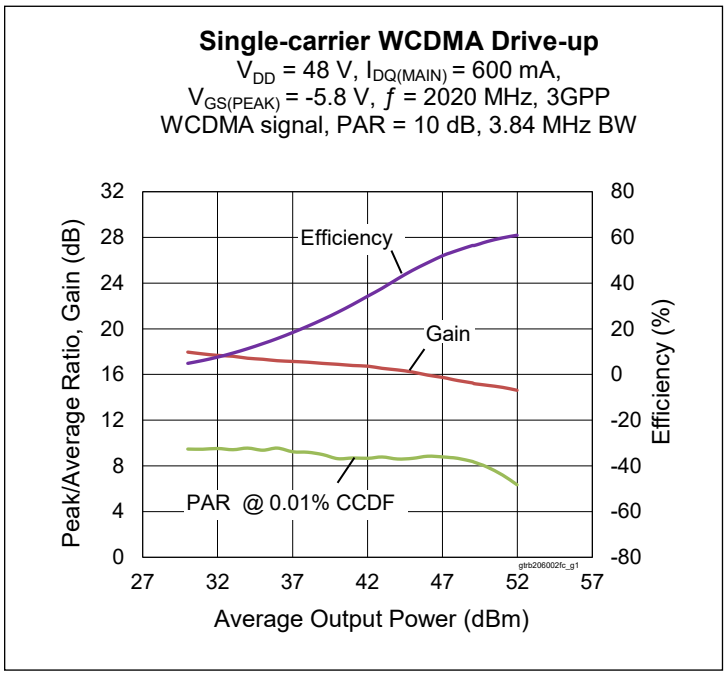
GTRB206002FC/1

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

Description

The GTRB206002FC/1 is a 500-watt (P3dB) 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.

GTRB206002FC/1
Package H-37248C-4



Features

- GaN on SiC HEMT technology
- Typical Pulsed CW performance, 2020 MHz, 48 V, 10 µs pulse width, 10% duty cycle, combined outputs
  - Output power at P_{3dB} = 500 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 V, I_{DQ} = 600 mA, $V_{GS(peak)}$ = V_{GS} at $I_{DQ(peak)}$ = 400 mA - 2.7 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°C unless otherwise indicated
ESD: Electrostatic discharge sensitive device—observe handling precautions!

RoHS compliant

Rev. 01, 2021-08-09

DC Characteristics

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage (main)	V_{GS} = –8 V, I_D = 10 mA	$V_{(BR)DSS}$	150	—	—	V
(peak)	V_{GS} = –8 V, I_D = 10 mA	$V_{(BR)DSS}$	150	—	—	V
Drain-source Leakage Current (main)	V_{GS} = –8 V, V_{DS} = 10 V	I_{DSS}	—	—	4.4	mA
(peak)	V_{GS} = –8 V, V_{DS} = 10 V	I_{DSS}	—	—	8.8	mA
Gate-Source Leakage Current (main)	V_{GS} = –8 V, V_{DD} = 50 V	I_{GSX}	—	—	–7.0	mA
(peak)	V_{GS} = –8 V, V_{DD} = 50 V	I_{GSX}	—	—	–15.0	mA
Gate Threshold Voltage (main)	V_{DS} = 10 V, I_D = 25 mA	$V_{GS(th)}$	–3.8	–3.05	–2.3	V
(peak)	V_{DS} = 10 V, I_D = 50 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 V, I_D = 600 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°C, P_{DISS} = 100 W DC)	$R_{\theta JC}$	1.4	°C/W
(peak, T_{CASE} = 85°C, P_{DISS} = 143 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 V, I_{DQ} = 600 mA, P_{OUT} = 81.2 W, $V_{GS(peak)}$ = V_{GS} at $I_{DQ(peak)}$ = 600 mA - 2.7 V, f = 2020 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

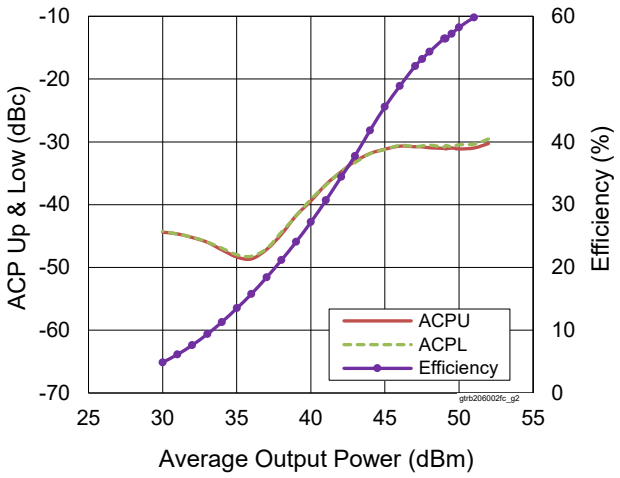
Characteristics	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	14	14.8	—	dB
Drain Efficiency	η_D	49	53	—	%
Adjacent Channel Power Ratio	ACPR	—	–29.9	–27.5	dBc
Output PAR @ 0.01% CCDF	OPAR	7	7.7	—	dB

Ordering Information

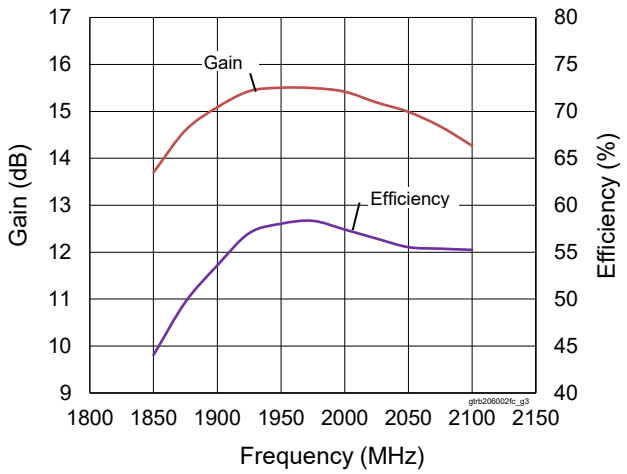
Type and Version	Order Code	Package	Shipping
GTRB206002FC/1 V1 R0	GTRB206002FC1V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRB206002FC/1 V1 R2	GTRB206002FC1V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in the Doherty evaluation board)

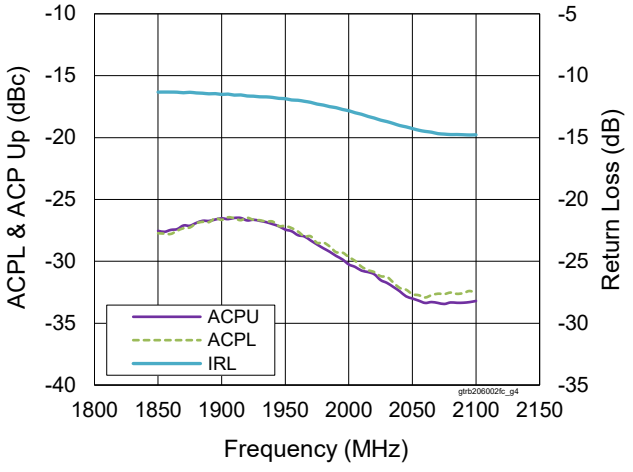
Single-carrier WCDMA Drive-up
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 600 mA,
$V_{GS(PEAK)}$ = -5.8 V, f = 2020 MHz, 3GPP
WCDMA signal, PAR = 10 dB, BW = 3.84 MHz



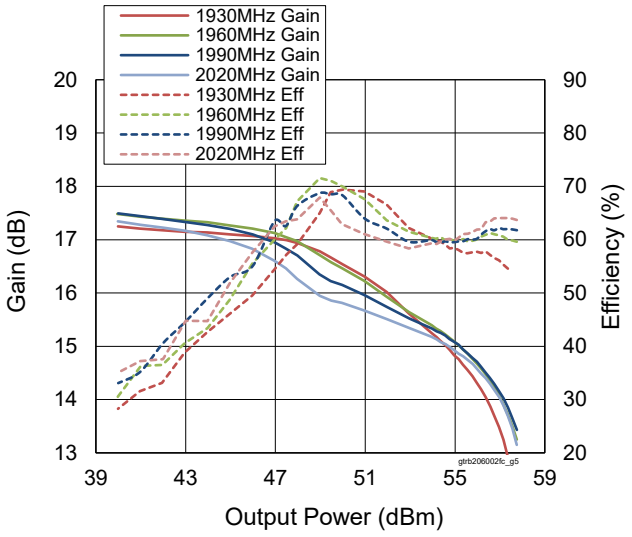
Single-carrier WCDMA Broadband Performance
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 600 mA,
$V_{GS(PEAK)}$ = -5.8 V, P_{OUT} = 49.1 dBm,
3GPP WCDMA signal, PAR = 10 dB



Single-carrier WCDMA Broadband Performance
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 600 mA,
$V_{GS(PEAK)}$ = -5.8 V, P_{OUT} = 49.1 dBm,
3GPP WCDMA signal, PAR = 10 dB

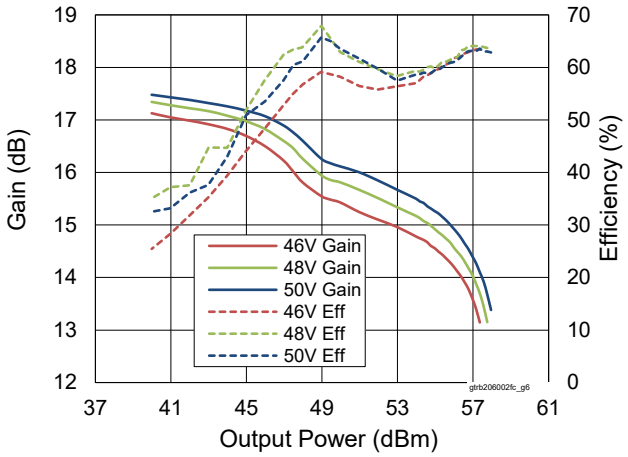


Pulse CW Performance
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 600 mA,
$V_{GS(PEAK)}$ = -5.8 V

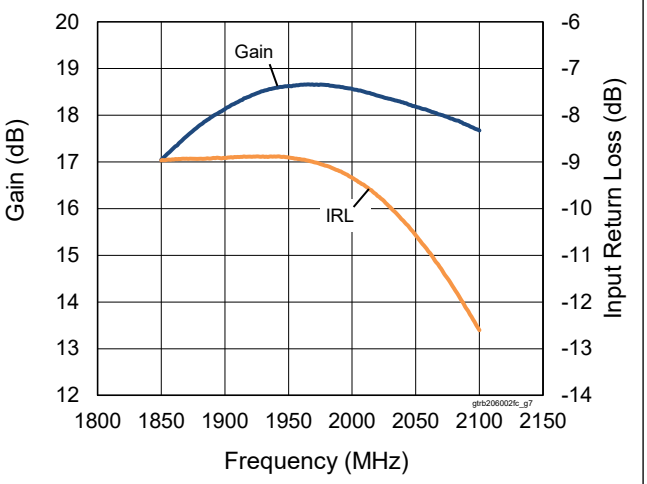


Typical Performance (cont.)

Pulse CW Performance at various V_{DD}
$I_{DQ(MAIN)}$ = 600 mA, $V_{GS(PEAK)}$ = -5.8 V,
f = 2020 MHz



Pulsed CW Performance Small Signal Gain & Input Return Loss
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 600 mA,
$V_{GS(PEAK)}$ = -5.8 V



Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal – 160 µsec, 10% duty cycle, 48 V, I_{DQ} = 200 mA, class AB

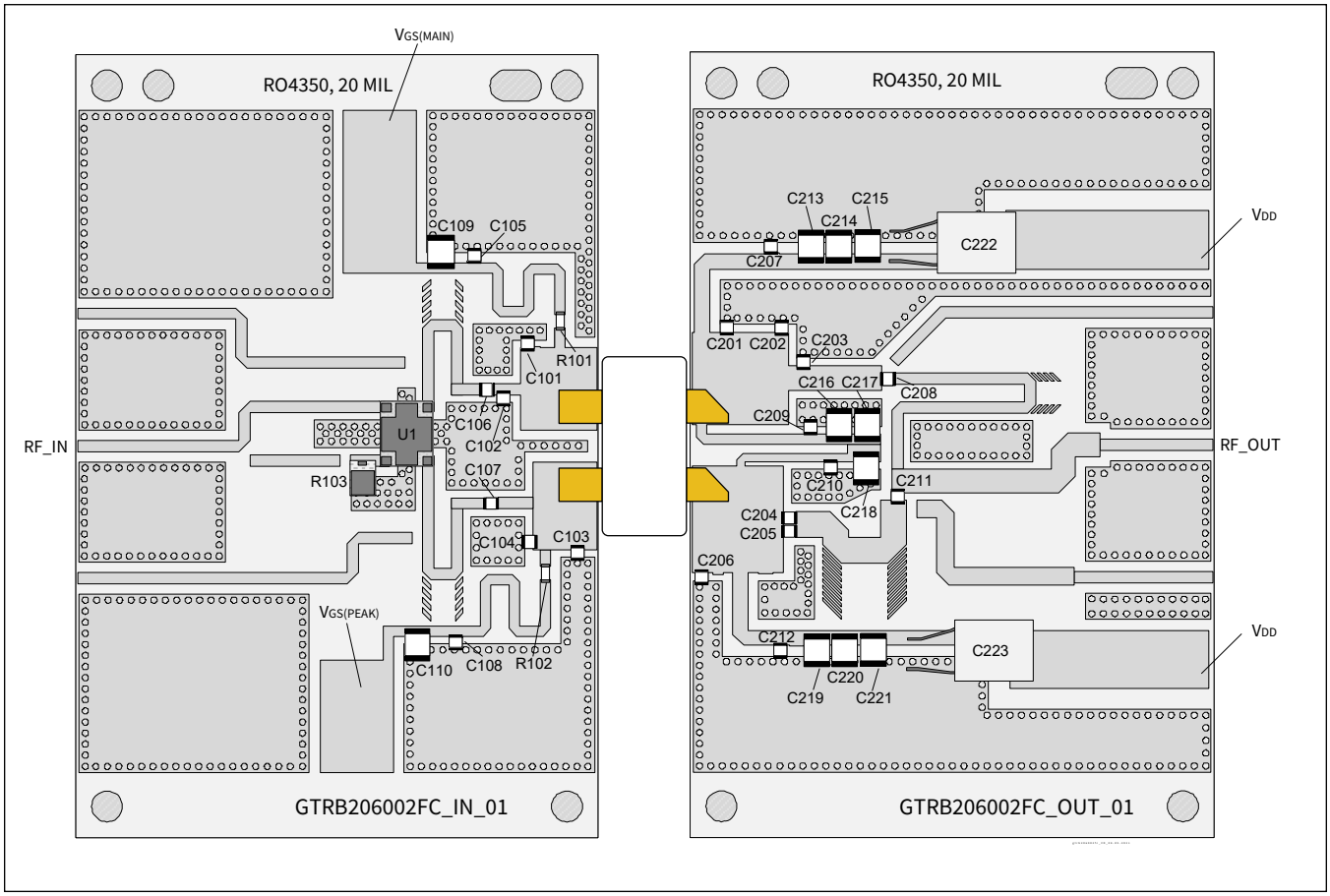
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Zl [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
1930	2.9-j7.5	3.04-j3.96	17.5	54.9	309.03	76.6	2.83-j2.10	18.79	53.93	247.17	89.28
1990	3.9-j7.7	2.62-j3.90	17.31	54.83	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 µsec, 10% duty cycle, 48 V, V_{GSPK} = –5 V, class C

		P_{1dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	ηD [%]	Zl [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	ηD [%]
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, ε_r = 3.66



Application circuit assembly diagram (not to scale)

Doherty Evaluation Board (cont.)

Components Information

Component	Description	Manufacturer	P/N
Input			
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 µF	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
Output			
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 µF	Murata Electronics	GRM32EC72A106KE05L
C222, C223	Capacitor, 470 µF	Panasonic Electronic Components	ECA-2AHG47B

Bias Sequencing

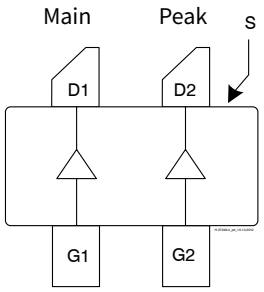
Bias ON

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)



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

Package H-37248C-4

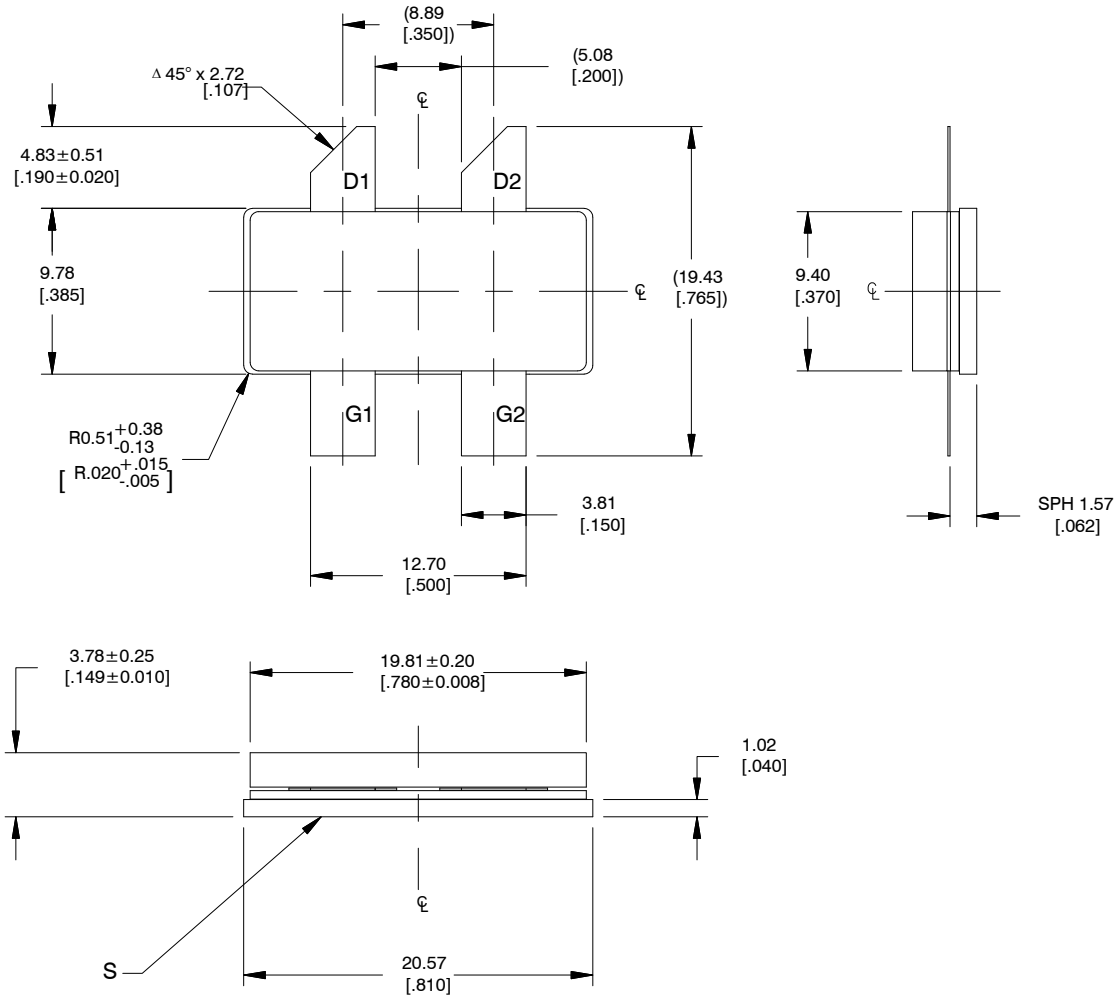


Diagram Notes—unless otherwise specified:

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].

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

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