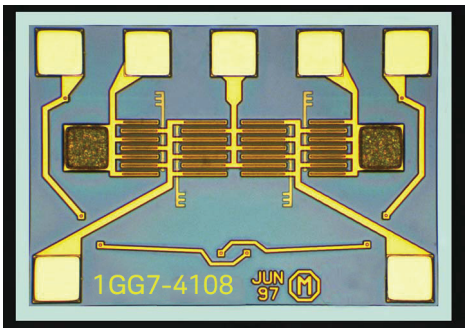
Keysight 1GG7-4108
DC - 10 GHz SPDT Switch

Data Sheet



Features

- Frequency range:
  DC - 10 GHz
  Usable to 13.5 GHz
- Insertion loss:
  0.7 dB @ 10 GHz
- Isolation:
  > 70 dB @ 45 MHz
  > 22 dB @ 10 GHz
- Return loss: 18 dB
- Switching speed:
  < 20 ns (10% - 90% RF)
- Settling time: < 4 msec to settle within 0.01 dB
- P_{-1dB}: 29 dBm
- Second harmonic intercept point (DC coupled):
  > 80 dBm
- Third harmonic intercept point: > 50 dBm

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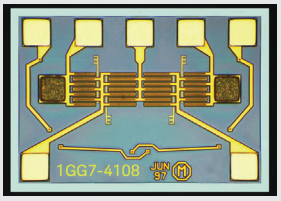
Description

The 1GG7-4108 is a GaAs monolithic microwave integrated circuit (MMIC) designed for low insertion loss from DC to 10 GHz. It is intended for use as a general-purpose, single-pole, double-throw (SPDT) switch. One series and one shunt MESFET per throw provide 0.7 dB typical insertion loss and 22 dB typical isolation at 10 GHz. This device is fabricated using Keysight Technologies, Inc.'s GaAs FET process, and uses through-substrate vias to provide ground connections to the chip backside and minimize the number of wire bonds required.



- Chip size: 750 × 530 µm (29.5 × 20.9 mils)
- Chip size tolerance: ±10 µm (±0.4 mils)
- Chip thickness: 127 ± 5 µm (5.0 ±0.6 mils)
- Pad dimensions: 70 × 70 µm (2.8 × 2.8 mils)

Absolute maximum ratings[1]

Symbol	Parameters/conditions	Min	Max	Units
V_{sel}	Series select voltages 1 & 2	–10.5	+10.5	volts
P_{in}	RF input power		29	dBm
T_{op}	Operating temperature	–55	+125	°C
T_{st}	Storage temperature	–65	+165	°C
T_{max}	Maximum assembly temperature		+260	°C
ESD	Electrostatic discharge (human body model) RFCOM port = ±10 V, SEL1/2 = ±10 V	–1000	1000	volts

1. Operation in excess of any one of these may result in permanent damage to this device. T_A = 25 °C except for T_{op}, T_{st}, and T_{max}.

DC specifications/physical properties

(T_A = 25 °C)

Symbol	Parameters/conditions	Min	Typ	Max	Units
$I_{SEL\ -10\ V}$	Select line leakage current @ –10 V			44	µA
$I_{SEL\ +10\ V}$	Select line leakage current @ +10 V			44	µA
V_p	Pinchoff voltage ($V_{SEL2} = V_p$, V_{RF2} = +2V, I_{RF2} = 8 mA, V_{SEL1} = –10 V, V_{RF1} = open circuit, V_{RFCOM} = GND)	–7.0		–3.00	volts
BV_{gss2}	Breakdown voltage (Test FET w/ $V_D = V_S$ = GND, I_G = –1.5 mA/mm)			–14.5	volts
R_{series}	On–resistance from RFCOM to RF1/2 SEL1/2 = ±10 V		4.7	6.7	ohms
R_{shunt}	On–resistance from RF1/2 to ground SEL1/2 = ±10 V		5.5	7.6	ohms
R_{off}	Off–resistance from RF1/2 to ground, SEL1/2 = –10 V	2.5			kohm

RF specifications

(T_A = 25 °C, Z_0 = 50 Ω, $V_{sel-high}$ = +10 V, $V_{sel-low}$ = –10 V)

Symbol	Parameters/conditions		Min	Typ	Max	Units
BW	Guaranteed operating bandwidth		DC		13.5[1]	GHz
IL	Insertion loss, selected ports	DC - 10 GHz	0.3	0.7	1.0[1]	dB
		10 - 13.5 GHz		1.5	3[1]	
IL_{tempco}	Insertion loss temperature coefficient			$–1.4 \times 10^{-3}$		dB/°C
ISO	Isolation, RFCOM to unselected RF1/2	10 GHz		22		dB
		13.5 GHz		18		
RL	Return loss (selected ports)	DC - 10 GHz		18		dB
		10 - 13.5 GHz		10		
P_{-1dB}	Input power where IL increases by 1 dB			29		dBm
t_s	Switching speed, 10% - 90% RF envelope (highly dependent on select line driver circuit)			20		ns
t_{settle}	Settling time, within 0.01 dB of final value			4		msec
SHI	2nd harm. intercept, @RFCOM input			80		dBm
THI	3rd harm. intercept, @RFCOM input			50		dBm

1. Not tested, guaranteed by design.

Applications

The 1GG7-4108 can be used in instrumentation, communications, radar, ECM, EW, and many other systems requiring SPDT switching. It can be used for pulse modulation, port isolation, transfer switching, high-speed switching, and replacement of mechanical switches.

Assembly Techniques

Die attach should be done with conductive epoxy. Gold thermosonic bonding is recommended for all bonds. The top and bottom metallization is gold.

GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly.

MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

Keysight Technologies GaAs MMIC ESD, Die Attach and Bonding Guidelines - Application Note, literature number 5991-3484EN provides basic information on these subjects. Moisture sensitivity classification: Class 1, per JESD22- A112-A.

Additional References

Keysight Technologies FET Switch Speed and Settling Time - Application Note, literature number 5991-3516EN

Recommended Operating Conditions

(Note: A DC path to ground should be provided on either the RFcom port and/or on both RF1/2 ports to accommodate leakage current from the FETs.)

Select line		RF path	
SEL1	**SEL2**	**RFCOM to RF2**	**RFCOM to RF1**
+10 V	–10 V	Isolated	Low loss
–10 V	+10 V	Low loss	Isolated

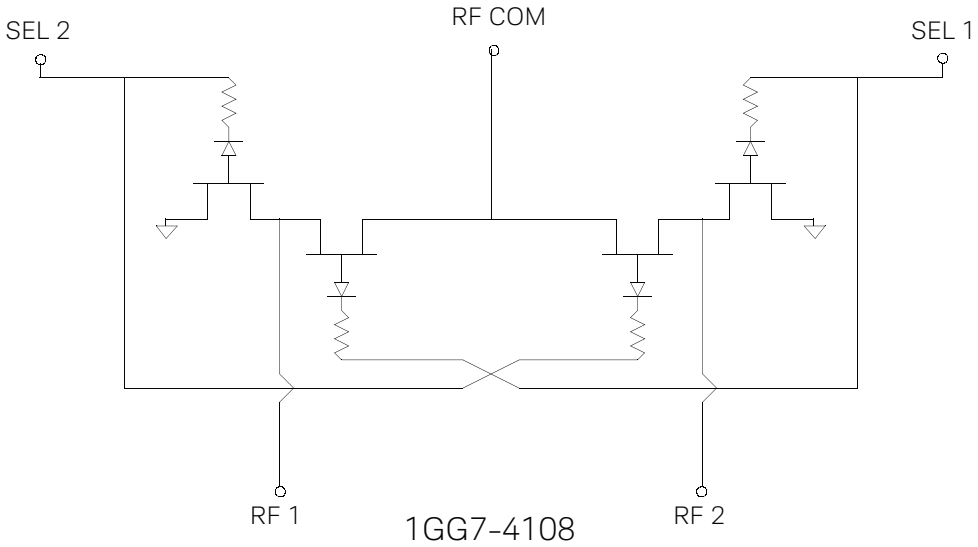


Figure 1. 1GG7-4108 schematic diagram

RoHS Compliance

This device is RoHS Compliant. This means the component meets the requirements of the European Parliament and the Council of the European Union *Restriction of Hazardous Substances* Directive 2011/65/EU, commonly known as *RoHS*. The six regulated substances are lead, mercury, cadmium, chromium VI (hexavalent), polybrominated biphenyls (PBB) and polybrominated biphenyl ethers (PBDE). RoHS compliance implies that any residual concentration of these substances is below the RoHS Directive's maximum concentration values (MVC); being less than 1000 ppm by weight for all substances except for cadmium which is less than 100 ppm by weight.

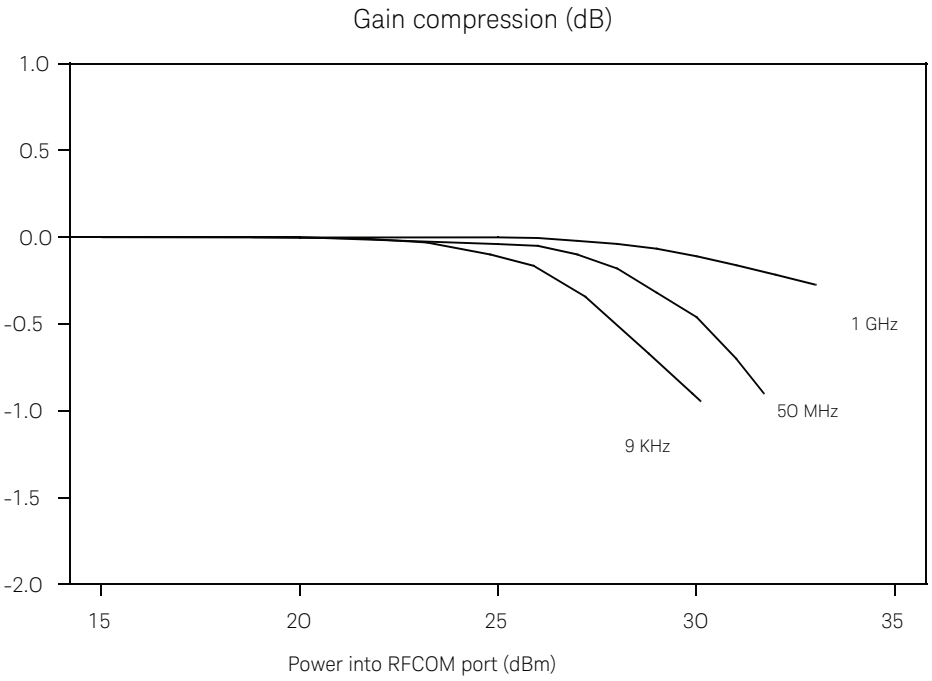


Figure 2. Typical gain compression

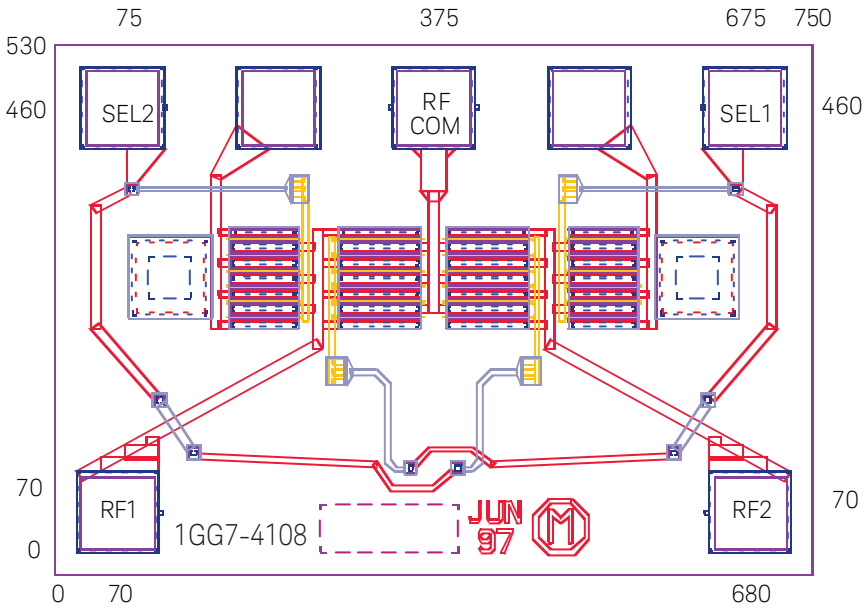
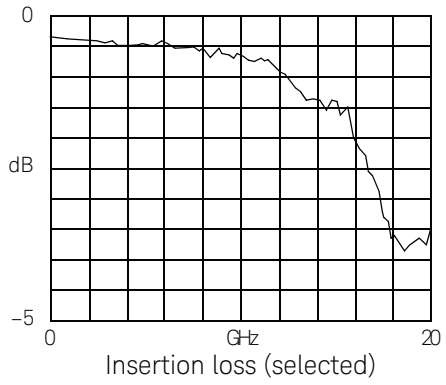
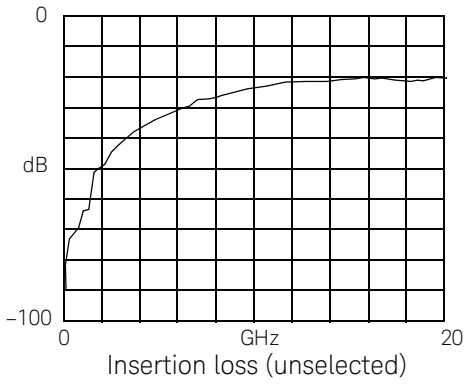
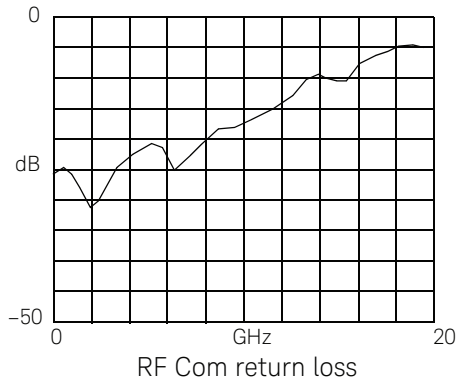


Figure 3. Bonding pad positions







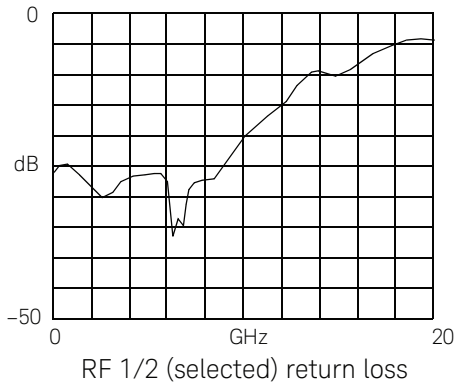


Figure 4. Typical small signal performance

(Measured in Modular Breadboard Package, insertion loss and isolation normalized to 50 ohm thru–line, includes effects of bond wire inductances on all RF ports).

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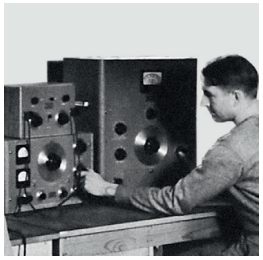

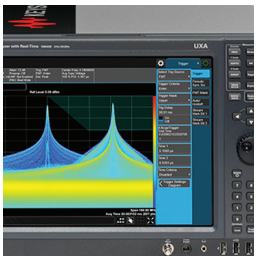

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The product described in this data sheet is RoHS Compliant. See *RoHS Compliance* section for more details.

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Published in USA, September 30, 2016
5992-1781EN
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