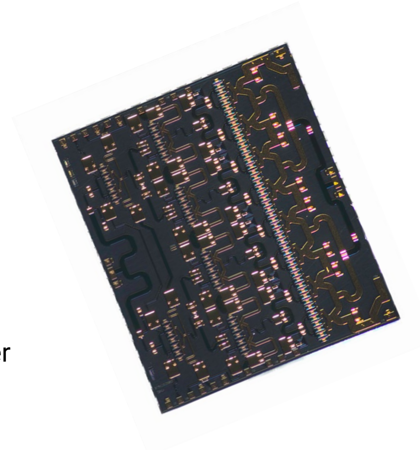
CMPA1C1D060D

60 W, 12.7 - 13.25 GHz, 40 V, GaN MMIC, Power Amplifier

Cree's CMPA1C1D060D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC) on a silicon carbide substrate, using a 0.25 μm gate length fabrication process. GaN-on-SiC has superior properties compared to silicon, gallium arsenide or GaN-on-Si, 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, GaAs, and GaN-on-Si transistors.



Typical Performance Over 12.7-13.25 GHz (T_c = 25˚C)

Parameter	12.7 GHz	13.0 GHz	13.25 GHz	Units
Small Signal Gain	26.5	26.2	26	dB
P_{SAT} @ P_{IN} = 28 dBm	65	63	60	W
PAE @ P_{IN} = 28 dBm	29	28	27	%

Note: All data in this table is based on fixtured, CW performance.

Features

- 26 dB Small Signal Gain
- 60 W Typical P_{SAT}
- Operation up to 40 V
- High Breakdown Voltage
- High Temperature Operation
- Size 0.209 x 0.240 x 0.004 inches

Applications

- Satellite Communications Uplink
- PTP Radio

Rev 0.0 – February 2017

Absolute Maximum Ratings (not simultaneous) at 25˚C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	84	V_{DC}	25˚C
Gate-source Voltage	V_{GS}	-10, +2	V_{DC}	25˚C
Storage Temperature	T_{STG}	-55, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	16.8	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	1.8	A	Stage 1, 25˚C
Maximum Drain Current[1]	I_{DMAX}	3.6	A	Stage 2, 25˚C
Maximum Drain Current[1]	I_{DMAX}	9	A	Stage 3, 25˚C
Thermal Resistance, Junction to Case[2]	$R_{\theta JC}$	1.12	˚C/W	85˚C, P_{DISS} = 118 W
Mounting Temperature (30 seconds)	T_S	320	˚C	30 seconds

Note[1] Current limit for long term, reliable operation. Total current when biased from top and bottom drain pads.
Note[2] Eutectic die attach using 80/20 AuSn mounted to a 55 mil thick CuMoCu carrier.

Electrical Characteristics (Frequency = 12.7 GHz to 13.25 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 = 27 mA
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V	V_{GS} = -8 V, I_D = 27 mA
RF Characteristics[2]						
Small Signal Gain	S21	–	27	–	dB	V_{DD} = 40 V, I_{DQ} = 0.45 A
Input Return Loss	S11	–	-15	–	dB	V_{DD} = 40 V, I_{DQ} = 0.45 A
Output Return Loss	S22	–	-5	–	dB	V_{DD} = 40 V, I_{DQ} = 0.45 A
Power Output	P_{OUT}	–	75	–	W	V_{DD} = 40 V, I_{DQ} = 0.45 A, CW, P_{IN} = 30 dBm
Power Added Efficiency	PAE	–	30	–	%	V_{DD} = 40 V, I_{DQ} = 0.45 A, CW, P_{IN} = 30 dBm
Power Gain	G_P	–	19	–	dB	V_{DD} = 40 V, I_{DQ} = 0.45 A, CW, P_{IN} = 30 dBm
Output Mismatch Stress	VSWR	–	5 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 40 V, I_{DQ} = 0.45 A, P_{OUT} = 30 W 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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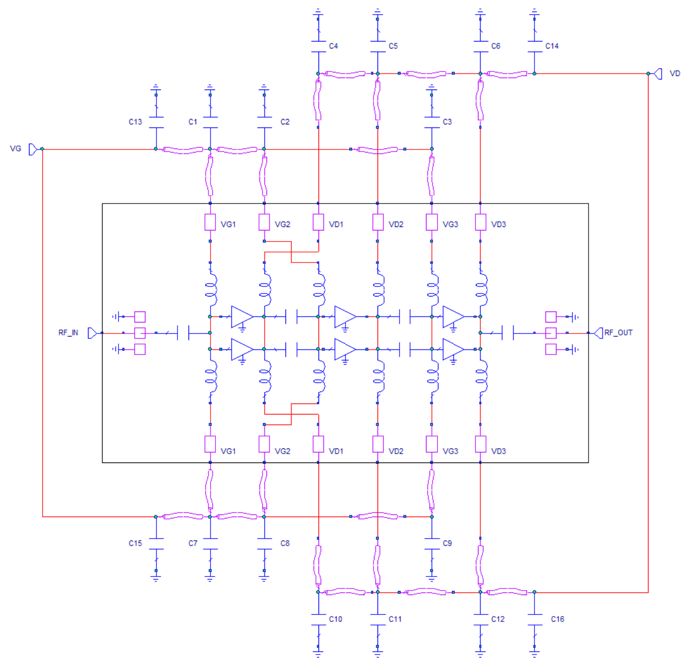
Block Diagram Showing Additional Capacitors for Operation Over 12.7 to 13.25 GHz



Designator	Description	Quantity
C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12	CAP, 51pF, +/-10%, SINGLE LAYER, 0.030", Er 3300, 100V, Ni/Au TERMINATION	12
C13,C14,C15,C16	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.

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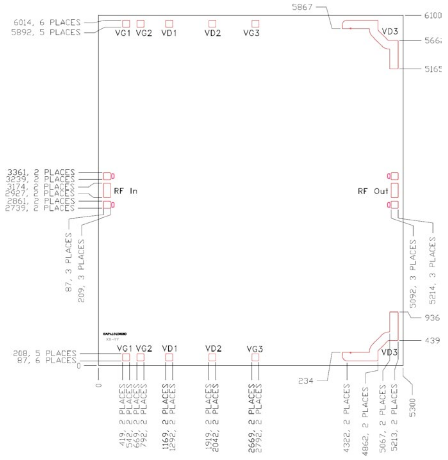
Die Dimensions (units in microns)



Overall die size 5300 x 6100 (+0/-50) microns, die thickness 100 (+/-10) microns.
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	125x250	3
2	VG1 bottom	Gate control for stage1. Vg = -2.0 to -3.5 V	125x125	1,2
3	VG1 top	Gate control for stage1. Vg = -2.0 to -3.5 V	125x125	1,2
4	VG2 bottom	Gate control for stage2. Vg = -2.0 to -3.5 V	125x125	1,2
5	VG2 top	Gate control for stage2. Vg = -2.0 to -3.5 V	125x125	1,2
6	VD1 bottom	Drain control for stage1. Vd = 40 V	125x125	1
7	VD1 top	Drain control for stage1. Vd = 40 V	125x125	1
8	VD2 bottom	Drain control for stage2. Vd = 40 V	125x125	1
9	VD2 top	Drain control for stage2. Vd = 40 V	125x125	1
10	VG3 bottom	Gate control for stage3. Vg = -2.0 to -3.5 V	125x125	1,2
11	VG3 top	Gate control for stage3. Vg = -2.0 to -3.5 V	125x125	1,2
12	VD3 bottom	Drain control for stage3. Vd = 40 V	540x150	1
13	VD3 top	Drain control for stage3. Vd = 40 V	150x500	1
14	RF_OUT	RF-Output pad. Matched to 50 ohm	125x250	3

Notes:

[1] Attach bypass capacitor to pads 2-13 per aplications circuit

[2] VG1&2&3 top and bottom are connected internally, so it would be enough to connect either one for proper operation

[3] The RF Input and Output pads have a ground-signal-ground with a nominal pitch of 10 mil (250 um). The RF ground pads are 125 x 250 microns

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/~/media/Files/Cree/RF/Application%20Notes/Appnote%202%20Eutectic.pdf
- 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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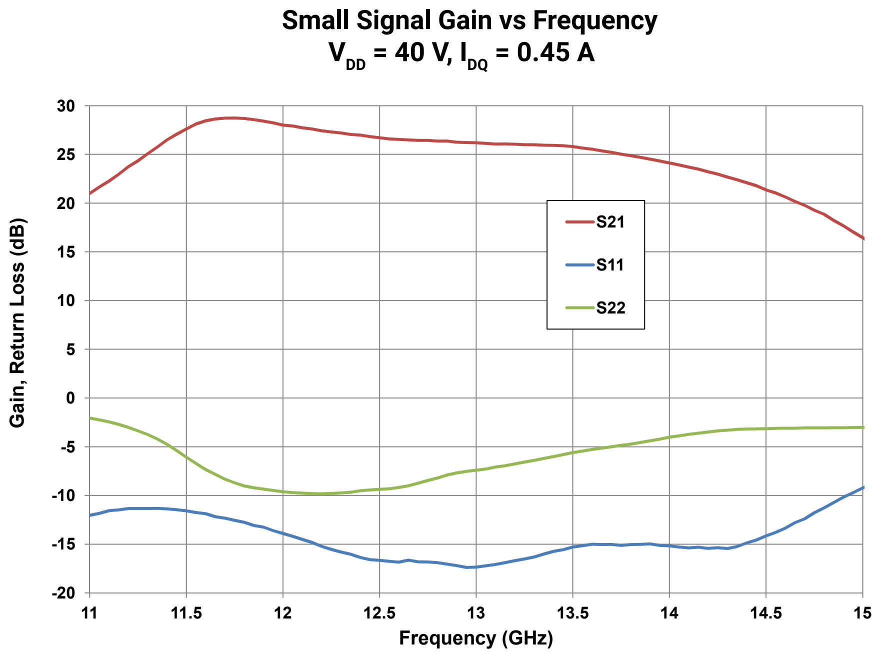
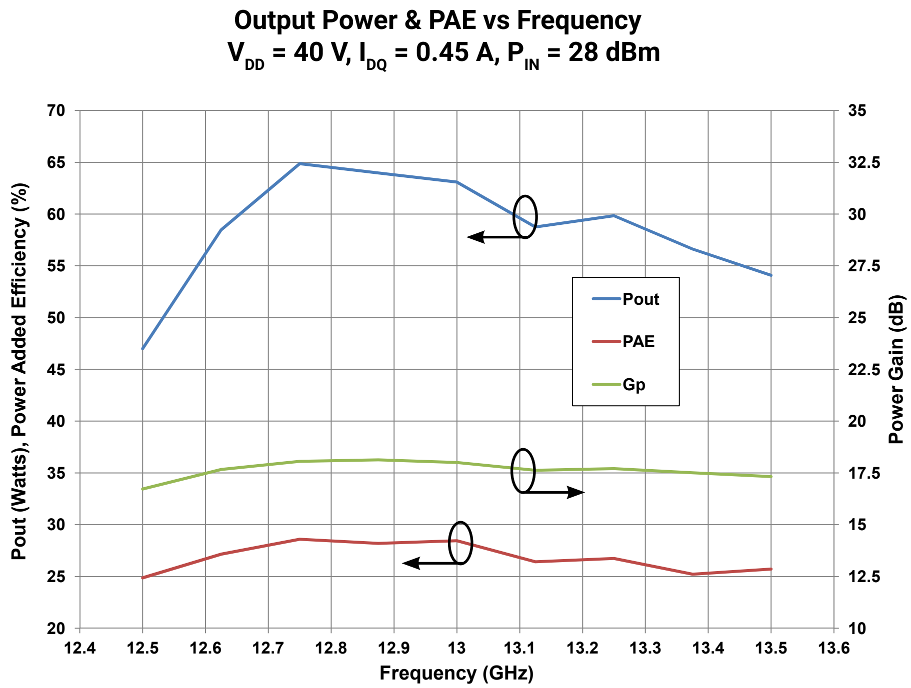
Typical Performance of the CMPA1C1D060D





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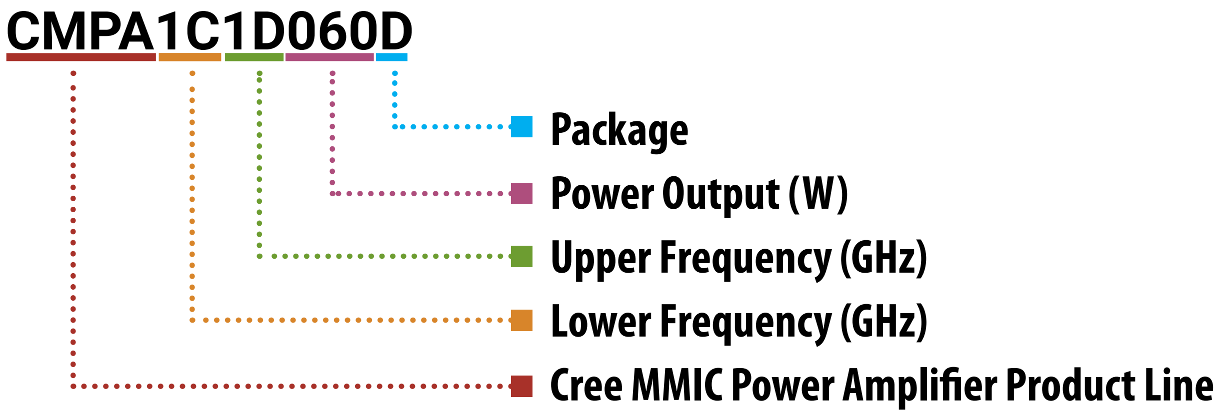
Part Number System



Parameter	Value	Units
Lower Frequency	12.7	GHz
Upper Frequency[1]	13.25	GHz
Power Output	60	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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Product Ordering Information

Order Number	Description	Unit of Measure
CMPA1C1D060D	GaN MMIC, Bare Die	Each

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