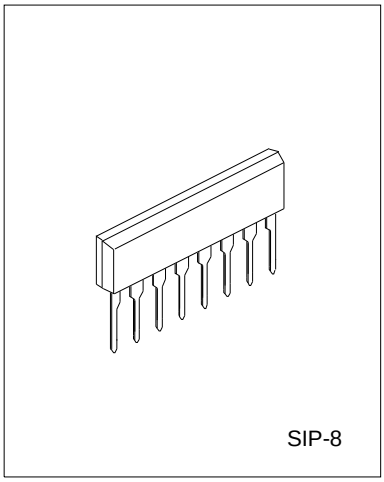
PROTECTOR IC FOR STEREO POWER AMPLIFIER



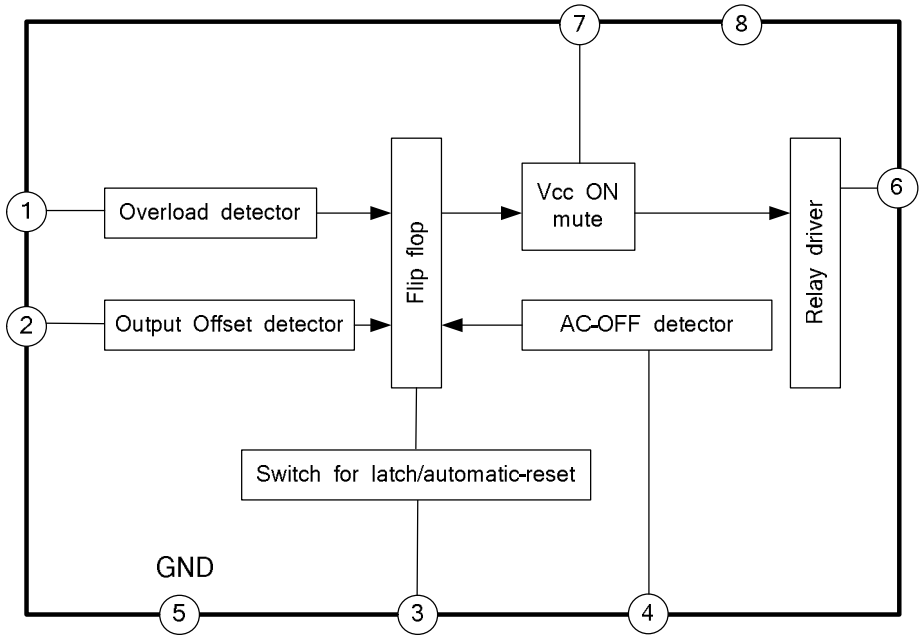
DESCRIPTION

UTC1237 is a monolithic integrated designed for protecting stero power amplifiers and loudsperkers.

FEATURES

* Work stably within a wide power suppy voltage range(v_{cc}=25 to 60V).
* Contain a relay driver(Max I_6=80mA)
* Work as either latching function or automatic resetting function by using pin 3. (in both overload detection and output offset detection, either function can be selected.)
* Need only single power supply
* Both positive and negative output offset can be detected through the same pin.(output offset detection through pin 2)
* AC voltage can be detected.(for AC-power OFF mute through pin 4)
* The time delay from amplifier power ON to relay ON can be freely set by selecting external components.(For AC-power-ON mute through pin 7)
* The moment that amplifier-power is turned off, it can make relay broken OFF and then loudsperker disconnected from amplifier to prevent a shock off noise.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristic	Symbol	Value	Unit
Power Supply Voltage	Vcc	60	V
Allowable Power Dissipation	P_D	320*	mW
Operational Temperature	Topt	-20 to +75	°C
Strong Temperature	Tstg	-40 to +125	°C
Pin 6 Maximum Current	I_6max	80	mA
Pin 4 Maximum Voltage	V_4max	10	V
Pin 8 Maximum Voltage	V_8max	8	V
Pin 1 Maximum Current	I_1ax	3	mA
Pin 2 Maximum Current	I_2max	± 3	mA
Pin 7 Maximum Voltage	V_7max	8	V

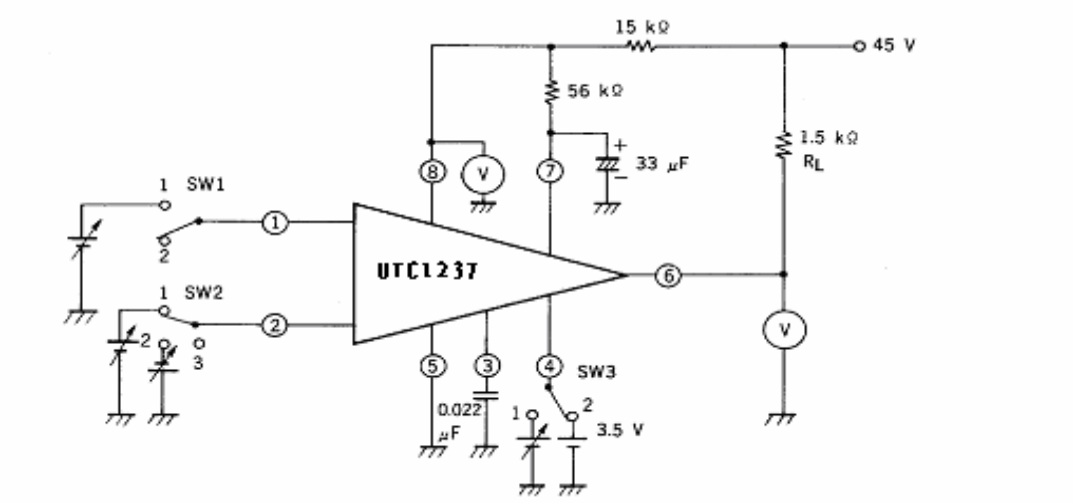
RECOMMENDED OPERATING CONDITION

Supply Voltage Vcc=25 to 45 to 60V

ELECTRICAL CHARACTERISTICS (Vcc=12V,Ta=+25°C,f=10.7MHZ,unless otherwise specified)

Characteristic	Symbol	Min	Typ.	Max	Unit	Condition
Pin 1 Threshold Voltage	Vth 1	0.58	0.67	0.76	V	Level to invert at pin 6
Pin 2 Positive Threshold Voltage	Vth +2	0.54	0.62	0.70	V	Level to invert at pin 6
Pin 2 Negative Threshold Voltage	Vth -2	-0.12	-0.17	-0.23	V	Level to invert at pin 6
Pin 4 Threshold Voltage	Vth 4	0.60	0.74	0.90	V	Level to invert at pin 6
Pin 8 Reference Voltage	V8	3.0	3.4	3..8	V	R_L=1.5KΩ

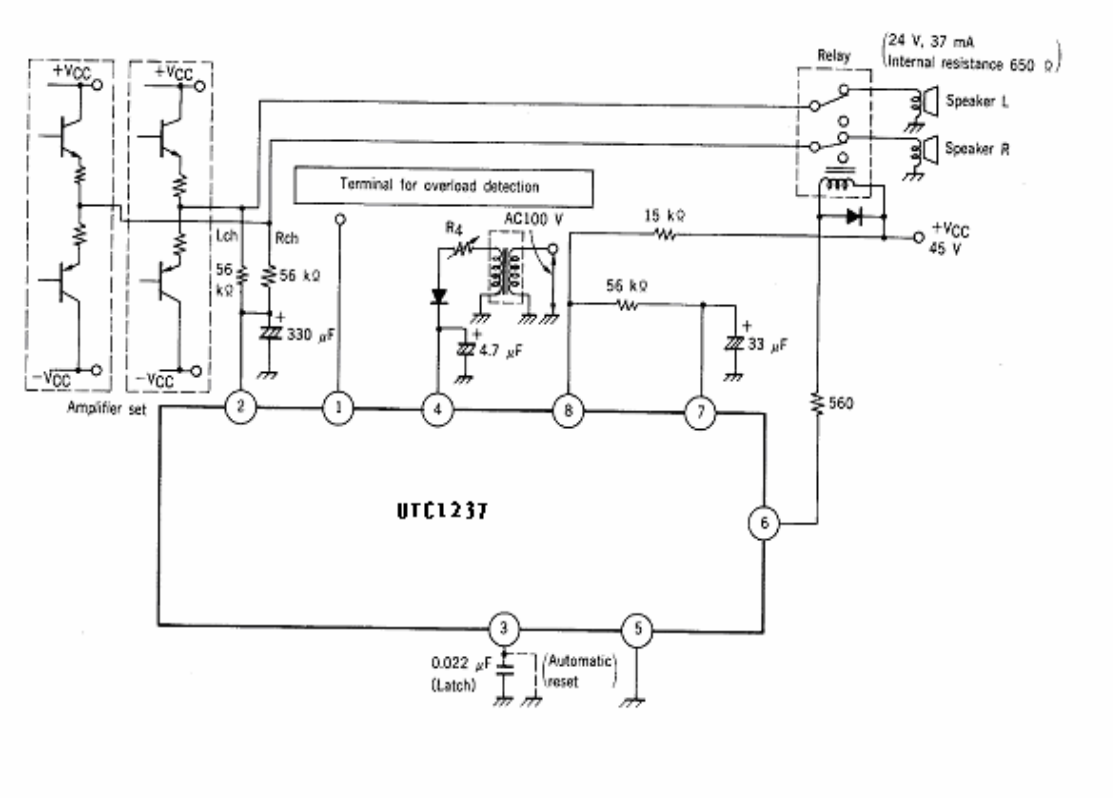
TEST CIRCUIT(State using latchung function)



SWITCH POSITIONS

Item	SW 1	SW 2	SW 3
Vth 1	1	3	2
Vth +2	2	1	2
Vth -2	2	2	2
Vth 4	2	3	1
V 8	2	3	2

TYPICAL APPLICATION CIRCUIT


+Vcc
+Vcc
-Vcc
-Vcc
Amplifier set
Relay
(24 V, 37 mA
Internal resistance 650 Ω)
Speaker L
Speaker R
Terminal for overload detection
Lch
Rch
56 kΩ
56 kΩ
330 μF
R4
AC100 V
4.7 μF
15 kΩ
56 kΩ
33 μF
+Vcc
45 V
560
UTC1237
2
1
4
8
7
6
3
5
0.022 μF
(Latch)
(Automatic
reset)

NOTE OFR USING UTC1237

1. FUNCTION FOR OUTPUT OFFSET DETECTION(pin 2)

1) If too much DC current flows through a speaker voice coil due to large output offset DC level, the voice coil might be overheated and the speaker might be brken. To prebent the damage, it is necessary to detect the Output Offset DC level and to disconnect the sperker from the power amplifier by breaking off a relay if the detected DC level is shfted beyond a threshold level. UTC1237 has a function to detect both the positive and the negative Output Offset DC level with its single power supply. As shown below, you can easily make the positive and the negative threshold level equivalent and also set up their level by choosing proper resistances.

2) How to determine the threshold levels of Output Offset detection.(± Vth)

(1)The threshold level of positive output offset detection(+Vth)is given by Eq.(1)

$$+Vth = (2 + \frac{R_A}{R_C}) \cdot Vth^{+}2 \quad \text{.....(1)}$$

Where $Vth^{+}2$ is the original positive threshold level of pin 2, and $Vth^{+}2$ =0.62V TYP.

(2)The threshold level of positive output offset detection(-Vth)is given by Eq.(2)

$$-Vth = -\left\{ -Vth^{-}2 \cdot (2 + \frac{R_A}{R_C}) + I_{c2} \cdot R_A \right\} \quad \text{.....(2)}$$

Where $Vth^{-}2$ is the original negative threshold level of pin2,and

$Vth^{-}2$=-0.17V TYP

And I_{C2} is the current from Mpc1237 and,

I_{C2}=12.5μA TYP

At nearly -Vth

3) You can easily find how to make ±Vth level equivalent as showm below

$$(2 + \frac{R_A}{R_C}) \cdot Vth^{+}2 = -\left\{ -Vth^{-}2 \cdot (2 + \frac{R_A}{R_C}) + I_{c2} \cdot RA \right\}, \quad \text{.....(3)}$$

Therefore determine RA,RB and RC from Eq.(3)

Attention: The original positive and neagative threshold level at pin 2 without any resistances are unbalanced;+Vth=0.62 V TYP.and −Vth=-0.17V TYP.

Example of design

If you need the output offset threshold level ±2.0V,determine R_A,R_B and R_C as shown below.

(1) Substitute 2.0 to +Vth in Eq.(1) and obtain R_A/R_c.

$$2.0 = (2 + \frac{R_A}{R_C}) \times 0.62$$

$$\frac{R_A}{R_C} \fallingdotseq 1.226$$

(2) Substitute-2.0 to −Vth in Eq.(2)and obtain RA(RB)anf RC.

$$-2.0 = -0.17\,(2 + 1.226) - 12.5\,(\mu A) \times R_A\,(k\Omega)\,(V)$$

$$R_A = 116.1\ k\Omega$$

$$R_C = 94.7\ k\Omega$$

Therefore, if you need ±Vth to be 2.0 volts ,choose RA,RB and RC as shown below.

RA=RB=120 kΩ and RC=91 kΩ

The lower limits of RA and RB are given by maximum rating (± 3mA) of pin 2 and

$$\frac{\pm V_{CC}}{R_A(B)} < \pm 3\ (mA)$$

In case of recommended condition ,that is RA=RB=56 kΩ and RC=∞, ±Vth can be obtained as shown below.

$$[1]\ +Vth = (2 + \frac{56\ (k\Omega)}{\infty})\ \ 0.62 = 1.24\ (V)$$

$$[2]\ -Vth = -0.17\,(2 + \frac{56\ (k\Omega)}{\infty}) - 12.5\,(\mu A) \times 56\,(k\Omega) = -1.04\ (V)$$

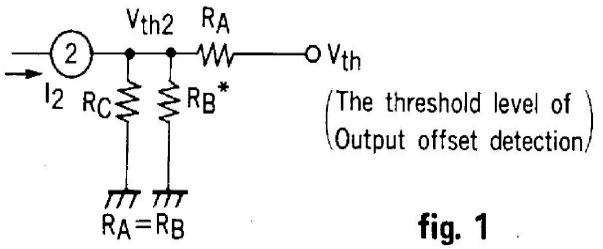


fig. 1

- Rch power amplifier output terminal is usually an imaginally GND as seen from Lch power amplifier ,so that the equivalent circuit can be obtained as shown above.

2. FUNCTION OF AC LEVEL DETECTION

When you turn off the power switch, it sometimes causes a shock-off noise, therefore it is necessary to break off the relay and then to keep the power amplifier apart from loud sperker at the moment that power switch is turned off. In other words, the protection circuit is required to have a function to detect that power-off time. However, in fact, it is difficult to detect that power-off time from actual DC supply voltage line. Because it cannot be turned 0 v instantaneously due to a large capacitance inserted between the power supply line and GND. In case of UTC1237, it can detect this power-off time fron AC power supply directly, that si, this is a function to detect AC level.

The AC power supply level(usuall 50Hz or 60Hz)can be transmitted to pin 4through a half-wave rectification circuit as shown below.

And it works within a wide range of AC level by choosing a proper resistance as R4(Refer to the characteristic curve shown as fig.5 for the choice of R4). If power switch is turned off while the relay is being made ON and the speaker is being connected to the power amplifier output, the relay will be broken OFF to disconnect the speaker after a time delay(AC OFF mute) according to the discharge time constant determined by the voltage on pin 4, the external capacitance C4, and the internal resistance of the IC.

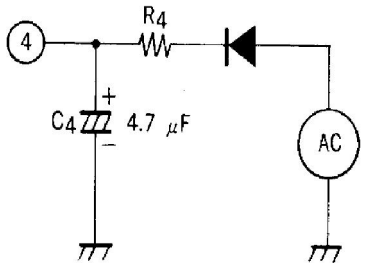


fig. 2

3. FUNCTION OF OVERLOAD DETECTION(pin 1)
The original threshold level of pin 1 is 0.67 V TYP. In case of using a constant-current drive, as the means of detection, the threshold current level is 110μA TYP. When current which is large than 110μA flows to the IC, the relay will be broken OFF.
Note: the overload detection circuit is not included in the IC because of patent problems. Use the external circuit as an overload detecton.

4. FUNCTION OF LATCHING AND AUTOMATIC RESETTING(pin 3)
If the IC detects the abnormal condition such as the large output offset level or the overlaod, the IC can make the relay broken OFF. And then, two functions can be selected after the condition returns to the normal state. One is that the relay is made ON automatically and the other is that it keeps the relay broken off until once the power switch is turned off and then is turned on again.
The former is a function of automatic resetting and the latter is a function of latching. UTC1237 has both functions and can be selected either function by using pin 3. In case of latching, connect pin 3 to the ground through the capacitor, which is for preventing misoperation. For automatic resetting, connect it to ground directy. This function si valid for both overload detection and output offset detection.

5. TIME DELAY FROM POWER AMPLIFIER POWER SWITCH ON TO RELAY ON (power-on mute at pin 7)
To suppress shock-on noise generated by power ON, a time delay is provided by connecting a circuit with a time constant. This time delay is set to make relay ON to connect sperkers after enough time for the power amplifier and the the preamplifier to reach a stable operating condition. The ON mute time is determined as follows,

$$T\,(\text{ON mute}) = -C_7 \cdot R_7 \cdot \ell n \frac{V_8 - V_7}{V_8},$$

Where V8 is reference voltage at pin 8,3.40 volts,TYP,and V7 is threshold level at pin 7,2.06 volts,TYP.

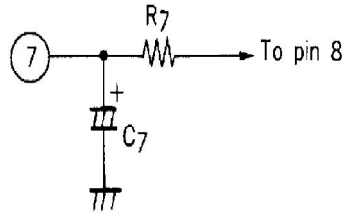
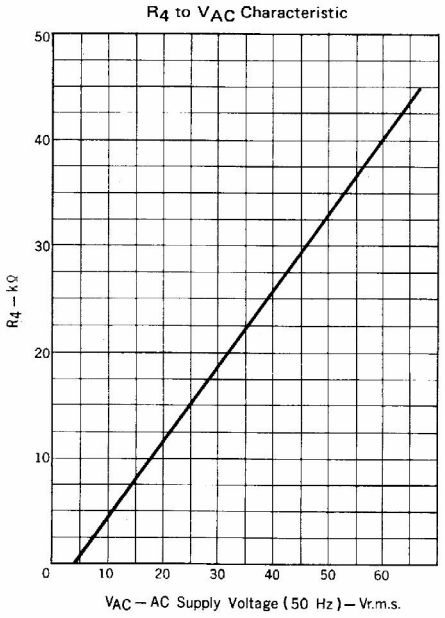


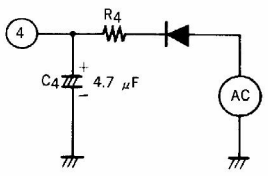
fig. 3

6. HOW TO MAKE IT WORK WITHIN A WIDE RANGE OF POWER SUPPLY VOLTAGE (Pin 8)
By choosing a proper resistance R8 connected to pin 8, the IC can work within a wide range of power supply voltage VCC from 25 to 60 volts.
In case that pin 8 is directly driven by a regulated power supply,set V8 to 3.40 volts,TYP.As for the choice of R8 value, refer to the characteristic curve shown as fig.6.

fig. 4

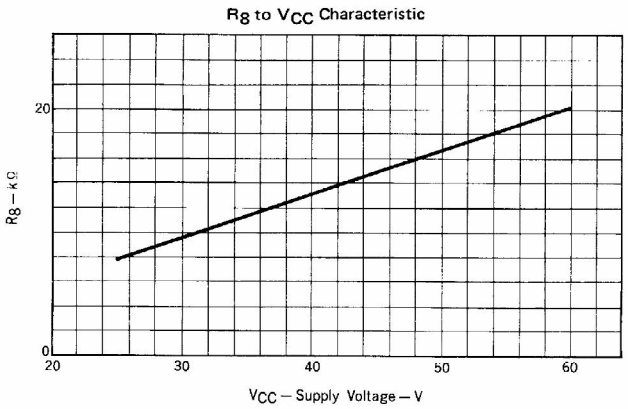
fig. 5 OPTIMUM VALUE OF EXTERNAL RESISTANCE R_4





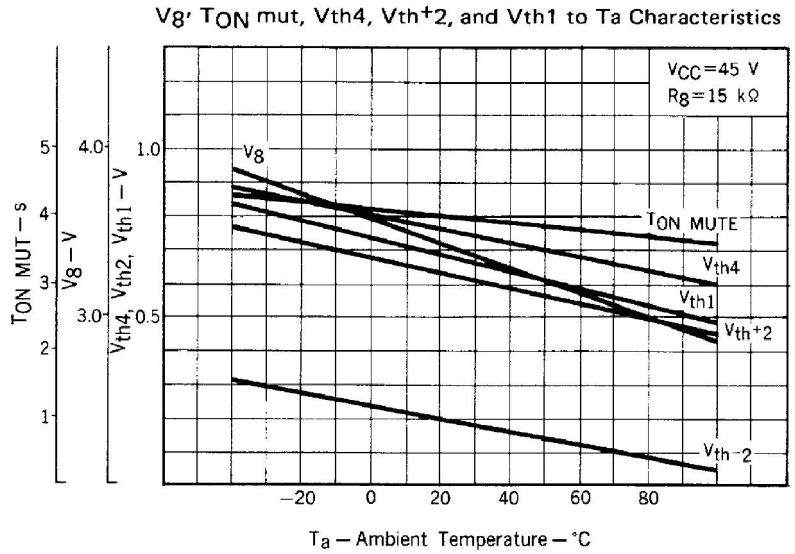
Example) Use of E-24 series.
Select 24 kΩ R_4 for 40 volts r.m.s. V_{AC}.
If no resistance of specified value is available, choose a resistance which is as close as possible to and lower than the value specified by the diagram.

fig. 6 OPTIMUM VALUE OF EXTERNAL RESISTANCE R_8



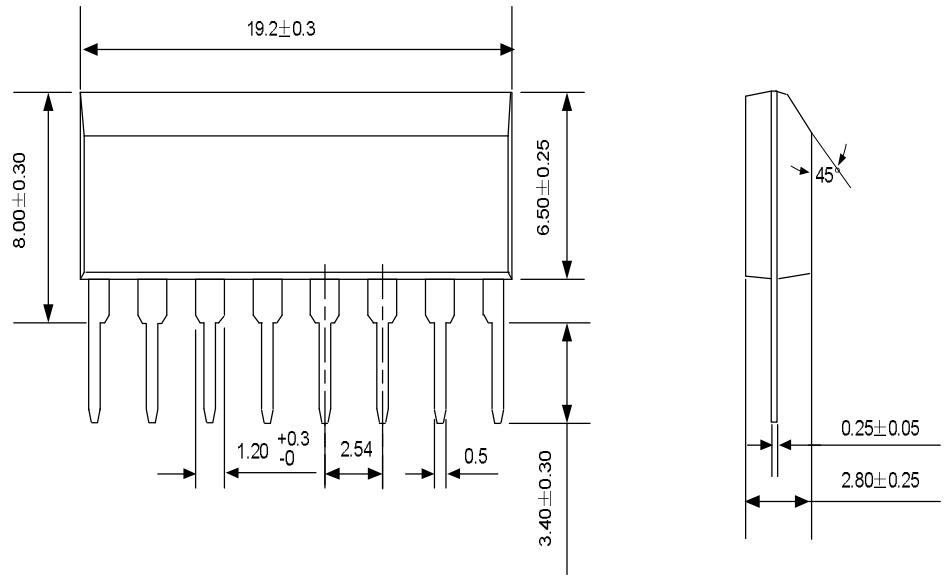
Example) Use of E-24 series.
Select 15 kΩ R_8 for 45 volts Vcc.
If no resistance of specified value is available, choose a resistance which is as close as possible to and lower than the value specified by the diagram.

TEMPERATURE CHARACTERISTIC



PACKAGE OUTLINE

SIP-8 UNIT: mm



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Revision History

Data	REV	Description	Page
	1.0	Original	