

12-Channel Gamma Buffers with VCOM Buffer

ADD8701

FEATURES

Single-Supply Operation: 7 V to 16 V Dual-Supply Operation: ± 3.5 V to ± 8 V Supply Current: 13 mA Max Upper/Lower Buffers Swing to V_{DD}/GND Continuous Output Current: 10 mA VCOM Peak Output Current: 250 mA Offset Voltage: 15 mV Max Slew Rate: 6 V/µs Fast Settling Time with Large C-Load

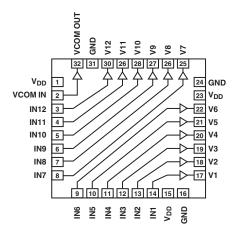
APPLICATIONS TFT LCD Panels

GENERAL DESCRIPTION

The ADD8701 is a low cost, 12-channel buffer amplifier and VCOM driver that operates from a single supply. The part is designed for high resolution TFT LCD panels, and is built on an advanced, high voltage, CBCMOS process.

The buffers have high slew rate, 10 mA continuous output current, and high capacitive load drive capability. The VCOM buffer has increased drive of 35 mA and can drive large capacitive loads. The ADD8701 offers wide supply range and offset voltages below 15 mV.

FUNCTIONAL BLOCK DIAGRAM



The ADD8701 is specified over the -40° C to $+85^{\circ}$ C temperature range and is available in a 32-lead lead frame chip scale package (LFCSP).

All inputs and outputs incorporate internal ESD protection circuits.

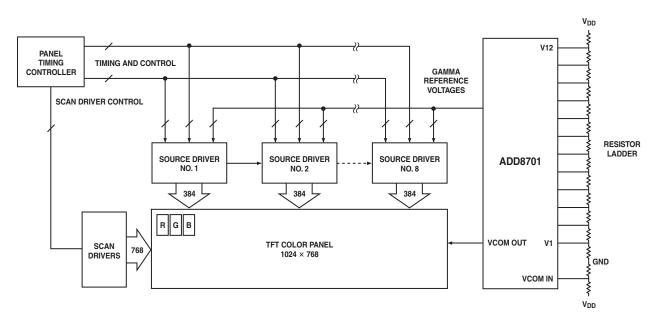


Figure 1. Typical SVGA TFT-LCD Application

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ADD8701-SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (7 V \leq V_{DD} \leq 16 V, T_A = 25°C, unless otherwise specified.)

Parameter	Symbol	Condition	Min	Тур	Max	Unit
INPUT CHARACTERISTICS Offset Voltage Offset Voltage Drift Input Bias Current Input Voltage Range	$\begin{matrix} V_{OS} \\ \Delta V_{OS} / \Delta T \\ I_B \end{matrix}$	$-40^{\circ}\mathrm{C} \leq \mathrm{T_{A}} \leq +85^{\circ}\mathrm{C}$ $-40^{\circ}\mathrm{C} \leq \mathrm{T_{A}} \leq +85^{\circ}\mathrm{C}$	-0.5	4 5 0.5	15 1.1 1.5 V _{DD} + 0.5	mV μV/°C μA μA V
Input Impedance Input Capacitance	Z _{IN} C _{IN}		0.5	400 1	100 + 0.9	kΩ pF
OUTPUT CHARACTERISTICS Output Voltage High (V11, V12)	V _{OUT}	$\begin{split} I_{L} &= 100 \ \mu A \\ V_{DD} &= 16 \ V, \ I_{L} = 5 \ mA \\ -40^{\circ}C &\leq T_{A} \leq +85^{\circ}C \\ V_{DD} &= 7 \ V, \ I_{L} = 5 \ mA \\ -40^{\circ}C &\leq T_{A} \leq +85^{\circ}C \end{split}$	15.85 15.75 6.75 6.65	15.995 15.9 6.85		V V V V V
Output Swing (V3 to V10) Output Swing (V3 to V10) Output Voltage Low (V1, V2)	V _{OUT} V _{OUT} V _{OUT}	$\begin{split} I_{L} &= 5 \text{ mA}, V_{DD} = 16 \text{ V} \\ I_{L} &= 5 \text{ mA}, V_{DD} = 7 \text{ V} \\ I_{L} &= 100 \mu\text{A} \\ V_{DD} &= 16 \text{ V}, I_{L} = 5 \text{ mA} \\ -40^{\circ}\text{C} \leq T_{A} \leq +85^{\circ}\text{C} \\ V_{DD} &= 7 \text{ V}, I_{L} = 5 \text{ mA} \\ -40^{\circ}\text{C} \leq T_{A} \leq +85^{\circ}\text{C} \end{split}$		14.6 5.6 5 85 140	150 250 300 400	V V mV mV mV mV mV
Continuous Output Current Peak Output Current	I_{OUT} I_{PK}	$V_{DD} = 16 V$		10 150		mA mA
VCOM CHARACTERISTICS Continuous Output Current Peak Output Current	I _{OUT} I _{PK}	V _{DD} = 16 V		35 250		mA mA
TRANSFER CHARACTERISTICS Gain	A _{VCL}	$\begin{array}{l} R_{L} = 2 \ k\Omega \\ -40^{\circ}C \leq T_{A} \leq +85^{\circ}C \end{array}$	0.995 0.995	0.9985 0.9980	1.005 1.005	V/V V/V
Gain Linearity	NL	$\begin{array}{c} R_{L} = 10 \ k\Omega \\ V_{O} = 0.5 \ to \ (V_{DD} - 0.5 \ V) \end{array}$		0.01		%
SUPPLY CHARACTERISTICS Supply Voltage Power Supply Rejection Ratio	V _{DD} PSRR	V _{DD} = 6 V to 17 V	7		16	v
Supply Current	I _{SYS}	$\begin{array}{l} -40^{\circ}\mathrm{C} \leq \mathrm{T_{A}} \leq +85^{\circ}\mathrm{C} \\ \mathrm{No} \ \mathrm{Load} \\ -40^{\circ}\mathrm{C} \leq \mathrm{T_{A}} \leq +85^{\circ}\mathrm{C} \end{array}$	70	90 10	13 15	dB mA mA
DYNAMIC PERFORMANCE Slew Rate Bandwidth Settling Time to 0.1% (Buffers) Settling Time to 0.1% (VCOM) Phase Margin Channel Separation	SR BW t _s t _s fo	$\begin{aligned} R_L &= 10 \text{ k}\Omega, \ C_L &= 200 \text{ pF} \\ -3 \text{ dB}, \ R_L &= 10 \text{ k}\Omega, \ C_L &= 200 \text{ pF} \\ 1 \text{ V}, \ R_L &= 10 \text{ k}\Omega, \ C_L &= 200 \text{ pF} \\ 1 \text{ V}, \ R_L &= 10 \text{ k}\Omega, \ C_L &= 200 \text{ pF} \\ R_L &= 10 \text{ k}\Omega, \ C_L &= 200 \text{ pF} \end{aligned}$	4	6 4.5 1.1 0.7 55 75		V/µs MHz µs Degrees dB
NOISE PERFORMANCE Voltage Noise Density Current Noise Density	e _n e _n i _n	f = 1 kHz f = 10 kHz f = 10 kHz		26 25 0.8		nV/√Hz nV/√Hz pA/√Hz

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage (V _{DD})
Input Voltage $\dots \dots \dots$
Storage Temperature Range65°C to +150°C
Operating Temperature Range40°C to +85°C
Junction Temperature Range65°C to +150°C
Lead Temperature Range (Soldering, 60 sec) 300°C
ESD Tolerance (HBM) ±1,000 V

*Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Package Type	$\theta_{JA}{}^1$	Ψ_{JB}^{2}	Unit
32-Lead LFCSP (CP)	35	13	°C/W

NOTES

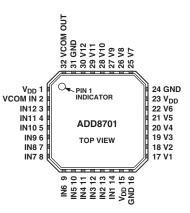
 ${}^{1}\theta_{JA}$ is specified for worst-case conditions, i.e., θ_{JA} is specified for device soldered in circuit board for surface-mount packages.

 $^2\psi_{JB}$ is applied for calculating the junction temperature by reference to the board temperature.

ORDERING GUIDE

Model	Temperature Range		Package Option	
ADD8701ACP	-40°C to +85°C	32-Lead LFCSP	CP-32	

PIN CONFIGURATION



PIN FUNCTION DESCRIPTION

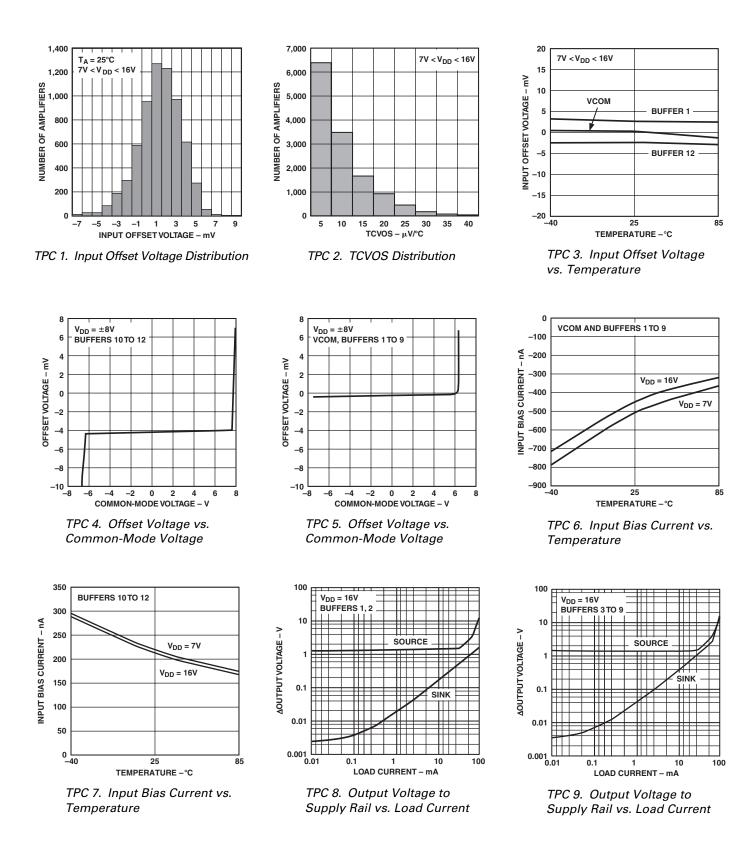
Pin No.	Mnemonic	Description		
1, 15, 23	V _{DD}	Power (+)		
2	VCOM IN	VCOM Buffer Input		
3–14	IN12–IN1	Gamma Buffer Inputs		
16, 24, 31	GND	Power (-)		
17–22, 25–30	V1-V12	Gamma Buffer Outputs		
32	VCOM OUT	VCOM Buffer Output		

CAUTION _

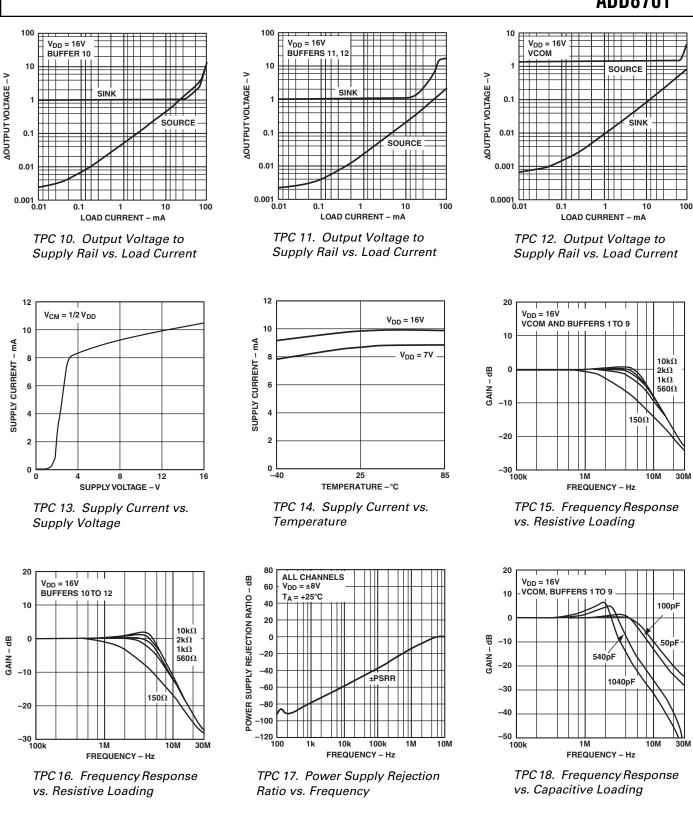
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADD8701 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



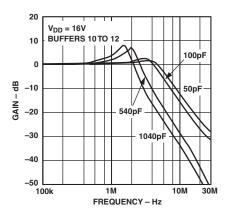
ADD8701–Typical Performance Characteristics



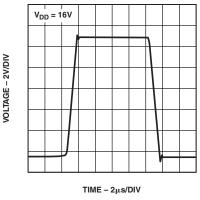
Downloaded from <u>Elcodis.com</u> electronic components distributor



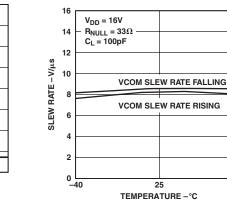
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TPC 19. Frequency Response vs. Capacitive Loading



Response



180

160

60

40 ∟ 0

200

400

600

CAPACITIVE LOAD - pF

TPC 20. Input-Output Phase

Shift vs. Capacitive Load

 $V_{DD} = 7V$ $R_L = 2k\Omega$

VCOM

CHANNELS 11 AND 12

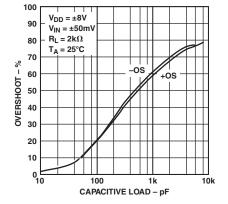
CHANNELS 3 TO 9

800 1,000 1,200

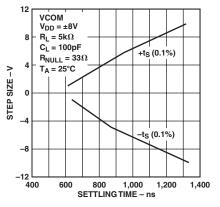
85

CHANNELS 1 AND 2

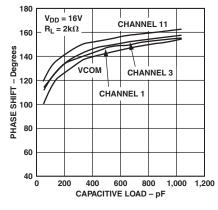
TPC 23. Slew Rate vs. Temperature



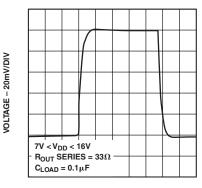
TPC 25. Small-Signal Overshoot vs. Capacitive Load



TPC 26. Settling Time vs. Step Size

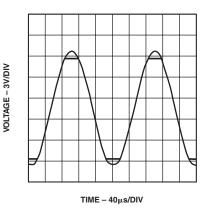


TPC 21. Input-Output Phase Shift vs. Capacitive Load

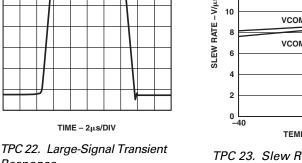


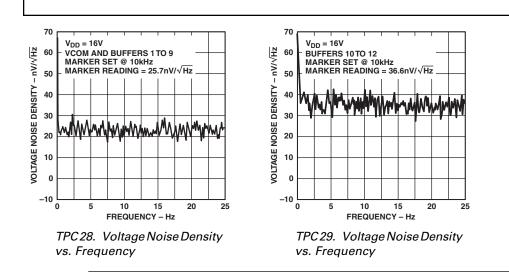
TIME - 20µs/DIV

TPC 24. Small Signal Transient Response









APPLICATIONS

LCD Gamma Reference Buffers

In high resolution TFT-LCD displays, gamma correction must be performed to correct the nonlinearity in the LCD panel's transmission characteristics. A typical TFT-LCD panel consisting of 256 grayscale levels takes an 8-bit digital word to select an appropriate gamma reference voltage. An 8-bit source driver may use 12 analog voltages that match the characteristic gamma curve for optimum panel picture quality. The ADD8701 is specifically designed to generate analog reference voltages to meet the gamma characteristics of an LCD panel used by the source driver. The gamma reference buffers offer 10 mA drive capability.

The ADD8701 is designed to meet the rail-to-rail capability needed by the application and yet offers a low cost-per-channel solution. The design maximizes the die area by offering channels to swing to the positive and negative rails. It is imperative that the channels swinging close to the supply rail be used for the positive gamma references and that the channels swinging close to GND be used for the negative gamma references. See Figure 2 for an example of the application circuit.

LCD VCOM Buffer

The output of the VCOM buffer is designed to control the voltage on the back plate of the LCD display. The buffer must be capable of sinking and sourcing capacitive pulse current. The amplifier stability is designed for high load capacitance. A high quality ceramic capacitor is recommended to supply short duration current pulses at the output. The VCOM buffer of the ADD8701 can handle up to 35 mA of continuous output current and can drive up to 1,000 nF of pure capacitive load.

Unused Buffers

Inputs of any unused buffer should be tied to the ground plane.

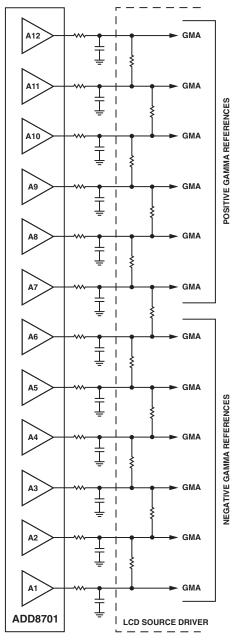


Figure 2. Application Circuit

OUTLINE DIMENSIONS

32-Lead Lead Frame Chip Scale Package [LFCSP] (CP-32)

Dimensions shown in millimeters

