Surface mount packaging

The circuits illustrated make use of through hole products. All the components mentioned however are available as surface mount alternatives making for even greater space saving. E-line is complemented by SOT23 and SOT223 products whilst the IC can be made available in an SO8 package as well as the DIL8.

Summary

The circuit described is only one example of the possible configurations of alarm circuit solutions produced from Zetex discrete and IC technologies. For whichever configuration is required the Zetex solution will offer reduced component count, space saving and cost saving whilst maintaining superior performance

If you would like to try the circuit in your own application then a call to Zetex local office will assist you in sourcing a demonstration board which includes a ZSD100 and an output bridge configuration.

ZETEX Zetex plc.
Fields New Road, Chadderton, Oldham, OL9-8NP, United Kingdom.
Telephone: (44)161-627 5105 (Sales), (44)161-627 4963 (General Enquiries)
Facsimile: (44)161-627 5467

Zetex GmbH
Streitfeldstraße 19
D-81673 München
Germany
Telefon: (49) 89 45 49 49 0
Fax: (49) 89 45 49 49 49

Zetex Inc.
87 Modular Avenue
Commack NY11725
USA
Telephone: (516) 543-7100
Fax: (516) 864-7630

Zetex (Asia) Ltd.
3510 Metroplaza, Tower 2
Hing Fong Road,
Kwai Fong, Hong Kong
Telephone:(852) 26100 611
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ZETEX Applications Note 16
Issue 1 June 1995

Automotive and Household Siren Driver Circuits

David Brotton

Many of today's modern alarm systems employ a moving coil loudspeaker as the siren element. To interface between the alarm systems processing unit and the speaker the usual circuits consist of a signal generation IC and a discrete H-bridge.

The signal generation circuit is often built around standard 555 timers, although other systems may use discrete transistor circuits, op-amp derived circuits or even small microcontrollers. The 555 configuration will consist of a slow running astable multivibrator, generating a ramp signal, which modulates a second multivibrator causing it to sweep over a range of frequencies.

The drive circuit usually employs TO126 or TO220 packaged power transistors, since the currents involved and the resulting power dissipation are both in excess of common smaller packaged products. The devices used normally require parallel collector emitter diodes, to divert destructive reverse transients generated by the inductive load, and base emitter resistors to provide a path for any transistor leakage current. This factor is particularly important with usual TO126/TO220 products as their poor $V_{CE(sat)}$ performance can lead to a significant temperature rise. Some circuits use darlington TO220's which can reduce the component count if the

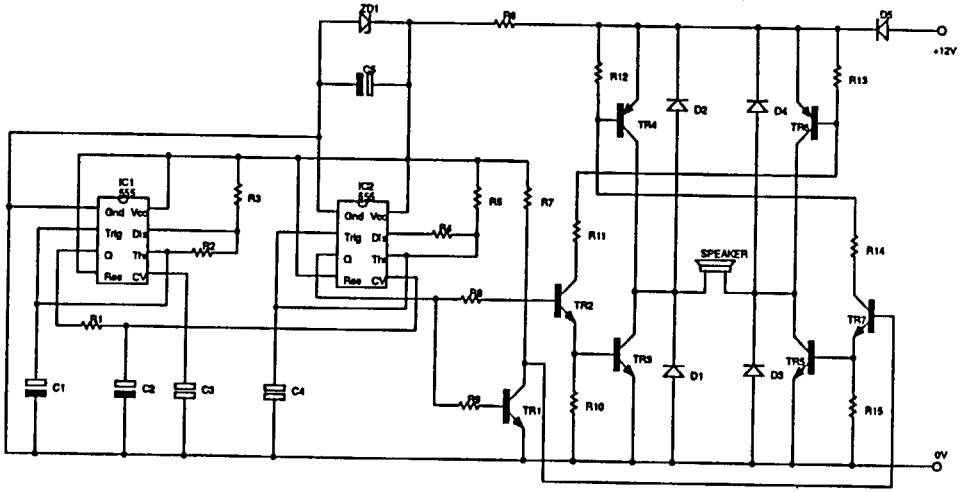

Figure 1.
Typical circuit based on 555 configuration

ZETEX

5 96 814 + ZSD 100

devices include integral collector emitter diodes however, the darlington configuration produces a high on-state voltage which causes excess dissipation. This type of circuit requires base emitter resistors and also reduces the power delivered to the load.

The result of the above is a complex circuit, with a high component count, requiring excessive board space and a consequential high cost. Fig 1 indicates a typical, and complex, solution to the circuits described above.

Zetex total siren driver solution addresses all these problems in one by utilising a custom designed ASIC, which has a minimal pin count and uses few external components, and the superior performance of its discrete transistors. The result is a low cost, minimum component count solution which still maintains the performance advantages expected from a Zetex product. Fig 2 shows the Zetex circuit solution to that shown in Fig 1.

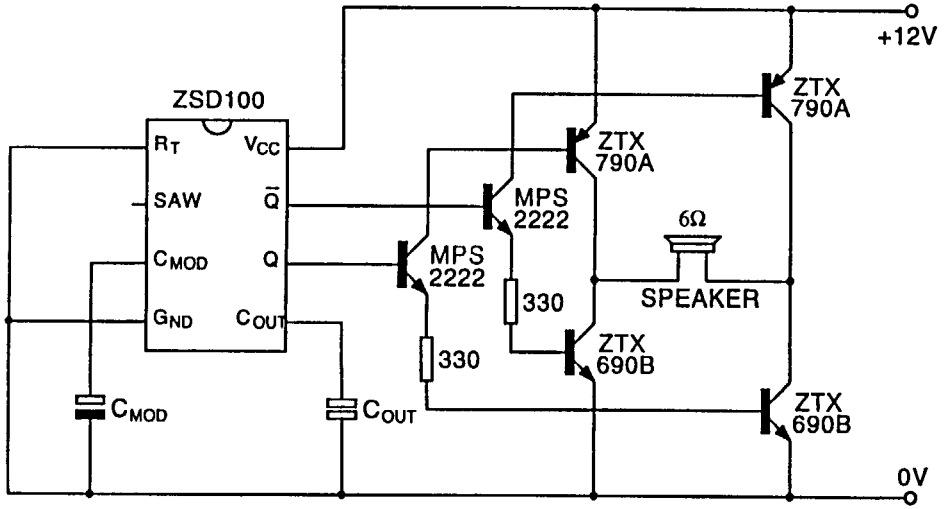

Figure 2
Zetex equivalent minimum component count solution.

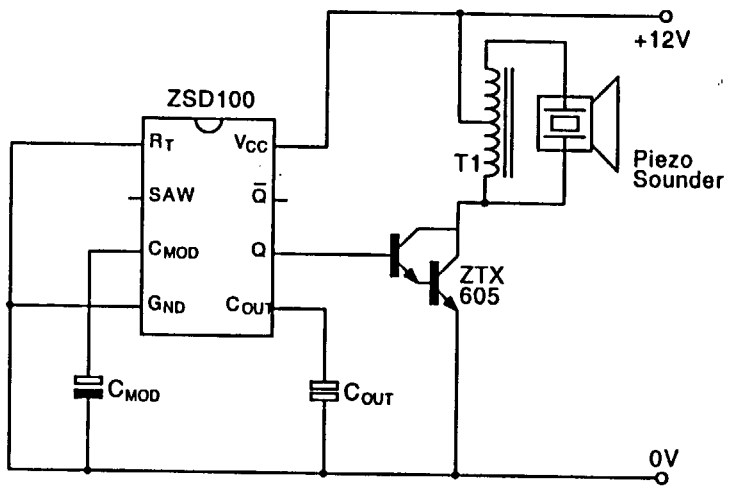

Figure 4
Single ended drive circuit for piezo sounders.

The external resistor pin can also perform another function in that if it is driven from a logic source, which could be the alarm microprocessor, it can act as a disable by inhibiting all the driver functions, Fig 6.

One further feature of the ASIC is that the modulation waveform can be simply selected as either ramp or sawtooth, by using the SAW pin, giving variety in the properties of the siren output waveform.

With battery operation in mind the IC can operate from 4 up to 18 volts consuming only 1mA in sleep mode. Another power saving property of the IC is the built in anti cross-conduction delay which, in full bridge circuits, prevents both arms of the bridge conducting simultaneously.

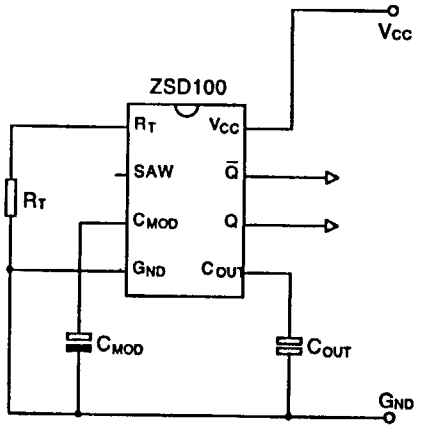

Figure 5
Improved frequency control.

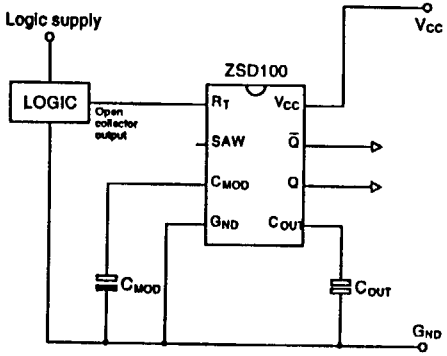

Figure 6
Logic controlled inhibit.

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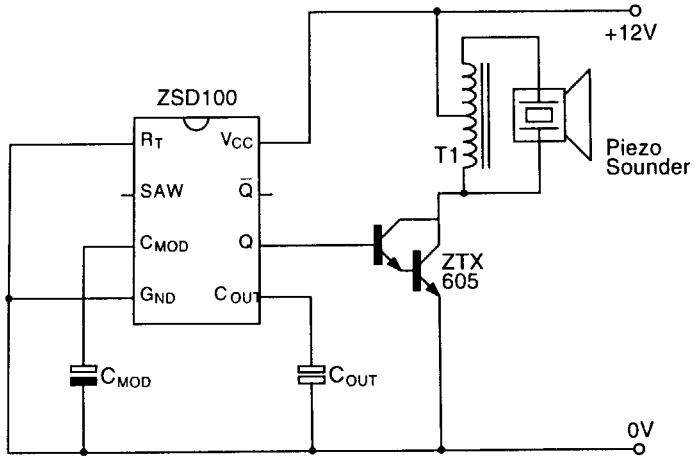
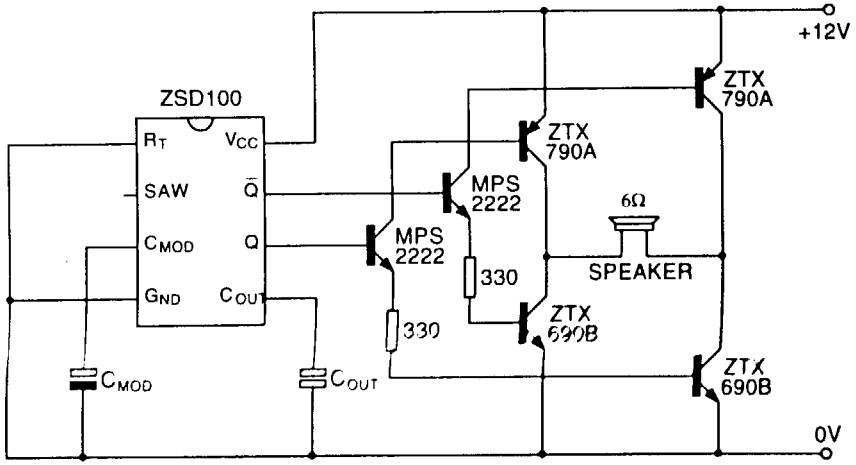
APPLICATIONS CIRCUITS

Piezo Sounder



Utilizing a standard autotransformer driven piezo sounder, this circuit indicates a minimum component count alarm solution. In this configuration a ZTX605 darlington transistor can be connected directly to the ouput of the IC without the need for base resistors.

Moving Coil Loudspeaker Sounder



Moving coil loudspeakers are often used for the very highest output automotive alarm sounders. The ZSD100 complementary outputs, with the selection of ZTX790A and ZTX690B transistors, can drive this H bridge ouput circuit without any additional interface components.

ZSD100

ABSOLUTE MAXIMUM RATINGS

V_{CC}	-0.5V Min to +20V Max
Operating Temperature Range	-40 to 125°C
Storage Temperature Range	-65 to 150°C
Power Dissipation	625mW MAX

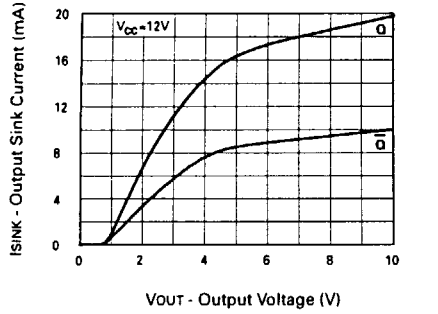
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated): T_{amb}=25°C, V_{CC}=12V

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	CONDITIONS.
Supply Voltage Operating Range	V_{CC}	4V		18V	
Supply Current Disabled Enabled	I_{CC}			 1µA 25mA	 R_T O/C, V_{CC}=18V R_T, Q, Q̄ at Gnd, V_{CC}=18V
Modulating Oscillator Frequency Range	F_{MOD}	0.1Hz		10Hz	V_{CC}=4 to 18V
Frequency Value See Note 1	F_{MOD}	0.34Hz 0.51Hz	0.43Hz 0.55Hz	0.52Hz 0.59Hz	R_T=0, C_{MOD}=10µF R_T=470kΩ, C_{MOD}=1µF
Output Oscillator Frequency Range	F_{OUT}	100Hz		10kHz	VCC=4 to 18V
Centre Frequency Deviation Duty Cycle See Note 2	F_{OUT} ΔF_{OUT}	1.01kHz	1.26kHz ±33% 49%	1.58kHz 55%	R_T=0, C_{OUT}=22nF
Output Source Current Sink Current Open Circuit Voltage	I_{SOURCE} I_{SINK} $V_{OUT(HIGH)}$ $V_{OUT(LOW)}$	 5mA 0.5mA V_{CC}-1.5V		 0.5V	 V_{OUT}=1.4V V_{OUT}=1.4V I_{OUT}=100µA I_{SINK}=0.1µA
Frequency Control Components Internal Resistor External Resistor Modulation Capacitor Output Capacitor	 R_T (INT) R_T (EXT) C_{MOD} C_{OUT}	 0 0.1µF 1nF	 61.5kΩ	 1MΩ 10µF 100nF	

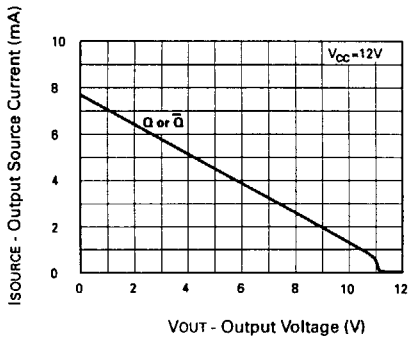
Note 1. $F_{MOD} = \frac{2850}{C_{MOD}(61.5+R_T(EXT))}$ Hz — C_{MOD} in µF, R_T (EXT) in kΩ

Note 2. $F_{OUT} = \frac{1710}{C_{OUT}(61.5+R_T(EXT))}$ kHz — C_{OUT} in µF, R_T (EXT) in kΩ

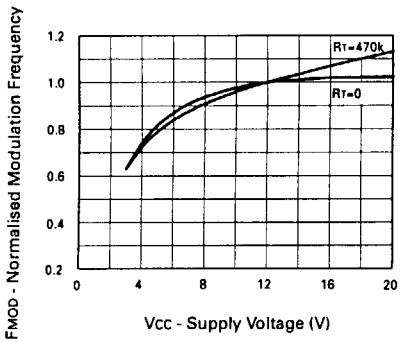
TYPICAL CHARACTERISTICS



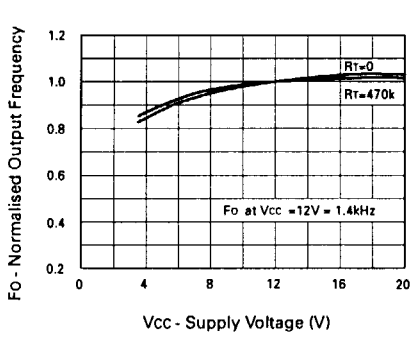
ISINK vVOUT



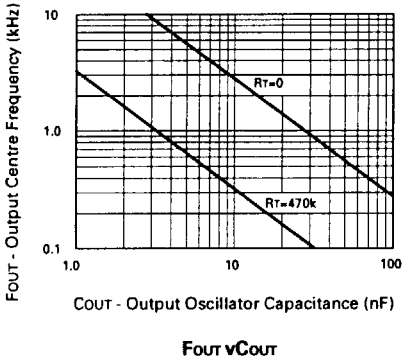
ISOURCE vVOUT



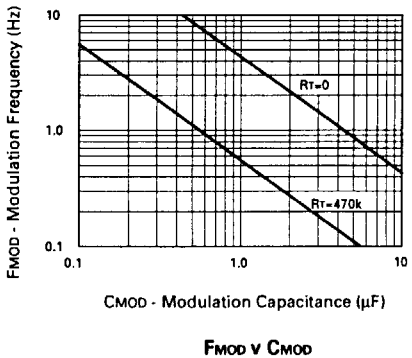
FMOD vVCC



FO vVCC



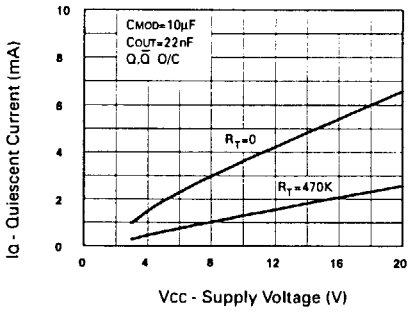
FOUT vCOUT



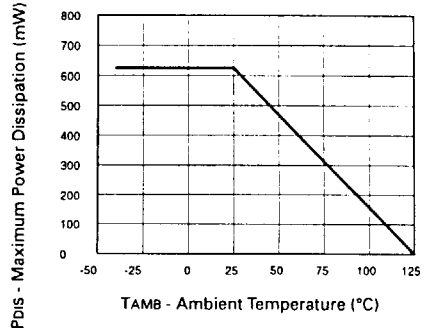
FMOD v CMOD

ZSD100

TYPICAL CHARACTERISTICS



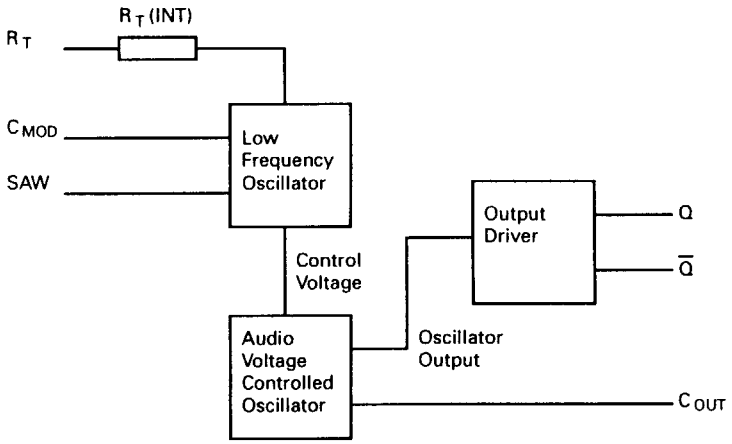
IQ v VCC



Derating Curve

FUNCTIONAL DESCRIPTION

The audio signal of the ZSD100 is generated using a squarewave oscillator whose output is capable of directly driving a wide range of output circuits. To produce a characteristic alarm siren sound, the frequency of the audio oscillator is swept over a fixed 2:1 range by a second, low frequency oscillator. The freqencies of both oscillators are controlled by R_T(INT) and capacitors C_{MOD} and C_{OUT}.



PIN DESCRIPTIONS

1. R_T — Optional external resistor for improved frequency control. An external resistor improves the control of both the modulating and output oscillators.

   The R_T pin is also used to power the device down. Either connecting R_T to V_{CC} or an open circuit will result in the device being disabled.

2. SAW — Selection of modulation waveform is made using the SAW pin. An open circuit produces a triangle wave, sawtooth is achieved by connecting SAW to the C_{MOD} pin.

3. C_{MOD} — An external capacitor is used to program the low frequency modulating oscillator. The value of C_{MOD} recommended is between 0.1µF and 10µF.

4. G_{ND}

5. C_{OUT} — An external capacitor is used to program the output oscillator. The value of C_{OUT} recommended is between 1nF and 100nF.

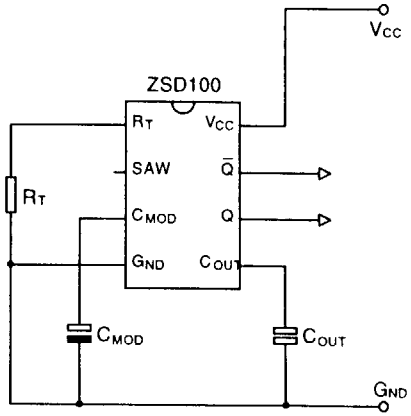
6. Q — Non inverted output driver

7. $\overline{Q}$ — Inverted output driver

8. V_{CC}

ZSD100

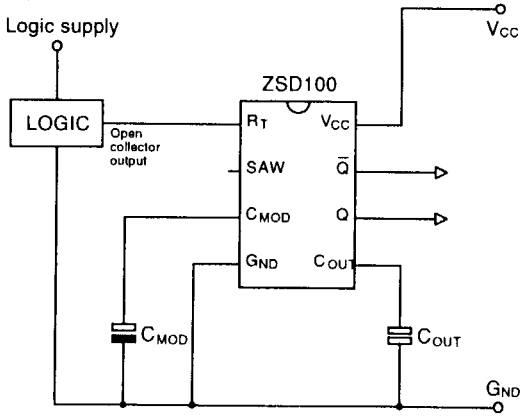
Improved Frequency Control



Improved frequency control can be achieved with an external resistor between the R_T pin and G_{ND}. An external resistor reduces the value of the timing capacitors required for the selected operating frequency and also reduces the ZSD100's power consumption.

Note: The outputs of the ZSD100 have been designed to avoid cross-conduction in full bridge output circuits. Large value external timing resistors can lead to a small level of cross-conduction. It is recommended that external timing resistors are not used with bridge output circuits.

Remote Switching



If the R_T pin is switched open-circuit, all internal functions of the IC are shut down.

Note: A small leakage current in the open collector logic controller will enable the IC. If such leakage cannot be eliminated, its effect can be easily negated by adding a high value resistor (eg. 100k) between pin R_T and V_{CC}. This resistor will have no effect on frequency control.

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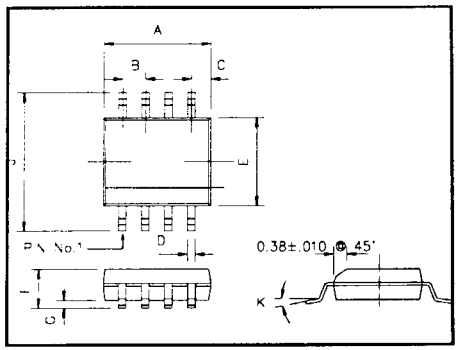
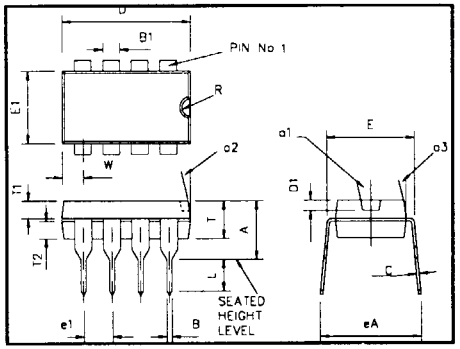
ZSD100

SO8



DIL8



DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.80	4.98	0.189	0.196
B	1.27 BSC		0.05 BSC	
C	0.53 REF		0.02 REF	
D	0.36	0.46	0.014	0.018
E	3.81	3.99	0.15	0.157
F	1.35	1.75	0.05	0.07
G	0.10	0.25	0.004	0.010
H	7° BSC		7° BSC	
I	0.19	0.25	0.007	0.010
J	5.80	6.20	0.23	0.24
K	0°	8°	0°	8°
L	0.41	1.27	0.016	0.050

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A		4.32		0.17
B	0.46 Nom		0.018 Nom	
B1	1.52 Nom		0.06 Nom	
C	0.25 Nom		0.01 Nom	
D	8.79	8.99	0.34	0.35
D1	0.76	1.52	0.03	0.06
E	7.49	8.13	0.29	0.32
E1	6.25	6.45	0.245	0.254
eA	8.13	9.40	0.32	0.37
e1	2.54 Nom		0.1 Nom	
L	3.08	3.28	0.12	0.13
R	0.76 Nom		0.03 Nom	
T	3.20	3.40	0.126	0.134
T1	1.52 Nom		0.06 Nom	
T2	1.52 Nom		0.06 Nom	
W	0.64 Ref		0.025 Ref	
a1	4°	10°	4°	10°
a2	4°	10°	4°	10°
a3	4°	10°	4°	10°

ORDERING INFORMATION

Part Number	Package	Partmark
ZSD100D8	DIL8	ZSD100
ZSD100N8	SO8	ZSD100

ZETEX Zetex plc.
Fields New Road, Chadderton, Oldham, OL9-8NP, United Kingdom.
Telephone: 0161-627 5105 (Sales), 0161-627 4963 (General Enquiries)
Facsimile: 0161-627 5467

Zetex GmbH
Drosselweg 30
D-81827 München
Telefon: (089) 430 90 29
Fax: (089) 439 37 64

Zetex Inc.
87 Modular Avenue
Commack NY11725
Telephone: (516) 543-7100
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AUTOMOTIVE AND HOUSEHOLD SECURITY SIREN DRIVER

ZSD100

ISSUE 4 – MAY 1995

INTRODUCTION

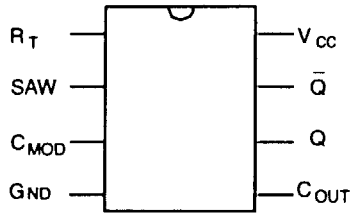
The ZSD100 is a frequency swept alarm signal generator designed specifically for static and automotive security alarm systems. One ZSD100, two timing capacitors, an in-expensive TO92 darlington, piezo transducer and coupling transformer is all that is necessary to produce an ear piercing 120 dB alarm siren.

Including an audio frequency signal generator, low frequency sweep generator, disable circuitry and output driver stages, the ZSD100 provides every function necessary to produce a standard alarm signal. Available in either an 8 pin DIL or SO package the IC gives a low cost compact solution to siren signal generation. The device operates from supplies of 4V up to 18V and is ideal for security alarms in battery powered applications, burglar alarms and automotive anti theft systems.

FEATURES

- 4-18V Operating voltage range.
- Small external component count.
- Direct drive of darlington, mosfet and IGBT output stages.
- Single ended or push-pull output stages.
- Suitable for automotive and static alarm systems.
- Low supply current - 10mA operating
  - 1µA sleep mode
- Low cost 8 pin DIL & SO packages.
- User selected audio and sweep frequencies.
- -40°C to 125°C operating temperature range.
- Choice of modulation waveform.

PIN CONNECTIONS



DIL8 or SO8

ZETEX

ZSD100 Siren Driver ASIC

The ZSD100 is a linear bipolar ASIC designed specifically to complement the drive circuits described above. The device utilises an 8 pin dual in line package and a minimum number of external components to generate a frequency swept signal suitable for either static or automotive security alarm systems. Fig 3 shows a schematic of the device.

As with other circuit approaches the device consists of a low frequency oscillator, which generates a control voltage to modulate the on-board voltage controlled oscillator.

The output stage of the device consists of a complementary driver which works equally well whether driving MOSFET's or IGBT's as alternatives to the bipolar transistor circuits shown. The output configuration enables not only the drive requirements required for full bridge circuits, as described above, but also single ended drive circuits such as would be required for piezo transducers, the other popular alarm sound generating device. This circuit is shown in Fig 4.

The frequency programming of the device can be achieved with only two capacitors, although an extra pin is provided which provides improved control of the both the low and high frequency oscillators if an external resistor is used, see Fig 5. Selection of the appropriate capacitors gives a low frequency sweep in the range 0.1 to 10Hz and an output frequency modulated between 100Hz and 10KHz.

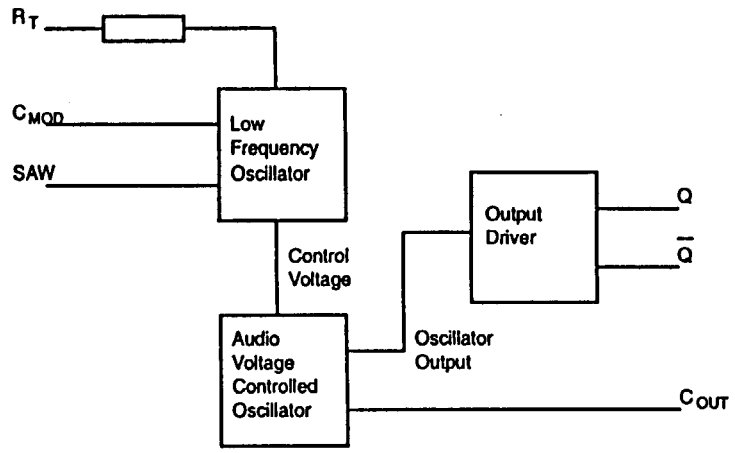


Figure 3
Schematic of the ZSD100

H-bridge circuits

Zetex recommend the use of their Super E-line transistors in this application. These TO92 style components have three important features which are exploited in addressing the problems described above.

Zetex discrete transistors use an exceptionally efficient matrix die geometry to achieve very low saturation voltages, $V_{CE(sat)}$, which is ideal for high current switching applications. This means for the typical operating currents required, normally in the region of 2A, there is very low dissipation and therefore minimal temperature rise. For example the ZTX690B devices shown in the diagram, with I_C=2A and I_B=20mA have a saturation voltage of only 300mV.This performance factor means that the need to divert leakage currents at high temperatures is removed and so the usual base emitter resistors are no longer required. This may be particularly important in automotive applications where the operating environment can produce very high temperatures.

The devices chosen for this application also possess an excellent reverse beta. Using the previous example, the ZTX690B has a typical peak beta of 125 in the reverse mode. This means that these transistors are still operating even with reverse transients such as those generated when driving an inductive load. The benefit of this is that for siren driving applications the need for collector emitter protection diodes is removed.

A further benefit of the transistor matrix design and low saturation voltage is that the devices can be housed in a very small package. The Zetex E-line package is smaller than a TO92 yet the performance of the devices matches that of similar TO126 and TO220 components. The result of this is equivalent or superior performance within a much smaller space.

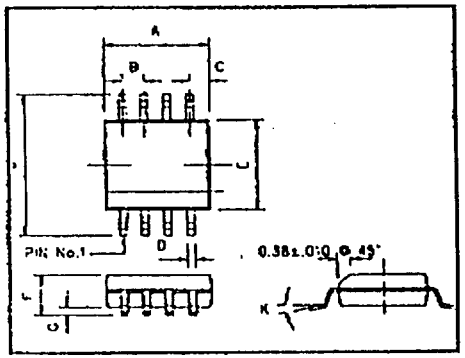
The circuit shown in Fig 2 has been designed to operate with a 6 ohm load impedance or higher. If a lower load impedance is required, say 4 ohms, then changing the transistors to a selection from the ZTX850 and ZTX950 series will provide up to 5 amps drive current.

The circuit we have shown has been tested and is 98.5% efficient- the resultant siren produces more than an ear piercing 120dB output.

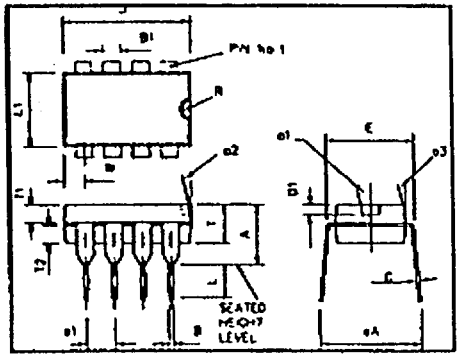
The drive circuit for this application has thus been minimised in terms of complexity, takes up less space, performs better and offers significant cost reductions.

ZSD100

SO8



DIL8



DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.37	4.77	0.17	0.18
B	2.16	2.41	0.085	0.095
C	3.61	4.01	0.14	0.16
D	13.00	13.97	0.51	0.55
E	NOM 1.27		NOM 0.05	
F	0.37	0.495	0.015	0.019

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.32	4.95	0.170	0.195
b	0.36	0.51	0.014	0.020
E	3.30	3.94	0.130	0.155
e	2.41	2.67	0.095	0.105
e1	1.14	1.40	0.045	0.055
L	12.70	15.49	0.500	0.610
R	2.16	2.41	0.085	0.095
S1	1.14	1.52	0.045	0.060
W	0.41	0.56	0.016	0.022
D	4.45	4.95	0.175	0.195
∝	4°	6°	4°	6°

ORDERING INFORMATION

Part Number	Package	Partmark
ZSD100D8	DIL8	ZSD100
ZSD100N8	SO8	ZSD100

ZETEX Zetex plc.
Fields New Road, Chadderton, Oldham, OL9 8NP, United Kingdom.
Telephone: 0161-627 5105 (Sales), 0161-627 4963 (General Enquiries)
Facsimile: 0161-627 5467

Zetex GmbH
Drosselweg 30
D-81927 München
Telefon: (089) 430 90 29
Fax: (089) 439 37 64

Zetex Inc.
67 Mackler Avenue
Commack NY 11725
Telephone: (516) 543-7100
Fax: (516) 864-7630

Zetex (Asia) Ltd.
3510 Metroplaza, Tower 2
Hing Fong Road, Kwai Fong
Telephone: 26100 611
Fax: 24250 494

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AUTOMOTIVE AND HOUSEHOLD SECURITY SIREN DRIVER

ZSD100

ISSUE 3 – MARCH 1995

INTRODUCTION

The ZSD100 is a frequency swept alarm signal generator designed specifically for static and automotive security alarm systems. One ZSD100, two timing capacitors, an in-expensive TO92 darlington, piezo transducer and coupling transformer is all that is necessary to produce an ear piercing 120 dB alarm siren.

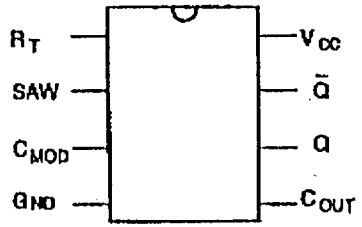
Including an audio frequency signal generator, low frequency sweep generator, disable circuitry and output driver stages, the ZSD100 provides every function necessary to produce a standard alarm signal. Available in either an 8 pin DIL or SO package the IC gives a low cost compact solution to siren signal generation. The device operates from supplies of 4V up to 18V and is ideal for security alarms in battery powered applications, burglar alarms, and automotive anti theft systems.

FEATURES

- 4-18V Operating voltage range.
- Small external component count.
- Direct drive of darlington, mosfet and IGBT output stages.
- Single ended or push-pull output stages.
- Suitable for automotive and static alarm systems.
- Low supply current - 10mA operating
  - 1µA sleep mode
- Low cost 8 pin DIL & SO packages.
- User selected audio and sweep frequencies.
- -40°C to 125°C operating temperature range.
- Choice of modulation waveform.

596-814

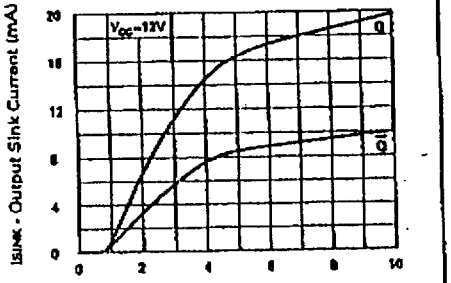
PIN CONNECTIONS



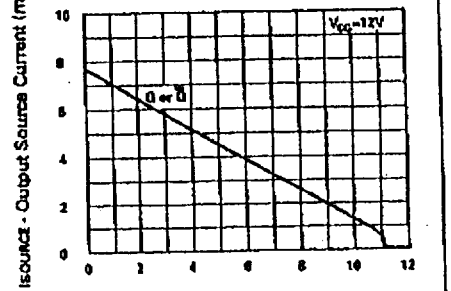
DIL8 or SO8

ZETEX

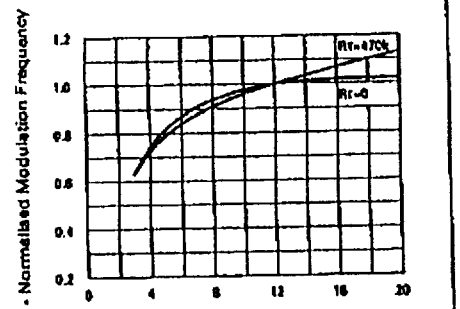
TYPICAL CHARACTERISTICS



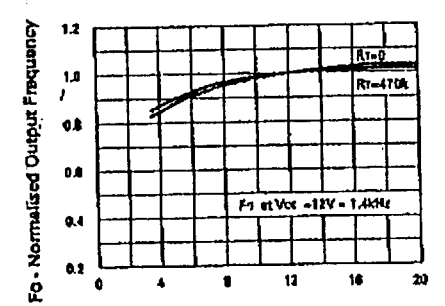
ISINK v VOUT



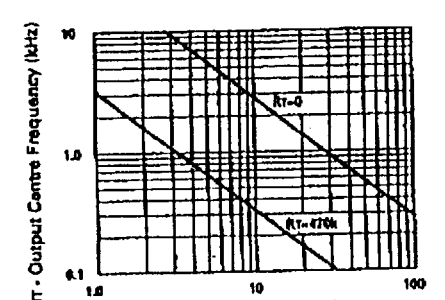
ISOURCE v VOUT



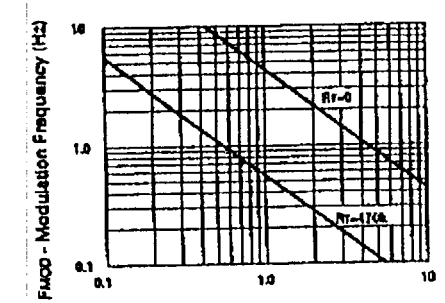
FMOD v VCC



FO v VCC



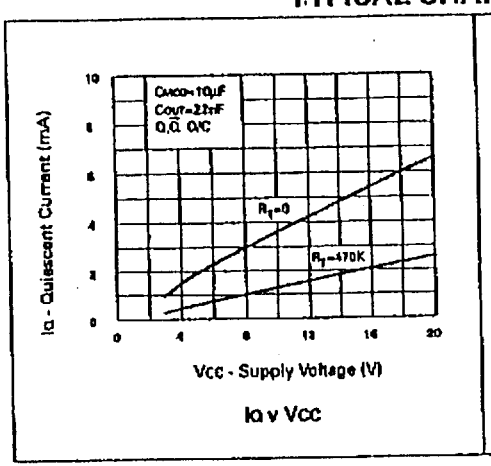
FOUT v COUT



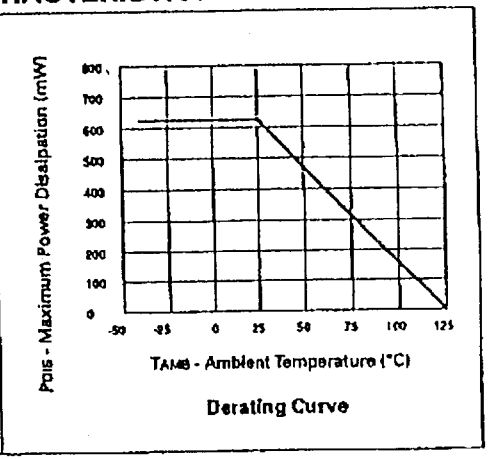
FMOD v CMOD

ZSD100

TYPICAL CHARACTERISTICS



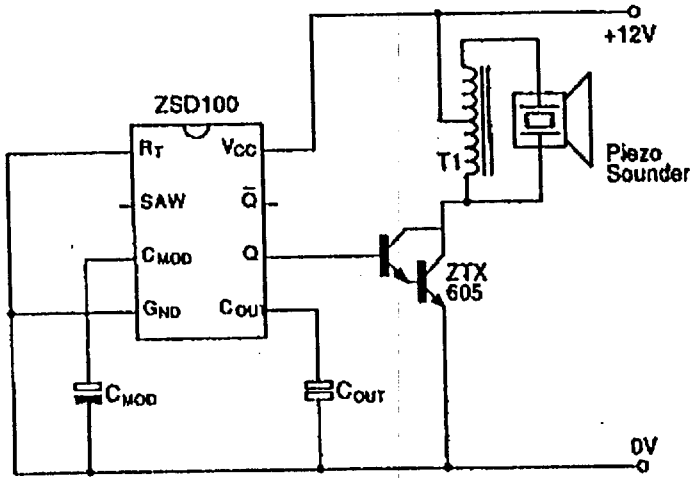
IQ v VCC



Derating Curve

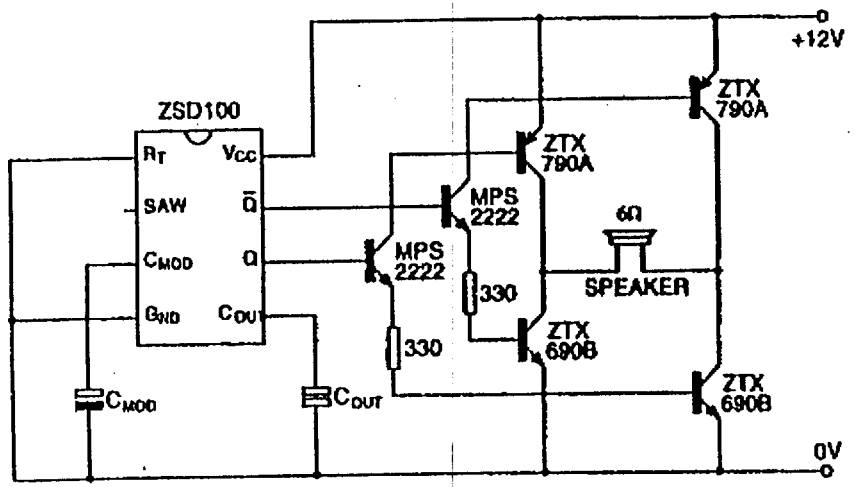
APPLICATIONS CIRCUITS

Piezo Sounder



Utilizing a standard autotransformer driven piezo sounder, this circuit indicates a minimum component count alarm solution. In this configuration a ZTX605 darlington transistor can be connected directly to the ouput of the IC without the need for base resistors.

Moving Coil Loudspeaker Sounder



Moving coil loudspeakers are often used for the very highest output automotive alarm sounders. The ZSD100 complementary outputs, with the selection of ZTX790A and ZTX690B transistors, can drive this H bridge ouput circuit without any additional interface components.

ZSD100

ABSOLUTE MAXIMUM RATINGS

V_{CC}	-0.5V Min to +20V Max
Operating Temperature Range	-40 to 125°C
Storage Temperature Range	-65 to 150°C
Power Dissipation	625mW MAX

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS (Unless otherwise stated): T_{amb}=25°C, V_{CC}=12V

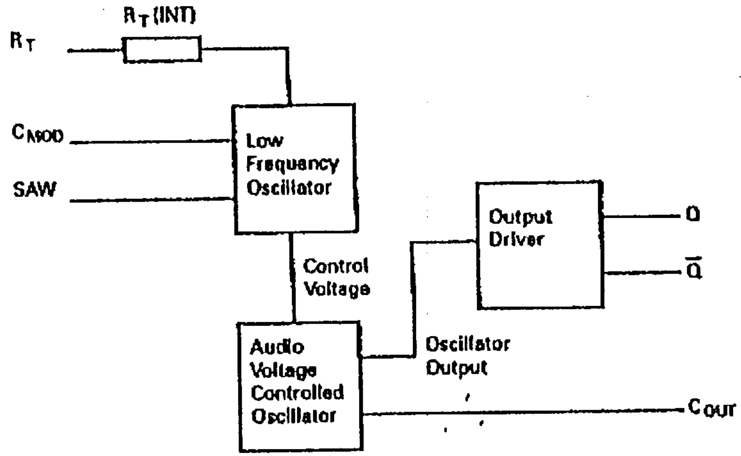
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	CONDITIONS.
Supply Voltage Operating Range	V_{CC}	4V		18V	
Supply Current Disabled Enabled	I_{CC}			1µA 25mA	R_T O/C, V_{CC}=18V R_T, Q, Q̄ at Gnd, V_{CC}=18V
Modulating Oscillator Frequency Range	F_{MOD}	0.1Hz		10Hz	V_{CC}=4 to 18V
Frequency Value See Note 1	F_{MOD}	0.34Hz 0.51Hz	0.43Hz 0.55Hz	0.52Hz 0.69Hz	R_T=0, C_{MOD}=10µF R_T=470kΩ, C_{MOD}=1µF
Output Oscillator Frequency Range	F_{OUT}	100Hz		10kHz	VCC=4 to 18V
Centre Frequency Deviation Duty Cycle See Note 2	F_{OUT} ΔF_{OUT}	1.01kHz	1.26kHz ±33% 49%	1.58kHz 55%	R_T=0, C_{OUT}=22nF
Output Source Current Sink Current Open Circuit Voltage	I_{SOURCE} I_{SINK} $V_{OUT(HIGH)}$ $V_{OUT(LOW)}$	5mA 0.5mA V_{CC}-1.5V		 0.5V	V_{OUT}=1.4V V_{OUT}=1.4V I_{OUT}=100µA I_{SINK}=0.1µA
Frequency Control Components Internal Resistor External Resistor Modulation Capacitor Output Capacitor	 R_T (INT) R_T (EXT) C_{MOD} C_{OUT}	 0 0.1µF 1nF	 61.5kΩ	 1MΩ 10µF 100nF	

Note 1. $F_{MOD} = \frac{2850}{C_{MOD}(61.5+R_T(EXT))}$ Hz — C_{MOD} in µF, R_T (EXT) in kΩ

Note 2. $F_{OUT} = \frac{1710}{C_{OUT}(61.5+R_T(EXT))}$ kHz — C_{OUT} in µF, R_T (EXT) in kΩ

FUNCTIONAL DESCRIPTION

The audio signal of the ZSD100 is generated using a squarewave oscillator whose output is capable of directly driving a wide range of output circuits. To produce a characteristic alarm siren sound, the frequency of the audio oscillator is swept over a fixed 2:1 range by a second, low frequency oscillator. The freqencies of both oscillators are controlled by R_T(INT) and capacitors C_{MOD} and C_{OUT}.



PIN DESCRIPTIONS

1. R_T — Optional external resistor for improved frequency control. An external resistor improves the control of both the modulating and output oscillators.

   The R_T pin is also used to power the device down. Either connecting R_T to V_{CC} or an open circuit will result in the device being disabled.

2. SAW — Selection of modulation waveform is made using the SAW pin. An open circuit produces a triangle wave, sawtooth is achieved by connecting SAW to the C_{MOD} pin.

3. C_{MOD} — An external capacitor is used to program the low frequency modulating oscillator. The value of C_{MOD} recommended is between 0.1µF and 10µF.

4. G_{ND}

5. C_{OUT} — An external capacitor is used to program the output oscillator. The value of C_{OUT} recommended is between 1nF and 100nF.

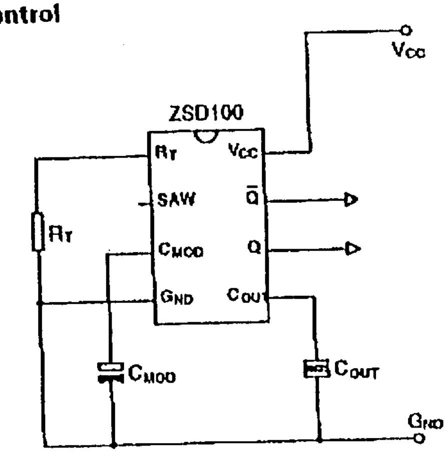
6. Q — Non inverted output driver

7. $\overline{Q}$ — Inverted output driver

8. V_{CC}

ZSD100

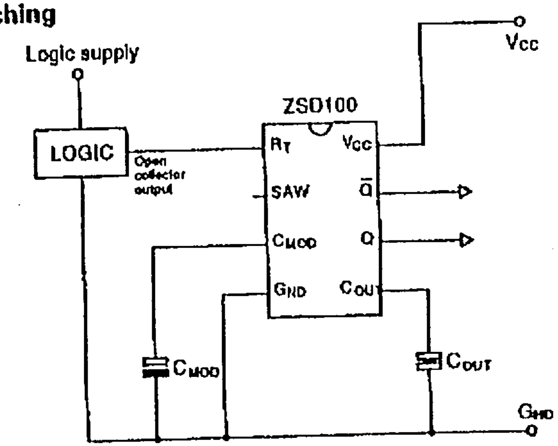
Improved Frequency Control



Improved frequency control can be achieved with an external resistor between the R_T pin and G_{ND}. An external resistor reduces the value of the timing capacitors required for the selected operating frequency and also reduces the ZSD100's power consumption.

Note: The outputs of the ZSD100 have been designed to avoid cross-conduction in full bridge output circuits. Large value external timing resistors can lead to a small level of cross-conduction. It is recommended that external timing resistors are not used with bridge output circuits.

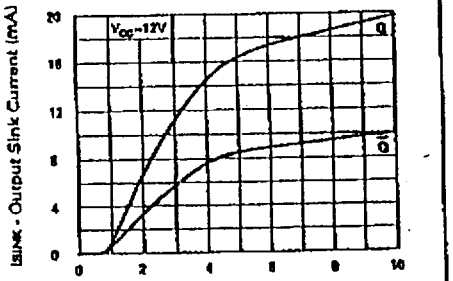
Remote Switching



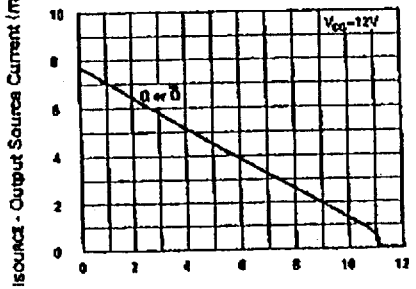
If the R_T pin is switched open-circuit, all internal functions of the IC are shut down.

Note: A small leakage current in the open collector logic controller will enable the IC. If such leakage cannot be eliminated, its effect can be easily negated by adding a high value resistor (eg. 100k) between pin R_T and V_{CC}. This resistor will have no effect on frequency control.

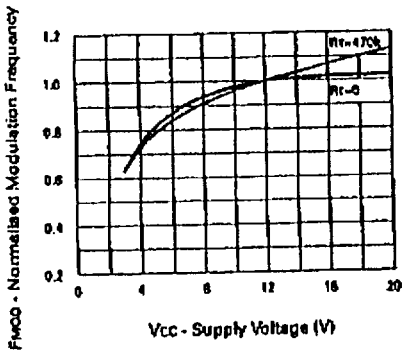
TYPICAL CHARACTERISTICS



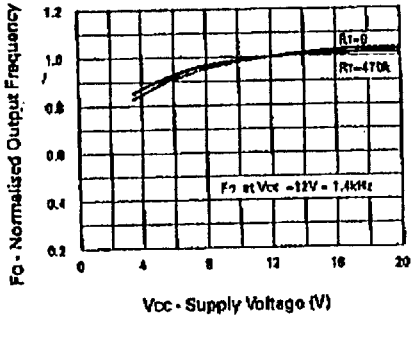
ISINK v VOUT



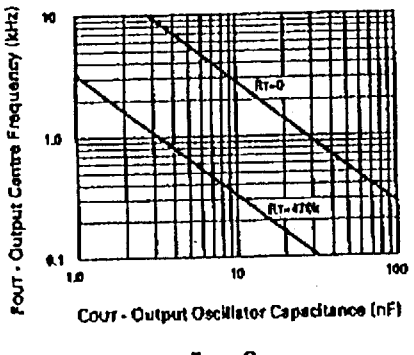
ISOURCE v VOUT



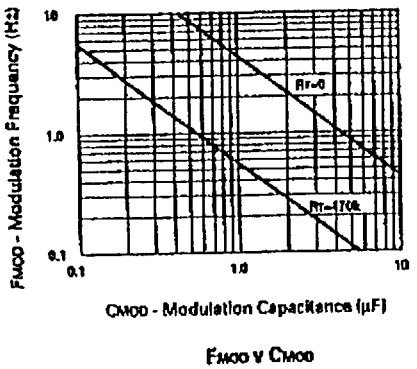
FMOD v VCC



FO v VCC



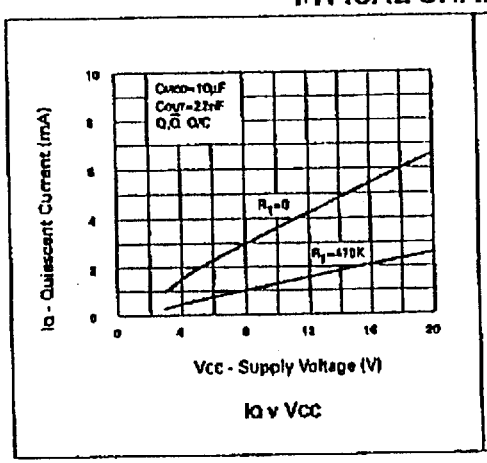
FOUT v COUT



FMOD v CMOD

ZSD100

TYPICAL CHARACTERISTICS



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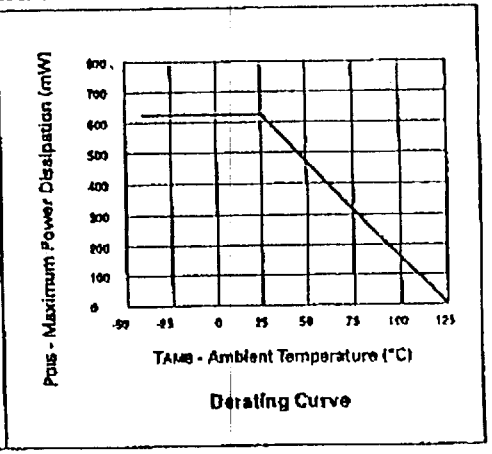

Derating Curve

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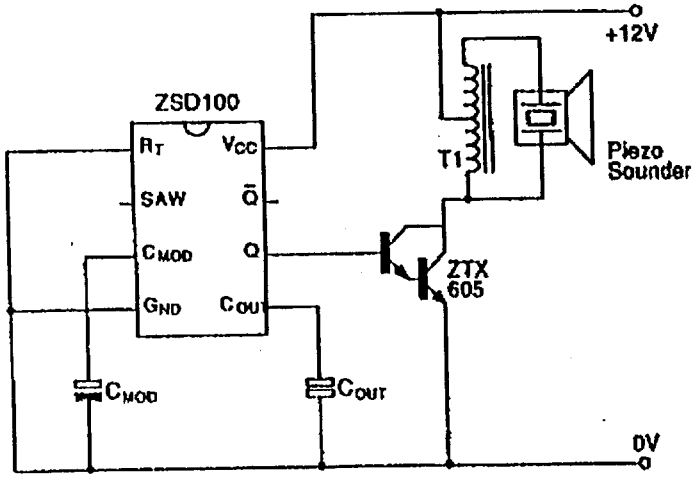

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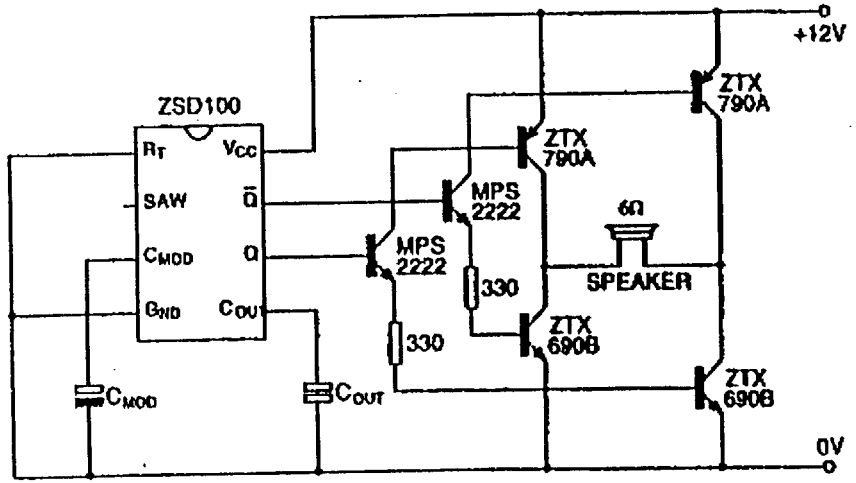

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Frequency Control Components Internal Resistor External Resistor Modulation Capacitor Output Capacitor	 R_T (INT) R_T (EXT) C_{MOD} C_{OUT}	 0 0.1µF 1nF	 61.5kΩ	 1MΩ 10µF 100nF	

Note 1. $$F_{MOD} = \frac{2850}{C_{MOD}(61.5+R_T(EXT))} Hz$$ C_{MOD} in µF, R_T (EXT) in kΩ

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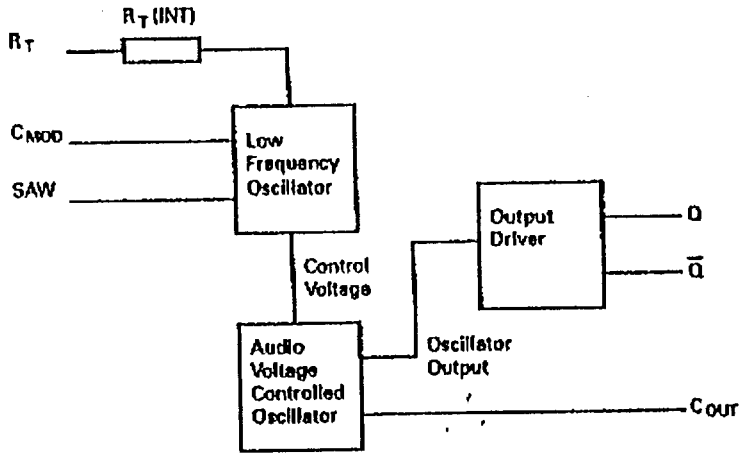

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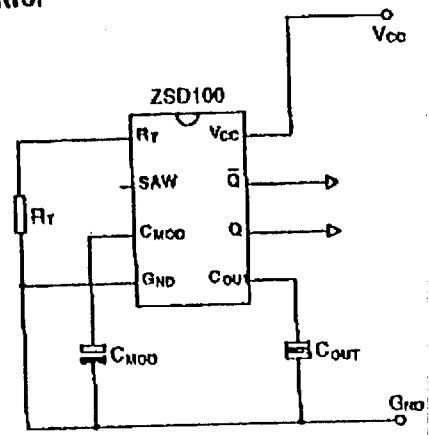
8.	V_{CC}	

ZSD100

Improved Frequency Control



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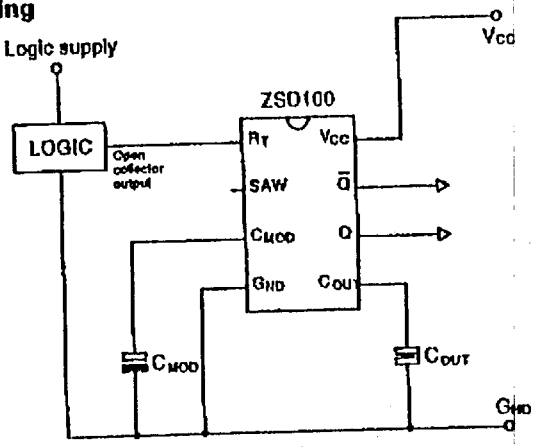
Remote Switching



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