1.Description

AP1511 is a driver IC designed for IR-Cut Removable (ICR) to switch infrared filters. AP1511 has a low saturation voltage bidirectional H-bridge driver circuit. Built-in protection diodes dredge the feedback current generated by ICR and prevent ESD damage.

The internal resistance of the bidirectional H-bridge drive circuit in AP1511 is less than 3 ohms, so the current required by the ICR module is determined by the impedance of its coil. Taking the working power supply of 5 volts as an example, when 300mA current flows through the internal coil of the ICR, the H-bridge drive circuit in AP1511 will produce a voltage drop of 0.73V. AP1511A provides single-line control and dual-line control, while AP1511B uses single-line control and provides one-step operation (One-Shot) function.

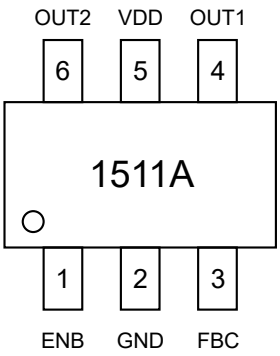
2.Features

- 1.8V INPUT LEVEL
- Low saturation voltage (0.73V@300mA, VDD=5V)
- Low standby current (<10uA)
- Operating voltage 2.5v to 5.5v
- 6-PIN SOT23-6 PACKAGE
- Only a single input is needed for control

3.Applications

- IR-Cut Removable (ICR) dedicated driver IC.

4.Pinning Information



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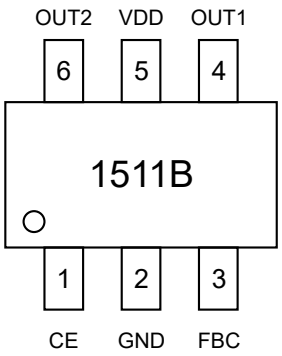


SOT23-6

Pin Functions

Pin	Mnemonic	I/O	Description
1	ENB	I	Low-active enable
-	CE	I	External capacitor
2	GND	-	Ground
3	FBC	I	Forward/Backward control
4	OUT1	O	Driver output 1
5	VDD	-	Power supply
6	OUT2	O	Driver output 2

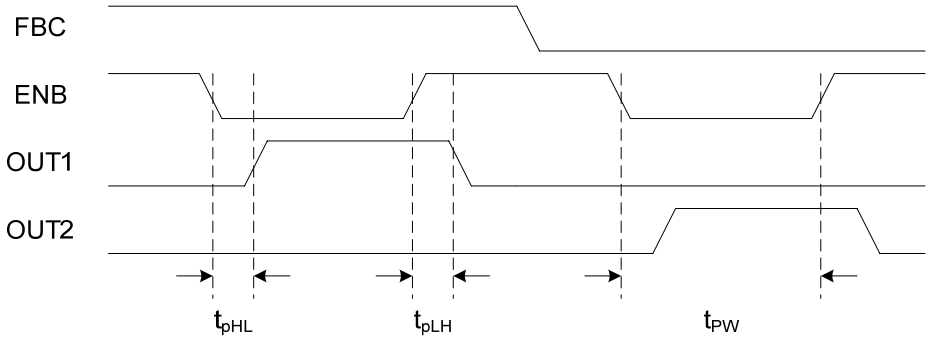
5.Absolute Maximum Ratings (unless otherwise specified, Temp=25°C)

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{DD}	5.5	V
Input Voltage	V_{IN}	V_{DD}+0.4V	V
Output Current (Continue)	I_{OUT}	500	mA
(Pulse, 50% duty)		600	mA
Operating Temperature Range	T_{OPR}	-40 to 125	°C
Storage Temperature Range	T_{STO}	-65 to 150	°C

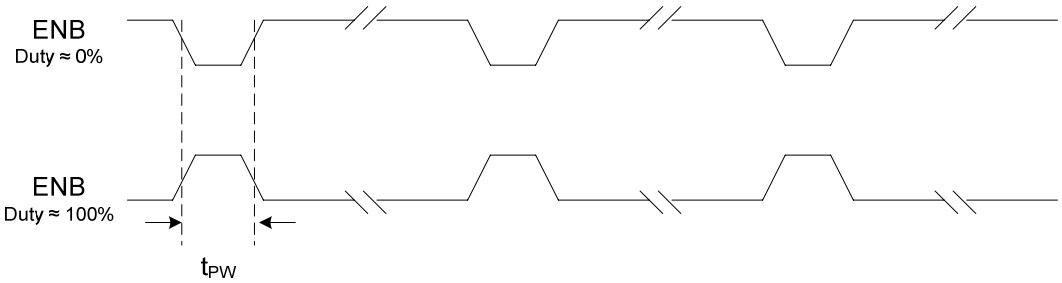
6.Electrical Characteristics

(unless otherwise specified, Temperature=25°C & V_{DD}=5.0V)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage	V_{DD}		2.5	5	5.5	V
Supply Current	$I_{STB(A)}$	Steady state or standby state version A			20	μA
	$I_{STB(B)}$	Steady state or standby state version B			10	μA
	I_{DD}	Transit state	0.8	1	1.2	mA
Driver input control ENB/FBC						
Input High “H”	V_{IH}		1.6		V_{DD}+0.4	V
Input High “L”	V_{IL}		-0.4		0.2*V_{DD}	V
Driver output OUT1/OUT2						
Output Voltage (upper + lower)	V_{OUT1}	I_{OUT}=200mA		0.42		V
	V_{OUT2}	I_{OUT}=300mA		0.73		V
	V_{OUT3}	I_{OUT}=400mA		1.03		V
Rise transition time	T_R	From 0.1*V_{DD} to 0.9*V_{DD}		2.5	5	ns
Fall transition time	T_F	From 0.9*V_{DD} to 0.1*V_{DD}		3.5	7	ns
Propagation Delay Time						
ENB → OUT1/2 (“L” to “H”)	t_{pLH}	V_{DD}= 5V, Load=18		13	16	ns
ENB → OUT1/2 (“H” to “L”)	t_{pHL}			36	43	ns
Pulse Width of ENB	t_{PW}		100			ns
Maximum frequency of ENB	f_{MAX}				5	MHz

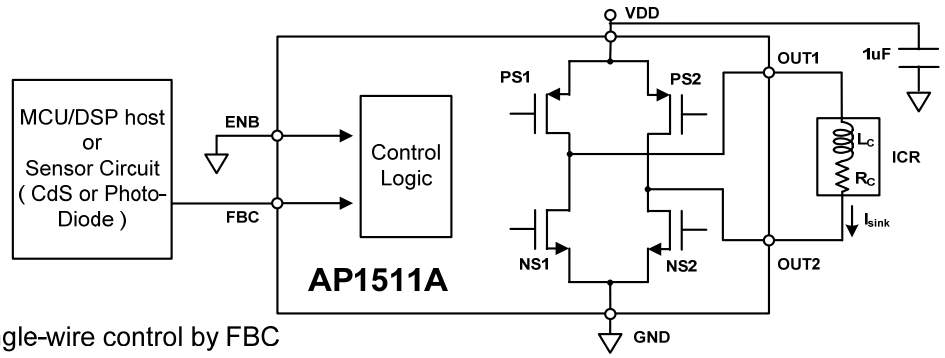


Propagation delay time between ENB and OUT1/2

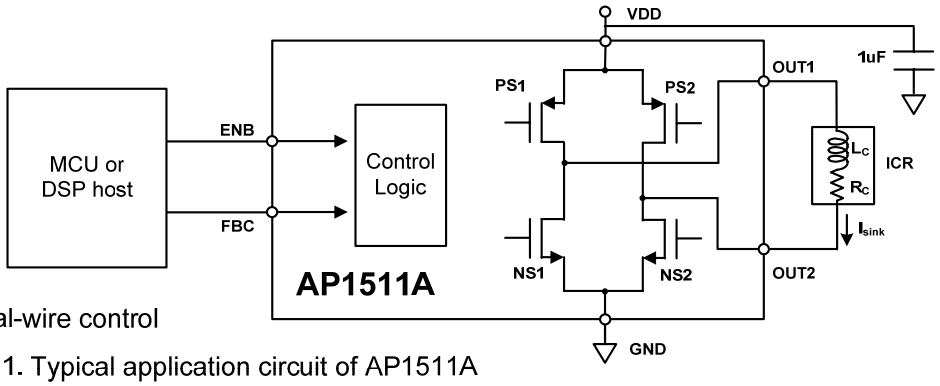


PWM waveform for ENB

7.Typical Application (AP1511A)



(a) Single-wire control by FBC

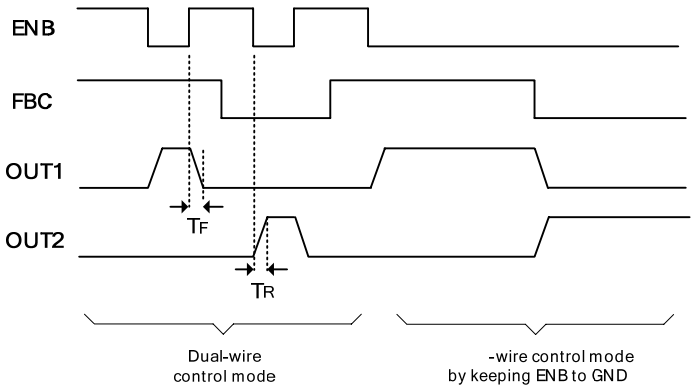


(b) Dual-wire control

Figure 1. Typical application circuit of AP1511A

8.Truth Table and Diagram of Controls

Input		Output	
ENB	FBC	OUT1	OUT2
H	X	L	L
L	H	H	L
L	L	L	H



9.Typical Application (AP1511B)

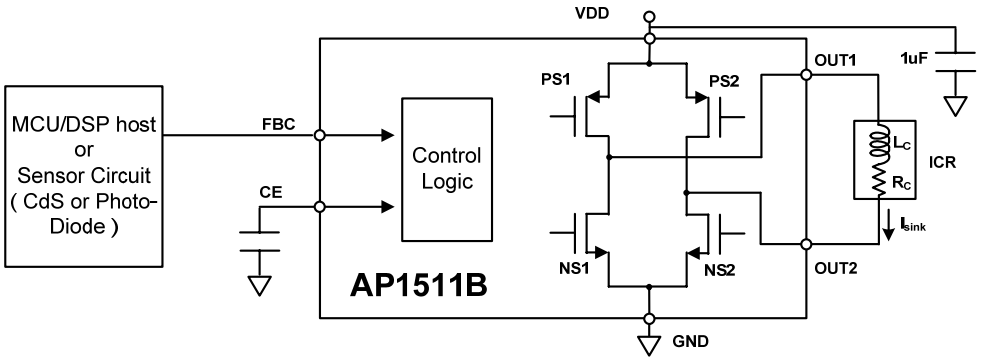
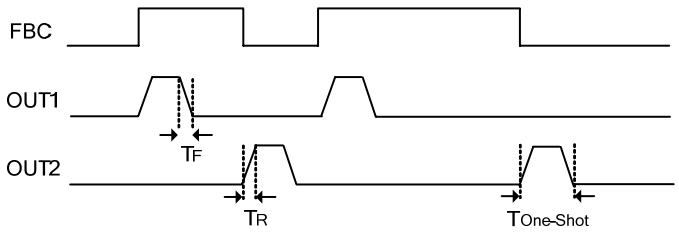


Figure 2. Typical application circuit of AP1511B

10.Truth Table and Diagram of Controls

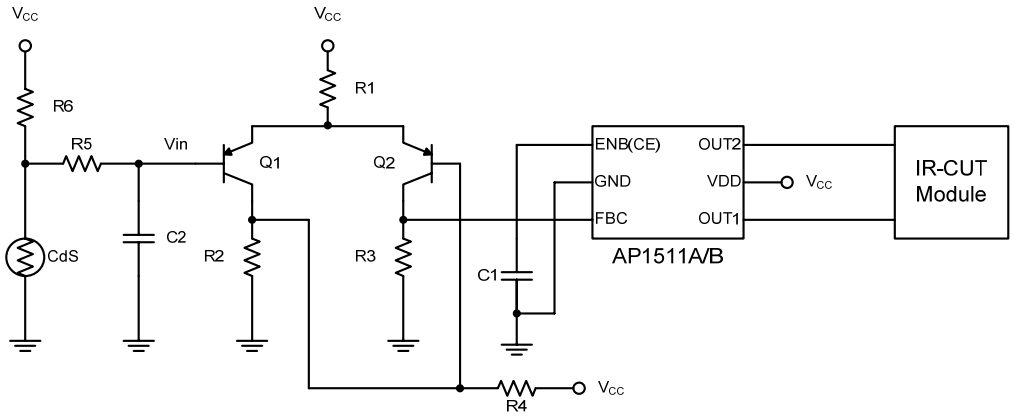
Input	Output	
FBC	OUT1	OUT2
⎍	∩	___
⎎	___	∩



The length of $t_{One-Shot}$ is determined by the external capacitor connected to the ce pin. The relationship is:

$T_{One-Shot}$= 0.6 x 10^6 x C_{CE} (second)

When the external capacitor value is fixed, $t_{One-Shot}$ will decrease by 0.2% for every 1°C rise in IC temperature. In fact, the general capacitance value will also change with temperature. The capacitance value is the largest at 25°C, and the capacitance value will decrease after deviating from 25°C. Therefore, it is recommended to set $t_{One-Shot}$ to twice the time required for ICR, so that it can operate normally at any temperature.

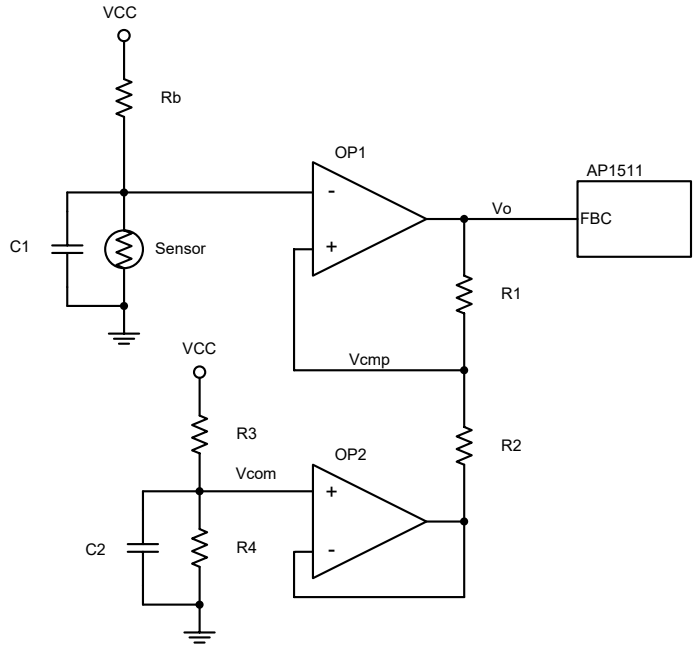


The above figure is an application circuit diagram of AP1511A/B. Photoresistors CdS R5 and R6 form a light sensing circuit, whose output is connected to the delay circuit R5 and C2. The voltage of Vin is the current ambient brightness. The Schmitt trigger circuit (Q1, Q2 and R1~R4) is used to determine whether it is daytime or nighttime and control the direction of the AP1511A/B FBC pin. In this way, the position of the infrared green light sheet in the ICR module will change according to the ambient brightness.

The function of the delay circuit is to ensure that the brightness signal is stable and will not be disturbed by the instantaneous change of ambient brightness. When R5 = 200k and C2 = 22uF, the delay time is about 3 seconds. Therefore, when the ambient brightness changes, it must be more than 3 seconds before AP1511 will act, otherwise it will be regarded as interference and AP1511 will not act.

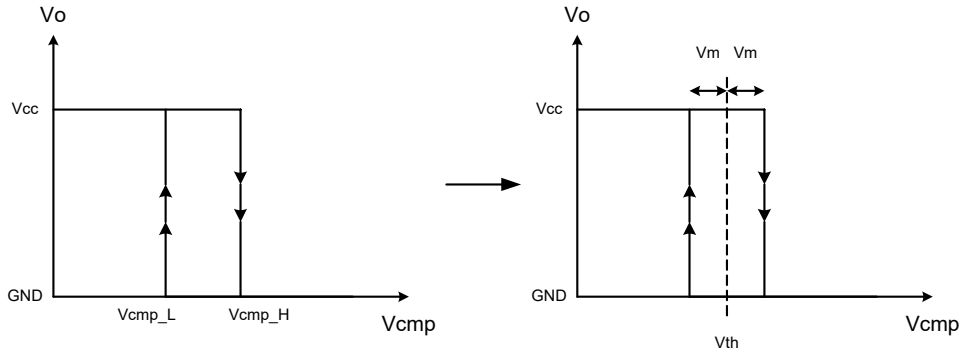
The Schmitt trigger circuit uses two critical voltages (V_{IH} and V_{IL} to obtain better noise tolerance to avoid environmental interference. When Vin is lower than V_{IL} , the Schmitt trigger circuit will send a low level to the FBC pin. When Vin is higher than V_{IH}, the Schmitt trigger circuit will send a high level to the FBC pin. If the Vin voltage is between V_{IH} and V_{IL} , the Schmitt trigger circuit output level will not change. This feature can improve noise tolerance and eliminate interference.

The critical voltage can be determined by the resistance value of r1~r4. Calculator" to do the calculation.



$$Vcmp\_H=\frac{R2}{R1+R2}V_{CC}+\frac{R1}{R1+R2}V_{COM},(V_O=V_{CC})$$

$$Vcmp\_L=\frac{R2}{R1+R2}\cdot 0+\frac{R1}{R1+R2}V_{COM}=\frac{R1}{R1+R2}V_{COM},(V_O=GND)$$

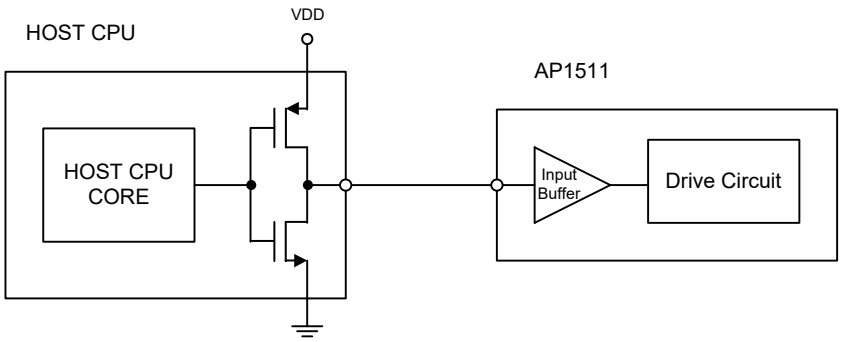


$$Vth=(cmp\_H+Vcmp\_L)/2=\frac{R2}{2(R1+R2)}V_{CC}+\frac{R1}{R1+R2}V_{CM}$$

$$Vm=(cmp\_H-Vcmp\_L)/2=\frac{R2}{2(R1+R2)}V_{CC}$$

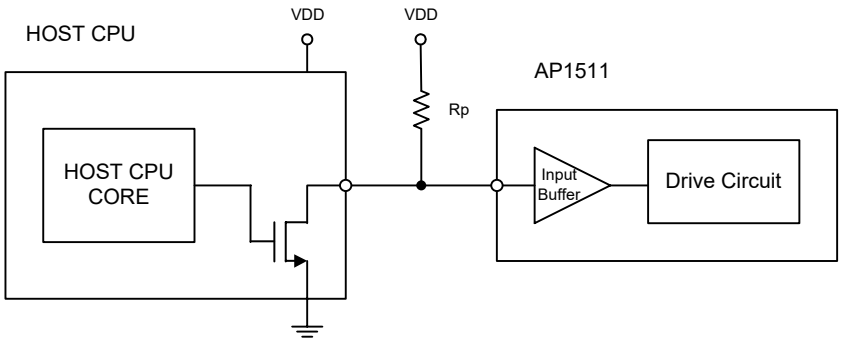
The above formulas explain how to calculate the Vth and Vm of the Schmitt trigger circuit composed of OPAMP. Its voltage value can be determined by R1 and R2. When the input signal is higher than Vcmp_H or lower than Vcmp_L, the output of the Schmitt trigger circuit will change. This feature can improve noise tolerance and eliminate interference.

AP1511's ENB and FBC pins are high impedance inputs, without built-in pull-up resistors. In most cases, AP1511 is controlled by the GPIO of the MCU or HOST CPU. GPIO has two forms: tri-state output and open-drain output.



HOST CPU with tri-state output buffer

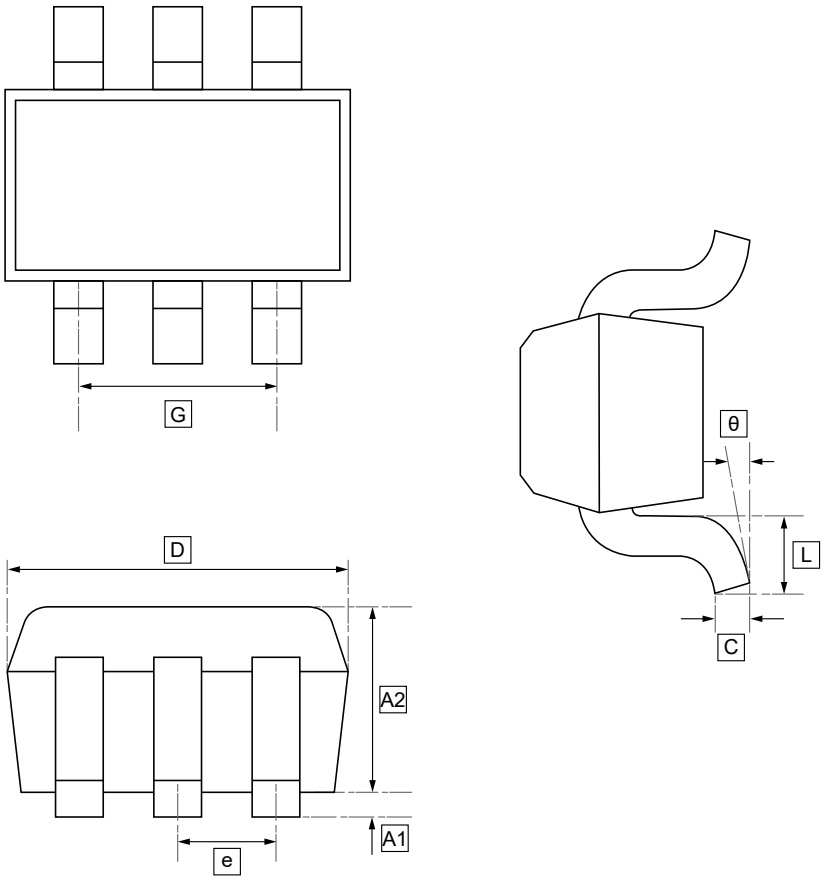
Because tri-state output can send high-level V_{DD} and low-level GND. So this type of GPIO can be directly connected to AP1511's ENB and FBC pins.



Host CPU with open-drain output buffer

If it is an open-drain output, it can only output low-level GND, so a boost resistor Rp must be added to the GPIO to generate a high-level VDD. The resistance of this boost resistor Rp can be about several hundred k. A smaller boost resistor can get a faster rise time, but it will consume more power when the GPIO outputs a low level.

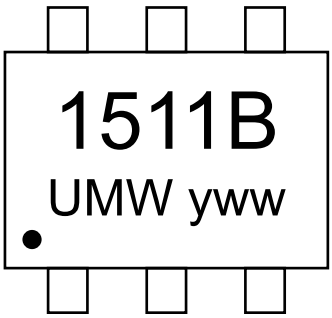
11.SOT23-6 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	b	C	D	E	E1	e	G	L	θ
Min	0.02	1.00	0.35	0.10	2.90	2.70	1.50	0.95	1.90	0.35	0°
Max	0.1	1.30	0.45	0.20	3.10	3.00	1.70			0.55	-

12.Ordering Information



yww: Batch Code

Order Code	Package	Base QTY	Delivery Mode
UMW AP1511B	SOT23-6	3000	Tape and reel

13.Disclaimer

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