EL9211, EL9212, EL9214

Data Sheet December 22, 2004 FN7007.0

100MHz 100mA V_{COM} Amplifiers

The EL9211, EL9212, and EL9214 feature 1, 2, and 4 channel high power output amplifiers. They are designed primarily for generation of V_{COM} voltages in TFT-LCD applications. Each amplifier features a -3dB bandwidth of 130MHz with slew rates of 115V/µs. Each device comes in a thermal package and can drive 300mA peak per output.

All units are available in Pb-free packaging only and are specified for operation over the -40°C to +85°C temperature range.

Ordering Information

PART NUMBER (See Note)	PACKAGE (Pb-Free)	TAPE & REEL	PKG. DWG. #
EL9211IWZ-T7	5-Pin SOT-23	7" (3K pcs)	MDP0038
EL9211IWZ-T7A	5-Pin SOT-23	7" (250 pcs)	MDP0038
EL9211IYEZ	8-Pin HMSOP	-	MDP0050
EL9211IYEZ-T7	8-Pin HMSOP	7"	MDP0050
EL9211IYEZ-T13	8-Pin HMSOP	13"	MDP0050
EL9212IYEZ	8-Pin HMSOP	-	MDP0050
EL9212IYEZ-T7	8-Pin HMSOP	7"	MDP0050
EL9212IYEZ-T13	8-Pin HMSOP	13"	MDP0050
EL9214IREZ	14-Pin HTSSOP	-	MDP0048
EL9214IREZ-T7	14-Pin HTSSOP	7"	MDP0048
EL9214IREZ-T13	14-Pin HTSSOP	13"	MDP0048

NOTE: Intersil Pb-free products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020C.

Features

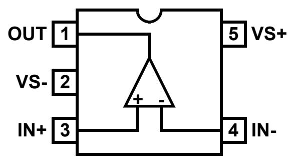
- 1, 2, and 4 channel versions
- 130MHz -3dB bandwidth
- 115V/µs slew rate
- 300mA peak output current
- Supply voltage from 5V to 13.5V
- Low supply current - <2.4mA per channel
- Pb-free available (RoHS compliant)

Applications

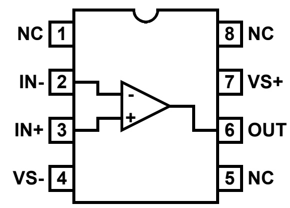
- TFT-LCD V_{COM} supply
- Electronics notebooks
- Computer monitors
- Electronics games
- Touch-screen displays
- Portable instrumentation

Pinouts

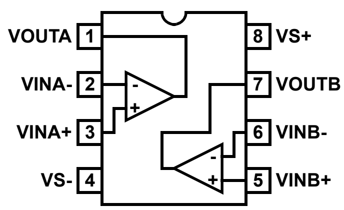
EL9211
(5-PIN SOT-23)
TOP VIEW



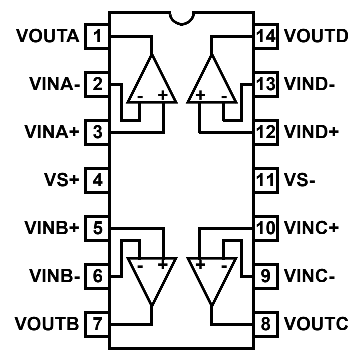
EL9211
(8-PIN HMSOP)
TOP VIEW



EL9212
(8-PIN HMSOP)
TOP VIEW



EL9214
(14-PIN HTSSOP)
TOP VIEW



Absolute Maximum Ratings (T_A = 25°C)

Supply Voltage between V_S+ and V_S- . . . .+15V
Input Voltage . . . . V_S- - 0.5V, V_S +0.5V
Maximum Continuous Output Current 100mA
Ambient Operating Temperature . . . . -40°C to +85°C
Power Dissipation . . . . See Curves
Maximum Die Temperature . . . . +125°C
Storage Temperature . . . . -65°C to +150°C

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

IMPORTANT NOTE: All parameters having Min/Max specifications are guaranteed. Typ values are for information purposes only. Unless otherwise noted, all tests are at the specified temperature and are pulsed tests, therefore: $T_J = T_C = T_A$

Electrical Specifications

V_S+ = +6V, V_S- = -6V, R_L = 10kΩ, R_F = 0Ω, C_L = 10pF to 0V, Gain = -1, T_A = 25°C, unless otherwise specified.

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS						
V_{OS}	Input Offset Voltage	V_{CM} = 6V	-6	-1	+2	mV
TCV_{OS}	Average Offset Voltage Drift	(Note)		10		µV/°C
I_B	Input Bias Current	V_{CM} = 6V	-1.4		-0.4	µA
R_{IN}	Input Impedance			1		GΩ
C_{IN}	Input Capacitance			1.35		pF
V_{REG}	Load Regulation	V_{COM} = 6V, -100mA < I_L < 100mA	-20		+20	mV
CMIR	Common Mode Input Range		-0.5		+12.5	V
CMRR	Common Mode Rejection Ratio	For V_{IN} from -0.5 to +12.5V	75	100		dB
A_{VOL}	Open Loop Gain		55	70		dB
OUTPUT CHARACTERISTICS						
V_{OL}	Output Swing Low	I_L = -5mA		0.9	1.1	V
V_{OH}	Output Swing High	I_L = +5mA	10.7	10.94		V
I_{SC}	Short Circuit Current			300		mA
POWER SUPPLY PERFORMANCE						
PSRR	Power Supply Rejection Ratio	V_S from 4.5V to 10.5V	50	75		dB
I_S	Total Supply Current	EL9211 (no load)		2.3	2.9	mA
		EL9212 (no load)		4.5	5	mA
		EL9214 (no load)		8.8	9.6	mA
DYNAMIC PERFORMANCE						
SR	Slew Rate (Note)	2V step, 20% to 80%	90	115		V/µs
t_S	Settling to +0.1% (A_V = -1)	(A_V = -1), V_O = 2V step		30		ns
BW	-3dB Bandwidth	R_L = 10kΩ, C_L = 10pF, A_V = +1		130		MHz
		R_L = 10kΩ, C_L = 10pF, A_V = -1		52		MHz
GBWP	Gain-Bandwidth Product	R_L = 10kΩ, C_L = 10pF		63		MHz
PM	Phase Margin	R_L = 10kΩ, C_L = 10pF		43		°

NOTE: Slew rate is measured on rising and falling edges.

Typical Performance Curves

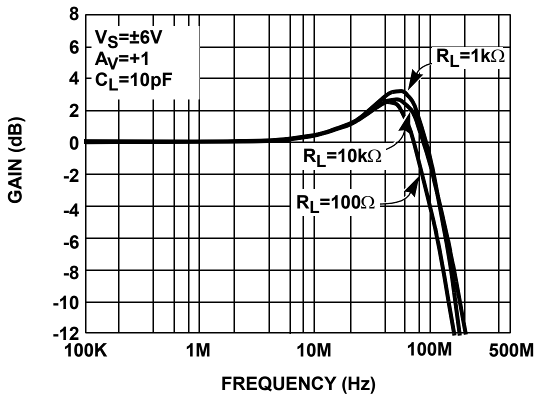


FIGURE 1. FREQUENCY RESPONSE FOR VARIOUS R_L

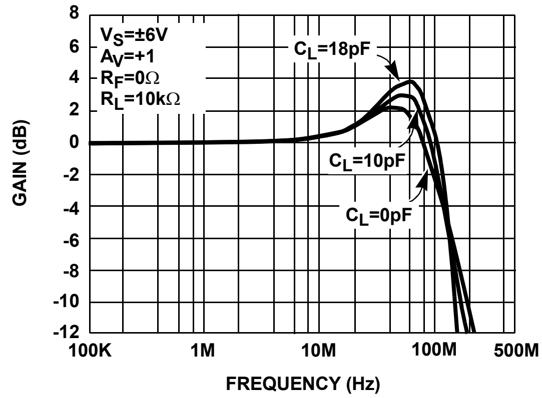


FIGURE 2. FREQUENCY RESPONSE FOR VARIOUS C_L

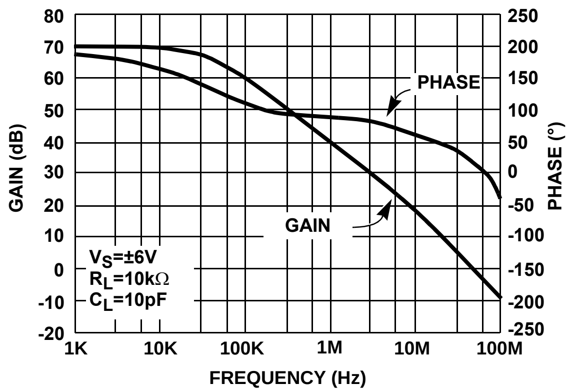


FIGURE 3. OPEN LOOP GAIN AND PHASE vs FREQUENCY

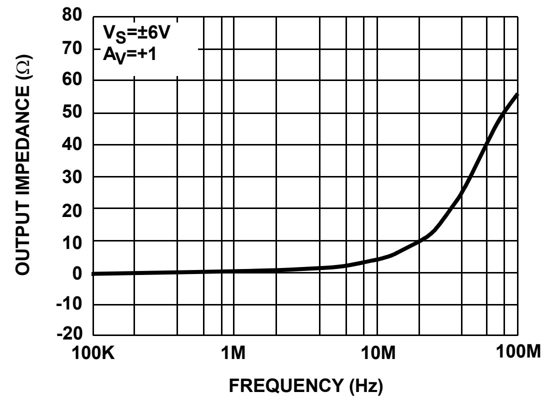


FIGURE 4. CLOSED LOOP OUTPUT IMPEDANCE vs FREQUENCY

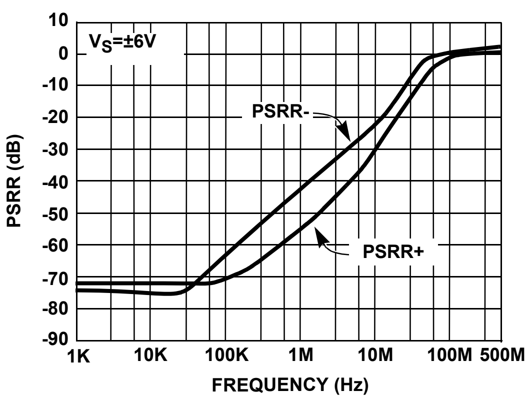


FIGURE 5. PSRR

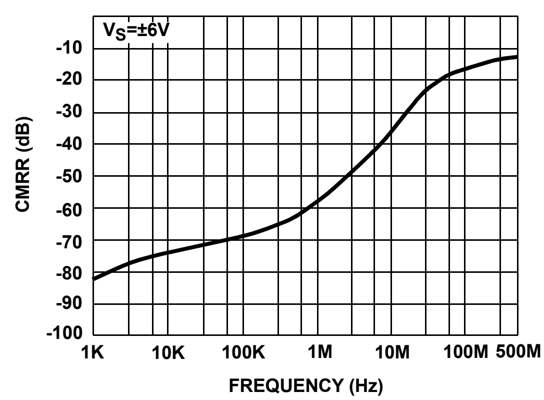


FIGURE 6. CMRR

Typical Performance Curves (Continued)

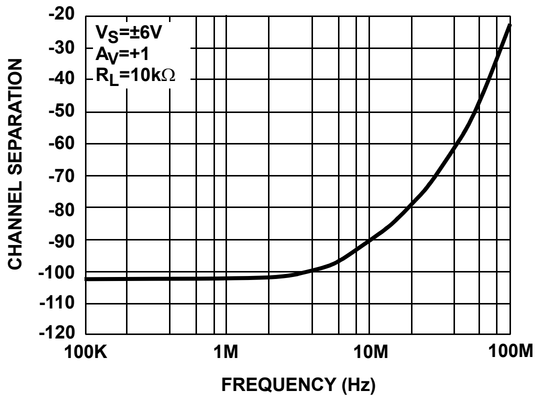


FIGURE 7. CHANNEL SEPARATION FOR EL9212/EL9214

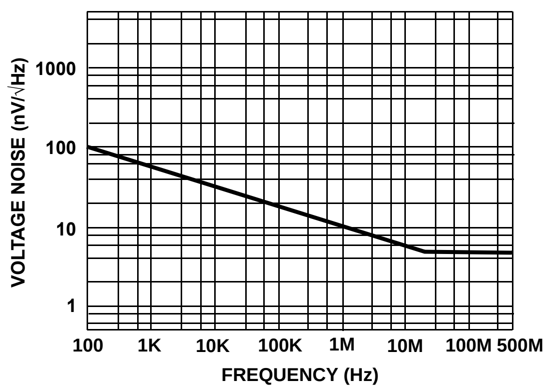


FIGURE 8. VOLTAGE NOISE vs FREQUENCY

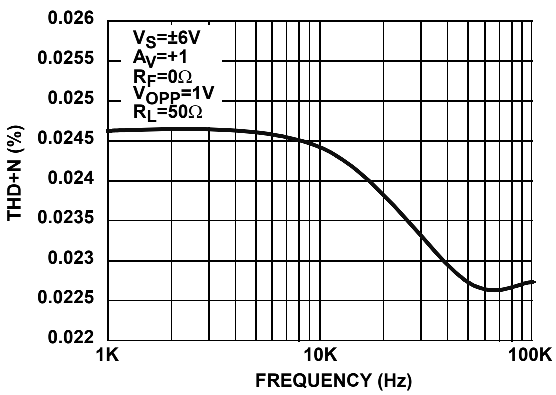


FIGURE 9. THD + NOISE vs FREQUENCY

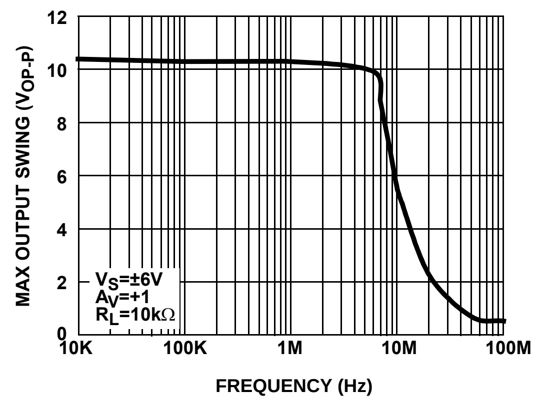


FIGURE 10. MAXIMUM OUTPUT SWING vs FREQUENCY

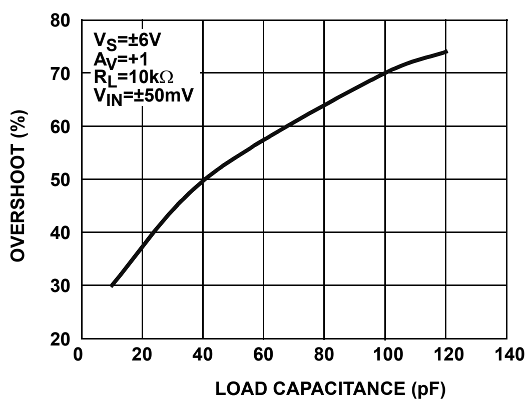


FIGURE 11. SMALL SIGNAL OVERSHOOT vs LOAD CAPACITANCE

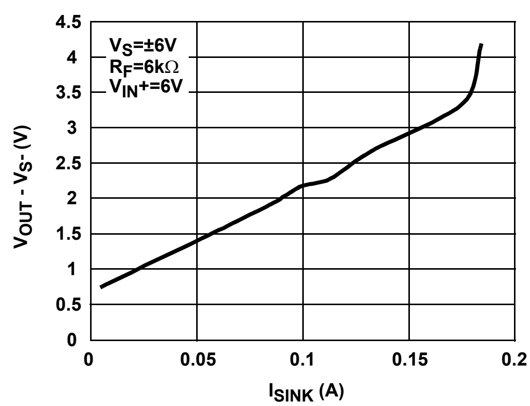


FIGURE 12. V_{OUT} - V_{S}- vs I_{SINK}

Typical Performance Curves (Continued)

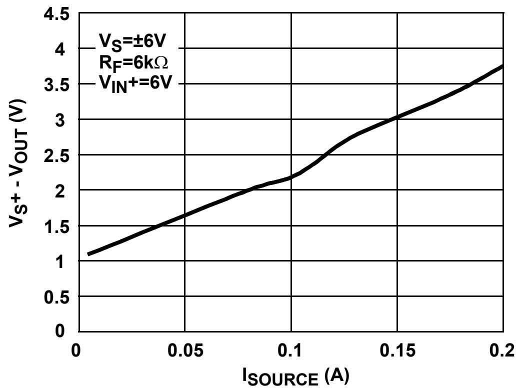


FIGURE 13. V_S+ - V_{OUT} vs I_{SOURCE}

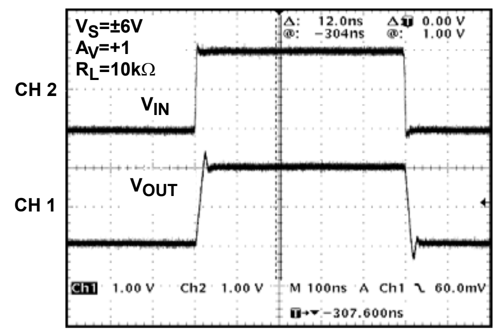


FIGURE 14. LARGE SIGNAL TRANSIENT RESPONSE

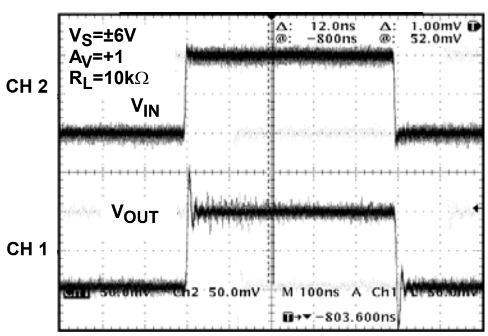


FIGURE 15. SMALL SIGNAL TRANSIENT RESPONSE

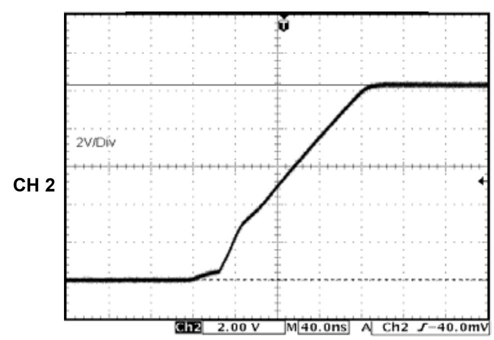


FIGURE 16. GOING INTO SATURATION POSITIVE EDGE

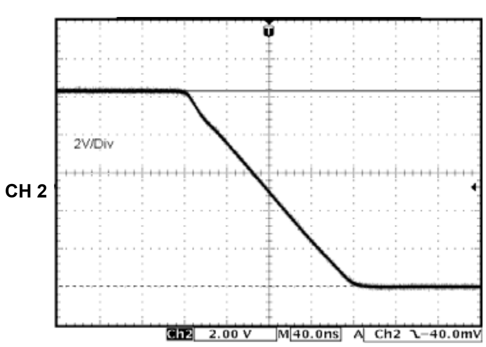


FIGURE 17. GOING INTO SATURATION NEGATIVE EDGE

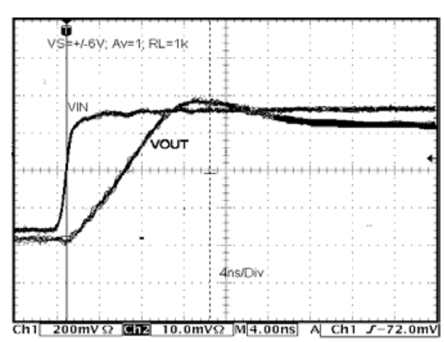


FIGURE 18. DELAY TIME

Typical Performance Curves (Continued)

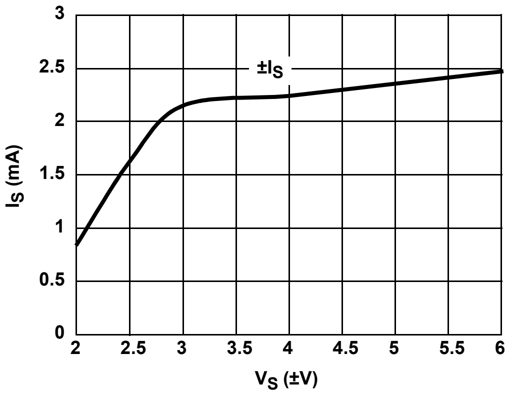


FIGURE 19. SUPPLY CURRENT(PER AMPLIFIER) vs SUPPLY VOLTAGE

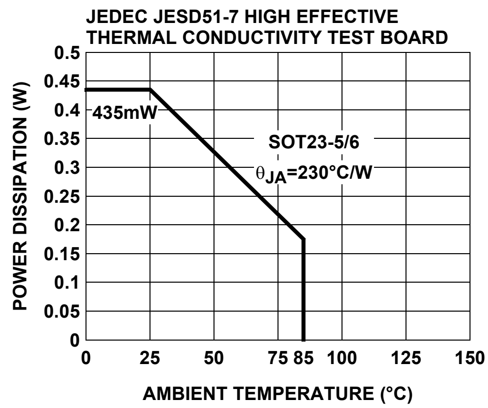


FIGURE 20. PACKAGE POWER DISSIPATION vs AMBIENT TEMPERATURE

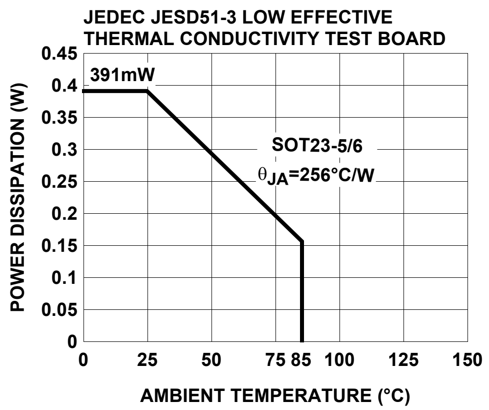


FIGURE 21. PACKAGE POWER DISSIPATION vs AMBIENT TEMPERATURE

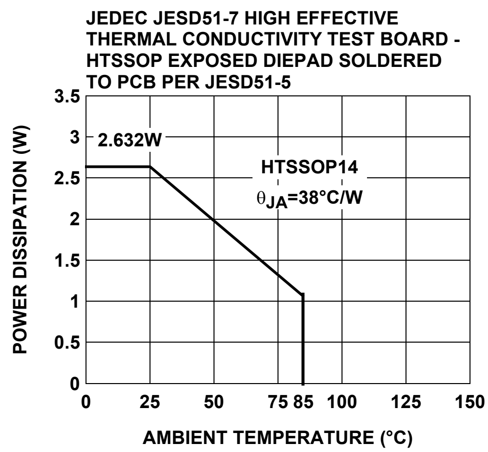


FIGURE 22. PACKAGE POWER DISSIPATION vs AMBIENT TEMPERATURE

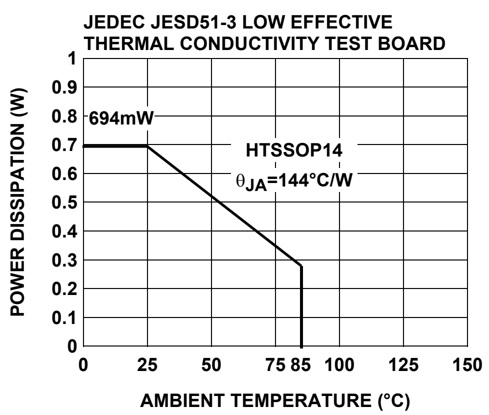
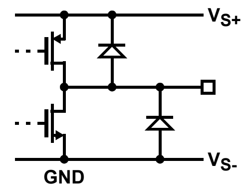
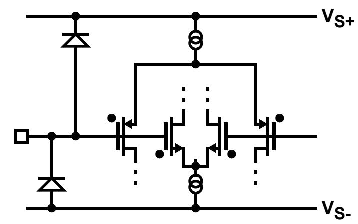


FIGURE 23. PACKAGE POWER DISSIPATION vs AMBIENT TEMPERATURE

Pin Descriptions

EL9211 (5-PIN SOT-23)	EL9211 (8-PIN HMSOP)	EL9212 (8-PIN HMSOP)	EL9214 (14-PIN HTSSOP)	PIN NAME	FUNCTION	EQUIVALENT CIRCUIT
1	6	1	1	VOUTA	Amplifier A output	 CIRCUIT 1
4	2	2	2	VINA-	Amplifier A inverting input	 CIRCUIT 2
3	3	3	3	VINA+	Amplifier A non-inverting input	(Reference Circuit 2)
5	7	8	4	VS+	Positive power supply	
		5	5	VINB+	Amplifier B non-inverting input	(Reference Circuit 2)
		6	6	VINB-	Amplifier B inverting input	(Reference Circuit 2)
		7	7	VOUTB	Amplifier B output	(Reference Circuit 1)
			8	VOUTC	Amplifier C output	(Reference Circuit 1)
			9	VINC-	Amplifier C inverting input	(Reference Circuit 2)
			10	VINC+	Amplifier C non-inverting input	(Reference Circuit 2)
2	4	4	11	VS-	Negative power supply	
			12	VIND+	Amplifier D non-inverting input	(Reference Circuit 2)
			13	VIND-	Amplifier D inverting input	(Reference Circuit 2)
			14	VOUTD	Amplifier D output	(Reference Circuit 1)
	1, 5, 8			NC	Not connected	

Application Information

Product Description

The EL9211, EL9212, and EL9214 voltage feedback amplifiers are fabricated using a high voltage CMOS process. They exhibit rail-to-rail input and output capability, are unity gain stable and have low power consumption (2.4mA per amplifier). These features make the EL9211, EL9212, and EL9214 ideal for a wide range of general-purpose applications. Connected in voltage follower mode and driving a load of 10K, the EL9211, EL9212, and EL9214 have a -3dB bandwidth of 130MHz while maintaining a 115V/µs slew rate. The EL9211 is a single amplifier, EL9212 is a dual amplifier, and EL9214 is a quad amplifier.

Operating Voltage, Input, and Output

The EL9211, EL9212, and EL9214 are specified with a single nominal supply voltage from 5V to 13.5V or a split supply with its total range from 5V to 13.5V. Most EL9211, EL9212, and EL9214 specifications are stable over both the full supply range and operating temperatures of -40°C to +85°C. Parameter variations with operating voltage and/or temperature are shown in the typical performance curves.

Short Circuit Current Limit

The EL9211, EL9212, and EL9214 will limit the short circuit current to 300mA if the output is directly shorted to the positive or negative supply. If an output is shorted indefinitely, the power dissipation could easily increase such that the device may be damaged. Maximum reliability is maintained if the output continuous current never exceeds ±65mA. This limit is set by the design of the internal metal interconnects.

Output Phase Reversal

The EL9211, EL9212, and EL9214 are immune to phase reversal as long as the input voltage is limited from -VS -0.5V to +VS +0.5V. Although the device's output will not change phase, the input's over-voltage should be avoided. If an input voltage exceeds supply voltage by more than 0.6V, electrostatic protection diodes placed in the input stage of the device begin to conduct and over-voltage damage could occur.

Unused Amplifiers

It is recommended that any unused amplifiers in a dual and quad package be configured as a unity gain follower. The inverting input should be directly connected to the output and the non-inverting input tied to the ground plane.

Power Supply Bypassing and Printed Circuit Board Layout

The EL9211, EL9212, and EL9214 can provide gain at high frequency. As with any high-frequency device, good printed circuit board layout is necessary for optimum performance. Ground plane construction is highly recommended, lead lengths should be as short as possible and the power supply pins must be well bypassed to reduce the risk of oscillation. For normal single supply operation, where the -VS pin is connected to ground, a 0.1µF ceramic capacitor should be placed from +VS to pin and -VS to pin. A 4.7µF tantalum capacitor should then be connected in parallel, placed in the region of the amplifier. One 4.7µF capacitor may be used for multiple devices. This same capacitor combination should be placed at each supply pin to ground if split supplies are to be used.