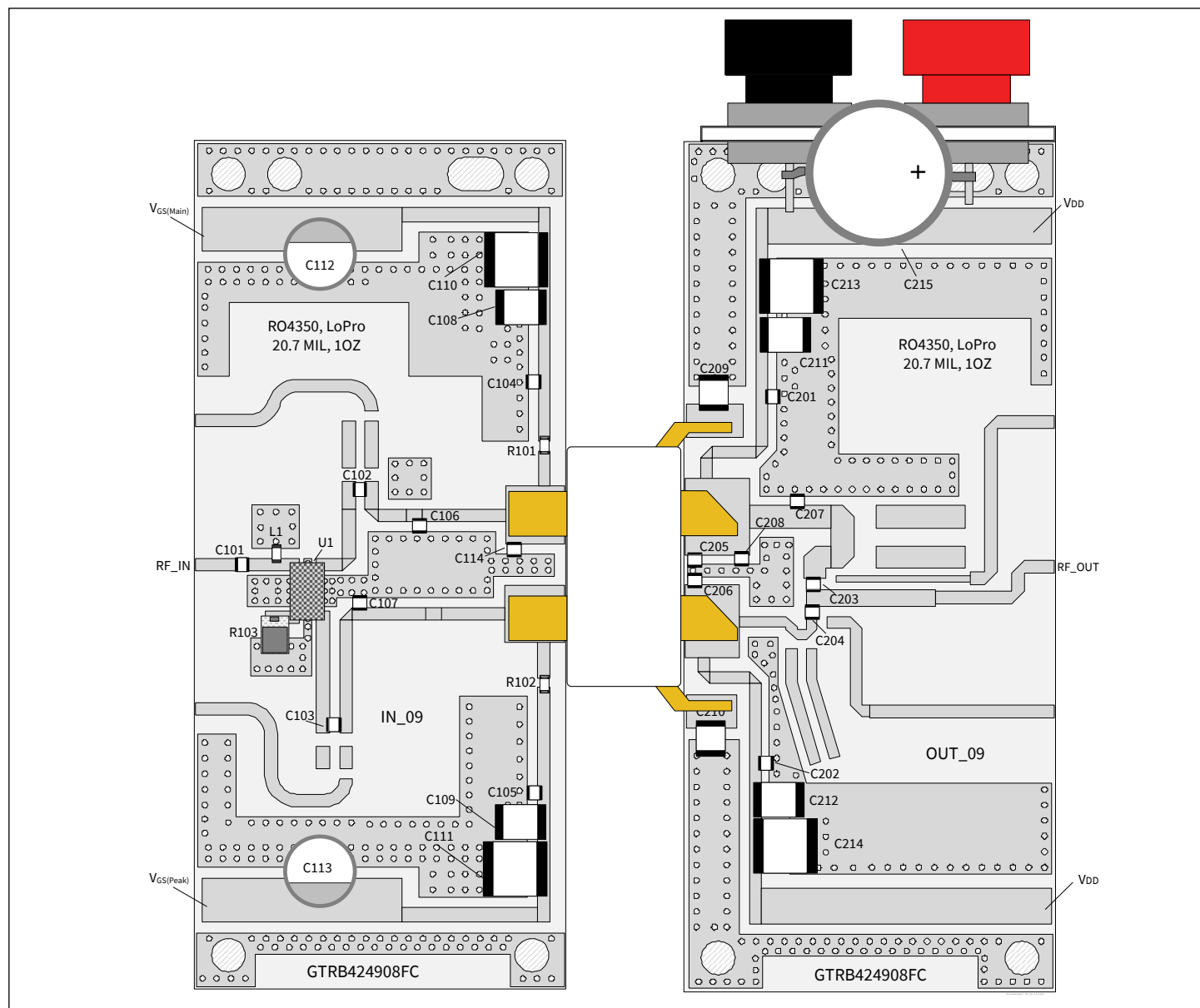
P_{3dB}											
Max Output Power							Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
3700	5.1-j21.3	3.8-j7.8	11.7	55.1	323.6	72.3	4-j7.7	11.7	55.00	316.2	72.8
3800	9.4-j21.2	2.4-j8.8	10.6	55.5	354.8	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 μ sec, 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]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
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

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, $\epsilon_r = 3.66$



Reference circuit assembly diagram (not to scale)

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 μ F	TDK Corporation	C4532X7R2A105K230KA
C110, C111	Capacitor, 100 V, 10 μ F	TDK Corporation	C5750X7S2A106M230KB
C112, C113	Capacitor, 35 V, 100 μ F	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 μ F	TDK Corporation	C4532X7S2A475M230KB
C211, C212	Capacitor, 100 V, 1 μ F	TDK Corporation	C4532X7R2A105K230KA
C213, C214	Capacitor, 100 V, 10 μ F	TDK Corporation	C5750X7S2A106M230KB
C215	Capacitor, 220 μ F	Panasonic Electronic Components	ECA-2AHG221

Bias Sequencing

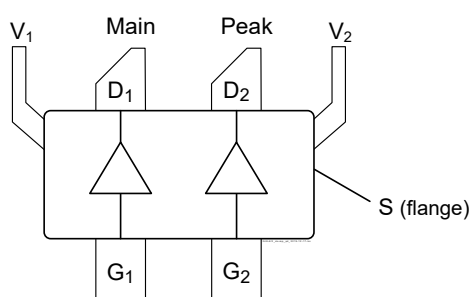
Bias On

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)



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)

Lead connections for GTRB424908FC/1

Technical drawing of a mechanical part, showing front and side views with dimensions in inches and millimeters.

Front View Dimensions:

- Overall width: 23.16 [.912]
- Top width: 2X 8.89 [.350]
- Top width: 5.23 [.206]
- Top width: (5.08 [.200])
- Top width: 2X 1.02 [.040]
- Top width: 2X 4.03 [.158]
- Top width: 2X 5.42 [.213]
- Top width: 2X 1.80 [.071]
- Top width: 9.40 [.370]
- Top width: (19.43 [.765])
- Top width: 20.07 [.790]
- Top width: 4X 3.81 [.150]
- Top width: 4X R0.51 ^{+0.38} _{-0.13} [R.020 ^{+0.015} _{-.005}]
- Top width: 6X 4.83 ± 0.20 [.190 ± 0.008]
- Top width: 9.78 [.385]
- Top width: 2X Δ 45° x 2.72 [45° X .107]
- Top width: V1
- Top width: D1
- Top width: D2
- Top width: V2
- Top width: G1
- Top width: G2
- Top width: 4X R0.51 ^{+0.38} _{-0.13} [R.020 ^{+0.015} _{-.005}]

Side View Dimensions:

- Overall height: 19.43 [.765]
- Overall height: 9.40 [.370]
- Overall height: 20.07 [.790]
- Overall height: 4X 3.81 [.150]
- Overall height: 4X R0.51 ^{+0.38} _{-0.13} [R.020 ^{+0.015} _{-.005}]
- Overall height: 6X 4.83 ± 0.20 [.190 ± 0.008]
- Overall height: 9.78 [.385]
- Overall height: 2X Δ 45° x 2.72 [45° X .107]
- Overall height: V1
- Overall height: D1
- Overall height: D2
- Overall height: V2
- Overall height: G1
- Overall height: G2
- Overall height: 4X R0.51 ^{+0.38} _{-0.13} [R.020 ^{+0.015} _{-.005}]

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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