

CMPA1C1D060D

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



PN: CMPA1C1D060D

Description

The 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 ($T_c = 25^\circ\text{C}$)

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



Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	120	V_{DC}	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-55, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	16.8	mA	25°C
Maximum Drain Current Stage 1 ¹	I_{DMAX}	1.8	A	
Maximum Drain Current Stage 2 ¹		3.6		
Maximum Drain Current Stage 2 ¹		9		
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

Notes:

¹ Current limit for long term, reliable operation. Total current when biased from top and bottom drain pads

² Eutectic die attach using 80/20 AuSn solder mounted to a 20 mil thick CuMoCu carrier.

Electrical Characteristics (Frequency = 12.7 GHz to 13.25 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$)

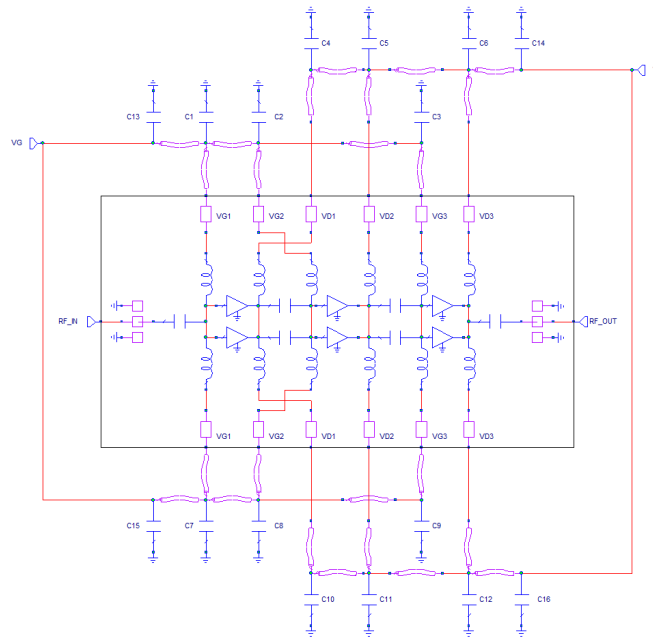
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold	V_{TH}	-3.8	-2.8	-2.3	V	$V_{DS} = 10$ V, $I_D = 27$ mA
Drain-Source Breakdown Voltage	V_{BD}	100	100	—		$V_{GS} = -8$ V, $I_D = 27$ mA
RF Characteristics²						
Small Signal Gain	S21	—	27	—	dB	$V_{DD} = 40$ V, $I_{DQ} = 0.45$ A
Input Return Loss	S11	—	-15	—		
Output Return Loss	S22	—	-5	—		
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	—	%	
Power Gain	G_P	—	19	—	dB	
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 μ s, Duty Cycle = 0.1%

Block Diagram Showing Additional Capacitors for Operation Over 12.7 to 13.25 GHz



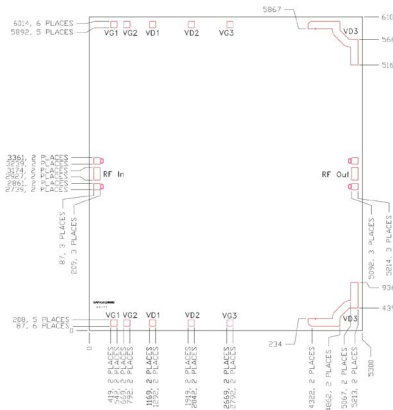
Designator	Description	Qty
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12	CAP, 51pF, +/-10%, SINGLE LAYER, 0.030", Er 3300, 100V, Ni/Au TERMINATION	12
C13, C14, C15, C16	CAP, 680pF, +/-10%, SINGLE LAYER, 0.070", Er 3300, 100V, Ni/Au TERMINATION	4

Note:
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

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D

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 (microns)	Note		
1	RF_IN ¹	RF-Input pad. Matched to 50 ohm	125x250	3		
2	VG1 bottom	Gate control for stage 1. $V_G = -2.0$ to -3.5 V	125x125	1, 2		
3	VG1 top					
4	VG2 bottom	Gate control for stage 2. $V_G = -2.0$ to -3.5 V		125x125	1	
5	VG2 top					
6	VD1 bottom	Drain control for stage 1. $V_D = 40$ V			125x125	1
7	VD1 top					
8	VD2 bottom	Drain control for stage 2. $V_D = 40$ V	125x125			1
9	VD2 top					
10	VG3 bottom	Gate control for stage 3. $V_G = -2.0$ to -3.5 V		540x150		1, 2
11	VG3 top					
12	VD3 bottom	Drain control for stage 3. $V_D = 40$ V		150x500	1	
13	VD3 top					
14	RF_OUT	RF-Output pad. Matched to 50 ohm	125x125	3		

Note:

¹ The RF In and Out pads have a ground-signal-ground configuration with a pitch of 1 mil (25µm)

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 (250µm). The RF ground pads are 125 x 250 microns

Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to the website for the Eutectic Die Bond Procedure application note
- 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

Typical Performance of the CPA1C1D060D

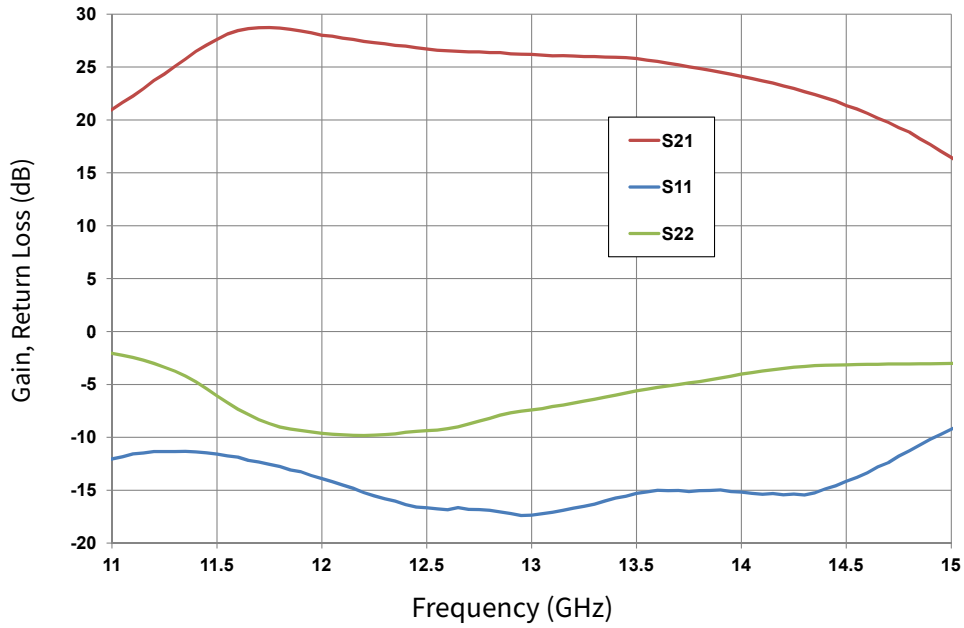


Figure 1. Small Signal Gain vs Frequency
 $V_{DD} = 40\text{ V}$, $I_{DQ} = 0.45\text{ A}$

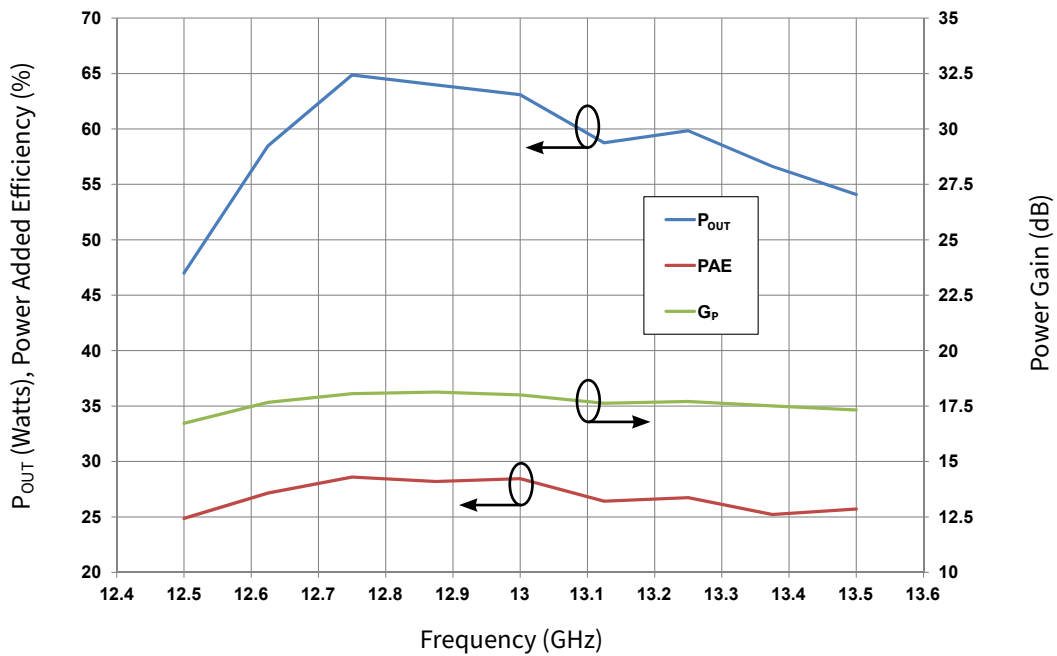


Figure 2. Output Power & PAE vs Frequency
 $V_{DD} = 40\text{ V}$, $I_{DQ} = 0.45\text{ A}$, $P_{IN} = 28\text{ dBm}$

Part Number System

CMPA1C1D060D

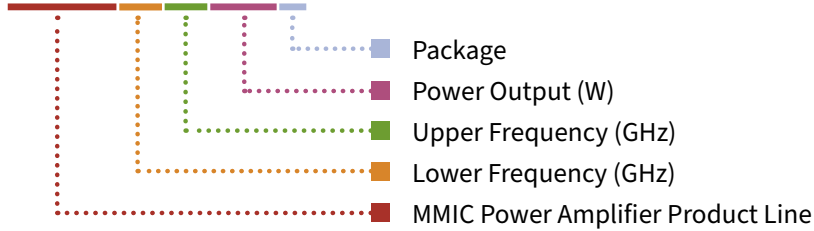


Table 1.

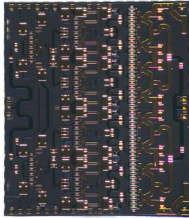
Parameter	Value	Units
Lower Frequency	12.7	GHz
Upper Frequency ¹	13.25	GHz
Power Output	60	W
Package	Bare Die	—

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

Table 2.

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

Product Ordering Information

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

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