LED Lighting Touch IC

BS45B2210

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General Description

The BS45B2210 is a capacitive LED Lighting Touch IC, which supports one-channel touch input and two-channel PWM output. This device can configure 7 light control modes and sensitivity adjustment test mode by configuring pins, which can meet the requirements of different situations. This device adopts a special integrated circuit internally, which has a high power supply rejection ratio and can reduce the occurrence of key detection errors. This feature ensures that the device still has high reliability in applications under adverse environmental conditions. It has the advantages of low power consumption, high anti-interference and instant use after power on.

Features

- Operating voltage: 2.2V~5.5V
- Sleep current about 2.5μA@3V
- Reliable one-channel touch input
- Maximum key pressed duration time detection: 32s
- Multiple optional modes: OPTION1~3
- Two-channel PWM output, frequency 31.25kHz

Pin Assignment

BS45B2210
8 SOP-A
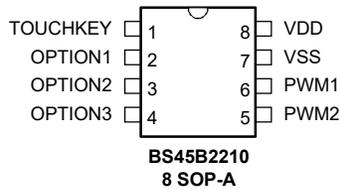
Pin Description

Pin Name	Pin No.	Type	Description
TOUCHKEY	1	Input	Touch key input pin
OPTION1	2	Input	Mode selection pin 1
OPTION2	3	Input	Mode selection pin 2
OPTION3	4	Input	Mode selection pin 3
PWM2	5	Output	Light adjustment, PWM2 output
PWM1	6	Output	Light adjustment, PWM1 output
VSS	7	—	Ground
VDD	8	—	Supply voltage

Functional Introduction

The TOUCHKEY touch input corresponds to PWM light control output, and the LED light switch and brightness change are controlled by adjusting the PWM output signal duty. The frequency of PWM signal is fixed at 31.25kHz, and there are 8 modes for selection, which are determined by the input status of OPTION1, OPTION 2 and OPTION 3 pins after power on. The device OPTION pin has an internal pull-up resistor, which is 1 when floating and 0 when connecting to GND, as follows:

Mode	OPTION3	OPTION2	OPTION1	Function Description
1	0	0	0	One-channel PWM1 cyclic stepless dimming with brightness memory and brightness buffering
2	0	0	1	Two-channel cyclic stepless dimming with brightness memory and brightness buffering (PWM1→PWM2→Off)
3	0	1	0	Two-channel cyclic stepless dimming with brightness memory and brightness buffering (PWM1→PWM2→PWM1+PWM2→Off)
4	0	1	1	One-channel PWM1 three-step dimming, High→Middle→Low→Off) cycle
5	1	0	0	Send touch data via UART
6	1	0	1	One-channel PWM1 three-step dimming, (Low→Middle→High→Off) cycle
7	1	1	0	Two-channel PWM three-step dimming, (High→Middle→Low→Off) cycle
8	1	1	1	Two-channel PWM three-step dimming, (Low→Middle→High→Off) cycle

Function Description

Mode Options	Detailed Function Description
OPTION=000	1. After the initial power on, PWM1 outpus low, LED light is Off. 2. Light On/Off can be controlled by key short press（the touch duration time is less than 1s）First short press, light is On. Next short press, light is Off. When short pressing the key for multiple times, cycle in sequence.There is a brightness buffer when the light On. The brightness of each short press to turn off the light will be saved, and the next time the light is touched to turn on, this brightness will be used as the initial brightness. 3. After the initial power on or power on again afer power off: After touching, the brightness of the light is the highest brightness, and the corresponding high duty of the output PWM signal is 100%. 4. Light stepless dimming can be implemented by key long press (touch duration time is greater than 1s). After the initial power on, long press to gradually decrease the light brightness. When released, the light brightness will remain at the corresponding brightness at the time of release. If the light has reached its darkest or brightest status, continue to touch for 2s, the brightness will start to flip. If keep pressing for more than 32s, the light brightness will remain at the corresponding brightness when the pressing is automatically released, and the light brightness will no longer change. When long pressing the key for multiple times, cycle in sequence. 5. The direction of the first dimming after turning on the light is determined by the previously memorised PWM duty. If the memorized PWM duty is greater than 45%, the dimming will be downward; If the memory PWM duty is lower than 45%, the dimming will be upward. The long press touch can only be used when the light is On.
OPTION=001	1. After the initial power on, PWM1 and PWM2 output low, LED light is Off. 2. First short press, the PWM1 outputs. Second short press, the PWM2 outputs. Third short press, light is Off. When pressing the key for multiple times, cycle in sequence. 3. After the initial power on or power on again after power off: After touching, the brightness of the light is the highest brightness, and the corresponding high duty of the output PWM signal is 100%. 4. The long press function is the same as OPTION=000.
OPTION=010	1. After the initial power on, PWM1 and PWM2 output low, LED light is Off. 2. After the initial power on or power on again afer power off: After touching, the brightness of the light is the highest brightness, and the corresponding high duty of the output PWM signal is 100%. 3. First short press, the PWM1 outputs. Second short press, the PWM2 outputs. Third short press, the PWM1 and PWM2 output simultaneously. Fourth short press, light is Off. When pressing the key for multiple times, cycle in sequence. 4. The long press function is the same as OPTION=000.

Mode Options	Detailed Function Description
OPTION=011	1. After the initial power on, PWM1 outputs low, LED light is Off. 2. First touch, the light is at high brightness. Second touch, the light is at medium brightness. Third touch, the light is at low brightness. Fourth touch, light is Off. When pressing the key for multiple times, cycle in sequence. The corresponding PWM signal duty of high, medium and low brightness are 100%, 40% and 6%.
OPTION=100	Test mode, sending touch data using the UART (PWM2) with a baud rate of 38400. Used with host computer HXT.
OPTION=101	1. After the initial power on, PWM1 and PWM2 output low, LED light is Off. 2. First touch, the light is at high brightness. Second touch, the light is at medium brightness. Third touch, the light is at low brightness. Fourth touch, light is Off. When pressing the key for multiple times, cycle in sequence. The corresponding PWM signal duty of high, medium and low brightness are 6%, 40% and 100%.
OPTION=110	1. After the initial power on, PWM1 and PWM2 output low, LED light is Off. 2. First touch, the light is at high brightness. Second touch, the light is at medium brightness. Third touch, the light is at low brightness. Fourth touch, light is Off. When pressing the key for multiple times, cycle in sequence. The corresponding PWM signal duty of high, medium and low brightness are 100%, 40% and 6%.
OPTION=111	1. After the initial power on, PWM1 and PWM2 output low, LED light is Off. 2. First touch, the light is at high brightness. Second touch, the light is at medium brightness. Third touch, the light is at low brightness. Fourth touch, light is Off. When pressing the key for multiple times, cycle in sequence. The corresponding PWM signal duty of high, medium and low brightness are 6%, 40% and 100%.

Detailed Function Description

Note: When using the long press touch to dim, the light will reaches its brightest or darkest status. Continuously touching for 2s to start flipping the brightness.

When using the three-step dimming, there is no long press function, and long press is also considered a short press. When using the two-channel PWM dimming, the duty of the PWM1 and PWM2 is consistent. After the two-channel PWM stops output and there is no touch action for 8s, the device will enter the sleep.

Electrical Characteristics

Absolute Maximum Ratings

Supply Voltage .... V_{SS}-0.3V to V_{SS}+6.0V

Storage Temperature.. -60°C to 150°C

Input Voltage .... V_{SS} -0.3V to V_{DD} +0.3V

Operating Temperature..-40˚C to 85˚C

I_{OL} Total 80mA

I_{OH} Total.. -80mA

Total Power Dissipation 500mW

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to these devices. Functional operation of these devices at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect devices reliability.

D.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.2	—	5.5	V
I_{DD}	Operating Current	3V	No load	—	1.2	1.8	mA
		5V		—	2.2	3.3	
I_{STB}	Standby Current	3V	No load	—	2.5	—	µA
		5V		—	4.0	—	
I_{OL}	Sink Current for I/O Ports	3V	$V_{OL}=0.1V_{DD}$	16	32	—	mA
		5V		32	65	—	
I_{OH}	Source Current for I/O Ports	3V	$V_{OH}=0.9V_{DD}$	-4	-8	—	mA
		5V		-8	-16	—	
R_{PH}	Pull-High Resistance for I/O Ports	3V	—	20	60	100	kΩ
		5V	—	10	30	50	
F_{PWM}	PWM Output Frequency	5V	—	—	31.25	—	kHz

Note: 1. I_{STB} is the average standby current.

2. All measurements are taken under conditions of no load and with all peripherals in an off state.

A.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
t_{KRT}	Key Response Time –Normal Mode	—	—	30	40	50	ms
	Key Response Time – Standby Mode	—	—	100	150	180	ms
t_{KH}	Maximum Key Hold Time	—	—	30	32	34	s
t_{CAL}	Auto-Calibration Period – Normal Mode	—	—	—	1	—	s
	Auto-Calibration Period – Standby Mode	—	—	—	2	—	
t_{NS}	Normal Mode → Standby Mode	—	—	7	8	9	s

Application Circuit

Schematic
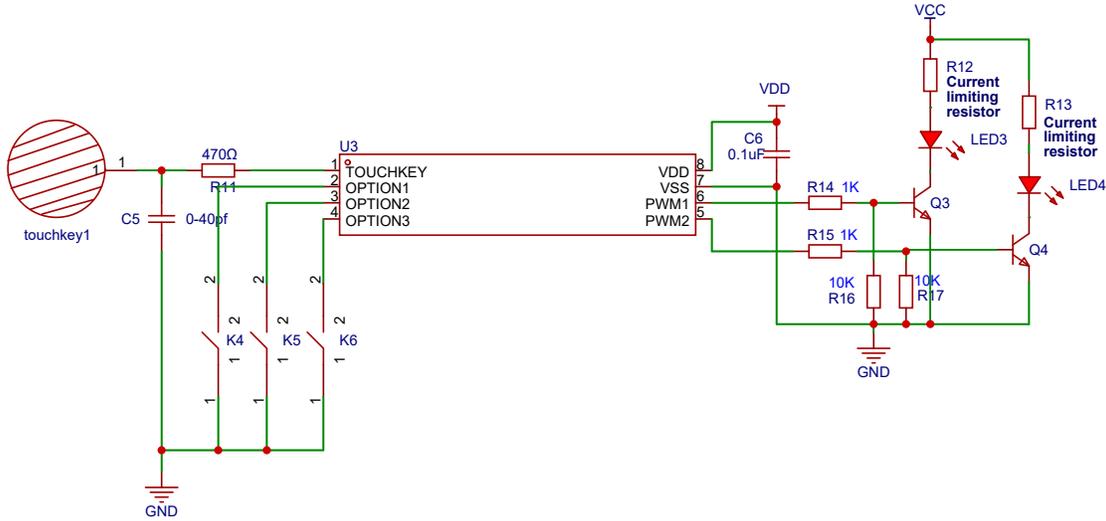
Note: 1. On the PCB, the PCB wirings from the touch PAD to the IC should be as short as possible. These wirings should not be parallel or cross with other wiring, and should be avoided from using via holes as much as possible.

2. The power supply must be stable. If the power supply voltage experiences drift, rapid drift or shift, it may cause abnormal sensitivity or false detection.

3. When laying out, it should be note that the 104 capacitor should be placed as close as possible to the IC, and it should be wired parallel with the power supply to the IC pins.

4. The PADs can be designed in any shape, it is generally recommended to design them in a circular shape. The springs, wirings and copper foil can be used to break free from the limitations of the PCB board. The larger the PAD, the higher the TOUCHKEY sensitivity.

5. If directly touching the PADs, it is recommended to add anti-ESD devices, such as connecting a 1~470Ω resistor in series or adding a TVS tube between the touch pin and ground.

Sensitivity Adjustment

When there is a significant difference in the medium material and panel thickness, users can enter the testing mode using OPTION=100, and check the sensitivity changes of the keys with the host computer HXT, which requires to be paired with BS_eBridge hardware. Then, adjust the touch sensitivity by adjusting the C5 capacitance between the TOUCHKEY and GND. The capacitance range is 0~40pF. The larger the capacitance value, the lower the sensitivity. The lower the capacitance value, the larger the sensitivity.

Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the Package/Carton Information.

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

• Package Information (include Outline Dimensions, Product Tape and Reel Specifications)

• Packing Meterials Information

• Carton information

8-pin SOP (150mil) Outline Dimensions
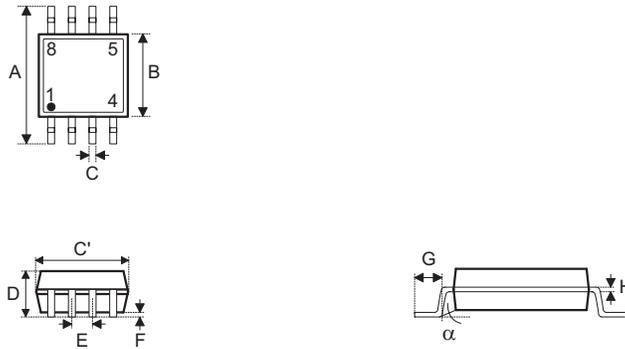
Symbol	Dimensions in inch		
	Min.	**Nom.**	**Max.**
A		0.236 BSC	
B		0.154 BSC	
C	0.012	—	0.020
C'		0.193 BSC	
D	—	—	0.069
E		0.050 BSC	
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	**Nom.**	**Max.**
A		6.00 BSC	
B		3.90 BSC	
C	0.31	—	0.51
C'		4.90 BSC	
D	—	—	1.75
E		1.27 BSC	
F	0.10	—	0.25
G	0.40	—	1.27
H	0.10	—	0.25
α	0°	—	8°