

Features

- Operating voltage: 2.2-5.5V
- Standby current: 10uA/3.0V
- Power-On Reset (POR)
- Low Voltage Reset (LVR)
- Key Response Time:
 - Normal Mode 48mS
 - Standby Mode 160mS
- AHLB pin selects the output level on power-on: level- high or level- low
- I2C output +INT interrupt pin
- Multi key output
- Maximum key on duration time : 13S
- Sensitivity adjustment using an external capacitor(1-47nF) on CS pin
- Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity for single key
- After power-on have about 0.3S stable-time, during the time do not touch the key
- Auto-calibration Function
- Anti-voltage fluctuation , High anti-interference
- Package
 - SOP16(150mil)(9.9mm x 3.9mm PP=1.27mm)
 - QFN16L(3.0mm x 3.0mm PP=0.5mm)

1 General Description

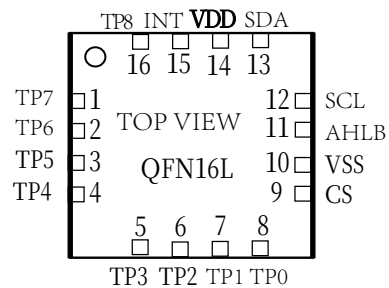
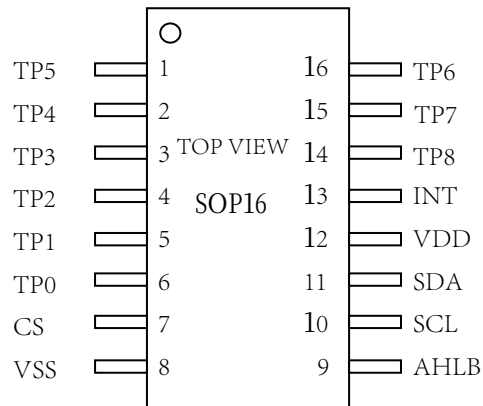
VK36N9I is a touch pad detector IC which offers 9 touch keys, It can detect human body contact using external touch pads. The high level of device integration enable applications to be implemented with a minimum number of external components.

It Provides I2C output, 1 INT interrupt output pin, The output active level can be selected through IO pin. 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 + I2C output operations in a wide variety of applications.

2 Pinouts and pin description

2.1VK36N9I SOP16/QFN16L Pin Assignment

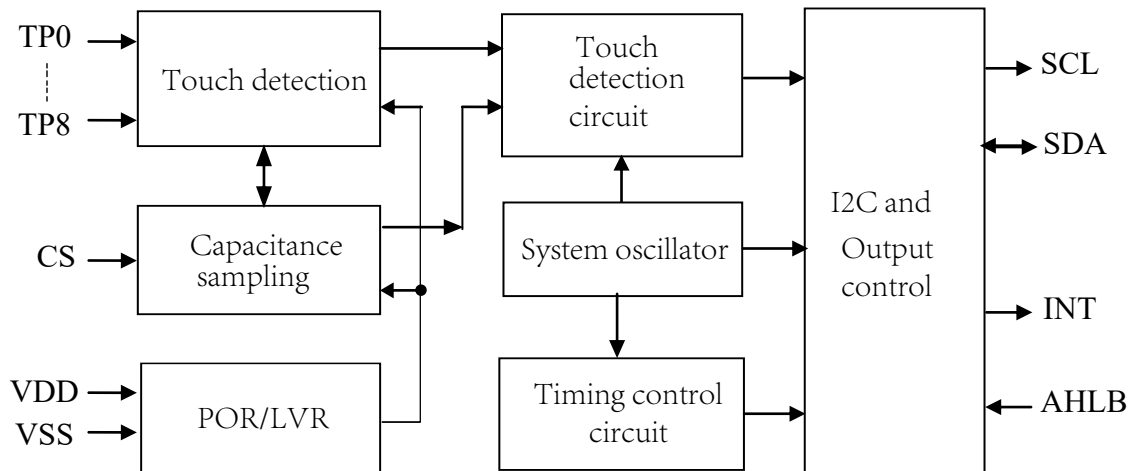


2.2 VK36N9I SOP16/QFN16L Pin Description

Pin name		I/O	Function Description
SOP16	QFN16L		
1-TP5	3-TP5	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
2-TP4	4-TP4	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
3-TP3	5-TP3	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
4-TP2	6-TP2	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
5-TP1	7-TP1	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
6-TP0	8-TP0	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
7-CS	9-CS	IN	Capacitance detection, the larger the capacitance the higher the sensitivity (1-47nF)
8-VSS	10-VSS	VSS	Negative power supply
9-AHLB	11-AHLB	IN	Selects the output level: floating->Active level- low, VSS->Active level- high
10-SCL	12-SCL	IN	Serial Clock Input pin for I2C, with an external pull-up resistor
11-SDA	13-SDA	I/O	Serial Data Input/Output pin for I2C, with an external pull-up resistor
12-VDD	14-VDD	VDD	Positive power supply
13-INT	15-INT	OUT	Touch status output pin, Open-drain output requires an external pull-up resistor
14-TP8	16-TP8	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
15-TP7	1-TP7	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity
16-TP6	2-TP6	IN	Touch key input pin, Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity

3 Functional Description

3.1 Block diagram



3.2 Auto-calibration Function

After power-on, the chip will be initialized to obtain the first reference value. If there is no touch, the chip will automatically calibrate the reference value, so that the reference value can be dynamically changed according to the external environment.

For example, reliable touch detection can be achieved through this mechanism when temperature changes or when there is environmental noise.

3.3 Max Key On Duration Time

To minimise the possibility of unintentional switch detections, such as undesired objects covering the sensing electrodes, the devices include a Maximum Key On duration time function. To implement this function the devices include an internal timer, which starts running after each switch detection. If the key on time of a touch key exceeds a value of about 13S, then the device will re-calibrate the key state, obtain a new reference value, while the output status is reset to the initial state.

3.4 Anti-Voltage Fluctuation

The chip has a built-in anti-voltage fluctuation function, which can prevent the touch button from malfunctioning caused by the external high current drive and the instantaneous drop of the working voltage.

3.5 Output mode

VK36N9I output is I2C+INT interrupt pin. AHLB pin selects the output level on power-on .
INT pin output touch status, When there is a touch, the output level changes, and the output level without touch returns to the power-on state.

AHLB	Output Function
VSS	active level- high,Power-on output 0
NC	active level- low,Power-on output 1

Data Format: INT+I2C data key value.

AHLB NC on POWER-ON					
Touch pin	I2C data key value.	INT	Touch pin	I2C data key value.	INT
	B8 B7 B6 B5 B4 B3 B2 B1 B0			B8 B7 B6 B5 B4 B3 B2 B1 B0	
TP0 Touch	1 1 1 1 1 1 1 1 0	0	TP0 Release	1 1 1 1 1 1 1 1 1	1
TP1 Touch	1 1 1 1 1 1 1 0 1	0	TP1 Release	1 1 1 1 1 1 1 1 1	1
TP2 Touch	1 1 1 1 1 1 0 1 1	0	TP2 Release	1 1 1 1 1 1 1 1 1	1
TP3 Touch	1 1 1 1 1 0 1 1 1	0	TP3 Release	1 1 1 1 1 1 1 1 1	1
TP4 Touch	1 1 1 1 0 1 1 1 1	0	TP4 Release	1 1 1 1 1 1 1 1 1	1
TP5 Touch	1 1 1 0 1 1 1 1 1	0	TP5 Release	1 1 1 1 1 1 1 1 1	1
TP6 Touch	1 1 0 1 1 1 1 1 1	0	TP6 Release	1 1 1 1 1 1 1 1 1	1
TP7 Touch	1 0 1 1 1 1 1 1 1	0	TP7 Release	1 1 1 1 1 1 1 1 1	1
TP8 Touch	0 1 1 1 1 1 1 1 1	0	TP8 Release	1 1 1 1 1 1 1 1 1	1

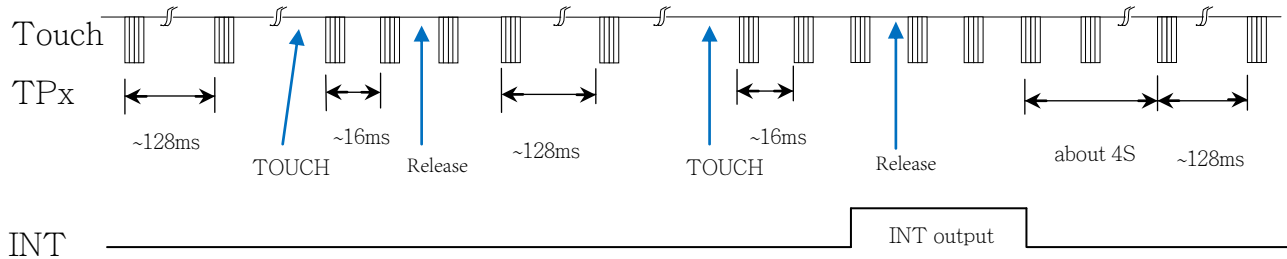
Note: when power on I2C data=0 1111 1111 INT=1

AHLB Connect VSS on POWER-ON					
Touch pin	I2C data key value.	INT	Touch pin	I2C data key value.	INT
	B8 B7 B6 B5 B4 B3 B2 B1 B0			B8 B7 B6 B5 B4 B3 B2 B1 B0	
TP0 Touch	0 0 0 0 0 0 0 0 1	1	TP0 Release	0 0 0 0 0 0 0 0 0	0
TP1 Touch	0 0 0 0 0 0 0 1 0	1	TP1 Release	0 0 0 0 0 0 0 0 0	0
TP2 Touch	0 0 0 0 0 0 1 0 0	1	TP2 Release	0 0 0 0 0 0 0 0 0	0
TP3 Touch	0 0 0 0 0 1 0 0 0	1	TP3 Release	0 0 0 0 0 0 0 0 0	0
TP4 Touch	0 0 0 0 1 0 0 0 0	1	TP4 Release	0 0 0 0 0 0 0 0 0	0
TP5 Touch	0 0 0 1 0 0 0 0 0	1	TP5 Release	0 0 0 0 0 0 0 0 0	0
TP6 Touch	0 0 1 0 0 0 0 0 0	1	TP6 Release	0 0 0 0 0 0 0 0 0	0
TP7 Touch	0 1 0 0 0 0 0 0 0	1	TP7 Release	0 0 0 0 0 0 0 0 0	0
TP8 Touch	1 0 0 0 0 0 0 0 0	1	TP8 Release	0 0 0 0 0 0 0 0 0	0

Note: when power on I2C data=0 0000 0000 INT=0

3.6 Operating Mode

There are two operating modes for VK36N9I, the normal mode and the standby mode. If any key is pressed, the device will be waken up and will then enter the normal mode. If no key press, After 4S, the system will then return to the standby mode again, it will be saving power. When VDD=5V, at standby mode output response time is about 160ms, at detective mode output response time is about 48 ms.



3.7 Sensitivity Adjustment

The touch PAD size and capacitance of connecting line on PCB can affect the sensitivity. The sensitivity adjustment must according to the practical application on PCB. The VK36N9I offers some methods for adjusting the sensitivity outside:

I. Touch PAD Size

Under other conditions are fixed. Using a larger Touch PAD size can increase sensitivity. Otherwise it can decrease sensitivity. But the touch PAD size must use in the effective scope.

II. Panel Thickness

Under other conditions are fixed. Using a thinner panel can increase sensitivity. Otherwise it can decrease sensitivity. But the panel thickness must be below the maximum value.

III. Value of CS

Under other conditions are fixed. CS pin to VSS capacitor Cs can adjust sensitivity, When adding the value of CS will increase sensitivity in the useful range (1nF-47nF) .

IV. Capacitor to a touch key pin

Add a capacitor (0-50pF) to a touch key can fine tune the sensitivity for single key, When adding the value of capacitor will decrease sensitivity .

Panel Thickness (Acrylic or Glass)	CS value (only reference)
<3mm	6.8nF/25V
3-6mm	10nF/25V
6-10mm	22nF/25V

4 I2C Serial Interface

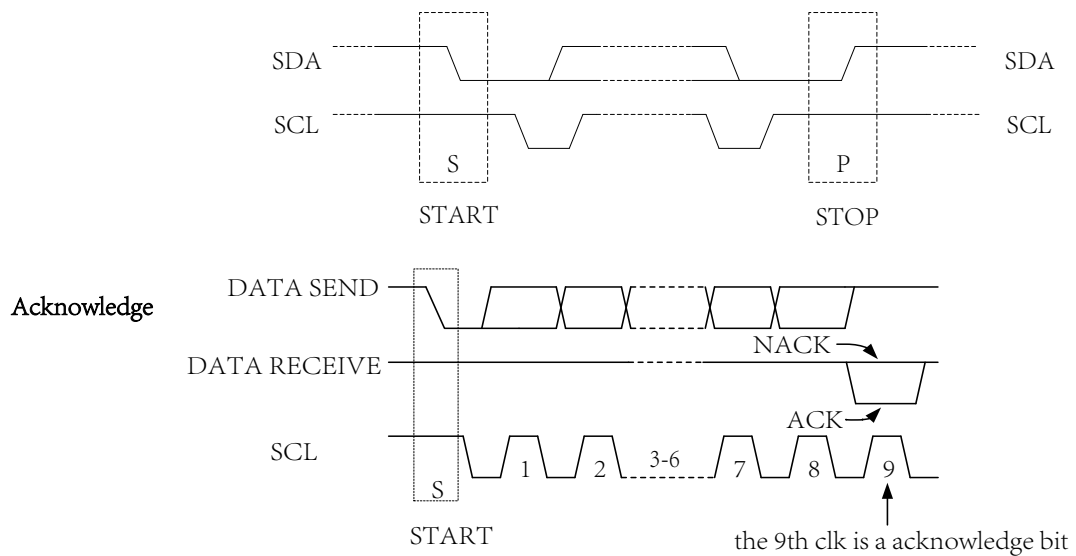
The device supports I2C serial interface. The maximum communication speed is 400kbit/S.

The two lines are a serial data line, SDA, and a serial clock line, SCL. Both lines are required external pull-up resistors.

When the bus is free, both lines are high level. When the SCL signal is high level, Start to work or restart when the SDA signal changes from high level to low level. When the SCL signal is high level, It stops working when the SDA signal changes from low level to high level.

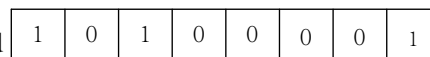
The level on the SDA port can only be changed when the SCL signal is low.

START and STOP

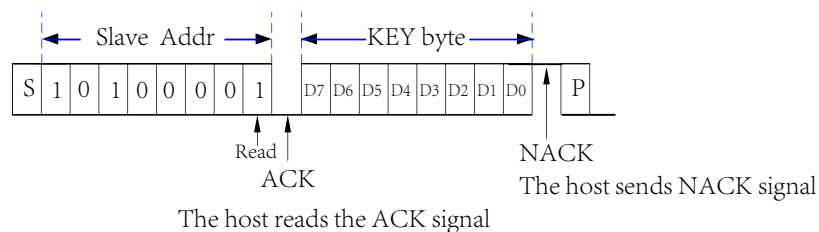


Slave Address

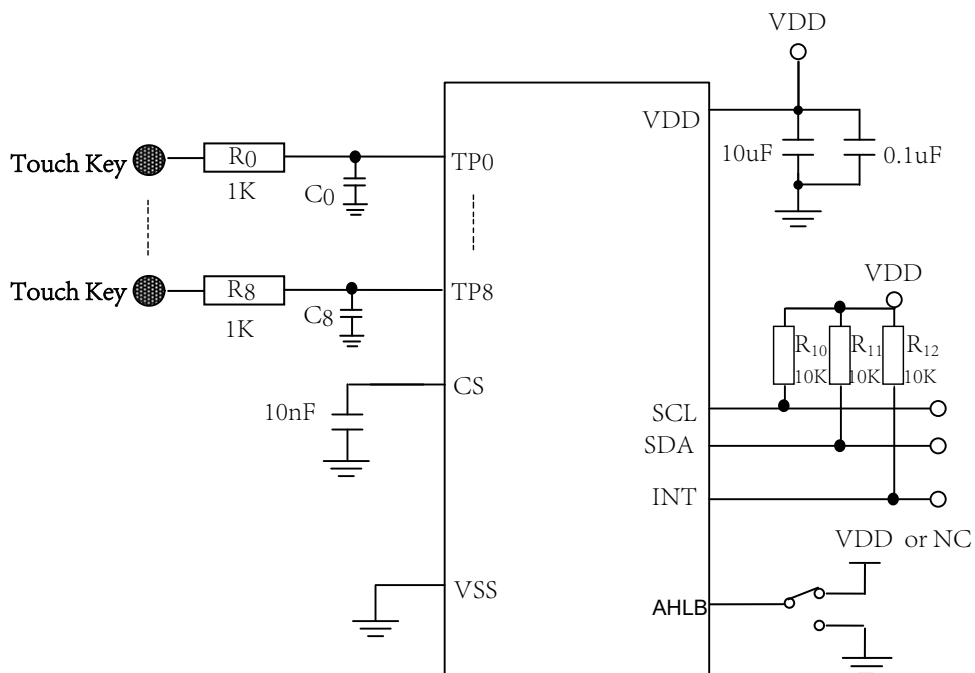
(0xA1) bit0=1 Read



Read a byte key value:



5 Application Circuits



6 Electrical characteristics

6.1 Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Power voltage	VDD	-0.3~6.0	V
Input Voltage	VIN	$V_{SS}-0.3 \sim V_{DD}+0.3$	V
Storage Temperature	TSTG	-50~+125	°C
Operating Temperature	TOTG	-40~+85	°C
Human Body Mode	ESD	4KV-8KV(Class 3A)	KV

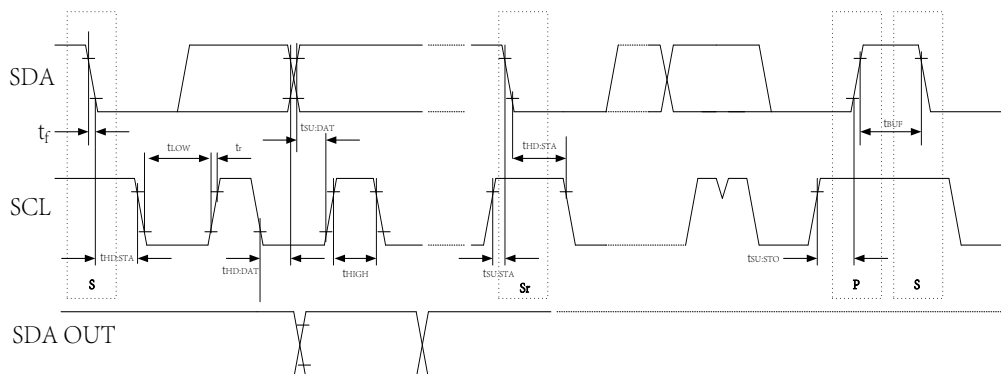
6.2 DC Characteristics

Item	Symbol	Min.	Typ.	Max	Unit	Test Conditions (25 °C)	
						VDD	Conditions
Operating voltage	VDD	2.2	3.0	5.5	V	—	—
Low voltage Reset	LVR	—	2.0	2.1	V	—	—
Operating current	I _{OP}	—	1.3	—	mA	3.0V	CS=10nF
		—	2.2	—		5.0V	
Standby current	I _{ST}	—	10	—	μA	3.0V	CS=10nF
		—	33	—		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
Input pull-up resistor	R _{PH}	—	150k	—	ohm	3.0V	VDD=3V
Input pull-low resistor	R _{PL}	—	50k	—	ohm	3.0V	VDD=3V
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

6.3 AC Characteristics

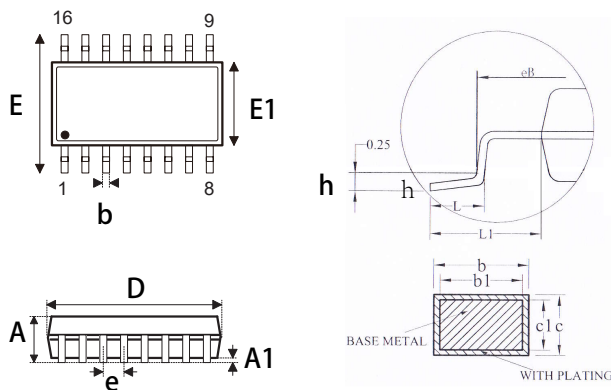
Symbol	Item	Min.	Max.	Unit	Test Conditions
					Conditions
f_{SCL}	Clock Frequency	-	400	kHZ	—
t_{BUF}	Bus Free Time	1.3	-	μs	Time in which the bus must be free before a new transmission can start
$t_{HD; STA}$	Start Condition Hold Time	0.6	-	μs	After this period, the first clock pulse is generated
t_{LOW}	SCL Low Time	1.3	-	μs	—
t_{HIGH}	SCL High Time	0.6	-	μs	—
$t_{SU; STA}$	Start Condition Setup Time	0.6	-	μs	Only relevant for repeated START condition —
$t_{HD; DAT}$	Data Hold Time	0	-	μs	—
$t_{SU; DAT}$	Data Setup Time	100	-	ns	—
t_r	Rising Time	-	0.3	μs	periodically sampled
t_f	Falling Time	-	0.3	μs	periodically sampled
$t_{SU; STO}$	Stop Condition Setup Time	0.6	-	μs	—
t_{AA}	Output Valid from Clock	-	0.9	μs	—
t_{SP}	Input Filter Time Constant (SDA and SCL pin)	-	50	ns	Noise suppression time

I²C Timing



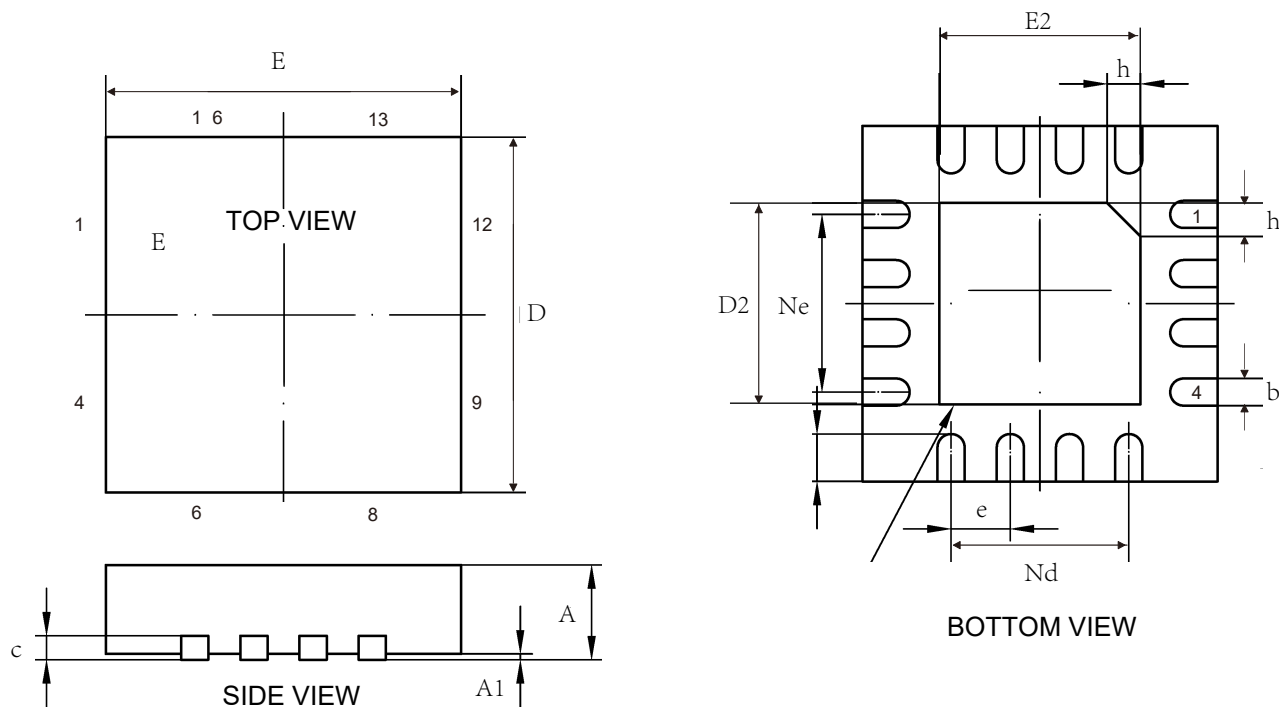
7 Package Information

7.1 SOP16(9.9mm x3.9mm PP=1.27mm):



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.55
A1	0.10	---	0.225
b	0.39	---	0.47
b1	0.38	0.41	0.44
c	0.20	---	0.24
c1	0.19	0.20	0.21
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	---	0.50
L	0.50	---	0.80
L1	1.05REF		

7.2 QFN16L(3.0mm x 3.0mm PP=0.5mm):



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	1.55	1.65	1.75
E	2.90	3.00	3.10
E2	1.55	1.65	1.75
Nd	1.50BSC		
Ne	1.50BSC		
e	0.50BSC		
L	0.35	0.40	0.45
h	0.20	0.25	0.30

8 Revision history

No.	Version	Date	Modify the content	Check
1	1.0	2018-08-10	Original version	Yes
2	1.1	2020-02-11	Update version	Yes

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