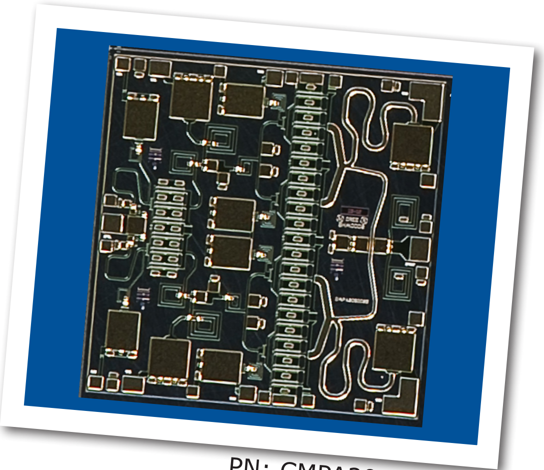
CMPA2060025D

25 W, 2.0 - 6.0 GHz, GaN MMIC, Power Amplifier

Cree's CMP2060025D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). 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 also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC contains a two-stage reactively matched amplifier design approach enabling very wide bandwidths to be achieved.



PN: CMPA2060025D

Typical Performance Over 2.0-6.0 GHz (T_C = 25˚C)

Parameter	2.0 GHz	3.0 GHz	4.0 GHz	5.0 GHz	6.0 GHz	Units
Small Signal Gain	31	33	27	23	27	dB
Saturated Output Power, P_{SAT}[1]	29	26	38	27	45	W
Power Gain @ P_{OUT} = 44 dBm	23	23	18	16	18	dB
PAE @ P_{OUT} 44 dBm	42	40	50	28	38	%

Note[1]: P_{SAT} is defined as the RF output power where the device starts to draw positive gate current in the range of 2-8 mA. Typical Data with 50Ω output load. Output transformer can improve performance.

Features

- 21 dB Small Signal Gain
- 23 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation
- Size 0.142 x 0.144 x 0.004 inches

Applications

- Ultra Broadband Drivers
- Fiber Drivers
- Test Instrumentation
- EMC Amplifier Drivers

Rev 0.2 – February 2011

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Absolute Maximum Ratings (not simultaneous) at 25˚C

Parameter	Symbol	Rating	Units
Drain-source Voltage	V_{DSS}	84	VDC
Gate-source Voltage	V_{GS}	-10, +2	VDC
Storage Temperature	T_{STG}	-55, +150	˚C
Operating Junction Temperature	T_J	225	˚C
Thermal Resistance, Junction to Case (packaged)[1]	$R_{\theta JC}$	2.3	˚C/W
Mounting Temperature (30 seconds)	T_S	320	˚C

Note[1] Eutectic die attach using 80/20 AuSn solder mounted to a 40 mil thick CuW carrier.

Electrical Characteristics (Frequency = 2.0 GHz to 6.0 GHz unless otherwise stated; T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold	V_{TH}	-3.8	-2.8	-2.3	V	V_{DS} = 10 V, I_D = 13.4 mA
Saturated Drain Current[1]	I_{DS}	9.3	13.1	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V	V_{GS} = -8 V, I_D = 13.4 mA
RF Characteristics[2]						
Small Signal Gain	S21	–	25	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA
Power Output	P_{OUT1}	–	30	–	W	V_{DD} = 28 V, I_{DQ} = 1200 mA, P_{IN} ≤ 26 dBm
Power Added Efficiency	PAE	–	40	–	%	V_{DD} = 28 V, I_{DQ} = 1200 mA
Power Gain	G_P	–	19	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA
Input Return Loss	S11	–	7	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA
Output Return Loss	S22	–	7	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA
Output Mismatch Stress	VSWR	–	5 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 1200 mA, P_{OUT} = 25W CW

Notes:
[1] Scaled from PCM data.
[2] All data pulse tested on-wafer with Pulse Width = 10 μs, Duty Cycle = 0.1%.

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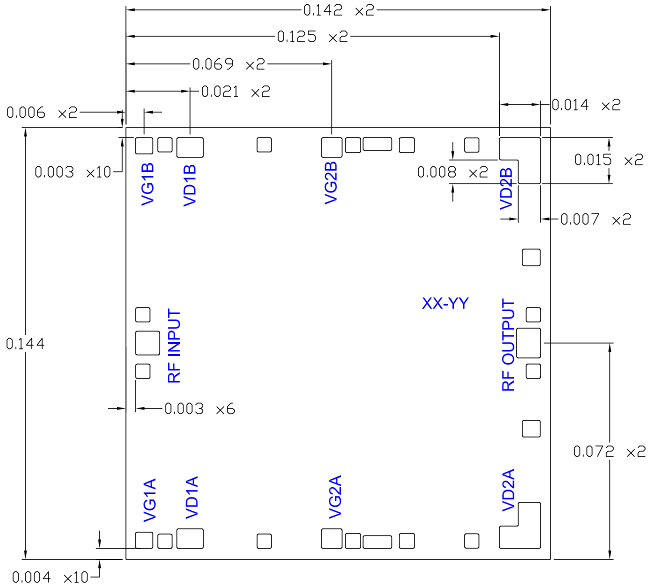
Die Dimensions (units in inches)



Overall die size 0.142 x 0.144 (+0/-0.005) inches, die thickness 0.004 inches.
All Gate and Drain pads must be wire bonded for electrical connection.

Pad Number	Function	Description	Pad Size (in)	Note
1	RF-IN	RF-Input pad. Matched to 50 ohm.	0.008" x 0.008"	3
2	VG1_A	Gate control for stage 1. V_G ~ 2.0 - 3.5 V.	0.006" x 0.005"	1,2
3	VG1_B	Gate control for stage 1. V_G ~ 2.0 - 3.5 V.	0.006" x 0.005"	1,2
4	VD1_A	Drain supply for stage 1. V_D = 28 V.	0.009" x 0.006"	1
5	VD1_B	Drain supply for stage 1. V_D = 28 V.	0.009" x 0.006"	1
6	VG2_A	Gate control for stage 2A. V_G ~ 2.0 - 3.5 V.	0.007" x 0.007"	1
7	VG2_B	Gate control for stage 2A. V_G ~ 2.0 - 3.5 V.	0.007" x 0.007"	1
8	VD2_A	Drain supply for stage 2A. V_D = 28 V.	–	1
9	VD2_B	Drain supply for stage 2B. V_D = 28 V.	–	1
10	RF-Out	RF-Output pad. Requires external matching circuit for optimal performance freq. > 4.0 GHz	0.008" x 0.008"	3

Notes:
[1] Attach bypass capacitor to pads 2-9 per application circuit.
[2] The RF Input and Output pad have a ground-signal-ground with a nominal pitch of 9 mil (240 um). The RF ground pads are 0.005" x 0.005."

Die Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at http://www.cree.com/products/wireless_appnotes.asp
- 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.

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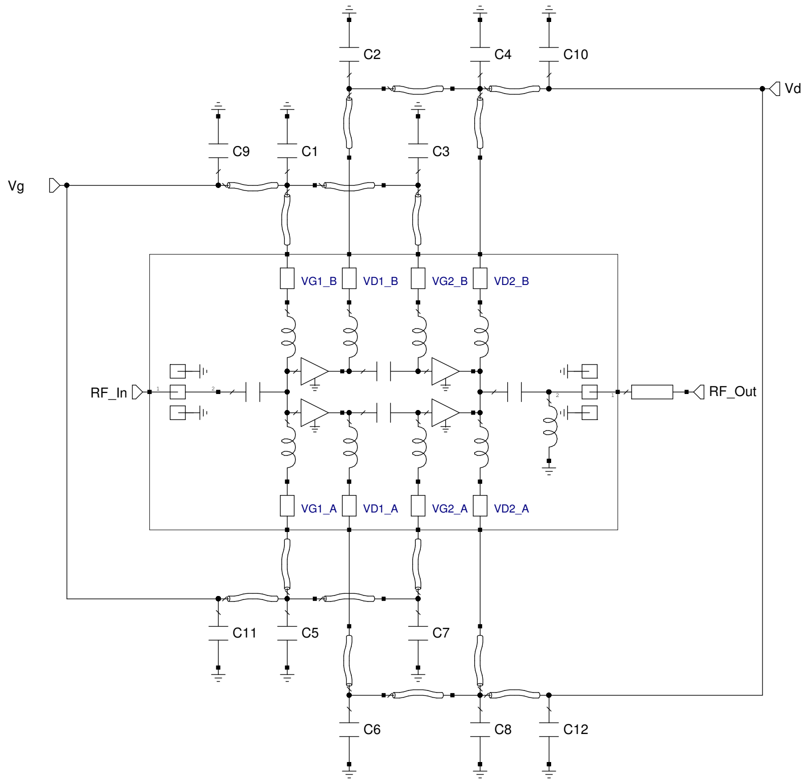
Block Diagram Showing Additional Capacitors & Output Matching Section for Operation Over 2.0 to 6.0 GHz



Designator	Description	Quantity
C1,C2,C3,C4,C5,C6,C7,C8	CAP, 120pF, +/-10%, SINGLE LAYER, 0.035", Er 3300, 100V, Ni/Au TERMINATION	8
C9,C10,C11,C12	CAP, 680pF, +/-10%, SINGLE LAYER, 0.070", Er 3300, 100V, Ni/Au TERMINATION	4

Notes:

[1] The input, output and decoupling capacitors should be attached as close as possible to the die- typical distance is 5 to 10 mils with a maximum of 15 mils.

[2] The MMIC die and capacitors should be connected with 2 mil gold bond wires.

[3] The output of the MMIC requires a transformer, (30Ω, 90° at 5.5GHz) for improved performance.

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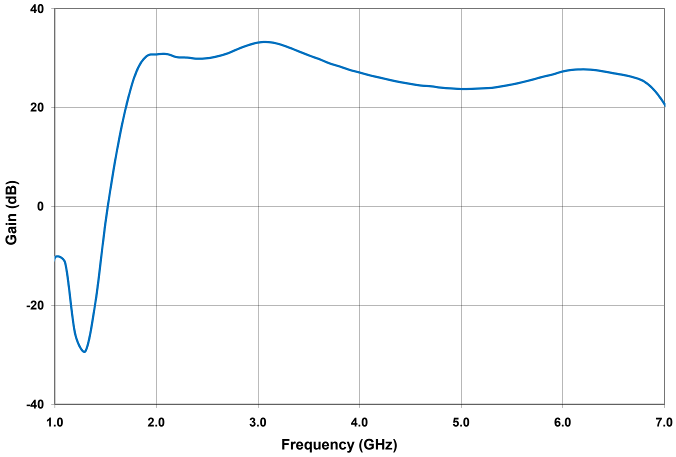
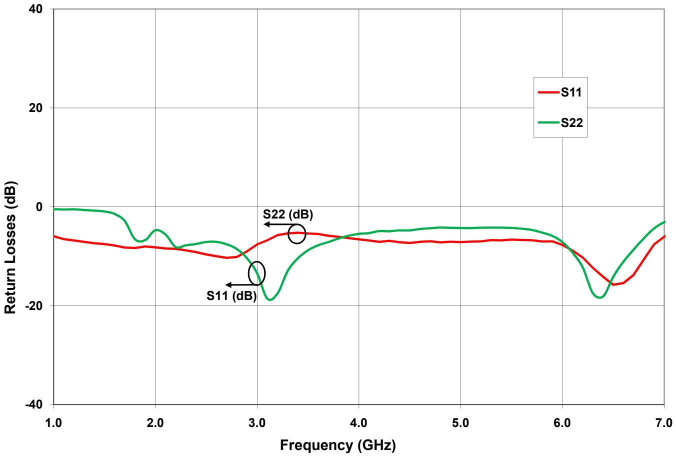
Typical Performance of the CMPA2060025D

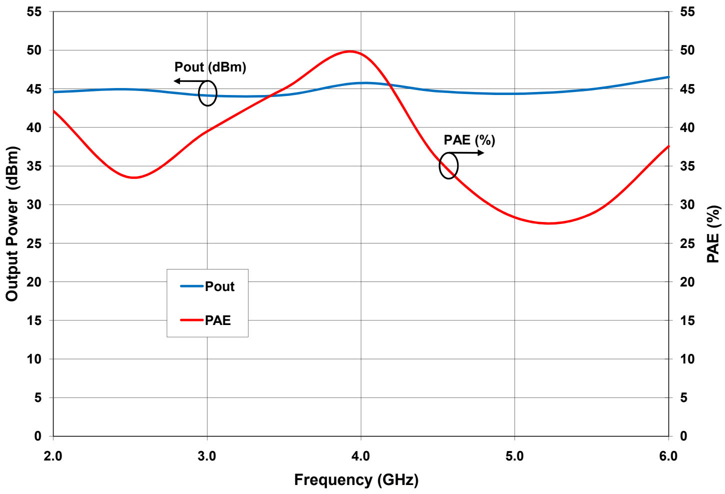
Small Signal Gain vs Frequency
V_{DD}=28V, I_{DQ}=1.2A, Unmatched Load



Input & Output Return Losses vs Frequency
V_{DD}=28V, I_{DQ}=1.2A, Unmatched Load



Output Power & Power Added Efficiency vs Frequency
V_{DD}=28V, I_{DQ}=1.2A, Unmatched Load



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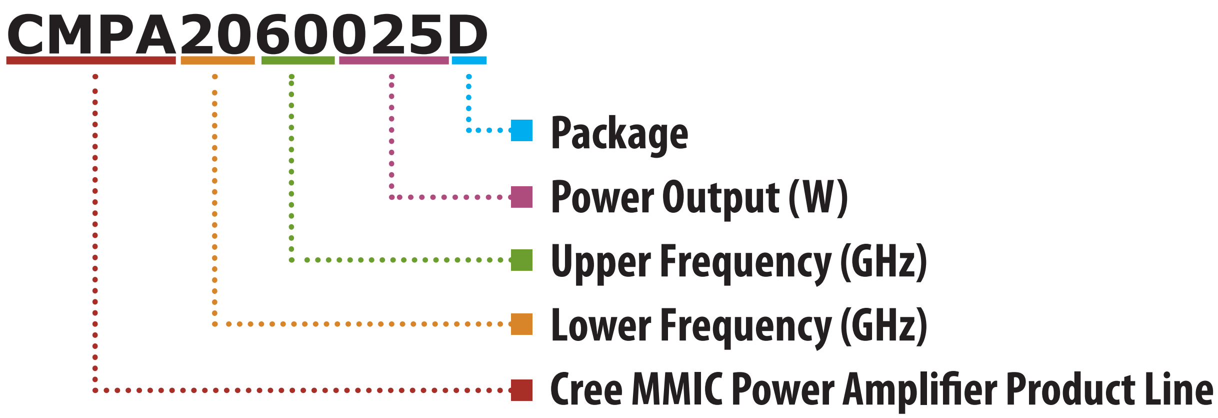
Part Number System



Parameter	Value	Units
Lower Frequency	2.0	GHz
Upper Frequency[1]	6.0	GHz
Power Output	25	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 2H = 27.0 GHz

Table 2.

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