永嘉微电
Vinka Microelectronics

VK3610I Datasheet

10-channel touch I2C output

Rev.1.2

1 General Description

VK3610I is a 10-channel touch detection chip designed to replace traditional mechanical buttons, making it suitable for compact products with high requirements for interference resistance and low power consumption.

The chip offers excellent anti-interference capability, high penetration performance, a wide operating voltage range, and low static current. It features an I2C communication interface and uses an INT pin to indicate touch events via level changes, with valid keys flagged as "1" in the corresponding data bit. It supports multi-key mode and includes a 10-second long-press reset function. Thanks to its specialized internal circuitry, low standby current, and high power supply rejection ratio, the chip effectively prevents false triggering and ensures stable and reliable operation even in harsh environments. This design also contributes to achieving a waterproof, dustproof, and seamlessly integrated panel appearance.

2 Key Features

- Operating voltage: 2.4-5.5V
- Operating current 30.0μA@VDD=3.0V
  Standby current 9.0μA@VDD=3.0V
- Power-on reset function（POR）
- Low-voltage reset function（LVR）
- Response time approximately 45ms @VDD=3V
- The overall sensitivity is adjusted by connecting a capacitor to ground through the CS pin. The capacitance value ranges from 1 to 100nF. The larger the capacitance value, the more sensitive it is. It is not allowed not to connect a capacitor.
- Connect a small capacitor to the ground for fine-tuning the sensitivity of each touch channel to make the sensitivity of each channel consistent. The capacitance value ranges from 1 to 100pF. The larger the capacitance value, the less sensitive it is. It is most sensitive without connecting a capacitor.
- Built-in key debouncing, no need for external software to debouncing again
- The output is 2-byte I2C data, with each bit corresponding to one touch key
  Multi-key mode
  Press and hold the key for 10 seconds to reset
- After power-on, there is approximately 0.25 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.
- It is relatively easy to pass the EMC test
- HBM Electrostatic 4KV-8KV(Class 3A)
- Available Packages:
  SOP16(150mil)(9.9mm x 3.9mm PP=1.27mm)

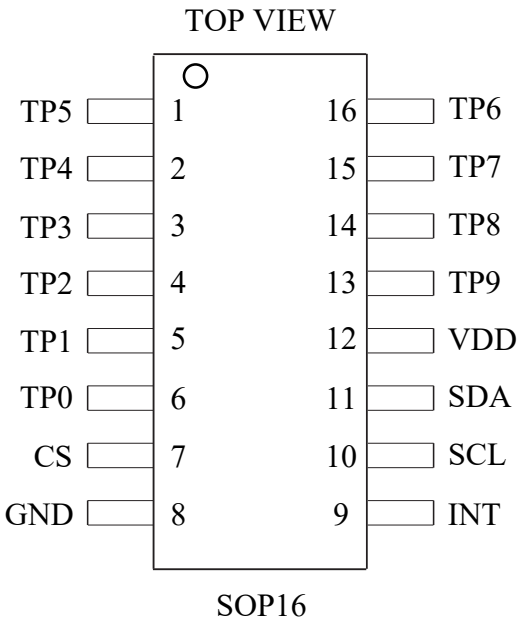
3 Product Selection

Part No.	Touch Channel	Working Voltage	Normal Mode/Standby	Output (/ Optional parameter)	Packaging
VK3601	1	2.4-5.5V	120μA/4μA(3V)	Direct CMOS output high/low level	SOT23-6
VK3602K	2	2.4-5.5V	60μA/8μA(3V)	Direct CMOS output high/low level	SOP8
VK3602XS	2	2.4-5.5V	60μA/8μA(3V)	Latch the CMOS output high/low level	SOP8
VK3603	3	2.4-5.5V	20μA/7μA(3V)	Direct CMOS output, low level effective	ESOP8
VK3604A	4	2.4-5.5V	20μA/7μA(3V)	Direct/latch high/low level multi-key/single-key CMOS/ Drain long press to keep output/ Long press for 16 seconds to reset	SOP16
VK3604B	4	2.4-5.5V	20μA/7μA(3V)	Direct/latch high/low level multi-key/single-key CMOS/ Drain long press to keep output/ Long press for 16 seconds to reset	TSSOP16
VK36E4	4	2.4-5.5V	20μA/6μA(3V)	Direct/latch high/low level multi-key/single-key CMOS/ Drain long press to keep output/ Long press for 16 seconds to reset	ESSOP10
VK36Q4	4	2.4-5.5V	20μA/6μA(3V)	Direct/latch high/low level multi-key/single-key CMOS/ Drain long press to keep output/ Long press for 16 seconds to reset	DFN10L
VK3606D	6	2.4-5.5V	20μA/7μA(3V)	Direct CMOS output, low level effective, multi-key mode, long press for 10 seconds to reset	SOP16
VK3610I	10	2.4-5.5V	45μA/9μA(3V)	I2C interface +INT pin, multi-key mode, hold for 10 seconds to reset	SOP16
VK3618I	18	2.4-5.5V	60μA/16μA(3V)	Two groups of touch correspond to I2C interface +INT pin, each group has 9 touch channels, multi-key mode, and reset after holding for 10 seconds	SSOP28

4 Ordering Information

Part No.	Packaging	Tube Qty	Tray(reel)Qty	Box Qty	Total Qty	Notes
VK3601	SOT23-6		3000/reel	30000/box	120000 PCS	
VK3602K	SOP8	100/tube		10000/box	60000 PCS	
VK3602XS	SOP8	100/tube		10000/box	60000 PCS	
VK3603	ESOP8		4000/reel	8000/box	64000 PCS	
VK3604A	SOP16	50/tube		5000/box	50000 PCS	
VK3604B	TSSOP16	100/tube		10000/box	100000 PCS	
VK36E4	ESSOP10		4000/reel	8000/box	64000 PCS	
VK36Q4	DFN10L		5000/reel		40000 PCS	
VK3606D	SOP16	50/tube		5000/box	50000 PCS	
VK3610I	SOP16	50/tube		5000/box	50000 PCS	
VK3618I	SSOP28	50/tube		5000/box	50000 PCS	

5 Package Pinout Information(SOP16)



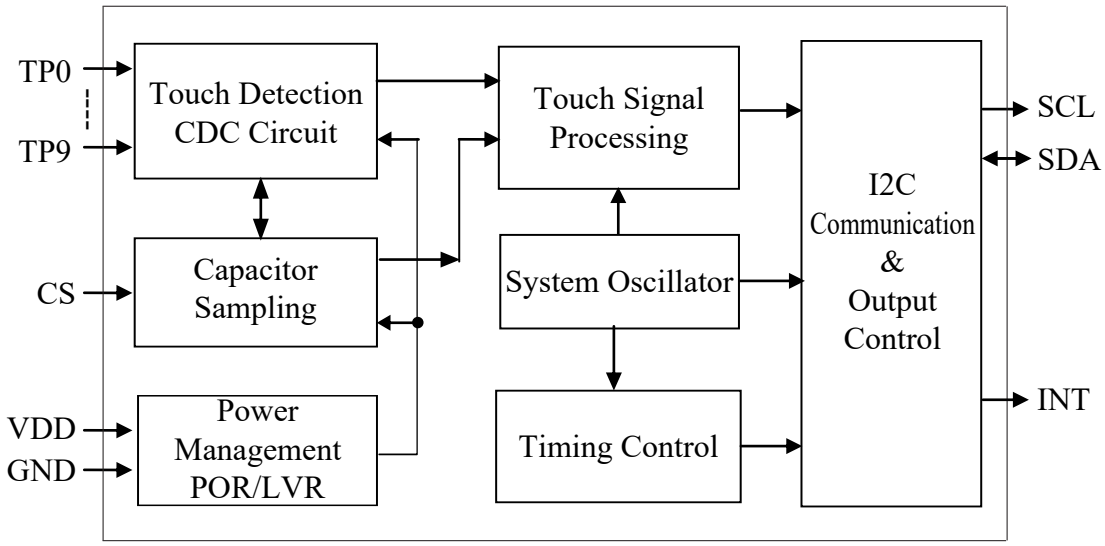
For more information: Page 12

5.1 VK3610I/SOP16 Pin Description

No.	Name	I/O	Function Description
1	TP5	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
2	TP4	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
3	TP3	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
4	TP2	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
5	TP1	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
6	TP0	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
7	CS	I	Sensitivity adjustment, connect to ground capacitance (1-100nF)
8	GND	GND	Negative power supply
9	INT	O	Touch state output and open-drain output require an external pull-up resistor
10	SCL	I	The I2C serial clock pin requires an external pull-up resistor for open-drain output
11	SDA	I/O	The I2C serial data input/output pins require an external pull-up resistor for open-drain output
12	VDD	VDD	Positive power supply
13	TP9	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
14	TP8	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
15	TP7	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected
16	TP6	I	Touch input: Connect a small capacitor to ground to fine-tune the sensitivity (1-100pF),and it is most sensitive when not connected

6 Functional Description

6.1 Block Diagram



6.2 Output Parameters

The output of VK3610I is I2C output +INT interrupt pin.

The INT interrupt pin outputs the touch status. A low level is output when there is a touch, and a high level is output when there is no touch.

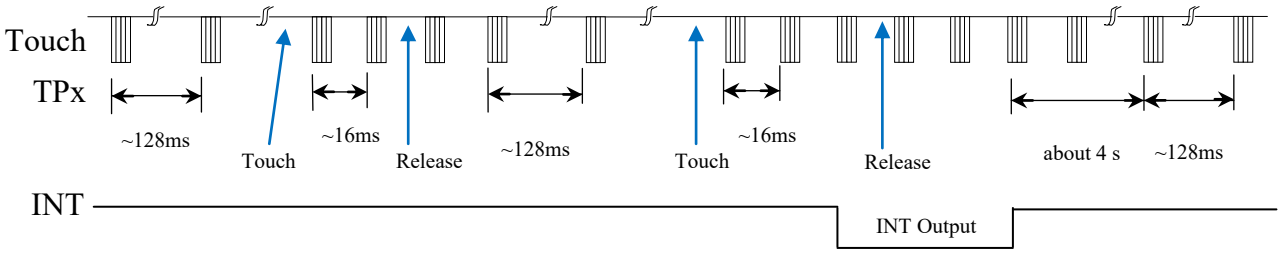
Supports simultaneous pressing of multiple keys. Press and hold for 10 seconds to reset the chip and restore the output to the powered state.

Data format: I2C data key-value + INT status, byte 1-0 (B9-B0)					
Touch Pin	I2C data corresponds to key values B9 B8 B7 B6 B5 B4 B3 B2 B1 B0	INT	Touch Pin	I2C data corresponds to key values B9 B8 B7 B6 B5 B4 B3 B2 B1 B0	INT
TP0 Touch	0 0 0 0 0 0 0 0 0 1	0	TP0 Release	0 0 0 0 0 0 0 0 0 0	1
TP1 Touch	0 0 0 0 0 0 0 0 1 0	0	TP1 Release	0 0 0 0 0 0 0 0 0 0	1
TP2 Touch	0 0 0 0 0 0 0 1 0 0	0	TP2 Release	0 0 0 0 0 0 0 0 0 0	1
TP3 Touch	0 0 0 0 0 0 1 0 0 0	0	TP3 Release	0 0 0 0 0 0 0 0 0 0	1
TP4 Touch	0 0 0 0 0 1 0 0 0 0	0	TP4 Release	0 0 0 0 0 0 0 0 0 0	1
TP5 Touch	0 0 0 0 1 0 0 0 0 0	0	TP5 Release	0 0 0 0 0 0 0 0 0 0	1
TP6 Touch	0 0 0 1 0 0 0 0 0 0	0	TP6 Release	0 0 0 0 0 0 0 0 0 0	1
TP7 Touch	0 0 1 0 0 0 0 0 0 0	0	TP7 Release	0 0 0 0 0 0 0 0 0 0	1
TP8 Touch	0 1 0 0 0 0 0 0 0 0	0	TP8 Release	0 0 0 0 0 0 0 0 0 0	1
TP9 Touch	1 0 0 0 0 0 0 0 0 0	0	TP9 Release	0 0 0 0 0 0 0 0 0 0	1

Note:
When powered on, the I2C data = 0000000000 INT output pin level =1
When multiple keys are touched simultaneously, the corresponding data bit is 1 at the same time

6.3 Working Mode

The VK3610I chip has two working modes: standby mode and normal mode. The key was touched and switched to the normal mode. The keyless touch 4S automatically enters standby mode to reduce power consumption. When VDD=5V, the INT output response is approximately 160 milliseconds in standby mode and about 48 milliseconds in working mode.



6.4 Sensitivity Adjustment

The sensitivity of VK3610I is related to the size of the touch PAD, the thickness of the shell, 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 four 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 capacitance value of pin CS to ground
   CS adjusts the overall sensitivity, with the larger the value, the more sensitive it is. Commonly used values range from 1 to 100nF, and for some special applications, there are also those exceeding 200nF. CS capacitors should be selected with smaller temperature coefficients, such as X7R and NPO.
4. Adjust the small capacitance between the touch foot and the ground
   The sensitivity is fine-tuned by touching the small capacitance of the touch foot to the ground. The larger the capacitance, the lower the sensitivity. It is most sensitive without a capacitance. Common values range from 1 to 100pF.

Shell thickness (acrylic or glass)	CS Electrical value (for reference only)
<3mm	10nF/25V
3-6mm	22nF/25V
6-10mm	47nF/25V

7 I2C Communication Interface

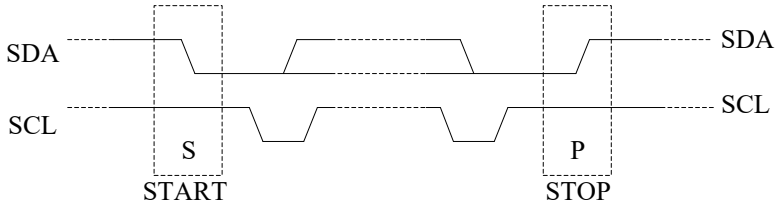
The VK3610I has two communication pins and follows the I2C protocol, with a maximum communication speed of 400kbit/S.

The SCL pin is the clock input pin, and the SDA pin is the serial data input/output pin, which requires an external pull-up resistor.

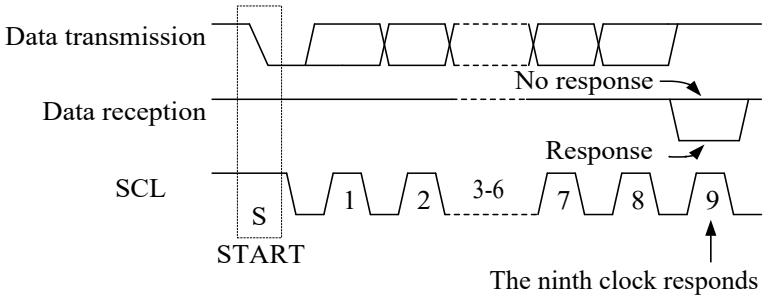
When the I2C bus is idle, both pins are at a high level. When the SCL signal is at a high level and the SDA signal changes from a high level to a low level, the operation starts or resumes. Conversely, when the SCL signal is at a high level and the SDA signal changes from a low level to a high level, the operation stops.

When the SCL signal is at a high level, the data on the SDA port is all valid and stable. Only when the SCL signal is at a low level can the level on the SDA port be changed.

START and STOP signals



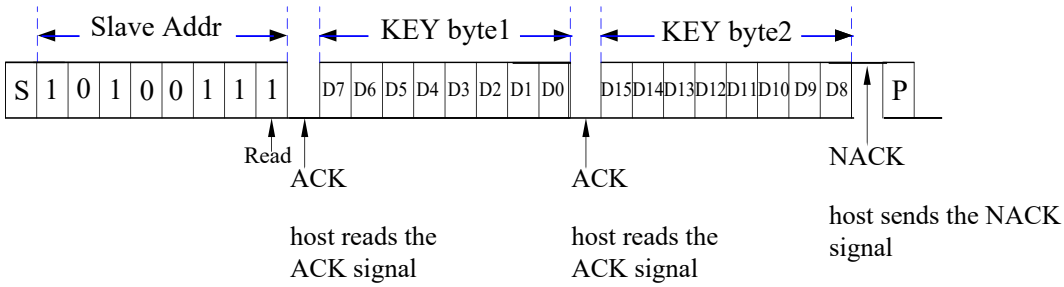
Response signal



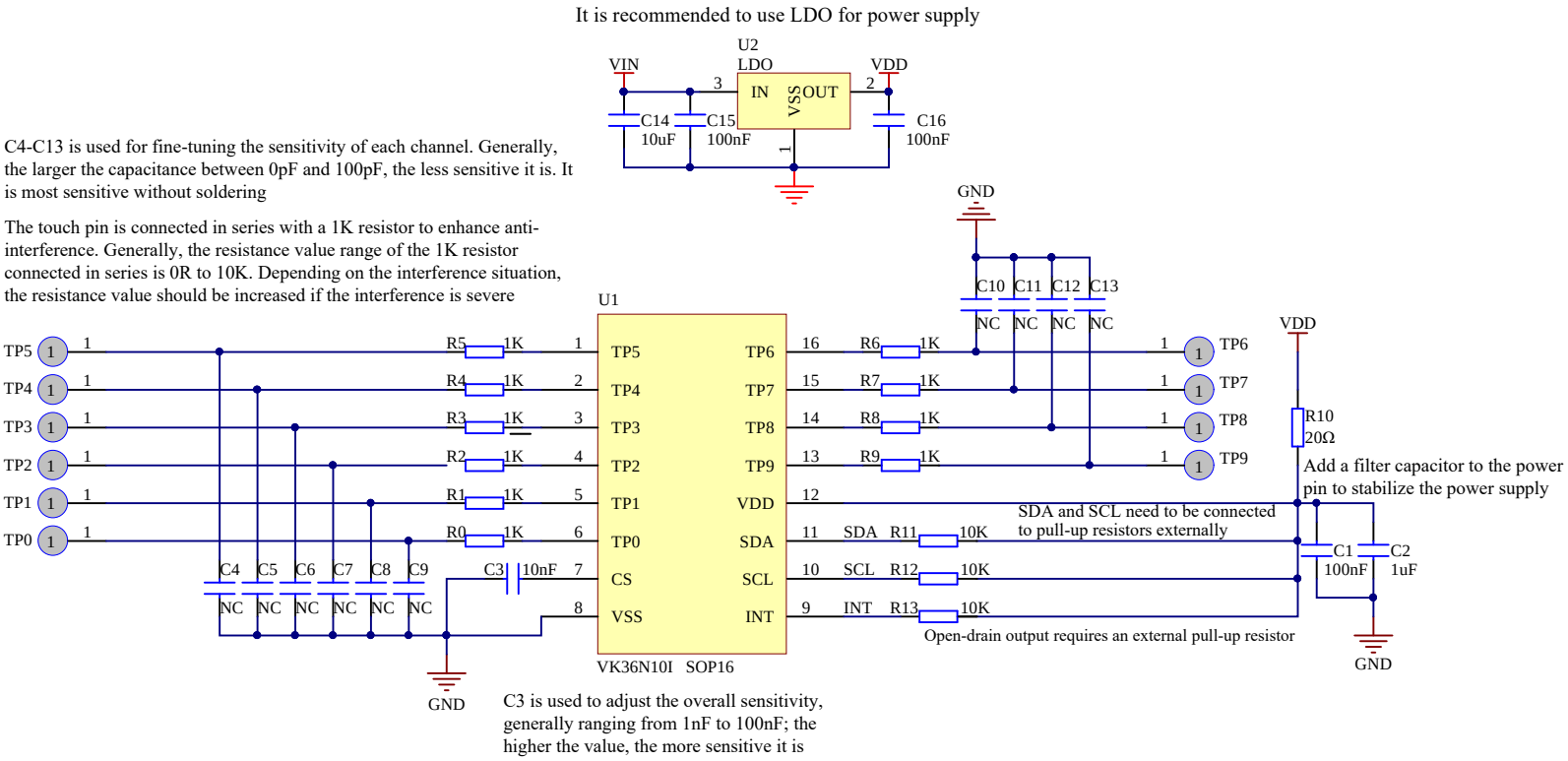
Chip address
(0xA7) Bit0=1 read bit

1	0	1	0	0	1	1	1

Read 2 bytes of 10-bit valid key values:



8 Application Circuits



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. CS adjusts the overall sensitivity. This capacitor must be connected and placed as close to the chip as possible. The larger it is, the more sensitive it is. Common values range from 1 to 100nF, and for some special applications, there are also those exceeding 200nF.CS capacitors should be selected with a smaller temperature coefficient and stability, such as X7R and NPO.
6. Fine-tune the sensitivity of capacitors C0-C9(0~100pF) 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.
7. Resistors R0-R9 are mainly used to effectively prevent radio frequency interference and enhance anti-static capability. The common values range from 470R to 1K, with a maximum not exceeding 10K. Resistors should be placed as close as possible to the chip. For conventional applications, they can be omitted.

9 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	4KV-8KV(Class 3A)	KV

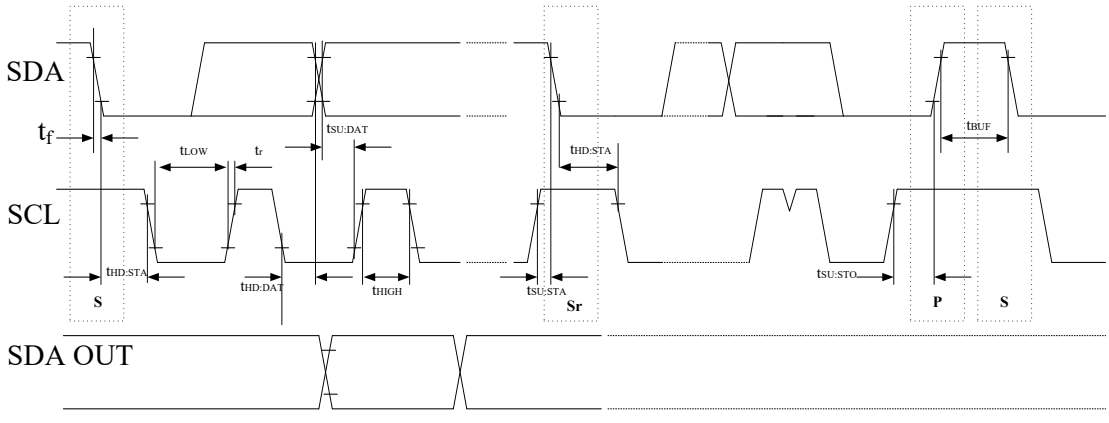
9.1 DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions (25 ℃)	
						VDD	Conditions
Operating voltage	VDD	2.4	3.0	5.5	V	—	—
Low-voltage reset	LVR	—	2.3	—	V	—	—
Operating current	I_{OP}	—	30	60	μA	3.0V	CS=10nF
		—	60	120		5.0V	
Standby current	I_{ST}	—	9	18	μA	3.0V	CS=10nF
		—	16	32		5.0V	
Output sink current	I_{IL}	—	4	—	mA	3.0V	V_{OL}=0.6V
		—	8	—		5.0V	
Output source current	I_{OL}	—	-2	—	mA	3.0V	V_{OH}=2.6V
		—	-4	—		5.0V	V_{OH}=4.3V
Input low voltage	V_{IL}	—	—	0.3	VDD	VDD	Input low voltage
Input high voltage	V_{IH}	0.7	—	1	VDD	VDD	Input high voltage
Output response time	T_R	—	45	—	mS	3.0V	Normal mode
		—	48	—		5.0V	Normal mode
		—	150	—	mS	3.0V	Standby mode
		—	160	—		5.0V	Standby mode

9.2 AC Electrical Characteristics

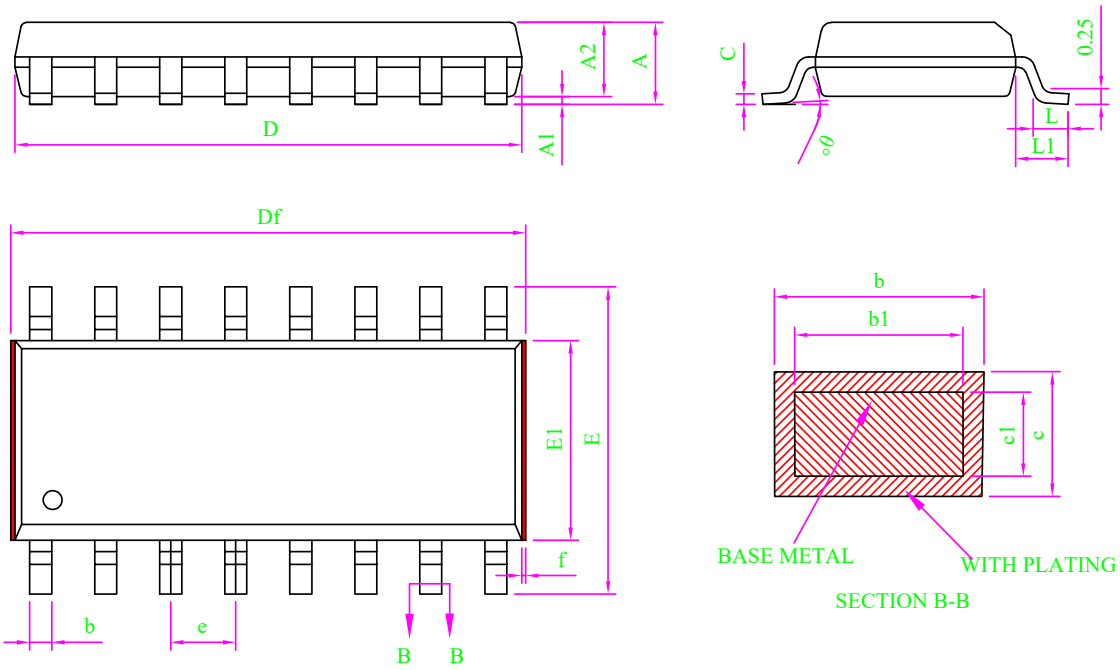
Symbol	Parameter	Min.	Max.	Unit	Test Conditions
					Conditions
f_{SCL}	Clock frequency	—	400	kHZ	—
t_{BUF}	Bus idle time	1.3	—	μs	During this period, the bus must remain idle until a new transmission begins
$t_{HD;\ STA}$	Start-up condition holding time	0.6	—	μs	After this period, the first clock pulse will be generated
t_{LOW}	SCL low-level time	1.3	—	μs	—
t_{HIGH}	SCL high-level time	0.6	—	μs	—
$t_{SU;\ STA}$	Set the time in the "Start" state	0.6	—	μs	It is only related to the repeated START signal
$t_{HD;\ DAT}$	Data retention time	0	—	μs	—
$t_{SU;\ DAT}$	Data setting time	100	—	ns	—
t_r	Rising time	—	0.3	μs	Periodic sampling
t_f	Decrease time	—	0.3	μs	Periodic sampling
$t_{SU;\ STO}$	Stop setting the time for the condition	0.6	—	μs	—
t_{AA}	The effective clock output time	—	0.9	μs	—
t_{SP}	Input filter time constant (SDA and SCL pins)	—	50	ns	Noise suppression time

I^2C timing



10 Package Information

10.1 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

11 Disclaimer

Warranty and liability —— The information provided in this document is believed to be accurate and reliable. However, Shenzhen Vinka Microelectronics Co., Ltd. (hereinafter "the Company") makes no warranties, express or implied, as to the completeness or suitability of this information for any specific purpose.

In no event shall the Company be liable for any indirect, incidental, or consequential damages, including but not limited to loss of profits, equipment damage, or system failure, arising out of the use of this product or documentation, regardless of the legal theory under which such liability is asserted.

Right to change —— The Company reserves the right to modify any information contained herein without prior notice. The latest version of this document is available at: https://www.szvinka.com/

Applicability —— This product is not designed or intended for use in life-critical, medical, or safety systems where failure could result in injury or death. The customer shall assume full responsibility for any such use.

Application —— All product application descriptions provided herein are intended for illustrative purposes only.
The Company makes no representations or warranties, express or implied, regarding the suitability of any specific application without further testing or modification.

The customer is solely responsible for determining whether the Company's products are appropriate for their intended applications or end customers.

The customer shall ensure proper design practices, implementation safeguards, and operational validation to minimize risks associated with product use.

The Company shall not be held liable for any defects, losses, costs, or damages arising from weaknesses or failures in the customer's own products or applications, or from the integration or use of third-party products.

Furthermore, the customer shall conduct all necessary testing and validation for any third-party deployment of the Company's products to avoid potential misuse or associated damages. The Company assumes no liability in this regard.

Commercial terms of sale —— Unless otherwise agreed in writing, sales of this product are subject to the Company's standard terms and conditions of sale. The Company expressly rejects the applicability of the customer's general terms and conditions.

Export control—— This product may be subject to applicable export control regulations. The customer is solely responsible for compliance with such regulations, including obtaining any necessary export licenses.

12 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	2025-12-23	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/