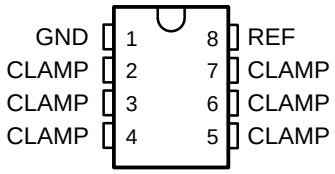
SLAS078B – SEPTEMBER 1993 – REVISED OCTOBER 1996

- **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 μA. 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°C to 70°C. The TL7726I is characterized for operation over the temperature range of –40°C to 85°C. The TL7726Q is characterized for operation over the temperature range of –40°C to 125°C.

AVAILABLE OPTIONS

OPERATING TEMPERATURE RANGE	DEVICE	PACKAGE
0°C – 70°C	TL7726CD	8-pin SO
0°C – 70°C	TL7726CP	8-pin DIP
–40°C – 85°C	TL7726ID	8-pin SO
–40°C – 85°C	TL7726IP	8-pin DIP
–40°C – 125°C	TL7726QD	8-pin SO
–40°C – 125°C	TL7726QP	8-pin DIP

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

Reference voltage, V_{ref} . . . . . 6 V
Clamping current, I_{IK} . . . . . ±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	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A \le 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING	$T_A = 125°C$ 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}	$V_I \ge V_{ref}$		25	mA
	$V_I \le$ GND	–25		

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

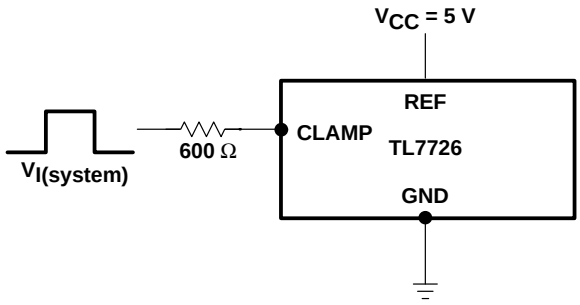
PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V_{IK+}	Positive clamp voltage	I_I = 20 mA	V_{ref}		$V_{ref}+200$	mV
V_{IK-}	Negative clamp voltage	I_I = 20 mA	–200		0	mV
I_Z	Reference current	V_{ref} = 5 V		25	60	µA
I_I	Input current	V_{ref} – 50 mV ≤ V_I ≤ V_{ref}			10	µA
		GND ≤ V_I ≤ 50 mV	–10			µA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

† All typical values are at T_A = 25°C.

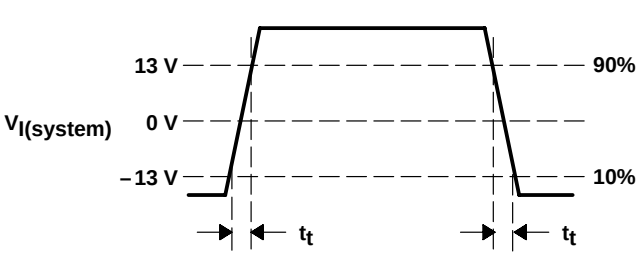
switching characteristics specified at T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
t_s	Settling time	$V_{I(system)}$ = ±13 V, R_I = 600 Ω, t_t < 1 µs, Measured at 10% to 90%, See Figure 1		30	µs

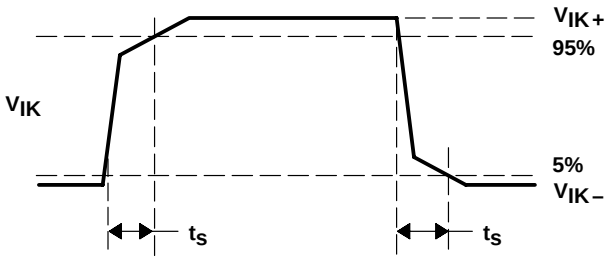
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



INPUT WAVEFORM



CLAMP WAVEFORM

Figure 1. Switching Characteristics

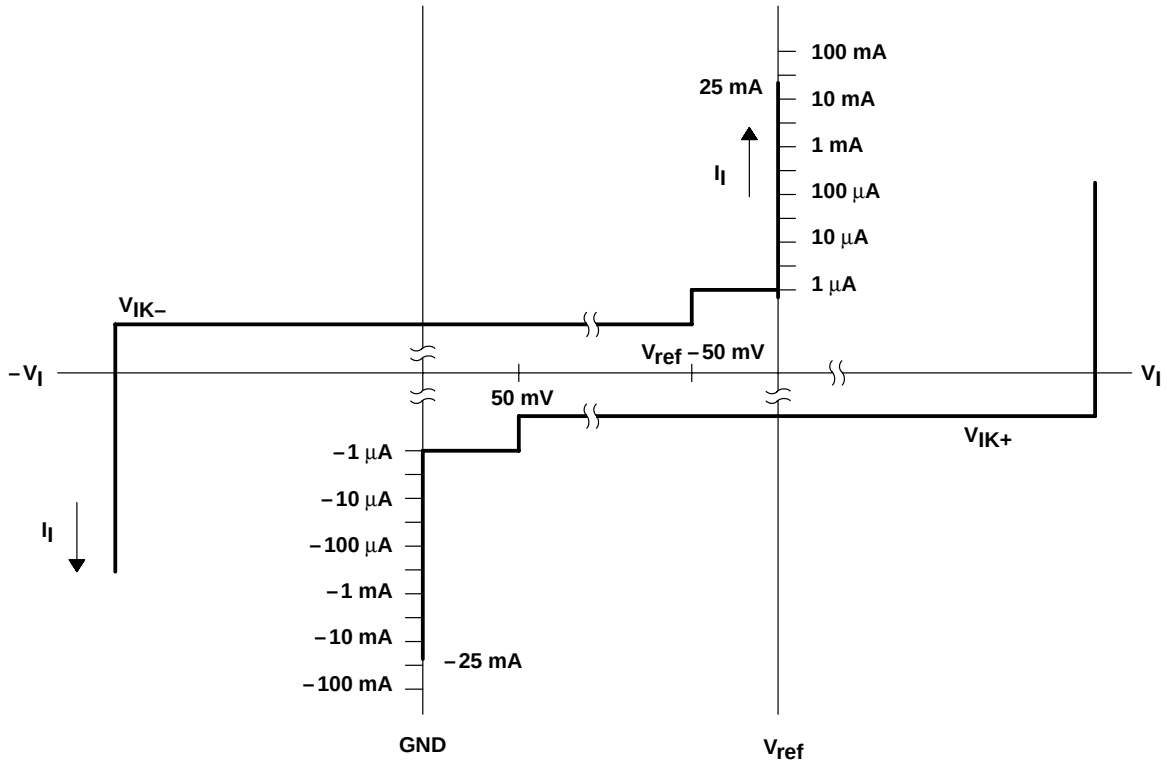
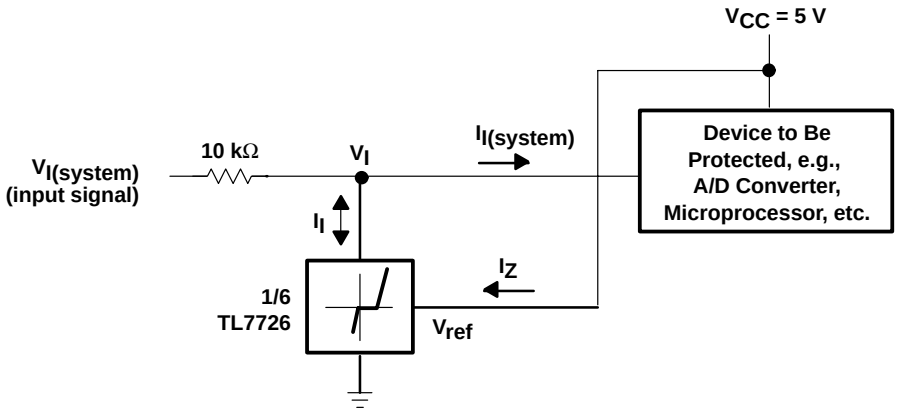


Figure 2. Tolerance Band for Clamping Circuit

APPLICATION INFORMATION



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

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

then the maximum input voltage

$V_{I(system)max} = V_{ref} + I_I max(10k\Omega)$
$= 5\ V + 25\ mA(10k\Omega)$
$= 5\ V + 250\ V$
$= 255\ V$

Figure 3. Typical Application

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.