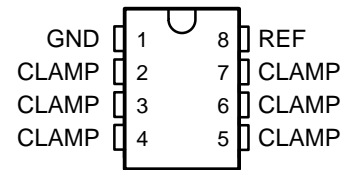


# TL7726C, TL7726I, TL7726Q HEX CLAMPING CIRCUITS

SLAS078A – SEPTEMBER 1993 – REVISED OCTOBER 1996

- Protects Against Latch-Up
- 25-mA Current Sink in Active State
- Less Than 1-mW Dissipation in Standby Condition
- Ideal for Applications in Environments Where Large Transient Spikes Occur
- Stable Operation for All Values of Capacitive Load
- No Output Overshoot

D OR P PACKAGE  
(TOP VIEW)



## description

The TL7726C, TL7726I, and TL7726Q each consist of six identical clamping circuits that monitor an input voltage with respect to a reference value, REF. For an input voltage ( $V_I$ ) in the range of GND to  $< REF$ , the clamping circuits present a very high impedance to ground, drawing current of less than  $10 \mu A$ . The clamping circuits are active for  $V_I < GND$  or  $V_I > REF$  when they have a very low impedance and can sink up to 25 mA.

These characteristics make the TL7726C, TL7726I, and TL7726Q ideal as protection devices for CMOS semiconductor devices in environments where there are large positive or negative transients to protect analog-to-digital converters in automotive or industrial systems. The use of clamping circuits provides a safeguard against potential latch-up.

The TL7726C is characterized for operation over the temperature range of  $0^\circ C$  to  $70^\circ C$ . The TL7726I is characterized for operation over the temperature range of  $-40^\circ C$  to  $85^\circ C$ . The TL7726Q is characterized for operation over the temperature range of  $-40^\circ C$  to  $125^\circ C$ .

AVAILABLE OPTIONS

OPERATING TEMPERATURE RANGE	DEVICE	PACKAGE
$0^\circ C - 70^\circ C$	TL7726CD	8-pin SO
$0^\circ C - 70^\circ C$	TL7726CP	8-pin DIP
$-40^\circ C - 85^\circ C$	TL7726ID	8-pin SO
$-40^\circ C - 85^\circ C$	TL7726IP	8-pin DIP
$-40^\circ C - 125^\circ C$	TL7726QD	8-pin SO
$-40^\circ C - 125^\circ C$	TL7726QP	8-pin DIP



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# TL7726C, TL7726I, TL7726Q HEX CLAMPING CIRCUITS

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## absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Reference voltage, $V_{ref}$ .....	6 V
Clamping current, $I_{IK}$ .....	$\pm 50$ mA
Junction temperature, $T_J$ .....	150°C
Continuous total power dissipation .....	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : TL7726C .....	0°C to 70°C
TL7726I .....	-40°C to 85°C
TL7726Q .....	-40°C to 125°C
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .....	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A \leq 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	728 mW	5.8 mW/°C	467 mW	380 mW	148 mW
P	900 mW	8 mW/°C	540 mW	420 mW	100 mW

## recommended operating conditions

	MIN	MAX	UNIT
Reference voltage, $V_{ref}$	4.5	5.5	V
Input clamping current, $I_{IK}$	$V_I \geq V_{ref}$	25	mA
	$V_I \leq GND$	-25	

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IK+}$ Positive clamp voltage	$I_I = 20$ mA	$V_{ref}$		$V_{ref} + 200$	mV
$V_{IK-}$ Negative clamp voltage	$I_I = 20$ mA	-200		0	mV
$I_Z$ Reference current	$V_{ref} = 5$ V		25	60	$\mu\text{A}$
$I_I$ Input current	$V_{ref} - 50$ mV $\leq V_I \leq V_{ref}$			10	$\mu\text{A}$
	$GND \leq V_I \leq 50$ mV	-10			$\mu\text{A}$
	$50$ mV $\leq V_I \leq V_{ref} - 50$ mV	-1		1	$\mu\text{A}$

† All typical values are at  $T_A = 25^\circ\text{C}$ .

## switching characteristics specified at $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
$t_s$ Settling time	$V_{I(system)} = \pm 13$ V, $R_I = 600 \Omega$ , $t_t < 1 \mu\text{s}$ , Measured at 10% to 90%, See Figure 1		30	$\mu\text{s}$



PARAMETER MEASUREMENT INFORMATION

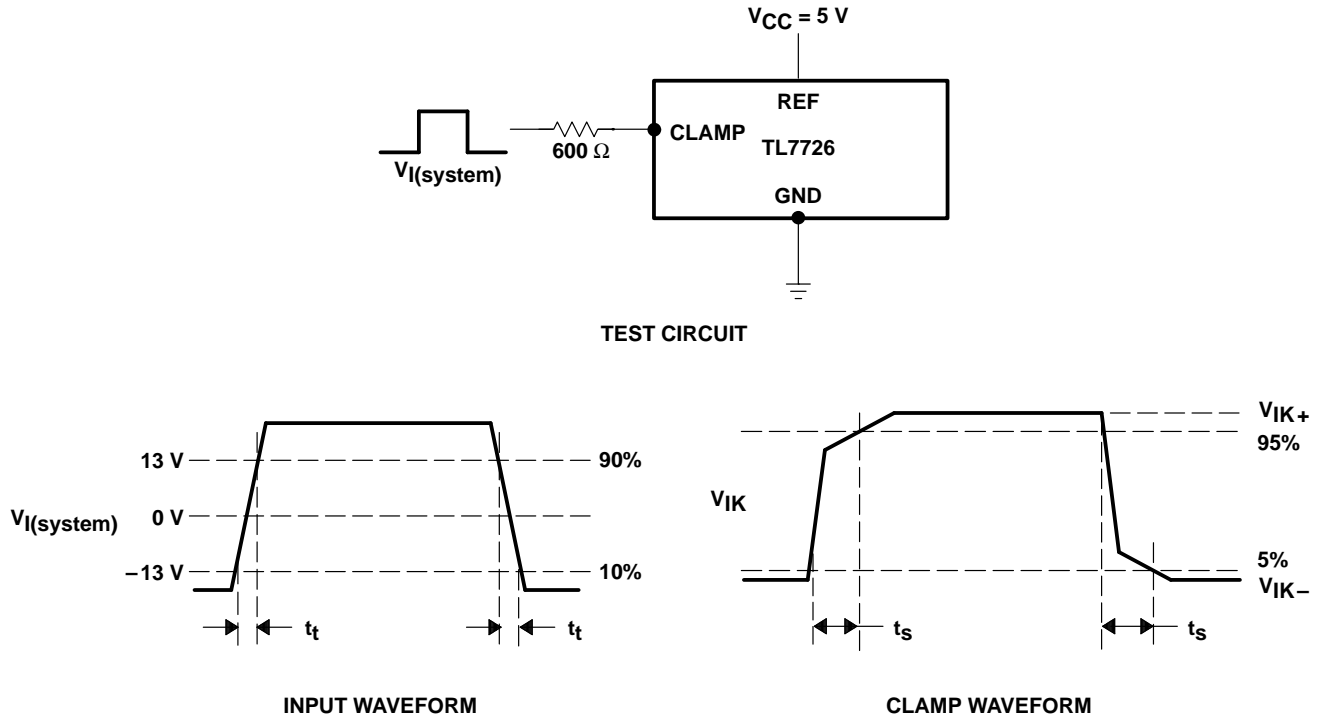


Figure 1. Switching Characteristics

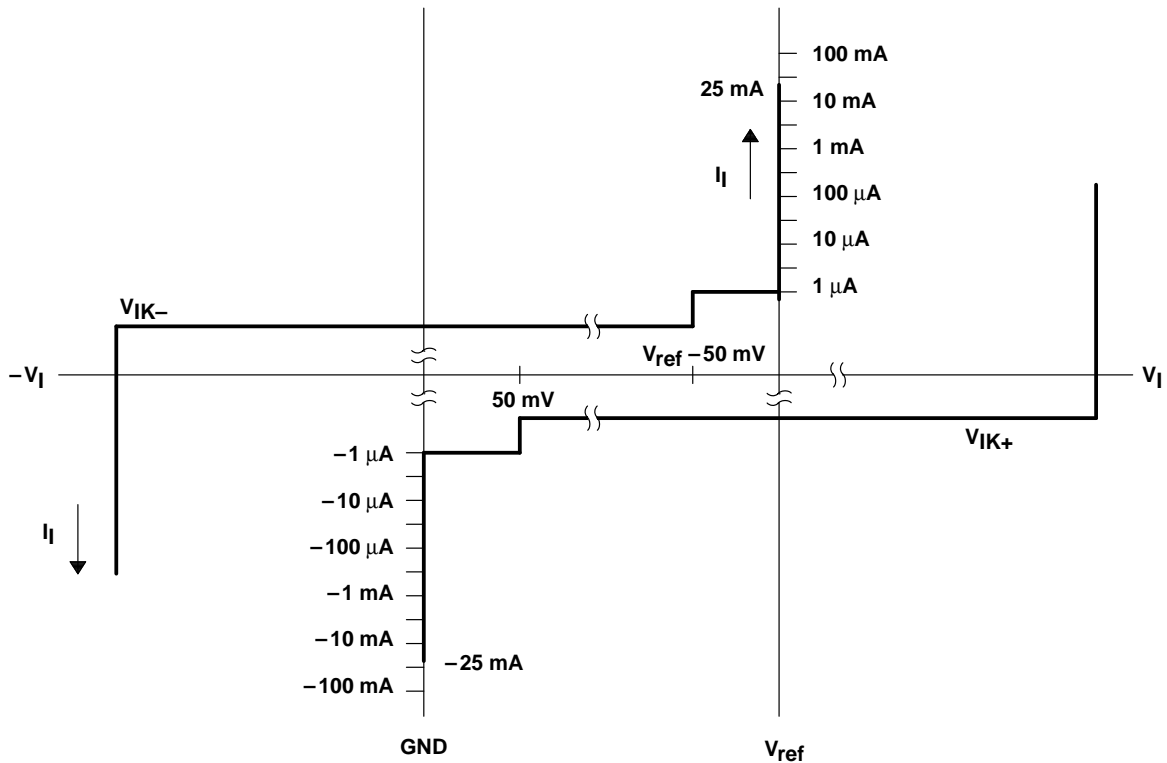
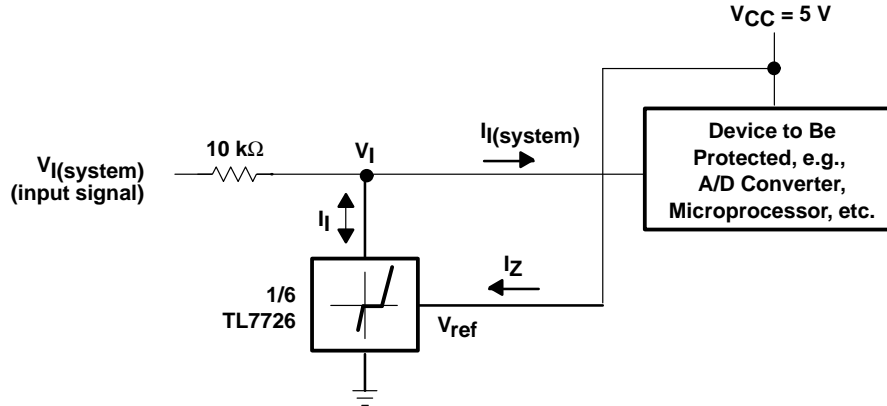


Figure 2. Tolerance Band for Clamping Circuit

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## APPLICATION INFORMATION



Example: If  $I_I \gg I_{I(\text{system})}$ , i.e.,  $V_{I(\text{system})} > V_{\text{ref}} + 200\text{ mV}$   
where:

$I_{I(\text{system})}$  = Input current to the device being protected

$V_{I(\text{system})}$  = Input voltage to the device being protected

then the maximum input voltage

$$\begin{aligned} V_{I(\text{system})\text{max}} &= V_{\text{ref}} + I_{I\text{max}}(10\text{ k}\Omega) \\ &= 5\text{ V} + 25\text{ mA}(10\text{ k}\Omega) \\ &= 5\text{ V} + 250\text{ V} \\ &= 255\text{ V} \end{aligned}$$

Figure 3. Typical Application

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