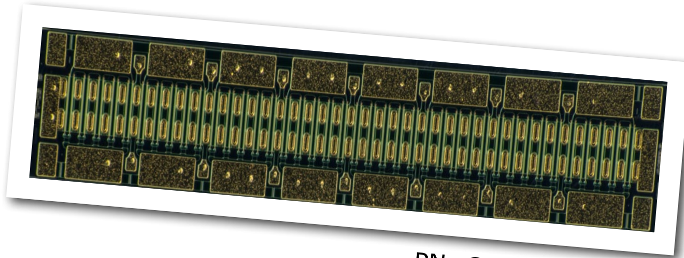
# CGHV60170D

**170 W, 6.0 GHz, 50V GaN HEMT Die**



PN: CGHV60170D

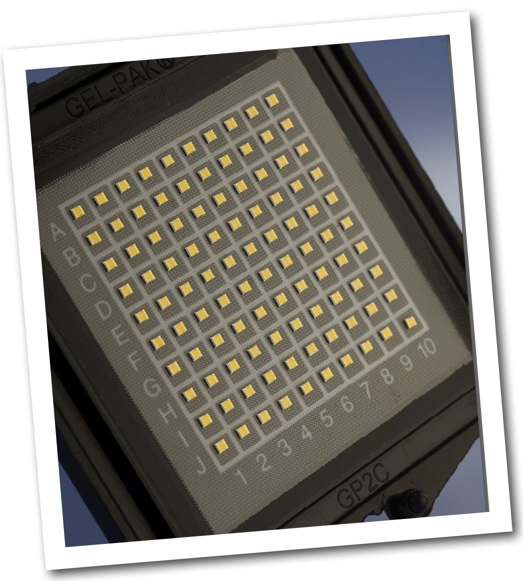
Cree's CGHV60170D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors.

## FEATURES

- 18 dB Typical Small Signal Gain at 4 GHz
- 17 dB Typical Small Signal Gain at 6 GHz
- 65% Typical Power Added Efficiency
- 170 W Typical $P_{SAT}$
- 50 V Operation
- High Breakdown Voltage
- Up to 6 GHz Operation

## APPLICATIONS

- Broadband amplifiers
- Tactical communications
- Satellite communications
- Industrial, Scientific, and Medical amplifiers
- Class AB, Linear amplifiers suitable for OFDM, W-CDMA, LTE, EDGE, CDMA waveforms




## Packaging Information

- Bare die are shipped on tape or in Gel-Pak® containers.
- Non-adhesive tacky membrane immobilizes die during shipment.

PRELIMINARY
Rev 0.0 – September 2014

## Absolute Maximum Ratings (not simultaneous)

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DSS}$ | 150 | $V_{DC}$ | 25˚C |
| Gate-source Voltage | $V_{GS}$ | -10, +2 | $V_{DC}$ | 25˚C |
| Storage Temperature | $T_{STG}$ | -65, +150 | ˚C | |
| Operating Junction Temperature | $T_J$ | 225 | ˚C | |
| Maximum Drain Current[1] | $I_{MAX}$ | 12.6 | A | 25˚C |
| Maximum Forward Gate Current | $I_{GMAX}$ | 20.8 | mA | 25˚C |
| Mounting Temperature | $T_S$ | 320 | ˚C | 30 seconds |

Note[1] Current limit for long term reliable operation.

## Electrical Characteristics (Frequency = 6 GHz unless otherwise stated; $T_C$ = 25˚C)

| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | |
| Gate Pinch-Off Voltage | $V_P$ | -3.8 | -3.0 | –2.3 | V | $V_{DS}$ = 10 V, $I_D$ = 20.8 mA |
| Drain Current[1] | $I_{DSS}$ | 16.8 | 20.8 | – | A | $V_{DS}$ = 6 V, $V_{GS}$ = 2.0 V |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 150 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 20.8 mA |
| On Resistance | $R_{ON}$ | – | 0.14 | – | Ω | $V_{DS}$ = 0.1 V |
| Gate Forward Voltage | $V_{G-ON}$ | – | 1.9 | – | V | $I_{GS}$ = 20.8 mA |
| **RF Characteristics** | | | | | | |
| Small Signal Gain | $G_{SS}$ | – | 17 | – | dB | $V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA |
| Saturated Power Output[2,3] | $P_{SAT}$ | – | 170 | – | W | $V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA |
| Drain Efficiency[4] | η | – | 65 | – | % | $V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA, $P_{SAT}$ = 170 W |
| Intermodulation Distortion | IM3 | – | -30 | – | dBc | $V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA,<br>$P_{OUT}$ = 170 W PEP |
| Output Mismatch Stress | VSWR | – | – | 10 : 1 | Ψ | No damage at all phase angles,<br>$V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA<br>$P_{OUT}$ = 170 W Pulsed |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{GS}$ | – | 28.3 | – | pF | $V_{DS}$ = 50 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Output Capacitance | $C_{DS}$ | – | 6.35 | – | pF | $V_{DS}$ = 50 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Feedback Capacitance | $C_{GD}$ | – | 0.6 | – | pF | $V_{DS}$ = 50 V, $V_{gs}$ = -8 V, f = 1 MHz |

Notes:

[1] Scaled from PCM data

[2] $P_{SAT}$ is defined as $I_G$ = 2.0 mA.

[3] Pulsed 100 μsec, 10%

[4] Drain Efficiency = $P_{OUT}$ / $P_{DC}$



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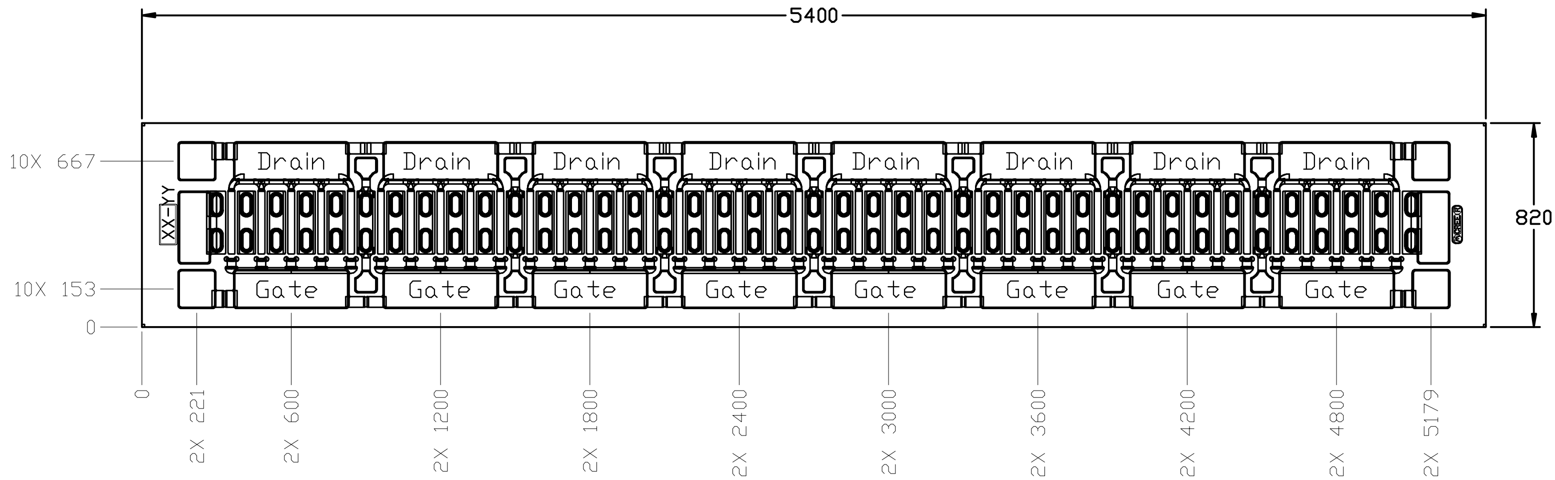
## DIE Dimensions (units in microns)




Overall die size 820 x 5400 (+0/-50) microns, die thickness 100 microns.
All Gate and Drain pads must be wire bonded for electrical connection.

**Assembly Notes:**

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at www.cree.com/RF.
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.
- Use the die label (XX-YY) for correct orientation.

## Electrostatic Discharge (ESD) Classifications

| Parameter | Symbol | Class | Test Methodology |
|---|---|---|---|
| Human Body Model | HBM | 1A (> 250 V) | JEDEC JESD22 A114-D |
| Charge Device Model | CDM | 2 (125 V to 250 V) | JEDEC JESD22 C101-C |



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# Typical Performance

**Figure 1. - CGHV60170D Output Power, Gain and Efficiency vs. Input Power at Tcase = 25°C**
**$V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA, Frequency = 2.7 GHz**

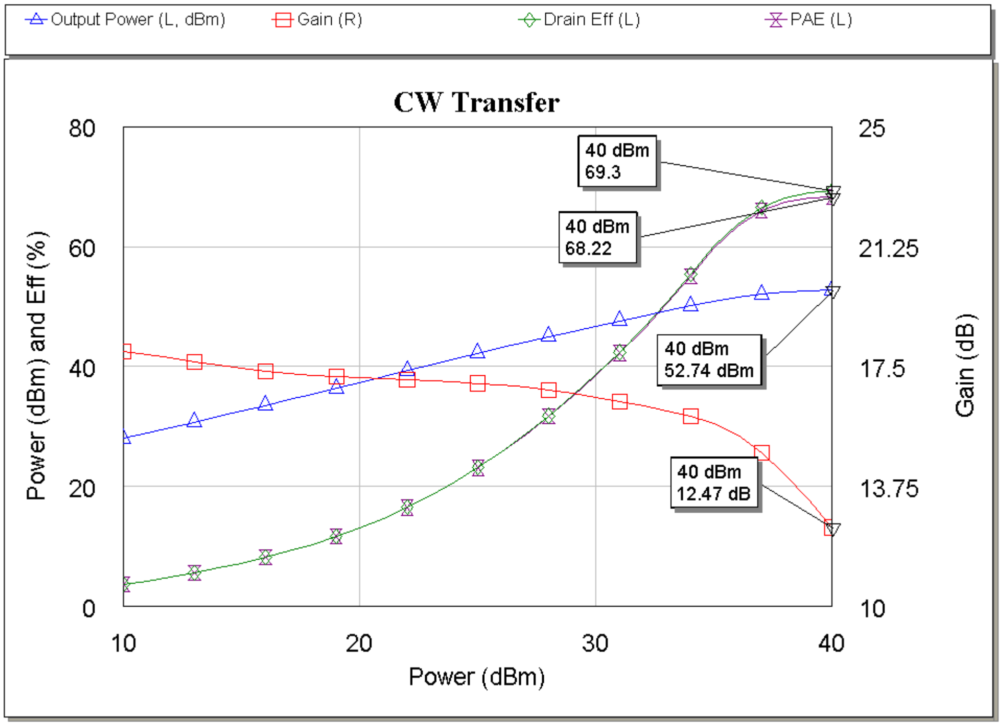
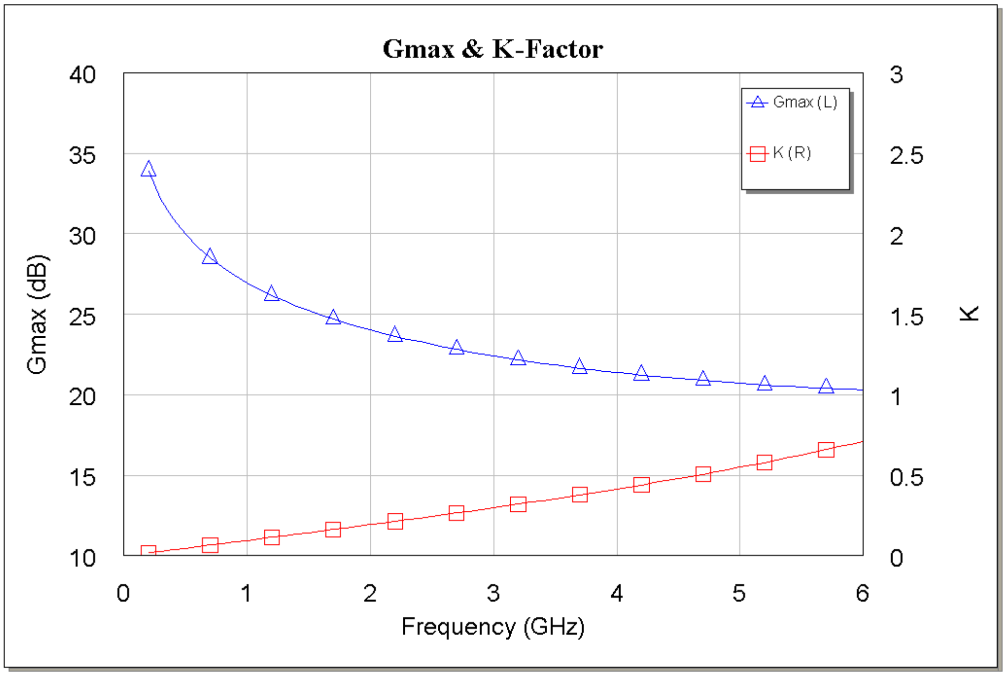



**Figure 2. - CGHV60170D $G_{MAX}$ and K Factor vs. Frequency at Tcase = 25°C**
**$V_{DD}$ = 50 V, $I_{DQ}$ = 260 mA**



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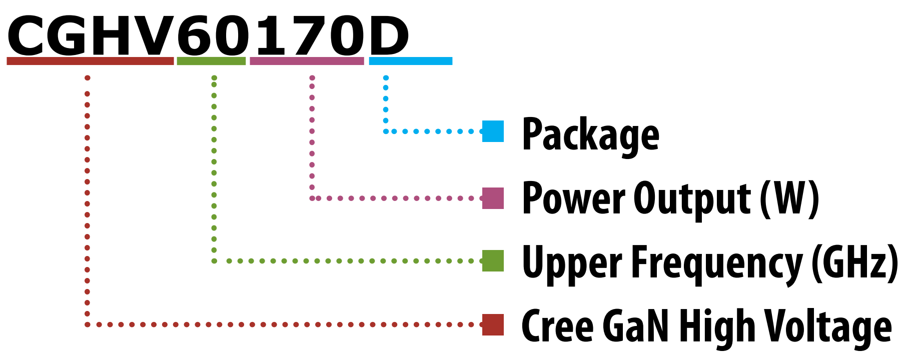
## Part Number System




| Parameter | Value | Units |
|---|---|---|
| Upper Frequency[1] | 6.0 | GHz |
| Power Output | 170 | W |
| Package | Bare Die | - |

**Table 1.**

**Note[1]:** Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

| Character Code | Code Value |
|---|---|
| A | 0 |
| B | 1 |
| C | 2 |
| D | 3 |
| E | 4 |
| F | 5 |
| G | 6 |
| H | 7 |
| J | 8 |
| K | 9 |
| Examples: | 1A = 10.0 GHz<br>2H = 27.0 GHz |

**Table 2.**



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