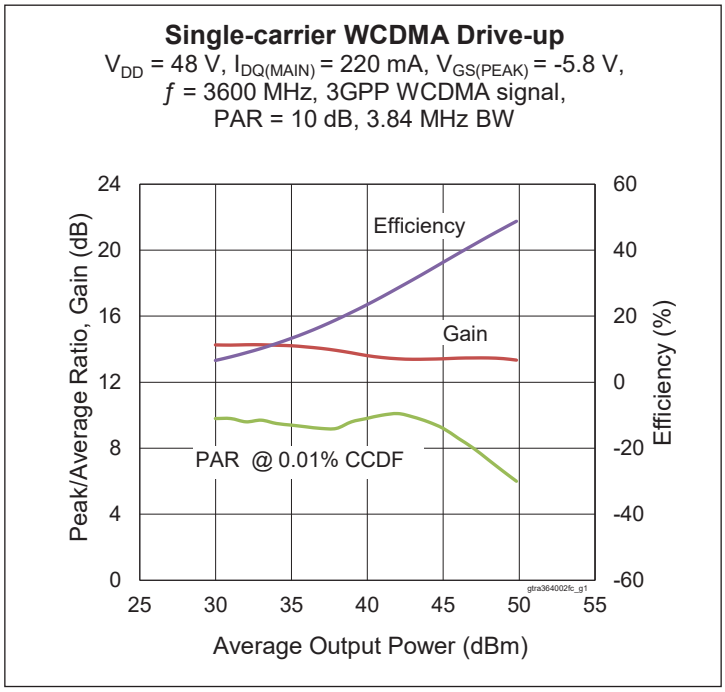
GTRA364002FC

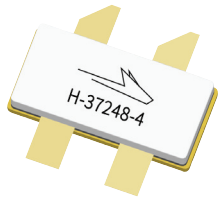
Thermally-Enhanced High Power RF GaN on SiC HEMT
400 W, 48 V, 3400 – 3600 MHz

Description

The GTRA364002FC is a 400-watt (P_{SAT}) GaN on SiC high electron mobility transistor (HEMT) designed for use in multi-standard cellular power amplifier applications. It features input matching, high efficency, and a themally-enhanced package with earless flange.



GTRA364002FC
Package H-37248C-4



Features

- GaN on SiC HEMT technology
- Input matched
- Asymmetrical Doherty design
  - Main: P_{3dB} = 170 W Typ
  - Peak: P_{3dB} = 230 W Typ
- Typical Pulsed CW performance, 3400 to 3600 MHz, 48 V, combined outputs, Doherty @ P_{3dB}, 10 µs, 10% duty cycle
  - Output power = 400 W
  - Efficiency = 60 %
  - Gain = 14 dB
- Capable of handling 10:1 VSWR @ 48 V, 50 W (WCDMA) output power
- 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} = 220 mA, P_{OUT} = 50 W avg, $V_{GS(peak)}$ = V_{GS} @ I_{DQ} = 200 mA – 2.7 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	13	—	dB
Drain Efficiency	η^D	36	40	—	%
Adjacent Channel Power Ratio	ACPR	—	–30	–27	dBc
Output PAR @ 0.01% CCDF	OPAR	6.4	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 (main)	V_{GS} = –8 V, I_D = 3 mA	$V_{(BR)DSS}$	150	—	—	V
(peak)	V_{GS} = –8 V, I_D = 4 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 = 21.6 mA	$V_{GS(th)}$	–3.8	–3.0	–2.3	V
(peak)	V_{DS} = 10 V, I_D = 28.8 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 = 220 mA	$V_{GS(Q)}$	–3.7	–2.9	–2.1	V

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source Voltage	V_{DSS}	125	V
Gate-source Voltage	V_{GS}	–10 to +2	V
Gate Current (main)	I_G	21.6	mA
(peak)	I_G	28.8	mA
Drain Current (main)	I_D	8.1	A
(peak)	I_D	10.8	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, 101 W DC)	$R_{\theta JC}$	1.55	°C/W
(peak, T_{CASE} = 70 °C, 130 W DC)	$R_{\theta JC}$	1.20	°C/W

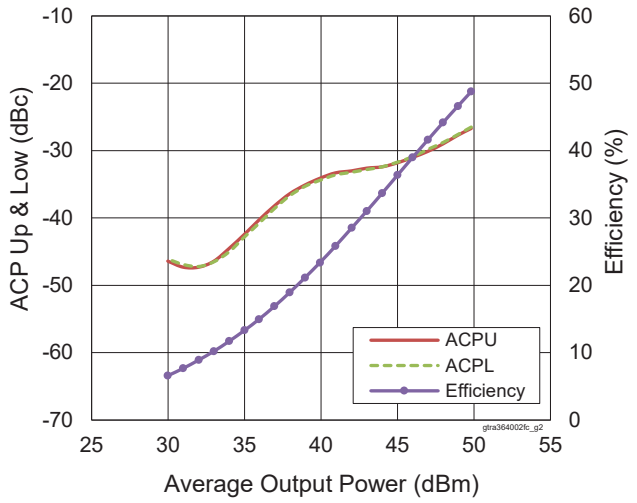
Ordering Information

Type and Version	Order Code	Package	Shipping
GTRA364002FC V1 R0	GTRA342002FC-V1-R0	H-37248C-4	Tape & Reel, 50 pcs
GTRA364002FC V1 R2	GTRA364002FC-V1-R2	H-37248C-4	Tape & Reel, 250 pcs

Typical Performance (data taken in test fixture)

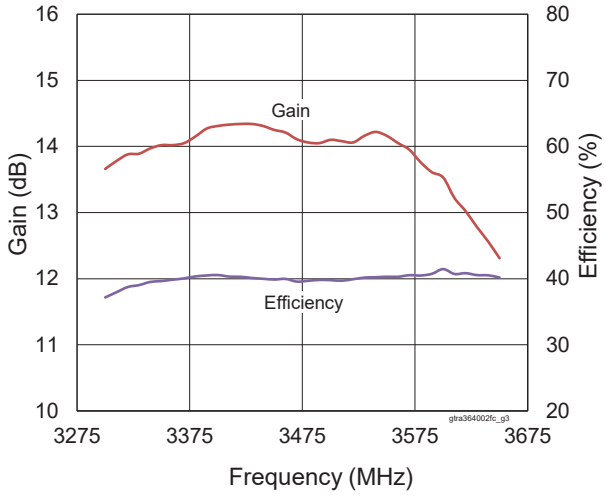
Single-carrier WCDMA Drive-up

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 220 mA, $V_{GS(PEAK)}$ = -5.8 V,
f = 3600 MHz, 3GPP WCDMA signal,
PAR = 10 dB, BW = 3.84 MHz



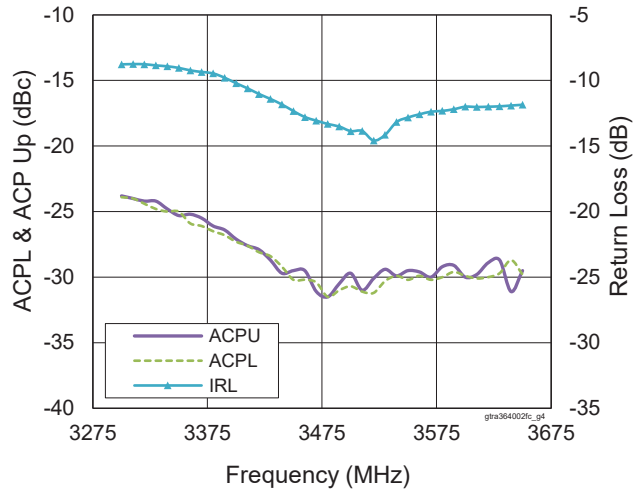
Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 220 mA, $V_{GS(PEAK)}$ =- 5.8 V,
P_{OUT} = 47 dBm, 3GPP WCDMA signal,
PAR = 10 dB



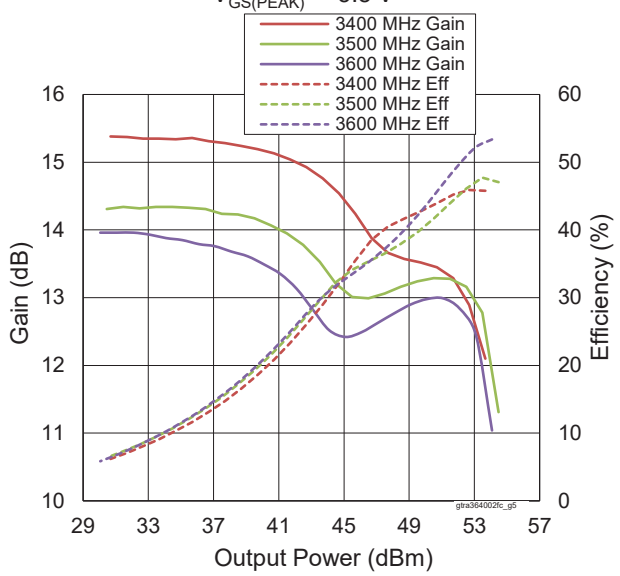
Single-carrier WCDMA Broadband Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 220 mA, $V_{GS(PEAK)}$ = -5.8 V,
P_{OUT} = 47 dBm, 3GPP WCDMA signal,
PAR = 10 dB

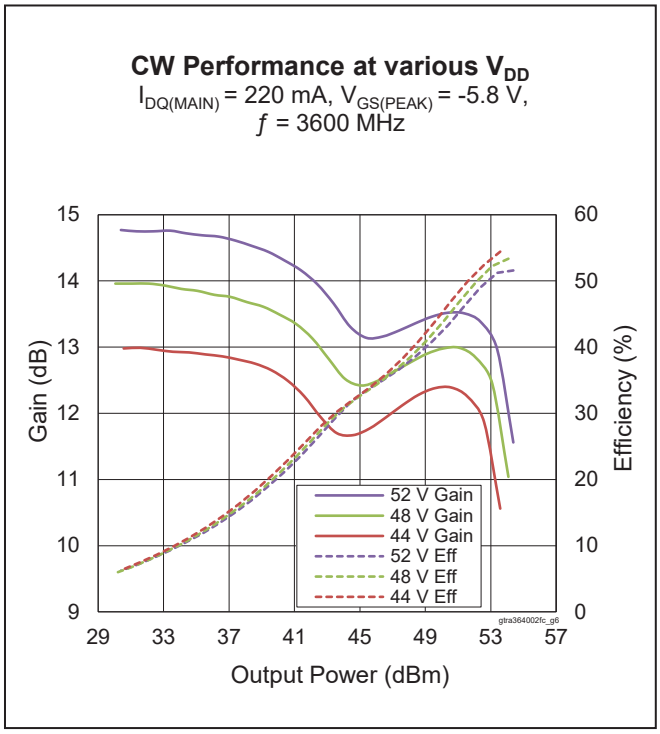


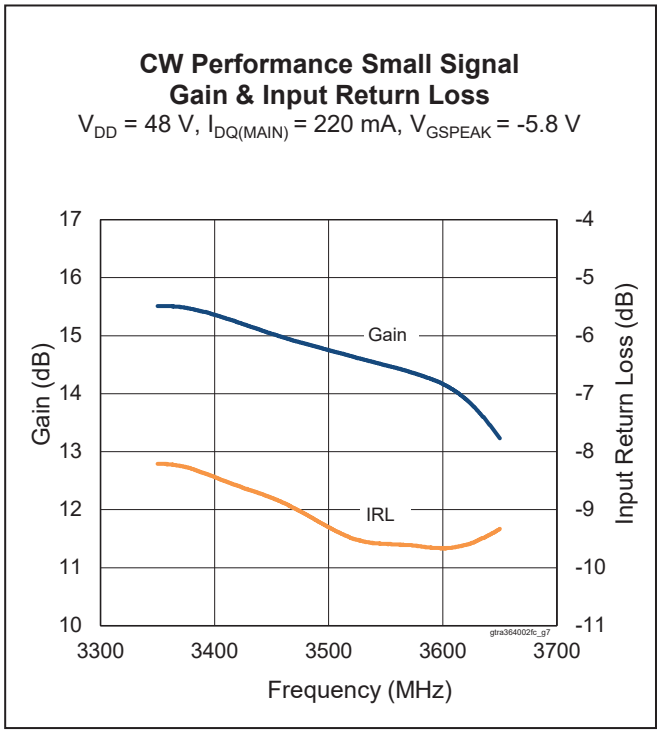
CW Performance

V_{DD} = 48 V, $I_{DQ(MAIN)}$ = 220 mA,
$V_{GS(PEAK)}$ = -5.8 V



Typical Performance (cont.)





Load Pull Performance

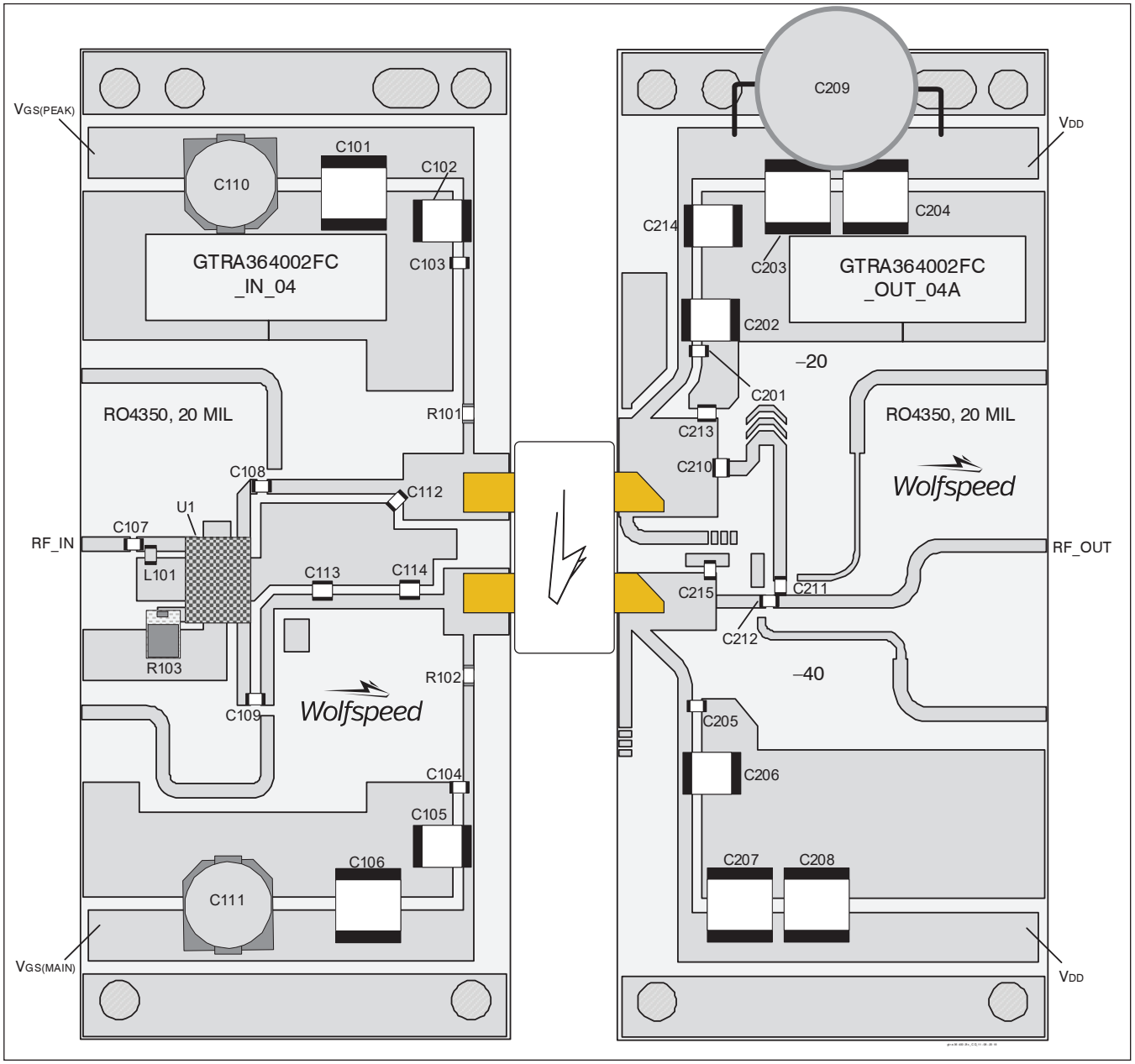
Main Side Load Pull Performance – Pulsed CW signal: 10 µs, 10% duty cycle, 48 V, I_{DQ} = 220 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [W]	Z_L [W]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Z_L [W]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
3400	9.0-j3.4	4.3-j6.5	15.3	53.90	245	62.5	1.7-j3.5	17.3	52.40	174	74.0
3500	5.0-j5.2	3.8-j7.0	15.4	54.00	251	63.9	2.2-j5.0	17.4	52.10	162	76.0
3600	3.5-j7.0	4.4-j7.1	14.9	53.80	240	61.2	2.4-j5.2	16.8	52.10	162	74.0

Peak Side Load Pull Performance – Pulsed CW signal: 10 µs, 10% duty cycle, 48 V, I_{DQ} = 280 mA, class AB

		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Zs [W]	Z_L [W]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]	Z_L [W]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	ηD [%]
3400	16.5-j22	3.1-j6.2	15.6	55.10	324	59.0	2.1-j4.4	17.8	53.70	234	70.0
3500	20-j13	2.8-j6.6	15.8	55.10	324	59.5	1.9-j4.7	18.3	53.00	200	69.0
3600	15.7-j7.4	3.7-j6.8	15.3	54.90	309	56.0	2.0-j4.8	17.5	53.00	200	66.0

Reference Circuit, 3400 – 3600 MHz



Reference circuit assembly diagram (not to scale)

Reference Circuit Assembly

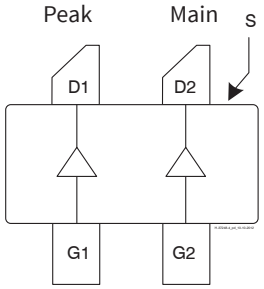
DUT	GTRA364002FC-V1
Test Fixture Part No.	LTA/GTRA364002FC-V1
PCB	Rogers 4350, 0.508 mm [0.020”] thick, 2 oz. copper, ε_r = 3.66, f = 3400 – 3600 MHz
Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF	

Reference Circuit (cont.)

Components Information

Component	Description	Manufacturer	P/N
Input			
C101, C106	Capacitor, 10 µF, 100 V	TDK Corporation	C5750X7S2A106M230KB
C102, C105	Capacitor, 1 µF	TDK Corporation	C4532X7R2A105M230KA
C103, C104, C107, C108, C109	Capacitor, 10 pF	ATC	ATC800A100JT250T
C110, C111	Capacitor, 100 µF, 35 V	Panasonic Electronic Components	EEE-FT1V101AP
C112, C114	Capacitor, 0.2 pF	ATC	ATC800A0R2BT250T
C113	Capacitor, 0.8 pF	ATC	ATC800A0R8CT250T
L101	Inductor, 4.7 nH	EPCOS (TDK)	B82496C3479J000
R101, R102	Resistor, 10 ohms	Panasonic Electronic Components	ERJ-3GEYJ100V
R103	Resistor, 50 ohms	Richardson	C8A50Z4A
U1	Hybrid Coupler	Anaren	XC3500P-03S
Output			
C201, C205, C211, C212	Capacitor, 10 pF	ATC	ATC800A100JT250T
C202, C206, C214	Capacitor, 1 µF	TDK Corporation	C4532X7R2A105M230KA
C203, C204, C207, C208	Capacitor, 10 µF, 100 V	TDK Corporation	C5750X7S2A106M230KB
C209	Capacitor, 220 µF, 100 V	Panasonic Electronic Components	ECA-2AHG221
C210	Capacitor, 1 pF	ATC	ATC800A1R0CT250T
C213	Capacitor, 0.2 pF	ATC	ATC800A0R2BT250T
C215	Capacitor, 0.6 pF	ATC	ATC800A0R6CT250T

Pinout Diagram (top view)



Pin	Description
D1	Drain Device 1 (Peak)
D2	Drain Device 2 (Main)
G1	Gate Device 1 (Peak)
G2	Gate Device 2 (Main)
S	Source (flange)

Package Outline Specifications

Package H-37248C-4

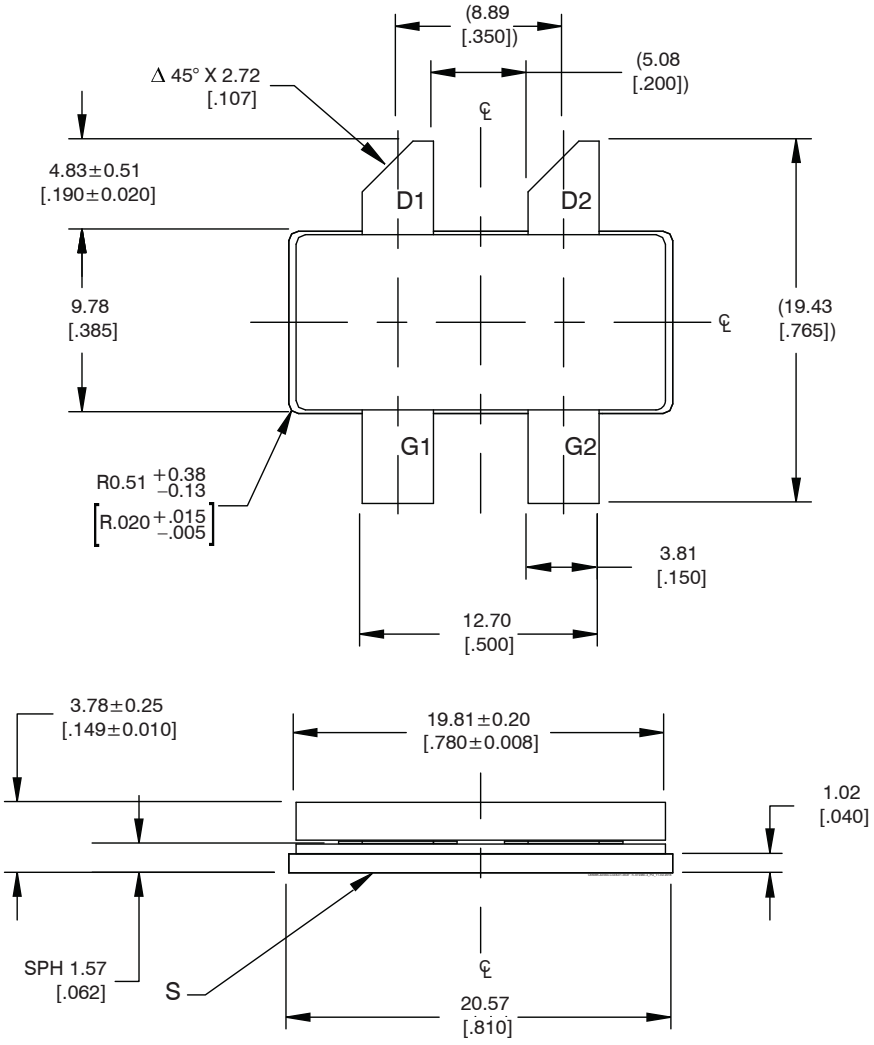


Diagram Notes—unless otherwise specified:

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	2016-09-02	Preliminary	All	Data Sheet reflects preliminary specification
02	2017-07-24	Advance	All	Data Sheet reflects advance specification for product development
03	2018-05-01	Advance	All 2	Converted to Wolfspeed Data Sheet Updated DC Characteristics and max ratings table format
04	2018-11-09	Production	All	Data Sheet reflects released product specification

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com
919.407.7816

Notes

Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. “Typical” parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer’s technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility..