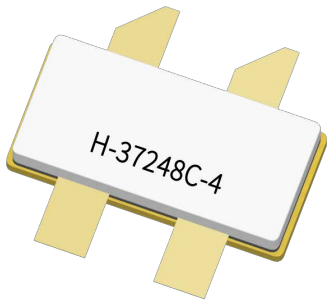
GTRB226002FC

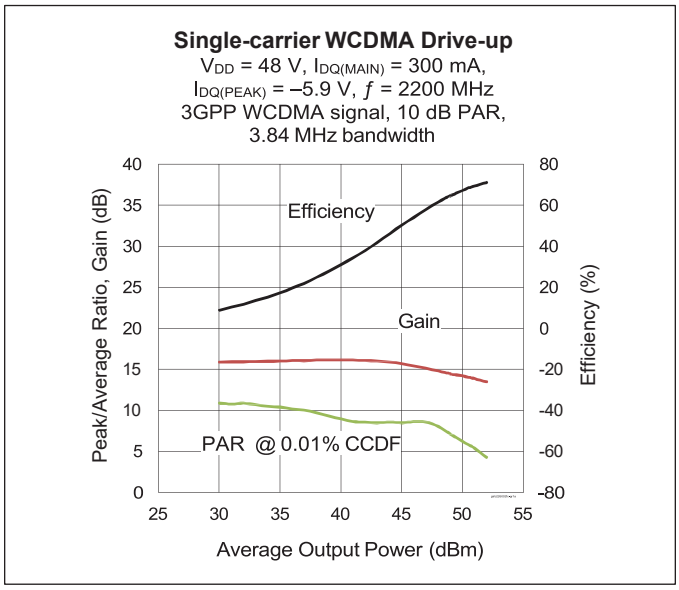
Thermally-Enhanced High Power RF GaN on SiC HEMT
450 W, 48 V, 2110 – 2200 MHz



Package Types: H-37248C-4
PN: GTRB226002FC

Description

The GTRB226002FC is a 450-watt (P_{3dB}) GaN on SiC high electron mobility transistor (HEMT) 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: 10 µs pulse width, 10% duty cycle, 2200 MHz, 48 V, Doherty fixture
  - Efficiency = 65%
  - Gain = 14 dB
  - Output power at P_{3dB} = 450 W
- Human Body Model Class 1B (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

Typical RF Characteristics

Single-carrier WCDMA Speci ications (tested in the evaluation board for 2110 – 2200 MHz)
V_{DD} = 48 V, I_{DQ} = 300 mA, $V_{GS(PEAK)}$ = –5.9 V, P_{OUT} = 80 W avg, 3GPP signal, channel bandwidth = 3.84 MHz, input PAR = 10 dB @ 0.01% CCDF

	P_{OUT} (dBM)	Gain (dB)	Efficiency (%)	OPAR (dB)	–ALT1 (dBc)	ALT1 (dBc)
2110	49.0	14.9	60.9	8	–27.1	–27.0
2155	49.0	14.9	62.4	8	–27.4	–27.3
2200	49.0	14.4	65.7	7	–27.0	–27.1

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

RoHS compliant

Rev. 05, 2022-03-18

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}	—	—	4.4	mA	V_{GS} = –8 V, V_{DS} = 10 V
Drain-source Leakage Current (peak)				8.8		
Gate-source Leakage Current (main)	I_{GSX}	—	—	-7.0		V_{GS} = –8 V, V_{DS} = 50 V
Gate-source Leakage Current (peak)				-15		
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.05	-2.3	V	V_{DS} = 10 V, I_D = 25 mA
Gate Threshold Voltage (peak)						V_{DS} = 10 V, I_D = 50 mA

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating Voltage	V_{DD}	0	—	50	V	
Gate Quiescent Voltage	$V_{GS(Q)}$	-3.6	-2.9	-2.1		V_{DS} = 48 V, I_D = 300 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	25	mA
Gate Current (peak)		50	
Drain Current (main)	I_D	9.5	A
Drain Current (peak)		19	
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 qualifications were performed at 225˚C. Operation at T_j = 275 ˚C reduces mean time to failure.

Thermal Characteristics

Thermal resistance, junction to case (T_{CASE} = 85˚C)

Parameter	Symbol	Value	Unit	Conditions
Thermal Resistance (main)	$R_{\theta JC}$	1.4	˚C/W	T_{CASE} = 85 ˚C, P_{DISS} = 100 W DC
Thermal Resistance (peak)		1.0		T_{CASE} = 85 ˚C, P_{DISS} = 143 W DC

Ordering Information

Type and Version	Order Code	Package Description	Shipping
GTRB226002FC V1 R0	GTRB226002FC-V1-R0	H-37248C-4, earless flange	Tape & Reel, 50 pcs
GTRB226002FC V1 R2	GTRB226002FC-V1-R2	H-37248C-4, earless flange	Tape & Reel, 250 pcs

RF Characteristics

Single-carrier WCDMA Speci ications (tested in the Doherty production test fixture) V_{DD} = 48 V, I_{DQ} = 300 mA, $V_{GS(PEAK)}$ = V_{GS} @ I_{DQ} = 600 mA –2.4 V, P_{OUT} = 80 W avg, f = 2200 MHz 3GPP signal, channel bandwidth = 3.84 MHz, input PAR = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Typ	Max	Unit
Gain	G_{ps}	13.5	15	—	dB
Drain Efficiency	η_D	53	60	—	%
Adjacent Channel Power Ratio	ACPR	—	–26.7	–24.5	dBc
Output PAR @ 0.01% CCDF	OPAR	6.5	7.1	—	dB

Typical Performance (data taken in a Worlfspeed production test fixture)

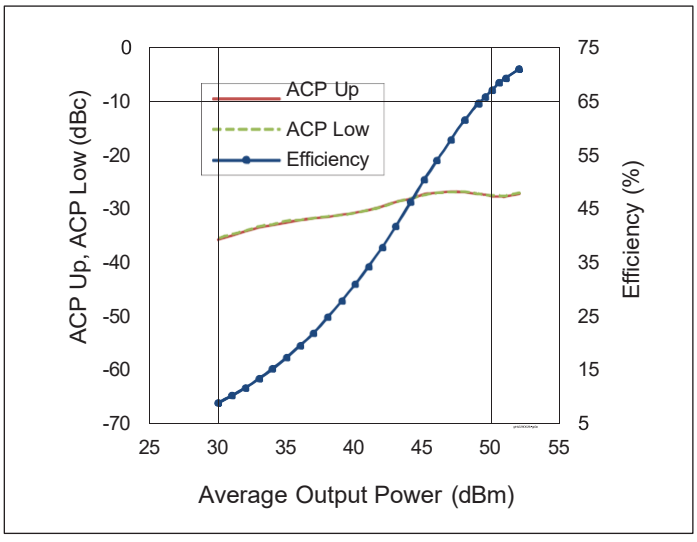


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 300 mA,
$V_{GS(PEAK)}$ = –5.9 V, f = 2200 MHz
3GPP WCDMA signal, 10 dB PAR,
3.84 MHz bandwidth

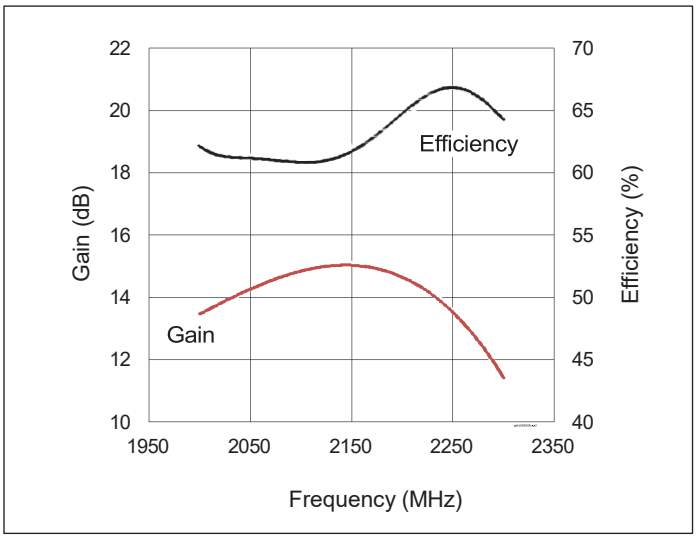


Figure 2. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 300 mA,
$V_{GS(PEAK)}$ = –5.9 V, P_{OUT} = 49.03 dBm,
3GPP WCDMA signal, 10 dB PAR,
3.84 MHz bandwidth

Typical Performance (cont.)

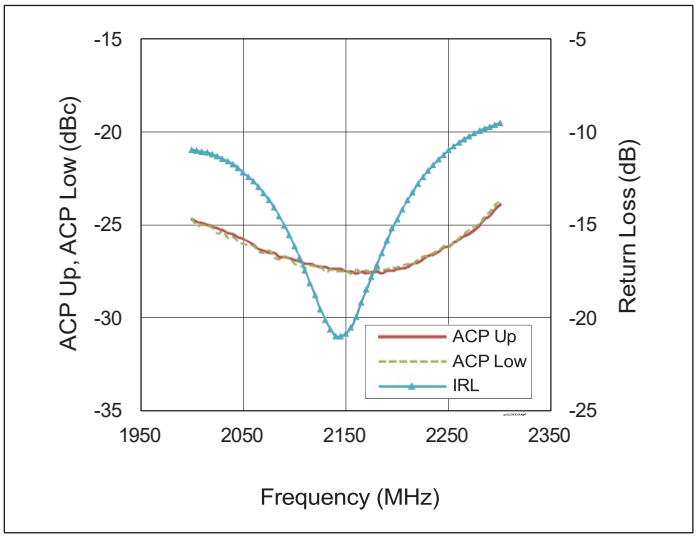


Figure 3. Single-carrier WCDMA Broadband

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 300 mA,
$V_{GS(PEAK)}$ = –5.9, P_{OUT} = 49.03 dBm,
3GPP WCDMA signal, 10 dB PAR,
3.84 MHz bandwidth

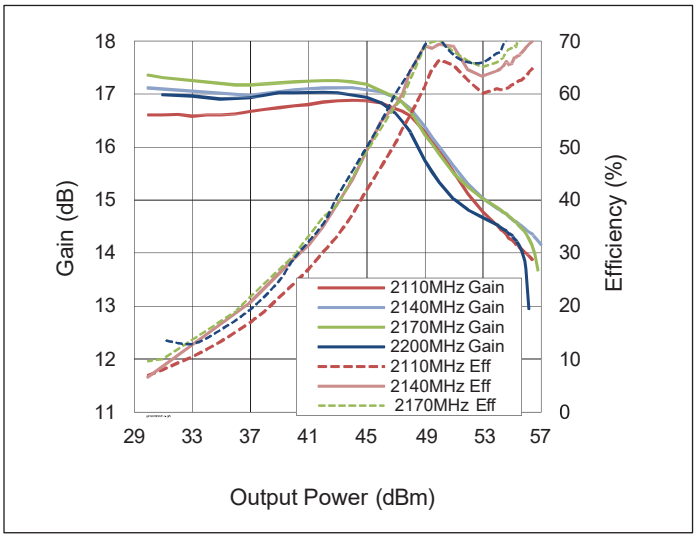


Figure 4. Pulsed CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$= 300 mA, $V_{GS(PEAK)}$= –5.9V

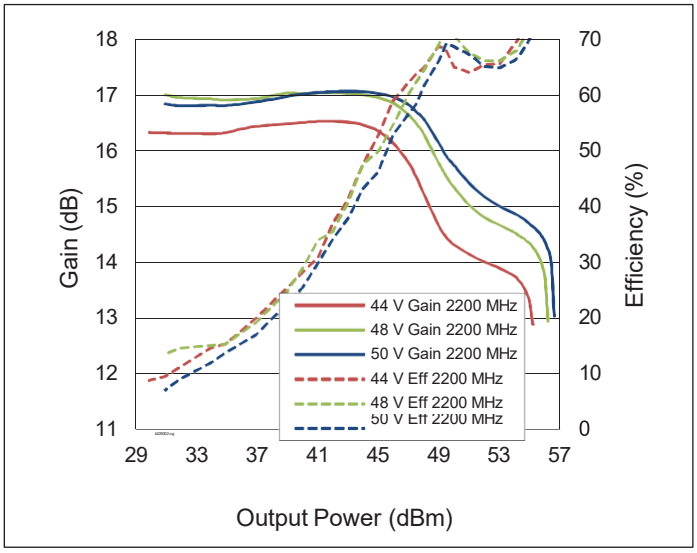


Figure 5. Pulsed CW Performance at various V_{DD}

$I_{DQ(MAIN)}$ = 300 mA, $V_{GS(PEAK)}$ = –5.9V
f = 2200 MHz

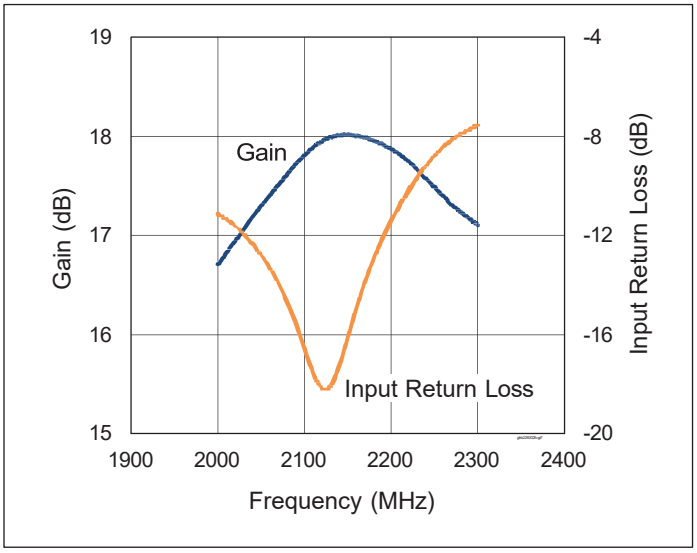


Figure 6. CW Performance Small Signal Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 300 mA,
$V_{GS(PEAK)}$ = –5.9V

Load Pull

Main Side Load Pull Performance – Pulsed CW signal – 10 µsec pulse width, 10% duty cycle, 48 V, I_{DQ} = 200 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
2110	9.0 – j12.2	3.0 – j3.4	15.8	54.70	295	70.7	1.8 – j0.3	17.8	50.90	123	82.5
2170	9.0 – j12.8	2.7 – j3.2	16.1	54.50	281	70.5	2.3 – j1.2	17.6	53.10	204	82.7
2200	8.8 – j12.7	2.6 – j3.2	16.1	54.40	275	69.8	2.3 – j1.2	17.7	52.90	195	82.1

Peak Side Load Pull Performance – Pulsed CW signal – 10 µsec pulse width, 10% duty cycle, 48 V, $V_{GS(PEAK)}$ = –4 V, class C

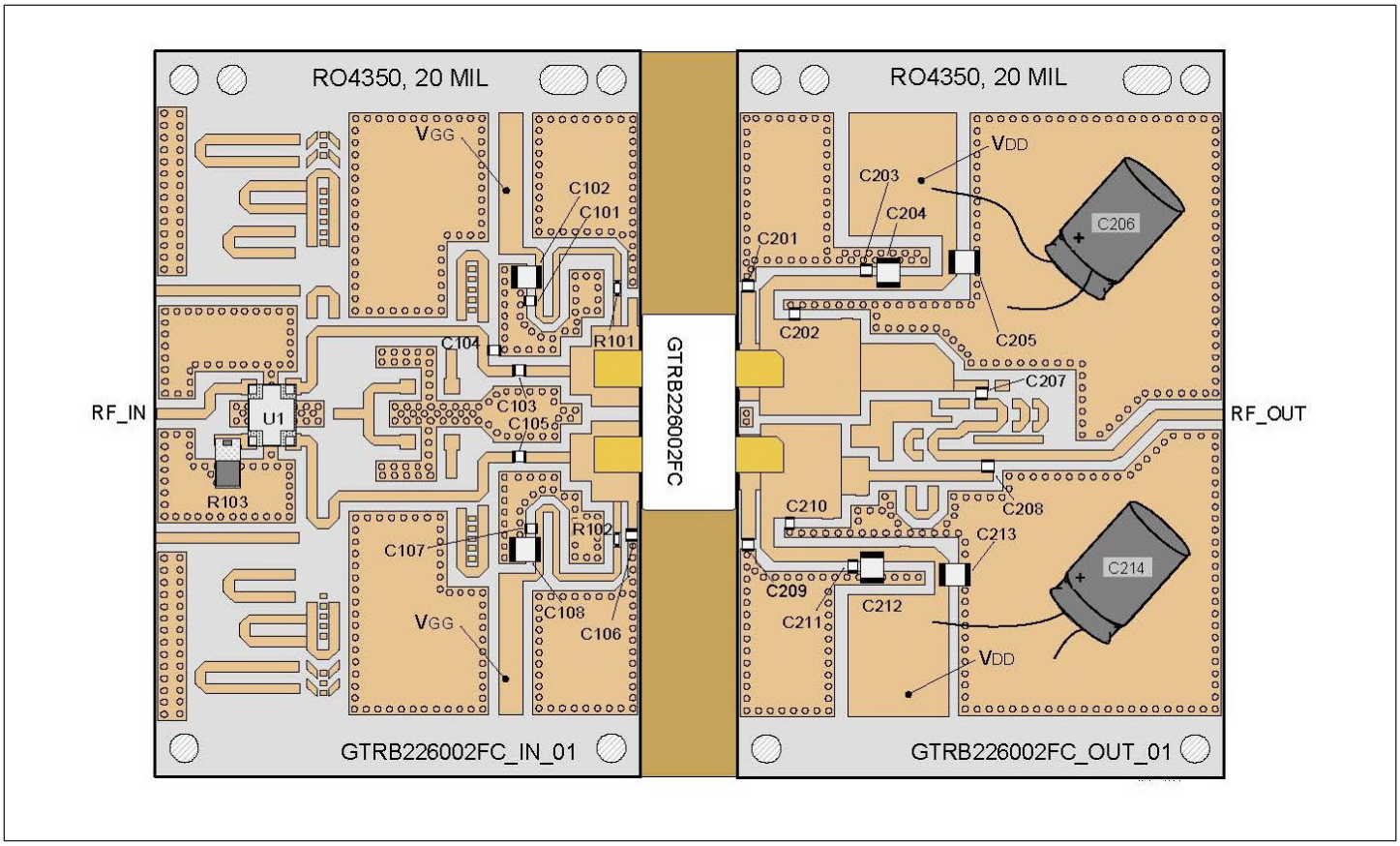
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
2110	3.2 – j8.6	1.4 – j3.9	13.6	56.90	489	61.1	1.7 – j2.5	15.4	55.90	389	78.0
2170	3.6 – j8.4	1.9 – j3.8	14	56.70	467	62.4	1.9 – j2.3	15.4	55.40	346	75.5
2200	4.0 – j8.3	1.8 – j3.8	14	56.60	457	61.1	1.5 – j2.0	15.4	54.40	275	73.4

See next page for reference circuit information

Reference Circuit, 2110 – 2200 MHz

Reference Circuit Assembly

DUT	GTRB226002FC V1
Test Fixture Part No.	LTA/GTRB226002FC-V1
PCB	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66



Reference circuit assembly diagram (not to scale)

Reference Circuit (cont.)

Components Table

Component	Description	Manufacturer	P/N
Input			
C101, C107	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C102, C108	Capacitor, 10 µF, 50 V	Taiyo Yuden	UMK325C7106MM-T
C103, C105	Capacitor, 15 pF	ATC	ATC600F150JT250XT
C104	Capacitor, 0.7 pF	ATC	ATC600F0R7BT250XT
C106	Capacitor, 1.3 pF	ATC	ATC600F1R3BT250XT
R101, R102	Resistor, 9.1 ohms	Panasonic Electronic Components	ERJ-8RQJ9R1V
R103	Resistor, 50 ohms	Anaren	C16A50Z4
U1	Hybrid coupler	Anaren	X3C21P1-03S
Output			
C201, C209	Capacitor, 1.6 pF	ATC	ATC600F1R6BT250XT
C202	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250XT
C203, C211	Capacitor, 18 pF	ATC	ATC600F180JT250XT
C204, C205, C212, C213	Capacitor, 10 µF, 100 V	Murata Electronics	GRM32EC72A106KE05L
C206, C214	Capacitor, 470 µF, 100 V	Cornell Dubilier Electronics (CDE)	SEK471M050ST
C207, C208	Capacitor, 15 pF	ATC	ATC600F150JT250XT
C210	Capacitor, 0.3 µF	ATC	ATC600F0R3BT250XT

Bias Sequencing

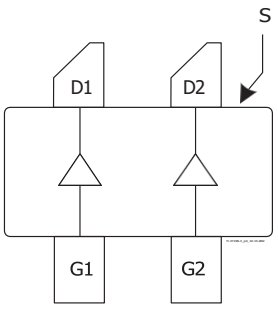
Bias ON

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. Appliy 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)

Package Outline Specifications – Package H-37248C-4

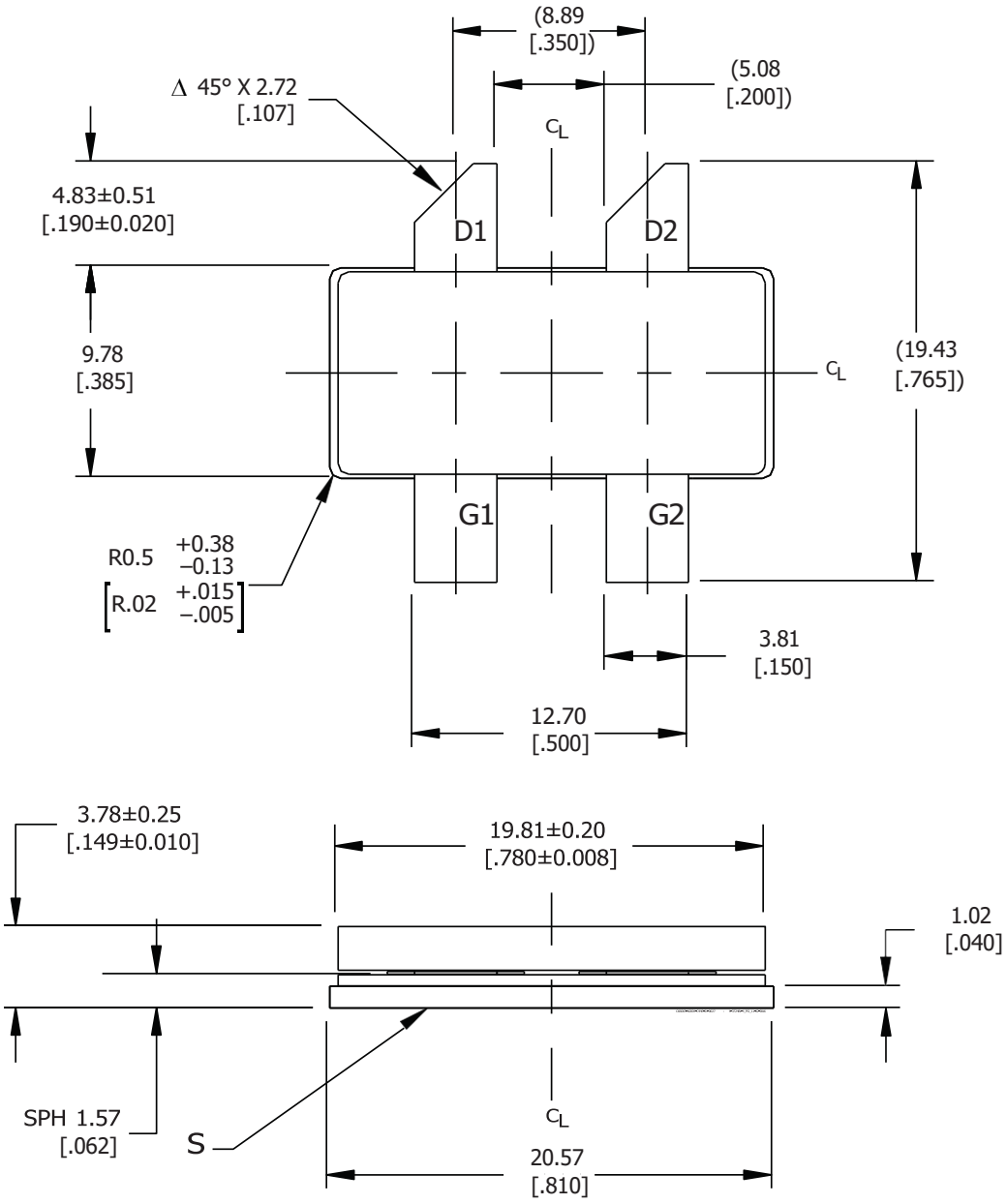


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994
2. Primary dimensions are mm, alternate dimensions are inches
3. All tolerances ± 0.127 [0.005]
4. Pins: D1, D2 – drain, G1, G2 – gate, S – source (flange)
5. Lead thickness: 0.13 ± 0.05 [0.005 ± 0.002]
6. Gold plating thickness: 1.14 ± 0.38 micron [45 ± 15 microinch]

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