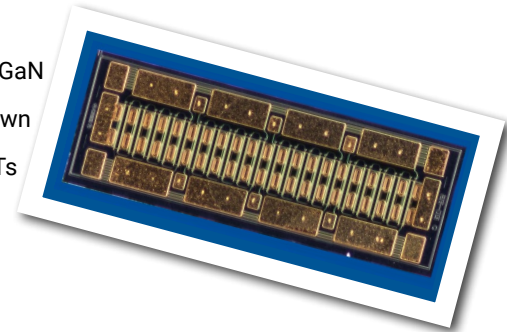


# CGHV60075D5

75 W, 6.0 GHz, GaN HEMT Die

Cree's CGHV60075D5 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

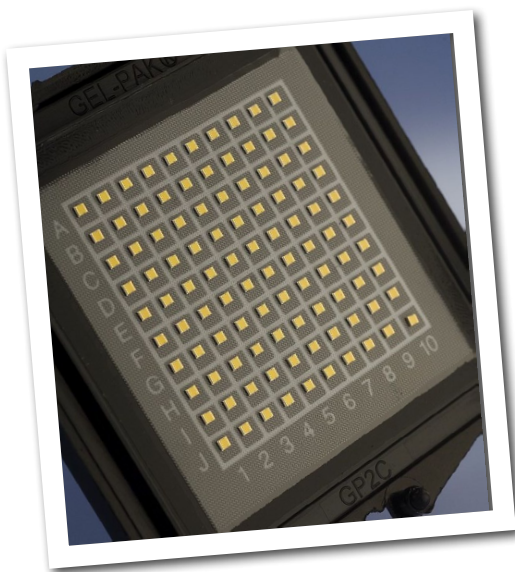
- 19 dB Typical Small Signal Gain at 4 GHz
- 17 dB Typical Small Signal Gain at 6 GHz
- 65% Typical Power Added Efficiency at 4 GHz
- 60% Typical Power Added Efficiency at 6 GHz
- 75 W Typical  $P_{SAT}$
- 50 V Operation
- High Breakdown Voltage
- Up to 6 GHz Operation

## APPLICATIONS

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

## Packaging Information

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



## Absolute Maximum Ratings (not simultaneous)

| Parameter  | Symbol          | Rating    | Units    | Conditions              |
|--|-----------------|-----------|----------|-------------------------|
| Drain-source Voltage   | $V_{DS}$        | 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 <sup>1</sup>                           | $I_{MAX}$       | 6.3       | A        | 25°C                    |
| Maximum Forward Gate Current                                 | $I_{GMAX}$      | 10        | mA       | 25°C                    |
| Thermal Resistance, Junction to Case (packaged) <sup>2</sup> | $R_{\theta JC}$ | 2.67      | °C/W     | 85°C, 41.6W Dissipation |
| Thermal Resistance, Junction to Case (die only)              | $R_{\theta JC}$ | 1.66      | °C/W     | 85°C, 41.6W Dissipation |
| Mounting Temperature   | $T_S$           | 320       | °C       | 30 seconds              |

Note<sup>1</sup> Current limit for long term reliable operation.

Note<sup>2</sup> Eutectic die attach using 80/20 AuSn mounted to a 10 mil thick Cu15Mo85 carrier.

## Electrical Characteristics (Frequency = 6 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$ )

| Characteristics                       | Symbol     | Min. | Typ. | Max.   | Units    | Conditions   |
|---------------------------------------|------------|------|------|--------|----------|--|
| <b>DC Characteristics</b>             |            |      |      |        |          |  |
| Gate Pinch-Off Voltage                | $V_P$      | -3.8 | -3.0 | -2.3   | V        | $V_{DS} = 10\text{ V}, I_D = 10\text{ mA}$   |
| Drain Current <sup>1</sup>            | $I_{DSS}$  | 8    | 10   | -      | A        | $V_{DS} = 6\text{ V}, V_{GS} = 2.0\text{ V}$   |
| Drain-Source Breakdown Voltage        | $V_{BD}$   | 150  | -    | -      | V        | $V_{GS} = -8\text{ V}, I_D = 10\text{ mA}$   |
| On Resistance                         | $R_{ON}$   | -    | 0.28 | -      | $\Omega$ | $V_{DS} = 0.1\text{ V}$  |
| Gate Forward Voltage                  | $V_{G-ON}$ | -    | 1.9  | -      | V        | $I_{GS} = 10\text{ mA}$  |
| <b>RF Characteristics</b>             |            |      |      |        |          |  |
| Small Signal Gain                     | $G_{SS}$   | -    | 17   | -      | dB       | $V_{DD} = 50\text{ V}, I_{DQ} = 125\text{ mA}$   |
| Saturated Power Output <sup>2,3</sup> | $P_{SAT}$  | -    | 75   | -      | W        | $V_{DD} = 50\text{ V}, I_{DQ} = 125\text{ mA}$   |
| Drain Efficiency <sup>3</sup>         | $\eta$     | -    | 60   | -      | %        | $V_{DD} = 50\text{ V}, I_{DQ} = 125\text{ mA}, P_{SAT} = 75\text{ W}$                                      |
| Intermodulation Distortion            | IM3        | -    | -30  | -      | dBc      | $V_{DD} = 50\text{ V}, I_{DQ} = 125\text{ mA}, P_{OUT} = 75\text{ W PEP}$                                  |
| Output Mismatch Stress                | VSWR       | -    | -    | 10 : 1 | $\Psi$   | No damage at all phase angles,<br>$V_{DD} = 50\text{ V}, I_{DQ} = 125\text{ mA}, P_{OUT} = 75\text{ W CW}$ |
| <b>Dynamic Characteristics</b>        |            |      |      |        |          |  |
| Input Capacitance                     | $C_{GS}$   | -    | 9.51 | -      | pF       | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$   |
| Output Capacitance                    | $C_{DS}$   | -    | 3.6  | -      | pF       | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$   |
| Feedback Capacitance                  | $C_{GD}$   | -    | 0.26 | -      | pF       | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$   |

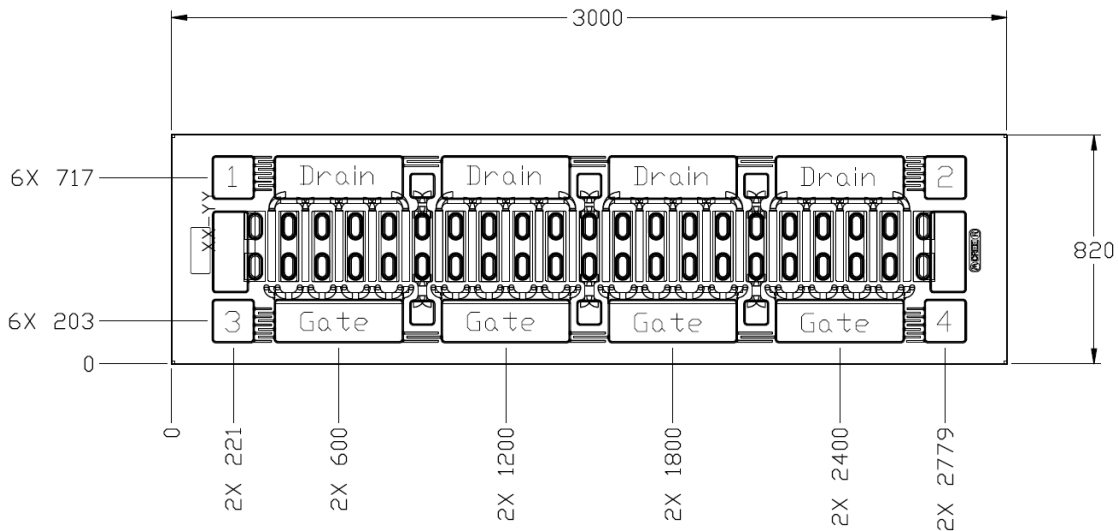
Notes:

<sup>1</sup> Scaled from PCM data

<sup>2</sup>  $P_{SAT}$  is defined as  $I_G = 1.0\text{ mA}$ .

<sup>3</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

## DIE DIMENSIONS (units in microns)



Overall die size 3000 x 820 (+0/-50) microns, die thickness 100 microns.  
All Gate and Drain pads must be wire bonded for electrical connection.

### Assembly Notes:

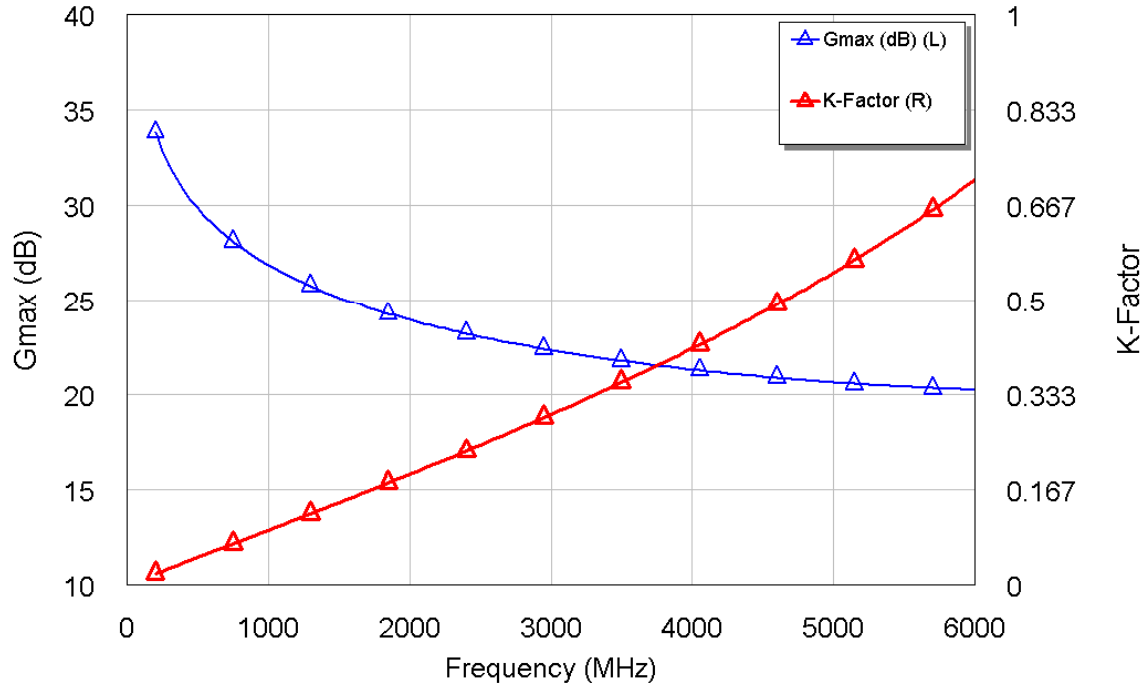
- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at [www.cree.com/rf/document-library](http://www.cree.com/rf/document-library)
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) 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

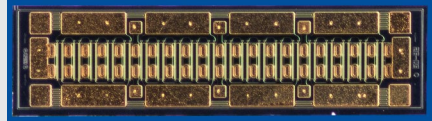
| Parameter           | Symbol | Class            | Test Methodology    |
|---------------------|--------|------------------|---------------------|
| Human Body Model    | HBM    | 1A (> 250 V)     | JEDEC JESD22 A114-D |
| Charge Device Model | CDM    | II (200 < 500 V) | JEDEC JESD22 C101-C |

## Typical Performance

**Figure 1. - CGHV60075D5  $G_{MAX}$  and K Factor vs. Frequency at  $T_{case} = 25^{\circ}C$   
 $V_{DD} = 50V, I_{DQ} = 125 mA$**



## Product Ordering Information

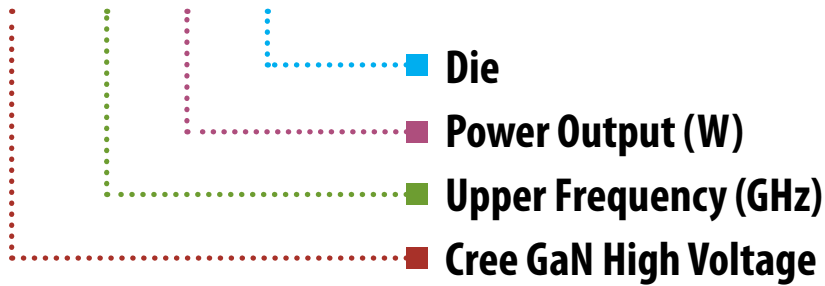
| Order Number | Description | Unit of Measure |   |
|--------------|-------------|-----------------|---|
| CGHV60075D5  | Bare Die    | Each            |  |

Typical Die S-Parameters (Small Signal,  $V_{DS} = 50\text{ V}$ ,  $I_{DQ} = 125\text{ mA}$ , magnitude / angle)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12   | Ang S12  | Mag S22 | Ang S22 |
|-----------|---------|---------|---------|---------|-----------|----------|---------|---------|
| 0.5       | 0.93309 | -154.44 | 14.266  | 88.053  | 0.014402  | -0.85181 | 0.35448 | -119.95 |
| 0.6       | 0.93352 | -158.34 | 11.838  | 83.444  | 0.01433   | -5.2391  | 0.3779  | -122.32 |
| 0.7       | 0.93452 | -161.14 | 10.06   | 79.434  | 0.014195  | -9.0268  | 0.40373 | -124.1  |
| 0.8       | 0.93586 | -163.24 | 8.7019  | 75.832  | 0.014019  | -12.407  | 0.43075 | -125.62 |
| 0.9       | 0.93743 | -164.87 | 7.6297  | 72.531  | 0.013813  | -15.485  | 0.45814 | -127.01 |
| 1         | 0.93917 | -166.17 | 6.761   | 69.468  | 0.013583  | -18.326  | 0.48532 | -128.36 |
| 1.1       | 0.94101 | -167.24 | 6.0431  | 66.6    | 0.013336  | -20.972  | 0.51193 | -129.69 |
| 1.2       | 0.94292 | -168.13 | 5.4398  | 63.9    | 0.013076  | -23.449  | 0.5377  | -131    |
| 1.3       | 0.94485 | -168.89 | 4.926   | 61.348  | 0.012806  | -25.779  | 0.56247 | -132.31 |
| 1.4       | 0.9468  | -169.55 | 4.4834  | 58.931  | 0.01253   | -27.974  | 0.58611 | -133.6  |
| 1.5       | 0.94872 | -170.12 | 4.0987  | 56.635  | 0.012249  | -30.047  | 0.60859 | -134.86 |
| 1.6       | 0.95062 | -170.64 | 3.7616  | 54.451  | 0.011966  | -32.007  | 0.62986 | -136.11 |
| 1.7       | 0.95247 | -171.1  | 3.4641  | 52.373  | 0.011683  | -33.861  | 0.64994 | -137.32 |
| 1.8       | 0.95426 | -171.51 | 3.2003  | 50.392  | 0.011401  | -35.619  | 0.66885 | -138.51 |
| 1.9       | 0.956   | -171.89 | 2.9648  | 48.503  | 0.011122  | -37.283  | 0.68662 | -139.66 |
| 2         | 0.95767 | -172.24 | 2.7539  | 46.699  | 0.010846  | -38.863  | 0.70331 | -140.77 |
| 2.1       | 0.95926 | -172.56 | 2.5641  | 44.976  | 0.010574  | -40.36   | 0.71895 | -141.85 |
| 2.2       | 0.96079 | -172.86 | 2.3927  | 43.33   | 0.010307  | -41.781  | 0.73359 | -142.89 |
| 2.3       | 0.96225 | -173.14 | 2.2375  | 41.754  | 0.010045  | -43.13   | 0.74731 | -143.9  |
| 2.4       | 0.96364 | -173.41 | 2.0963  | 40.247  | 0.0097893 | -44.411  | 0.76014 | -144.87 |
| 2.5       | 0.96496 | -173.65 | 1.9677  | 38.802  | 0.0095396 | -45.629  | 0.77216 | -145.8  |
| 2.6       | 0.96621 | -173.89 | 1.8502  | 37.416  | 0.0092961 | -46.787  | 0.78341 | -146.7  |
| 2.7       | 0.9674  | -174.11 | 1.7425  | 36.087  | 0.0090588 | -47.888  | 0.79393 | -147.57 |
| 2.8       | 0.96853 | -174.32 | 1.6437  | 34.811  | 0.0088279 | -48.935  | 0.80379 | -148.4  |
| 2.9       | 0.96959 | -174.52 | 1.5528  | 33.584  | 0.0086033 | -49.933  | 0.81303 | -149.2  |
| 3         | 0.9706  | -174.71 | 1.4689  | 32.404  | 0.0083851 | -50.882  | 0.82169 | -149.97 |
| 3.2       | 0.97246 | -175.07 | 1.3198  | 30.177  | 0.0079668 | -52.647  | 0.83741 | -151.43 |
| 3.4       | 0.97412 | -175.4  | 1.1918  | 28.105  | 0.0075724 | -54.252  | 0.85128 | -152.78 |
| 3.6       | 0.97561 | -175.71 | 1.081   | 26.175  | 0.0072005 | -55.712  | 0.86354 | -154.03 |
| 3.8       | 0.97695 | -175.99 | 0.98461 | 24.373  | 0.0068495 | -57.041  | 0.87439 | -155.19 |
| 4         | 0.97815 | -176.26 | 0.90032 | 22.681  | 0.0065185 | -58.254  | 0.88404 | -156.27 |
| 4.2       | 0.97923 | -176.5  | 0.82619 | 21.091  | 0.0062057 | -59.361  | 0.89265 | -157.28 |
| 4.4       | 0.9802  | -176.74 | 0.76072 | 19.592  | 0.0059099 | -60.372  | 0.90034 | -158.21 |
| 4.6       | 0.98108 | -176.96 | 0.70262 | 18.175  | 0.0056299 | -61.295  | 0.90725 | -159.09 |
| 4.8       | 0.98187 | -177.17 | 0.65085 | 16.832  | 0.0053644 | -62.137  | 0.91345 | -159.91 |
| 5         | 0.98259 | -177.36 | 0.60454 | 15.558  | 0.0051122 | -62.903  | 0.91905 | -160.68 |
| 5.2       | 0.98324 | -177.55 | 0.56297 | 14.343  | 0.0048724 | -63.603  | 0.92411 | -161.41 |
| 5.4       | 0.98383 | -177.73 | 0.52552 | 13.185  | 0.0046441 | -64.237  | 0.9287  | -162.09 |
| 5.6       | 0.98437 | -177.91 | 0.49168 | 12.078  | 0.0044262 | -64.81   | 0.93287 | -162.73 |
| 5.8       | 0.98487 | -178.07 | 0.46099 | 11.017  | 0.0042182 | -65.327  | 0.93667 | -163.34 |
| 6         | 0.98532 | -178.23 | 0.4331  | 9.9987  | 0.0040191 | -65.79   | 0.94015 | -163.92 |

To download the s-parameters in s2p format, go to the CGHV60075D5 Product Page and click the documentation tab.

### CGHV60075D5



| Parameter                    | Value    | Units |
|------------------------------|----------|-------|
| Upper Frequency <sup>1</sup> | 6.0      | GHz   |
| Power Output                 | 75       | W     |
| Package                      | Bare Die | -     |

**Table 1.**

**Note<sup>1</sup>:** 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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For more information, please contact:

Cree, Inc.  
4600 Silicon Drive  
Durham, NC 27703  
[www.cree.com/rf](http://www.cree.com/rf)

Sarah Miller  
Marketing  
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