

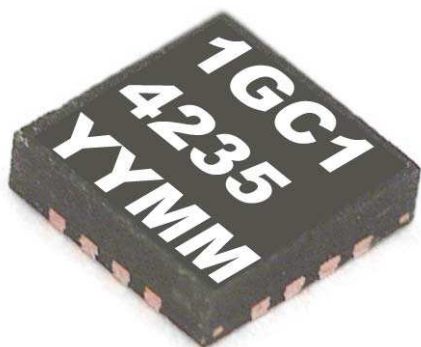


Agilent 1GC1-8235

0-20 GHz Integrated Diode Limiter

TC231P

Data Sheet



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: 0.20 mm (8 mils)

Features

- **Two Independent Limiters for Single-ended or Differential Signals**
- **Can be Biased for Adjustable Limit Level and Signal Detection**
- **Minimum Group Delay.**

Description

The TC231 is a 20 GHz integrated diode limiter that can be used to protect sensitive RF circuits from excess RF power, DC transients, and ESD. Two limiters are provided on-chip to enable single-ended or differential use.

The TC231 can be used as an unbiased 10 or 18 dBm passive limiter; it also provides adjustable limiting and peak power detection capabilities.

The TC231 has been designed for minimal insertion loss. Group delay characteristics have been optimized to allow use in millimeter-wave analog and gigabit digital designs..

Absolute maximum ratings¹

Symbol	Parameters/conditions	Min	Max	Units
P_{in}	Continuous RF Power A & C Grounded DGND Grounded		+17 +19	dBm
I_{BIAS}	Continuous Forward Current into $A_1, A_2, C_1, C_2,$ DGND ₁₋₄		36	mA
V_{BIAS}	Voltage at $A_1, A_2, C_1, C_2, DGND_{1-4}$	-5	+5	V
V_{rev}	Reverse Bias Voltage on Each Diode		8	V
I_{fwd}	Forward Bias Current on Each Diode		36	mA
V_{in}	Voltage at IN_1, IN_2, OUT_1, OUT_2	+5	5	V
I_{IN}	Current at IN_1, IN_2, OUT_1, OUT_2	-80	80	mA
T_A	Ambient Temperature		+85	°C
T_{max}	Maximum Assembly Temperature		240	°C
T_{stg}	Storage Temperature	-65	165	°C

Notes:

- 1 Operation in excess of any one of these ratings may result in permanent damage to this device. For normal operation, all combined bias and thermal conditions should be chosen such that the maximum junction temperature (T_J) is not exceeded. $T_A = 25^\circ\text{C}$ except for T_{op} , T_{st} , and T_{max} .
- 2 Sixty-second maximum



DC specifications/physical properties¹

Symbol	Parameters/conditions	Minimum	Typical	Maximum	Units
V_{fwd_A} V_{fwd_C}	Limiting Diode Forward Voltage @ 0.1 mA	0.5	0.64	0.8	V
V_{fwd_D}	2-Diode Bias Stack Forward Voltage @0.1 mA	0.8	1.15	1.5	V
R_{S_A} R_{S_C}	Limiting Diode Series Resistance @ 15mA Including 2 ohm Resistor	5	12	20	Ω
I_A, I_C	Limiting Diode Reverse Leakage Current @-1V		0.1	1.2	μ A
R_{S_Series}	Through Series Resistance		1.2	5.5	Ω

Notes:

1 Measured on wafer with $T_{chuck} = 25^\circ\text{C}$ unless otherwise noted.

RF specifications¹

Symbol	Parameters/conditions	Minimum	Typical	Maximum	Units
S_{11}, S_{22}	Relection 10 GHz		-24	-20	dB
S_{21}, S_{12}	Through Loss 10 GHz	-0.4	-0.2		dB
$\Delta\tau_d$	Group Delay Flatness 26.5 GHz		± 0.5		pS
P_{-1dB}	1 dB Gain Compression A&C Grounded DGND Grounded A&C Biased		10 18 Voltage Variable		dBm
SHI	Second Harmonic Intercept $f_0=5$ GHz, A&C or DGND Grounded		70		dBm
THI	Third Harmonic Intercept $f_0=5$ GHz, A&C or DGND Grounded		32		dBm
TOI	Third Order Intercept $f_1=5$ GHz, $f_2=5.25$ GHz, A&C or DGND Grounded		32		dBm

Notes:

1 Measured on wafer with $T_{chuck} = 25^\circ\text{C}$ unless otherwise noted.

ESD Specifications¹

Symbol	Parameters/conditions	Minimum	Typical	Maximum	Units
ESD	ESD No Damage A&C Grounded DGND Grounded		2400 2800		V

Notes:

1 Using Human Body Model as ESD generator. Circuit equivalent is 100 pF, 1500 Ω

Applications

The TC231 can be used as a protection circuit for ESD and DC transients, as a Reverse Power Protection (RPP) device, or as an RF limiter with optional power detection.

The different modes of use require different attachments. These are described under Operation.

Biasing

None required for traditional operation. For adjustable limiting, the bias voltage will set the limiting value as described under Operation.

Operation

The TC231 has three primary modes of operation. 10 dBm and 18 dBm limiting can be done with no active

bias required. See Figures 1(a) & 1(b). Both of these uses will provide ESD protection at the limiting value. For adjustable limiting and detection, the bias should be applied as shown in Figure 1(c). Adjustable limiting is achieved by setting the A pin to a DC voltage ~0.7 volts higher than the desired minimum voltage, and the C pin to a DC voltage ~0.7 volt lower than the desired maximum voltage. If the voltage is not forced, the capacitor will function as a peak detector. As an ESD protection device, the TC231 can protect ESD sensitive components. The degree of protection depends on the protected components characteristics. ESD damage level for the TC231 by itself is around 2400V using the human body model.

Assembly techniques

The 1GC1-4235 is designed for surge mount on a printed surface board using standard SMT techniques and wave solder.

Well-designed PCB transitions and via structures are essential for obtaining good performance from this and other high-frequency parts. Diodes are ESD sensitive. ESD preventive measures must be employed in all aspects of handling and assembly. Diode ESD precautions, handling considerations, and soldering methods are critical factors in successful diode performance and reliability.

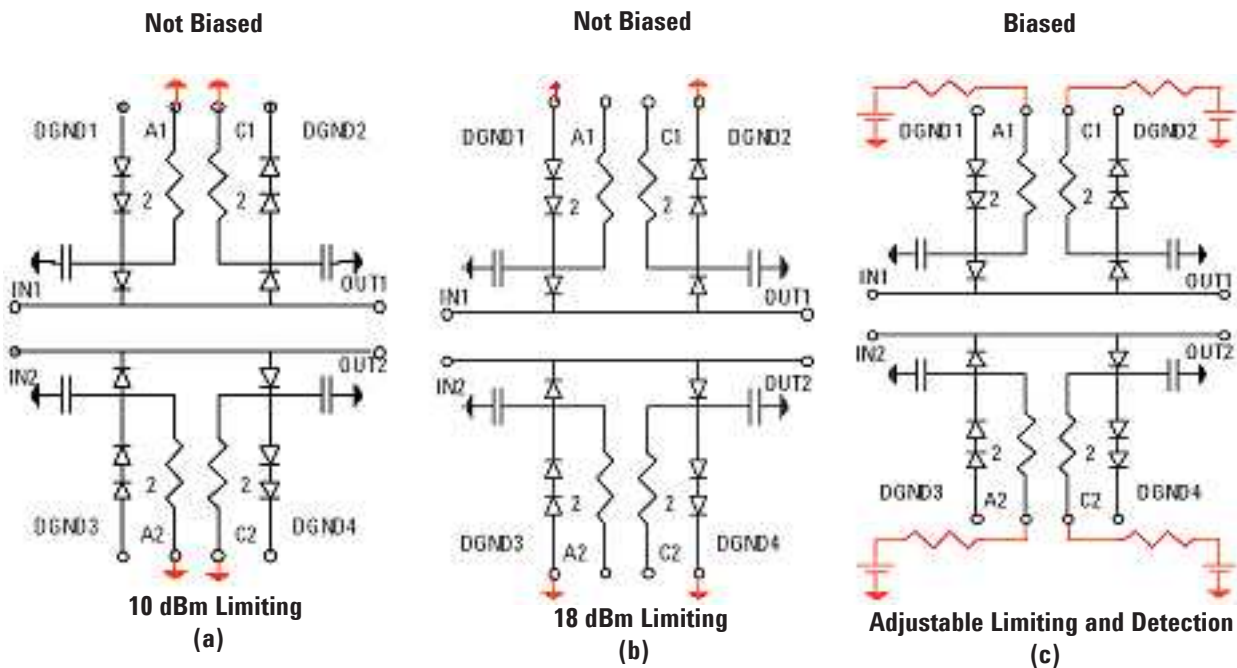


Figure 1. TC231 Functional Topologies

Top View

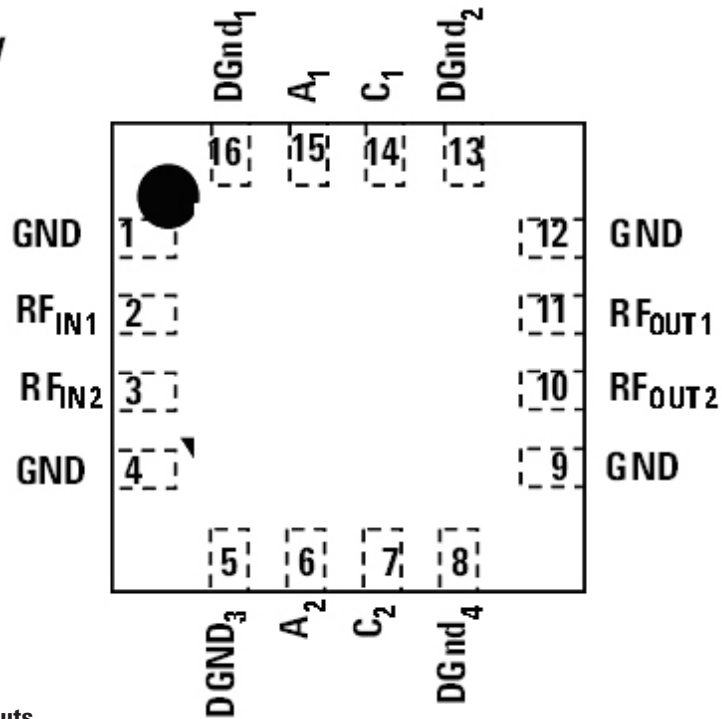


Figure 2. TC231P Pin Outs

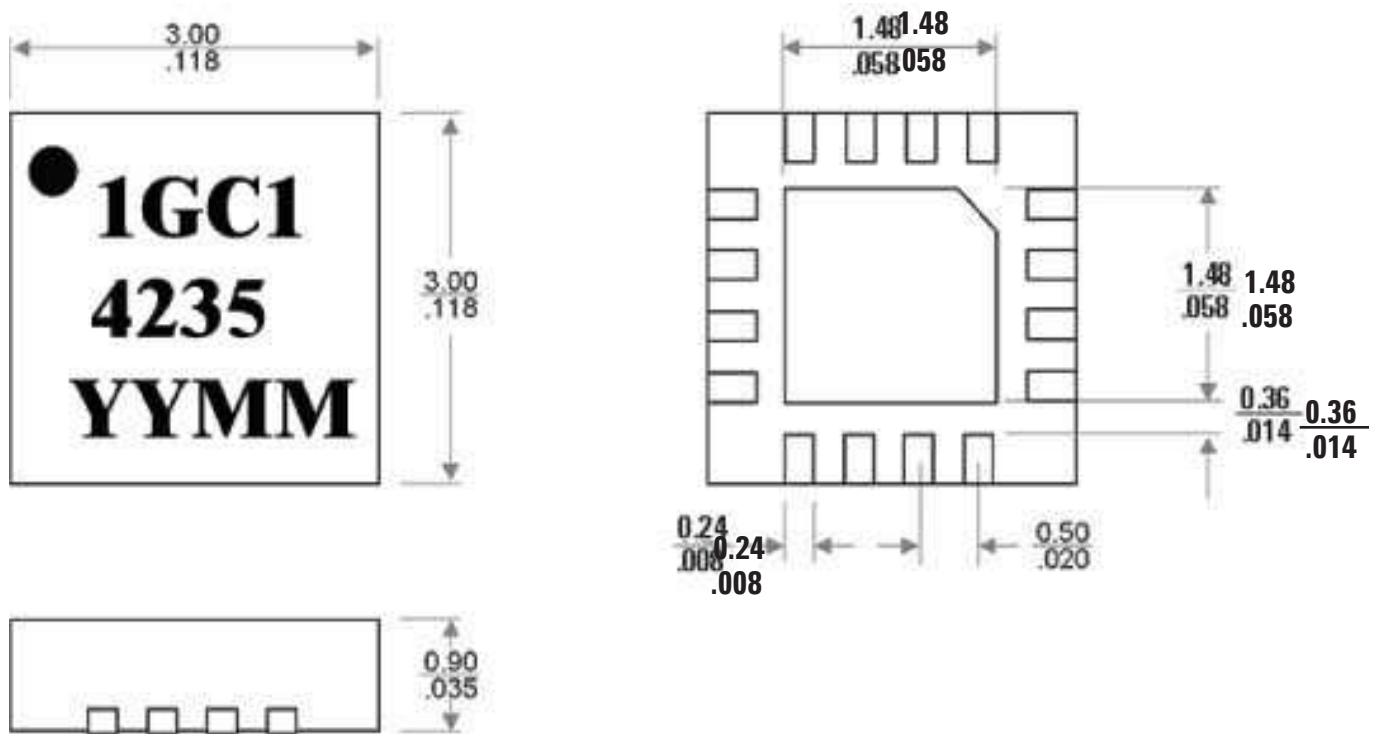


Figure 3. TC231P Dimensions

This datasheet 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 design should obtain the current production specifications from Agilent. In this datasheet, the term typical refers to the 50th percentile performance



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