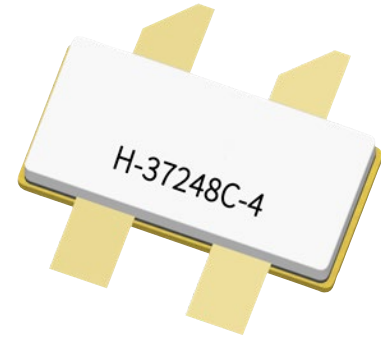


# GTRA374902FC

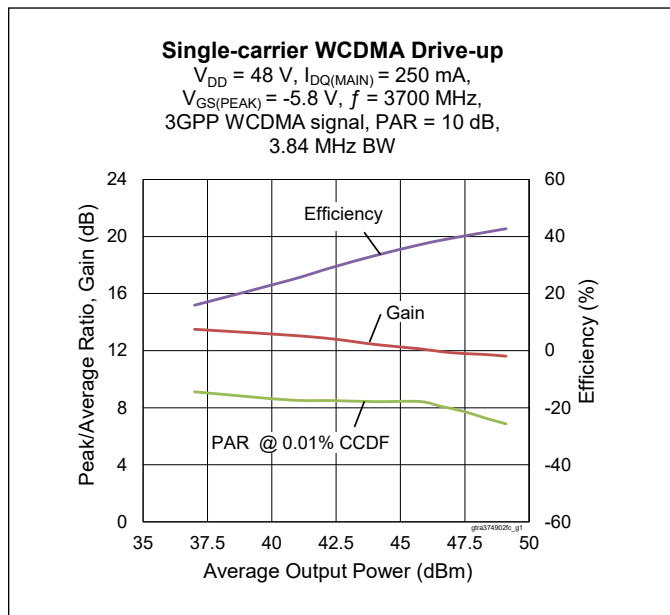
Thermally-Enhanced High Power RF GaN on SiC Amplifier, 450 W, 48 V, 3600 – 3700 MHz



Package Types: H-37248C-4

## Description

The GTRA374902FC is a 450-watt ( $P_{3dB}$ ) GaN on SiC HEMT D-mode amplifier 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:  $P_{3dB} = 220\text{ W Typ}$
  - Peak:  $P_{3dB} = 300\text{ W Typ}$
- Typical Pulsed CW performance, 3700 MHz, 48 V, Doherty @  $P_{3dB}$ , 10  $\mu\text{s}$ , 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 the Doherty production test fixture)

$V_{DD} = 48\text{ V}$ ,  $I_{DQ} = 250\text{ mA}$ ,  $P_{OUT} = 63\text{ W avg}$ ,  $V_{GS(PEAK)} = -5.8\text{ V}$ ,  $f = 3700\text{ MHz}$ , 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	$\eta_D$	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  $T_{CASE} = 25^\circ\text{C}$  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	$I_{DSS}$	—	—	5	mA	$V_{GS} = -8\text{ V}, V_{DS} = 10\text{ V}$
Gate Threshold Voltage (main)	$V_{GS(th)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10\text{ V}, I_D = 25.2\text{ mA}$
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	$V_{GS(Q)}$	-3.65	-3	-2.4		

## 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.

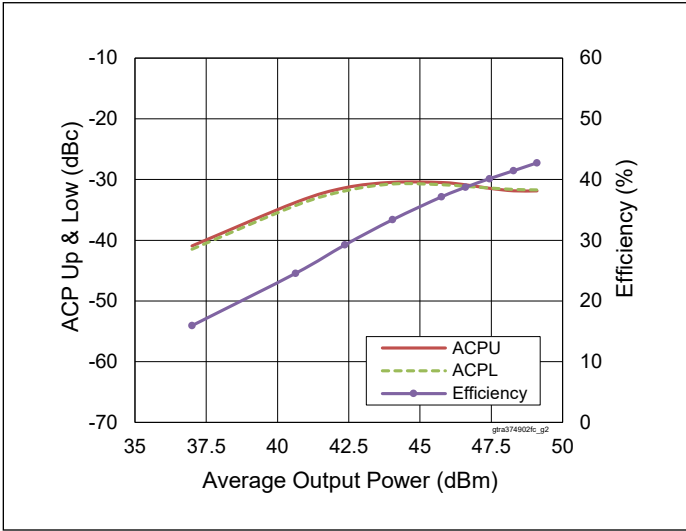
## Thermal Characteristics

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

## Ordering Information

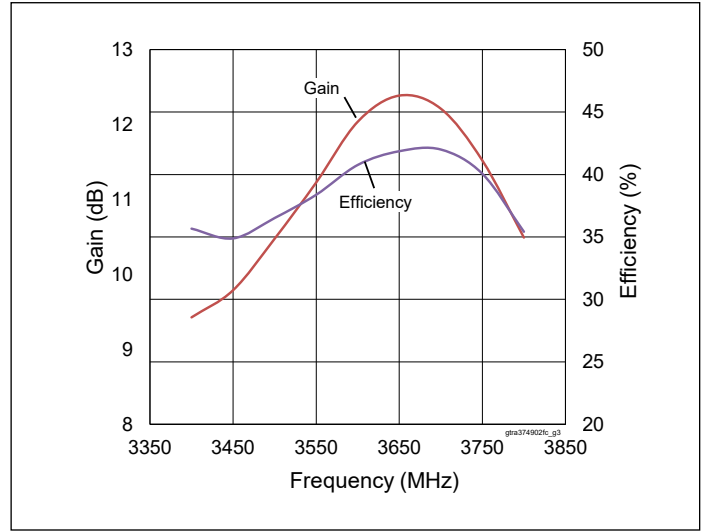
Type and Version	Order Code	Package Description	Shipping
GTRA374902FC V1 R0	GTRA374902FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRA374902FC V1 R2	GTRA374902FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

**Typical Performance** (data taken in test fixture)



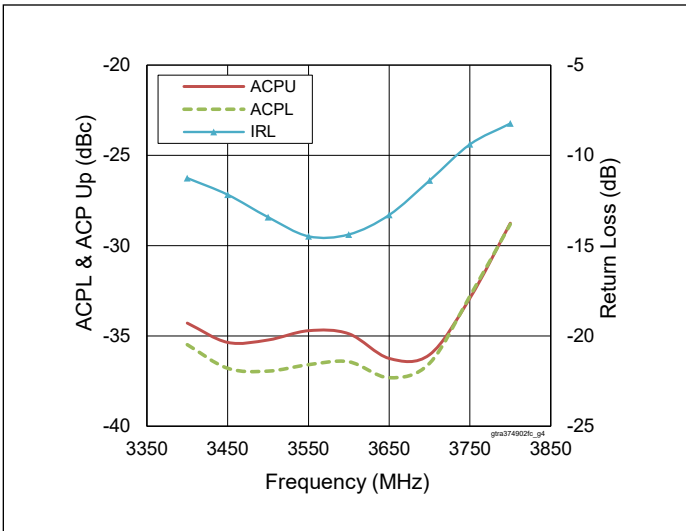
**Figure 1.** Single-carrier WCDMA Drive-up

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



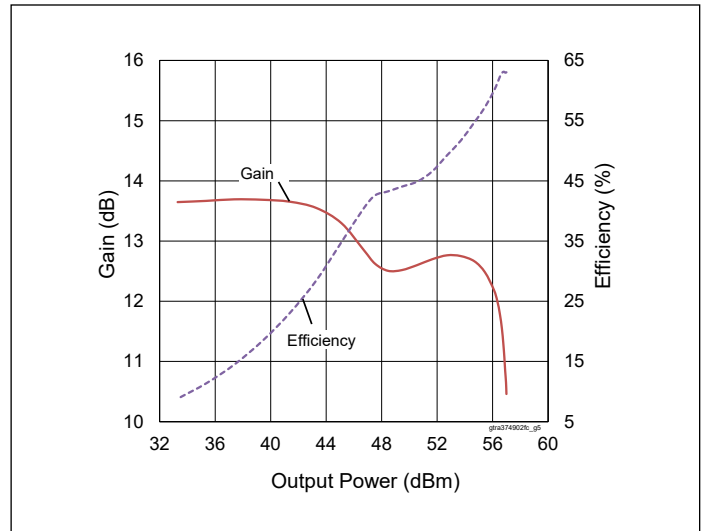
**Figure 2.** Single-carrier WCDMA Broadband Performance

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



**Figure 3.** Single-carrier WCDMA Broadband Performance

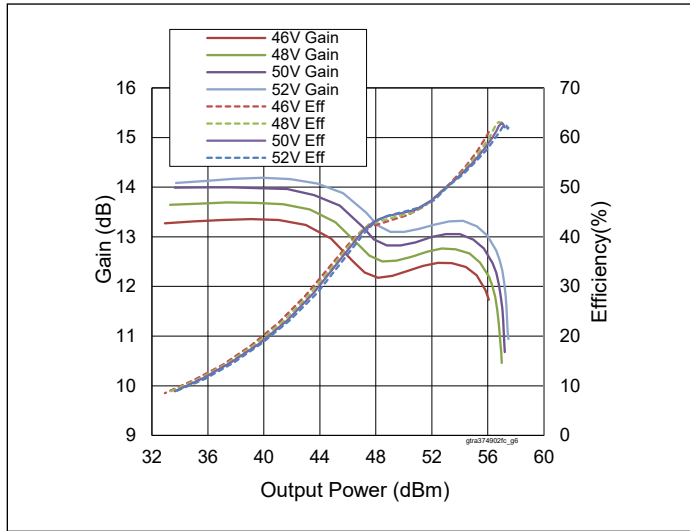
$V_{DD} = 48\text{ V}$ ,  $I_{DQ(MAIN)} = 250\text{ mA}$ ,  
 $V_{GS(PEAK)} = -5.8\text{ V}$ ,  $P_{OUT} = 48\text{ dBm}$ ,  
 3GPP WCDMA signal, PAR = 10 dB



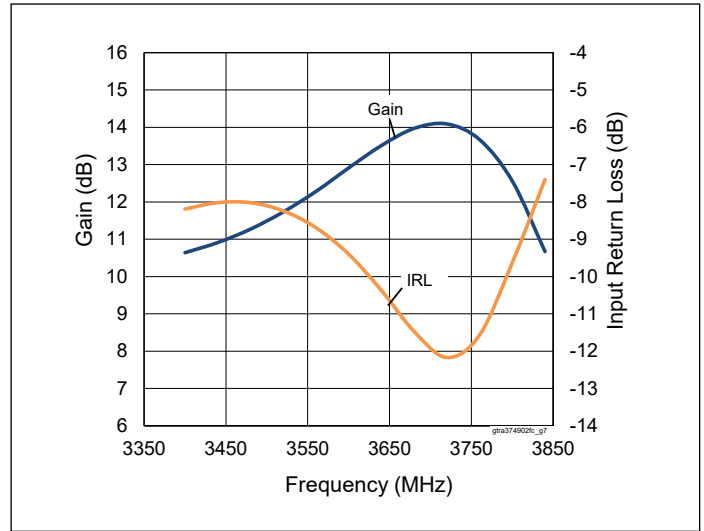
**Figure 4.** Pulse CW Performance

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

**Typical Performance (cont.)**



**Figure 5.** Pulse CW Performance at various  $V_{DD}$   
 $I_{DQ(MAIN)} = 250 \text{ mA}$ ,  $V_{GS(PEAK)} = -5.8 \text{ V}$   
 $f = 3700 \text{ MHz}$



**Figure 6.** CW Performance Small Signal Gain & Input Return Loss  
 $V_{DD} = 48 \text{ V}$ ,  $I_{DQ(MAIN)} = 250 \text{ mA}$ ,  
 $V_{GS(PEAK)} = -5.8 \text{ V}$

**Load Pull Performance**

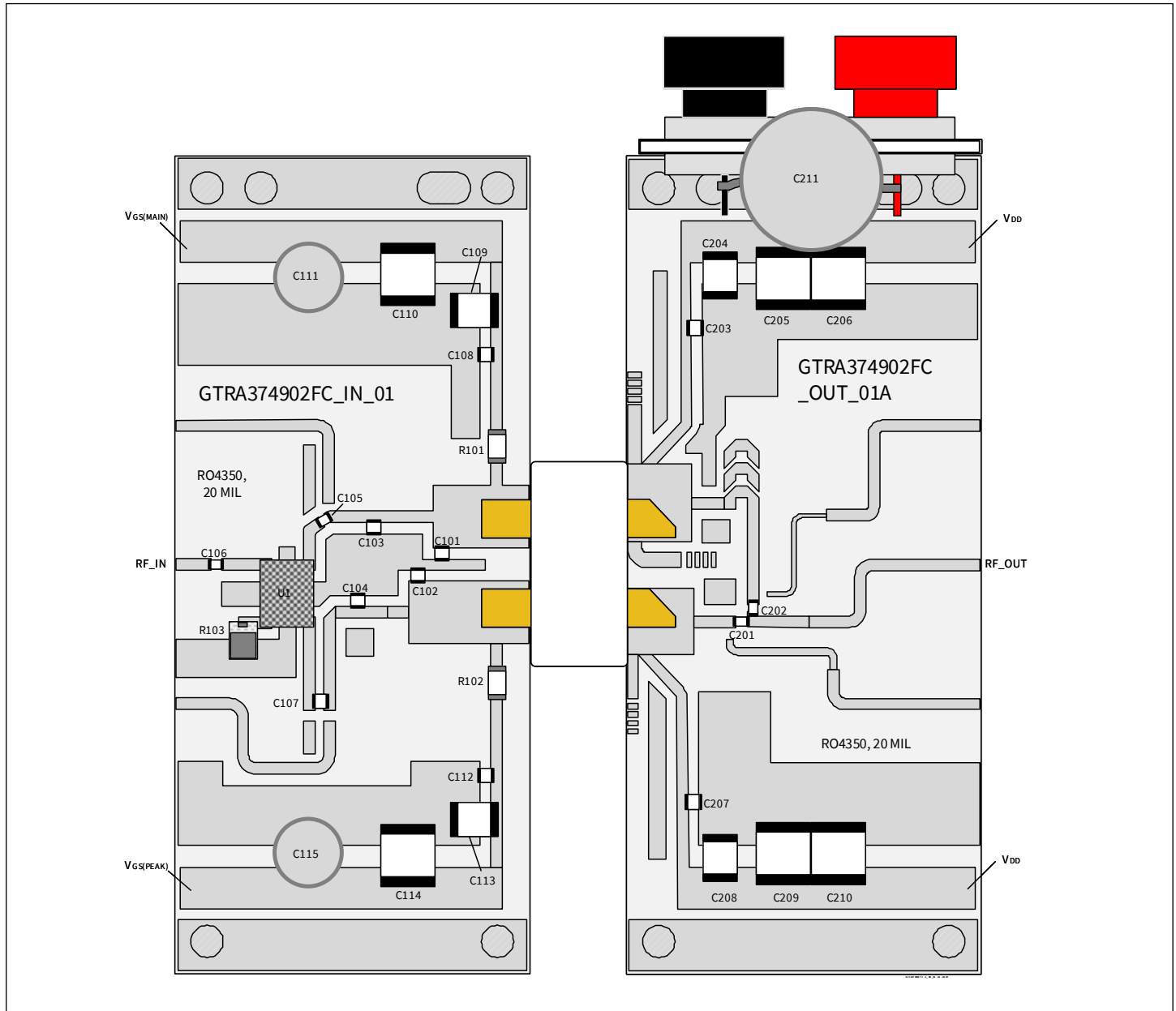
**Main Side Load Pull Performance** – Pulsed CW signal: 10  $\mu\text{s}$ , 10% duty cycle, 48 V,  $I_{DQ} = 250 \text{ mA}$ , class AB

		$P_{3dB}$									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	$Z_s [\Omega]$	$Z_l [\Omega]$	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]	$Z_l [\Omega]$	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]
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  $\mu\text{s}$ , 10% duty cycle, 48 V,  $V_{GSPK} = -5 \text{ V}$ , class C

		$P_{3dB}$									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	$Z_s [\Omega]$	$Z_l [\Omega]$	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]	$Z_l [\Omega]$	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]
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, $\epsilon_r = 3.66$ , $f = 3600 - 3700$ MHz

## Components Information

Component	Description	Manufacturer	P/N
<b>Input</b>			
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 $\mu$ F, 100 V	TDK Corporation	C4532X7R2A105M230KA
C110, C114	Capacitor, 10 $\mu$ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C111, C115	Capacitor, 100 $\mu$ F, 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
<b>Output</b>			
C201, C202, C203, C207	Capacitor, 10 pF	ATC	ATC800A100JT250XT
C204, C208	Capacitor, 1 $\mu$ F, 100 V	TDK Corporation	C4532X7R2A105M230KA
C205, C206, C209, C210	Capacitor, 10 $\mu$ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C211	Capacitor, 220 $\mu$ F, 100 V	Panasonic Electronic Components	ECA-2AHG221

## Bias Sequencing

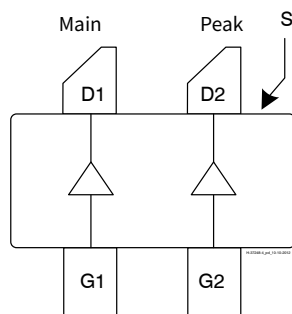
### Bias ON

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

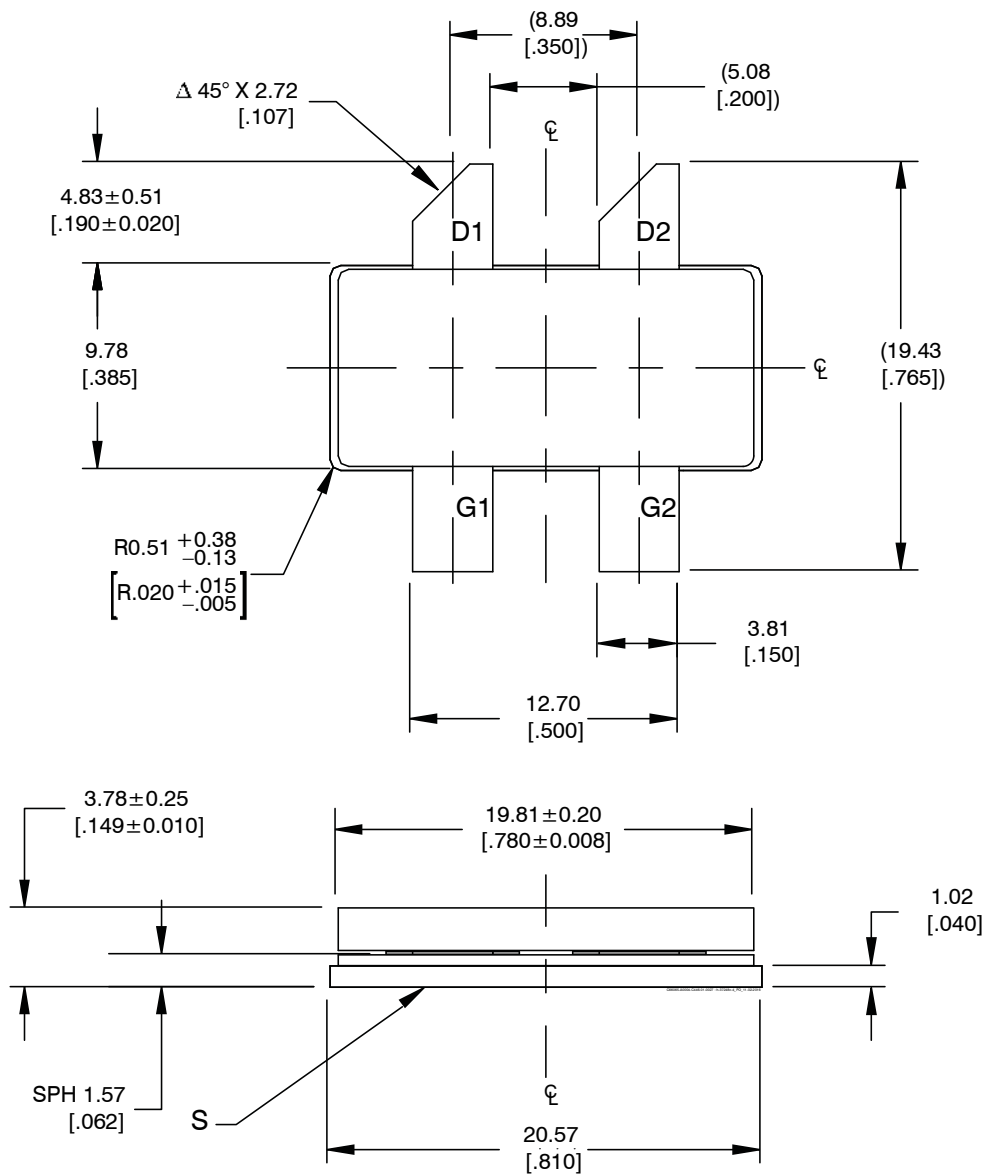
## Pinout Diagram (top view)



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  $\pm 0.127$  [0.005]
4. Pins: D1, D2 – drain, G1, G2 – gate, S – source (flange)
5. Lead thickness:  $0.13 \pm 0.05$  [0.005 ± 0.002]
6. Gold plating thickness:  $1.14 \pm 0.38$  micron [45 ± 15 microinch]

## Notes & Disclaimer

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