



HEX PRECISION LIMITER

- HIGH PERFORMANCE CLAMPING AT GROUND AND POSITIVE REFERENCE VOLTAGE
- FAST ACTIVE CLAMPING
- OPERATING RANGE 4.75 5.25 V
- SINGLE VOLTAGE FOR SUPPLY AND POSITI-VE REFERENCE
- LOW QUIESCENT CURRENT
- LOW INPUT LEAKAGE CURRENT

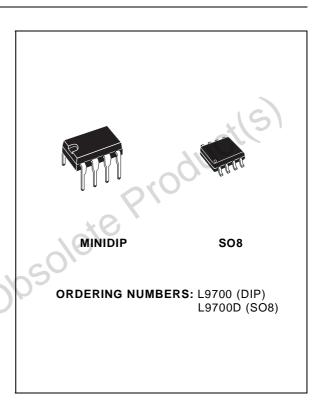
DESCRIPTION

The L9700 is a monolithic circuit which is suited for input protection and voltage clamping purpose.

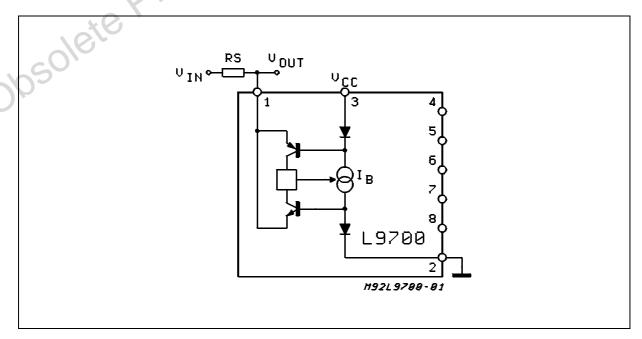
The limiting function is referred to ground and the positive supply voltage.

One single element contains six independent channels.

Very fast speed is achieved by internal feedback and the application of a new vertical PNP-transistor with isolated collector.



BLOCK DIAGRAM



September 2000

ABSOLUTE MAXIMUM RATINGS

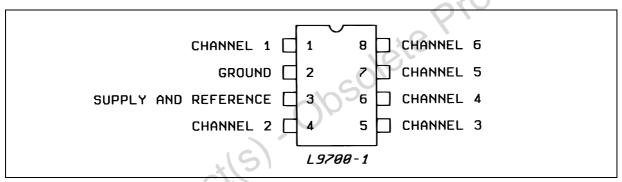
Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	20	V
I _{IN}	Input Current per Channel	30	mA
T_j , T_{stg}	Junction and Storage Temperature	-55 to 150	°C
P _{tot}	Total Power Dissipation (T _{amb} = 85°C)	650	mW

Note: The circuit is ESD protected according to MIL-STD-883C

THERMAL DATA

Symbol	Parameter	MINIDIP	S08	Unit
R _{th j-amb}	Thermal Resistance Junction to Ambient Max.	100	200	°C/W

PIN CONNECTION



ELECTRICAL CHARACTERISTICS (V_{CC} = 5V, T_J = -40 to 125°C unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
Vcc	Supply Voltage		4.75		5.25	V
Icc	Supply Current			1.5	3	mA
V _{cis}	Static Input Clamping Voltage	Negative $I_{IN} = -10\text{mA}$ Positive $I_{IN} = +10\text{mA}$	–250 V _{CC}		0 V _{CC} +250	mV
I _{IN}	Input Current (static)	$\begin{aligned} &V_{IN} = 0 \\ &V_{IN} = V_{CC} \\ &V_{IN} = 50 mV \\ &V_{IN} = V_{CC} -50 mV \end{aligned}$			15 15 5 5	μΑ μΑ μΑ μΑ
V _{cld} (*)	Dynamic Input Clamping Voltage	I _{IN} = ± 10mA, t _R = 5ns Positive Overshoot Negative Overshoot			400 400	mV mV
t _S (*)	Setting Time	See fig. 2			20	ns
R _{IN} (*)	Dynamic Input Resistance				5	Ω

^(*) Design limits are guaranteed by statistical control on production samples over the indicated temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels.

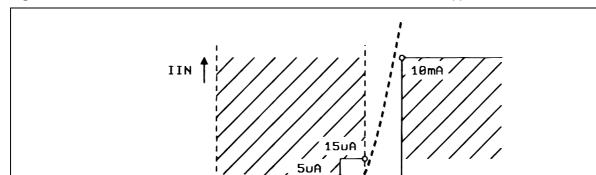
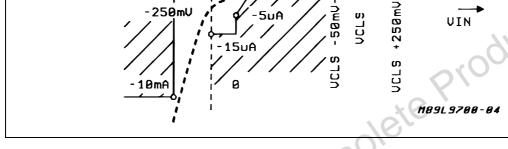
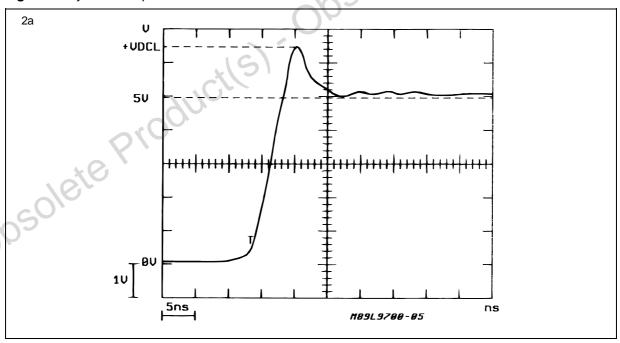


Figure 1 : DC INPUT CHARACTERISTIC Limit Points of the Characteristic Approximation.



0 50mV

Figure 2: Dynamical Input Characteristics.



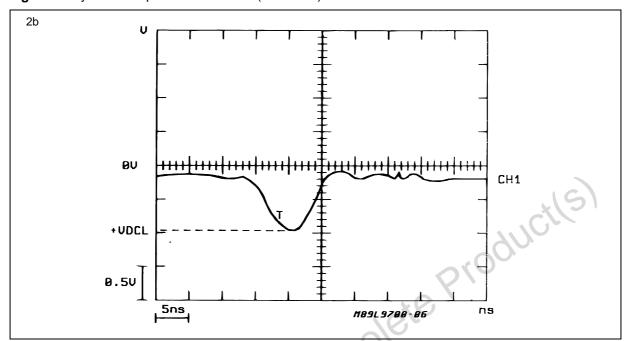


Figure 2: Dynamical Input Characteristics (continued).

APPLICATION INFORMATION

Most integrated circuits, both HNMOS and bipolar, are very sensitive to positive and negative overvoltages on the supply and at the inputs.

These transients occur in large numbers and with different magnitudes in the automotive environment, making adequate protection for devices ai-med at it indispensible.

Overvoltages on the supply line are faced through high voltage integration technologies or through external protection (transil, varistor).

Signal inputs are generally protected using clamp diodes to the supply and ground, and a current limiter resistor. However, such solutions do not always completely satisfy the protection specifications in terms of intervention speed, negative clamping and current leakage high enough to change analog signals.

The L9700 device combines a high intervention speed with a high precision positive and negative

clamp and a low current leakage providing the optimal solution to the problems of the automotive environment.

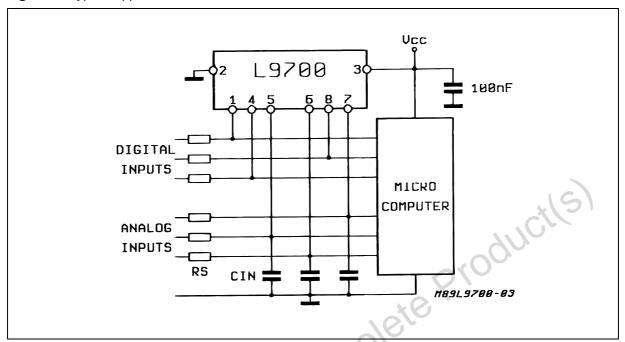
The high intervention speed, due to the pre-bias of the limiter stage and internal feedback, limits the voltage overshoot and avoid the use of external capacitors for the limitation of the transient rise times.

Figure 3 illustrates a typical automotive application scheme. The resistor R_S limits the input current of the device and is therefore dimensioned considering the characteristics of the transients to be eliminated. Consequently:

$$R_S = \frac{V_{\text{transient Peak}}}{I_{\text{IN MAX}}}$$

The C_{IN} capacitors must be used only on analog inputs because they present a low impedance during the sampling period.

Figure 3: Typical Application.



but

The minimum value for C_{IN} is determined by the accuracy required, the time taken to sample the input and the input impedance during that time, while the maximum value is determined by the required frequency response and the value of $R_{\rm S}$.

Thus for a resistive input A/D connector where:

 T_S = Sample time (Seconds)

R_D = Device input resistance (Ohms)

V_{IN} = Input voltage (Volts)

k = Required accuracy (%)

 Q_1 = Charge on capacitor before sampling

Q₂ = Charge on capacitor after sampling

I_D = Device input current (Amps)

Thus:

$$Q_1 - Q_2 = \frac{k \cdot Q_1}{100}$$

and
$$\begin{aligned} Q_{1} - Q_{2} &= I_{D} - T_{S} \\ \text{so that} \quad I_{D} T_{S} &= \frac{k \cdot C_{IN} - V_{IN}}{100} \\ \text{and} \quad C_{IN} \, (\text{min}) &= \frac{I_{D} \cdot T_{S}}{V_{IN} \cdot k} \, \text{Farad} \\ \text{so} \quad C_{IN} \, (\text{min}) &= \frac{100 \cdot T_{S}}{k \cdot R_{D}} \, \text{Farad} \end{aligned}$$

 $Q_1 = C_{IN} V_{IN}$

The calculation for a sample and hold type convertor is even simpler:

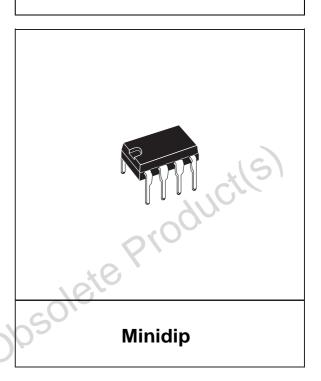
k = Required accuracy (%)

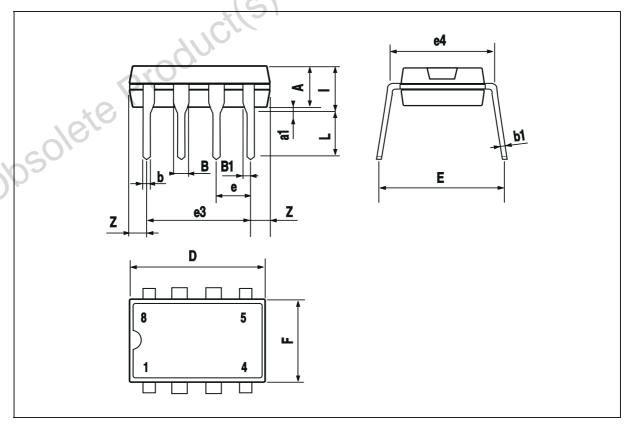
C_H = Hold capacitor (Farad)

$$C_{IN}$$
 (min) = $\frac{100 \cdot C_H}{k}$ Farad

DIM.	mm			inch			
Diwi.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Α		3.32			0.131		
a1	0.51			0.020			
В	1.15		1.65	0.045		0.065	
b	0.356		0.55	0.014		0.022	
b1	0.204		0.304	0.008		0.012	
D			10.92			0.430	
Е	7.95		9.75	0.313		0.384	
е		2.54			0.100		
e3		7.62			0.300		
e4		7.62			0.300		
F			6.6			0.260	
I			5.08			0.200	
L	3.18		3.81	0.125		0.150	
Z			1.52			0.060	

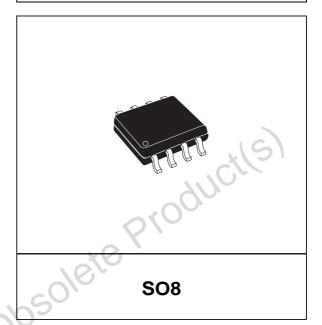
OUTLINE AND MECHANICAL DATA



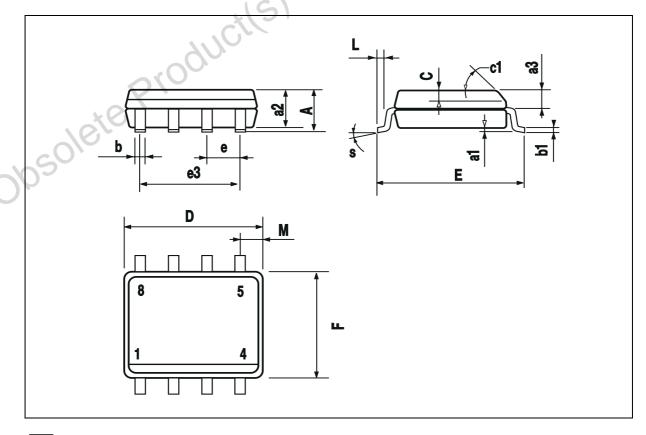


DIM.	mm			inch			
Dilvi.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Α			1.75			0.069	
a1	0.1		0.25	0.004		0.010	
a2			1.65			0.065	
аЗ	0.65		0.85	0.026		0.033	
b	0.35		0.48	0.014		0.019	
b1	0.19		0.25	0.007		0.010	
С	0.25		0.5	0.010		0.020	
c1			45° ((typ.)			
D (1)	4.8		5.0	0.189		0.197	
Е	5.8		6.2	0.228		0.244	
е		1.27			0.050		
еЗ		3.81			0.150		
F (1)	3.8		4.0	0.15		0.157	
L	0.4		1.27	0.016		0.050	
М			0.6			0.024	
S	8° (max.)						

OUTLINE AND MECHANICAL DATA



⁽¹⁾ D and F do not include mold flash or protrusions. Mold flash or potrusions shall not exceed 0.15mm (.006inch).





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