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°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

RoHS compliant

Rev. 1.0, 2022-8-30

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

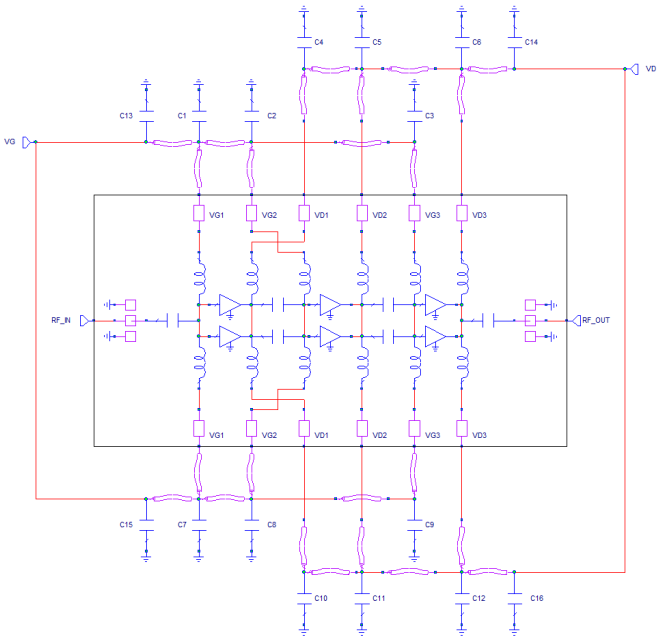
Notes:
[1] Current limit for long term, reliable operation. Total current when biased from top and bottom drain pads
[2] Eutectic die attach using 80/20 AuSn solder mounted to a 20 mil thick CuMoCu carrier.

Electrical Characteristics (Frequency = 12.7 GHz to 13.25 GHz unless otherwise stated; T_C = 25°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 Characteristics[2]						
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 = 10µs, Duty Cycle = 0.1%

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



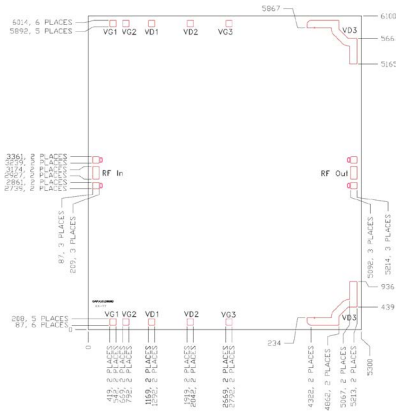
Designator	Description	Qty
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12	CAP, 51pF, +/-10%, SINGLE LAYER, 0.030", Er 3300, 100V, Ni/Au TERMINATION	12
C13, C14, C15, C16	CAP, 680pF, +/-10%, SINGLE LAYER, 0.070", Er 3300, 100V, Ni/Au TERMINATION	4

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		
5	VG2 top			
6	VD1 bottom	Drain control for stage 1. V_D = 40 V		1
7	VD1 top			
8	VD2 bottom	Drain control for stage 2. V_D = 40 V		
9	VD2 top			
10	VG3 bottom	Gate control for stage 3. V_G = -2.0 to -3.5 V		1, 2
11	VG3 top			
12	VD3 bottom	Drain control for stage 3. V_D = 40 V	540x150	1
13	VD3 top		150x500	
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 CMPA1C1D060D

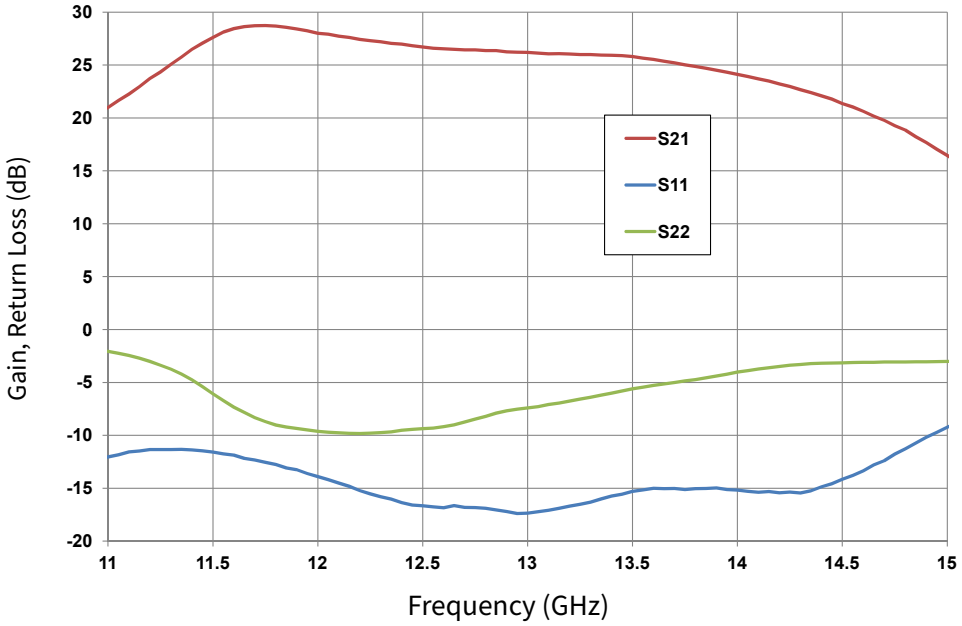


Figure 1. Small Signal Gain vs Frequency
V_{DD} = 40 V, I_{DQ} = 0.45 A

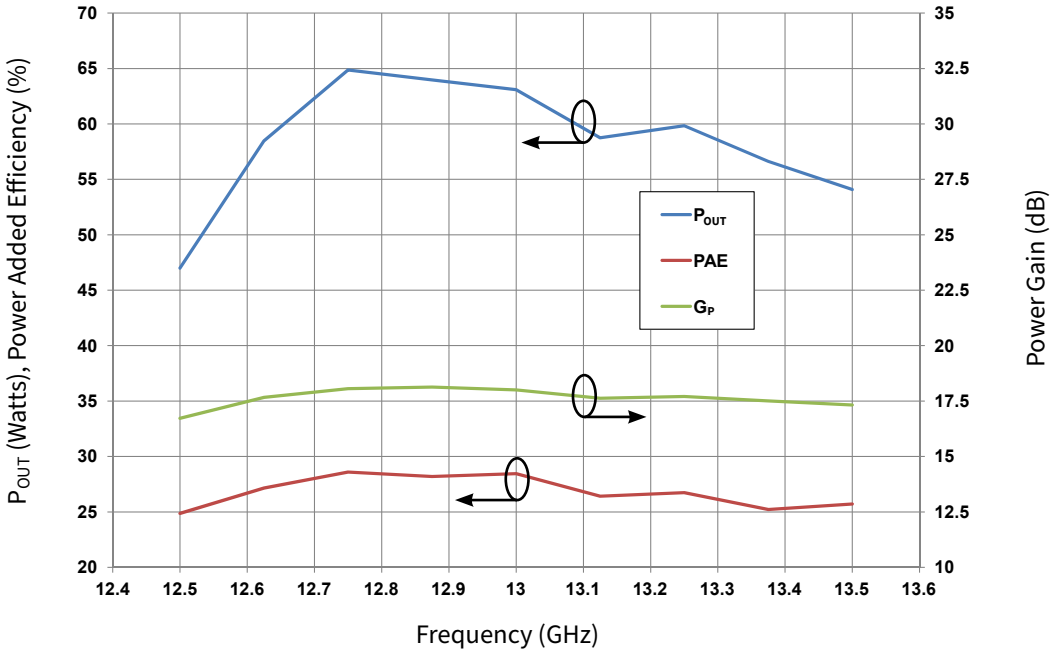


Figure 2. Output Power & PAE vs Frequency
V_{DD} = 40 V, I_{DQ} = 0.45 A, P_{IN} = 28 dBm

Part Number System

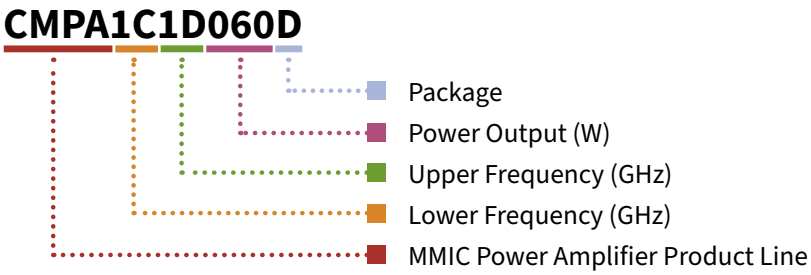


Table 1.

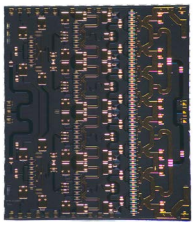
Parameter	Value	Units
Lower Frequency	12.7	GHz
Upper Frequency[1]	13.25	GHz
Power Output	60	W
Package	Bare Die	—

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	

Notes & Disclaimer

These materials are provided in connection with MACOM’s products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.