

Keysight 1GG7-4252

DC - 10 GHz SPDT Packaged 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

Description

The 1GG7-4252 is a packaged 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 0.6 dB typical insertion loss and 35 dB typical isolation at 3 GHz. The device is mounted in a 16-lead QFN plastic package. The 1GG7-4252 is fabricated with Keysight Technologies, Inc. GaAs FET MMIC process.

Absolute maximum ratings¹

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}^2	Maximum assembly temperature		+260	°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} .

2. Refer to JEDEC J-STD-020D for detailed reflow profile



- Package type: 3 x 3 mm MLF-16/QFN-16
- Package dimensions: 3 x 3 mm (118 x 118 mils)
- Package thickness: 0.90 mm (35 mils)
- Pad (lead) pitch: 0.5 mm (20 mils)
- Pad (lead) width: 0.25 mm (10 mils)

DC specifications/physical properties

($T_A = 25^\circ\text{C}$)

Symbol	Parameters/conditions	Min	Typ	Max	Units
$I_{\text{SEL}-10\text{V}}$	Select line leakage current @ -10 V			44	μA
$I_{\text{SEL}+10\text{V}}$	Select line leakage current @ +10 V			44	μA
V_p	Pinchoff voltage ($V_{\text{SEL}2} = V_p$, $V_{\text{RF}2} = +2\text{V}$, $I_{\text{RF}2} = 4.8\text{ mA}$, $V_{\text{SEL}1} = -10\text{V}$, $V_{\text{RF}1} = \text{open circuit}$, $\text{VRFCOM} = \text{GND}$)	-7.0		-3.00	volts
$BV_{\text{gss}2}$	Breakdown voltage (Test FET w/ $V_D = V_S = \text{GND}$, $I_G = -0.5\text{ mA/mm}$)			-14.5	volts
R_{series}	On-resistance from RFCOM to RF1/2 SEL1/2 = $\pm 10\text{ V}$		4.7	6.7	ohms
R_{shunt}	On-resistance from RF1/2 to ground SEL1/2 = $\pm 10\text{ V}$		5.5	7.6	ohms
R_{off}	Off-resistance from RF1/2 to ground, SEL1/2 = -10 V	2.5			kohm

RF specifications

($T_A = 25^\circ\text{C}$, $Z_0 = 50\ \Omega$, $V_{\text{sel-high}} = +10\text{ V}$, $V_{\text{sel-low}} = -10\text{ V}$)

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
		10 - 13.5 GHz	1.5	3 ¹	
IL_{tempco}	Insertion loss temperature coefficient		-1.4×10^{-3}		$\text{dB}/^\circ\text{C}$
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		
$P_{-1\text{dB}}$	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 1GG7-4252 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.

Operation

The 1GG7-4252 package introduces noticeable parasitic elements, which results in 11 dB typical return loss when all ports are at 50 ohms. For narrow-band applications, it is possible to cancel those parasitics with PC-board matching elements to achieve a 20 dB return loss.

Assembly Techniques

This package is compatible with wave-solder or reflow printed circuit board soldering processes.

GaAs MMICs in either chip or SMT packages 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

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

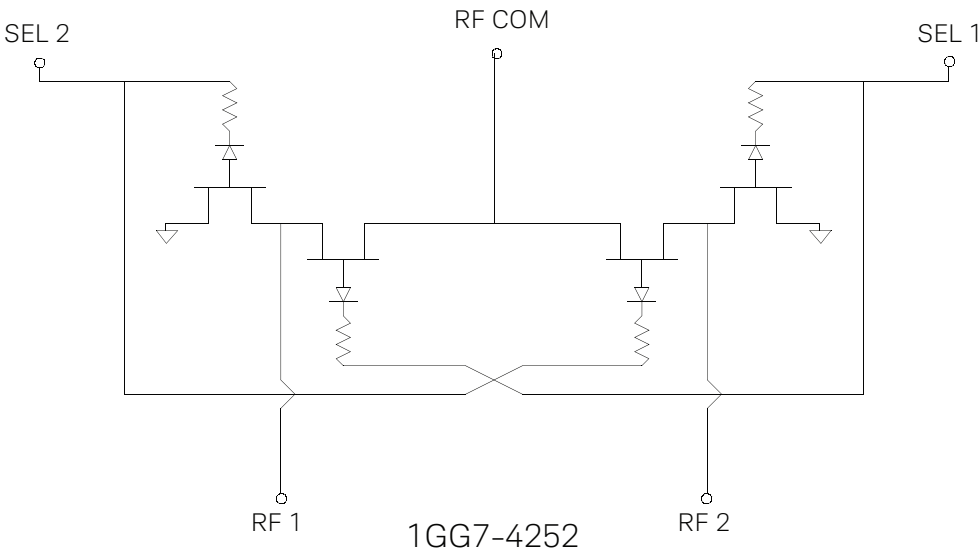


Figure 1. 1GG7-4252 schematic diagram

The 1GG7-4252 die is fabricated using a GaAs-based FET semiconductor material structure which is compatible with newer RoHS assembly temperatures and allows the device to be attached to a hybrid microcircuit housing or to thermally conductive embedded heatsinks which exist in QFN SMT Packages.

Moisture Compatibility

Injection mold components like the 1GG7-4252 in QFN are moisture-sensitive. The product is tested to the Moisture and Reflow Sensivity Level 5A as per IPC/Jedec J-STD-020 and must be mounted within 24 hours of opening the shipping container. Store and handle parts for reflow and for rework per IPC/Jedec JSTD- 033B. An example of the moisture sensitivity label is shown in Figure 2.

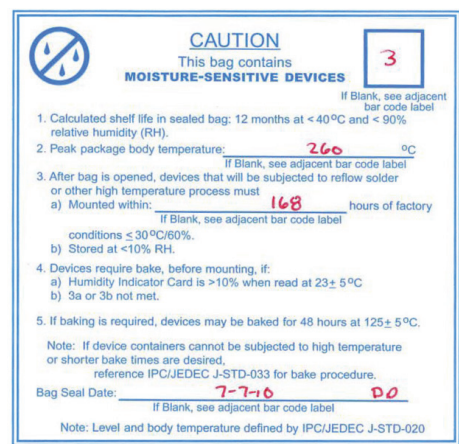


Figure 2. 1GG7-4252 moisture sensitivity label

Tape and Reel

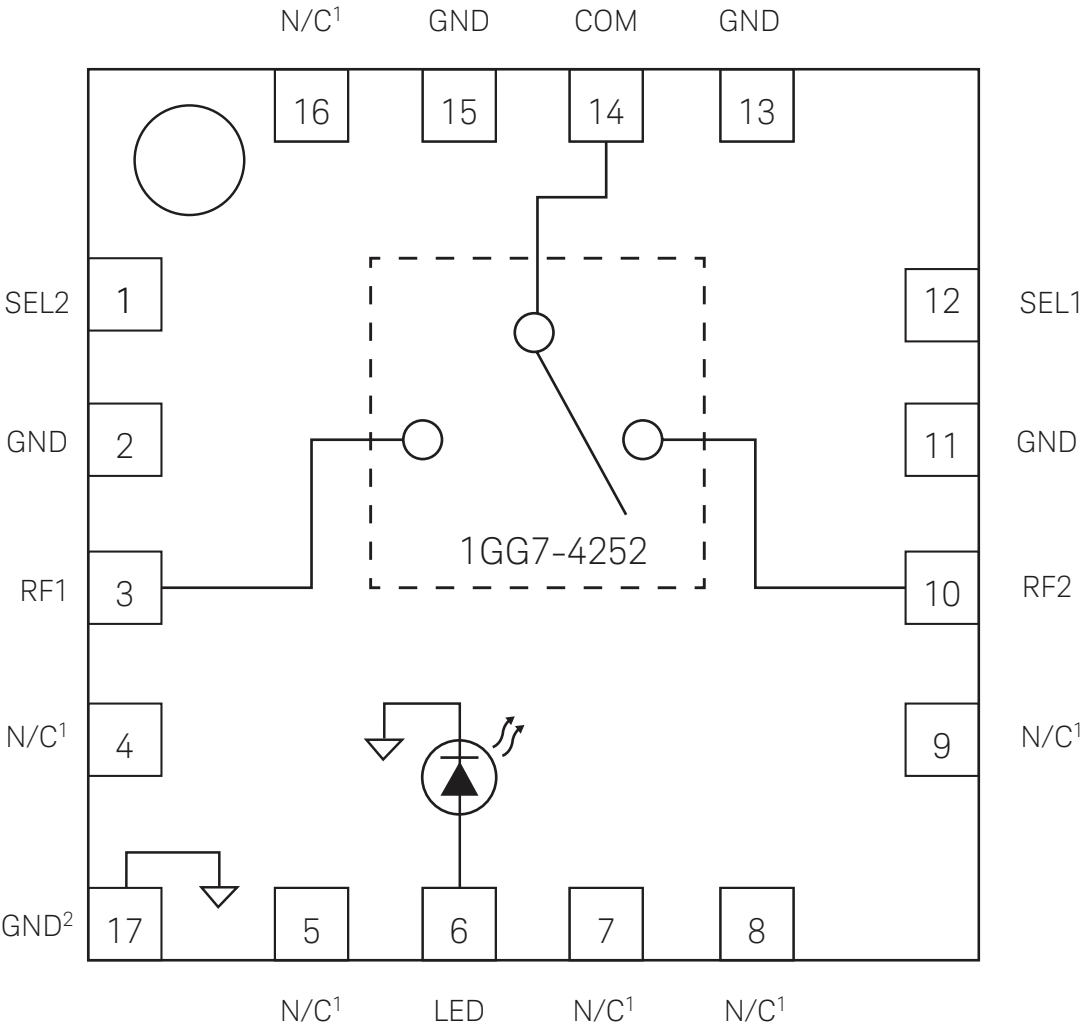
The 1GG7-4252 is available in tape and reel format to facilitate automatic pick and place manufacturing. See Figure 7.

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 3. Tape and reel label



1. N/C pins can be left open, but it is recommended to connect these to RF/DC ground.
2. Pin 17 is the center heat slug this must be connected to RF/DC ground. Use "filled" vias to prevent solder voids.

Figure 4. 1GG7-4252 simplified schematic and pin-out diagram

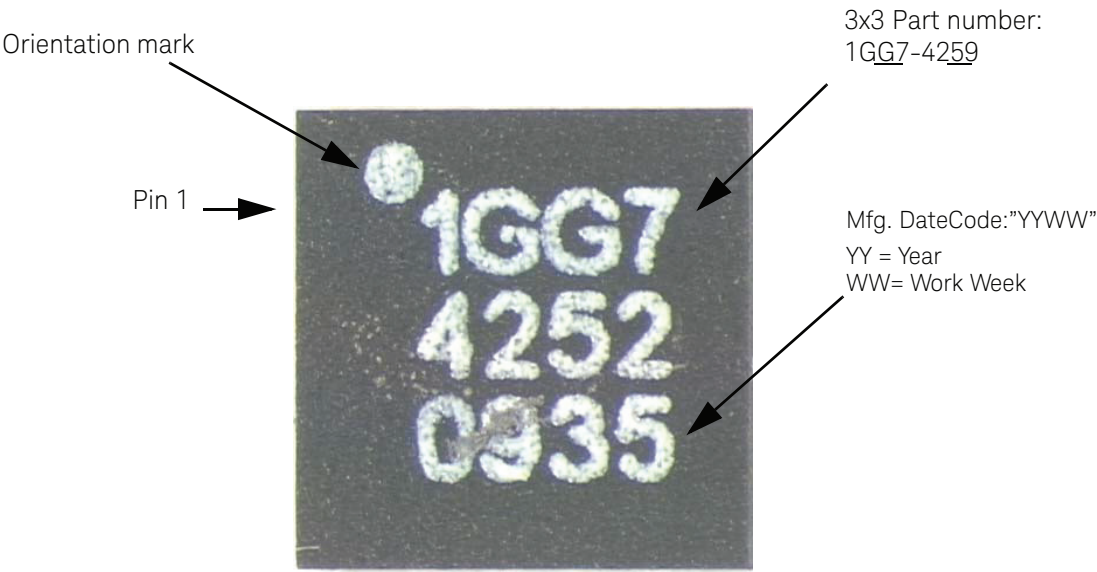


Figure 5. 1GG7-4252 package photo

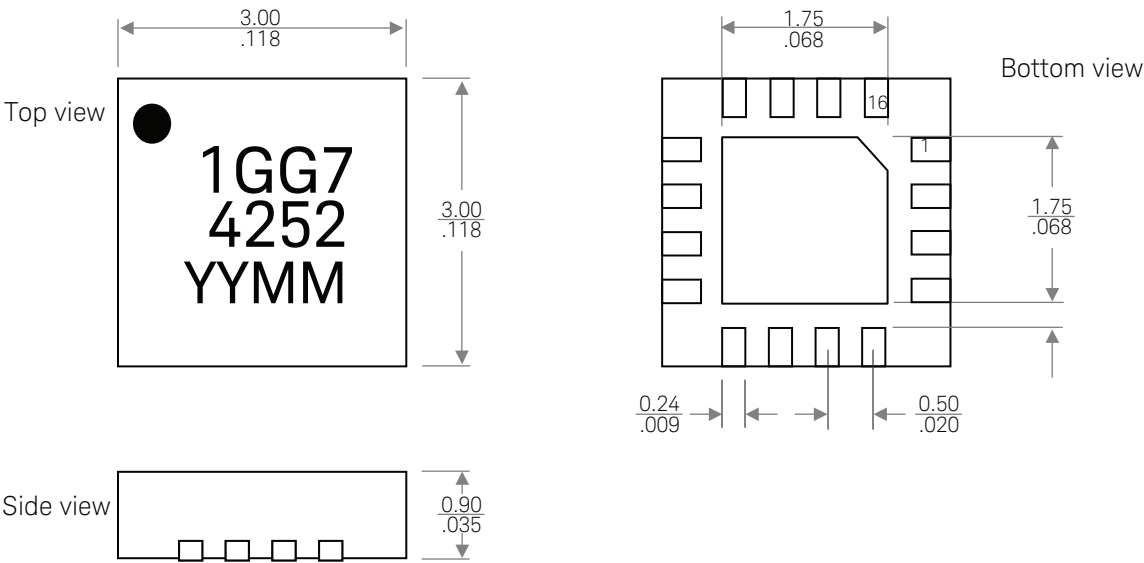


Figure 6. 1GG7-4252 dimensioned drawing

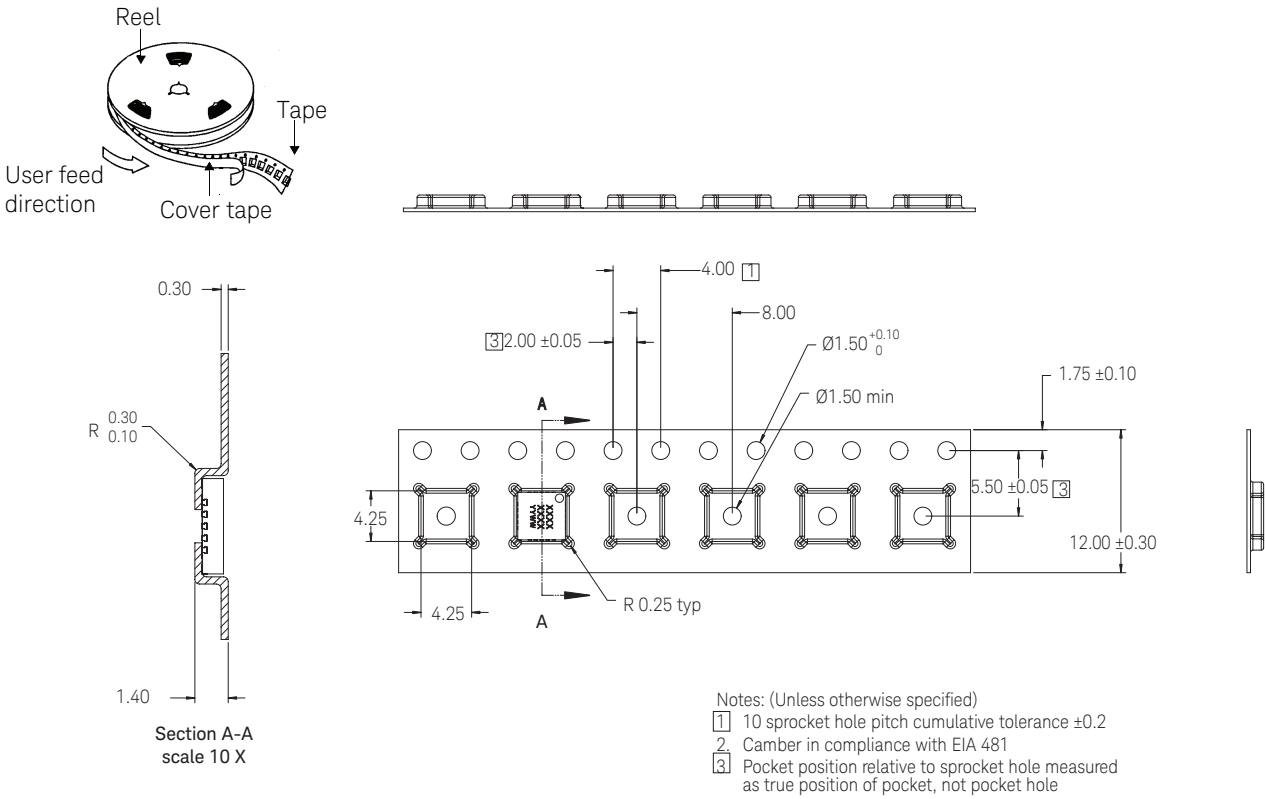


Figure 7. 1GG7-4252 tape and reel configuration

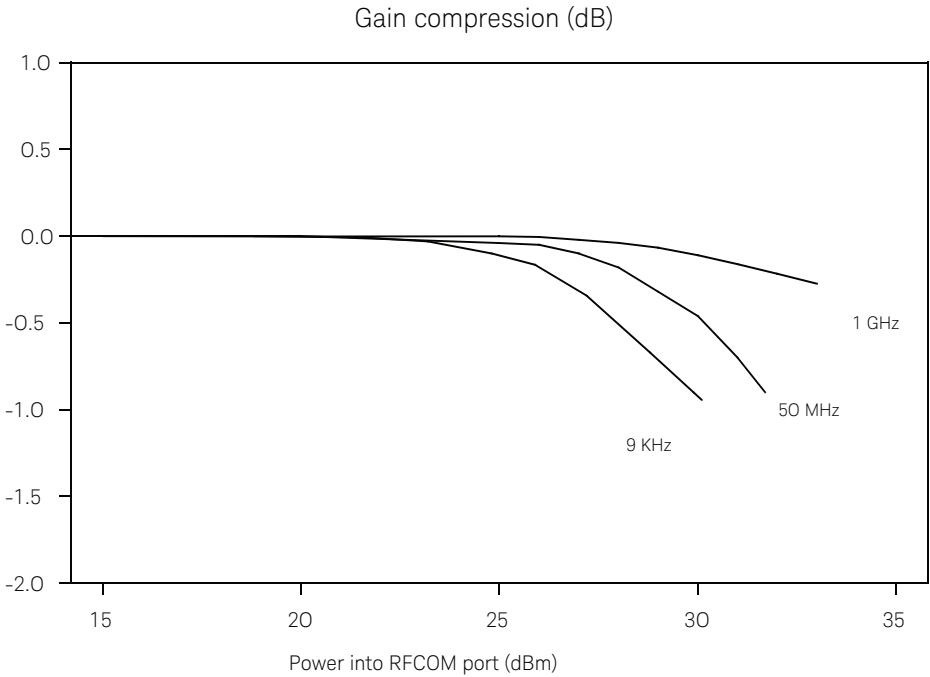


Figure 8. Typical gain compression

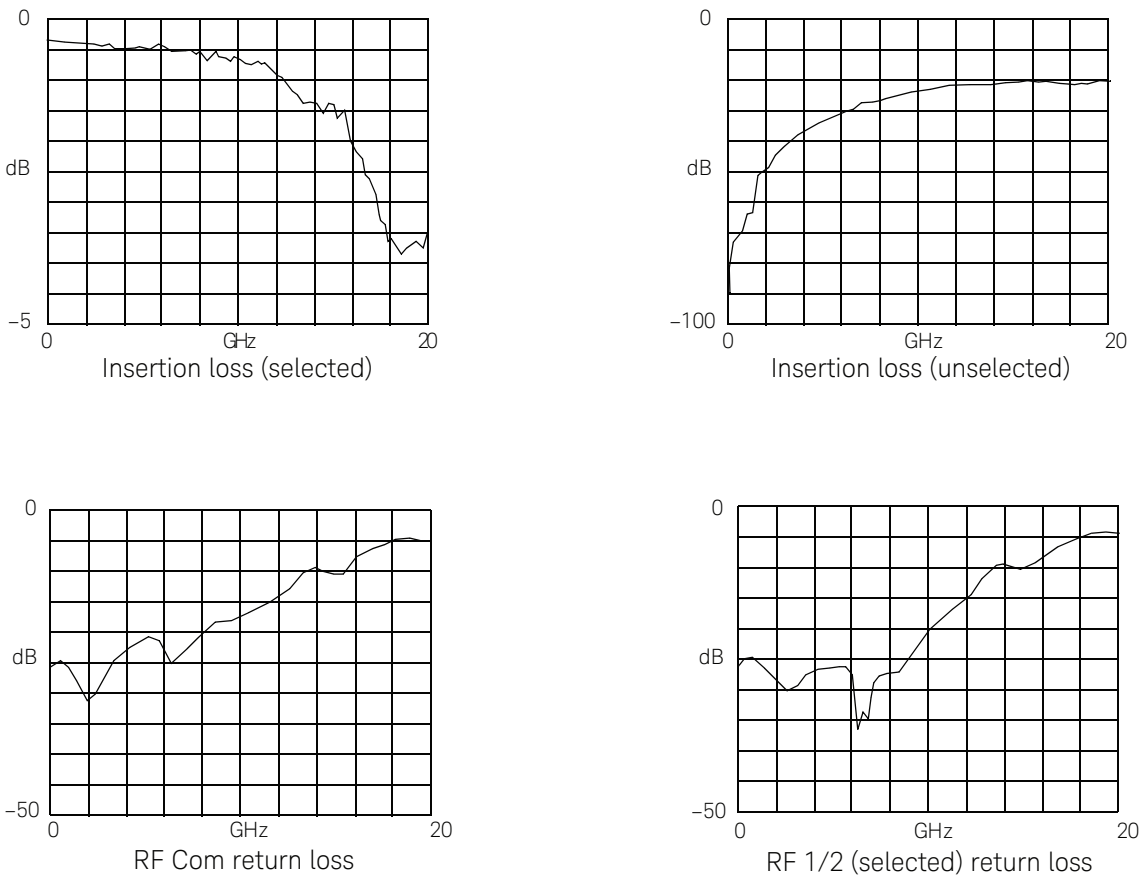


Figure 9. Typical small signal performance

(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).
Data taken with a IC device mounted in modular breadboard package, see 1GG7-4108 data sheet for detail.

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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* and RoHS Process Compatible with a maximum temperature of 260 °C and a maximum of 3 temperature cycles.

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