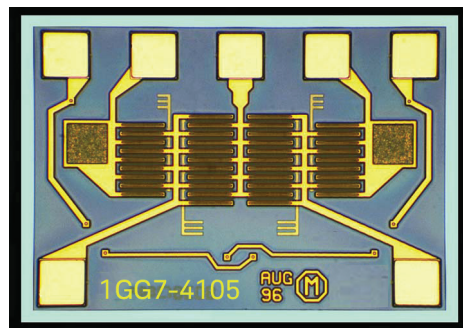# Keysight 1GG7-4105
DC – 3 GHz SPDT Switch

Data Sheet

Features

- Frequency range:
  DC – 3 GHz, usable to 6 GHz
- Insertion loss:
  0.4 dB @ 3 GHz
- Isolation:
  > 70 dB @ 45 MHz
  > 40 dB @ 3 GHz
- Return loss: 20 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 order intercept point:
  > 50 dBm

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Description

The 1GG7-4105 is a GaAs monolithic microwave integrated circuit (MMIC) designed for low insertion loss from DC to 3 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 0.4 dB typical insertion loss and 40 dB typical isolation at 3 GHz. This device is fabricated using the Keysight Technologies, Inc. GaAs FET process, and uses through-substrate vias to provide ground connections to the chip backside and minimize the number of wire bonds required.

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		27	dBm
T_{op}	Operating temperature	−55	+125	°C
T_{st}	Storage temperature	−65	+165	°C
T_{max}	Maximum assembly temperature		+200	°C
ESD	Electrostatic discharge (human body model) RFCOM port , SEL1/2 = ±10 V	−1500	1500	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}.
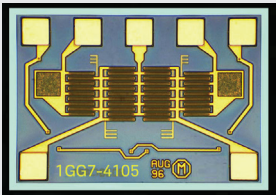
– Chip size: 750 × 530 μm (29.5 × 20.9 mils)
– Chip size tolerance: ±10 μm (±0.4 mils)
– Chip thickness: 127 ± 15 μm (5.0 ±0.6 mils)
– Pad dimensions: 70 × 70 μm (2.8 × 2.8 mils)

DC specifications/physical properties

(T_A = 25 °C)

Symbol	Parameters/conditions	Min	Typ	Max	Units
$I_{SEL-10V}$	Select line leakage current @ −10 V			70	μA
$I_{SEL+10V}$	Select line leakage current @ +10 V			70	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		3.1	4.0	ohms
R_{shunt}	On−resistance from RF1/2 to ground SEL1/2 = ±10 V		3.8	4.9	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		3.0	GHz
IL	Insertion loss, selected ports, DC to 3 GHz		0.4	0.45[1]	dB
IL_{tempco}	Insertion loss temperature coefficient		-1.4×10^{-3}		dB/°C
ISO	Isolation, RFCOM to unselected RF1/2, 3 GHz		40		dB
RL	Return loss @ 3 GHz (selected ports)		20		dB
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	75[1]	90		dBm
THI	3rd order intercept (2−tone), @RFCOM input	35[1]	50		dBm

1. Not tested, guaranteed by design.

Applications

The 1GG7-4105 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, replacement of mechanical switches, and so on.

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.

Additional References

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

Recommended Operating Conditions

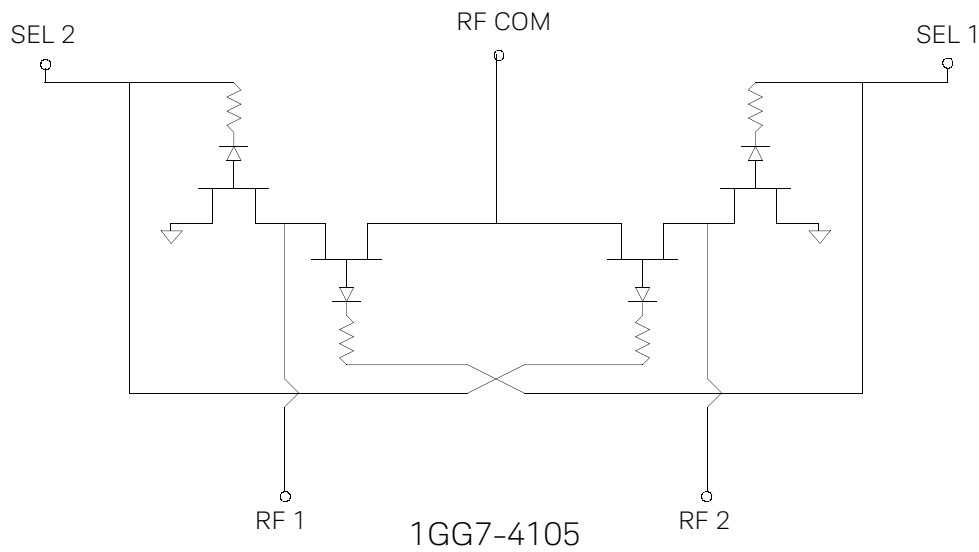| Select line		RF path	
SEL1	**SEL2**	**RFCOM to RF2**	**RFCOM to RF1**
+10 V	–10 V	Isolated	Low loss
–10 V	+10 V	Low loss	Isolated

Figure 1. 1GG7-4105 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.
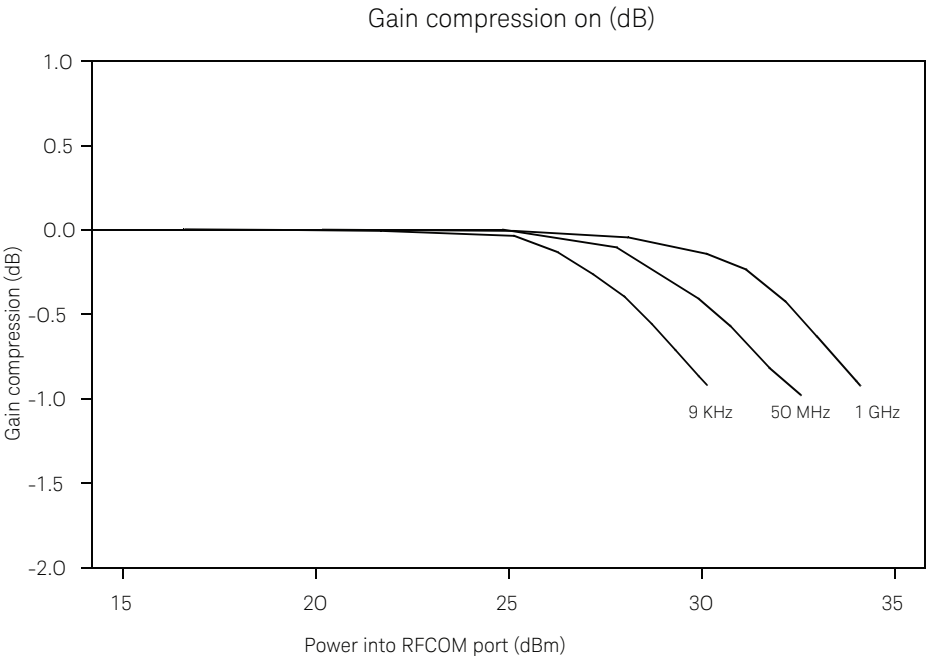
Gain compression on (dB)
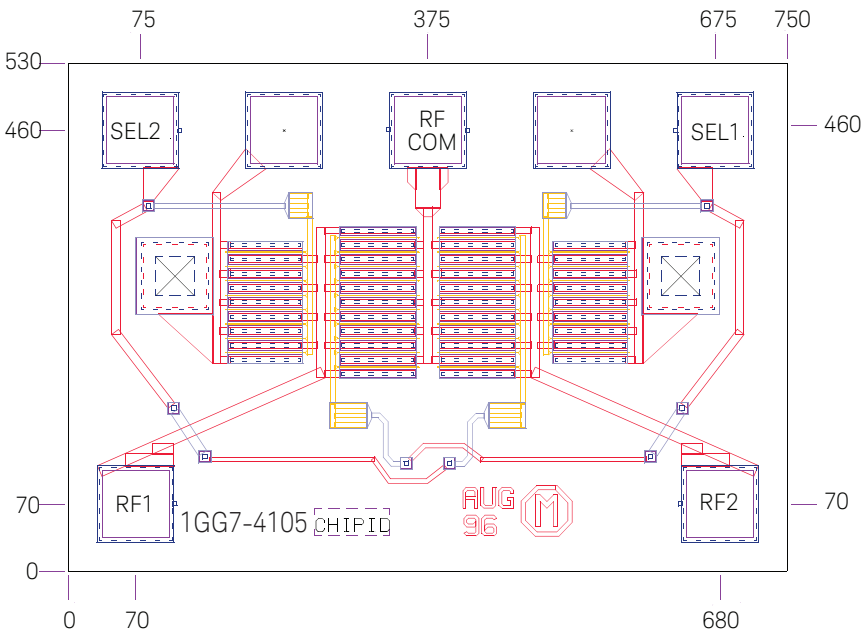

Figure 2. Typical 1GG7-4105 gain compression

Figure 3. 1GG7-4105 bonding pad positions

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This data sheet contains a variety of typical and guaranteed performance data. The information supplied should not be interpreted as a complete list of circuit specifications. Customers considering the use of this, or other Keysight Technologies GaAs ICs, for their design should obtain the current production specifications from Keysight. In this data sheet the term typical refers to the 50th percentile performance. For additional information contact Keysight at MMIC_Helpline@keysight.com.

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

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