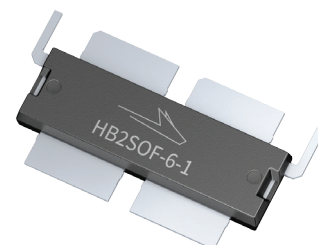


PTRA097008NB

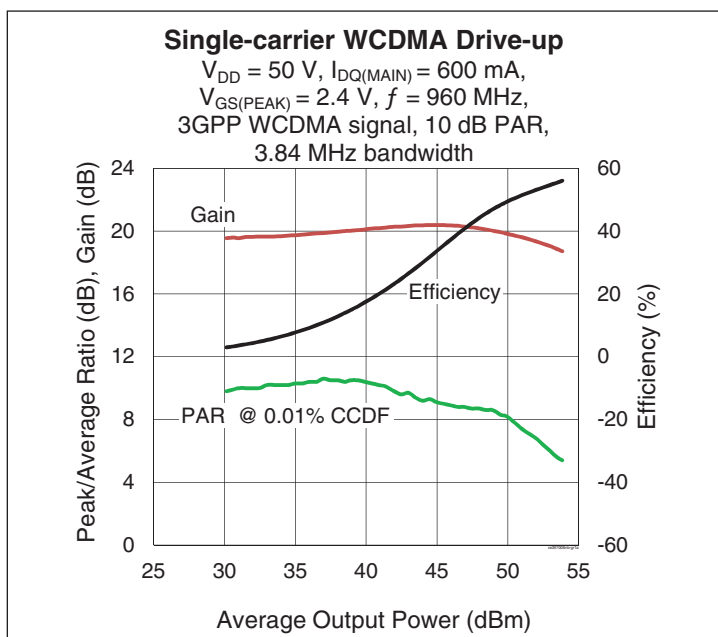
Thermally-Enhanced High Power RF LDMOS FET 630 W, 48 V, 920 – 960 MHz

Description

The PTRA097008NB is a 630-watt LDMOS FET intended for use in multi-standard cellular power amplifier applications in the 920 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.



PTRA097008NB
Package PG-HB2SOF-6-1



Features

- Broadband internal input and output matching
- Asymmetric design
 - Main: $P_{1dB} = 300\text{ W}$ typical
 - Peak: $P_{1dB} = 400\text{ W}$ typical
- Typical pulsed CW performance (10 μs , 10% duty cycle, class AB test), 942 MHz, 48 V, combined outputs, Doherty configuration
 - Output power at $P_{1dB} = 180\text{ W}$
 - Output power at $P_{3dB} = 600\text{ W}$
 - Efficiency = 52%
 - Gain = 19 dB
- Capable of handling 10:1 VSWR at 48 V, 89 W (CW) 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

Single-carrier WCDMA Specifications (tested in Wolfspeed Doherty test fixture)

$V_{DD} = 50\text{ V}$, $I_{DQ} = 600\text{ mA}$, $V_{GS(PEAK)} = 2.4\text{ V}$, $P_{OUT} = 90\text{ W}$ avg, $f_1 = 960\text{ MHz}$, 3GPP signal, channel bandwidth = 3.84 MHz, peak/average = 10 dB @ 0.01% CCDF

| Characteristic | Symbol | Min | Typ | Max | Unit |
|------------------------------|----------|-------|-----|-----|------|
| Gain | G_{ps} | 18.25 | 19 | — | dB |
| Drain Efficiency | η_D | 46.5 | 49 | — | % |
| Adjacent Channel Power Ratio | ACPR | — | -29 | -26 | dBc |
| Output PAR @ 0.01% CCDF | OPAR | 6.0 | 6.8 | — | dB |

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 | $V_{GS} = 0\text{ V}, I_{DS} = 10\text{ mA}$ | $V_{(BR)DSS}$ | 105 | — | — | V |
| Drain Leakage Current | $V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 1 | μA |
| | $V_{DS} = 105\text{ V}, V_{GS} = 0\text{ V}$ | I_{DSS} | — | — | 10 | μA |
| On-State Resistance | (Main) $V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$ | $R_{DS(on)}$ | — | 0.07 | — | Ω |
| | (Peak) $V_{GS} = 10\text{ V}, V_{DS} = 0.1\text{ V}$ | $R_{DS(on)}$ | — | 0.05 | — | Ω |
| Operating Gate Voltage | (Main) $V_{DS} = 48\text{ V}, I_{DQ} = 600\text{ mA}$ | V_{GS} | 3 | 3.65 | 4 | V |
| | (Peak) $V_{DS} = 48\text{ V}, I_{DQ} = 0\text{ mA}$ | V_{GS} | — | 2.4 | — | V |
| Gate Leakage Current | $V_{GS} = 14\text{ V}, V_{DS} = 0\text{ V}$ | I_{GSS} | — | — | 1 | μA |

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.

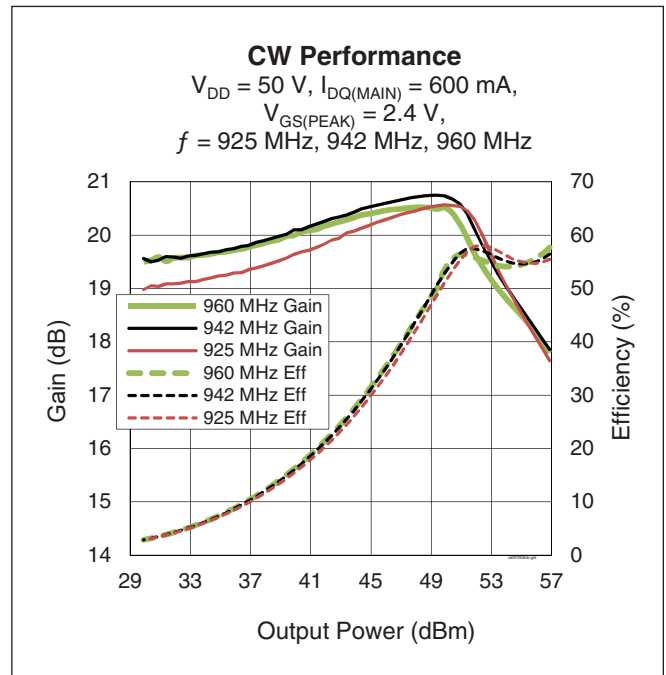
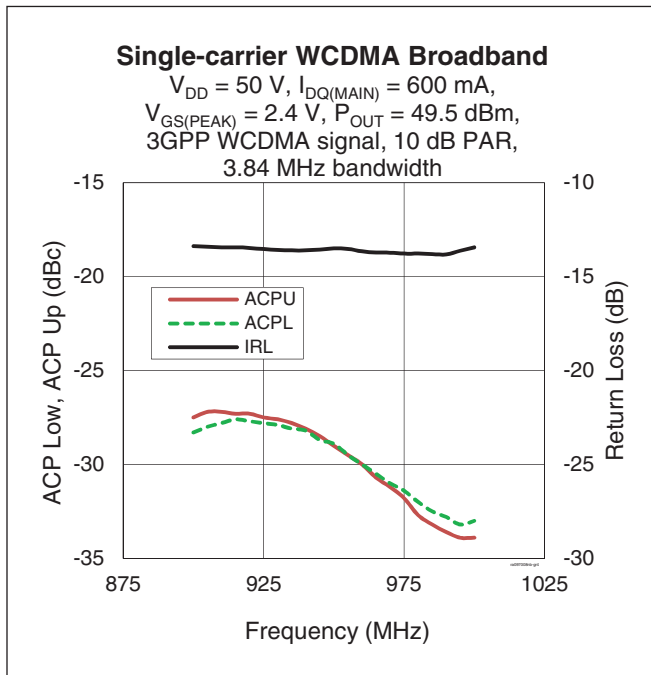
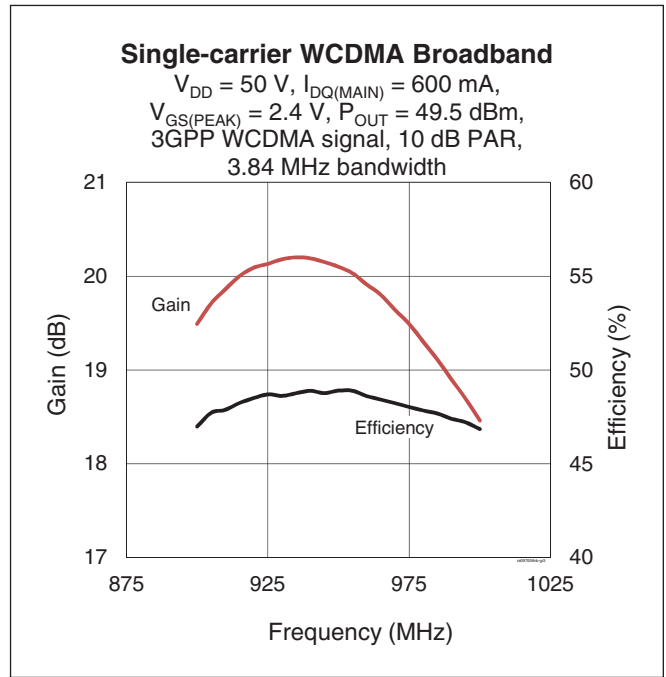
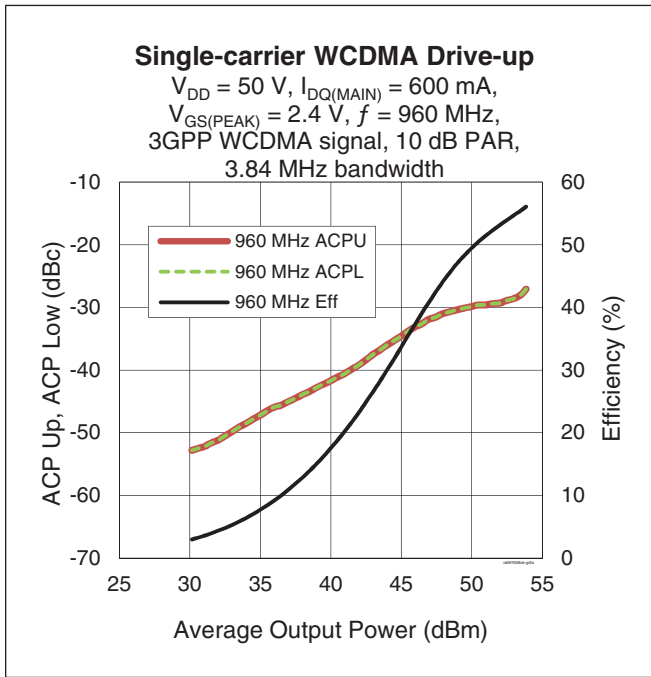
Thermal Characteristics

| Parameter | Symbol | Value | Unit | |
|--------------------|--|-----------------|------|----------------------|
| Thermal Resistance | Main ($T_{CASE} = 70^{\circ}\text{C}, P_{avg} = 90\text{ W CW}$) | $R_{\theta JC}$ | 0.45 | $^{\circ}\text{C/W}$ |

Ordering Information

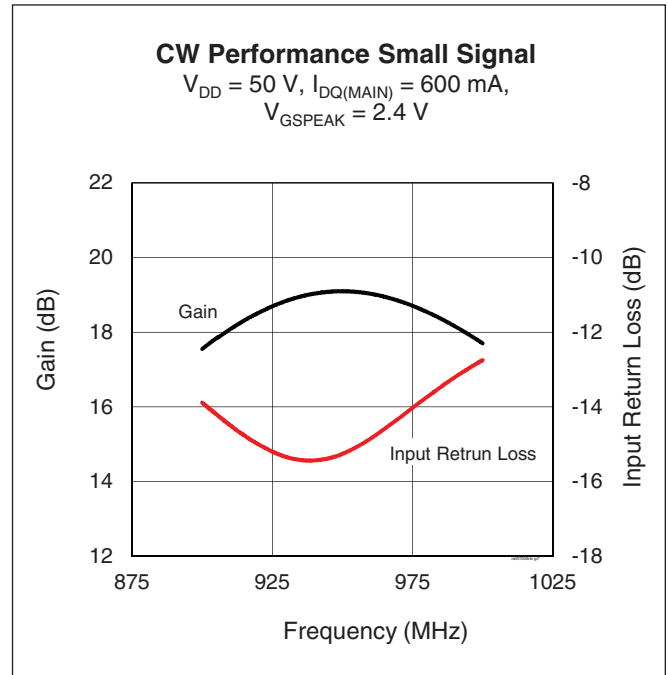
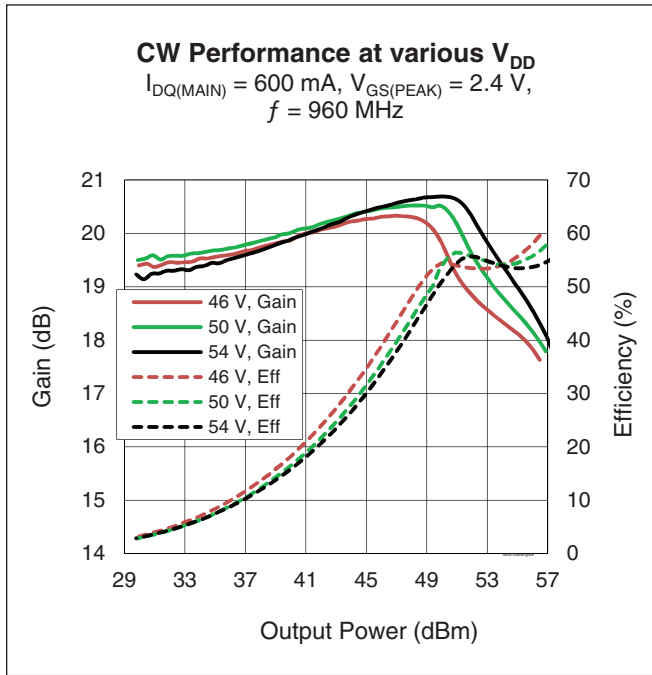
| Type and Version | Order Code | Package Description | Shipping |
|--------------------|--------------------|---------------------|----------------------|
| PTRA097008NB V1 R2 | PTRA097008NB-V1-R2 | PG-HB2SOF-6-1 | Tape & Reel, 250 pcs |

Typical Performance (data taken in a production test fixture)





Typical Performance (cont.)



Load Pull Performance

Main Side Load Pull Performance – Pulsed CW signal – 100 μsec, 10% duty cycle, 48 V, IDQ = 600 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 [%] |
| 925 | 3.3 – j4.4 | 1.4 – j1.0 | 21.0 | 54.85 | 305 | 62.5 | 1.9 + j0.4 | 22.3 | 52.43 | 175 | 68.4 |
| 960 | 2.9 – j5.1 | 1.1 – j1.0 | 20.7 | 54.73 | 297 | 60.0 | 1.8 – j0.2 | 22.1 | 53.05 | 201 | 68.5 |

| | | 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 [%] |
| 925 | 3.3 – j4.4 | 1.18 – j1.06 | 18.3 | 55.53 | 357 | 60.6 | 1.7 + j0.1 | 20.5 | 53.54 | 225 | 70.5 |
| 960 | 2.9 – j5.1 | 1.12 – j1.22 | 18.6 | 55.40 | 346 | 59.1 | 1.8 – j0.2 | 20.1 | 53.80 | 239 | 70.7 |

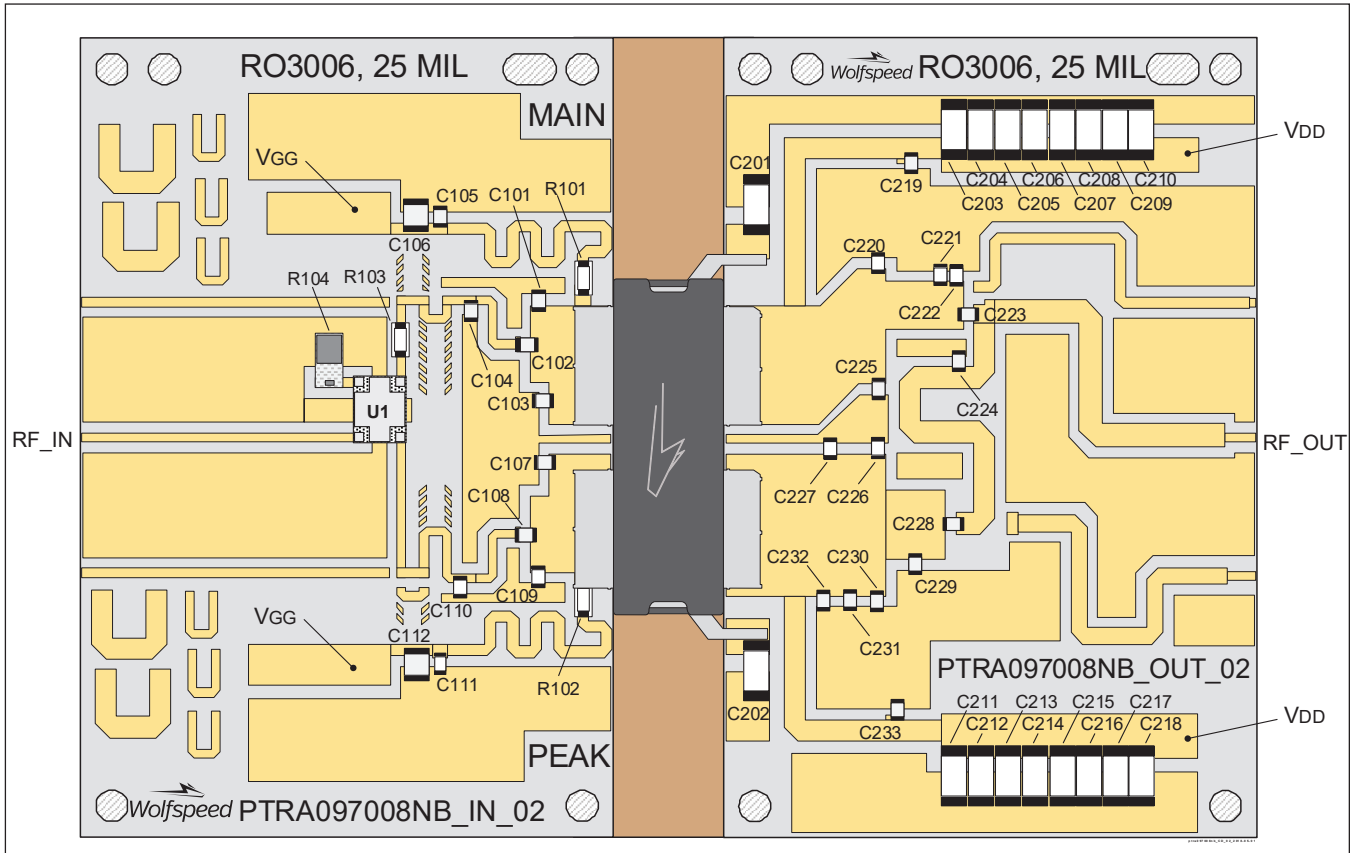
Peak Side Load Pull Performance – Pulsed CW signal – 100 μsec, 10% duty cycle, 48 V, V_{GSPK} = 3.58 V, class AB

| | | 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 [%] |
| 925 | 3.2 – j5.9 | 0.7 – j0.6 | 20.2 | 56.44 | 440 | 58.0 | 1.2 + j0.2 | 21.9 | 53.51 | 224 | 66.3 |
| 960 | 3.7 – j6.3 | 0.8 – j0.9 | 20.0 | 56.23 | 419 | 58.7 | 1.3 + j0.2 | 21.2 | 53.32 | 214 | 65.8 |

| | | 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 [%] |
| 925 | 3.2 – j5.9 | 0.67 – j0.64 | 18.2 | 57.17 | 521 | 60.3 | 1.1 – j0.2 | 19.6 | 55.81 | 381 | 67.9 |
| 960 | 3.7 – j6.3 | 0.82 – j0.92 | 18.0 | 57.09 | 511 | 61.1 | 1.2 – j0.4 | 19.0 | 55.51 | 355 | 67.3 |

Reference Circuit tuned for 920 to 960 MHz

| | |
|--|--|
| DUT | PTRA097008NB V1 |
| Reference Circuit Part No. | LTA/PTRA097008NB V1 |
| PCB | Rogers 3006, 0.064 mm [.025"] thick, 2 oz. copper, $\epsilon_r = 6.50$ |
| Find Gerber files for this reference circuit on the Wolfspeed Web site at www.wolfspeed.com/RF | |



Reference circuit assembly diagram (not to scale)

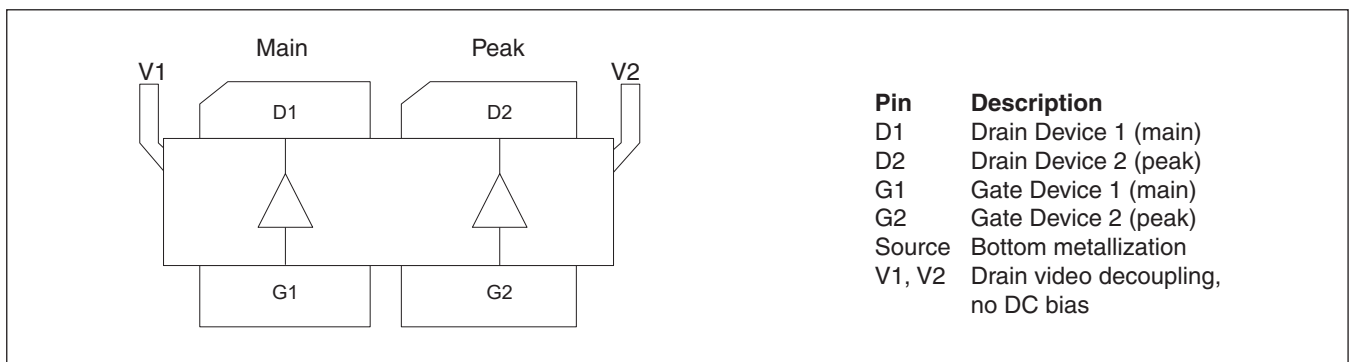


Reference Circuit (cont.)

Components Information

| Component | Description | Manufacturer | P/N |
|--|-------------------------|-----------------|---------------------|
| Input | | | |
| C101, C103, C107 | Capacitor, 4.7 pF | ATC | ATC600F4R7CT250X |
| C102, C108 | Capacitor, 36 pF | ATC | ATC600F360JT250X |
| C104, C109 | Capacitor, 3.0 pF | ATC | ATC600F3R0CT250X |
| C105, C111 | Capacitor, 39 pF | ATC | ATC600F390JT250X |
| C106, C112 | Capacitor, 10 μF, 50 V | Taiyo Yuden | UMK325C7106MM-T |
| C110 | Capacitor, 2.4 pF | ATC | ATC600F2R4CT250X |
| R101, R102, R103 | Chip resistor, 5.1 ohms | Panasonic | ERJ-8GEYJ5R1V |
| R104 | Resistor, 50 ohms | Richardson | C16A50Z4 |
| U1 | Hybrid coupler | Anaren | X3C09P1-03S |
| Output | | | |
| C201, C202, C203, C204, C205, C206, C207, C208, C209, C210, C211, C212, C213, C214, C215, C216, C217, C218 | Capacitor, 10 μF, 100 V | TDK Corporation | C5750X7S2A106M230KB |
| C219, C228, C233 | Capacitor, 39 pF | ATC | ATC600F390JT250X |
| C220, C224, C225 | Capacitor, 3.3 pF | ATC | ATC600F3R3CT250X |
| C221 | Capacitor, 0.3 pF | ATC | ATC600F0R3CT250X |
| C222 | Capacitor, 1.2 pF | ATC | ATC600F1R2CT250X |
| C223 | Capacitor, 12 pF | ATC | ATC600F120JT250X |
| C226 | Capacitor, 5.1 pF | ATC | ATC600F5R1CT250X |
| C227 | Capacitor, 8.2 pf | ATC | ATC600F8R2CT250X |
| C229 | Capacitor, 1.0 pF | ATC | ATC600F1R0CT250X |
| C230, C231 | Capacitor, 2.0 pF | ATC | ATC600F2R0CT250X |
| C232 | Capacitor, 7.5 pF | ATC | ATC600F7R5CT250X |

Pinout Diagram (top view)



Package Outline Specifications

Package PG-HB2SOF-6-1 (top and side views)

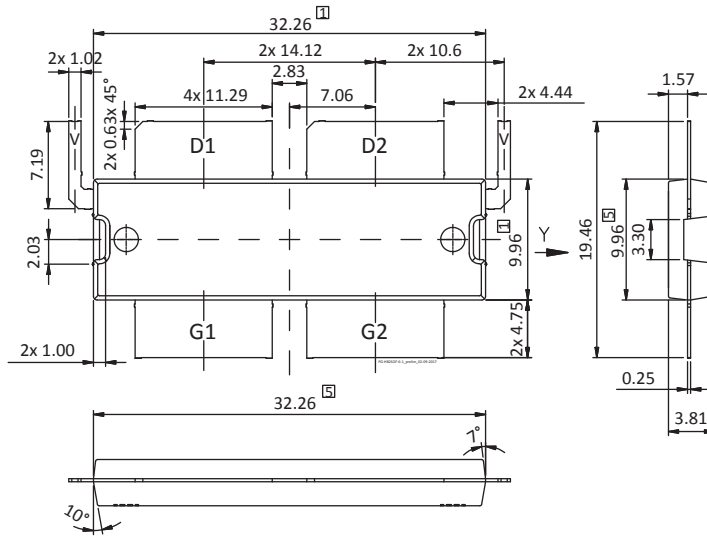


Diagram Notes—unless otherwise specified:

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included
2. Fillets and radii: all radii are 0.30t 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 ± 0.1 mm
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; Source – bottom metallization; V – drain video decoupling, no DC bias

Package Outline Specifications

Package PG-HB2SOF-6-1 (bottom view)

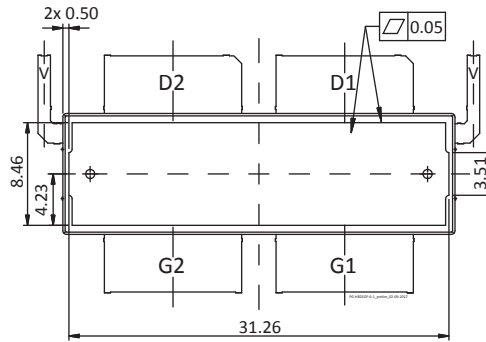


Diagram Notes—unless otherwise specified:

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included
2. Fillets and radii: all radii are 0.30t 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 ± 0.1 mm
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; Source – bottom metallization; V – drain video decoupling, no DC bias

Revision History

| Revision | Date | Data Sheet | Page | Subjects (major changes at each revision) |
|----------|-------------|------------|--------|---|
| 01 | 2017- 03-01 | Advance | all | Proposed specification for new product development |
| 02 | 2018-01-26 | Production | all | Product released to production—Data Sheet now includes updated specifications, performance graphs, and reference circuit information. |
| 03 | 2018-05-01 | Production | All, 2 | Converted to Wolfspeed Data Sheet, updated ordering code |

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Notes

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