ADVANCED ANALOG

A Division of intech

DESCRIPTION

3030

TEMPERATURE ALARM

The 3030 monolithic integrated circuit activates both a steady TTL compatible output and a tone output if the temperature of the IC package exceeds a preset level. The steady output can serve to shut down a power supply or other equipment. The tone generator output can, with an external transistor, produce a loud tone in a loud-speaker or flash an indicator lamp or LED.

BLOCK DIAGRAM

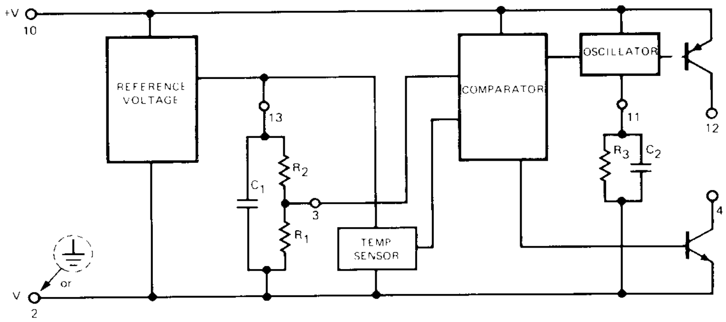
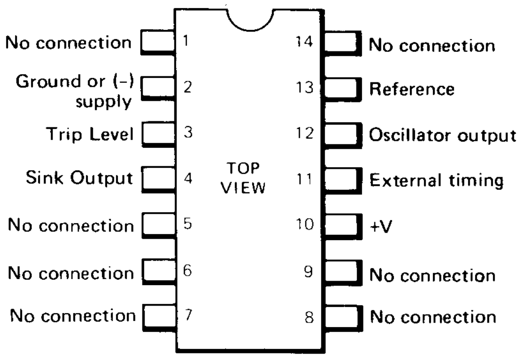


Figure 1: Block Diagram of 3030.

PIN DESIGNATION 14 Pin Dual-In-Line



FEATURES

- **Wide Temperature Range**
- **Excellent Repeatability**
- **Oscillating Output Tone**
- **Steady Output TTL Compatible**
- **Accurate Temperature Compensated Reference Voltage Externally Available**
- **Low Current Drain**

APPLICATIONS

- **Over Temperature Alarm for Equipment**
- **Fire Alarm**
- **Automatic Shut Down of Power Supplies or Equipment**
- **Temperature Controller**
- **Refrigeration Controller**

APPLICATIONS

For the reasons outlined above every effort has been made to reduce the circuit dissipation to a minimum. To this end, both the outputs are intentionally low powered. The steady out is geared to a normal TTL gate type level, and the oscillating output of typically 0.5 mA is suitable for driving a Darlington transistor capable of activating a loud-speaker or LED (Figure 10), or a single transistor or drive TTL or other circuit loads.

To monitor the temperature of critical or sensitive components, the 3030 can attached to a heat sink on the component by one of the standard IC heat sink attachment devices (e.g., IERC), or placed in the cooling fluid flow from the part. The steady output can be used to deactivate the circuit if it becomes overheated; when the temperature is reduced the circuit is reactivated (Figure 11).

The "oscillating" output can also be converted into a long period, so that the circuit triggers after a delay (Figure 11).

The 3030 may also be used as a temperature controller, for temperatures above and below ambient. Figure 13 shows a simple low power temperature controller for temperatures above ambient. The power transistor (this could be a Darlington device for higher powers) is dissipating power either in itself or in the heater when the temperature is below the set point, and is off above the set point. The circuit of Figure 14 may be used with either a thermoelectric cooler, or a low-power compressor or refrigerator.

SPECIFICATIONS ($T_A = 25°C, V_{CC} = +5$ to $+15V$)

PARAMETER	MIN	TYP	MAX	UNIT
Supply Voltage Range	4.5		18	V
Supply Current				
$V_{CC} = 5V$, alarm off		2	4	mA
$V_{CC} = 15V$, alarm off		4	8	mA
$V_{CC} = 5V$, alarm on without load		3		mA
$V_{CC} = 15V$, alarm on without load		8.5		mA
Temperature Reference Accuracy†				
$V_{CC} = 5V$ at 0°C		±3	±5	°C
Temperature Reference Repeatability				
$V_{CC} = 5V$ at 0°C		±0.5		°C
Steady Output				
ON Voltage Drop at 10 mA		0.5	1.5	V
OFF leakage current at 15V		0.01	10	μA
Oscillating Output Current Capability*	0.3	0.5		mA
Oscillating Output Timing Range**	0.0001		10	sec
Duty Cycle Range**	30		70	%
Operating Temperature	−25		+100	°C
Storage Temperature	−55		+125	°C

Notes: * Measured at 1 kHz.
** Measured using Figure 9.
† Using either method 1 or 2 for setting up threshold temperature described on page 2.

MAXIMUM RATINGS

Supply Voltage	+18V
Steady Output Current	10V
Oscillating Output Current	0.5 mA
Operating Temperature Range	−25°C to +100°C
Storage Temperature Range	−55°C to +125°C

Table A

Temperature °C	Multiplication Factor for R_X
−20	0.78
−10	0.83
0	0.88
+10	0.93
+20	0.99
+30	1.05
+40	1.11
+50	1.18
+60	1.25
+70	1.32
+80	1.40
+90	1.49
+100	1.58

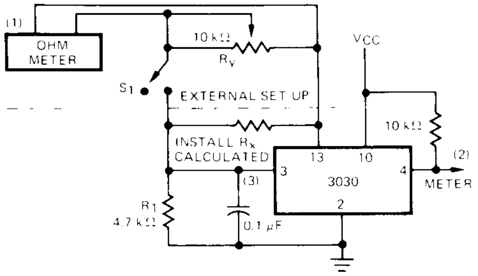


Figure 2.

NOTES:
1. 0.1% accuracy required.
2. If tone output (pin 12) is used, either pin 4 or 12 may be used to determine trip point.
3. Capacitor is for noise suppression at trip point. May not be required.

Table B

Temperature °C	R_2 (Ohms)
−20	511
−10	388
0	276
+10	143
+20	23.7
+30	100
+40	232
+50	370
+60	511
+70	665
+80	835
+90	1000
+100	1200

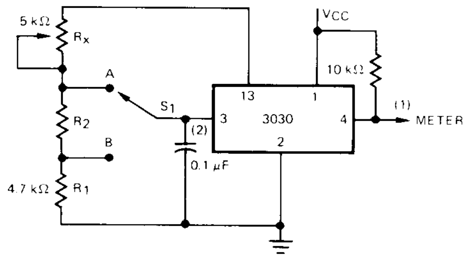


Figure 3.

NOTES:
1. If tone output (pin 12) is used, either pin 4 or 12 may be used to determine trip point.
2. Capacitor is for noise suppression at trip point. May not be required.

S_1 in position B for setting R_X at ambient

S_2 in position A for setting R_X at ambient

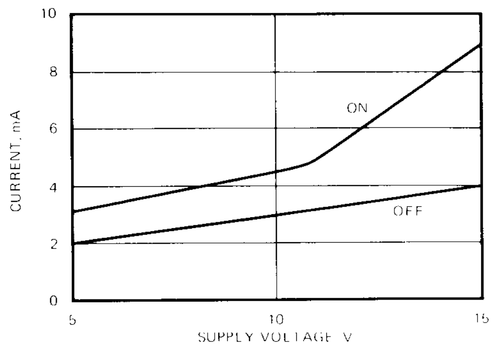


Figure 4: Current Drain vs. Supply Voltage (All Temperatures).

APPLICATION NOTES

The 3030, a monolithic integrated circuit, will activate both a TTL compatible steady output and an oscillating output if the die temperature exceeds a set level. A block diagram is shown in Figure 1. The reference circuit generates a predictable reference voltage essentially independent of temperature and supply voltage variations. This voltage drives a temperature sensitive circuit (two diodes) internal to the circuit, and an external voltage divider R_1 and R_2. When the temperature-dependent voltage falls below that set by the external resistors, the comparator circuit activates both a steady output and an oscillator. A small amount of electrical hysteresis is added to the comparator, to insure positive snap action. The oscillator frequency and duty cycle are controlled by the external capacitor and resistor C_2 and R_3. The capacitor C_1 is necessary to stabilize the voltage reference circuit, and also prevents noise spikes from interferring with the sensitive comparator circuit.

SETTING UP THE THRESHOLD TEMPERATURE

Two types of threshold set-up methods are shown. Both provide easy calibration for a desired temperature trip point.

Inaccuracies in resistors R_1 and R_X (Figure 2) or R_1, R_2 and R_X (Figure 3) will cause about 1.5°C temperature error for a 1% change in resistance. Temperature coefficient of 100 ppm/°C for resistors will cause about a 1.2°C error for a 100°C change. RN55D or equivalent type resistors are recommended (1%, 100 ppm/°C). Lab temperatures are generally within ±2°C allowing calibration without controlled ovens. Both calibration methods will typically give accurancies of better than ±4°C when specified resistor types are installed.

Threshold Calibration Method 1

Figure 2 shows a simple calibration method that is well suited for production. All parts are installed in normal production assembly except for R_X which is selected in the procedure.

The multiplier factor for R_X is found from Table A for the desired trip temperature.

Calibration Steps:

1. Set potentiometer R_y (10 kΩ) for full resistance.
2. Check pin 4 output for a voltage of greater than V_{CC} – 1 volt.
3. Adjust potentiometer R_y until pin 4 output switches low.
4. Open switch S_1 and measure resistance.
5. Multiply measured resistance by multiplier factor (Table A) and install resistor in place of potentiometer R_y.

The 3030 is now calibrated for a trip point at the desired temperature.

Calibration Method 2

Figure 3 shows a second method of calibrating the 3030 for a desired temperature trip point. In this method the potentiometer is adjusted and left in the circuit. Use a potentiometer with a temperature coefficient of better than 150 ppm/°C.

Use Table B to obtain value of R_2 for desired temperature.

For temperatures greater than ambient (22°C) S_1 is in position A for ambient trip point and position B for desired trip point. For temperatures less than ambient (22°C) S_1 is in position B for ambient trip point and in position A for desired trip temperature.

R_X is adjusted by ambient until pin 4 output switches low. Switch S_1 (or jumper is changed to opposite position.

The 3030 is now calibrated for a trip point at the desired temperature.

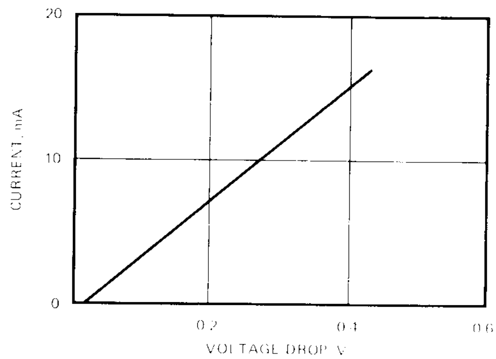


Figure 5: Voltage Drop of Steady Output vs. Current.

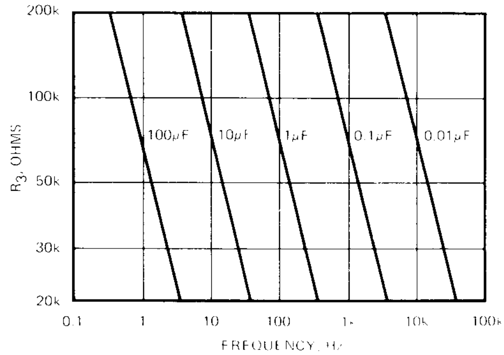


Figure 6: Frequency of Period Oscillator vs. R_3, C_2, V_{CC} = 10V.

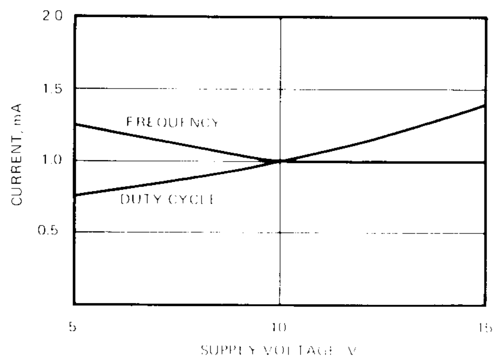


Figure 7: Frequency and Duty Cycle of Oscillator vs. Supply Voltage.

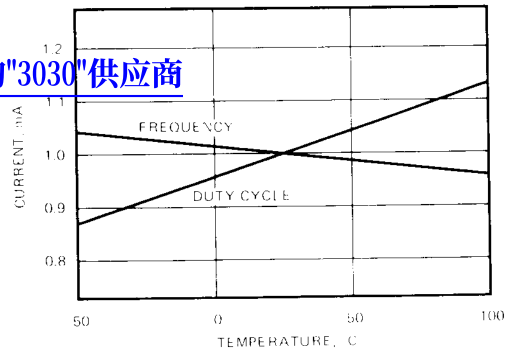


Figure 8: Frequency and Duty Cycle of Oscillator vs. Temperature.

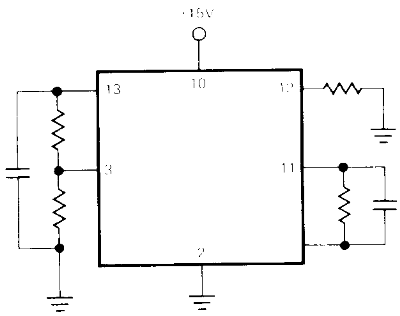


Figure 9: Timing and Duty Cycle Test Configuration.

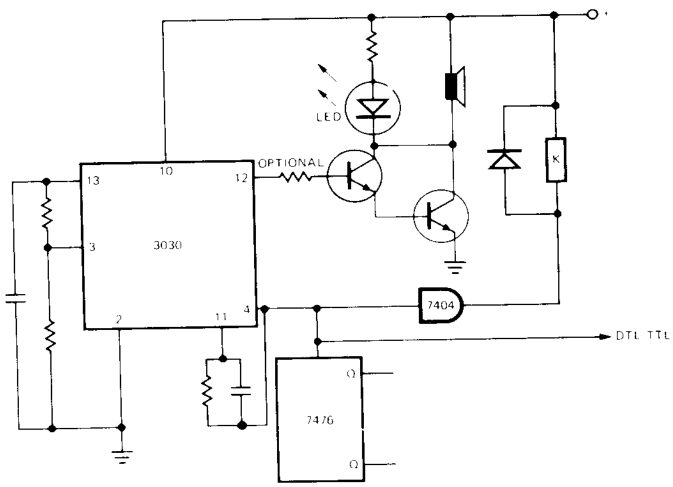


Figure 10: Intech 3030 shown driving relay, setting flip-flop and other DTL/TTL loads, while driving loudspeaker and LED.

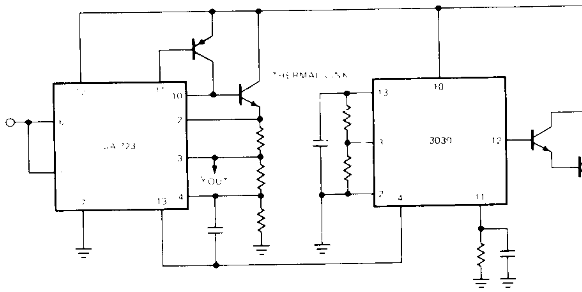


Figure 11: 3030 thermally coupled to pass transistor in series regulator will shut down if transistor becomes overheated.

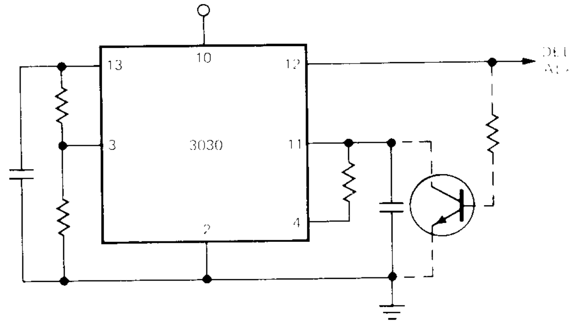


Figure 12: Intech 3030 generates delayed alarm; components shown will lock alarm on after delay.

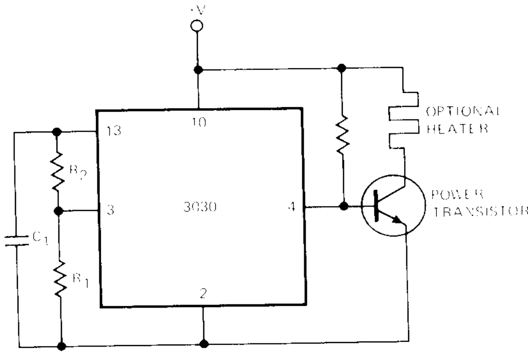


Figure 13: Simple Low Power Temperature Controller.

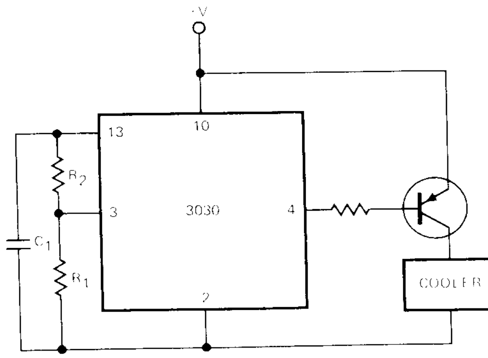


Figure 14: Simple Low Power Cooler Controller.

ADVANCED ANALOG

A Division of intech

2270 MARTIN AVENUE, SANTA CLARA, CA 95050
(408) 988-4930 • TWX 910-338-2213 • FAX (408) 988

008949