

# **VCA2614/18/19EVM**

## ***Evaluation Module***

# *User's Guide*

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## **EVM WARNINGS AND RESTRICTIONS**

It is important to operate this EVM within the specified input and output ranges described in the EVM User's Guide.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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# VCA2614/18/19EVM

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The VCA2614/18/19EVM is designed to provide ease of use in evaluating the performance of the VCA2614, VCA2618 or VCA2619 variable gain amplifier.

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## 1.1 Initial Configuration

By using simple slide switches and DIP switches, the VCA2614/18/19EVM can be configured to accommodate several different modes of operation. Before using the evaluation board, each user should determine the configuration and setting needed for the specific evaluation. The demonstration board comes from the factory with the following factory settings:

- Switches SW1, SW2, SW3, and SW4 are all set to positions 2–3. (See Table 1.)
- DIP-switch S1 has the following settings:
  - MGS1, MGS2, and MGS3 are set to the off position.
  - /PD is set to off position.
- Components C9 and C16 are not populated.

## 1.2 Power Supply

The VCA2614/18/19EVM requires +5V supplies (connector J4) for the output amplifiers (U2 and U3) and a separate +5V supply (connector J1) for the VCA2614/18/19. This configuration allows for the monitoring of supply currents to the VCA2614/18/19 independent of the rest of the evaluation board. If monitoring of the supplies is not required, a single +5V supply can be substituted for the two separate +5V supplies. In this case, the –5V supply is still required.

## 1.3 Signals

### 1.3.1 Input Signals

The input signals are applied to SMA connectors J2 and J3. The input signals should be provided from a low impedance source. The inputs are ac coupled into the VCA2614/18/19 through 0.01 $\mu$ F capacitors.

### 1.3.2 VCA<sub>CNTL</sub>

The gain control signal is applied to the input SMA connector J7. This can be a dc voltage or a customer-specific waveform. The source for the control input should also be low impedance. The range for the control voltage, as specified in the VCA2614, VCA2618, or VCA2619 data sheet, is from 0.2V to 3V.

### 1.3.3 Output Signals

The outputs of the evaluation board are located at SMA connectors J5 and J6. When testing the EVM board, the outputs J5 and J6 should be terminated into 50 $\Omega$  loads such as that of the inputs to a spectrum analyzer. This will result in a 6dB loss of the signal magnitude. This loss should be taken into account when taking all measurements.

## 1.4 Output Configuration

By utilizing the switches provided at the inputs to amplifiers U2 and U3, the outputs of the VCA2614/18/19 can be monitored on SMA connectors J5 and J6. Amplifiers U2 and U3 are configured to have a gain of 1/2 in all modes except where the signals are terminated to ground through a 500 $\Omega$  equivalent resistance. Table 1 lists the switch combinations and the resulting output:

Table 1. VCA2614/18/19 Switch Combinations

	Single-Ended Noninverting	Single-Ended Inverting	Difference <sup>(1)</sup>	No Output at J5 and J6 (output at test points)
U2				
SW1	1–2	2–3	2–3	1–2
SW3	2–3	1–2	2–3	1–2
U3				
SW2	1–2	2–3	2–3	1–2
SW4	2–3	1–2	2–3	1–2

1) Denotes factory preset.

The outputs of the VCA2614/18/19 can be terminated through 500 $\Omega$  on each output and the output signals can then be observed at test points TP1 and TP4 and test points TP2 and TP3 respectively.

## 1.5 Switches

The four dip switches (S1) control the gain range bits (MGS1, MGS2, and MGS3) of the PGA and the power down ( $\overline{\text{PD}}$ ) function of the VCA2614/18/19. Table 2, Table 3 and Table 4 show the MGS settings and the corresponding gain ranges for each device.

Table 2. MGS Settings for the VCA2614

MGS Setting	Attenuator Gain VCA <sub>CNTL</sub> = 0.02V to 3V	Attenuator + Differential PGA Gain
000	Not valid	Not valid
001	-24.1dB to 0dB	2.6dB to 26.7dB
010	-26.9dB to 0dB	2.6dB to 29.5dB
011	-29.5dB to 0dB	3.0dB to 35.6dB
100	-32.4dB to 0dB	3.1dB to 35.5dB
101	-34.8dB to 0dB	3.4dB to 38.3dB
110	-37.3dB to 0dB	3.7dB to 44.1dB
111	-40.0dB to 0dB	4.1dB to 44.2dB

Table 3. MGS Settings for the VCA2618

MGS Setting	Attenuator Gain VCA <sub>CNTL</sub> = 0V to 3V	Attenuator + Differential PGA Gain
000	Not valid	Not valid
001	-27dB to 0dB	0dB to 27dB
010	-30dB to 0dB	0dB to 30dB
011	-33dB to 0dB	0dB to 33dB
100	-36dB to 0dB	0dB to 36dB
101	-39dB to 0dB	0dB to 39dB
110	-42dB to 0dB	0dB to 42dB
111	-45dB to 0dB	0dB to 45dB

Table 4. MGS Settings for the VCA2619

MGS Setting	Attenuator Gain VCA <sub>CNTL</sub> = 0.2V to 3V	Attenuator + Differential PGA Gain
000	Not valid	Not valid
001	Not valid	Not valid
010	-41.0dB to 0dB	-12dB to 29dB
011	-43.3dB to 0dB	-11.5dB to 31.8dB
100	-46.4dB to 0dB	-11.5dB to 34.9dB
101	-48.2dB to 0dB	-10.6dB to 37.6dB
110	-50.2dB to 0dB	-9.8dB to 40.4dB
111	-52.3dB to 0dB	-9.3dB to 43.3dB



## 1.6 User-Selectable Capacitors

Capacitors C9 and C16 are user-selectable and optional. Placing an external capacitor at these positions will lower the low frequency bandwidth of the VCA2614/18/19. The following equation is used to calculate the low frequency cutoff:

$$f_{(low-3dB)} = \frac{1}{2 \times \pi \times 500k\Omega \times (220pF + C_{EXTERNAL})}$$

Care must be taken not to select too large a value because the charging time may exceed the time constant set by the input coupling capacitors, thus causing a longer-than-expected power-on delay. Please refer to the Input Buffer section of the VCA2614, VCA2618 or VCA2619 data sheet, located at [www.ti.com](http://www.ti.com), for further details.

### 1.7 Schematic and PCB

Figure 1. VCA2614/18/19EVM Schematic

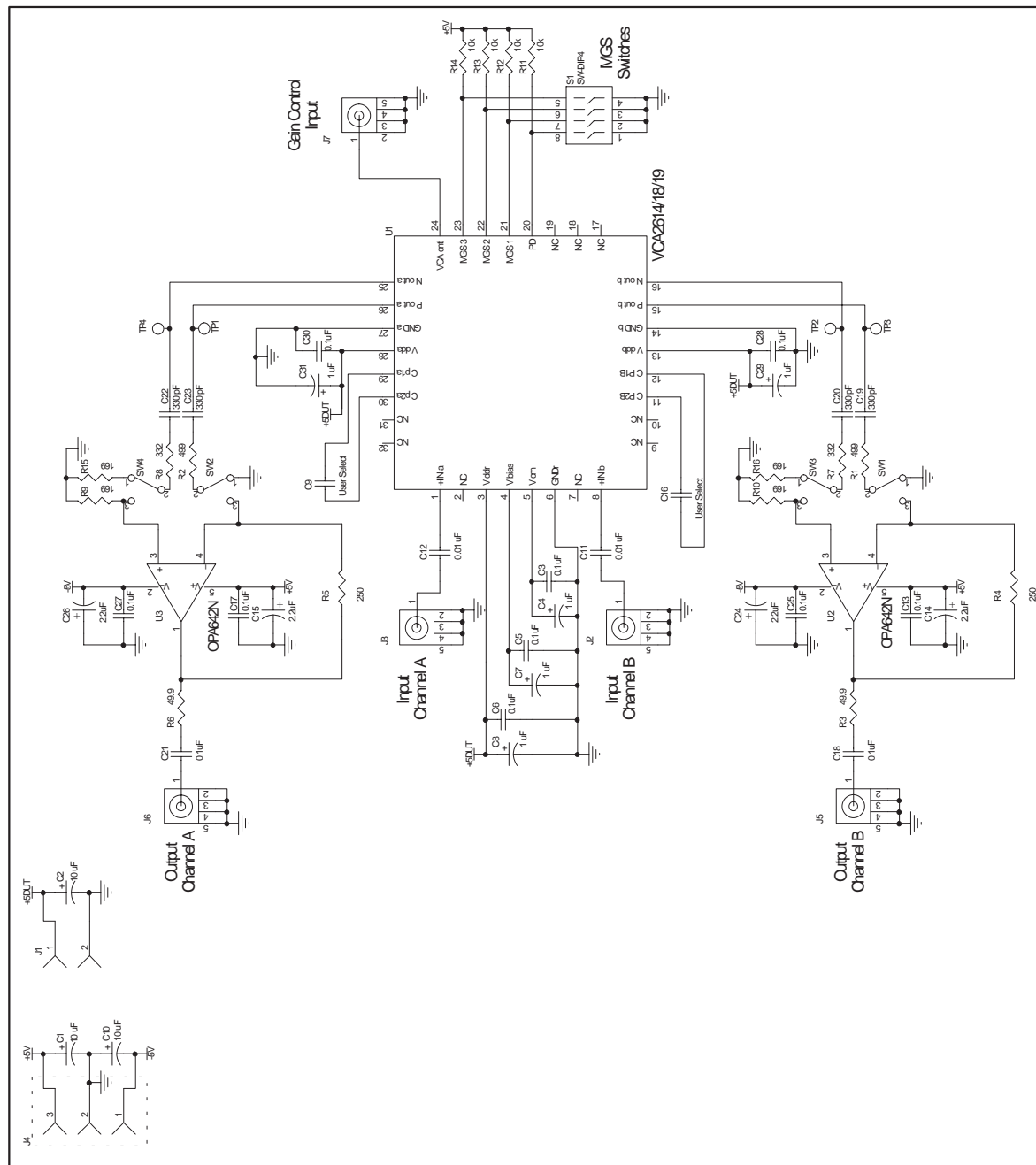


Figure 2. VCA2614/18/19EVM PCB Top Layer

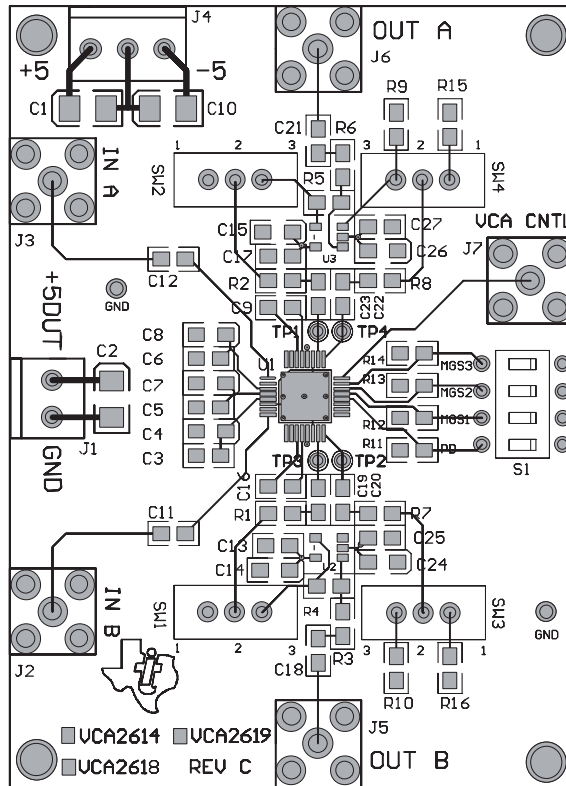


Figure 3. VCA2614/18/19EVM PCB Ground Layer

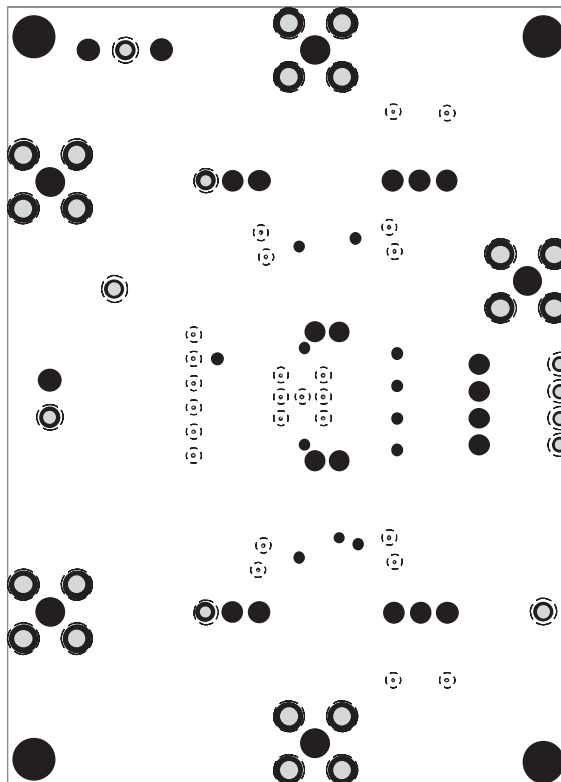


Figure 4. VCA2614/18/19EVM PCB Power Layer

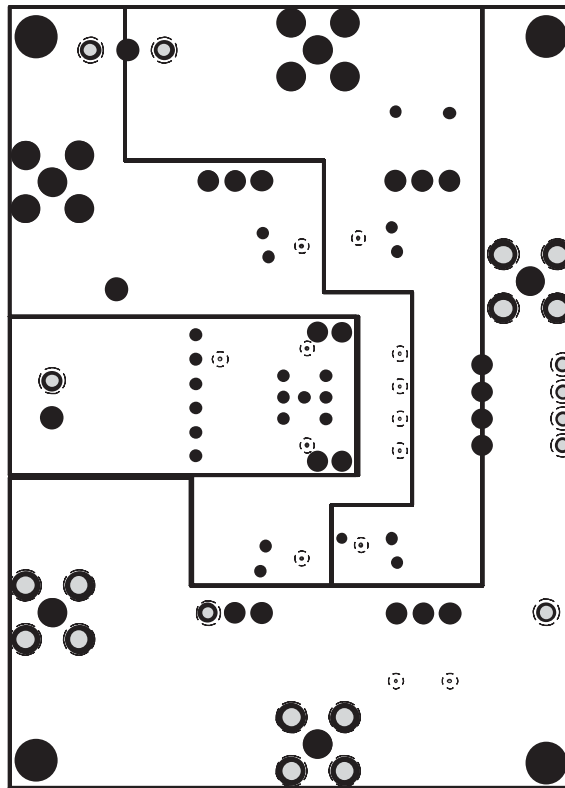
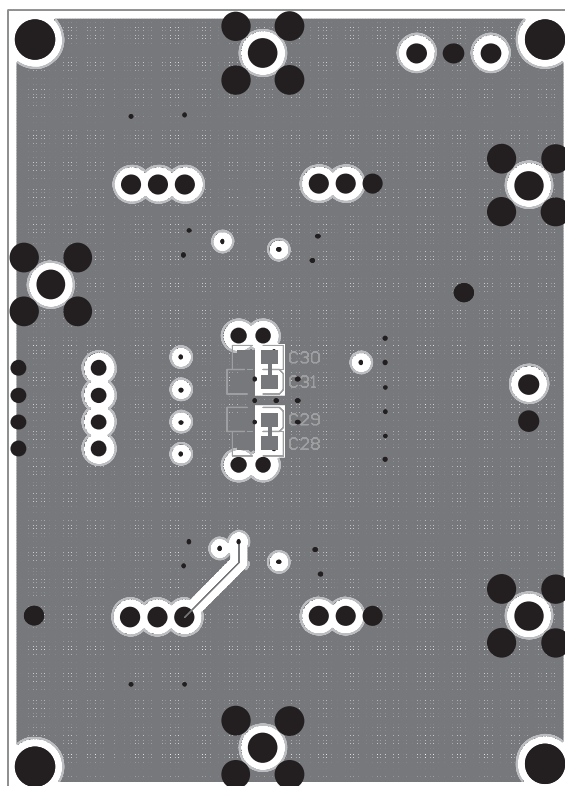


Figure 5. VCA2614/18/19EVM PCB Bottom Layer



## 1.8 Component List

Table 5. Component List

Qty	Part Type	Designator	Footprint	Mfg	Part Number	Description
11	0.1 $\mu$ F	C3, C5, C6, C13, C17, C18, C21, C25, C27, C28, C30	805	Kemet	C0805C104M5UAC	Multilayer ceramic – 0805 size
2	0.01 $\mu$ F	C11, C12	805	Kemet	C0805C103K5RAC	Multilayer Ceramic – 0805 Size
5	1 $\mu$ F	C4, C7, C8, C29, C31	3216	Kemet	T491A105M016AS	Low Profile Tantalum Capacitor
4	2.2 $\mu$ F	C14, C15, C24, C26	3216	Kemet	T491A225M016AS	Low Profile Tantalum Capacitor
4	10k $\Omega$	R11, R12, R13, R14	805	Dale	CRCW0805103F	1/10W 0805 Chip Resistor
3	10 $\mu$ F	C1, C2, C10	3528	Kemet	T491B106M016AS	Low Profile Tantalum Capacitor
2	49.9 $\Omega$	R3, R6	805	Dale	CRCW080549R9F	1/10W 0805 Chip Resistor
4	169 $\Omega$	R9, R10, R15, R16	805	Dale	CRCW08051690F	1/10W 0805 Chip Resistor
2	250 $\Omega$	R4, R5	805	Dale	CRCW08052490F	1/10W 0805 Chip Resistor
4	330pF	C19, C20, C22, C23	805	Kemet	C0805C331K3GAC	Multilayer Ceramic – 0805 Size
2	332 $\Omega$	R7, R8	805	Dale	CRCW08053320F	1/10W 0805 Chip Resistor
2	499 $\Omega$	R1, R2	805	Dale	CRCW08054990F	1/10W 0805 Chip Resistor
1	CON_2TERM_SCREW	J1	2P-TERM	Digi-Key	ED-1514-ND	2 Terminal Screw Connector
1	CON_3TERM_SCREW	J4	3P-TERM	Digi-Key	ED-1515-ND	3 Terminal Screw Connector
2	OPA642N (OPA842)	U2, U3	SOT23-5	TI	OPA642N	High-Speed, Low THD Op Amp
5	SMA_PCB_MT_MOD	J2, J3, J5, J6, J7	SMA_JACK_RIGHT_ANGLE	Johnson	142-0801-301	Right-angle SMA
4	SPDT_SLIDE	SW1, SW2, SW3, SW4	SPDT_SLIDE	Digi-Key	EG-1903-ND	C&K / TS01-C-K-E
1	SW-DIP4	S1	4POS_SPST_DIP	Digi-Key	A5204-ND	4 Position SPST Dip Switch
2	User Select(1)	C9, C16	805	—	User Select	Multilayer Ceramic – 0805 Size
1	VCA2614 VCA2618 VCA2619	U1	32-TQFP	TI	VCA2614Y VCA2618Y VCA2619Y	Voltage Controlled Amplifier

1) Not populated on board. Optional component.