Advance Information

Long Duration Automotive Timer

This circuit is a Long Duration Automotive Timer primarily designed as a deffoger timer, but as it is realised using a digital divider techniques and it is suitable for a variety of long duration timing functions. The circuit is available in an 8 pin surface plastic package.

- Operating Ambient Temperature from -40°C to 85°C
- Operating Voltage Range from 5V to 18V
- 400mA Output Current Capability
- Integrated Input Debounce Circuitry
- Few External Components
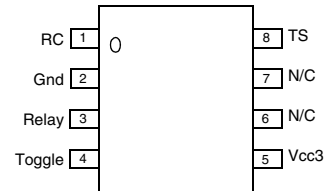- Toggle Input for Timing Start and Stop

MC33187

LONG DURATION AUTO-MOTIVE TIMER

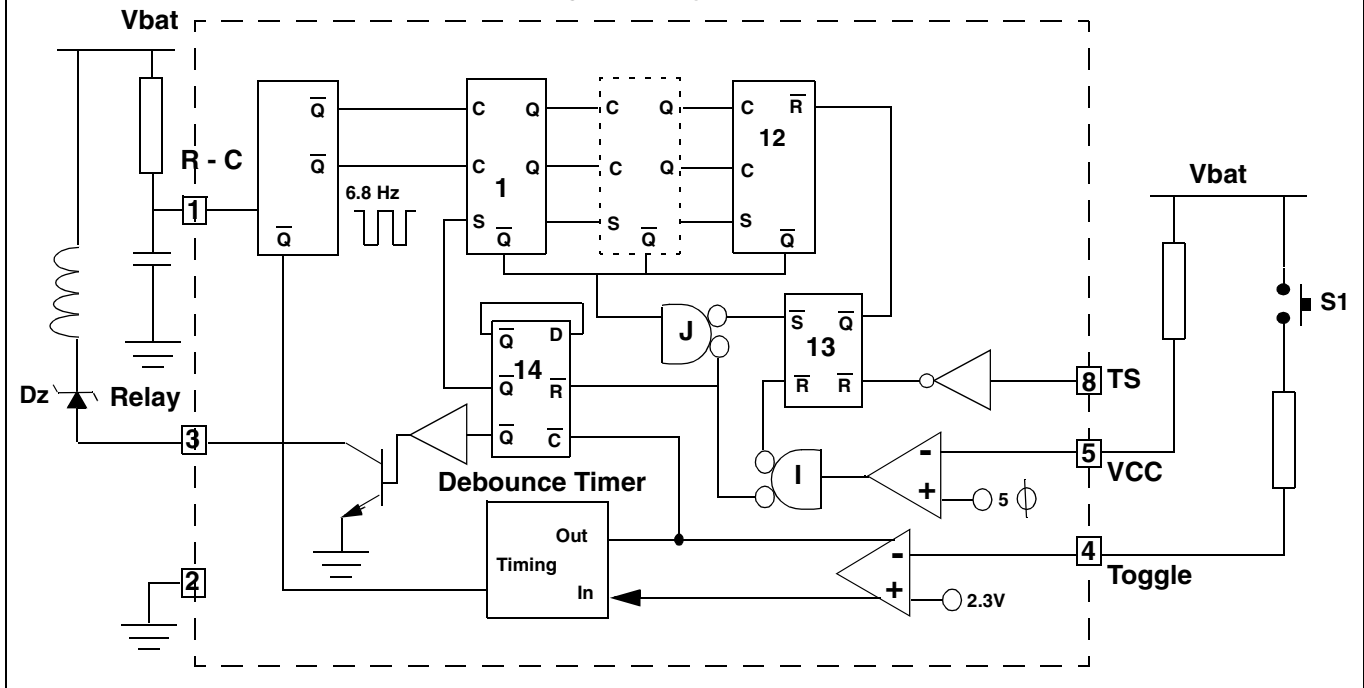### SEMICONDUCTOR TECHNICAL DATA

D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO-8)

PIN CONNECTIONS

RC [1]	[8] TS
Gnd [2]	[7] N/C
Relay [3]	[6] N/C
Toggle [4]	[5] Vcc3

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC33187D	-40°C to +85°C	SO8

Block Diagram and Typical Application

For More Information On This Product,
Go to: www.freescale.com

MOTOROLA *digital dna* ™

Freescale Semiconductor, Inc.

MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
ELECTRICAL RATINGS			
Pin 5 voltage	Vpin5	18	V
Pin 3 Voltage	Vpin3	18	V
Pin 3 Current	Ipin3	400	mA
THERMAL RATINGS			
Storage Temperature	Tstg	-55 to +175	°C
Operating Junction Temperature	Tj	-40 to +150	°C

ELECTRICAL CHARACTERISTICS. Tamb from - 40°C to + 85°C, Vcc = 14V through 1KΩ, unless otherwise noted. Typical values reflect approximate mean at 25°C, nominal VCC, at time of device characterization.

Parameters	Symbol	Min	Typ	Max	Unit
RC PIN 1					
Oscillator Frequency Vbat = 14V trough 1KΩ	fo	300		400	Hz
Internal Counter Divider step	VR1		4096		
RELAY PIN 3					
Output Leakage current @ Vpin3 = 28V / Vbat =14V	IO1			100	uA
Output Leakage current @ Vpin3 = 22V / Vbat = 0V	IO2			100	uA
Output Saturation Voltage @ 250mA / Vbat = 14V	VO1			1.35	V
Output Saturation Voltage @ 400mA	VO2			2.60	V
TOGGLE PIN 4					
Toggle Input Clamp @ Vbat = 14V / Vpin8 = 14V through 9.1KΩ	TCLP	6.0		9.0	V
Toggle Threshold	VTG-T	1.0		4.0	V
VCC3 PIN 5					
Supply Current @ Vcc = 5V	ICC	0.5		3.5	mA
VCC Zener Regulation @ Vbat = 14V through 1K	VCC	6.0		8.0	V
TS PIN 8					
Time Select Current @ TS = 5V	ITS	25		200	uA

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DEVICE DESCRIPTION

Pin 1 : RC

Oscillator frequency control. Rt and Ct control the frequency of the clock oscillator. The period of oscillation is nominally given by t = RtCt with the overall time period given by T = 4096 RtCt. However, the following formula is believed to give a more accurate forecast of the overall time interval provided by the circuit for values of Rt between 200K and 2M and values of Ct between 1nF and 1uF.

Formula : $T = 4.1 \cdot 10e{-3} (RT * (RT/150)*2.7) *CT$.

Pin 2 : GND

Ground : Most negative supply terminal.

Pin 3 : RELAY

Relay output driver. Open collector drive from a Darlington transistor rated. Icmax = 400mA and Vmax = 18V. The relay driver output is on (low) during the time period.

Pin 4 : TOGGLE

On/Off Control. A positive going voltage transition on this input toggles the timer between the On and Off state. If the timer is On and timing, it may be turned off by a positive going signal on the toggle pin before the time delay has elapsed.

Pin 5 : VCC

Positive supply terminal. The timer requires a supply voltage of 5 to 18V applied to Vcc through Rs. An internal 7V zener limits the Vcc terminal voltage. Cs is included to provide supply rail decoupling.

Recommended values of Rs and Cs on a standard 12V vehicle system are Rs = 1KOhm and Cs = 100nF.

APPLICATION

This is the standard operation of this circuit requiring the minimum of extra components.

The ON/OFF switch is a non-latching push button (or similar), illuminated by a lamp in parallel with the rear window defogger. Rin protects the toggle input from supply line transients with a nominal of Rin = 10KΩ. The relay is intended to be a standard automotive relay (Rnom = 60Ω) with contacts rated appropriately for the defogger controlled. Dz with a nominal value of 16V +-5% is included to provide protection of

the relay drive output transistor against relay turn-off and supply lines transients.

The type of zener used is dependent of the level of protection required. An MZD16 will provide adequate protection for all relay turn-off and low energy supply transients, while a P6KE16A will provide full protection against all known transients. If the relay output is to be connected in any other way or to a non-standard relay, the maximum ratings quoted under the General Description above should be noted.

Figure 1. .Defogger Timer Operation

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The circuit shown demonstrates the use of the timer to provide a delay in turning the courtesy light off after the vehicle doors are closed. The components are the same as the defogger timer and Rt, Ct, Rs and Cs are as described in the general description above, while Dz and Rin are described in the description of the defogger timer. S1 to Sn represent the doors switches which can be basically the same as for a conventional system, except that only the relay coil current and not the full lamp current passes through them.

The operation of the circuit is as follows :

While one of the door switches is closed, the courtesy light is on with the relay current flowing through the switch.

As soon as the last switch is opened, the energy stored in the relay coil causes the common connection of the switches to rise to the voltage permitted by the clamp consisting of Dz (approximately 16V).

This provides a toggle input via Rin, causing the relay output of the integrated circuit to go low, thus keeping the relay energised for the period preset, with the direct connection to Rin ensuring that any switch bounce or noise during this period cannot cause toggle input to be detected. Retriggering at the end of the timing period is prevented by the built in the debounce timer.

Figure 2. Courtesy Light Timer Operation
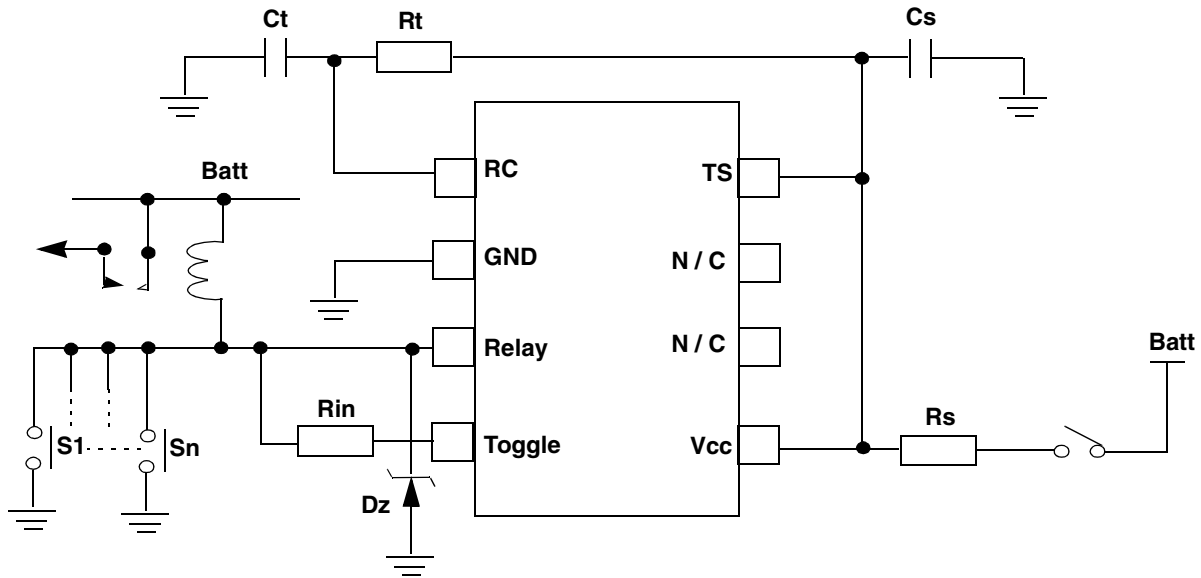
This circuit is designed to just use the toggle and relay drive feature of the long duration timer.

The functions of components Rs, Cs, Rt, Ct, Rin and Dz are as previously described. Although the circuit is not intended to be allowed to time out, Rt and Ct need to be included as it is necessary for the timer to run for the internal debounce timer to be reset.

The control switch S1 needs to be a normally closed momentary type.

While it is closed, D1 ensures that the oscillator does not run, while R1 ensures that D1 is reverse biassed when the switch is operated (open). C1 is included to provide a time constant RinC1 to delay the detection of a toggle input.

Thus the operation of the circuit is as follows :

When S1 is operated, the oscillator is allowed to start ; the toggle input is then recognised and the relay output changes state assuming that the switch has been released, the oscillator is stopped and the sequence above can be repeated.

If the switch is held operated for 9 seconds, with the values recommended below, after it has been used to switch the relay on the circuit will time out and the relay switch off. No further action takes place until the circuit is reset by releasing the button.

If the switch is held operated after it has been used to switch the relay off, nothing happens until the circuit is reset by releasing the button.

Recommended values :

Rs = 1KΩ
Cs = 100nF
Rt = 220KΩ
Ct = 10nF
Rin = 100KΩ
R1 = 1KΩ
C1 = 220nF
Dz = MZD16
D1 = 1N4148

Note that the time constant RtCt and RinC1 are related (start up time and basic frequency of oscillator/switch to toggle delay time) and need to stay in the ratio (1:10).

Figure 3. Relay Drive and Latch (No Timeout
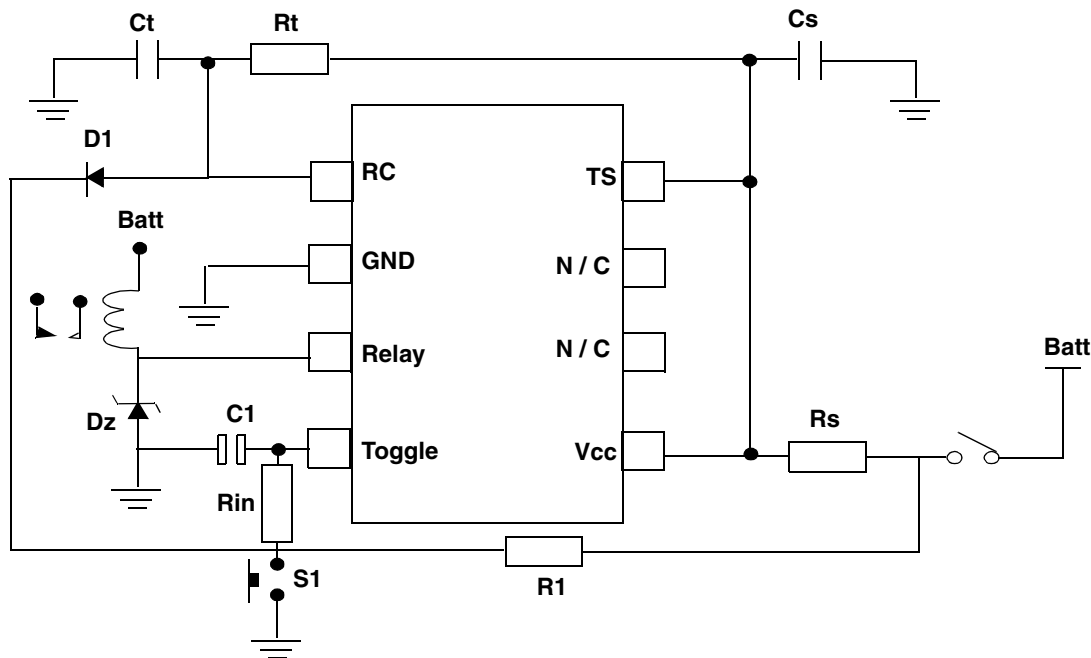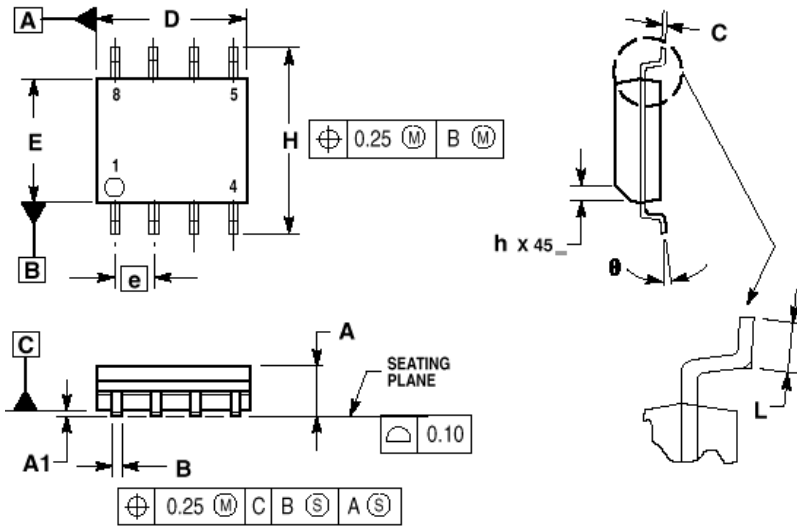
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0_	7_
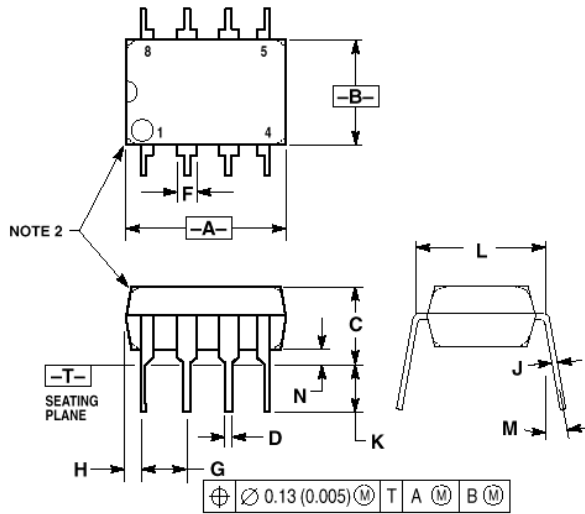
NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10	—	10
N	0.76	1.01	0.030	0.040

STYLE 1:
PIN 1. AC IN
2. DC + IN
3. DC – IN
4. AC IN
5. GROUND
6. OUTPUT
7. AUXILIARY
8. V$_{CC}$

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How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

Technical Information Center: 1-800-521-6274

HOME PAGE: http://www.motorola.com/semiconductors

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3-20-1, Minami-Azabu, Minato-ku, Tokyo 106-8573 Japan. 81-3-344-3569

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2, Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852-26668334

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