ORDERING INFORMATION

Device	Temperature Range	Package
MC3344L	−40°C to +85°C	Ceramic DIP
MC3344P	−40°C to +85°C	Plastic DIP

MC3344

Advance Information

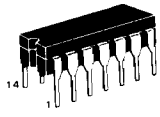
PROGRAMMABLE FREQUENCY SWITCH

SILICON MONOLITHIC INTEGRATED CIRCUIT

PROGRAMMABLE FREQUENCY SWITCH WITH ADJUSTABLE HYSTERESIS

The MC3344 is a general purpose programmable frequency switch designed for use in systems where a load must be switched on or off at a predetermined frequency. Switch frequency is determined by an external resistor (R_R) and capacitor (C_R). Hysteresis is adjustable and determined by an external resistor (R_H).

- Isolated Driver Transistor
- Complementary Outputs
- Adjustable Hysteresis
- Wide Supply Operating Range (7 to 24 Volts)
- Wide Input Frequency Range (10 Hz to 100 kHz)
- Internal Regulator
- Ideal for Automotive and Industrial Applications



L SUFFIX
CERAMIC PACKAGE
CASE 632-02
MO-001AA

P SUFFIX
PLASTIC PACKAGE
CASE 646-05

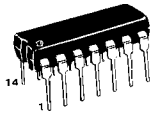
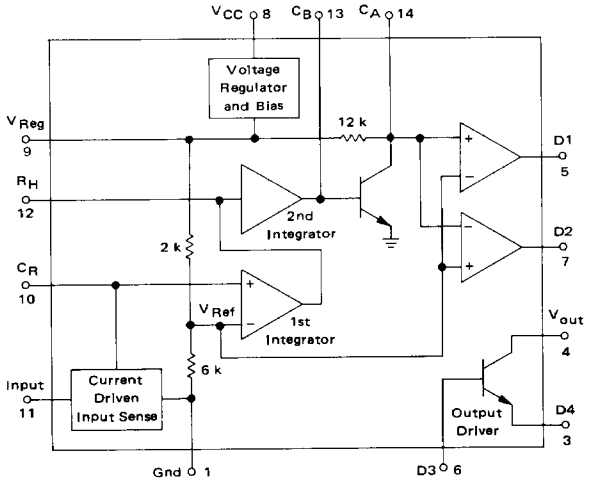
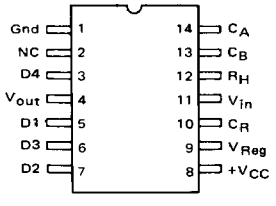


FIGURE 1 – CIRCUIT BLOCK DIAGRAM



PIN CONNECTIONS



This document contains information on a new product. Specifications and information herein are subject to change without notice.

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply	V_{CC}	24	Vdc
Peak Input Current	I_I	10	mA
Junction Temperature	T_J	150	°C
Operating Ambient Temperature Range	T_A	-40 to +85	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{CC} = +15 Vdc unless otherwise specified)

Characteristic	Test Ckts	Symbol	Min	Typ	Max	Unit
Supply Current	2	I_D	–	2.5	4.0	mA
Trigger Reset Voltage I_{in} = 200 μA I_{in} = 600 μA	3	 V_{CR1} V_{CR2}	 0.25 –	 – –	 – 0.25	Vdc
Regulator Output Voltage	4	V_{Reg}	4.0	4.5	5.0	Vdc
Threshold Output Voltage $V_{TCR} = V_{CR}/V_{Reg}$	5	V_{TCR}	0.739	0.750	0.761	V/V
Hysteresis Sink Current	6	I_H	100	400	–	μA
Second Comparator Output D1 Leakage D2 Source D1 Source D2 Leakage	7	 I_{D1L} I_{D2S} I_{D1S} I_{D2L}	 – 100 100 –	 – 250 200 –	 100 – – 100	 nA μA μA nA
Output Driver Gain I_C = 5.0 mA	8	h_{FE1}	50	100	–	–
Output Driver Voltage Standoff I_D = 5.0 mA	9	$V_{(BR)CEO}$	25	30	–	Vdc
Integrator Transistor Gain $h_{FE2} = \Delta I_C/\Delta I_B$, I_{C1} = 0.4 mA, I_{C2} = 0.6 mA	10	h_{FE2}	50	200	300	–

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TEST CIRCUITS

FIGURE 2 – SUPPLY CURRENT

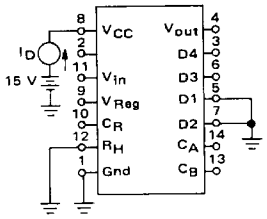
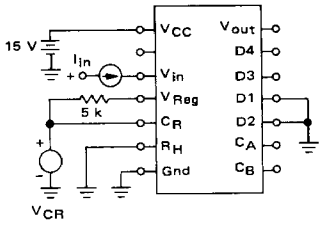


FIGURE 3 – TRIGGER RESET VOLTAGE



I_{in} = 200 μA, $V_{CR} \geq 0.25$ V

I_{in} = 600 μA, $V_{CR} \leq 0.25$ V

FIGURE 4 – REGULATOR OUTPUT VOLTAGE

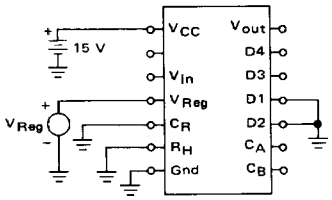
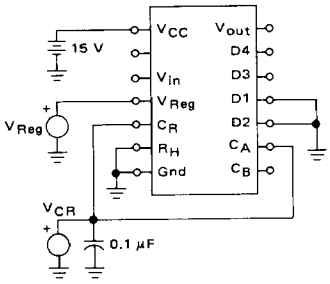


FIGURE 5 – THRESHOLD VOLTAGE RATIO



$V_{TCR} = V_{CR}/V_{Reg}$

FIGURE 6 – HYSTERESIS SINK CURRENT

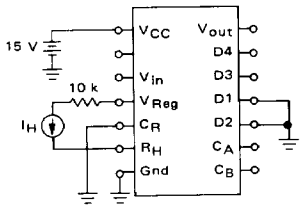
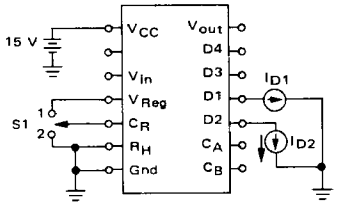


FIGURE 7 – I_{D1L}/I_{D2S}, I_{D2L}/I_{D1S}



I_{D1L}/I_{D2S} – S1 in position 1

I_{D2L}/I_{D1S} – S1 in position 2

FIGURE 8 – OUTPUT DRIVER GAIN

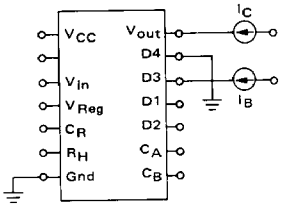


FIGURE 9 – BV_{CEO} OF OUTPUT TRANSISTOR

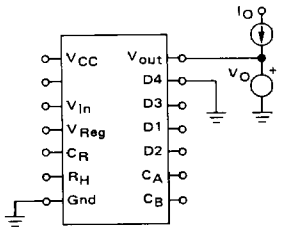
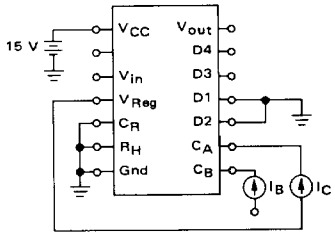


FIGURE 10 – INTEGRATOR TRANSISTOR GAIN



APPLICATIONS INFORMATION

The voltage regulator and bias section provides the proper biasing and regulated supply voltage to the integrated circuit.

A square wave, when applied to the RC differentiator, provides input current pulses to the IC. The input circuit discharges and clamps, for a predetermined time, the voltage across capacitor C_R. This establishes the initial ramp voltage (V_{sat}) and allows initiation of a new voltage ramp after each positive transistion of the input waveform.

The voltage, V_{CR}, ramps from V_{sat} to the final value, V_{Reg}, charging through R_R.

If V_{CR} is never allowed to reach V_{Ref} due to quick reset pulses, the second integrator amplifier will not be activated, and capacitor C_{AB} is allowed to charge through the 12 kΩ resistor until V_{CA} is greater than V_{Ref}. At this point, D1 will switch ON and D2 will switch OFF. By connecting either D1 or D2 to the D3 drive pin, the output drive transistor may be either switched ON or OFF at the switch point.

If V_{CR} is allowed to ramp above V_{Ref} before being reset, the second integrator amplifier is driven ON which discharges and resets capacitor C_{AB} keeping V_{CA} low with respect to V_{Ref}.

V_{CA} will always be low with respect to V_{Ref} if the time from reset C_R to $V_{CR} = V_{Ref}$ is less than the time from reset C_{AB} to $V_{CA} = V_{Ref}$.

Resistor R_H provides hysteresis around the switch point (i.e., frequency to switch the output driver ON, when connected to the D1 terminal, is higher than the frequency required to switch the output driver OFF). If no hysteresis is desired then the R_H resistor should be omitted and pin 12 grounded.

Circuit Equations:

The first integrator time constant is
$T1 = R_H \parallel R_R\, C_R$. If R_H is omitted then
$T1 = R_R\, C_R$.

The second integrator time constant is
$T2 = (12\text{ k})\,(h_{FE2})\,(C_{AB})$.

$$f1 = \text{Switch Point frequency} \cong \frac{1}{1.39\, R_R\, C_R}$$

$$f2 = \text{Hysteresis Switch Point frequency} \approx \frac{1}{R_R \parallel R_H\, C_R \ln\left[\frac{R_H}{0.25\, R_H - 0.75\, R_R}\right]}$$

FIGURE 11 – TYPICAL APPLICATION

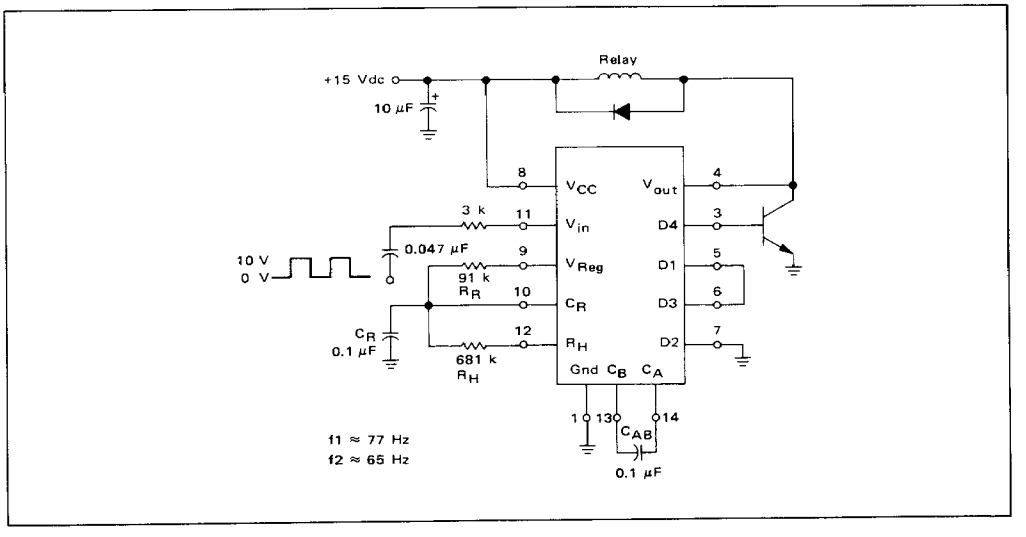


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FIGURE 12 – CIRCUIT SCHEMATIC