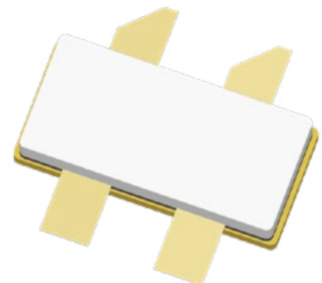
GTRB184402FC

Thermally-Enhanced High Power RF GaN on SiC Amplifier, 440 W, 48 V, 1805 – 1880 MHz



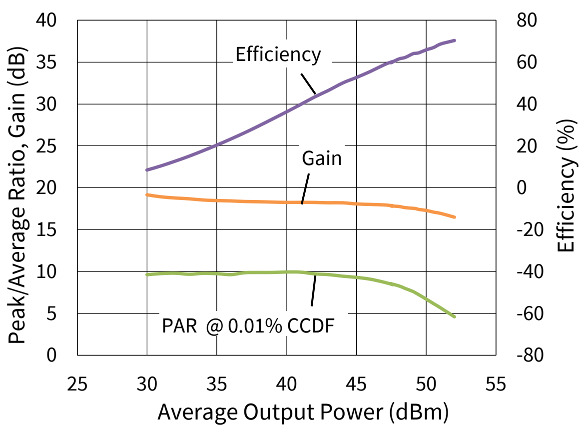
Package Type: H-37248C-4

Description

The GTRB184402FC is a 440-watt (P_{4dB}) GaN on SiC HEMT D-mode amplifier for use in multi-standard cellular power amplifier applications. It features high efficiency, and a thermally-enhanced package with earless flange.

Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA, $V_{GS(PEAK)}$ = -4.3 V, f = 1880 MHz, 3GPP WCDMA signal, PAR = 10 dB, 3.84 MHz BW



Features

- GaN on SiC HEMT technology
- Typical pulsed CW performance, 1880 MHz, 48 V, combined outputs, 10 µs pulse width, 10% duty cycle
  - Output power at P_{4dB} = 440 W
  - Efficiency at P_{4dB} = 70.9%
- 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 1805 – 1880 MHz)

V_{DD} = 48 V, I_{DQ} = 500 mA, $V_{GS(Peak)}$ = – 4.3 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)
1805 MHz	47.6	18.2	61	-26.6	-26.6	8.7
1842.5 MHz	47.6	18.1	60	-28.9	-28.6	8.4
1880 MHz	47.6	17.8	60	-30.4	-30.4	8.4

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) (peak)	$V_{BR(DSS)}$	150	—	—	V	V_{GS} = –8 V, I_D = 10 mA
Drain-source Leakage Current (main)	I_{DSS}	—	—	3.1	mA	V_{GS} = -8 V, V_{DS} = 10 V
(peak)		—	—	6.3		
Gate-source Leakage Current (main)	I_{GSX}	—	—	–5.0	mA	V_{GS} = -8 V, V_{DS} = 50 V
(peak)		—	—	–9.9		
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.0	–2.3	V	V_{DS} = 10 V, I_D = 18 mA
(peak)						V_{DS} = 10 V, I_D = 36 mA

Recommended Operating Voltages

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Drain Operating Voltage	V_{DD}	0	—	50	V	
Gate Quiescent Voltage	$V_{GS(Q)}$	-3.5	–2.8	-2.0		V_{DS} =48 V, I_D = 500 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, 78 W DC , 48 V
Thermal Resistance (peak)		0.9		T_{CASE} = 85°C, 148 W DC, 48 V

RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty production test circuit)
V_{DD} = 48 V, I_{DQ} = 500 mA, P_{OUT} = 57.5 W avg, $V_{GS(PEAK)}$ = (V_{GS} at $I_{DQ(PEAK)}$ = 1000 mA) - 1.70 V, f = 1880 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	15.3	16.7	—	dB
Drain Efficiency	ηD	50.5	56.3	—	%
Adjacent Channel Power Ratio	ACPR	—	–28.1	–25.5	dBc
Output PAR @ 0.01% CCDF	OPAR	7.1	7.9	—	dB

Ordering Information

Type and Version	Order Code	Package	Shipping
GTRB184402FC V1 R0	GTRB184402FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRB184402FC V1 R2	GTRB184402FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in the Doherty evaluation board)

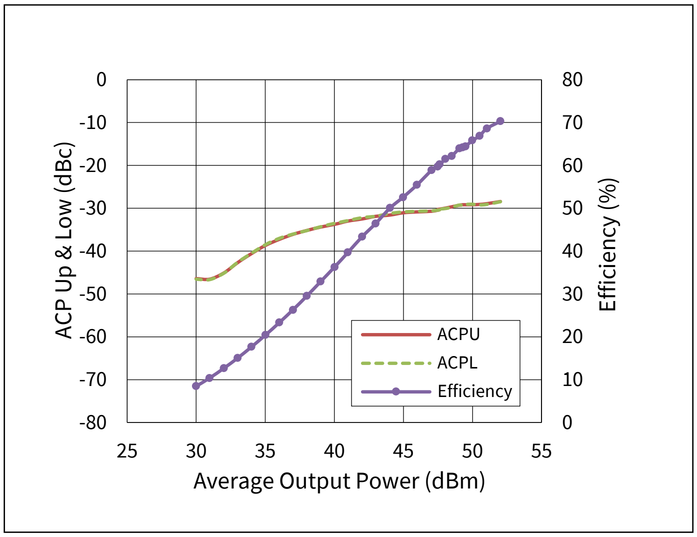


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA, $V_{GS(PEAK)}$ = -4.3 V,
f = 1880 MHz, 3GPP WCDMA signal,
PAR = 10 dB, BW = 3.84 MHz

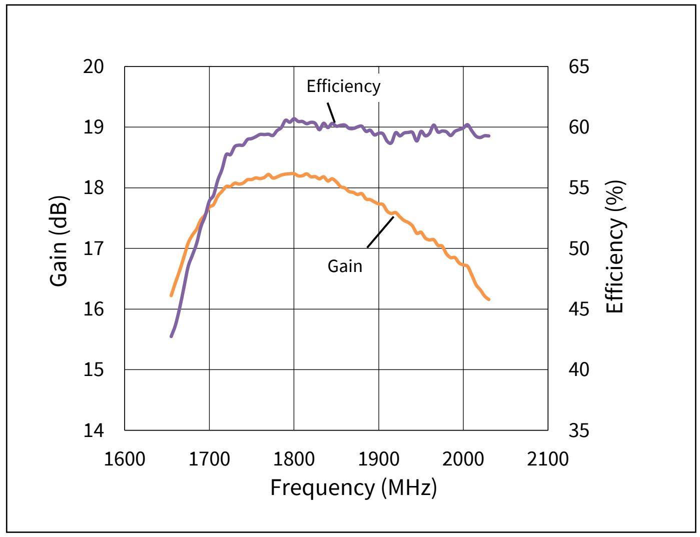


Figure 2. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA,
$V_{GS(PEAK)}$ = -4.3 V, P_{OUT} = 47.6 dBm,
3GPP WCDMA signal, PAR = 10 dB

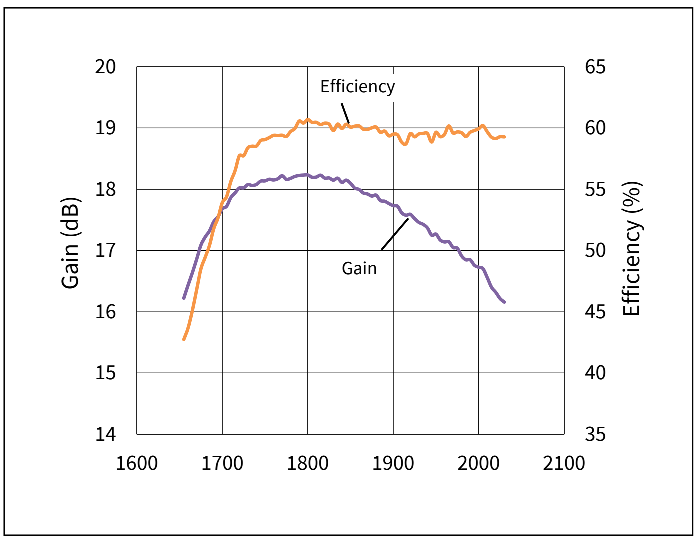


Figure 3. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA,
$V_{GS(PEAK)}$ = -4.3 V, P_{OUT} = 47.6 dBm,
3GPP WCDMA signal, PAR = 10 dB

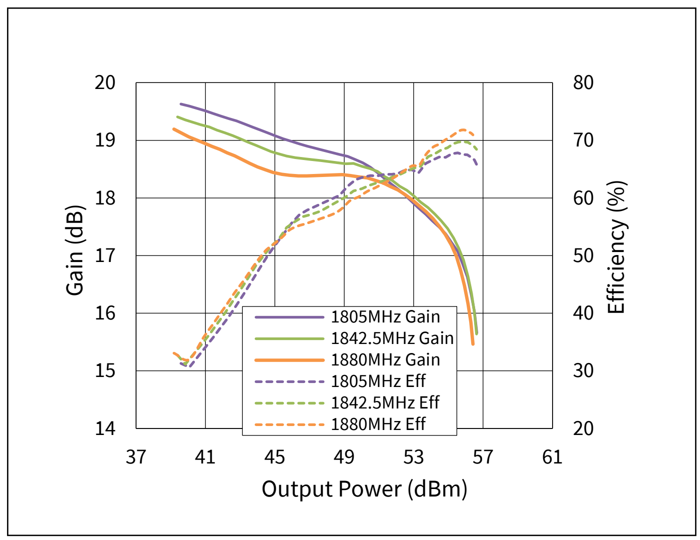


Figure 4. Pulsed CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA,
$V_{GS(PEAK)}$ = -4.3 V

Typical Performance (cont.)

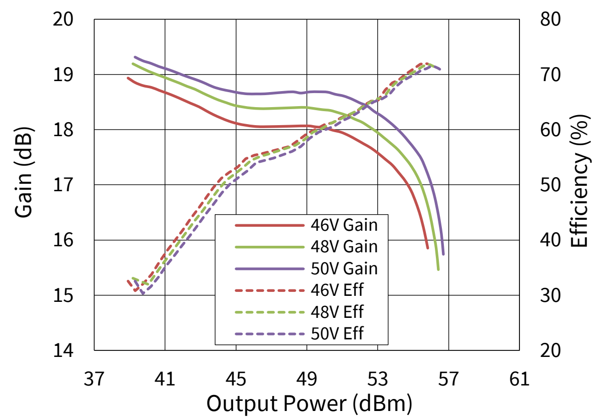


Figure 5. Pulsed CW Performance at various V_{DD}

$I_{DQ(MAIN)}$ = 500 mA, $V_{GS(PEAK)}$ = -4.3 V,
f = 1880 MHz

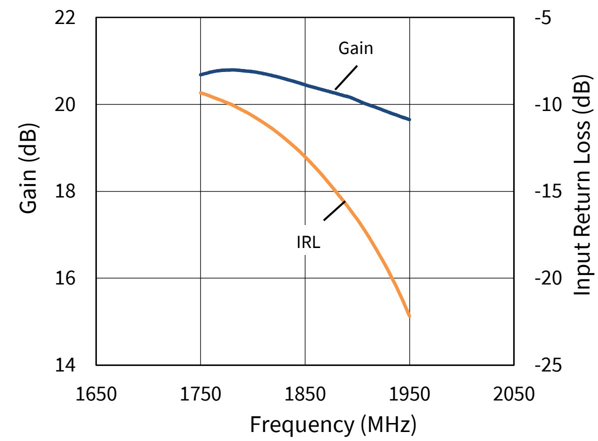


Figure 6. Small Signal CW Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 500 mA,
V_{GSPEAK} = -4.3 V

Load Pull Performance

Main side load pull performance – pulsed CW signal: 10 µsec, 10% duty cycle, 48 V, I_{DQ} = 150 mA , class AB

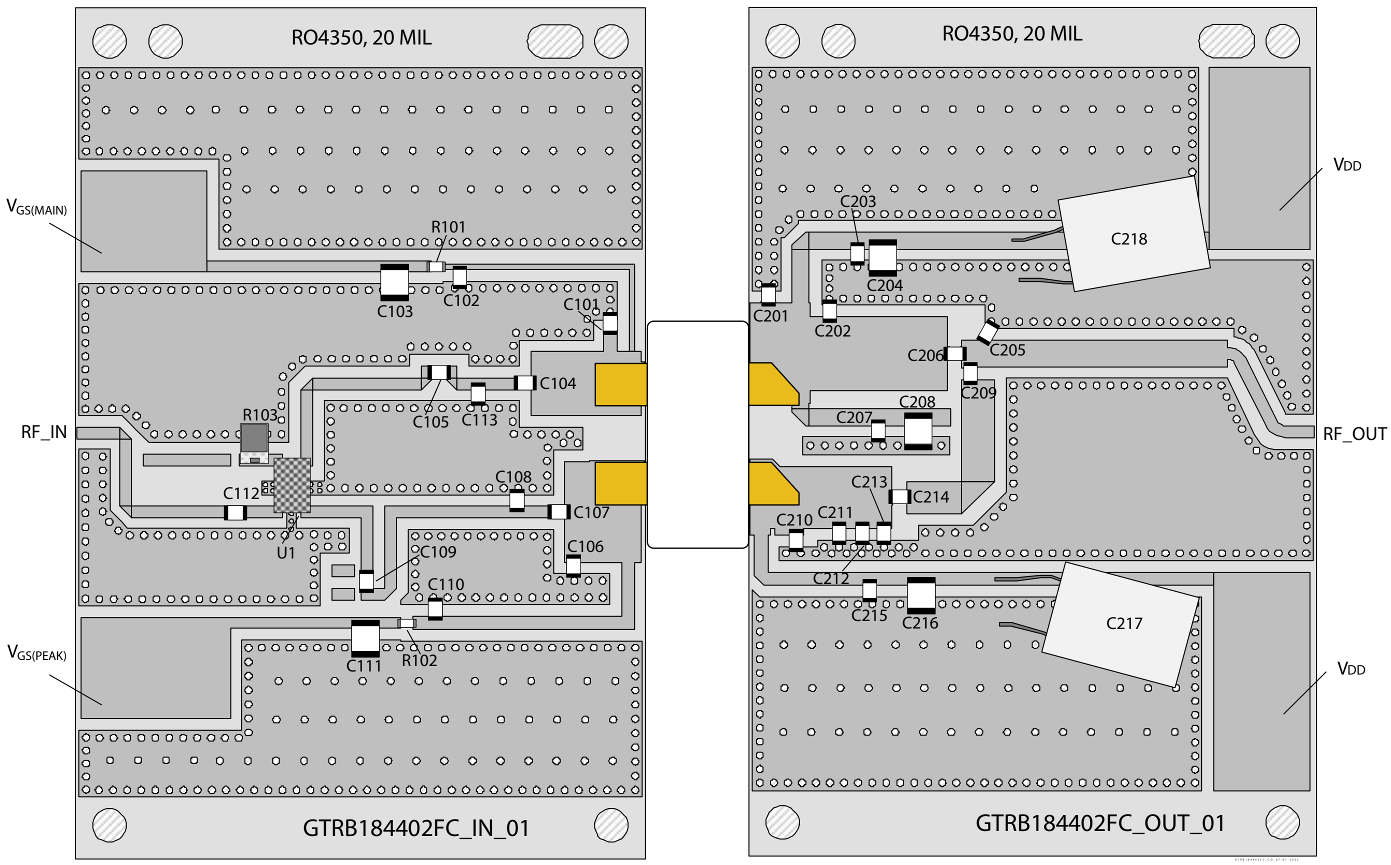
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	Efficiency [%]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	Efficiency [%]
1810	4.08-j10.87	3.99-j3.37	17.7	53.3	212.3	73.8	3.45+j1.14	19.6	49.8	95.3	87.7
1840	3.95-j12.62	4.26-j3.55	17.4	53.1	204.6	73.0	3.47-j0.43	19.2	51.7	147.6	87.5
1880	5.77-j11.5	4.35-j4.01	17.3	53.0	199.5	70.8	3.33-j0.43	19.2	51.3	134.0	86.2

Peak side load pull performance – pulsed CW signal: 10 µsec, 10% duty cycle, 48 V, $V_{GS(PEAK)}$ = -5 V, Class C

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	Efficiency [%]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	Efficiency [%]
1810	3.82-j7	2.53-j2.35	13.8	56.2	413.0	70.1	1.12+j1.18	14.2	51.1	127.1	87.4
1840	4.21-j7.12	2.56-j1.94	14.2	56.0	396.3	73.8	1.67+j0.67	14.4	52.9	195.9	87.5
1880	4.08-j7.25	2.54-j2.21	14.3	55.9	389.9	70.8	1.68+j0.4	15.1	53.1	202.3	87.5

Doherty Evaluation Board, 1805 – 1880 MHz

Test Circuit Part Number	LTA/GTRB184402FC-V1
PCB Information	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66



Reference circuit assembly diagram (not to scale)

Components Information

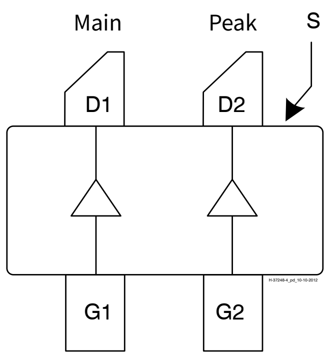
Component	Description	Manufacturer	P/N
Input			
C101	Capacitor, 1 pF	ATC	ATC600F1R0BT250XT
C102, C105, C109, C110, C112	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C103, C111	Capacitor, 10 µF, 100 V	Murata	GRM32EC72A106KE05L
C104	Capacitor, 3.6 pF	ATC	ATC600F3R6BT250XT
C106	Capacitor, 1.2 pF	ATC	ATC600F1R2BT250XT
C107	Capacitor, 5.6 pF	ATC	ATC600F5R6BT250XT
C108	Capacitor, 0.7 pF	ATC	ATC600F0R7BT250XT
C113	Capacitor, 0.5 pF	ATC	ATC600F0R5BT250XT
R101, R102	Resistor, 9.1 ohms	Panasonic Electronic Components	ERJ-3GEYJ9R1V
R103	Resistor, 50 ohms	Richardson	C8A50Z4B
U1	Hybrid Coupler	Anaren	X3C19F1-03S
Output			
C201	Capacitor, 1.6 pF	ATC	ATC600F1R6BT250XT
C202	Capacitor, 0.3 pF	ATC	ATC600F0R3BT250XT
C203, C207	Capacitor, 15 pF	ATC	ATC600F150JT250XT
C204, C208, C216	Capacitor, 10 µF, 100 V	Murata	GRM32EC72A106KE05L
C205, C211, C213	Capacitor, 0.4 pF	ATC	ATC600F0R4BT250XT
C206	Capacitor, 2.7 pF	ATC	ATC600F2R7BT250XT
C209	Capacitor, 22 pF	ATC	ATC600F220JT250XT
C210	Capacitor, 1.8 pF	ATC	ATC600F1R8BT250XT
C212	Capacitor, 0.8 pF	ATC	ATC600F0R8BT250XT
C214	Capacitor, 3.0 pF	ATC	ATC600F3R0BT250XT
C215	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C217, C218	Capacitor, 220 µF	Nichicon	UVR2A221MHD1TO

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 GTRB184402FC

Rev. 03, 2023-07-07

Package Outline Specifications – Package H-37248C-4

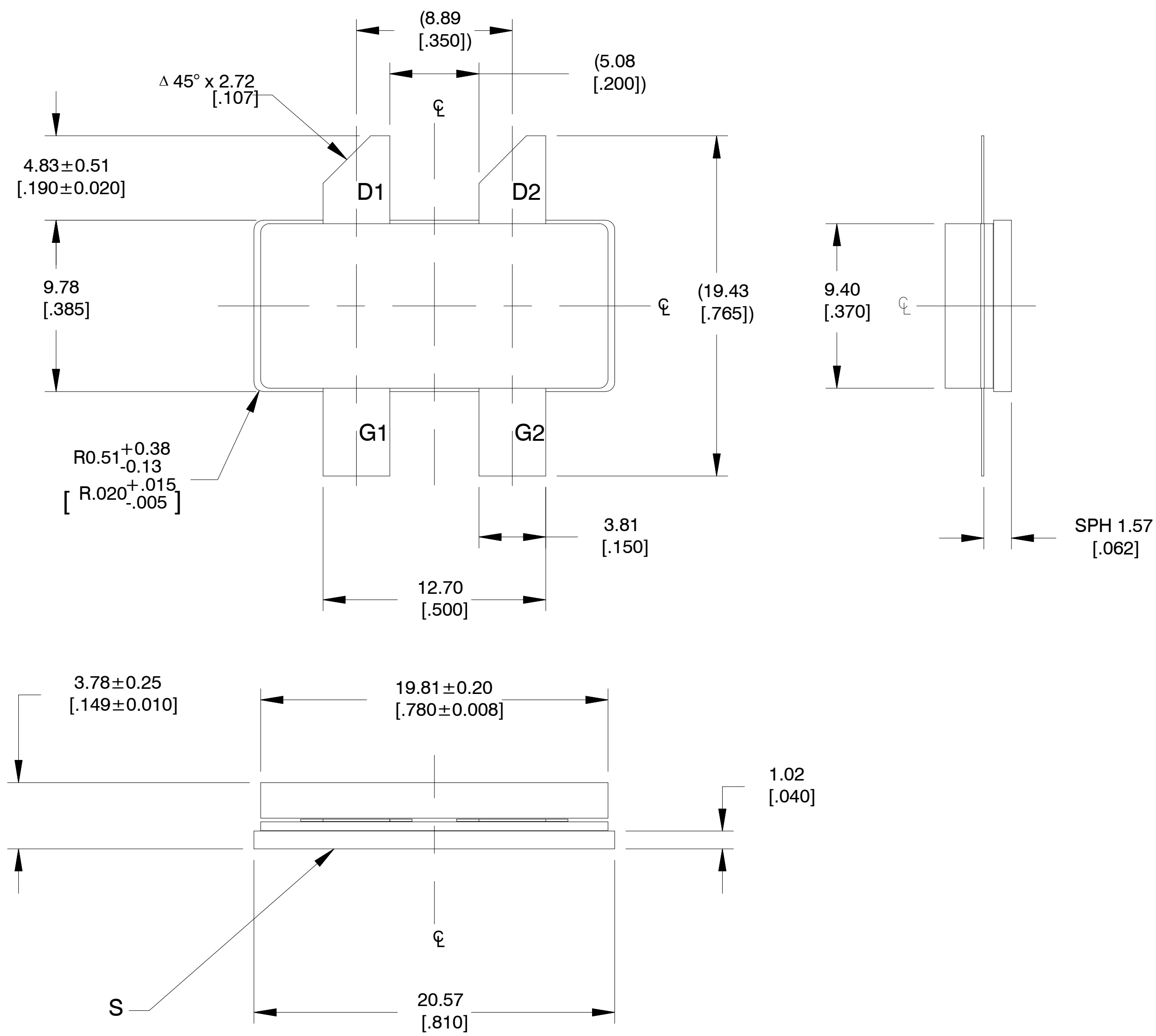


Diagram Notes—unless otherwise specified:

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].

Notes & Disclaimer