2 GHz to 6 GHz, 500 W Power Amplifier

Data Sheet **HMC8113**

FEATURES

- 2 GHz to 6 GHz frequency range
- 85 dB typical small signal gain
- 57 dBm typical saturated output power
- 61 dB gain control range with 1 dB LSB
- Standard 5U 19-inch rack chassis (per EIA-310D)
- 10°C to 50°C operating temperature
- Status and control interface 5 V TTL compatible
- 8-bit SPI attenuator control
- User replaceable air filter on front panel
- Overtemperature and overvoltage standing wave ratio protection
- Alarm status communicated via front panel LED and control connector
- Air cooled by front to rear airflow (2 rear mounted fans)
- Active RF hermetically sealed circuitry
- Control printed wiring assemblies conformal coated for environmental protection
- Meets Grade A, high impact shock per MIL-S-901D
- Meets MIL-STD-167-1A vibration

APPLICATIONS

- Test and measurement equipment
- Electronic warfare (EW)
- Commercial and military radars

FUNCTIONAL BLOCK DIAGRAM

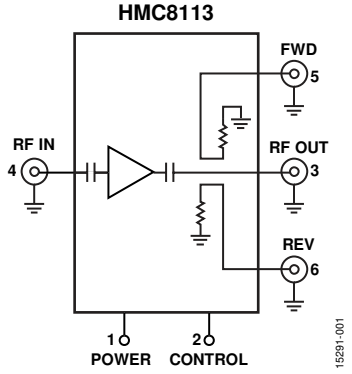

Figure 1.

GENERAL DESCRIPTION

The HMC8113 is a 500 W, gallium nitride (GaN), monolithic microwave integrated circuit (MMIC), power amplifier (PA) module that operates between 2 GHz and 6 GHz, provided in an EIA-310D standard 5U 19-inch rack mount chassis. The amplifier typically provides 85 dB of small signal gain and 57 dBm of saturated radio frequency (RF) output power. The amplifier draws 3390 W of power from a 220 V_{AC} supply. The RF inputs and outputs are dc blocked and matched to 50 Ω for ease of use.

Rev. 0 Document Feedback

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REVISION HISTORY

10/2017—Revision 0: Initial Version

SPECIFICATIONS

Power = 208 V_{AC}, T_A = 25°C, digital attenuator (DATT) set to 0 dB attenuation unless otherwise noted.

Table 1.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
FREQUENCY RANGE		2		6	GHz	
GAIN						
Small Signal Gain			85		dB	Input power (P_{IN}) = −45 dBm
Power Gain			57		dB	P_{IN} = 0 dBm
VOLTAGE STANDING WAVE RATIO (VSWR)						
Input			2:1			
Output			2:1			
RF OUTPUT						
Saturated Output Power	P_{SAT}	55.9	57		dBm	P_{IN} = 0 dBm
Gain Control Range			61		dB	
Output Power for 1 dB Compression	OP1dB		47.5		dBm	
Output Third-Order Intercept	OIP3		57		dBm	
Spurious			−60		dBc	Excluding harmonics
Harmonics			−12		dBc	
RF COUPLED OUTPUTS						
FWD Port Level		37	38	43	dBc	
REV Port Level		46	50	53	dBc	
Third-Order Intermodulation Products	OIP3		−40		dBc	P_{OUT} = P1dB − 10 dB; 10 MHz spacing on two tones
CONTROL INPUTS						
Input Voltage						
High	V_{INH}		2.0 to 5.0		V	
Low	V_{INL}		0 to 0.8		V	
SWITCHING CHARACTERISTICS						P_{IN} = −45 dBm
Cold Start			0.5		sec	From ac applied to the POWER connector
Standby Mode to ENABLE			5		ms	From rising edge of the ENABLE pin to the RF OUT connector
Attenuation Level Change			0.3		ms	From rising edge of the ATTN_SYNC pin to the RF OUT connector
ATTENUATION STEP ACCURACY						P_{IN} = −45 dBm
1 dB Bit		−2	−1	0	dB	
2 dB Bit		−3	−2	−1	dB	
4 dB Bit		−5	−4	−3	dB	
8 dB Bit		−9	−8	−7	dB	
16 dB Bit		−18	−15	−14	dB	
31 dB Bit		−33	−31	−29	dB	
SUPPLY INPUTS						
Voltage		175	220	227	V_{AC}	
Frequency			60		Hz	
Power			2600	3390	W	
WEIGHT			100		lbs	

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
RF Input (RFIN) Power	5 dBm
Operating Temperature Range	10°C to 50°C
Storage Temperature Range	−40°C to +70°C

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

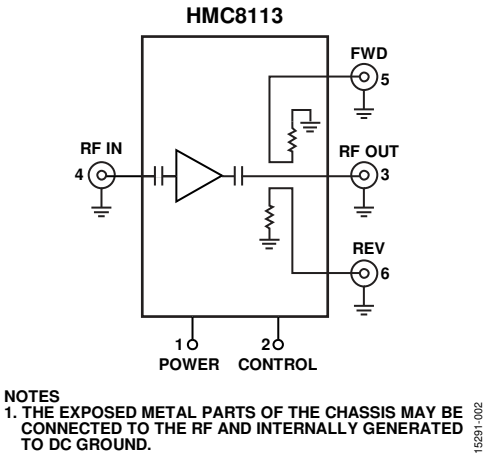

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	POWER	Supply Voltage Connector. POWER connects to a 220 V_{AC} typical source. See Table 4 for the POWER connector pin descriptions. This connector contains multiple pin options available within the main connector. See Table 6 for the connector type.
2	CONTROL	Alarm and Command Interfaces. See Table 5 for the CONTROL connector pin descriptions. This connector contains multiple pin options available within the main connector. See Table 6 for connector type.
3	RF OUT	RF Output. This connector is ac-coupled and matched to 50 Ω. See Table 6 for the connector type.
4	RF IN	RF Input. This connector is ac-coupled and matched to 50 Ω. See Table 6 for the connector type.
5	FWD	RF Output, Forward. This connector is ac-coupled and matched to 50 Ω. See Table 6 for the connector type.
6	REV	RF Output, Reversed. This connector is ac-coupled and matched to 50 Ω. See Table 6 for the connector type.
Chassis	GND	Ground. The exposed metal parts of the chassis may be connected to the RF and internally generated to dc ground.

Table 4. POWER Connector Pins

Pin Label	Description
A	L1
B	GND
C	L2/N
D	Not internally connected

Table 5. CONTROL Connector Pins

Pin No.	Mnemonic	High Power Amplifier Input or Output	Description
1	VENDOR_ALARM	TTL output	Low = normal operation High = alarm (overcurrent/undercurrent condition, or gate voltage dropout)
2	TEMPERATURE	TTL output	Low = normal operation High = alarm
3	VSWR	TTL output	Low = normal operation High = alarm
4	PWR_SUPPLY	TTL output	Low = power supply not functioning properly High = normal operation
5, 6, 7, 16, 17	GROUND	Not applicable	Ground
8	ENABLE	TTL input	Low = standby (RF amplifier off) High = enabled (RF amplifier on)
9	RESET	TTL input	Low = normal operation High = reset latched alarms (held high for at least 500 ns)
10, 18 to 21	NIC	Not applicable	Not internally connected
11	ATTN_CLOCK	Serial peripheral interface (SPI)	SPI clock for gain control (up to 10 MHz)
12	ATTN_DIN	SPI	SPI 8-bit data for gain control. Clocked in on negative edge of ATTN clock. Bit sequence 0 0 0 0 D7 D6 D5 D4 D3 D2 D1 D0 0 0 0 0 = 16 bits total. D7 to D0 represents the 8-bit gain control data where D7 is the MSB.
13	ATTN_SYNC	SPI	SPI latch enable for gain control (active low)
14	BATTLE_MODE	TTL input	Low = normal operation High = do not shut down for alarms or self protection Power supply alarms excluded
15	CAPTAIN	GND/open input	Ground = allow high power amplifier (HPA) to be enabled Open = prohibit HPA from being enabled

Table 6. Connector Type

Connector No.	Mnemonic	Description
1	POWER	MS3450W20-4P
2	CONTROL	M28840/10AC1S1
3	RF IN	N-type female jack
4	RF OUT	N-type female jack
5	FWD	N-type female jack
6	REV	N-type female jack

TYPICAL PERFORMANCE CHARACTERISTICS

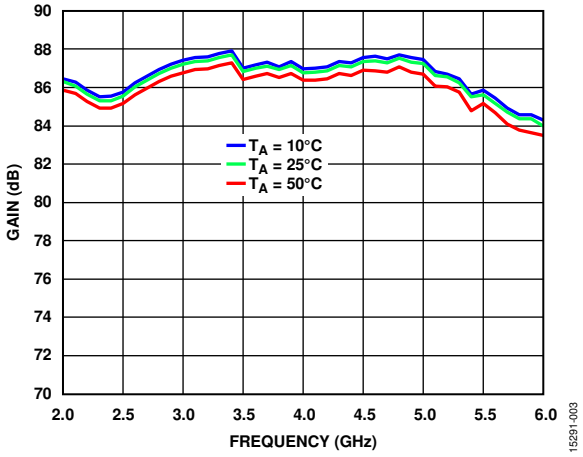

Figure 3. Gain vs. Frequency at Various Temperatures

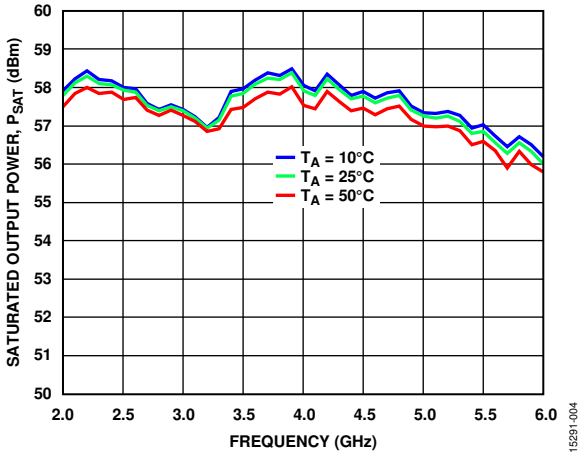

Figure 4. Saturated Output Power (P_{SAT}) vs. Frequency at Various Temperatures

THEORY OF OPERATION

The HMC8113 is a 500 W, GaN, MMIC, PA module that operates between 2 GHz and 6 GHz, provided in an EIA-310D standard 5U 19-inch rack mount. The amplifier typically provides 85 dB of small signal gain and 57 dBm of saturated RF output power. The amplifier draws 3390 W of power from a 220 V_{AC} supply. The RF inputs and outputs are dc blocked and matched to 50 Ω for ease of use.

The HMC8113 is powered by 220 V_{AC} and is suitable for both rack-mounted applications, such as test and measurement, and benchtop use. The amplifier is designed using Analog Devices, Inc., GaN MMICs housed in a hermetic assembly. Driver amplification and bias and pulse control are integrated in this amplifier module.

APPLICATIONS INFORMATION

To turn on the amplifier, complete the following steps:

1. Apply 220 V of ac to the POWER pin.
2. Apply the RF input power to the RF IN pin.

To turn off the amplifier, complete the following steps:

1. Remove the RF input power from the RF IN pin.
2. Disconnect 220 V of ac from the POWER pin.

OUTLINE DIMENSIONS

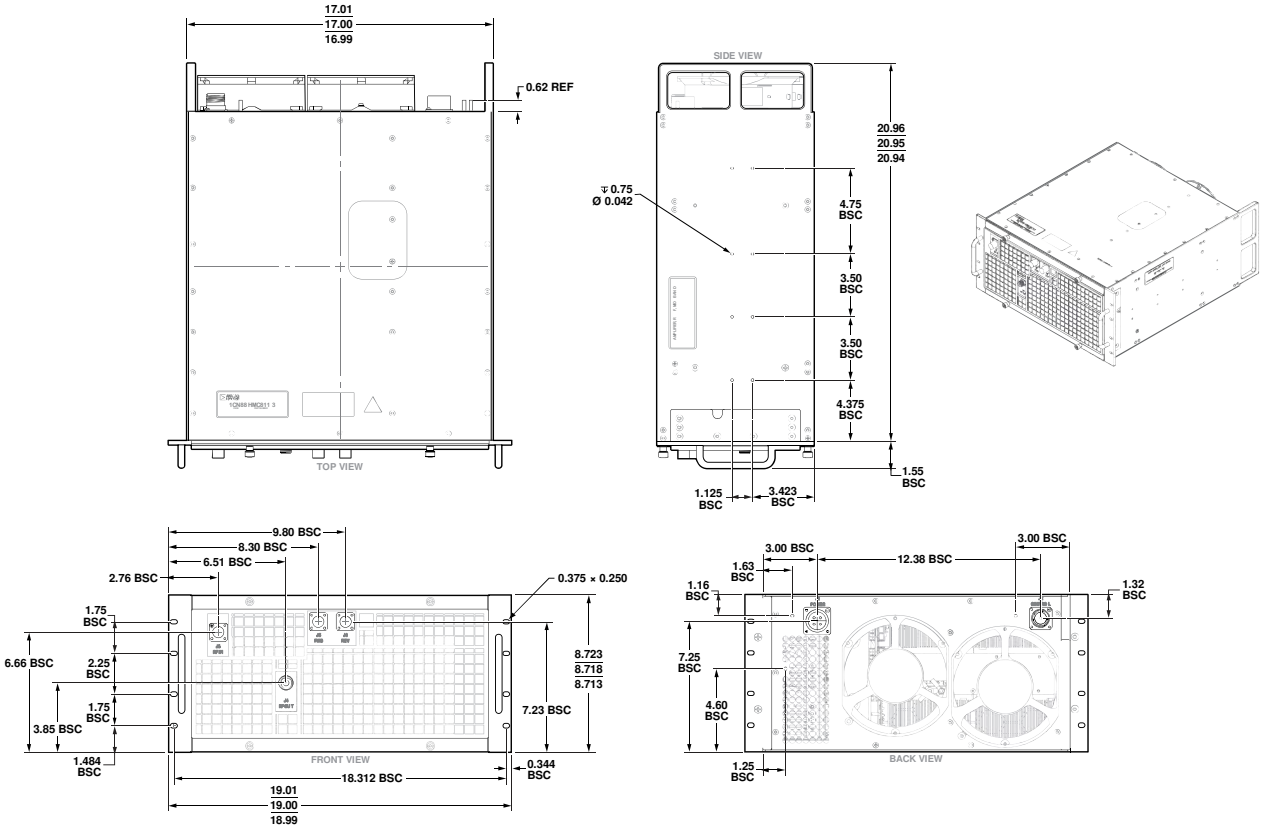

Figure 5. 6-Connectorized Module [MODULE]
(ML-6-2)
Dimensions shown in inches

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
HMC8113	10°C to 50°C	6-Connectorized Module [MODULE]	ML-6-2