

CGHV27200

200 W, 2500-2700 MHz, GaN HEMT for LTE

Cree's CGHV27200 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV27200 ideal for 2.5-2.7 GHz LTE and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.



Package Type: 440162 and 440161
PN: CGHV27200F and CGHV27200P

Typical Performance Over 2.5 - 2.7 GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

| Parameter | 2.5 GHz | 2.6 GHz | 2.7 GHz | Units |
|---------------------------|---------|---------|---------|-------|
| Gain @ 47 dBm | 15.0 | 16.0 | 16.0 | dB |
| ACLR @ 47 dBm | -36.5 | -37.5 | -37.0 | dBc |
| Drain Efficiency @ 47 dBm | 29.0 | 28.5 | 29.0 | % |

Note:

Measured in the CGHV27200-TB amplifier circuit, under WCDMA 3GPP test model 1, 64 DPCH, 45% clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF.

Features

- 2.5 - 2.7 GHz Operation
- 16 dB Gain
- -37 dBc ACLR at 50 W P_{AVE}
- 29 % Efficiency at 50 W P_{AVE}
- High Degree of DPD Correction Can be Applied





Absolute Maximum Ratings (not simultaneous) at 25 °C Case Temperature

| Parameter | Symbol | Rating | Units | Units |
|---|-----------------|-----------|-------|--------------------------|
| Drain-Source Voltage | V_{DSS} | 125 | Volts | 25 °C |
| Gate-to-Source Voltage | V_{GS} | -10, +2 | Volts | 25 °C |
| Storage Temperature | T_{STG} | -65, +150 | °C | |
| Operating Junction Temperature | T_J | 225 | °C | |
| Maximum Forward Gate Current | I_{GMAX} | 32 | mA | 25 °C |
| Maximum Drain Current ¹ | I_{DMAX} | 12 | A | 25 °C |
| Soldering Temperature ² | T_S | 245 | °C | |
| Screw Torque | τ | 80 | in-oz | |
| Thermal Resistance, Junction to Case ³ | $R_{\theta JC}$ | 1.22 | °C/W | 85 °C, $P_{DISS} = 96$ W |
| Thermal Resistance, Junction to Case ⁴ | $R_{\theta JC}$ | 1.54 | °C/W | 85 °C, $P_{DISS} = 96$ W |
| Case Operating Temperature ⁵ | T_C | -40, +150 | °C | 30 seconds |

Note:

¹ Current limit for long term, reliable operation.

² Refer to the Application Note on soldering at <http://www.cree.com/rf/document-library>

³ Measured for the CGHV27200P

⁴ Measured for the CGHV27200F

⁵ See also, the Power Dissipation De-rating Curve on Page 6

Electrical Characteristics ($T_C = 25$ °C)

| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|--------------|------|-------|--------|----------|--|
| DC Characteristics¹ | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -3.8 | -3.0 | -2.3 | V_{DC} | $V_{DS} = 10$ V, $I_D = 32$ mA |
| Gate Quiescent Voltage | $V_{GS(Q)}$ | - | -2.7 | - | V_{DC} | $V_{DS} = 50$ V, $I_D = 1.0$ A |
| Saturated Drain Current ² | I_{DS} | 24 | 28.8 | - | A | $V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V |
| Drain-Source Breakdown Voltage | V_{BR} | 125 | - | - | V_{DC} | $V_{GS} = -8$ V, $I_D = 32$ mA |
| RF Characteristics⁵ ($T_C = 25$ °C, $F_0 = 2.7$ GHz unless otherwise noted) | | | | | | |
| Saturated Output Power ^{3,4} | P_{SAT} | - | 300 | - | W | $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A |
| Pulsed Drain Efficiency ³ | η | - | 62 | - | % | $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = P_{SAT}$ |
| Gain ⁶ | G | - | 15.25 | - | dB | $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm |
| WCDMA Linearity ⁶ | ACLR | - | -37 | - | dBc | $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm |
| Drain Efficiency ⁶ | η | - | 30.5 | - | % | $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm |
| Output Mismatch Stress ³ | VSWR | - | - | 10 : 1 | Ψ | No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 200$ W Pulsed |
| Dynamic Characteristics | | | | | | |
| Input Capacitance ⁷ | C_{GS} | - | 97 | - | pF | $V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz |
| Output Capacitance ⁷ | C_{DS} | - | 13.4 | - | pF | $V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz |
| Feedback Capacitance | C_{GD} | - | 0.94 | - | pF | $V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz |

Notes:

¹ Measured on wafer prior to packaging.

² Scaled from PCM data.

³ Pulse Width = 100 μ s, Duty Cycle = 10%

⁴ P_{SAT} is defined as $I_G = 3$ mA peak.

⁵ Measured in CGHV27200-TB.

⁶ Single Carrier WCDMA, 3GPP Test Model 1, 64 DPCH, 45% Clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF.

⁷ Includes package and internal matching components.

Typical Performance

Figure 1. - Small Signal Gain and Return Losses vs Frequency for the CGHV27200 measured in CGHV27200-TB Amplifier Circuit
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$

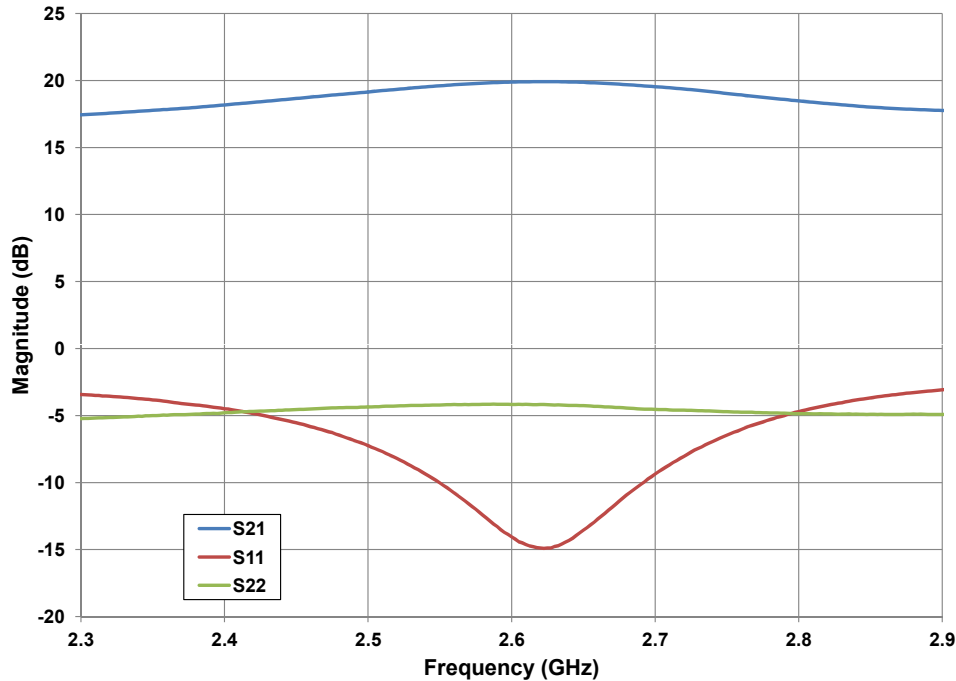
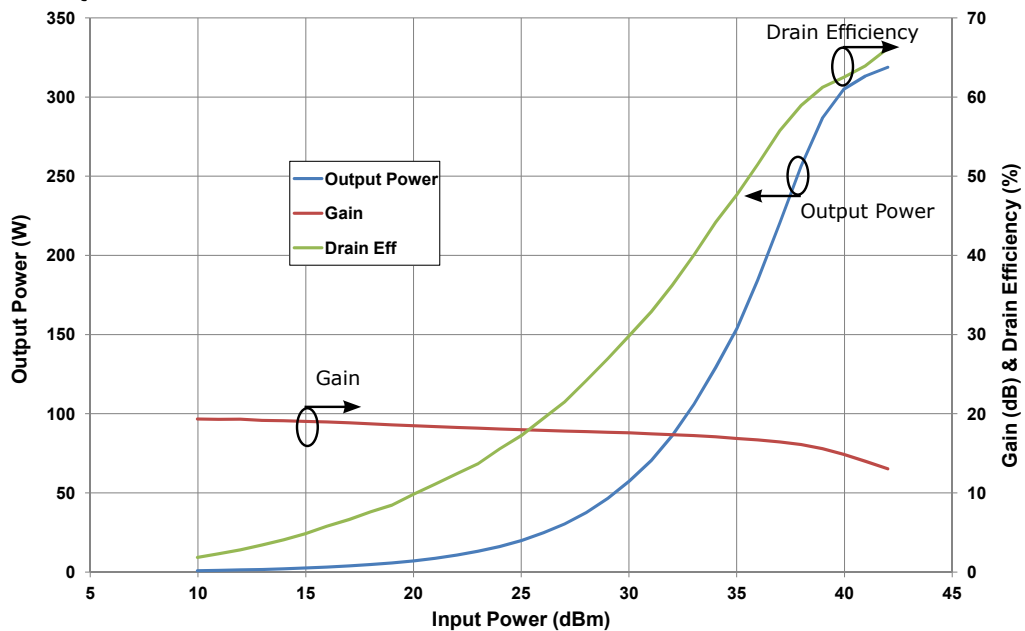


Figure 2. - Typical Pulsed Measurements vs Input Power of the CGHV27200 measured in CGHV27200-TB Amplifier Circuit.
 $V_{DS} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Freq = 2.6 GHz, Pulse Width = 100 μs , Duty Cycle = 10 %



Typical Performance

Figure 3. - Typical Linearity vs Output Power for the CGHV27200 measured in CGHV27200-TB Amplifier Circuit
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Freq = 2.6 GHz, 1c WCDMA 7.5 dB PAR

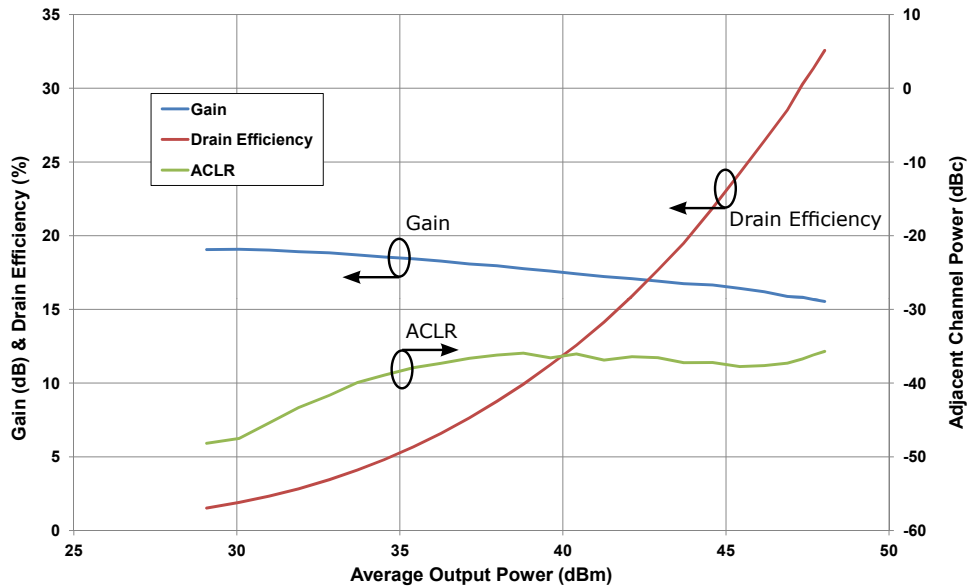
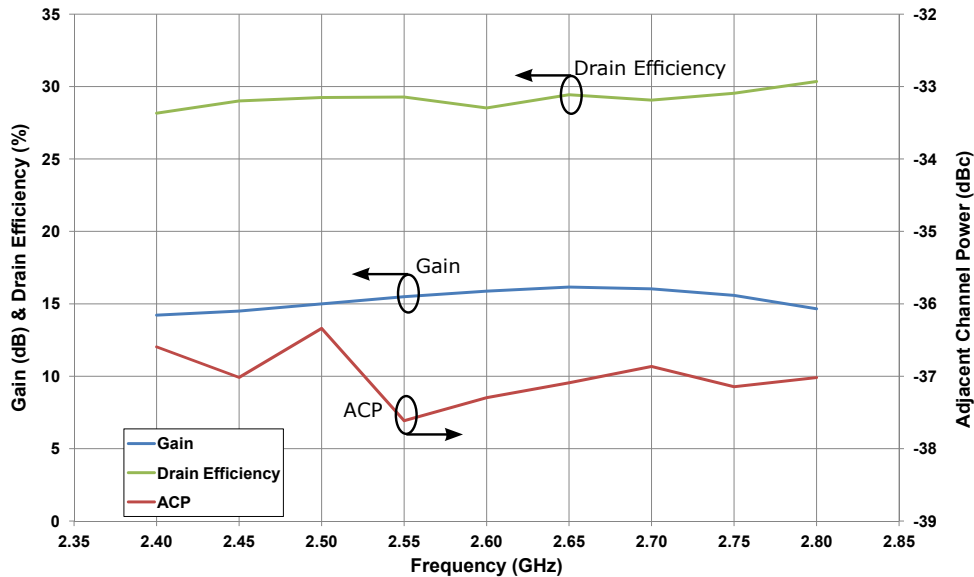


Figure 4. - Typical Linearity at $P_{AVE} = 47\text{ dBm}$ over Frequency of the CGHV27200 measured in CGHV27200-TB Amplifier Circuit.
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, 1c WCDMA 7.5 dB PAR



Typical Performance

Figure 5. - Typical Linearity under DPD vs Output Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Freq = 2.6 GHz, 1c WCDMA 7.5 dB PAR

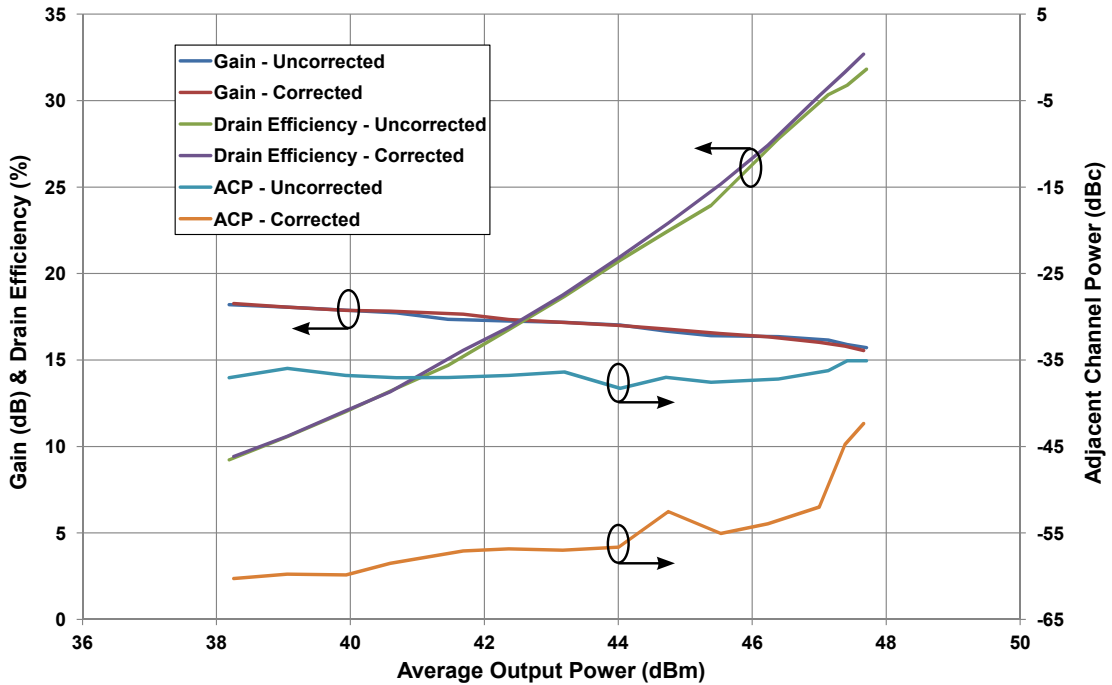
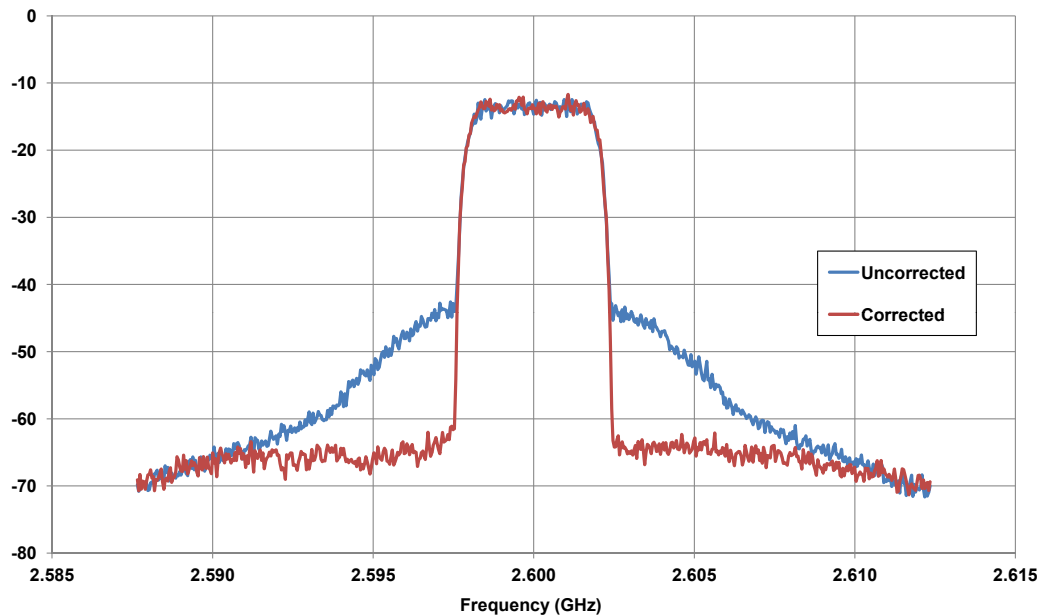


Figure 6. - Spectral Mask at $P_{AVE} = 47\text{ dBm}$ with and without DPD
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, 1c WCDMA 7.5 dB PAR



Typical Performance

Figure 7. - Intermodulation Distortion Products vs Output Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Tone Spacing = 100 kHz

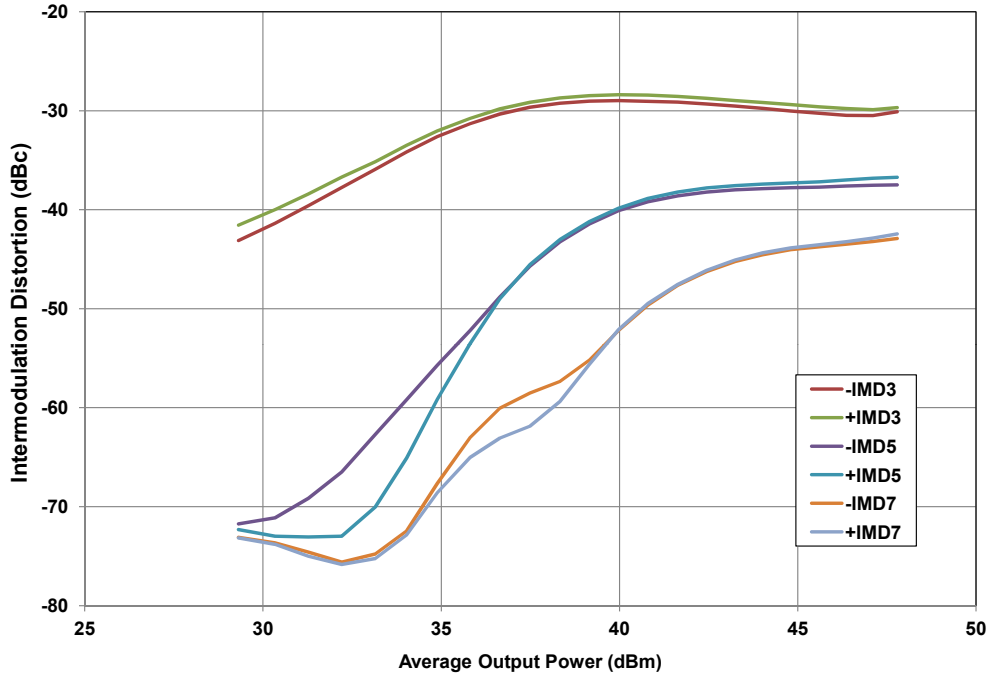
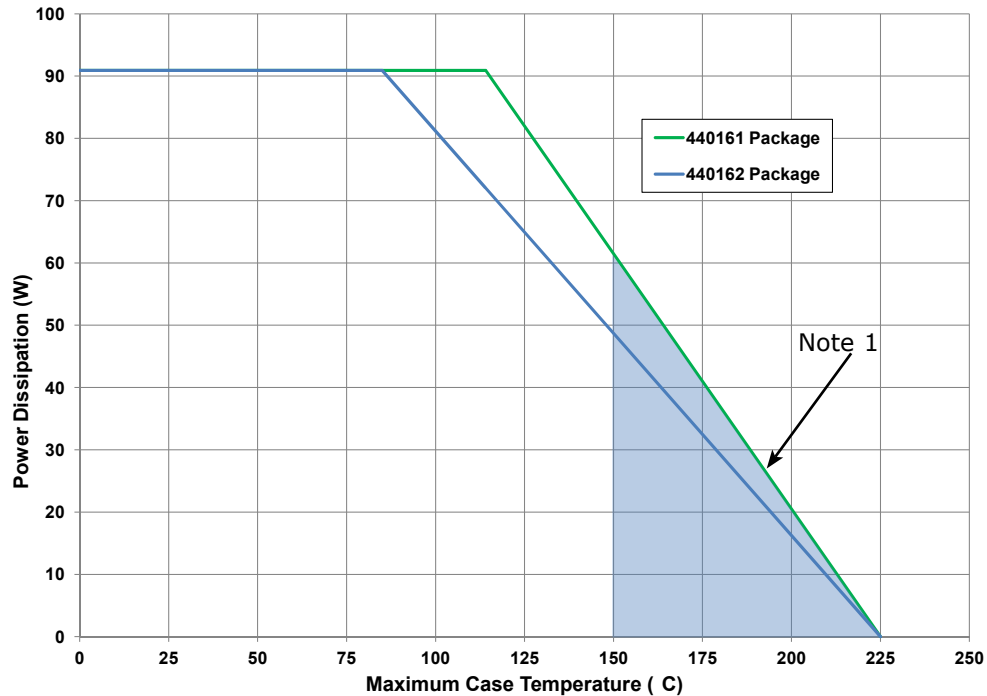
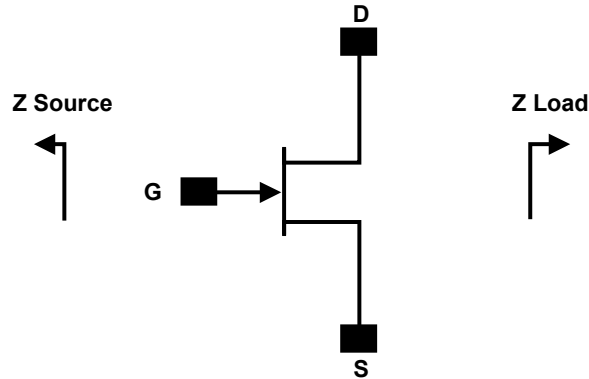


Figure 8. - Power Dissipation Derating Curve



Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

Source and Load Impedances

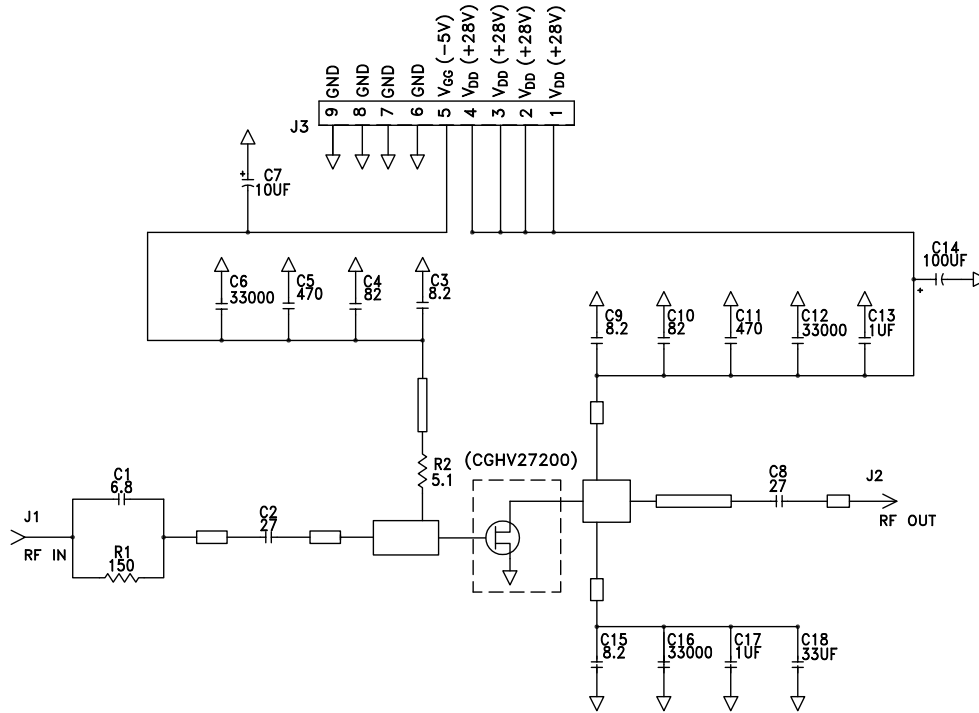


| Frequency (MHz) | Z Source | Z Load |
|-----------------|---------------|--------------|
| 2500 | 7.12 - j10.19 | 2.23 - j0.03 |
| 2550 | 6.93 - j10.38 | 2.27 + j0.08 |
| 2600 | 6.61 - j10.59 | 2.32 + j0.18 |
| 2650 | 6.17 - j10.77 | 2.37 + j0.27 |
| 2700 | 5.61 - j10.87 | 2.41 + j0.33 |

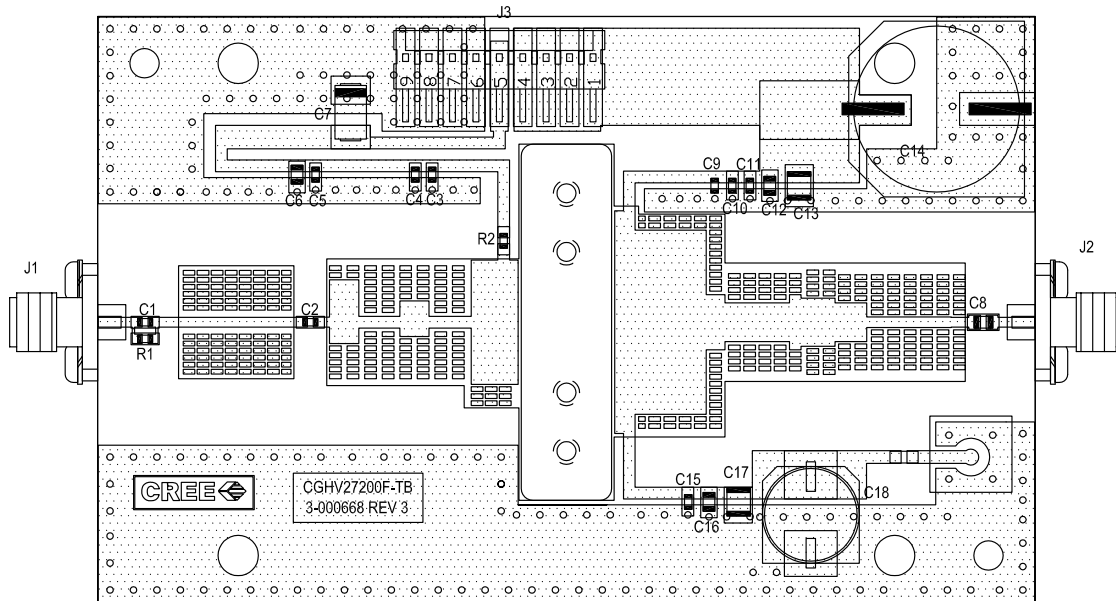
Note¹: $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$. In the 440162 package.

Note²: Impedances are extracted from CGHV27200-TB demonstration circuit and are not source and load pull data derived from transistor.

CGHV27200-TB Demonstration Amplifier Circuit Schematic



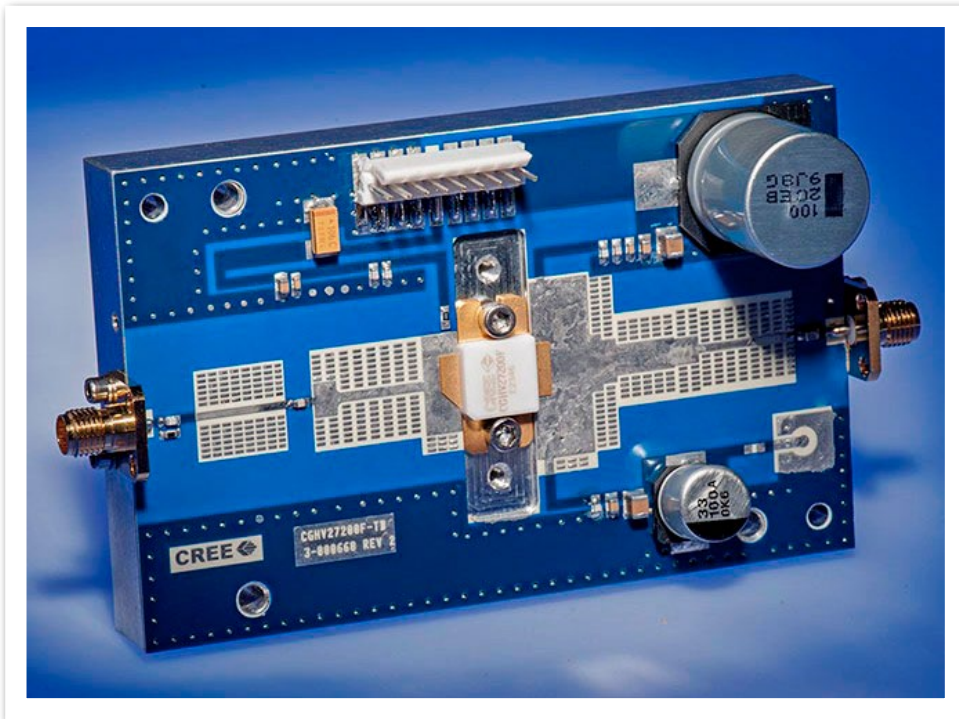
CGHV27200-TB Demonstration Amplifier Circuit Outline



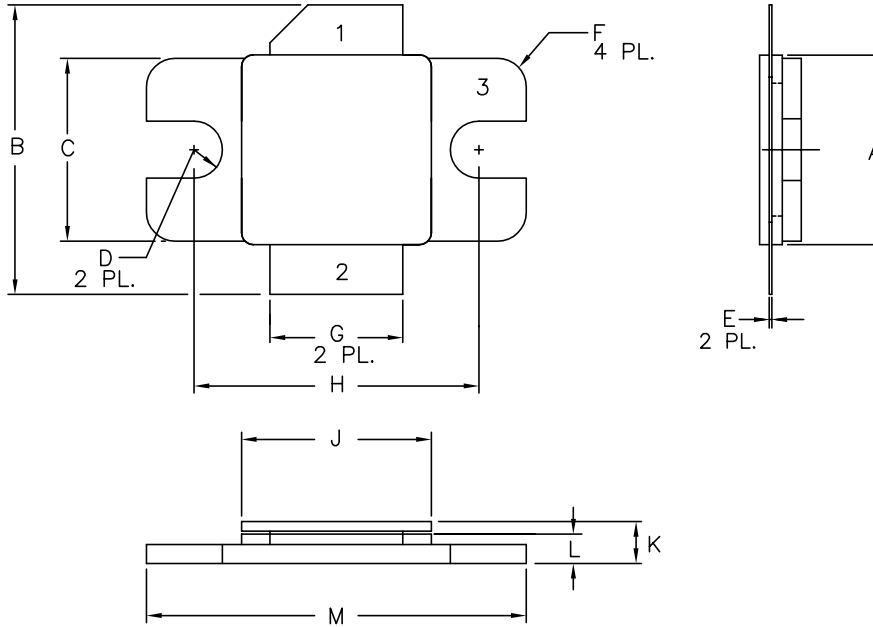
CGHV27200-TB Demonstration Amplifier Circuit Bill of Materials

| Designator | Description | Qty |
|------------|---|-----|
| R1 | RES, 1/16 W, 0603, 1%, 150 OHMS | 1 |
| R2 | RES, 1/16 W, 0603, 1%, 5.1 OHMS | 1 |
| C1 | CAP, 6.2 pF, +/-0.25 pF, 0603, ATC600S | 1 |
| C2 | CAP, 27 pF, +/-5%, 0603, ATC600S | 1 |
| C3,C9,C15 | CAP, 8.2 pF, +/-0.25 pF, 0603, ATC600S | 3 |
| C4,C10 | CAP, 82.0 pF, +/-5%, 0603, ATC600S | 2 |
| C5,C11 | CAP, 470 pF, 5%, 100 V, 0603, X7R | 2 |
| C6,C12,C16 | CAP, 33000 pF, 0805, 100 V, X7R | 3 |
| C7 | CAP, 10 UF, 16V, TANTALUM | 1 |
| C8 | CAP, 27 pF, +/-5%, 250 V, 0603, ATC600S | 1 |
| C13,C17 | CAP, 1.0 UF, 100 V, 10%, X7R, 1210 | 2 |
| C14 | CAP, 100 UF, +/-20%, 160V, ELECTROLYTIC | 2 |
| C18 | CAP, 33 UF, 20%, G CASE | 1 |
| J1,J2 | CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST | 2 |
| J3 | CONN, Header, RT> PLZ, 0.1 CEN, LK, 9 POS | 1 |
| | PCB, RO4350, 0.020" THK, CGHV27200 | 1 |
| | 2-56 SOC HD SCREW 1/4 SS | 4 |
| | #2 SPLIT LOCKWASHER SS | 4 |
| | CGHV27200 | 1 |

CGHV27200-TB Demonstration Amplifier Circuit



Product Dimensions CGHV27200F (Package Type — 440162)



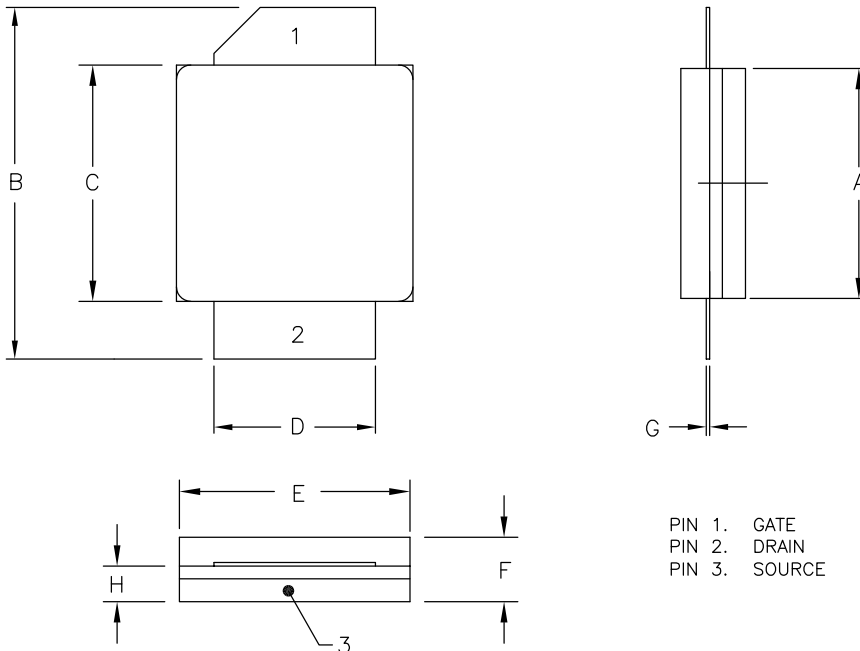
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .395 | .405 | 10.03 | 10.29 |
| B | .580 | .620 | 14.73 | 15.75 |
| C | .380 | .390 | 9.65 | 9.91 |
| D | .055 | .065 | 1.40 | 1.65 |
| E | .004 | .006 | 0.10 | 0.15 |
| F | .055 | .065 | 1.40 | 1.65 |
| G | .275 | .285 | 6.99 | 7.24 |
| H | .595 | .605 | 15.11 | 15.37 |
| J | .395 | .405 | 10.03 | 10.29 |
| K | .129 | .149 | 3.28 | 3.78 |
| L | .053 | .067 | 1.35 | 1.70 |
| M | .795 | .805 | 20.19 | 20.45 |

PIN 1. GATE
 PIN 2. DRAIN
 PIN 3. SOURCE

Product Dimensions CGHV27200P (Package Type — 440161)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .395 | .407 | 10.03 | 10.34 |
| B | .594 | .634 | 15.09 | 16.10 |
| C | .395 | .407 | 10.03 | 10.34 |
| D | .275 | .285 | 6.99 | 7.24 |
| E | .395 | .407 | 10.03 | 10.34 |
| F | .129 | .149 | 3.28 | 3.78 |
| G | .004 | .006 | 0.10 | 0.15 |
| H | .057 | .067 | 1.45 | 1.70 |

PIN 1. GATE
 PIN 2. DRAIN
 PIN 3. SOURCE



Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/rf

Sarah Miller
Marketing & Export
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639