

## Preamplifier for IR Remote Control

### Description

The IC U2535B is a complete IR receiver for data communication. The PIN photodiode converts the transmitted IR telegram into electronic input signals. This is separated by a special input circuit. The characteristics (filter, gain) of the following amplifier are determined by exter-

nal components. The signal detector, consisting of a comparator, an integrator and a Schmitt trigger, forms the input signal to an output pulse that can be interfaced to a microcomputer.

### Features

- Low current requirement (typical 260  $\mu$ A/ 12 V)
- Carrier frequencies 20 to 100 kHz
- Supply voltages:  
5 or 7 to 16 V with internal stabilization
- Filter characteristics and gain are specified by few external components
- Demodulator with Schmitt trigger
- Open collector output

### Applications

- Keyless entry
- Remote control
- Wireless data transfer

### Ordering Information

Extended Type Number	Package	Remarks
U2535B-FP	SO8	

### Block Diagram

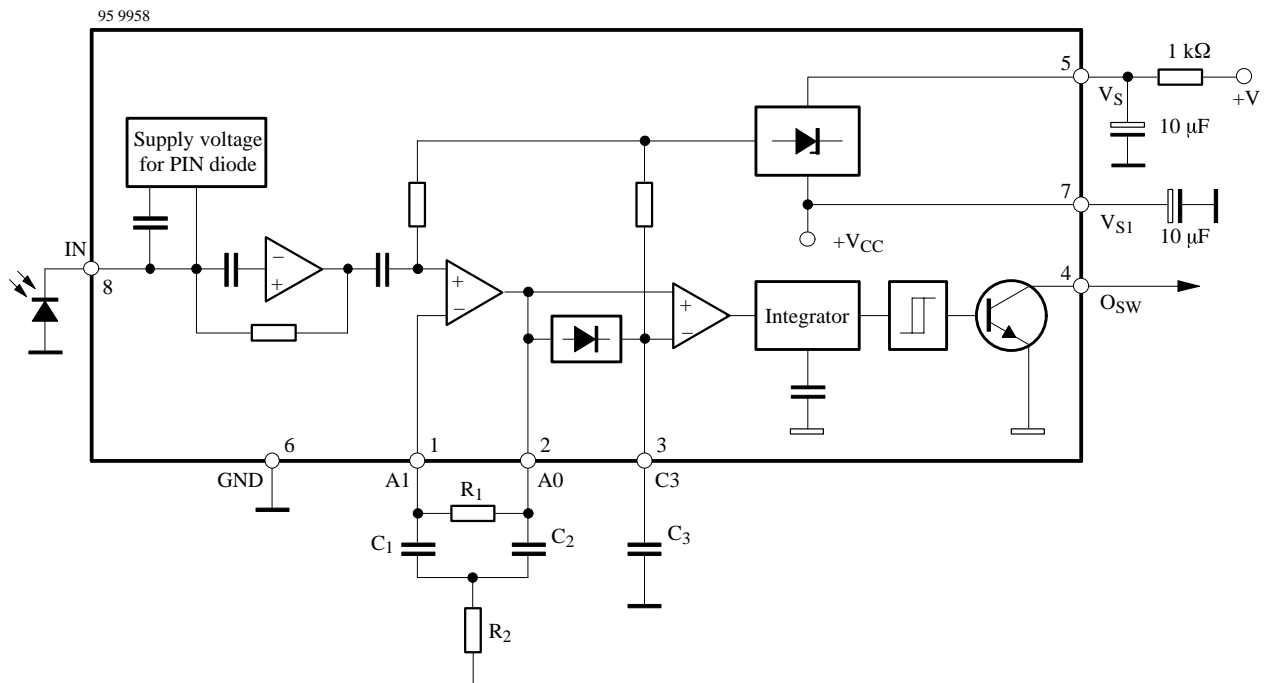


Figure 1. Block diagram

## Pin Description

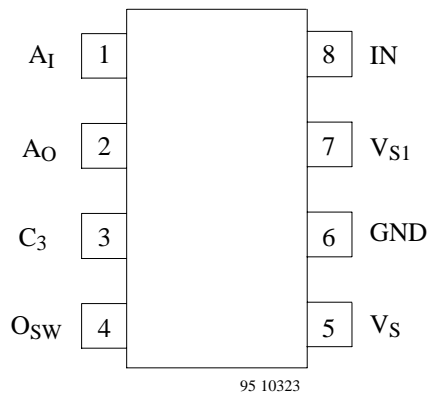


Figure 2. Pinning

Pin	Symbol	Function
1	A <sub>I</sub>	Inverting input of bandpass amplifier, pin connection for external filter function
2	A <sub>O</sub>	Output of bandpass amplifier
3	C <sub>3</sub>	Capacitor at Pin 3 to reject (suppress) ripple during transmission, also functions as delay time for reference voltage of the comparator
4	O <sub>SW</sub>	Switching output Open collector output which switches with time delay and turns to LOW (transistor switched ON) when the signal is identified at Pin 2.
5	V <sub>S</sub>	Supply voltage The integrated Z-diode (typically 17 V) protects the circuit against positive voltage spikes
6	GND	Ground
7	V <sub>S1</sub>	Unregulated supply voltage for 5 V operation
8	IN	Input connection for photodiode with regulated bias voltage

## Absolute Maximum Ratings

Reference point Pin 6, unless otherwise specified

Parameters	Symbol	Value	Unit
Supply-voltage range	V <sub>S</sub>	-0.3 to +16	V
Supply currents: tp ≤ 250 ms	I <sub>S</sub>	20	mA
	i <sub>S</sub>	150	mA
Input voltages	V <sub>A(I)</sub>	-0.3 to 5	V
	V <sub>O(SW)</sub>	-0.3 to 16	V
	V <sub>IN</sub>	-0.3 to 5	V
Output currents	I <sub>O</sub>	±5	mA
Junction temperature	T <sub>j</sub>	125	°C
Storage-temperature range	T <sub>stg</sub>	-40 to +125	°C
Ambient-temperature range	T <sub>amb</sub>	-40 to +105	°C

## Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R <sub>thJA</sub>	180	K/W

## Electrical Characteristics

$T_{amb} = 25^{\circ}\text{C}$ , reference point Pin 6, test circuit, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply currents	$V_{S1} = 5\text{ V}$ , $I_{IN} = 0$ , Pin 7	$I_{S1}$	140		200	$\mu\text{A}$
	$V_S = 12\text{ V}$ , $I_{IN} = 0$ , Pin 5	$I_S$	200		320	$\mu\text{A}$
Internal stabilization	$V_S = 12\text{ V}$ , $I_{IN} = 0$ , Pin 7	$V_{S1}$	4.9		5.4	V
Maximum input current	$V_{S1} = 5\text{ V}$ , $V_{IN} = 0$ , Pin 8	$-I_{IN}$	0.8		1.2	mA
Low-level voltage	$V_{S1} = 5\text{ V}$ , $I_{OL} = 0.5\text{ mA}$ Pin 4	$V_{OL}$			0.2	V
Leakage current	$V_{S1} = 5\text{ V}$ , $V_0 = 12\text{ V}$ , Pin 4	$I_{OH}$			1	$\mu\text{A}$
<b>Input stage, amplifier</b>						
Cut-off frequency		$f_L$			15	kHz
		$f_H$	100			kHz
Gain	$v_i = 2\text{ mV}_{\text{rms}}$ , $f = 40\text{ kHz}$ $f = 100\text{ kHz}$	$G_v$	47	50		dB
		$G_v$	46	49		dB
<b>Detector</b>						
Threshold voltage	$t_d \leq 200\ \mu\text{s}$ , $f = 40\text{ kHz}$ , Pin 2	$V_{A0}$		150		$\text{mV}_{\text{rms}}$
Delay time	$f = 40\text{ kHz}$ , $V_{A0} = 1\text{ V}_{\text{rms}}$ see figure 4	$t_d$	50	90		$\mu\text{s}$
Storage time	$f = 40\text{ kHz}$ , $V_{A0} = 1\text{ V}_{\text{rms}}$ see figure 4	$t_s$	100		150	$\mu\text{s}$

## Test Circuit

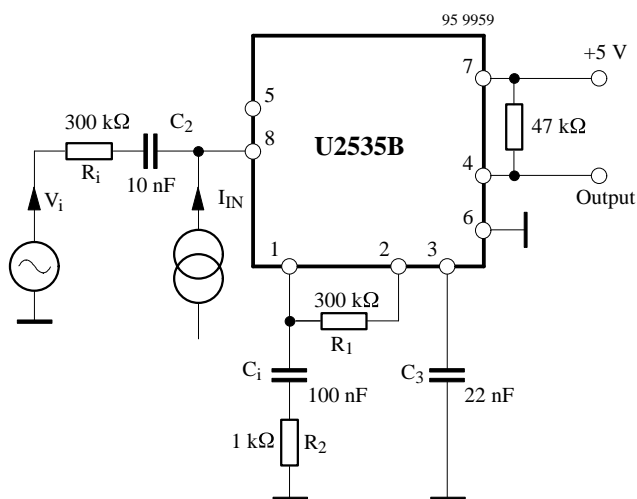


Figure 3. Test circuit

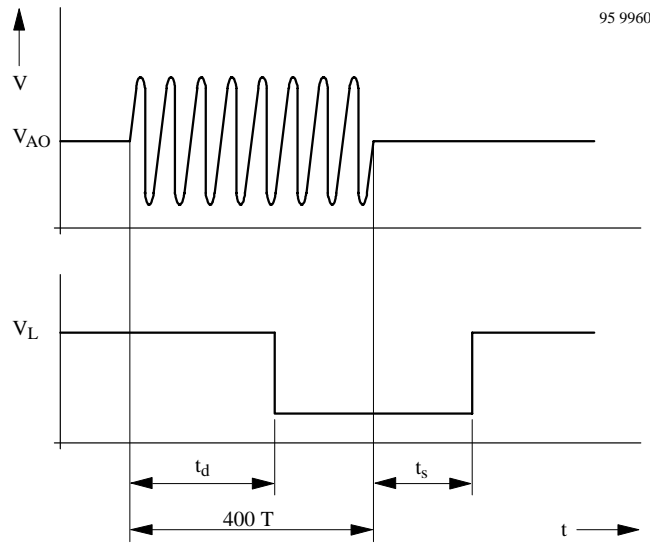


Figure 4. Waveforms for  $t_d$  and  $t_s$  measurement

## Application Circuit

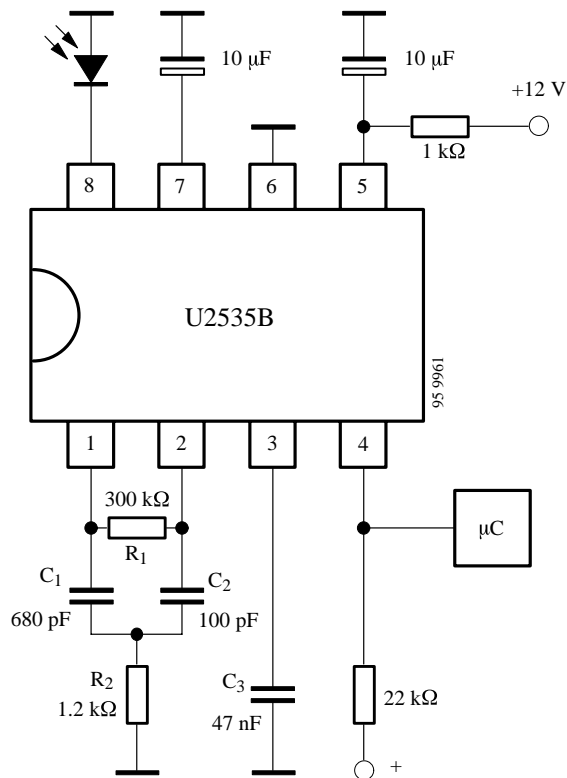


Figure 5. Application circuit

## Bandpass Filter Design

Center frequency

$$f_0 = \frac{1}{2\pi \sqrt{R_1 \times C_1 \times R_2 \times C_2}}$$

$$\text{GAIN} \approx \frac{R_1 \times C_1}{R_2 (C_1 + C_2)} \quad \begin{array}{l} R_1 \gg R_2 \\ C_1 \cong C_2 \end{array}$$

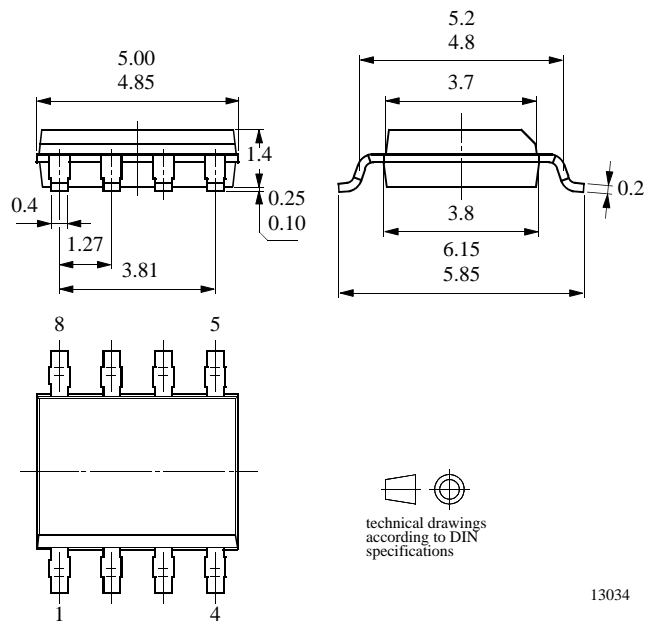
$$\text{Bandwidth} \approx \frac{C_1 + C_2}{2\pi \times R_1 \times C_1 \times C_2} \quad \text{BW} \ll f_0$$

**Note:**  $R_1$  should be about 300 k $\Omega$ .  
Results can be influenced by feedback (Pin 2  $\rightarrow$  Pin 8)

## Package Information

Package SO8

Dimensions in mm



## Ozone Depleting Substances Policy Statement

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2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

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The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**TEMIC Semiconductor GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

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