OMRON

Capacitive Touch Sensing ICs
B6TS

OMRON expands its switch product range by introducing the new touch sensor switch family B6TS which is based on a capacitive measurement principle:

• B6TS-04LT – 4 channel sensor
• B6TS-08NF – 8 channel sensor
• B6TS-16NF – 16 channel sensor   (Release 2007)

Features

• B6TS is '**Application Ready**' The B6TS was developed to be highly tolerant of its working environment with adaptive features such as self teaching, auto threshold and intelligent filtering to meet the demands of most applications today. B6TS resists EMC and compensates continuously for long-term drift.

• The customer has the '**Freedom to Design**' With the exception of a few rules of thumb you are limited only by your imagination. Panel designers are free to decide electrode size, shape, spacing etc. The design is quick and easy – simulation, pcb design, cover material design, assembly – Finished Panel Solution!

• '**Freedom in Material**' You can make touch keys through any non-conducting panel material including plastic, rubber, glass, marble and wood. You can use low cost commercial PCB materials to create your designs. Most designs can be done on low cost single sided PCB like FR-2 or CEM-1.

• '**Standard or custom**' B6TS is μController based, so we can provide off the shelf solutions as well as "quick to market" customized types. Additional features may be possible at very low development cost.

Tools

• Excellent Tool support enables the customer to have an easy entry in the capacitive sensing technology and customized panel solutions.

■ Evaluation kit 'B6T Workbench' which includes

• A PC tool to program custom parameters of the B6TS like: (Sensitivity adjustment, hysteresis, timing to judge a touch event, drift-compensation, output mode selectable -> a) momentary switching b) latching switching c) serial data via SPI interface)
• RS232 to SPI interface board

• Demo panel for either (4, 8 or 12 channels) to have an application ready evaluation platform available. The demo panel can be used to immediately carry out investigations with different cover materials and geometries.

■ Simulation Software

To evaluate the behavior of the custom panel design before making a PCB.

■ Application Note

Touch panel reference design.

Target Applications

• Dish washer
• Washing machine
• Oven
• Fitness equipment
• Television
• Medical equipment
• HVAC controls

• Lighting controls
• Elevator
• Automatic door
• Vending machine
• Alarm clock
• In general Man Machine Interfaces (MMI)
• 3 Dimensional switch solutions

Electrical Characteristics

■ B6TS-04LT - 4 Channel Sensor

Absolute maximum ratings

Designation	Item	Condition	Rated value	Unit
V_{dd}	Supply voltage		-0.3 – 6.5	V
V_I	Input voltage		-0.3 – V_{dd}+0.3	V
V_O	Output voltage		-0.3 – V_{dd}+0.3	V
P_d	Power dissipation	T_{opr}=25°C	300	mW
T_{opr}	Ambient operating temperature		-20 – 85	°C
T_{stg}	Storage temperature		-60 – 150	°C

Recommended operating conditions

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
V_{dd}	Supply voltage		3.0		5.5	V
V_{IH}	High input voltage		$0.8V_{dd}$		V_{dd}	V
V_{IL}	Low input voltage		0		$0.2V_{dd}$	V
I_{OH}	High output voltage				-5	mA
I_{OL}	Low output voltage				5	mA

Note: Unless otherwise specified, V_{dd} = 3.0 – 5.5V, T_{OPR} = -20 – 85°C.

Electrical characteristics (1) [Vdd=5V]

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
V_{OH}	High output voltage	I_{OH} = -5mA	V_{dd}-2.0		V_{dd}	V
		I_{OH} = -200 A	V_{dd}-0.3		V_{dd}	V
V_{OL}	High input voltage	I_{OL} = 5Ma			2.0	V
		I_{OH} = 200 A			0.45	V
I_{IH}	High input voltage	V_I = 5V			5	A
I_{IL}	Low input voltage	V_I = 0V			-5	A
I_{CC}	Supply voltage	Normal measurement mode		5		A
		During sleep		0.4		mA

Note: Unless otherwise specified, V_{dd} = 4.20 – 5.5V, T_{OPR} = -20 – 85°C.

Electrical characteristics (2) [Vdd=3V]

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
V_{OH}	High output voltage	I_{OH} = -1mA	V_{dd}-0.5		V_{dd}	V
V_{OL}	Low output voltage	I_{OL} = 1mA			0.5	V
I_{IH}	High input voltage	V_I = 3V			4	A
I_{IL}	Low input voltage	V_I = 0V			-4	A
I_{CC}	Supply voltage	Normal measurement mode		4.8		mA
		During sleep		0.4		mA

Note: Unless otherwise specified, V_{dd} = 3.0 – 3.3V, T_{OPR} = -20 – 85°C.

Electrical characteristics (3)

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
—	Number of times of EEPROM write	T_{OPR} = 0~60°C	10000			Times
—	EEPROM write time	V_{dd} = 5V, T_{OPR} = 25°C (Note 2)		0.3		S
—	EEPROM data retention period	T_{OPR} = 55°C	20			Years

Note: 1. Unless otherwise specified, V_{dd} = 3.0 – 5.5V, T_{OPR} = -20 – 85°C.
    2. The period following receipt of the EEPROM write command in setup mode until the data write finishes.

Necessary timing conditions

Designation	Item	Condition	Rated value		Unit
			Minimum	Maximum	
$t_{c(SCK)}$	Serial communication clock cycle time		15		S
$t_{w(SCKH)}$	Serial communication clock high pulse width		0.4	0.6	$t_{c(SCK)}$
$t_{w(SCKL)}$	Serial communication clock low pulse width		0.4	0.6	$t_{c(SCK)}$
$t_{r(SCK)}$	Serial communication clock rise time			1	S
$t_{f(SCK)}$	Serial communication clock fall time			1	S
$T_{su(SCS)}$	Serial communication chip select setup time		320		nS
$T_{h(SCS)}$	Serial communication chip select hold time		320		nS
$t_{d(SO)}$	Serial communication output delay time			280	nS
$T_{d(SCS)}$	Serial communication chip select delay time			320	nS
$T_{su(SI)}$	Serial communication input setup time		100		nS
$t_{h(SI)}$	Serial communication input hold time		280		nS
$t_{w(BD)}$	Serial communication byte to byte interval		90		S
$t_{w(CD)}$	Serial communication command reception interval		130		S
$T_{w(CHG)}$	CHG pulse width	(Note 2)	50		S
$T_{su(SETUP)}$	Mode shift delay time	(Note 3)		95	S
$T_{w(RESET)}$	Reset pulse width		500		S

Note: 1. Unless otherwise specified, V_{dd} = 3.0 – 5.5V, T_{OPR} = 25°C.
    2. This is the time period when the condition that CHG pulse width is at its minimum in the serial communication mode of normal measurement mode is set.
(CHG pin function is set to output at the end of every measurement [CHG bit = 0 with MODE command] and the sleep time is set to zero [SLP command value = 0]).
    3. The delay time for the mode shift between normal measurement mode and setup mode.

■ B6TS-08NF - 8 Channel Sensor

Absolute maximum ratings

Designation	Item	Condition	Rated value	Unit
V_{dd}	Supply voltage		-0.3 – 6.5	V
V_I	Input voltage		-0.3 – V_{dd}+0.3	V
V_O	Output voltage		-0.3 – V_{dd}+0.3	V
P_d	Power dissipation	T_{opr}=25°C	300	mW
T_{opr}	Ambient operating temperature		-20 – 85	°C
T_{stg}	Storage temperature		-65 – 150	°C

Recommended operating conditions

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
V_{dd}	Supply voltage		4.5		5.5	V
V_{IH}	High input voltage		$0.8V_{dd}$		V_{dd}	V
V_{IL}	Low input voltage		0		$0.2V_{dd}$	V
I_{OH}	High output voltage				-5	mA
I_{OL}	Low output voltage				5	mA

Note: Unless otherwise specified, $V_{dd} = 4.5 - 5.5V$, $T_{OPR} = -20 - 85°C$.

Electrical characteristics

Designation	Item	Condition	Rated value			Unit
			Minimum	Standard	Maximum	
V_{OH}	High output voltage	$I_{OH} = -5mA$	$V_{dd}-2.0$		V_{dd}	V
V_{OL}	Low input voltage	$I_{OL} = 5mA$			2.0	V
I_{IH}	High input voltage	$V_I = 5V$			5	A
I_{IL}	Low input voltage	$V_I = 0V$			-5	A
I_{CC}	Supply voltage	Normal measurement mode		4		mA
—	Number of times of EEPROM write	$T_{OPR} = 0 - 60°C$	10000			Times
—	EEPROM write time	$V_{dd} = 5V$, $T_{OPR} = 25°C$ (Note 2)		0.3		S
—	EEPROM data retention period	$T_{OPR} = 55°C$	20			Years

Note: 1. Unless otherwise specified, $V_{dd} = 4.5 - 5.5V$, $T_{OPR} = -20 - 85°C$.
    2. The period following receipt of the EEPROM write command in setup mode until the data write finishes.

Necessary timing conditions

Designation	Item	Condition	Rated value		Unit
			Minimum	Maximum	
$t_{c(SCK)}$	Serial communication clock cycle time		8650		nS
$t_{w(SCKH)}$	Serial communication clock high pulse width		100		nS
$t_{w(SCKL)}$	Serial communication clock low pulse width		100		nS
$t_{d(SO)}$	Serial communication output delay time			80	nS
$t_{h(SO)}$	Serial communication output hold time		0		nS
$T_{su(SI)}$	Serial communication input setup time		35		nS
$t_{h(SI)}$	Serial communication input hold time		90		nS
$t_{w(BD)}$	Serial communication byte to byte interval		70		S
$t_{w(CD)}$	Serial communication command reception interval		265		S
$T_{w(CHG)}$	CHG pulse width	(Note 2)	85		S
$T_{su(SETUP)}$	Mode shift delay time	(Note 3)		150	S
$T_{w(RESET)}$	Reset pulse width		500		S

Note: 1. Unless otherwise specified, $V_{dd} = 4.5 - 5.5V$, $T_{OPR} = -20 - 85°C$.
    2. This is the time period when the condition that CHG pulse width is at its minimum in the serial communication mode of normal measurement mode is set.
(CHG pin function is set to output at the end of every measurement [CHG bit = 0 with MODE command] and the sleep time is set to zero [SLP command value = 0]).
    3. The delay time for the mode shift between normal measurement mode and setup mode.

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