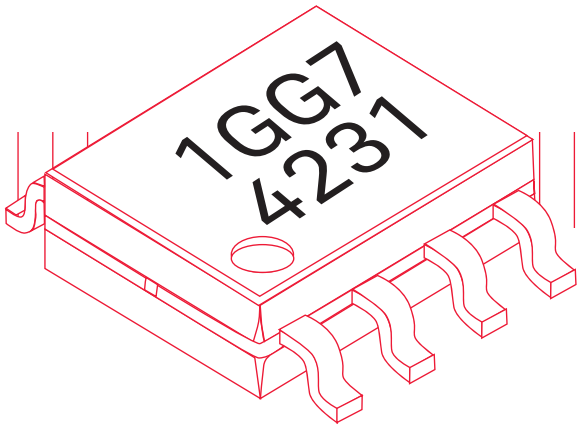
Keysight 1GG7-4231
DC - 6 GHz 15 dB/3 Bit GaAs MMIC Step Attenuator

Data Sheet



Features

- Frequency range:
- DC - 6.0 GHz
- Attenuation values:
  3 bit
  5, 10, 15 dB
- Min. insertion loss:
  < 1.5 @ 3 GHz
  < 4.0 @ 6 GHz
- Step accuracy:
  (–15 dB state)
  ±0.4 dB
- Return loss:
  17 dB through 3 GHz
  10 dB through 6 GHz
- Switching speed:
  < 1 µs (10% - 90% T_R)
- P_{-1dB}:
  25 dBm @ 10 MHz
  30 dBm @ 3 GHz
- Distortion:
  SHI: + 100 dBm
  THI: + 70 dBm
  TOI: + 57 dBm

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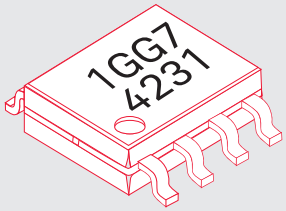
Description

The 1GG7-4231 is a packaged 3 Bit, 0 - 15 dB by 5 dB step GaAs MMIC Step Attenuator designed for low insertion loss and low distortion from DC to 6 GHz. It is intended for use as a general–purpose solid–state step–attenuator for RF instrumentation or commercial communication systems. Each 5 dB cell incorporates a "T" attenuator combined with integral series and shunt MESFET switching elements. This device incorporates a unique diode/resistor bias topology to improve low frequency RF performance and is fabricated with Keysight's DF7S GaAs MMIC process which is specifically designed to eliminate GaAs anomalies common in control circuit components. The device is mounted in a 8–lead plastic package.



- Package type: 8–lead SSOP plastic
- Package dimensions: 4.9 × 3.9 mm typ.
- Package thickness: 1.55 mm typ.
- Lead pitch: 1.25 mm nom.
- Lead width: 0.42 mm nom.

Absolute maximum ratings[1]

Symbol	Parameters/conditions	Min	Max	Units
$V_{C1,2,3,4}$	Control line voltages	–12	+12	volts
$P_{in(CW)}$	CW RF input power		33	dBm
T_{op}	Operating temperature	–55	+125	°C
T_{st}	Storage temperature	–65	+165	°C
T_{max}	Max. assembly temperature		+300	°C

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
$V_{C1,2,3,4(+)}$	Positive control line voltage	7	10	10.5	volts
$V_{C1,2,3,4(-)}$	Negative control line voltage	–10.5	–10	–7	volts
$I_{L(+)}$	Positive control line leakage current ($V_{C1,2,3,4}$ = +10 volts)			100	µA
$I_{L(-)}$	Negative control line leakage current ($V_{C1,2,3,4}$ = –10 volts)			100	µA

α_T	Attenuation temperature coefficient	50 MHz	1 GHz	2 GHz	3 GHz	4 GHz	dB/°C
	@ Min. insertion loss state	.0008	.0007	.0006	.0005	.0003	
	@ –5 dB state	.0002	.0001	.0000	–.0002	–.0003	
	@ –10 dB state	–.0004	–.0005	–.0006	–.0008	–.0010	
	@ –15 dB state	–.0009	–.0011	–.0012	–.0014	–.0016	

RF specifications

(T_A = 25 °C, Z_0 = 50 Ω, $V_{C1,2,3,4}$ = ±10 volts)

Symbol	Parameters/conditions		Min	Typ	Max	Min	Typ	Max	Units
BW	Guaranteed operating bandwidth			DC - 3.0			DC - 6.0		GHz
$IL_{(min)}$	Minimum insertion loss (V_{C1} = V_{C3} = +10 v, V_{C2} = V_{C4} = –10 v)			1.4[1]			4.0		dB
D_{step}	Attenuation step	@ –5 dB state	4.8	5	5.2	4.8	5	5.2	dB
		@ –10 dB state	9.7	10	10.3	9.7	10	10.3	
		@ –15 dB state	14.6	15	15.6	14.6	15	15.8	
RL	Return loss				17			10	dB
T_R	Rise time switching speed (10% - 90% of RF swing, f_0 = 3 GHz)			1.0			1.0		µs
SHI	Second harmonic intercept point (Referred to P_{in})			100			100		dBm
THI	Third harmonic intercept point (Referred to P_{in})			70			70		
TOI	Two–tone third order intercept point (For two–tone power levels < +20 dBm)			57			57		dBm
P_{-1dB}	Input power @ 1 dB increase in insertion loss:			30[2]			30		dBm
P_{in}(max)	Maximum continuous RF input power				30			30	dBm

1. Typical $IL_{(min)}$ @ < 10 MHz = 0.4 dB.
2. Typical P_{-1dB} @ < 10 MHz = 25 dBm.

Applications

The 1GG7-4231 is designed for use in instrumentation, communications, radar, ECM, EW, and many other systems requiring fast switching speed, low distortion to input signals, and high cycle lifetimes. It can be used for pulse modulation, port isolation, replacement of mechanical relays, and in any application requiring the advantages of solid-state performance.

This device does not include any on-chip driver circuitry. An external driver circuit is required to convert TTL or ECL logic signals to the ±10 volt switching levels required by this device.

Assembly Techniques

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

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

The Keysight Technologies, Inc. document, *GaAs MMIC ESD, Die Attach and Bonding Guidelines,* Application Note (5991-3484EN) provides basic information on these subjects.

Moisture Sensitivity Classification: Class 1, per JESD22-A112-A.

RoHS Compliance

The 1GG7-4231 prescaler 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.

Logic table

(V_{C1-C4} typical values in volts)

Attenuation setting	**V_{C1}**	**V_{C2}**	**V_{C3}**	**V_{C4}**
Min. insertion loss	+10	–10	+10	–10
–5 dB state	+10	–10	–10	+10
–10 dB state	–10	+10	+10	–10
–15 dB state	–10	+10	–10	+10

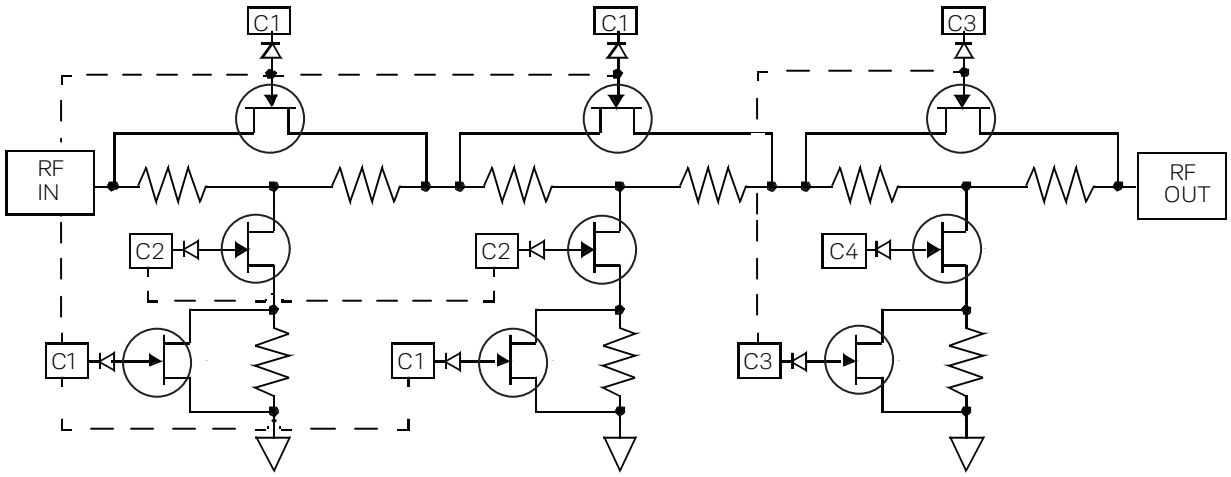
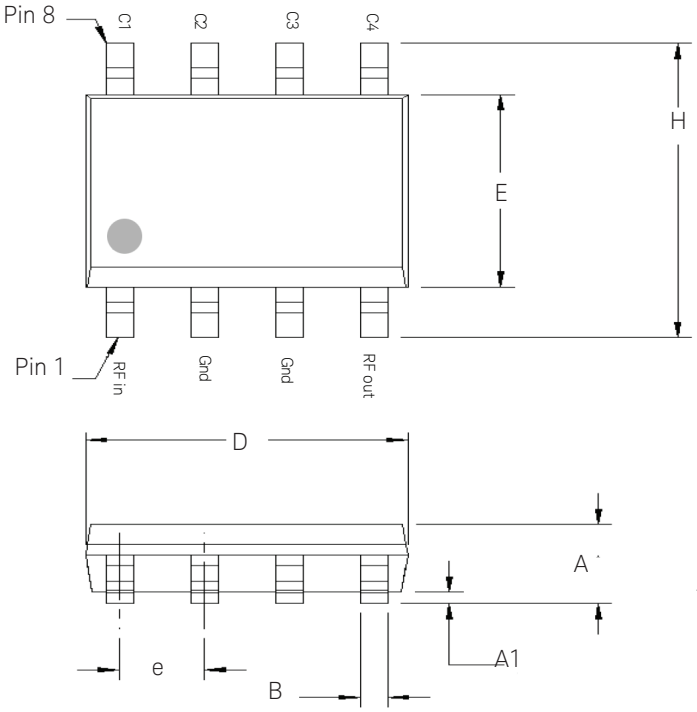


Figure 1. Simplified schematic diagram



– All dimensions in millimeters.
– Refer to JEDEC Outline MO-150 for additional tolerances

Symbol	Min	Max
A	1.35	1.75
A1	0.0	.10
B	0.33	0.51
C	0.19	.025
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
L	0.40	1.27
a	0°	8°

– Exposed heat slug area on pkg bottom = 2.67 × 1.65.

Figure 2. Package and dimensions

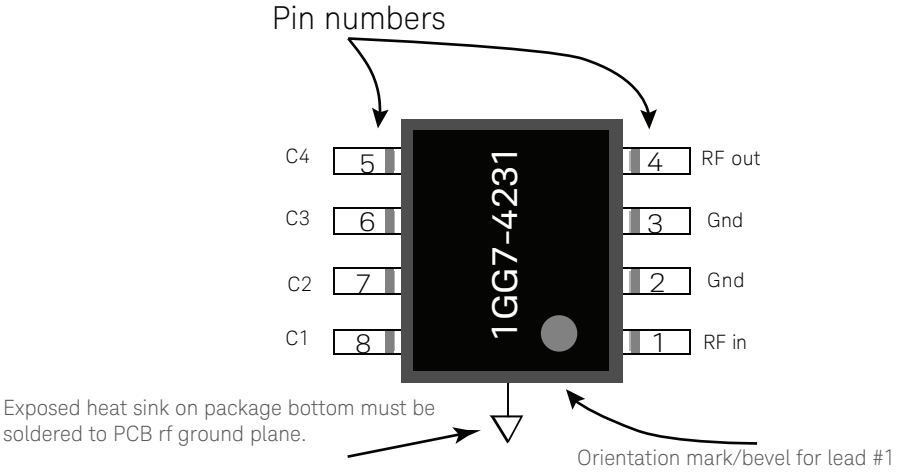


Figure 3. 1GG7-4231 package diagram

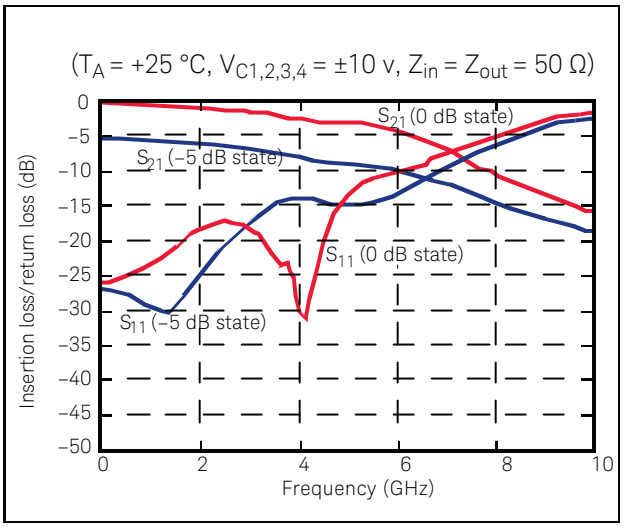


Figure 4. Insertion loss and return loss vs. frequency @ 0 dB/–5 dB states[1]

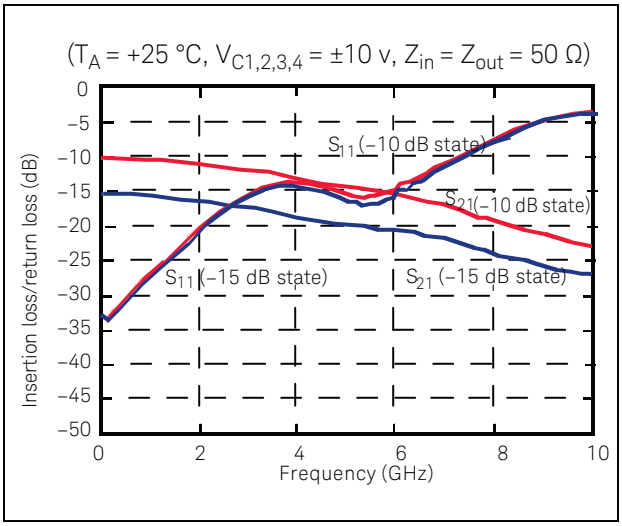


Figure 5. Insertion loss and return loss vs. frequency @ –10 dB/–15 dB states[1]

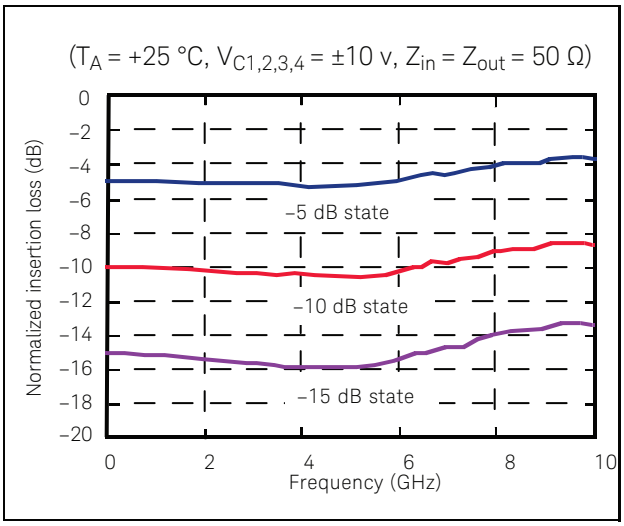


Figure 6. Typical attenuation step values vs. frequency[1]

1. Data taken with a device mounted in a PC board, also see the 1GG7-4081 data sheet for IC level performance data.
Note: Output return loss should be similar with the input return loss.

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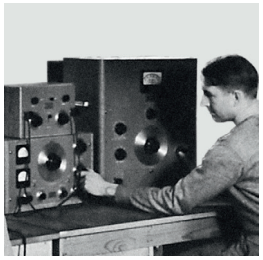

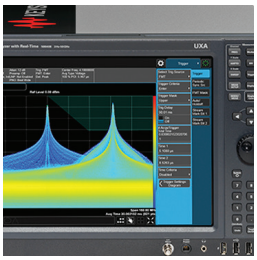

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This data sheet contains a variety of typical and guaranteed performance data. The information supplied should not be interpreted as a complete list of circuit specifications. Customers considering the use of this, or other Keysight Technologies GaAs 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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