

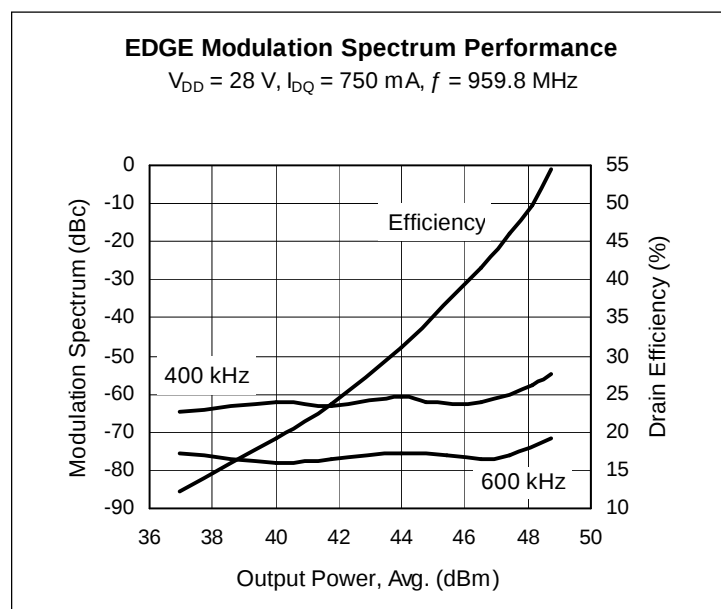
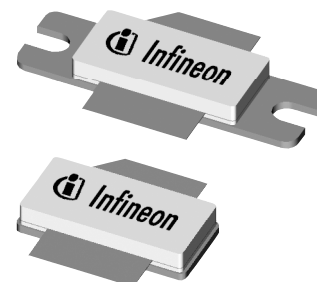
## Thermally-Enhanced High Power RF LDMOS FETs 120 W, 920 – 960 MHz

### Description

The PTFA091201E and PTFA091201F are 120-watt LDMOS FETs designed for ultra-linear GSM/EDGE power amplifier applications in the 920 to 960 MHz band. Features include input and output matching, and thermally-enhanced packages with slotted or earless flanges. Manufactured with Infineon's advanced LDMOS process, these devices provide excellent thermal performance and superior reliability.

PTFA091201E  
Package H-36248-2

PTFA091201F  
Package H-37248-2



### Features

- Thermally-enhanced packages
- Broadband internal matching
- Typical EDGE performance
  - Average output power = 50 W
  - Gain = 19.0 dB
  - Efficiency = 44%
- Typical CW performance
  - Output power at P-1dB = 135 W
  - Gain = 18.0 dB
  - Efficiency = 64%
- Integrated ESD protection: Human Body Model, Class 2 (minimum)
- Pb-free and RoHS compliant
- Excellent thermal stability, low HCI drift
- Capable of handling 10:1 VSWR @ 28 V, 120 W (CW) output power

### RF Characteristics

**EDGE Measurements** (not subject to production test—verified by design/characterization in Infineon test fixture)

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $P_{OUT} = 50\text{ W}$ ,  $f = 959.8\text{ MHz}$

| Characteristic                | Symbol    | Min | Typ | Max | Unit |
|-------------------------------|-----------|-----|-----|-----|------|
| Error Vector Magnitude        | EVM (RMS) | —   | 2.5 | —   | %    |
| Modulation Spectrum @ 400 kHz | ACPR      | —   | -62 | —   | dBc  |
| Modulation Spectrum @ 600 kHz | ACPR      | —   | -74 | —   | dBc  |
| Gain                          | $G_{ps}$  | —   | 19  | —   | dB   |
| Drain Efficiency              | $\eta_D$  | —   | 44  | —   | %    |

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

**ESD:** Electrostatic discharge sensitive device—observe handling precautions!

## RF Characteristics (cont.)

### Two-tone Measurements (tested in Infineon test fixture)

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $P_{OUT} = 110\text{ W PEP}$ ,  $f = 960\text{ MHz}$ , tone spacing = 1 MHz

| Characteristic             | Symbol   | Min | Typ | Max | Unit |
|----------------------------|----------|-----|-----|-----|------|
| Gain                       | $G_{ps}$ | 18  | 19  | —   | dB   |
| Drain Efficiency           | $\eta_D$ | 45  | 48  | —   | %    |
| Intermodulation Distortion | IMD      | —   | -31 | -28 | dBc  |

## DC Characteristics

| Characteristic                 | Conditions                                        | Symbol        | Min | Typ  | Max  | Unit          |
|--------------------------------|---------------------------------------------------|---------------|-----|------|------|---------------|
| Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$ , $I_{DS} = 10\text{ mA}$   | $V_{(BR)DSS}$ | 65  | —    | —    | V             |
| Drain Leakage Current          | $V_{DS} = 28\text{ V}$ , $V_{GS} = 0\text{ V}$    | $I_{DSS}$     | —   | —    | 1.0  | $\mu\text{A}$ |
|                                | $V_{DS} = 63\text{ V}$ , $V_{GS} = 0\text{ V}$    | $I_{DSS}$     | —   | —    | 10.0 | $\mu\text{A}$ |
| On-State Resistance            | $V_{GS} = 10\text{ V}$ , $V_{DS} = 0.1\text{ V}$  | $R_{DS(on)}$  | —   | 0.07 | —    | $\Omega$      |
| Operating Gate Voltage         | $V_{DS} = 28\text{ V}$ , $I_{DQ} = 750\text{ mA}$ | $V_{GS}$      | 2.0 | 2.5  | 3.0  | V             |
| Gate Leakage Current           | $V_{GS} = 10\text{ V}$ , $V_{DS} = 0\text{ V}$    | $I_{GSS}$     | —   | —    | 1.0  | $\mu\text{A}$ |

## Maximum Ratings

| Parameter                                                         | Symbol          | Value       | Unit                  |
|-------------------------------------------------------------------|-----------------|-------------|-----------------------|
| Drain-Source Voltage                                              | $V_{DSS}$       | 65          | V                     |
| Gate-Source Voltage                                               | $V_{GS}$        | -0.5 to +12 | V                     |
| Junction Temperature                                              | $T_J$           | 200         | $^{\circ}\text{C}$    |
| Total Device Dissipation<br>Above 25 $^{\circ}\text{C}$ derate by | $P_D$           | 427         | W                     |
|                                                                   |                 | 2.44        | W/ $^{\circ}\text{C}$ |
| Storage Temperature Range                                         | $T_{STG}$       | -40 to +150 | $^{\circ}\text{C}$    |
| Thermal Resistance ( $T_{CASE} = 70^{\circ}\text{C}$ , 120 W CW)  | $R_{\theta JC}$ | 0.41        | $^{\circ}\text{C/W}$  |

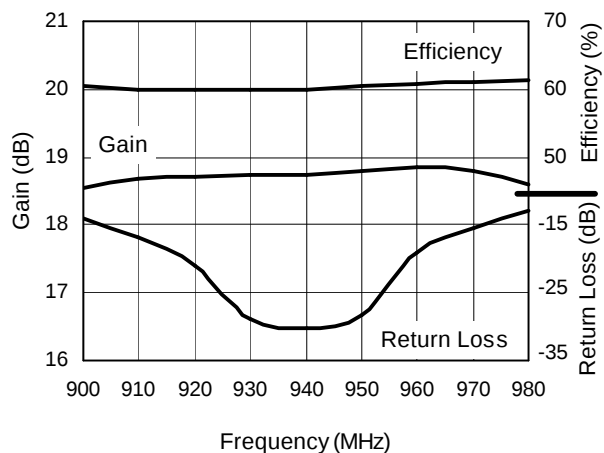
## Ordering Information

| Type and Version    | Order Code             | Package Description       | Shipping             |
|---------------------|------------------------|---------------------------|----------------------|
| PTFA091201E V4 R0   | PTFA091201EV4R0XTMA1   | H-36248-2, bolt-down      | Tape & Reel, 50 pcs  |
| PTFA091201E V4 R250 | PTFA091201EV4R250XTMA1 | H-36248-2, bolt-down      | Tape & Reel, 250 pcs |
| PTFA091201F V4 R0   | PTFA091201FV4R0XTMA1   | H-37248-2, earless flange | Tape & Reel, 50 pcs  |
| PTFA091201F V4 R250 | PTFA091201FV4R250XTMA1 | H-37248-2, earless flange | Tape & Reel, 250 pcs |

## Typical Performance (data taken in a production test fixture)

### CW Sweep in a Broadband Test Fixture

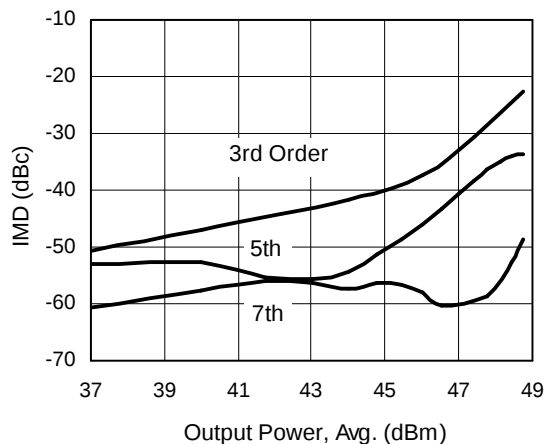
$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $P_{OUT} = 50.79\text{ dBm}$



### Intermodulation Distortion vs. Output Power

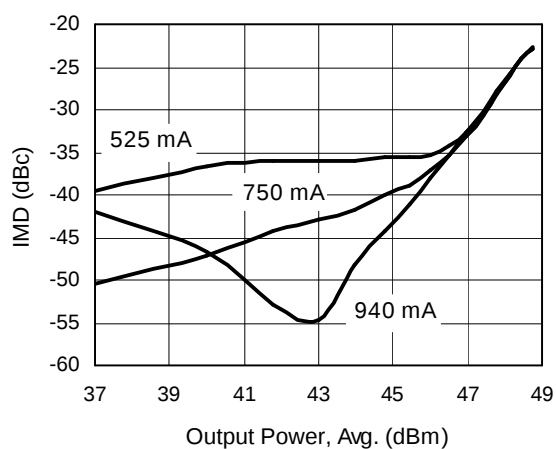
(as measured in a broadband circuit)

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $f_1 = 959\text{ MHz}$ ,  $f_2 = 960\text{ MHz}$



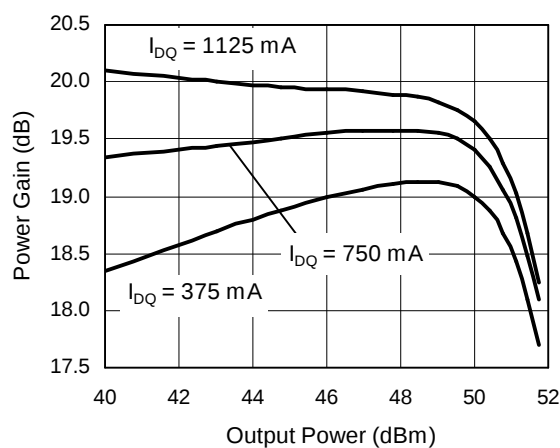
### IM3 vs. Output Power at Selected Biases

$V_{DD} = 28\text{ V}$ ,  $f_1 = 959\text{ MHz}$ ,  $f_2 = 960\text{ MHz}$ ,  
series show  $I_{DQ}$



### Power Sweep

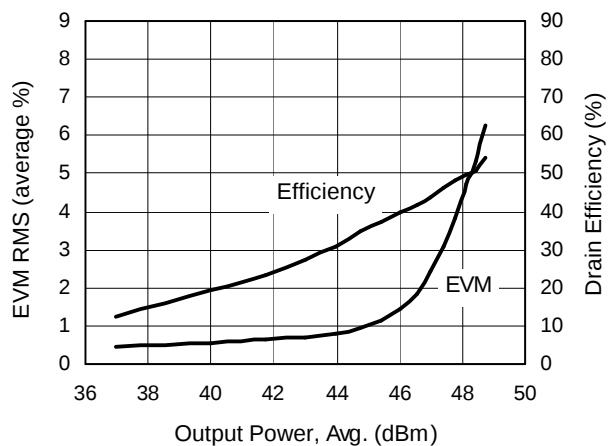
$V_{DD} = 28\text{ V}$ ,  $f = 960\text{ MHz}$



## Typical Performance (cont.)

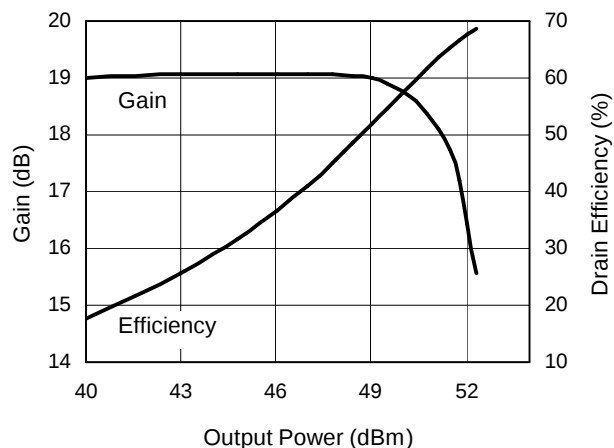
### EDGE EVM Performance

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $f = 959.8\text{ MHz}$



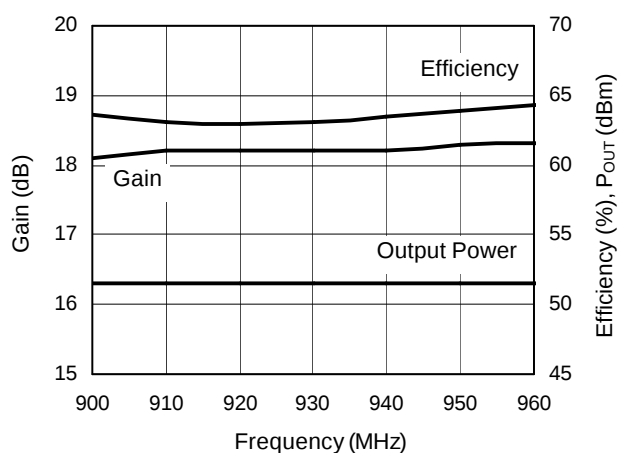
### Gain & Efficiency vs. Output Power

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $f = 960\text{ MHz}$



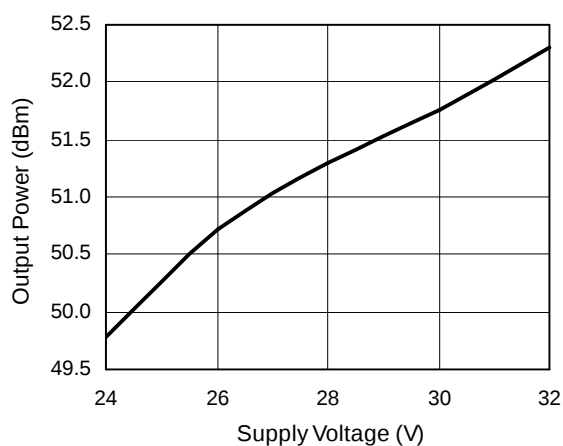
### Frequency Sweep at P-1dB

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$

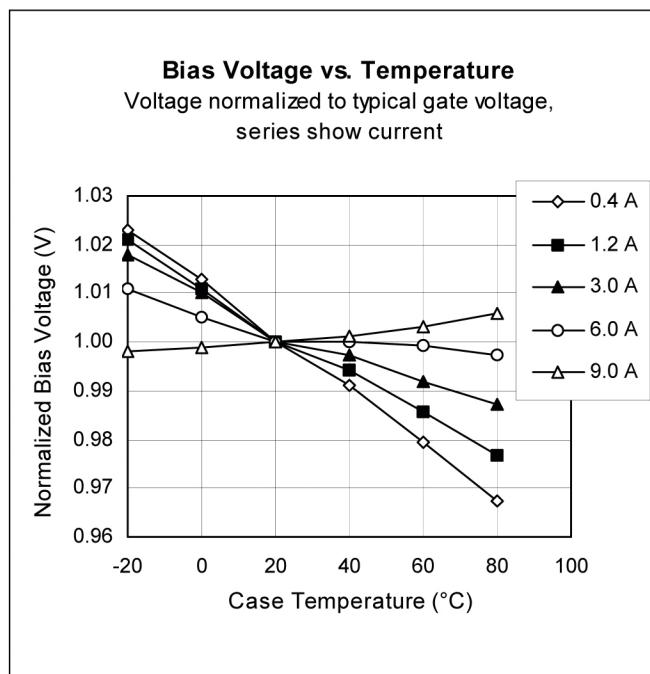
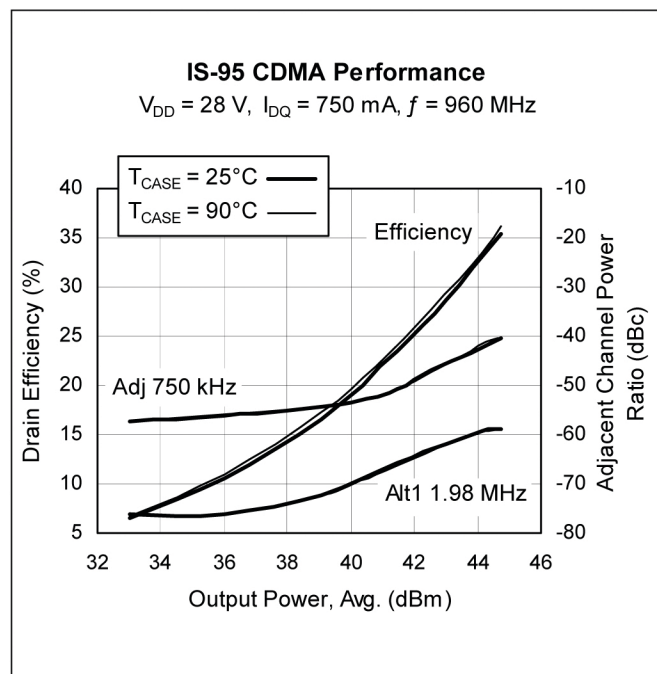


### Output Power (P-1 dB) vs. Supply Voltage

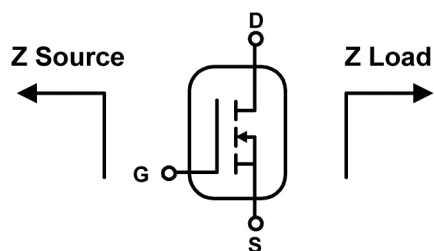
$I_{DQ} = 750\text{ mA}$ ,  $f = 960\text{ MHz}$



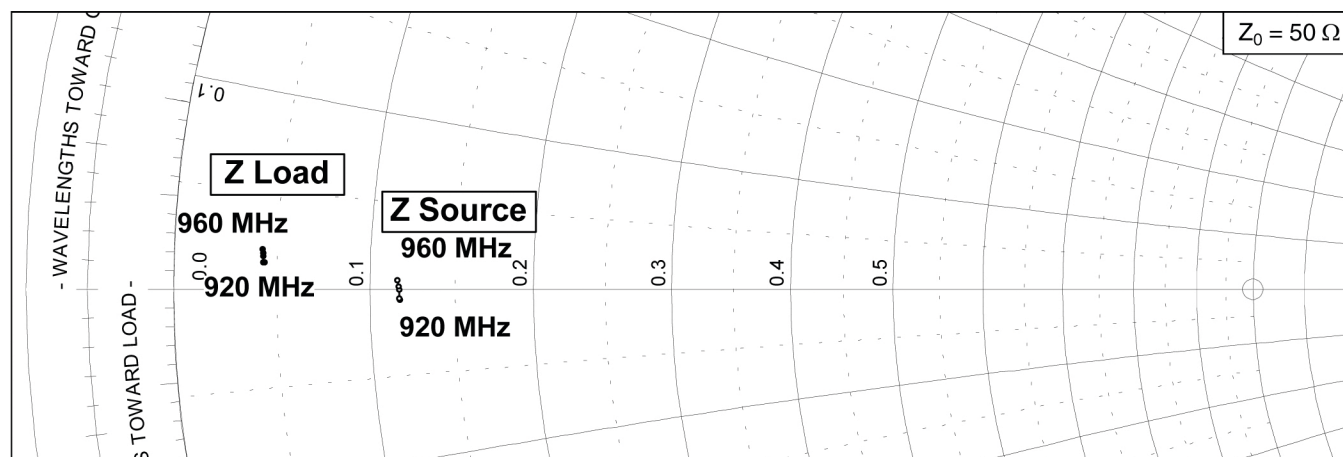
## Typical Performance (cont.)



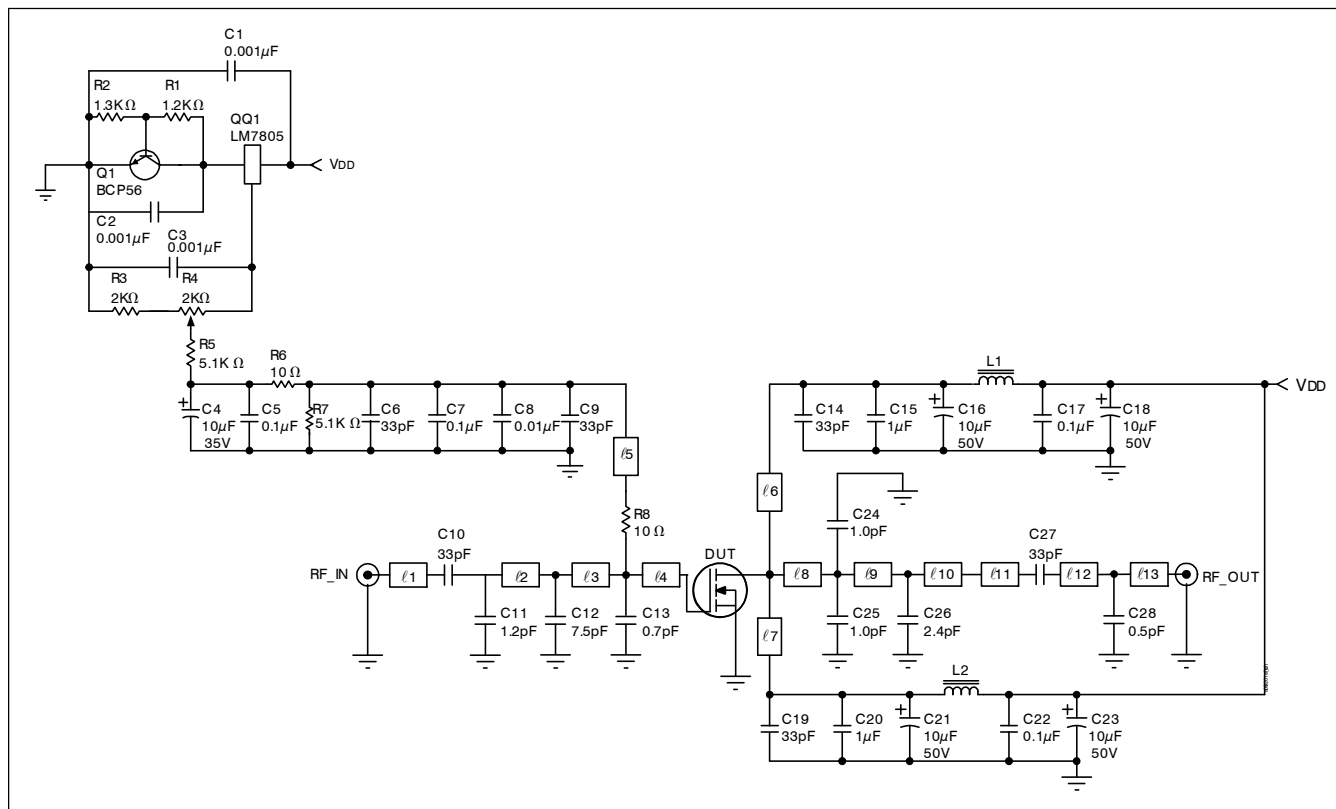
## Broadband Circuit Impedance



| Frequency<br>MHz | Z Source $\Omega$ |       | Z Load $\Omega$ |      |
|------------------|-------------------|-------|-----------------|------|
|                  | R                 | jX    | R               | jX   |
| 920              | 5.86              | -0.32 | 2.20            | 0.69 |
| 930              | 5.84              | -0.27 | 2.17            | 0.69 |
| 940              | 5.85              | -0.02 | 2.16            | 0.85 |
| 950              | 5.82              | 0.10  | 2.15            | 0.92 |
| 960              | 5.79              | 0.27  | 2.13            | 1.02 |



## Reference Circuit



Reference circuit schematic for  $f = 960 \text{ MHz}$

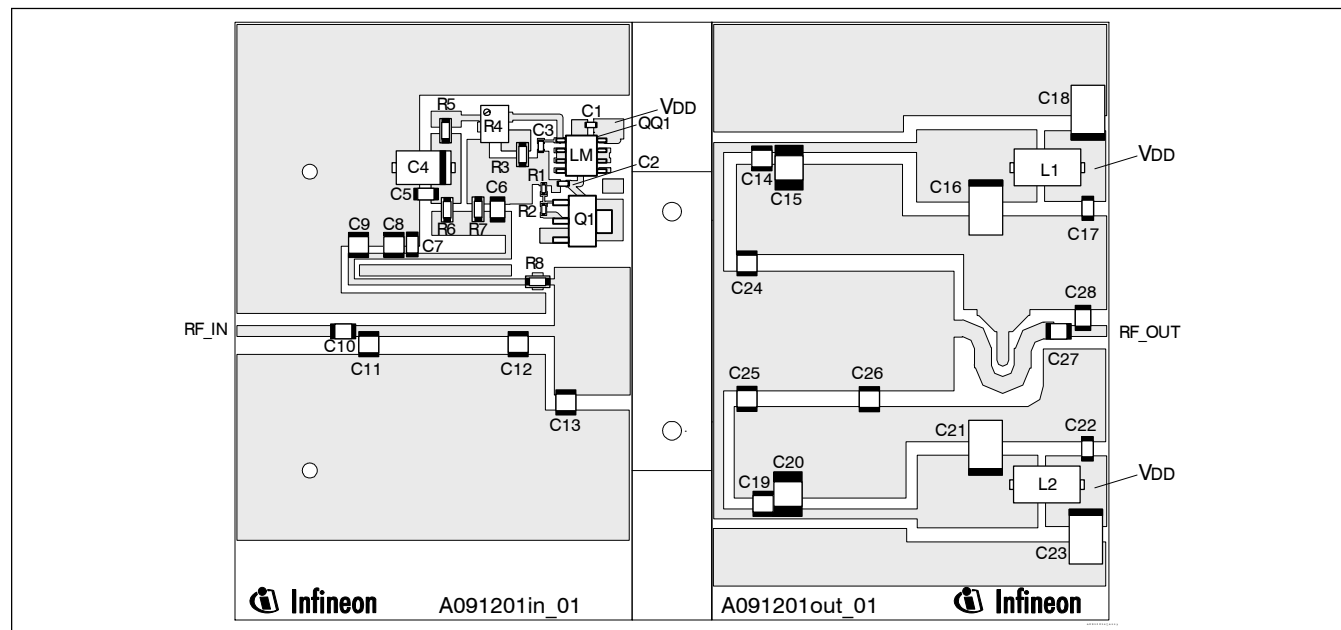
### Circuit Assembly Information

|     |                                           |                  |              |
|-----|-------------------------------------------|------------------|--------------|
| DUT | PTFA091201E or PTFA091201F                | LDMOS Transistor |              |
| PCB | 0.76 mm [.030"] thick, $\epsilon_r = 4.5$ | Rogers TMM4      | 2 oz. copper |

| Microstrip       | Electrical Characteristics at 960 MHz <sup>1</sup> | Dimensions: L x W ( mm ) | Dimensions: L x W ( in. ) |
|------------------|----------------------------------------------------|--------------------------|---------------------------|
| $\ell_1$         | $0.072 \lambda$ , 50.0 $\Omega$                    | 12.27 x 1.40             | 0.483 x 0.055             |
| $\ell_2$         | $0.115 \lambda$ , 50.0 $\Omega$                    | 19.53 x 1.40             | 0.769 x 0.055             |
| $\ell_3$         | $0.029 \lambda$ , 50.0 $\Omega$                    | 5.08 x 1.40              | 0.200 x 0.055             |
| $\ell_4$         | $0.062 \lambda$ , 7.5 $\Omega$                     | 9.53 x 16.15             | 0.375 x 0.636             |
| $\ell_5$         | $0.149 \lambda$ , 70.0 $\Omega$                    | 26.31 x 0.71             | 1.036 x 0.028             |
| $\ell_6, \ell_7$ | $0.122 \lambda$ , 55.0 $\Omega$                    | 20.96 x 1.17             | 0.825 x 0.046             |
| $\ell_8$         | $0.027 \lambda$ , 7.9 $\Omega$                     | 4.06 x 15.24             | 0.160 x 0.600             |
| $\ell_9$         | $0.103 \lambda$ , 7.9 $\Omega$                     | 15.75 x 15.24            | 0.620 x 0.600             |
| $\ell_{10}$      | $0.072 \lambda$ , 7.9 $\Omega$                     | 11.02 x 15.24            | 0.434 x 0.600             |
| $\ell_{11}$      | $0.155 \lambda$ , 38.0 $\Omega$                    | 25.78 x 2.13             | 1.015 x 0.084             |
| $\ell_{12}$      | $0.013 \lambda$ , 50.0 $\Omega$                    | 2.24 x 1.40              | 0.088 x 0.055             |
| $\ell_{13}$      | $0.015 \lambda$ , 50.0 $\Omega$                    | 2.59 x 1.40              | 0.102 x 0.055             |

<sup>1</sup>Electrical characteristics are rounded.

## Reference Circuit (cont.)

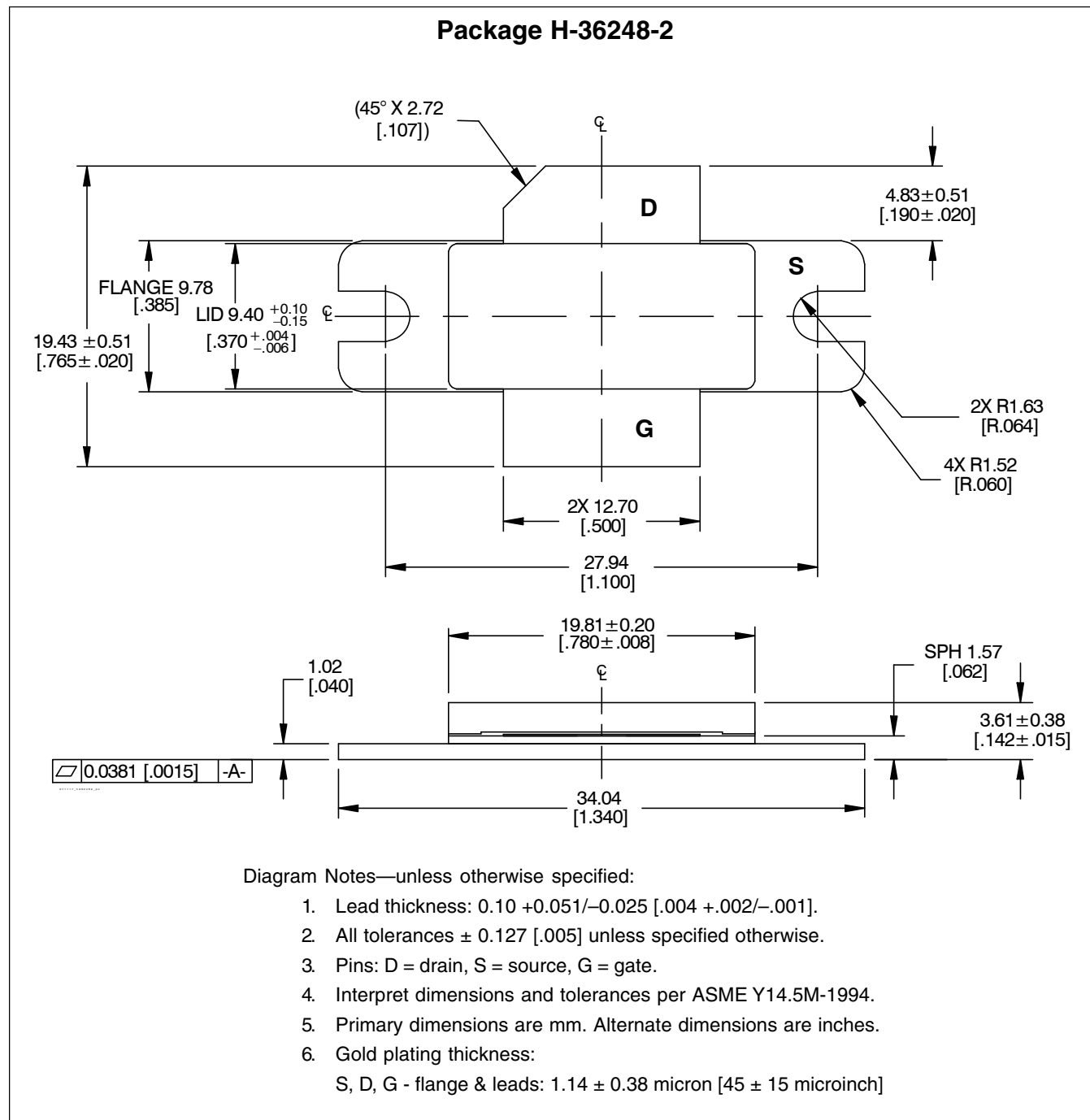


Reference circuit assembly diagram (not to scale)\*

| Component                  | Description                          | Suggested Manufacturer | P/N or Comment    |
|----------------------------|--------------------------------------|------------------------|-------------------|
| C1, C2, C3                 | Capacitor, 0.001 $\mu$ F             | Digi-Key               | PCC1772CT-ND      |
| C4                         | Tantalum capacitor, 10 $\mu$ F, 35 V | Digi-Key               | 399-1655-2-ND     |
| C5, C7, C17, C22           | Capacitor, 0.1 $\mu$ F               | Digi-Key               | PCC104BCT-ND      |
| C6, C9, C10, C14, C19, C27 | Ceramic capacitor, 33 pF             | ATC                    | 100B 330          |
| C8                         | Capacitor, 0.01 $\mu$ F              | ATC                    | 200B 103          |
| C11                        | Ceramic capacitor, 1.2 pF            | ATC                    | 100B 1R2          |
| C12                        | Ceramic capacitor, 7.5 pF            | ATC                    | 100B 7R5          |
| C13                        | Ceramic capacitor, 0.7 pF            | ATC                    | 100B 0R7          |
| C15, C20                   | Capacitor, 1.0 $\mu$ F               | ATC                    | 920C105           |
| C16, C18, C21, C23         | Tantalum capacitor, 10 $\mu$ F, 50 V | Garrett Electronics    | TPSE106K050R0400  |
| C24, C25                   | Ceramic capacitor, 1.0 pF            | ATC                    | 100B 1R0          |
| C26                        | Ceramic capacitor, 2.4 pF            | ATC                    | 100B 2R4          |
| C28                        | Ceramic capacitor, 0.5 pF            | ATC                    | 100B 0R5          |
| L1, L2                     | Ferrite, 8.9 mm                      | Elna Magnetics         | BDS 4.6/3/8.9-4S2 |
| Q1                         | Transistor                           | Infineon Technologies  | BCP56             |
| QQ1                        | Voltage regulator                    | National Semiconductor | LM7805            |
| R1                         | Chip Resistor 1.2 k-ohms             | Digi-Key               | P1.2KGCT-ND       |
| R2                         | Chip Resistor 1.3 k-ohms             | Digi-Key               | P1.3KGCT-ND       |
| R3                         | Chip Resistor 2 k-ohms               | Digi-Key               | P2KECT-ND         |
| R4                         | Potentiometer 2 k-ohms               | Digi-Key               | 3224W-202ETR-ND   |
| R5, R7                     | Chip Resistor 5.1 k-ohms             | Digi-Key               | P5.1KECT-ND       |
| R6, R8                     | Chip Resistor 10 ohms                | Digi-Key               | P10ECT-ND         |

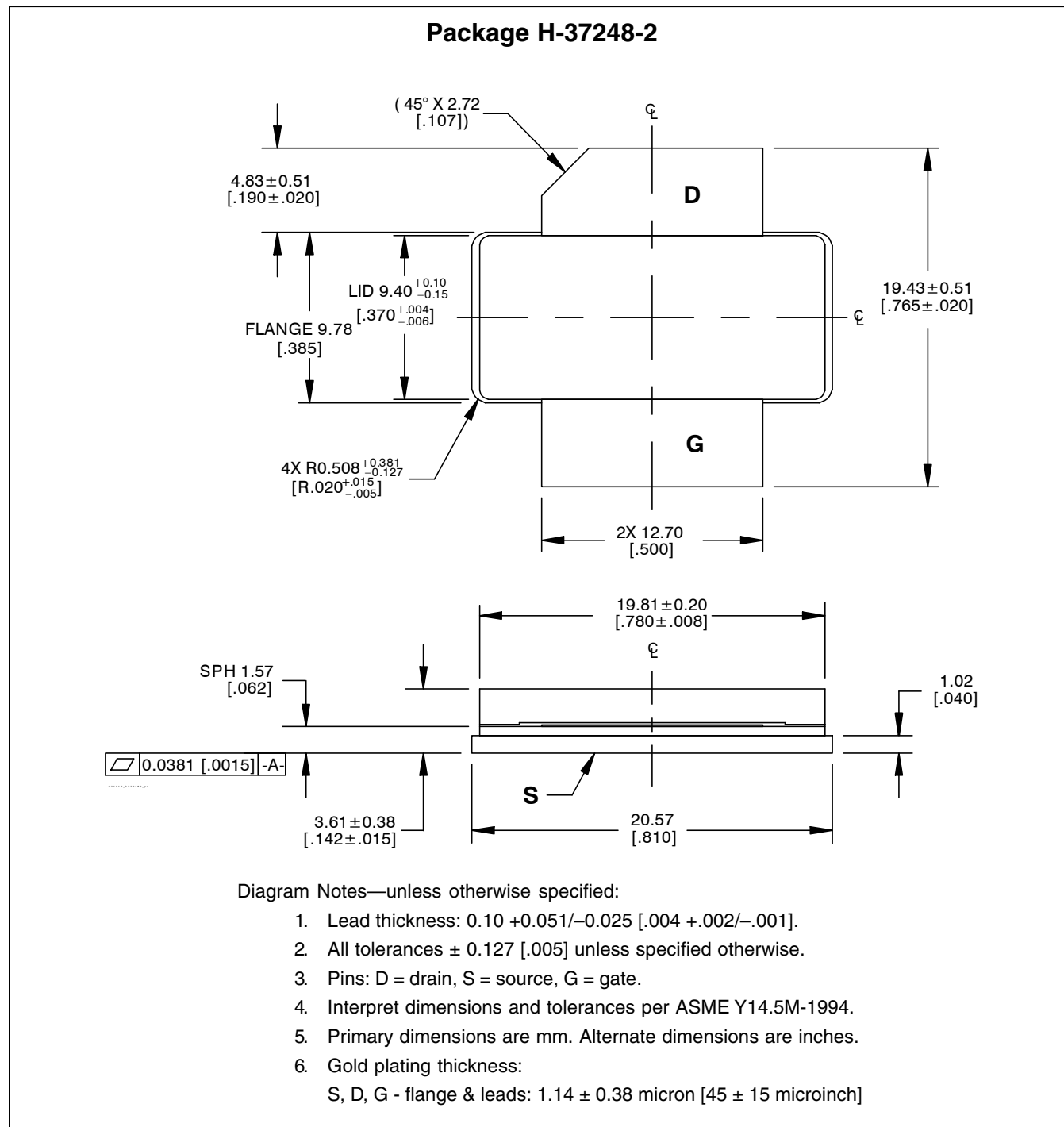
\*Gerber Files for this circuit available on request

## Package Outline Specifications



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## Package Outline Specifications (cont.)



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**Revision History: 2016-06-21**

Data Sheet

Previous Version: 2007-11-19, Data Sheet

| Page | Subjects (major changes since last revision) |
|------|----------------------------------------------|
| 2    | Update ordering information.                 |
|      |                                              |
|      |                                              |
|      |                                              |
|      |                                              |

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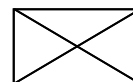
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**Edition 2007-11-19**

**Published by**

**Infineon Technologies AG**

**81726 München, Germany**

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