AN8353UB

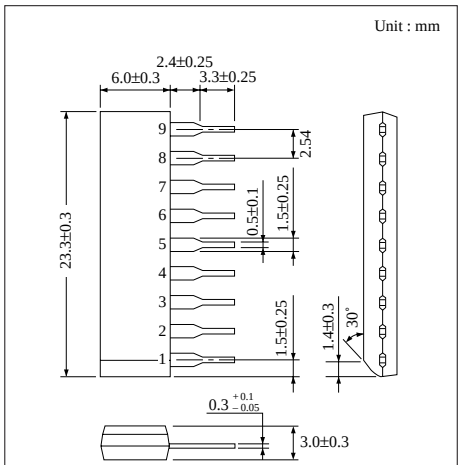
High Efficiency Car Dashboard Dimmer IC

■ Overview

The AN8353UB is a dimmer IC to control illumination of the car dashboard at high efficiency and high performance by pulse width control. It outputs pulses at a duty proprotional to an input voltage.

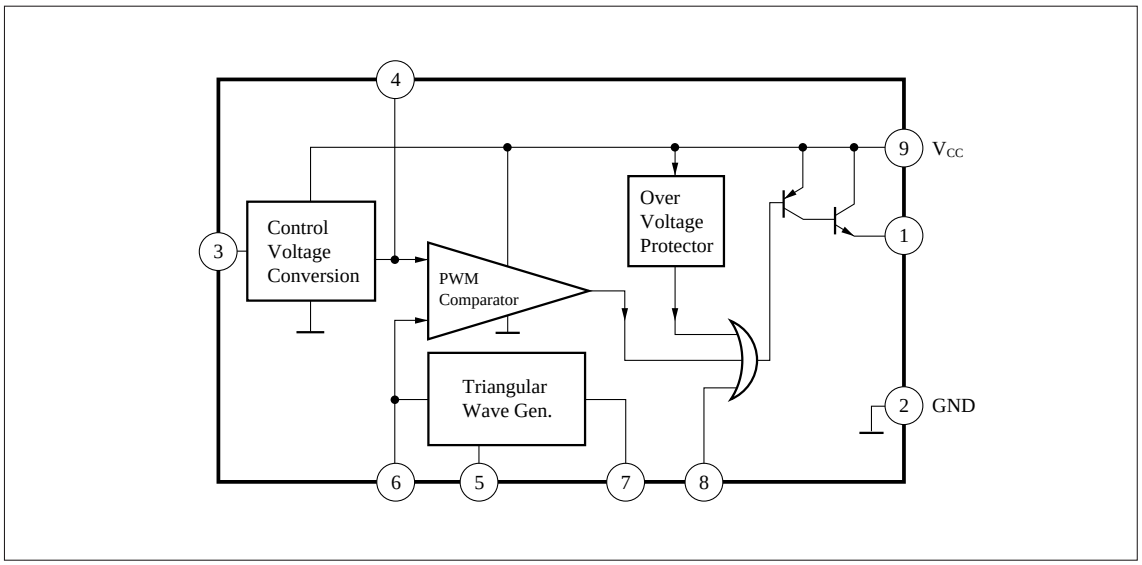
■ Features

- Low power consumption by pulse control
- External ON/OFF control by the standby pin
- Pulse frequency range : 50Hz to 10kHz
- Built-in overvoltage protective circuit approx. 20V
- Wide operating ambient temperature range : –40˚C to+100˚C
- All products temperature cycle, high reliability by normal and high temperature checks reliability equivalent to the air bags requested in U.S.



9-pin SIL Plastic Package (SIP009-P-0000C)

■ Block Diagram



■ Pin Descriptions

Pin No.	Pin name	Description
1	Output pin	Outputs an intermittent source current at a duty proportional to an input voltage
2	GND	GND
3	Input pin	Applies a control voltage.
4	Noise eliminating capacity connection pin 1	Connect a capacitor to eliminator a noise.
5	Square wave output pin	Output a triangular wave, which serves as a reference for the PWM signal, to the Pin6 by connecting the resistor R_T between the Pins5 and6, and capacity C_T between the Pin6 and GND.
6	Triangular wave output pin	Output a triangular wave, which serves as a reference for the PWM signal, to this pin by connecting the resistor R_T between the Pins6 and 5, and capasity C_T between the Pin6 and GND.
7	Noise eliminating capacity connection pin 2	Connect a capacitor to eliminator a noise.
8	Standby pin	Forces to shut off an output current if a voltage higher than a threshold voltage of 1.1V is applied to the Pin8.
9	V_{CC}	Supply Voltage

■ Absolute Maximum Ratings (Ta=25˚C)

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	22	V
Power dissipation	P_D	550	mW
Storage temperature	T_{opr}	–40 to +100	˚C
Operating ambient temperature	T_{stg}	–50 to +150	˚C

■ Recommended Operating Range (Ta=25˚C)

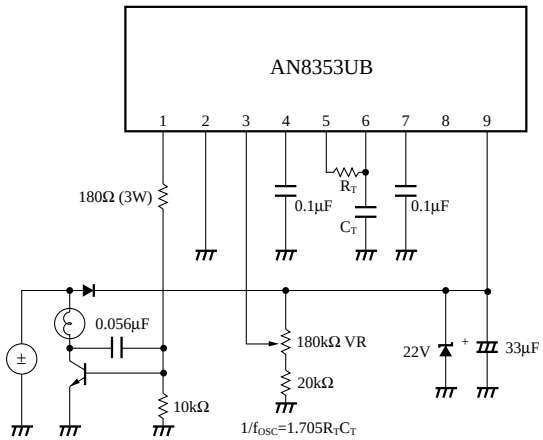
Parameter	Symbol	Range
Operating supply voltage range	V_{CC}	8 to 18V

■ Electrical Characteristics (Ta=25˚C)

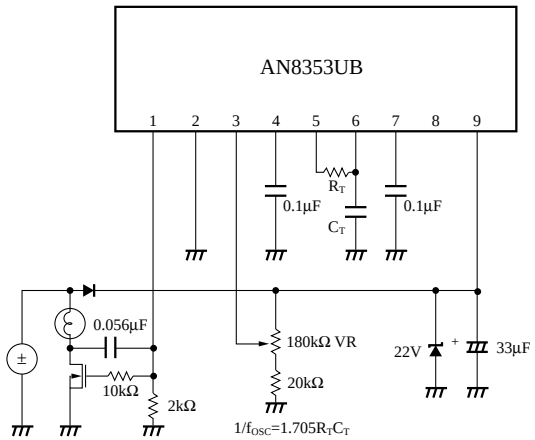
Parameter	Symbol	Condition	min	typ	max	Unit
Supply current	I_{CC}	Eliminate C_T and R_T	4	7.5	11	mA
Oscillation frequency	f_{osc}	C_T=0.027µF	90	115	140	Hz
0% duty input voltage	V_{IN-0}	C_T=0.027µF	2	2.5	3	V
100% duty input voltage	V_{IN-100}	C_T=0.027µF	9.5	10	10.5	V
Center duty (V_{CC}=12V)	D_{12V}	C_T=0.027µF	35	45	55	%
Center duty (V_{CC}=8V)	DD_{8V}	C_T=0.027µF	–1	0	1	%
Center duty (V_{CC}=18V)	DD_{18V}	C_T=0.027µF	–1	0	1	%
Output duty gain	D_G	C_T=0.027µF	45	50	55	%
Output voltage at ON	V_{ON}	C_T=2100pF	0.6	0.9	1.2	V
Leakage current at OFF	I_L	C_T=2100pF	—	0	4	µA
Over voltage detection voltage	V_{OV}	C_T=2100pF	18	20	22	V
Standby threshold voltage	V_{STH}	C_T=2100pF	0.55	1.1	1.65	V

■ Application Circuit

• Bipolar Transister Output



• MOS FET Output



■ Supplementary Description

• System Operational Principle

The following describes the operational principle of the system using the AN8353UB.

As shown in the block diagram in Fig. 1, a battery voltage is divided by the VR and input to the input Pin3 in accordance with rotation amount. The voltage at the output Pin1 is controlled by the AN8353UB so that the duty of the ON/OFF period of the external output transistor will be proportional to the input voltage, thus controlling a current flowing to the lamps of the dashboard, etc. to adjust their brightness. Since the output transistors are saturated at ON time and no current flows at OFF time, power consumption is low.

The PWM method is used to control the output transistors. This method, as shown in Fig. 2 I/O Characteristic Chart (III), generates the triangular wave V_6 as a reference signal to generate pulses and input them to one end (Pin6) of the PWM comparator. The triangular wave frequency f_{OSC} can be freely set from 50Hz to 10kHz, depending on the resistance value R_T connected between the square wave output Pin5 and triangular wave output Pin6, and capacity value C_T connected between the triangular wave output Pin6 and ground Pin2. The approximating expression for the then PWM frequency f_{OSC} is ;

$$1/f_{OSC}=1.705C_TR_T \cdots\cdots(1)$$

For your refence, Fig. 3 shows the relations among C_T, R_T, and oscillation frequency f_{OSC}. The voltage V_4, whose voltage level is made matching the amplitude of the triangular wave by the control voltage converter, is given to the other input (Pin4) of the PWM comparator. That is, in Fig. 2 (II), the input voltage V_3 is linearly converted into V_4 by the control voltage converter so that the amplitude of the triangular wave will be about 20% to 80% of the input voltage input range (axis of abscissas in Fig. 2 (II)).

Then, a current is supplied from the output Pin1 to turn on the output transistors during the period (T_{ON}) when the inverted input voltage is larger than the triangular wave. (Fig. 2 (II), (IV)) To the contrary, while the converted input voltage is smaller than the triangular wave, no current is supplied from the output Pin1 and the output transistors are turned off. The output pulse duty is expressed as follows.

$$Duty=T_{ON} \cdot f_{OSC} \cdots\cdots(2)$$

For the duty control characteristic of the output pulses to the input voltage V_3, the duty of the output pulses is controlled from 0% to 100% at high-precision linearity while the “input voltage V_3/supply voltage V_9” is between about

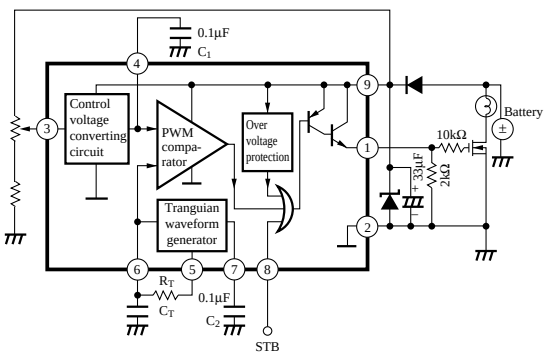


Fig. 1 AN8353UB Block Diagram

■ Supplementary Description (cont.)

• System Operational Principle (cont.)

0.2 (B-point) and 0.8 (C-point). The A-point in the figure shows the I/O characteristics when the "input voltage V_3/supply voltage V_9" is 0.7. And, when V_3/V_9 is from 0.05V to about 0.2V (B-point), the duty is controlled to 0%, and when V_3/V_9 is from 0.8V (C-point) to t.0V, the duty is controlled to 100%.

The standby Pin8 can forcibly turn off the output transistors by applying a voltage of about 1.1V or more to this pin. When it is not necessary to forcibly turn off the output transistors, Leave the standby Pin8 open.

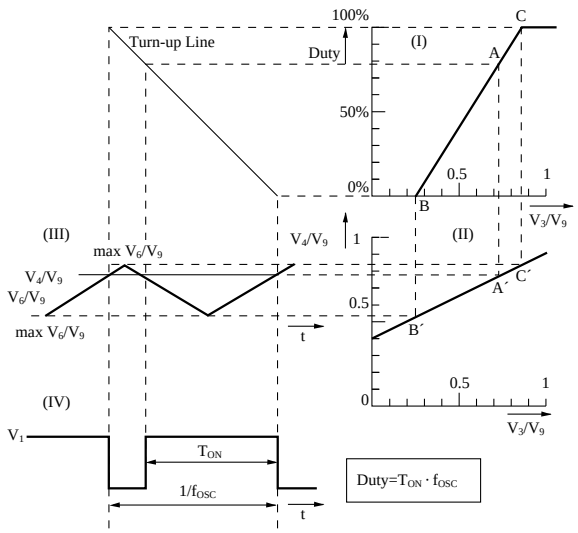


Fig. 2 I/O Characteristic Chart

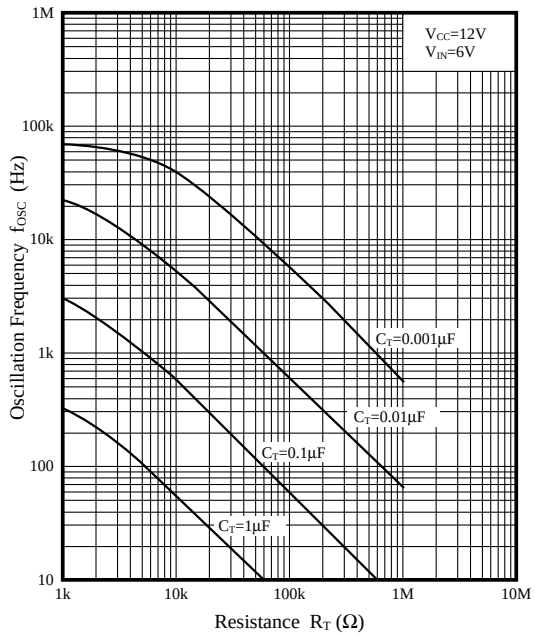
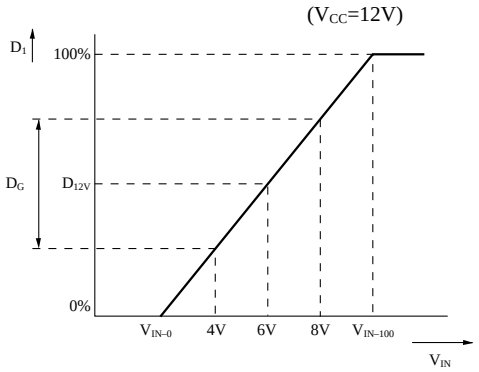


Fig. 3 Relations between Oscillation Frequency and C_T and R_T

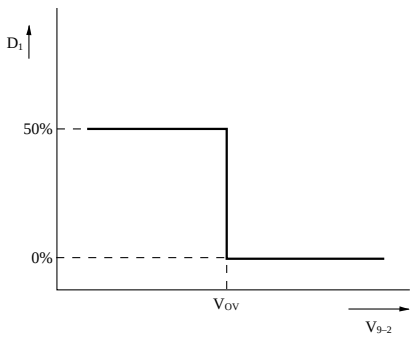
• Duty D_1 vs. Input Voltage V_{IN}



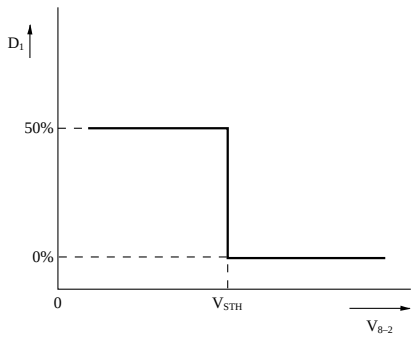
· Output voltage at ON V_{ON} · Leakage current at OFF

$V_{ON}=V_{CC}-V_{1-2}$ $I_L=\frac{V_{1-2}}{IM\Omega}$

• Over voltage Detecting Voltage vs. Output



• Standby Threshold Voltage vs. Output



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