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VK36W8I Datasheet

8-channel water level detection I2C output

Rev.1.2

1 General Description

The VK36W8I has 8 touch detection channels, which can be used to detect the water level at 8 points. This chip has a high degree of integration and only requires a few external components to achieve the detection of touch buttons.

It provides I2C output function, which facilitates communication with external MCU and achieves the purposes of equipment installation and touch pin detection. The chip internally adopts a special integrated circuit, featuring a high power supply voltage suppression ratio, which can reduce the occurrence of key detection errors. This characteristic ensures that the chip maintains high reliability even in adverse environmental conditions. This touch chip features automatic calibration, low standby current, and voltage stability resistance, providing a simple and effective solution for the application of detecting 8-point water levels.

2 Key Features

- Operating voltage: 2.2-5.5V
- Standby current 10μA/3.0V
- Power-on reset function（POR）
- Low-voltage reset function（LVR）
- 4S Automatic Calibration Function
- Reliable touch button detection
- 4S test detects no water and enters standby mode
- It is possible to conduct a reliable detection even if there is water before powering on.
- 8 o'clock water level measurement
- I2C output + INT interrupt pin
- Any channel has the OUT_FLAG output signal indicating the presence of water.
- When powering on, does the OPT pin select the output as being high-active or low-active
- External capacitors (1nF-47nF) connected to the dedicated pins are used to adjust the sensitivity.
- Very few peripheral components
- Has the function of resisting voltage fluctuations
- The detection can be carried out by using a metal probe to make contact with the water, or by detecting the signal outside the water tank without making contact with the water.
- Available Packages:
  SOP16(150mil)(9.9mm x 3.9mm PP=1.27mm)
  QFN16L(3.0mm x 3.0mm PP=0.5mm)

3 Product Selection

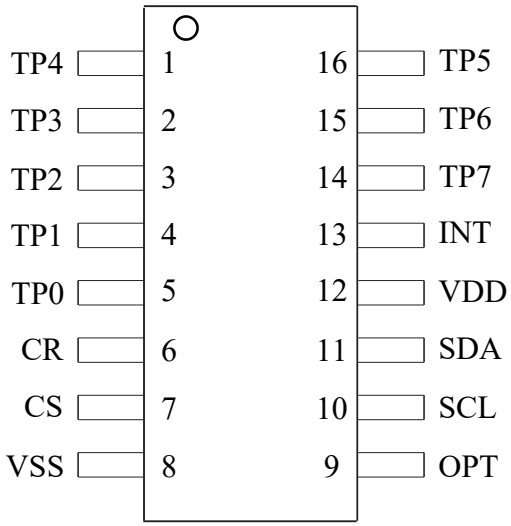
Part No.	Voltage/Standby Current	Output	Packaging
VK36W1D	2.2V-5.5V/10μA-3V3(SLEEP)	1-to-1 direct output	SOT23-6
VK36W2D	2.2V-5.5V/10μA-3V3(SLEEP)	1-to-1 direct output	SOP8
VK36W4D	2.2V-5.5V/10μA-3V3(SLEEP)	1-to-1 direct output	SOP16/QFN16L
VK36W6D	2.2V-5.5V/10μA-3V3(SLEEP)	1-to-1 direct output	SOP16/QFN16L
VK36W8I	2.2V-5.5V/10μA-3V3(SLEEP)	I2C output	SOP16/QFN16L

4 Ordering Information

Part No.	Packaging	Tube Qty	Tray(reel)Qty	Box Qty	Total Qty	Notes
VK36W1D	SOT23-6		3000/reel	30000/box	120000 PCS	
VK36W2D	SOP8	100/tube		10000/box	60000 PCS	
VK36W4D	SOP16	50/tube		5000/box	50000 PCS	
	QFN16L		3000/reel	30000/box	120000 PCS	
VK36W6D	SOP16	50/tube		5000/box	50000 PCS	
	QFN16L		3000/reel	30000/box	120000 PCS	
VK36W8I	SOP16	50/tube		5000/box	50000 PCS	
	QFN16L		3000/reel	30000/box	120000 PCS	

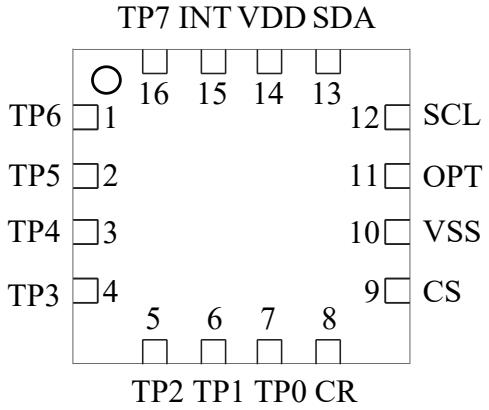
5 Package Pinout Information(SOP16/QFN16L)

TOP VIEW



SOP16

TOP VIEW



QFN16L

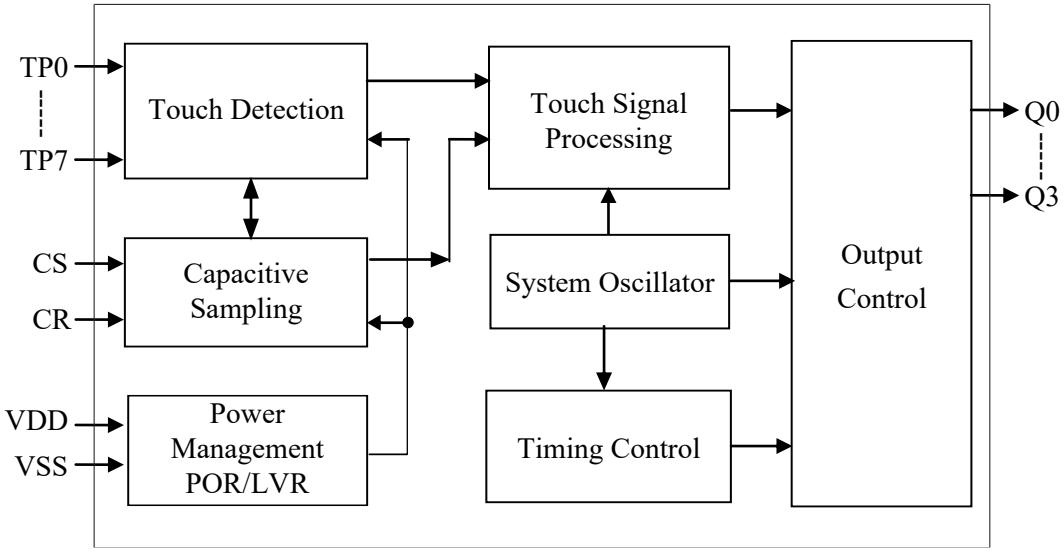
For more information: Page 11-12

5.1 VK36W8I /SOP16/QFN16L Pin Description

Pin Names		I/O	Function Description
QFN16L	SOP16		
3-TP4	1-TP4	I	Touch input, connect to ground with a small capacitor for fine-tuning sensitivity (1-50pF)
4-TP3	2-TP3	I	Touch input, connect to ground with a small capacitor for fine-tuning sensitivity (1-50pF)
5-TP2	3-TP2	I	Touch input, connect to ground with a small capacitor for fine-tuning sensitivity (1-50pF)
6-TP1	4-TP1	I	Touch input, connect to ground with a small capacitor for fine-tuning sensitivity (1-50pF)
7-TP0	5-TP0	I	Touch input, connect to ground with a small capacitor for fine-tuning sensitivity (1-50pF)
8-CR	6-CR	I	Reference capacitor
9-CS	7-CS	I	Sensitivity adjustment, connect to ground capacitor (1-47nF)
10-VSS	8-VSS	VSS	Negative power supply
11-OPT	9-OPT	I	Select the output level. When powered on: Open circuit - I2C/SDA pin outputs high, GND - I2C/SDA outputs low
12-SCL	10-SCL	I	I2C clock input
13-SDA	11-SDA	I/O	I2C data input/output
14-VDD	12-VDD	VDD	Positive power supply
15-INT	13-INT	O	Interrupt output, power-on output high
16-TP7	14-TP7	O	Touch input. Connect a ground capacitor to fine-tune the sensitivity (1-50pF). No connection results in the highest sensitivity.
1-TP6	15-TP6	O	Touch input. Connect a ground capacitor to fine-tune the sensitivity (1-50pF). No connection results in the highest sensitivity.
2-TP5	16-TP5	O	Touch input. Connect a ground capacitor to fine-tune the sensitivity (1-50pF). No connection results in the highest sensitivity.

6 Functional Description

6.1 Block Diagram



6.2 Auto-calibration Function

After power-on, the chip will perform initialization and obtain the first reference value. Subsequently, when there is no touch, the touch chip will automatically calibrate the reference value, enabling the reference value to dynamically change according to the external environment.

For example, this mechanism can achieve reliable touch detection when there is a temperature change or environmental noise.

6.3 Resistance To Voltage Fluctuations

The chip is equipped with an anti-voltage fluctuation function, which can prevent the occurrence of touch button malfunction caused by the sudden drop in working voltage due to the large current driving from the peripheral devices.

6.4 Operating Mode

The VK36W8I has two operating modes: standby mode and normal mode.
Upon power-on, it immediately detects whether there is water or not;
If all 8 channels are detected as being dry, 4S will automatically enter the standby mode; If any channel is detected as having water, it will switch to the normal mode;
If the water status of any channel changes from dry to wet, the INT pin will output a 20ms low pulse signal;
If the water status of any channel changes from wet to dry, the INT pin will output a 20ms low pulse signal;

OPT	Select the output of the valid level
VSS	The I2C and INT pins are powered on and the output is low; When there is no water, there is a 20ms high pulse output from the INT pin; When there is water, there is a 20ms low pulse output from the INT pin.
NC	The I2C and INT pins are powered up and output a high level; When there is no water, there is a water signal, and the INT pin outputs a 20ms low pulse; When there is water but no water before that, the INT pin outputs a 20ms high pulse.

Data format: INT + I2C data key value.

When the Clock pin receives the clock signal, the touch chip will generate an 8-bit data byte and transfer it from the Data pin. Among them, TP0 corresponds to bit 0 of the first byte, and TP7 corresponds to bit 7 of the first byte.

The OPT is floating during power-on.					
Touch Pin	I2C data corresponding key value B7 B6 B5 B4 B3 B2 B1 B0	INT	Touch Pin	I2C data corresponding key value B7 B6 B5 B4 B3 B2 B1 B0	INT
TP0 Touch	1 1 1 1 1 1 1 0	0	TP0 Release	1 1 1 1 1 1 1 1	1
TP1 Touch	1 1 1 1 1 1 0 1	0	TP1 Release	1 1 1 1 1 1 1 1	1
TP2 Touch	1 1 1 1 1 0 1 1	0	TP2 Release	1 1 1 1 1 1 1 1	1
TP3 Touch	1 1 1 1 0 1 1 1	0	TP3 Release	1 1 1 1 1 1 1 1	1
TP4 Touch	1 1 1 0 1 1 1 1	0	TP4 Release	1 1 1 1 1 1 1 1	1
TP5 Touch	1 1 0 1 1 1 1 1	0	TP5 Release	1 1 1 1 1 1 1 1	1
TP6 Touch	1 0 1 1 1 1 1 1	0	TP6 Release	1 1 1 1 1 1 1 1	1
TP7 Touch	0 1 1 1 1 1 1 1	0	TP7 Release	1 1 1 1 1 1 1 1	1
Note: When powered on, I2C data =1111, 1111, INT output pin level =1					

When powering on, OPT is connected to GND.					
Touch Pin	I2C data corresponding key value B7 B6 B5 B4 B3 B2 B1 B0	INT	Touch Pin	I2C data corresponding key value B7 B6 B5 B4 B3 B2 B1 B0	INT
TP0 Touch	0 0 0 0 0 0 0 1	1	TP0 Release	0 0 0 0 0 0 0 0	0
TP1 Touch	0 0 0 0 0 0 1 0	1	TP1 Release	0 0 0 0 0 0 0 0	0
TP2 Touch	0 0 0 0 0 1 0 0	1	TP2 Release	0 0 0 0 0 0 0 0	0
TP3 Touch	0 0 0 0 1 0 0 0	1	TP3 Release	0 0 0 0 0 0 0 0	0
TP4 Touch	0 0 0 1 0 0 0 0	1	TP4 Release	0 0 0 0 0 0 0 0	0
TP5 Touch	0 0 1 0 0 0 0 0	1	TP5 Release	0 0 0 0 0 0 0 0	0
TP6 Touch	0 1 0 0 0 0 0 0	1	TP6 Release	0 0 0 0 0 0 0 0	0
TP7 Touch	1 0 0 0 0 0 0 0	1	TP7 Release	0 0 0 0 0 0 0 0	0
Note: When powered on, the I2C data =0000 0000 ， INT output pin level =0					

6.5 Sensitivity Adjustment

The sensitivity of VK36W8I is related to the size of the touch pad, the thickness of the casing, the size of the sensitivity capacitor, etc. The sensitivity should be adjusted according to the actual application of the product. The sensitivity can be adjusted from the following aspects:

1. Touch the area of the PAD
   Other conditions remaining the same, the larger the touch area, the more sensitive it will be. However, the area must be within the effective range.
2. The thickness of the shell
   If all other conditions remain the same, 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 the CS terminal to ground
   The CS adjusts the overall sensitivity. The higher the value, the more sensitive it is. The common values range from 1 to 47 nF. For some special applications, there are even values exceeding 200 nF.
4. Adjust the ground capacitance value of the CR terminal
   Adjust the capacitance value of the CR capacitor. The smaller the value, the more sensitive it is. The common values range from 1 to 10 pF.
5. Adjust the small capacitance between the touch pad and the ground
   Adjust the small for ground capacitor of the touch pin（TP）. The larger the capacitance, the higher the sensitivity. The common value is 1-50pF.

Shell thickness (acrylic or glass)	CS Electrical value (for reference only)
<3mm	6.8nF/25V
3-6mm	10nF/25V
6-10mm	22nF/25V

7 I2C Communication Interface

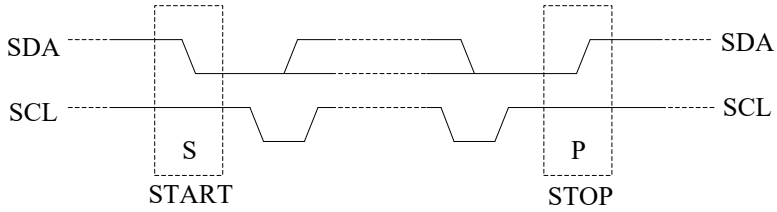
The VK36W8I has 2 communication pins and follows the I2C protocol. Its maximum communication speed is 400 kbit/s.

The SCL pin is the clock input pin, and the SDA pin is the serial data input/output pin. An external pull-up resistor needs to be connected.

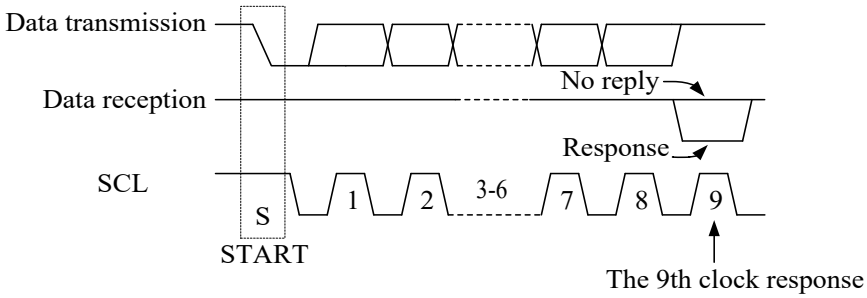
When the I2C bus is idle, both of these two pins are at a high level. When the SCL signal is at a high level and the SDA signal changes from a high level to a low level, the operation begins or resumes. And when the SCL signal is at a high level and the SDA signal changes from a low level to a high level,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

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

START and STOP signals



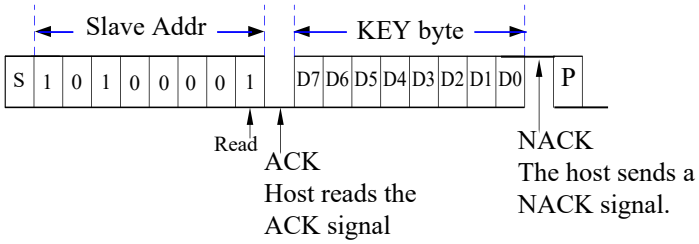
Response signal



Chip address
(0xA1) bit0 = 1 Read bit

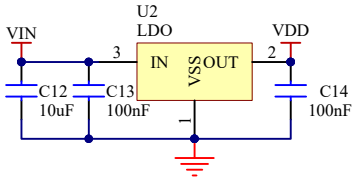
1	0	1	0	0	0	0	1

Read a byte key value:

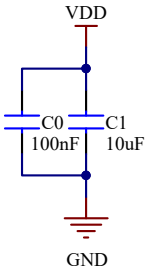


8 Application Circuits

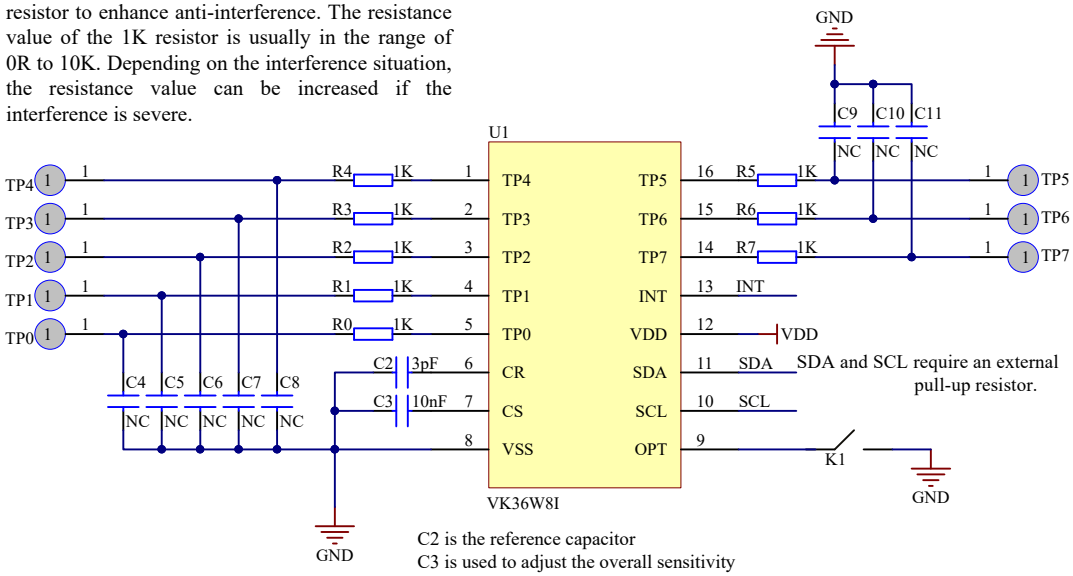
It is recommended to use LDO for power supply



The power supply pin is stabilized by adding a filter capacitor.



C4-C11 is used to fine-tune the sensitivity of each channel. Generally, the larger the capacitance (0pF to 50pF), the more sensitive it is.
The touch pins are connected in series with a 1K resistor to enhance anti-interference. The resistance value of the 1K resistor is usually in the range of 0R to 10K. Depending on the interference situation, the resistance value can be increased if the interference is severe.



SDA and SCL require an external pull-up resistor.

C2 is the reference capacitor
C3 is used to adjust the overall sensitivity
Generally, C2 is selected as 10nf and C3 as 3pF, which can meet the application requirements of most products

9 Electrical Characteristics

Absolute Maximum Ratings

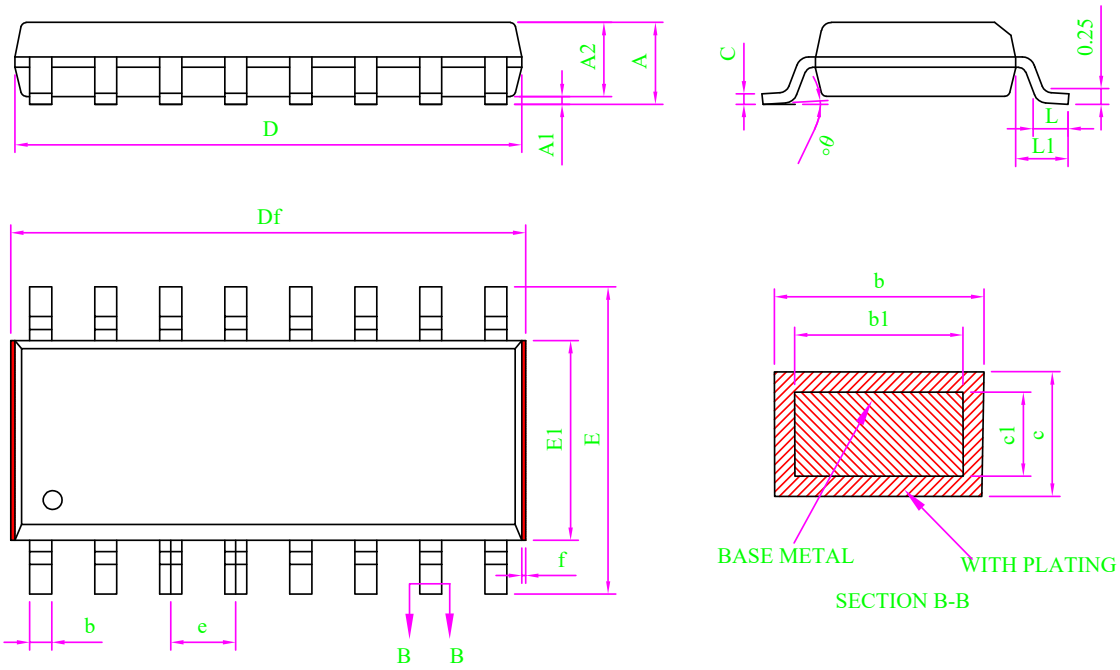
Parameter	Symbol	Ratings	Unit
Power Voltage	VDD	-0.3～6.0	V
Input Voltage	V_{IN}	VSS-0.3～VDD+0.3	V
Storage Temperature	T_{STG}	-50～+125	℃
Operating Temperature	T_{OTG}	-40～+85	℃
Human Body Mode	ESD	4KV-8KV(Class 3A)	KV

9.1 DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions (25 ℃)	
						VDD	Conditions
Operating voltage	VDD	2.2	3.0	5.5	—	—	—
Low-voltage reset	LVR	—	2.0	2.1	—	—	—
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
INT pin pull resistance	R_{PL}	—	60k	—	ohm	3.0V	VDD=3V
Output response time	T_R	—	125	—	mS	3.0V	Normal mode
		—	125	—		5.0V	Normal mode
		—	150	—	mS	3.0V	Standby mode
		—	150	—		5.0V	Standby mode

10 Package Information

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

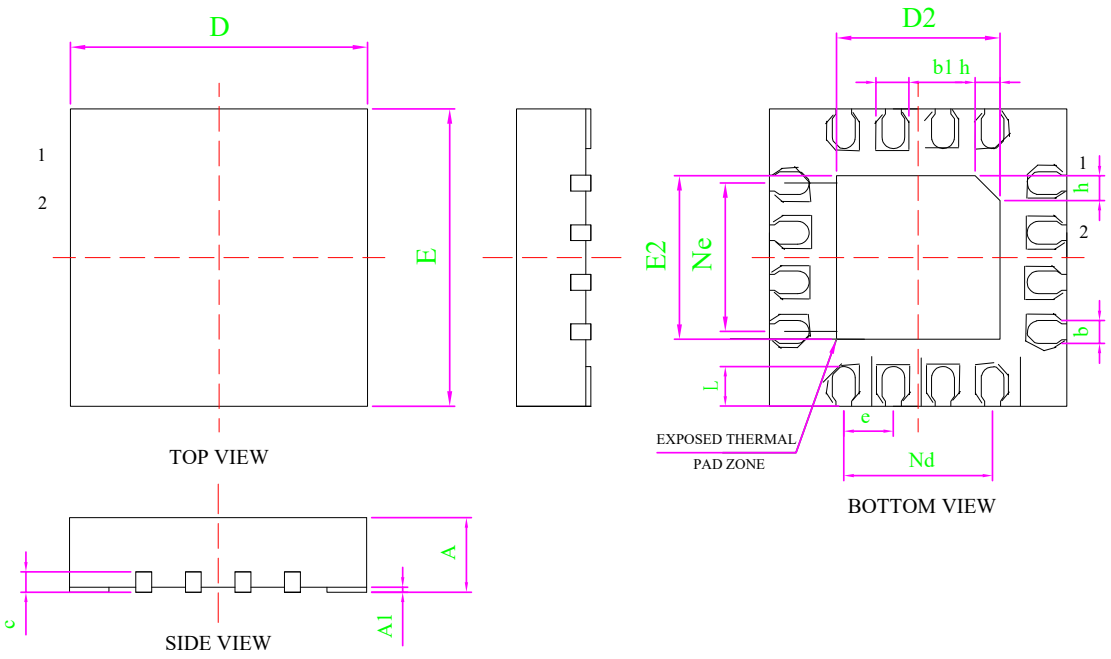


Note:

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

10.2 QFN16L(3.0mm x 3.0mm PP=0.5mm)



Dimensions			
SYMBOL	MIN	NOMINAL	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.18	0.25	0.30
b1	0.30	0.35	0.40
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	1.55	1.65	1.75
e	0.50BSC		
Ne	1.50BSC		
Nd	1.50BSC		
E	2.90	3.00	3.10
E2	1.55	1.65	1.75
L	0.35	0.40	0.45
h	0.20	0.25	0.30
L/F carrier size (mil)	75*75		

11 Disclaimer

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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	2026-01-29	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/