RC6303

Triple Video Amplifier

with Separate Enable Inputs

Features

- Triple video amplifier
- Independently enabled amplifiers
- 90 MHz -3 dB Bandwidth (A_V = 2)
- 20 MHz ±0.1 dB gain flatness
- Stable at $A_V \geq 2$
- 0.06% differential gain (A_V = 2, R_L = 150Ω)
- 0.06° differential phase (A_V = 2, R_L = 150Ω)
- High CMRR (100dB), High PSRR (80 dB)
- Dual ±5V power supply
- Low offset 1.0 mV
- 16-pin narrow SO package
- 300 V/μs slew rate
- Fast settling time: 0.1% in 35 ns
- TTL or CMOS compatible enable inputs

Applications

- RGB amplifier
- 3:1 crosspoint switch
- RGB switch
- Video instrumentation amplifier
- Selectable gain amplifier
- Active filter

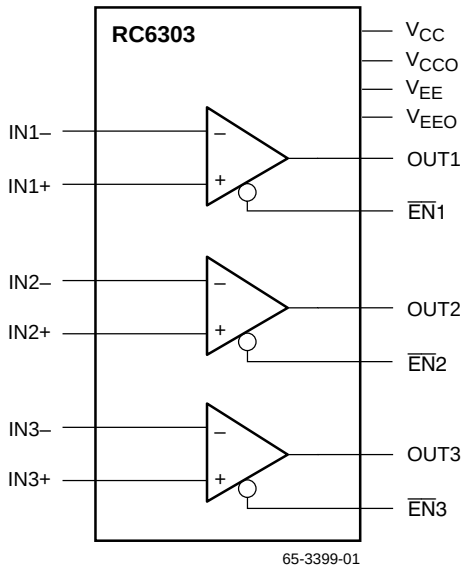
Description

The RC6303 consists of three low power, wide band voltage feedback operational amplifiers. Each channel is capable of delivering a load current of at least 35mA. Each amplifier can be independently enabled or disabled with a TTL or CMOS signal. When disabled, the amplifier is in a high impedance output state, presenting a very high input to output isolation.

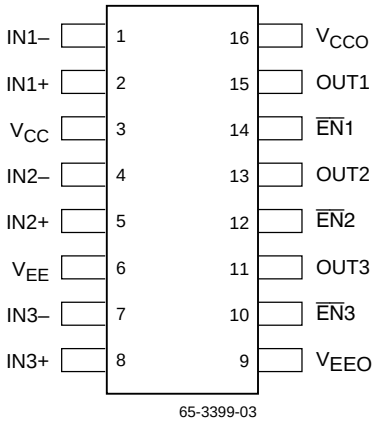
The amplifiers are optimized for video applications with gain ≥ 2 where low differential gain and low phase distortion are significant requirements.

The layout is optimized for minimal crosstalk between amplifiers.

Block Diagram



Pin Assignments



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Pin Definitions

Pin Name	Pin Number	Pin Function Description
$\overline{EN1}$	14	Enables amplifier 1 when low
$\overline{EN2}$	12	Enables amplifier 2 when low
$\overline{EN3}$	10	Enables amplifier 3 when low
IN1–	1	Amplifier 1 inverting input
IN1+	2	Amplifier 1 non-inverting input
IN2–	4	Amplifier 2 inverting input
IN2+	5	Amplifier 2 non-inverting input
IN3–	7	Amplifier 3 inverting input
IN3+	8	Amplifier 3 non-inverting input
OUT1	15	Amplifier 1 output
OUT2	13	Amplifier 2 output
OUT3	11	Amplifier 3 output
V_{CC}	3	Analog positive supply
V_{CCO}	16	Positive supply for output stages
V_{EE}	6	Analog negative supply
V_{EEO}	9	Negative supply for output stages

Absolute Maximum Ratings

(beyond which the device may be damaged)[1]

Parameter	Min	Typ	Max	Units
Positive power supply, V_{CC}			7	V
Negative power supply, V_{EE}			-7	V
Differential input voltage			10	V
Operating Temperature	0		+70	°C
Storage Temperature	-40		+125	°C
Junction Temperature			150	°C
Lead Soldering Temperature (10 seconds)			300	°C
Short circuit tolerance: No more than one output can be shorted to ground.				

Note:

1. Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if Operating Conditions are not exceeded.

Operating Conditions

Parameter		Min	Typ	Max	Units
V_{CC}	Power Supply Voltage	4.75	5.0	5.25	V
V_{EE}	Negative Supply Voltage	-4.75	-5.0	-5.25	V
θ_{JA}	SO16 thermal resistance		105		°C/W

DC Characteristics

V_{CC} = 5V, V_{EE} = -5V, A_V = 2, R_{LOAD} = 150Ω, T_A = 0°C to 70°C, unless otherwise specified. Open Loop.

Parameter		Conditions	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage	No Load		1.0	±5	mV
$\Delta V_{OS}/\Delta T$	Offset Voltage Drift[1]			6.0	±50	µV/°C
I_B	Input Bias Current			±1.0	±5	µA
$\Delta I_B/\Delta T$	Input Bias Current Drift[1]			±8.0	±50	nA/°C
Rin	Input Resistance[1]		1			MΩ
Cin	Input Capacitance[1]			0.5	2	pF
CMIR	Common Mode Input Range		±2.5			V
CMRR	Common Mode Rejection Ratio	No Load	70	100		dB
PSRR	Power Supply Rejection Ratio	No Load	60	80		dB
Is	Quiescent Supply Current	No Load, Whole IC		25	33	mA
Isd	Supply Current Disabled			3	4	mA
R_{OUT}	Output Impedance (Closed Loop) [1]	Enabled, At DC		0.2		Ω
		Disabled, V_O = ±2V	10	200		kΩ
C_{OUT}	Output Capacitance[1]	Disabled		0.5	2	pF
I_{OUT}	Output Current		35			mA
V_{OUT}	Output Voltage Swing	No Load	±2.5	±3.0		V
		R_L = 150Ω	±2.5	±3.0		V
A_{VOL}	Open-loop Gain		58	68		dB
Venh	Enable High Voltage		2.4			V
Venl	Enable Low Voltage				0.8	V
Ien	Enable Input Current			3	10	µA
t_{off}	Disable Time [1]			200		ns
t_{on}	Enable Time [1]	Settling to 1%		160		ns
Iso	Off Isolation (Input to Output)[1]	@ 5 MHz		60		dB

Note:

1. Guaranteed by design.

AC Characteristics

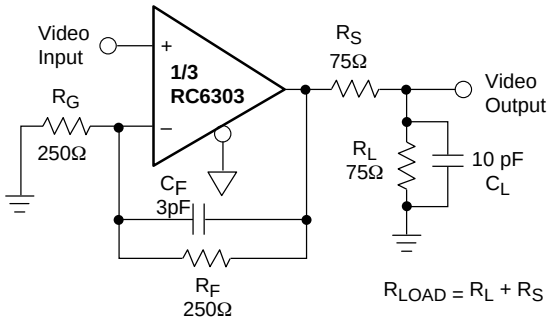
V_{CC} = 5V, V_{EE} = -5V, A_V = 2, T_A = 0 to 70°C, R_{LOAD} = 150Ω, R_G = R_F = 250Ω, C_L = 10 pF, C_F = 3 pF unless otherwise specified. Closed Loop. See Typical Test Circuit.

Parameter		Conditions	Min	Typ	Max	Units
Frequency Response						
BW	-3 dB Bandwidth (A_V = 2)[1]	V_{OUT} = 0.4 Vpp		90		MHz
		V_{OUT} = 0.8 Vpp	70	85		MHz
Flat	±0.1 dB Bandwidth[1]		15	20		MHz
Peak	Maximum Small Signal AC Peaking[1]			0.3		dB
X_{TALK}	Crosstalk Isolation[1]	@ 5 MHz		60		dB
Time Domain Response						
t_{r1}, t_{f1}	Rise and Fall Time 10% to 90%[1]	2V Output Step		6	8	ns
ts	Settling Time to 0.1 %[1]	2V Output Step		35		ns
OS	Overshoot[1]	2V Output Step		13		%
US	Undershoot[1]	2V Output Step		4		%
SR	Slew Rate[1]	V_{OUT} = ±2.0V	200	300		V/µs
Distortion						
HD_2	2nd Harmonic Dist. @ 20 MHz[1]	V_{OUT} = 0.8 Vpp		-50		dB
HD_3	3nd Harmonic Dist. @ 20 MHz[1]	V_{OUT} = 0.8 Vpp		-50		dB
Equivalent Input Noise						
NF	Noise Floor > 100 KHz[1]			-140		dBm
SND	Spectral Noise Density[1]	100 kHz to 200 MHz		10		nV/√Hz
Video Performance						
DG	Diff. Gain (p-p), NTSC & PAL[1]	R_L = 150Ω, V_{OUT} = ±1.5V		0.06		%
DP	Diff. Phase (p-p), NTSC & PAL[1]	R_L = 150Ω, V_{OUT} = ±1.5V		0.06		Deg.

Note:

1. Guaranteed by design.

Test Circuit



Applications Discussion

Each of the three sections of the RC6303 is provided with an Enable input, thus the part is useful for selecting and multiplexing. A three-channel video multiplexer can be built with just one RC6303 and a decoder, as shown in Figure 1.

Note that RC6303 enable time is shorter than its disable time, hence a make-before-break action is provided, minimizing switching transients on the signal output.

An RGB switch is shown in Figure 2.

Capacitive Load

The RC6303 can drive a capacitive load from 10 to over 100 pF. In back terminated video applications, bandwidth will only be limited by the RC time constants of the external output components. A minimum 10 pF capacitive load is required. When driving a 75Ω cable, place the 75Ω source termination resistor as close to the amplifier output as possible.

Enable/Disable

The enable pins (10, 12, 14), when pulled to a TTL or CMOS logic low or when tied to ground, activate each amplifier individually. When pulled to a TTL or CMOS logic high, the amplifier is tri-stated and presents a high impedance at its output. When disabled the amplifier's power consumption drops, and the non-inverting input signal is isolated from its respective output.

DC Accuracy

Since the RC6303 is a voltage-feedback amplifier, the inverting and non-inverting inputs have similar impedances and bias currents. To minimize offset voltage, match the source resistances seen by inverting and non-inverting inputs.

Feedback Components

Because the RC6303 is a voltage-feedback amplifier, it facilitates using reactive (capacitive and inductive) feedback components for implementing filters, integrators, sample/hold circuits, etc. The feedback network and the parasitic capacitance at the inverting (summing junction) input create a pole and affect the transfer function of the circuit. For stable operation, minimize the parasitic capacitance and equivalent resistance of the components used in the feedback circuit.

Circuit Board

High-frequency applications require good grounding, power supply decoupling, low parasitic capacitance and inductance, and good isolation between the inputs to minimize their crosstalk. Avoid coupling from output to input to prevent positive feedback.

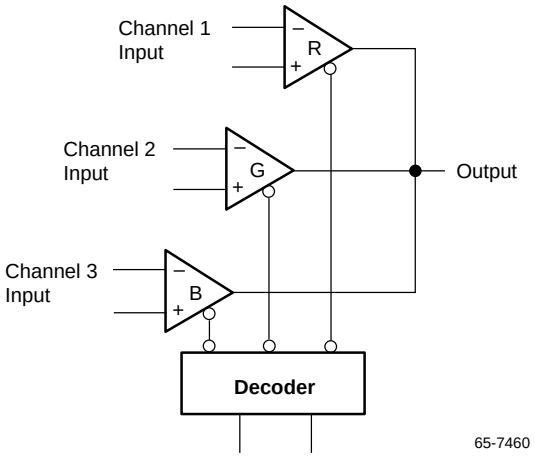


Figure 1.

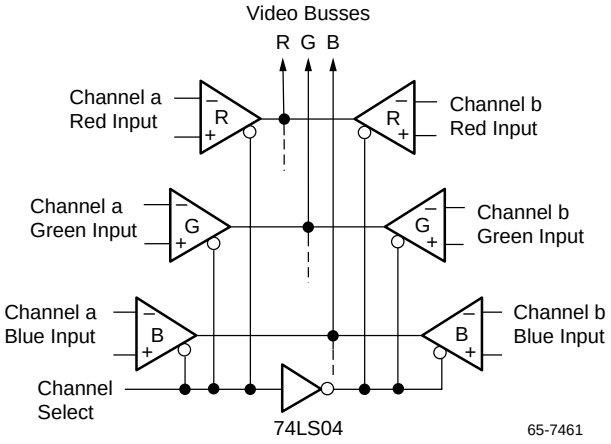


Figure 2.

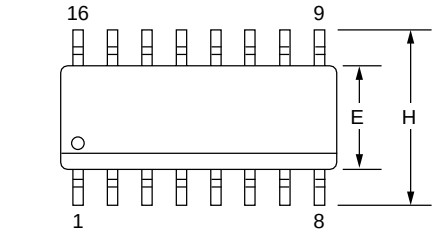
Notes:

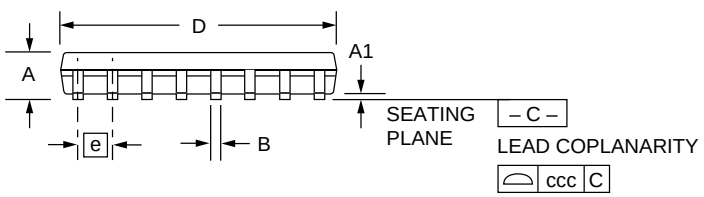
Mechanical DImensions – 16-Lead SOIC Package

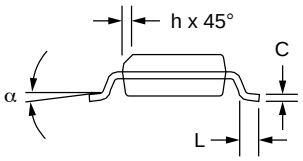
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	.053	.069	1.35	1.75	
A1	.004	.010	0.10	0.25	
B	.013	.020	0.33	0.51	
C	.008	.010	0.19	0.25	5
D	.386	.394	9.80	10.00	2
E	.150	.158	3.81	4.00	2
e	.050 BSC		1.27 BSC		
H	.228	.244	5.80	6.20	
h	.010	.020	0.25	0.50	
L	.016	.050	0.40	1.27	3
N	16		16		6
α	0°	8°	0°	8°	
ccc	—	.004	—	0.10	

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E" do not include mold flash. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. "L" is the length of terminal for soldering to a substrate.
4. Terminal numbers are shown for reference only.
5. "C" dimension does not include solder finish thickness.
6. Symbol "N" is the maximum number of terminals.







Ordering Information

Product Number	Temperature Range	Screening	Package	Package Marking
RC6303M	0° to 70°C	Commercial	16 Pin Narrow SOIC	RC6303M

5/20/98 0.0m 001
Stock#DS30006303