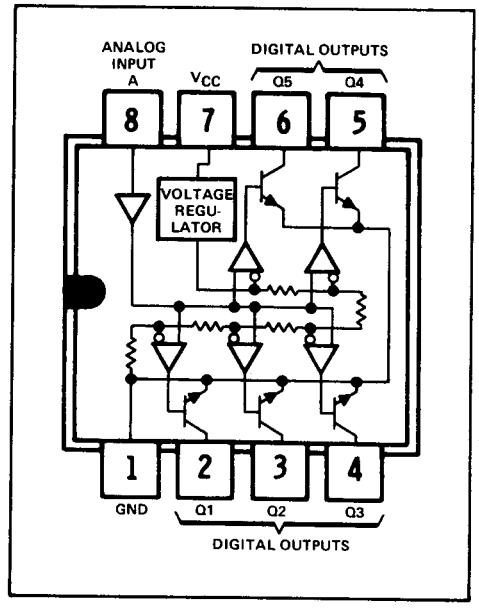
TYPE TL489C
5-STEP ANALOG LEVEL DETECTOR

BULLETIN NO. DL-S 12584, JANUARY 1978 – REVISED OCTOBER 1979

- 5 Comparators to Digitize Analog Input Signals in 200 mV Increments
- High Input Impedance . . . 100 kΩ Typ
- Open-Collector Outputs Capable of Sinking up to 40 mA and Withstanding up to 18 V
- Supply Voltage Range of 10 to 18 V
- Economical 8-Pin Dual-in-Line Plastic Package

P DUAL-IN-LINE PACKAGE (TOP VIEW)



FUNCTION TABLE

INPUT A (NOM)	OUTPUTS				
	Q1	Q2	Q3	Q4	Q5
0–≈200 mV	H	H	H	H	H
≈200–≈400 mV	L	H	H	H	H
≈400–≈600 mV	L	L	H	H	H
≈600–≈800 mV	L	L	L	H	H
≈800–≈ 1000 mV	L	L	L	L	H
>≈1000 mV	L	L	L	L	L

H = high level, L = low level

description

The TL489C consists of five comparators and a reference voltage network to detect the level of an analog input signal at the A input. Output Q1 is switched to a low logic level at a typical input voltage of 200 millivolts. After each 200-millivolt step, the next output is switched to low logic levels. All outputs are at low logic levels at a typical input voltage of 1000 millivolts. The open-collector outputs are capable of sinking currents up to 40 milliamperes and may be operated at voltages up to 18 volts. The analog input has a high impedance of typically 100 kilohms.

Since all five trigger points have a switching hysteresis of typically 10 millivolts, the circuit may be operated with slow input signals without the danger of oscillation at the outputs. To prevent pickup of noise, a capacitor should be connected between the high-impedance input and ground, especially when the input is driven from a high-impedance source.

The TL489C is especially designed to detect and indicate analog signal levels. The device may be used in various industrial, consumer, or automotive applications such as low-precision meters, warning signal indicators, A/D converters, feedback regulators, pulse shapers, delay elements, and automatic range switching. The power outputs are suitable for driving a variety of display elements such as LED's or filament lamps. The outputs may also drive digital integrated logic such as TTL, CMOS, or other high-level logic.

The TL489C is characterized for operation from 0°C to 70°C.

absolute maximum ratings

Supply voltage, V_{CC} (see Note 1)	20 V
Voltage at analog input A	8 V
Off-state output voltage	20 V
Current through analog input A	−10 mA
Low-level output current (each output)	80 mA
Total low-level output current	200 mA
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 2)	1000 mW
Operating free-air temperature range	0°C to 70°C
Lead temperature 1/16 inch (1,6 mm) from case for 10 seconds	260°C

NOTES: 1. Voltage values are with respect to network ground terminal.
2. Derate linearly to 640 mW at 70°C free-air temperature at the rate of 8,0 mW/°C.

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	10	12	18	V
Output voltage, V_O			18	V
Low-level output current			40	mA
Operating free-air temperature, T_A	0		70	°C

electrical characteristics over recommended range of V_{CC} and operating free-air temperature range (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V_{T+}	Positive-going threshold voltage at input A	Switching Q1	T_A = 25°C	160	200	240	mV
		Switching Q2		350	400	450	
		Switching Q3		540	600	660	
		Switching Q4		730	800	870	
		Switching Q5		920	1000	1080	
$V_{T+} - V_{T-}$	Input hysteresis				10		mV
I_{OH}	High-level output current		V_{OH} = 18 V		0.5	20	μA
V_{OL}	Low-level output voltage		I_{OL} = 16 mA		0.15		V
			I_{OL} = 40 mA		0.25	0.5	
I_I	Input current		V_I = 1 V		0.5		μA
I_{CC}	Supply current	All outputs high	V_{CC} = 12 V		8	12	mA
		All outputs low	All outputs open		15	25	

†All typical values are at V_{CC} = 12 V, T_A = 25°C.

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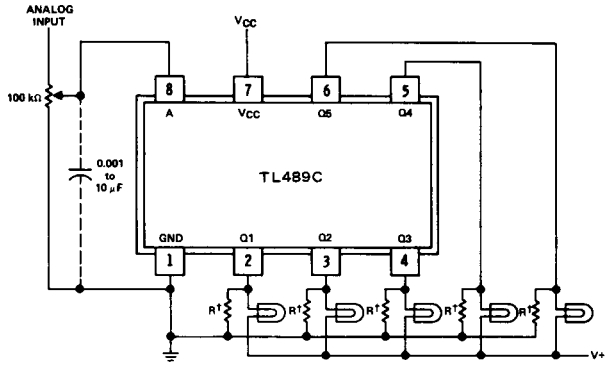
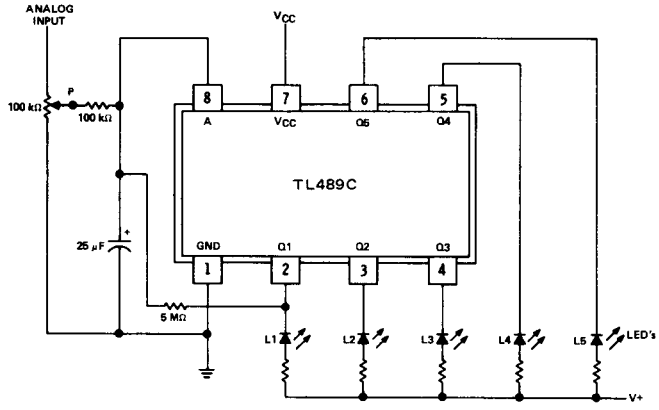
TYPICAL APPLICATIONS DATA



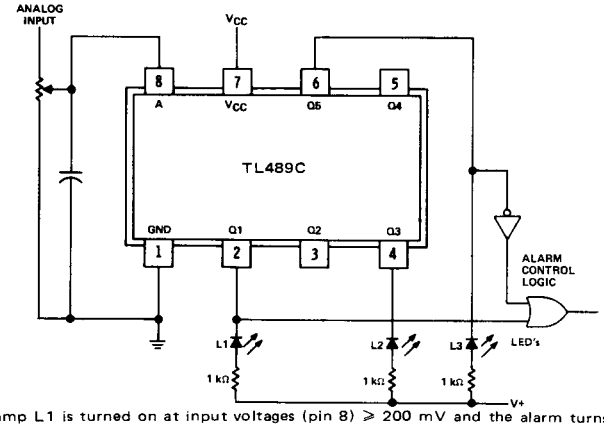
†Keep-alive resistors to avoid high switching current.

FIGURE 1–INTERFACING WITH INCANDESCENT LAMPS



Lamps L1 through L5 illuminate as the input voltage increases in nominally 200-mV steps.
Additionally, lamp L1 will flash periodically when the input voltage at point P is below 200 mV.

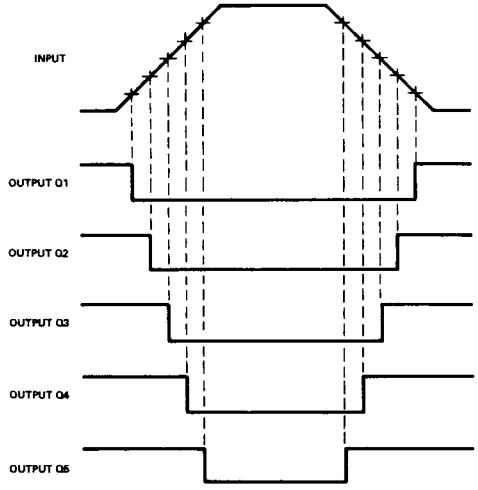
FIGURE 2–LEVEL INDICATION WITH FLASHING FEATURE



Lamp L1 is turned on at input voltages (pin 8) ≥ 200 mV and the alarm turns off.
Lamp L2 is turned on at input voltages ≥ 600 mV to indicate correct operation.
Lamp L3 is turned on at input voltages ≥ 1000 mV and the over-range alarm turns on.

FIGURE 3–THREE-STAGE LEVEL INDICATION AND CONTROL

TYPICAL APPLICATION DATA



The delay times are determined by the rate of change of the input signal.

FIGURE 4—WAVEFORMS FOR FIVE DELAYED OUTPUTS

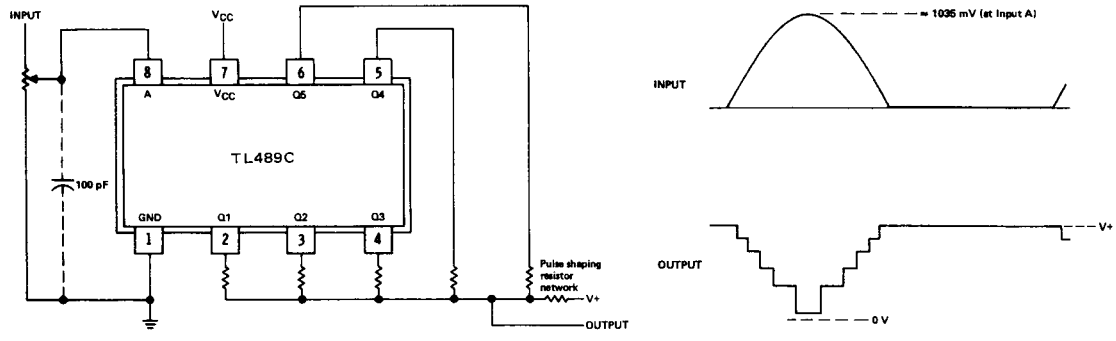
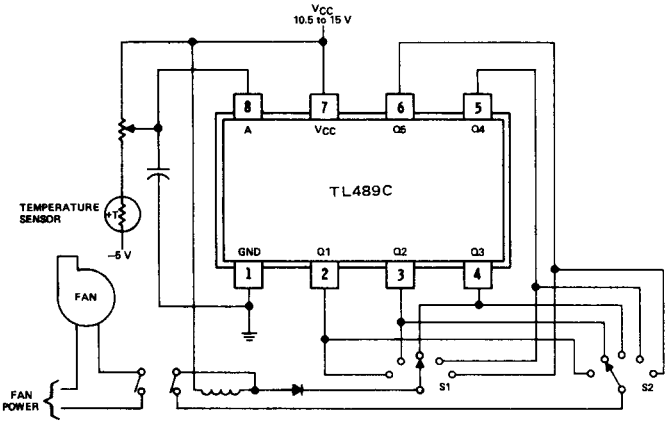


FIGURE 5—PULSE-SHAPE CONVERTER



Switch S1 selects the temperature at which the fan starts operating, and S2 selects the temperature at which the fan stops operating.

FIGURE 6—TEMPERATURE FEEDBACK REGULATION WITH SELECTABLE SYSTEM HYSTERESIS

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