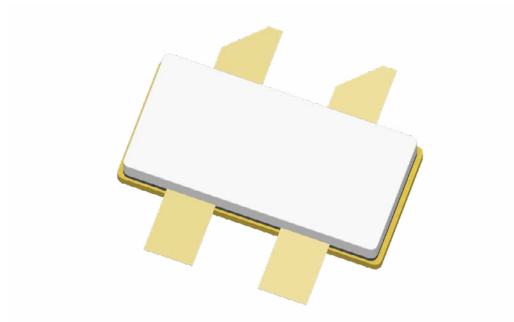
GTRB097152FC

Thermally-Enhanced High Power RF GaN on SiC HEMT
900 W, 48 V, 758 – 960 MHz

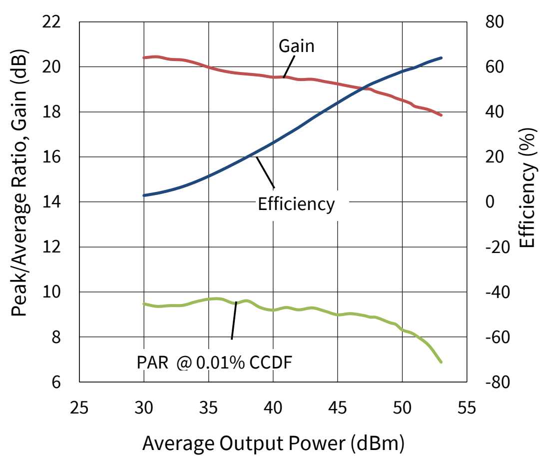


Package Type: H-37248C-4

Description

The GTRB097152FC is a 900-watt (P_{4dB}) 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.

Single-carrier WCDMA Drive-up
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA, $V_{GS(PEAK)}$ = -4.8 V,
f = 960 MHz, 3GPP WCDMA signal, PAR = 10 dB,
3.84 MHz BW



Features

- GaN on SiC HEMT technology
- Typical Pulsed CW performance, 960 MHz, 48 V, 10 µs pulse width, 10% duty cycle, combined outputs
  - Output power at P_{4dB} = 900 W
  - Efficiency at P_{4dB} = 73%
- 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 925 to 960 MHz)
V_{DD} = 48 V, I_{DQ} = 1000 mA, P_{OUT} = 115.6 W avg, $V_{GS(PEAK)}$ = (V_{GS} @ I_{DQ} = 500 mA) – 1.68 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)
925 MHz	50.6	18.5	58.1	-28.2	-27.9	8.3
940 MHz	50.6	18.5	58.2	-29.1	-29.4	8.4
960 MHz	50.6	18.3	58.0	-30.0	-30.0	8.4

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 (main)	I_{DSS}	—	—	5.7	mA	V_{GS} = –8 V, V_{DS} = 10 V
Drain-source Leakage Current (peak)				11.5		
Gate-source Leakage Current (main)	I_{GSX}	—	—	–9.1		V_{GS} = –8 V, V_{DD} = 50 V
Gate-source Leakage Current (peak)				–18.3		
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.0	–2.3	V	V_{DS} = 10 V, I_D = 33 mA
Gate Threshold Voltage (peak)						V_{DS} = 10 V, I_D = 66 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 = 1000 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	33	mA
Gate Current (peak)		66	
Drain Current (main)	I_D	2.5	A
Drain Current (peak)		5	
Junction Temperature	T_J	275	°C
Storage Temperature Range	T_{STG}	–65 to +150	

Notes:
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)	$R_{\theta JC}$	1.36	°C/W	T_{CASE} = 85°C, P_{DISS} = 84 W DC
Thermal Resistance (peak)		0.76		T_{CASE} = 85°C, P_{DISS} = 149 W DC

Note:
1. The junction to case thermal resistance value was calculated by a composite of direct thermal measurements and simulation.

RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty production test circuit)
V_{DD} = 48 V, I_{DQ} = 1000 mA, P_{OUT} = 115.6 W avg, $V_{GS(PEAK)}$ = (V_{GS} @ IDQ = 500 mA) - 1.68 V, ƒ = 960 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Gain	G_{ps}	16.8	18	—	dB
Drain Efficiency	ηD	55.3	59	—	%
Adjacent Channel Power Ratio	ACPR	—	–28	–22	dBc
Output PAR @ 0.01% CCDF	OPAR	7.4	8	—	dB

Ordering Information

Type and Version	Order Code	Package Type	Shipping
GTRB097152FC V1 R0	GTRB097152FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRB097152FC V1 R2	GTRB097152FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in a Doherty evaluation board)

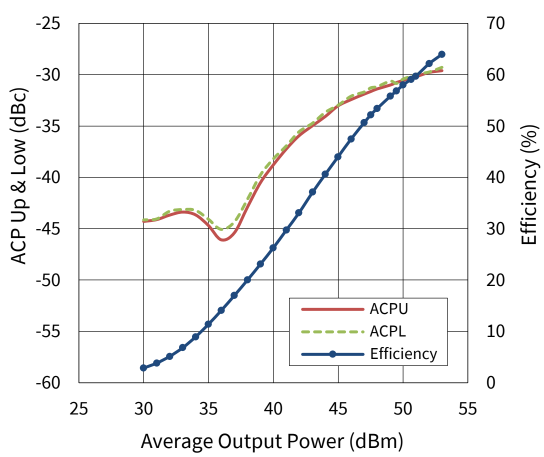

Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA, $V_{GS(PEAK)}$ = -4.8 V, ƒ = 960 MHz, 3GPP WCDMA signal, PAR = 10 dB, BW = 3.84 MHz

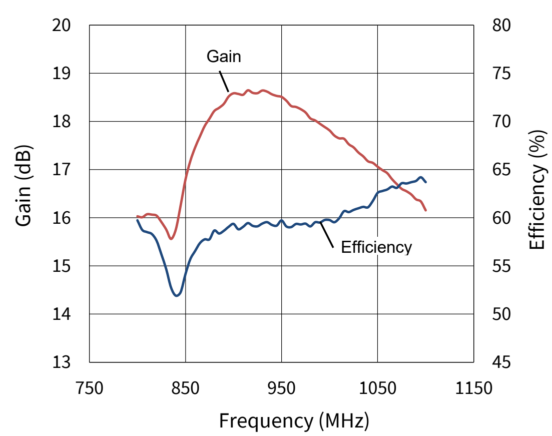

Figure 2. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA, $V_{GS(PEAK)}$ = -4.8 V, P_{OUT} = 50.63 dBm, 3GPP WCDMA signal, PAR = 10 dB

Typical Performance (cont.)

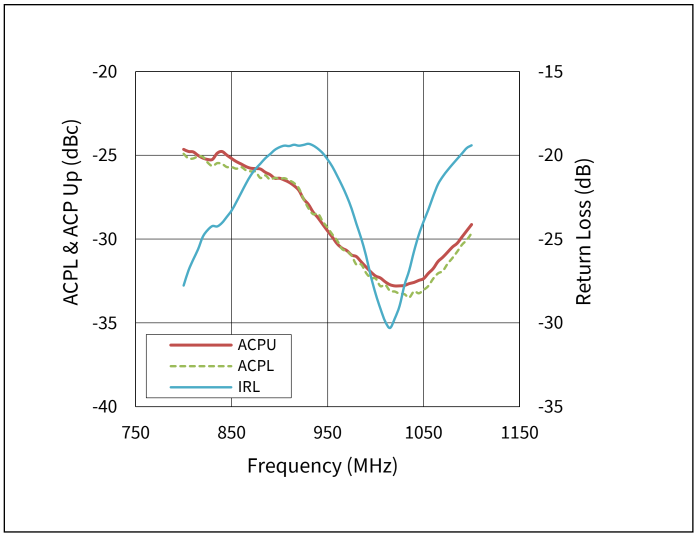

Figure 3. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA, $V_{GS(PEAK)}$ = -4.8 V,
P_{OUT} = 50.63 dBm, 3GPP WCDMA signal,
PAR = 10 dB

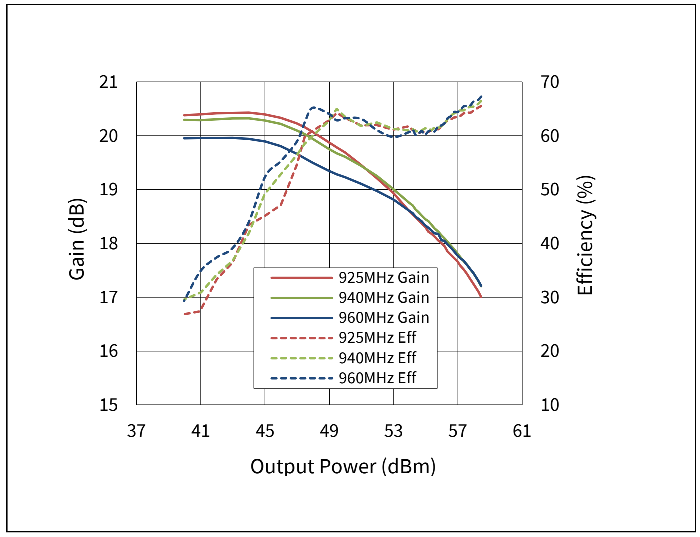

Figure 4. Pulsed CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA,
$V_{GS(PEAK)}$ = -4.8 V

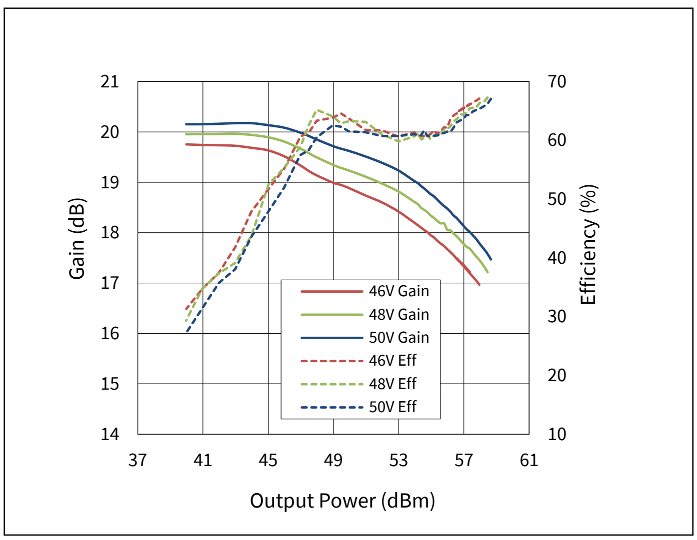

Figure 5. Pulsed CW Performance at various V_{DD}

$I_{DQ(MAIN)}$ = 1000 mA, $V_{GS(PEAK)}$ = -4.8 V,
f = 960 MHz

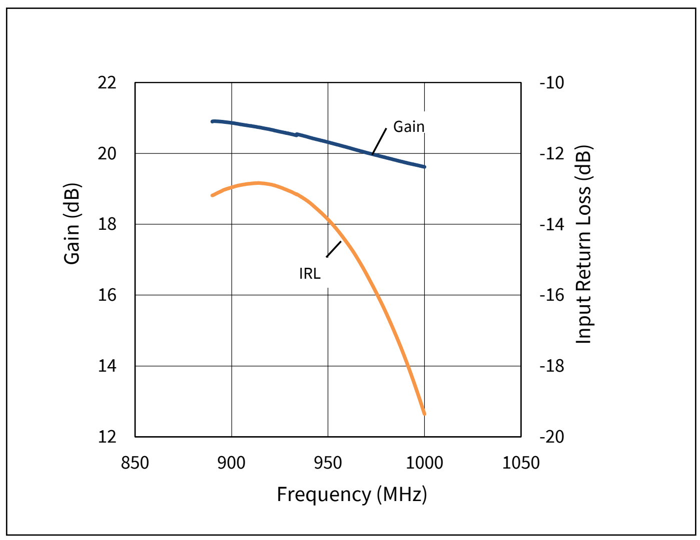

Figure 6. Small Signal CW Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 1000 mA,
$V_{GS(PEAK)}$ = -4.8 V

Load Pull Performance

Main side load pull performance – pulsed CW signal: 10 µsec, 10% duty cycle, 48 V, I_{DQ} = 350 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]	ηD [%]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	ηD [%]
925	3.30-j4.71	3.03-j0.23	19.39	56.39	435.51	78.58	3.78+j2.88	20.44	53.76	237.68	88.16
940	4.46-j7.67	2.94+j0.18	18.9	56.27	423.64	79.18	3.95+j3.66	20.21	53.03	200.91	87.15
960	4.47-j5.06	2.95-j0.68	18.6	56.14	411.15	71.9	4.06+j2.41	20.04	54.39	274.79	89.36

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]	ηD [%]	Z_l [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	ηD [%]
925	1.60-j1.46	1.41-j0.98	14.98	58.43	696.63	67.4	3.02+j0.87	14.33	55.85	384.59	84.2
940	1.9-j1.92	1.56-j0.96	15.26	58.44	698.23	70.05	2.60+j1.04	14.95	55.7	371.54	84.17
960	1.89-j2.89	1.55-j1.22	15.12	58.35	683.91	66.07	2.10+j1.21	15.7	55.56	359.75	83.59

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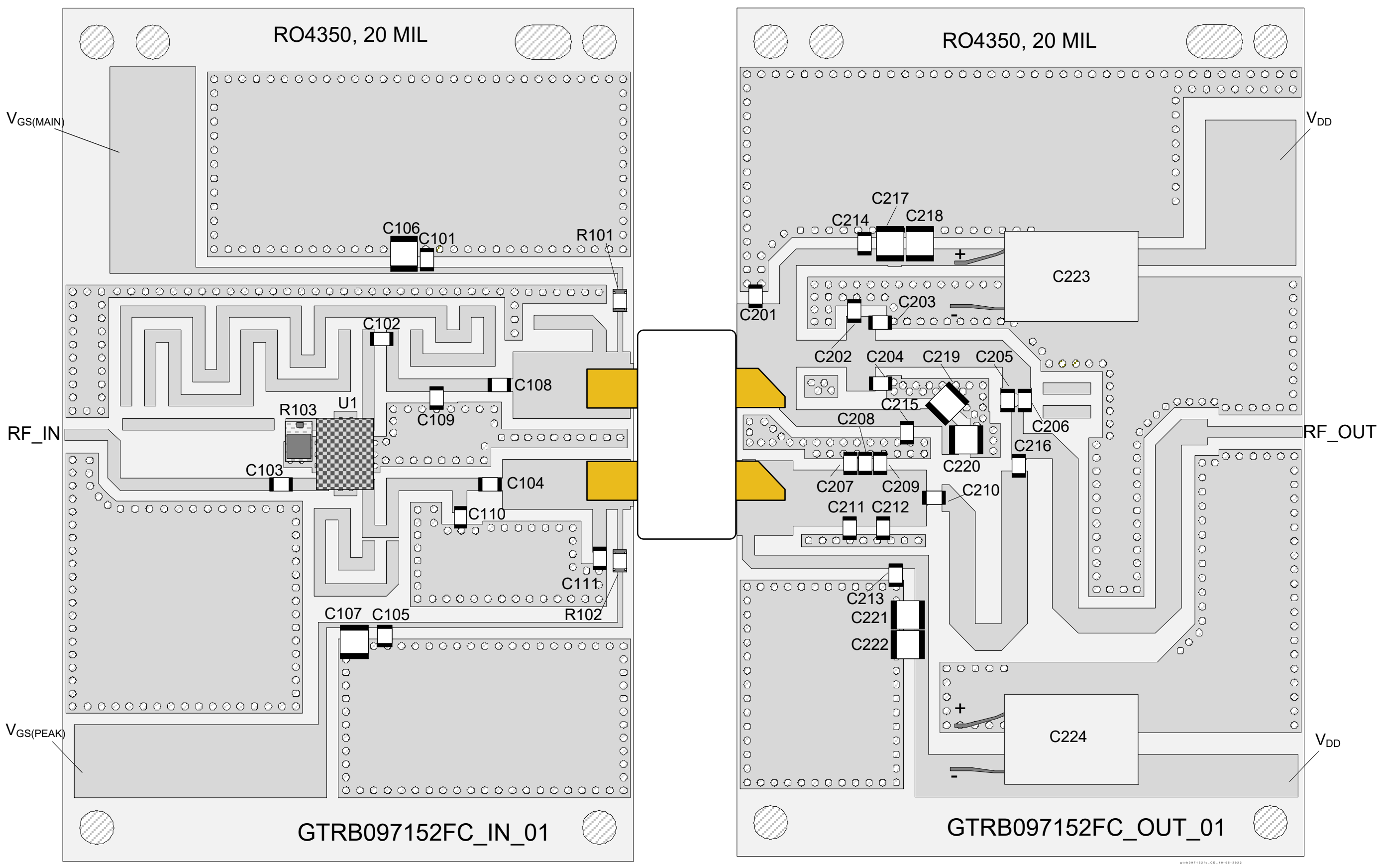
Production Test Circuit, 925 – 960 MHz

Test Circuit Part Number	LTA/GTRB097152FC-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, C102, C103, C104, C105	Capacitor, 100 pF	ATC	ATC600F101JT250XT
C106, C107	Capacitor, 10 µF, 50 V	Taiyo Yuden	UMK325C7106MM-T
C108	Capacitor, 39 pF	ATC	ATC600F390JT250XT
C109, C110	Capacitor, 5.6 pF	ATC	ATC600F5R6BT250XT
C111	Capacitor, 8.2 pF	ATC	ATC600F8R2BT250XT
R101	Resistor, 5.6 ohms	Yageo	RC0805JR-075R6L
R102	Resistor, 18 ohms	Yageo	RCO0805JR-0718RL
R103	Resistor, 50 ohms	Anaren	C8A50Z4B
U1	Hybrid Coupler	Anaren	X3C09P1-03S

Components Information

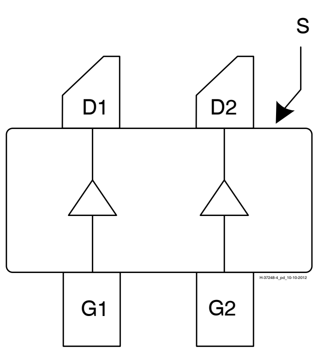
Component	Description	Manufacturer	P/N
Output			
C201	Capacitor, 2.7 pF	ATC	ATC600F2R7BT250XT
C202	Capacitor, 3.6 pF	ATC	ATC600F3R6BT250XT
C203	Capacitor, 3.9 pF	ATC	ATC600F3R9BT250XT
C204, C207	Capacitor, 3.0 pF	ATC	ATC600F3R0BT250XT
C205, C206	Capacitor, 3.3 pF	ATC	ATC600F3R3BT250XT
C208	Capacitor, 10 pF	ATC	ATC600F100JT250XT
C209	Capacitor, 0.7 pF	ATC	ATC600F0R7BT250XT
C210	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C211	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250XT
C212	Capacitor, 2.4 pF	ATC	ATC600F2R4BT250XT
C213	Capacitor, 51 pF	ATC	ATC600F510JT250XT
C214, C215, C216	Capacitor, 100 pF	ATC	ATC600F101JT250XT
C217, C218, C219, C220, C221, C222	Capacitor, 10 µF, 100 V	Murata	GRM32EC72A106KE05L
C223, C224	Capacitor, 470 µF, 100 V	Panasonic	ECA-2AHG47B

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 GTRB097152FC

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

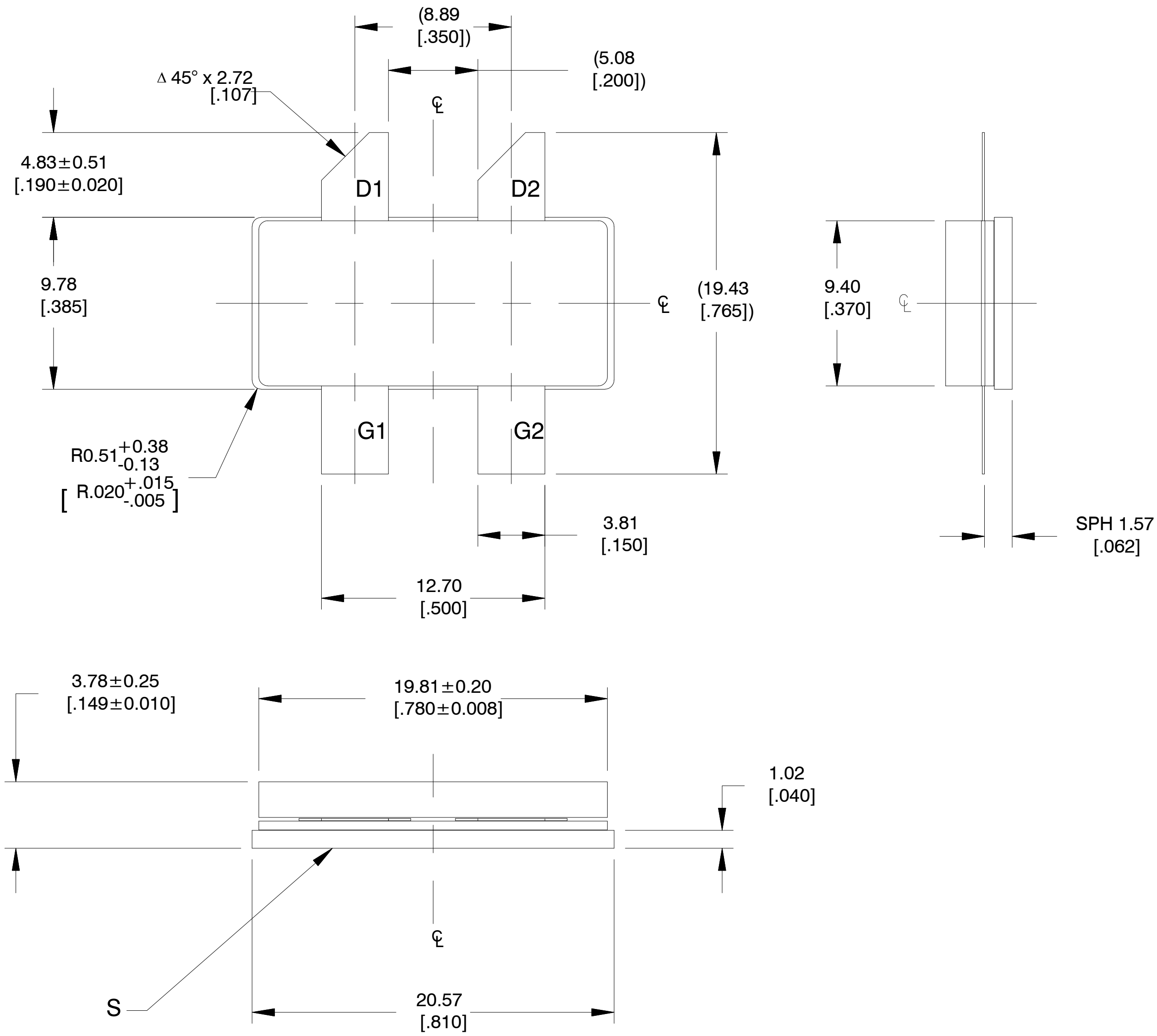


Diagram Notes—unless otherwise specified:

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].

Notes & Disclaimer