

# GTRB206002FC/1

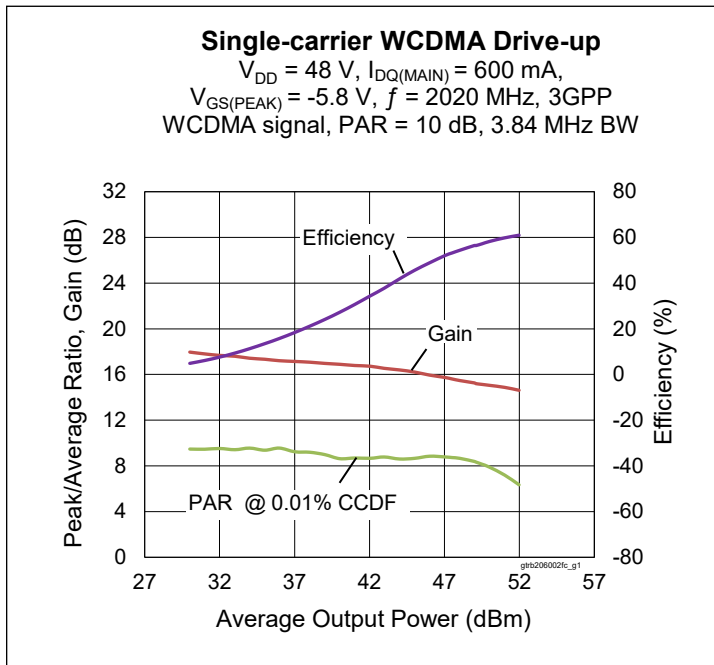
Thermally-Enhanced High Power RF GaN on SiC HEMT  
500 W, 48 V, 1930 – 2020 MHz

## Description

The GTRB206002FC/1 is a 500-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.



GTRB206002FC/1  
Package H-37248C-4



## Features

- GaN on SiC HEMT technology
- Typical Pulsed CW performance, 2020 MHz, 48 V, 10  $\mu$ s pulse width, 10% duty cycle, combined outputs
  - Output power at  $P_{3dB} = 500\text{ W}$
  - Efficiency at  $P_{3dB} = 63\%$
- Human Body Model Class 1B (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 1930 – 2020 MHz)

$V_{DD} = 48\text{ V}$ ,  $I_{DQ} = 600\text{ mA}$ ,  $V_{GS(peak)} = V_{GS}$  at  $I_{DQ(peak)} = 400\text{ mA} - 2.7\text{ V}$ , channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

	$P_{OUT}$ (dBm)	Gain (dB)	Efficiency (%)	ACPR + (dBc)	ACPR – (dBc)	OPAR (dB)
1930	49.3	15.4	57.3	-26.7	-26.8	7.9
1960	49.3	15.5	58.6	-27.6	-27.6	8.2
1990	49.3	15.4	57.9	-29.5	-29.3	8.1
2020	49.3	15.2	56.8	-31.0	-30.6	8.2

All published data at  $T_{CASE} = 25^\circ\text{C}$  unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!



## DC Characteristics

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage (main)	$V_{GS} = -8\text{ V}, I_D = 10\text{ mA}$	$V_{(BR)DSS}$	150	—	—	V
(peak)	$V_{GS} = -8\text{ V}, I_D = 10\text{ mA}$	$V_{(BR)DSS}$	150	—	—	V
Drain-source Leakage Current (main)	$V_{GS} = -8\text{ V}, V_{DS} = 10\text{ V}$	$I_{DSS}$	—	—	4.4	mA
(peak)	$V_{GS} = -8\text{ V}, V_{DS} = 10\text{ V}$	$I_{DSS}$	—	—	8.8	mA
Gate-Source Leakage Current (main)	$V_{GS} = -8\text{ V}, V_{DD} = 50\text{ V}$	$I_{GSX}$	—	—	-7.0	mA
(peak)	$V_{GS} = -8\text{ V}, V_{DD} = 50\text{ V}$	$I_{GSX}$	—	—	-15.0	mA
Gate Threshold Voltage (main)	$V_{DS} = 10\text{ V}, I_D = 25\text{ mA}$	$V_{GS(th)}$	-3.8	-3.05	-2.3	V
(peak)	$V_{DS} = 10\text{ V}, I_D = 50\text{ mA}$	$V_{GS(th)}$	-3.8	-3.05	-2.3	V

## Recommended Operating Conditions

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Voltage		$V_{DD}$	0	—	50	V
Gate Quiescent Voltage	$V_{DS} = 48\text{ V}, I_D = 600\text{ mA}$	$V_{GS(Q)}$	-3.5	-2.75	-2.0	V

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source Voltage	$V_{DSS}$	125	V
Gate-source Voltage	$V_{GS}$	-10 to +2	V
Operating Voltage	$V_{DD}$	55	V
Gate Current (main)	$I_G$	25	mA
(peak)	$I_G$	50	mA
Drain Current (main)	$I_D$	9.5	A
(peak)	$I_D$	19	A
Junction Temperature	$T_J$	275	°C
Storage Temperature Range	$T_{STG}$	-65 to +150	°C

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

Characteristics	Symbol	Value	Unit
Thermal Resistance (main, $T_{CASE} = 85^\circ\text{C}, P_{DISS} = 100\text{ W DC}$ )	$R_{\theta JC}$	1.4	°C/W
(peak, $T_{CASE} = 85^\circ\text{C}, P_{DISS} = 143\text{ W DC}$ )	$R_{\theta JC}$	1.0	°C/W

## RF Characteristics

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

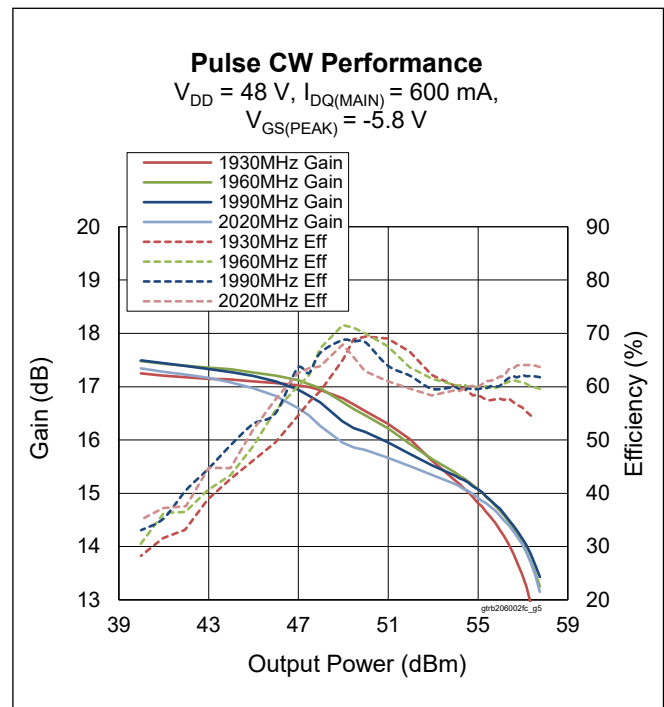
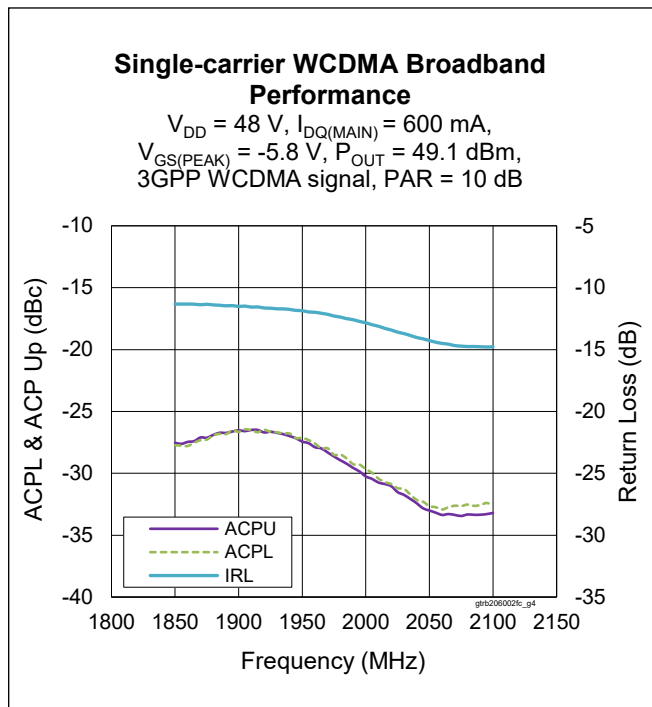
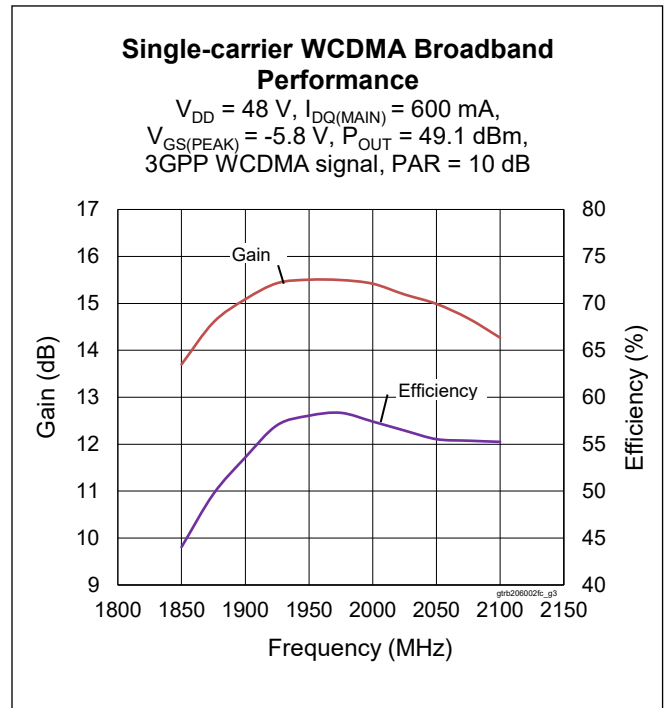
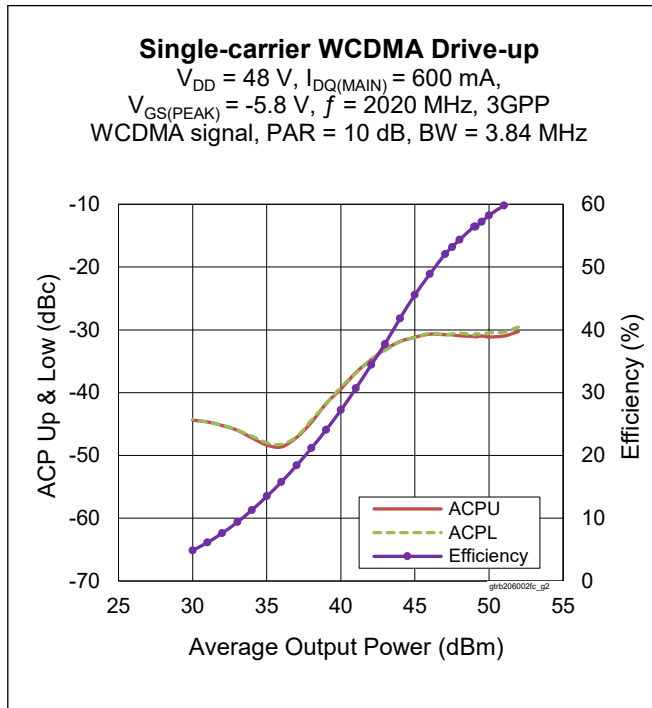
$V_{DD} = 48\text{ V}$ ,  $I_{DQ} = 600\text{ mA}$ ,  $P_{OUT} = 81.2\text{ W}$ ,  $V_{GS(peak)} = V_{GS}$  at  $I_{DQ(peak)} = 600\text{ mA} - 2.7\text{ V}$ ,  $f = 2020\text{ MHz}$ , 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristics	Symbol	Min	Typ	Max	Unit
Gain	$G_{ps}$	14	14.8	—	dB
Drain Efficiency	$\eta_D$	49	53	—	%
Adjacent Channel Power Ratio	ACPR	—	-29.9	-27.5	dBc
Output PAR @ 0.01% CCDF	OPAR	7	7.7	—	dB

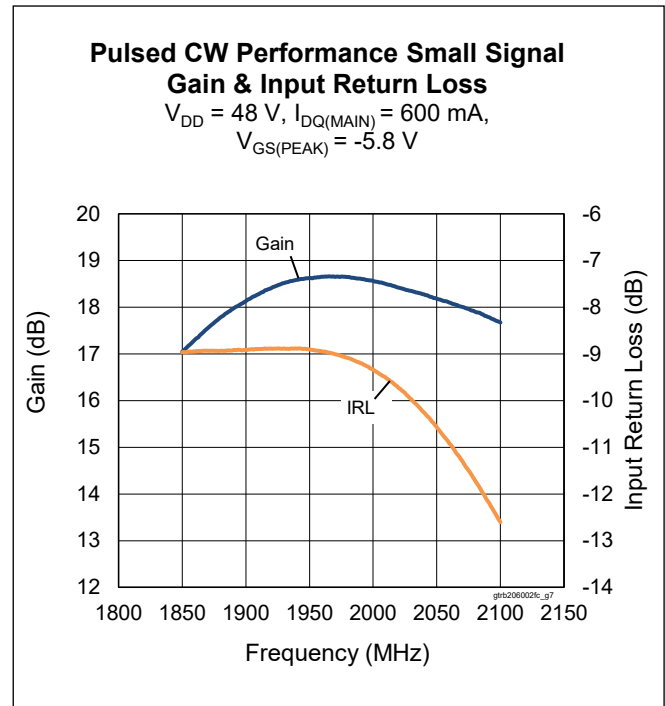
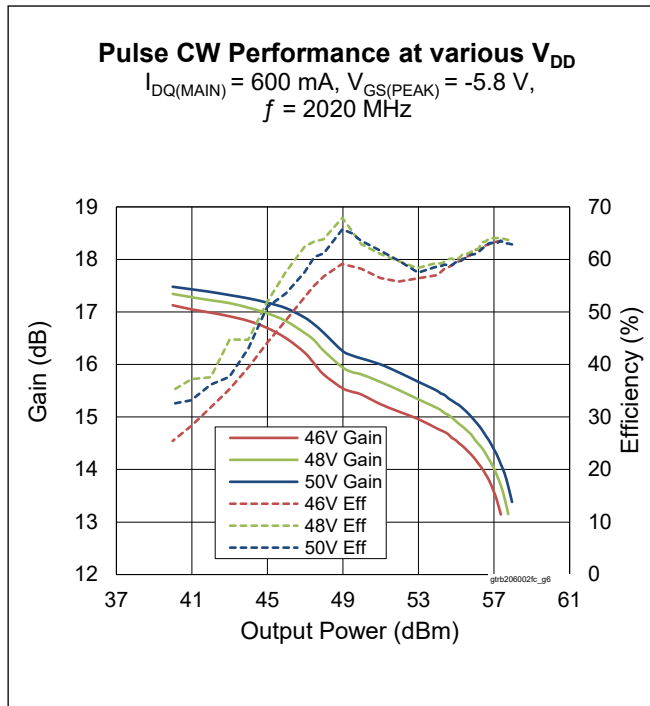
## Ordering Information

Type and Version	Order Code	Package	Shipping
GTRB206002FC/1 V1 R0	GTRB206002FC1V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRB206002FC/1 V1 R2	GTRB206002FC1V1-R2	H-37248C-4	Tape & Reel, 250 pcs

**Typical Performance** (data taken in the Doherty evaluation board)



## Typical Performance (cont.)



## Load Pull Performance

**Main Side Load Pull Performance** – Pulsed CW signal – 160  $\mu\text{sec}$ , 10% duty cycle, 48 V,  $I_{DQ} = 200 \text{ mA}$ , class AB

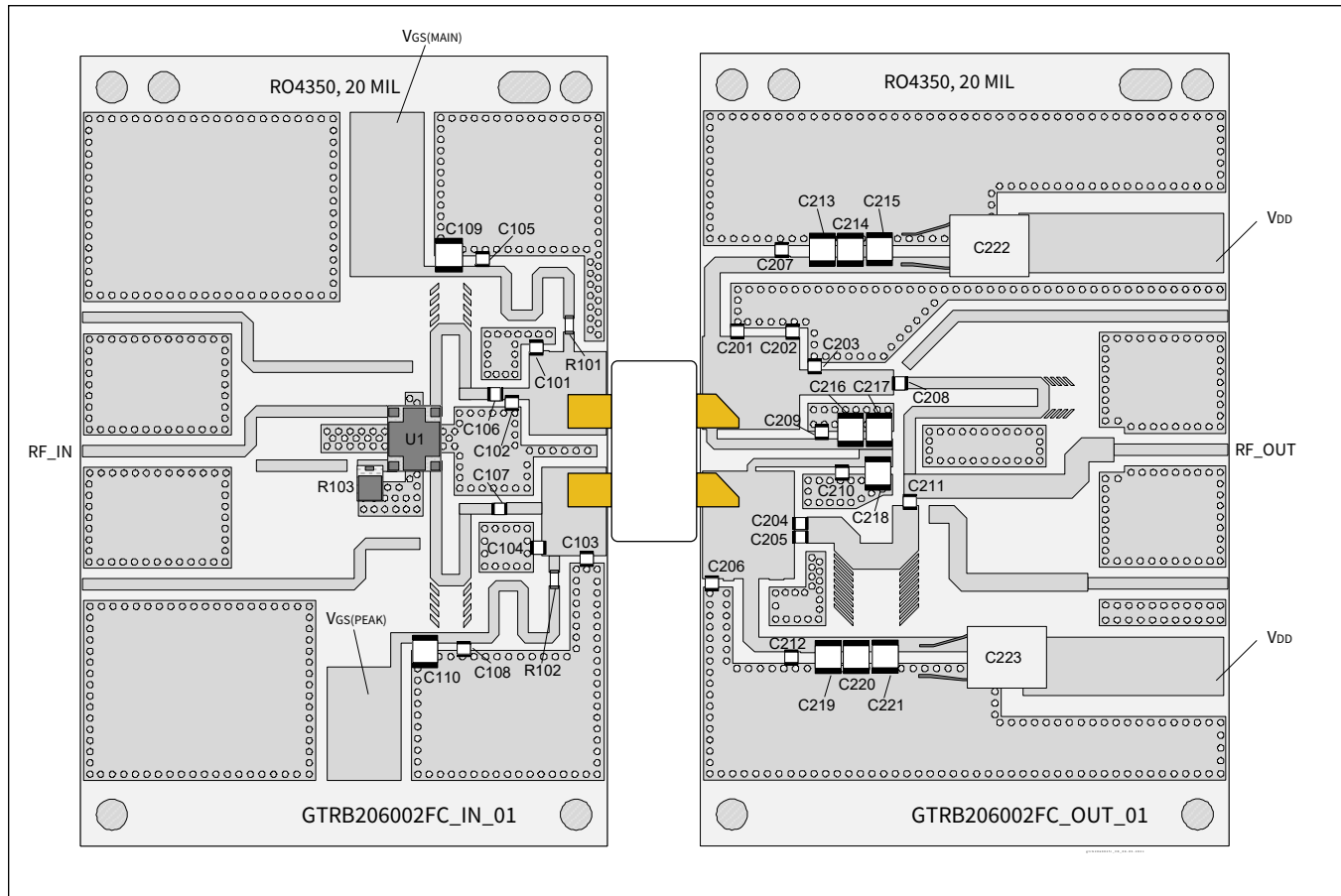
Freq [MHz]	$Z_s$ [ $\Omega$ ]	$P_{3dB}$									
		Max Output Power					Max Drain Efficiency				
		$Z_L$ [ $\Omega$ ]	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]	$Z_L$ [ $\Omega$ ]	Gain [dB]	$P_{3dB}$ [dBm]	$P_{3dB}$ [W]	$\eta_D$ [%]
1930	2.9-j7.5	3.04-j3.96	17.5	54.9	309.03	76.6	2.83-j2.10	18.79	53.93	247.17	89.28
1990	3.9-j7.7	2.62-j3.90	17.31	54.83	304.09	75.03	2.29-j1.92	19.01	53.41	219.28	89.48
2020	3.9-j8.4	2.92-j3.80	17.76	54.83	304.09	79.07	2.30-j1.78	19.29	52.98	198.61	88.49

**Peak Side Load Pull Performance** – Pulsed CW signal – 160  $\mu\text{sec}$ , 10% duty cycle, 48 V,  $V_{GSPK} = -5 \text{ V}$ , class C

Freq [MHz]	$Z_s$ [ $\Omega$ ]	$P_{1dB}$									
		Max Output Power					Max Drain Efficiency				
		$Z_L$ [ $\Omega$ ]	Gain [dB]	$P_{1dB}$ [dBm]	$P_{1dB}$ [W]	$\eta_D$ [%]	$Z_L$ [ $\Omega$ ]	Gain [dB]	$P_{1dB}$ [dBm]	$P_{1dB}$ [W]	$\eta_D$ [%]
1930	2.8-j6.8	1.74-j5.00	12.78	57.86	610.94	75.43	1.69-j3.63	13.13	56.3	426.58	87.73
1990	3.3-j6.7	1.98-j5.18	12.86	57.69	587.49	73.86	1.69-j3.63	13.27	55.81	381.07	83.04
2020	2.0-j7.0	2.00-j5.75	12.37	57.5	562.34	67.85	1.69-j3.63	12.83	55.47	352.37	83.09

## Doherty Evaluation Board, 1930 – 2020 MHz

DUT	LTAGTRB206002FC1V1
Test Fixture Part No.	LTA/GTRB206002FC/1-V1
PCB	Rogers 4350, 0.508 mm [0.020"] thick, 2 oz. copper, $\epsilon_r = 3.66$



Application circuit assembly diagram (not to scale)

## Doherty Evaluation Board (cont.)

### Components Information

Component	Description	Manufacturer	P/N
<b>Input</b>			
C101	Capacitor, 0.3 pF	ATC	ATC600F0R3BT250XT
C102	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250XT
C103	Capacitor, 1.5 pF	ATC	ATC600F1R5BT250XT
C104	Capacitor, 0.8 pF	ATC	ATC600F0R8BT250XT
C105, C106, C107, C108	Capacitor, 15 pF	ATC	ATC600F150JT250XT
C109, C110	Capacitor, 50 V, 10 $\mu$ F	Taiyo Yuden	UMK325C7106MM-T
R101, R102	Resistor, 10 ohms	Panasonic Electronic Components	ERJ-3GEYJ100V
R103	Resistor, 50 ohms	Anaren	C8A50Z4A
U1	Hybrid Coupler	Anaren	X3C19P1-04S
<b>Output</b>			
C201, C203	Capacitor, 1.5 pF	ATC	ATC600F1R5BT250XT
C202	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250XT
C204, C205	Capacitor, 8.2 pF	ATC	ATC600F8R2BT250XT
C206	Capacitor, 3.3 pF	ATC	ATC600F3R3BT250XT
C207, C208, C209, C210, C211, C212	Capacitor, 15 pF	ATC	ATC600F150JT250XT
C213, C214, C215, C216, C217, C218, C219, C220, C221	Capacitor, 100 V, 10 $\mu$ F	Murata Electronics	GRM32EC72A106KE05L
C222, C223	Capacitor, 470 $\mu$ F	Panasonic Electronic Components	ECA-2AHG47B

## Bias Sequencing

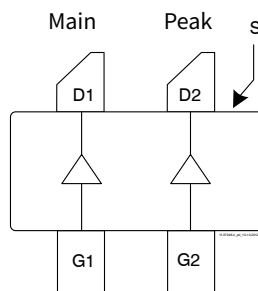
### Bias ON

1. Ensure RF is turned off
2. Apply pinch-off voltage of  $-5\text{ V}$  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)

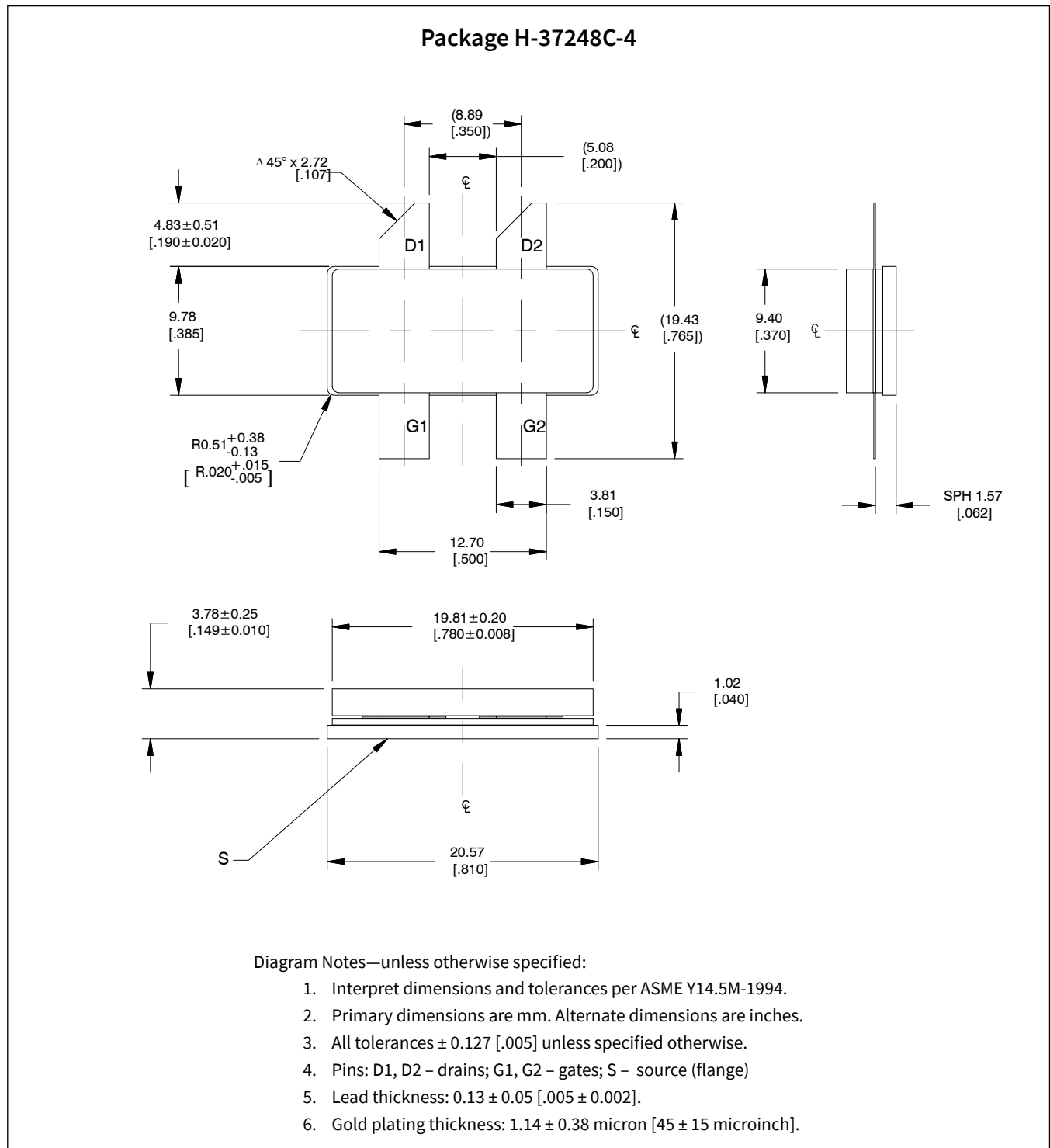


Pin	Description
D1	Drain Device 1 (Main)
D2	Drain Device 2 (Peak)
G1	Gate Device 1 (Main)
G2	Gate Device 2 (Peak)
S	Source (flange)

Lead connections for GTRB206002FC/1



## Package Outline Specifications



## Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
01	2021-08-09	Production	All	Data Sheet reflects released product specification

## Notes & Disclaimer

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