HOLTEK

Touch Key

BS211C-1/BS212C-1/BS213C-1/BS214C-1
BS214C-2/BS216C-1/BS218C-2/BS218C-3

www.holtek.com

Features

- Operating voltage: 2.2V~5.5V

- Low standby current

- Auto-calibration

- Reliable touch detections

- Standby and normal operating modes

- Maximum key on duration time detection

- Adaptive voltage drop function

- Level Hold, selectable active level-low or high

- NMOS output with internal pull-high/CMOS-Direct Output

- Both serial interface and parallel outputs

- Sensitivity adjustment using an external capacitor

- Minimal number of external components

General Description

The BS21x is a series of 1~8 key touch key devices which can detect human body contact using external touch pads. The high level of device integration enable applications to be implemented with a minimum number of external components.

The BS21x series devices are equipped with serial or parallel interfaces to allow easy communication with an external MCU for device setup and for touch pin monitoring purposes. Special internal circuitry is also employed to ensure excellent power noise rejection to reduce the possibility of false detections, increasing the touch switch application reliability under adverse environmental conditions.

With auto-calibration, low standby current, excellent resistance to voltage fluctuation and other features, this range of touch key devices provide a simple and effective means of implementing touch key operation in a wide variety of applications.
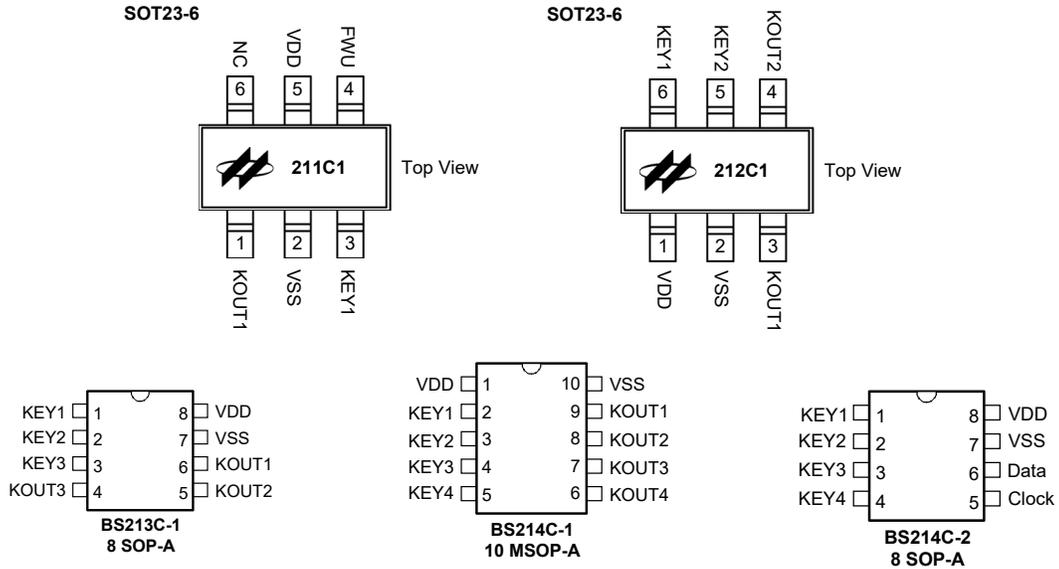
Selection Table

For this device series, most of the feature are similar. The BS218C-3 provide I²C function. The BS214C-2 and BS218C-2 include a serial interface function while the BS211C-1, BS212C-1, BS213C-1, BS214C-1 and BS216C-1 have parallel outputs. Meanwhile the BS218C-3 can set up some options and the sensitivity through the I²C communication interface and the BS216C-1 and BS218C-2 include two hardware options. The following table summarizes the main characteristics of each device.
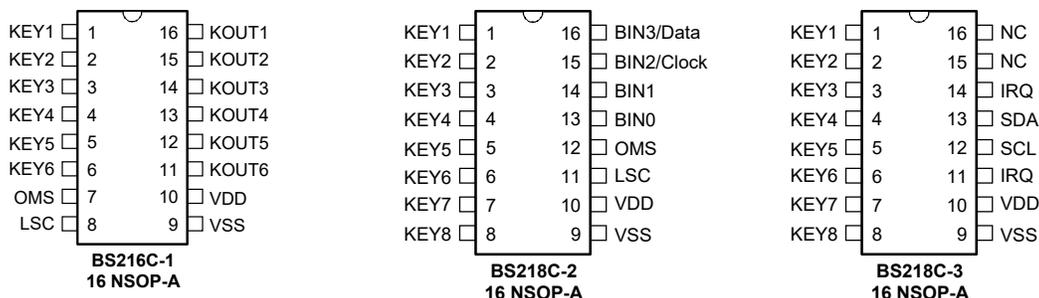
Part No.	Touch Key	V_{DD}	Standby Current at 3V		Key Output Type	Package
			One-key Wake-up	Any-key Wake-up		
BS211C-1	1-Key	2.2V~5.5V	—	4.0µA/2.5µA	Active Low	SOT23-6
BS212C-1	2-Key	2.2V~5.5V	—	3.5µA	Active Low	SOT23-6
BS213C-1	3-Key	2.2V~5.5V	—	4.0µA	Active Low	8SOP
BS214C-1	4-Key	2.2V~5.5V	—	5.0µA	Active Low	10MSOP
BS214C-2	4-Key	2.2V~5.5V	—	5.0µA	2-Wire Series Interface Mode	8SOP
BS216C-1	6-Key	2.2V~5.5V	—	7.5µA/3.5µA*	Active Low/ Active High*	16NSOP
BS218C-2	8-key	2.2V~5.5V	—	8.5µA/3.5µA*	2-Wire Series Interface Mode / 4-Wrie Binary Parallel Mode*	16NSOP
BS218C-3	8-Key	2.2V~5.5V	3.5µA/2.5µA**	8.0µA/3.5µA**	I²C	16NSOP

Note: 1. * pin selected option.

2. ** option by I²C communication.

Pin Assignment

SOT23-6

211C1   Top View

SOT23-6

212C1   Top View

BS213C-1
8 SOP-A

BS214C-1
10 MSOP-A

BS214C-2
8 SOP-A

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         ┌───∪───┐                           ┌───∪───┐                           ┌───∪───┐
 KEY1 ──┤1    16├── KOUT1         KEY1 ──┤1    16├── BIN3/Data      KEY1 ──┤1    16├── NC
 KEY2 ──┤2    15├── KOUT2         KEY2 ──┤2    15├── BIN2/Clock     KEY2 ──┤2    15├── NC
 KEY3 ──┤3    14├── KOUT3         KEY3 ──┤3    14├── BIN1           KEY3 ──┤3    14├── IRQ
 KEY4 ──┤4    13├── KOUT4         KEY4 ──┤4    13├── BIN0           KEY4 ──┤4    13├── SDA
 KEY5 ──┤5    12├── KOUT5         KEY5 ──┤5    12├── OMS            KEY5 ──┤5    12├── SCL
 KEY6 ──┤6    11├── KOUT6         KEY6 ──┤6    11├── LSC            KEY6 ──┤6    11├── IRQ
 OMS  ──┤7    10├── VDD           KEY7 ──┤7    10├── VDD            KEY7 ──┤7    10├── VDD
 LSC  ──┤8     9├── VSS           KEY8 ──┤8     9├── VSS            KEY8 ──┤8     9├── VSS
         └───────┘                           └───────┘                           └───────┘
         BS216C-1                             BS218C-2                             BS218C-3
         16 NSOP-A                            16 NSOP-A                            16 NSOP-A
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Pin Description

BS211C-1

Pin Name	I/O	Description
KEY1	Input	Touch key input pin, unused touch keys require grounding
KOUT1	NMOS output	NMOS output with internal pull-high
VSS	—	Negative power supply, ground
VDD	—	Positive power supply
NC	—	Not Connected
FWU	Input	Open = General power-saving mode Grounded = Fast wake-up mode

BS212C-1

Pin Name	I/O	Description
KEY1~KEY2	Input	Touch key input pin, unused touch keys require grounding
KOUT1~KOUT2	NMOS output	NMOS output with internal pull-high
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS213C-1

Pin Name	I/O	Description
KEY1~KEY3	Input	Touch key input pin, unused touch keys require grounding
KOUT1~KOUT3	NMOS output	NMOS output with internal pull-high
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS214C-1

Pin Name	I/O	Description
KEY1~KEY4	Input	Touch key input pin, unused touch keys require grounding
KOUT1~KOUT4	NMOS output	NMOS output with internal pull-high
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS214C-2

Pin Name	I/O	Description
KEY1~KEY4	Input	Touch key input pin, unused touch keys require grounding
Clock	Input	2-wire series interface Clock input with internal pull-high
Data	NMOS output	2-wire series interface Date NMOS output with internal pull-high
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS216C-1

Pin Name	I/O	Description
KEY1~KEY6	Input	Touch key input pin, unused touch keys require grounding
OMS	Input	Output Mode Selection Open=NMOS output (low active) Grounded=CMOS-Direct output (high active)
LSC	Input	Power-saving mode selection Open= General power-saving mode Grounded=More power-saving mode
KOUT1~KOUT6	NMOS output CMOS output	OMS open, NMOS output with internal pull-high OMS grounded, CMOS-Direct output
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS218C-2

Pin Name	I/O	Description
KEY1~KEY8	Input	Touch key input pin, unused touch keys require grounding
OMS	Input	Output mode selection Open=2-wire serial mode Grounded=4-wire binary parallel mode
LSC	Input	Power-saving mode selection Open=General power-saving mode Grounded=More power-saving mode
Clock	Input	2-wire series interface Clock input – internal pull-high
Data	NMOS output	Serial interface Data NMOS output – internal pull-high
BIN3~BIN0	CMOS output	2-wire series output mode or 4-wrie binary parallel output mode
VSS	—	Negative power supply, ground
VDD	—	Positive power supply

BS218C-3

Pin Name	I/O	Description
KEY1~KEY8	Input	Touch key input pin, unused touch keys require grounding
IRQ	Output	Interrupt request or wake-up function, NMOS output with internal pull-high
SCL	Input / Output	I^{2}C clock input/output
SDA	Input / Output	I^{2}C data input/output
VSS	—	Negative power supply, ground
VDD	—	Positive power supply
NC	—	Not Connected

Absolute Maximum Ratings

Supply Voltage .... V_{SS} -0.3V to V_{SS} +6.5V

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

I_{OL} Total 80mA

I_{OH} Total .... -80mA

Storage Temperature... -60°C to 150°C

Operating Temperature.. -40°C to 85°C

Total Power Dissipation 500mW

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device 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 (BS211C-1/BS212C-1)	3V	No load	—	0.6	0.9	mA
		5V		—	1.2	1.8	mA
	Operating Current (BS213C-1/BS214C-1/ BS214C-2/BS216C-1/BS218C-2/BS218C-3)	3V	No load	—	1.2	1.8	mA
		5V		—	2.2	3.3	mA
I_{STB}	Standby Current (BS211C-1) [1]	3V	FWU open	—	2.5	—	μA
		5V		—	6.0	—	μA
		3V	FWU grounded	—	4.5	—	μA
		5V		—	10.0	—	μA
	Standby Current (BS212C-1) [1]	3V	No load	—	3.5	—	μA
		5V		—	6.0	—	μA
	Standby Current (BS213C-1) [1]	3V	No load	—	4.0	—	μA
		5V		—	8.0	—	μA
	Standby Current (BS214C-1/BS214C-2) [1]	3V	No load	—	5.0	—	μA
		5V		—	9.5	—	μA
	Standby Current (BS216C-1) [1] LSC=V_{SS} [2]	3V	No load	—	3.5	—	μA
		5V		—	5.5	—	μA
	Standby Current (BS218C-2) [1] LSC=V_{SS} [2]	3V	No load	—	3.5	—	μA
		5V		—	6.0	—	μA
	Standby Current (BS216C-1) [1] LSC=Open [2]	3V	No load	—	7.5	—	μA
		5V		—	15	—	μA
	Standby Current (BS218C-2) [1] LSC=Open [2]	3V	No load	—	8.5	—	μA
		5V		—	16	—	μA
I_{STB}	Standby Current (BS218C-3) [1] LSC Enable [3]	One Key Wake Up	3V	No load	—	2.5	—	μA
			5V	—	3.0	—	μA
		Any Key Wake Up	3V	—	3.5	—	μA
			5V	—	6.0	—	μA
	Standby Current (BS218C-3) [1] LSC Disable [3]	One Key Wake Up	3V	No load	—	3.5	—	μA
			5V	—	5.5	—	μA
		Any Key Wake Up	3V	—	8.0	—	μA
			5V	—	16	—	μA

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{IL}	Input Low Voltage for Clock, SCL or SDA Pins	5V	—	0	—	1.5	V
		—	—	0	—	$0.2V_{DD}$	V
V_{IH}	Input High Voltage for Clock, SCL or SDA Pins	5V	—	3.5	—	5.0	V
		—	—	$0.8V_{DD}$	—	V_{DD}	V
I_{OL}	KOUT Sink Current (CMOS) Data/SDA/SCL Sink Current (NMOS)	3V	$V_{OL}=0.1V_{DD}$	15	30	—	mA
		5V		30	60	—	mA
I_{OH}	KOUT Source Current (CMOS)	3V	$V_{OH}=0.9V_{DD}$	-4	-8	—	mA
		5V		-8	-16	—	mA
R_{PH}	Pull-high Resistance to Clock/KOUT/SDA/SCL/IRQ Pin	3V	—	20	60	100	kΩ
		5V	—	10	30	50	kΩ

Note: 1. I_{STB} is the average standby current
     2. Refer to the OMS/LSC Option table
     3. Refer to the I²C Option table

A.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
t_{KRT}	Key Response Time – Normal Mode BS211C-1/BS212C-1/BS213C-1/BS214C-1/ BS214C-2/BS216C-1/BS218C-2	—	—	40	60	80	ms
	Key Response Time – Normal Mode BS218C-3	—	DEBOUNCE=1	40	60	80	ms
	Key Response Time – Standby Mode BS211C-1	—	FWU open	100	150	250	ms
			FWU grounded	70	90	110	
	Key Response Time – Standby Mode BS212C-1/BS213C-1/BS214C-1/BS214C-2	—	—	100	150	250	ms
	Key Response Time – Standby Mode BS216C-1/BS218C-2	—	LSC=Open (disable)	100	150	250	ms
		—	LSC=V_{SS} (enable)	400	600	1000	ms
	Key Response Time – Standby Mode BS218C-3	—	LSC disable / IRQ enable	100	150	250	ms
		—	LSC enable / IRQ enable	400	600	1000	ms
t_{KH}	Maximum Key Hold Time BS211C-1/BS212C-1/BS213C-1/BS214C-1/ BS214C-2/BS216C-1/BS218C-2	—	—	60	64	68	s
	Maximum Key Hold Time BS218C-3	—	MaximumKeyHoldTime = 15	60	64	68	s
t_{CAL}	Auto-Calibration Period – Normal Mode	—	—	—	1	—	s
	Auto-Calibration Period – Standby Mode	—	—	—	2	—	s
t_{NS}	Normal to Standby Mode Conversion Time (Except BS218C-3)	—	—	7	8	9	s

Serial Interface Characteristics

BS214C-2/BS218C-2

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
T_{START}	Start Bit Low Time	—	—	—	—	t_{NS}	s
T_{LOW}	Clock Low Time	—	—	20	—	—	µs
T_{HIGH}	Clock High Time	—	—	20	—	—	µs
T_{BR}	Data Transfer Rate	—	—	—	—	25	Kbps
T_{ED}	Delay Time between a Error Reading and the Next Reading	—	—	6	—	—	ms

I²C Interface Characteristics

BS218C-3

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
T_{LOW}	Clock Low Time	—	—	5	—	—	µs
T_{HIGH}	Clock High Time	—	—	5	—	—	µs
T_{BR}	Data Transfer Rate	—	—	—	—	100	Kbps
T_{TO}	Time-Out Period	—	—	—	64	—	ms
T_{WRL}	Register Write/Read Operation Time Limitation	—	—	—	—	6	s

Functional Description

Introduction

This range of BS21x touch key devices offer an easy and reliable means of implementing touch switch functions in a wide range of applications which require 1~8 touch keys. Very few external components are required for full touch key implementations. In addition to simple parallel output, a two-wire serial interface offer a convenient communication with an external MCU.

Sensitivity adjustment is also an easy matter. By the simple connection of a small capacitor to the touch key input pin, the changes in the capacitor value will be reflected in different sensitivity values. By having a fully integrated adaptive voltage drop function, touch switch applications can save on the usually required LDO.

Option Table

OMS/LSC Option Table

The BS216C-1 and BS218C-2 provide two options to enhance application flexibility.

• OMS Option

	OMS – Output Mode Selection	Description
BS216C-1	Open	NMOS output with internal pull-high, low active
	Vss	CMOS output, high active
BS218C-2	Open	2-wire serial mode
	Vss	4-wire Binary parallel mode

• LSC Option

	LSC – Lower Standby Current	Description
BS216C-1 BS218C-2	Open	General power-saving
	Vss	More power-saving (wake-up time of 0.5~1s)

I²C Option Table

BS218C-3 provides options can be setup by I²C communication interface.

• IRQ_OMS / STANDBY MODE Option

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
0B0H			—				STANDBY MODE	IRQ_OMS	R/W

Name	Default	Function
STANDBY MODE	0	0: Power-saving function 1: Not enter power-saving function
IRQ_OMS	0	0: Level hold, low active 1: One-shot, low active

• **DEBOUNCE Option**

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
0B2H	1	0	0	0	DEBOUNCE				R/W

Name	Default	Function
DEBOUNCE	0001	0000: Debounce set 1 0001: Debounce set 2 : 1110: Debounce set 15 1111: Debounce set 16

• **MaximumKeyHoldTime/TOUCH FREQ/SENSITIVE Option**

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
0B3H	MaximumKeyHoldTime				0	TOUCH FREQ		SENSITIVE	R/W

Name	Default	Function
MaximumKeyHoldTime	1111	Maximum key hold time: 0000: Turn off 0001: 4s 0010: 8s 0011: 12s ... 1110: 56s 1111: 60s Note: The maximum key hold time is equal to MaximumKeyHoldTime × 4s (except the 0000 is turn off)
TOUCH FREQ	00	00: Touch frequency set 1 01: Touch frequency set 2 10: Touch frequency set 3 11: Can't be used
SENSITIVE	1	0: Low sensitive 1: High sensitive

• **LSC Option**

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
0B4H	1	LSC	0	1	1	0	0	0	R/W

Name	Default	Function
LSC	1	0: General power-saving 1: More power-saving (wake-up time of 0.5~1s)

• **Touch Key Wake-up Option**

Part No.	Address	Name	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
BS218C-3	0B5H~0BCH	Kn_TH	KnWU	0	Key n Trigger threshold value						R/W

Name	Default	Function
KnWU	0	0: Enable wake-up function 1: Disable wake-up function

• **Standby Time Control Option**

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
E0H	0	Standby time value							R/W

Name	Default	Function
Standby Time Control	127	0~7: Can't be used 8: 512ms 9: 576ms 10: 640ms ⋮ 127: 8128ms

Note: 1. When the working time reaches the default value will enter the standby mode automatically.
  2. Normal to Standby Mode Conversion Time (Typ.) = 64ms × standby time value.

Operating Mode

There are two operating modes for this device series, the normal mode and the standby mode. During the 8 seconds after power-on, if no touch key actions are detected, the devices will automatically enter the standby mode to reduce their power consumption. If a key or several keys are pressed, the device will be woken up and will then enter the normal mode and output the key state value until all keys are released. After 8 seconds, the system will then revert to the standby mode again. Note that the BS218C-3 device can set up the wake-up keys individually.

Touch Key Outputs

For the BS211C-1, BS212C-1, BS213C-1 and BS214C-1 devices, all output pins are NMOS structures with connected internal pull-high resistors without requiring external resistors. The non touch detect output logic level is high. When a touch action is detected, the corresponding output will change to a low state.

For the BS216C-1 device, except the NMOS output type, users can also select a CMOS output type. The non touch detect output logic level is low. When a touch action is detected, the corresponding output will change to a high state.

Serial Interface

The BS214C-2 and BS218C-2 are equipped with a serial interface allowing for easy interfacing to an external master MCU. When the device detects that a touch key has been pressed, it will output a low on the Data pin which can be used to wake up the master MCU. After receiving this low level, the master can then send a clock signal to the Clock pin and read back the key status from the Data pin.

When a low clock signal is received the key status data is prepared by the touch key device. When the clock signal changes to a high level, the master reads the touch key status data from the Data line. The timings associated with the communication protocol can be fully described within 8 clock periods. Without waiting for a start bit, the touch key status condition can also be directly read using a polling method. If there are any errors in reading the data, it is necessary to wait for about 6ms and then read the data again.

4-key Data Format

After a clock signal is received on the Clock pin, an 8-bit data byte will be generated by the touch key device and shifted out on the Data pin. Data bits, bit6~bit4, will also generate a checksum whose content informs how many touch keys have been touched. For example, if the checksum is equal to "010", it means that two keys have been touched. As to which keys are actually touched, this information can be retrieved from the condition of data bits, bit3~bit0. The state of the data bits, bit3~bit0, is used to indicate which touch keys, KEY4~KEY1, are touched or not respectively. A low bit means the corresponding key is touched. Otherwise, the key is not touched if the corresponding data condition is high.

Start bit: When a key changes state, the Data pin outputs a low, which can wake up the master, which can then read the key status.

Bit0: KEY1 state – "0"= touch, "1"= no touch

Bit1: KEY2 state – "0"= touch, "1"= no touch

Bit2: KEY3 state – "0"= touch, "1"= no touch

Bit3: KEY4 state – "0"= touch, "1"= no touch

Bit6~4: Checksum – the total number of "0"s is used to indicate how many keys have been touched.

Bit7: Stop bit, always a "1", high level.
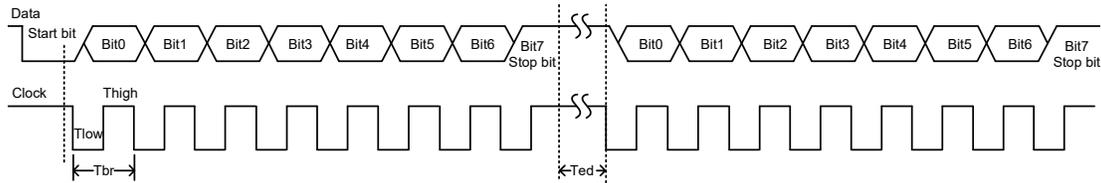
Data Transfer Timing – BS214C-2

| Bit	7	6~4	3~0	Descriptions
Function	**Stop bit**	**Check Sum**	**KEY4 ~ KEY1 state**	**0: touched / 1: not touched**
Data Stream	1	100	0000	Check Sum = 100, Four keys are touched
		011	0001, 0010, 0100 or 1000	Check Sum = 011, Three keys are touched
		010	0011, 0101, 0110, 1001, 1010 or 1100	Check Sum = 010, Two keys are touched
		001	0111, 1011, 1101 or 1110	Check Sum = 001, One key is touched
		000	1111	Check Sum = 000, No key is touched

4-key Serial Data Stream Format
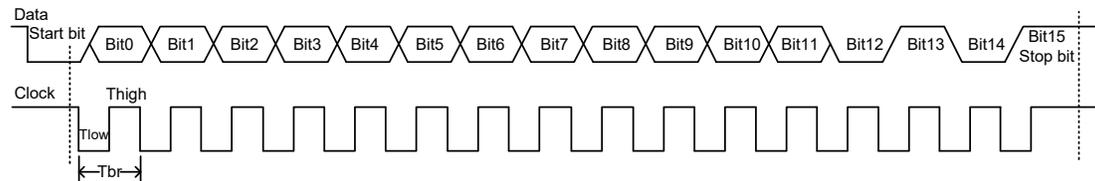
Data Transfer Timing – BS218C-2

8-key Data Format

After a clock signal is received on the Clock pin, a 16-bit data byte will be generated by the touch key device and shifted out on the Data pin. Data bits, bit11~bit8, will also generate a checksum whose content informs how many touch keys have been touched. For example, if the check sum is equal to "0010", it means that two keys have been touched. As to which keys are actually touched, this information can be retrieved from the condition of data bits, bit7~bit0. The state of the data bits, bit7~bit0, is used to indicate which touch keys, KEY8~KEY1, are touched or not respectively. A low bit means the corresponding key is touched. Otherwise, the key is not touched if the corresponding data condition is high.

Start bit: When a key state is changed, Data pin outputs a low, which can wake up the master, which can then read the key status.

Bit0: KEY1 state – "0" = touch, "1" = no touch

Bit1: KEY2 state – "0" = touch, "1" = no touch

Bit2: KEY3 state – "0" = touch, "1" = no touch

Bit3: KEY4 state – "0" = touch, "1" = no touch

Bit4: KEY5 state – "0" = touch, "1" = no touch

Bit5: KEY6 state – "0" = touch, "1" = no touch

Bit6: KEY7 state – "0" = touch, "1" = no touch

Bit7: KEY8 state – "0" = touch, "1" = no touch

Bit11~8: Checksum – the total number of "0"s is used to indicate how many keys have been touched.

Bit15~12: Stop bits, always "1010B".

Parallel Interface

The BS218C-2 also provides a parallel interface function which shows directly the key state condition. When the parallel output type is selected, the touch key data reflects only one key state, not more keys, at the same time. When no touch key is pressed, BIN3~BIN0 are high. When any key is pressed, BIN3 must output a low to wake up the master while BIN2~BIN0 reflect which keys are pressed as shown in the following table.

Pressed Key	BIN3	BIN2	BIN1	BIN0
No key	1 (high)	1	1	1
KEY1	0 (low)	1	1	1
KEY2	0	1	1	0
KEY3	0	1	0	1
KEY4	0	1	0	0
KEY5	0	0	1	1
KEY6	0	0	1	0
KEY7	0	0	0	1
KEY8	0	0	0	0

I²C Interface

START and STOP Conditions
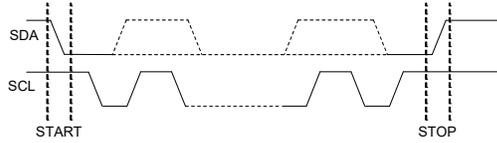
Bit	15~12	11~8	7~0	Descriptions
Function	Stop bit	Check Sum	KEY8~KEY1 state	0: touch / 1: not touched
Data Stream	1010	1000	00000000	Check Sum= 1000, 8 keys are touched.
		0111	00000001, 00000010, 00000100, 00001000, 00010000, 00100000, 01000000 or 10000000	Check Sum = 0111, 7 keys are touched.
		0110	00000011, 00000110, 00011000, 00110000, 11000000 or 10000001……..	Check Sum = 0110, 6 keys are touched.
		0101	00000111, 00001110, 11100000, 10000011, 10000110, 10001100 or 10011000…	Check Sum = 0101, 5 keys are touched.
		0100	00001111, 00011110, 00111100, 01111000, 11110000 or 10000111…..	Check Sum = 0100, 4 keys are touched.
		0011	00011111, 00111110, 01111100, 11111000 100011111 or 110001111……	Check Sum = 0011, 3 keys are touched.
		0010	00111111, 01111110, 11111100, 01111110, 01111101 or 01111011…..	Check Sum = 0010, 2 keys are touched.
		0001	11111110, 11111101, 11111011, 11110111 11101111, 11011111, 10111111 or 01111111	Check Sum = 0001, 1 key is touched.
		0000	11111111	Check Sum = 0000, No key is touched.

Serial Data Stream Format for 8-key

Slave Address

After the START signal, a 7-bit slave address will be transmitted. The slave address is 0x50. (slave address + R/W = 0xA1 or 0xA0)
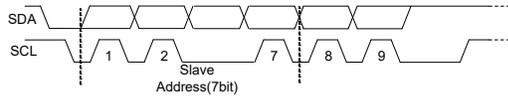
Read or Write Control
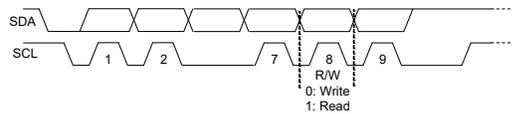
Acknowledge
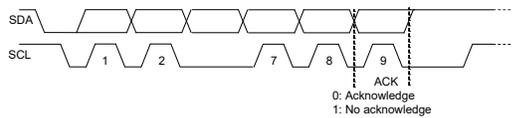
Slave Busy

After a date byte (8-bit+ACK) is transmitted, the slave device is busy with processing the received data (slave busy) and cannot receive the next data byte. At this time the SCL line is pulled low and the master can continue to transmit the data until the SCL line is pulled high again.
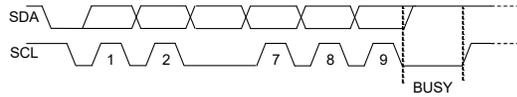
• **Read**

• **Write**
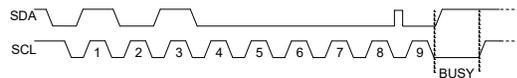
Read Status Output Register

The structure of reading status from the BS218C-3.
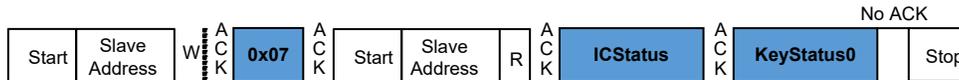
BS218C-3 Status Output Register

Address	Name	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
07H	ICStatus	—	—	—	—	—	—	—	ResetFlag	R
08H	KeyStatus0	KEY8	KEY7	KEY6	KEY5	KEY4	KEY3	KEY2	KEY1	R

ResetFlag=0: IC reset
ResetFlag=1: The address has been read
Refer to the IRQ function for the relevant operating methods.
KeyN=0: No key
KeyN=1: Key
N=1~8

BS218C-3 Write Setting Register

When the master writes the setting byte to the BS218C-3, it writes 14 date bytes consecutively with the start byte of 0xB0 and the last byte of the checksum.

CheckSum (8-bit): DATA1 + DATA2 + … + DATA13
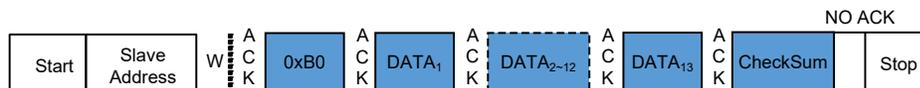
When the setting is changed, the Touch Key module will be reset. For about 0.8s later the Touch Key module can normally operate after reset.

BS218C-3 Read Setting Register

The master reads a setting byte of the BS218C-3.

The master reads n setting bytes of the BS218C-3.

• **BS218C-3 Touch-key Setting Registers**

Address	Name	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	R/W
B0H	Option1	—						STANDBY MODE	IRQ_OMS	R/W
B1H	Reserve	—								R/W
B2H	Reserve	1	0	0	0	DEBOUNCE				R/W
B3H	Option2	MaximumKeyHoldTime			0	TOUCH FREQ			SENSITIVE	R/W
B4H	Option3	1	LSC	0	1	1	0	0	0	R/W
B5H	K1_TH	K1WU	KEY1 Trigger threshold value							R/W
B6H	K2_TH	K2WU	KEY2 Trigger threshold value							R/W
B7H	K3_TH	K3WU	KEY3 Trigger threshold value							R/W
B8H	K4_TH	K4WU	KEY4 Trigger threshold value							R/W
B9H	K5_TH	K5WU	KEY5 Trigger threshold value							R/W
BAH	K6_TH	K6WU	KEY6 Trigger threshold value							R/W
BBH	K7_TH	K7WU	KEY7 Trigger threshold value							R/W
BCH	K8_TH	K8WU	KEY8 Trigger threshold value							R/W
BDH	Check sum	Check sum								R/W
E0H	Standby time control	0	Standby time value							R/W

Note: It is recommended that the trigger threshold value is lower than 64.

IRQ Function

The IRQ function includes IC reset notification, key establishment/status change notification.

Reset notification mode:

• When the IC is reset, the IRQ will be pulled low continuously. After pulling low, the master will read the ResetFlag

• After reading the ResetFlag, it will switch to "Key notification mode"

Key notification mode:

• IRQ_OMS = 0 (Level hold, low active)

The master reads the key data when the IRQ is low and will stop reading data until the key data is 0.
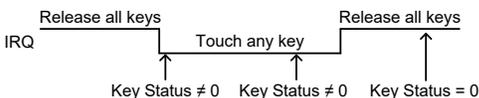
• IRQ_OMS = 1 (One-shot, low active)

The master reads the key data when the IRQ is low.
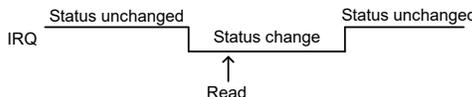
Not using the IRQ function:

The master will use the polling to read key data. It is recommended to note the ResetFlag when reading the key status. When the IC is reset, the option should be corrected in real time. It is recommended to use IRQ for power-saving products to maintain the best state.

Maximum Key On Duration Time

To minimise the possibility of unintentional key detections, such as undesired objects covering the sensing electrodes, the devices include a Maximum Key On duration function. To implement this function the devices include an internal timer, which starts running after each key detection. If the key on time of a touch key exceeds the configured seconds, then the device will re-calibrate the key state, obtain a new reference value, while the output status is reset to the initial state.

Auto-calibration Function

The devices include a full auto-calibration function which will be initiated after the device is powered-on. In addition to the power-on calibration, if no key pressed has been detected for about more than 1 second in the normal mode or 2 seconds in the standby mode, then a further calibration procedure will be carried out. By implementing this feature, changes in the touch key environmental conditions are automatically catered for dynamically.

Adaptive Voltage Drop

This series of touch key devices include an adaptive voltage drop function to prevent touch key malfunction due to power supply voltage variations which may be caused by high current switching. With the adaptive voltage drop function, there is no need for an external LDO to deal with these voltage drop issues.

Sensitivity Adjustment

The sensitivity of the key is a very important consideration in most applications whose requirements will vary according to the user application. The user should therefore be aware of the methods which can adjust the sensitivity of their touch key application. Changing the PCB electrode size, the conductive layout area below the electrode and the thickness of the dielectric material panel can all be used to adjust the touch switch sensitivity. Additionally for the BS21x device series, except the BS218C-3 device, an external capacitor connected to the touch key input pin can also be used to adjust the sensitivity for different applications. While for the BS218C-3 device, changing related settings through the I²C can be used to adjust the sensitivity for different demands.

The touch threshold adjustment range is from 8~63.
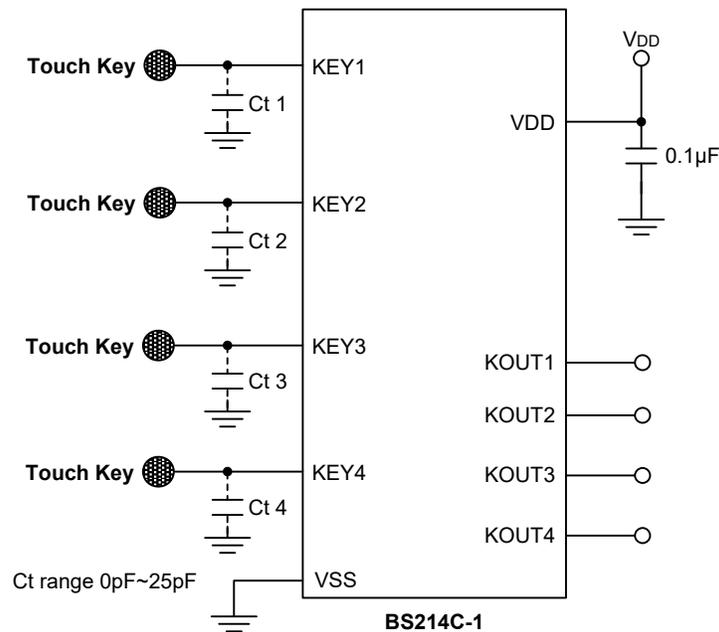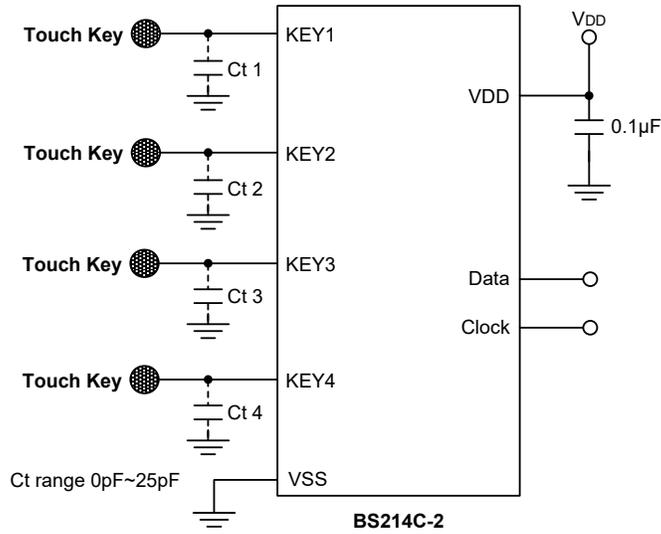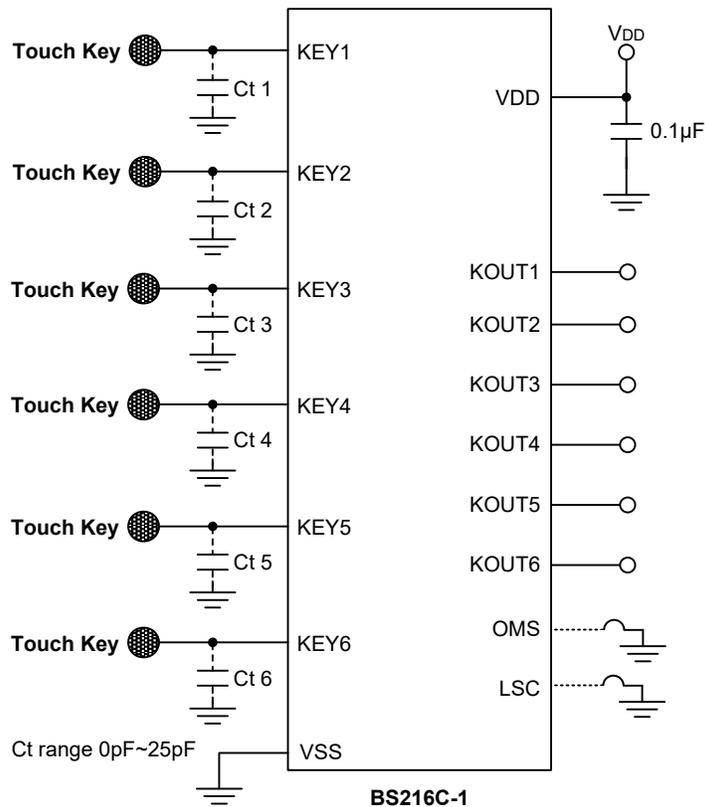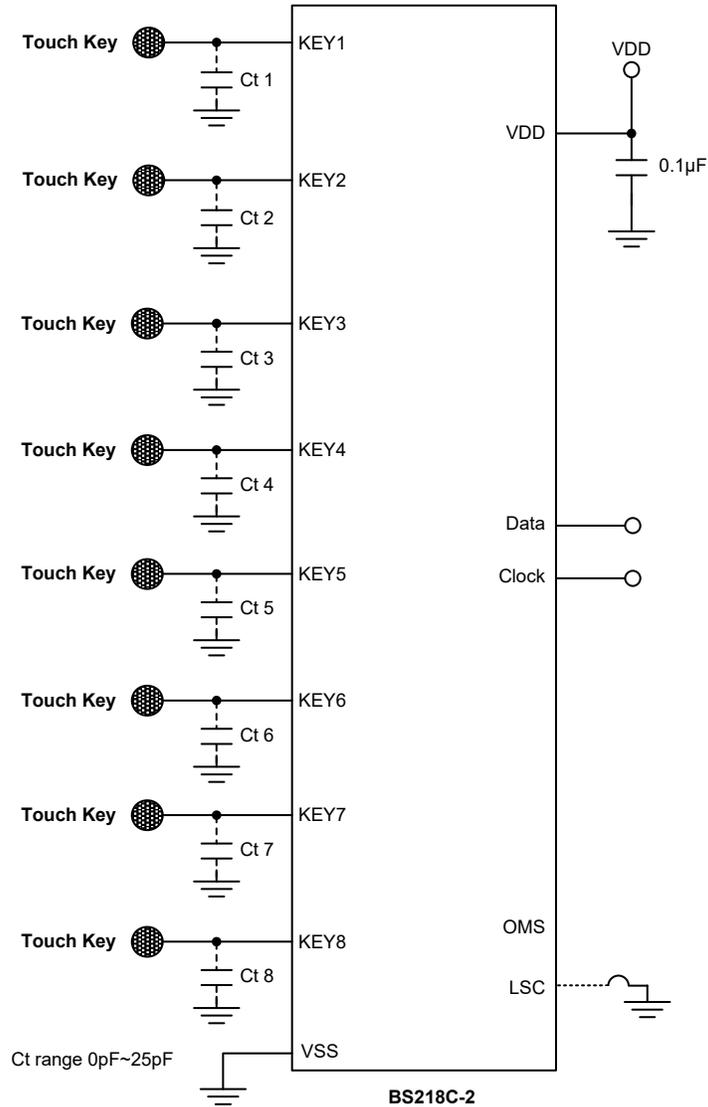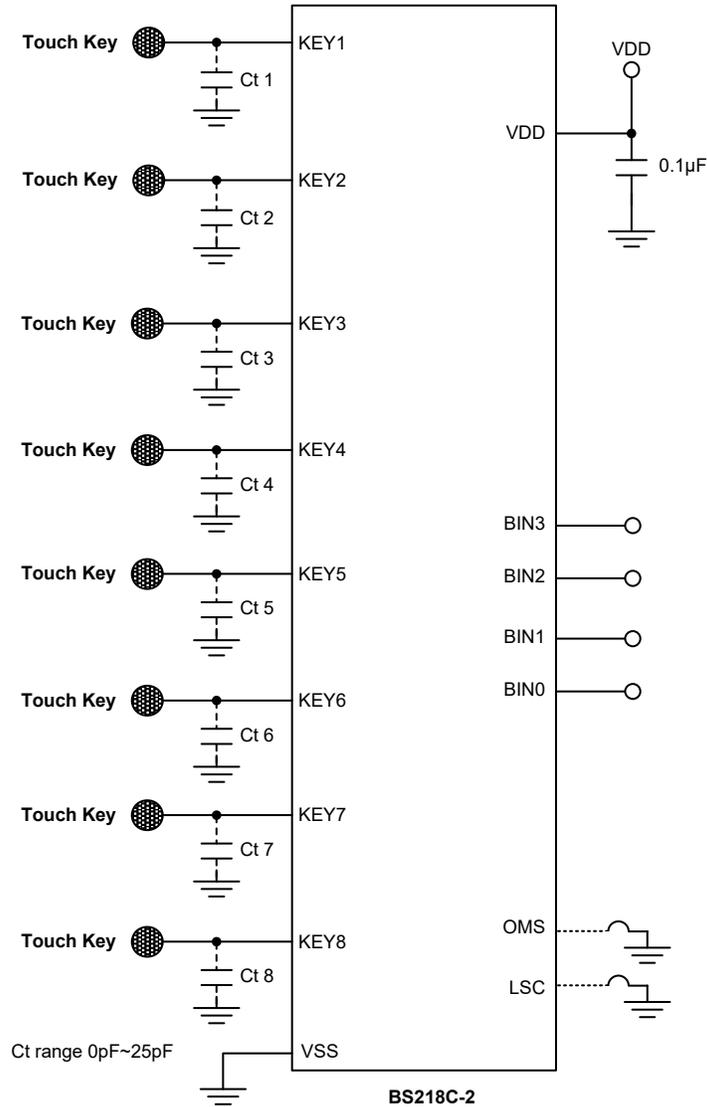
Application Circuits

BS211C-1
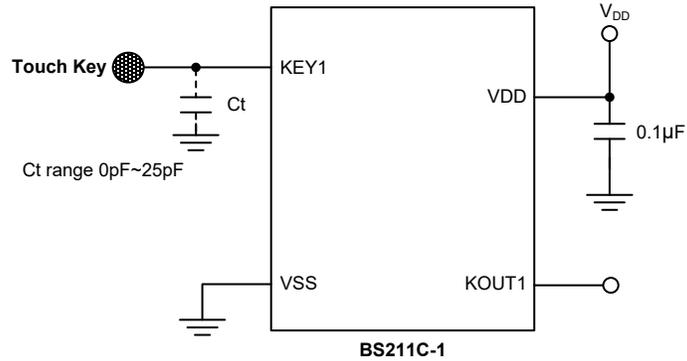
Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF

2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS212C-1
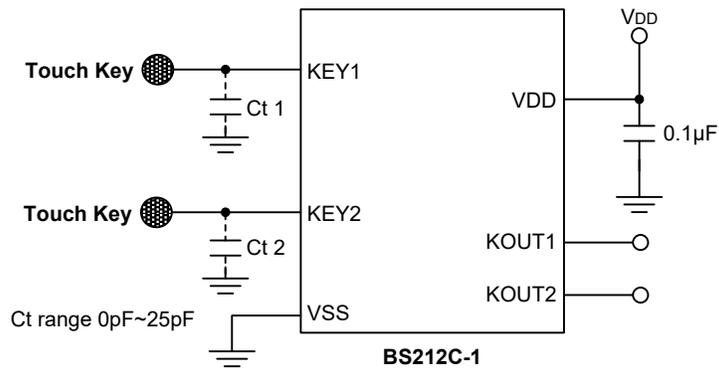
Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF

2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS213C-1
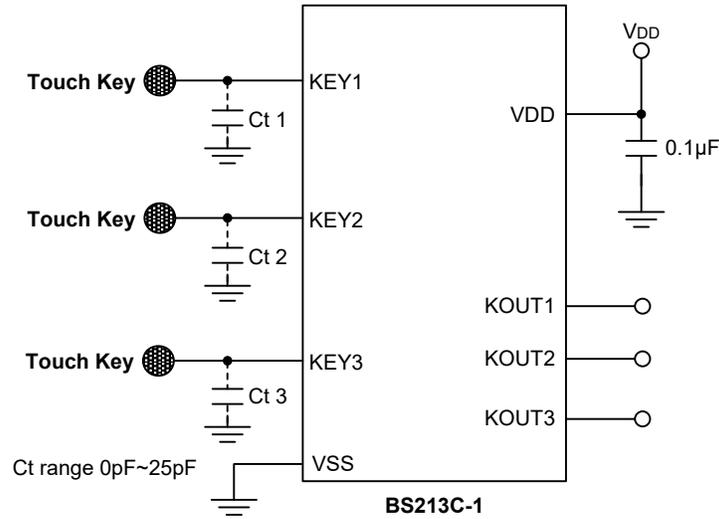
Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF
   2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS214C-1

Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF
   2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS214C-2

BS214C-2

Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF
    2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS216C-1

BS216C-1

Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF
    2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS218C-2

BS218C-2

Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF

2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS218C-2 – Parallel Interface Mode

Note: 1. Ct (C threshold) is used for adjustment of Trigger Threshold. Recommended value: 0~25 pF

    2. Ct value can be changed to obtain different sensitivity values. Higher Ct values will result in lower sensitivity levels. (0pF = no Ct)

BS218C-3

BS218C-3
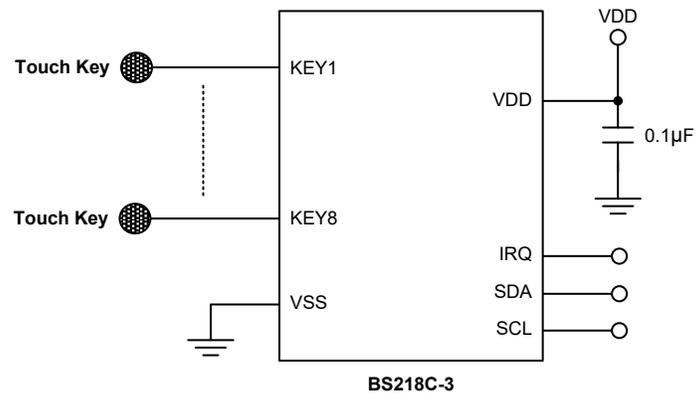
Package Information

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)

- The Operation Instruction of Packing Materials

- Carton information

6-pin SOT23 Outline Dimensions
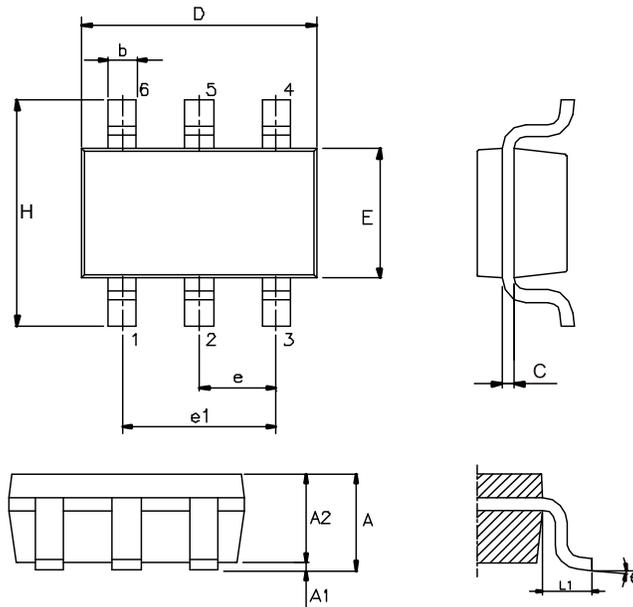
Symbol	Dimensions in inch		
	Min.	**Nom.**	**Max.**
A	—	—	0.057
A1	—	—	0.006
A2	0.035	0.045	0.051
b	0.012	—	0.020
C	0.003	—	0.009
D	0.114 BSC		
E	0.063 BSC		
e	0.037 BSC		
e1	0.075 BSC		
H	0.110 BSC		
L1	0.024 BSC		
θ	0°	—	8°

Symbol	Dimensions in mm		
	Min.	**Nom.**	**Max.**
A	—	—	1.45
A1	—	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
C	0.08	—	0.22
D	2.90 BSC		
E	1.60 BSC		
e	0.95 BSC		
e1	1.90 BSC		
H	2.80 BSC		
L1	0.60 BSC		
θ	0°	—	8°

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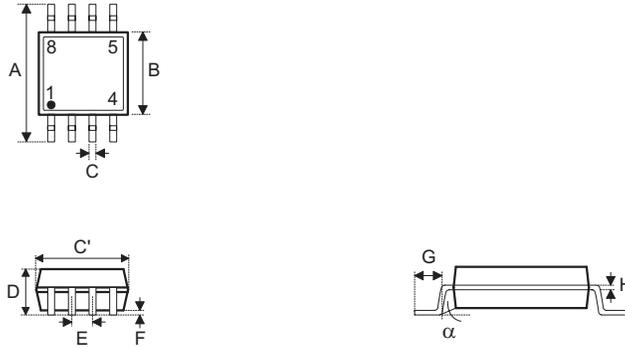
Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A		0.236 BSC	
B		0.154 BSC	
C	0.012	—	0.020
C'		0.193 BSC	
D	—	—	0.069
E		0.050 BSC	
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
α	0°	—	8°

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°

10-pin MSOP Outline Dimensions
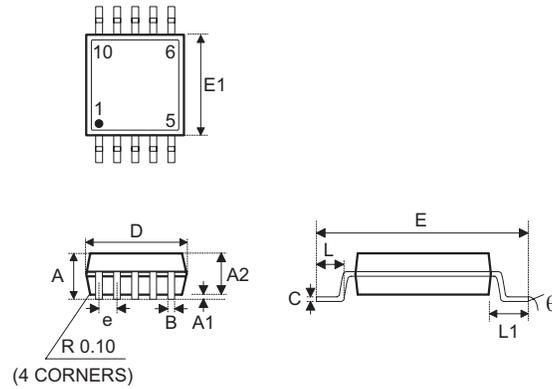
Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	—	0.043
A1	0.000	—	0.006
A2	0.030	0.033	0.037
B	0.007	—	0.013
C	0.003	—	0.009
D	0.118 BSC		
D1	0.059	—	0.076
E	0.193 BSC		
E1	0.118 BSC		
E2	0.055	—	0.071
e	0.020 BSC		
L	0.016	0.024	0.031
L1	0.037 BSC		
y	—	0.004	—
θ	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	—	1.10
A1	0.00	—	0.15
A2	0.75	0.85	0.95
B	0.17	—	0.33
C	0.08	—	0.23
D	3.00 BSC		
D1	1.51	—	1.93
E	4.90 BSC		
E1	3.00 BSC		
E2	1.40	—	1.80
e	0.50 BSC		
L	0.40	0.60	0.80
L1	0.95 BSC		
y	—	0.10	—
θ	0°	—	8°

16-pin NSOP (150mil) Outline Dimensions
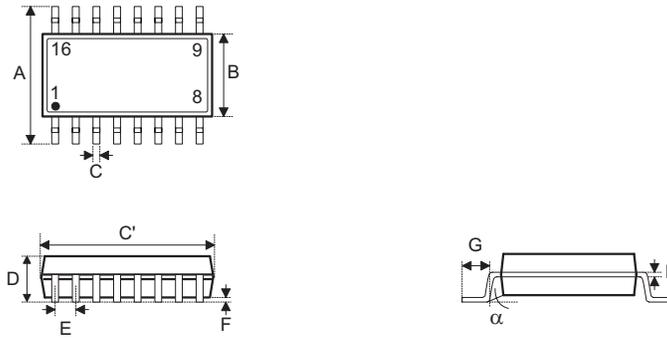
Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A		0.236 BSC	
B		0.154 BSC	
C	0.012	—	0.020
C'		0.390 BSC	
D	—	—	0.069
E		0.050 BSC	
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A		6.00 BSC	
B		3.90 BSC	
C	0.31	—	0.51
C'		9.90 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°