

## Features

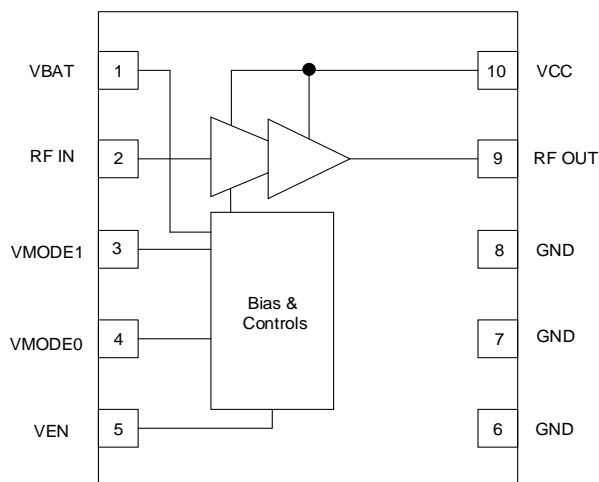
- Optimized for 400–510 MHz operation
- VCC up to 4.5V
- Output power 31dBm @ 3.4V
- Output power 33dBm @ 4.5V
- High PAE at maximum output power
- Multi-bias mode control
- Low leakage current
- Single-ended 50  $\Omega$  input and output ports
- Fully on-chip matching circuitry

## Applications

- Automated meter reading
- ISM systems
- IoT Modules
- LoRa

## Product Highlights

- Small package size
- Support low voltage vbat
- High Efficiency
- High output power



**Block Diagram**

## Description

The Geo-Chip GC0631 is a high-performance, high-power PA (Power Amplifier), which is mainly designed for 400-510MHz band applications.

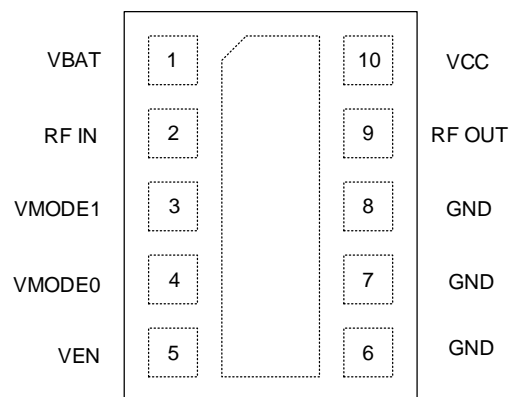
Packaged in a compact LGA 3mm x 3mm x 0.75mm, the GC0631 is a 10-pad PA, exhibits high efficiency, low temperature variation, strong reliability and robust ruggedness.



Geo-chip Green™ products are compliant with all applicable legislation and are halogen-free.

## Pin Description

Name	Pin	Description
RF IN	2	RF signal input
RF OUT	9	RF signal output
VBAT	1	Power supply for digital and internal drive PA
VCC	10	Power supply for last stage PA
VMODE	3,4	Digital Control signal input for mode selection
VEN	5	PA Enable Control signal
GND	6,7,8	Ground



GC0631 Pinout (Top view)

## Absolute Maximum Ratings

Parameters	Symbol	Maximum	Unit
RF Input Power	Pin	10	dBm
Supply Voltage	VBAT	4.5	Volts
Supply Voltage	VCC	5	Volts
Enable Control Voltage	VEN	4.0	Volts
Mode Control Voltage	VMODE	4.0	Volts
Operating Temperature	Tcase	-40~125	°C
Storage Temperature	Tstg	-55~150	°C
ESD (HBM)		+2000	Volts
ESD (CDM)		+750	Volts

## Recommended Operating Condition

Parameters	Symbol	Minimum	Nominal	Maximum	Unit
Operating Frequency	f	400	----	510	MHz
Supply Voltage	VBAT	2.1	3.7	4.2	Volts
Supply Voltage	VCC	0.5	3.7	4.5	Volts
Enable Control Voltage High	VEN_High	1.2	----	3.6	Volts
Enable Control Voltage Low	VEN_Low	0	----	0.3	Volts
Mode Control Voltage High	VMODE_High	1.2	----	3.3	Volts
Mode Control Voltage Low	VMODE_Low	0	----	0.3	Volts
Operating Temperature	Tcase	-40	+25	+105	°C

Note: 1. VEN/VMODE voltage level must not exceed VBAT voltage

2. VBAT must be prior to VEN for the power on sequence.

## GC0631 Control Logic (VCC &amp; Vbat on)

Mode	VEN	VMODE0	VMODE1
High Bias Mode	1	0	0
Medium Bias Mode	1	1	0
Low Bias Mode	1	0	1
Power down mode	0	X	X

"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.

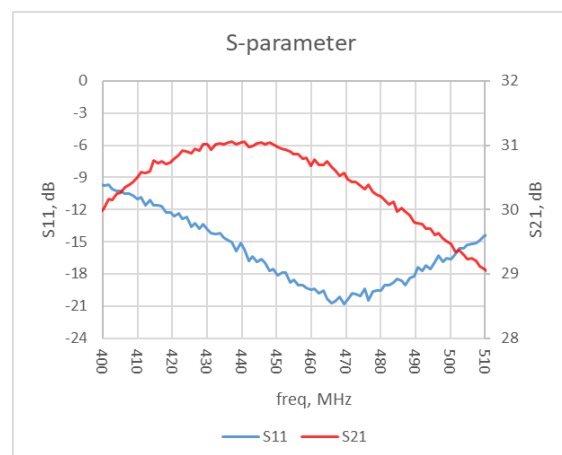
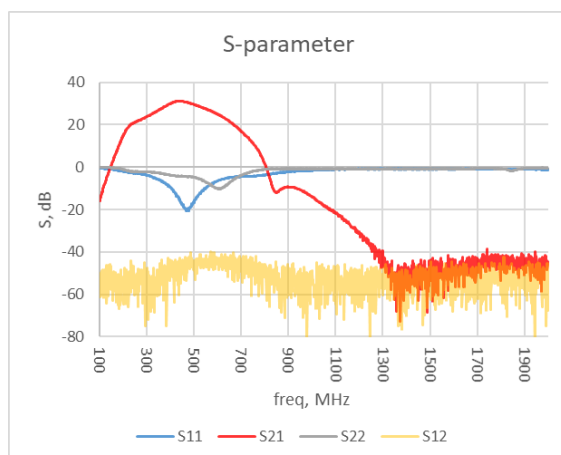
## Electrical Specifications (VBAT=3.7V, VCC=3.7V, Temp=25°C, CW Test)

Parameters	Conditions	Min	Typ	Max	Units
Frequency range		400	450	510	MHz
Saturated power			31		dBm
Quiescent Current	High Bias Mode		80		mA
	Medium Bias Mode		60		mA
	Low Bias Mode		50		mA
Power Added Efficiency	RFin=8dBm		50		%
Gain	High Bias Mode		30		dB
	Medium Bias Mode		28.5		dB
	Low Bias Mode		26.5		dB
Harmonics	2fo@Psat		-40		dBc
	3fo@Psat		-60		dBc
Input VSWR		2:1			
Stability	VSWR = 6:1, all phase				
Ruggedness	VSWR = 10:1, all phase				
Rise/Fall Time	DC			20	us
	RF			20	us
Leakage Current	VCC = High, Enable = Low, VMODE = Low		1	10	uA

## Typical Performance Curves

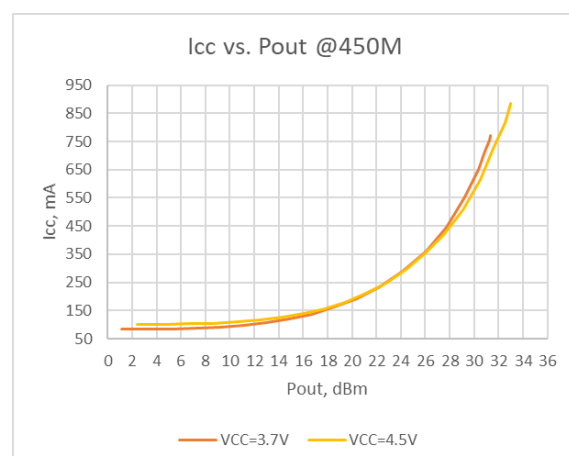
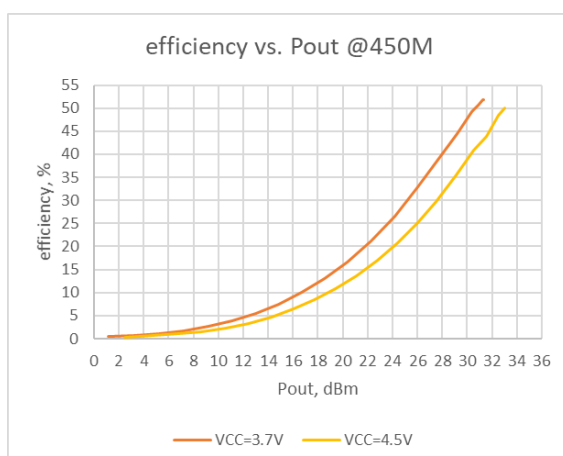
### 1. S Parameters @ High Bias Mode

(Conditions: VCC=VBAT=VEN= 3.7V, VMODE0=VMODE1=0V, Temp=25°C)



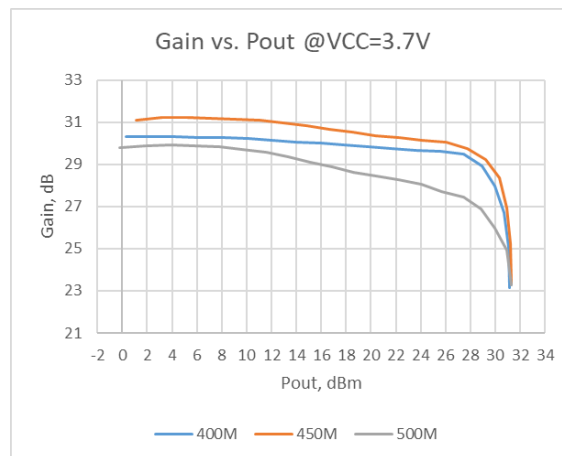
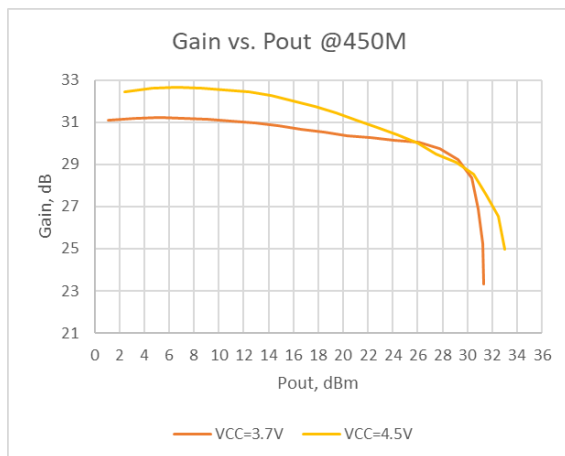
### 2. Efficiency & Icc @ High Bias Mode

(Conditions: VBAT=VEN= 3.7V, VMODE0=VMODE1=0V, Temp=25°C)



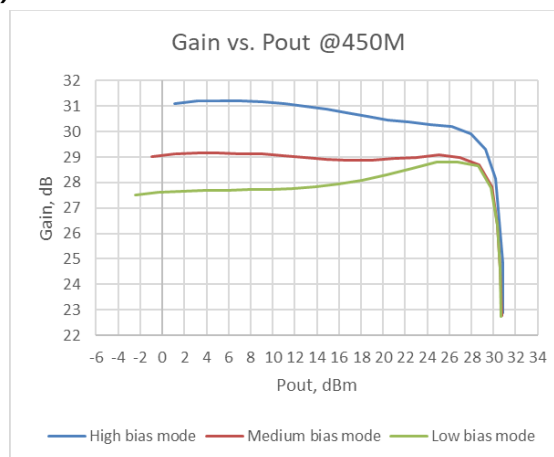
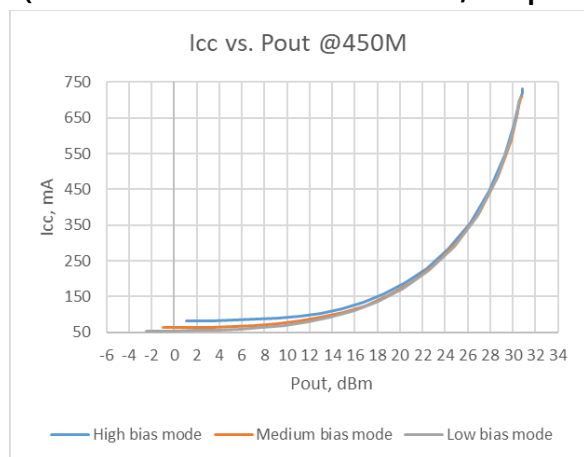
## 3. Gain vs Pout @ High Bias Mode

(Conditions: VBAT=VEN= 3.7V, VMODE0=VMODE1=0V, Temp=25°C)



## 4. Icc & Gain @Different Bias Mode

(Conditions: VCC=VBAT=VEN= 3.7V, Temp=25°C)



Technical drawing of a PCB layout for a 10-pin connector. The drawing includes a top view, a side view, and three detailed views (A, B, and C) of the pads.

**Top View:**

- Overall dimensions: 10x14 and 4x1.375.
- Pin dimensions: 4x0.6 and 4x1.2.
- PIN 1 INDICATOR (top left).
- PAD 1 INDICATOR (top right).
- 10x SMT PAD with dimensions 0.15x0.15.
- SOLDER MASK OPENING with dimensions 0.2x0.2.
- 0.2x0.2 PAD 1 INDICATOR.
- 2.8x1.3 PAD 1 INDICATOR.

**Side View:**

- Thickness: 0.9±0.1.

**Detailed View A:**

- Pad dimensions: 0.35±0.1 and 0.35±0.05.
- SOLDER MASK EDGE: 0.5±0.05.
- METAL PAD EDGE.
- DETAIL A PAD, SCALE: 2x, 3x THIS ROTATION, 3x ROTATED 180°.

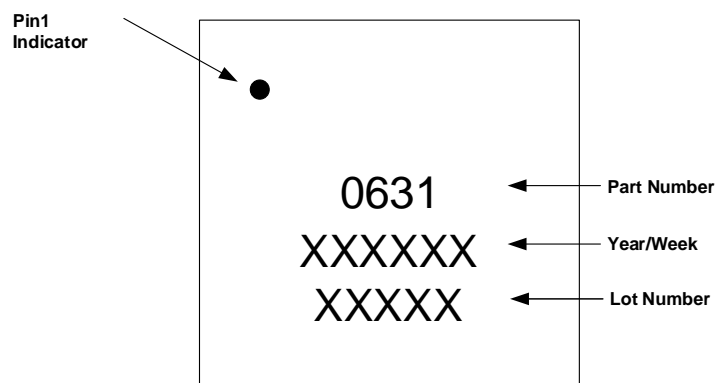
**Detailed View B:**

- Pad dimensions: 0.35±0.1 and 0.35±0.05.
- SOLDER MASK EDGE: 0.075±0.05.
- METAL PAD EDGE.
- DETAIL B PAD, SCALE: 2x, 1x THIS ROTATION, 1x ROTATED 180°.

**Detailed View C:**

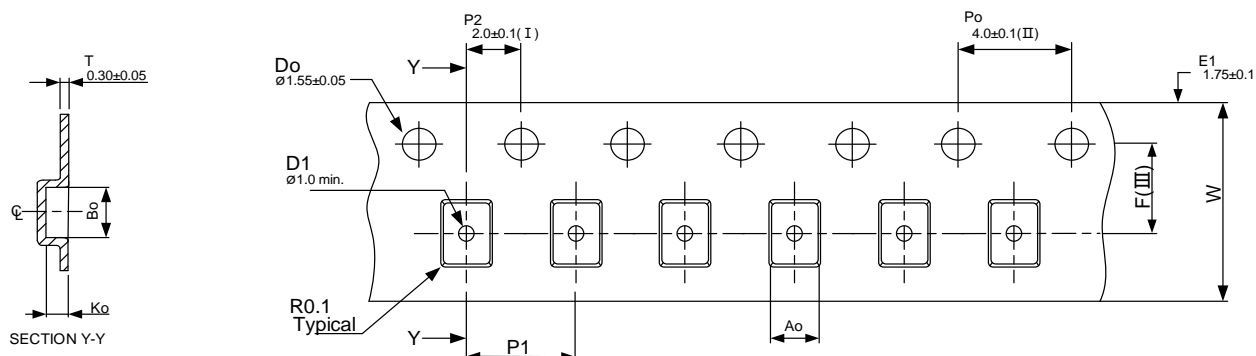
- Pad dimensions: 0.35±0.1 and 0.35±0.05.
- SOLDER MASK EDGE: 0.075±0.05.
- METAL PAD EDGE.
- DETAIL C PAD, SCALE: 2x, 1x THIS ROTATION, 1x ROTATED 180°.

## Part Marking



GC0631 Typical Part Markings (Top View)

## Packaging Information



Ao	2.25 +/-0.05
Bo	2.80 +/-0.05
Ko	1.10 +/-0.1
F	3.50 +/-0.05
P1	4.00 +/-0.1
W	8.00 +0.3/-0.1

- ( I ) Measured from centreline of sprocket hole to centreline of pocket.
- ( II ) Cumulative tolerance of 10 sprocket holes is  $\pm 0.20$  .
- ( III ) Measured from centreline of sprocket hole to centreline of pocket.
- ( IV ) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Package Type	Unit Size	Max Reel Diameter	Type Width	Pocket Pitch	Reel Capacity
Tape and Reel	3mm x 3mm x 0.75mm	13"	8mm	4mm	3000

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