

PTRA094858NF

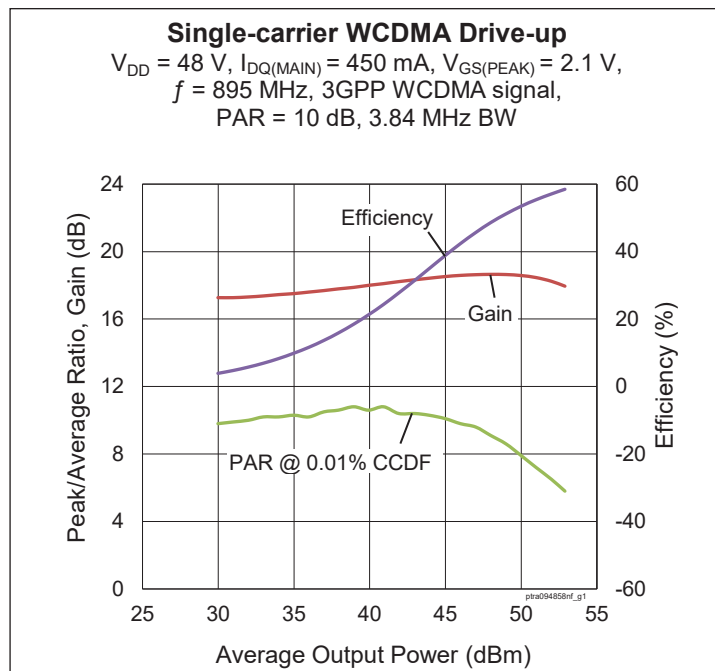
Thermally-Enhanced High Power RF LDMOS FET 400 W, 48 V, 859 – 960 MHz

Description

The PTRA094858NF is a 400-watt Doherty LDMOS transistor 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.



PTRA094858NF
Package PG-HBSOF-6-3



Features

- Broadband internal input and output matching
- Asymmetrical Doherty design
 - Main : $P_{1dB} = 150\text{ W Typ}$
 - Peak : $P_{1dB} = 250\text{ W Typ}$
- Typical Pulsed CW performance, 895 MHz, 48 V, Doherty configuration, 10 μsec pulse width, 10% duty cycle, class AB
 - Output power at $P_{1dB} = 400\text{ W}$
 - Output power at $P_{3dB} = 500\text{ W}$
 - Efficiency = 63%
 - Gain = 18.5 dB
- Capable of handling 10:1 VSWR @ 48 V, 87 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 test fixture)

$V_{DD} = 48\text{ V}$, $I_{DQ} = 450\text{ mA}$, $P_{OUT} = 87\text{ W avg}$, $V_{GS(PEAK)} = 2.1\text{ V}$, $f = 895\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	16.8	17.75	—	dB
Drain Efficiency	η_D	48	52	—	%
Adjacent Channel Power Ratio	ACPR	—	-29	-26.5	dBc
Output PAR @ 0.01% CCDF	OPAR	6.5	7.2	—	dB

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

ESD: Electrostatic discharge sensitive device—observe handling precautions!

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$	$V_{(BR)DSS}$	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	$V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1	μA
On-State Resistance (Main) (Peak)	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.2	—	Ω
	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.13	—	Ω
Operating Gate Voltage (Main) (Peak)	$V_{DS} = 48\text{ V}$, $I_{DQ} = 450\text{ mA}$	V_{GS}	3.4	3.6	3.9	V
	$V_{DS} = 48\text{ V}$, $I_{DQ} = 0\text{ mA}$	V_{GS}	—	2.1	—	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)	$R_{\theta JC}$	0.41	$^{\circ}\text{C/W}$

Moisture Sensitivity Level

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

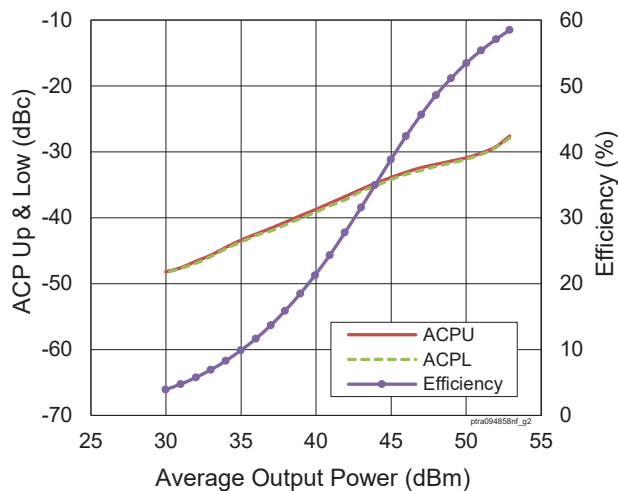
Ordering Information

Type and Version	Order Code	Package	Shipping
PTRA094858NF V1 R5	PTRA094858NF-V1-R5	PG-HBSOF-6-3	Tape & Reel, 500 pcs

Typical Performance (data taken in test fixture)

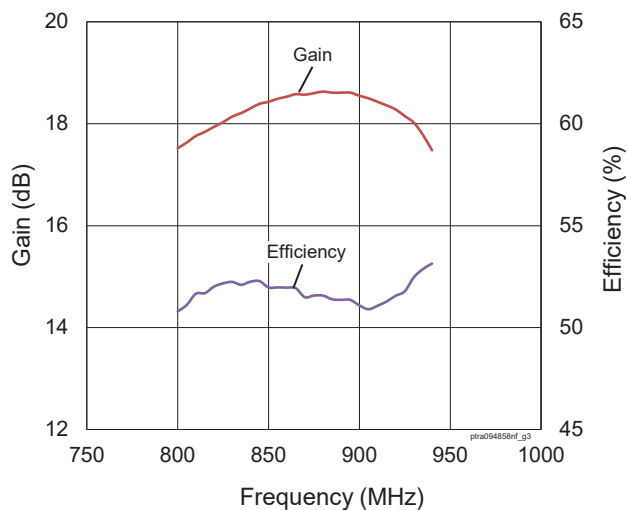
Single-carrier WCDMA Drive-up

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$, $V_{GS(PEAK)} = 2.1\text{ V}$,
 $f = 895\text{ MHz}$, 3GPP WCDMA signal,
 $PAR = 10\text{ dB}$, $BW = 3.84\text{ MHz}$



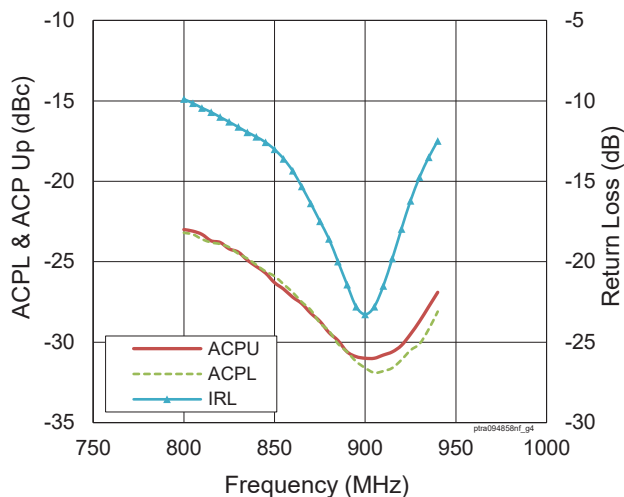
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$, $V_{GS(PEAK)} = 2.1\text{ V}$,
 $P_{OUT} = 49.4\text{ dBm}$, 3GPP WCDMA signal,
 $PAR = 10\text{ dB}$



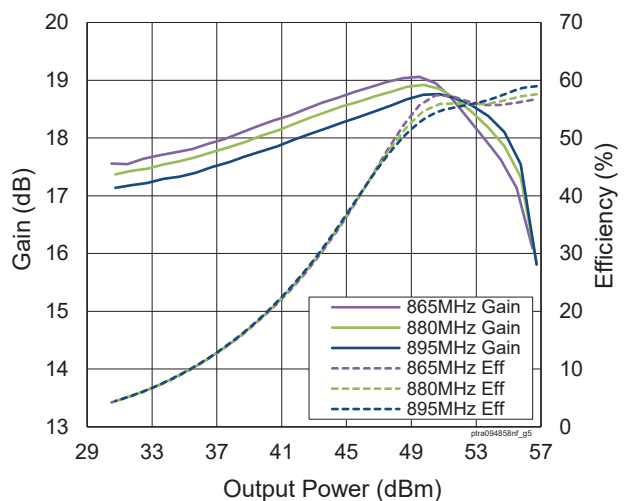
Single-carrier WCDMA Broadband Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$, $V_{GS(PEAK)} = 2.1\text{ V}$,
 $P_{OUT} = 49.4\text{ dBm}$, 3GPP WCDMA signal,
 $PAR = 10\text{ dB}$

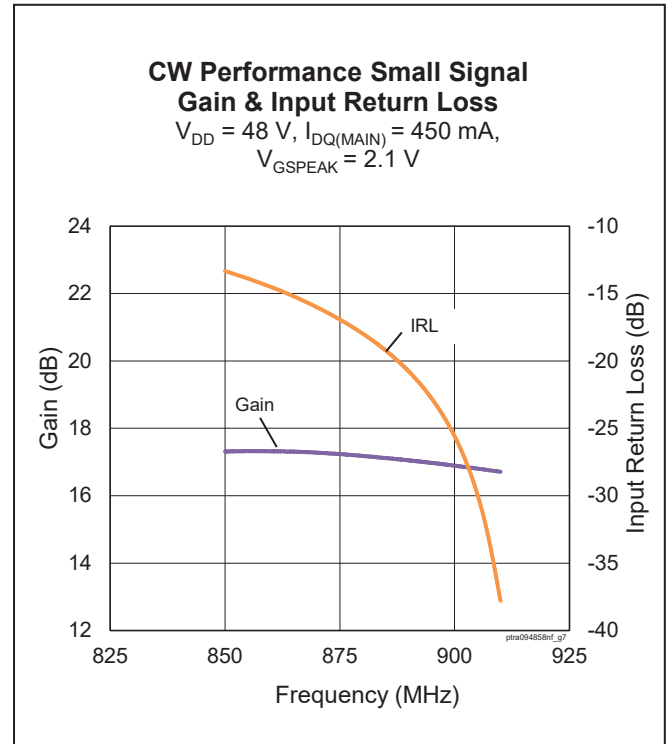
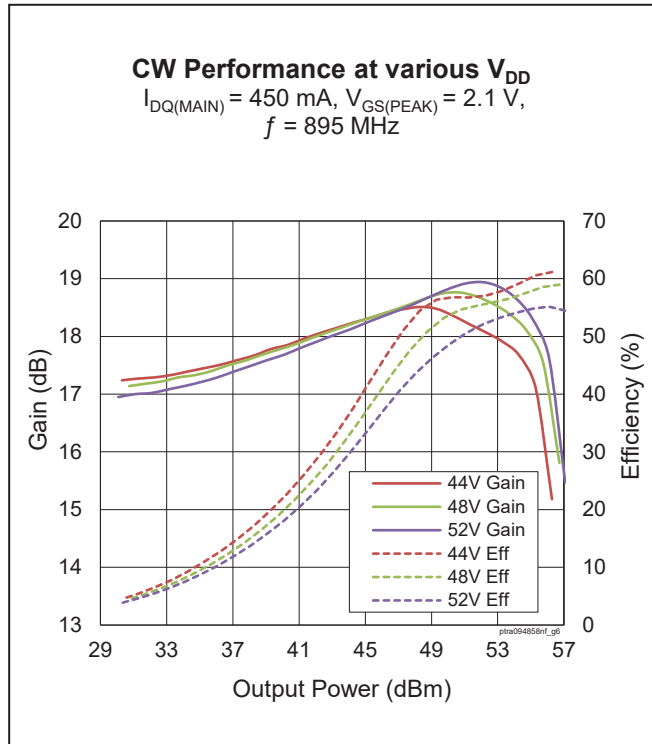


CW Performance

$V_{DD} = 48\text{ V}$, $I_{DQ(MAIN)} = 450\text{ mA}$,
 $V_{GS(PEAK)} = 2.1\text{ V}$



Typical Performance (cont.)



Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal: 10 μ sec, 10% duty cycle, $V_{DD} = 48$ V, $I_{DQ} = 450$ 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	$1.43 - j5.04$	$2.29 - j0.67$	21.06	53.32	214.78	54.9	$4.77 + j1.31$	22.83	51.65	146.22	66.0
895	$2.31 - j6.58$	$2.26 - j0.24$	21.03	53.47	222.33	57.0	$4.26 + j1.68$	22.7	51.84	152.76	68.1

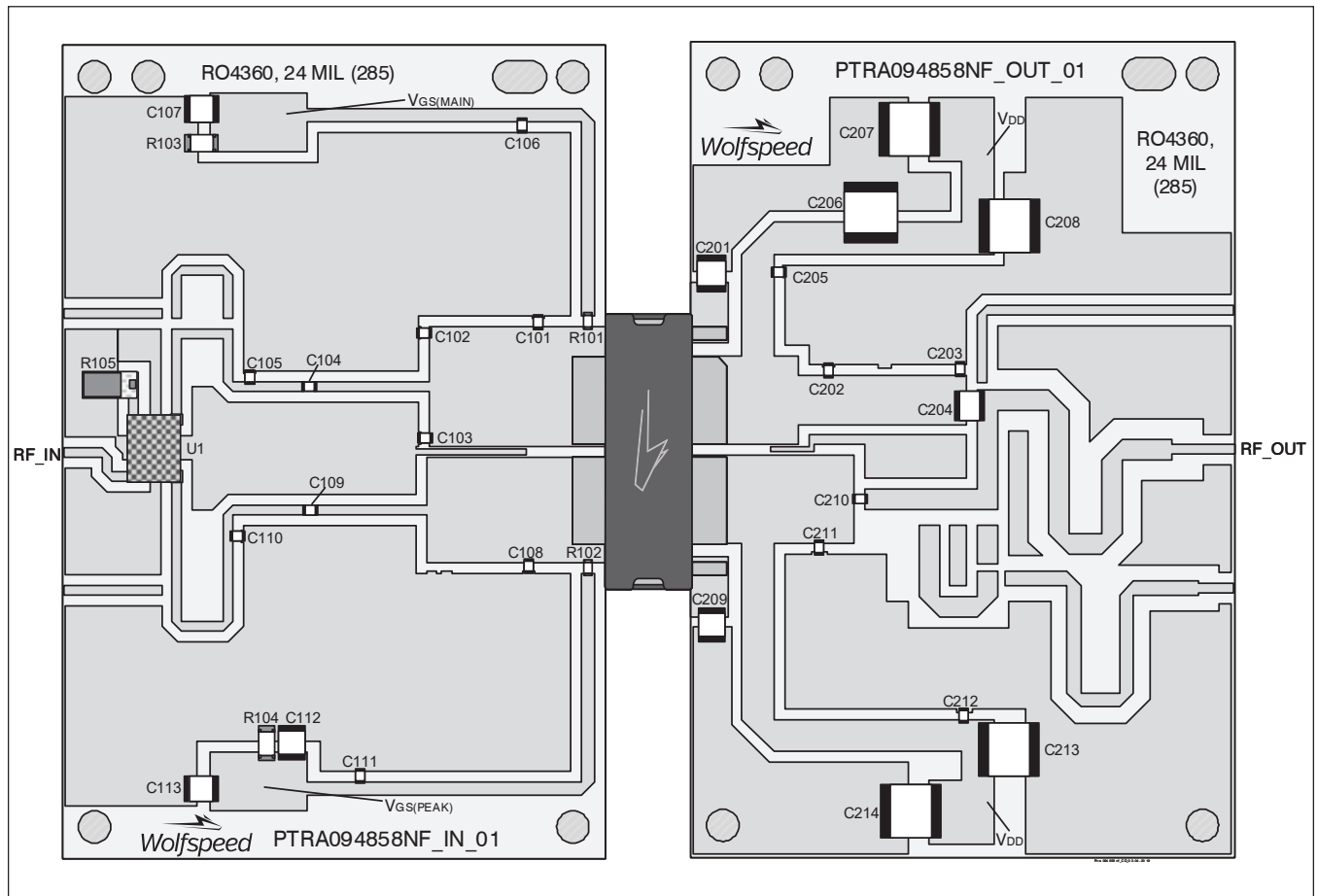
		P_{3dB}									
		Max Output Power					Max Drain Efficiency				
Freq [MHz]	Z_s [Ω]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]	Z_l [Ω]	Gain [dB]	P_{3dB} [dBm]	P_{3dB} [W]	η_D [%]
865	$1.43 - j5.04$	$2.32 - j0.79$	19.07	54.24	265.46	58.5	$4.68 + j1.09$	20.78	52.59	181.55	67.3
895	$2.31 - j6.58$	$2.29 - j0.32$	19.03	54.35	272.27	60.4	$4.14 + j1.5$	20.64	52.77	189.23	69.3

Peak Side Load Pull Performance – Pulsed CW signal: 10 μ sec, 10% duty cycle, $V_{DD} = 48$ V, $V_{GS(PEAK)} = 2.1$ 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	$1.78 - j4.94$	$1.20 - j0.29$	16.83	55.60	363.08	57.9	$0.97 + j1.36$	17.44	52.28	169.04	74.5
895	$2.94 - j6.74$	$1.34 - j0.19$	16.54	55.65	367.28	58.9	$0.98 + j1.35$	17.24	52.81	191	74.2

		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	$1.78 - j4.94$	$1.36 - j0.19$	15.03	56.38	434.51	63.4	$1.17 + j0.98$	15.72	54.31	269.77	72.5
895	$2.94 - j6.74$	$1.36 - j0.19$	14.54	56.45	441.57	61.2	$1.15 + j1$	15.54	54.69	294.44	74.0

Reference Circuit, 865 – 895 MHz



Reference circuit assembly diagram (not to scale)

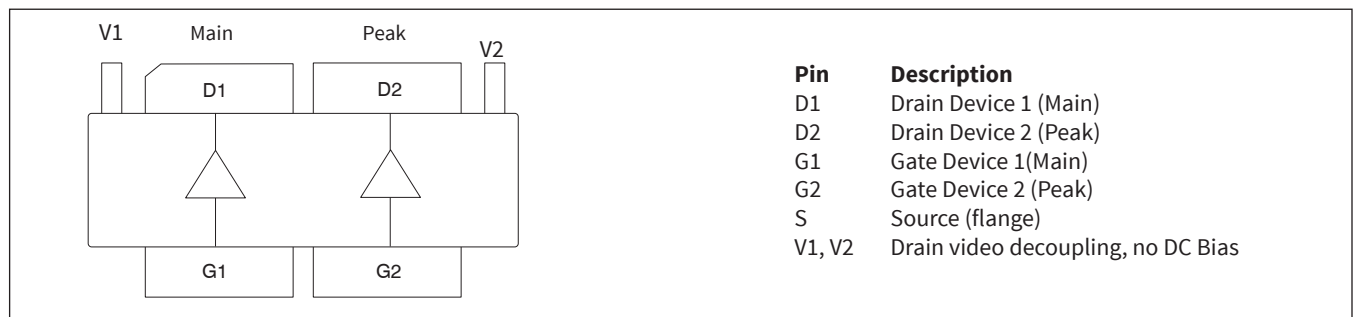
Reference Circuit Assembly

DUT	PTRA094858NF V1
Test Fixture Part No.	LTA/PTRA094858NF-V1
PCB	Rogers 4360, 0.024" thick, 2 oz. copper, $\epsilon_r = 6.4$, $f = 865 - 895$ MHz
Find Gerber files for this test fixture on the Wolfspeed Web site at www.wolfspeed.com/RF	

Components Information

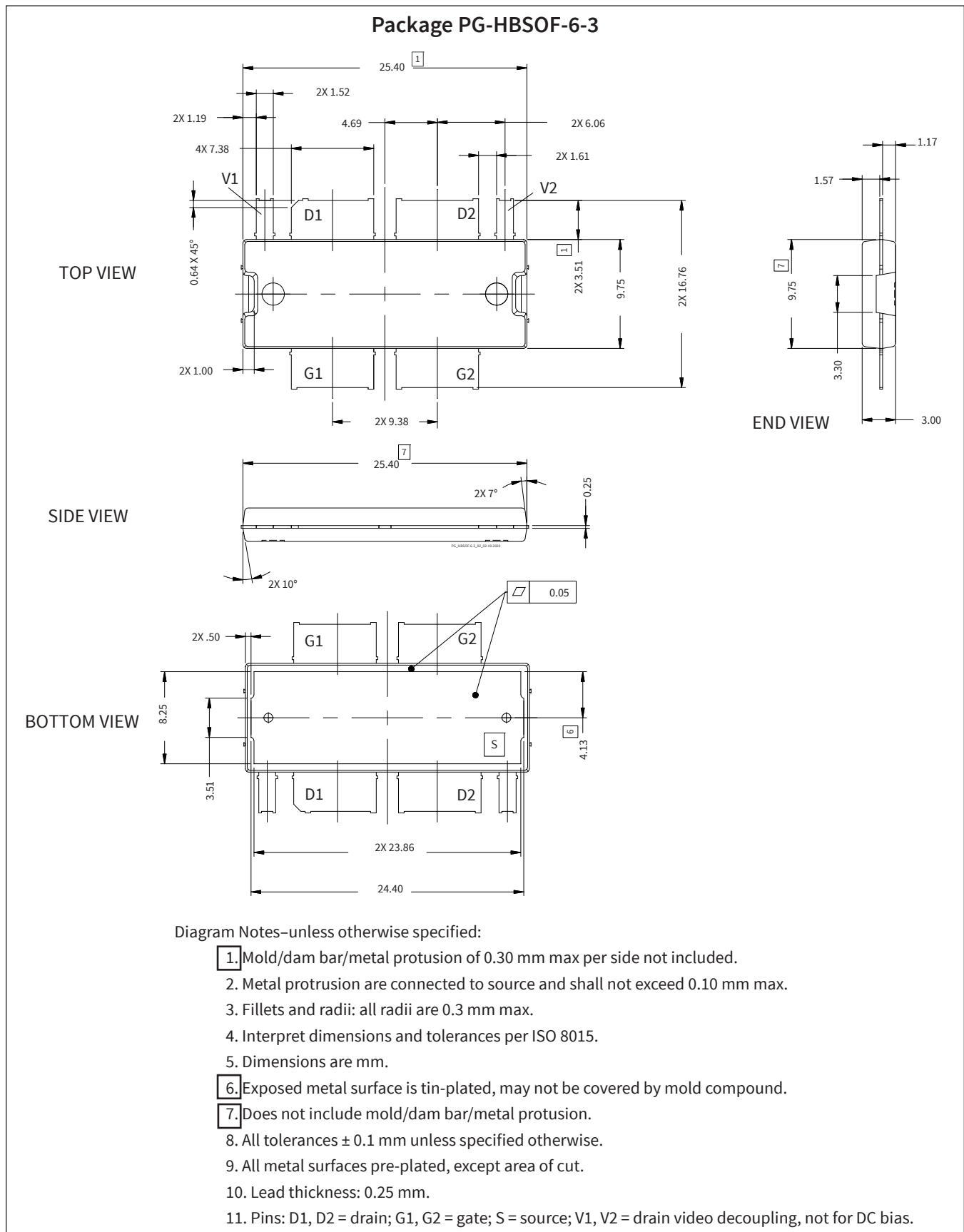
Component	Description	Manufacturer	P/N
Input			
C101, C108	Capacitor, 6.8 pF	ATC	ATC600F6R8CT250XT
C102	Capacitor, 2.7 pF	ATC	ATC600F2R7CT250XT
C103, C105	Capacitor, 1.8 pF	ATC	ATC600F1R8CT250XT
C104, C109	Capacitor, 33 pF	ATC	ATC600F330JT250XT
C106, C111	Capacitor, 68 pF	ATC	ATC600F680JT250XT
C107, C112, C113	Capacitor, 10 μ F, 50 V	Murata Electronics North America	GRM31CR61H106KA12K
C110	Capacitor, 3 pF	ATC	ATC600F3R0CT250XT
R101, R102	Resistor, 5.6 ohms	Panasonic Electronic Components	ERJ-8RQJ5R6V
R103, R104	Resistor, 1000 ohms	Panasonic Electronic Components	ERJ-8GEYJ102V
R105	Resistor, 50 ohms	Richardson	C16A50Z4
U1	Hybrid Coupler	RN2 Tech	RN2 CMX09Q02
Output			
C201, C209	Capacitor, 10 μ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C202	Capacitor, 10 pF	ATC	ATC600F100JT250XT
C203	Capacitor, 3.3 pF	ATC	ATC600F3R3CT250XT
C204	Capacitor, 20 pF	ATC	ATC100B200KW500XT
C205	Capacitor, 68 pF	ATC	ATC600F680JT250XT
C206, C207, C208, C213, C214	Capacitor, 10 μ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C210, C212	Capacitor, 47 pF	ATC	ATC600F470JT250XT
C211	Capacitor, 15 pF	ATC	ATC600F150JT250XT

Pinout Diagram (top view)



Lead connections for PTRA094858NF

Package Outline Specifications



Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
01	2019-02-06	Preliminary	All	Data Sheet reflects preliminary specification
02	2019-04-03	Final	All	Corrected package throughout, updated HBM classification, Data Sheet reflects released product specification
02.1	2020-03-02	Final	8	Updated package outline

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Notes

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