

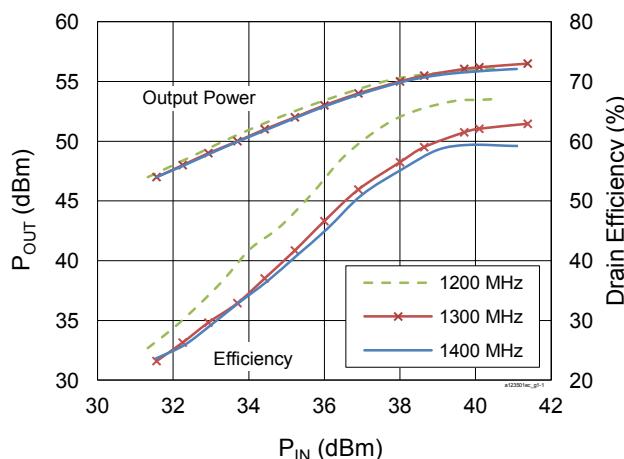
# PTVA123501EC/FC

## Thermally-Enhanced High Power RF LDMOS FETs 350 W, 50 V, 1200 – 1400 MHz

### Description

The PTVA123501EC and PTVA123501FC LDMOS FETs are designed for use in power amplifier applications in the 1200 MHz to 1400 MHz frequency band. Features include high gain and thermally-enhanced package with slotted and earless flanges. Manufactured with an advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

**Power Sweep, Pulsed RF**  
 $I_{DQ} = 150 \text{ mA}$ ,  $V_{DD} = 50 \text{ V}$ ,  $T_{CASE} = 25^\circ\text{C}$ ,  
300  $\mu\text{s}$  pulse width, 12% duty cycle



PTVA123501EC  
Package H-36248-2



PTVA123501FC  
Package H-37248-2



### Features

- Broadband internal input and output matching
- High gain and efficiency
- Integrated ESD protection
- Human Body Model Class 2 (per ANSI/ESDA/JEDEC JS-001)
- Low thermal resistance
- Excellent ruggedness
- Pb-free and RoHS compliant
- Capable of withstanding a 10:1 load mismatch (all phase angles) at 55.5 dBm under pulsed conditions: 300  $\mu\text{s}$  pulse width, 12% duty cycle,  $V_{DD} = 50 \text{ V}$

### RF Characteristics

#### Pulsed RF Performance (tested in the test fixture)

$V_{DD} = 50 \text{ V}$ ,  $I_{DQ} = 0.15 \text{ A}$ ,  $P_{OUT} = 350 \text{ W}$ ,  $f_1 = 1200 \text{ MHz}$ ,  $f_2 = 1300 \text{ MHz}$ ,  $f_3 = 1400 \text{ MHz}$ , 300  $\mu\text{s}$  pulse width, 12% duty cycle

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	$G_{ps}$	16.5	17	—	dB
Drain Efficiency	$\eta_D$	54	55	—	%
Return Loss	$IRL$	—	-12	-9	dB

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

ESD: Electrostatic discharge sensitive device—observe handling precautions!

## RF Characteristics

### Typical RF Performance (not subject to production test, verified by design/characterization in the test fixture)

$V_{DD} = 50$  V,  $I_{DQ} = 150$  mA, Input signal ( $t_r = 5$  ns,  $t_f = 6.5$  ns), 300  $\mu$ s pulse width, 12% duty cycle, class AB test

Mode of Operation	$f$ (MHz)	IRL (dB)	P <sub>1dB</sub>			P <sub>3dB</sub>			Max P <sub>droop (pulse)</sub> dB @ 350 W	$t_r$ (ns) @ 350 W	$t_f$ (ns) @ 350 W
			Gain (dB)	Eff (%)	P <sub>OUT</sub> (W)	Gain (dB)	Eff (%)	P <sub>OUT</sub> (W)			
Pulsed RF	1200	-14	16.2	59	375	14.2	59	415	0.10	4	5<
Pulsed RF	1300	-14	16.0	59	390	14.0	59	435	0.15	4	5<
Pulsed RF	1400	-12	15.8	56	375	13.8	57	415	0.15	4	5<

### Typical RF Performance (not subject to production test, verified by design/characterization in the test fixture)

$V_{DD} = 50$  V,  $I_{DQ} = 150$  mA, 30 ms pulse width, 30% duty cycle, class AB test

Mode of Operation	$f$ (MHz)	P <sub>1dB</sub>			P <sub>3dB</sub>			P <sub>droop (pulse)</sub> dB @ 300 W
		Gain (dB)	Eff (%)	P <sub>OUT</sub> (W)	Gain (dB)	Eff (%)	P <sub>OUT</sub> (W)	
Pulsed RF	1200	16	47	316	14	48	350	0.23
Pulsed RF	1300	16	47	324	14	48	355	0.25
Pulsed RF	1400	15.5	45	315	13.5	47	355	0.29

## DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_{DS} = 10$ mA	$V_{(BR)DSS}$	105	—	—	V
Drain Leakage Current	$V_{DS} = 50$ V, $V_{GS} = 0$ V	$I_{DSS}$	—	—	1.0	$\mu$ A
	$V_{DS} = 105$ V, $V_{GS} = 0$ V	$I_{DSS}$	—	—	10.0	$\mu$ A
On-State Resistance	$V_{GS} = 10$ V, $V_{DS} = 0.1$ V	$R_{DS(on)}$	—	0.1	—	$\Omega$
Operating Gate Voltage	$V_{DS} = 50$ V, $I_{DQ} = 150$ mA	$V_{GS}$	3	3.35	4	V
Gate Leakage Current	$V_{GS} = 10$ V, $V_{DS} = 0$ V	$I_{GSS}$	—	—	1.0	$\mu$ A

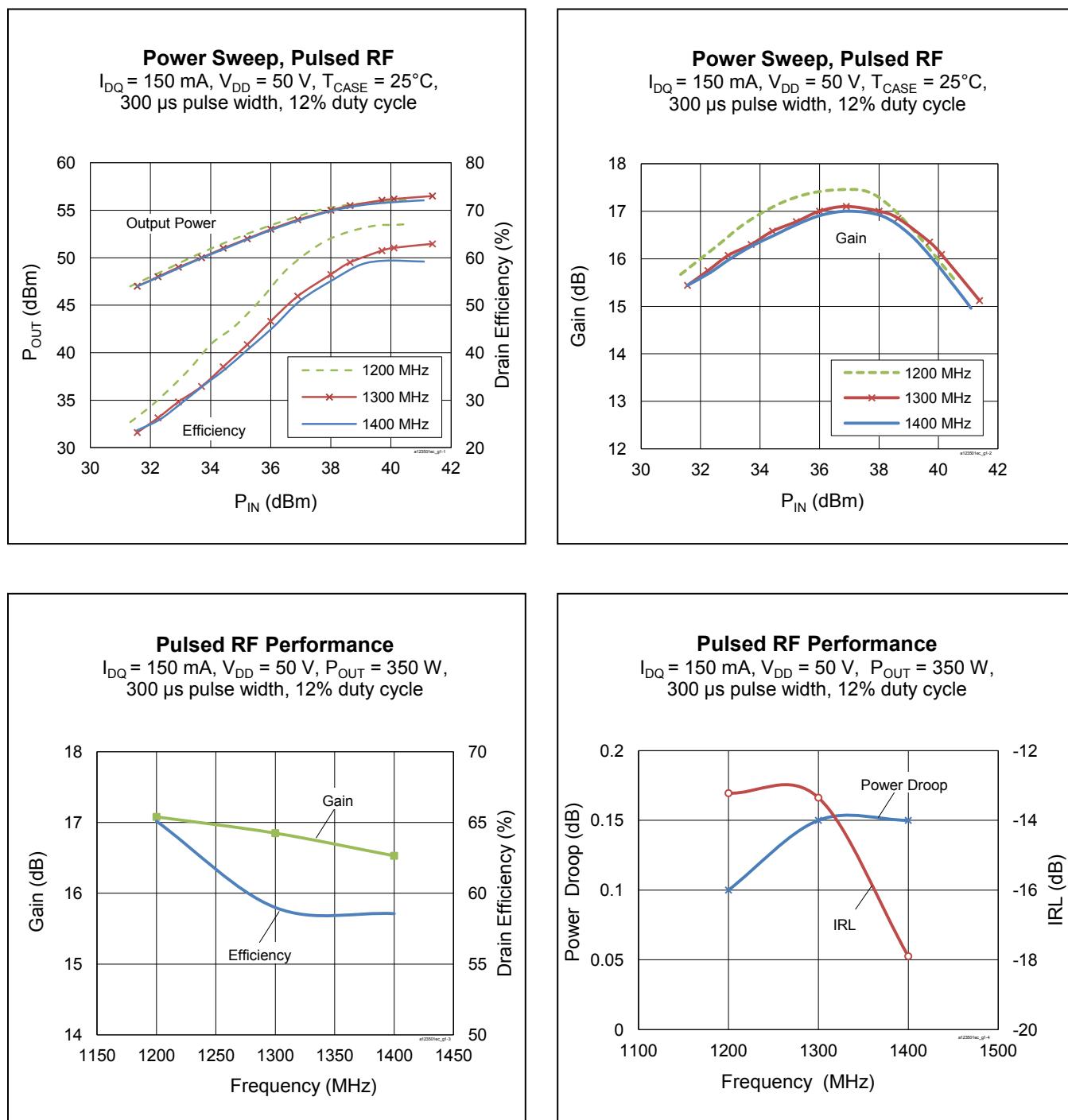
## Maximum Ratings

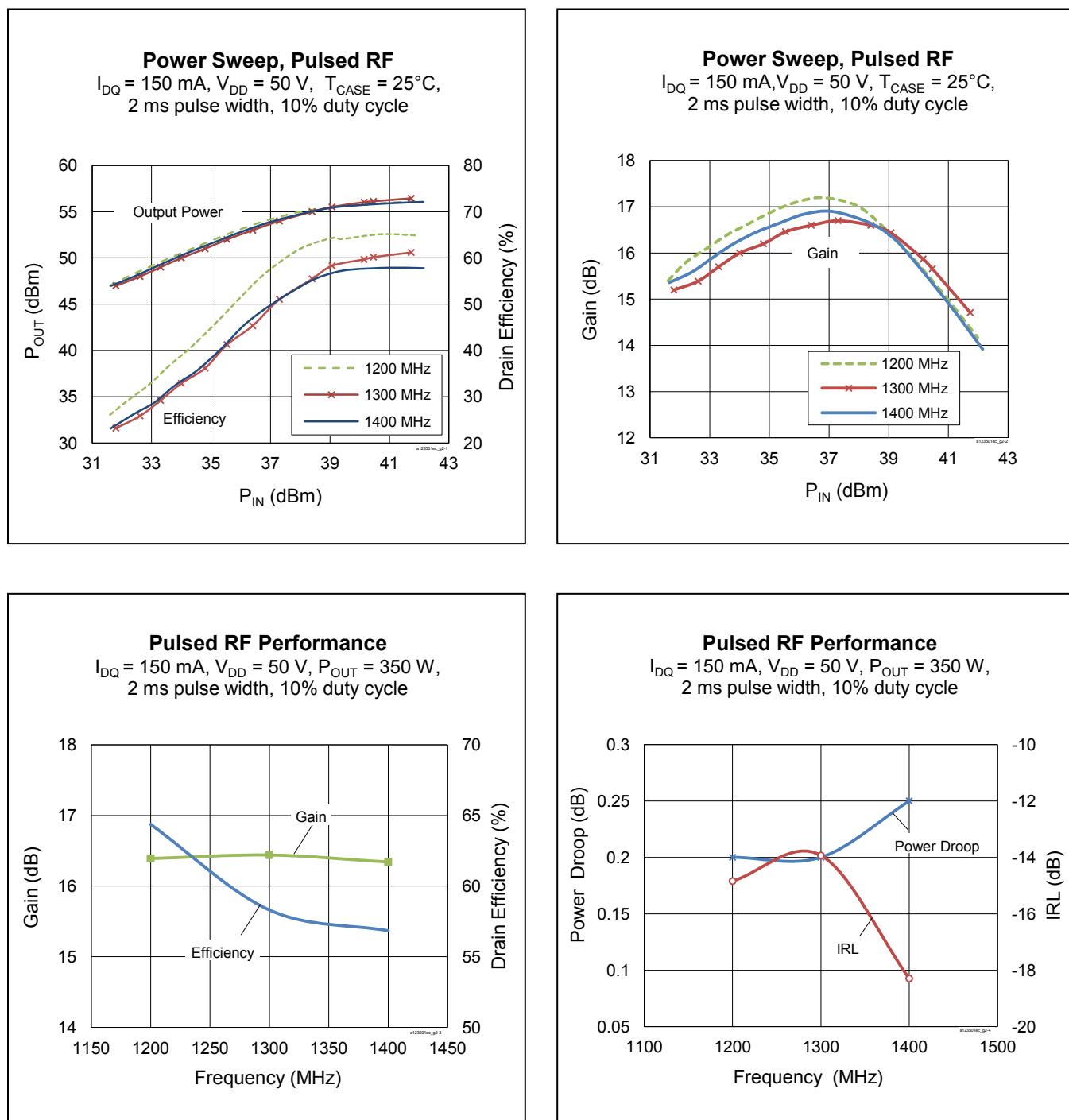
Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	105	V
Gate-Source Voltage	$V_{GS}$	-6 to +12	V
Operating Voltage	$V_{DD}$	0 to +55	V
Junction Temperature	$T_J$	225	$^{\circ}$ C
Storage Temperature Range	$T_{STG}$	-65 to +150	$^{\circ}$ C
Thermal Resistance ( $T_{CASE} = 70$ $^{\circ}$ C, 300 W CW)	$R_{\theta JC}$	0.34	$^{\circ}$ C/W

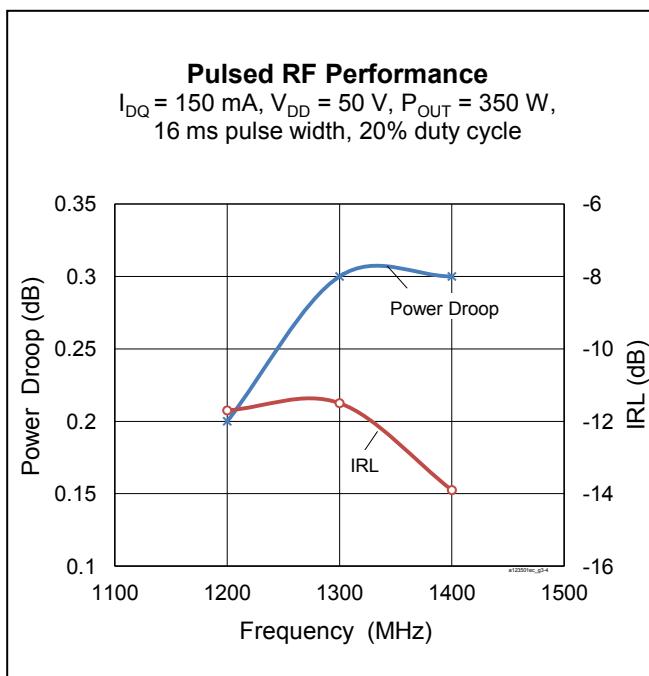
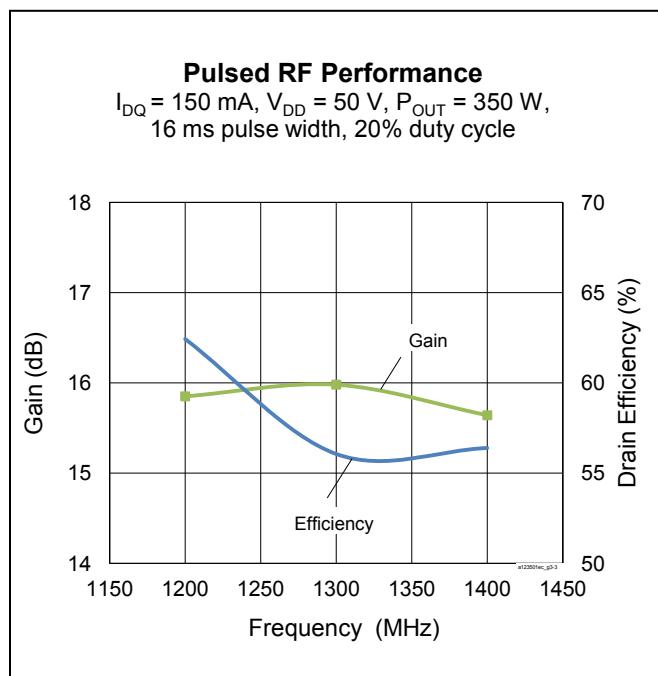
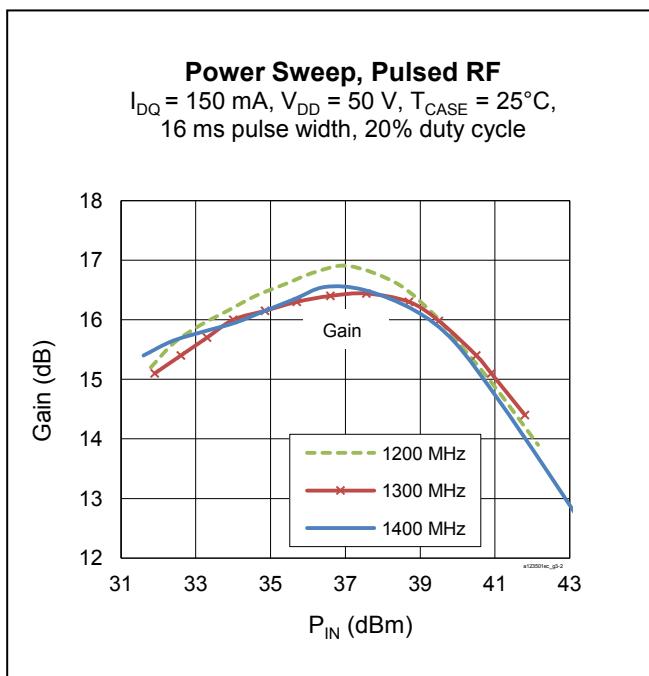
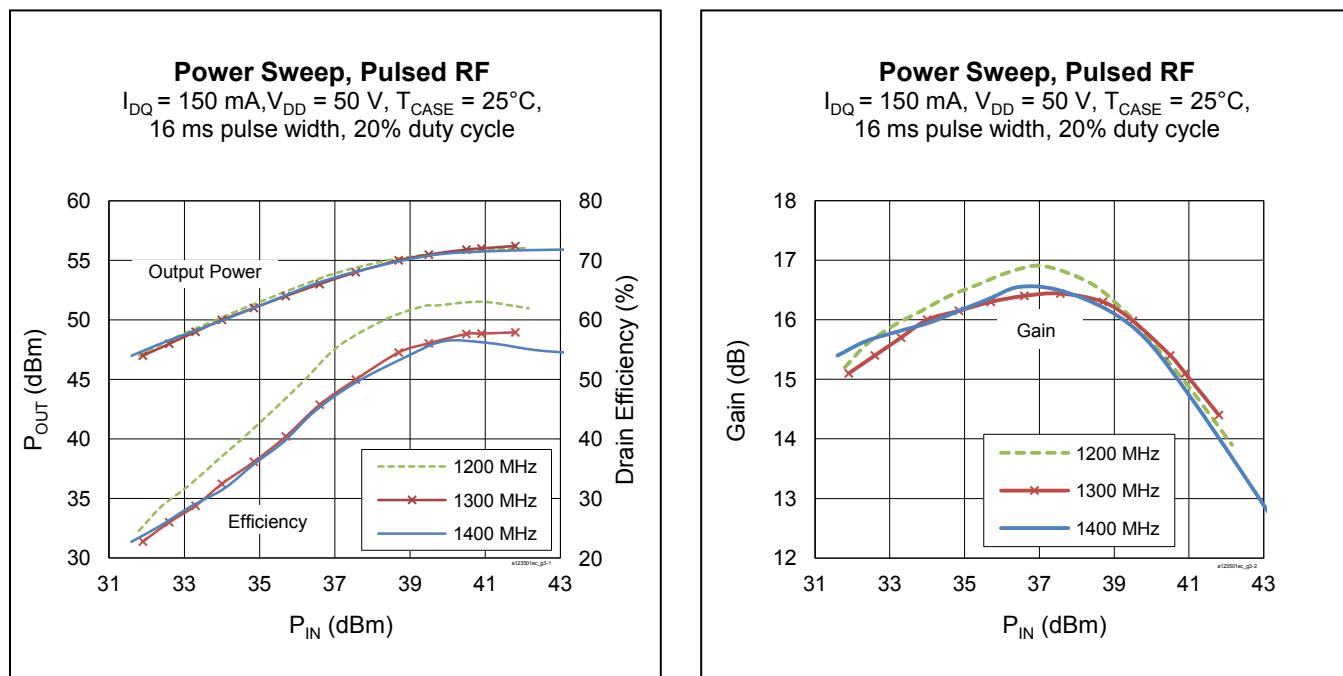
## Ordering Information

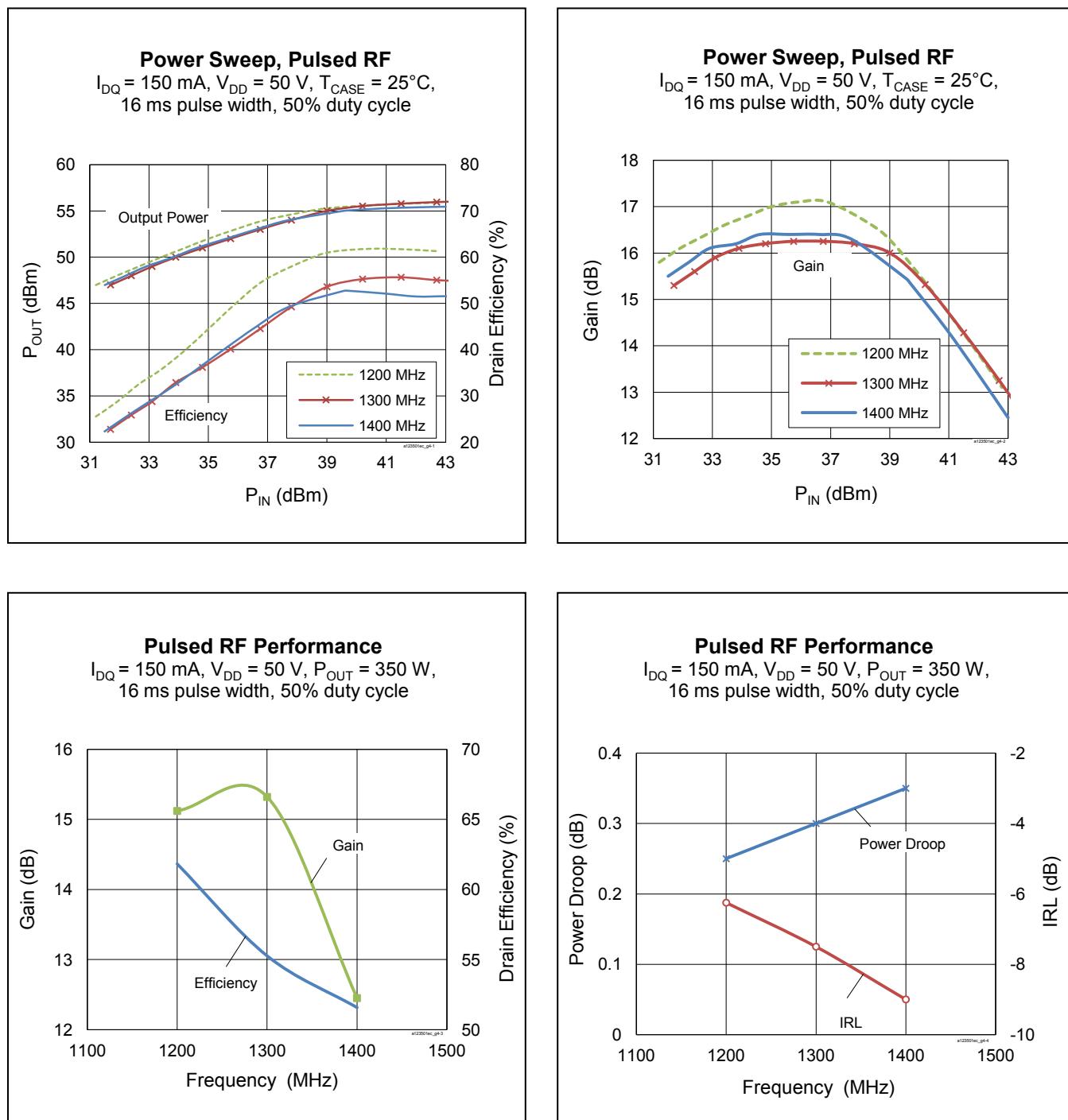
Type and Version	Order Code	Package Description	Shipping
PTVA123501EC V2 R0	PTVA123501EC-V2-R0	H-36248-2, bolt-down	Tape & Reel, 50 pcs
PTVA123501EC V2 R250	PTVA123501EC-V2-R250	H-36248-2, bolt-down	Tape & Reel, 250 pcs
PTVA123501FC V1 R0	PTVA123501FC-V1-R0	H-37248-2, earless	Tape & Reel, 50 pcs
PTVA123501FC V1 R250	PTVA123501FC-V1-R250	H-37248-2, earless	Tape & Reel, 250 pcs

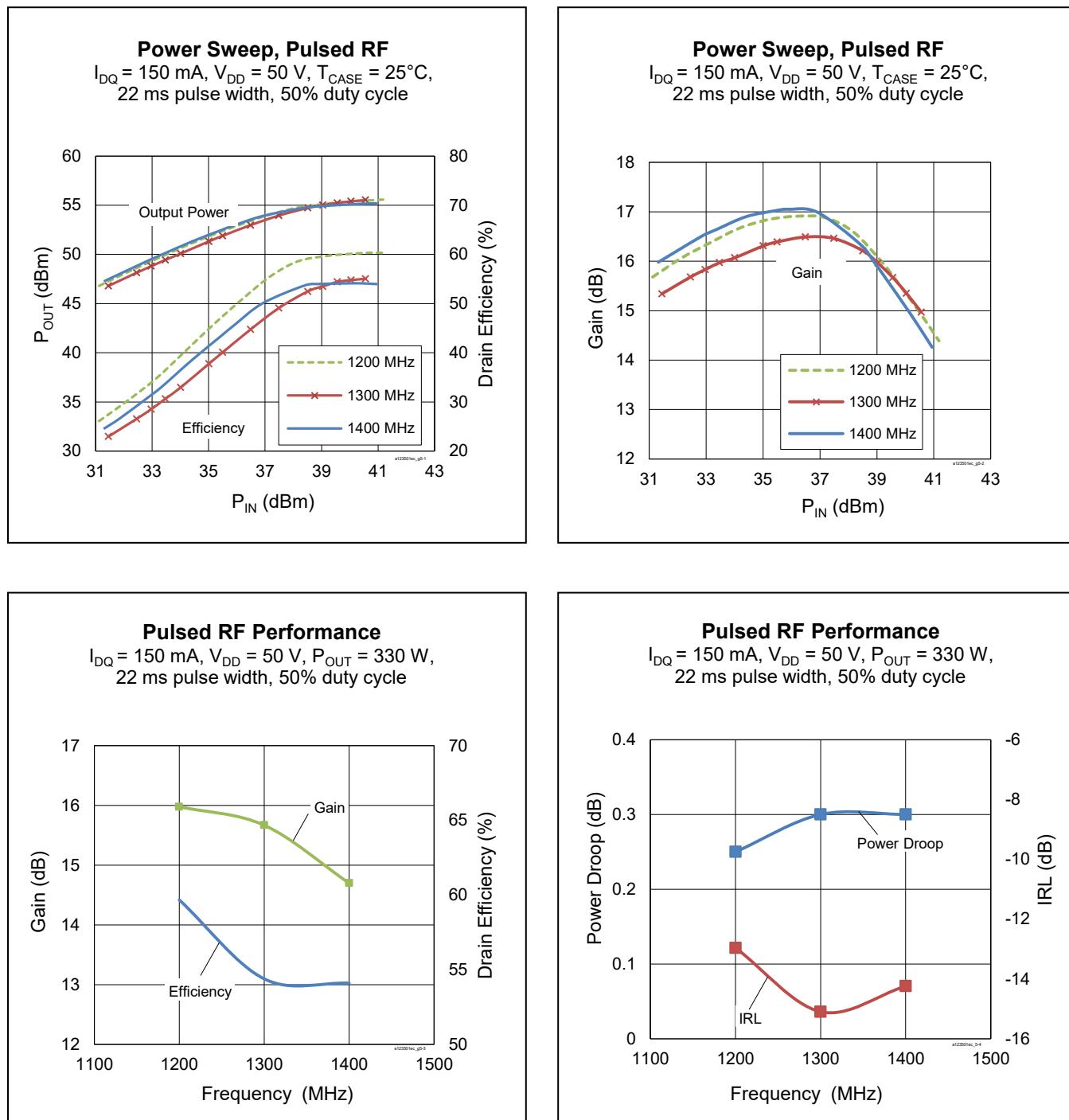
See next page for Typical RF Performance

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

**Typical RF Performance** (cont.)

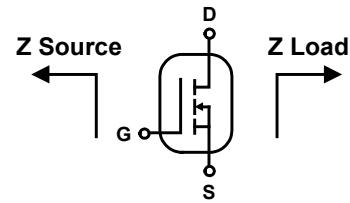
**Typical RF Performance (cont.)**

**Typical RF Performance (cont.)**

**Typical RF Performance (cont.)**

**Broadband Circuit Impedance**

Freq [MHz]	Z Source $\Omega$		Z Load $\Omega$	
	R	jX	R	jX
1200	1.25	-1.99	1.96	-2.23
1300	1.54	-1.52	1.59	-2.03
1400	1.66	-1.58	1.26	-1.75

**Load Pull Performance**

**Load Pull at Max P<sub>OUT</sub> Point** – 16  $\mu$ s pulse width, 10% duty cycle, class AB, V<sub>DD</sub> = 50 V, 150 mA

Freq [MHz]	Z <sub>I</sub> [ $\Omega$ ]	P <sub>IN</sub> [dBm]	P <sub>OUT</sub> [dBm]	P <sub>OUT</sub> [W]	P <sub>G</sub> [dB]	PAE Eff [%]	Z <sub>OUT</sub> [ $\Omega$ ]
1200	1.91 – j2.04	41.40	56.40	436.52	15	53.80	1.30 – j2.03
1300	2.72 – j3.13	42.24	56.54	450.82	14.30	54.48	1.25 – j1.94
1400	4.83 – j1.46	41.66	56.31	427.56	14.65	53.27	1.03 – j1.94

**Load Pull at Max G<sub>T</sub> Point** – 16  $\mu$ s pulse width, 10% duty cycle, class AB, V<sub>DD</sub> = 50 V, 150 mA

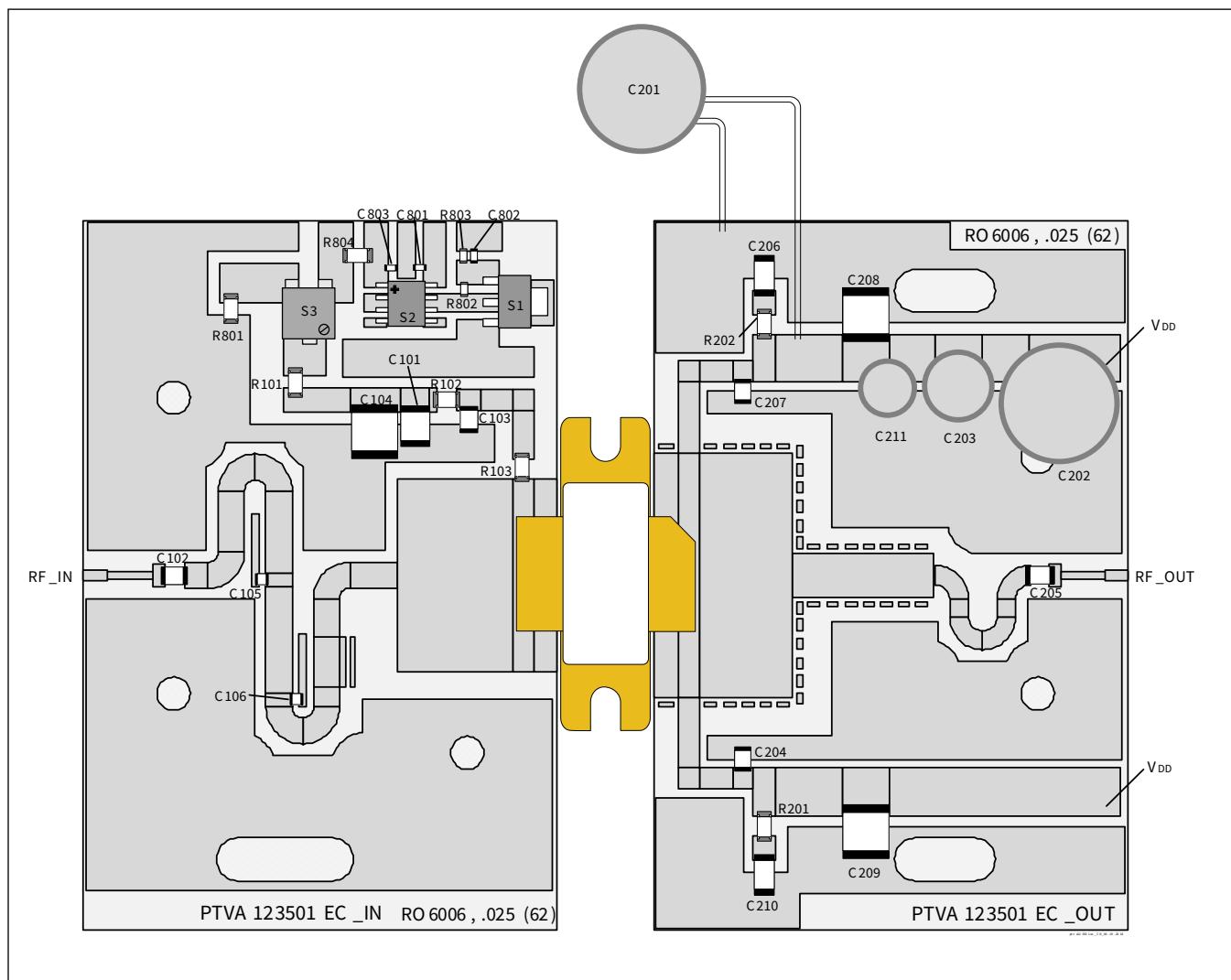
Freq [MHz]	Z <sub>I</sub> [ $\Omega$ ]	P <sub>IN</sub> [dBm]	P <sub>OUT</sub> [dBm]	P <sub>OUT</sub> [W]	P <sub>G</sub> [dB]	PAE Eff [%]	Z <sub>OUT</sub> [ $\Omega$ ]
1200	1.91 – j2.04	38.10	54.72	296.48	16.62	57.89	3.03 – j3.11
1300	2.72 – j3.13	38.84	54.83	304.09	15.99	62.54	3.22 – j1.63
1400	4.83 – j1.46	37.21	53.42	219.79	16.21	57.25	2.30 – j0.09

**Load Pull at Max Efficiency Point** – 16  $\mu$ s pulse width, 10% duty cycle, class AB, V<sub>DD</sub> = 50 V, 150 mA

Freq [MHz]	Z <sub>I</sub> [ $\Omega$ ]	P <sub>IN</sub> [dBm]	P <sub>OUT</sub> [dBm]	P <sub>OUT</sub> [W]	P <sub>G</sub> [dB]	PAE Eff [%]	Z <sub>OUT</sub> [ $\Omega$ ]
1200	1.91 – j2.04	39.60	55.80	380.19	16.20	60.71	2.22 – j2.43
1300	2.72 – j3.13	39.44	55.23	333.43	15.79	63.71	2.81 – j1.90
1400	4.83 – j1.46	39.39	55.19	330.37	15.80	62.26	2.40 – j1.45

**Z Optimum** – 16  $\mu$ s pulse width, 10% duty cycle, class AB, V<sub>DD</sub> = 50 V, 150 mA

Freq [MHz]	Z <sub>I</sub> [ $\Omega$ ]	P <sub>IN</sub> [dBm]	P <sub>OUT</sub> [dBm]	P <sub>OUT</sub> [W]	P <sub>G</sub> [dB]	PAE Eff [%]	Z <sub>OUT</sub> [ $\Omega$ ]
1200	1.91 – j2.04	39.18	55.58	361.41	16.4	60.5	2.41 – j2.50
1300	2.72 – j3.13	39.50	55.30	338.84	15.8	62.6	2.73 – j1.51
1400	4.83 – j1.46	40	55.60	363.08	15.6	60.7	1.86 – j1.37

**Reference Circuit**

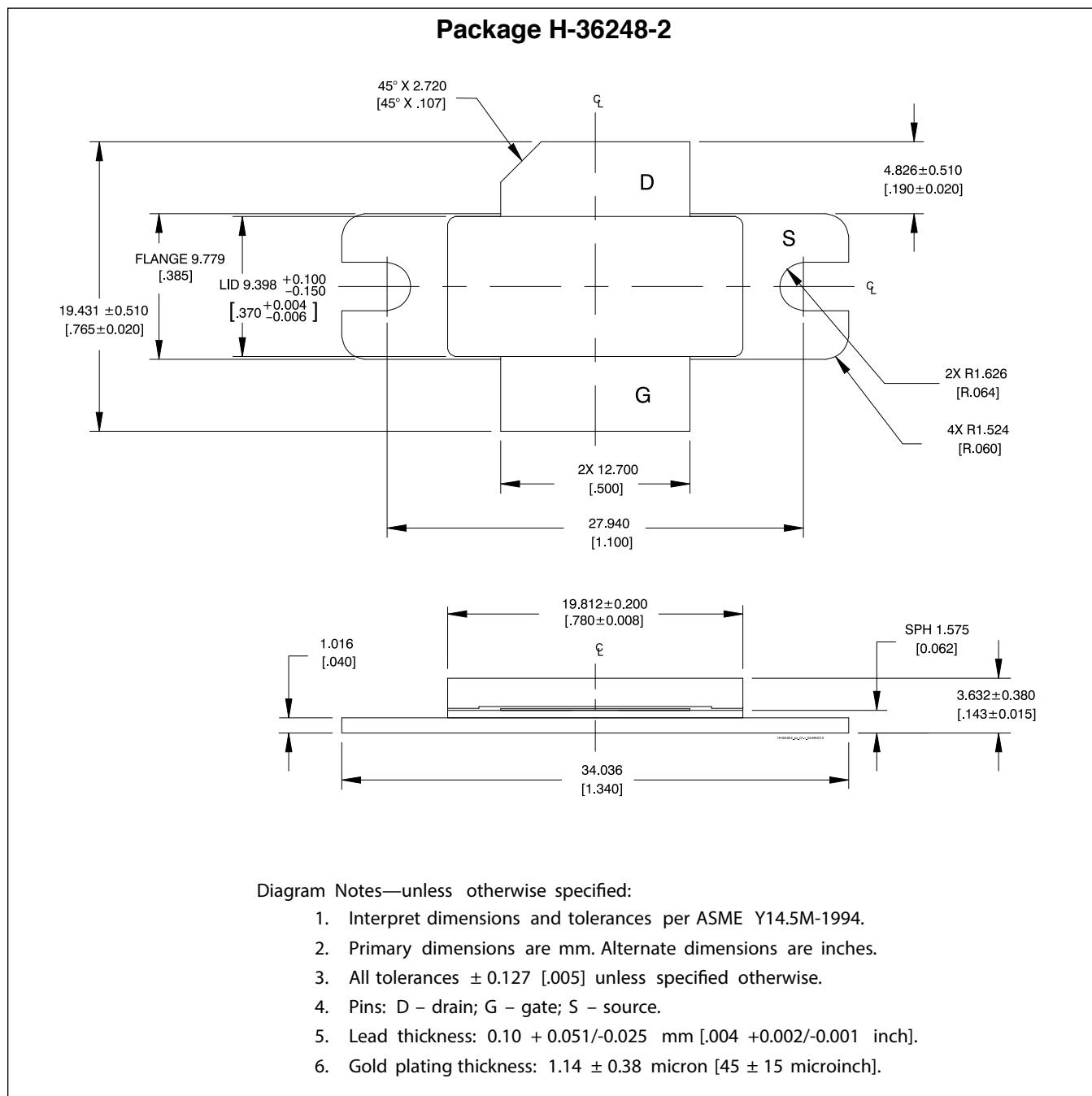
Reference circuit assembly diagram (not to scale)\*

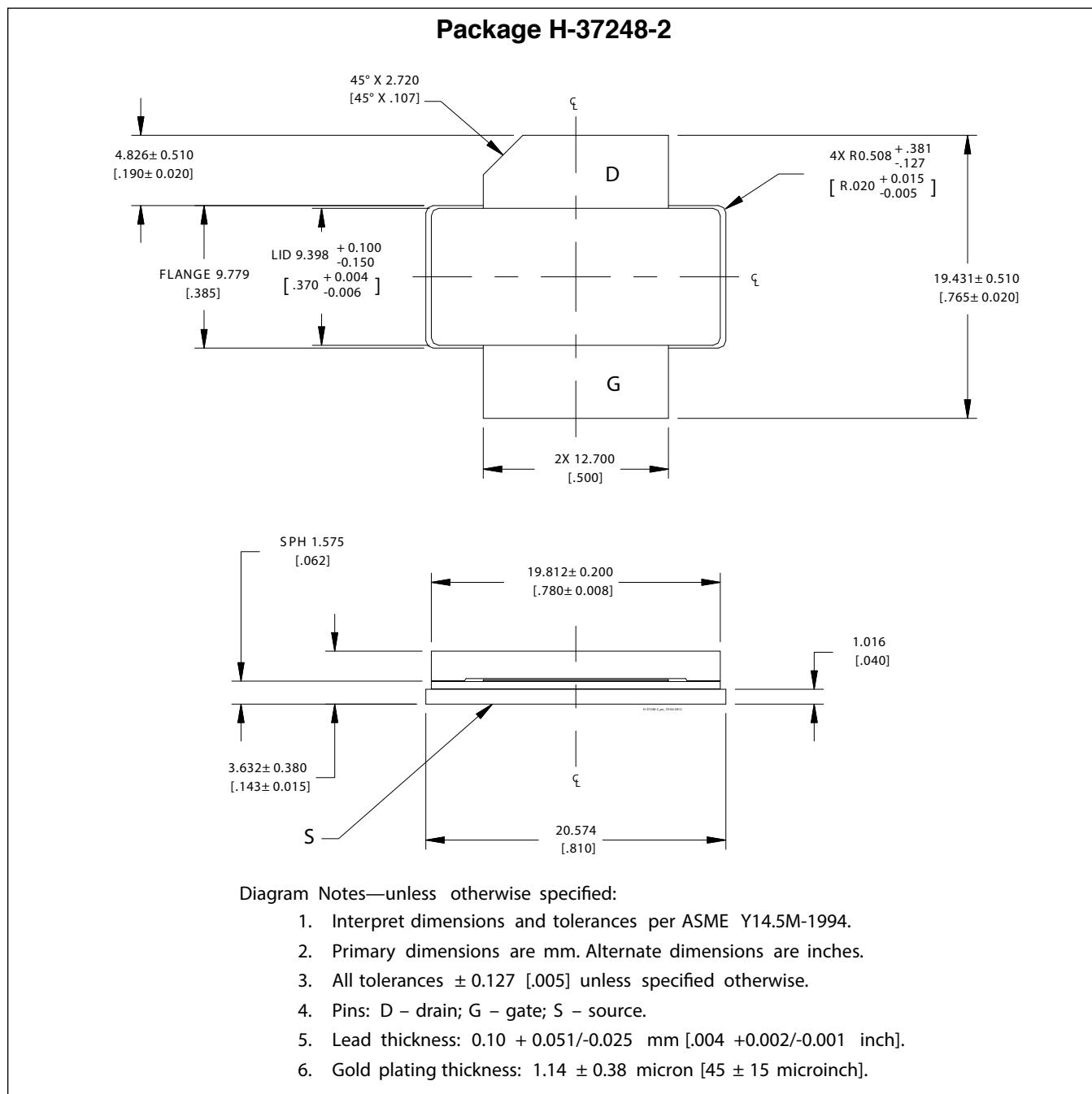
**Reference Circuit (cont.)****Reference Circuit Assembly**

DUT	PTVA123501EC or PTVA123501FC
Test Fixture Part No.	LTN/PTVA123501EC V2 or LTN/PTVA123501FC V1
PCB	Rogers 6006, 0.635 mm [0.025"] thick, 2 oz. copper, $\epsilon_r = 6.15$

**Components Information**

Component	Description	Suggested Manufacturer	P/N
<b>Input</b>			
C101	Capacitor, 1 $\mu$ F	TDK Corporation	C4532X7R2A105M230KA
C102, C103	Capacitor, 39 pF	ATC	ATC100B390KW500XB
C104	Capacitor, 10 $\mu$ F	TDK Corporation	C5750X5R1H106K230KA
C105	Capacitor, 3 pF	ATC	ATC100A3R0CW150XB
C106	Capacitor, 0.5 pF	ATC	ATC100A0R5CW150XB
C801, C802, C803	Capacitor, 1000 pF	Panasonic Electronic Components	ECJ-1VB1H102K
R101	Resistor, 1000 $\Omega$	Panasonic Electronic Components	ERJ-8GEYJ102V
R102	Resistor, 5600 $\Omega$	Panasonic Electronic Components	ERJ-8GEYJ562V
R103, R804	Resistor, 10 $\Omega$	Panasonic Electronic Components	ERJ-8GEYJ100V
R801	Resistor, 2000 $\Omega$	Panasonic Electronic Components	ERJ-8GEYJ202V
R802	Resistor, 1200 $\Omega$	Panasonic Electronic Components	ERJ-3GEYJ122V
R803	Resistor, 1300 $\Omega$	Panasonic Electronic Components	ERJ-3GEYJ132V
S1	Transistor	Infineon Technologies	BCP56
S2	Voltage Regulator	Texas Instruments	LM7805
S3	Potentiometer, 2k $\Omega$	Bourns Inc.	3224W-1-202E
<b>Output</b>			
C201	Capacitor, 6800 $\mu$ F	Panasonic Electronic Components	ECO-S2AP682EA
C202	Capacitor, 100 $\mu$ F	Cornell Dubilier Electronics (CDE)	SK101M100ST
C203	Capacitor, 22 $\mu$ F	Cornell Dubilier Electronics (CDE)	SEK220M100ST
C204, C205, C207	Capacitor, 39 pF	ATC	ATC100B390KW500XB
C206, C210	Capacitor, 1 $\mu$ F	TDK Corporation	C4532X7R2A105M230KA
C208, C209	Capacitor, 10 $\mu$ F	TDK Corporation	C5750X5R1H106K230KA
C211	Capacitor, 10 $\mu$ F	Panasonic Electronic Components	EEV-HD1H100P
R201, R202	Resistor, 5600 $\Omega$	Panasonic Electronic Components	ERJ-8GEYJ562V

**Package Outline Specifications**

**Package Outline Specifications (cont.)**

## Revision History

Revision	Date	Data Sheet Type	Page	Subjects (major changes since last revision)
01	2012-06-05	Preliminary	All	Data Sheet reflects preliminary specification
02	2013-03-06	Production	All	Data Sheet reflects released product specification
03	2013-07-11	Production	All 1, 9, 12	Updated to include FC version Revised Pulsed RF performance table, Minor cosmetic changes only, Added package outline
04	2014-04-29	Production	All, 1	Revised product from V1 to V2, Revised target RF Charateristics table
04.1	2014-06-26	Production	All 3	Corrected FC version to V1 throughout Corrected package to H-36248-2 and H-37248-2 in ordering table
05	2015-07-07	Production	8	Added typical performance at 22ms, 50% pulse
05.1	2016-04-26	Production	1, 3	Added ESD rating, updated ordering information
05.2	2016-02-07	Production	2	Updated operating voltage and junction temperature
06	2018-06-19	Production	All	Converted to the Data Sheet

## Notes & Disclaimer

---

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.