

1. Features

- Integrated PA with +30 dBm output power
- Integrated LNA with noise figure of 2dB, typical
- Alternate TX input pin simplifies connection to any SoC
- Transmit bypass path with low loss: < 1.0 dB
- Single-ended 50 Ω input and output ports
- Fast turn-on/turn-off time: < 2 μ s Rx mode and < 4 μ s Tx mode
- Supply voltage on VCC up to 4V
- Sleep mode current: < 1 μ A
- MCM (16-pin, 3.0 x 3.0 x 0.75 mm) NiPdAu plated package

2. Applications

- LP-WAN devices
- Internet of Things
- Smart meters
- Industrial applications
- Range extender

3. Product Highlights

- High output power
- Integrated PA output match

4. Description

The GEO chip GC1109 is a high-performance, highly integrated RF front-end module designed for high-power Industrial, Scientific, Medical (ISM) band applications operating in the 860 to 930 MHz frequency range.

The GC1109 is designed for ease of use and maximum flexibility with fully matched 50 Ω TX and RX inputs and antenna outputs, and digital controls compatible with 1.2 to 3.6 V CMOS levels.

The GC1109 is packaged in a 16-pin, 3.0 x 3.0 x 0.75 mm Multi-Chip Module (MCM) package.

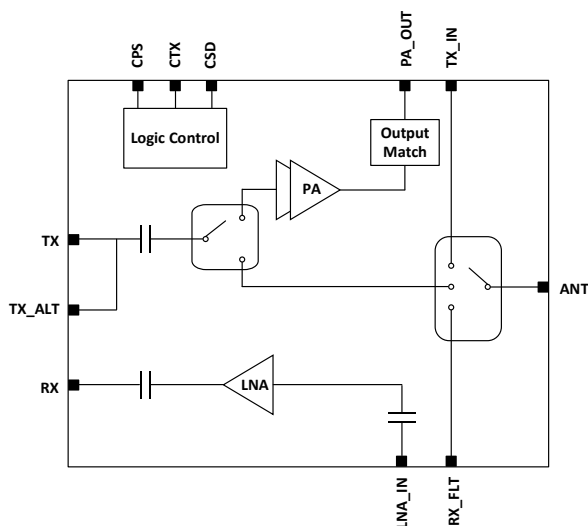


Figure 1 GC1109 Block Diagram

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5. Absolute Maximum Rating

Parameters	Symbol	Minimum	Maximum	Unit
Tx input power at TX port	PIN_TX_MAX		+5	dBm
TX input power at TX port (bypass mode)	PIN_TX_BYP_MAX		+20	dBm
Rx input power at ANT port	PIN_RX_MAX		+10	dBm
Supply voltage on VBAT (no RF)	VBAT	2.8	4.6	Volts
Supply voltage on VCC (no RF)	VCC	-0.3	4.2	Volts
Operating Temperature	Tcase	-40	85	°C
Storage Temperature	Tstg	-40	125	°C
ESD (HBM)			+3000	Volts
ESD (CDM)			+500	Volts

Table 1 Absolute Maximum Ratings

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

6. Pin Assignment

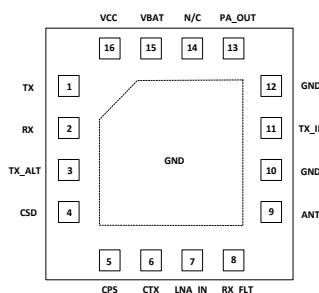


Figure 2 GC1109 Pinout (Top view)

Name	Pin	Description
TX	1	Transmit mode RF input
RX	2	Receive mode RF output
TX_ALT	3	Transmit mode RF input (alternate pin)
CSD	4	Shut down control input
CPS	5	Bypass mode select input
CTX	6	Transmit mode select input
LNA_IN	7	LNA input (from RX filter)
RX_FLT	8	RX signal from antenna (to RX filter)
ANT	9	Connect to 50 Ω antenna
GND	10	Connect to PCB ground
TX_IN	11	TX input signal to antenna (from OMN)
GND	12	Connect to PCB ground
PA_OUT	13	PA output and positive power supply
N/C	14	Not connected internally to the device
VBAT	15	Positive power supply
VCC	16	Positive power supply
Paddle	17	Expose die paddle; electrical and thermal ground. Connect to PCB ground

Table 2 Pin Description

7. Recommended Operating Condition

Parameters	Symbol	Minimum	Nominal	Maximum	Unit
Operating Frequency	F	860		930	MHz
Supply Voltage on VBAT	VBAT	2.8	3.3	4.2	Volts
Supply Voltage on VCC	VCC	0.5	3.3	4	Volts
Mode Control Voltage High	VMODE_High	1.2		3.6	Volts
Mode Control Voltage Low	VMODE_Low	0		0.3	Volts
Operating Temperature	Tcase	-40	+25	+85	°C

Table 3

Note: 1. CSD/CPS/CTX voltage level must not exceed VBAT voltage.

2. VBAT must be prior to CSD/CPS/CTX for the power on sequence.

8. GC1109 Control Logic(VBAT & VCC on)

Mode	CSD	CTX	CPS
Shutdown	0	X	X
Receive LNA mode	1	0	X
Transmit bypass	1	1	0
Transmit	1	1	1

Table 4

Note: "1" denotes high voltage state (> 1.2 V).

"0" denotes low voltage stage (< 0.3 V) at control pins.

"X" denotes do not care: either "1" or "0" can be applied.

9. Electrical Specifications

VBAT=3.3V, VCC=4V, f=915MHz, Temp=25°C, Unless Otherwise Noted.

Parameters	Symbol	Test Condition	Min	Typ	Max	Units
Total supply current, transmit mode	ICC_TX30	POUT = +30 dBm		600		mA
Total supply current, receive mode	ICC_RX	No RF		6.5		mA
Total supply current, transmit bypass mode	ICC_TXB	No RF		250		μA
Quiescent current, transmit mode	ICQ_TX	No RF		55		mA
Sleep supply current	ICC_OFF	No RF		1		μA

Table 5 DC Electrical Specifications

VBAT=3.3V, VCC=4V, Temp=25°C, All Unused Ports Terminated at 50 Ω, Unless Otherwise Noted. Input Port TX, Output Port ANT, 0 Ω between the PA_OUT and TX_IN

Parameters	Conditions	Min	Typ	Max	Units
Frequency range		860		930	MHz
Saturated power		30			dBm
Small signal gain			30		dB
Harmonics	2fo@Psat		-11		dBm
	3fo@Psat		-9		dBm
S11	Into 50 Ω (TX port)		-15		
Input 1 dB compression point, bypass mode	Bypass mode	20			dBm
Insertion loss (bypass mode)	TX to ANT		1		dB
Turn-on time			3		μS
Turn-off time			100		nS
Stability	CW, PIN=+6 dBm	All non-harmonically related outputs less than			

Preliminary Data Sheet

GC1109

	0.1 GHz to 20 GHz VSWR = 6:1, all phase	-42 dBm
Ruggedness	CW, POUT= +30 dBm into 50 Ω , VSWR = 10:1, all phase	No permanent damage

Table 6 Electrical Specifications: Transmit Mode

V_{BAT}=3.3V, V_{CC}=4V, Temp=25°C, All Unused Ports Terminated at 50 Ω , Unless Otherwise Noted. Input Port ANT, Output Port RX, Matching Network Connected between the RX_FLT and LNA_IN

Parameters	Conditions	Min	Typ	Max	Units
Frequency range		860		930	MHz
Receive gain			17		dB
Receive noise figure			2	2.5	dB
Input third order intercept	IIP3		-2		dBm
Input 1-dB compression point			-10		dBm
Antenna port return loss	Into 50 Ω (ANT port)		-10		dB
RX port return loss	Into 50 Ω (RX port)		-15		dB
Turn-on time			1.5		μ S
Turn-off time			200		nS

Table 7 Electrical Specifications: Receive Mode

10. Typical Performance Curves

Conditions: VBAT=3.3 V, Unless Otherwise Noted

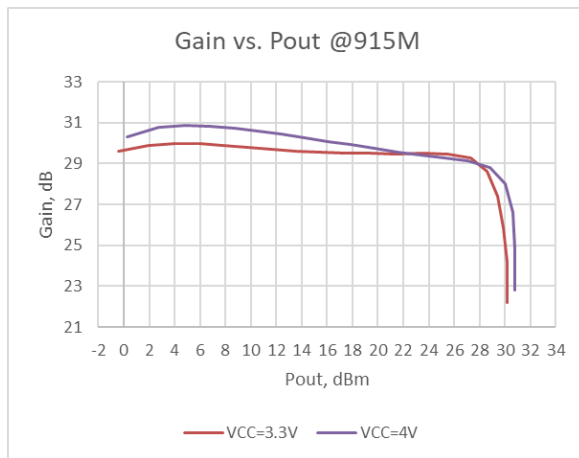


Figure 3 Gain vs POUT

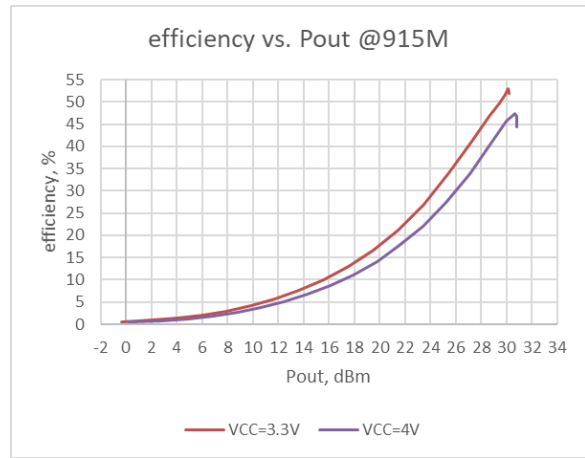


Figure 4 Efficiency vs POUT

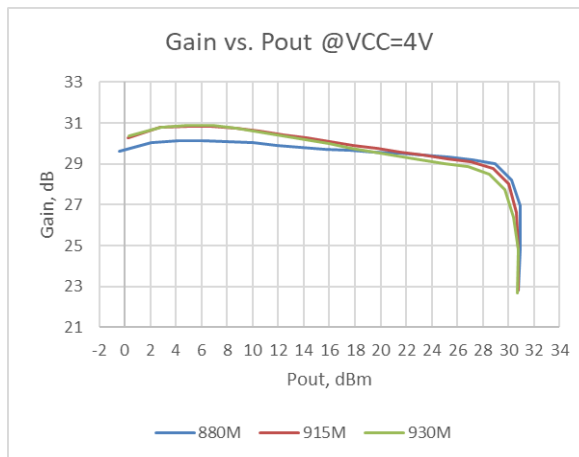


Figure 5 Gain vs POUT

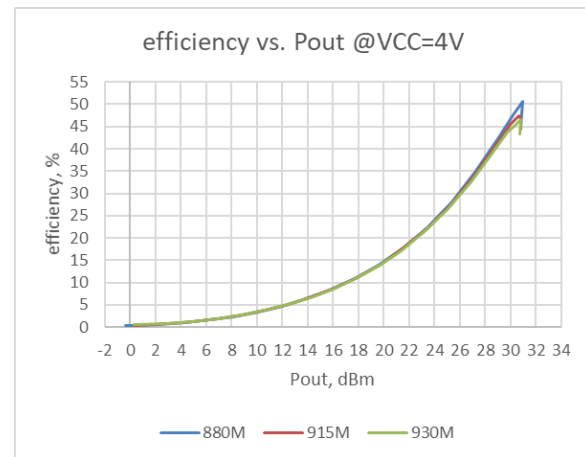


Figure 6 Efficiency vs POUT

11. Application Schematic

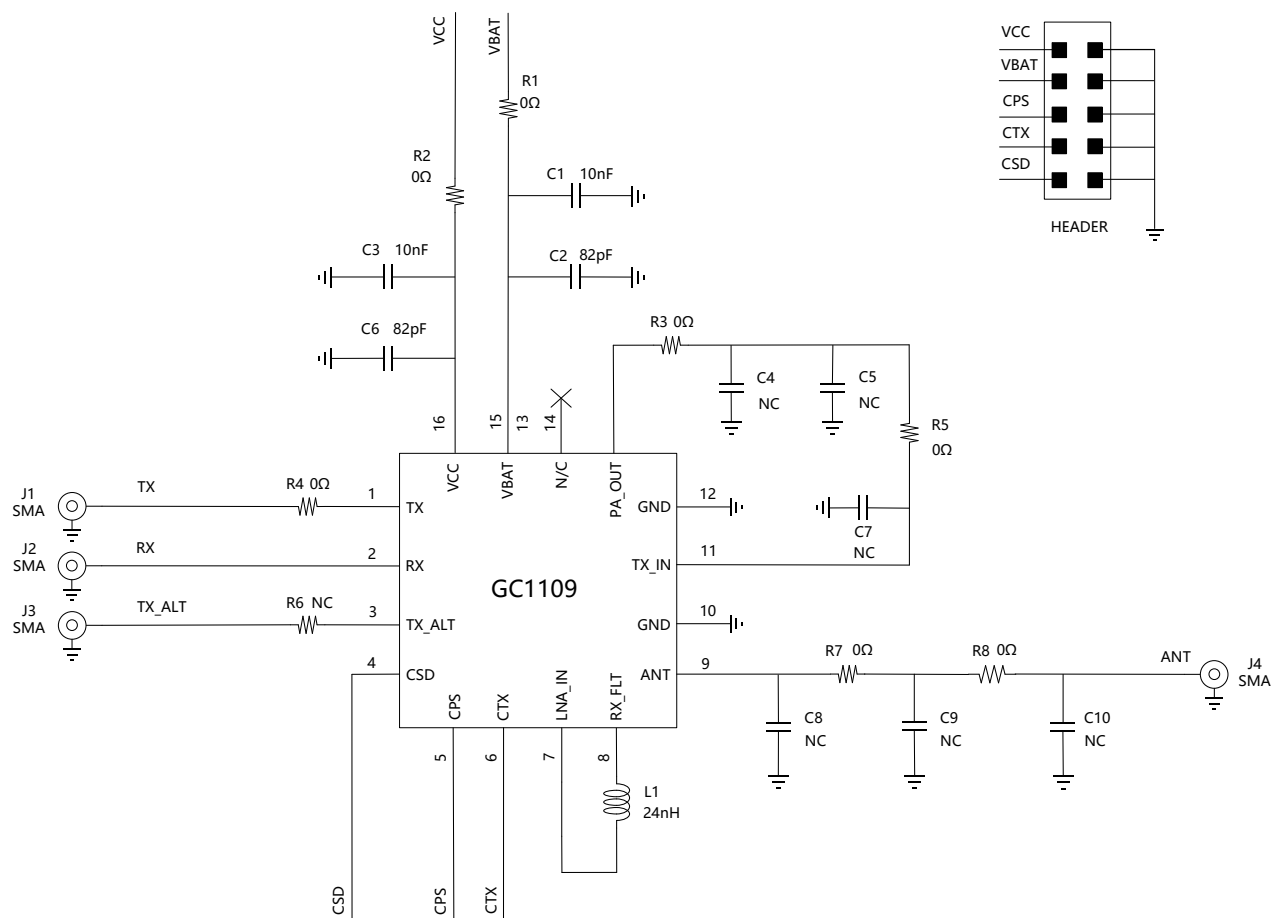
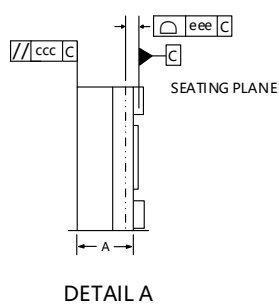
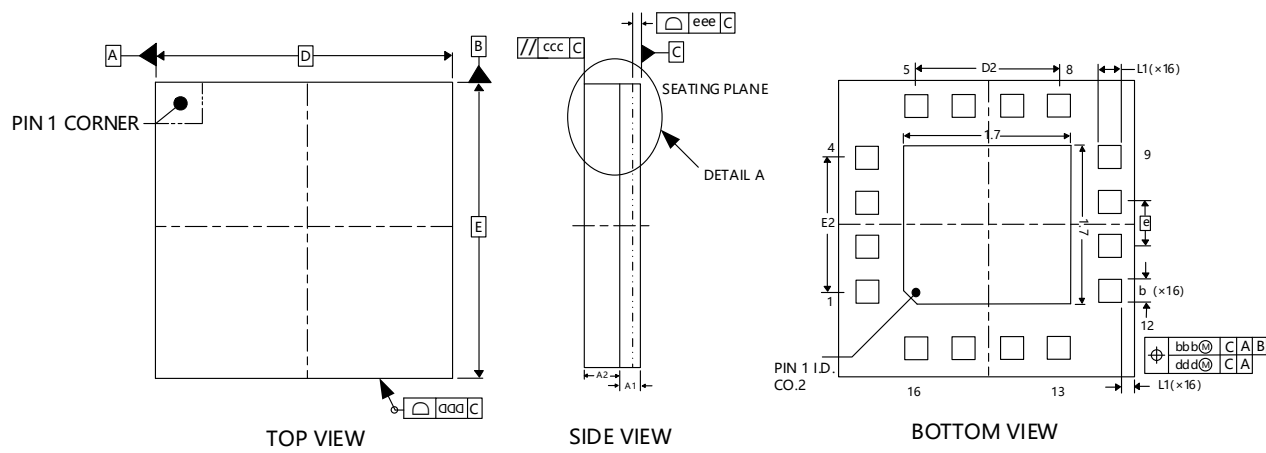


Figure 7 Evaluation Board Schematic Application

Component	Value	Manufacturer	Mfr Part Number	Size	Description
J1,J2,J3,J4	SMA				
R1,R2,R3,R4,R5, R7,R8	0ohm	Panasonic	ERJ2GE0R00	0402	Resistor, SMD, 0 ohm jumper, 1/10 W
L1	24nH	muRata	LQW15AN24NG00D	0402	
R6,C4,C5,C7,C8,C9,C10	NC			0402	
C2,C6	82pF	muRata	GRM1555C1H820JA01	0402	
C1,C3	10nF	muRata	GRM155R71H103KA88	0402	

Table 8 Evaluation Board Bill of Materials Application

12. Package Dimensions



	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.7	0.75	0.8
MOLD CAP	A2	---	0.50	---
SUBSTRATE THICKNESS	A1	0.22	0.25	0.28
LEAD WIDTH	b	0.2	0.25	0.3
BODY SIZE	X	D	2.95	3
	Y	E	2.95	3
LEAD PITCH	e	0.5 BSC		
EDGE PAD CENTER TO CENTER	D2	1.5 BSC		
	E2	1.5 BSC		
LEAD LENGTH	L	0.2	0.25	0.3
LEAD TIP TO PKG EDGE	L1	0.025	0.1	0.175
PACKAGE EDGE TOLERANCE	ddd	0.1		
MOLD FLATNESS	ccc	0.1		
COPLANARITY	eee	0.08		
LEAD OFFSET	bbb	0.1		
	ddd	0.08		
EXPOSED PAD SIZE	B1(X*Y)	-		

Notes:
 1. ALL DIMENSIONS ARE IN MILLIMETERS ANGLES ARE IN DEGREES;
 2. DIMENSIONS AND TOLERANCE CONFORM TO ASME Y14.5-2009;

Figure 8 Package Dimensions

13. Part Marking

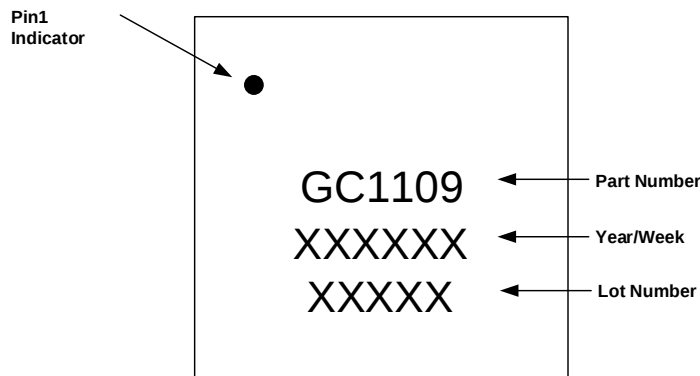


Figure 9 GC1109 Typical Part Markings (Top View)

14. Packaging Information

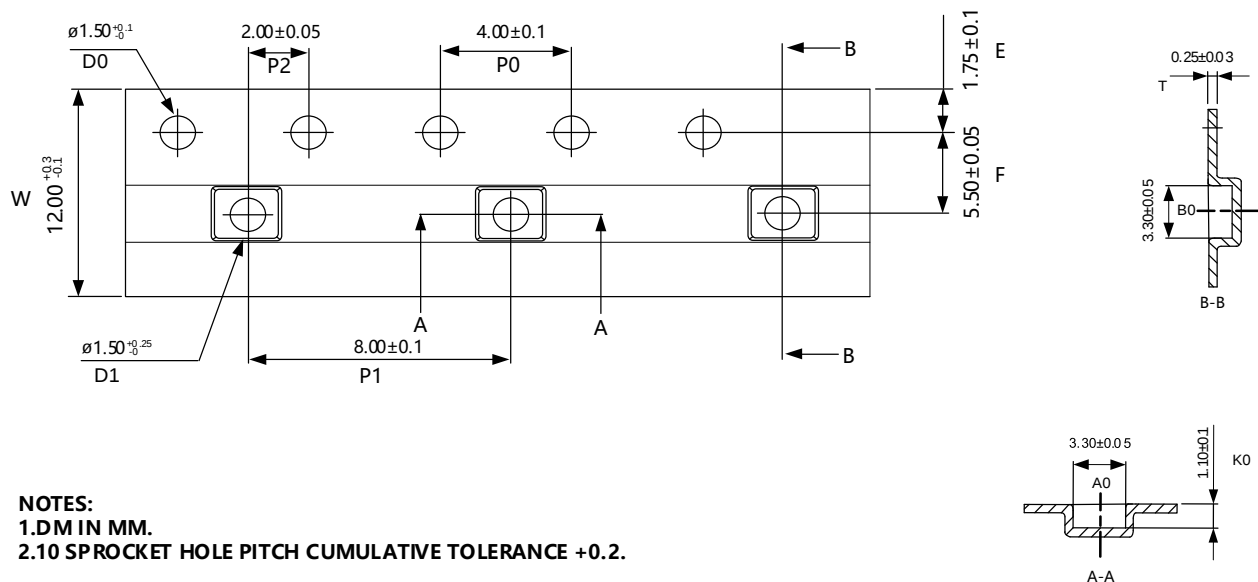


Figure 10 Packaging Information

15. Disclaimer

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16. Ordering Information

Model	Package	Packaging Type	Minimum Order Quantity
GC1109	MCM3*3 16pin	Reel	3000

17. Revision Record

Version	Date	Description
0.2	1/16/2023	
0.2.1	2/1/2023	Update table2 T_{case} , T_{stg} , VCC range
0.2.2	5/10/2023	Added ordering info and packaging info
0.2.3	08/24/2023	Update figure 8 and 10 to VISIO format;Update figure 7
0.9	01/29/2024	Update RX gain
0.9.1	05/15/2024	Modify the maximum input power
0.9.2	07/15/2024	Modify Pin assignment figure2