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VKD104CC Datasheet

4-channel touch 1-to-1 output

Rev.1.2

1 General Description

The VKD104CC is a 4-channel touch detection chip specifically designed to replace traditional mechanical buttons. It features low power consumption, wide operating voltage range and high detection stability, and is suitable for a variety of application scenarios. The chip is equipped with an internal voltage stabilizing circuit, providing reliable power support for touch detection. The sensitivity of the touch pad can be adjusted through reasonable design.

Supports power-on configuration. Output parameters (level, mode, structure) can be set through IO, and standby mode, 16-second long press reset, and single-key/multi-key mode can be selected. It integrates a special circuit internally, featuring a high power supply rejection ratio, significantly reducing false touches and enhancing operational reliability in harsh environments.

2 Key Features

- Operating voltage: 2.4-5.5V
- Operating current 13.0μA@VDD=3.0V
  Standby current 2.5μA@VDD=3.0V
- Built-in dedicated voltage stabilizing circuit for touch detection
- The response time is approximately 60ms @VDD=3V
- The sensitivity can be adjusted by an external capacitor (1 to 60pF)
- Built-in key debouncing, no need for external software to debouncing again
- The touchless 8S has entered standby mode
- Pins Q0 to Q3 are the output
  Output level is selected by the MHL pin as either high level active or low level active
  Output mode is selected by the MDT pin as direct output or latched output
  Output pin structure is selected by the MOD pin as CMOS output or open-drain output
- Select the touch multi-key mode or single-key mode through the MMS pin
- Select whether to enable the standby mode through the MLP pin
- Select through the MT0S pin whether to enable the 16-second long-press reset function of the key
- After power-on, there is approximately 0.5 seconds of stabilization time during which all functions are disabled. Do not touch the detection point during this period
- Self-calibrate parameters according to environmental changes
- The static electricity of HBM is greater than 5KV
- Available Packages:
  SOP16(150mil)(9.9mm x 3.9mm PP=1.27mm)

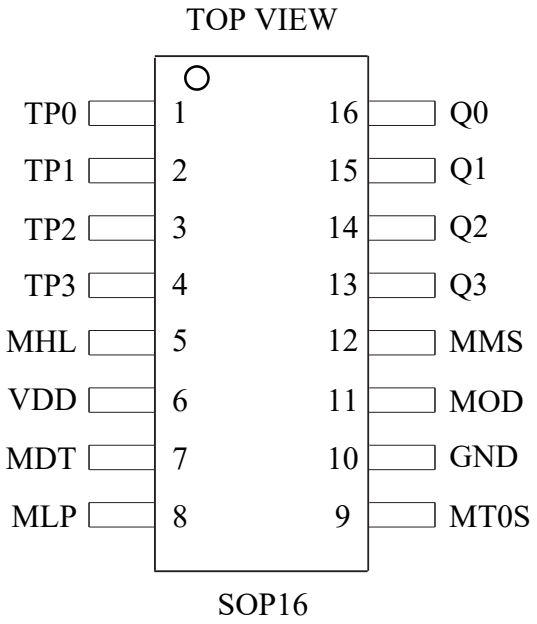
3 Product Selection

Part No.	Touch Channel	Working Voltage	Normal Mode/Standby	Output (/ Optional parameter)	Packaging
VKD232C	2	2.4-5.5V	4.0μA/2.5μA(3V)	Direct output Low level effective	SOT23-6L
VKD104CR	2	2.4-5.5V	13.0μA/2.5μA(3V)	Direct/latch high/low level	SOP8
VKD104CR-3H	3	2.4-5.5V	13.0μA/2.5μA(3V)	Directly output a high level and hold for 16 seconds to reset	SOP8
VKD104CC	4	2.4-5.5V	13.0μA/2.5μA(3V)	Direct/latch high/low level multi-key/ single key CMOS/ Open drain, long press to keep output/Long press for 16 seconds to reset	SOP16
VKD104CB	4	2.4-5.5V	13.0μA/2.5μA(3V)	Direct/latch high/low level multi-key/ single key CMOS/ Open drain, long press to keep output/Long press for 16 seconds to reset	SSOP16
VKD104	4	2.4-5.5V	13.0μA/2.5μA(3V)	Direct/latch high/low level multi-key/ single key CMOS/ Open drain, long press to keep output/Long press for 16 seconds to reset	DICE

4 Ordering Information

Part No.	Packaging	Tube Qty	Tray(reel)Qty	Box Qty	Total Qty	Notes
VKD232C	SOT23-6L		3000/reel	30000/box	120000 PCS	
VKD104CR	SOP8	100/tube		10000/box	100000 PCS	
VKD104CR-3H	SOP8	100/tube		10000/box	100000 PCS	
VKD104	DICE		400/tray	2000/box	4000 PCS	
VKD104CC	SOP16	50/tube		5000/box	50000 PCS	
VKD104CB	SSOP16	100/tube		10000/box	100000 PCS	

5 Package Pinout Information(SOP16)



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5.1 VKD104CC/SOP16 Pin Description

No.	Name	I/O	Function Description
1	TP0	I	Touch input,Connect a small capacitor to ground to fine-tune the sensitivity (1-60pF), and it is most sensitive when not connected
2	TP1	I	Touch input,Connect a small capacitor to ground to fine-tune the sensitivity (1-60pF), and it is most sensitive when not connected
3	TP2	I	Touch input,Connect a small capacitor to ground to fine-tune the sensitivity (1-60pF), and it is most sensitive when not connected
4	TP3	I	Touch input,Connect a small capacitor to ground to fine-tune the sensitivity (1-60pF), and it is most sensitive when not connected
5	MHL	I—RL	Select output level: 1-> low level effective, 0-> high level effective (default)
6	VDD	VDD	Positive power supply
7	MDT	I—RL	Select the output mode: 1-> latch output, 0-> direct output (default)
8	MLP	I—RL	Whether to enable standby mode: 1-> Not enabled, 0-> Enabled (default)
9	MT0S	I—RH	Whether to enable the long-press reset function: 1-> continuous output (default), 0->16S reset
10	GND	GND	Negative power supply
11	MOD	I—RH	Select the output pin structure: 1->CMOS output (default), 0-> open-drain output
12	MMS	I—RH	Select the touch mode: 1-> Multi-key (default), 0-> single-key
13	Q3	O	Touch output
14	Q2	O	Touch output
15	Q1	O	Touch output
16	Q0	O	Touch output

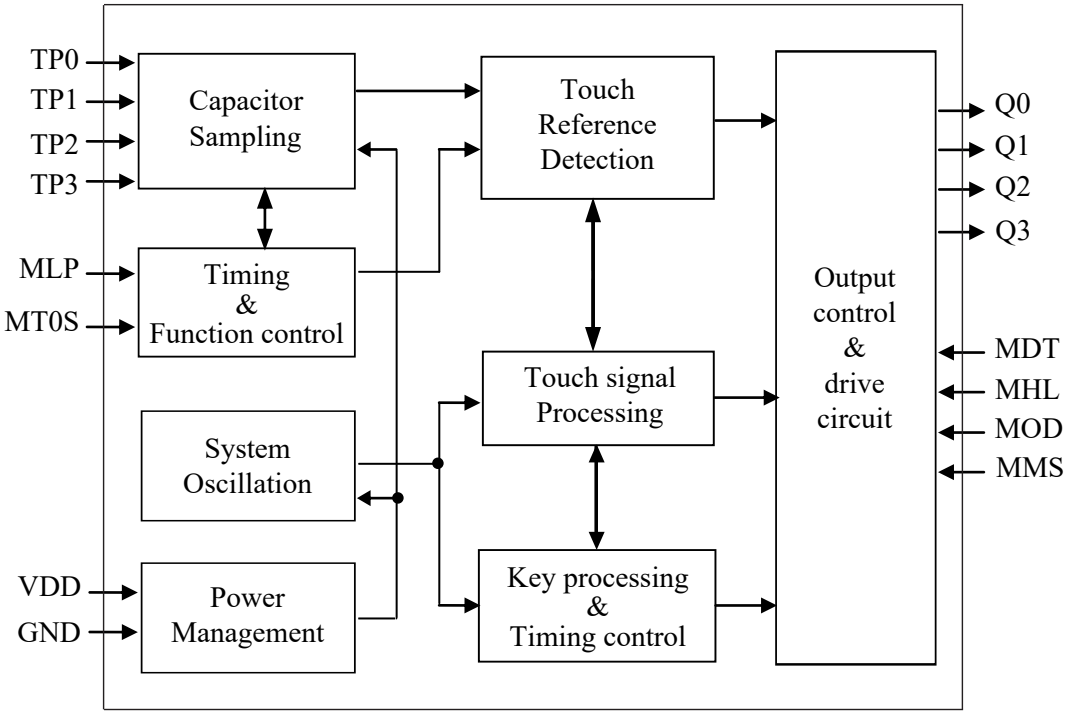
Note：

Input - RH CMOS input with built-in pull-up resistor

Input - RL CMOS input with built-in pull-down resistor

6 Functional Description

6.1 Block Diagram



6.2 Output Parameters

The output of VKD104CB is Q0 to Q3, and the output parameters can be configured.

MDT	MOD	MHL	Configure output parameters
NC	NC	NC	Direct CMOS output, high level effective
NC	NC	VDD	Direct CMOS output, low level effective
NC	GND	NC	Direct leakage output, high level effective
NC	GND	VDD	Direct leakage output, low level effective
VDD	NC	NC	Latch CMOS output, power-on output 0
VDD	NC	VDD	Latch CMOS output, power-on output 1
VDD	GND	NC	Latch open drain output, power-on output high resistance, high level effective
VDD	GND	VDD	Latch open drain output, high resistance output upon power-on, and effective at low level

MMS	Select the touch multi-key/single-key mode
NC	Touch multi-key output, supporting simultaneous pressing
GND	Single-key touch output only outputs the key touched first

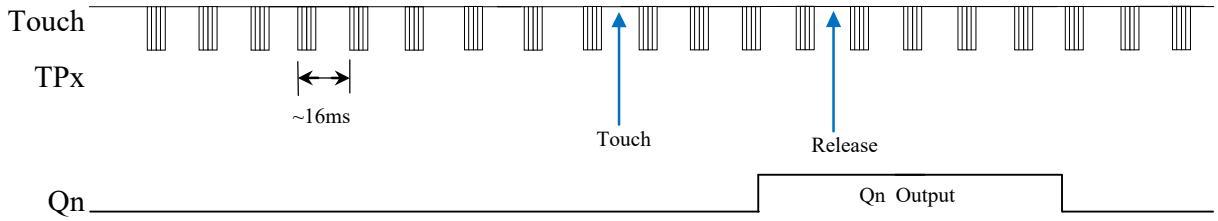
MT0S	Whether to enable the long-press button reset function
NC	Press and hold the key continuously to output
GND	Press and hold the button for 16 seconds and then reset it

MLP	Whether the standby mode is enabled
NC	Enable standby mode
VDD	Prohibit standby mode

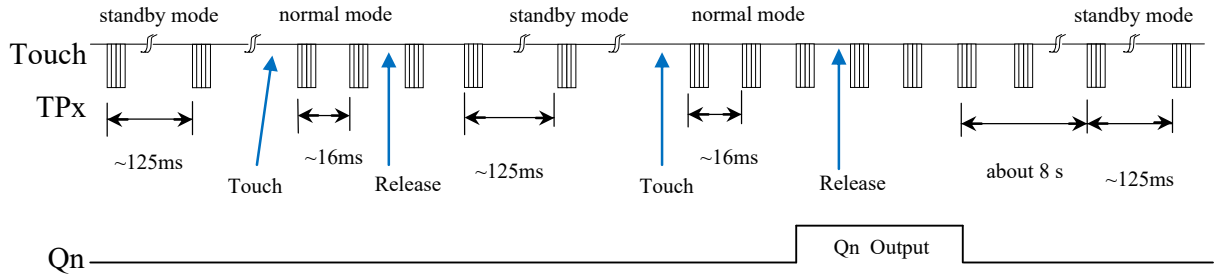
6.3 Operating Mode

The VKD104CC chip has two Operating modes: standby mode and normal mode. The selection is made when the MLP pin is powered on. When the MLP pin is connected to the VDD, the VKD104CC is in normal mode. When the MLP is left floating or connected to GND. VKD104CC enters standby mode. In normal mode, the response speed is relatively fast but the power consumption is high. In standby mode, power consumption is reduced, but the response speed will be slower for the first touch. After that, the response speed will be the same as in normal mode, and it has automatically switched to normal mode for operation. When all keys are released for more than approximately 8 seconds, it will return to standby mode again.

Normal working mode sequence diagram (MLP connected to VDD)：



Standby mode timing diagram (MLP left floating or connected to GND)：



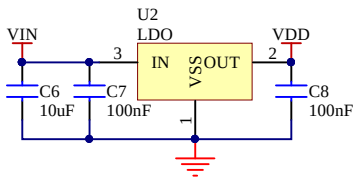
6.4 Sensitivity Adjustment

The sensitivity of VKD104CC is related to the size of the touch PAD, the thickness of the casing, the size of the sensitivity capacitance, etc. The sensitivity should be adjusted according to the actual application of the product. The sensitivity can be adjusted from the following three aspects:

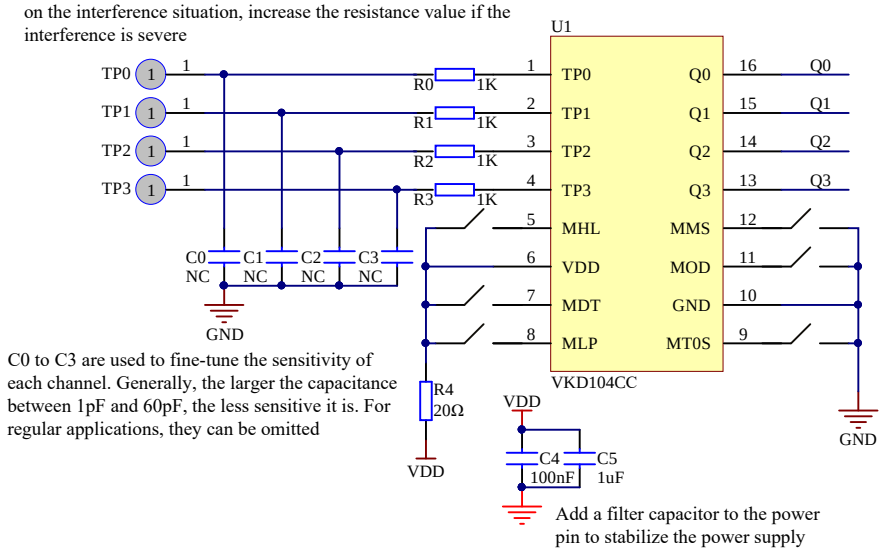
1. Touch the area of the PAD
   Under other unchanged conditions, the larger the touch area, the more sensitive it is, but the area must be within the effective area.
2. The thickness of the shell
   Under other unchanged conditions, the thinner the casing, the higher the sensitivity; the thicker the casing, the lower the sensitivity. However, the thickness must not exceed the maximum limit.
3. Adjust the small capacitance between the touch foot and the ground
   The sensitivity can be fine-tuned by touching the small capacitance of the touch foot to the ground. The larger the capacitance, the lower the sensitivity. The most sensitive is when no capacitance is connected. The sensitivity must be adjusted according to the actual application. Common values: 1-60pF.

7 Application Circuits

It is recommended to use an LDO for power supply



The touch pin is connected in series with a 1K resistor to enhance anti-interference performance. Generally, a 1K resistor is connected in series The resistance range is 0R to 10K. Depending on the interference situation, increase the resistance value if the interference is severe



C0 to C3 are used to fine-tune the sensitivity of each channel. Generally, the larger the capacitance between 1pF and 60pF, the less sensitive it is. For regular applications, they can be omitted

Add a filter capacitor to the power pin to stabilize the power supply

The output of pin Q is configurable

MDT	MOD	MHL	Output function
NC	NC	NC	Direct CMOS output, high level effective (default)
NC	NC	**VDD**	Direct CMOS output, low level effective
NC	**GND**	NC	Direct leakage output, high level effective
NC	**GND**	**VDD**	Direct leakage output, low level effective
VDD	NC	NC	CMOS latch output, power-on output 0
VDD	NC	**VDD**	CMOS latch output, power-on output 1
VDD	**GND**	NC	Open the drain latch output, power on the output high resistance, high level effective
VDD	**GND**	**VDD**	Open the drain latch output, output high resistance upon power-on, and be effective at low levels

MMS	Select multi-key/single-key output
NC	Multi-key output, supporting simultaneous pressing (default)
GND	Single-key output, only output the key touched first
MT0S	Whether to enable the long-press button reset function
NC	Long press and keep outputting(default)
GND	Press and hold for 16 seconds to reset
MLP	Select the working mode
NC	Enable standby mode (default)
VDD	Prohibit standby mode

Notes:

1. On the PCB, the length of the line from the touch PAD to the touch pin should be as short as possible, and the touch traces must not be parallel or cross with other lines.
2. The power supply must be stable. Fluctuations, rapid drift or interference in the supply voltage may cause abnormal sensitivity or false detection.
3. The board covering the PCB must not contain any metal or conductive materials, and the same applies to the surface coating.
4. A 0.1uF capacitor must be used between VDD and GND, and the distance from the VDD and GND pins of the chip should be the shortest. It is recommended to add a 20Ω resistor and a 1uF capacitor on the power supply.
5. Fine-tune the sensitivity of capacitors C0-C3(0~60oF) to ensure consistent sensitivity across all channels. The smaller the capacitance value, the more sensitive it is. The highest sensitivity is achieved without connecting capacitors. Sensitivity adjustments must be made based on the actual PCB application. For conventional applications, it is not necessary to connect them. Capacitors with smaller temperature coefficients and greater stability, such as X7R and NPO, must be selected.
6. Resistors R0-R3 are mainly used to effectively prevent radio frequency interference and enhance anti-static capabilities. The common values range from 470R to 1K, with a maximum not exceeding 10K. They can be omitted in conventional applications.

8 Electrical Characteristics

Absolute Maximum Ratings

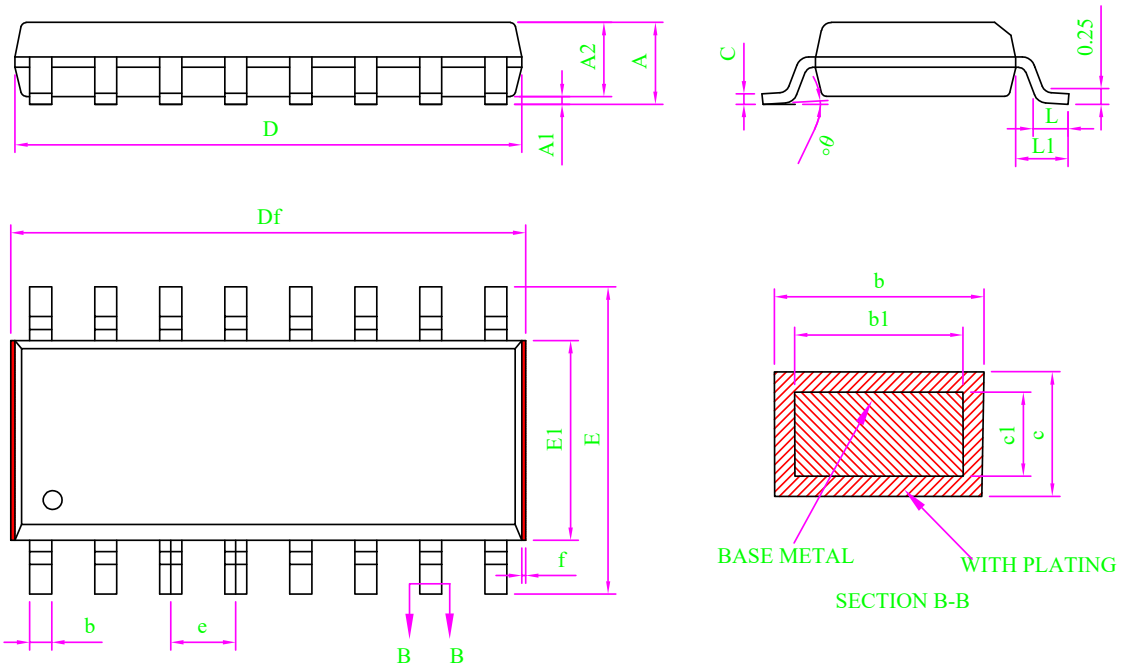
Parameter	Symbol	Ratings	Unit
Power Voltage	VDD	-0.3～6.0	V
Input Voltage	V_{IN}	GND-0.3～VDD+0.3	V
Storage Temperature	T_{STG}	-50～+125	℃
Operating Temperature	T_{OTG}	-40～+85	℃
Human Body Mode	ESD	≧5	KV

8.1 DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions (25 ℃)	
						VDD	Conditions
Operating voltage	VDD	2.4	3.0	5.5	V	—	—
Operating current	I_{OP}	—	13	—	μA	3.0V	Normal mode
		—	16	—		5.0V	
Standby current	I_{ST}	—	2.5	—	μA	3.0V	Standby mode
		—	5.5	—		5.0V	
Output sink current	I_{IL}	—	8	—	mA	3.0V	V_{OL}=0.6V
		—	15	—		5.0V	
Output source current	I_{OL}	—	-5	—	mA	3.0V	V_{OH}=2.4V
		—	-8	—		5.0V	V_{OH}=4.4V
Input low voltage	V_{IL}	—	—	0.2	VDD	VDD	Input low voltage
Input high voltage	V_{IH}	0.8	—	1	VDD	VDD	Input high voltage
Input the pull-up resistor	R_{PH}	—	30k	—	ohm	3.0V	VDD=3V
Input the pull-down resistor	R_{PL}	—	25k	—	ohm	3.0V	VDD=3V
Output response time	T_R	—	60	—	mS	3.0V	Operating mode
		—	60	—		5.0V	Operating mode
		—	160	—	mS	3.0V	Standby mode
		—	160	—		5.0V	Standby mode

9 Package Information

9.1 SOP16(9.9mm x 3.9mm PP=1.27mm)



Note:

1. All dimension are in mm.
   Dim D&El does not include plastic flash; Df includes plastic flash(f);
   Flash: Plastic residual around body edge after de junk/singulation.
2. Dim b does not include dambar protrusion/intrusion.
3. Plating thickness 0.007mm-0.020mm

MILLIMETER			
SYMBOL	MIN	NOM	MAX
A	-	-	1.75
A1	0.10	0.15	0.20
A2	1.35	1.45	1.55
b	0.39	-	0.47
b1	0.38	0.41	0.43
c	0.20	-	0.25
c1	0.19	0.20	0.21
D	9.80	9.90	10.00
Df	9.90	-	10.40
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.51	0.66	0.81
L1	0.95	1.05	1.15
θ	0	-	8°
f	0.05	-	0.20

10 Disclaimer

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11 Revision History

No.	Version	Date	Modify the content	Check
1	1.0	2018-08-10	Original version	YES
2	1.1	2020-02-11	Add reference circuit	YES
3	1.2	2025-11-27	Update version	YES

[1] Consult the recently published documents before starting or finishing the design.

[2] Since the release of this document , the device product status described in this document may have changed and may differ in several cases. The latest product status information can be found on the Internet at https://www.szvinka.com/