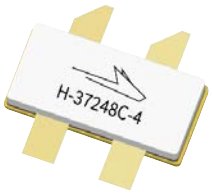
GTRA362002FC

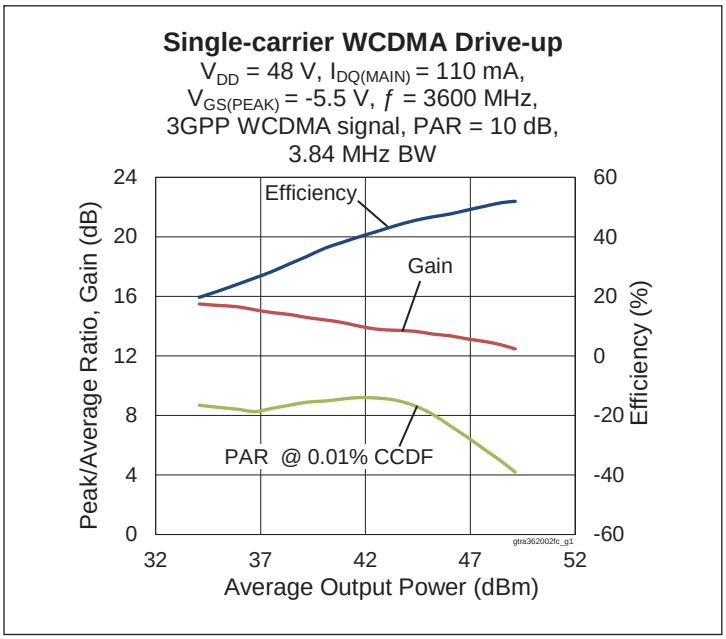
Thermally-Enhanced High Power RF GaN on SiC HEMT
200 W, 48 V, 3400 – 3600 MHz

Description

The GTRA362002FC is a 200-watt (P_{3dB}) GaN on SiC high electron mobility transistor (HEMT) designed for use in multi-standard cellular power amplifier applications. It features input matching, high efficiency, and a thermally-enhanced package with earless flange.

GTRA362002FC
Package H-37248C-4





Features

- GaN on SiC HEMT technology
- Input matched
- Asymmetrical Doherty design
  - Main: P_{3dB} = 85 W Typ
  - Peak: P_{3dB} = 115 W Typ
- Typical Pulsed CW performance, 3500 MHz, 48 V, combined outputs
  - Output power at P_{3dB} = 200 W
  - Efficiency = 60%
  - Gain = 12.5 dB
- Capable of handling 10:1 VSWR @50 V, 30 W (WCDMA) 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 Wolfspeed Doherty production test fixture)
V_{DD} = 48 V, I_{DQ} = 110 mA, P_{OUT} = 29 W avg, $V_{GS(peak)}$ = V_{GS} @I_{DQ} = 140 mA – 2.0 V, f = 3600 MHz, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	12.5	13.5	—	dB
Drain Efficiency	η_D	38	42	—	%
Adjacent Channel Power Ratio	ACPR	—	–29	–26	dBc
Output PAR @ 0.01% CCDF	OPAR	7	7.7	—	dB

All published data at T_{CASE} = 25°C unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

DC Characteristics

Characteristic		Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage		V_{GS} = –8 V, I_D = 10 mA	$V_{(BR)DSS}$	150	—	—	V
Drain-source Leakage Current		V_{GS} = –8 V, V_{DS} = 10 V	I_{DSS}	—	—	5	mA
Gate Threshold Voltage	(main)	V_{DS} = 10 V, I_D = 10.8 mA	$V_{GS(th)}$	–3.8	–3.0	–2.3	V
	(peak)	V_{DS} = 10 V, I_D = 14.4 mA	$V_{GS(th)}$	–3.8	–3.0	–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 = 110 mA	$V_{GS(Q)}$	–3.6	–3.0	–2.3	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	10.8	mA
	(peak)	I_G	14.4	mA
Drain Current	(main)	I_D	4.1	A
	(peak)	I_D	5.4	A
Junction Temperature		T_J	225	°C
Storage Temperature Range		T_{STG}	–65 to +150	°C

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

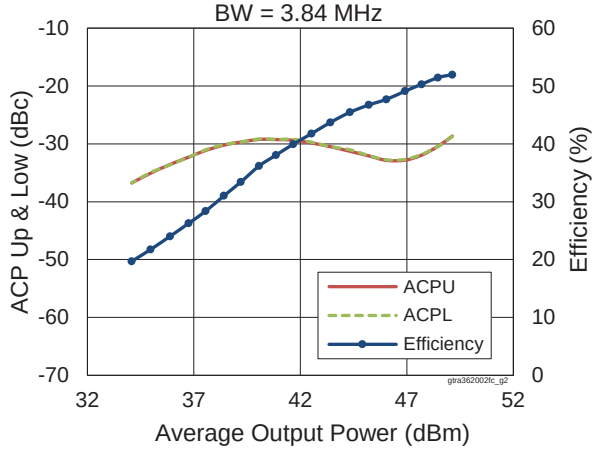
Parameter		Symbol	Value	Unit
Thermal Resistance	(main, T_{CASE} = 70 °C, 53 W DC)	$R_{\theta JC}$	2.8	°C/W
	(peak, T_{CASE} = 70 °C, 73 W DC)	$R_{\theta JC}$	2.1	°C/W

Ordering Information

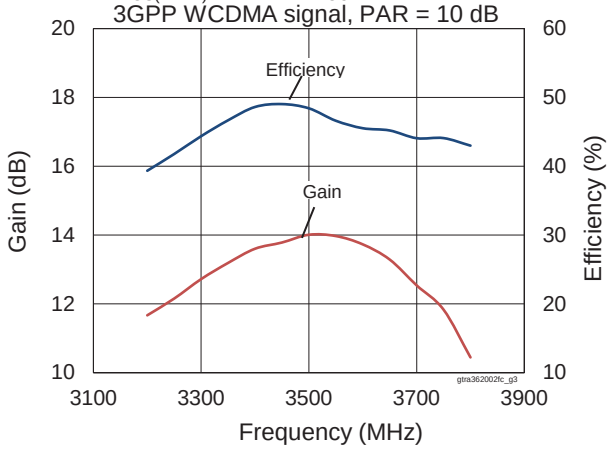
Type and Version	Order Code	Package	Shipping
GTRA362002FC V1 R0	GTRA362002FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRA362002FC V1 R2	GTRA362002FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in test fixture)

Single-carrier WCDMA Drive-up
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 110 mA,
$V_{GS(PEAK)}$ = -5.5 V, f = 3600 MHz,
3GPP WCDMA signal, PAR = 10 dB,
BW = 3.84 MHz



Single-carrier WCDMA Broadband Performance
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 110 mA,
$V_{GS(PEAK)}$ = -5.5 V, P_{OUT} = 44.6 dBm,
3GPP WCDMA signal, PAR = 10 dB



Single-carrier WCDMA Broadband Performance
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 110 mA,
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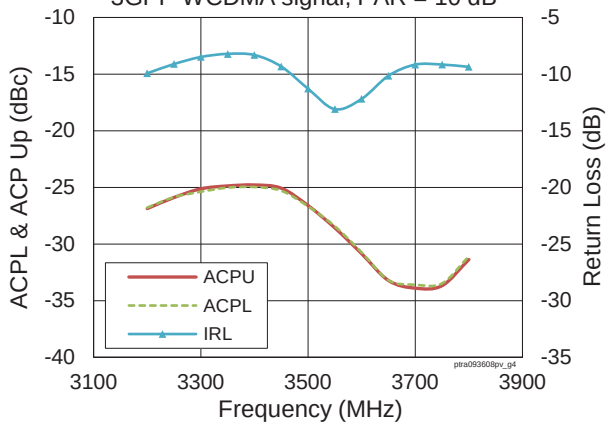
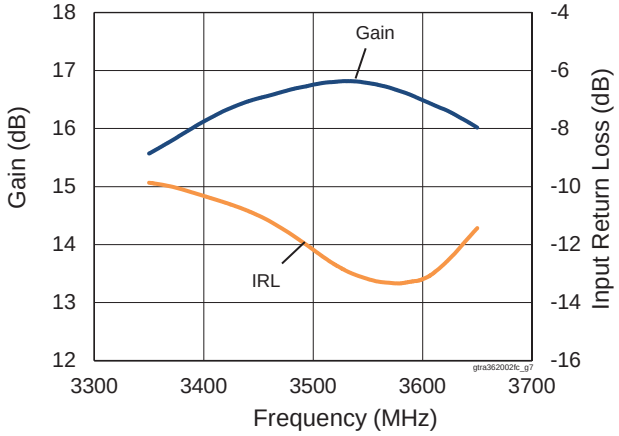
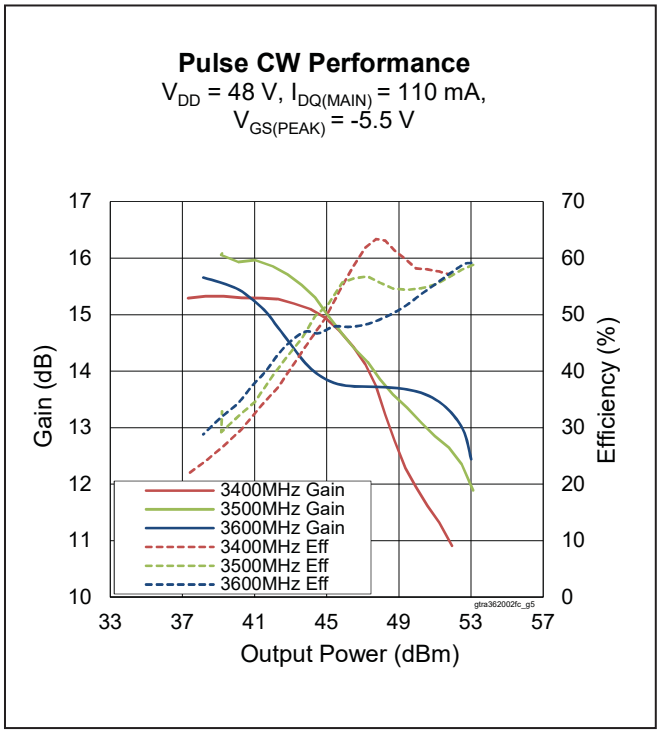
3GPP WCDMA signal, PAR = 10 dB

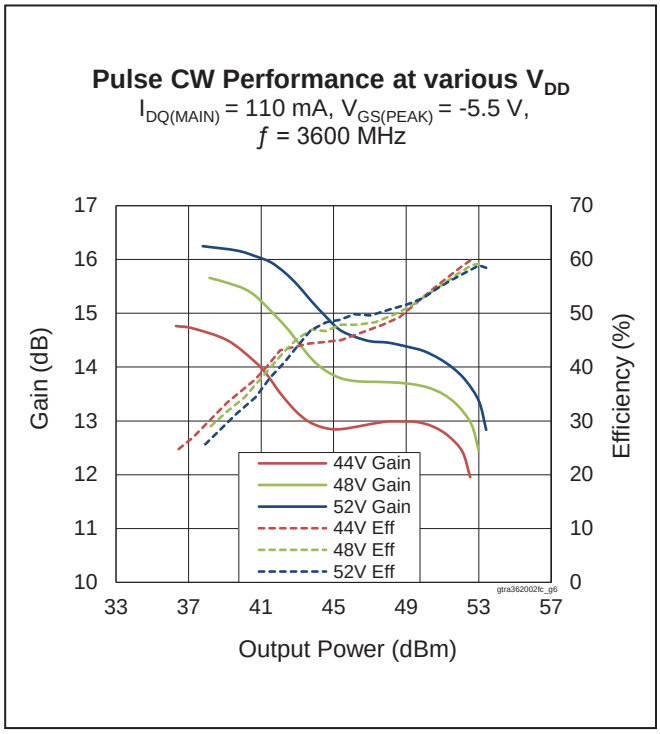


CW Performance Small Signal Gain & Input Return Loss
V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 110 mA,
V_{GSPEAK} = -5.5 V



Typical Performance (cont.)





Load Pull

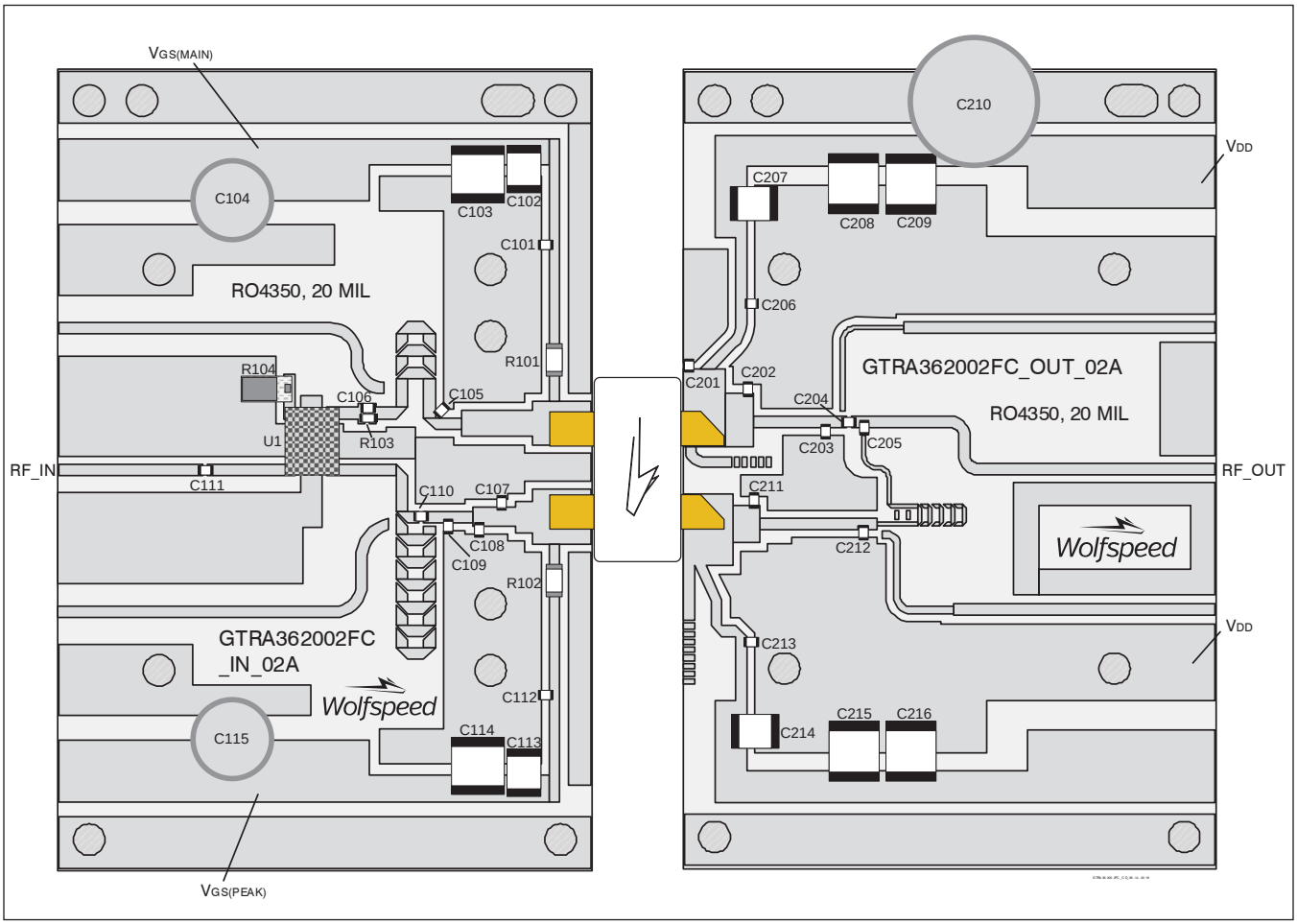
Main Side Load Pull Performance – Pulsed CW signal: 10 µs, 10% duty cycle, 48 V, I_{DQ} = 110 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
3400	21+j11	8.9-j7.7	15.5	51.31	135	70.0	5.2-j6.6	16.7	50.10	102	76.5
3500	14+j4	9.6-j9.2	15.3	51.23	133	68.6	4.9-j6.9	16.6	49.60	91	77.7
3600	11+j0	10.1-j10.4	15.1	51.33	136	68.1	5.5-j8.2	16.4	50.00	100	77.9

Peak Side Load Pull Performance – Pulsed CW signal: 10 µs, 10% duty cycle, 48 V, I_{DQ} = 140 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [Ω]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
3400	30+j8	6.8-j9.8	15.1	52.23	167	61.1	4.4-j7.1	16.8	51.06	127	69.0
3500	21+j3.5	8.0-j10	14.9	52.20	166	61.3	5.4-j6.3	16.2	50.90	123	68.0
3600	17-j0.8	9.1-j9	14.7	52.04	160	60.8	5.3-j7.3	16.2	50.72	118	66.0

Reference Circuit, 3400 – 3600 MHz



Reference circuit assembly diagram (not to scale)

Reference Circuit Assembly

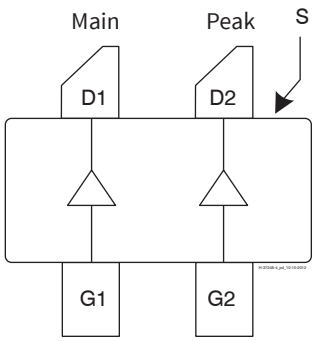
DUT	GTRA362002FC V1
Test Fixture Part No.	LTA/GTRA362002FC V1
PCB	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66
Find Gerber files for this test fixture on the Wolfspeed Web site at **www.wolfspeed.com/RF**	

Reference Circuit (cont.)

Components Information

Component	Description	Manufacturer	P/N
Input			
C101, C106, C110, C111, C112	Capacitor, 12 pF	ATC	ATC800A120JT250T
C102, C113	Capacitor, 1 µF	TDK Corporation	C4532X7R2A105M230KA
C103, C114	Capacitor, 100 V, 10 µF	TDK Corporation	C5750X7S2A106M230KB
C104, C115	Capacitor, 100 µF	Panasonic Electronic Components	EEE-FP1H101AP
C105	Capacitor, 0.7 pF	ATC	ATC800A0R7CT250T
C107	Capacitor, 0.5 pF	ATC	ATC800A0R5CT250T
C108	Capacitor, 1.5 pF	ATC	ATC800A1R5CT250T
C109	Capacitor, 0.9 pF	ATC	ATC800A0R9CT250T
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 10 ohms	Panasonic Electronic Components	ERJ-3GEYJ100V
R104	Resistor, 50 ohms	Richardson	C16A50Z4
U1	Hybrid coupler	Anaren	XC3500P-03S
Output			
C201, C202	Capacitor, 0.7 pF	ATC	ATC800A0R7CT250T
C203, C211, C212	Capacitor, 0.3 pF	ATC	ATC800A0R3CT250T
C204, C205, C206, C213	Capacitor, 12 pF	ATC	ATC800A120JT250T
C207, C214	Capacitor, 1 µF	TDK Corporation	C4532X7R2A105M230KA
C208, C209, C215, C216	Capacitor, 100 V, 10 µF	TDK Corporation	C5750X7S2A106M230KB
C210	Capacitor, 220 µF	Panasonic Electronic Components	ECA-2AHG221

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

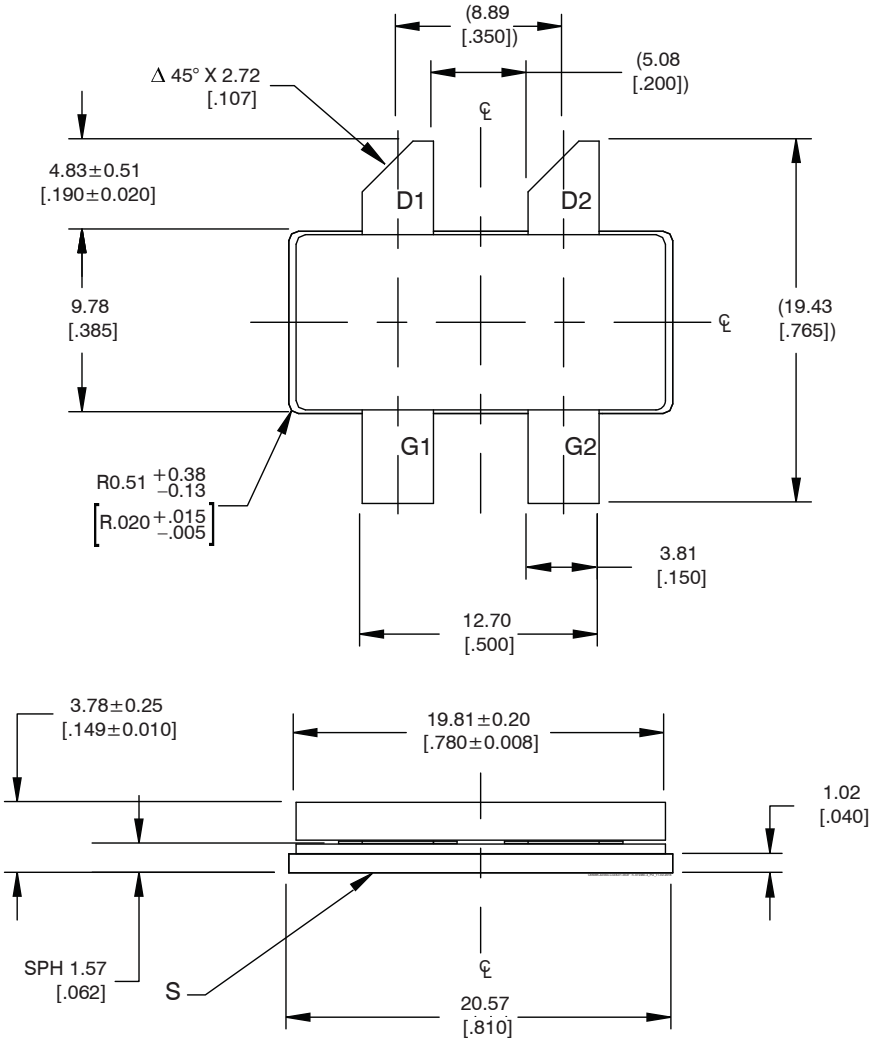


Diagram Notes—unless otherwise specified:

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]

Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
01	2016-07-14	Advance	All	Data Sheet reflects advance specification for product development
02	2017-07-21	Advance	All	Revised Features and Target RF Characteristics Includes Package
03	2018-04-03	Preliminary	All	Data Sheet reflects preliminary specification
04	2018-08-15	Production	All	Data Sheet reflects released product specification
04.1	2019-01-30	Production	1	Added ESD rating
04.2	2019-07-02	Production	2	Added operating voltage maximun and thermal characteristics for peak side
05	2020-05-11	Production	2	Added gate voltage minimum and maximun

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Notes

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