

PTRA094808NF

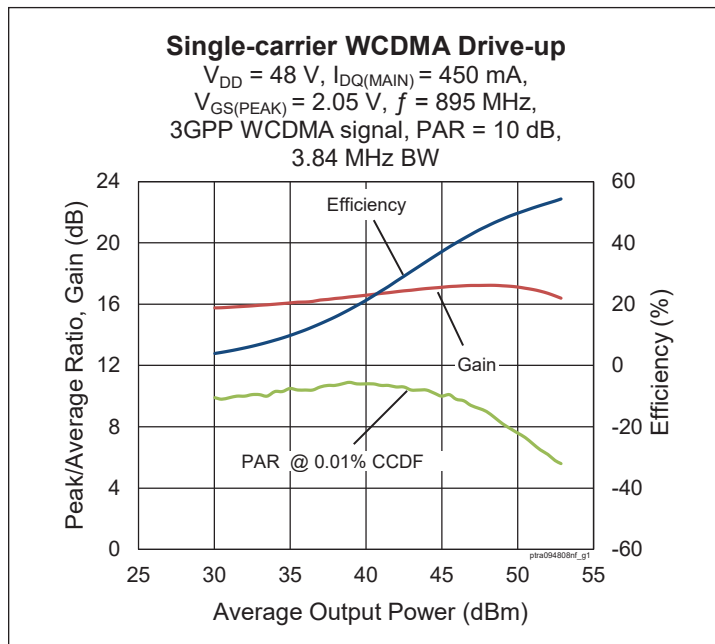
Thermally-Enhanced High Power RF LDMOS FET 480 W, 48 V, 859 – 960 MHz

Description

The PTRA094808NF is a 480-watt LDMOS FET intended for use in multi-standard cellular power amplifier applications in the 859 to 960 MHz frequency band. Features include input and output matching, high gain and thermally-enhanced package with earless flange. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.



PTRA094808NF
Package PG-HBSOF-6-2



Features

- Broadband internal input and output matching
- Asymmetrical design
 - Main: $P_{1dB} = 210\text{ W Typ}$
 - Peak: $P_{1dB} = 340\text{ W Typ}$
- Typical Pulsed CW performance, 896 MHz, 48 V, Doherty configuration
 - Output power at $P_{1dB} = 300\text{ W}$
 - Output power at $P_{3dB} = 420\text{ W}$
 - Efficiency = 53%
 - Gain = 17.5 dB
- Capable of handling 10:1 VSWR @ 48 V, 100 W (CW) output power
- Integrated ESD protection
- Human Body Model class 1C (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)

$V_{DD} = 48\text{ V}$, $I_{DQ} = 450\text{ mA}$, $V_{GS(PEAK)} = 2.05\text{ V}$, $P_{OUT} = 87\text{ W avg}$, $f = 895\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Linear Gain	G_{ps}	16.5	17.5	—	dB
Drain Efficiency	η_D	48.5	52.5	—	%
Adjacent Channel Power Ratio	ACPR	—	-30.5	-26.5	dBc
Output PAR@0.01% CCDF	OPAR	7.1	7.5	—	dB

All published data at $T_{CASE} = 25^\circ\text{C}$ unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

DC Characteristics (each side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$	$V_{(BR)DSS}$	105	—	—	V
Drain Leakage Current	$V_{DS} = 48\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	1	μA
	$V_{DS} = 105\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	10	μA
Gate Leakage Current	$V_{GS} = 14\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1	μA
On-State Resistance	(Main) $V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.08	—	Ω
	(Peak) $V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.05	—	Ω
Operating Gate Voltage	(Main) $V_{DS} = 48\text{ V}$, $I_{DQ} = 0.45\text{ A}$	V_{GS}	3	3.5	4	V
	(Peak) $V_{DS} = 48\text{ V}$, $I_{DQ} = 0\text{ A}$	V_{GS}	—	2.05	—	V

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	105	V
Gate-Source Voltage	V_{GS}	−6 to +12	V
Operating Voltage	V_{DD}	0 to +55	V
Junction Temperature	T_J	225	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	−65 to +150	$^{\circ}\text{C}$

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. Parameters values can be affected by end application and product usage. Values may change over time.

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance (Main, $T_{CASE} = 70^{\circ}\text{C}$, 87.1 W CW)	$R_{\theta JC}$	0.51	$^{\circ}\text{C/W}$

Moisture Sensitivity Level

Level	Test Signal	Package Temperature	Unit
3	IPC/JEDEC J-STD-020	260	$^{\circ}\text{C}$

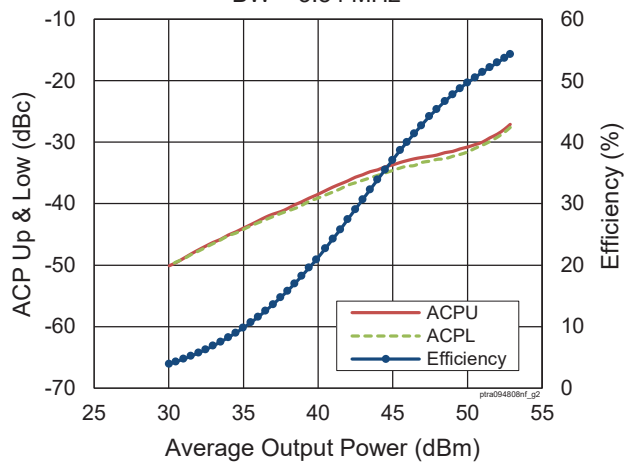
Ordering Information

Type and Version	Order Code	Package Description	Shipping
PTRA094808NF V1 R5	PTRA094808NF-V1-R5	PG-HBSOF-6-2	Tape & Reel, 500 pcs

Typical RF Performance (data taken in production test fixture)

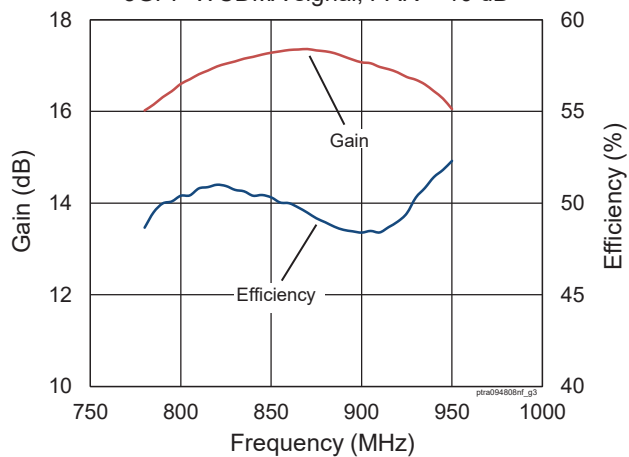
Single-carrier WCDMA Drive-up

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$,
 $V_{GS(PEAK)} = 2.05\text{ V}$, $f = 895\text{ MHz}$,
 3GPP WCDMA signal, PAR = 10 dB,
 BW = 3.84 MHz



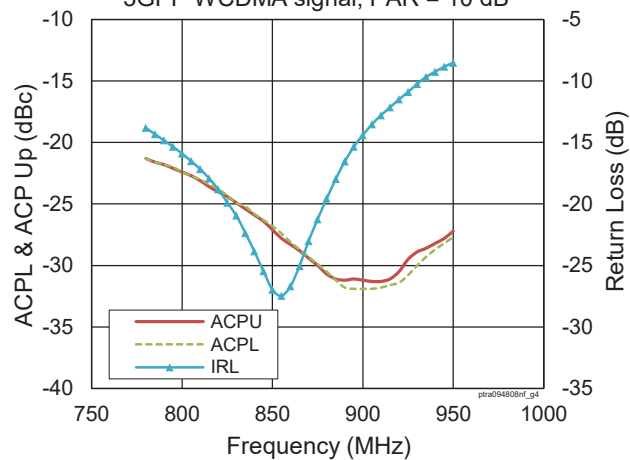
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$,
 $V_{GS(PEAK)} = 2.05\text{ V}$, $P_{OUT} = 49.4\text{ dBm}$,
 3GPP WCDMA signal, PAR = 10 dB



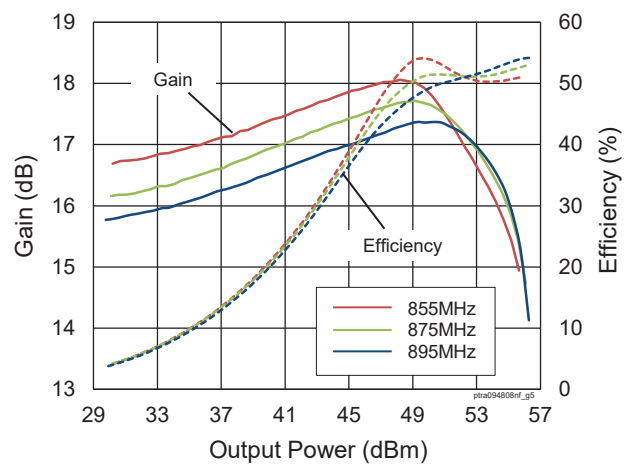
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$,
 $V_{GS(PEAK)} = 2.05\text{ V}$, $P_{OUT} = 49.4\text{ dBm}$,
 3GPP WCDMA signal, PAR = 10 dB

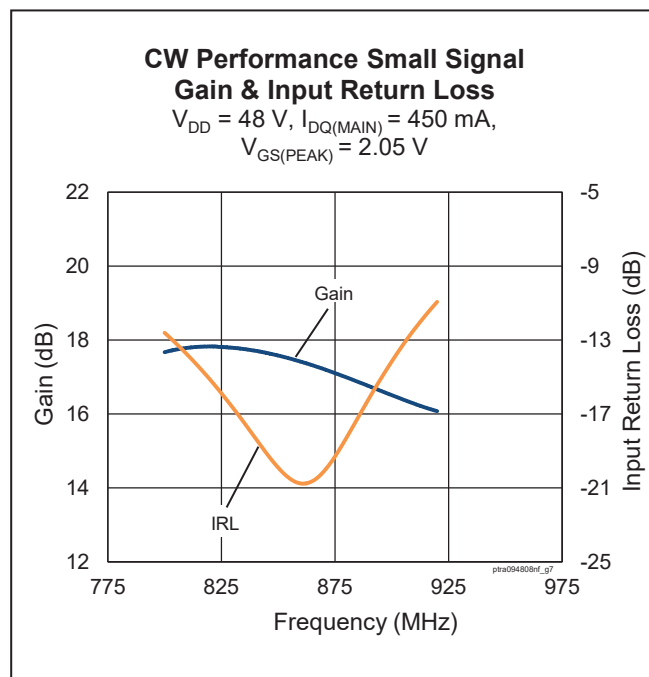
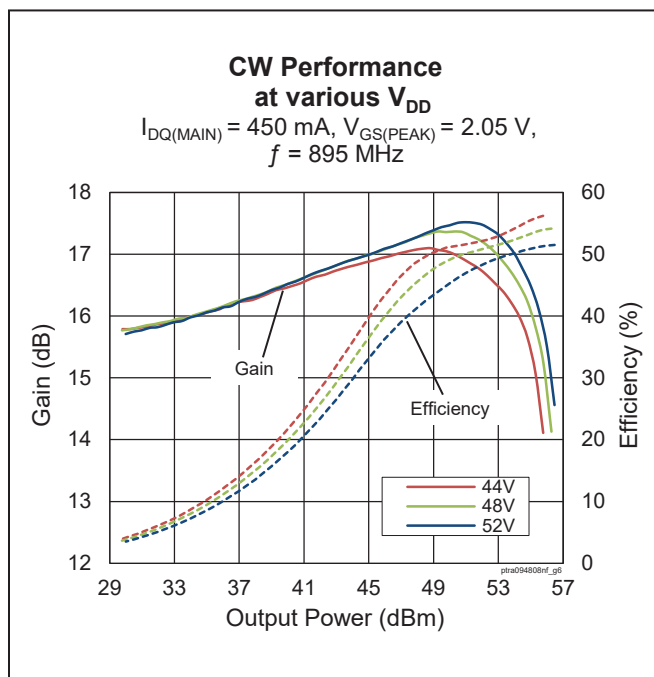


CW Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$,
 $V_{GS(PEAK)} = 2.05\text{ V}$



Typical RF Performance (cont.)



Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal: 10 μ sec, 10% duty cycle, $V_{DD} = 48$ V, $I_{DQ} = 350$ mA, class AB

		P_{1dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_L [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	η_D [%]
865	1.4-j4.1	1.93-j1.35	20.25	53.40	219	57.4	4.16-j0.34	22.1	51.50	141	67.2
880	1.6-j4.65	1.67-j1.24	19.8	53.40	219	54.6	4.0-j0.5	22.1	51.50	141	67.7
895	2.0-j4.33	1.87-j1.62	20	53.37	217	56.7	4.08-j0.33	22	51.37	137	67.6

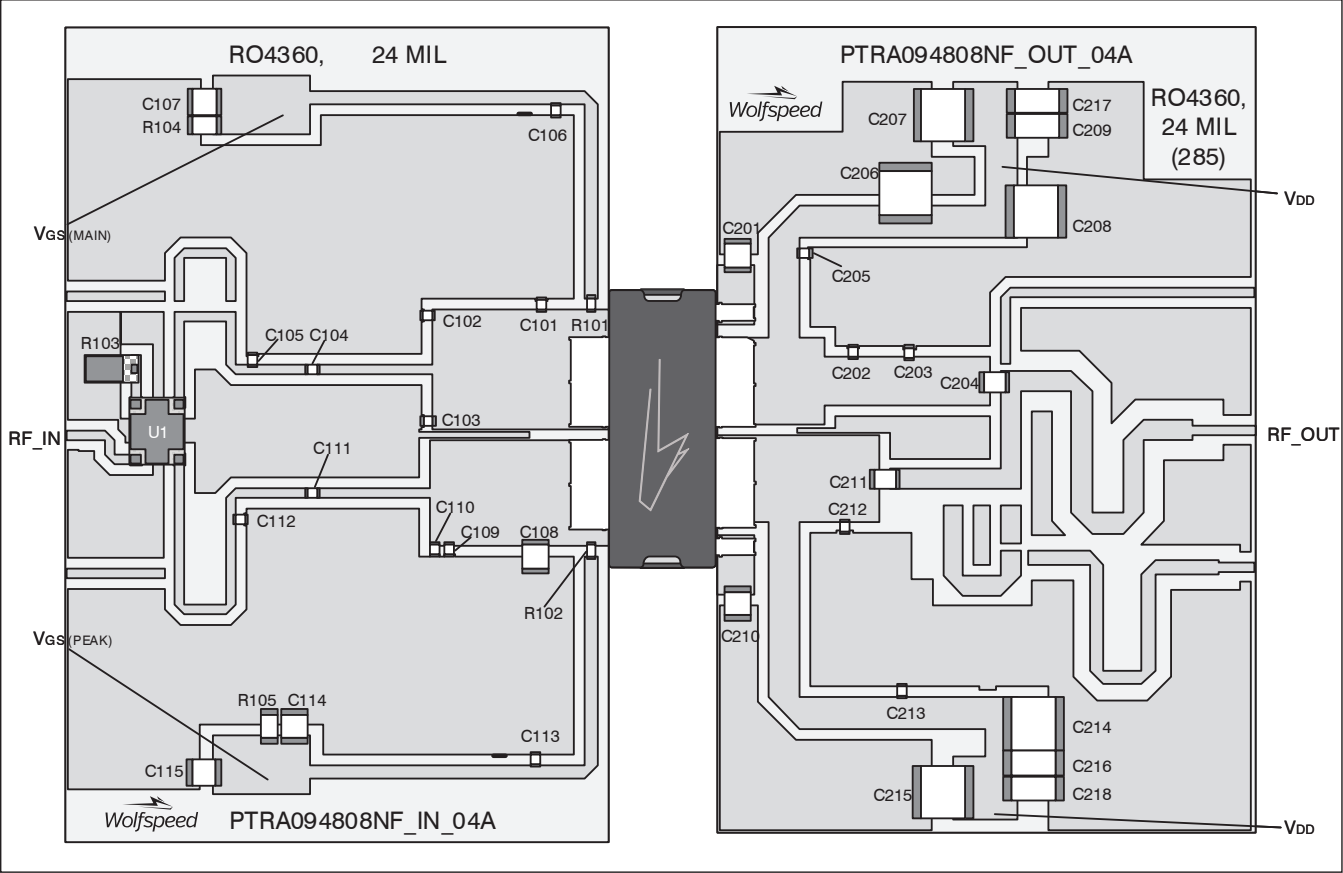
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
865	1.4-j4.1	2.09-1.87	18.4	54.30	270	61.8	3.8+0	20	52.62	182	69.1
880	1.6-j4.65	1.87-1.73	18	54.20	263	58.7	3.56+0.05	19.85	52.67	184	69.5
895	2.0-j4.33	1.81-1.78	17.9	54.20	263	59.1	3.33+0.04	19.73	52.65	184	69.43

Peak Side Load Pull Performance – Pulsed CW signal: 10 μ sec, 10% duty cycle, $V_{DD} = 48$ V, $V_{GS(PEAK)} = 2$ V, class C

		P_{1dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_L [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{1dB} [dBm]	P_{1dB} [W]	η_D [%]
865	1.57-j3.71	1.17-j1.97	16	55.80	380	58.8	1.01-j0.55	17.1	53.17	207	71.1
880	1.58-j3.55	1.15-j3.55	16	55.70	372	59.0	1.08-j0.83	17	53.70	234	70.9
895	1.82-3.82	1.14-j2.05	16	55.84	384	60.9	1.11-j1.04	16.9	54.10	257	71.1

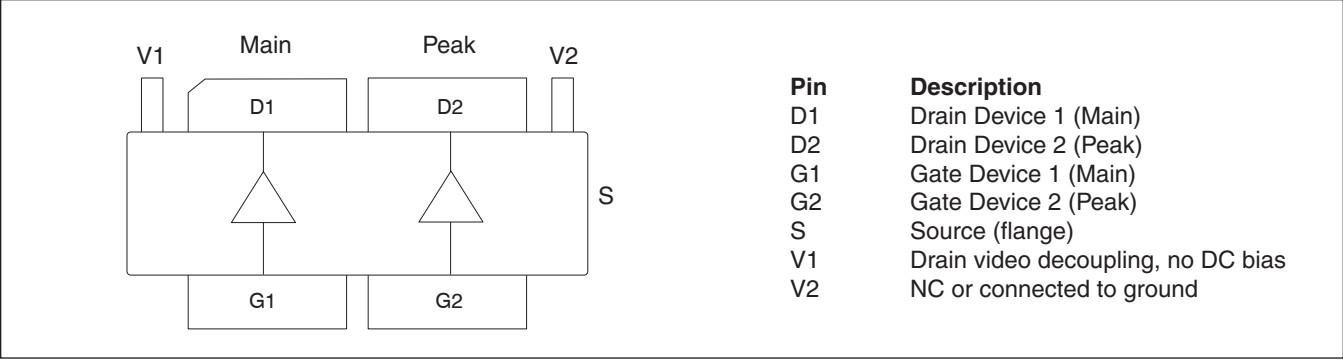
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_L [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
865	1.57-j3.71	1.2-1.97	14	56.68	466	61.9	1.17-0.93	15.1	55.12	325	71.2
880	1.58-j3.55	1.32-2.11	13.8	56.46	443	60.6	1.15-1.05	15	55.00	316	70.7
895	1.82-3.82	1.19-2.09	13.9	56.59	456	62.4	1.05-1.04	14.8	54.72	296	71.0

Reference Circuit, 869 – 894 MHz



Reference circuit assembly diagram (not to scale)

Pinout Diagram (top view)



Reference Circuit (cont.)**Reference Circuit Assembly**

DUT	PTRA094808NF-V1
Test Fixture Part No.	LTA/PTRA094808NF-V1
PCB	Rogers 4360, 0.609 mm [0.024"] thick, 2 oz. copper, $\epsilon_r = 6.15$
Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF	

Components Information

Component	Description	Manufacturer	P/N
Input			
C101	Capacitor, 6.8 pF	ATC	ATC600F6R8BT250T
C102	Capacitor, 2.7 pF	ATC	ATC600F2R7BT250T
C103, C105	Capacitor, 1.8 pF	ATC	ATC600F1R8BT250T
C104, C111	Capacitor, 33 pF	ATC	ATC600F330JT250T
C106, C113	Capacitor, 68 pF	ATC	ATC600F680JT250T
C107, C114, C115	Capacitor, 10 μ F	Taiyo Yuden	UMK325C7106MM-T
C108	Capacitor, 8.2 pF	ATC	ATC100B8R2BT500XB
C109	Capacitor, 2.0 pF	ATC	ATC600F2R0BT250T
C110	Capacitor, 1.0 pF	ATC	ATC600F1R0BT250T
C112	Capacitor, 3.3 pF	ATC	ATC600F3R3BT250T
R101, R102	Resistor, 5.6 Ω	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103	Resistor, 50 Ω	Anaren	C16A50Z4
R104, R105	Resistor, 1,000 Ω	Panasonic Electronic Components	ERJ-8GEYJ102V
U1	Hybrid coupler	CEMAX	CMX09Q02
Output			
C201, C210	Capacitor, 10 μ F	Taiyo Yuden	UMK325C7106MM-
C202	Capacitor, 10 pF	ATC	ATC600F100JT250T
C203	Capacitor, 1.5 pF	ATC	ATC600F1R5CT250T
C204	Capacitor, 20 pF	ATC	ATC100B200JT500XB
C205	Capacitor, 68 pF	ATC	ATC600F680JT250T
C206, C207, C208, C209, C214, C215, C216, C217, C218	Capacitor, 10 μ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C211	Capacitor, 47 pF	ATC	ATC100B470JT500XB
C212	Capacitor, 12 pF	ATC	ATC600F120JT250T
C213	Capacitor, 47 pF	ATC	ATC600F470JT250T

Package Outline Specifications

Package PG-HBSOF-6-2

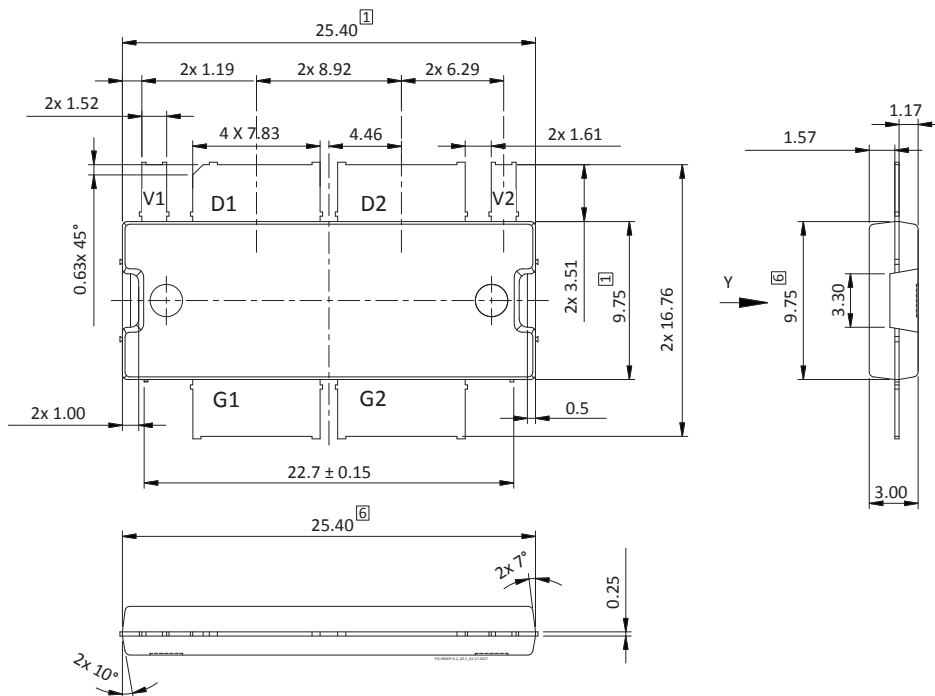


Diagram Notes—unless otherwise specified:

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included.
2. Metal protrusions are connected to source and shall not exceed 0.10 mm max.
3. Fillets and radii: all radii are 0.3 mm max.
4. Interpret dimensions and tolerances per ISO 8015.
5. Dimensions are mm.
6. Does not include mold/dam bar and metal protrusion.
7. Exposed metal surface is tin-plated, may not be covered by mold compound.
8. All tolerances ± 0.1 mm unless specified otherwise.
9. All metal surfaces are tin-plated, except area of cut.
10. Lead thickness: 0.25 mm.
11. Pins: D1, D2 = drain; G1, G2 = gate; S = source; V1 = drain video decoupling, no DC bias, V2 = NC or connected to ground

Package Outline Specifications

Package PG-HBSOF-6-2 (bottom view)

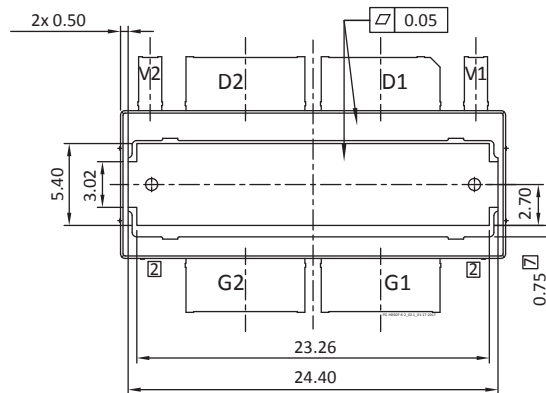


Diagram Notes—unless otherwise specified:

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included.
2. Metal protrusions are connected to source and shall not exceed 0.10 mm max.
3. Fillets and radii: all radii are 0.3 mm max.
4. Interpret dimensions and tolerances per ISO 8015.
5. Dimensions are mm.
6. Does not include mold/dam bar and metal protrusion.
7. Exposed metal surface is tin-plated, may not be covered by mold compound.
8. All tolerances ± 0.1 mm unless specified otherwise.
9. All metal surfaces are tin-plated, except area of cut.
10. Lead thickness: 0.25 mm.
11. Pins: D1, D2 = drain; G1, G2 = gate; S = source; V1 = drain video decoupling, no DC bias, V2 = NC or connected to ground



Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes at each revision)
01	2016-09-30	Advance	All	Data Sheet reflects advance specification for product development
02	2017-04-28	Production	All	Data Sheet reflects released product specification
03	2017-08-21	Production	6, 7	Updated PCB layout and components information
04	2017-09-01	Production	7	Update components information
05	2018-06-20	Production	All	Converted to Wolfspeed Data Sheet
05.1	2019-03-06	Production	2	Added MSL table

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.