CMPA2060035D

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

PN's: CMPA2060035D

Description

The CMP2060035D 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.

Features

- 29 dB small signal gain
- 35 W typical P_{SAT}
- Operation up to 28 V
- High breakdown voltage
- High temperature operation
- Size 0.144 x 0.162 x 0.004 inches

Applications

- Ultra broadband drivers
- Fiber drivers
- Test instrumentation
- EMC amplifier drivers

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	28	31	29	30	27	dB
Output Power[1]	37	38	57	41	37	W
Power Added Efficiency	42	46	53	42	38	%

Note:
[1] Typical data with 50 Ω output load, measured under CW drive at fixed P_{IN} = 26 dBm, Temp = 25 °C.

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Absolute Maximum Ratings (Not Simultaneous) at 25 °C

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	V_{DC}
Gate-to-Source Voltage	V_{GS}	-10, +2	V_{DC}
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 Voltage	$V_{GS(th)}$	-3.4	-3.0	-2.7	V	V_{DS} = 10 V, I_D = 16.5 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.6	–	V_{DC}	V_{DD} = 28 V, I_{DQ} = 1200 mA
Saturated Drain Current[1]	I_{DS}	11.9	16.5	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	84	–	–	V	V_{GS} = -8 V, I_D = 16.5 mA
RF Characteristics[2,3]						
Small Signal Gain	S21	–	29	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA, Frequency = 2 - 6 GHz
Input Return Loss	S11	–	-10	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA, Frequency = 2 - 6 GHz
Output Return Loss	S22	–	9.5	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA, Frequency = 2 - 6 GHz
Output Power	P_{OUT1}	–	34	–	W	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 2.0 GHz, P_{IN} = 26 dBm
Output Power	P_{OUT2}	–	61	–	W	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 4.0 GHz, P_{IN} = 26 dBm
Output Power	P_{OUT3}	–	47	–	W	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 6.0 GHz, P_{IN} = 26 dBm
Power Added Efficiency	PAE^1	–	42	–	%	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 2.0 GHz, P_{IN} = 26 dBm
Power Added Efficiency	PAE^2	–	56	–	%	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 4.0 GHz, P_{IN} = 26 dBm
Power Added Efficiency	PAE^3	–	42	–	%	V_{DD} = 28 V, I_{DQ} = 1200 mA, Freq = 6.0 GHz, P_{IN} = 26 dBm
Power Gain	G_P		20.5	–	dB	V_{DD} = 28 V, I_{DQ} = 1200 mA, P_{IN} = 26 dBm
Output Mismatch Stress	VSWR	–	–	5 : 1	Ψ	No Damage at All Phase Angles, V_{DD} = 28 V, I_{DQ} = 1200 mA, P_{OUT} = 35 W

Notes:
[1] Scaled from PCM data.
[2] All data pulse tested on-wafer with pulse width = 10 µs, duty cycle = 1%.
[3] Data measured into an output load with a 15 dB maximum return loss.

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Typical Performance of the CMPA2060035D

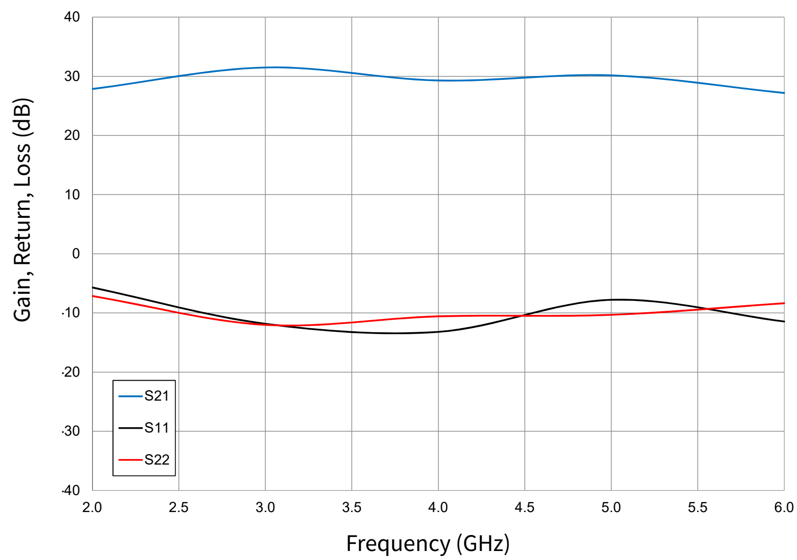


Figure 1. Small Signal Gain and Return Loss of the CMPA2060035D
V_{DD} = 28 V, I_{DQ} = 1.2 A

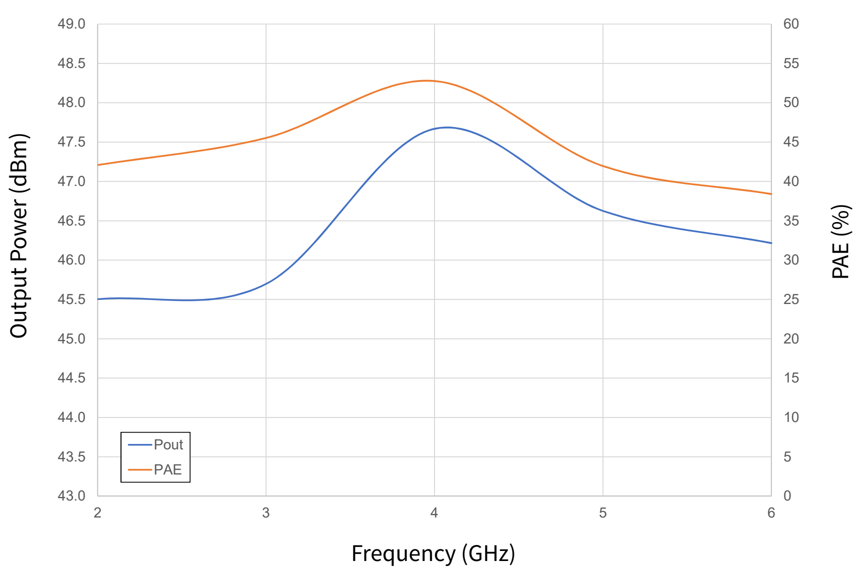
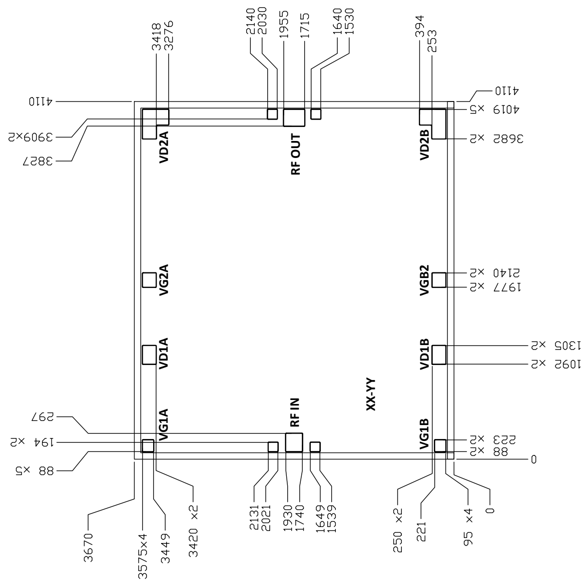


Figure 2. Output Power and Power Added Efficiency vs Frequency Scaled
from Measured on Wafer Data for CMPA2060035D V_{DD} = 28 V, I_{DQ} = 1.2 A, T_C = 25 °C, CW

Electrostatic Discharge (ESD) Classifications

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

Die Dimensions (Units in Microns)



Overall Die Size 3670 x 4110 (+0/-50) Microns, Die Thickness 100 (+/-10) Microns.
All Gate and Drain Pads Must be Wire Bonded for Electrical Connection.

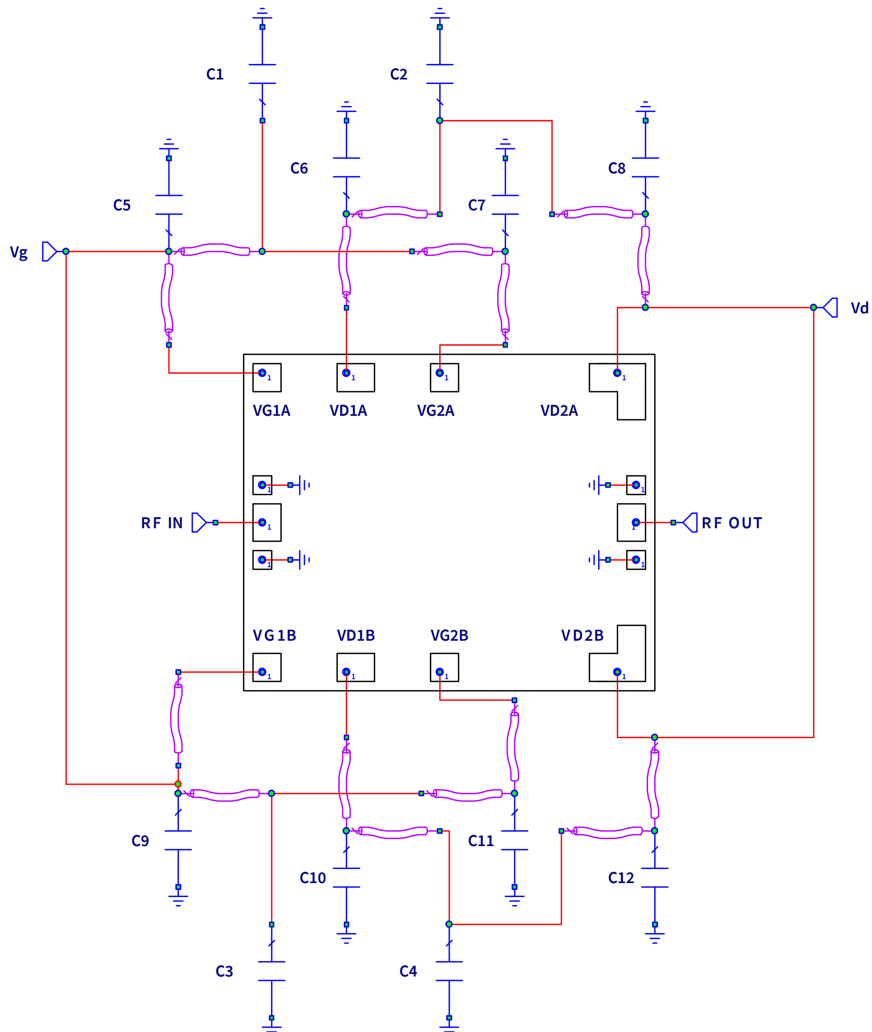
Pad Number	Function	Description	Pad Size (Microns)	Note
1	RF_IN	RF-Input Pad. Matched to 50 ohms	208 x 190	2, 3
2	VG1_A	A Gate Control for Stage 1. V_G ~ 2.0 - 3.5 V	135 x 126	1
3	VG1_B	Gate Control for Stage 1. V_G ~ 2.0 - 3.5 V	135 x 126	1
4	VD1_A	Drain Supply for Stage 1. V_D = 28 V	213 x 155	1
5	VD1_B	Drain Supply for Stage 1. V_D = 28 V	213 x 155	1
6	VG2_A	Gate Control for Stage 2A. V_G ~ 2.0 - 3.5 V	163 x 155	1
7	VG2_B	Gate Control for Stage 2B. V_G ~ 2.0 - 3.5 V	163 x 155	1
8	VD2_A	Drain Supply for Stage 2A. V_D = 28 V	See Drawing	1
9	VD2_B	Drain Supply for Stage 2B. V_D = 28 V	See Drawing	1
10	RF_OUT	RF-Output Pad. Matched to 50 ohms	192 x 240	2, 3

Notes:
[1] Attach bypass capacitors 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).
[3] The RF ground pads are 105 x 100 microns.

Die 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

Block Diagram Showing Additional Capacitors for Operation Over 2.0 to 6.0 GHz



Designator	Description	Quantity
C1, C2, C3, C4	560 pF +/-40% SINGLE LAYER, 103 X 180, Er 3300, 100 V, Ni/Au TERMINATION	4
C5, C6, C7, C8, C9, C10, C11, C12	110 pF, +/-40% SINGLE LAYER, 103 X 180, Er 3300, 100 V, Ni/Au TERMINATION	8

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.

Part Number System

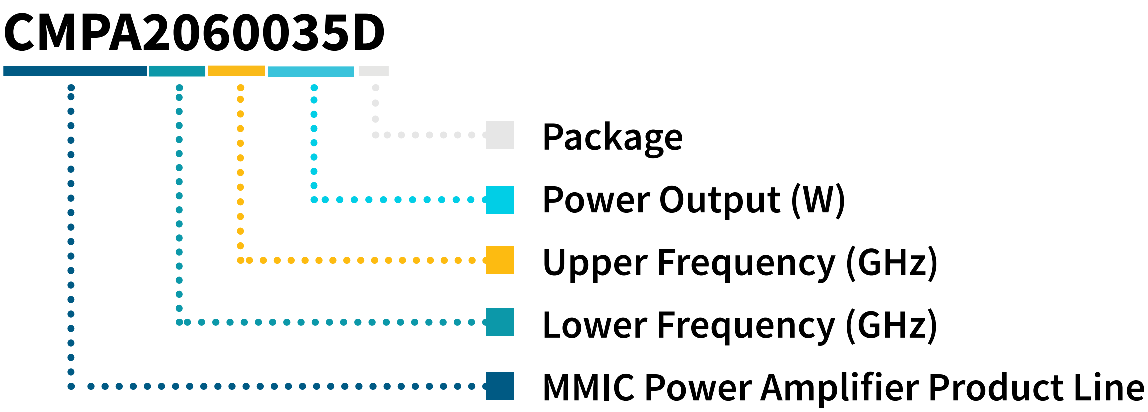


Table 1.

Parameter	Value	Units
Lower Frequency	2.0	GHz
Upper Frequency[1]	6.0	GHz
Power Output	35	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:	1 A = 10.0 GHz 2 H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure
CMPA2060035D	GaN MMIC Power Amplifier Bare Die	Each

Notes & Disclaimer