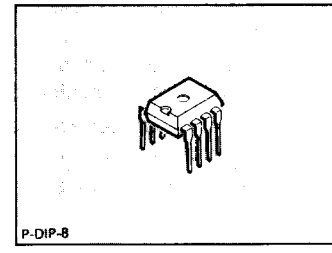
Audible Signal Device

SAE 0700

Bipolar IC

Features

- Direct AC-voltage feeding possible through integrated bridge rectifier
- Integrated overvoltage protection through Z-diode, approx. 28 V
- Bridge rectifier provides for protection against reverse polarity in DC operation
- Few external components (one resistor and one capacitor minimum)



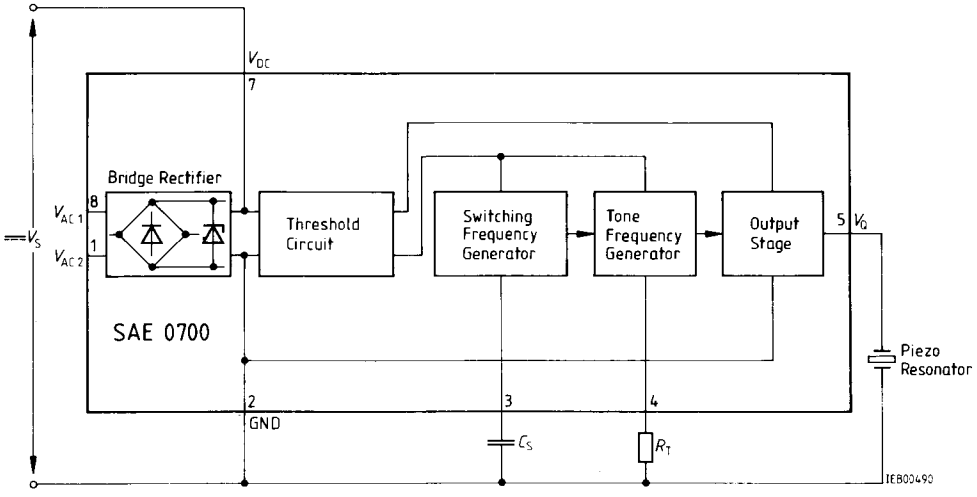
Type	Ordering Code	Package
S SAE 0700	Q67000-A2445	P-DIP-8

The audible signal device SAE 0700 generates two tone frequencies in a ratio of approx. 1.4:1 that follow one another in a periodic sequence. The tone frequency can be varied throughout a range between 100 Hz and 15 kHz by an external resistor. The switching frequency of 0.5 to 50 Hz is set by an external capacitor. The SAE 0700 can be used to drive either a loudspeaker or a piezo-ceramic transducer. The SAE 0700 can be supplied with voltage in two ways:

1. rms AC voltage from 10 V
2. DC voltage from 9 to 25 V

The SAE 0700 issues the tone sequence for as long as the supply voltage is applied. After application of the supply voltage, the tone sequence commences with the higher of the two tones.

Figure 1
Block Diagram (with external components for DC supply)



Pin Definitions and Functions

Pin	Symbol	Function
1	V_{AC2}	AC-voltage input
2	GND	Ground
3	C_S	Connection for capacitor C_S
4	R_T	Connection for resistor R_T
5	Q	Output
6	N.C.	Not connected
7	V_{DC}	DC-voltage input
8	V_{AC1}	AC-voltage input

Functional Description

The audible signal device SAE 0700 (see block diagram, **fig. 1**) includes the following functional blocks:

- bridge (for voltage supply) and overvoltage protection
- threshold circuit
- switching-frequency generator
- tone-frequency generator
- output stage

Bridge rectifier: The bridge rectifier enables direct feeding with AC voltage or DC voltage (independent of polarity). DC-voltage supply without integrated bridge is also possible via pins V_{DC} and GND.

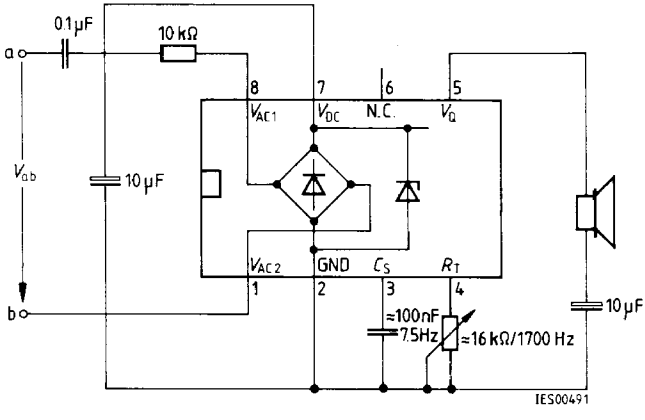
If the voltage is supplied via the bridge, the input voltage V_{81} should be dimensioned such that at least 9 V appear at the pin V_{DC} (also with output loading). It should also be noted that in the case of voltage supply via the bridge, the maximum output current has to be limited to 50 mA.

Response of the SAE 0700 as a result of spikes on the AC line is prevented by a built-in initial resistance R_{INI}. In a voltageless condition R_{INI} provides for discharging the storage capacitor of V_{DC} to ground.

The Z-diode following the bridge serves as overvoltage protection. The bridge circuitry shown in **figure 2** efficiently protects the SAE 0700 against damage as a result of the following voltage values:

- overvoltages in acc. with VDE 0433 (2 kV – 10/700 µs)
- AC voltages up to 220 V/50 Hz for a duration of 30 s

Figure 2



Threshold circuit: With a threshold voltage of typically 8.6 V this ensures that the SAE 0700 is not activated by noise pulses.

Switching-frequency generator: This switches periodically between the two frequencies produced by the tone-frequency generator. Wiring with a capacitor C_S produces a switching frequency f_S according to the following formula:

$$f_S\,[\mathrm{Hz}] = \frac{750}{C\,[\mathrm{nF}]} \pm 25\% \quad \text{(valid from 0.5 to 50 Hz)}$$

Tone-frequency generator: This generates a squarewave voltage with the two tone frequencies f_{T1} and f_{T2}. The basic frequency f_{T1} and the second tone frequency f_{T2} are calculated according to the following formulae:

$$f_{T1}\,[\mathrm{Hz}] = \frac{2.72 \times 10^4}{R\,[\mathrm{k\Omega}]} \pm 25\% \quad \text{(valid from 0.1 to 15 kHz)}$$

$$f_{T2}\,[\mathrm{Hz}] = f_{T1} \times (0.725 \pm 5\%)$$

The tone-frequency generator is temperature-compensated for better stability.

Output stage: This boosts the generated tone voltage for direct driving of a piezo-ceramic transducer or a loudspeaker, possibly across a dropping resistor.

Absolute Maximum Ratings

Parameter	Symbol	Limit Values min.	Limit Values max.	Unit
Voltage at pin 7	V_{DC}	−0.5	26	V
Voltage at pin 3	$V_{3\,2}$	−0.5	5.5	V
Voltage at pin 4	$V_{4\,2}$	−0.5	7	V
Output voltage at pin 5	V_Q	−0.5	V_{DC} +0.5	V
AC voltage at pin 8 and 1 (peak value)	V_{AC}		28	V
Input current of bridge	$I_{8\,1}$	−50	50	mA
AC input current of bridge	$I_{8\,1\,rms}$		25	mA
Output current (50 µs, duty cycle 1:10)	I_Q	−100	100	mA
Output current	$I_{Q\,rms}$		50	mA
Total power dissipation ($T_A = 25\,°C$)	P_{tot}		0.8	W
Junction temperature	T_j		150	°C
Storage temperature	T_{stg}	−40	125	°C
Thermal resistance system – air	$R_{th\,SA}$		120	K/W

Operating Range

Supply voltage	V_{DC}	9	25	V
Tone frequency	f_{T1}	0.1	15	kHz
Ambient temperature	T_A	−25	85	°C

Characteristics

$T_A = -25\,°C$ to $85\,°C$

Parameter	Symbol	Limit Values min.	Limit Values typ.	Limit Values max.	Unit	Test Conditions
Current consumption	I_{DC}		1.5	1.8	mA	$V_{DC} = 9$ V to 25 V without load
Switching threshold	$V_{DC\,ON/OFF}$	8	8.6	9	V	
Initial resistance	R_{INI}	3.5	4.7	6	kΩ	see characteristic, **figure 3**
Output-voltage swing	V_Q	V_{DC}−3.7	V_{DC}−3		V	$I_Q = \pm 10$ mA
Tone frequency	$f_{T\,1}$	1.275	1.700	2.125	kHz	$V_{DC} = 15$ V, $V_{3\,2} = 0$ V $R_T = 16$ kΩ
Switching frequency	f_S	5.6	7.5	9.4	hZ	$V_{DC} = 15$ V, $C_S = 100$ nF
Tone frequency ratio	$f_{T\,1}/f_{T\,2}$	1.31	1.38	1.45		
Temperature coefficient of tone frequencies	TC_f		8×10^{-4}		K^{-1}	

Characteristic Curves

Figure 3
Current consumption versus supply voltage V_{DC} without output load

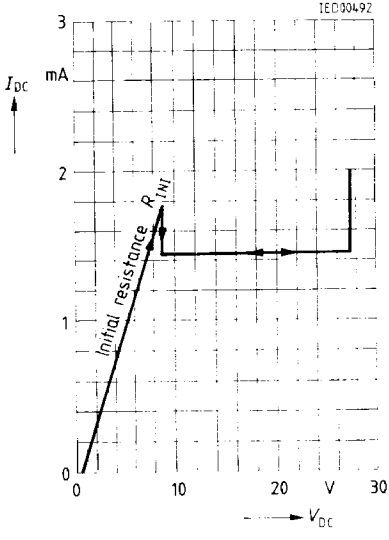


Figure 4
Tone frequencies f_{T1} and f_{T2} versus resistance R_T

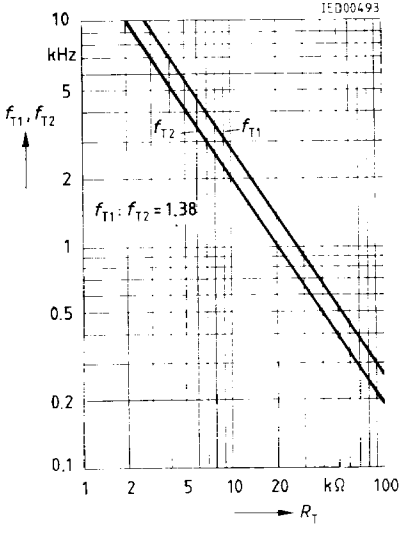
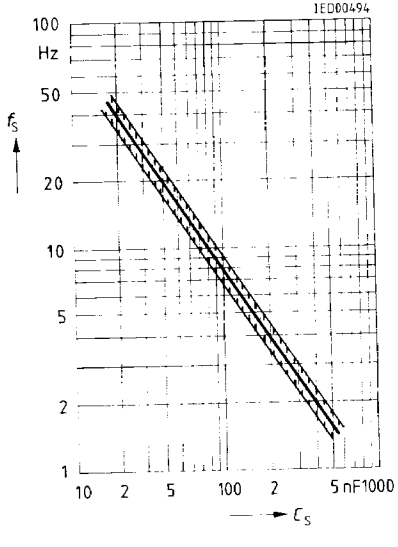


Figure 5
Switching frequency f_S versus capacitance C_S



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