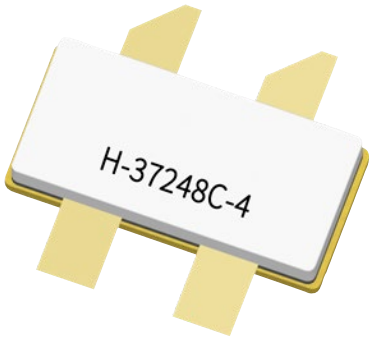
GTRB224402FC

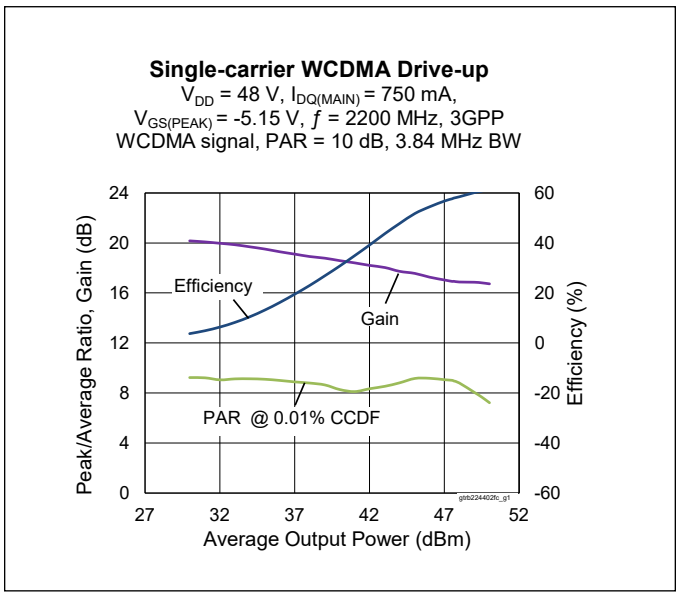
Thermally-Enhanced High Power RF GaN on SiC Amplifier, 400 W, 48 V, 2110– 2200 MHz



Package Types: H-37248C-4

Description

The GTRB224402FC is a 400-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, 2200 MHz, 48 V, 10 µs pulse width, 10% duty cycle, combined outputs
  - Output power at P_{3dB} = 400 W
  - Efficiency at P_{3dB} = 65%
- 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 2110 – 2200 MHz)
V_{DD} = 48 V, I_{DQ} = 750 mA, $V_{GS(peak)}$ = –5.15 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)
2100 MHz	47.6	16.6	58.8	–28.6	–28.7	8.4
2155 MHz	47.6	16.8	57.3	–30.3	–29.9	8.8
2200 MHz	47.6	16.9	57.7	–31.2	–30.8	8.8

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

RoHS compliant

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}	—	—	3.1	mA	V_{GS} = -8 V, V_{DS} = 10 V
Drain-source Leakage Current (peak)				6.3		
Gate-Source Leakage Current (main)	I_{GSX}	—	—	-5		V_{GS} = -8 V, V_{DD} = 50 V
Gate-Source Leakage Current (main)				-10		
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.05	–2.3	V	V_{DS} = 10 V, I_D = 18 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	$V_{GS(Q)}$	-3.5	–2.75	-2.0		V_{DS} =48 V, I_D = 750 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	18	mA
Gate Current (peak)		36	
Drain Current (main)	I_D	6.75	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

Parameter	Symbol	Value	Unit	Conditions
Thermal Resistance (main)	$R_{\theta JC}$	1.8	°C/W	T_{CASE} = 85°C, P_{DISS} = 76 W DC
Thermal Resistance (peak)		1.0		T_{CASE} = 85°C, P_{DISS} = 136 W DC

RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty production test fixture)
V_{DD} = 48 V, I_{DQ} = 750 mA, P_{OUT} = 47.6 dBm, $V_{GS(PEAK)}$ = V_{GS} @ $I_{DQ(PEAK)}$ = 300 mA - 2.4 V, f = 2200 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	14	15.5	—	dB
Drain Efficiency	η_D	52	55	—	%
Adjacent Channel Power Ratio	ACPR	—	–28.8	-26	dBc
Output PAR @ 0.01% CCDF	OPAR	7.8	8.3	—	dB

Ordering Information

Type and Version	Order Code	Package	Shipping
GTRB224402FC V1 R0	GTRB224402FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRB224402FC V1 R2	GTRB224402FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in the Doherty evaluation board)

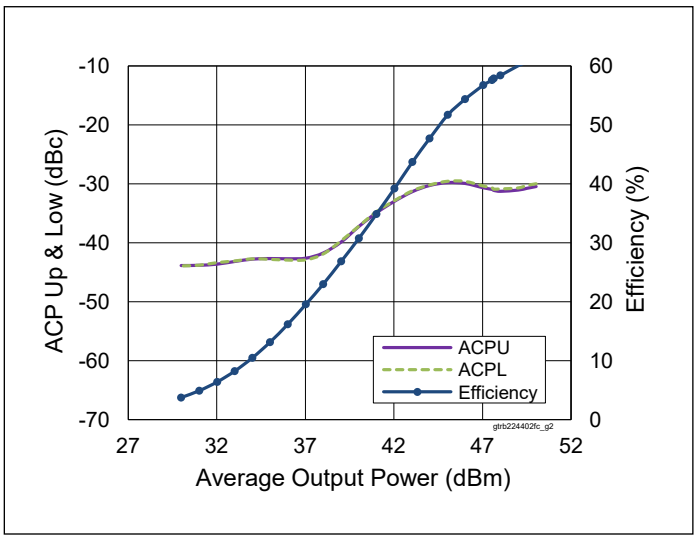


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 750 mA,
$V_{GS(PEAK)}$ = -5.15 V, f = 2200 MHz, 3GPP
WCDMA signal, PAR = 10 dB, BW = 3.84 MHz

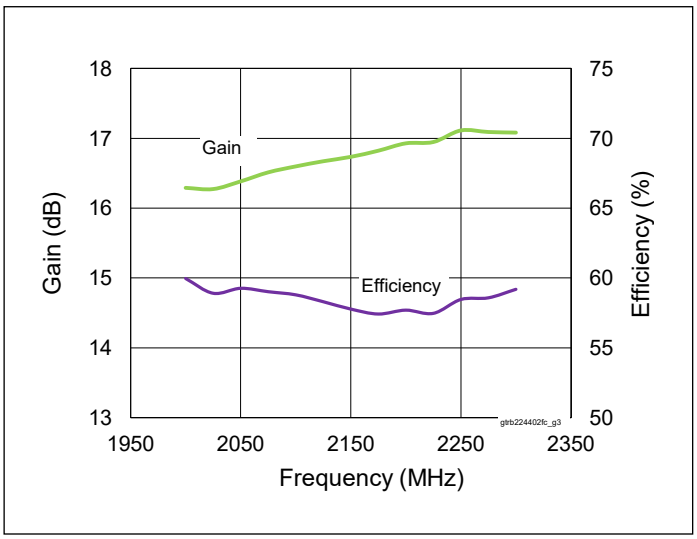


Figure 2. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 750 mA,
$V_{GS(PEAK)}$ = -5.15 V, P_{OUT} = 47.6 dBm, 3GPP
WCDMA signal, PAR = 10 dB

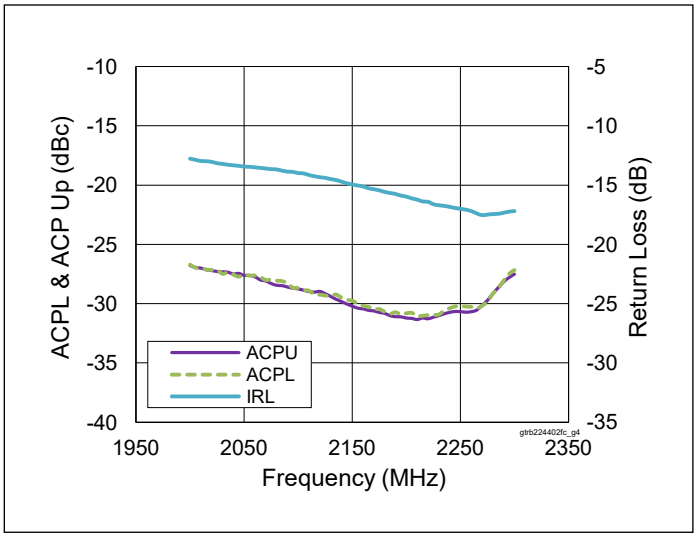


Figure 3. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 750 mA,
$V_{GS(PEAK)}$ =-5.15 V, P_{OUT} =47.6 dBm, 3GPP
WCDMA signal, PAR = 10 dB

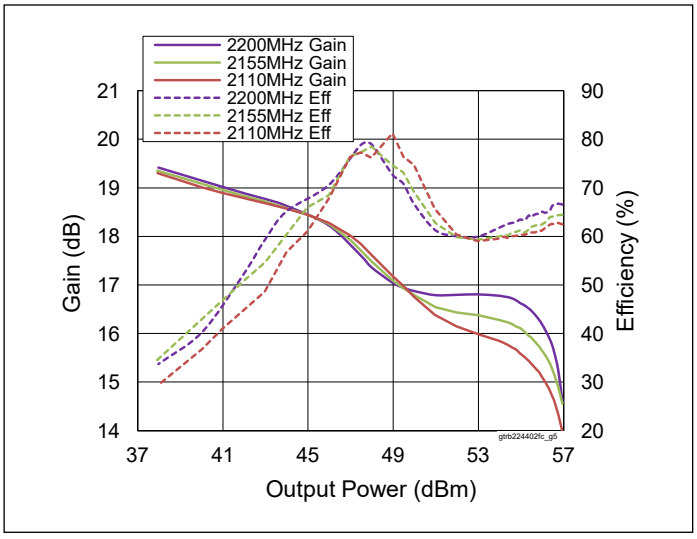


Figure 4. Pulse CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 750 mA,
$V_{GS(PEAK)}$ = -5.15 V

Typical Performance (cont.)

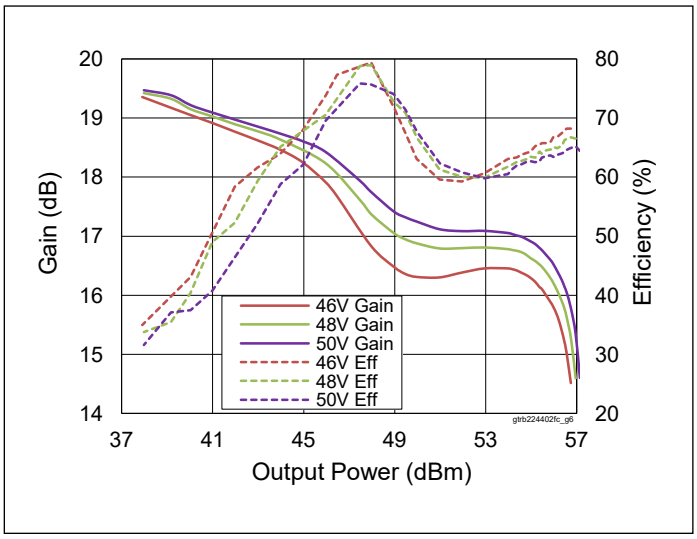


Figure 5. Pulse CW Performance at Various V_{DD}

$I_{DQ(MAIN)}$ = 750 mA, $V_{GS(PEAK)}$ = -5.15 V
f = 2200 MHz

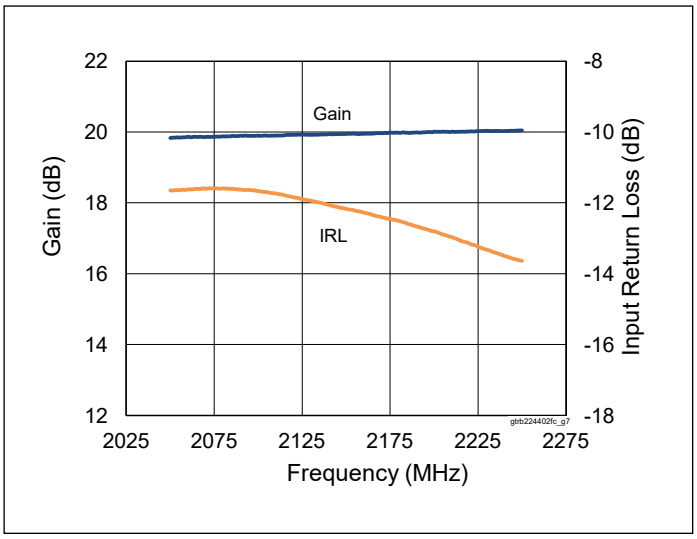


Figure 6. Pulsed CW Performance Small Signal Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 750 mA,
$V_{GS(PEAK)}$ = -5.15 V

Load Pull Performance

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

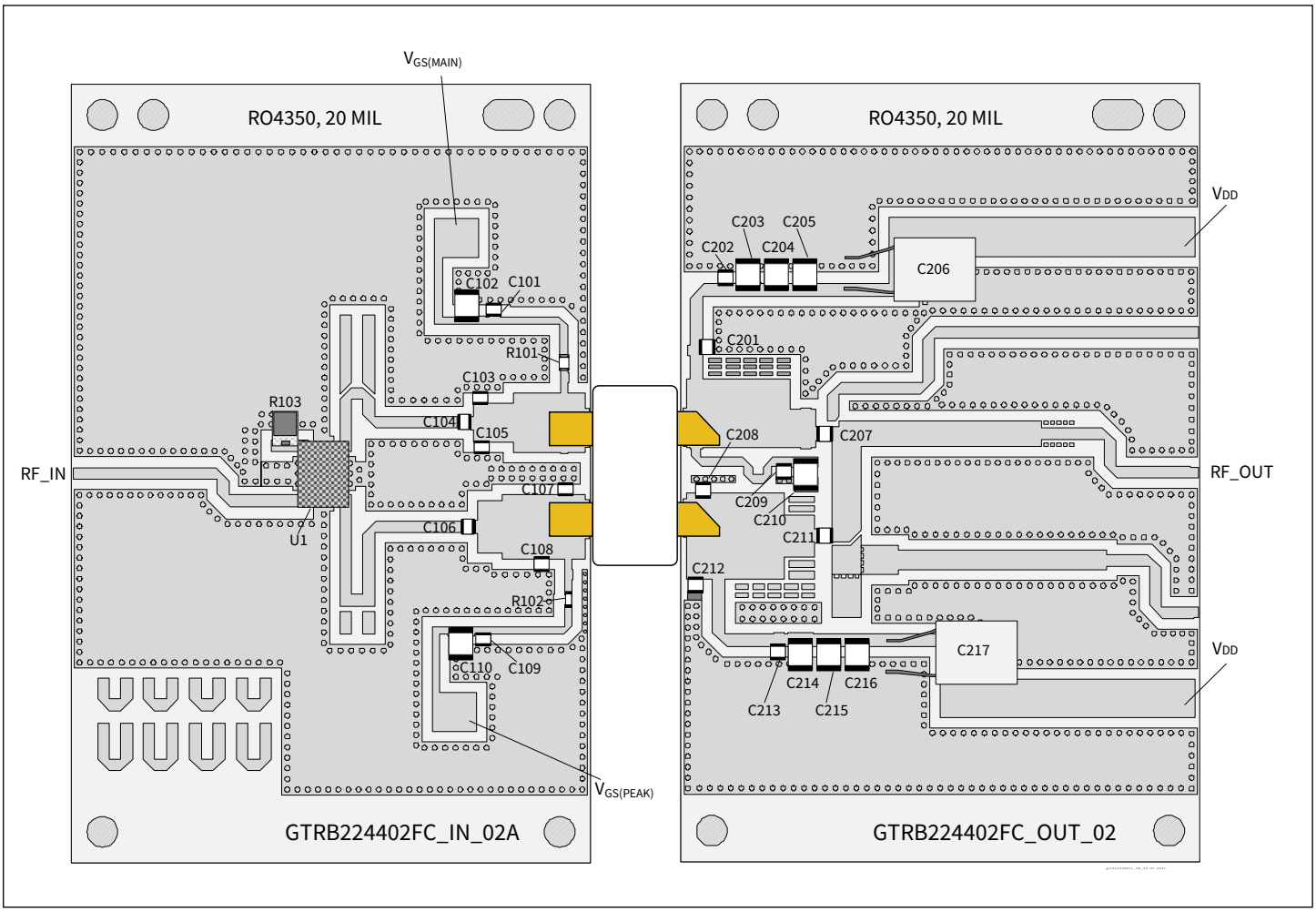
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
2110	7.2-j16.2	8.1-j9.0	16.88	52.83	191.9	67.2	11.3+j1.3	19.61	50.39	109.4	82.0
2200	11.9-j14.3	8.1-j9.2	17.91	52.79	190.1	68.6	9.2-j2.5	19.76	51.37	137.1	81.0

Peak Side Load Pull Performance – Pulsed CW signal – 10 µsec, 10% duty cycle, 48 V, V_{GSPK} = –3.3 V, class B

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
2110	2.0-j8.8	2.5-j2.9	17.52	56.45	441.6	70.2	2.2-j1.2	18.68	54.91	309.7	78.2
2200	3.0-j11.2	2.6-j2.9	17.24	56.33	429.5	68.7	2.2-j1.6	18.56	55.26	335.7	75.9

Doherty Evaluation Board, 2110 – 2200 MHz

Evaluation Board Part Number	LTA/GTRB224402FC-V1
PCB Information	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66



Doherty Evaluation Board (cont.)

Components Information

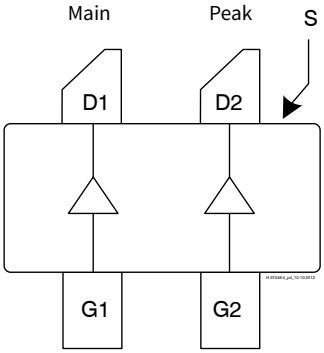
Component	Description	Manufacturer	P/N
Input			
C101, C104, C106, C109	Capacitor, 10 pF	ATC	ATC600F100JT250XT
C102, C110	Capacitor, 100 V, 10 µF	Murata Electronics	GRM32EC72A106KE05L
C103	Capacitor, 1.2 pF	ATC	ATC600F1R2BT250XT
C105	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250XT
C107, C108	Capacitor, 0.9 pF	ATC	ATC600F0R9BT250XT
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 50 ohms	Richardson	C8A50Z4B
U1	Hybrid Coupler	Anaren	X3C21P1-03S
Output			
C201	Capacitor, 0.7 pF	ATC	ATC600F0R7BT250XT
C202, C209, C213	Capacitor, 10 pF	ATC	ATC600F100JT250XT
C203, C204, C205, C210, C214, C215, C216	Capacitor, 100 V, 10 µF	Murata Electronics	GRM32EC72A106KE05L
C206, C217	Capacitor, 220 µF	Panasonic Electronic Components	ECA-2AHG221
C207	Capacitor, 6.8 pF	ATC	ATC600F6R8BT250XT
C208	Capacitor, 2.0 pF	ATC	ATC600F2R0BT250XT
C211	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C212	Capacitor, 2.4 pF	ATC	ATC600F2R4BT250XT

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 GTRB224402FC

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)

Package Outline Specifications – Package H-37248C-4

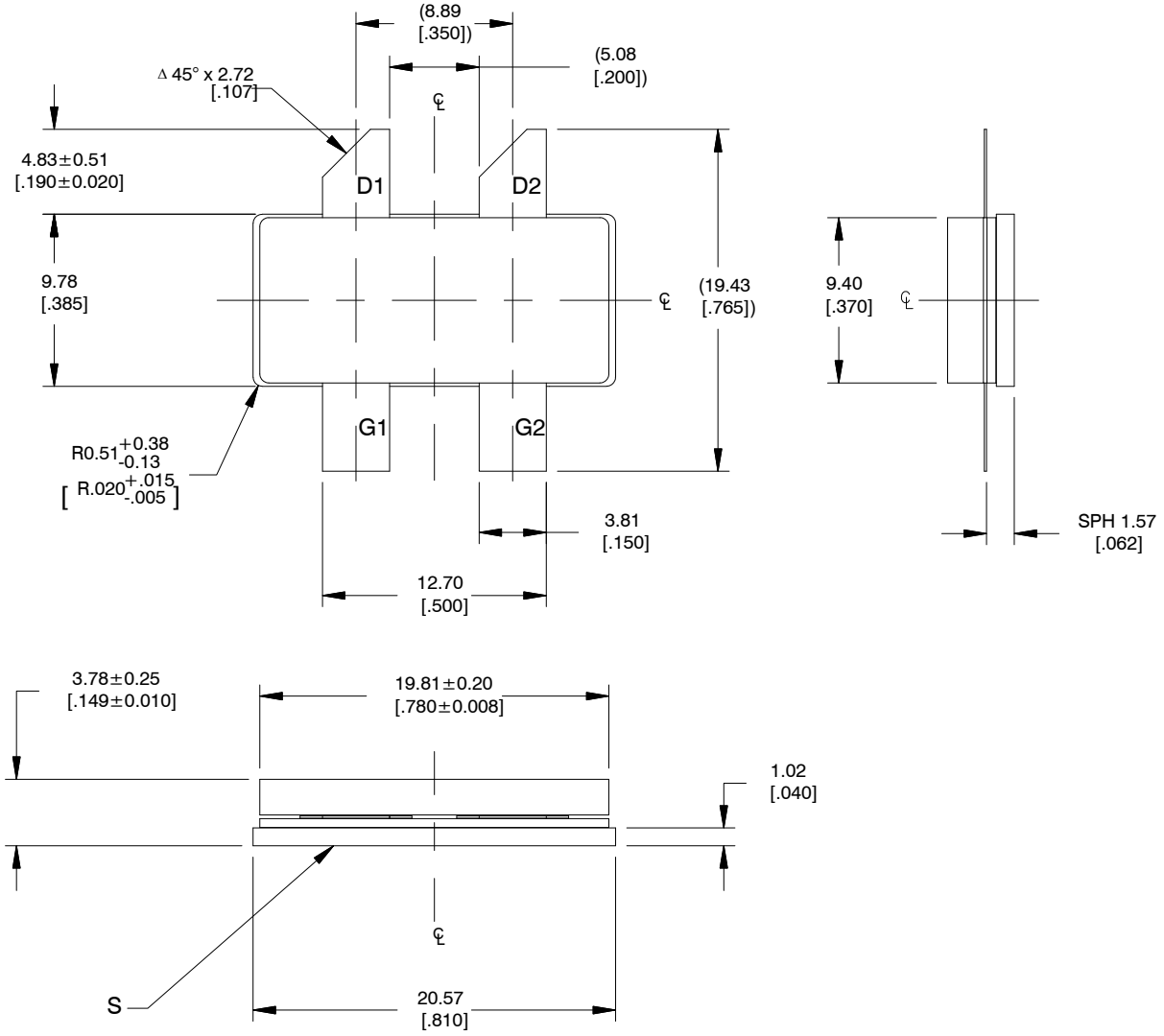


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Primary dimensions are mm. Alternate dimensions are inches.
3. All tolerances ± 0.127 [.005] unless specified otherwise.
4. Pins: D1, D2 – drains; G1, G2 – gates; S – source (flange)
5. Lead thickness: 0.13 ± 0.05 [.005 ± 0.002].
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch].

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