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Vinka Microelectronics

VKD233HH Datasheet

1ch Touch/One-to-one output

Rev.1.2

1 General Description

VKD233HH is a single-channel touch detection chip. Its low power consumption, wide operating voltage range and stable touch detection effect can widely meet the needs of different applications. This touch detection chip is specially designed to replace traditional keys. It is equipped with a built-in voltage stabilizing circuit to provide a stable voltage for the touch detection circuit to use. The size of the touch detection PAD can be designed within a reasonable range according to different sensitivities.

2 Key Features

- Operating voltage: 2.4V to 5.5V
- Operating current 4.0uA@VDD=3.0V
  Standby current 1.5uA@VDD=3.0V
- Low-voltage reset function (LVR)
- Built-in dedicated voltage stabilizing circuit for touch detection
- The response time is approximately 46ms @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
- Touch without leaving and keep outputting
- Pin Q is the CMOS output
  The output level is selected by the MHL pin as either high level valid or low level valid
  The output mode is selected by the MDT pin as either direct output or latch output
- There is approximately 0.3 seconds of stabilization time after power-on. During this period, all functions are disabled. Do not touch the detection point during this time
- Self-calibrate parameters according to environmental changes
- The static electricity of HBM is greater than 4KV
- Available Packages:
  SOT23-6L(3mm x 3mm PP=0.95mm)

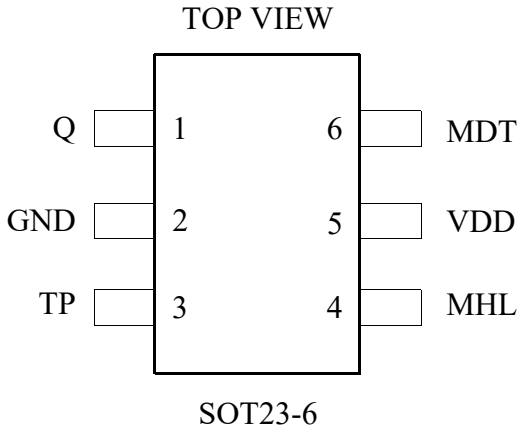
3 Product Selection

Part No.	Working voltage	Mode working/standby	Output (/ Optional)	Packaging
VKD223EB	2.0-5.5V	4.0uA/1.5uA(3V)	Directly/latch high/low levels	SOT23-6L
VKD233HB	2.4-5.5V	4.0uA/1.5uA(3V)	Directly/latch high/low levels	SOT23-6L
VKD233HH	2.4-5.5V	4.0uA/1.5uA(3V)	Directly/latch high/low levels and hold for 16 seconds to reset	SOT23-6L
VKD233HS	2.4-5.5V	4.0uA/no(3V)	Directly/latch high/low levels and hold for 16 seconds to reset	DFN6L
VKD233HR	2.4-5.5V	4.0uA/1.5uA(3V)	Directly/latch high/low levels and hold for 16 seconds to reset	DFN6L
VKD233HM	2.4-5.5V	5.0uA/no(3V)	Direct/latch open leakage low valid press and hold for 16 seconds to reset	SOT23-6L
VKD101HH	2.4-5.5V	4.0μA/1.5μA(3V)	Directly/latch high/low levels	SOT23-6L

4 Ordering Information

Part No.	Packaging	Tube Qty	Tray(reel) Qty	Box Qty	Total Qty	Notes
VKD223EB	SOT23-6L	—	3000/reel	30000/box	120000 PCS	
VKD233HB	SOT23-6L	—	3000/reel	30000/box	120000 PCS	
VKD233HH	SOT23-6L	—	3000/reel	30000/box	120000 PCS	
VKD233HS	DFN6L	—	3000/reel	30000/box	120000 PCS	
VKD233HR	DFN6L	—	3000/reel	30000/box	120000 PCS	
VKD233HM	SOT23-6L	—	3000/reel	30000/box	120000 PCS	
VKD101HH	SOT23-6L	—	3000/reel	30000/box	120000 PCS	

5 Package Pinout Information(SOT23-6)



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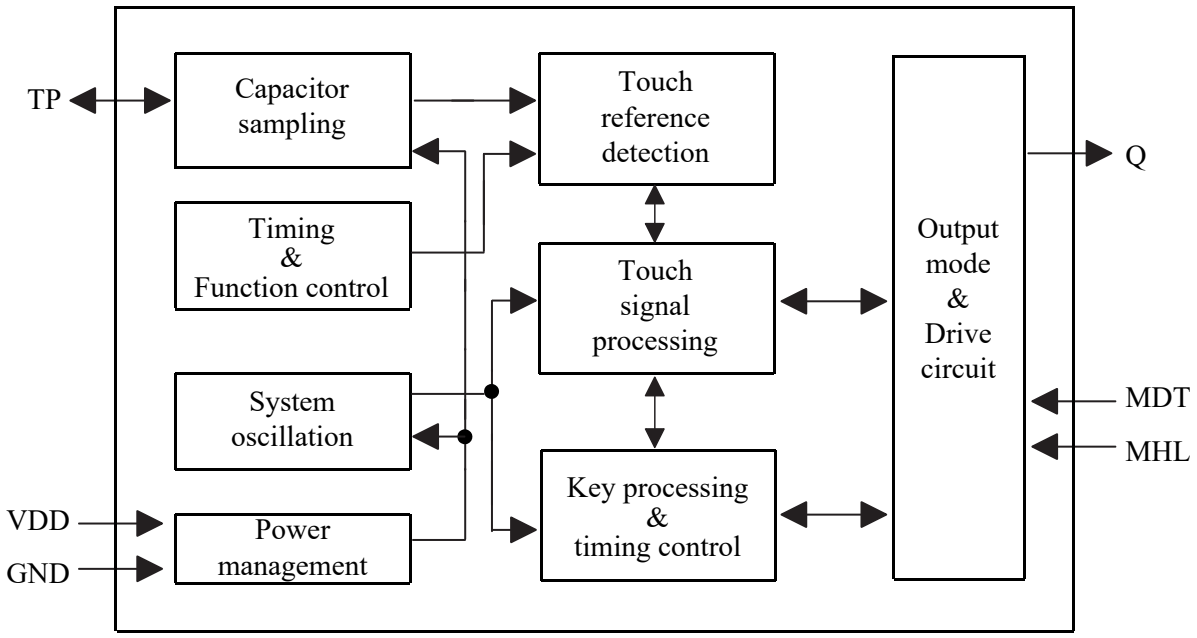
5.1 VKD233HH/SOT23-6L Pin Description

Pin No.	Pin name	I/O	Function Description
1	Q	O	CMOS Output
2	GND	P	Negative power supply
3	TP	I/O	Touch detection
4	MHL	I—RL	Select the effective output level： 0(default)- High level valid; 1- Low level effective
5	VDD	P	Positive power supply
6	MDT	I—RL	Select the output mode 0(default)➔Direct output ； 1➔Latch output

- **I** CMOS Inp
- O CMOS Output
- I/O CMOS Input/Output
- **P** Power supply/Groundin
- I-RH CMOS input has a built-in pull-up resistor
- I-RL CMOS input has a built-in pull-down resistor
- OD Open-drain output, no diode protection circuit

6 Functional Description

6.1 Block Diagram



6.2 Output Mode (selected using pins MDT and MHL)

MDT：Choose direct output or latch output.
MHL：Select whether the output is high level effective or low level effective.

Q Pin output parameters：

MDT	MHL	Output parameters
0	0	Direct CMOS output, high level effective
0	1	Direct CMOS output, low level effective
1	0	Latched CMOS output, power-on state = 0
1	1	Latched CMOS output, power-on state = 1

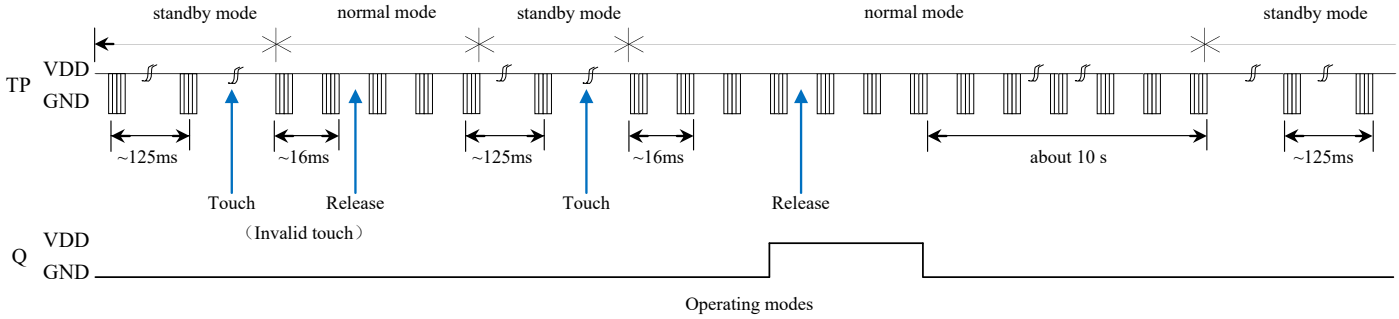
Notes：Considering energy conservation and packaging, the MDT/MHL pins are designed as latch types at the beginning of power-on The status is 0 or 1; If the MDT/ MHL pin is connected to VDD or GND, the state will become 1 or 0 and will not occur Current leakage.

Output option pin	The initial state after power-on
MDT	0
MHL	0

Press and hold the button (touch without leaving) for 16 seconds to reset：
To minimize the detection of unintentional keys such as accidentally touching the sensor PAD, the chip is equipped with a maximum key duration function internally. When a touch key is pressed, the internal timer starts to count. Once the key is pressed for too long, exceeding approximately 16 seconds, the touch chip will ignore the status of the touched key, recaliculate it, obtain a new reference value, and simultaneously reset the output status to the initial power-on state.

6.3 Operating Modes

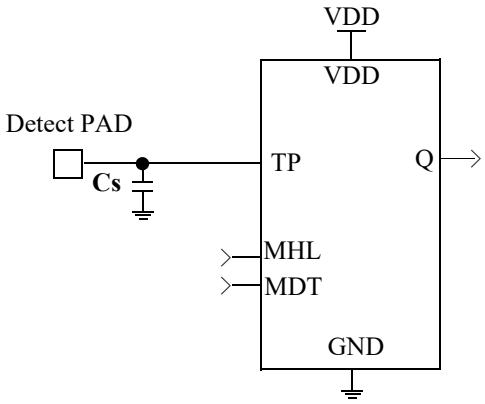
VKD233HH operates in standby mode to save energy. When a key touch is detected in this mode, it will switch to normal mode until the key touch is released and remain so for approximately 10 seconds before returning to standby mode.



6.4 Sensitivity Adjustment

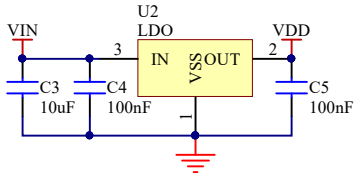
The size of the detection PAD connected on the PCB and the total load of the capacitance (parasitic capacitance and Cs capacitance) will affect the sensitivity. The sensitivity adjustment needs to be made according to the actual application. The following are some methods for externally adjusting the sensitivity:

1. Adjust the size of the detection PAD
   Under the condition that other factors remain unchanged, using a larger detection PAD size can increase the sensitivity, and vice versa It will reduce the sensitivity, but the detection of PAD size must be used within the effective range.
2. Adjust the thickness of the medium (shell)
   Under the condition that other factors remain unchanged, using a thinner medium can increase sensitivity; conversely, it will reduce sensitivity Sensitivity, but the thickness of the medium must be below the maximum limit value.
3. Adjust the Cs capacitance value (please refer to the following figure)
   Under the condition that other factors remain unchanged, it is sensitive if the Cs capacitor is not connected to GND on the touch PAD The degree is the most sensitive. The Cs capacitance is within the usable range ($1 \leq Cs \leq 60pF$), and the larger the Cs capacitance value, the more sensitive it is The lower the sensitivity.



7 Application Circuits

It is recommended to use an LDO for power supply

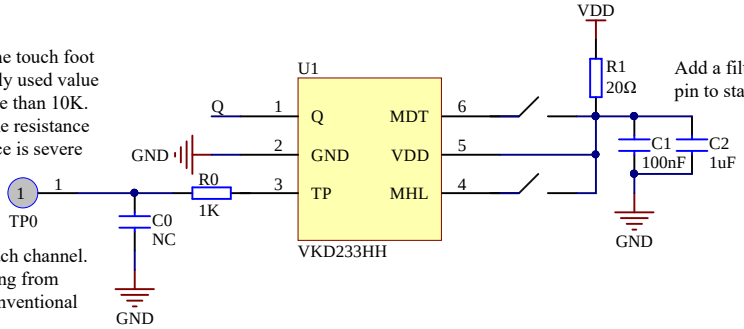


The output mode is determined by the states of the MHL pin and the MDT pin

MDT	MHL	
NC	NC	Direct CMOS output, high level effective
NC	**VDD**	Direct CMOS output, low level effective
VDD	NC	CMOS latch output, power-on output 0
VDD	**VDD**	CMOS latch output, power-on output 1

A 1K resistor is connected in series with the touch foot to enhance anti-interference. The commonly used value is 470R to 1K, with a maximum of no more than 10K. Depending on the interference situation, the resistance value should be increased if the interference is severe

C0 is used to fine-tune the sensitivity of each channel. Generally, the larger the capacitance ranging from 1pF to 60pF, the less sensitive it is. For conventional applications, it can be left unconnected



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

Notes:

1. On the PCB, the wire length from the touch PAD to the touch foot should be as short as possible, and the touch trace must not be parallel or cross with other wires.
2. The power supply must be stable. Fluctuations, rapid drifts or interference in the supply voltage may cause abnormal sensitivity or false detection.
3. The boards covering the PCB must not contain metals or conductive materials, and the same applies to surface coatings.
4. C1 capacitor must be used between VDD and GND, and the distance between it and the VDD and GND pins of the chip should be the shortest. The resistor R2 on the power supply. It is recommended to add capacitor C2.
5. Adjust the sensitivity with capacitor C0(0-60pF). The smaller the capacitor value, the more sensitive it is. The sensitivity is the highest when no capacitor is connected. Sensitivity adjustment is essential. The adjustment should be made based on the actual application of the PCB. For regular applications, it can be omitted. The C0 must be selected with a smaller temperature coefficient and greater stability Fixed capacitors, such as X7R, NPO.
6. The resistor R0 is mainly used to effectively prevent radio frequency interference and enhance anti-static capability. Its common values range from 470R to 1K, with a maximum not exceeding 10K, Regular applications can be left unconnected.

8 Electrical Characteristics

Absolute Maximum Ratings

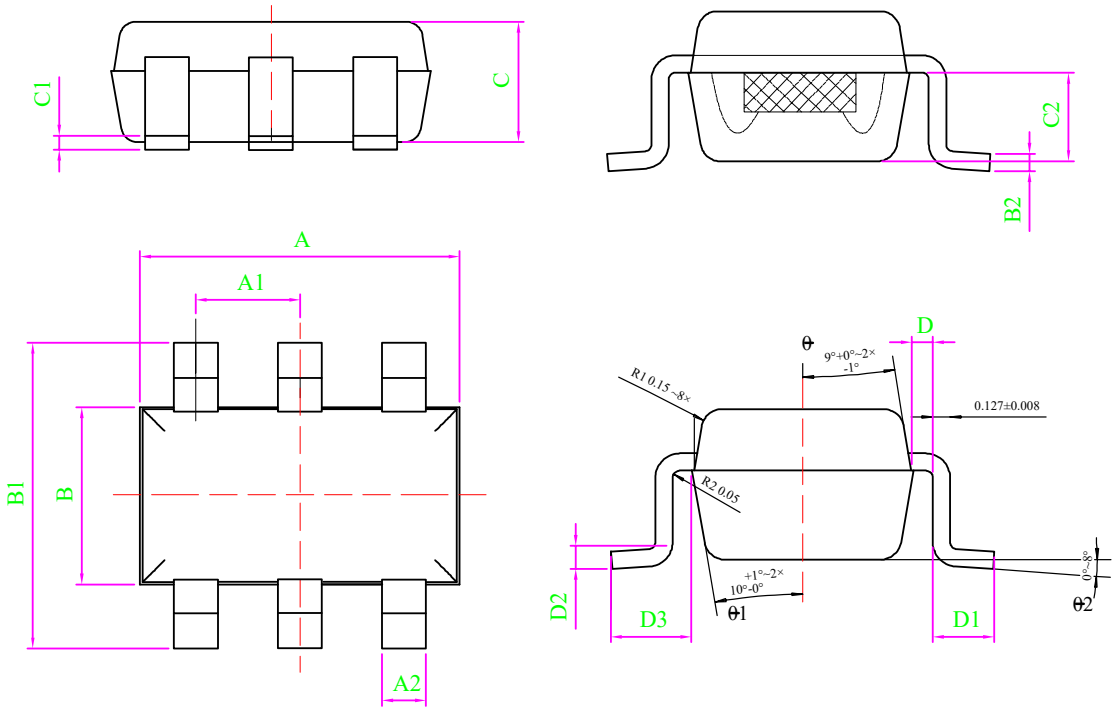
Parameter	Symbol	Ratings	Unit
Power voltage	VDD	-0.3～6.0	V
Input Voltage	V_{IN}	GND-0.3～VDD+0.3	V
Storage Temperature	T_{STG}	-50～+125	℃
Operating Temperature	T_{OTG}	-40～+85	℃
Human Body Mode	ESD	≧4	KV

DC/AC: (Test condition: Room temperature 25 ℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions (25 ℃)	
						VDD	Conditions
Operating voltage	VDD	2.4	3.0	5.5	V	—	—
Internal voltage regulator	VREG	2.2	2.3	2.4	V	—	—
Operating current	I_{OP}	—	4.0	8.0	—	3.0V	Operating mode
Standby current	I_{ST}	—	1.5	3.0	—	3.0V	Standby mode
Output Sink Current	I_{IL}	—	8	—	mA	3.0V	V_{OL}=0.6V
		—	16	—		5.0V	
Output Source Current	I_{OL}	—	-4	—	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 pull-low resistor	R_L	—	25k	—	ohm	3.0V	VDD=3V
Output Response Time	T_R	—	46	—	mS	3.0V	Operating mode
		—	46	—		5.0V	Operating mode
		—	160	—	mS	3.0V	Standby mode
		—	160	—		5.0V	Standby mode

9 Package Information

9.1 SOT23-6L(3mm x 3mm PP=0.95mm)



MILLIMETER			
SYMBOL	MIN	NOM	MAX
A	2.72	2.92	3.12
A1	0.90	0.95	1.00
A2	0.30	0.35	0.40
B	1.40	1.60	1.80
B1	2.60	2.80	3.00
B2	0.12	0.128	0.135
C	1.00	1.10	1.20
C1	0.04	-	0.10
C2	0.60	0.65	0.70
D	0.03	0.08	0.13
D1	0.30	-	0.60
D2	0.25TYP		
D3	0.60	0.65	0.70

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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	2025-11-13	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/