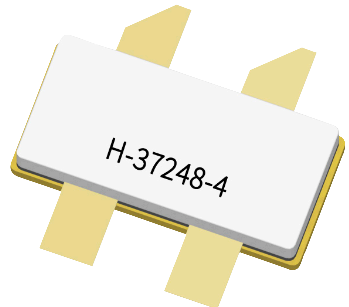
GTRA184602FC

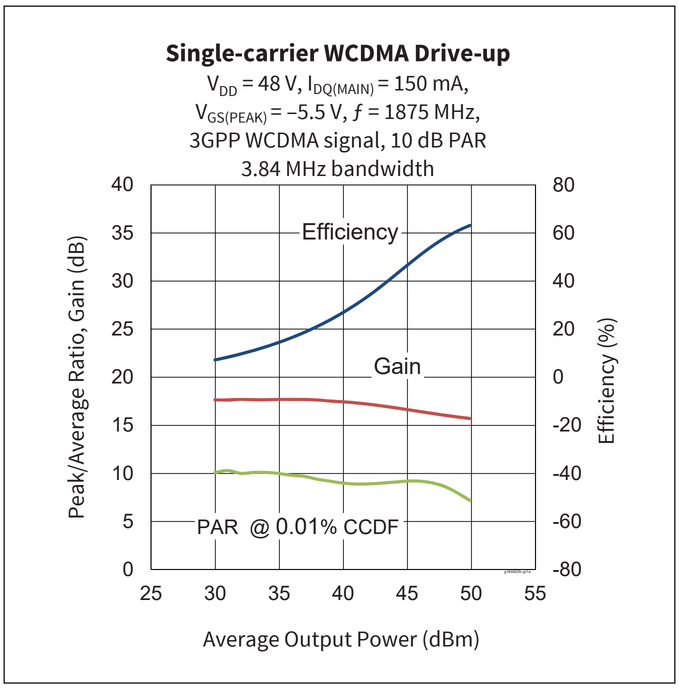
Thermally-Enhanced High Power RF GaN on SiC Carbide Amplifier, 460 W, 48 V, 1805 – 1880 MHz



Package Types: H-37248C-4

Description

The GTRA184602FC is a 460-watt (P_{3dB}) GaN on SiC HEMT D-mode amplifier designed for use in multi-standard cellular power amplifier applications. It features input matching, high efficiency, and a thermally-enhanced package with earless flange.



Features

- GaN on SiC HEMT technology
- Input matched
- Asymmetric Doherty design
  - Main: P_{3dB} = 160 W Typ
  - Peak: P_{3dB} = 300 W Typ
- Typical pulsed CW performance: 48 V, 1845 MHz, 16µsec pulse width, 10% duty cycle (Doherty configuration)
  - Output Power: 460 W @ P_{3dB}
  - Efficiency: 62% @ P_{OUT} = 49 dBm
  - Gain: 16 dB @ P_{OUT} = 49 dBm
- Capable of handling 10:1 VSWR @48 V, 80 W (CW) output power
- Human Body Model Class 1A (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

RF Characteristics

Single-carrier WCDMA Specifications (tested in the Doherty test fixture)

V_{DD} = 48 V, I_{DQ} = 150 mA, P_{OUT} = 80 W avg, $V_{GS(PEAK)}$ = –5.5 V, ƒ = 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}	14	15.5	—	dB
Drain Efficiency	η_D	54.5	60	—	%
Adjacent Channel Power Ratio	ACPR	—	–27.5	–24.5	dBc
Output PAR @ 0.01% CCDF	OPAR	7.1	7.8	—	dB

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

RoHS compliant

RF Characteristics, 1805 MHz

Single-carrier WCDMA Specifications (not subject to production test. Verified by design/characterization in production test circuit)
V_{DD} = 48 V, I_{DQ} = 150 mA, P_{OUT} = 80 W avg, $V_{GS(PEAK)}$ = –5.5 V, f = 1805 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min.	Max.	Unit
Gain	G_{ps}	14.5	—	dB
Drain Efficiency	η_D	52	—	%
Adjacent Channel Power Ratio	ACPR	—	–23.5	dBc
Output PAR @ 0.01% CCDF	OPAR	6.5	—	dB

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	I_{DSS}	—	—	5.5	mA	V_{GS} = -8 V, V_{DS} = 10 V
Gate Threshold Voltage (main)	$V_{GS(th)}$	–3.8	–3.0	–2.3	V	V_{DS} = -10 V, I_D = 20 mA
Gate Threshold Voltage (peak)						V_{DS} = -10 V, I_D = 38 mA

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Drain Operating Voltage	V_{DD}	0	—	50	V	
Gate Quiescent Voltage	$V_{GS(Q)}$	–3.9	–3.0	-2.1		V_{DS} = 48 V, I_D = 150 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	20	mA
Gate Current (peak)		38	
Drain Current (main)	I_D	7.5	A
Drain Current (peak)		14.4	
Junction Temperature	T_J	225	°C
Storage Temperature Range	T_{STG}	–65 to +150	

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.

Thermal Characteristics

Thermal resistance, junction to case (T_{CASE} = 70°C, ƒ = 1842.5 MHz))

Characteristic	Symbol	Value	Unit	Conditions
Thermal Resistance (main)	$R_{\theta JC}$	2.0	°C/W	P_{DISS} = 40 W DC, 48 V, I_{DQ} = 150 mA
Thermal Resistance (peak)		1.2		P_{DISS} = 77 W DC, 48 V, V_{GSPK} = –5.5 VmA

Type and Version	Order Code	Package	Shipping
GTRA184602FC V1 R0	GTRA184602FC-V1-R0	H-37248C-4, earless flange	Tape & Reel, 50 pcs
GTRA184602FC V1 R2	GTRA184602FC-V1-R2	H-37248C-4, earless flange	Tape & Reel, 250 pcs

Rev. 03, 2023-03-02

Typical Performance (data taken in a production test fixture)

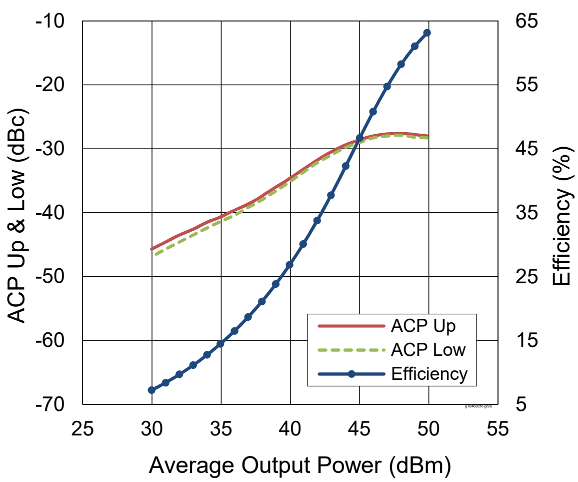


Figure 1. Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 150 mA,
$V_{GS(PEAK)}$ = - 5.5V, f = 1875 MHz,
3GPP WCDMA signal, 10 dB PAR,
3.84 MHz bandwidth

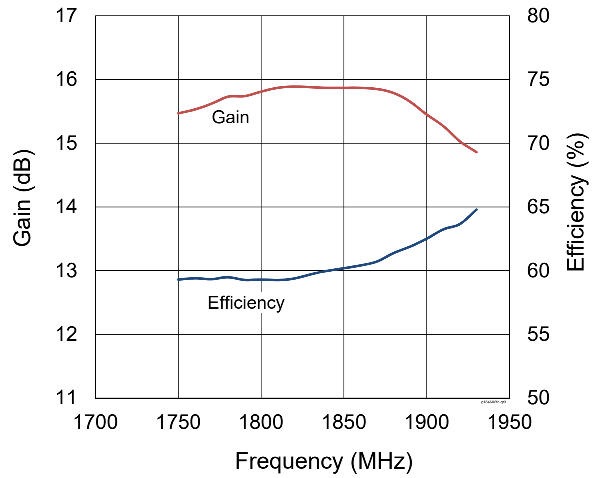


Figure 2. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 150 mA,
$V_{GS(PEAK)}$ =- 5.5V, P_{OUT} = 49.03 dBm,
3GPP WCDMA signal, PAR = 10 dB

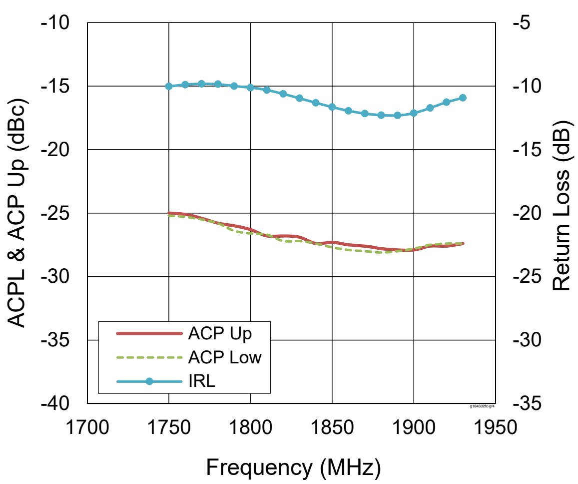


Figure 3. Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 150 mA,
$V_{GS(PEAK)}$ = - 5.5V, P_{OUT} = 49.03 dBm,
3GPP WCDMA signal, PAR = 10 dB

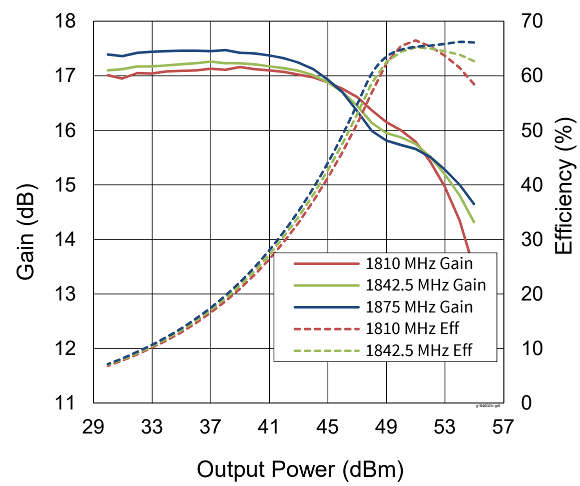


Figure 4. CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 150 mA,
$V_{GS(PEAK)}$ =- 5.5V

(cont.)

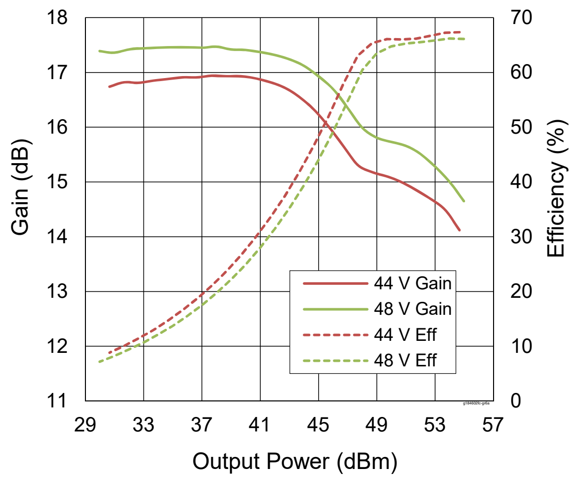


Figure 5. CW Performance at various V_{DD}

$I_{DQ(MAIN)}$ = 150 mA, $V_{GS(PEAK)}$ = - 5.8 V,
f = 1875 MHz

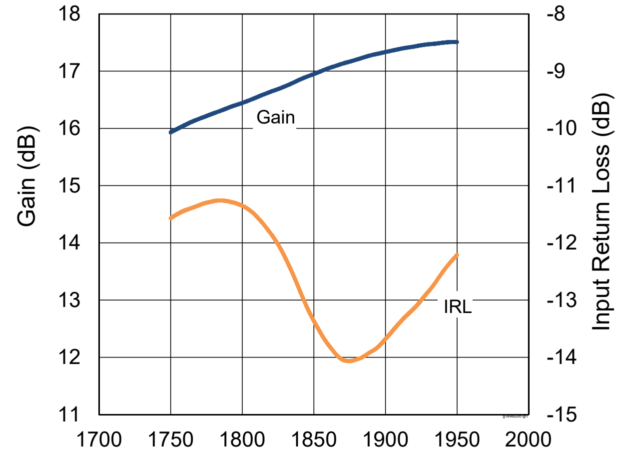


Figure 6. CW Performance Small Signal Gain & Input Return Loss

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 150 mA, V_{GSPEAK} = - 5.5 V

Load Pull

Main Side Load Pull Performance – Pulsed CW signal: 16 µs, 10% duty cycle, 48 V, I_{DQ} = 150 mA

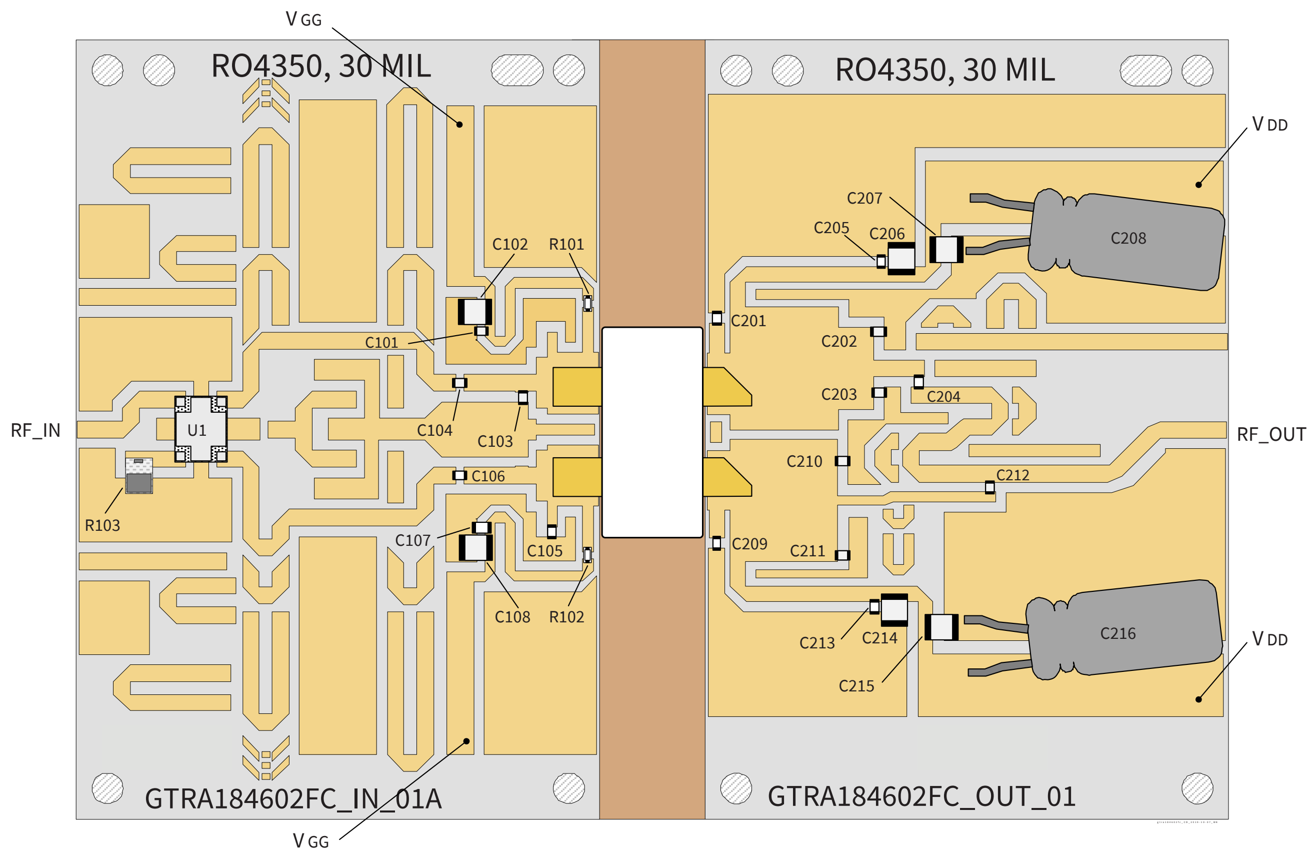
Class AB		P3dB									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	η_D [%]
1805	7.6 – j7.2	3 – j5.1	16.4	53.35	216	65	3.1 – j2.4	18.8	52.30	170	80
1880	7.4 – j7.6	3 – j5.1	17.3	53.40	219	71	2.9 – j2.8	19.2	51.80	151	80

Peak Side Load Pull Performance – Pulsed CW signal: 16 µs, 10% duty cycle, 48 V, $V_{GS(PEAK)}$ = –3.3 V

Class C		P3dB									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Zl [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	η_D [%]	Zl [Ω]	Gain [dB]	P_{OUT} [dBm]	P_{OUT} [W]	η_D [%]
1805	4.54 – j6.07	2.21 – j4.67	15.8	56.70	468	66	2.23 – j2.6	17.6	55.30	339	78
1880	4.53 – j6.07	2.22 – j5.37	15.9	56.80	479	65	1.58 – j2.27	17.4	53.60	229	81

Evaluation Board

Test Fixture Part Number	LTA/GTRA184602FC-V1
PCB Information	Rogers 4350, 0.762mm [0.030”] thick, 2 oz. copper, ε_r = 3.66



Reference circuit assembly diagram (not to scale)

Components Information

Component	Description	Manufacturer	P/N
In			
C101, C104, C106, C107	Capacitor, 18 pF	ATC	ATC600S180JT250XT
C102, C108	Capacitor, 10 µF, 100 V	Murata Electronics	GRM32EC72A106KE05L
C103, C105	Capacitor, 2.7 pF	ATC	ATC600S2R7CT250XT
R101, R102	Resistor, 10 ohms	Panasonic – ECG	ERJ-3GEYJ100V
R103	Resistor, 50 ohms	Anaren	C8A50Z4A
U1	Hybrid Coupler	Anaren	X3C19P1-03S

Components Information (cont.)

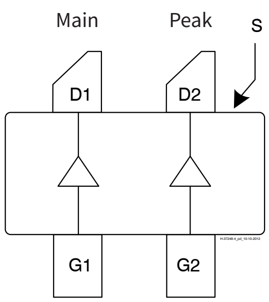
Out			
C201	Capacitor, 1.5 pF	ATC	ATC600S1R5CT250XT
C202, C210	Capacitor, 0.5 pF	ATC	ATC600S0R5CT250XT
C203	Capacitor, 1.0 pF	ATC	ATC600S1R0CT250XT
C204	Capacitor, 6.8 pF	ATC	ATC800A6R8CT250XT
C205, C213	Capacitor, 18 pF	ATC	ATC600S180JT250XT
C206, C207, C214, C215	Capacitor, 10 µF, 100 V	Murata Electronics	GRM32EC72A106KE05L
C208, C216	Capacitor, 470 µF, 100 V	Panasonic – ECG	ECA-2AHG471B
C209	Capacitor, 1.3 pF	ATC	ATC6001R3CT250XT
C211	Capacitor, 1.2 pF	ATC	ATC6001R2CT250XT
C212	Capacitor, 2.7 pF	ATC	ATC6002R7CT250XT

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
D2	Drain device 2
G1	Gate device 1
G2	Gate device 2
S	Source (flange)

Package Outline Specifications – Package H-37248C-4

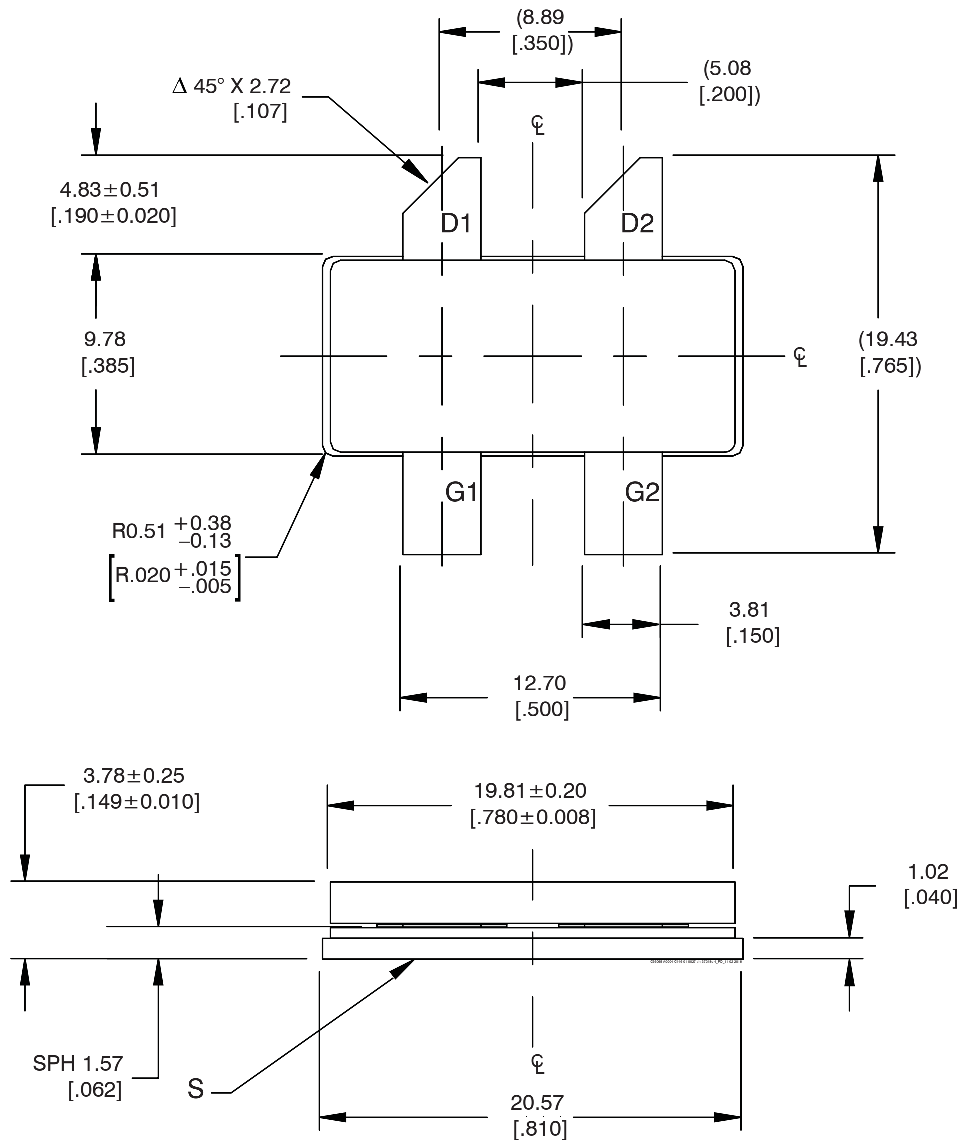


Diagram Notes—unless otherwise specified:

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]

Notes & Disclaimer