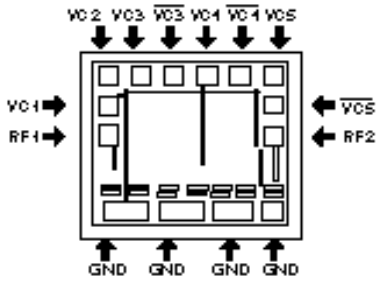
5-Bit GaAs Digital Attenuator
DC - 2 GHz

MADA2030G

V 2.00

Features

- Attenuation 0.5-dB Steps to 15.5 dB
- Temperature Stability ±0.1 dB from -55° to +85°C Typical
- Fast Switching Speed, 3 ns Typical to 90%



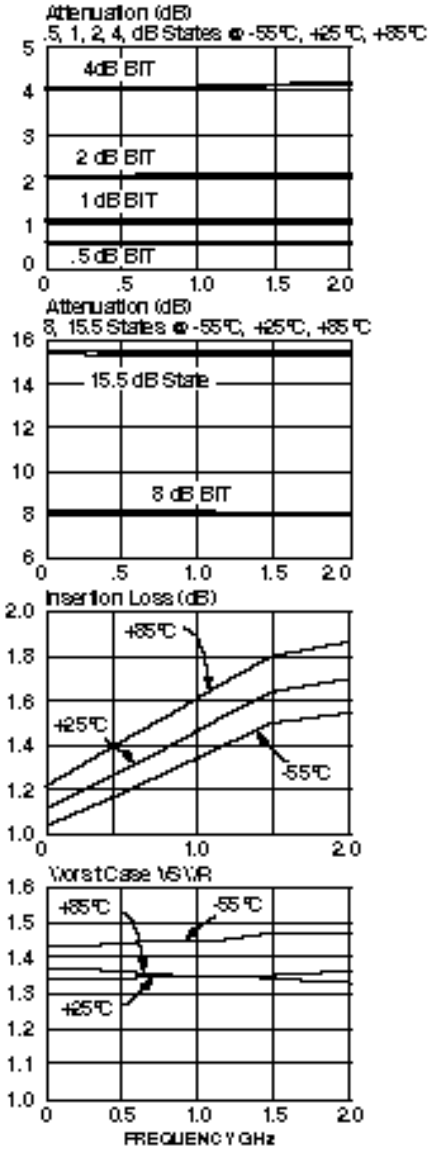
Guaranteed Specifications (From -55°C to +85°C)

Frequency Range		DC - 2.0 GHz
Nominal Attenuation		0.5 dB Steps to 15.5 dB Max
Attenuation Accuracy	±0.15 dB	±3% of Attenuation Setting
VSWR Worst Case Setting	DC - 2 GHz	1.6:1 Max
Reference Insertion Loss	DC - 2 GHz	2.3 dB Max
	DC - 1 GHz	1.9 dB Max

Operating Characteristics

Impedance		50 Ω Nominal
Phase Balance (For any bit or combinations of bits per unit)		
2 GHz		+4/-6 Degrees Typ
1 GHz		+2/-3 Degrees Typ
500 MHz		+1/-2 Degrees Typ
Switching Characteristics		
Switching Time (50% CTL to 90/10% RF)		3 ns Typ
Switching Transients (Unfiltered)		7 mV Typ
Input Power for 1 dB Compression		
Above 500 MHz		+27 dBm Typ
100 MHz		+24 dBm Typ
Intermodulation Intercept Point (for two-tone input power up to +5 dBm)		
Intercept Points	IP_2	IP_3
Above 500 MHz	+68 dBm Typ	+45 dBm Typ
100 MHz	+45 dBm Typ	+40 dBm Typ
Control Voltages (Complementary Logic)		
V_{IN}Low		0 to -0.2 V @ 5 µA Max
V_{IN}Hi		-5 V @ 75 µA Typ to -8 V @ 250 µA Max
Die Size		0.045" x 0.039" x 0.010" (1.14mm x 0.99mm x 0.25mm

Typical Performance



Handling Precautions

Permanent damage to the MADA2030 may occur if the following precautions are not adhered to:

A. Cleanliness – The MADA2030 should be handled in a clean environment. DO NOT attempt to clean unit after the MADA2030 is installed.

B. Static Sensitivity – All chip handling equipment and personnel should be DC grounded.

C. Transient – Avoid instrument and power supply transients while bias is applied to the MADA2030. Use shielded signal and bias cables to minimize inductive pick-up.

D. Bias – Apply voltage to either complementary control ports only when the other is grounded. Neither port should be allowed to "float".

E. General Handling – It is recommended that the MADA2030 chip be handled along the long side of the die with a sharp pair of bent tweezers. DO NOT touch the surface of the chip with fingers or tweezers.

Mounting

The MADA2030 is back-metallized with Pd/Ni/Au (100/1,000/10,000Å) metallization. It can be die-mounted with AuSn eutectic preforms or with thermally conductive epoxy. The package surface should be clean and flat before attachment.

Eutectic Die Attach:

A. A 80/20 gold/tin preform is recommended with a work surface temperature of approximately 255°C and a tool temperature of 265°C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be approximately 290°C.

B. DO NOT expose the MADA2030 to a temperature greater than 320°C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

Epoxy Die Attach:

A. Apply a minimum amount of epoxy and place the MADA2030 into position. A thin epoxy fillet should be visible around the perimeter of the chip.

B. Cure epoxy per manufacturer's recommended schedule.

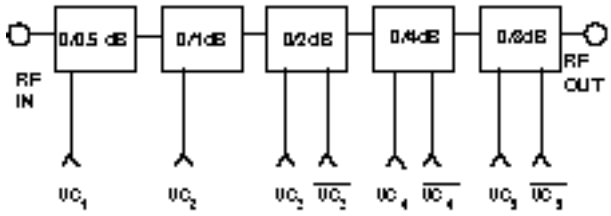
C. Electrically conductive epoxy may be used but is not required.

Wire Bonding

A. Ball or wedge bond with 1.0 mil diameter pure gold wire. Thermo- sonic wirebonding with a nominal stage temperature of 150°C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Ultrasonic energy and time should be adjusted to the minimum levels to achieve reliable wirebonds.

B. Wirebonds should be started on the chip and terminated on the package. GND bonds should be as short as possible; at least three and no more than four bond wires from ground pads to package are recommended.

Schematic



DA2030 Truth Table
Control Input

VC1	VC2	VC3	$\overline{VC3}$	VC4	$\overline{VC4}$	VC5	$\overline{VC5}$	Attenuation Settings
V_{in}Hi	V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	Reference
V_{in}Low	V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	.5dB
V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	1dB
V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	2dB
V_{in}Hi	V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Low	V_{in}Hi	V_{in}Hi	V_{in}Low	4dB
V_{in}Hi	V_{in}Hi	V_{in}Hi	V_{in}Low	V_{in}Hi	V_{in}Low	V_{in}Low	V_{in}Hi	8dB

V_{in}Low 0 to -0.2V
V_{in}Hi -5V to -8V

Maximum Ratings

A. Control Voltage : -8.5 Vdc
B. Max Input RF Power: +34 dBm
(500 MHz - 4 GHz)
C. Storage Temperature: -65°C to +175°C
D. Maximum Operating Temperature: +175°C

BondPad Dimensions
Inches (mm)

RFin, RFout: 0.004" x 0.004"
(0.100mm x 0.100mm)
VC1,VC2,VC3,$\overline{VC3}$,VC4,$\overline{VC4}$: 0.004" x 0.004"
(0.100mm x 0.100mm)
GND1,GND2,GND3: 0.009" x 0.004"
GND4: 0.004" x 0.004"
(0.100mm x 0.100mm)

Die Size
Inches (mm)

0.045" x 0.039" x 0.010"
(1.14mm x 0.99mm x 0.25mm)