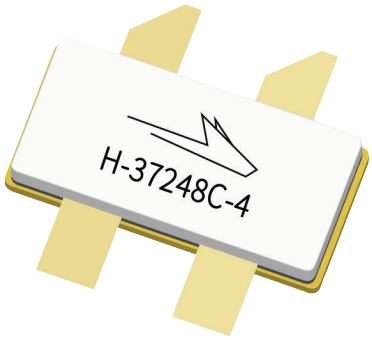
GTRA374902FC

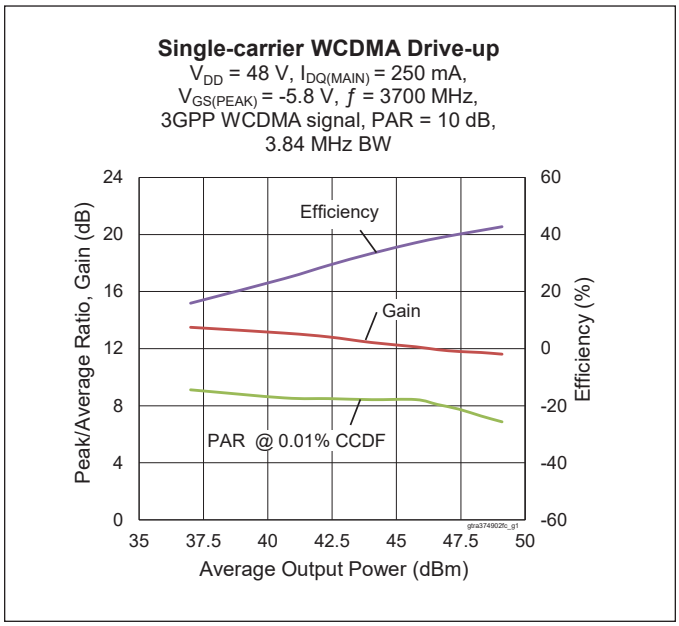
Thermally-Enhanced High Power RF GaN on SiC HEMT
450 W, 48 V, 3600 – 3700 MHz



Package Types: H-37248C-4

Description

The GTRA374902FC is a 450-watt (P_{3dB}) GaN on SiC high electron mobility transistor (HEMT) for use in multi-standard cellular power amplifier applications. It features input matching, high efficiency, and a thermally-enhanced package with earless flange.



Features

- GaN on SiC HEMT technology
- Input matched
- Asymmetrical Doherty design
  - Main: P_{3dB} = 220 W Typ
  - Peak: P_{3dB} = 300 W Typ
- Typical Pulsed CW performance, 3700 MHz, 48 V, Doherty @ P_{3dB}, 10 µs, 10% duty cycle
  - Output power = 450 W
  - Drain efficiency = 60%
  - Gain = 11.5 dB
- Capable of handling 10:1 VSWR @ 48 V, 63 W (WCDMA) output power
- Human Body Model Class 1A, (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

RF Characteristics

Single-carrier WCDMA Specifications (tested in Wolfspeed Doherty production test fixture)
V_{DD} = 48 V, I_{DQ} = 250 mA, P_{OUT} = 63 W avg, $V_{GS(PEAK)}$ = –5.8 V, ƒ = 3700 MHz, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	10.8	12	—	dB
Drain Efficiency	η_D	32	37.5	—	%
Adjacent Channel Power Ratio	ACPR	—	–32.5	–28.5	dBc
Output PAR @ 0.01% CCDF	OPAR	7.5	8.2	—	dB

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	I_{DSS}	—	—	5	mA	V_{GS} = -8 V, V_{DS} = 10 V
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.0	–2.3	V	V_{DS} = 10 V, I_D = 25.2 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	$V_{GS(Q)}$	-3.65	–3	-2.4		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	9.5	A
Drain Current (peak)		13.5	
Junction Temperature	T_J	225	°C
Storage Temperature Range	T_{STG}	–65 to +150	

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.

Thermal Characteristics

Characteristics	Symbol	Value	Unit	Conditions
Thermal Resistance (main)	$R_{\theta JC}$	1.6	°C/W	T_{CASE} = 85°C, 100 W DC
Thermal Resistance (peak)		1.1		T_{CASE} = 85 °C, 140 W DC

Ordering Information

Type and Version	Order Code	Package Description	Shipping
GTRA374902FC V1 R0	GTRA374902FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRA374902FC V1 R2	GTRA374902FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in test fixture)

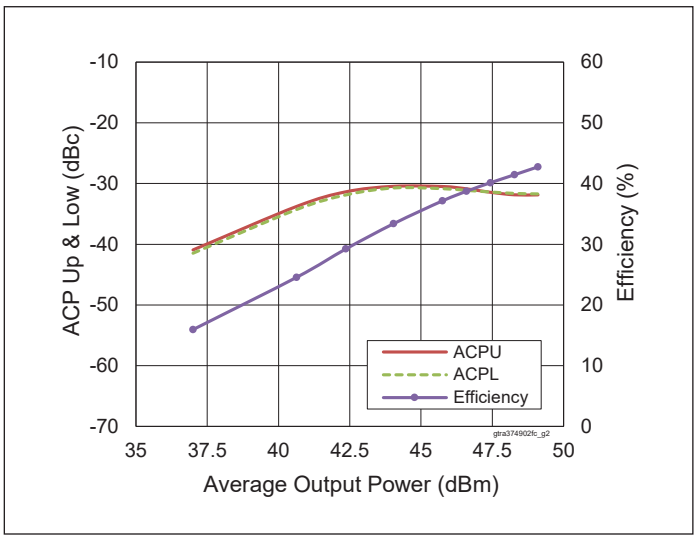


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 250 mA,
$V_{GS(PEAK)}$ = -5.8 V, f = 3700 MHz,
3GPP WCDMA signal, PAR = 10 dB,
BW = 3.84 MHz

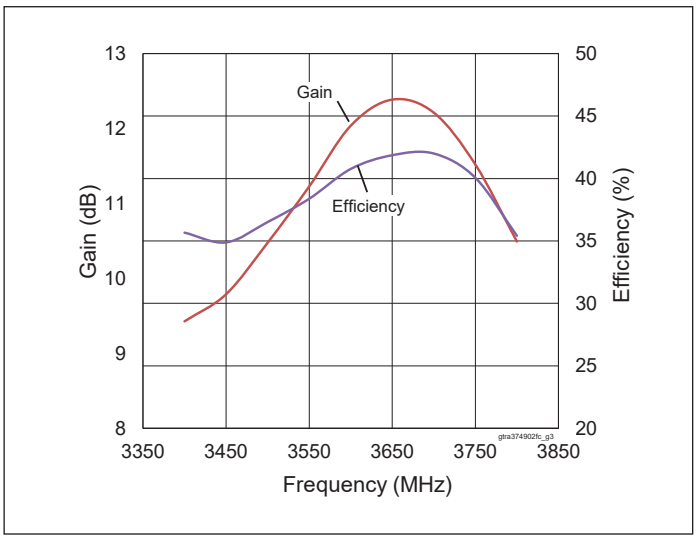


Figure 2. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 250 mA,
$V_{GS(PEAK)}$ = -5.8 V, P_{OUT} = 48 dBm,
3GPP WCDMA signal, PAR = 10 dB

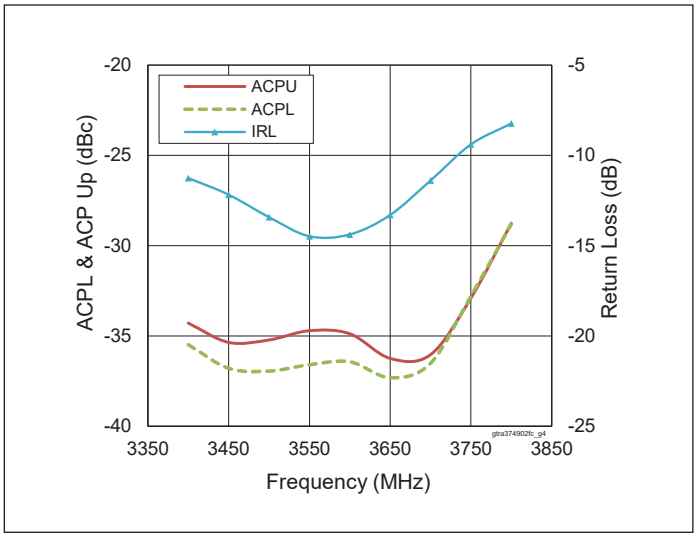


Figure 3. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 250 mA,
$V_{GS(PEAK)}$ = -5.8 V, P_{OUT} = 48 dBm,
3GPP WCDMA signal, PAR = 10 dB

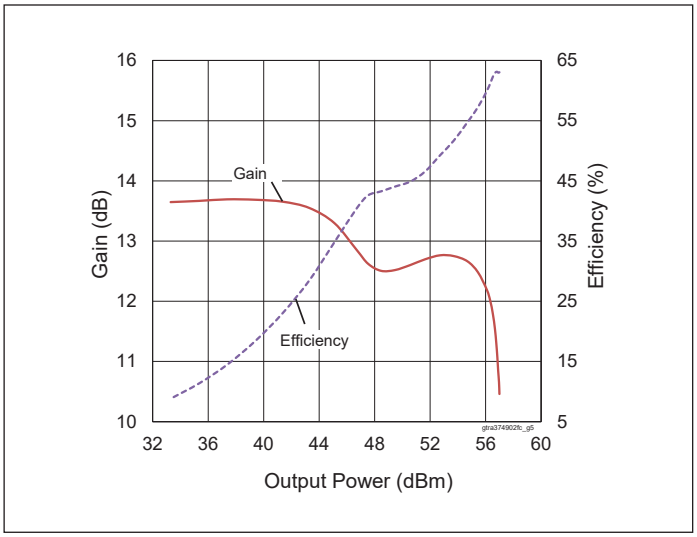


Figure 4. Pulse CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 250 mA,
$V_{GS(PEAK)}$ = -5.8 V , f = 3700 MHz

Typical Performance (cont.)

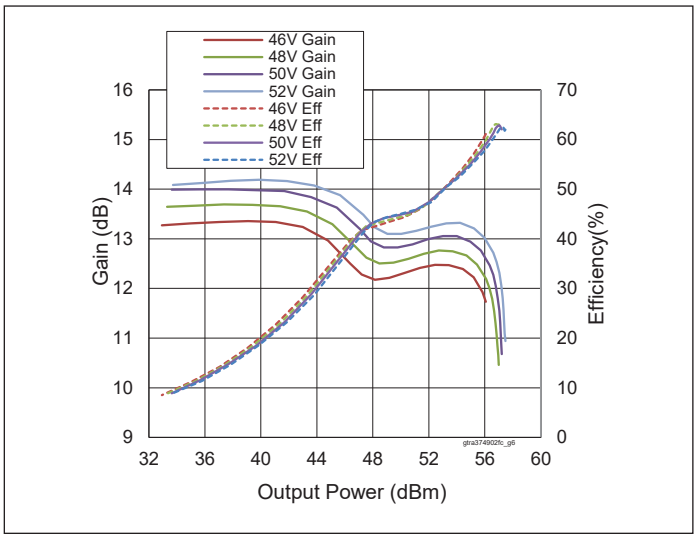


Figure 5. Pulse CW Performance at various V_{DD}

$I_{DQ(MAIN)}$ = 250 mA, $V_{GS(PEAK)}$ = -5.8 V
f = 3700 MHz

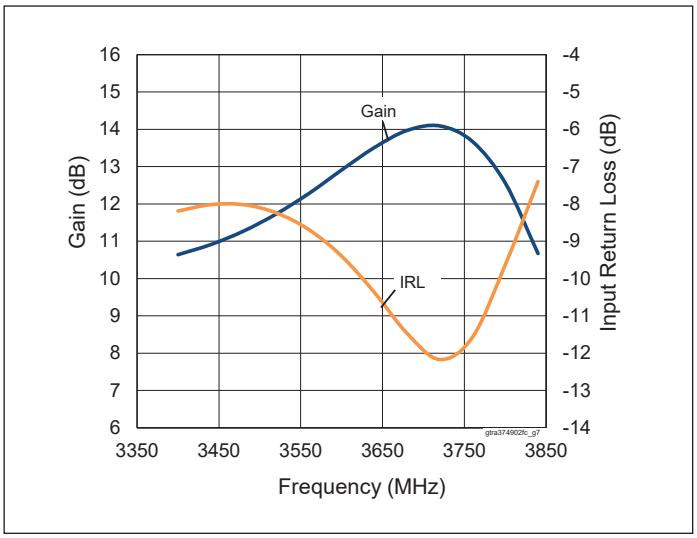


Figure 6. CW Performance Small Signal Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 250 mA,
$V_{GS(PEAK)}$ = -5.8 V

Load Pull Performance

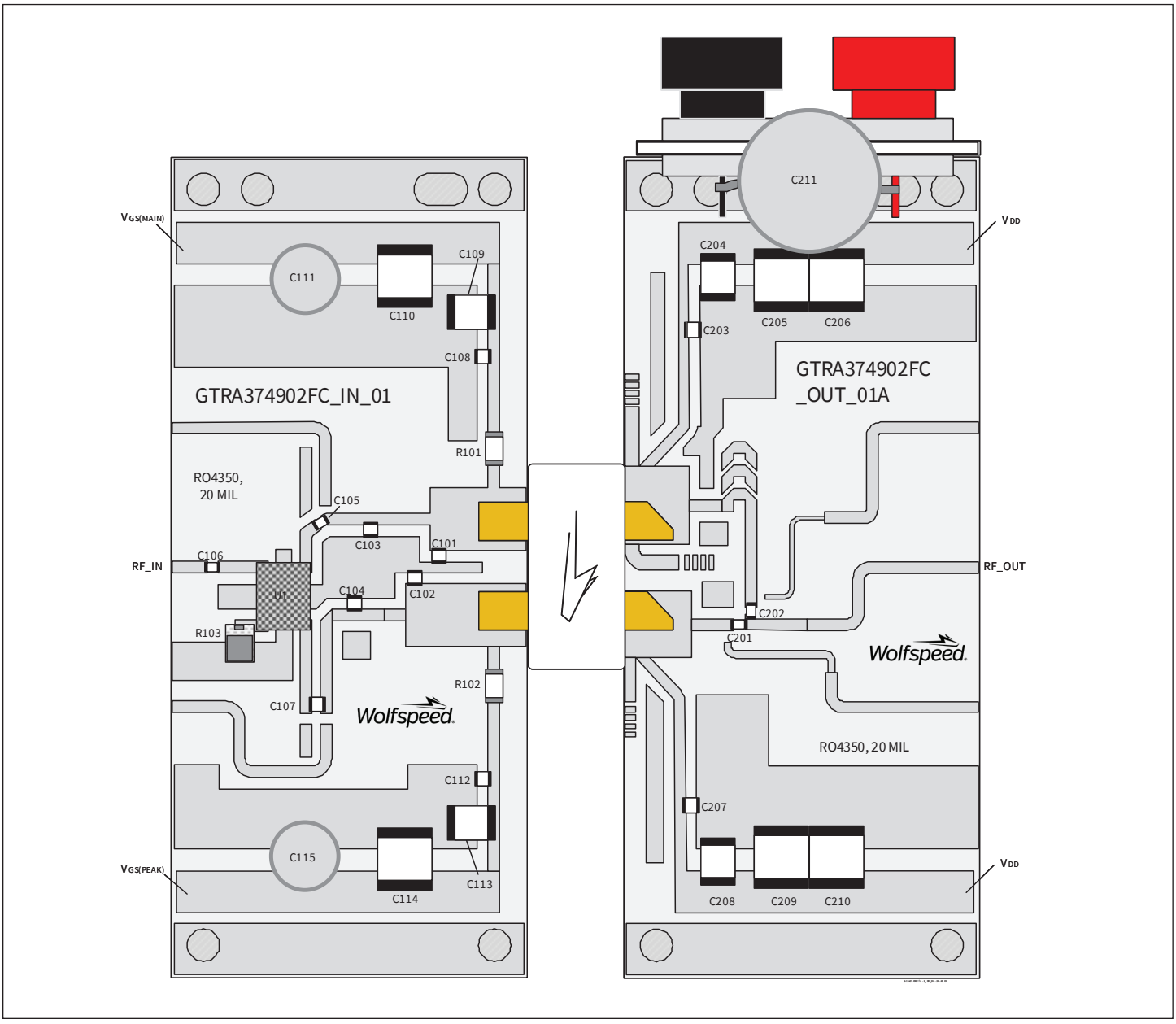
Main Side Load Pull Performance – Pulsed CW signal: 10 µs, 10% duty cycle, 48 V, I_{DQ} = 250 mA, class AB

		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 [%]
3600	7-j5.7	3.5-j6.7	16.4	54.20	263	61.0	2-j4.4	17.9	52.20	166	71.0
3700	6.2-j9.3	3.7-j6.6	16.2	54.20	263	60.0	1.8-j5.2	17.4	52.30	170	70.0

Peak Side Load Pull Performance – Pulsed CW signal: 10 µs, 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 [%]
3600	15-j11.3	3.2-j8.4	11.8	55.60	363	58.6	2.9-j7.1	12.4	55.10	324	66.7
3700	10.8-j8.8	3.2-j8.7	11.3	55.40	347	55.0	2.4-j7	12.2	54.80	302	68.4

Evaluation Board, 3600 – 3700 MHz



Reference circuit assembly diagram (not to scale)

Evaluation Board Part Number	LTA/GTRA374902FC-V1
PCB Information	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66, f = 3600 – 3700 MHz

Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF

Components Information

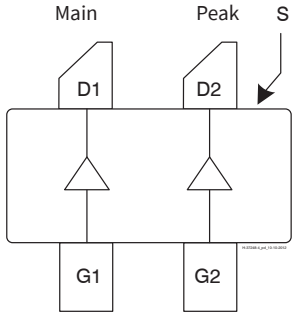
Component	Description	Manufacturer	P/N
Input			
C101, C102	Capacitor, 0.5 pF	ATC	ATC800A0R5CT250XT
C103	Capacitor, 0.9 pF	ATC	ATC800A0R9CT250XT
C104	Capacitor, 1.2 pF	ATC	ATC800A1R2CT250XT
C105, C106, C107, C108, C112	Capacitor, 10 pF	ATC	ATC800A100JT250XT
C109, C113	Capacitor, 1 µF, 100 V	TDK Corporation	C4532X7R2A105M230KA
C110, C114	Capacitor, 10 µF, 100 V	TDK Corporation	C5750X7S2A106M230KB
C111, C115	Capacitor, 100 µF, 35 V	Panasonic Electronic Components	EEE-FT1V101AP
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 50 ohms	Richardson	C8A50Z4A
U1	Hybrid Coupler	Anaren	XC3500P-03S
Output			
C201, C202, C203, C207	Capacitor, 10 pF	ATC	ATC800A100JT250XT
C204, C208	Capacitor, 1 µF, 100 V	TDK Corporation	C4532X7R2A105M230KA
C205, C206, C209, C210	Capacitor, 10 µF, 100 V	TDK Corporation	C5750X7S2A106M230KB
C211	Capacitor, 220 µF, 100 V	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 (Main)
D2	Drain Device 2 (Peak)
G1	Gate Device 1 (Main)
G2	Gate Device 2 (Peak)
S	Source (flange)

Lead connections for GTRA374902FC

Package Outline Specifications – Package H-37248C-4

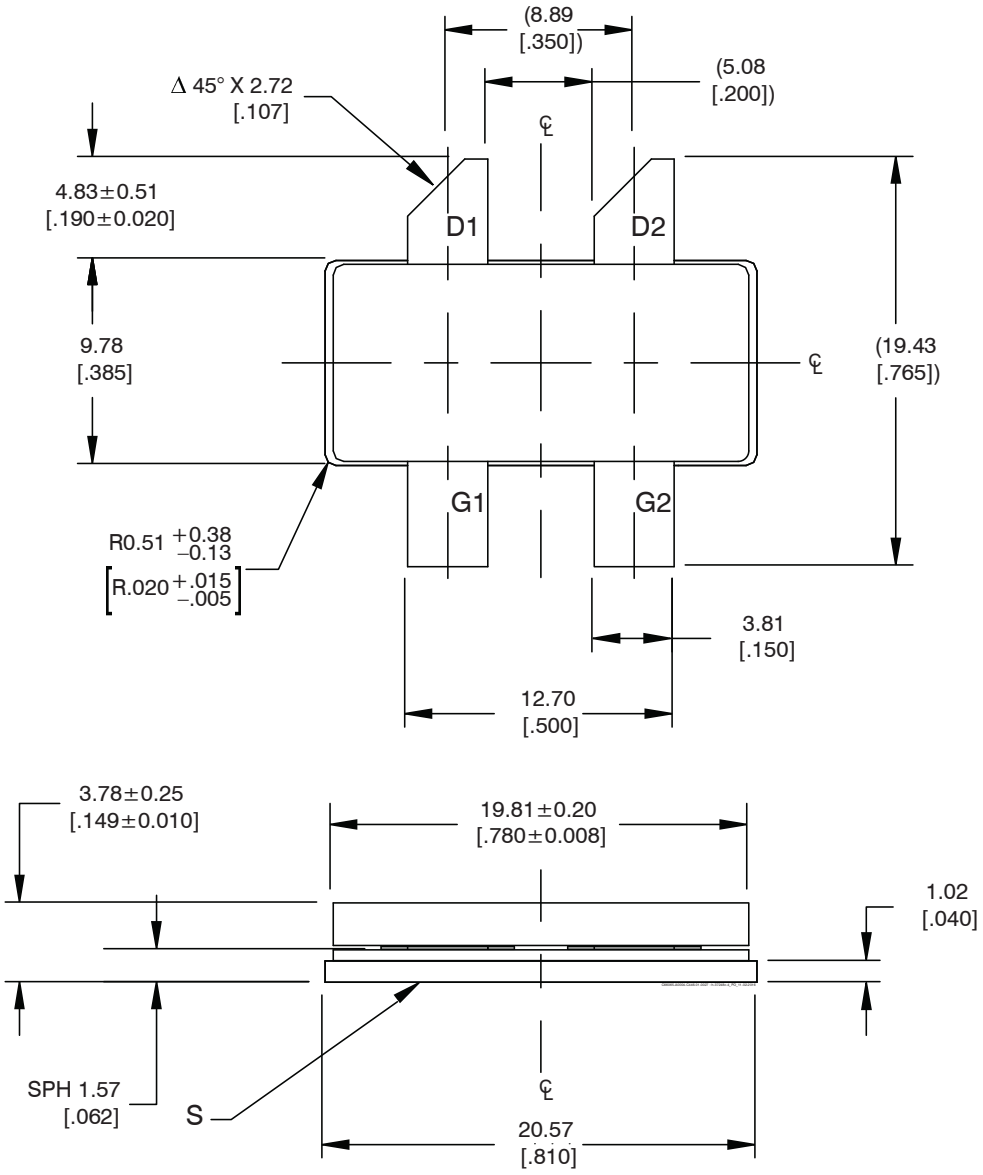


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994
2. Primary dimensions are mm, alternate dimensions are inches
3. All tolerances ± 0.127 [0.005]
4. Pins: D1, D2 – drain, G1, G2 – gate, S – source (flange)
5. Lead thickness: 0.13 ± 0.05 [0.005 ± 0.002]
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch]

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