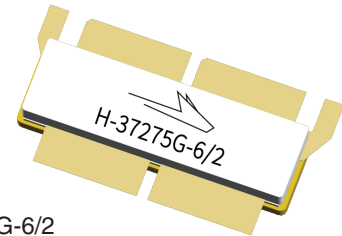


# PXAD214218FV

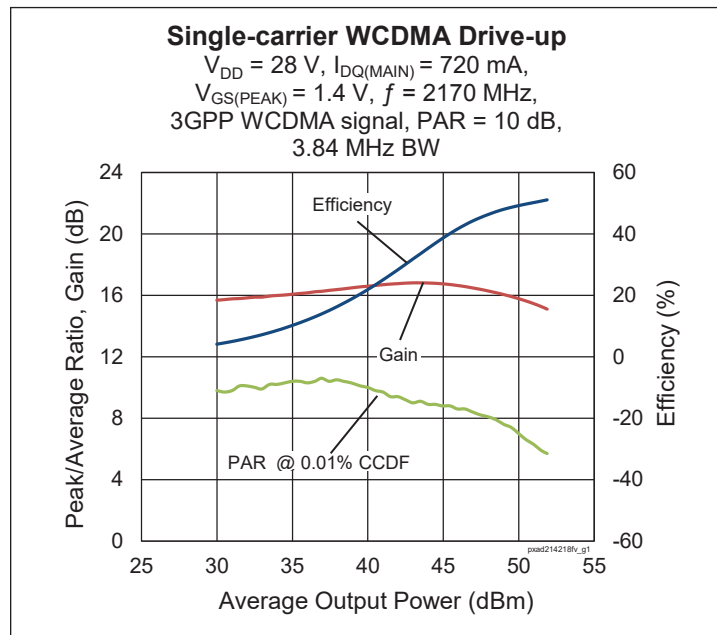
## Thermally-Enhanced High Power RF LDMOS FET 430 W, 28 V, 2110 – 2170 MHz

### Description

The PXAD214218FV is a 430-watt ( $P_{3dB}$ ) LDMOS FET with an asymmetrical design intended for use in multi-standard cellular power amplifier applications in the 2110 to 2170 MHz frequency band. Features include dual-path design, 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.



PXAD214218FV  
Package H-37275G-6/2



### Features

- Broadband internal input and output matching
- Asymmetrical Doherty design
  - Main :  $P_{1dB} = 130\text{ W Typ}$
  - Peak :  $P_{1dB} = 290\text{ W Typ}$
- Typical Pulsed CW performance, 2140 MHz, 28 V, Doherty configuration
  - Output power at  $P_{3dB} = 436\text{ W}$
  - Efficiency = 55%
  - Gain = 13.5 dB
- Capable of handling 10:1 VSWR @28 V, 110 W (WCDMA) output power
- Integrated ESD protection
- Human Body Model class 2 (per ANSI/ESDA/ JEDEC JS-001)
- Low thermal resistance
- Pb-free and RoHS compliant

### RF Characteristics

#### Two-carrier WCDMA Specifications (tested in Wolfspeed Doherty production test fixture)

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 720\text{ mA}$ ,  $V_{GS(PEAK)} = 1.5\text{ V}$ ,  $P_{OUT} = 56\text{ W avg}$ ,  $f = 2170\text{ MHz}$ , 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

| Characteristic               | Symbol   | Min | Typ   | Max | Unit |
|------------------------------|----------|-----|-------|-----|------|
| Linear Gain                  | $G_{ps}$ | 15  | 16    | —   | dB   |
| Drain Efficiency             | $\eta_D$ | 45  | 48.7  | —   | %    |
| Adjacent Channel Power Ratio | ACPR     | —   | -24.5 | -22 | dBc  |
| Output PAR@0.01% CCDF        | OPAR     | 6.1 | 7.4   | —   | dBc  |

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 | $V_{GS} = 0\text{ V}, I_{DS} = 10\text{ mA}$         | $V_{(BR)DSS}$ | 65  | —    | —   | V             |
| Drain Leakage Current          | $V_{DS} = 28\text{ V}, V_{GS} = 0\text{ V}$          | $I_{DSS}$     | —   | —    | 1   | $\mu\text{A}$ |
|                                | $V_{DS} = 63\text{ V}, V_{GS} = 0\text{ V}$          | $I_{DSS}$     | —   | —    | 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)     | $V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$        | $R_{DS(on)}$  | —   | 0.09 | —   | $\Omega$      |
|                                | (Peak) $V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$ | $R_{DS(on)}$  | —   | 0.05 | —   | $\Omega$      |
| Operating Gate Voltage (Main)  | $V_{DS} = 28\text{ V}, I_{DQ} = 720\text{ mA}$       | $V_{GS}$      | 2.3 | 2.7  | 2.9 | V             |
|                                | (Peak) $V_{DS} = 28\text{ V}, I_{DQ} = 0\text{ mA}$  | $V_{GS}$      | —   | 1.4  | —   | V             |

**Maximum Ratings**

| Parameter                 | Symbol    | Value       | Unit               |
|---------------------------|-----------|-------------|--------------------|
| Drain-Source Voltage      | $V_{DSS}$ | 65          | V                  |
| Gate-Source Voltage       | $V_{GS}$  | -6 to +10   | V                  |
| Junction Temperature      | $T_J$     | 225         | $^{\circ}\text{C}$ |
| Storage Temperature Range | $T_{STG}$ | -65 to +150 | $^{\circ}\text{C}$ |

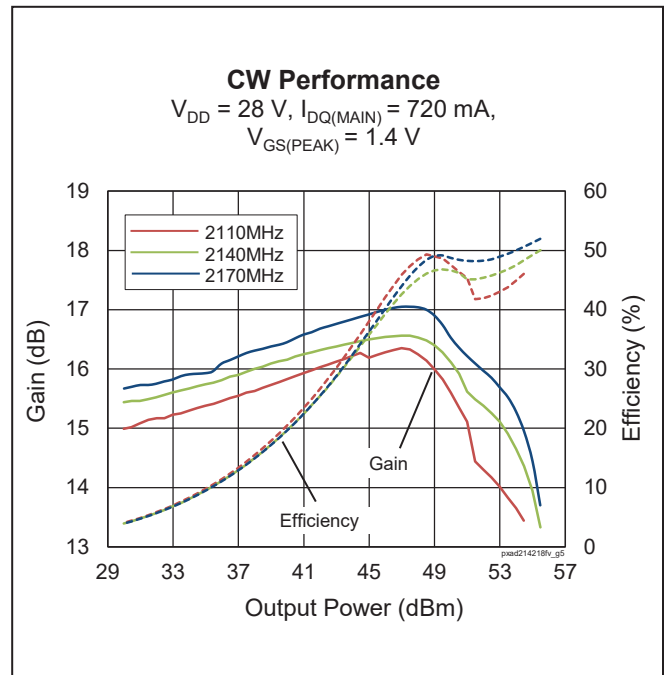
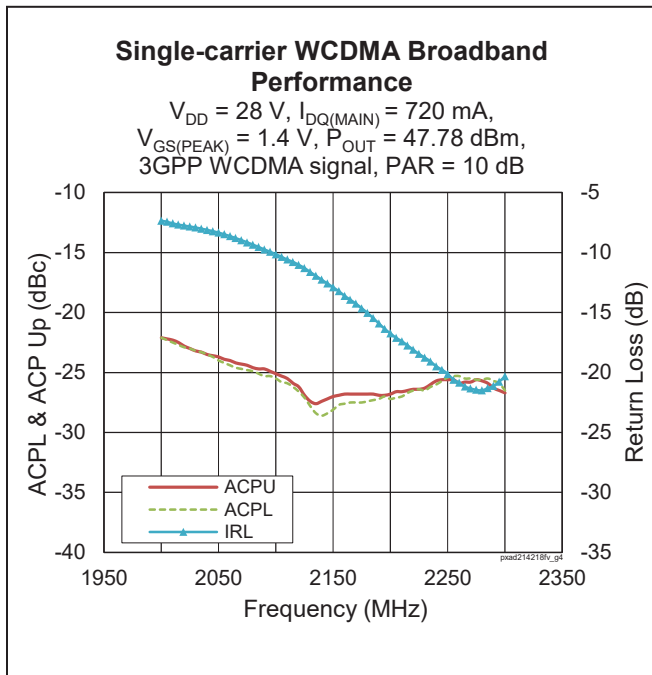
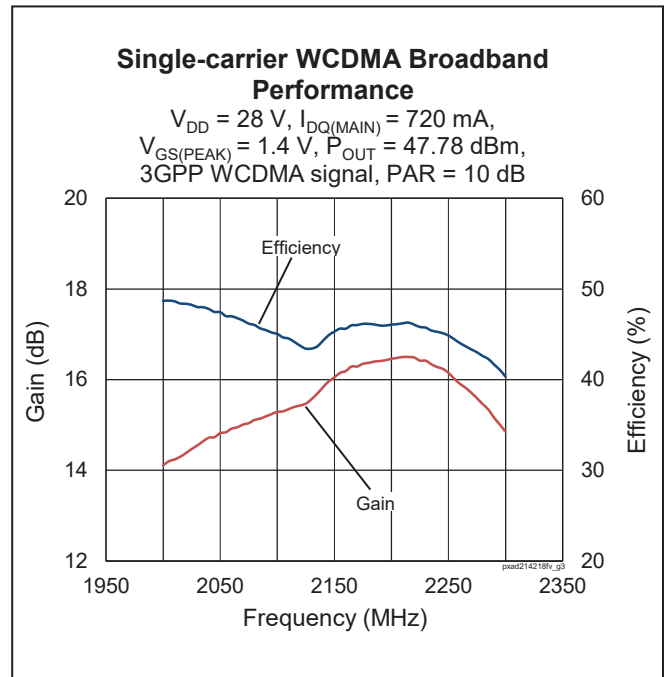
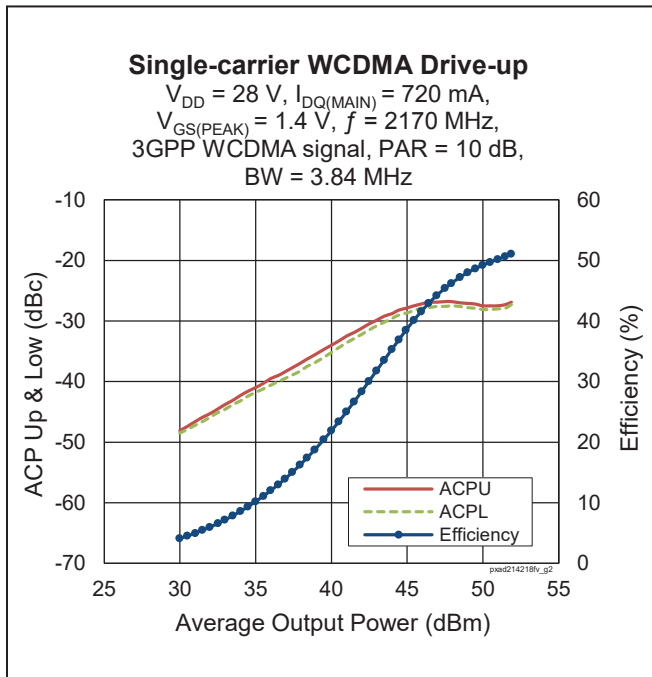
**Thermal Characteristics**

| Parameter  | Symbol          | Value | Unit                 |
|--|-----------------|-------|----------------------|
| Thermal Resistance (Main, $T_{CASE} = 70^{\circ}\text{C}$ , 60 W CW) | $R_{\theta JC}$ | 0.44  | $^{\circ}\text{C/W}$ |
| (Peak, $T_{CASE} = 70^{\circ}\text{C}$ , 280 W CW)                   | $R_{\theta JC}$ | 0.246 | $^{\circ}\text{C/W}$ |

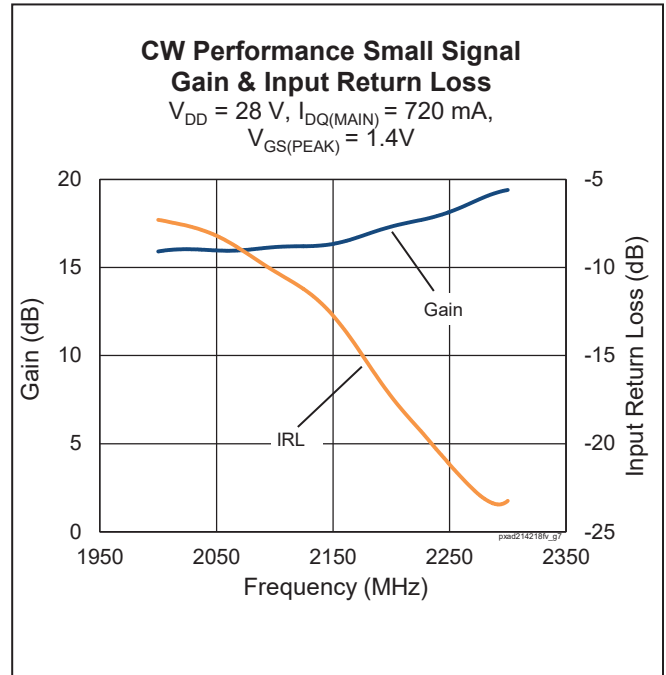
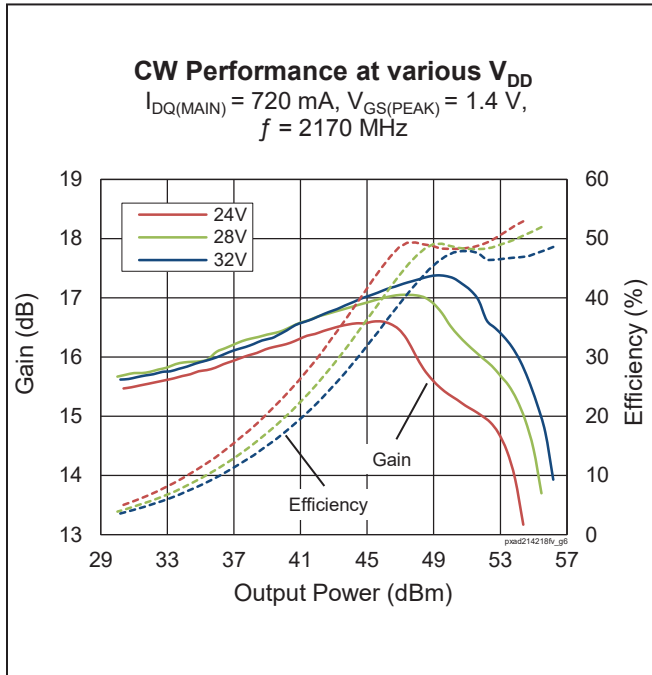
**Ordering Information**

| Type and Version   | Order Code         | Package Description | Shipping             |
|--------------------|--------------------|---------------------|----------------------|
| PXAD214218FV V1 R0 | PXAD214218FV-V1-R0 | H-37275G-6/2,       | Tape & Reel, 50 pcs  |
| PXAD214218FV V1 R2 | PXAD214218FV-V1-R2 | H-37275G-6/2,       | Tape & Reel, 250 pcs |

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



Typical RF Performance (cont.)



## Load Pull Performance

**Main Side Load Pull Performance** – Pulsed CW signal: 10  $\mu$ s, 10% duty cycle,  $V_{DD} = 28$  V,  $I_{DQ} = 960$  mA, class AB

|            |                             | P <sub>1dB</sub>            |           |                        |                      |              |                             |           |                        |                      |              |
|------------|-----------------------------|-----------------------------|-----------|------------------------|----------------------|--------------|-----------------------------|-----------|------------------------|----------------------|--------------|
|            |                             | Max Output Power            |           |                        |                      |              | Max Drain Efficiency        |           |                        |                      |              |
| Freq [MHz] | Z <sub>s</sub> [ $\Omega$ ] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>1dB</sub> [dBm] | P <sub>1dB</sub> [W] | $\eta^D$ [%] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>1dB</sub> [dBm] | P <sub>1dB</sub> [W] | $\eta^D$ [%] |
| 2110       | 3.7 - j8.1                  | 1.4 - j3.7                  | 19.7      | 52.58                  | 181                  | 57.3         | 2.7 - j3.1                  | 21.7      | 51.21                  | 132                  | 65.8         |
| 2140       | 5.2 - j8.0                  | 1.5 - j3.8                  | 20.4      | 52.53                  | 179                  | 59.2         | 2.4 - j3.2                  | 22        | 51.40                  | 138                  | 65.5         |
| 2170       | 7.2 - j9.5                  | 1.4 - j3.8                  | 19.7      | 52.60                  | 182                  | 57.7         | 2.2 - j3.1                  | 21.5      | 51.43                  | 139                  | 65.1         |

|            |                             | P <sub>3dB</sub>            |           |                        |                      |              |                             |           |                        |                      |              |
|------------|-----------------------------|-----------------------------|-----------|------------------------|----------------------|--------------|-----------------------------|-----------|------------------------|----------------------|--------------|
|            |                             | Max Output Power            |           |                        |                      |              | Max Drain Efficiency        |           |                        |                      |              |
| Freq [MHz] | Z <sub>s</sub> [ $\Omega$ ] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>3dB</sub> [dBm] | P <sub>3dB</sub> [W] | $\eta^D$ [%] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>3dB</sub> [dBm] | P <sub>3dB</sub> [W] | $\eta^D$ [%] |
| 2110       | 3.7 - j8.1                  | 1.4 - j3.8                  | 17.6      | 53.26                  | 212                  | 58.4         | 2.7 - j3.0                  | 19.8      | 51.79                  | 151                  | 67.1         |
| 2140       | 5.2 - j8.0                  | 1.4 - j4.0                  | 17.8      | 53.22                  | 210                  | 56.7         | 2.6 - j3.0                  | 20.2      | 51.76                  | 150                  | 67.4         |
| 2170       | 7.2 - j9.5                  | 1.5 - j4.2                  | 17.7      | 53.28                  | 213                  | 59.4         | 2.5 - j2.8                  | 19.9      | 51.64                  | 146                  | 67.3         |

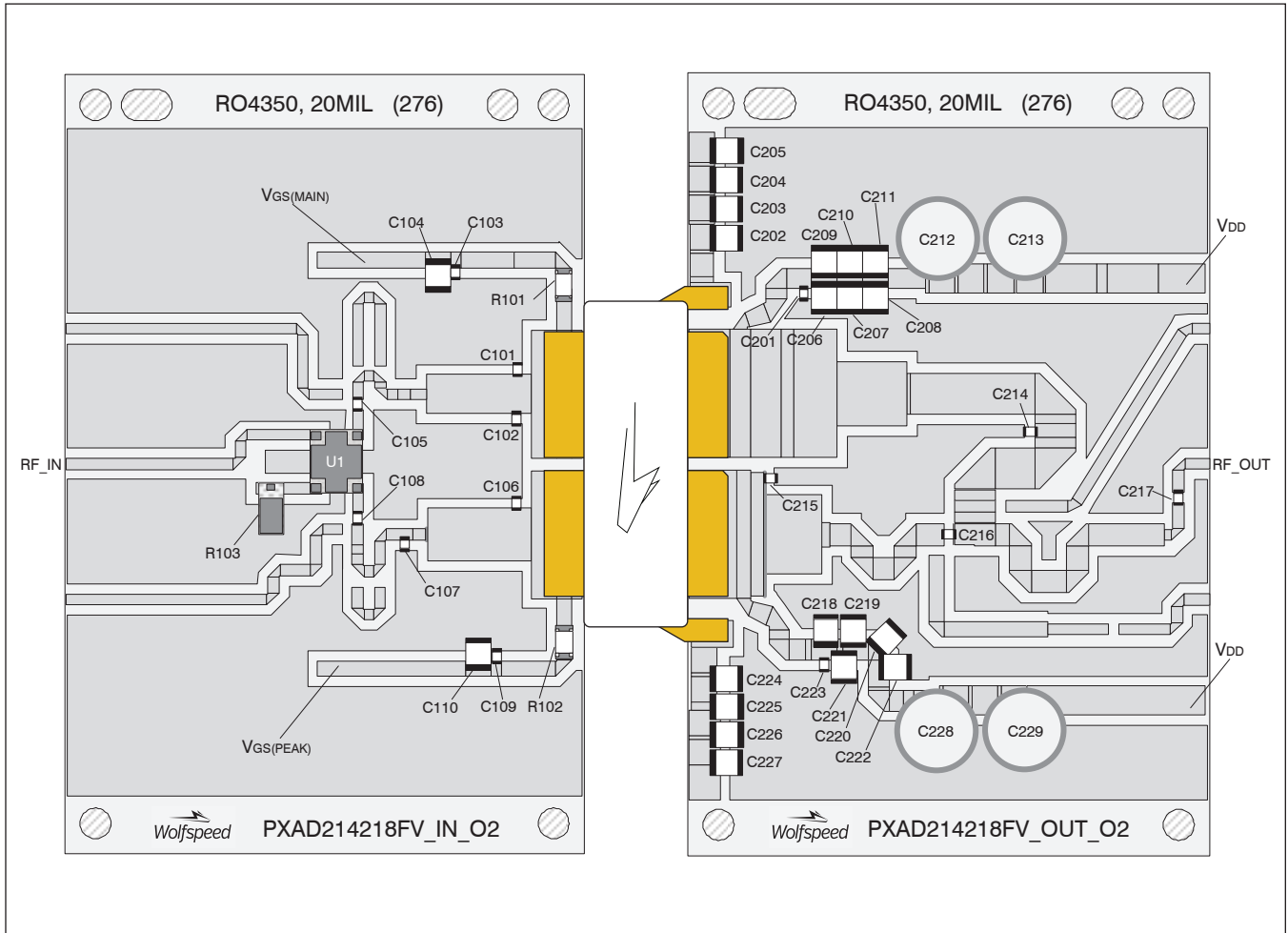
**Peak Side Load Pull Performance** – Pulsed CW signal: 10  $\mu$ s, 10% duty cycle,  $V_{DD} = 28$  V,  $I_{DQ} = 10$  mA, class B

|            |                             | P <sub>1dB</sub>            |           |                        |                      |              |                             |           |                        |                      |              |
|------------|-----------------------------|-----------------------------|-----------|------------------------|----------------------|--------------|-----------------------------|-----------|------------------------|----------------------|--------------|
|            |                             | Max Output Power            |           |                        |                      |              | Max Drain Efficiency        |           |                        |                      |              |
| Freq [MHz] | Z <sub>s</sub> [ $\Omega$ ] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>1dB</sub> [dBm] | P <sub>1dB</sub> [W] | $\eta^D$ [%] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>1dB</sub> [dBm] | P <sub>1dB</sub> [W] | $\eta^D$ [%] |
| 2110       | 3.0 - j6.2                  | 2.3 - j5.8                  | 16.2      | 55.39                  | 346                  | 54.0         | 3.4 - j3.3                  | 17.6      | 53.62                  | 230                  | 65.2         |
| 2140       | 4.0 - j6.1                  | 2.6 - j6.1                  | 16.6      | 55.43                  | 349                  | 55.1         | 3.0 - j3.3                  | 18        | 53.46                  | 222                  | 65.1         |
| 2170       | 5.0 - j5.3                  | 2.9 - j6.7                  | 16.2      | 55.33                  | 341                  | 52.8         | 3.1 - j3.0                  | 17.8      | 53.00                  | 200                  | 64.9         |

|            |                             | P <sub>3dB</sub>            |           |                        |                      |              |                             |           |                        |                      |              |
|------------|-----------------------------|-----------------------------|-----------|------------------------|----------------------|--------------|-----------------------------|-----------|------------------------|----------------------|--------------|
|            |                             | Max Output Power            |           |                        |                      |              | Max Drain Efficiency        |           |                        |                      |              |
| Freq [MHz] | Z <sub>s</sub> [ $\Omega$ ] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>3dB</sub> [dBm] | P <sub>3dB</sub> [W] | $\eta^D$ [%] | Z <sub>l</sub> [ $\Omega$ ] | Gain [dB] | P <sub>3dB</sub> [dBm] | P <sub>3dB</sub> [W] | $\eta^D$ [%] |
| 2110       | 3.0 - j6.2                  | 2.6 - j6.2                  | 14.1      | 56.13                  | 410                  | 56.1         | 3.2 - j3.7                  | 15.7      | 54.55                  | 285                  | 65.4         |
| 2140       | 4.0 - j6.1                  | 2.8 - j6.6                  | 14.2      | 56.13                  | 410                  | 55.3         | 3.4 - j3.9                  | 15.8      | 54.64                  | 291                  | 65.7         |
| 2170       | 5.0 - j5.3                  | 3.0 - j6.8                  | 14.1      | 56.03                  | 401                  | 54.7         | 3.2 - j4.0                  | 15.8      | 54.59                  | 288                  | 65.0         |



### Reference Circuit, 2110 – 2170 MHz



Reference circuit assembly diagram (not to scale)



**Reference Circuit** (cont.)

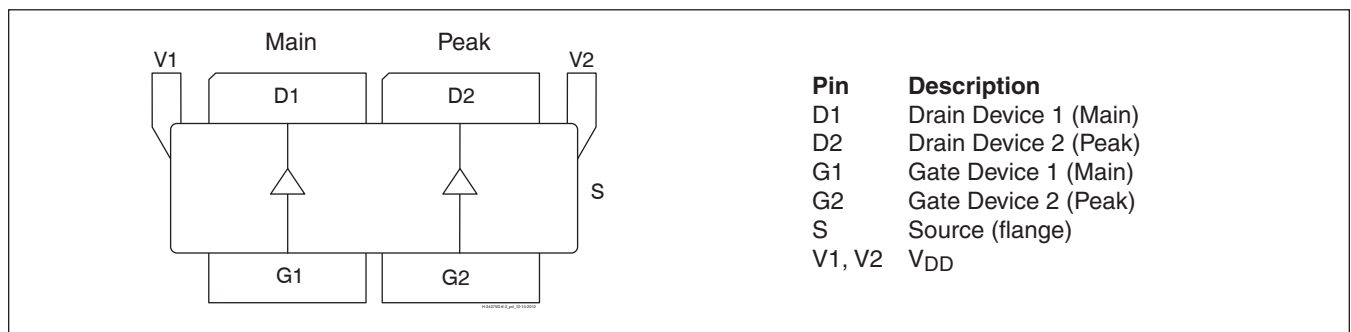
**Reference Circuit Assembly**

|  |   |
|--|---|
| DUT  | PXAD214218FV V1   |
| Test Fixture Part No.  | LTA/PXAD214218FV V1   |
| PCB  | Rogers 4350, 0.508 mm [0.020"] thick, 2 oz. copper, $\epsilon_r = 3.66$ , $f = 2110 - 2170$ MHz |
| Find Gerber files for this test fixture on the Wolfspeed Web site at <a href="http://www.wolfspeed.com/RF">http://www.wolfspeed.com/RF</a> |   |

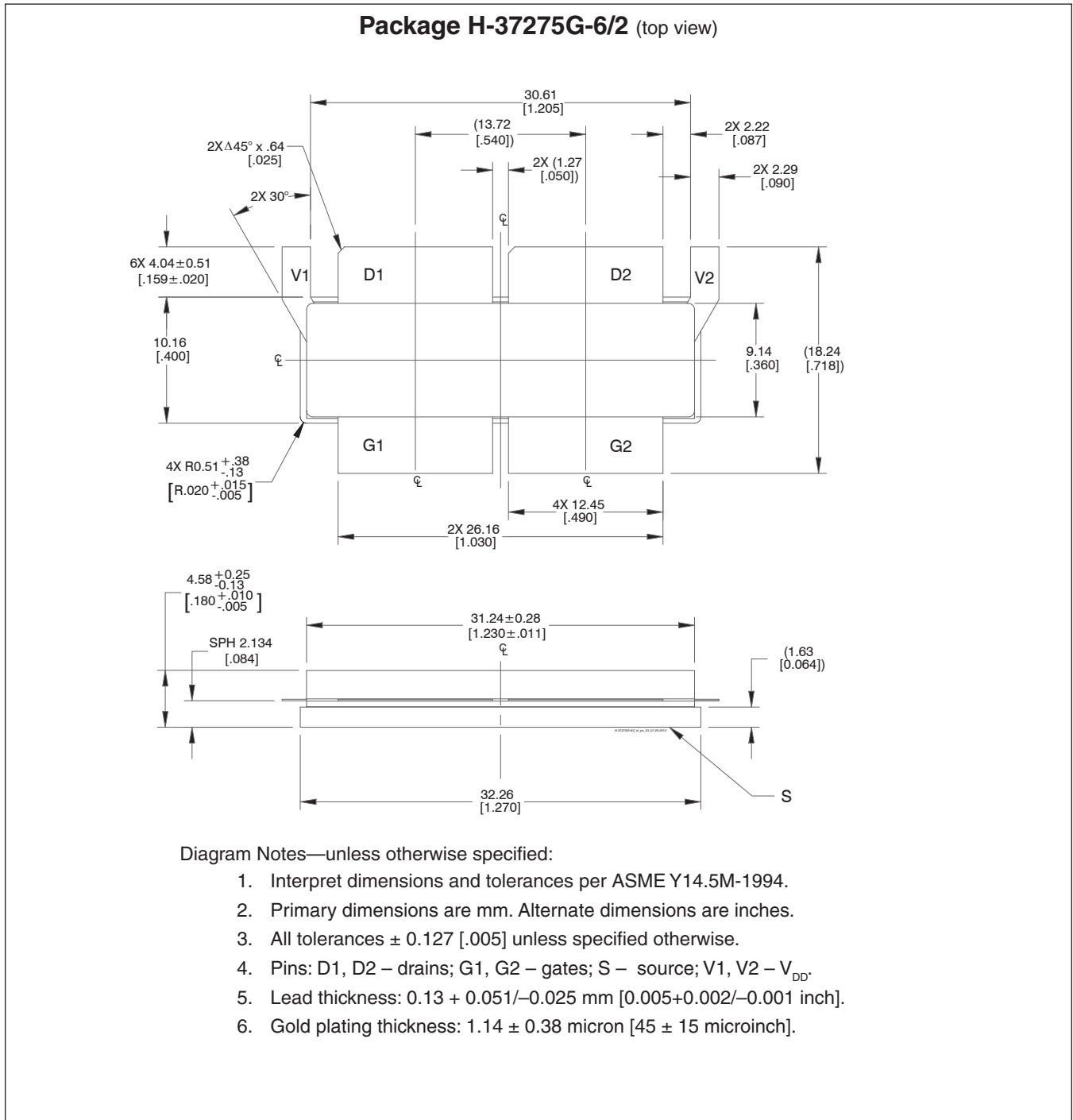
**Components Information**

| Component  | Description            | Manufacturer                    | P/N              |
|--|------------------------|---------------------------------|------------------|
| <b>Input</b>   |                        |                                 |                  |
| C101, C102, C106   | Capacitor, 0.5 pF      | ATC                             | ATC800A0R5CT250T |
| C103, C105, C108, C109   | Capacitor, 18 pF       | ATC                             | ATC800A180JT250T |
| C104, C110   | Capacitor, 10 $\mu$ F  | Taiyo Yuden                     | UMK325C7106MM-T  |
| C107   | Capacitor, 0.4 pF      | ATC                             | ATC800A0R4CT250T |
| R101, R102   | Resistor, 5.6 ohms     | Panasonic Electronic Components | ERJ-8RQJ5R6V     |
| R103   | Resistor, 50 ohms      | Richardson                      | C16A50Z4         |
| U1   | Hybrid Coupler         | Anaren                          | X3C21P1-04S      |
| <b>Output</b>  |                        |                                 |                  |
| C201, C216, C217, C223   | Capacitor, 18 pF       | ATC                             | ATC800A180JT250T |
| C202, C203, C204, C205, C206, C207, C208, C209, C210, C211, C218, C219, C220, C221, C222, C224, C225, C226, C227 | Capacitor, 10 $\mu$ F  | Taiyo Yuden                     | UMK325C7106MM-T  |
| C212, C213, C228, C229   | Capacitor, 220 $\mu$ F | Panasonic Electronic Components | EEE-FP1V221AP    |
| C214   | Capacitor, 0.3 pF      | ATC                             | ATC800A0R3CT250T |
| C215   | Capacitor, 1.2 pF      | ATC                             | ATC800A1R2CT250T |

**Pinout Diagram** (top view)



Package Outline Specifications







## Revision History

| Revision | Date       | Data Sheet Type | Page      | Subjects (major changes since last revision)                                      |
|----------|------------|-----------------|-----------|---|
| 01       | 2016-04-20 | Advance         | All       | Data Sheet reflects advance specification for product development                 |
| 02       | 2016-11-07 | Production      | All       | Data Sheet reflects released product specification                                |
| 02.1     | 2016-12-07 | Production      | 1, 5      | Revised typo in Features, revised PAE to Drain Eff in Load Pull performance       |
| 02.2     | 2017-03-30 | Production      | 1<br>3. 4 | Updated RF Characteristics table<br>Fixed missing labels on CW performance graphs |
| 03       | 2018-07-02 | Production      | All       | Converted to Wolfspeed Data Sheet   |

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## Notes

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