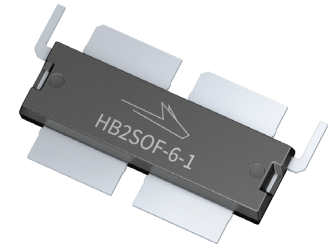


# PTRA097058NB

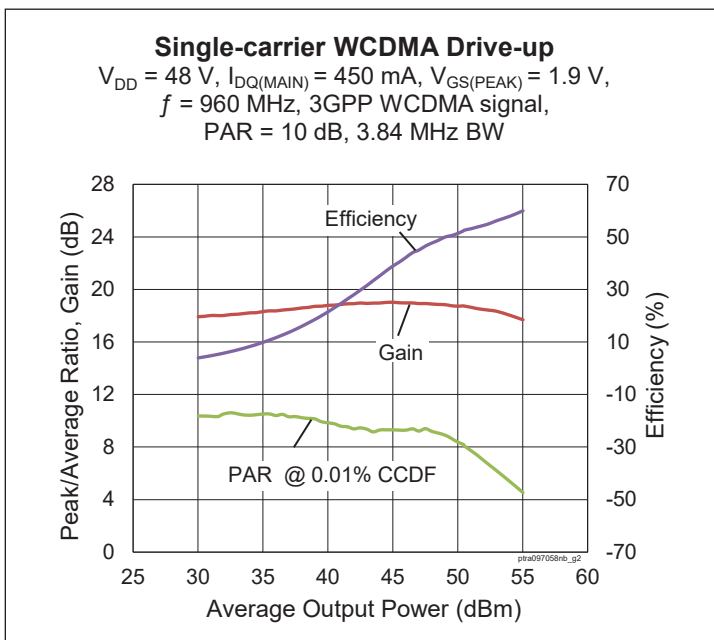
Thermally-Enhanced High Power RF LDMOS FET  
800 W, 48 V, 730 – 960 MHz

## Description

The PTRA097058NB is a 800-watt LDMOS FET intended for use in multi-standard cellular power amplifier applications in the 730 to 960 MHz frequency band. Features include input and output matching, high gain and thermally-enhanced package with earless flanges. Manufactured with Wolfspeed's advanced LDMOS process, this device provides excellent thermal performance and superior reliability.



PTRA097058NB  
Package PG-HB2SOF-6-1



## Features

- Broadband internal input and output matching
- Asymmetric design
  - Main:  $P_{1dB} = 250\text{ W}$  typical
  - Peak:  $P_{1dB} = 500\text{ W}$  typical
- Typical pulsed CW performance, 960 MHz, 48 V, 10  $\mu\text{s}$ , 10% duty cycle, class AB test, Doherty configuration
  - Output power at  $P_{1dB} = 630\text{ W}$
  - Output power at  $P_{3dB} = 800\text{ W}$
  - Efficiency = 55%
  - Gain = 19 dB
- Capable of handling 10:1 VSWR at 48 V, 112 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)

$V_{DD} = 48\text{ V}$ ,  $I_{DQ} = 450\text{ mA}$ ,  $P_{OUT} = 112\text{ W}$  avg,  $V_{GS(peak)} = 1.9\text{ V}$ ,  $f = 960\text{ MHz}$ , 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

Characteristics	Symbol	Min	Typ	Max	Unit
Gain	$G_{ps}$	17.3	18.4	—	dB
Drain Efficiency	$\eta_D$	45	48	—	%
Adjacent Channel Power Ratio	ACPR	—	-30	-26.5	dBc
Output PAR @ 0.01% CCDF	OPAR	6.5	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

Characteristics	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	$\mu\text{A}$
	$V_{DS} = 105\text{ V}, V_{GS} = 0\text{ V}$		—	—	10	$\mu\text{A}$
Gate Leakage Current	$V_{GS} = 10\text{ V}, V_{DS} = 0\text{ V}$	$I_{GSS}$	—	—	1	$\mu\text{A}$
On-State Resistance (main) (peak)	$V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.07	—	$\Omega$
	$V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.04	—	$\Omega$
Operating Gate Voltage (main) (peak)	$V_{DS} = 48\text{ V}, I_{DQ} = 450\text{ mA}$	$V_{GS}$	3.3	3.55	3.8	V
	$V_{DS} = 48\text{ V}, I_{DQ} = 0\text{ mA}$	$V_{GS}$	—	1.9	—	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

Characteristics	Symbol	Value	Unit
Thermal Resistance (main, $T_{CASE} = 70\text{ }^{\circ}\text{C}$ , 112 W CW)	$R_{\theta JC}$	0.48	$^{\circ}\text{C}/\text{W}$
(peak, $T_{CASE} = 70\text{ }^{\circ}\text{C}$ , 457 W CW)	$R_{\theta JC}$	0.204	$^{\circ}\text{C}/\text{W}$

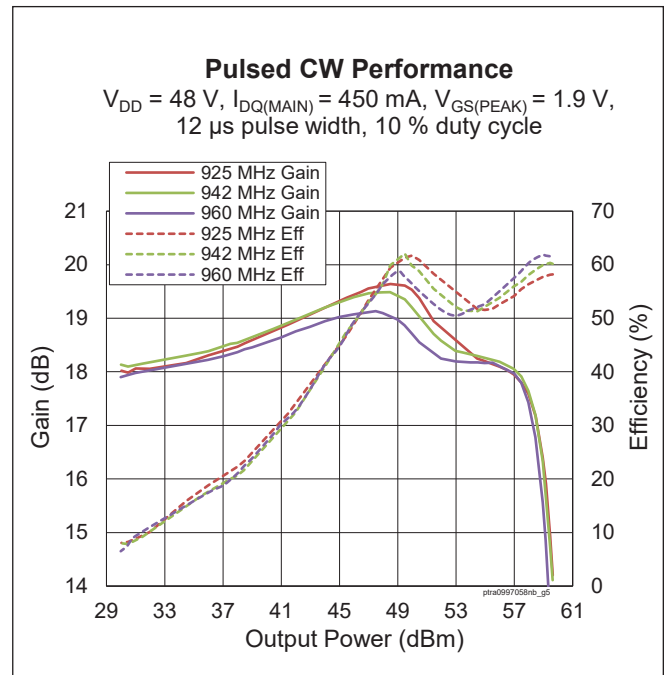
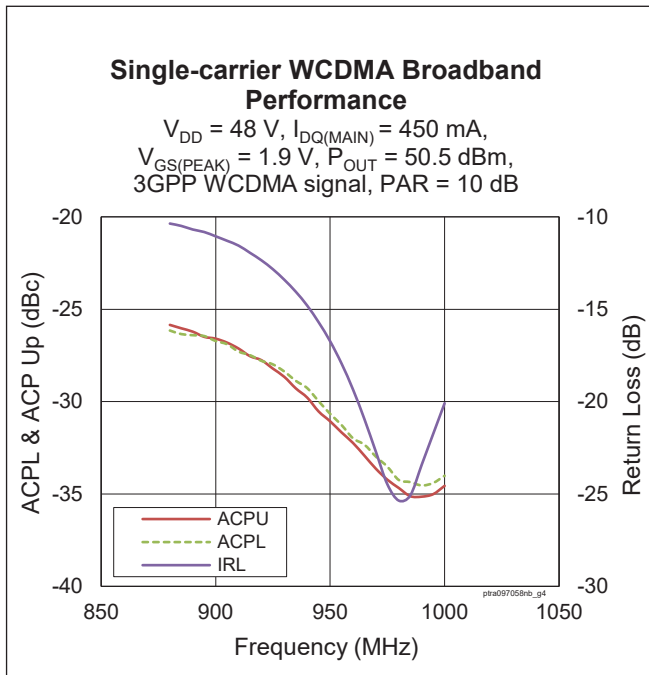
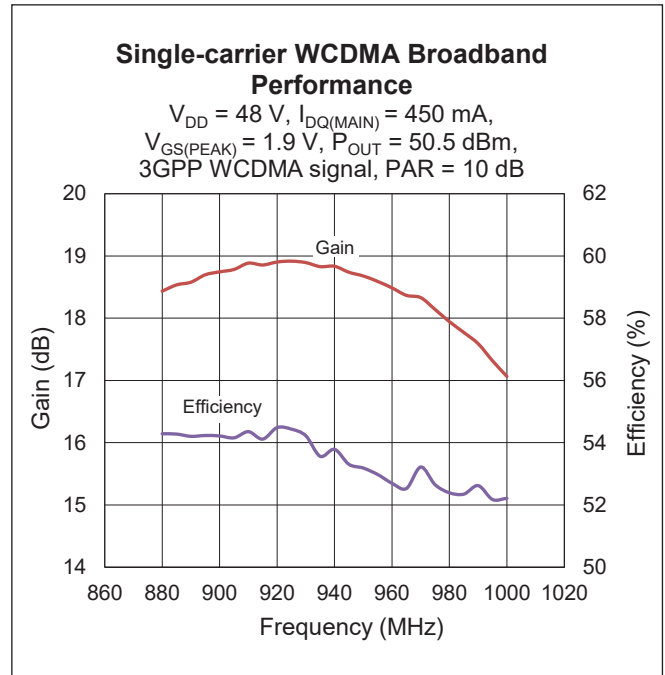
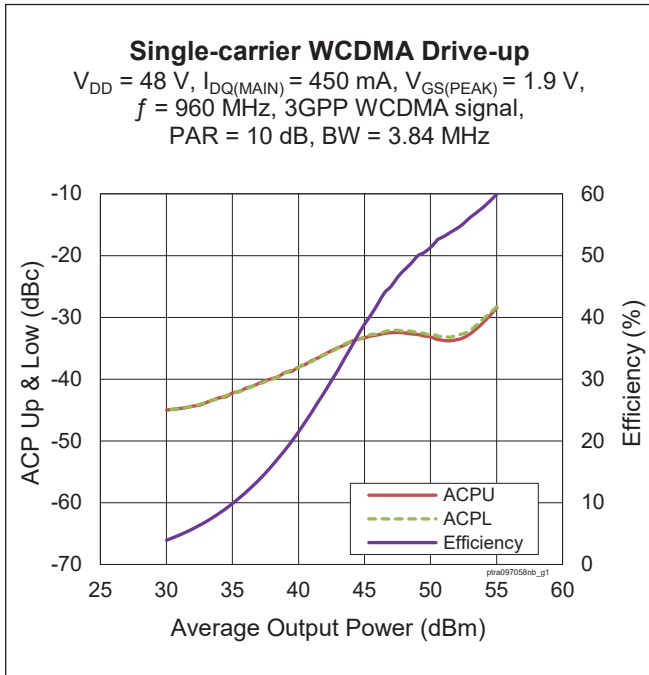
## Moisture Sensitivity Level

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

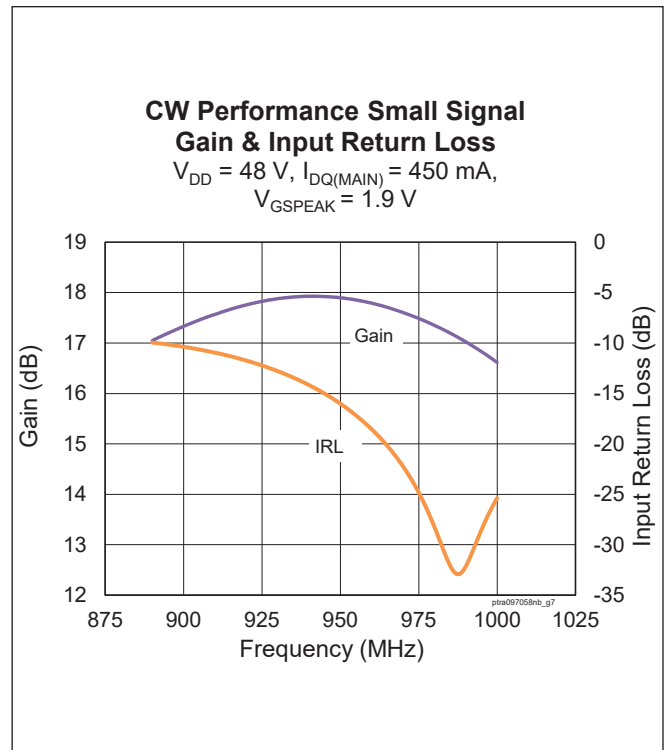
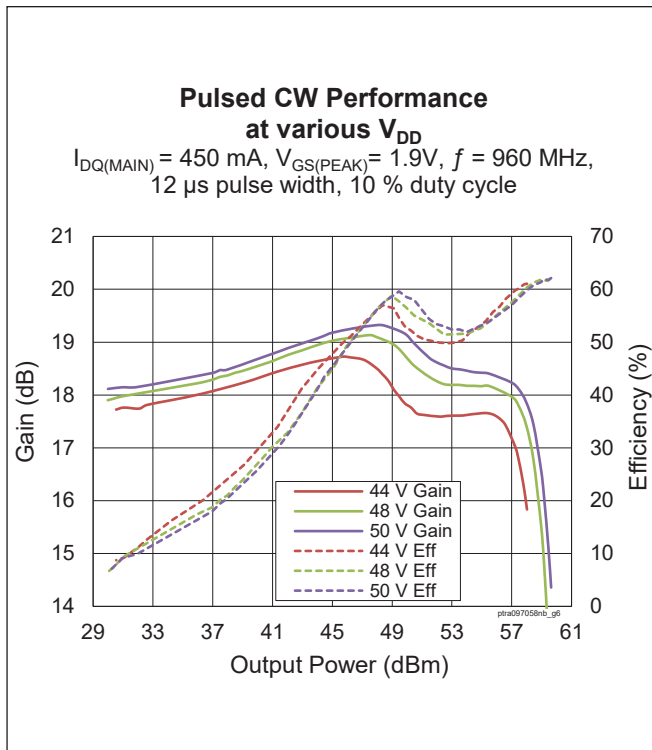
## Ordering Information

Type and Version	Order Code	Package	Shipping
PTRA097058NB V1 R2	PTRA097058NB-V1-R2	PG-HB2SOF-6-1	Tape & Reel, 250 pcs

**Typical Performance** (data taken in test fixture)



**Typical Performance** (cont.)



### Load Pull Performance

**Main Side Load Pull Performance** – Pulsed CW signal – 10 µsec, 10% duty cycle, 48 V, IDQ = 450 mA, class AB

		<b>P<sub>1dB</sub></b>									
		<b>Max Output Power</b>					<b>Max Drain Efficiency</b>				
<b>Freq [MHz]</b>	<b>Z<sub>s</sub> [Ω]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>1dB</sub> [dBm]</b>	<b>P<sub>1dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>1dB</sub> [dBm]</b>	<b>P<sub>1dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>
760	3.3 + j0.76	2.4 – j0.48	22.08	54.29	268.53	62.2	3.9 + j1.6	23.5	52.60	181.97	73.8
820	2.1 – j1.35	1.7 – j0.14	21.53	54.10	257.04	61.2	3.4 + j2.5	23.26	51.23	132.74	72.3
925	2.2 – j3.3	1.7 – j1.2	20.41	54.27	267.3	57.8	2.2 + j0.7	22.09	52.16	164.44	69.0
960	2.8 – j4	1.6 – j0.9	20.54	54.32	270.4	61.6	1.7 + j1	22.44	51.67	146.89	73.0

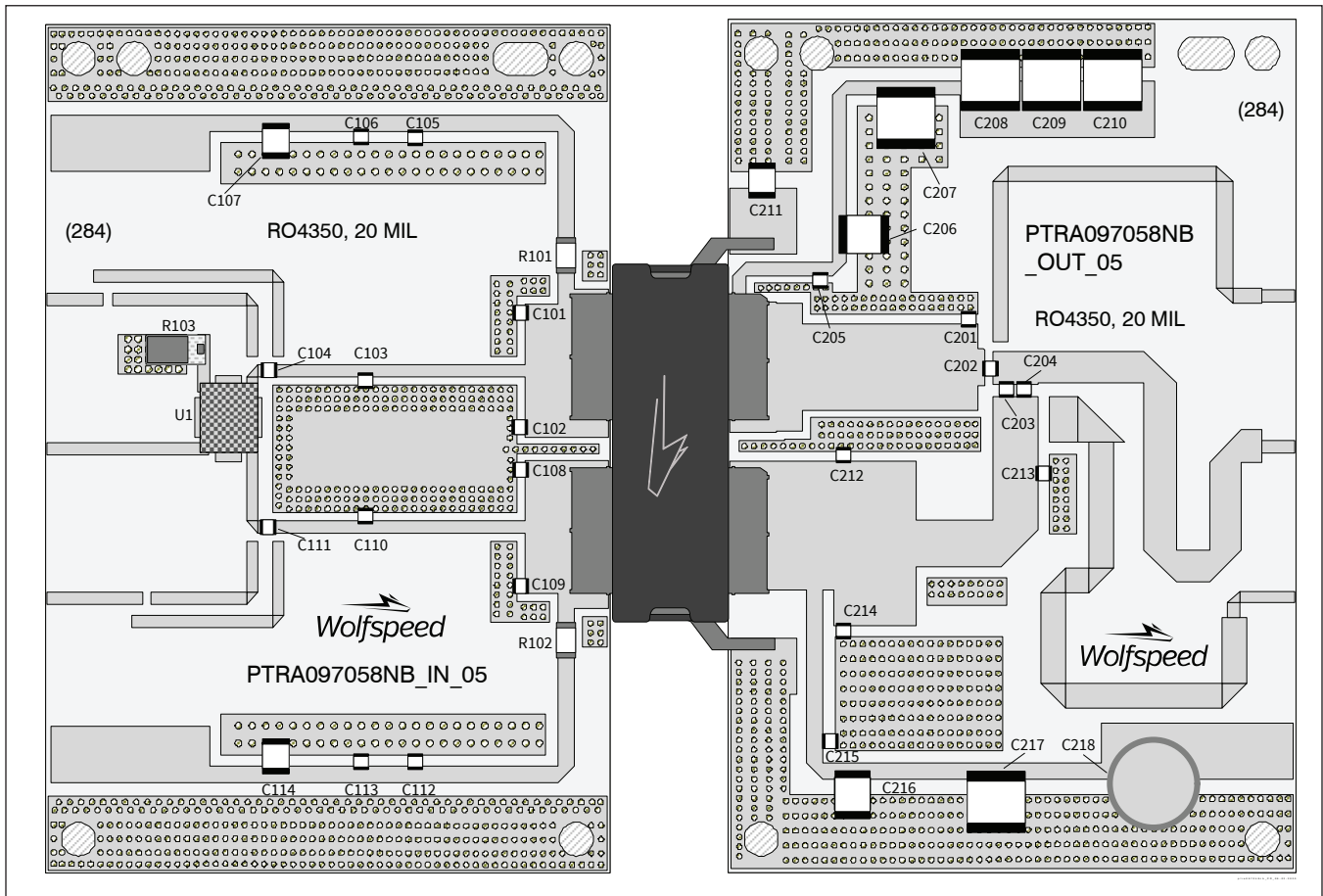
		<b>P<sub>3dB</sub></b>									
		<b>Max Output Power</b>					<b>Max Drain Efficiency</b>				
<b>Freq [MHz]</b>	<b>Z<sub>s</sub> [Ω]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>3dB</sub> [dBm]</b>	<b>P<sub>3dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>3dB</sub> [dBm]</b>	<b>P<sub>3dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>
760	3.3 + j0.76	2.4 – j0.6	20.03	55.09	322.85	65.6	4.5 + j2.4	21.65	52.48	177.01	75.9
820	2.1 – j1.35	1.7 – j1.1	19.04	55.08	322.11	59.9	2.85 + j0.6	20.8	53.86	243.22	74.8
925	2.2 – j3.3	1.7 – j1.3	18.42	55.11	324.34	60.9	2 + j0.6	20	53.00	199.53	70.9
960	2.8 – j4	1.6 – j1	18.4	55.16	328.1	63.1	1.7 + j0.9	20.36	52.55	179.89	73.2

**Peak Side Load Pull Performance** – Pulsed CW signal – 10 µsec, 10% duty cycle, 48 V, V<sub>GSPK</sub> = 2 V, class C

		<b>P<sub>1dB</sub></b>									
		<b>Max Output Power</b>					<b>Max Drain Efficiency</b>				
<b>Freq [MHz]</b>	<b>Z<sub>s</sub> [Ω]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>1dB</sub> [dBm]</b>	<b>P<sub>1dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>1dB</sub> [dBm]</b>	<b>P<sub>1dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>
760	0.8 – j0.4	0.87 – j0.7	18.88	57.94	622.3	62.5	0.54 + j0.4	19.87	53.88	244.3	75.6
820	0.7 – j1.55	0.85 – j0.57	18.27	57.74	594.3	60.8	0.55 + j0.39	19.27	54.47	279.9	74.2
925	1.15 – j3.13	0.83 – j0.55	17.18	57.62	578.1	61.0	0.53 + j0.32	17.79	54.56	285.8	73.9
960	1.66 – j3.68	0.8 – j0.63	16.76	57.54	567.5	59.1	0.55 + j0.1	17.87	55.26	335.7	72.9

		<b>P<sub>3dB</sub></b>									
		<b>Max Output Power</b>					<b>Max Drain Efficiency</b>				
<b>Freq [MHz]</b>	<b>Z<sub>s</sub> [Ω]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>3dB</sub> [dBm]</b>	<b>P<sub>3dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>	<b>Z<sub>l</sub> [Ω]</b>	<b>Gain [dB]</b>	<b>P<sub>3dB</sub> [dBm]</b>	<b>P<sub>3dB</sub> [W]</b>	<b>η<sub>D</sub> [%]</b>
760	0.8 – j0.4	0.89 – j0.72	16.81	58.64	731.1	64.4	0.84 + j0.07	17.83	56.86	485.3	74.9
820	0.7 – j1.55	0.88 – j0.63	16.15	58.46	701.5	62.1	0.54 + j0.22	17.75	55.90	389	74.2
925	1.15 – j3.13	0.86 – j0.6	15.06	58.33	680.8	61.7	0.55 + j0.1	16.33	56.24	420.7	72.7
960	1.66 – j3.68	0.9 – j0.67	14.69	58.23	665.3	60.8	0.55 + j0.06	15.93	56.00	398.1	72.4

**Reference Circuit, 925 – 960 MHz**



Reference circuit assembly diagram (not to scale)

**Reference Circuit Assembly**

DUT	PTRA097058NB V1
Test Fixture Part No.	LTA/PTRA097058NB-V1
PCB	Rogers 4350, 0.020" thick, 2 oz. copper, $\epsilon_r = 3.66$ , $f = 925 - 960$ MHz
Find Gerber files for this test fixture on the WolfSpeed Web site at <a href="http://www.wolfspeed.com/RF">www.wolfspeed.com/RF</a>	

**Components Information**

Component	Description	Manufacturer	P/N
<b>Input</b>			
C101, C102	Capacitor, 8.2 pF	ATC	ATC600F8R2CT250X
C103	Capacitor, 4.3 pF	ATC	ATC600F4R3BT250X
C104, C105, C111, C112	Capacitor, 68 pF	ATC	ATC600F680JT250X
C106, C113	Capacitor, 1 $\mu$ F, 6.3 V	Murata Electronics	GRM188R60J105KA01D
C107, C114	Capacitor, 10 $\mu$ F, 100 V	Murata Electronics	GRM32EC72A106KE05L
C108, C109	Capacitor, 12 pF	ATC	ATC600F120JT250X
C110	Capacitor, 4.7 pF	ATC	ATC600F4R7BT250X
R101, R102	Resistor, 10 ohms	Panasonic Electronic Components	ERJ-8GEYJ100V
R103	Resistor, 50 ohms	RICHARDSON	C16A50Z4
U1	Hybrid Coupler	RJ2	CMX09Q02



**Reference Circuit, 925 – 960 MHz** (cont.)

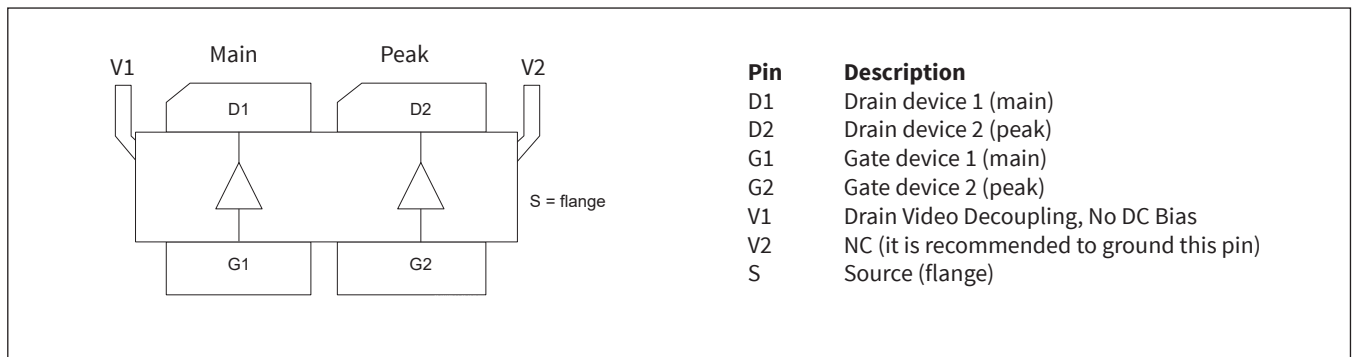
**Components Information**

Component	Description	Manufacturer	P/N
<b>Output</b>			
C201, C214	Capacitor, 6.2 pF	ATC	ATC600F6R2CT250X
C202	Capacitor, 12 pF	ATC	ATC600F120JT250X
C203, C204	Capacitor, 33 pF	ATC	ATC600F330JT250X
C205, C215	Capacitor, 68 pF	ATC	ATC600F680JT250X
C206, C216	Capacitor, 1 $\mu$ F, 100 V	TDK Corporation	C4532X7R2A105M230KA
C207, C208, C209, C210, C217	Capacitor, 10 $\mu$ F, 100 V	TDK Corporation	C5750X7S2A106M230KB
C211	Capacitor, 10 $\mu$ F, 100 V	Murata Electronics	GRM32EC72A106KE05L
C212	Capacitor, 15 pF	ATC	ATC600F150JT250X
C213	Capacitor, 1.5 pF	ATC	ATC600F1R5CT250X
C218	Capacitor, 100 $\mu$ F, 63 V	Panasonic Electronic Components	EEE-FK1J101P

**Bias Sequencing**

Bias ON	Bias OFF
1. Ensure RF is turned off	1. Turn RF off
2. Apply pinch-off voltage of 0 V to the gate	2. Apply pinch-off voltage of 0 V to the gate
3. Apply nominal drain voltage	3. Turn-off drain voltage
4. Bias gate to desired quiescent drain current	4. Turn-off gate voltage
5. Apply RF	

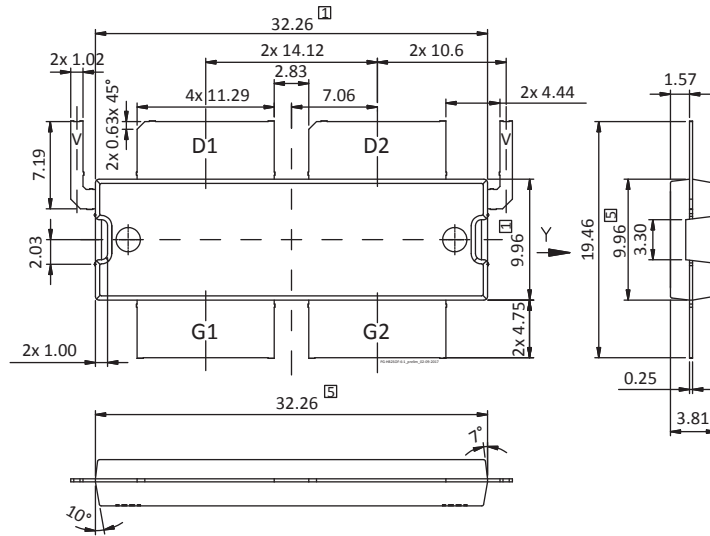
**Pinout Diagram** (top view)



Package Outline Specifications

Package PG-HB2SOF-6-1

TOP VIEW



BOTTOM VIEW

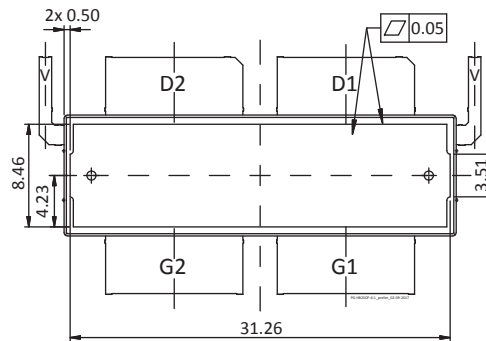


Diagram Notes—unless otherwise specified:

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included.
2. Fillets and radii: all radii are 0.3 mm max.
3. Interpret dimensions and tolerances per ISO 8015.
4. Dimensions are mm.
5. Does not include mold/dam bar and metal protrusion.
6. All tolerances  $\pm 0.1$  mm unless specified otherwise.
7. All metal surfaces tin pre-plated, except area of cut.
8. Lead thickness: 0.25 mm.
9. Pins : D1, D2 – drain; G1, G2 – gate; V1 – drain video decoupling, no DC bias; V2 – NC (it is recommended to ground this pin); S – source